SERVICE MANUAL

AUTOMATIC TRANSMISSION REPAIR ON CUSHMAN 660 ENGINE

Part No. 844739 Rev. B

Table of Contents

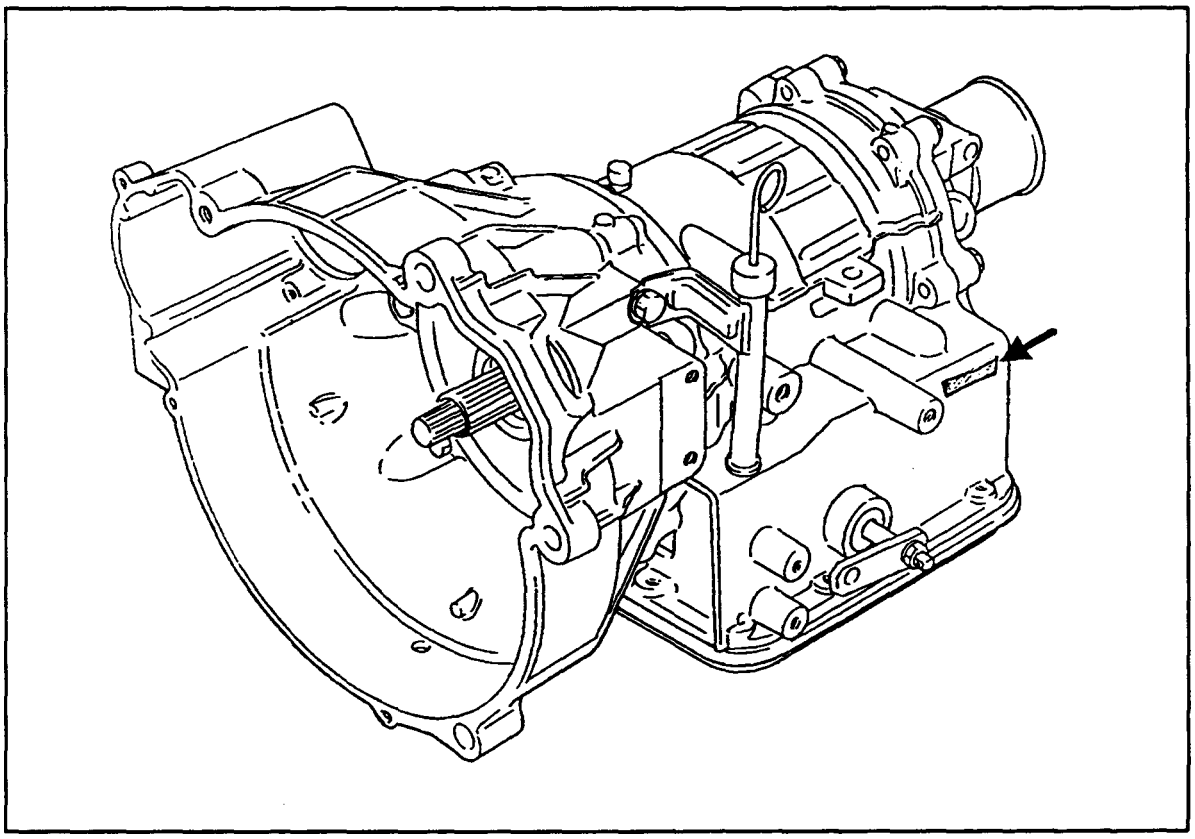
Section 2B2

Automatic Transmission

Outline 2b2–1

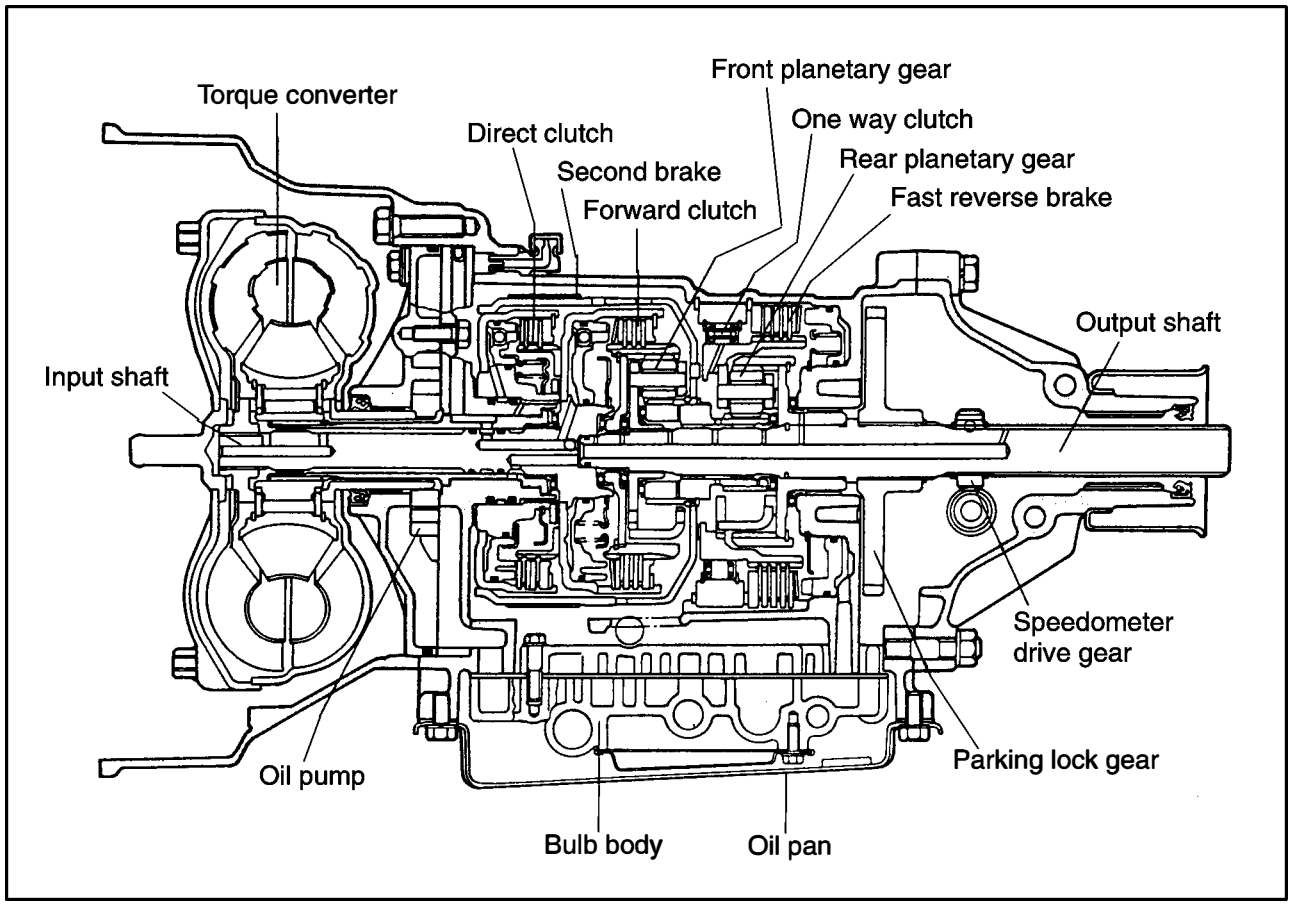
Automatic Transmission Identification Numbers

Automatic transmission identification numbers are located as shown below.



Summary

Liquid torque converter and electronic advance control
with three stages, and a separate reverse stage.



Item	Model
Torque converter	
Style	3 Main 1 stage 2 phase
Stall torque ratio	2.30
Oil pump	
Style Driving system	Trochoid form oil pump Engine drive
Gear Ratio	
Style	Simpson type planetary tooth wheel form Advance Three stage Reverse One Stage
Shift position	P Range: Gearbox neutral, output axis, engine starting R Range: Reverse gear N Range: Gearbox neutral, engine starting D Range: Advance, low gear«2nd gear«high gear; automatic shift 2 Range: Advance, low gear«2nd gear–high gear; automatic shift L Range: Advance, low gear–2nd gear; fixed low gear
GEAR RATIO 1st gear(Low) . . . . . 2.727 2nd gear(Second) . . . . 1.536 3rd gear(top gear) . . . . 1.000 Reverse gear 2.22	Front sun gear toothed wheel . . . . . 37 Rear sun gear toothed wheel . . . . . 27 Front pinion toothed wheel . . . . . 16 Rear pinion gear . . . . . 17 Front internal gear toothed wheel . . . . . 69 Rear internal gear toothed wheel 60
Main Control	Wet type multiple disk clutch . . . . . 2 sets Band type brake . . . . . 1 set Wet type multiple brake . . . . . 1 set One way clutch . . . . . 1 set
Primary Deceleration Ratio	————
Final Reduction Ratio	6.142
Lubricating	
Lubricating method	Oil Pump transfers forced pressure
Cooling	
Cooling method	Radiator cooling support (cold water)
Recommended Oil	Suzuki ATF 5D06

Clutch Operation

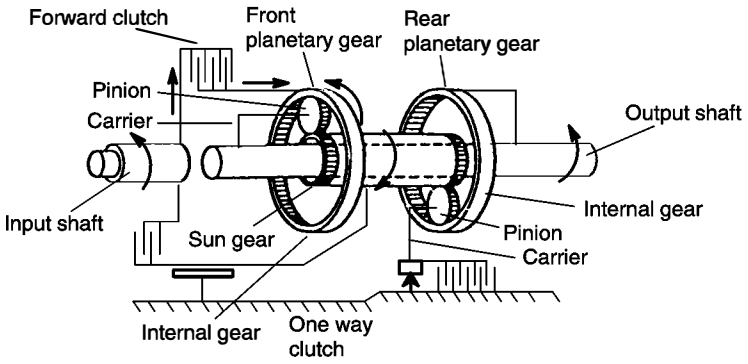
Item Name	Function
Direct clutch	Input shaft rotation transmitting to sun gear or cutting off .
Forward clutch	Input shaft rotation transmitting to front internal gear or cutting off.
Second brake band	Fixed or opens sun gear.
First reverse brake	Fixed or opens rear planetary carrier.
One way clutch	Keeps rear planetary carrier fixed.

Operation List of Primary Elements

Element Shift Position	Direct Clutch	Forward Clutch	Second Brake Band	First Reverse Brake
P	—	—	—	—
R	Engaged	Disengaged	Disengaged	Engaged
N	—	—	—	—
D 1st Gear	Disengaged	Engaged	Disengaged	Disengaged
D 2nd Gear	Disengaged	Engaged	Engaged	Disengaged
D 3rd Gear	Engaged	Engaged	Disengaged	Disengaged
2 1st Gear	Disengaged	Engaged	Disengaged	Disengaged
2 2nd Gear	Disengaged	Engaged	Engaged	Disengaged
L 1st Gear	Disengaged	Engaged	Disengaged	Engaged

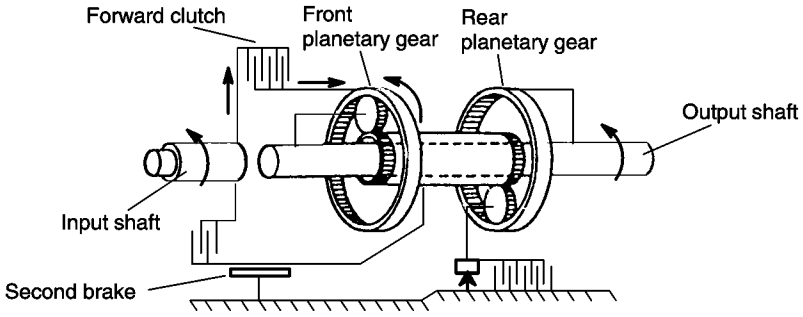
Transmission Operation Process

DV2 Range 1 Speed



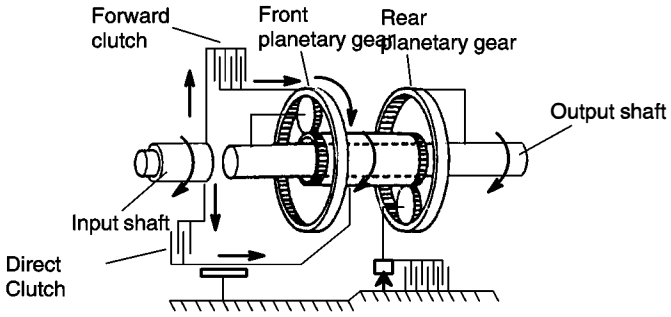
The oil passes over the forward clutch . Then the input shaft and the front planetary gear's internal gears are together in gear union. Because of that gear union, the input shaft's rotation is passed on directly to the internal gears. From the front planetary carrier to the output shaft, the rotation is passed on in the right direction. On the other side, the pinion of the front planetary gear and the sun gear engage each other. The sun gear rotates in the left direction and the sun gear's rotation passes on to the pinion of the rear planetary gear. Because the sun gear rotates left and the link between the sun gear and the pinion, the rear planetary gear tries to rotate left but the one way clutch obstructs the rotation. The pinion gear has to spin to the right instead. The internal gear of the rear planetary gear rotate in the right direction and pass the rotation on to the output shaft in the right direction.

DV2 Range 2 Speed



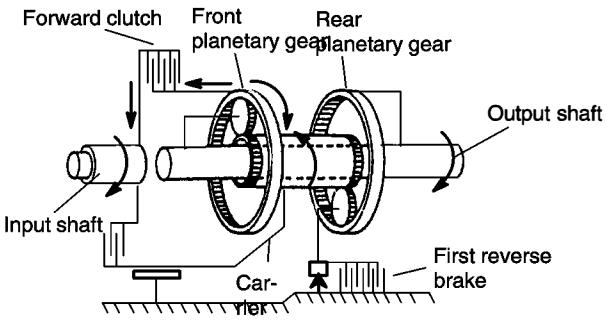
The oil passes over the forward clutch . Then the input shaft and the front planetary gear's internal gears are together in gear union. Because of that gear union, the input shaft's rotation is passed on directly to the internal gears. From the front planetary carrier to the output shaft, the rotation is passed on in the right direction. On the other side, the pinion of the front planetary gear and the sun gear engage each other. The sun gear tries to rotate in the left direction but the second brake grips it into a fixed state so it can not turn.
The pinion of the front planetary gear revolve around the sun gear. The front planetary gear turns in the right direction and the output also turns in the same direction.

DV Range 3 Speed



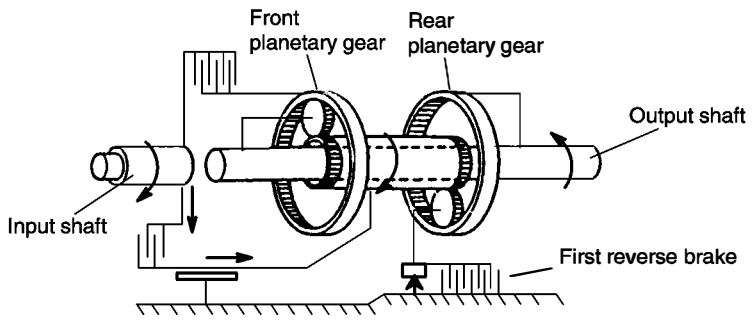
Oil passes over the forward clutch and the direct clutch. The input shaft is connected to the front planetary gear's internal gear and the sun gear. The input shaft directly connects to the planetary gear unit itself. The pinion of the front planetary gear locks into a stationary status. In that situation the input shaft rotation passes on to the output shaft.

LV Range 1 Speed



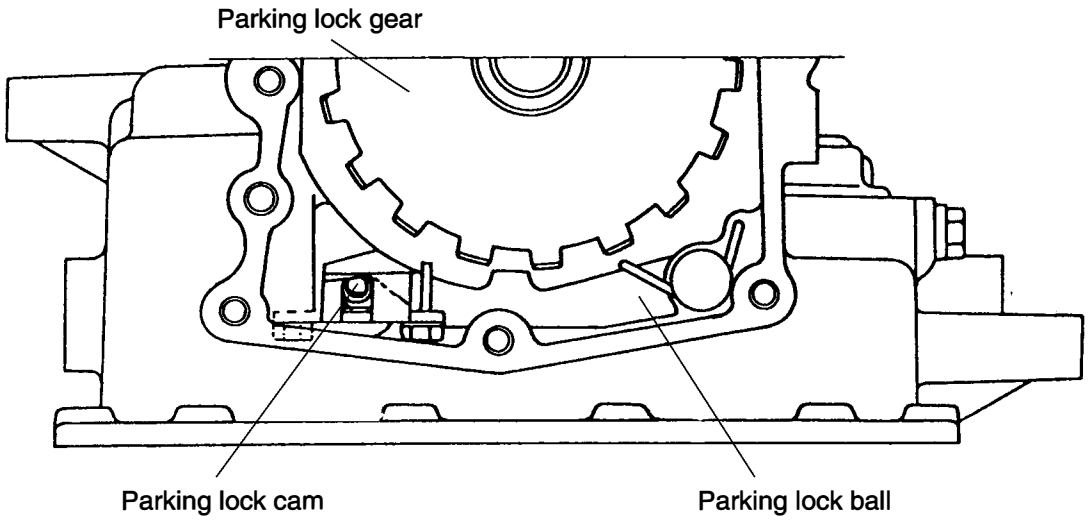
The rotation passing in **D** and **2** range is the same as in low gear, but when the rear planetary carrier is obstructed by the engine brake, it turns to the right direction and the oil pressure spreads to the first reverse brake and then fixes the rear planetary carrier in a stationary position. When driving in **D** range, the one way clutch action obstructs the rear planetary carrier's left directional rotation. The engine brake output shaft's action is not affected by the one way clutch because the output shaft rotates to the right. The one way clutch has no effect. The rear planetary carrier will be racing. It will be necessary to activate the first reverse brake, fix the rear planetary carrier, and engage the strong engine brake.

RV Range



The oil passes over the direct clutch. Then the input shaft and the planetary gear's sun gear are connected in gear union. The input shaft's rotation is directly passed on to the sun gear. In the case where the first reverse brake is applied, the action will affect the rear planetary carrier. The rear planetary carrier will affect the pinion gear. The pinion gear will spin by itself but will not revolve. (In this case, the difference between spin and revolve is that spin is referring to a twisting in place, revolve is referring to orbiting like planets around a sun.) The output shaft fits into the internal gear. It rotates in the left direction and reverses the vehicle.

NVP Range



Because of the forward clutch and the direct clutch release, the input shaft rotation is not passed on. In the **P** range the output shaft counter drive gear and the parking lock gear become united. That causes the parking lock pole to engage in the parking lock gear.
Then the back wheel is mechanically locked.

Valve Functions

Valve Name	Function
Manual Valve	Line pressure distributed to proper section positions in each circuit.
Pressure Regulator Valve	Adjusts slot pressure for proper pressure for traveling.
1 –2 Shift Valve	1 – 2 speed gear shift.
2 –3 Shift Valve	2 – 3 speed gear shift
Low cost modulator valve	Adjusts line pressure to relieve shock in Range **L.**
Solenoid Number 1	Puts line pressure on 2 – 3 shift valve.
Solenoid Number 2	Puts line pressure on 1 – 2 shift valve.

Shift Solenoid
Solenoid Number 1, Number 2

The Shift Solenoids, solenoid number 1 and 2, are attached to the valve body of the transmission. The AT control sends an ON or OFF signal to each of the gears as needed and regulates gear shift control.

Solenoid Operation Cases

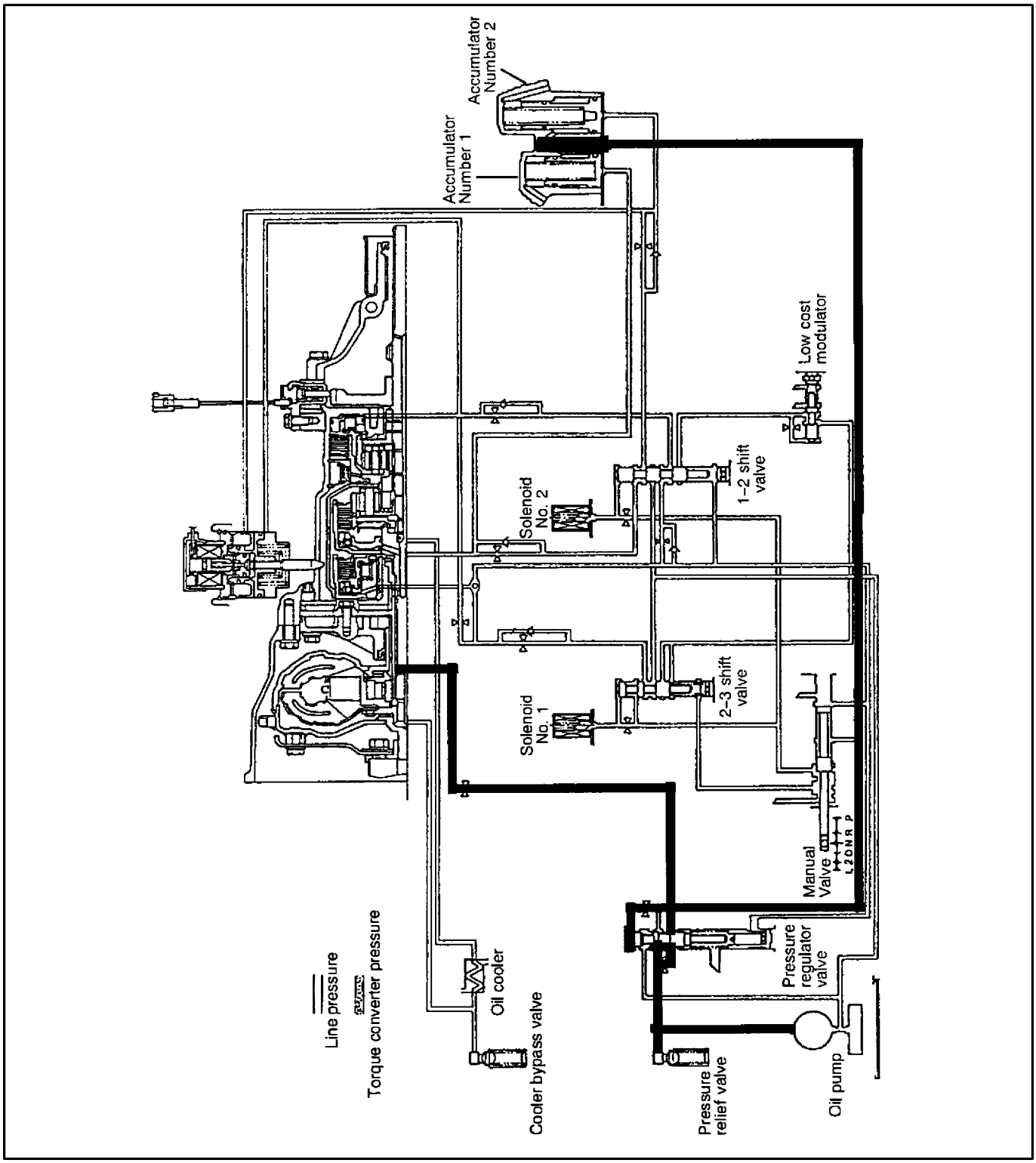
Bottom Chart Grid Labels (Top to Bottom):

Shift Position
Gear Position
Soft Solenoid Number 1
Soft Solenoid Number 2

O: ON (carrying current; electric charge passing through)
X: OFF (not carrying current; no electric charge passing through)

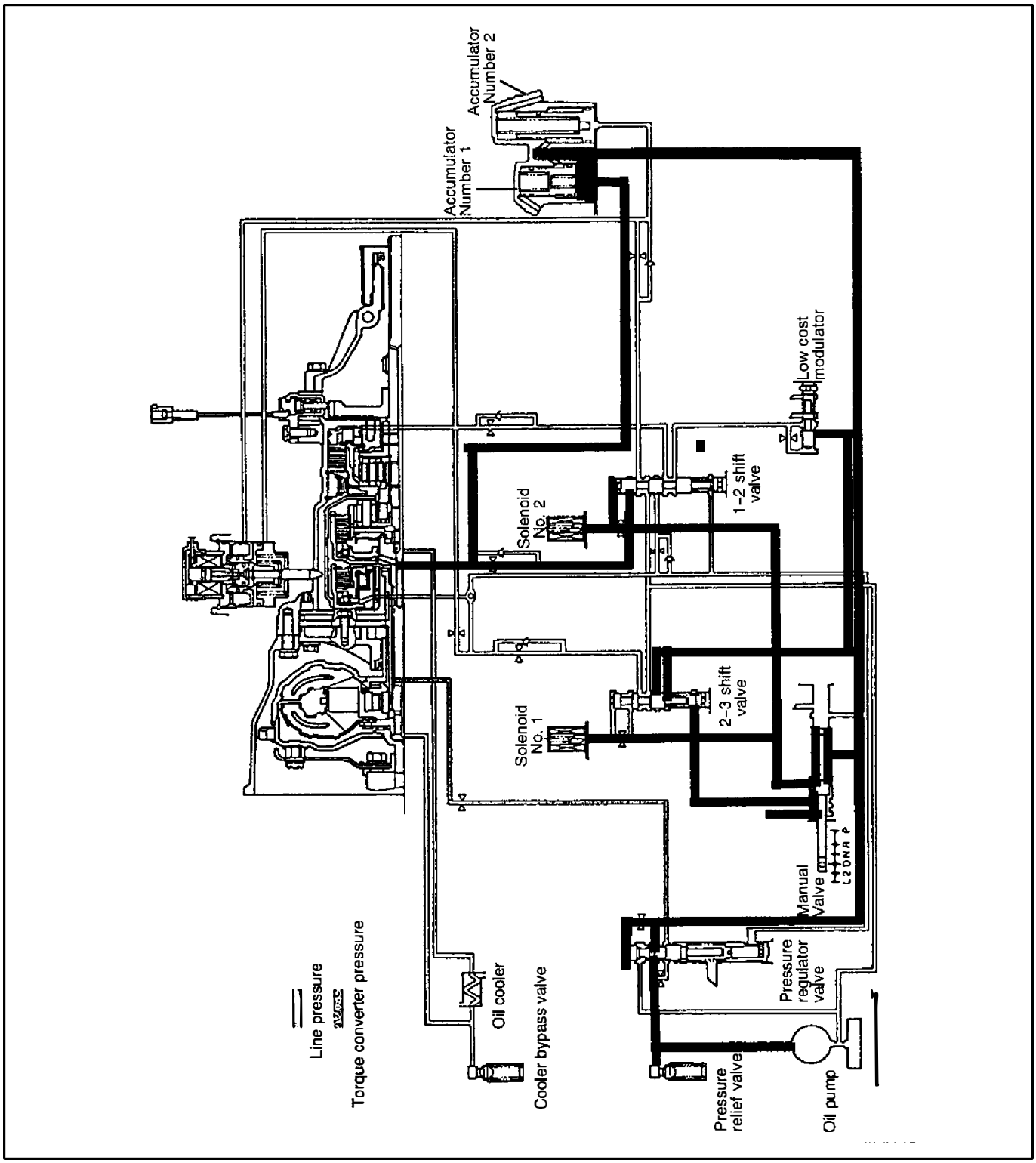
In regards to (3) and (2), operation shown is only for the time of down shifting.

Oil Pressure circuit
N Range (P Range is the same).



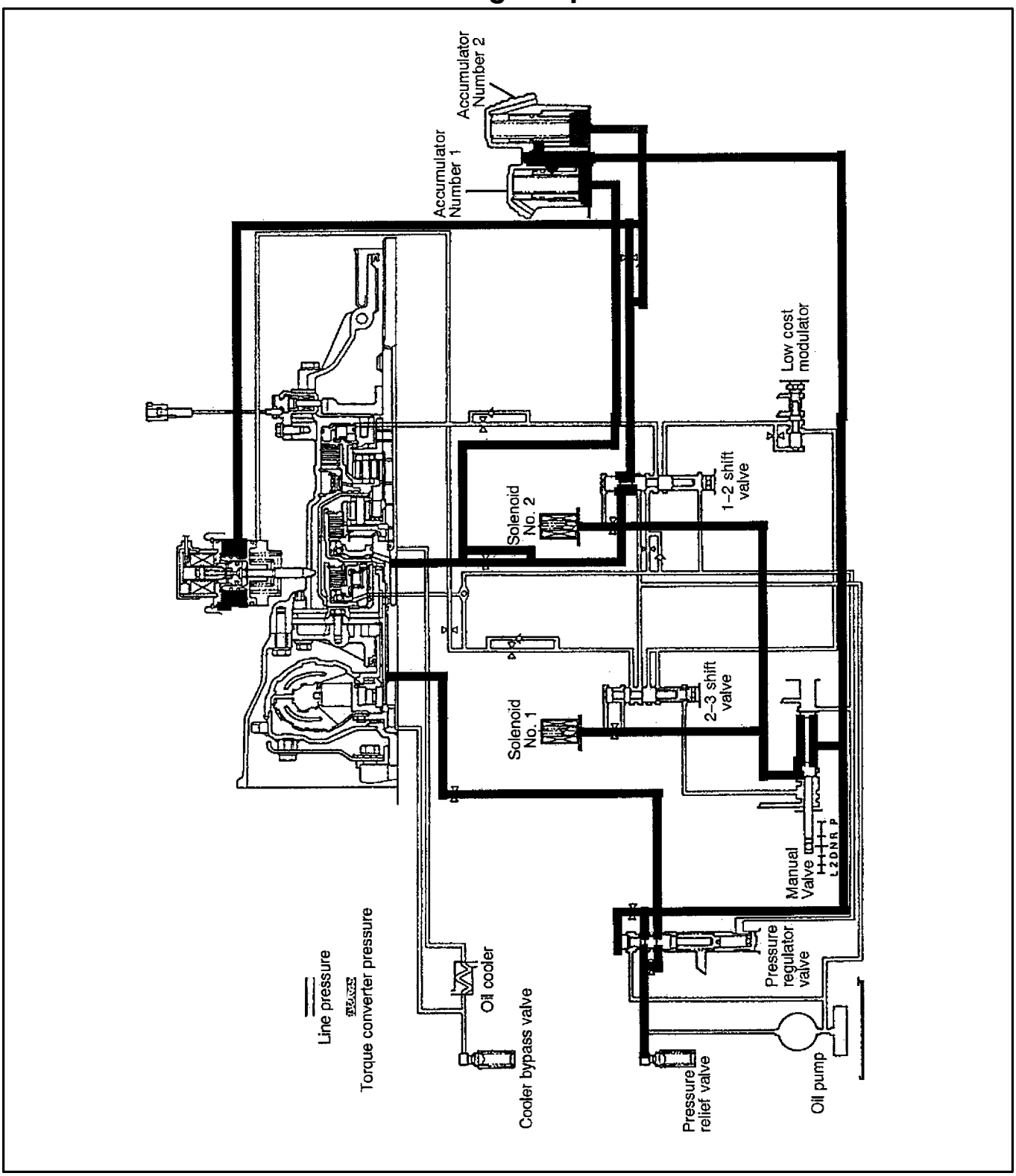
When the engine starts, the oil pump starts rotating. The oil pressure regulator valve regulates the valve that provides oil pressure. Then it is passed on to the torque converter. From the pressure regulator valve, line pressure closes the circuit using a manual valve. That is why neither the clutch nor the brake have an effect on the oil pressure.

DV2 Range 1 Speed



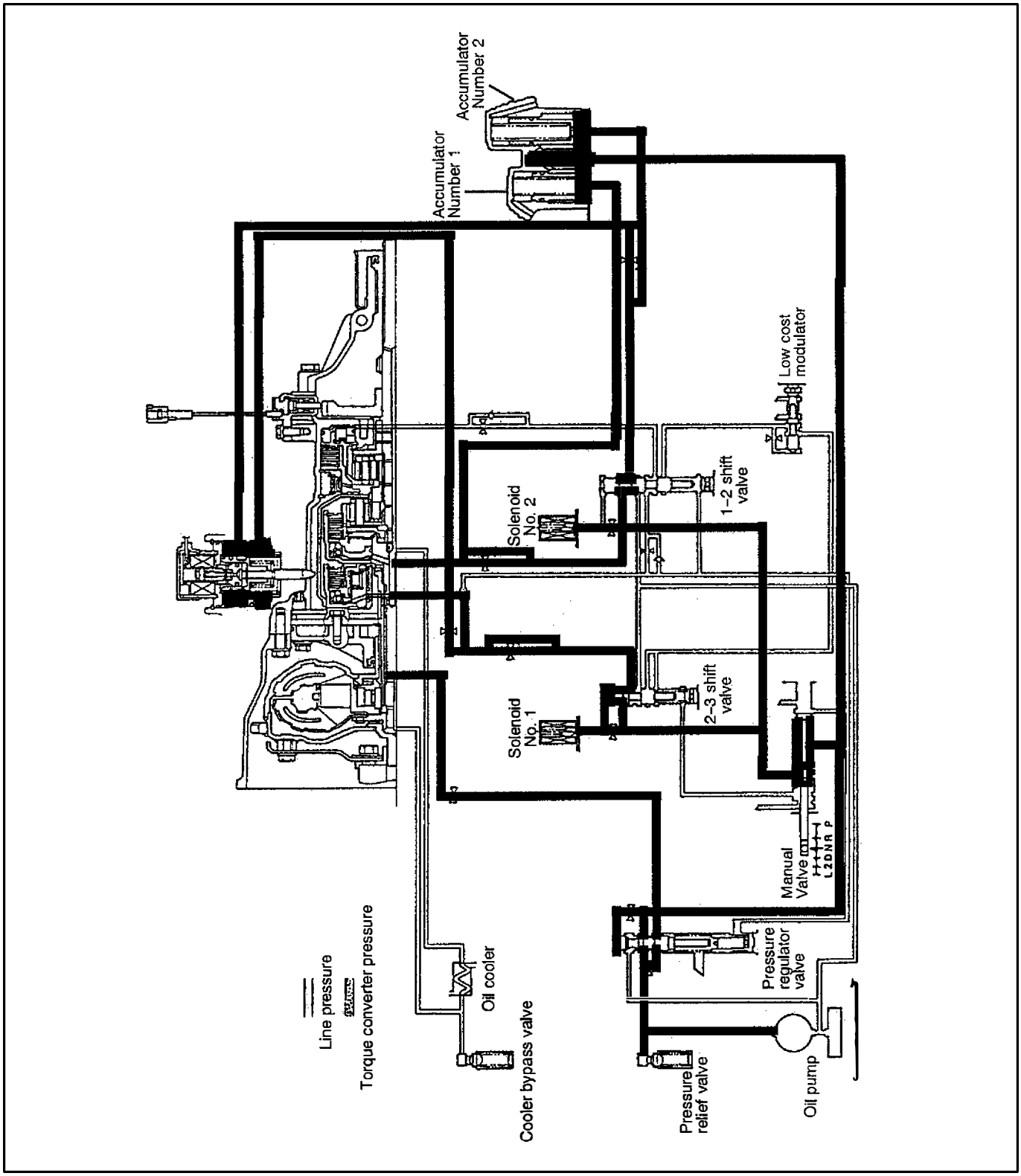
Pressure on the regulator valve regulates the line pressure. The line pressure passes through the manual valve and affects the 1–2 shift valve. (Solenoid Number 2 OFF means closed. Solenoid Number 1 means open). Line pressure does not affect 2–3 shift valve. Therefore, the oil pressure affects the forward clutch and switches into low gear. At this time, line pressure affects accumulator number 1 and also functions to relieve the shock that is produced when the clutch connects.

DV2 Range 2 Speed



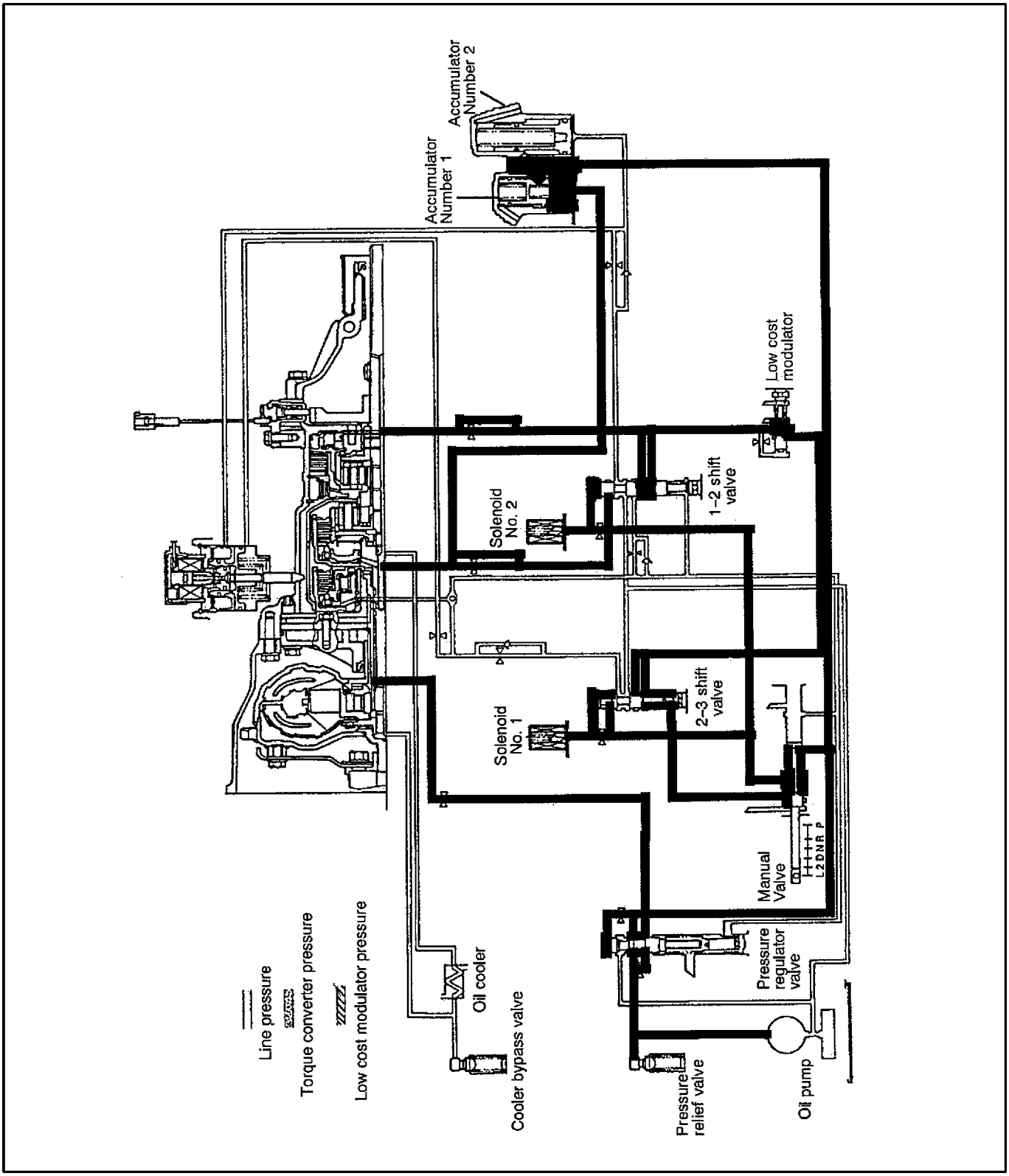
When the vehicle gets to second gear, solenoid number 2 is ON providing line pressure relief. Therefore, line pressure passes through the 1–2 shift valve. The line pressure affects the second brake piston. At this time it affects accumulator number 1 and 2 and also functions to relieve the shock that is produced when the clutch connects.

DV2 Range 3 Speed



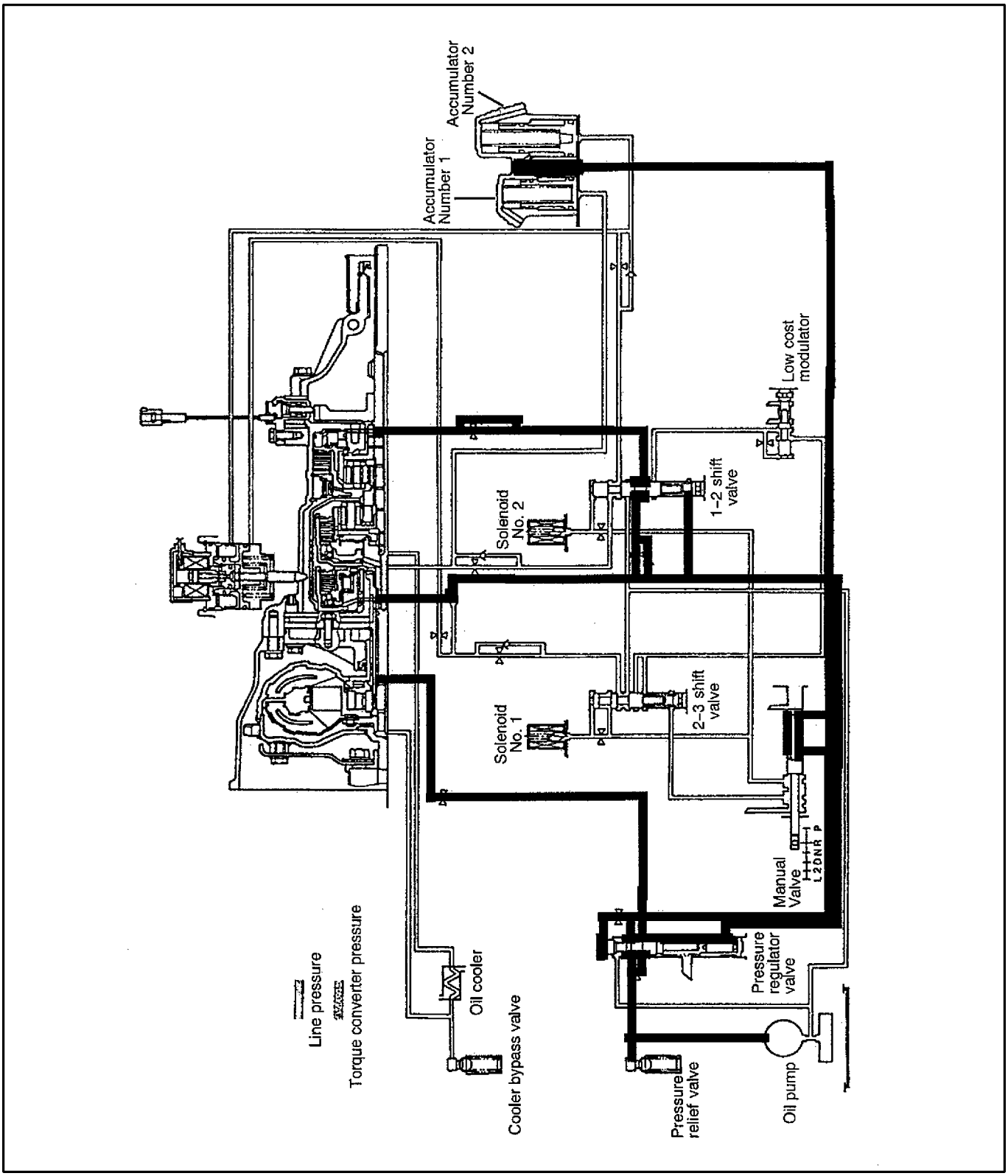
When third gear is reached, solenoid number one is OFF and line pressure passes through the 2–3 shift valve and affects the direct clutch. At this same time, line pressure changes to back pressure and affects the second brake and pushes back the second brake piston. Then third gear will be reached.

L Range

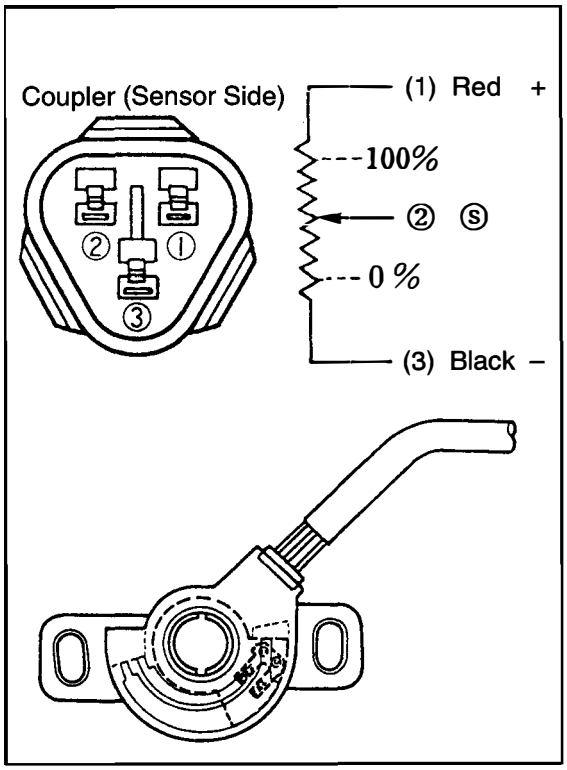


Line pressure passes through the manual valve and affects the forward clutch. On the other side, line pressure passes through the 2–3 shift valve. The low cost modulator valve adjusts that pressure. That pressure passes through the 1–2 shift valve and affects the first reverse brake.

R Range

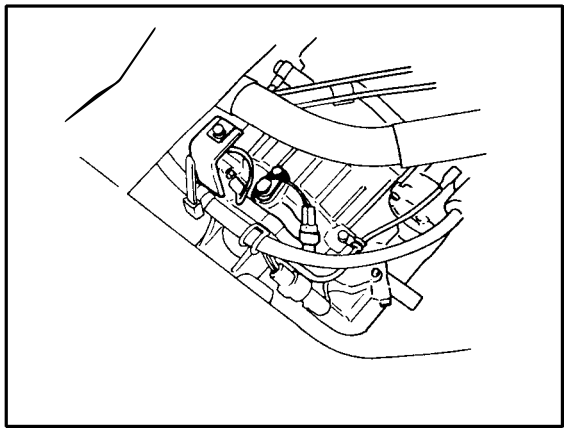


Line pressure passes the manual valve and affects the direct clutch. On the other side, the line pressure passes through the 1–2 shift valve. That line pressure affects first reverse gear.



Throttle Sensor

The throttle sensor is attached to the carburetor throttle valve shaft and the degree of opening is signaled to AT control.



Car Speed Sensor

The pulse generator system detects the output shaft's rotation inside the transmission case.
This pulse generator detection is done without any point of contact sensor. The pulse generator is comprised of a permanent magnet, rotor and coil. The parking gear is attached to the output shaft. This parking gear starts to rotate. From the permanent magnet, a magnetic induction flux field is produced. As the magnetic flux changes, the coil gear's rotation is directly proportional to the frequency of the voltage. This voltage enters the AT control and the control module measures and determines the rotation of the output shaft. In effect, the control module is able to distinguish the car speed.

Shift Switch

The lever positions for shifting are **P** and **N** only. The engine can only be started in **P** and **N**. This is the way the switches are set up.

Terminal Number	1	2	3	4	5	6	7	8
Color	Black & Red	Black & Yellow	Yellow	Red	Black	Green & Red	Green & white	Blue & White
Switch Position								
P	X	X			X	X	X	X
R			X	X				
N	X	X						
D								
2					X	X		
L					X	X	X	

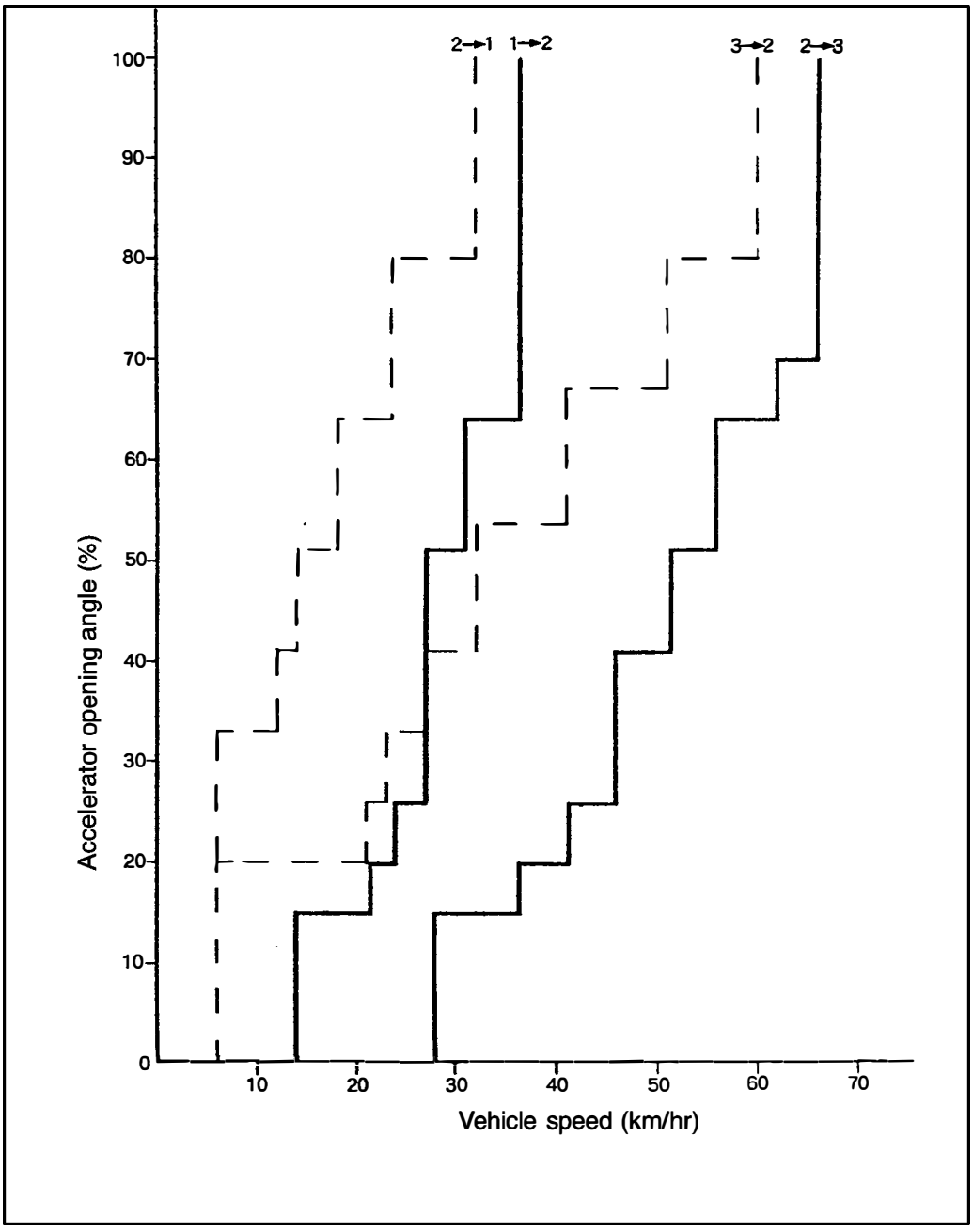
Fuel Saving Function

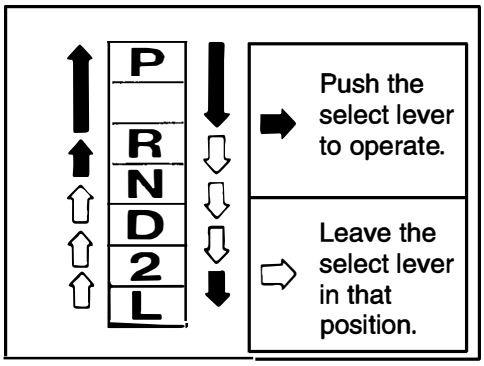
There are some cases where problems may develop with the shift solenoid and the car speed sensor. Even when those types of problems occur, there are mechanical safety backup systems set up to ensure safe driving. In the following chart, the situations of both normal and malfunctioning units are compared for gear shift positions.

Status / Shift Position	Normal Condition	Shift Solenoid No. 1 Abnormal	Shift Solenoid No. 2 Abnormal	Shift Solenoid No. 1 & 2 Abnormal
D	1st	3rd	1st	3rd
	2nd	3rd	3rd	3rd
	3rd	3rd	3rd	3rd
2	1st	3rd	1st	3rd
	2nd	3rd	3rd	3rd
	(3rd)	3rd	3rd	3rd
L	1st	1st	1st	1st
	2nd	2nd	1st	1st

Gear Special Features

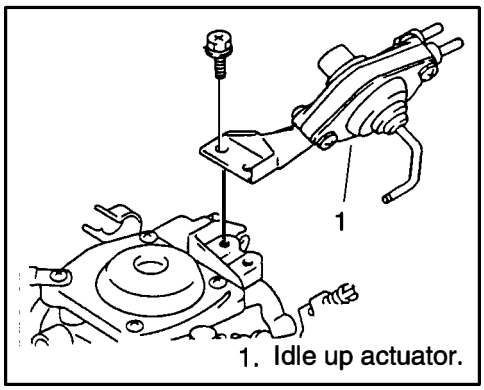
D, 2 Range and L Range gear speeds are dependent on the throttle opening. The diagram below illustrates how the amount that the throttle is opened affects the vehicle speed.





Shift Mechanism Select Pattern

Because of the high frequency of use, the shift lever is set up for the **N** and **D** range gears to function as free release or free select.



1. Idle up actuator.

Idle up Mechanism

Traveling range gear settings (all gear settings except **P** and **N**) can either idle up or idle stably. The idle up actuator is shared with the electric load actuator.

Diagnostics

	Status of situation	Probable presumed causes	Treatment
T R A	Oil level is low.	· ·Oil is leaking from oil filler tube. · There appears to be oil leaking.	Refill oil to standard recommended level. Repair
N S M	Transmission Case has oil leaking out of its joints.	· ·Oil level too high. · ·Breather hose is broken. · Gasket · O– Ring · Seal Ring	Refill oil to standard recommended level. Repair hose. Exchange Exchange Exchange
I S S	Oil leaking from transmission case.	· ·Manual select shaft oil seal · Oil pan gasket · Oil filler tube O–Ring · Oil pressure gauge plug · Electric connector O–Ring	Exchange Change Gasket. Change O–Ring. Tighten plug. Exchange.
I O N	Low oil pressure.	· ·Oil level low. · Oil pump strainer plugged up. · Oil pressure circuit leaking. · Pressure regulator valve ruptured or in bad condition.	Refill oil to correct level. Rinse out strainer. Overhaul. Overhaul the valve body.
	Oil pressure high.	Pressure regulator valve.	Overhaul the valve body.

	Status of situation	Probable presumed causes	Treatment
S T A R T I N G	Impossible to move vehicle in any of the gear ranges.	AT Oil shortage Oil Pump worn out. Oil Pump burned out. Regulator valve sticking. Oil strainer clogged Planetary gear burned or damaged. Oil pump bushing worn out causing an oil pressure leak. Input shaft seal ring worn out or damaged causing an oil leak. Torque converter internal parts in poor condition. Manual valve in poor condition.	Bring oil level back to standard range. Exchange Exchange Exchange Wash strainer. Repair or exchange Exchange Exchange Exchange
	D and 2 range not functioning. Traveling in 1st gear only and slipping easily.	Oil pump bushing worn out causing an oil pressure leak. Input shaft seal ring worn out causing an oil pressure leak. Forward clutch slipping. One way clutch poor condition.	Exchange Exchange Exchange Exchange
	Impossible to travel in **L** range. Slipping easily.	Oil pump bushing worn out and causing an oil pressure leak. Input shaft seal ring worn out or damaged causing an oil pressure leak. First reverse brake disk slipping. First reverse brake piston O–ring damaged.	Exchange Exchange Exchange Exchange
	Impossible to travel in **R** range. Slipping easily.	Oil pump seal ring worn out or damaged causing oil pressure leak from the direct clutch. Direct clutch bushing worn out. Direct clutch worn out.	Exchange Exchange Exchange
GEAR SHIFT	1–2 Gear shift change performing poorly. Slipping easily.	Regulator valve sticking. Second brake band poor condition. Second brake piston seal ring damaged. 1–2 shift valve sticking. Shift solenoid Valve Number 2 sticking.	Exchange Exchange Exchange Exchange Exchange

	Status of situation	Probable presumed causes	Treatment
G e a r S h i f t	Poor shifting from **2®3** gear ranges. Slipping.	Oil pump cover seal ring worn out or damaged causing direct clutch oil pressure leak. Direct clutch bushing worn out. Direct clutch slipping. 2–3 shift valve sticking. Shift solenoid valve No. 1 sticking. Direct clutch piston check ball gripping foreign object.	Exchange Exchange Exchange Exchange Exchange Exchange
	D range starting poorly and acting jerky.	Regulator valve sticking. Oil pump bushing worn out causing forward clutch oil pressure leak. Input shaft seal ring worn out or damaged causing forward clutch oil pressure leak. Forward clutch functioning poorly.	Exchange Exchange Exchange Exchange
	R range starting poorly. Shuddering.	Oil pump cover seal ring worn out or damaged causing direct clutch oil pressure leak. Direct clutch bushing worn out.	Exchange Exchange
	Big shock when shifting from **1®2** gears.	Regulator valve sticking One way clutch poor condition. Accumulator second brake piston poor condition.	Exchange Exchange Exchange
	Big shock when shifting from **2®3** gears.	Regulator valve sticking. Second brake piston poor condition.	Exchange Exchange
	Big shock when shifting from **N®D**.	Accumulator forward clutch piston poor condition.	Exchange
NOISE	Funny, rumbling noise sounding like “gatta–gatta”	Oil pump bushing worn out and causing an oil pressure leak from the forward clutch.	Exchange
	Funny noise sounding like “jajaja”	AT oil shortage	Bring oil level back up to standard level.
	P·N range noise	AT oil shortage Oil pump worn out.	Bring oil level back up to standard level. Exchange.

Vehicle Maintenance and Servicing

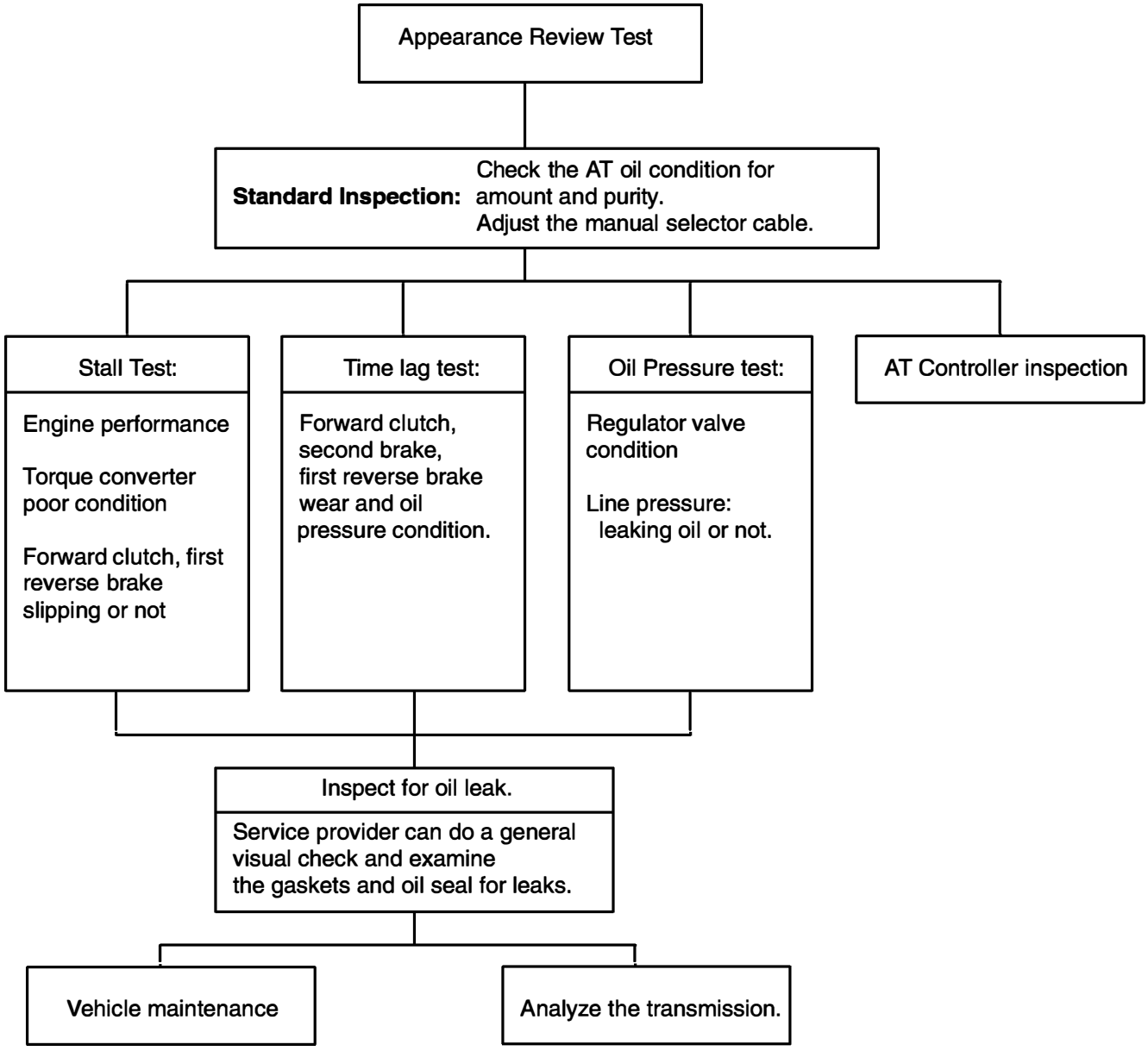
Inspection

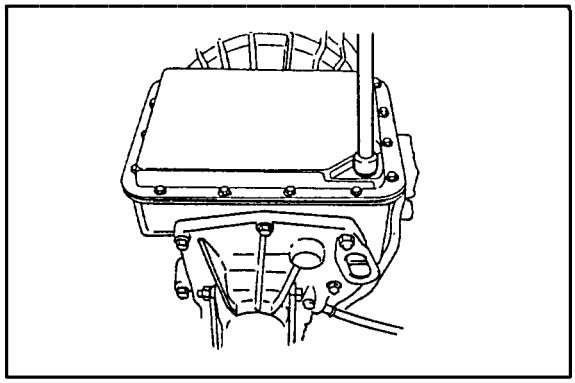
Before analyzing the automatic transmission, first do a vehicle test. Find and isolate the problems and what is causing them. Then, make the decision whether an automatic transmission analysis is called for. If you do not check carefully for the factors causing the problems, you can create additional new problems besides the one you started with and also waste time.

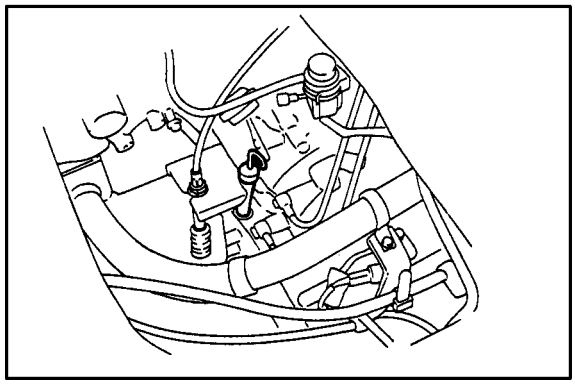
The traveling problems experienced when the automatic transmission is in poor condition can be grouped into the following classifications:

1. Inspection when adjustments were made was not appropriate.
2. The engine is performing poorly.
3. Oil pressure control mechanism is in poor condition.
4. Electronic control system is in poor condition.
5. The transmission is in poor internal, mechanical condition.

When users bring vehicle for servicing, the service providers need to carefully ask questions to determine which general classification group of problems the symptoms seem to point to. Depending on the responses of the user, the service provider may choose the appropriate group of tests and remedies.







AT Oil Exchange

1. When the engine cools down, take off the oil band's oil plug and let the oil drain out.

Oil should be changed every 4000 km traveled.

2. After the oil is drained out, the oil should be replaced through the oil filler tube with the same amount of oil up to the appropriate level. The oil should be the recommended type. Start the car and let it idle until the car warms up. Move the transmission select lever through each of the settings and then check the oil level again. If the oil level is below the recommended amount, refill with additional oil to bring the level up to the recommended amount.

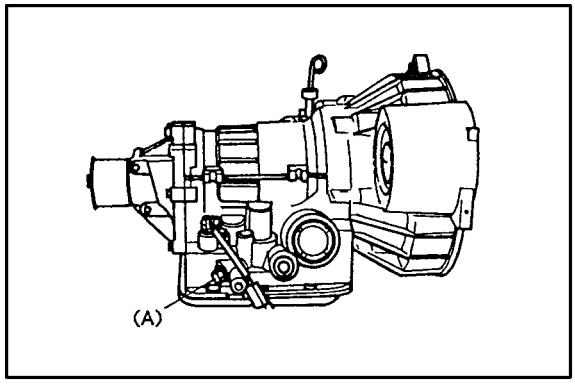
	Oil Capacity (l)
Time of Oil Change	0.8
Time of Overhaul	2.7

AT Oil: Suzuki ATF 5D06
Oil drain plug tightening torque: 180 ~ 270 kg · cm

Oil Pressure Test

Measure the oil pressure in the oil pressure line. Then inspect each of the functions during operation.

1. Attach an ATM oil pressure gauge to the spout of the transmission case.



Special Tool:
(A) ATM Oil Pressure Gauge: 09925 – 37810

2. Prevent the wheels from moving. Pull up the side brake all the way.

3. Step on the foot brake and bring the engine to idling and stall status. Then measure the oil pressure in the **D** and **R** ranges.

Engine Running Status	Oil Pressure (kg/cm)	
	D Range	R Range
Engine Idling	5.5 ~ 6.6	12.5 ~ 15.7
Engine Stalling	5.8 ~ 6.6	12.8 ~ 15.7

Notice: After attaching the oil pressure gauge, make sure to check for leaking oil.
Oil temperature should be normal traveling temperature (70–80° C).
Do not continue the stalling test more than 5 seconds.

	Test Results	Probable presumed causes
Main	Oil Pressure higher than standard pressure in each range.	Regulator Valve not functioning properly.
Evaluation	Oil Pressure lower than standard pressure in each range.	Oil pump not functioning properly. Regulator Valve functioning poorly.
Points	Oil Pressure lower than standard pressure in **D** range.	Oil leaking from forward clutch. Leak in oil circuit in the **D** Range.
	Oil Pressure lower than standard pressure in. **R** range.	Direct clutch leaking oil. First–Reverse brake is leaking oil in the **R** range.

Stall Test

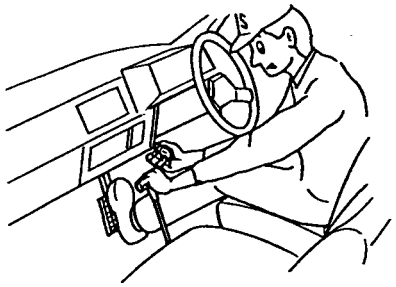
Measure the engine's maximum rotation number for each gear range and check the general performance of the automatic transmission and engine.

1. Be sure to block off the front and back wheels securely so the car will not roll. Hold the foot brake down.
2. Connect the engine revolution counter.
3. Start the engine.
4. Move the select bar to the **D** range. Step on the accelerator and watch the engine revolution measurement (rpms) as the degree of acceleration is increased. Then get the revolution number (rpms) to hold constant at the standard stall point and take a quick measurement reading of the engine (revolution number at stall point).
5. Perform the same test procedure in the **R** range.

Stall Revolution range numbers: **D** range 2550 ~ 2850 rpm
R range 2550 ~2800 rpm

Note: This test should not be continued for more than 5 seconds because the oil temperature will rise too high. This test should be done when the engine is already warmed up. Once this test has been performed, leave the engine idling for at least 30 seconds.

Main Evaluation Points	Symptoms	Causes
	Lower than standard value	engine generator in poor condition. torque converter in poor condition.
	D range higher than standard value.	Forward clutch slipping Starter one way clutch not performing properly.
	R range higher than standard value.	Direct clutch slipping First/reverse brake slipping Oil pressure is low. Starter one way clutch not performing properly.



Time lag test With the engine idling and revolving, shift the gear select lever. Measure the time lag between the time of shifting the lever and the time that the shock or jolt is felt, indicating that the gear has changed. Then check the oil pressure of the clutch and the reverse brake.

Note: This test should be done again with an interval of more than 1 minute in between testings. The gear should be in the N position between tests. This test should be performed when warm.

1. The front wheel and back wheel should be blocked securely. The foot brake should also be held down.
2. Start the engine.
3. Shift the select lever from the N to the D position. At this time, measure the time of the shock with a stop watch.
4. Use the same process with N to R positions.

Time lag standard values: N®D 0.7 seconds or more
N®R 1.2 seconds or less

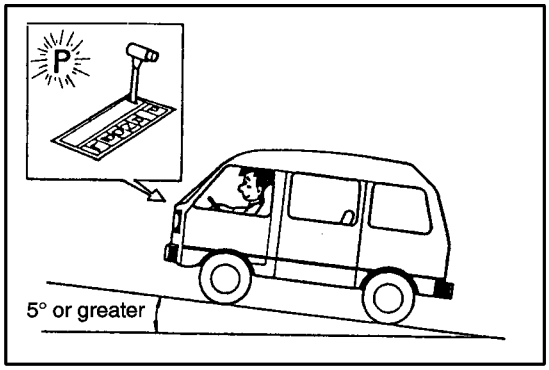
	Test Results	Probable presumed causes
Main Evaluation Points	N®D time exceeds standard time.	Oil pressure is low. Forward clutch worn out.
	N®R time lag exceeds standard time.	Oil pressure is low. First reverse brake worn out from friction. Direct clutch friction

Traveling Test

Operate the vehicle in the **D** Range making sure to check that the gear shift point and the gear shift line meet.

Note: When doing the driving test, make sure to watch out for traffic. Think about safety and stay alert for hazards.

	Gear Status	Probable presumed causes
Main Evaluation Points	1®2 will not upshift	1–2 shift valve sticking. Solenoid No. 2 sticking Gear shift control system problem
	2®3 will not upshift	2–3 shift valve sticking. Solenoid No.1 sticking. Gear shift control system problem.
	Gear shift point is in poor condition	1–2, 2–3, shift valve not working properly. Gear shift control system problem.

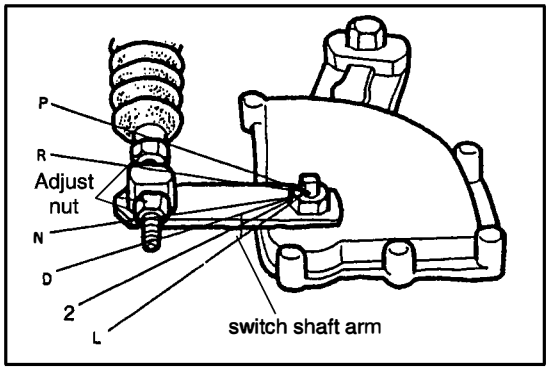


P Range test

1. Set up an inclined plank raised at one end with a 5° inclination angle. Drive the vehicle onto the inclined plank and stop. Move the gear shift select bar into the **P** range and set the parking brake. At this time, make sure that the vehicle will not move.

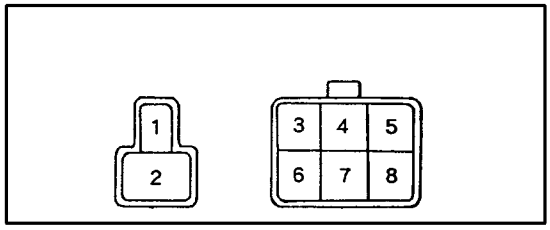
2. Do a similar test on the inclined plank with the vehicle pointing downhill instead of uphill.

3. Move the select bar from the **P** range to the other ranges and be sure that the vehicle will not move.



Shift lever Switch Inspection

1. Check to be sure that the starter starts and the engine begins to run in ranges **P** and **N.** Be sure that the starter will not turn in ranges **D, 2, L** and **R.** This indicates an OK status. In **R** range, be sure that the vehicle back up lights work. Also, check the reverse alarm buzzer to make sure it is working properly and will make a warning noise when backing up. If those features are not working properly, loosen the attachment bolt and then adjust the depth that the bolt enters the hole.

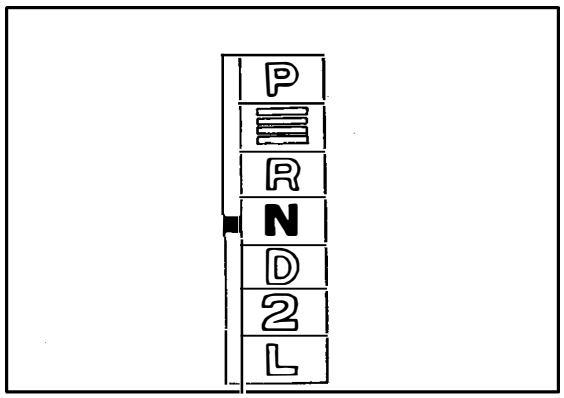


2. In the case where the procedure above does not improve the situation, take off the shift switch connector and move the gear shift select bar as directed in the following chart. Make sure to perform a continuity test using the guide in the chart.

Terminal number	1	2	3	4	5	6	7	8
Color	Black–Red	Black–Yellow	Yellow	Red	Black	Green–Red	Green–White	Blue–White
Switch Position								
P	X	X			X			X
R			X	X				
N	X	X						
D								
2					X	X		
L					X		X	

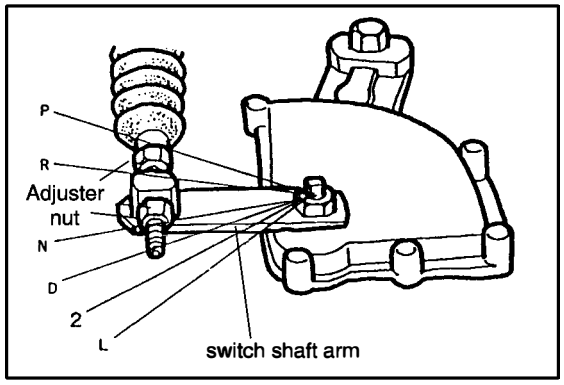
Main Problems:

Starter will not turn: snapping of wire between 1–2 or contact is not proper.
Back up lamp and reverse alarm buzzer both not working: snapping of the wire between 3–4 or improper contact.
2 and L ranges are not downshifting: snapping of the wire between 5–6 and 6–7 or improper contact.
D range will not upshift past 2 Range: ground connection between 6–AT Controller.
Gear fixed in **L** range: ground connection between 7–8AT controller.

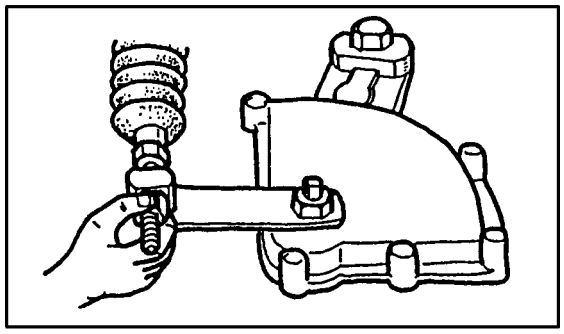


Adjusting the Select Lever

1. Put the select lever in **N** range.



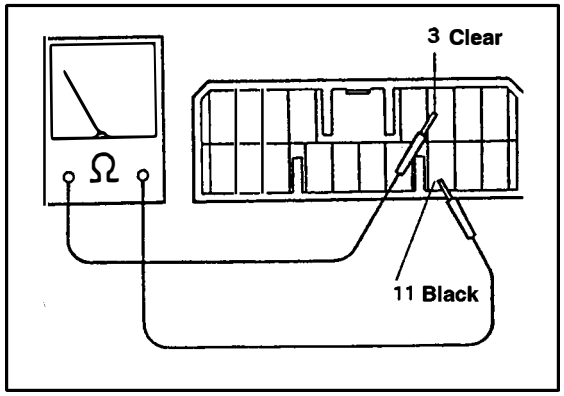
2. Loosen the adjuster nuts for the Select Cable Joints and then shift the switch shaft arm to the **N** range.



3. Have the cable in a free condition and move the lower adjuster nut to the selector cable joint at the edge of the surface. Then tighten up the upper adjuster nut with a spanner wrench.

Vehicle Speed Sensor Inspection

Inspect the AT controller coupler terminal between 3–11 for resistance values.

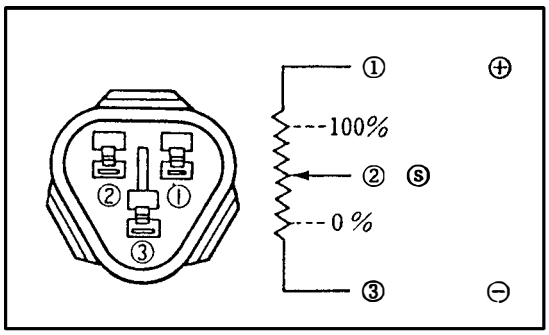


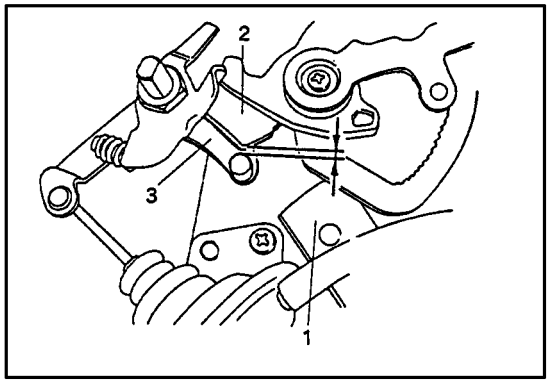
Vehicle speed sensor resistance amount: 160~200 O

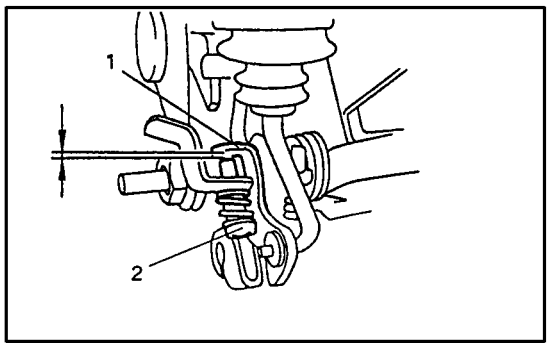
In the case of a vehicle speed sensor found not to be at the standard resistance amount shown above, measure the resistance of the coupler (2 poles).

In the case of the sensor not working, replace the non–working sensor.

In the case of the AT controller not being at the standard value, perform a solid test when the vehicle is functioning normally. Between the AT controller and the vehicle speed sensor, there may be problems with the harness snapping, a harness wire that may be shorted, or the coupler not making contact properly.







Throttle sensor

Inspection

Take the throttle sensor connector from the vehicle harness. Then, measure the resistance from the throttle sensor connector.

Accelerator Full open

1–3 Resistance Value (KO)	2.5–7.5
2–3 Resistance Value (KO)	3 or greater

Accelerator Full open

When going from **2** to **3,** the resistance should increase more than 1 KO with the accelerator in full open position.

Maintenance

1. Take off the carburetor assembly.

2. Insert a washer between the rod's thermal element and the stopper screw while they are still completely warm. At this time, make sure to check that there is space between the first idle cam and the throttle lever.

3. Idle screw should be warm. Open the throttle valve fully. Then, make sure the idle adjust screw and the throttle lever have space between them.

4. Battery voltage should be going to Coupler 1 and 2. Connect tester to Coupler 2 and 3. Then measure the generated voltage. As an example, if the measurement shows battery voltage of 13%, this equals a reading of 13 volts. Generated voltage should be 1.69. This would indicate that the throttle sensor needs servicing.

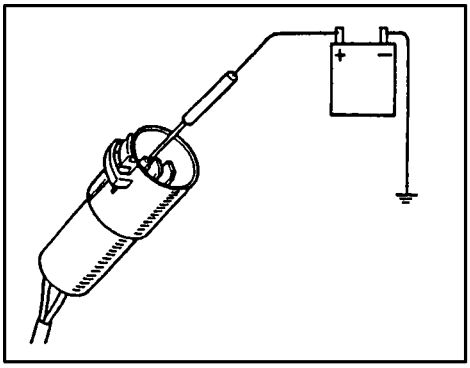
Reference: When generated voltage rate is 13% with the throttle totally closed, the voltage rate would be 87% with the throttle fully open.

5. Take off the washer that was attached in Step # 2 above.

6. Install the carburetor assembly.

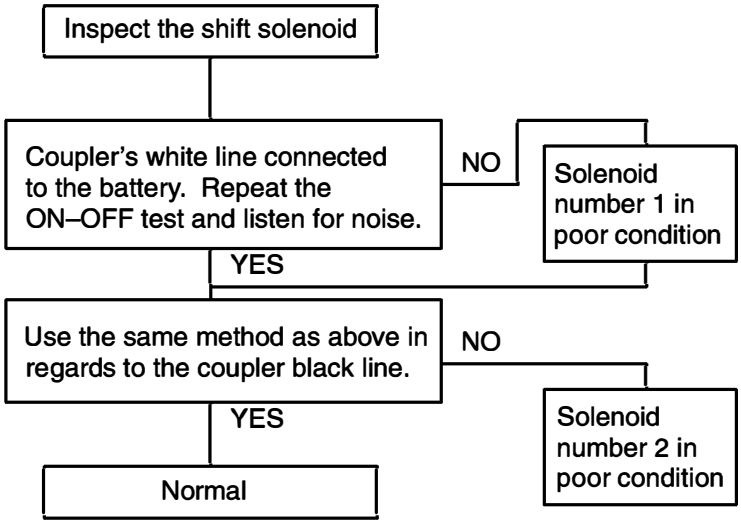
7. Radiator hose should be kept sufficiently warm.

8. Adjust the idle. (Refer to Section 2D).

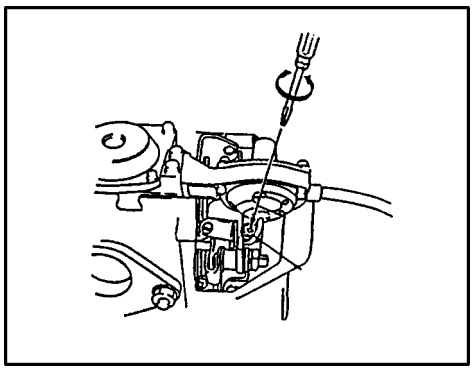


Inspection of Shift Solenoid

Take off the transmission shift solenoid harness coupler. Then connect the battery to the transmission's coupler side.
Then check for unusual noises.



Shift Solenoid	Harness color	
	Vehicle harness	Coupler ~ Grommet
Number 1	light green/black	white
Number 2	light green/white	black



D Range Idle Up Adjustments

1. Warm up until the radiator upper hose gets hot.
2. Inspect the carburetor link mechanism and the smoothness of the valve functioning.
3. Do a **D** Range shift.
4. Turn the **D** range idle up adjuster screw. Adjust the number of rotations to the normal recommended level.

Idle up RPM: 1100 ± 50 rpm

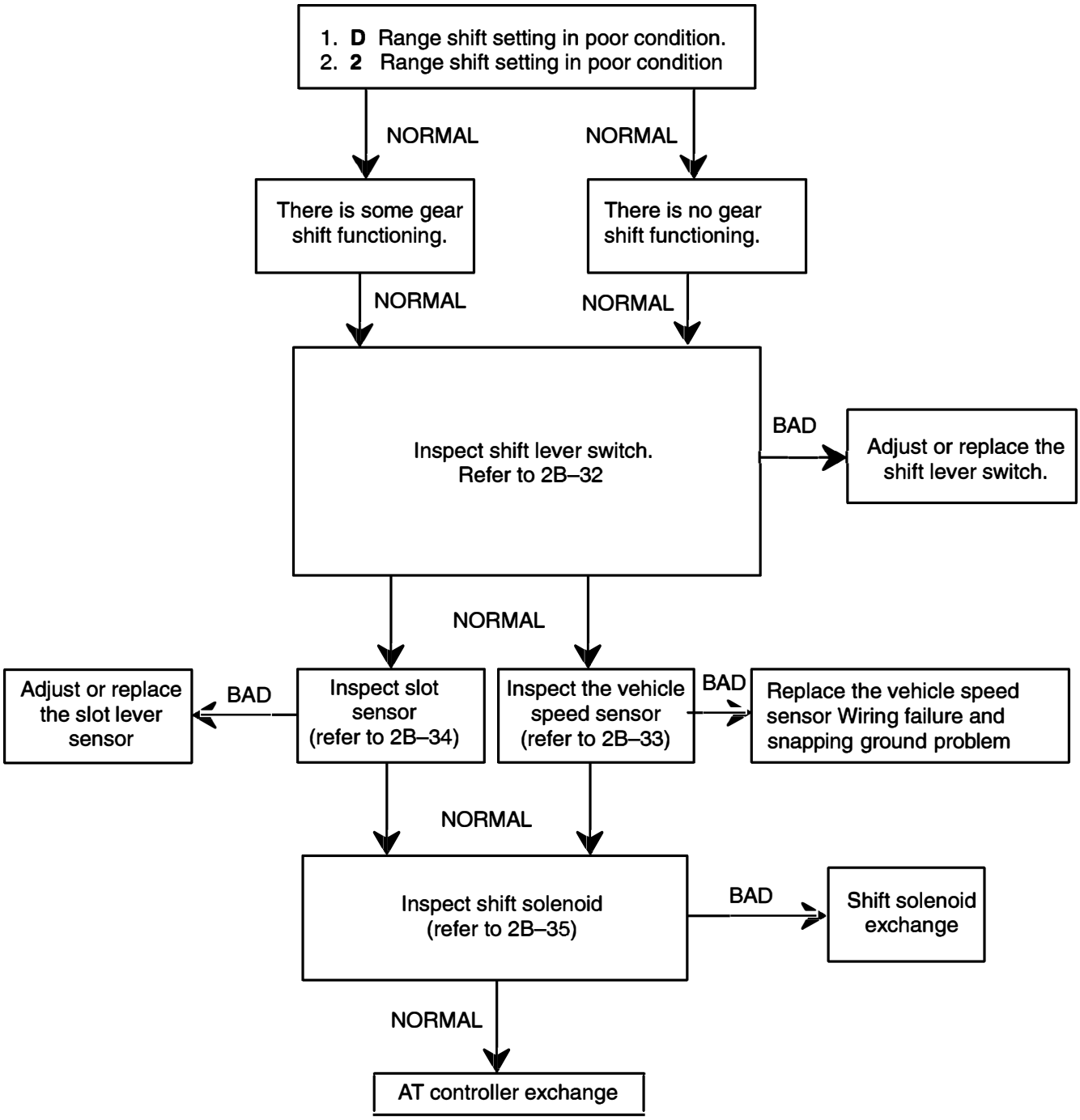
Note: Do these procedures with two people.
Make sure that the front and back wheels are completely blocked off. Keep the foot brake pedal held down.
Be careful that the car does not move or roll away.

Troubleshooting (AT Controller)

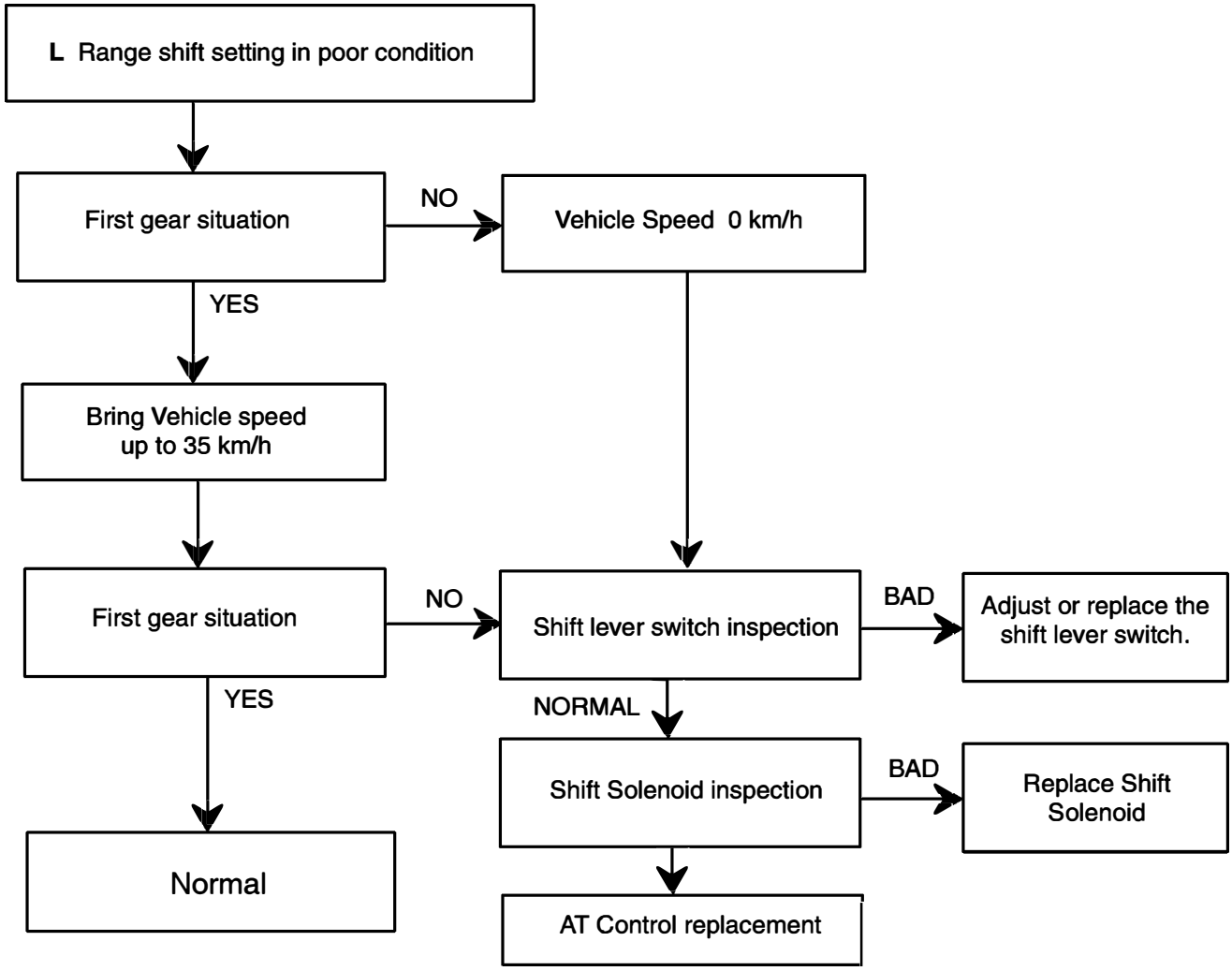
In this place, we will explain how to diagnose problems with the AT Controller.

Flow chart

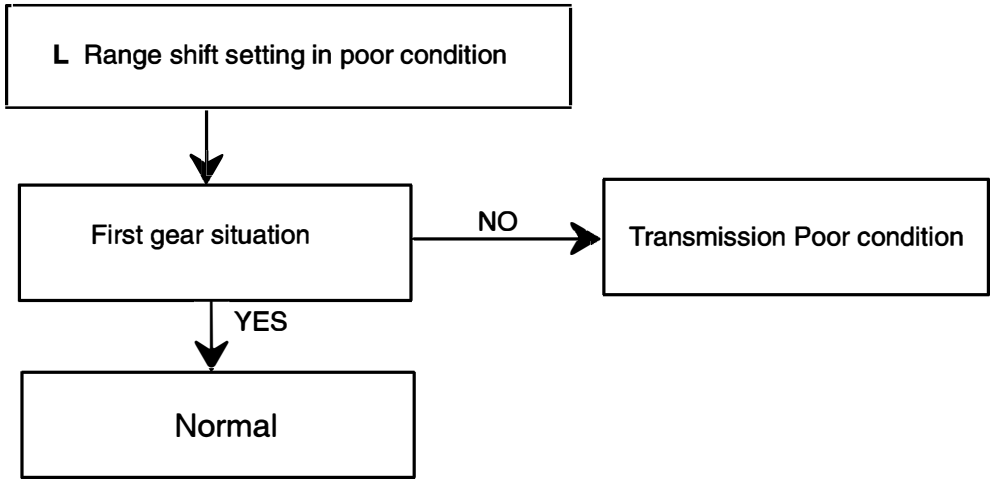
1. Gear shift in poor condition.



2. L Range shift poor condition



3. R Range Shift Poor condition



Analysis

Notes regarding Analysis of the Assembly and Internal Workings

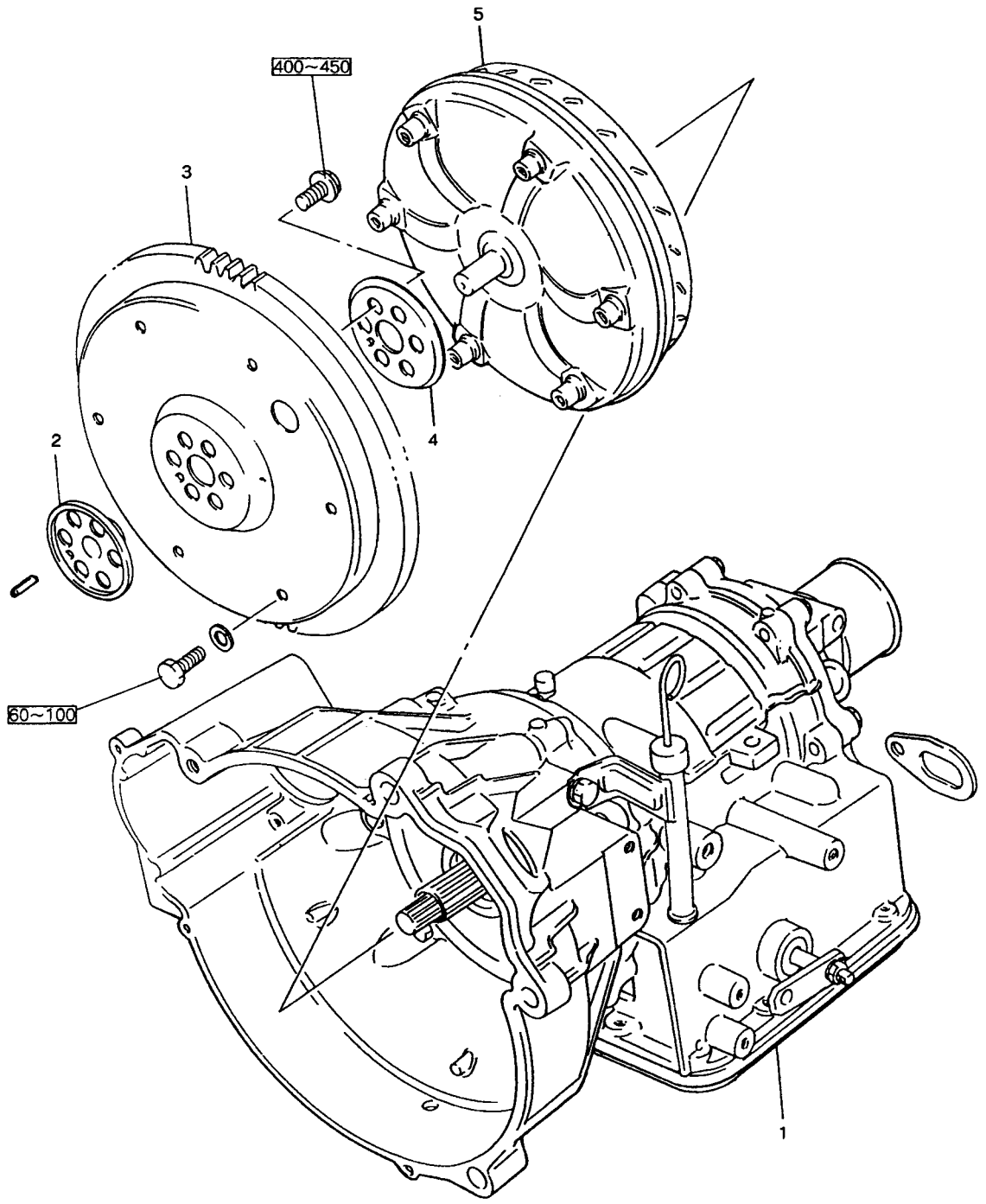
Because of the Automatic Transmission, vehicles are composed of precision made parts.
Please be careful when doing analysis and assembly not to damage the precision parts.
Please keep the following rules:

Make sure analysis and maintenance is done in a clean and dust–free environment.
Make sure to put rubber mats on the work benches to avoid damage to the parts.
Do not use rags or gloves. Use paper towels or towels made from nylon cloth.
When analyzing the case joint, please do not use a screw driver as a wedge to try to open the case. Instead, use a plastic hammer and use gentle taps.
Before doing analysis, make sure to wash out the dirt. Do not let dirt or other foreign objects enter into the transmission.
Clean parts with kerosene or ATF and wash them thoroughly. Make sure oil passage is not clogged by using the air blow test. (Use ATF or kerosene. Do not let any splash into your eyes or face). However, only disks, brake pans, resin washers, and rubber parts should be washed with ATF.
Gasket, oil seal and O–ring should be exchanged for new.
Make sure that ATF is applied to the sliding or rotating parts
When preparing a new disk or new brake band, soak them first in ATF at least two hours before.
Do not use oil and grease unless you are certain they are a well–know brandname

Inspection and Treatment of Parts

Item	Inspection Content	Treatment
Cast metal part & Machine processed or tooled parts.	Small marks, scratches, burrs, body damage, deep marks, grooves, oil passage clogged, marks on the surface of the attachment face, gasket remnants, cracks	Take off small marks with an oil stone; Clean clogs with air or wire; Use an oilstone . Exchange
Bearing Inspection	Will not turn smoothly. Pitching, mark, cracking	Exchange Exchange
Bushing, thrust washer Inspection	Marked or worn out	Exchange
Oil seal, gasket inspection	See if the oil seal is marked or scratched up. Material very hard. Seal ring perimeter and side surface worn out,	Exchange Exchange Exchange
Gear type Inspection	Mark or burr Teeth worn out	Repair with an oil stone or Exchange Exchange
Spline Inspection	Dented, twisted	Repair with an oil stone. Exchange
Snap ring inspection	Worn out or burred Shape changed	Repair with an oil stone. Exchange
Screw Inspection	Burr present Damaged	Repair with an oil stone. Exchange
Spring Inspection	Burned out, scarred, marked	Exchange
Clutch disk, brake disk inspection	Worn out; burned; bent; clutch strained; damaged with nail	Exchange
Clutch plate, brake plate inspection	Burned; worn out; strained; Damaged with a nail	Exchange
Seal face inspection	Mark; non–smooth surface Biting into foreign object	Exchange Repair

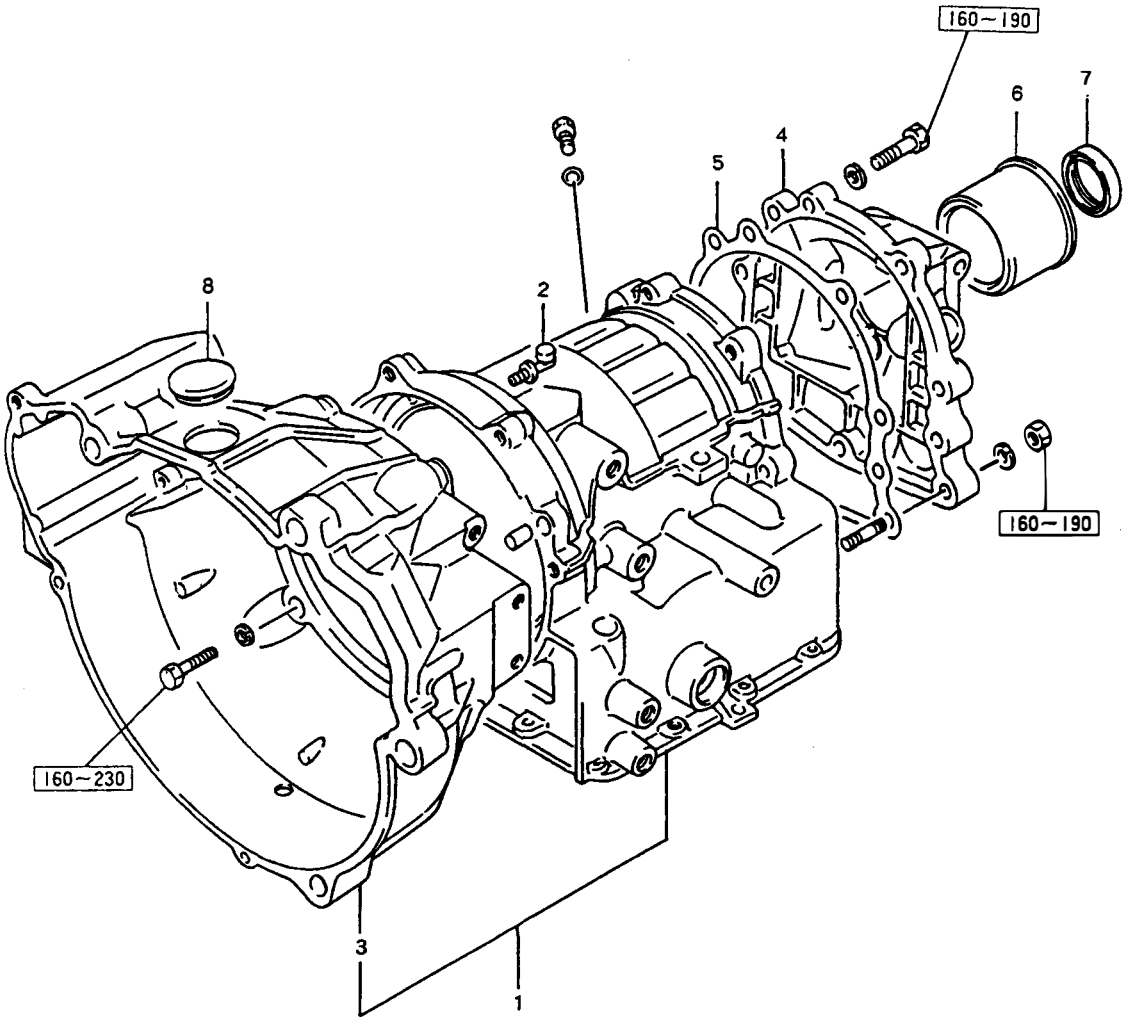
Transmission Assembly



1. Automatic transmission assembly
2. Drive plate flange
3. Drive plate
4. Drive rear plate
5. Torque converter

: Screw Torque (kg·cm)

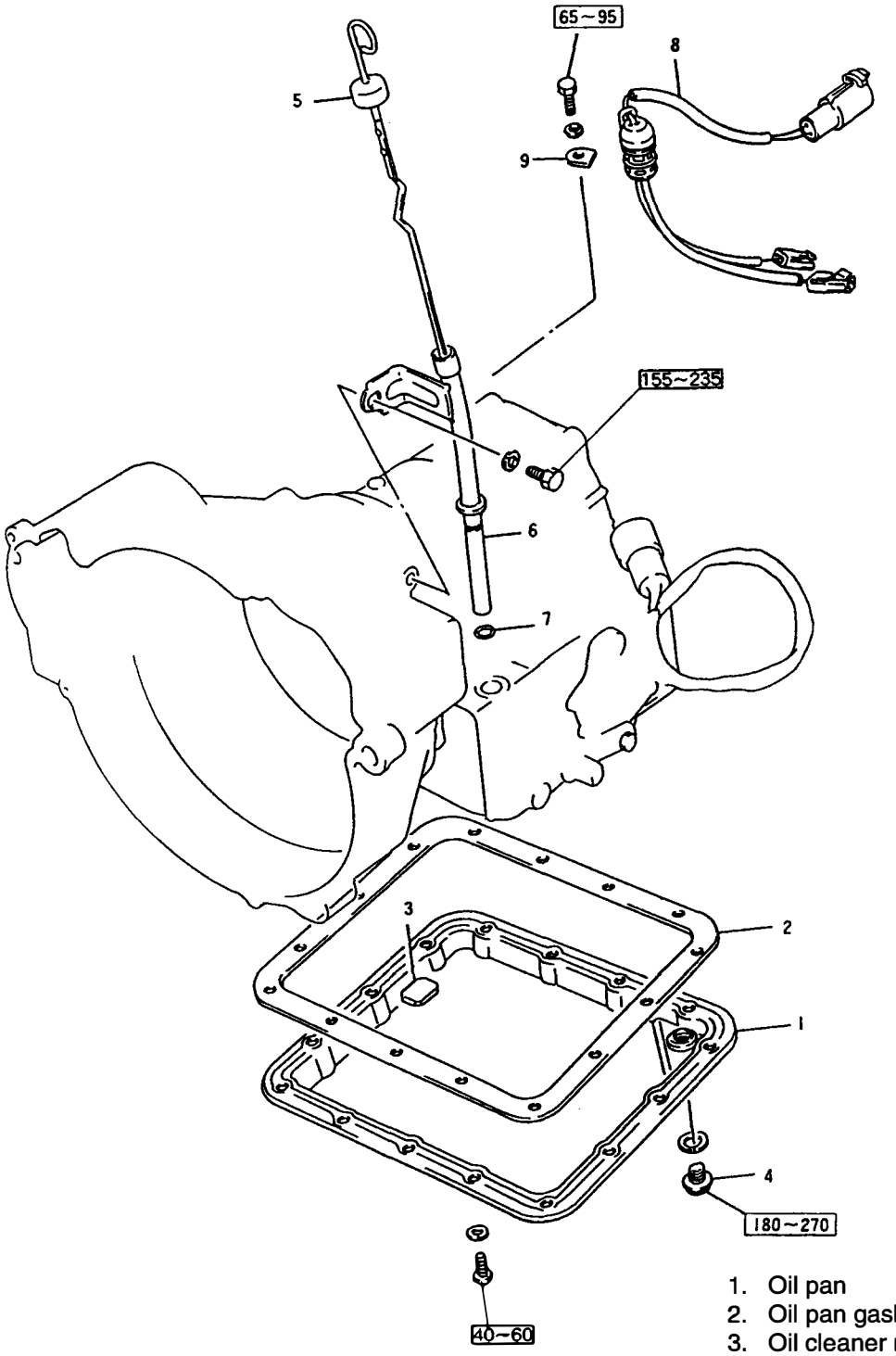
Transmission Case Assembly



1. Transmission case assembly
2. Breather plug
3. Torque converter housing
4. Extension case
5. Extension case gasket
6. Dust cover
7. Extension case oil seal
8. Cap

: Screw Torque (kg·cm)

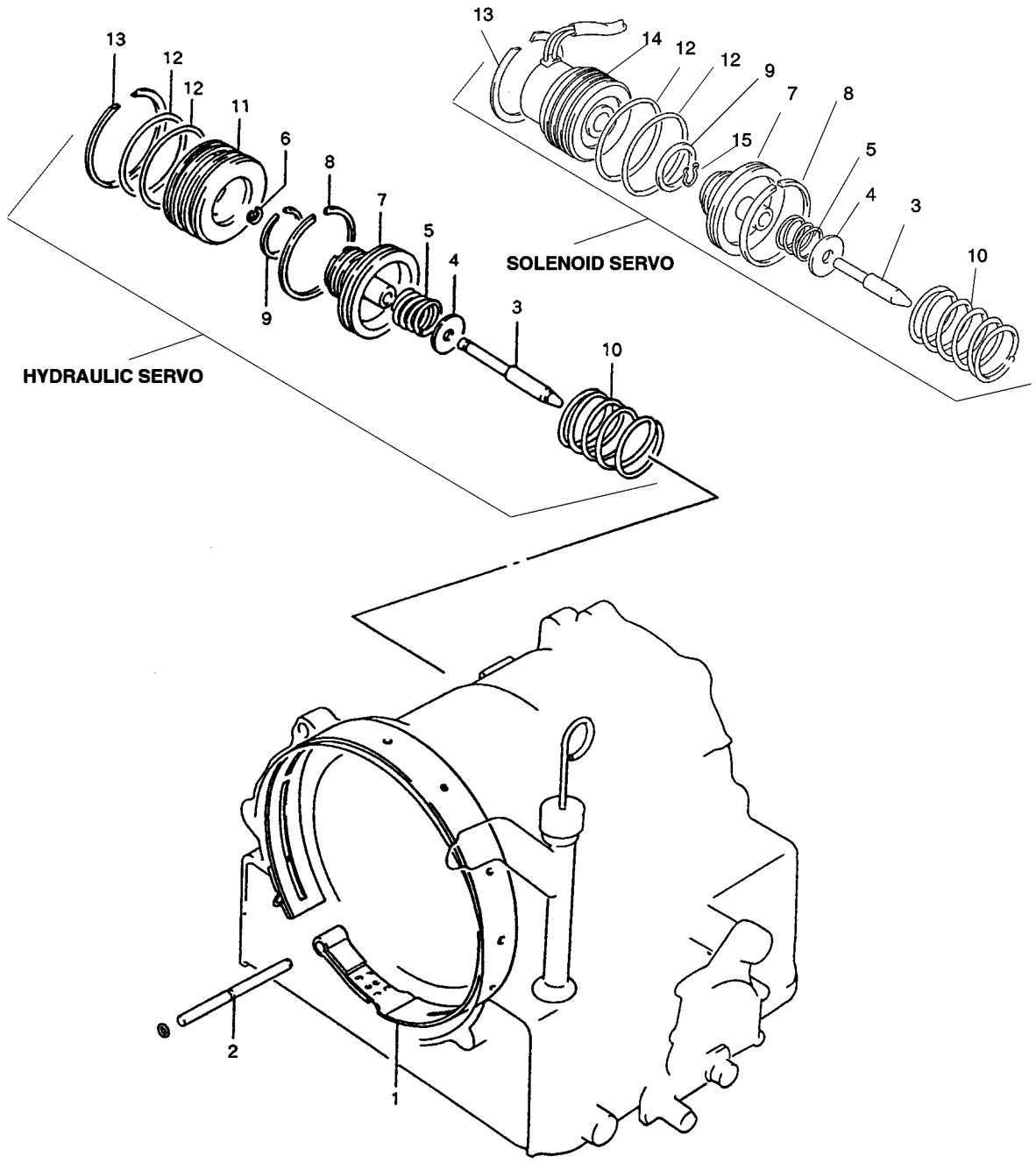
Oil Pan Assembly



1. Oil pan
2. Oil pan gasket
3. Oil cleaner magnet
4. Drain plug
5. Oil level gauge
6. Oil level guage
7. O–ring
8. Solenoid wire harness
9. Solenoid wire harness plate

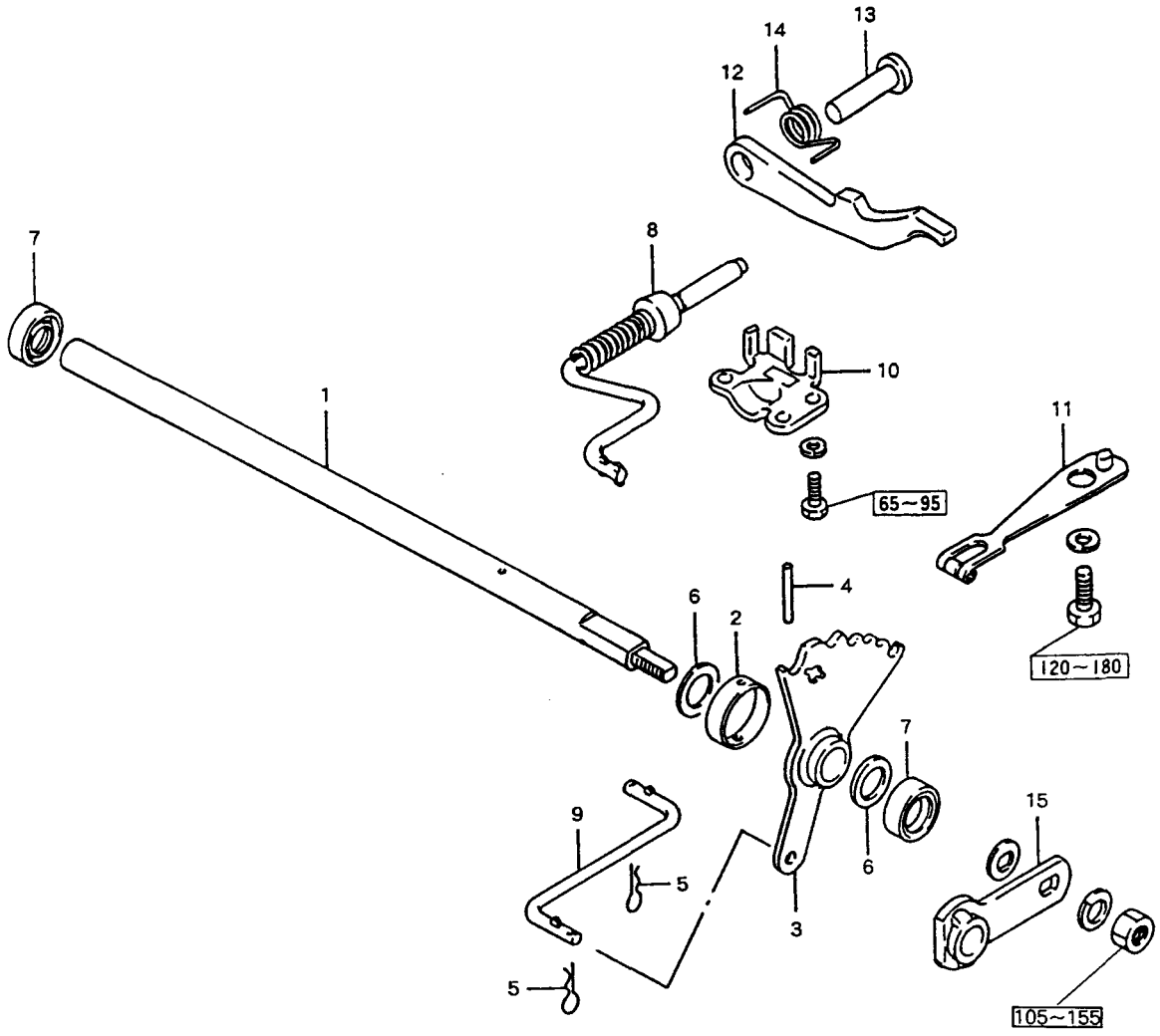
[ ]: Screw Torque (kg·cm)

Second Brake Assembly



1. Second brake band assembly
2. Brake band pin
3. Piston rod
4. Brake rod washer
5. Piston rod spring
6. E ring
7. Second brake piston
8. Piston seal
9. Piston seal ring
10. Piston return spring
11. Piston cover
12. Piston cover O–ring
13. Piston cover snap ring
14. Piston cover with solenoid
15. Snap ring

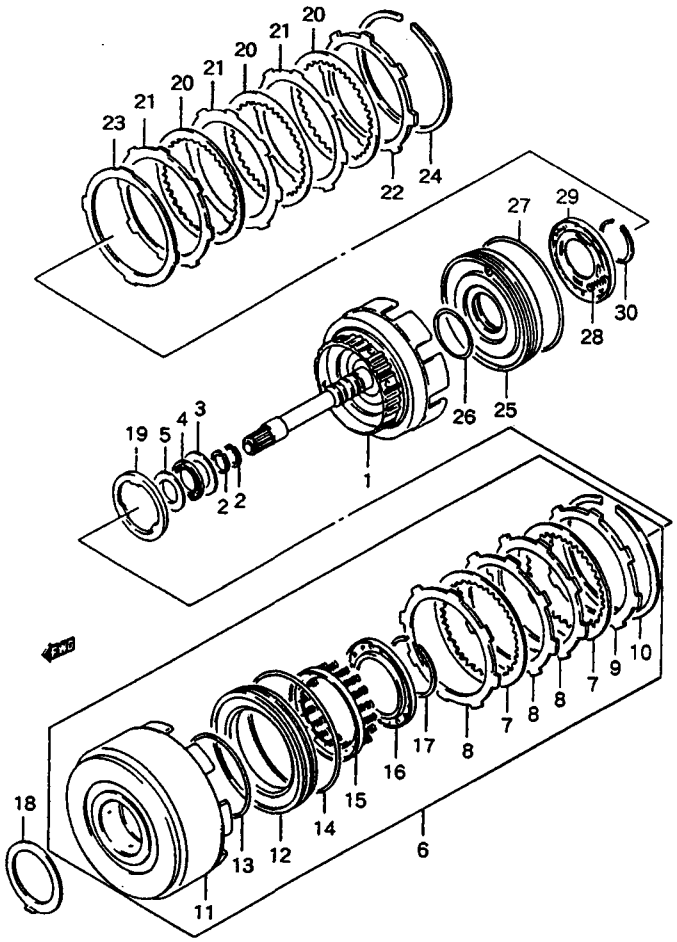
Manual Shift Assembly



1. Manual shift shaft
2. Spacer
3. Manual shift lever
4. Spring pin
5. Cotter pin
6. Washer
7. Oil seal
8. Parking lock rod
9. Manual shift lever rod
10. Parking lock ball bracket
11. Manual detent spring
12. Parking lock ball
13. Ball shaft
14. Spring
15. Manual shift lever

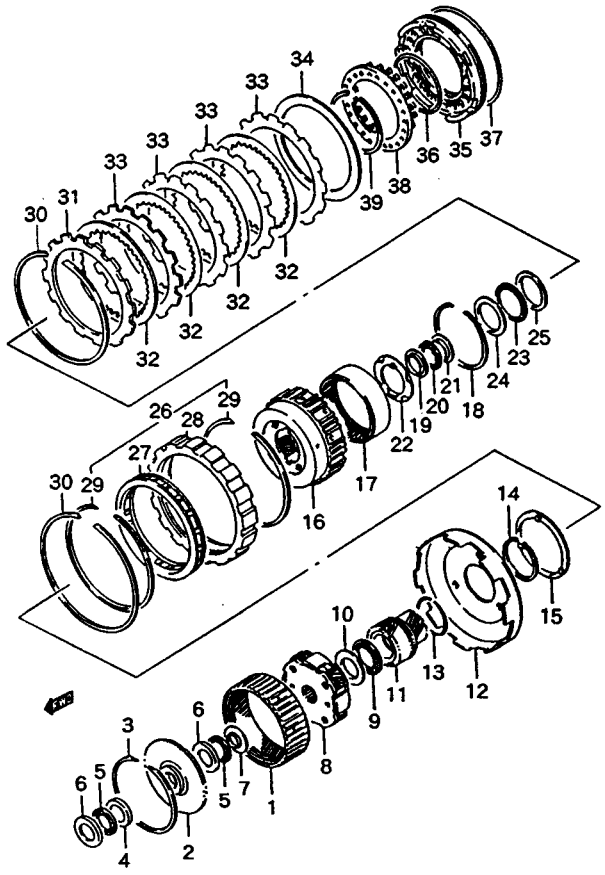
[ ] : Screw torque (kg ·cm)

Direct, Forward Clutch Assembly



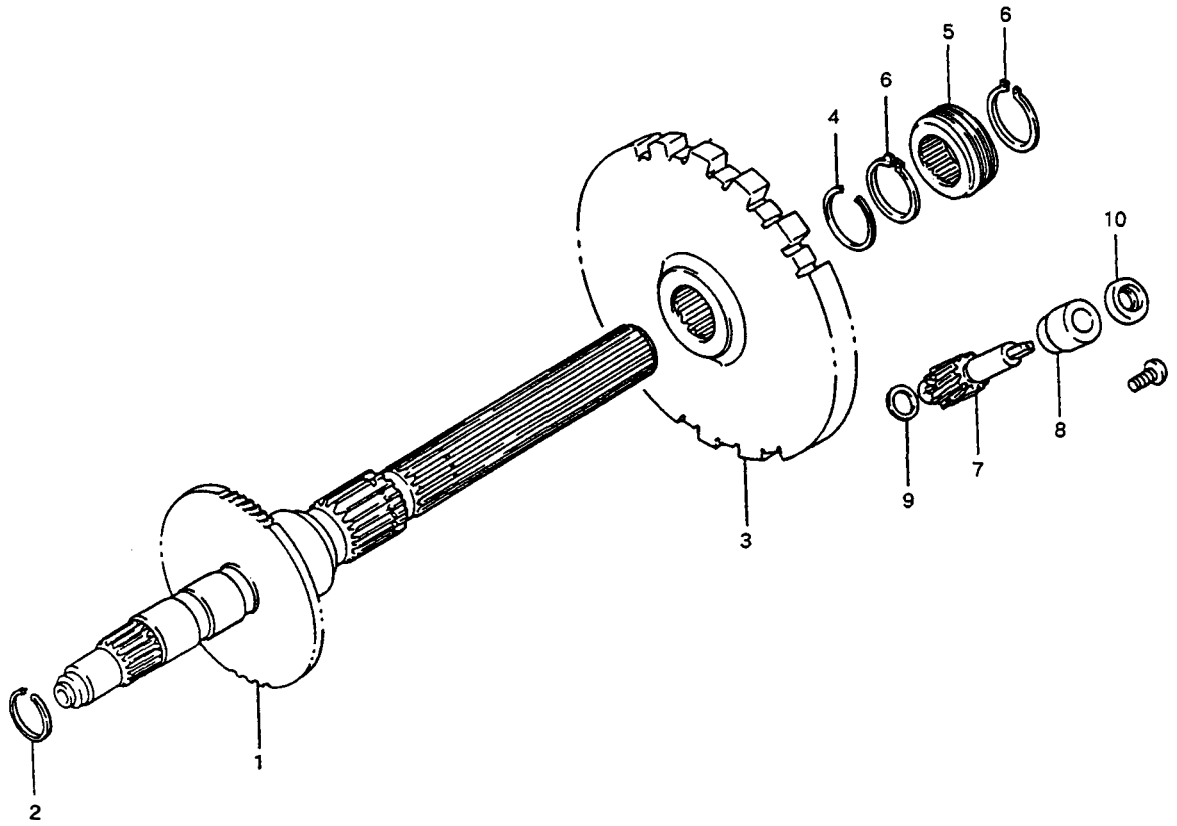
1. Input shaft
2. Input shaft seal ring
3. Input shaft bearing race
4. Input shaft bearing
5. Input shaft bearing race
6. Direct clutch assembly
7. Direct clutch plate
8. Direct clutch plate
9. Direct clutch flange
10. Clutch plate snap ring
11. Direct clutch drum
12. Direct clutch piston
13. Inner O–ring
14. Outer O–ring
15. Clutch return spring
16. Return spring seat
17. Clutch plate snap ring
18. Direct clutch Number 1 washer
19. Direct clutch Number 2 washer
20. Forward clutch disk
21. Forward clutch plate
22. Forward clutch flange
23. Forward clutch cushion plate
24. Clutch plate snap ring
25. Forward clutch piston
26. Inner O–ring
27. Outer O–ring
28. Piston leader spring
29. Return spring seat
30. Spring seat snap ring

Direct, Forward Clutch Assembly

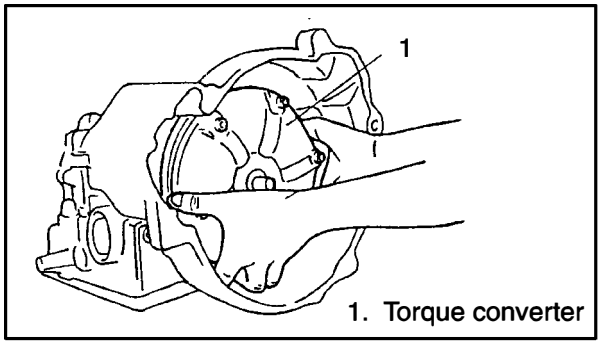


1. Front planetary ring gear
2. Ring gear flange
3. Ring gear snap ring
4. Ring gear race
5. Ring gear bearing
6. Ring gear race
7. Ring gear race
8. Front planetary gear assembly
9. Front planetary gear bearing
10. Front planetary gear race
11. Planetary sun gear
12. Sun gear input drum
13. Input drum snap Number 1 ring
14. Input drum snap Number 2 ring
15. Planetary thrust washer
16. Rear planetary gear assembly
17. Rear planetary ring gear
18. Ring gear snap ring
19. Rear ring gear race
20. Ring gear bearing
20. Ring gear bearing
21. Ring gear race
22. Rear planetary gear thrust washer
23. Rear ring gear bearing
24. Ring gear bearing race
25. Ring gear bearing race
26. One way clutch assembly
27. One way clutch
28. One way clutch race
29. One way clutch snap ring
30. One way clutch snap ring
31. First • Reverse brake flange
32. First • Reverse brake disk
33. First • Reverse brake plate
34. First • Reverse brake damper plate
35. First • Reverse brake piston
36. First • Reverse brake piston
37. Piston Inner O–ring
38. First • Reverse brake return spring
39. Return spring snap ring

Output Shaft Assembly



1. Output shaft
2. Output shaft seal ring
3. Parking lock gear
4. Snap ring
5. Speedometer drive gear
6. Saw clip
7. Speedometer driven gear
8. Bushing
9. Washer
10. Oil seal

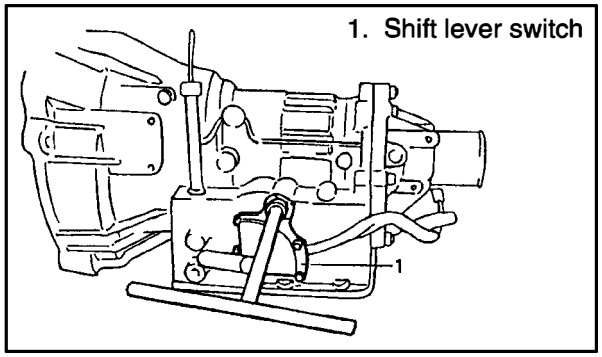


1. Torque converter

Transmission Unit

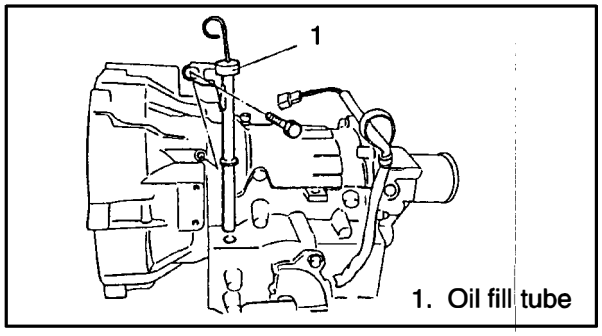
Analysis

1. Pull out the torque converter.
2. Remove the bolt. Take off the car speed sensor.



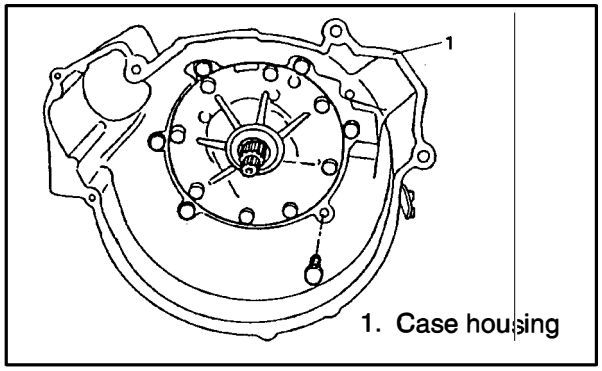
1. Shift lever switch

3. Take off the manual shaft lock nut. After taking off the shift select bar, take off the shift lever switch.



1. Oil fill tube

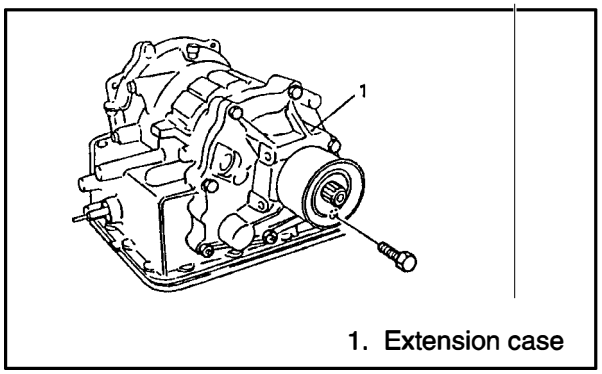
4. Remove the attachment bolt from the oil filler tube. Then pull out the tube. The tube should be lifted out in an upward direction.



1. Case housing

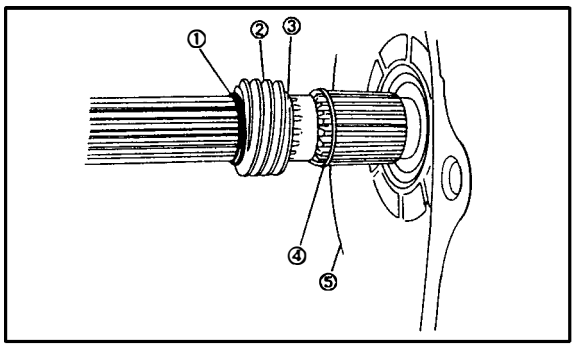
5. Take off all 6 bolts and remove the case housing with a plastic hammer.

Note: Make sure that the joint surface of the case has not been damaged by the driver.

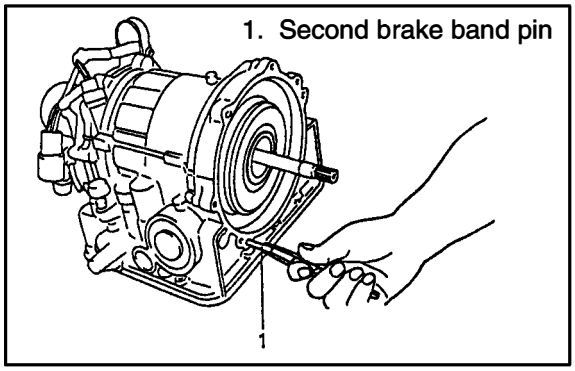


1. Extension case

6. Take off the seven bolts and remove the extension case.

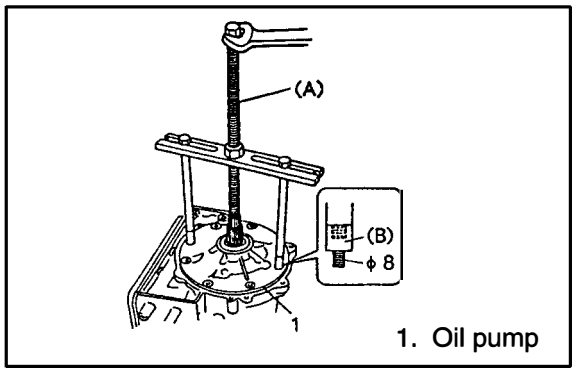


7. Speedometer drive gear & parking lock gear should be removed in the following order:
   1. Snap ring
   2. Speedometer drive gear
   3. Snap ring
   4. Snap ring
   5. Parking lock gear



8. Pull out the second brake band pin.

Note: Remember the chamfer direction.

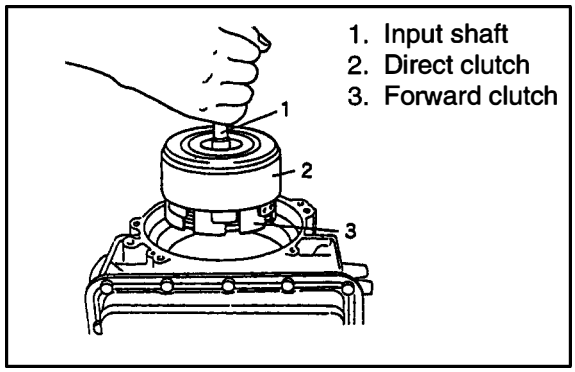


9. Remove the 8 bolts from the oil pump. Use a special tool and remove the oil pump.

Special Tools: (A) Oil pump remover: 09918–48211
(B) Oil pump remover attachment: 09918–48220

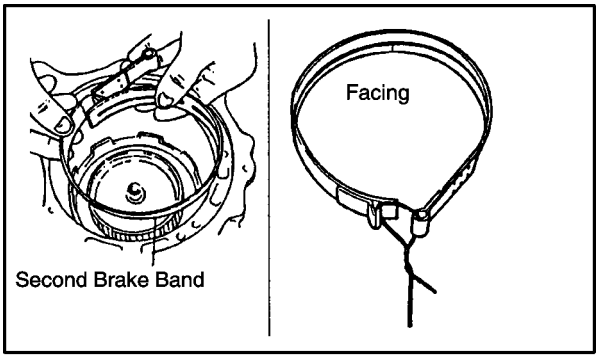
Note : The oil pump's front surface should be pulled out in an upward direction.

The oil pump cover O–ring should be removed from the housing. Then the oil pump can be removed. The oil pump should be shaken and twisted while it is being removed.



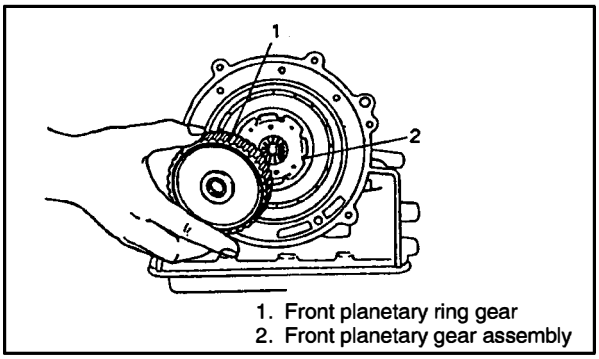
10. Remove the direct clutch and the input shaft.

Note : Be careful not to mix up the order of the ring gear race and the bearings attached to the for ward clutch. When the unit is taken apart, be sure to keep the pieces safely together in the appropriate order.



11. Remove the second brake band.

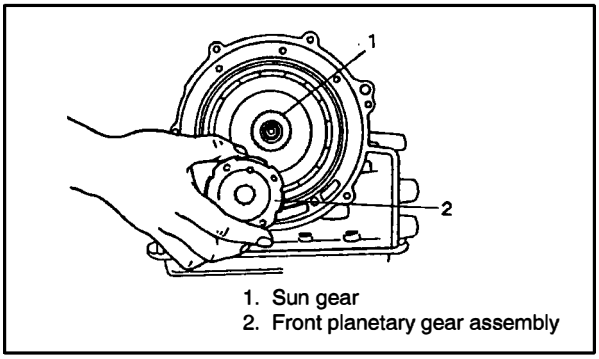
Note: When the second brake band is opened, it is easy to get a crack in the facing. It should be kept together with a wire.



1. Front planetary ring gear
2. Front planetary gear assembly

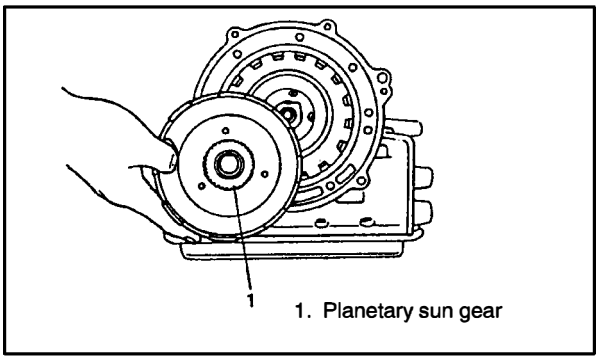
12. Remove the front planetary ring gear.

Note : Be careful not to mix up the order of the ring gear race and the bearings attached to the front plane tary ring gear. When the unit is taken apart, be sure to keep the pieces safely together in the appropri ate order.



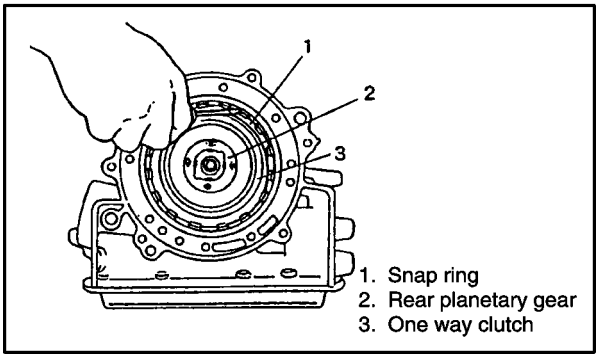
1. Sun gear
2. Front planetary gear assembly

13. Remove the front planetary gear assembly.



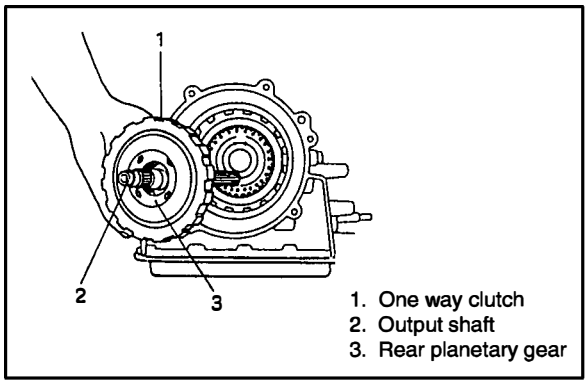
1. Planetary sun gear

14. Remove the planetary sun gear and sun gear input drum.

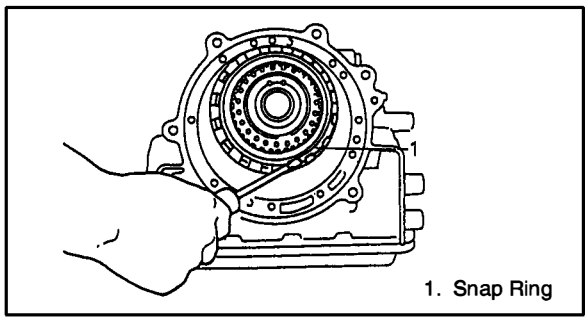


1. Snap ring
2. Rear planetary gear
3. One way clutch

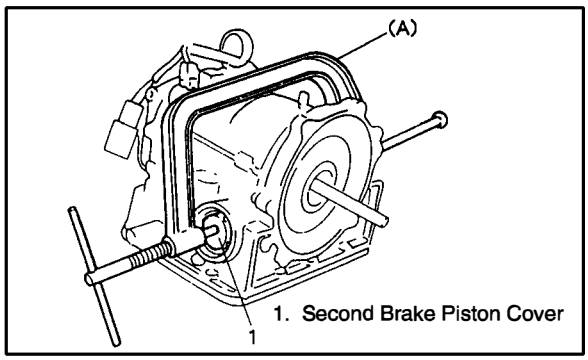
15. Remove the one– way clutch snap ring



16. Remove the one way clutch, rear planetary gear and the output shaft.



17. Remove the first reverse brake snap ring. Then remove the flange, the disk, the plate, and the cushion plate.

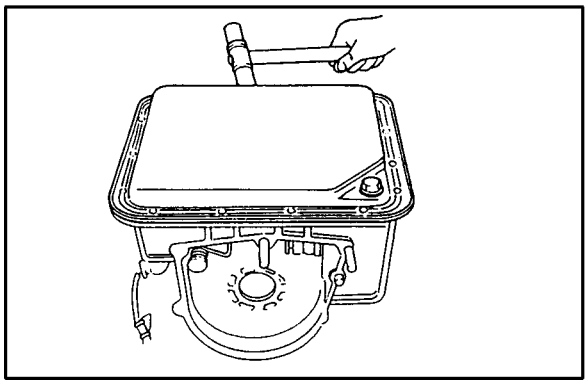


18. Use a special tool to push the piston cover and take off the snap ring and then remove the second brake piston.

Special tool: (A): Valve lifter : 09916–14510

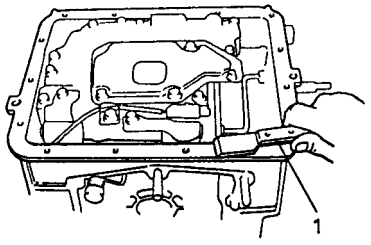
Note: Do not push the piston cover any more than necessary.

Push the center of the piston cover.



19. Take off Bolt 15. Then use a plastic hammer to pound around and remove the oil pan.

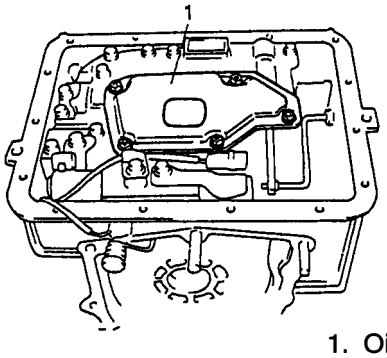
Note: Do not insert any object such as a screwdriver into the oil pump joint surface.



1. Scraper

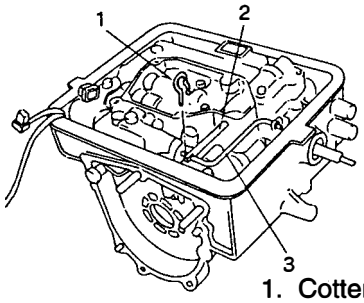
20. Remove the oil pan gasket.

Note: Completely remove the gasket that is attached to the joint surface.Make sure there are no small pieces of the gasket loose inside the mechanism. Keep all parts clean.



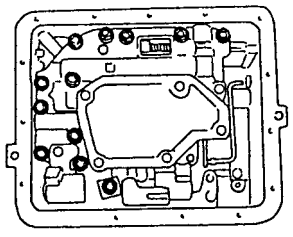
1. Oil Strainer

21. Takeoff the five bolts and remove the oil strainer. At this time, the solenoid coupler two pieces can be removed.

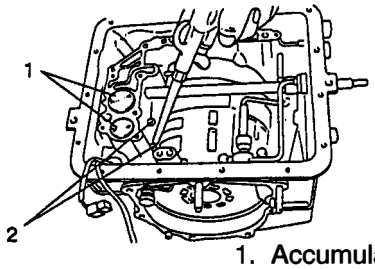


1. Cotter pin
2. Manual valve
3. Manual valve links

22. Pull out the cotter pin from the manual valve side . Then remove the manual valve links.



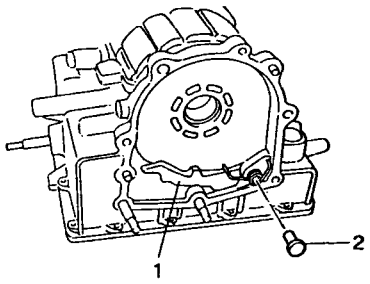
23. Take off the 12 bolts and remove the valve body..



1. Accumulator piston
2. Oil hole

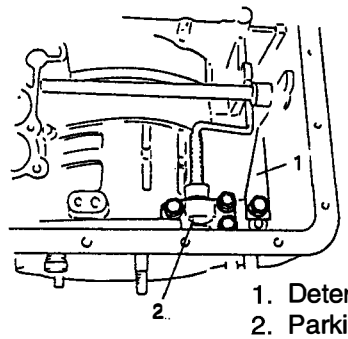
24. Use an air gun to blow air through the oil passage. (The compressed air pressure should be about 1 kg/sq. cm). Then remove the accumulator piston.

Note: The accumulator piston may blow out. The recom mended procedure is to put your hands on it.



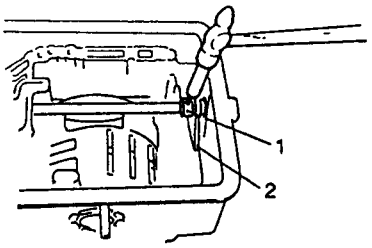
1. Parking lock ball
2. Parking lock ball shaft

25. Pull out the parking lock ball shaft. Remove the parking lock pole.



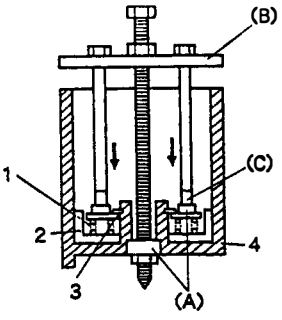
1. Detent spring
2. Parking lock bolt bracket

26. Remove the 4 Bolts. Then remove the manual detent spring and the parking lock ball bracket.



1. Cover
2. Shift lever

27. Use a drill to take off the manual lever collar caulking. Then pull the spring pin and pull the shaft out the shift lever side. Then lift out the lever, the links, and the parking lock rod. These pieces should be lifted straight out together and removed.



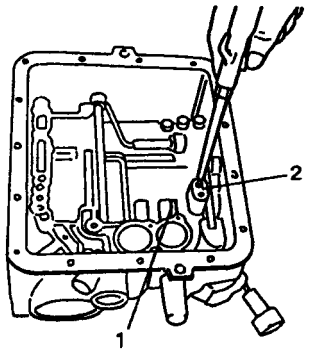
1. Return spring
2. Piston
3. Snap ring
4. Case

28. Use a special tool to push down the return spring and remove the snap ring.

Special Tools

A.	Spring compressor Number 1 set:	09926–98320
B.	Oil pump remover:	09918–48211
C.	Oil pump remover attachment:	09918–48220

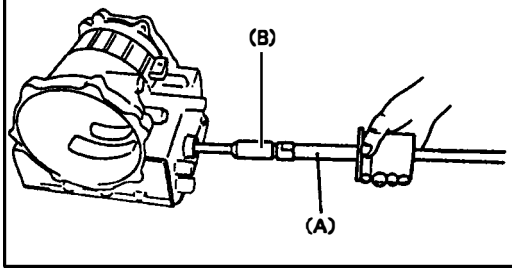
Note: Fix the oil pump remover shaft in a stable position.
Tighten up the nut side.
Do not push on the return spring any more than necessary.



1. Piston
2. Oil Hole

29. Blow air through the oil passage. Pull out the first reverse brake piston.

Note: Do not let the piston be positioned in a slanted orientation. Be sure to only blow the air through gently a little at a time, so the piston does not end up slanted.
If blowing air through the passage does not release the piston, it can be pulled out with pliers.

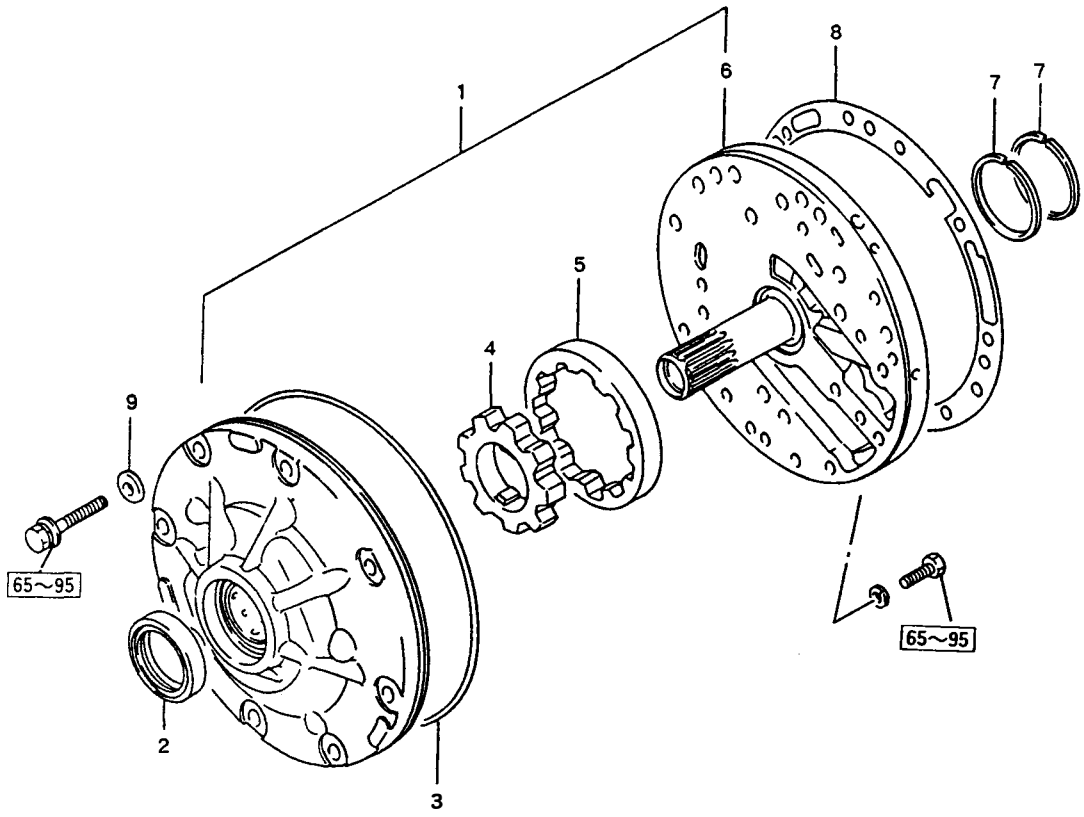


30. Use a special tool to pull out the oil seal.

Special Tools

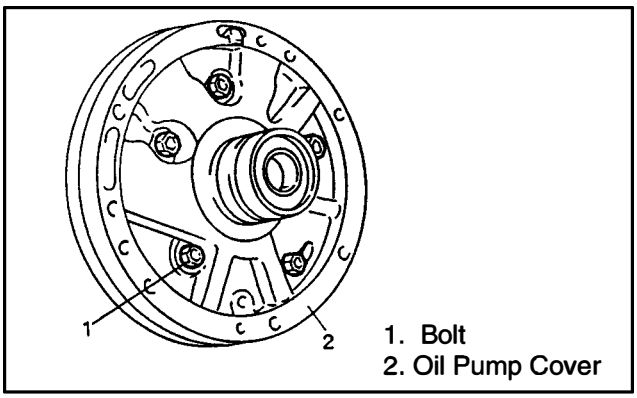
(A) Rotor remover slide shaft: 09930–30102
(B) Bearing remover: 09921–20201

Subassembly Analysis
Oil Pump Assembly



1. Oil pump body assembly
2. Oil pump body oil seal
3. Oil pump cover O–ring
4. Inner Gear
5. Outer gear
6. Oil pump cover
7. Oil pump cover seal ring
8. Oil pump gasket
9. Seal

Tightening torque (kg w cm)

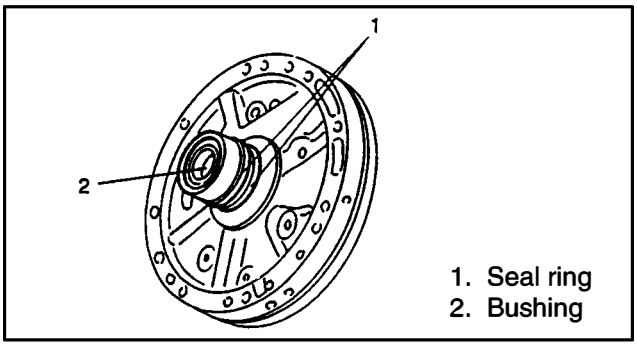


1. Bolt
2. Oil Pump Cover

Analysis

1. There are 5 bolts that should be taken off. Then take off the oil cover. Then remove the outer and the inner gears.

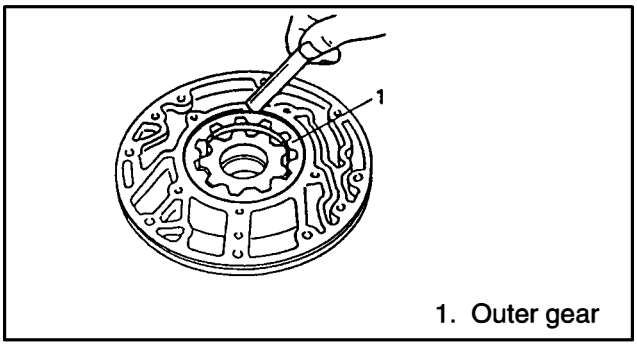
2. Take off the oil pump cover O–ring.



1. Seal ring
2. Bushing

Inspection

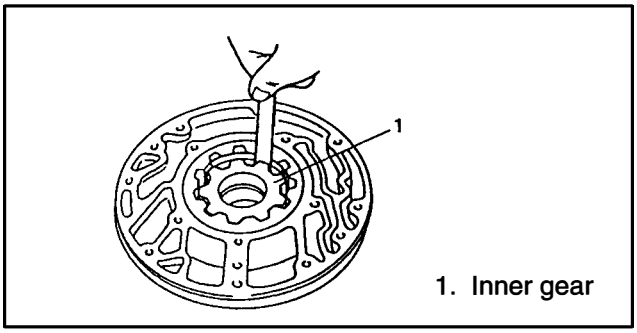
1. Make sure to check for damaged and worn seal rings and bushings.



1. Outer gear

2. Measure the outer gear body clearance with a thickness gauge.

Clearance:	**Standard amount:**	**.08 ~ .15 mm**
	Limits:	.30 mm

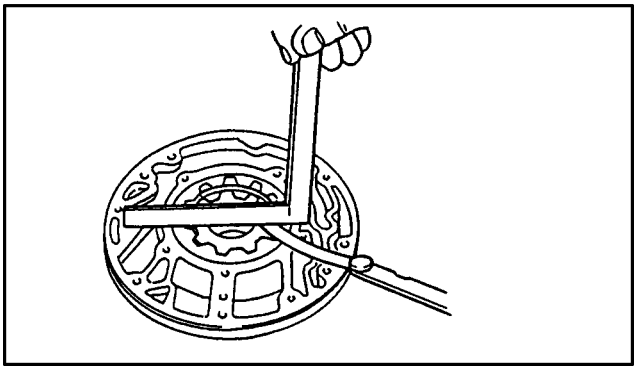


1. Inner gear

3. Measure the inner gear and the outer gear chip clearance with a thickness gauge.

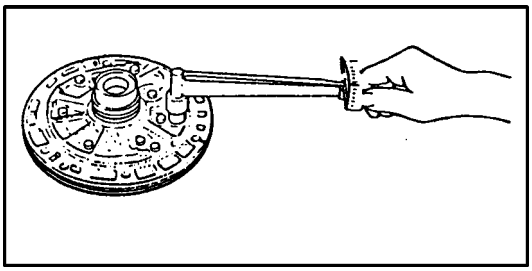
Clearance:	**Standard amount:**	**.13 ~ .20 mm**
	Limits:	0.30 mm

Note: Make sure to do the measurements when the torque converter is attached.



4. Measure the inner gear, the outer gear and the pump body for side clearance.

Clearance:	**Standard amount:**	**.02 ~ .05 mm**
	Limits:	0.1 mm



Installation

The installation procedure is exactly the opposite of the disassembly procedure. Be sure to be careful about the following points:

When the inner gear and the outer gear are attached to the pump body, make sure to apply ATF to the gears first.

When attaching the pump cover, make sure not to damage the oil seal. The spline can scrape or damage the oil seal. Please be careful.

Use the standard tightening torque when tightening the pump body.

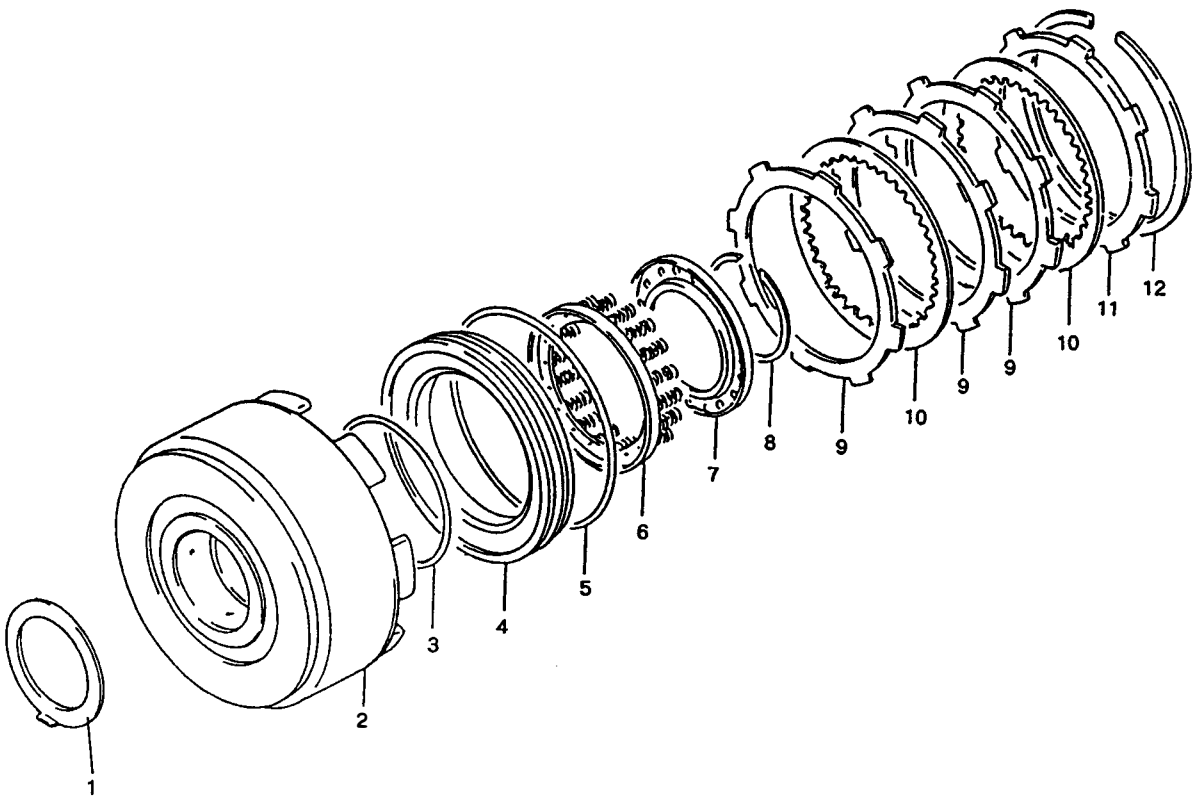
Tightening torque: 65 ~ 95 kg·cm

When attaching the O–ring and the oil seal, make sure that there is sufficient ATF applied and that they fit properly in their grooves.

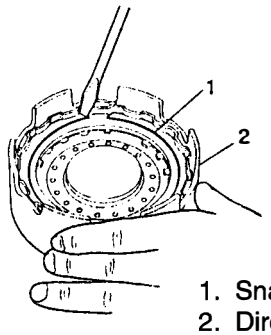
After the O–ring and the oil seal are attached, make sure that the inner gear rotates smoothly. At this time use a torque converter to check the rotation.

Note: When attaching the oil pump, and attaching bolts in the bolt holes, be careful that the bolts fit well. The bolts with double–cut tops and ridged slices on the sides need to match up well with the machine holes.

Direct Clutch Assembly



1. Direct clutch washer
2. Direct clutch drum
3. Inner O–ring
4. Direct clutch piston
5. Outer O–ring
6. Clutch return spring
7. Return spring seat
8. Spring seat snap ring
9. Clutch plate
10. Clutch plate
11. Clutch flange
12. Clutch plate snap ring



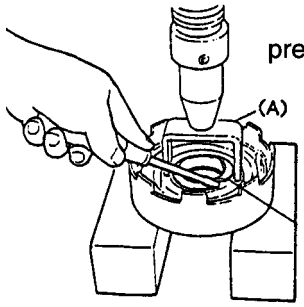
1. Snap ring
2. Direct clutch assembly

Analysis

1. Take off the snap ring. Then take off the clutch flange and the clutch disk.

Note: Before performing the analysis, measure the height of the snap ring and the flange.

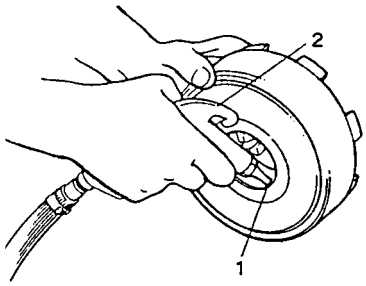
Make sure to check to see if they are within the standard value range. (Refer to 2B–61)



2. Use a special tool to push down the spring seat and then take off the snap ring.

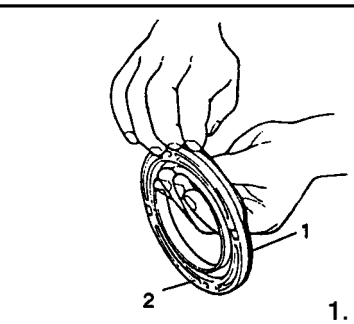
Note: Do not push the spring seat down any more than necessary.

Special tool : (A): Spring Compressor 09926–98330



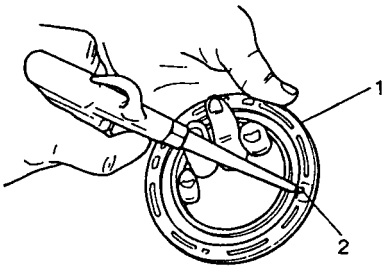
1. oil hole
2. air gun

3. From the oil passage use an air gun to blow air. Make sure that the other holes are closed. Then take off the piston.



1. Outer O–ring
2. Piston

4. Take off the O–ring.

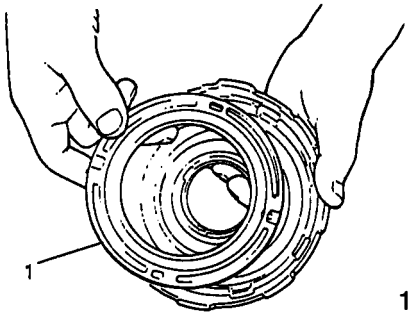


1. Piston
2. Check valve

Inspection and Maintenance

Make sure to check that the check ball is able to move freely.

Blow air and check the check valve to be sure that it is not clogged up.



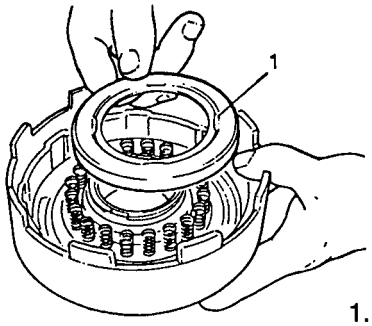
1. Piston

Installation

The installation procedure is exactly the opposite of the disassembly procedure. Be sure to be careful about the following points:

Inner and outer O–ring should be replaced with new parts.

Install the ATF application.



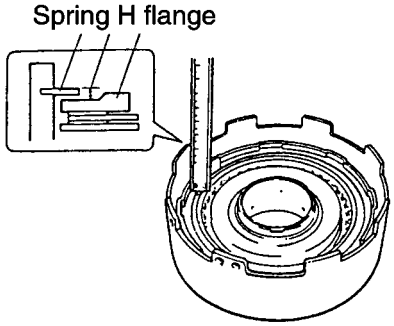
1. Projection

When the piston is inserted into the clutch drum, make sure that the O–ring does not get twisted or come off. You need to be especially careful on this point.

Make sure that the C–ring fits into the spring seat of the four projections.

The clutch disk and the clutch plate need to be put in the proper order. Be certain not to mix up the clutch disk and the clutch plate. (Plate®Disk®Plate®Plate®Disk)

When the new clutch disks are installed, be sure to soak them for at least two hours in ATF.

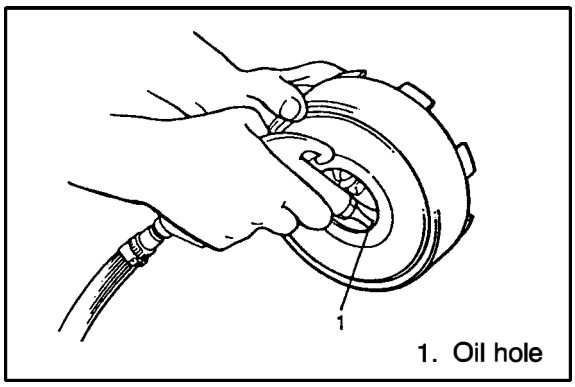


Measure the height of the snap ring and the clutch flange.

Snap Ring Height: 2.53~3.06 mm

Even when a new clutch and new plates are installed, they still may not be within the standard range. Follow the thickness of the clutch flange when making a selection of replacement materials.

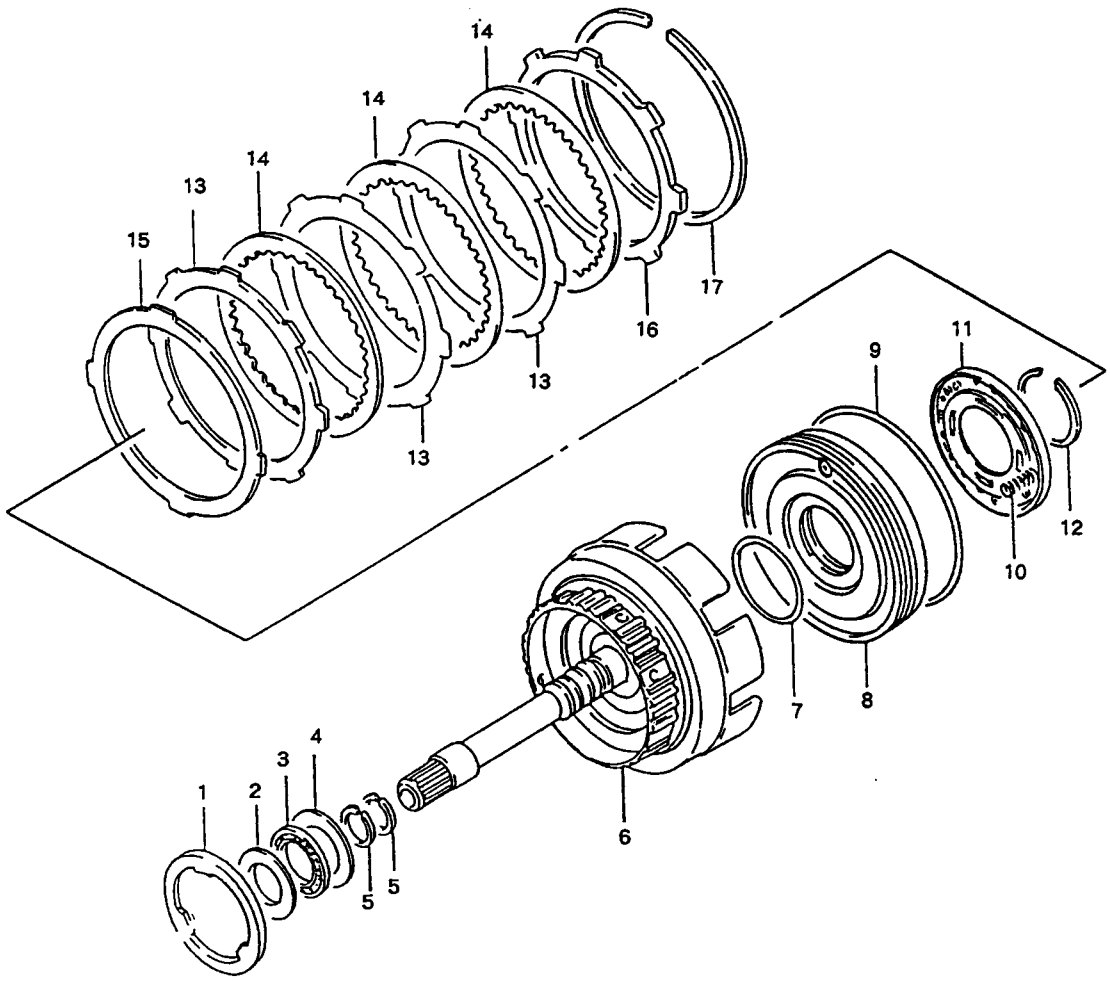
Spare clutch flange thickness: 3.30 mm
3.33 mm
3.51 mm



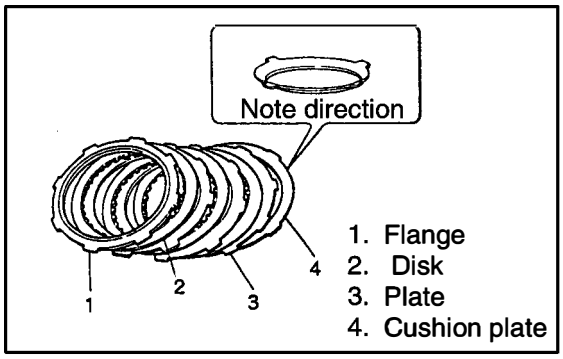
1. Oil hole

Blow air through the oil drum passage and make sure that the piston will move.

Forward Clutch Assembly



1. Direct clutch washer
2. Input shaft bearing race
3. Input shaft bearing
4. Input shaft bearing race
5. Input shaft seal ring
6. Input shaft
7. Inner O–ring
8. Forward clutch piston
9. Outer O–ring
10. Piston return spring
11. Return spring seat
12. Spring seat snap ring
13. Clutch plate
14. Clutch disk
15. Clutch cushion plate
16. Clutch cushion flange
17. Clutch plate snap ring

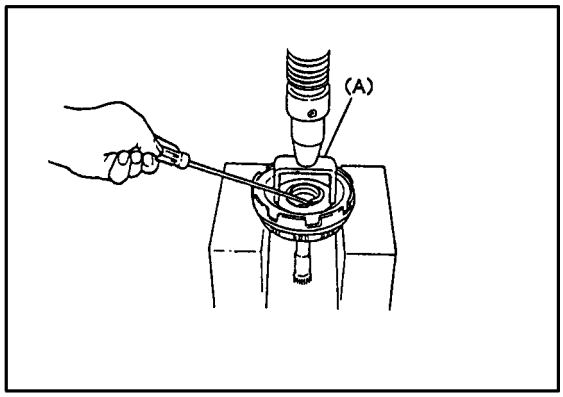


1. Flange
2. Disk
3. Plate
4. Cushion plate

Analysis

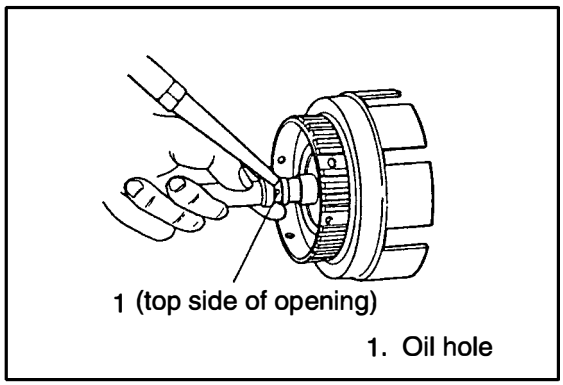
1. Remove the clutch plate snap ring and the flange, disk, plate, and cushion plate.

Note: Make sure to remember to follow the cushion plate direction.



2. Use a special tool and take off the snap ring.

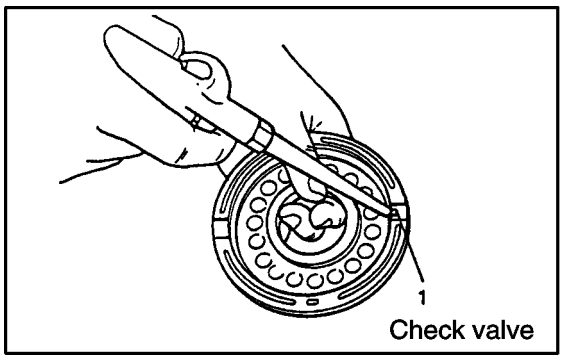
Special Tool: (A) Spring compressor: 09926–98330



1 (top side of opening)

1. Oil hole

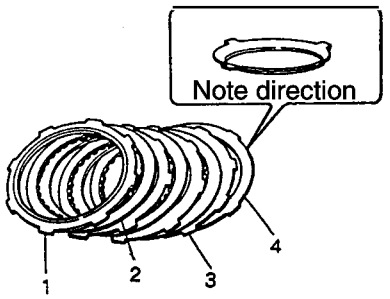
3. From the input shaft's oil hole, blow air through and take off the piston.



Check valve

Check valve

Be sure that the check ball moves freely.
Blow air through and then check to see if the check valve is clogged up.



1. Flange
2. Disk
3. Plate
4. Cushion plate

Installation

The installation procedure is exactly the opposite of the disassembly procedure. Be sure to be careful about the following points:

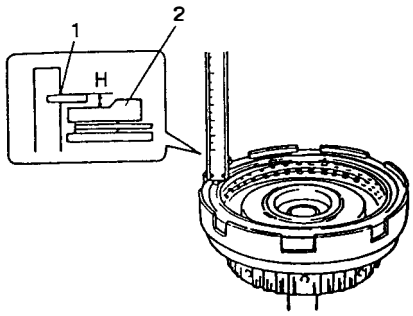
Inner and outer O–ring should be replaced with new parts. Install the ATF application.

When the piston is inserted in the clutch drum, make sure that the O–ring does not get twisted or come off. You need to be especially careful on this point.

The dumper plate should be attached like a dish.

Make sure that the C–ring fits into the spring seat of the four projections.

The clutch disk and the clutch plate need to be put in the proper order. Be certain not to mix up the clutch disk and the clutch plate.



1. Snap Ring
2. Flange

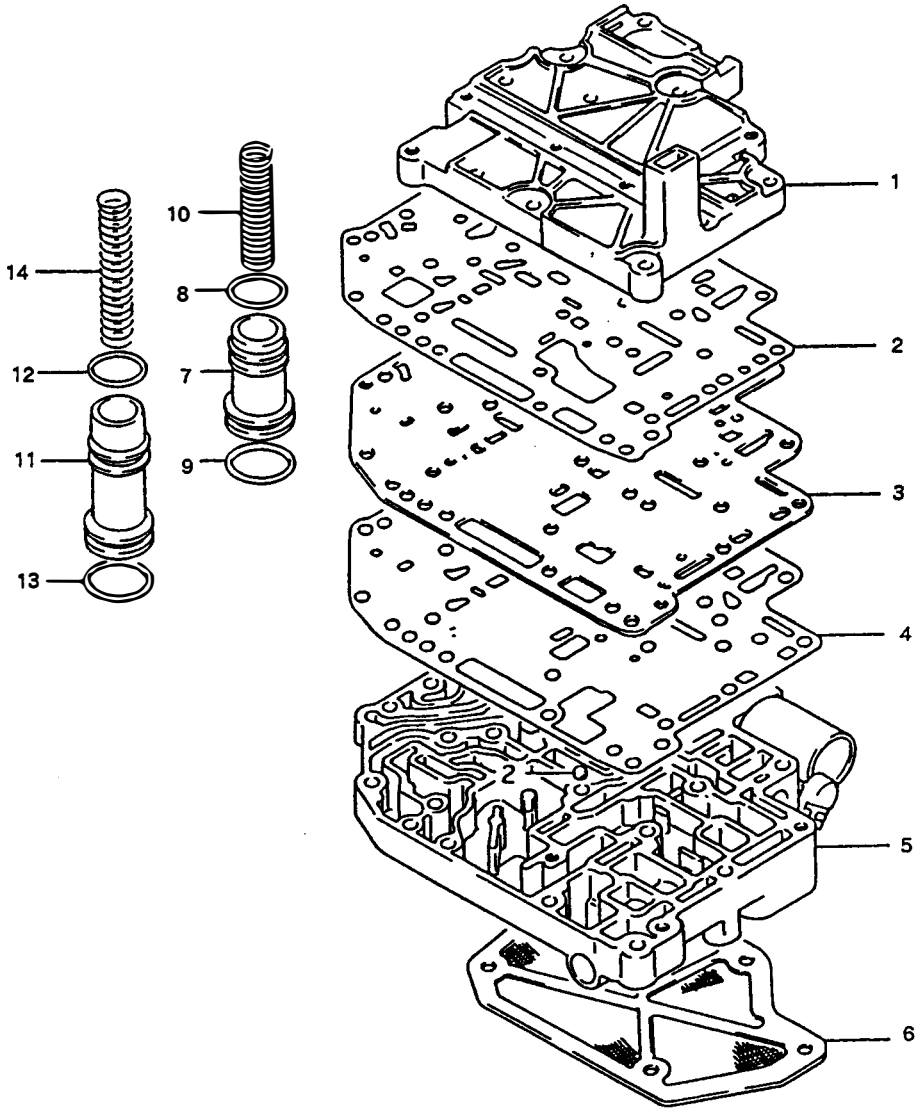
Measure the height of the snap ring and the clutch flange.

Snap Ring Height: 2.01~2.68 mm

Even when a new clutch and new plates are installed, they still may not be within the standard range. Follow the thickness of the clutch flange when making a selection of replacement materials.

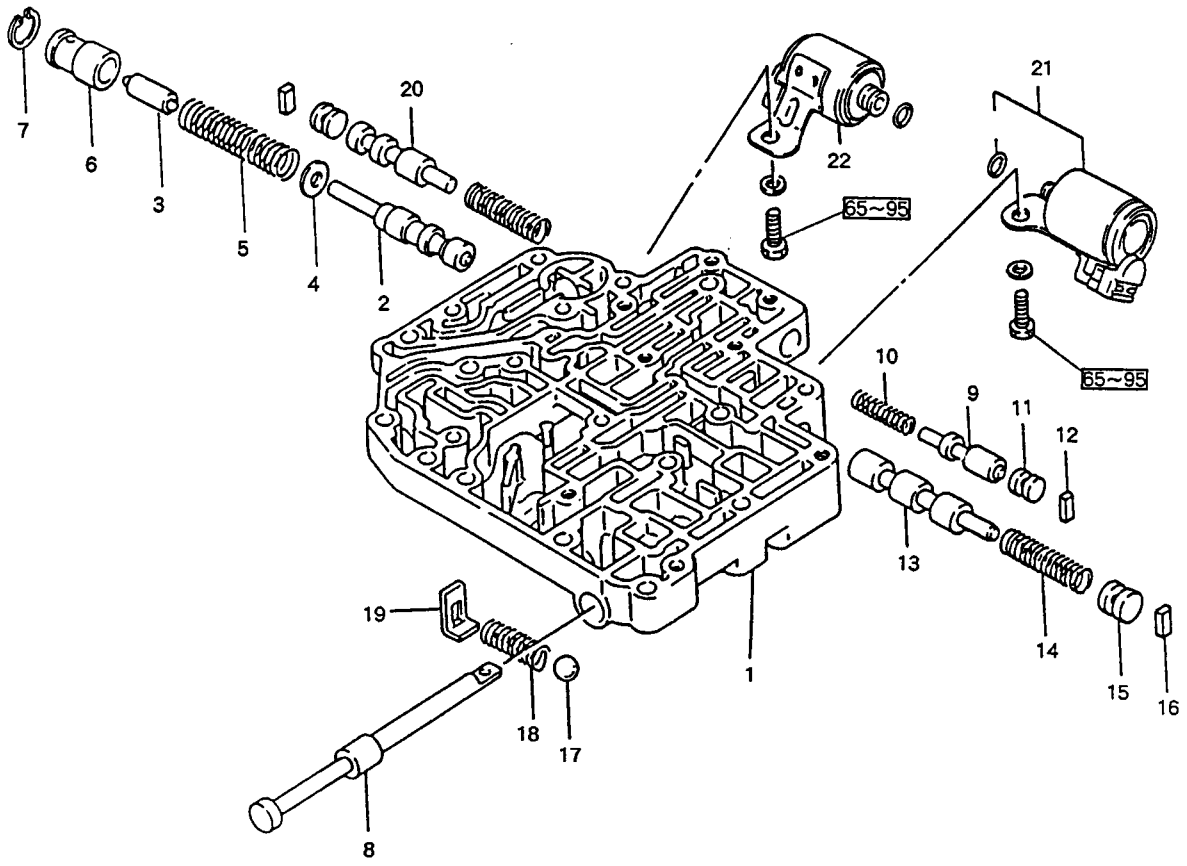
Spare clutch flange thickness:	3.30 mm
	3.33 mm
	3.51 mm

Valve Body

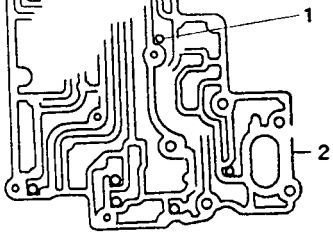


1. Upper Valve Body
2. Valve Body Gasket Number 1
3. Valve Body Plate
4. Valve Body Gasket Number 2
5. Lower Valve Body
6. Oil Strainer
7. Accumulator Forward Clutch Piston
8. Upper O–Ring
9. Lower O–Ring
10. Accumulator Return Spring
11. Accumulator Second Brake Piston
12. Upper O–Ring
13. Lower O–Ring
14. Accumulator Return Spring

Inspection Analysis



1. Lower Valve Body
2. Pressure Regulator Valve
3. Pressure Regulator Valve Plunger
4. Plate Washer
5. Valve Spring
6. Valve Sleeve
7. Ring
8. Manual Valve
9. Low Cost Modulator Valve
10. Modulator Valve Spring
11. Plug
12. Key
13. 1–2 Shift Valve
14. Shift Valve Spring
15. Plug
16. Key
17. Ball
18. Spring
19. Bracket
20. 2–3 Shift Valve
21. Shift Solenoid Number 1
22. Shift Solenoid Number 2

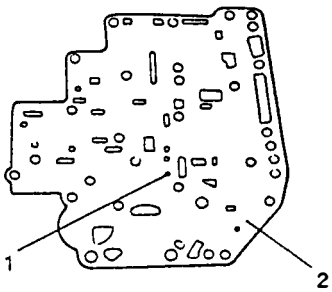


1. Steel ball
2. Upper body

Analysis Procedure Warning

When pulling the upper body from the lower body, lay the upper body down on its lower side.

In the event of clutch and brake burnout, you have to perform control valve maintenance and analysis.



1. Orifice
2. Plate

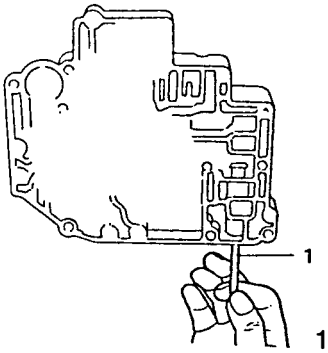
Inspection and Maintenance

Valve body gasket, plate

Check the gasket for damage or swelling..

Check for damage to the plate.

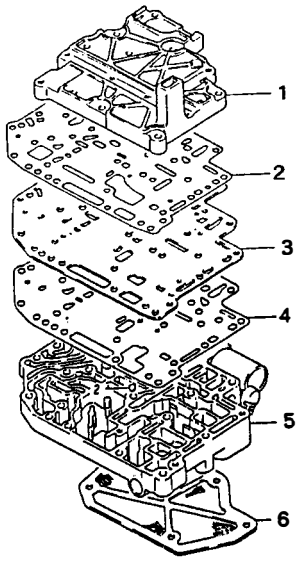
Make sure to check that the plate orifice is not clogged. If it is clogged, use the air blow– through treatment.



1. Manual valve

Control Valve

Check to see that each valve is moving smoothly.
Each valve should be checked for damage or for foreign objects that may have become stuck in them.



1. Upper body
2. Gasket Number 1
3. Plate
4. Gasket Number 2
5. Lower body
6. Strainer

Caution regarding Assembly

Assembly is the reverse order of the steps in analysis.

When attaching the valve, make sure that ATF is applied first.

The valve body strainer should be washed completely and then dried with an air gun.

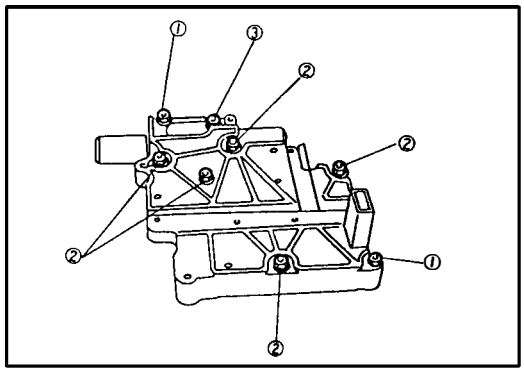
Do not use the waste.

Be careful when assembling the gaskets not to mix them up.

Gasket number 1 should be on the upper body side.

Gasket number 2 should be on the lower body side.

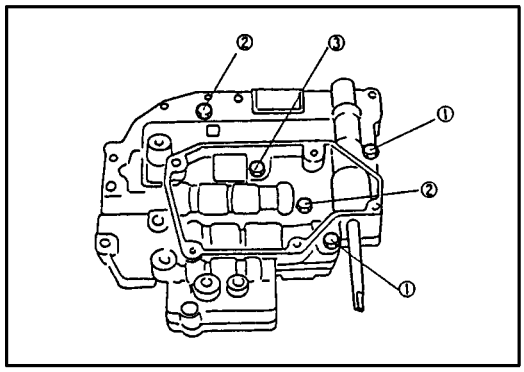
Upper Body Attachment



Use two reamer bolts to temporarily hold position.
Tighten the bolts in diagonal order.
Use a limit wrench to tighten to standard torque.

Number	Type	Length from Neck to Base (mm)
1	Reamer Bolt	23
2	Regular bolt	23
3	Regular bolt	18

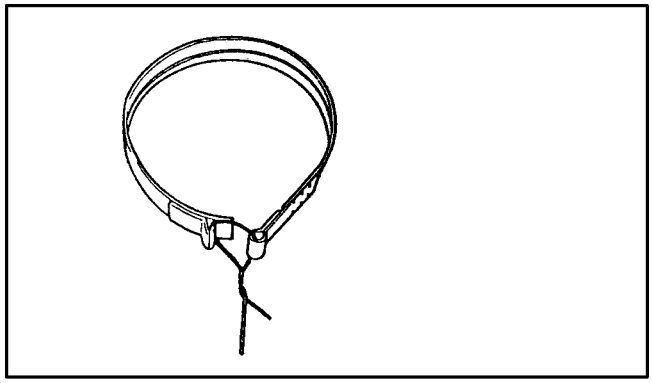
Tightening torque: 52~58kg·cm



Attach the lower body.
Tighten the bolts in diagonal order.
Use a limit wrench and tighten to standard torque.

Number	Type	Length from Neck to Base (mm)
1	Regular bolt	38
2	Regular bolt	30
3	Regular bolt	23

Tightening torque: 52 ~ 58 kg · cm

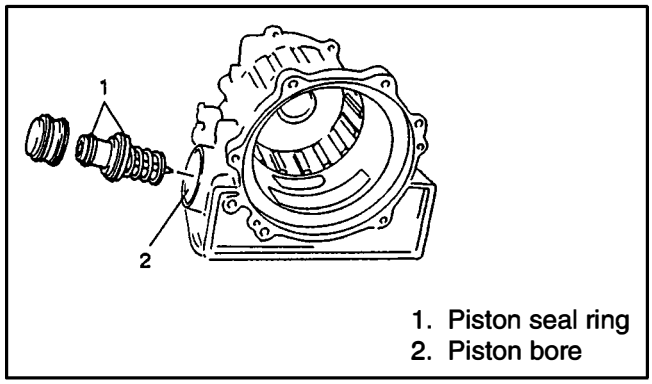


Second Brake Inspection

Second Brake Band

Perform a general visual inspection of the second brake band and look out for bands that may be damaged, worn out or changed from the original color. All of these need to be replaced.

Note: New second brake bands should be soaked at least two hours in ATF before they are used.

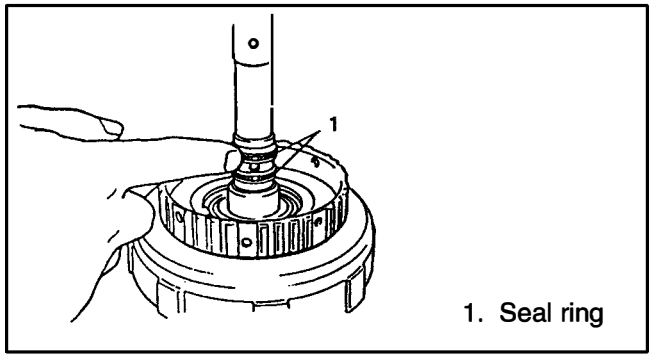


1. Piston seal ring
2. Piston bore

Second Brake Piston

The piston seal ring should be checked for damage.

Perform a visual inspection of the transmission case piston bore. Look for damage or signs of worn out parts.

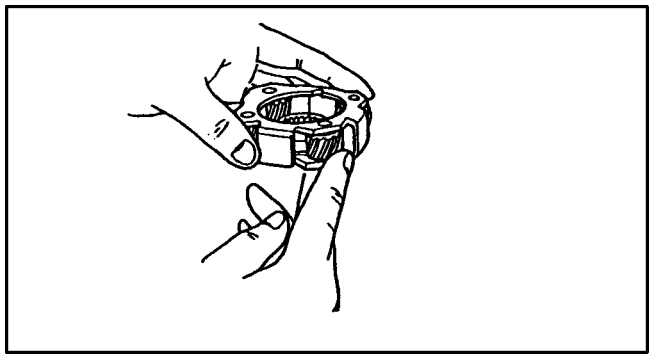


1. Seal ring

Input Shaft Inspection

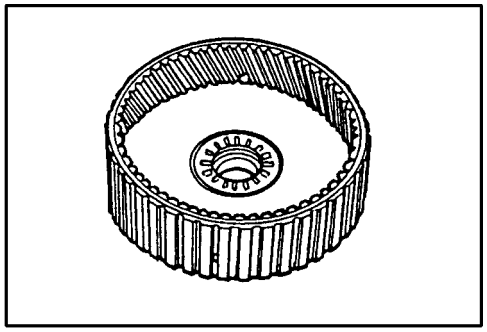
Perform a visual inspection of the spline. Watch for damage or signs of worn out parts.

Perform a visual inspection of the seal ring. Watch for damage or signs of worn out parts



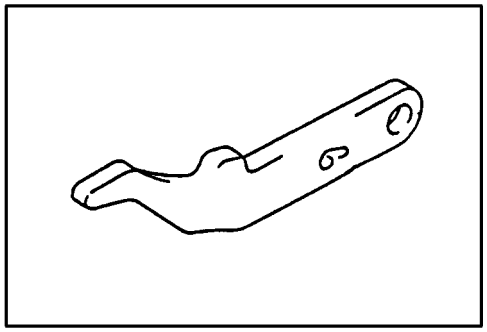
Planetary Gear Inspection

Inspect each gear and check to see if there is damage, color change, noise, and smoothness.



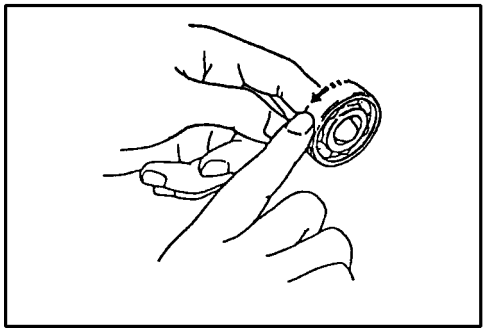
Planetary ring gear
Inspection

The gear teeth surface should be given a general visual inspection and checked for damaged or worn out parts.



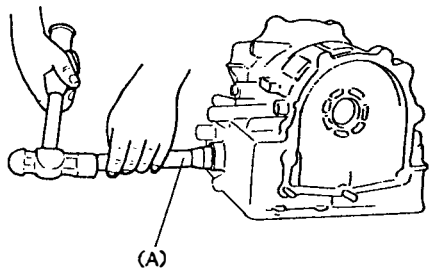
Parking lock pole
Inspection

Check for damage or signs that the parking lock pole may be worn out.



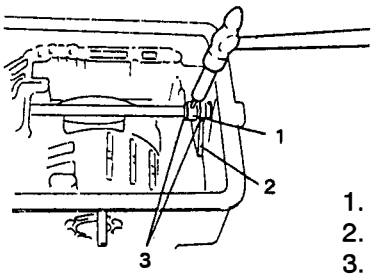
Bearing
Inspection

Turn the bearing with your hands. Check to see if there are jagged places. Check for noise and smoothness of rotation.



Assembly Method

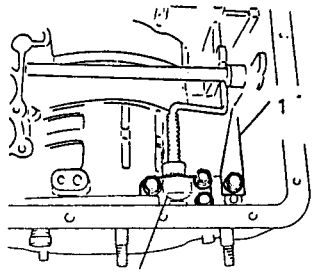
1. Oil Seal
Use a special tool to pound the oil seal.
Special Tool:
(A) Bearing Installer: 009943–8821



1. Claw
2. Shift lever
3. Washer

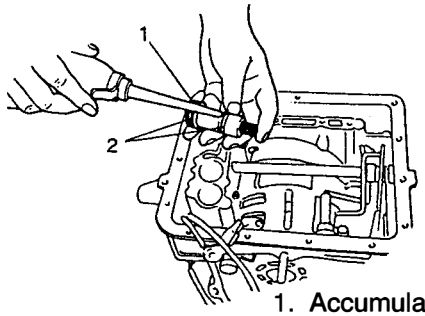
2. Attach the manual shift shaft receiver and pound the spring pin. Then turn the collar 90°and tighten it up. The concave side should fit snugly

Notice: The shaft should be inserted on the shift lever side. Attach washers to the front and the back. (The pur pose is to avoid damage to the oil seal.)



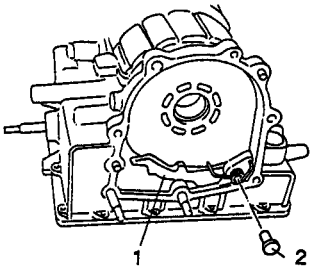
1. Manual detent spring
2. Parking lock ball bracket

3. Attach the manual detent spring and the parking lock pole bracket.



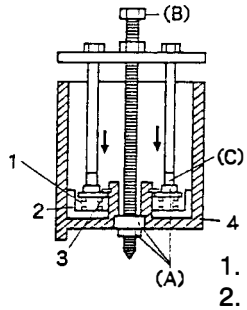
1. Accumulator piston
2. O–ring

4. Attach the accumulator piston's O–ring. Be sure to apply ATF when attaching.



1. Parking lock ball
2. Parking lock ball shaft

5. Attach the parking lock pole. Move the manual shift lever and then make sure that the parking lock pole moves smoothly.



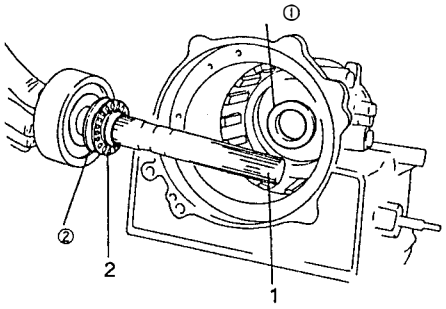
1. Return spring
2. Piston
3. Snap ring
4. Case

6. Attach the first reverse brake piston.
Replace the piston outer O–ring and inner ring with new parts. Be sure to apply ATF first before installing.
Insert the brake piston in the case with the spring hole in the upper direction.

Notice: Be careful that the O–ring is not bent, twisted or broken and does not come off.

Use a special tool to push up the return spring assembly. Attach the snap ring.

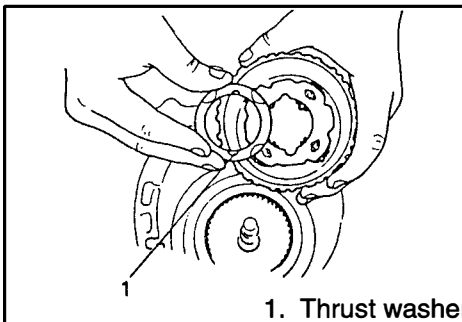
Special tools
(A) Spring Compressor Number 1 Set: 09926–98320
(B) Oil Pump Remover: 09918–48211
(C) Oil Pump Remover Attachment: 09918–48220



1. Output shaft
2. Bearing

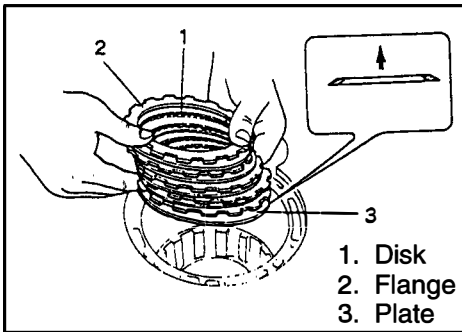
7. Attach the output shaft. Attach the Race (1) to the case side. Apply grease to the bearing and the Race (2) and then, attach the bearing and the Race (2) to the output shaft side.

	Internal diameter (mm)	External perimeter (mm)	Flange
Race (1)	19	32	Inner diameter of Flange
Bearing	20.9	32	
Race (2)	21.1	32.2	Inner diameter of Flange



1. Thrust washer

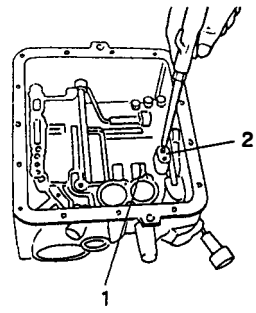
8. Use Suzuki Super Grease C on the thrust washer. Fix the rear planetary gear into a stationary position. Then insert the rear planetary gear.



1. Disk
2. Flange
3. Plate

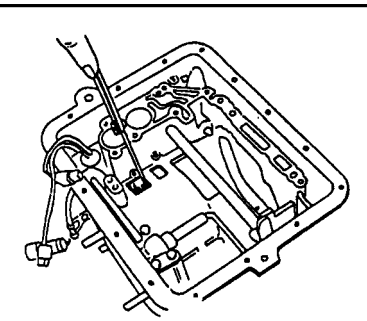
9. First reverse brake, dump plate, plate, disk and flange should be attached to the case in that order.
The dump plate's converse side should be raised up and attached.
The plate, disk, and flange should be attached in that order.
Fix the snap ring into a stationary position.

Notice: When first using newly installed disks make sure to soak them at least two hours in ATF. Do not forget to attach the snap ring.



1. Oil hole
2. Piston

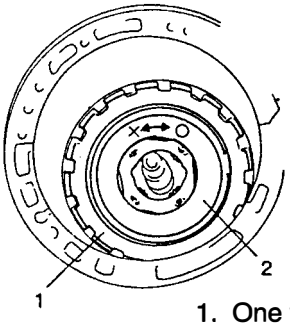
Blow air through the oil hole. Then check to see if the brake pistons are able to move or not.



Measure the gap between the snap ring and the flange.

Standard Gap: 0.65~1.94 mm

If the gap is not within the standard value range, replace the first reverse brake disk with new parts.

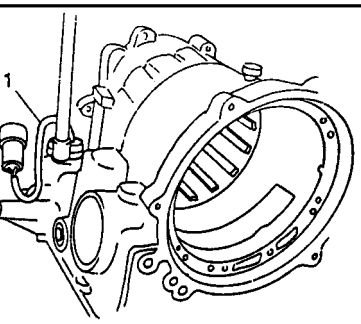


1. One way clutch
2. Planetary gear

10. Turn the rear planetary gears clockwise and then push in the one way clutch until it fits in the groove.

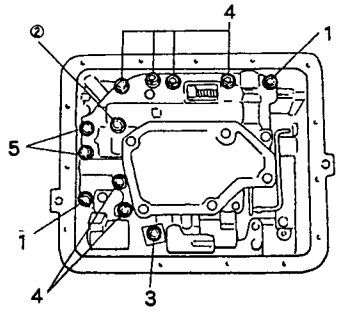
Note: When the planetary is rotated in the right direction, the rota tion will be smooth. When the planetary gear is rotated in the left direction, it will be locked.

When the planetary gear is turned to the left, the one way clutch will go in easily.



1. Solenoid harness

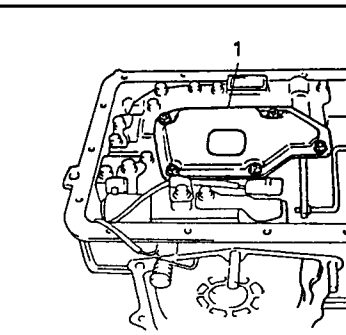
11. Attach the solenoid harness.



12. Attach the valve body.
Tighten the reamer bolts lightly.
Use a limit wrench to tighten all the other bolts in diagonal order.

Tightening torque: 80~120 kg·cm

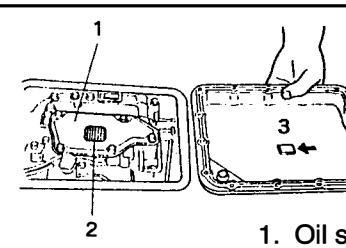
Number	Type	Length from Neck to Base (mm)
1	Reamer bolt	31
2	Regular bolt	45
3	Regular bolt	39
4	Regular bolt	31
5	Regular bolt	25



1. Oil strainer

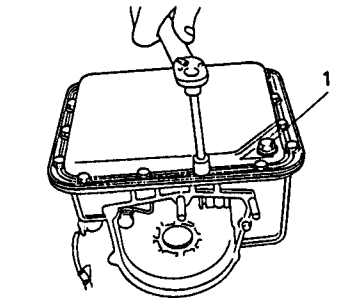
13. Attach the oil strainer:

Tightening torque: 52 ~ 58 kg ·cm



1. Oil strainer
2. Vent
3. Magnet

14. Attach the oil pan. Attach the magnet right under the oil strainer.



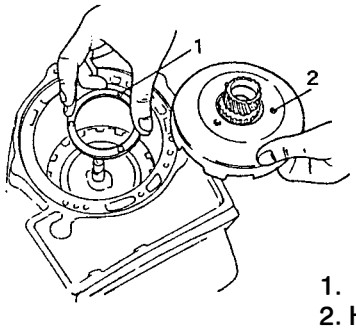
1. Drain Bolt

Attach the bolt with the standard tightening torque.

Tightening torque: 40 ~ 60 kg ·cm

The oil pan drain bolt should be tightened to a standard tightening torque.

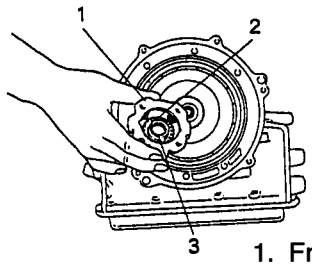
Tightening torque: 180 ~ 270 kg ·cm



1. Projection
2. Hole

15. Attach the sun gear.
To prevent the thrust washers from falling off, it is advised to use Suzuki Super Grease C on them when installing them. The thrust washer projections should be matched up with the holes in the sun gear.

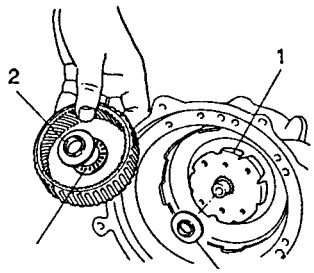
Note: Before inserting the sun gear, the rear gear race should be matched up at the center.



1. Front planetary gear
2. Bearing
3. Race

16. Attach the front planetary gear.
Bearings and race need Suzuki Super Grease C. The planetary gear (lower part) should be fixed in a stationary position.

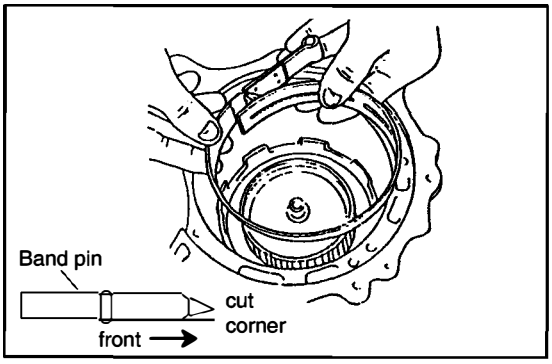
	Internal Diameter (mm)	External Perimeter (mm)
Bearing	24	37.2
Race	22	37.2



1. Front bearing gear
2. Bearing

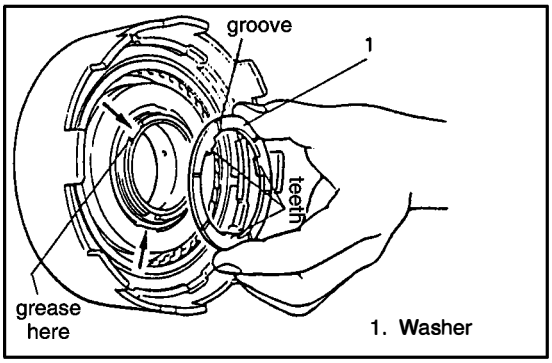
17. Attach the front planetary ring gear. The gear race (1) requires AT oil. Then the race may be attached to the upper portion of the planetary gear.
Race (2) and bearings need Suzuki Super Grease C. Then attach the lower portion of the ring gears. Ring gear attaches to the planetary gear.

	Internal Diameter (mm)	External Perimeter (mm)
Race (1)	14	27.9
Bearing	17.2	29
Race (1)	17	30.9



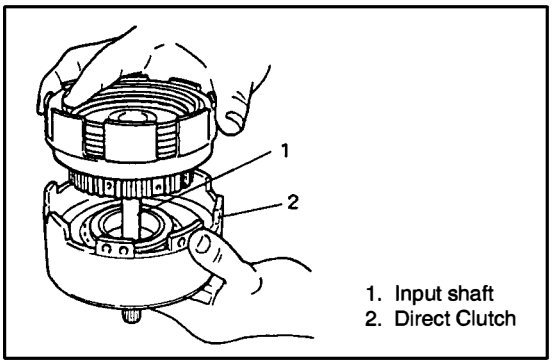
18. Second brake band, band pin

Note: When attaching the band pin, notice that there are cut corners. The cut corners should be placed in the front.

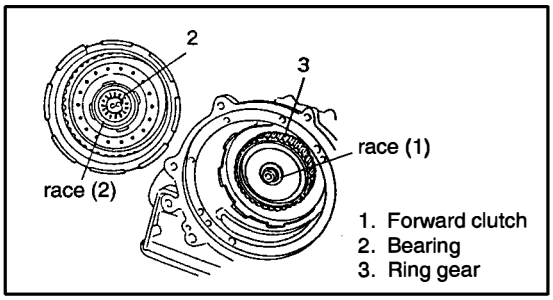


19. Attach the direct clutch to the input shaft. Place Suzuki Super Grease C on the washer and the washer projections and the concave surface of the direct clutch.

Note: There is a groove on the washer that indicates the part that is meant to be the top side. The groove is gold colored.



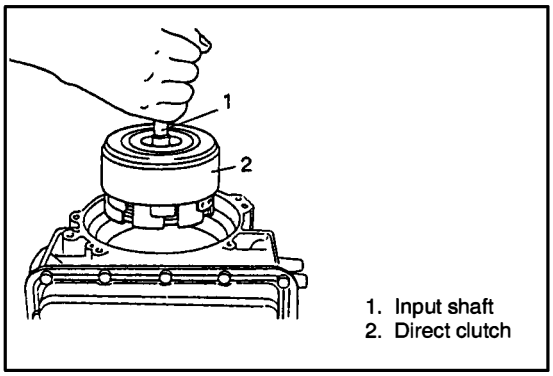
The teeth of the direct clutch mesh with the input shaft and the direct clutch is inserted into the input shaft.



20. Ring gear race & bearing

Apply AT oil to the race (1) and then attach to ring on right side. Apply Suzuki Super Grease C to bearing and race (2). Then attach to forward clutch side

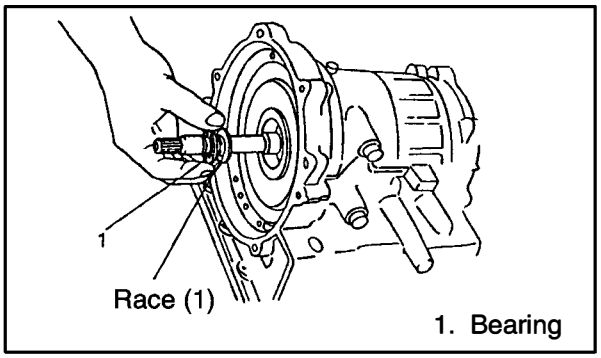
	Internal Diameter (mm)	External Perimeter (mm)
Race (1)	14	28.7
Bearing	17.2	29
Race (2)	17	30.9



21 Attach the input shaft and direct shaft. Open up the second brake band. Insert input shaft with direct clutch. Insert and turn.

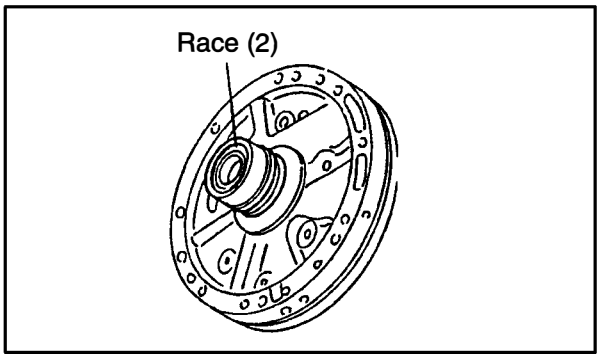
Note: When attaching the input shaft, be careful not to drop the bearing and the race.

Be careful that those items do not bite into the output shaft seal ring.

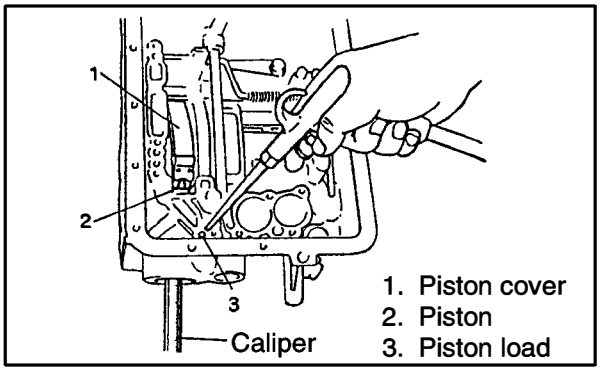


22. Attach the input shaft bearing and race. Apply ATF to bearing and race with flange.
Bearing race (1) has the flange attached. Attach bearing race (1) to the input shaft.

	Internal Diameter (mm)	External Perimeter (mm)	Flange
Race (1)	19	32	Inner Diameter of Flange
Bearing	20.9	32	———
Race (2)	22.3	35	None

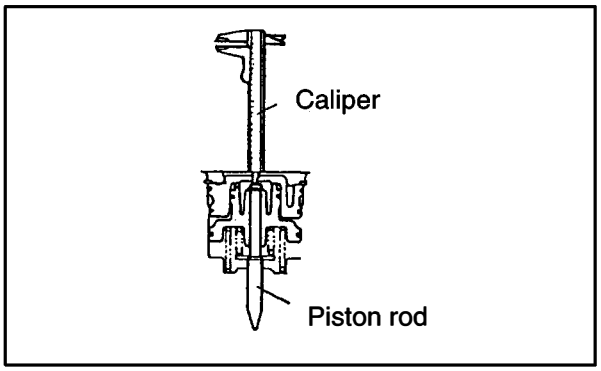


Put Suzuki Super Grease C on the other bearing race (2) without the flange. Then attach on the oil pump side.

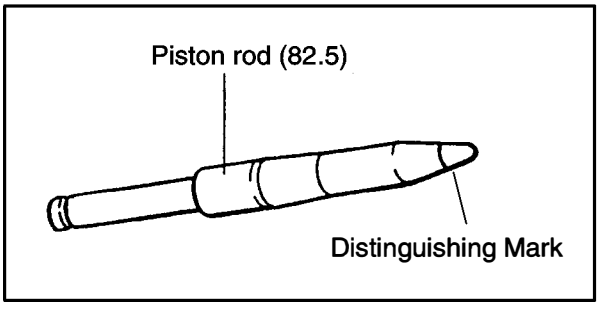


23. Attach the second brake piston following the inspection.
The head of the piston cover should be opened with Æ 5 holes using a drill .
Use this piston cover head as a special tool. Attach calipers to the piston rod head.
Then blow air in the oil hole. Then measure the piston rod stroke.

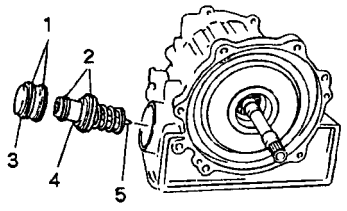
The second brake piston rod stroke: 1.5~3.0 mm.



In the case of non–standard volume, exchange the second brake band or a different length piston rod.



Piston Rod Selection	Length (mm)	Distinguishing Mark
	81.3	no mark
	82.5	1 ridge or groove.

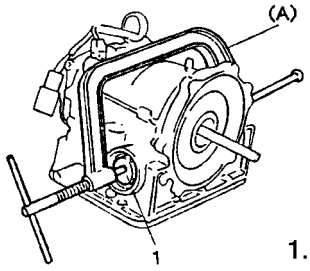


1. O–ring
2. Seal ring
3. Piston cover
4. Piston
5. Piston rod

Take off the piston cover with the hole. Apply Suzuki Super Grease C to the C–ring.
That C–ring fits into the ring groove. Then the brake piston should be inserted into the case.

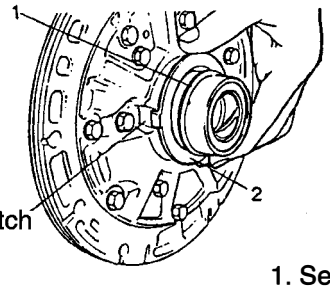
Note: Make sure that the piston rod completely fits into the brake band rod.

Apply AT oil to the piston cover O–ring. Use a special tool to attach the piston cover to the case.



1. Second brake piston cover

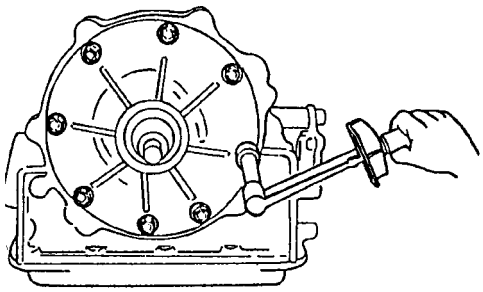
Special Tool:
(A) Valve lifter: 09916–14510



1. Seal ring
2. Direct clutch washer

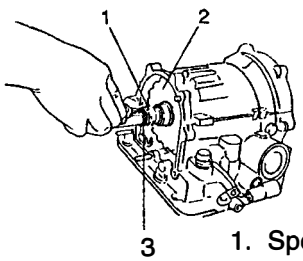
24. Apply Suzuki Super Grease C to the direct clutch washer. Then match and attach the oil pump body's notch to the direct clutch washer.

Note: Suzuki Super Grease should be applied to the seal ring. Then make sure that it fits into the groove. When attaching the oil pump, do not let the oil pump bite into the seal ring.



25 Exchange the oil pump cover O–ring for a new one. Be careful not to let the input shaft bearing race and direct clutch drop. Then attach the oil pump to the case.

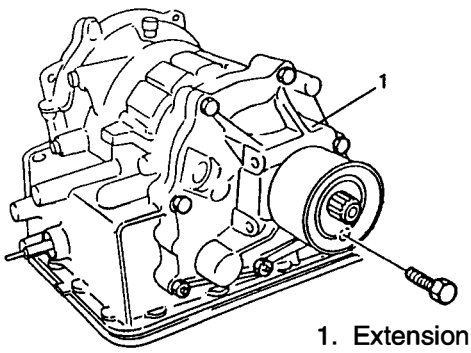
Tightening torque: 65 ~ 95 kg ·cm



1. Speedometer drive gear
2. Parking lock gear
3. Snap ring

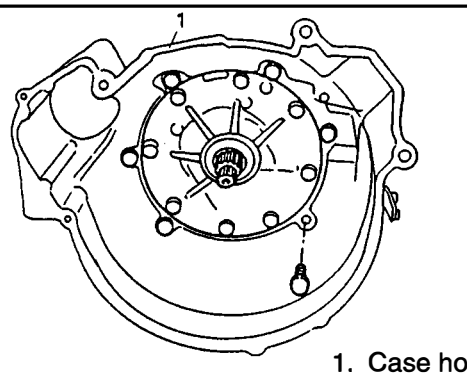
26. Attach the parking lock gear and the speedometer drive gear.

Note: Do not forget that there are three snap rings.



1. Extension case

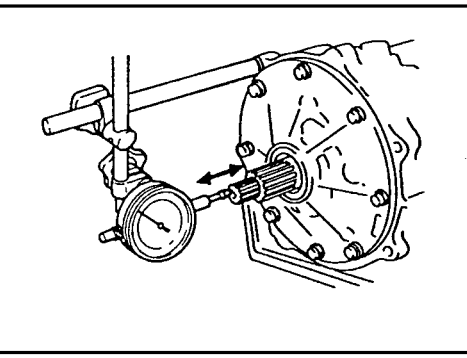
27. Attach the extension case.



1. Case housing

28. Case Housing
Apply Suzuki Three Bond 1215 to the case housing's 6 attachment bolts and attach them to the designated area. Use the recommended tightening torque below to tighten them up.

Suzuki Three Bond 1215: 99000–3108–15A
Tightening torque: 160 ~ 230 kg ·cm

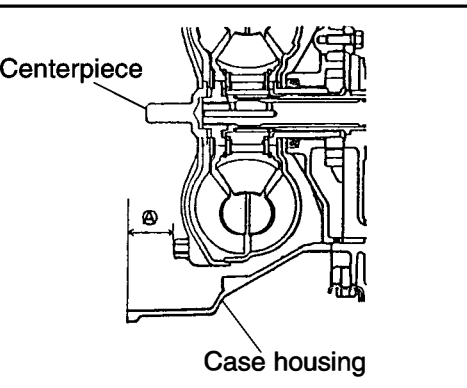


29. Measure the thrust direction play of the input shaft edge surface.

Input shaft thrust play: 0.3 ~ 0.9

When the play measurement is found to be outside of the standard range, take off the oil pump. On the oil pump side there is the input shaft bearing race. Depending on the thickness of the race, exchange.

Input shaft bearing's pair of race: 0.8 · 1.2 mm



30 Attach the speed sensor.

31 Attach the torque converter.

Note: When attaching the torque converter, you need to be careful not to damage the oil pump's oil seal.

Make sure to check that the torque converter fits completely into the transmission.

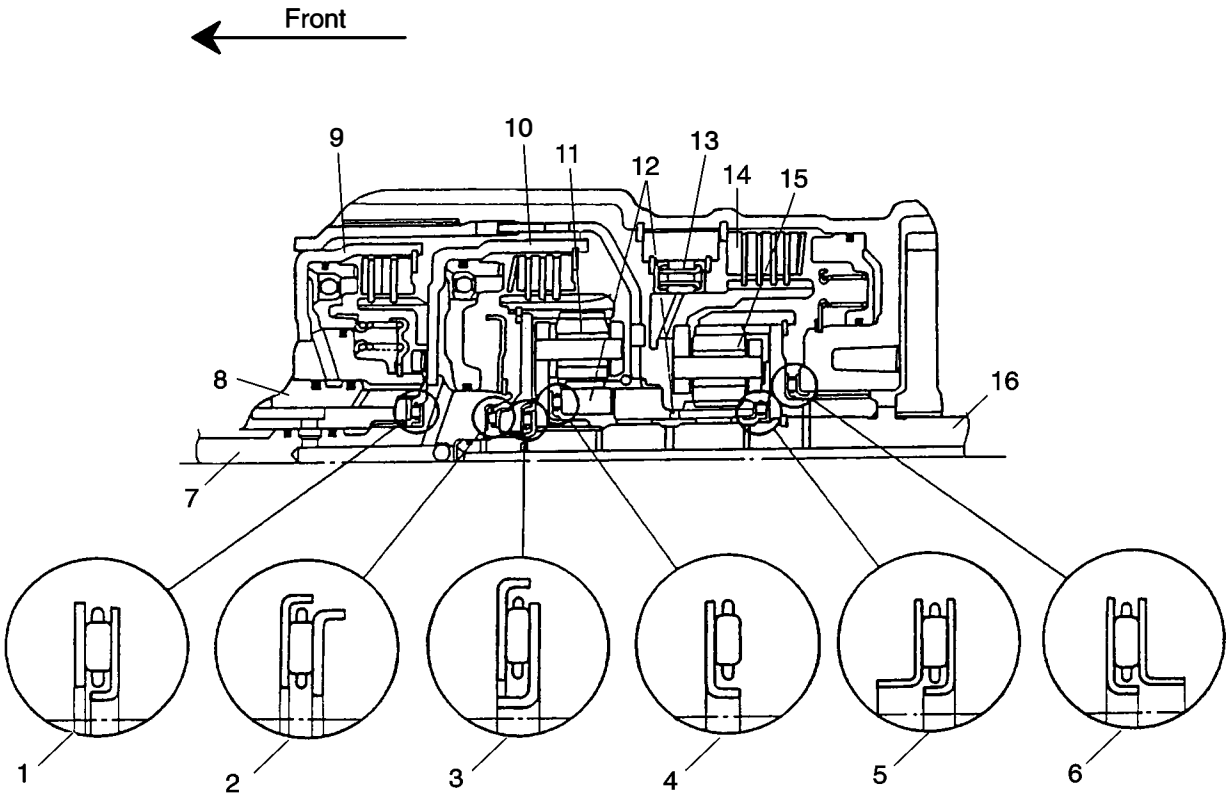
Strategy for checking above items:

From the case housing edge surface to the drive plate attachment use a standard size (A) for mea surement purposes.

Standard size (A): 28 mm or more
Make sure that the torque converter turns smoothly.
Apply grease to the torque converter centerpiece.

Use Suzuki Super Grease A: 99000–25010

Thrust Bearing, Race Installation Schematic Diagram

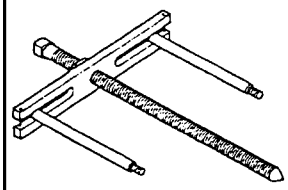


1. Input shaft bearing, race
2. Front planetary ring gear bearing, race
3. Front planetary ring gear bearing, race
4. Front planetary ring gear bearing, race
5. Rear planetary ring gear bearing, race
6. Rear planetary ring gear bearing, race
7. Input shaft
8. Oil pump
9. Direct clutch
10. Forward Clutch
11. Front planetary gear
12. Sun Gear
13. One Way clutch
14. First / Reverse Brake
15. Rear planetary gear
16. Output shaft

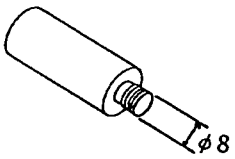
Maintenance Material List

Material	Genuine Part	Use
AT Oil	Suzuki ATF 5D06 (99000–22810)	AT Oil
Grease	Suzuki Super Grease A (99000–25010)	Select Assembly Oil Seal Lip Torque Converter Center Piece
	Suzuki Super Grease C (99000 – 25030)	The grease maintains the thrust bearings and the bearing race.
Sealant	Suzuki Three Bond 1215 (99000 – 3108 – 15A)	Case Housing

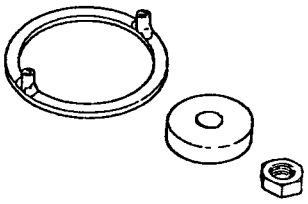
Special Tools



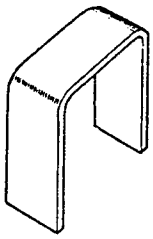
09918 – 48211
oil pump remover



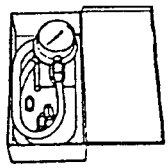
09918 – 48220
Oil pump remover
attachment



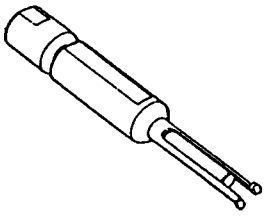
09926 – 98320
Spring Compressor
Number 1 set



09926 – 98330
Spring Compressor
Number 2



09925 – 37810
ATM Oil
pressure gauge



09921 – 20120
Bearing Remover
(∅ 12)