INDEX

TOYOTA 140L/140E

AUTOMATIC TRANSMISSION SERVICE GROUP
18639 SW 107TH AVENUE
MIAMI, FLORIDA 33157
(305) 670-4161

INTRODUCTION
TOYOTA A140/A140E

Updated
November, 2003

The Toyota A140/A140E is a fully automatic, electronically controlled transaxle that features a combination of electronic and mechanical systems to control the upshift and downshift of all forward gears and the apply and release of the torque converter clutch.
This manual provides the procedures necessary to diagnose, service, repair and overhaul this unit.

We wish to thank Toyota Motor Company for the information and illustrations that have made this booklet possible.

The information and part numbers contained in this booklet have been carefully compiled from industry sources known for their reliability, but ATSG does not guarantee its accuracy.

DALE ENGLAND
FIELD SERVICE CONSULTANT

WAYNE COLONNA
TECHNICAL SUPERVISOR

PETER LUBAN
TECHNICAL CONSULTANT

JON GLATSTEIN
TECHNICAL CONSULTANT

ROLAND ALVAREZ
TECHNICAL CONSULTANT

GERALD CAMPBELL
TECHNICAL CONSULTANT

JIM DIAL
TECHNICAL CONSULTANT

ED KRUSE
TECHNICAL CONSULTANT

GREGORY LIPNICK
TECHNICAL CONSULTANT

DAVID CHALKER
TECHNICAL CONSULTANT

JERRY GOTT
TECHNICAL CONSULTANT

MIKE SOUZA
TECHNICAL CONSULTANT

AUTOMATIC TRANSMISSION SERVICE GROUP
18639 SW 107TH AVENUE
MIAMI, FLORIDA 33157
(305) 670-4161

TROUBLESHOOTING

Problem	Possible cause	Remedy
Fluid discolored or smells burnt	Fluid contaminated Torque converter faulty	Replace fluid Replace torque converter
Vehicle does not move in any forward range or reverse	Valve body or primary regulator faulty Park lock pawl faulty Touque converter faulty Converter drive plate broken Oil strainer blocked Transmission faulty	Inspect valve body Inspect park pawl Replace torque converter Replace torque converter Clean oil strainer Disassemble and inspect transmission
Shift lever position incorrect	Control cable out of adjustment Manual valve and lever faulty Transmission faulty	Adjust control cable Inspect valve body Disassemble and inspect transmission
Harsh engagement into any drive range	Throttle cable out of adjustment Valve body or primary regulator faulty Accumulator pistons faulty Transmission faulty	Adjust throttle cable Inspect valve body Inspect accumulator pistons Disassemble and inspect transmission
Delayed 1-2, 2-3 or 3-OD up-shift, or down-shifts from 4-3 or 3-2 then shifts back to 4 or 3	Electric control faulty Valve body faulty Solenoid valve faulty	Inspect electric control Inspect valve body Inspect valve body
Slips on 1-2, 2-3 or 3-OD up-shift, or slips or shudders on take-off	Control cable out of adjustment Throttle cable out of adjustment Valve body faulty Solenoid valve faulty Transmission faulty	Adjust control cable Adjust throttle cable Inspect valve body Inspect valve body Disassemble and inspect transmission
Drag, binding or tie-up on 1-2, 2-3 or 3-OD up-shift	Control cable out of adjustment Valve body faulty Transmission faulty	Adjust control cable Inspect valve body Disassemble and inspect transmission
No lock-up in 2nd, 3rd or OD	Electric control faulty Valve body faulty Solenoid valve faulty Transmission faulty	Inspect electric control Inspect valve body Inspect valve body Disassemble and inspect transmission

TROUBLESHOOTING (Cont'd)

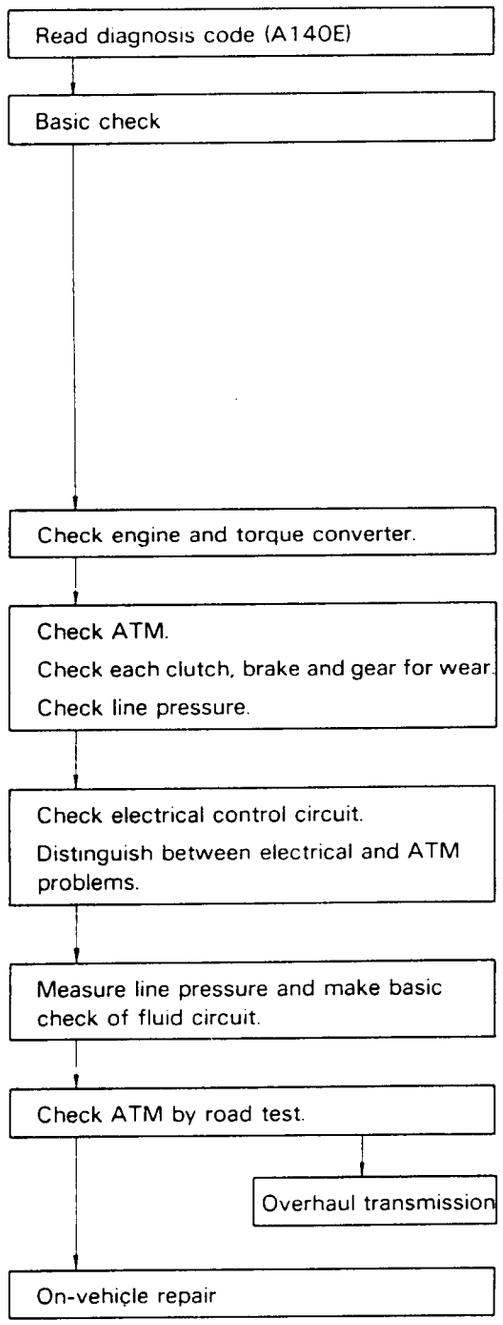
Problem	Possible cause	Remedy
Harsh down-shift	Throttle cable out of adjustment Throttle cable and cam faulty Accumulator pistons faulty Valve body faulty Transmission faulty	Adjust throttle cable Inspect throttle cable and cam Inspect accumulator pistons Inspect valve body Disassemble and inspect transmission
No down-shift when coasting	Valve body faulty Solenoid valve faulty Electric control faulty	Inspect valve body Inspect solenoid valve Inspect electric control
Down-shift occurs too quick or too late while coasting	Throttle cable faulty Valve body faulty Transmission faulty Solenoid valve faulty Electric control faulty	Inspect throttle cable Inspect valve body Disassemble and inspect transmission Inspect solenoid valve Inspect electric control
No OD-3, 3-2 or 2-1 kickdown	Solenoid valve faulty Electric control faulty Valve body faulty	Inspect solenoid valve Inspect electric control Inspect valve body
No engine braking in "2" or "L" range	Solenoid valve faulty Electric control faulty Valve body faulty Transmission faulty	Inspect solenoid valve Inspect electric control Inspect valve body Disassemble and inspect transmission
Vehicle does not hold in "P"	Control cable out of adjustment Parking lock pawl cam and spring faulty	Adjust control cable Inspect cam and spring

GENERAL NOTES

1. Troubles occuring with the automatic transmission can be caused by either the engine, electrical control or the automatic transmission itself. These three areas should be distinctly isolated before proceeding with troubleshooting.

2. Troubleshooting should begin with the simpliest operation, working up in order of difficulty, but initially determine whether the trouble lies within the engine, electrical control or transmission.

3. Proceed with the inspection as follows:



(1) Diagnosis System (A140E)
(See page AT-7)

(2) Preliminary Check

(a) Check the oil level

(b) Check the throttle cable mark

(c) Check the shift linkage

(d) Check the neutral start switch

(e) Check the idling speed (A/C OFF)

"N" or "P" range:
2S-E Engine 750 rpm
1C-T Engine 750 rpm

(f) Check the tire inflation pressure
(See page FA-3)

(3) Stall Test

Repair as necessary.

(4) Time Lag Test

Confirm by road test and repair as necessary.

(5) Electric Control Circuit

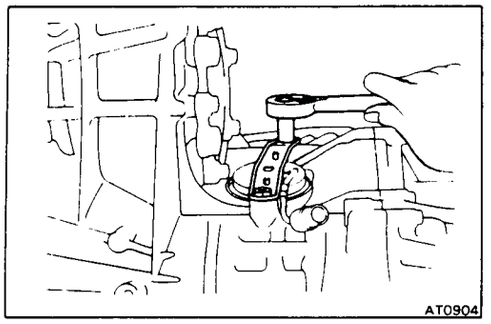
Repair electrical system.
Confirm ATM problems by a road test and repair as necessary.

(6) Hydraulic Test

Confirm the shaft point and extent of shock by a road test.
Repair as necessary.

(7) Road Test

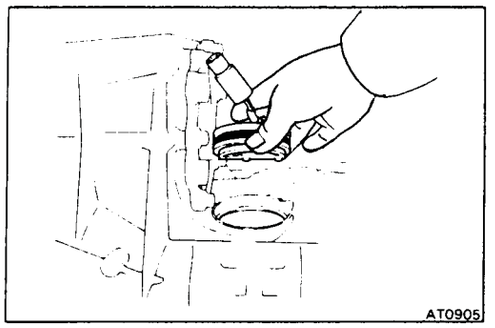
Confirm if the trouble lies within the ATM.
If noisy or vibrating, the cause is possibly with either the compressor, engine, propeller shaft, tires, etc.



ON-VEHICLE REPAIR

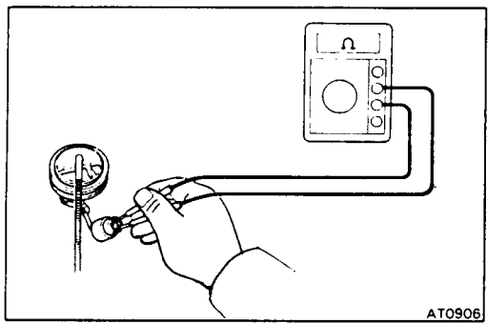
REMOVAL OF SPEED SENSOR (A140E/2S-E)

1. REMOVE LH FRONT DRIVE SHAFT (See page FA-14)
2. REMOVE TRANSMISSION DUST COVER
3. REMOVE TWO BOLTS AND BRACKET



4. REMOVE SPEED SENSOR AND O-RING

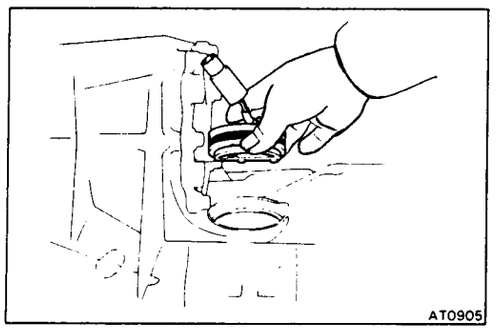
INSPECTION OF SPEED SENSOR (A140E/2S-E)



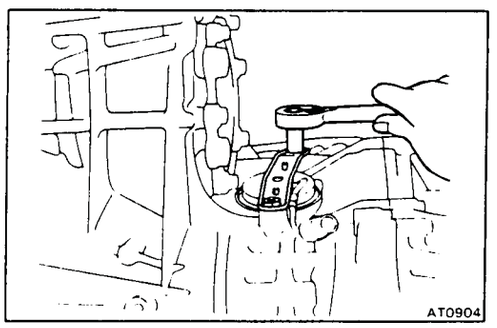
INSPECT SPEED SENSOR

Connect an ohmmeter to the speed sensor and check that the meter deflects when the sensor is repeatedly brought close to a magnet and removed from it.

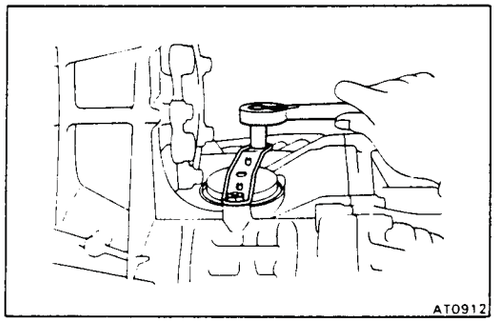
INSTALLATION OF SPEED SENSOR (A140E/2S-E)



1. INSTALL SPEED SENSOR AND O-RING

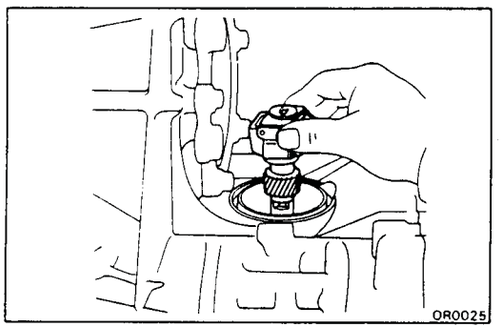


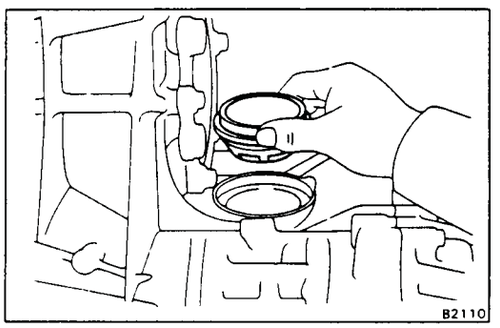
2. INSTALL BRACKET AND TWO BOLTS
   Torque: 130 kg-cm (9 ft-lb, 13 N·m)
3. INSTALL TRANSAXLE DUST COVER
4. INSTALL LH FRONT DRIVE SHAFT (See page FA-20)



REMOVAL OF GOVERNOR VALVE (A140L/1C-T)

1. REMOVE LH FRONT DRIVE SHAFT
2. REMOVE TRANSAXLE DUST COVER
3. REMOVE TWO BOLTS AND BRACKET
4. REMOVE GOVERNOR COVER AND O-RING
5. REMOVE THRUST WASHER
6. REMOVE GOVERNOR BODY WITH WASHER

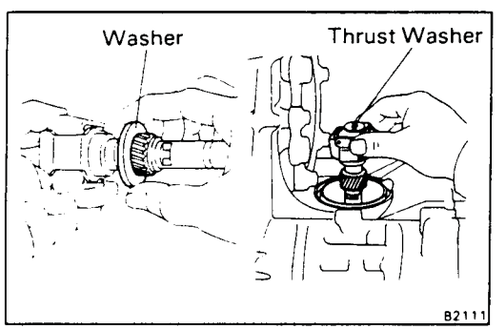




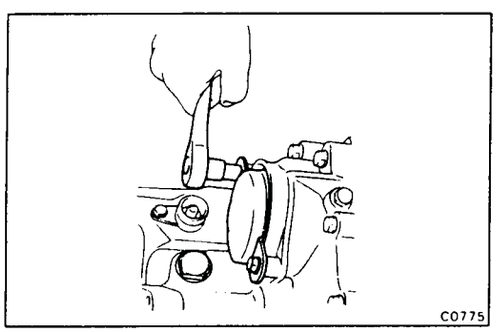
7. REMOVE GOVERNOR BODY ADAPTOR

INSTALLATION OF GOVERNOR VALVE (A140L/1C-T)

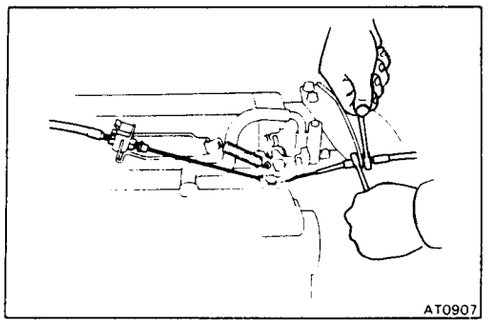
1. INSTALL GOVERNOR BODY ADAPTOR



2. INSTALL GOVERNOR BODY WITH WASHER
   (a) Install the thrust washer onto the governor body.
   (b) Install the washer into the governor body.
   (c) Install the governor body to the ATM.



3. INSTALL GOVERNOR COVER WITH O-RING
4. INSTALL BRACKET AND TWO BOLTS
   Torque: 130 kg-cm (9 ft-lb, 13 N·m)
5. INSTALL TRANSAXLE DUST COVER
6. INSTALL LH FRONT DRIVE SHAFT

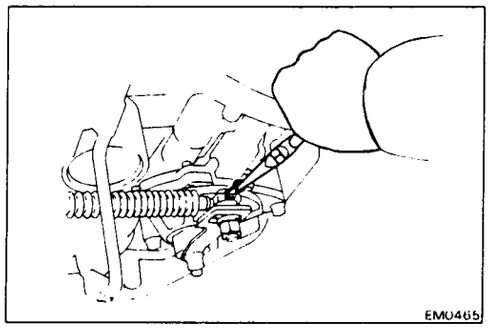


REMOVAL OF THROTTLE CABLE

1. DISCONNECT THROTTLE CABLE

(a) Disconnect the cable housing from the bracket.

(b) Disconnect the cable from the throttle linkage.

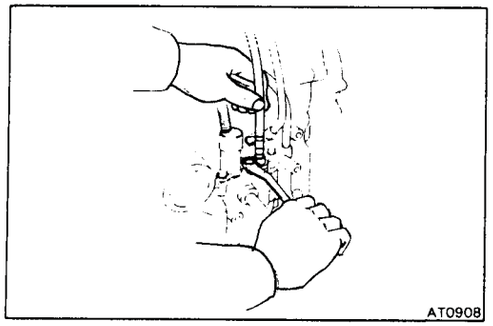


2. REMOVE NEUTRAL START SWITCH

(a) Remove the clip and, disconnect the transmission control cable from manual shift lever.

(b) Remove the manual shift lever.

(c) Remove the neutral start switch.

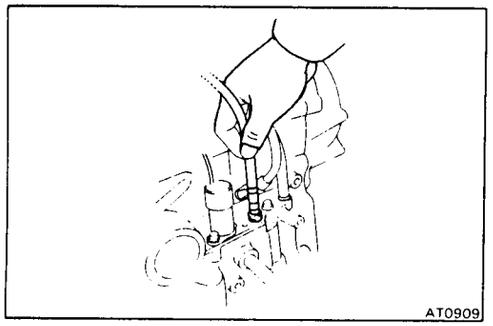


3. REMOVE VALVE BODY

4. PULL THROTTLE CABLE OUT OF TRANSMISSION CASE

(a) Remove the one bolt and retaining plate.

(b) Pull the cable out of the transmission case.



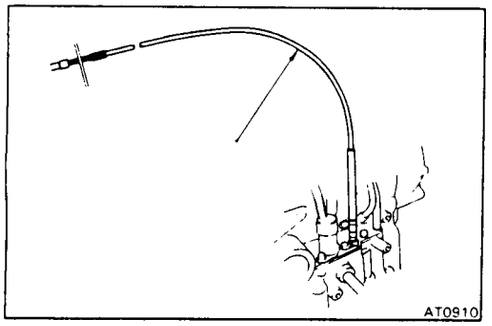
INSTALLATION OF THROTTLE CABLE

1. INSTALL CABLE IN TRANSMISSION CASE

(a) Be sure to push it in all the way.

(b) Install the retaining plate and one bolt.

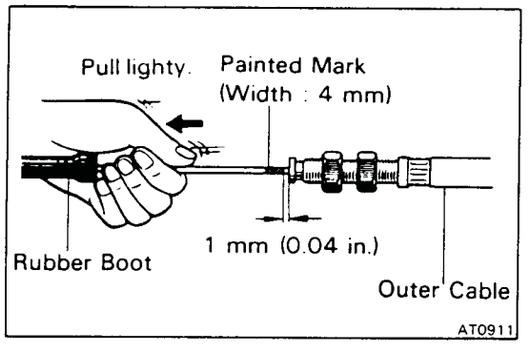
2. INSTALL VALVE BODY



3. IF THROTTLE CABLE IS NEW, PAINT MARK ON INNER CABLE

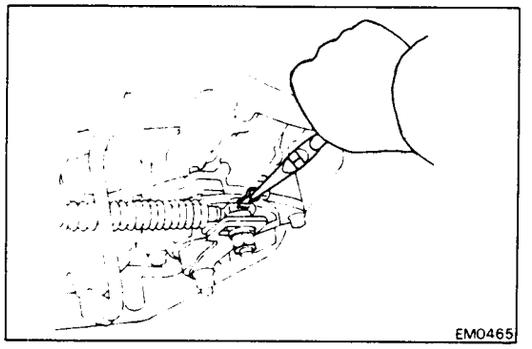
NOTE: New cables do not have a cable stopper installed. Therefore, to make adjustment possible, paint a mark as described below.

(a) Bend the cable about 200 mm (7.87 in.) in radius.



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

(c) Paint a mark as shown, about 4 mm (0.16 in.) in width.

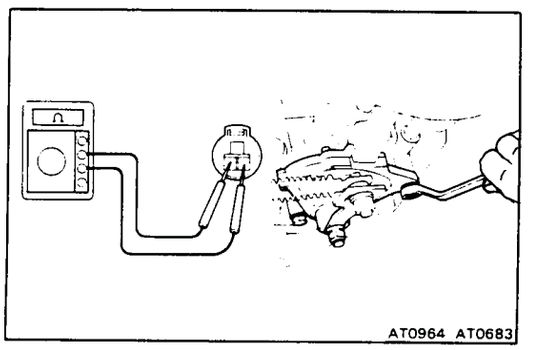


4. CONNECT THROTTLE CABLE

(a) Connect the cable to the throttle linkage.

(b) Connect the cable housing to the bracket.

5. ADJUST THROTTLE CABLE



6. INSTALL NEUTRAL START SWITCH

(a) Install the neutral start switch.

(b) Install the manual shift lever.

(c) Adjust the neutral start switch.
(See page AT-5)

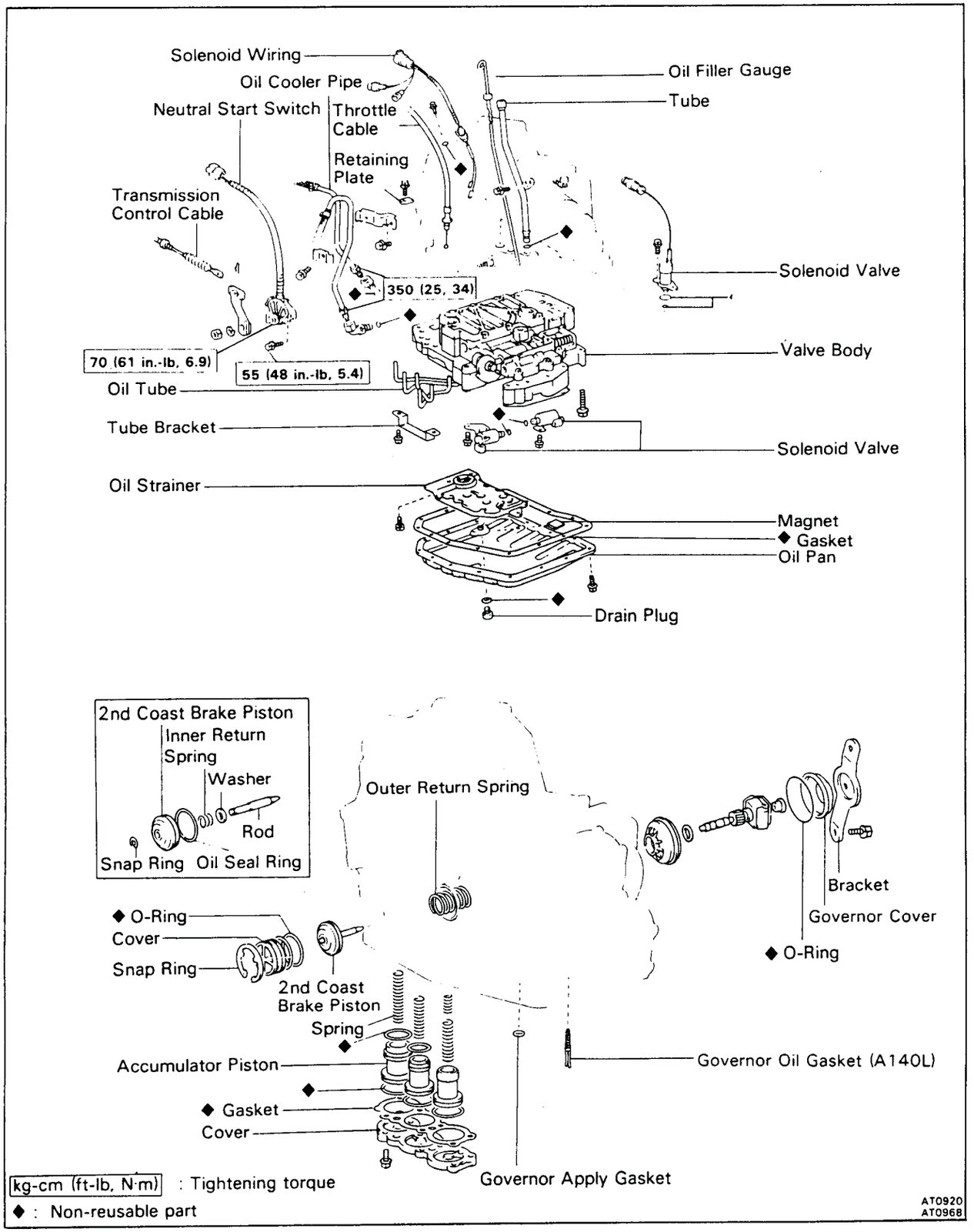
(d) Connect the transmission control cable.

(e) Adjust the transmission control cable.
(See page AT-5)

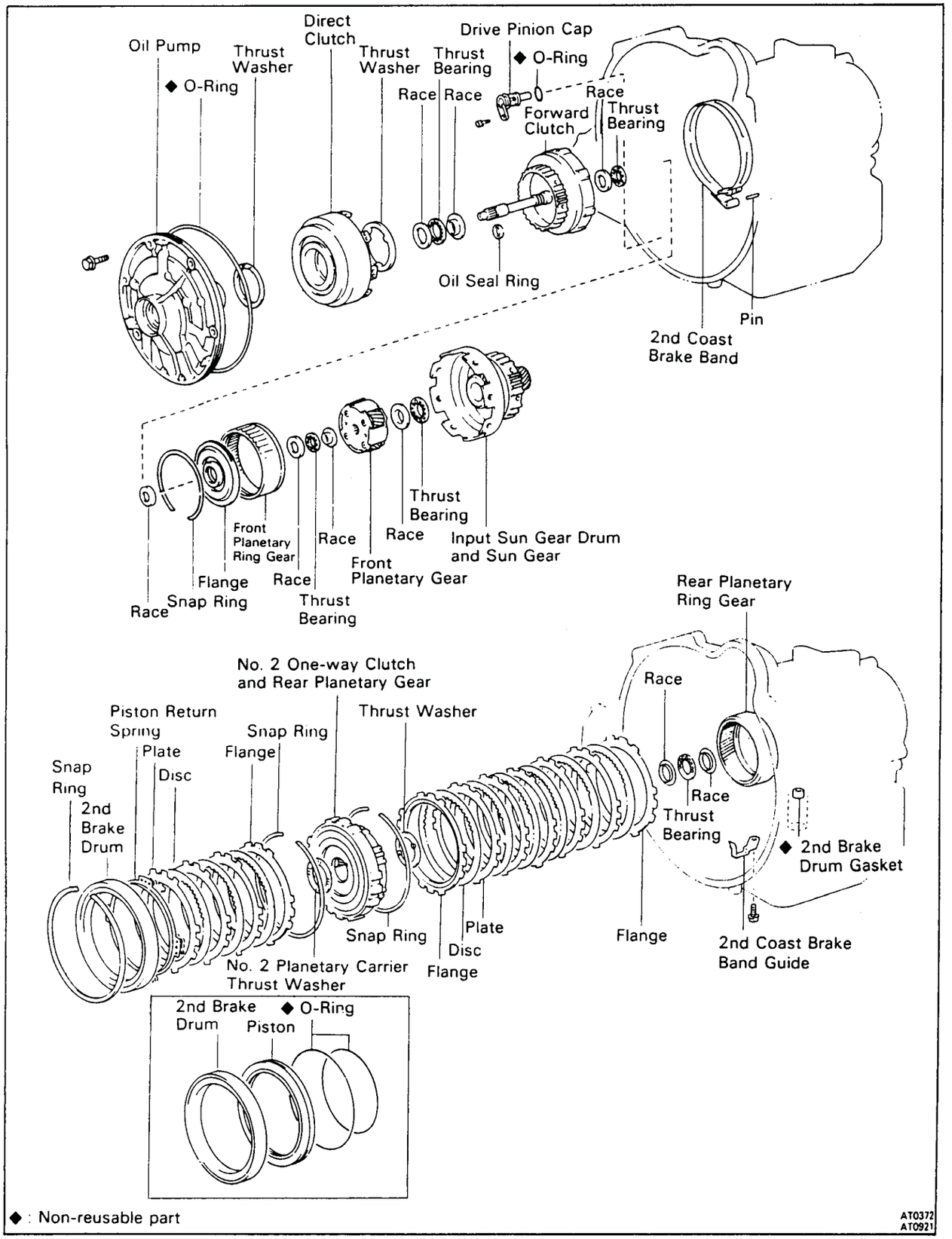
7. TEST DRIVE VEHICLE

DISASSEMBLY OF TRANSMISSION

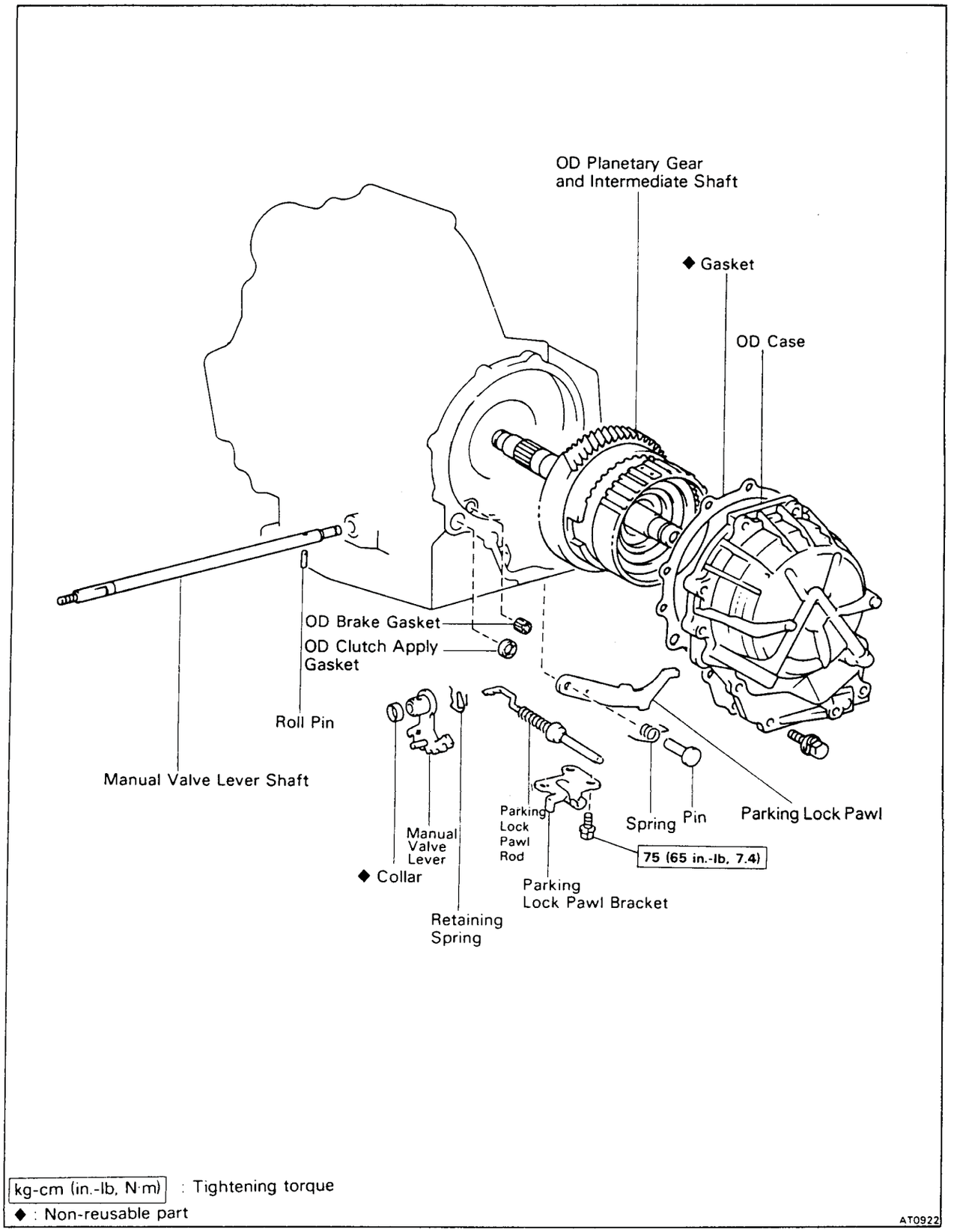
COMPONENTS

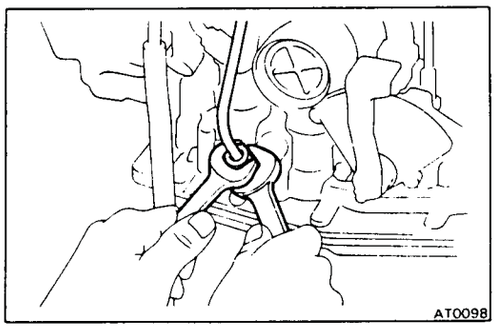


COMPONENTS (Cont'd)



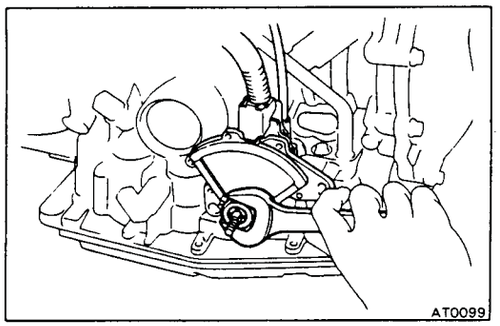
COMPONENTS (Cont'd)



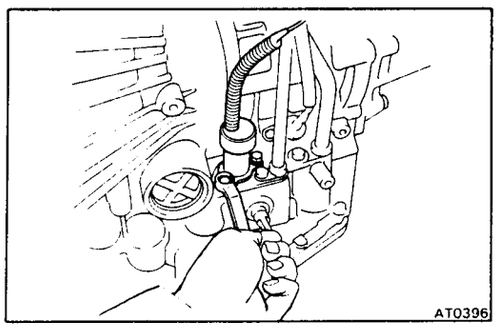


SEPARATE BASIC SUBASSEMBLY

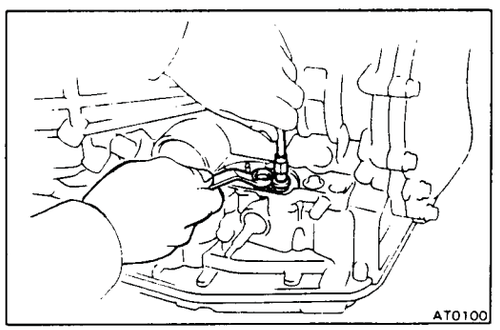
1. **REMOVE TWO OIL COOLER PIPES**
2. **REMOVE SHIFT LEVER**



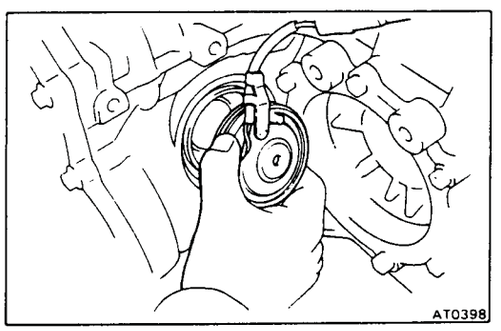
3. **REMOVE NEUTRAL START SWITCH**



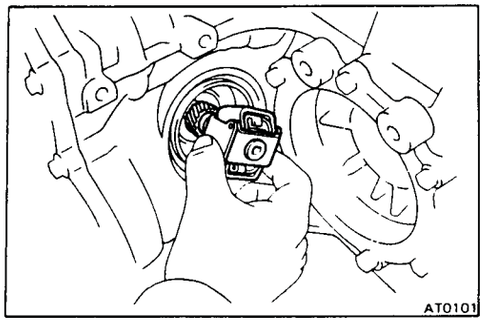
4. **REMOVE SOLENOID**
   (a) Disconnect connector.
   (b) Remove the two bolts and solenoid.
5. **REMOVE OIL FILLER GAUGE AND TUBE**



6. **REMOVE FOLLOWING PARTS:**
   (a) Throttle cable retaining plate
   (b) Solenoid wiring retaining bolt



7. **REMOVE SPEED SENSOR (A140E)**
   (a) Disconnect the connector.
   (b) Remove the two bolts and cover bracket.
   (c) Remove the speed sensor and O-ring.



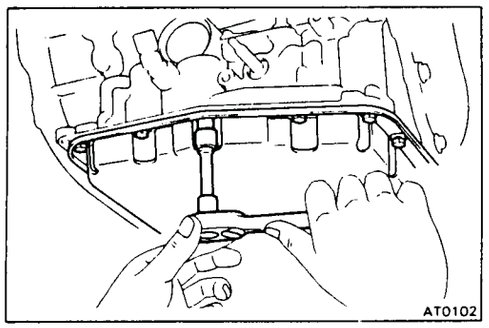
8. REMOVE GOVERNOR BODY (A140L)

(a) Remove the two bolts and cover bracket.

(b) Remove the governor cover and O-ring.

(c) Remove the governor body with thrust washer.

(d) Remove the plate washer and governor body adaptor.



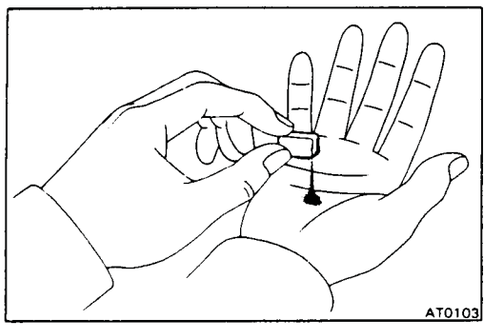
9. REMOVE OIL PAN AND GASKET

(a) Remove the fifteen bolts.

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

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

(c) Place the ATM on wooden blocks to prevent damage to the pipe bracket.

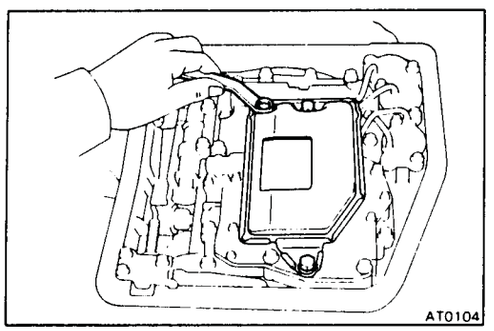


10. EXAMINE PARTICLES IN PAN

Remove the magnet and use it to collect any steel chips. Look 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 clutch plate wear

Brass (non-magnetic) . . . bushing wear

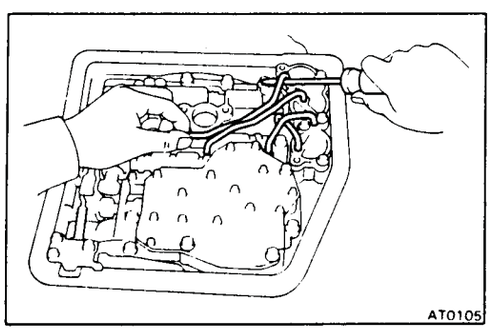


11. TURN TRANSMISSION OVER AND REMOVE FOLLOWING:

(a) Tube bracket

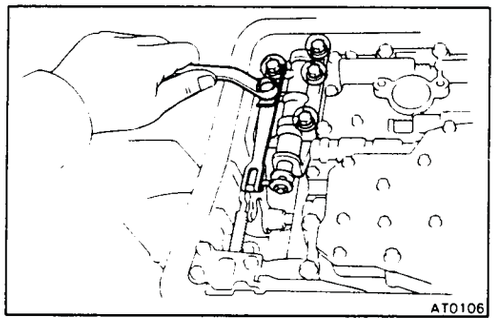
(b) Oil strainer

(c) Solenoid connectors



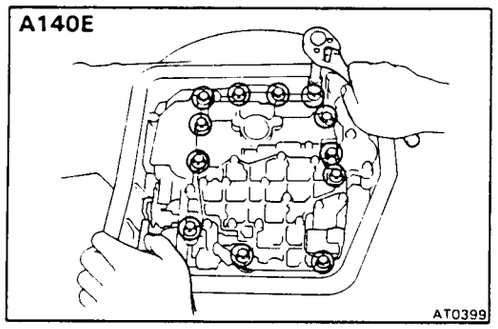
12. REMOVE FOUR OIL TUBES

Pry up both tube ends with a large screwdriver and remove the four tubes.



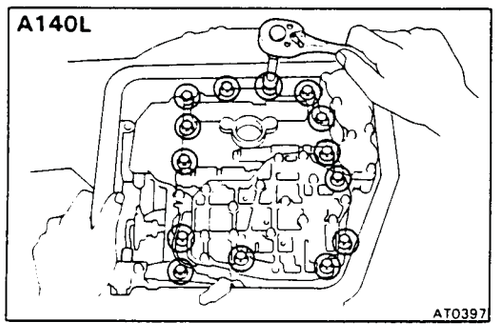
13. REMOVE MANUAL DETENT SPRING

14. REMOVE MANUAL VALVE AND MANUAL VALVE BODY

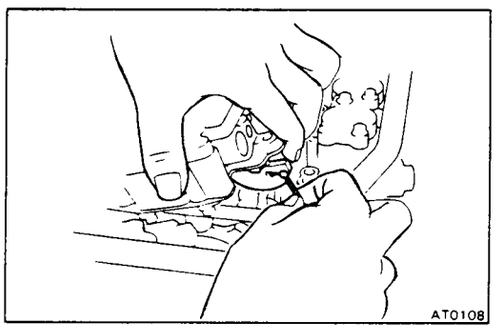


15. REMOVE VALVE BODY

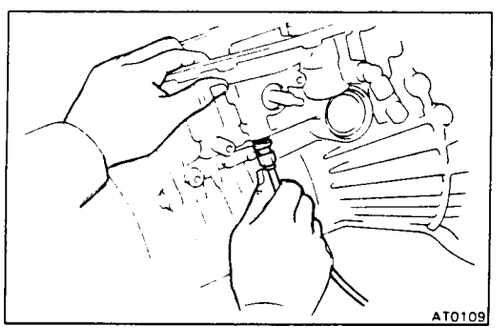
(a) Remove the twelve bolts. (A140E)



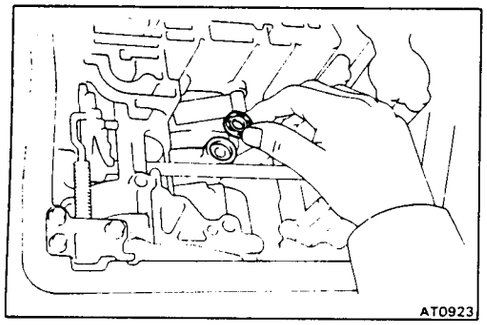
(b) Remove the fourteen bolts. (A140L)



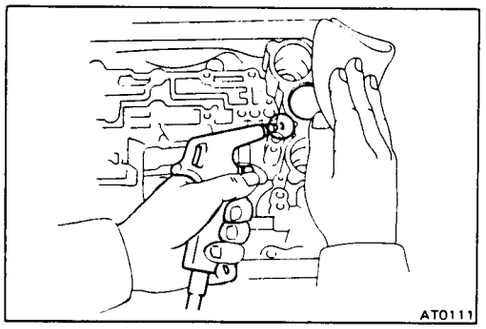
(c) Disconnect the throttle cable from the cam and remove the valve body.



16. REMOVE THROTTLE CABLE AND SOLENOID WIRING FROM CASE



17. REMOVE GOVERNOR APPLY GASKET



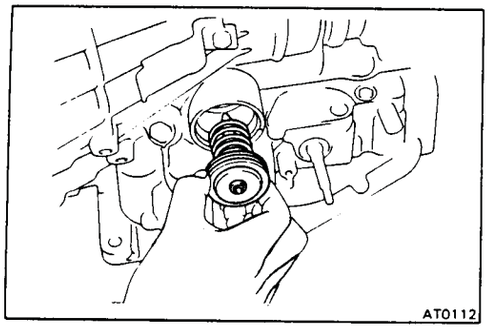
18. REMOVE ACCUMULATOR PISTON AND SPRINGS

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

(b) Remove the cover and the gasket.

(c) Remove the piston and spring for C_1 and C_2.

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



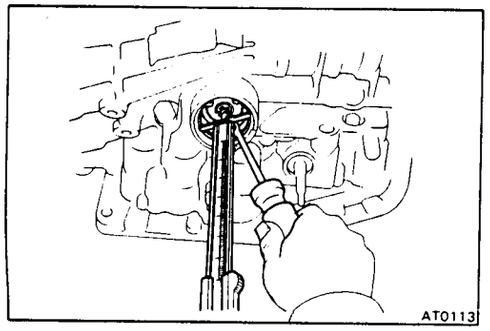
19. TURN TRANSMISSION OVER

20. MEASURE PISTON DISTANCE OF SECOND COAST BRAKE

(a) Remove the snap ring.

(b) Remove the cover.

(c) Remove the piston and the outer return spring.

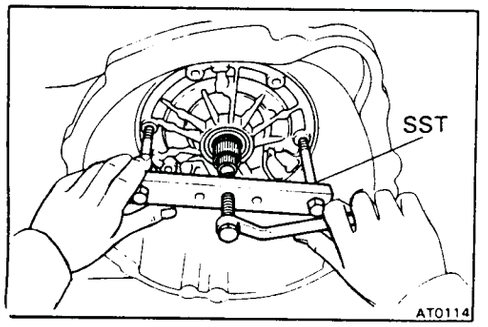


(d) Install the piston without the outer return spring.

(e) Install the snap ring.

(f) Firmly push the brake apply rod into the case. At this time, measure the distance between the outside of the snap ring and the tip of piston rod as shown.

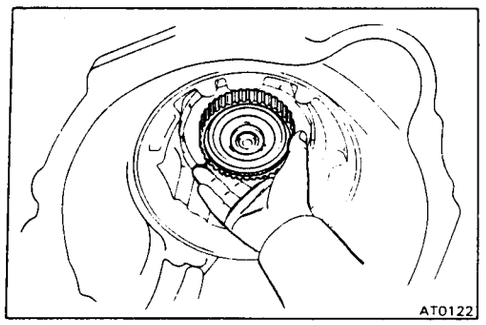
Distance: 14.0 – 15.5 mm (0.551 – 0.610 in.)
[Actual piston stroke is 1.5 – 3.0 mm (0.059 – 0.118 in.).]



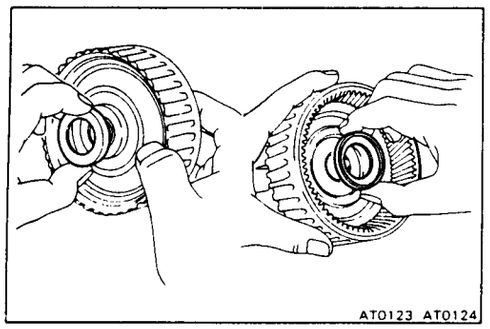
21. REMOVE SEVEN BOLTS HOLDING OIL PUMP TO TRANSMISSION CASE

22. PULL OIL PUMP FREE WITH SST FROM TRANSMISSION CASE

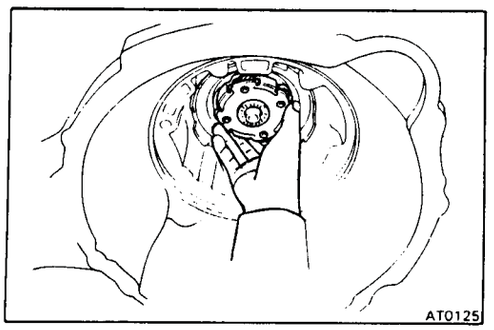
SST 09350-32011


AT0122

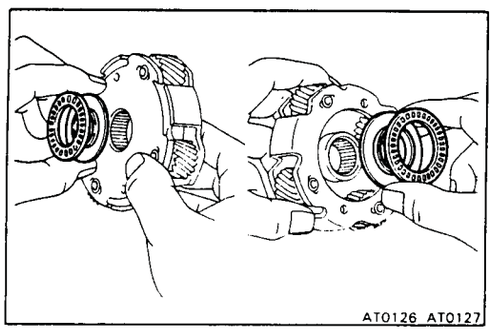
30. REMOVE FRONT PLANETARY RING GEAR


AT0123 AT0124

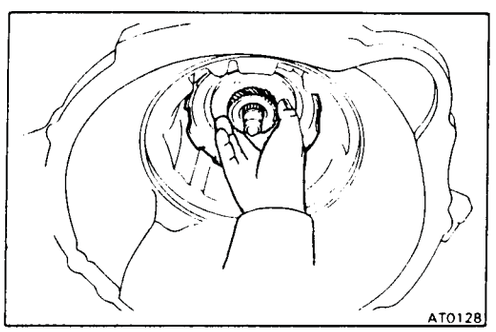
31. WATCH FOR RACES ON RING GEAR


AT0125

32. REMOVE PLANETARY GEAR

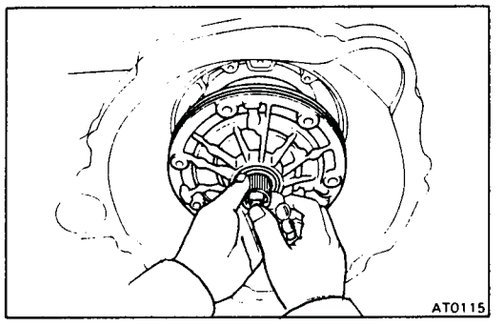

AT0126 AT0127

33. WATCH FOR RACES AND BEARINGS ON PLANETARY GEAR


AT0128

34. REMOVE BEARING FROM PLANETARY SUN GEAR

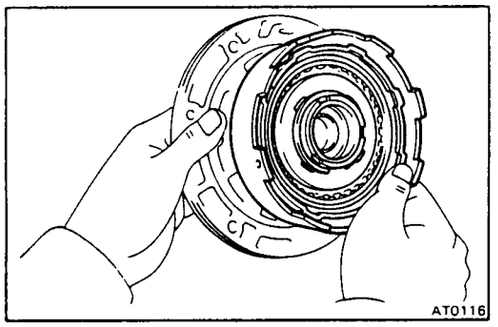
35. REMOVE SUN GEAR, SUN GEAR INPUT DRUM, SECOND BRAKE HUB AND NO. 1 ONE-WAY CLUTCH



23. REMOVE OIL PUMP AND DIRECT CLUTCH

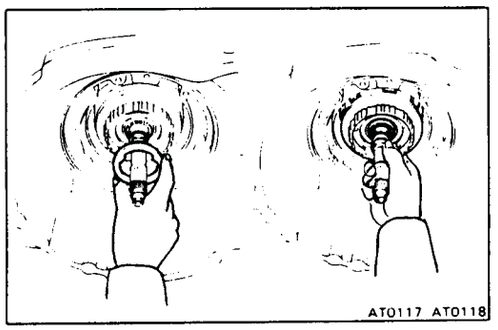
While holding the input shaft, grasp the pump stator shaft and pull the oil pump and direct clutch together out the transmission case.

NOTE: Push the 2nd coast brake band into the case, being careful not to catch it on the direct clutch drum.



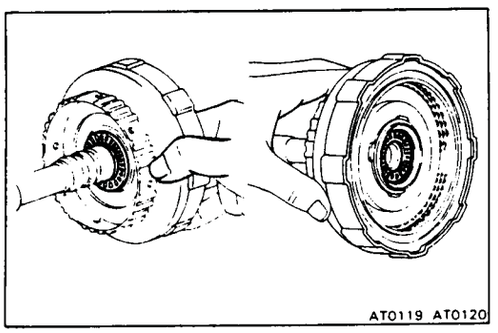
24. REMOVE DIRECT CLUTCH FROM OIL PUMP

25. WATCH FOR RACE BEHIND OIL PUMP

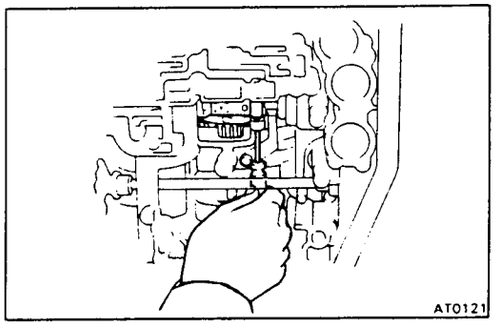


26. REMOVE CLUTCH DRUM THRUST WASHER

27. REMOVE FORWARD CLUTCH



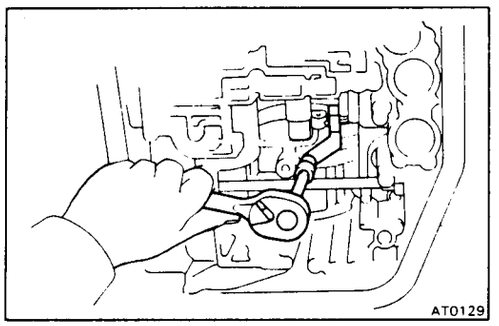
28. WATCH FOR BEARINGS AND RACES



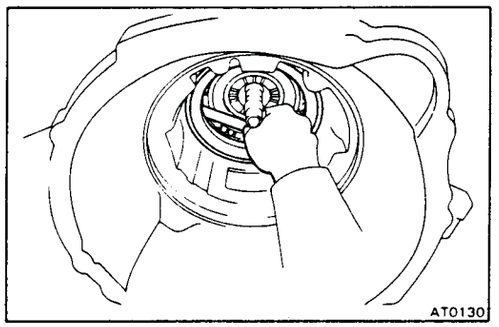
29. REMOVE SECOND COAST BRAKE BAND

(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.



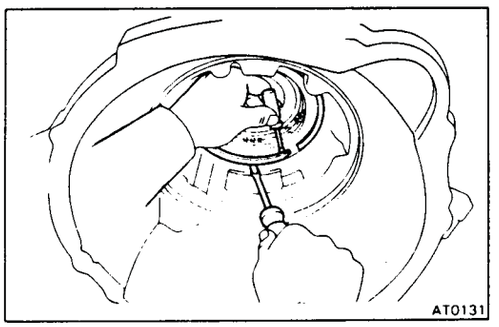
36. STAND TRANSMISSION CASE UP AND REMOVE SECOND COAST BRAKE BAND GUIDE



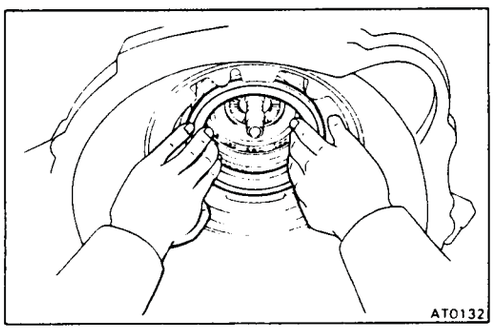
37. MEASURE CLEARANCE OF SECOND BRAKE

Using a thickness gauge, measure the clearance between the seat of return spring assembly and top of the plate.

Clearance: 0.37 – 1.56 mm (0.0146 – 0.0614 in.)



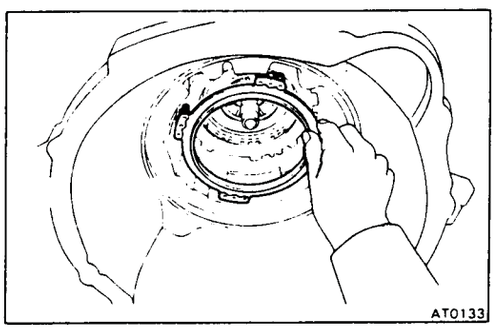
38. REMOVE SNAP RING HOLDING SECOND BRAKE DRUM TO CASE



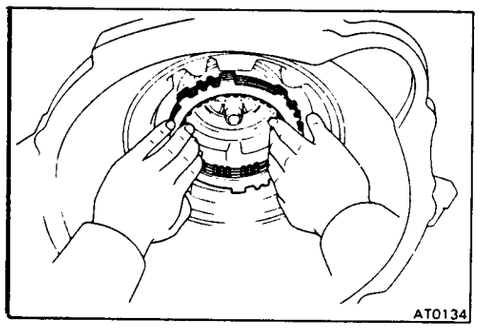
39. REMOVE SECOND BRAKE DRUM

If the piston is difficult to remove, lightly tap the drum with a wooden block.

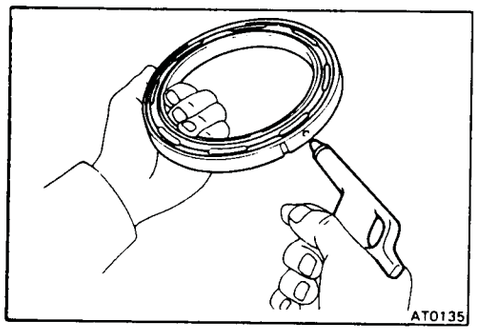
40. REMOVE SECOND BRAKE DRUM GASKET



41. REMOVE SECOND BRAKE PISTON RETURN SPRING



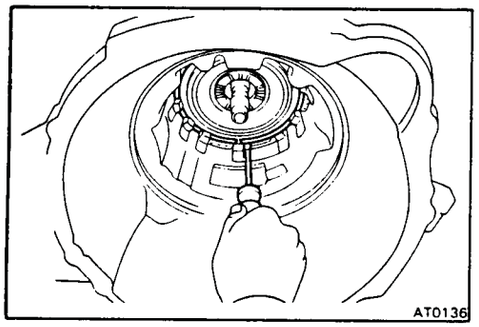
42. REMOVE PLATES, DISCS AND FLANGE



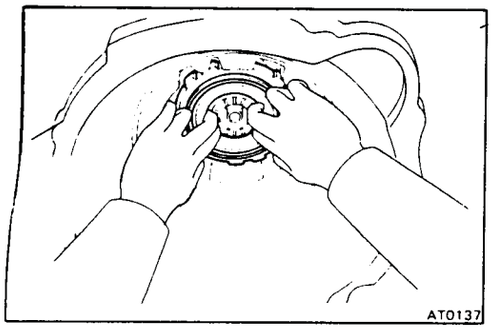
43. BLOW OUT PISTON WITH COMPRESSED AIR

Use compressed air to remove the piston.

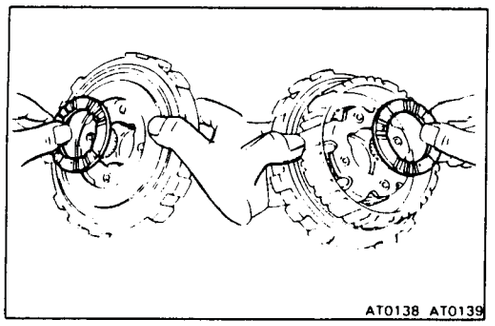
NOTE: Hold the piston so it does not slant and then blow with the gun slightly away from the oil hole.



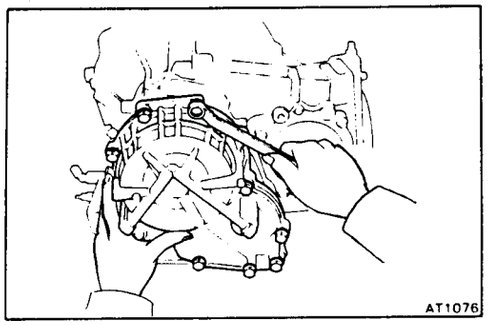
44. REMOVE SNAP RING HOLDING NO. 2 ONE-WAY CLUTCH OUTER RACE TO CASE



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

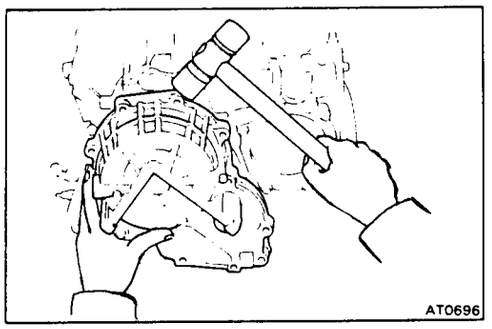


46. WATCH FOR THRUST WASHER OF PLANETARY CARRIER ON BOTH SIDES



52. TURN TRANSMISSION CASE AROUND

53. REMOVE ELEVEN BOLTS HOLDING OVERDRIVE UNIT TO TRANSMISSION CASE

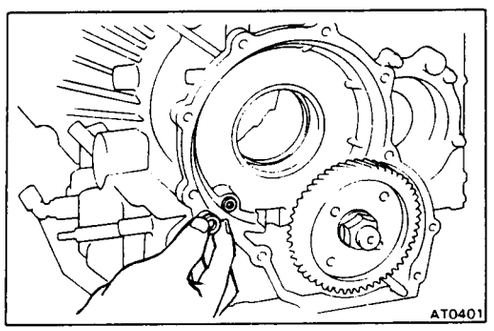


54. REMOVE OVERDRIVE UNIT WITH ALL PARTS

(a) Tap on circumference of overdrive case with a plastic hammer to remove the unit from the transmission case.

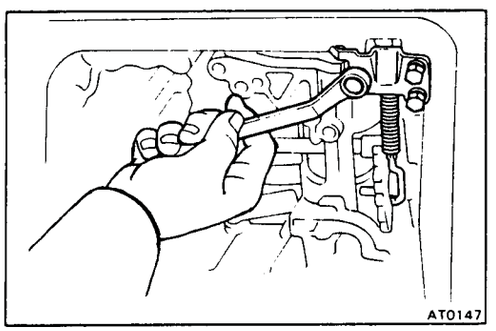
(b) Remove the overdrive planetary gear and counter gear if they remained in the transmission.

NOTE: The overdrive unit is heavy,so be careful not to drop it.



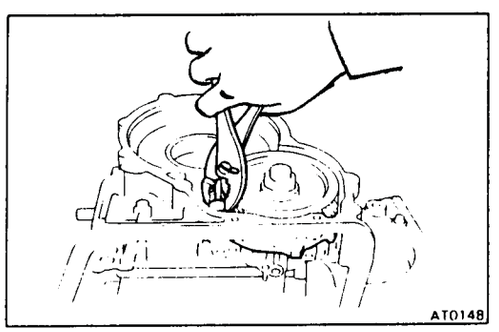
55. REMOVE CASE GASKET

56. REMOVE OVERDRIVE CLUTCH APPLY GASKET AND OVERDRIVE BRAKE APPLY GASKET



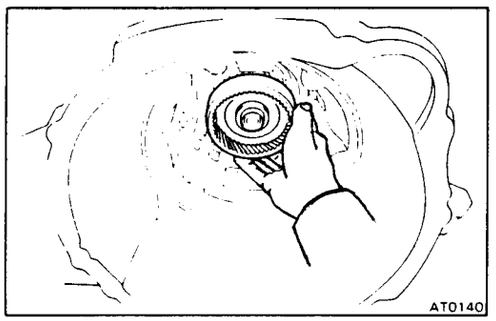
57. REMOVE PARKING LOCK PAWL BRACKET

58. REMOVE PARKING LOCK ROD

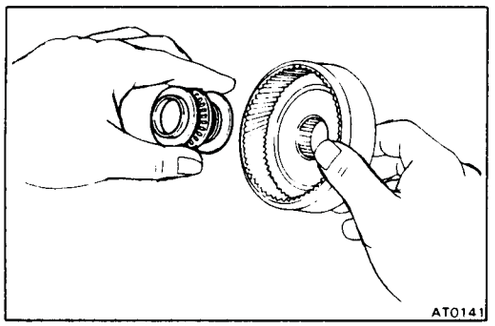


59. REMOVE PARKING LOCK PAWL SHAFT

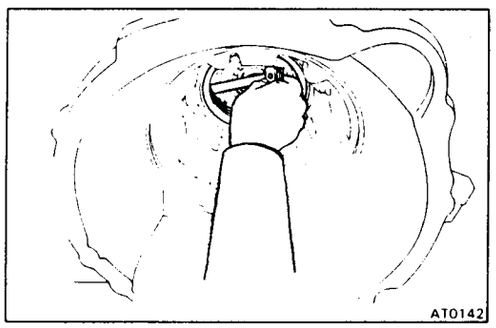
60. REMOVE SPRING AND PARKING LOCK PAWL



47. REMOVE REAR PLANETARY RING GEAR, BEARING AND RACE



48. WATCH FOR RACES AND BEARING ON RING GEAR

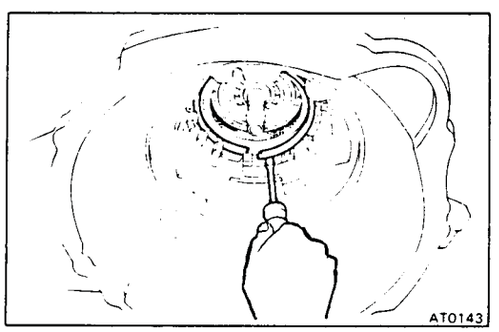


49. MEASURE CLEARANCE OF FIRST AND REVERSE BRAKE

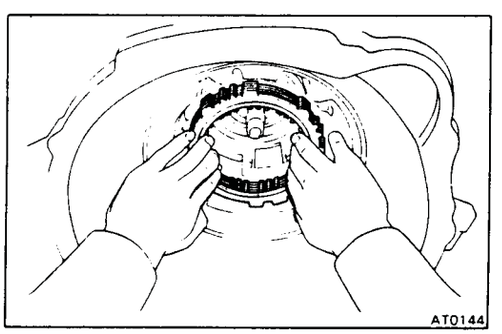
Using a thickness gauge, measure the clearance between the piston and the flange end.

Clearance:

A140E 1.06 – 2.38 mm (0.0417 – 0.0937 in.)
A140L 1.18 – 2.42 mm (0.0465 – 0.0953 in.)



50. REMOVE SNAP RING HOLDING FLANGE TO CASE



51. REMOVE FLANGES, PLATES AND DISCS

COMPONENT GROUP DISASSEMBLY, INSPECTION AND ASSEMBLY

The instructions here are organized so that you work on only one component group at a time. This will help avoid confusion of similar-looking parts from 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 cannot 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 of other component groups.
Recommended ATF type DEXRON II.

GENERAL CLEANING NOTES:

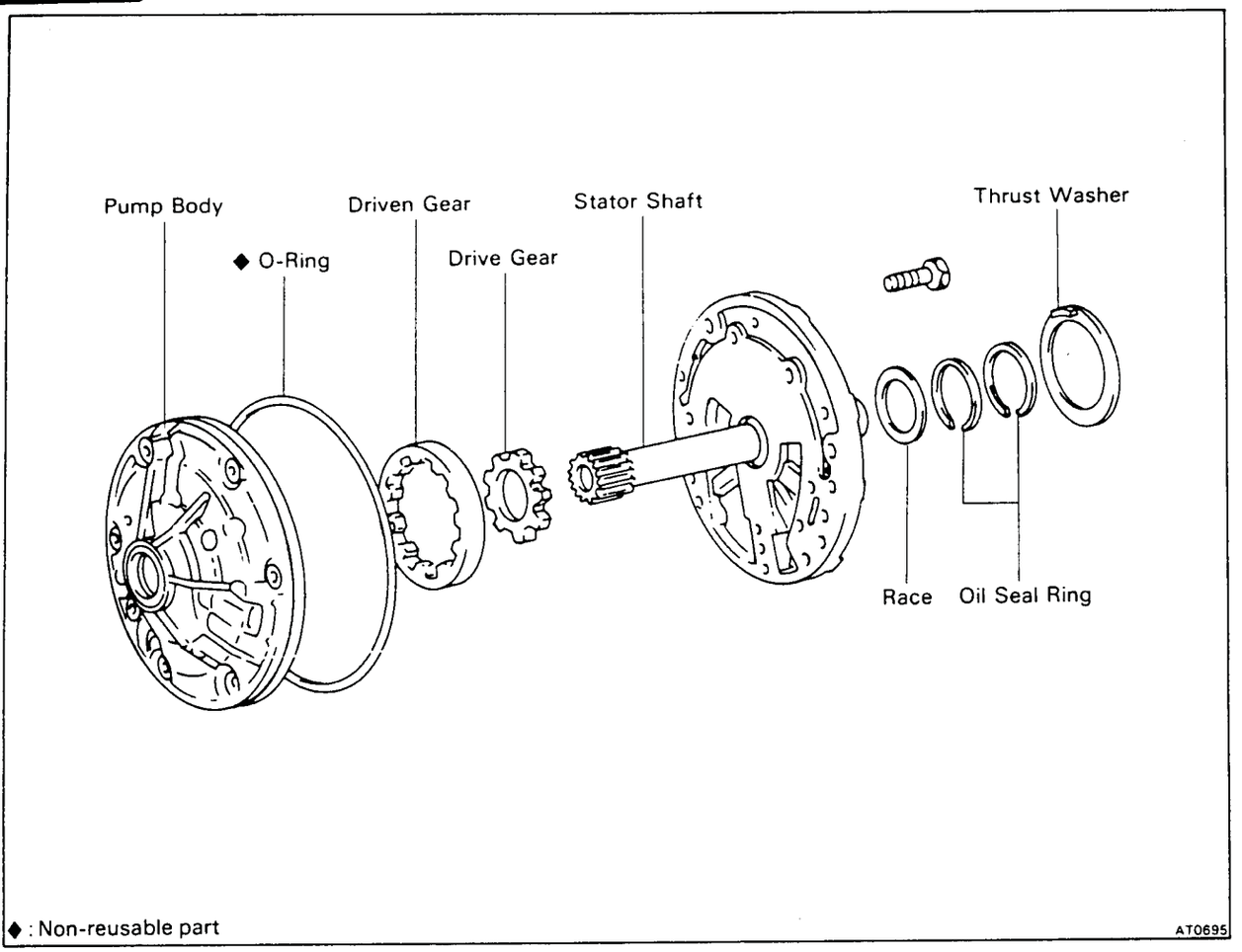
1. All disassembled parts should be washed clean and the fluid passages and holes blown through with compressed air to make sure that they are not clogged.
2. When using compressed air to dry parts, keep face away to avoid spraying solvent in your face.
3. The recommended automatic transmission fluid or kerosene should be used for cleaning.

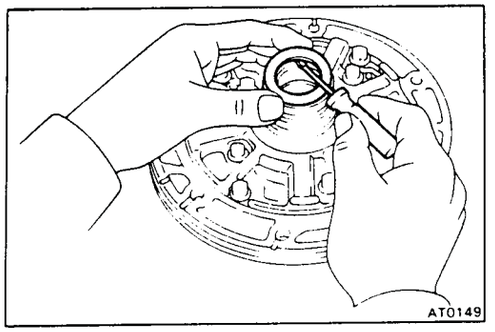
PARTS ARRANGEMENT:

1. After cleaning, the parts should be arranged in proper order to allow performing the inspection, repairs, and reassembly with efficiency.
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:

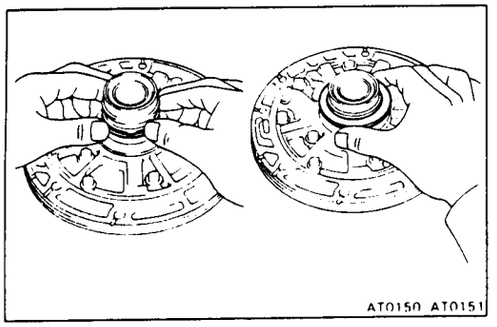
1. All oil seal rings, clutch discs, clutch plates, rotating parts, and sliding surfaces should be coated with transmission fluid prior to reassembly.
2. All gaskets and rubber O-rings should be replaced.
3. Make sure that the ends of a snap ring are not aligned with one of the cutouts and are installed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



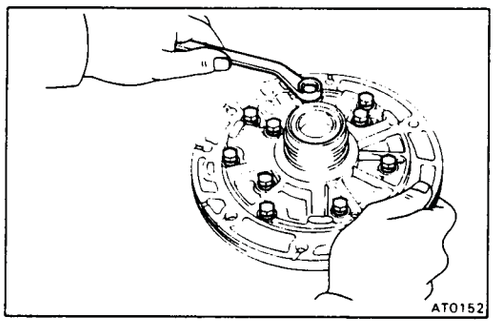


DISASSEMBLY OF OIL PUMP

1. **REMOVE RACE FROM STATOR SHAFT**



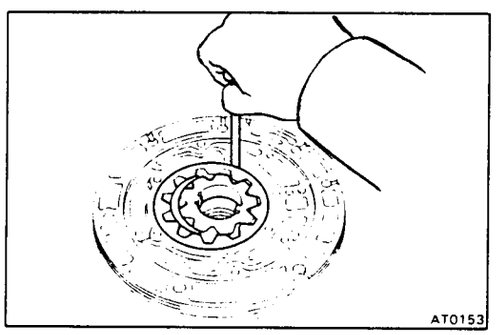
2. **REMOVE O-RING FROM PUMP BODY**
3. **REMOVE TWO OIL SEAL RINGS FROM BACK OF STATOR SHAFT**
4. **REMOVE THRUST WASHER OF CLUTCH DRUM FROM STATOR SHAFT**



5. REMOVE STATOR SHAFT

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

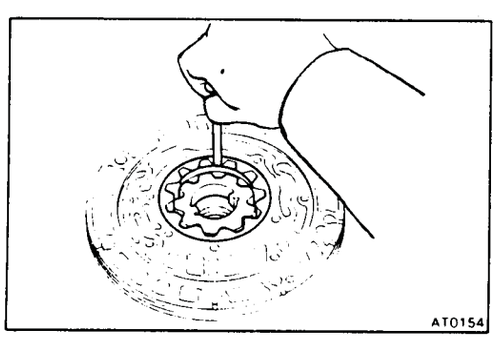
INSPECTION OF OIL PUMP



1. CHECK BODY CLEARANCE OF DRIVEN GEAR

Push the driven gear to one side of the body.
Using a feeler gauge, measure the clearance.

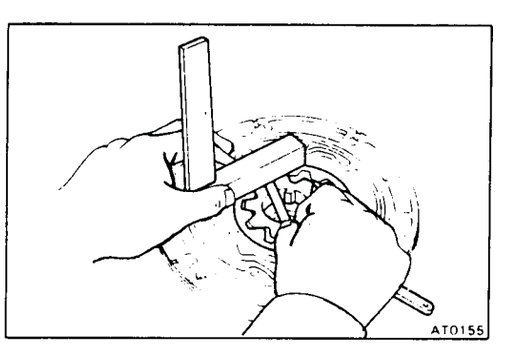
Standard body clearance:	**0.07 – 0.15 mm (0.0028 – 0.0059 in.)**
Maximum body clearance:	**0.3 mm (0.012 in.)**



2. CHECK TIP CLEARANCE OF BOTH GEARS

Measure between the gear teeth and the cresent-shaped part of the pump body.

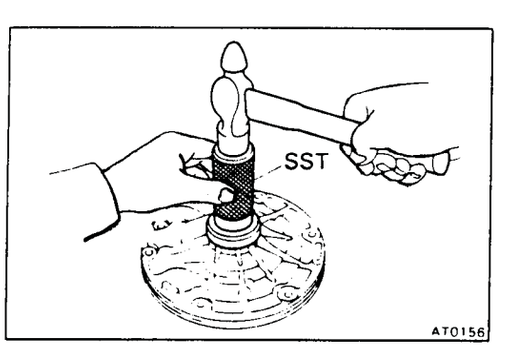
Standard tip clearance:	**0.11 – 0.14 mm (0.0043 – 0.0055 in.)**
Maximum tip clearance:	**0.3 mm (0.012 in.)**



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.)**



4. INSPECT FRONT OIL SEAL

Check for wear, damage or cracks.

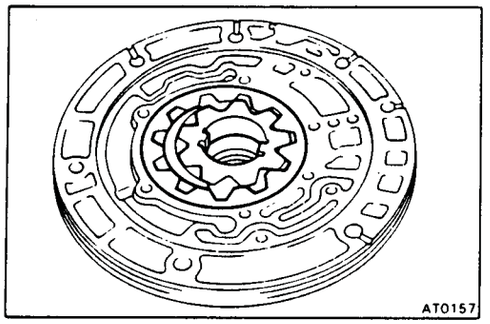
5. IF NECESSARY, REPLACE FRONT OIL SEAL

(a) Pry off the oil seal with a screwdriver.

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

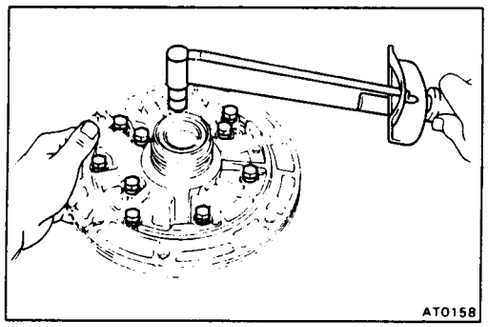
SST 09350-32011

ASSEMBLY OF OIL PUMP



1. INSTALL DRIVEN GEAR AND DRIVE GEAR

Make sure the top of the gears are facing upward.

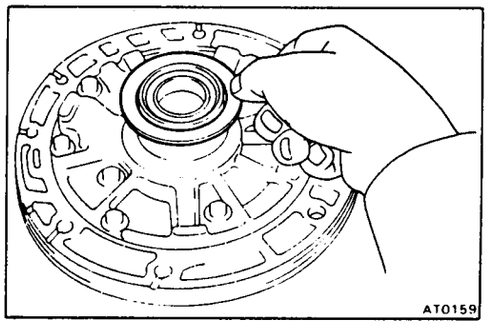


2. INSTALL STATOR SHAFT ONTO PUMP BODY

Align the stator shaft with each bolt hole.

3. TIGHTEN ELEVEN BOLTS

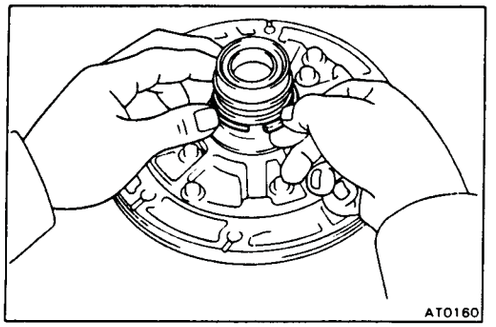
Torque: 100 kg-cm (7 ft-lb, 10 N·m)



4. INSTALL THRUST WASHER

(a) Coat the thrust washer with petroleum jelly.

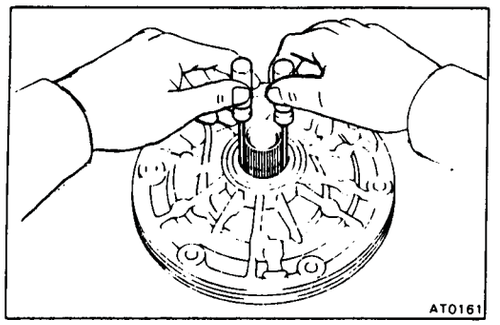
(b) Align the tab of the washer with the hollow of the pump body.



5. INSTALL TWO OIL SEAL RINGS ON OIL PUMP

Spread the rings apart and install them into the groove.

CAUTION: Do not spread the ring ends too much.



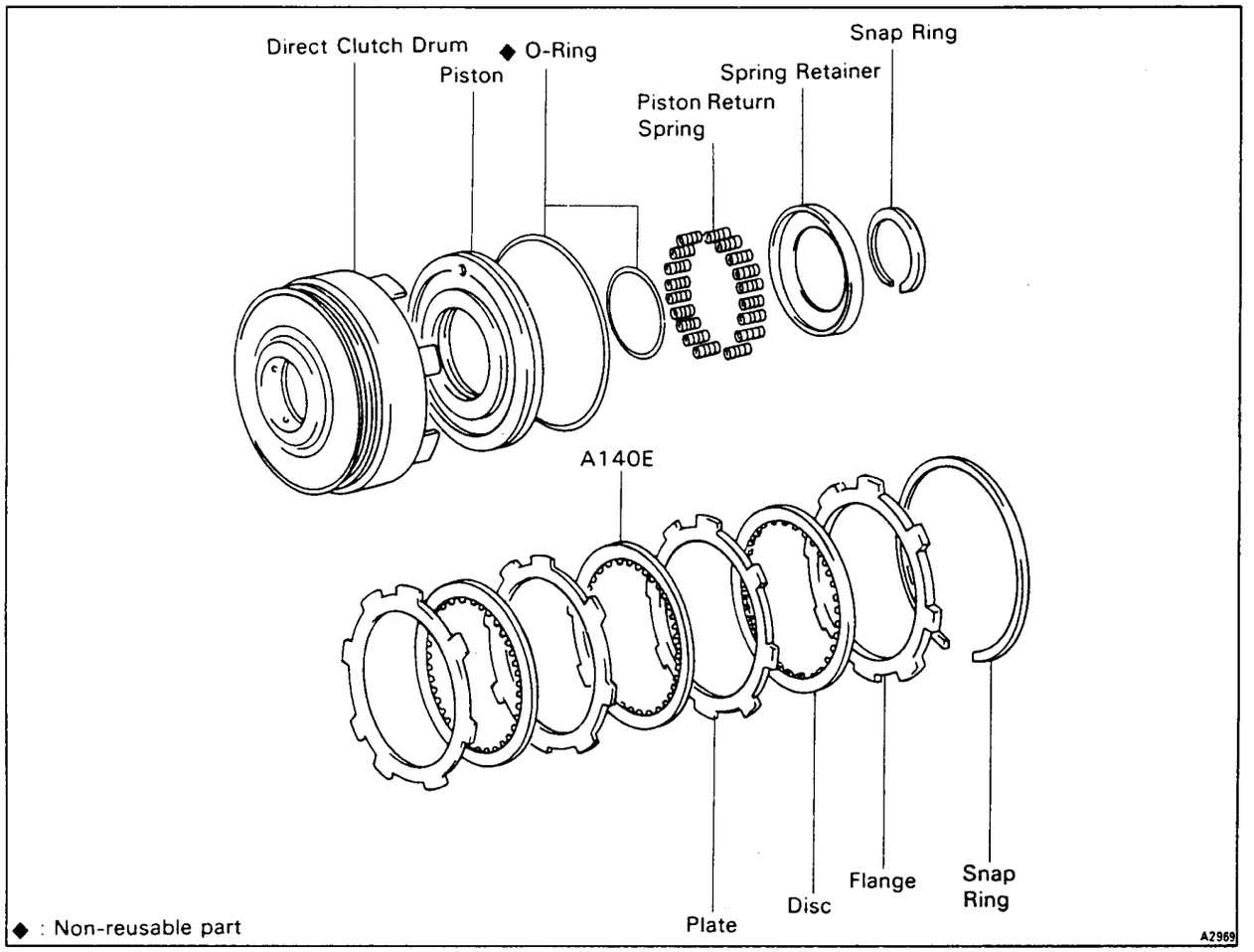
6. CHECK PUMP DRIVE GEAR ROTATION

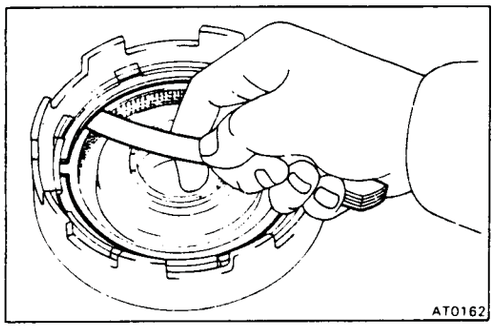
Turn the drive gear with screwdrivers and make sure that it rotates smoothly.

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

7. INSTALL RACE ONTO STATOR SHAFT

Direct Clutch





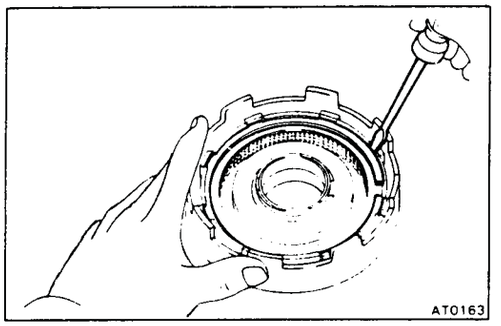
DISASSEMBLY OF DIRECT CLUTCH

1. **MEASURE CLEARANCE OF DIRECT CLUTCH**

   Using a thickness gauge, measure the clearance between the snap ring and the flange.

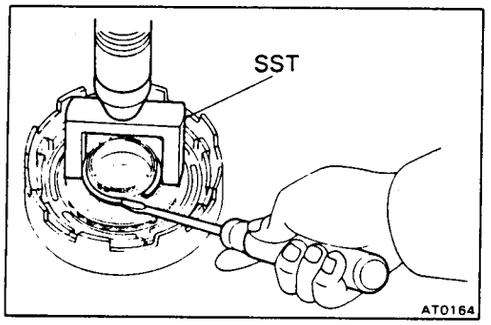
   Clearance:

   A140E 0.44 – 1.11 mm (0.0173 – 0.0437 in.)
   A140L 0.89 – 1.46 mm (0.0350 – 0.0575 in.)



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

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

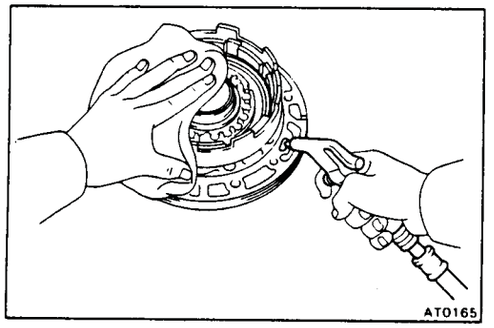


4. COMPRESS PISTON RETURN SPRINGS AND REMOVE SNAP RING

Place SST on the spring retainer and compress the springs with a shop press. Using a screwdriver, remove the snap ring.

SST 09350-32011

5. REMOVE SPRING RETAINER AND EIGHTEEN SPRINGS



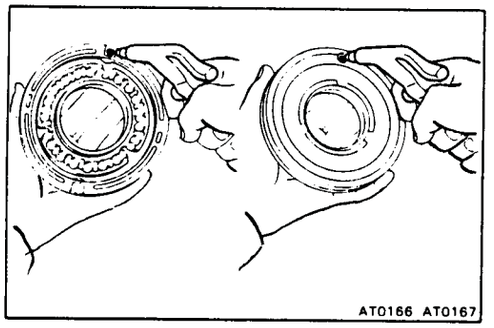
6. ASSEMBLE DIRECT CLUTCH ON OIL PUMP AND BLOW OUT PISTON

(a) Slide 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.

7. REMOVE CLUTCH PISTON O-RING

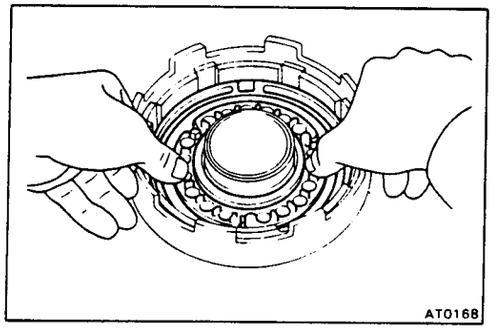


INSPECTION OF DIRECT CLUTCH

INSPECT CLUTCH PISTON

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

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

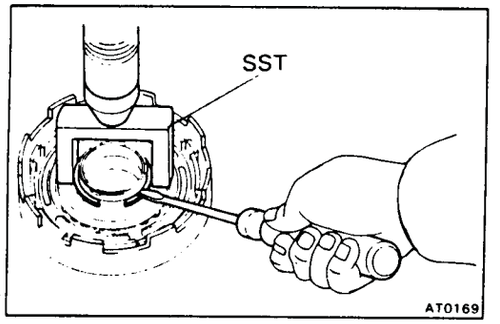


ASSEMBLY OF DIRECT CLUTCH

1. INSTALL CLUTCH PISTON IN DIRECT CLUTCH DRUM

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

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



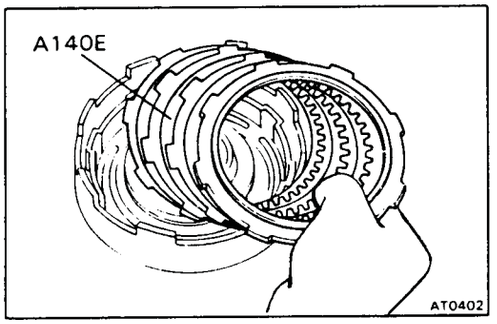
2. INSTALL EIGHTEEN PISTON RETURN SPRINGS AND SET RETAINER AND SNAP RING IN PLACE

3. COMPRESS RETURN SPRINGS AND INSTALL SNAP RING IN GROOVE

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

SST 09350-32011

(b) Install the snap ring with a screwdriver.
Be sure the end gap of snap ring is not aligned with the spring retainer claw.

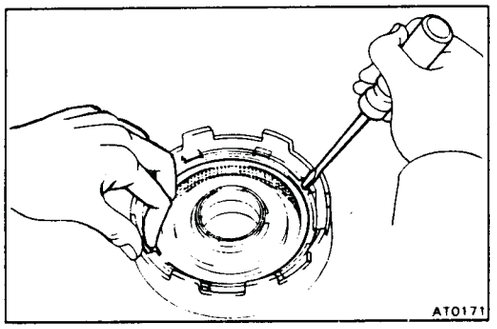


4. INSTALL PLATES, DISCS AND FLANGE

Install in order:

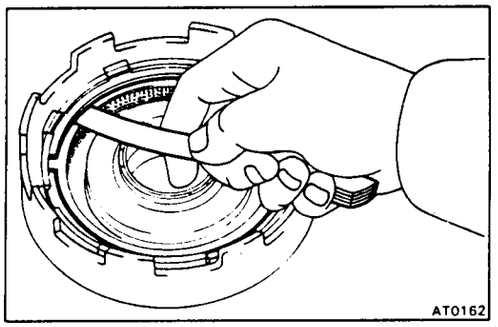
A140E Plate-disc-plate-disc-plate-disc
A140L Plate-disc-plate-plate-disc

Then install the flange, facing the flat end downward.



5. INSTALL OUTER SNAP RING

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



6. CHECK CLEARANCE OF DIRECT CLUTCH

Using a thickness gauge, check the clearance between the snap ring and the flange.

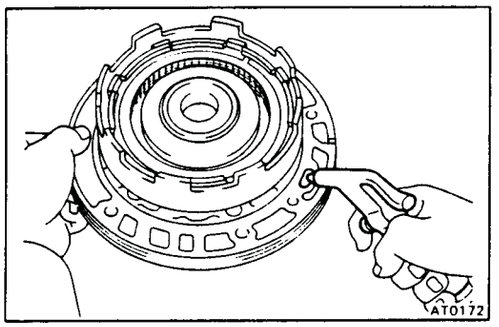
Clearance:

A140E 0.44 – 1.11 mm (0.0173 – 0.0437 in.)
A140L 0.89 – 1.46 mm (0.0350 – 0.0575 in.)

If not within specification, select a proper flange.

NOTE: There are two different flange thickness.

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



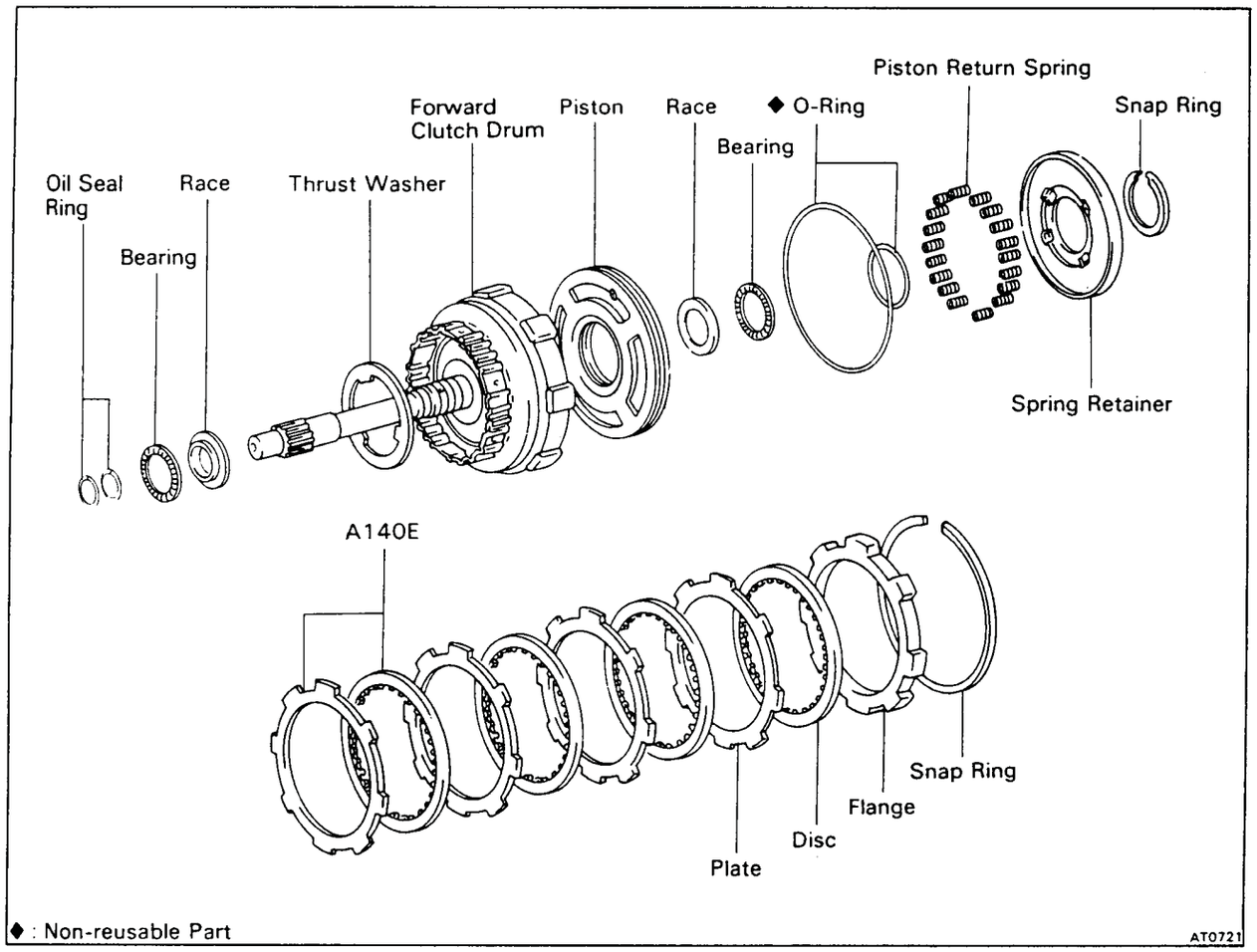
7. CHECK OPERATION OF DIRECT CLUTCH

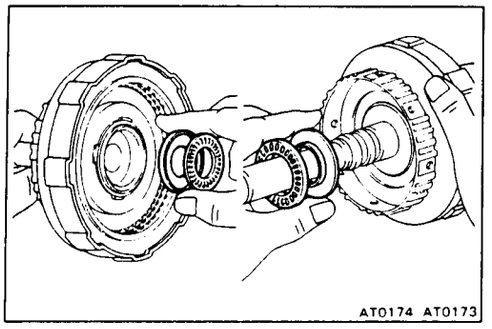
(a) Install the direct clutch onto the oil pump.

(b) Apply compressed air into the passage with the oil pump body and be sure that the piston moves.

If the piston does not move, disassemble and inspect.

Forward Clutch

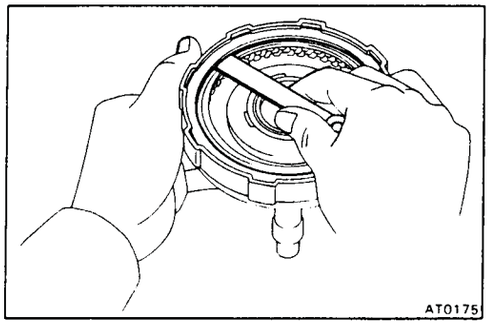




DISASSEMBLY OF FORWARD CLUTCH

1. **REMOVE THRUST BEARINGS AND RACES FROM BOTH SIDES OF CLUTCH**

   Note the position of the races.

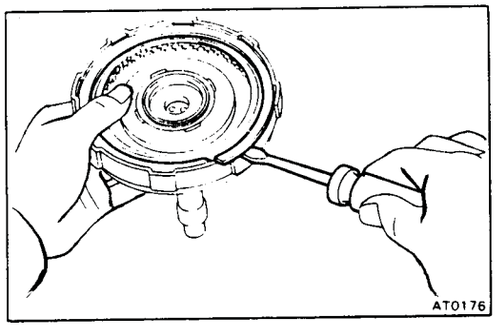


2. **MEASURE CLEARANCE OF FORWARD CLUTCH**

   Using a thickness gauge, measure the clearance between the snap ring and the flange.

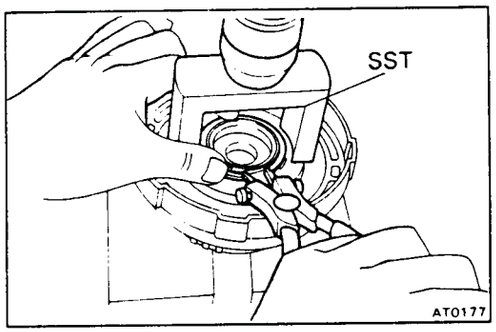
   Clearance:

   A140E 0.50 – 1.30 mm (0.0197 – 0.0512 in.)
   A140L 0.41 – 1.08 mm (0.0161 – 0.0425 in.)



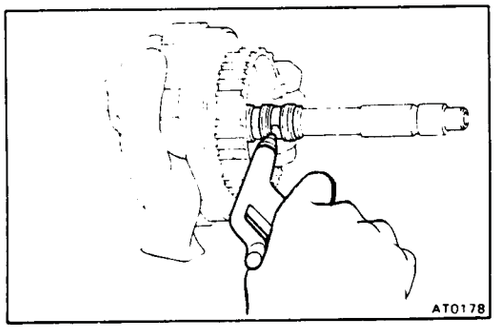
3. **REMOVE SNAP RING FROM CLUTCH DRUM**

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



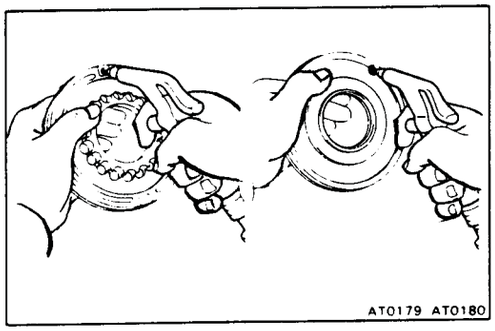
5. **COMPRESS PISTON RETURN SPRINGS AND REMOVE SNAP RING**
   (a) Place SST on the spring retainer and compress the springs with a shop press.
   SST 09350-32011
   (b) Remove the snap ring with snap ring pliers.

6. **REMOVE SPRING RETAINER AND EIGHTEEN SPRINGS**

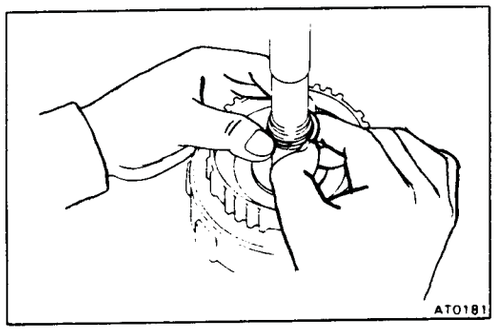


7. **BLOW OUT PISTON**
   Apply compressed air into oil passage to remove the piston.
   If the piston does not come out, use needle-nose pliers to remove it.

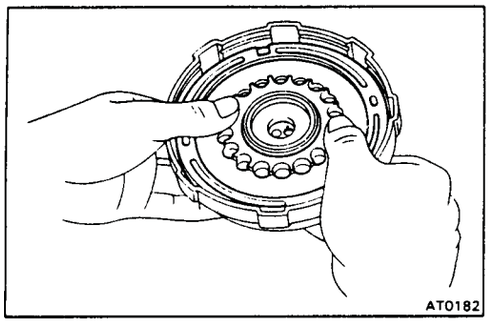
INSPECTION OF FORWARD CLUTCH



1. **INSPECT CLUTCH PISTON**
   (a) Check that the check ball is free by shaking the piston.
   (b) Check that valve does not leak by applying low-pressure compressed air.



2. **REPLACE OIL SEAL RINGS**
   (a) Remove the oil seal rings.
   (b) Spread the rings apart and install them into the groove.
   CAUTION: Do not spread the ring ends too much.



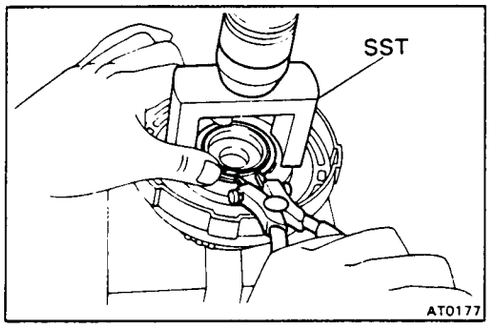
ASSEMBLY OF FORWARD CLUTCH

1. INSTALL NEW O-RINGS ON PISTON

Coat the O-ring with ATF.

2. INSTALL PISTON IN FORWARD CLUTCH DRUM

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



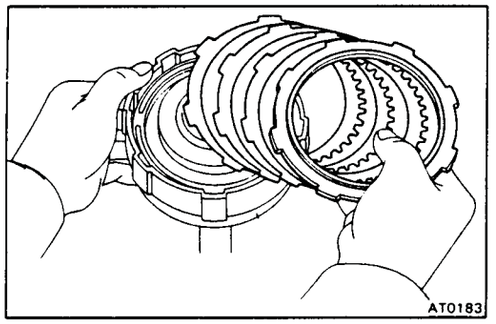
3. INSTALL EIGHTEEN PISTON RETURN SPRINGS, SPRING RETAINER AND SNAP RING IN PLACE

4. COMPRESS RETURN SPRINGS AND INSTALL SNAP RING IN GROOVE

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

SST 09350-32011

(b) Install the snap ring with snap ring pliers.
The end gap of snap ring is not aligned with the spring retainer claw.



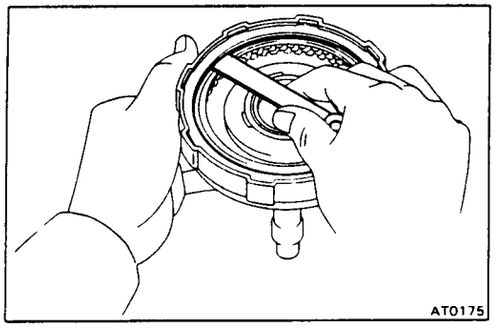
5. INSTALL PLATES, DISCS AND FLANGE

Install in order: A140E — P–D–P–D–P–D–P–D
A140L — P–D–P–D–P–D

Then install the flange, facing the flat end downward.

6. INSTALL OUTER SNAP RING

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



7. CHECK CLEARANCE OF FORWARD CLUTCH

Using a thickness gauge, check the clearance between the snap ring and the flange.

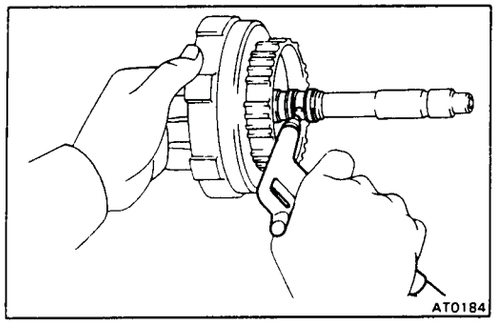
Clearance:

A140E 0.50 — 1.30 mm (0.0197 — 0.0512 in.)
A140L 0.41 — 1.08 mm (0.0161 — 0.0425 in.)

If not within specification, select a proper flange.

NOTE: There are two different flange thickness.

Flange thickness: 2.60 mm (0.1024 in.) A140E
3.00 mm (0.1181 in.) A140E, A140L
3.37 mm (0.1327 in.) A140L



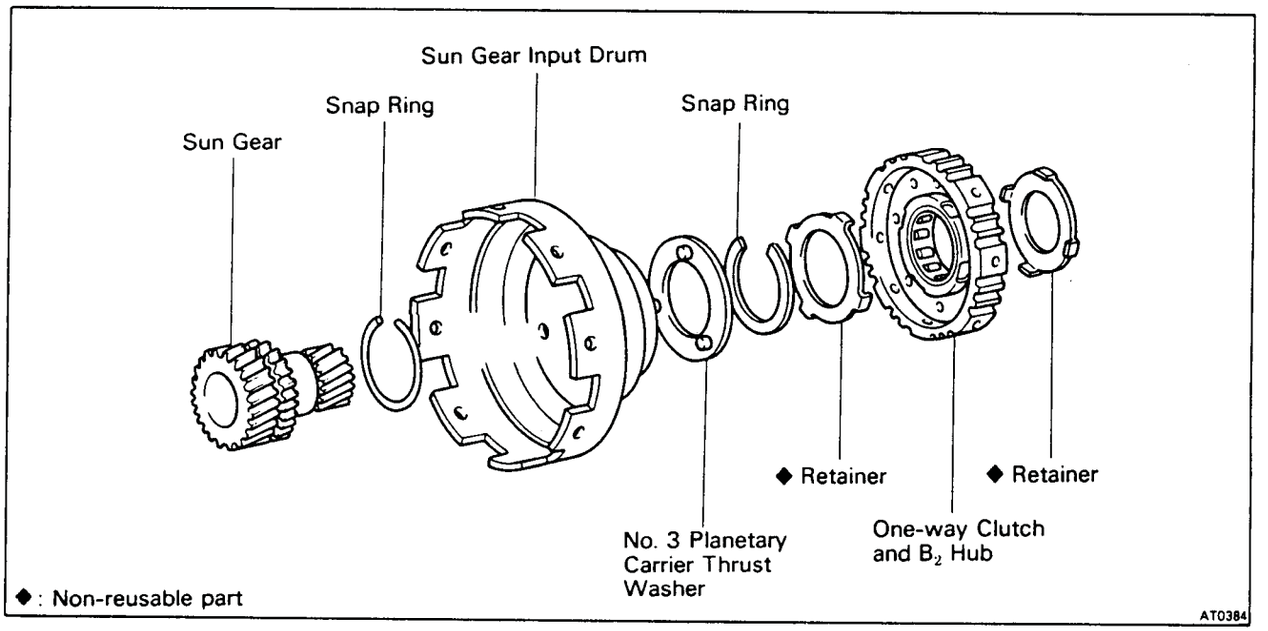
8. CHECK OPERATION OF FORWARD CLUTCH

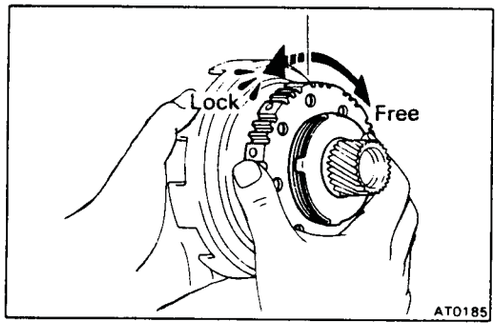
Apply compressed air into the oil passage with the shaft and be sure that the piston moves.

If the piston does not move, disassemble and inspect.

9. INSTALL BEARINGS AND RACES

No. 1 One-way Clutch and Sun Gear

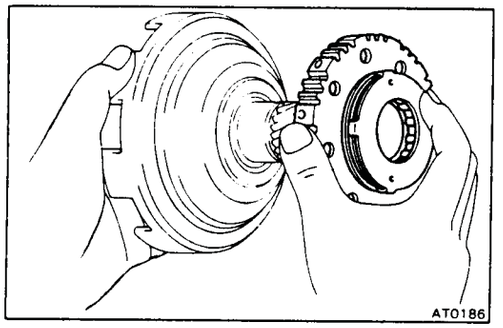




DISASSEMBLY OF NO.1 ONE-WAY CLUTCH AND SUN GEAR

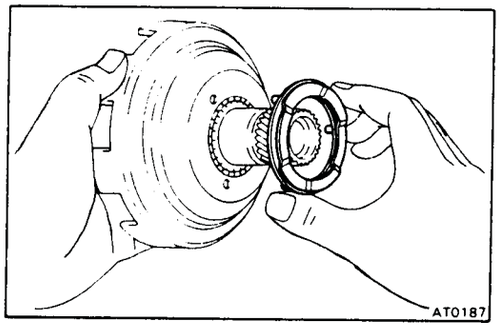
1. **CHECK OPERATION OF ONE-WAY CLUTCH**

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



2. **REMOVE SECOND BRAKE HUB AND ONE-WAY CLUTCH FROM INNER RACE**

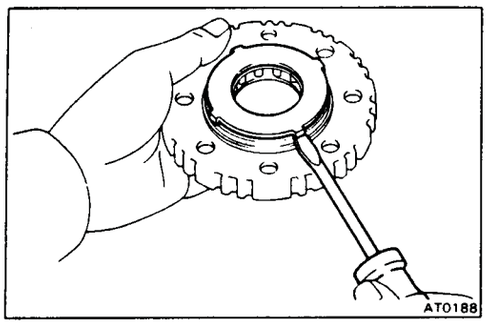
   While turning the hub clockwise, remove the one-way clutch from the inner race.



3. **REMOVE NO.3 PLANETARY CARRIER THRUST WASHER FROM SUN GEAR INPUT DRUM**

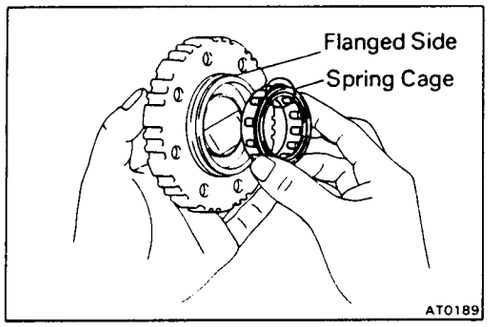
4. **REMOVE SHAFT SNAP RING AND REMOVE SUN GEAR INPUT DRUM**

5. **REMOVE SHAFT SNAP RING**

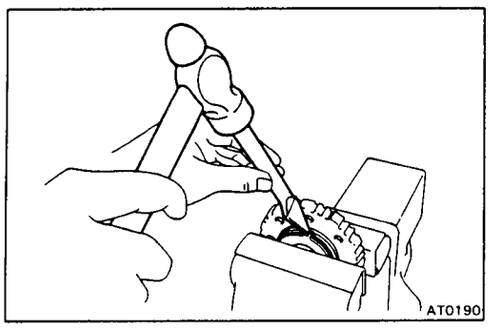


INSPECTION OF NO.1 ONE-WAY CLUTCH

1. **IF NECESSARY, REPLACE ONE-WAY CLUTCH**
   (a) Pry off the retainer with a screwdriver.
   (b) Remove the one-way clutch.

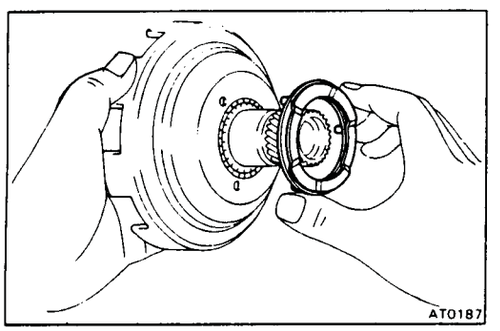


   (c) Install a new one-way clutch into the brake hub, facing the spring cage inward from the flanged side of the brake hub.



   (d) Hold the brake hub in a vise with soft jaws, and flatten the ears with a chisel.
   (e) Check to make sure that the retainer is centered.

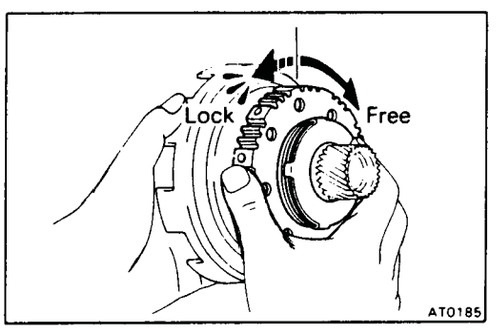
2. **CHECK OPERATION OF ONE-WAY CLUTCH**



ASSEMBLY OF NO.1 ONE-WAY CLUTCH AND SUN GEAR

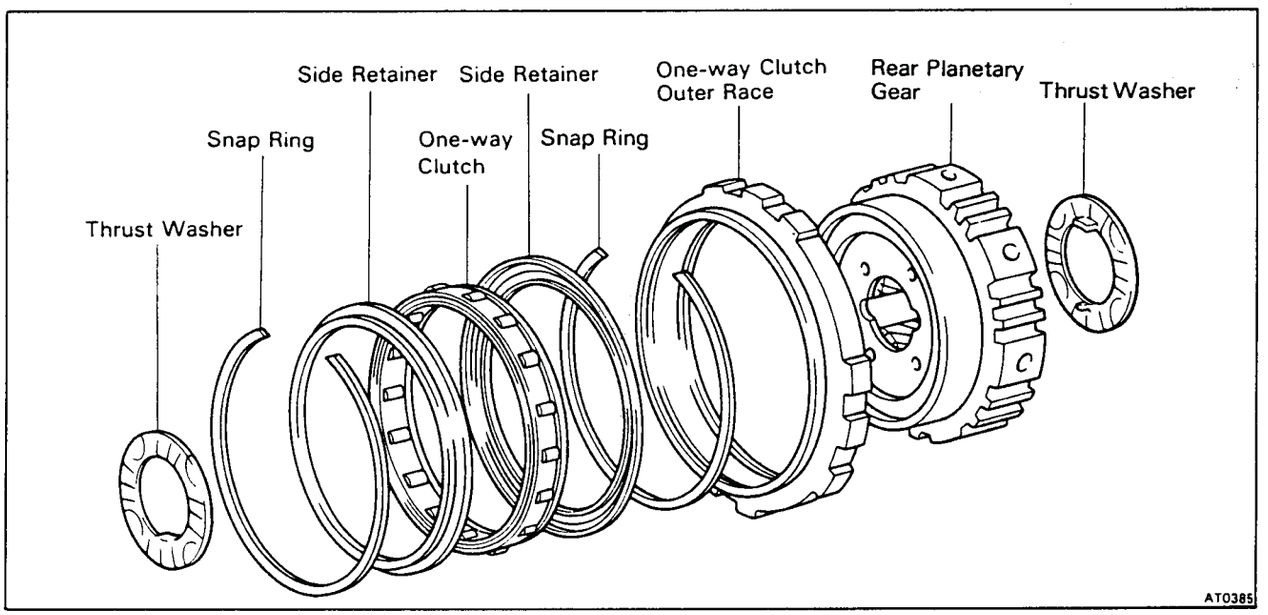
(See page AT-72)

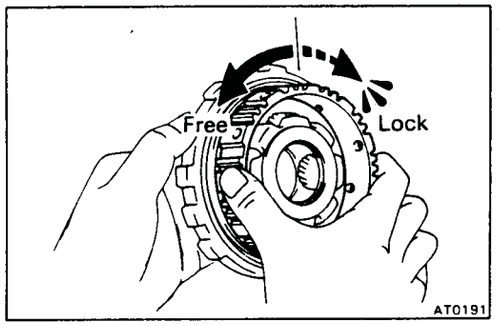
1. **INSTALL SHAFT SNAP RING ON SUN GEAR**
2. **INSTALL SUN GEAR INPUT DRUM ON SUN GEAR AND INSTALL SHAFT SNAP RING**
3. **INSTALL NO.3 PLANETARY CARRIER THRUST WASHER ON SUN GEAR INPUT DRUM**
4. **INSTALL ONE-WAY CLUTCH AND SECOND BRAKE HUB ON INNER RACE**
   While turning the hub clockwise, slide the one-way clutch onto the inner race.



5. **RECHECK OPERATION OF NO.1 ONE-WAY CLUTCH**

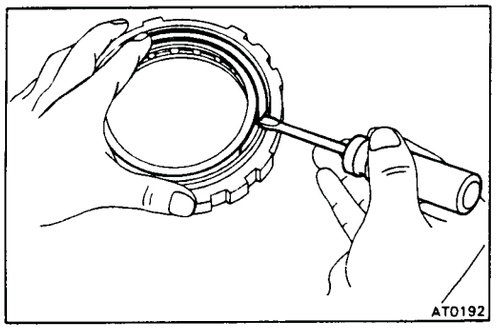
No. 2 One-way Clutch and Rear Planetary Gear

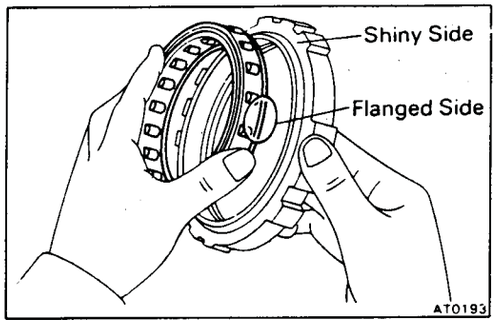




DISASSEMBLY OF ONE-WAY CLUTCH

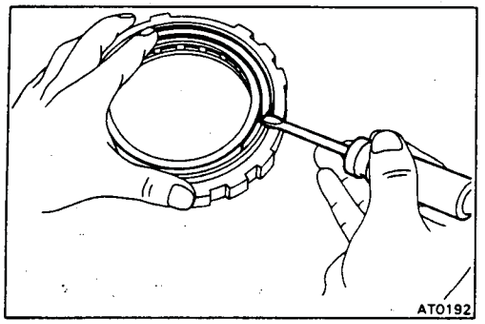
1. **CHECK OPERATION OF ONE-WAY CLUTCH**
   Hold the outer race and turn the hub.
   The hub should turn freely counterclockwise and should lock clockwise.
2. **REMOVE NO.2 PLANETARY CARRIER THRUST WASHERS FROM BOTH SIDES OF CARRIER**
3. **DISASSEMBLE ONE-WAY CLUTCH**
   Remove the hub and the planetary gear from the one-way clutch.
4. **REMOVE BOTH SIDE SNAP RINGS AND TWO SIDE RETAINERS**
5. **REMOVE ONE-WAY CLUTCH FROM OUTER RACE**



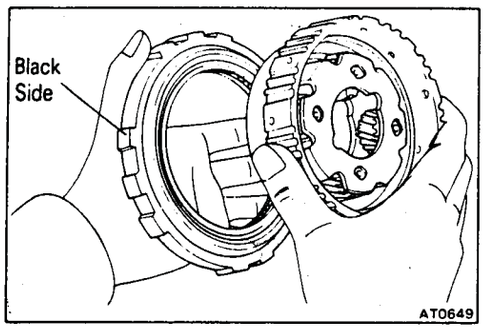


ASSEMBLY OF ONE-WAY CLUTCH

1. **INSTALL ONE-WAY CLUTCH**
   Install the one-way clutch into the outer race, facing the flanged side of the one-way clutch inward from the shiny side of the outer race.

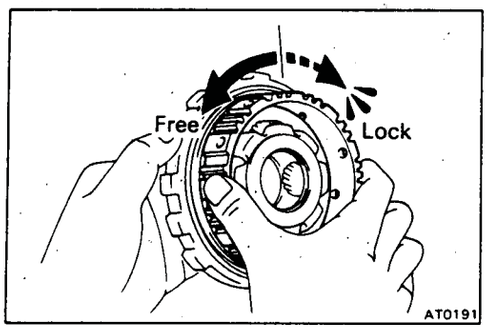


2. INSTALL BOTH RETAINERS AND TWO SNAP RINGS



3. INSTALL REAR PLANETARY GEAR INTO ONE-WAY CLUTCH

Install the planetary gear into the one-way clutch, facing the inner race of planetary gear inward from the black side of the outer race.



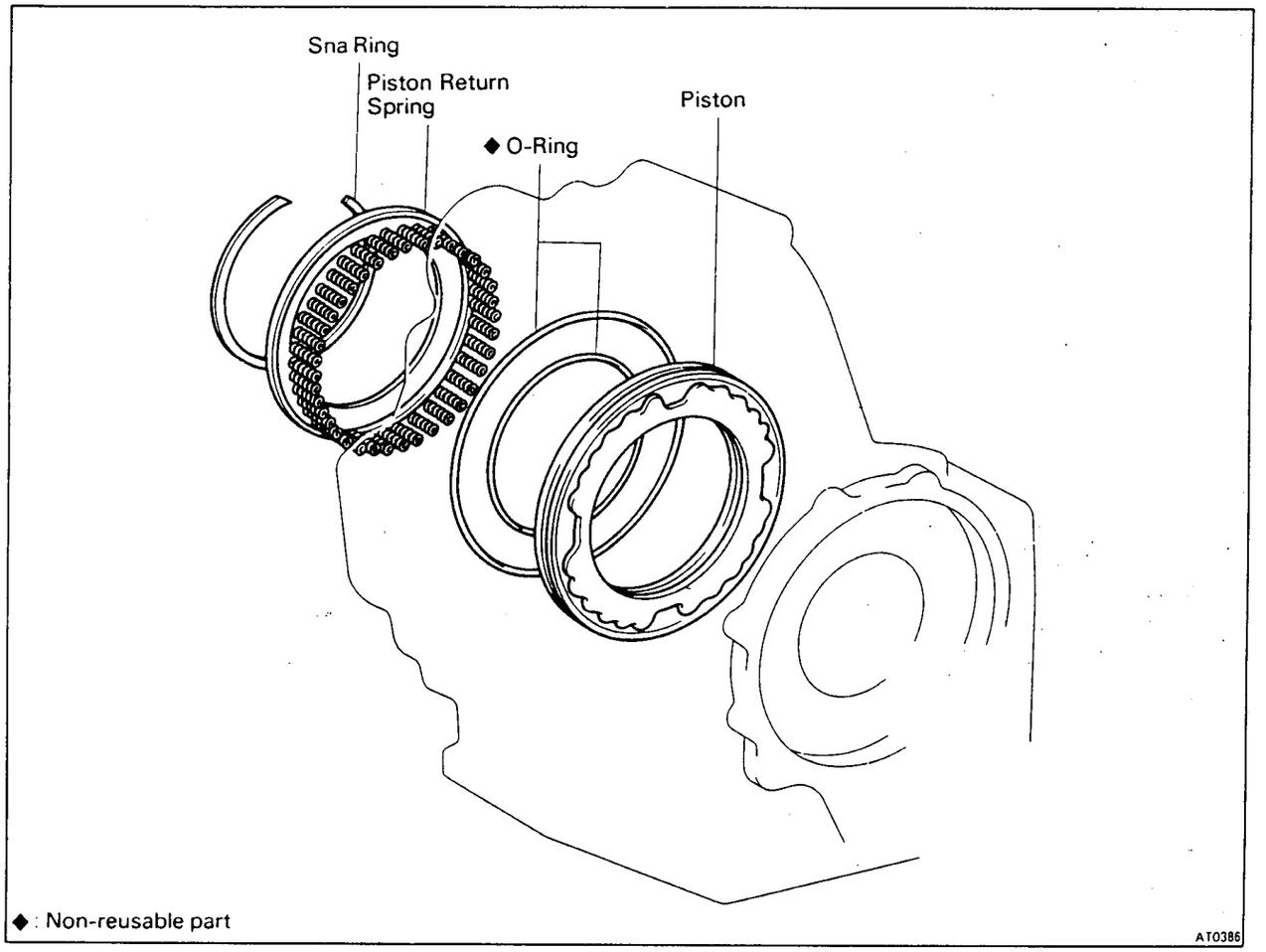
4. CHECK OPERATION OF ONE-WAY CLUTCH

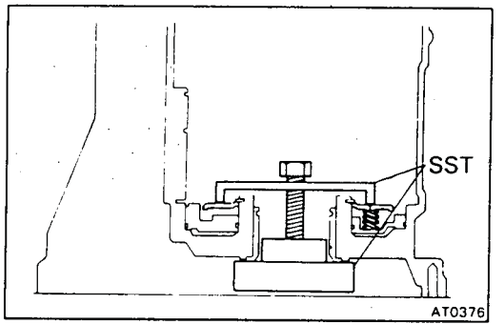
5. INSTALL NO. 2 PLANETARY CARRIER THRUST WASHERS ONTO BOTH SIDES OF CARRIER

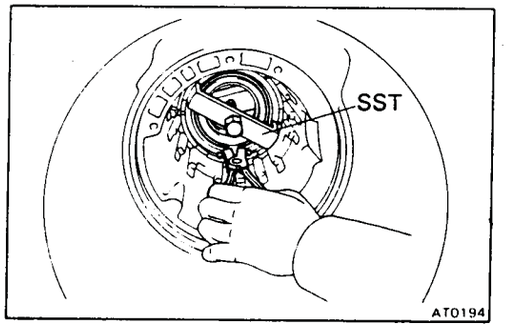
(a) Coat the thrust washers with petroleum jelly.

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

First and Reverse Brake Piston

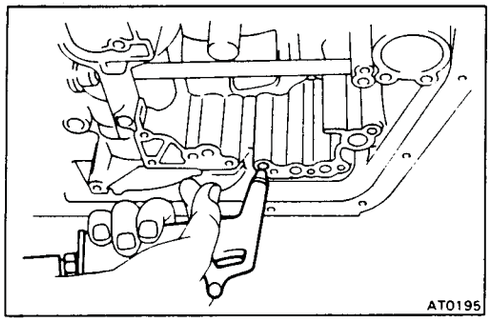






DISASSEMBLY OF FIRST AND REVERSE BRAKE PISTON

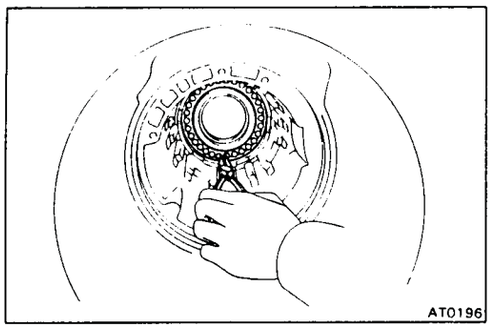
1. **COMPRESS RETURN SPRINGS AND REMOVE SPRING RETAINER SNAP RING**
   (a) Install SST. Compress the springs evenly by tightening the bolt gradually.
   SST 09350-32011
   (b) Using snap ring pliers, remove the snap ring.
   (c) Remove SST.
   SST 09350-32011
2. **REMOVE SNAP RING AND RETURN SPRING ASSEMBLY**


AT0195

3. **REMOVE PISTON FROM TRANSMISSION CASE WITH COMPRESSED AIR**

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

NOTE: Hold the piston so it does not slant and then blow with the gun slightly away from the oil hole.


AT0196

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

4. **REMOVE O-RINGS FROM PISTON**

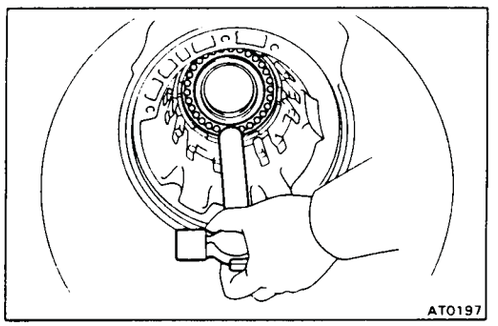
ASSEMBLY OF FIRST AND REVERSE BRAKE PISTON

1. **INSTALL NEW O-RINGS ON PISTON**

Coat the O-rings with ATF.

2. **INSTALL PISTON IN TRANSMISSION CASE**

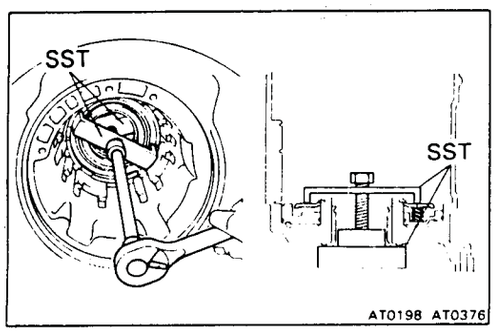
Push the piston into the bore of the case facing the spring seats upward.


AT0197

3. **PLACE SST BASE UNDER CASE**

SST 09350-32011

4. **INSTALL PISTON RETURN SPRING ASSEMBLY AND SET SNAP RING IN PLACE**



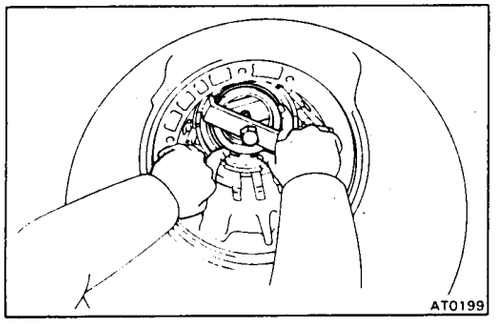
AT0198 AT0376

5. **COMPRESS PISTON RETURN SPRINGS TO ALLOW INSTALLATION OF SNAP RING**

CAUTION: Do not overtighten the bolt.

Gradually and evenly tighten the bolt to compress the springs, being careful not to damage the transmission case with SST.

SST 09350-32011


AT0199

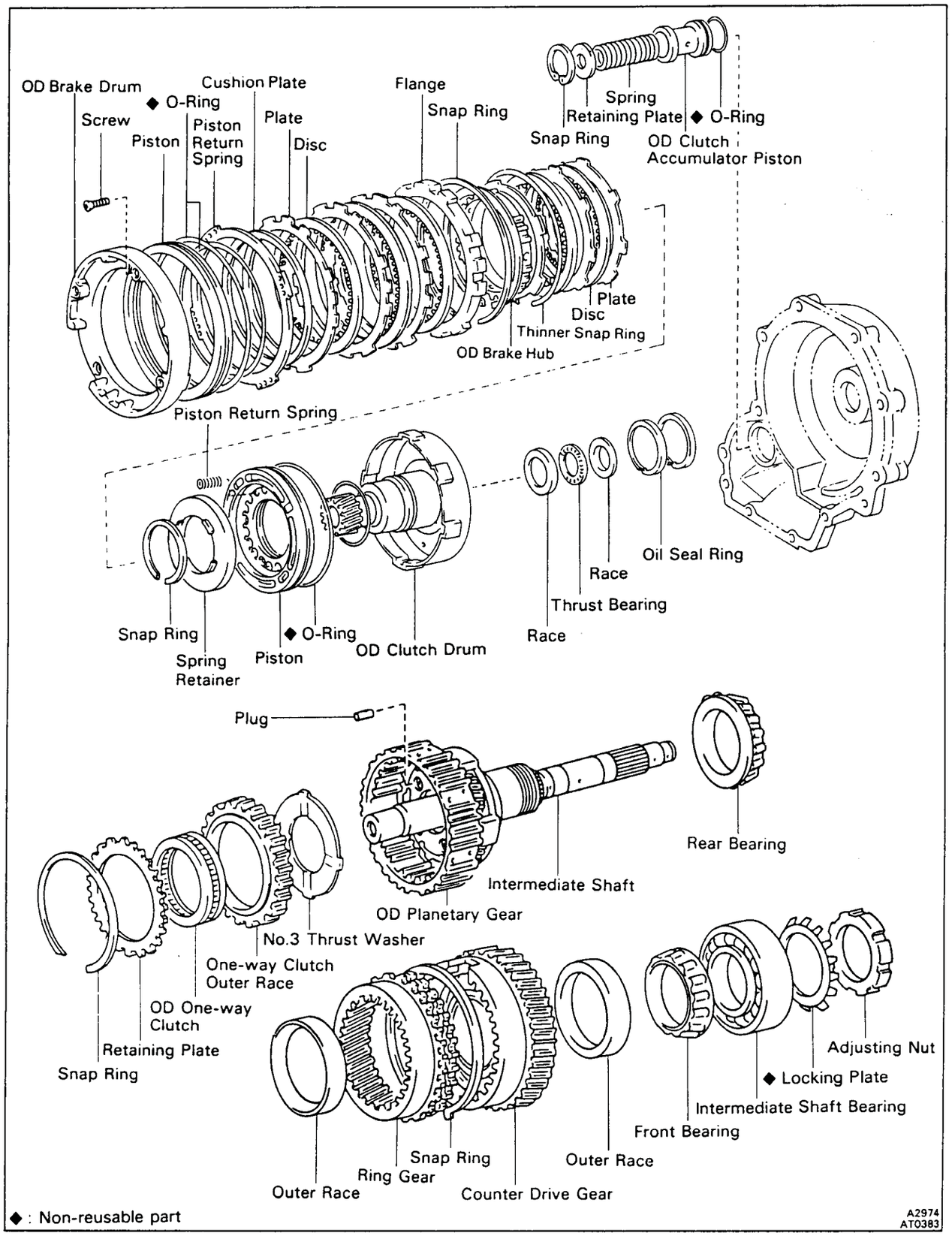
6. **INSTALL SNAP RING**

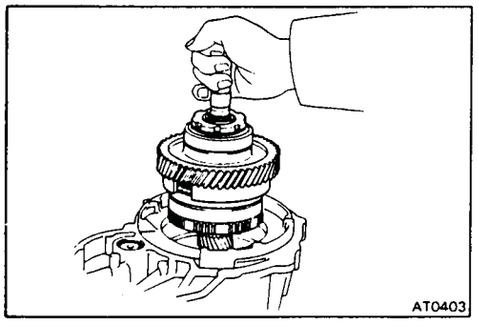
(a) Push the snap ring into place with your fingers. Visually check to make sure it is fully seated and centered by the three lugs on the spring retainer. Be sure the end gap of snap ring is not aligned with the spring retainer claw.

(b) Remove the SST.

SST 09350-32011

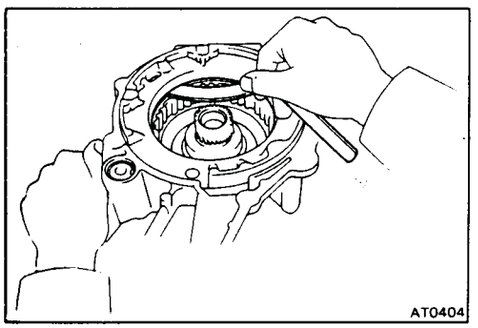
Overdrive Unit





REMOVAL OF OVERDRIVE GEAR ASSEMBLY

REMOVE OVERDRIVE PLANETARY GEAR AND COUNTER GEAR FROM CASE

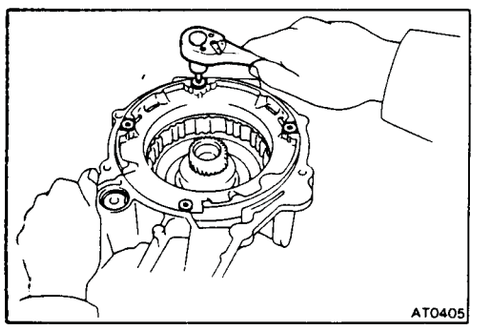


DISASSEMBLY OF OVERDRIVE BRAKE

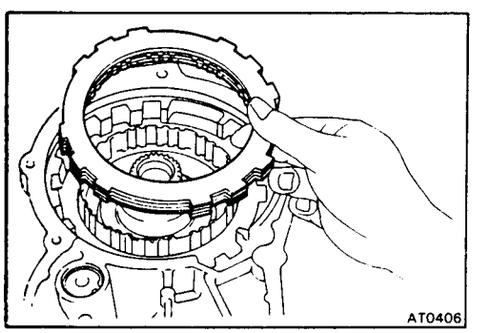
1. **MEASURE CLEARANCE BETWEEN PISTON RETURN SPRING AND CUSHION PLATE**

   Clearance:

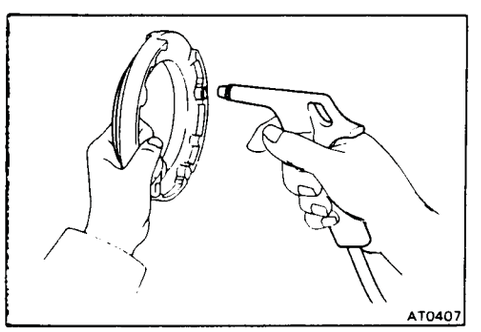
   A140E 0.51 – 1.68 mm (0.0201 – 0.0661 in.)
   A140L 0.63 – 1.72 mm (0.0248 – 0.0677 in.)



2. **REMOVE OVERDRIVE BRAKE DRUM**
   (a) Using a TORX socket wrench, loosen the four screws one turn at a time until spring tension is released.
   (b) Remove the overdrive brake drum with the piston.
3. **REMOVE PISTON RETURN SPRING ASSEMBLY**
4. **REMOVE CUSHION PLATE**



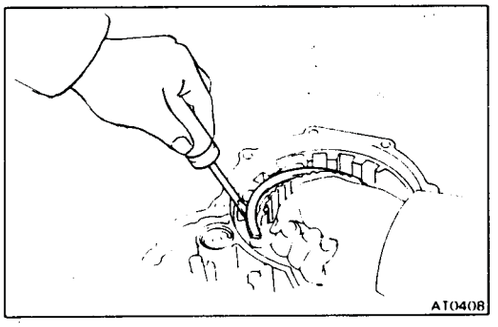
5. **REMOVE PLATES, DISCS AND FLANGE**



6. **BLOW OUT PISTON FROM DRUM**

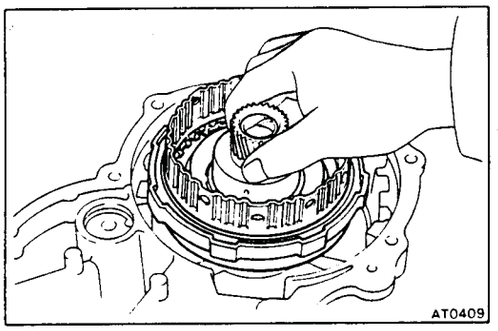
   Apply compressed air to oil hole to remove the piston.

   NOTE: Blow with the gun slightly away from the oil hole, and be careful that the piston doesn't tilt.
7. **REMOVE O-RING FROM PISTON**

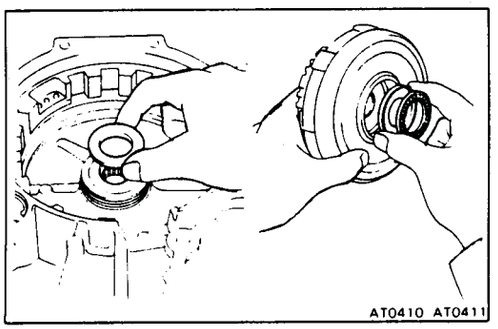


REMOVAL OF OVERDRIVE CLUTCH

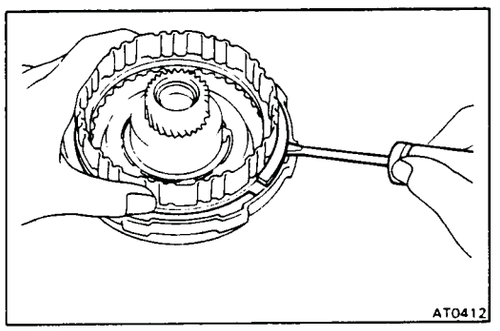
1. REMOVE SNAP RING



2. REMOVE OVERDRIVE CLUTCH FROM CASE



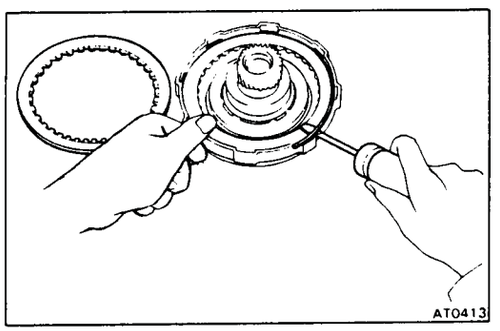
3. REMOVE BEARING AND RACE FROM CLUTCH DRUM AND CASE



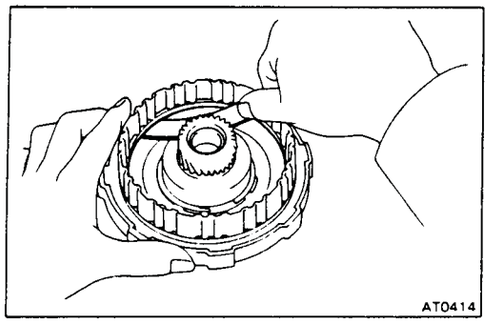
DISASSEMBLY OF OVERDRIVE CLUTCH

(See page AT-78)

1. REMOVE SNAP RING AND HUB FROM OVERDRIVE CLUTCH DRUM



2. REMOVE ONE DISC AND THINNER SNAP RING

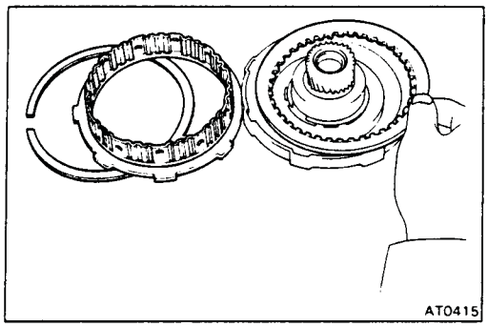


3. MEASURE CLEARANCE OF OVERDRIVE CLUTCH

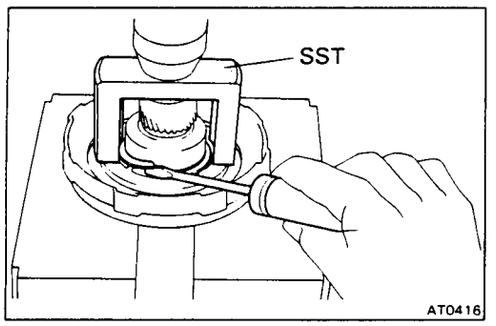
(a) Install the disc hub and snap ring without the thinner snap ring.

(b) Measure the clearance between the piston and the end of the plate.

Clearance: 0.72 – 1.68 mm (0.0283 – 0.0661 in.)



4. REMOVE SNAP RING, OD BRAKE HUB, PLATES AND DISCS



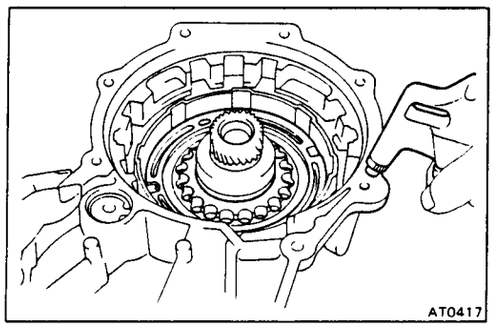
5. COMPRESS PISTON RETURN SPRING AND REMOVE SNAP RING

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

SST 09350-32011

(b) Remove the snap ring with a screwdriver.

6. REMOVE SPRING RETAINER AND EIGHTEEN SPRINGS



7. ASSEMBLE OVERDRIVE CLUTCH DRUM ON CASE AND BLOW OUT PISTON

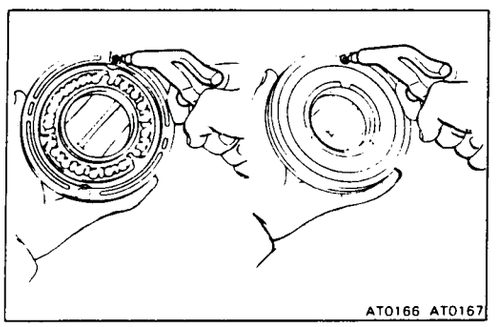
(a) Install the clutch drum on the case.

(b) Apply compressed air to the pressure apply hole with the case.

(c) Remove the overdrive clutch drum from the case.

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

8. REMOVE O-RINGS FROM PISTON

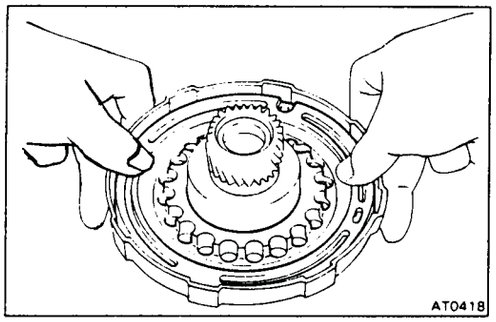


INSPECTION OF CLUTCH PISTON

INSPECT CHECK BALL FOR OPERATION

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

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

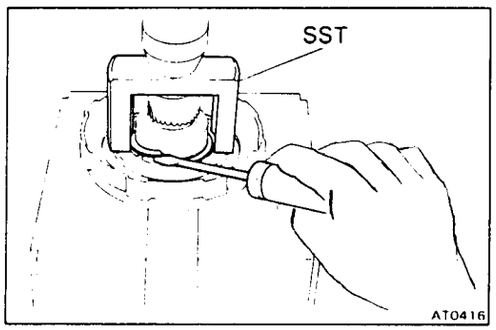


ASSEMBLY OF OVERDRIVE CLUTCH

1. INSTALL CLUTCH PISTON IN OVERDRIVE CLUTCH DRUM

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

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



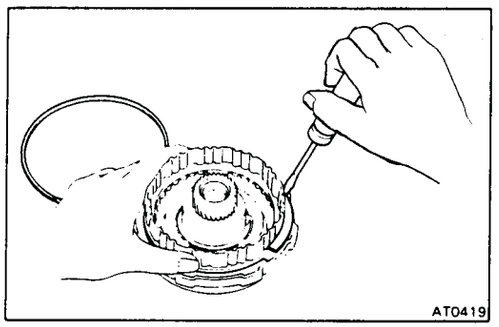
2. INSTALL EIGHTEEN PISTON RETURN SPRINGS AND SET RETAINER AND SNAP RING IN PLACE

3. COMPRESS RETURN SPRINGS AND INSTALL SNAP RING IN GROOVE

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

SST 09350-32011

(b) Install the snap ring with your hands.
Be sure end gap of snap ring is not aligned with the spring retainer claw.



4. INSTALL PLATES AND DISCS WITHOUT ASSEMBLING THINNER SNAP RING

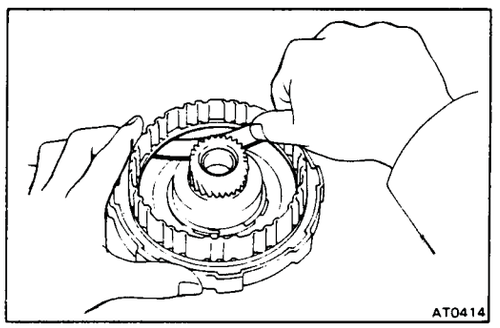
(a) Do not assemble the thinner snap ring yet.

(b) Using low-pressure compressed air, blow all excess ATF from the discs.

CAUTION: High-pressure air will damage the discs.

(c) Install in order: Plate-disc-plate-disc

5. INSTALL HUB AND SNAP RING

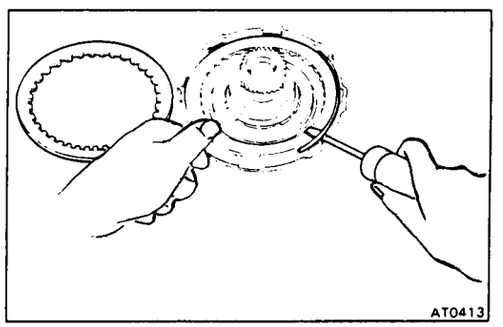


6. CHECK CLEARANCE OF OVERDRIVE CLUTCH

Using a thickness gauge, check the clearance between the piston and end of the plate.

Clearance: 0.72 – 1.68 mm (0.0283 – 0.0661 in.)

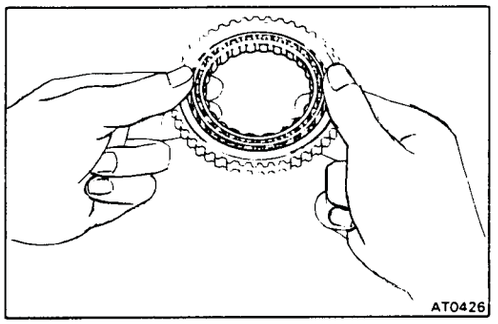
If the clearance exceeds specification, the clutch pack is probably worn. If the clearance is less than the limit, parts may be mis-assembled or excess ATF may be on the discs.



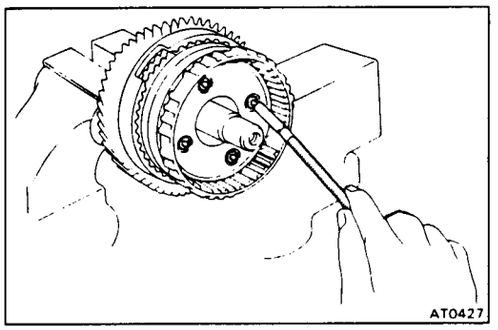
7. INSTALL THINNER SNAP RING IN OVERDRIVE CLUTCH DRUM

(a) Remove the overdrive clutch snap ring, hub and disc to allow installation of the thinner snap ring.

(b) Compress and lower the snap ring into the groove by hand. Check that the ends of the snap ring are not aligned with one of the cutouts.

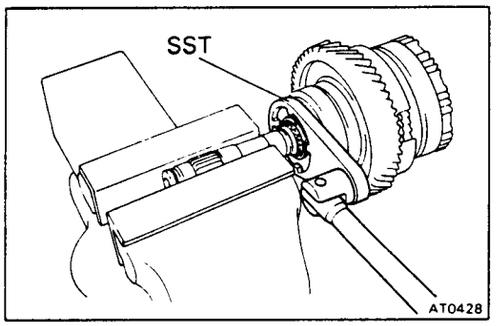


5. **REMOVE ONE-WAY CLUTCH FROM OUTER RACE**
   Note the direction of the one-way clutch.

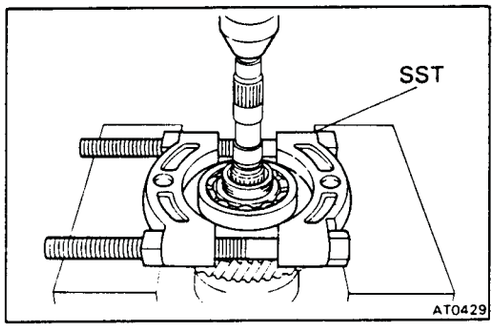


6. **REMOVE FOUR PLUGS WITH MAGNETIC FINGER**
   NOTE: Be careful not to lose them.

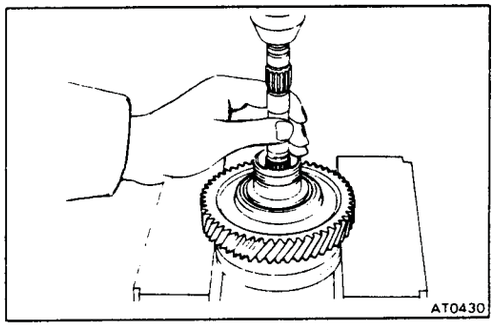
REPLACEMENT OF COUNTER DRIVE GEAR AND BEARING



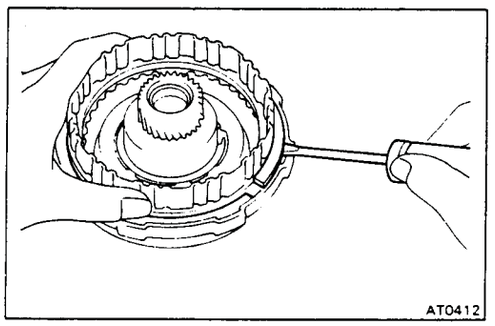
1. **PRY OFF LOCKING WASHER WITH SCREWDRIVER**
2. **HOLD SHAFT IN VISE WITH SOFT JAWS, AND LOOSEN ADJUSTING NUT WITH SST**
   SST 09350-32011
3. **REMOVE ADJUSTING NUT AND WASHER**



4. **REMOVE INTERMEDIATE SHAFT BEARING**
   Using SST, press out the bearing from the shaft.
   SST 09950-00020

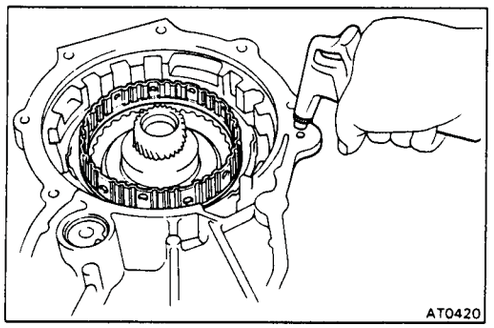


5. **REMOVE COUNTER DRIVE GEAR AND FRONT BEARING**
   Using a press, press out the gear and bearing together.



8. INSTALL DISC, HUB AND SNAP RING

Check that the ends of the snap ring are not aligned with one of the cutouts.



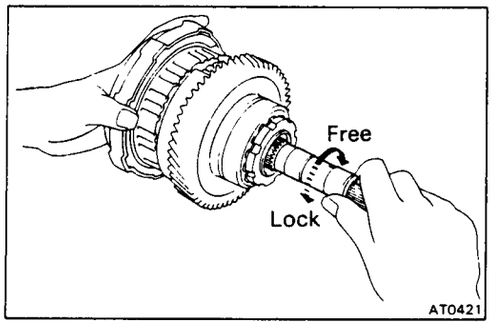
9. CHECK OPERATION OF OVERDRIVE PISTON

(a) Install the overdrive clutch into the case.

(b) Apply compressed air into the case passage and confirm that the piston moves.

If the piston does not move, disassemble and inspect.

(c) Remove the overdrive clutch from the case.



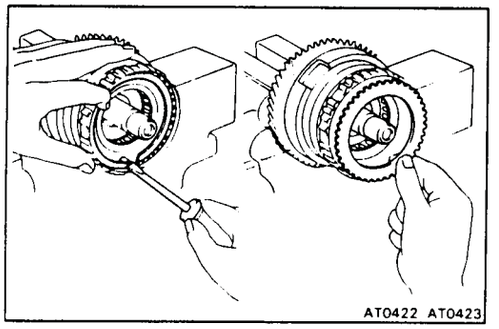
DISASSEMBLY OF OVERDRIVE ONE-WAY CLUTCH

1. CHECK OPERATION OF ONE-WAY CLUTCH

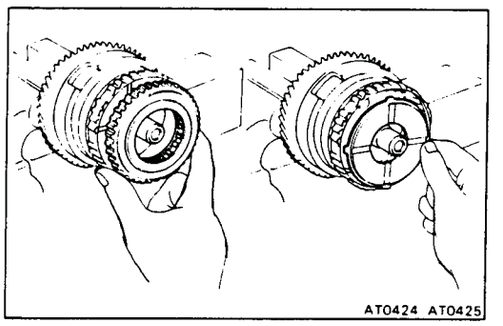
(a) Install the overdrive clutch into the one-way clutch while turning the overdrive gear clockwise.

(b) Hold the overdrive clutch and turn the intermediate shaft. The shaft should turn freely clockwise and should lock counterclockwise.

If the one-way clutch does not work properly, replace it.

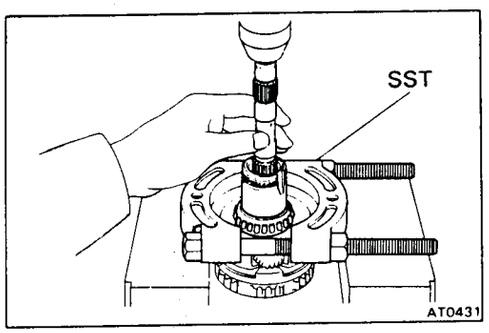


2. REMOVE SNAP RING AND RETAINING PLATE



3. REMOVE ONE-WAY CLUTCH AND OUTER RACE TOGETHER

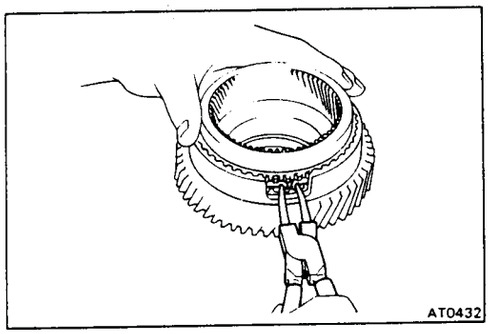
4. REMOVE NO.3 OVERDRIVE PLANETARY THRUST WASHER



6. REMOVE REAR BEARING

Using SST, press out the bearing.

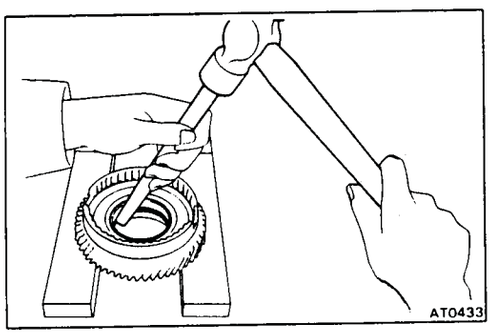
SST 09950-00020



7. REMOVE OVERDRIVE PLANETARY RING GEAR FROM COUNTER DRIVE GEAR

(a) While pulling up the ring gear, compress the snap ring with needle-nose pliers and remove it from the groove.

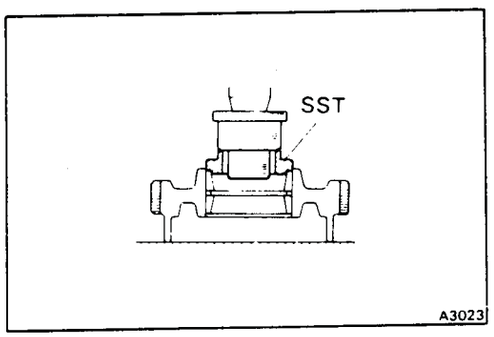
(b) Remove the ring gear from the counter drive gear.



8. REMOVE TWO OUTER RACES FROM COUNTER DRIVE GEAR

Drive out the races with a brass bar and hammer.

9. REMOVE SNAP RING FROM COUNTER DRIVE GEAR



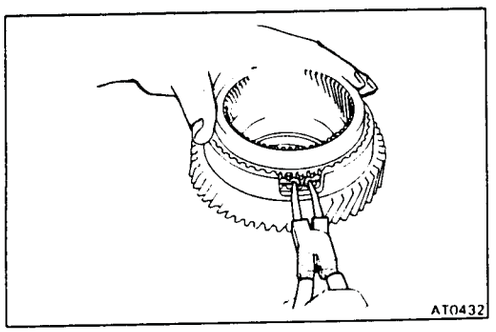
10. INSTALL SNAP RING INTO COUNTER DRIVE GEAR

11. INSTALL TWO OUTER RACES INTO COUNTER DRIVE GEAR

Using SST, press the outer races into the gear.

SST 09350-32011

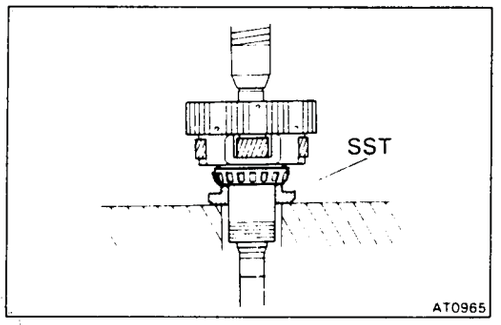
NOTE: Press in the outer races until they touch the snap ring. Tap the races in straight, so that they do not tilt.



12. INSTALL OVERDRIVE PLANETARY RING GEAR INTO COUNTER DRIVE GEAR

While pushing down the ring gear, squeeze the snap ring end with a needle-nose pliers, and install it into the groove.

NOTE: When the snap ring is fully seated, the end will be free.

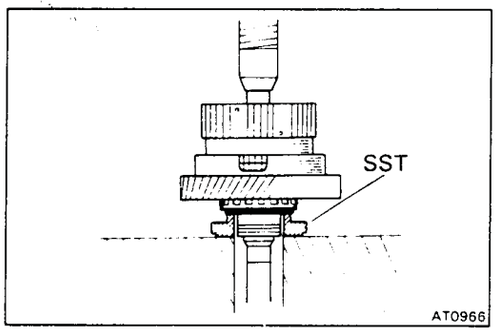


13. INSTALL REAR BEARING

Using SST, press in the bearing into the shaft.

SST 09350-32011

NOTE: Press in the bearing until the side surface of the inner race touches the shaft.

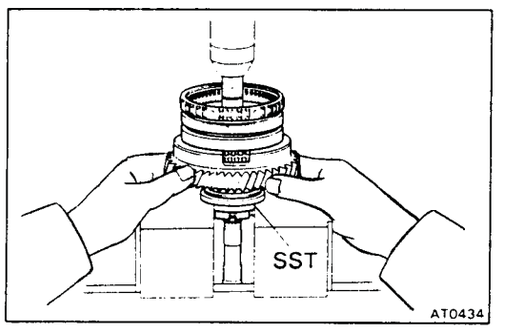


14. INSTALL COUNTER DRIVE GEAR AND FRONT BEARING

(a) Install the gear onto the shaft, and mesh the ring gear with the planetary pinions.

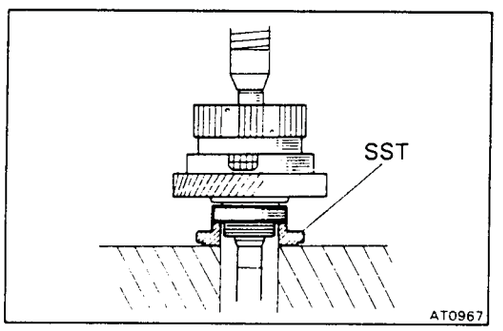
(b) Place the front bearing onto the shaft.

NOTE: Hold the ring gear to prevent it from falling.



(c) Using SST, press in the bearing until axial play between the bearings is 0.5 mm (0.020 in.).

SST 09350-32011

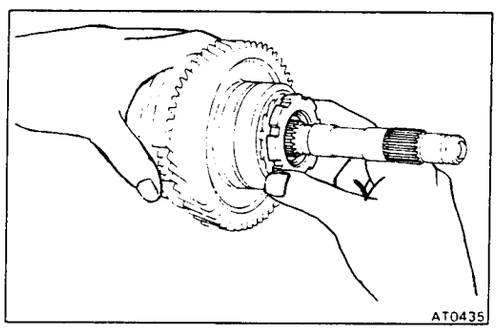


15. INSTALL INTERMEDIATE SHAFT BEARING

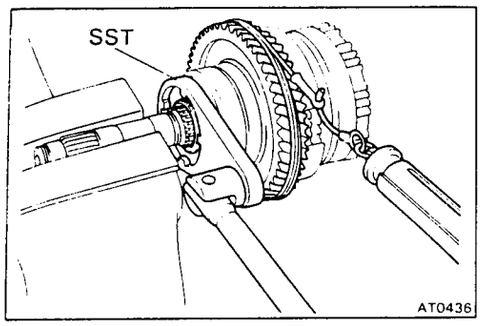
Using SST, press in the bearing until it slightly touches the front bearing of the counter drive gear.

SST 09350-32011

NOTE: The counter drive gear can be turned lightly.



16. PLACE LOCKING WASHER AND ADJUSTING NUT ONTO INTERMEDIATE SHAFT



17. ADJUST PRELOAD OF COUNTER DRIVE GEAR

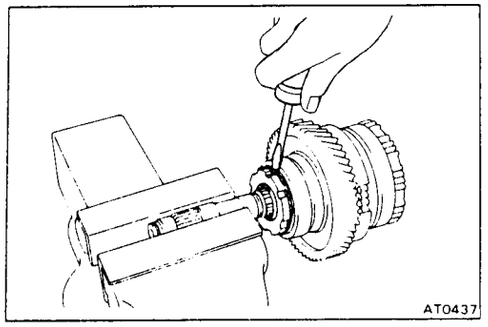
(a) Place SST onto the adjusting nut and hold the shaft in a vise with soft jaws.

SST 09350-32011

(b) Tighten the adjusting nut to the point where the following gear starting load occurs with SST.

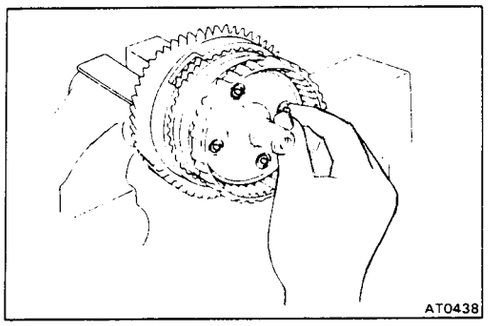
Preload (at starting): 920 – 1,530 g (2.0 – 3.4 lb, 9 – 15 N)

NOTE: Turn the counter drive gear right and left several times before measuring the preload.



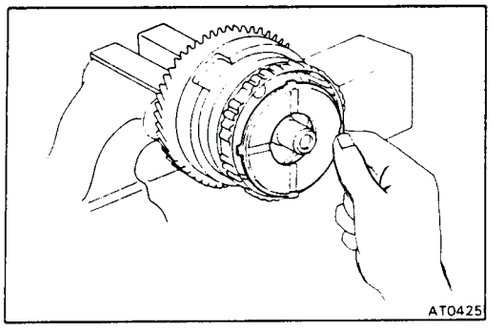
18. LOCK ADJUSTING NUT WITH ONE TAB ON LOCKING WASHER

Bend the locking washer tab until it is even with the adjusting nut groove.



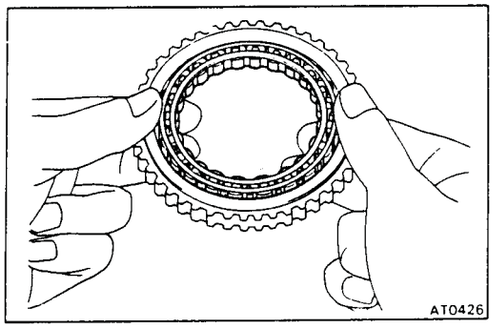
ASSEMBLY OF OVERDRIVE ONE-WAY CLUTCH

1. INSTALL FOUR PLUGS INTO HOLE OF PINION SHAFT



2. INSTALL NO.3 OVERDRIVE PLANETARY THRUST WASHER

Install the thrust washer, facing the groove toward the overdrive case.

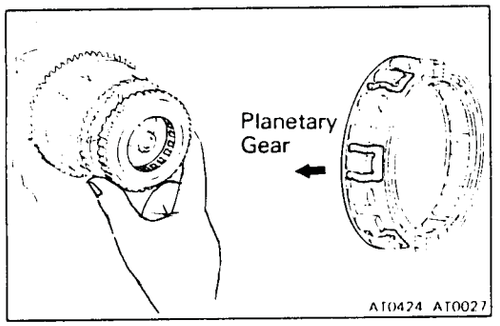


3. ASSEMBLE OVERDRIVE ONE-WAY CLUTCH

(a) Install the one-way clutch into the outer race.

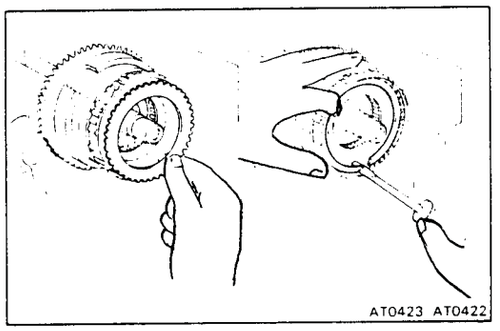
NOTE: Be sure that the flange of cage faces toward the outer side.

(b) Install a retainer on both sides of the one-way clutch.

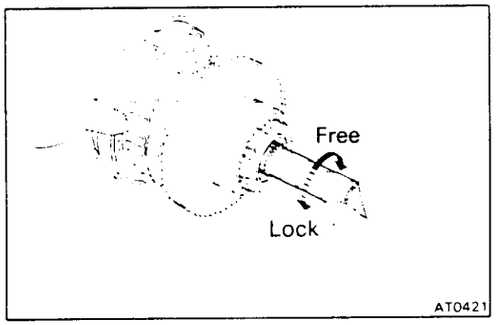


4. INSTALL OVERDRIVE ONE-WAY CLUTCH INTO HUB

Be sure that the one-way clutch is installed in correct direction.



5. INSTALL RETAINING PLATE AND SNAP RING



6. CHECK OPERATION OF ONE-WAY CLUTCH

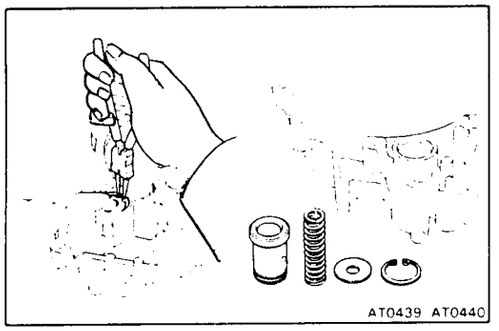
(a) Install the overdrive clutch into the one-way clutch.

(b) Hold the overdrive clutch and turn the intermediate shaft. The shaft should turn freely clockwise and should lock counterclockwise.

(c) Remove overdrive clutch from the one-way clutch.

DISASSEMBLY OF OVERDRIVE CASE

(See page AT-78)

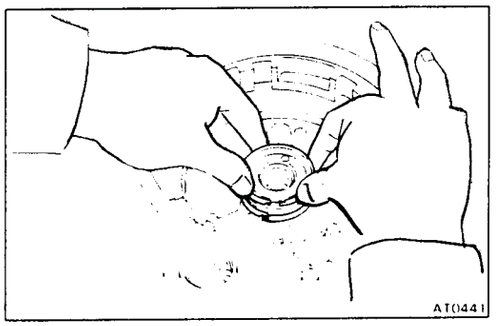


1. REMOVE ACCUMULATOR PISTON OF OVERDRIVE CLUTCH

(a) Remove the snap ring, retaining plate and spring.

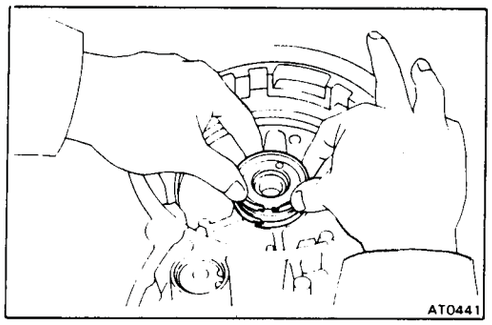
(b) Assemble the overdrive clutch onto the case and apply compressed air to oil hole to remove the piston.

(c) Remove the overdrive clutch.



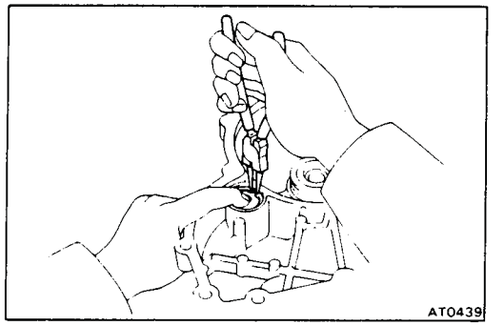
2. REMOVE TWO OIL SEAL RINGS FROM CASE

Spread the rings apart and remove them.

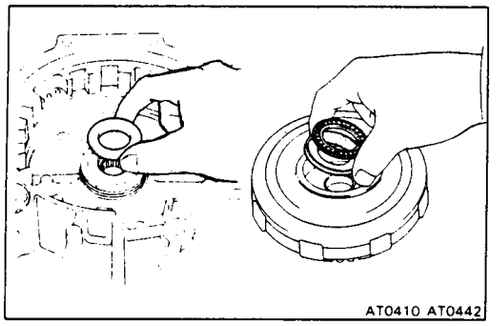

AT0441

ASSEMBLY OF OVERDRIVE CASE

1. **INSTALL TWO OIL SEAL RINGS ON OVERDRIVE CASE**
   Spread the rings apart and install them into the groove.

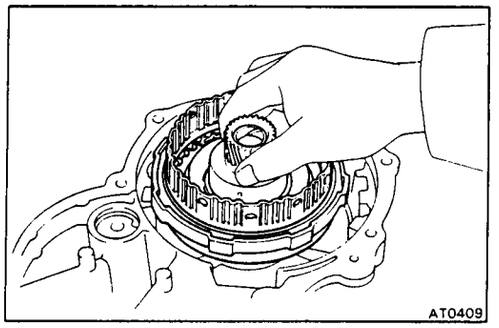

AT0439

2. **INSTALL ACCUMULATOR PISTON OF OVERDRIVE CLUTCH**
   (a) Install the accumulator piston.
   (b) Install the piston spring, retaining plate and snap ring.

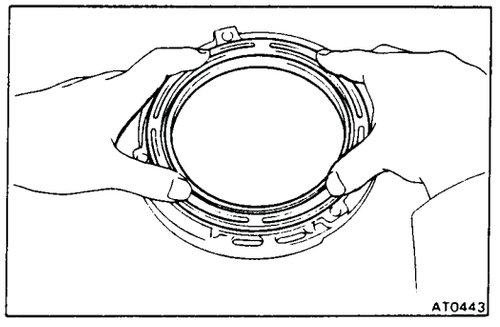

AT0410 AT0442

INSTALLATION OF OVERDRIVE CLUTCH

1. **INSTALL THRUST BEARING AND RACES ON CASE AND OVERDRIVE CLUTCH**
   Make sure that the races are installed in correct direction. Coat the bearing and races with petroleum jelly to hold them in place.

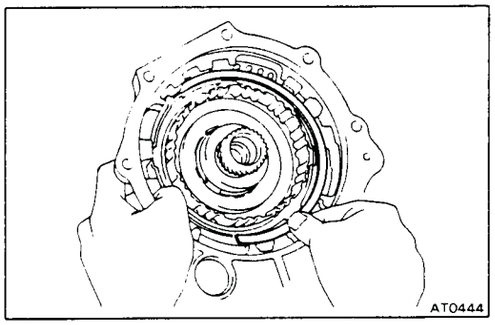

AT0409

2. **INSTALL OVERDRIVE CLUTCH ONTO CASE**


AT0443

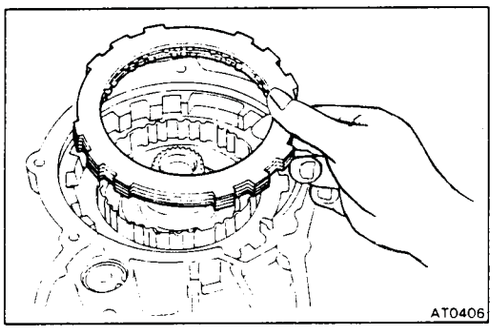
ASSEMBLY OF OVERDRIVE BRAKE

1. **INSTALL NEW O-RINGS ONTO PISTON**
2. **INSTALL PISTON INTO DRUM**
   (a) Coat the O-rings with ATF.
   (b) Press the piston into the drum, being careful not to damage the O-rings.



3. INSTALL SNAP RING INTO CASE

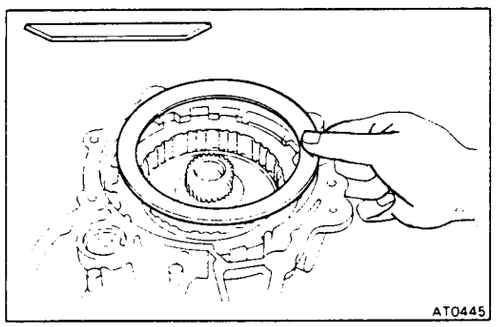
The end gap is placed in the groove.



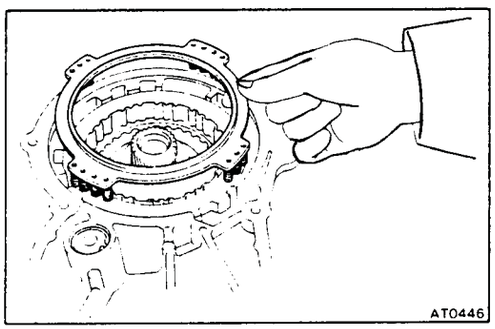
4. INSTALL FLANGE, DISCS AND PLATES

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

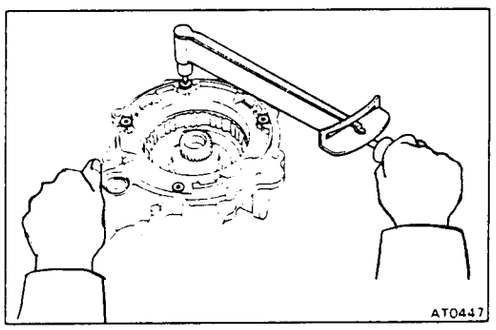
Install in order: A140E — D–P–D–P–D–P
A140L — D–P–P–D–P–P



(b) Install the cushion plate facing the rounded end downward.



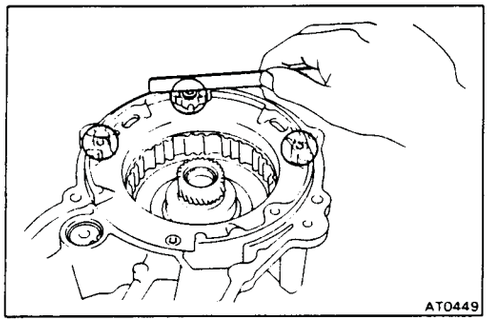
5. INSTALL PISTON RETURN SPRING ASSEMBLY



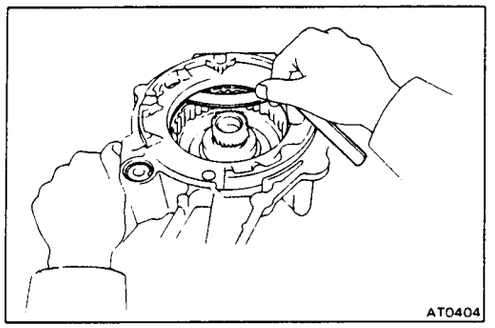
6. INSTALL OVERDRIVE BRAKE DRUM

Using a TORX socket wrench, tighten the four screws evenly and gradually until the return springs are snug.

Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)



7. MAKE SURE THAT TOP LEVEL OF THREE SCREWS ARE LOWER THAN SURFACE OF CASE

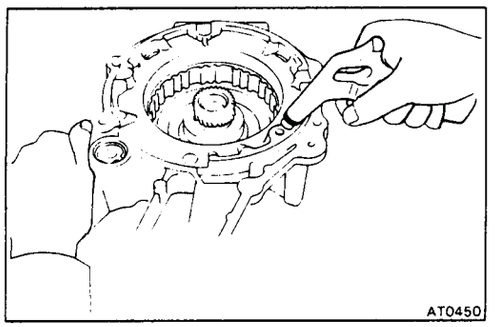


8. CHECK CLEARANCE OF OVERDRIVE BRAKE

Using a thickness gauge, check the clearance between the cushion plate and the piston.

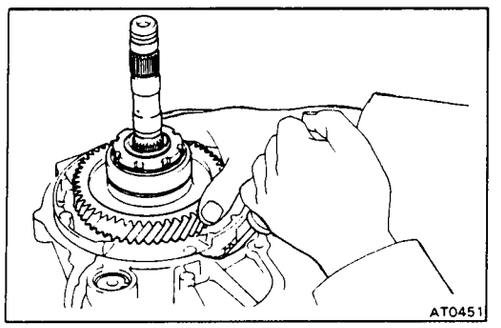
Clearance:

A140E 0.51 – 1.68 mm (0.0201 – 0.0661 in.)
A140L 0.63 – 1.72 mm (0.0248 – 0.0677 in.)



9. CHECK OPERATION OF OVERDRIVE BRAKE

Apply compressed air into the passage with the drum and listen for sound of piston movement.



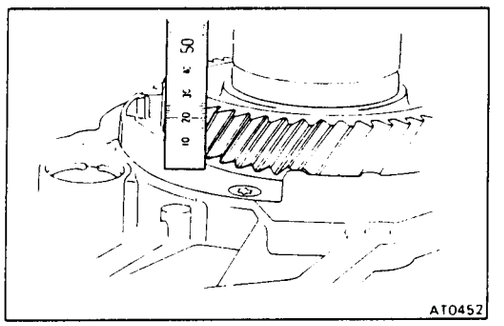
INSTALLATION OF OVERDRIVE GEAR ASSEMBLY

INSTALL OVERDRIVE GEAR ASSEMBLY ONTO CASE

(a) Place the overdrive gear assembly onto the case and align the center of shaft and the bearing.

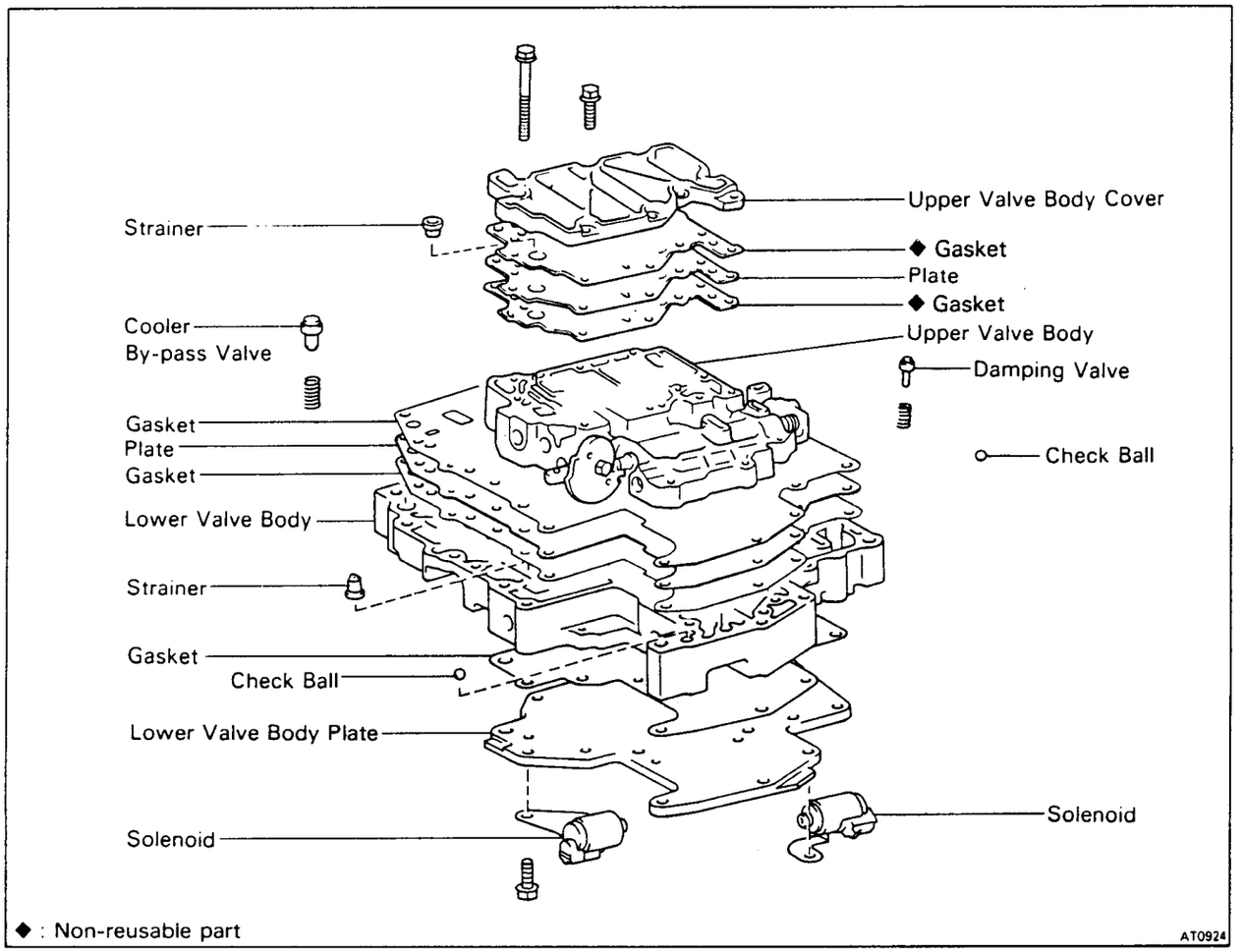
(b) Lock the overdrive clutch drum with a screwdriver and turn the counter drive gear clockwise.

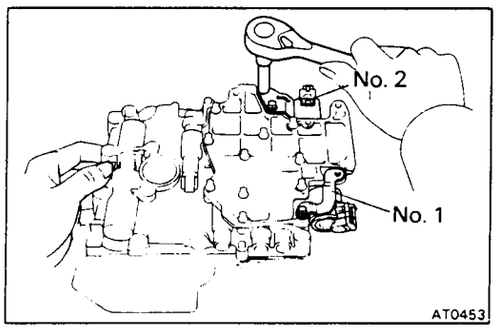
NOTE: When meshing the flukes of the discs with the hub, also mesh the one-way clutch with the inner race.

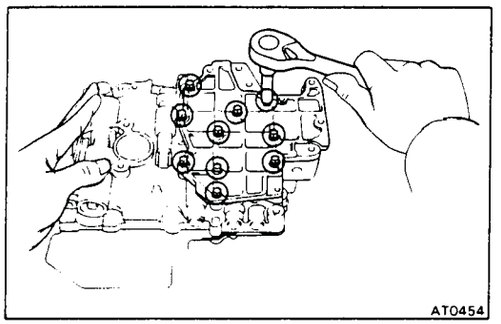


If the overdrive gear assembly is properly installed to the overdrive case, the clearance between them will be about 3.5 mm (0.138 in.).

Valve Body (A140E/2S-E)





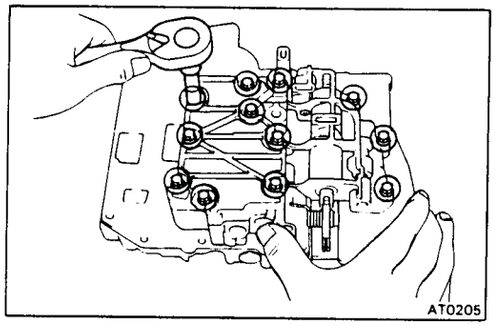


(Disassembly of Valve Body)

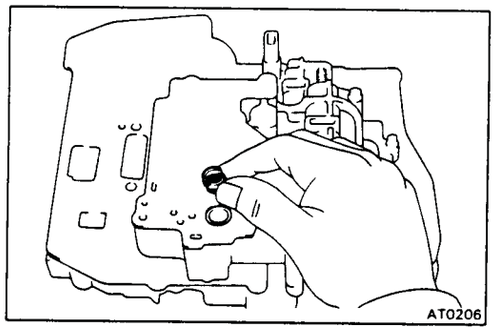
1. **REMOVE NO.1 SOLENOID**
   Remove the one bolt and the solenoid.

2. **REMOVE NO.2 SOLENOID**
   Remove the two bolts and the solenoid.

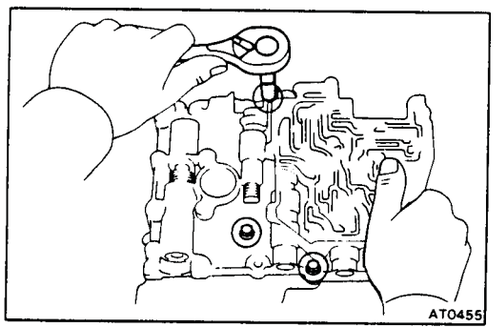
3. **REMOVE LOWER VALVE BODY COVER**
   (a) Remove the ten bolts.
   (b) Remove the cover and the gasket.



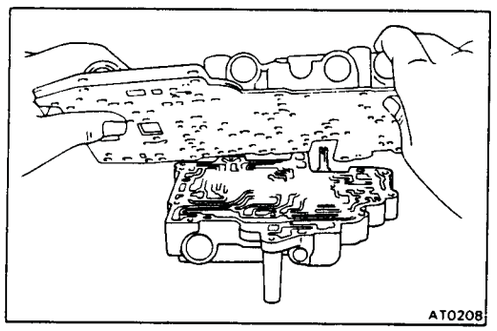
4. **TURN ASSEMBLY OVER AND REMOVE TWELVE BOLTS FROM UPPER VALVE BODY AND UPPER VALVE BODY COVER**



5. **REMOVE UPPER VALVE BODY COVER, STRAINER, GASKETS AND PLATE**



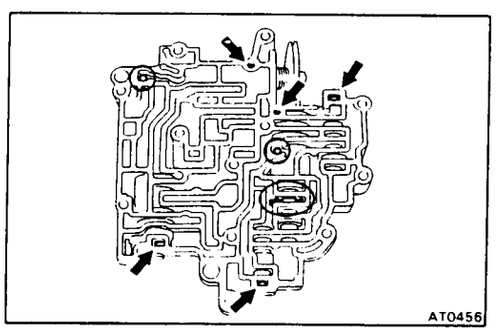
6. **TURN ASSEMBLY OVER AND REMOVE THREE BOLTS FROM LOWER VALVE BODY**



7. **LIFT OFF LOWER VALVE BODY AND PLATE AS SINGLE UNIT**

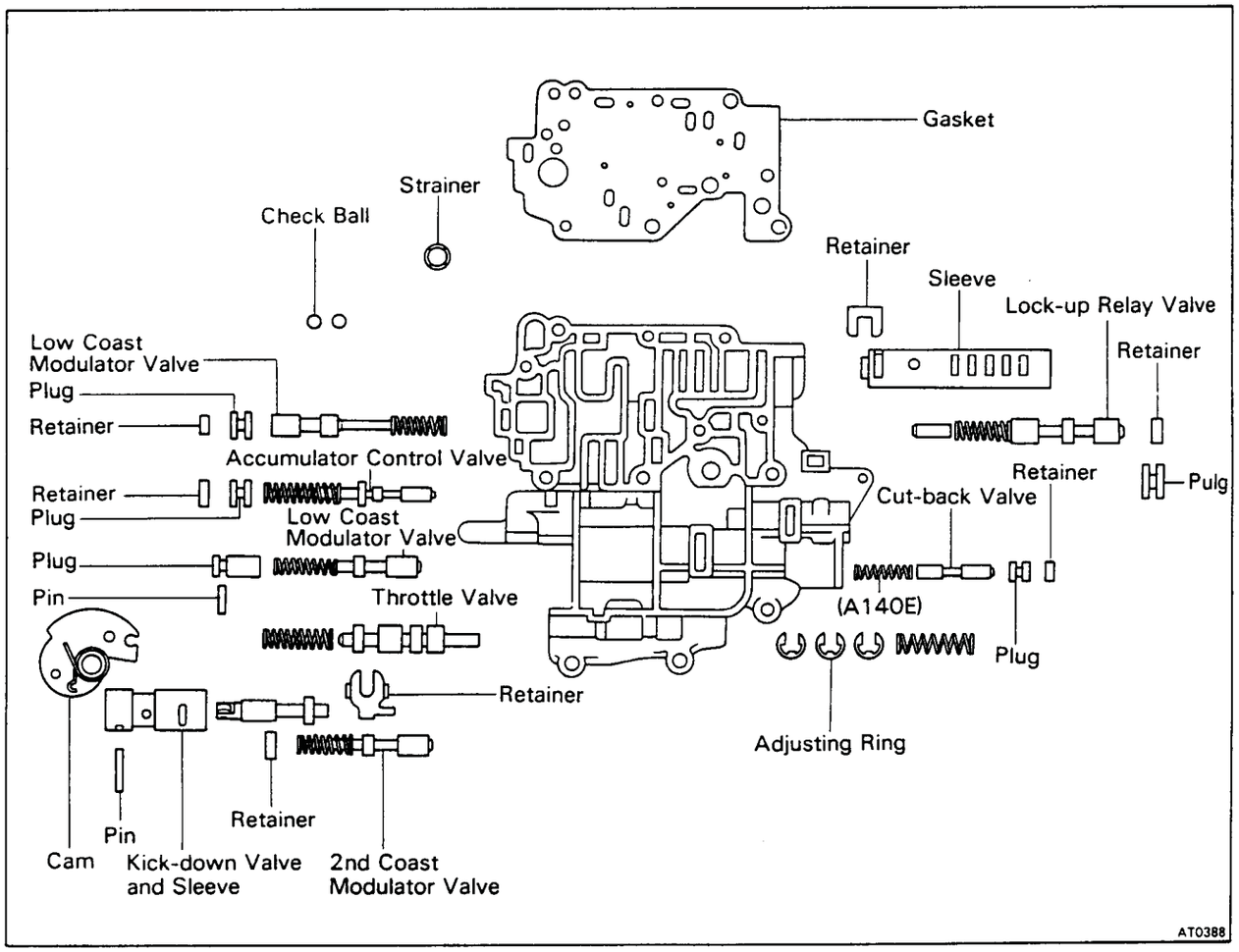
Hold valve body plate to lower valve body.

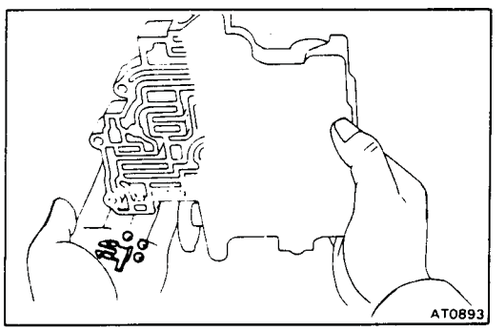
NOTE: Be careful that the check valve and balls do not fall out.

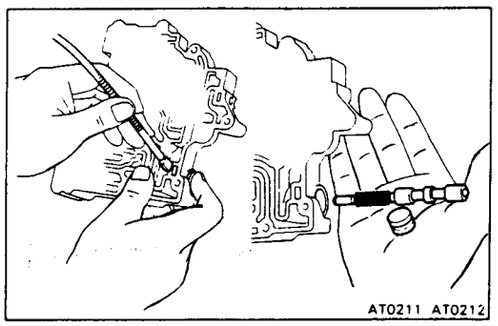


8. **WATCH FOR STEEL BALLS, RETAINERS AND PINS IN VALVE BODY**

(Upper Valve Body)







DISASSEMBLY OF UPPER VALVE BODY

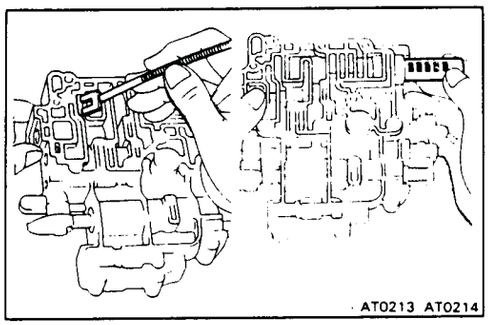
1. REMOVE THROTTLE VALVE RETAINER AND CHECK BALLS

NOTE: A140E Two check balls
A140L Three check balls

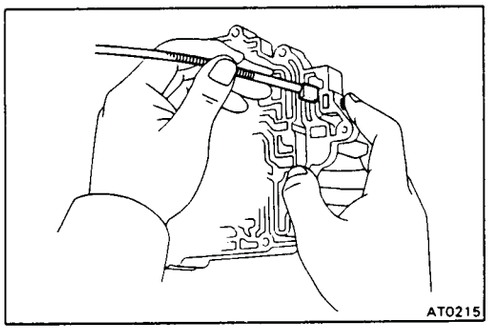
2. REMOVE LOCK-UP RELAY VALVE

(a) Remove the retainer for the plug with a magnetic finger and remove the plug.

(b) Remove the lock-up relay valve, control valve and spring.

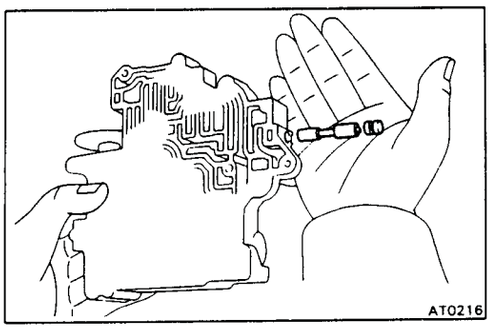

AT0213 AT0214

(c) Remove the retainer for the sleeve with a magnetic finger, and remove the sleeve.


AT0215

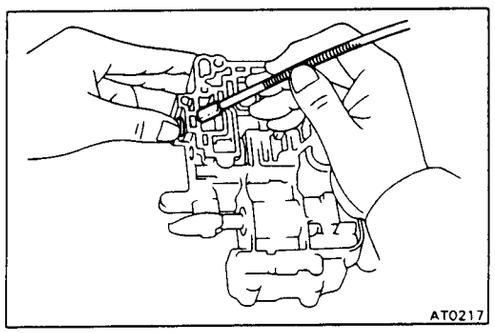
3. REMOVE CUT-BACK VALVE

(a) Remove the retainer with a magnetic finger.


AT0216

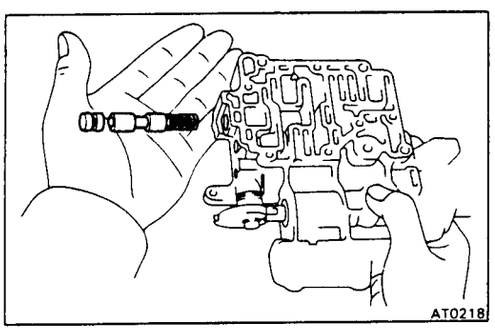
(b) Remove the cut-back valve.

(c) Remove the spring. (A140E)

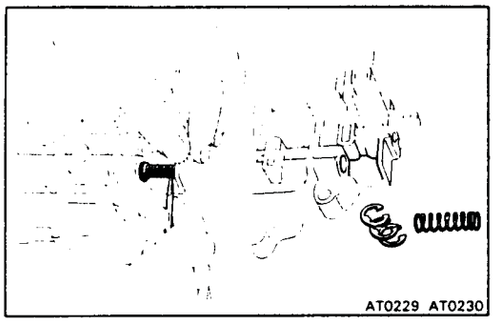

AT0217

4. REMOVE THROTTLE MODULATOR VALVE

(a) Remove the retainer with a magnetic finger.

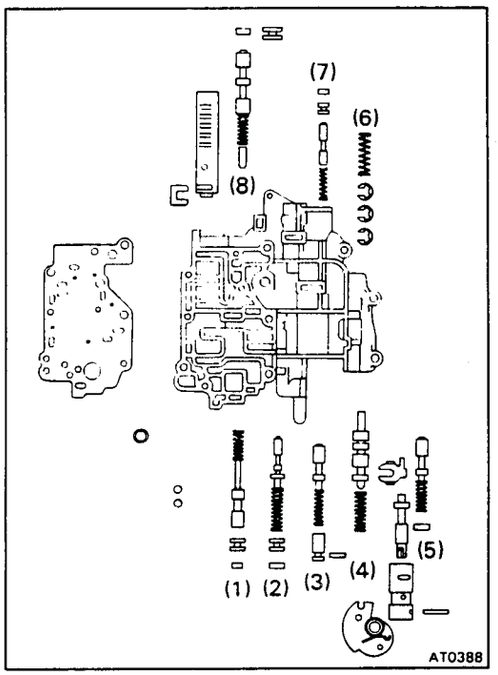

AT0218

(b) Remove the plug, valve and spring.



REMOVE SPRING AND ADJUSTING RINGS

Note the number of adjusting rings installed.

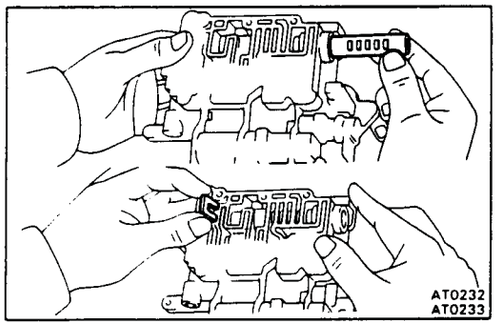


INSPECTION OF UPPER VALVE BODY

INSPECT VALVE SPRINGS

Check for damage, squareness, rust and collapsed coils. Measure the spring free height and replace if less than that shown below.

Spring	Free length mm (in.)	Color	Remarks
(1) Throttle modulator valve	21.70 (0.8543)	Orange	
(2) Accumulator control valve	28.06 (1.1047)	Yellow	A140E
	23.82 (0.9378)	Light Blue	A140L
(3) Low coast modulator valve	21.60 (0.8504)	Non	A140E
	23.40 (0.9213)	Red	A140L
(4) Kick-down valve	29.76 (1.1717)	White	A140E
	31.00 (1.2205)	Gray	A140L
(5) 2nd coast modulator valve	20.93 (0.8240)	Yellow Green	
(6) Throttle valve	30.70 (1.2087)	White	
(7) Cut-back valve	21.80 (0.8583)	Non	A140E
(8) Lock-up relay valve	26.56 (1.0457)	Green	

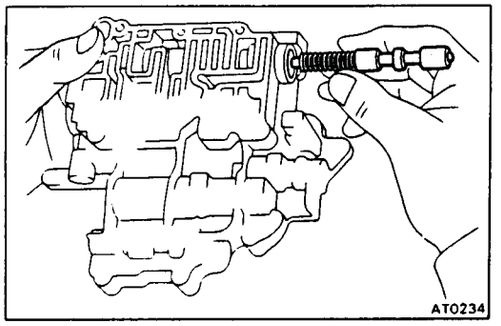


ASSEMBLY OF UPPER VALVE BODY

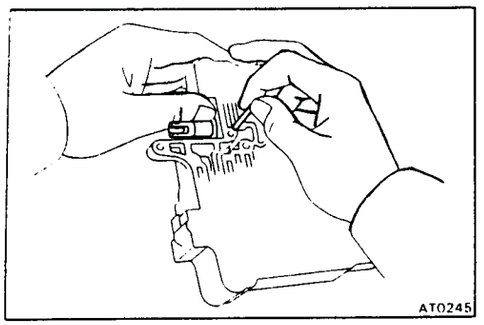
INSTALL LOCK-UP RELAY VALVE

(a) Install the sleeve into the bore.

(b) Coat the retainer with petroleum jelly and install it onto the end of the sleeve.

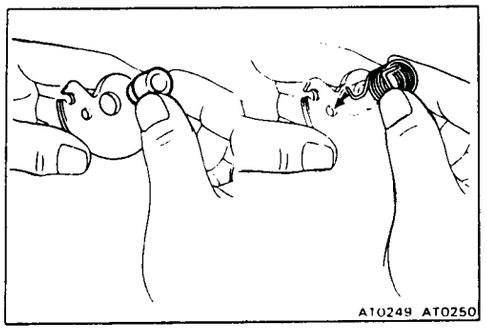


(c) Install the control valve, spring and lock-up relay valve into the bore in horizontal position.



INSTALL PIN TO HOLD SLEEVE IN PLACE

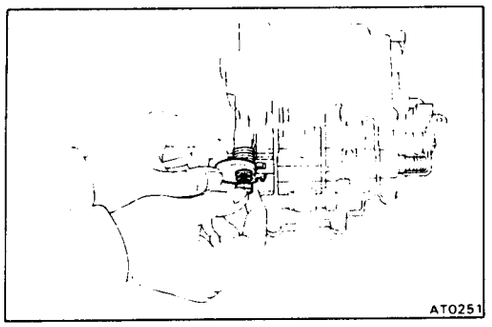
Coat the pin with petroleum jelly.



ASSEMBLE THROTTLE CAM

(a) Insert the sleeve through one side of the cam.

(b) Install the spring with the hook through the hole in the cam.

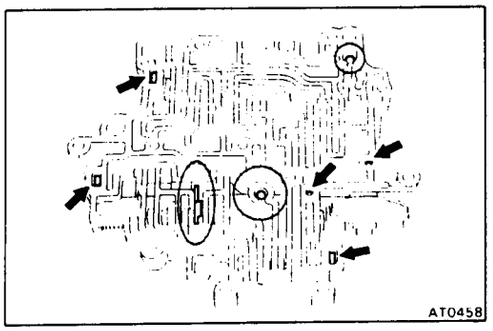


INSTALL CAM ASSEMBLY ON UPPER VALVE BODY

Make sure the spring ends are positioned correctly. Tighten the bolt.

Torque: 75 kg-cm (65 in.-lb, 7.4 N·m)

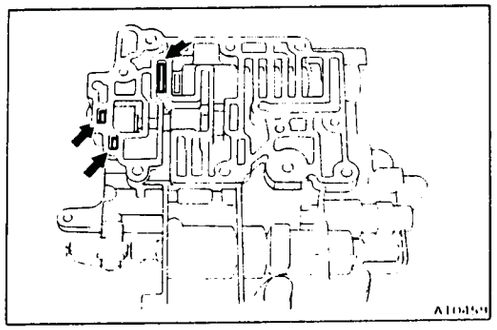
MAKE SURE THAT CAM MOVES ON ROLLER OF DOWN SHIFT PLUG



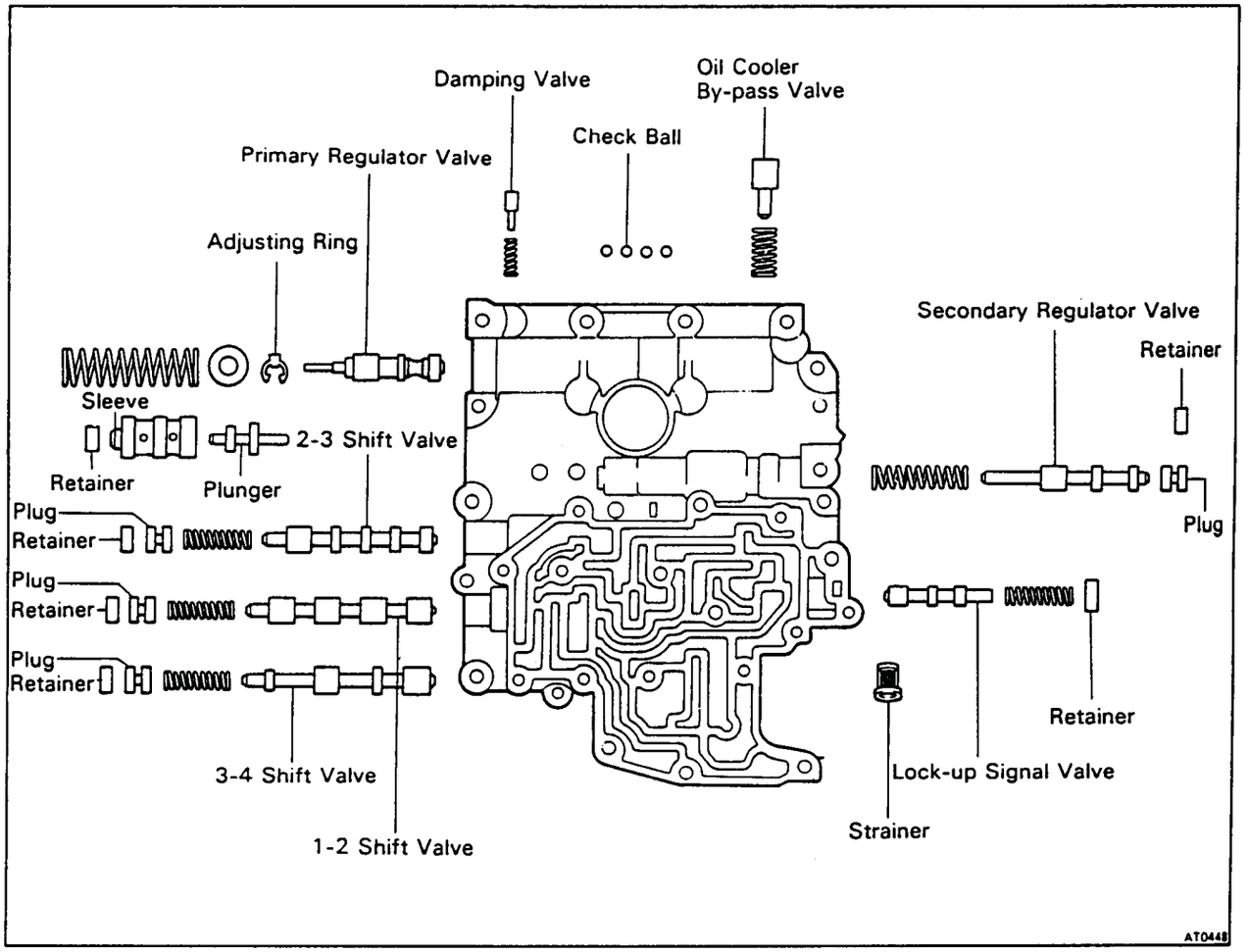
INSTALL CHECK BALLS

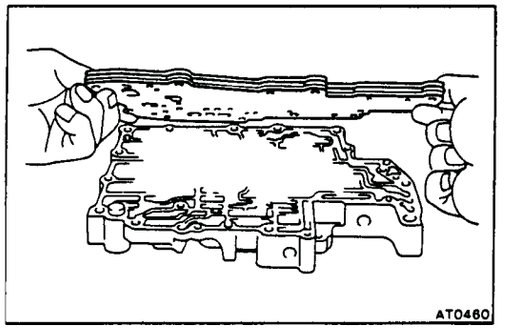
NOTE: A140E Two check balls
A140L Three check balls

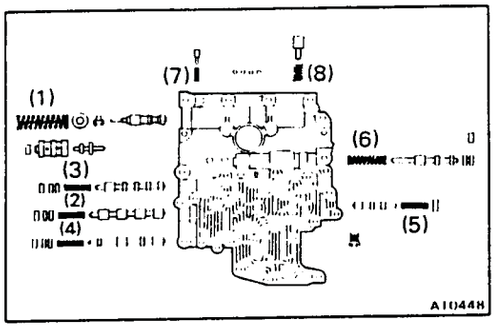
MAKE SURE THAT PINS AND RETAINER ARE INSTALLED CORRECTLY



(Lower Valve Body)







DISASSEMBLY OF LOWER VALVE BODY

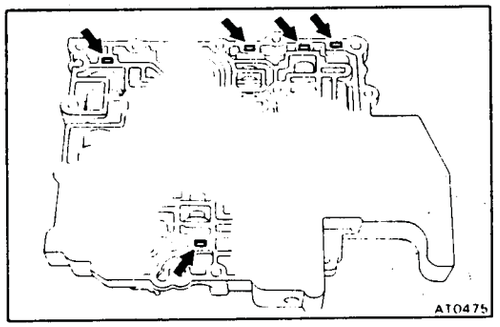
1. REMOVE LOWER VALVE BODY PLATE AND GASKETS

INSPECTION OF LOWER VALVE BODY

INSPECT VALVE SPRINGS

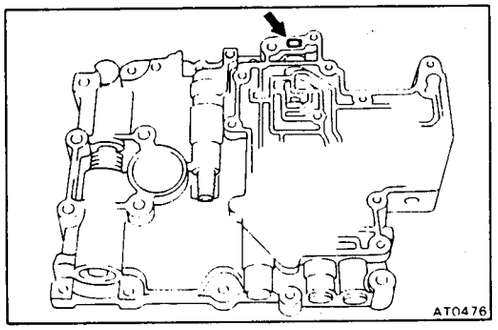
Check for damage, squareness, rust and distorted coils. Measure the spring free height and replace if less than that shown below.

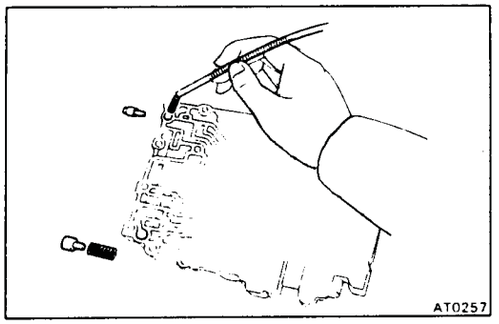
Spring	Free length mm (in.)	Color
(1) Primary regulator valve	66.65 (2.6240)	Non
(2) 1-2 shift valve	29.27 (1.1524)	Non
(3) 2-3 shift valve	29.27 (1.1524)	Non
(4) 3-4 shift valve	29.27 (1.1524)	Non
(5) Lock-up signal valve	30.00 (1.1811)	Non
(6) Secondary regulator valve	43.60 (1.7165)	Non
(7) Damping valve	11.20 (0.4409)	Non
(8) Cooler by-pass valve	19.90 (0.7835)	Non



CHECK RETAINERS AND LOCATING PIN

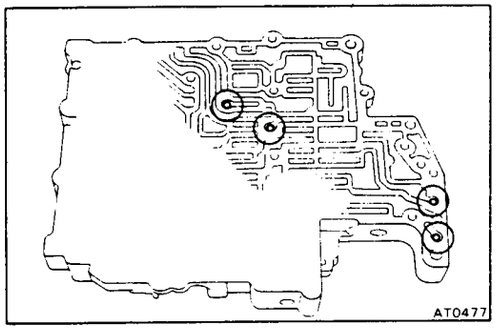
Make sure that the retainers and pin are installed correctly.





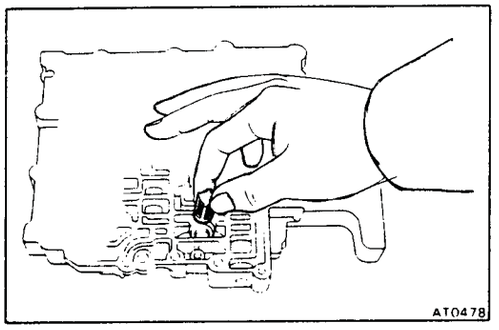
INSTALL SPRING AND COOLER BY-PASS VALVE

INSTALL SPRING AND DAMPING VALVE



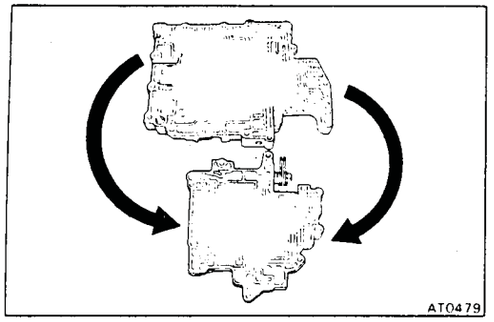
INSTALL CHECK BALLS AS SHOWN

Install the four rubber balls in the position shown in the figure.

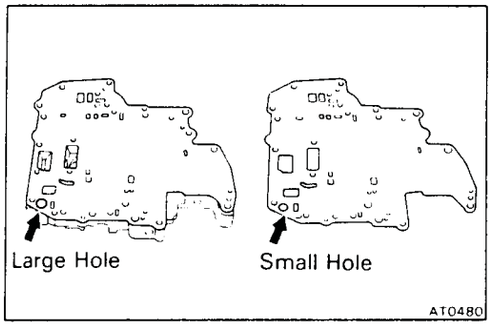


INSTALL STRAINER ONTO LOWER VALVE BODY

(Assembly of Valve Body)

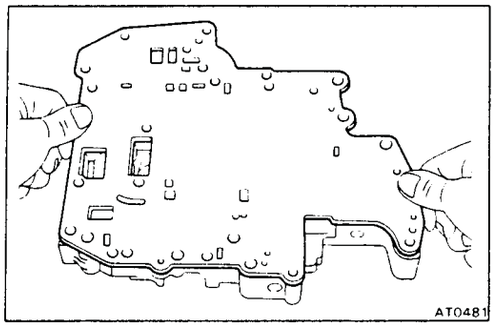


NOTE: Install the lower valve body on the upper valve body together with the plate.



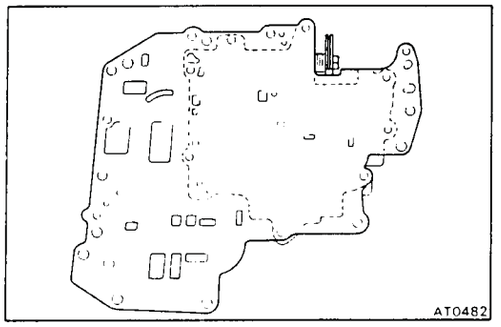
POSITION NEW GASKET AND PLATE ON LOWER VALVE BODY

NOTE: As shown at left, match the large cooler by-pass valve hole with that in the lower valve body.



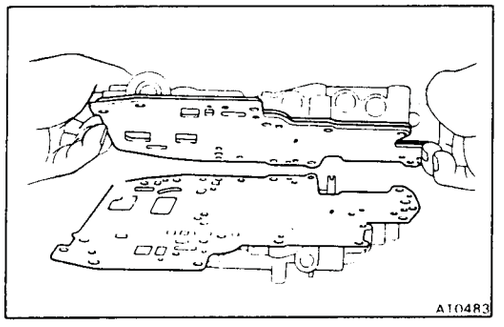
(a) Place the gasket and plate onto the lower valve body.

(b) Align each bolt hole in the valve body with the gasket and plate.



POSITION NEW GASKET ON UPPER VALVE BODY

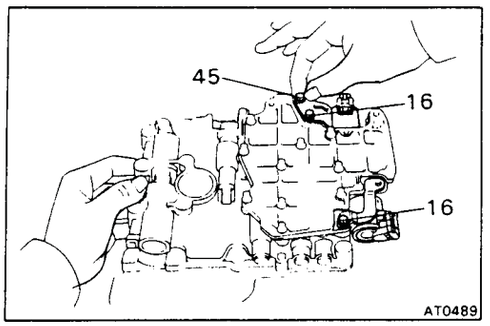
Align the gasket at each bolt hole.



PLACE LOWER VALVE BODY WITH PLATE ON TOP OF UPPER VALVE BODY

NOTE: Hold the lower valve body and plate securely so they do not separate.

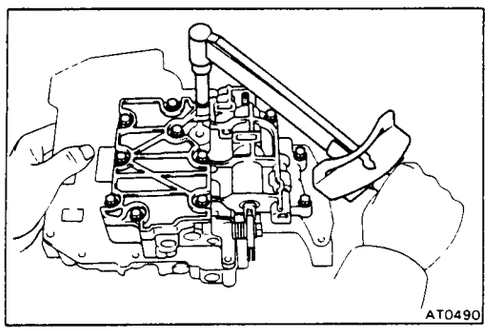
Align each bolt hole in the valve bodies with a gasket and plate.



INSTALL NO.1 AND NO.2 SOLENOIDS

(a) Install the No.2 solenoid onto the lower valve body.
(b) Tighten the bolt.
(c) Install the No.1 solenoid onto the lower valve body.
(d) Tighten the two bolts.

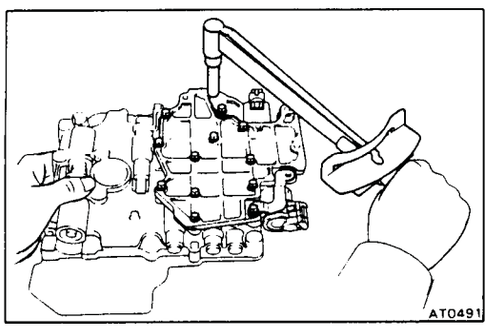
NOTE: Each bolt length (mm) is indicated in the figure.



TIGHTEN BOLTS OF UPPER AND LOWER VALVE BODIES

Recheck the alignment of the gaskets. Tighten the bolts.

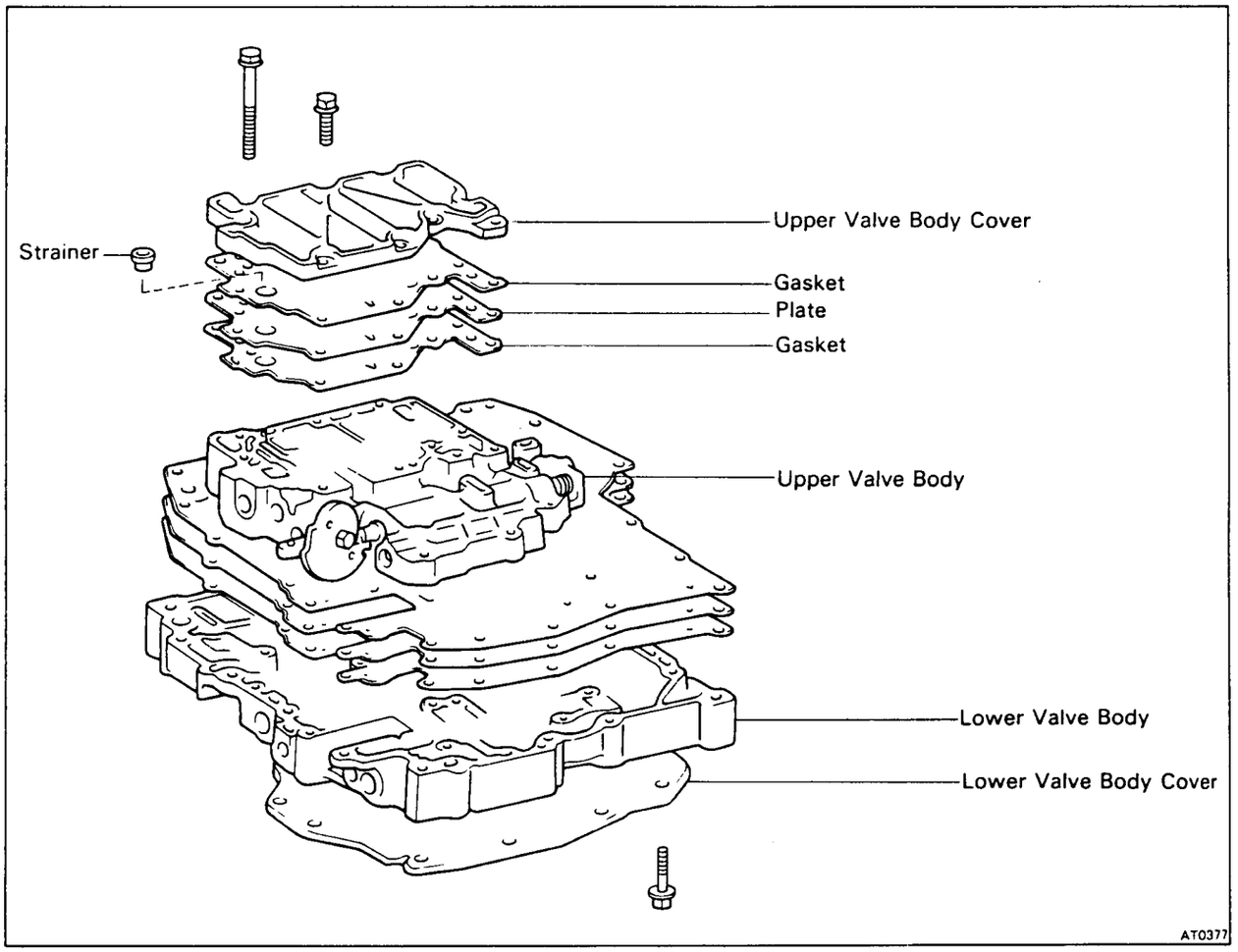
Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)

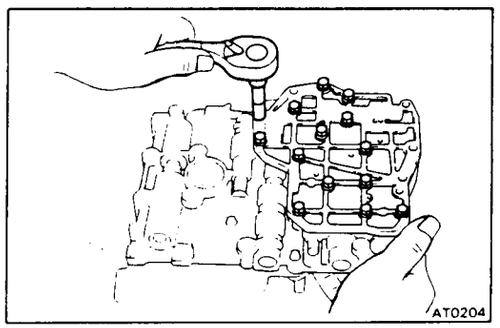


TURN ASSEMBLY OVER AND TIGHTEN BOLTS ON LOWER VALVE BODY

Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)

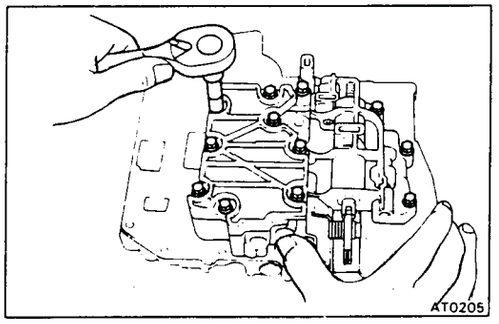
Valve Body(A140L/1C-T)



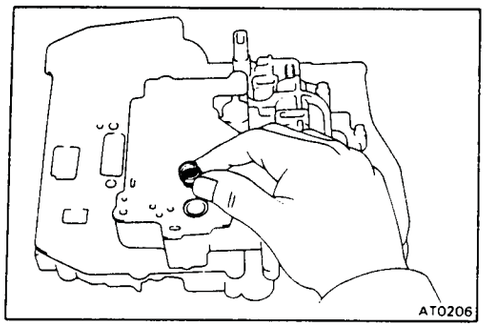


(Disassembly of Valve Body)

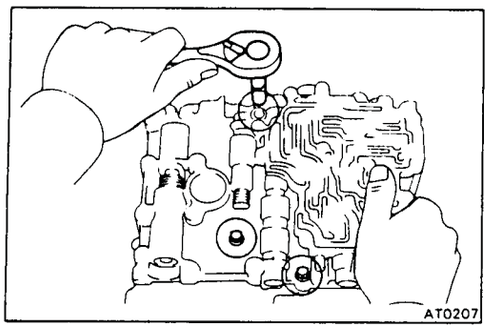
1. **REMOVE LOWER VALVE BODY COVER**
   (a) Remove the fourteen bolts.
   (b) Remove the cover and the gasket.



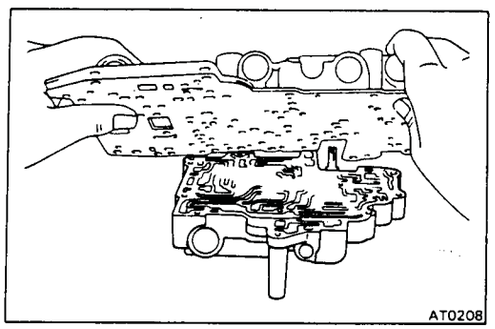
2. **TURN ASSEMBLY OVER AND REMOVE TWELVE BOLTS FROM UPPER VALVE BODY AND UPPER VALVE BODY COVER**



3. **REMOVE UPPER VALVE BODY COVER, STRAINER, GASKETS AND PLATE**



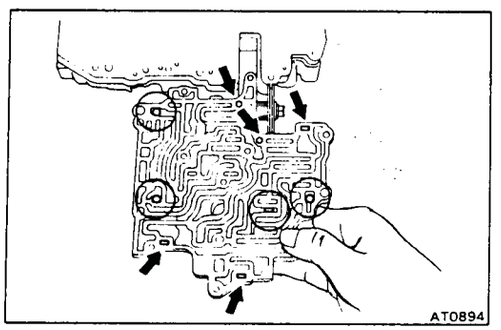
4. **TURN ASSEMBLY OVER AND REMOVE THREE BOLTS FROM LOWER VALVE BODY**



5. **LIFT OFF LOWER VALVE BODY AND PLATE AS SINGLE UNIT**

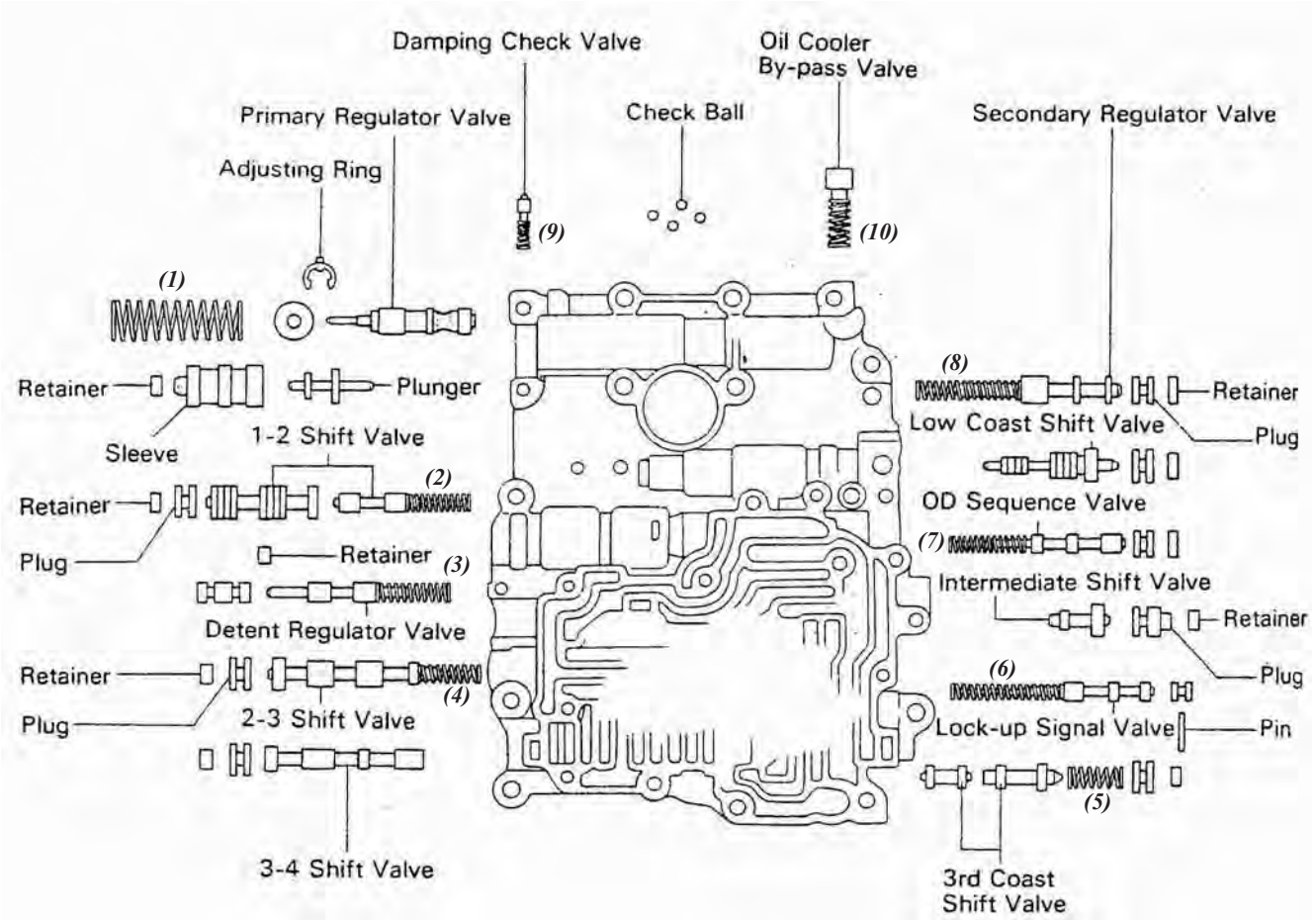
Hold valve body plate to lower valve body.

NOTE: Be careful that the check valve and balls do not fall out.



6. **WATCH FOR THREE STEEL BALLS, RETAINERS AND PINS IN VALVE BODY**

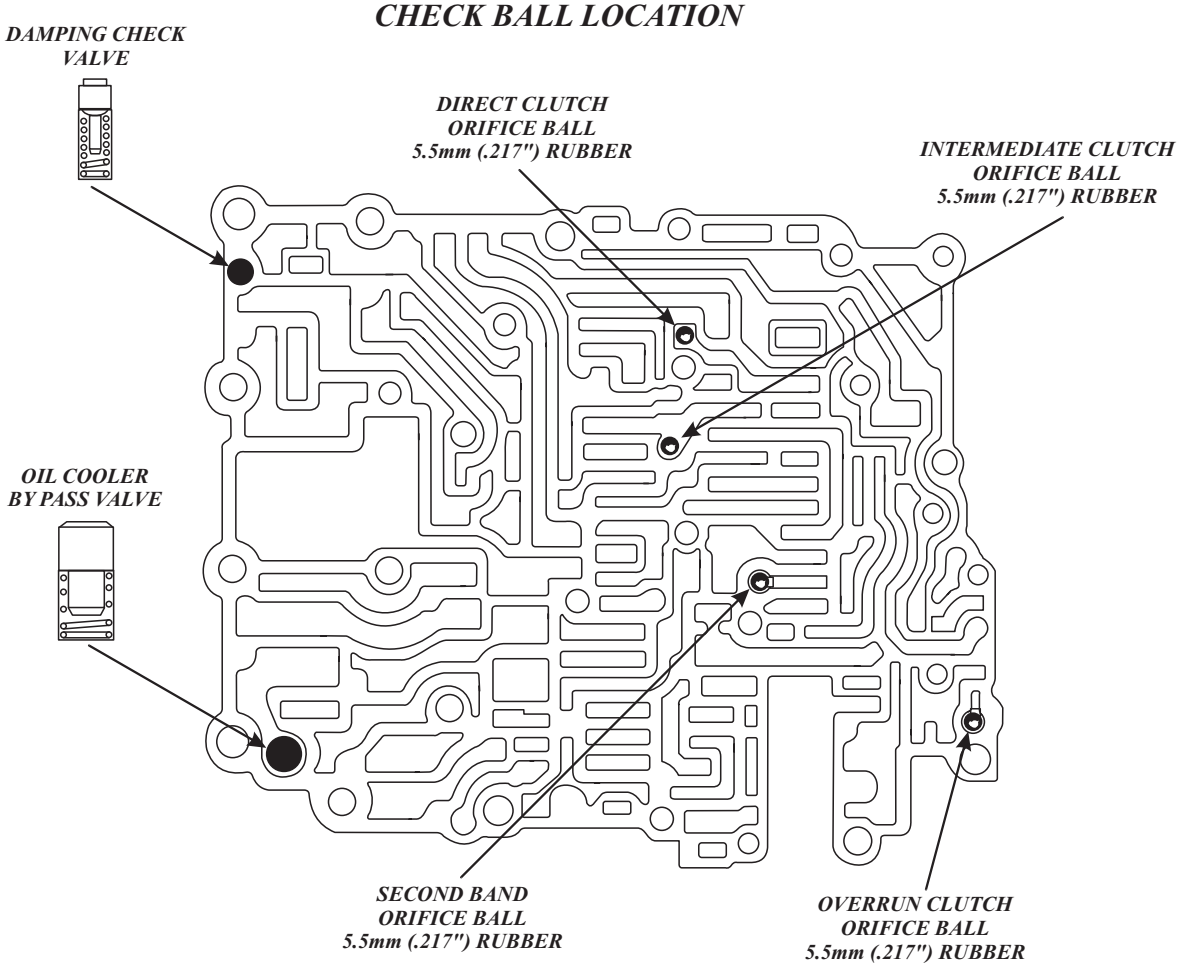
A140L "LOWER" VALVE BODY



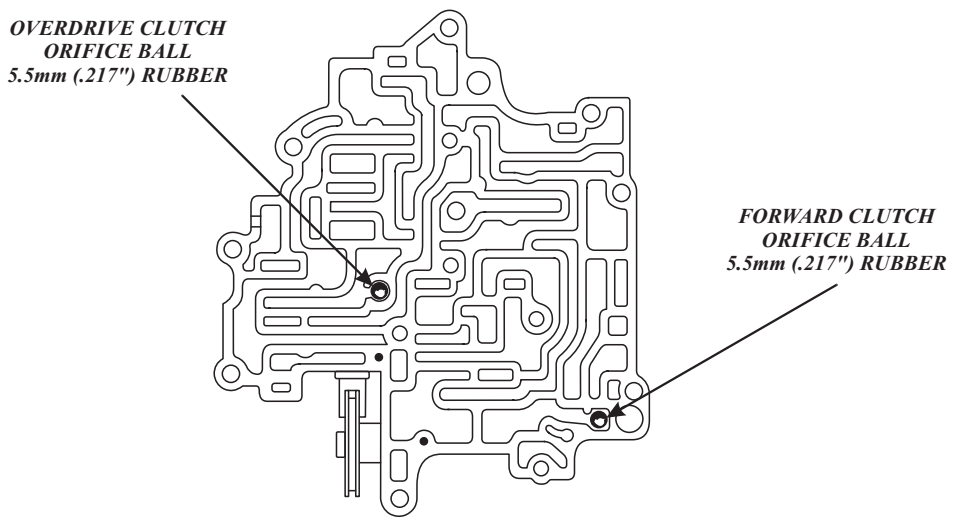
Spring Specifications

Spring	Free Length mm (in.)	Color
(1) Primary Regulator Valve	66.65 (2.624")	None
(2) 1-2 Shift Valve	27.17 (1.069")	Yellow
(3) Detent Regulator Valve	29.05 (1.143")	Orange
(4) 2-3 Shift Valve	27.74 (1.092")	Pink
(5) 3rd Coast Shift Valve	24.40 (0.960")	Violet
(6) Lock-Up Signal Valve	35.30 (1.390")	Lt Blue
(7) OD Sequence Valve	30.90 (1.216")	None
(8) Secondary Regulator Valve	43.60 (1.716")	None
(9) Damping Check Valve	11.20 (0.440")	None
(10) Cooler By-pass Valve	19.90 (0.783")	None

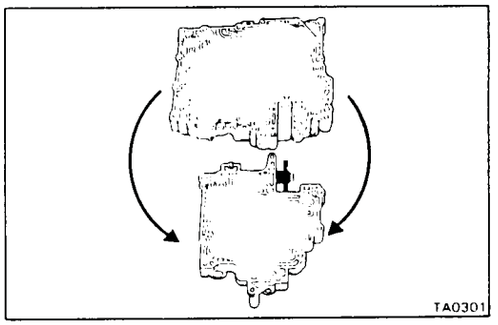
A140L "LOWER" VALVE BODY CHECK BALL LOCATION



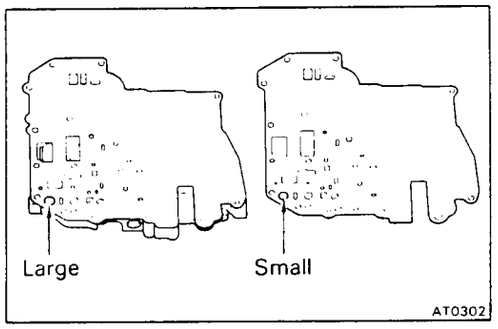
A140L "UPPER" VALVE BODY CHECK BALL LOCATION



(Assembly of Valve Body)

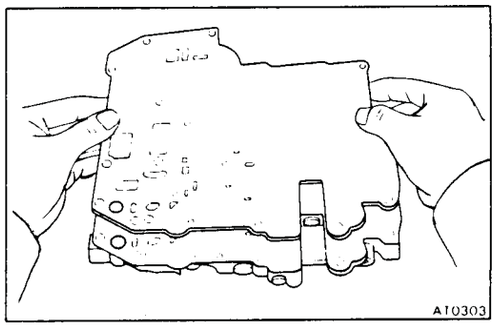


NOTE: Install the lower valve body on the upper valve body together with the plate.



POSITION NEW GASKET AND PLATE ON LOWER VALVE BODY

NOTE: As shown at left, assemble the large cooler by-pass valve hole to the lower valve body.

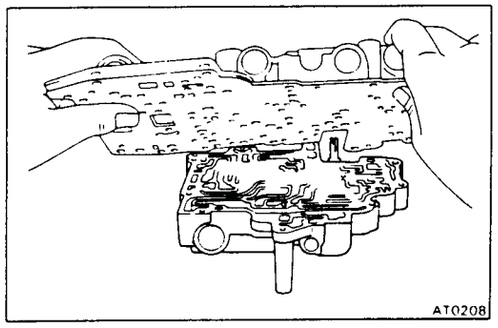


(a) Place the gasket and plate onto the lower valve body.

(b) Align each bolt hole in the valve body with the gasket and plate.

POSITION NEW GASKET ON UPPER VALVE BODY

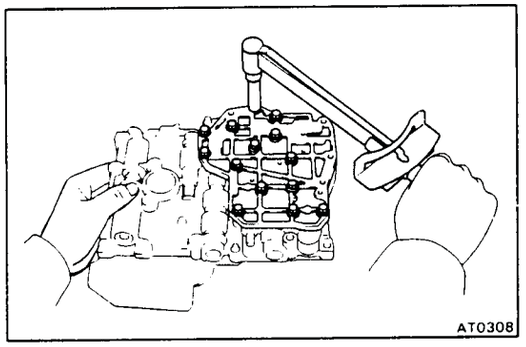
Align the gasket at each bolt hole.



PLACE LOWER VALVE BODY WITH PLATE ON TOP OF UPPER VALVE BODY

NOTE: Hold the lower valve body and plate securely so they do not separate.

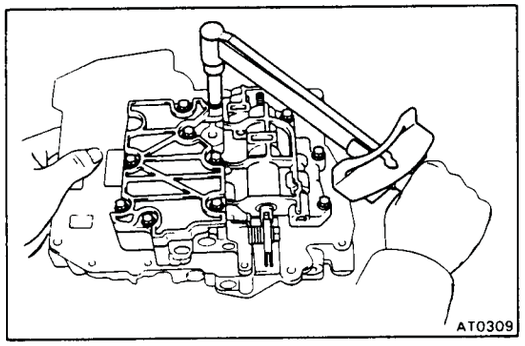
Align each bolt hole in the valve bodies with a gasket and plate.



TIGHTEN BOLTS OF LOWER VALVE BODY COVER

Recheck the alignment of the gaskets. Tighten the bolts.

Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)



TURN ASSEMBLY OVER AND TIGHTEN BOLTS IN UPPER VALVE BODY COVER

Tighten the bolts.

Torque: 55 kg-cm (48 in.-lb, 5.4 N·m)

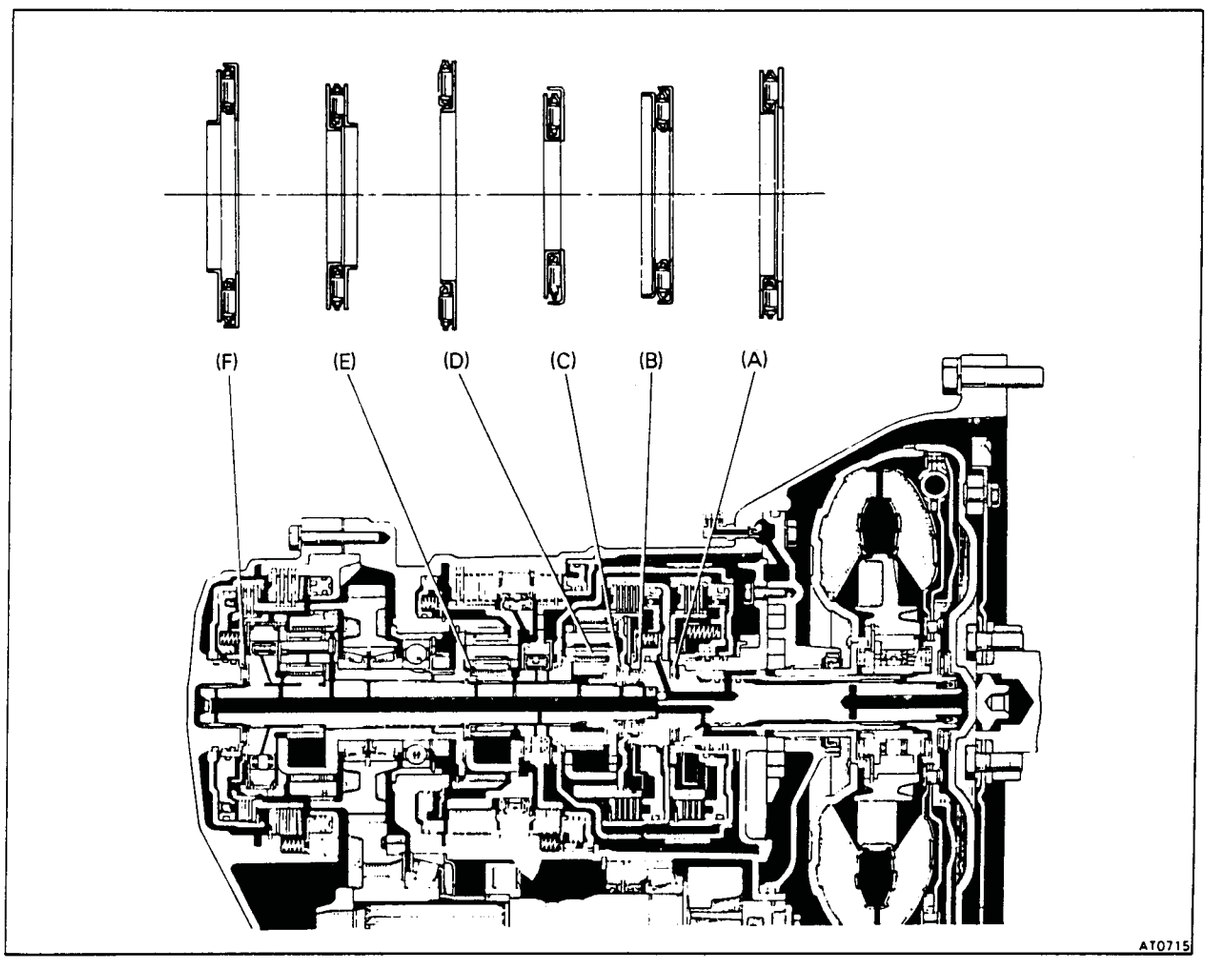
ASSEMBLY OF TRANSMISSION

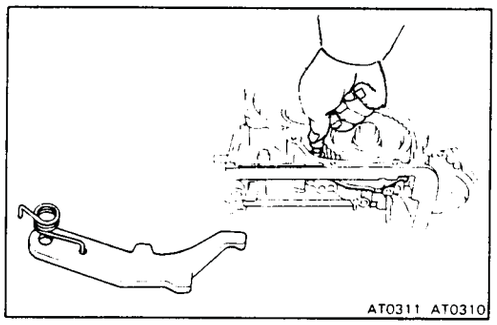
Disassembly, inspection and assembly of each component group have been indicated in the preceding chapter. This chapter deals with assembly of A140E transmission.

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 type DEXRON II.

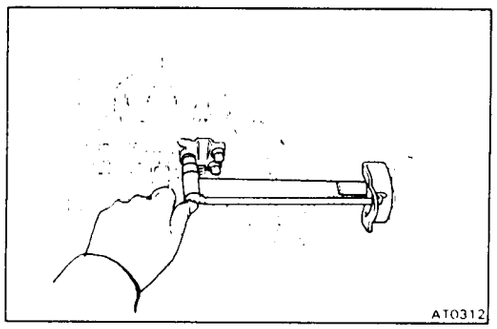
GENERAL ASSEMBLY NOTE:

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. Do not use adhesive cements on gaskets and similar parts.
3. Before assembling new clutch discs, soak them in automatic transmission fluid for at least two hours.
4. When assembling the transmission, be sure to use new gaskets and O-rings.
5. Apply automatic transmission fluid on sliding or rotating surfaces of the parts before assembly.
6. Dry all parts by blowing with compressed air. Never use shop regs.
7. Use petroleum jelly to keep the small parts in their places.
8. Be sure to install the thrust bearings and races in the correct direction and position.

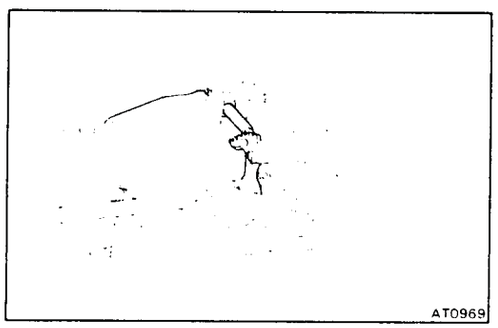




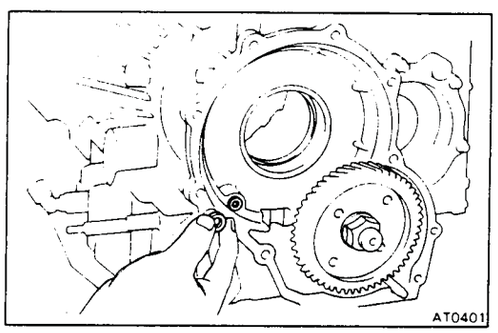
1. **INSTALL PARKING LOCK PAWL**
   (a) Place the parking pawl onto the case. Hook the spring ends to the case and pawl.
   (b) Install the pin into the hole of the case through the spring and the pawl.
2. **INSTALL PARKING LOCK ROD**



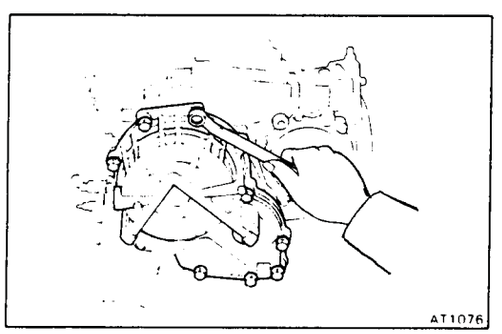
3. **INSTALL PARKING LOCK PAWL BRACKET**
   Torque: 75 kg-cm (65 in.-lb, 7.4 N·m)



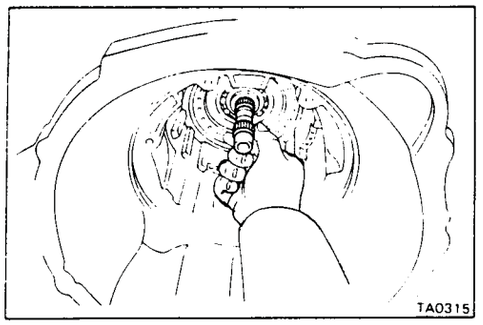
4. **CHECK OPERATION OF PARKING LOCK PAWL**
   Make sure the counter driven gear is locked when the manual valve lever is in "P" range.



5. **INSTALL TWO GASKETS ON TRANSMISSION CASE**
   (a) Coat the gaskets with petroleum jelly to hold them in place.
   (b) Install the overdrive brake gasket into the hole of the case.
   (c) Install the overdrive clutch apply gasket into the hole of the case.



6. **INSTALL OVERDRIVE UNIT OVER GASKET**
   Align each bolt hole in the gasket and the case.
   Tighten the bolts.
   Torque: 250 kg-cm (18 ft-lb, 25 N·m)

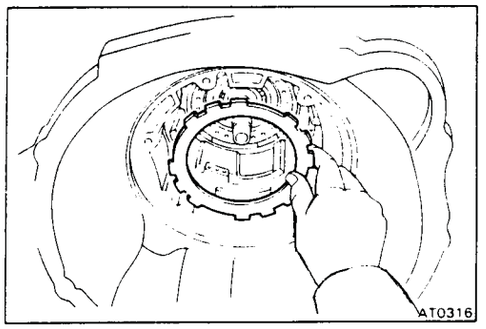


7. CHECK INTERMEDIATE SHAFT END PLAY

(a) Make sure that the intermediate shaft has thrust play.

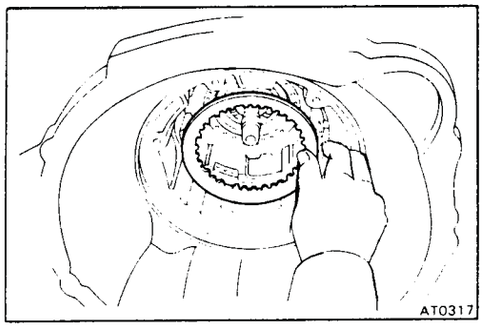
Thrust play: 0.49 – 1.51 mm (0.0193 – 0.0594 in.)

(b) Make sure that the intermediate shaft turns smoothly.

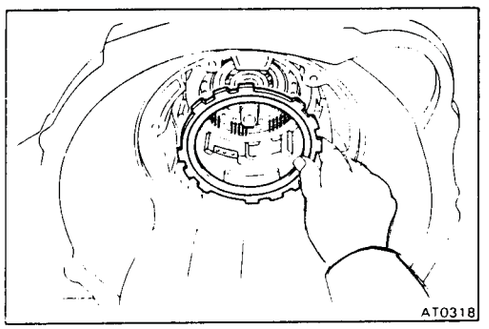


8. INSTALL FIRST AND REVERSE BRAKE IN CASE

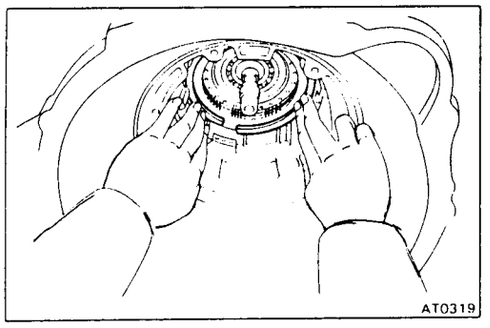
(a) Install the inner flange facing the flat end toward you.



(b) Install in order:
- A140E D-P-D-P-D-P-D-P-D-P-D
- A140L D-P-D-P-P-D-P-P-D-P-D

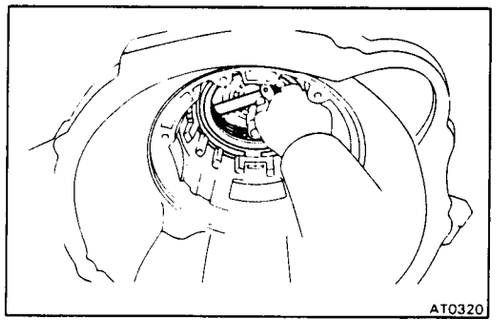


(c) Install the outer flange, facing the flat end toward the piston side.



9. INSTALL SNAP RING

The snap ring end gap is installed into the groove.

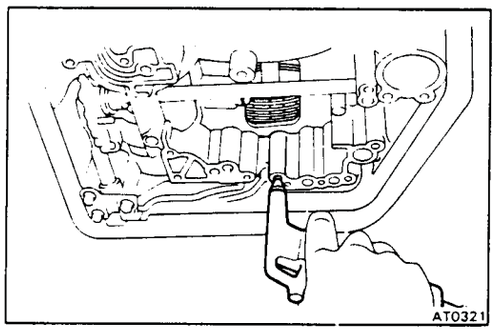


10. CHECK CLEARANCE OF FIRST AND REVERSE BRAKE

Using a thickness gauge, check the clearance between the piston and the flange.

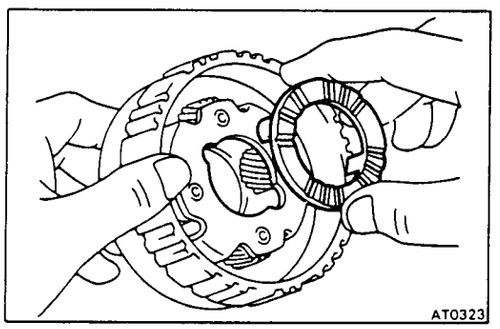
Clearance:

A140E 1.06 – 2.38 mm (0.0417 – 0.0937 in.)
A140L 1.18 – 2.42 mm (0.0465 – 0.0953 in.)



11. CHECK OPERATION OF FIRST AND REVERSE BRAKE

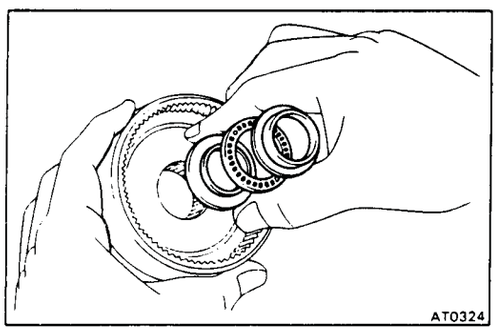
Apply the compressed air into the oil passage with the case and be sure that the piston moves.



12. INSTALL NO.2 PLANETARY CARRIER THRUST WASHER

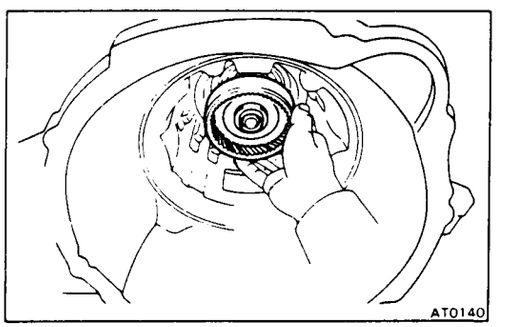
Coat the thrust washer with petroleum jelly and install it onto the planetary carrier.

NOTE: Make sure that the different lug shapes match the openings on the carrier.

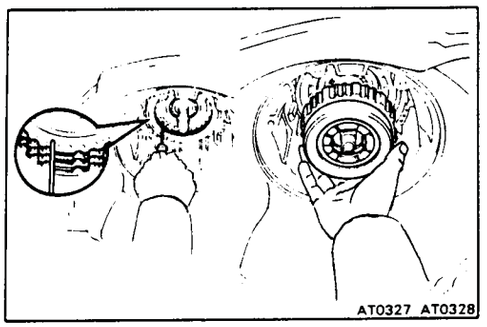


13. INSTALL RING GEAR INTO CASE

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



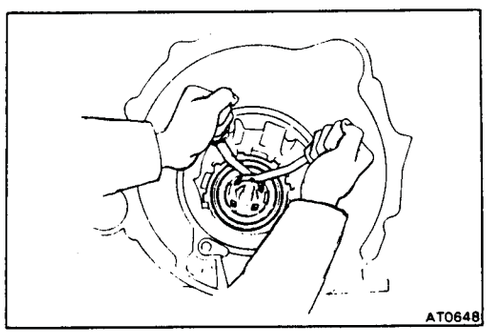
(b) Install the ring gear into the case.



14. INSTALL REAR PLANETARY GEAR INTO CASE

(a) Align the flukes of the discs in the first and reverse brake.

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



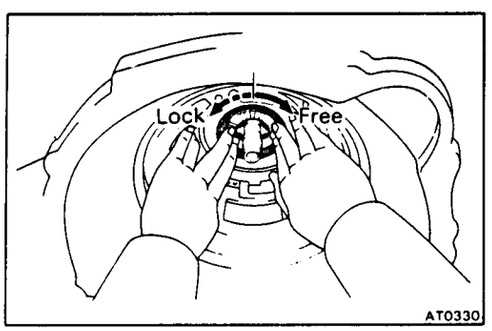
15. INSTALL NO.2 ONE-WAY CLUTCH INTO CASE WITH SHINY SIDE UPWARD

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

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

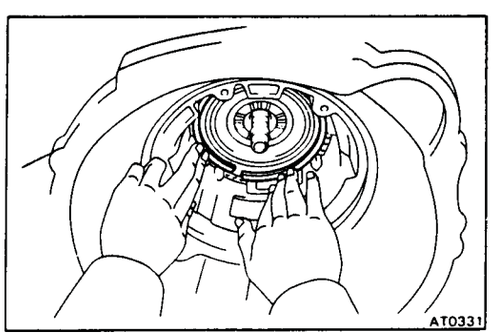
SST 09350-32011

(c) Coat the thrust washer with petroleum jelley and install it onto the planetary gear.



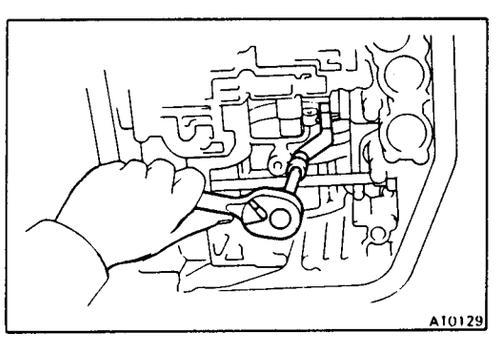
16. CHECK OPERATION OF NO.2 ONE-WAY CLUTCH

Turn the planetary carrier. The carrier should turn freely clockwise and should lock counterclockwise.



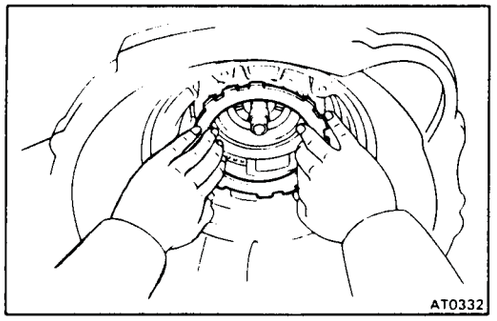
17. INSTALL SNAP RING

The snap ring end gap is installed into the groove.



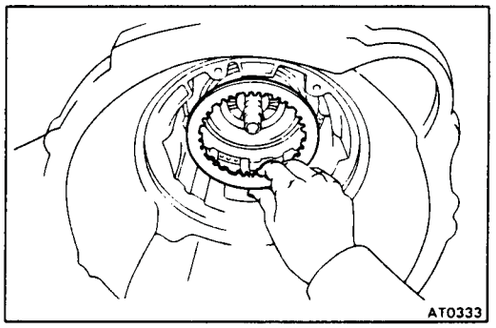
18. INSTALL SECOND COAST BRAKE BAND GUIDE

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

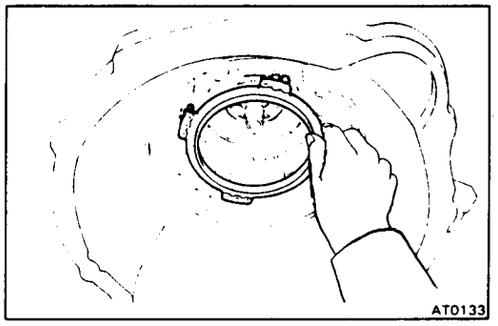


19. INSTALL SECOND BRAKE INTO CASE

(a) Install the flange, facing the flat end toward you.

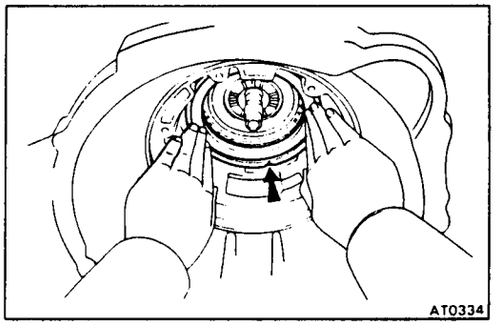


(b) Install in order: D-P-D-P-D-P



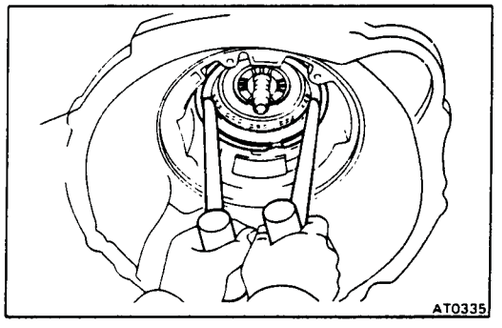
20. INSTALL PISTON RETURN SPRING ASSEMBLY

Each spring end is installed onto the protrution with the case.



21. INSTALL SECOND BRAKE DRUM INTO CASE

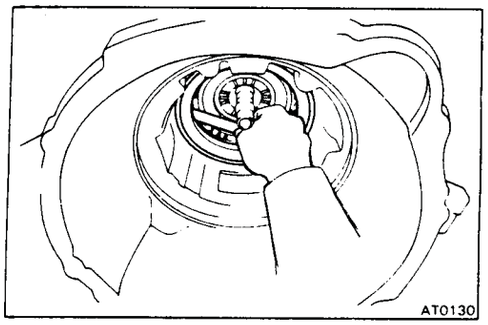
Align the groove of the drum with the bolt and place it into the case.



22. INSTALL SNAP RING

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

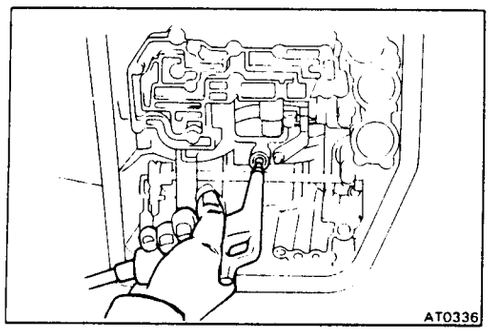
(b) While compressing the piston return springs over the drum with hammer handles, install the snap ring into the groove.


AT0130

23. CHECK CLEARANCE OF SECOND BRAKE

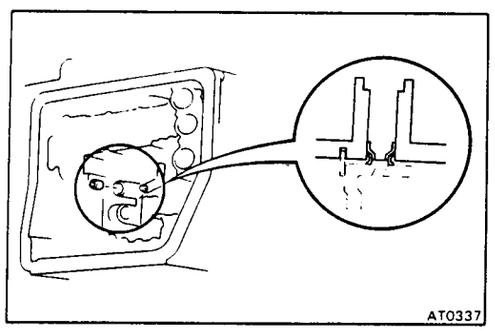
Using a thickness gauge, check the clearance between the plate and the seat of the return spring assembly.

Clearance: 0.37 – 1.56 mm (0.0146 – 0.0614 in.)


AT0336

24. CHECK OPERATION OF SECOND BRAKE

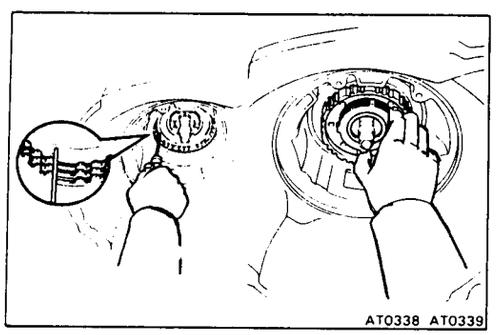
Apply compressed air into the oil passage with the case, and be sure that the piston moves.


AT0337

25. INSTALL NEW SECOND BRAKE DRUM GASKET

Drive in a new gasket until the distance between the surface of the case and the top of the seal is 29 ± 0.05 mm (1.14 ± 0.0020 in.).

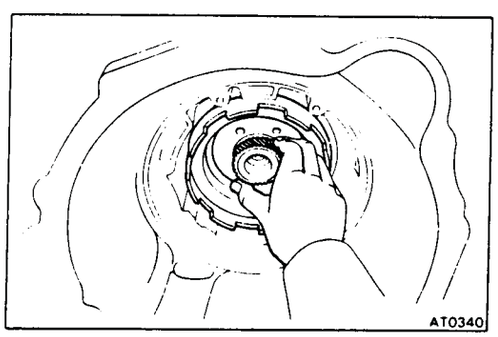
NOTE: Tap in the drum gasket until it makes contact with the 2nd brake drum.


AT0338 AT0339

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

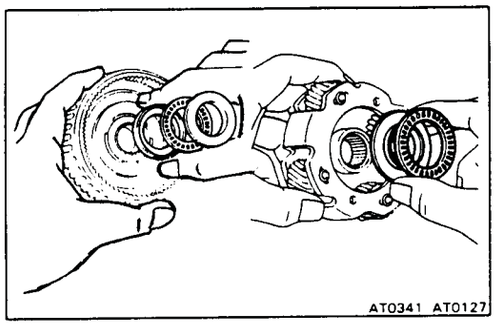
(a) Align the flukes of the discs in the 2nd brake.

(b) Align the spline of the hub with the flukes of the discs and install the hub into the 2nd brake discs.


AT0340

27. INSTALL SUN GEAR AND SUN GEAR INPUT DRUM

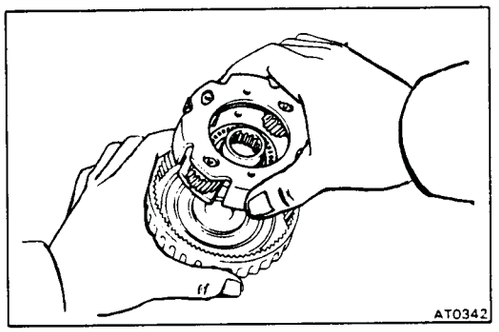
While turning the sun gear clockwise, install it into the one-way clutch.



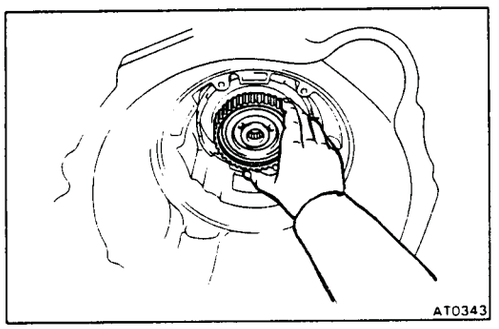
28. INSTALL FRONT PLANETARY GEAR ONTO RING GEAR

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

(b) Coat the race and the bearing with petroleum jelly and install them onto the carrier.

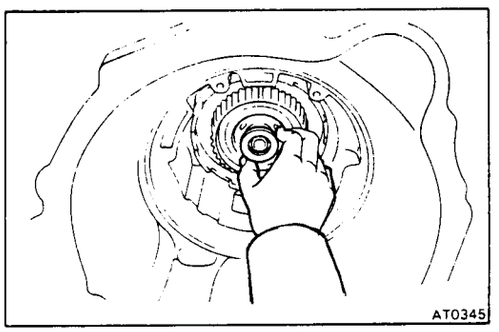


(c) Install the planetary gear onto the ring gear.



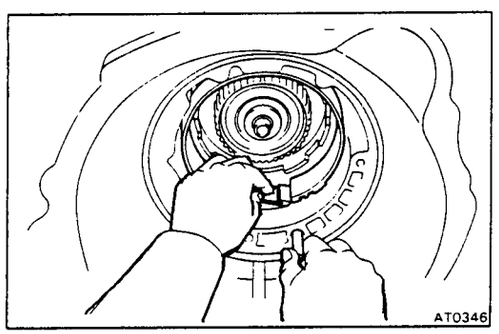
29. INSTALL FRONT PLANETARY GEAR ASSEMBLY ONTO SUN GEAR

(a) If the planetary gear and the other parts are installed correctly into the case, the end of bushing with the ring gear flange will be flush with the intermediate shaft.



(b) Coat the race with petroleum jelly and install it onto the tip of ring gear flange.

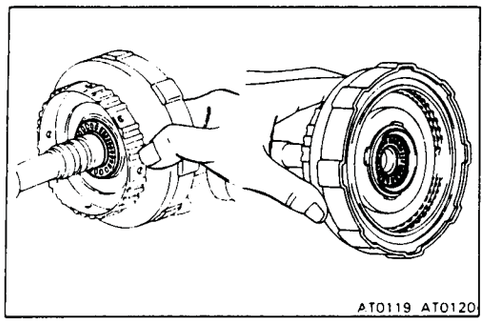
30. INSTALL INTERMEDIATE SHAFT OIL SEAL RING



31. INSTALL SECOND COAST BRAKE BAND

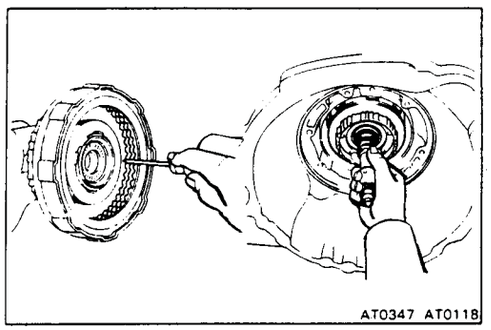
(a) Place the band into the case.

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



32. INSTALL FORWARD CLUTCH INTO CASE

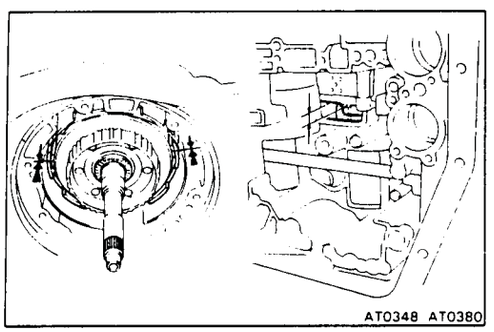
(a) Coat the races and bearings with petroleum jelly and install them onto both sides of the clutch drum.



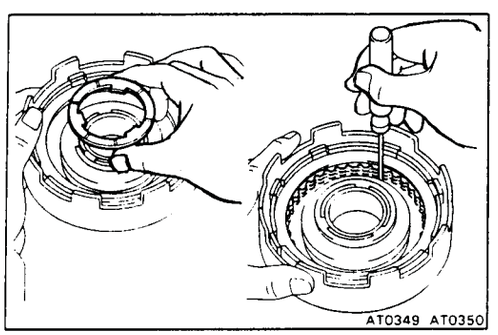
(b) Align the flukes of the disc in the forward clutch.

(c) Hold the sun gear input drum and rotate the input shaft to mesh the hub with the clutch discs of the forward clutch.

NOTE: Align the center of the input shaft and intermediate shaft, and while pushing on the input shaft, rotate it to mesh the hub and disc.



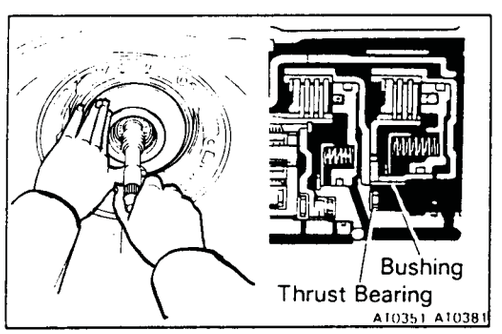
(d) If the flukes of the discs are meshed with the hub correctly, the protrusion of the input shaft drum will have entered deeper than the tip of the sun gear input drum.



33. INSTALL DIRECT CLUTCH INTO CASE

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

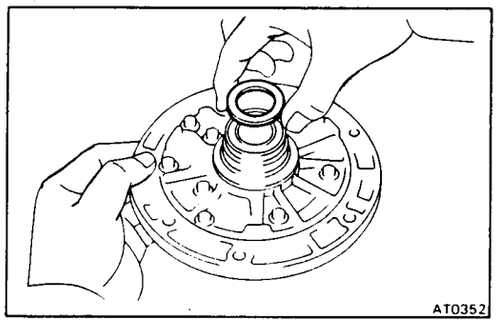
(b) Align the flukes of discs in the direct clutch.



(c) Hold the input shaft, and put the direct clutch drum through the 2nd coast brake band.

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

(e) If the flukes of the discs are meshed with the hub correctly, the end of the bushing with the direct clutch drum is flush with the thrust bearing on the forward clutch.

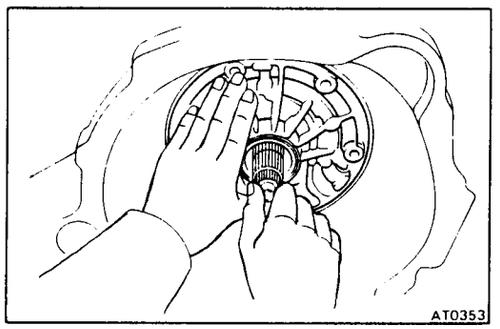


34. INSTALL OIL PUMP INTO CASE

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

NOTE: After installing the oil pump, measure the input shaft thrust play.

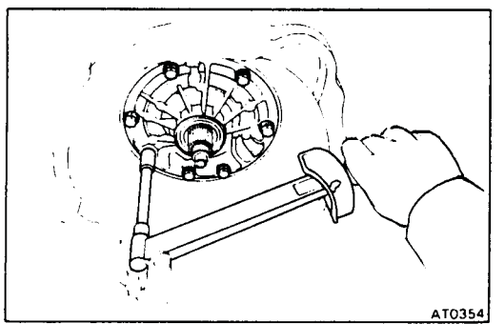
If the thrust play is in excess of standard, select and insert one of the two different size races.



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

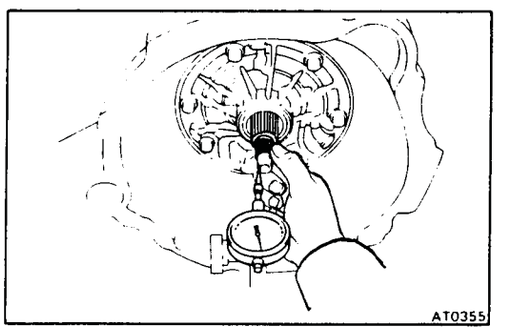
(c) Hold the input shaft, and lightly press the oil pump body to slide the oil seal rings on the stator shaft through the direct clutch drum.

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



(d) Install the seven bolts.

Torque: 225 kg-cm (16 ft-lb, 22 N·m)



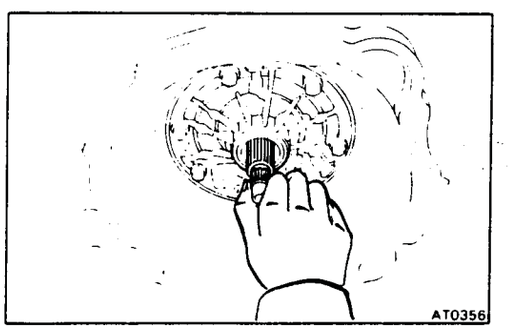
35. MEASURE THRUST PLAY OF INPUT SHAFT

Measure the thrust play.

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

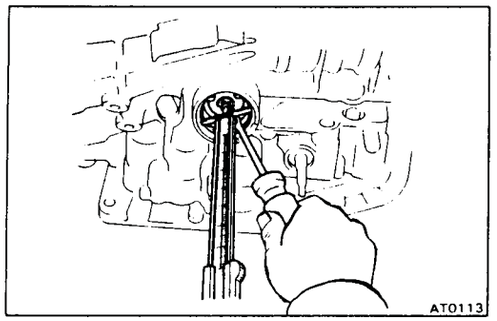
NOTE: There are two different thickness of races for the end of stator shaft. If necessary, select one of them.

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



36. CHECK INPUT SHAFT ROTATION

Make sure that the input shaft rotates smoothly.



37. CHECK SECOND COAST BRAKE PISTON STROKE

(a) Install the brake piston without the outer spring into the bore.

(b) Install the snap ring.

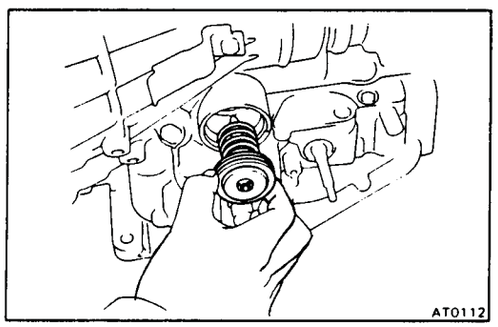
(c) Push the end of the piston rod firmly. At this time, measure the distance between the tip of the piston rod and the outside of snap ring.

Distance: 14.0 – 15.5 mm (0.551 – 0.610 in.)
[Actual piston stroke is 1.5 – 3.0 mm (0.059 – 0.118 in.).]

If the stroke is more than standard value, replace the piston rod with a longer one.

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

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



38. INSTALL SECOND COAST BRAKE PISTON

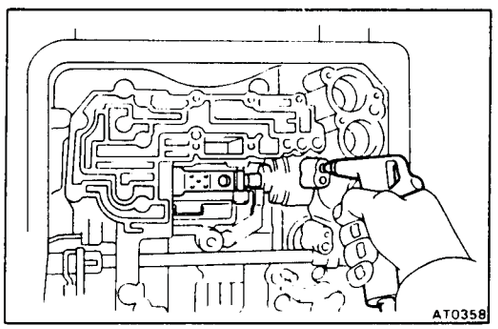
(a) Remove the installed parts from the bore.

(b) Install the outer spring with the piston.

(c) Place the cover into the bore.

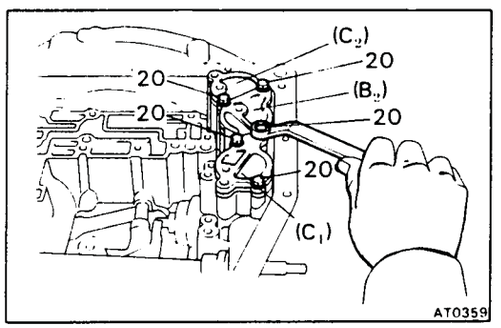
(d) Using SST, install the snap ring while pressing the cover.

SST 09350-32011



39. CHECK OPERATION OF SECOND COAST BRAKE

Apply the compressed air into the hole with the case and make sure that the piston rod moves.



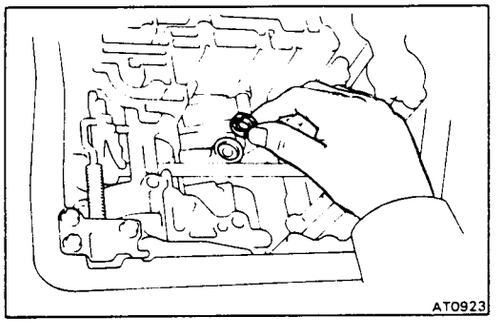
40. INSTALL ACCUMULATOR PISTONS AND SPRINGS

(a) Install the springs and pistons into the bore.

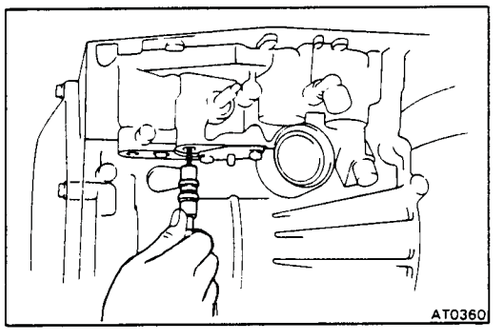
Spring		Free length mm (in.)		Color	Remarks
C_1	No. 1	48.00	(1.8898)	Red	
	No. 2	81.09	(3.1925)	Yellow Green	
C_2		72.18	(2.8417)	Yellow	A140E
		70.75	(2.7854)	Orange	A140L
B_2		66.68	(2.6252)	Orange	

(b) Place the cover with the gasket and tighten the bolts gradually in sequence.

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



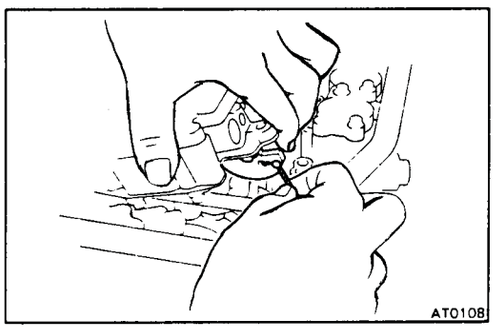
41. INSTALL GOVERNOR APPLY GASKET



42. INSTALL THROTTLE CABLE AND SOLENOID WIRING IN CASE

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

CAUTION: In subsequent work, do not roll the case over the cable and break the cable fitting.

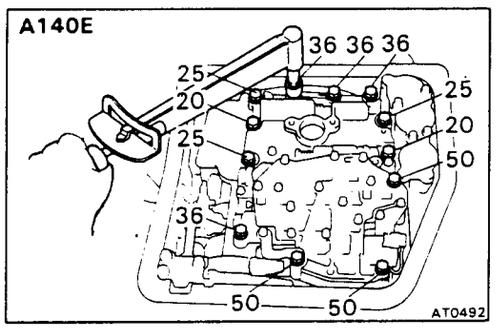


43. PLACE VALVE BODY ON TRANSMISSION

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

(b) Lower valve body into place.

CAUTION: Do not entangle the throttle cable.



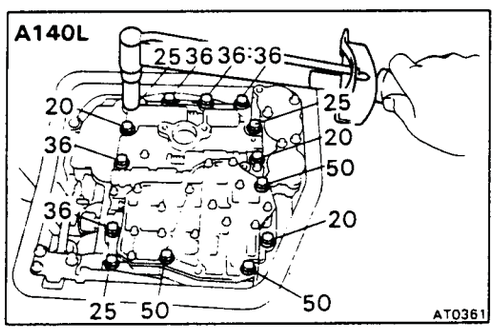
44. INSTALL BOLTS IN VALVE BODY

[A140E]

(a) Finger tighten the twelve bolts first, then tighten them with torque wrench.

Torque: 100 kg-cm (7 ft-lb, 10 N·m)

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

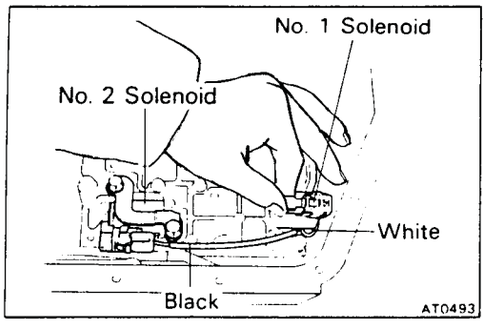


[A140L]

(b) Finger tighten the fourteen bolts first, then tighten them with torque wrench.

Torque: 100 kg-cm (7 ft-lb, 10 N·m)

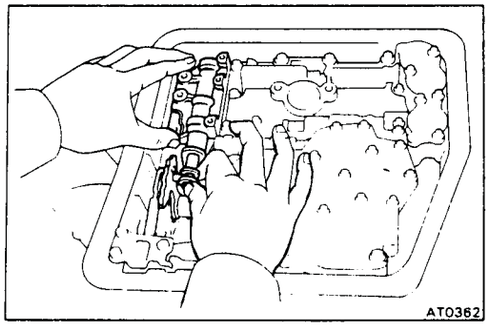
NOTE: Each bolt length (mm) is indicated in the figure.



45. CONNECT SOLENOIDS WIRING

(a) Connect the No. 1 solenoid connector. (white and shorter wire)

(b) Connect the No. 2 solenoid connector. (black and longer wire)



46. PLACE MANUAL VALVE AND BODY ON TRANSMISSION

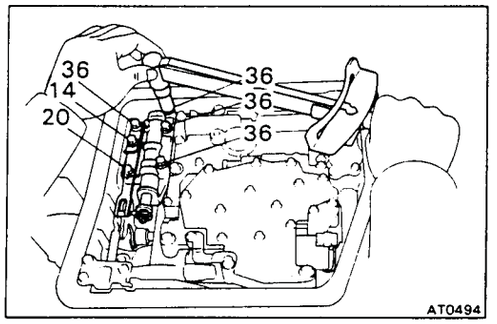
(a) Align the manual valve with the pin on the manual valve lever.

(b) Lower the manual valve body into place.

(c) Finger tighten the four bolts first. Then tighten them with a torque wrench.

Torque: 100 kg-cm (7 ft-lb, 10 N·m)

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



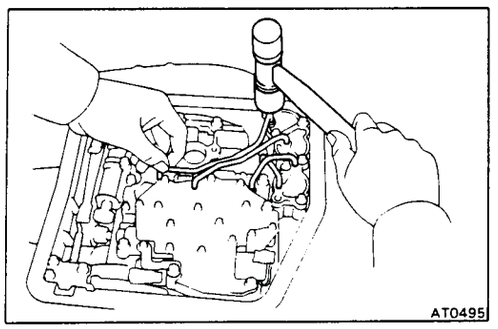
47. INSTALL DETENT SPRING

(a) Finger tighten the two bolts first. Then tighten them with a torque wrench.

Torque: 100 kg-cm (7 ft-lb, 10 N·m)

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

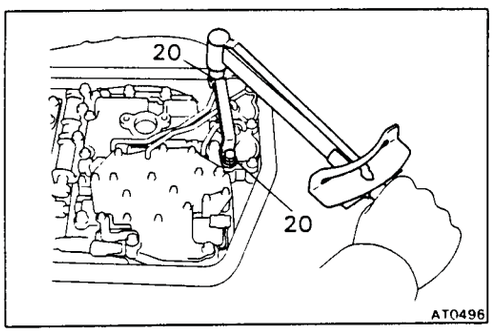
(b) Check that the manual valve lever is touching the center of the detent spring tip roller.



48. INSTALL OIL TUBES

Using a plastic hammer, install the tubes into the positions indicated in the figure.

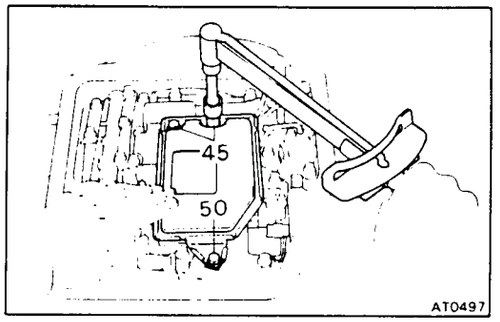
CAUTION: Be careful not to bend or damage the tubes.



49. INSTALL TUBE BRACKET

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

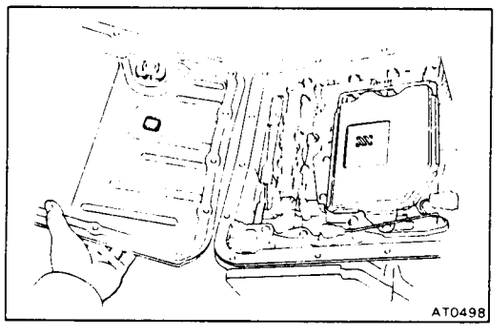
Torque: 100 kg-cm (7 ft-lb, 10 N·m)



50. INSTALL OIL STRAINER

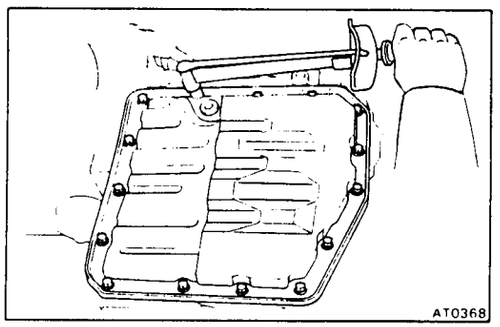
Each bolt length (mm) is indicated in the figure.

Torque: 100 kg-cm (7 ft-lb, 10 N·m)



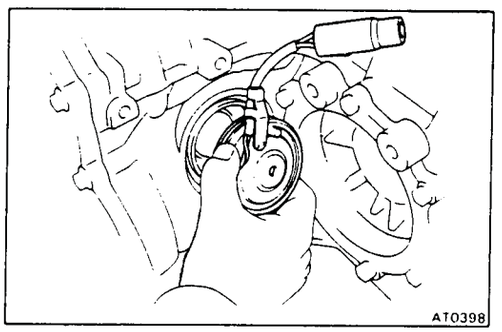
51. INSTALL MAGNET IN PLACE AS SHOWN

CAUTION: Make sure that the magnet does not interfere with the oil tubes.



52. INSTALL OIL PAN WITH GASKET

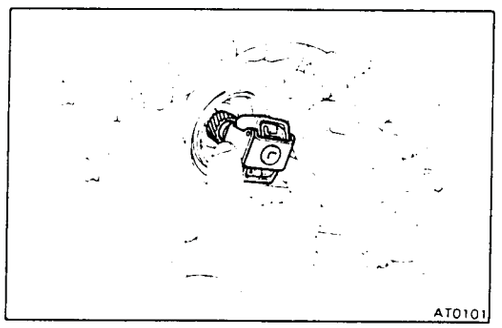
Torque: 50 kg-cm (43 in.-lb, 4.9 N·m)



53. INSTALL SPEED SENSOR (A140E)

(a) Install the speed sensor with a new O-ring.

(b) Install the cover bracket with the two bolts.



54. INSTALL GOVERNOR BODY

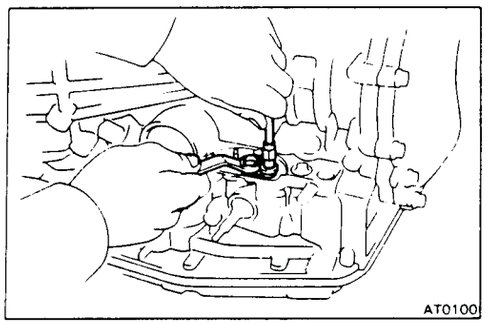
(a) Install the governor body adaptor.

(b) Install the thrust washer onto the governor body.

(c) Install the governor body with the plate washer.

(d) Install the cover over a new O-ring.

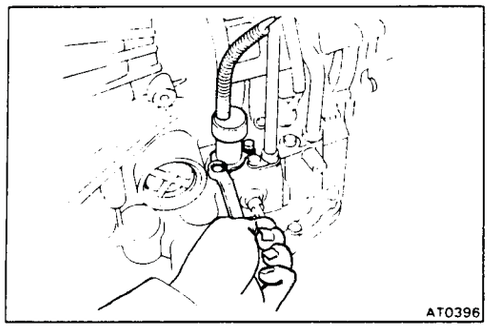
(e) Install the cover bracket with the two bolts.



55. INSTALL RETAINING PLATES

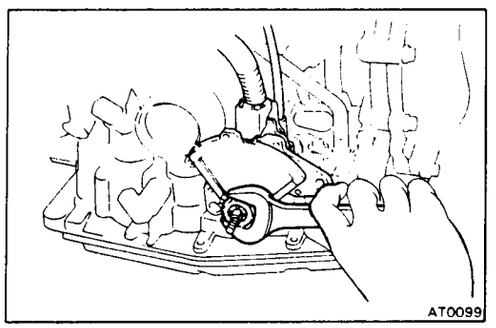
(a) Install the solenoid wiring retaining plate.
(b) Install the throttle cable retaining plate.

56. INSTALL TUBE AND FILLER GAUGE



57. INSTALL SOLENOID

(a) Coat a new O-rings with ATF and push the tip of solenoid into the hole.
(b) Tighten the two bolts evenly and gradually.

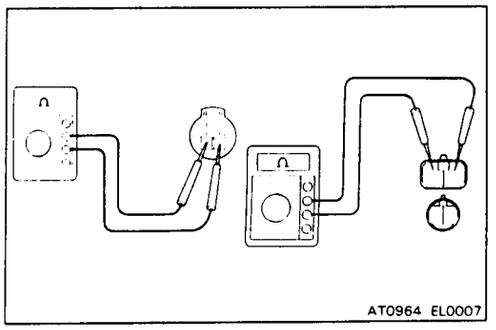


58. INSTALL NEUTRAL START SWITCH

(a) Install the seal gasket, facing the lip inward.
(b) Tighten the nut and stake it with the lock washer.

Torque: 70 kg-cm (61 in.-lb, 6.9 N·m)

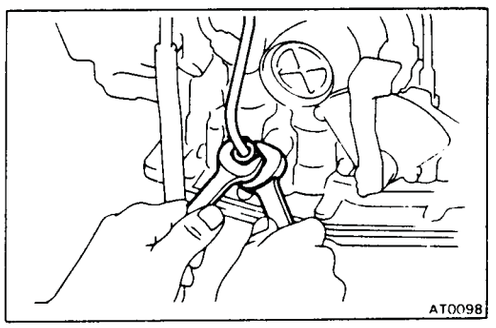
59. INSTALL SHIFT HANDLE



60. ADJUST NEUTRAL START SWITCH

(a) Connect an ohmmeter between the terminals.
(b) Shift the lever into "N" position.
(c) Adjust the switch to the point where there is continuity between the terminals.
(d) Lock the switch with two bolts.

Torque: 55kg-cm (48 in.-lb, 5.4 N·m)

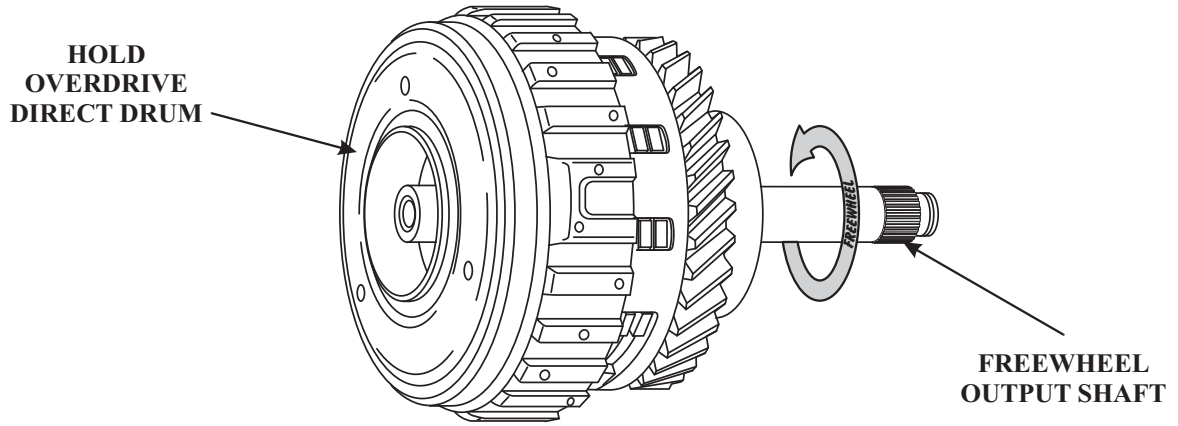


61. INSTALL TWO OIL COOLER PIPES

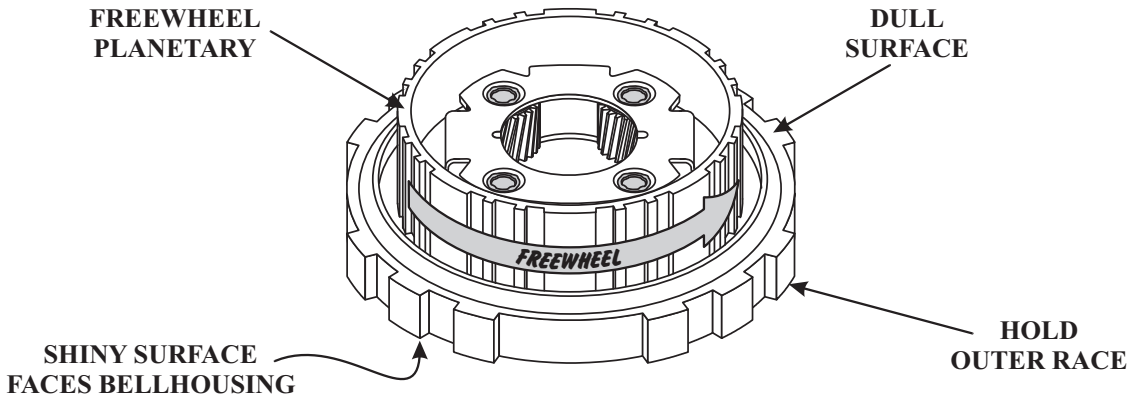
(a) Install the bracket onto the case.
(b) Connect the pipes to the union.
(c) Clamp the two pipes onto bracket.
(d) Tighten the union nuts.

Torque: 350 kg-cm (25 ft-lb, 34 N·m)

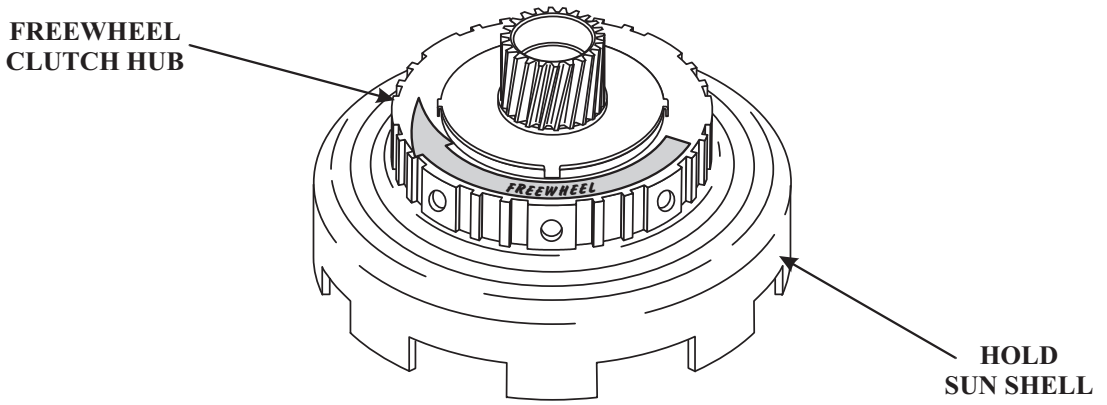
THE SHAFT MUST FREEWHEEL CLOCKWISE AND LOCK COUNTER CLOCKWISE WHEN THE OVERDRIVE DIRECT DRUM IS HELD

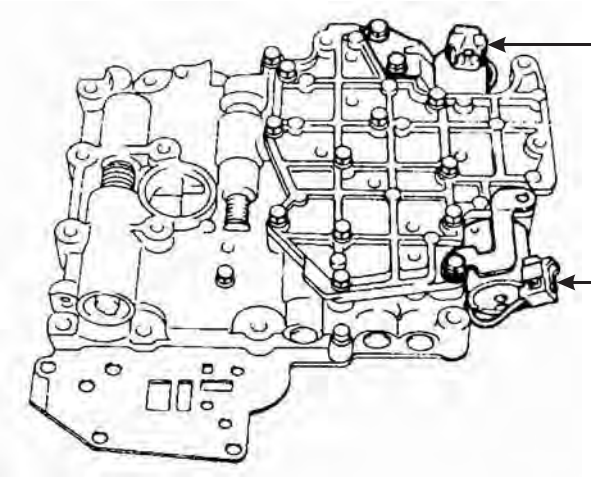


THE PLANETARY MUST FREEWHEEL COUNTER CLOCKWISE AND LOCK CLOCKWISE WHEN THE OUTER RACE IS HELD



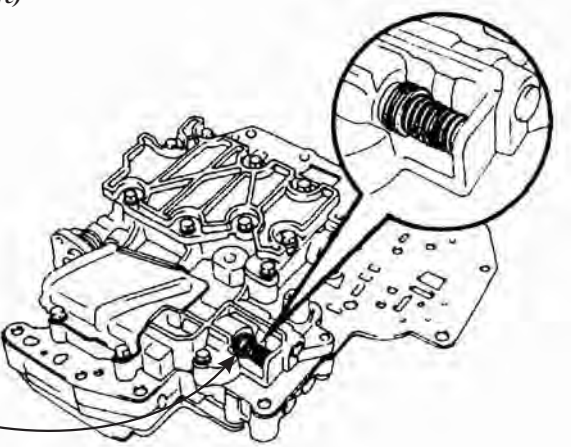
THE CLUTCH HUB MUST FREEWHEEL CLOCKWISE AND LOCK COUNTER CLOCKWISE WHEN THE SUN SHELL IS HELD





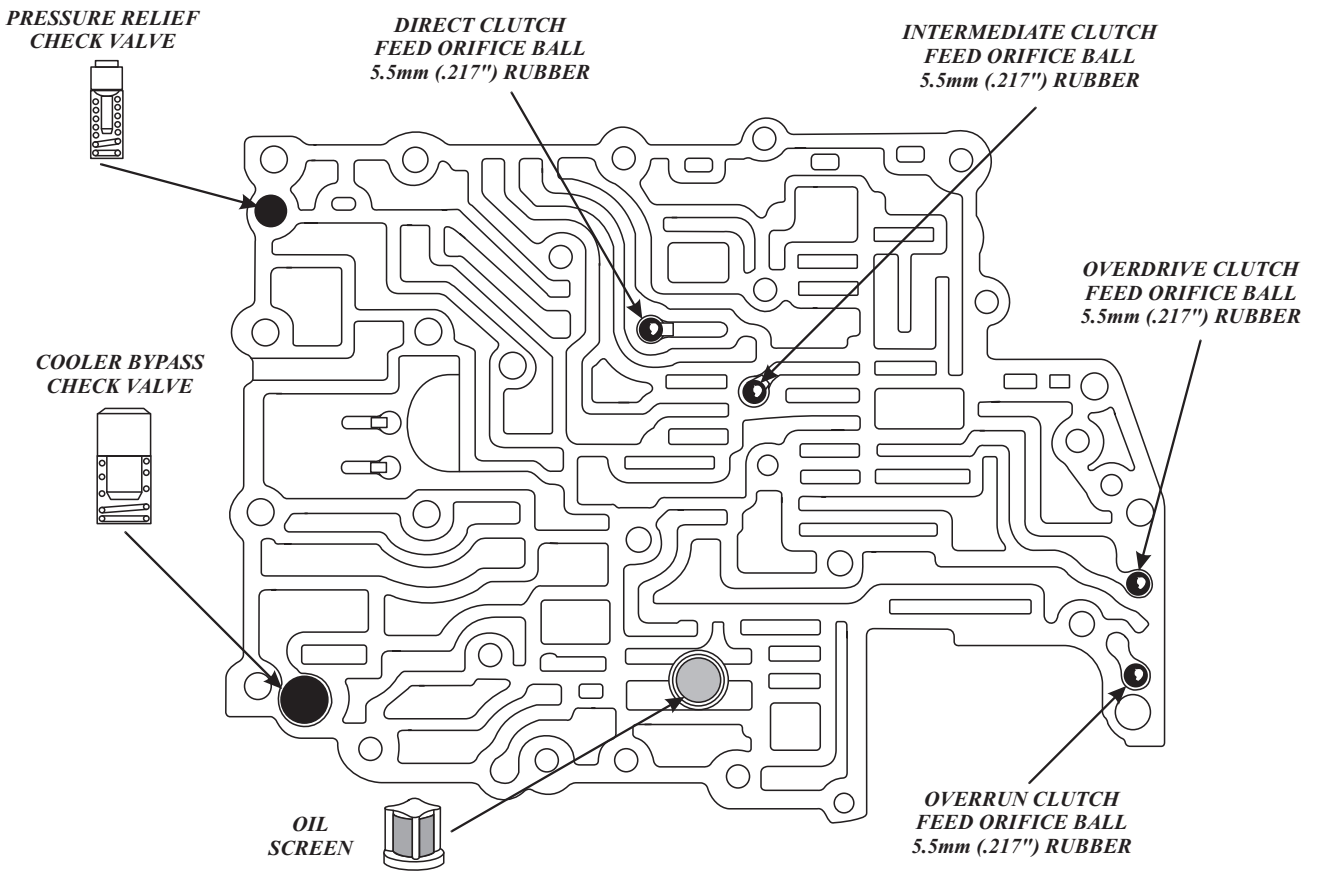
Wire Color	White	Black	Yellow
Gear Range	No. 1 Solenoid	No. 2 Solenoid	Lock-Up Solenoid
1st Gear	On	Off	Off
2nd Gear	On	On	Off
3rd Gear	Off	On	Off
4th Gear	Off	Off	*On
Reverse	On	Off	Off
* = Determined by TCM			

All Solenoids 11-15 Ohms resistance @ 72°F

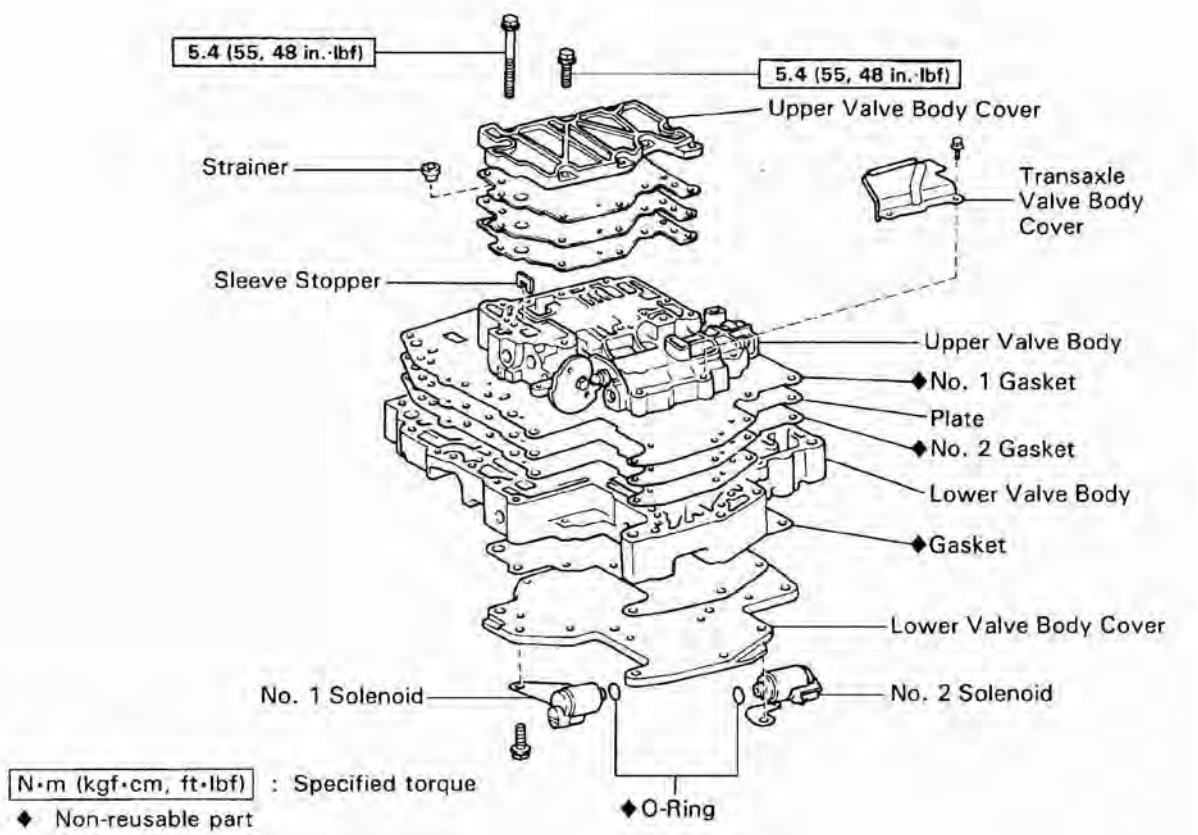


Note: Count the number of "E" clips before disassembly of the valve body, as the throttle pressure is changed according to the number of "E" clips on the throttle valve. Some valve bodies do not have any "E" clips.
(Increasing number of "E" clips decreases throttle pressure)

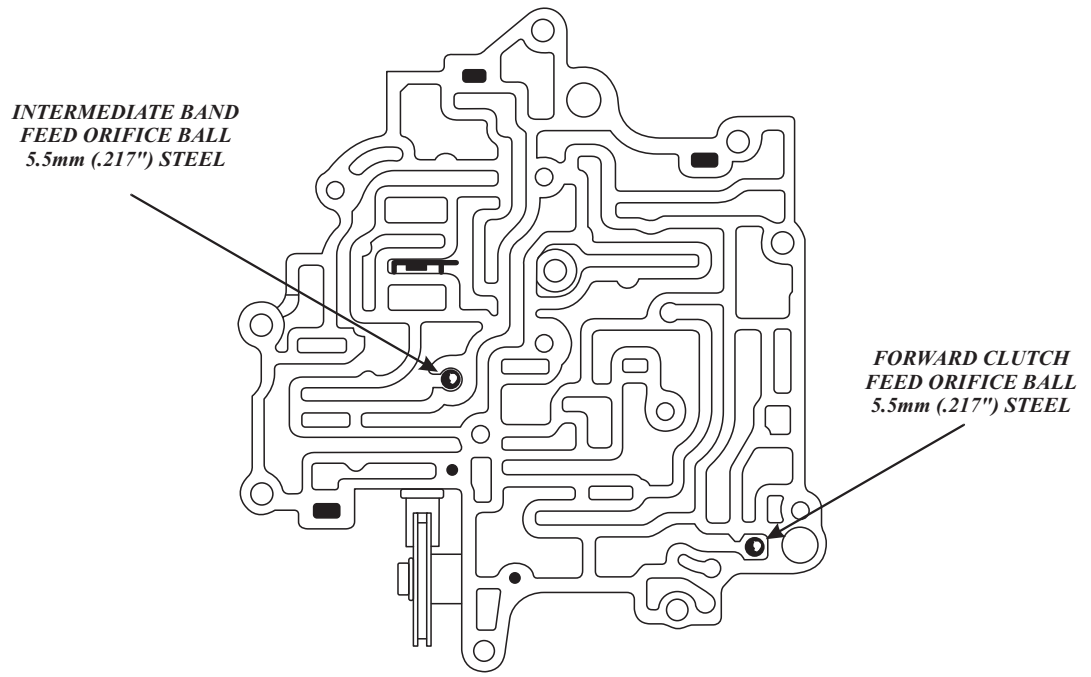
A140E "LOWER" VALVE BODY CHECKBALL AND VALVE LOCATIONS



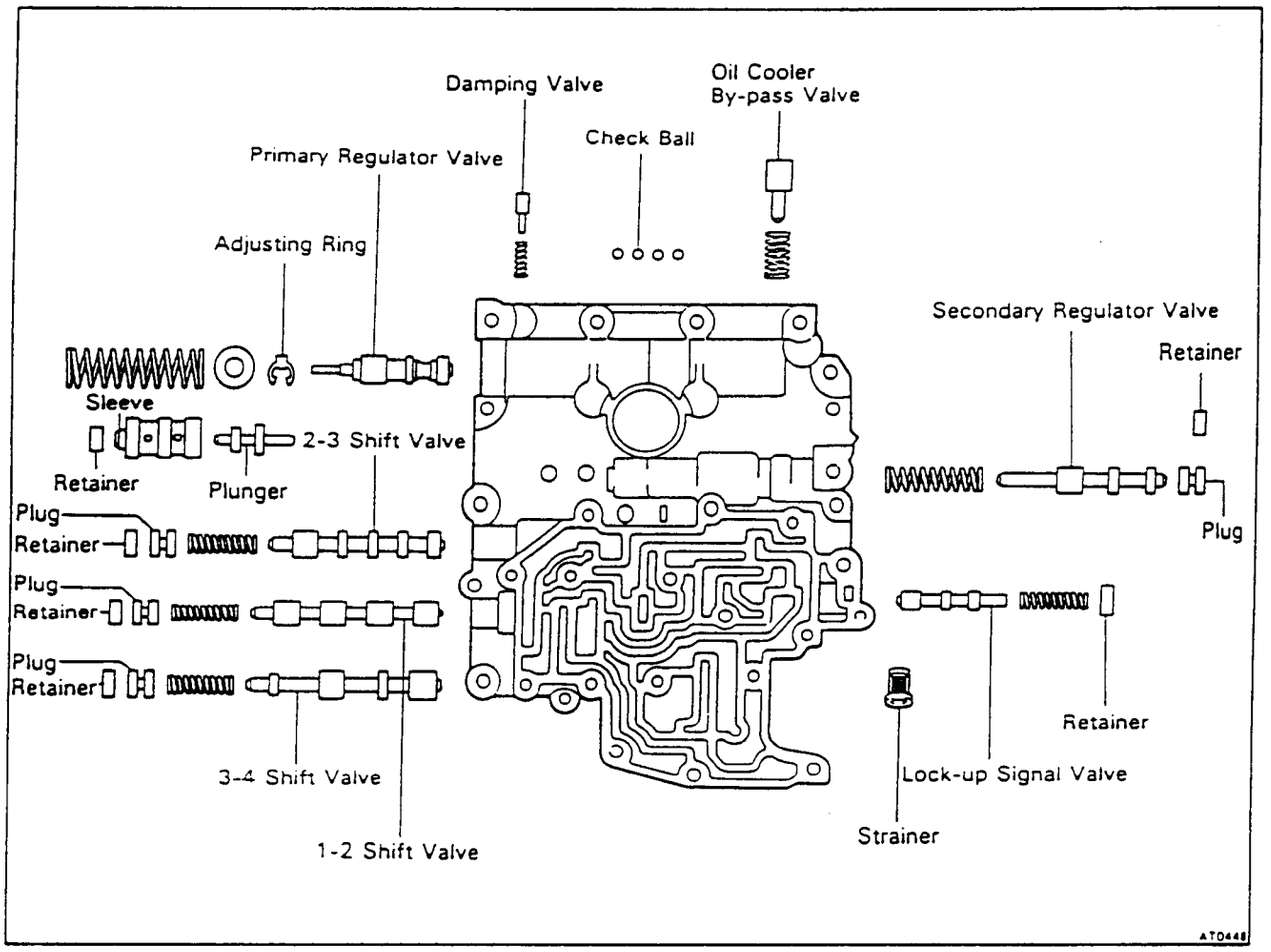
A140E VALVE BODY

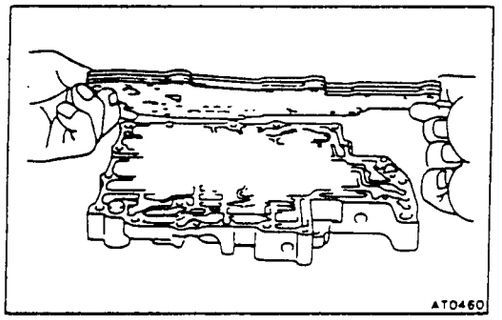


A140E "UPPER" VALVE BODY CHECKBALL LOCATIONS



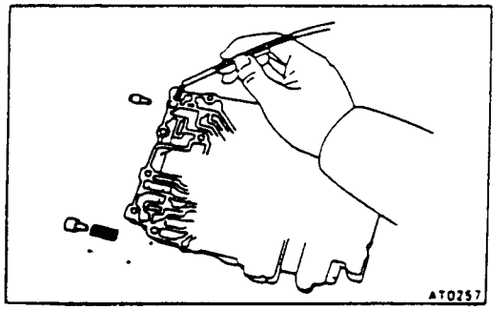
(Lower Valve Body)





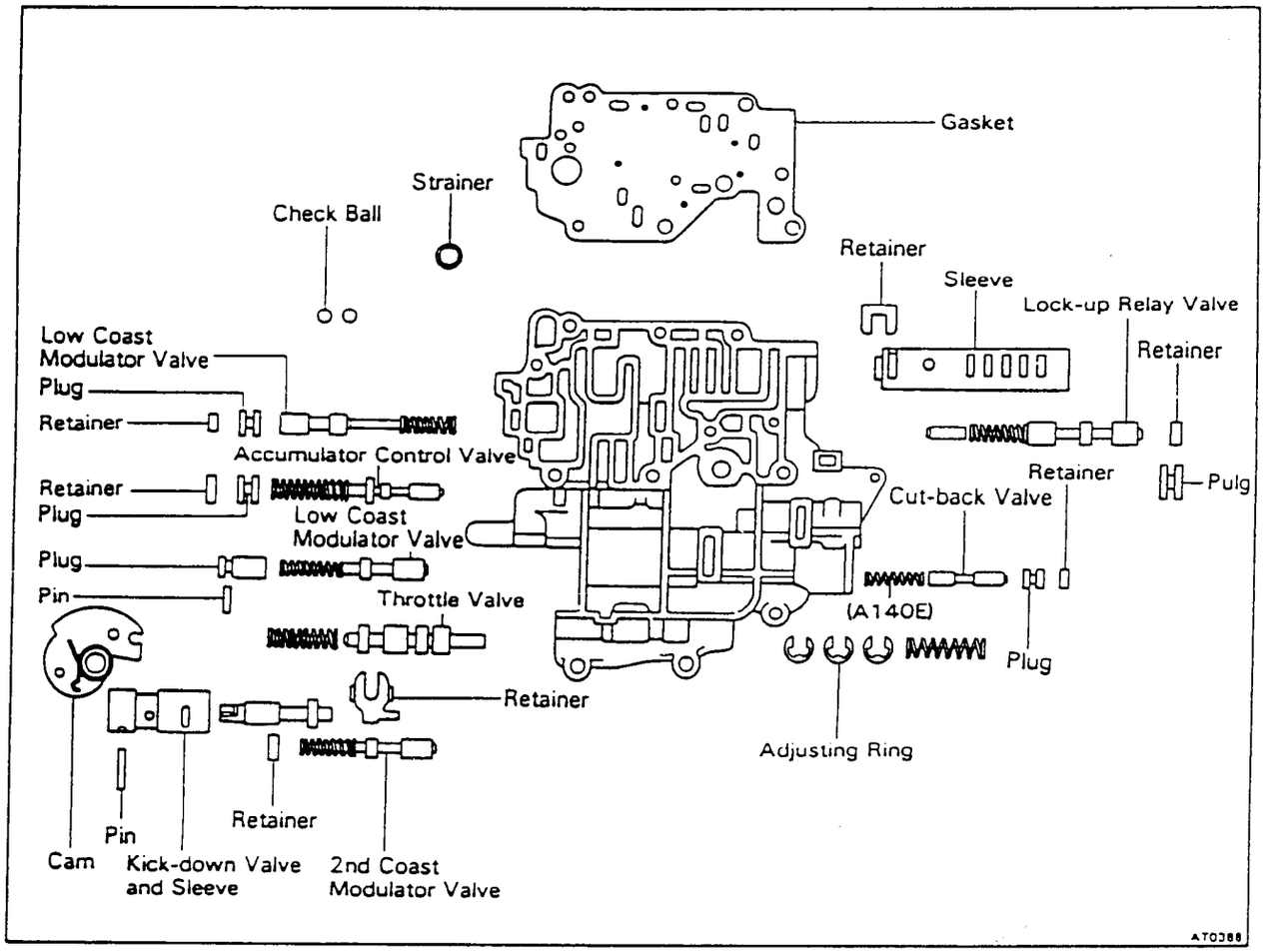
DISASSEMBLY OF LOWER VALVE BODY

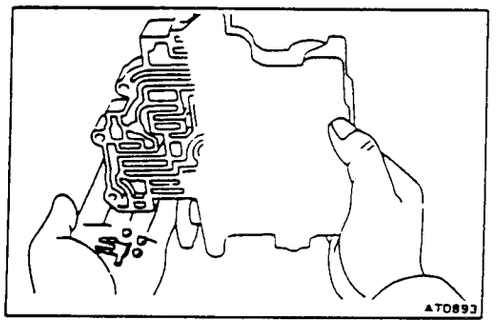
1. REMOVE LOWER VALVE BODY PLATE AND GASKETS



2. REMOVE COOLER BY-PASS VALVE AND SPRING
3. REMOVE DAMPING VALVE AND SPRING

(Upper Valve Body)

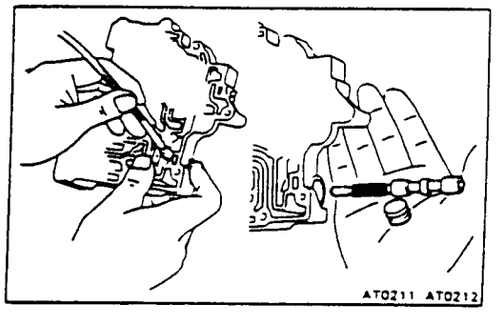




DISASSEMBLY OF UPPER VALVE BODY

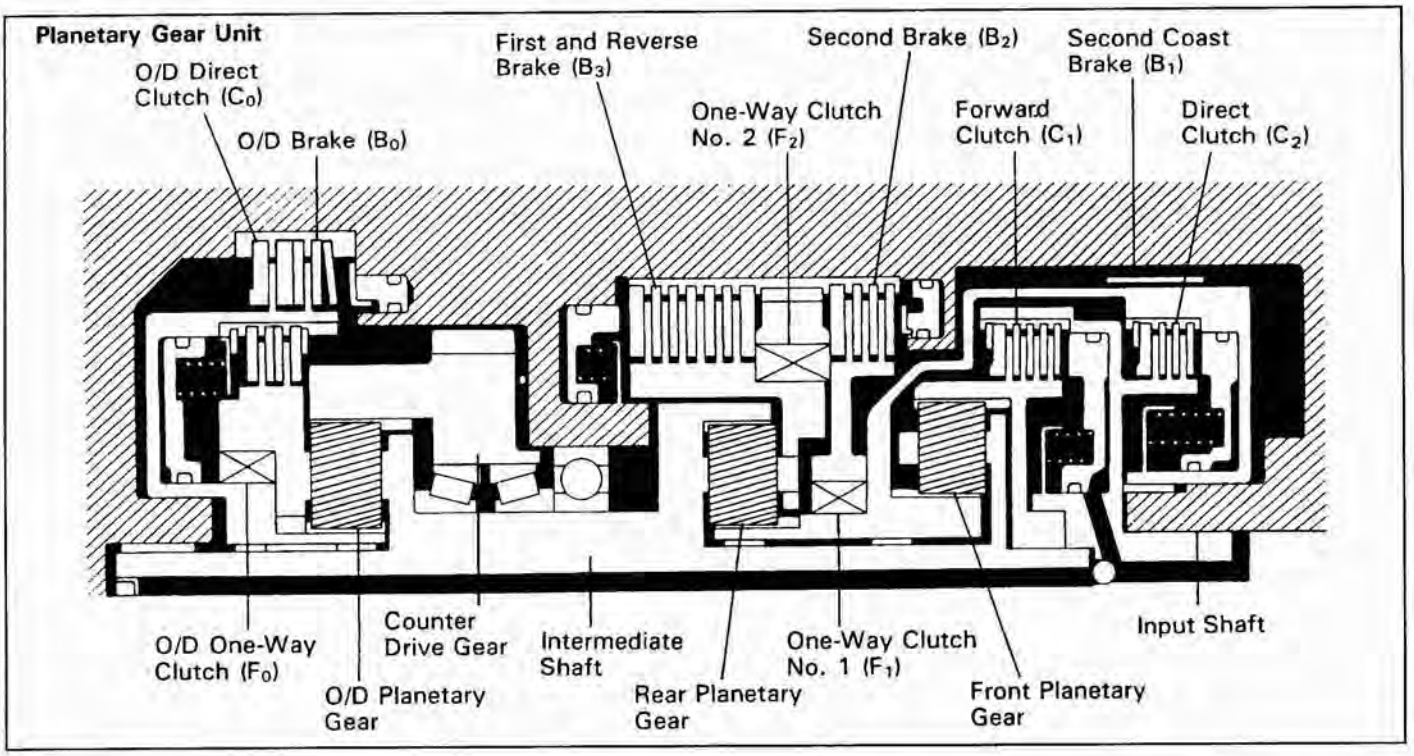
1. REMOVE THROTTLE VALVE RETAINER AND CHECK BALLS

   NOTE: A140E Two check balls
   A140L Three check balls



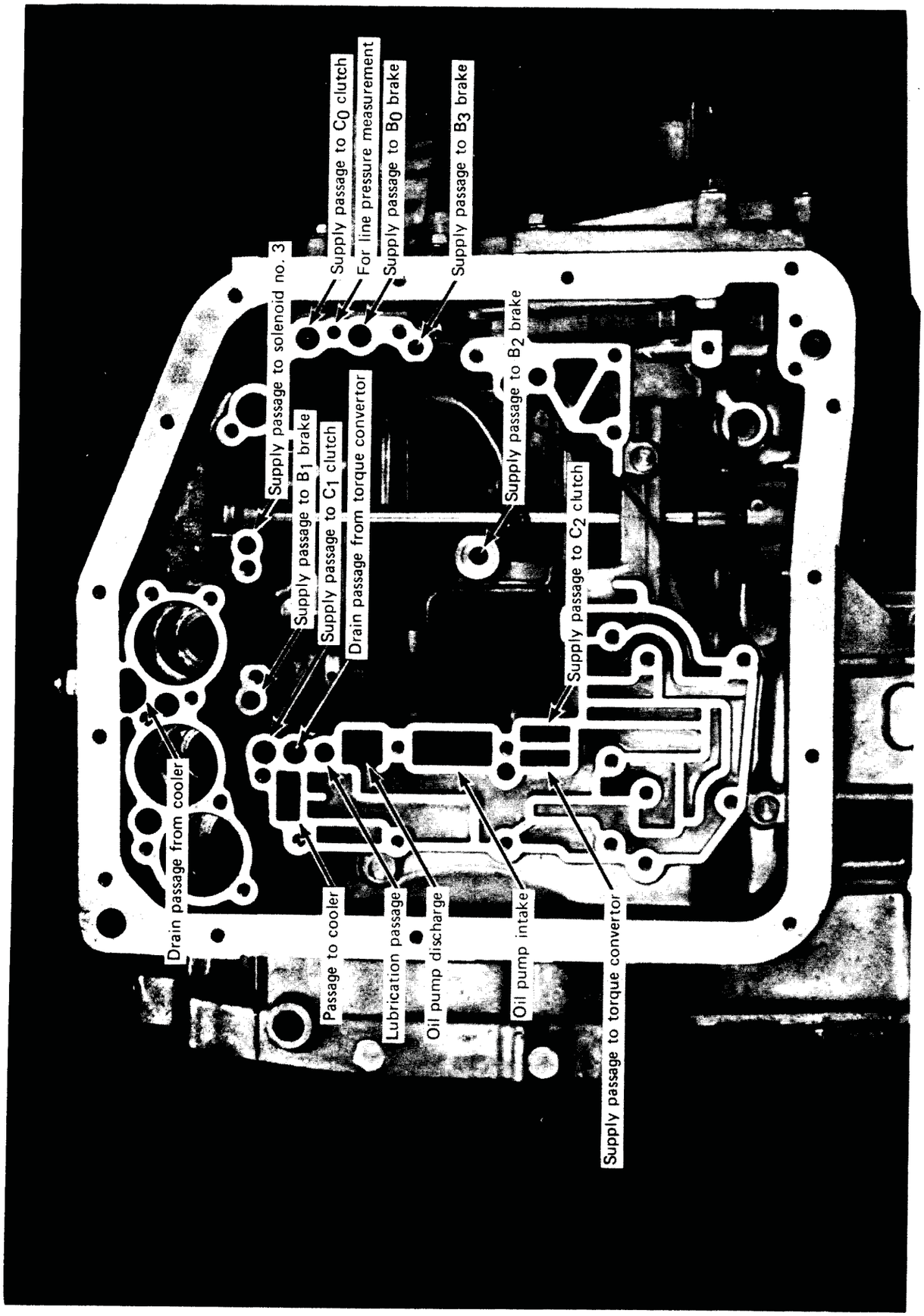
2. REMOVE LOCK-UP RELAY VALVE
   (a) Remove the retainer for the plug with a magnetic finger and remove the plug.
   (b) Remove the lock-up relay valve, control valve and spring.

COMPONENT APPLICATION CHART



Shift lever position	Gear Position	C_0	C_1	C_2	B_0	B_1	B_2	B_3	F_0	F_1	F_2
P	Parking	○									
R	Reverse	○		○				○			
N	Neutral	○									
D	1st	○	○						○		○
	2nd	○	○				○		○	○	
	3rd	○	○	○			○		○		
	O/D		○	○	○		○				
2	1st	○	○						○		○
	2nd	○	○			○	○		○	○	
	*3rd	○	○	○			○		○		
L	1st	○	○					○	○		○
	*2nd	○	○			○	○		○	○	

*** Downshift from higher gear only, No upshift in this range.**



A140E TRANSMISSION OIL PASSAGES

Hydraulic Test

1. PREPARATION

(a) Warm up the transmission fluid.

(b) Remove the transmission case test plug and mount 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).

2. MEASURE LINE PRESSURE

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

(b) Start the engine and check the idling rpm.

(c) Shift into D range, step down strongly on the brake pedal with your left foot and while manipulating the accelerator pedal with the right foot, measure the line pressure at the engine speeds specified in table.

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

Engine speed	Line pressure kg/cm² (psi, kPa)	
	D range	R range
Idling	3.7 – 4.3 (53 – 61) (363 – 422)	5.4 –7.2 (77 – 102) (530 – 706)
Stall	9.2 – 10.7 (131 – 152) (902 – 1,049)	14.4 – 16.8 (205 – 239) (1,412 – 1,648)

(e) If the measured pressures are not up to specified values, recheck the throttle cable adjustment and retest.

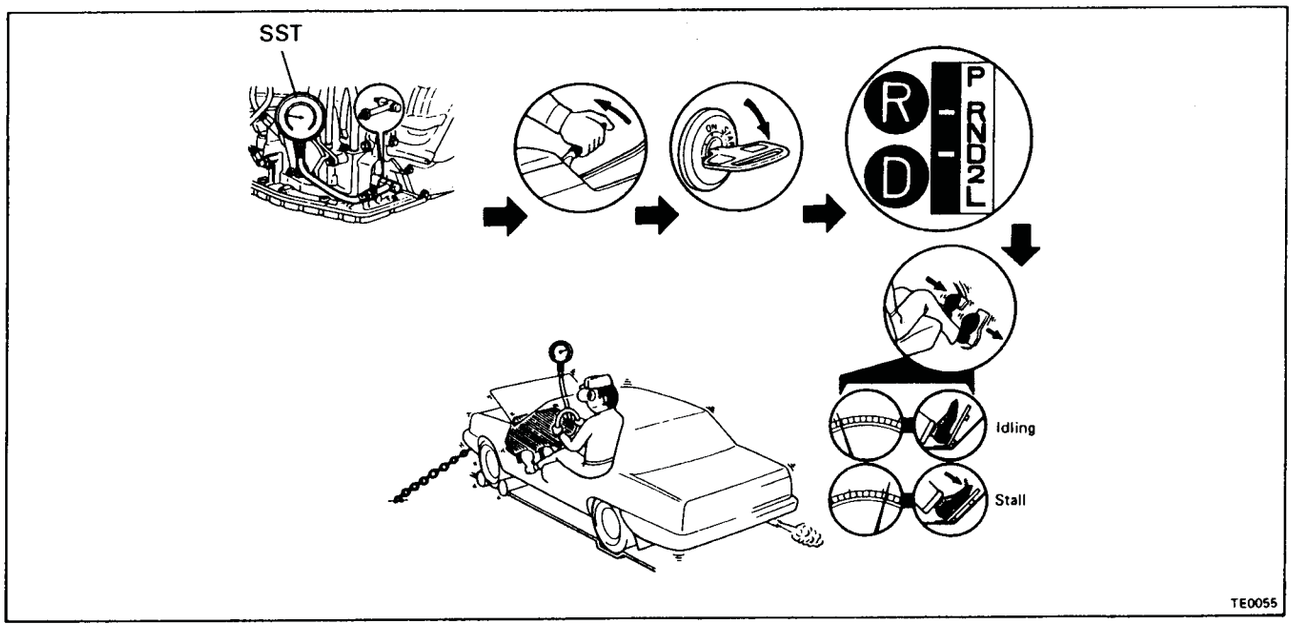
EVALUATION

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

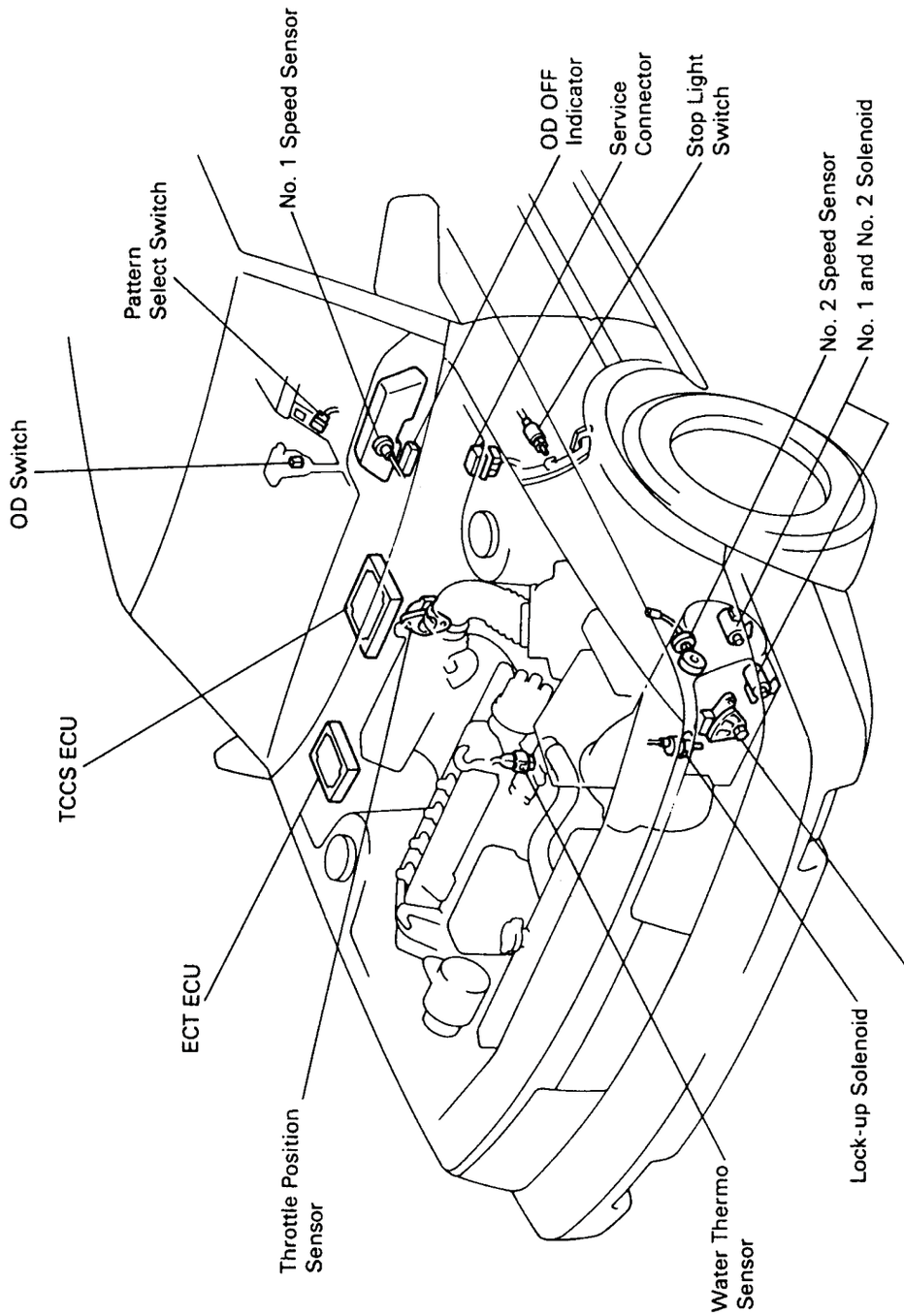
(b) If the measured values at all ranges are lower than specified:
- Throttle cable out-of-adjustment
- Throttle valve defective
- Regulator valve defective
- Oil pump defective
- OD clutch defective

(c) If pressure is low in D range only:
- D range circuit fluid leakage
- Forward clutch defective

(d) If pressure is low in R range only:
- R range circuit fluid leakage
- First and reverse brake defective
- Direct clutch defective

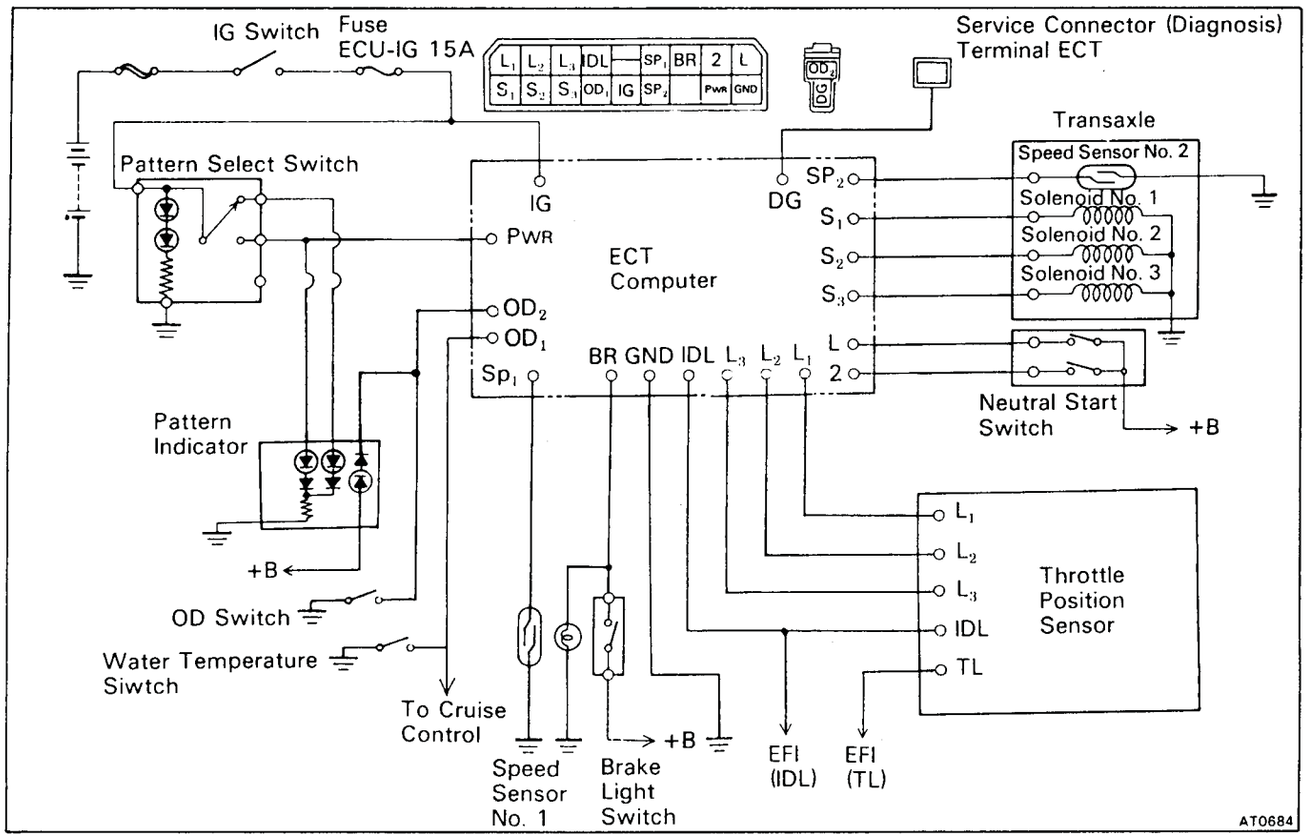


ELECTRONIC CONTROL COMPONENTS



1985 ELECTRONIC CONTROL ONLY

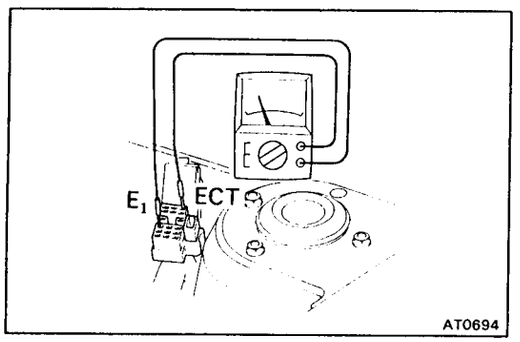
CIRCUIT

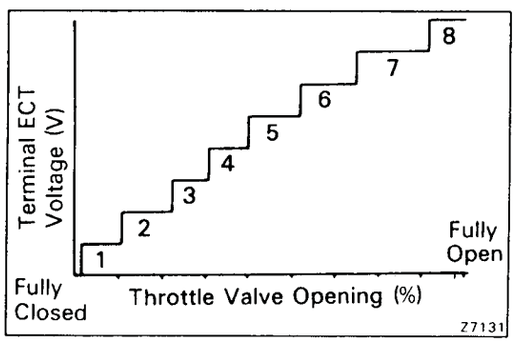


1985 ELECTRONIC CONTROL ONLY

INSPECT DIAGNOSTIC VOLTAGE

NOTE: If the trouble disappears due to an impact or such and the ignition switch is turned off, the trouble code (Diagnostic voltage) will be cancelled out. In this case, the vehicle must be road tested until the trouble appears again and the trouble code read before turning off the ignition.



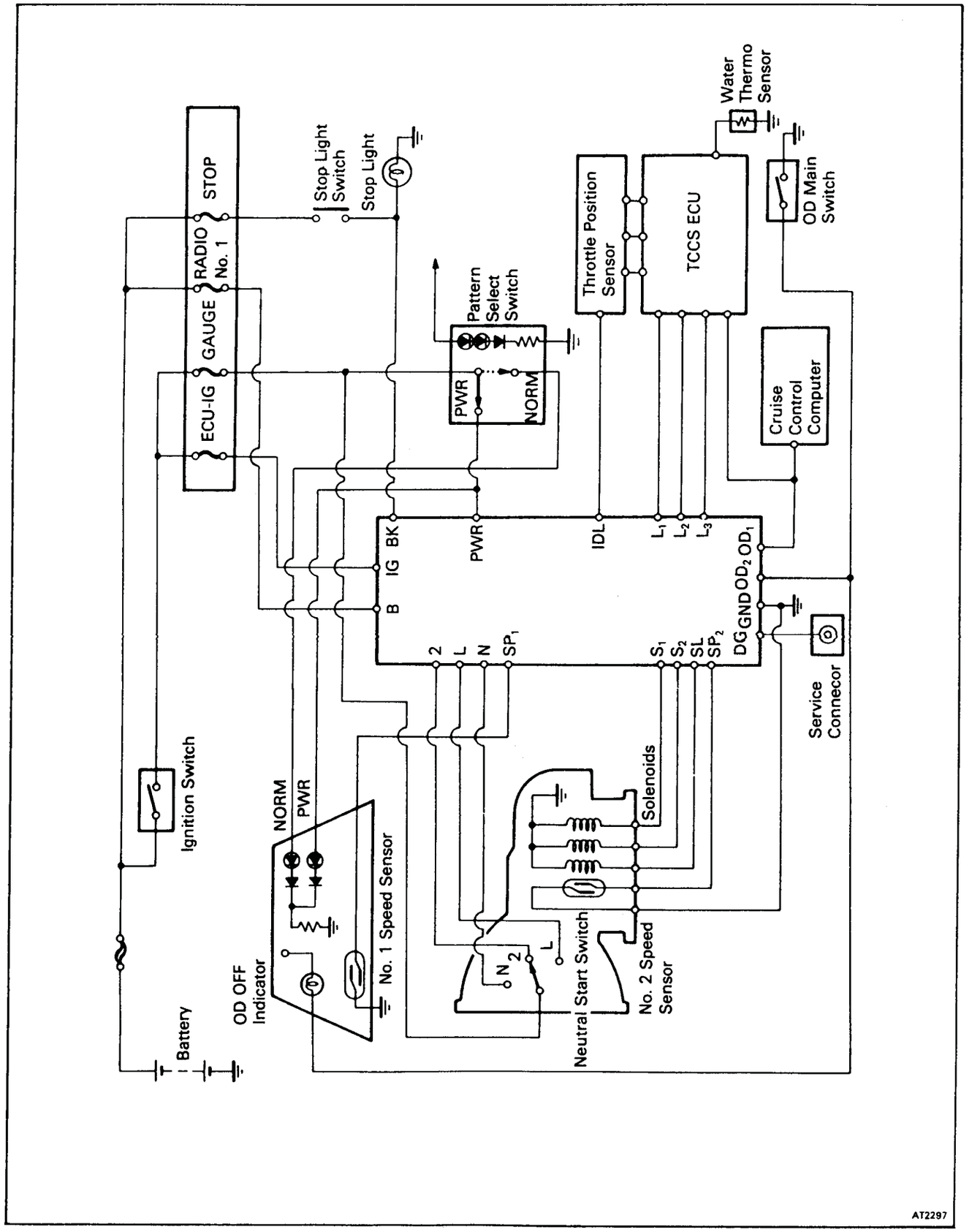


1. Connect a voltmeter to the service connector (Diagnosis) terminals ECT and E_1.
2. With the ignition switch ON, slowly depress the accelerator pedal and check that the diagnostic voltage rises in sequence.
   (a) If voltages rises from 0V to 8V in the sequence shown, the control system is okay.
   (b) If there is a constant 4V indication, the speed sensor is faulty.
   (c) If there is a constant 8V indication, the solenoid is defective.
   (d) If there is a constant 0V indication, the stop light switch faulty.
3. Inspect brake signal.
   (a) Depress the accelerator pedal to where 8V is indicated for the service connector terminal ECT.
   (b) Depress the brake pedal and check the voltage reading for the service connector terminal ECT.

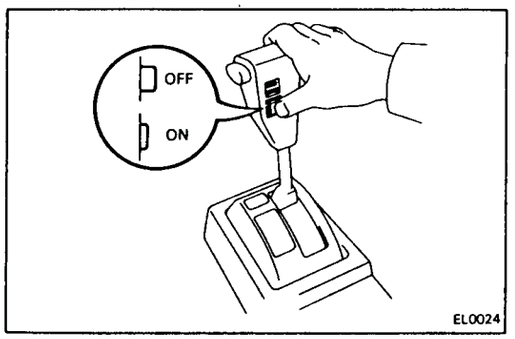
   Brake pedal depressed . . . 0V
   Brake pedal released 8V
4. Warm up the engine.

   Coolant temp: 80°C (176°F)
   ATF temp: 50 – 60°C (122 – 140°F)

1986 - UP ELECTRONIC CONTROL



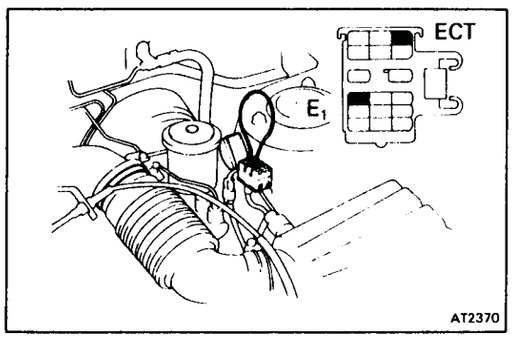
READ OF DIAGNOSTIC CODE



1. TURN IGNITION SWITCH AND OD SWITCH TO ON

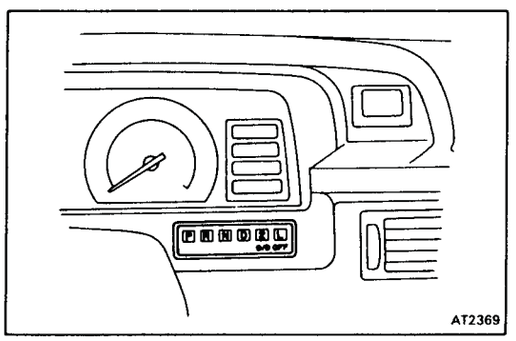
Do not start engine.

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



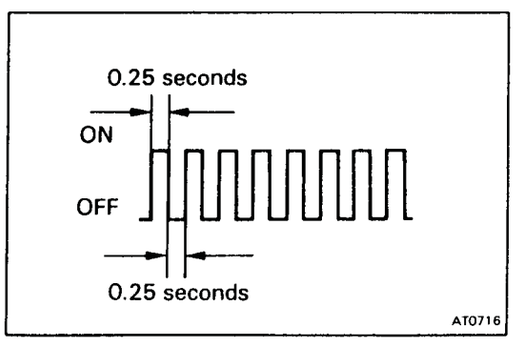
2. SHORT DG TERMINAL CIRCUIT

Using a service wire, short the terminals ECT AND E_1.



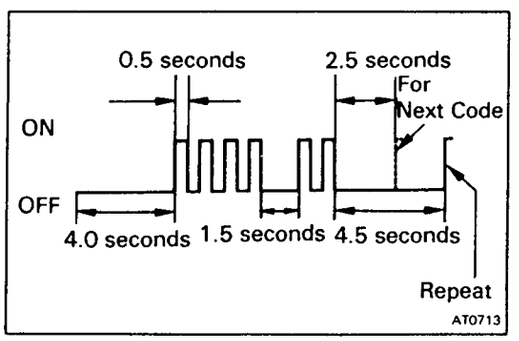
3. READ DIAGNOSTIC CODE

Read the diagnostic code as indicated by the number of times the OD "OFF" light flashes.



4. DIAGNOSTIC CODE

(a) If the system is operating normally, the light will blink for 0.25 seconds every 0.5 seconds.



(b) In the event of a malfunction, the light will blink for 0.5 seconds every 1.0 seconds. The number of blinks will equal the first number and, after 1.5 second pause, the second number of the two digit diagnostic code. If there are two or more codes, there will be a 2.5 second pause between each.

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

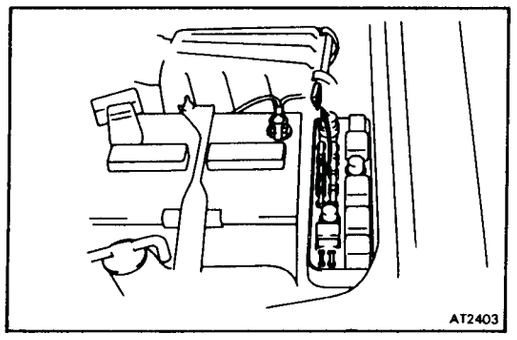
(c) Remove the service wire from the DG terminal.

Diagnostic Code

Code No.	Light Pattern	Diagnosis System
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 No. 3 solenoid or short circuit – severed wire harness or short circuit

NOTE: If codes 62, 63 and 64 appear, there is an electrical malfunction in the solenoid.

Causes due to mechanical failure, such as a stuck switch, will not appear.



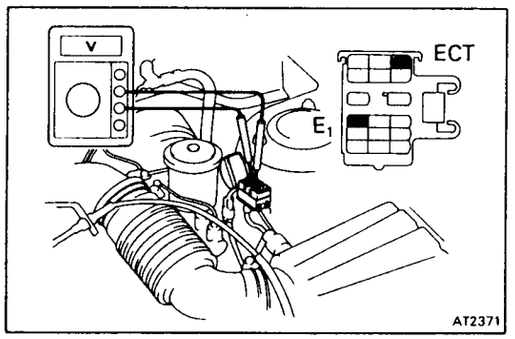
CANCEL OUT DIAGNOSTIC CODE

1. After repair of the trouble area, the diagnostic code retained in memory by the ECT computer 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.

   NOTE:

   - Cancellation can also be done by removing the battery negative (–) terminal, but in this case other memory system (TCCS diagnosis memory, etc.) will also be canceled out.
   - The diagnostic code can also be canceled out by disconnecting the ECT computer connector.
   - If the diagnostic code is not canceled out, it will be retained by the ECT computer 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 OD "OFF" light.**

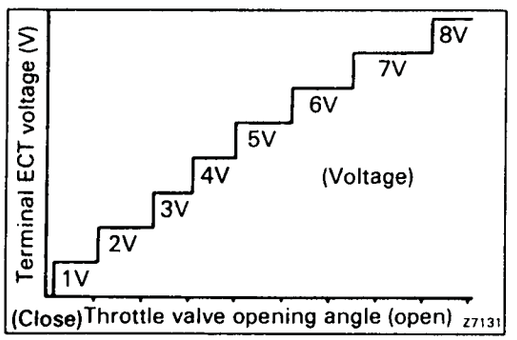


INSPECT ECT TERMINAL VOLTAGE

1. INSPECT THROTTLE POSITION SENSOR SIGNAL

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

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



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

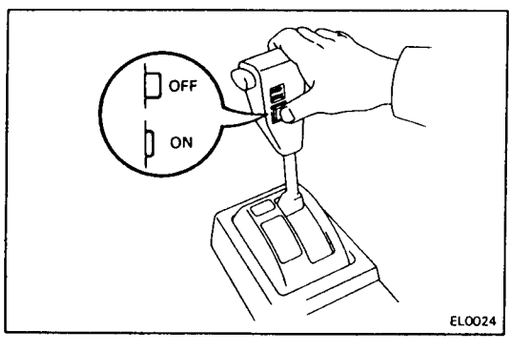
If the voltage does not change in proportion to the throttle opening angle, there is a malfunction in the throttle position sensor or circuit.

2. INSPECT BRAKE SIGNAL

(a) Depress the accelerator pedal until the ECT terminal indicates 8V.

(b) Depress the brake pedal and check the voltage reading from the ECT terminal.
Brake pedal depressed 0V
Brake pedal released 8V

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



3. INSPECT EACH UP-SHIFT POSITION

(a) Warm up the engine.

Coolant temperature: 80°C (176°F)

(b) Turn the OD switch to "ON".

(c) Place the pattern selection switch in "Normal" and the shift selector into the D range.

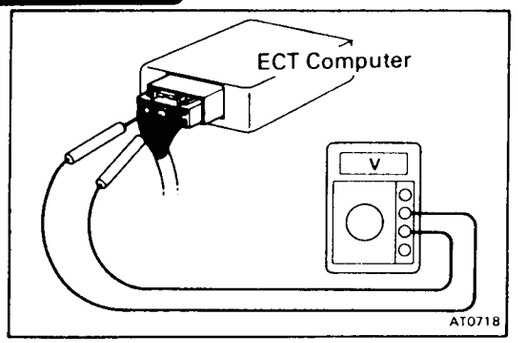
(d) During a road test (above 10 km/h or 6 mph) check that voltage at the ECT terminal is as indicated below for each up-shift position.

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

(f) Take the voltage reading when the vehicle speed is 10 km/h (6 mph) or more. The chart on the left shows the voltmeter reading and corresponding gears.

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

Terminal ECT (V)	Gear Position
0	1st
2	2nd
3	2nd Lock-up
4	3rd
5	3rd Lock-up
6	OD
7	OD Lock-up



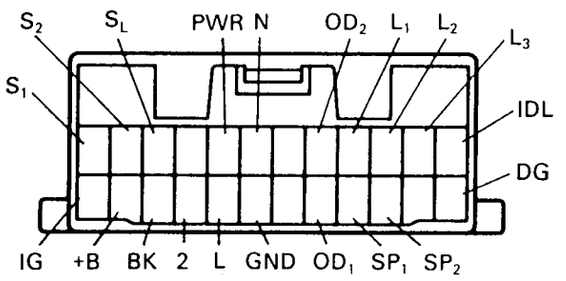
INSPECTION ELECTRONIC CONTROL COMPONENTS

1. INSPECT VOLTAGE OF ECT COMPUTER CONNECTOR

(a) Remove the glove box and instrument panel.

(b) Turn on the ignition switch.

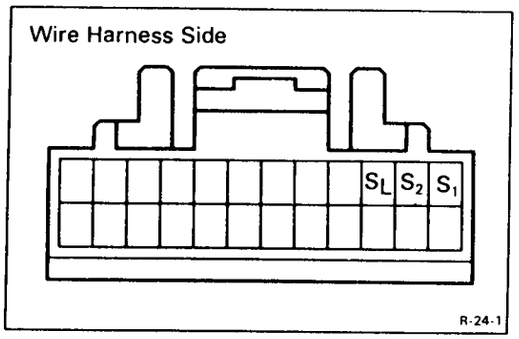
(c) Measure the voltage at each terminal.



R-24-2

Terminal	Measuring condition	Voltage (V)	
		DENSO type computer	AISIN type computer
L_1 – GND	Throttle valve fully closed	5	12
	Throttle valve fully closed to fully open	5 to 0	12 to 0
	Throttle valve fully open	0	←
L_2 – GND	Throttle valve fully closed	5	12
	Throttle valve fully closed to fully open	5 to 0 to 5	12 to 0 to 12
	Throttle valve fully open	5	12
L_3 – GND	Throttle valve fully closed	5	12
	Throttle valve fully closed to fully open	5 to 0 to 5 to 0 to 5	12 to 0 to 12 to 0 to 12
	Throttle valve fully open	5	12
IDL – GND	Throttle valve fully closed	0	←
	Throttle valve opening above 1.5°	12	←
SP_1 – GND	Standing still (Cruise control OFF)	5 or 0	12 or 0
	Vehicle moving (Cruise control OFF)	2.5	6
BK — GND	When brake pedal is depressed	12	←
	When brake pedal is not depressed	0	←
2 – GND	2 range	10 — 16	←
	Except 2 range	0 — 2	←
L – GND	L range	10 — 16	←
	Except	0 — 2	←
N — GND	N range	10 — 16	←
	Except N range	0 — 2	←

Terminal	Measuring condition	Voltage (V)	
		DENSO type computer	AISIN type computer
S_1 - GND	-	12	←
S_2, S_L - GND	-	0	←
OD_1 - GND	Coolant temp. below 50°C (122°F)	0	←
	Coolant temp. above 50°C (122°F)	5	12
OD_2 - GND	OD main switch turned ON	12	12
	OD main switch turned OFF	0	←
IG - GND	Ignition switch ON	12	←
SP_2 - GND	Standing still	5 or 0	←
	Vehicle moving	4	←
PWR - GND	PWR pattern	12	←
	NORM pattern	0 — 2	←
+B - GND	-	12	←



2. INSPECT SOLENOID

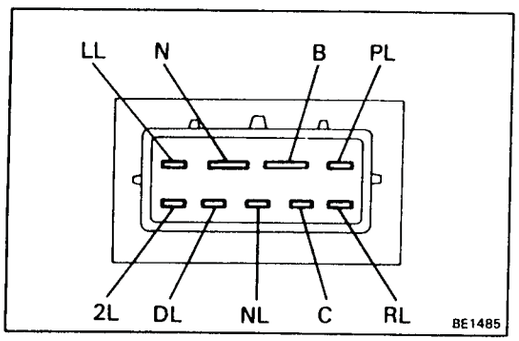
(a) Disconnect the connector from the ECT computer.

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

STD: 11 — 15 Ω

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

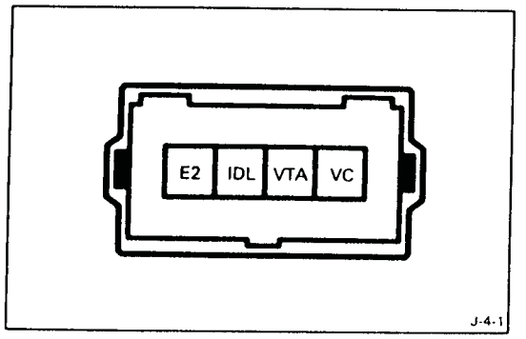
NOTE: If there is foreign matter in the solenoid valve, there will be no fluid control even with solenoid operation.



3. INSPECT NEUTRAL START SWITCH

Inspect that there is continuity between terminal LL-C, 2L-C and NL-C.

Terminal / Shift Position	LL	2L	NL	C
N range			○	○
2 range		○		○
L range	○			○



4. 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
V_C - E_2	-	3 - 7
V_{TA} - E_2	Fully closed	0.2 - 0.8
	Fully open	3.3 - 10