A241E AUTOMATIC TRANSAXLE

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AT

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DESCRIPTION

General

The A241E automatic transaxle is a 4-speed Electronically Controlled Transaxle (hereafter called ECT) with a lock-up mechanism developed exclusively for the new MR2.

The A241E automatic transaxle is already in use in the Celica (ST184 series.)

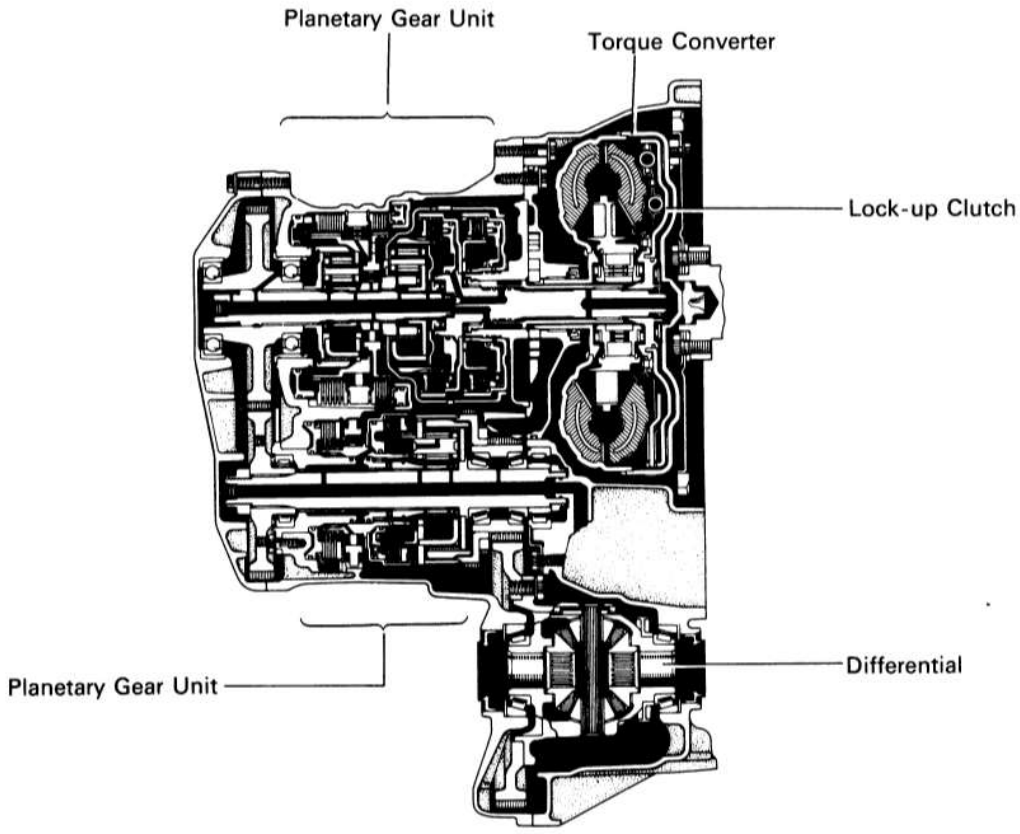
This automatic transaxle has the following features.

- ▶ The "Super-Flow" torque converter is used to improve the transmission efficiency.
- ▶ When shifting the transmission, the engine torque is controlled and the clutch hydraulic pressure in the transmission is electronically controlled to reduce transmission shift shock.
- ▶ Transaxle control ECU has been integrated with the Engine ECU.

This automatic transaxle are mainly composed of the torque converter with lock-up clutch, 4-speed planetary gear unit, the hydraulic control system and the electronic control system.

To minimize the possibility of incorrect operation of the automatic transaxle, a shift lock mechanism has also been added.

Sectional View



A241E

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General Specifications

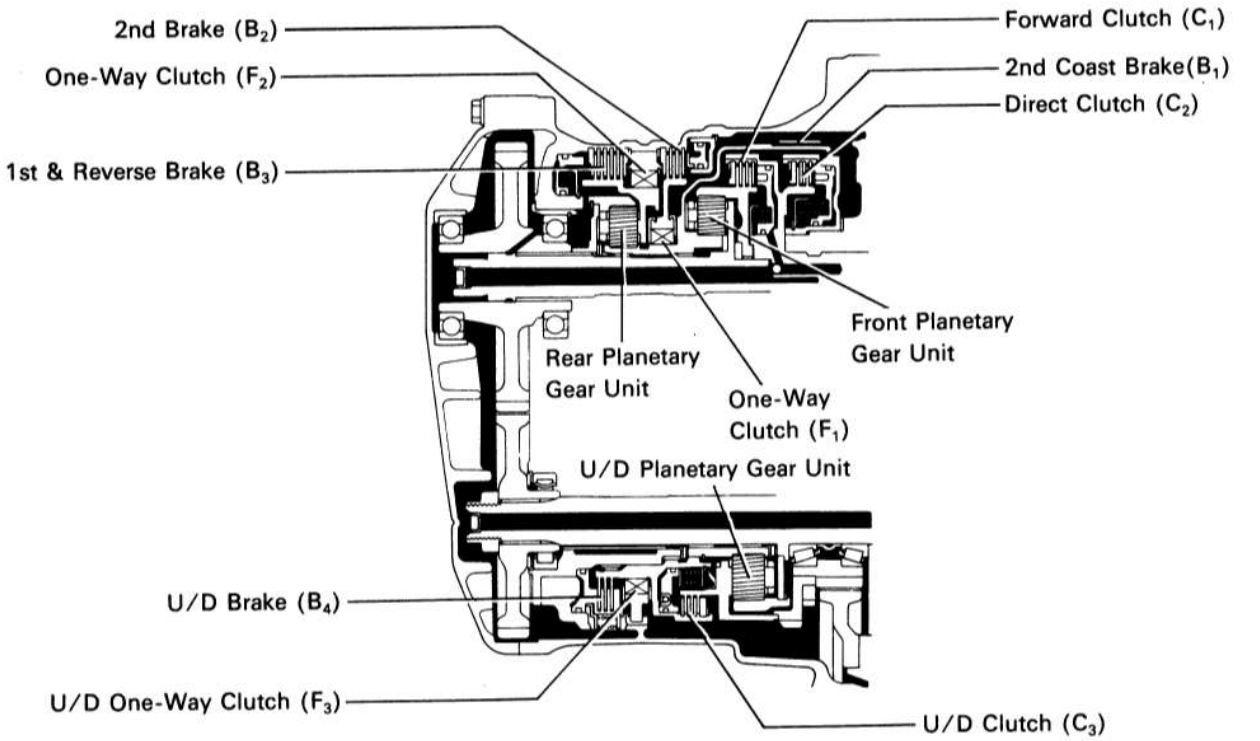
Type of Transaxle			A241E
Type of Engine			5S-FE
Torque Converter	Stall Torque Ratio		2.1 : 1
	Lock-Up Mechanism		Equipped
Gear Ratio	1st Gear		3.643
	2nd Gear		2.008
	3rd Gear		1.296
	O/D Gear		0.892
	Reverse Gear		2.977
Number of Discs and Plates (Disc/Plate)	C_1	Forward Clutch	4/4
	C_2	Direct Clutch	3/3
	C_3	Underdrive Clutch	3/5
	B_2	2nd Brake	3/3
	B_3	1st & Reverse Brake	6/5
	B_4	Underdrive Brake	3/3
2nd Coast Brake (B_1) Band Width mm(in.)			25 (0.98)
Number of Sprags	F_1	No. 1 One-Way Clutch	18
	F_2	No. 2 One-Way Clutch	30
	F_3	Underdrive One-Way Clutch	30
Front Planetary Gear	No. of Sun Gear Teeth		39
	No. of Pinion Gear Teeth		16
	No. of Ring Gear Teeth		71
Rear Planetary Gear	No. of Sun Gear Teeth		27
	No. of Pinion Gear Teeth		18
	No. of Ring Gear Teeth		62
Underdrive Planetary Gear	No. of Sun Gear Teeth		33
	No. of Pinion Gear Teeth		20
	No. of Ring Gear Teeth		73
ATF	Type		ATF DEXRON® II
	Capacity liter (US qts, Imp. qts)	Total	8.0 (8.5, 7.0)
		Drain & Refill	3.3 (3.5, 2.9)

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OPERATION

Mechanical Operation

OPERATING CONDITIONS



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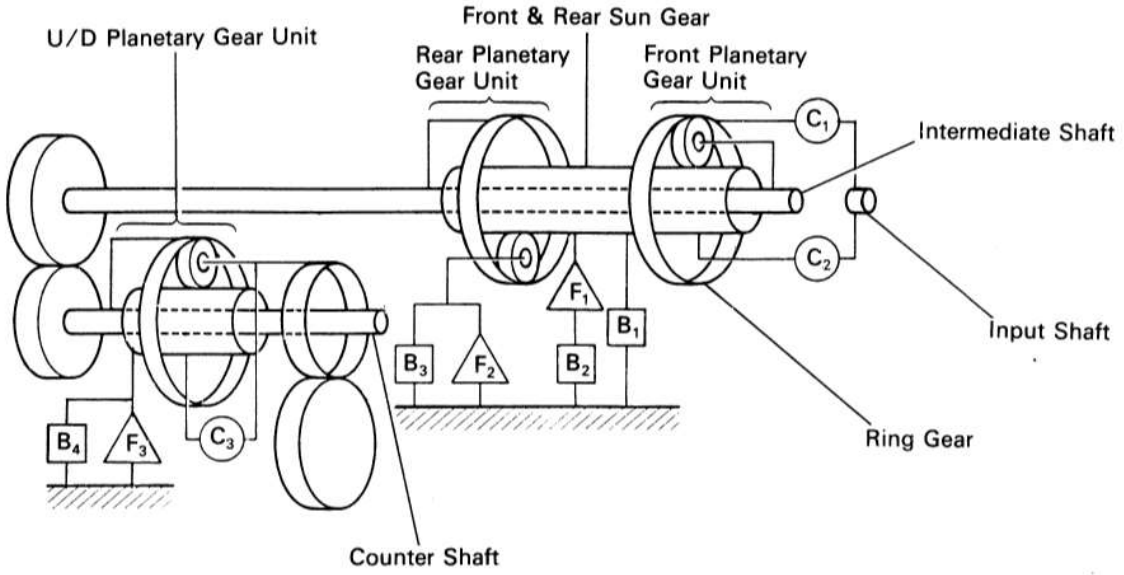
Range (i.e, Shift Lever Position)	Gear	No.1 Solenoid Valve	No.2 Solenoid Valve	C_1	C_2	C_3	B_1	B_2	B_3	B_4	F_1	F_2	F_3
P	Park	ON	OFF							●			
R	Reverse	ON	OFF		●				●	●			
N	Neutral	ON	OFF							●			
D	1st	ON	OFF	●						●		●	●
	2nd	ON	ON	●				●		●	●		●
	3rd	OFF	ON	●	●			●		●			●
	O/D	OFF	OFF	●	●	●		●					
2	1st	ON	OFF	●						●		●	●
	2nd	ON	ON	●			●	●		●	●		●
	3rd*1	OFF	ON	●	●			●		●			●
L	1st	ON	OFF	●					●	●		●	●
	2nd*1	ON	ON	●			●	●		●	●		●

●: Operating
*1 : Down-shift only in the 3rd gear for the 2 range and 2nd gear for the L range – no up-shift

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FUNCTION OF COMPONENTS

Component		Function
C_1	Forward Clutch	Connects input shaft and front planetary ring gear.
C_2	Direct Clutch	Connects input shaft and front & rear planetary sun gear.
C_3	U/D Clutch	Connects underdrive sun gear and underdrive planetary carrier.
B_1	2nd Coast Brake	Prevents front & rear planetary sun gear from turning either clockwise or counterclockwise.
B_2	2nd Brake	Prevents outer race of F_1 from turning either clockwise or counterclockwise, thus preventing the front & rear planetary sun gear from turning counterclockwise.
B_3	1st & Reverse Brake	Prevents rear planetary carrier from turning either clockwise or counterclockwise.
B_4	U/D Brake	Prevents underdrive sun gear from turning either clockwise or counterclockwise.
F_1	No. 1 One-Way Clutch	When B_2 is operating, this clutch prevents the front & rear planetary gear from turning counterclockwise.
F_2	No. 2 One-Way Clutch	Prevents rear planetary carrier from turning counterclockwise.
F_3	U/D One-Way Clutch	Prevents underdrive planetary sun gear from turning clockwise.
Planetary Gears		These gears change the route through which driving force is transmitted, in accordance with the operation of each clutch and brake, in order to increase or reduce the input and output speed.



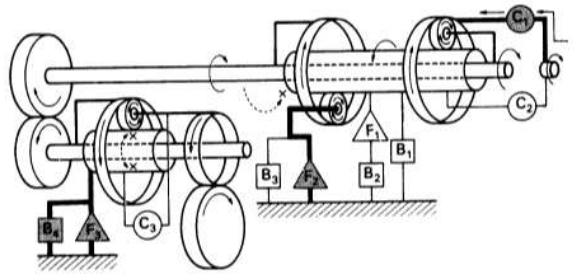
AT2690

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FUNCTION OF COMPONENTS (Cont'd)

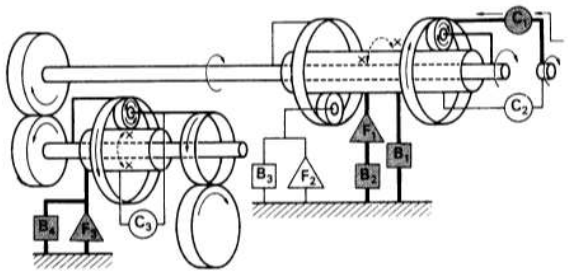
The conditions of operation for each gear position are shown on the following illustrations:

D or 2 Range 1st Gear



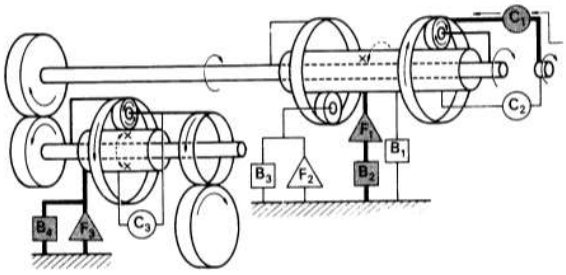
AT3216

2 Range 2nd Gear



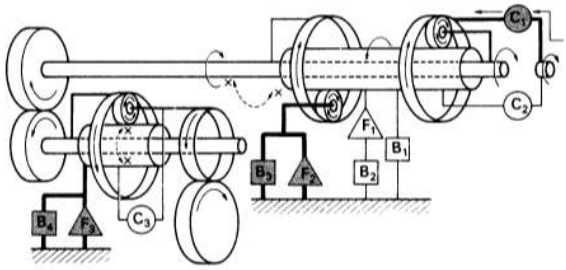
AT3220

D Range 2nd Gear



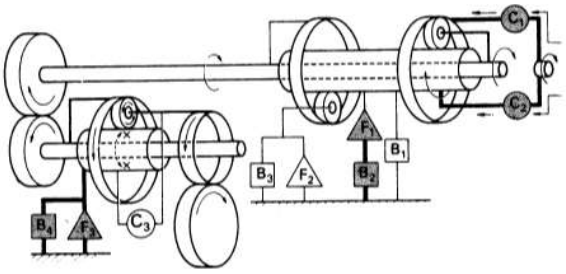
AT3217

L Range 1st Gear



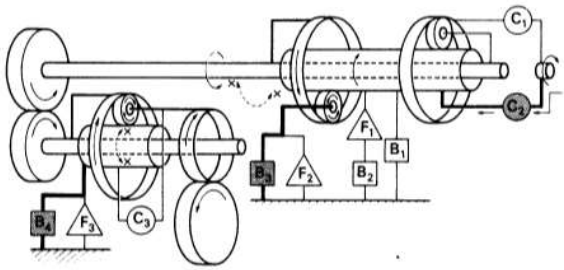
AT3221

D Range 3rd Gear



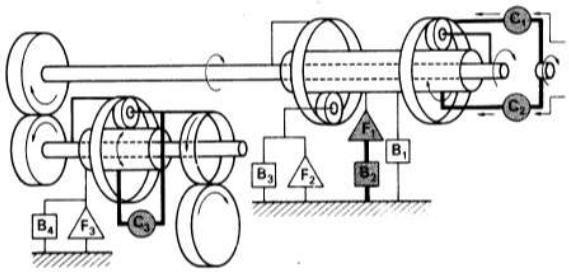
AT3218

R Range Reverse Gear



AT3222

D Range O/D



AT3219

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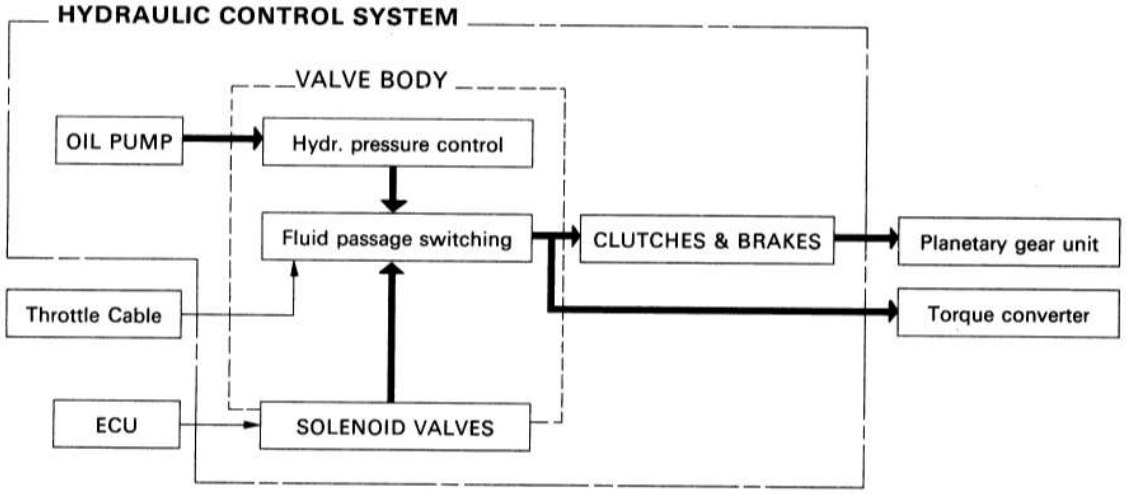
Hydraulic Control System

The hydraulic control system is composed of the oil pump, the valve body, the solenoid valves, the accumulators, the clutches and brakes, and the governor valve as well as the fluid passages which connect all of these components.

Based on the hydraulic pressure created by the oil pump, the hydraulic control system governs the hydraulic pressure acting on the torque converter, clutches and brakes in accordance with the vehicle driving conditions.

There are three solenoid valves on the valve body.
The No. 1 and No. 2 solenoid valves are turned on and off by signals from the ECU to operate the shift valves and change the gear shift position.
The No. 3 solenoid valve is operated by signals from the ECU to engage or disengage the lock-up clutch of the torque converter.

► A241E



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A241E Electronic Control System (See page AT-20)

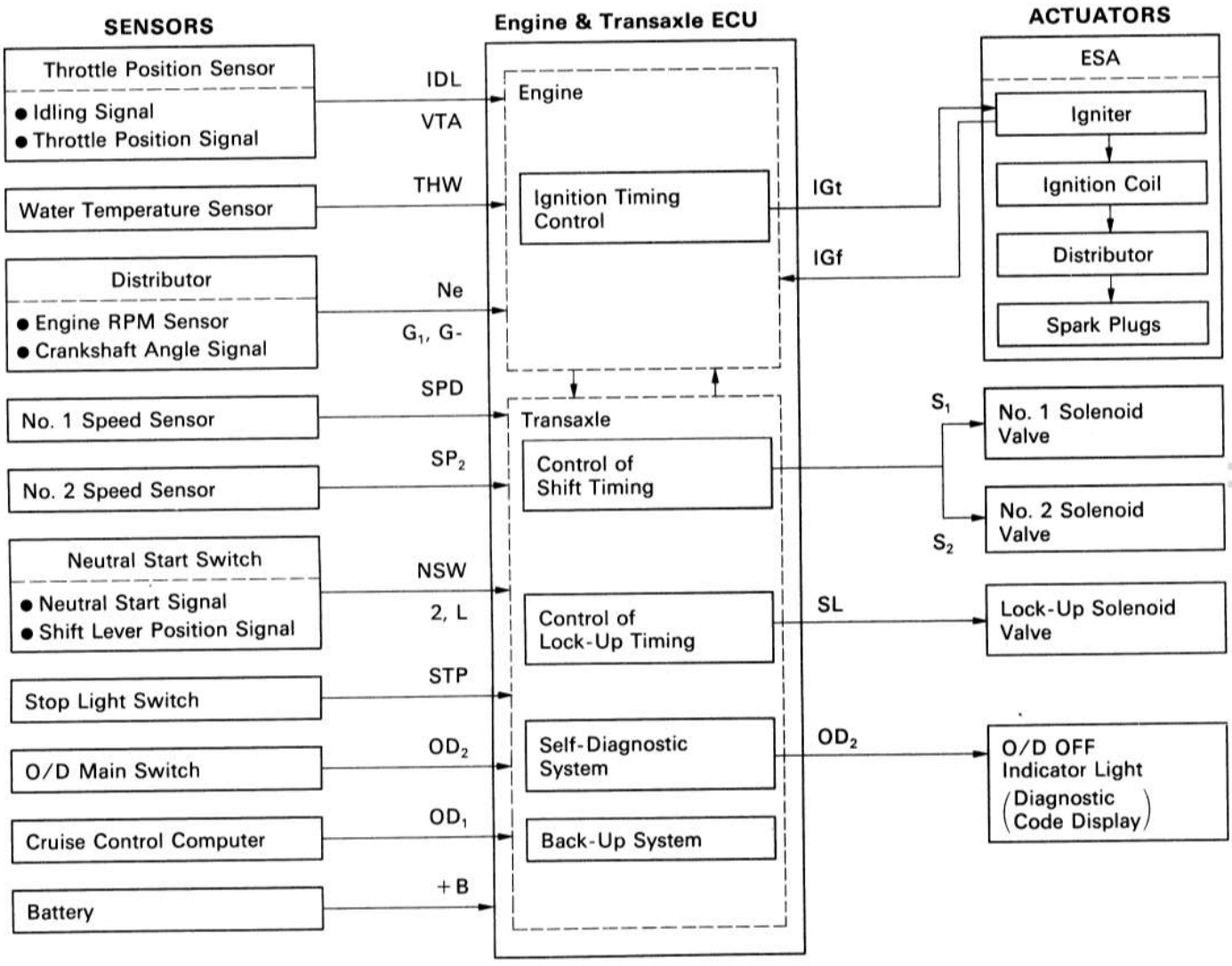
GENERAL

The electronic control system for the A241E automatic transaxle provides extremely precise control of the gear shift timing and lock-up timing in response to driving conditions as sensed by various sensors located throughout the vehicle and in response to the engine's running condition.

At the same time, the ECU control reduces vehicle squat when the vehicle starts out the gear shift shock. The electronic control system is also equipped with a self diagnosis system which diagnoses malfunctions of electronically controlled components and warns the driver, and a fail-safe which makes it possible for the vehicle to continue functioning when a malfunction occurs.

CONSTRUCTION

The electronic control system can be broadly divided into three groups; the sensors, ECU and actuators.



ELECTRONIC CONTROL CIRCUIT (See page AT-20)

ELECTRONIC CONTROL COMPONENTS (See page AT-21)

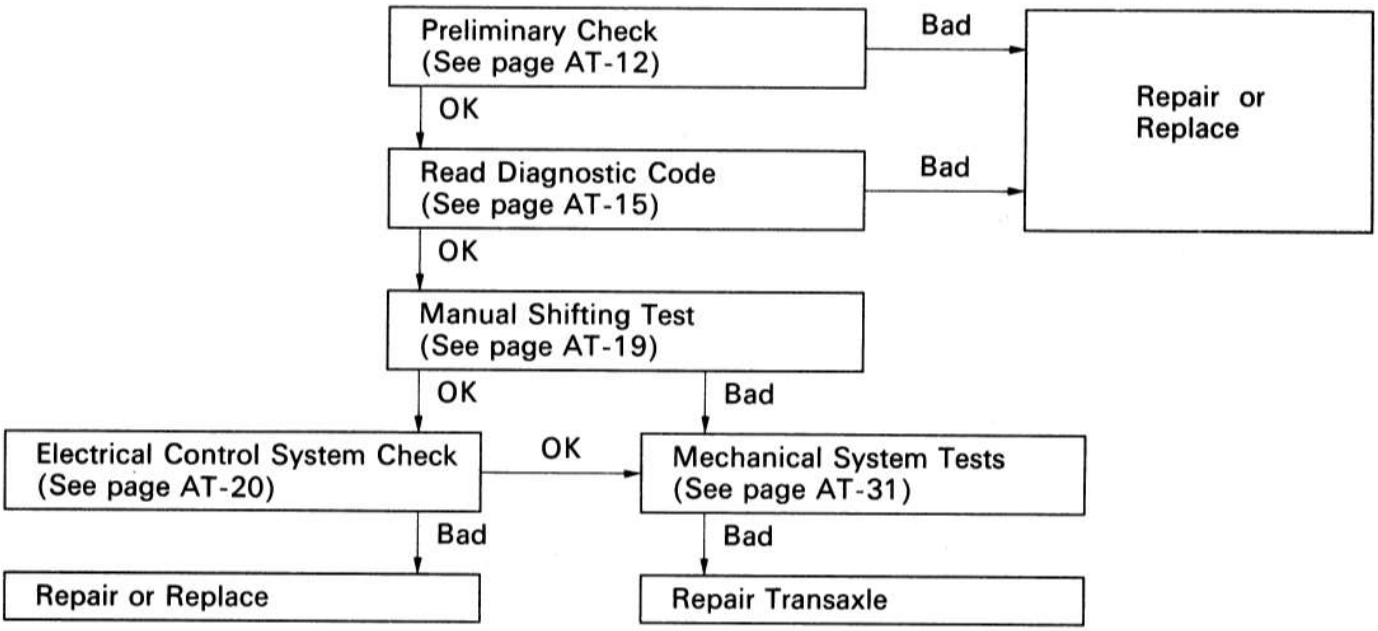
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TROUBLESHOOTING

Trouble occurring in the ECT can stem from one of three sources: the engine, the ECT electronic control unit or the transaxle itself. Before troubleshooting, determine in which these three sources the problem lies, and begin troubleshooting with the simplist operation, gradually working up in order of difficulty.

Basic Troubleshooting

Before troubleshooting and ECT, first determine whether the problem is electrical or mechanical. To do this, just refer to the basic troubleshooting flow-chart provided below.
If the cause is already known, using the basic troubleshooting chart below along with the general troubleshooting chart on the following page should speed the procedure.



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General Troubleshooting

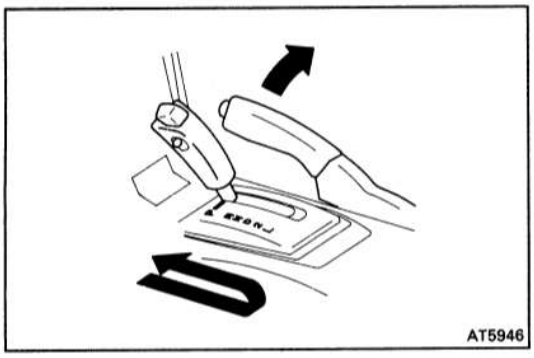
Problem	Possible cause	Remedy	Page A241E
Fluid discolored or smells burnt	Fluid contaminated	Replace fluid	AT-12
	Torque converter faulty	Replace torque converter	AT-43
	Transaxle faulty	Disassemble and inspect transaxle	AT-44
Vehicle does not move in any forward range or reverse	Shift cable out of adjustment	Adjust shift cable	AT-13
	Valve body or primary regulator faulty	Inspect valve body	AT-112
	Parking lock pawl faulty	Inspect parking lock pawl	AT-66
	Torque converter faulty	Replace torque converter	AT-43
	Converter drive plate broken	Replace drive plate	AT-43
	Oil strainer intake screen blocked	Clean screen	AT-49
	Transaxle faulty	Disassemble and inspect transaxle	AT-44
Shift lever position incorrect	Shift cable out of adjustment	Adjust shift cable	AT-13
	Manual valve and lever faulty	Inspect valve body	AT-112
	Transaxle faulty	Disassemble and inspect transaxle	AT-44
Harsh engagement into any drive range	Throttle cable out of adjustment	Adjust throttle cable	AT-12
	Valve body or primary regulator faulty	Inspect valve body	AT-112
	Accumulator pistons faulty	Inspect accumulator pistons	AT-156
	Transaxle faulty	Disassemble and inspect transaxle	AT-44
Delayed 1-2, 2-3 or 3-O/D up-shift, or down-shifts from O/D-3 or 3-2 and shift back to O/D or 3	Electronic control faulty	Inspect electronic control	AT-20
	Valve body faulty	Inspect valve body	AT-112
	Solenoid valve faulty	Inspect solenoid valve	AT-28
	Throttle cable out of adjustment	Adjust throttle cable	AT-12
Slips on 1-2, 2-3 or 3-O/D up-shift, or slips or shudders on acceleration	Shift cable out of adjustment	Adjust shift cable	AT-13
	Throttle cable out of adjustment	Adjust throttle cable	AT-12
	Valve body faulty	Inspect valve body	AT-112
	Solenoid valve faulty	Inspect solenoid valve	AT-28
	Transaxle faulty	Disassemble and inspect transaxle	AT-44
Drag, binding or tie-up on 1-2, 2-3, or 3-O/D up-shift	Shift cable out of adjustment	Adjust shift cable	AT-13
	Valve body faulty	Inspect valve body	AT-112
	Transaxle faulty	Disassemble and inspect transaxle	AT-44

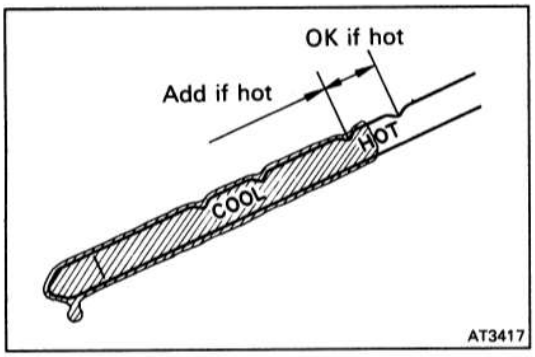
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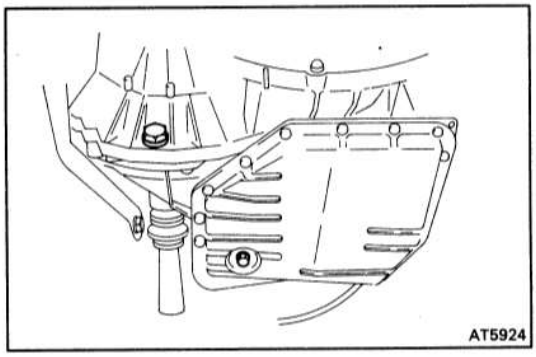
General Troubleshooting (Cont'd)

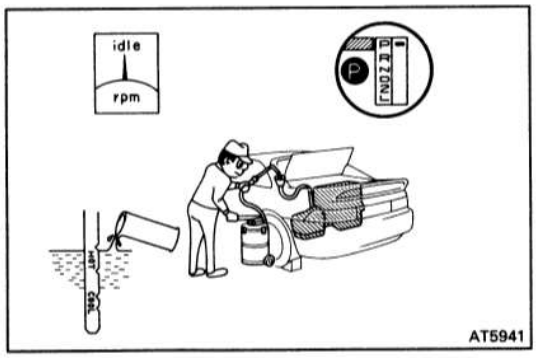
Problem	Possible cause	Remedy	Page A241E
No lock-up in 2nd, 3rd or O/D	Electronic control faulty	Inspect electronic control	AT-20
	Valve body faulty	Inspect valve body	AT-112
	Solenoid valve faulty	Inspect solenoid valve	AT-28
	Transaxle faulty	Disassemble and inspect transaxle	AT-44
Harsh down-shift	Throttle cable out of adjustment	Adjust throttle cable	AT-13
	Throttle cable and cam faulty	Inspect throttle cable and cam	AT-50
	Accumulator pistons faulty	Inspect accumulator pistons	AT-156
	Valve body faulty	Inspect valve body	AT-112
	Transaxle faulty	Disassemble and inspect transaxle	AT-44
No down-shift when coasting	Valve body faulty	Inspect valve body	AT-112
	Solenoid valve faulty	Inspect solenoid valve	AT-28
	Electronic control faulty	Inspect electronic control	AT-20
Down-shift occurs too quickly or too late while coasting	Throttle cable faulty	Inspect throttle cable	AT-12
	Valve body faulty	Inspect valve body	AT-112
	Transaxle faulty	Disassemble and inspect transaxle	AT-44
	Solenoid valve faulty	Inspect solenoid valve	AT-28
	Electronic control faulty	Inspect electronic control	AT-20
No O/D-3, 3-2 or 2-1 kick-down	Solenoid valve faulty	Inspect solenoid valve	AT-28
	Electronic control faulty	Inspect electronic control	AT-20
	Valve body faulty	Inspect valve body	AT-112
	Throttle cable out of adjustment	Adjust throttle cable	AT-12
No engine braking in 2 or L range	Solenoid valve faulty	Inspect solenoid valve	AT-28
	Electronic control faulty	Inspect electronic control	AT-20
	Valve body faulty	Inspect valve body	AT-112
	Transaxle faulty	Disassemble and inspect transaxle	AT-44
Vehicle does not hold in P range	Shift cable out of adjustment	Adjust shift cable	AT-13
	Parking lock pawl and spring faulty	Inspect cam and spring	AT-66

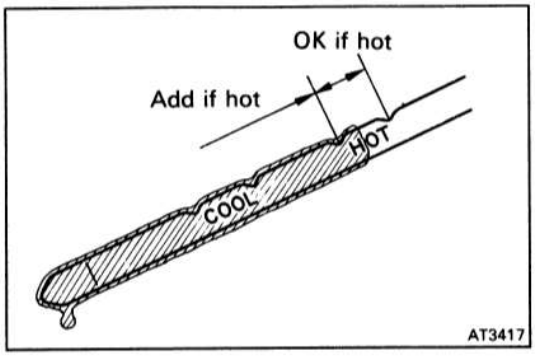
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Preliminary Check

1. CHECK FLUID LEVEL

HINT: The vehicle must have been driven so that the engine and transmission are at normal operating temperature.
(Fluid temperature: 70 – 80 °C or 158 – 176 °F)

(a) Park the vehicle on a level surface, set the parking brake.

(b) With the engine idling, shift the selector into each gear from P range to L range and return to P range.

HINT: Depress the brake pedal.

(c) Pull out the transmission dipstick and wipe it clean.

(d) Push it back fully into the tube.

(e) Pull it out and check that the fluid level is in the HOT range. If the level is at the low side of the hot range, and fluid.

Fluid type: ATF DEXRON®II

NOTICE: Do not overfill.

2. CHECK FLUID CONDITION

If the fluid smells burnt or is black, replace it.

3. REPLACE ATF

NOTICE: Do not overfill.

(a) Remove the drain plug and drain the fluid.

(b) Reinstall the drain plug securely.

(c) With the engine OFF, add new fluid through the dipstick tube.

Fluid: ATF DEXRON®II

Capacity:
8.0 liters (8.5 US qts, 7.0 Imp. qts)
Drain and refill (Reference):
3.3 liters (3.5 US qts, 8.9 Imp. qts)

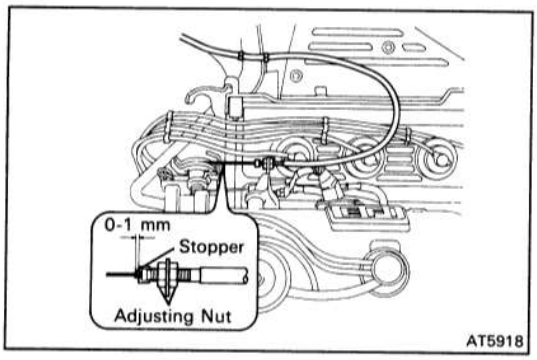
(d) Start the engine and shift the selector into all positions from P through L and then shift into P.

(e) With the engine idling, check the fluid level. Add fluid up to the "COOL" level on the dipstick.

(f) Check the fluid level at the normal fluid temperature (70 – 80 °C or 158 – 176 °F) and add as necessary.

NOTICE: Do not overfill.

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4. INSPECT AND ADJUST THROTTLE CABLE

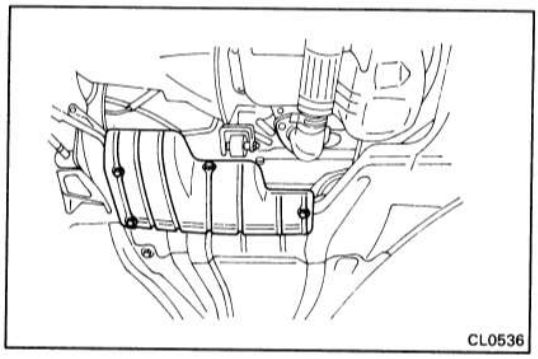
(a) Check that the throttle valve is fully closed.

(b) Check that the inner cable is not slack.

(c) Measure the distance between the outer cable end and stopper on the cable.

Standard distance: 0 – 1 mm (0 – 0.04 in.)

If the distance is not standard, adjust the cable by the adjusting nuts.

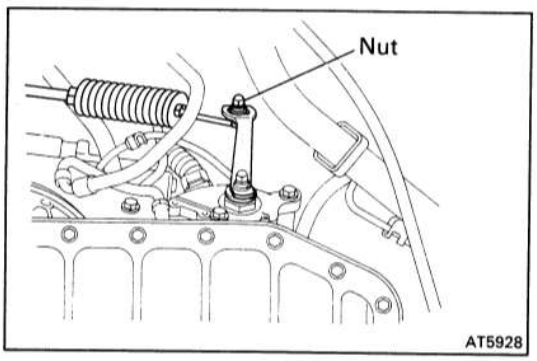


5. INSPECT AND ADJUST SHIFT CABLE

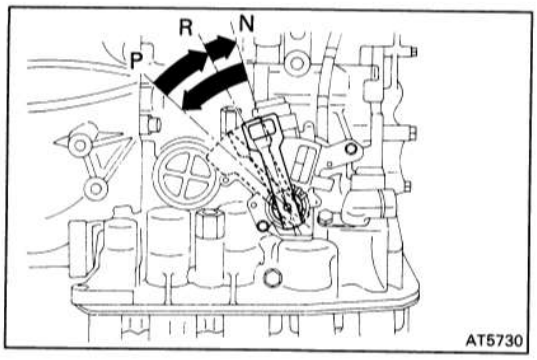
When shifting the shift lever from the N position to other positions, check that the lever can be shifted smoothly and accurately to each position and that the position indicator correctly indicates the position.

If the indicator is not aligned with the correct position, carry out the following adjustment procedure.

(a) Remove the No. 1 engine under cover.



(b) Loosen the swivel nut on manual shift lever.



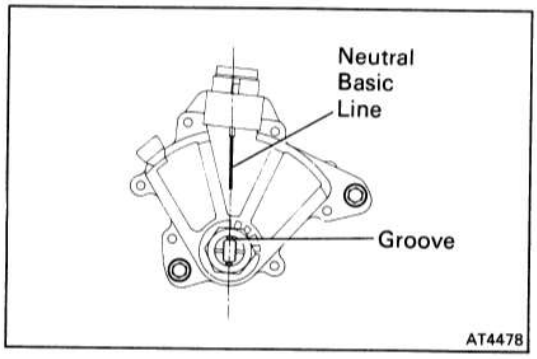
(c) Push the manual shift lever fully toward the right side of the vehicle.

(d) Return the lever two notches to NEUTRAL position.

(e) Set the shift lever to N.

(f) While holding the lever lightly toward the R range side, tighten the swivel nut.

(g) Install the No. 1 engine under cover.



6. ADJUST NEUTRAL START SWITCH

If the engine will start with the shift selector in any range other than N or P range, adjustment is required.

(a) Loosen the neutral start switch bolts and set the shift selector to the N range.

(b) Align the groove and neutral basic line.

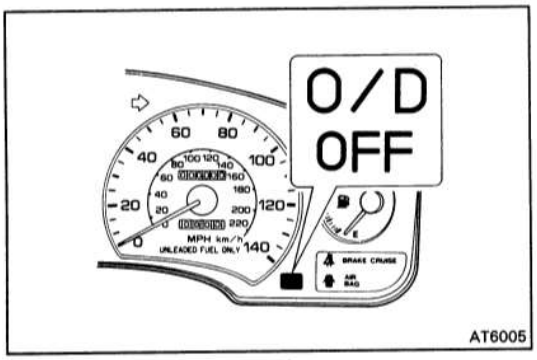
(c) Hold in position and tighten the bolts.

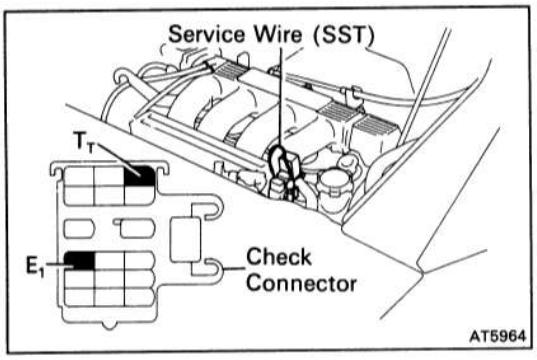
Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)

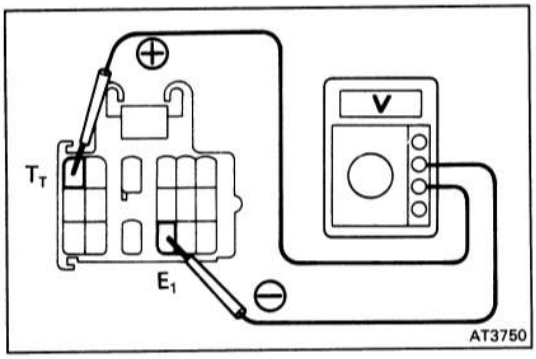
7. INSPECT IDLE SPEED (N RANGE)

Idle speed: 700 ± 50 rpm

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Diagnosis System

DESCRIPTION

1. A self-diagnosis function is built into the electrical control system. Warning is indicated by the overdrive OFF indicator.

   HINT: Warning and diagnostic codes can be read only when the overdrive switch is ON. If OFF, the overdrive OFF indicator is lit continuously and will not blink.

   (a) If a malfunction occurs within the speed sensors or solenoids, the overdrive OFF light will not blink to warn the driver.
   However, there will be no warning of a malfunction with lock-up solenoid.

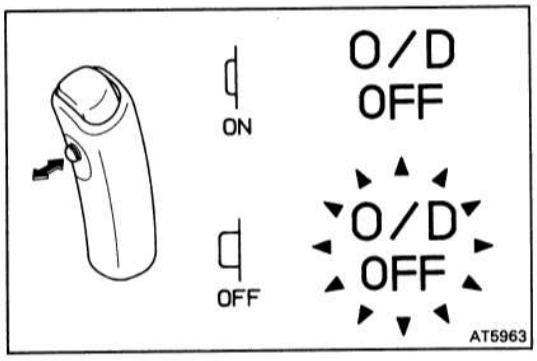
   (b) The diagnostic code can be read by the number of blinks of the overdrive OFF indicator when terminals T_T and E_1 are short-circuited. (See page AT-15)

   (c) The throttle position sensor or brake signal are not indicated, but inspection can be made by checking the voltage at terminal T_T of the check connector.

   (d) The signals to each gear can be checked by measuring the voltage at terminal T_T of the check connector while driving.

2. The diagnostic (malfunction) code is retained in memory by the ECU and due to back-up voltage, is not canceled out when the engine is turned off. Consequently, after repair, it is necessary to turn the ignition switch off and remove the fuse EFI (15A) or disconnect the ENGINE and ECT ECU connector to cancel out the diagnostic (malfunction) code. (See page AT-16)

   HINT:
   - Low battery voltage will cause faulty operation of the diagnosis system. Therefore, always check the battery first.
   - Use a voltmeter and ohmmeter that have an impedance of at least 10 kΩ/V.

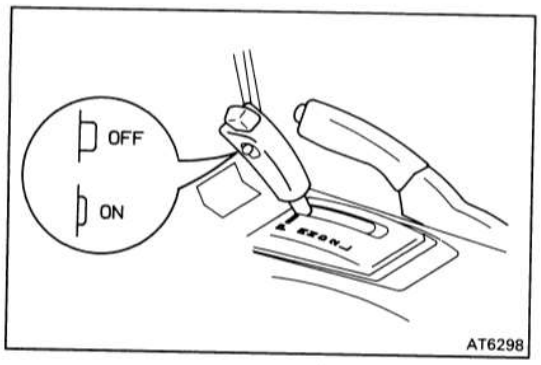


CHECK O/D OFF INDICATOR LIGHT

1. Turn the ignition switch ON.
2. The O/D OFF light will come on when the O/D switch is placed at OFF.
3. When the O/D switch is set to ON, the O/D OFF light should go out.

   If the O/D OFF light flashes when the O/D switch is set to ON, the electronic control system is faulty.

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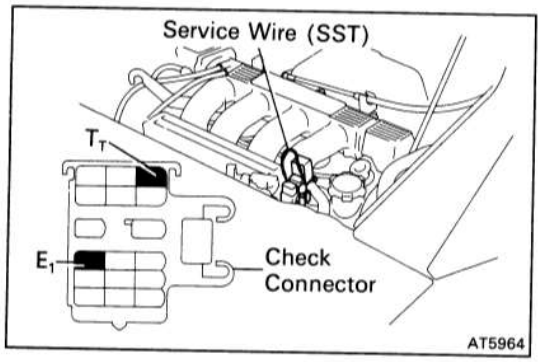


READ DIAGNOSTIC CODE

1. TURN IGNITION SWITCH AND O/D SWITCH TO ON

Do not start the engine.

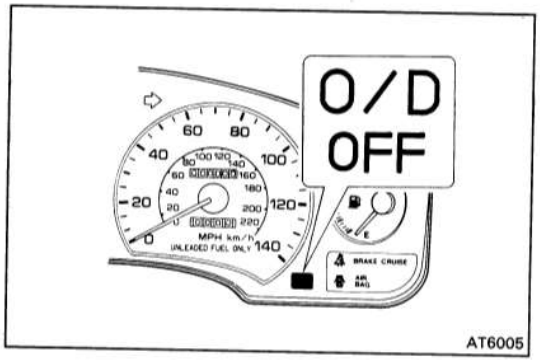
HINT: Warning and diagnostic codes can be read only when the overdrive switch is ON. If OFF, the overdrive OFF light will light continuously and will not blink.



2. SHORT T_T TERMINAL CIRCUIT OF CHECK CONNECTOR

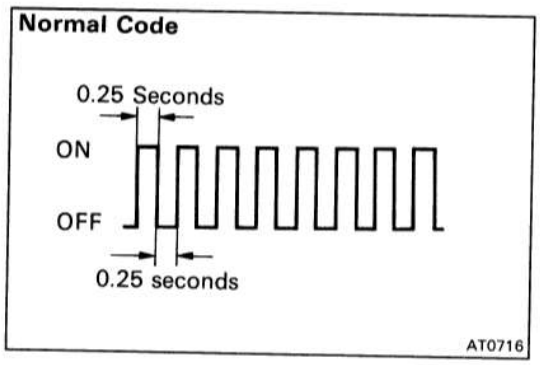
Using SST, short terminals T_T and E_1 of the check connector.

SST 09843-18020



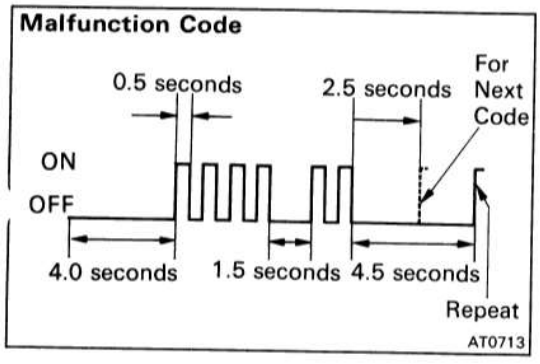
3. READ DIAGNOSTIC CODE

Read the diagnostic code as indicated by the number of times the O/D OFF indicator flashes.



(Diagnostic Code Indication)

- If the system is operating normally, the light will blink once every 0.25 seconds.



- In the event of a malfunction, the light will blink once every 0.5 seconds. The number of blinks will equal the first number and, after 1.5 seconds pause, the second number of the two digit diagnostic code. If there are two or more codes, there will be a 2.5 seconds pause between each.

HINT: In the event of several trouble codes occurring simultaneously, indication will begin from the smaller value and continue to the larger.

4. REMOVE SST

SST 09843-18020

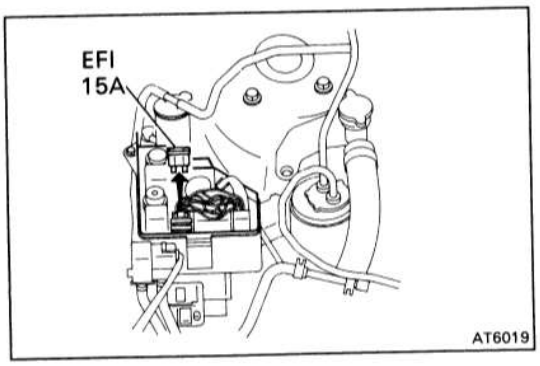
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DIAGNOSTIC CODES

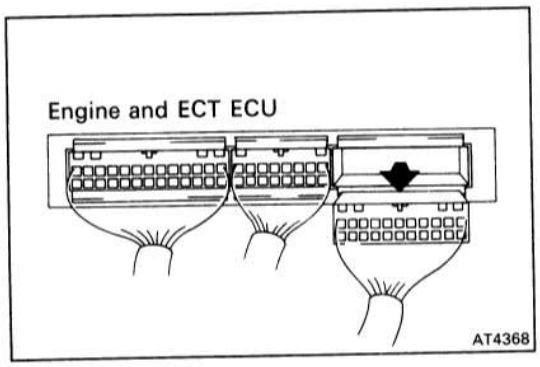
Code No.	Light Pattern	Diagnosis System
—		Normal
42		Defective No. 1 speed sensor (in combination meter) – severed wire harness or short circuit
61		Defective No. 2 speed sensor (in ATM) – severed wire harness or short circuit
62		Severed No. 1 solenoid or short circuit – severed wire harness or short circuit
63		Severed No. 2 solenoid or short circuit – severed wire harness or short circuit
64		Severed lock-up solenoid or short circuit – severed wire harness or short circuit

AT2020

HINT: If codes 62, 63 or 64 appear, there is an electrical malfunction in the solenoid.
Causes due to mechanical failure, such as a stuck valve, will not appear.



AT6019



AT4368

CANCEL OUT DIAGNOSTIC CODE

1. After repair of the trouble area, the diagnostic code retained in memory by the Engine an ECT ECU must be canceled by removing the fuse EFI (15A) for 10 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch OFF.

   HINT:
   - Cancellation can be also done by removing the battery negative (–) terminal, but in this case other memory systems will be also canceled out.
   - The diagnostic code can be also canceled out by disconnecting the Engine and ECT ECU connector.
   - If the diagnostic code is not canceled out, it will be retained by the Engine and ECT ECU and appear along with a new code in event of future trouble.

2. After cancellation, perform a road test to confirm that a "normal code" is now read on the O/D OFF light.

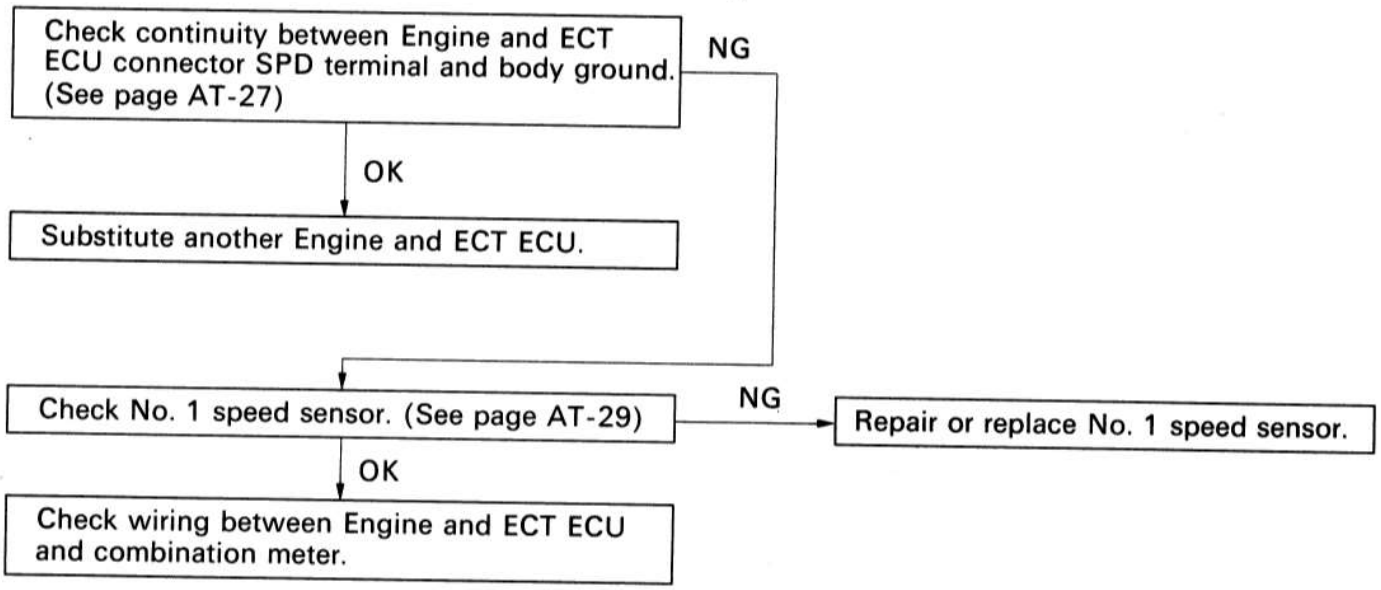
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TROUBLESHOOTING FLOW-CHART

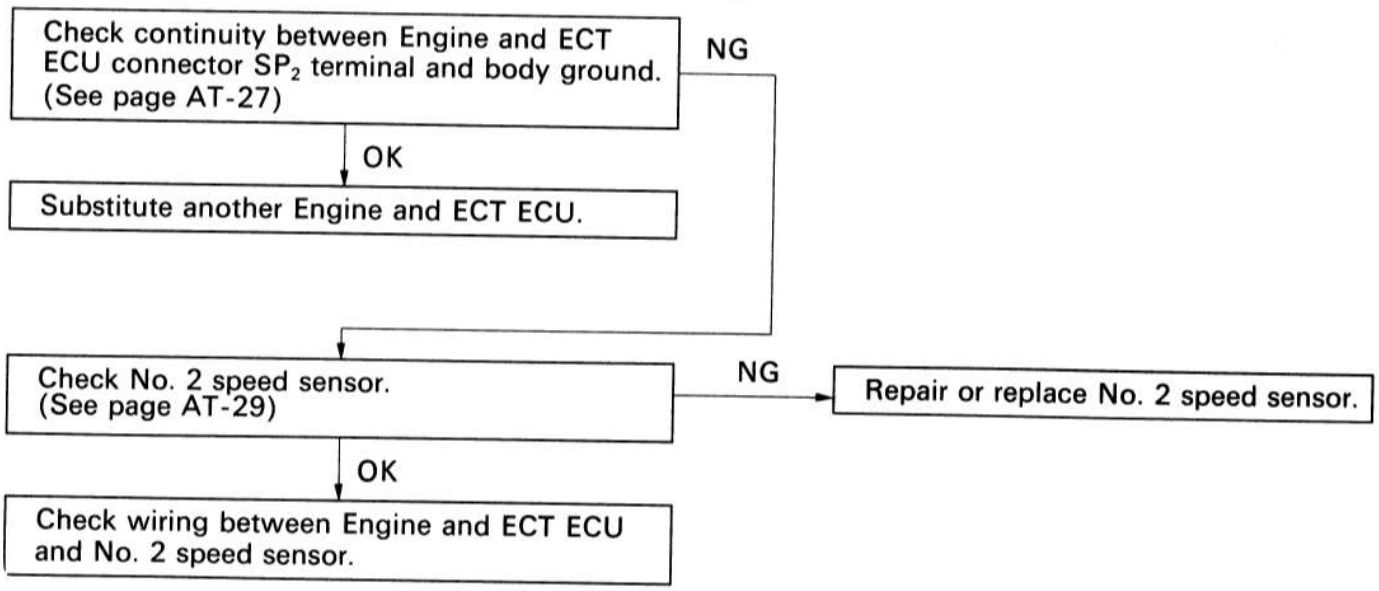
HINT:

- If diagnostic code Nos. 42, 61, 62 or 63 are output, the overdrive OFF indicator light will begin to blink immediately to warn the driver. However, an impact or shock may cause the blinking to stop; but the code will still be retained in the Engine and ECT ECU memory until canceled out.
- There is no warning for diagnostic code No. 64.
- In the event of a simultaneous malfunction of both No. 1 and No.2 speed sensors, no diagnostic code will appear and the fail-safe system will not function. However, when driving in the D range, the transaxle will not up-shift from first gear, regardless of the vehicle speed.

1. Diagnostic code 42 (No. 1 speed sensor circuitry)

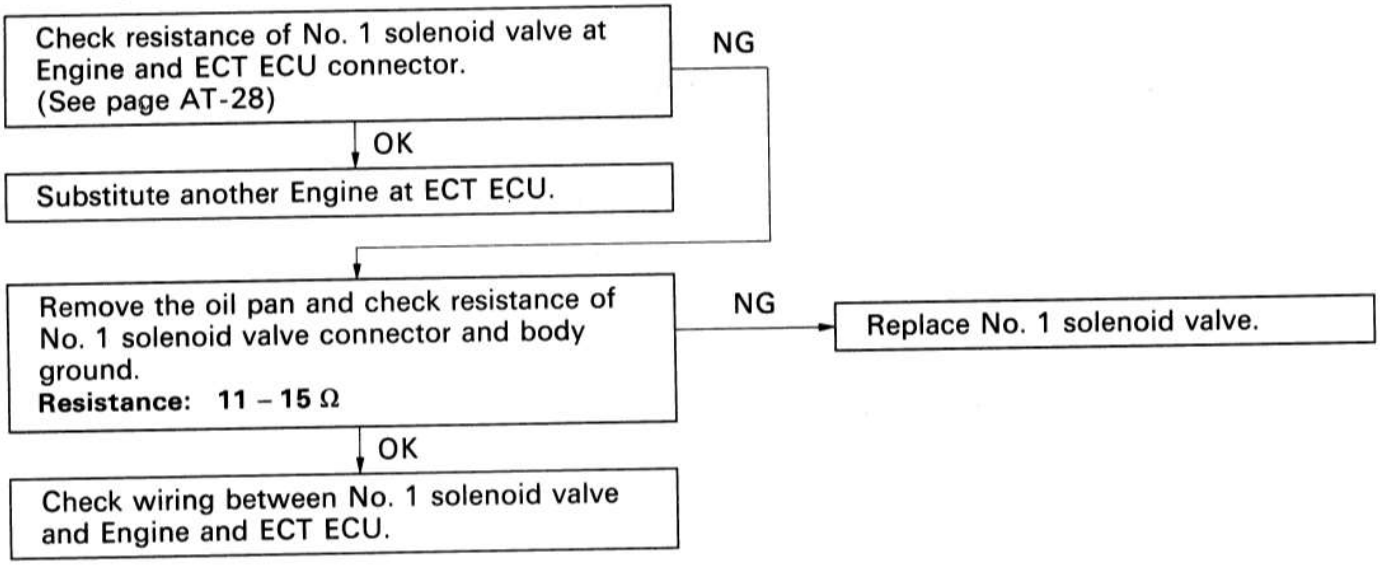


2. Diagnostic code 61 (No. 2 speed sensor circuitry)

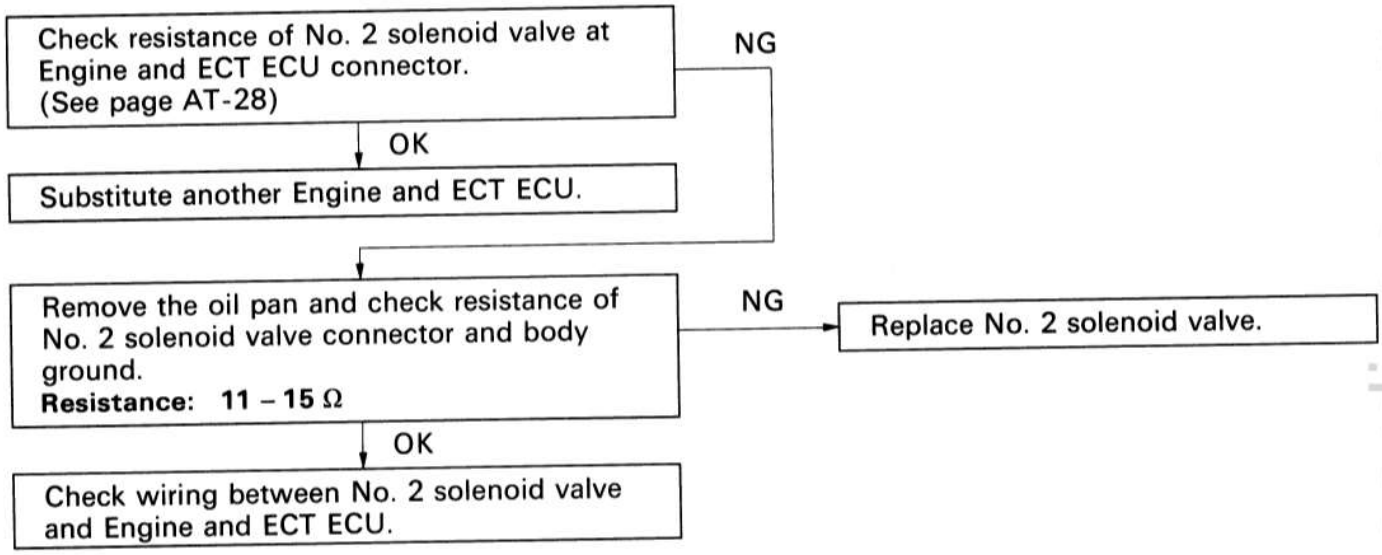


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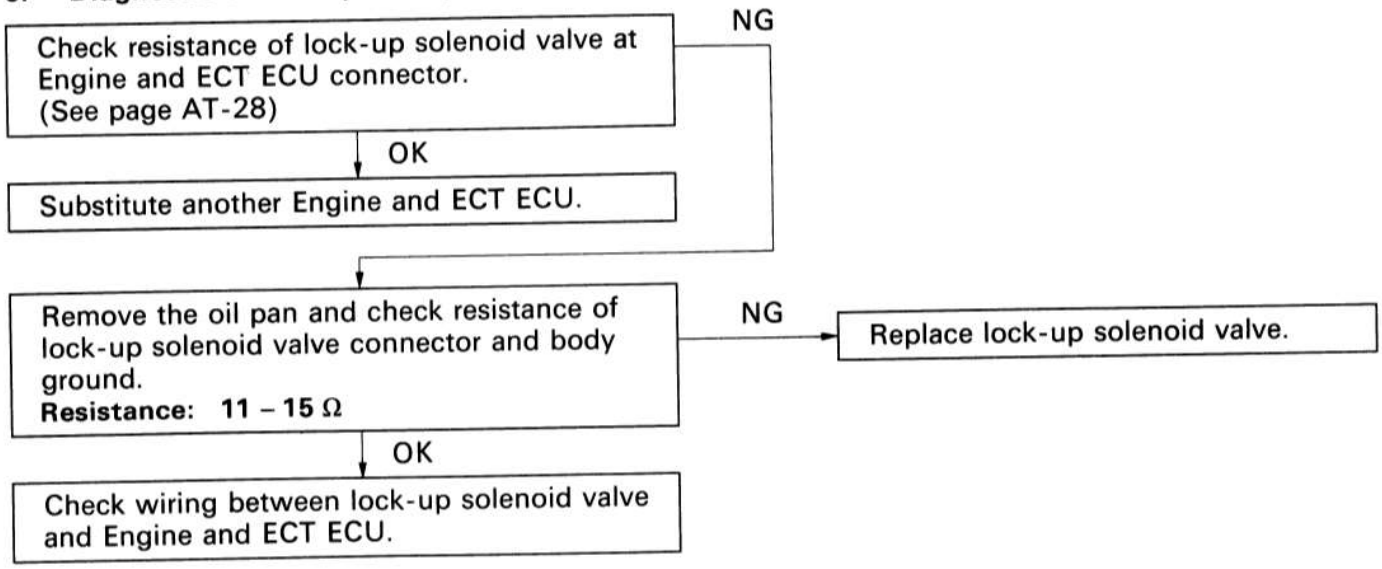
3. Diagnostic code 62 (No. 1 solenoid valve circuitry)



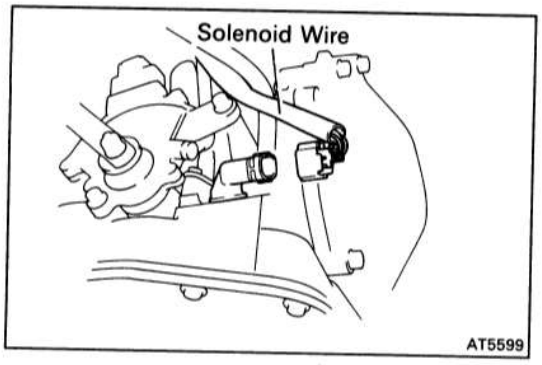
4. Diagnostic code 63 (No. 2 solenoid valve circuitry)



5. Diagnostic code 64 (Lock-up solenoid valve circuitry)



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Manual Shifting Test

HINT: With this test, it can be determined whether the trouble lies within the electrical circuit or is a mechanical problem in the transaxle.

1. **DISCONNECT SOLENOID WIRE**

2. **INSPECT MANUAL DRIVING OPERATION**

Check that the shift and gear positions correspond with the table below.

Shift position	D range	2 range	L range	R range	P range
Gear position	O/D	3rd	1st	Reverse	Pawl Lock

HINT: If the L, 2 and D range gear positions are difficult to distinguish, perform the following road test.

- While driving, shift through the L, 2 and D ranges. Check that the gear change corresponds to the shift position.

If any abnormality is found in the above test, the problem lies in transaxle itself.

3. **CONNECT SOLENOID WIRE**

4. **CANCEL OUT DIAGNOSTIC CODE**
(See page AT-16)

REFERENCE: Possible gear positions in accordance with solenoid operating conditions.

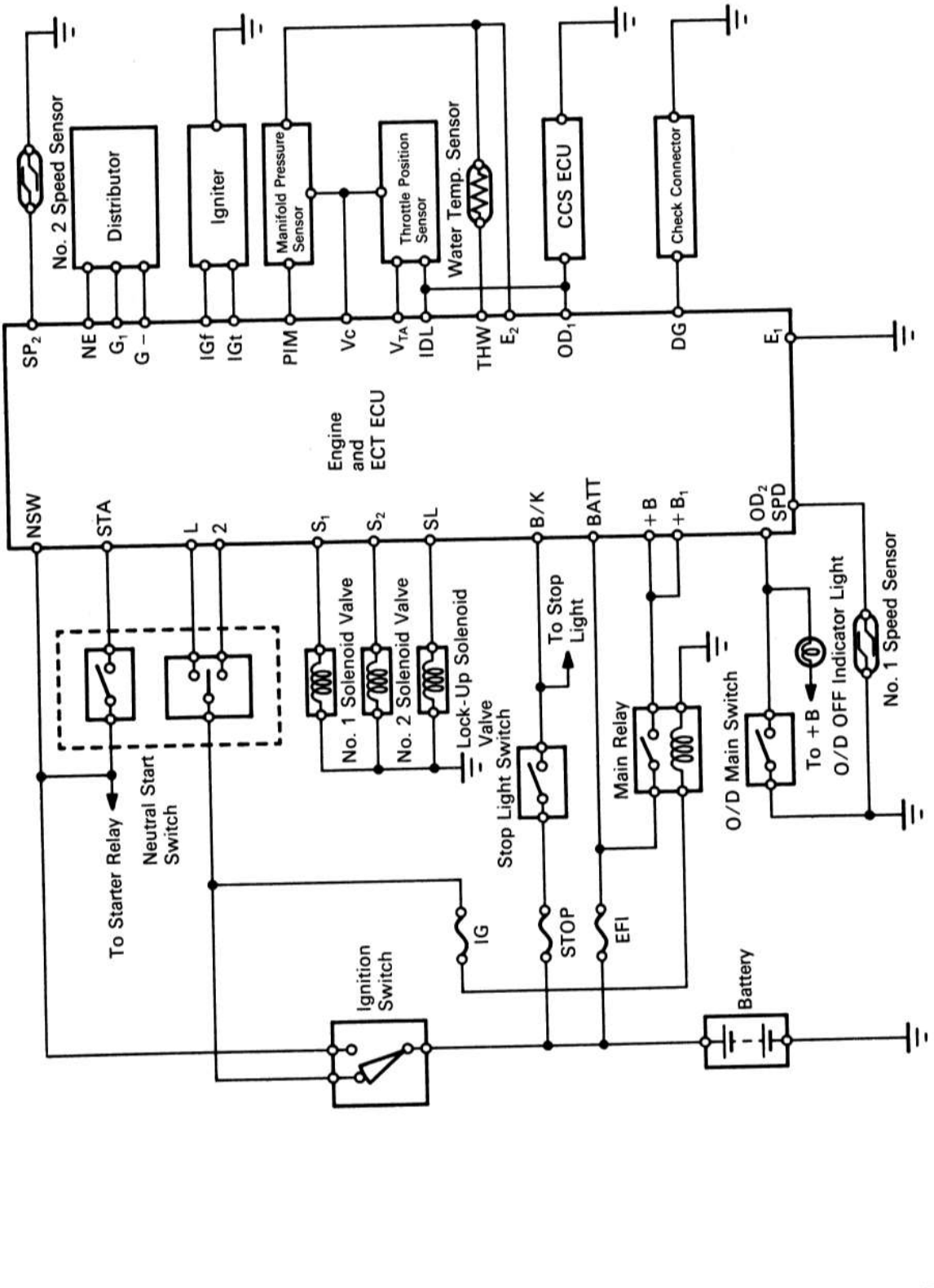
Range	NORMAL			No. 1 SOLENOID MALFUNCTIONING			No. 2 SOLENOID MALFUNCTIONING			BOTH SOLENOIDS MALFUNCTIONING		
	Solenoid Valve		Gear Position	Solenoid Valve		Gear Position	Solenoid Valve		Gear Position	Solenoid Valve		Gear Position
	No. 1	No. 2		No. 1	No. 2		No. 1	No. 2		No. 1	No. 2	
D range	ON	OFF	1st	X	ON	3rd	ON	X	1st	X	X	O/D
	ON	ON	2nd	X	ON	3rd	OFF	X	O/D	X	X	O/D
	OFF	ON	3rd	X	ON	3rd	OFF	X	O/D	X	X	O/D
	OFF	OFF	O/D	X	OFF	O/D	OFF	X	O/D	X	X	O/D
2 range	ON	OFF	1st	X	ON	3rd	ON	X	1st	X	X	3rd
	ON	ON	2nd	X	ON	3rd	OFF	X	3rd	X	X	3rd
	OFF	ON	3rd	X	ON	3rd	OFF	X	3rd	X	X	3rd
L range	ON	OFF	1st	X	OFF	1st	ON	X	1st	X	X	1st
	ON	ON	2nd	X	ON	2nd	ON	X	1st	X	X	1st

X: Malfunctions

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Electronic Control System

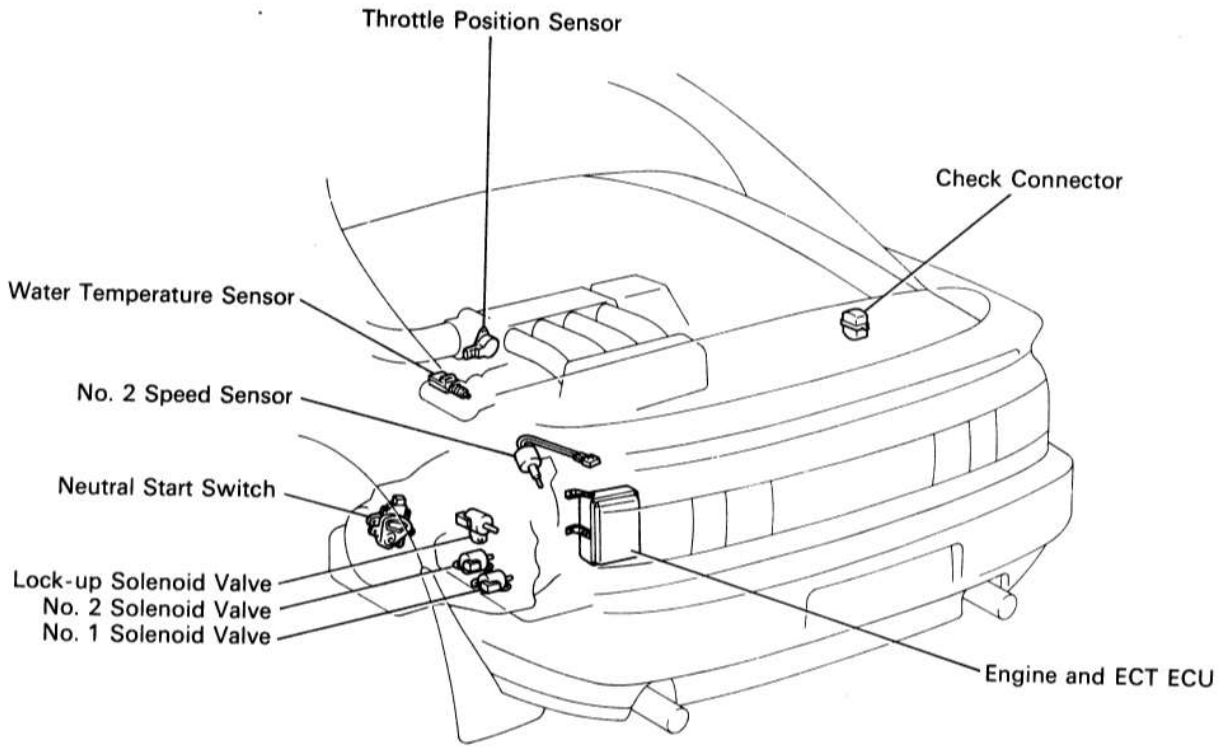
ELECTRONIC CONTROL CIRCUIT

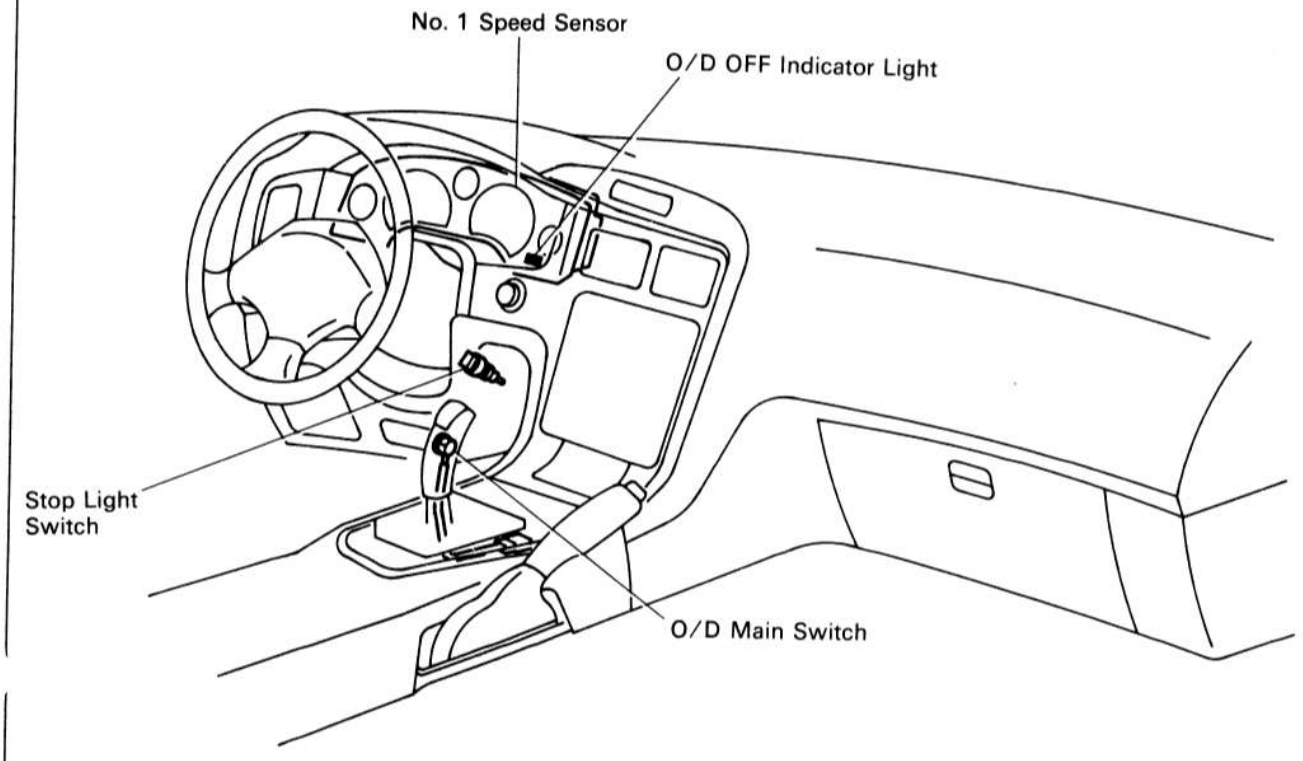


AT6299

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ELECTRONIC CONTROL COMPONENTS



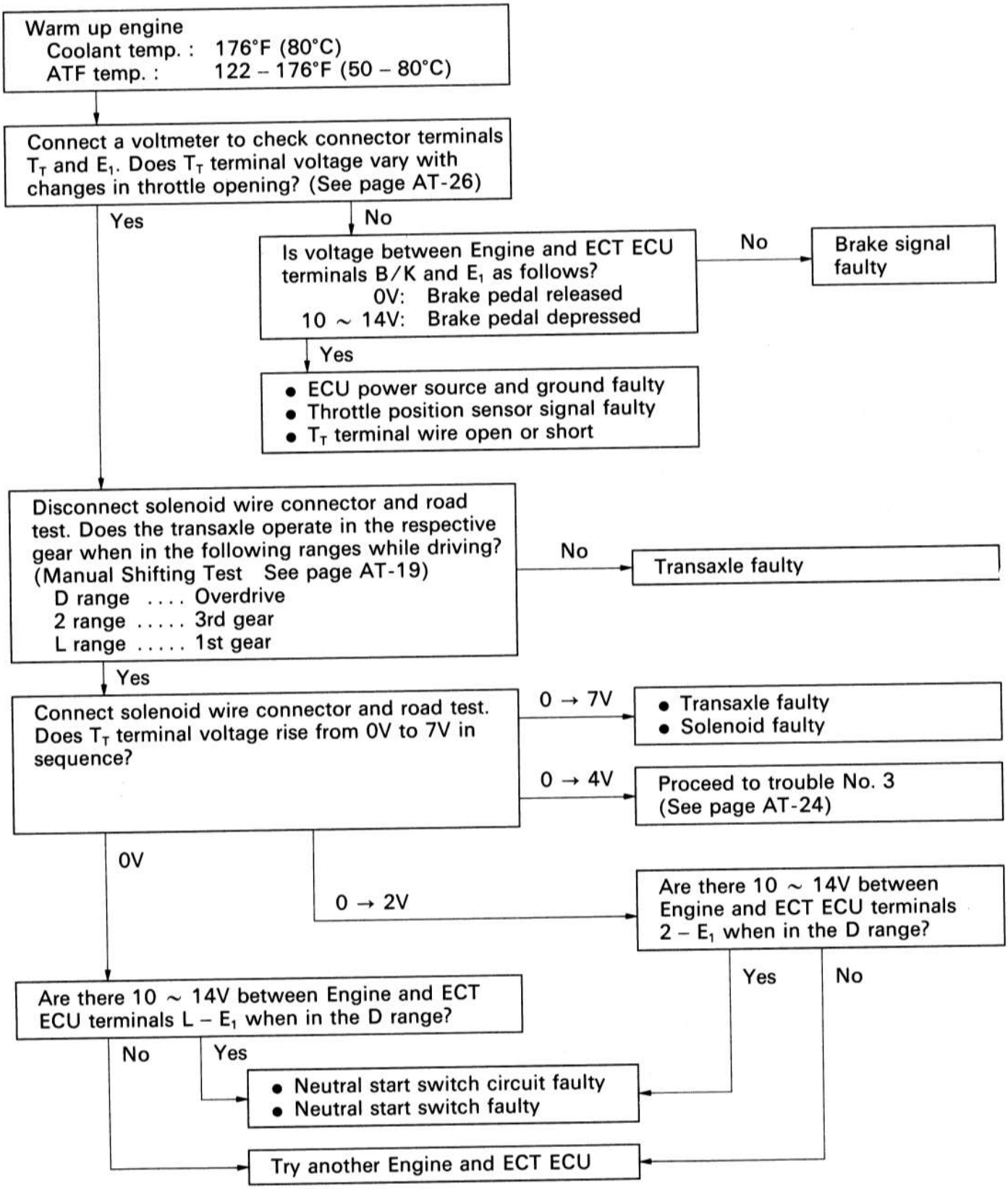


AT6013
AT6295

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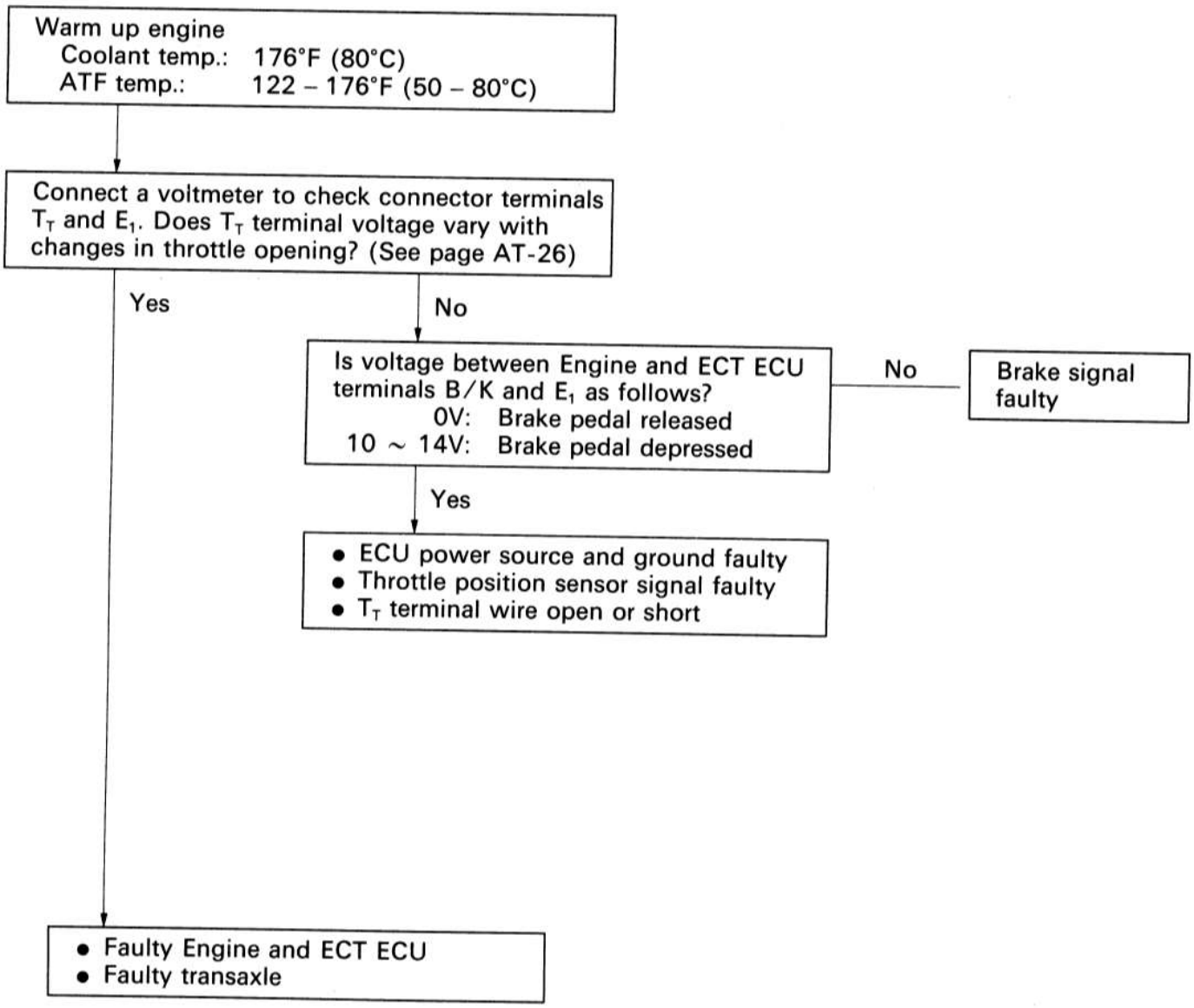
TROUBLESHOOTING FLOW-CHART

Trouble No. 1 No shifting



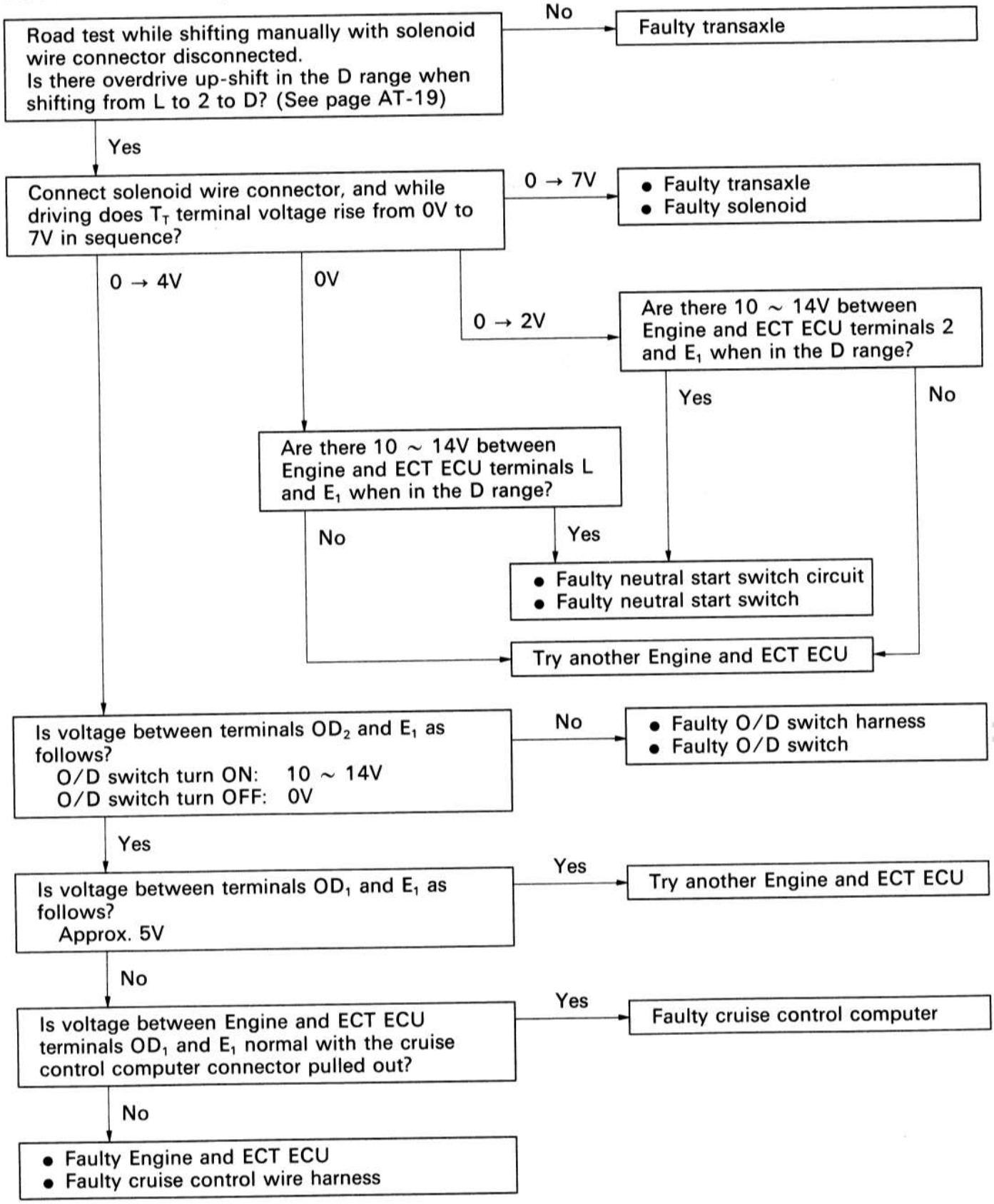
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Trouble No. 2 Shift point too high or too low



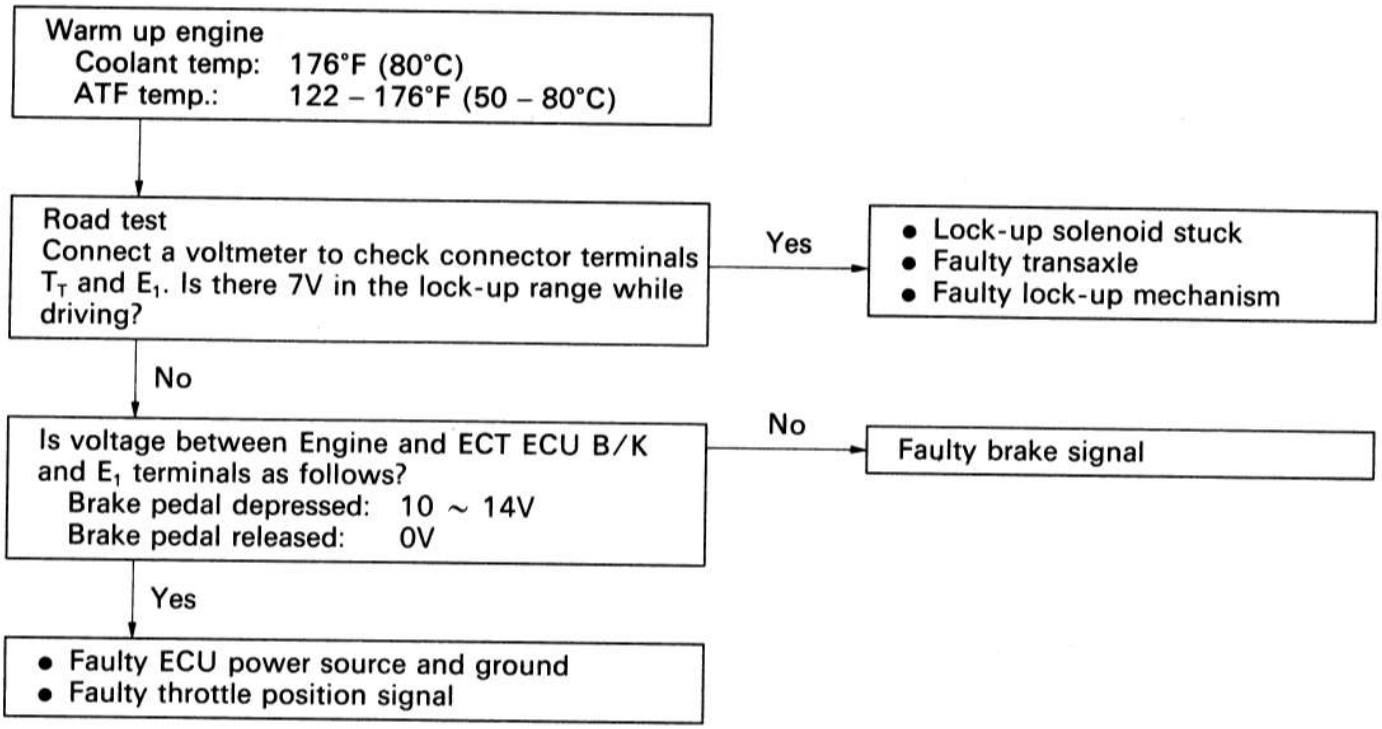
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Trouble No. 3 No up-shift to overdrive (After warm-up)

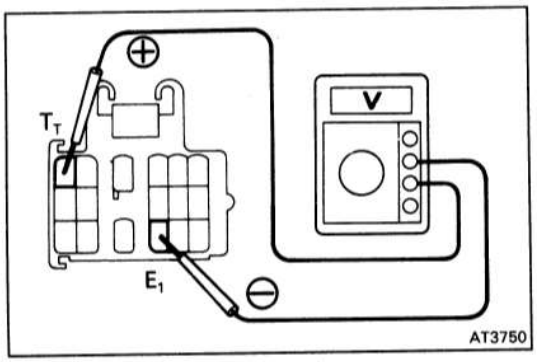


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Trouble No. 4 No lock-up (After warm-up)



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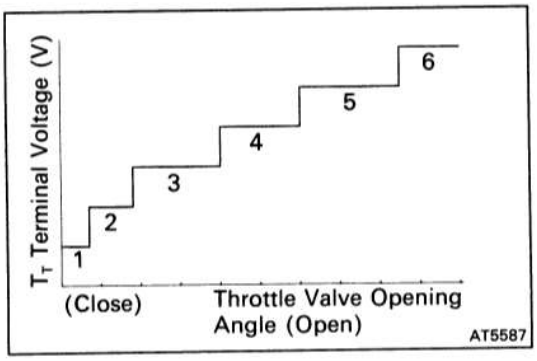


INSPECTION OF T_T TERMINAL VOLTAGE

1. INSPECT THROTTLE POSITION SENSOR SIGNAL

(a) Turn the ignition switch to ON. Do not start the engine.

(b) Connect a voltmeter to terminals T_T and E_1.



(c) While slowly depressing the accelerator pedal, check that T_T terminal voltage rises in sequence.

If the voltage does not change in proportion to the throttle opening angle, there is a malfunction in the throttle position sensor or circuit.

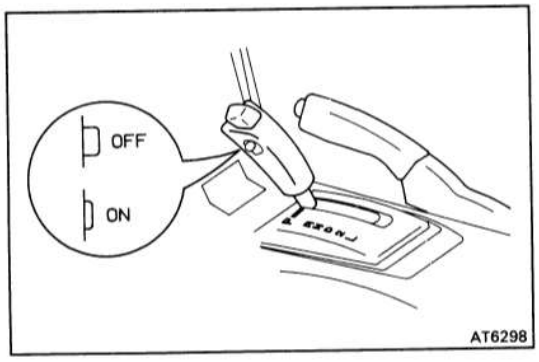
2. INSPECT BRAKE SIGNAL

(a) Depress the accelerator pedal until the T_T terminal indicates 6V.

(b) Depress the brake pedal and check the voltage reading from the T_T terminal.

Brake pedal depressed 0V
Brake pedal released 6V

If not as indicated, there is a malfunction in either the stop light switch or circuit.



T_T Terminal (V)	Gear position
0	1st
2	2nd
4	3rd
6	O/D
7	O/D Lock up

3. INSPECT EACH UP-SHIFT POSITION

(a) Warm up the engine.

Coolant temperature: 176°F (80°C)

(b) Turn the O/D switch to "ON".

(c) Place the pattern select switch in "NORMAL" and the shift level into the D range.

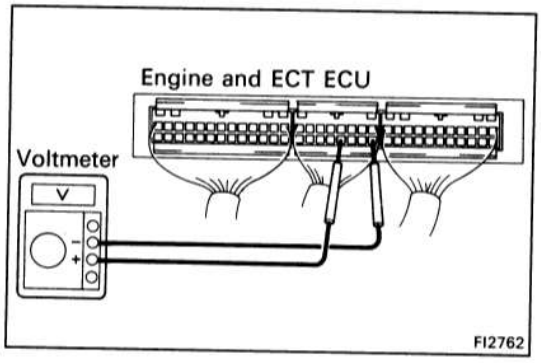
(d) During a road test (above 10 km/h or 6 mph) check that voltage at the T_T terminal is as indicated below for each up-shift position.

If the voltage rises from 0V to 7V in the sequence shown, the control system is okay.

The chart on the left shows the voltmeter reading and corresponding gears.

HINT: Determine the gear position by a light shock or change in engine rpm when shifting.

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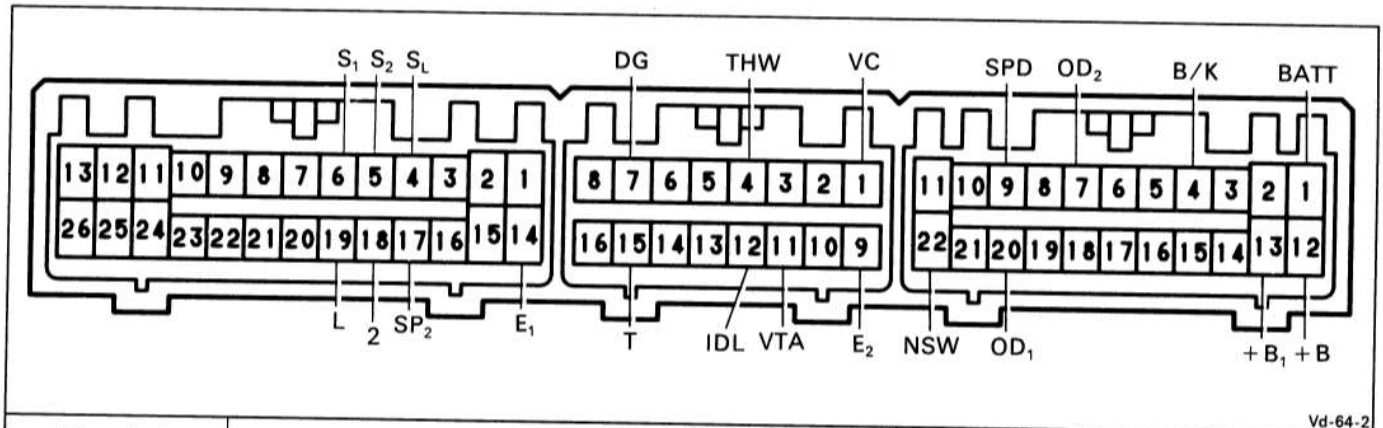


INSPECTION OF ELECTRONIC CONTROL COMPONENTS

1. INSPECT VOLTAGE OF ENGINE AND ECT ECU CONNECTOR

(a) Turn on the ignition switch.

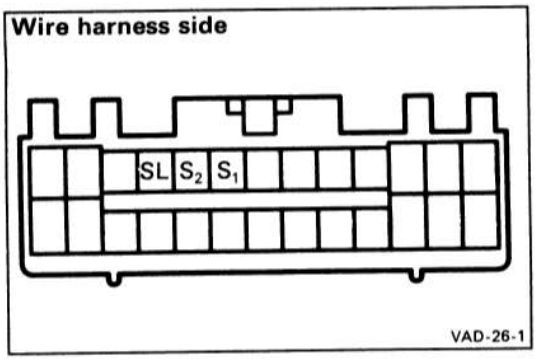
(b) Do not disconnect Engine and ECT ECU connector. Measure the voltage at each terminal.



Terminal	Measuring condition		Voltage (V)
$S_1 - E_1$	Ignition switch turned ON		10 – 14
S_2, $S_L - E_1$	Ignition switch turned ON		1 or less
STP – E_1	Brake pedal is depressed		10 – 14
	Brake pedal is released		1 or less
THW – E_2	Coolant temp. 176°F (80°C)		0.1 – 0.8
IDL – E_2	Throttle valve fully closed		1 or less
	Throttle valve open		4.5 – 5.5
VTA – E_2	Thottle valve fully closed		0.1 – 0.8
	Throttle valve open		4.5 – 5.5
VC – E_2	———		4.5 – 5.5
$OD_1 - E_1$	———		10 – 14
$OD_2 - E_1$	O/D main switch turned ON		10 – 14
	O/D main switch turned OFF		1 or less
SPD – E_1	Cruise control main switch OFF	Standing still	1 or less
		Vehicle moving	Repeat : 0 ↔ 10 – 4
$SP_2 - E_1$	Standing still		1 or less
	Vehicle moving		Repeat : 0 ↔ 4.5 – 5.5

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Terminal	Measuring condition	Voltage (V)
NSW – E_1	P, N range	10 – 14
	R, D, 2, L range	1 or less
2 – E_1	2 range	10 – 14
	Except 2 range	1 or less
L – E_1	L range	10 – 14
	Except L range	1 or less
+B, +B – E_1	Ignition switch turned ON	10 – 14
BATT– E_1	All conditions	10 – 14



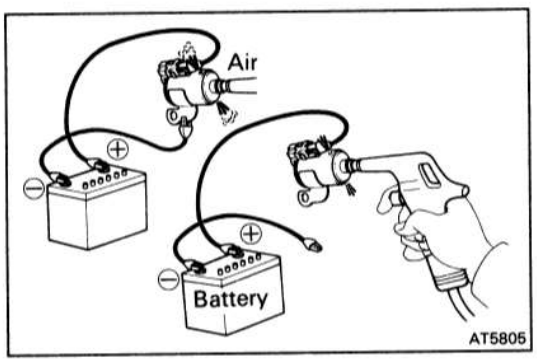
2. INSPECT SOLENOIDS

(a) Disconnect the connector from Engine and ECT ECU.

(b) Measure the resistance between S_1, S_2, S_L and body ground.

Resistance: 11 – 15 Ω

(c) Apply battery voltage to each terminal.
Check that an operation noise can be heard from the solenoid.



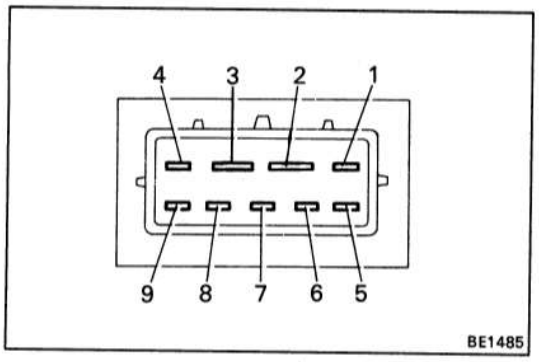
3. CHECK SOLENOID SEALS

If there is foreign material in the solenoid valve, there will be no fluid control even with solenoid operation.

Check No. 1, No. 2 and lock-up solenoid valves.

- Applying 5 kg/cm² (71 psi, 490 kPa) of compressed air, check that the solenoid valves do not leak the air.
- When battery voltage is supplied to the solenoids, check that the solenoid valves open.

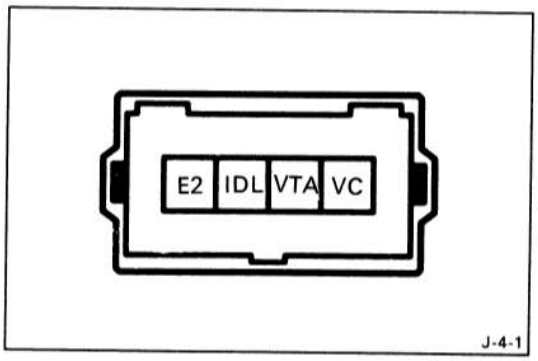
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4. INSPECT NEUTRAL START SWITCH

Using an ohmmeter, check the continuity of the terminals for each switch position shown in the table below.

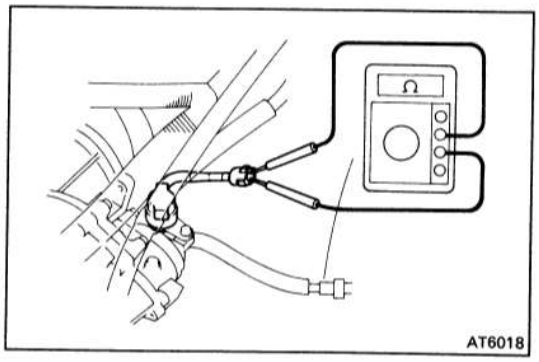
Range \ Terminal	2	3	6	1	5	7	8	9	4
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
2			○					○	
L			○						○



5. INSPECT THROTTLE POSITION SENSOR

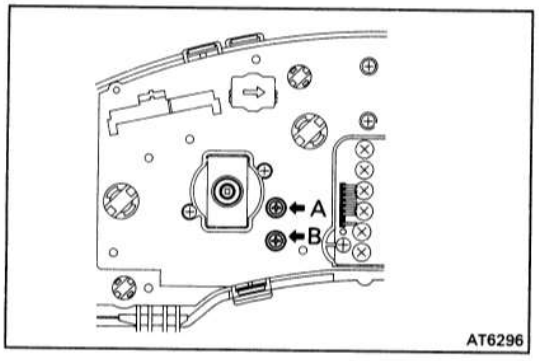
Using an ohmmeter, check the resistance between each terminal.

Terminal	Throttle valve condition	Resistance (kΩ)
IDL – E_2	Fully closed	0 – 0.1
	Open	Infinity
Vc – E_2	–	3 – 7
V_{TA} – E_2	Fully closed	0.2 – 0.8
	Fully open	3.2 – 10



6. INSPECT NO. 2 SPEED SENSOR

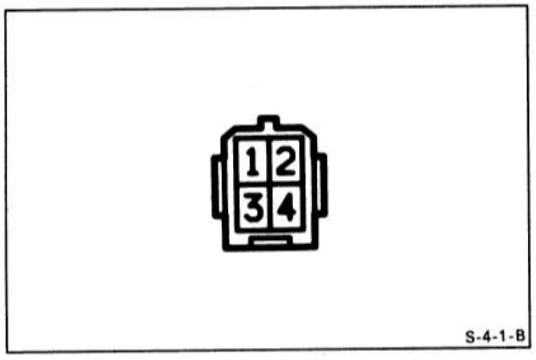
(a) Remove the air cleaner assembly.
(b) Jack up a front wheel on one side.
(c) Connect an ohmmeter between the terminals.
(d) Spin the wheel and check that the meter needle deflects from 0 to ∞ Ω.



7. INSPECT NO. 1 SPEED SENSOR IN COMBINATION METER

(a) Remove the combination meter.
(b) Connect an ohmmeter between terminals A and B.
(c) Revolve the meter shaft and check that the meter needle repeatedly deflects from 0 Ω to ∞ Ω.

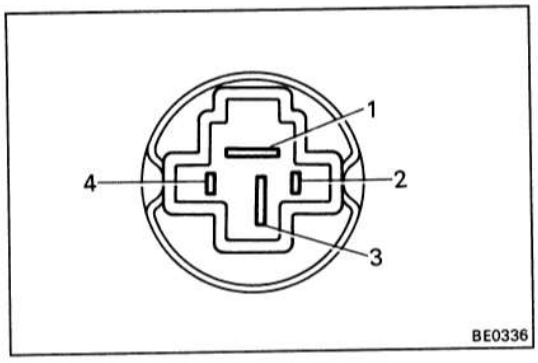
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8. INSPECT O/D MAIN SWITCH

Inspect that there is continuity between terminals 1 and 3.

S/W position \ Terminal	1	3
ON		
OFF	O——	——O



9. INSPECT STOP LIGHT SWITCH

Inspect that there is continuity between terminals 1 and 3.

S/W position \ Terminal	1	3
OFF (Release brake pedal)		
ON (Depress brake pedal)	O——	——O

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Mechanical System Tests

STALL TEST

The object of this test is to check the overall performance of the transaxle and engine by measuring the stall speeds in the D and R ranges.

NOTICE:

- **Perform the test at normal operation fluid temperature (50 – 80°C or 122 – 176°F).**
- **Do not continuously run this test longer than 5 seconds.**
- **To ensure safety, conduct this test in a wide, clear, level area which provides good traction.**
- **The stall test should always be carried out in pairs. One should observe the condition of wheels or wheel stoppers outside the vehicle while the other is performing the test.**

MEASURE STALL SPEED

(a) Chock the front and rear wheels.

(b) Connect a tachometer to the engine.

(c) Fully apply the parking brake.

(d) Keep your left foot pressed firmly on the brake pedal.

(e) Start the engine.

(f) Shift into the D range. Step all the way down on the accelerator pedal with your right foot. Quickly read the stall speed at this time.

Stall speed: 2,550 ± 150 rpm

(g) Perform the same test in R range.

EVALUATION

(a) If the stall speed is the same for both ranges without the rear wheels rotating but lower than specified value:

- Engine output may be insufficient
- Stator one-way clutch is not operating properly

(b) If the stall speed in D range is higher than specified:

- Line pressure too low
- Forward clutch slipping
- No. 2 one-way clutch not operating properly
- Underdrive one-way clutch not operating properly

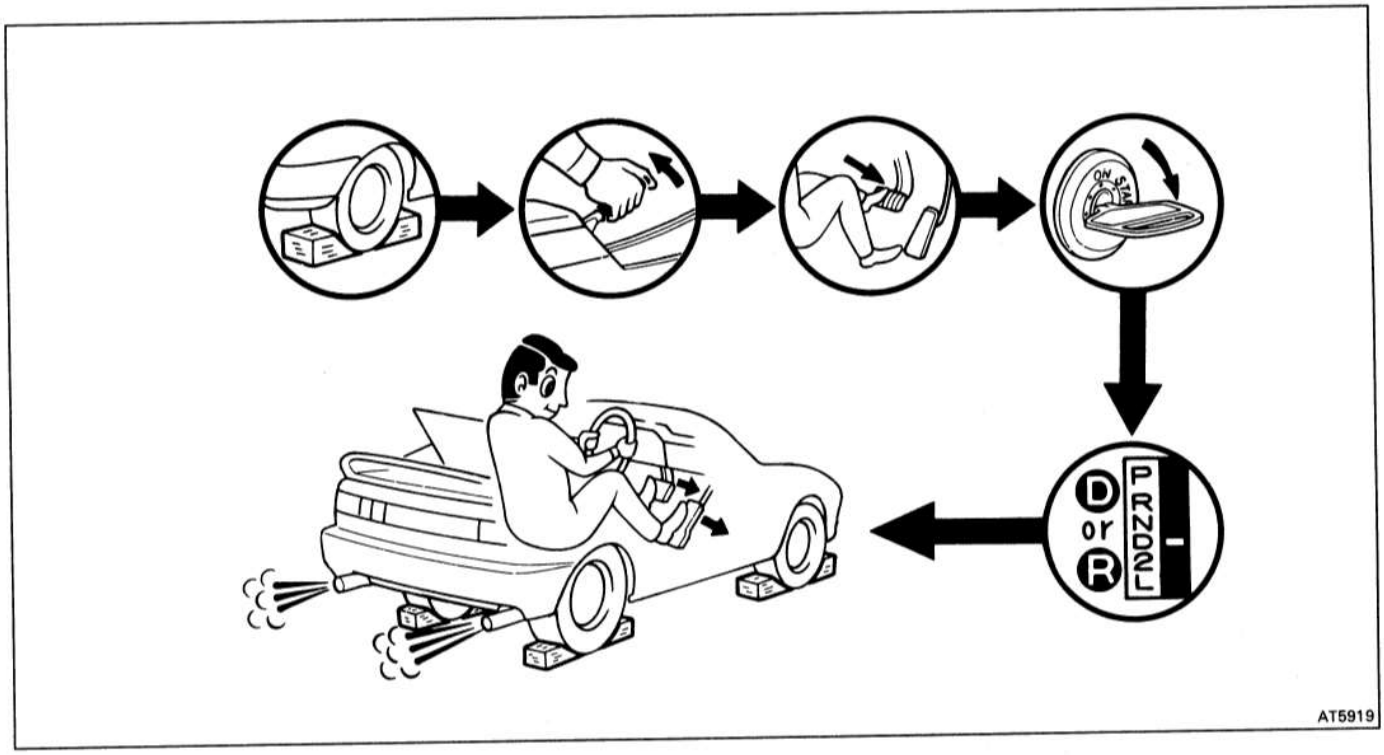
(c) If the stall speed in R range is higher than specified:

- Line pressure too low
- Direct clutch slipping
- First and reverse brake slipping
- Underdrive brake slipping

(d) If the stall speed in both R and D ranges are higher than specified:

- Line pressure too low
- Improper fluid level
- Underdrive brake slipping

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TIME LAG TEST

When the shift lever is shifted while the engine is idling, there will be a certain time lapse or lag before the shock can be felt. This is used for checking the condition of the underdrive clutch, forward clutch, direct clutch and first and reverse brake.

NOTICE:

- **Perform the test at normal operating fluid temperature (50 – 80°C or 122 – 176°F).**
- **Be sure to allow one minute interval between tests.**
- **Make three measurements and take the average value.**

MEASURE TIME LAG

(a) Fully apply the parking brake.

(b) Start the engine and check the idle speed.

Idle speed (N range): 700 ± 150 rpm

(c) Shift the shift lever from N to D position. Using a stop watch, measure the time it takes from shifting the lever until the shock is felt.

Time lag: Less than 1.2 seconds

(d) In the same manner, measure the time lag for N to R.

Time lag: Less than 1.5 seconds

EVALUATION

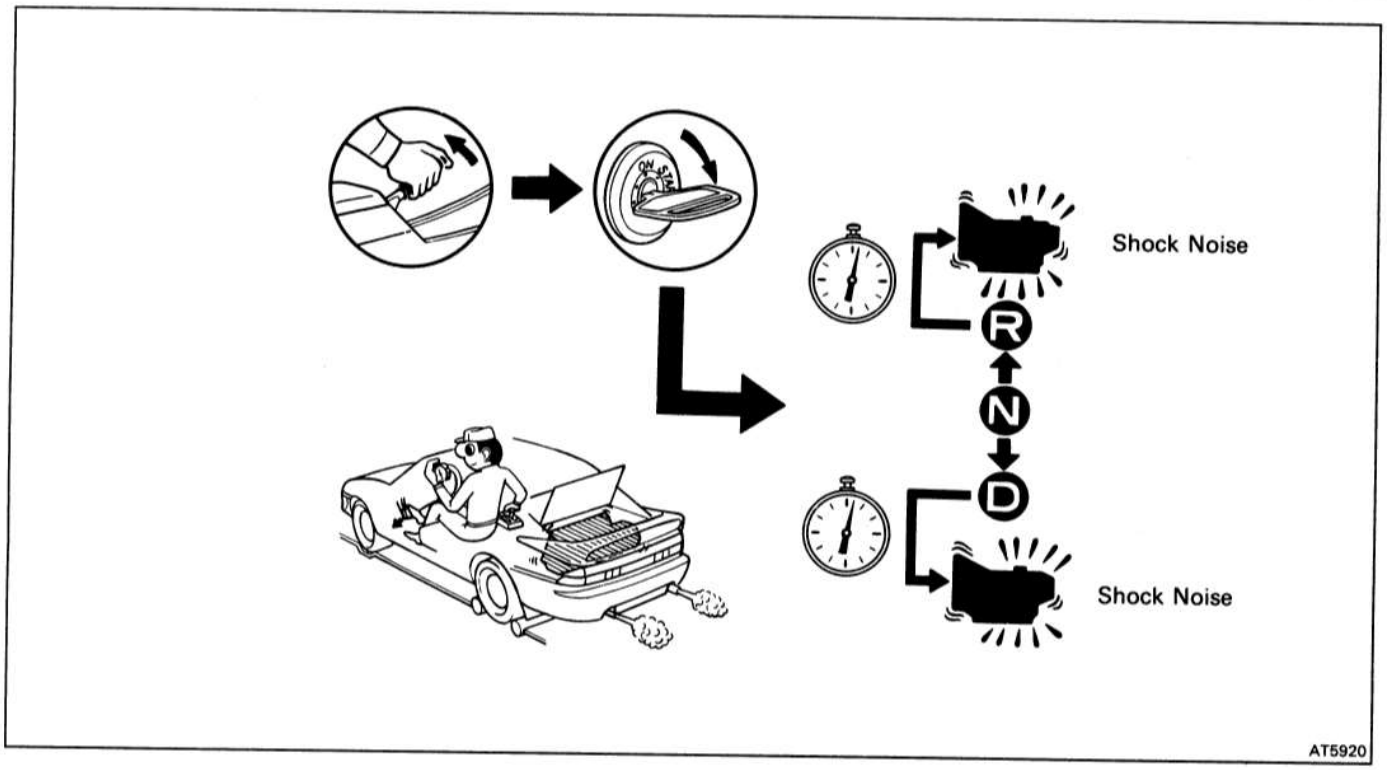
(a) If N → D time lag is longer than specified:

- Line pressure too low
- Forward clutch worn
- No. 2 and underdrive one-way clutch not operating properly

(b) If N → R time lag is longer than specified:

- Line pressure too low
- Direct clutch worn
- First and reverse brake worn
- Underdrive brake worn

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HYDRAULIC TEST

PREPARATION

(a) Warm up the transaxle fluid.

(b) Remove the transaxle case test plug and connect the hydraulic pressure gauge.

SST 09992-00094 (Oil pressure gauge)

CAUTION:

- **Perform the test at normal operating fluid temperature (50 – 80°C or 122 – 176°F).**
- **The line pressure test should always be carried out in pairs. One should observe the conditions of wheels or wheel stoppers outside the vehicle while the other is performing the test.**

MEASURE LINE PRESSURE

(a) Fully apply the parking brake and chock the front wheels.

(b) Start the engine and check idling rpm.

(c) Step down strongly on the brake pedal with your left foot an shift into D range.

(d) Measure the line pressure when the engine is idling.

(e) Press the accelerator pedal all the way down. Quickly read the highest line pressure when engine speed reaches stall speed.

(f) In the same manner, perform the test in R range.

ATM Type	Line pressure kg/cm² (psi, kPa)			
	D range		R range	
	Idling	Stall	Idling	Stall
A241E	3.8 – 4.3 (54 – 61, 373 – 422)	7.3 – 8.8 (104 – 125, 716 – 863)	6.5 – 8.1 (92 – 115, 637 – 794)	13.6 – 16.1 (193 – 229, 1,334 – 1,579)

If the measured pressures are not up to specified values, recheck the throttle cable adjustment and perform a retest.

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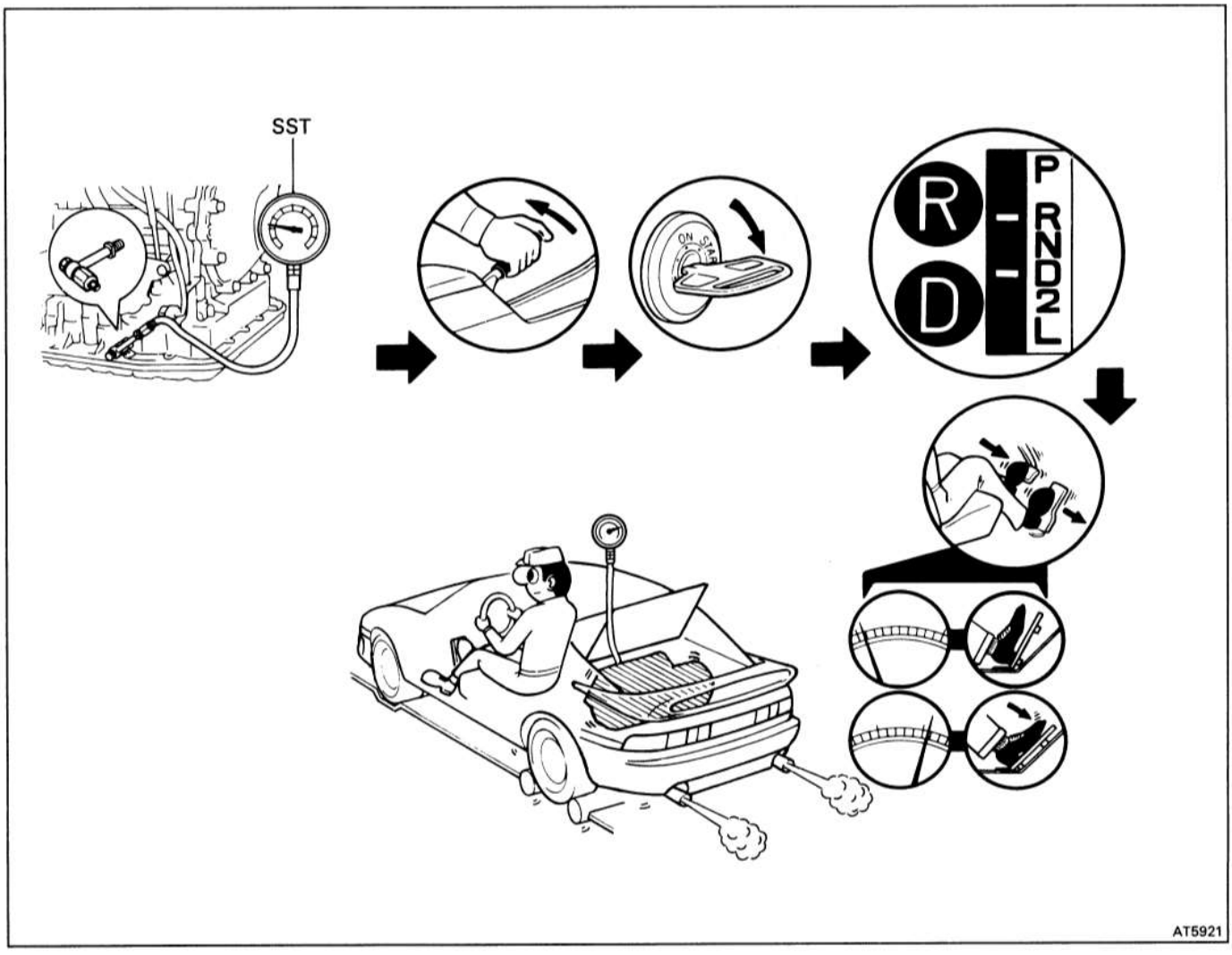
EVALUATION

(a) If the measured values at all ranges are higher than specified:
- Throttle cable out of adjustment
- Throttle valve defective
- Regulator valve defective

(b) If the measured values at all ranges are lower than specified:
- Throttle cable out of adjustment
- Throttle valve defective
- Regulator valve defective
- Oil pump defective
- Underdrive one-way clutch not operating properly

(c) If pressure is low in the D range only:
- D range circuit fluid leakage
- Forward clutch defective
- Underdrive one-way clutch not operating properly

(d) If pressure is low in the R range only:
- R range circuit fluid leakage
- Direct clutch defective
- First and reverse brake defective
- Underdrive one-way clutch not operating properly



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Road Test

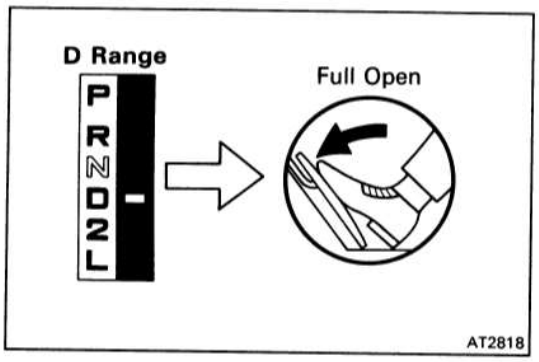
NOTICE: Perform the test at normal operating fluid temperature (50 – 80°C or 122 – 176°F).

1. D RANGE TEST IN NORM AND PWR PATTERN RANGES

Shift into the D range and hold the accelerator pedal constant at the full throttle valve opening position.

Check the following:

(a) 1-2, 2-3 and 3-O/D up-shifts should take place, and shift points should conform to those shown in the automatic shift schedule. (See page AT-38)



HINT:

- There is no O/D up-shift and lock-up when the coolant temp. is below 53°C (127°F).
- When the coolant temp. is below 60°C (140°F), the shift point is lower than specified in the automatic shift schedule.

EVALUATION

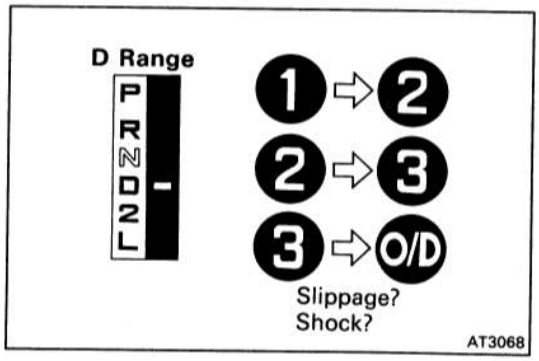
(1) If there is no 1 → 2 up-shift:
- No. 2 solenoid is stuck
- 1-2 shift valve is stuck

(2) If there is no 2 → 3 up-shift:
- No. 1 solenoid is stuck
- 2-3 shift valve is stuck

(3) If there is no 3 → O/D up-shift:
- 3-4 shift valve is stuck

(4) If the shift point is defective:
- Throttle valve, 1-2 shift valve, 2-3 shift valve, 3-4 shift valve etc., are defective

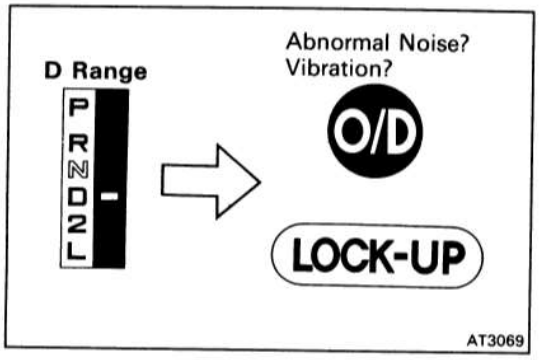
(5) If the lock-up is defective:
- Lock-up solenoid is stuck
- Lock-up relay valve is stuck



(b) In the same manner, check the shock and slip at the 1 → 2, 2 → 3 and 3 → O/D up-shifts.

EVALUATION

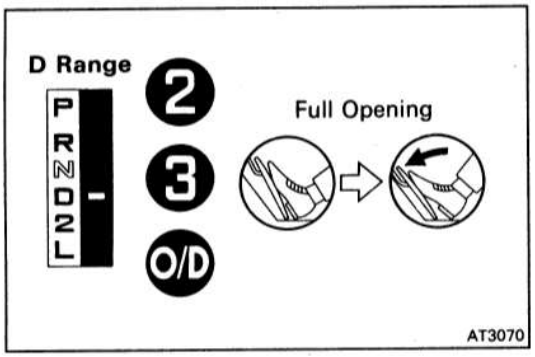
If the shock is excessive:
- Line pressure is too high
- Accumulator is defective
- Check ball is defective



(c) Run at the D range lock-up or O/D gear and check for abnormal noise and vibration.

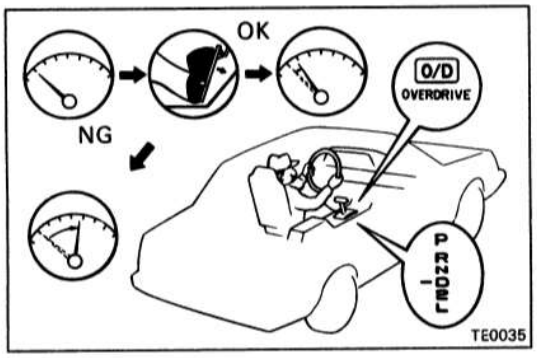
HINT: The check for the cause of abnormal noise and vibration must be made with extreme care as it could also be due to loss of balance in the drive shaft, tire torque converter, etc.

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(d) While running in the D range, 2nd, 3rd and O/D gears, check to see that the possible kick-down vehicle speed limits for 2 → 1, 3 → 2 and O/D → 3 kick-downs conform to those indicated on the automatic shift schedule. (See page AT-38)

(e) Check for abnormal shock and slip at kick-down.

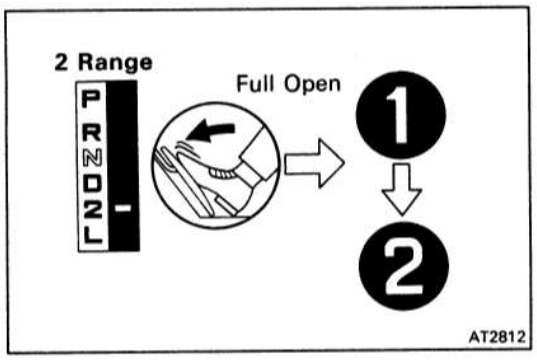


(f) Check for the lock-up mechanism.

(1) Drive in D range, O/D gear, at a steady speed (lock-up ON) of about 80 – 87 km/h (50 – 54 mph).

(2) Lightly depress the accelerator pedal and check that the engine rpm does not change abruptly.

If there is a big jump in engine rpm, there is no lock-up.



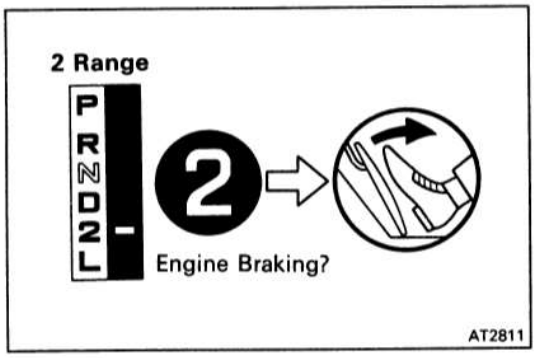
2. 2 RANGE TEST

Shift into the 2 range and, while driving with the accelerator pedal held constantly at the full throttle valve opening position, push in one of the pattern selectors and check on the following points.

(a) Check to see that the 1 → 2 up-shift takes place and that the shift point conforms to it shown on the automatic shift schedule. (See page AT-38)

HINT:

- To prevent overrun, the transmission shifts up into 3rd gear at around 112 km/h (70 mph).
- In range 2, there will be no lock-up to 2nd gear.

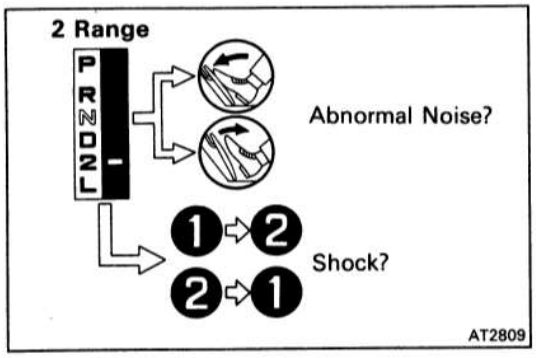


(b) While running in the 2 range and 2nd gear, release the accelerator pedal and check the engine braking effect.

EVALUATION

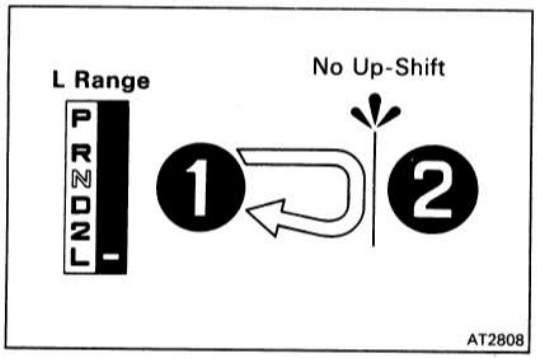
If there is no engine braking effect:

- Second coast brake is defective



(c) Check for abnormal noise at acceleration and deceleration, and for shock at up-shift and down-shift.

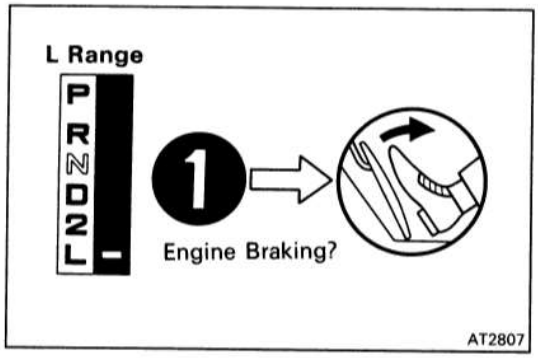
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3. L RANGE TEST

(a) While running in the L range, check to see that there is no up-shift to 2nd gear.

HINT: To prevent overrun, the transmission up-shifts into 2nd gear at around 59 km/h (37 mph).

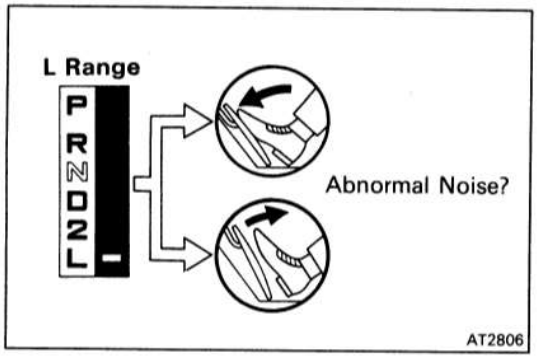


(b) While running in the L range, release the accelerator pedal and check the engine braking effect.

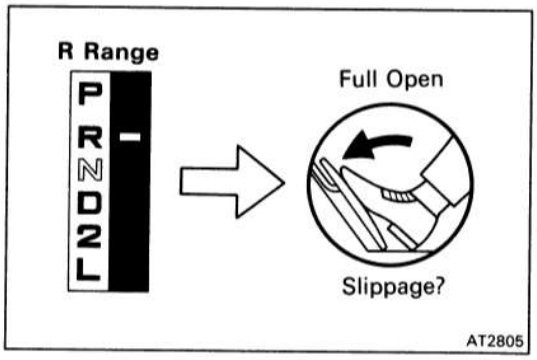
EVALUATION

If there is no engine braking effect:

- First and reverse brake is defective

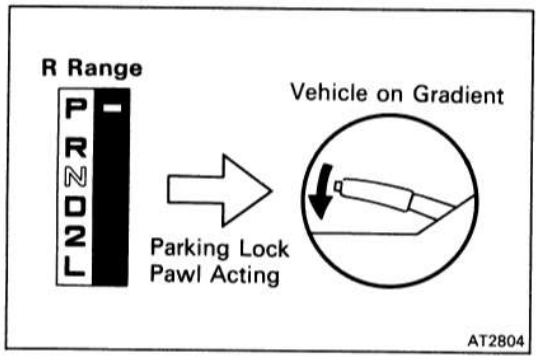


(c) Check for abnormal noise during acceleration and deceleration.



4. R RANGE TEST

Shift into R range and, while starting at full throttle, check for slipping.



5. P RANGE TEST

Stop the vehicle on a gradient (more than 5°) and after shifting into the P range, release the parking brake.

Then check to see that the parking lock pawl holds the vehicle in place.

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Automatic Shift Schedule

	Throttle valve fully open [ ] Fully closed km/h (mph)							
	1 → 2	2 → 3	3 → O/D	[3 → O/D]	[O/D → 3]	O/D → 3	3 → 2	2 → 1
D range	53 – 59 (33 – 37)	102 – 112 (63 – 70)	137 – 149 (85 – 93)	(46 – 52 (29 – 32))	(19 – 24 (12 – 15))	131 – 143 (81 – 89)	98 – 108 (61 – 67)	44 – 50 (27 – 31)
2 range	53 – 59 (33 – 37)	—	—	—	—	—	—	44 – 50 (27 – 31)
L range	—	—	—	—	—	—	—	34 – 40 (21 – 25)

	Throttle valve opening 5 % km/h (mph)	
	Lock-up ON	Lock-up OFF
	O/D	O/D
D range	80 – 87 (50 – 54)	74 – 80 (46 – 50)

HINT:

(1) In the 2 and L ranges, all stages lock-up is OFF.

(2) In the following cases, the lock-up will be released regardless of the lock-up pattern.
- When the throttle is completely closed.
- When the brake switch is ON.

(3) Shift up to O/D will not occur when the engine coolant temp. is below 53°C (127°F).

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ON-VEHICLE REPAIR

CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.

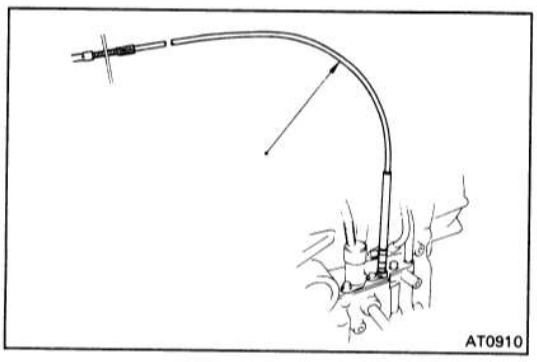
HINT: The components mentioned below can be replaced on the vehicle without any necessity for removal of the transmission. For the respective operating procedures refer to the following pages:

Components	Removal	Installation	Remarks
Valve body	AT-49 to AT-51	AT-157 to AT-160	
Throttle cable	AT-39	AT-39 and AT-40	

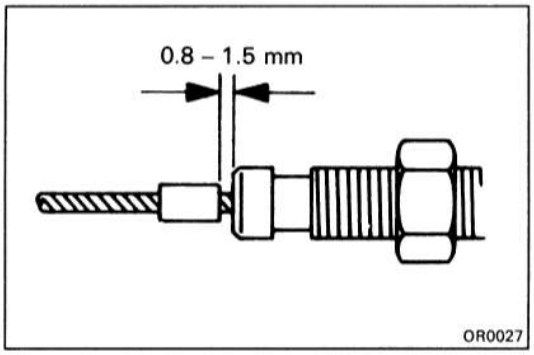
THROTTLE CABLE

REPLACEMENT OF THROTTLE CABLE

1. **DISCONNECT THROTTLE CABLE FROM ENGINE**
2. **REMOVE NEUTRAL START SWITCH**
   (See page AT-47)
3. **REMOVE THROTTLE CABLE RETAINING PLATE**
   (See page AT-47)
4. **REMOVE VALVE BODY**
   (See pages AT-49 to AT-51)
5. **REMOVE THROTTLE CABLE FROM CASE**
   (See page AT-51)
6. **INSTALL THROTTLE CABLE IN CASE**
   (See page AT-157)
7. **INSTALL VALVE BODY**
   (See pages AT-157 to AT-160)
8. **IF THROTTLE CABLE IS NEW, STAKE STOPPER ON INNER CABLE**
   (a) Bend the cable so there is a radius of about 200 mm (7.87 in.).



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(b) Pull the inner cable lightly until a slight resistance is felt, and hold it.

(c) Stake the stopper 0.8 – 1.5 mm (0.031 – 0.059 in.) from the surface of outer cable as shown.

9. **INSTALL THROTTLE CABLE RETAINING PLATE**
(See page AT-161)

10. **INSTALL NEUTRAL START SWITCH**
(See page AT-161)

11. **CONNECT THROTTLE CABLE TO ENGINE**

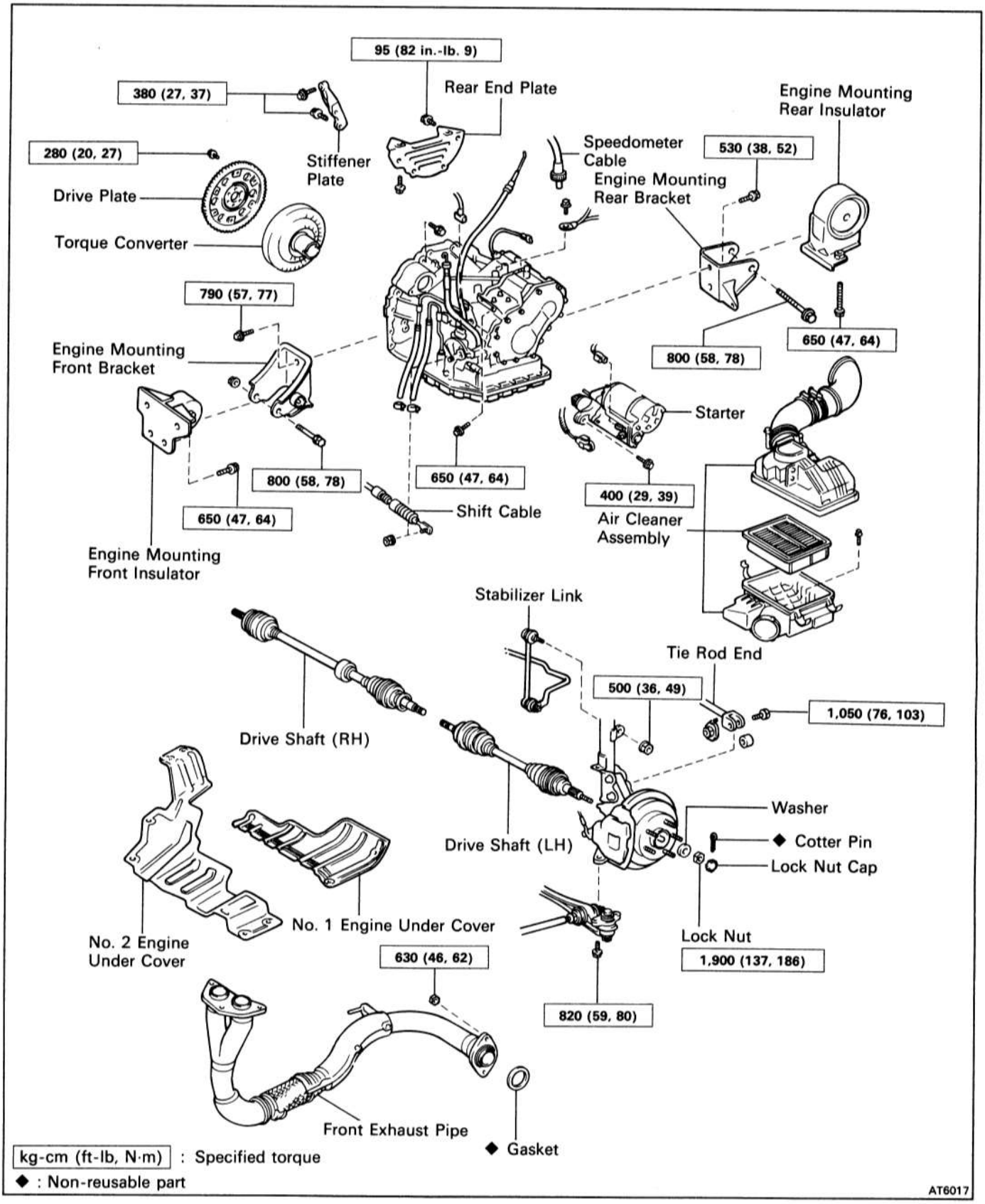
12. **ADJUST THROTTLE CABLE**
(See page AT-13)

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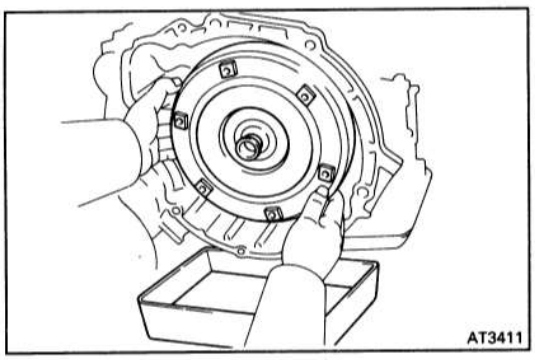
REMOVAL AND INSTALLATION OF TRANSAXLE

Remove and install the parts as shown.

CAUTION: Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.

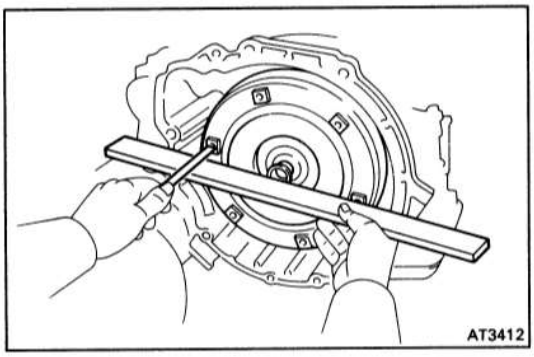


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(MAIN POINT OF INSTALLATION)

1. INSTALL TORQUE CONVERTER IN TRANSAXLE



2. CHECK TORQUE CONVERTER INSTALLATION

Using a scale and a straight edge, measure from the installed surface to the front surface of the transaxle housing.

Correct distance: 13 mm (0.51 in.) or more

3. INSTALL TORQUE CONVERTER MOUNTING BOLTS

(a) Clean the threads of the bolts with the gasoline.

(b) Coat the threads of the bolts with sealer.

Sealer: Part No.08833-00070, THREE BOND 1324 or equivalent.

(c) Tighten the bolts evenly.

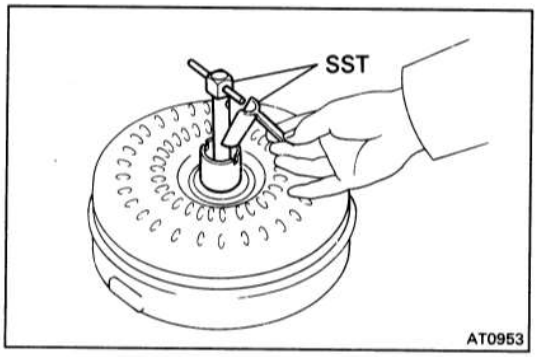
Torque: 280 kg-cm (20 ft-lb, 27 N·m)

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TORQUE CONVERTER

CLEAN TORQUE CONVERTER

If the transmission is contaminated, the torque converter and transmission cooler should be thoroughly flushed with ATF.



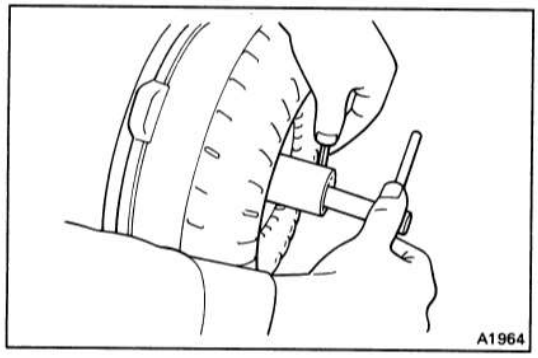
INSPECTION OF TORQUE CONVERTER

1. INSERT SST IN END OF TORQUE CONVERTER

(a) Insert a turning tool in the inner race of the one-way clutch.

(b) Install the stopper so that it fits in the notch of the converter hub and outer race of the one-way clutch.

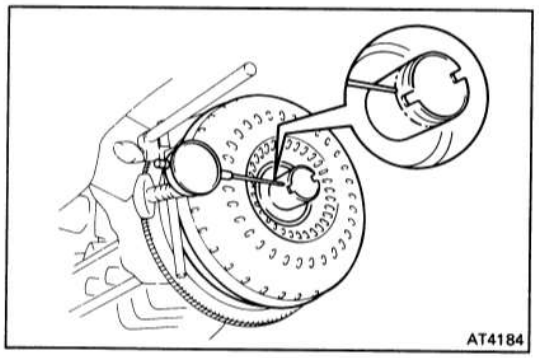
SST 09350-32014 (09351-32010, 09351-32020)



2. TEST ONE-WAY CLUTCH

With the torque converter standing on its side, the clutch should lock when turned counterclockwise, and rotate freely and smoothly clockwise.

If necessary, clean the converter and retest the clutch. Replace the converter if the clutch still fails the test.



3. MEASURE TORQUE CONVERTER SLEEVE RUNOUT

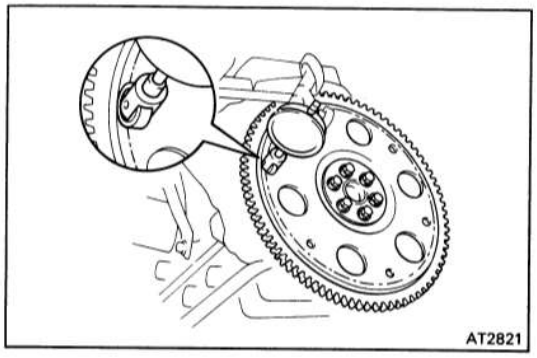
(a) Temporarily mount the torque converter to the drive plate. Set up a dial indicator.

Torque: 280 kg-cm (20 ft-lb, 27 N·m)
Runout: 0.30 mm (0.0118 in.)

If runout exceeds 0.30 mm (0.0118 in.), try to correct it by reorienting the installation of the converter. If excessive runout cannot be corrected, replace the torque converter.

HINT: Mark the position of the converter to ensure correct installation.

(b) Remove the torque converter.



4. MEASURE DRIVE PLATE RUNOUT AND INSPECT RING GEAR

Set up a dial indicator and measure the drive plate runout.

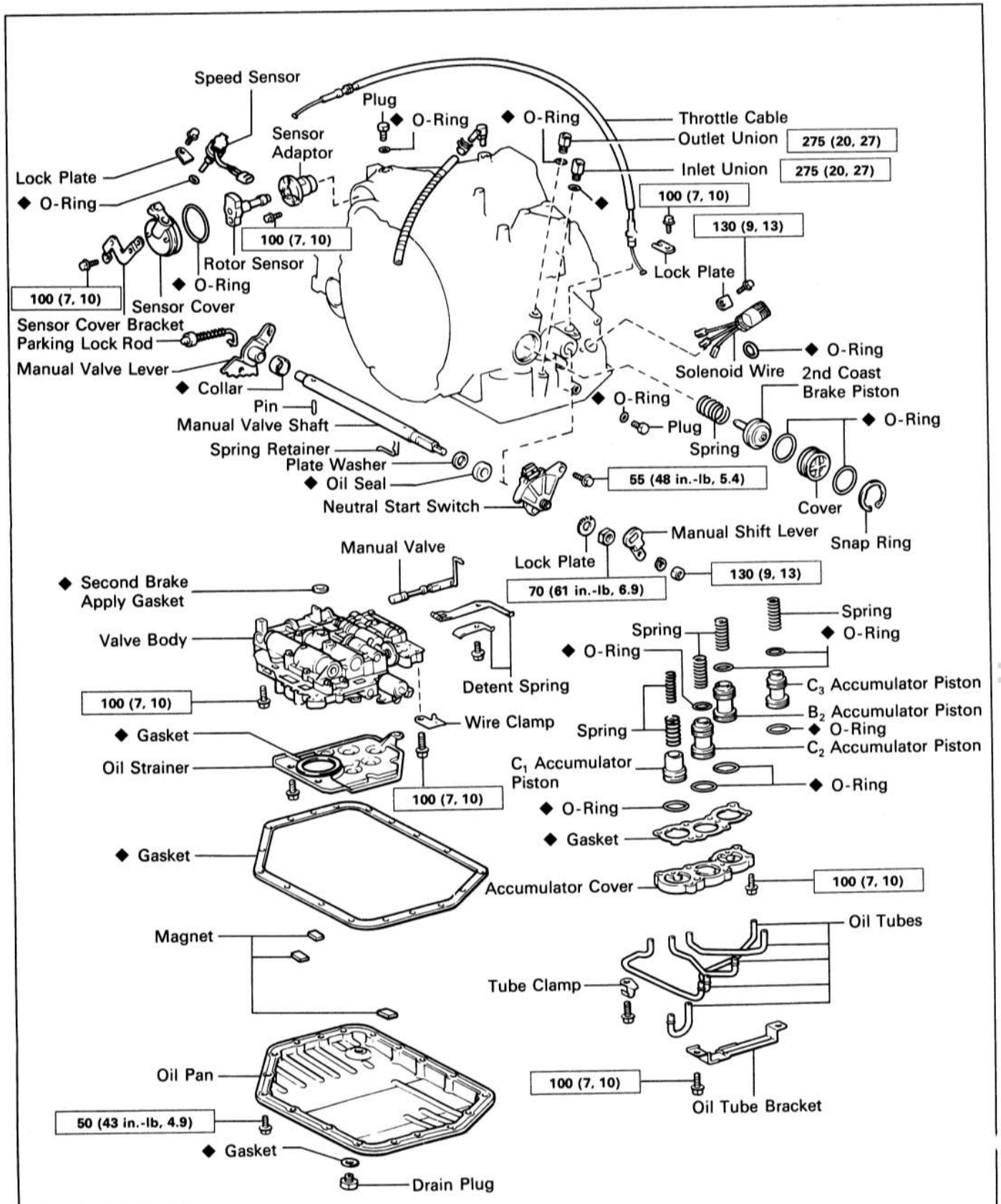
If runout exceeds 0.20 mm (0.0079 in.) or if the ring gear is damaged, replace the drive plate. If installing a new drive plate, note the orientation of the spacers and tighten the bolts.

Torque: 850 kg-cm (61 ft-lb, 83 N·m)
Runout: 0.20 mm (0.0079 in.)

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REMOVAL OF COMPONENT PARTS

COMPONENTS



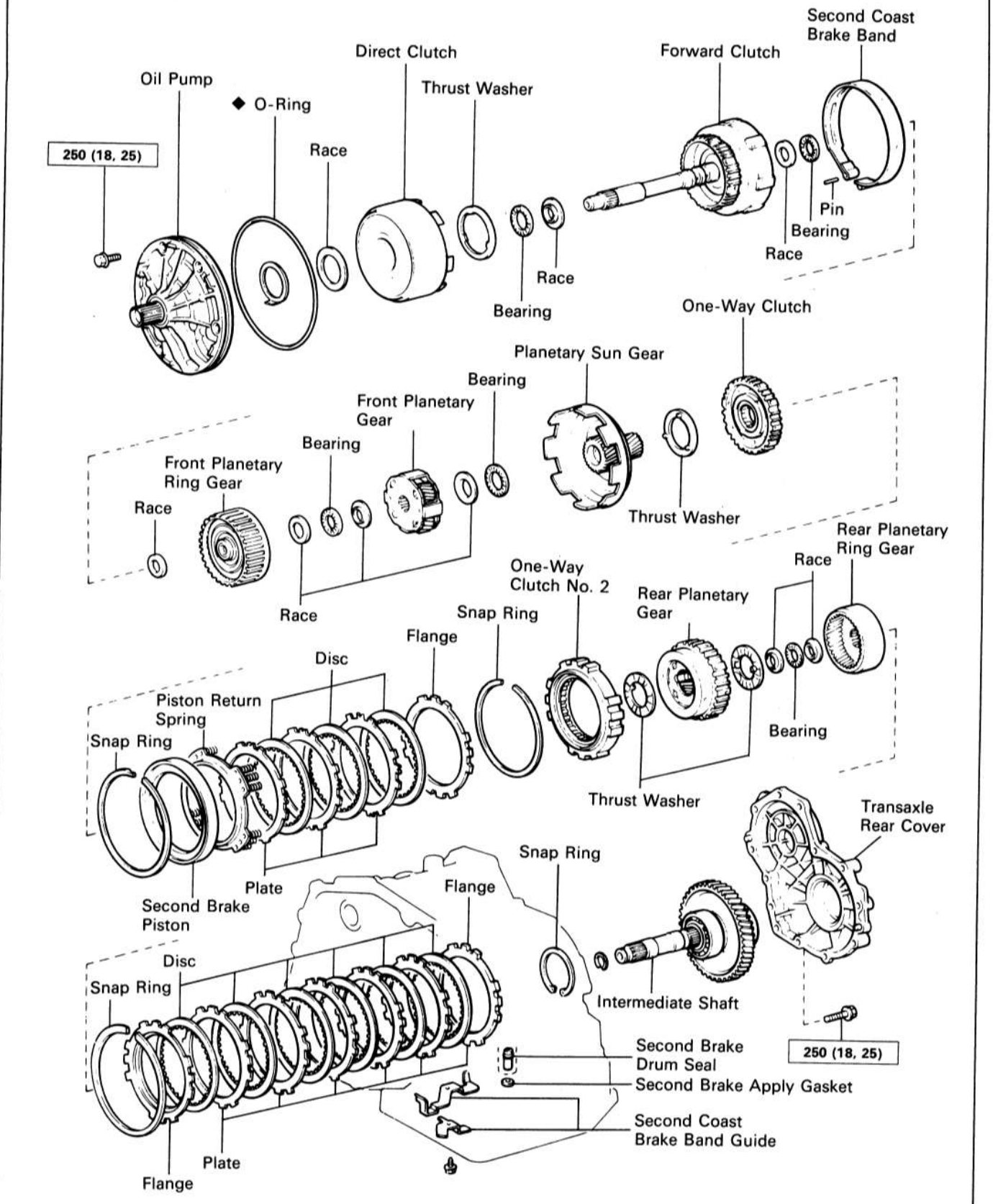
kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

AT6007

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COMPONENTS (Cont'd)



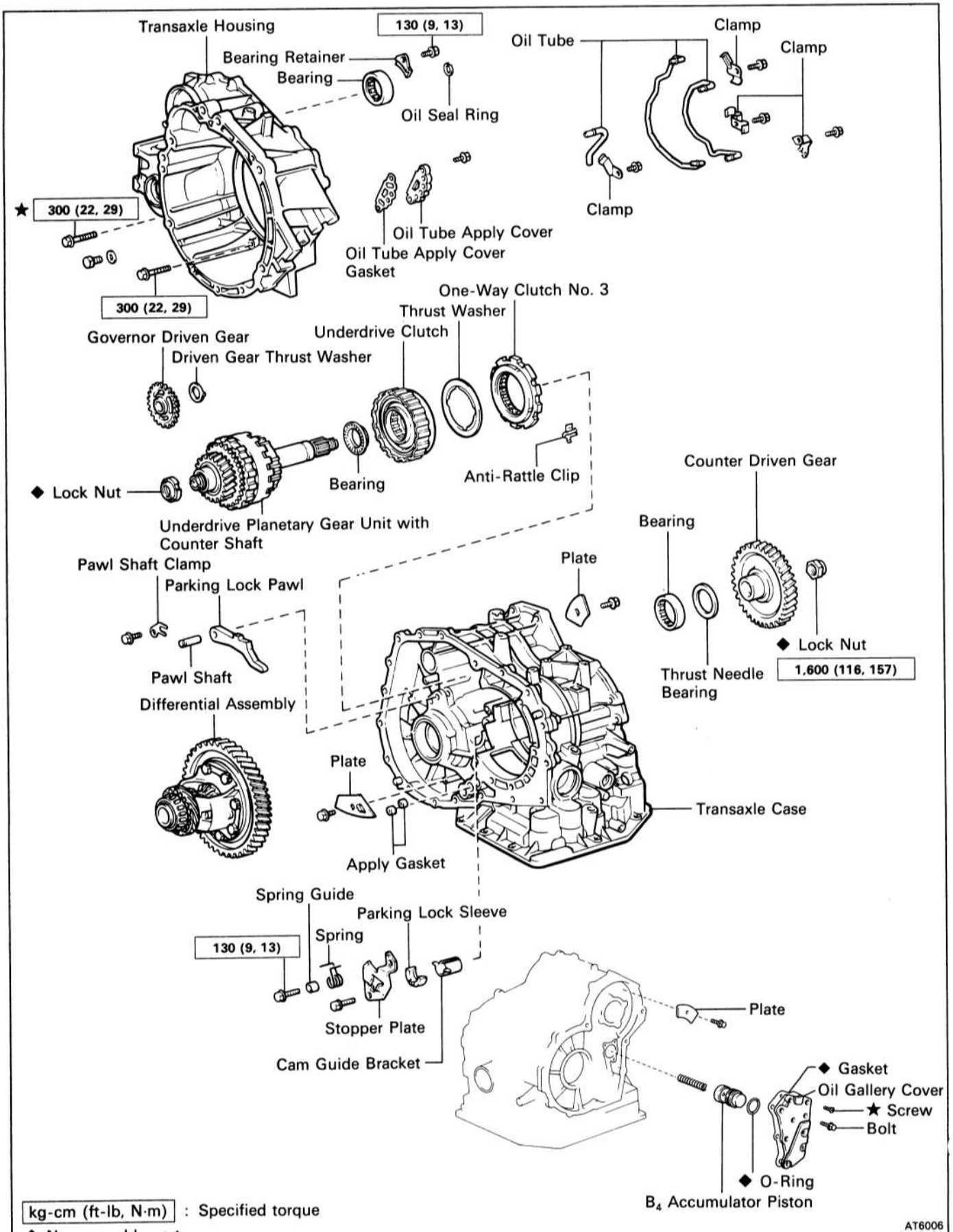
kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

AT3368

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COMPONENTS (Cont'd)



kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

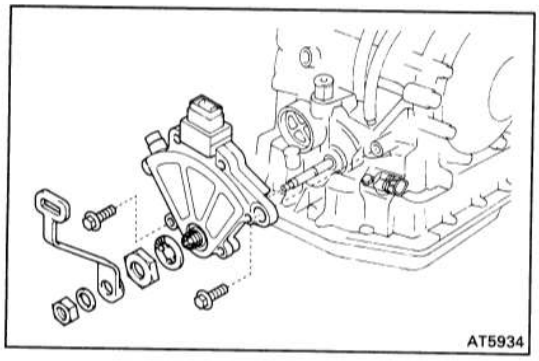
AT6006
AT5721

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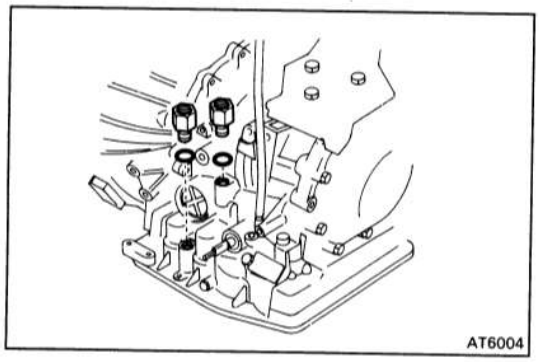
SEPARATE BASIC SUBASSEMBLY

1. **REMOVE TWO OIL COOLER PIPES**

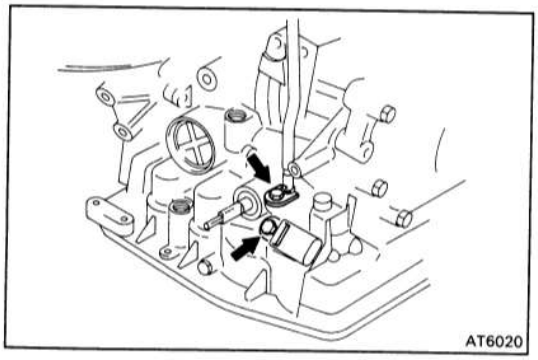
2. **REMOVE TRANSMISSION DIPSTICK AND FILLER TUBE**



3. **REMOVE NEUTRAL START SWITCH**
   (a) Remove the manual shift lever.
   (b) Pry off the lock washer and remove the manual valve shaft nut.
   (c) Remove the two bolts and pull out the neutral start switch.

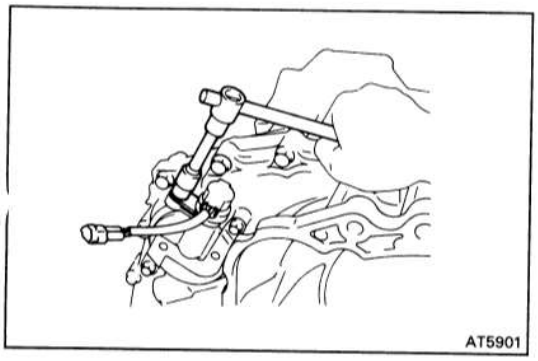


4. **REMOVE UNION**
   (a) Using the open end wrench, remove the union.
   (b) Remove the O-ring from union.



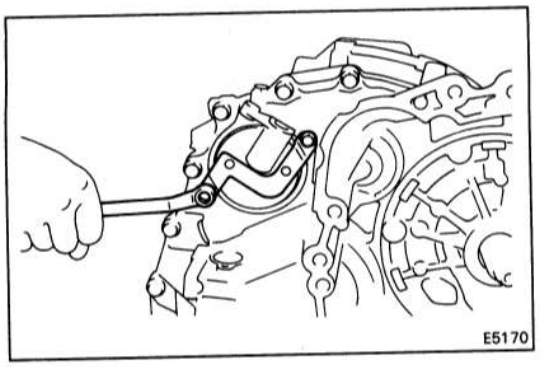
5. **REMOVE THROTTLE CABLE RETAINING BOLT AND PLATE**

6. **REMOVE SOLENOID WIRE RETAINING BOLT AND PLATE**

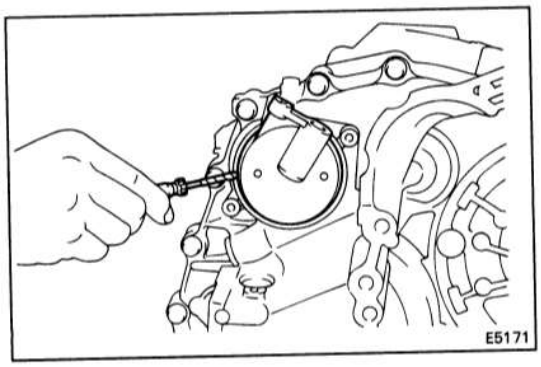


7. **REMOVE SPEED SENSOR AND SENSOR ROTOR**
   (a) Remove the retaining plate and pull out the speed sensor.
   (b) Remove the O-ring from speed sensor.

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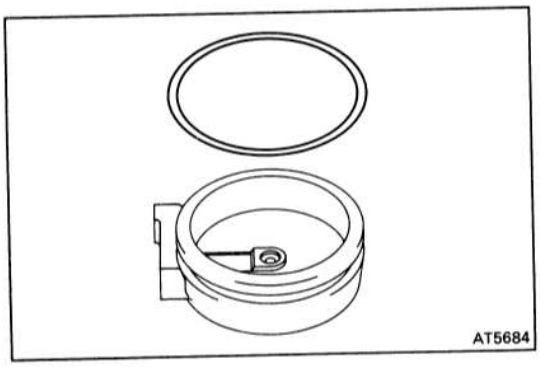


(c) Remove the two bolts and sensor cover bracket.

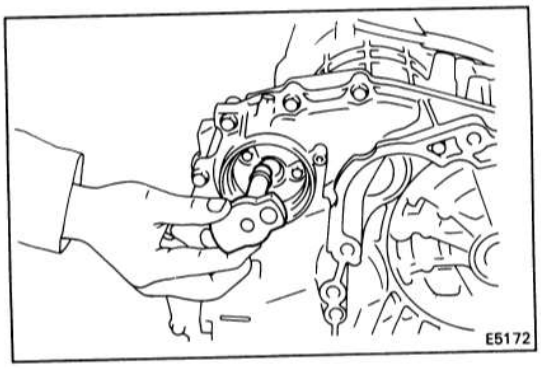


(d) Using a screwdriver, remove the sensor cover.

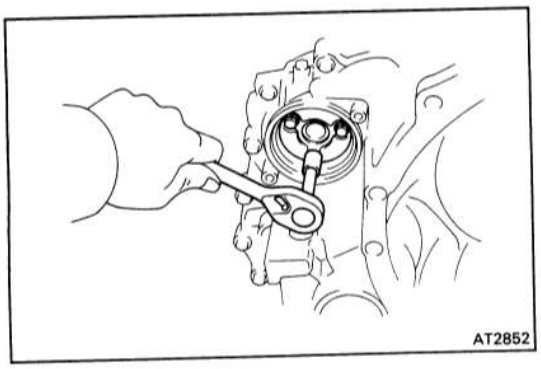
HINT: Tape the screwdriver tip before use so as not to damage the cover or transaxle.



(e) Remove the O-ring from the sensor cover.

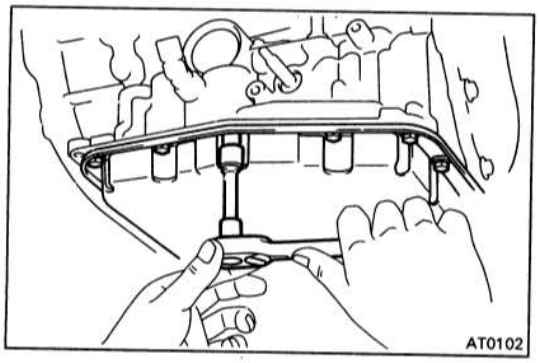


(f) Remove the sensor rotor.



(g) Remove the three bolts and sensor adaptor.

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8. REMOVE PAN AND GASKET

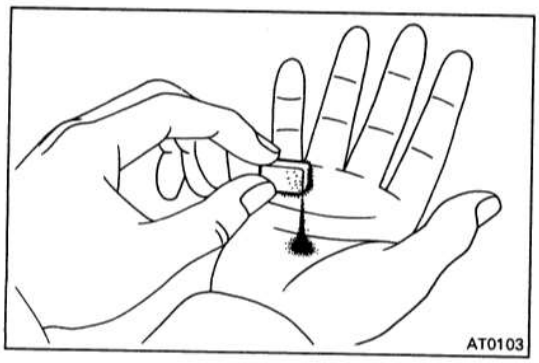
(a) Remove the eighteen bolts.

(b) Remove the pan by lifting the transmission case.

NOTICE: Do not turn the transmission over as it will contaminate the valve body with the foreign materials in the bottom of the pan.

(c) Remove the gasket.

(d) Place the transmission on wooden blocks to prevent damage to the pipes.

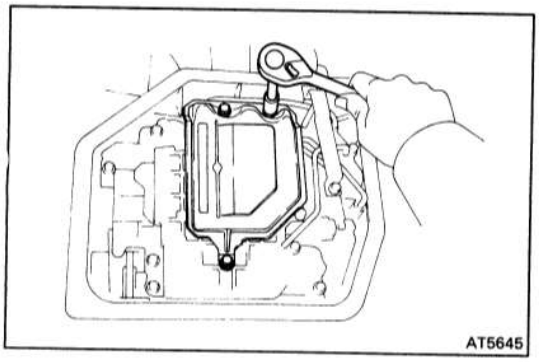


9. EXAMINE PARTICLES IN PAN

Remove the magnets and use them to collect any steel chips. Lock carefully at the chips and particles in the pan and on the magnet to anticipate what type of wear you will find in the transmission:

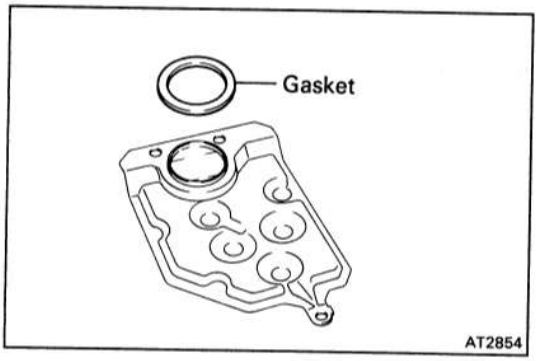
Steel (magnetic) .. bearing, gear and plate wear
Brass (non-magnetic) .. bushing wear

10. TURN TRANSMISSION OVER

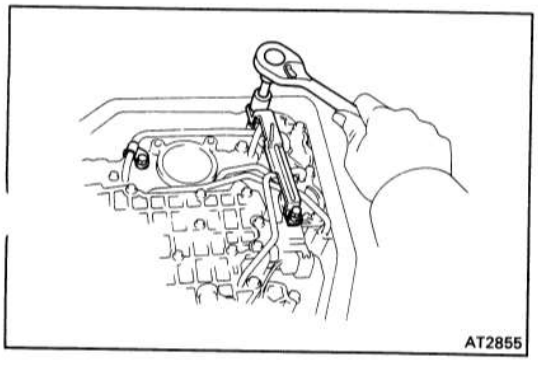


11. REMOVE OIL STRAINER

(a) Remove the three bolts and oil strainer.



(b) Remove the gasket.

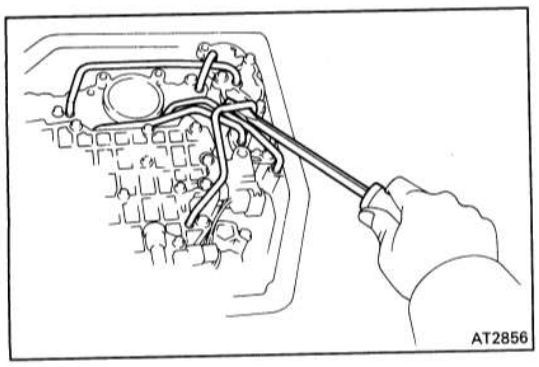


12. REMOVE OIL TUBES

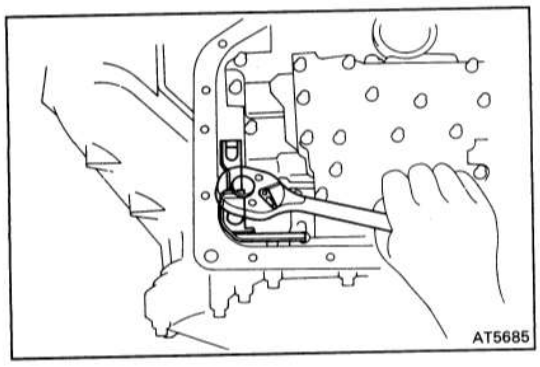
(a) Remove the two bolts and tube bracket.

(b) Remove the tube clamp bolt and clamp.

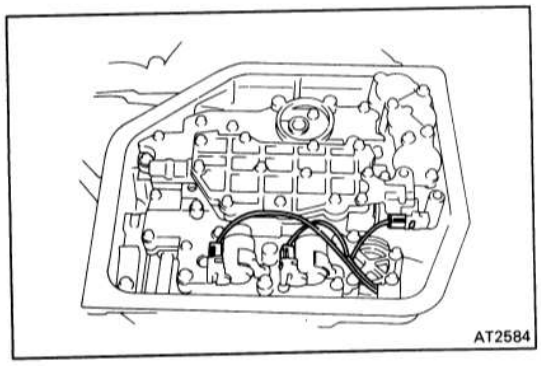
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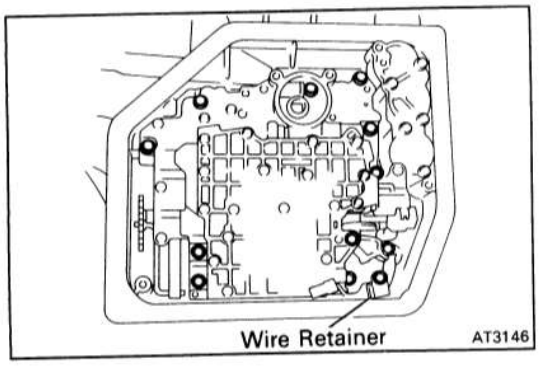
(c) Pry up both ends with a large screwdriver and remove the five tubes.



13. REMOVE MANUAL DETENT SPRING

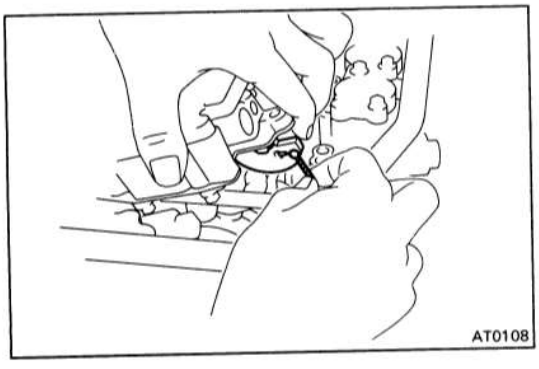


14. DISCONNECT SOLENOID CONNECTORS



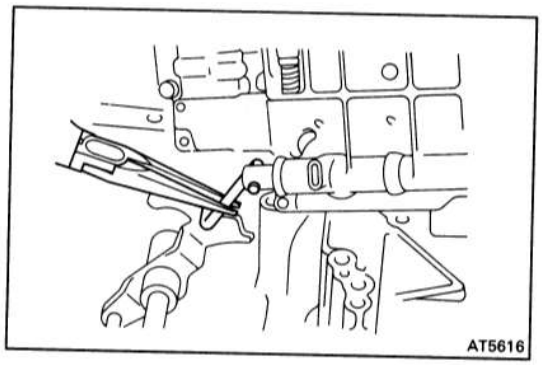
15. REMOVE VALVE BODY

(a) Remove the twelve bolts and wire retainer as shown.



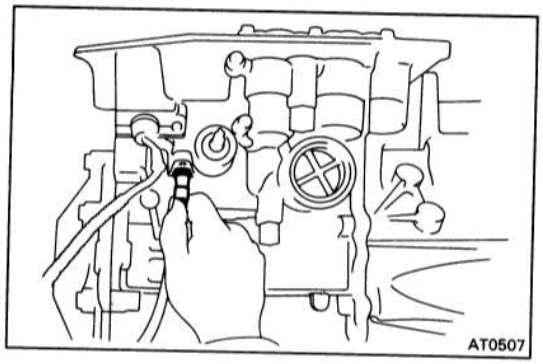
(b) Disconnect the throttle cable from the cam.

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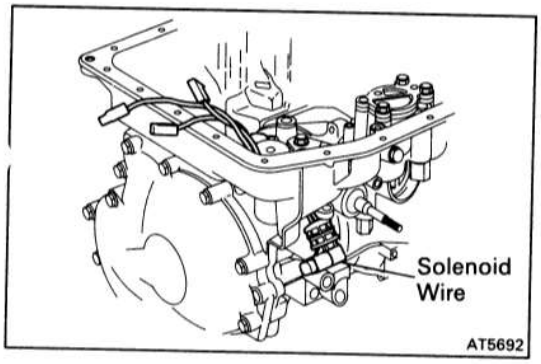
(c) While disconnecting the manual valve connecting rod from the manual valve lever, remove the valve body.

(d) Remove the manual valve from the valve body.

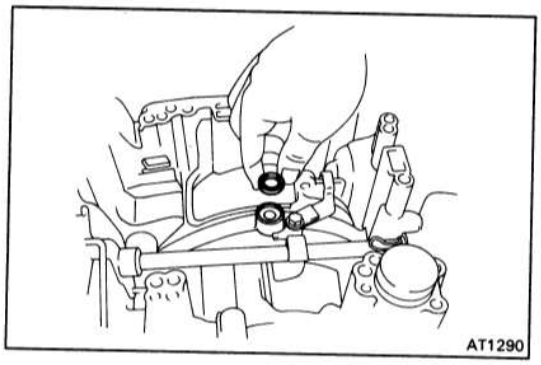


16. REMOVE THROTTLE CABLE FROM CASE

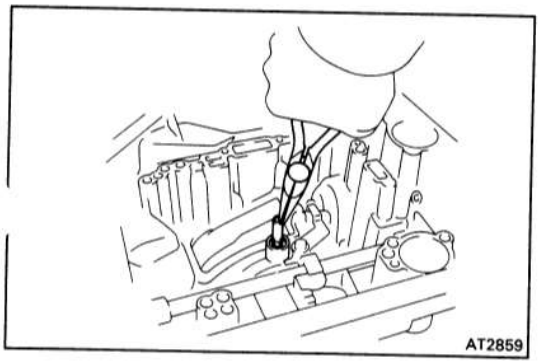
Pull out the throttle cable.



17. REMOVE SOLENOID WIRE



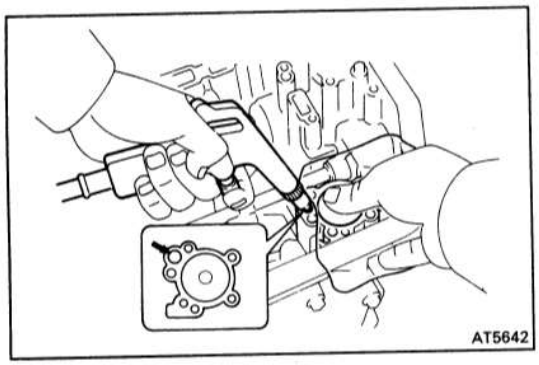
18. REMOVE SECOND BRAKE APPLY GASKET



19. REMOVE SECOND BRAKE DRUM SEAL

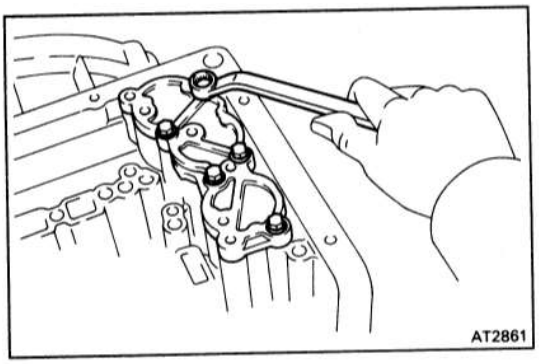
Using a needle nose pliers, pull out the second brake drum seal.

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20. REMOVE C_3 ACCUMULATOR PISTON AND SPRING

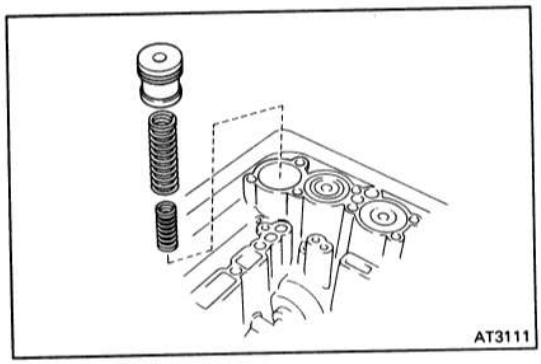
Using low-pressure compressed air (1 kg/cm², 14 psi or 98 kPa) pop out the piston into a rag. Force air into the hole shown and remove the piston and spring.



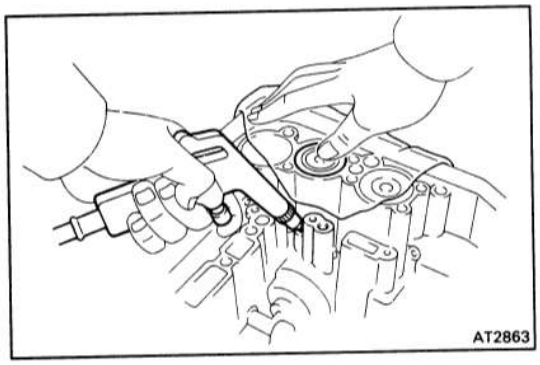
21. REMOVE ACCUMULATOR PISTONS AND SPRINGS

(a) Loosen the five bolts one turn at a time until the spring tension is released.

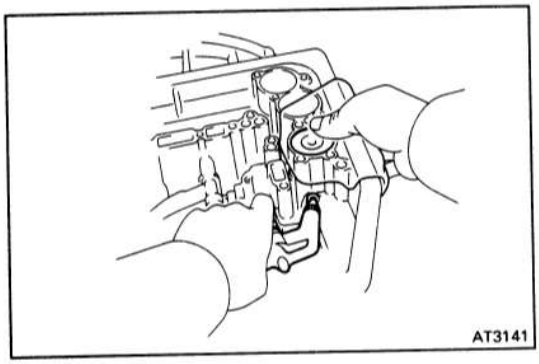
(b) Remove the cover and gasket.



(c) Remove the C_1 piston and two springs.

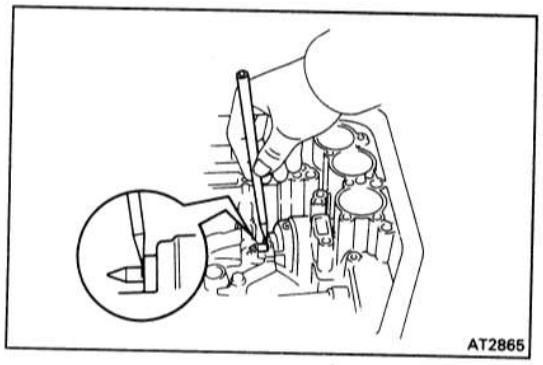


(d) Using low-pressure compressed air (1 kg/cm², 14 psi, 98 kPa), pop out the C_2 piston into a rag. Force air into the hole shown and remove the piston and spring.



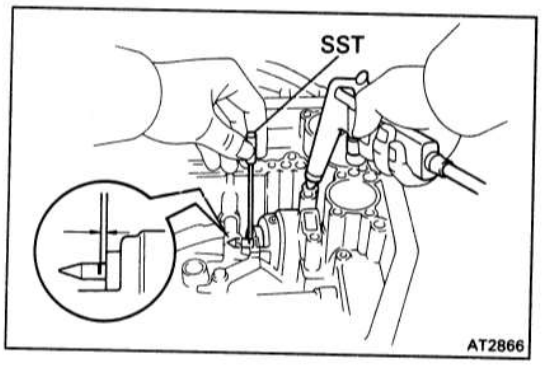
(e) Using low-pressure compressed air (1 kg/cm², 14 psi, 98 kPa), pop out the B_2 piston into a rag. Force air into the hole shown and remove the piston and spring.

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22. MEASURE PISTON STROKE OF SECOND COAST BRAKE

(a) Apply a small amount of paint to the piston rod at the point it meets the case as shown in the illustration.

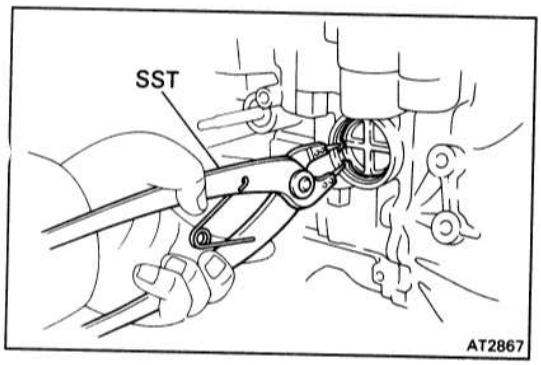


(b) Using SST, measure the piston stroke applying and releasing the compressed air (4 – 8 kg/cm², 57 – 114 psi, 392 – 785 kPa) as shown.

SST 09240-00020

Piston stroke: 1.5 – 3.0 mm (0.059 – 0.118 in.)

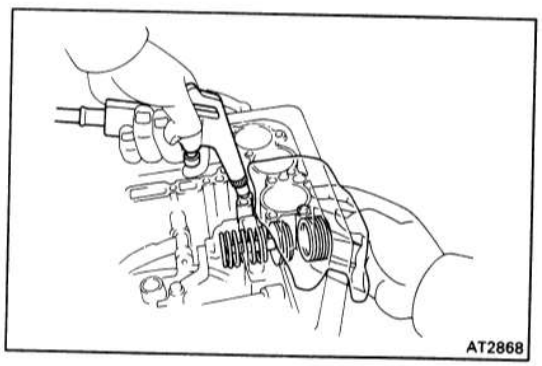
If the piston stroke exceeds the limit, inspect the brake band.



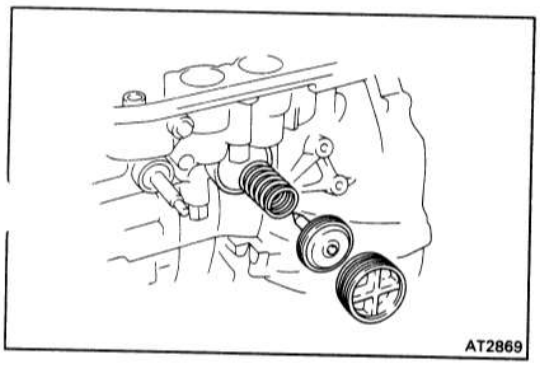
23. REMOVE SECOND COAST BRAKE PISTON

(a) Using SST, remove the snap ring.

SST 09350-32014 (09351-32050)



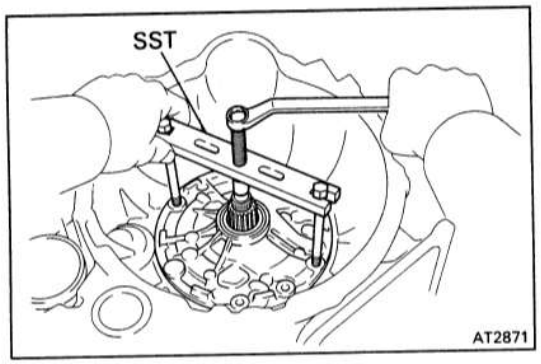
(b) Using low-pressure compressed air (1 kg/cm², 14 psi, 98 kPa), pop out the cover into a rag. Force air into the hole shown.



(c) Remove the cover, piston and spring.

(d) Remove the two O-rings from the cover.

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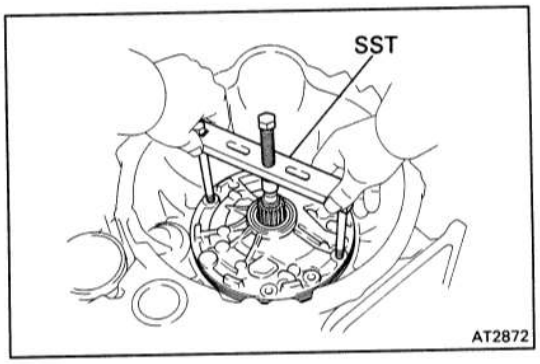


24. REMOVE OIL PUMP

(a) Remove the six bolts holding the oil pump to the transmission case.

(b) Using SST, pull the oil pump free from the transmission case.

SST 09350-32014 (09351-32061)

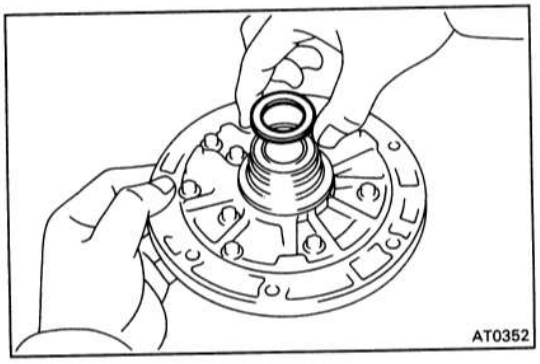


(c) Remove the oil pump with SST.

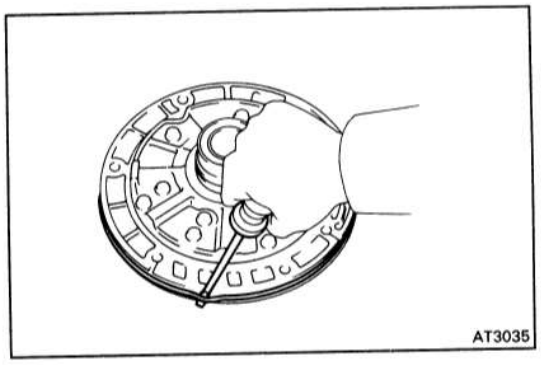
SST 09350-32014 (09351-32061)

NOTICE: Be careful not to drop or damage the races and bearing behind oil pump.

(d) Remove SST from the oil pump.

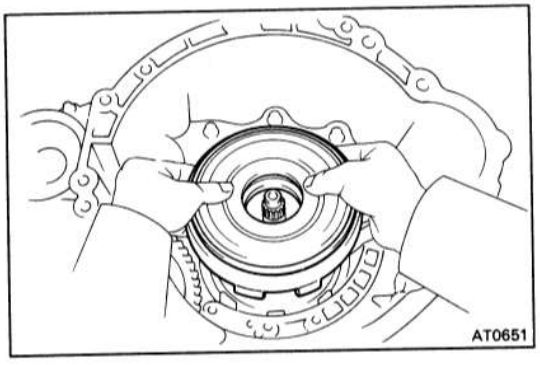


(e) Remove the race from the oil pump.

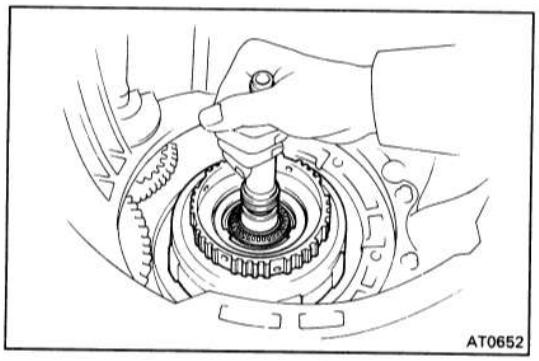


(f) Remove the O-ring from the oil pump.

25. REMOVE DIRECT CLUTCH

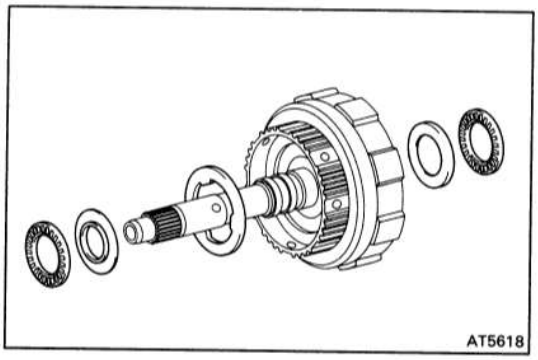


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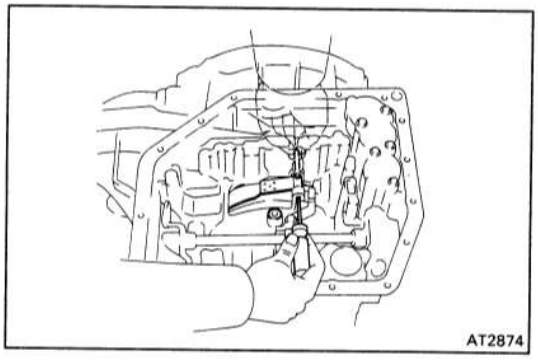


26. REMOVE FORWARD CLUTCH

(a) Remove the forward clutch with bearing and race.



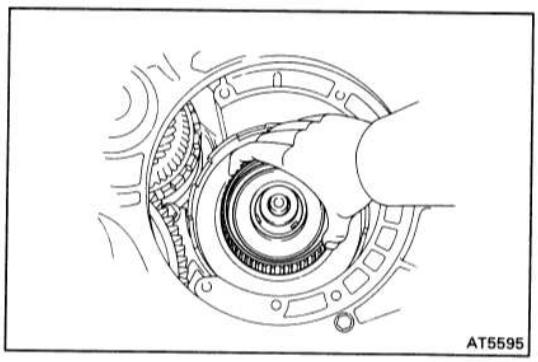
(b) Remove the thrust washer, bearings and races from the forward clutch.



27. REMOVE SECOND COAST BRAKE BAND

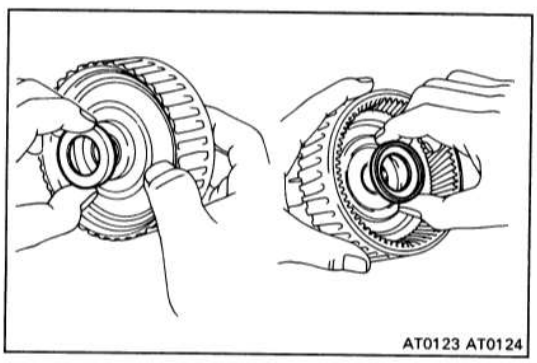
(a) Push the pin with a small screwdriver and remove it from the bolt hole of the oil pump mounting.

(b) Remove the brake band.



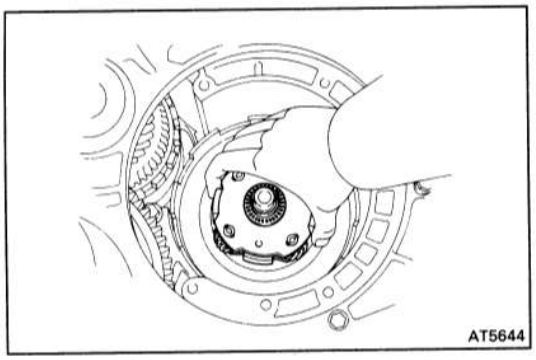
28. REMOVE FRONT PLANETARY RING GEAR

(a) Remove the front planetary ring gear with race.



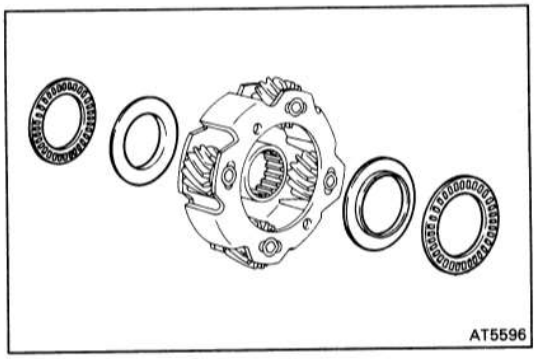
(b) Remove the races from the ring gear.

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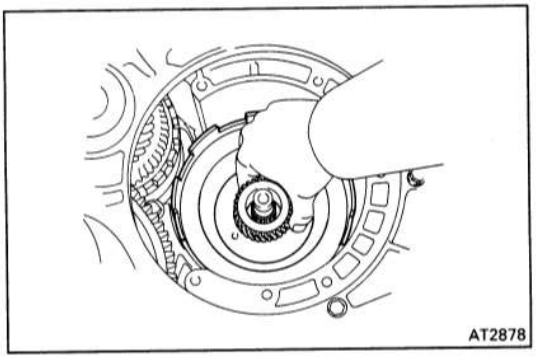


29. REMOVE FRONT PLANETARY GEAR

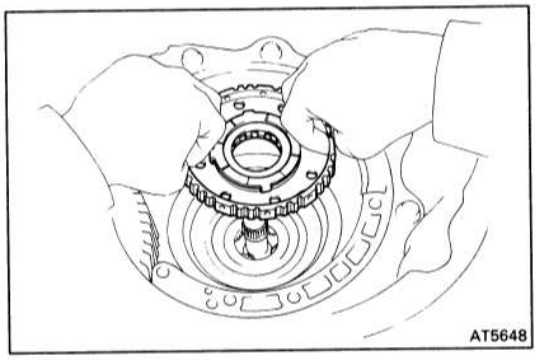
(a) Remove the front planetary gear with bearing and race.



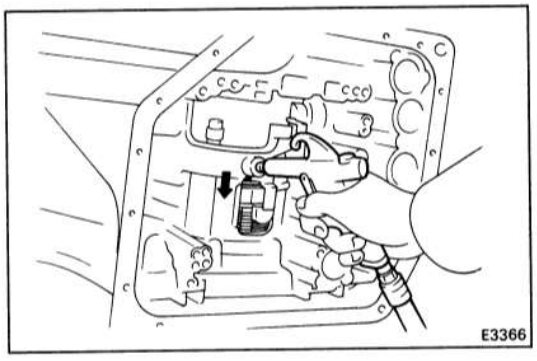
(b) Remove the races and bearings from the planetary gear.



30. REMOVE SUN GEAR, SUN GEAR INPUT DRUM AND THRUST WASHER



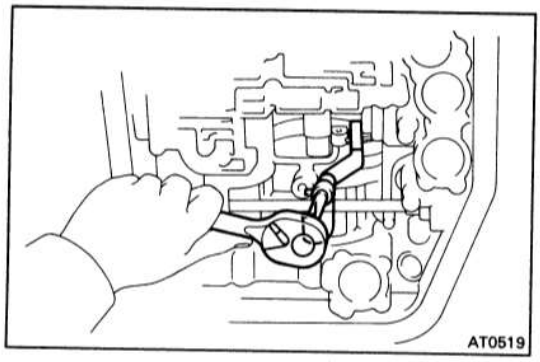
31. REMOVE SECOND BRAKE HUB AND NO. 1 ONE-WAY CLUTCH



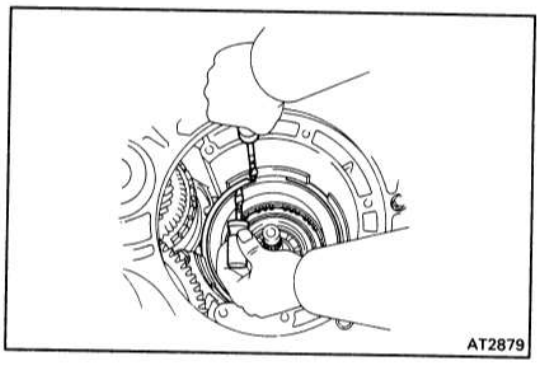
32. CONFIRM THAT SECOND BRAKE PISTON MOVES

Using compressed air, confirm that the second brake piston moves smoothly.

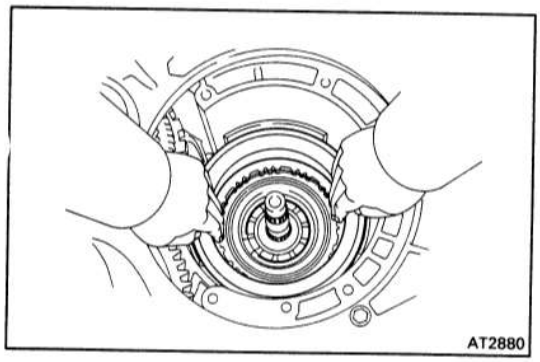
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33. REMOVE SECOND COAST BRAKE BAND GUIDE

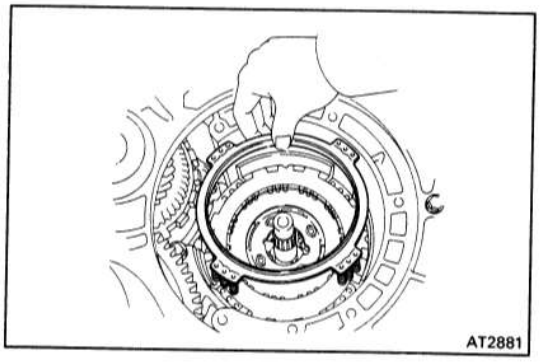


34. REMOVE SNAP RING HOLDING SECOND BRAKE DRUM TO CASE



35. REMOVE SECOND BRAKE DRUM

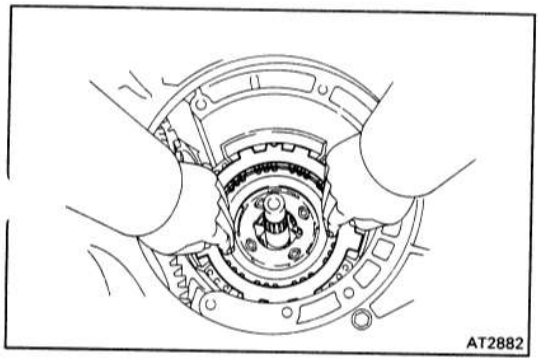
HINT: If the brake drum is difficult to remove, lightly tap it with a wooden block.



36. REMOVE SECOND BRAKE PISTON RETURN SPRING

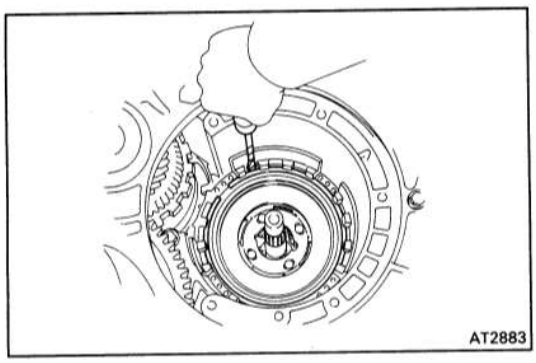
(a) Remove the thrust washer.

(b) Remove the return spring.



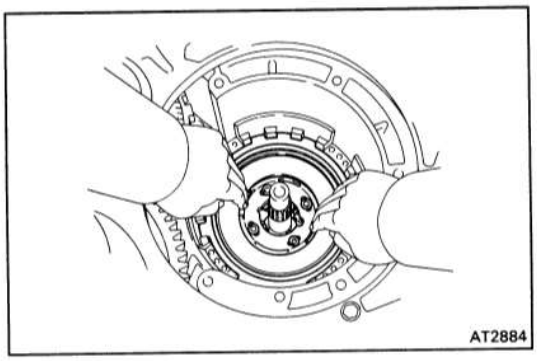
37. REMOVE PLATES, DISCS AND FLANGE

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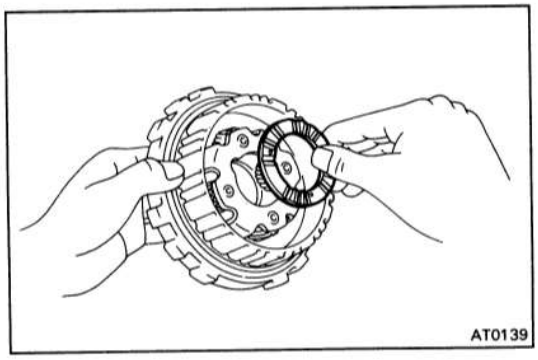
38. REMOVE SNAP RING HOLDING NO. 2 ONE-WAY CLUTCH OUTER RACE TO CASE

Using a screwdriver, remove the snap ring.

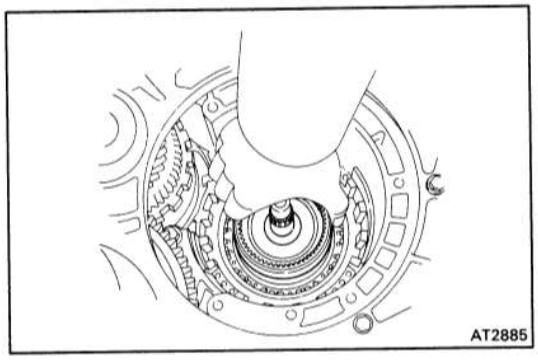


39. REMOVE NO. 2 ONE-WAY CLUTCH AND REAR PLANETARY GEAR

(a) Remove the No. 2 one-way clutch and rear planetary gear with thrust washer.

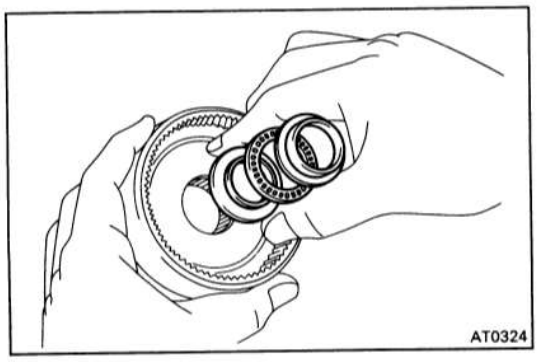


(b) Remove the thrust washer from the gear.



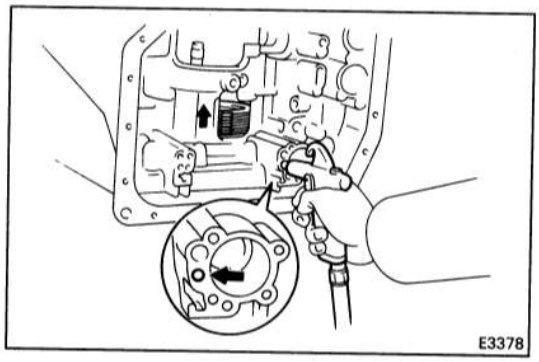
40. REMOVE REAR PLANETARY RING GEAR

(a) Remove the rear planetary ring gear with bearing and races.



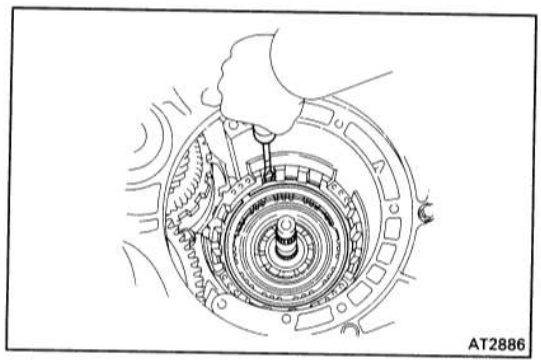
(b) Remove the bearing and races from the ring gear.

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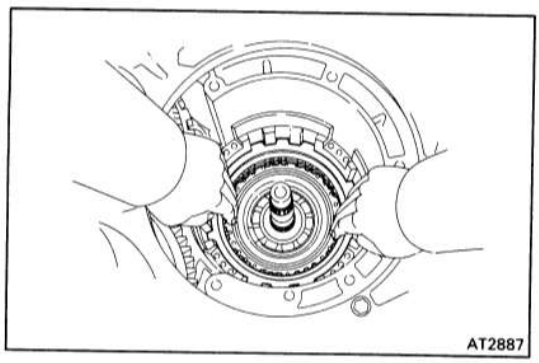
41. CONFIRM THAT FIRST AND REVERSE BRAKE PISTON MOVES

Using compressed air, confirm that the first and reverse brake piston moves smoothly.

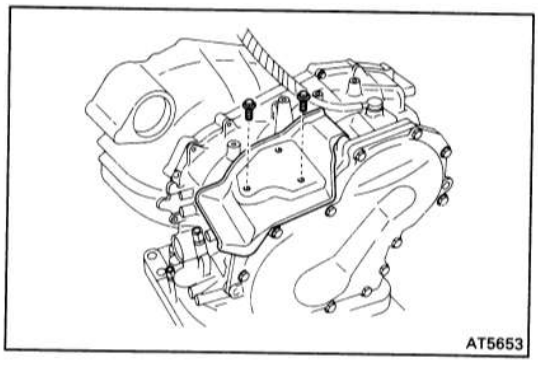


42. REMOVE SNAP RING HOLDING FLANGE TO CASE

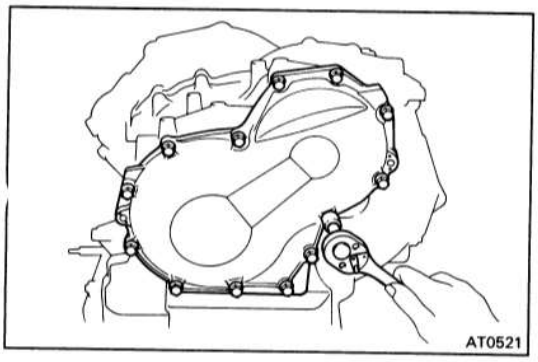
Using a screwdriver, remove the snap ring.



43. REMOVE FLANGES, PLATES AND DISCS



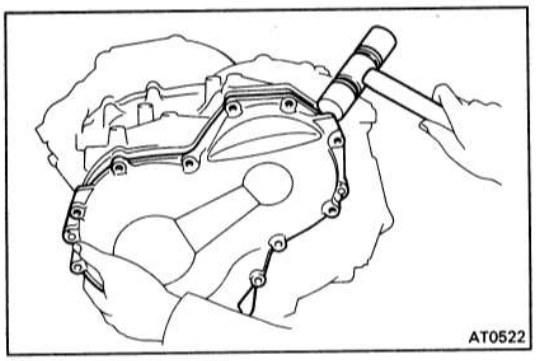
44. REMOVE ENGINE MOUNTING LEFT BRACKET



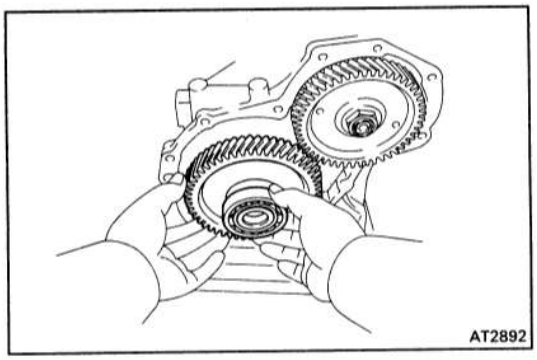
45. REMOVE TRANSAXLE REAR COVER

(a) Remove the thirteen bolts.

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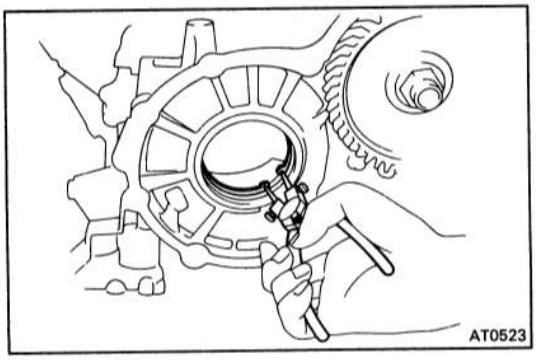


(b) Tap off the circumference of the cover with a plastic hammer to remove the cover from the transmission case, and remove the cover.



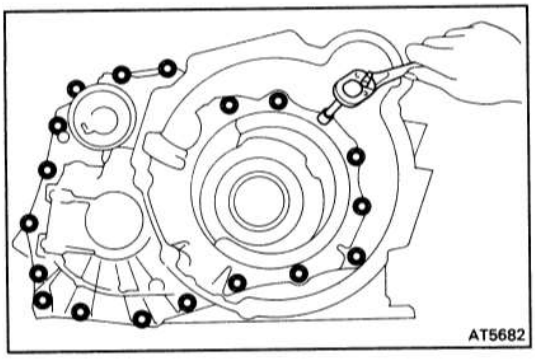
46. REMOVE INTERMEDIATE SHAFT

Remove the intermediate shaft from the transmission case.



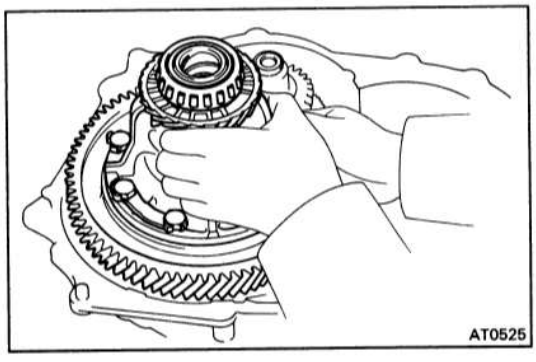
47. REMOVE SNAP RING

Using snap ring pliers, remove the snap ring.



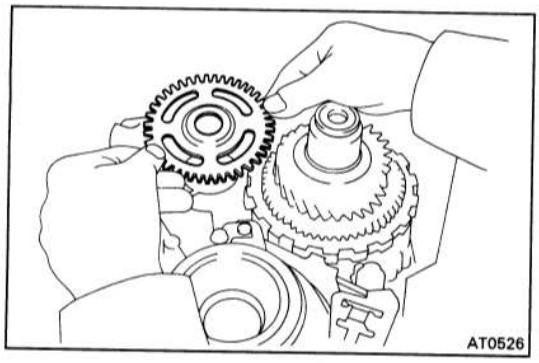
48. REMOVE TRANSAXLE HOUSING

Remove the nineteen bolts and transaxle housing.



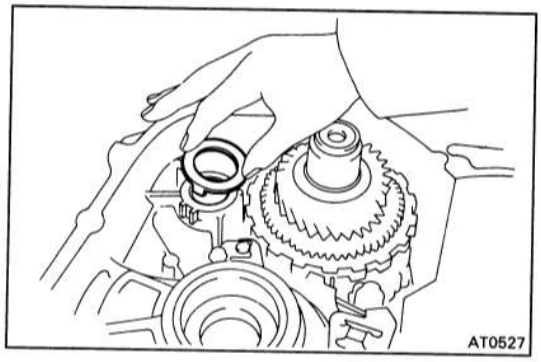
49. REMOVE DIFFERENTIAL

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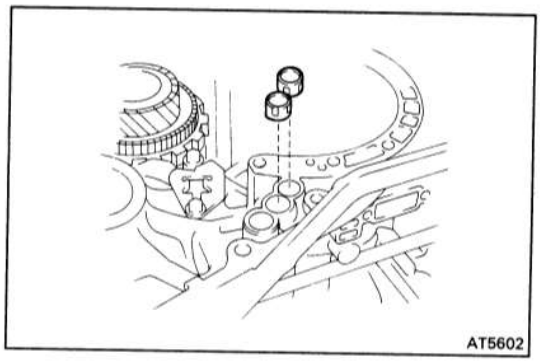


50. REMOVE GOVERNOR DRIVEN GEAR

(a) Remove the governor driven gear.

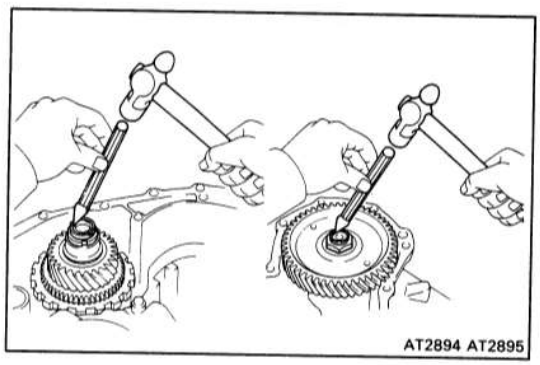


(b) Remove the thrust washer.



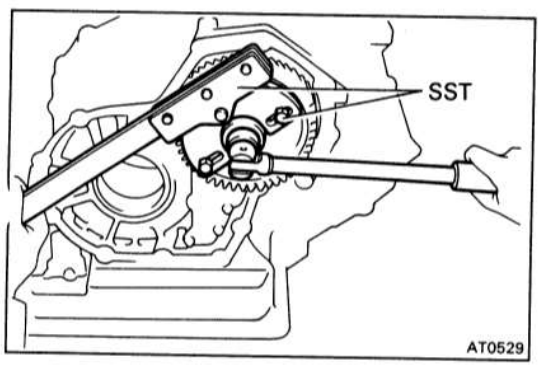
51. REMOVE APPLY GASKETS

Remove the two gaskets.



52. REMOVE COUNTER SHAFT LOCK NUTS

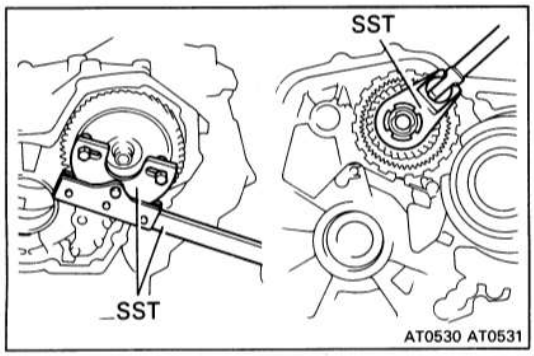
(a) Using a chisel and hammer, unstake the counter shaft lock nut on both sides.



(b) Using SST, remove the lock nut of the driven gear side.

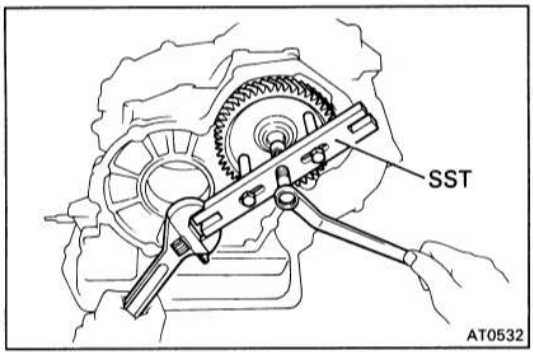
SST 09330-00021, 09350-32014 (09351-32032)

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(c) Using SST to hold the driven gear, remove the lock nut of the another side.

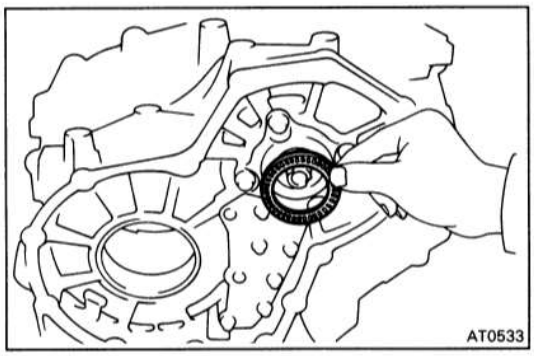
SST 09330-00021 and
09350-32014 (09351-32032, 09351-32170)



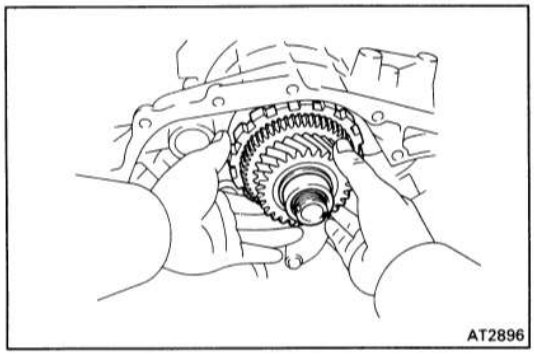
53. REMOVE COUNTER DRIVEN GEAR

Using SST, remove the driven gear.

SST 09350-32014 (09351-32061)

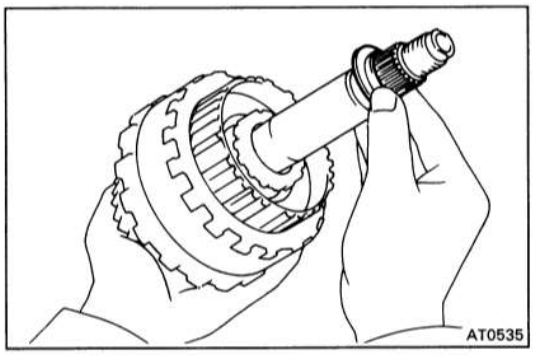


54. REMOVE THRUST NEEDLE BEARING



55. REMOVE COUNTER SHAFT ASSEMBLY

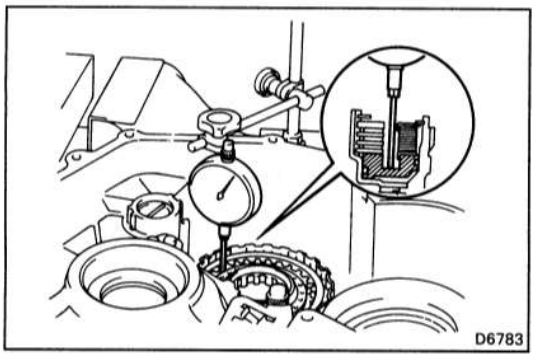
Pull out the counter shaft assembly.



56. REMOVE THRUST BEARING WITH RACE

Remove the thrust bearing with race from the counter shaft assembly.

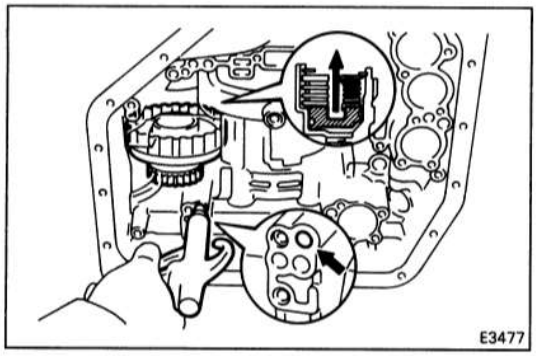
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57. CHECK PISTON STROKE OF UNDERDRIVE CLUTCH

(a) Set a dial indicator (long type pick or SST) as shown.

SST 09350-32014 (09351-32190)



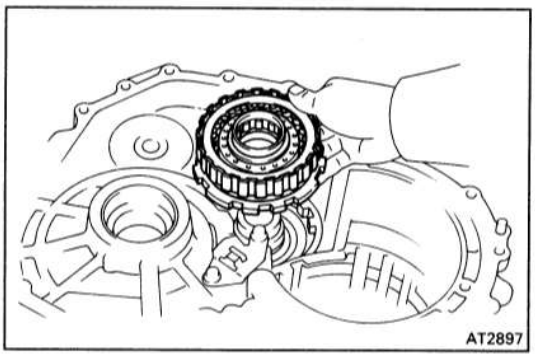
(b) Applying and releasing the compressed air (4 – 8 kg/cm², 57 – 114 psi, 392 – 785 kPa), measure the underdrive clutch piston stroke.

Piston stroke: 1.22 – 1.54 mm (0.0480 – 0.0606 in.)

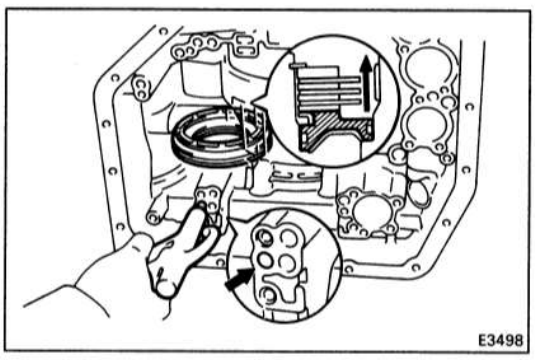
If the piston stroke is nonstandard, select another flange.

HINT: There are two different flange thickness.

Flange thickness: 2.30 mm (0.0906 in.)
2.50 mm (0.0984 in.)
2.70 mm (0.1063 in.)

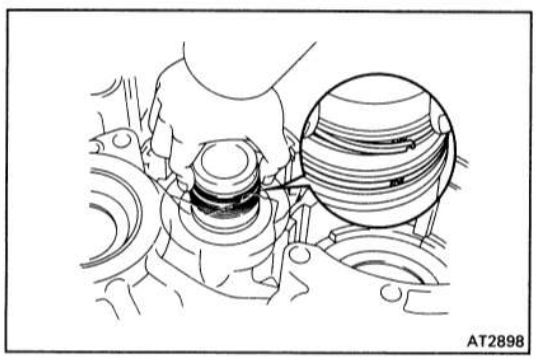


58. REMOVE UNDERDRIVE CLUTCH DRUM AND ANTI-RATTLE CLIP



59. CONFIRM THAT UNDERDRIVE BRAKE PISTON MOVES

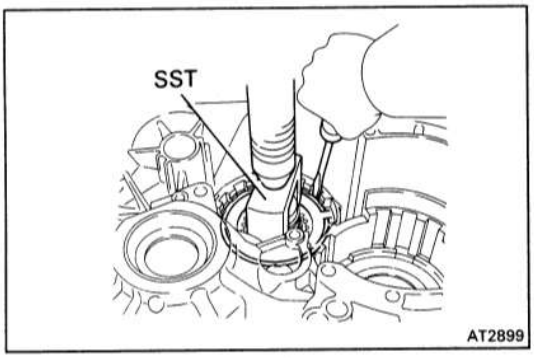
Using compressed air, confirm that the underdrive brake piston moves smoothly.



60. REMOVE OIL SEAL RINGS

Remove the two oil seal rings.

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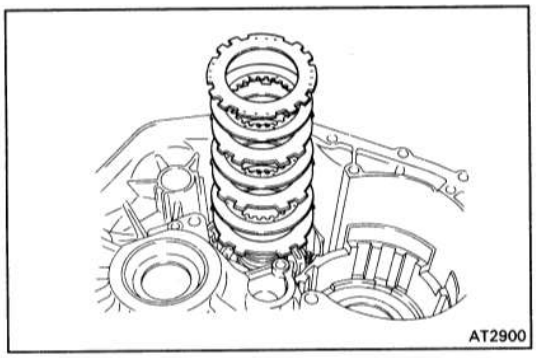


61. REMOVE FLANGE, PLATES AND DISCS

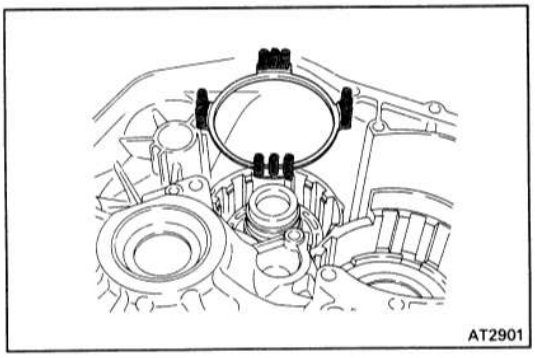
(a) Using SST and press, press in the flange until the snap ring is free from the flange.

SST 09350-32014 (09351-32070)

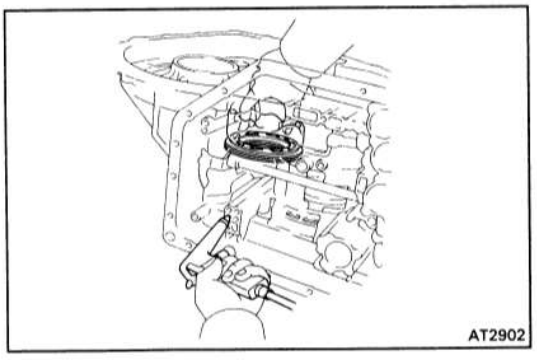
(b) Using a screwdriver, remove the snap ring.



(c) Remove the flange, three plates and discs.

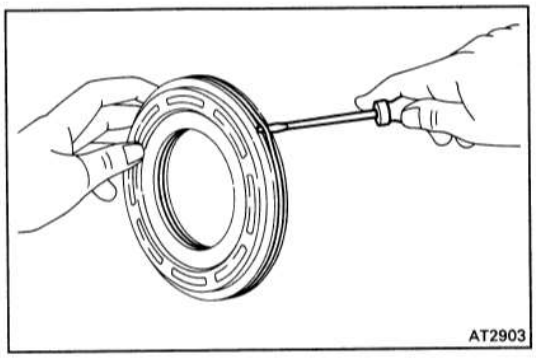


62. REMOVE RETURN SPRING



63. REMOVE UNDERDRIVE BRAKE PISTON

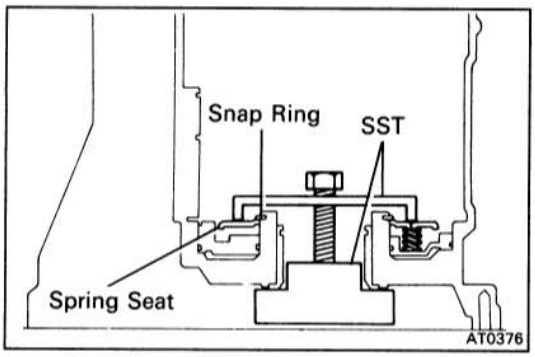
Using low-pressure compressed air (1 kg/cm^2, 14 psi, 98 kPa), pop out the brake piston into a rag. Force air into the hole shown and remove the brake piston.



64. REMOVE O-RINGS FROM PISTON

Remove the two O-rings from the piston.

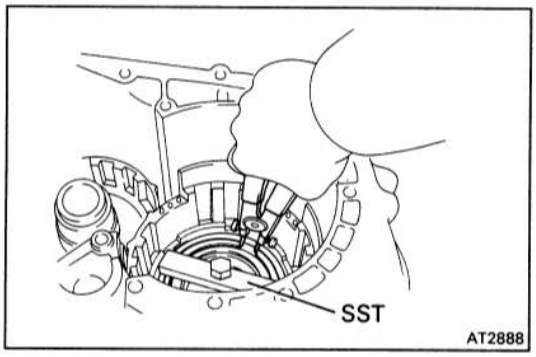
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65. REMOVE SNAP RING

(a) Set SST, and tighten the bolt gradually to compress the springs until the snap ring is free from the spring seat.

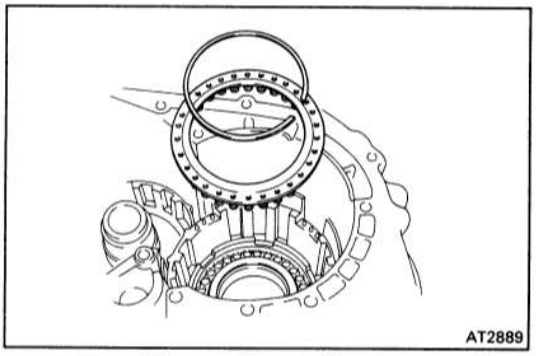
SST 09350-32014 (09351-32040)



(b) Using snap ring pliers, remove the snap ring.

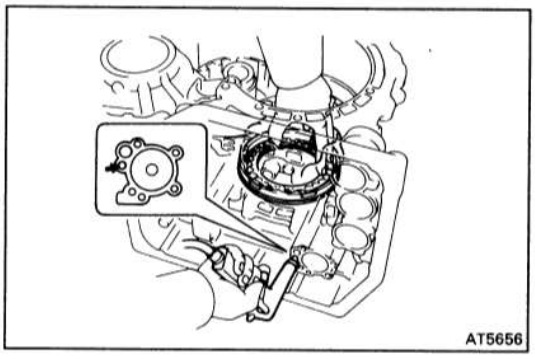
(c) Remove SST.

SST 09350-32014 (09351-32040)



66. REMOVE RETURN SPRING

Remove the return spring and snap ring.

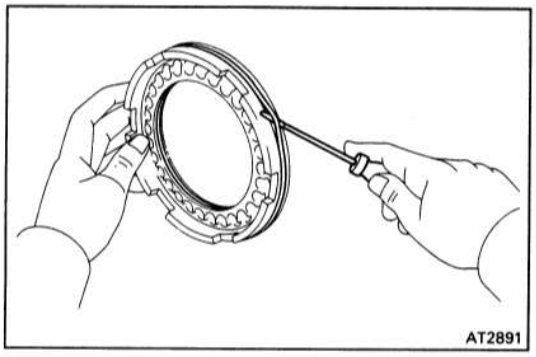


67. REMOVE PISTON FROM TRANSMISSION CASE WITH COMPRESSED AIR

(a) Apply compressed air into the oil passage of the case to remove the piston.

HINT: Hold the piston so it is not slanted and blow with the gun slightly away from the oil hole.

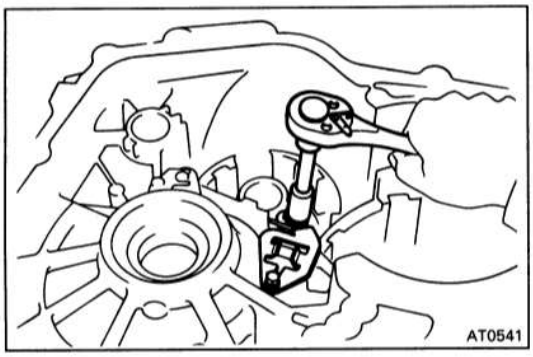
(b) If the piston does not pop out with compressed air, use needle-nose pliers to remove it.



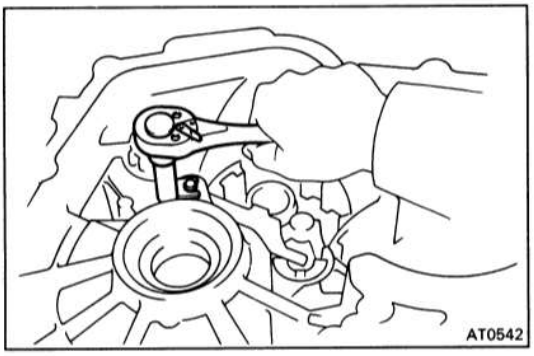
68. REMOVE O-RINGS FROM PISTON

Remove the two O-rings from the piston.

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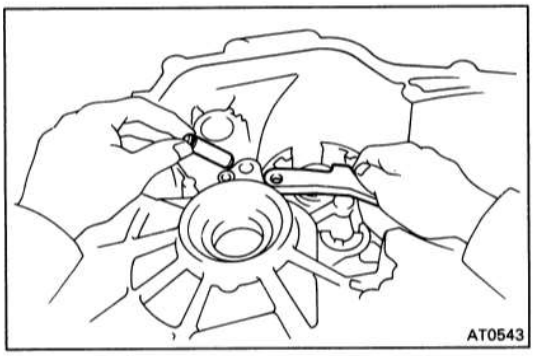


69. REMOVE PARKING LOCK PAWL STOPPER PLATE, TORSION SPRING AND SPRING GUIDE

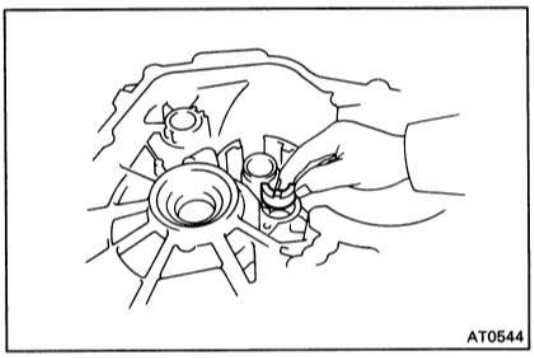


70. REMOVE PAWL SHAFT CLAMP

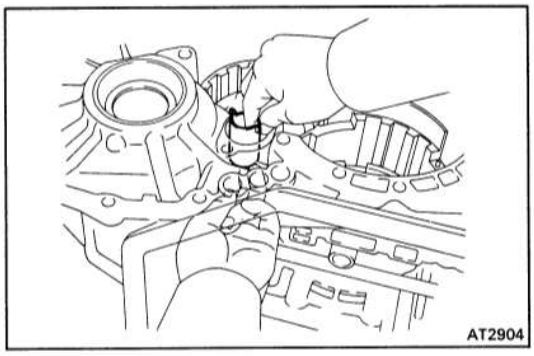
Remove the bolt and pawl shaft clamp.



71. REMOVE PARKING LOCK PAWL SHAFT AND LOCK PAWL



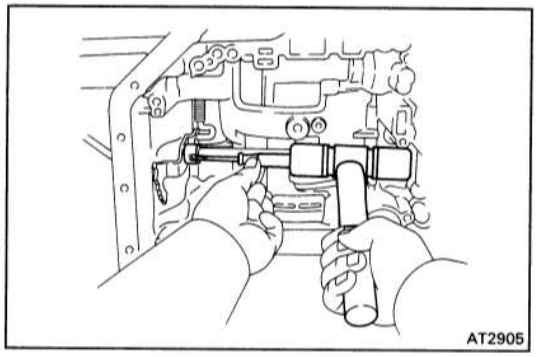
72. REMOVE PARKING LOCK SLEEVE



73. REMOVE CAM GUIDE BRACKET

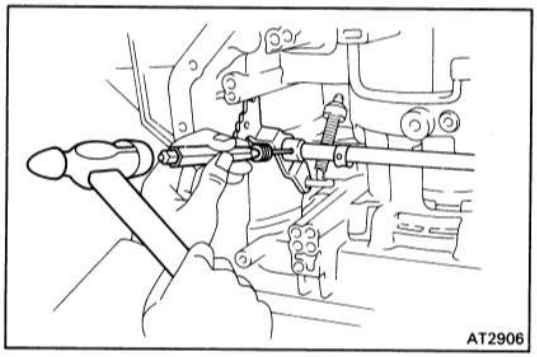
Remove the cam guide bracket as shown.

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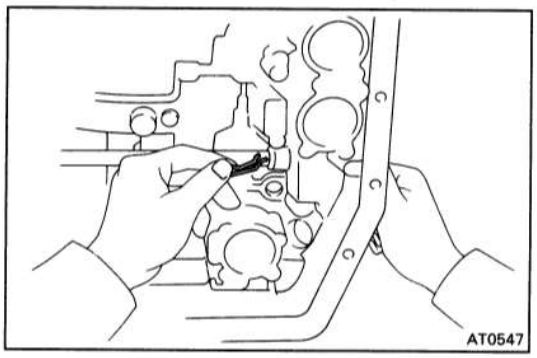
74. REMOVE MANUAL VALVE SHAFT SPACER

Using a screwdriver and hammer, unstake the spacer and remove it.



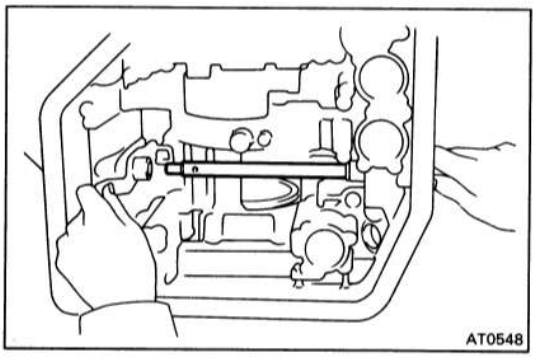
75. REMOVE PIN

Using a punch and hammer, drive out the pin.

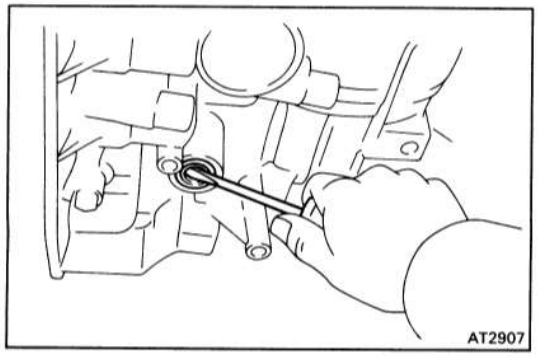


76. REMOVE MANUAL VALVE SHAFT AND LEVER

(a) Remove the retaining spring.



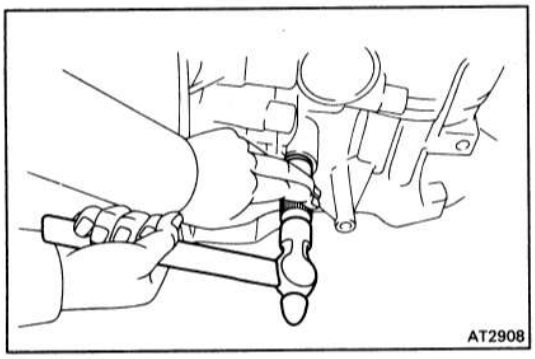
(b) Slide out the manual valve shaft and remove the manual valve lever and washer.



77. IF NECESSARY, REPLACE OIL SEAL OF MANUAL SHAFT

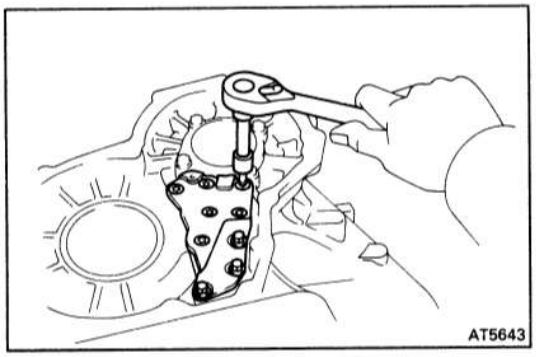
(a) Using a screwdriver, remove the oil seal.

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(b) Using a 14 mm socket wrench and hammer, drive in a new oil seal.

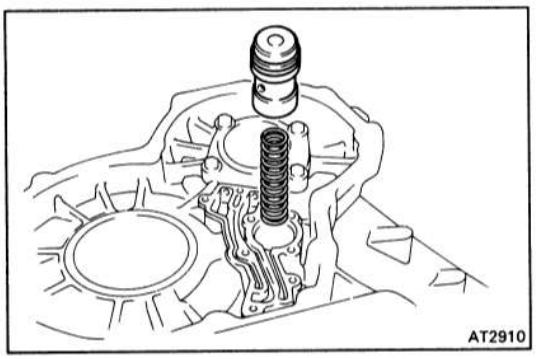
(c) Apply MP grease to the oil seal lip.



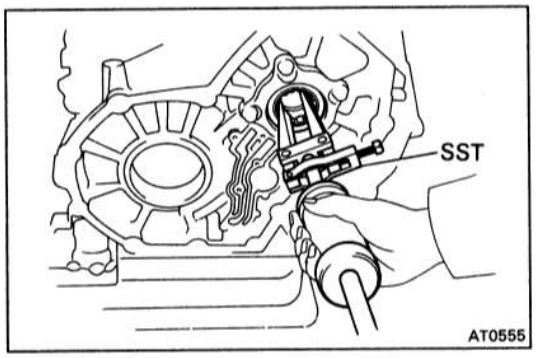
78. REMOVE OIL GALLERY COVER AND GASKET

(a) Remove the three bolts.

(b) Using a torx wrench, remove the six screws. Remove the gallery cover and gasket.



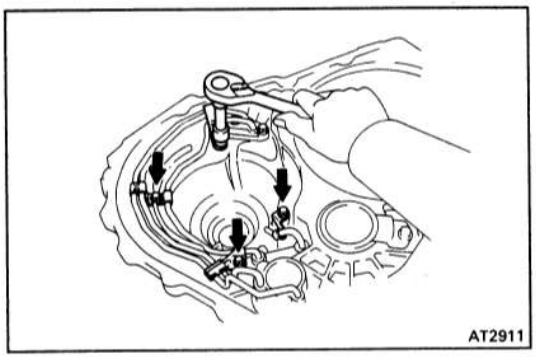
79. REMOVE B_4 ACCUMULATOR PISTON AND SPRING



80. REMOVE BEARING

Using SST, remove the bearing.

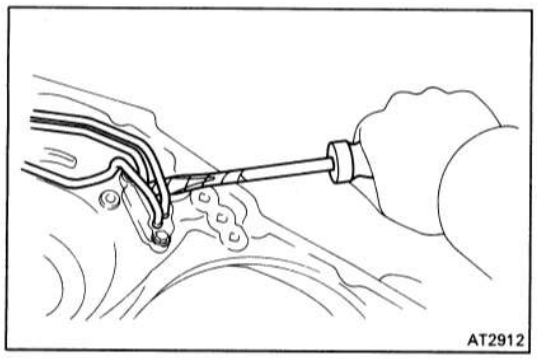
SST 09308-00010



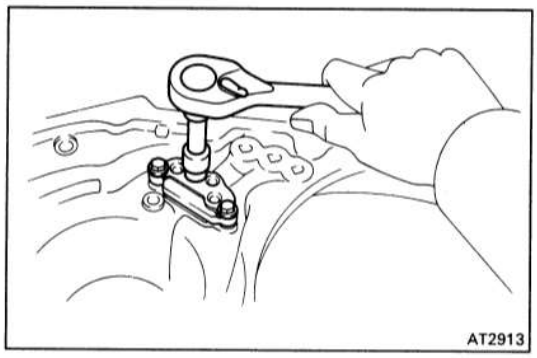
81. REMOVE OIL TUBES

(a) Remove the four tube clamps from transaxle housing.

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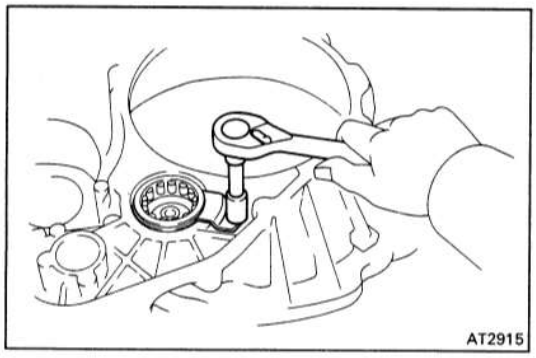


(b) Using a screwdriver, remove the three oil tubes.



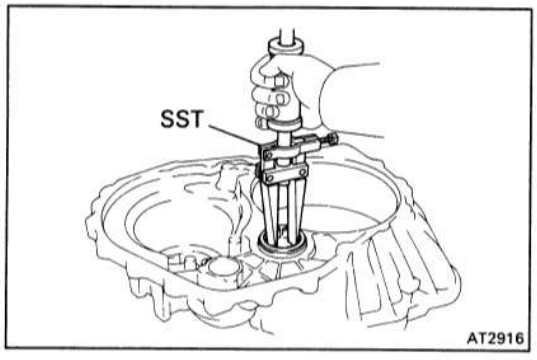
82. REMOVE OIL TUBE APPLY COVER AND GASKET

Remove the three bolts, and remove the cover and gasket.



83. REMOVE BEARING

(a) Remove the bolt and retainer.



(b) Using SST, remove the bearing.

SST 09308-00010

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COMPONENT PARTS

General Notes

The instructions here are organized so that you work on only one component group at a time. This will help avoid confusion from similar-looking parts of different subassemblies being on your workbench at the same time.
The component groups are inspected and repaired from the converter housing side.
As much as possible, complete the inspection, repair and assembly before proceeding to the next component group. If a component group can not be assembled because parts are being ordered, be sure to keep all parts of that group in a separate container while proceeding with disassembly, inspection, repair and assembly for other component groups.

GENERAL CLEANING NOTES:

1. All disassembled parts should be washed clean with any fluid passages and holes blown through with compressed air.
2. When using compressed air to dry parts, always aim away from yourself to prevent accidentally spraying automatic transmission fluid or kerosene in your face.
3. The recommended automatic transmission fluid kerosene should be used for cleaning.

PARTS ARRANGEMENT:

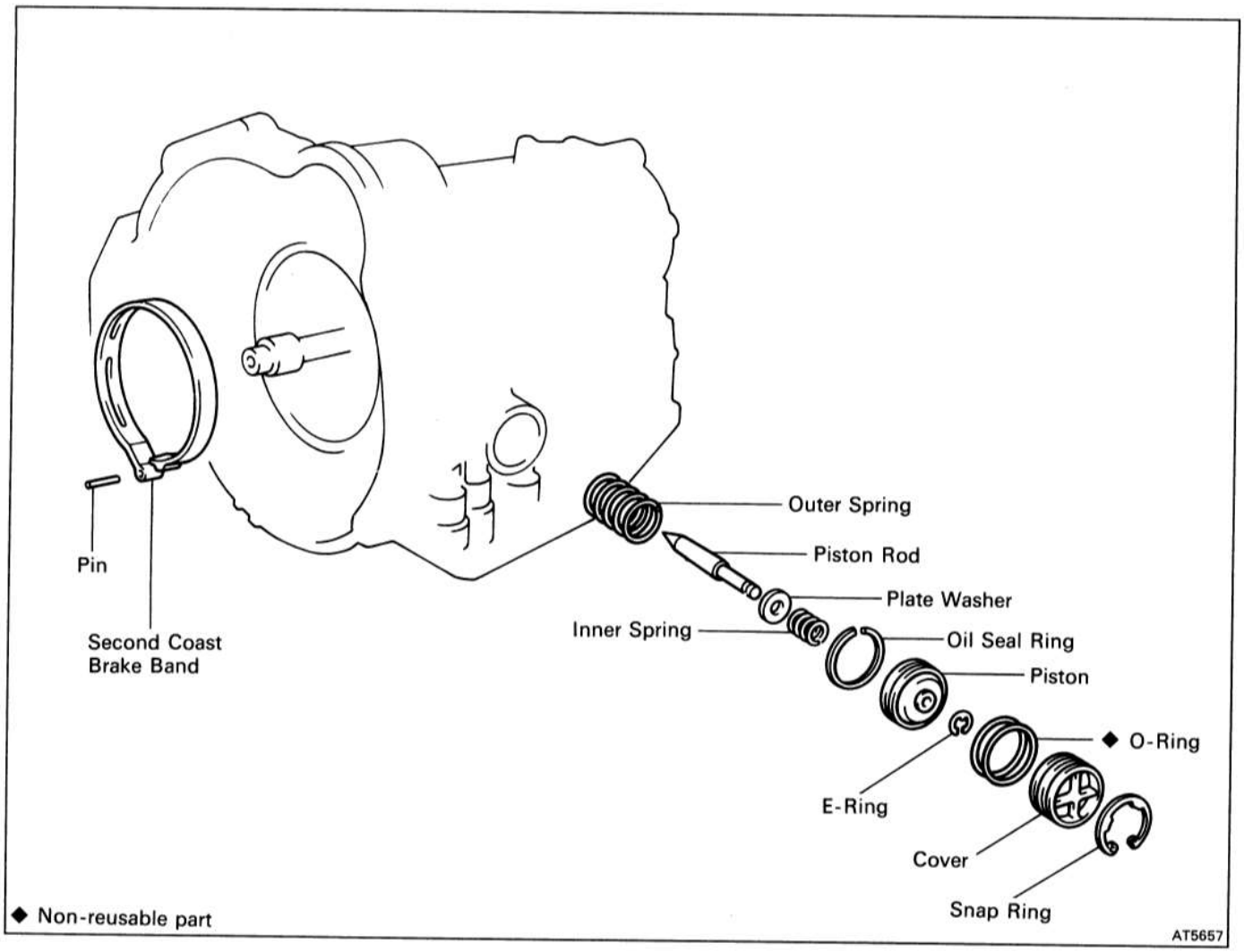
1. After cleaning, the parts should be arranged in proper order to allow efficient inspection, repairs, and reassembly.
2. When disassembling a valve body, be sure to keep each valve together with the corresponding spring.
3. New brakes and clutches that are to be used for replacement must be soaked in transmission fluid for at least two hours before assembly.

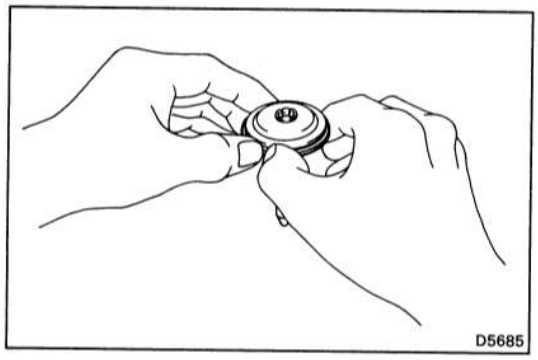
GENERAL ASSEMBLY:

1. All oil seal rings, clutch discs, clutch plates, rotating parts, and sliding surfaces should be coated with transmission fluid prior to reassembly.
2. All gaskets and rubber O-rings should be replaced.
3. Make sure that the ends of a snap ring are not aligned with one of the cutouts and are installed in the groove correctly.
4. If a worn bushing is to be replaced, the subassembly containing that bushing must be replaced.
5. Check thrust bearings and races for wear or damage. Replace if necessary.
6. Use petroleum jelly to keep parts in place.

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Second Coast Brake

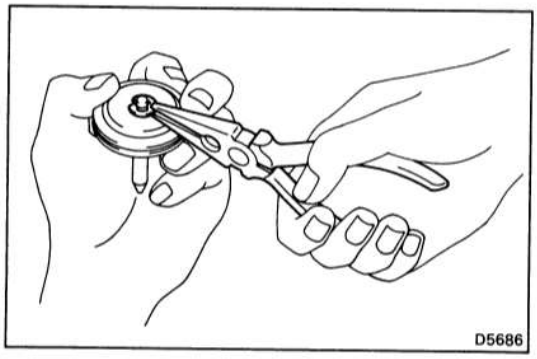




DISASSEMBLY OF SECOND COAST BRAKE PISTON

1. REMOVE OIL SEAL RING

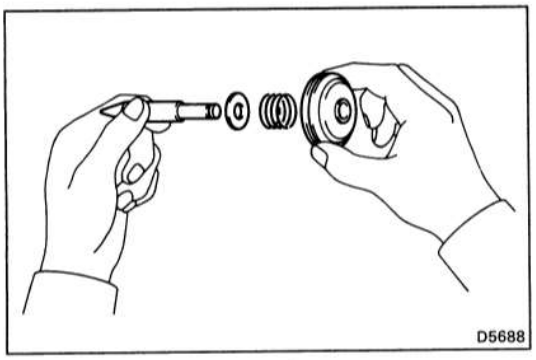
Remove the oil seal ring from the piston.



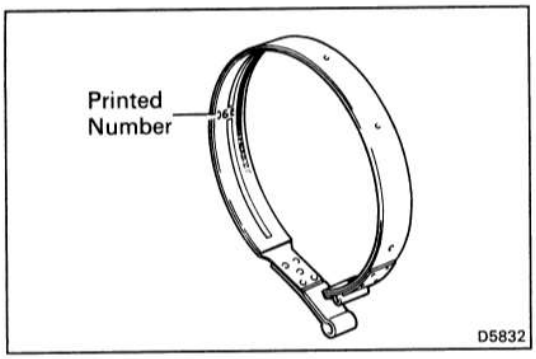
2. REMOVE PISTON ROD

(a) Remove the E-ring while pushing the piston with needle-nose pliers.

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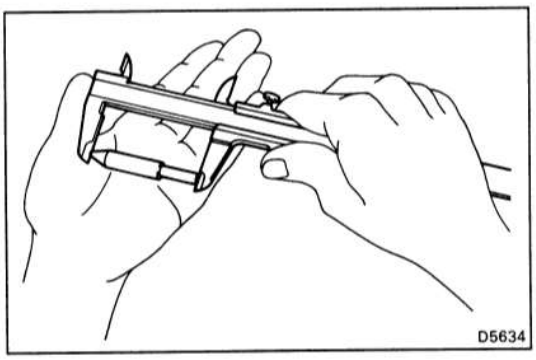
(b) Remove the spring, washer and piston rod.



INSPECTION OF SECOND COAST BRAKE COMPONENT

INSPECT BRAKE BAND

If the lining of the brake band is exfoliated or discolored, or even part of the printed numbers are defaced, replace the brake band.



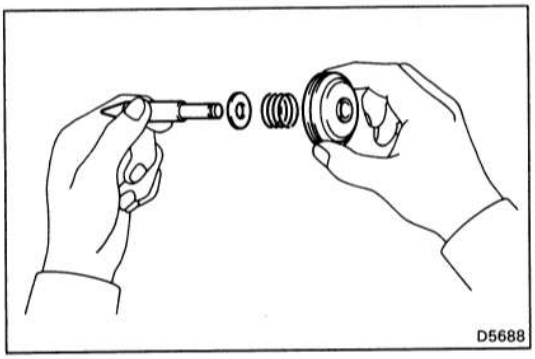
ASSEMBLY OF SECOND COAST BRAKE PISTON

1. SELECT PISTON ROD

If the band is OK with piston stroke not within the standard value, select the piston rod.

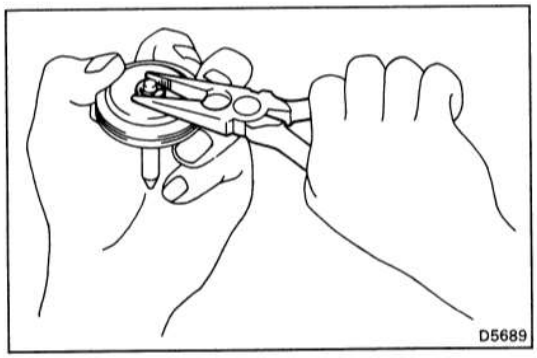
There are two lengths of piston rod.

Piston rod length: 72.9 mm (2.870 in.)
71.4 mm (2.811 in.)



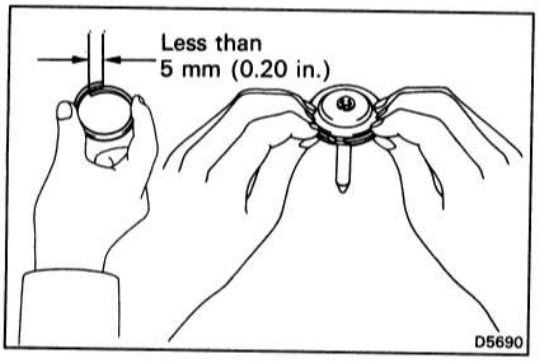
2. INSTALL PISTON ROD

(a) Install the washer and spring to the piston rod.



(b) Install an E-ring while pushing the piston.

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3. **INSTALL OIL SEAL RING**

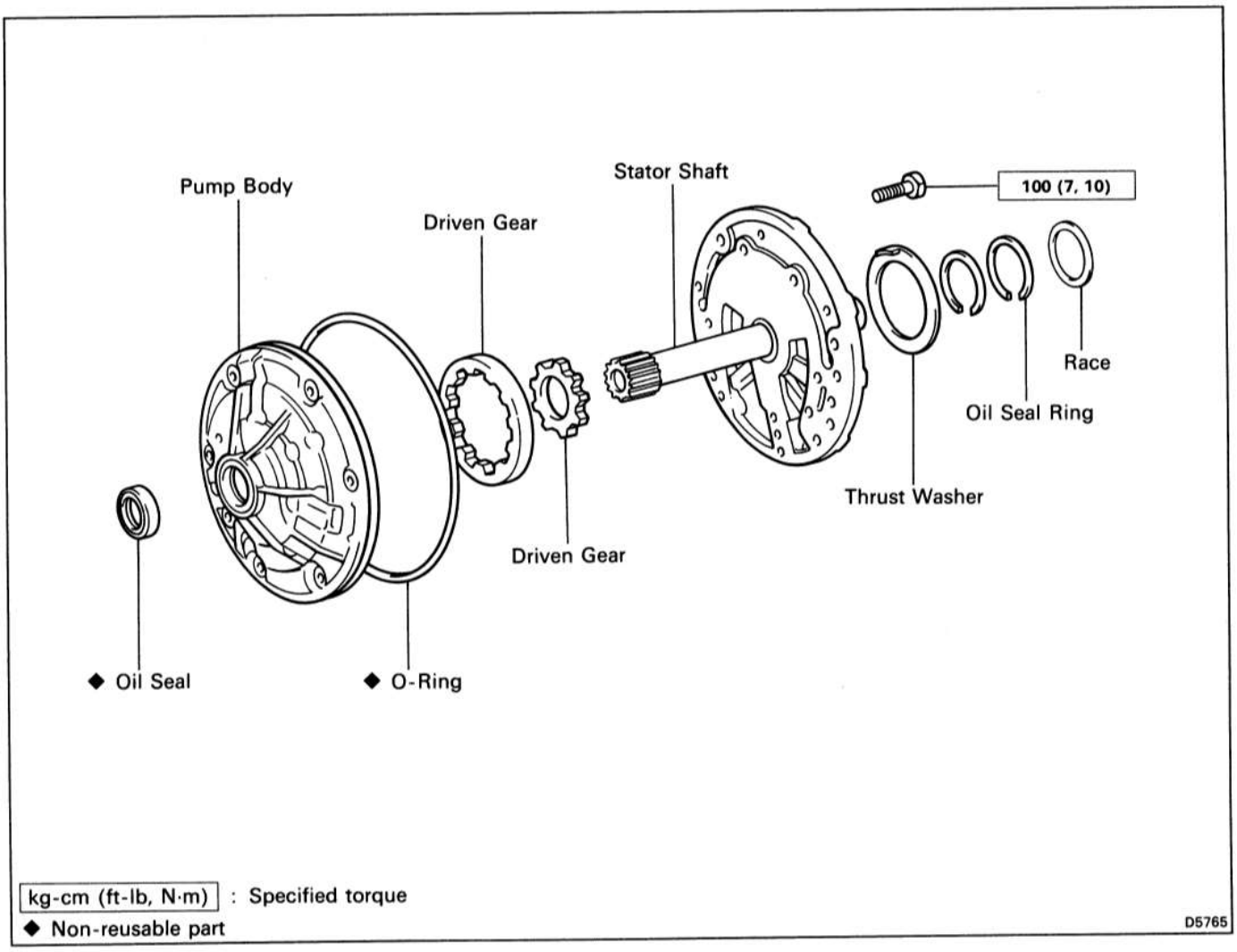
(a) Apply ATF to the oil seal ring.

(b) Install the oil seal ring to the piston.

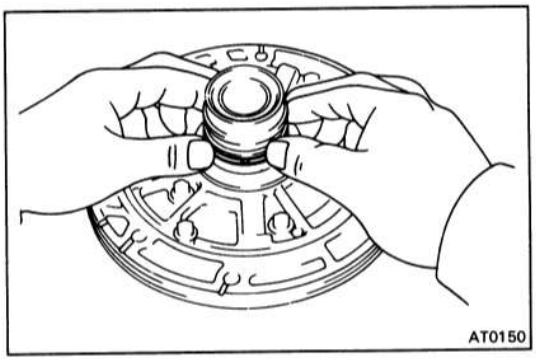
NOTICE: Do not spread the ring ends more than necessary.

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Oil Pump



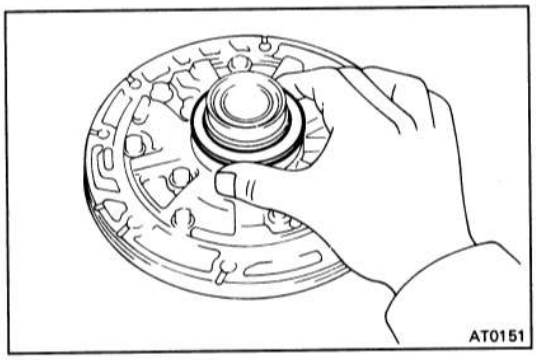
kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part



DISASSEMBLY OF OIL PUMP

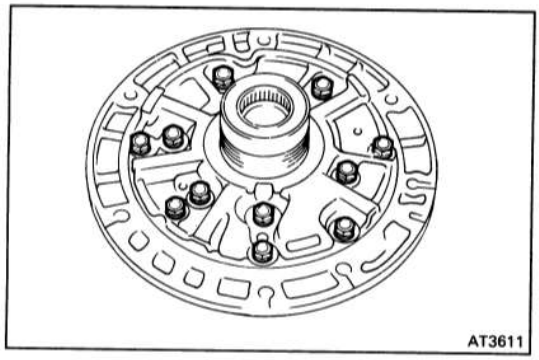
1. REMOVE OIL SEAL RINGS

Remove the two oil seal rings from the stator shaft back side.



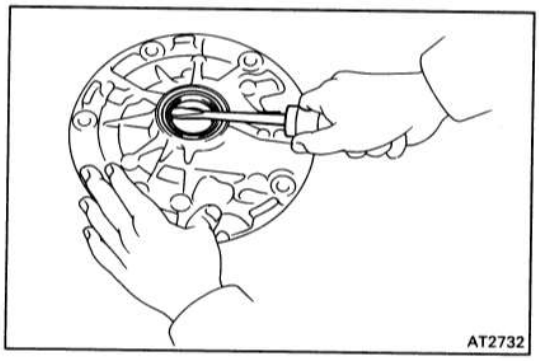
2. REMOVE THRUST WASHER FROM STATOR SHAFT BACK SIDE

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3. REMOVE STATOR SHAFT

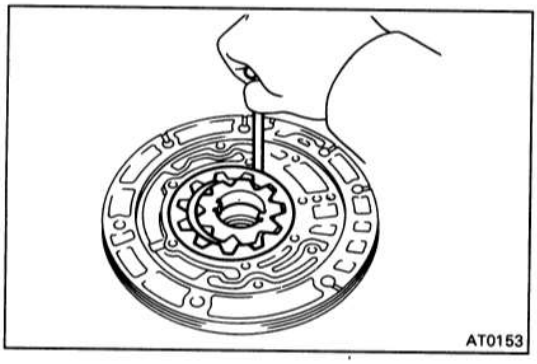
Remove the eleven bolts and stator shaft. Keep the gears in assembly order.



4. REMOVE FRONT OIL SEAL

Pry off the oil seal with a screwdriver.

INSPECTION OF OIL PUMP



1. CHECK BODY CLEARANCE OF DRIVEN GEAR

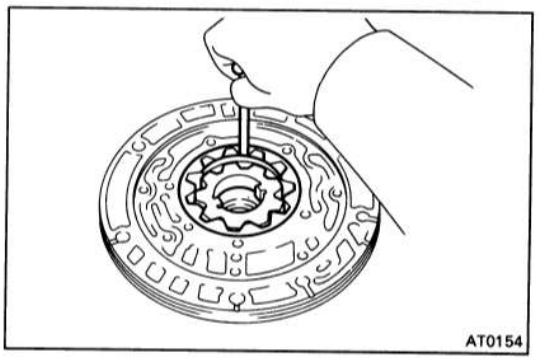
Push the driven gear to one side of the body.

Using a feeler gauge, measure the clearance.

Standard body clearance: **0.07 – 0.15 mm (0.0028 – 0.0059 in.)**

Maximum body clearance: **0.3 mm (0.012 in.)**

If the body clearance is greater than the maximum, replace the oil pump body subassembly.



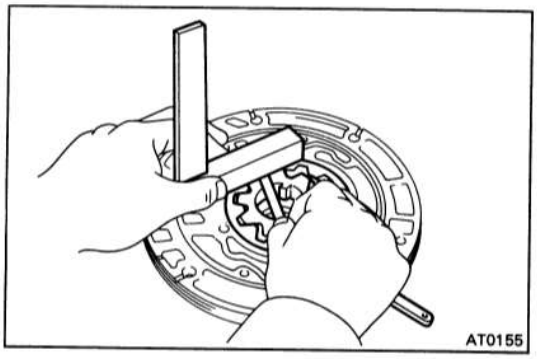
2. CHECK TIP CLEARANCE OF DRIVEN GEAR

Measure between the driven gear teeth and the crescentshaped part of the pump body.

Standard tip clearance: **0.11 – 0.14 mm (0.0043 – 0.0055 in.)**

Maximum tip clearance: **0.3 mm (0.012 in.)**

If the tip clearance is greater than the maximum, replace the oil pump body subassembly.



3. CHECK SIDE CLEARANCE OF BOTH GEARS

Using a steel straightedge and a feeler gauge, measure the side clearance of both gears.

Standard side clearance: **0.02 – 0.05 mm (0.0008 – 0.0020 in.)**

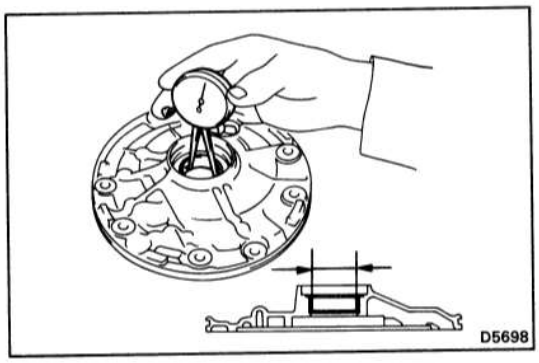
Maximum side clearance: **0.1 mm (0.004 in.)**

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There are different thicknesses for drive and driven gears.

Drive and driven gear thickness:
10.715 mm (0.4219 in.)

If the thickest gear can not make the side clearance within standard specification, replace the oil pump body subassembly.

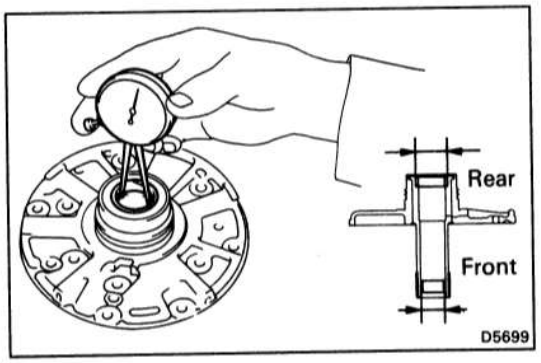


4. CHECK OIL PUMP BODY BUSHING

Using a dial indicator, measure the inside diameter of the oil pump body bushing.

Maximum inside diameter: 38.18 mm (1.5031 in.)

If the inside diameter is greater than the maximum, replace the oil pump body subassembly.



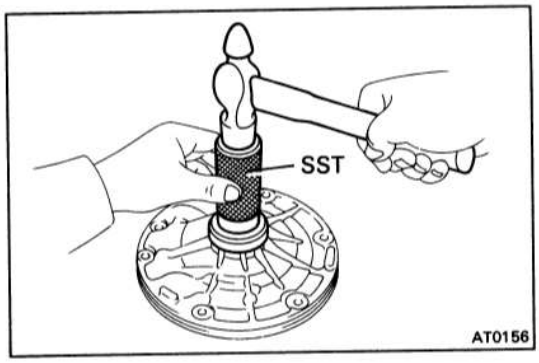
5. CHECK STATOR SHAFT BUSHINGS

Using a dial indicator, measure the inside diameter of the stator shaft bushings.

Maximum inside diameter:
Front side 21.57 mm (0.8492 in.)
Rear side 27.07 mm (1.0657 in.)

If the inside diameter is greater than the maximum, replace the stator shaft.

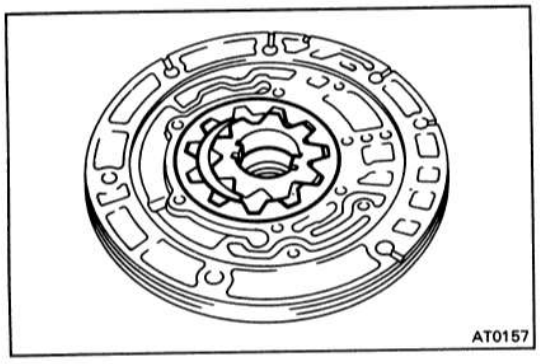
ASSEMBLY OF OIL PUMP



1. INSTALL FRONT OIL SEAL

Using SST and a hammer, install a new oil seal. The seal end should be flush with the outer edge of the pump body.

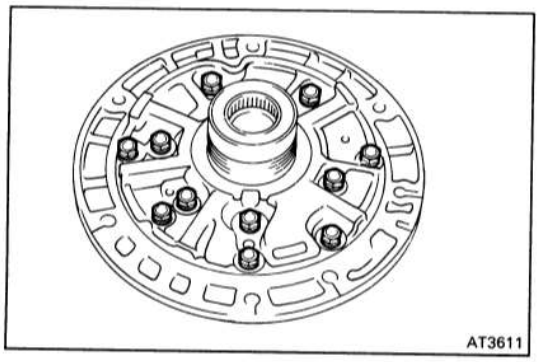
SST 09350-32014 (09351-32140)



2. INSTALL DRIVEN GEAR AND DRIVE GEAR

Make sure the top of the gears are facing upward.

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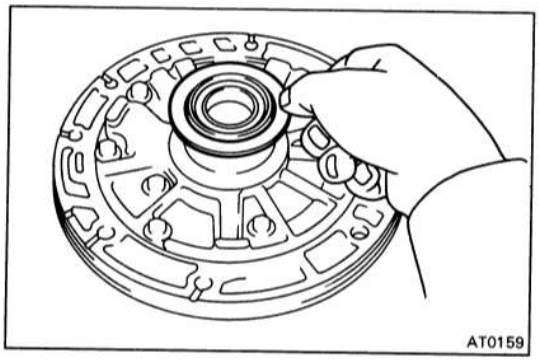


3. INSTALL STATOR SHAFT TO PUMP BODY

(a) Align the stator shaft with each bolt hole.

(b) Torque the eleven bolts.

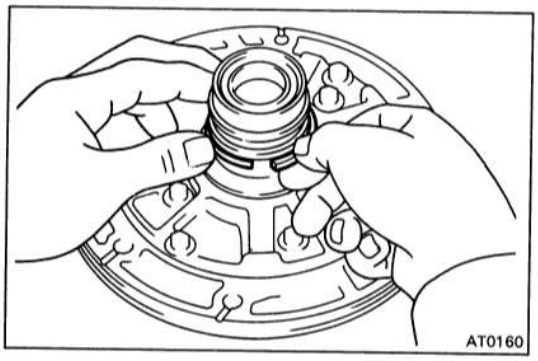
Torque: 100 kg-cm (7 ft-lb, 10 N·m)



4. INSTALL THRUST WASHER

(a) Coat the thrust washer with petroleum jelly.

(b) Align the tab of the washer with the hollow of the pump body.

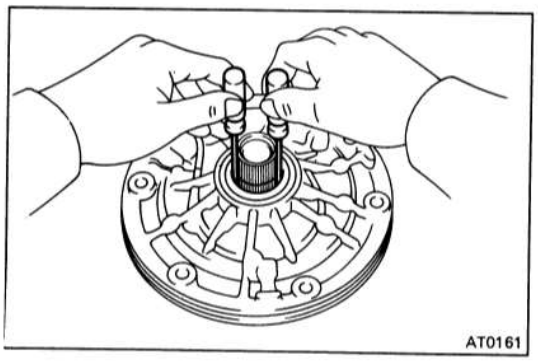


5. INSTALL OIL SEAL RINGS

Install the two oil seal rings to the stator shaft back side.

NOTICE: Do not spread the ring ends more than necessary.

HINT: After installing the oil seal rings, check that they move smoothly.



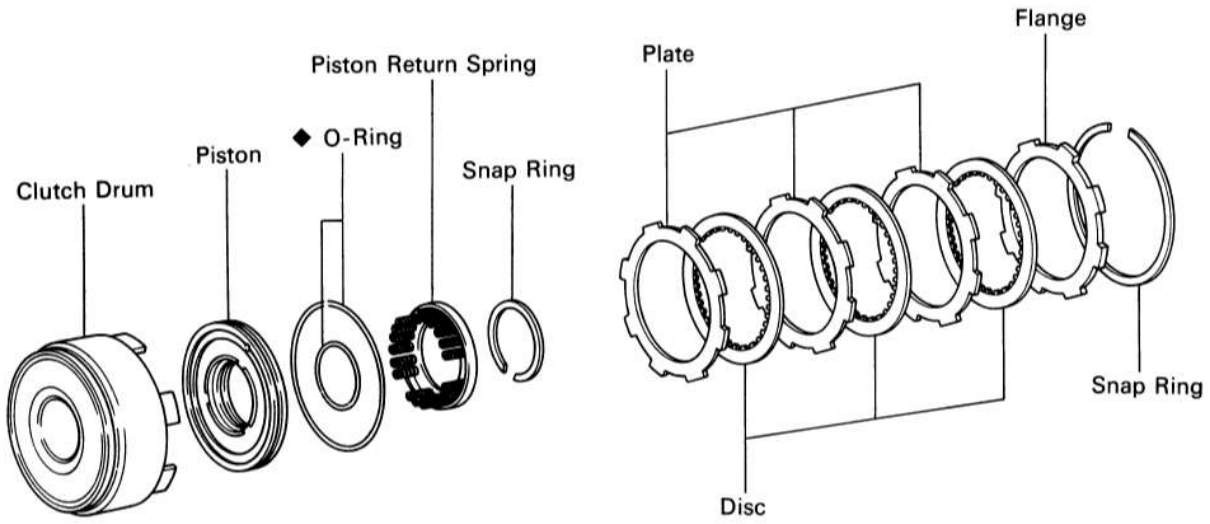
6. CHECK PUMP DRIVE GEAR ROTATION

Turn the drive gear with two screwdrivers and make sure it rotates smoothly.

NOTICE: Be careful not to damage the oil seal lip.

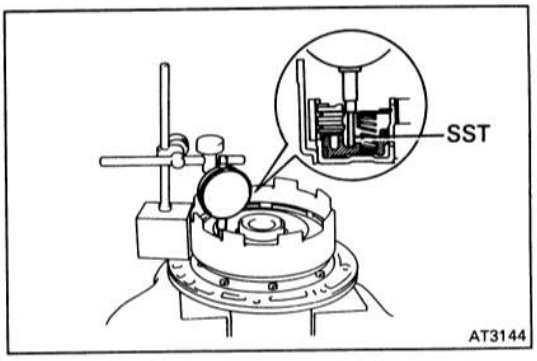
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Direct Clutch

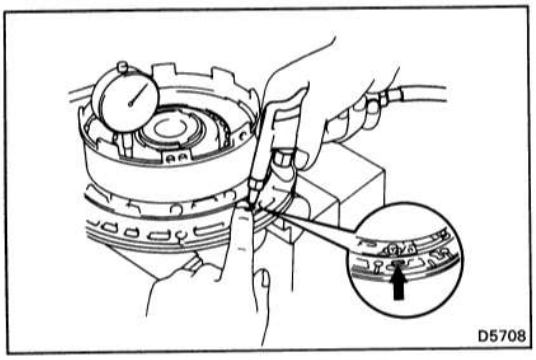


◆ Non-reusable part

AT5893



AT3144



D5708

DISASSEMBLY OF DIRECT CLUTCH

1. CHECK PISTON STROKE OF DIRECT CLUTCH

(a) Install the direct clutch on the oil pump.

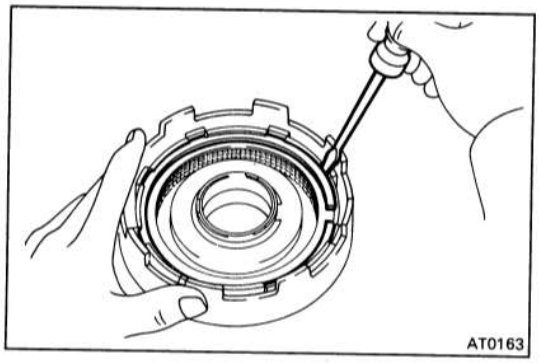
(b) Using a dial indicator (long type pick or SST), measure the direct clutch piston stroke applying and releasing the compressed air (4 – 8 kg/cm^2, 57 – 114 psi, 392 – 785 kPa) as shown.

SST 09350-32014 (09351-32190)

Piston stroke: 1.11 – 1.47 mm (0.0437 – 0.0579 in.)

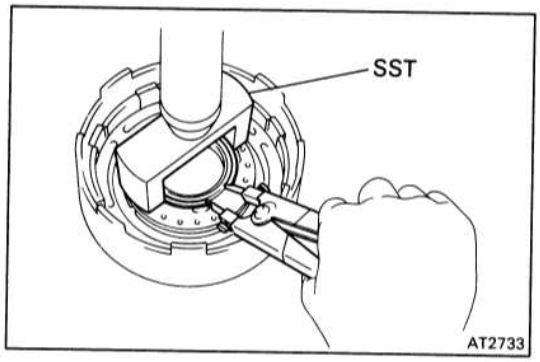
If the piston stroke is greater than the maximum inspect the each component.

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2. **REMOVE SNAP RING FROM CLUTCH DRUM**

3. **REMOVE FLANGE, DISCS AND PLATES**

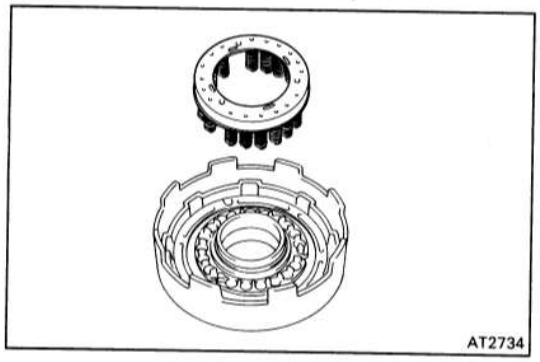


4. **REMOVE PISTON RETURN SPRING**

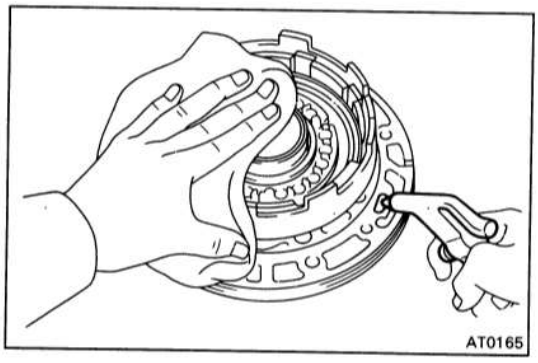
(a) Place SST on the spring retainer and compress the springs with a shop press.

SST 09350-32014 (09351-32070)

(b) Remove the snap ring with the snap ring pliers.



(c) Remove the piston return spring.

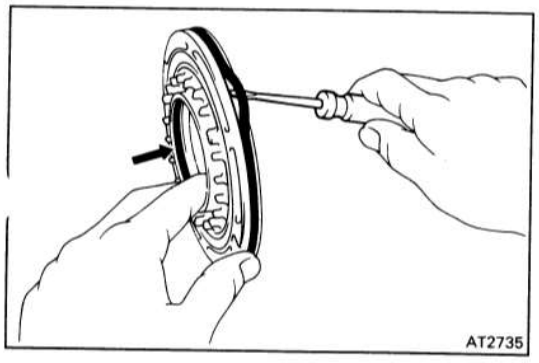


5. **REMOVE CLUTCH PISTON**

(a) Install the direct clutch onto the oil pump.

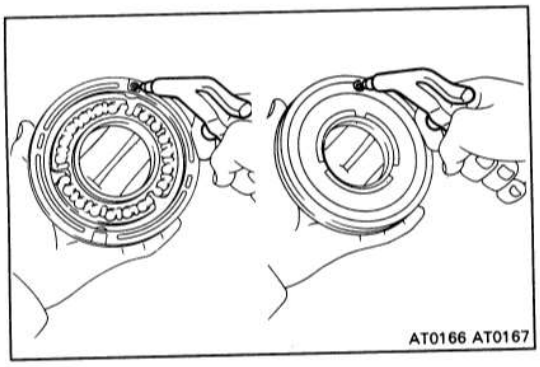
(b) Apply compressed air to the oil pump to remove the piston. (If the piston does not come out completely, use needle-nose pliers to remove it.)

(c) Remove the direct clutch from the oil pump.



(d) Remove the two O-rings from the piston.

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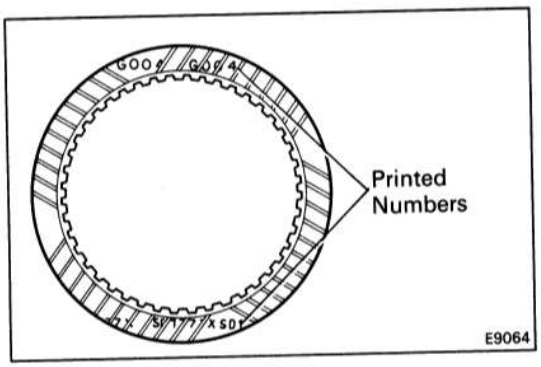

AT0166 AT0167

INSPECTION OF DIRECT CLUTCH

1. INSPECT CLUTCH PISTON

(a) Check that the check ball is free by shaking the piston.

(b) Check that the valve does not leak by applying low-pressure compressed air.



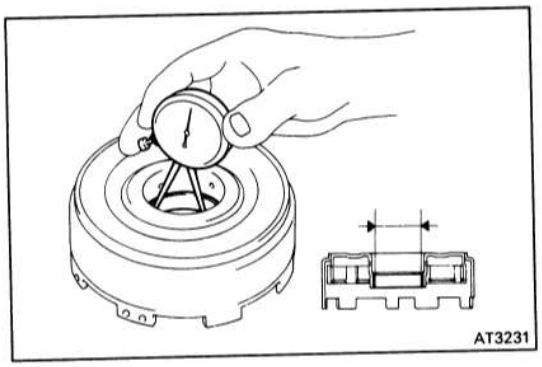
E9064

2. INSPECT DISC, PLATE AND FLANGE

Check if the sliding surface of the discs, plates and flanges are worn or burnt. If necessary, replace them.

HINT:

- If the lining of the disc is exfoliated or discolored, or even a part of the printed number is defaced, replace all discs.
- Before assembling new discs, soak them in ATF for at least two hours.


AT3231

3. CHECK DIRECT CLUTCH BUSHING

Using a dial indicator, measure the inside diameter of the direct clutch bushing.

Maximum inside diameter: 47.07 mm (1.8531 in.)

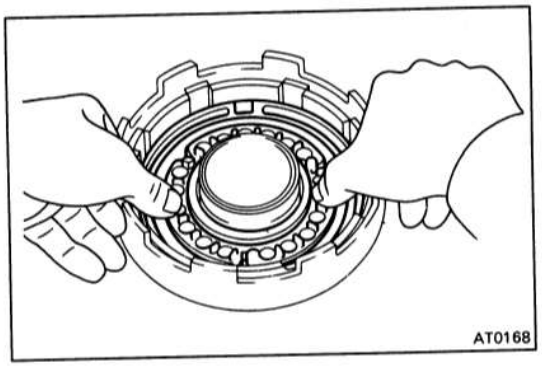
If the inside diameter is greater than the maximum, replace the direct clutch.

ASSEMBLY OF DIRECT CLUTCH

1. INSTALL CLUTCH PISTON IN DIRECT CLUTCH DRUM

(a) Install new O-rings to the piston. Coat the O-rings with ATF.

(b) Being careful not to damage the O-rings, press the piston into the drum with the cup side up.


AT0168

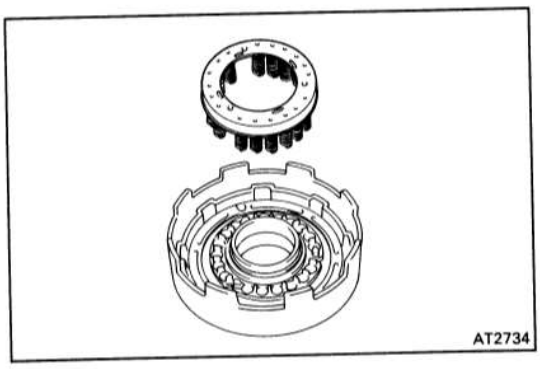
2. INSTALL PISTON RETURN SPRING

(a) Place the return spring and snap ring onto the piston.

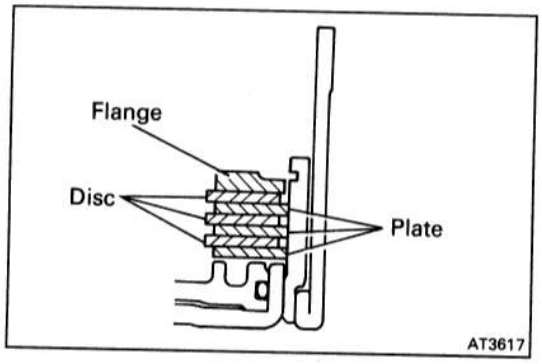
(b) Place SST on the return spring, and compress the return spring with a shop press.

SST 09350-32014 (09351-32070)

(c) Install the snap ring with the snap ring pliers. Be sure the end gap of snap ring is not aligned with the spring retainer claw.


AT2734

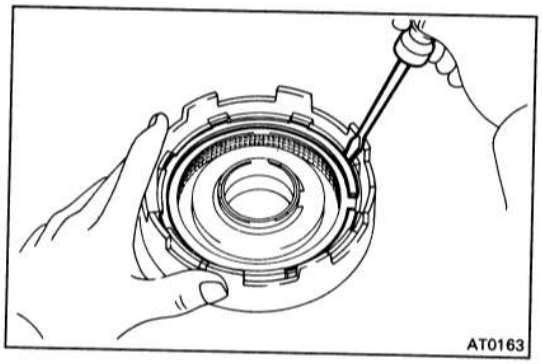
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3. INSTALL PLATES, DISCS AND FLANGE

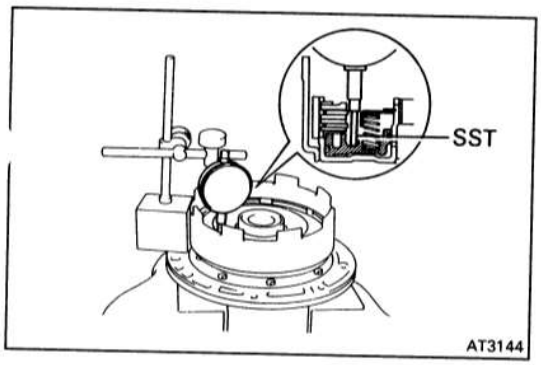
(a) Install plates and discs.
Install in order: P = Plate D = Disc
P – D – P – D – P – D

(b) Install the flange with the flat end facing downward.



4. INSTALL SNAP RING

Check that the end gap of the snap ring is not aligned with one of the cutouts.



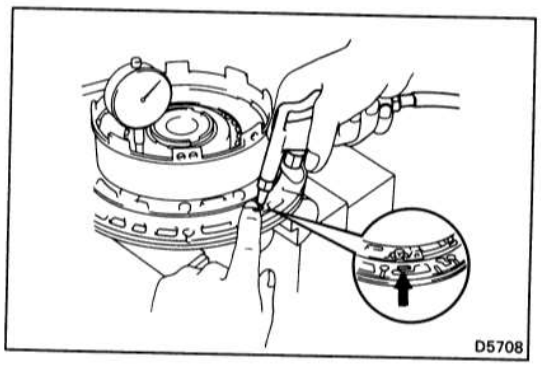
5. RECHECK PISTON STROKE OF DIRECT CLUTCH

(a) Install the direct clutch on the oil pump.

(b) Using a dial indicator (long type pick or SST), measure the direct clutch piston stroke applying and releasing the compressed air (4 – 8 kg/cm^2, 57 – 114 psi, 392 – 785 kPa) as shown.

SST 09350-32014 (09351-32190)

Piston stroke: 1.11 – 1.47 mm (0.0437 – 0.0579 in.)



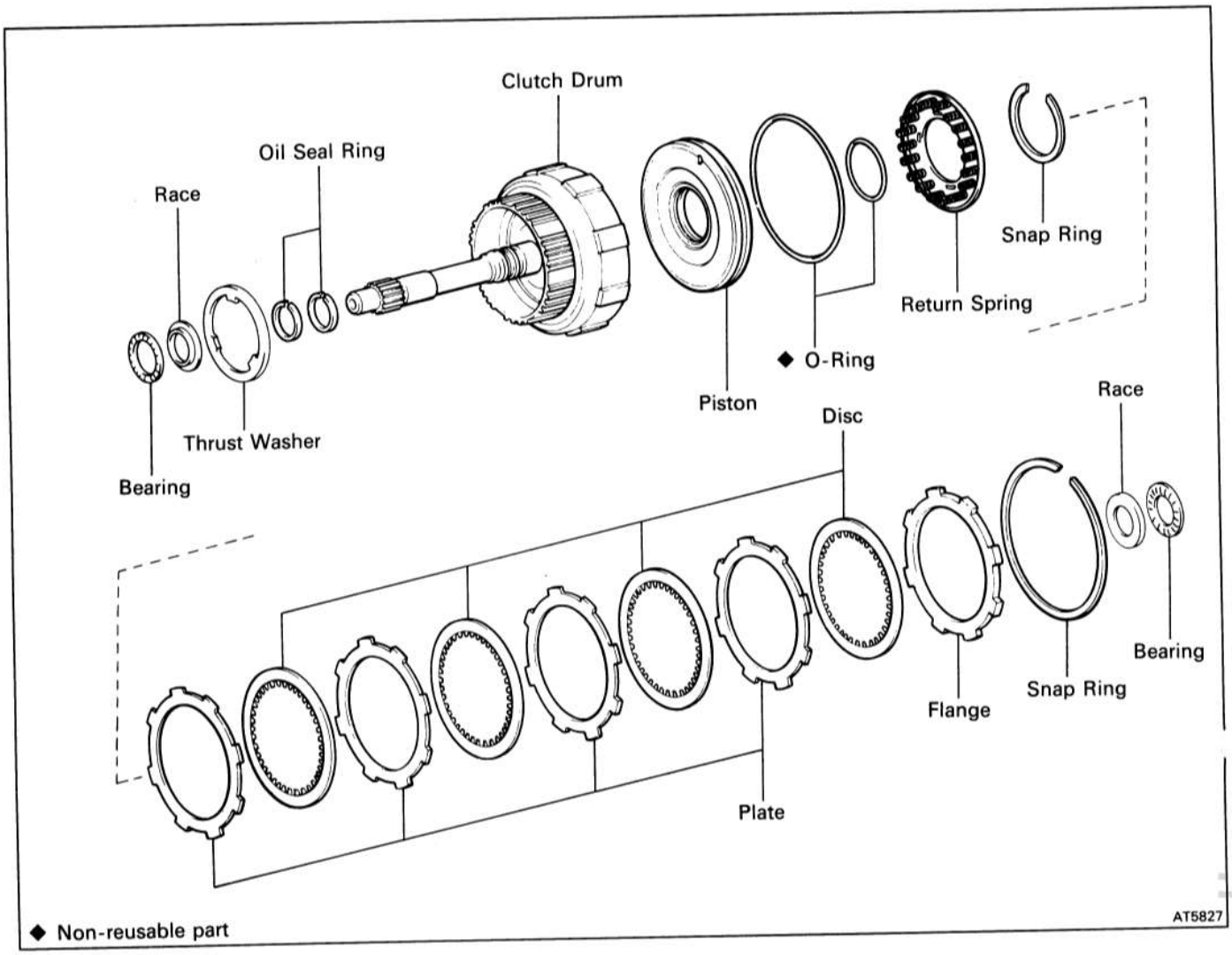
If the piston stroke is nonstandard, select another flange.

HINT: There are two different thicknesses for the flange.

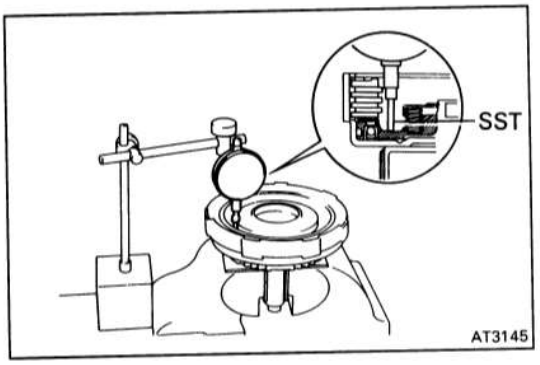
Flange thicknesses: 2.6 mm (0.102 in.)
3.0 mm (0.118 in.)

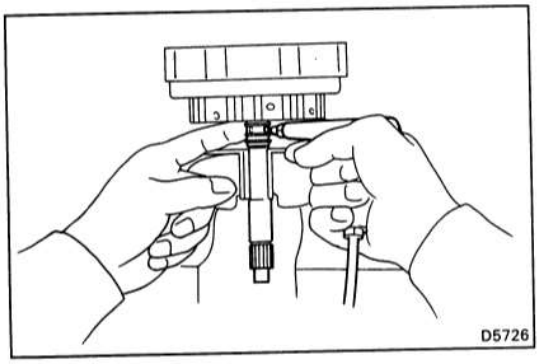
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Forward Clutch



◆ Non-reusable part





DISASSEMBLY OF FORWARD CLUTCH

1. **CHECK PISTON STROKE OF FORWARD CLUTCH**

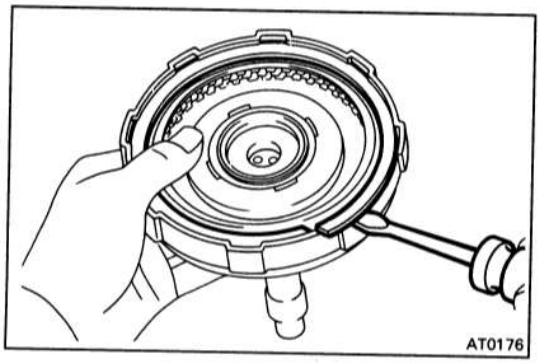
Using a dial indicator (long type pick or SST), measure the forward clutch piston stroke applying and releasing the compressed air (4 – 8 kg/cm^2, 57 – 114 psi, 392 – 785 kPa) as shown.

SST 09350-32014 (09351-32190)

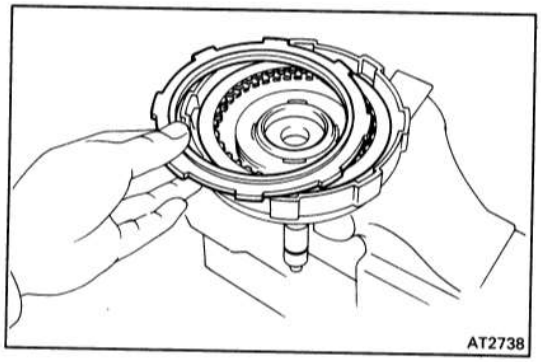
Piston stroke: 1.42 – 1.81 mm (0.0559 – 0.0713 in.)

If the piston stroke is greater than the maximum inspect the each component.

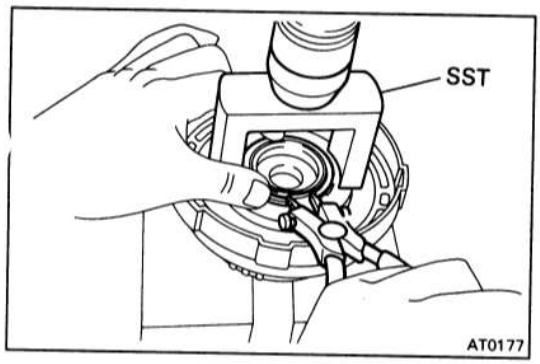
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2. REMOVE SNAP RING FROM CLUTCH DRUM



3. REMOVE FLANGE, DISCS AND PLATES

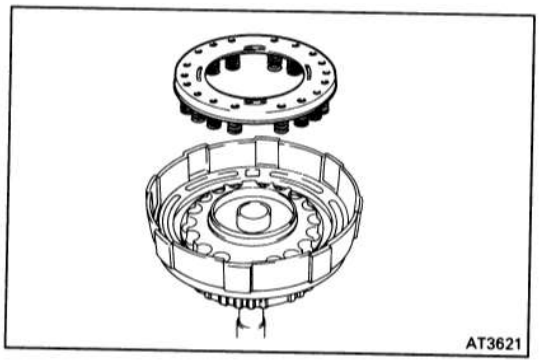


4. REMOVE RETURN SPRINGS

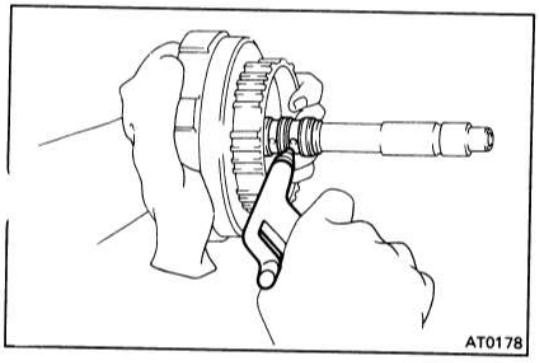
(a) Place SST on the spring retainer and compress the springs with a shop press.

SST 09350-32014 (09351-32070)

(b) Remove the snap ring with the snap ring pliers.



(c) Remove the return spring.

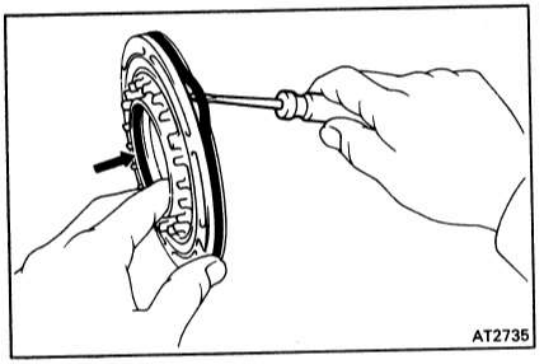


5. REMOVE CLUTCH PISTON

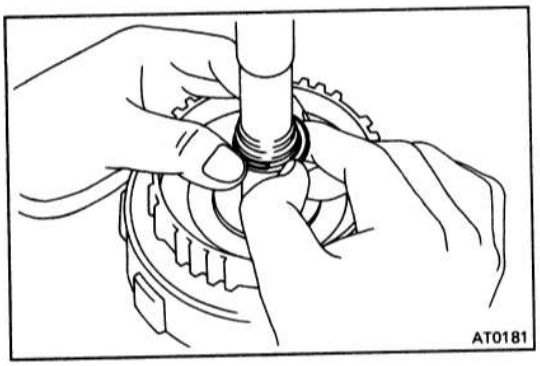
(a) Apply compressed air into the oil passage to remove the piston.

If the piston does not come out, use needle-nose pliers to remove it.

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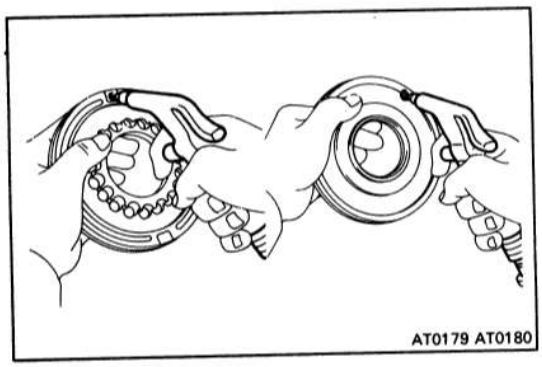
(b) Remove the two O-rings from the piston.



6. IF NECESSARY, REMOVE OIL SEAL RINGS

Remove the two oil seal rings from the shaft.

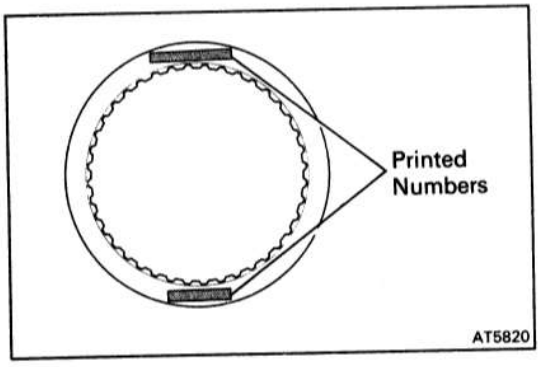
INSPECTION OF FORWARD CLUTCH



1. INSPECT CLUTCH PISTON

(a) Check that the check ball is free by shaking the piston.

(b) Check that the valve does not leak by applying low-pressure compressed air.



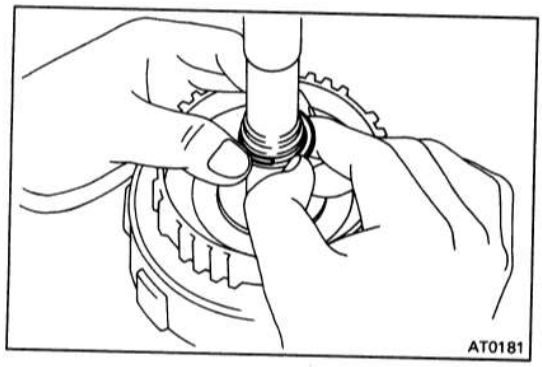
2. INSPECT DISC, PLATE AND FLANGE

Check if the sliding surface of the discs, plates and flanges are worn or burnt. If necessary, replace them.

HINT:

- If the lining of the disc is exfoliated or discolored, or even a part of the printed numbers are defaced, replace all discs.
- Before assembling new discs, soak them in ATF for at least two hours.

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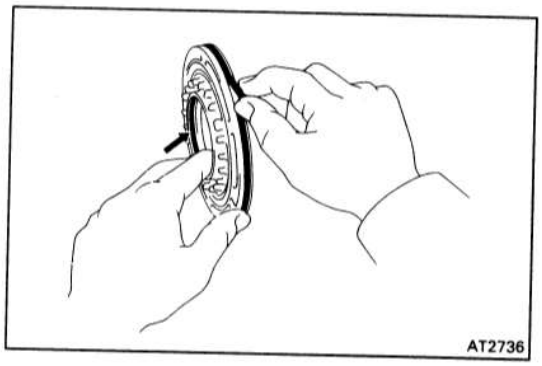
ASSEMBLY OF FORWARD CLUTCH

1. INSTALL OIL SEAL RINGS

Install the two oil seal rings to the shaft.

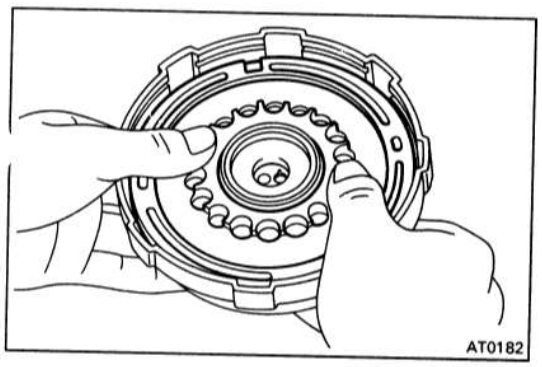
NOTICE: Do not spread the ring ends more than necessary.

HINT: After installing the oil seal rings, check that they move smoothly.



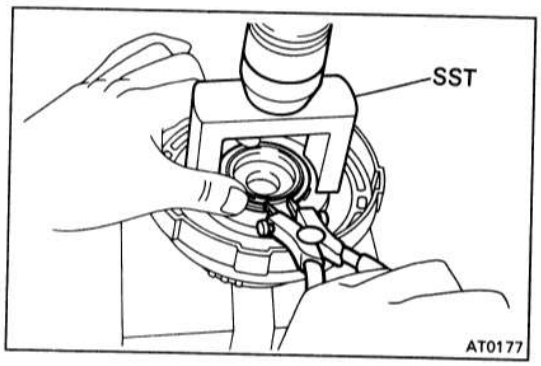
2. INSTALL CLUTCH PISTON TO CLUTCH DRUM

(a) Install the two new O-rings to the piston.



(b) Coat the O-rings with ATF.

(c) Press the piston into the drum with the cup side up, being careful not to damage the O-ring.



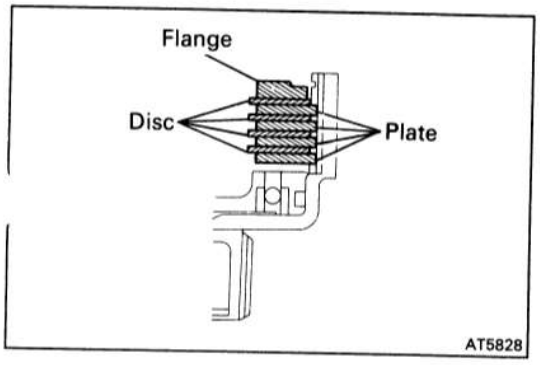
3. INSTALL PISTON RETURN SPRINGS

(a) Place the eighteen springs, spring retainer and snap ring onto the piston.

(b) Place SST on the spring retainer, and compress the springs with a shop press.

SST 09350-32014 (09351-32070)

(c) Install the snap ring with snap ring pliers.
Be sure the end gap of the snap ring is not aligned with the spring retainer claw.



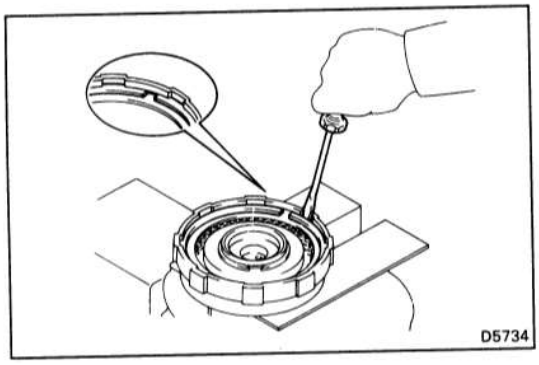
4. INSTALL PLATES, DISCS AND FLANGE

(a) Install the plates and discs.

Install in order: P = Plate D = Disc
P – D – P – D – P – D – P – D

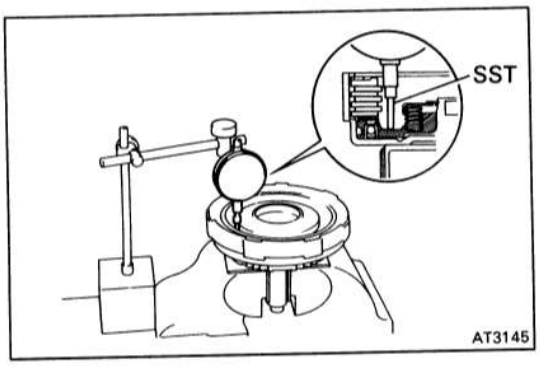
(b) Install the flange with the flat end facing downward.

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5. INSTALL SNAP RING

Check that the end gap of snap ring is not aligned with one of the cutouts.



6. RECHECK PISTON STROKE OF FORWARD CLUTCH

Using a dial indicator (long type pick or SST), measure the forward clutch piston stroke applying and releasing the compressed air (4 – 8 kg/cm^2, 57 – 114 pis, 392 – 785 kPa) as shown.

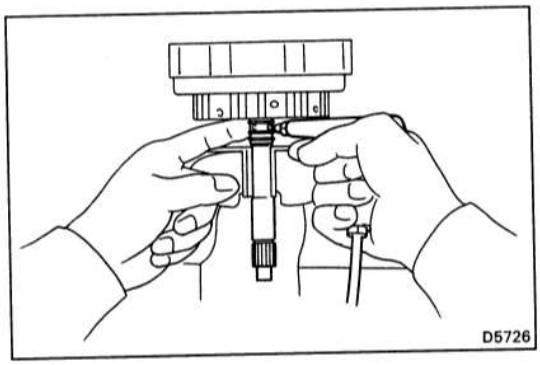
SST 09350-32014 (09351-32190)

Piston stroke: 1.42 – 1.81 mm (0.0559 – 0.0713 in.)

If the piston stroke is nonstandard, select another flange.

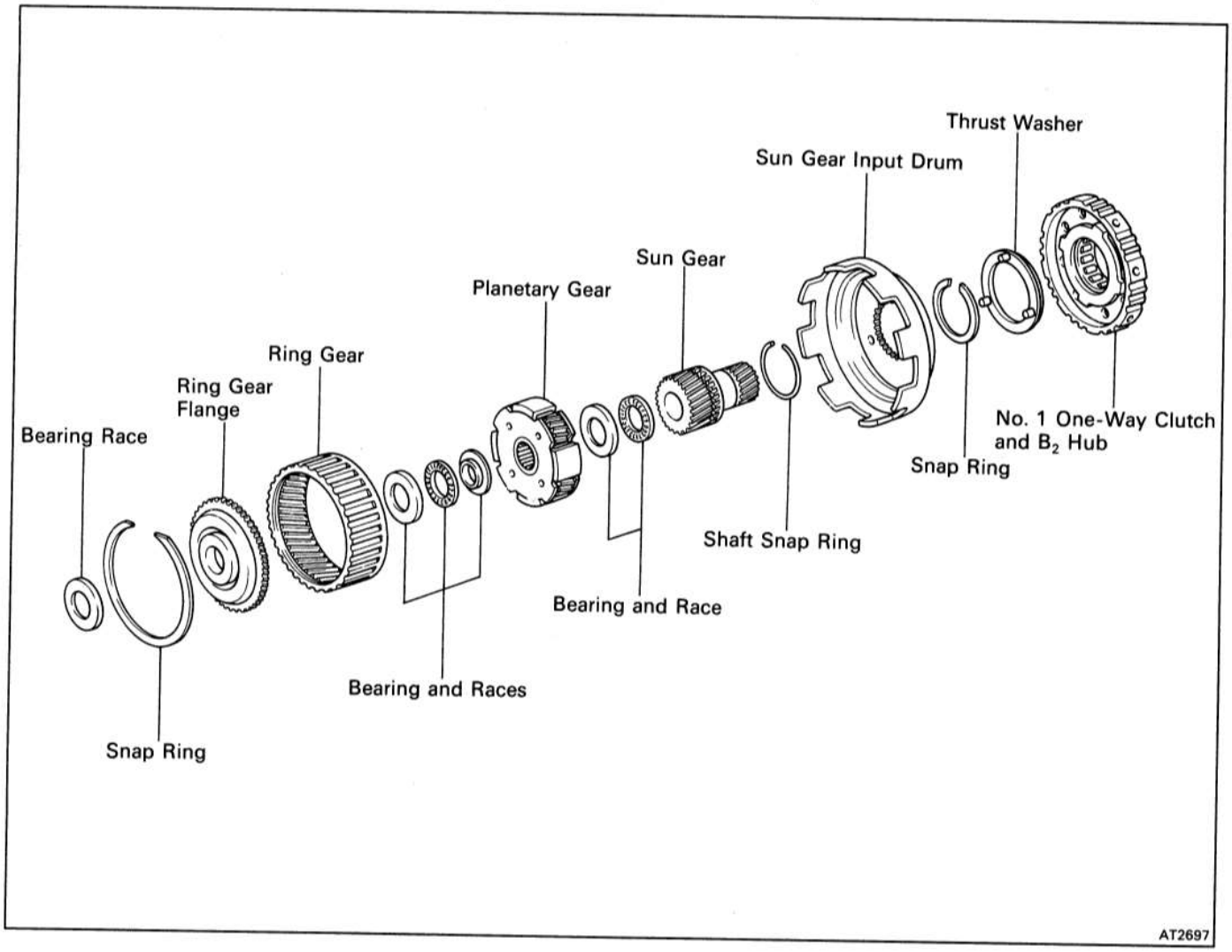
HINT: There are two different thicknesses for the flange.

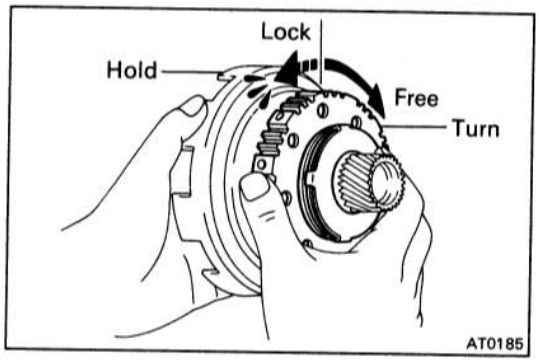
Flange thickness: 3.00 mm (0.1181 in.)
3.37 mm (0.1327 in.)



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Front Planetary Gear

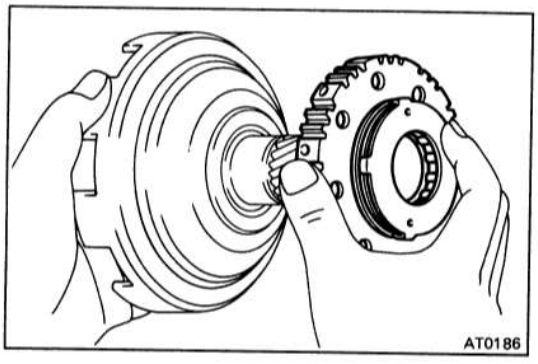




DISASSEMBLY OF ONE-WAY CLUTCH AND SUN GEAR

1. **CHECK OPERATION OF ONE-WAY CLUTCH**

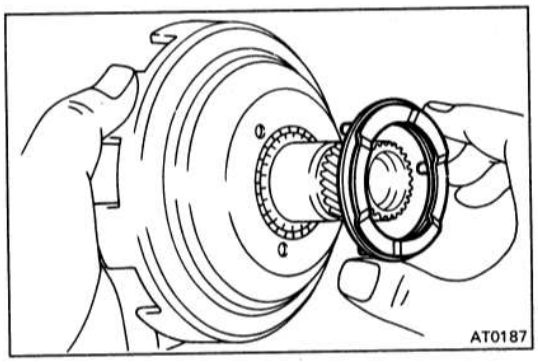
   Hold the sun gear and turn the hub. The hub should turn freely clockwise and should lock counterclockwise.



2. **REMOVE SECOND BRAKE HUB AND ONE-WAY CLUTCH FROM SUN GEAR**

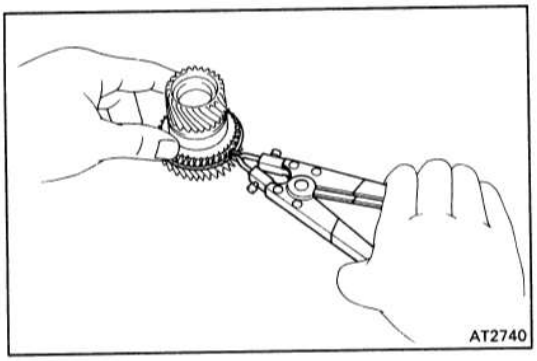
   While turning the hub clockwise, remove the one-way clutch from the sun gear.

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3. **REMOVE THRUST WASHER FROM SUN GEAR INPUT DRUM**

4. **REMOVE SUN GEAR FROM DRUM**
   (a) Using the snap ring pliers, remove the snap ring from the drum.
   (b) Remove the sun gear from the drum.



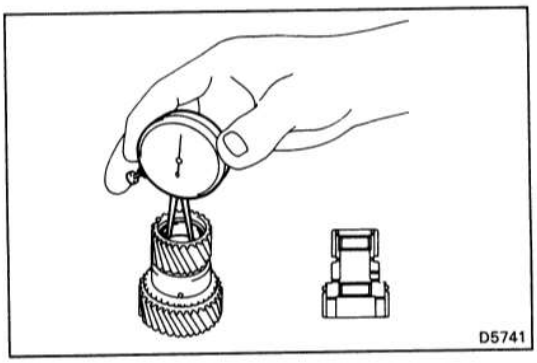
5. **REMOVE SHAFT SNAP RING**
   Using the snap ring pliers, remove the shaft snap ring from the sun gear.

INSPECTION OF SUN GEAR

INSPECT SUN GEAR FLANGE BUSHING

Using a dial indicator, measure the inside diameter of the sun gear.

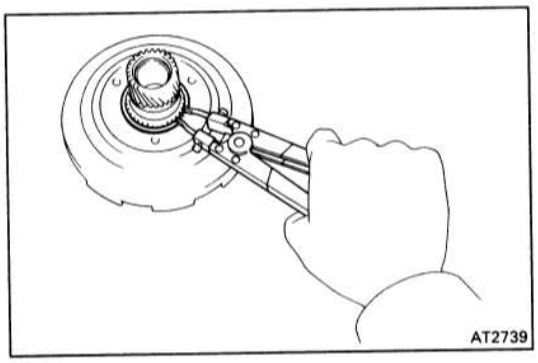
Standard inside diameter:	**22.025 – 22.046 mm (0.8671 – 0.8680 in.)**
Maximum diameter:	**22.096 mm (0.8699 in.)**



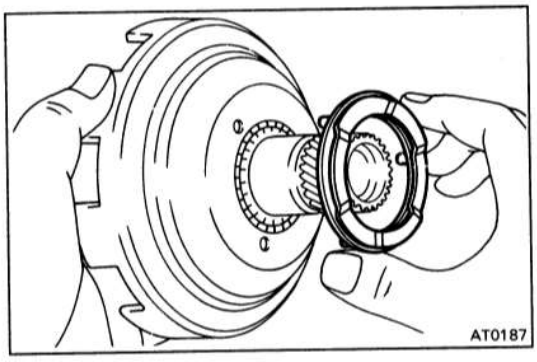
ASSEMBLY OF ONE-WAY CLUTCH AND SUN GEAR

1. **INSTALL SHAFT SNAP RING TO SUN GEAR**

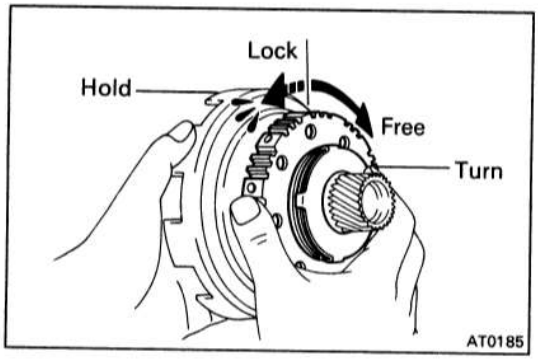
2. **INSTALL SUN GEAR TO DRUM**
   (a) Install the sun gear to the drum.
   (b) Using the snap ring pliers, install the snap ring to the drum.



3. **INSTALL THRUST WASHER TO SUN GEAR INPUT DRUM**



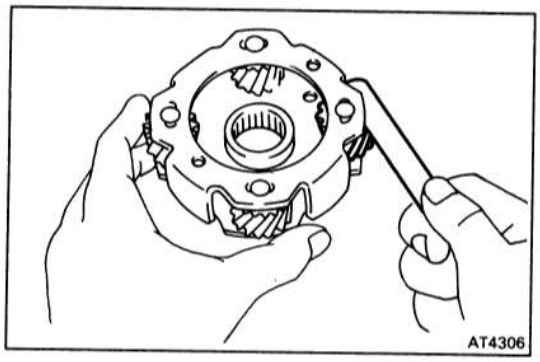
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4. INSTALL ONE-WAY CLUTCH AND SECOND BRAKE HUB ON SUN GEAR

While turning the hub clockwise, slide the one-way clutch onto the sun gear.

5. RECHECK OPERATION OF ONE-WAY CLUTCH



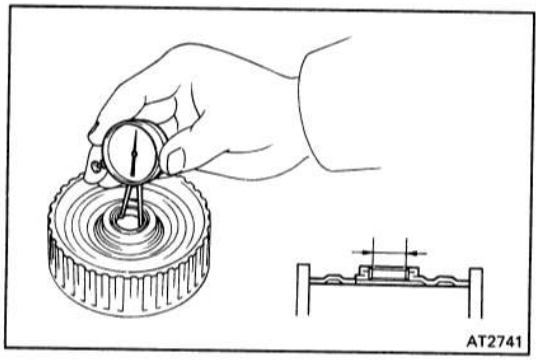
INSPECTION OF FRONT PLANETARY GEAR

MEASURE PLANETARY PINION GEAR THRUST CLEARANCE

Using a feeler gauge, measure the planetary pinion gear thrust clearance.

Standard clearance: 0.2 – 0.5 mm (0.008 – 0.020 in.)
Maximum clearance: 0.5 mm (0.020 in.)

If the clearance is greater than the maximum, replace the planetary gear assembly.



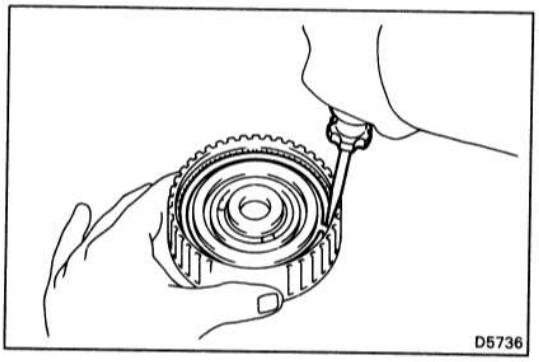
INSPECTION OF PLANETARY RING GEAR

1. INSPECT RING GEAR FLANGE BUSHING

Using a dial indicator, measure the inside diameter of the flange bushing.

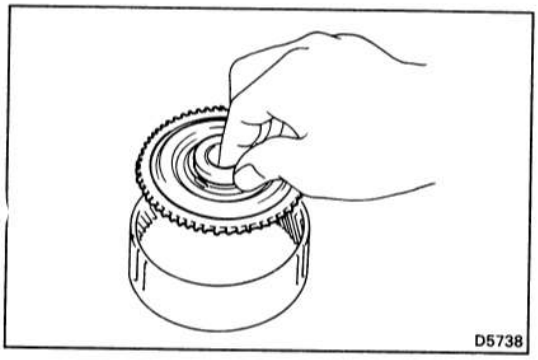
Standard inside diameter: 19.025 – 19.050 mm (0.7490 – 0.7500 in.)

If the inside diameter is greater than maximum, replace the flange.



2. REMOVE RING GEAR FLANGE

(a) Using a screwdriver, remove the snap ring.
(b) Remove the flange from the ring gear.

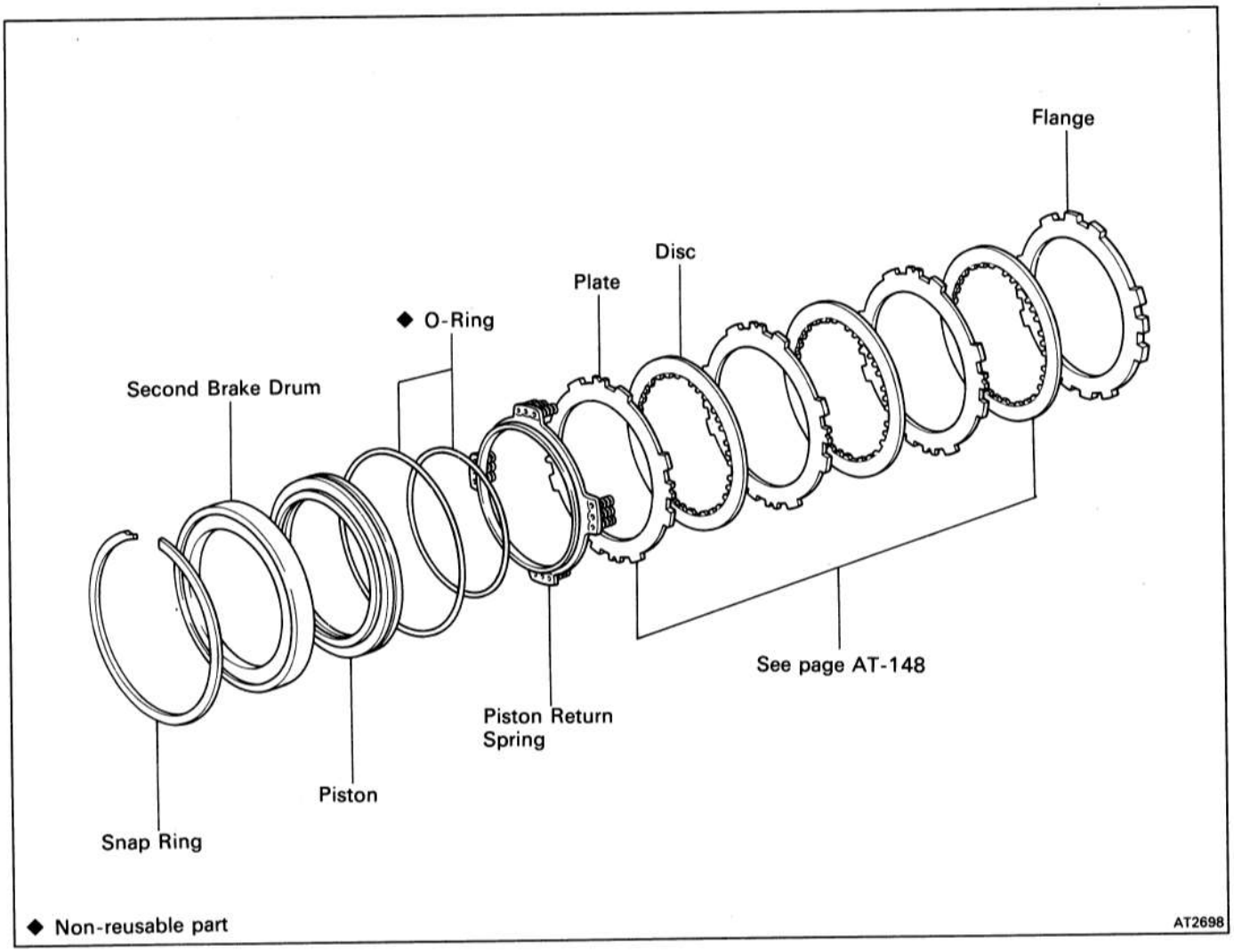


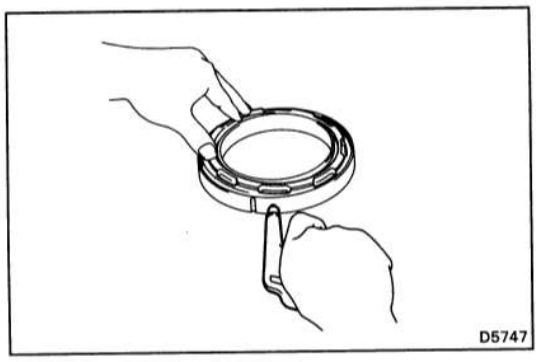
3. INSTALL RING GEAR FLANGE

(a) Position the flange onto the ring gear.
(b) Using a screwdriver, install the snap ring.

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Second Brake

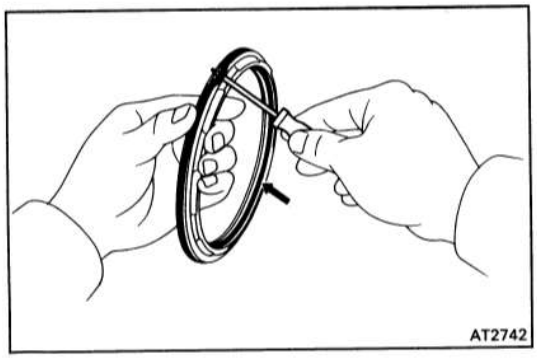




DISASSEMBLY OF SECOND BRAKE PISTON

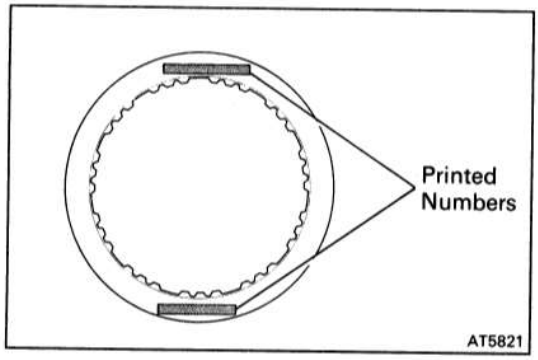
REMOVE SECOND BRAKE PISTON

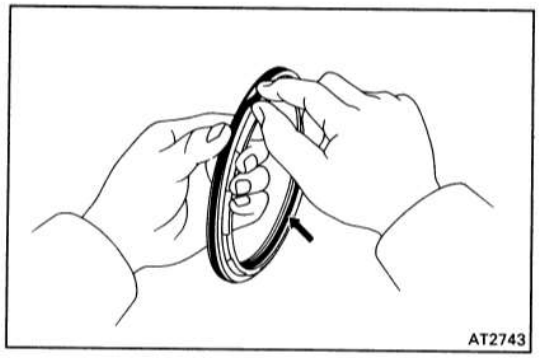
(a) Apply compressed air to the oil hole to remove the piston.

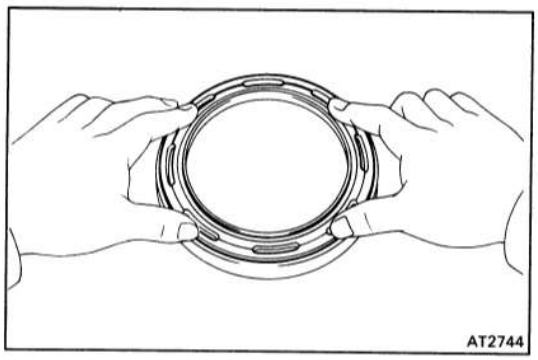


(b) Remove the two O-rings from the piston.

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INSPECTION OF SECOND BRAKE COMPONENT

INSPECT DISCS, PLATES AND FLANGE

Check if the sliding surface of the discs, plates and flanges are worn or burnt. If necessary, replace them.

HINT:

- If the lining of the disc is exfoliated or discolored, or even a part of the printed numbers are defaced, replace all discs.
- Before assembling new discs, soak them in ATF for at least two hours.

ASSEMBLY OF SECOND BRAKE PISTON

INSTALL PISTON

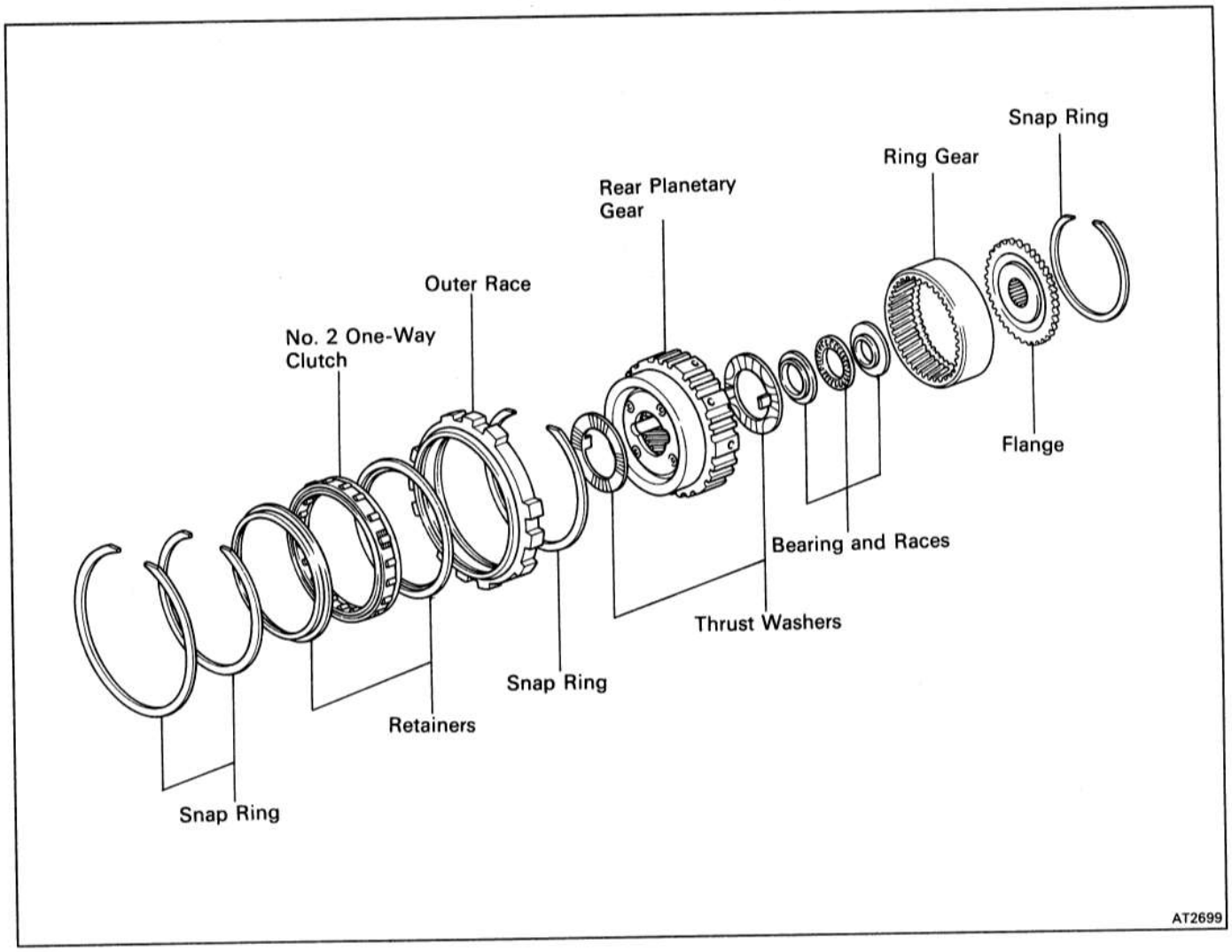
(a) Coat a new O-ring with ATF.

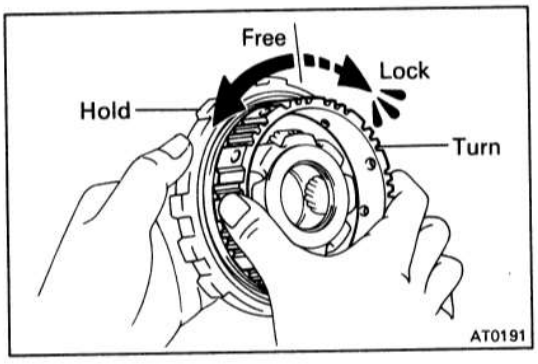
(b) Install the two O-rings on the piston.

(c) Press the piston into the drum, being careful not to damage the O-rings.

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Rear Planetary Gear

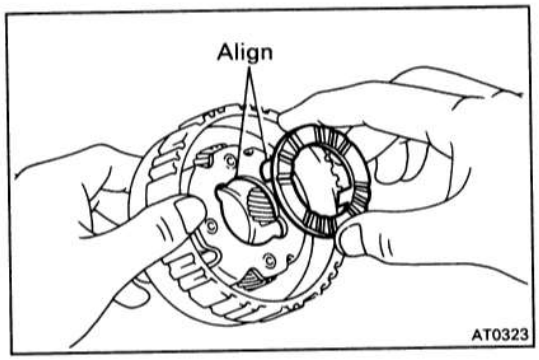




DISASSEMBLY OF ONE-WAY CLUTCH

1. CHECK OPERATION OF ONE-WAY CLUTCH

Hold the outer race and turn the hub. The hub should turn freely counterclockwise and should lock clockwise.

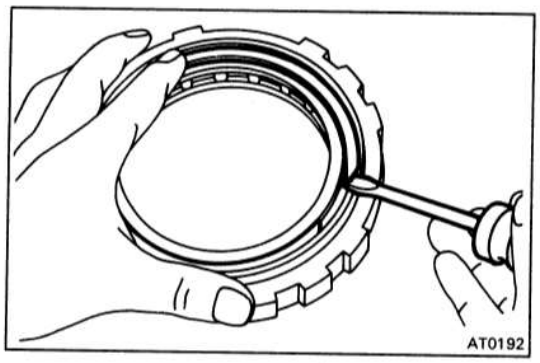


2. REMOVE THRUST WASHERS

Remove the two thrust washers from the both sides of planetary gear.

3. SEPARATE ONE-WAY CLUTCH AND PLANETARY GEAR

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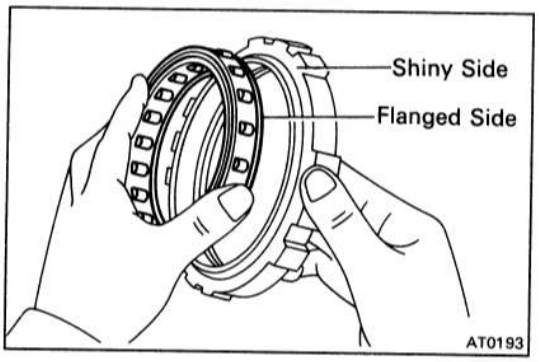


4. REMOVE ONE-WAY CLUTCH FROM OUTER RACE

(a) Remove the two snap rings and retainers from the both sides.

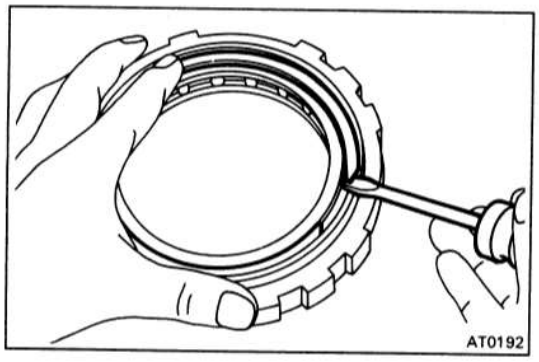
(b) Remove the one-way clutch from the outer race.

ASSEMBLY OF ONE-WAY CLUTCH

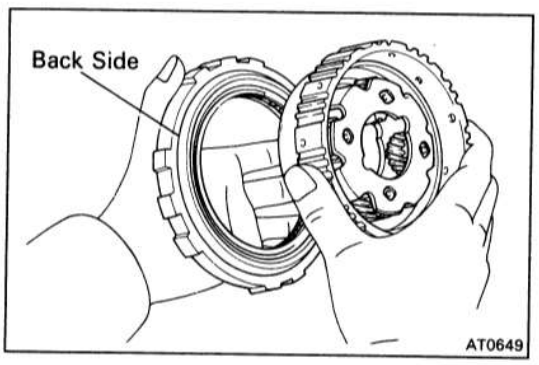


1. INSTALL ONE-WAY CLUTCH

(a) Install the one-way clutch into the outer race, facing the flanged side of the one-way clutch toward the shiny side of the outer race.

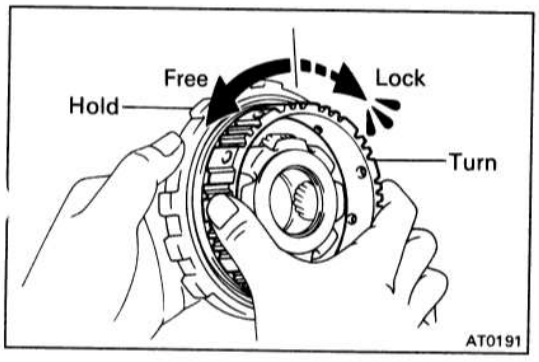


(b) Install the two retainers and snap rings to the both sides.



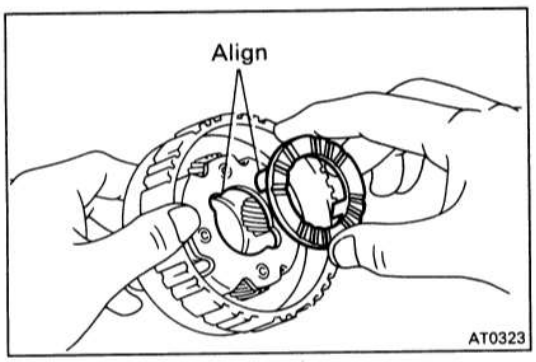
2. INSTALL PLANETARY GEAR INTO ONE-WAY CLUTCH

Install the planetary gear into the one-way clutch facing the inner race of the planetary gear toward the back side of the one-way clutch outer race.



3. CHECK OPERATION OF ONE-WAY CLUTCH

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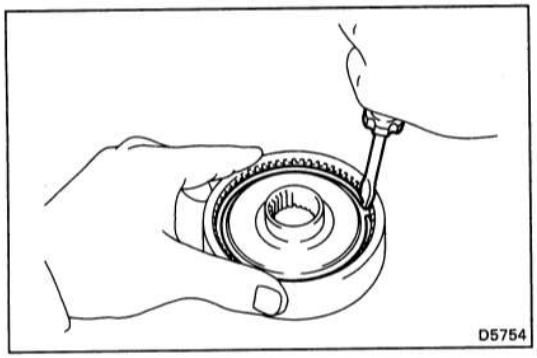


4. INSTALL THRUST WASHERS

(a) Coat the two thrust washers with petroleum jelly.

(b) Align the tab of the washers with the hollow of the carrier.

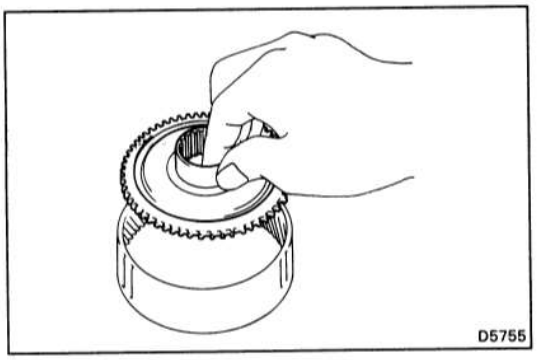
REPLACEMENT OF RING GEAR FLANGE



1. REMOVE RING GEAR FLANGE

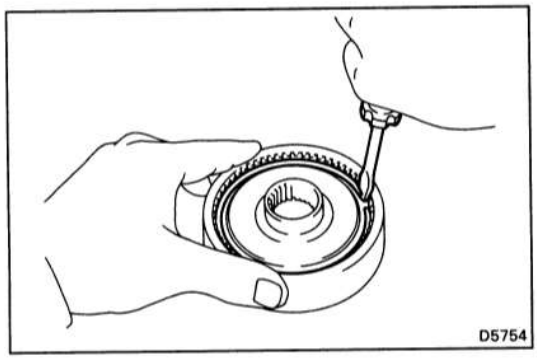
(a) Using a screwdriver, remove the snap ring.

(b) Remove the flange from the ring gear.



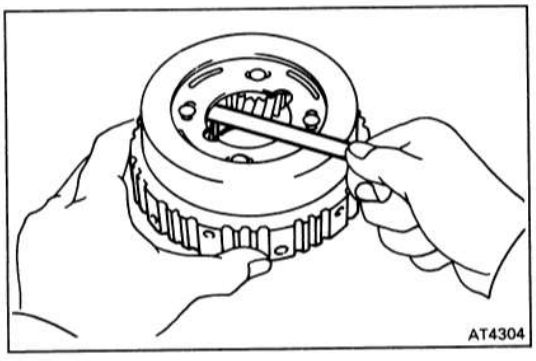
2. INSTALL RING GEAR FLANGE

(a) Position the flange into the ring gear.



(b) Using a screwdriver, install the snap ring.

INSPECTION OF REAR PLANETARY GEAR



MEASURE PLANETARY PINION GEAR THRUST CLEARANCE

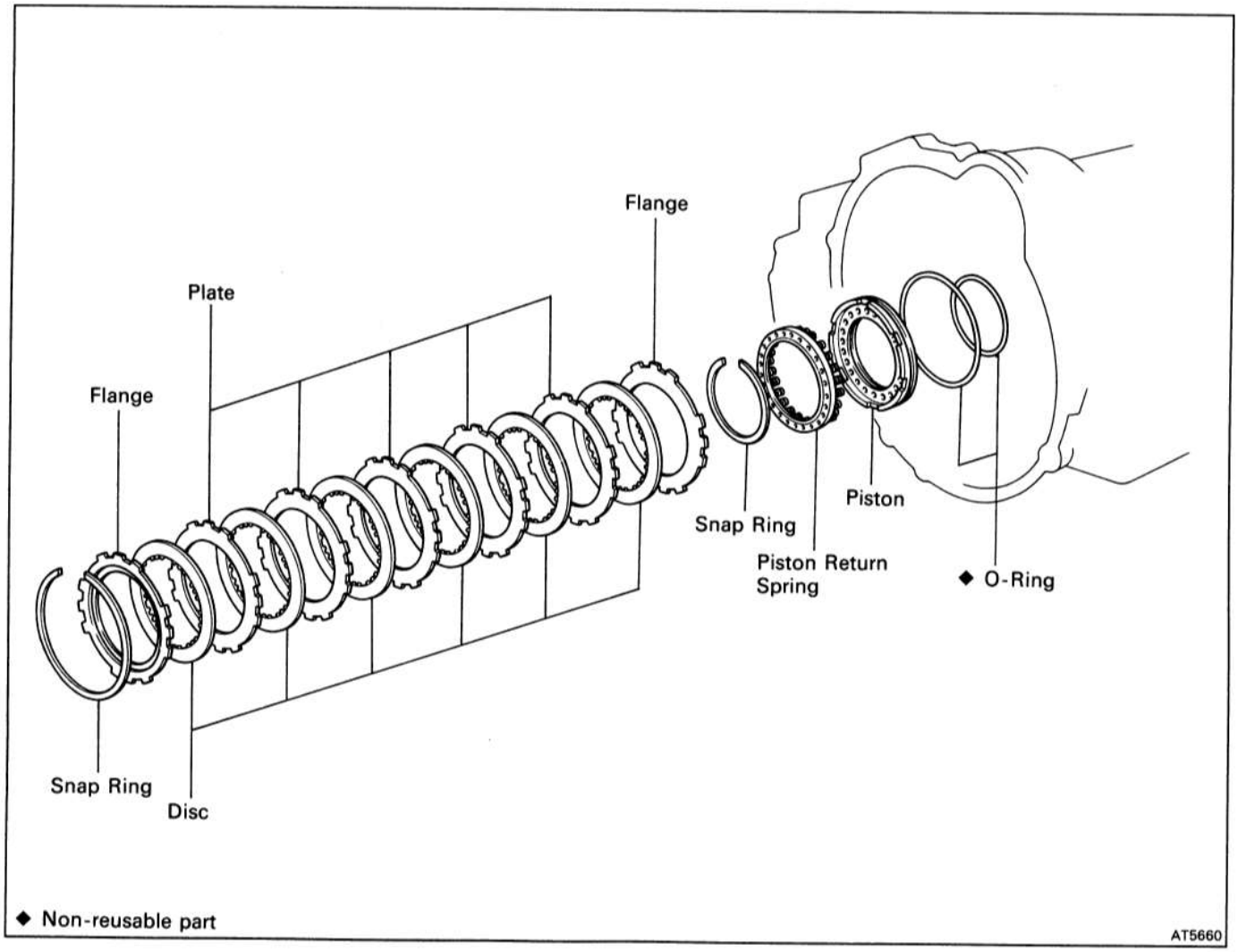
Using a feeler gauge, measure the planetary pinion gear thrust clearance.

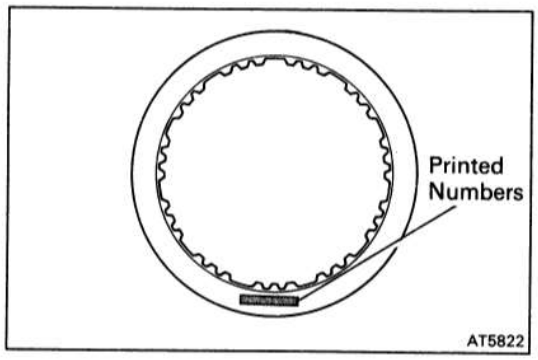
Standard clearance: 0.2 – 0.5 mm (0.008 – 0.020 in.)
Maximum clearance: 0.5 mm (0.020 in.)

If the clearance is greater than maximum, replace the planetary gear assembly.

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First and Reverse Brake





INSPECTION OF FIRST AND REVERSE BRAKE COMPONENT

INSPECT DISCS, PLATE AND FLANGE

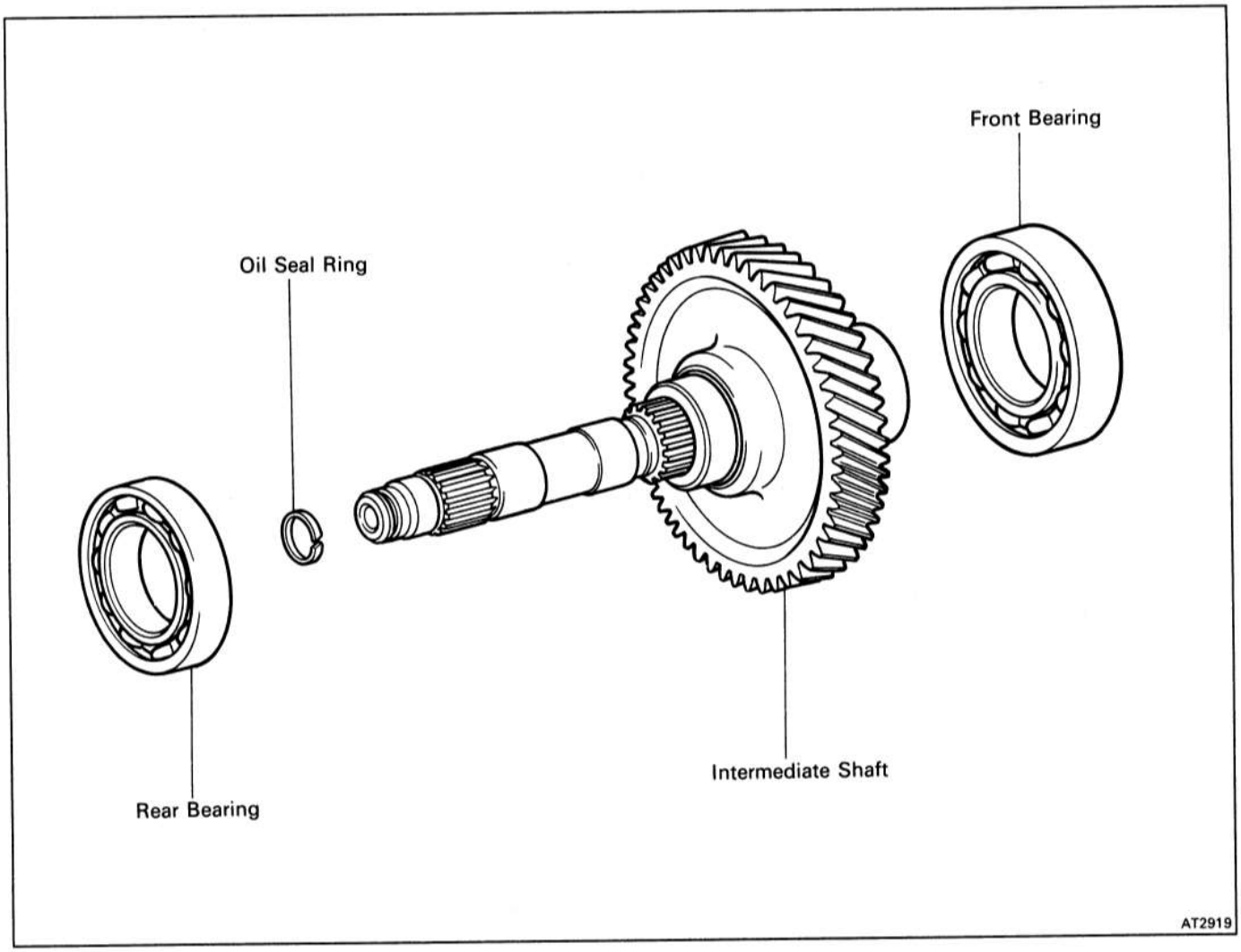
Check if the sliding surface of the discs, plates and flanges are worn or burnt. If necessary, replace them.

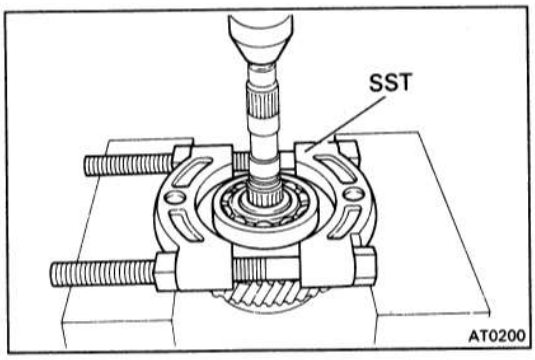
HINT:

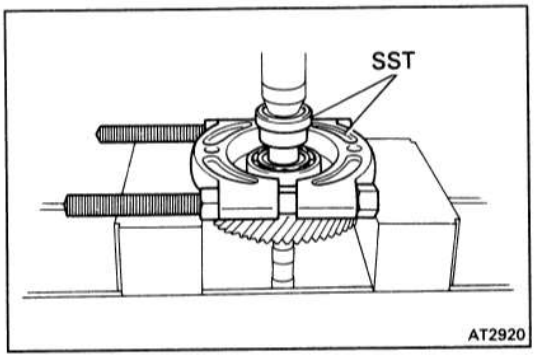
- If the lining of the disc is exfoliated or discolored, or even a part of the printed number is defaced, replace all discs.
- Before assembling new discs, soak them in ATF for at least two hours.

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Intermediate Shaft







DISASSEMBLY OF INTERMEDIATE SHAFT

1. **REMOVE INTERMEDIATE SHAFT FRONT BEARING**

   Using SST and press, press out the bearing.

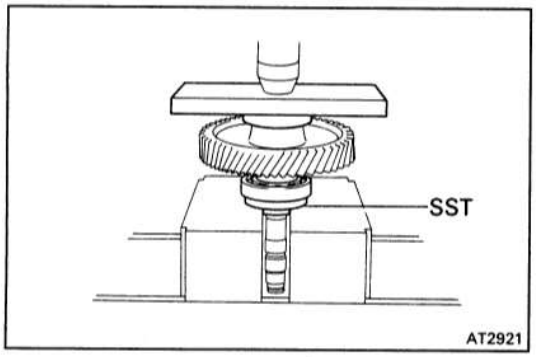
   SST 09555-55010

2. **REMOVE INTERMEDIATE REAR BEARING**

   Using SST and press, press out the bearing.

   SST 09350-32014 (09351-32090) and 09555-55010

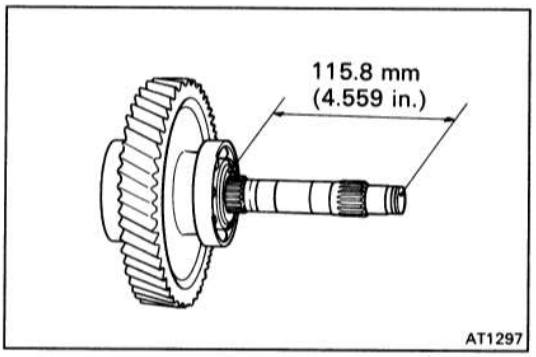
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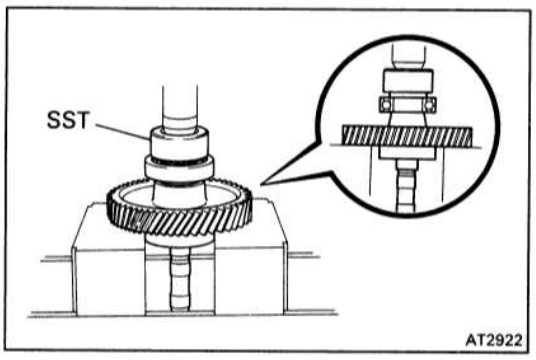
ASSEMBLY OF INTERMEDIATE SHAFT

1. INSTALL INTERMEDIATE SHAFT FRONT BEARING

(a) Using SST and press, press in a new bearing.
SST 09350-32014 (09351-32120)



(b) Check that the distance from the gear flange end to the intermediate shaft end is 115.8 mm (4.559 in.).

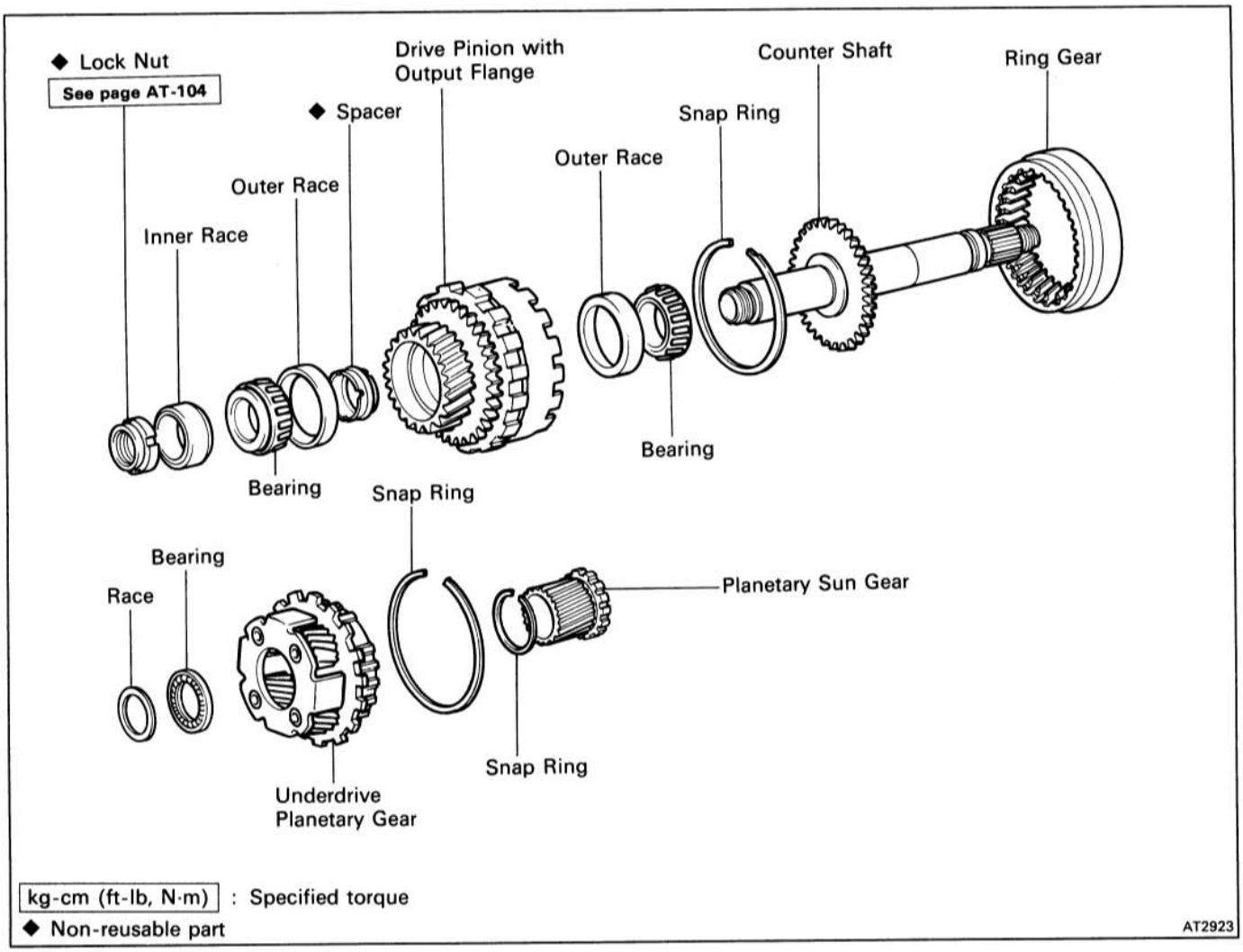


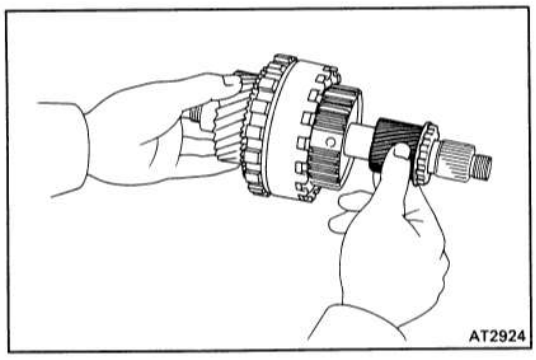
2. INSTALL INTERMEDIATE SHAFT REAR BEARING

Using SST and press, press in a new bearing.
SST 09350-32014 (09351-32150)

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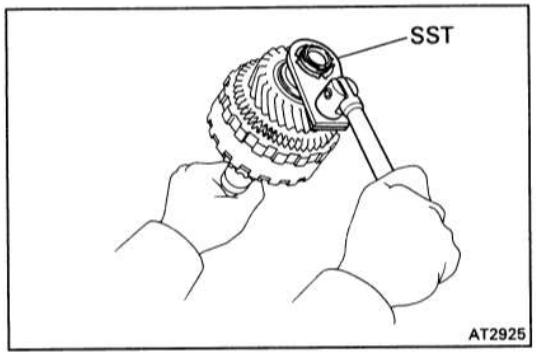
Counter Shaft





DISASSEMBLY OF COUNTER SHAFT

1. REMOVE UNDERDRIVE PLANETARY SUN GEAR FROM COUNTER SHAFT

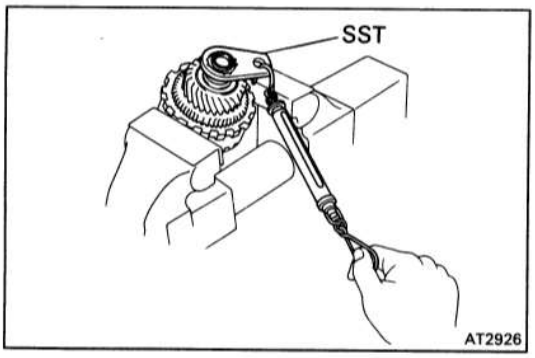


2. MEASURE STARTING TORQUE OF COUNTER SHAFT

(a) Using SST, temporarily tighten the lock nut.

SST 09350-32014 (09351-32170)

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(b) Using soft jaws, hold the drive pinion in a vise.

(c) Using SST and spring tension gauge, measure the starting torque of the counter shaft.

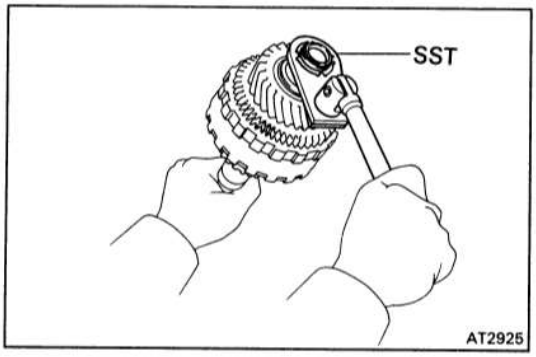
SST 09350-32014 (09351-32170)

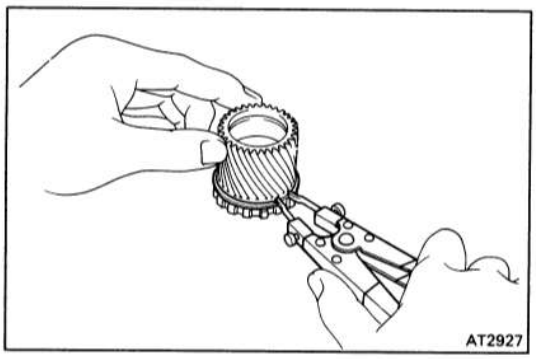
Starting torque: **with spring tension gauge**
1.2 – 2.0 kg (2.6 – 4.4 lb)
with torque gauge
(hexagon nut side)
New bearing 6 – 10 kg-cm
(5.2 – 8.7 in.-lb, 0.6 – 1.0 N·m)
Reused bearing 3 – 5 kg-cm
(2.6 – 4.3 in.-lb, 0.3 – 0.5 N·m)

If the torque is exceeded, replace the spacer.

(d) Using SST, remove the lock nut.

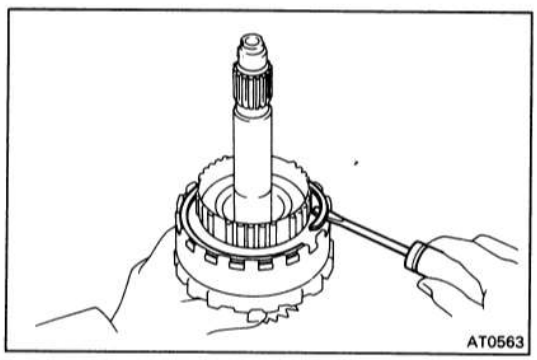
SST 09350-32014 (09351-32170)





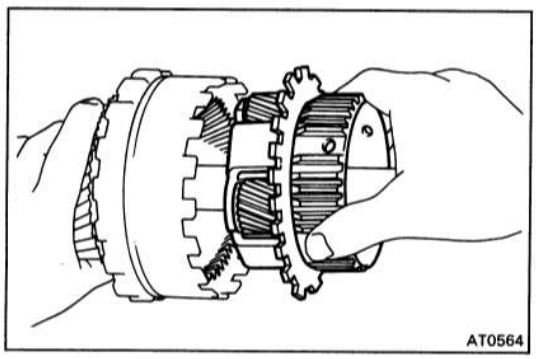
3. REMOVE SNAP RING FROM SUN GEAR

Using snap ring pliers, remove the snap ring from the sun gear.



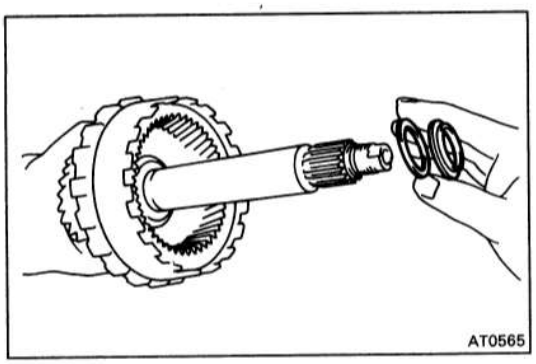
4. REMOVE SNAP RING FROM COUNTER SHAFT ASSEMBLY

Using a screwdriver, remove the snap ring from the counter shaft assembly.

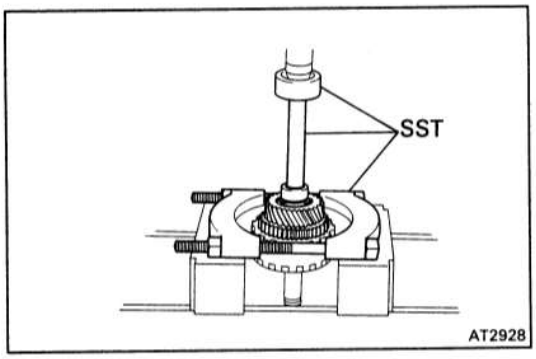


5. REMOVE UNDERDRIVE PLANETARY GEAR

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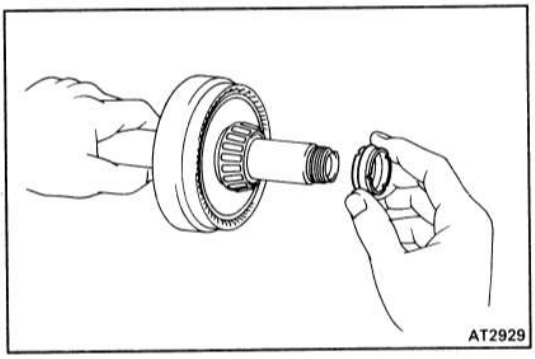
6. REMOVE THRUST NEEDLE ROLLER BEARING AND RACE



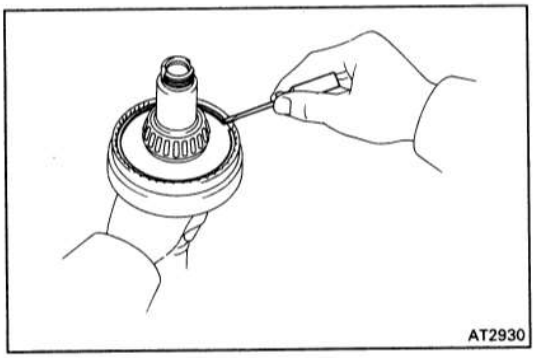
7. REMOVE DRIVE PINION WITH OUTPUT FLANGE, BEARING, INNER RACE AND SPACER

(a) Using SST and press, remove the drive pinion with output flange, bearing and inner race.

SST 09350-32014 (09351-32150, 09351-32130), 09555-55010

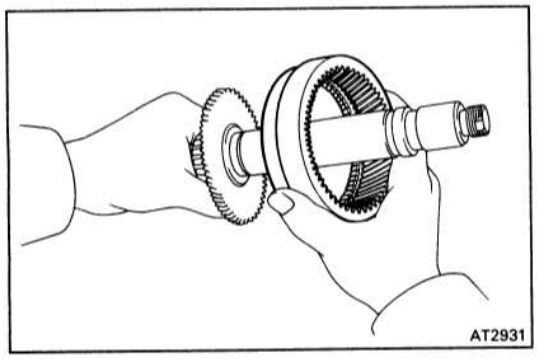


(b) Remove the spacer from the counter shaft.



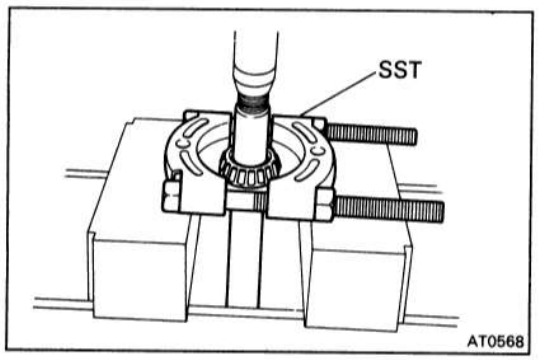
8. REMOVE RING GEAR

(a) Using a screwdriver, remove the snap ring from the counter shaft.



(b) Remove the ring gear from the counter shaft.

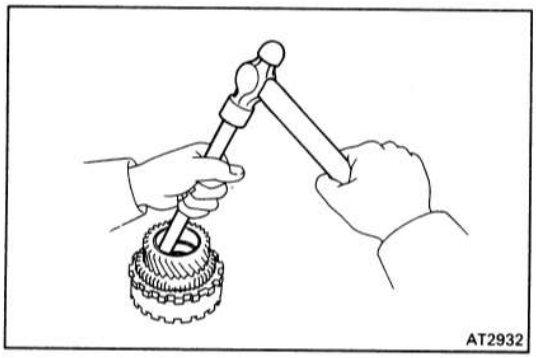
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9. REMOVE BEARING

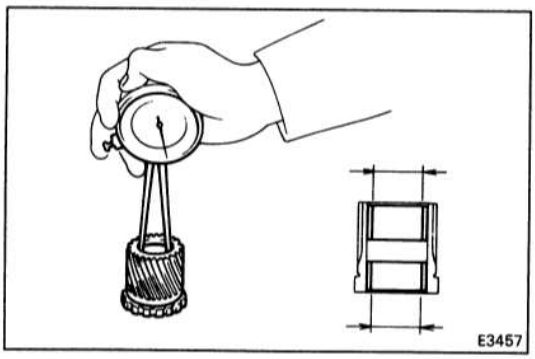
Using SST and press, remove the bearing

SST 09950-00020



10. REMOVE BEARING OUTER RACES

Using a brass bar and hammer, tap out both bearing outer races.

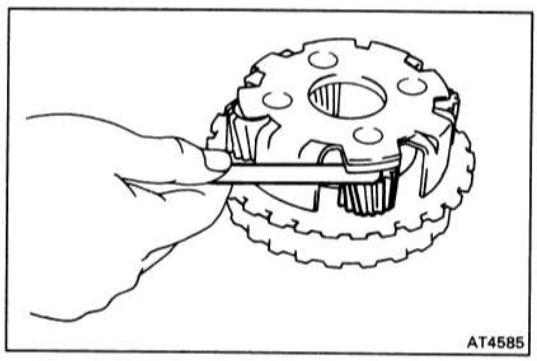


INSPECTION OF COUNTER SHAFT COMPONENTS

1. MEASURE PLANETARY SUN GEAR BUSHING INSIDE DIAMETER

Using a caliper gauge, measure the bushing inside diameter of the planetary sun gear as shown.

Standard inside diameter: 29.800 – 29.825 mm (1.1732 – 1.1742 in.)
Maximum inside diameter: 29.870 mm (1.1760 in.)

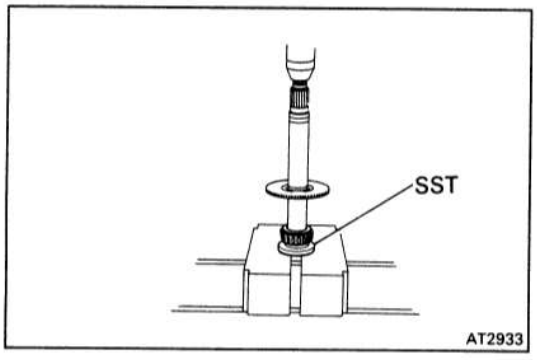


2. MEASURE PLANETARY PINION GEAR THRUST CLEARANCE

Using a feeler gauge, measure the planetary pinion gear thrust clearance.

Standard clearance: 0.2 – 0.5 mm (0.008 – 0.020 in.)
Maximum clearance: 0.5 mm (0.020 in.)

If the clearance is greater than the maximum, replace the planetary gear assembly.



ASSEMBLY OF COUNTER SHAFT

1. INSTALL BEARING TO COUNTER SHAFT

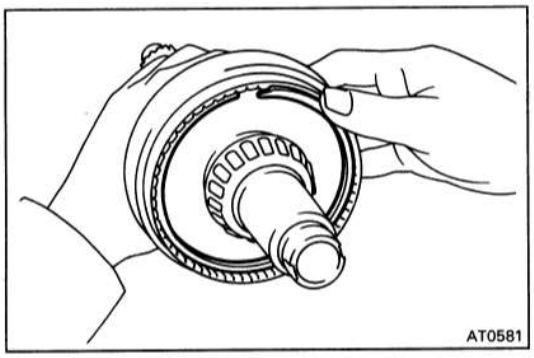
Using SST and press, press in the bearing of the thick inner race side.

SST 09350-32014 (09351-32180)

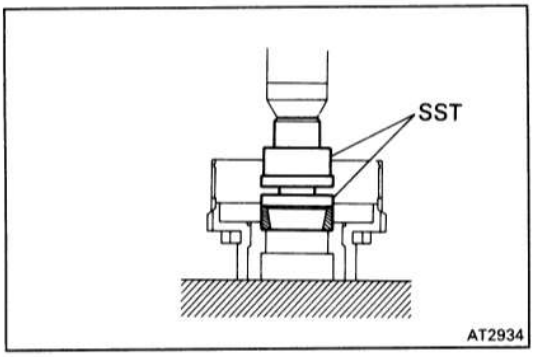
2. INSTALL RING GEAR

(a) Install the ring gear to the counter shaft.

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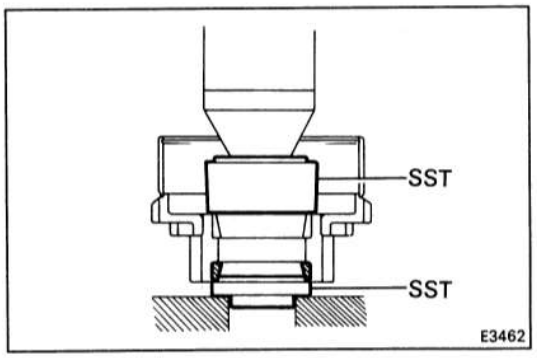
(b) Install the snap ring.



3. INSTALL BEARING OUTER RACES TO DRIVE PINION

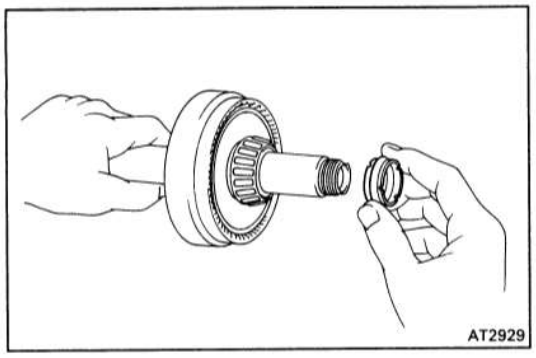
(a) Using SST and press, press in the thick race to the flange side of the drive pinion.

SST 09350-32014 (09351-32090, 09351-32180)



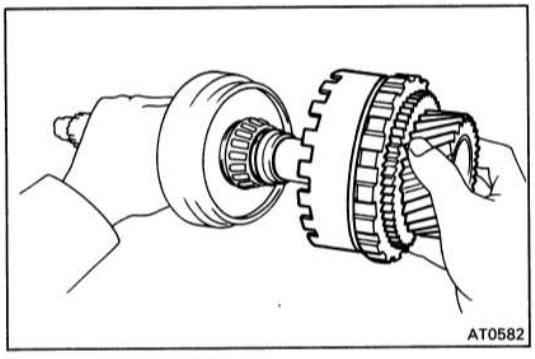
(b) Using SST and press, press in the thin race to the other side.

SST 09350-32014 (09351-32150, 09351-32180)



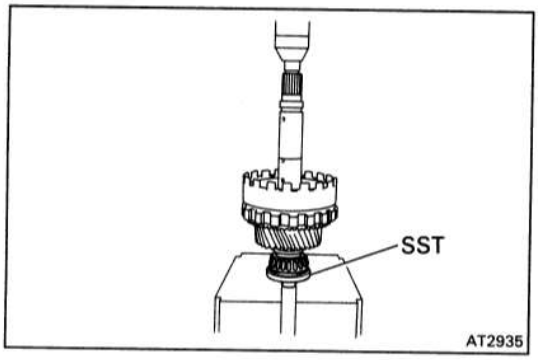
4. INSTALL DRIVE PINION TO COUNTER SHAFT

(a) Install the new spacer to the counter shaft.



(b) Install the drive pinion to the counter shaft.

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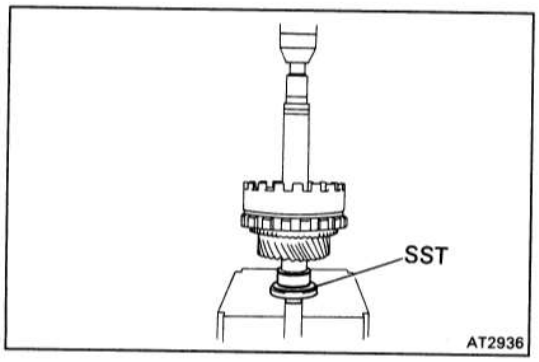


5. INSTALL ANOTHER BEARING TO COUNTER SHAFT

Using SST and press, press in the another bearing.

SST 09350-32014 (09351-32180)

NOTICE: Be sure there is some clearance between the output flange and bearing

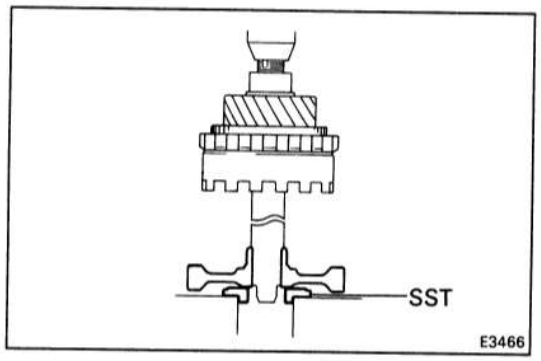


6. INSTALL BEARING INNER RACE

Using SST and press, press in the inner race.

SST 09350-32014 (09351-32180)

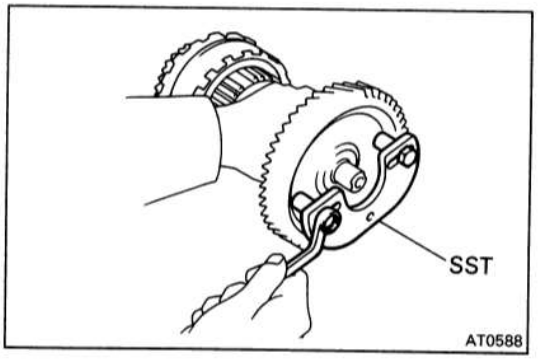
NOTICE: Be sure there is some clearance.



7. ADJUST COUNTER SHAFT STARTING TORQUE

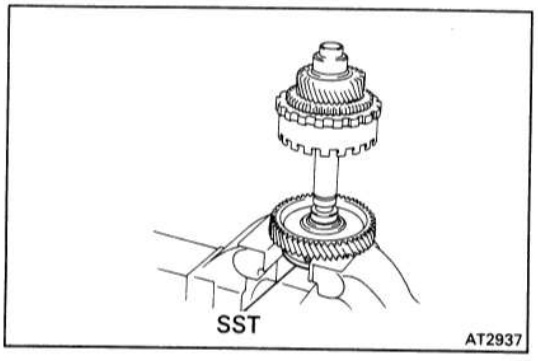
(a) Using SST and press, press in the counter driven gear to the counter shaft.

SST 09350-32014 (09351-32100)



(b) Install SST to the driven gear.

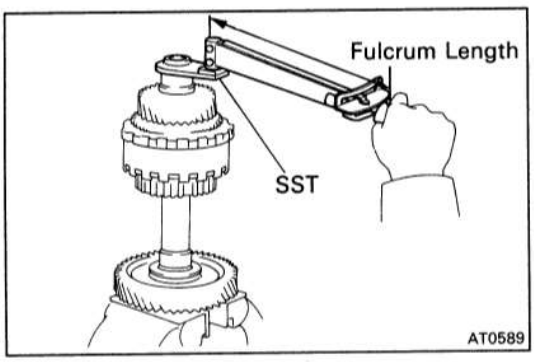
SST 09350-32014 (09351-32032)



(c) Secure the counter shaft by holding the SST in a vise.

SST 09350-32014 (09351-32032)

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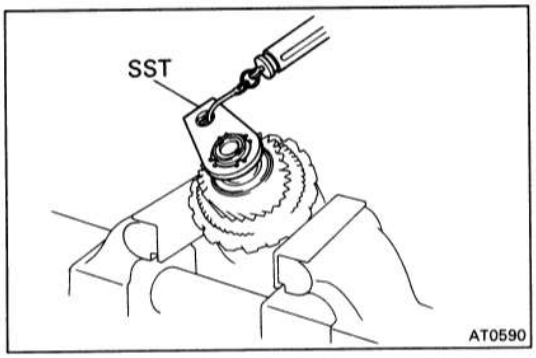


(d) Temporarily install the new lock nut, and using SST, tighten the lock nut until the counter shaft starting torque is in specification.

SST 09350-32014 (09351-32170)

Torque (Reference): 1,800 – 2,200 kg-cm (130 – 159 ft-lb, 177 – 216 N·m)

HINT: Use a torque wrench with a fulcrum length of 42 cm (16.54 in.).

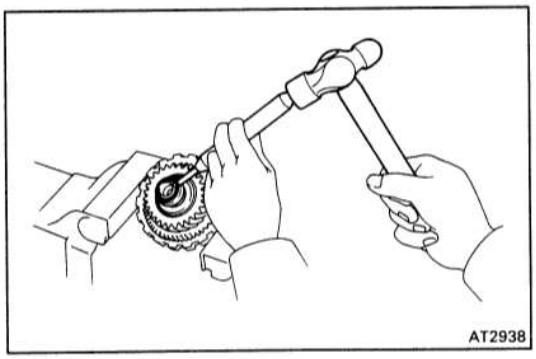


(e) Using soft jaws, hold the drive pinion in a vise.

(f) Using SST and spring tension gauge, measure the starting torque of the counter shaft.

SST 09350-32014 (09351-32170)

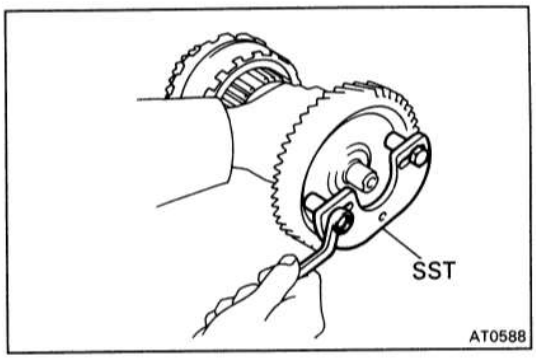
Starting torque: with tension gauge
1.2 – 2.0 kg (2.6 – 4.4 lb)
with torque gauge
(hexagon nut side)
New bearing 6 – 10 kg-cm
(5.2 – 8.7 in.-lb, 0.6 – 1.0 N·m)
Reused bearing 3 – 5 kg-cm
(2.6 – 4.3 in.-lb, 0.3 – 0.5 N·m)



If the starting torque is exceeded, replace the spacer and retorque.

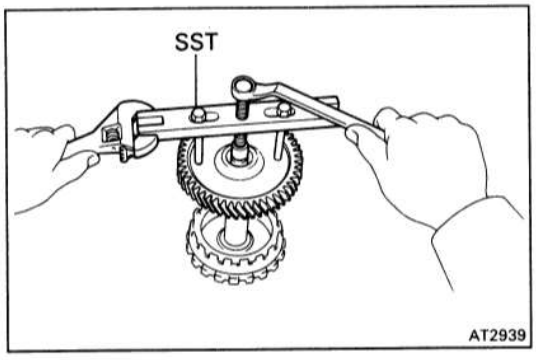
HINT: Before measuring the starting torque, snug down the bearing by turning the counter shaft.

(g) Using a punch and hammer, stake the lock nut.



(h) Remove the SST from the counter driven gear.

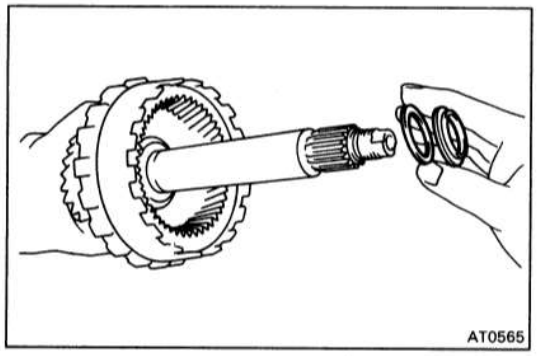
SST 09350-32014 (09351-32032)



(i) Using SST, remove the counter driven gear.

SST 09350-32014 (09351-32061)

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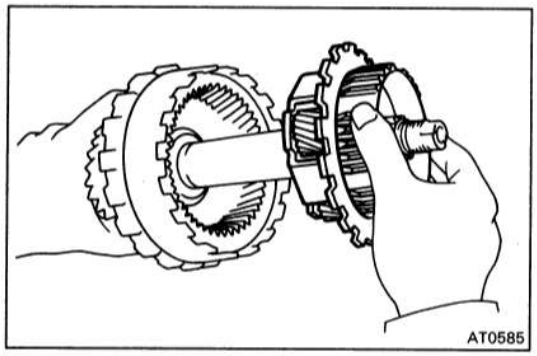
8. INSTALL RACE AND BEARING

Coat the race and bearing with petroleum jelly and install them to the counter shaft.

Bearing and race

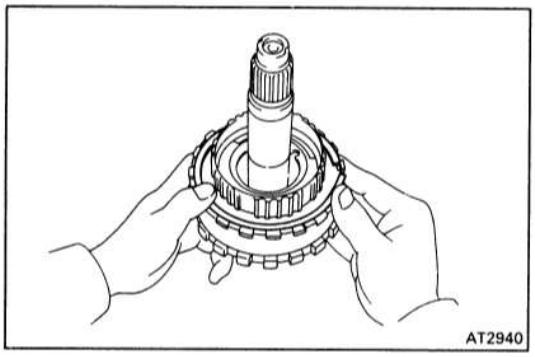
mm (in.)

	Outer Diameter	Inner Diameter
Race	41.8 (1.646)	30.0 (1.181)
Bearing	43.85 (1.726)	31.0 (1.220)

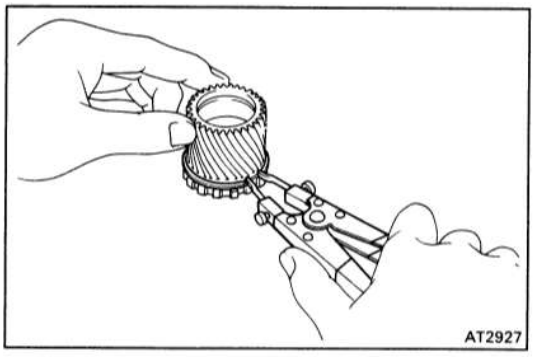


9. INSTALL UNDERDRIVE PLANETARY GEAR

(a) Install the underdrive planetary gear to the counter shaft.

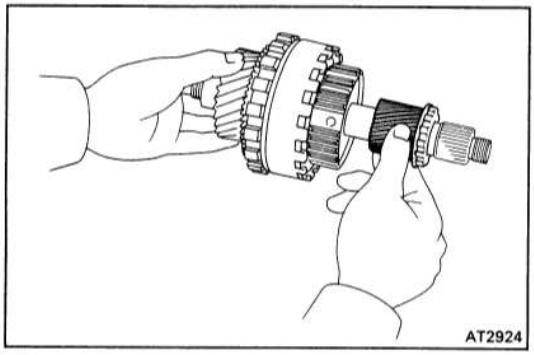


(b) Install the snap ring.



10. INSTALL UNDERDRIVE PLANETARY SUN GEAR

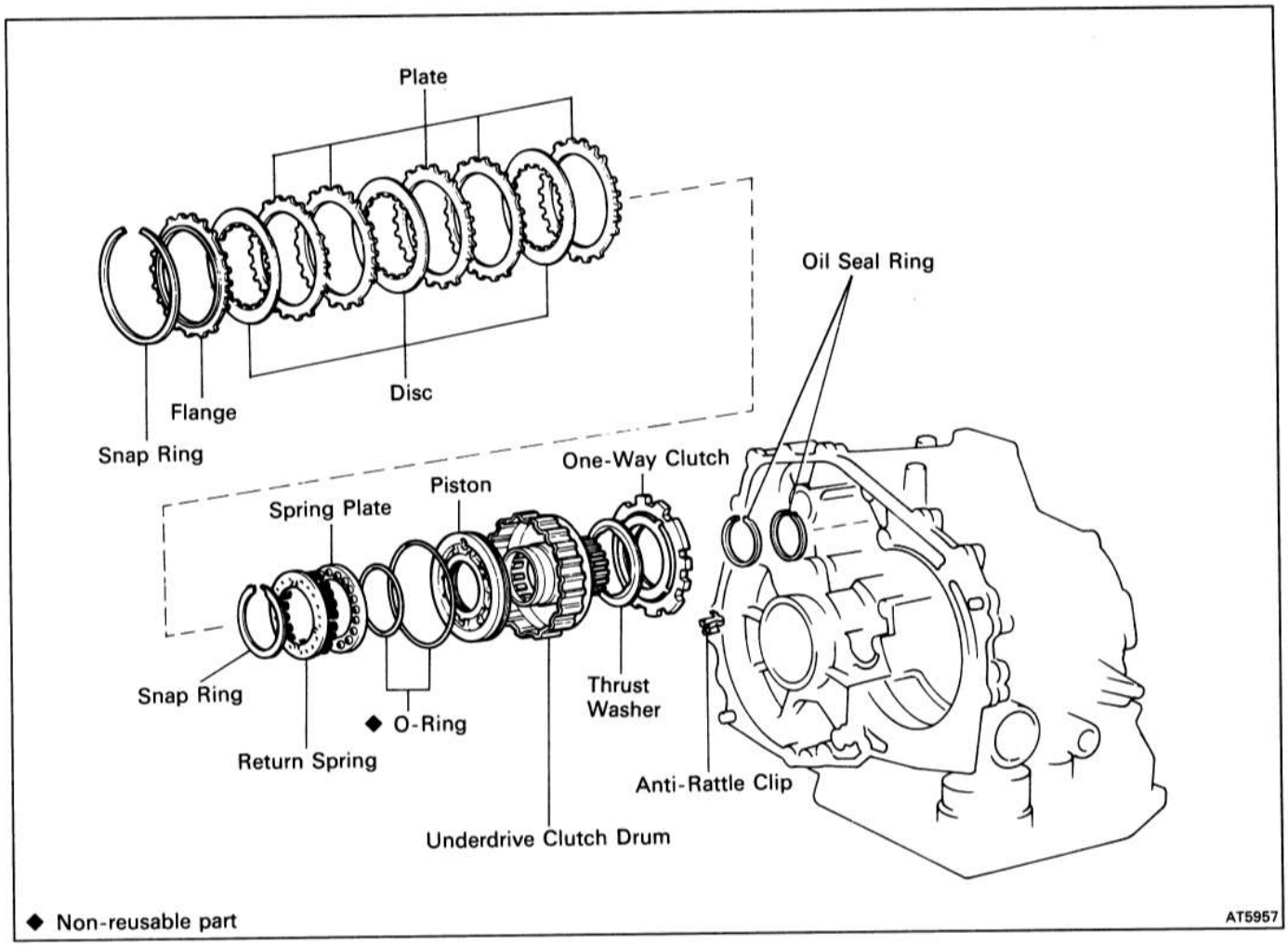
(a) Using snap ring pliers, install the snap ring to the sun gear.



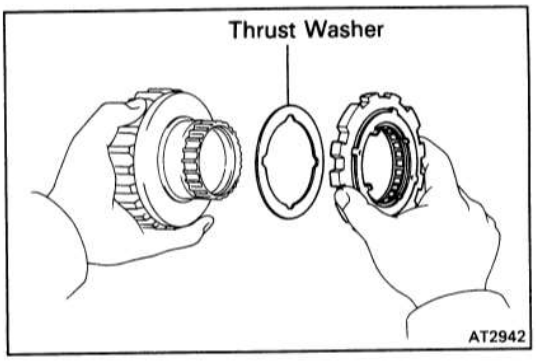
(b) Install the underdrive planetary sun gear to the counter shaft as shown.

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Underdrive Clutch and One-Way Clutch No. 3



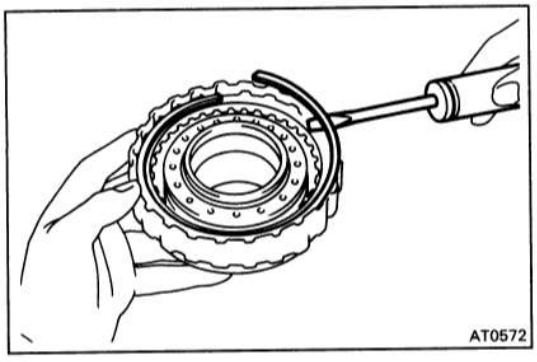
◆ Non-reusable part



DISASSEMBLY OF UNDERDRIVE CLUTCH

1. REMOVE ONE-WAY CLUTCH FROM CLUTCH DRUM

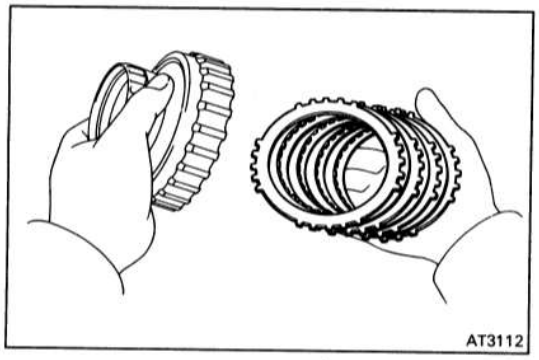
Remove the one-way clutch and thrust washer from the underdrive clutch drum.



2. REMOVE SNAP RING

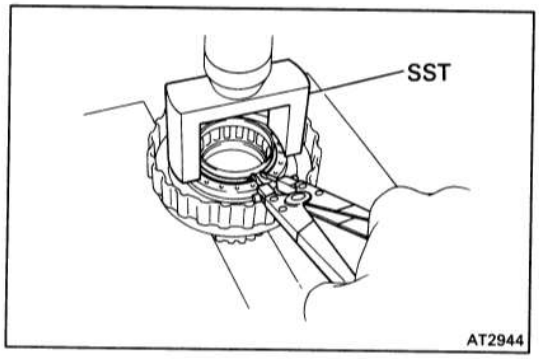
Using a screwdriver, remove the snap ring.

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3. REMOVE FLANGE, DISCS AND PLATES

Remove the flange, discs and plates from the clutch drum.



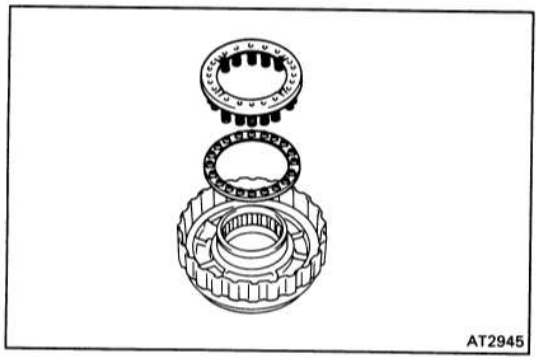
4. REMOVE RETURN SPRING AND SPRING PLATE

(a) Using SST and press, compress the return spring retainer.

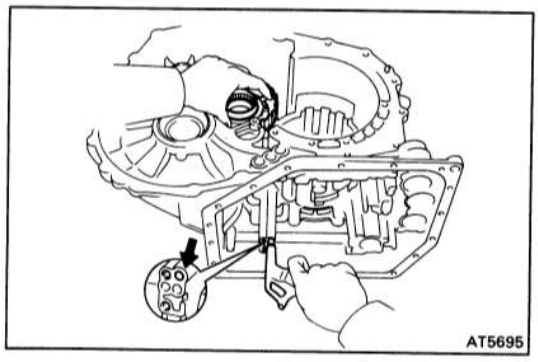
SST 09350-32014 (09351-32070)

(b) Using snap ring pliers, remove the snap ring.

(c) Remove SST.



(d) Remove the return spring and spring plate.



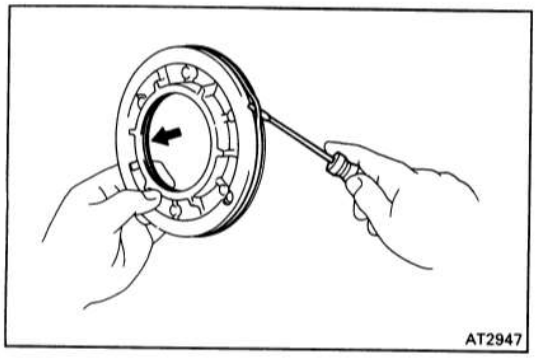
5. REMOVE UNDERDRIVE CLUTCH PISTON

(a) Install the underdrive clutch to the transaxle case.

HINT: Before installing the clutch, install the oil seal rings to the transaxle case.

(b) Apply compressed air into the oil passage of the case, and remove the piston from the clutch drum.

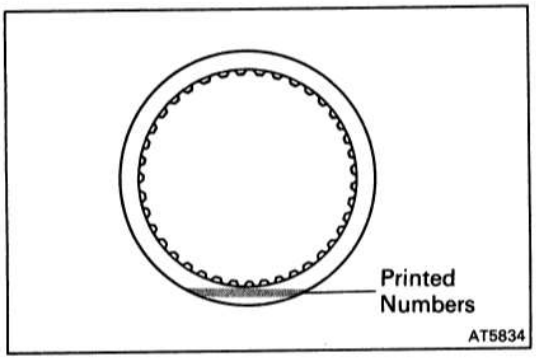
(c) If the piston does not pop out with compressed air, use needle-nose pliers to remove it.



6. REMOVE O-RINGS FROM PISTON

Using a screwdriver, remove the two O-rings from the underdrive clutch piston.

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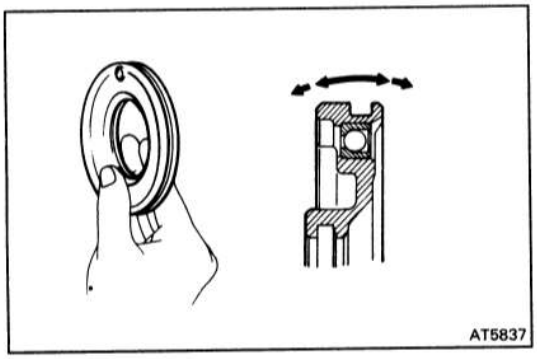
INSPECTION OF UNDERDRIVE CLUTCH COMPONENTS

1. INSPECT DISCS, PLATES AND FLANGES

Check if the sliding surface of the discs, plates and flanges are worn or burnt. If necessary, replace them.

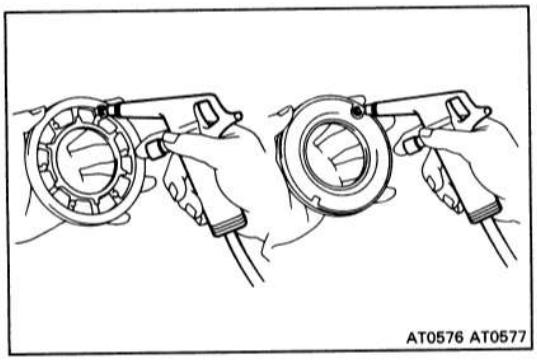
HINT:

- If the lining of the disc is exfoliated or discolored, or even a part of the printed numbers are defaced, replace the disc.
- Before assembling new discs, soak them in ATF for at least two hours.

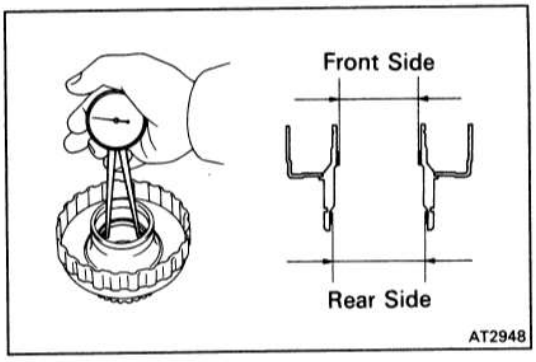


2. INSPECT UNDERDRIVE CLUTCH PISTON

(a) Check that the check ball is free by shaking the piston.



(b) Check that the valve does not leak by applying low-pressure compressed air.



3. INSPECT UNDERDRIVE CLUTCH DRUM

Using a caliper gauge, measure the bushing inside diameter of the underdrive clutch drum as shown.

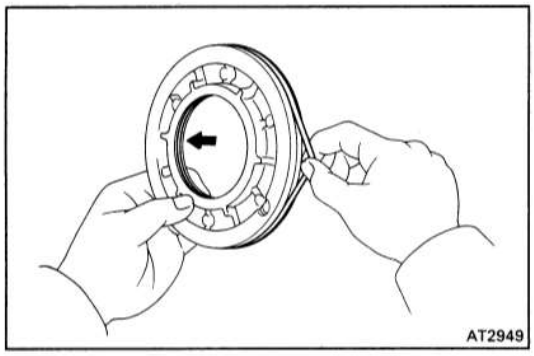
Standard inside diameter:

Front side	**46.500 – 46.525 mm (1.83071 – 1.83169 in.)**
Rear side	**55.000 – 55.030 mm (2.16535 – 2.16653 in.)**

Maximum inside diameter:

Front side	**46.570 mm (1.83346 in.)**
Rear side	**55.080 mm (2.16850 in.)**

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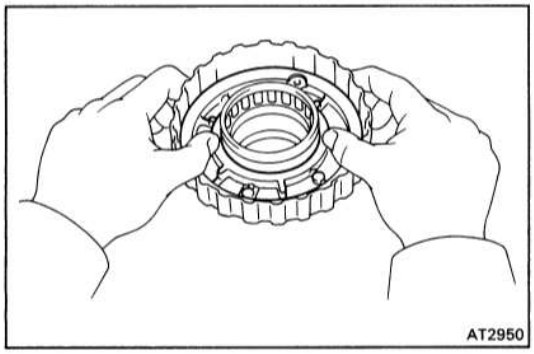


ASSEMBLY OF UNDERDRIVE CLUTCH

1. INSTALL UNDERDRIVE CLUTCH PISTON INTO CLUTCH DRUM

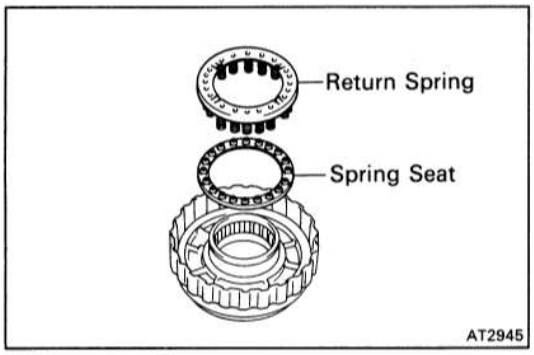
(a) Install the two new O-rings to the piston.

HINT: Before installing, coat the O-rings with ATF.



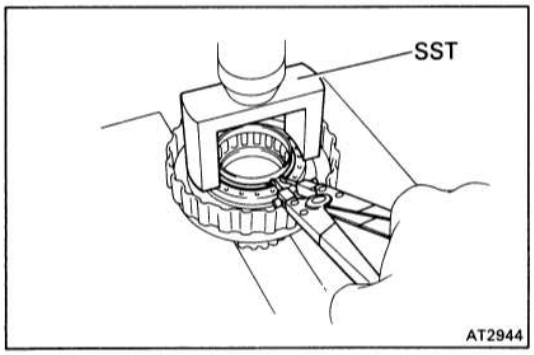
(b) Install the underdrive clutch piston into the clutch drum.

HINT: Be careful not to damage the O-rings.



2. INSTALL SPRING SEAT AND RETURN SPRING

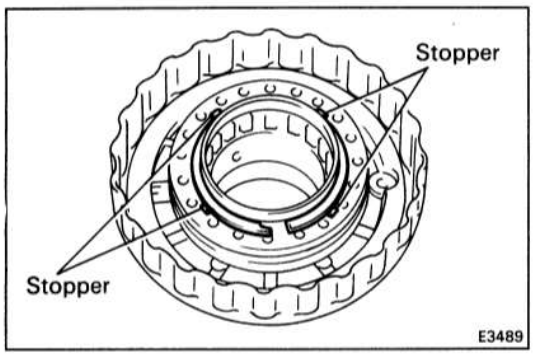
(a) Install the spring seat and return spring to the underdrive clutch as shown.



(b) Using SST and press, compress the return spring retainer.

SST 09350-32014 (09351-32070)

(c) Using snap ring pliers, install the snap ring.

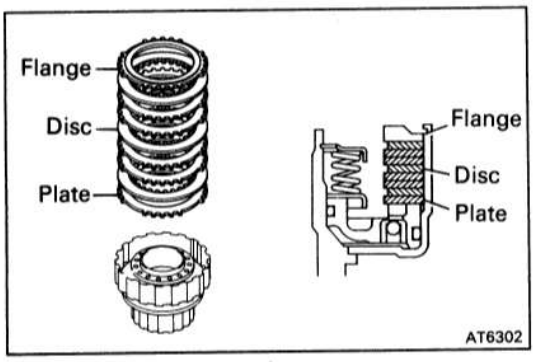


HINT: Install the snap ring as shown.

(d) Remove SST.

SST 09350-32014 (09351-32070)

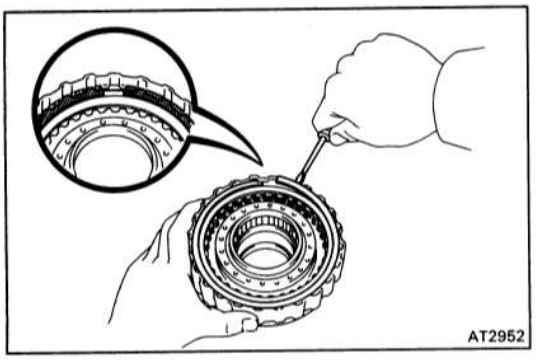
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3. INSTALL PLATES, DISCS AND FLANGE

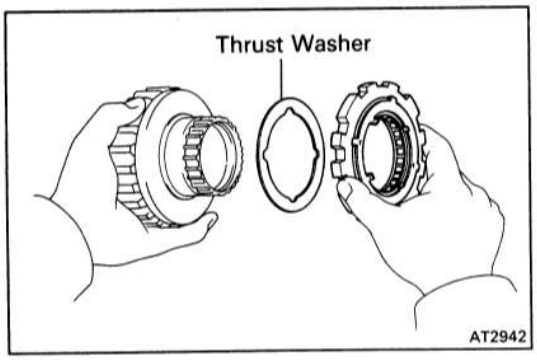
Install in order: D = Disc P = Plate F = Flange
F – D – P – P – D – P – P – D – P

HINT: Install the flange the flat end facing downward.



4. INSTALL SNAP RING

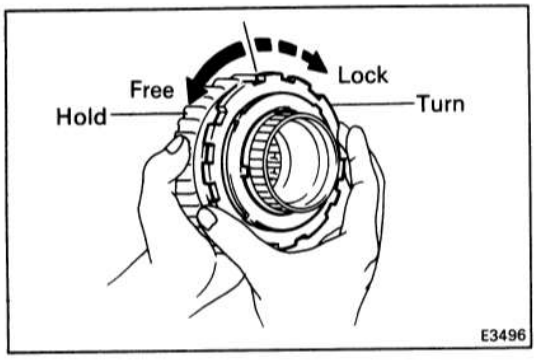
Install the snap ring to the underdrive clutch.



5. INSTALL ONE-WAY CLUTCH TO CLUTCH DRUM

(a) Install the thrust washer to clutch drum.

(b) Install the one-way clutch with the claw of retainer up.



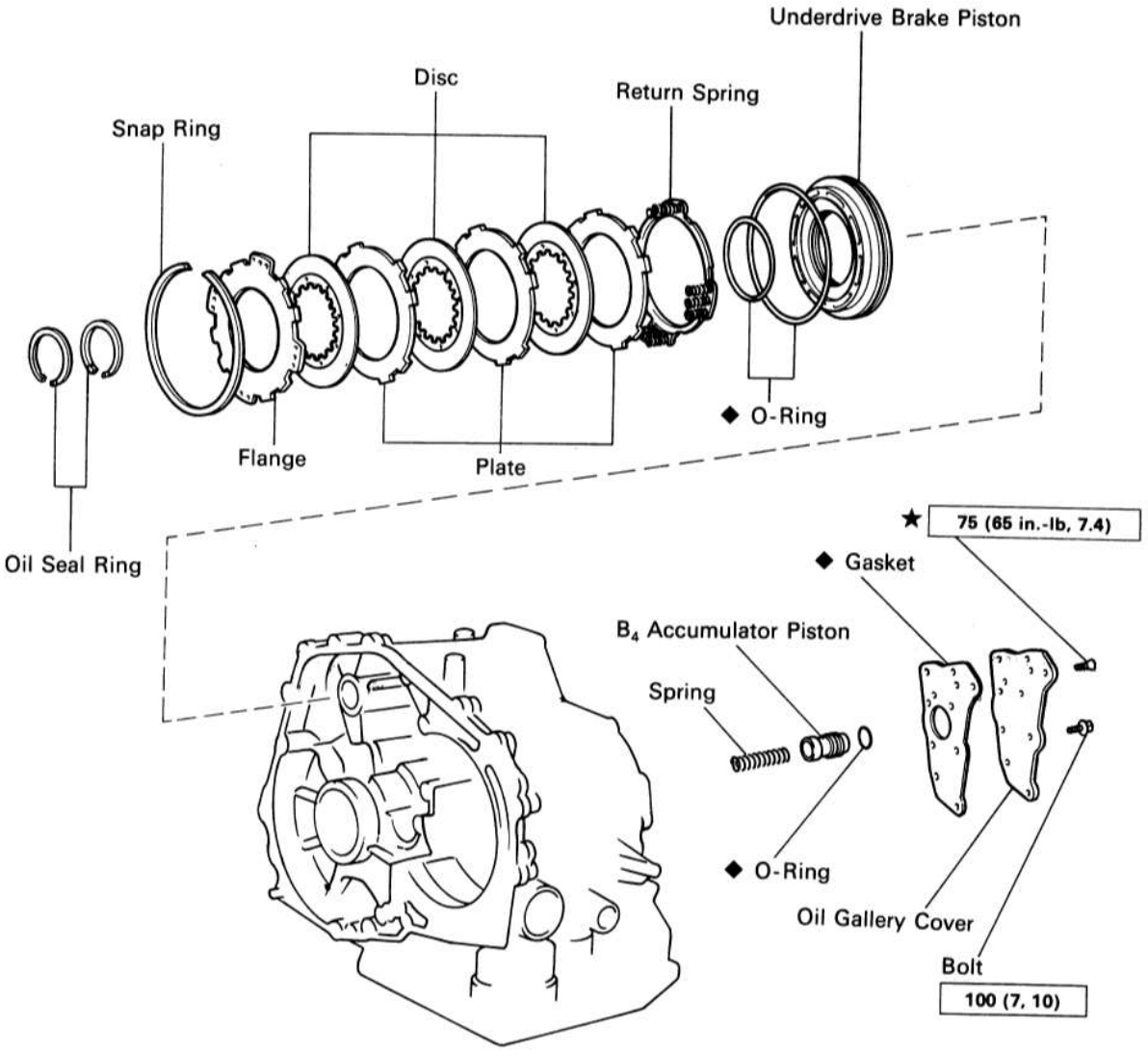
6. CHECK OPERATION OF ONE-WAY CLUTCH

Hold the one-way clutch drum and turn the one-way clutch.

Check that the one-way clutch turns freely counterclockwise and lock clockwise.

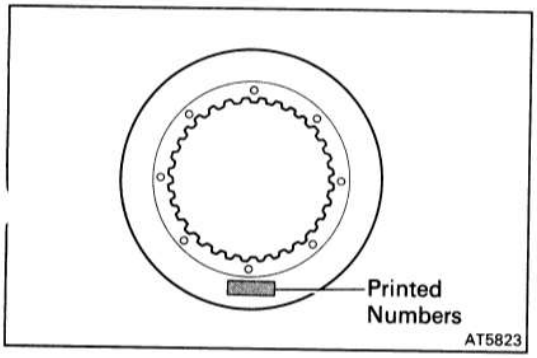
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Underdrive Brake and B_4 Accumulator Piston



kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part
★ Precoated part

AT2953



AT5823

INSPECTION OF UNDERDRIVE BRAKE COMPONENTS

INSPECT DISCS, PLATES AND FLANGES

Check if the sliding surface of the discs, plates and flanges are worn or burnt. If necessary, replace them.

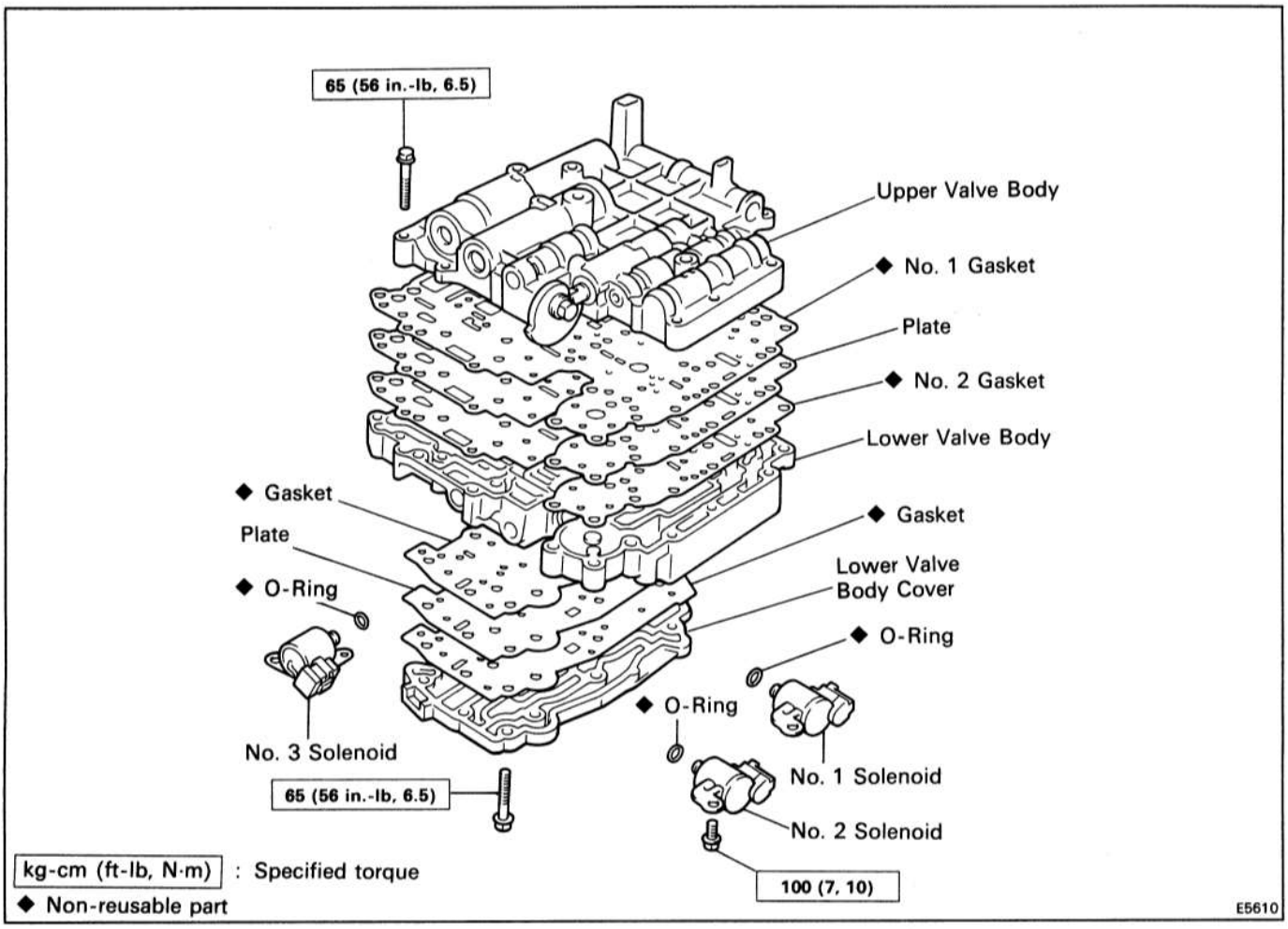
HINT:

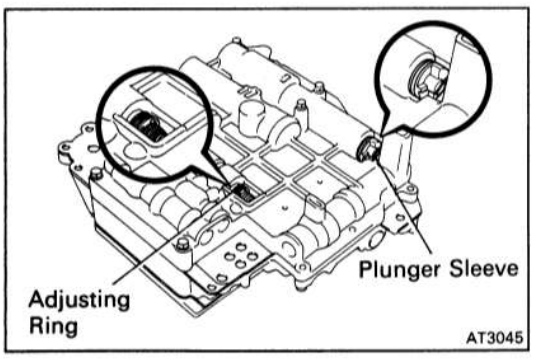
- If the lining of the disc is exfoliated or discolored, or even a part of the printed numbers are defaced, replace the disc.
- Before assembling new discs, soak them in ATF for at least two hours.

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Valve Body

COMPONENTS





(Disassembly of Valve Body)

1. **NOTE THE NUMBERS OF ADJUSTING RINGS**

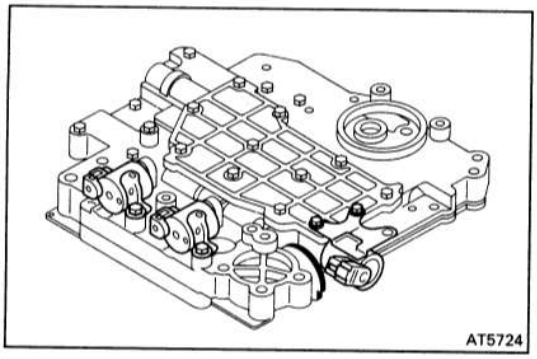
   HINT: Count the number of adjusting rings before disassembly of the valve body because the throttle pressure is changed according to the number. (Some of the valve bodies do not have any adjusting rings.)

2. **NOTE THE POSITION OF PLUNGER SLEEVE**

   Note which step at the end of the plunger sleeve is in contact with the valve body.

   HINT: Be certain to check this before disassembly because the line pressure changes according to the part of the plunger sleeve which comes into contact with the valve body.

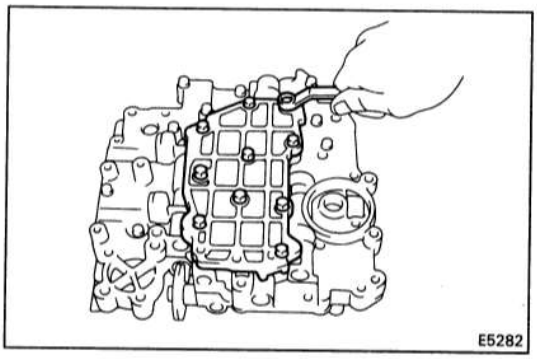
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3. REMOVE SOLENOID

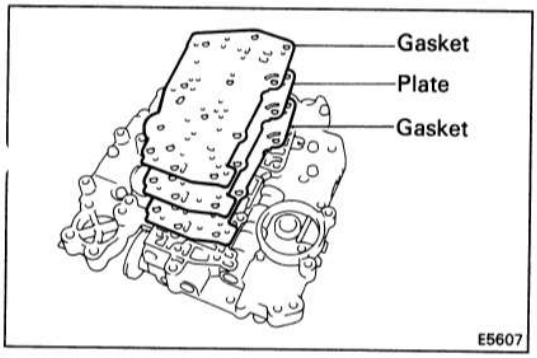
(a) Remove the solenoids.

(b) Remove the O-rings from the each solenoids.



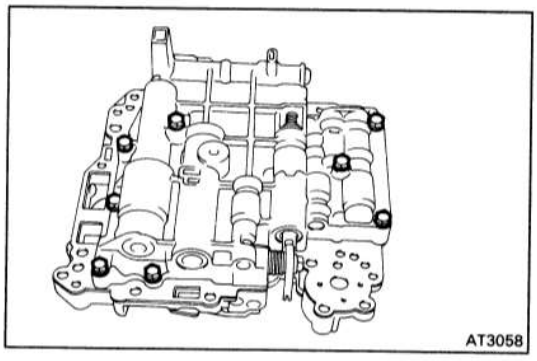
4. REMOVE LOWER VALVE BODY COVER

Remove the ten bolts and the lower valve body cover.



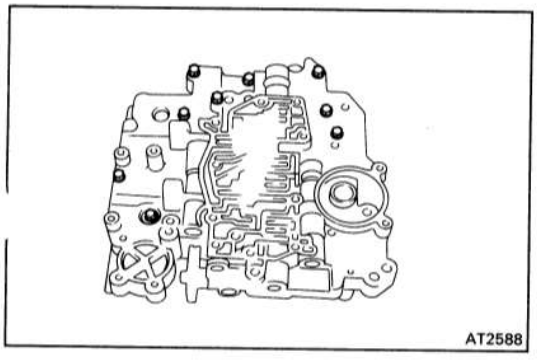
5. REMOVE GASKETS, PLATE AND STRAINER

Remove the two gaskets and plate.



6. REMOVE BOLTS FROM UPPER VALVE BODY

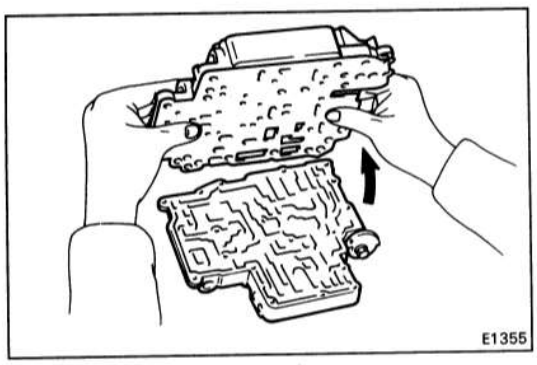
Remove the eight bolts from the upper valve body.



7. REMOVE BOLTS FROM LOWER VALVE BODY

Remove the nine bolts from the lower valve body.

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8. LIFT OFF LOWER VALVE BODY AND PLATE AS SINGLE UNIT

Hold the plate to the lower valve body and lift off the lower valve body.

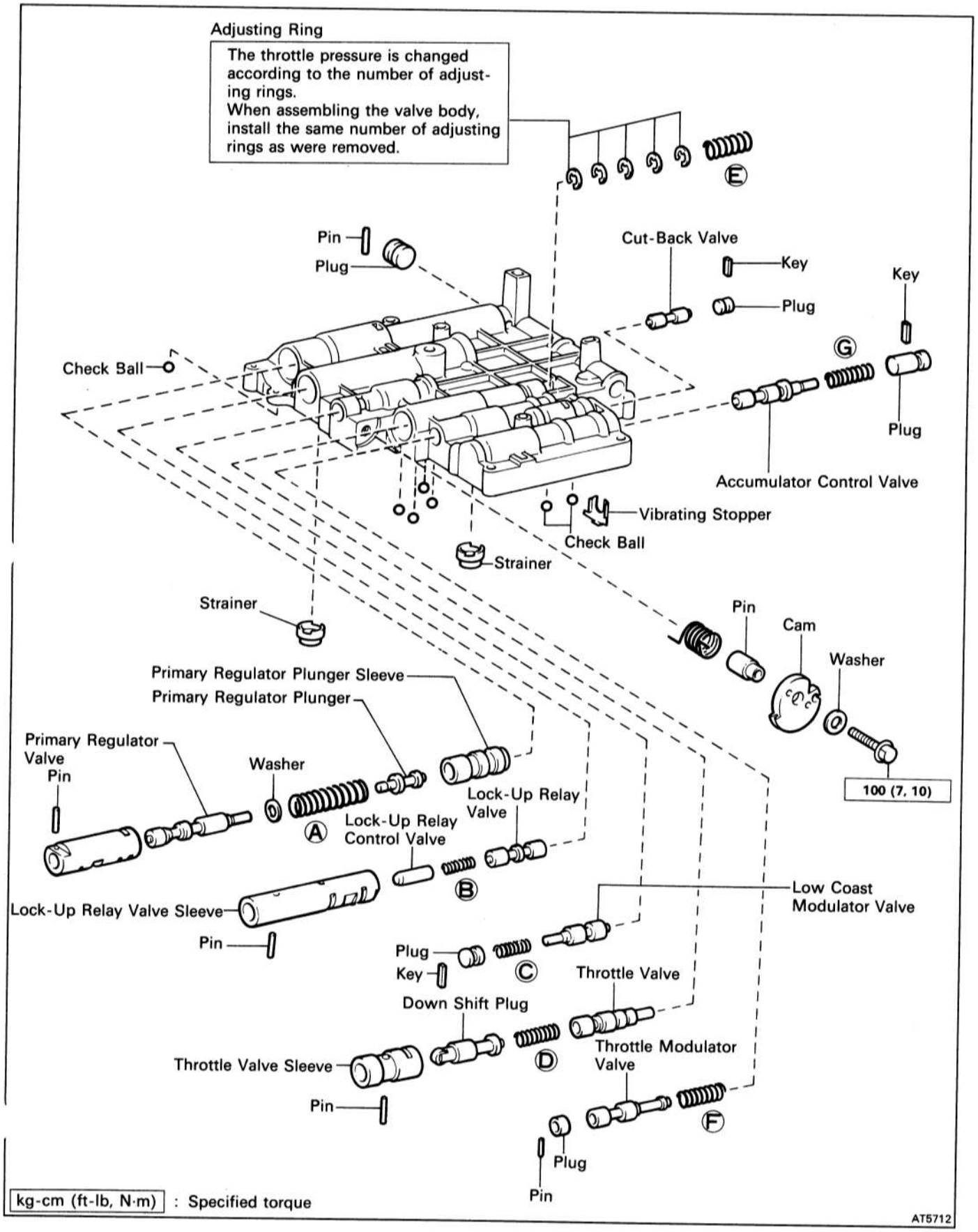
HINT: Be careful that the valves, springs and strainer do not fall out.

9. REMOVE PLATE AND GASKETS FROM LOWER VALVE BODY

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(Upper Valve Body)

COMPONENTS



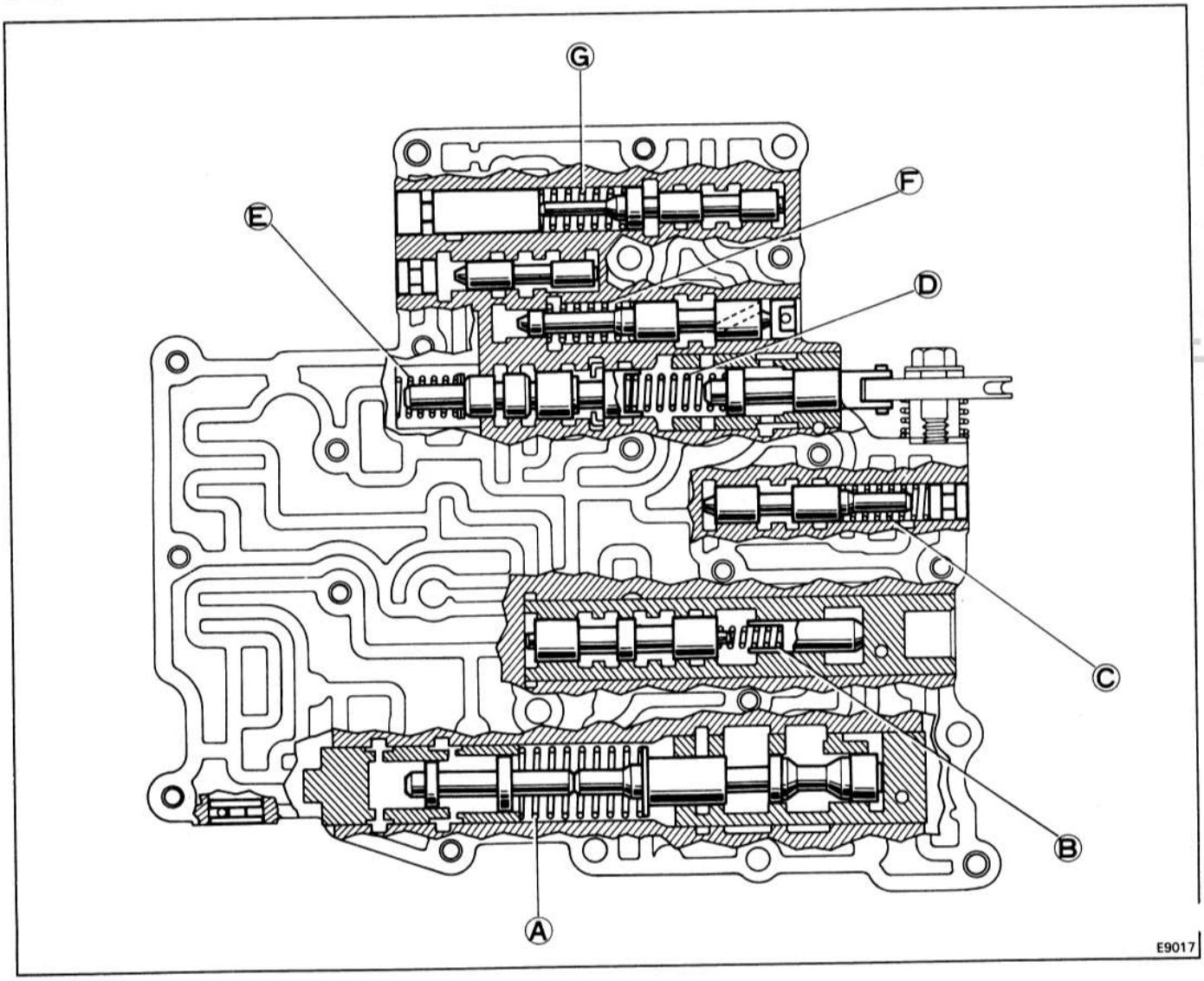
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SPECIFICATIONS OF VALVE BODY SPRING

	Spring	Free Length mm (in.)	Coil Outer Diameter mm (in.)	Number of Coils	Color
Ⓐ	Primary Regulator Valve Spring	66.7 (2.626)	18.6 (0.732)	12.5	Purple
Ⓑ	Lock-up Relay Valve Spring	18.8 (0.740)	5.1 (0.201)	14.5	None
Ⓒ	Low Coast Modulator Valve Spring	27.5 (1.083)	8.3 (0.327)	12.5	Yellow
Ⓓ	Down Shift Plug Spring	30.0 (1.181)	8.7 (0.343)	12.5	Red
Ⓔ	Throttle Valve Spring	29.2 (1.150)	9.2 (0.362)	9.5	Light Green
Ⓕ	Throttle Modulator Valve Spring	29.9 (1.177)	9.0 (0.354)	15.5	Green
Ⓖ	Accumulator Control Valve Spring	33.2 (1.307)	10.0 (0.394)	11.5	Orange

HINT: During re-assembly please refer to the spring specifications above to help discriminate between the different springs.

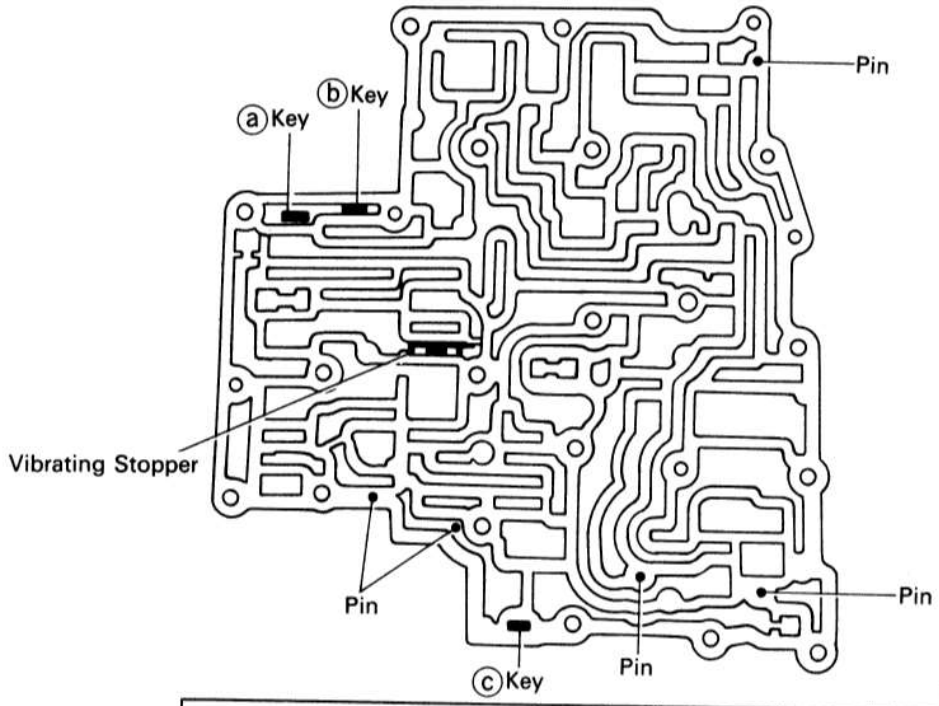
SECTIONAL VIEW OF VALVE BODY



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LOCATION OF KEYS, PINS, VIBRATING STOPPER AND CHECK BALLS

1. KEY, STOPPER AND PIN

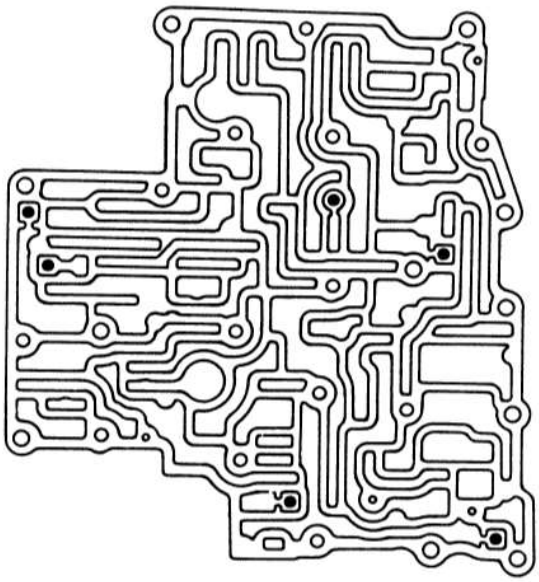


mm (in.)

Key		Height	Width	Thickness
ⓐ	Accumulator Control Valve	15.0 (0.591)	5.0 (0.197)	3.2 (0.126)
ⓑ	Cut-back Valve	16.0 (0.630)	5.0 (0.197)	3.2 (0.126)
ⓒ	Low Coast Modulator Valve	21.2 (0.835)	5.0 (0.197)	3.2 (0.126)

AT5689

2. CHECK BALL

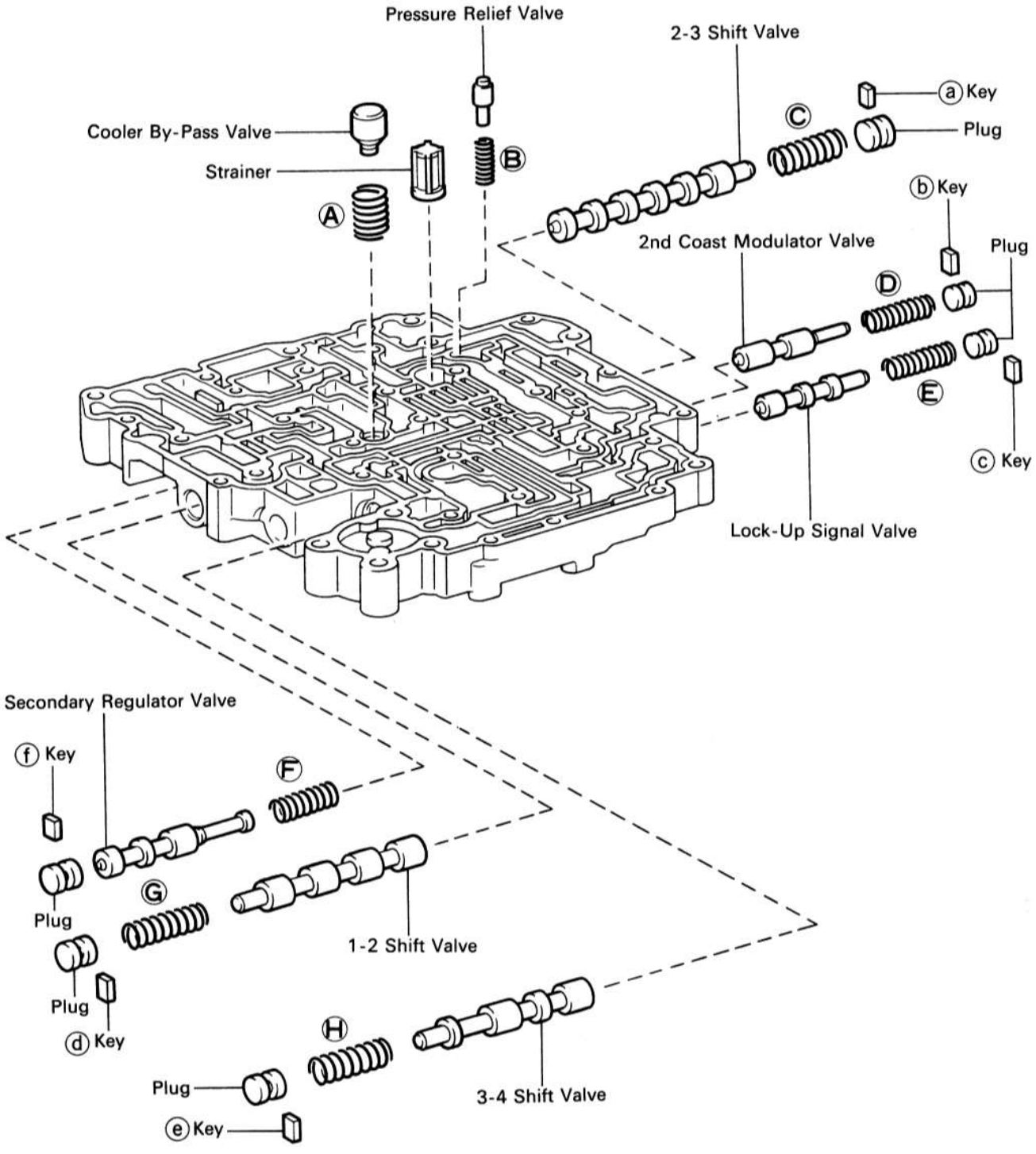


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(Lower Valve Body)

COMPONENTS



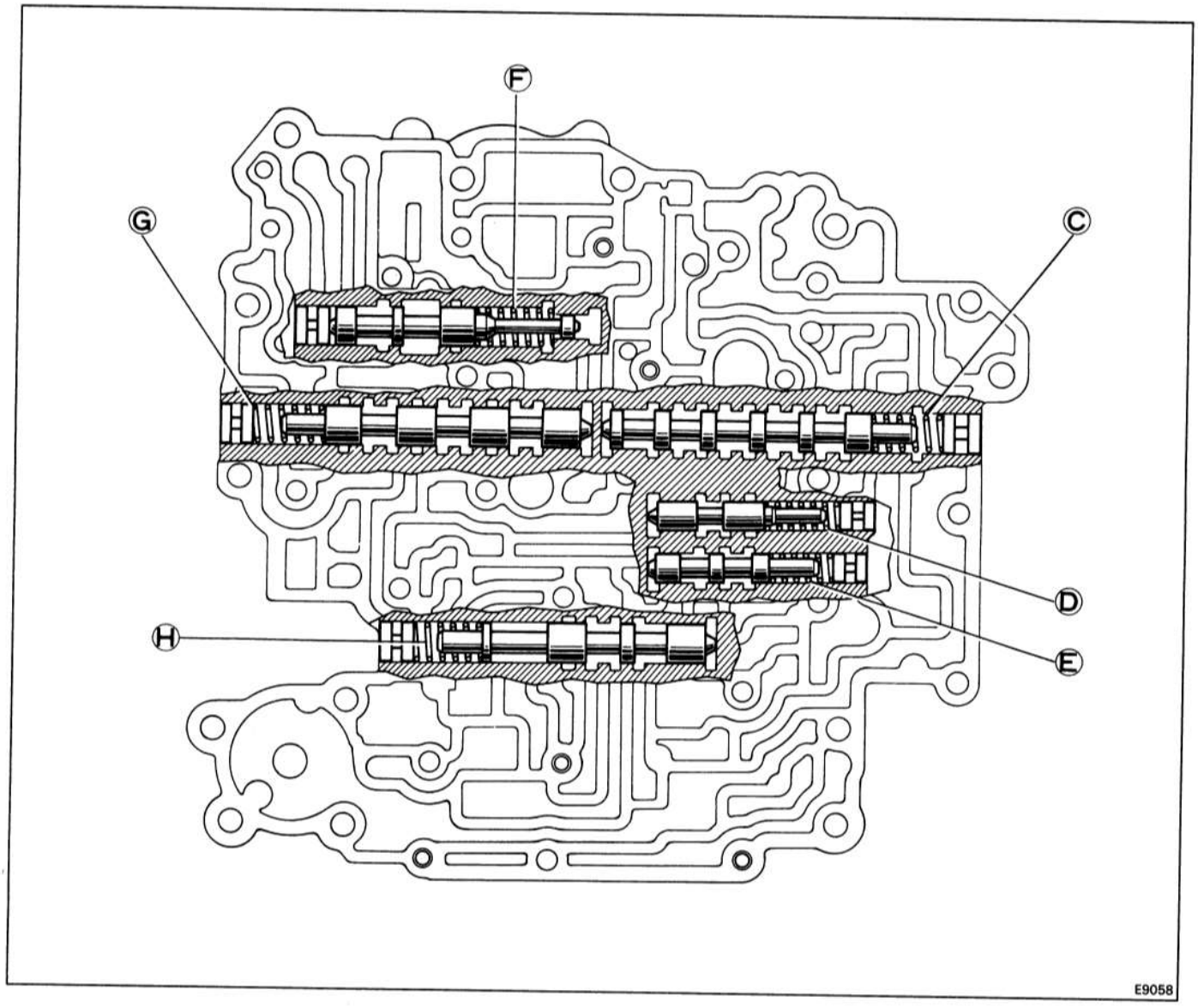
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SPECIFICATIONS OF VALVE BODY SPRINGS

Spring		Free Length mm (in.)	Coil Outer Diameter mm (in.)	Number of Coils	Color
Ⓐ	Cooler By-pass Valve Spring	18.3 (0.720)	12.0 (0.472)	6.5	Yellow
Ⓑ	Pressure Relief Valve Spring	11.2 (0.441)	6.4 (0.252)	7.5	None
Ⓒ	2-3 Shift Valve Spring	30.7 (1.209)	9.7 (0.382)	10.5	Purple
Ⓓ	2nd Coast Modulator Valve Spring	29.6 (1.165)	8.3 (0.327)	12.5	Red
Ⓔ	Lock-up Signal Valve Spring	30.0 (1.181)	8.2 (0.323)	11.5	Orange
Ⓕ	Secondary Regulator Valve Spring	27.4 (1.079)	11.0 (0.433)	11.5	Blue
Ⓖ	1-2 Shift Valve Spring	30.8 (1.213)	9.7 (0.382)	10.5	Purple
Ⓗ	3-4 Shift Valve Spring	30.8 (1.213)	9.7 (0.382)	10.5	Purple

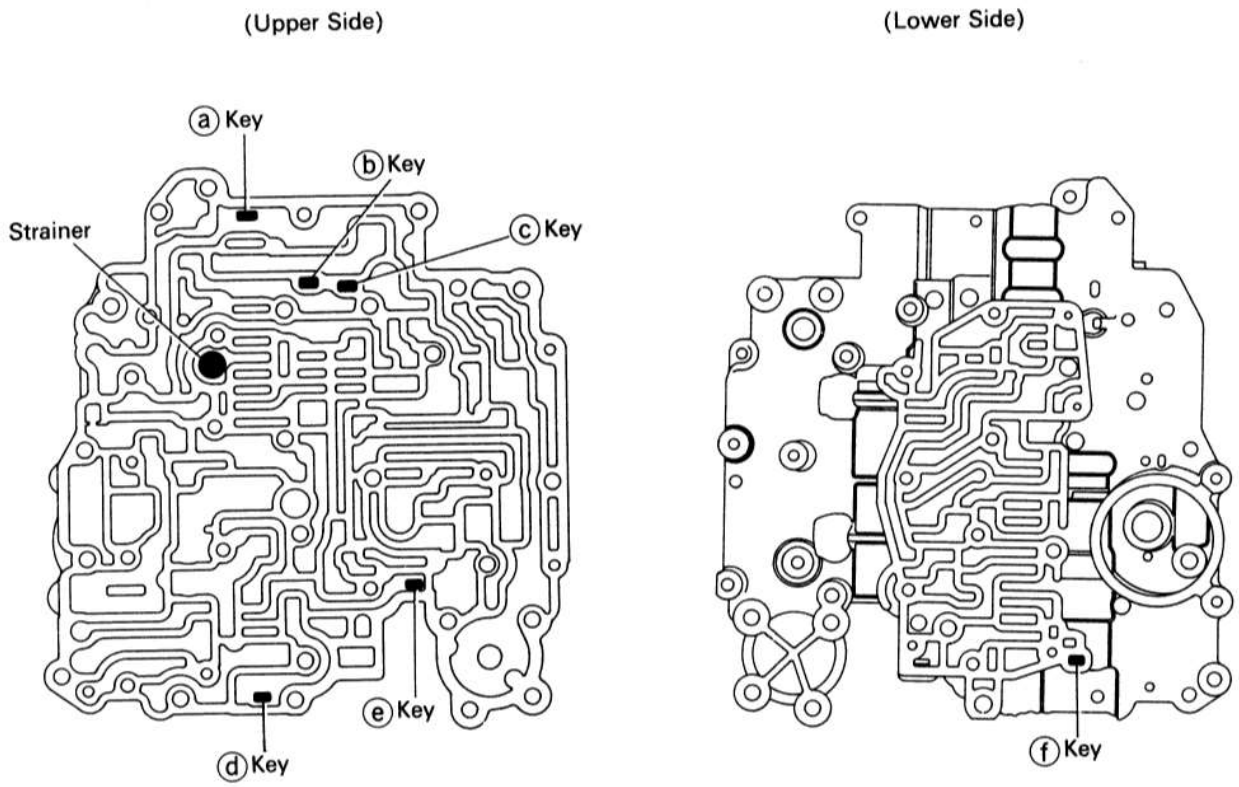
HINT: During re-assembly please refer to the spring specifications above to help discriminate between the different springs.

SECTIONAL VIEW OF VALVE BODY



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LOCATION OF KEYS AND STRAINER

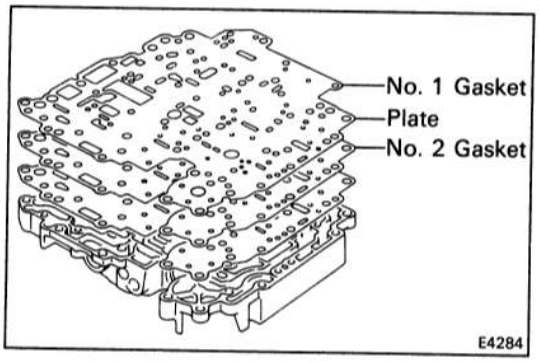


mm (in.)

Key		Height	Width	Thickness
ⓐ	2-3 Switch Valve	11.5 (0.453)	5.0 (0.197)	3.2 (0.126)
ⓑ	2nd Coast Modulator Valve	11.5 (0.453)	5.0 (0.197)	3.2 (0.126)
ⓒ	Lock-up Signal Valve	11.5 (0.453)	5.0 (0.197)	3.2 (0.126)
ⓓ	1-2 Shift Valve	11.5 (0.453)	5.0 (0.197)	3.2 (0.126)
ⓔ	3-4 Shift Valve	11.5 (0.453)	5.0 (0.197)	3.2 (0.126)
ⓕ	Secondary Regulator Valve	9.2 (0.362)	5.0 (0.197)	3.2 (0.126)

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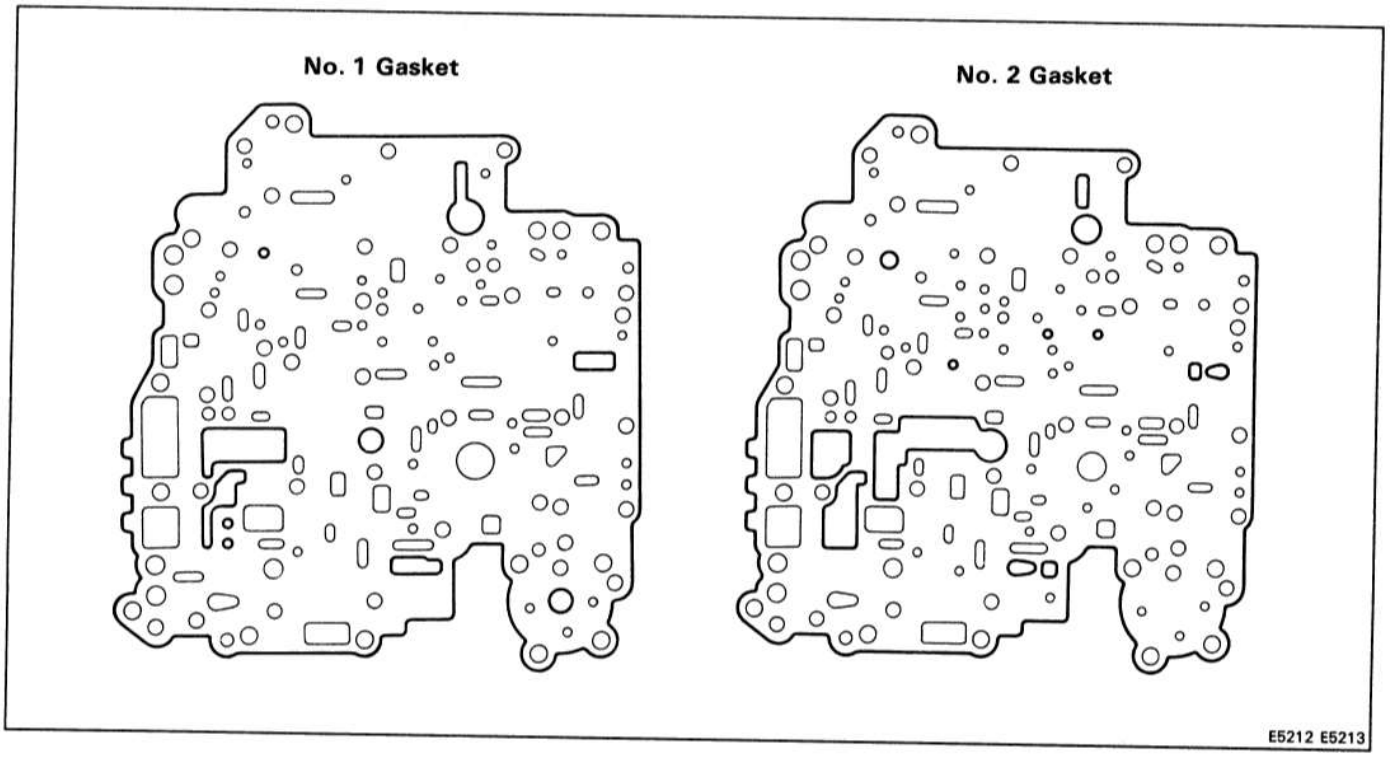
(Assembly of Valve Body)

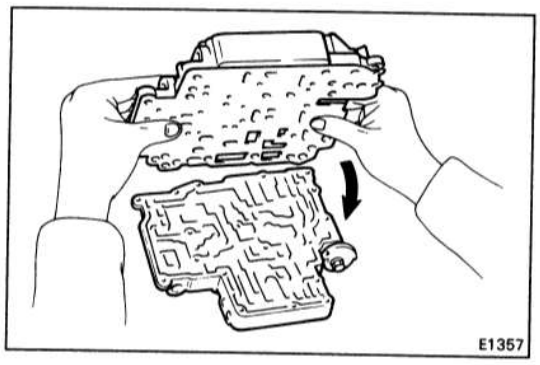
(See page AT-112)

1. **POSITION PLATE AND NEW GASKETS ON LOWER VALVE BODY**

Position the new No.2 gasket, the plate and then the new No.1 gasket on the lower valve body.

HINT: Since the No.1 gasket and No.2 gasket are similar use the illustration below to discriminate between them.

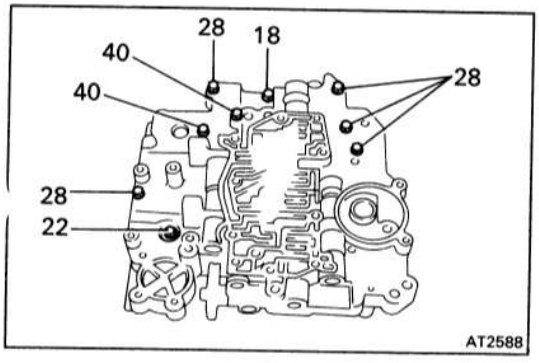




2. **PLACE LOWER VALVE BODY WITH PLATE AND GASKETS ON UPPER VALVE BODY**

HINT: Hold the lower valve body, gaskets and plate securely so they do not separate.

Align each bolt hole in the valve bodies with the gaskets and plate.

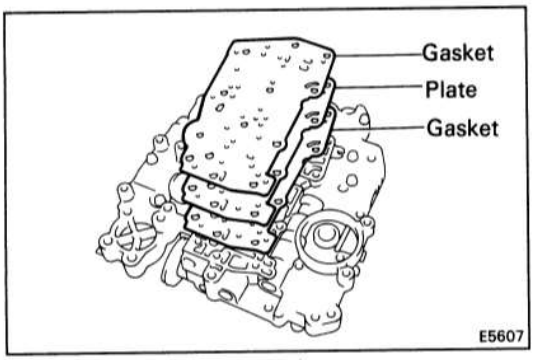


3. **INSTALL AND FINGER TIGHTEN BOLTS IN LOWER VALVE BODY TO SECURE UPPER VALVE BODY**

Install and finger tighten the nine bolts.

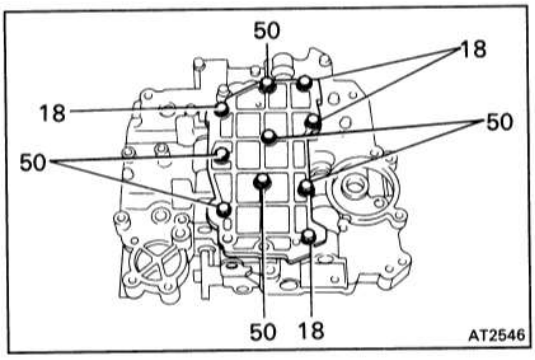
HINT: Each bolt length (mm) is indicated in the figure.

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4. INSTALL LOWER VALVE BODY COVER

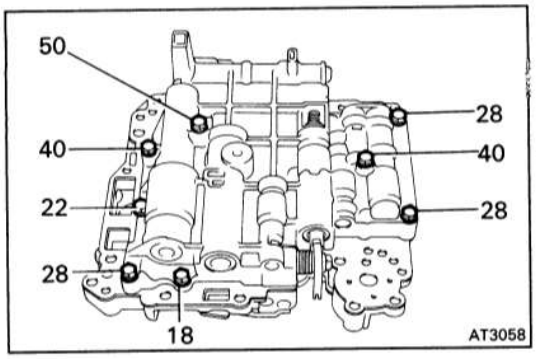
(a) Position a new gasket and plate and then another new gasket.



(b) Position the lower valve body cover.

(c) Install and finger tighten the ten bolts.

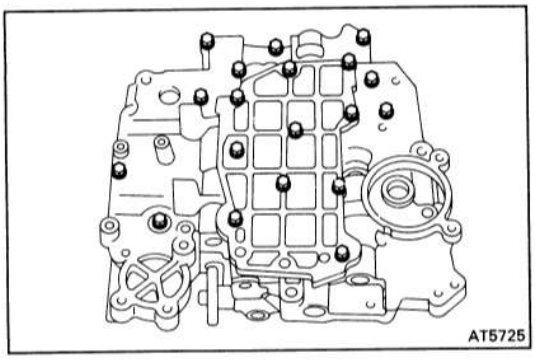
HINT: Each bolt length (mm) is indicated in the figure.



5. INSTALL AND FINGER TIGHTEN BOLTS IN UPPER VALVE BODY

Install and finger tighten the eight bolts.

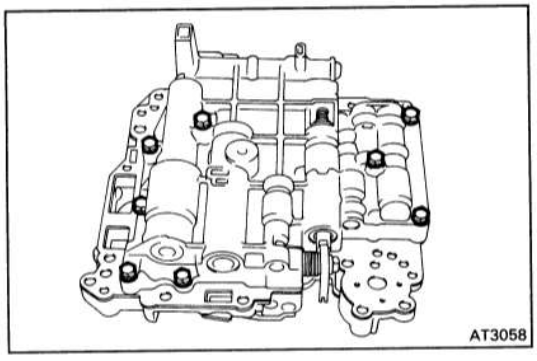
HINT: Each bolt length (mm) is indicated in the figure.



6. TIGHTEN BOLTS OF UPPER AND LOWER VALVE BODIES

(a) Tighten the nineteen bolts in the lower valve body.

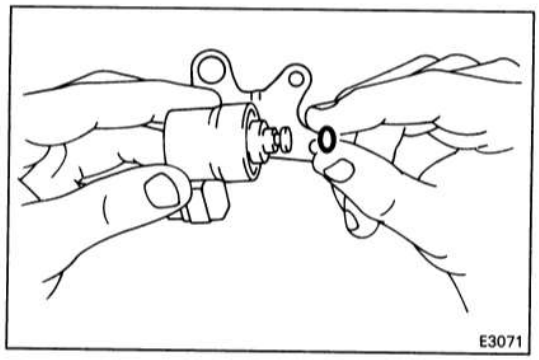
Torque: 65 kg-cm (56 in.-lb, 6.4 N·m)



(b) Tighten the eight bolts in the upper valve body.

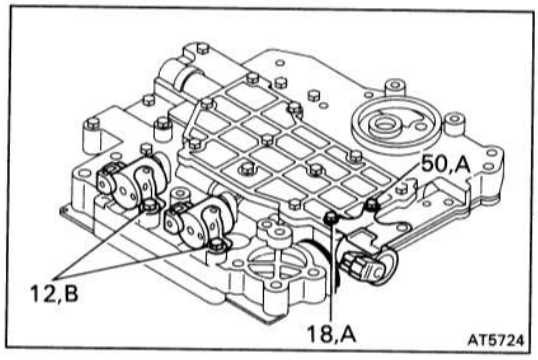
Torque: 65 kg-cm (56 in.-lb, 6.4 N·m)

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7. INSTALL SOLENOID

(a) Install the new O-rings on the each solenoids.



(b) Install the solenoids.

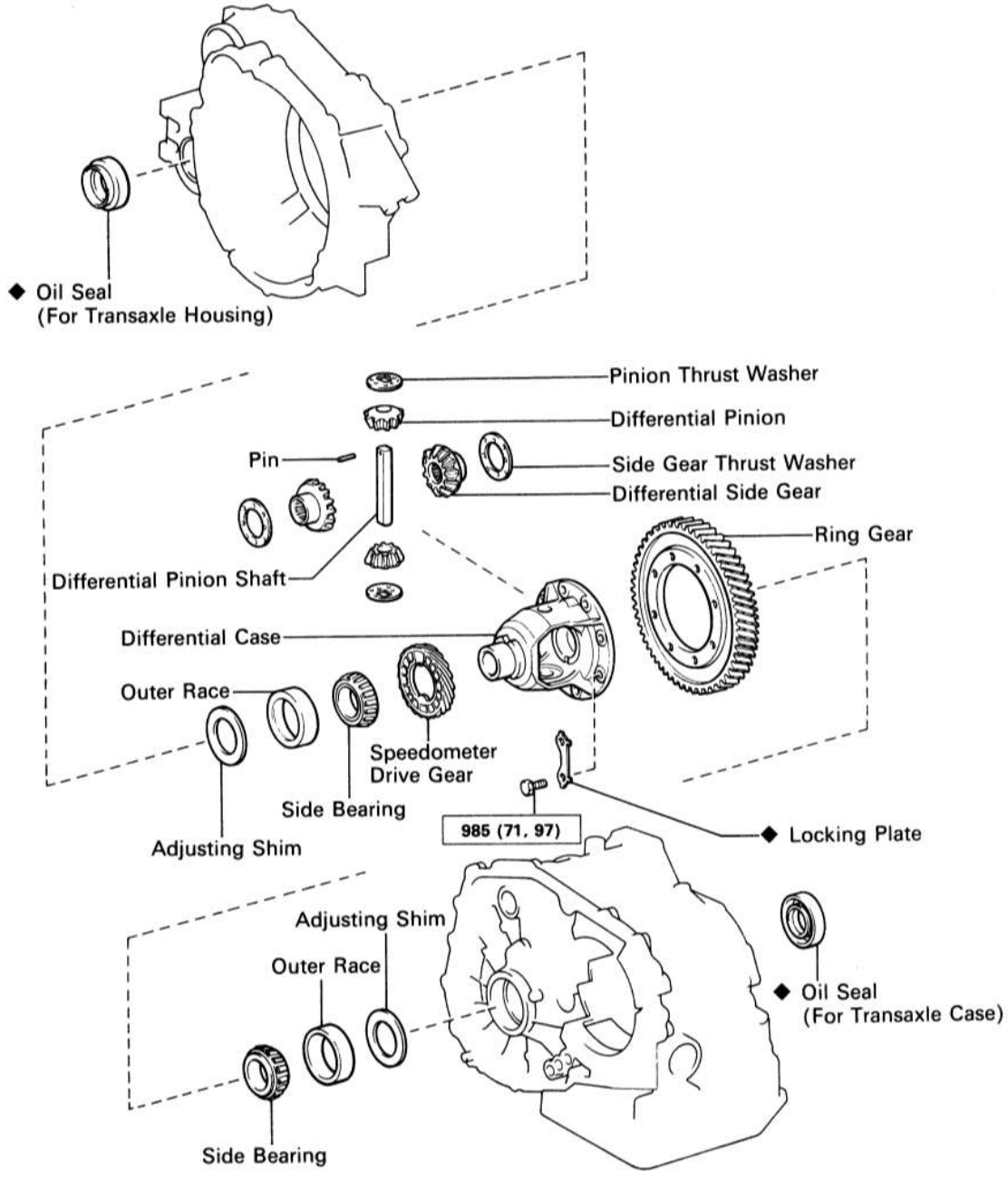
HINT: Each bolt length (mm) is indicated in the figure.

Torque: A 65 kg-cm (56 in.-lb, 6.4 N·m)
B 100 kg-cm (7 ft-lb, 10 N·m)

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Differential

COMPONENTS

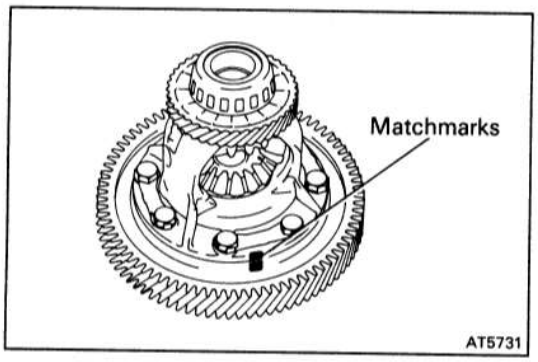


kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

E9120

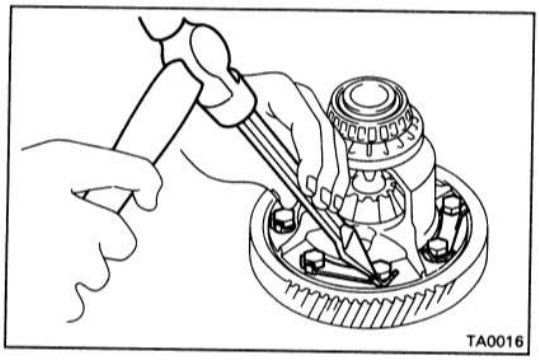
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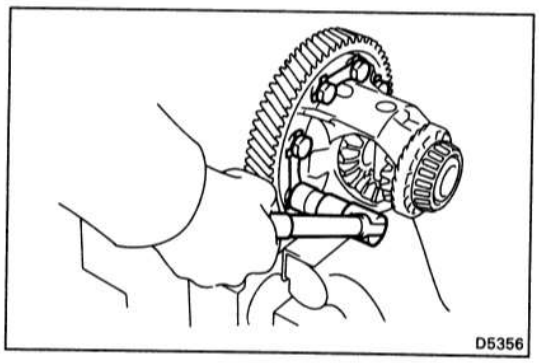
DISASSEMBLY OF DIFFERENTIAL

1. REMOVE RING GEAR

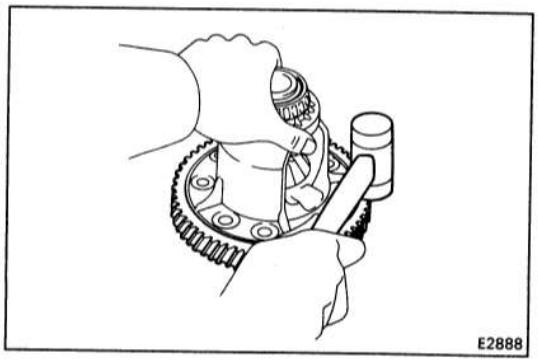
(a) Place the matchmarks on the ring gear and differential case.



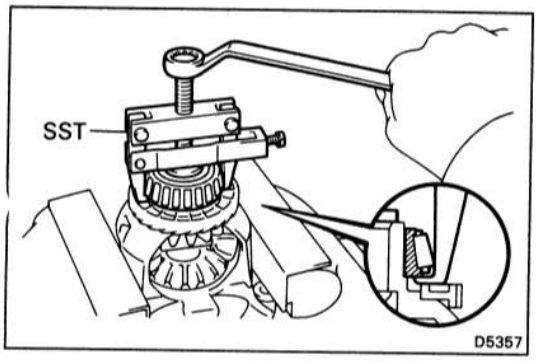
(b) Loosen the staked part of the locking plate.



(c) Remove the eight bolts and four locking plates.



(d) Using a plastic hammer, tap on the ring gear to remove it from the case.



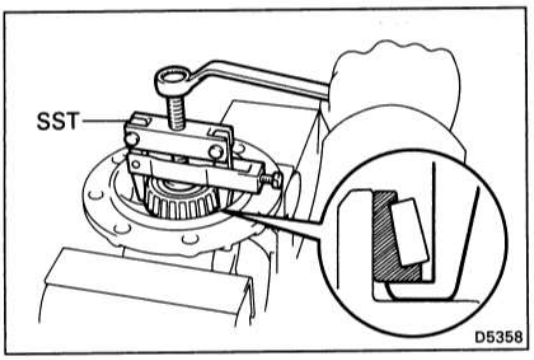
2. REMOVE SIDE BEARINGS FROM DIFFERENTIAL CASE

(a) Setting SST to the cut-out portion on the speedometer drive gear, remove the bearing from the differential case.

SST 09502-10012

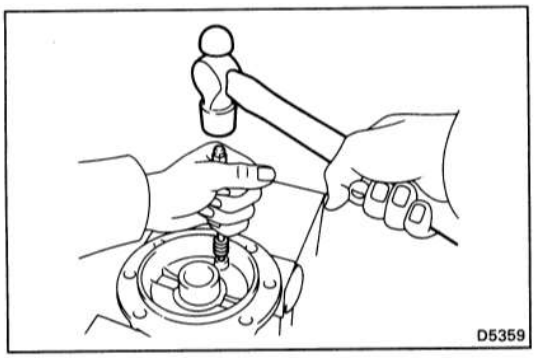
(b) Remove the speedometer drive gear.

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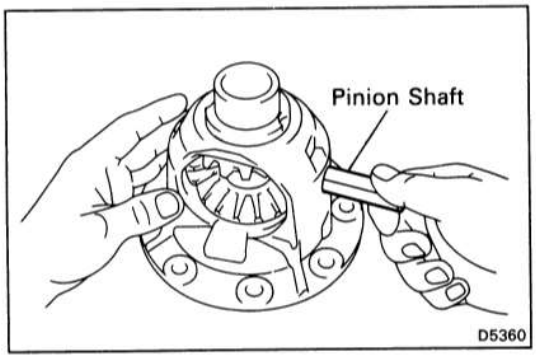
(c) Setting SST to the cut-out portion on the differential case, remove the bearing.

SST 09502-10012

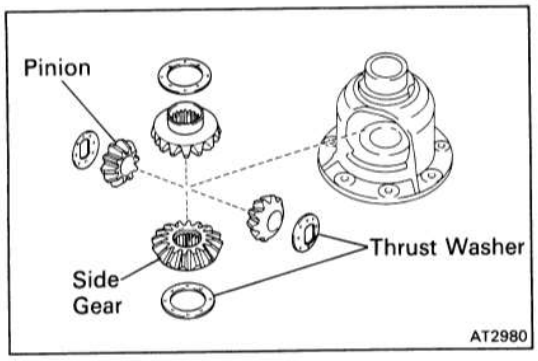


3. DISASSEMBLE DIFFERENTIAL CASE

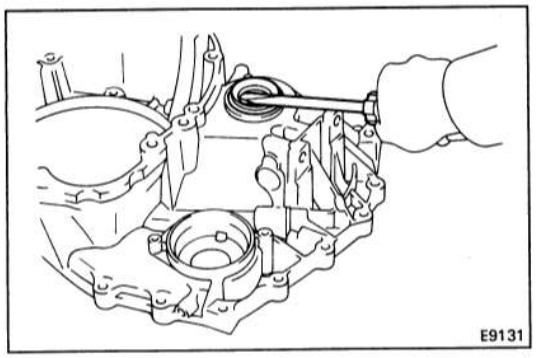
(a) Drive out the pinion shaft lock pin from the ring gear side.



(b) Remove the pinion shaft from the case.



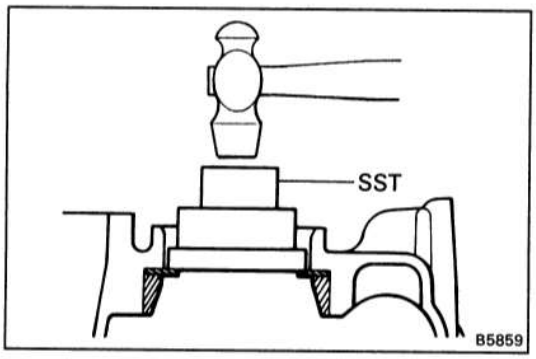
(c) Remove the two pinions, two side gears and four thrust washers.



4. REMOVE OIL SEAL OF TRANSAXLE HOUSING

Using a screwdriver, remove the oil seal.

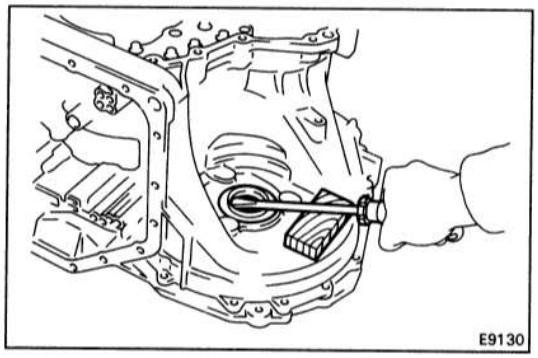
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5. REMOVE SIDE BEARING OUTER RACE OF TRANSAXLE HOUSING

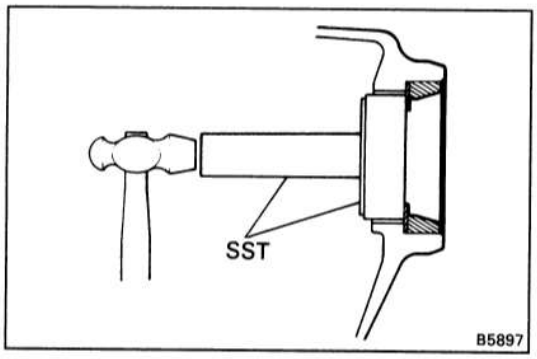
Using SST and a hammer, drive out the outer race and shim.

SST 09350-32014 (09351-32090)



6. REMOVE OIL SEAL OF TRANSAXLE CASE

Using a screwdriver, remove the oil seal.

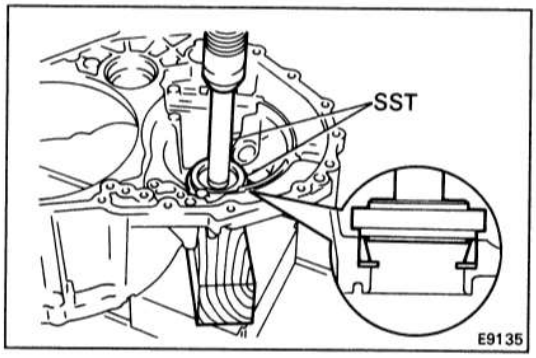


7. REMOVE SIDE BEARING OUTER RACE OF TRANSAXLE CASE

Using SST and a hammer, drive out the outer race and adjusting shim.

SST 09350-32014 (09351-32130, 09351-32150)

ASSEMBLY OF DIFFERENTIAL

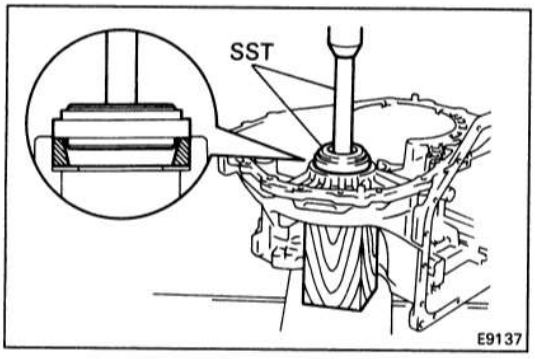


1. INSTALL SIDE BEARING OUTER RACE OF TRANSAXLE HOUSING

(a) Place the shim onto the transaxle housing.

(b) Using SST and press, press a new outer race into the transaxle housing.

SST 09350-32014 (09351-32111, 09351-32130)



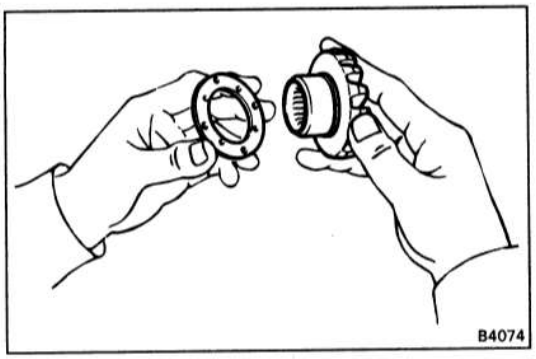
2. INSTALL SIDE BEARING OUTER RACE OF TRANSAXLE CASE

(a) Place the adjusting shim onto the transaxle case.

(b) Using SST and press, press a new outer race into the transaxle case.

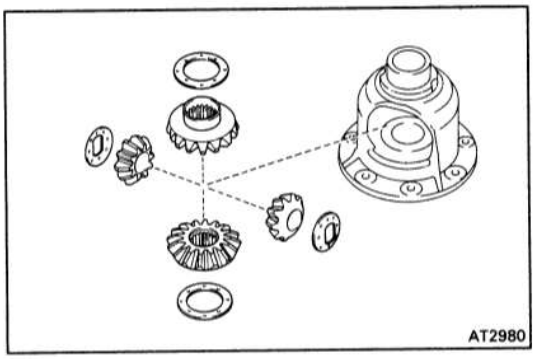
SST 09350-32014 (09351-32111, 09351-32130)

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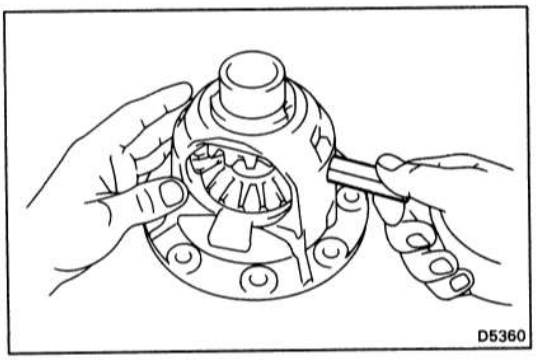


3. ASSEMBLE DIFFERENTIAL CASE

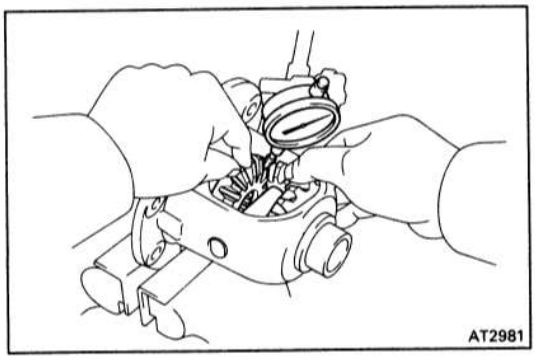
(a) Install the thrust washers to the side gears.



(b) Install the side gears with thrust washers, pinion gears and pinion thrust washers into the differential case.



(c) Install the pinion shaft so as to align the lock pin holes on the pinion shaft and differential case.



4. CHECK SIDE GEAR BACKLASH

(a) Measure the side gear backlash while holding one pinion gear toward the case.

Standard backlash: 0.05 – 0.20 mm (0.0020 – 0.0079 in.)

If the backlash is out of specification, install the correct thrust washer to the side gear.

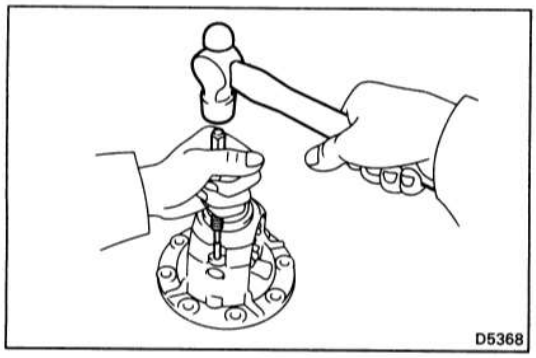
(b) Referring to the table below, select thrust washers which will ensure that the backlash is within specification. Try to select washers of the same size of both sides.

Thrust washer thicknesses

Thickness mm (in.)	Thickness mm (in.)
0.95 (0.0374)	1.10 (0.0433)
1.00 (0.0394)	1.15 (0.0453)
1.05 (0.0413)	1.20 (0.0472)

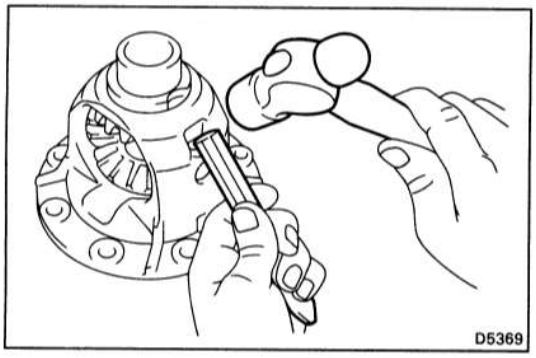
If the backlash is not within specification, install a thrust washer of a different thickness.

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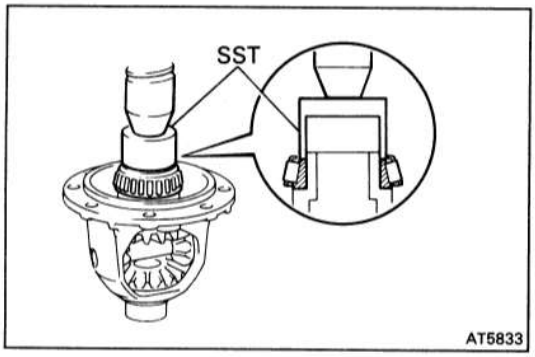


5. INSTALL LOCK PIN

(a) Using a hammer and punch, drive the lock pin through the case and hole in the pinion shaft.



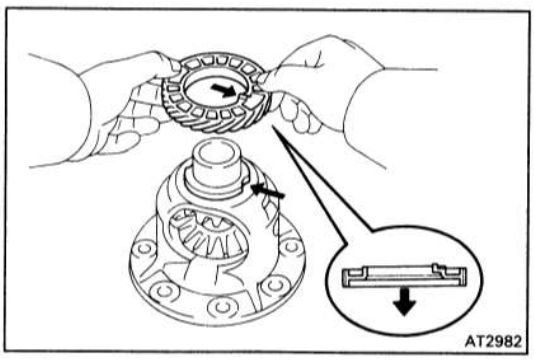
(b) Stake the differential case.



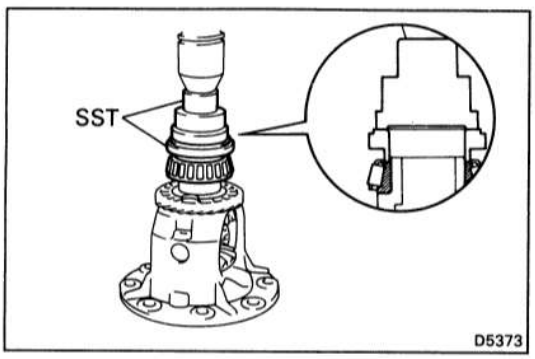
6. INSTALL SIDE BEARINGS TO DIFFERENTIAL CASE

(a) Using SST and press, press the side bearing into the differential case.

SST 09710-30030 (09710-03160)



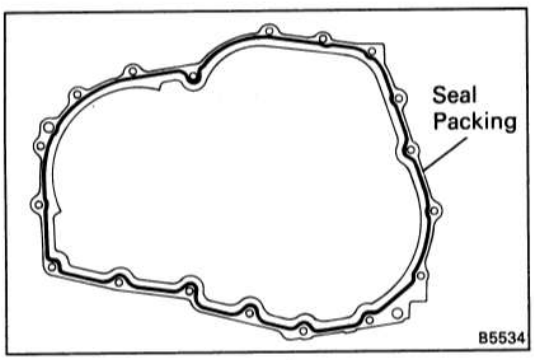
(b) Install the speedometer drive gear to the differential case.



(c) Using SST and press, press the side bearing into the differential case.

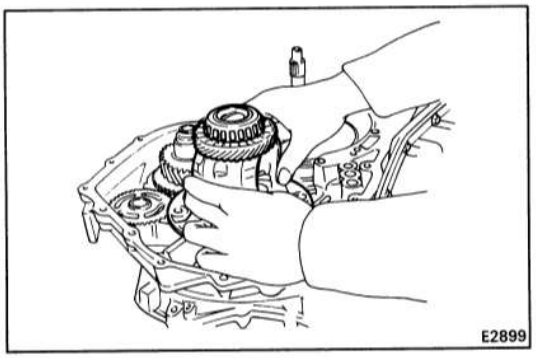
SST 09350-32014 (09351-32090, 09351-32120)

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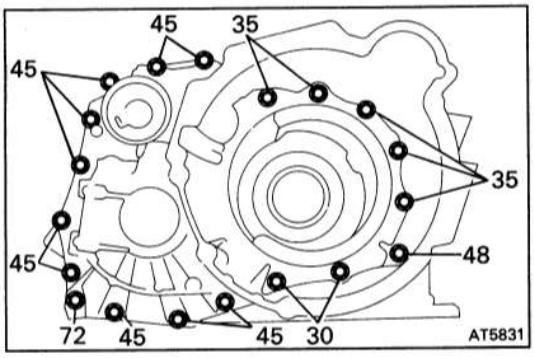


7. ADJUST SIDE BEARING PRELOAD

(a) Remove any packing material and be careful not to get oil on the contacting surfaces of the transaxle housing or transmission case.



(b) Install the differential to the transaxle case.

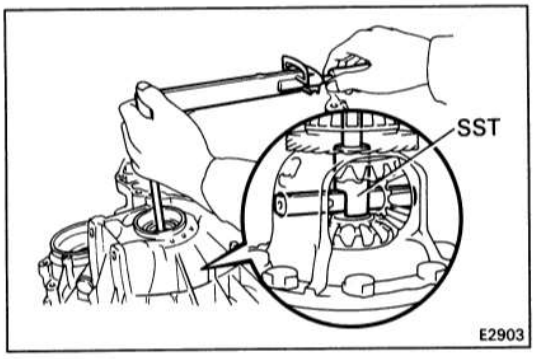


(c) Install the transaxle housing to the transaxle case.

(b) Install and tighten the bolts.

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

HINT: Each bolt length (mm) is indicated in the illustration.



(e) Using SST, rotate the differential in both directions to snug the bearing down.

SST 09564-32011

(f) Using SST and a torque meter, measure the preload of the side bearing.

SST 09564-32011

Preload (at starting):

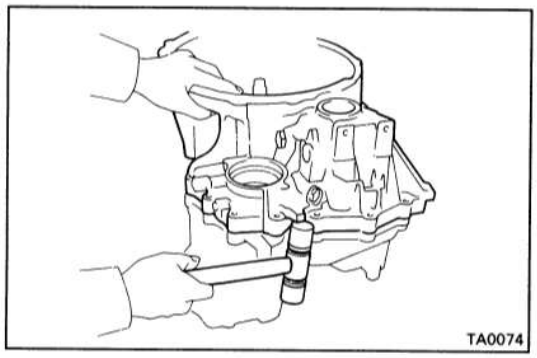
New bearing	**8 – 14 kg-cm (6.9 – 12.2 in.-lb, 0.8 – 1.4 N·m)**
Used bearing	**4 – 7 kg-cm (3.5 – 6.1 in.-lb, 0.4 – 0.7 N·m)**

If the preload is not within specification, remove the differential from the transaxle case. Re-select the transaxle case side adjusting shim.

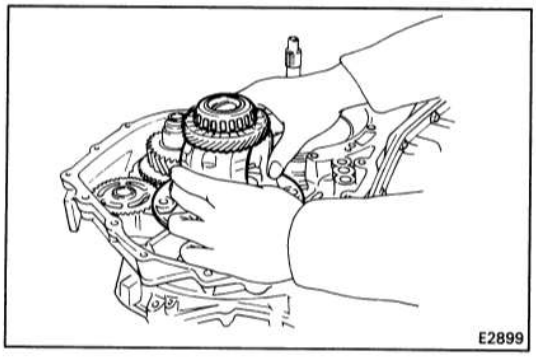
Thickness				mm (in.)
2.00 (0.0787)	2.20 (0.0866)	2.40 (0.0945)	2.60 (0.1024)	2.80 (0.1102)
2.05 (0.0807)	2.25 (0.0886)	2.45 (0.0965)	2.65 (0.1043)	2.85 (0.1122)
2.10 (0.0827)	2.30 (0.0906)	2.50 (0.0984)	2.70 (0.1063)	2.90 (0.1142)
2.15 (0.0846)	2.35 (0.0925)	2.55 (0.1004)	2.75 (0.1083)	

HINT: The preload will change about 3 – 4 kg-cm (2.6 – 3.5 in.-lb, 0.3 – 0.4 N·m) with each shim thickness.

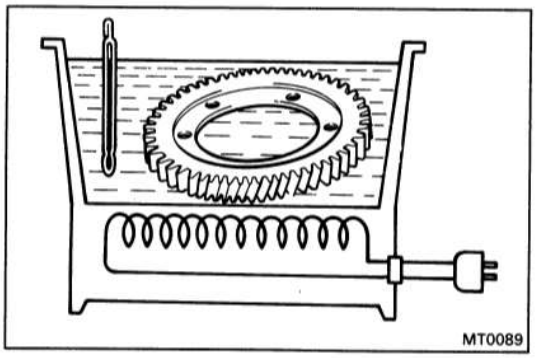
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(g) Remove the bolts and transaxle housing.



(h) Remove the differential from the transaxle case.



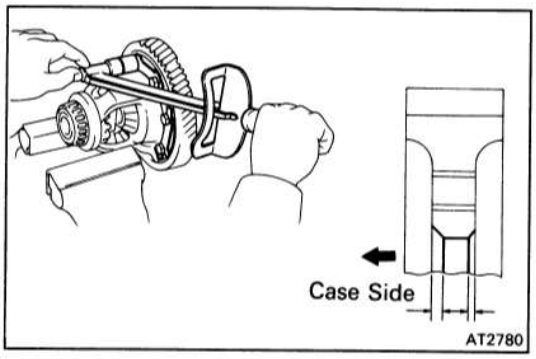
8. INSTALL RING GEAR TO DIFFERENTIAL

(a) Clean the contact surface of the differential case.

(b) Heat the ring gear to about 100°C (212°F) in an oil bath.

NOTICE: Do not heat the ring gear above 110°C (230°F)

(c) Clean the contact surface of the ring gear with cleaning solvent.

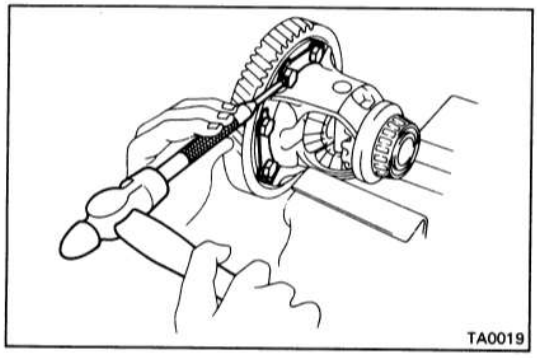


(d) Quickly install the ring gear on the differential case.

(e) Install new locking plates and set bolts.

HINT: Tighten the set bolts uniformly and a little at a time. Torque the bolts.

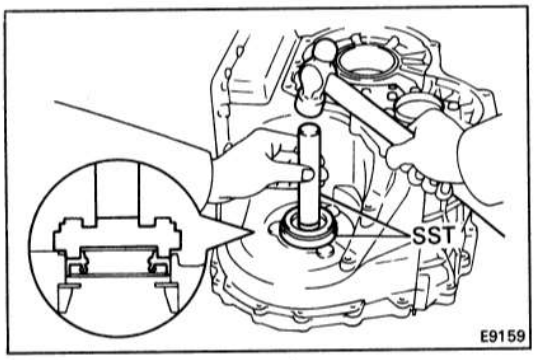
Torque: 985 kg-cm (71 ft-lb, 97 N·m)



(f) Using a hammer and drift punch, stake the locking plates.

HINT: Stake one claw flush with the flat surface of the nut. For the claw contacting the protruding portion of the nut, stake only the half on the tightened side.

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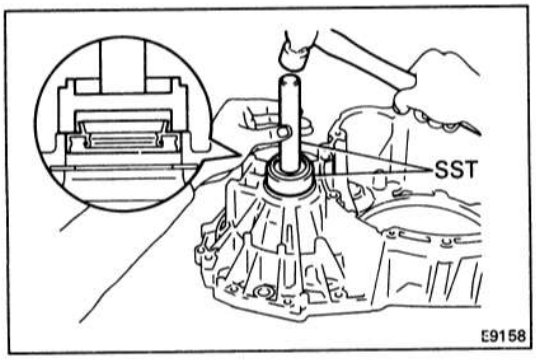


9. INSTALL OIL SEAL OF TRANSAXLE CASE

(a) Using SST and a hammer, drive in a new oil seal.

SST 09350-32014 (09351-32130, 09351-32111)

(b) Coat the lip of oil seal with MP grease.



10. INSTALL OIL SEAL OF TRANSAXLE HOUSING

(a) Using SST and a hammer, drive in a new oil seal.

SST 09350-32014 (09351-32130, 09351-32150)

(b) Coat the lip of oil seal with MP grease.

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INSTALLATION OF COMPONENT PARTS

(See pages AT-52 to 54)

Disassembly, inspection and assembly of each component group have been indicated in the preceding chapter. Before assembly, make sure again that all component groups are assembled correctly.

If something wrong is found in a certain component group during assembly, inspect and repair this group immediately.

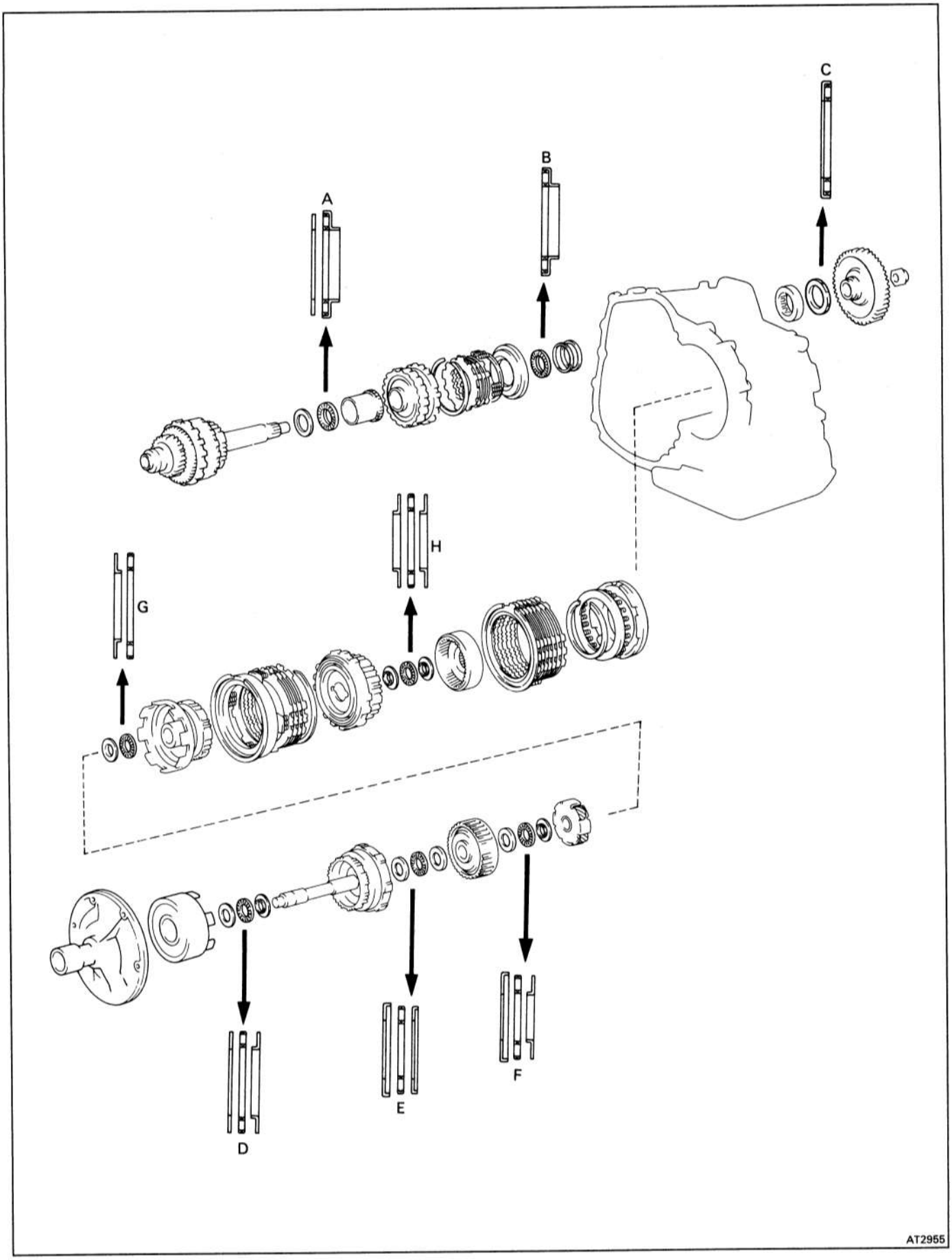
Recommended ATF: DEXRON® II

GENERAL NOTES:

1. The automatic transmission is composed of highly precision-finished parts, necessitating careful inspection before assembly because even a small nick could cause fluid leakage or affect performance.
2. Before assembling new clutch discs, soak them in automatic transmission fluid for at least two hours.
3. Apply automatic transmission fluid on sliding or rotating surfaces of parts before assembly.
4. Use petroleum jelly to keep small parts in their place.
5. Do not use adhesive cements on gaskets and similar parts.
6. When assembling the transmission, sure to use new gaskets and O-rings.
7. Dry all parts with compressed air – never use shop rags.

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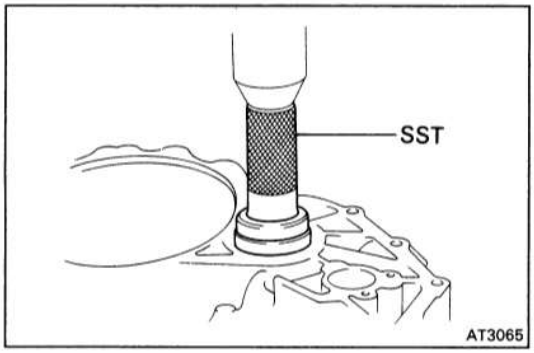
8. Be sure to install the thrust bearings and races in the correct direction and position.



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mm (in.)

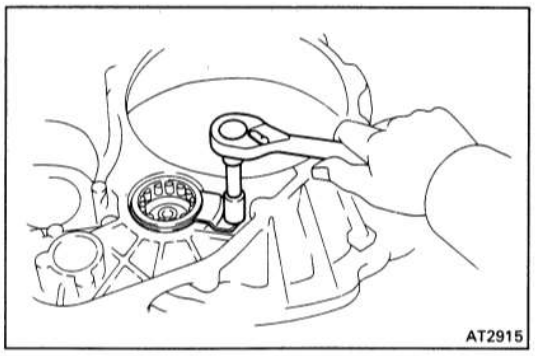
		A	B	C	D	E	F	G	H
Front Bearing Race	Outer Diameter	41.8 (1.646)	–	–	43.0 (1.693)	37.9 (1.492)	←	45.0 (1.772)	37.3 (1.469)
	Inner Diameter	30.0 (1.181)	–	–	30.5 (1.201)	22.0 (0.866)	←	28.0 (1.102)	24.1 (0.949)
Thrust Bearing	Outer Diameter	43.7 (1.720)	45.2 (1.780)	57.7 (2.272)	42.0 (1.654)	36.1 (1.421)	←	45.0 (1.772)	37.6 (1.480)
	Inner Diameter	31.0 (1.220)	←	41.0 (1.614)	28.9 (1.138)	22.2 (0.874)	←	30.0 (1.181)	24.0 (0.945)
Rear Bearing Race	Outer Diameter	–	–	–	42.0 (1.654)	35.7 (1.406)	35.0 (1.378)	–	37.6 (1.480)
	Inner Diameter	–	–	–	27.1 (1.067)	23.0 (0.906)	19.0 (0.748)	–	22.2 (0.874)



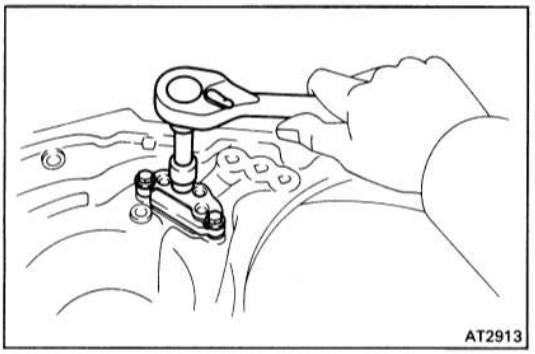
1. INSTALL BEARING TO TRANSAXLE HOUSING

(a) Using SST and a press, press the bearing into the transaxle housing.

SST 09350-32014 (09351-32140)



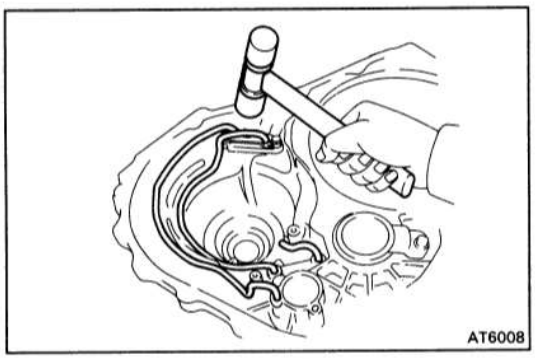
(b) Install the bearing stopper with a bolt.



2. INSTALL NEW GASKET AND OIL TUBE APPLY COVER

Install the new gasket and oil tube apply cover, and tighten the three bolts.

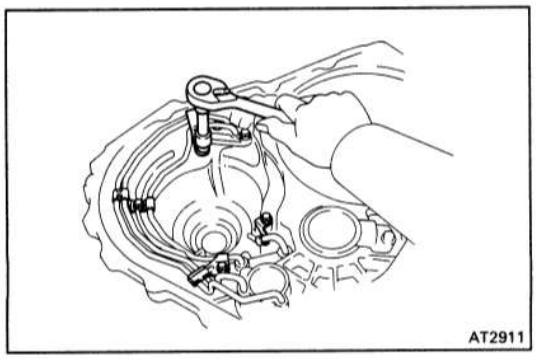
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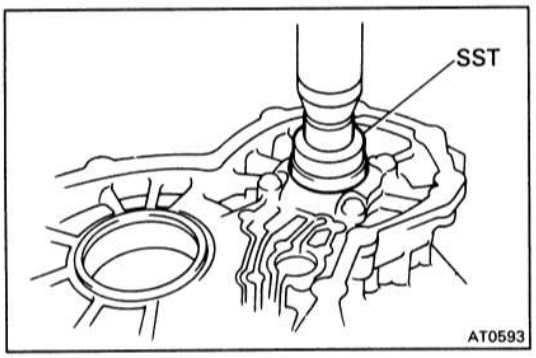
3. INSTALL OIL TUBES

(a) Using a plastic hammer, install the three oil tubes.

NOTICE: Be careful not to bend or damage the tubes.



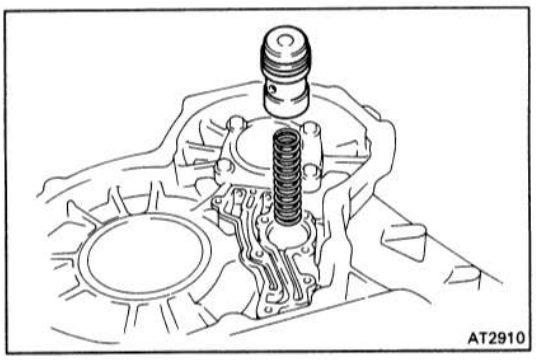
(b) Install the four tube clamps.



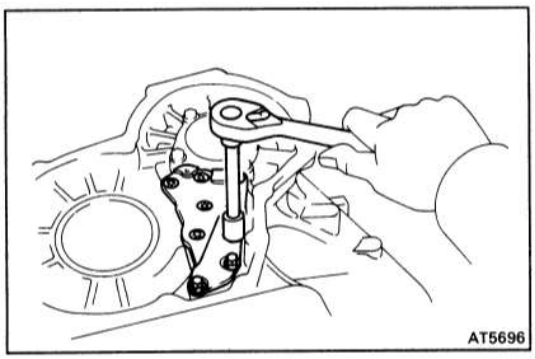
4. INSTALL BEARING TO TRANSMISSION CASE

Using SST and a press, press the bearing into the transmission case.

SST 09350-32014 (09351-32090)



5. INSTALL B_4 ACCUMULATOR PISTON AND SPRING



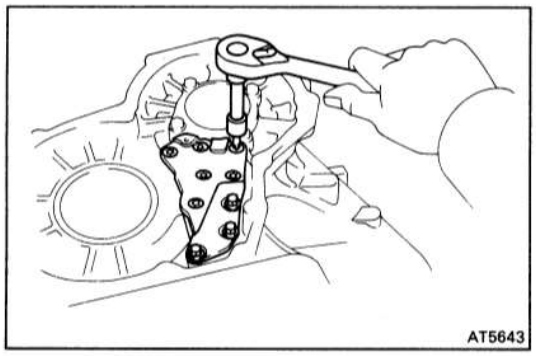
6. INSTALL OIL GALLERY COVER AND GASKET

(a) Clean the threads of the screws and case with white gasoline.

(b) Install the new gasket and oil gallery cover in place.

(c) Install and tighten the three bolts.

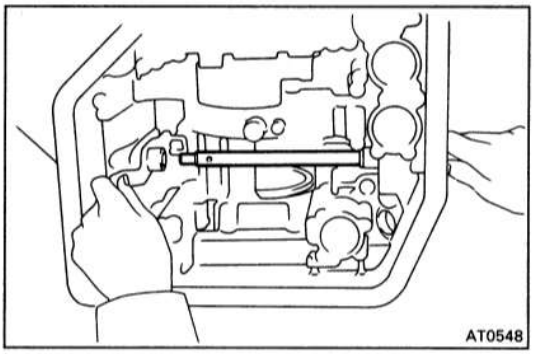
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(d) Apply seal packing or equivalent to the six screws.

Seal packing: Part No. 08833-00070, THREE BOND 1324 or equivalent

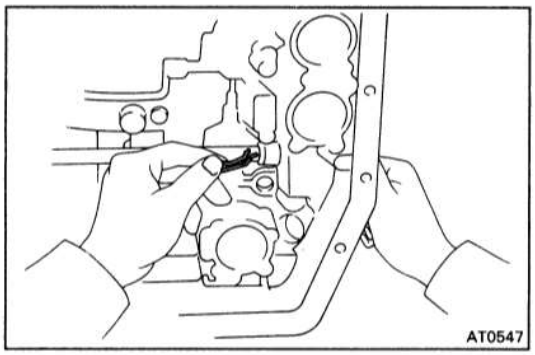
(e) Using a torx wrench, install and tighten the three screws.



7. INSTALL MANUAL VALVE SHAFT AND LEVER

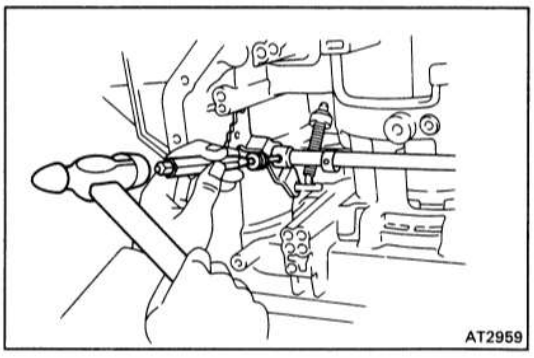
(a) Install the parking lock rod to the manual valve lever.

(b) Slide in the shaft and install the washer, new spacer and manual lever.



(c) Install the retaining spring.

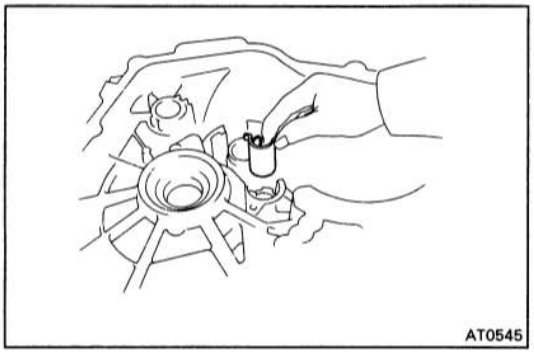
HINT: Make sure there is a washer between the retaining spring and case.



8. INSTALL PIN

(a) Using a punch and hammer, drive in the pin.

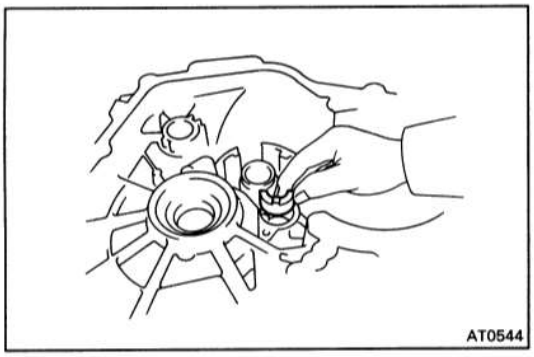
(b) Position the spacer and stake it.



9. INSTALL CAM GUIDE BRACKET

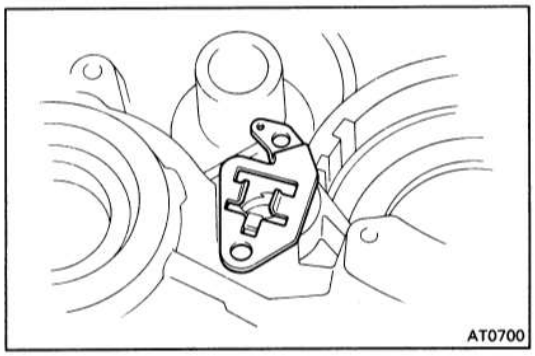
Install the cam guide bracket and then insert the parking lock rod into the guide bracket.

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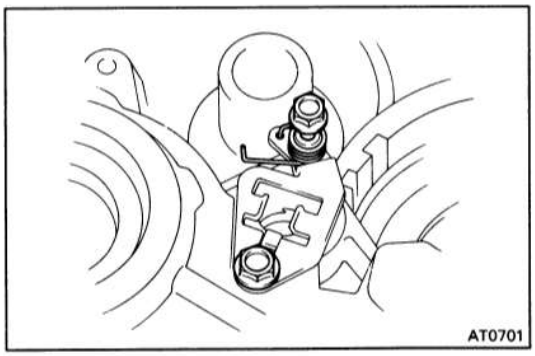
10. INSTALL PARKING LOCK SLEEVE

Install the parking lock sleeve protruding portion upward.

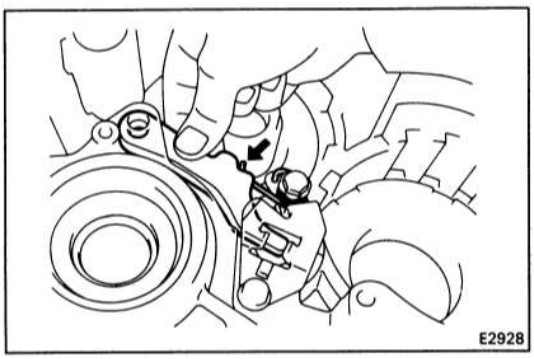


11. PLACE STOPPER PLATE

Place the stopper plate on the protruding portion of lock sleeve.

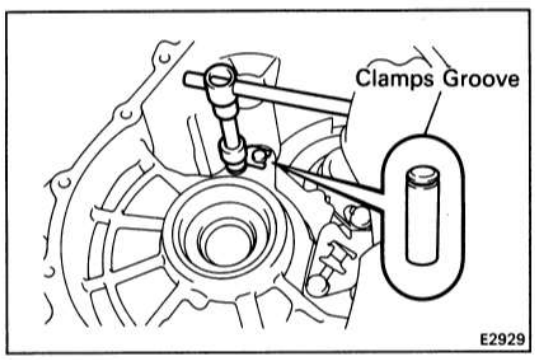


12. INSTALL GUIDE SLEEVE AND SPRING



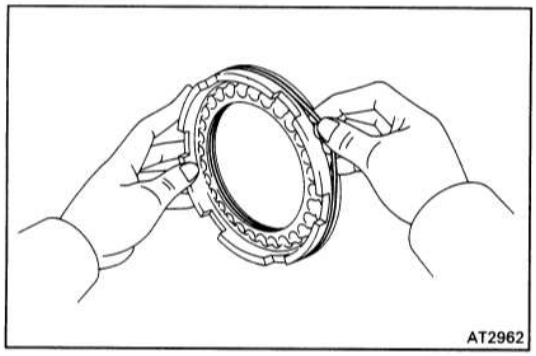
13. INSTALL PARKING LOCK PAWL, PAWL SHAFT AND SHAFT CLAMP

(a) Install the parking lock pawl.



(b) Insert the parking lock pawl shaft and install the shaft clamp.

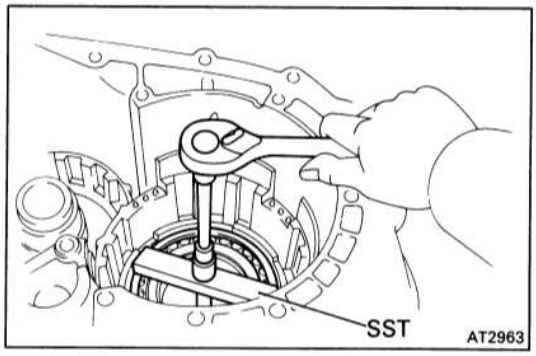
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14. INSTALL FIRST AND REVERSE BRAKE PISTON

(a) Install the two new O-rings to the piston.

(b) Coat the O-rings with ATF.



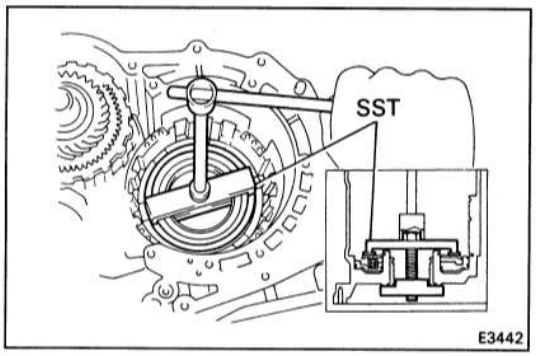
(c) Place the piston into the bore of the case, facing the spring seats upward.

(d) Using SST, press in the piston.

SST 09350-32014 (09351-32040)

HINT: Be careful not to damage the O-rings.

(e) Remove SST.



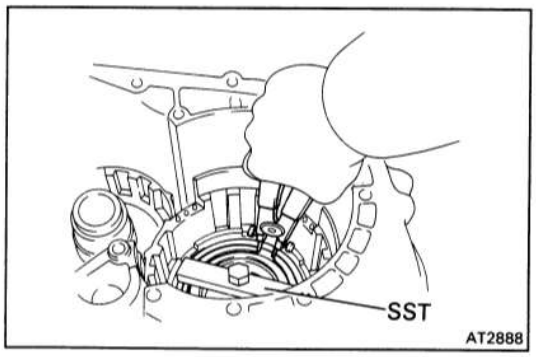
15. INSTALL PISTON RETURN SPRING AND SNAP RING

(a) Install the piston return spring assembly and snap ring in place.

(b) Set SST, and tighten the bolt gradually to compress the springs.

SST 09350-32014 (09351-32040)

NOTICE: Avoid bending the spring retainer by over-tightening the bolt.



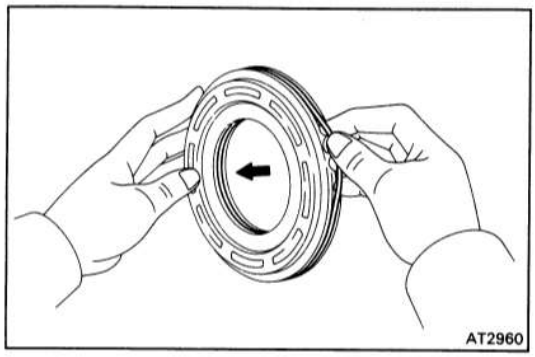
(c) Using snap ring pliers, install the snap ring.

HINT: Visually check to make sure it is fully seated and centered by the three lugs on the spring retainer.

Be sure the end gap of snap ring is not aligned with the spring retainer claw.

(b) Remove SST.

SST 09350-32014 (09351-32040)

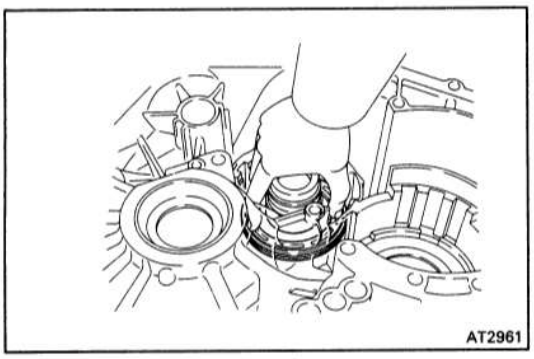


16. INSTALL UNDERDRIVE BRAKE PISTON

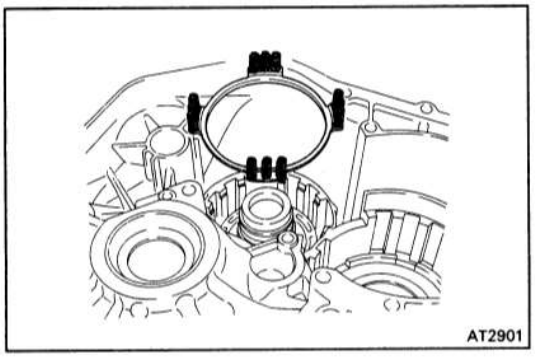
(a) Coat the O-rings with ATF.

(b) Install the two new O-rings to the piston.

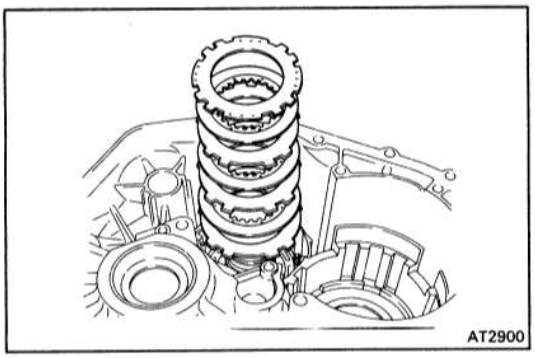
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(c) Place the piston into the case with the cup side up, being careful not to damage the O-rings.



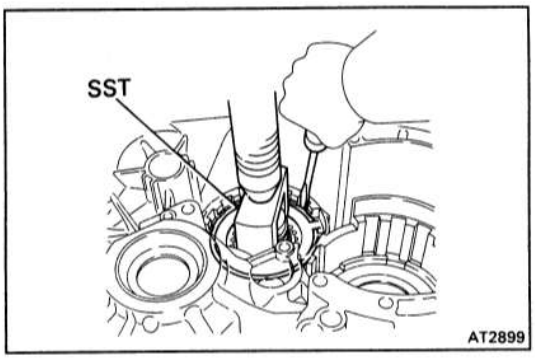
17. INSTALL RETURN SPRING



18. INSTALL PLATES, DISCS AND FLANGE

(a) Install in order: D = Disc P = Plate F = Flange
P – D – P – D – P – D – F

HINT: Install the flange with the flat end facing downward.

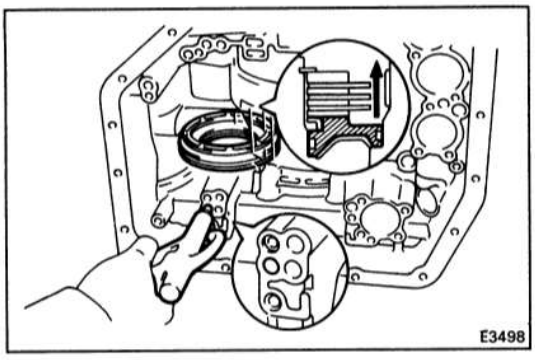


(b) Place SST on the flange, and compress the flange with a press.

SST 09350-32014 (09351-32070)

(c) Install the snap ring.

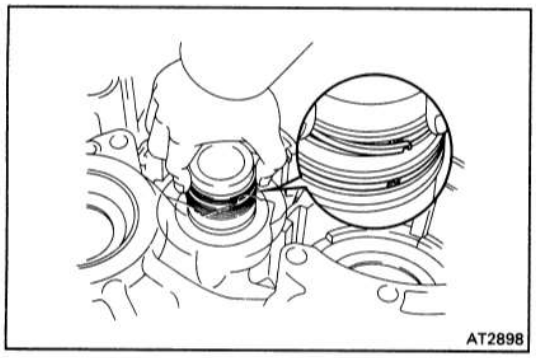
HINT: Be sure the end gap of the snap ring is not aligned with one of the cutouts.



19. CONFIRM THAT UNDERDRIVE BRAKE PISTON MOVES

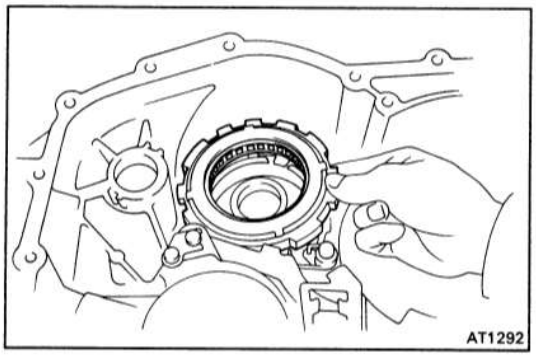
Using compressed air, confirm that the underdrive brake piston moves smoothly.

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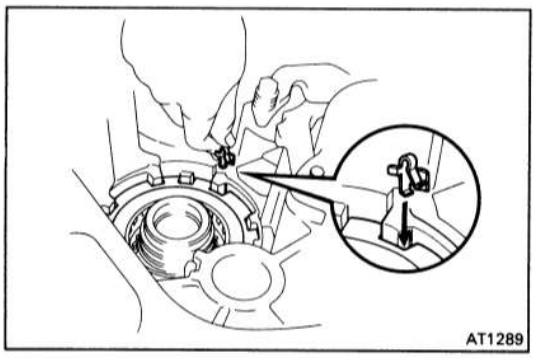


20. INSTALL OIL SEAL RINGS TO TRANSMISSION CASE

Install the two oil seals to the transmission case.

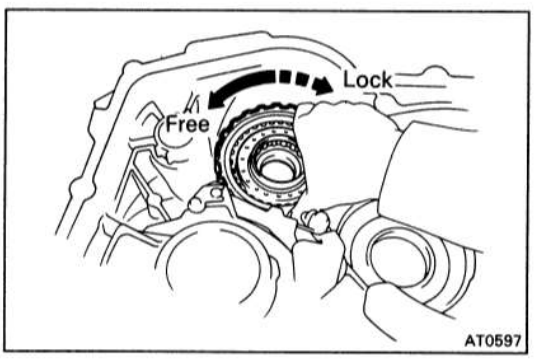


21. INSTALL UNDERDRIVE ONE-WAY CLUTCH



22. INSTALL ANTI-RATTLE CLIP

In the place shown in the figure (the space between the one-way clutch outer race and case), push the anti-rattle clip in until you hear the "click".

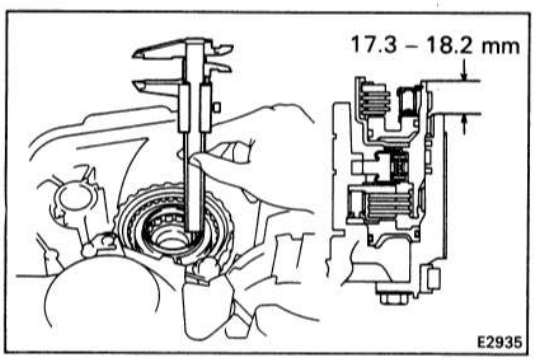


23. INSTALL UNDERDRIVE CLUTCH ASSEMBLY

(a) Align the flukes of discs in the underdrive brake.

(b) Install the clutch assembly.

(c) Turn the clutch assembly. The clutch assembly should turn freely counterclockwise and should lock clockwise.

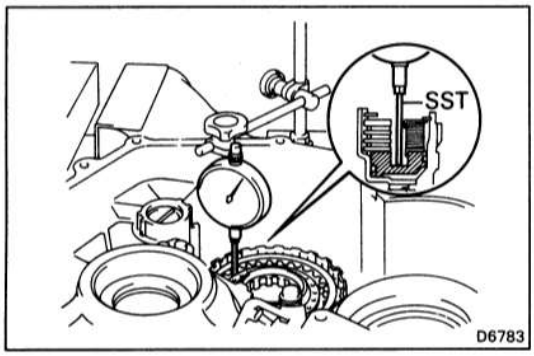


24. CHECK HEIGHT OF CLUTCH ASSEMBLY

Using vernier calipers, check the height from the sleeve to the inner race.

Height: 17.3 – 18.2 mm (0.681 – 0.717 in.)

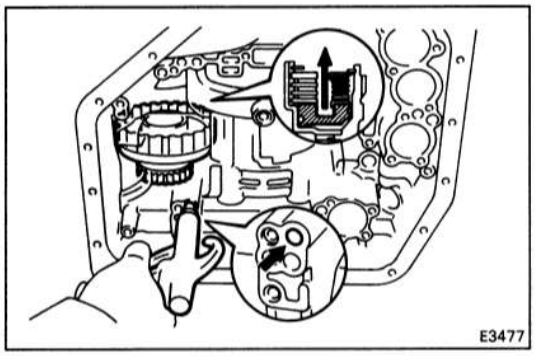
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25. CHECK PISTON STROKE OF UNDERDRIVE CLUTCH

(a) Set a dial indicator (long type pick or SST) as shown.

SST 09350-32014 (09351-32190)



(b) Applying and releasing the compressed air (4 – 8 kg/cm², 57 – 114 psi, 392 – 785 kPa), measure the underdrive clutch piston stroke.

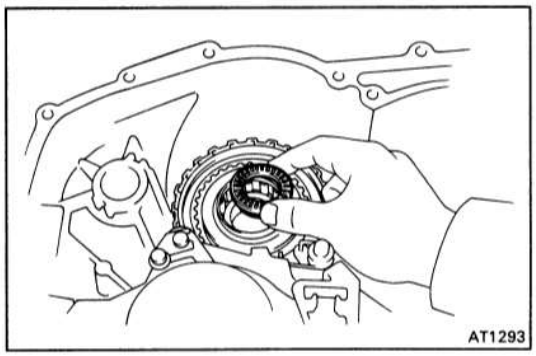
Piston stroke: 1.22 – 1.54 mm (0.0480 – 0.0606 in.)

If the piston stroke is less than limit, parts may have been misassembled. Check them.

If the piston stroke is nonstandard, select another flange.

HINT: There are two different flange thicknesses.

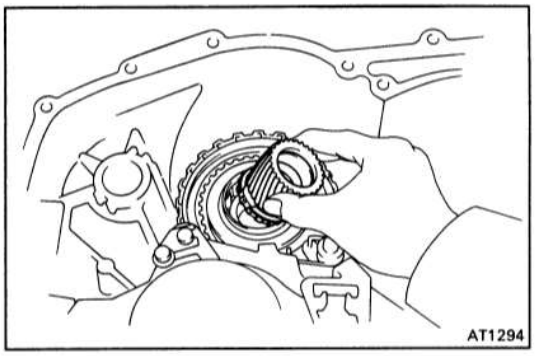
Flange thickness: 2.30 mm (0.0906 in.)
2.50 mm (0.0984 in.)
2.70 mm (0.1063 in.)



26. INSTALL BEARING WITH RACE

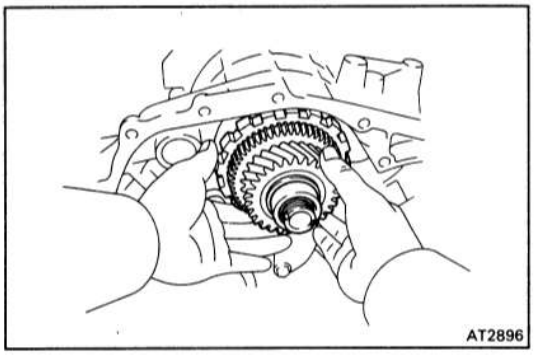
Install the thrust bearing with race, with the bearing facing upward.

Bearing: Outer diameter 45.2 mm (1.780 in.)
Inner diameter 31.0 mm (1.220 in.)



27. INSTALL SUN GEAR TO CASE

Install the sun gear of the counter shaft to the case.

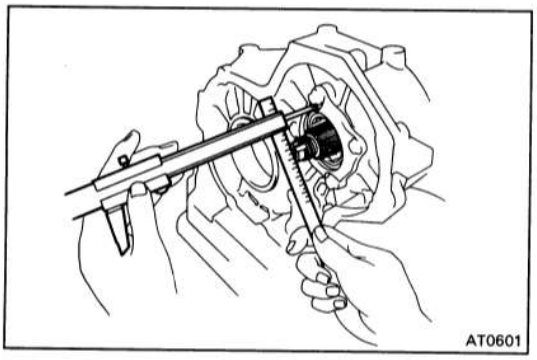


28. INSTALL COUNTER SHAFT ASSEMBLY

(a) Align the flukes of the discs in the underdrive clutch.

(b) Install the counter shaft assembly.

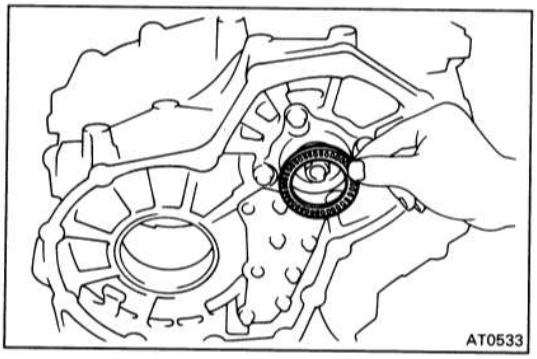
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29. CHECK HEIGHT OF COUNTER SHAFT

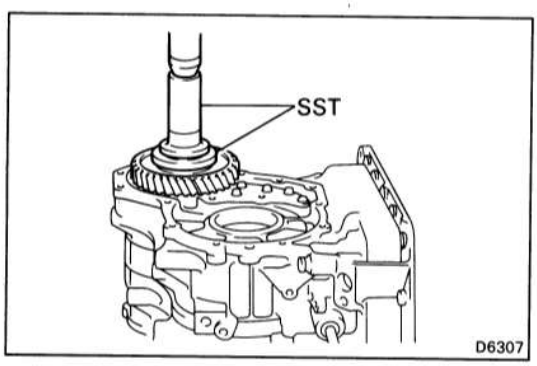
Using vernier calipers, measure the distance between the tip of the counter shaft and bolt seat of the clutch support.

Height: 33.3 – 35.5 mm (1.311 – 1.398 in.)



30. INSTALL THRUST NEEDLE BEARING

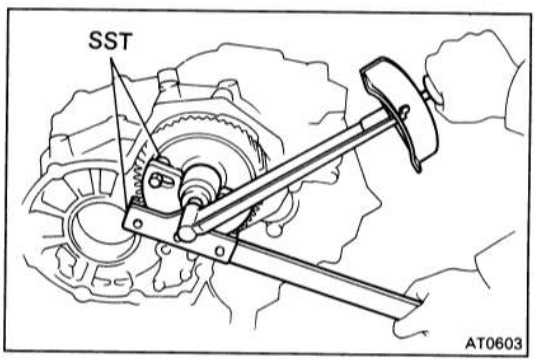
Bearing: Outer diameter 57.7 mm (2.272 in.)
Inner diameter 41.0 mm (1.614 in.)



31. INSTALL COUNTER DRIVEN GEAR

Using SST and press, press in the driven gear.

SST 09350-32014 (09351-32100, 09351-32140)



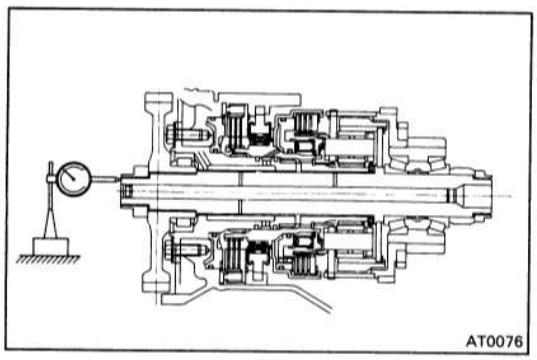
32. TIGHTEN NEW LOCK NUT

(a) Using SST to hold the driven gear, tighten a new lock nut.

SST 09330-00021 and 09350-32014 (09351-32032)

Torque: 1,600 kg-cm (116 ft-lb, 157 N·m)

(b) Remove SST.

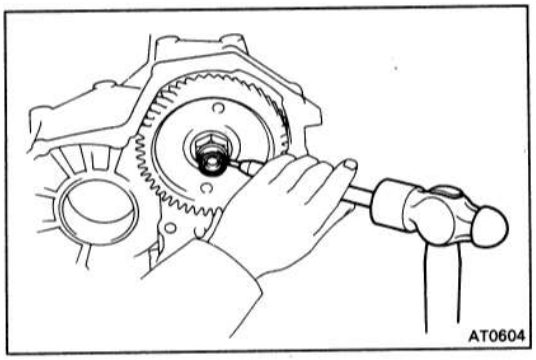


33. CHECK END PLAY OF COUNTER SHAFT

Using a dial indicator, measure the end play of the counter shaft.

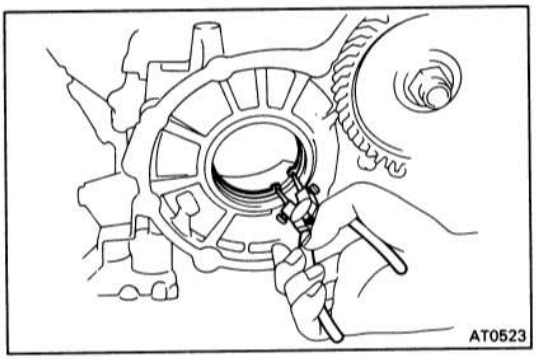
End play: 0.23 – 0.89 mm (0.0091 – 0.0350 in.)

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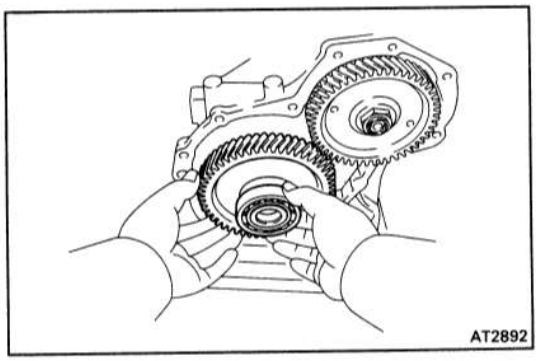
34. STAKE LOCK NUT

Using a punch and hammer, stake the lock nut.

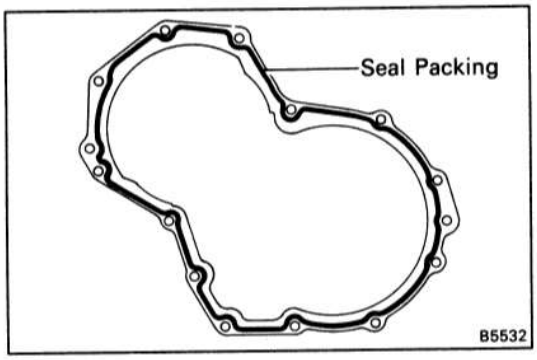


35. INSTALL SNAP RING TO TRANSMISSION CASE

Using snap ring pliers, install the snap ring to the transmission case.



36. INSTALL INTERMEDIATE SHAFT

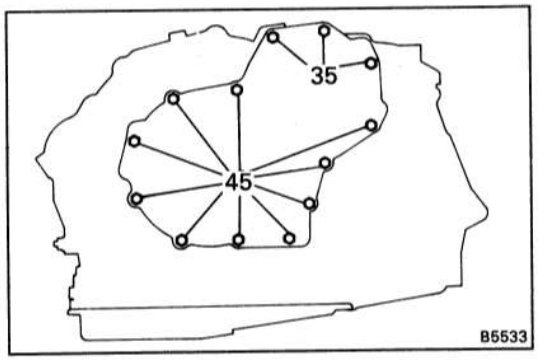


37. INSTALL TRANSAXLE REAR COVER

(a) Remove any packing material and be careful not to get oil on the contacting surfaces of the transaxle rear cover or transmission case.

(b) Apply seal packing to the rear cover as shown.

Seal packing: Part No.08833-00090, THREE BOND 1131, LOCTITE 518 or equivalent

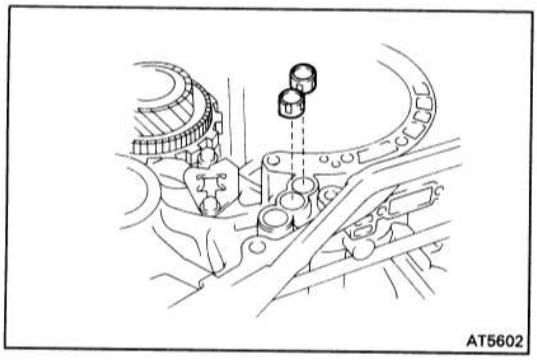


(c) Install and tighten the thirteen bolts.

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

HINT: Each bolt length (mm) is indicated in the figure.

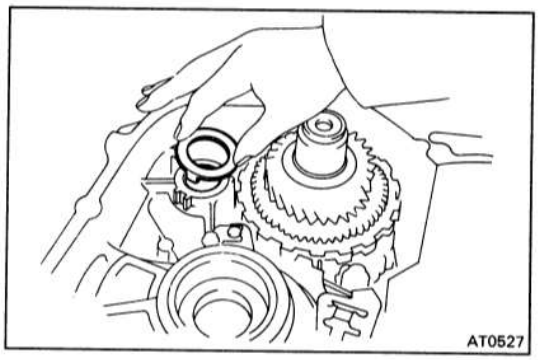
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38. INSTALL NEW APPLY GASKETS

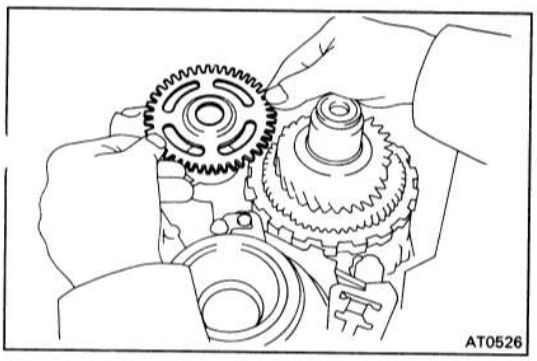
Install the two new apply gaskets.

HINT: The oil seal may be inserted with either end up or down.

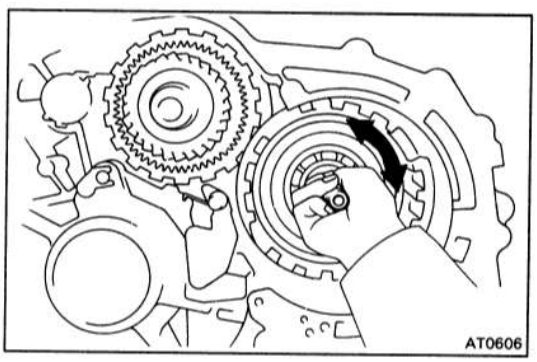


39. INSTALL GOVERNOR DRIVEN GEAR

(a) Install the thrust washer.

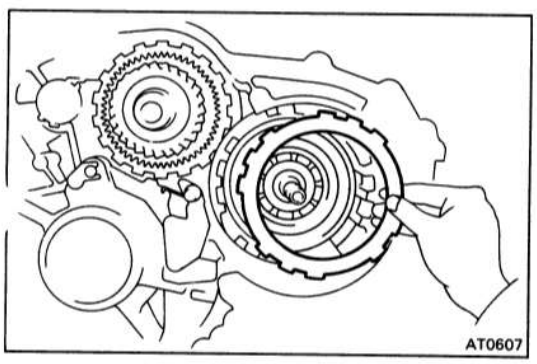


(b) Install the governor driven gear.



40. CHECK INTERMEDIATE SHAFT

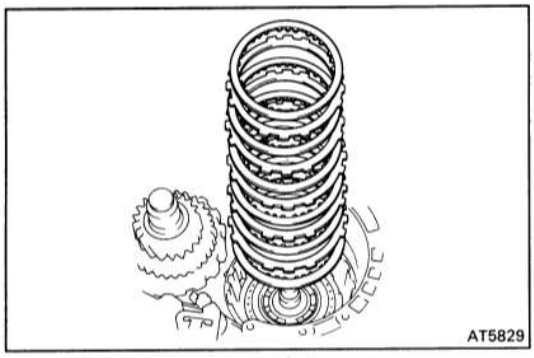
Make sure that the intermediate shaft turns smoothly.



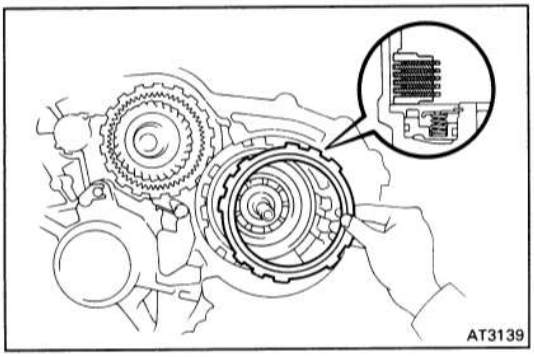
41. INSTALL DISCS, PLATES AND FLANGE

(a) Install the inner flange, facing the flat end upward.

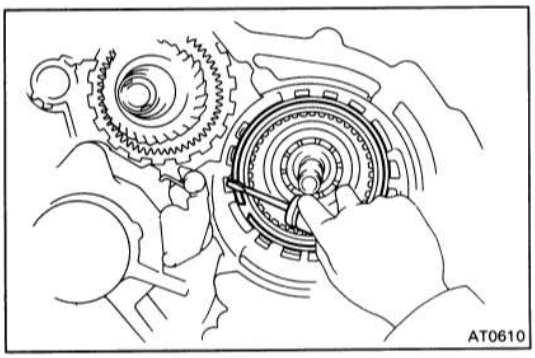
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(b) Install in order: D = Disc P = Plate
D – P – D – P – D – P – D – P – D – P – D

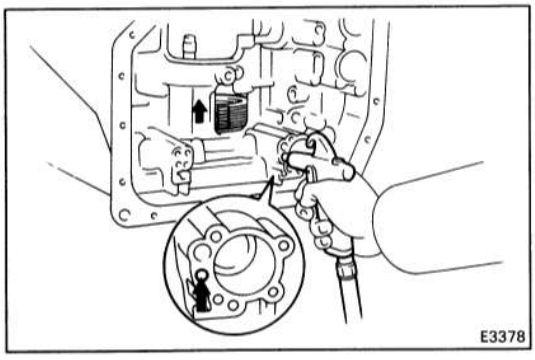


(c) Install the outer flange, the flat end facing downward.



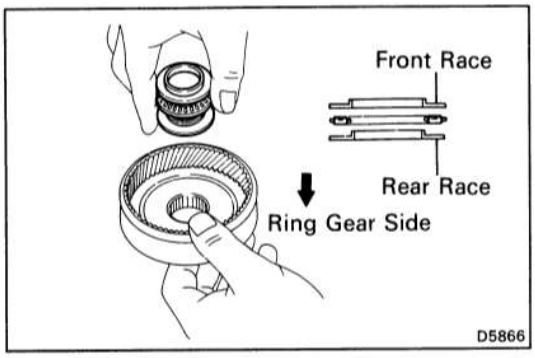
42. INSTALL SNAP RING

HINT: Be sure the snap ring end gap is not aligned with one of the cutouts.



43. CONFIRM THAT FIRST AND REVERSE BRAKE PISTON MOVES

Using compressed air, confirm that the first and reverse brake piston moves smoothly.



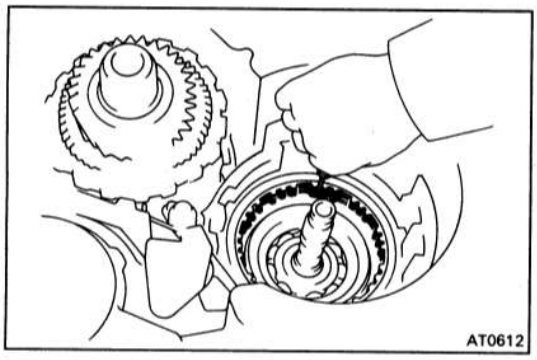
44. INSTALL REAR PLANETARY RING GEAR TO CASE

(a) Coat the races and bearing with petroleum jelly, and install them onto the ring gear as shown.

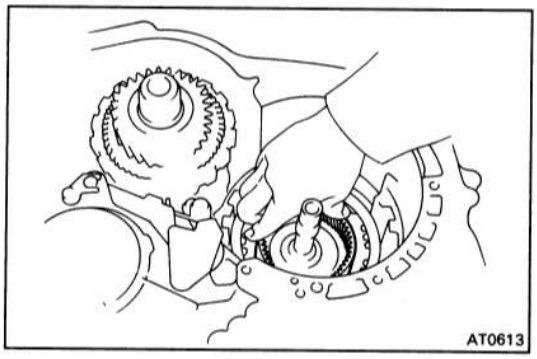
Bearing and races: mm (in.)

	Outer diameter	Inner diameter
Front Race	37.3 (1.469)	24.1 (0.949)
Bearing	37.6 (1.480)	24.0 (0.945)
Rear Race	37.6 (1.480)	22.2 (0.874)

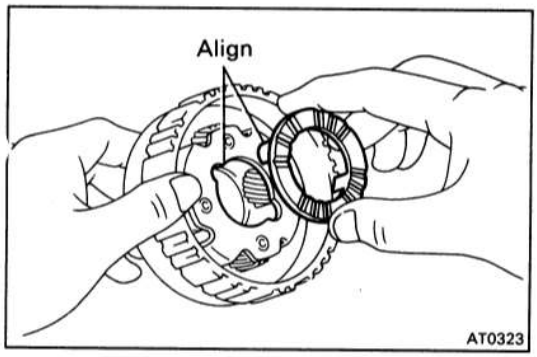
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(b) Using a screwdriver, align the flukes of the discs.



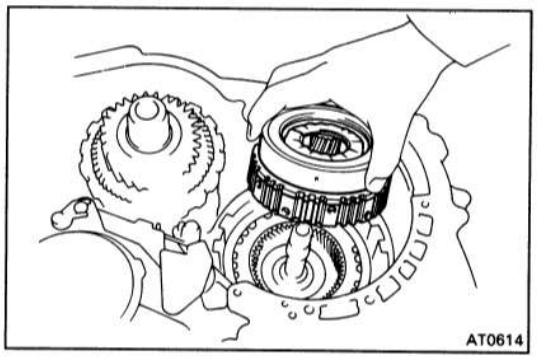
(c) Install the rear planetary ring gear into the case.



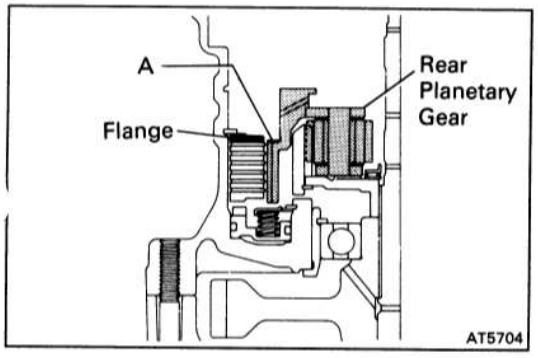
45. INSTALL REAR PLANETARY GEAR

(a) Coat thrust washer with petroleum jelly and install it onto the planetary gear.

HINT: Make sure that the different lug shapes match the openings on the gear.

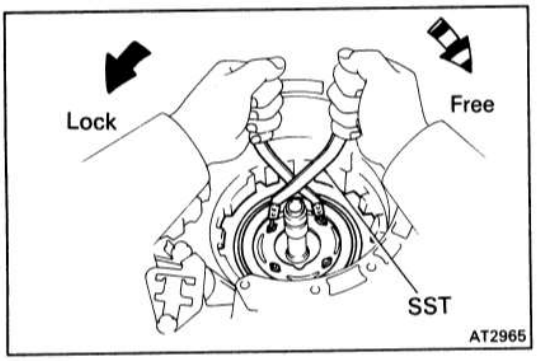


(b) Align the spline of the planetary gear with the flukes of the discs and install the planetary gear into the first and reverse brake discs.



(c) Check that parts A of the rear planetary gear is below the upper surface of the flange.

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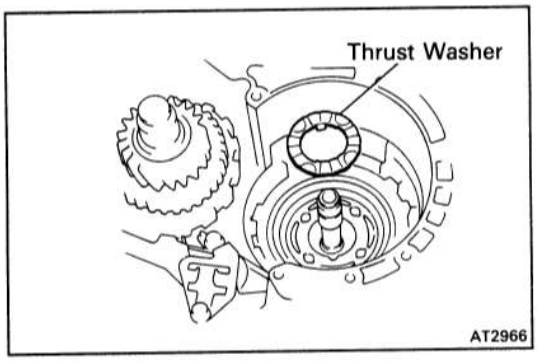
46. INSTALL NO. 2 ONE-WAY CLUTCH

(a) Place the one-way clutch into the case, the shiny side facing upward.

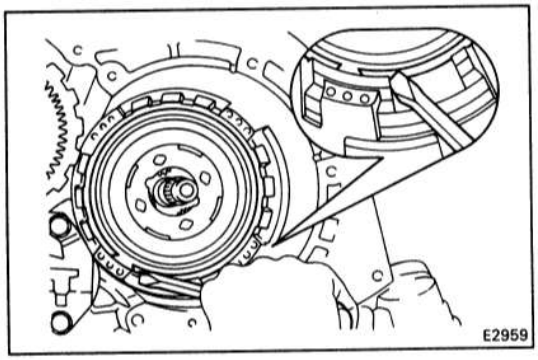
(b) Install the one-way clutch onto the inner race while turning the planetary gear clockwise with SST.

SST 09350-32014 (09351-32050)

(c) Check that the planetary gear turns freely clockwise and locks counterclokwise.

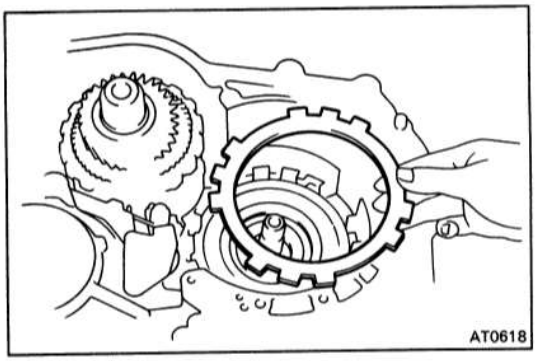


(d) Coat the thrust washer with petroleum jelly and install it onto the planetary gear.



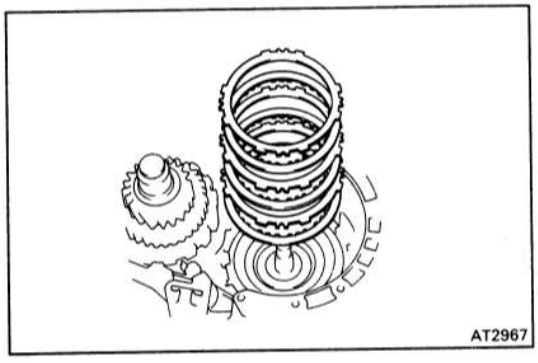
47. INSTALL SNAP RING

Be sure the end gap of the snap ring is not aligned with one of the cutouts.



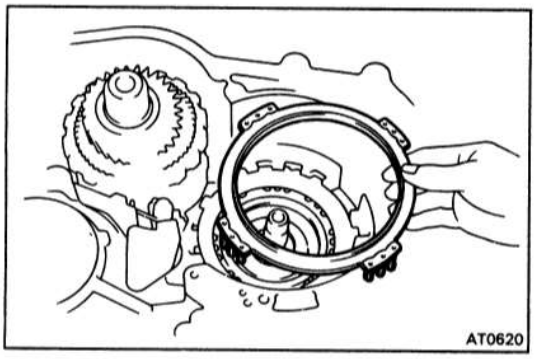
48. INSTALL SECOND BRAKE INTO CASE

(a) Install the flange, the flat side facing upward.



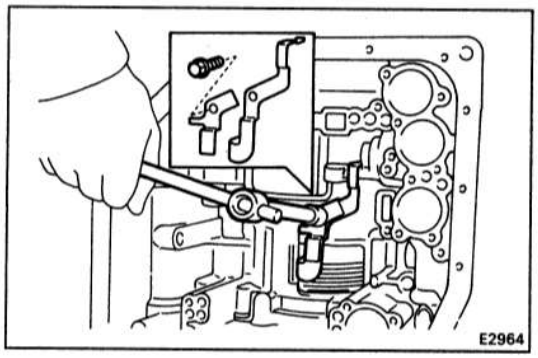
(b) Install the discs and plates in order.
D = Disc P = Plate
D – P – D – P – D – P

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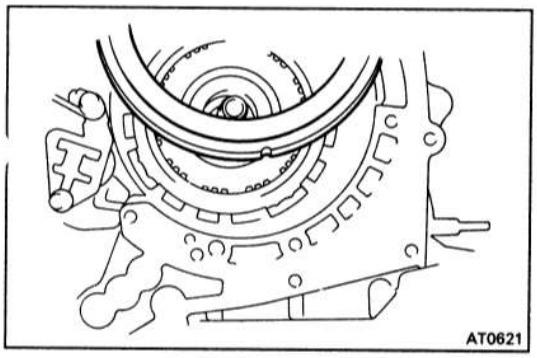
49. INSTALL SECOND BRAKE PISTON RETURN SPRING

Install each of the springs over the protrusions in the case.



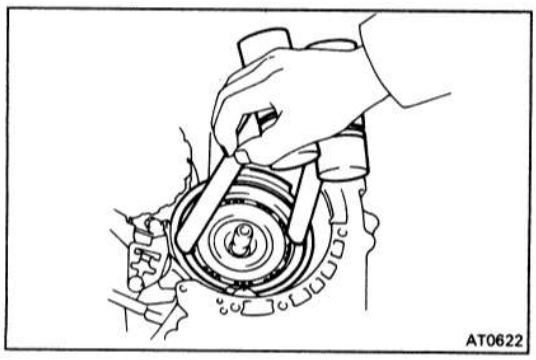
50. INSTALL SECOND COAST BRAKE BAND GUIDE

Install the band guide so that its tip touches the case.



51. INSTALL SECOND BRAKE DRUM INTO CASE

Align the groove of the drum with the bolt and place it into the case.

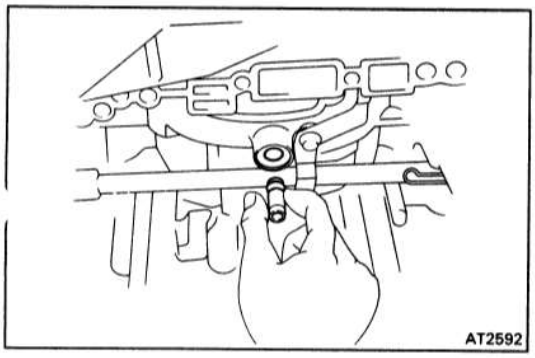


52. INSTALL SNAP RING

(a) Place the snap ring into the case so that the end gap is installed into the groove.

(b) While compressing the piston return springs over the drum with hammer handles, install the snap ring.

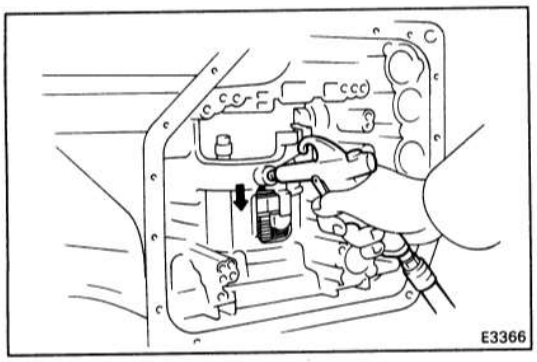
HINT: Be sure the end gap of the snap ring is not aligned with one of the cutouts.



53. INSTALL SECOND BRAKE DRUM GASKET

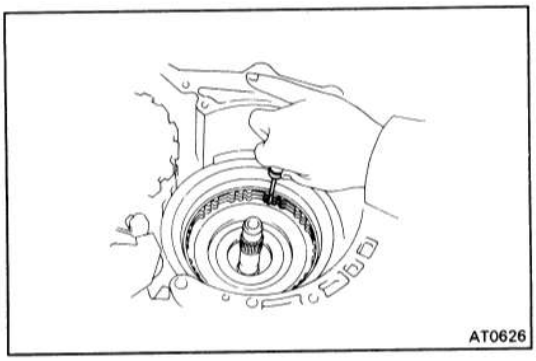
Drive in a new drum gasket until it makes contact with the second brake drum.

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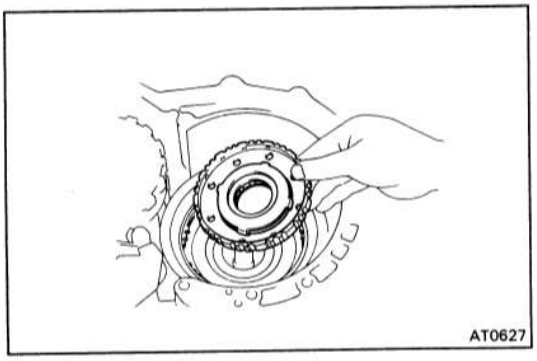
54. CONFIRM THAT SECOND BRAKE PISTON MOVES

Using compressed air, confirm that the second brake piston moves smoothly.

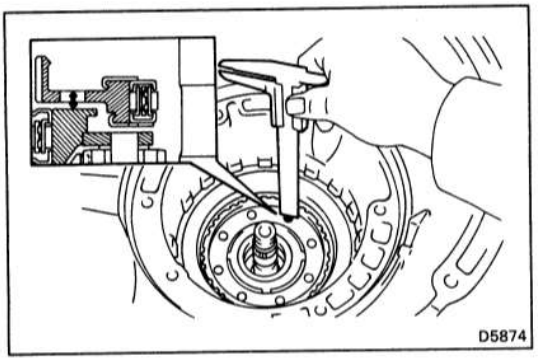


55. INSTALL SECOND BRAKE HUB AND NO. 1 ONE-WAY CLUTCH

(a) Using a screwdriver, align the flukes of the discs in the second brake.



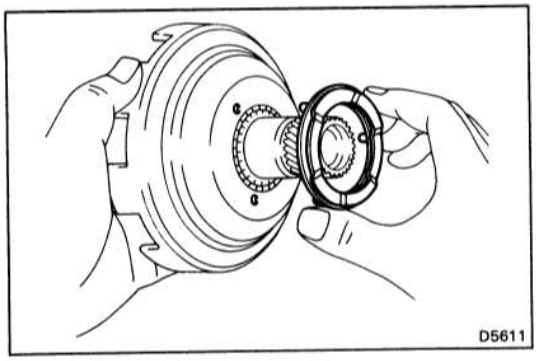
(b) Align the spline of the hub with the flukes of the discs and install the hub to the second brake discs.



56. CHECK SECOND BRAKE HUB INSTALLATION DISTANCE

Check the distance between the surface of the second brake hub and rear planetary gear.

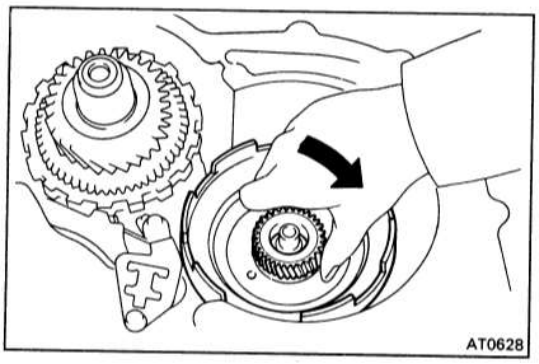
Distance: Approx. 5 mm (0.20 in.)



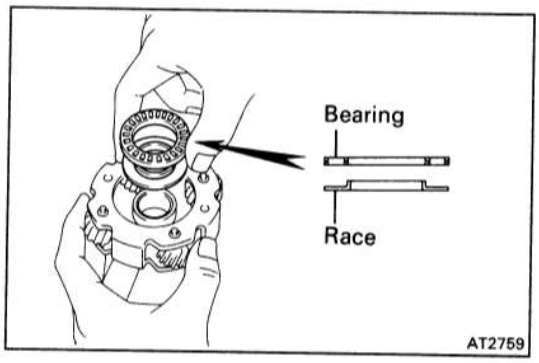
57. INSTALL SUN GEAR AND SUN GEAR INPUT DRUM

(a) Coat the thrust washer with petroleum jelly and install it on the sun gear input drum.

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(b) While turning the sun gear clockwise, install it into the No. 1 one-way clutch.

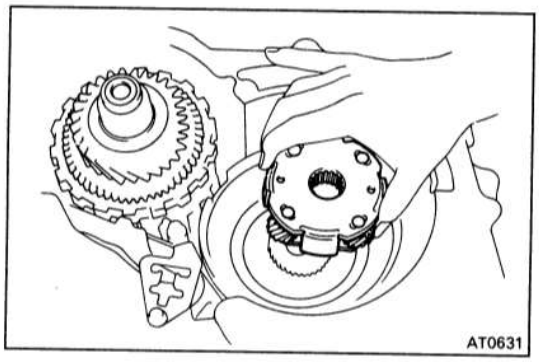


58. INSTALL FRONT PLANETARY GEAR

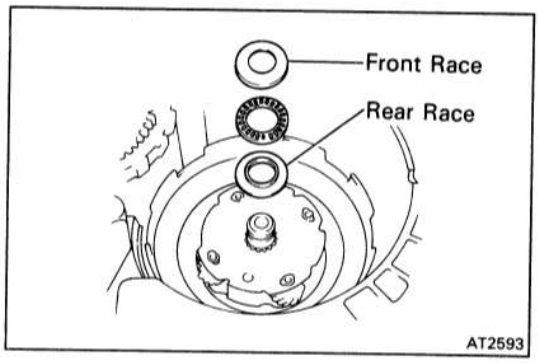
(a) Coat the race and bearing with petroleum jelly and install them onto the planetary gear.

Bearing and races: mm (in.)

	Outer diameter	Inner diameter
Bearing	45.0 (1.772)	30.0 (1.181)
Race	45.0 (1.772)	28.0 (1.102)



(b) Install the planetary gear.

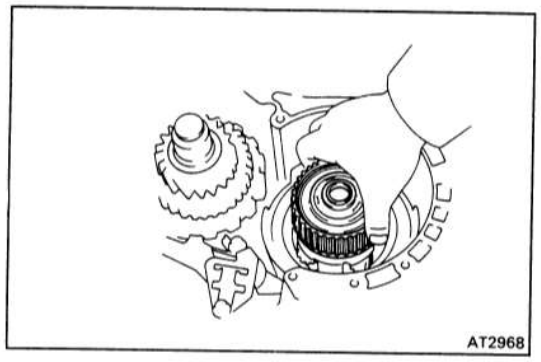


59. INSTALL FRONT PLANETARY RING GEAR

(a) Coat the races and bearing with petroleum jelly and install them onto the planetary ring gear.

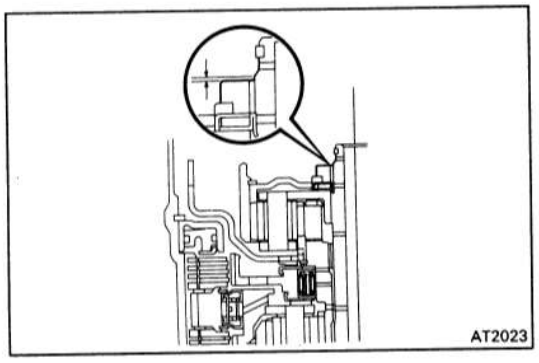
Bearing and races: mm (in.)

	Outer diameter	Inner diameter
Front Race	37.9 (1.492)	22.0 (0.866)
Bearing	36.1 (1.421)	22.2 (0.874)
Rear Race	35.0 (1.378)	19.0 (0.748)

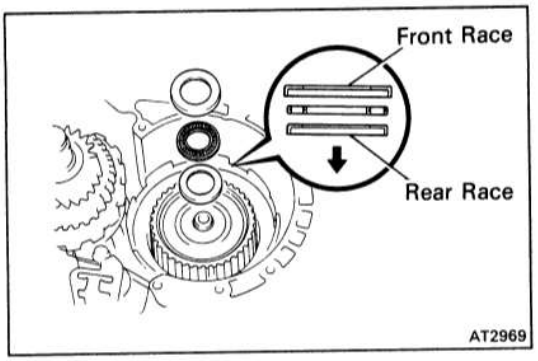


(b) Install the ring gear.

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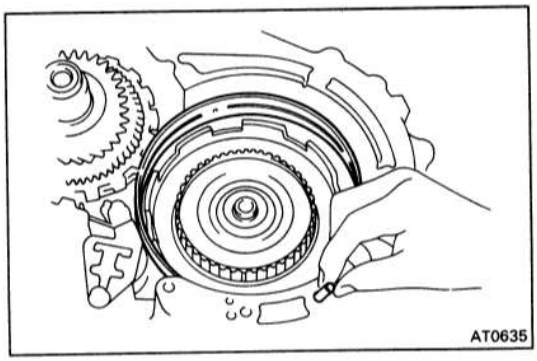
HINT: If the planetary ring gear and the other parts are installed correctly into the case, the end of the bushing with the ring gear flange will be flush with a shoulder of the intermediate shaft or under.



(c) Coat the races and bearing with petroleum jelly and install them onto the tip of ring gear flange as shown.

Bearing and races: mm (in.)

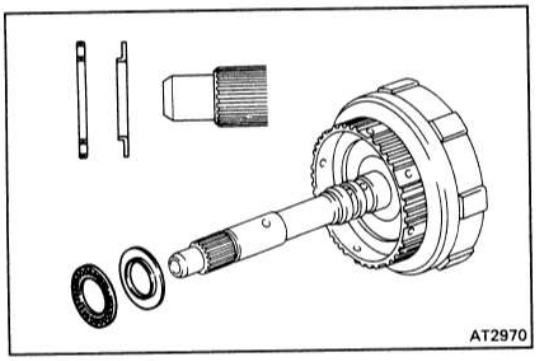
	Outer diameter	Inner diameter
Front Race	37.9 (1.492)	22.0 (0.866)
Bearing	36.1 (1.421)	22.2 (0.874)
Rear Race	35.7 (1.406)	23.0 (0.906)



60. INSTALL SECOND COAST BRAKE BAND

(a) Place the band into the case.

(b) Install the pin through the oil pump mounting bolt hole.

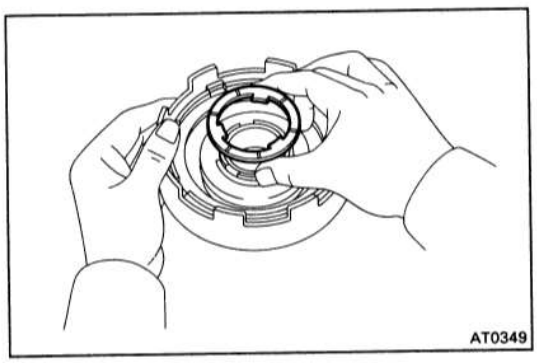


61. INSTALL FORWARD CLUTCH AND DIRECT CLUTCH

(a) Coat the race and bearing with petroleum jelly, and install them onto the forward clutch drum.

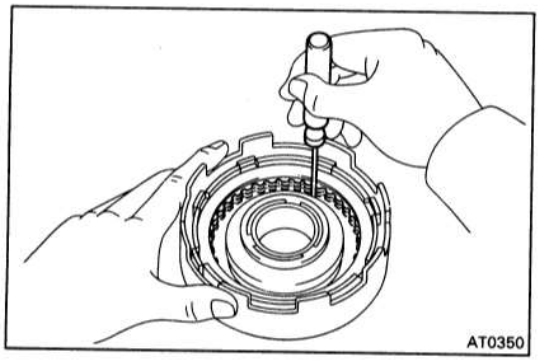
Bearing and race: mm (in.)

	Outer diameter	Inner diameter
Bearing	42.0 (1.654)	28.9 (1.138)
Race	42.0 (1.654)	27.1 (1.067)

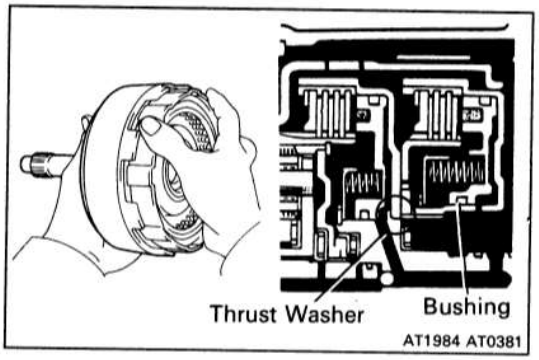


(b) Coat the clutch drum thrust washer with petroleum jelly, and install it onto the direct clutch drum with the oil groove facing upward.

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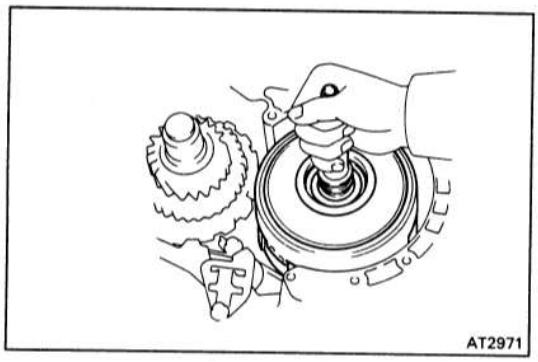


(c) Using a screwdriver, align the flukes of discs in the direct clutch.



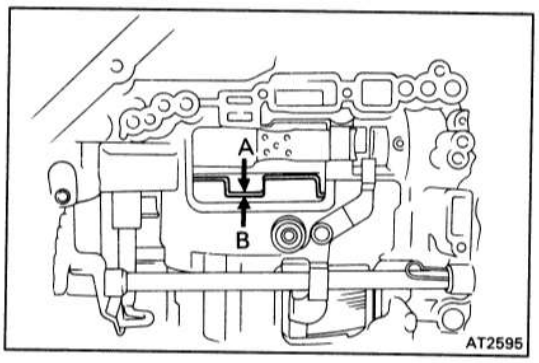
(d) Mesh the hub with the flukes of the direct clutch while turning the clutch drum or forward clutch.

HINT: If the flukes of the discs are meshed with the hub correctly, the end of the bushing with the direct clutch drum will be flush with the surfaces of the forward clutch.



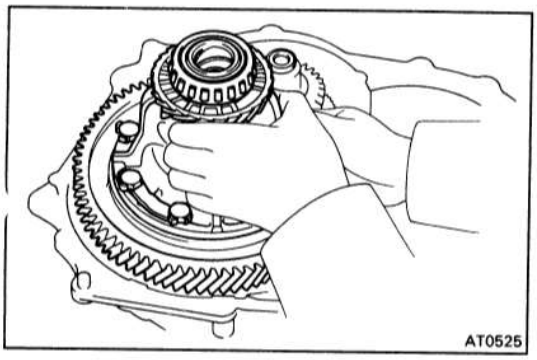
(e) Place the direct clutch and forward clutch into the case.

(f) While rotating the forward clutch to mesh the front planetary ring gear and discs, install them.



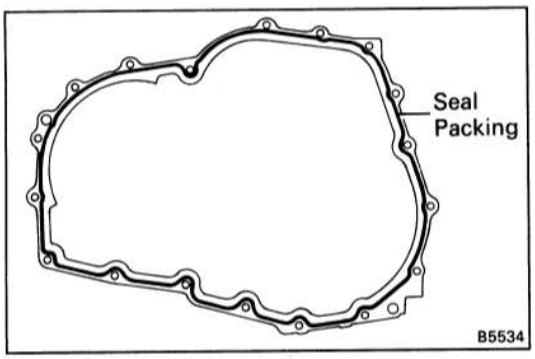
(g) Check the distance between A and B as shown in the illustration.

Distance: Approx. 3 mm (0.118 in.)



62. INSTALL DIFFERENTIAL

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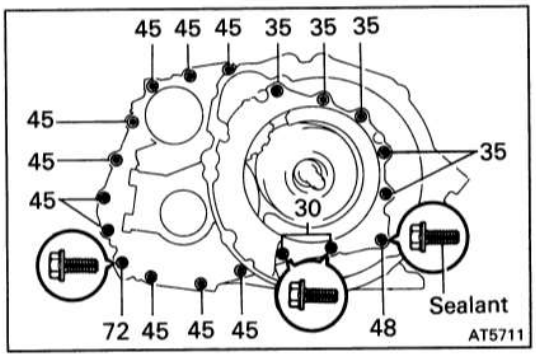


63. INSTALL TRANSAXLE HOUSING

(a) Remove any packing material and be careful not to get oil on the contacting surfaces of the transaxle housing or transmission case.

(b) Apply seal packing to the transaxle housing as shown.

Seal packing: Part No.08833-00090, THREE BOND 1131, LOCTITE 518 or equivalent.



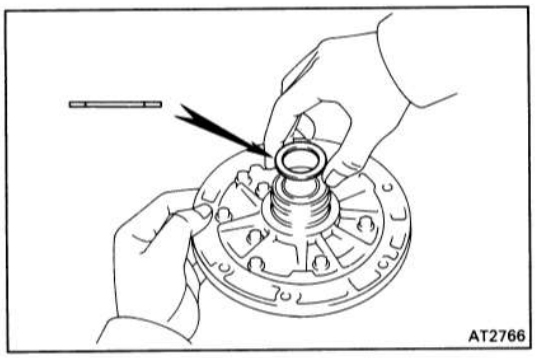
(c) Apply sealant to the bolt threads.

Sealant: Part No.08833-00080, adhesive 1344, THREE BOND 1344, LOCTITE 242 or equivalent

(d) Install and tighten the bolts.

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

HINT: Each bolt length (mm) is indicated in the illustration.

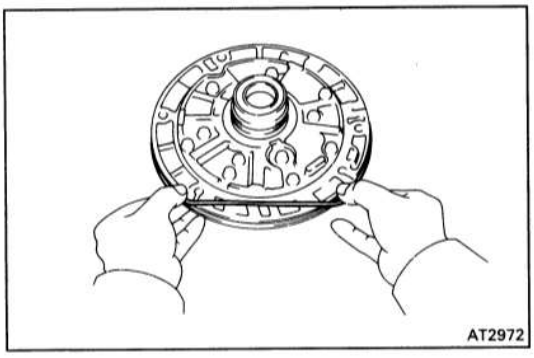


64. CHECK PRELOAD OF DIFFERENTIAL SIDE BEARING (See page AT-130)

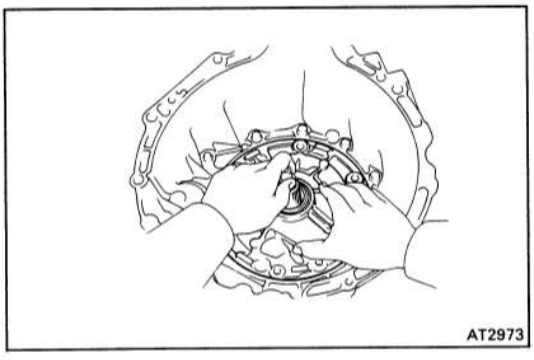
65. INSTALL OIL PUMP INTO CASE

(a) Coat the race with petroleum jelly and install it onto the stator shaft.

Race: Outer diameter 43.0 mm (1.693 in.)
Inner diameter 30.5 mm (1.201 in.)



(b) Coat the new O-ring with ATF, and install it to pump body.

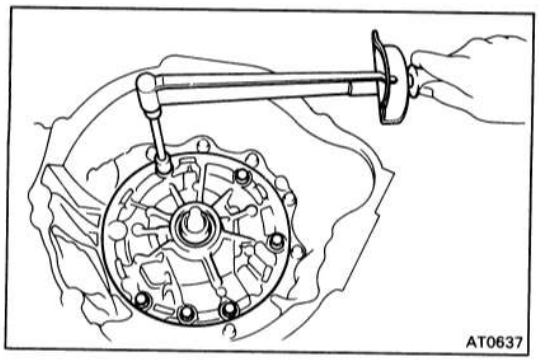


(c) Place the oil pump through the input shaft, and align the bolt holes of the pump body with the transmission case.

(d) Hold the input shaft, and lightly press the oil pump body to slide the oil seal rings on the stator shaft through the direct clutch drum.

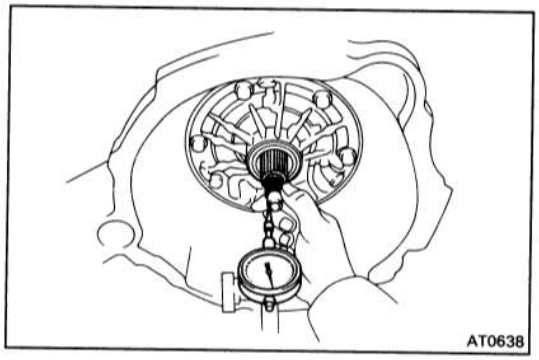
NOTICE: Do not push on the oil pump strongly, or the oil seal ring will stick to the direct clutch drum.

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(e) Install and tighten the six bolts.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)



66. MEASURE THRUST PLAY OF INPUT SHAFT

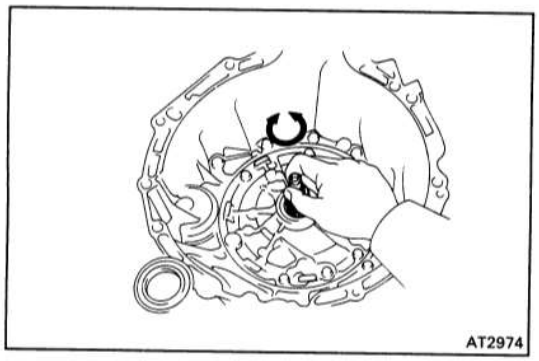
Measure the thrust play in axial direction.

Thrust play: 0.3 – 0.9 mm (0.012 – 0.035 in.)

If the play is not as specified, select and replace the race for the end of the stator shaft.

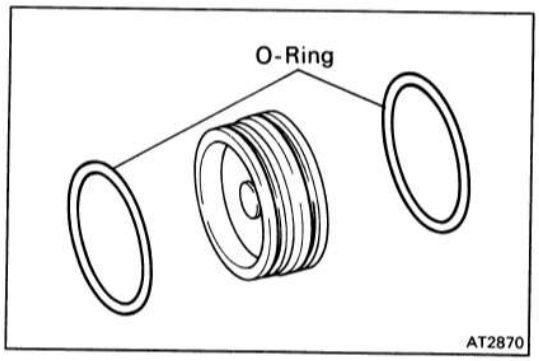
HINT: There are two different thicknesses of races. If necessary, select one of them.

Race thickness: 0.8 mm (0.031 in.)
1.4 mm (0.055 in.)



67. CHECK INPUT SHAFT ROTATION

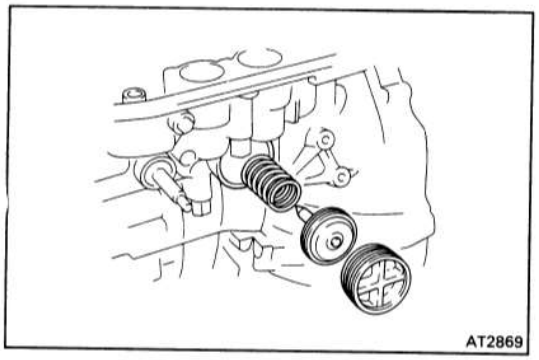
Make sure that the input shaft rotates smoothly.



68. INSTALL SECOND COAST BRAKE PISTON

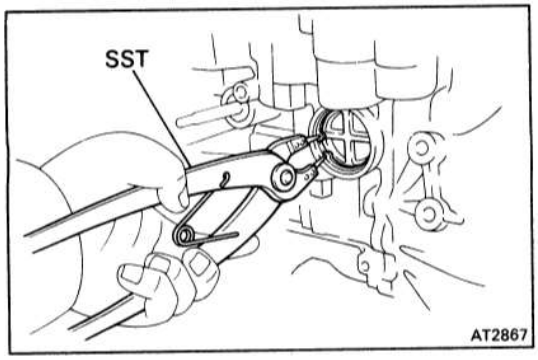
(a) Install the two new O-rings to the cover.

HINT: Coat the O-rings with ATF before installing.



(b) Install the spring, piston and cover into the bore.

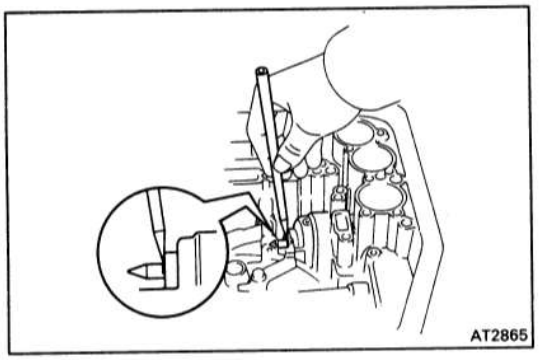
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(c) Using SST, install the snap ring while pressing the cover.

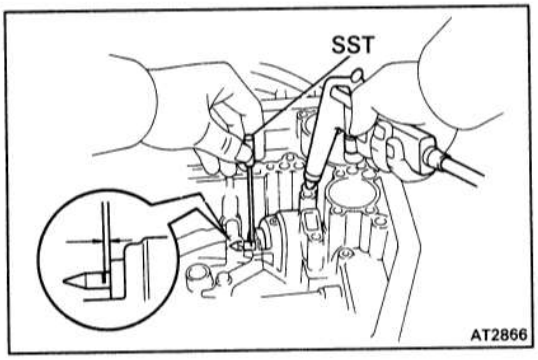
SST 09350-32014 (09351-32050)

(d) Check that the front end of the piston rod contacts the center of the second brake band depression.



69. MEASURE PISTON STROKE OF SECOND COAST BRAKE

(a) Apply a small amount of paint to the piston rod at the point it meets the case as shown in the illustration.

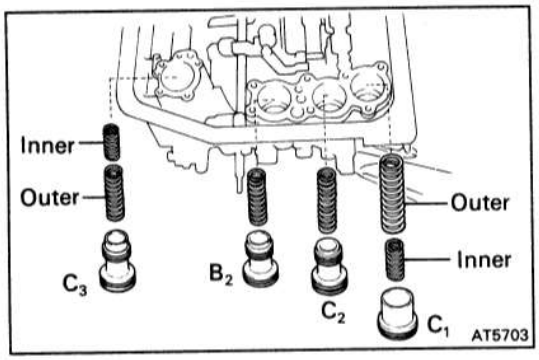


(b) Using SST, measure the piston stroke applying and releasing the compressed air (4 - 8 kg/cm^2, 57 - 114 psi, 392 - 785 kPa) as shown.

SST 09240-00020

Piston stroke: 1.5 – 3.0 mm (0.059 – 0.118 in.)

If it is still more than standard value, replace the brake band with a new one.



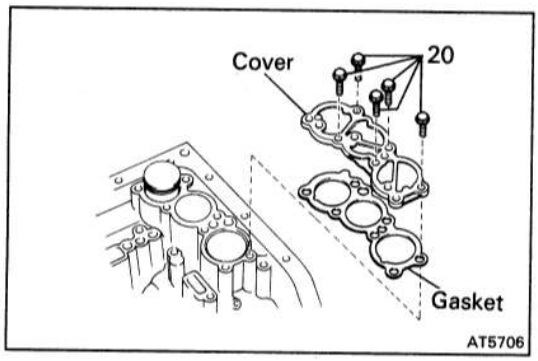
70. INSTALL ACCUMULATOR PISTONS AND SPRINGS

(a) Coat the new O-rings with ATF, and install them to the pistons.

(b) Install the pistons and springs to the case.

Spring		Free length mm (in.)	Color
C_1	Outer	74.1 (2.917)	Pink
	Inner	41.0 (1.614)	Pink
C_2		62.5 (2.461)	Pink
B_2		64.5 (2.539)	Green
C_3	Outer	65.2 (2.570)	Blue
	Inner	48.0 (1.890)	Orange

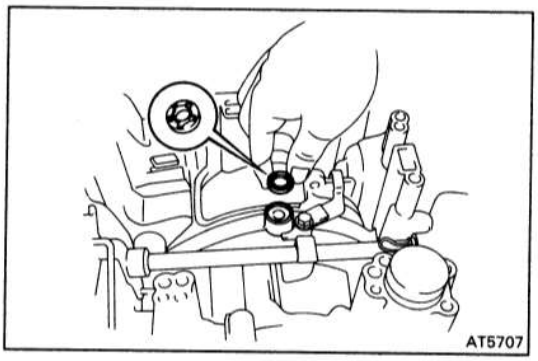
cardiagn.com



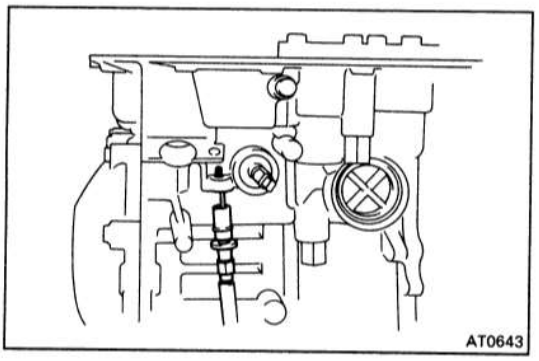
(c) Place the cover with a new gasket and gradually tighten the bolts a little a time in sequence.

HINT: Each bolt length (mm (in.)) is indicated in the figure.

Torque: 100 kg-cm (7 ft-lb, 10 N·m)



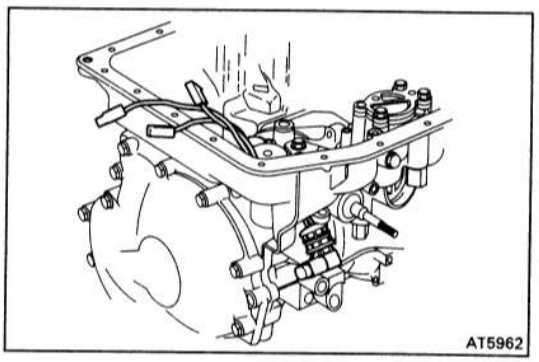
71. INSTALL NEW SECOND BRAKE APPLY GASKET



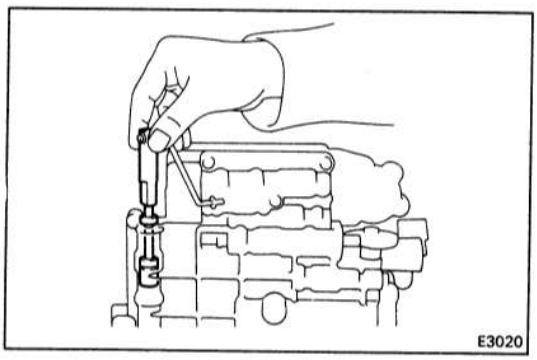
72. INSTALL THROTTLE CABLE IN CASE

Push the cable through the hole on the case, being careful not to damage the O-ring. Check for full seating.

NOTICE: In subsequent work, to avoid breaking the cable fitting do not roll the case over the cable.



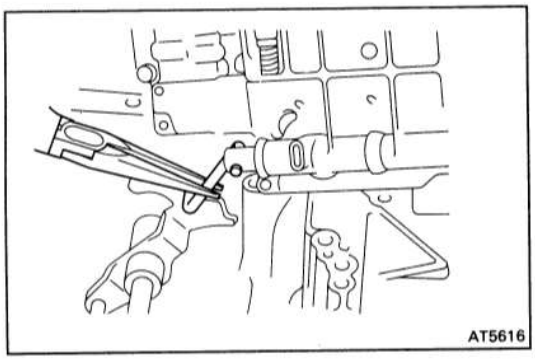
73. INSTALL SOLENOID WIRE



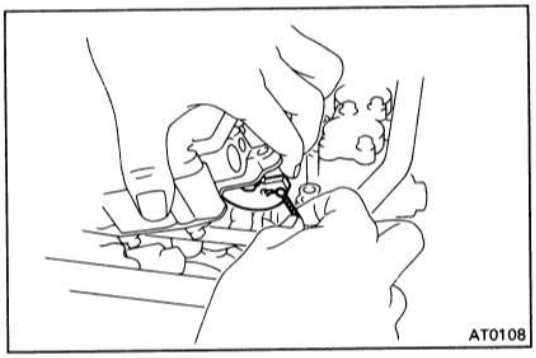
74. INSTALL VALVE BODY

(a) Coat the manual valve with ATF and install it to the valve body.

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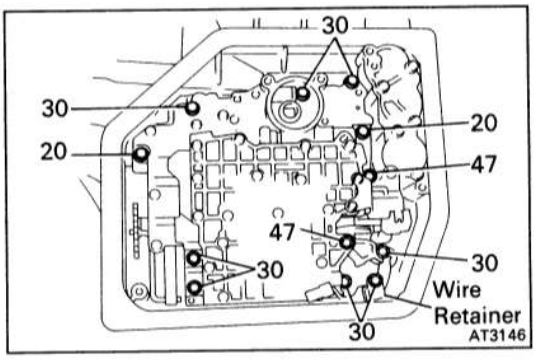


(b) Connect the connecting rod to the manual valve lever.



(c) Place the valve body on the transmission.

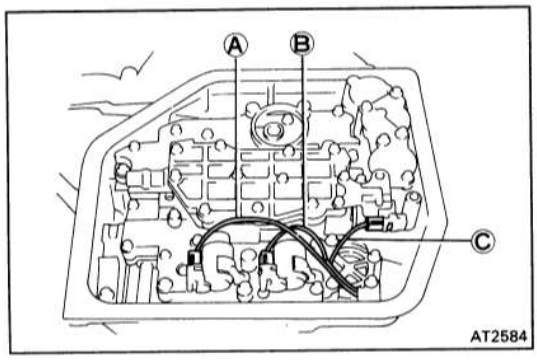
(d) While holding the cam down with your hand, slip the cable end into the slot.



(e) Install the twelve bolts and wire retainer shown in the illustration, and hand tighten all the bolts first. Then tighten them with a torque wrench.

HINT: Each bolt length (mm) is indicated in the illustration.

Torque: 100 kg-cm (7 ft-lb, 10 N·m)



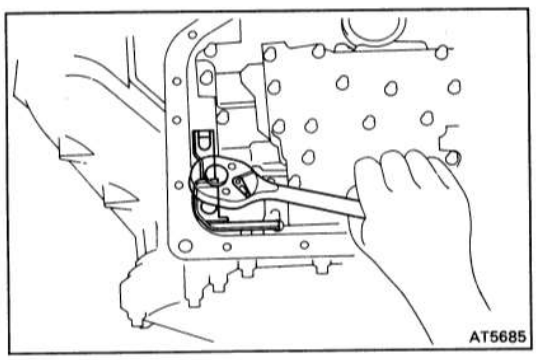
75. CONNECT SOLENOID CONNECTOR

HINT: Wire color

Ⓐ White

Ⓑ Black

Ⓒ Yellow



76. INSTALL MANUAL DETENT SPRING

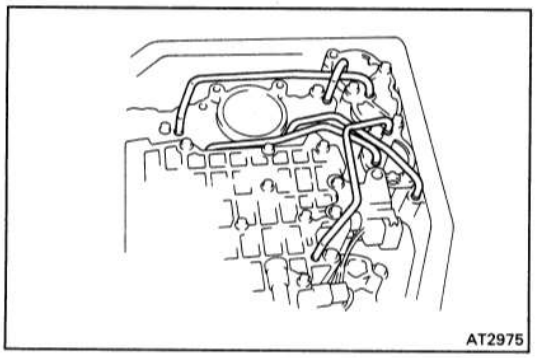
(a) Install the detent spring and cover in place, and install the bolt (length: 16mm).

(b) Hand tighten the bolt first, then tighten the bolt with a torque wrench.

Torque: 100 kg-cm (7 ft-lb, 10 N·m)

(c) Check that the manual valve lever is in contact with the center of the roller at the tip of the detent spring.

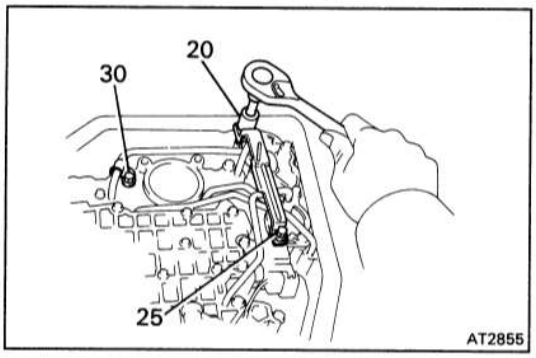
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77. INSTALL OIL TUBES

(a) Tap the tubes with a plastic hammer to install them into the positions indicated in the illustration.

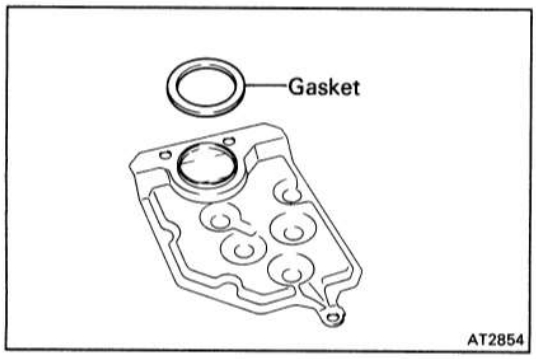
NOTICE: Be careful not to bend or damaged the tubes.



(b) Install the oil tube clamp and bracket.

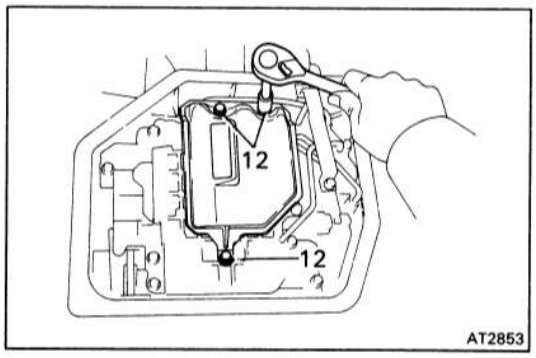
HINT: Each bolt length (mm) is indicated in the illustration. Hand tighten all bolts first, then tighten them with a torque wrench.

Torque: 100 kg-cm (7 ft-lb, 10 N·m)



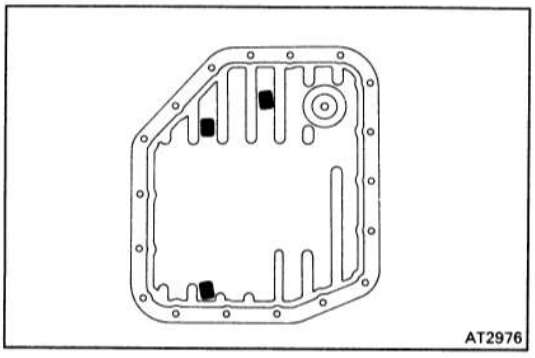
78. INSTALL OIL STRAINER

(a) Install the new gasket to the oil strainer.



(b) Install the oil strainer with the three bolts.

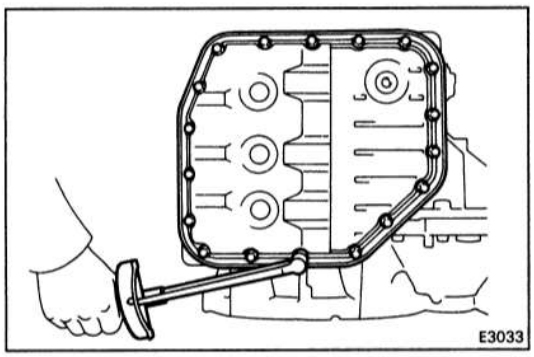
HINT: Each bolt length (mm) is indicated in the illustration.



79. INSTALL THREE MAGNETS IN OIL PAN

NOTICE: Make sure that the magnets do not interfere with the oil tubes.

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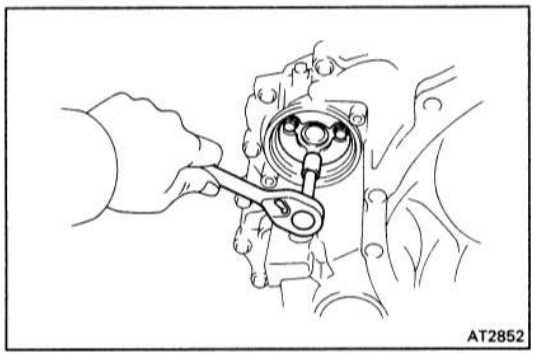


80. INSTALL OIL PAN

(a) Install a new gasket to the oil pan and install them to the transmission.

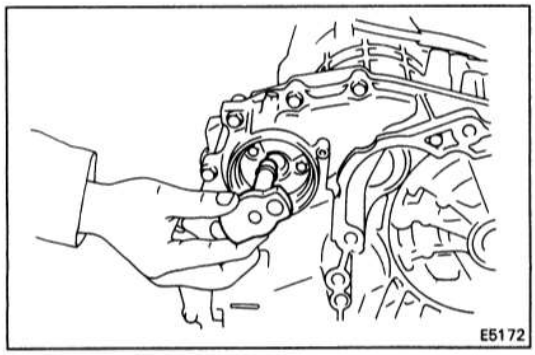
(b) Tighten the eighteen bolts.

Torque: 50 kg-cm (43 in.-lb, 4.9 N·m)

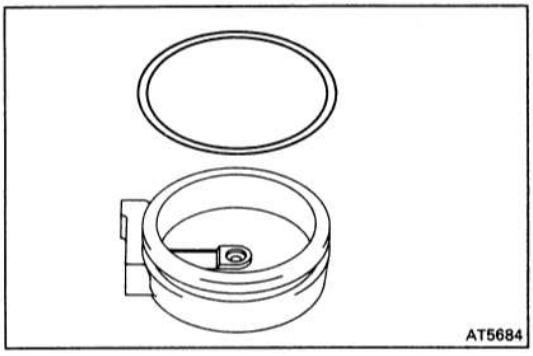


81. INSTALL SPEED SENSOR AND SENSOR ROTOR

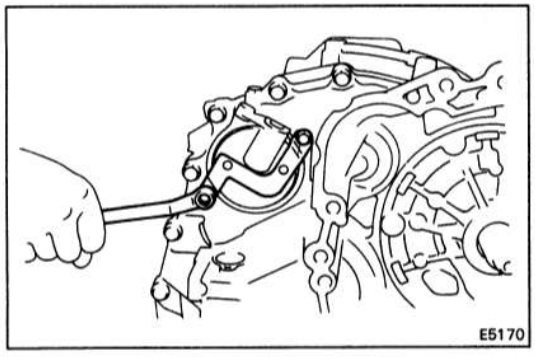
(a) Install the sensor adaptor with three bolts.



(b) Install the sensor rotor.



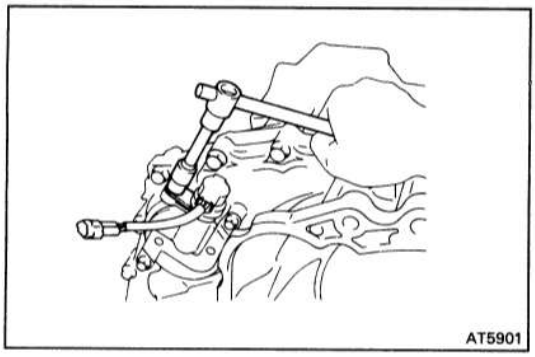
(c) Install a new O-ring to the sensor cover.



(d) Install the sensor cover to the transmission and then install the sensor cover bracket with the two bolts.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

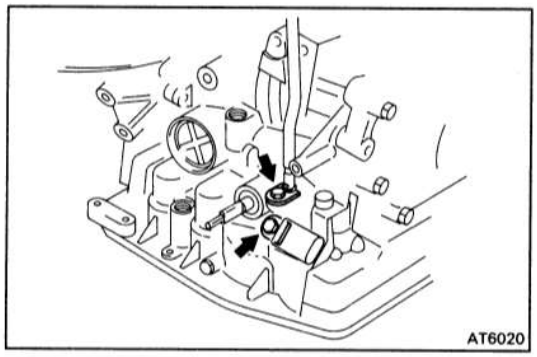
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(e) Coat a new O-ring with ATF and install it to the speed sensor.

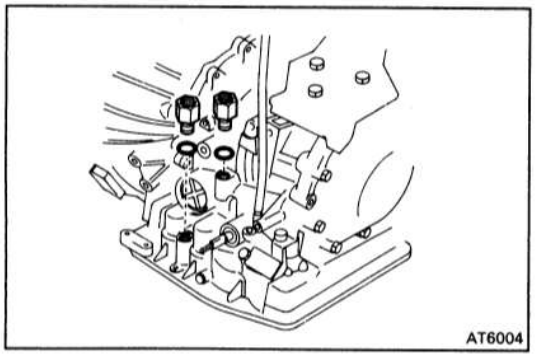
(f) Install the speed sensor and retaining plate.

Torque: 100 kg-cm (7 ft-lb, 10 N·m)



82. INSTALL SOLENOID WIRE RETAINING PLATE

83. INSTALL THROTTLE CABLE RETAINING PLATE

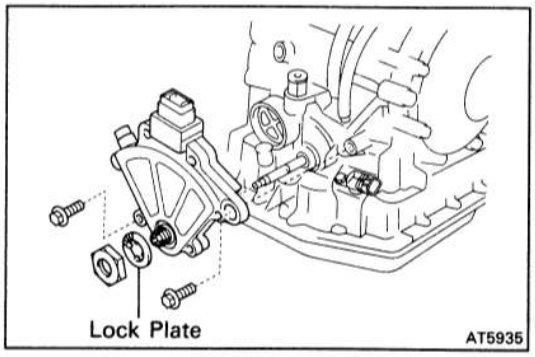


84. INSTALL UNION

(a) Install the new O-rings to the union.

(b) Install the union to the transaxle case.

Torque: 275 kg-cm (20 ft-lb, 27 N·m)



85. INSTALL NEUTRAL START SWITCH

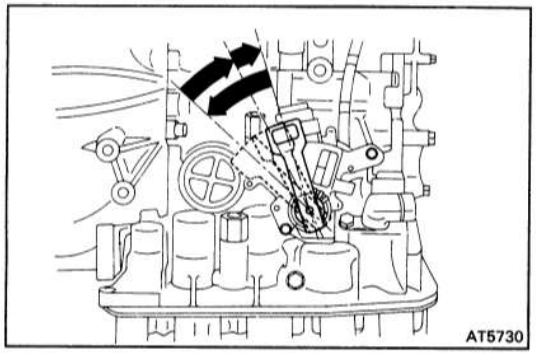
(a) Install the neutral start switch to the manual valve shaft.

(b) Place the new locking plate and tighten the nut.

Torque: 70 kg-cm (61 in.-lb, 6.9 N·m)

(c) Stake the nut with locking plate.

(d) Install the two bolts.

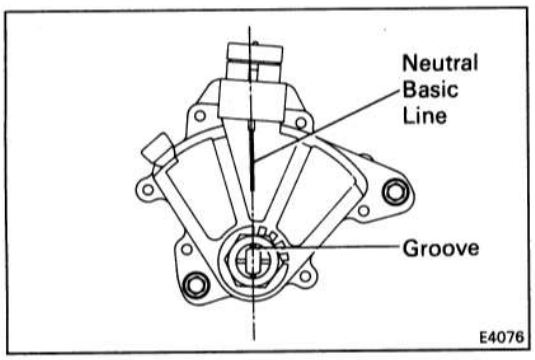


(e) Temporarily install the manual shift lever.

(f) Turn the lever counterclockwise until it stops, then turn it clockwise two notches.

(g) Remove the manual shift lever.

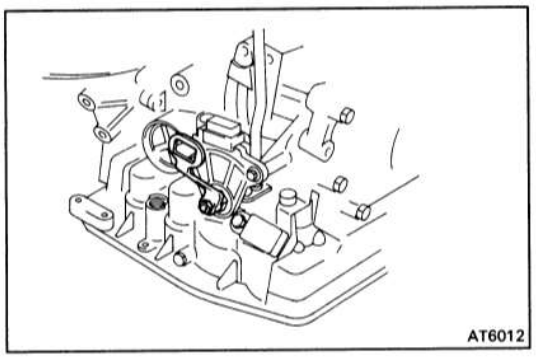
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(h) Align the groove and neutral basic line as shown.

(i) Install and tighten the two bolts.

Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)



86. INSTALL MANUAL SHIFT LEVER

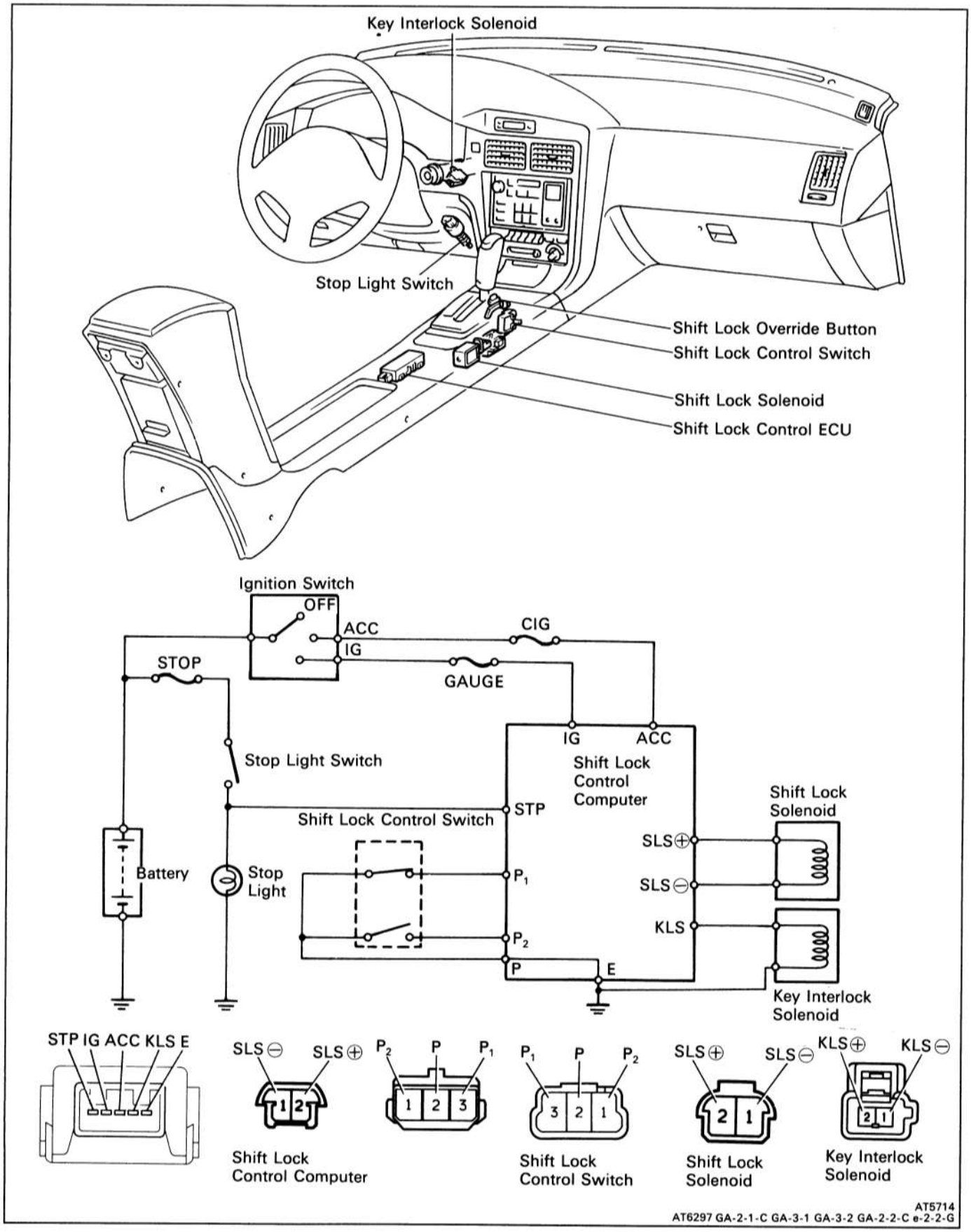
87. INSTALL FILLER TUBE AND TRANSMISSION DIPSTICK

88. INSTALL TWO OIL COOLER PIPES

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SHIFT LOCK SYSTEM

COMPONENT AND CIRCUIT

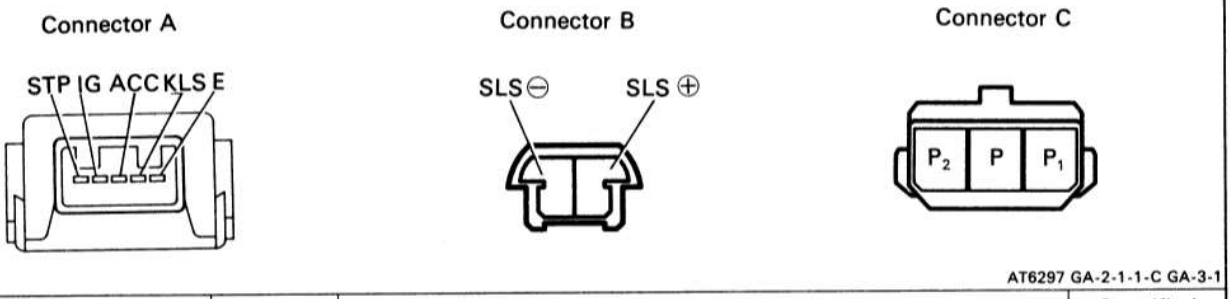


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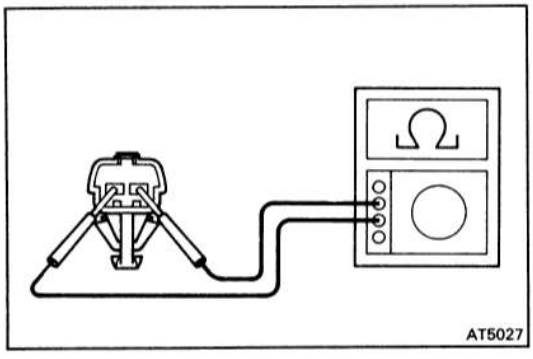
INSPECTION OF ELECTRIC CONTROL COMPONENTS

1. INSPECT SHIFT LOCK CONTROL ECU

Do not disconnect the ECU connector.
Measure the voltage and continuity between terminals.



Connector	Terminal	Measured Item	Measuring Condition	Specified Value
A	ACC – E	Voltage	Ignition switch ACC position	10 – 14 V
	IG – E	Voltage	Ignition switch ON position	10 – 14 V
	KLS – E	Voltage	① Ignition switch ACC position and "P" range	0 V
			② Ignition switch ACC position and other than "P" range	7.5 – 11.5 V
			③ ② and approx-after one second	6 – 9 V
	E – Ground	Continuity	All conditions	Continuity
	STP – E	Voltage	Release brake pedal	0 V
			Depress brake pedal	10 – 14 V
B	SLS⊖ – E	Continuity	All conditions	Continuity
	SLS⊕ – E	Voltage	① Ignition switch ON position and "P" range	0 V
			② ① and depress brake pedal	8.5 – 13.5 V
			③ ② and release brake pedal or ② and shift to range other than "P" range	0 V
C	P_2 – E	Voltage	① Ignition switch ACC position and "P" range	0 – 13.5 V
			② ① and push the shift lever knob, or Ignition switch ACC position and shift to range other than "P" range.	0 V
	P – E	Continuity	All conditions	Continuity
	P_1 – E	Voltage	Ignition switch ON position, "P" range and brake pedal depressed.	0 V
			Ignition switch ON position brake pedal depressed and shift to range other than "P" range	9 – 13.5 V



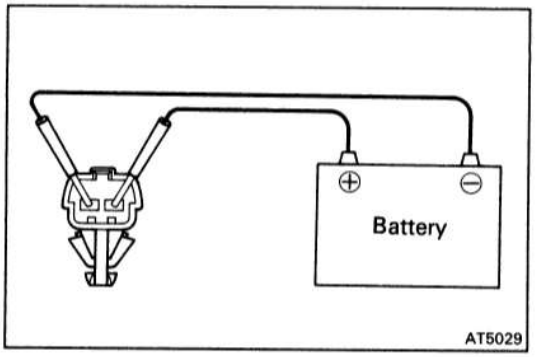
2. INSPECT SHIFT LOCK SOLENOID

(a) Disconnect the solenoid connector.

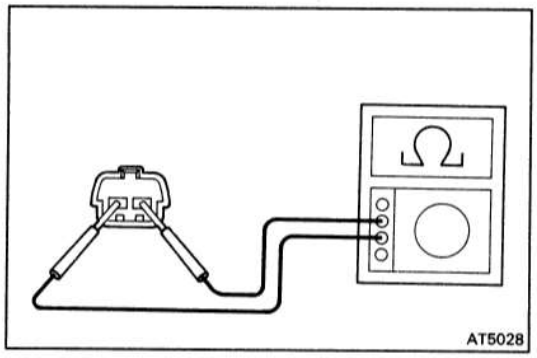
(b) Using an ohmmeter, measure the resistance between terminals.

Standard resistance: 21 – 27 Ω

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(c) Apply battery voltage between terminals. Check that an operation noise can be heard from the solenoid.

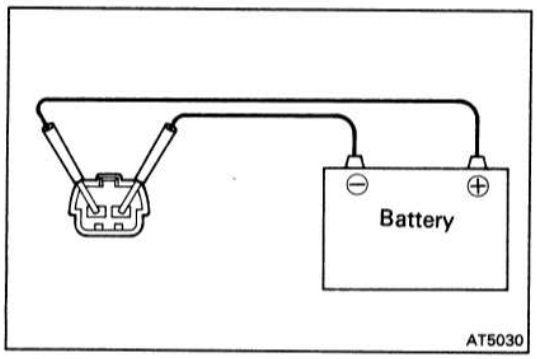


3. INSPECT KEY INTERLOCK SOLENOID

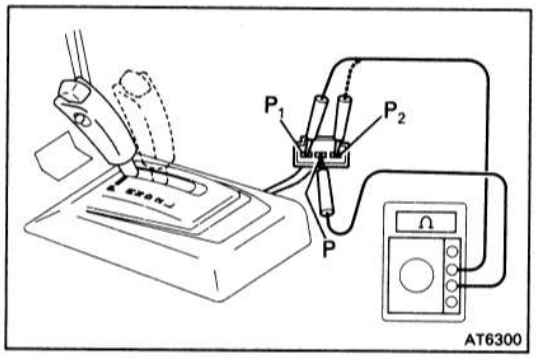
(a) Disconnect the solenoid connector.

(b) Using an ohmmeter, measure the resistance between terminals.

Standard resistance: 12.5 – 16.5 Ω



(c) Apply the battery voltage between terminals. Check that an operation noise can be heard from the solenoid.



4. INSPECT SHIFT LOCK CONTROL SWITCH

Check whether there is continuity between each terminals.

O—O : Continuity

Terminal / Shift Position	P	P_1	P_2
P range (Release button is not pushed)	O—O		
P Range (Release button is pushed)	O—O O		O
R, N, D, 2, L range	O		O

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