TRANSMISSION MANUAL AUTOMATIC

CONTENTS

GENERAL SPECIFICATIONS

Manual transmission and transfer case model	KM145
Transmission	
Type	Forward full-synchromeshed
Gear ratio 1st	3.740
2nd	2.136
3rd	1.360
4th	1.000
5th	0.856
Reverse	3.578
Final gear ratio	4.625 4.875 (Option)
Speedometer gear ratio	26/8 . . . Final gear ratio 4.625 27/8 . . . Final gear ratio 4.875 (Option)
Transfer case	
Type	Constant mesh type
Gear ratio High	1.000
Low	1.944
Drive system Front wheel	Chain drive
Rear wheel	Direct drive
Automatic transmission and transfer case model	KM146
Automatic transmission	
Type	Full automatic three speed with torque converter
Torque converter diameter	241 mm (9.5 in.)
Oil capacity – transmission and torque converter	6.8 liters (7.2 U.S.pts.) (6.0 Imp.pts.)
Cooling method	Water cooling
Oil pump	Rotor type
Gear ratio 1st	2.745
2nd	1.545
3rd	1.000
Reverse	2.214
Speedometer gear ratio	24/8 . . . Final gear ratio 4.222 26/8 . . . Final gear ratio 4.625 (Option)
Transfer case	
Type	Constant mesh type
Gear ratio High	1.000
Low	1.944
Drive system Front wheel	Chain drive
Rear wheel	Direct drive

SERVICE SPECIFICATIONS

mm (in.)

Manual transmission	
Retainer to bearing clearance	0-0.1 (0-.004) . . . Adjusting with spacer
Reverse idler gear end play	0.12-0.28 (.005-.011)
Over drive gear end play	0.1-0.25 (.004-.10)
Main drive gear end play	0-0.06 (0-.002) . . . Adjusting with snap ring
3rd-4th synchronizer hub end play	0-0.08 (0-.003) . . . Adjusting with snap ring
Resistance springs free length	28 (1.10)
Plunger springs free length	42 (1.65)
Automatic transmission	
Inhibitor switch to selector lever clearance	2.5 (.1)
Clutches	
Number of front clutch plates	3
Number of front clutch discs	3
Number of rear clutch plates	3
Number of rear clutch discs	4
Clutch plate clearance	
Front clutch	0.61-1.78 (.024-.070)
Rear clutch	0.64-1.22 (.025-.048) . . . Adjusting snap ring
Input shaft end play	0.56-2.3 (.022-.091)
Gear train end play	0.16-0.83 (.006-.033)
Pump clearance	
Side clearance	0.025-0.064 (.001-.0025)
Tip clearance	0.13-0.25 (.005-.010)
Body clearance	0.09-0.19 (.0035-.0075)
Band adjustments	
Kickdown	Backed off 3 1/2 turns from 5.9 Nm (4.3 ft.lbs.)
Low-reverse band	Backed off 7 turns from 4.9 Nm (3.6 ft.lbs.)
Transfer case	
Rear bearing end play	0-0.1 (0-.004) . . . Adjusting with snap ring

Adjustment Spacer and Snap Ring

Manual transmission		
Snap ring for main drive gear		
Thickness mm (in.)-Ident. color-Part No.		2.30 (.091)-White-MD701729
		2.35 (.093)-None-MD701730
		2.40 (.094)-Red-MD701731
		2.45 (.096)-Blue-MD701732
		2.50 (.098)-Yellow-MD701733
Spacer for main drive gear bearing to front retainer		
Thickness mm (in.)-Ident. color-Part No.		0.84 (.033)-Black-MD701845
		0.93 (.037)-None-MD701839
		1.02 (.040)-Red-MD701840
		1.11 (.044)-White-MD701841
		1.20 (.047)-Yellow-MD701842
		1.29 (.051)-Blue-MD701843
		1.38 (.054)-Green-MD701844
Snap ring for mainshaft front end		
Thickness mm (in.)-Ident. color-Part No.		2.15 (.085)-Blue-MD701761
		2.22 (.087)-None-MD701762
		2.29 (.090)-Brown-MD701763
		2.36 (.093)-White-MD701764
Automatic transmission		
Snap rings		
Rear clutch snap ring		
Thickness mm (in.)		1.52-1.57 (.060-.062)
		1.93-1.98 (.076-.078)
		2.49-2.54 (.098-.100)
Output shaft forward end		
Thickness mm (in.) – color		1.02-1.12 (.040-.044) – Red
		1.57-1.68 (.062-.066) – Green
		2.08-2.18 (.082-.086) – White
Thrust washers		
Reaction shaft support to front clutch retainer	#1	1.55-1.60 (.061-.063)
Front clutch to rear clutch	#2	1.55-1.60 (.061-.063)
Input shaft to output shaft	#3	selective
		1.32-1.37 (.052-.054)
		1.73-1.78 (.068-.070) – Red
		2.11-2.16 (.083-.085) – Green
Front annulus gear support to snap ring	#4	3.07-3.18 (.120-.125)
Front annulus support to front carrier	#5	1.22-1.27 (.048-.050)
Front carrier to driving shell thrust plate	#6	1.22-1.27 (.048-.050)
Driving shell thrust plate	#7, #8	1.27-1.32 (.050-.052)
Driving shell thrust plate to rear carrier	#9	1.22-1.27 (.048-.050)
Rear carrier to rear annulus support	#10	1.22-1.27 (.048-.050)

Transfer case	
Snap ring for input gear assemby	
Thickness mm (in.) – color	2.70 (.106) – Purple
	2.75 (.108) – Pink
	2.80 (.110) – Yellow
	2.85 (.112) – White
	2.90 (.114) – Blue
Snap ring for H-L clutch hub	
Thickness mm (in.) – color	2.14 (.084) – None
	2.21 (.087) – Yellow
	2.28 (.090) – White
	2.35 (.093) – Blue
	2.42 (.095) – Red
Snap ring for input gear bearing	
Thickness mm (in.) – color	2.30 (.091) – None
	2.35 (.093) – Red
	2.40 (.094) – White
	2.45 (.096) – Blue
	2.50 (.098) – Green
Spacer for rear output shaft bearing	
Thickness mm (in.) – color	0.84 (.033) – Black
	0.93 (.037) – None
	1.02 (.040) – Red
	1.11 (.044) – White
	1.20 (.047) – Yellow
	1.29 (.051) – Blue
	1.38 (.054) – Green

TORQUE SPECIFICATIONS

	Nm (ft.lbs.)
Manual transmission	
Transmission mounting bolts	42-54 (31-40)
Starting motor mounting bolts	22-31 (16-23)
Clutch cable bracket attaching bolts	9.8-12.7 (7.2-9.4)
Mainshaft lock nut	98-127 (72-94)
Idler shaft lock nut	19.6-58.8 (14.5-43)
Under cover attaching bolt	7.8-9.8 (6-7)
Control lever housing attaching bolts	4.9-6.9 (4-5)
Countershaft gear lock nut	68.6-98.0 (50-72)
Reverse shaft nut	19.6-58.8 (15-43)
Backup light switch	29.4 (22)
Drain plug	58.8 (43)
Oil filler plug	29.4-34.3 (22-25)
Automatic transmission	
Selector handle set screw	2.0 (1.4) or more
Control arm to control rod (B)	13 (9)
Cross shaft bracket mounting bolt	10-13 (7-9)
Control arm-to-selector lever lock nut	18-24 (13-17)
Cooler line fitting	11-14 (8-10)
Cooler line nut	9.6 (7.1)
Transmission mounting bolts	42-54 (31-40)
Starting motor mounting bolts	20-29 (15-22)
Converter drive plate to crankshaft bolt	112.7-121.5 (83-90)
Converter drive plate to torque converter bolt	46-51 (34-38)
Governor body to support bolt	10-12 (8-9)
Kickdown band adjusting screw lock nut	41-54 (30-40)
Kickdown lever shaft plug	15-19 (11-14)
Oil pan bolt	15-19 (11-14)
Oil pump housing to transmission case bolt	17-23 (12-17)
Output shaft support bolt	15-19 (11-14)
Pressure test take-off plug	11-14 (8-10)
Reaction shaft support to oil pump bolt	16-21 (12-15)
Reverse band adjusting screw lock nut	35-47 (26-34)
Transmission to engine bolt	38.2 (28)
Valve body screw	2.9-4.9 (2.2-3.6)
Valve body to transmission case bolt	10-13 (7-9)

Nm (ft.lbs.)

Transfer case	
Adapter to transfer case mounting bolts and nuts	30-41 (22-30)
Chain cover bolt	30-41 (22-30)
Side cover bolt	30-41 (22-30)
Rear cover bolt	8-9.5 (6-7)
Cover bolt	15-21 (11-15)
Control housing bolt	10-12 (7.5-9)
Oil filler plug	30-34 (22-25)
Drain plug	30-34 (22-25)
Select plug	30-34 (22-25)
Rocking plate bolt	15-21 (11-15)
Rear output shaft lock nut	98-127 (73-94)
Speedometer sleeve clamp bolt	15-21 (11-15)
Seal plug	30-41 (22-30)
4WD switch	30 (22)

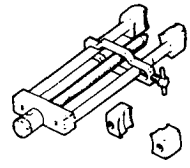
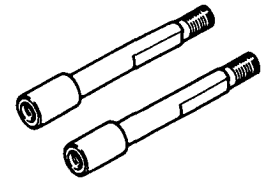
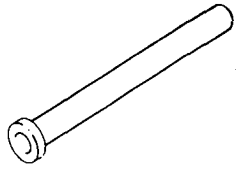
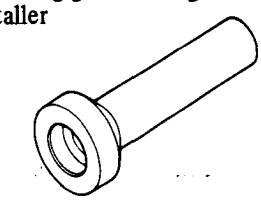
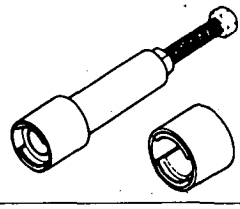
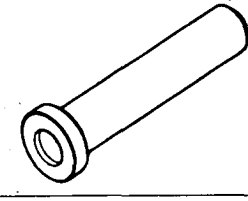
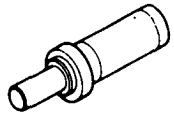
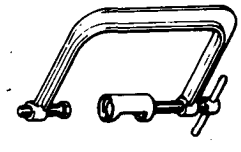
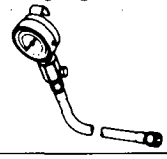
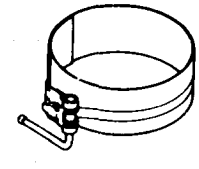
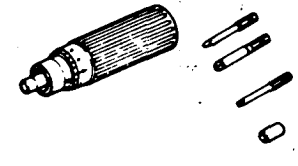
LUBRICANTS

lit. (U.S.qts., Imp.qts.)

	Specified lubricant	Quantity
Manual transmission	Hypoid gear oil SAE80W, 75W-85W, conforming to API GL-4	2.2 (2.3, 1.9)
Automatic transmission	ATF "DEXRON" or "DEXRON II" type	6.8 (7.2, 6.0)
Transfer case	Hypoid gear oil SAE80W, 75W-85W, conforming to API GL-4	2.2 (2.3, 1.9)
Sliding parts of the selector lever	Multipurpose grease SAE J310a, NLGI grade #3	As required
Sliding parts of the selector handle	Multipurpose grease SAE J310a, NLGI grade #3	As required
Sliding parts of the control rods	Multipurpose grease SAE J310a, NLGI grade #3	As required

SEALANT

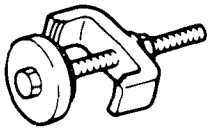
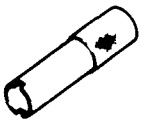
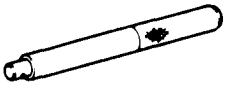
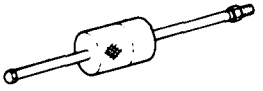
	Specified sealant	Quantity
Both sides of the extension housing gasket	3M Super silicone 8662 or equivalent	As required
Threads of extension housing attaching bolts	3M Super silicone 8662 or equivalent	As required

Tool (Number and name)	Use	Tool (Number and name)	Use
MD998020 Bearing puller 	Removal of the main drive gear bearing	MD998028 Bearing puller adapter 	Use with MD998020
MD998067 "*" Mainshaft bearing installer 		MD998029 "*" Main ring gear bearing installer 	
MD998192 "*" Counter gear bearing puller 		MD998199 "*" Countershaft bearing installer 	
MD998200 "*" Front bearing retainer oil seal installer 		MD998303 "*" (C-3422-B) Valve spring compressor 	Common to engine and automatic transmission Removal and installation of the kickdown servo and low-reverse servo
MD998330 "*" (C-3292 for 100 psi. and C-3293 for 300 psi.) Oil pressure gauge 	Measurement of the oil pressure	MD998335 "*" Oil pump band 	Assembling the oil pump
MD998352 "D" Dial gauge support 	Measurement of the input shaft end play	MD998353 "D" Torque driver set 	Tightening the valve body bolts

"*", "D" see page 2 for instructions.

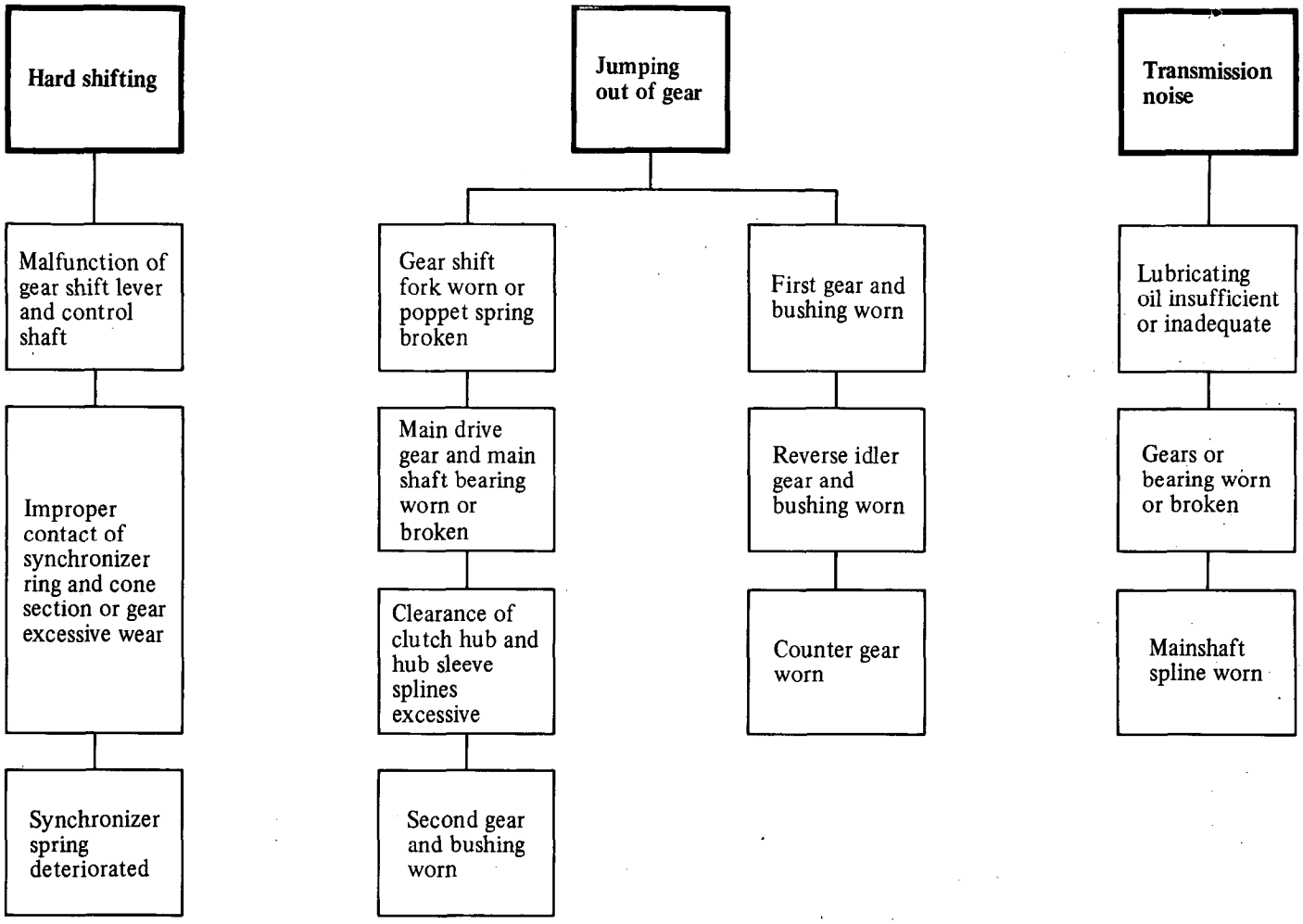
Tool (Number and name)	Use	Tool (Number and name)	Use
MD998356 "*" Oil pressure gauge adapter 	Connecting the oil pressure gauge	MD998357 "D" Kickdown band adjusting wrench 	Adjustment of the kickdown band
MD998358 "D" Low-reverse band adjusting wrench 	Adjustment of the low-reverse band	MD998500 "D" (SP-3551) Pump housing bushing remover 	
MD998501 "D" (SP-5117) Pump housing bushing installer 		MD998502 "D" (SP-3524) Reaction shaft bushing remover 	
MD998503 "D" (SP-3633) Cup 	Use with MD998502	MD998504 "D" (SP-1911) Nut 	Use with MD998502
MD998505 "D" (SP-5325) Reaction shaft bushing installer 		MD998506 "D" (SP-3627) Front clutch retainer bushing 	
MD998507 "D" (SP-3626) Front clutch retainer bushing 		MD998563 "*" (C-3763) Throttle pressure adjust tool 	Adjustment of the throttle pressure

"*", "D" see page 2 for instructions.

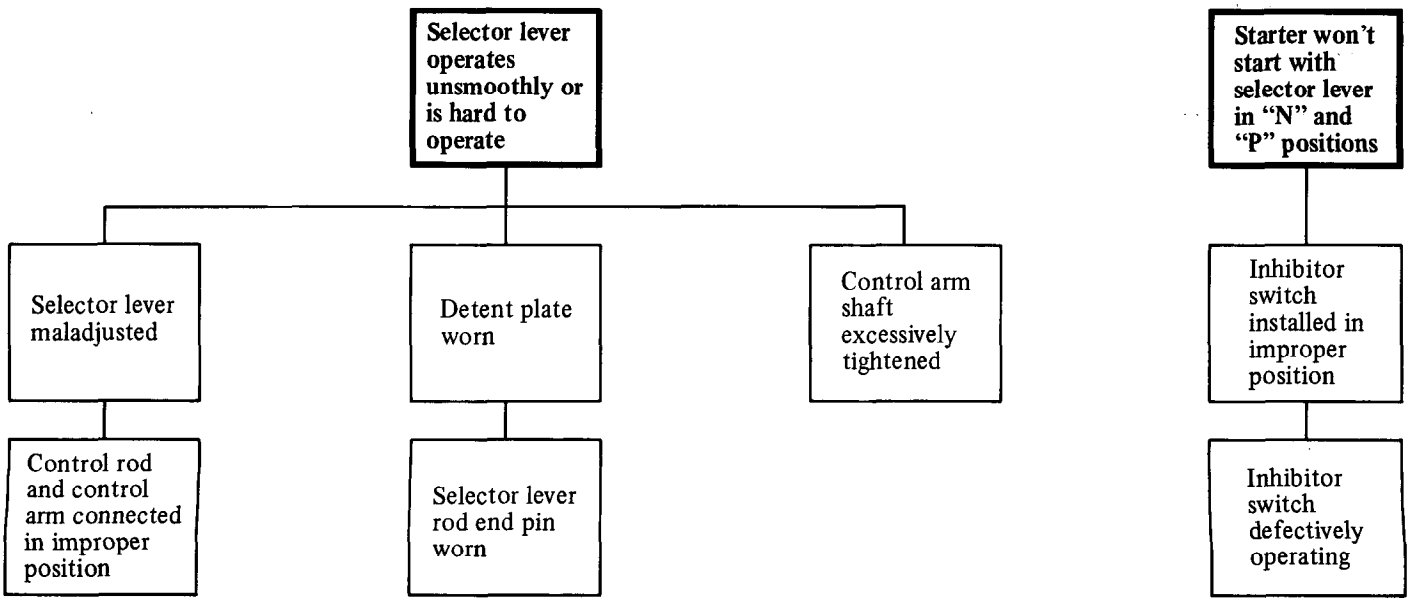
Tool (Number and name)	Use	Tool (Number and name)	Use
MD998572 "*" (C-3575-A) Spring compressor 	Removal and installation of the front clutch bearing	MD998573 "D" (C-3756) Converter alignment tool 	Alignment of holes of the oil pump rotor
MD998580 "*" (C-4193) Oil pump oil seal installer 		MD998581 "*" (C-4171) Driver handle 	Removal and installation of pump housing bushing Use with MD998500 or MD998501
MD998583 "*" (C-3752) Oil pump remover 	Removing oil pump housing	MD998584 "*" (C-3238-B) Pilot stud "A" 	Installation of output shaft support
MD998585 "*" (C-3283-A) Pilot stud "B" 	Assembly of oil pump		

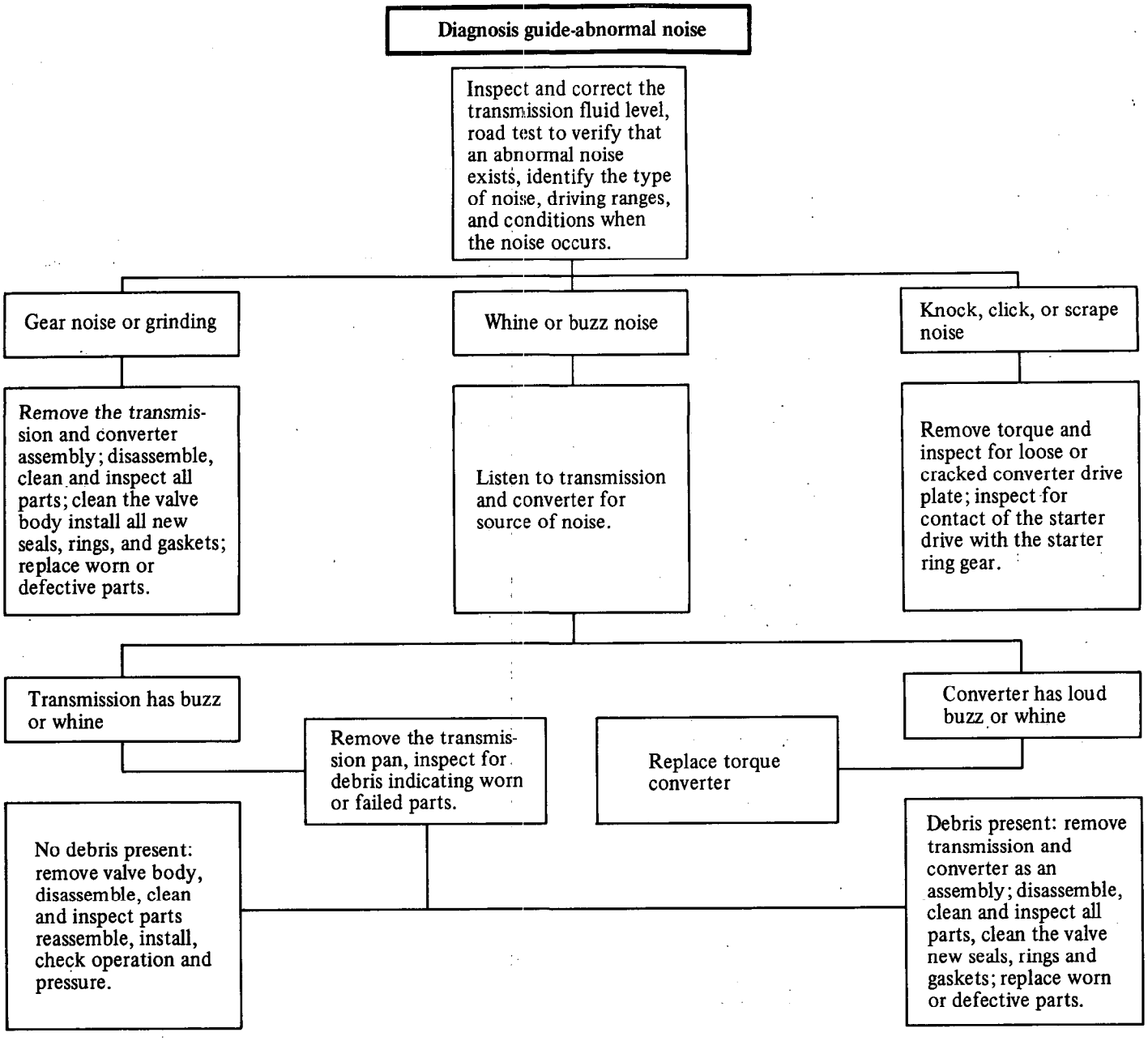
"*", "D" see page 2 for instructions.

MANUAL TRANSMISSION



AUTOMATIC TRANSMISSION




Diagnosis guide-abnormal noise
Inspect and correct the transmission fluid level, road test to verify that an abnormal noise exists, identify the type of noise, driving ranges, and conditions when the noise occurs.
Gear noise or grinding
Whine or buzz noise
Knock, click, or scrape noise
Remove the transmission and converter assembly; disassemble, clean and inspect all parts; clean the valve body install all new seals, rings, and gaskets; replace worn or defective parts.
Listen to transmission and converter for source of noise.
Remove torque and inspect for loose or cracked converter drive plate; inspect for contact of the starter drive with the starter ring gear.
Transmission has buzz or whine
Converter has loud buzz or whine
Remove the transmission pan, inspect for debris indicating worn or failed parts.
Replace torque converter
No debris present: remove valve body, disassemble, clean and inspect parts reassemble, install, check operation and pressure.
Debris present: remove transmission and converter as an assembly; disassemble, clean and inspect all parts, clean the valve new seals, rings and gaskets; replace worn or defective parts.

Diagnosis guide-vehicle will not move

Check the transmission fluid level before starting the engine. If no fluid is visible on the dip stick, add fluid to the 'L' mark before starting the engine. Then start the engine with the transmission in neutral and listen for noise.

- Abnormal noise: stop engine immediately; remove the transmission and converter as an assembly. Disassemble, clean and inspect all parts. Clean valve body; install all new seals, rings, and gaskets; replace worn or defective parts.
- No abnormal noise, move the selector to a forward drive range and observe the propeller shaft for turning.
  - Propeller shaft turns but rear wheels do not turn: inspect for broken rear axle parts.
  - Propeller shaft does not turn: remove the transmission oil pan. Inspect for debris.
    - No debris: remove valve body; disassemble, clean and inspect all parts. Reassemble, install and check pressures and operation.
    - Debris is present: remove transmission and converter as an assembly; disassemble, clean and inspect all parts. Clean valve body; install all new seals, rings, and gaskets; replace worn or defective parts.

Diagnosis guide-fluid leaks

Visually inspect for source of leak. If the source of leak cannot be readily determined, clean the exterior of the transmission. Check transmission fluid level. Correct if necessary.

- The following leaks may be corrected without removing the transmission: manual lever shaft oil seal, filler tube 'O' ring pressure, gauge plug neutral start switch, pan gasket oil cooler fittings, extension housing to case gasket, extension housing to case bolts, extension housing yoke seal, speedometer adapter 'O' ring, front band adjusting screw.
- The following leaks require removal of the transmission and torque converter for correction: transmission fluid leaking from the lower edge of the converter housing, caused by front pump to case seal, or torque converter weld. Cracked or porous transmission case.

DIAGNOSIS CHART-GENERAL (AUTOMATIC TRANSMISSION)

Diagnosis Chart-General

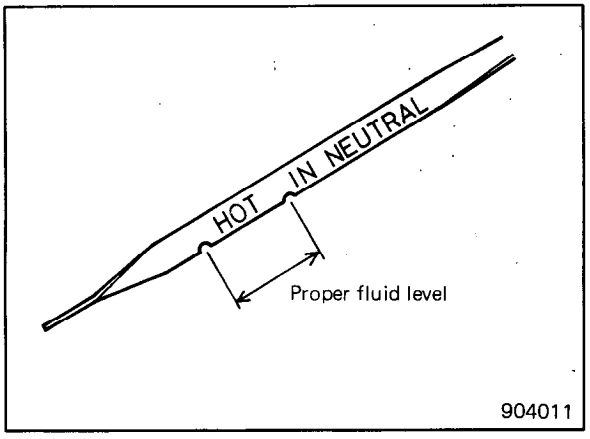
CONDITION	POSSIBLE CAUSE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
HARSH ENGAGEMENT FROM NEUTRAL TO D OR R	Engine idle speed too high.	X																															
	Hydraulic pressures too low.		X		X																				X								
	Low-reverse band out of adjustment.			X																													
	Valve body malfunction or leakage.		X		X		X	X			X																						
	Low-reverse servo, band or linkage malfunction.		X		X	X	X	X	X	X	X	X	X																				
	Low fluid level.		X		X		X	X	X	X	X	X	X																				
	Incorrect gearshift control linkage adjustment.							X	X																								
	Oil filter clogged.							X	X	X	X																						
	Faulty oil pump.							X	X	X	X																						
	Worn or broken input shaft seal rings.										X	X	X																				
	Aerated fluid.											X	X																				
	Engine idle speed too low.													X	X																		
	Incorrect throttle linkage adjustment.													X																			
	Kickdown band out of adjustment.														X																		
	Overrunning clutch not holding.															X																	
	Output shaft bearing and/or bushing damaged.																X																
	Governor support seal rings broken or worn.																	X															
	Worn or broken reaction shaft support seal rings.																	X	X														
	Governor malfunction.																			X	X												
	Kickdown servo band or linkage malfunction.																			X	X												
	Worn or faulty front clutch.																	X				X											
	High fluid level.																						X										
	Breather clogged.																							X									
	Hydraulic pressure too high.																								X								
	Kickdown band adjustment too tight.																									X							
	Faulty cooling system.																										X						
	Insufficient clutch plate clearance.																											X					
	Worn or faulty rear clutch.																											X					
	Rear clutch dragging.																																
	Planetary gear sets broken or seized.																																
	Overrunning clutch worn, broken or seized.																																
	Overrunning clutch inner race damaged.																																
HARSH ENGAGEMENT FROM NEUTRAL TO D OR R		X																															
DELAYED ENGAGEMENT FROM NEUTRAL TO D OR R			X		X	X		X	X	X	X	X	X																				
RUNAWAY UPSHIFT			X		X		X		X			X		X					X		X	X										
NO UPSHIFT			X		X		X	X					X					X	X	X	X											
3-2 KICKDOWN RUNAWAY			X		X		X					X	X	X					X		X	X										
NO KICKDOWN OR NORMAL DOWNSHIFT					X									X						X	X												
SHIFTS ERRATIC			X		X		X	X	X	X		X		X					X	X	X	X										
SLIPS IN FORWARD DRIVE POSITIONS			X		X		X	X	X	X		X		X		X						X										
SLIPS IN REVERSE ONLY			X	X	X	X	X	X		X		X							X			X										
SLIPS IN ALL POSITIONS			X		X		X		X	X	X	X																					
NO DRIVE IN ANY POSITION			X		X		X	X	X	X																					X		
NO DRIVE IN FORWARD DRIVE POSITIONS			X		X		X				X					X													X	X	X		
NO DRIVE IN REVERSE			X	X	X	X		X											X		X	X							X	X			
DRIVES IN NEUTRAL					X			X																					X	X			
DRAGS OR LOCKS				X																						X				X	X		
GRATING, SCRAPING, GROWLING NOISE				X											X		X													X	X		
BUZZING NOISE					X		X					X																				X	
HARD TO FILL, OIL BLOWS OUT FILLER TUBE									X			X											X	X									
TRANSMISSION OVERHEATS			X	X			X	X		X																X			X	X			
HARSH UPSHIFT				X											X	X									X								
DELAYED UPSHIFT															X	X			X	X	X	X											

DIAGNOSIS

Automatic transmission malfunctions may be caused by four general conditions: poor engine performance, improper adjustments, hydraulic malfunctions, and mechanical malfunctions, Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and ATF condition, control rod adjustment, and throttle linkage adjustment. Then perform a road test to determine whether the problem has been corrected or that more diagnosis is necessary. If the problem exists after the preliminary tests and corrections are completed, hydraulic pressure tests should be performed.

Fluid level and condition

1. Drive to a flat surface.
2. Before the dipstick is removed, clean the protective cap and the top of the filler tube.
3. Run the engine at idle.
4. Move the selector lever through a round of all positions (P-L) before placing it in "N" position. Pull the parking brake lever beforehand.
5. Make sure that the ATF is heated to normal operating temperature [approx. 80°C (170°F)].
6. The fluid level should be between the notches above "ADD-1-PINT" and below "FULL" inscribed on the dipstick. (904011)



Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

Improper filling can also raise the fluid level too high. When the transmission has too much fluid, the gears churn up foam and cause the same conditions which occur with a low fluid level.

In either case, the air bubbles can cause overheating, fluid oxidation and varnish which can interfere with normal valve, clutch and servo operation. Foaming can also result in fluid escaping from the transmission vent and oil filler tube where it may be mistaken for a leak.

Along with fluid level, it is important to check the condition of the fluid. When the fluid smells burned and is contaminated with metal or friction material particles, a complete transmission overhaul is needed. Be sure to examine the fluid on the dipstick closely. If there is any doubt about its condition, drain out a sample for a double check.

7. Insert the dipstick all the way in.

Adjustment of control rod

1. Check to ensure that when the manual control lever of the transmission is placed in the "N" position, the position indicator correctly shows "N".
2. Check to ensure that the selector lever can be operated smoothly and clicks into each position and that the position indicator correctly indicates the position.
3. For adjustment, refer to "Maintenance and Adjustment."

Throttle linkage

The throttle linkage adjustment is very important to proper transmission operation. This adjustment positions a valve which controls shift speed, shift quality and part throttle down shift sensitivity. If the setting is too short, early shifts and slippage between shifts may occur. If the setting is too long, shifts may be delayed and part throttle down shifts may be very sensitive.
For adjustment, refer to "Maintenance and Adjustment."

Road test

Prior to performing a road test, be certain that the fluid level and ATF condition, control rod adjustments and throttle linkage adjustments have been checked and approved.

During the road test the transmission should be operated in each position to check for slipping and any variation in shifting. Note whether the shifts are harsh or spongy and check the speeds where the upshifts and downshifts occur. Approximate shift speeds for the various modes of operation are shown in the "Automatic Shift Speed Pattern".

Observe closely for slipping or engine speed flare-up. Slipping or flare-up in any gear usually indicates clutch, band or overrunning clutch problems. If the condition is far advanced, an overhaul will probably be necessary to restore normal operation.

In most cases, the clutch or band that is slipping can be determined by noting the transmission operation in all selector positions and by comparing which internal units are applied in those positions. The "Elements in Use Chart" provides a basis for road test analysis.

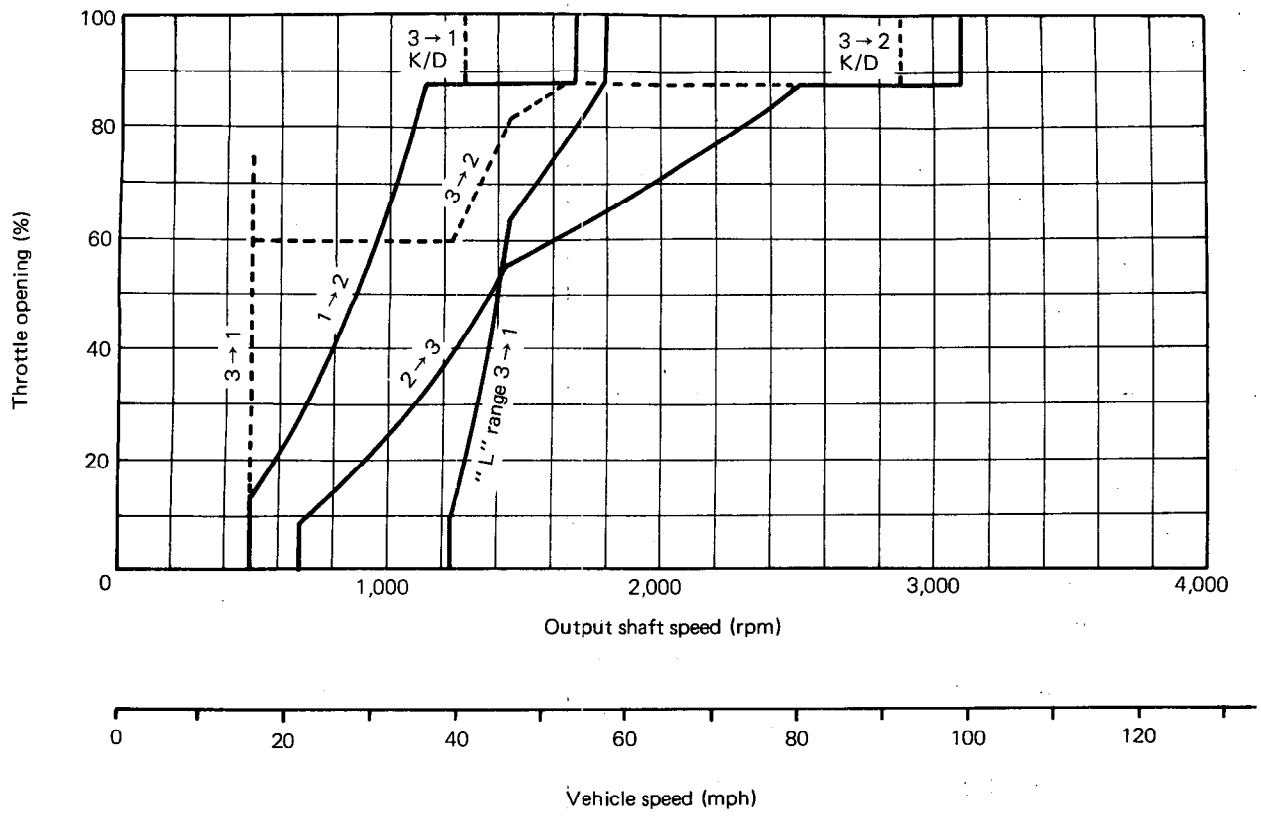
By observing that the rear clutch and the overrunning clutch are applied in the "D" first gear and that the rear clutch and low-reverse band are applied in "L" first, if the transmission slips in "D" range first gear but does not slip in "L" first gear, the overrunning clutch must be the unit that is slipping. Similarly, if the transmission slips in any two forward gears, the rear clutch is the slipping unit.

Using the same procedure, the rear clutch and front clutch are applied in "D" third gear. If the transmission slips in third gear, either the front clutch or the rear clutch is slipping. By selecting another gear which does not use one of those units, the unit which is slipping can be determined. If the transmission also slips in reverse, the front clutch is slipping. If the transmission does not slip in reverse, the rear clutch is slipping.

This process of elimination can be used to detect any unit which slips and to confirm proper operation of good units. However, although road test analysis can usually diagnose slipping units, the actual cause of the malfunction usually cannot be decided. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

Therefore, unless the condition is obvious, like no drive in "D" range first gear only, the transmission should never be disassembled until hydraulic pressure tests have been performed.

Automatic Shift Speed Pattern



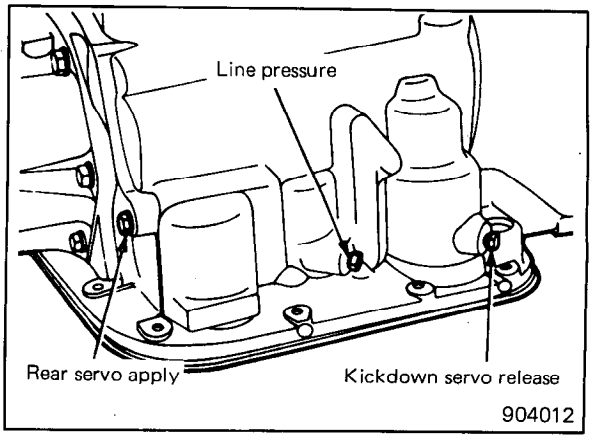
Elements in Use at Each Position of the Selector Lever

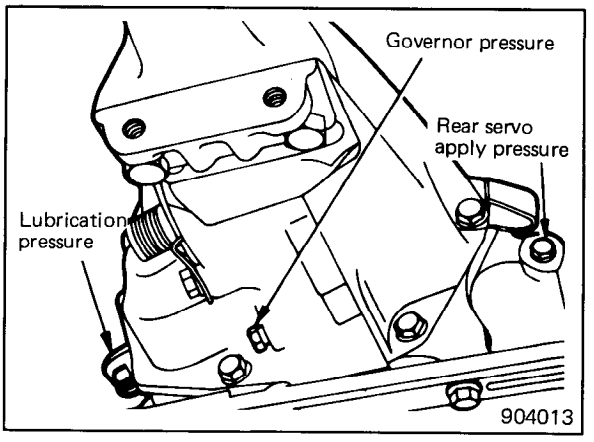
Selector Lever Position	Gear Ratio	Start Safety	Parking Sprag	Clutches Front	Clutches Rear	Clutches Over-running	Bands (Kickdown) Front	Bands (Low-Rev.) Rear
P–PARK		X	X					
R–REVERSE	2.21			X				X
N–NEUTRAL		X						
D–DRIVE								
First	2.45				X	X		
Second	1.45				X		X	
Direct	1.00			X	X			
2–SECOND								
First	2.45				X	X		
Second	1.45				X		X	
L–LOCK–UP								
First	2.45				X			X

HYDRAULIC PRESSURE TESTS

Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most transmission problems.

1. Before performing pressure tests, be certain that fluid level and ATF condition, control rod adjustments and throttle linkage adjustments have been checked and approved. Fluid must be at operating temperature [approx. 80°C (170°F)].
2. Install an engine tachometer, raise vehicle on hoist which allows rear wheels to turn, and position tachometer so it can be read under the vehicle.
3. Disconnect throttle rod and shift rod A from transmission levers so they can be controlled under the vehicle.
4. Attach 3MPa (300 psi) gauge (MD998300) and adaptor (MD998356) to ports required for test being conducted.
5. Test port locations are shown in illustration. (904012, 904013)





Test 1 (Selector in "L")

1. Attach gauges to "line" and "rear servo" ports.
2. Operate engine at 1,600 rpm for test.
3. Move selector lever on transmission all the way forward ("L" position).
4. Read pressures on both gauges as throttle lever on transmission is moved from full rearward position to full forward position.
5. Line pressure should read 372 to 414 kPa (54 to 60 psi) with throttle lever rearward and gradually increase, as lever is moved forward, to 621 to 662 kPa (90 to 95 psi).
6. Rear servo pressure should read the same as line pressure within 21 kPa (3 psi).
7. This tests oil pump, oil pressure regulating valves (regulator valve and throttle valve) and hydraulic circuit conditions.

Test 2 (Selector in "2")

1. Attach gauge to "line pressure" port and "tee" into rear cooler line fitting to read "lubrication" pressure.
2. Operate engine at 1,600 rpm for test.
3. Move selector lever on transmission one "detent" rearward from full forward position. This is selector "2" position.
4. Read pressures on both gauges as throttle lever on transmission is moved from full rearward position to full forward position.
5. Line pressure should read 372 to 657 kPa (54 to 95 psi) with throttle lever rearward and gradually increase, as lever is moved forward, to 621 to 662 kPa (90 to 96 psi).
6. Lubrication pressure should be 39 to 108 kPa (6 to 16 psi) with lever rearward and 69 to 207 kPa (10 to 30 psi) with lever forward.
7. This tests pump output, pressure regulation, and condition of rear clutch and lubrication hydraulic circuits.

Test 3 (Selector in "D")

1. Attach gauges to "line" and "kickdown servo release" ports.
2. Operate engine at 1,600 rpm for test.
3. Move selector lever on transmission two "detents" rearward from full forward position. This is selector "D" position.
4. Read pressures on both gauges as throttle lever on transmission is moved from full rearward position to full forward position.
5. Line pressure should read 372 to 414 kPa (54 to 60 psi) with throttle lever rearward and gradually increase, as lever is moved forward.
6. Kickdown servo release is pressurized only in 3rd gear (direct drive) and should be same as line pressure within 21 kPa (3 psi), up to downshift point.
7. This tests pump output, pressure regulation, and condition of rear clutch and front clutch hydraulic circuits.

Test 4 (Selector in Reverse)

1. Attach gauge to "rear servo apply" port.
2. Operate engine at 1,600 rpm for test.
3. Move selector lever on transmission four "detents" rearward from full forward position. This is selector "R" position.
4. Rear servo pressure should read 1,570 to 1,790 kPa (230 to 260 psi).
5. This tests pump output, pressure regulation, and condition of front clutch and rear servo hydraulic circuits.
6. Move selector lever on transmission to "D" position to check that rear servo pressure drops to zero.
7. This tests for leakage into rear servo, due to case porosity, which can cause low-reverse band burn out.

Test result indications

1. If proper line pressure, minimum to maximum, is found in any one test, the pump and pressure regulator are working properly.
2. Low pressure in "D, L and 2" but correct pressure in "R" indicates rear clutch circuit leakage.
3. Low pressure in "D and R" but correct pressure in "L" indicates front clutch circuit leakage.
4. Low pressure in "R and L" but correct pressure in "2" indicates rear servo circuit leakage.
5. Low line pressure in all positions indicates a defective pump, a clogged filter or a stuck pressure regulator valve or throttle valve.

GOVERNOR PRESSURE TEST

Test only if transmission shifts at wrong vehicle speeds when throttle rod is correctly adjusted.

1. Connect a pressure gauge, to governor pressure take-off point, located at lower left side of extension near the mounting flange.
2. Operate transmission in third gear to read pressures and compare speeds shown in chart.
   If governor pressures are incorrect at the given vehicle speeds, the governor valve and/or weights are probably sticking. The governor pressure should respond smoothly to changes in km/h (mph) and should return to 0 to 10 kPa (0 to 1.5 psi) when vehicle is stopped. High pressure at stand still [above 14 kPa (2 psi)] will prevent the transmission from down shifting.

THROTTLE PRESSURE TEST

No gauge port is provided for the throttle pressure. Incorrect throttle pressure should only be suspected if part throttle up-shift speeds are either delayed or occur too early in relation to vehicle speeds. Engine runaway on either up shifts or down shifts can also be an indicator of incorrect (low) throttle pressure setting.

Caution

In no case should throttle pressure be adjusted until the transmission throttle linkage adjustment has been verified to be correct.

CONVERTER STALL TEST

Warning

During test let no one stand in front of vehicle

The stall test consists of determining the engine speed obtained at full throttle in "D" position. This test checks the torque converter stator clutch operation, and the holding ability of the transmission clutches. The transmission fluid level should be checked and the engine brought to normal operating temperature before stall operation. Both the parking and service brakes must be fully applied and front wheels blocked while making this test.

Do not hold the throttle open any longer than is necessary to obtain a maximum engine speed reading, and never longer than five seconds at a time. If more than one stall check is required, operate the engine at idle in neutral for 20 seconds to cool the ATF between runs. If engine speed exceeds the maximum limits shown, release the accelerator immediately since transmission clutch slippage is indicated.

Engine stall speed	2,300-2,800 rpm

Stall Speed Above Specification in "D"

If stall speed exceeds specification, transmission overrunning clutch or rear clutch slippage is indicated. Follow the transmission oil pressure checks outlined in this section to determine the cause of slippage.

Stall Speed Below Specification

Low stall speeds with a properly tuned engine indicate torque converter problems.

If stall speeds are below specification and the vehicle operates properly at highway speeds, but has poor through-gear acceleration, the stator overrunning clutch is slipping.

If stall speed and acceleration are normal, but abnormally high throttle opening is required to maintain highway speeds, the stator clutch has seized.

Both of these stator defects require replacement of the torque converter.

Noise

A whining or siren-like noise due to fluid flow is normal during stall operation with some converters; however, loud metallic noises from loose parts or interference within the assembly indicate a defective torque converter. To confirm that the noise originates within the converter, operate the vehicle at light throttle in "D" and "N" on a hoist and listen under the transmission bell housing.

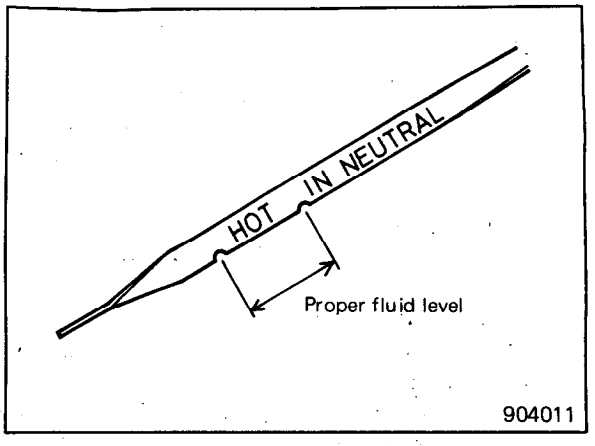
FLUID LEAKAGE–TRANSMISSION CONVERTER HOUSING AREA

1. Check for Source of Leakage. Since fluid leakage at or around the converter area may originate from an engine oil leak, the area should be examined closely. Factory fill ATF is dyed red and, therefore, can be distinguished from engine oil.
2. Prior to removing the transmission, perform the following checks:
   When leakage is determined to originate from the transmission, check fluid level prior to removal of the transmission and torque converter.
   High fluid level can result in fluid leakage out of the vent located at the top of the front pump housing. If the fluid level is high, adjust to proper level.
   After performing these operations, re-check for leakage. If a leakage persists, carefully check to determine whether it is the converter or the transmission (the oil seal of the oil pump housing or the fitting portions of the oil pump housing and case) that is leaking.

LUBRICATION

Checking Fluid Level and Replenishing Fluid

Check and replenish interval:
Every 48,000 km (30,000 miles)
Inspect fluid level of dipstick with engine idling and transmission in neutral position. When ATF temperature is about 80°C (170°F) (average operating temperature), fluid level should be between upper and lower notches of dipstick. (904011)



Changing Fluid

Recommended fluid .....
ATF "DEXRON" or "DEXRON II" type

NOTES
1. When factory fill fluid is changed as recommended above, only fluids of type labeled ATF "DEXRON" or "DEXRON II" type should be used.
2. If the transmission is disassembled for any reason, the fluid and filter should be changed.

Fluid Changing Procedure

1. Raise vehicle on a hoist. Place a drain container with a large opening, under transmission fluid pan.
2. Loosen pan bolts and tap the pan at one corner to break it loose allowing fluid to drain, then remove the oil pan.
3. If necessary, adjust the low-reverse band.
4. Install a new filter on bottom of the valve body, and tighten retaining screws to specified torque.

Tightening torque ..... 3-5 Nm (2.2-3.6 ft.lbs.)

5. Clean the oil pan, and reinstall using a new gasket. Tighten oil pan bolts to specified torque.

Tightening torque ..... 15-20 Nm (11-14 ft.lbs.)

6. Pour 3.8 liter (4.0 U.S. qts., 3.4 Imp. qts.) of recommended fluid through the filler tube.

Recommended fluid .....
ATF "DEXRON" or "DEXRON II" type

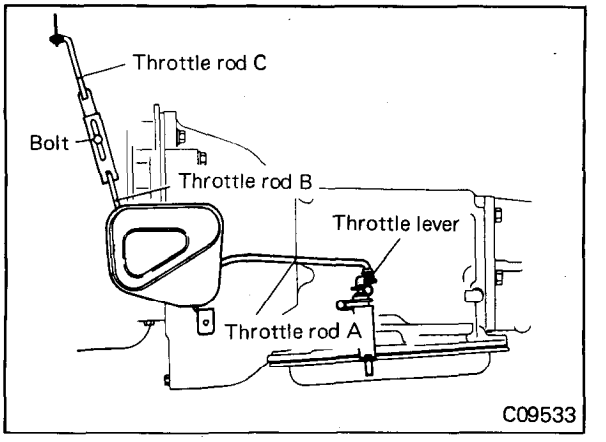
7. Start engine and allow it to idle for at least two minutes. Then, with parking brake on, move selector lever momentarily to each position ("P" to "L"), ending in the neutral position.
8. Add ATF until fluid level reaches lower notch of dipstick. After transmission has reached average operating temperature, recheck fluid level. Fluid level should be between notches of dipstick.

Caution
Check fluid level with vehicle on flat surface.
Use care to prevent entry of dust and foreign matter through filler tube. After inspection, reinsert dipstick all the way into filler tube.

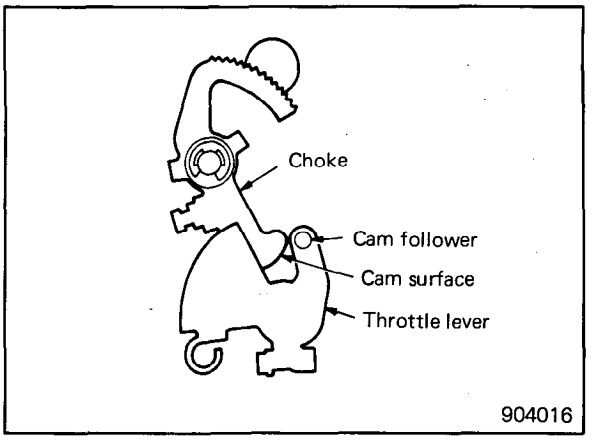
ADJUSTMENT OF THROTTLE LINKAGE

Caution
When engine idling adjustment is made, make sure that throttle linkage is readjusted.

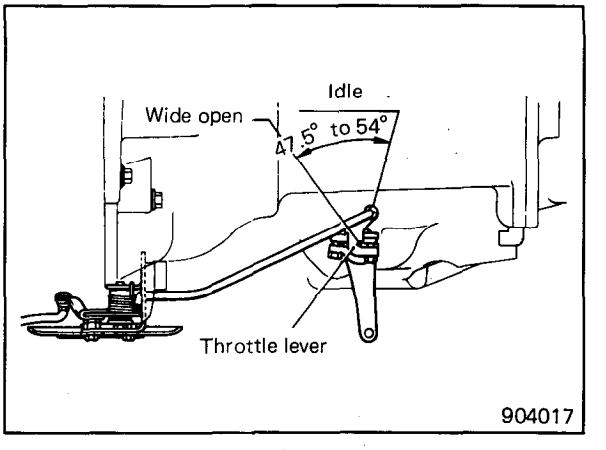
1. Install each linkage. Loosen the bolts so that rods B and C slide properly.



2. Allow engine to warm up until engine coolant temperature reaches average operating temperature [about 80°C (170°F)]. Confirm complete release of fast idle. This confirmation can be made by checking to see if cam surface of choke lever of carburetor is completely off cam follower of throttle lever.



3. Lightly push rod A or the transmission throttle lever toward the idle stopper (to the right in illustration (904017)), and set the rods to the idle position. Tighten the bolt securely to connect rods B and C.
4. Make sure that, when the carburetor throttle valve is wide-open, the transmission throttle lever moves as shown in illustration (904017) (operating angle: 47.5°-54°), and that there is some range in the lever stroke. Also make sure that, when the throttle linkage alone is slowly returned from the fully opened position, the transmission throttle lever completely returns to IDLE by return-spring force.



BAND ADJUSTMENTS

Kickdown Band

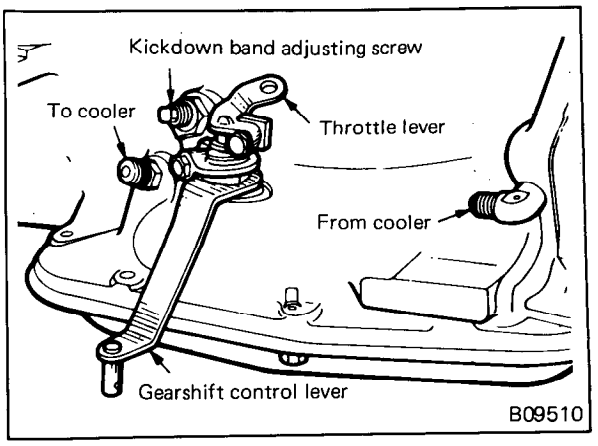
The kickdown band adjusting screw is located on left side of the transmission case. (B09510)

1. Loosen lock nut and back off approximately five turns. Test adjusting screw for free turning in the transmission case.
2. Using torque wrench with kickdown band adjusting wrench MD998357, tighten band adjusting screw to specified torque.

Tightening torque	
When adjuster MD998357 is used	5.9 Nm (4.3 ft.lbs.)
When adjuster MD998357 is not used	7.8 Nm (5.8 ft.lbs.)

3. Back off adjusting screw three and a half turns from 5.9 Nm (4.3 ft.lbs.). Hold adjusting screw in this position and tighten lock nut to specified torque.

Tightening torque ..... 40-55 Nm (30-41 ft.lbs.)



Low and Reverse Band

1. Raise vehicle, drain ATF from loosened oil pan and remove the oil pan.
2. After lock nut has been removed, tighten adjusting screw to specified torque using special tool. (904133)

Tightening torque ..... 4.9 Nm (3.6 ft.lbs.)

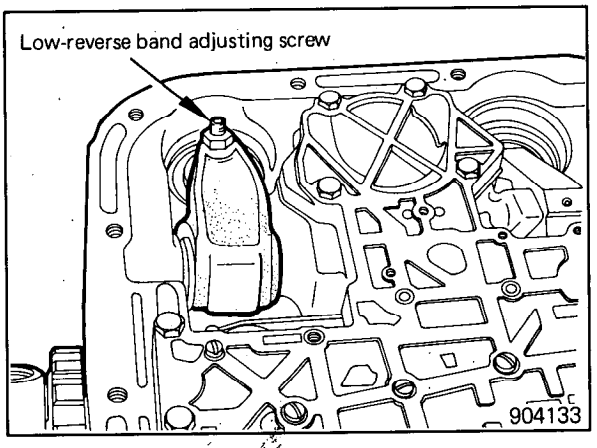
3. Back off adjusting screw 7 turns from 4.9 Nm (3.6 ft.lbs.)
4. Mount and tighten lock nut to specified torque.

Tightening torque ..... 34-47 Nm (25-35 ft.lbs.)

5. Clean oil pan, replace gasket, and reinstall. Tighten oil pan bolts to specified toruqe.

Tightening torque ..... 15-20 Nm (11-14 ft.lbs.)

6. Fill transmission with specified ATF. For how to pour in ATF, refer to "Lubrication" in this section.



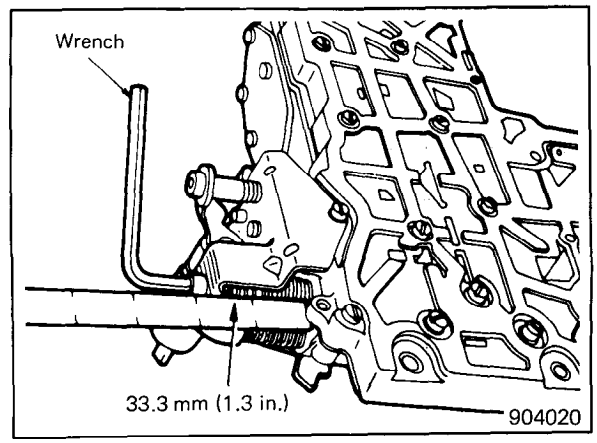
HYDRAULIC CONTROL PRESSURE ADJUSTMENTS

Line Pressure

An incorrect throttle pressure setting will cause incorrect line pressure readings even though line pressure adjustment is correct. Always inspect and correct throttle pressure adjustment before adjusting the line pressure.

The approximate adjustment is 33.3 mm (1.3 in.), measured from valve body to inner edge of adjusting nut. However, due to manufacturing tolerances, the adjustment can be varied to obtain specified line pressure.

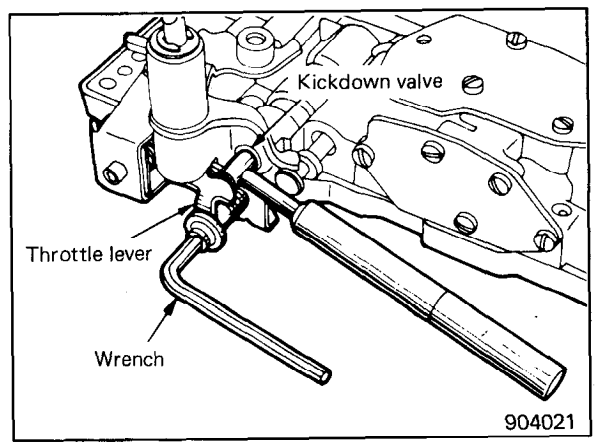
The adjusting screw may be turned with an Allen wrench. One complete turn of adjusting screw changes closed throttle line pressure approximately 9.8 kPa (1.4 psi). Turning adjusting screw counterclockwise increases pressure, and clockwise decreases pressure.



Throttle Pressure

Throttle pressures cannot be tested accurately; therefore, the adjustment should be measured if a malfunction is evident.

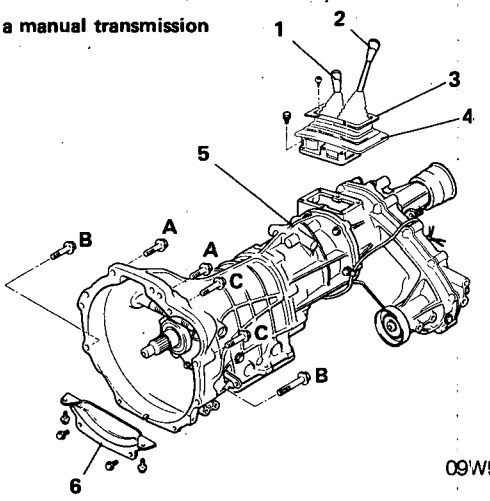
1. Insert Special Tool Throttle Pressure Adjust Tool MD998563 between the throttle lever cam and kickdown valve.
2. By pushing in on tool, compress kickdown valve against its spring so that throttle valve is completely bottomed inside the valve body.
3. As force is being exerted to compress spring, turn throttle lever stop screw with Allen wrench until head of screw touches the throttle lever tang with throttle lever cam touching tool and the throttle valve bottomed. Be sure adjustment is made with spring fully compressed and valve bottomed in the valve body.



COMPONENTS

1. Transfer gearshift lever
2. Transmission gearshift lever
3. Dust cover retaining plate
4. Gearshift lever cover
5. Manual transmission and transfer assembly
6. Bell housing cover
7. Automatic transmission and transfer assembly

Vehicles with a manual transmission



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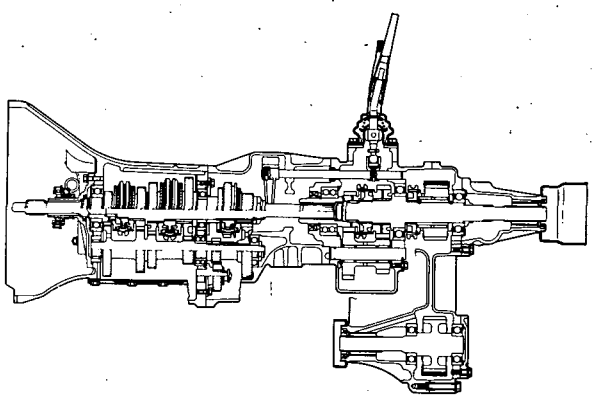

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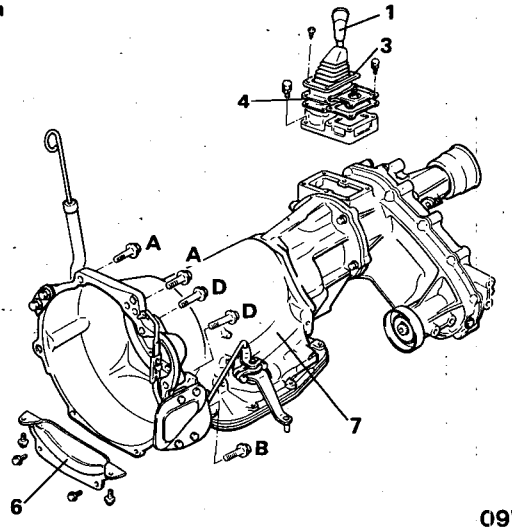
Vehicles with an automatic transmission



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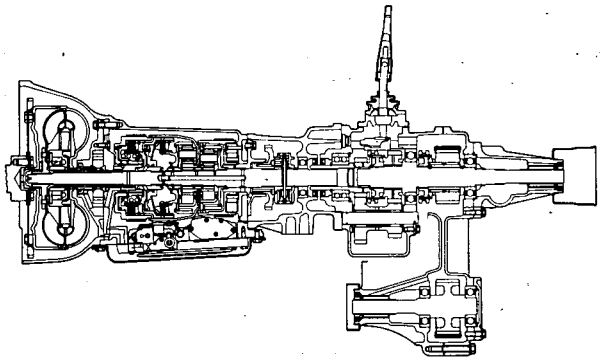
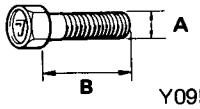


146001

	Nm	ft.lbs.	O.D. x Length mm (in.)
A	42-54	31-40	(7) 10 x 40 (.4 x 1.6)
B	42-54	31-40	(7) 10 x 65 (.4 x 2.6)
C	22-31	16-23	(7) 10 x 60 (.4 x 2.4)
D	20-29	15-22	(7) 10 x 65 (.4 x 2.6)

Bolt identification

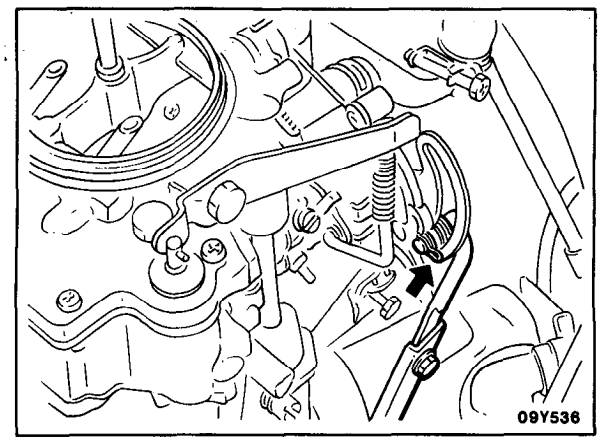
(7) A x B



Y09512

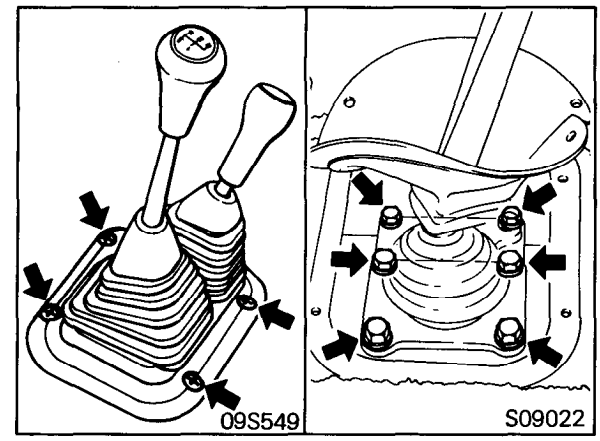
REMOVAL

1. Disconnect the negative cable from the battery.
2. Vehicles with an automatic transmission, disconnect the down shift link. (09Y536)

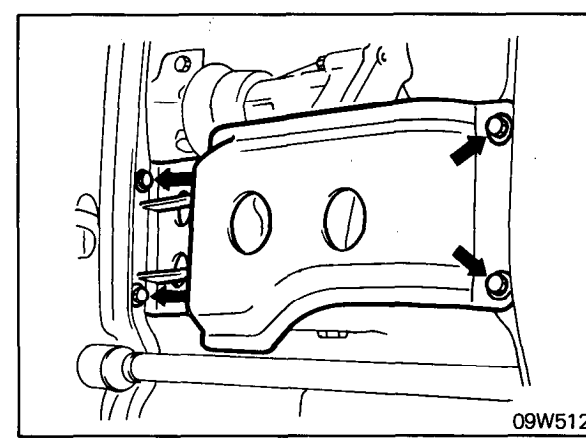


3. Remove the transmission gearshift lever (vehicles with a manual transmission) or transmission selecter lever (vehicles with an automatic transmission, refer to P.21-33.) and transfer shift lever. (09S549, S09022)

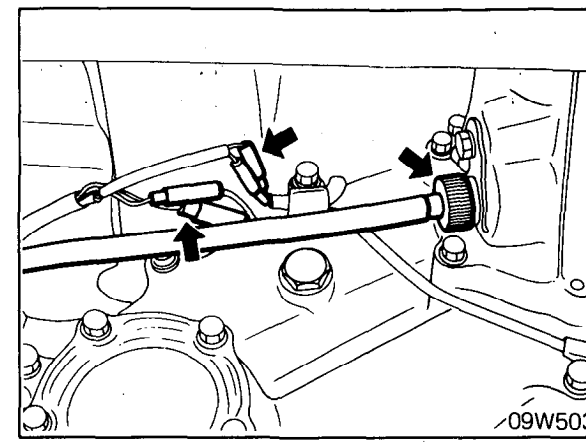
Caution
When removing the gearshift lever assembly, keep the transmission gearshift lever and the transfer gearshift lever in the following positions:
Transmission gearshift lever (vehicles with a manual transmission only) –
Neutral position
Transfer gearshift lever –
4H (4-wheel drive – high range) position
After the gearshift lever assembly has been removed, cover it with a shop towel to prevent entry of foreign substances into the extension housing.



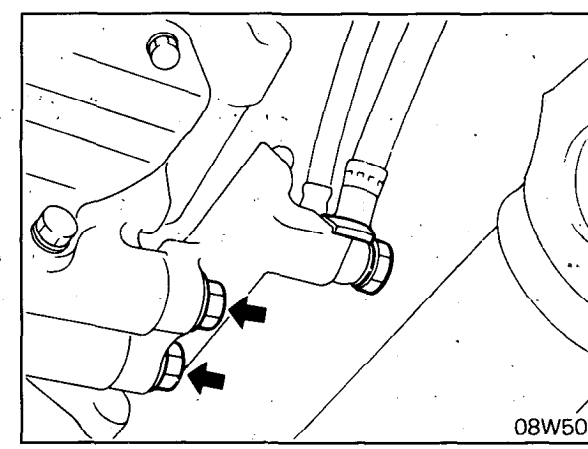
4. Raise the vehicle.
5. Remove the transfer case protector. (09W512)
6. Vehicles with an automatic transmission, remove the control arm, control rod, cross select shaft. (Refer to P. 21-34.)
7. Drain the transmission and transfer case oil.
8. Vehicles with an automatic transmission, remove the oil cooler hoses and tubes. (Refer to GROUP 7.)
9. Remove the front and rear propeller shafts. (Refer to GROUP 16.)



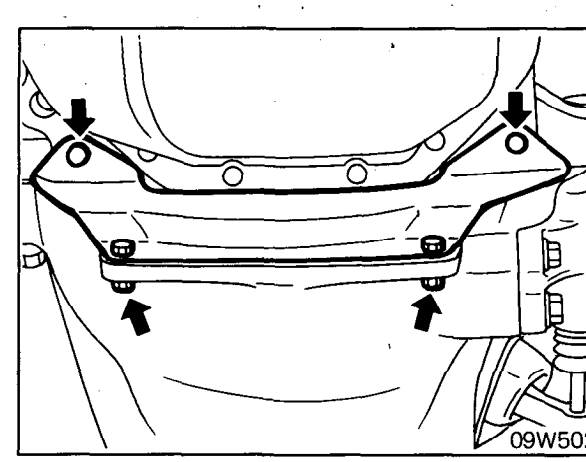
10. Disconnect speedometer cable, back-up light switch harness, and the 4-wheel-drive indicator light harness.



11. Vehicles with a manual transmission, detach the clutch release cylinder from the transmission.

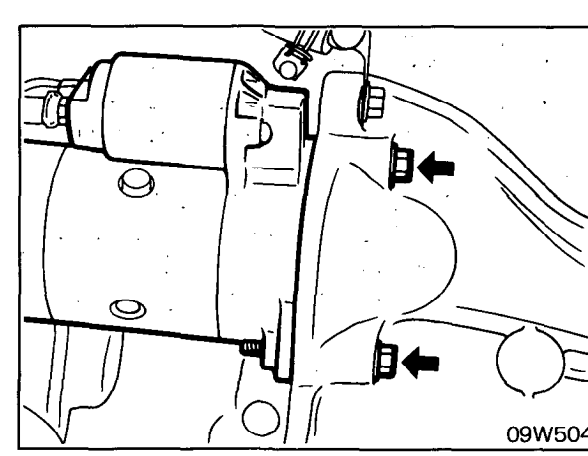


12. Remove the bell housing cover.

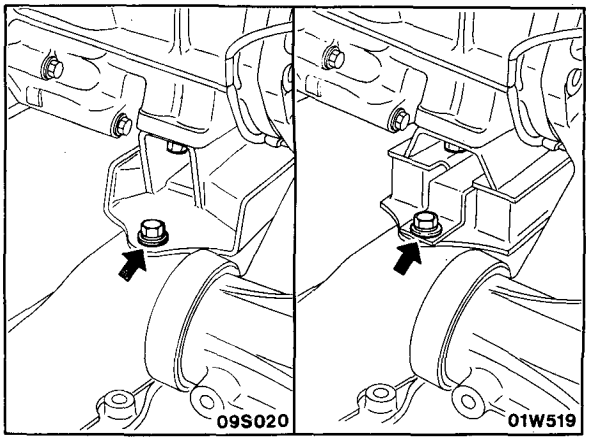


13. Detach the starting motor from the transmission.

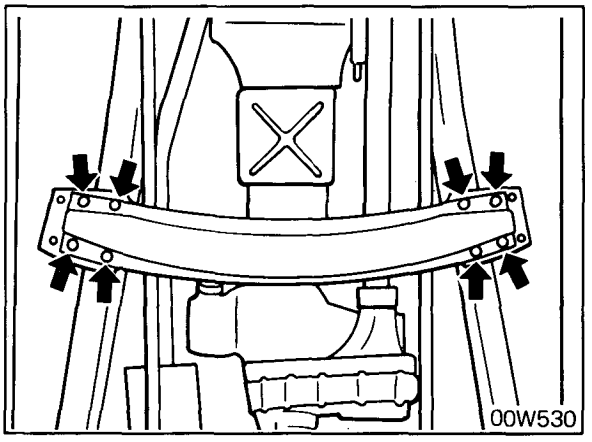
NOTE
On vehicles with an air conditioner, remove the front propeller shaft and then lower the starting motor downward from under the vehicle to remove it.



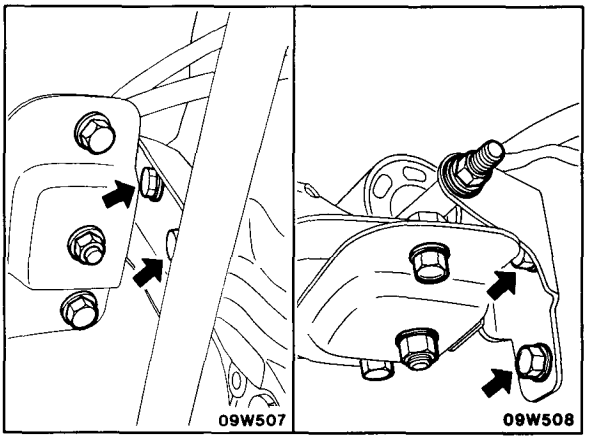
14. Detach the engine support rear insulator from the No. 2 crossmember.



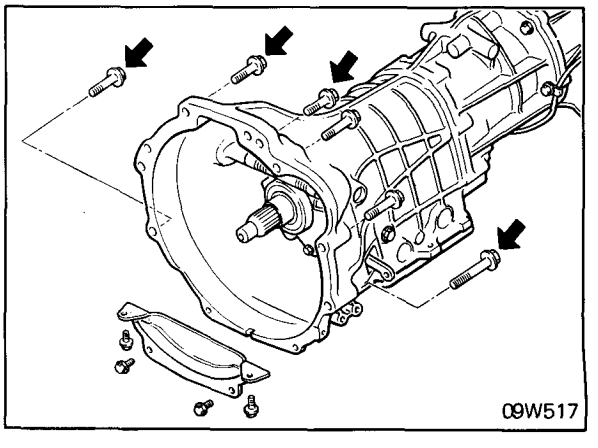
15. Remove the No. 2 crossmember. (00W530)
16. Support the transmission and transfer assembly with a transmission jack.



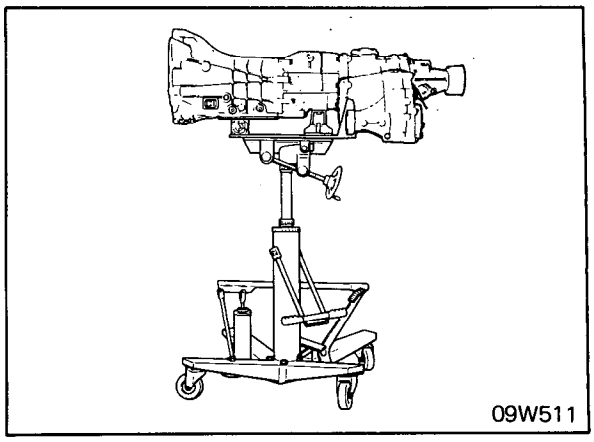
17. Detach the transfer from the transfer mounting bracket.



18. Remove the transmission mounting bolts from the engine.



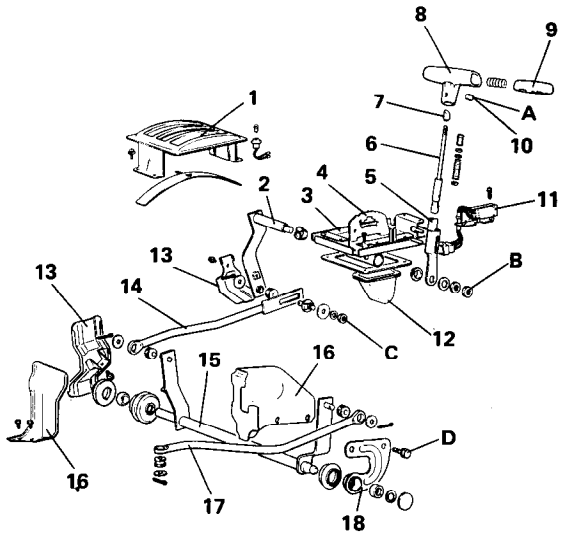
19. Disconnect the transmission and transfer assembly from the engine by pulling it slowly toward the rear of the vehicle. (09W511)
20. When lowering the transmission and transfer assembly, tilt the front of the transmission downward and slowly lower forward, while using care to make sure that the rear of the transmission does not hit the No. 4 crossmember. (09W511)



COMPONENTS

1. Position indicator cover
2. Control arm
3. Lever bracket assembly
4. Detent plate
5. Selector lever
6. Selector lever rod assembly
7. Rod adjusting cam
8. Selector handle
9. Pushbutton
10. Set screw
11. Inhibitor switch
12. Lever bracket cover
13. Heat protector
14. Control rod (B)
15. Cross select shaft
16. Protector
17. Control rod (A)
18. Cross shaft bracket

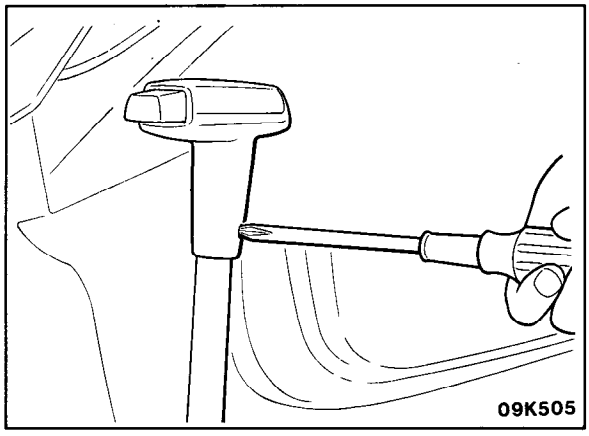
	Nm	ft.lbs.
A	2 or more	1.4 or more
B	18-24	13-17
C	13	9
D	10-13	7-9



09W001

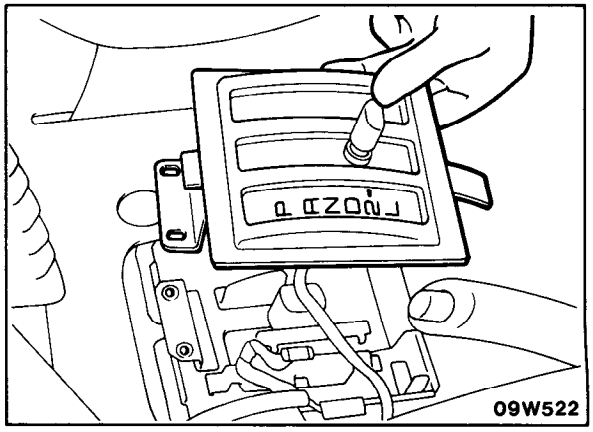
REMOVAL

1. Remove the selector handle from the selector lever. (09K505)
2. Remove the console box. (Refer to GROUP 23.)



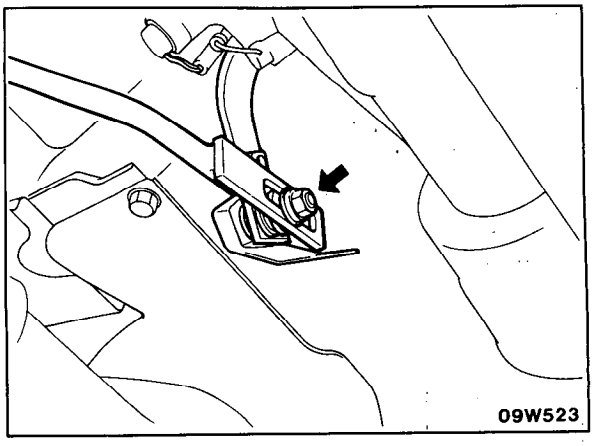
09K505

3. Remove the indicator panel. (09W522)
4. Disconnect the connector of the position indicator light.



09W522

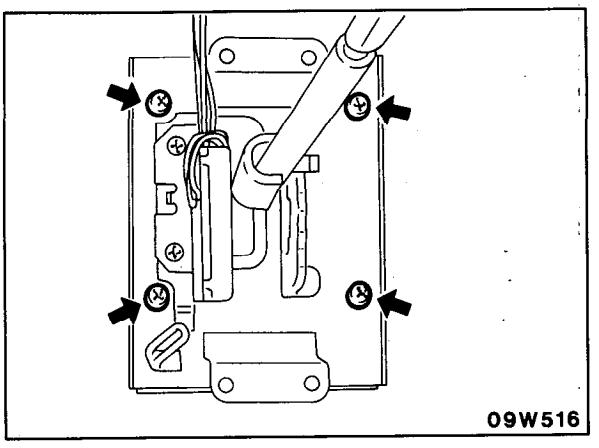
5. Disconnect the control rod (B) from the control arm by lossening the nut from under the floor.



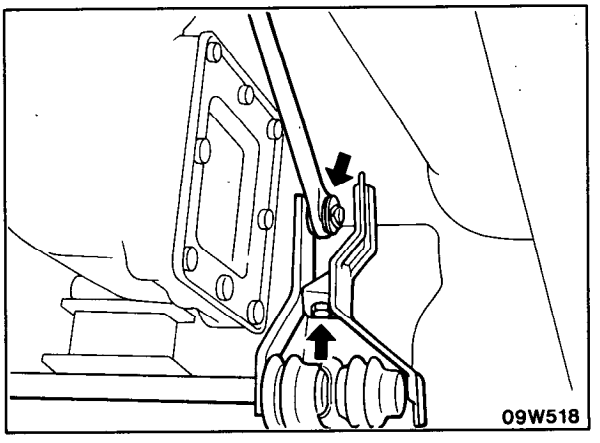
6. Disconnect the connector of the inhibitor switch.

NOTE
Do not remove the inhibitor switch from the lever bracket assembly unless it is necessary to do so.

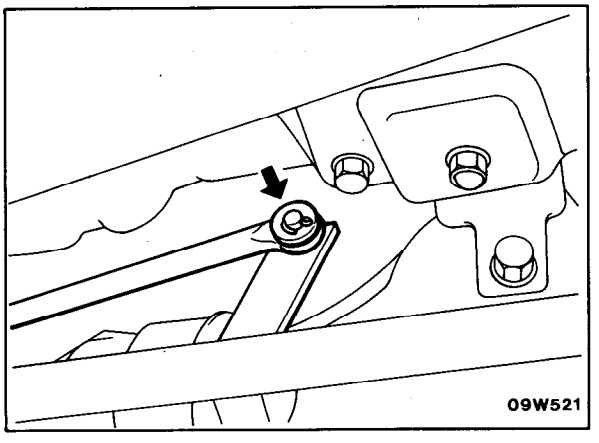
7. Remove the lever bracket assembly by loosening the attaching screws. (09W516)



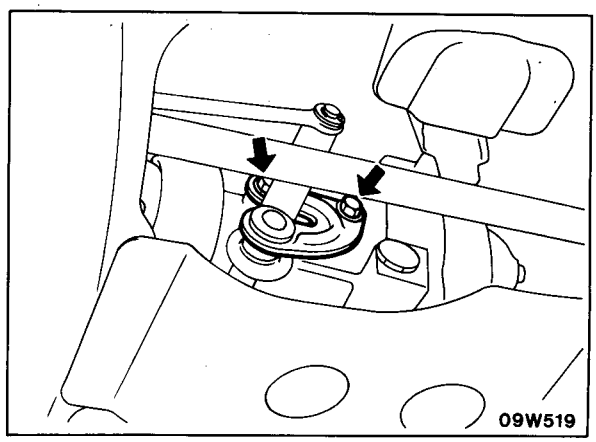
8. Disconnect the cross select shaft from the heat protector.
9. Disconnect the cross select shaft from control rod B. (09W518)



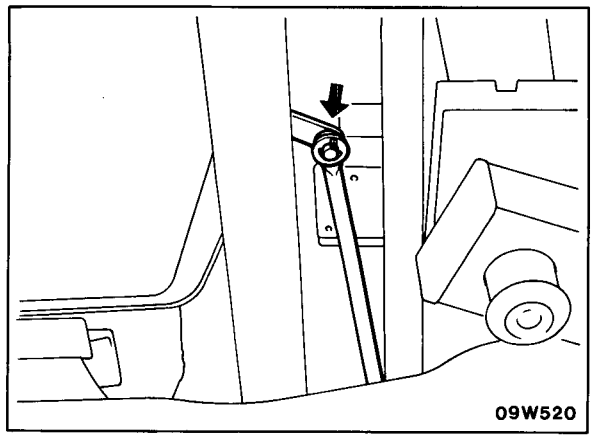
10. Disconnect the cross select shaft from control rod A.



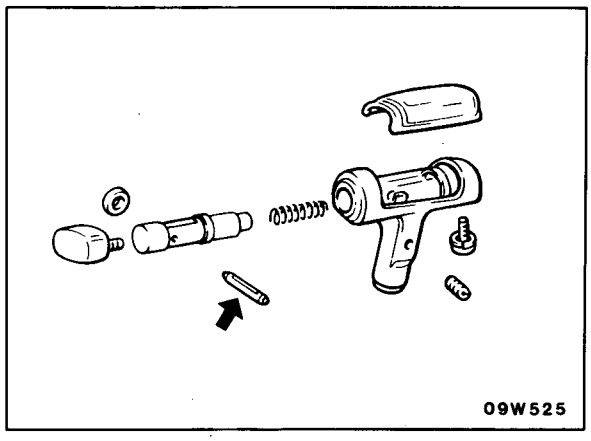
11. Remove the cross shaft bracket mounting bolts from the transfer assembly. (09W519)
12. Detach the cross shaft bracket from the bracket on the No. 1 crossmember side.



13. Remove control rod A from the transmission.



14. Remove the cover of selector handle.
15. Remove the spring pin in order to disassemble the selector handle. (09W525)



INSPECTION

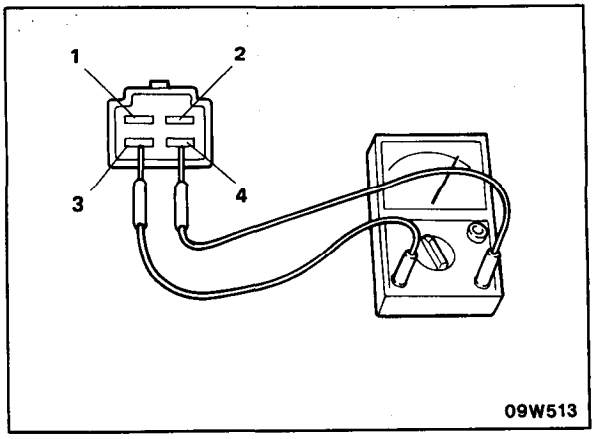
1. Check detent plate for wear.
2. Check pin at the end of selector lever for wear.
3. Check the pushbutton and the rod adjusting cam for worn contact surface.
4. Check control rods for damage, cracking, or deformation.
5. Check each bushing for cracking, deterioration, or wear.
6. Check the cross select shaft for damage, cracking, or deformation.

Operating Condition of the Inhibitor Switch

Shift the selector lever to each position, and check for continuity as shown in the table.

Position \ Terminal	1	2	3	4
P			O—O	
R	O—O			
N			O—O	

O—O: Continuity



INSTALLATION

Selector Lever

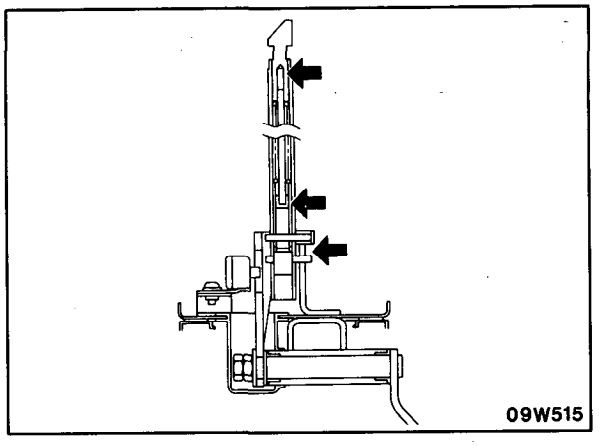
1. Apply multipurpose grease to each sliding part. (09W515)

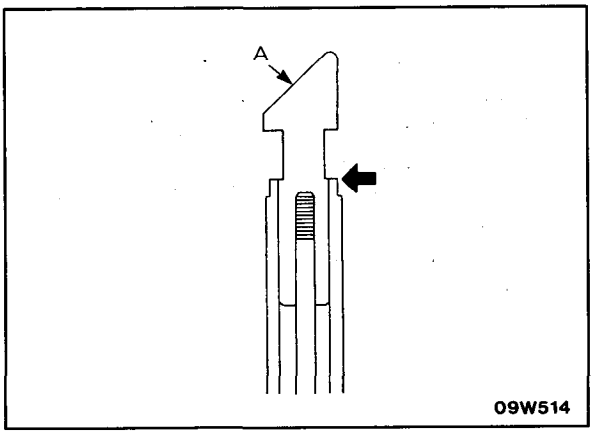
   Recommended grease ..... Multipurpose grease, SAE J310a, NLGI grade #3

2. Mount the selector lever and the control arm onto the lever bracket assembly, and then tighten the lock nut to the specified torque.

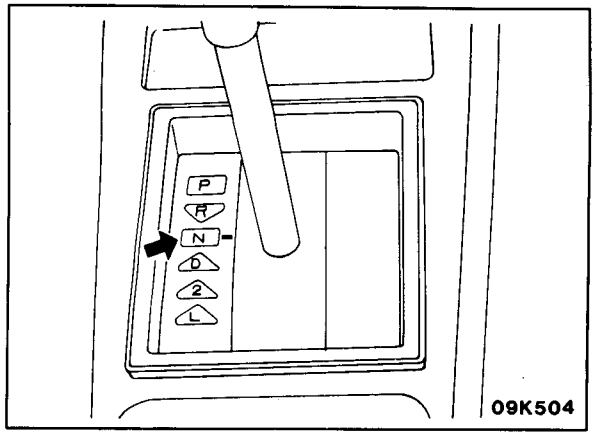
   Lock nut tightening torque ..... 18-24 Nm (13-17 ft.lbs.)

3. Set the selector lever to the "N" position, and then turn the rod adjusting cam to adjust it so that its bottom surface is flush with the end of the selector lever as shown in the illustration. At this time, position the rod adjusting cam so that surface A faces the direction of the driver's seat.





4. Set the selector lever to the "N" position, and then mount the indicator panel so that the "N" indication is properly aligned. (09K504)



Selector Handle

1. Apply multipurpose grease to each sliding part.

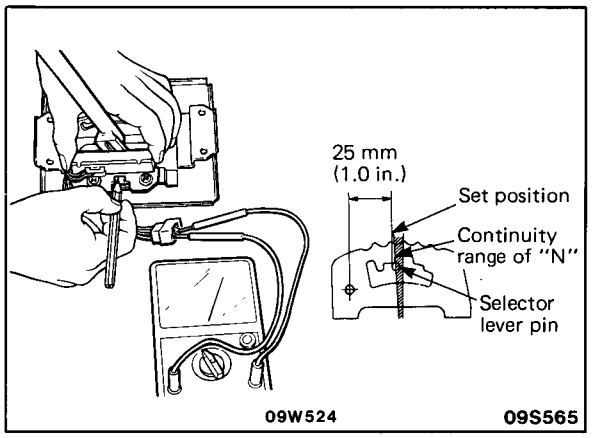
Recommended grease	Multipurpose grease, SAE J310a, NLGI grade #3

2. Tighten the selector handle to the specified torque.

Selector handle set screw tightening torque	2.0 Nm (1.4 ft.lbs.) or more

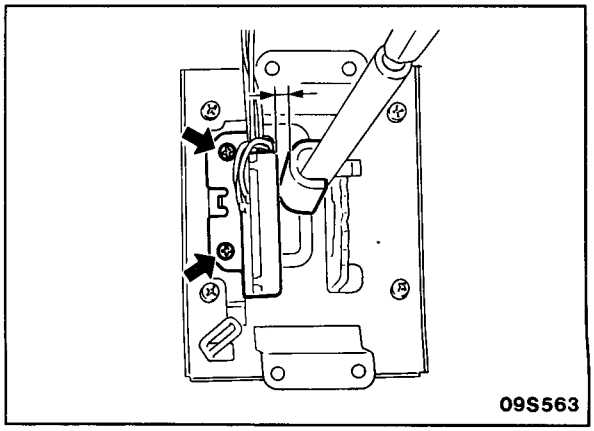
Inhibitor Switch

1. Install the inhibitor switch temporarily.
2. Connect an ohmmeter to the terminals (BY-BY) of the inhibitor switch connector, and prepare for continuity check.
3. Set the selector lever so that the selector lever pin comes to the position shown in the illustration. (09S565)
4. Slide the inhibitor switch from the rear to the front, secure it at the point at which continuity begins, and then make a mark on the lever bracket assembly. (09W524)



5. Tighten the inhibitor switch mounting screws at the position where the clearance between the inhibitor switch and the selector lever is the specified distance.

Clearance between the side of the inhibitor switch and the selector lever	2.5 mm (.1 in.)

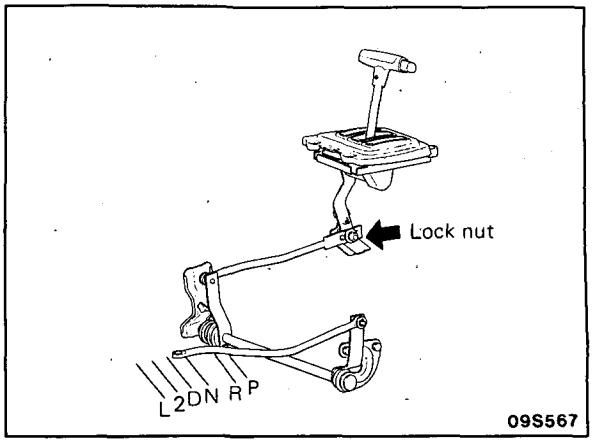


Control Rods

1. Apply multipurpose grease to each sliding part.

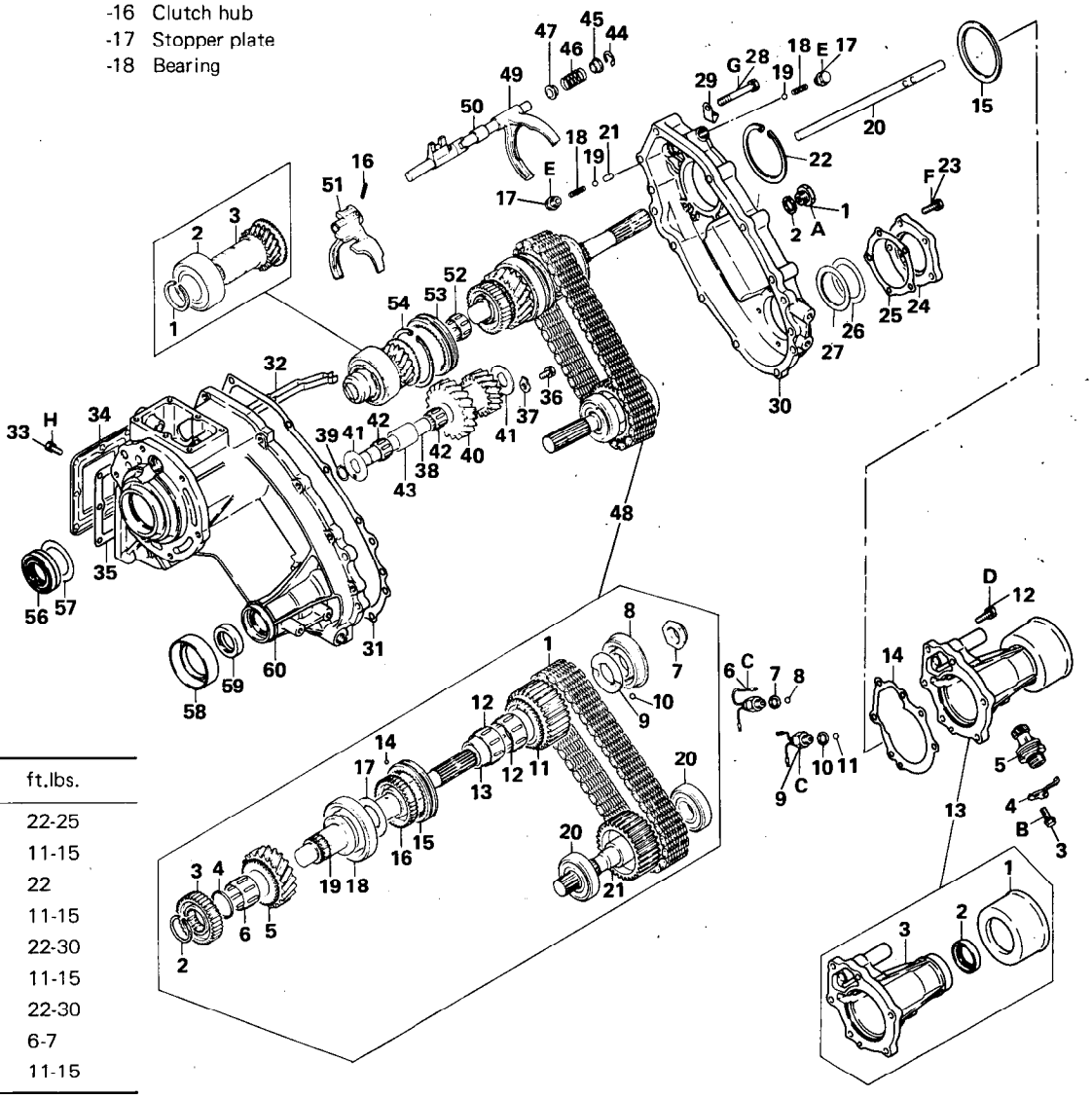
Recommended grease	Multipurpose grease, SAE J310a, NLGI grade #3

2. To connect the control rod (B) to the control arm, set the selector lever to the "N" position, move the control rod (A) to place the transmission in the Neutral position, and then tighten the rod to the lever lock nut. (09S567)
3. Torque all parts to specifications during assembly.
4. After installing each part, make certain that the selector lever moves smoothly and that the lever on the transmission side moves properly to each selector position. (09S567)



COMPONENTS

1. Filler plug
2. Gasket
3. Bolt
4. Sleeve clamp
5. Speedometer sleeve assembly
6. 4WD indicator lamp switch
7. Gasket
8. Steel ball
9. 4WD indicator lamp switch
10. Gasket
11. Steel ball
12. Bolt (6)
13. Rear cover assembly
    -1 Dust seal
    -2 Dust seal guard
    -3 Rear cover
14. Rear cover gasket
15. Wave spring
16. Spring pin
17. Seal plug (2)
18. Poppet spring (2)
19. Steel ball (2)
20. Interlock plunger
21. H-L shift rail
22. Snap ring
23. Bolt (5)
24. Cover
25. Cover gasket
26. Spacer (AR)
27. Wave spring
28. Bolt (10)
29. Cord fastener (4)
30. Chain cover
31. Chain cover gasket
32. Oil guide
33. Bolt (8)
34. Side cover
35. Side cover gasket
36. Bolt
37. Lock plate
38. Counter gear shaft
39. O-ring
40. Counter shaft gear
41. Thrust washer (2)
42. Needle bearing (2)
43. Bearing spacer
44. Snap ring
45. Spring retainer
46. Spring
47. Spring retainer
48. Output shaft assembly
    -1 HY-VO chain
    -2 Snap ring
    -3 Clutch hub (High and Low)
    -4 Bearing spacer
    -5 Low speed gear
    -6 Needle bearing
    -7 Locking nut
    -8 Radial ball bearing
    -9 Sprocket spacer
    -10 Steel ball
    -11 Drive sprocket
    -12 Needle bearing (2)
    -13 Sprocket sleeve
    -14 Steel ball
    -15 Clutch sleeve
    -16 Clutch hub
    -17 Stopper plate
    -18 Bearing
    -19 Rear output shaft
    -20 Bearing (2)
    -21 Front output shaft
49. Rear-wheel drive-4-wheel drive shift fork
50. Rear-wheel drive-4-wheel drive shift rail
51. H-L shift fork
52. Needle bearing
53. Clutch sleeve
54. Snap ring
55. Input gear assembly
    -1 Snap ring
    -2 Bearing
    -3 Input gear
56. Oil seal
57. Baffle plate
58. Dust seal guard
59. Oil seal
60. Transfer case



	Nm	ft.lbs.
A	30-34	22-25
B	15-21	11-15
C	30	22
D	15-21	11-15
E	30-41	22-30
F	15-21	11-15
G	30-41	22-30
H	8.0-9.5	6-7
I	15-21	11-15

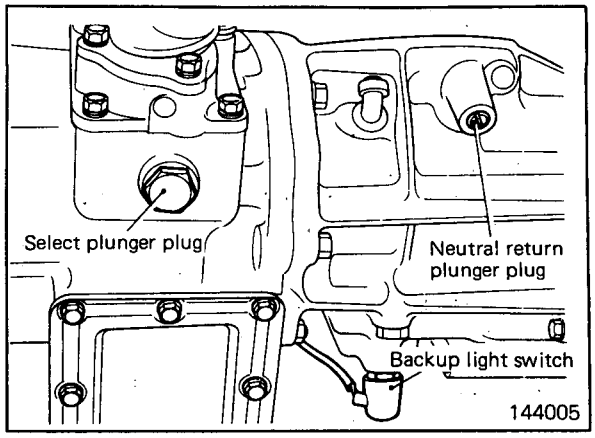
NOTE
Numbers show order of disassembly.
For reassembly, reverse order of disassembly.

145026

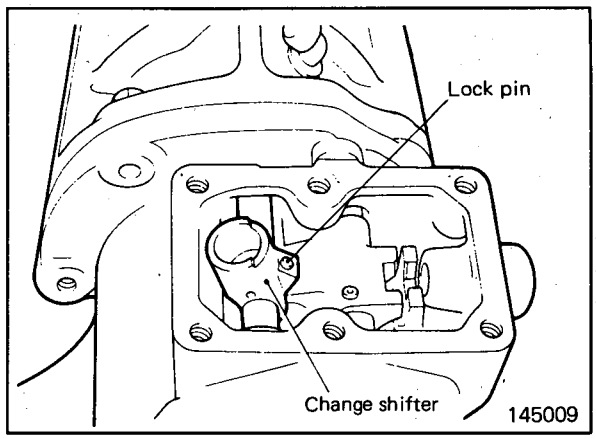
REMOVAL

Manual Transmission

1. Remove the backup light switch from the lower right of the adapter. Remove the steel ball. (144005)
2. Remove the plug from the right side of the transfer case and then remove the select spring and the select plunger. (144005)
3. Remove the six bolts securing the control lever assembly and remove the control lever assembly and the gasket.
4. Remove the plugs from the top of the adapter and remove the resistance spring, steel ball, neutral return springs and plungers.



5. Remove the lock pin from the change shifter using a 4.8-mm (3/16-in.) punch. (145009)
6. Remove the four bolts and two nuts securing the transfer case to the adapter.
7. Remove the transfer case assembly from the adapter and remove the change shifter from the control shaft.

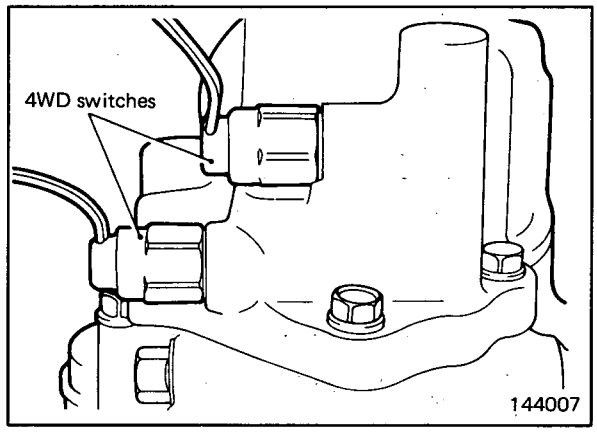


Automatic Transmission

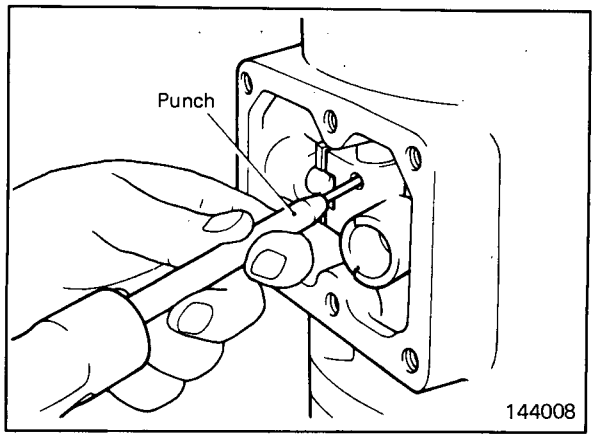
1. Remove the bolts securing the transfer case and transmission case.
2. Remove the transfer case assembly from the transmission.
3. Remove the four bolts and two nuts securing the transfer case to the adapter.
4. Remove the adapter from the transfer case.

DISASSEMBLY

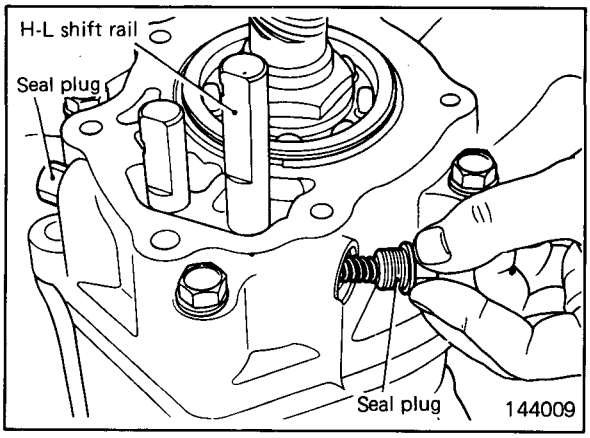
1. Remove two 4WD indicator light switches. Remove two steel balls. (144007)
2. Remove the speedometer sleeve clamp and remove the speedometer sleeve assembly.
3. Remove the bolts securing the rear cover and remove the rear cover, the gasket and the wave spring.
4. Remove the cover and gasket and then remove the wave spring and spacer.



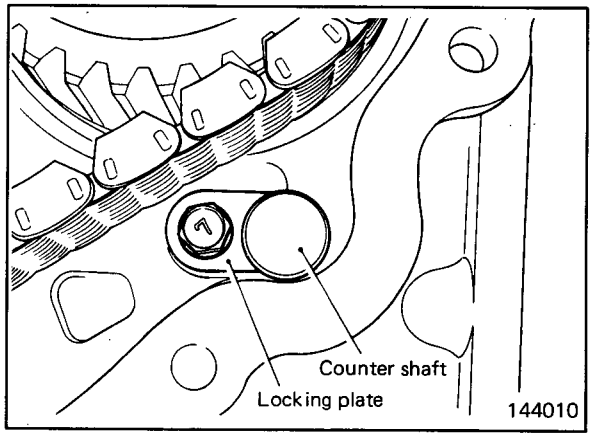
5. Remove the spring pin from the H-L shift fork using a 4.8-mm (3/16-in.) punch.



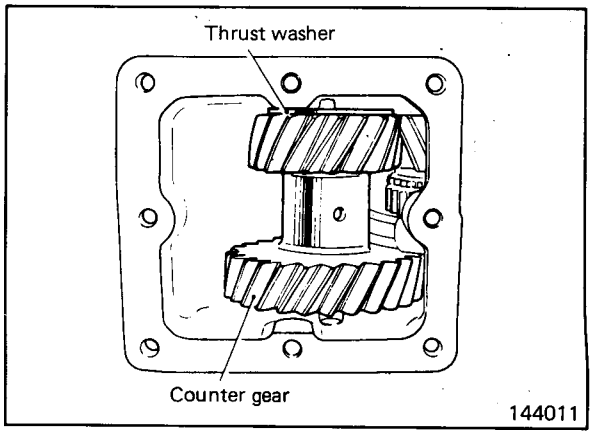
6. Remove the two seal plugs and remove the two poppet springs and two balls. (144009)
7. Pull the H-L shift rail out toward the rear.
8. Remove the interlock plunger.
9. Remove the snap ring from the rear bearing of the rear output shaft.
10. Remove the chain cover.
11. Remove the oil guide.
12. Remove the side cover.



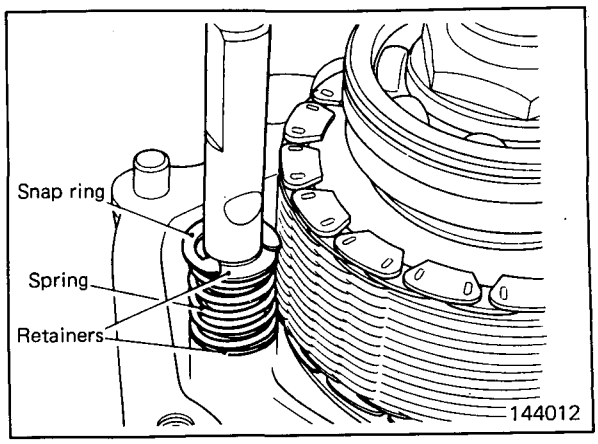
13. Remove the counter shaft locking plate and remove the counter shaft.



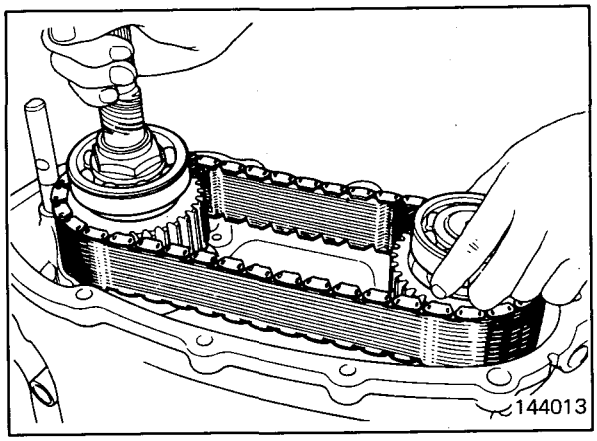
14. Remove the counter gear, two thrust washers, two needle bearings and the spacer through the side cover opening.



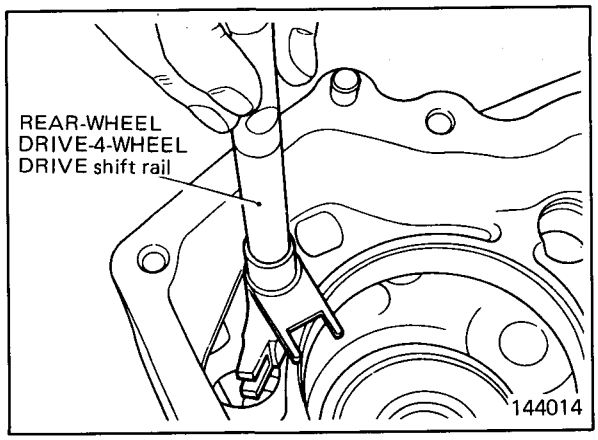
15. Remove the snap ring from the REAR-WHEEL DRIVE-4-WHEEL DRIVE shift rail and remove the two spring retainers and the spring from the shift rail.



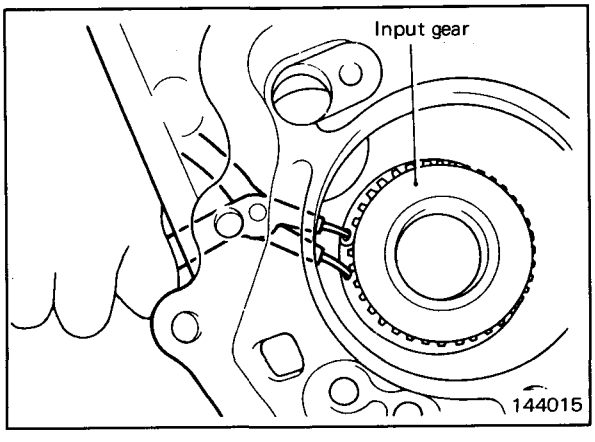
16. Remove the front output shaft, the rear output shaft and the chain from the transfer case as a unit.



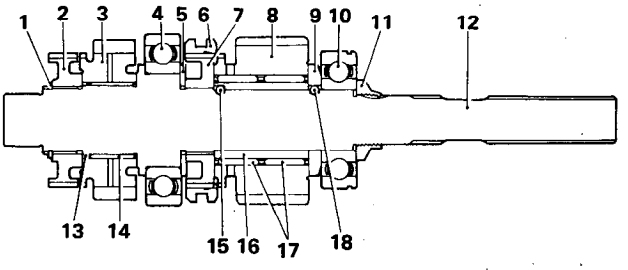
17. Remove the REAR-WHEEL DRIVE-4-WHEEL DRIVE shift rail. (144014)
18. Remove the H-L shift fork and the clutch sleeve.
19. Remove the needle bearing from the input gear.



20. Remove the snap ring, and the input gear assembly. (144015)
21. Remove the snap ring from the front end of the rear output shaft and remove the H-L clutch hub, the low speed gear, the thrust washer and the needle bearing.



1. Snap ring
2. H — L clutch hub
3. Low speed gear
4. Ball bearing
5. Stop plate
6. REAR-WHEEL DRIVE-4-WHEEL DRIVE clutch sleeve
7. REAR-WHEEL DRIVE-4-WHEEL DRIVE clutch hub
8. Drive sprocket
9. Sprocket spacer
10. Ball bearing
11. Lock nut
12. Rear output shaft
13. Thrust washer
14. Needle bearing
15. Steel ball
16. Sprocket sleeve
17. Needle bearings
18. Steel ball



144016

22. Loosen the staking on the rear output shaft lock nut and remove the lock nut.
23. Remove the ball bearing from the rear end using a universal bearing puller or a press.
24. Remove the sprocket spacer and the steel balls.
25. Remove the drive sprocket, the two needle bearings, the sprocket sleeve and the steel ball.
26. Remove the REAR-WHEEL DRIVE-4-WHEEL DRIVE clutch sleeve, the hub and the stop plate and remove the ball bearing using a puller or press.
27. Remove the snap ring from the input gear. With the bearing supported by the press base, push on the front end of the input gear to remove the bearing.
28. Remove two bearings from the front output shaft using a universal bearing puller or a press base.
29. Remove the control shaft oil seal, input gear oil seal and front output shaft oil seal from the transfer case.

REASSEMBLY

Cautions

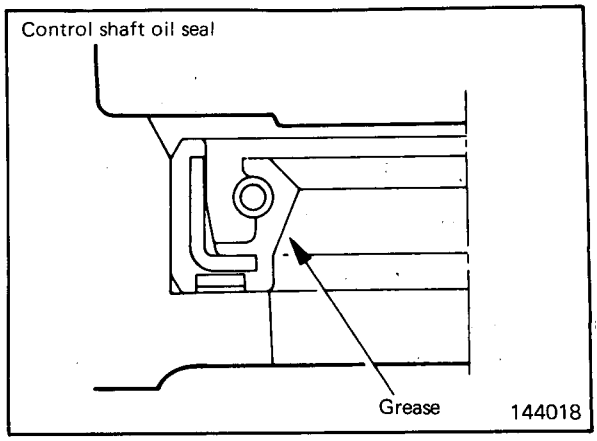
1. **Replace gaskets, oil seals, etc., with new ones.**
2. **Coat the gaskets and threads with sealant.**
3. **Apply transmission oil to sliding and rotating parts before assembling.**
4. **Do not reuse spring pin.**

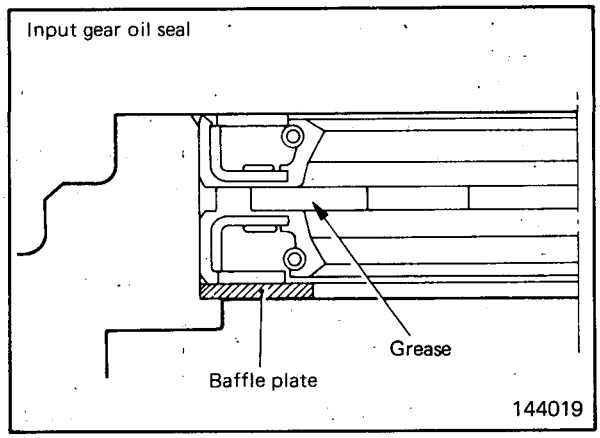
1. Press the control shaft oil seal, the input gear oil seal and the front output shaft oil seal into the transfer case. When press fitting the oil seals, push down on the outer circumference uniformly. After press fitting, pack grease between lips. (144018, 144019, 144020)
2. Assemble the adapter and the transfer case with a new gasket placed between them. Tighten the bolts and nuts. Be sure to install the change shifter over the control shaft before tightening the bolts and nuts.

Caution

If this sequence is reversed, the change shifter cannot be installed.

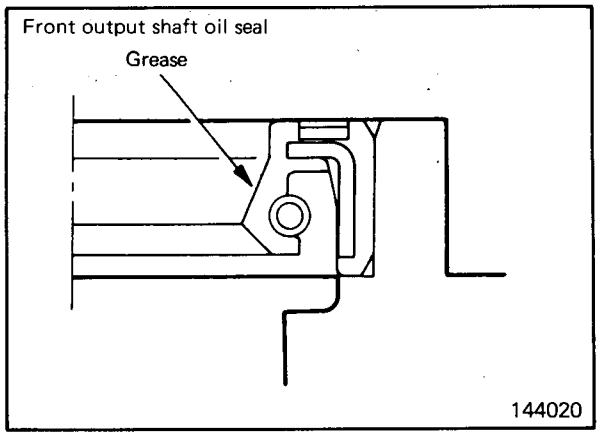
Transfer case mounting bolts and nuts tightening torque	30-41 Nm (22-30 ft.lbs.)



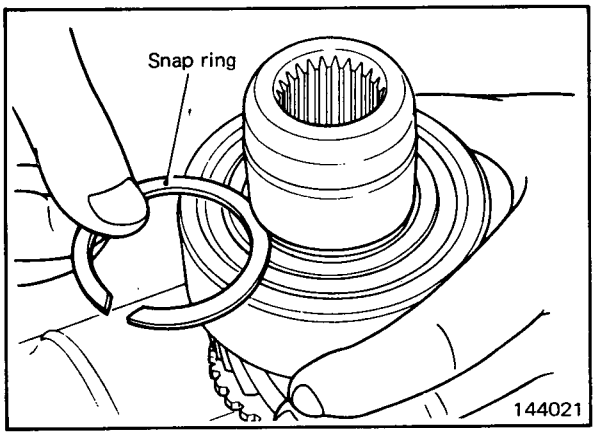


Caution

When inserting the transmission control shaft through the oil seal, take care not to damage the oil seal lip. If the change shifter lock pin hole in the shaft has burrs, remove them before inserting the shaft through the oil seal.



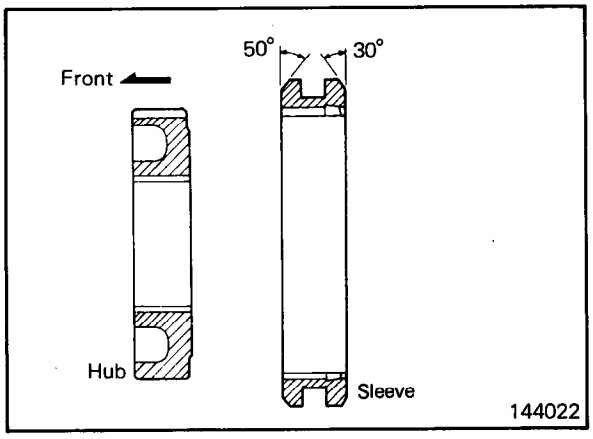
3. Press the bearing onto the input gear, being sure to push on the inner race. After fitting, check to see that the bearing rotates smoothly.
4. Fit a snap ring over the front end of the input gear. Snap rings are available in five different thicknesses. Use the thickest one that will fit into the groove. (144021)

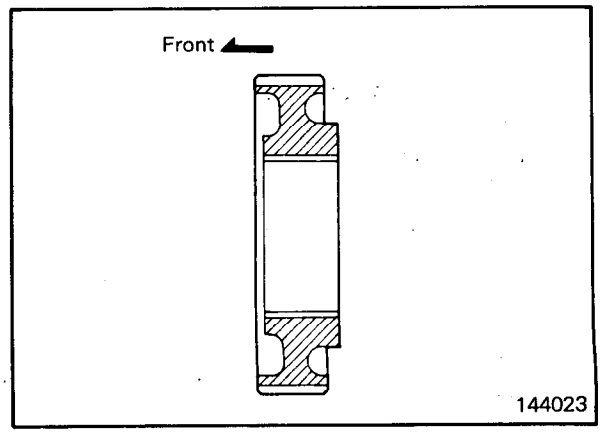


Snap ring thickness mm (in.)	Identification color
2.30 (.091)	None
2.35 (.093)	Red
2.40 (.094)	White
2.45 (.096)	Blue
2.50 (.098)	Green

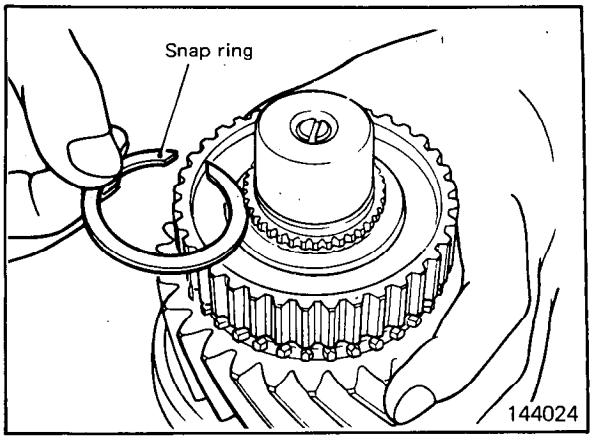
5. Press two ball bearings over the front output shaft, pushing down on the inner race. After fitting, check to see that they rotate smoothly.
6. Install the ball bearing over the rear output shaft from the rear and press into place. To install, push on the inner race. (Refer to p.21-43.) After installation, check to see that the ball bearing rotates smoothly.

7. Mount the stop plate and install the REAR-WHEEL DRIVE-4-WHEEL DRIVE clutch hub and sleeve. (Refer to p.21-43.) When mounting the hub and sleeve, be sure the direction of installation is correct. (144022)
8. Mount the steel ball (for sprocket sleeve positioning) on the rear output shaft and mount the sprocket sleeve. (Refer to p.21-43.)
9. Mount the two needle bearings on the outer circumference of the sprocket sleeve, and then mount the drive sprocket. (Refer to p.21-43.)
10. After mounting the steel balls and the sprocket spacer, press the ball bearing (Refer to p.21-43.), by pushing on the inner race. Check that the bearing rotates smoothly after it is fully installed.
11. Tighten the mainshaft lock nut and drive in the detent section with a punch.
    After the lock nut is tightened, check that the drive sprocket rotates smoothly.
12. Mount the needle bearing, the thrust washer and the low-speed gear on the rear output shaft from the front end.
13. Mount the H-L clutch hub, making sure that the direction of installation is correct. (144023)





14. Mount the H-L clutch hub snap ring on the front end of the rear output shaft. Snap rings are available in five different thicknesses. Use the thickest one that will fit into the groove. (144024)

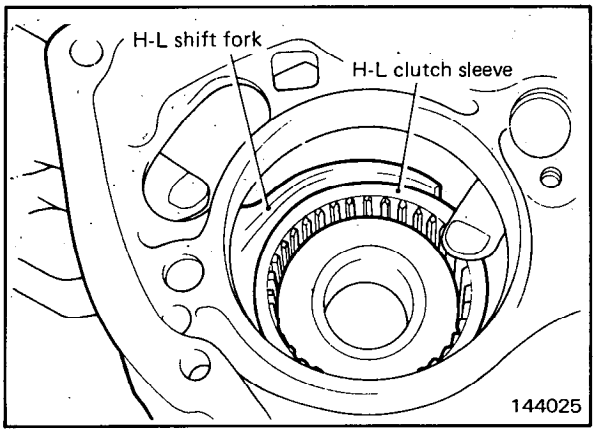


Snap ring thickness mm (in.)	Identification color
2.14 (.084)	None
2.21 (.087)	Yellow
2.28 (.090)	White
2.35 (.093)	Blue
2.42 (.095)	Red

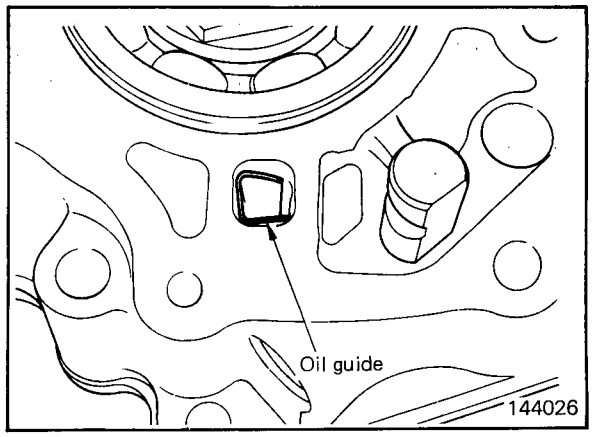
15. Insert the input gear assembly into the transfer case and mount the snap ring. (Refer to p.21-42.) Snap rings are available in five different thicknesses. Use the thickest one that will fit into the groove.

Snap ring thickness mm (in.)	Identification color
2.70 (.106)	Purple
2.75 (.108)	Pink
2.80 (.110)	Yellow
2.85 (.112)	White
2.90 (.114)	Blue

16. Insert the needle bearing into the input gear.
17. Mount the H-L clutch sleeve and shift fork, making sure that the direction of the clutch sleeve is correct. The direction of installation is the same as for the clutch sleeve for REAR-WHEEL DRIVE-4-WHEEL DRIVE. (144025)
18. Install the REAR-WHEEL DRIVE-4-WHEEL DRIVE shift rail. (Refer to p.21-42.)
19. Securely engage the chain with the front and rear output shaft sprockets. Assemble the REAR-WHEEL DRIVE-4-WHEEL DRIVE clutch sleeve with the REAR-WHEEL DRIVE-4-WHEEL DRIVE shift fork and install the assembly over the REAR-WHEEL DRIVE-4-WHEEL DRIVE shift rail. At the same time, mount the front and rear output shafts and chain, etc. as a unit. (Refer to p.21-42.)
20. Mount the two spring retainers and the spring. (Refer to p.21-42.)

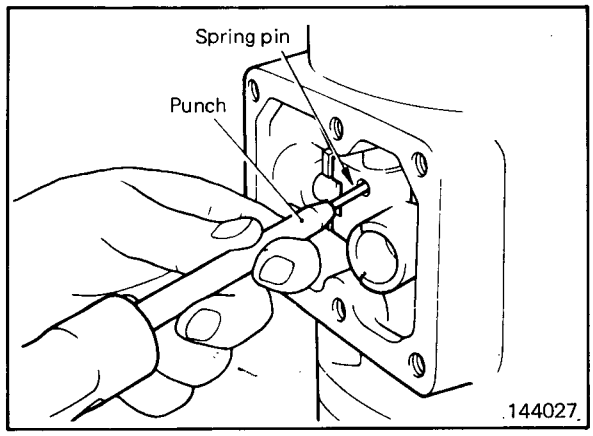


21. Insert the two needle bearings and the spacer into the counter gear, and install the assembly into the transfer case. Mount one thrust washer at the front of the counter gear and the other at the rear. (Refer to p.21-41.)
22. Insert the counter shaft and install the locking plate. (Refer to p.21-41.)
23. Install the side cover and gasket.
24. Install the oil guide. (144026)
25. Install the chain cover and gasket, making sure that the oil guide end fits into the chain cover opening. (144026)
26. Fit the snap ring into the groove of the rear output shaft rear bearing.
27. Insert the interlock plunger.
28. Insert the H-L shift rail and pass it through the H-L shift fork.

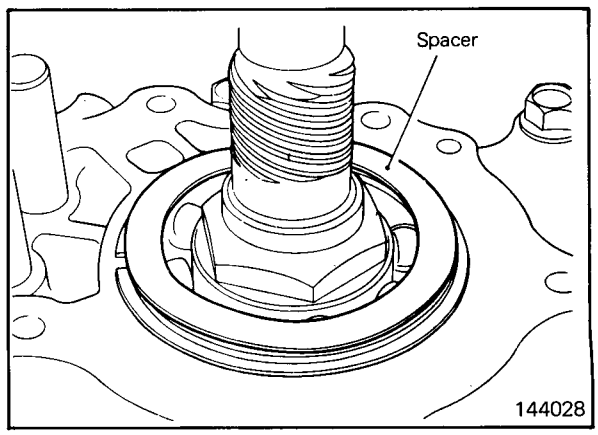


Caution
Unless the REAR-WHEEL DRIVE-4-WHEEL DRIVE shift fork is shifted to the 4-WHEEL DRIVE side, the H-L shift rail can not be inserted.

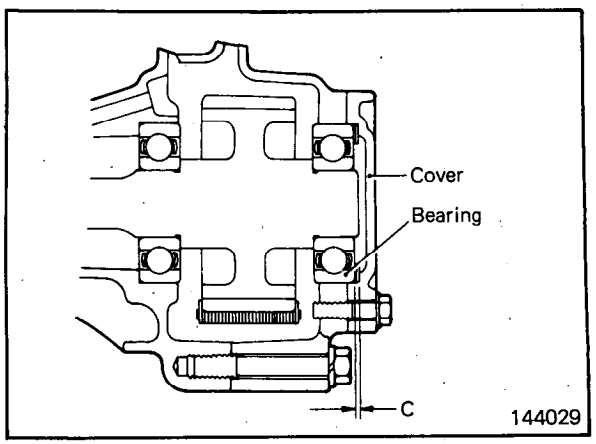
29. Mount the two poppet balls and springs, and mount the seal plugs. (Refer to p.21-41.) When mounting the poppet springs, the smaller end should face toward the ball.
30. With the H-L shift fork and shift rail spring pin holes aligned, drive in the spring pin using a punch. When driving in the spring pin, position it so that its slot is placed on the center line of the shift rail. (144027)
31. Mount the spacer onto the rear end of the rear output shaft bearing, and install the rear cover and gasket. Be sure to select and mount a spacer which is thick enough to keep the end play of the rear bearing outer race in the range of 0 to 0.1 mm (0 to .04 in.).



Thickness of spacer mm (in.)	Identification color
0.84 (.033)	Black
0.93 (.037)	None
1.02 (.040)	Red
1.11 (.044)	White
1.2 (.047)	Yellow
1.29 (.051)	Blue
1.38 (.054)	Green



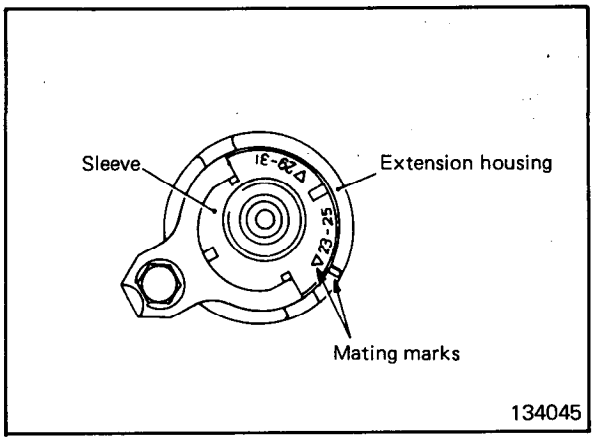
32. Mount the wave spring on the rear end of the front output shaft rear bearing, and install the cover and the gasket. (144028) If the bearing rear end to cover clearance (C) exceeds 2 mm (.079 in.), use an appropriate spacer to reduce the clearance to 2 mm (.079 in.) or less. (144029)



33. Insert the speedometer sleeve assembly into the rear cover. Align the mating mark on the sleeve with that on the case according to the number of teeth of the speedometer driven gear. (134045)
34. Mount the sleeve clamp and tighten the bolt.

Clamp bolt tightening torque . . . . . 10-12 Nm (7.5-9 ft.lbs.)

35. Install two 4WD indicator light switches, along with their steel balls.

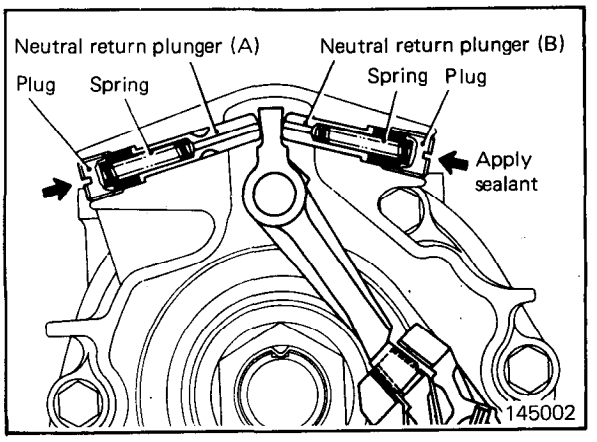


INSTALLATION

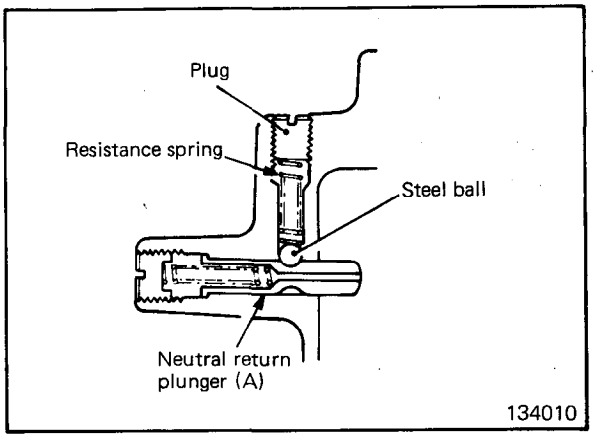
Manual Transmission

Perform reinstallation in reverse procedure of removal, pay attention to the following items:

1. Mount the neutral return plungers and the springs in the hole on top of the adapter and tighten the plug until it is flush with the adapter surface.



2. Install steel ball, resistance spring and plug.

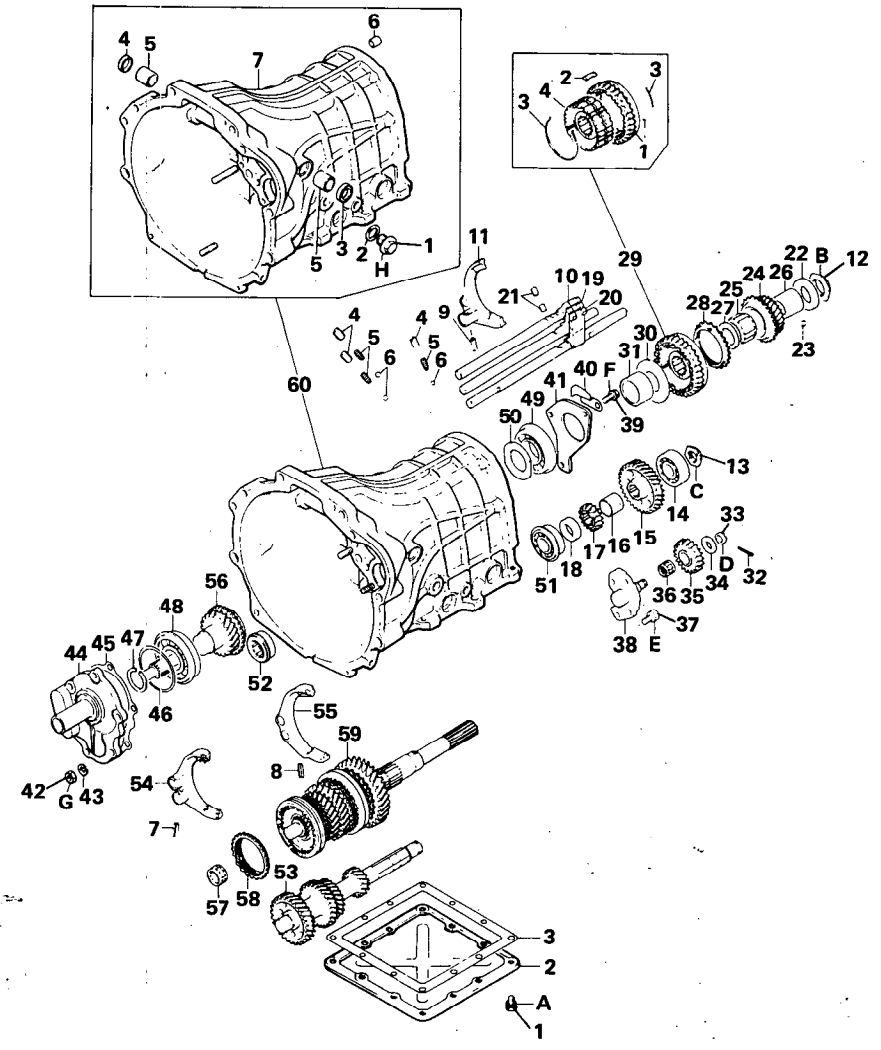


Automatic Transmission

Perform reinstallation in reverse procedure of removal.

COMPONENTS

1. Bolt w/washer (12)
2. Under cover
3. Under cover gasket
4. Plug (3)
5. Poppet spring (3)
6. Steel ball (3)
7. Spring pin for 3-4 shift fork
8. Spring pin for 1-2 shift fork
9. Spring pin for OD-R shift fork
10. OD-R shift rail
11. OD-R shift fork
12. Mainshaft lock nut
13. Counter gear lock nut
14. Ball bearing
15. Counter overdrive gear
16. Spacer
17. Counter reverse gear
18. Spacer
19. 3-4 shift rail
20. 1-2 shift rail
21. Interlock plunger
22. Spacer
23. Steel ball
24. Overdrive gear
25. Needle bearing
26. Overdrive gear sleeve
27. Bearing spacer
28. Synchronizer ring
29. Overdrive synchronizer assembly
    -1 Synchronizer sleeve
    -2 Synchronizer key (3)
    -3 Synchronizer spring (2)
    -4 Synchronizer hub
30. Stop plate
31. Spacer
32. Split pin
33. Nut
34. Thrust washer
35. Reverse idler gear
36. Needle bearing
37. Bolt w/washer (4)
38. Reverse idler shaft
39. Bolt w/washer (3)
40. Baffle plate
41. Rear bearing retainer
42. Nut (6)
43. Spring washer (6)
44. Front bearing retainer
45. Front bearing retainer gasket
46. Spacer
47. Snap ring
48. Ball bearing
49. Ball bearing
50. Spacer
51. Counter rear bearing
52. Counter front bearing
53. Counter gear
54. 3-4 shift fork
55. 1-2 shift fork
56. Main drive gear
57. Needle bearing
58. Synchronizer ring
59. Mainshaft assembly
60. Transmission case assembly
    -1 Oil filler plug
    -2 Gasket
    -3 Oil seal
    -4 Cap
    -5 Clutch shaft bushing
    -6 Bush knock
    -7 Transmission case

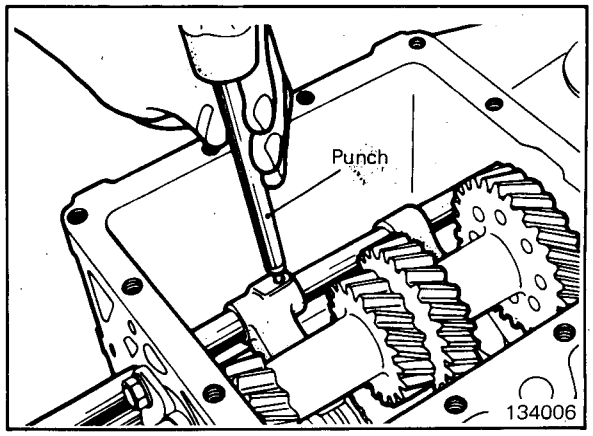


	Nm	ft.lbs.
A	8.0-9.5	6-7
B	99-127	73-94
C	69-98	51-72
D	20-58	15-43
E	15-21	11-15
F	15-21	11-15
G	10-12	7.5-9.0
H	30-34	22-25

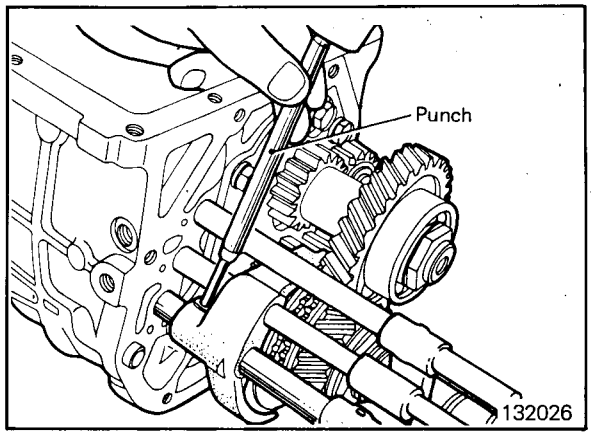
145013

DISASSEMBLY

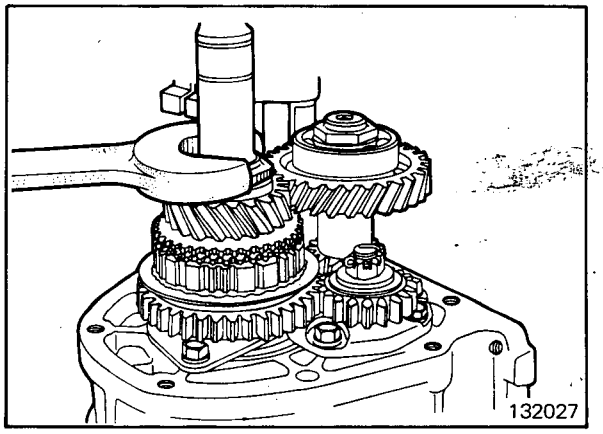
1. Remove the under cover.
2. Remove the snap ring and ball bearing from the rear end of the mainshaft.
3. Loosen the three poppet spring plugs, then remove three poppet springs and three steel balls.
4. Using a 3/16-in. punch, remove 3-4 and 1-2 shift fork spring pins. (134006)



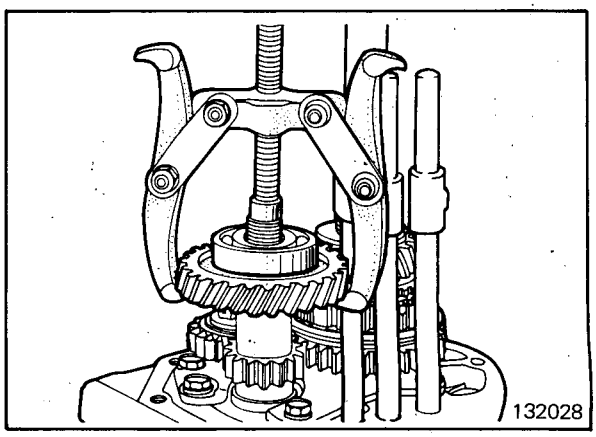
5. Using a 3/16-in. punch, drive the overdrive-reverse shift forks spring pins out, then remove the shift rails and forks.



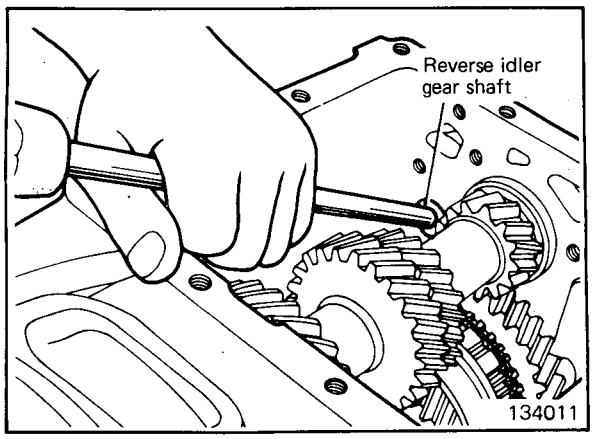
6. Bend back the locking washer and loosen the lock nuts (mainshaft and countershaft). The nuts can be loosened by double-engaging reverse and 2nd gears. (132027)
7. Move the 1-2 shift rail toward the 1st speed side.



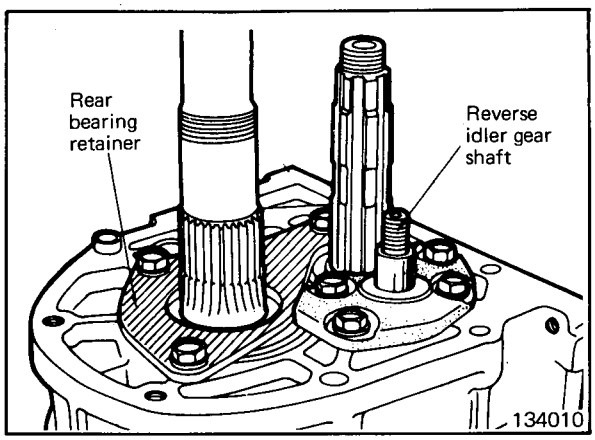
8. Remove the counter overdrive gear and ball bearing with a suitable puller. (132028) Be sure to remove the ball bearing and the overdrive gear as a unit by installing the puller onto the gear.
9. Remove distance spacers and counter reverse gear from countergear shaft.
10. Remove the shift rails toward the rear of the transmission case. Remove the shift forks.
11. Remove the spacer and steel ball from the mainshaft.
12. Remove the overdrive gear, needle bearing and synchronizer ring from the mainshaft.
13. Remove the overdrive synchronizer sleeve from the hub.



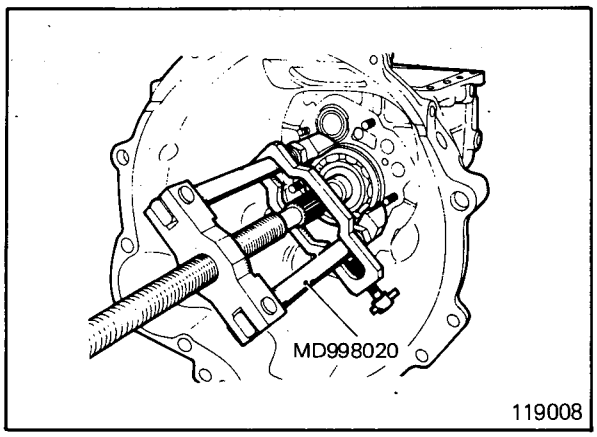
14. Using special tool MD998056, remove synchronizer hub and overdrive gear bearing sleeve.
15. Remove the synchronizer key stop plate and the distance spacer from the mainshaft.
16. Remove the cotter pin from the reverse idler gear shaft and loosen the nut, and then remove the thrust washer, reverse idler gear and needle bearing.
17. Remove the idler gear shaft locking bolts.
18. Loosen the reverse idler gear shaft by driving from inside the case. (134011)



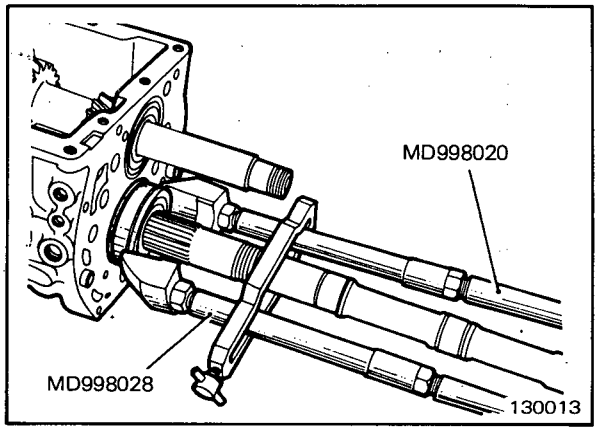
19. Remove the rear bearing retainer. (134010)
20. Remove the front bearing retainer.
21. Remove snap rings from main drive gear and main drive gear bearing.



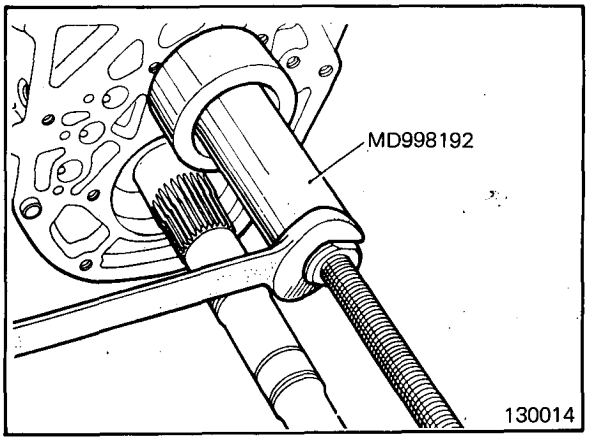
22. Using special tool, remove the main drive gear bearing.



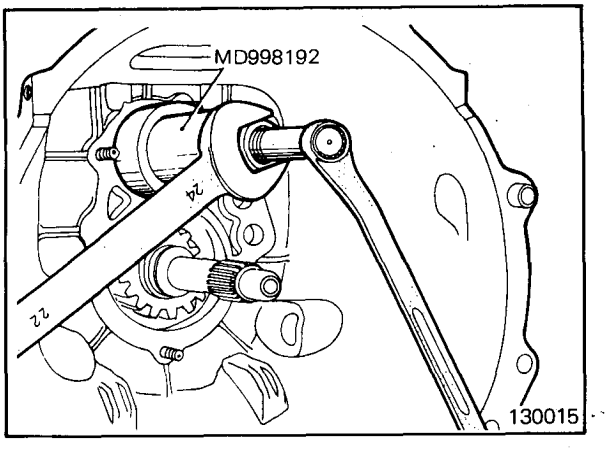
23. Remove the mainshaft bearing outer race snap ring.
24. Using special tools, remove the double row ball bearing. The inner race of the front bearing will remain on the mainshaft. (130013)



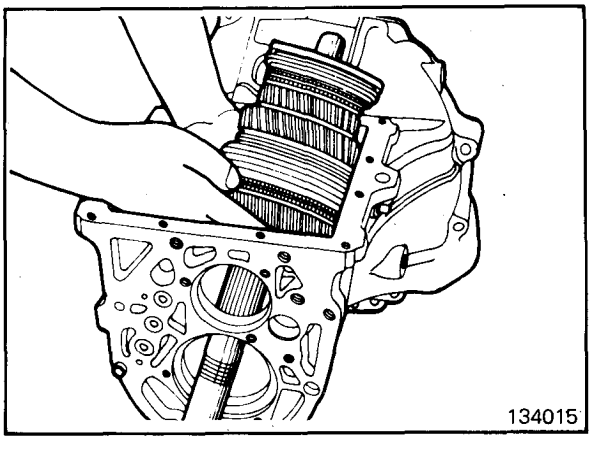
25. Remove the rear bearing snap ring. Then remove the counter rear bearing, using special tool.



26. Remove the snap ring from the counter front bearing, and then remove the bearing with the special tool.

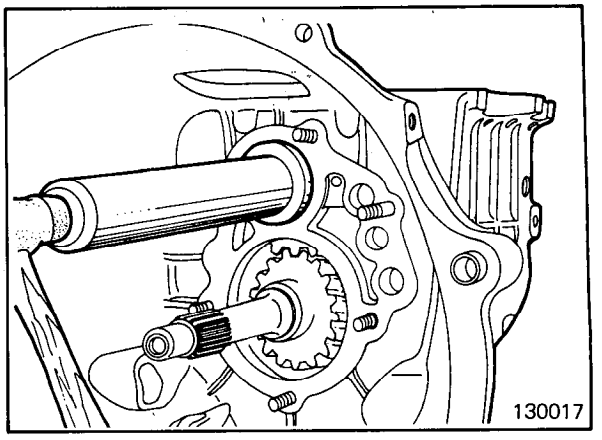


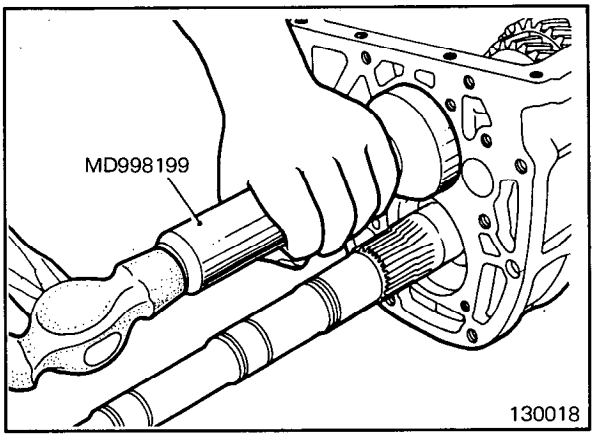
27. Remove the countershaft gear from the transmission case.
28. Remove the main drive gear from case.
29. Lift the mainshaft assembly from the case. (134015)
30. Disassemble the mainshaft assembly in the following order.
    (1) Install suitable puller to the 1st speed gear and remove it along with the inner race of the double row bearing.
    (2) Remove the 1-2 synchronizer and the 2nd speed gear by moving them toward the rear of the mainshaft.
    (3) Remove the snap ring from the front end of the mainshaft, and then remove the 3-4 synchronizer and the 3rd speed gear.



REASSEMBLY

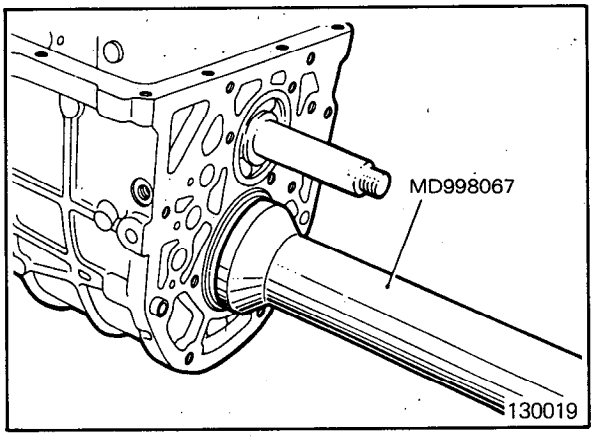
1. Insert the mainshaft assembly in the transmission case.
2. Install the pilot bearing (needle bearing) on front end of the mainshaft.
3. Install the synchronizer ring to 3-4 synchronizer assembly.
4. Install the main drive gear to the mainshaft.
5. Insert the 1-2 and 3-4 shift forks to the synchronizer sleeve groove.
6. Insert the countershaft gear into the transmission case.
7. With the snap ring fitted to the countershaft front bearing (needle), drive the bearing into the case by pushing on the outer race. (130017)
8. Install the snap ring to the countershaft rear bearing (ball), then install it into place with special tool. (130018)
9. Drive in the main drive gear bearing using special tool (MD998029)
10. Drive in the mainshaft bearing using special tool. (130019) While driving the bearing in, make sure that the synchronizer ring is properly positioned between the main drive gear and the 3-4 synchronizer.





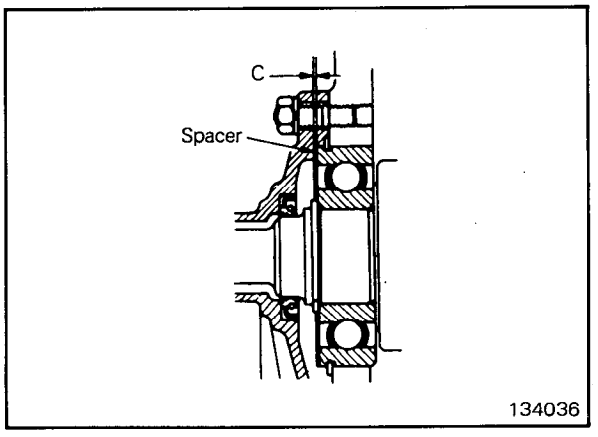
11. Install the snap ring (large) to the main drive gear bearing.
12. Select and install a main drive gear snap ring of the proper thickness to minimize clearance between the snap ring and bearing. In other words, install the thickest snap ring that will fit into the snap ring groove.

Thickness of snap ring mm (in.)	Identification color
2.3 (.091)	White
2.35 (.092)	None
2.4 (.094)	Red
2.45 (.096)	Blue
2.5 (.098)	Yellow

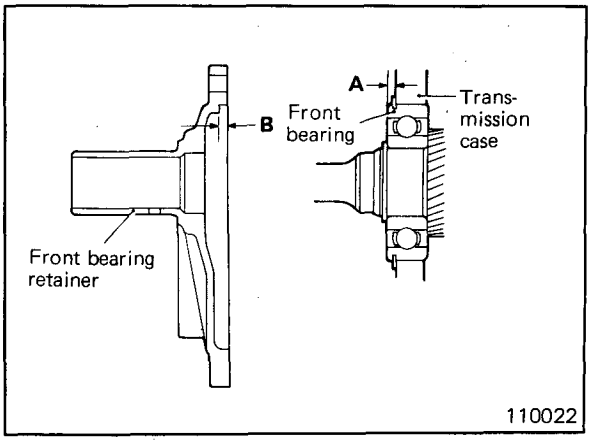


13. Install the front bearing retainer. When installing the retainer, install a spacer of proper size so that the clearance (C) shown in illustration will be within the specified tolerance. (134036 and 110022)

Front bearing retainer to bearing clearance (C) ..... 0-0.1 mm (0-.004 in.)
Clearance (C) ..... B + 0.3 mm (.012 in.) – A

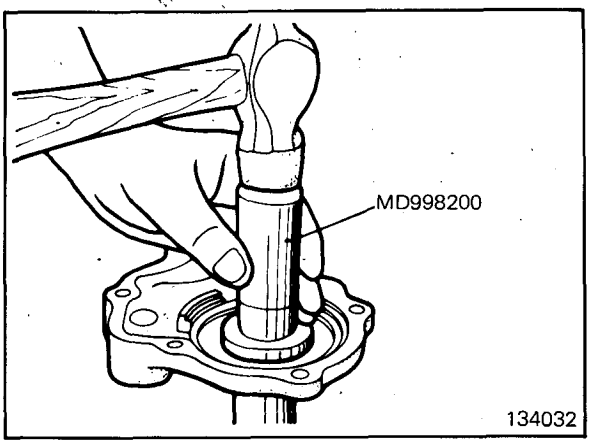


Thickness of spacer mm (in.)	Identification color
0.84 (.033)	Black
0.93 (.037)	None
1.02 (.040)	Red
1.11 (.044)	White
1.2 (.047)	Yellow
1.29 (.051)	Blue
1.38 (.054)	Green



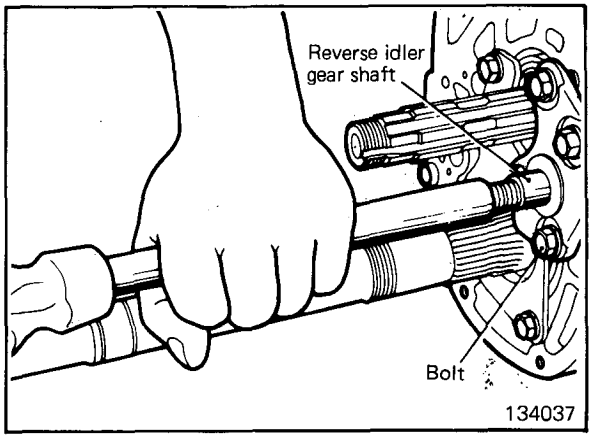
14. Apply recommended sealant to both sides of the front bearing retainer gasket and fill with gear oil to the oil seal lip; then install the gasket and oil seal. When installing the new oil seal, use special tool. (134032)

Recommended sealant .....
3M Super Silicone 8662 or equivalent



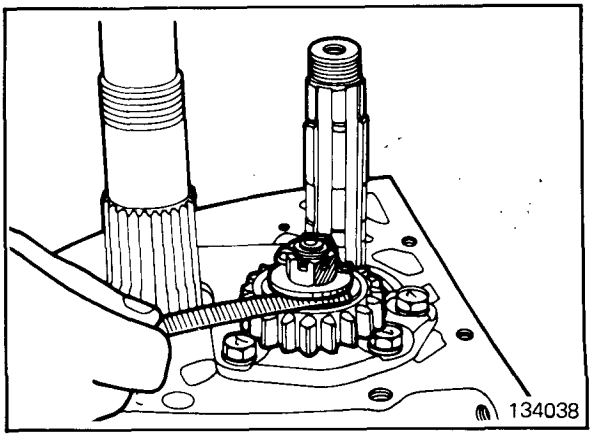
15. Install the rear bearing retainer.

16. Install the reverse idler gear shaft. When installing the shaft, install the bolts as guides as illustrated.

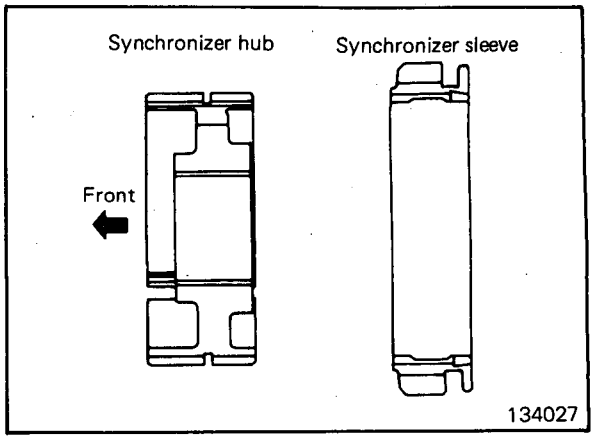


17. Install the needle bearing, the reverse idler gear, the thrust washer and the nut. Install the cotter pin to lock the nut and prevent it from turning, and check the reverse idler gear end play. (134038)
Install the thrust washer with the ground side directed toward the gear.

Reverse idler gear end play .....
0.12-0.28 mm (.005-.011 in.)

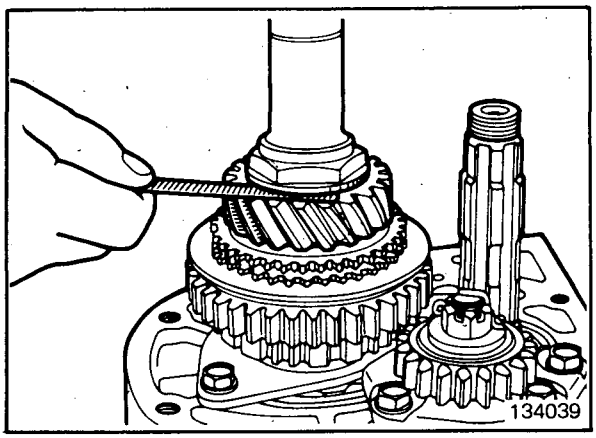


18. Assemble the overdrive synchronizer. The front and rear directions of the synchronizer hub and sleeve can be identified as illustrated. (134027) The spring can be installed in a manner similar to the installation of the 3-4 and 1-2 synchronizer springs.



19. Install the spacer, the stop plate, the overdrive synchronizer assembly, the overdrive gear bearing sleeve, the needle bearing, the synchronizer ring and the overdrive gear, in that order, onto the mainshaft from the rear end. Tighten the lock nut and stake it at the mainshaft notch and then check the overdrive gear end play. (134039)

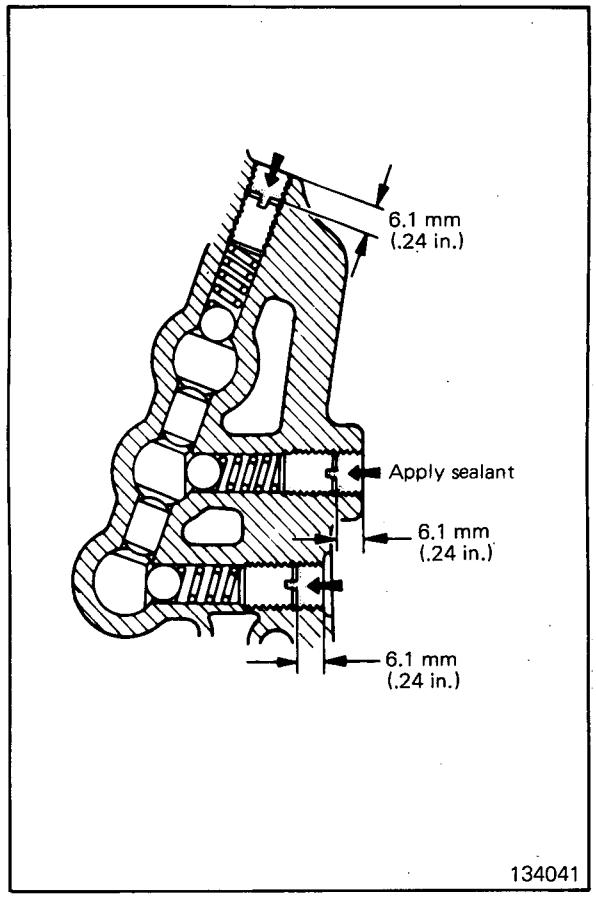
Overdrive gear end play	0.1-0.25 mm (.004-.010 in.)



20. Install the spacer, the counter reverse gear, the spacer, the counter overdrive gear and the ball bearing onto the countershaft gear from the rear end. After tightening the nut, stake the nut at the notch at the rear end of the counter shaft gear.
21. Insert the 3-4 and 1-2 shift forks into their respective synchronizer sleeves. Insert each shift rail from the rear of the case. Lock the shift forks and rails with spring pins, and then install the interlock plunger between shift rails. The spring pin should be installed with the slot in the axial direction of the shift rail.

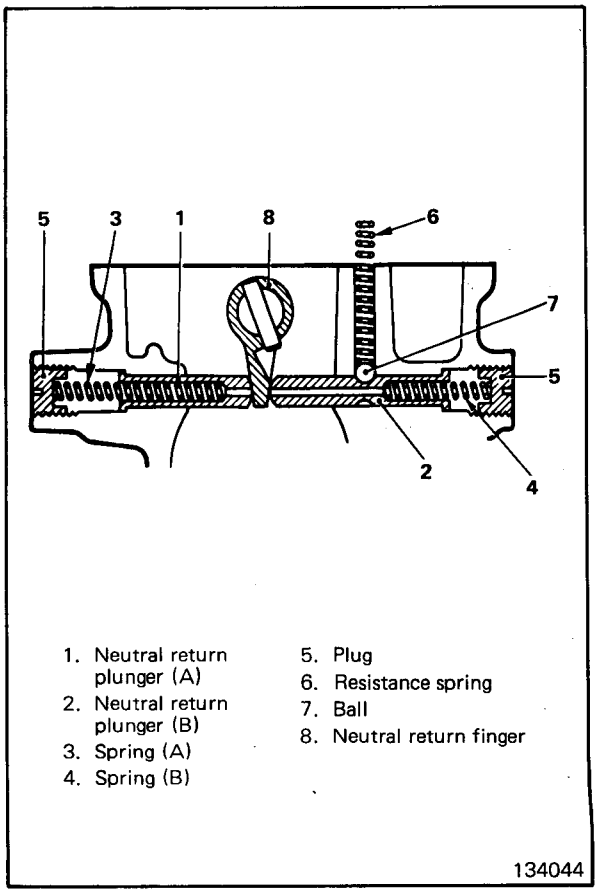
22. Insert the ball and poppet spring (small end facing the ball) into each shift rail. Tighten the plug to the specified position. After installation, seal the plug head with sealant. (134041)
23. Install the ball bearing on to the rear end of the mainshaft.
24. Install the speedometer drive gear.
25. Apply recommended sealant to both sides of the extension housing gasket and install the gasket on the housing. Next, install the extension housing to the transmission case. When installing the housing, turn the change shifter fully down to the left. Make sure the forward end of the control finger fits snugly in the slot of the shift lug.
    Apply recommended sealant to the threads of extension housing attaching bolts before installation.

Recommended sealant .....
3M Super Silicone 8662 or equivalent



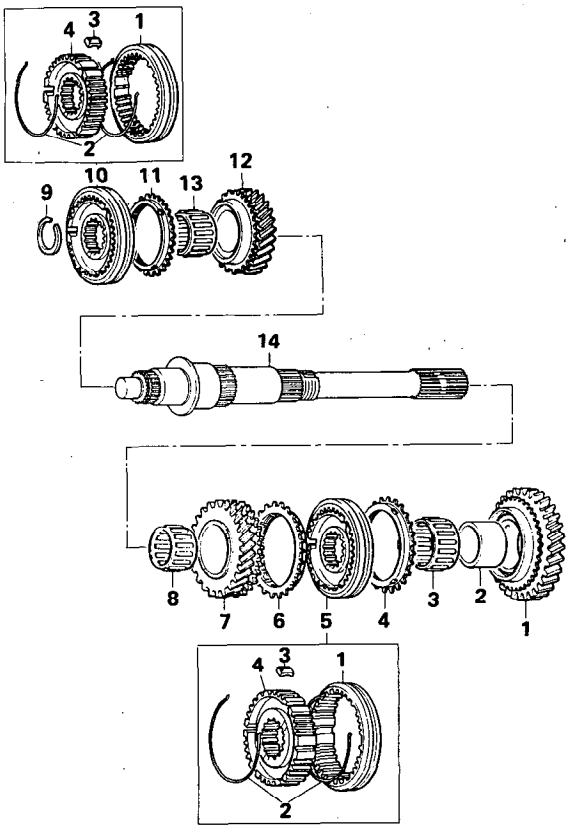
26. Install the neutral return plungers (A) and (B), the springs, and resistance spring and ball. Tighten each plug till the top is flush with the boss top surface. Apply sealant to the plug heads. (134044)
27. Apply sealant to the outside surface of the speedometer driven gear sleeve, install the sleeve into the extension housing and mesh it with the drive gear. After installing into the locking plate groove, lock the sleeve with the locking plate.
28. Install the backup light switch after applying sealant to the threads. Remember to install the steel ball.
29. Install the under cover, and then tighten attaching bolts to the specified torque. Be careful not to overtighten the bolts, otherwise the gasket will be damaged, resulting in oil leakage.

Under cover attaching bolts
torque specification ..... 7.8-9.8 Nm (6-7 ft.lbs.)



COMPONENTS

1. First speed gear
2. Needle bearing
3. Bearing sleeve
4. Synchronizer ring
5. 1-2 synchronizer assembly
-1 1-2 synchronizer sleeve
-2 Synchronizer spring (2)
-3 Synchronizer key (3)
-4 1-2 synchronizer hub
6. Synchronizer ring
7. Second speed gear
8. Needle bearing
9. Snap ring
10. 3-4 synchronizer assembly
-1 3-4 synchronizer sleeve
-2 Synchronizer spring (2)
-3 Synchronizer key (3)
-4 3-4 synchronizer hub
11. Synchronizer ring
12. Third speed gear
13. Needle bearing
14. Mainshaft



NOTE
Numbers show order of disassembly.
For reassembly, reverse order of disassembly.

145024

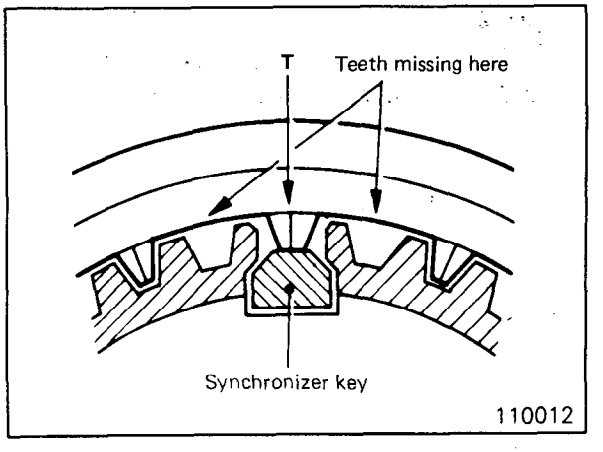
DISASSEMBLY

1. Disassemble in the numerical order indicated in the component illustration. (145024)
2. Before synchronizer assembly is disassembled, put an alignment mark on synchronizer hub and sleeve at appropriate location in aid of reassembly.
3. Since synchronizer key is common to both 1-2 and 3-4 synchronizers, do not change the combination.

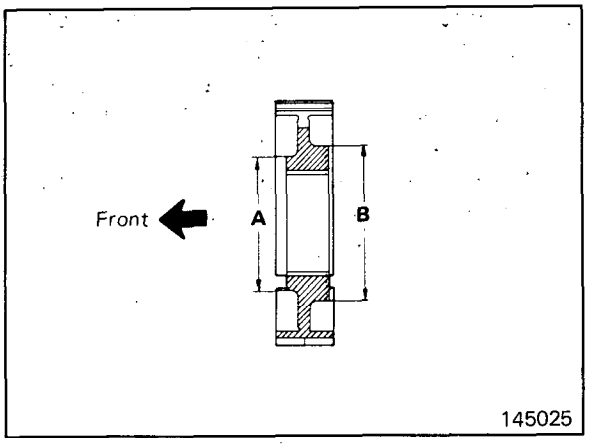
REASSEMBLY

1-2 and 3-4 synchronizer

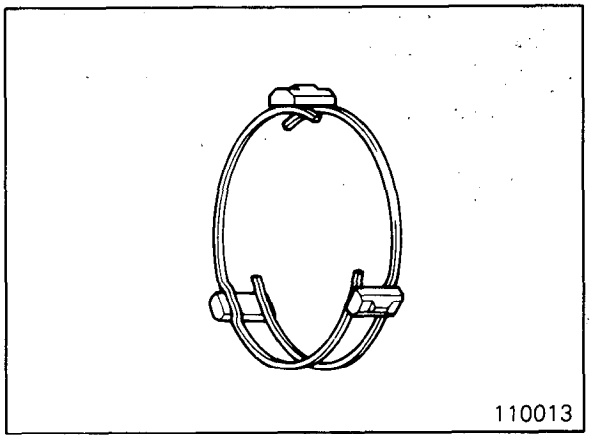
1. Mate synchronizer hub with sleeve using mark made at disassembly. Make sure that hub and sleeve slide smoothly. If they slide unsmoothly, replace hub and sleeve assembly.
2. 3-4 synchronizer sleeve has teeth missing at six portions. Assemble hub to sleeve in such a way that center tooth "T" between two missing teeth will touch synchronizer key. (110012)



3. Use care when installing 3-4 synchronizer hub since only 3-4 synchronizer is directional. Smaller diameter side "A" of center boss is front of 3-4 synchronizer hub.



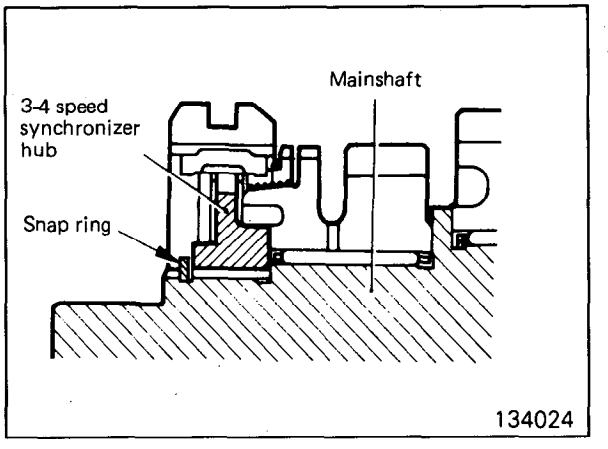
4. Insert three keys into groove of synchronizer hub.
5. Install two synchronizer springs to synchronizer. When synchronizer springs are installed, make sure that front and rear ones are not faced in same direction. (110013)



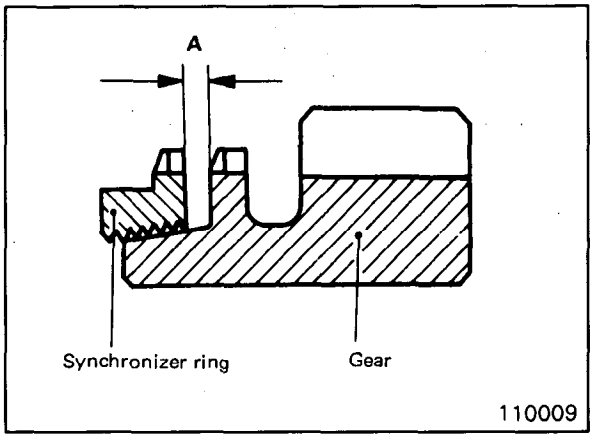
Mainshaft

1. Assemble the mainshaft assembly in the reverse of the order indicated in the component illustration. (145024)

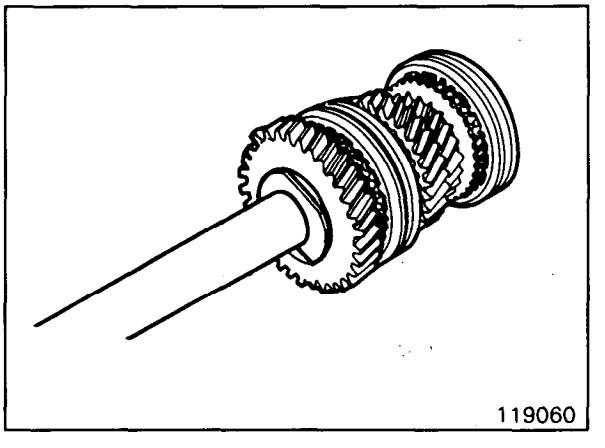
2. Assemble 3-4 synchronizer positioning hub toward correct direction. (110009)
3. As for mainshaft front end snap ring, select and install one of such thickness that will minimize clearance between snap ring and hub. In other words, install the thickest snap ring that fits in snap ring groove.
4. Make sure that 3rd speed gear turns smoothly.



5. Check synchronizer ring for worn and damaged internal threads and teeth.
6. With synchronizer assembled to cone of each gear, check dimension"A" (110009)
   If "A" is less than 0.5 mm (.02 in.), replace synchronizer ring and/or gear.

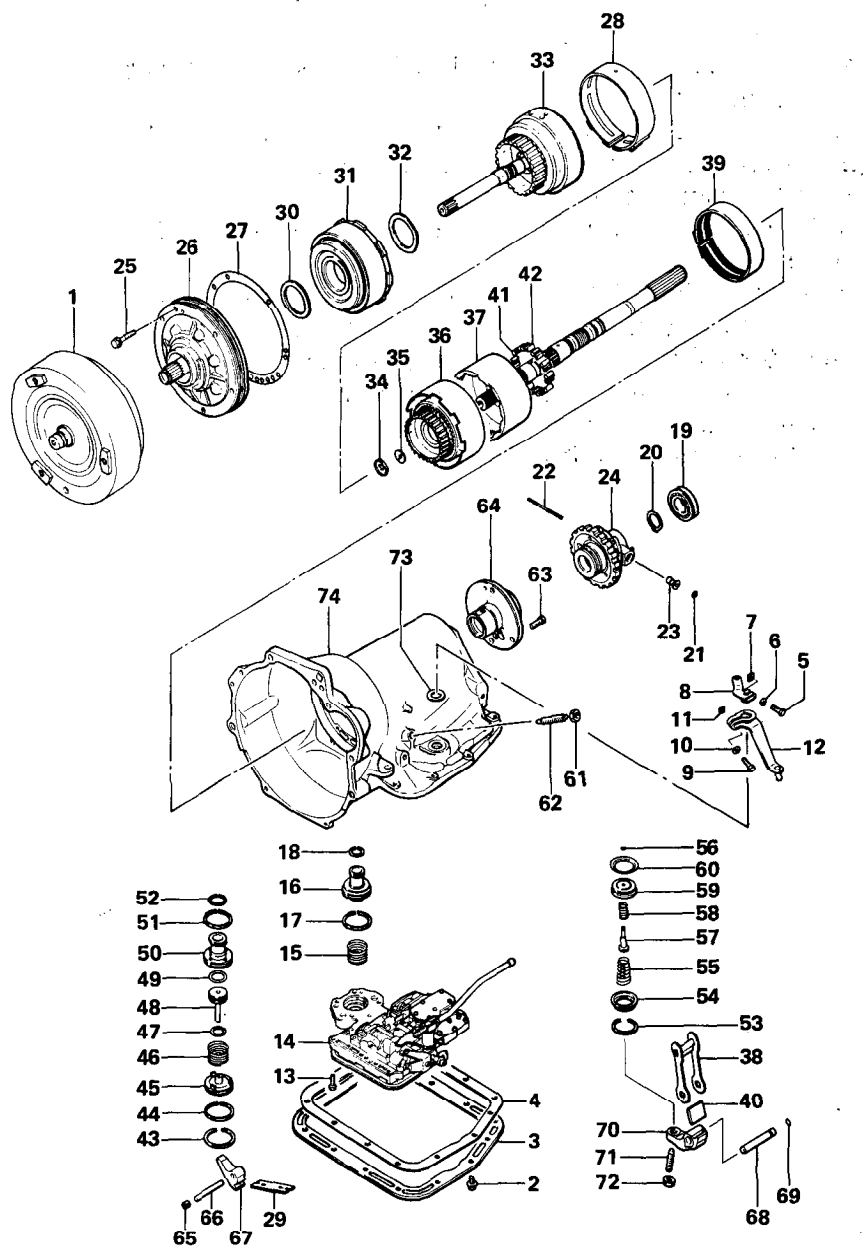


7. After installation of 2nd speed gear, 1st-2nd synchronizer and 1st speed gear, push bearing spacer firmly toward 1st speed gear and make sure that 1st and 2nd speed gears turn smoothly.



COMPONENTS

1. Torque converter
2. Screw (14)
3. Oil pan
4. Oil pan gasket
5. Bolt
6. Plain washer
7. Square nut
8. Transmission throttle lever
9. Bolt
10. Plain washer
11. Square nut
12. Manual control lever
13. Flange bolt (10)
14. Valve body assembly
15. Accumulator spring
16. Accumulator piston
17. Seal ring
18. Seal ring
19. Output shaft bearing
20. Governor body snap ring
21. Governor valve shaft snap ring
22. Governor valve shaft
23. Governor valve
24. Governor and support
25. Screw (6)
26. Oil pump and reaction shaft support assembly
27. Reaction shaft support gasket
28. Kickdown band
29. Kickdown band strut
30. Thrust washer (#1)
31. Front clutch assembly
32. Front clutch thrust washer (#2)
33. Rear clutch assembly
34. Input shaft thrust plate (#3)
35. Output shaft thrust washer (#4)
36. Planet and output shaft assembly
37. Low-reverse drum
38. Reverse band link
39. Reverse band
40. Reverse band strut
41. Overrunning clutch roller (10)
42. Overrunning clutch roller spring (10)
43. Kickdown servo snap ring
44. Kickdown servo guide
45. Kickdown servo guide ring
46. Kickdown servo spring
47. Snap ring
48. Kickdown servo piston rod
49. O-ring
50. Kickdown servo piston
51. Seal ring
52. Seal ring
53. Spring retainer snap ring
54. Reverse servo spring retainer
55. Reverse servo spring
56. Reverse servo plug ring
57. Reverse servo piston plug
58. Reverse servo cushion spring
59. Reverse servo piston
60. Reverse servo piston seal
61. Kickdown band locking nut
62. Kickdown band adjusting screw
63. Output shaft support bolt (4)
64. Output shaft support
65. Kickdown lever shaft plug
66. Kickdown band lever shaft
67. Kickdown band lever
68. Reverse band lever shaft
69. Seal
70. Reverse band lever
71. Reverse band adjusting screw
72. Locking nut
73. Manual valve shaft seal
74. Transmission case



NOTE
Numbers show order of disassembly.
For reassembly, reverse order of disassembly.

904131

GENERAL INFORMATION

The MA904A automatic transmission combines a torque converter and a fully-automatic 3-speed gear system. The converter housing and transmission case are an integral aluminum alloy die casting. The transmission consists of two multiple disc clutches, an overruning clutch, two servos and bands, and two planetary gear sets to provide three forward ratios and a reverse ratio. The common sun gear of the planetary gear sets is connected to the front clutch by a driving shell which is splined to the sun gear and to the front clutch retainer. The hydraulic system consists of an oil pump, and a single valve body which contains all of the valves except the governor valve.

Venting of the transmission is accomplished by a passage through the upper part of the oil pump housing.

The torque converter is attached to the crankshaft through a flexible driving plate.

Cooling of the ATF (automatic transmission fluid) heated in the converter is accomplished by circulating the ATF through the water cooled type cooler in the radiator lower tank. The torque converter assembly is a sealed unit which cannot be disassembled.

The ATF is filtered by an internal "Dacron Type" filter attached to the lower side of the valve body assembly.

Engine torque is transmitted to the torque converter and then through the input shaft to the multiple disc clutches in the transmission. The power flow depends on the application of the two clutches and two bands.

HYDRAULIC CONTROL SYSTEM

The hydraulic control circuits show the position of the various valves with color coded passages to indicate those under hydraulic pressure for all operations of the transmission.

The hydraulic control system makes the transmission fully automatic, and has four important functions to perform. In a general way, the components of any automatic control system may be grouped into the following four basic groups: 1: the pressure supply system, 2: the pressure regulating valves, 3: the flow control valves, and 4: the clutches and band servos.

Taking each of these basic groups of systems in turn, the control system may be described as follows:

Pressure Supply System

The pressure supply system consists of an oil pump driven by the engine through the torque converter.

The single front pump furnishes pressure for all the hydraulic and lubrication requirements.

Pressure Regulating Valves

The pressure regulating valves consist of a regulator valve which controls line pressure at a value dependent on throttle opening.

The switch valve maintains torque converter operating pressure and transmission lubricating pressure.

The governor valve transmits regulated pressure to the transmission (in conjunction with vehicle speed) to control upshift and downshift speeds.

The throttle valve transmits regulated pressure to the transmission (in conjunction with throttle position) to control upshift and downshift speeds.

Flow Control Valves

The manual valve provides the different transmission drive ranges as selected by the vehicle operator.

The 1-2 shift valve and governor pressure plug automatically shifts the transmission from low to second or vice versa depending on vehicle operation.

When a shift is made from direct to second, the 1-2 shift control valve controls the orifice of the hydraulic pressure feed circuit to the kickdown servo to assure smooth shifting.

The 2-3 shift valve, governor pressure plug and throttle pressure plug automatically shift the transmission from second to direct or vice versa depending on vehicle operation.
The kickdown valve makes possible a forced downshift from direct to second or from second to low or from direct to low (depending on vehicle speed) by depressing the accelerator pedal past the detent near wide open throttle.
The limit valve determines the maximum speed at which a 3-2 part downshift can be made.
The shuttle valve has two separate functions and performs each independently of the other. The first is that of providing fast release of the kickdown band and smooth front clutch engagement when the driver takes a "lift-foot" upshift from second to direct.
The second function of the shuttle valve is to regulate kickband application and timing when making direct to second kickdowns.

Clutches, Band Servos and Accumulator

The front and rear clutch pistons, and both servo pistons are moved hydraulically to engage the clutches and apply the bands. The pistons are released by spring tension when hydraulic pressure is released. On the 2-3 upshift, the kickdown servo piston is released by spring tension and hydraulic pressure.
The accumulator controls the hydraulic pressure on the apply side of the kickdown servo during the 1-2 shift; thereby, cushioning the kickdown band application at any throttle position.

OPERATING INSTRUCTIONS

The transmission will automatically upshift and downshift at approximately the speeds shown in the "Automatic Shift Speed Chart." (described under SERVICE DIAGNOSIS AND TESTS). All shift speeds given in the "Chart" may vary somewhat due to production tolerances and rear axle ratios. The quality of the shifts is very important. All shifts should be smooth and positive with no noticeable engine runaway.

Selector Lever and Parking Lock Controls

The transmission is controlled by a "lever type" selector lever incorporated within the console box.
The control has six selector lever positions: "P" (park) "R" (reverse), "N" (neutral), and "D" (drive), "2" (second) and "L" (lock-up).
The parking lock is applied by moving the selector lever to the "P" position.

Caution

Do not apply the parking lock until the vehicle has stopped; otherwise, a severe ratcheting noise will occur.

Starting the Engine

The engine will start with the selector lever in either the "P" or "N" positions. As a safety precaution when starting in the "N" position, apply the parking or foot brake. The automatic transmission will not permit starting the engine by pushing or towing.

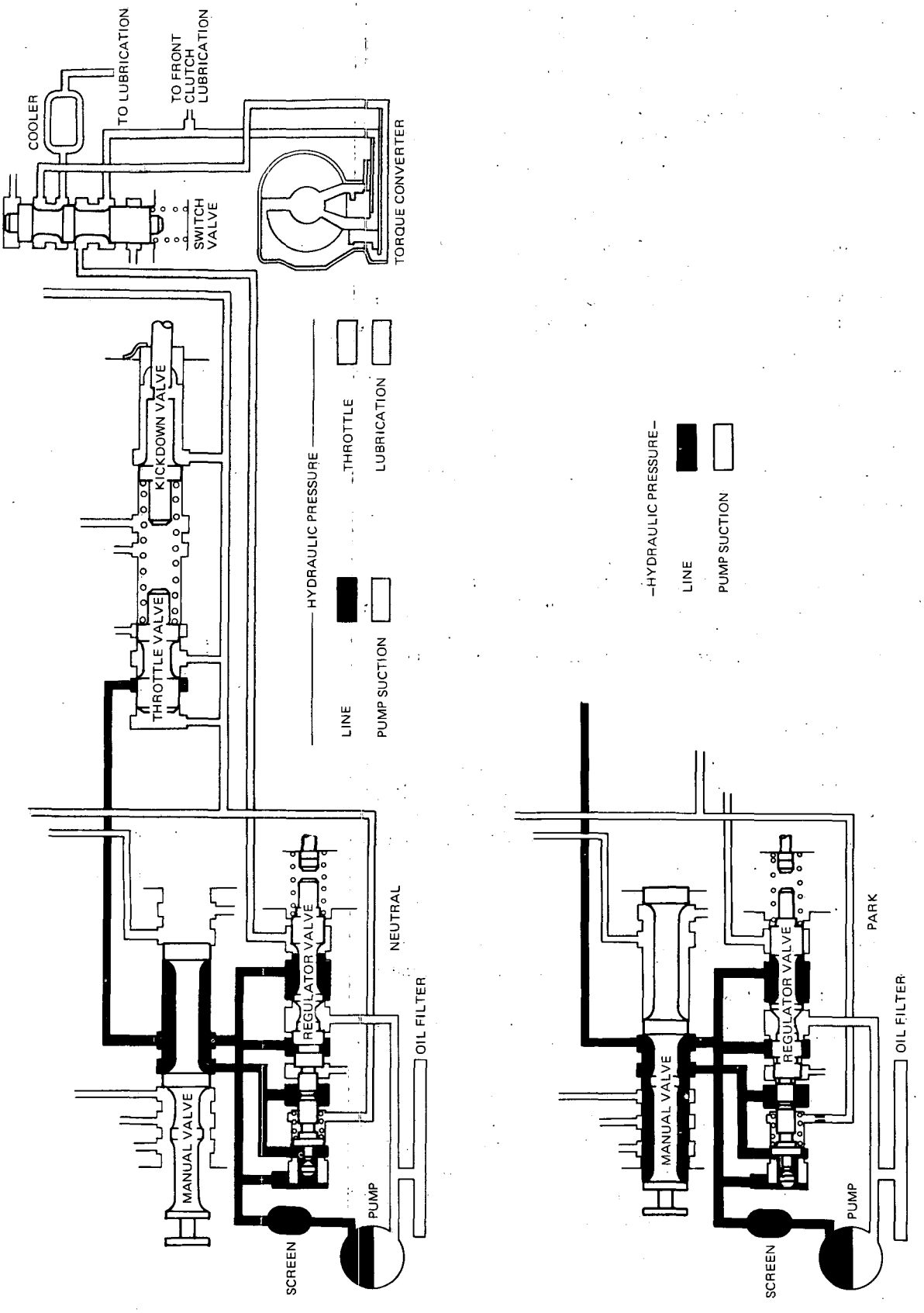
Mountain Driving

When driving in the mountains with heavy loads or when pulling a trailer, the "2" or "L" position should be selected on upgrades which require heavy throttle for 0.8 km (1/2 mile) or more. This reduces the possibility of overheating the transmission and converter under these conditions.

Towing Vehicle

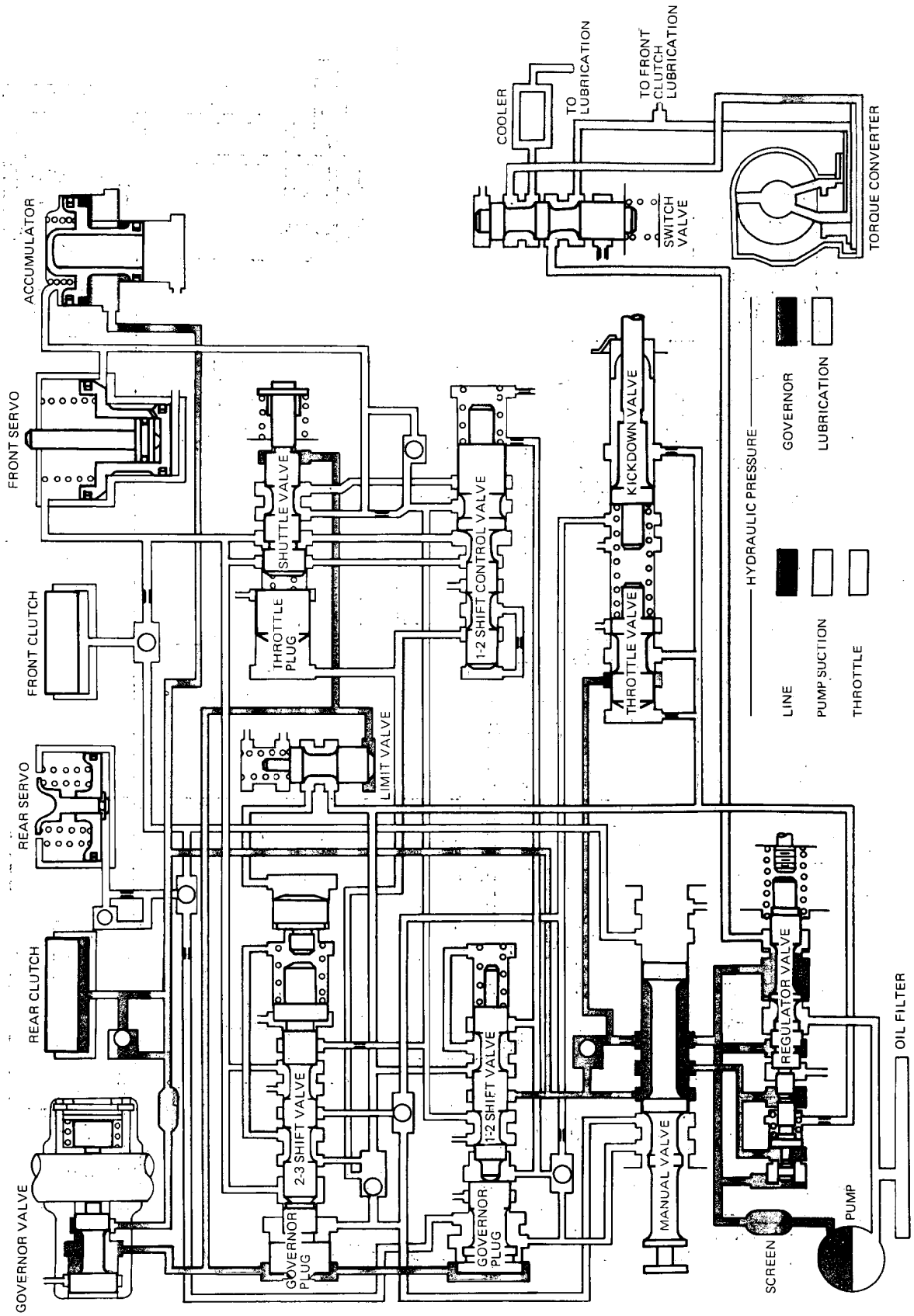
Transmission Inoperative: Tow the vehicle with a rear end pickup and place the free wheel hub lever to free position or remove the propeller shaft.
Transmission Operating Properly: The vehicle may be towed safety in "N" (neutral) with rear wheels on the ground at a speed not to exceed 50 km/h (30 mph). If the vehicle is to be towed for extended distance, it should be done with a rear end pickup and place the free wheel hub lever to free position or the propeller shaft removed. Because the transmission receives lubrication only when the engine is running, it is good practice to always tow a disabled vehicle with a rear end pickup or remove the propeller shaft.

Neutral and Parking



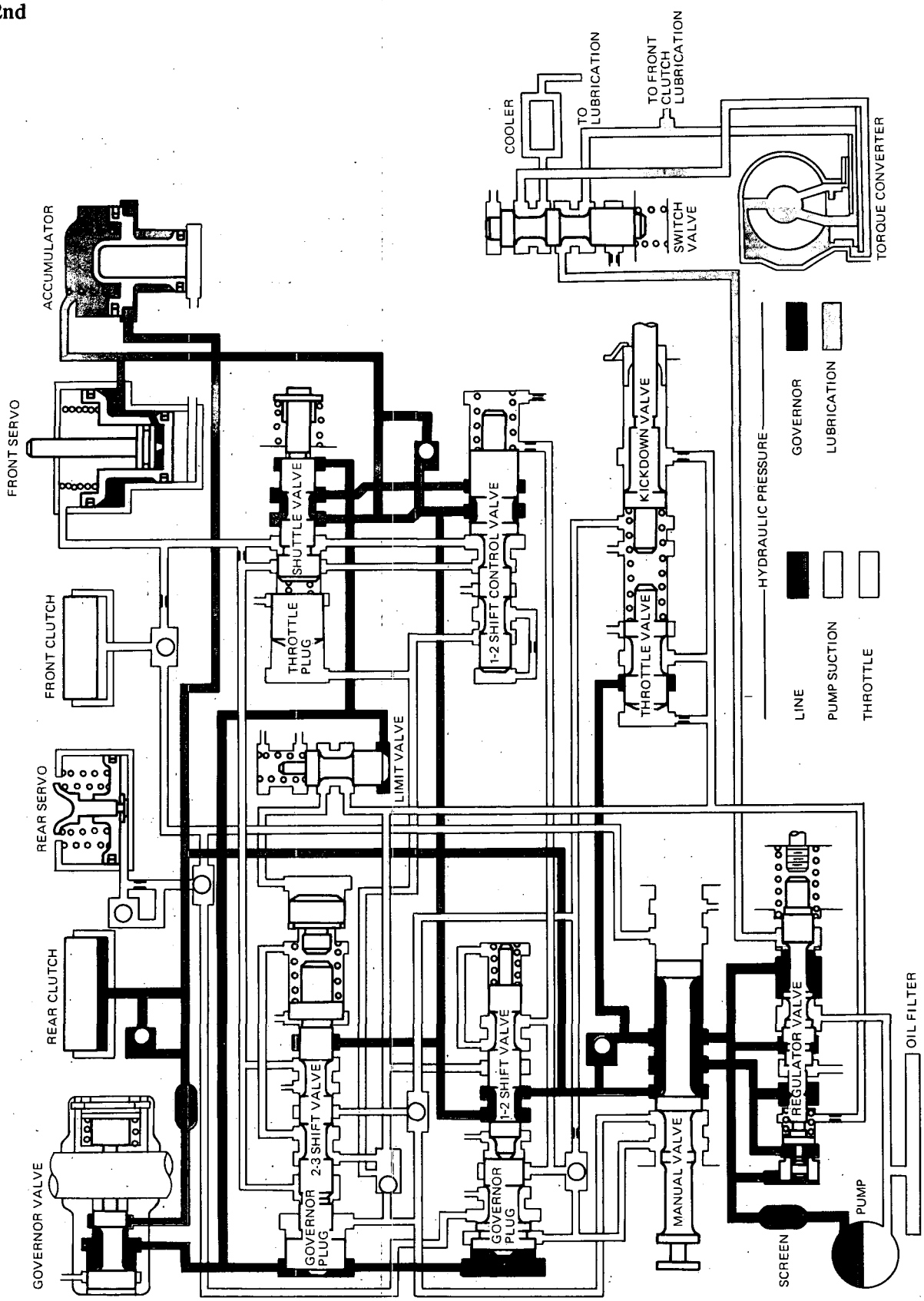
904002

Drive-1st



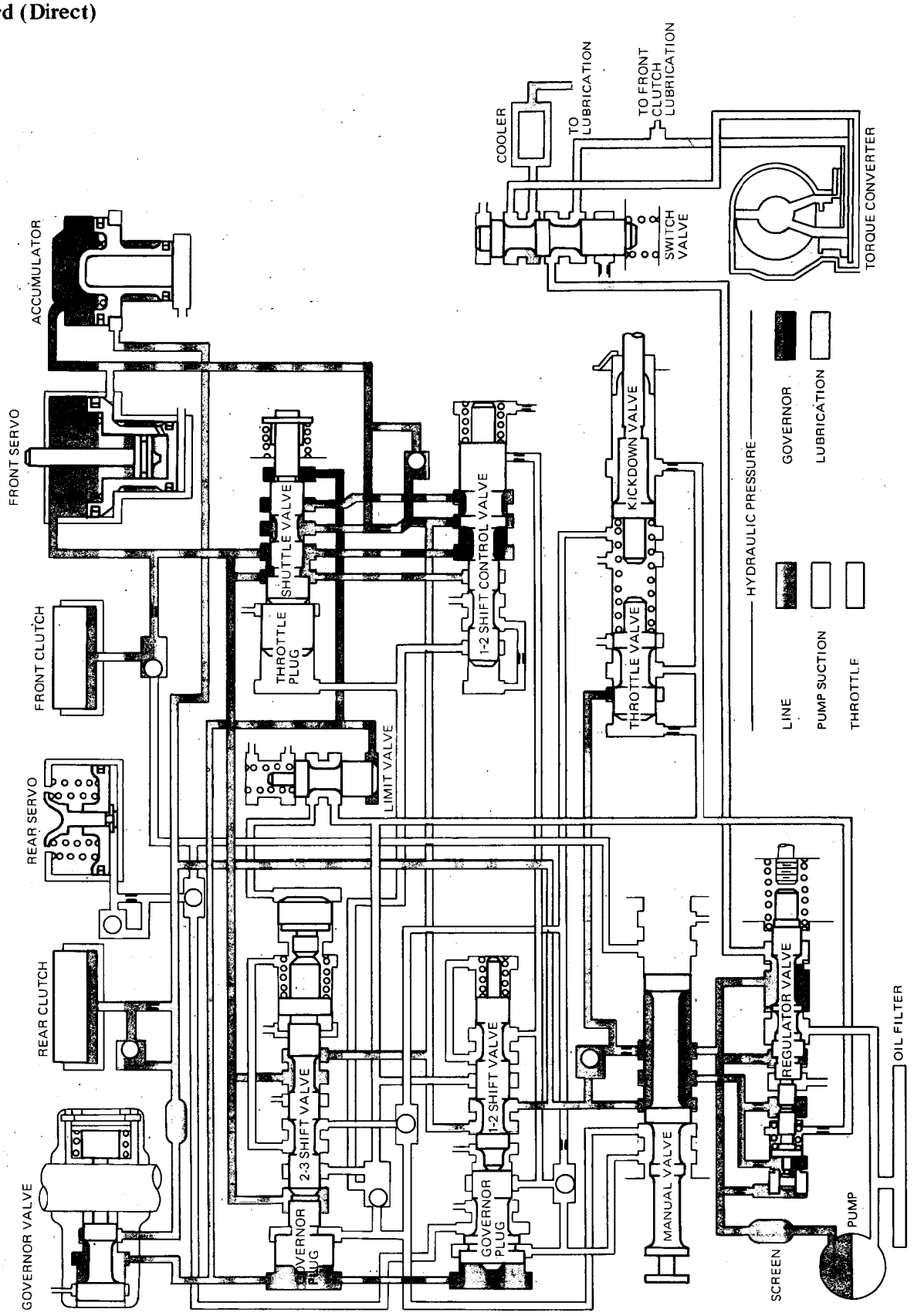
904003

Drive-2nd



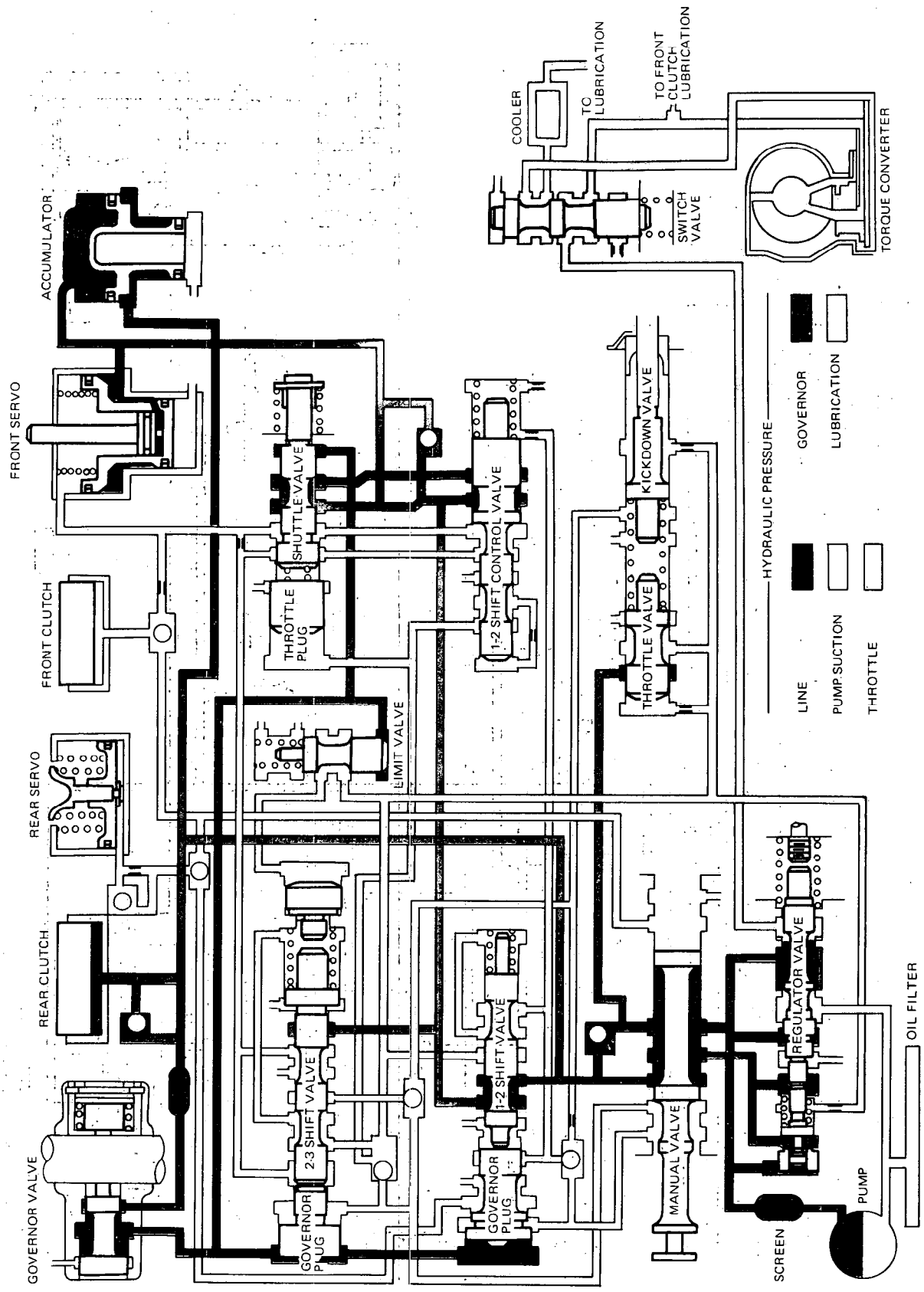
904004

Drive-3rd (Direct)



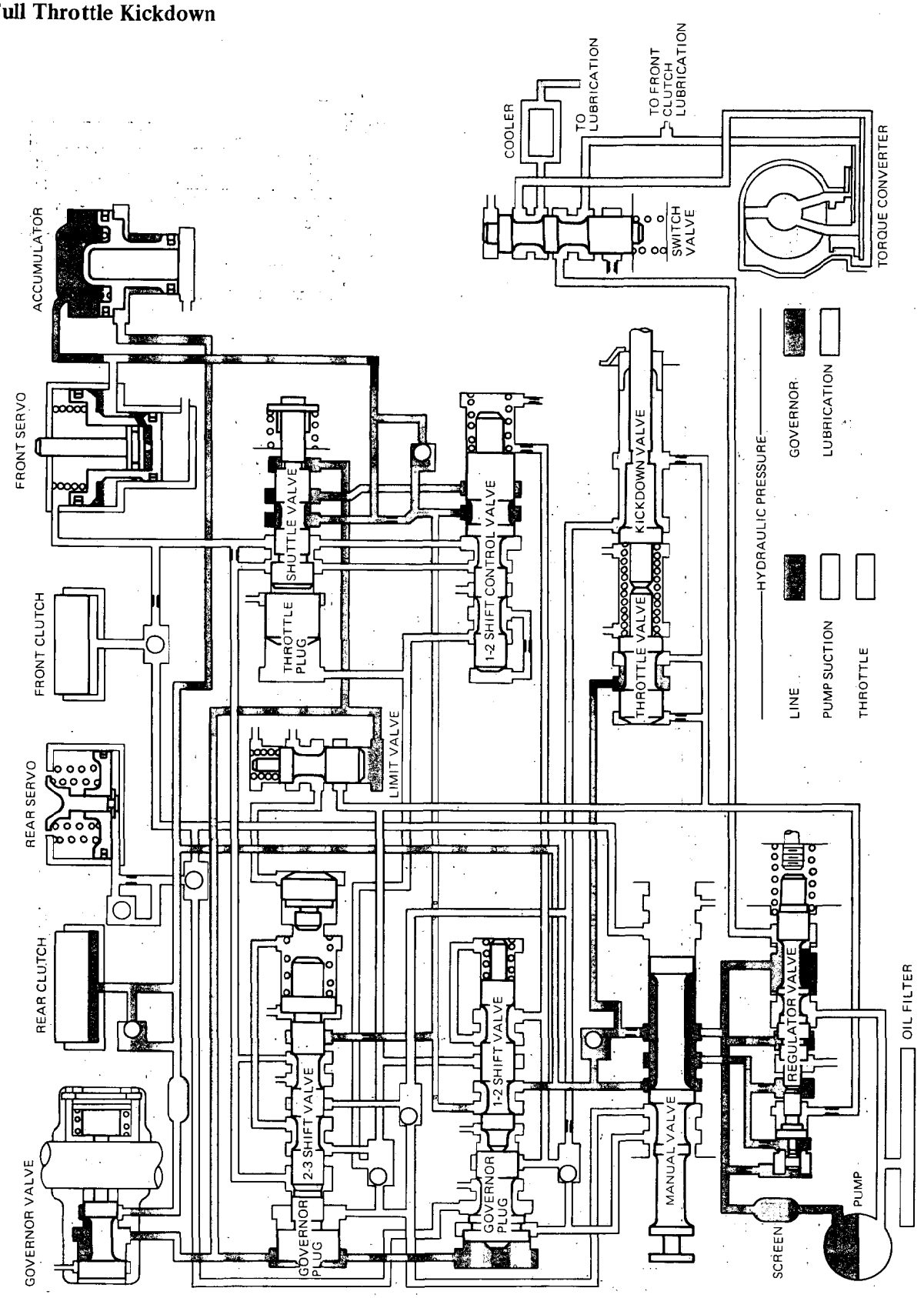
904005

Drive-Part Throttle Kickdown



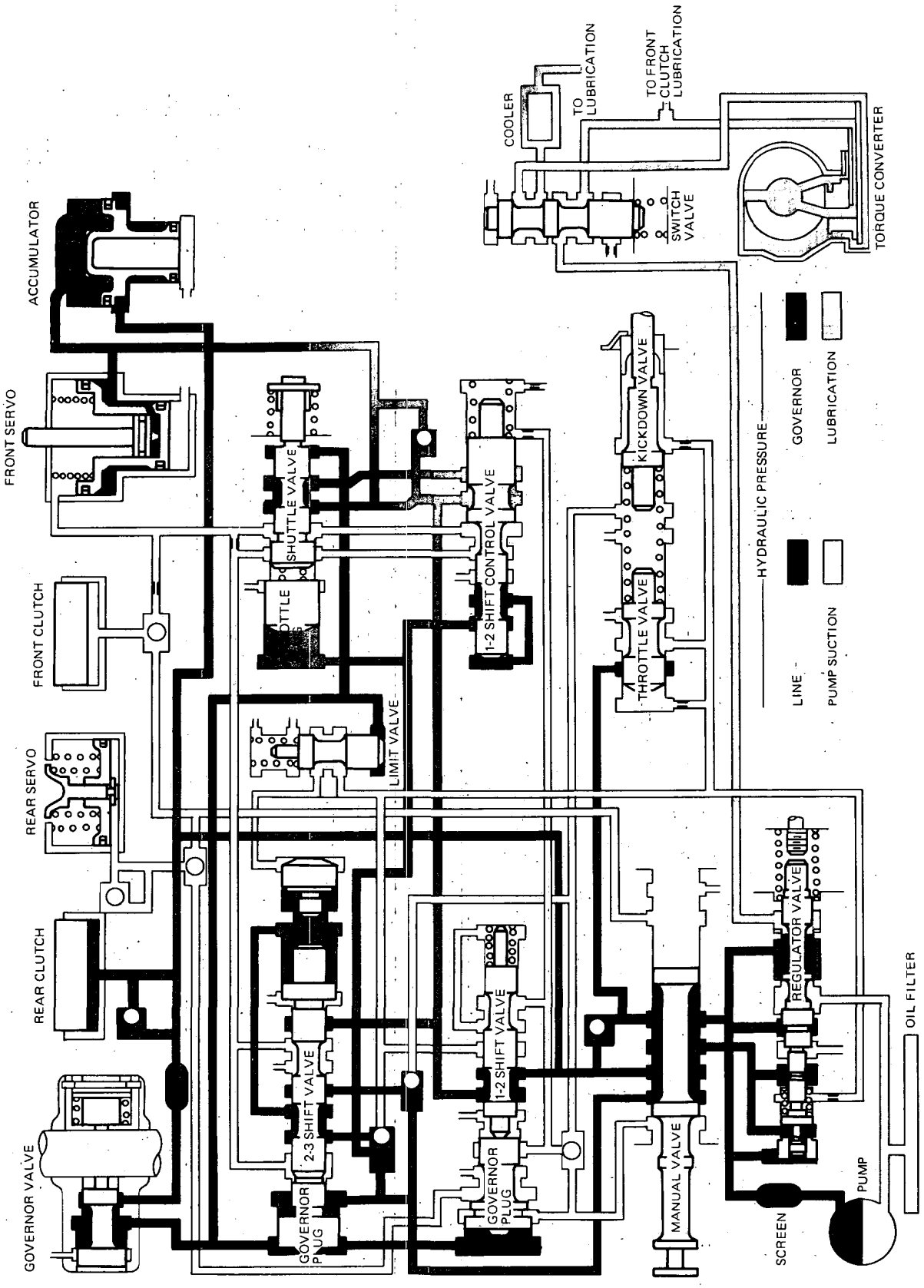
904006

Drive-Full Throttle Kickdown



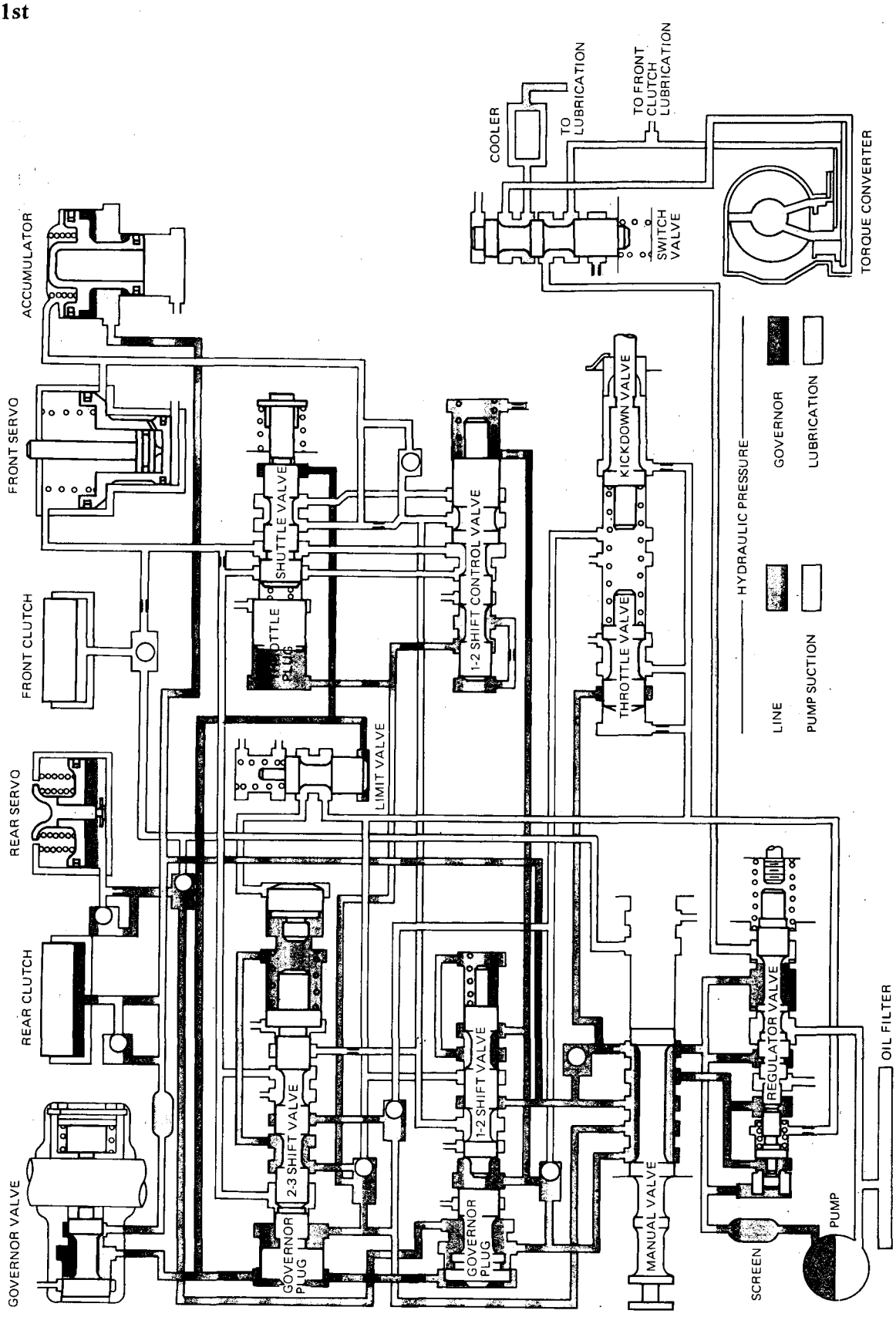
904007

2-Second



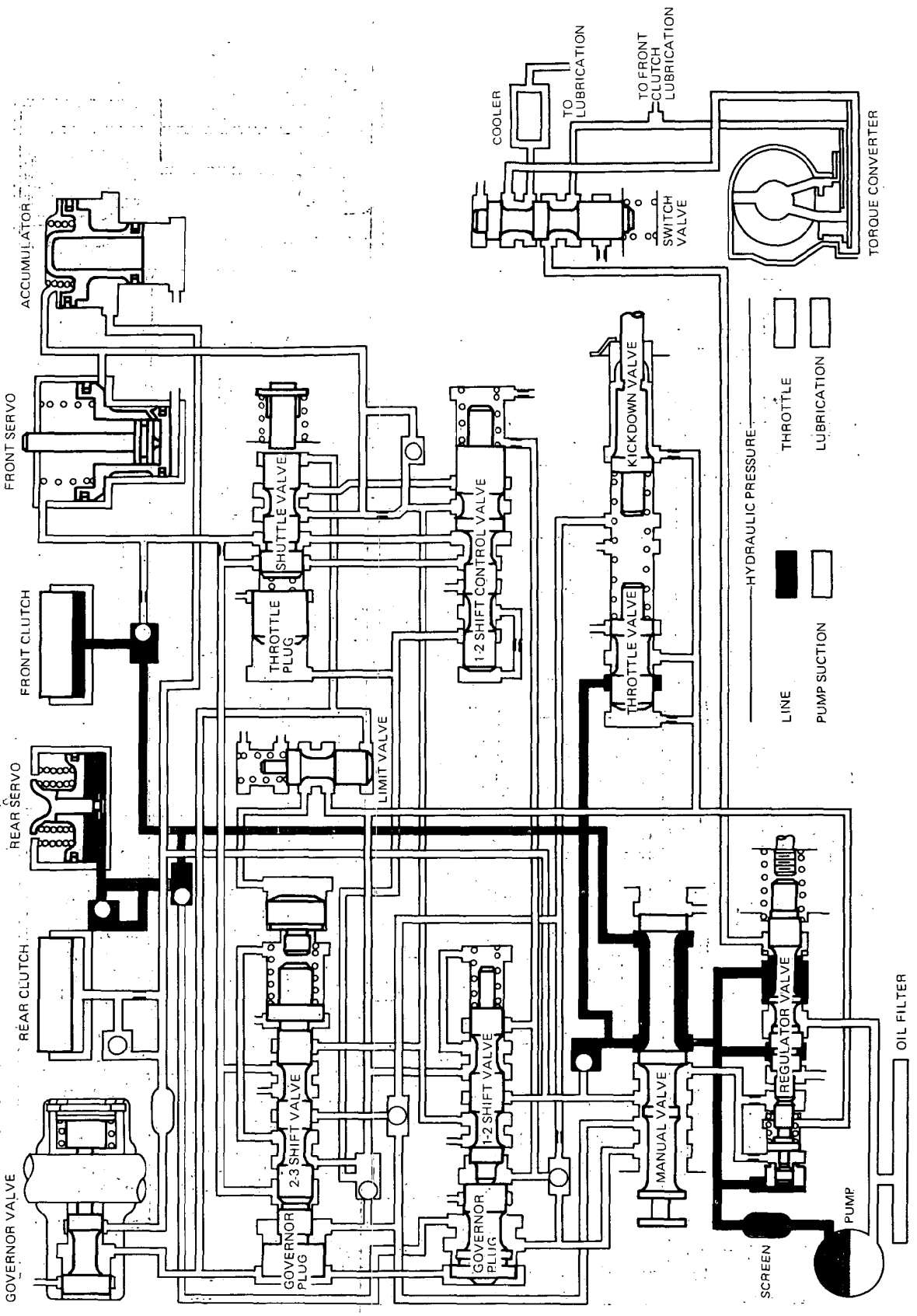
904008

Lock-up-1st



904009

Reverse



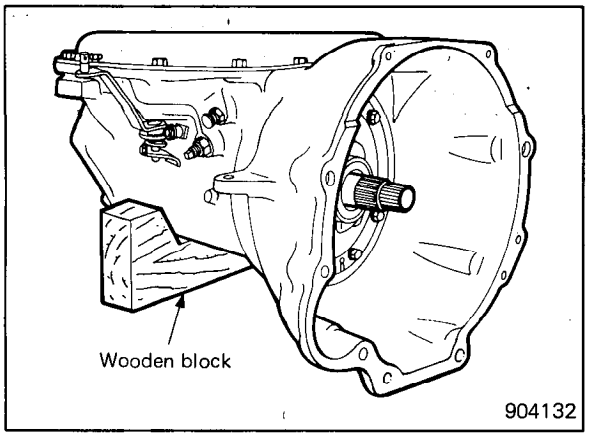
904010

DISASSEMBLY

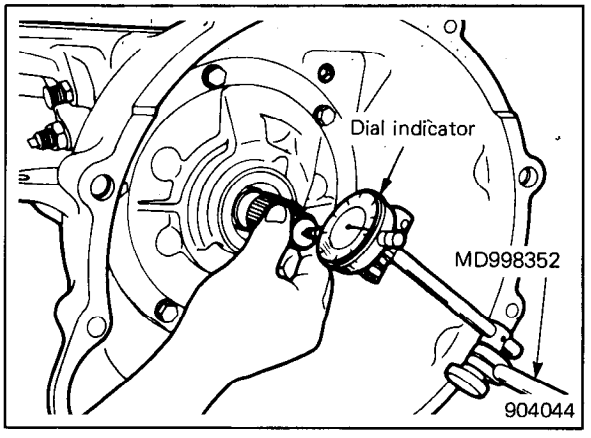
Caution

Prior to removing any transmission sub-assemblies, plug all openings and thoroughly clean exterior of the unit, preferably by steam. Cleanliness through entire disassembly and assembly cannot be overemphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. Do not wipe parts with shop towels. All mating surfaces in the transmission are accurately machined; therefore, careful handling of parts must be exercised to avoid *nicks or burrs*.

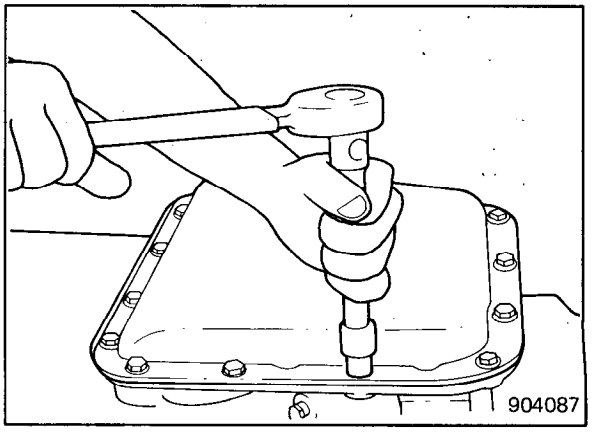
1. Remove torque converter.
2. Remove the transfer case assembly.
   See "Component Service-Transfer Case", for detailed procedure.
3. Place transmission assembly on work bench with oil pan upward. Use block such as the one shown in illustration (904132) under rear of case to hold assembly in position.



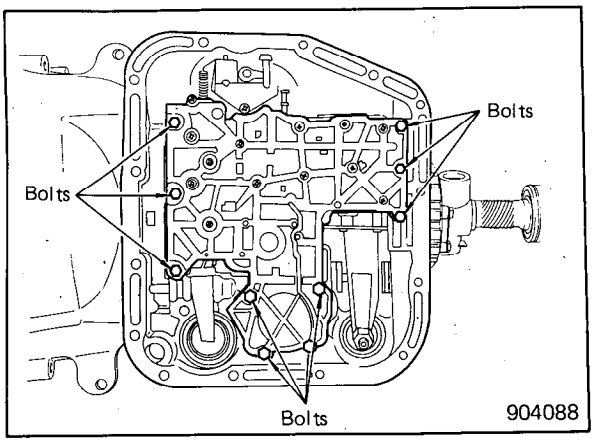
4. Measuring input shaft end play before disassembly will usually indicate when a thrust washer change is required (except when major parts are replaced). Thrust washer is located between input and output shafts.
   Attach a dial indicator to transmission bell housing with its plunger seated against end of input shaft.
   Move input shaft in and out to obtain end play reading.
   Record indicator reading for reference when reassembling the transmission.



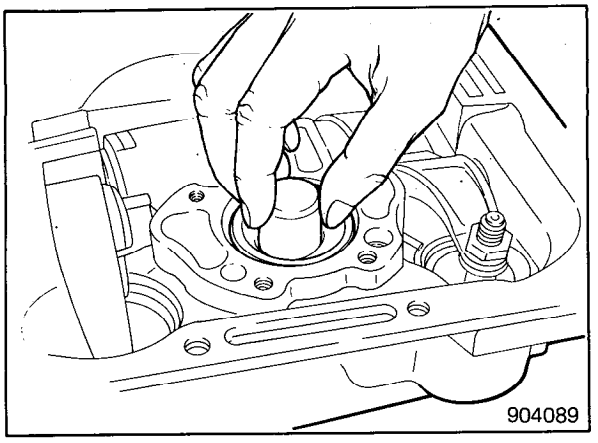
5. Unscrew oil pan screws and remove oil pan and gasket. (904087)
6. Loosen clamp bolts and remove throttle and manual control levers from transmission.



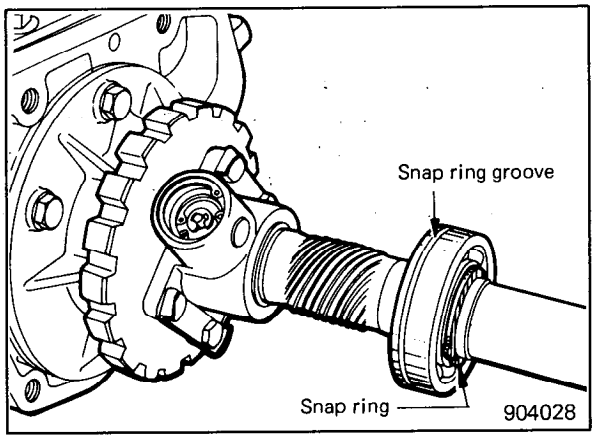
7. Remove ten hex-head valve body to transmission case bolts. (904088)
8. Remove valve body assembly, while lifting the valve body assembly upward out of transmission case.



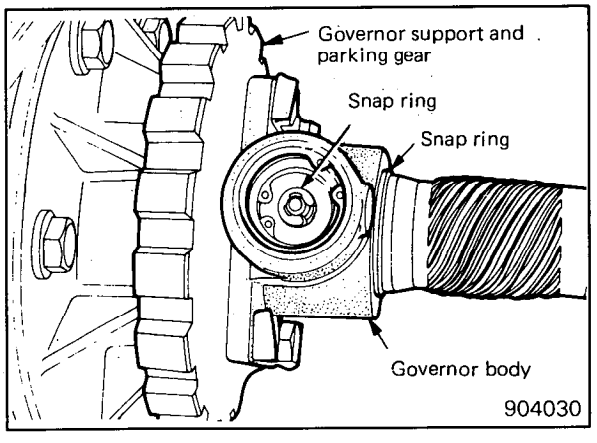
9. Remove accumulator piston and spring from transmission case. Inspect piston for nicks, scores and wear. Inspect spring for distortion. Inspect rings for freedom in piston grooves and wear or breakage. Replace parts as required.



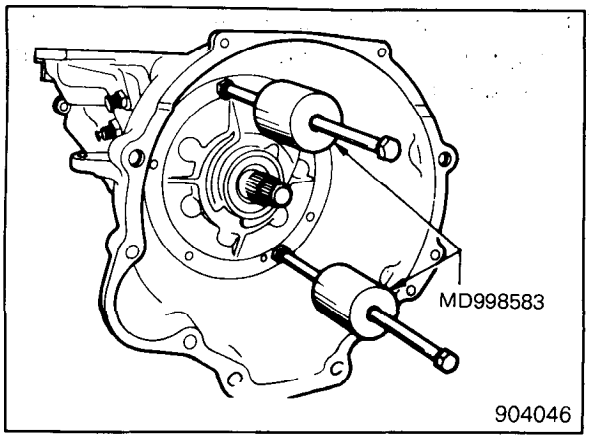
10. Using snap ring pliers, remove output shaft bearing snap ring and remove bearing from shaft.



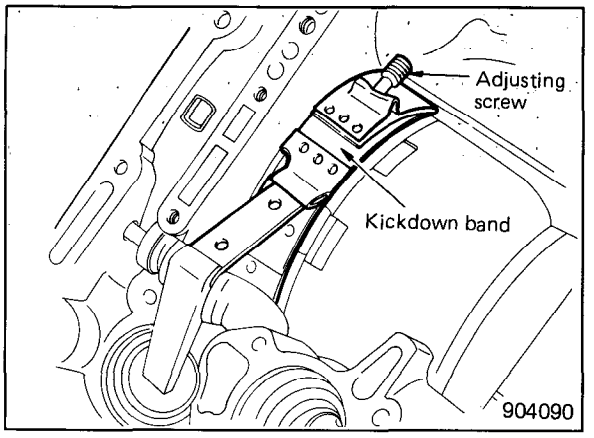
11. Carefully pry snap ring from weight end of governor valve shaft. Slide valve and shaft assembly out of governor body.
12. Remove snap ring from behind governor body, then slide governor and support assembly off output shaft. (904030)



13. Tighten kickdown band adjusting screw until band is tight on front clutch retainer. This prevents front clutch retainer from coming out with pump which might cause unnecessary damage to clutches.
14. Remove oil pump housing retaining bolts.
15. Attach two Special Tools (904046) to pump housing flange in threaded holes in flange.
16. Bump outward evenly with two "knocker weights" to withdraw pump and reaction shaft support assembly from the case.

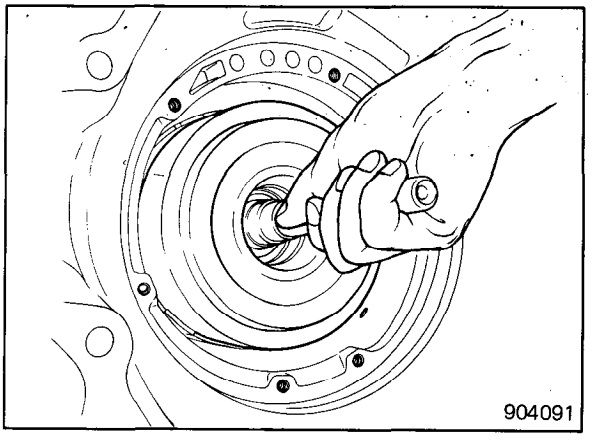


17. Loosen kickdown band adjusting screw, remove band strut and slide band out of the case. (904090)
18. Slide front clutch assembly out of the case.



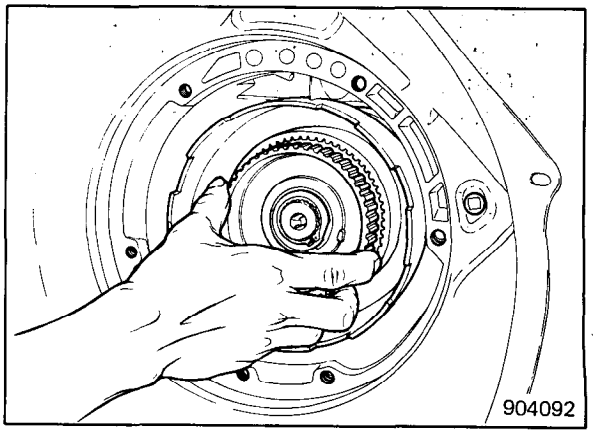
19. Grasp input shaft, and slide input shaft and rear clutch assembly out of the case.

Caution
Be careful not to lose thrust washer located between rear end of input shaft and forward end of output shaft.

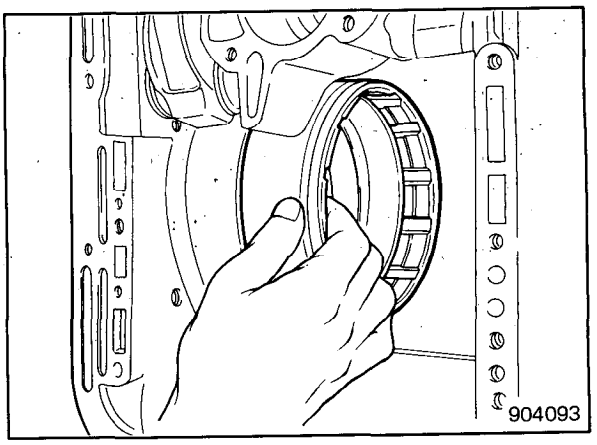


20. While supporting output shaft and driving shell, carefully slide assembly forward and out through the case.

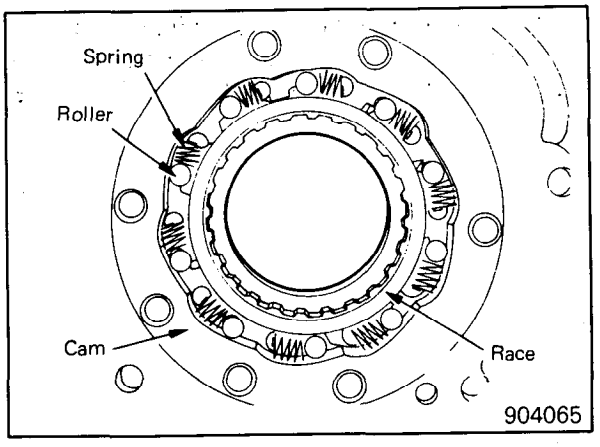
Caution
Be very careful not to damage ground surfaces on output shaft during removal.



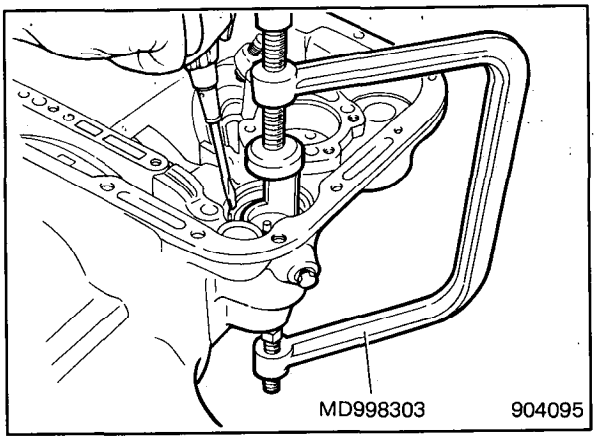
21. Remove low-reverse drum, then loosen low-reverse band adjusting screw, remove band strut and link, then remove band from the case.



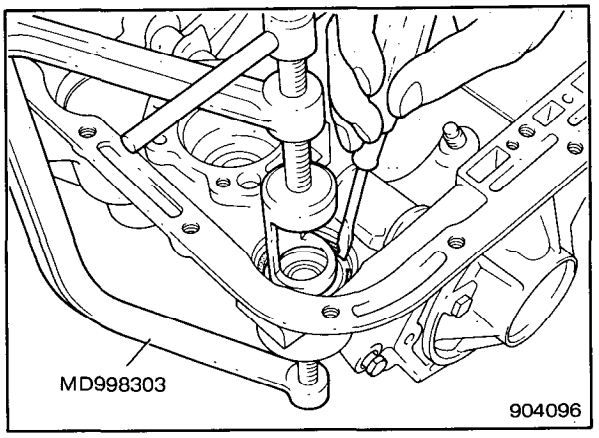
22. Note position of overrunning clutch rollers and springs before disassembly to assist in reassembly.
23. Carefully slide out clutch race and remove rollers and springs. If overrunning clutch cam and/or roller spring retainer are found damaged or worn, replace. (904065)



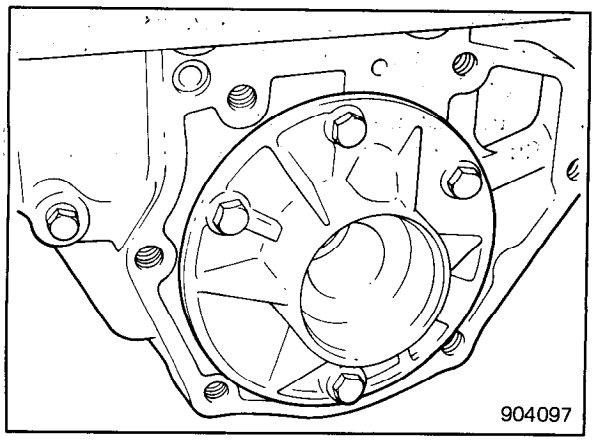
24. Compress kickdown servo spring by using Special Tool, then remove snap ring. (904095)
25. Remove servo guide, spring rod and servo piston from the case. Be careful not to damage piston rod or guide during removal.



26. Compress low-reverse servo piston spring by using Engine Valve Spring Compressor, then remove snap ring. (904096)
27. Remove spring retainer, spring and servo piston from the case.

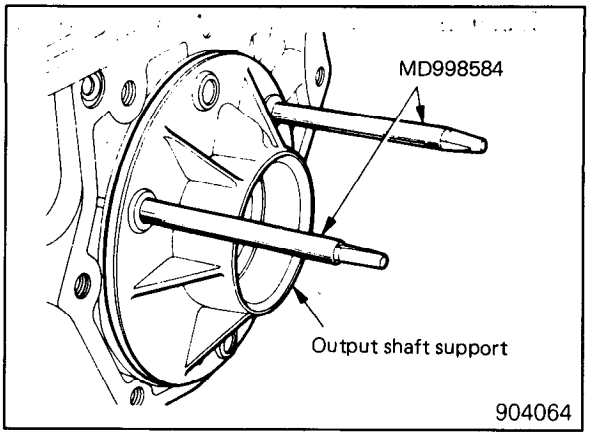


28. Remove four output shaft support to case bolts and then remove output shaft support.

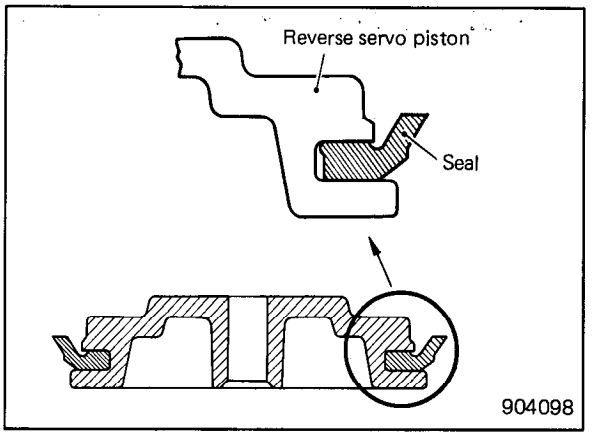


REASSEMBLY

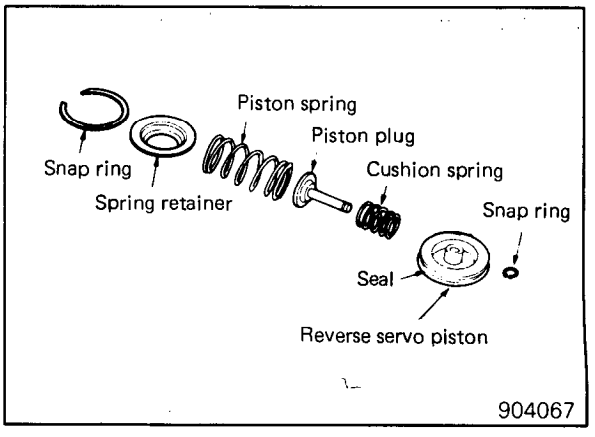
1. Screw two Special Tools into the case. Position output shaft support over pilot studs, and tap it firmly into the case with a soft faced hammer. (904064)
2. Remove pilot studs.
3. Install four bolts and tighten to specified torque.



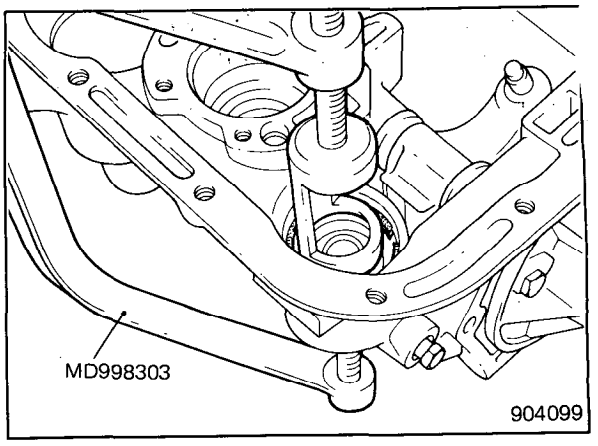
4. Install new seal to reverse servo piston.



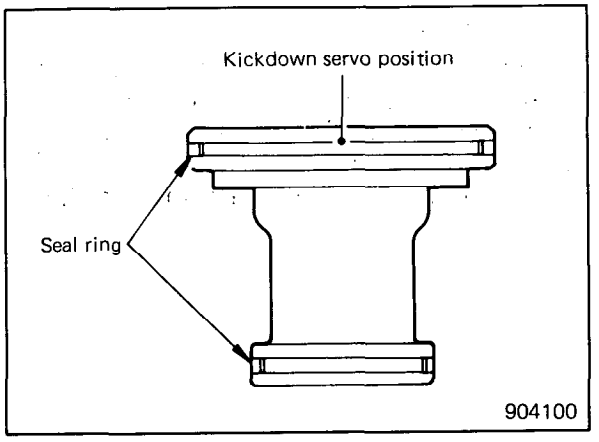
5. Install cushion spring and piston plug to reverse servo piston, and secure with snap ring.



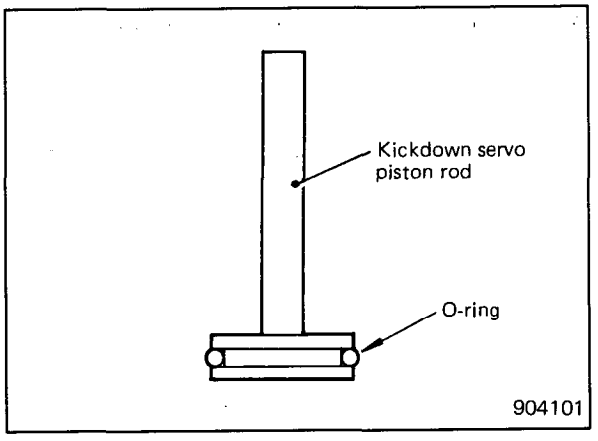
6. Carefully work servo piston assembly into the case with a twisting motion. Place spring, retainer and snap ring over piston.
7. Compress low and reverse servo piston spring by using Special Tool, and then install snap ring. (904099)



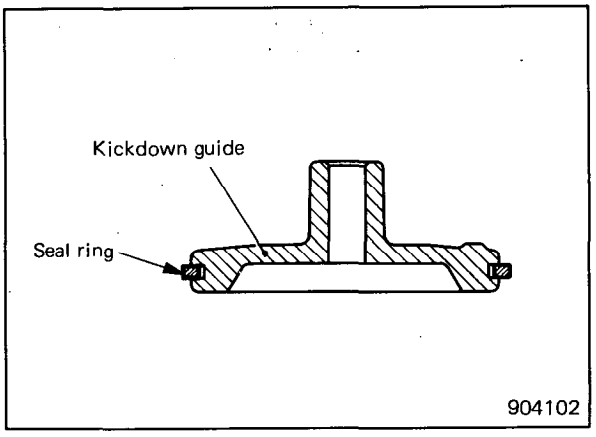
8. Install new seal rings to kickdown servo piston.



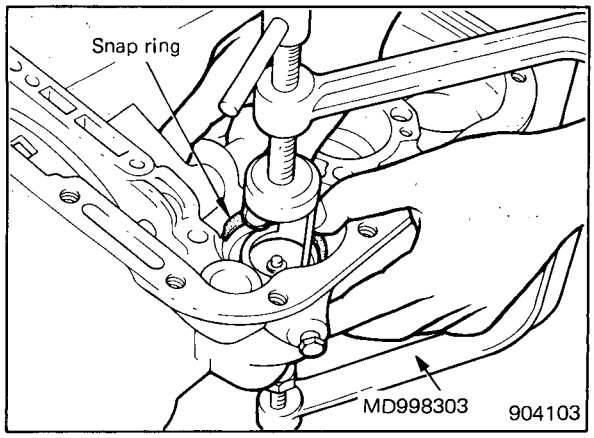
9. Install new O-ring to kickdown servo piston rod.



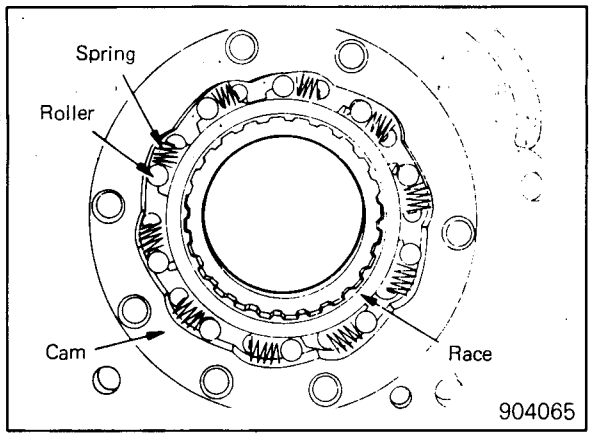
10. Install new seal ring to kickdown guide.



11. Carefully push kickdown servo piston into case bore.
12. Install piston rod, spring and guide.
13. Compress kickdown servo springs by using Special Tool, then install snap ring. (904103)

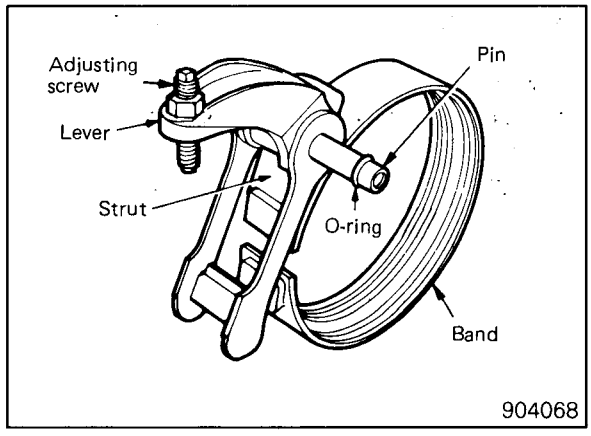


14. With transmission case in an upright position, insert overrunning clutch race inside the cam.
15. Install overrunning clutch rollers and springs exactly as shown in illustration. (904065)

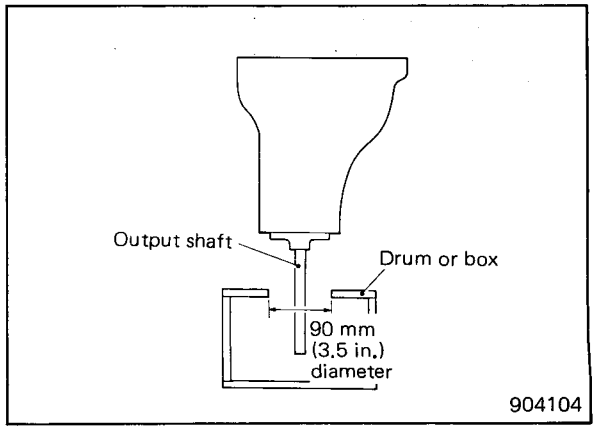


16. Position low-reverse band in the case, install short strut, then connect long link to band. Screw in band adjusting screw just enough to hold strut in place. (904068)
17. Install low-reverse drum. Be sure long link assembly is installed to provide running clearance for the low and reverse drum.
18. While supporting assembly in the case, insert output shaft through rear support. Carefully work assembly rearward, engaging rear planetary carrier lugs into low-reverse drum slots.

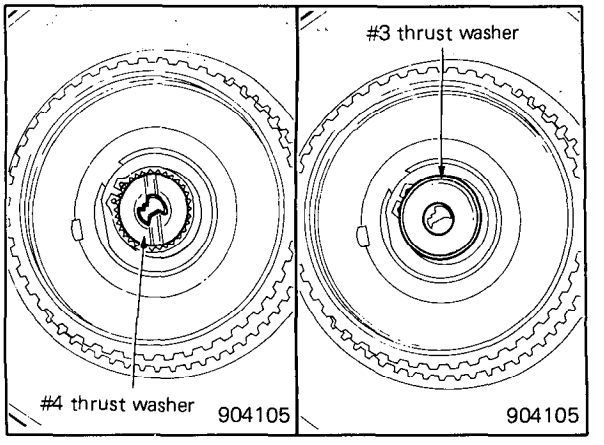
Caution
Be very careful not to damage ground surfaces on output shaft during installation.



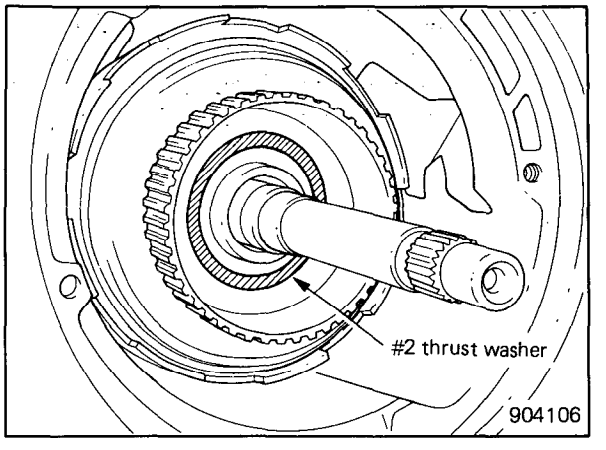
19. Front and rear clutches, kickdown band and oil pump assembly are more easily installed with transmission in an upright position.
    One method to support transmission is outlined as follows:
(1) Cut a 90 mm (3.5 in.) diameter hole in a bench, in the end of a small oil drum or a large wooden box strong enough to support transmission. Cut or file notches at edge of 90 mm (3.5 in.) hole so that output shaft support will fit and lay flat in the hole.
(2) Carefully insert output shaft into hole to support transmission upright, with its weight resting on flange of output shaft support.



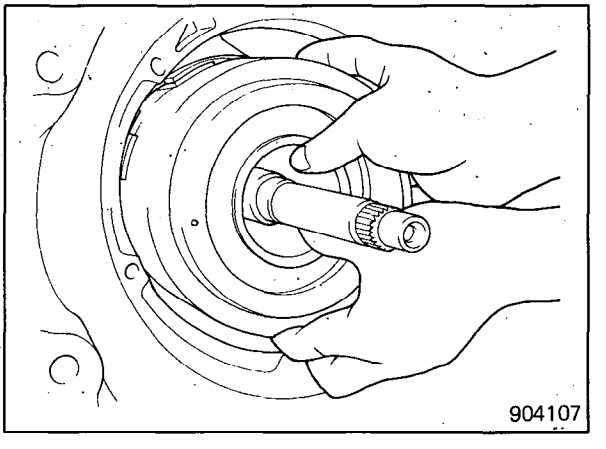
20. Apply a coat of grease to #4 selective thrust washer and install washer on front end of output shaft. If input shaft end play was not within specifications when tested before disassembly, replace thrust washer with one of proper thickness. (904105)
21. Apply a coat of grease to #3 thrust plate and install plate on thrust washer. (904105)



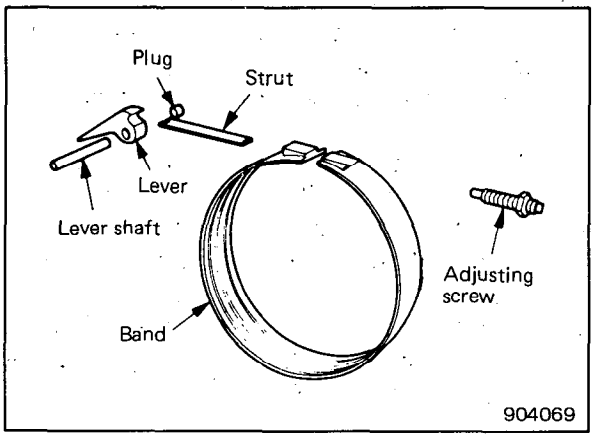
22. Apply a coat of grease to #2 thrust washer and install washer on rear clutch retainer. (904106)
23. Align front clutch disc inner splines, and place front clutch in position on rear clutch. Make sure front clutch disc splines are fully engaged on rear clutch splines.



24. Align rear clutch disc inner splines, grasp input shaft and lower the front and rear clutch assemblies into transmission case. (904107)
25. Engage rear clutch splines over splines of front annulus gear. Make sure front clutch retainer lugs are fully engaged in slots in the driving shell.



26. Slide kickdown band over front clutch assembly.
27. Install band strut, screw in adjusting screw just enough to hold strut in place. (904069)

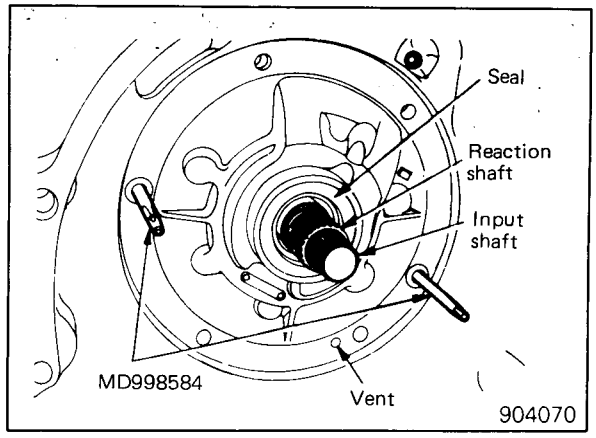


Caution
If difficulty was encountered in removing pump assembly due to an exceptionally tight fit in the case, it may be necessary to expand the case with heat during pump installation. Using a suitable heat light, heat the case in area of pump for a few minutes prior to installing pump assembly.

28. Screw two Special Tools in pump opening in the case. Install a new gasket over the pilot studs. (904070)
29. Place a new rubber seal ring in groove on outer flange of pump housing. Make sure seal ring is not twisted. Coat seal ring with grease for easy installation.
30. Install pump assembly in the case; tap it lightly with a soft mallet, if necessary.
    Make sure #1 thrust washer is installed on reaction shaft support hub.
31. Remove pilot studs, install bolts and snug down evenly. Rotate input and output shafts to see if any binding exists, then tighten bolts to specified torque. Check shafts again for free rotation.

Tightening torque .....
Oil pump tightening bolts 17-23 Nm (20-17ft.lbs.)

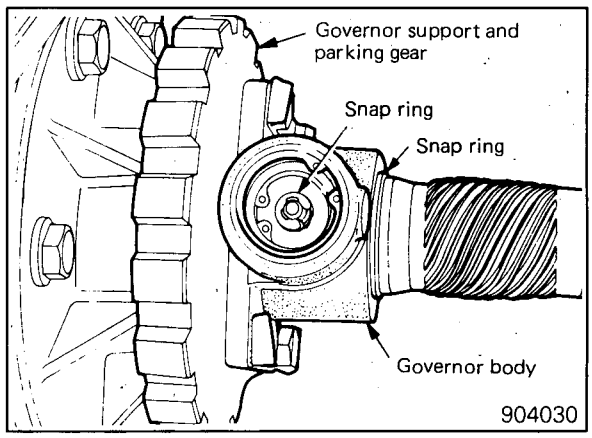
32. Adjust both bands as described in "Maintenance and adjustment".



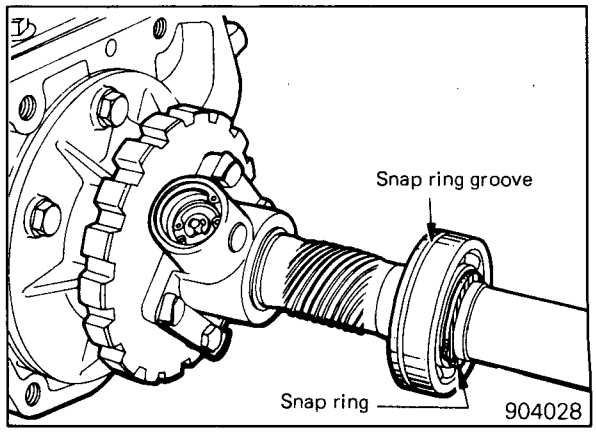
33. Position support and governor body assembly on output shaft. Align assembly so governor valve shaft hole in governor body aligns with hole in output shaft. Install snap ring behind governor body. Tighten body to support bolts to specified torque.

Tightening torque .....
Governor tightening bolt 10-12 Nm (8-9 ft.lbs.)

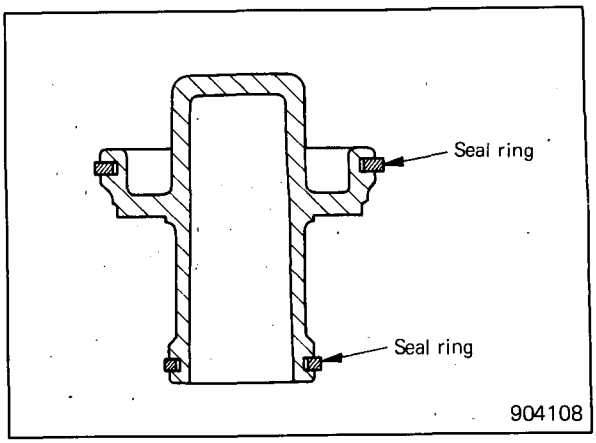
34. Place governor valve on valve shaft, insert assembly into body and through governor weights. Install valve shaft retaining snap ring. (904030)



35. Install bearing on shaft with its outer race ring groove toward front. Press or tap bearing tightly against front shoulder on output shaft, then install rear snap ring.

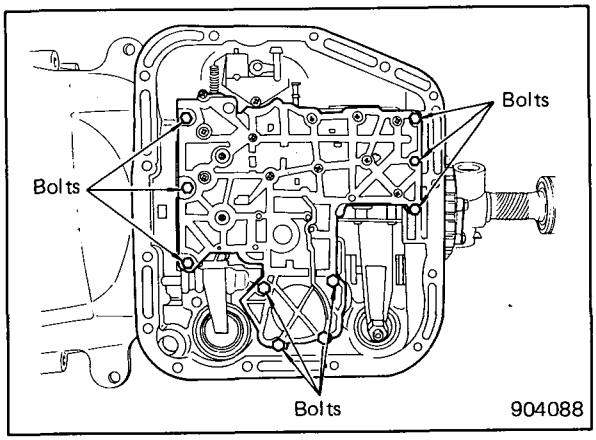


36. Install seal rings to accumulator piston. (904108)
37. Install accumulator piston in transmission case.
38. Position accumulator spring between piston and valve body.



39. Place valve body in position, working parking sprag rod through opening, install ten hex-head valve body to transmission case bolts finger tight. (904088)
40. Snug bolts down evenly, then tighten to specified torque.

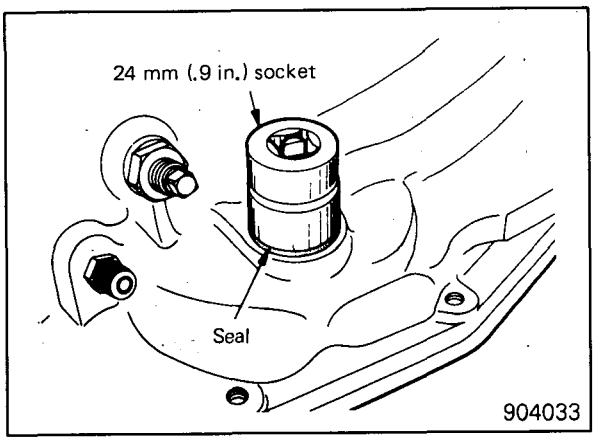
Tightening torque ..... 10-13 Nm (7-9 ft.lbs.)



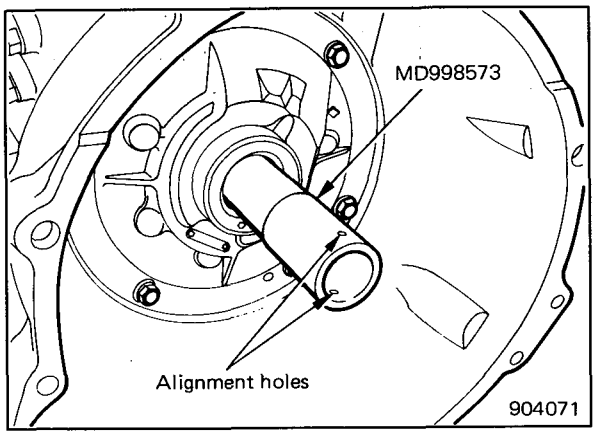
41. Drive a new seal into the case with a 24 mm (.9 in.) socket and hammer. (904033)

NOTE
This seal can be replaced without removing valve body from transmission by using a small screwdriver to pry seal out of its bore. Be careful not to scratch manual lever shaft or the seal bore in transmission.

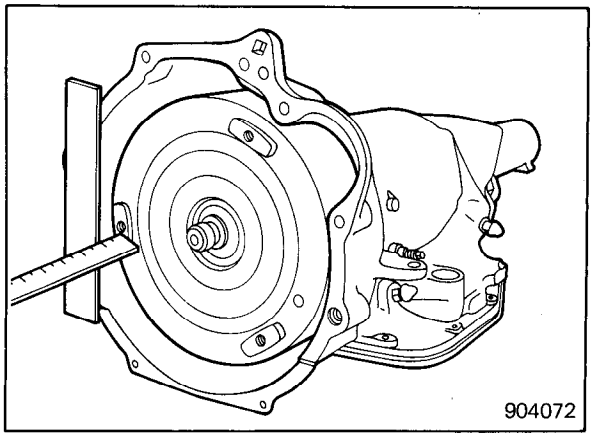
42. Install gearshift lever and tighten clamp bolt. Check lever shaft for binding in the case by moving lever through all detent positions. If binding exists, loosen valve body bolts and realign.
43. Install throttle lever and tighten clamp bolt.
44. Install oil pan and a new gasket.



45. Insert Special Tool into oil pump rotor and turn tool until two small holes of handle are vertical. Remove tool, while using care not to turn tool. By so doing, projection of pump inner rotor can be set in vertical position.

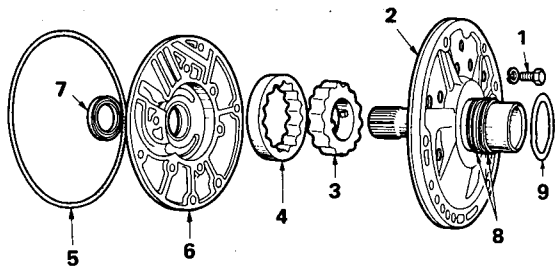


46. Apply thin coat of vaseline to outside periphery of converter. Turn converter hub until slots are vertical, carefully install converter assembly onto input shaft and reaction shaft until it securely fits projection of pump inner rotor.
    To confirm that they are in complete engagement, measure distance from transmission case bell housing front surface to ends of three drive plate attaching bosses of torque converter. Distance should be at least 15 mm (.6 in.) when torque converter is pushed all the way into transmission.



COMPONENTS

1. Bolt (6)
2. Reaction shaft support
3. Inner rotor
4. Outer rotor
5. Oil pump housing seal
6. Oil pump housing
7. Oil seal
8. Reaction shaft support seal ring (2)
9. Front clutch thrust washer (#1)



NOTE
Numbers show order of disassembly.
For reassembly, reverse order of disassembly.

904047

DISASSEMBLY

Thrust washer #1 cannot be removed unless two seal rings of reaction shaft support are removed.

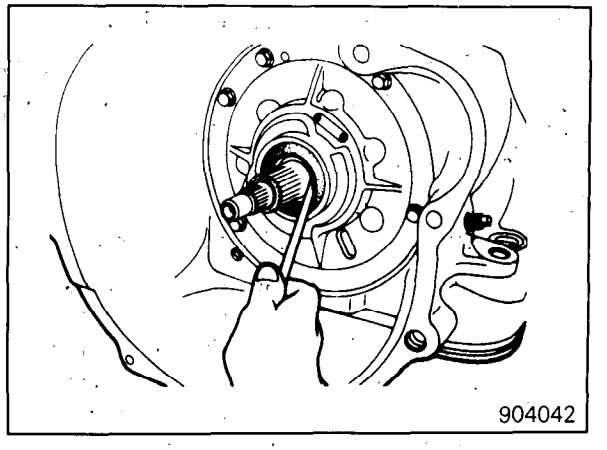
INSPECTION

1. Check seal ring of reaction shaft support for wear and damage. Check to ensure that it turns freely in groove.
2. Check thrust washer #1 (inserted between reaction shaft support and front clutch retainer) for wear and replace if necessary.
3. Check finished surfaces of oil pump housing and reaction shaft support for damage and burr. Check bushing for wear and damage.
4. Check pump rotor for scratches and pitching. Clean pump rotor, reinstall to pump housing, and measure all clearances with thickness gauge. Hold straight edge to rotor end and pump housing surface to measure clearance between rotor end and straight edge (side clearance). Measure rotor tip clearance between inside and outside teeth of rotor. Measure clearance between bore (I.D.) of oil pump housing and outer rotor O.D. (body clearance).

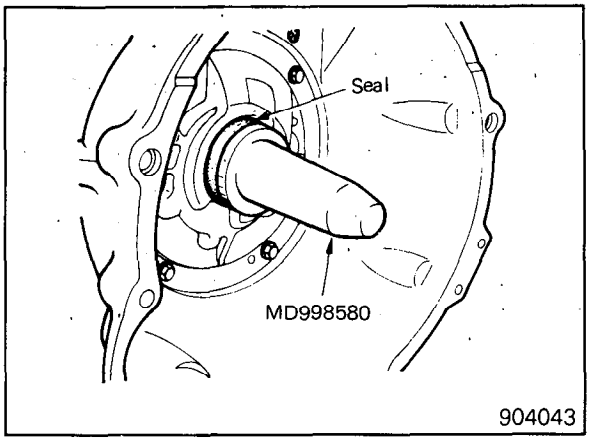
OIL PUMP SEAL REPLACEMENT

Oil pump seal can be replaced without removing oil pump housing assembly from transmission case.

1. Use screwdriver as lever to remove oil seal.

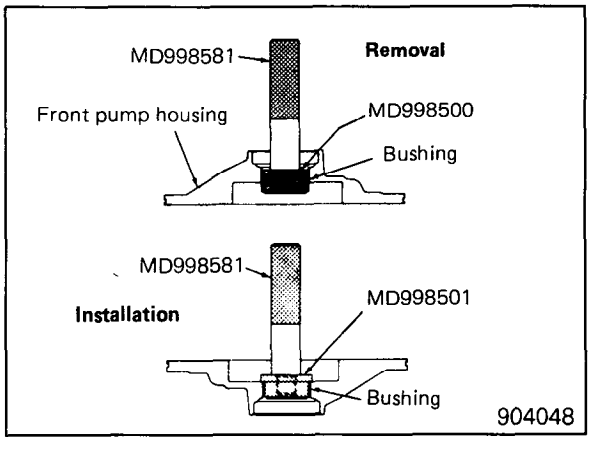


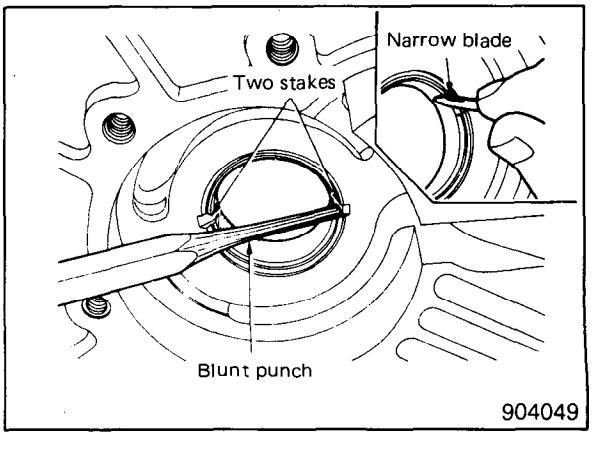
2. To install a new seal, place seal in opening of pump housing (lip side facing inward). Using Special Tool, drive seal into housing until tool bottoms.



PUMP HOUSING BUSHING REPLACEMENT

1. Place pump housing (seal face down) on a smooth firm surface.
2. Place Special Tool in bushing and install Special Tool in the removing head. (904048)
3. Drive bushing straight down and out of pump housing bore. Be careful not to cock tool in the bore.
4. Position new bushing on Special Tool. (904048)
5. With pump housing on a smooth clean surface, start bushing and installer in bushing bore. Install Handle (MD998581), in installer.
6. Drive bushing into housing until tool bottoms in the pump rotor housing. Be careful not to cock tool during installation.
7. Stake bushing in place by using a blunt punch or similar tool. A gentle tap at each stake slot location will suffice. (904049)
8. Using a narrow-bladed knife or similar tool, remove high points or burrs around staked area. Do not use a file or similar tool that will remove more metal than is necessary.





REACTION SHAFT BUSHING REPLACEMENT

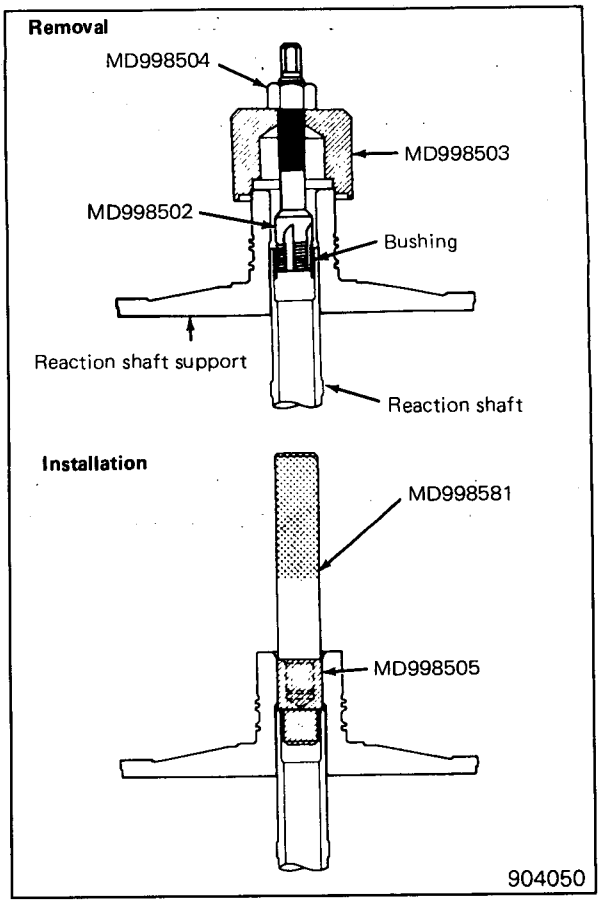
In case of a reaction shaft bushing failure, always inspect the support for wear from input shaft seal ring lands. If worn or grooved, replace reaction shaft support assembly.

1. Assemble Special Tools.

Caution

Do not clamp any part of reaction shaft or support in a vise.

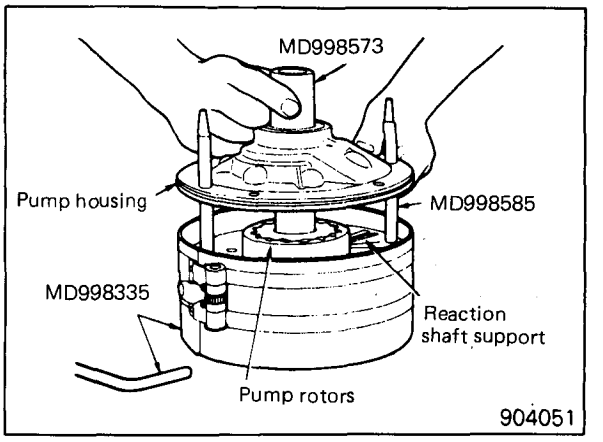
2. With cup held firmly against reaction shaft, screw bushing remover into bushing as far as possible by hand.
3. Using a wrench, screw bushing remover into bushing 3 to 4 additional turns to firmly engage threads in bushing.
4. Turn hex nut down against cup to pull bushing from reaction shaft. Thoroughly clean reaction shaft to remove chips made by remover threads.
5. Lightly grip bushing in a vise or with pliers and back tool (remover) out of bushing. Be careful not to damage threads on bushing remover.
6. Slide a new bushing on Special Tool and start them in the bore of reaction shaft. (904050)
7. Support reaction shaft upright on a clean smooth surface and install Special Tool in installing head. Drive bushing into shaft until tool bottoms.
8. Thoroughly clean reaction shaft support assembly before installation.



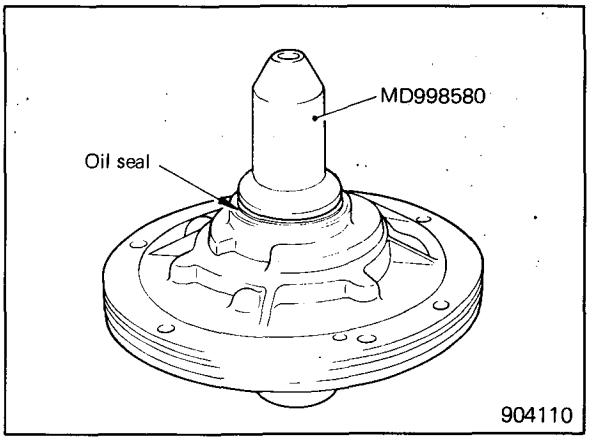
REASSEMBLY

1. Place reaction shaft support in Special Tool with hub of support and tool resting on a smooth flat surface bench. Screw two Special Tools into threaded holes of reaction shaft support flange. (904051)
2. Assemble and place rotors in center of the support.
3. Lower pump body over pilot studs, insert Special Tool through pump body and engage pump inner rotor. Rotate rotors with tool to center rotors in pump body, then with pump body firm against reaction shaft support, tighten clamping tool securely. (904051)
4. Invert pump housing and reaction shaft support assembly with oil pump band intact. Install support to pump housing bolts and tighten to specified torque. Remove oil pump band, pilot studs B and rotor alignment tool.

Tightening torque	16-21 Nm (12-15 ft.lbs.)

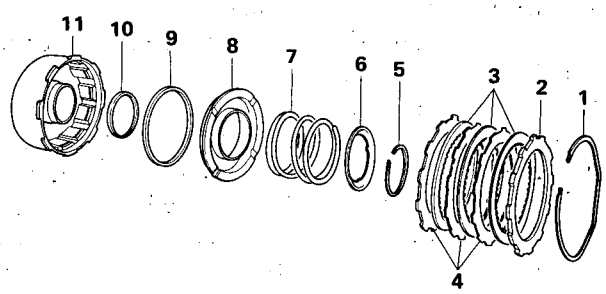


5. Place a new oil seal in opening of pump housing (lip of seal facing inward). Using Special Tool, drive seal into housing until tool bottoms. (904110)



COMPONENTS

1. Wave snap ring
2. Pressure plate
3. Clutch disc (3)
4. Clutch plate (3)
5. Snap ring
6. Piston spring retainer
7. Piston spring
8. Front clutch piston
9. Seal (outer)
10. Seal (inner)
11. Front clutch retainer

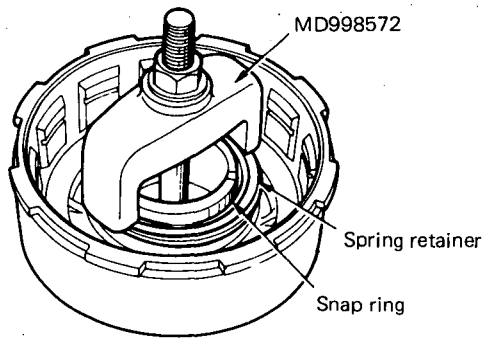


NOTE
Numbers show order of disassembly.
For reassembly, reverse order of disassembly.

904134

DISASSEMBLY

1. Install Special Tool over piston spring retainer. Compress spring and remove snap ring, then slowly release tool until spring retainer is free of hub. Remove tool, retainer and spring. (904053)
2. Invert clutch retainer assembly and bump it on a wood block to remove piston. Remove seals from piston and clutch retainer hub.



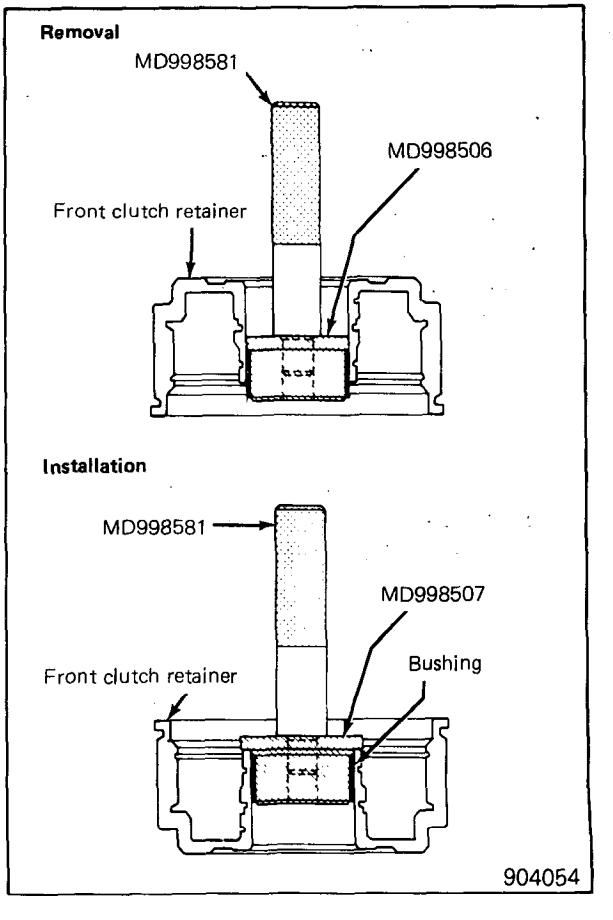
904053

INSPECTION

1. Inspect plates and discs for flatness. They must not be warped or cone shaped.
   Inspect facing material on all clutch discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they shown evidence of mateiral flaking off or if facing material can be scraped off easily. Inspect clutch disc splines for wear or other damage. Inspect clutch plate and pressure plate surfaces for burning, scoring or damaged driving lugs.
2. Inspect clutch plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in grooves. Inspect band contacting surface on clutch retainer for scores, the contact surface should be protected from damage during disassembly and handling. Note ball check in clutch retainer, make sure ball moves freely. Inspect piston seal surfaces in clutch retainer for nicks or deep scratches, light scratches will not interfere with sealing of seal rings. Inspect clutch retainer inner bore surface for wear from reaction shaft support seal rings. Inspect clutch retainer bushing for wear or scores.
   Inspect inside bore of piston for score marks; if light, remove with crocus cloth. Inspect seal grooves for nicks and burrs. Inspect seal rings for deterioration, wear and hardness. Inspect piston spring, retainer and snap ring for distortion.

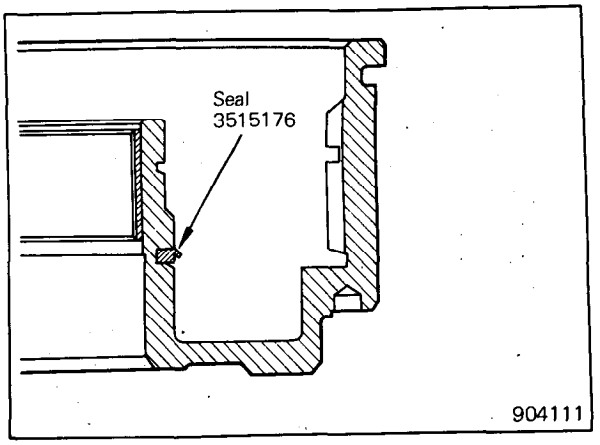
FRONT CLUTCH RETAINER BUSHING REPLACEMENT

1. Lay clutch retainer (open end down) on a clean smooth surface and place Special Tool in bushing. Install Special Tool in removing head. (904054)
2. Drive bushing straight down and out of clutch retainer bore. Be careful not to cock tool in the bore.
3. Lay clutch retainer (open end up) on a clean smooth surface. Slide a new bushing on Special Tool and start them in clutch retainer bore. (904054)
4. Install handle in installing head. Drive bushing into clutch retainer until tool bottoms.
5. Thoroughly clean clutch retainer before assembly and installation.

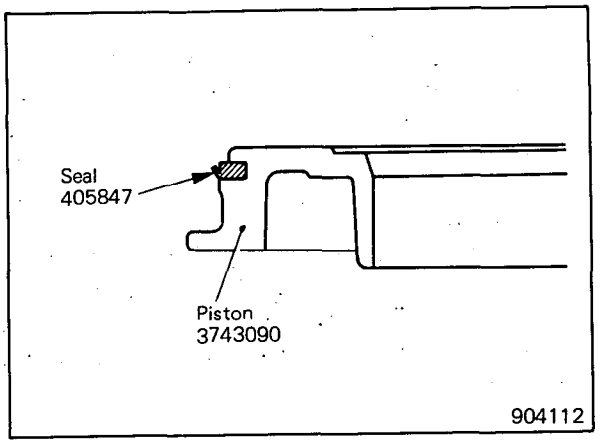


REASSEMBLY

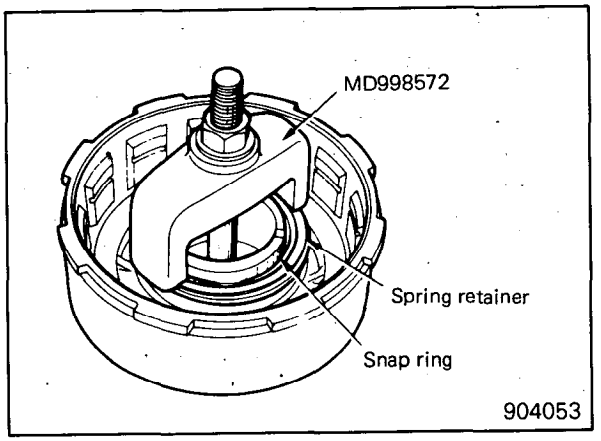
1. Lubricate inner seal with ATF and install on hub of clutch retainer. Make sure lip of seal faces down and is properly seated in groove.



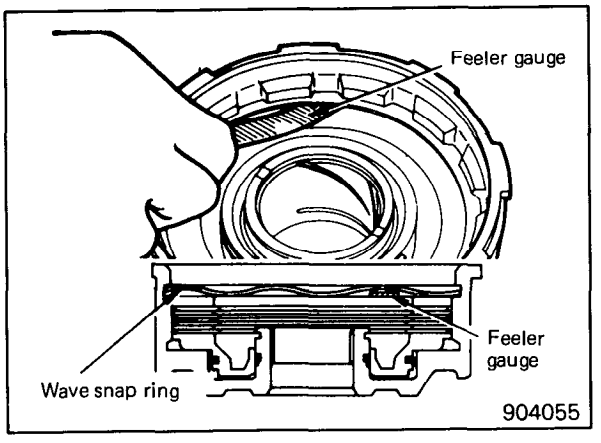
2. Install outer seal on clutch piston, with lip of seal toward bottom of clutch retainer. Apply vaseline to outer edge of seals and press seal to bottom of its groove around piston diameter for easier installation of piston assembly. Place piston assembly in retainer and carefully seat piston in bottom of retainer.



3. Place spring on piston hub and position spring retainer and snap ring on spring. Compress spring with Special Tool and seat snap ring in hub groove. Remove compressor tool. (904053)
4. Immerse all clutch plates and discs in ATF and install two clutch plates (made of steel) and clutch discs (with facing) each alternately in retainer. Install pressure plate and snap ring.
   Check to ensure that snap ring is correctly positioned in groove.

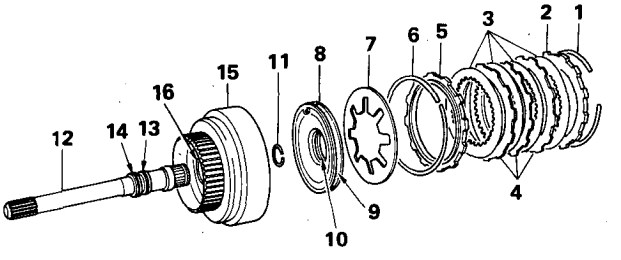


5. Insert a feeler gauge between pressure plate and wave snap ring to measure maximum clearance where snap ring is waved away from pressure plate.



COMPONENTS

1. Snap ring (selective)
2. Pressure plate
3. Clutch disc (4)
4. Clutch plate (3)
5. Pressure plate
6. Wave snap ring
7. Piston spring
8. Rear clutch piston
9. Seal (outer)
10. Seal (inner)
11. Input shaft snap ring
12. Input shaft
13. Seal ring
14. Seal ring
15. Rear clutch retainer
16. Seal ring

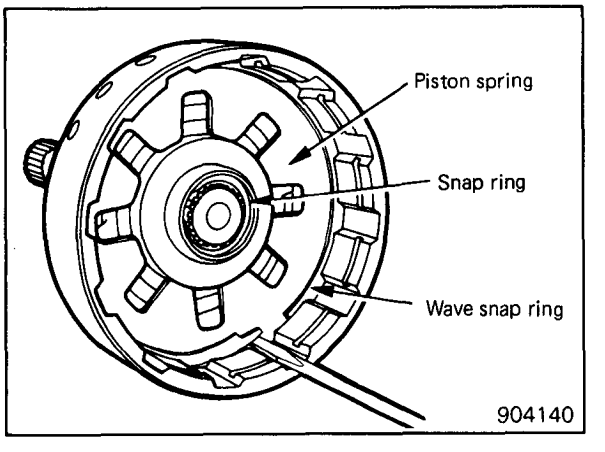


NOTE
Numbers show order of disassembly.
For reassembly, reverse order of disassembly.

904060

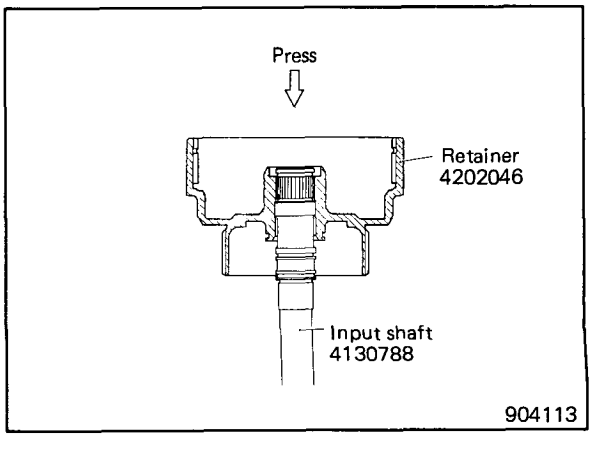
Disassembly

1. Carefully pry one end of wave snap ring out of its groove in clutch retainer, then remove wave spring and clutch piston spring. (904140)
2. Invert clutch retainer assembly and bump it on a wood block to remove piston. Remove seals from piston.



904140

3. If necessary, remove snap ring and press input shaft from clutch retainer.



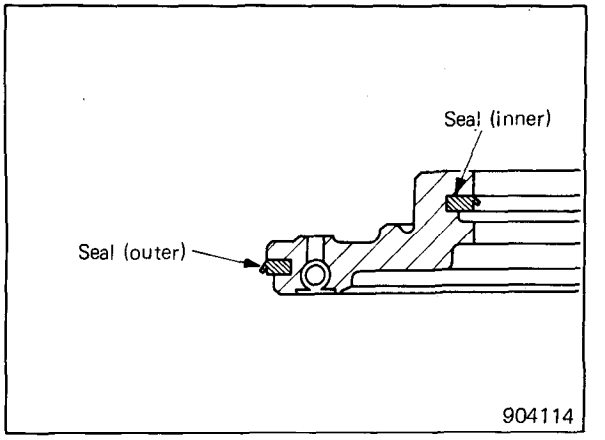
904113

INSPECTION

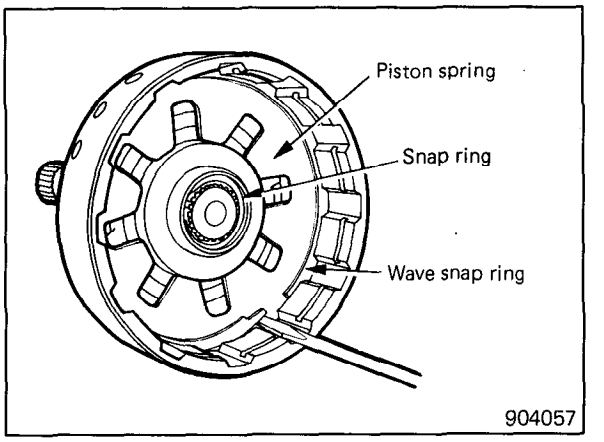
1. Inspect plates and discs for flatness. They must not be warped or cone shaped. Inspect facing material on all clutch discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect clutch disc splines for wear or other damage. Inspect clutch plate and pressure plate surface for burning, scoring or damaged driving lugs. Replace if necessary.
2. Inspect clutch plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in grooves. Inspect piston seal surfaces in clutch retainer for nicks or deep scratches. Light scratches will not interfere with sealing of seal rings.
3. Check to ensure that check ball of piston can move freely.
4. Inspect piston spring and wave spring for distortion or breakage.
5. Inspect teflon seal rings on input shaft for wear. Do not remove rings unless conditions warrant.
6. Inspect rear clutch to front clutch thrust washer for wear.

REASSEMBLY

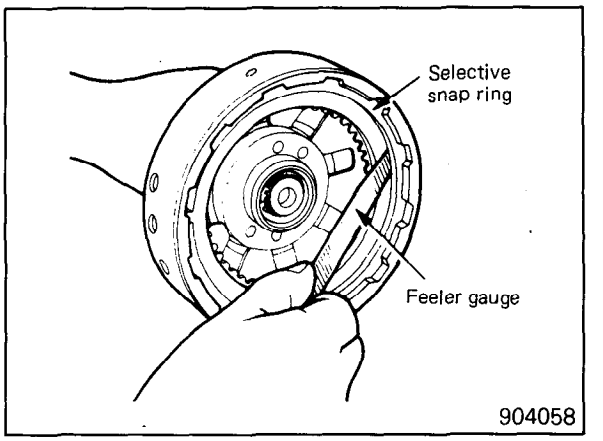
1. If removed, press input shaft into clutch retainer and install snap ring.
2. Install inner and outer seals on clutch piston and lubricate with ATF. Make sure lip of seals face toward head of clutch retainer, and are properly seated in piston grooves. (904114)
3. Place piston assembly in retainer and with a twisting motion, seat piston in bottom of retainer.



4. Place clutch piston spring on top of piston in clutch retainer. Start one end of wave spring in retainer groove, then progressively push or tap spring into place making sure it is fully seated in groove. (904057)
5. Install inner pressure plate in clutch retainer with raised portion of plate resting on spring.
6. Lubricate all clutch plates and discs with ATF, install one clutch disc (facing material) followed by a steel clutch plate until all plates are installed. Install outer pressure plate and selective snap ring.



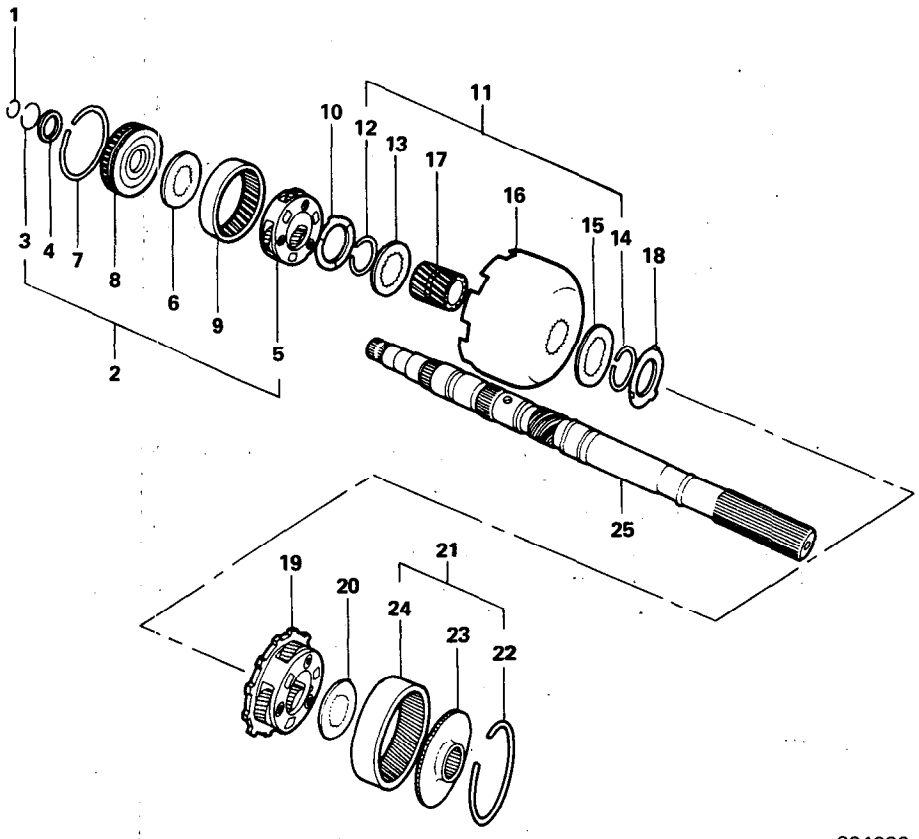
7. Measure rear clutch plate clearance by having an assistant press down firmly on outer pressure plate, then insert a feeler gauge between plate and snap ring.
   If necessary, install a new snap ring of proper thickness to obtain specified clearance. Low limit clearance is desirable. Rear clutch plate clearance is very important in obtaining proper clutch operation. Clearance can be adjusted by use of various thickness snap rings.



COMPONENTS

1. Snap ring (selective)
2. Front planetary gear assembly
3. Snap ring
4. Thrust washer (#5)
5. Front planetary gear
6. Thrust washer (#6)
7. Snap ring
8. Front annulus gear support
9. Annulus gear
10. Thrust washer (#7)
11. Sun gear and driving shell assembly
12. Lock ring
13. Thrust plate (#8)
14. Lock ring
15. Thrust plate (#9)
16. Sun gear driving shell
17. Sun gear
18. Thrust washer (#10)
19. Rear planetary gear
20. Thrust washer (#11)
21. Rear annulus gear assembly
22. Snap ring
23. Annulus gear support
24. Annulus gear
25. Output shaft

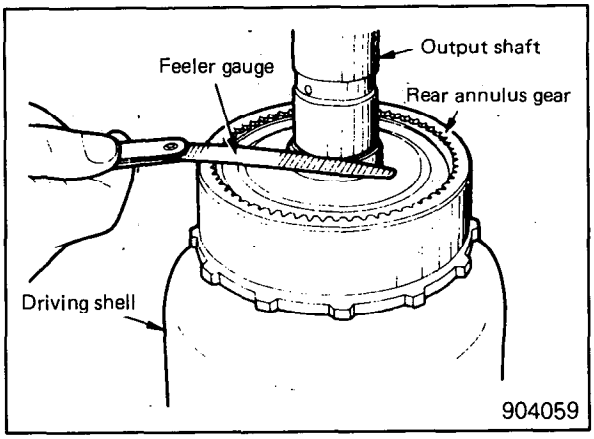
NOTE
Numbers show order of disassembly.
For reassembly, reverse order of disassembly.



904060

DISASSEMBLY

Measure end play of planetary gear assemblies, sun gear and driving shell before removing these parts from output shaft. Stand assembly upright with forward end of output shaft on a wood block so that all parts will move forward against selective snap ring at front of shaft. Insert a feeler gauge between rear annulus gear support hub and shoulder on output shaft. The clearance should satisfy specifications. If clearance exceeds specifications, replace thrust washers and/or necessary parts.



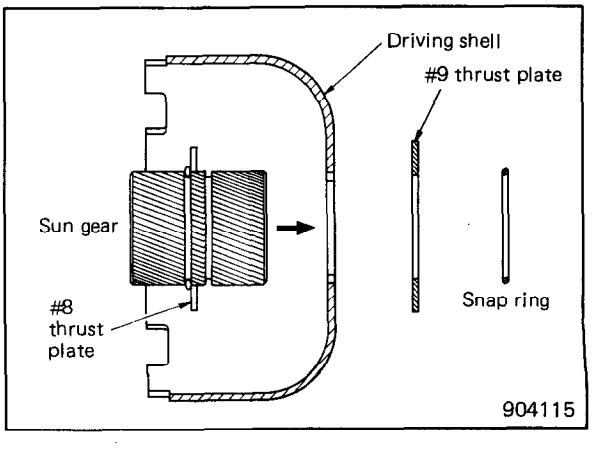
904059

INSPECTION

1. Inspect bearing surfaces on output shaft for nicks, burrs, scores or other damage. Light scratches, small nicks or burrs can be removed with crocus cloth or a fine stone. Inspect speedometer drive gear for any nicks or burrs, and remove with a sharp edged stone. Make sure all oil passages in shaft are open and clean.
2. Inspect bushings in sun gear for wear or scores. Replace sun gear assembly if bushings are damaged.
3. Inspect all thrust washers for wear and scores, and replace if damaged or worn below specifications.
4. Inspect thrust faces of planetary gear carriers for wear, scores or other damage, and replace as required. Inspect planetary gear carrier for cracks and pinions for broken or worn gear teeth, and for broken pinion shaft lock pins. Inspect annulus gear and support teeth for damage. Replace distorted snap rings.

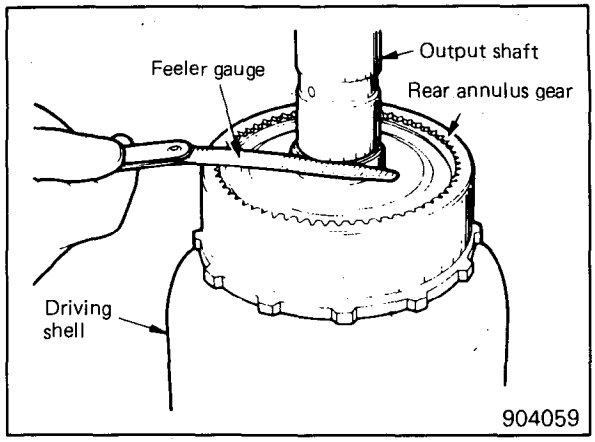
REASSEMBLY

1. Place rear annulus gear support in annulus gear and install snap ring.
2. Position rear planetary gear assembly in rear annulus gear and place #10 and #11 thrust washers on front and rear sides of planetary gear assembly.
3. Carefully work output shaft through annulus gear support. Make sure shaft splines are fully engaged in splines of annulus gear support.
4. Install thrust plate and snap ring on one end of sun gear. Insert sun gear through front side of driving shell and install rear thrust plate and snap ring. (904115)
5. Carefully slide driving shell and sun gear assembly on output shaft, engaging sun gear teeth with rear planetary pinion teeth.
6. Place front annulus gear support in annulus gear and install snap ring.



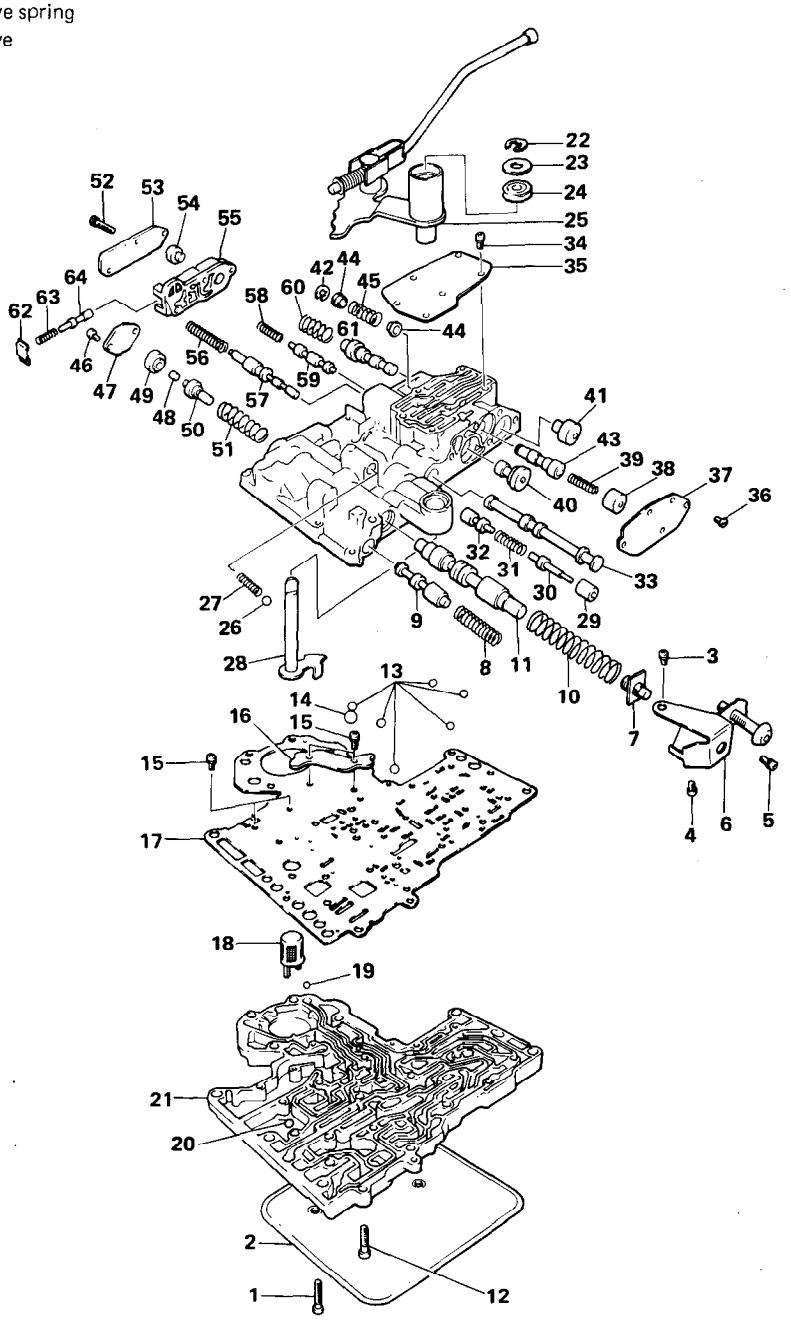
7. Position front planetary gear assembly in front annulus gear, place #5 thrust washer over planetary gear assembly hub and install snap ring. Position #6 and #7 thrust washers on front and rear sides of planetary gear assembly.
8. Carefully work front planetary and annulus gear assembly on output shaft, meshing planetary pinions with sun gear teeth.

9. With all components properly positioned, install selective snap ring on front end of output shaft. Check end play of planetary gear train. End play can be adjusted by the use of various thickness snap rings.



COMPONENTS

1. Screw (3)
2. Fluid filter
3. Screw
4. Screw
5. Screw
6. Adjusting screw bracket
7. Line pressure adjusting screw
8. Switch valve spring
9. Switch valve
10. Regulator valve spring
11. Regulator valve
12. Screw (13)
13. Check ball-small (6)
14. Check ball-large (1)
15. Screw (4)
16. Transfer plate support
17. Valve body plate
18. Screen
19. Steel ball
20. Steel ball
21. Transfer plate
22. Snap ring
23. Washer
24. Seal
25. Manual valve lever
26. Detent ball
27. Detent spring
28. Throttle valve lever
29. Kickdown detent
30. Kickdown valve
31. Throttle valve spring
32. Throttle valve
33. Manual valve
34. Screw (6)
35. Shuttle valve cover
36. Screw (5)
37. Shift valve plug cover
38. Shuttle valve plug
39. Primary spring
40. 1-2 shift valve plug
41. 2-3 shift valve plug
42. Snap ring
43. Shuttle valve
44. Sleeve (2)
45. Secondary spring
46. Screw (2)
47. Regulator valve cover
48. Line pressure plug
49. Sleeve
50. Throttle pressure plug
51. Spring
52. Screw (3)
53. Shift valve cover
54. Throttle plug
55. Limit valve body
56. 1-2 shift control valve spring
57. 1-2 shift control valve
58. 1-2 shift valve spring
59. 1-2 shift valve spring
60. 2-3 shift valve spring
61. 2-3 shift valve
62. Retainer
63. Limit valve spring
64. Limit valve



NOTE
Numbers show order of disassembly.
For reassembly, reverse order of disassembly.

904116

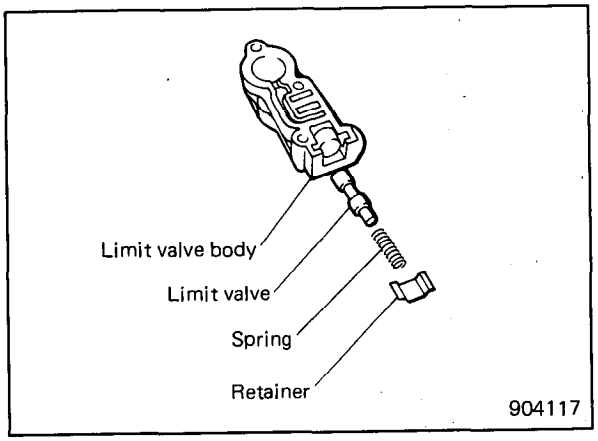
DISASSEMBLY

Caution
Never clamp any portion of valve body or transfer plate in a vise. Any slight distortion of valve body or transfer plate will result in sticking valves, excessive leakage or both.
When removing or installing valves or plugs, slide them in or out carefully. Do not use force.
Tag all springs and valves as they are removed for reassembly identification.

REASSEMBLY

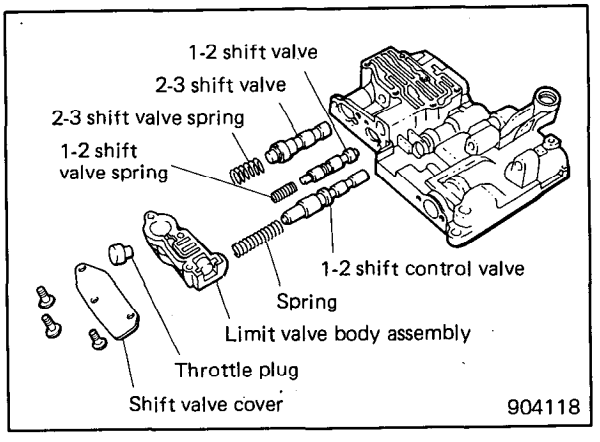
Caution
Tighten all valve body screws to 2.9 to 4.9 Nm (2.2 to 3.6 ft.lbs.). Using torque set driver, etc., torque all screws evenly.

1. Insert limit valve and spring into limit valve body. (904117)
2. Fit spring retainer in groove of limit valve body. (904117)
3. Put throttle plug in limit valve body.

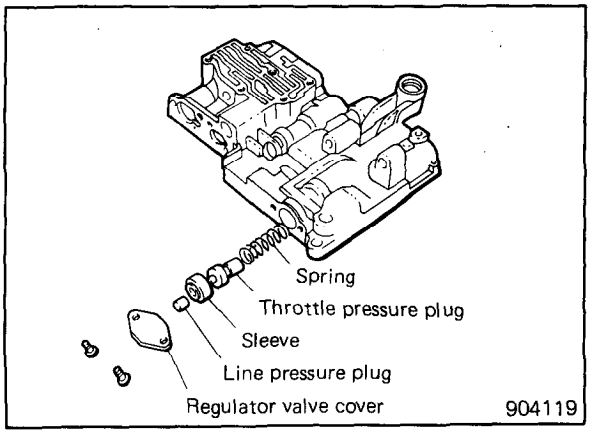


4. Insert 1-2 and 2-3 shift valves and springs into hole of valve body. (904118)
5. Set limit valve body assembly against shift valve spring.
6. Mount shift valve cover to valve body. Tighten screw to specified torque.

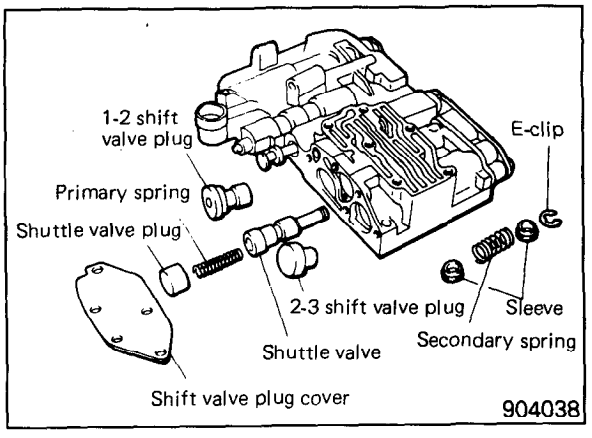
Tightening torque	
Cover screw	2.9-4.9 Nm (2.2-3.6 ft.lbs.)



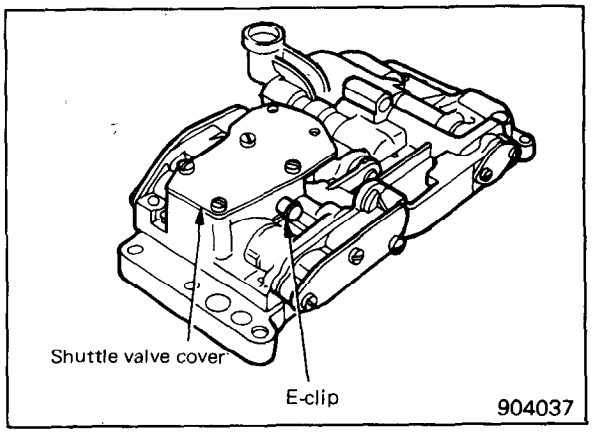
7. Install springs, throttle pressure plug, line pressure plug and sleeve and secure regulator valve cover to valve body.



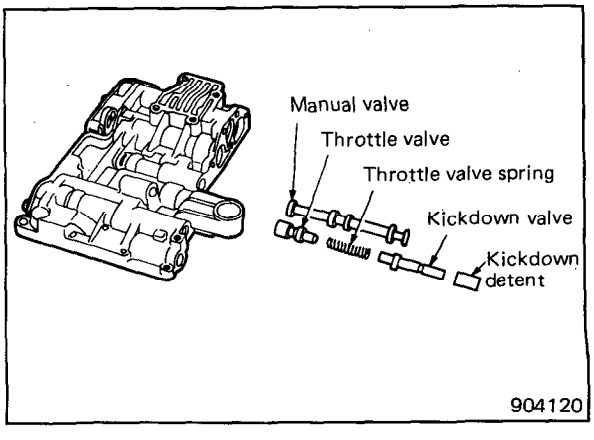
8. Place 1-2 and 2-3 shift valve plugs in their respective bores. (904038)
9. Install shuttle valve, primary spring and shuttle valve throttle plug. (904038)
10. Install sleeve and secondary spring to shuttle valve end and secure with E-clip. (904038)
11. Install shift valve plug cover and tighten five screws.



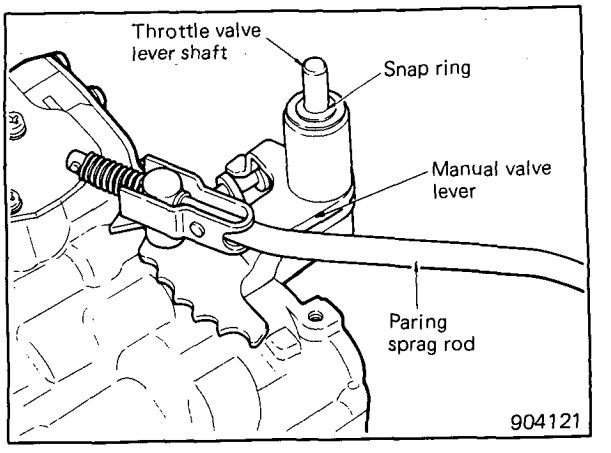
12. Install shuttle valve cover and tighten six screws.



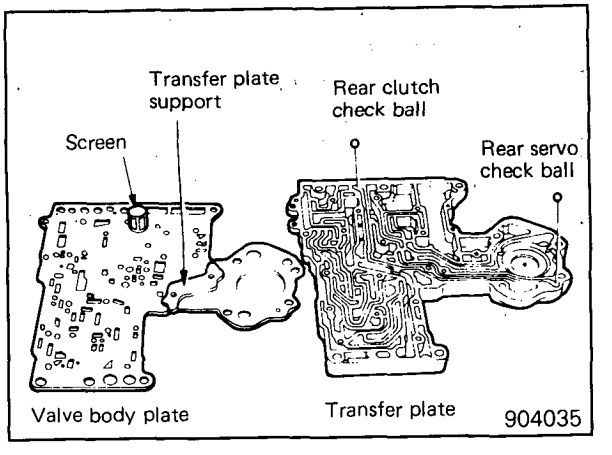
13. Install throttle valve, throttle valve spring, kickdown valve and kickdown detent plug. (904120)
14. Slide manual valve into its bore.



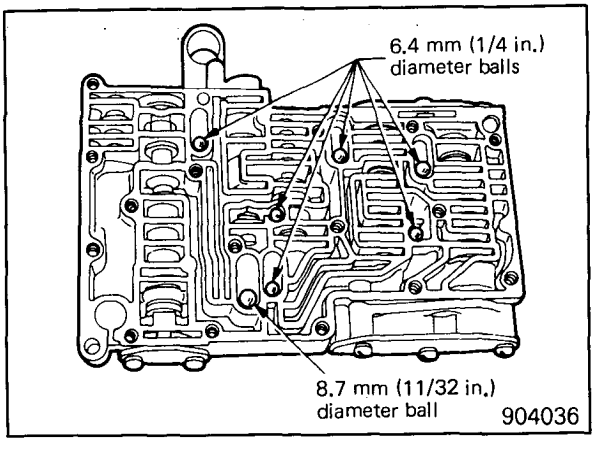
15. Install throttle lever on valve body. Insert detent spring and ball in its bore in valve body. Depress ball and spring and slide manual lever over throttle shaft so that it engages manual valve and detent ball. Install seal, retaining washer and E-clip on throttle shaft.



16. Install rear clutch check ball and rear servo check ball to transfer plate and install regulator valve screen to valve body plate. (904035)
17. Install transfer plate support and valve body plate to transfer plate with four screws. (904035)

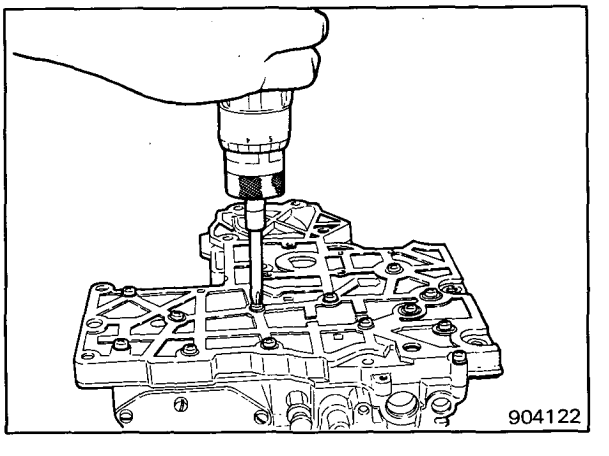


18. Install the seven check balls in valve body.

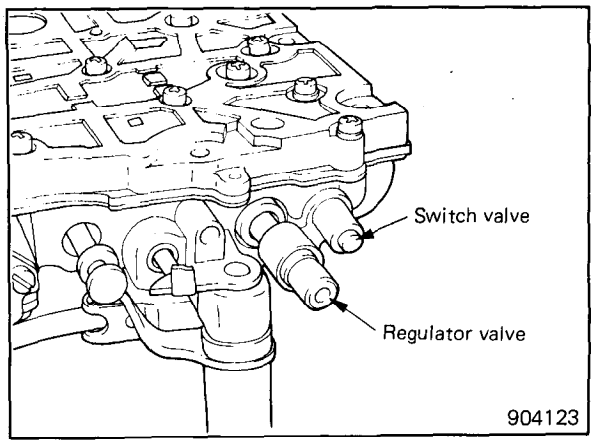


19. Place transfer plate assembly on valve body and temporarily tighten 13 screws. (904122)
20. Torque screws to specified torque in correct sequence, working from center screw to outward ones.

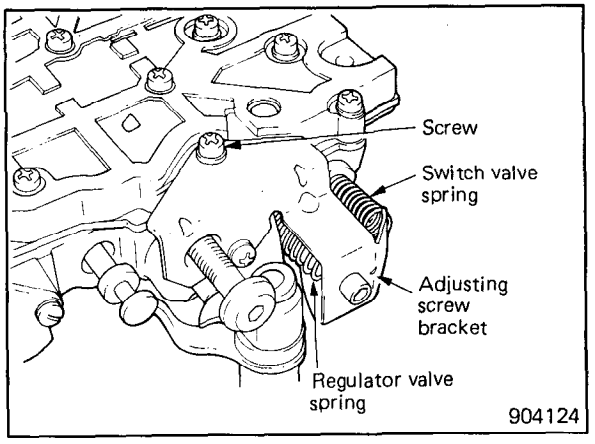
Tightening torque	
Valve body screw	2.9-4.9 Nm (2.2-3.6 ft.lbs.)



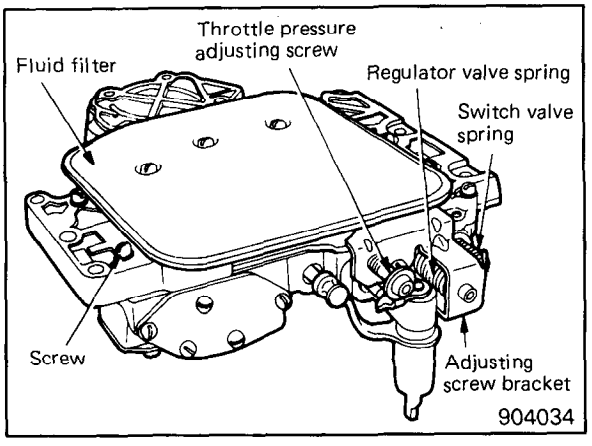
21. Put switch valve, regulator valve and spring in respective bores.



22. Set adjustment screw bracket on spring and temporarily tighten one screw (one for mounting to side of valve body). After top and bottom screws have been tightened, tighten side screw.

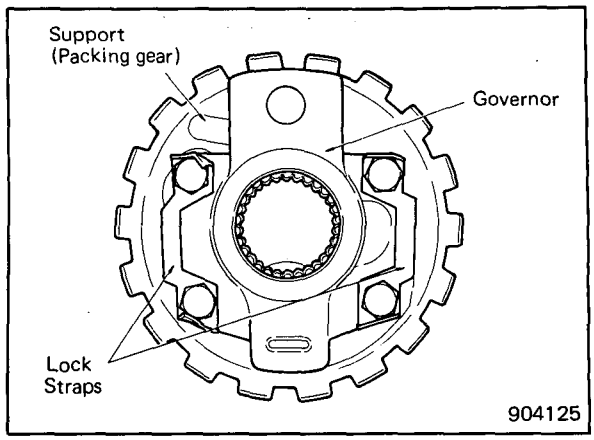


23. Install oil filter and tighten.
24. After valve body has been serviced and completely assembled, measure throttle and line pressure adjustments. However, if pressures were satisfactory prior to disassembly, use original settings. (904034)

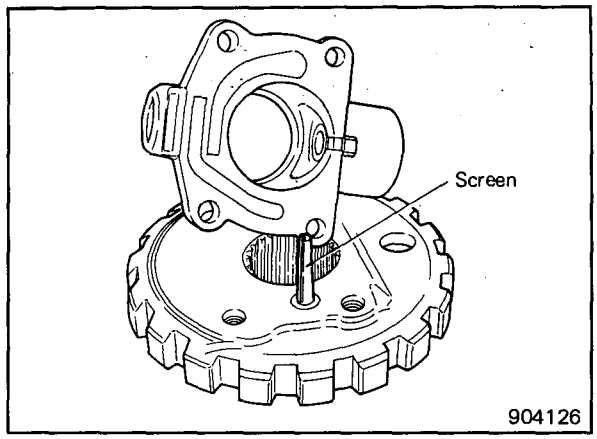


DISASSEMBLY

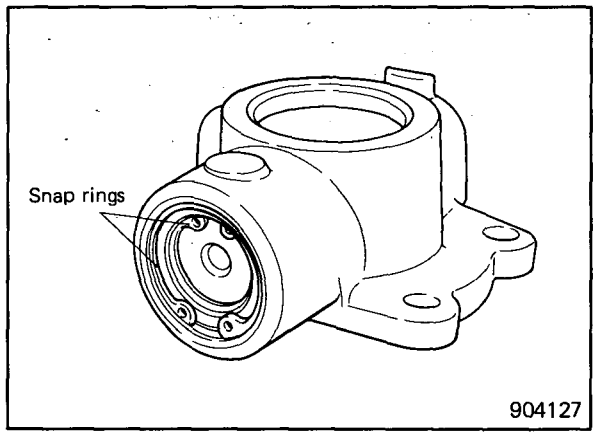
1. Remove four bolts and separate governor and support (parking gear).



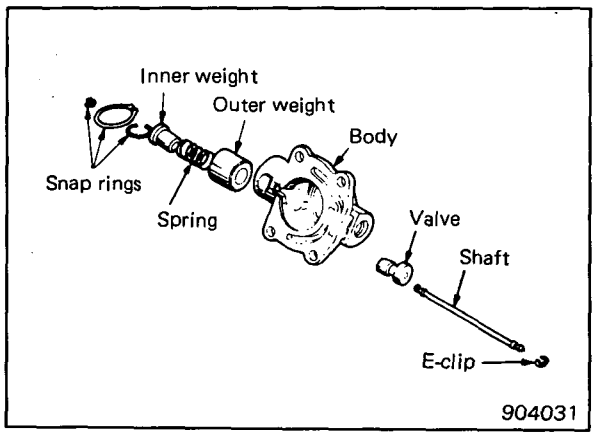
2. Take out governor screen from governor body.



3. Remove two snap rings.



4. Take out governor weight and spring.



INSPECTION

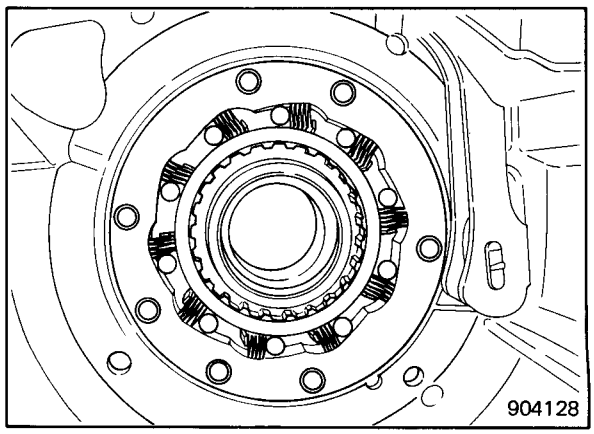
1. Check all parts for burrs and wear.
2. Check inner weight for free movement in outer weight, and outer weight for free movement in governor body.
3. Check valve for free movement in governor body.
4. Weights and valve should fall freely in bores when clean and dry.
5. Rough surfaces may be removed with crocus cloth.
6. Wash governor screen.
7. Check governor weight spring for distortion.
8. Thoroughly clean all governor parts in clean solvent, dry with compressed air and test for free movement before assembly.
9. Check lugs on parking gear for broken edges or other damage.

REASSEMBLY

1. Assemble governor body and filter to the support and tighten bolts finger tight. Make sure oil passage of governor body aligns with passage in the support.
2. Assemble inner weight and spring to outer weight, and secure with snap ring. Place weight assembly in governor body and install snap ring.

INSPECTION

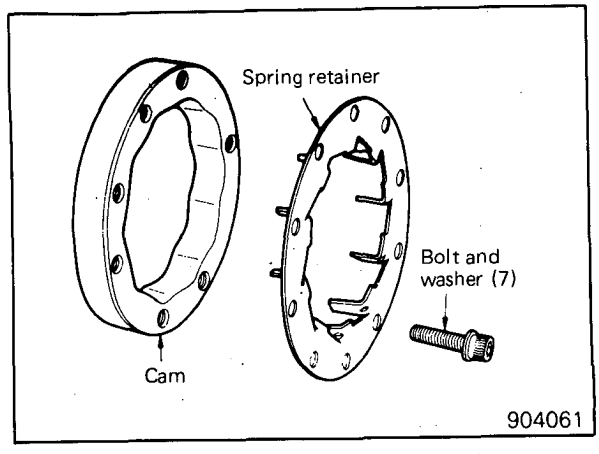
Inspect clutch rollers for smooth round surfaces, they must be free of flat spots and chipped edges. Inspect roller contacting surfaces in cam and race for brinelling.
Inspect roller springs for distortion, wear or other damage.



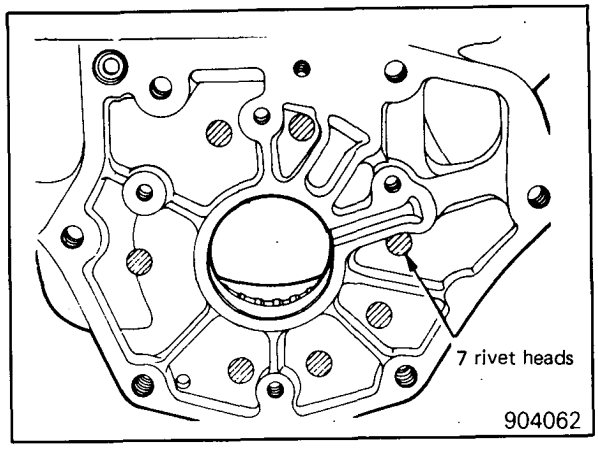
OVERRUNNING CLUTCH CAM REPLACEMENT

If overrunning clutch cam or spring retainer is found damaged, it can be replaced with a service replacement cam, spring retainer and retaining bolts.
The service parts are retained in the case with bolts instead of rivets. To install, proceed as follows:

1. Remove four bolts securing output shaft support to rear of transmission case. Tap support rearward out of the case with a soft faced hammer.

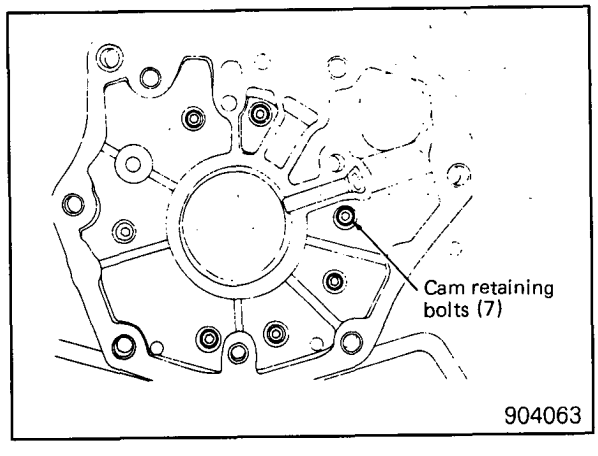


2. Center punch rivets exactly in center of each rivet head. (904062)
3. Drill through each rivet head with a 9.5 mm (.4 in.) drill. Be careful not to drill into transmission case. Chip off rivet heads with a small chisel and drive rivets and cam from the case with a blunt punch of proper size. (904062)
4. Carefully enlarge rivet holes in the case with a 6.7 mm (17/64 in.) drill. Remove all chips and foreign matter from the case, and make sure cam area is free of chips and burrs. (904062)



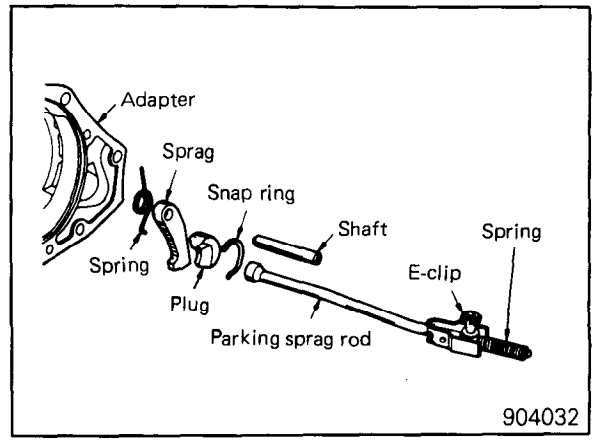
5. To install, position cam and roller spring retainer in the case. Align cam bolt holes with holes in the case, then thread all seven retaining bolts and washer assemblies into cam a few turns. (904063)
6. Tap cam firmly into the case if necessary. Draw retaining bolts down evenly, then tighten to specified torque.

Tightening torque	12 Nm (9ft.lbs.)



DISASSEMBLY

1. Slide shaft out of adapter to remove parking sprag and spring. (904032)
2. Remove snap ring and slide reaction plug assembly out of the housing. (904032)



INSPECTION

1. Check sprag shaft for scores and free movement in adapter and sprag.
2. Check sprag and sprag rod springs for distortion and tension.
3. Check square lug on sprag for broken edges, also lugs on parking gear for damage.
4. Check cam on end of sprag rod for nicks, burrs and free turning.

REASSEMBLY

1. Install reaction plug assembly in adapter and secure with snap ring.
2. Position sprag and spring in adapter and insert shaft. Make sure square lug on sprag is toward parking gear, and spring is positioned so it moves sprag away from gear.