AUTOMATIC TRANSMISSION

GROUP 7

PART 7-1 GENERAL TRANSMISSION SERVICE

1 DIAGNOSIS AND TESTING

When diagnosing transmission problems, first refer to the diagnosis guide for the detail information on the items that could be causing the problem.

The following preliminary checks should be made before proceeding with other diagnosis checks.

TRANSMISSION FLUID LEVEL CHECK

Check the transmission fluid level. Low fluid level can affect the operation of the transmission, and may indicate fluid leaks that could cause transmission damage.

A fluid level that is too high will cause the fluid to become aerated. Aerated fluid will cause a low control pressure, and the aerated fluid may be forced out the vent.

TRANSMISSION FLUID LEAKAGE CHECKS

Check the speedometer cable connection at the transmission. Replace the rubber seal if necessary.

Inspect the governor inspection plate for leakage. Install a new gasket if needed.

Leakage at the oil pan gasket often can be stopped by tightening the attaching bolts to the proper torque. If necessary replace the gasket.

Check the fluid filler tube connection at the transmission oil pan.

If leakage is found here, tighten the fitting.

Check the fluid lines and fittings between the transmission and the cooler in the radiator tank for looseness, wear, or damage. If leakage cannot be stopped by tightening a fitting, replace the leaking parts.

Check the engine coolant in the radiator. If transmission fluid is present in the coolant, the cooler in the radiator tank is probably leaking.

The cooler can be further checked for leaks by disconnecting the lines at the cooler fittings and applying 5 psi air pressure to the fittings. If the cooler is leaking and will not hold this pressure, the radiator must be replaced. **The cooler cannot be replaced separately.**

If leakage is found at either the throttle lever shaft or the manual lever shaft, replace either or both seals.

Inspect the pipe plug on the left side of the transmission case at the front. If the plug shows leakage, torque the plug to specification. If tightening does not stop the leaks, replace the plug.

When converter drain plugs leak, remove the two drain plugs with a sixpoint wrench. Coat the threads with FoMoCo Perfect Seal Sealing Compound or its equivalent, and install the plugs. Torque the drain plugs to specification. **Fluid leakage from the converter housing may be caused by engine oil leaking past the rear main bearing or from oil gallery plugs, or power steering oil leakage from the steering system. Be sure to determine the exact cause of the leak before repair procedures are started.**

Oil-soluble aniline or fluorescent dyes premixed at the rate of ½ teaspoon of dye powder to ½ pint of transmission fluid have proved helpful in locating the source of the fluid leakage. Such dyes may be used to determine whether an engine oil or transmission fluid leak is present, or if the fluid in the oil cooler leaks into the engine coolant system. A black light, however, must be used with the fluorescent dye solution.

OIL LEAKAGE CONVERTER AREA

In diagnosis and correcting fluid leaks in the front pump and converter area, the following procedures are to be used to facilitate locating the exact cause of oil leakage. Leakage at the front of the transmisssion, as evidenced by oil around the converter housing may have several sources. By careful observation, it is possible, in many instances, to pinpoint the source of the leak before

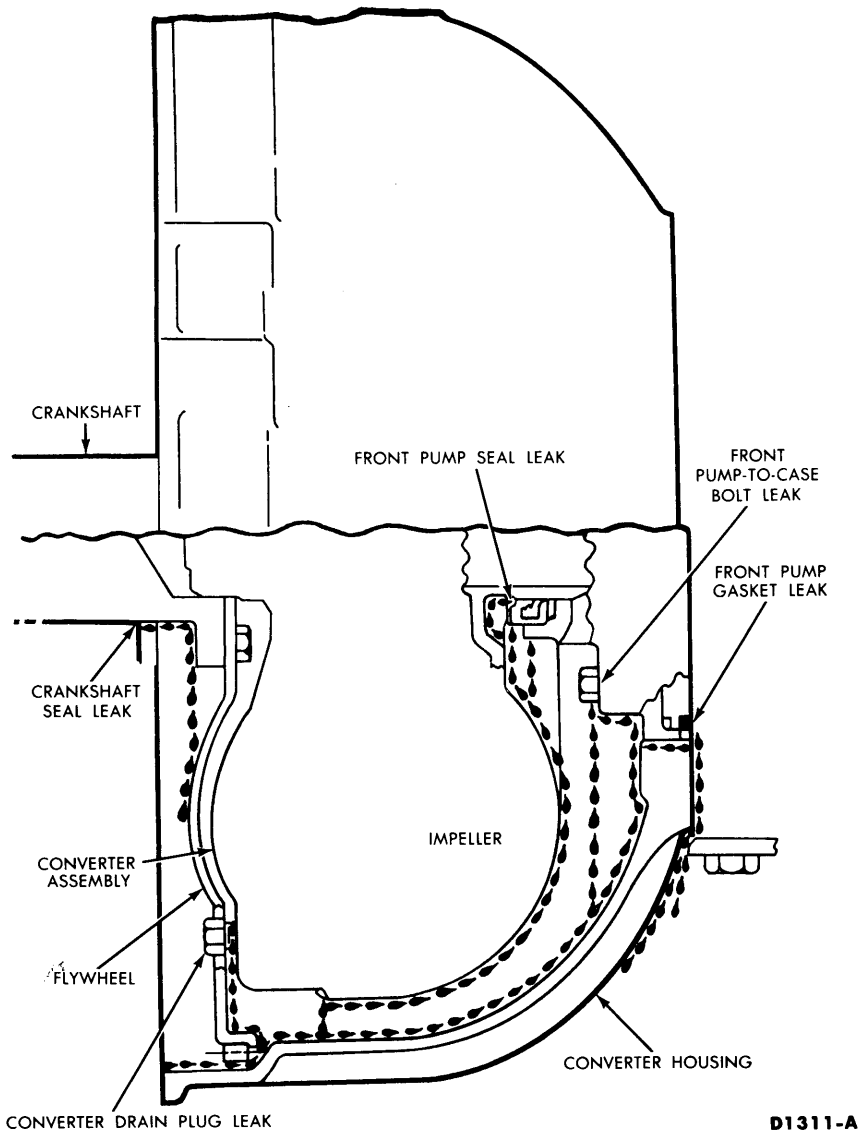


FIG. 1 – Converter Area Oil Leakage Check

removing the transmission from the car. The paths the fluid takes to reach the bottom of the converter housing are shown in Fig. 1.

1. Fluid that leaks by the seal lip will tend to move along the drive hub and onto the back of the impeller housing. Except in the case of a total seal failure, fluid leakage by the lip of the seal will be deposited on the inside of the converter housing only, near the outside diameter of the housing.

2. Fluid leakage by the outside diameter of the seal and front pump body will follow the same path as leakage by the front pump seal.

3. Fluid that leaks by a front pump to case bolt will be deposited on the inside of the converter housing only. Fluid will not be deposited on the back of the converter.

4. Leakage by the front pump to case gasket may cause fluid to be deposited inside the converter housing, or it may seep down between the front of the case and converter housing. Fluid on the front of the case, above the pan gasket, is evidence that the front pump to case gasket could be leaking.

5. Fluid leakage from the converter drain plugs will appear at the outside diameter of the converter on the back face of the flywheel, and in the converter housing only, near the flywheel.

6. Engine leaks are sometimes improperly diagnosed as front pump seal leaks.

The following engine leakage areas should also be checked to determine if engine oil leakage is causing the problem.

1. Leakage at the rocker arm cover (valley cover) may allow oil to flow over the converter housing or seep down between the converter housing and engine block causing oil to be present in or at the bottom of the converter housing.

2. Oil gallery plug leaks will allow oil to flow down the rear face of the block to the bottom of the converter housing.

3. Leakage by the crankshaft seal will work back to the flywheel, and from there into the converter housing.

Oil leakage from other areas forward of the transmission, such as the power steering system, could cause oil to be present around the converter housing due to blow back or road draft.

The following procedure should be used to determine what is causing the oil leakage before any repairs are made.

1. Remove the transmission dipstick and note the color of the fluid. Original factory fill fluid is dyed red to aid in determining if leakage is from the engine or transmission. Unless a considerable amount of "make-up" fluid has been added or the fluid has been changed, the red color should assist in pinpointing the leak. Fluid used in the power steering system is also dyed red. This source of leakage should be eliminated, if present, before performing work on the transmission since road draft may cause power steering fluid to be present on the transmission.

2. Remove the lower converter housing cover. Clean off any fluid from the top and bottom of the converter housing, front of the transmission case, and rear face of the engine and engine oil pan. Clean by washing with suitable non-flammable solvent, and blow dry with compressed air.

3. Wash out the converter housing, the front of the flywheel, and the converter drain plugs. The converter housing may be washed out using cleaning solvent and a squirt-type oil can. Blow all washed areas dry with compressed air.

4. Start and run the engine until the transmission reaches operating temperature. Observe the back of the block and top of the converter housing for evidence of oil leakage. Raise the car on a hoist and run the engine at fast idle, then at engine idle, and occasionally shifting to the drive and reverse ranges to increase pressures within the transmission. Observe the front of the flywheel, back of the block (in as far as possible), and inside the converter housing and front of the transmission case. Run the engine until oil leakage is evident and the probable source of leakage can be determined.

CONVERTER LEAKAGE CHECK

If there are indications that the welds on the torque converter housing are leaking, the converter will have to be removed and the following check should be made before the unit is replaced. A leak checking tool (Fig. 2) can be made from standard parts.

1. Install the plug in the converter (Fig. 3) and expand it by tightening the wing nut. Attach the safety chains.

2. Install the air valve in one of the drain plug threads.

3. Introduce air pressure into the converter housing. Check the pressure with a tire gauge and adjust it to 20 psi.

4. Place the converter in a tank of water. Observe the weld areas for bubbles. If no bubbles are observed, it may be assumed that the welds are not leaking.

ENGINE IDLE SPEED CHECK

Check and, if necessary, adjust the engine idle speed, using the procedure given in Group 10.

If the idle speed is too low, the engine will run roughly. An idle speed that is too high will cause the car to creep when the transmission is shifted out of neutral.

ANTI-STALL DASHPOT CLEARANCE CHECK

After the engine idle speed has been properly adjusted, check the anti-stall dashpot clearance. Follow the procedure given in Group 10 for checking and adjusting this clearance.

MANUAL LINKAGE CHECKS

Correct manual linkage adjustment is necessary to position the manual valve for proper fluid pressure direction to the different transmission components. Improperly adjusted manual linkage may cause cross-leakage and subsequent transmission failure. Refer to "Manual Linkage Adjustments," Part 7-2, for detailed manual linkage adjustment procedures.

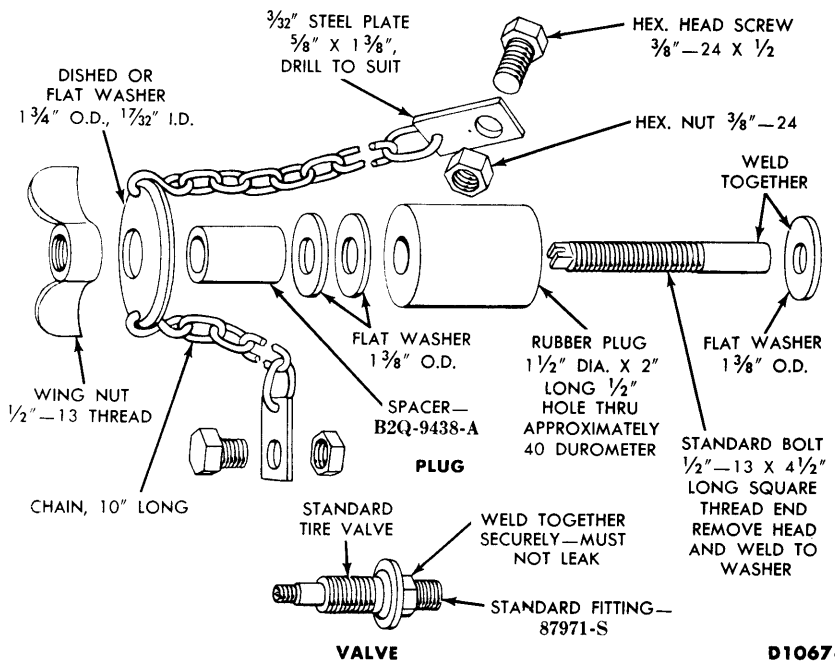


FIG. 2—Converter Leak Checking Tool

CONTROL PRESSURE, AUTOMATIC SHIFTS, VACUUM DIAPHRAGM UNIT CHECKS

When the vacuum diaphragm unit (Fig. 4)) is operating properly and the downshift linkage is adjusted properly, all the transmission shifts (automatic and kickdown) should occur within the road speed limits given in Part 7-3.

If the automatic shifts do not occur within limits, the following checking procedure is suggested to separate engine, transmission, linkage, and diaphragm unit troubles. The results of these checks should agree with the specifications outlined in Table 1.

1. Attach a tachometer to the engine and vacuum gauge to the transmission vacuum line, at the transmission vacuum unit.

2. Attach a pressure gauge to the control pressure outlet at the rear of the transmission (Fig. 4).

3. Firmly apply the service brakes and start the engine. During this test, the parking brake can not be used, because the brake automatically releases when the transmission selector lever is moved to a drive position.

4. Adjust engine idle speed to the specified rpm in D1 or D2. If engine idle speed cannot be brought within limits by adjustment at the carburetor idle adjustment screw, check the throttle and downshift linkage for binding condition. If the linkage is satisfactory, check for vacuum leaks in the transmission diaphragm unit and its connecting tubes and hoses. Check all other vacuum oper-

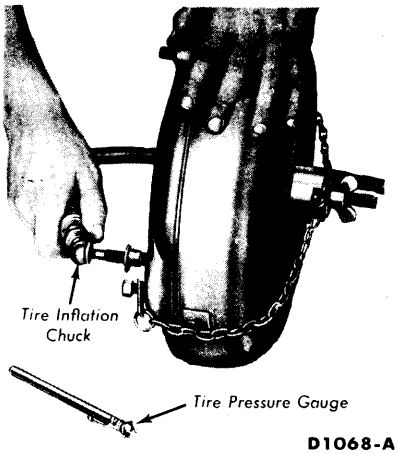


FIG. 3—Converter Leak Checking Tool Installation

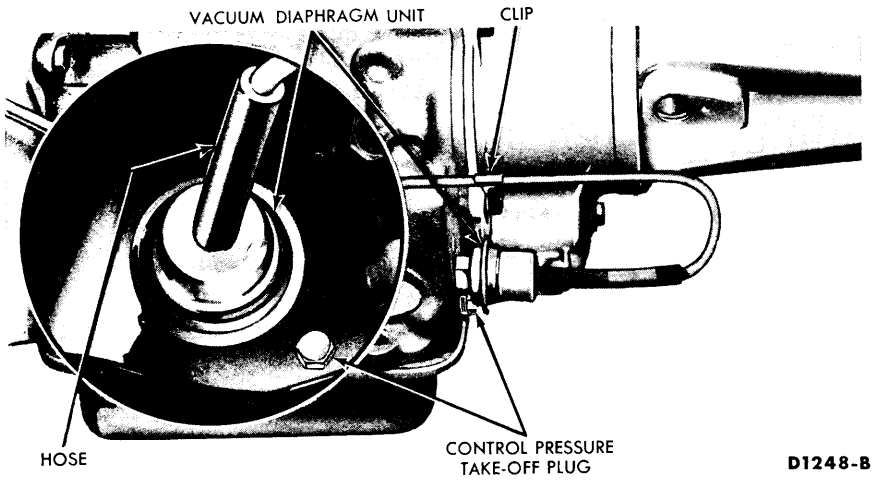


FIG. 4–Vacuum Diaphragm and Control Pressure Connecting Point

TABLE 1–Control Pressure Ranges

Test No.	Manifold Vacuum HG (inches)	Engine Speed RPM	Transmission Selector Position	Gauge Reading PSI
1	18 (Minimum	Idle	P-L-N-D1-D2	57-77
			R	71-106
2	16 to 13.7	As Required	D1-D2 L-R	Pressure Starts Rising
3	1.5 or Less	Stall 1800-2000	D1-D2-L	151-176
			R	201-213

ated units (such as the power brake and distributor vacuum advance) for vacuum leaks.

5. At engine idle speed, read the engine vacuum gauge and the transmission control pressure gauge.

The engine vacuum gauge should read a minimum of 18.0 inches. If the vacuum gauge reading is lower than 18.0 inches, an engine problem is indicated. Repair as necessary.

TEST NUMBER 1

The transmission control pressure should agree with the control pressures as outlined in Table 1 for test number one. If transmission control pressure is within limits, shift the transmission into D1 or D2 or L.

TEST NUMBER 2

Advance the throttle until the engine vacuum gauge reading falls below 16-13.7 inches. As the vacuum gauge reading passes through the 16-13.7 inches range, transmission control pressure should start to rise and continue to rise with throttle opening, until maximum control pressure for stall is obtained. If the vacuum and pressure gauge readings follow the pattern described above, the diaphragm unit and transmission control pressure regulation system are operating properly.

TEST NUMBER 3

To perform test number 3, place the selector lever in each required position, and completely open the throttle to obtain less than 1.5 inches of vacuum. The control pressure should be within the limits as outlined in Table 1. **While making this test, do not hold the throttle open for more than five seconds in each detent position. Then move the selector lever to N and run the engine at 1000 RPM to cool the transmission.**

If transmission control pressure is too low, too high, fails to rise with throttle opening, or is extremely erratic, follow the procedure given under the following appropriate heading.

CONTROL PRESSURE IS LOW –TEST NUMBER 1

If control pressure at engine idle is low in all selector lever positions, trouble other than the diaphragm unit is indicated.

When control pressure at engine idle is low in all ranges, check for excessive leakage in the front oil pump, case, and control valve body.

CONTROL PRESSURE IS HIGH –TEST NUMBER 1

If transmission control pressure at engine idle is too high in P, N, D1, D2, L or R (Table 1), the trouble may be in the diaphragm unit or its connecting tubes and hoses.

With the engine idling, disconnect the hose from the diaphragm unit (Fig. 4) and check the engine manifold vacuum. Hold a thumb over the end of the hose and check for vacuum. If the engine speeds up when the hose is disconnected and slows down as the thumb is held against the end of the hose, the vacuum source is satisfactory.

Stop the engine, and remove the diaphragm unit and the diaphragm unit push rod. Inspect the push rod for a bent condition and for corrosion. Install the diaphragm unit in the case to prevent fluid loss, but leave the push rod out. With the push rod removed, the diaphragm unit cannot affect transmission control pressure. Start the engine and check control pressure at engine idle in P, N, D1 and D2. If control pressure is still too high, the trouble is in the transmission control system. If the pressure is now within limits, the diaphragm unit was not operating properly and should be checked.

To check the vacuum unit for diaphragm leakage, remove the vacuum unit from the transmission. Use a distributor tester equipped with a vacuum pump (Fig. 5). Set the regulator knob so the vacuum gauge reads 18 inches with the end of the vacuum hose blocked to obtain a maximum vacuum reading 18 in. Hg.

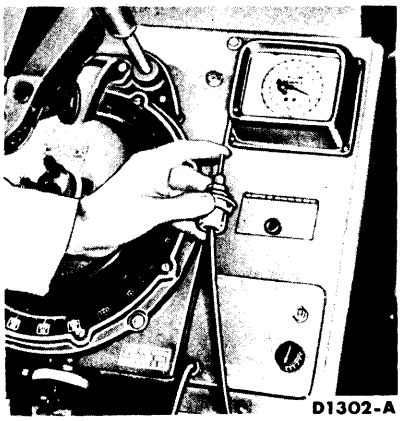


FIG. 5–Testing Transmission Vacuum Unit For Leakage

Then, connect the vacuum hose to the transmission vacuum unit. If the vacuum gauge still reads 18 inches, the vacuum unit diaphragm is not leaking. As the hose is removed from the transmission vacuum unit, hold your finger over the end of the control rod. When the hose is removed, the internal spring of the vacuum unit should push the control rod outward.

CONTROL PRESSURE DOES NOT RISE WITH THROTTLE OPENING—TEST NUMBER 2

If transmission control pressure does not rise in D1, D2 and L as engine vacuum falls below 16-13.7 inches, check the transmission's pressure rise capacity by shifting to R. In this position, control pressure should be higher than the other detent positions.

If pressure rise is normal in R, remove the hose from the diaphragm unit and check the hoses and tubes as given above. If the vacuum reading at the diaphragm end of the hose is 18 in. Hg or greater, check the diaphragm unit and again check for presure rise with throttle opening in D1, D2, L and R. If control pressure does not rise now, the trouble is in the transmission, hydraulic circuits to clutches or servos.

Control Pressure Not Within Limits—Stall Test Number 9. If idle pressure and pressure point increase are within specifications but stall pressures are not within specification in all ranges, excessive leakage, low pump capacity or restricted oil pan screen is indicated.

If stall pressures are not within specifications for specific ranges only, this indicates excessive leakage in the clutch or servo circuits used in those ranges.

CONTROL PRESSURE IS EXTREMELY ERRATIC

If transmission control pressure is extremely erratic in L, N, D1 and D2, check the diaphragm unit tubes, hoses, and diaphragm push rod as given above under **Control Pressure Is High.** If the vacuum source is satisfactory, replace the diaphragm unit and repeat the tests for transmission control pressure. If control pressure is still extremely erratic, the trouble is in the transmission. Clean and inspect the control valve body and pressure regulator.

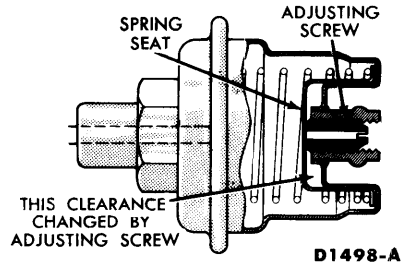


FIG. 6—Adjustable Vacuum Unit

TABLE 2—Control Pressure Check

Test No.	Engine Speed and Manifold Vacuum	Throttle Position	Selector Lever Position	Control Pressure PSI
1	Idle/Above 16.7 Inches	Closed	P, N, D1, D2, L R	57-77 64-106
2	As Required 13.7 Inches to 16.7 Inches	Open As Required	D1, D2, L	Start of pressure build up
3	10 Inches	As Required	D1, D2, L	97-113
4	Stall: Below 1.5 Inches	To and thru Detent	D1, D2, L R	145-176 196-213

ADJUSTING CONTROL PRESSURE

To correct transmission problems causing a soft or harsh automatic shift condition, an adjustable vacuum diaphragm assembly is released as a service part. There is an adjustment screw in the vacuum connecting tube (Fig. 6). By turning the screw the control pressure can be increased or decreased to correct the shift condition.

Before installing an adjustable diaphragm, a pressure and vacuum check should be made with the original non-adjustable diaphragm, to insure that pressures are within specifications and that the cause of the problem is not due to other items within the transmission or vacuum connecting lines.

CHECKING CONTROL PRESSURE

1. With engine idling (throttle closed), manifold vacuum should be above 16 inches at sea level. Select each range and note pressure gauge reading. Pressure should be within specifications as outlined in Table 2.

2. Position selector lever in Drive range with engine idling. Open throttle gradually while observing pressure gauge. Pressure should remain within idle limits until vacuum drops to between 16.7 and 13.7 inches and then the pressure should start to increase.

3. Place selector in Drive range (D1, D2, or L), open throttle until vacuum reading is 10 inches, and check transmission control pressure.

4. Open throttle until vacuum reading is below 1.5 inches and check pressure gauge reading.

5. Shift transmission to reverse and open throttle until vacuum reading is below 1.5 inches and check the pressure gauge reading.

Adjustable diaphragm may be installed when pressures are within specification. An initial adjustment should be made to provide 105 psi line pressure at 10 inches of vacuum. Once the initial adjustment has been made, further adjustments may be made in an effort to overcome shift feel problems.

If shifts are harsh, an adjustment should be made to reduce line pressure. If shifts are soft, an adjustment should be made to increase line pressure. To increase control pressure, turn the adjusting screw in (clockwise). To decrease control line pressure, back the adjusting screw out (counterclockwise).

After the vacuum unit has been adjusted re-check the control pressure as outlined in Table 2. **All tests must be within specifications. The adjustable vacuum unit can not be used to allow for adjusting control pressures that are out of specications.** If control pressures are found to be out of specification, the cause must be determined and corrected before making an adjustment.

KICKDOWN SHIFTS

With the linkage adjusted as outlined, the transmission still might not downshift when it is road-tested because of bent or otherwise defective downshift control rod. Check this rod as follows:

1. With the engine off, depress the accelerator pedal to the floor, and hold it there.

2. Disconnect the downshift rod at the accelerator downshift lever and firmly push the rod all the way down.

3. Rotate the accelerator downshift lever clockwise against its stop and, **while holding the downshift rod all the way down,** try to connect the rod. If the connection cannot be made, the rod is too short and should be replaced.

STALL TEST

The stall test is made in D2, D1, L, or R (at full throttle only) to determine if the bands and clutches are holding properly. **While making this test, do not hold the throttle open for more than five seconds at a time.** Then move the selector lever to N and run the engine at 1000 rpm for about one minute to cool the converter before making the next test.

Connect a tachometer, and start the engine to allow it to reach its normal temperature. **Apply the service brakes firmly. The parking brake, due to the vacuum release operation, will not hold in R, D1, D2 or L.**

With the selector lever at D2, press the accelerator to the floor. Note the engine speed. Stall speeds are given in Part 7-3.

In D1 (car standing still), the front clutch and the one-way clutch are engaged at all accelerator pedal positions.

In D2 (car standing still), the front clutch and front band are engaged at all accelerator pedal positions. If the front band slips, the one-way clutch will hold, but operation will be for first gear.

In L, the front clutch and rear band are applied.

In R, the rear clutch and rear band are applied.

Perform the converter tests described in "Cleaning and Inspection" to determine if the stator clutch is defective.

If the engine speed exceeds the maximum limits, release the accelerator immediately because clutch or band slippage is indicated.

The band or clutch that is causing the slippage can be found by testing in another selector lever position. For example, should the transmission slip in R but not in D2, D1 or L, the probable cause is the rear clutch.

PERFORMANCE CHECKS

Performance checks should be made only after all preliminary checks have been completed. If an unsatisfactory operating condition is found during these checks, stop the checks and proceed to final diagnosis and correction of trouble.

INITIAL ENGAGEMENT CHECKS

Initial engagement checks are made to determine if initial band and clutch engagements are smooth.

Run the engine until the normal operating temperature is reached. **With the engine at the correct idle speed,** shift the selector lever from N to D2, and from N to D1. Observe the initial band and clutch engagements. Band and clutch engagements should be smooth in all positions. Rough initial engagements in D1, D2, L or R are caused by high engine idle speed, high control pressure, faulty operation of the pressure regulator valve or of the main control valve.

SHIFT POINT CHECKS

Check the light throttle upshifts in D1. The transmission should start in first gear and shift to second and then shift to third within the shift points as oulined in Part 7-3.

While the transmission is in third gear, depress the accelerator pedal through the detent (to the floor). The transmission should shift from third to second or third to first, depending on the car speed.

Check the closed throttle downshift from third to first by coasting down from about 30 mph in third gear. The shift should occur within the limits given in Part 7-3. A 3-2-1 shift may be experienced under the above conditions.

Partial-throttle downshifts in D1 may be checked by using the service brakes as a load. With the transmission in third gear, D1, and car speed at about 30 mph, depress and hold the accelerator at a half-throttle position. At the same time, apply the service brakes to the point that road speed is slowly reduced. The third to second and then second to first shifts should occur as road speed decreases.

When the selector lever is at D2, the transmission can operate only in second and third gears. Shift points for second to third and third to second are the same in both D2 and D1.

If the transmission is in third gear and road speed is above about 28 mph, the transmission should shift to second gear when the selector lever is moved from D2 or D1 to L. When the same manual shift is made below about 25 mph, the transmission will shift from second or third to first. This check will determine if the governor pressure and shift control valves are functioning properly.

CONVERTER CHECK

When the stall test speeds are low and the engine is properly tuned, converter stator clutch problems are indicated. A road test must be performed to determine the exact cause of the trouble.

If the stall test speeds are 300 to 400 rpm below the values shown in the specifications, Part 7-3, and the car cruises properly but has very poor acceleration, the stator clutch is slipping.

Remove the converter and check the stator clutch as described in "Cleaning and Inspection".

If the stall test speeds are 300 to 400 rpm below specifications and the car drags at cruising speeds and acceleration is poor, the stator clutch is installed backwards.

When the stall test shows normal speeds, the acceleration is good, but the car drags at cruising speeds, the difficulty is due to a seized stator assembly. If the stator is defective, replace the converter.

AIR PRESSURE CHECKS

A "NO DRIVE" condition can exist, even with correct transmission fluid pressure, because of inoperative clutches or bands. The inoperative units can be located through a series of checks by substituting air pressure for the fluid pressure to determine the location of the malfunction.

When the selector lever is at D2, D1 or L a "NO DRIVE" condition may be caused by an inoperative front clutch. When there is no drive in only L range, the difficulty could be caused by improper functioning

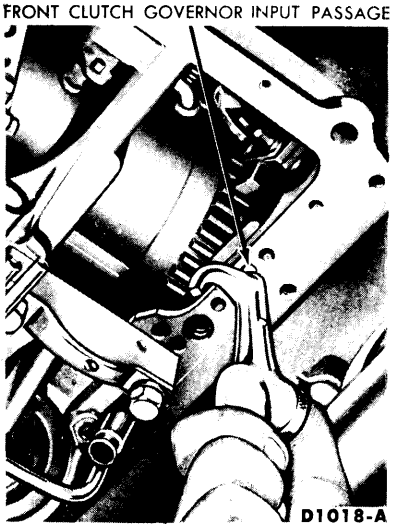


FIG. 7—Typical Front Clutch Air Check

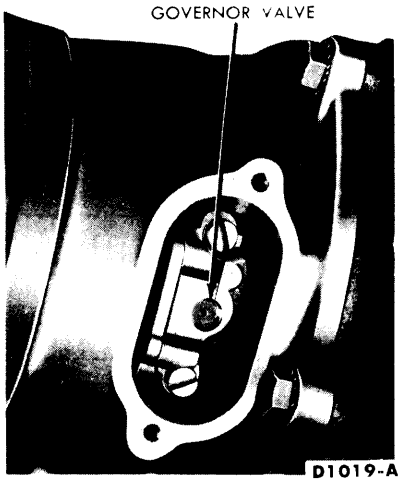


FIG. 8—Governor Valve

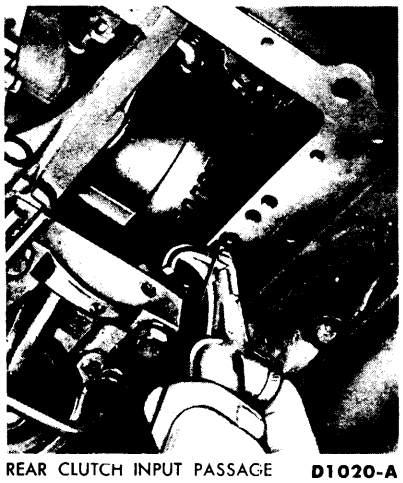


FIG. 9—Typical Rear Clutch Air Check

FIG. 10—Typical Rear Servo Air Check

of the planet one-way clutch. Failure to drive in reverse range could be caused by a malfunction of the rear clutch or rear band. Erratic shifts could be caused by a malfunction of the governor.

To make the air pressure checks, drain the transmission fluid, and then remove the oil pan and the control valve assembly.

The inoperative units can be located by introducing air pressure into the transmission case passages leading to the clutches, rear servo, and governor, and into the front servo apply and release tubes.

FRONT CLUTCH

Apply air pressure to the transmission case front clutch passage (Fig. 7). A dull thud can be heard when the clutch piston is applied. If no noise is heard, place the finger tips on the drum and again apply air pressure to the front clutch passage. Movement of the piston can be felt as the clutch is applied.

GOVERNOR

Remove the governor inspection cover from the extension housing. Apply air pressure to the front clutch passage, listen for a sharp click, and watch to see if the governor weight snaps inward (Fig. 8). Inward weight movement indicates correct governor valve operation.

REAR CLUTCH

Apply air pressure to the rear clutch passage (Fig. 9). A dull thud indicates that the rear clutch piston has moved to the applied position. If no noise is heard, place the finger tips on the rear drum and again apply air pressure to detect movement of the piston.

FRONT SERVO

Hold the air nozzle in the front servo apply tube. Operation of the front servo is indicated by a tightening of the front band around the drum. Continue to apply air pressure to the front servo apply tube, and introduce air pressure into the front servo release tube. **Hold a cloth over the release tube while applying the servo to catch the spray from the release tube.** The front servo should release the band against the apply pressure.

REAR SERVO

Apply air pressure to the rear servo apply passage (Fig. 10). The rear band should tighten around the drum if the rear servo is operating properly.

If either servo is inoperative, remove the inoperative unit and apply air pressure directly to its passages. Proper operation of the servos indi-

(Continued on page 7-9)

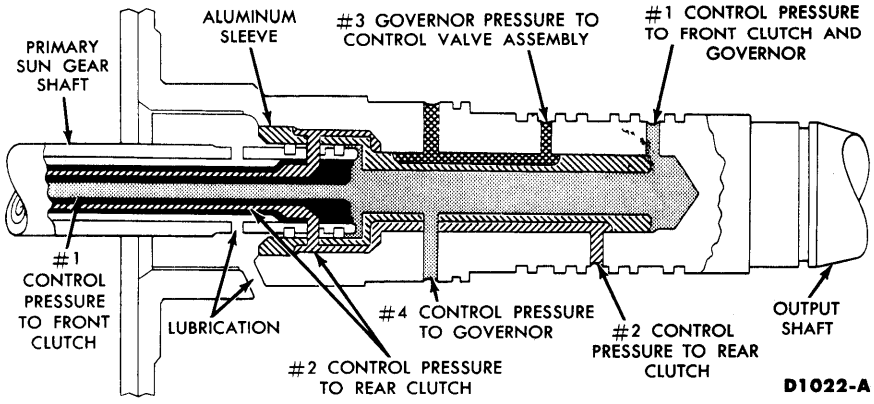


FIG. 11—Output and Primary Sun Gear Fluid Passages

DIAGNOSIS GUIDE—CRUISE-O-MATIC TRANSMISSION

The Cruise-O-Matic Diagnosis Guide lists the most common trouble symptoms that may be found and gives the items that should be checked to find the cause of the trouble.

The items to check are arranged in a logical sequence which should be followed for quickest results. The letter symbols for each item are explained in the key. If items A, B, C, K, and the stall test have already been checked during preliminary checks and adjustments, they need not be repeated.

CRUISE-O-MATIC DIAGNOSIS GUIDE

Trouble Symptom	Items to Check		Probable Trouble Sources
	Transmission in car	Transmission out of car	
Rough Initial Engagement in D1 or D2	K B W F E G		A. Fluid Level
1-2 or 2-3 Shift Points Incorrect	A B C D W E L		B. Vacuum Diaphragm Unit or Tubes
Rough 2-3 Shift	B G F E J		C. Manual Linkage
Engine Overspeeds on 2-3 Shift	B G E F	r	D. Governor
No 1-2 or 2-3 Shift	B D E C G J	b c f	E. Valve Body
No 3-1 Shift	K B E		F. Pressure Regulator
No Forced Downshifts	L W E		G. Front Band
Runaway Engine on Forced Downshift	G F E J B	c	H. Rear Band
Rough 3-2 or 3-1 Shift at Closed Throttle	K B E		I. Rear Servo
Creeps Excessively in D1 or D2	K		J. Front Servo
Slips or Chatters in First Gear, D1	A B W F E	a c f i	K. Engine Idle Speed
Slips or Chatters in Second Gear	A B G W F E J	a c	L. Downshift Linkage
Slips or Chatters in R	A H W F E I B	b c f	M. Converter Drain Plugs
No Drive in D1	C E	i	N. Oil Pan Gasket, Drain Plug or Tube
No Drive in D2	E R C	a c f	O. Oil Cooler and Connections
No Drive in L	E R	c f	P. Manual or Throttle Lever Shaft Seal
No Drive in R	H I E R C	b c f	Q. ⅛-inch Pipe Plug in Side of Case
No Drive in Any Selector Lever Position	A C W F E R	c	R. Perform Air-Pressure Check
Lockup in D1	C I J	b g c	S. Extension Housing to Case Gaskets and Lockwashers
Lockup in D2	C H I	b g c i	T. Center Support Bolt Lockwashers
Lockup in L	G J E	b g c	U. Extension Housing Rear Oil Seal
Lockup in R	G J	a g c	V. Governor Inspection Cover Gasket
Parking Lock Binds or Does Not Hold	C	g	W. Perform Control Pressure Check
Engine Does Not Start by Pushing Car	A C F E	e c	X. Speedometer Driven Gear Adapter Seal
Transmission Overheats	O F	n	a. Front Clutch
Maximum Speed Too Low, Poor Acceleration		n	b. Rear Clutch
Transmission Noisy in N	F	a d	c. Leakage in Hydraulic System
Transmission Noisy in First, Second, Third, or Reverse Gear	F	h a b d	d. Front Pump
Transmission Noisy in P	F	d	e. Rear Pump
Transmission Noisy During Coast at 30-20 mph in N, Engine Stopped		e	f. Fluid Distributor Sleeve in Output Shaft
Fluid Leak	M N O P Q S T U V X	j m p	g. Parking Linkage
			h. Planetary Assembly
			i. Planetary One-Way Clutch
			j. Engine Rear Oil Seal
			m. Front Pump Oil Seal
			n. Converter One-Way Clutch
			p. Front Pump to Case Gasket
			r. Rear Clutch Piston Air Bleed Valve

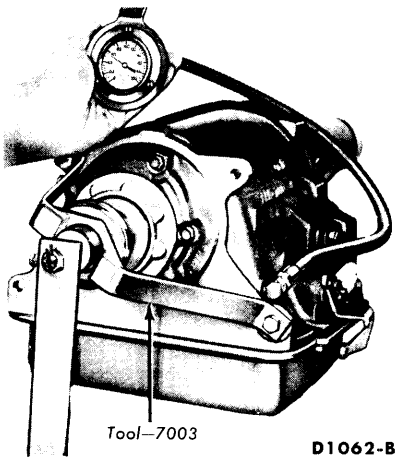


FIG. 12—Bench Testing Tool Installation—Typical

cates that the trouble is in the case passages. If the servo does not operate, disassemble, clean and inspect it to locate the source of the trouble.

If air pressure applied to either of the clutch passages fails to operate a clutch or operates both clutches at once, remove and, with air pressure, check the fluid passages at the output shaft aluminum sleeve for correct indexing with the shaft holes. Check the primary sun gear shaft assembly passages with air pressure to detect obstructions (Fig. 11).

If the output shaft and primary sun gear shaft passages are clear, remove the clutch assemblies, and clean and inspect the malfunctioning clutch to locate the trouble.

HYDRAULIC SYSTEM BENCH TESTS

After the transmission has been assembled and is ready for installation in the car, check the hydraulic system to make sure it is operating properly. These hydraulic tests can be made on the bench so that most malfunctions of the system can be corrected before the transmission is installed in the car.

TESTING TOOL INSTALLATION

1. Install a plug in the filler tube hole in the oil pan, and pour about 4 quarts of transmisssion fluid into the transmission through the speedometer gear opening.

2. Remove the vacuum diaphragm unit and the diaphragm unit push rod and install the vacuum unit, if these parts had been previously installed.

3. Install the bench testing tool on the transmission.

4. Remove the ⅛-inch pipe plug at the transmission case. Turn the front pump in a clockwise direction at 75-100 rpm until a regular flow of transmission fluid leaves the hole in the transmission case. This operation "bleeds" the air from the pump.

5. Install the pressure gauge (77820 or T57L-77820-A) as shown in Fig. 12.

PRESSURE TESTS

Turn the front pump at 75-100 rpm and note the gauge readings. The pressure readings on the bench test must be within the limits as outlined in Table 1 for test number one.

If pressure gauge readings are within limits in all selector lever positions, install the vacuum diaphragm push rod unit.

2 COMMON ADJUSTMENTS AND REPAIRS

TRANSMISSION FLUID LEVEL CHECK

The transmission fluid level should be checked using the following procedure.

1. Make sure that the car is standing level. Then firmly apply the parking brake.

2. Run the engine at normal idle speed. If the transmission fluid is cold, run the engine at fast idle speed (about 1200 rpm) until the fluid reaches its normal operating temperature. When the fluid is warm, slow the engine down to normal idle speed.

3. Shift the selector lever through all positions, and place the lever at P. Do not turn off the engine during the fluid level checks.

4. Clean all dirt from the transmission fluid dipstick cap before removing the dipstick from the filler tube.

5. Remove the dipstick from the tube, wipe it clean, and push it all the way back into the tube.

6. Pull the dipstick out of the tube again, and check the fluid level. If necessary, add enough fluid to the transmission through the filler tube to raise the fluid level to the F (Full) mark on the dipstick. **Do not overfill the transmission.**

TRANSMISSION FLUID DRAIN AND REFILL

Normal maintenance and lubrication requirements do not necessitate periodic automatic transmission fluid changes.

If a major failure has occurred within the transmission such as a clutch, band, bearing, etc., the transmission will have to be removed for service. At this time the converter must be thoroughly flushed to remove any dirt.

When filling a dry transmission and converter, install 6 quarts of fluid. Start the engine, shift the selector lever as in step 7 below, check and add fluid as necessary.

Following is the procedure for partial drain and refill due to front band adjustment or minor repair.

1. Disconnect the fluid filler tube from the transmission oil pan.

2. When the fluid has stopped draining from the transmission and converter, remove and thoroughly clean the oil pan. The filter-type screen cannot be cleaned. Discard the oil pan gasket.

3. Place a new gasket on the oil pan, and install the filter-type screen and pan on the transmission.

4. Connect the filler tube to the oil pan, and tighten the fitting securely.

5. Add 3 quarts of fluid to the transmission through the filler tube.

6. Run the engine at idle speed for about 2 minutes. Then run the engine at fast idle speed (about 1200 rpm) until it reaches its normal operating temperature. **Do not race the engine.**

7. Shift the selector lever through all the positions, place it at P, and check the fluid level. If necessary, add enough fluid to the transmission to raise the level to the F (Full) mark on the dipstick. **Do not overfill the transmission.**

OIL COOLER FLUSHING PROCEDURE

When a clutch or band failure or other internal trouble has occurred in the transmission, any metal particles or clutch plate or band material that may have been carried into the cooler should be removed

from the system by flushing the cooler before the transmission is put back into service.

1. Disconnect the fluid return line from the rear of the transmission.

2. Start the engine and drain about two quarts of fluid from the cooler into a pan. Discard the drained fluid. If there is no fluid flow or the fluid does not flow freely from the return line, shut off the engine and disconnect both lines from the cooler and transmission.

3. Use an air hose (with not more than 100 psi air pressure) to reverse flush the lines and the cooler.

4. Connect both lines to the cooler, and the pressure line to the transmission.

5. Start the engine and check the fluid flow. If the fluid flows freely, connect the return line to the transmission and fill the transmission with new fluid to the specified level. If there is no fluid flow or if the flow is restricted, replace the radiator. **Do not attempt to correct cooler or cooling line leaks by closing off the lines.**

6. When fluid leakage is found at the oil cooler, the entire radiator must be replaced. **The oil cooler cannot be removed from the radiator for replacement.**

3 CLEANING AND INSPECTION

Clean all parts with suitable solvent and use moisture free air to dry off all parts and clean out oil passages.

CONVERTER CLEANING

The converter cannot be disassembled for cleaning. If there is reason to believe that the converter has an excessive amount of foreign material in it, the following cleaning procedure should be used.

1. With the converter on the bench, remove both drain plugs and tilt the converter in all directions to drain as much fluid as possible.

2. Install the drain plugs and fill the converter through the pump drive hub with a light-body oil such as kerosene, or a cleaning solvent suitable for transmission cleaning.

3. Install the tool shown in Fig. 13 in the converter. Expand the bushing in the turbine spline. Rotate the tool to circulate the fluid in the converter.

4. Remove both drain plugs and thoroughly drain the converter.

Repeat steps 2, 3, and 4 as required to clean the converter. Replace the drain plugs.

TURBINE AND STATOR END PLAY CHECK

1. Insert the tool into the converter pump drive hub until it bottoms (Fig. 13).

2. Install the guide over the converter pump drive hub.

3. Expand the split fiber bushing in the turbine spline by tightening the adjusting nut. Tighten the adjusting nut until the tool is securely locked to the spline.

4. Attach a dial indicator to the tool (Fig. 13). Position the indicator button on a converter pump drive hub lug, and set the dial face at 0 (zero).

5. Lift the tool upward as far as it will go and note the indicator reading. The indicator reading is the total end play which the turbine and stator share. If the total end play exceeds the limits as outlined in the specifications, Part 7-3, replace the converter unit.

STATOR ONE-WAY CLUTCH CHECK

1. Loosen the adjusting nut to free the split bushing, and then remove the tool from the converter.

2. Install the stator outer race holding tool in one of the four holes provided in the stator (Fig 13).

3. Insert the tool in the converter pump drive hub. As the tool enters the converter, the pins will engage the stator clutch inner race spline.

4. Place a torque wrench on the tool (Fig. 13). The tool (and stator inner race) should turn freely clockwise (from the pump drive hub side of the converter). It should lock up and hold a 10 ft-lb pull when the wrench is turned counterclockwise. Try the clutch for lockup and hold in at least 5 different locations around the converter.

5. If the clutch fails to lock up and hold a 10 ft-lb torque, replace the converter unit.

STATOR TO IMPELLER INTERFERENCE CHECK

1. Position the front pump assembly on a bench with the spline end of the stator shaft pointing up (Fig. 14).

2. Mount a converter on the pump so that the splines on the one-way clutch inner race engage the mating splines of the stator support, and the converter hub engages the pump drive gear.

3. While holding the pump stationary, try to rotate the converter counterclockwise. The converter should rotate freely without any signs of inteference or scraping within the converter assembly.

4. If there is an indication of scraping, the trailing edges of the stator blades may be interfering with the leading edges of the impeller blades. In such cases, replace the converter.

STATOR TO TURBINE INTERFERENCE CHECK

1. Position the converter on the bench front side down.

2. Install a front pump assembly to engage the mating splines of the stator support and stator, and pump drive gear lugs.

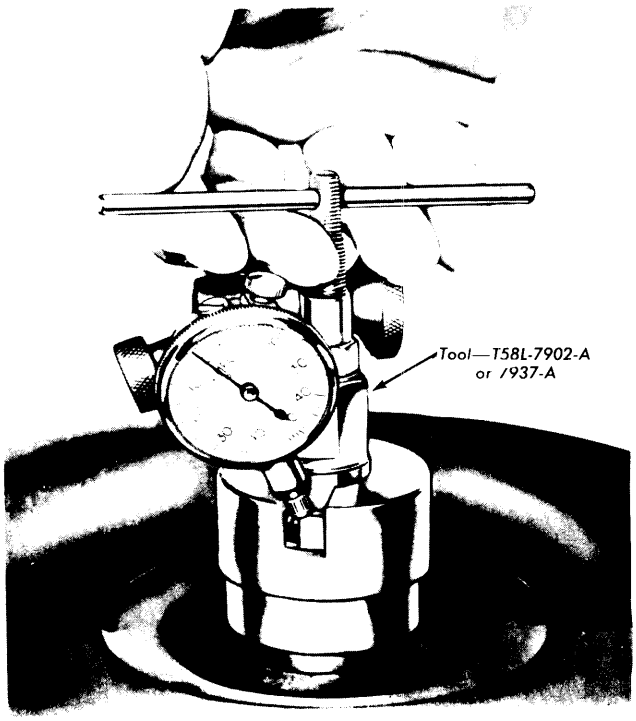
3. Install the input shaft, engaging the splines with the turbine hub (Fig. 15).

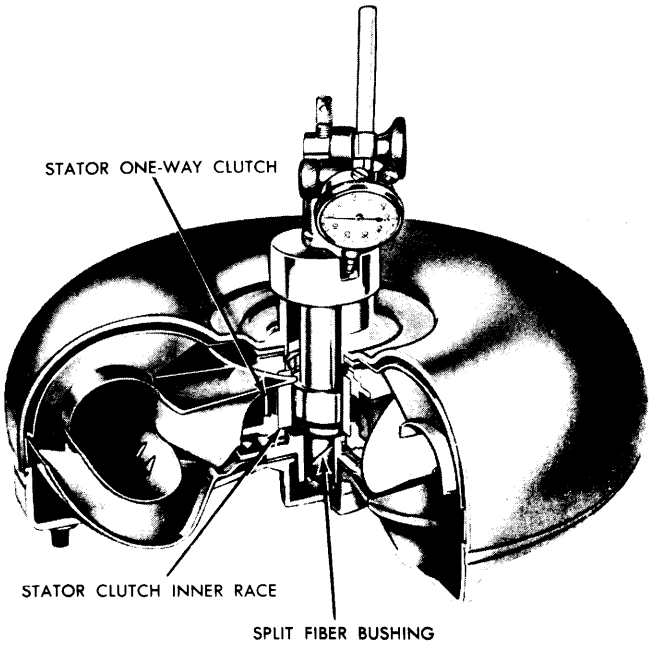
4. While holding the pump stationary, attempt to rotate the turbine with the input shaft. The turbine should rotate freely in both directions without any signs of interference or scraping noise.

5. If interference exists, the stator front thrust washer may be worn, allowing the stator to hit the turbine. In such cases, the converter must be replaced.

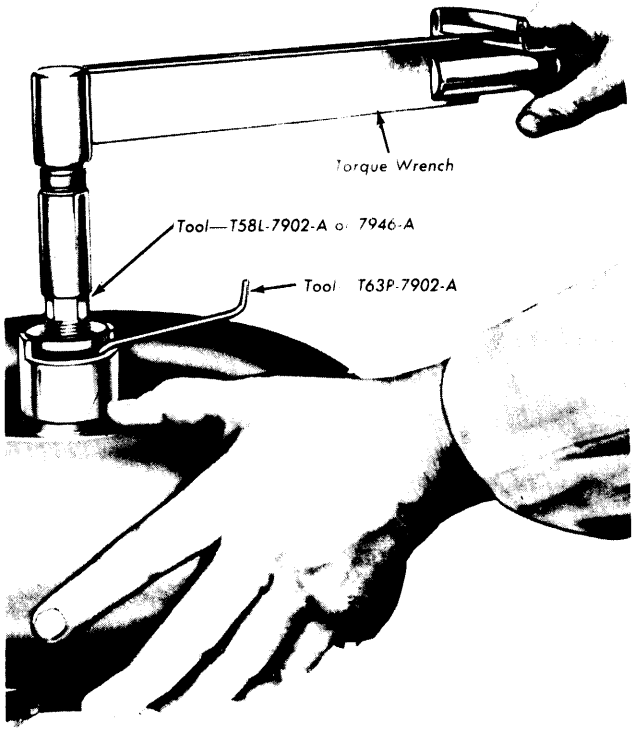
OUTPUT SHAFT AND PRIMARY SUN GEAR SHAFT

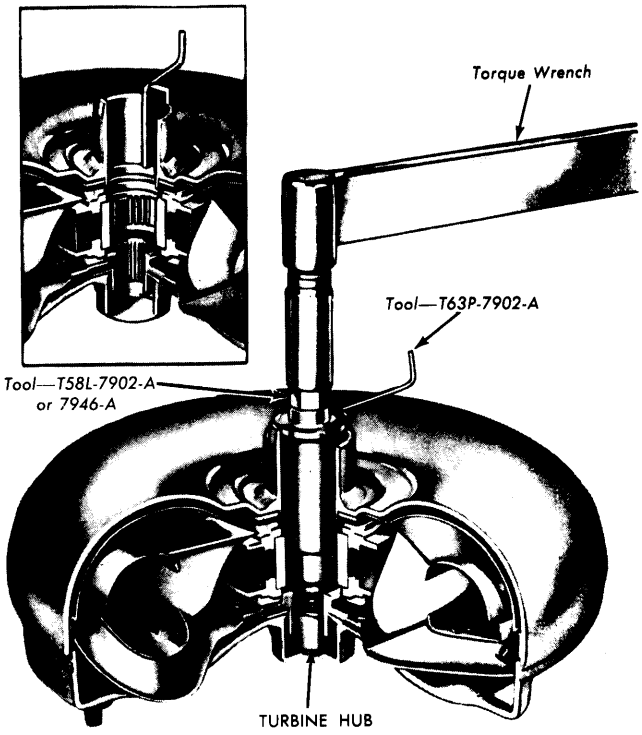
1. Inspect the thrust surfaces and journals for scores. Inspect the internal gear for broken or worn teeth.





END PLAY CHECK





STATOR CLUTCH CHECK

D1064-B

FIG. 13—Typical Converter Checking Tool

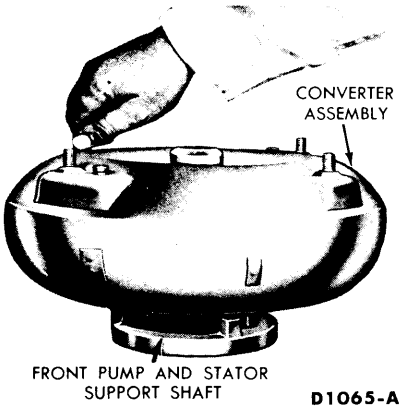


FIG. 14–Stator To Impeller Interference Check

2. Inspect the aluminum sleeve for scores or leakage. Inspect the ring grooves for burrs.

3. Inspect the keyway and drive ball pocket for wear, and inspect the splines for burrs or wear.

4. Inspect the output shaft sleeve for alignment with the governor drive ball (Fig. 16).

5. Inspect the external parking gear teeth for damage and the speedometer drive gear teeth for burrs.

6. If either the output shaft or ring gear has been replaced, place the assembled unit with the gear face down on the bench, push the shaft downward, and check the clearance between the top of the snap ring and its groove (Fig. 17). If this clearance exceeds 0.002 inch, replace the snap ring with a thicker ring to reduce the clearance to less than 0.002 inch. Selective snap rings are available in several thicknesses for this purpose.

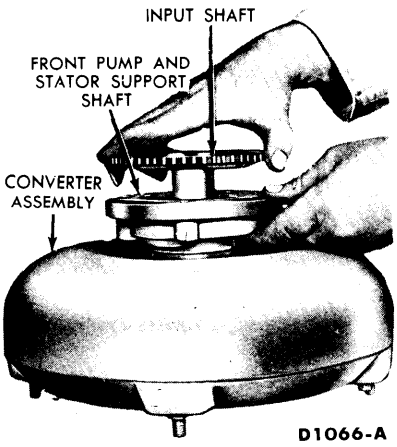


FIG. 15–Stator To Turbine Interference Check

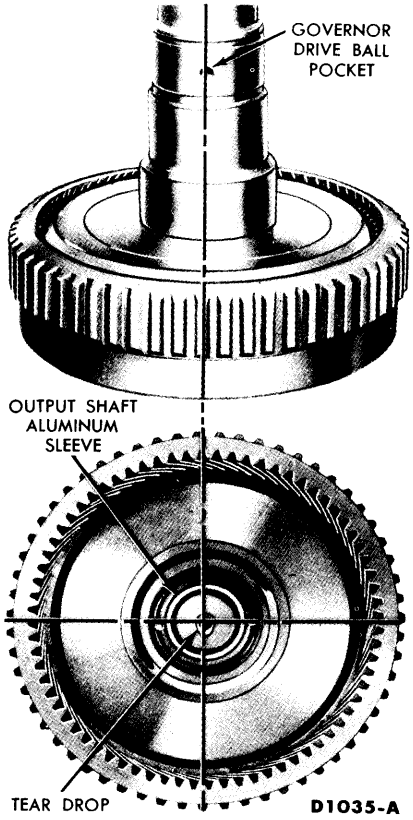


FIG. 16–Correct Position of Output Shaft Sleeve

7. Inspect the rubber seal and stop ring at the front of the output shaft spline. If wear or damage is evident, replace the parts.

8. Inspect the primary sun gear for broken or worn teeth. Inspect all thrust surfaces and journals for scores. Check all fluid passages (Fig. 18) for obstructions and leakage. Inspect the seal ring grooves for burrs.

9. Inspect the sun gear shaft splines for burrs and wear.

10. Check the fit of the seal rings in the grooves of the sun gear shaft. The rings should enter the grooves freely without bind.

11. Check the fit of the sun gear seal rings in their respective bores. A clearance of 0.002-0.009 inch should exist between the ends of the rings.

12. Install the seal rings on the sun gear shaft, and check for free movement in the grooves.

DISTRIBUTOR SLEEVE

1. Inspect the distributor sleeve for scores or excessive ring wear.

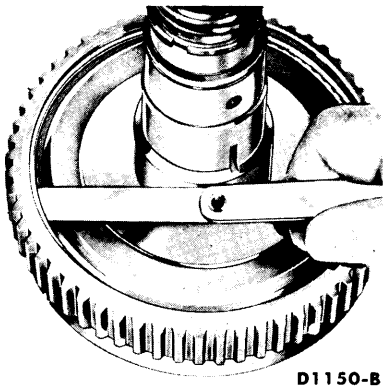


FIG. 17–Checking Output Shaft Snap Ring Clearance

Inspect the distributor sleeve passages for obstructions.

2. Check the fit of the fluid tubes in the distributor.

PINION CARRIER, ONE-WAY CLUTCH AND CENTER SUPPORT

1. Inspect the clutch outer race, inner race, band surface, pinion gears, bearings, and thrust washer for roughness.

2. Inspect the center support bushings for roughness.

3. Inspect the one-way clutch cage rollers and springs for excessive wear or damage.

EXTENSION HOUSING

1. Inspect the housing for cracks. Inspect the gasket surface for burrs or warpage. Check for leakage around the governor inspection cover and gasket. If leakage is found, install a new gasket.

2. Inspect the bushing for scores or wear.

3. Inspect the rear seal for hardness, cracks, or wear. If the seal shows wear or deterioration replace the seal.

Inspect the seal counterbore and remove all burrs and scores with crocus cloth.

REAR CLUTCH

1. Inspect the drum band surface, the bushings, and thrust surfaces for scores. Minor scores may be removed with crocus cloth. Do not smooth out the surface of the drum below a 63 micro finish. **Badly scored parts must be replaced.**

2. Inspect the needle bearing for worn rollers. Inspect the clutch

piston bore and the piston inner and outer bearing surfaces for scores.

Check the air bleed ball valve in the clutch piston for free movement. Check the orifice to make sure it is not plugged.

3. Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.

4. Inspect the clutch plates for scores, and check the plates for fit on the clutch hub serrations. Replace all plates that are badly scored or do not fit freely in the hub serrations. **Front clutch plates differ in friction characteristics from rear clutch plates and are not interchangeable.**

5. Inspect the clutch pressure plate for scores on the clutch plate bearing surface. Check the clutch release spring for distortion. Position the steel plates on a flat surface. Check the coning with a feeler gauge (Fig. 19). The plates are coned 0.010 inch.

FRONT CLUTCH

1. Inspect the clutch cylinder thrust surfaces, piston bore, and clutch plate serrations for scores or burrs. Minor scores or burrs may be removed with crocus cloth. Replace the clutch cylinder if it is badly scored or damaged.

2. Check the fluid passage in the clutch cylinder for obstructions. Clean out all fluid passages. Inspect the clutch piston for scores and replace if necessary.

Inspect the piston check ball for freedom of movement and proper seating.

3. Check the clutch release spring for distortion and cracks. Replace the spring if it is distorted or cracked.

4. Inspect the bronze composition and the steel clutch plates and the clutch pressure plate for scored bearing surfaces. Replace all parts that are deeply scored.

5. Check the clutch plates for flatness and fit on the clutch hub serrations. Discard any plate that does not slide freely on the serrations or that is not flat. **Front clutch plates differ in friction characteristics from the rear clutch plates and are not interchangeable.**

6. Check the clutch hub thrust surfaces for scores and the clutch hub splines for wear.

7. Inspect the turbine shaft bearing surfaces for scores. If excessive clearance or scores are found, discard the unit.

8. Check the splines on the turbine shaft for wear and replace the shaft if the splines are excessively worn. Inspect the bushing in the turbine shaft for scores.

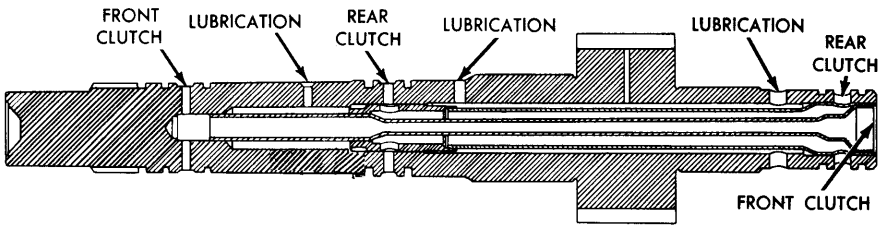


FIG. 18—Cross Section of Primary Sun Gear Shaft

FRONT PUMP

1. Inspect the mating surfaces of the pump body and cover for burrs.

2. Inspect the drive and driven gear bearing surface for scores, and check the gear teeth for burrs. Inspect the stator support splines for burrs and wear.

3. Check the fluid passages for obstructions.

4. If any parts other than the stator support are found defective, replace the pump as a unit. Minor burrs and scores may be removed with crocus cloth. The stator support is serviced separately.

REAR PUMP

1. Remove the drive and driven gears from the pump body.

2. Inspect the gear pockets and the crescent of the pump body for scores or pitting.

3. Inspect the inner bushing and the drive and driven gear bearing surfaces for scores.

4. Check all fluid passages for obstructions, and check mating surfaces and gasket surfaces of the pump body and cover for burrs.

5. Inspect the pump cover bearing surface for scores. Minor burrs or scores may be removed with crocus cloth.

6. If any pump parts, other than the pump cover, are defective, replace the pump as a unit. The pump cover can be replaced separately.

PRESSURE REGULATOR

1. Inspect the regulator body and cover mating surface for burrs.

2. Check all fluid passages for obstructions.

3. Inspect the control pressure and converter pressure valves and bores for burrs and scores. Remove all burrs carefully with crocus cloth.

4. Check free movement of the valves in their bores. The valves should fall freely into the bores when both the valve and bore are dry.

5. Inspect the valve springs and spacers for distortion.

VALVE BODY

1. Clean all parts thoroughly in clean solvent, and then blow them dry with moisture-free compressed air.

2. Inspect all valve and plug bores for scores. Check all fluid passages for obstructions. Inspect the check valve for free movement. Inspect all mating surfaces for burrs or distortion. Inspect all plugs and valves for burrs and scores. **Crocus cloth can be used to polish valves and plugs if care is taken to avoid rounding the sharp edges of the valves and plugs.**

3. Inspect all springs for distortion. Check all valves and plugs for free movement in their respective bores. Valves and plugs, when dry, must fall from their own weight in their respective bores.

4. Roll the manual valve on a flat surface to check it for a bent condition.

GOVERNOR

1. Inspect the governor valve and bore for scores. Minor scores may be removed with crocus cloth. Replace the governor if the valve or body is deeply scored.

2. Check for free movement of the valve in the bore. Inspect fluid passages in the valve body and counterweight for obstructions. **All fluid passages must be clean.**

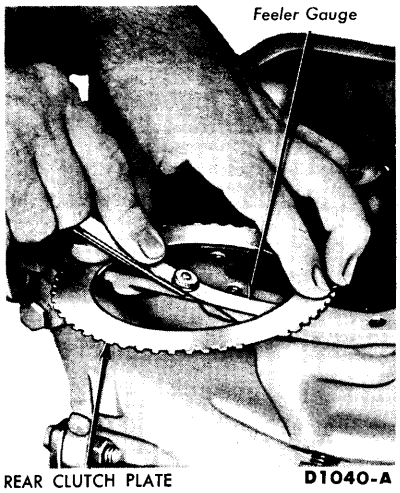


FIG. 19–Check Rear Clutch Steel Plate Coning

3. Inspect the mating surfaces of the governor body and counterweight for burrs and distortion. Mating surfaces must be smooth and flat.

FRONT SERVO

1. Inspect the servo body for cracks and the piston bore and the servo piston stem for scores. Check fluid passages for obstructions.

2. Check the actuating lever for free movement, and inspect it for wear. If necessary to replace the actuating lever or shaft, remove the retaining pin and push the shaft out of the bracket.

Inspect the adjusting screw threads and the threads in the lever.

3. Check the servo spring and servo band strut for distortion.

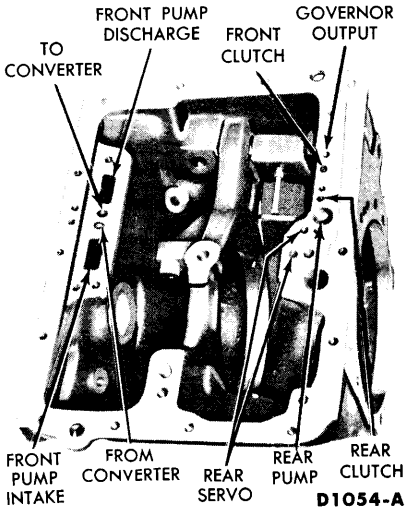


FIG. 20–Transmission Case Fluid Passages

REAR SERVO

1. Inspect the servo body for cracks and the piston bore for scores. Inspect the servo body to transmission case mating surface for burrs.

2. Check the fluid passages for obstructions. Inspect the fluid passage plugs for tightness in the body. Check the orifice in the servo piston for dirt. Inspect the check valve in the servo piston for freedom of movement and proper seating.

3. Inspect the actuating lever socket for scores and wear. Check the actuating lever and shaft for wear.

4. Inspect the band and the struts for distortion. Inspect the band ends for cracks.

5. Inspect the servo spring for distortion.

6. Inspect the servo band lining for excessive wear and bonding to the metal band. **The band should be replaced if worn to a point where grooves are not clearly evident.**

CASE

Inspect the case for cracks and stripped threads. Inspect the gasket surfaces and mating surfaces for burrs. Check the vent for obstructions, and check all fluid passages for obstructions and leakage (Fig. 20).

Inspect the case bushing and center support bushing for scores. Inspect the torsion lever pin for wear.

Check all parking linkage parts for wear or damage.

PART 7-2 CRUISE-O-MATIC TRANSMISSION

1 DESCRIPTION AND OPERATION

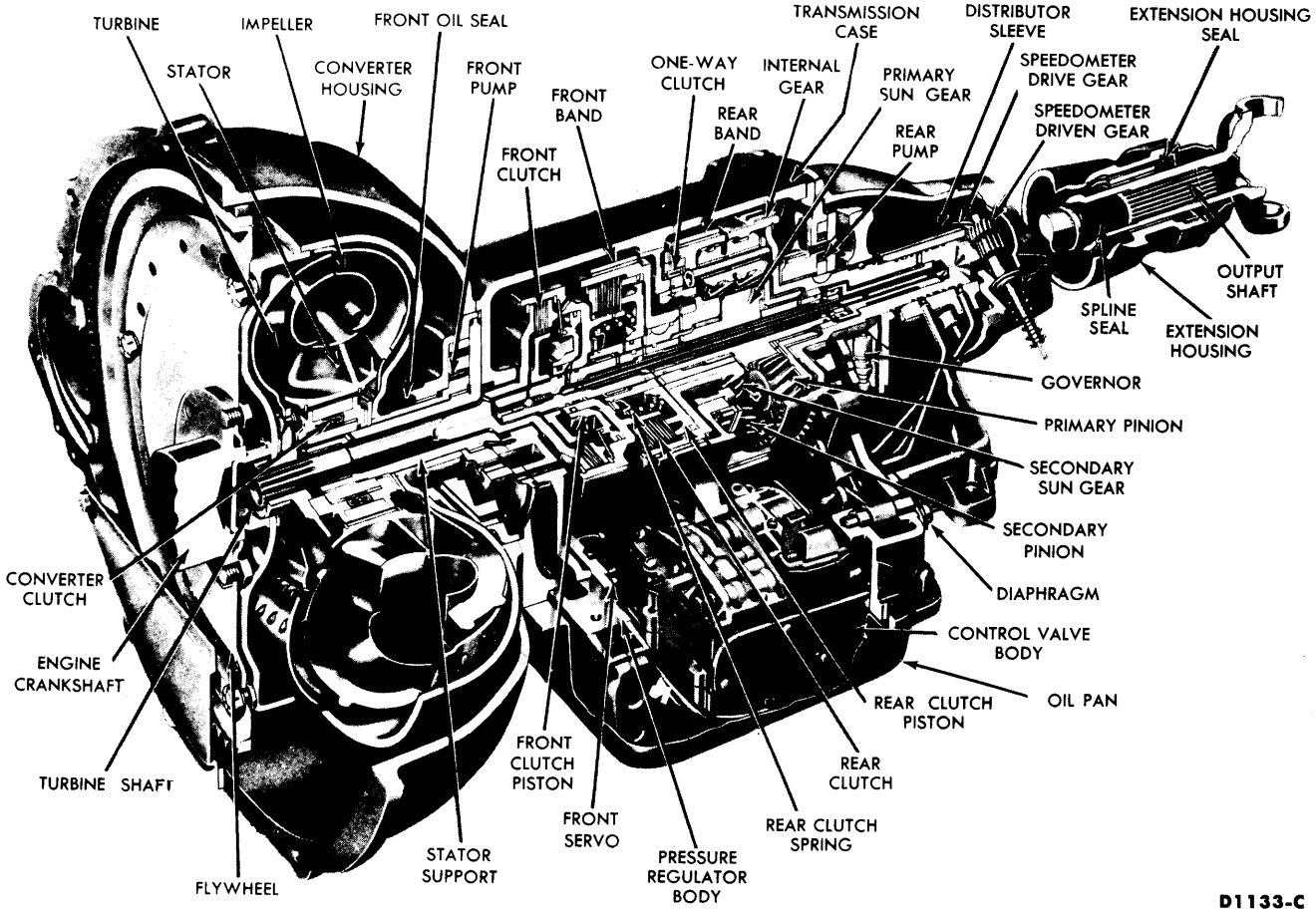


FIG. 1—Typical Cruise-O-Matic Transmission

DESCRIPTION

The Cruise-O-Matic transmission consists of a hydraulic torque converter (Fig. 1) and a planetary gear train along with a hydraulic control system. The various driving ranges are selected by the driver by positioning the shift lever on the steering column in the desired range. The hydraulic control system regulates transmission pressures and automatically selects or changes the gear ratios in relation to the position of the shift lever and speed of the car.

IDENTIFICATION

An identification tag (Fig. 2) attached to the side of the transmission, includes the model prefix and suffix, as well as a service identification number and serial number. The service identification number indicates changes to service details which affect interchangeability **when the transmission model is not changed.** For interpretation of this number, see the Master Parts Catalog.

The tag must be kept with the individual transmission it was originally installed on. If the tag was removed during disassembly, reinstall it on the same unit.

TORQUE CONVERTER

The hydraulic torque converter (Fig. 3) consists of an impeller (pump), a turbine, and a stator. All these parts are enclosed and operate in a fluid-filled housing.

When the engine is running, the fluid in the torque converter flows from the impeller to the turbine and back to the impeller through the

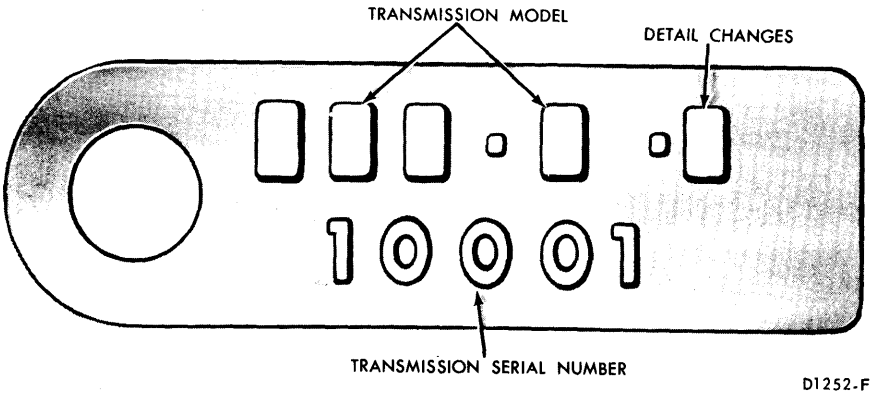


FIG. 2—Transmission Identification Tag

stator. This flow produces a maximum torque increase of about 2 to 1 when the turbine is stalled. When enough torque is developed by the impeller, the turbine begins to rotate, turning the turbine shaft.

The converter torque multiplication gradually tapers off as turbine speed approaches impeller speed, and it becomes 1 to 1 when the turbine is being driven at 9/10 impeller speed. This is known as the "coupling point."

When the turbine is rotating at less than 9/10 impeller speed, the converter is multiplying torque. The fluid leaving the turbine blades strikes the front face of the stator blades. These blades are held stationary by the action of a one-way clutch (Fig. 3) as long as the fluid is directed against the front face of the blades.

When the turbine rotates faster than 9/10 impeller speed, the converter no longer multiplies torque. The fluid is directed against the back face of the stator blades. As the one-way clutch permits the stator to rotate only in the direction of impeller rotation, the stator begins to turn with the impeller and turbine. The converter operates as an efficient fluid coupling as long as the turbine speed remains greater than 9/10 impeller speed.

A constant flow of fluid into and out of the converter is maintained. Some of the fluid coming out of the converter is forced through a cooler located in the radiator tank.

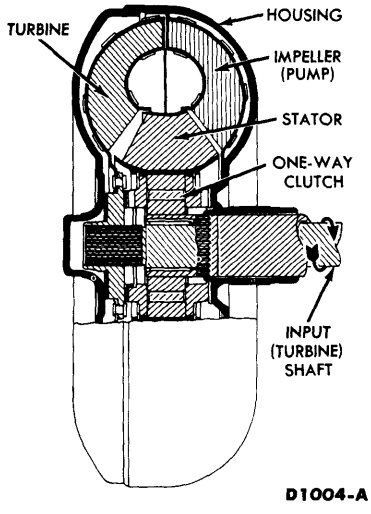


FIG. 3—Cross-Section of Typical Torque Converter

OPERATION OF PLANETARY GEAR TRAIN, CLUTCHES, BANDS, AND SERVOS

PLANETARY GEAR TRAIN

The planetary gear train consists of a primary sun gear, secondary sun gear, primary and secondary pinions which are held in a common carrier, and an internal gear to which the transmission output shaft is attached (Fig. 4).

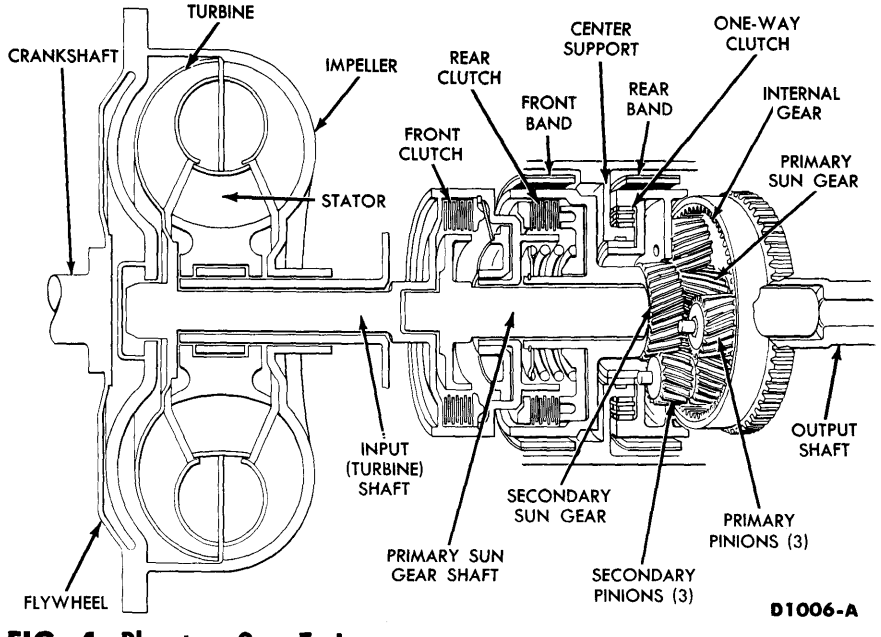


FIG. 4—Planetary Gear Train

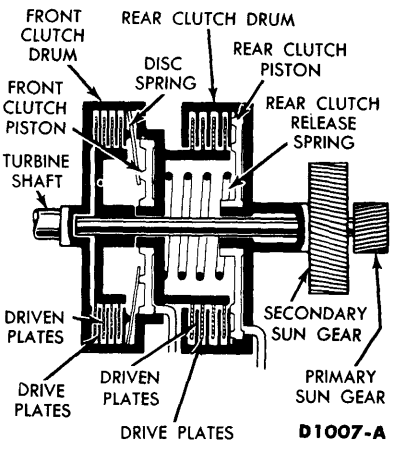


FIG. 5—Front and Rear Clutches

FRONT CLUTCH

The front clutch drive plates (Fig. 5) are connected to the turbine shaft through the front clutch drum. The driven plates are connected to the primary sun gear shaft.

The front clutch is operated by fluid pressure against the clutch piston. The piston moves against a disc spring which acts as a lever to lock the drive and driven plates together. When the clutch is applied, the primary sun gear is locked to and driven by the turbine shaft. The piston is returned to the release position by the

disc spring when the fluid pressure is removed (Fig. 5). A check ball is installed in the front clutch piston to permit fluid exhaust when the piston is in its released position.

In neutral, the front clutch drum and steel plates are being driven while the bronze plates are stationary. In reverse, the clutch is not applied, since the steel and bronze plates must rotate in opposite directions.

REAR CLUTCH

The rear clutch (Fig. 5) is operated by fluid pressure against the clutch piston. Movement of the piston compresses the release spring and locks the multiple-disc clutch. The rear clutch drive plates are splined to the front clutch drum and the driven plates are connected to the rear clutch drum and secondary sun gear. When the rear clutch is applied (in the reverse and third gear ratios) the secondary sun gear is driven. The piston is returned to the released position by the release spring (Fig. 5).

In neutral, the rear clutch bronze plates are being driven while the steel plates are free. In second gear, the bronze plates are driven, but the steel plates are held stationary. In first gear, the bronze plates are driven clockwise at engine speed while the steel plates are driven counterclockwise.

FRONT BAND AND SERVO

One end of the front band, which encircles the rear clutch drum, is anchored to the transmission case, and the other end is connected to the front servo (Fig. 6).

Fluid pressure moves the front servo piston against the inner end of the front servo acuating lever. Force is transmitted through a strut between the outer end of the lever and the end of the band to tighten the band around the rear clutch drum. Under certain conditions, the servo is released by directing fluid pressure to the opposite end of the piston, assisted by release spring force.

REAR BAND AND SERVO

The rear band fits around the planetary gear drum. One end of the band contacts the end of the band adjusting screw, and the other end connects to the rear servo.

Two rear servo pistons apply the rear band (Fig. 7). The small (fast acting) piston, which is in direct contact with the servo lever, is located inside the large piston.

Fluid pressure against the large piston flows through a check valve to work against the small piston, which has low pressure resistance from the spring force of the rear band and whatever friction is in the servo lever and band struts. At a low apply pressure and small volume of fluid flow, the small piston moves and tightens the rear band on the pinion carrier.

When the apply pressure builds up to about 10 psi, the large piston moves against its return spring, allowing the check valve to close. When the check valve closes, the fluid in the small piston is trapped, and the apply force of the large piston is added to that of the small piston.

POWER FLOWS

Table 1 lists the ratios obtained through the various power flows.

POWER FLOW—NEUTRAL

When the transmission is in neutral (Fig. 8), no gears are held or driven, and no power is transmitted to the output shaft.

POWER FLOW—FIRST GEAR, L

In first gear when the selector lever is at L, the primary sun gear is driven and the pinion carrier is held by the rear band (Fig. 8). Power is transmitted to the primary pinions,

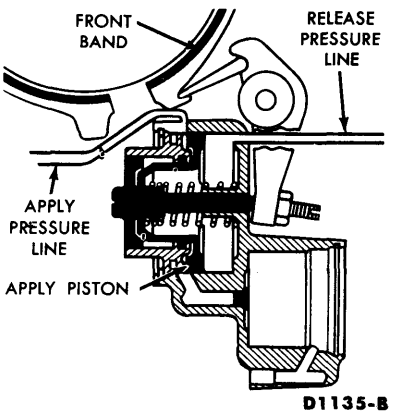


FIG. 6—Typical Front Servo

the secondary pinions, and the internal gear, driving the internal gear in the same direction as the primary sun gear. The secondary sun gear turns free in the reverse direction and has no effect on the gear train.

POWER FLOW—FIRST GEAR, D1

In first gear at the D1 selector lever position (large dot on selector indicator), the pinion carrier is held against rotation by the one-way clutch instead of by the rear band (Fig. 8). First gear in D1 is the only gear that uses the one-way clutch.

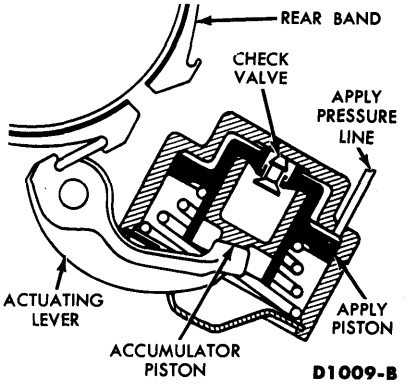


FIG. 7—Typical Rear Band and Servo

Table 1—Cruise-O-Matic Gear Ratios

Gear	Selector Lever Position	Clutch Applied	Band Applied	Gear Ratio
Neutral	N	None	None	—
First	D1 or L	Front	Rear*	2.40:1
Second	D1 or D2	Front	Front	1.47:1
Third	D1 or D2	Front and Rear	None	1.00:1
Reverse	R	Rear	Rear	2.00:1

*In first gear D1, the planet carrier is held against rotation by the one-way clutch.

POWER FLOW–SECOND GEAR

Second gear ratio is obtained by driving the primary sun gear and holding the secondary sun gear (Fig. 8). The primary pinions drive the secondary pinions, causing them to "walk" around the secondary sun gear and to carry the internal gear and output shaft around with them.

POWER FLOW–THIRD GEAR

In third gear, the primary and secondary sun gears are locked together and driven as a unit (Fig. 8). Therefore, the pinions cannot rotate and the entire planetary train revolves as a unit, which causes the output shaft to rotate at the same speed as the turbine shaft.

POWER FLOW–REVERSE

Reverse gear is obtained by driving the secondary sun gear and holding the pinion carrier (Fig. 8). The secondary pinions drive the internal gear in the reverse direction. The primary sun gear and the primary pinions rotate freely and have no effect on the gear train.

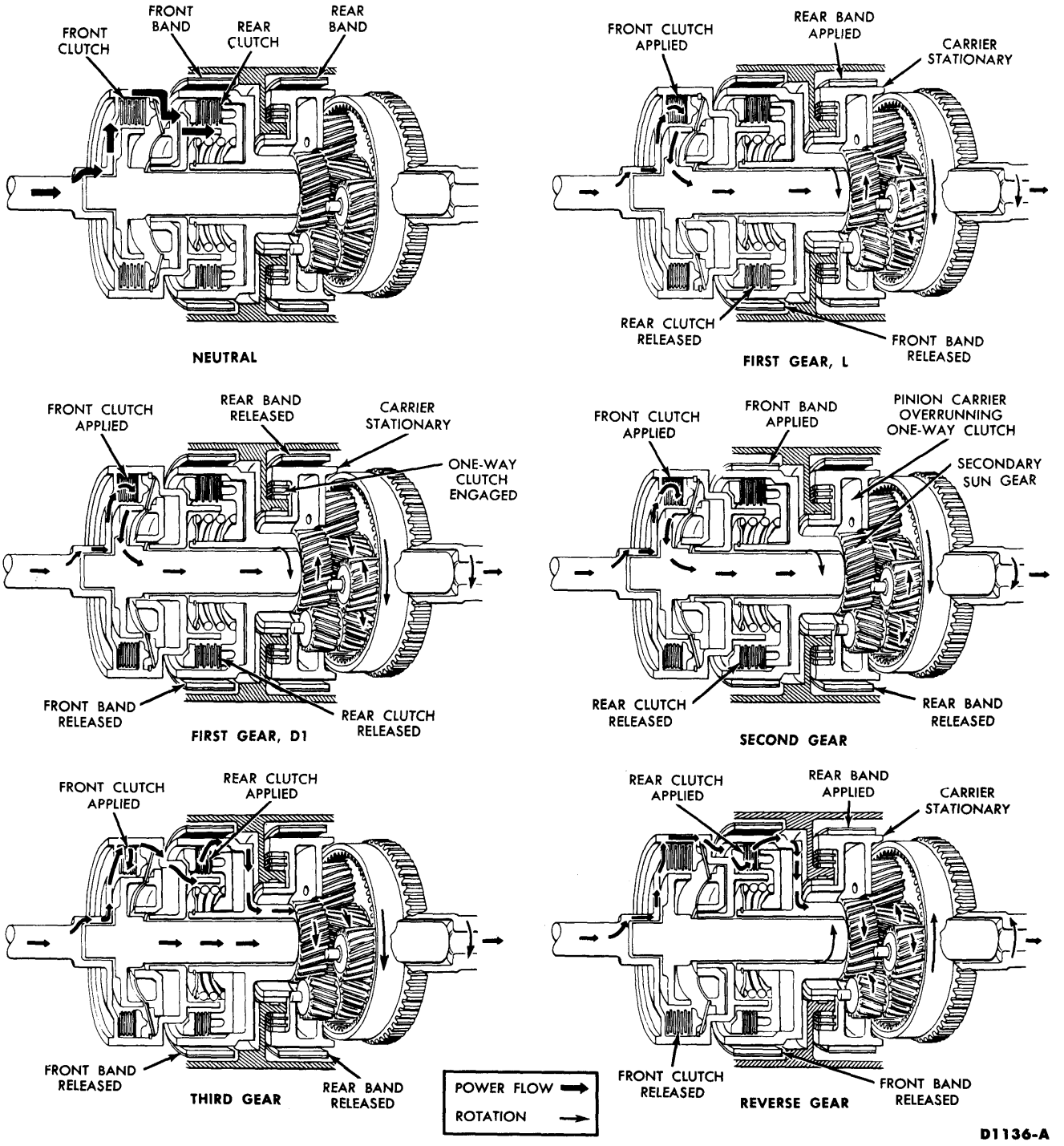


FIG. 8–Power Flow

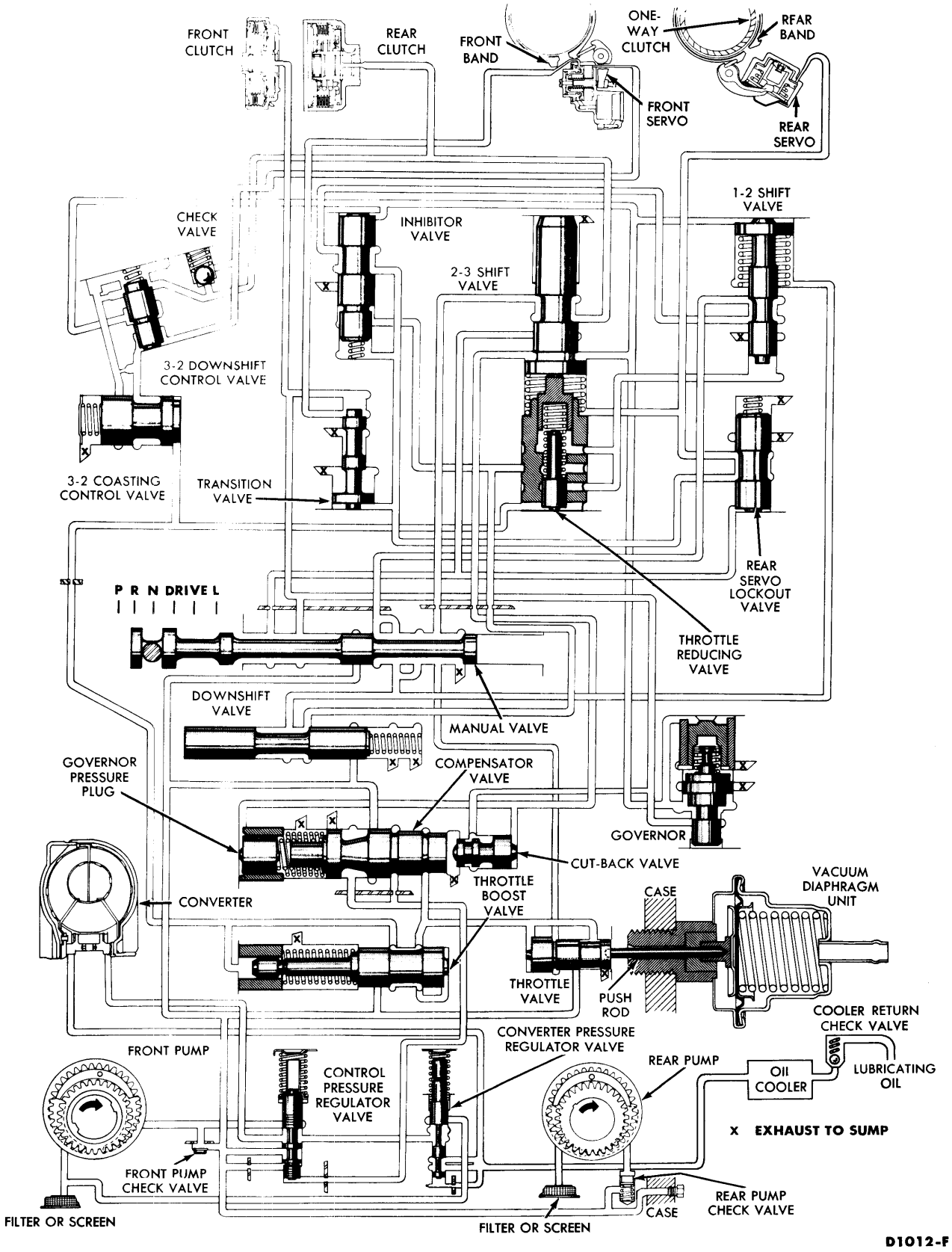


FIG. 9—Hydraulic Control System—Neutral Position

POWER FLOW–PARK POSITION

When the selector lever is in the P (park) position, the parking pawl engages the external teeth on the internal gear to lock the internal gear and output shaft to the case. This locks the rear wheels to prevent movement of the car.

HYDRAULIC CONTROL SYSTEM OPERATION

PRESSURE PUMPS

The front pump, driven by the converter impeller, delivers fluid pressure to the hydraulic control system whenever the engine is running. The rear pump, driven by the transmission output shaft, delivers fluid pressure to the control system when the car moves forward.

Both pumps deliver fluid pressure to the control pressure regulator and control valve body. A regulated control pressure is available at the control valve body whenever the engine is running.

CONTROL PRESSURE AND COMPENSATOR PRESSURE

Control pressure is regulated by the spring-loaded control pressure regulator valve (Fig. 9). It is adjusted to engine torque, road speed, and selector lever position.

To accomplish this, compensator pressure under various conditions is adjusted by throttle pressure (engine torque), governor pressure (road speed), or selector lever position. Compensator pressure, in turn, adjusts control pressure.

CONVERTER PRESSURE

Like control pressure, converter pressure is regulated by the converter pressure regulator valve spring and is adjusted to driving conditions by compensator pressure and selector lever positions.

THROTTLE PRESSURE

Throttle pressure adjusts the transmission operation to engine torque. Throttle pressure is produced from control pressure by the throttle valve (Fig. 9). The throttle valve is controlled by a spring-loaded vacuum diaphragm unit mounted on the rear of the transmission case.

The vacuum diaphragm is actuated by the engine intake manifold vacuum, working against spring pressure. When the vacuum is higher than 16" Hg the diaphragm moves against spring pressure and moves the push rod away from the throttle valve to cut off the throttle pressure regulation. As the engine throttle is advanced, manifold vacuum will fall below 16" Hg. As the vacuum drops, the spring-loaded diaphragm moves the push rod to open the throttle valve and increase the throttle pressure.

THROTTLE PRESSURE BOOST VALVE

To compensate for the slight manifold vacuum changes with throttle movements beyond about 50° carburetor valve opening, a throttle pressure boost valve comes into operation. At 51 psi throttle pressure, the spring-loaded boost valve (Fig. 9) comes into balance. Throttle pressure below 51 psi cannot move the boost valve against spring force plus throttle pressure force acting at the boost valve plug. Below 51 psi, therefore, throttle pressure will flow through the boost valve without interference.

Throttle pressure above 51 psi will move the boost valve to the left (Fig. 9). This movement will first cut off throttle pressure flow to the shift valves and coasting control valve and it will then open a passage to permit the new boosted throttle pressure to flow to the shift valves and the coasting control valve. Throttle pressure will continue to work against the right-hand end of the boost valve. For each pound of increase in throttle pressure (above 51 psi), the boosted throttle pressure will increase about three pounds.

GOVERNOR PRESSURE

Governor pressure is produced from front clutch control pressure by the valve in the governor body which rotates at output shaft speed.

The governor valve is a balanced valve. It is balanced between centrifugal force acting on the governor valve plus governor spring force and governor pressure force (Fig. 9). Governor pressure is, therefore, proportional to road speed.

TRANSITION VALVE

The transition valve controls the front servo apply pressure flow.

In the D1 range, the transition valve blocks front servo apply pressure flow, until the 1-2 valve is closed by governor pressure.

In the D2 range (small dot to the right of N), the transition valve permits front servo apply pressure to flow through it at all times.

1-2 SHIFT VALVE

The 1-2 shift valve controls the 1-2 upshift in the D1 range. On the 2-1 downshift, either manual (shift to L) or kickdown, the 1-2 shift valve controls the shift only within the road speed range permitted by the inhibitor valve.

The 1-2 valve is held in its rest (open) position by a spring. It is closed by governor pressure. Under various driving conditions, governor pressure is opposed by spring force plus reduced throttle and reduced boosted throttle pressures, and control pressure.

REAR SERVO LOCKOUT VALVE

The rear servo lockout valve blocks control pressure flow to the rear servo (rear servo apply pressure) in the D1 and D2 ranges.

THROTTLE REDUCING VALVE

Before throttle pressure or boosted throttle pressure is admitted to the front face of the 2-3 shift valve, it must open a passage past the spring-loaded throttle reducing valve.

Approximately 20 psi throttle pressure is required to move the plug against its spring far enough to open the passage. Once past the valve, throttle pressure will work on the spring end of the valve and exert a force to cut off throttle pressure flow past the valve. In this case, the valve becomes balanced between throttle pressure force on the one end and spring force plus throttle pressure force on the other end. The pressure past the valve will, therefore, be reduced.

2-3 SHIFT VALVE

The 2-3 shift valve controls the 2-3 upshift and the 3-2 downshift. The valve is held in its rest (closed) position by springs. It is opened by governor pressure. Under various driving conditions, governor pressure is opposed by spring force plus throttle or boosted throttle pressures, and control pressure.

INHIBITOR VALVE

The inhibitor valve prevents a 2-1 downshift, either manual or kickdown, at excessive road speeds.

The inhibitor valve is held in its rest (open) position by a spring, and is closed by governor pressure. Under various driving conditions, governor pressure is opposed by spring force plus control pressure.

3-2 COASTING CONTROL VALVE

The 3-2 coasting control valve operates in the front servo release passage.

During a 3-2 closed-throttle downshift in D2 range, the valve is positioned by its spring so that front servo release pressure must exhaust slowly through an orifice. This slow exhaust of release pressure provides a slow front band application.

During a partial-to-full-throttle 3-2 downshift, the 3-2 coasting control valve is positioned by throttle pressure or boosted throttle pressure so that front servo release pressure can exhaust rapidly to provide a rapid front band application.

DOWNSHIFT VALVE

The downshift valve is in the control valve upper body. The inner downshift lever contacts one end of the spring-loaded down-shift valve.

Control pressure is directed to a land of the valve. Linkage is connected between the accelerator pedal and downshift lever. The downshift valve is moved to open a passage to direct control pressure to the shift valves and the inhibitor valve, when the acclerator pedal is depressd through the detent (Fig. 9).

3-2 DOWNSHIFT CONTROL VALVE

The 3-2 downshift control valve operates in the front servo release pressure passage between the 2-3 valve and the front servo. A check valve is installed parallel with the downshift valve in the same passage so that release pressure flow to the servo by-passes it.

The downshift valve controls the rate of front servo release pressure exhaust (flow from the servo), and thereby the rate of front band application.

The 3-2 downshift control valve eliminates the possibility of a runaway condition in the transmission during a 3-2 kickdown at low car speeds (about 25 mph). It also eliminates the possibility of a tie-up during the same shift at higher speeds (50 mph and more).

HYDRAULIC CONTROL SYSTEM–NEUTRAL

The manual valve at N selector lever position blocks the fluid flow to both clutches and both bands (Fig. 9). With no fluid pressure in the clutches or servos, the clutches and bands are released by spring pressure, preventing power being transmitted to the transmission ouput shaft.

Neutral operation of the transmission keeps control pressure up to its proper value, maintains a full torque converter, lubricates the transmission, and maintains a flow of fluid through the cooling system.

HYDRAULIC CONTROL SYSTEM–D1, FIRST GEAR

When the selector lever is moved from N to D1, the manual valve opens three passages to control pressure. From left to right, the first passage admits control pressure to supply the 2-3 valve and close the rear servo lockout valve. The second passage admits control pressure to apply the front clutch, supply the governor and transition valve. The third passage admits control pressure to flow through the 1-2 and inhibitor valves and close the transition valve.

With the front clutch applied, the primary sun gear tries to drive the pinion carrier in a counterclockwise direction. Counterclockwise rotation at the pinion carrier is prevented by the one-way clutch. With the front clutch applied and the pinion carrier held, the transmission is in first gear.

HYDRAULIC CONTROL SYSTEM – D1, SECOND GEAR

The 1-2 shift occurs when governor pressure force on the 1-2 shift valve overcomes shift plug pressure and spring forces. The 1-2 valve moves inward, exhausting the fluid which holds the transition valve closed. The transition valve opens and admits control pressure to apply the front band.

The front clutch remains on, and the front band applies to put the transmission in second gear.

HYDRAULIC CONTROL SYSTEM – D1, THIRD GEAR

The 2-3 shift occurs when governor pressure force overcomes spring and shift plug pressure force at the 2-3 shift valve. When the shift valve opens, control pressure flows through it to apply the rear clutch and release the front band. With both clutches applied, the transmission is in third gear.

HYDRAULIC CONTROL SYSTEM – D2, SECOND GEAR

When the manual valve is at the D2 selector lever position, control pressure to the 1-2 shift valve is cut off. This condition permits control pressure to flow through the transition valve to apply the front band.

With the front clutch and the front band applied the transmission operates in second gear.

HYDRAULIC CONTROL SYSTEM – D2, THIRD GEAR

Operation in D2 range, third gear is the same as in D1 range, third gear except that the closed throttle downshift is from third to second in D2 instead of from third to first as in D1.

HYDRAULIC CONTROL SYSTEM–D1 AND D2 RANGES, 3-2 KICKDOWN

When the accelerator pedal is depressed through the detent, the downshift valve opens a passage that admits control pressure behind the 2-3 shift throttle reducing valve to oppose governor pressure. If the transmission is in high and road speed is below 47-69 mph, the 2-3 valve will be forced closed against governor pressure. When the 2-3 valve closes, control pressure which has been applying the rear clutch and releasing the front band is exhausted. The apply pressure that was in the front servo in third gear is now free to apply the front band. As soon as the front band applies, the transmission is in second gear.

HYDRAULIC CONTROL SYSTEM – L, FIRST GEAR

In L range, first gear, control pressure is directed by the manual valve to apply the front clutch and rear band. Control pressure is also directed by the manual valve to lock the 1-2 and 2-3 shift valves in their closed

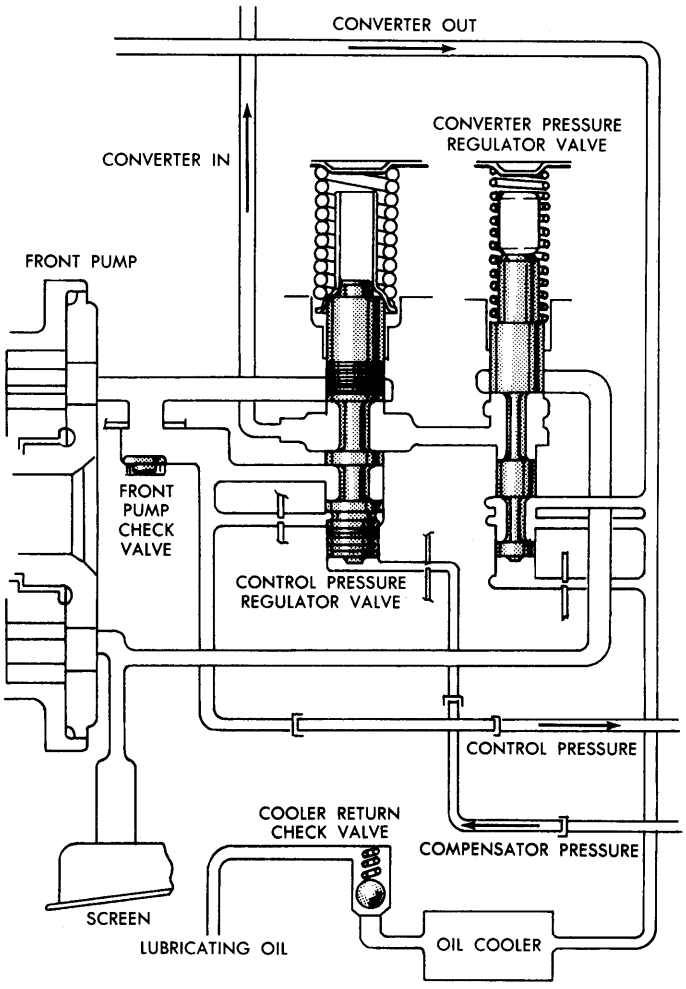


FIG. 10–Series Cooling Pressure Regulator Circuit

positions. Since neither shift valve can move, the transmission will stay in first gear regardless of throttle position or road speed.

HYDRAULIC CONTROL SYSTEM – REVERSE

When the manual valve is shifted into reverse, control pressure is directed to apply the rear clutch and rear band. Governor supply pressure is cut off by the manual valve; hence, the transmission cannot shift automatically. Rear clutch pressure is also directed to the throttle valve to regulate throttle pressure to obtain the correct line pressure for the reverse circuit.

OIL COOLING AND LUBRICATING SYSTEM

Figure 10 shows the transmission series cooling circuit that is used. The converter out circuit is directed through the oil cooler, then the cooled oil is used in the transmission lubricating circuit. Compensator pressure is replaced by converter out pressure at the end of the converter pressure regulator valve.

A spring-loaded check valve is used in the circuit to maintain about 3-5 psi in the converter out circuit. When the converter out circuit exceeds 3-5 psi the check ball opens against spring pressure and cooled oil is directed to lubricate the various parts of the transmission gear train.

2 IN-CAR ADJUSTMENTS AND REPAIRS

The transmission control linkage adjustments should be performed in the order in which they appear in this section of the manual.

THROTTLE AND DOWNSHIFT LINKAGE ADJUSTMENT

1. Apply the parking brake, and place the selector lever in N.

2. Run the engine at normal idle speed. If the engine is cold, run the engine at fast idle speed (about 1200 rpm) until it reaches normal operating temperature. When the engine is warm, slow it down to normal idle speed.

3. Connect a tachometer to the engine.

4. Adjust engine idle speed to specified idle rpm with the transmission selector in D1 or D2. Due to the vacuum release operation, the parking brake will not hold in D1 or D2. Keep the service brake applied.

The carburetor throttle lever must be against the idle adjusting screw (Fig. 11), at specified idle rpm in D1 or D2.

5. After the engine idle speed has been properly adjusted, stop the engine and adjust the anti-stall dashpot clearance.

Check the clearance between the dashpot plunger and the throttle lever. Bottom the dashpot plunger against its spring, and then adjust the clearance between the bottomed plunger and the throttle lever to specification. Check the position of the fast idle cam. It must be in the hot position.

6. Adjust the accelerator pedal height (Fig. 11) by disconnecting the carburetor connecting link from the carburetor and turning in or out as necessary.

7. Position the speed nut on the downshift lever rod 1¼ inches from the forward face of the bushing in the downshift lever (Fig. 11).

MANUAL LINKAGE ADJUSTMENT

1. With the engine stopped, loosen the nut at the lower end of the manual shift rod on the transmission shift lever.

2. With the steering column in the

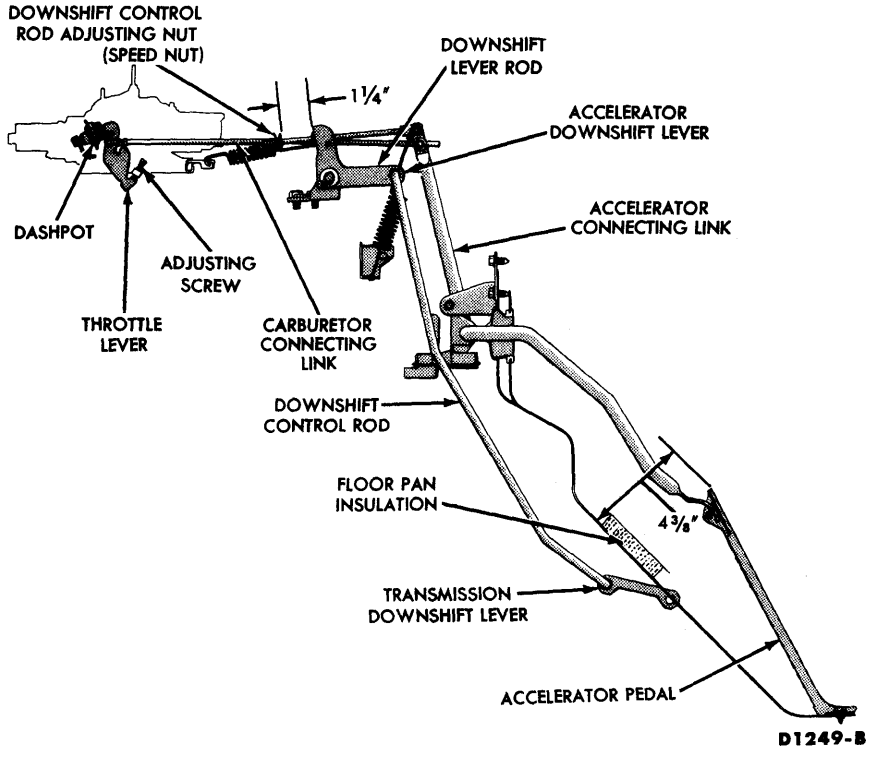


FIG. 11—Throttle Linkage

straight ahead (locked in place) position, move the manual selector lever so that the pointer is down against the steering column stop in the D1 position. **The large green dot on the shift selector indicator is the D1 position (Fig. 12).**

3. Move the shift lever on the transmission to the D1 detent position (second from the bottom).

4. Tighten the nut on the shift rod and shift lever.

5. Check the pointer alignment for all positions of the selector lever and reset if necessary. **Check and if necessary adjust the neutral start switch.**

STARTER NEUTRAL SWITCH ADJUSTMENT

1. With the manual linkage properly adjusted, check the starter engagement circuit in all transmission selector lever positions. The circuit must be open in all drive positions and closed only in park and neutral. (The starter should engage only in park or neutral.)

2. To adjust the switch, loosen the retaining screws that locate the switch on the steering column (Fig. 13).

3. Place the transmission selector lever firmly against the stop of the neutral detent position.

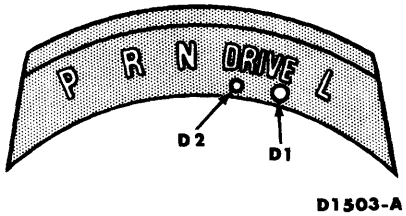


FIG. 12—Selector Lever Positions

4. Rotate the switch actuating lever until the gauge pin (No. 43 drill shank end) can be inserted into the gauge pin holes (Fig. 13).

5. Tighten the 2 switch retaining screws and remove the gauge pin.

6. Check the operation of the switch in each selector lever position. **The starter should engage in only the neutral and park detent positions. Whenever the manual linkage is adjusted the starter neutral switch should be re-set.**

FRONT BAND ADJUSTMENT

1. Disconnect the fluid filler tube from the oil pan, and drain the fluid from the transmission. **If the same fluid is to be used again in the transmission after the band adjustment, filter the fluid through a 100-mesh screen as it drains from the transmission. Make sure that the container is clean. Re-use the fluid only if it is in good condition.**

2. Remove and thoroughly clean the oil pan. **Do not attempt to clean the filter. If dirty, install a new one.** Discard the oil pan gasket.

3. Loosen the front servo adjusting screw locknut two full turns with a 9/16-inch wrench. Check the adjusting screw for free rotation in the actuating lever after the locknut is loosened, and free the screw if necessary.

4. Pull the adjusting screw end of the actuating lever away from the servo body, and insert the adjusting tool gauge block (Fig. 14) between

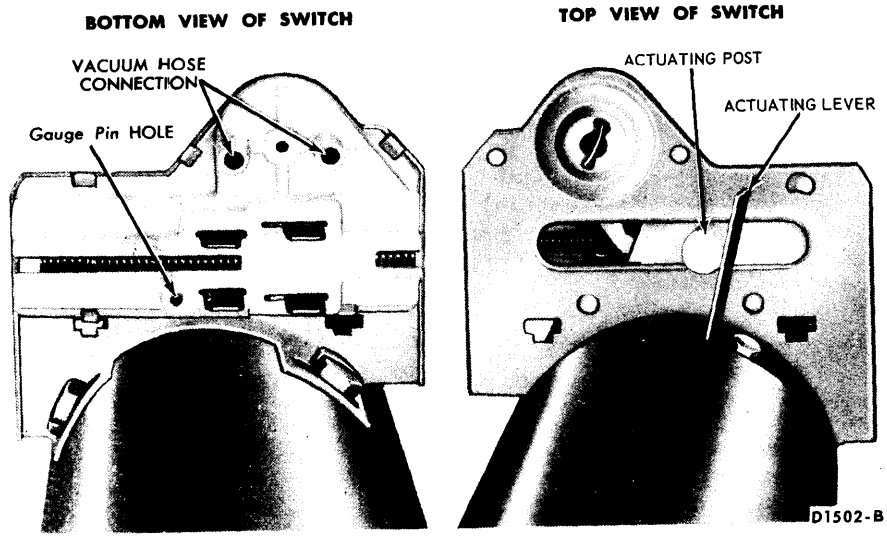


FIG. 13—Starter Neutral Switch

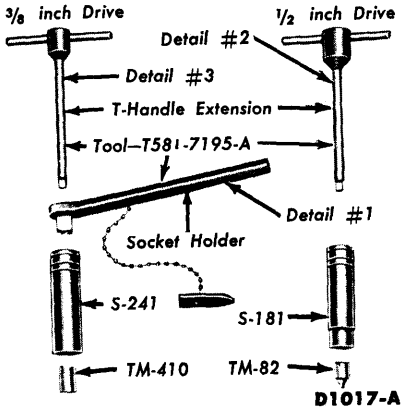


FIG. 14—Front and Rear Band Adjusting Tool

the servo piston stem and the adjusting screw.

5. Install the socket handle on the 9/16-inch socket. Insert the T-handle extension through the socket handle and socket, and install the screwdriver socket on the T-handle extension. Place the tool on the adjusting screw so that the screwdriver socket engages the screw and the 9/16-inch socket engages the locknut. With a torque wrench on the T-handle extension, tighten the adjusting screw to 10 in-lbs torque, and then back off the screw exactly one full turn. **Severe damage may result to the transmission if the adjusting screw is not backed off exactly one full turn.**

6. Hold the adjusting screw stationary, and torque the locknut to specification.

7. Remove the gauge block from the transmission.

8. Place a new gasket on the oil pan; install the filter and pan on the transmission.

9. Connect the filler tube to the oil pan and torque the retaining nut to specifications.

10. Add 3 quarts of transmission fluid. Run the engine for 2 minutes. Place selector lever in P position and check fluid level. Add fluid if necessary.

REAR BAND ADJUSTMENT

1. Working from under the right side of the instrument panel, lift enough carpet away from the console to gain access to the rear band adjustment opening.

2. Remove the plastic plug from the floor pan.

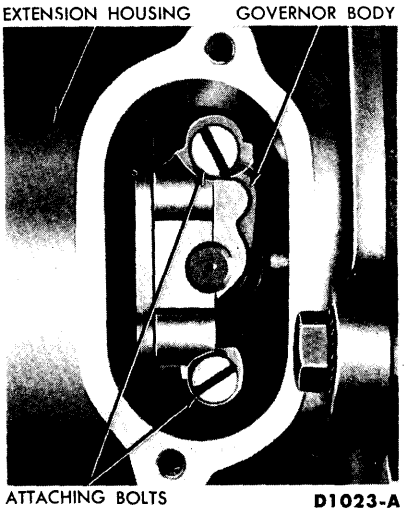


FIG. 15—Governor In Extension Housing

3. Wipe all dirt from the rear band adjusting screw threads, and oil the threads.

4. Place the socket holder on the 3/4-inch socket (Fig. 14). Insert the T-handle extension through the handle and socket. Place the 5/16-inch 8-point socket on the extension. Place a torque wrench on the T-handle extension.

5. Insert the assembled tool in the access hole so that it engages the adjusting screw and the locknut.

6. Loosen the adjusting screw locknut.

7. Torque the adjusting screw to specification.

8. Remove the torque wrench from the T-handle extension and back off the adjusting screw exactly 1½ turns. **Severe damage may result to the transmission if the adjusting screw is not backed off exactly 1½ turns.**

9. Hold the adjusting screw stationary, and torque the locknut to specification.

10. Install the plastic plug in the floor pan.

11. Fit the carpet into place on the console.

GOVERNOR REPLACEMENT

1. Raise the car so that the transmission extension housing is accessible.

2. Remove the governor inspection cover from the extension housing.

3. Rotate the drive shaft until the governor is in line with the inspection hole (Fig. 15).

4. Remove the governor valve body from the counterweight. **Do not drop the attaching bolts or the valve parts into the extension housing.**

5. Lubricate the new governor valve parts with transmission fluid. **The valve must move freely in the valve body bore.**

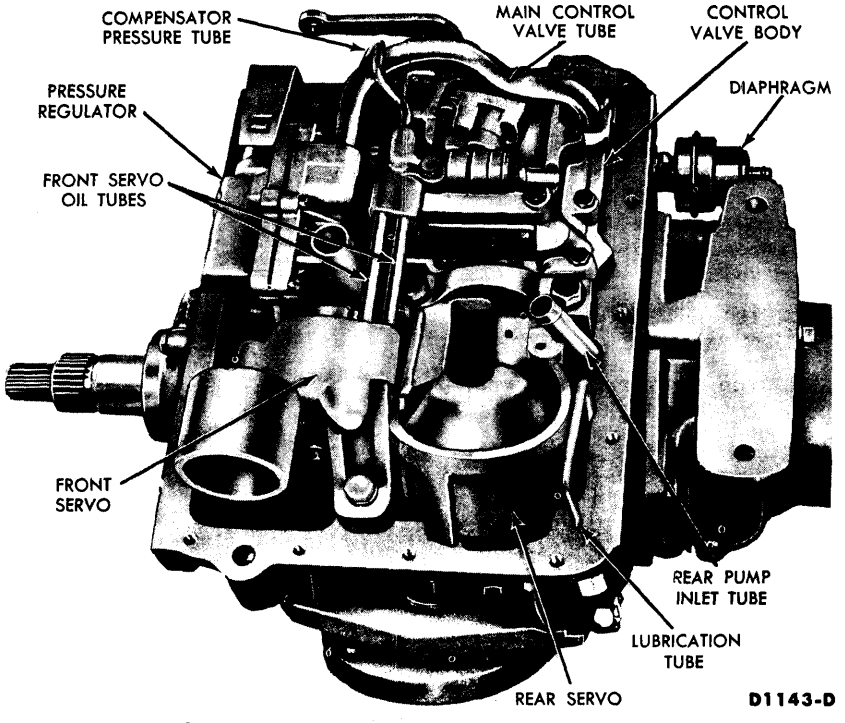


FIG. 16—Typical Hydraulic Control System Parts

6. Install the governor valve body on the counterweight so that the valve body cover is facing rearward. Tighten the two attaching bolts securely.

7. Install the governor inspection cover and a new gasket on the extension housing. Torque the attaching screws to specifications.

OIL PAN AND CONTROL VALVE BODY REPLACEMENT

1. Raise the car so that the transmission oil pan is accessible.

2. Disconnect the fluid filler tube from the oil pan, and drain the fluid from the transmission. **If the same fluid is to be used again in the transmission, filter the fluid through a 100-mesh screen as it drains from the transmission. Reuse the fluid only if it is in good condition.**

3. Disconnect the hose from the vacuum diaphragm unit. Remove the diaphragm unit using tool FCO-24. **Do not use any tools such as pliers, pipe wrenches, etc., on the diaphragm housing. Do not allow solvents to enter the diaphragm unit.** Remove the push rod.

4. Remove the oil pan and gasket, and discard the gasket.

5. Remove the fluid filter-type screen retaining clip and the screen.

6. Remove the two tubes which connect to the pressure regulator and the control valve body (Fig. 16).

7. Loosen the front servo attaching bolts three turns.

8. Remove the three control valve body attaching bolts, and lower the valve body while pulling it off the front servo oil tubes (Fig. 16). **Be careful not to damage the valve body or the tubes.**

9. Before installing the control valve body, check for a bent manual valve. This is done by rolling the valve on a flat surface.

10. Install the control valve body by aligning the front servo oil tubes with the holes in the valve body. Shift the manual lever to the L detent, and place the inner downshift lever between the downshift lever stop and the downshift valve. **The manual valve must engage the actuating pin in the manual detent lever.**

11. Install, but do not tighten the control valve body attaching bolts.

12. Install the tubes to the pressure regulator and the control valve body.

13. Move the control valve body toward the center of the case as far as the attaching bolts will permit. This movement is made to take up clearance between the manual valve and the actuating pin on the manual detent lever.

14. Torque the attaching bolts to specification.

15. Turn the manual valve one full turn in each manual lever detent position. If the manual valve binds against the actuating pin in any detent position, loosen the valve body attaching bolts and move the body away from the center of the case. Move the valve body only enough to relieve the binding. Torque the attaching bolts and recheck the manual valve for binding.

16. Position the push rod in the bore of the vacuum diaphragm unit. Using the diaphragm unit as a guide, insert the push rod into the threaded opening of the case. Torque the diaphragm unit to specification. Connect the vacuum hose.

17. Torque the front servo attaching bolts to specification.

18. Adjust the front band.

19. Install the fluid filter-type screen and the screen retaining clip.

20. Position a new oil pan gasket on the bottom of the transmission case, and install the oil pan. Torque the oil pan screws to specification.

21. Connect the fluid filter tube to the oil pan, and tighten the fittings securely.

22. Fill the transmission with fluid. **If the fluid that was drained from the transmission is to be used again, filter the fluid through a 100-mesh screen as it is poured back into the transmission. Re-use the fluid only if it is in good condition.**

PRESSURE REGULATOR REPLACEMENT

1. Drain the fluid from the transmission, and remove the oil pan and filter-type screen.

2. Remove the small compensator pressure tube and the large control pressure tube from the control valve body and the pressure regulator (Fig. 16).

3. Remove the pressure regulator spring retainer, springs, and spacer. **Maintain pressure on the retainer to prevent the springs from flying out.**

4. Remove the pressure regulator attaching bolts and washers, and remove the regulator.

5. Position the replacement regulator body in the transmission case and onto the front servo tube, and install the attaching bolts. Torque the bolts to specification.

6. Check the converter pressure and control pressure valves to be sure the valves operate freely in the bores.

7. Install the valve springs, spacer, and retainer.

8. Install the large control pressure tube and small compensator pressure tube.

9. Install the filter-type screen, retaining clip, and the oil pan. Fill the transmission with fluid.

FRONT SERVO REPLACEMENT

1. Drain the fluid from the transmission, and remove the oil pan and fluid screen.

2. Remove the vacuum diaphragm unit.

3. Loosen the three control valve body attaching bolts.

4. Remove the attaching bolts from the front servo (Fig. 16), hold the strut with the fingers, and remove the servo.

5. To install the front servo, position the front band forward in the case with the ends of the band facing downward. Align the large end of the servo strut with the servo actuating lever, and align the small end with the band end.

6. Rotate the band, strut, and servo to align the anchor end of the band with the anchor in the case. Push the servo body onto the control valve body tubes.

7. Install the servo retaining bolts and torque them to specification.

8. Torque the control valve body retaining bolts to specification.

Check the clearance between the manual valve and the manual lever actuating pin as given in Oil Pan and Control Valve Body Replacement.

9. Adjust the front band.

10. Install the vacuum diaphragm unit and rod.

11. Install the filter-type screen, retaining clip and oil pan. Fill the transmission with fluid.

REAR SERVO REPLACEMENT

1. Drain the fluid from the transmission, and remove the oil pan and filter-type screen.

2. Remove the vacuum diaphragm unit.

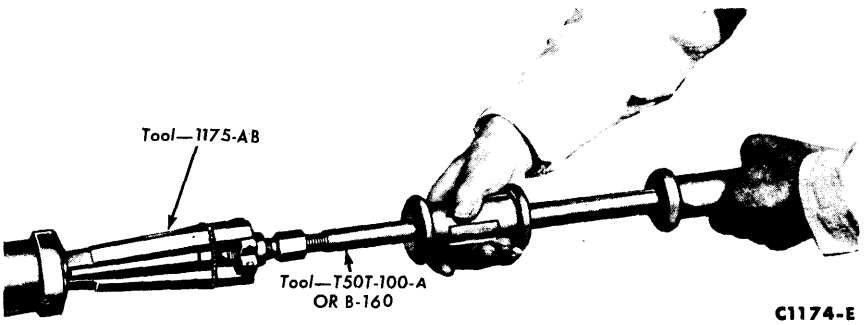


FIG. 17—Extension Housing Seal Removal

3. Remove the control valve body and the two front servo oil tubes.

4. Remove the attaching bolts from the rear servo, hold the actuating and anchor struts with the fingers, and remove the servo.

5. To install the rear servo, position to servo anchor strut on the servo band, and rotate the band to engage the strut.

6. Hold the servo anchor strut in position with the fingers, position the actuating lever strut, and install the servo.

7. Install the servo attaching bolts, and torque them to specification. **The longer bolt must be installed in the inner bolt hole.**

8. Install the two front servo oil tubes and the control valve body.

Check the clearance between the manual valve and the manual lever actuating pin as given in "Oil Pan and Control Valve Body Replacement."

9. Adjust the rear band.

10. Install the filter-type screen and oil pan. Fill the transmission with fluid.

EXTENSION HOUSING BUSHING AND REAR SEAL REPLACEMENT

1. Disconnect the drive shaft from the transmission.

2. Carefully remove the seal with the tool shown in Fig. 17.

3. Remove the bushing as shown in Fig. 18. **Use the bushing remover carefully so that the spline seal is not damaged.**

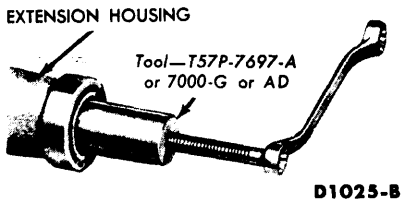


FIG. 18—Extension Housing Bushing Removal

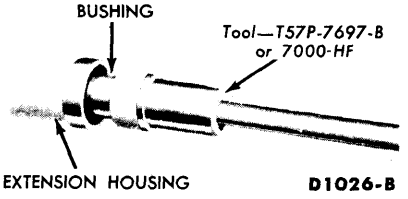


FIG. 19—Installing Extension Housing Bushing

4. When installing a new bushing, use the special tool shown in Fig. 19.

5. Before installing a new seal (Fig. 20), inspect the sealing surface of the universal joint yoke for scores. If scores are found, replace the yoke.

6. Inspect the counterbore of the housing for burrs. Polish off all burrs with crocus cloth.

7. Drive the seal into the housing with the tool shown in Fig. 20. The seal should be firmly seated in the bore.

PARKING PAWL

1. Refer to the "Rear Band Adjustment" procedures for Band Adjusting tool usage.

2. With tool T58L-7195-A, loosen the adjusting stud locknut. Turn the adjusting stud and torque to specification. **This will tighten the rear band around the planet carrier and will hold the planet carrier and clutch assemblies in position during the parking pawl repair operation.**

3. Raise the car and drain the oil from the transmission.

4. Place the adjustable support stand under the rear of the engine.

5. Disconnect the inlet pipes from the exhaust manifolds.

6. Remove the drive shaft.

7. Disconnect the parking brake cables from the crossmember and equalizer bracket.

8. Remove the crossmember to extension housing bolts.

9. Raise the engine with the adjustable support stand until the extension housing clears the rear crossmember.

10. Remove the retaining bolts and crossmember from the frame.

11. Disconnect the speedometer cable from the transmission.

12. Remove the transmission oil pan and filter-type screen.

13. Remove the vacuum control diaphragm unit and control rod.

14. Remove the main control valve assembly retaining bolts and valve assembly.

15. Remove the tubes that go from the case into the rear pump.

16. Remove the extension housing retaining bolts and housing.

17. Remove the output shaft assembly from the case. Do not bend or damage the distributor tubes as they are removed from the case (Fig. 24).

18. Remove the parking pawl toggle pin from the case with a magnet.

19. Remove the retainer, washer

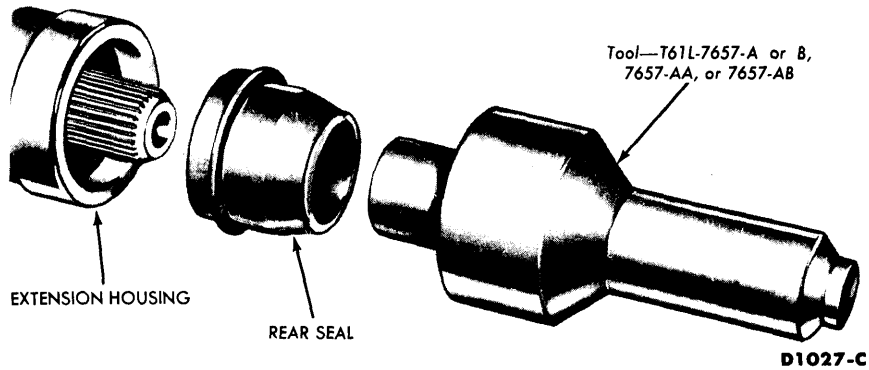


FIG. 20—Extension Housing Rear Seal Installation

and the end of the clip-type spring from the end of the parking pawl link pin.

20. Remove the pawl link pin and broken parking pawl.

21. To assemble the new parking pawl, reverse the above procedure. Use new gaskets and refill the transmission with the specified lubricant. Reset the transmission linkage. **Readjust the rear band and replace console parts.**

3 REMOVAL AND INSTALLATION

TRANSMISSION REMOVAL (GEAR CASE)

1. Raise the car on a hoist.

2. Disconnect the fluid filler tube from the oil pan and drain the fluid.

3. Remove the cover from the lower front side of the converter housing. Remove one of the converter drain plugs, rotate the converter 180°, and remove the other plug. Use a commercial flywheel turning tool. **Do not attempt to turn the converter with a wrench on the converter stud nuts.**

4. Disconnect the drive shaft from the pinion flange, and remove the drive shaft. Install the seal replacer in the extension housing seal.

5. Disconnect the Pitman arm to idler arm rod at the Pitman arm end.

6. Remove one bolt on each muffler inlet pipe to chassis bracket (toward rear of chassis).

7. Disconnect the inlet pipes from the engine exhaust manifolds.

8. Disconnect the cooler lines.

9. Disconnect the manual and downshift control rods from the transmission.

10. Remove the diaphragm unit tube from the clip and from the diaphragm unit.

11. Disconnect the speedometer cable from the extension housing.

12. Remove the two engine rear support to transmission bolts.

13. Position a transmission jack under the transmission and raise it slightly to take the weight off the crossmember.

14. Remove two transmission rear support bracket-to-chassis-bracket bolts. Remove the support and hand brake cables from the equalizer. Allow the support and equalizer to hang down from the front brake cable.

15. With the transmission jack in position, remove the four transmission to converter housing bolts.

16. Tilt the rear of the transmission assembly slightly upward, and with the jack move the assembly toward the rear until clear of the converter housing. Lower the assembly and remove it from the car.

TRANSMISSION (GEAR CASE) INSTALLATION

1. Install guide pins in the two top transmission to converter housing attaching bolt holes.

2. Mount the transmission on the jack and position it under the car. **Be sure to align the turbine shaft splines with the turbine splines and the converter impeller lugs with the slots in the front pump drive gear.**

3. Raise the transmission, move it toward the front of the car, and position it on the converter housing.

4. Install the transmission to converter housing lower attaching bolts. Remove the two guide pins and install the two upper bolts. Torque the bolts to specification.

5. Install the transmission rear support and bolts.

6. Lower the transmission onto the rear support, and install the rear support to transmission bolts.

7. **Lubricate the front universal slip yoke with Ford lubricant B8A-19589-A.** Slide the universal joint yoke onto the output shaft, and then connect the drive shaft to the rear axle.

8. Connect the parking brake linkage.

9. Connect the exhaust system and steering linkage.

10. Connect the vacuum tube.

11. Connect the oil cooler to transmission oil inlet and outlet lines to the transmission and radiator. Tighten the fittings securely.

12. Connect the speedometer cable to the extension housing.

13. Connect the manual linkage to the transmission manual lever, and connect the downshift linkage to the transmission downshift lever.

14. Install the converter drain plugs and converter lower cover.

15. Connect the fluid filler tube to the oil pan. Tighten the fittings securely.

16. Lower the car to the floor, and fill the transmission with fluid. Then check the fluid level.

17. Adjust the linkage.

CONVERTER REMOVAL

1. Remove the transmission.

2. Remove the four stud nuts and flat washers that attach the converter to the flywheel. Replace the converter housing lower front cover to prevent the converter from falling when the housing is removed.

3. Remove the starter cable. Then remove the starter.

4. Remove the six converter housing to engine block bolts.

5. Work the converter housing off the engine dowel pins and remove the housing and converter.

CONVERTER INSTALLATION

1. Place the converter in the housing, and retain it there by installing the lower front cover.

2. Raise the housing and converter into position and start the housing on the engine dowel pins.

3. Start the six converter housing to engine bolts.

4. Remove the converter housing lower front cover and position the converter on the flywheel. Install the four converter to flywheel stud flat washers and nuts. Torque to specification.

5. Torque the converter housing to engine bolts to specification.

6. Install the converter housing lower front cover. Install the starter.

7. Install the transmission.

4 MAJOR REPAIR OPERATIONS

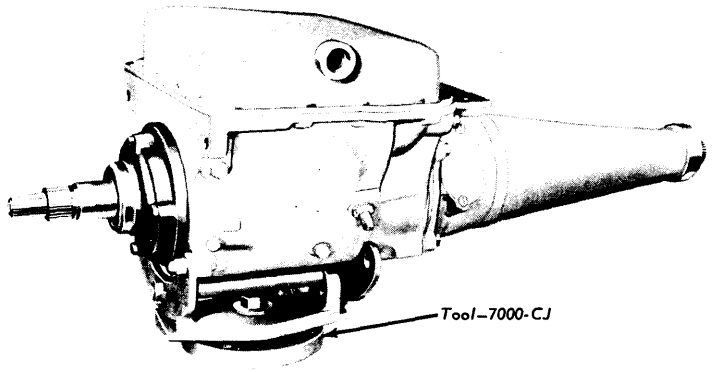


FIG. 21—Transmission Mounted on Bench

DISASSEMBLY

1. Before removing any of the transmission sub - assemblies, thoroughly clean the outside of the transmission case to prevent dirt from getting inside the mechanism.

2. After the transmission has been removed from the car, place the assembly in the transmission holder shown in Fig. 21.

3. Remove the oil pan, gasket, and filter-type screen clip.

4. Lift the filter-type screen off the forward tube, and then lift it off the rear tube.

5. Remove the spring seat from the pressure regulator. **Maintain constant pressure on the seat to prevent distortion of the spring seat and the sudden release of the springs.** Remove the pressure regulator springs and pilots, but do not remove the valves.

6. Loosen, **but do not remove,** the regulator body attaching bolts.

7. Lift the rear pump intake tube out of the bore in the transmission case. **Be careful not to bend the tube.**

8. Remove the small compensator pressure tube. Then remove the large control pressure tube from the pressure regulator and the control valve body. If necessary, tap the tubes with a soft hammer but do not distort them.

9. Loosen the front and rear servo band adjusting screws 5 turns. Loosen the front servo attaching bolts 3 turns.

10. Remove the vacuum diaphragm unit and push rod.

11. Remove the control valve body attaching bolts. Align the levers to permit removal of the valve body. Then lift the valve body clear of the transmission case. Pull the body off the servo tubes, and then remove it from the case.

12. Remove the regulator body from the case. **Keep the control pressure valve and the converter pressure regulator valve in the pressure regulator to avoid damage to the valves.**

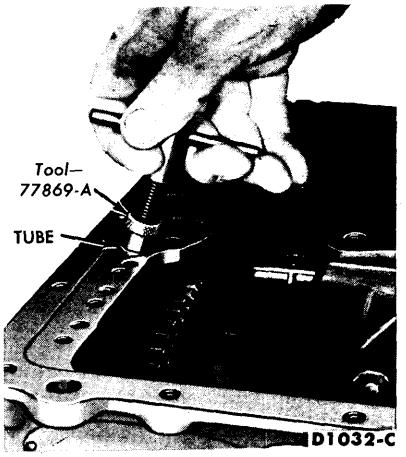


FIG. 23—Rear Pump Discharge Tube Removal

13. Remove the front servo apply and release tubes by twisting and pulling at the same time. Remove the front servo attaching bolts. Hold the front servo strut with the fingers, and lift the servo assembly from the case.

14. Remove the rear servo attaching bolts. Hold the actuating and anchor struts with the fingers, and lift the servo from the case.

TRANSMISSION END PLAY CHECK

1. Remove one of the front pump attaching bolts. Mount the dial indi-

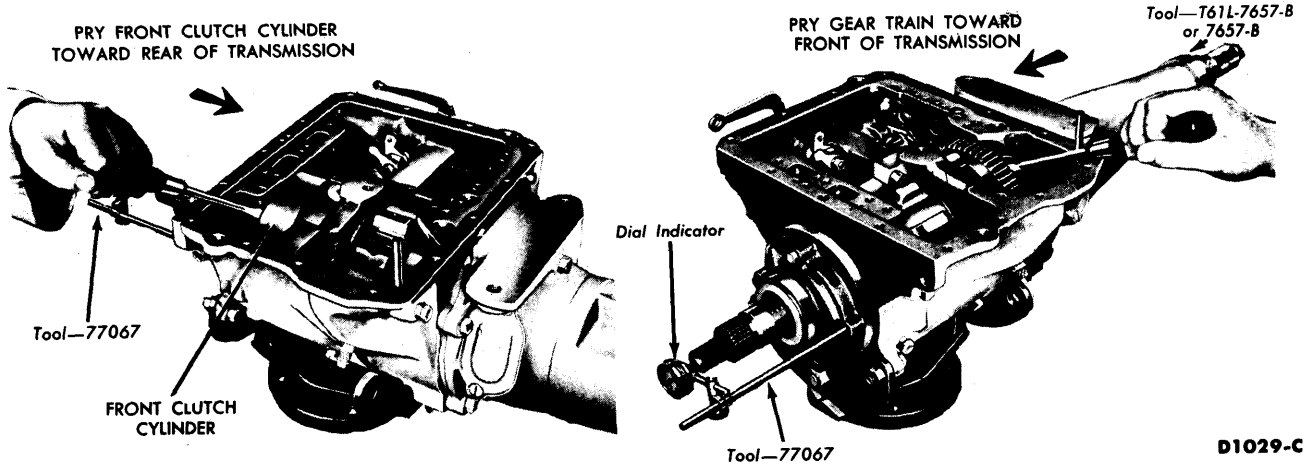


FIG. 22—Transmission End Play Check

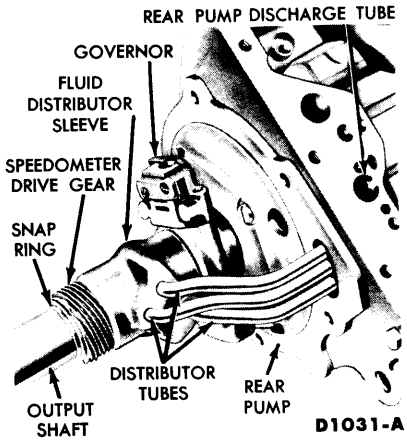


FIG. 24—Output Shaft, Governor and Rear Pump

cator support tool in the front pump bolt hole. Mount a dial indicator on the support so that the contact rests on the end of the turbine shaft as shown in Fig. 22.

2. Install the extension housing seal replacer on the output shaft to provide support for the shaft.

3. Pry the front clutch cylinder to the rear of the transmission with a large screwdriver (Fig. 22). Set the dial indicator at zero while maintaining a slight pressure on the screwdriver.

4. Remove the screwdriver and pry the units toward the front of the transmission by inserting the screwdriver between the large internal gear and the transmission case (Fig. 22).

5. Record the indicator reading for use during transmission assembly. End play should be 0.010-0.029 inch (minimum end play is preferred). If end play is not within specifications, a new selective thickness thrust washer has to be used when the transmission is assembled.

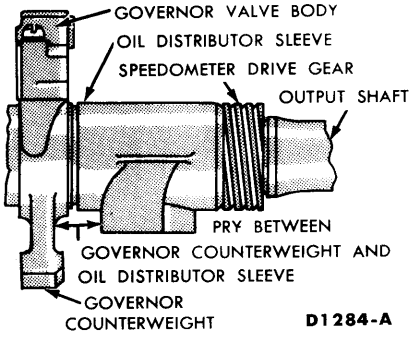


FIG. 25—Pressure Apply Area for Removing Speedometer Gear

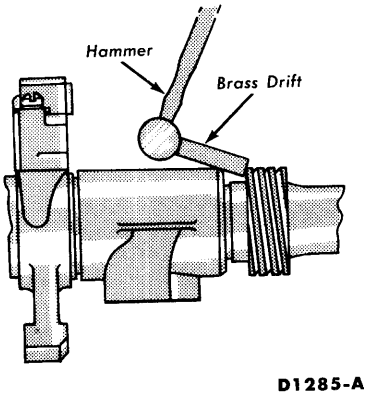


FIG. 26—Speedometer Drive Gear Removal

6. Remove the indicator support, and then remove the seal replacer from the output shaft.

REMOVAL OF CASE AND EXTENSION HOUSING PARTS

1. Remove the remaining front pump attaching bolts. Then remove the front pump assembly and gasket. **If necessary, tap the bolt bosses with a soft hammer to loosen the pump from the case.**

2. Remove the five transmission to extension housing bolts. These bolts also attach the rear pump to the case. Remove the extension housing. Install the tube extractor tool in the rear pump discharge tube (Fig. 23) and remove the tube. Remove the lubrication tube from the case.

3. Remove the output shaft complete assembly (Fig. 24). Be careful not to bend the pressure tubes between the distributor sleeve and case as the tubes are removed from the case.

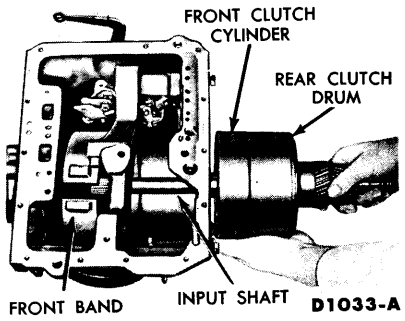


FIG. 28—Input Shaft and Clutch Removal or Installation

4. A nylon speedometer drive gear is used on the output shaft. If gear replacement is necessary, the old type steel gear may be used.

The nylon drive gear is a 0.004-0.010-inch shrink fit on the output shaft and can be removed in the following manner:

5. With the output shaft assembly on the bench, remove the oil distributor tubes from the sleeve. Remove the speedometer drive gear snap ring from the shaft. Pry the oil delivery sleeve toward the rear of the shaft with a hammer handle. Make certain to apply pressure on the governor counterweight, and not against the governor valve body. (Fig. 25).

6. Slide the oil delivery sleeve toward the front of the shaft.

7. Using a hammer and a small brass drift, tap the gear evenly and alternately (Fig. 26) to prevent cocking it on the shaft. Tap the gear gently to prevent damaging it.

8. If the drive gear ball does not fall out as the speedometer gear is removed, remove the ball from the seat in the output shaft.

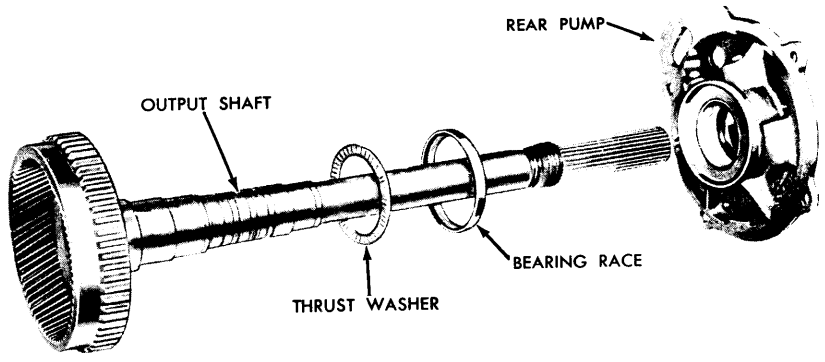


FIG. 27—Output Shaft and Thrust Washer

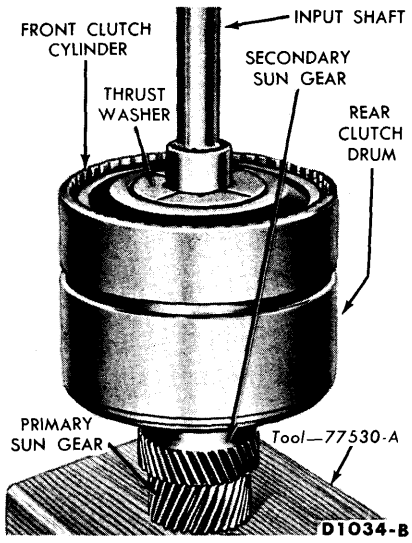


FIG. 29—Input Shaft and Clutch Mounted in Holding Fixture

9. Remove the distributor sleeve. Remove the four seal rings from the output shaft with the fingers to prevent breaking the rings.

10. Remove the governor snap ring from the output shaft. Slide the governor assembly off the output shaft. Then remove the governor drive ball. Remove the rear pump and remove the extension housing and pump gaskets. Remove the rear pump thrust washer and race (Fig. 27).

11. Remove the rear pump drive key from the output shaft. Then remove the bronze thrust washer from the output shaft.

12. Remove the selective thrust washer from the rear of the pinion carrier.

13. Remove the two seal rings from the primary sun gear shaft. Remove the pinion carrier.

14. Remove the primary sun gear rear thrust bearing and race from the pinion carrier.

15. Remove the front clutch sun gear thrust washer race from the sun gear.

16. Note the rear band position for reference in assembly. The end of the band next to the adjusting screw has a depression (dimple) in the center of the boss. Squeeze the ends of the rear band together, tilt the band to the rear, and remove the rear band from the case.

17. Remove the two center support outer bolts (one each side) from the transmission case.

18. Exert enough pressure on the end of the input shaft to hold the clutch units together. Then remove the center support, front and rear clutch assemblies as a unit. (Fig. 28).

19. Install the clutch assemblies in the bench fixture (Fig. 29).

20. Remove the thrust washer from the front of the input shaft.

21. Remove the front band from the case. Lift the front clutch assembly from the primary sun gear shaft.

22. Remove the bronze and the steel thrust washers from the rear clutch assembly. Wire the thrust washers together to assure correct installation.

23. Remove the front clutch seal rings from the primary sun gear shaft.

24. Lift the rear clutch assembly from the primary sun gear shaft.

25. Remove the rear clutch seal rings from the primary sun gear shaft. **Do not break the seal rings.**

26. Remove the primary sun gear front thrust washer.

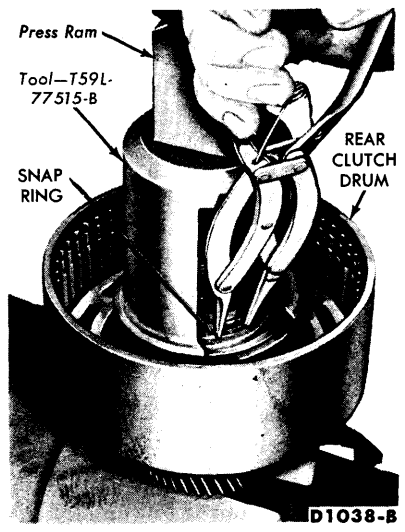


FIG. 30—Rear Clutch Spring Snap Ring Removal

PARTS REPAIR AND REPLACEMENT

During the repair of the sub-assemblies, certain general instructions which apply to all units of the transmisson must be followed. These instructions are given here to avoid unnecessary repetition.

Handle all transmission parts carefully to avoid nicking or burring the bearing or mating surfaces.

Lubricate all internal parts of the transmission before assembly with transmission fluid. **Do not use any other lubricants.**

Gaskets and thrust washers may be coated with petroleum jelly to facilitate assembly. **Always install new gaskets when assembling parts of the transmission.**

Tighten all bolts and screws to the recommended torque. For detailed Cleaning and Inspection operations refer to Part 7-1.

PRIMARY SUN GEAR SHAFT

1. Position the primary sun gear shaft in the clutch bench fixture.

2. Check the fit of the seal rings in their respective bores. A clearance of 0.002-0.009 inch should exist between the ends of the rings.

3. Install the seal rings on the shaft, and check for free movement of the rings in the grooves of the shaft.

REAR CLUTCH

1. Remove the clutch pressure plate snap ring, and remove the pressure plate from the drum. Remove the bronze and steel plates.

2. Compress the spring in an arbor press with the tool shown in Fig. 30 and remove the snap ring.

3. Guide the spring retainer while releasing the press to prevent the retainer from locking in the snap ring groove.

4. Position the primary sun gear shaft in the rear clutch. Place an air hose nozzle in one of the holes in the shaft, and place one finger over the other hole. Then force the clutch piston out of the clutch drum with air pressure.

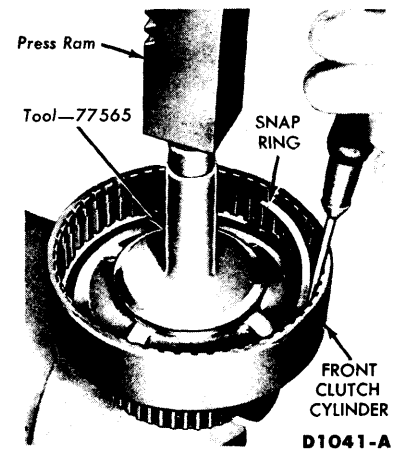


FIG. 31—Front Clutch Snap Ring Removal or Installation

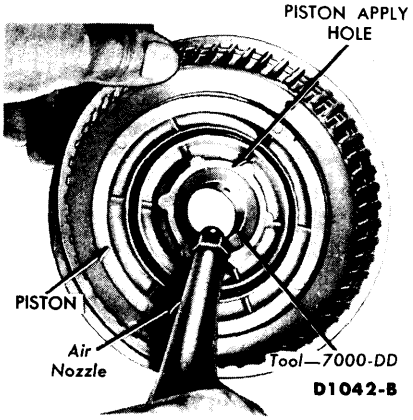


FIG. 32—Front Clutch Piston Removal

Hold one hand over the piston to prevent damage.

5. Remove the clutch piston inner seal ring from the clutch drum. Remove the clutch piston outer seal ring from the groove in the piston.

6. Lubricate all parts to facilitate assembly. Install the clutch piston inner seal ring in the groove in the drum. Install a new outer seal ring on the piston, and install the piston in the clutch drum.

7. Install the clutch release spring, and position the retainer on the spring.

8. Position the clutch assembly in an arbor press, and then position the proper tool on the spring retainer. Compress the clutch spring, and install the snap ring. **While compressing the spring, guide the retainer to avoid interference of the retainer with the snap ring groove. Make sure the snap ring is fully seated in the groove.**

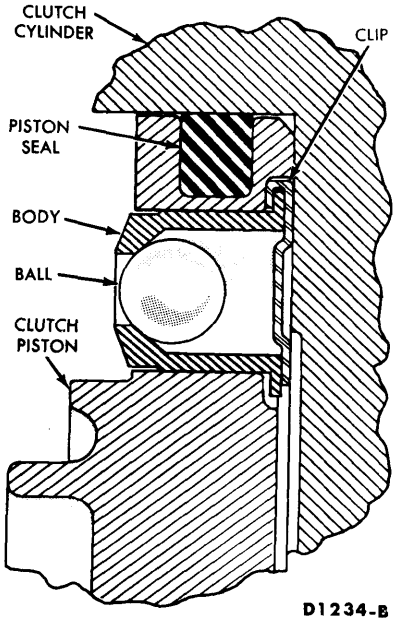


FIG. 33—Front Clutch Piston Seal and Check Valve

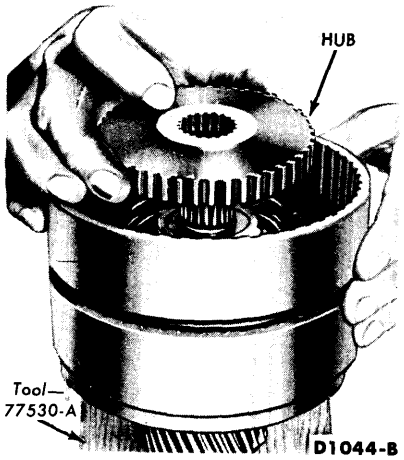


FIG. 34—Front Clutch Hub Installation

9. Install the composition and the steel clutch plates alternately, starting with a steel plate. Because of coning, all steel plates must face the same direction with either all concave or all convex sides up.

10. Install the clutch pressure plate with the bearing surface down. Then install the clutch pressure plate snap ring. Make sure the snap ring is fully seated in the groove.

11. Install the thrust washer on the primary sun gear shaft. Lubricate all parts with automatic transmission fluid or petroleum jelly. Install the two center seal rings.

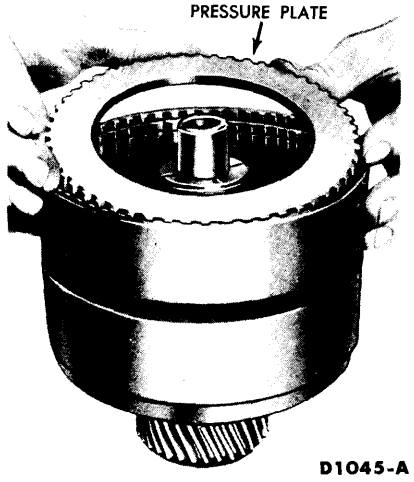


FIG. 35—Pressure Plate Installation

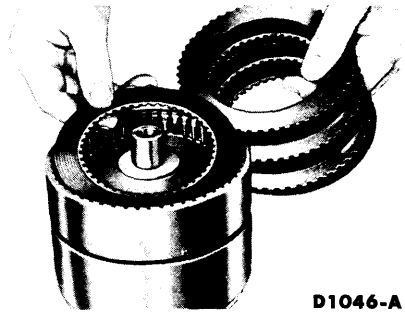


FIG. 36—Clutch Plate Installation

12. Install the rear clutch on the primary sun gear shaft. **Be sure all of the needles are in the hub if the unit is equipped with loose needle bearings.** Assemble two seal rings in the front grooves.

13. Install the steel and the bronze thrust washers on the front of the secondary sun gear assembly. If the steel washer is chamfered, place the chamfered side down.

FRONT CLUTCH

1. Remove the clutch cover snap ring with a screwdriver, and remove the input shaft from the clutch drum.

2. Remove the thrust washer from the thrust surface of the clutch hub. Insert one finger in the clutch hub, and lift the hub straight up to remove the hub from the clutch drum.

3. Remove the composition and the steel clutch plates, and then remove the pressure plate from the clutch drum.

4. Place the front clutch spring compressor on the release spring, position the clutch drum on the bed of an arbor press, and then compress the release spring with the arbor press until the release spring snap ring can be removed (Fig. 31).

5. Remove the clutch release spring from the clutch drum.

6. Install the special nozzle shown in Fig. 32 on an air hose. Place the nozzle against the clutch apply hole

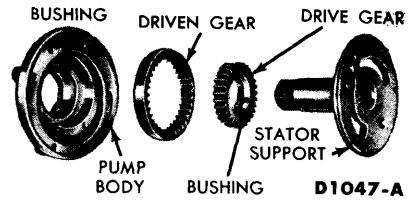


FIG. 37—Front Pump Disassembled

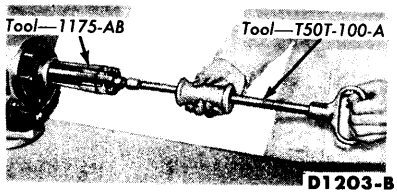


FIG. 38—Front Pump Seal Removal

in the front clutch housing, and force the piston out of the housing.

7. Remove the piston inner seal from the clutch housing. Remove the piston outer seal from the groove in the piston as shown in Fig. 33.

8. Lubricate all parts with transmission fluid. Install a new piston inner seal ring in the clutch cylinder. Install a new piston outer seal in the groove in the piston as shown in Fig. 33.

9. Install the piston in the clutch housing. **Make sure the steel bearing ring is in place on the piston.**

10. Position the release spring in the clutch cylinder with the concave side up. Place the release spring compressor on the spring, and compress the spring with an arbor press. Then install the snap ring as shown in Fig. 31. **Make sure the snap ring is fully seated in the groove.**

11. Install the front clutch housing on the primary sun gear shaft by rotating the clutch units to mesh the rear clutch plates with the serrations on the clutch hub. **Do not break the seal rings.**

12. Install the clutch hub in the clutch cylinder with the deep

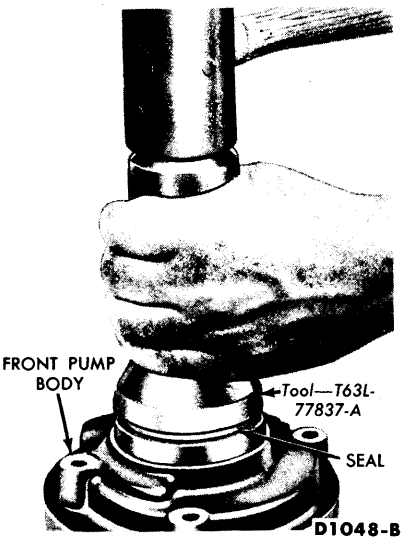


FIG. 39—Installing Front Pump Seal

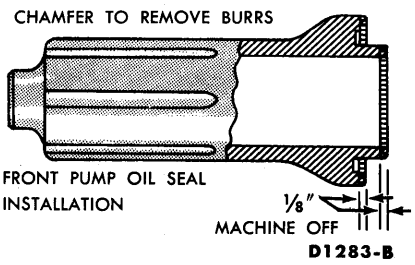


FIG. 40—Dimensions for Reworking Front Pump Seal Installing Tool

counter-bore down (Fig. 34). Install the thrust washer on the clutch hub.

13. Install the pressure plate in the clutch cylinder with the bearing surface up (Fig. 35). Install the bronze composition and the steel clutch plates alternately, starting with a bronze plate (Fig. 36). Lubricate the plates as they are installed.

14. Install the turbine shaft in the clutch cylinder, and then install the snap ring. **Make sure the snap ring is fully seated in the groove.**

15. Install the thrust washer on the turbine shaft.

FRONT PUMP

1. Remove the stator support attaching screws and remove the stator support. Mark the top surface of the pump driven gear with Prussian blue to assure correct assembly. **Do not scratch the pump gears.**

2. Remove the drive and driven gears from the pump body.

3. Refer to Fig. 37 for a disassembled view of the front pump. Inspect the pump body housing, drive gear bushing, gear pockets, and crescent for scores.

4. If any parts other than the stator support are found defective, replace the pump as a unit. Minor burrs and

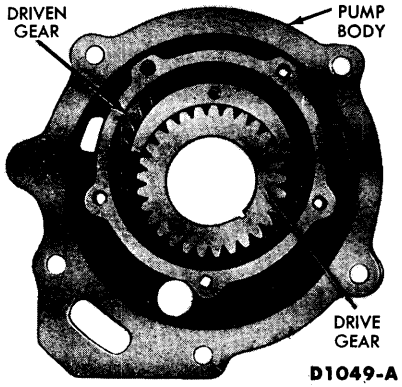


FIG. 41—Rear Pump

scores may be removed with crocus cloth. The stator support is serviced separately.

5. Bolt the front pump to the transmission case with capscrews.

6. Install the oil seal remover shown in Fig. 38. Then pull the front seal from the pump body.

7. Clean the pump body counterbore. Then inspect the bore for rough spots. Smooth up the counterbore with crocus cloth.

8. Remove the pump body from the transmisssion case.

9. Coat the outer diameter of a new seal with FoMoCo Sealing Compound, or its equivalent. Then position the seal in the pump body. Drive the seal into the pump body with the tool shown in Fig. 39 until the seal is firmly seated in the body. Tool 77837 may be reworked (Fig. 40) to install the latest type seal.

10. Place the pump driven gear in the pump body with the mark on the gear facing upward. Install the drive gear in the pump body.

11. Install the stator support and attaching screws. Check the pump gears for free rotation.

REAR PUMP

1. Remove the screws and lockwashers which secure the pump cover to the pump body, and remove the cover. Mark the top face of the pump drive and driven gear with Prussian blue to assure correct installation of gears at assembly (Fig. 41). **Do not scratch or punch marks on the pump gears.**

2. Remove the drive and driven gears from the pump body.

3. Place the pump driven gear in the pump body with the mark (placed on the gear at disassembly) facing upward.

4. Install the drive gear in the body with the mark facing upward. Install the pump cover, attaching screws, and lockwashers. Torque the screws to specification.

5. Check the pump for free rotation of the gears.

PRESSURE REGULATOR

1. Remove the valves from the regulator body.

2. Remove the regulator body cover attaching screws, and remove the cover (Fig. 42).

3. Remove the separator plate. Then remove the front pump check

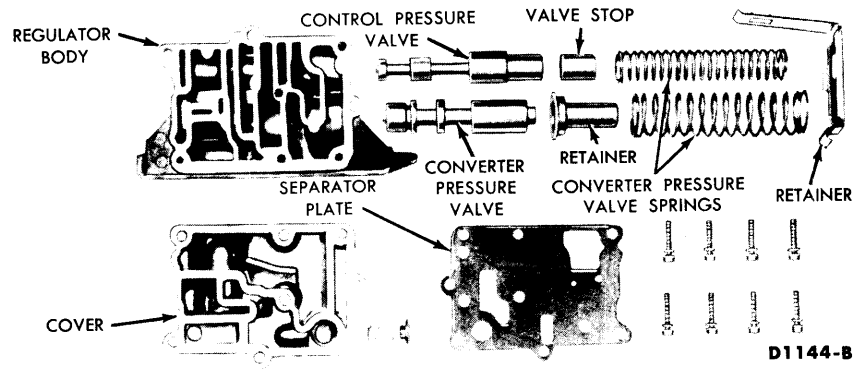


FIG. 42–Pressure Regulator Assembly

valve and spring from the regulator cover.

4. Wash all parts thoroughly in clean solvent and blow dry with moisture-free compressed air.

5. Inspect the regulator body and cover mating surfaces for burrs.

6. Check all fluid passages for obstructions.

7. Inspect the control pressure and converter pressure valves and bores for burrs and scores. Remove all burrs carefully with crocus cloth.

8. Check the free movement of valves in their bores. Each valve should fall freely into its bore when both the valve and bore are dry.

9. Inspect the valve springs for distortion.

10. Position the check valve spring and valve in the regulator cover.

11. Position the separator plate on the regulator cover.

12. Position the regulator cover and separator plate on the regulator body, and install the attaching screws. Torque the screws to specification.

13. Insert the valves in the pressure regulator body (Fig. 42).

CONTROL VALVE BODY

During the disassembly of the control valve assembly, avoid damage to valve parts and keep the valve parts clean. Place the valve assembly on a clean shop towel while performing the disassembly operation. **Do not separate the upper and lower valve bodies and cover until after the valves have been removed.**

1. Remove the manual valve (Fig. 43).

2. Remove the throttle valve body and the separator plate. Remove the throttle valve and retainer.

3. Remove one screw attaching the separator plate to the lower valve body. Remove the upper body front plate. **The plate is spring-loaded. Apply pressure to the plate while removing the attaching screws.**

4. Remove the compensator sleeve and plug, and remove the compensator valve springs. Remove the compensator valve.

5. Remove the throttle boost short valve and sleeve. Remove the throttle boost valve spring and valve.

6. Remove the downshift valve and spring.

7. Remove the upper valve body rear plate.

8. Remove the compensator cut back valve.

9. Remove the lower body side plate (Fig. 43). **The plate is spring-loaded. Apply pressure to the plate while removing the attaching screws.**

10. Remove the 1-2 shift valve and spring. Remove the inhibitor valve and spring.

11. Remove the two screws attaching the separator plate to the cover. Remove the lower body end plate. **The end plate is spring-loaded. Apply pressure to the plate while removing the attaching screws.**

12. Remove the rear servo lockout valve and spring.

13. Remove the 2-3 delay and throttle reducing valve sleeve, the throttle reducing valve, spring, and the 2-3 shift delay valve. Remove the 2-3 shift valve spring and valve.

14. Remove the transition valve.

15. Remove the plate (Fig. 43) from the valve body cover.

16. Remove the check ball spring and check ball. Remove the 3-2 kick-down control valve spring and valve.

17. Remove the 3-2 coasting control valve spring retainer from the cover. Remove the spring and valve.

18. Remove the through bolts and screws. Then separate the bodies.

19. Inspect the rear pump check valve for freedom of movement. This valve seats in the lower body, is staked for a firm fit and should not be removed unless a new one is to be installed.

20. Arrange all parts in their correct positions (Fig. 43). Rotate the valves and plugs when inserting them in their bores to avoid shearing of soft body castings.

21. Position the separator plate on the upper body.

22. Be sure that the rear pump check valve spring, valve, and seat in the lower body are correctly installed. Position the lower body on the upper body, and start **but do not tighten** the attaching screw.

23. Position the cover and separator plate on the lower body and start the four through bolts.

24. Align the separator with the upper and lower valve body attaching bolt holes. Install and torque the four valve body bolts to specification. **Excessive tightening of these bolts may distort the valve bodies, causing valves or plugs to stick.**

25. Install the 3-2 kick-down control valve and spring and the check ball and spring in the cover. Install the plate.

26. Install the 3-2 coasting control valve, spring, and spring retainer in the cover.

27. Install the transition valve in the lower body.

28. Install the 2-3 shift valve and spring. Install the 2-3 shift delay valve and the spring and throttle reducing valve in the sleeve. Slide the sleeve and valve into position in the lower body.

29. Install the rear servo lockout valve spring and valve. Install the lower body end plate.

30. Install the inhibitor valve spring and valve in the lower body.

31. Install the 1-2 shift valve spring and valve. Install the lower body side plate.

32. Install the compensator cutback valve in the upper body. Install the upper body rear plate.

33. Install the downshift valve spring and valve.

34. Install the throttle boost valve and spring. Install the throttle boost short valve and sleeve.

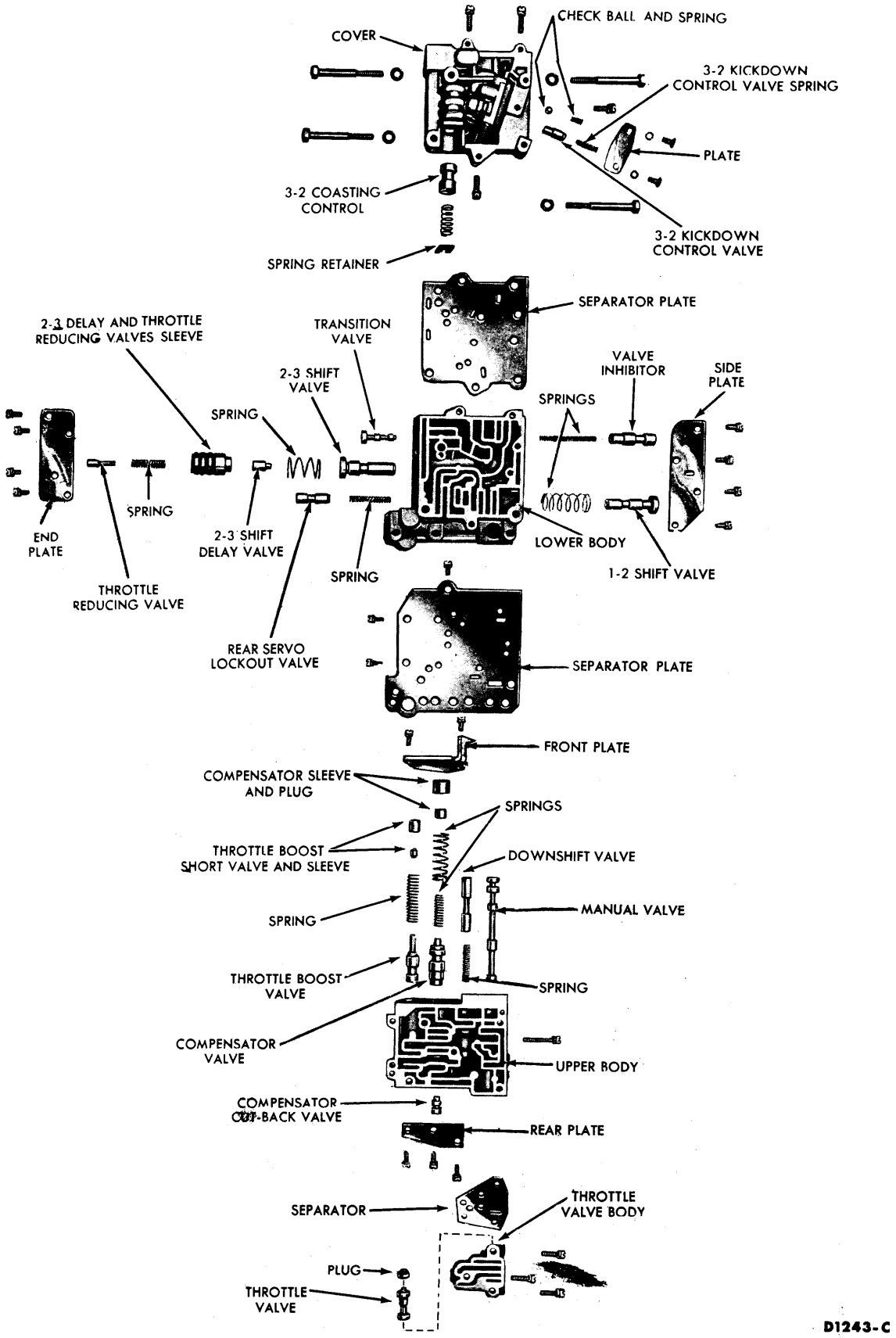


FIG. 43—Control Valve Body Disassembled

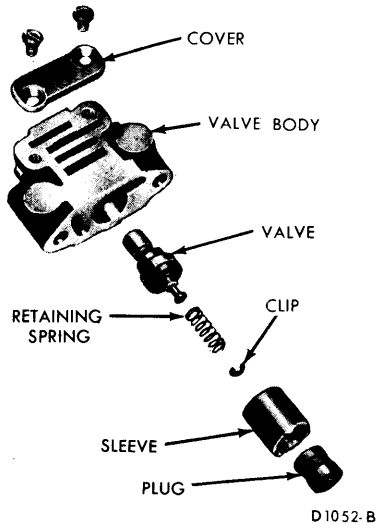


FIG. 44—Governor Disassembled

35. Install the compensator valve, inner and outer compensator springs, and the compensator sleeve and plug.

36. Position the front plate. Apply pressure to the plate while installing the two attaching screws.

37. Install the throttle valve and retainer in the throttle valve body. Position the separator on the upper body and install the throttle valve body. Install the three attaching screws.

38. Install four screws attaching the cover to the lower body, two screws attaching the separator plate to the upper body, and one screw attaching the separator plate to lower body. Torque the cover and body screws to specification.

39. Install the manual valve.

GOVERNOR

1. Remove the governor valve body cover.

2. Remove the valve body from the counterweight.

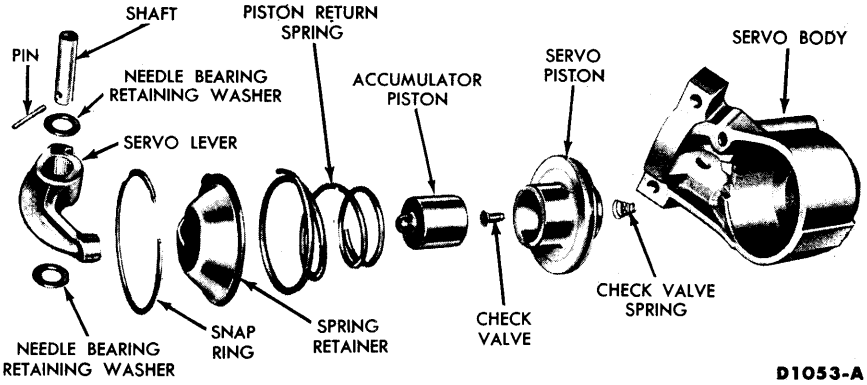


FIG. 46—Rear Servo

3. Remove the plug, sleeve, and valve from the body (Fig. 44).

4. Install the governor valve and spring assembly in the bore of the valve body. Install the sleeve, and plug. Make sure the three points on the end of the sleeve seat in the slots in the washer.

5. Install the body on the counterweight. **Make sure the fluid passages in the body and the counterweight are aligned.**

6. Position the valve body cover on the body, and install the screws.

FRONT SERVO

1. Remove the servo piston retainer snap ring (Fig. 45). The servo piston is spring loaded. **Apply pressure to the piston when removing the snap ring.**

2. Remove the servo piston retainer, servo piston, and the return piston from the servo body. It may be necessary to tap the piston stem lightly with a soft hammer to separate the piston retainer from the servo body.

3. Remove the screw and washer from the end of the piston stem, and separate the piston retainer, return piston, and servo piston.

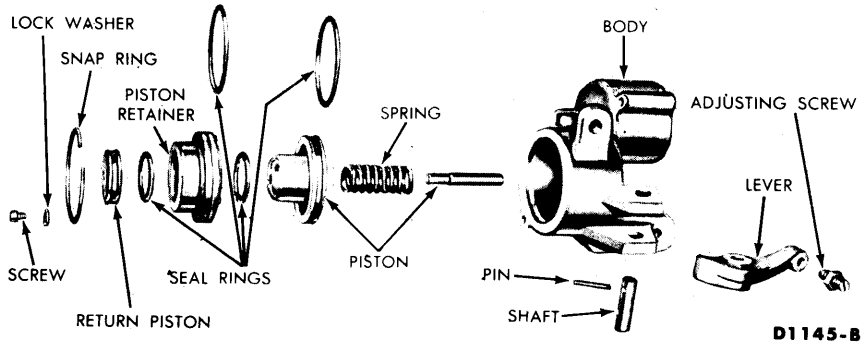


FIG. 45—Front Servo Disassembled

4. Remove all the seal rings, and remove the spring from the servo body.

5. Inspect the servo body for cracks and the piston bore and the servo piston stem for scores (Fig. 45). Check fluid passages for obstructions.

6. Check the actuating lever for free movement, and inspect it for wear. If necessary to replace the actuating lever or shaft, remove the retaining pin and push the shaft out of the bracket. If the shaft is not retained by a pin, it is retained in the body by serrations on one end of the shaft. These serrations cause a press fit at that end. To remove the shaft, press on the end opposite the serrations.

Inspect the adjusting screw threads and the threads in the lever.

7. Check the servo spring and servo band strut for distortion.

8. Inspect the servo band lining for excessive wear and bonding to the metal. **The band should be replaced if worn to a point where grooves are not clearly evident.**

9. Inspect the band ends for cracks and check the band for distortion.

10. To assemble, reverse the disassembly procedure.

REAR SERVO

1. Remove the servo actuating lever shaft retaining pin with a ⅛-inch punch. Remove the shaft and actuating lever needle bearings and thrust washers.

2. Press down on the servo spring retainer, and remove the snap ring. **Release the pressure on the retainer slowly to prevent the spring from flying out.**

3. Remove the retainer and servo spring (Fig. 46).

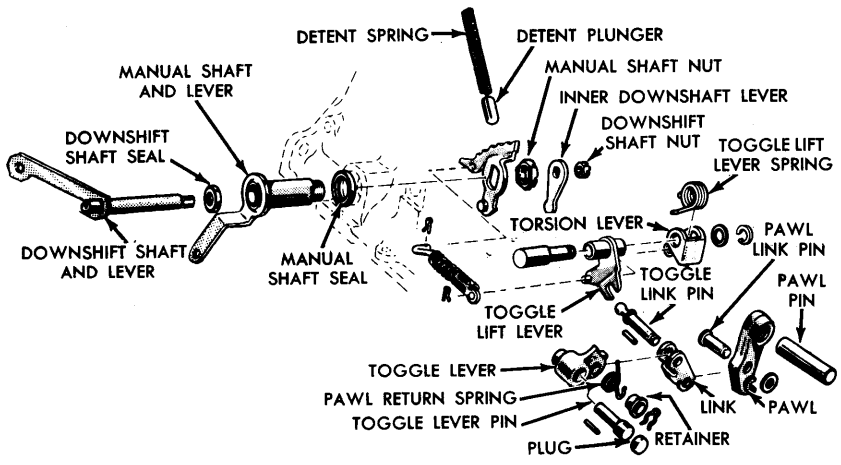


FIG. 47—Cruise-O-Matic Transmission Case Control Linkage

4. Force the piston out of the servo body with air pressure. Hold one hand over the piston to prevent damage.

5. Remove the piston seal ring. Remove the accumulator piston from the servo piston.

6. Install the accumulator piston in the servo piston.

7. Install a new seal ring on the servo piston.

8. Install the piston in the servo body. **Lubricate the parts to facilitate assembly.** Install the servo spring with the small coiled end against the servo piston.

9. Install the spring retainer. Compress the spring with a C-clamp. Then install the snap ring. **The snap ring must be fully seated in the groove.**

10. Install the needle bearings in the actuating lever. Install the actuating lever and thrust washers with the socket in the lever bearing on the piston stem. Install the actuating lever shaft, aligning the retaining pin holes, and install the pin.

11. Check the actuating lever for free movement.

TRANSMISSION CASE AND LINKAGE REPAIR

1. Remove the inner downshift lever shaft nut (Fig. 47). Then remove the inner downshift lever.

2. Remove the outer downshift lever and shaft. Remove the downshift shaft seal from the counterbore in the manual lever shaft.

3. Remove the cotter pin from the parking pawl toggle operating rod and remove the clip from the parking pawl operating lever. Remove the parking pawl operating rod assembly.

4. Rotate the manual shaft until the detent lever clears the detent plunger. Then remove the detent plunger and spring. **Do not allow the detent plunger to fly out of the case.**

5. Remove the manual lever shaft nut, and remove the detent lever. Remove the outer manual lever and shaft from the transmission case.

6. Remove the clip retaining the toggle operating lever and remove the assembly and disassemble the parts.

7. Tap the toggle lever sharply toward the rear of the case to remove the plug and pin.

8. Remove the pawl pin by working the pawl back and forth. Remove the pawl and toggle lever assembly, and then disassemble.

9. Remove the manual shaft seal and case vent tube.

10. If necessary remove cooler return check valve from the case.

11. To assemble the case linkage parts or cooler return check valve reverse the above disassembly procedure and check for free linkage operation.

ASSEMBLY

Do not use force to assemble mating parts. If the parts do not assemble freely, examine them for the cause of the difficulty. **Always use new gaskets during the assembly operations.**

CLUTCH ASSEMBLIES

1. Install the front band in the transmission case so that the anchor end is aligned with the anchor in the case.

2. Make sure the thrust washer is in place on the input shaft. Lift the clutch assemblies out of the holding block. **Do not allow the clutches to separate.**

3. Install the clutch sub-assemblies in the transmission case while positioning the servo band on the drum. Hold the units together while installing them (Fig. 28).

CENTER SUPPORT, ONE-WAY CLUTCH, PINION CARRIER, AND OUTPUT SHAFT

The production center supports are chamfered at the edge of the race (Fig. 48). The service center supports are not chamfered. The following assembly procedures cover both type of center supports.

INSTALLATION CENTER SUPPORT WITH CHAMFERED EDGE

1. Install the center support and the rear band in the case.

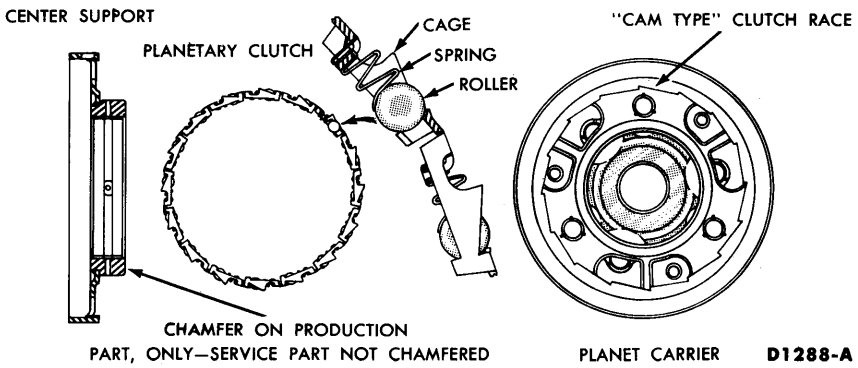


FIG. 48—Planetary Clutch, Planet Carrier and Center Support

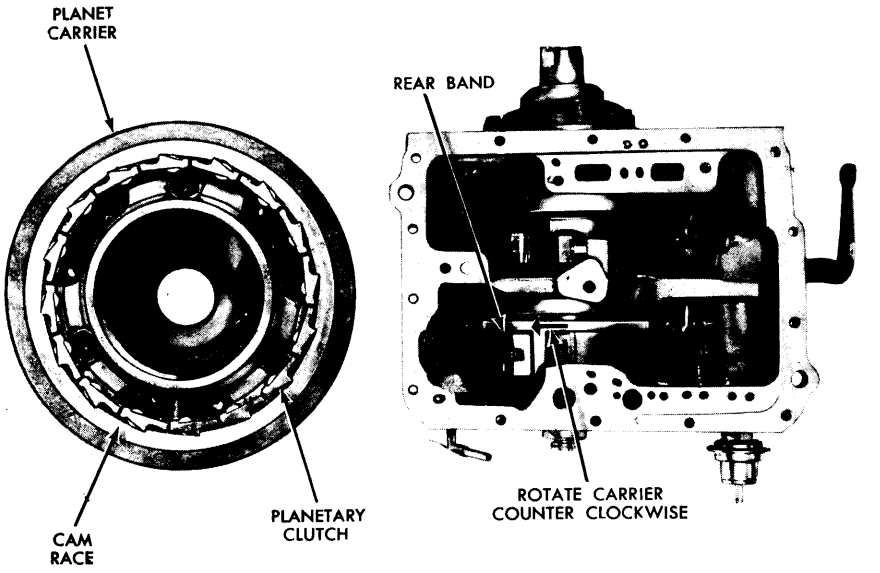


FIG. 49—Planetary Clutch Installation in Carrier—Using Chamfered Center Support

2. Install the primary sun gear rear thrust bearing race, needle bearing and front thrust bearing race, in the planet carrier, using petroleum jelly to retain them in place.

3. Lubricate the bearing surface on the center support, the rollers of the planetary clutch and the cam race in the carrier with petroleum jelly.

4. Install the planetary clutch in the carrier (Fig. 49).

5. Carefully position the planet carrier on the center support. Move the carrier forward until the clutch rollers are felt to contact the bearing surface of the center support.

6. While applying forward pressure on the planet carrier, rotate it counterclockwise as viewed from the rear (Fig. 49). This will cause the clutch rollers to roll toward the large opening end of the cams in the race, compressing the springs slightly, so that the rollers will ride up the chamfer on the planetary support and onto the inner race.

7. Push the planet carrier all the way forward.

8. Check the operation of the planetary clutch by rotating the carrier counterclockwise (viewed from the rear). It should rotate in this direction with a slight drag, and it should lock up when attempting to rotate it in a clockwise direction.

INSTALLATION—CENTER SUPPORT NOT CHAMFERED

1. Install the center support and the rear band in the case.

2. Install the primary sun gear rear thrust bearing race, needle bearing, and front thrust bearing race, in the planet carrier, using petroleum jelly to retain them in place.

3. Lubricate the bearing surface on the center support, the rollers of the planetary clutch and the cam race in the carrier with vaseline.

4. Install the planetary clutch on the center support with the "saw teeth" of the clutch cage pointing in the clockwise direction as viewed from the rear (Fig. 50). Make sure that all rollers are in the cage.

5. Position the planet carrier on the support so that the cams in the carrier engage the "saw teeth" on the clutch cage.

6. Push the planet carrier forward until the rollers are felt to contact the surface of the cam race.

7. While applying forward pressure on the carrier, rotate it counterclockwise as viewed from the rear. This will cause the rollers to roll toward the large opening end of the cams in the race, compressing the springs slightly, so that the rollers will enter the cams.

8. Some rollers may become cocked preventing their entry into the outer race. These rollers must be positioned individually with a small screwdriver by pushing the rear of the rollers toward the transmission and into the cam race (Fig. 50).

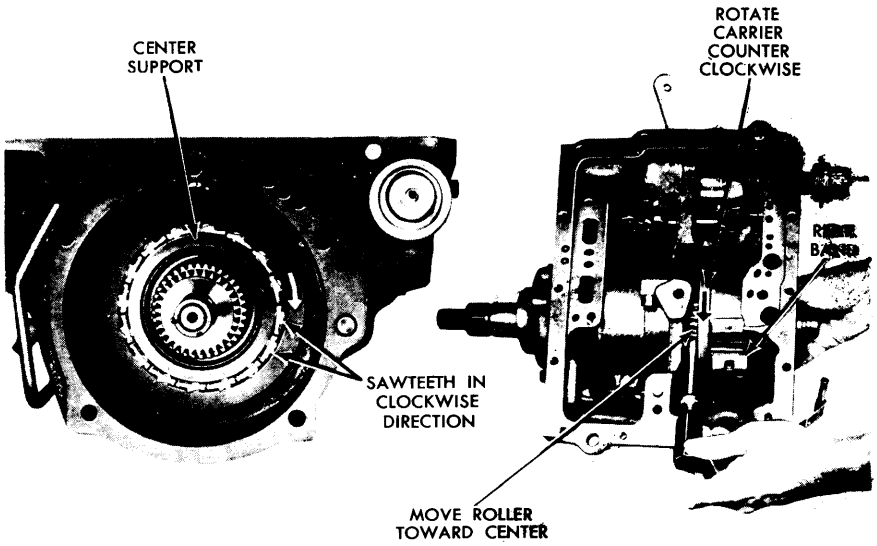


FIG. 50—Planetary Clutch Installation in Carrier—Using Center Support Not Chamfered

Keep pressure applied to the carrier at all times.

9. After all of the rollers have been started into the cam race, rotate the carrier counterclockwise while pushing it forward. Again, straighten any rollers which still may be in a cocked position and prevent the carrier from sliding onto the support.

10. Make sure that all springs are entered in the cam race before attempting to push the carrier on the support. Push the carrier all the way forward and check the operation of the clutch by rotating it in a counterclockwise direction. The carrier should rotate in this direction with a slight drag and should lock up when attempting to rotate it in a clockwise direction.

11. Install the selective thrust washer on the pinion carrier rear pilot. **If the end play was not within specifications when checked prior to disassembly, replace the washer with one of proper thickness.** Refer to the specifications, Part 7-3, for thrust washer selective thickness.

12. Install the output shaft, carefully meshing the internal gear with the pinions.

REAR PUMP

1. Position the rear pump drive key in the keyway on the output shaft.

2. Position new front and rear gaskets on the pump body. Retain the gaskets with transmission fluid.

3. Install the thrust washer and race in the rear pump (Fig. 27). Then install the rear pump. **Be sure the drive key is aligned with the keyway in the pump drive gear.**

GOVERNOR

1. Position the governor drive ball in the pocket in the output shaft. Retain the ball with transmission fluid.

2. Install the governor assembly, aligning the groove with the ball in the output shaft.

3. **Install the governor with the governor body plate toward the rear of the transmission.** Install the governor snap ring.

DISTRIBUTOR

1. Place the four seal rings in the distributor sleeve, and check the ring gap.

2. Check the fit of the seal rings in the grooves in the output shaft. The rings should rotate freely. Install the rings in the grooves of the output shaft.

3. Install the three tubes in the distributor sleeve.

4. Install the distributor sleeve on the output shaft, chamfer forward. Lubricate parts to facilitate assembly. Slide the sleeve forward over the 4 rings and at the same time start the tubes into the case. The distributor sleeve is located between the governor snap ring and speedometer driving gear.

5. Install a new seal on the rear pump outlet tube and install the tube in the transmission case and rear pump body.

SPEEDOMETER DRIVE GEAR

1. Position the speedometer drive gear ball in the pocket of the output shaft. Retain it with fluid.

2. To install the nylon gear, dip it in transmission fluid and place it on an illuminated 100-watt light bulb. If a steel gear is used, it will not be necessary to heat the gear to install it.

3. Allow the gear to remain on the bulb for five minutes. Then turn it over and heat the other side for five minutes. This will heat the gear to approximately 180° F.

4. Make sure the lock ball is in place on the shaft, and then quickly slide the gear into place.

5. Install the speedometer drive gear snap ring on the output shaft.

EXTENSION HOUSING

1. Insert the extension housing oil seal replacer and pilot in the housing, and install the extension housing on the transmission case. Coat the bolt threads with B5A-19554-A sealer and install the extension housing attaching bolts, breather tube clip, vacuum tube clip, and external tooth lockwashers. **The lockwashers must be installed with the rolled edge toward the transmission case to insure a tight seal.**

2. Torque the extension housing attaching bolts to specification.

3. Install the governor inspection cover and a new gasket on the housing.

FRONT PUMP

1. Position a new front pump gasket in the counterbore of the transmission case.

2. Install the front pump, aligning the pump bolt holes with the holes in the case. Install 3 of the front pump attaching bolts. Torque the bolts to specification.

TRANSMISSION END PLAY CHECK

1. Mount the dial indicator support in a front pump bolt hole. Mount a dial indicator on the support so that the contact rests on the end of the turbine shaft (Fig. 22).

2. Use a large screwdriver to pry the front of the clutch drum toward the rear of the transmission (Fig. 22). Set the dial indicator at zero.

3. Remove the screwdriver and pry the units toward the front of the transmission by inserting a screwdriver between the large internal gear and the transmission case (Fig. 22). Note the indicator reading. End play should be 0.010-0.029 inch (minimum end play is preferred).

4. Remove the indicator and the tool from the extension housing.

5. Install the one remaining front pump attaching bolt. Torque the bolt to specification.

FRONT SERVO

1. Position the front band forward in the case with the band ends up.

2. Position the servo strut with the slotted end aligned with the servo actuating lever, and with the small end aligned with the band end. Rotate the band, strut, and servo into position engaging the anchor end of the band with the anchor pin in the case.

3. Locate the servo on the case, and install the attaching bolts. **Tighten the attaching bolts only 2 or 3 threads.**

4. Install the servo tubes and lubrication tube.

REAR SERVO

1. Position the servo anchor strut, and rotate the rear band to engage the strut.

2. Position the servo actuating lever strut with a finger, and then install the servo and attaching bolts. Torque the bolts to specification.

PRESSURE REGULATOR BODY

1. Install the pressure regulator body and attaching bolts, and torque the bolts to specifications.

2. Install the control and converter valve guides and springs. Install the spring retainer.

3. Install a new seal ring on the rear pump intake tube, and install the tube in the case.

CONTROL VALVE BODY

1. Install the control valve assembly, carefully aligning the servo tubes with the control valve. Align the inner downshift lever between the stop and the downshift valve. Shift the manual lever to the L position. **Align the manual valve with the actuating pin in the manual detent lever. Do not tighten the attaching bolts.**

2. Install the large control pressure tube in the valve body and regulator.

3. Install the small control pressure compensator tube in the valve body and regulator.

4. Move the control valve body toward the center of the case as far as the attaching bolts will permit. This movement is made to take up clearance between the manual valve and the actuating pin on the manual detent lever.

5. Torque the attaching bolts to specification.

6. Turn the manual valve one full turn in each manual lever detent position. If the manual valve binds against the actuating pin in any detent position, loosen the valve body attaching bolts and move the body away from the center of the case. Move the body only enough to relieve the binding. Torque the attaching bolts and recheck the manual valve for binding.

7. Torque the front servo attaching bolts to specification.

FRONT SERVO ADJUSTMENT

1. Loosen the front servo adjusting screw lock nut, and back off the nut three turns.

2. Loosen the adjusting screw 5 complete turns.

3. Using the front band adjusting wrench shown in Fig. 14, adjust the front band.

REAR SERVO ADJUSTMENT

1. Loosen the adjusting screw lock nut 3 turns with the ¾-inch socket of the rear band adjusting wrench.

2. Back off the adjusting screw until free travel is obtained.

3. Use the special tools shown in Fig. 14 to adjust the rear band.

VACUUM DIAPHRAGM UNIT

1. Position the push rod in the bore of the vacuum diaphragm unit and install the diaphragm unit. Make sure the rod enters the hole in throttle valve.

2. Torque the diaphragm unit to specification.

FILTER-TYPE SCREEN AND OIL PAN

1. Position the filter-type screen over the rear pump inlet tube, and then over the front pump inlet tube. Press the filter-type screen down firmly. Install the retaining clip.

2. Place a new gasket on the transmission case, and install the pan. Install the attaching bolts and lockwashers. Torque the bolts to specification.

If the converter and converter housing were removed from the transmission, install these components. Position the transmission assembly on the transmission jack, and refer to "Transmission Installation Procedures" for installing the transmission.

PART 7-3 SPECIFICATIONS

CONTROL PRESSURE RANGES

Manifold Vacuum HG (Inches)	Engine Speed (RPM)	Selector Position	Gauge Reading (PSI)
18 Minimum	450-475	P-N-D1-D2-L	57-77
		R	71-106
16 to 13.7	As Required	D1-D2-L R	Pressure Starts Increasing
1.5 or Less	Stall 1800-2000	D1-D2-L	151-176
		R	201-213

TORQUE SPECIFICATIONS

Name	Foot Pounds
Converter to Flywheel Nuts	20-30
Converter Housing to Transmission Case Bolts	35-45
Front Pump to Transmission Case Bolts	17-22
Front Servo to Transmission Case Bolts	30-35
Rear Servo to Transmission Case Bolts	40-50
Planetary Support to Transmission Case Screws	20-25
Upper Valve Body to Lower Valve Body Bolts	4-6
Control Valve Body to Transmission Case Bolts	8-10
Pressure Regulator Assembly to Transmission Case Screws	17-22
Extension Assembly to Transmission Case Bolts	28-38
Oil Pan to Transmission Case Bolts	10-13
Case Assembly—Gauge Hole Plugs	7-15
Rear Band Adjusting Screw Locknut	35-40
Front Band Adjusting Screw Locknut	20-25
Manual Control Lever Nut	35-40
Downshift Lever Nut	17-20
Front Pump Cover Screws	25-35*
Rear Pump Cover Screws (¼-20)	80-90*
Rear Pump Cover Screws (10-24)	25-35*
Governor Inspection Cover Screws	50-60*
Converter Cover Drain Plug	15-28
Converter Housing to Engine Bolts	45-50
Transmission Vent Assembly	7-12
Governor Valve Body to Counterweight Screws	50-60*
Governor Valve Body Cover Screws	20-30*
Pressure Regulator Cover Screws	20-30*
Control Valve Body Screws	20-30*
Case Assembly—Oil Cover Inlet & Outlet Plugs	10-15
Front Servo Release Piston to Servo Piston Screws	20-30*
Vacuum Diaphragm Unit to Case	18-27†
Cooler Return Check Valve (In Case)	15-21

*Inch-Pounds †Using Tool FCO-24

TRANSMISSION GEAR RATIOS

Gear	Selector Lever Position	Clutch Applied	Band Applied	Gear Ratio
Neutral	N	None	None	—
First	D1	Front	Rear*	2.40:1
Second	D1 or D2	Front	Front	1.47:1
Third	D1 or D2	Front and Rear	None	1.00:1
Reverse	R	Rear	Rear	2.00:1

*In first gear D1, the planet carrier is held against rotation by the one-way clutch.

STALL SPEEDS

Selector Lever Position	Clutch Applied	Band Applied	Engine RPM
D2	Front	Front	1800-2000
D1	Front	One-Way Clutch	
L	Front	Rear	
R	Rear	Rear	

LUBRICANT REFILL CAPACITY

Type of Lubricant	Approximate Capacity
Ford Automatic Transmission Fluid C1AZ-19582-A	11½ Quarts (System Dry) 10 Quarts (Drain and Refill)

CHECKS AND ADJUSTMENTS

Operation	Specification
Transmission End Play Check	0.010-0.029 inch Selective Thrust Washers Available: 0.063-0.061 inch, 0.069-0.067 inch 0.076-0.074 inch, 0.083-0.081 inch
Turbine and Stator End Play Check	0.060 inch (maximum)
Front Band Adjustment (Use ¼-inch spacer between adjustment screw and servo piston stem)	Adjust screw to 10 in-lbs torque, and back off one full turn; lock nut to 20-25 ft-lbs
Rear Band Adjustment	Adjust screw to 10 ft-lbs torque, and back off 1½ turns; lock nut to 35-40 ft-lbs
Primary Sun Gear Shaft Ring End Gap Check	0.002-0.009 inch
Accelerator Pedal Height Adjustment	3 11/16 inches above floor mat
Rear Clutch Steel Plate Coning Clearance Check	0.010 inch (maximum)
Output Shaft to Fluid Distributor Seal Ring End Gap	0.001 to 0.006 inch

TRANSMISSION SHIFT POINTS (APPROXIMATE)

Automatic Shift Speeds (mph) (with 3.00:1 axle ratio)								Manual Shift Speeds (mph)
D1		D1 or D2		D1	D1 or D2	D1	D2	L
1-2 Minimum Throttle	1-2 Maximum Throttle	2-3 Minimum Throttle	2-3 Maximum Throttle	3-1 Minimum Throttle	3-2 Maximum Throttle	2-1 Maximum Throttle	3-2 Minimum Throttle	2-1
8-11	41-49	14-24	65-75	8-10	60-69	28-36	7-10	18-26

AUTOMATIC TRANSMISSION TOOLS

Ford Tool No.	Former No.	Description
T50T-100-A	—	Impact Hammer
TOOL-1175-AB	1175-AB	Grease Seal Remover (Head Only)
T50T-100-A & TOOL-1175-AB	1175-AE	Seal Remover (Head and Handle)
TOOL-4201-C	4201-C	Differential Backlash & Runout Gauge, with Universal Bracket, Dial Indicator & Bracket
TOOL-7000-CJ	7000-CJ	Transmission Overhaul Holding Fixture
TOOL-7000-DD	7000-DD	Air Nozzle Rubber-Tip Assembly
TOOL-7003	7003	Bench Test Turning Tool
TOOL-7195-C	7195-C	Rear Brake Adjusting Wrench
T58L-7195-A	—	Fordomatic Band Adjusting Wrench
TOOL-7225-B	7225-B	Front Band Adjustment Wrench
TOOL-7225-C13-B	7225-C13-B	Gauge Block and Chain Assembly
T61L-7657-A	7657-AA	Transmission Extension Housing Oil Seal Replacer
T61L-7657-B	7657-AB	Transmission Extension Housing Oil Seal Replacer
T57P-7697-A	7000-AD	Transmission Extension Housing Bushing Remover
T57P-7697-B	7000-J	Transmission Extension Housing Bushing Replacer
T58L-7902-A or B	7937-A 7946-A	Welded Converter Sprag Driver and Gauge Post
T63P-7902-A	—	Converter Stator Check Adapter
TOOL-77067	77067	Dial Indicator Support Fixture
TOOL-77515	—	Rear Clutch Spring Compressor
TOOL-77530-A	77530-A	Clutch Assembly Fixture
TOOL-77565	77565	Front Clutch Spring Compressor
T57L-77820-A	77820-B	Automatic Transmission 400 Pound Pressure Gauge
T59L-77837-A	—	Front Pump Seal Replacer
T63L-77837-A	—	Front Pump Seal Replacer
TOOL-77869-A	77869-A 77869-W	Transmission Sleeve Remover and Replacer

CLUTCH PLATE APPLICATION

FRONT CLUTCH		REAR CLUTCH	
Steel Plates	Composition Plates	Steel Plates	Composition Plates
4	5	6	6