AUTOMATIC TRANSAXLE (A241E, A243L)

DESCRIPTION

General

The A241 E and A243L automatic transaxles are 4–speed transaxles with a lock–up mechanism developed exclusively for the New Celica.

The A241 E automatic transaxle is an Electronically Controlled Transaxle (hereafter called ECT).

The A243L automatic transaxles are based on the A240L automatic transaxle.

These automatic transaxles have the following features.

© The ”Super– Flow” torque converter is used to improve the transmission efficiency.

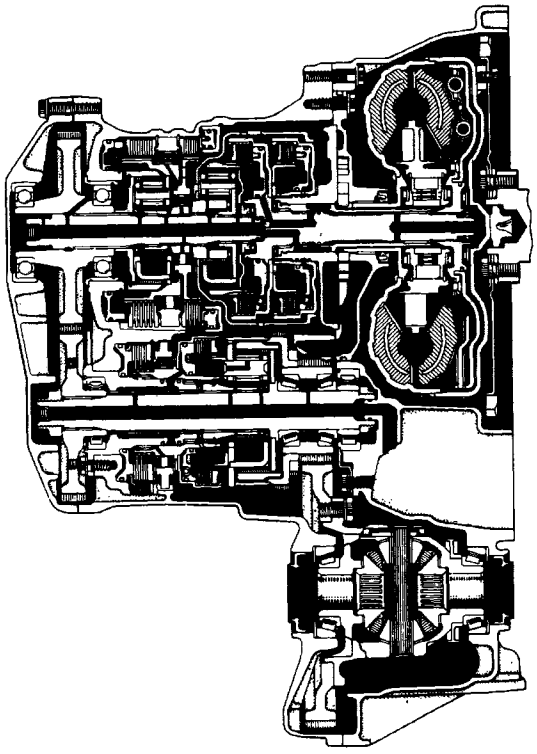
© When shifting the transmission, the engine torque is controlled and the clutch hydraulic pressure in the transmission is electronically controlled to reduce transmission shift shock. (A241 E)

© Transaxle control ECU has been integrated with the Engine ECU (A241 E).

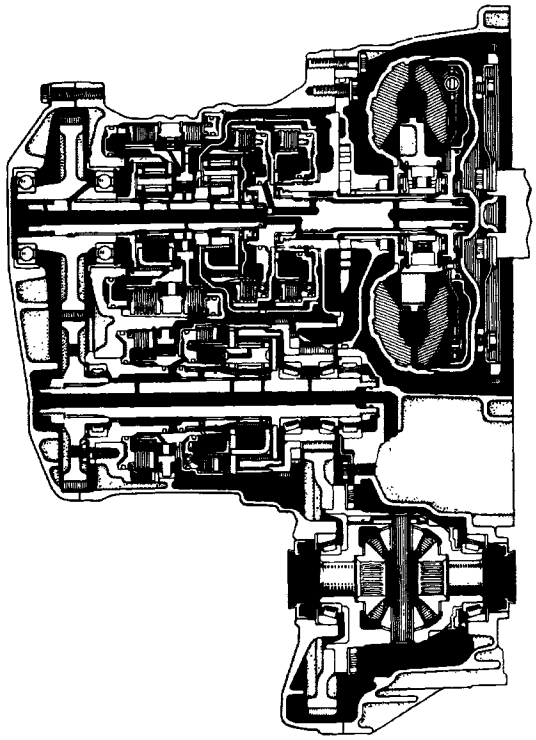
These automatic transaxles are mainly composed of the torque converter with lock–up clutch, 4–speed planetary gear unit, the hydraulic control system and the electronic control system.

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

Sectional View



A241E



A243L

AT5715 AT5716

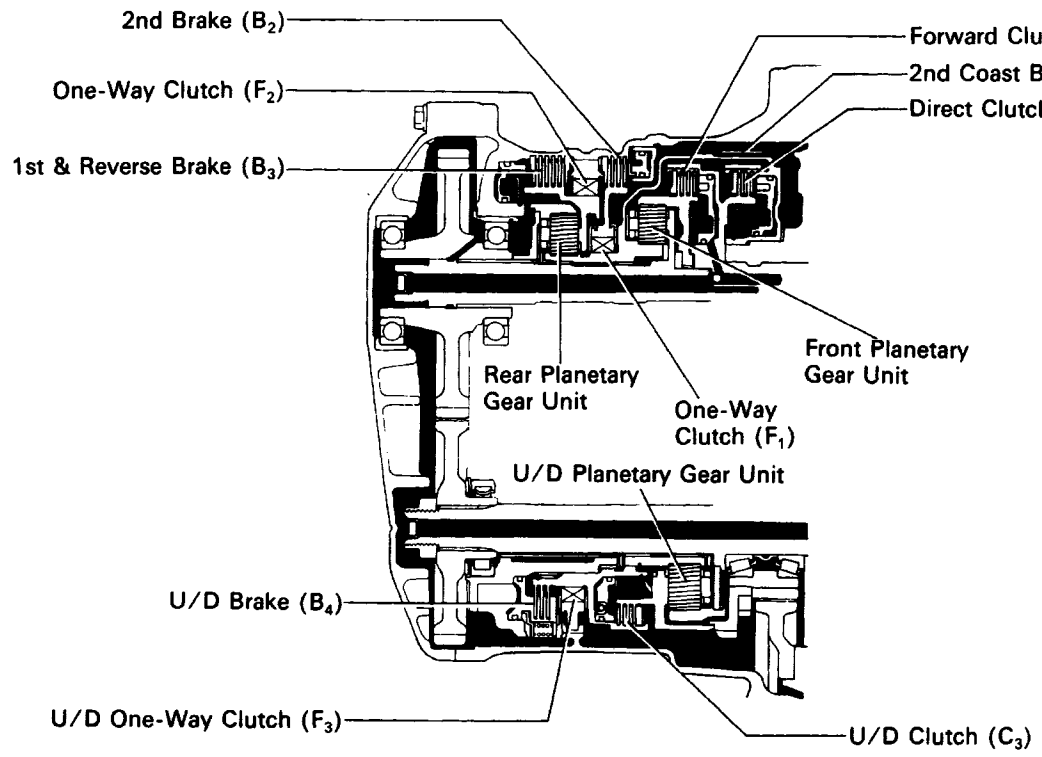
General Specifications

Type of Transaxle				A243L	A241E
Type of Engine				4A-FE	5S-FE
Torque Converter	Stall Torque Ratio			2.5 : 1	2.1 : 1
	Lock–Up Mechanism			Equipped	←
Gear Ratio	1st Gear			4.005	3.643
	2nd Gear			2.208	2.008
	3rd Gear			1.425	1.296
	O/D Gear			0.981	0.892
	Reverse Gear			3.272	2.977
Number of Discs and Plates (Disc/Plate)	C_1	Forward Clutch		4/4	4/4
	C_2	Direct Clutch		2/3	3/3
	C_3	Underdrive Clutch		3/3	3/5
	B_2	2nd Brake		3/3	←
	B_3	1st & Reverse Brake		6/5	←
	B_4	Underdrive Brake		3/3	←
2nd Coast Brake (B1) Band Width mm (in.)				25 (0.98)	←
ATF	Type			ATF DEXRON® II	←
	Capacity litter (US qts, Imp. qts)		Total	7.7 (8.1, 6.8)	8.0 (8.5, 7.0)
			Drain & Refill	3.3 (3.5, 2.9)	←

OPERATION

Mechanical Operation

OPERATING CONDITIONS



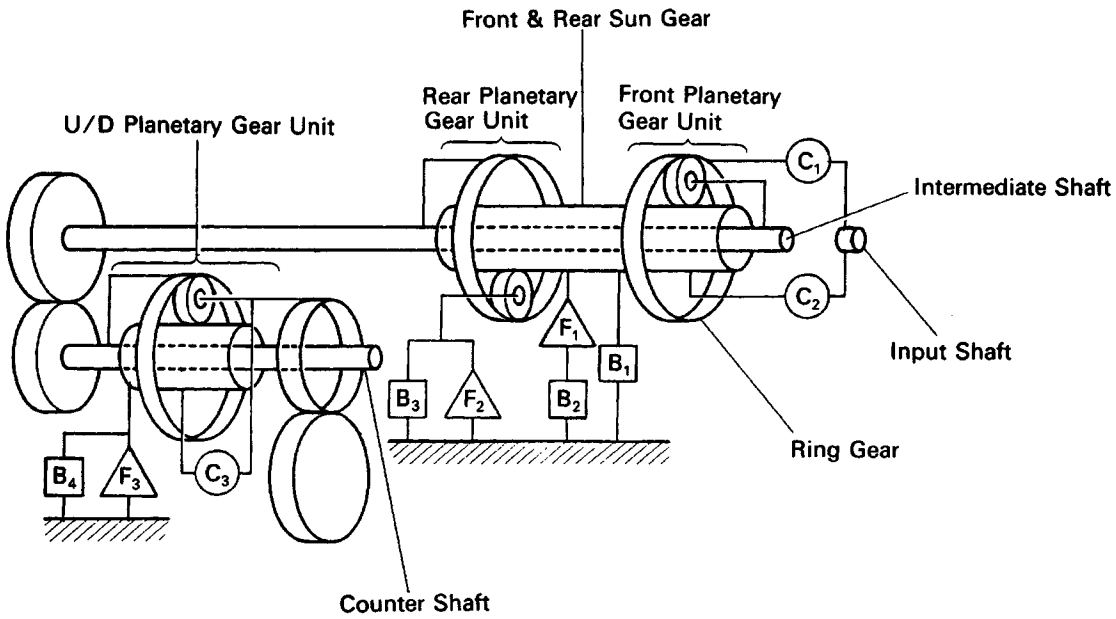
AT7927

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

*1: A241 E Only ©: Operating
*2: Down–Shift only in the 3rd gear for the 2 range and 2nd gear for the L range – no up–shift

FUNCTION OF COMPONENTS

Component		Function
C_1	Forward Clutch	Connects input shaft and front planetary ring gear.
C_2	Direct Clutch	Connects input shaft and front & rear planetary sun gear.
C_3	U/D Clutch	Connects underdrive sun gear and underdrive planetary carrier.
B_1	2nd Coast Brake	Prevents front & rear planetary sun gear from turning either clockwise or counterclockwise.
B_2	2nd Brake	Prevents outer race of F1 from turning either clockwise or counterclockwise thus preventing the front & rear planetary sun gear from turning counterclockwise.
B_3	1st & Reverse Brake	Prevents rear planetary carrier from turning either clockwise or counterclockwise.
B_4	U/D Brake	Prevents underdrive sun gear from turning either clockwise or counterclockwise.
F_1	No.1 One–Way Clutch	When B2 is operating, this clutch prevents the front & rear planetary sun gear from turning counterclockwise.
F_2	No.2 One–Way Clutch	Prevents rear planetary carrier from turning counterclockwise.
F_3	U/D One–Way Clutch	Prevents underdrive planetary sun gear from turning clockwise.
Planetary Gears		These gears change the route through which driving force is transmitted in accordance with the operation of each clutch and brake in order to increase or reduce the input and output speed.

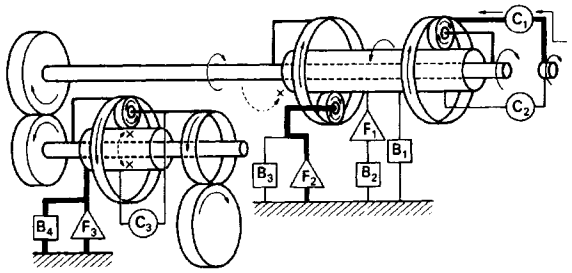


AT2690

FUNCTION OF COMPONENTS (Cont'd)

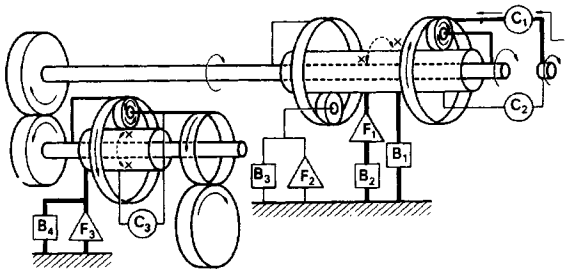
The conditions of operation for each gear position are shown on the following illustration:

D or 2 Range 1st Gear



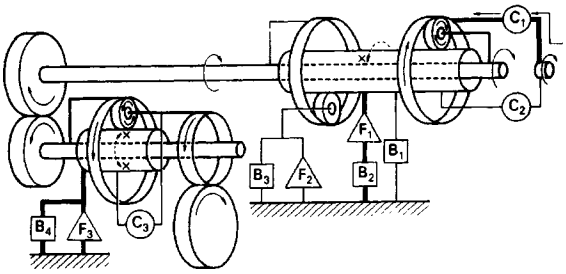
AT3216

2 Range 2nd Gear



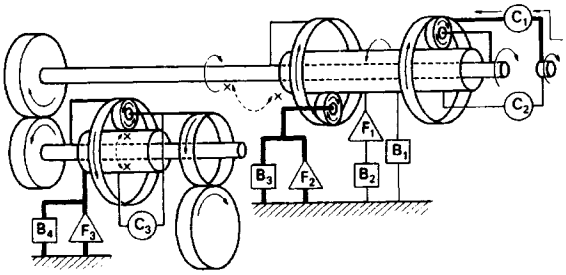
AT3220

D Range 2nd Gear



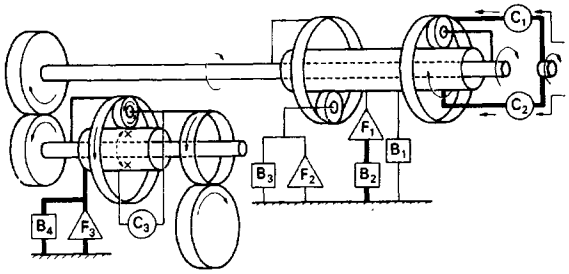
AT3217

L Range 1st Gear



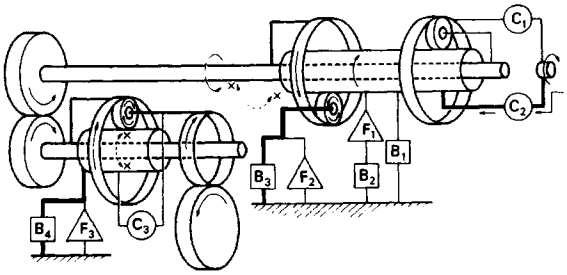
AT3221

D Range 3rd Gear



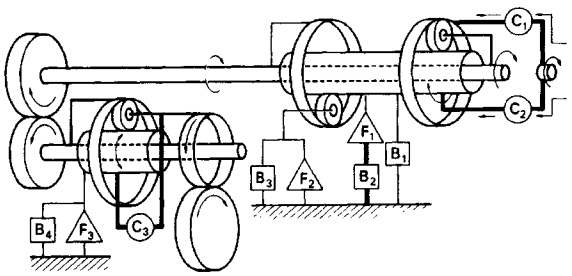
AT3218

R Range Reverse Gear



AT3222

D Range O/D



AT3219

Hydraulic Control System

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

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

The governor valve produces hydraulic pressure in response to vehicle speed. Governor pressure increases as vehicle speed increases. (A243L)

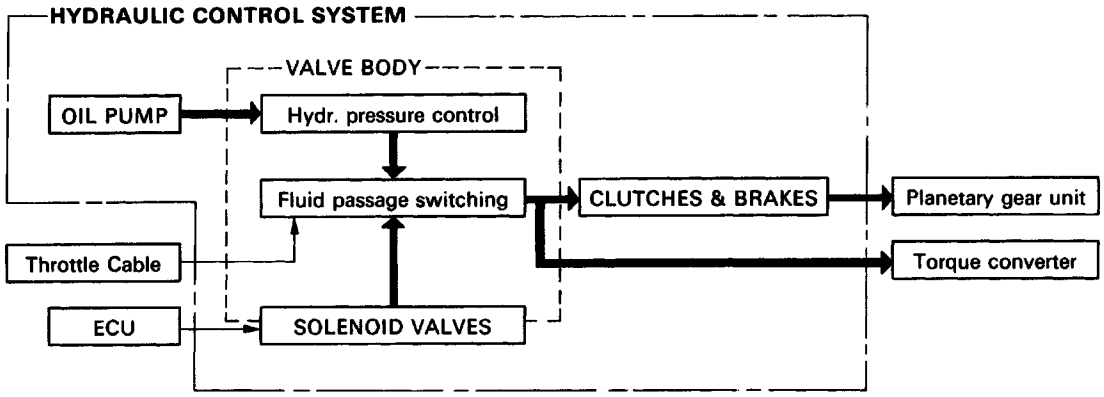
There are three solenoid valves on the valve body of the A241 E automatic transaxle.

The No. 1 and No. 2 solenoid valves are turned on and off by signals from the ECU to operate the shift valves and change the gear shift position.

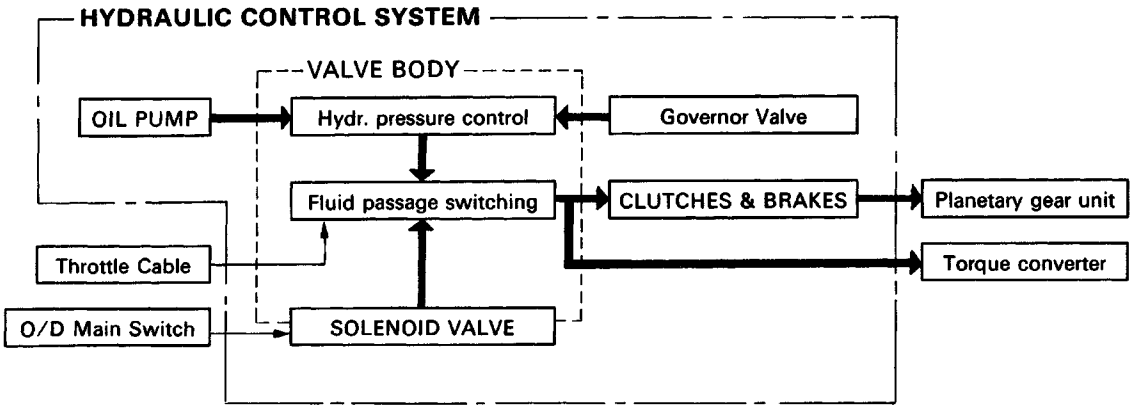
The No. 3 solenoid valve is operated by signals from the ECU to engage or disengage the lock–up clutch of the torque converter.

The valve body of the A243L automatic transaxle has one solenoid valve, which is for overdrive control.

▶ A241E



▶ A243L



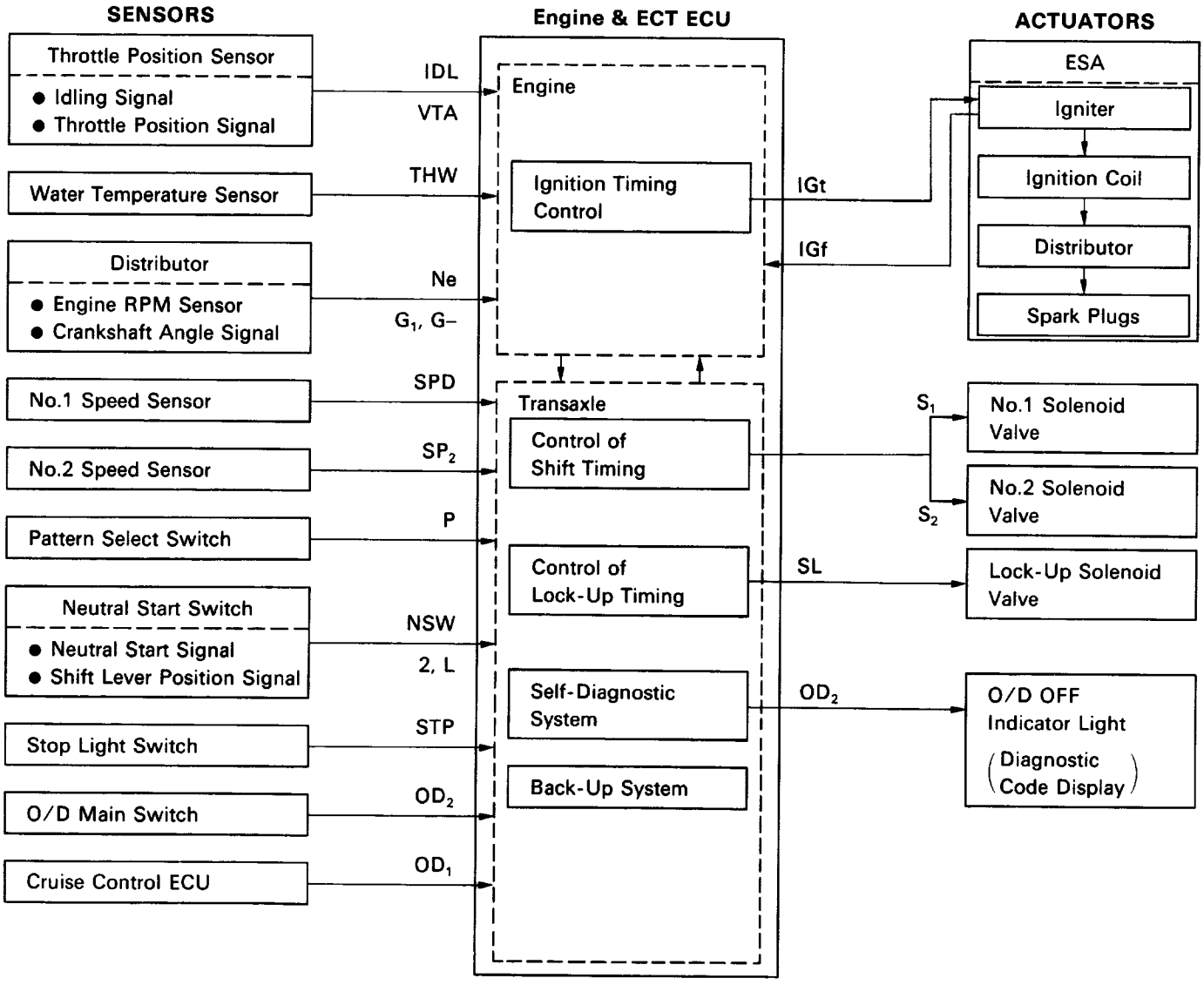
A241 E Electronic Control System (See page AT–21)

GENERAL

The electronic control system for the A241E automatic transaxle provides extremely precise control of the gear shift timing and lock–up timing in response to driving conditions as sensed by various sensors located throughout the vehicle and in response to the engine's running condition.
At the same time, the ECU control reduces vehicle squat when the vehicle starts out and gear shift shock. The electronic control system is also equipped with a self diagnosis system which diagnoses malfunctions of electronically controlled components and warns the driver, and a fail–safe system which makes it possible for the vehicle to continue functioning when a malfunction occurs,

CONSTRUCTION

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



ELECTRONIC CONTROL CIRCUIT (See page AT–21)

ELECTRONIC CONTROL COMPONENTS (See page AT–22)

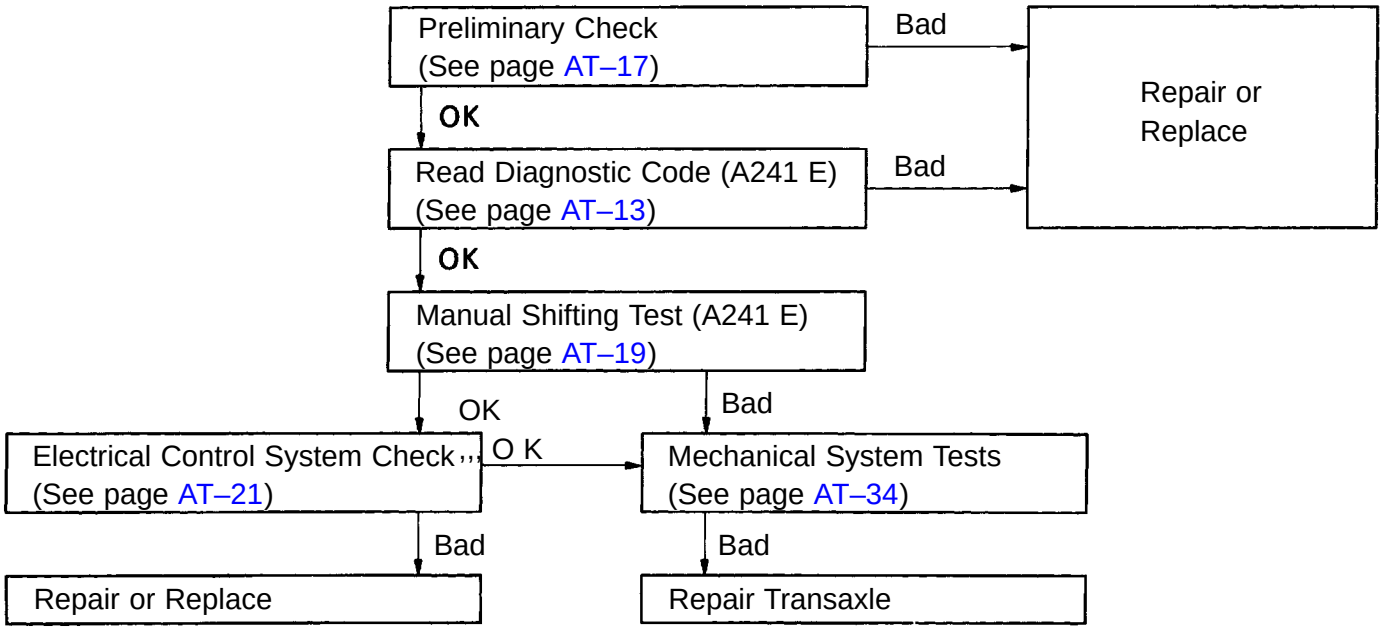
A243L Electronic Control System (See page AT–32)

TROUBLESHOOTING

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

Basic Troubleshooting

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



General Troubleshooting

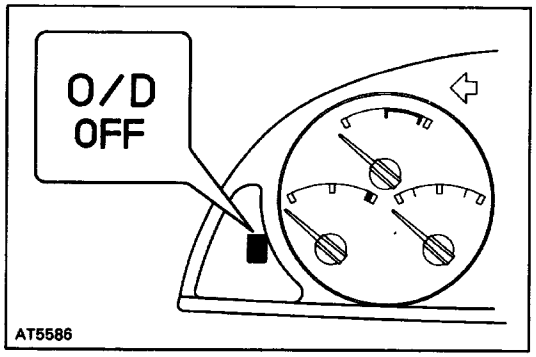
Problem	Possible cause	Remedy	Page	
			A241 E	A243 L
Fluid discolored or smells burnt	Fluid contaminated Torque converter faulty Transaxle faulty	Replace fluid Replace torque converter Disassemble and inspect transaxle	AT–17 AT–62 ©	← ← ←
Vehicle does not move in any forward range or reverse	Shift cable out of adjustment Valve body or primary regulator faulty Parking lock pawl faulty Torque converter faulty Converter drive plate broken Oil strainer intake screen blocked Transaxle faulty	Adjust shift cable Inspect valve body Inspect parking lock pawl Replace torque converter Replace drive plate Clean screen Disassemble and inspect transaxle	AT–18 © © AT–62 AT–62 © ©	← ← ← ← ← ← ←
Shift lever position incorrect	Shift cable out of adjustment Manual valve and lever faulty Transaxle faulty	Adjust shift cable Inspect valve body Disassemble and inspect transaxle	AT–18 © ©	← ← ←
Harsh engagement into any drive range	Throttle cable out of adjustment Valve body or primary regulator faulty Accumulator pistons faulty Transaxle faulty	Adjust throttle cable Inspect valve body Inspect accumulator pistons Disassemble and inspect transaxle	AT–17 © © ©	AT–18 ← ← ←
Delayed 1–2, 2–3 or 3–O/D up–shift, or down–shifts from O/D–3 or 3–2 and shifts back to O/D or 3	Electronic control faulty Valve body faulty Solenoid valve faulty Throttle cable out of adjustment	Inspect electronic control Inspect valve body Inspect solenoid valve Adjust throttle cable	AT–21 © AT–29 AT–17	AT–32 ← AT–33 AT–18
Slips on 1–2, 2–3 or 3–O/D up–shift, or slips or shudders on acceleration	Shift cable out of adjustment Throttle cable out of adjustment Valve body faulty Solenoid valve faulty Transaxle faulty	Adjust shift cable Adjust throttle cable Inspect valve body Inspect solenoid valve Disassemble and inspect transaxle	AT–18 AT–17 © AT–29 ©	← AT–18 ← AT–33
Drag, binding or tie up on 1–2, 2–3, or 3–O/D up–shift	Shift cable out of adjustment Valve body faulty Transaxle faulty	Adjust shift cable Inspect valve body Disassemble and inspect transaxle	AT–18	← ← ←

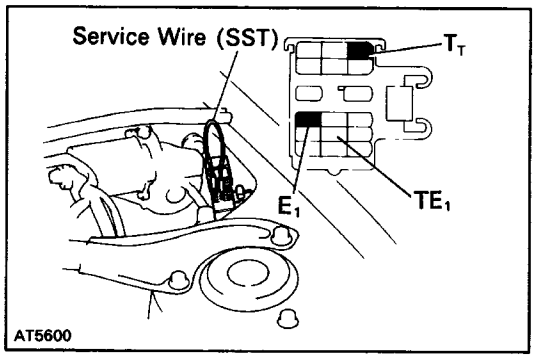
© Refer to A240L, A241 E, A241 H, A243L, Automatic Transaxle Repair Manual. (Pub. No. RM270U)

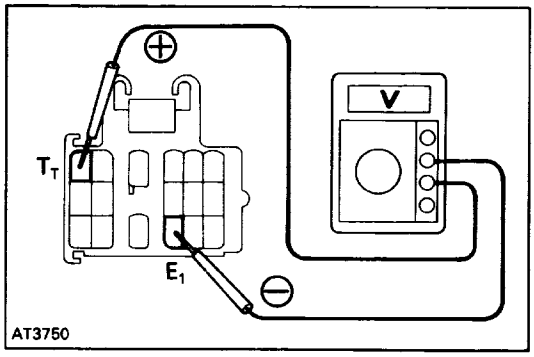
General Troubleshooting (Cont'd)

Problem	Possible cause	Remedy	Page	
			A241 E	A243 L
No lock–up in 2nd, 3rd or O/D	Electronic control faulty Valve body faulty Solenoid valve faulty Transaxle faulty	Inspect electronic control Inspect valve body Inspect solenoid valve Disassemble and inspect transaxle	AT–21 © AT–29 ©	– ← – ←
Harsh down–shift	Throttle cable out of adjustment Throttle cable and cam faulty Accumulator pistons faulty Valve body faulty Transaxle faulty	Adjust throttle cable Inspect throttle cable and cam Inspect accumulator pistons Inspect valve body Disassemble and inspect transaxle	AT–18 © © © ©	← ← ← ← ←
No down–shift when coasting	Valve body faulty Solenoid valve faulty Electronic control faulty	Inspect valve body Inspect solenoid valve Inspect electronic control	© AT–29 AT–21	← AT–32 AT–31
Down–shift occurs too quickly or too late while coasting	Throttle cable faulty Valve body faulty Transaxle faulty Solenoid valve faulty Electronic control faulty	Inspect throttle cable Inspect valve body Disassemble and inspect transaxle Inspect solenoid valve Inspect electronic control	AT–17 © © AT–29 AT–21	AT–13 ← ← AT–32 AT–31
No O/D–3, 3–2 or 2–1 kick–down	Solenoid valve faulty Electronic control faulty Valve body faulty Throttle cable out of adjustment	Inspect solenoid valve Inspect electronic control Inspect valve body Adjust throttle cable	AT–29 AT–21 © AT–17	AT–32 AT–31 ← AT–13
No engine braking in 2 or L range	Solenoid valve faulty Electronic control faulty Valve body faulty Transaxle faulty	Inspect solenoid valve Inspect electronic control Inspect valve body Disassemble and inspect transaxle	AT–29 AT–21 © ©	– – ← ←
Vehicle does not hold in P range	Shift cable out of adjustment Parking lock pawl and spring faulty	Adjust shift cable Inspect cam and spring	AT–18 ©	← ←

© Refer to A240L, A241 E, A241 H, A243L Automatic Transaxle Repair Manual. (Pub. No. RM270U)







Diagnosis System (A241 E)

DESCRIPTION

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

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

(a) If a malfunction occurs within the speed sensors or solenoids, the overdrive OFF indicator light will blink to warn the driver.
However, there will be no warning of a malfunction with lock–up solenoid.

(b) The diagnostic code can be read by the number of blinks of the overdrive OFF indicator when terminals TE1 and E1 are short–circuited. (See page AT–13)

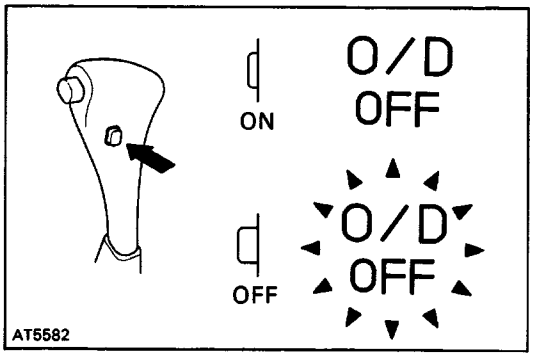
(c) The throttle position sensor or brake signal are not indicated, but inspection can be made by checking the voltage at terminal TT of the check connector.

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

2. The diagnostic (malfunction) code is retained in memory by the ECU and due to back–up voltage, is not canceled out when the engine is turned off. Consequently, after repair, it is necessary to turn the ignition switch oft and remove the fuse EFI (15A) or disconnect the ENGINE and ECT ECU connector to cancel out the diagnostic (malfunction) code. (See page AT–14)

HINT:

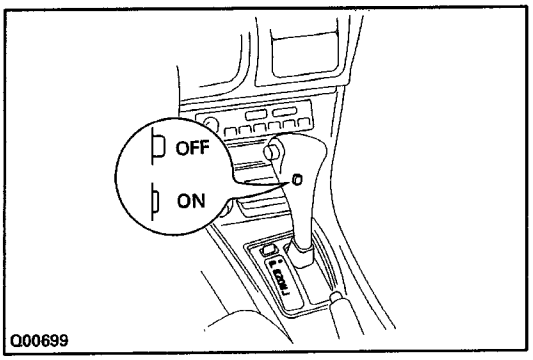
- Low battery voltage will cause faulty operation of the diagnosis system. Therefore, always check the battery first.
- Use a voltmeter and ohmmeter that have an impedance of at least 10 kΩ/V.



CHECK O/D OFF INDICATOR LIGHT

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

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

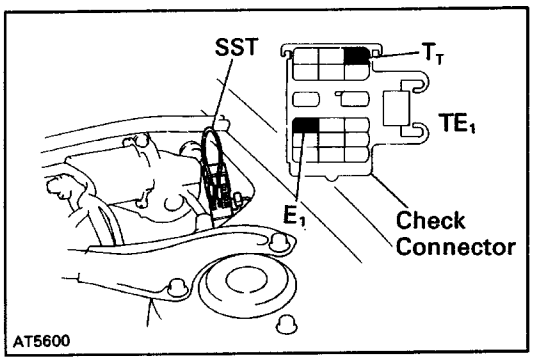


READ DIAGNOSTIC CODE

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

Do not start the engine.

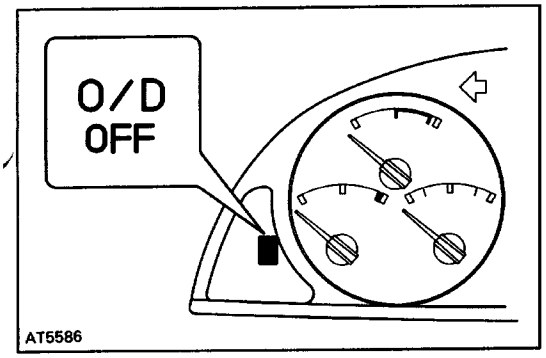
HINT: Warning and diagnostic codes can be read only when the overdrive switch is ON. If OFF, the overdrive OFF indicator light will light continuously and will not blink.



2. SHORT TE1 TERMINAL CIRCUIT OF CHECK CONNECTOR

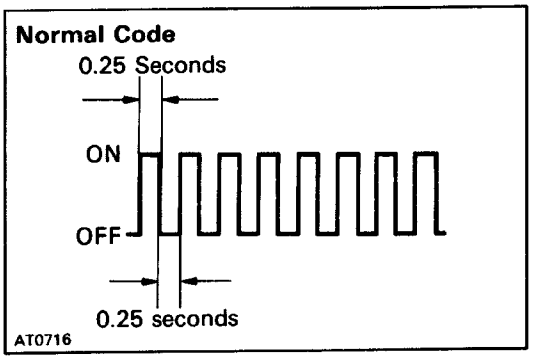
Using SST, short terminals TE1 and E1 of the check connector.

SST 09843–18020



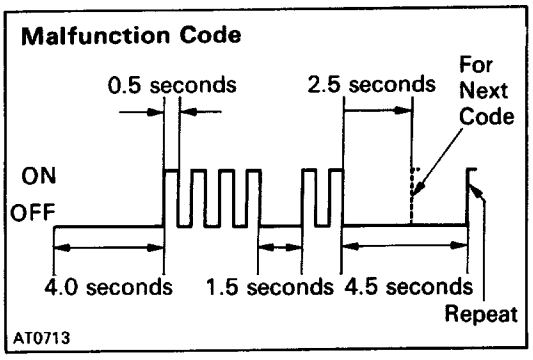
3. READ DIAGNOSTIC CODE

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



(Diagnostic Code Indication)

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



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

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

4. REMOVE SST

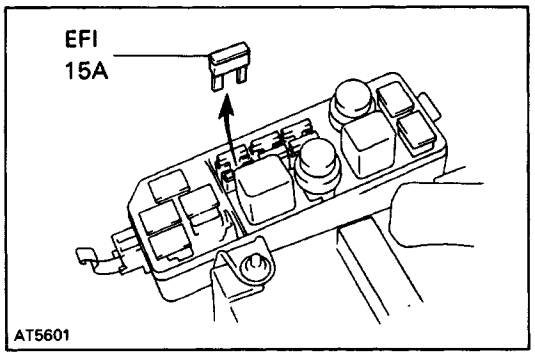
SST 09843–18020

DIAGNOSTIC CODES

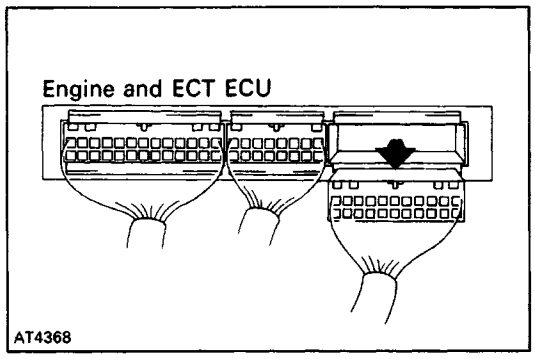
Code No.	Light Pattern	Diagnosis System
—		Normal
42		Defective No.1 speed sensor (in combination meter) – severed wire harness or short circuit
61		Defective No–2 speed sensor (in ATM) – severed wire harness or short circuit
62		Severed No–1 solenoid or short circuit – severed wire harness or short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

AT2020

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



AT5601



AT4368

CANCEL OUT DIAGNOSTIC CODE

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

HINT:

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

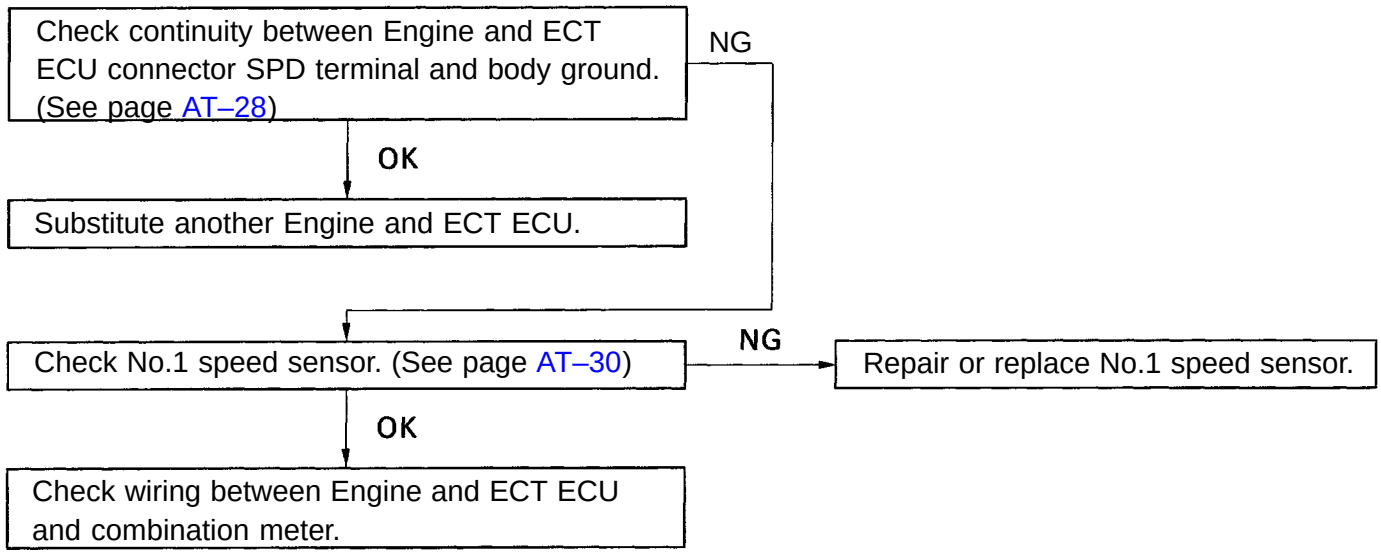
2. After cancellation, perform a road test to confirm that a ”normal code” is now read on the O/D OFF indicator light.

TROUBLESHOOTING FLOW–CHART

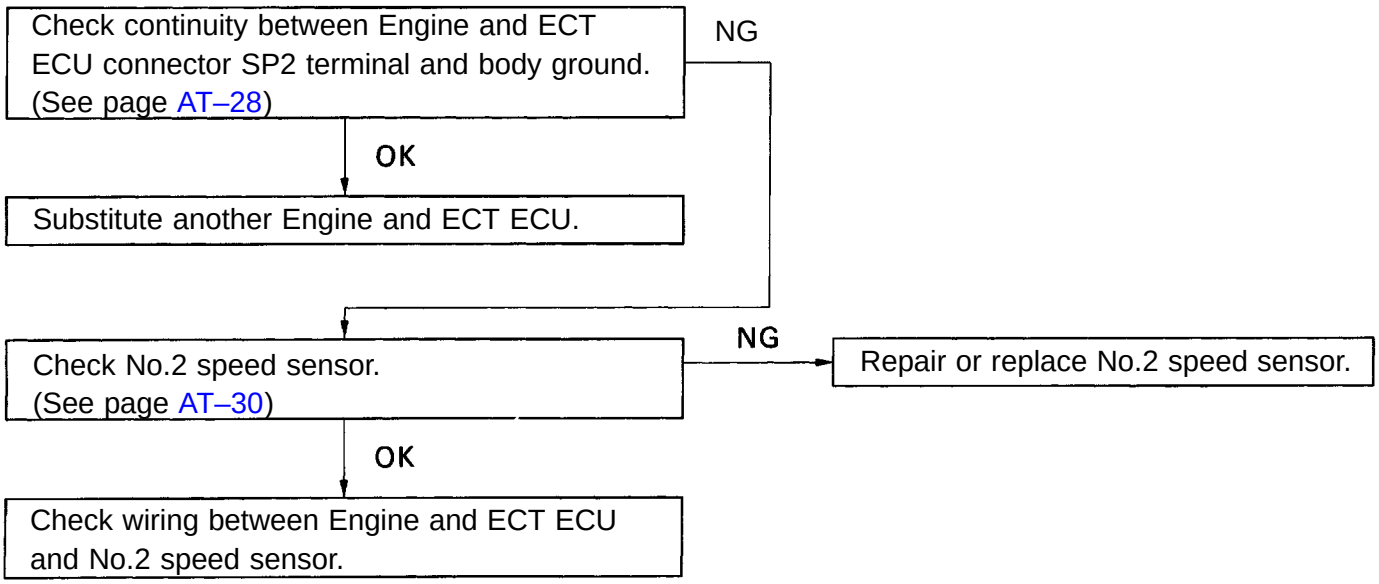
HINT;

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

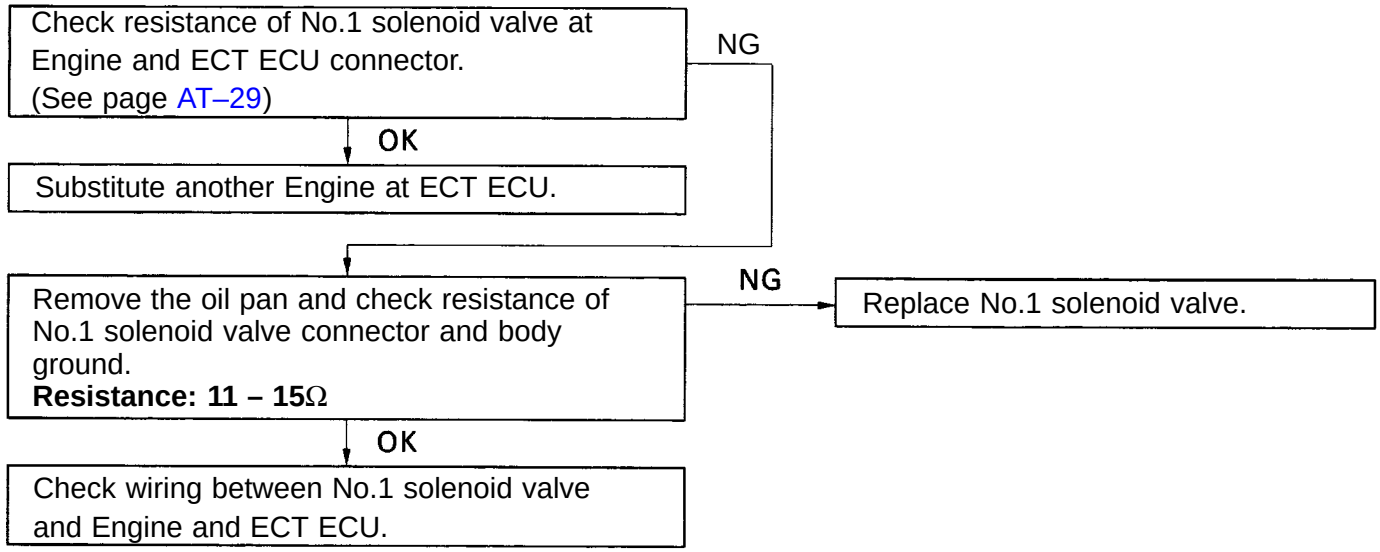
1. Diagnostic code 42 (No.1 speed sensor circuitry)



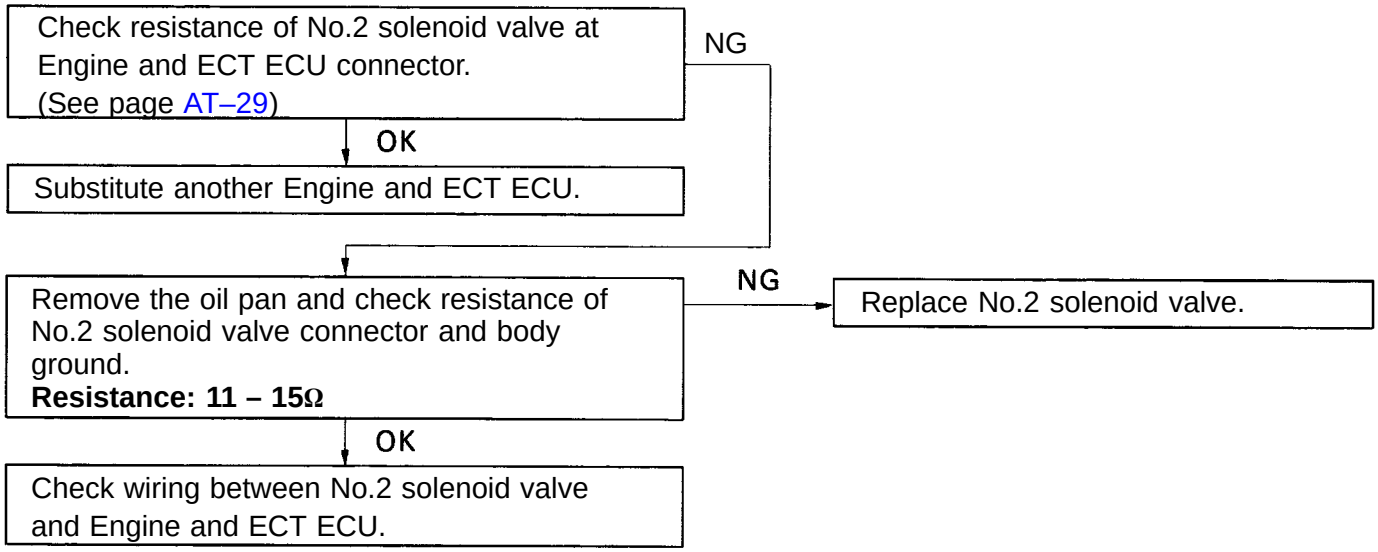
2. Diagnostic code 61 (No.2 speed sensor circuitry)



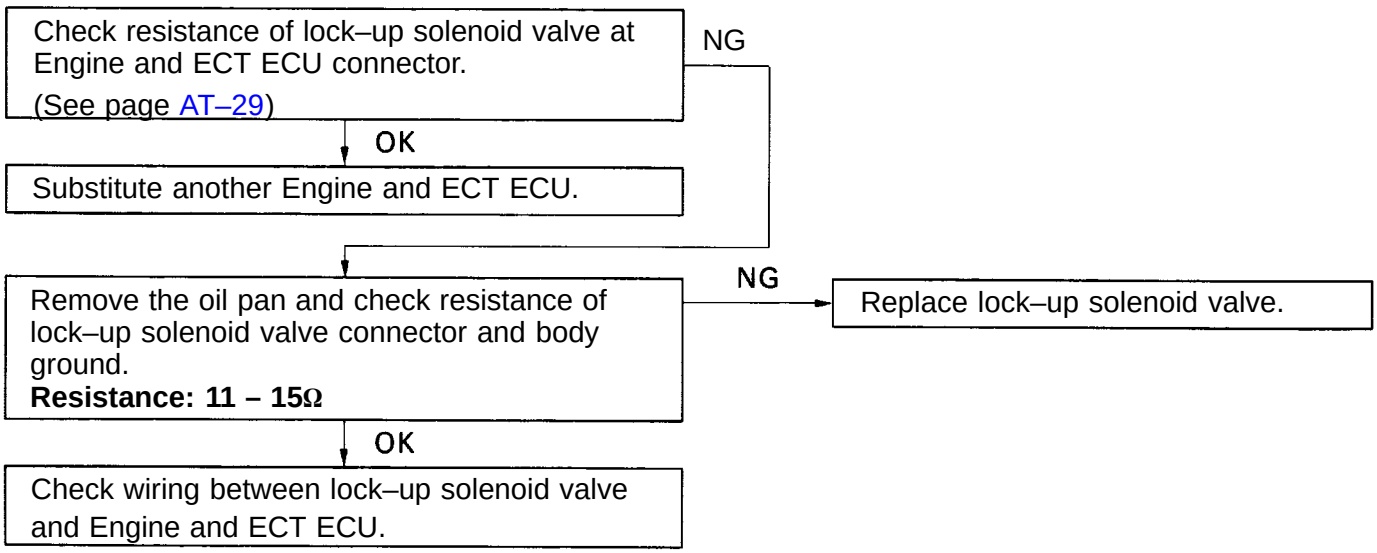
3. Diagnostic code 62 (No.1 solenoid valve circuitry)

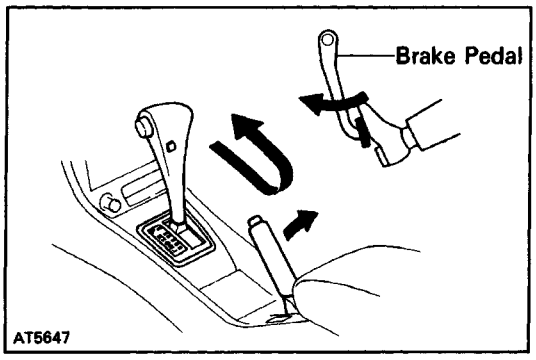


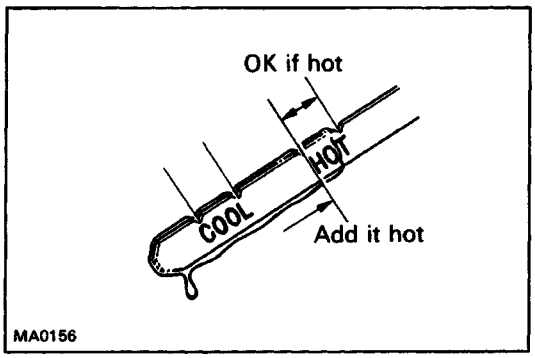
4. Diagnostic code 63 (No.2 solenoid valve circuitry)

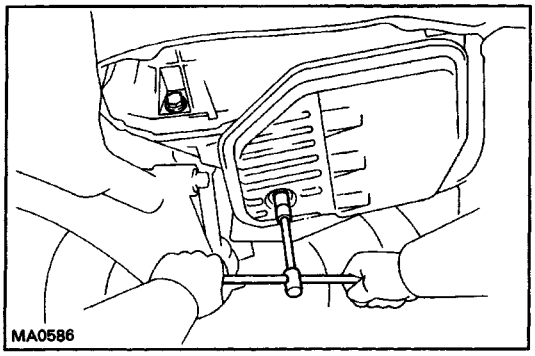


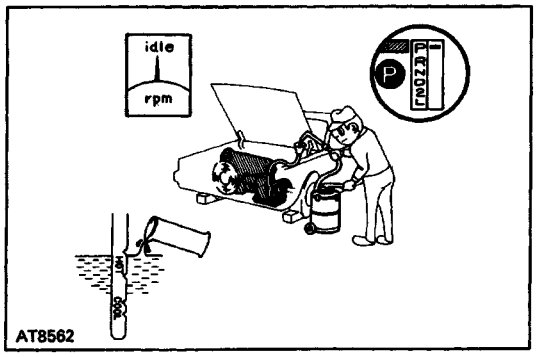
5. Diagnostic code 64 (Lock–Up solenoid valve circuitry)

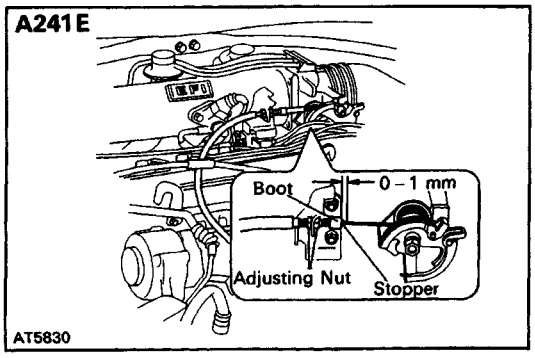












Preliminary Check

1. CHECK FLUID LEVEL

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

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

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

HINT: Depress the brake pedal.

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

(d) Push it back fully into the tube.

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

Fluid type: ATF DEXRON © II

NOTICE: Do not overfill.

2. CHECK FLUID CONDITION

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

3. REPLACE ATF

CAUTION: Do not overfill.

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

(b) Reinstall the drain plug securely.

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

Fluid: ATF DEXRON © II

Capacity:

A241 E 8.0 liters (8.5 US qts, 7.0 Imp. qts)

A243L 7.7 liters (8.1 US qts, 6.8 Imp. qts)

Drain and refill (Reference):

3.3 liters (3.5 US qts, 2.9 Imp. qts)

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

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

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

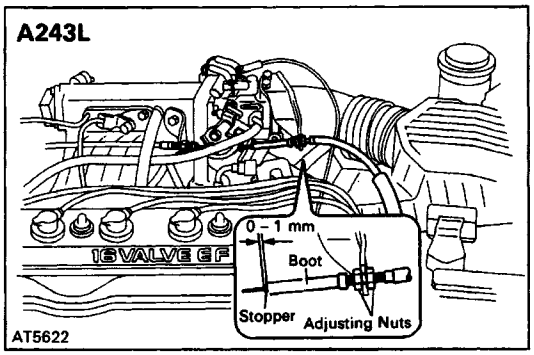
NOTICE: Do not overfill.

4. INSPECT AND ADJUST THROTTLE CABLE (A241 E)

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

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

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



(A243L)

(a) Depress the accelerator pedal all the way and check that the throttle valve opens fully.

HINT: If the valve does not open fully, adjust the accelerator cable.

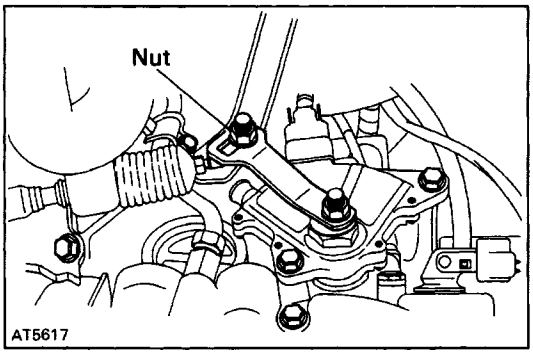
(b) Fully depress the accelerator pedal.

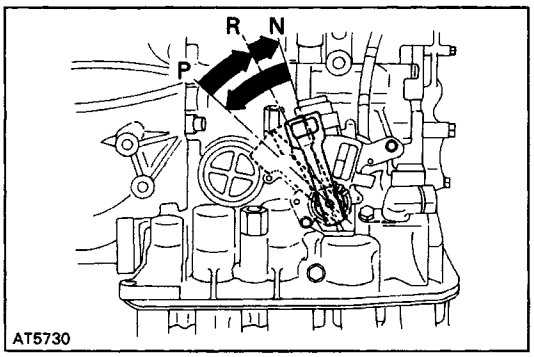
(c) Measure the distance between the end of the boot and stopper on the cable.

(A241 E, A243L)

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

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





5. INSPECT AND ADJUST SHIFT CABLE

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

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

(a) Remove the No.2 engine under cover and air duct.

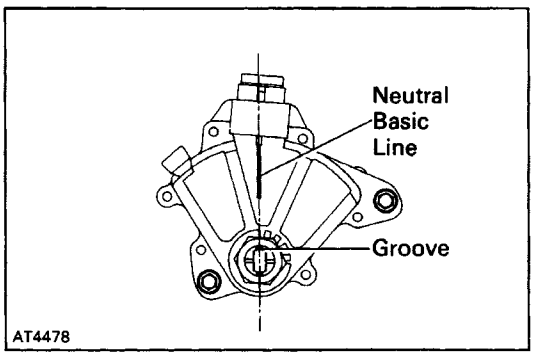
(b) Loosen the swivel nut on manual shift lever.

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

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

(e) Set the shift lever to N.

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



6. ADJUST NEUTRAL START SWITCH

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

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

(b) Align the groove and neutral basic line.

(c) Hold in position and tighten the bolts.

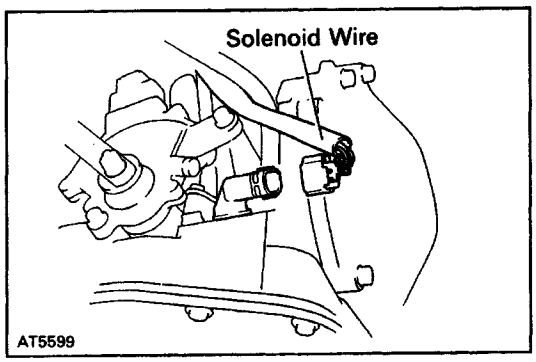
Torque: 5.4 N–m (55 kgf–cm, 48 in.–lbf)

7. INSPECT IDLE SPEED (N RANGE)

Idle speed:

5S–FE 650 – 750 rpm

4A–FE 750 – 850 rpm



Manual Shifting Test (A241 E)

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

1. DISCONNECT SOLENOID WIRE

2. INSPECT MANUAL DRIVING OPERATION

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

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

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

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

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

3. CONNECT SOLENOID WIRE

4. CANCEL OUT DIAGNOSTIC CODE

(See page AT–14)

Operating Mechanism for Solenoid

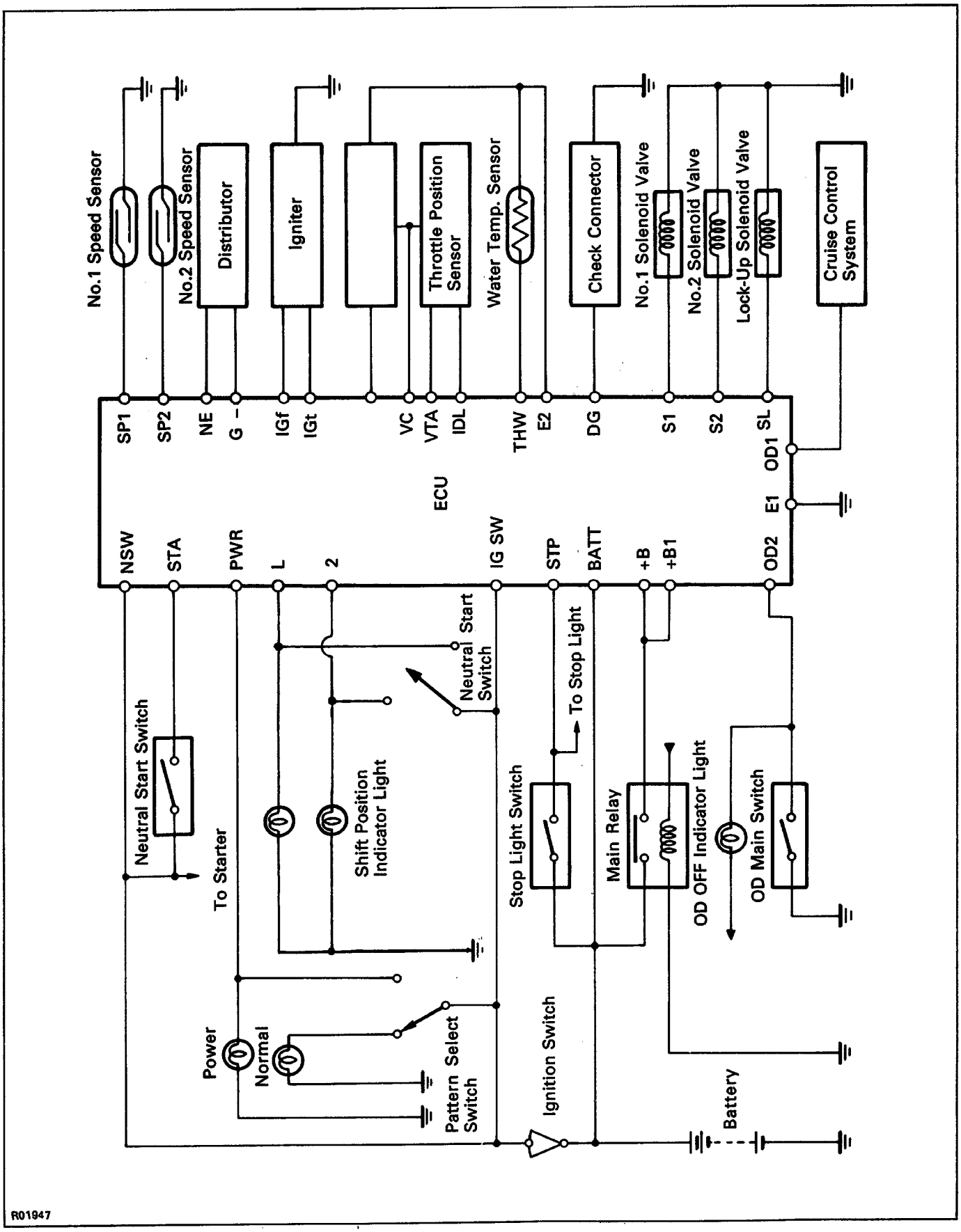
Possible gear position in accordance with solenoid operating conditions.

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

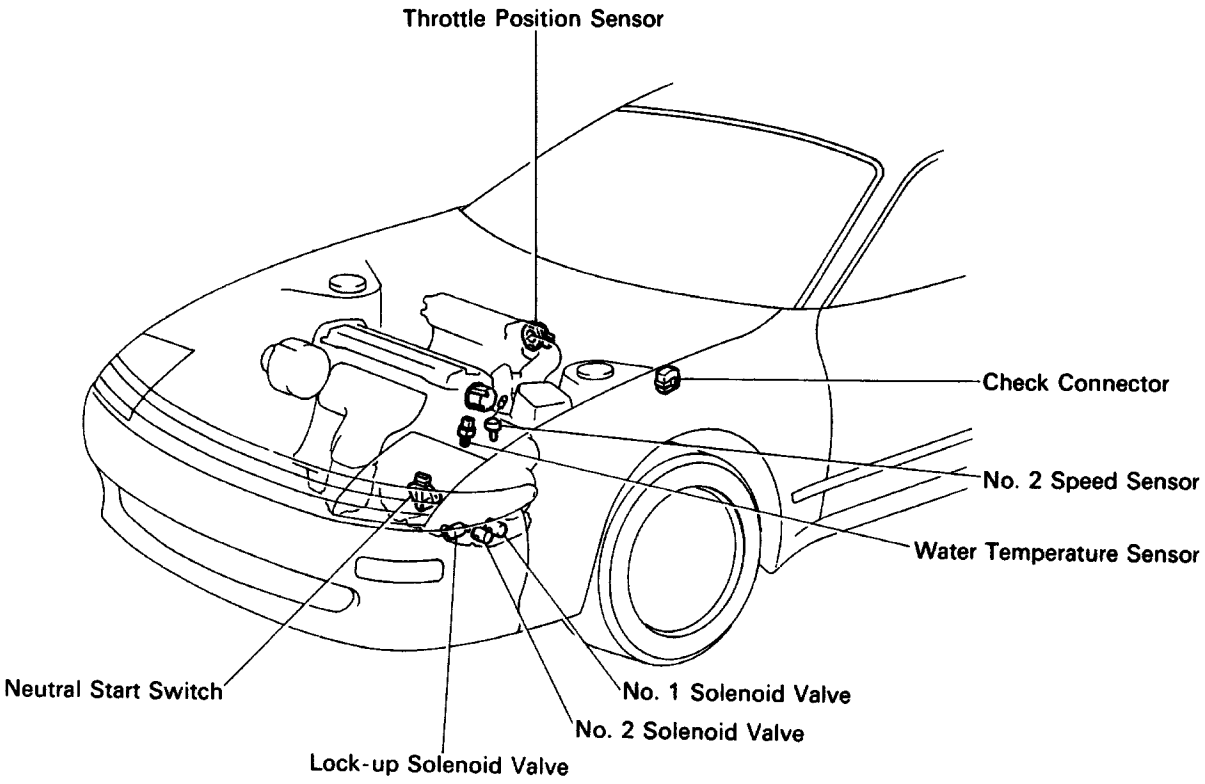
X: Malfunctions

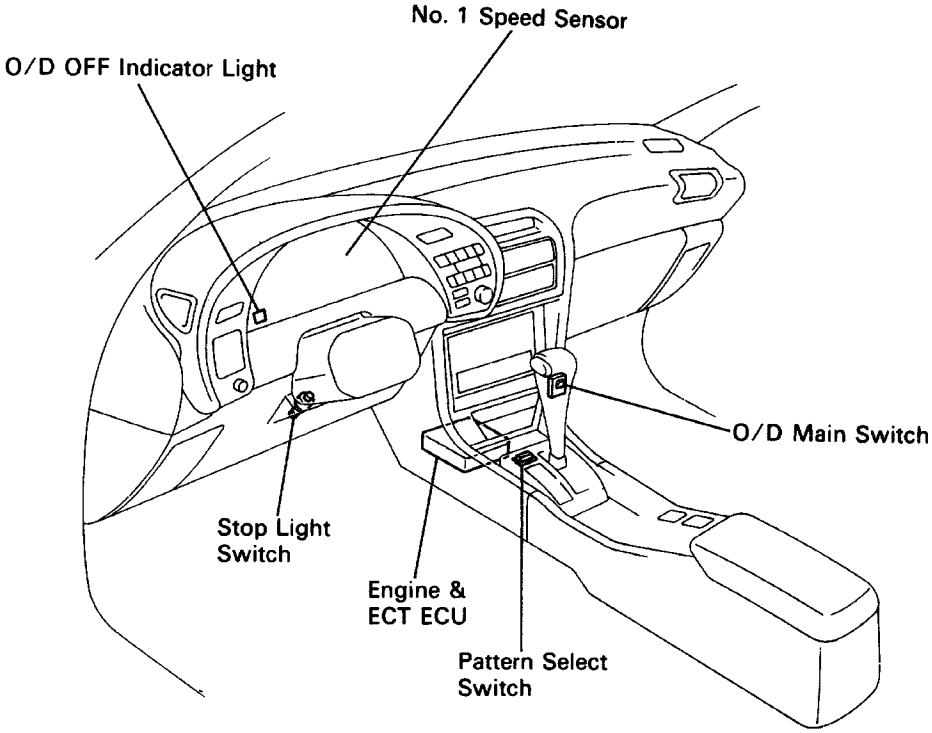
Electronic Control System (A241 E)

ELECTRONIC CONTROL CIRCUIT



ELECTRONIC CONTROL COMPONENTS

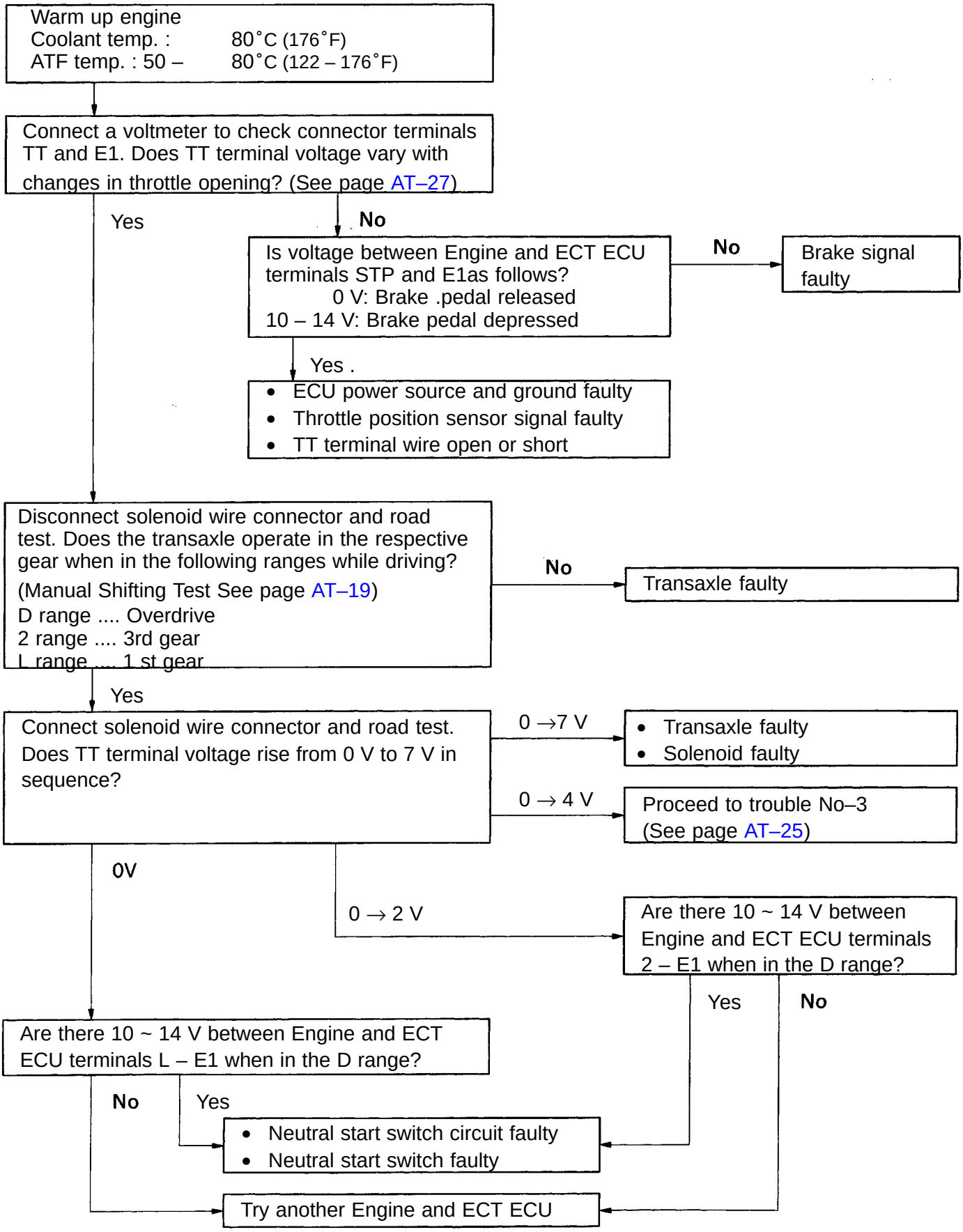




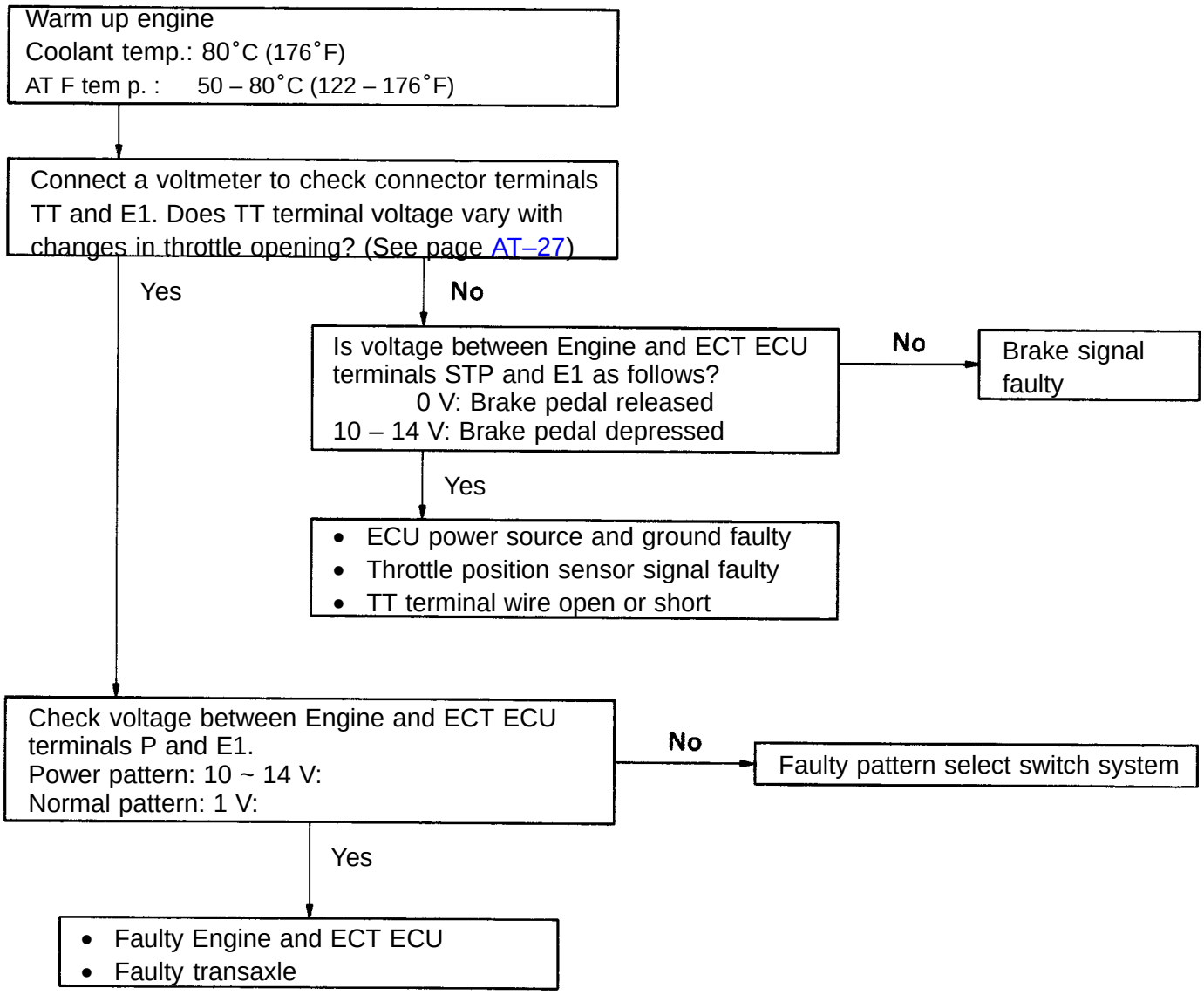
AT5718
Q00700

TROUBLESHOOTING FLOW–CHART

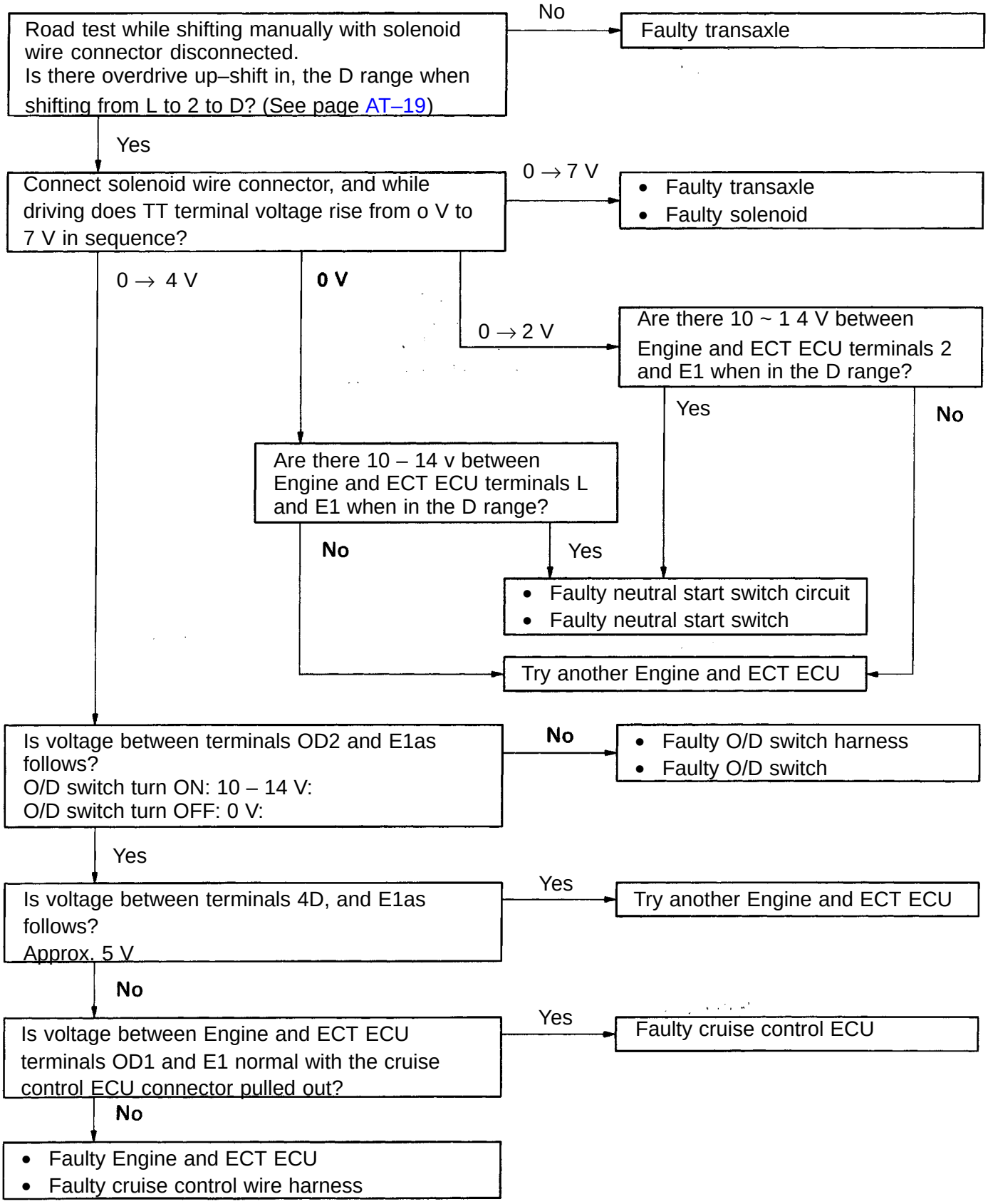
Trouble No.1 No shifting



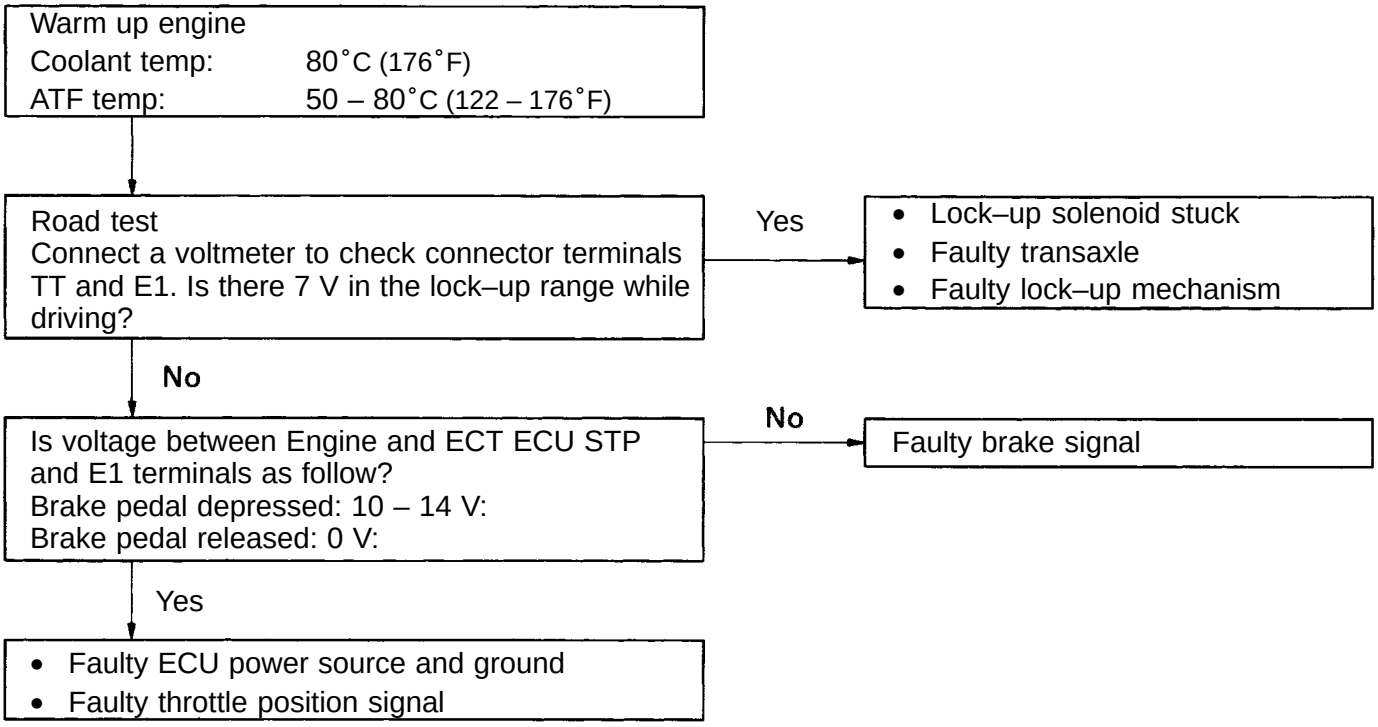
Trouble No.2 **Shift point too high or too low**

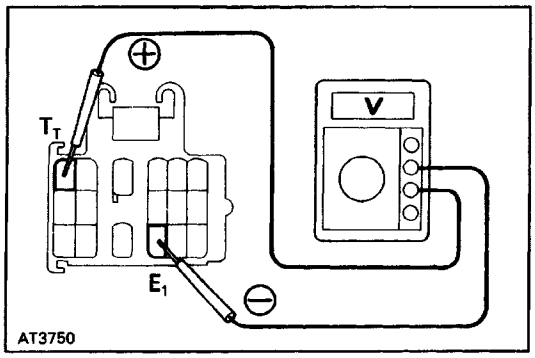


Trouble No. 3 No up–shift to overdrive (After warm–up)



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



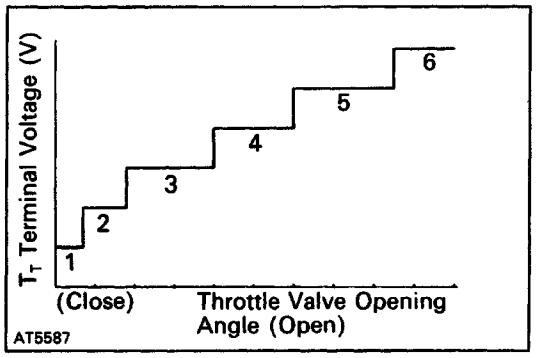


INSPECTION OF TT TERMINAL VOLTAGE

1. INSPECT THROTTLE POSITION SENSOR SIGNAL

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

(b) Connect a voltmeter to terminals TT and E1.



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

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

2. INSPECT BRAKE SIGNAL

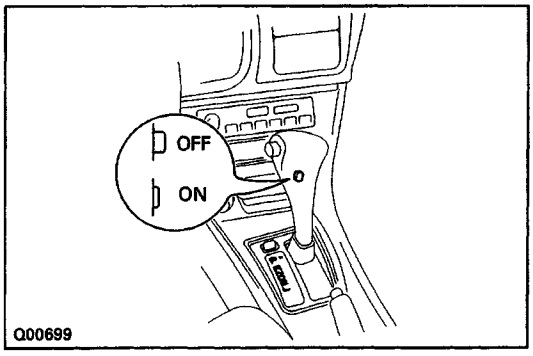
(a) Depress the accelerator pedal until the TT terminal indicates 6V.

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

Brake pedal depressed . . . . . 0 V

Brake pedal released .. . . . . 6 V

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



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

3. INSPECT EACH UP–SHIFT POSITION

(a) Warm up the engine.

Coolant temperature: 80˚C (176˚F)

(b) Turn the O/D switch to ”ON”.

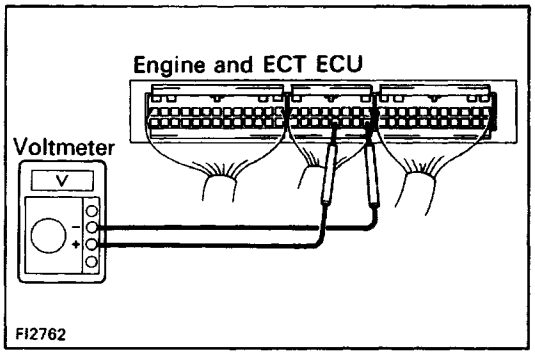
(c) Place the pattern select switch in ”Normal” and the shift lever into the D range.

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

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

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

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

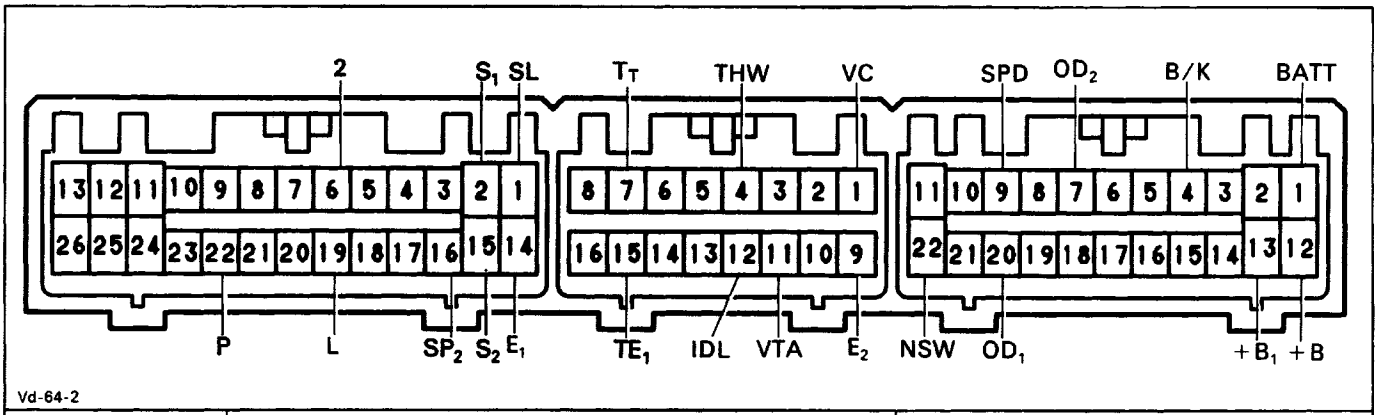


INSPECTION OF ELECTRONIC CONTROL COMPONENTS

1. INSPECT VOLTAGE OF ENGINE AND ECT ECU CONNECTOR

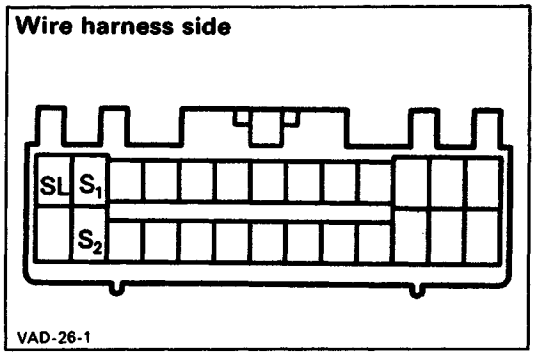
(a) Turn on the ignition switch.

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



Terminal	Measuring condition		Voltage (V)
$S_1 - E_1$	Ignition switch turned ON		10 – 14
S_2, $S_L - E_1$	Ignition switch turned ON		10 – 14
$P - E_1$	PW R pattern		10 – 14
	NORM pattern		Under 1
$STP - E_1$	Brake pedal is depressed		10 – 14
	Brake pedal is released		Under 1
$THW - E_2$	Coolant temp. 80°C (176°F)		0.3 – 0.8
$IDL - E_2$	Throttle valve fully closed		Under 0.5
	Throttle valve open		4.5 – 5.5
$VTA - E_2$	Throttle valve fully closed		Under 0.5
	Throttle valve open		4.5 – 5.5
$VC - E_2$	———		4.5 – 5.5
$OD_1 - E_1$	———		10 – 14
$OD_2 - E_1$	O/D main switch turned ON		10 – 14
	O/D main switch turned OFF		Under 1
$SPD - E_1$	Cruise control main switch OFF	Standing still	Under 1
		Vehicle moving	Repeat : 0 ↔ 10 – 4
$SP_2 - E_1$	Standing still		Under 1
	Vehicle moving		Repeat : 0 ↔ 4.5 – 5.5

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



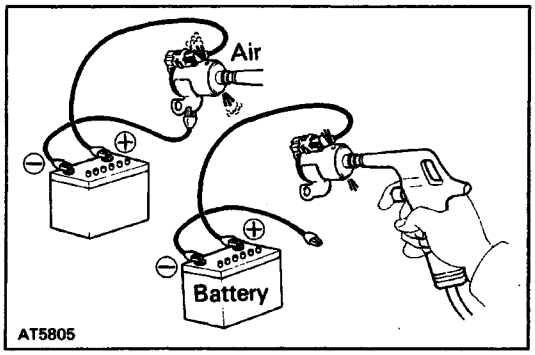
2. INSPECT SOLENOIDS

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

(b) Measure the resistance between S,, S2, SL and body ground.

Resistance: 11 –15 Ω

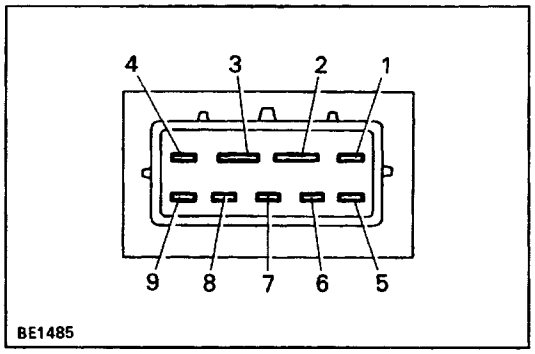
(c) Apply battery voltage to each terminal.
Check that an operation noise can be heard from the solenoid.



3. CHECK SOLENOID SEALS

If there is foreign material in the solenoid valve, there will be no fluid control even with solenoid operation.
Check No.1, No.2 and lock–up solenoid valves.

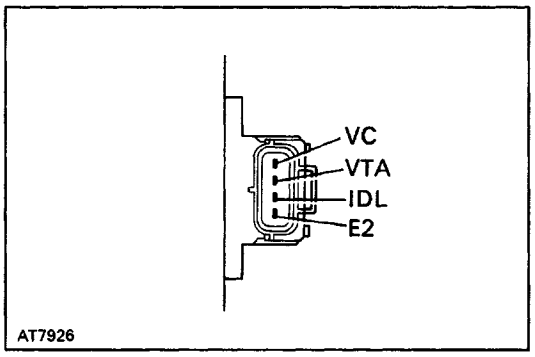
- Applying 490 kPa (5, kgf/cm^2, 71 psi) of compressed air, check that the solenoid valves do not leak the air.
- When battery voltage is supplied to the solenoids, check that the solenoid valves open.



4. INSPECT NEUTRAL START SWITCH

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

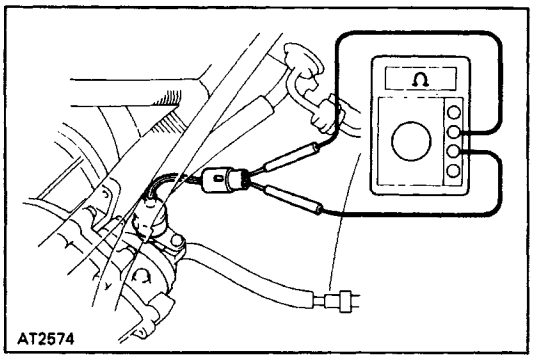
Range \ Terminal	2	3	6	1	5	7	8	9	4
P	○—○		○—○						
R			○		○				
N	○—○		○			○			
D			○				○		
2			○					○	
L			○						○



5. INSPECT THROTTLE POSITION SENSOR

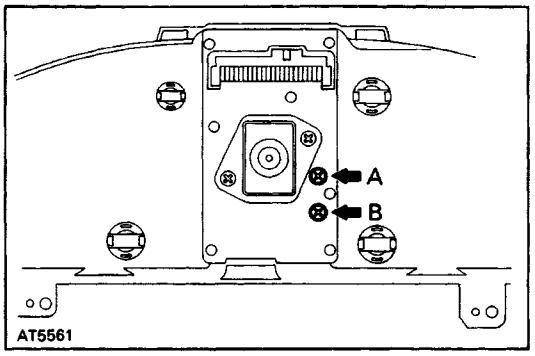
Using an ohmmeter, check the resistance between each terminal.

Terminall	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	3.2 – 10



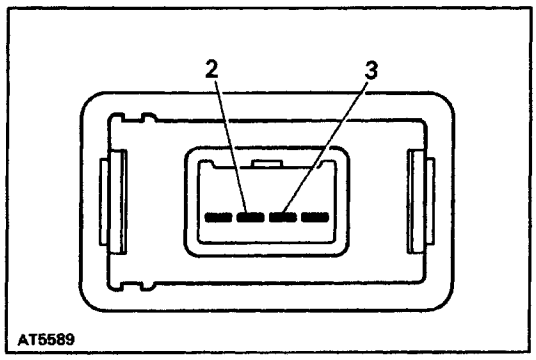
6. INSPECT NO.2 SPEED SENSOR

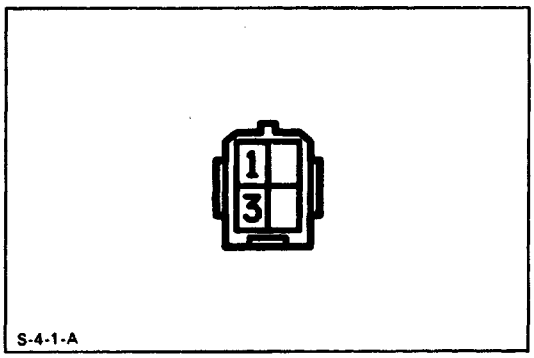
(a) Remove the air cleaner assembly.
(b) Jack up a front wheel on one side.
(c) Connect an ohmmeter between the terminals.
(d) Spin the wheel and check that the meter needle deflects from 0 to ∞Ω.

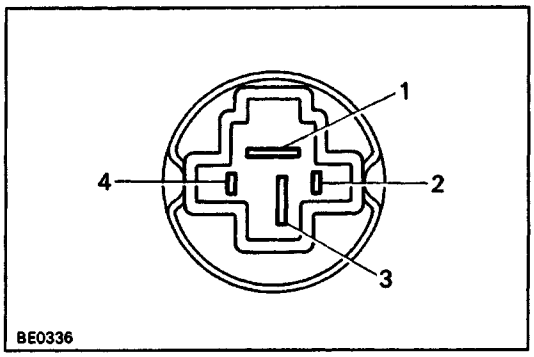


7. INSPECT NO.1 SPEED SENSOR IN COMBINATION METER

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







8.. INSPECT PATTERN SELECT SWITCH

Inspect that there is continuity between terminals 2 and 3.

HINT: As there are diodes inside, be careful of the tester probe polarity.

Terminal / Pattern	2	3
POWER	O	O
NORMAL		

9. INSPECT O/D MAIN SWITCH

Inspect that there is continuity between terminals 1 and **3. .**

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

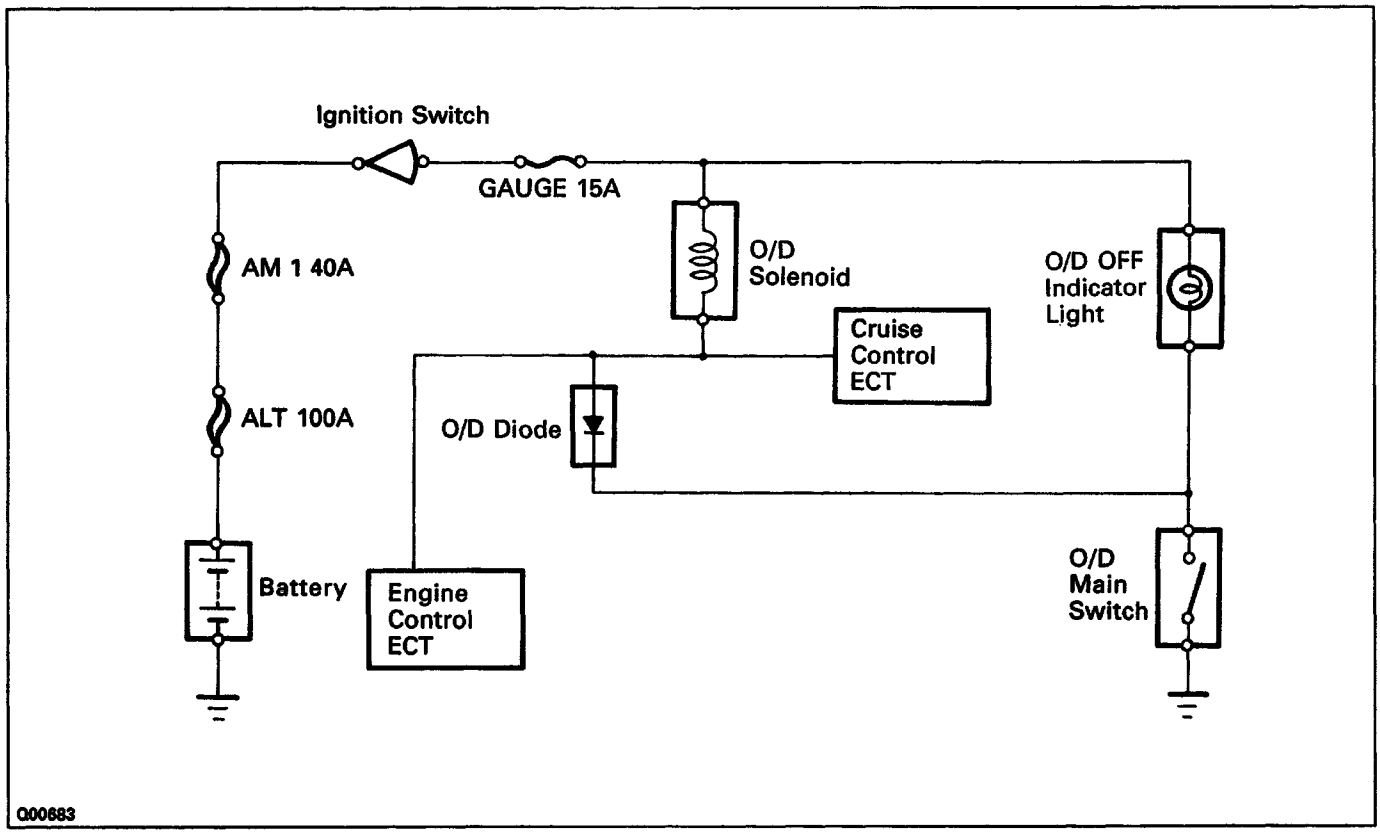
10. INSPECT STOP LIGHT SWITCH

Inspect that there is continuity between terminals 1 and 3.

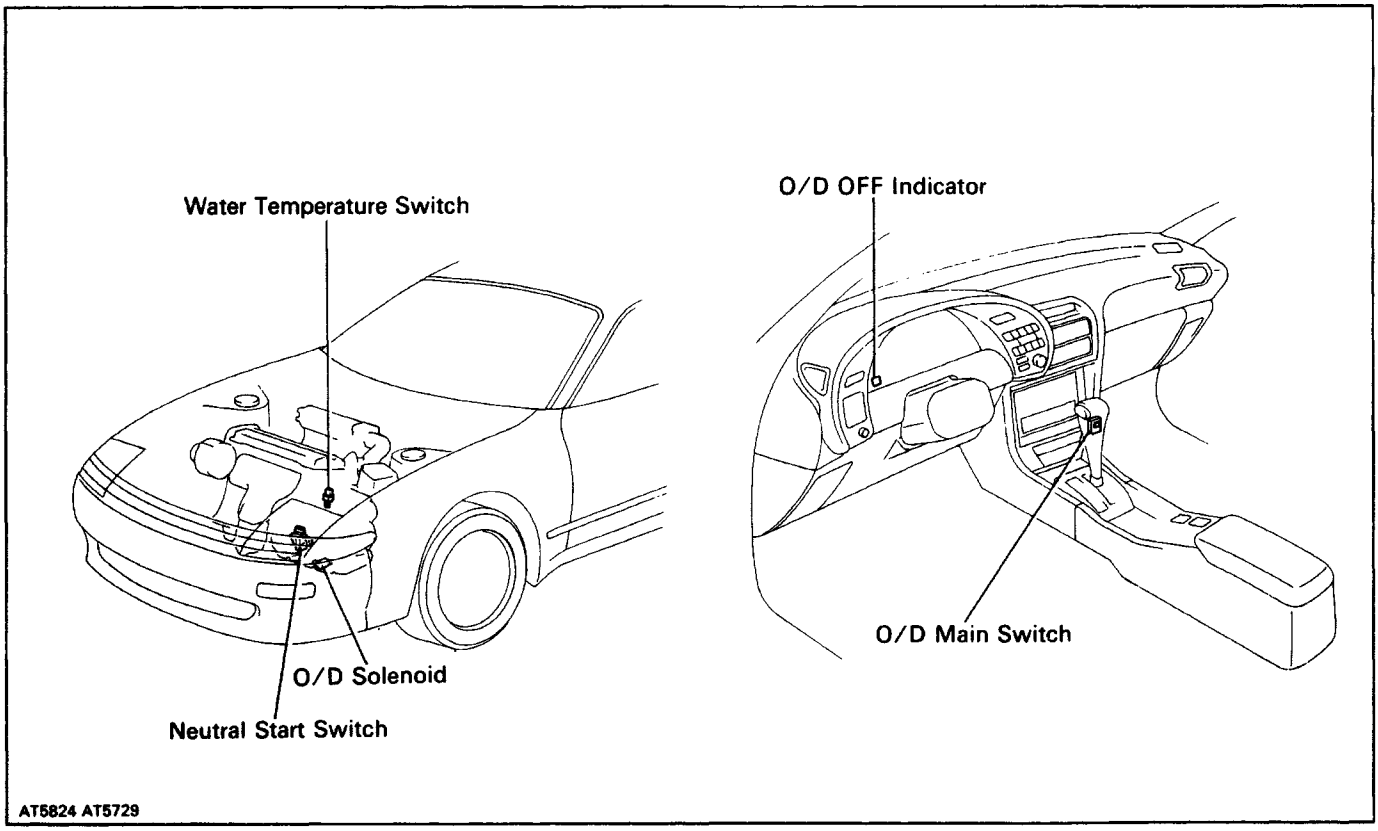
Terminal / S/W position	1	3
OFF (Release brake pedal)		
ON (Depress brake pedal)	O	O

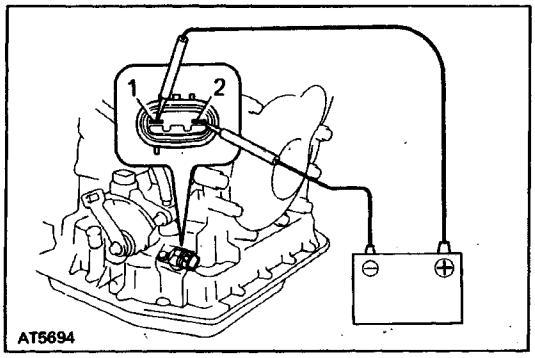
Electronic Control System (A243L 4A–FE)

ELECTRONIC CONTROL CIRCUIT



ELECTRONIC CONTROL COMPONENTS



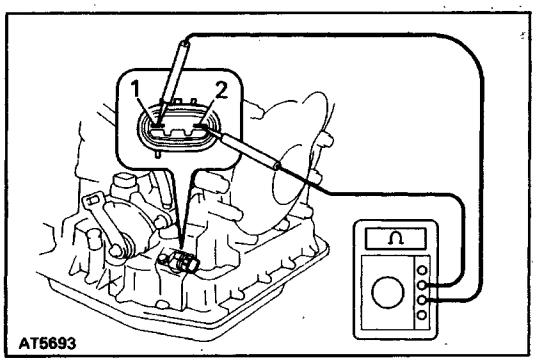


INSPECTION OF ELECTRONIC CONTROL COMPONENTS

1. INSPECT O/D SOLENOID

(a) Disconnect the solenoid connector.

(b) Apply voltage between terminals 1 and 2.
At this time, confirm that a solenoid operation sound in heard.



(c) Using an ohmmeter, measure the solenoid coil resistance between terminals 1 and 2.
Resistance: 11 –15 Ω

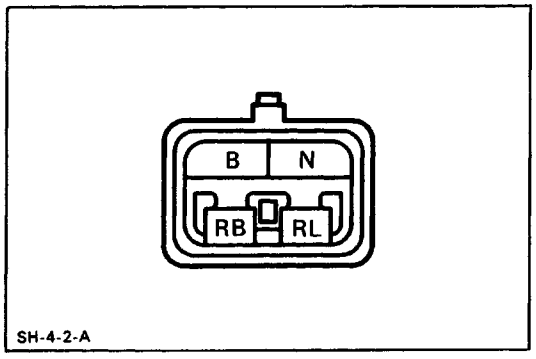
(d) Connect the solenoid connector.

2. INSPECT O/D MAIN SWITCH

(Seepage AT–30)

3. INSPECT O/D OFF INDICATOR LIGHT

(See page AT–12)



4. INSPECT NEUTRAL START SWITCH

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

Terminal / Range	RB	RL	N	B
P			○—○	
R	○—○			
N			○—○	

Mechanical System Tests

STALL TEST

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

NOTICE:

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

MEASURE STALL SPEED

(a) Chock the front and rear wheels.
(b) Connect a tachometer to the engine.
(c) Fully apply the parking brake.
(d) Step down strongly on the brake pedal with your left foot.
(e) Start the engine.
(f) Shift into the D range. Step all the way down on the accelerator pedal with your right foot.
Quickly read the stall speed at this time.

Stall speed: A241 E (5S–FE) rpm 2,500 – 2,800 rpm
A243L (4A–FE) rpm 2,300 – 2,800 rpm

(g) Perform the same test in R range.

EVALUATION

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

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

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

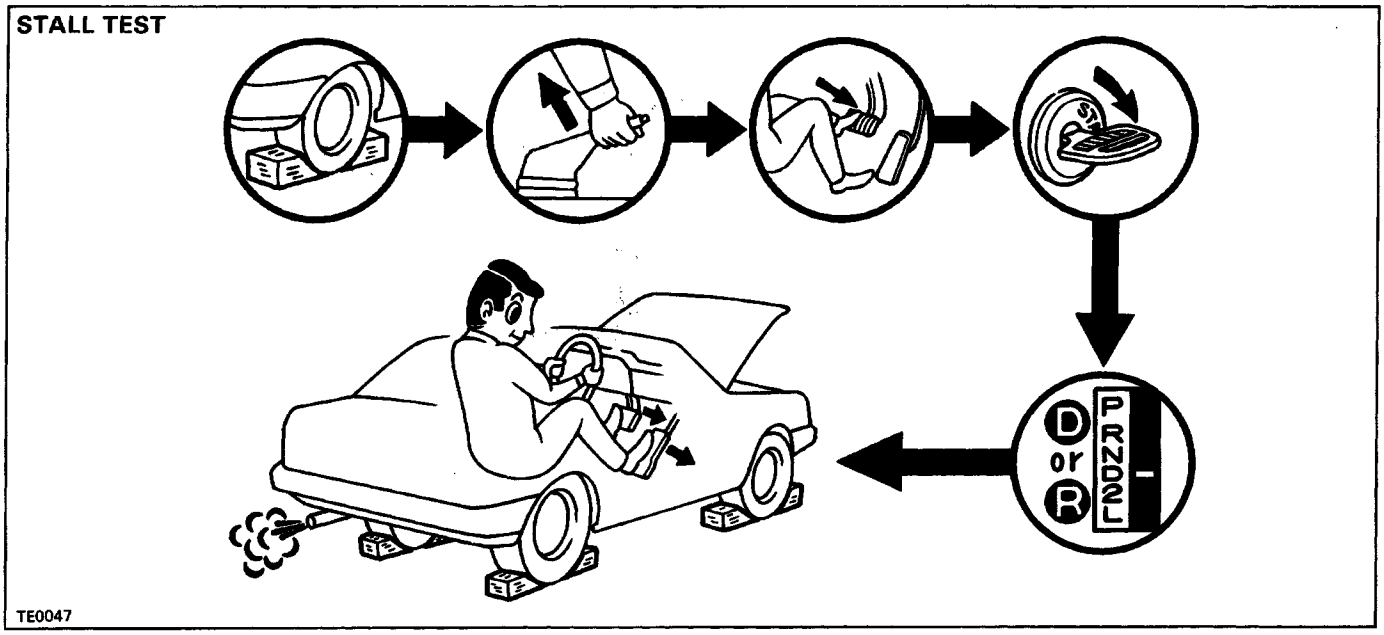
- Line pressure too low
- Forward clutch slipping
- No. 2 one–way clutch not operating properly
- Underdrive one–way clutch not operating properly

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

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

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

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



TIME LAG TEST

When the shift lever is shifted while the engine is idling, there will be a certain time E1apse or lag before the shock can be felt. This is used for checking the condition of the O/D direct clutch, forward clutch, direct clutch and first and reverse brake.

NOTICE:

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

MEASURE TIME LAG

(a) Fully apply the parking brake.

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

Idle speed (N range): 5S–FE 650 – 750 rpm

4A–FE 750 – 850 rpm

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

Time lag: Less than 1.2 seconds

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

Time lag: Less than 1.5 seconds

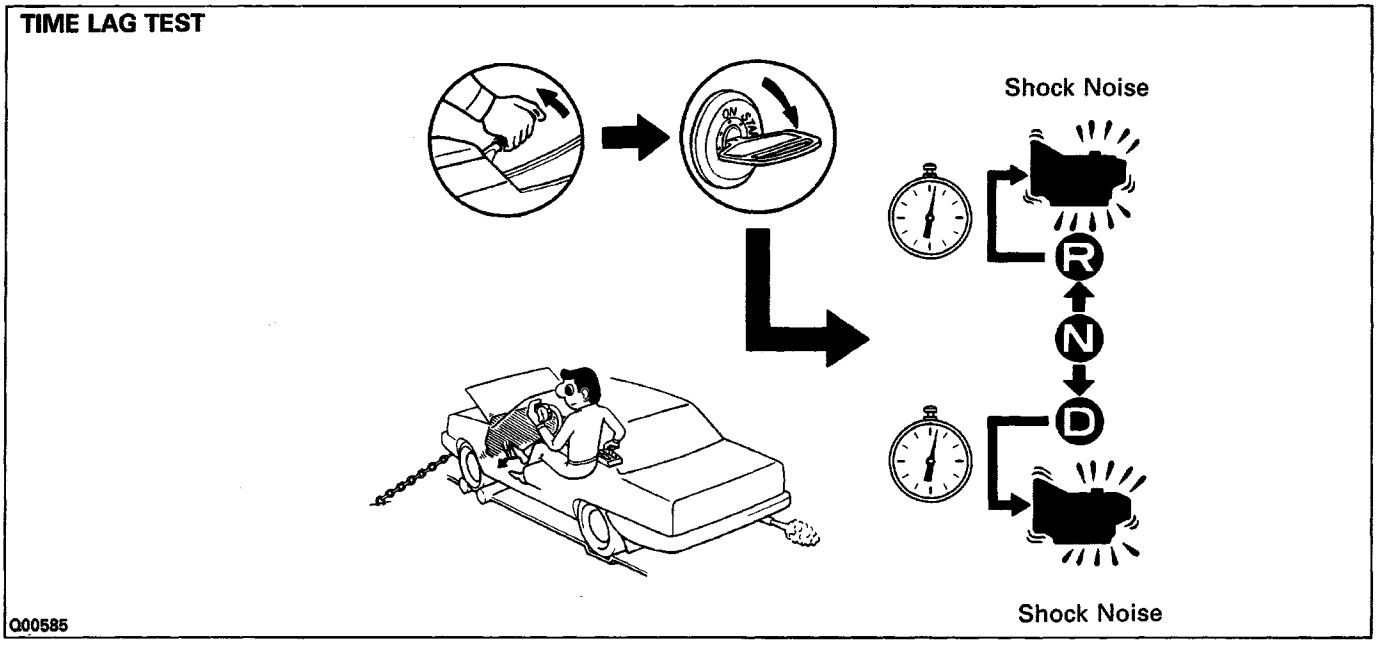
EVALUATION

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

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

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

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



HYDRAULIC TEST

PREPARATION

(a) Warm up the transaxle fluid.
(b) Remove the transaxle case test plug and connect the hydraulic pressure gauge.
SST 09992–00094 (Oil pressure gauge)

CAUTION:

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

MEASURE LINE PRESSURE

(a) Fully apply the parking brake and chock the four wheels.
(b) Start the engine and check idling rpm.
(c) Step down strongly on the brake pedal with your left foot and shift into D range.
(d) Measure the line pressure when the engine is idling.
(e) Press the accelerator pedal all the way down. Quickly read the highest line pressure when engine speed reaches stall speed.
(f) In the same manner, perform the test in R range.

ATM Type	Line pressure kPa (kgf/cm^2, psi)			
	D range		R range	
	Idling	Stall	Idling	Stall
A241 E	373 – 422 (3.8 – 4.3, 54 – 61)	716 – 863 (7.3 – 8.8, 104 – 125)	637 – 794 (6.5 – 8.1, 92 – 115)	1.334 – 1.579 (13.6 – 16.1, 193 – 229)
A243 L		902 – 1,049 (9.2 – 10.7, 131 – 152)	549 – 706 (5.6 – 7.2, 80 – 102)	1.412 – 1.667 (14.4 – 17.0, 205 – 242)

If the measured pressure are not up to specified values, recheck the throttle cable adjustment and perform 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:

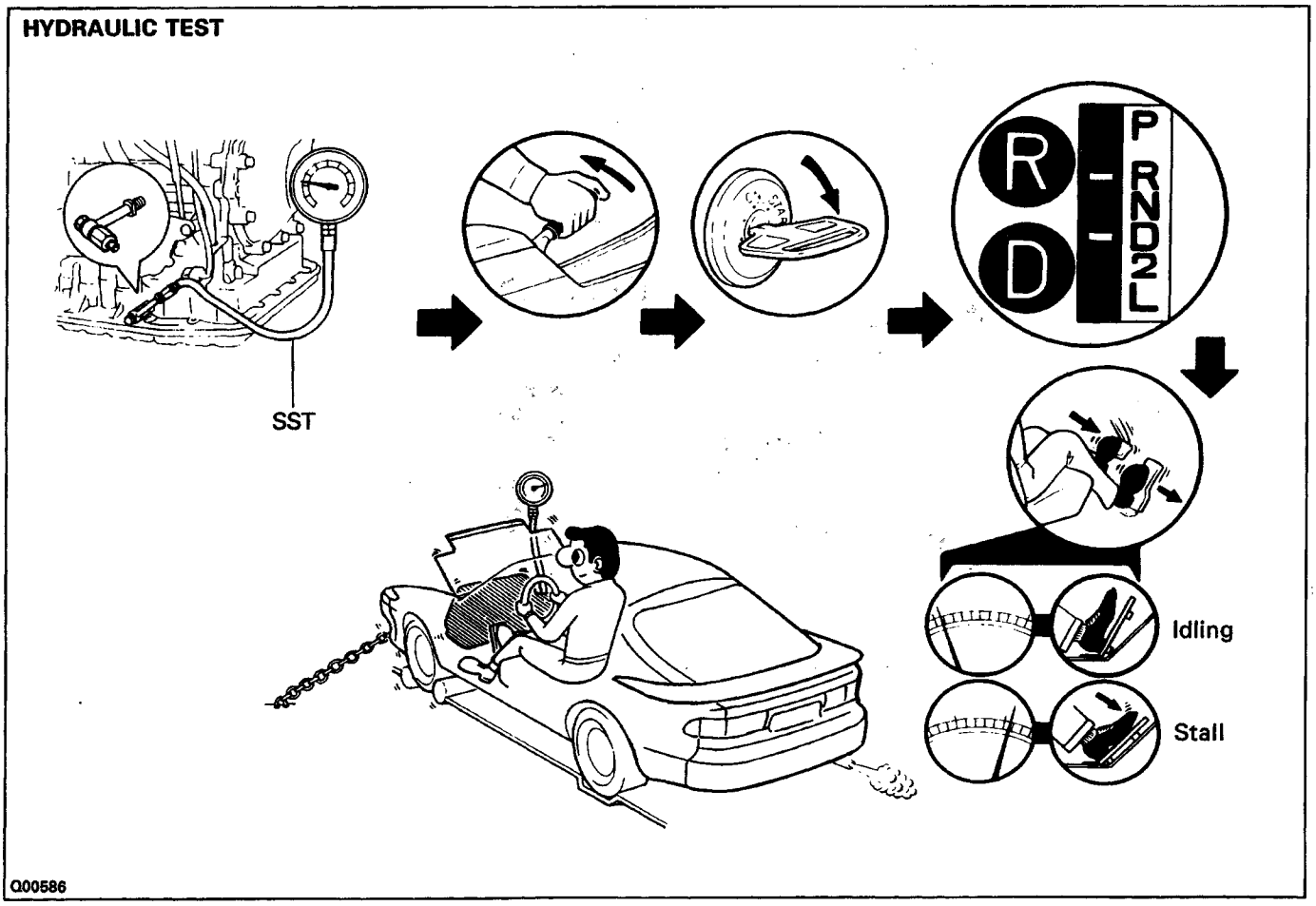
- Throttle cable out of adjustment
- Throttle valve defective
- Regulator valve defective
- Oil pump defective
- Underdrive one–way clutch not operating properly

(c) If pressure is low in the D range only:

- D range circuit fluid leakage
- Forward clutch defective
- Underdrive one–way clutch not operating properly

(d) If pressure is low in the R range only:

- R range circuit fluid leakage
- Direct clutch defective
- First and reverse brake defective
- Underdrive one–way clutch not operating properly.



MEASURE GOVERNOR PRESSURE (A243L)

(a) Check the parking brake to see that it is not applied.
(b) Start the engine.
(c) Shift into D range and measure the governor pressures at the speeds specified in the table.

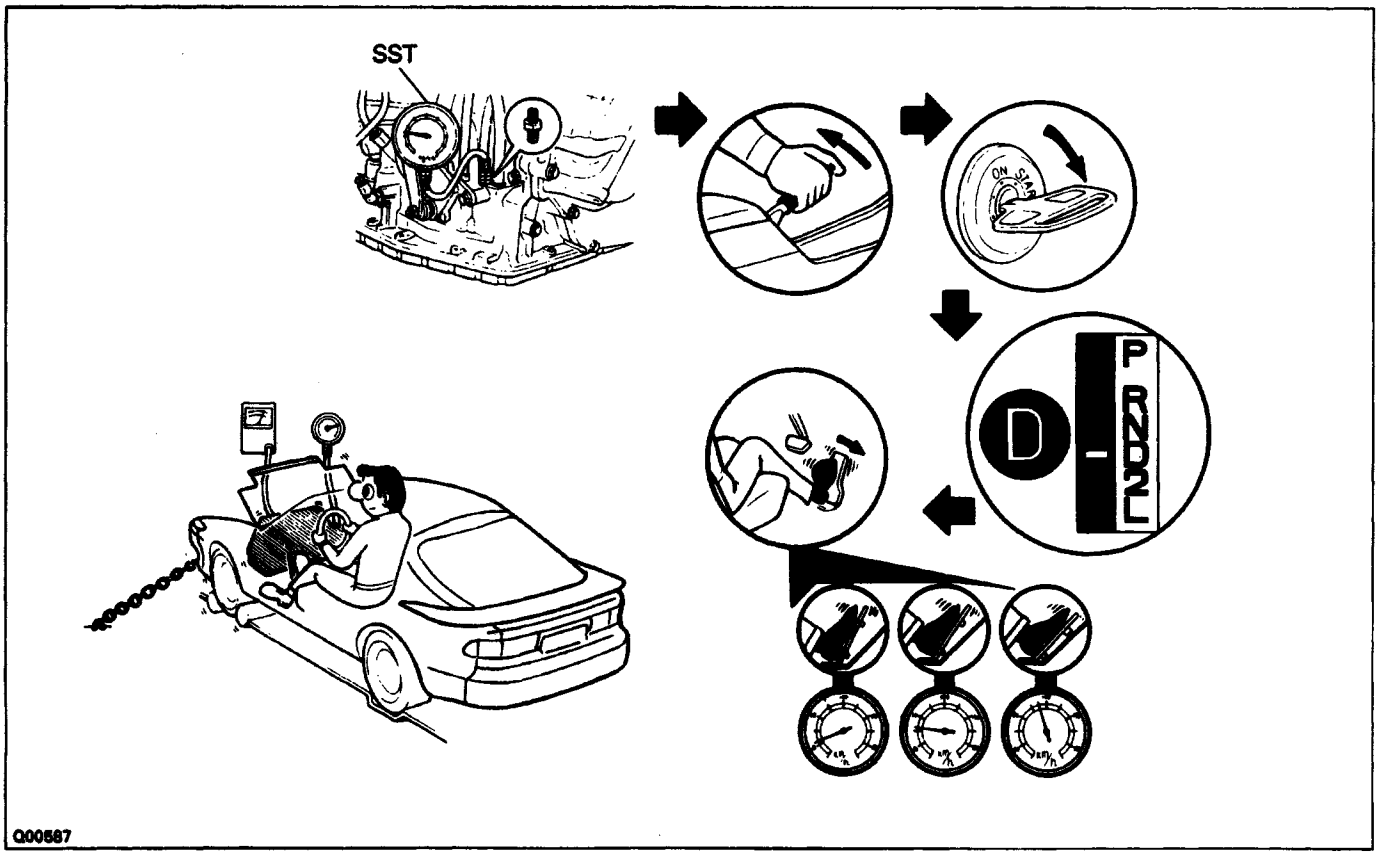
EVALUATION

If governor pressure is defective;

- Line pressure defective
- Fluid leakage in governor pressure circuit
- Governor valve operation defective

A243 L

Drive pinion shaft	Vehicle speed (Reference only)	Governor pressure
490 rpm	18 km/h (11 mph)	20 – 49 kPa (0.2 – 0.5 kgf/cm ^{2}, 3 – 7 psi)
1,300 rpm	47 km/h (29 mph)	176 – 205 kPa (1.79 – 2.09 kgf/cm^2, 25 – 30 psi)
2,600 rpm	94 km/h (58 mph)	412 – 490 kPa (4.2 – 5.0 kgf/cm^2, 60 – 71 psi)



Road Test (A241 E)

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

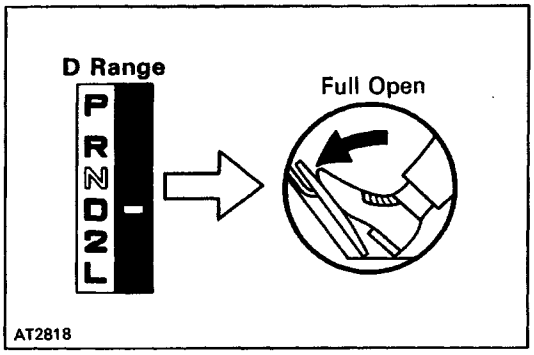
1. D RANGE TEST IN NORM AND PWR PATTERN RANGES

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

Check the following:

(a) 1–2, 2–3 and 3–O/D up–shifts should take place, and shift points should conform to those shown in the automatic shift schedule. (See page AT–46)

Conduct a test under both Normal and Power patterns.



HINT:

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

EVALUATION

(1) If there is no 1 → 2 up–shift:

- No.2 solenoid is stuck
- 1–2 shift valve is stuck

(2) If there is no 2 → 3 up–shift:

- No. 1 solenoid is stuck
- 2–3 shift valve is stuck

(3) If there is no 3 → O/D up–shift:

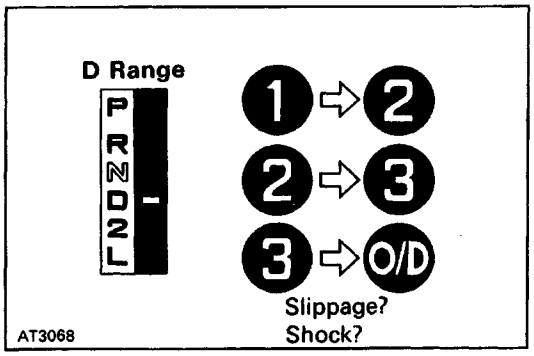
- 3–4 shift valve is stuck

(4). If the shift point is defective:

- Throttle valve, 1–2 shift valve, 2–3 shift valve, 3–4 shift valve etc., are defective

(5) If the lock–up is defective:

- Lock–up solenoid is stuck
- Lock–up relay valve is stuck

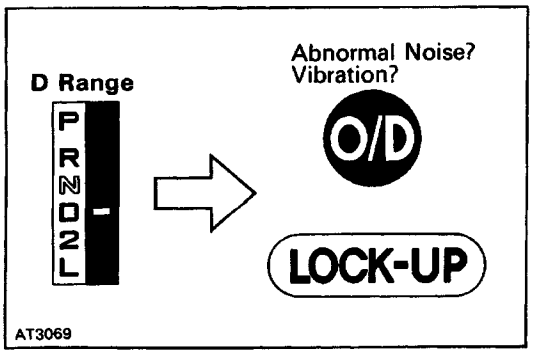


(b) In the same manner, check the shock and slip at the 1 → 2, 2 → 3 and 3 → O/D up–shifts.

EVALUATION

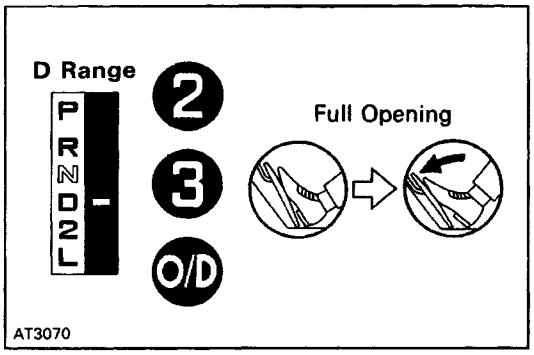
If the shock is excessive:

- Line pressure is too high
- Accumulator is defective
- Check ball is defective



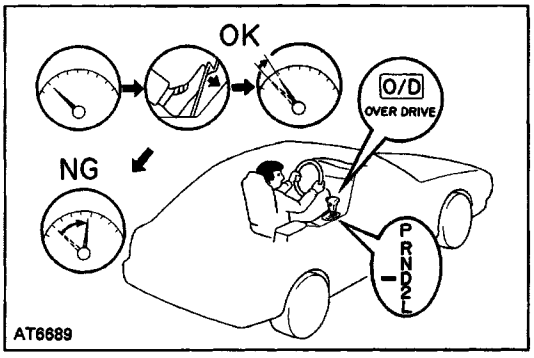
(c) Run at the D range lock–up or O/D gear and check for abnormal noise and vibration.

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



(d) While running in the D range, 2nd, 3rd and O/D gears, check to see that the possible kick–down vehicle speed limits for 2 → 1, 3 → 2 and O/D → 3 kick–downs conform to those indicated on the automatic shift schedule.. (See page AT–45)

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

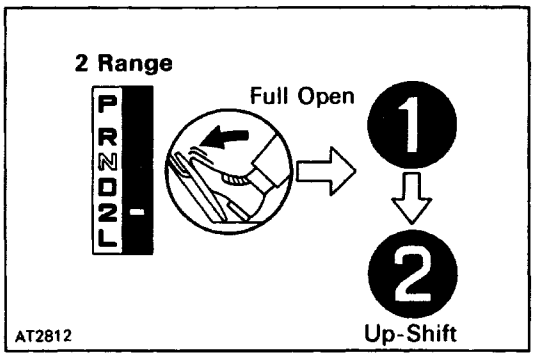


(f) Check for the lock–up mechanism.

(1) Drive in D range, O/D gear, at a steady speed (lock–up ON) of about 66 – 70 km/h (41 – 43 mph) (NORM).

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

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



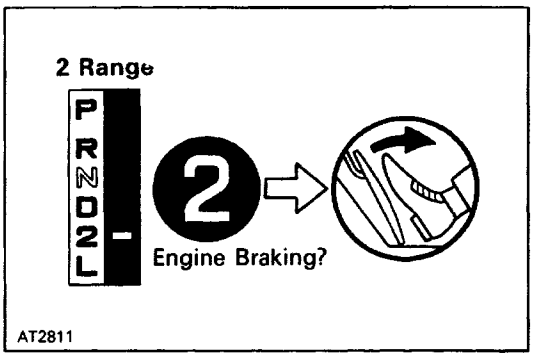
2. 2 RANGE TEST

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

(a) Check to see that the 1 → 2 up–shift takes place and that the shift point conforms to it shown on the automatic shift schedule. (See page AT–45)

HINT:

- To prevent overrun, the transmission shifts up into 3rd gear at around 162 km/h (101 mph).
- In range 2, there will be no lock–up to 2nd gear.

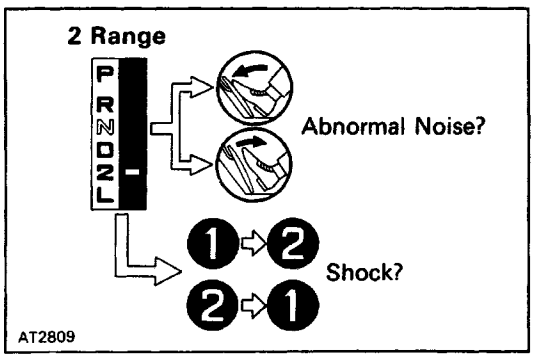


(b) While running in the 2 range and 2nd gear, release the accelerator pedal and check the engine braking effect.

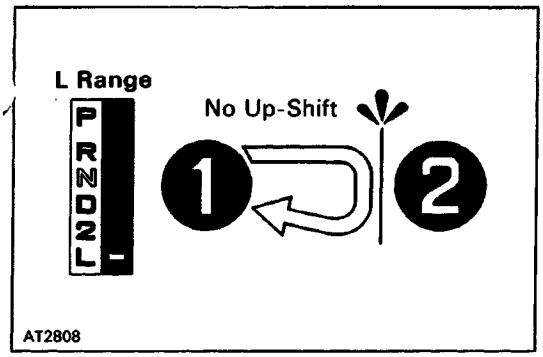
EVALUATION

If there is no engine braking effect:

- Second coast brake is defective



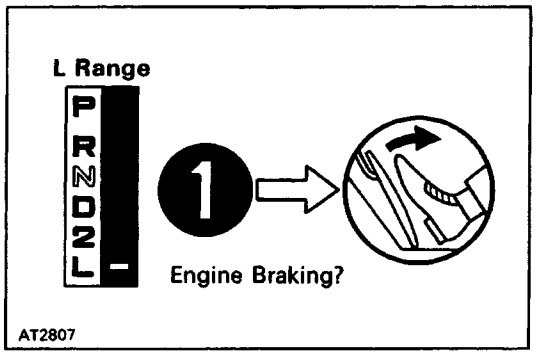
(c) Check for abnormal noise at acceleration and deceleration, and for shock at up–shift and down–shift.



3. L RANGE TEST

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

HINT: To prevent overrun, the transmission up–shifts into 2nd gear at around 53 km/h (33 mph).

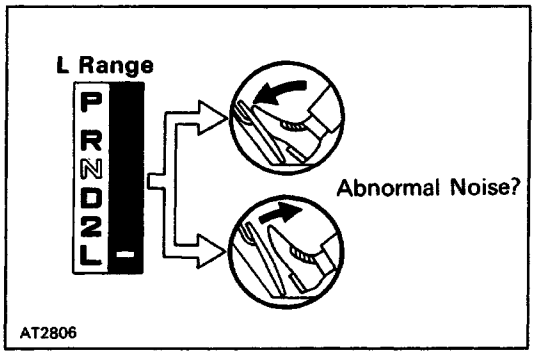


(b) While running in the L range, release the accelerator pedal and check the engine braking effect.

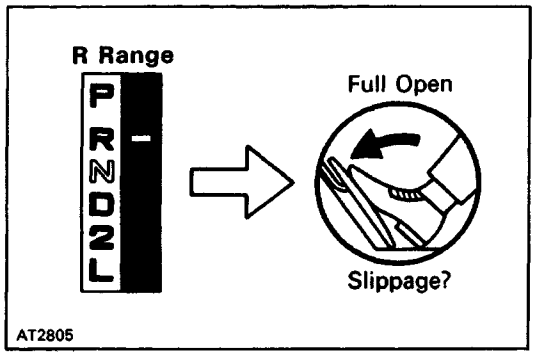
EVALUATION

If there is no engine braking effect:

- First and reverse brake is defective

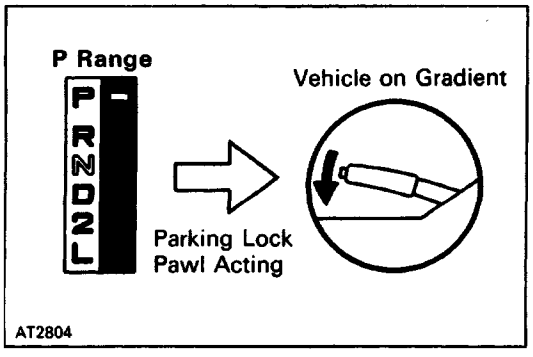


(c) Check for abnormal noise during acceleration and deceleration.



4. R RANGE TEST

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



5. P RANGE TEST

Stop the vehicle on a gradient (more than 5°) and after shifting into the P range, release the parking brake. Then check to see that the parking lock pawl holds the vehicle in place.

Road Test (A243L)

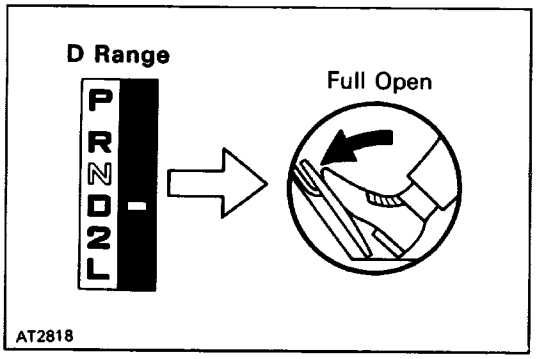
NOTICE: Perform this test at normal fluid temperature (50 – 80˚C or 122 –176˚F).

INSPECTION OF AUTOMATIC SHIFT POINT

1. D RANGE TEST

Shift into D range and while driving with the accelerator pedal held constant at the throttle valve full open, check on the following points:

(a) Check to see that the 1–2, 2–3 and 3–O/D up–shifts take place and also that the shift points conform to those shown in the automatic shift schedule (See page AT–45 or 46)



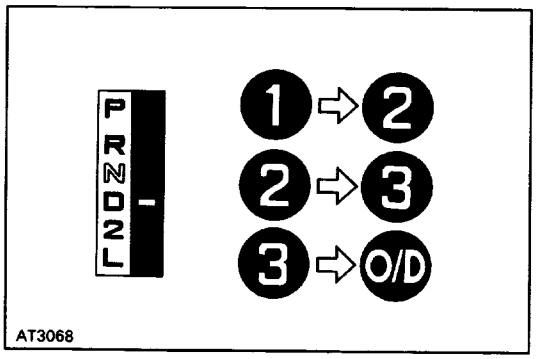
EVALUATION

(1) If there is no 1–2 up–shift:
- Governor valve is defective.
- 1–2 shift valve stuck.

(2) If there is no 2–3 up–shift:
- 2–3 shift valve stuck.

(3) If there is no 3–O/D up–shift (throttle valve opening less than 86%):
- 3–4 shift valve is stuck.
- Solenoid valve or circuit defective.

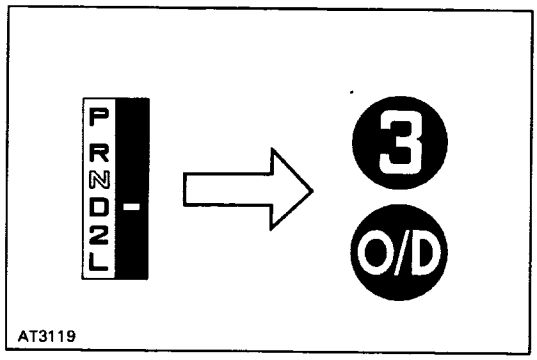
(4) If the shift point is defective:
- Throttle cable out–of adjustment.
- Throttle valve, 1–2 shift valve, 2–3 shift valve, 3–4 shift valve, etc. defective.



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

EVALUATION:

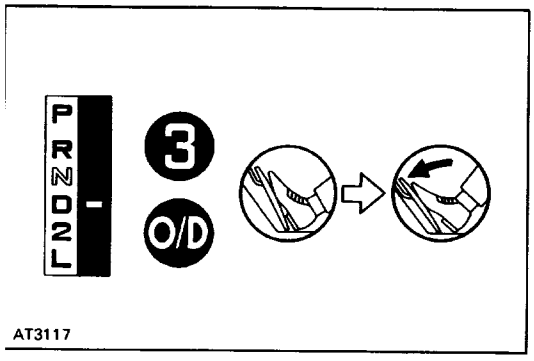
If the shock is severe:
- Line pressure is too high.
- Accumulator is defective.
- Check ball is defective.



(c) Run in the 3rd gear or O/D of D range and check the abnormal noise and vibration.

HINT: Check for cause of abnormal noise and vibration must be made with extreme care as they could also due to unbalance in the drive shaft, differential, tires, torque converter, etc.

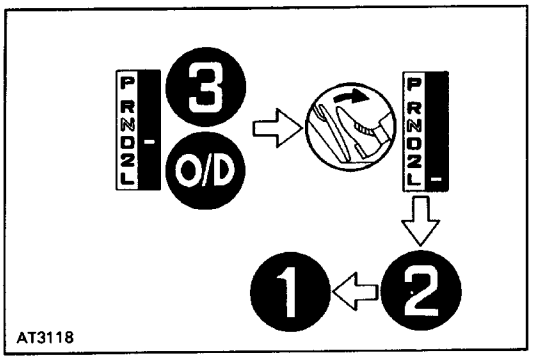
(d) While running in the 3rd gear or O/D of D range, check to see that the possible kick–down vehicle speed limits for the 3–1, 3–2, O/D–3 and O/D–2 kick–downs conform to those indicated in the automatic shift schedule.



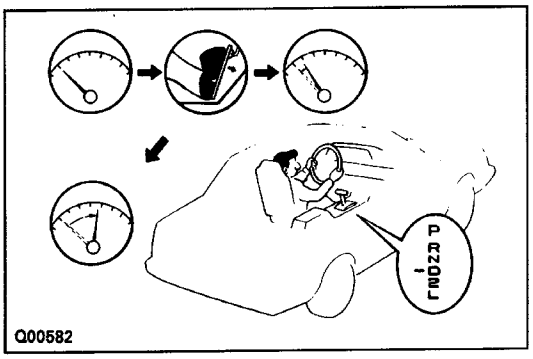
EVALUATION:

If the possible kick–down vehicle speed limit is defective:
- Throttle cable out–of adjustment.
- Throttle valve, 1–2 shift valve, 2–3 shift valve, 3–4 shift valve, etc. defective.

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



(f) While running more than 46 km/h (29 mph) in the O/D of D range, release your foot from the accelerator pedal and shift into L range. Then check to see if the 2–1 down–shift point conform to those indicated in the automatic shift schedule. (See page AT–45 or 46)

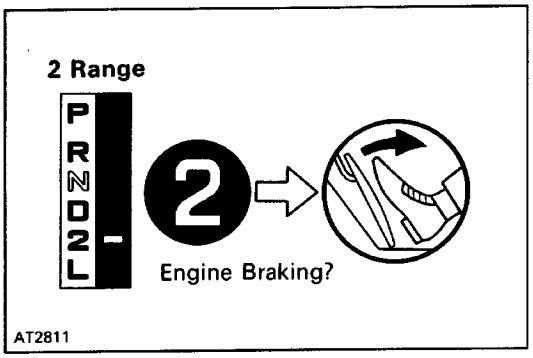


2. INSPECT LOCK–UP MECHANISM

(a) Drive in D range, at a steady speed (Lock–up ON) or about 75 km/h (47 mph) (A243L).

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

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



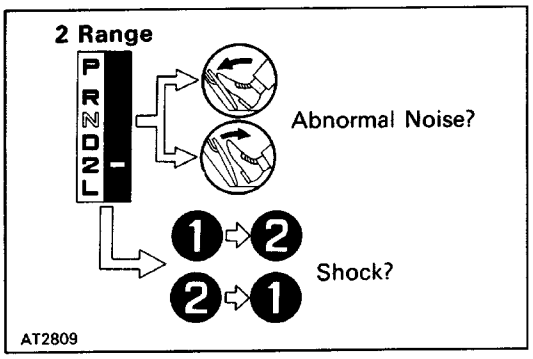
3. 2 RANGE TEST

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

EVALUATION

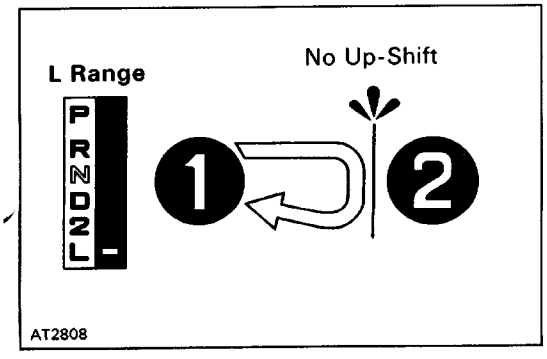
If there is no engine braking effect:

- Second coast brake is defective:



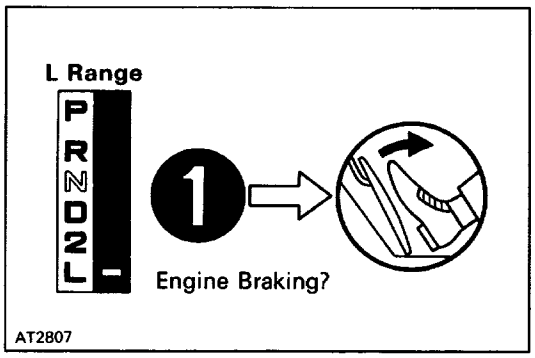
(b) Check the abnormal noise during acceleration and deceleration.

(c) Check the shock at up–shift and down–shift.



4. L RANGE TEST

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

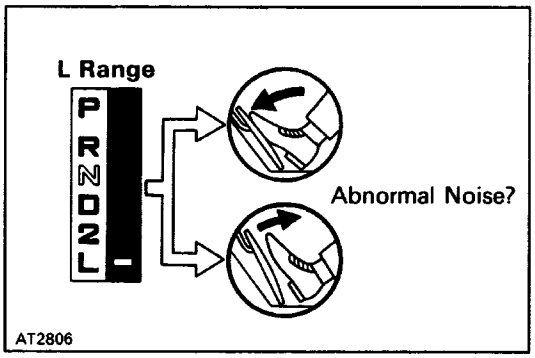


(b) While running in L range, release the accelerator pedal and check the engine braking effect.

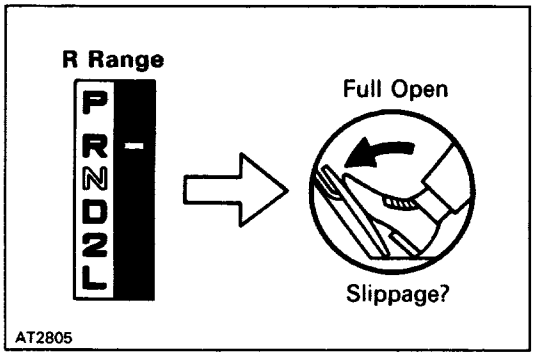
EVALUATION

If there is no engine braking effect:

- First and reverse brake defective:

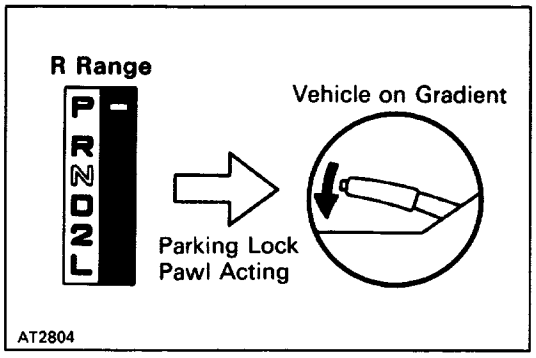


(c) Check the abnormal noise during acceleration and deceleration.



5. R RANGE TEST

Shift into R range and, while running at full throttle, check the slipping.



6. P RANGE TEST

Stop the vehicle on a gradient (more than 9%) and, after shifting into P range, release the parking brake. Then check to see that the parking lock pawl prevents the vehicle from moving.

Automatic Shift Schedule

(A241 E)

		Throttle valve fully open [ ] Fully closed km/h (mph)							
		1 → 2	2 → 3	3 → O/D	[3 → O/D]	[O/D → 3]	O/D → 3	3 → 2	2 → 1
D range	NORM	53 - 60 (33 - 37)	98 - 110 (61 - 68)	130 - 145 (81 - 90)	[39 - 45 (24 - 28)]	[18 - 23 (11 - 14)]	125 - 139 (78 - 86)	89 - 101 (55 - 63)	42 - 49 (26 - 30)
	PWR	53 - 60 (33 - 37)	98 - 110 (61 - 68)	131 - 146 (81 - 91)	[59 - 66 (37 - 41)]	[18 - 23 (11 - 14)]	125 - 139 (78 - 86)	93 - 106 (58 - 66)	42 - 49 (26 - 30)
2 range	NORM PWR	53 - 60 (33 - 37)	–	–	–	–	–	–	42 - 49 (26 - 30)
L range	NORM PWR	–	–	–	–	–	–	–	47 - 54 (29 - 34)

		Throttle valve opening 5% km/h (mph)	
		Lock–up O N	Lock–up OFF
		O/D	O/D
D range	NORM	65 - 72 (40 - 45)	59 - 66 (37 - 41)
	PWR	76 - 84 (47 - 52)	70 - 78 (43 - 48)

HINT:

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

(2) In the following cases, the lock–up will be released regardless of the lock–up pattern.

- When the throttle is completely closed.
- When the brake switch is ON.

(3) Shift up to O/D will not occur when the engine coolant temp. is below 53˚C (1 27˚F).

(A243L)

km/h. (mph)

Differential gear ratio	D range (Throttle valve fully open)								L range
	1 → 2	2 → 3	3 → O/D	Lock-up ON	Lock-up OFF	O/D → 3	3 → 2	2 → 1	2 → 1
3.034	44 - 59 (27 - 37)	87 - 101 (54 - 63)	–*1	–*2	–*3	–*4	83 - 99 (52 - 62)	32 - 42 (20 - 26)	40 - 51 (25 - 32)

*1 3 → O/D up-shift point with closed throttle valve is at 25 – 38 km/h (16 – 24 mph).
*2 Lock-up "ON" point with closed throttle valve is at 71 – 80 km/h (44 – 50 mph).
*3 Lock-up "OFF" point with closed throttle valve is at 60 – 69 km/h (37 – 43 mph).
*4 O/D → 3 down-shift is possible up to maximum speed.

ON–VEHICLE REPAIR

Valve Body

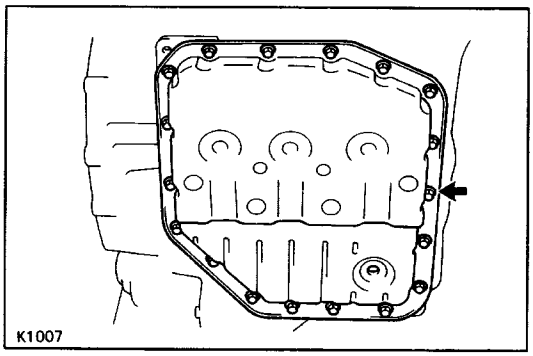
REMOVAL OF VALVE BODY AND/OR SOLENOID VALVE

1. CLEAN TRANSAXLE EXTERIOR

To prevent contamination, clean the exterior of the transaxle.

2. DRAIN TRANSAXLE FLUID

Remove the drain plug and drain the fluid into a suitable container.

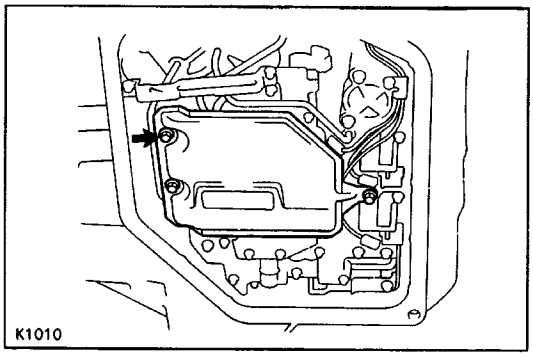


3. REMOVE ENGINE UNDER COVER

4. REMOVE OIL PAN AND GASKET

NOTICE: Some fluid will remain in the oil pan.

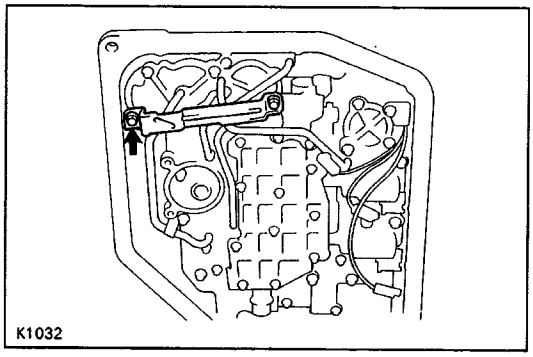
Remove all pan bolts, and carefully remove the pan assembly. Discard the gasket.



5. REMOVE OIL STRAINER

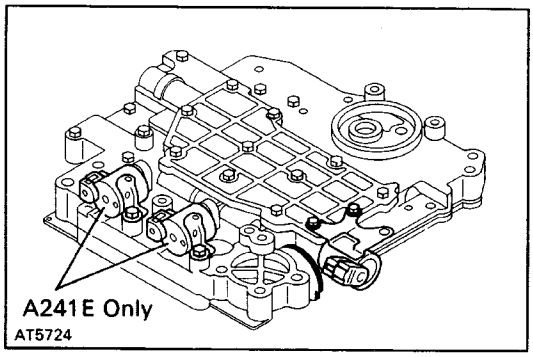
NOTICE: Be careful as some fluid will come out with the oil strainer.

Remove the three bolts, oil strainer and gasket.



6. REMOVE APPLY TUBE BRACKET

Remove the two bolts and apply tube bracket.

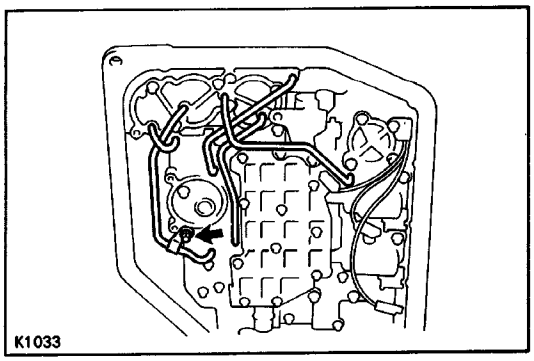


7. WHEN REPLACING SOLENOIDS

(a) Disconnect the connectors from the solenoids.

(b) Remove the solenoid mounting bolts.

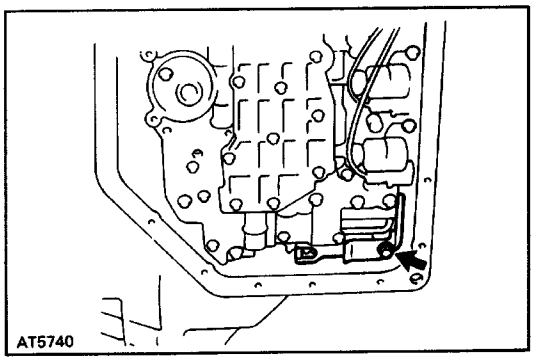
(c) Remove the solenoids.



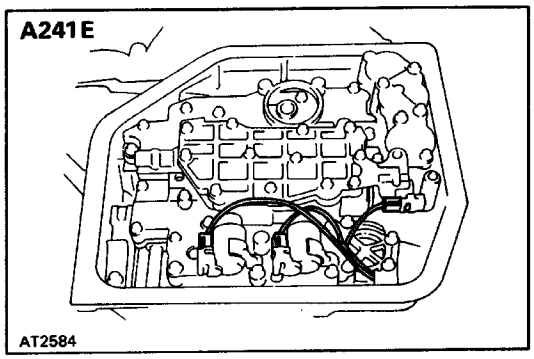
8. REMOVE OIL TUBES

(a) Remove the tube clamp bolt and clamp.

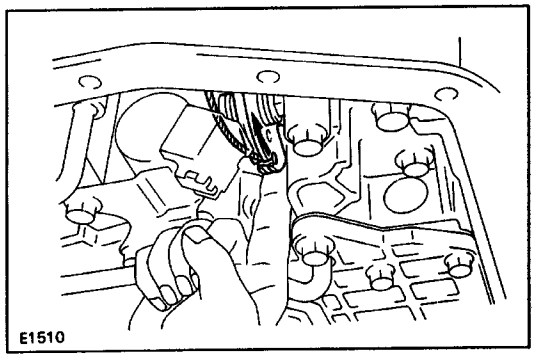
(b) Pry up both ends with a large screwdriver and remove the five tubes.



9. REMOVE MANUAL DETENT SPRING

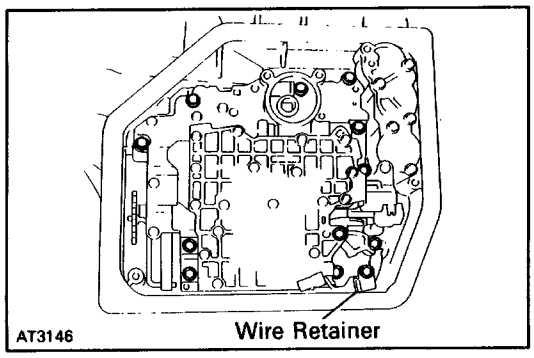


10. DISCONNECT SOLENOID CONNECTORS

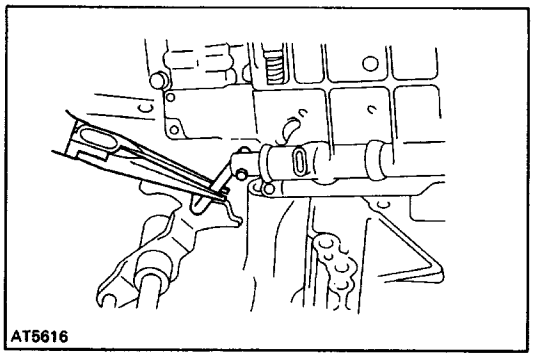


11. REMOVE VALVE BODY

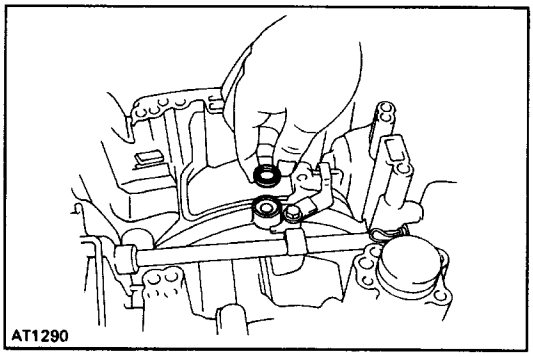
(a) Disconnect the throttle cable from the cam.



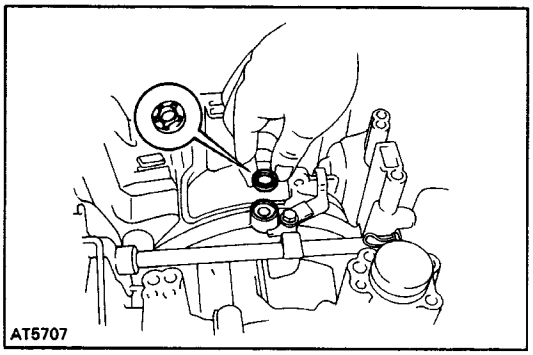
(b) Remove the twelve bolts and wire retainer.



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

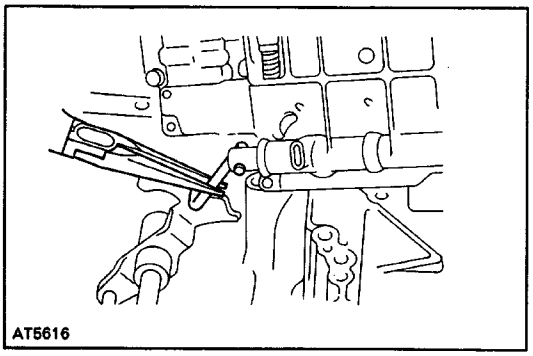


12. REMOVE SECOND BRAKE APPLY GASKET



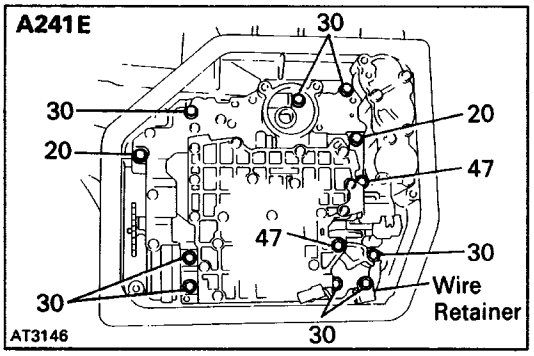
INSTALLATION OF VALVE BODY AND/OR SOLENOID VALVE

1. INSTALL NEW SECOND BRAKE APPLY GASKET



2. INSTALL VALVE BODY

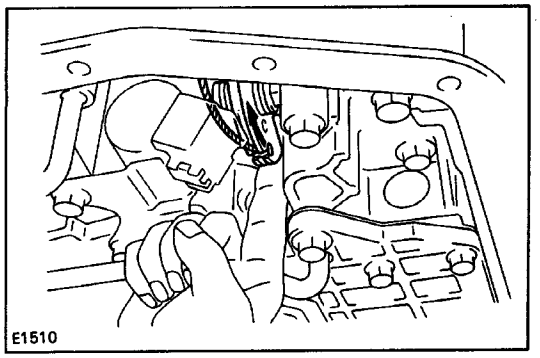
(a) Connect the connecting rod to the manual valve lever.



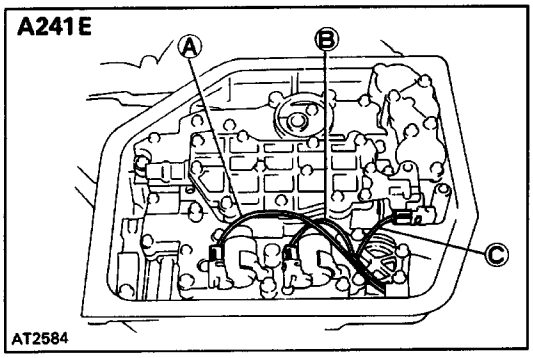
(b) Install the twelve bolts and wire retainer, and hand tighten all the bolts first. Then tighten them with a torque wrench.

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

Torque: 10 N–m (100 kgf–cm, 7 ft–lbf)



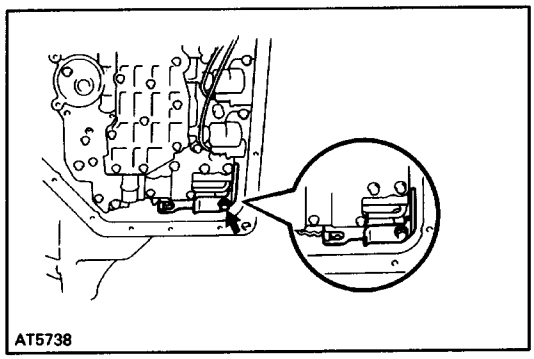
(c) Connect the throttle cable to the cam.



3. CONNECT SOLENOID CONNECTOR

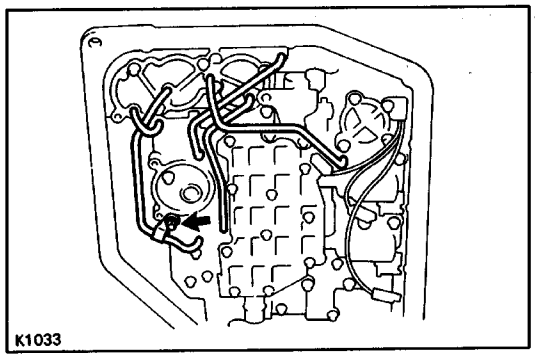
HINT: Wire color

(A) White
(B) Black
(C) Yellow



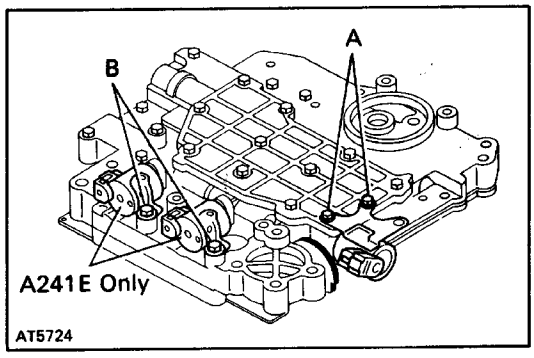
4. INSTALL MANUAL DETENT SPRING

(a) , Install the detent spring and cover in place, and install the bolt (length: 16 mm).
(b) Hand tighten the bolt first, then tighten the bolt with a torque wrench.
Torque: 10 N–m (100 kgf–cm, 7 ft–lbf)
(c) Check that the manual valve lever is in contact with the center of the roller at the tip of the detent spring.



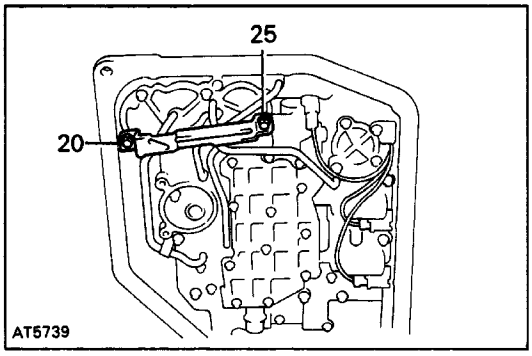
5. INSTALL OIL TUBES

(a) Tap the tubes with a plastic hammer to install them into the positions indicated in the illustration.
NOTICE: Be careful not to bend or damage the tubes.
(d) Install the oil tube clamp.
HINT: The bolt length (mm) is indicated in the illustration. Hand tighten a bolt first, then tighten them with a torque wrench.
Torque: 10 N–m (100 kgf–cm, 7 ft–lbf)

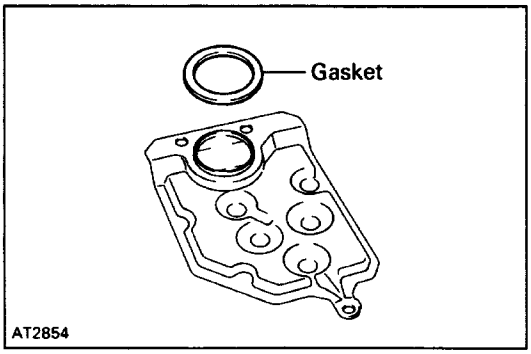


6. WHEN REPLACING SOLENOID

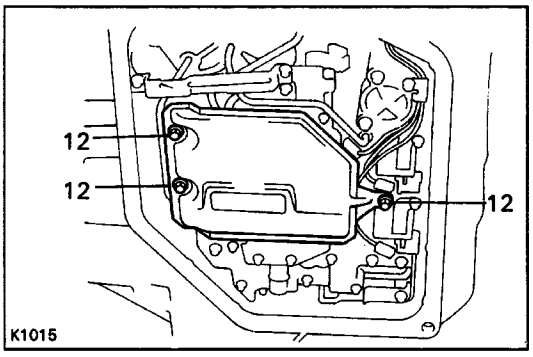
. (a) Install a new O–ring to the solenoid.
(b) Install the solenoid and torque the bolt.
Torque: A 6.4 N–m (65 kgf–cm, 56 in–lbf)
B 10 N–m (100 kgf–cm, 7 ft–lbf)
(c) Connect the connector to the solenoid.
(d) Clamp the solenoid wire.



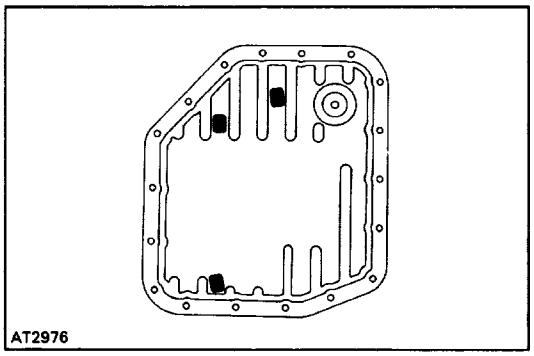
7. INSTALL APPLY TUBE BRACKET
Install the apply tube bracket.
HINT: Each bolt length (mm) is indicated in the illustration.
Torque: 10 N–m (700 kgf–cm, 7 ft–lbf)



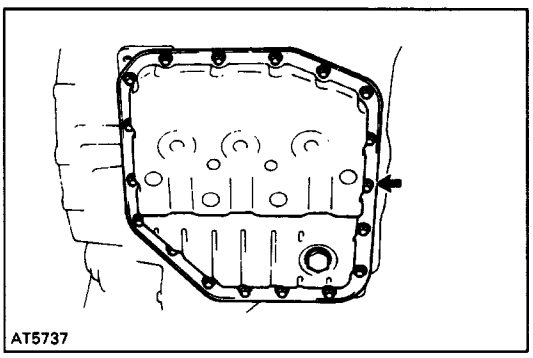
8. INSTALL OIL STRAINER
(a) Install the new gasket to the oil strainer.



(b) Install the oil strainer with the three bolts.
HINT: Each bolt length (mm) is indicated in the illustration.

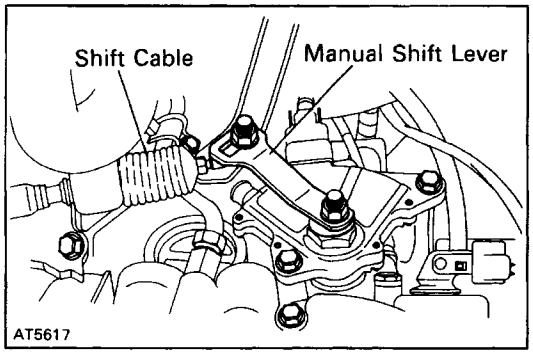


9. INSTALL THREE MAGNETS IN OIL PAN
NOTICE: Make sure that the magnets do not interfere with the oil tubes.



10. INSTALL OIL PAN
(a) Install a new gasket to the oil pan and install them to the transmission.
(b) Tighten the eighteen bolts.
Torque: 4.9 N–m (50 kgf–cm, 43 in.–lbf)
11. INSTALL OIL PAN DRAIN PLUG
Torque the drain plug.
Torque: 17 N–m (775 kgf–cm, 13 ft–lbf)

12. INSTALL ENGINE UNDER COVER
13. FILL TRANSAXLE WITH ATF
(See page AT–17)
NOTICE: Do not overfill.
Fluid type: ATF DEXRON © II
14. CHECK FLUID LEVEL

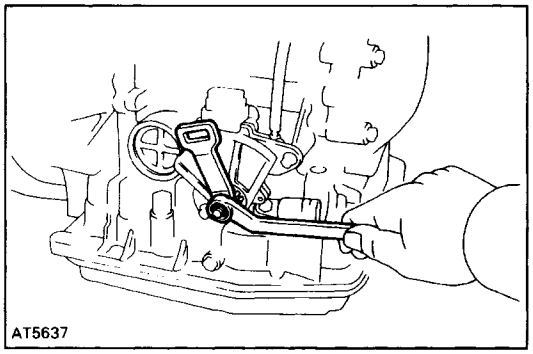


Neutral Start Switch

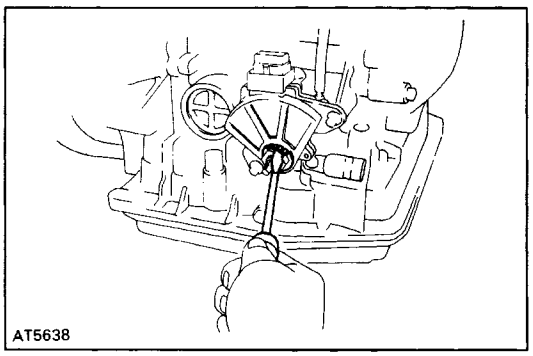
REMOVAL OF NEUTRAL START SWITCH

1. REMOVE ENGINE UNDER COVER

2. DISCONNECT SHIFT CABLE FROM MANUAL SHIFT LEVER

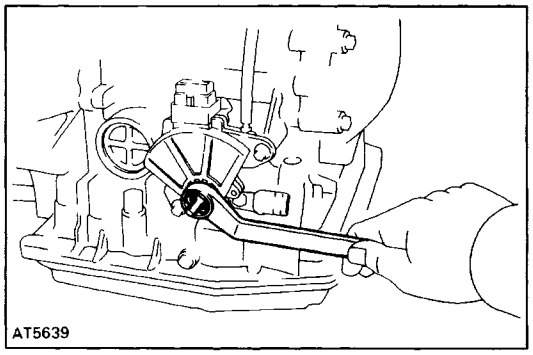


3. REMOVE MANUAL SHIFT LEVER



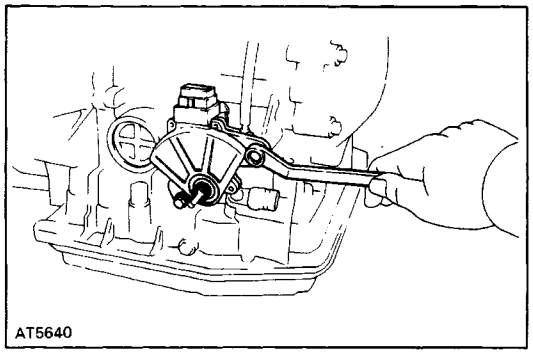
4. REMOVE NEUTRAL START SWITCH

(a) Using a screwdriver, pry off the lock washer.



(b) Remove the nut and lock washer.

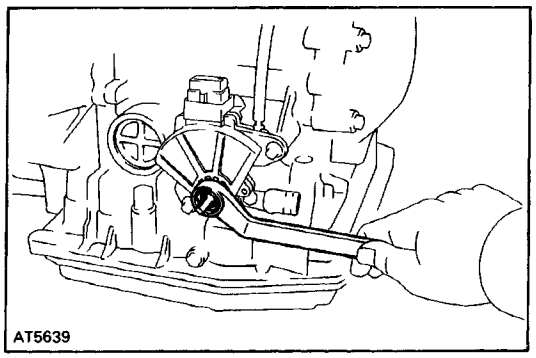
(c) (A241 E)
Remove the packing.



(d) Remove the two bolts and pull out the neutral start switch from manual valve shaft.

INSPECT NEUTRAL START SWITCH

A240E: See page AT–30



INSTALLATION OF NEUTRAL START SWITCH

1. INSTALL NEUTRAL START SWITCH

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

(b) (A241 E)

Install the packing.

(c) Install the nut and lock stopper.

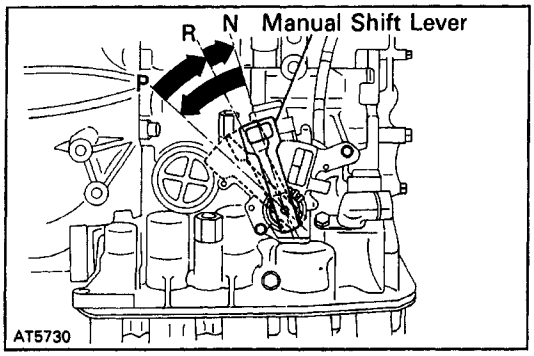
(d) Tighten the nut.

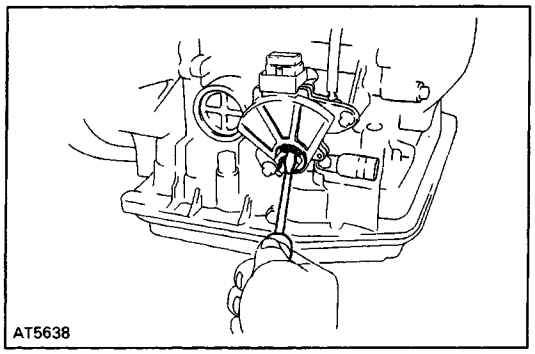
Torque: 6.9 N–m (70 kgf–cm, 61 in.–lbf)

(e) Temporarily install the manual shift lever.

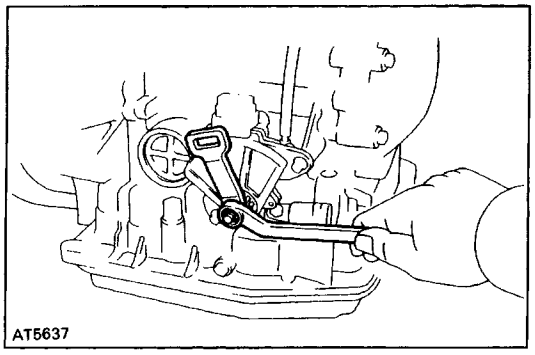
(f) Turn the lever counterclockwise until it stops, then turn it clockwise two notches.

(g) Remove the manual shift lever.





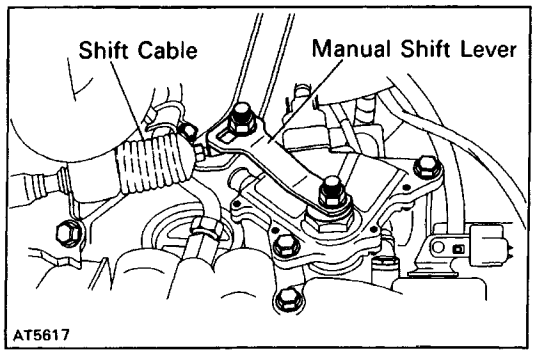
(h) Using a screwdriver, stake the nut with the nut stopper.



(i) Install the manual shift lever with the washer, and tighten the nut.

2. ADJUST NEUTRAL START SWITCH

(See page AT–18**)**



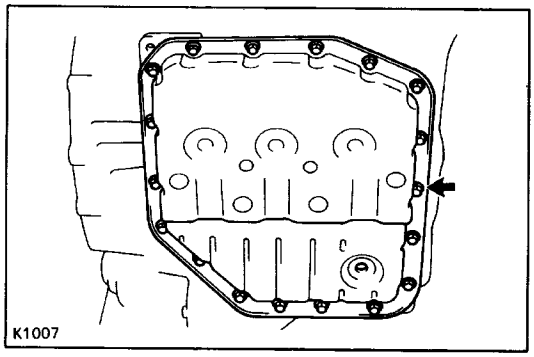
3. CONNECT SHIFT CABLE TO MANUAL SHIFT LEVER

4. INSTALL ENGINE UNDER COVER

Throttle Cable

REMOVAL OF THROTTLE CABLE

1. DISCONNECT THROTTLE CABLE FROM ENGINE



2. DRAIN TRANSAXLE FLUID

Remove the drain plug and drain the fluid into a suitable container.

3. REMOVE ENGINE UNDER COVER

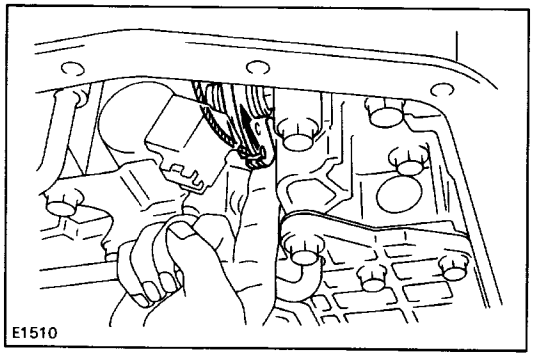
4. REMOVE NEUTRAL START SWITCH

(See page AT–51**)**

5. REMOVE OIL PAN AND GASKET

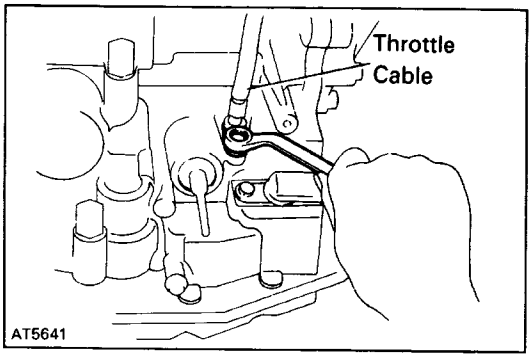
NOTICE: Some fluid will remain in the oil pan.

Remove all pan bolts, and carefully remove the pan assembly. Discard the gasket.



6. DISCONNECT THROTTLE CABLE FROM VALVE BODY

Disconnect the throttle cable from the cam.

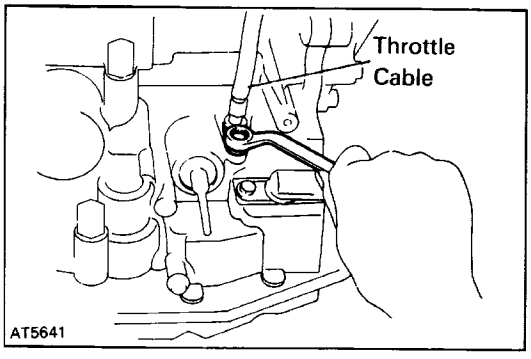


7. REMOVE THROTTLE CABLE

(a) Remove the retaining bolt and plate.

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

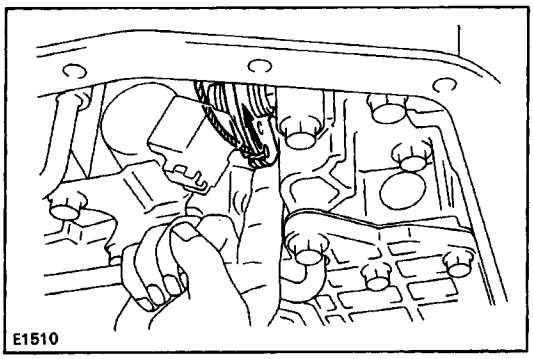
INSTALLATION OF THROTTLE CABLE



1. INSTALL CABLE INTO TRANSMISSION CASE

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

(b) Install the retaining plate and bolt.



2. CONNECT THROTTLE CABLE TO VALVE BODY

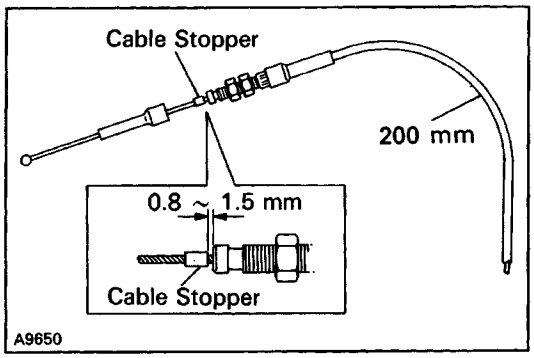
Connect the throttle cable to the cam.

3. INSTALL OIL PAN AND OIL PAN DRAIN PLUG

(See page AT–50**)**

4. INSTALL AND ADJUST NEUTRAL START SWITCH

(See page AT–18**)**



5. INSTALL ENGINE UNDER COVER

6. IF THROTTLE CABLE IS NEW, STAKE STOPPER ON INNER CABLE

HINT: New cable do not have a cable stopper staked.

(a) Bend the cable so there is a radius of about 200 mm (7.87 in.).

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

(c) Stake the stopper, 0.8 –1.5 mm (0.031 – 0.059 in.) from the end of outer cable.

7. CONNECT THROTTLE CABLE TO ENGINE

8. ADJUST THROTTLE CABLE

(See page AT–18**)**

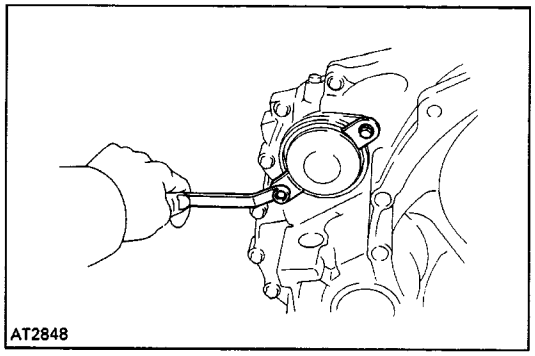
9. FILL TRANSAXLE WITH ATF

(See page AT–17**)**

NOTICE: Do not overfill.

Fluid type: ATF DEXRON © II

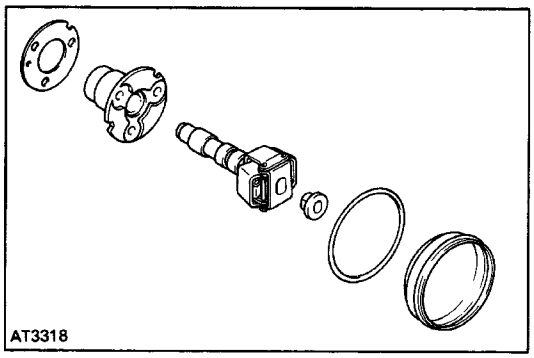
10. CHECK FLUID LEVEL



Governor Valve (A240L)

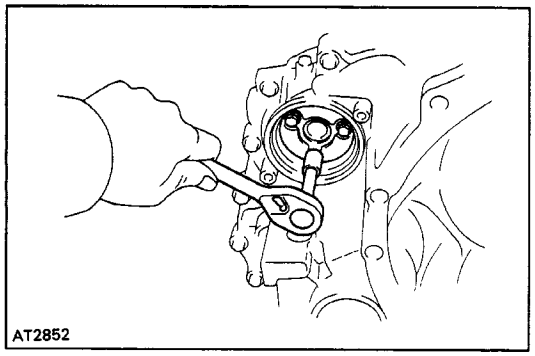
REMOVAL OF GOVERNOR VALVE

1. DISCONNECT SPEEDOMETER CABLE
2. REMOVE GOVERNOR COVER AND O–RING

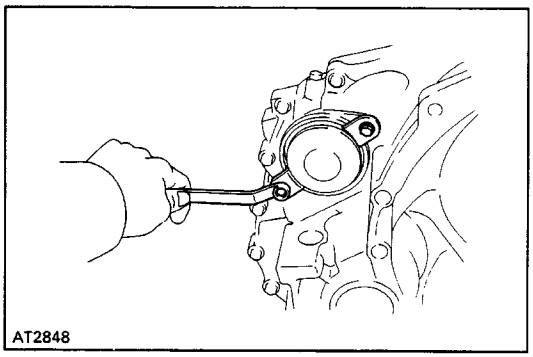


3. REMOVE GOVERNOR BODY WITH THRUST WASHER
4. REMOVE GOVERNOR BODY ADAPTOR
5. REMOVE GASKET

INSTALLATION OF GOVERNOR VALVE



1. INSTALL NEW GASKET TO GOVERNOR BODY ADAPTOR
2. INSTALL GOVERNOR BODY ADAPTOR



3. INSTALL GOVERNOR BODY WITH THRUST WASHER
4. INSTALL GOVERNOR COVER WITH NEW O–RING
5. CONNECT SPEEDOMETER CABLE

Differential Oil Seal

REMOVAL OF DIFFERENTIAL OIL SEALS

1. DRAIN TRANSAXLE FLUID

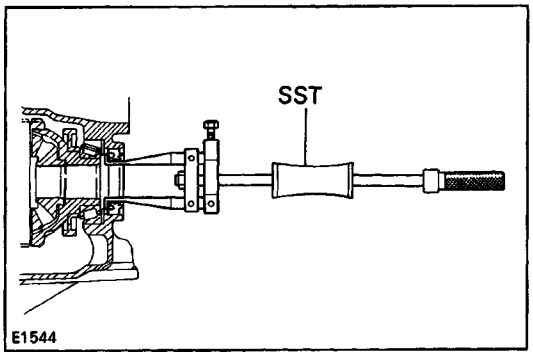
Remove the drain plug and drain the fluid into a suitable container.

2. REMOVE ENGINE UNDER COVER

3. REMOVE LH AND RH DRIVE SHAFTS

(See page SA–20**)**

4. REMOVE LH AND RH SIDE OIL SEALS

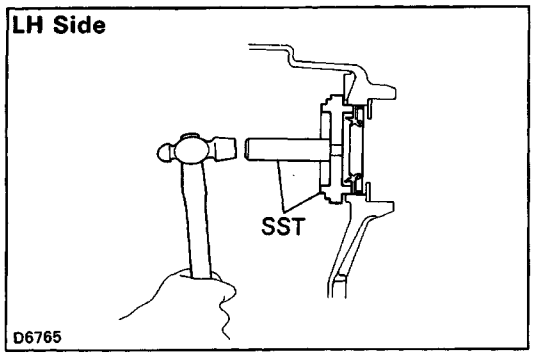


Using SST, drive out the both side oil seals.

SST 09308–00010

INSTALLATION OF DIFFERENTIAL OIL SEALS

1. INSTALL LH SIDE OIL SEAL



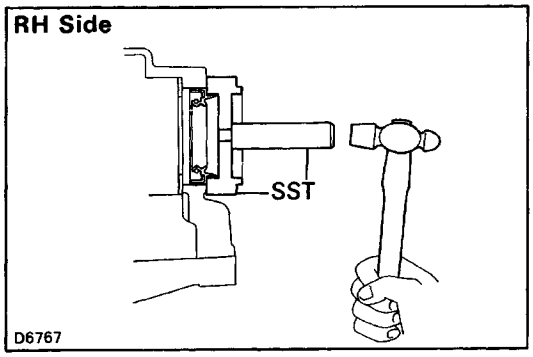
(a) Using SST, drive in a new oil seal until SST makes contact with the case surface.

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

Oil seal drive in depth: 5.3 mm (0.209 in.)

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

2. INSTALL RH SIDE OIL SEAL



(a) Using SST, drive in a new oil seal until SST makes contact with the case surface.

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

Oil seal drive in depth: 0 ± 0.5 mm (0.020 in.)

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

3. INSTALL LH AND RH DRIVE SHAFT

(See page SA–38**)**

4. INSTALL ENGINE UNDER COVER

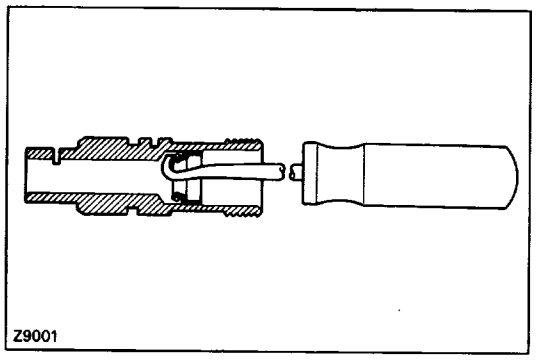
5. FILL TRANSMISSION WITH ATF

(See page AT–17**)**

NOTICE: Do not overfill.

Fluid type: ATF DEXRON © II

6. CHECK FLUID LEVEL

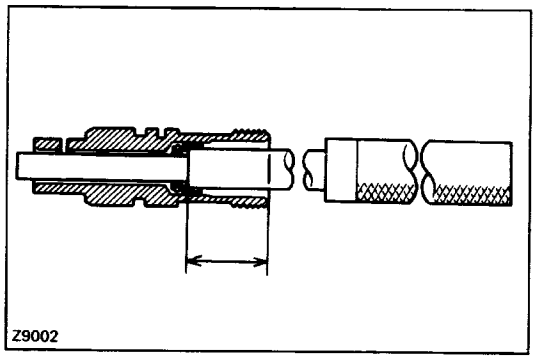


Speedometer Driven Gear
REPLACEMENT OF SPEEDOMETER DRIVEN GEAR OIL SEAL

1. REMOVE SPEEDOMETER DRIVEN GEAR OIL SEAL

Using SST, pull out the oil seal.

SST 09921–00010



2. INSTALL SPEEDOMETER DRIVEN GEAR OIL SEAL

Using SST, drive in the oil seal.

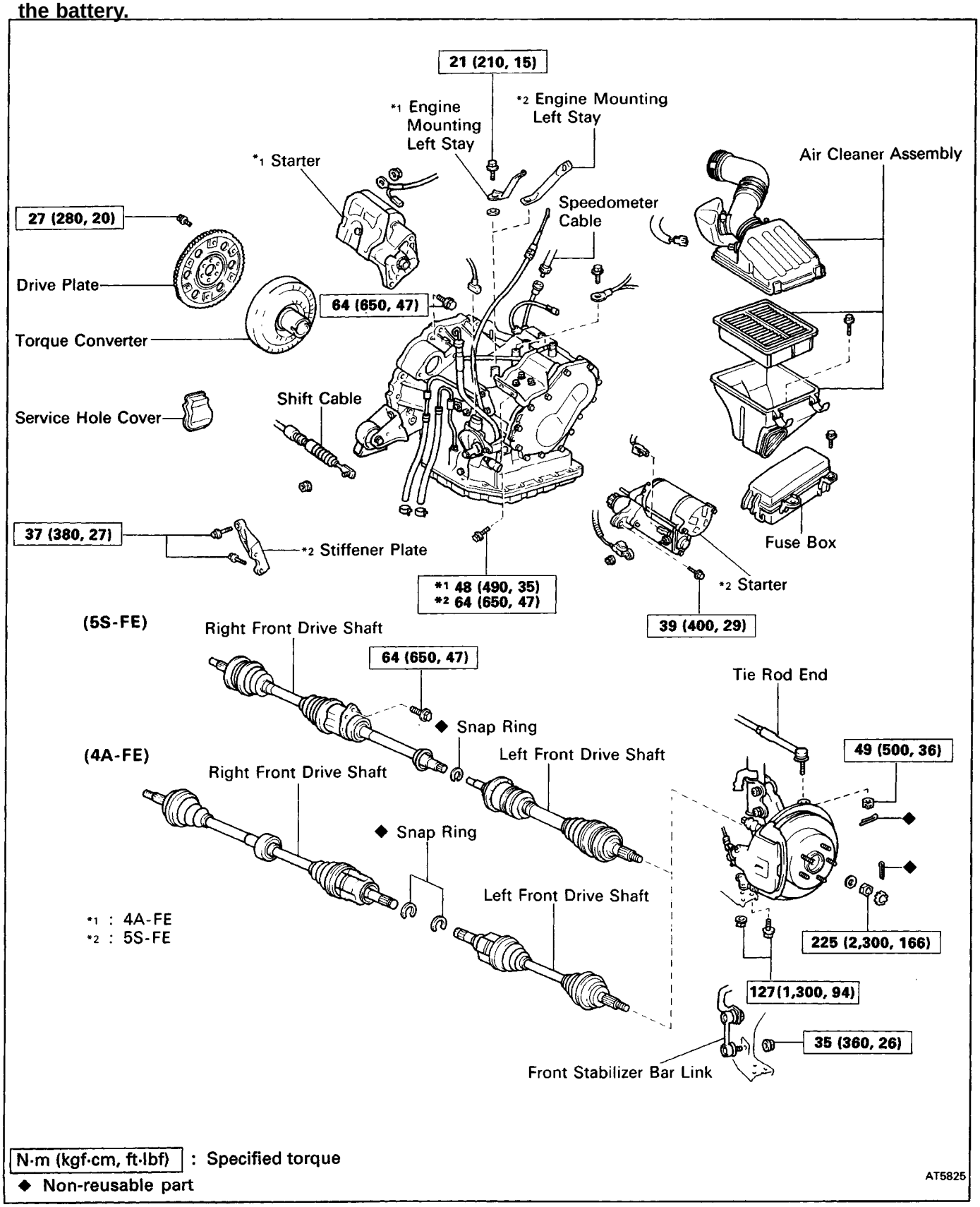
SST 09201–60011

Drive in depth: 19 mm (0.75 in.)

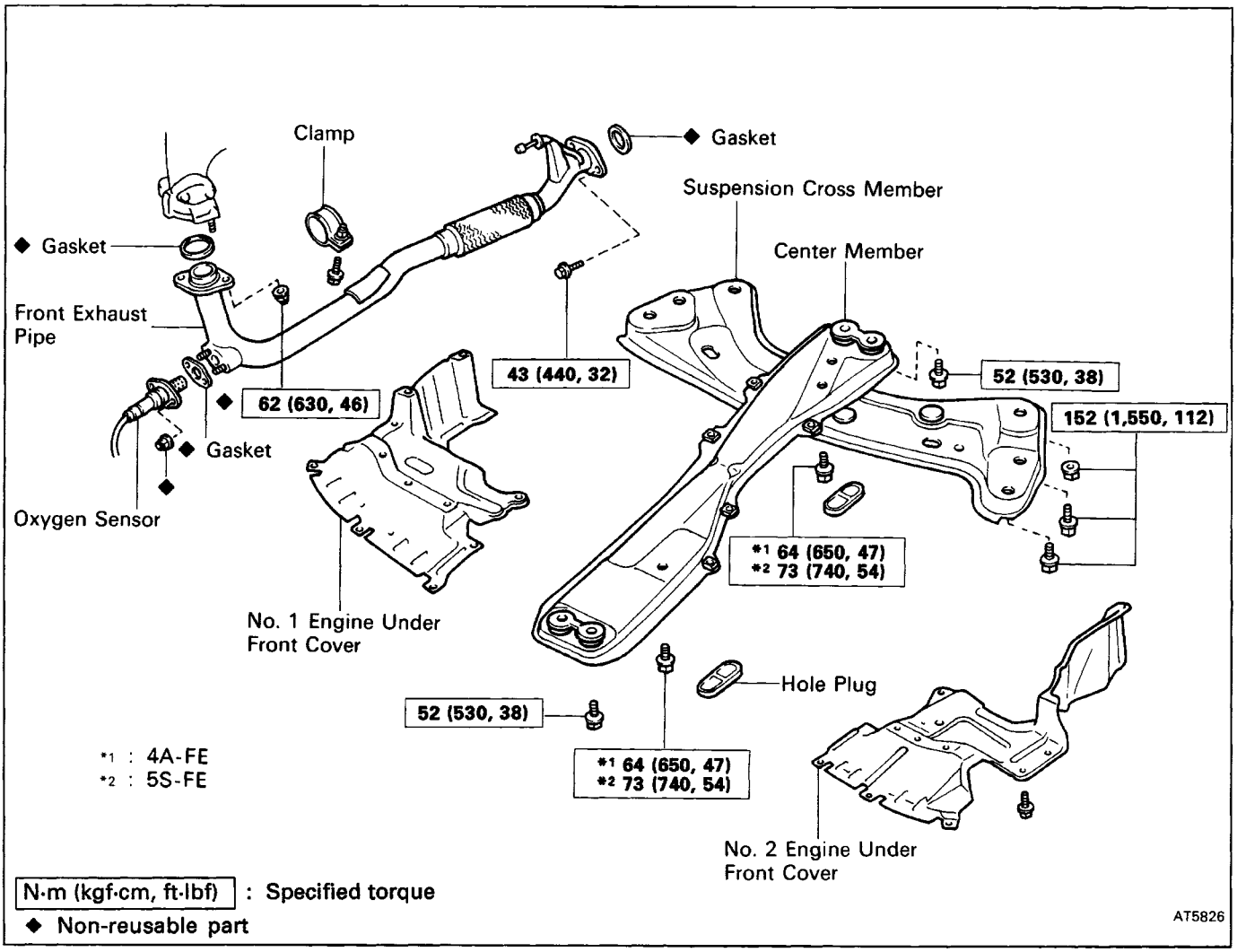
REMOVAL AND INSTALLATION OF TRANSAXLE

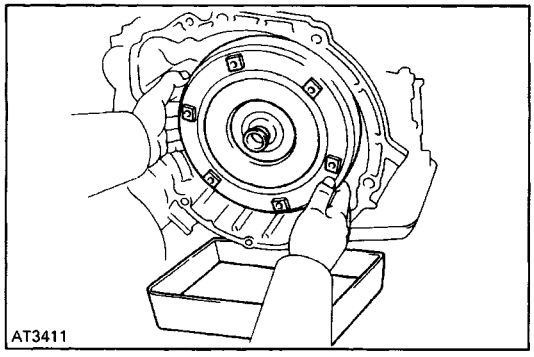
Remove and install the parts as shown.

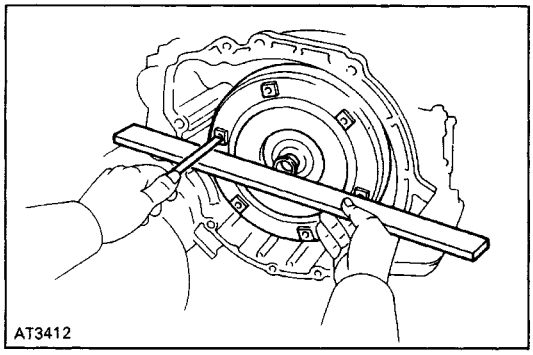
CAUTION: Work must be started after approx.30 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (–) terminal cable is disconnected from the battery.



REMOVAL AND INSTALLATION OF TRANSAXLE Cont'd







(MAIN POINT OF REMOVAL AND INSTALLATION)

1. DISCONNECT THROTTLE CABLE CONNECTIONS IN ENGINE COMPARTMENT BEFORE REMOVAL

2. INSTALL TORQUE CONVERTER IN TRANSAXLE

3. CHECK TORQUE CONVERTER INSTALLATION

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

Correct distance: 4A–FE 22.8 mm (0.898 in.)
5S–FE 16.7 mm (0.657 in.)

4. INSTALL TORQUE CONVERTER MOUNTING BOLTS

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

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

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

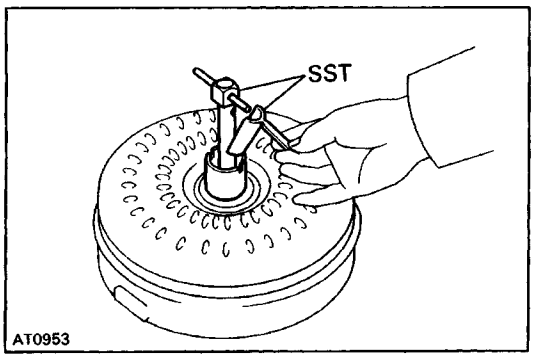
(c) Tighten the bolts evenly.

Torque: 27 N–m (280 kgf–cm, 20 ft–lbf)

TORQUE CONVERTER AND DRIVE PLATE

CLEAN TORQUE CONVERTER

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



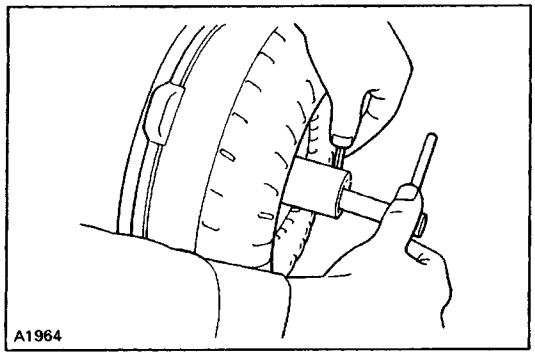
INSPECTION OF TORQUE CONVERTER

1. INSERT SST IN END OF TORQUE CONVERTER

(a) Install a turning tool in the inner race of the one–way clutch.

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

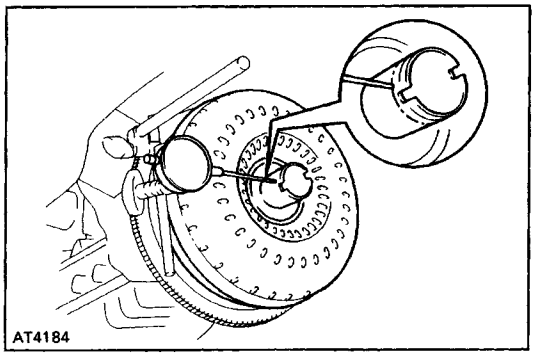
SST 09350–32014 (09351–32010, 09351–32020)



2. TEST ONE–WAY CLUTCH

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

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



3. MEASURE TORQUE CONVERTER SLEEVE RUNOUT

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

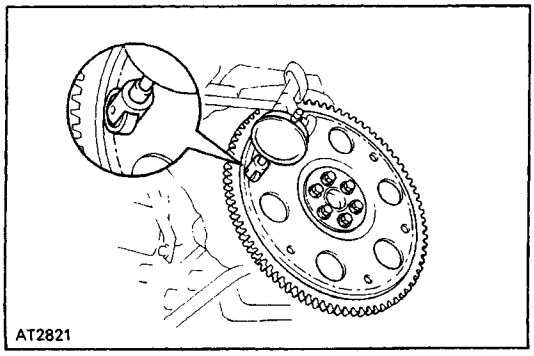
Torque: 27 N–m (280 kgf–cm, 20 ft–lbf)

Runout: 0.30 mm (0.0118 in.)

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

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

(b) Remove the torque converter.



4. MEASURE DRIVE PLATE RUNOUT AND INSPECT RING GEAR

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

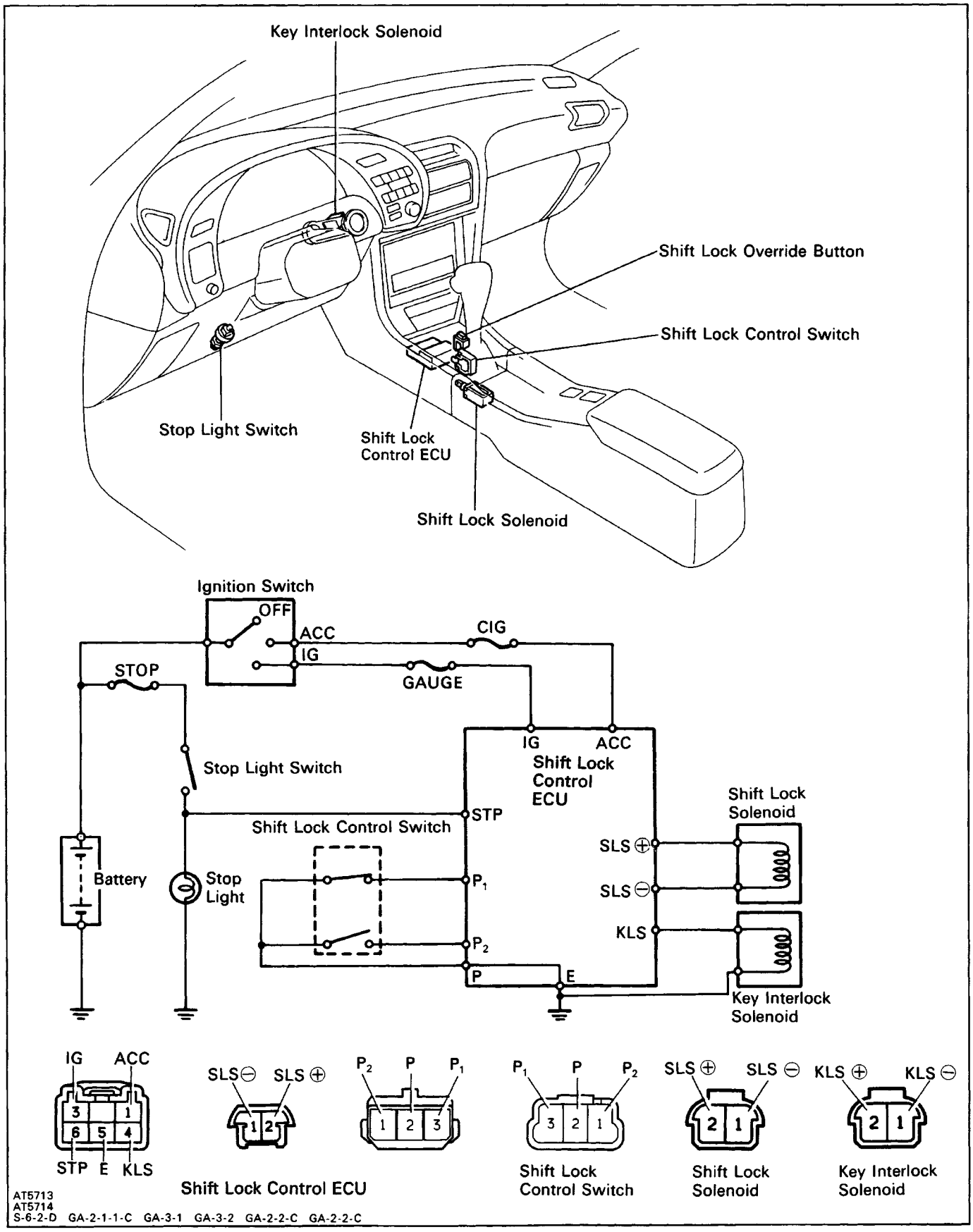
If runout exceeds 0.20 mm (0.0079 in.) or if the ring gear is damaged, replace the drive plate. If installing a new drive plate, note the orientation of the spacers and tighten the bolts.

Torque: 83 N–m (850 kgf–cm, 61 ft–lbf)

Runout: 0.20 mm (0.0079 in.)

SHIFT LOCK SYSTEM

COMPONENT AND CIRCUIT

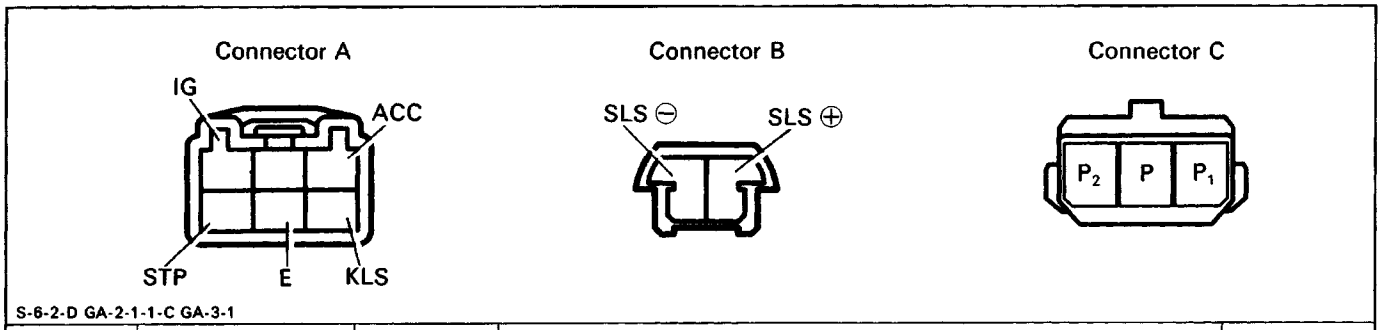


INSPECTION OF ELECTRIC CONTROL COMPONENTS

1. INSPECT SHIFT LOCK CONTROL ECU

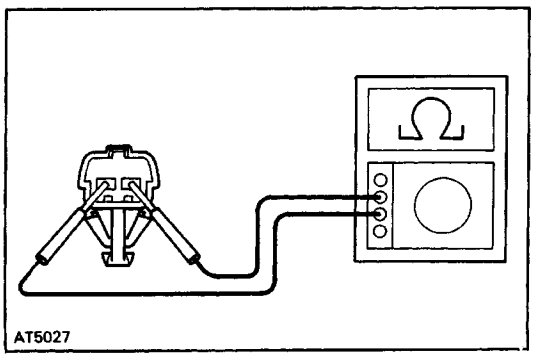
Do not disconnect the ECU connector.

Measure the voltage and continuity between terminals.



S-6-2-D GA-2-1-1-C GA-3-1

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

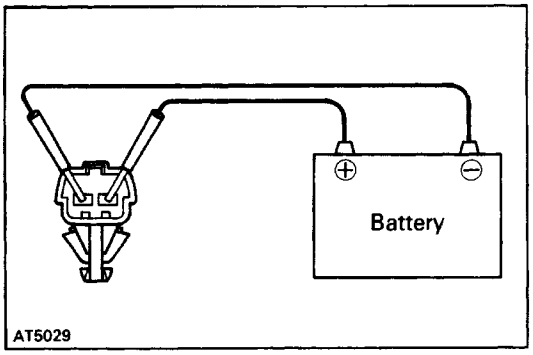


2. INSPECT SHIFT LOCK SOLENOID

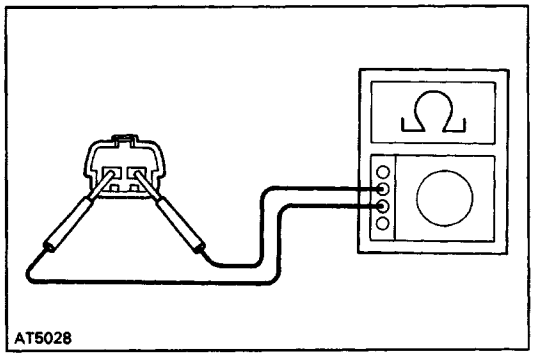
(a) Disconnect the solenoid connector.

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

Standard resistance: 21 – 27Ω



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

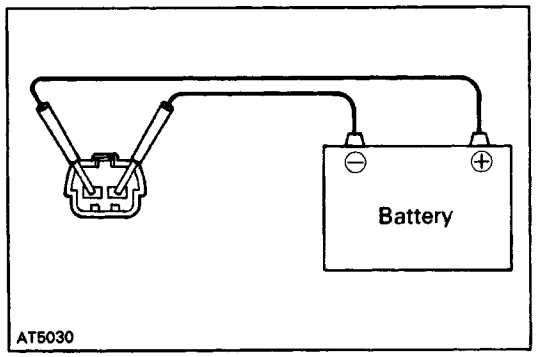


3. INSPECT KEY INTER LOCK SOLENOID

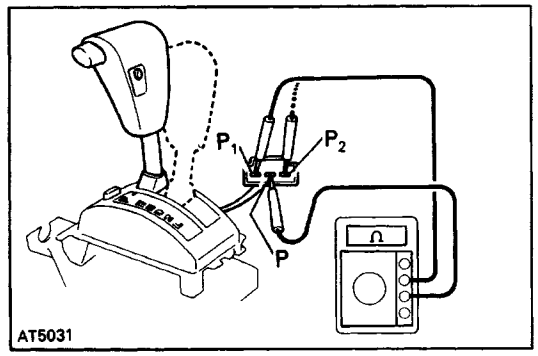
(a) Disconnect the solenoid connector.

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

Standard resistance: 12.5 –16.5Ω



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



4. INSPECT SHIFT LOCK CONTROL SWITCH

Check whether there is continuity between each terminals.

○—○ : Continuity

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