7A1 DIAGNOSIS

CONTENTS

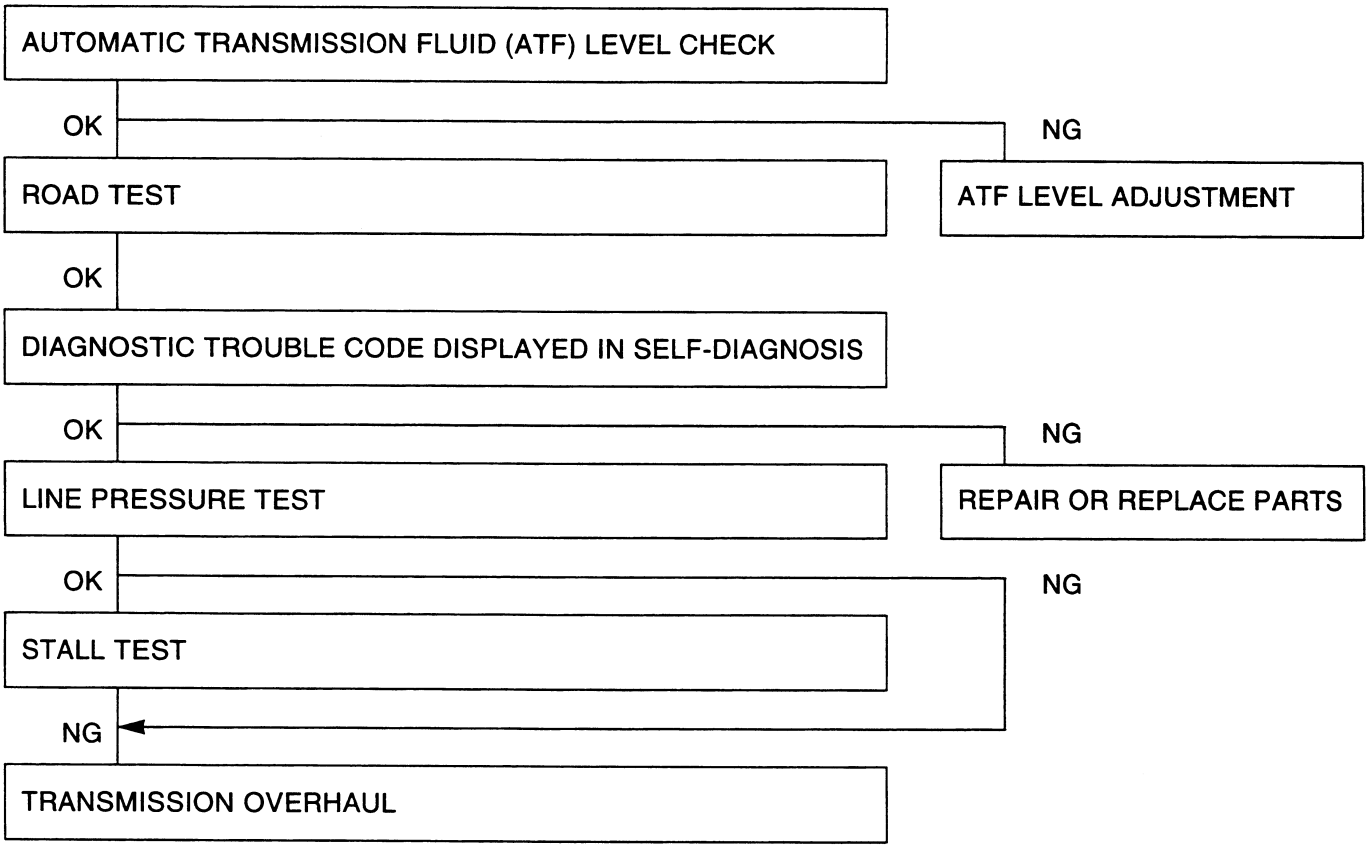
DESCRIPTION

Transmission fluid pressure together with clutch and brake band friction and other important transmission functions are controlled by electrical signals from the microcomputer.

This system is quite complex. Random diagnosing can produce inaccurate and misleading indications. It is important that the diagnosing procedure be carried out systematically.

Carefully follow the sequence outlined below to diagnose the automatic transmission assembly.

CAUTION:When the clutch appears to be slipping off in a road test, etc., or when the line pressure does not reach a preset value in a line pressure test, do not proceed to a stall test.



ROAD TEST

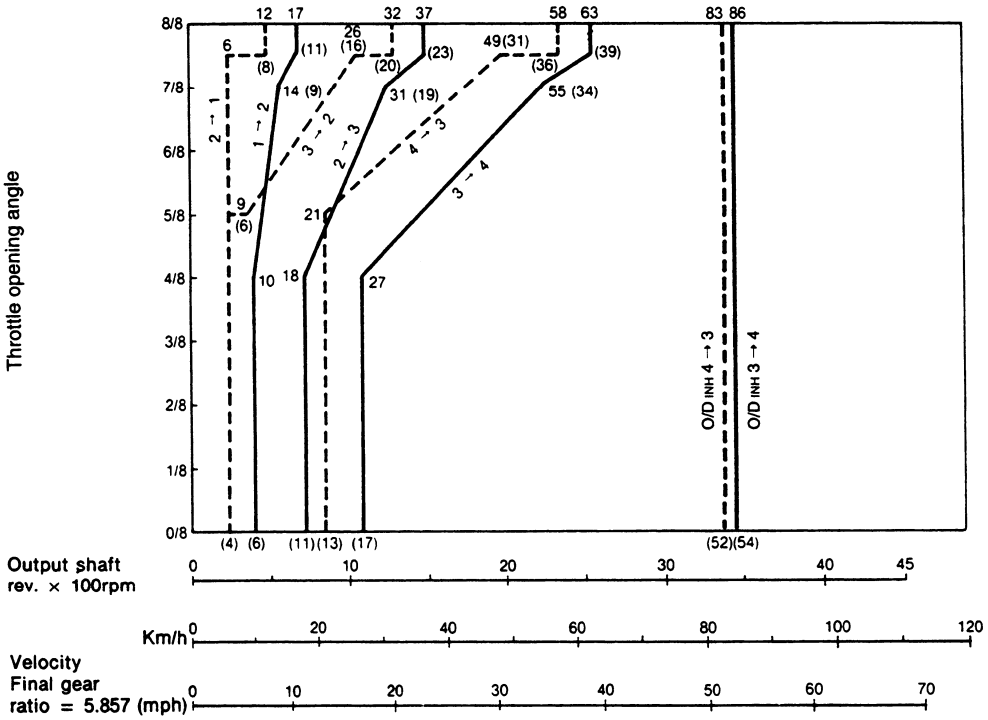
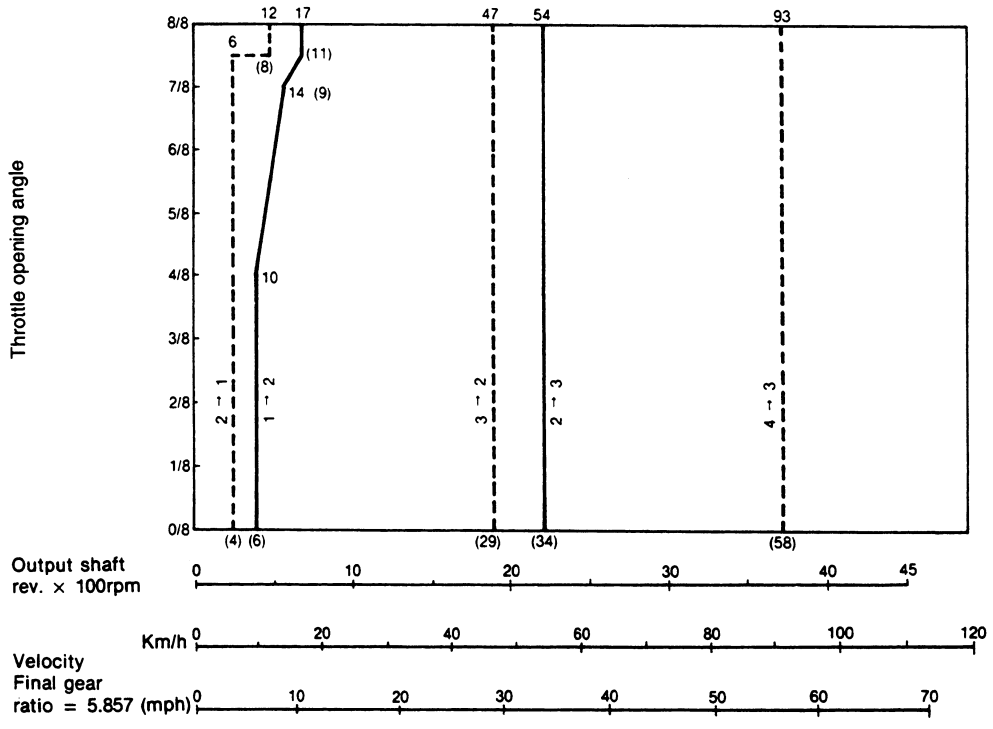
The road test should be performed by two people (one to drive and the other to note the required data) on a lightly traveled ordinary public road.

General Test Items

1. Compare the actual automatic shift speeds with the fixed shift schedule.
   a. Perform the diagnosis procedures.
   b. Note the actual shift up, shift down, and lock up speeds on the fixed shift schedule.
2. Check for shock or drag when the transmission shifts from one gear to another.
3. Check that the engine brake functions in the "2" and "1" ranges.
4. Check for abnormal noise or vibration.
   After completing the road test, make the necessary adjustments and repairs to the automatic transmission and related parts.

SHIFT POINT DIAGRAM AND LOCK-UP POINT DIAGRAM

Economy Pattern

Range \ Diagram	Shift Point Diagram
"D"	
"2"	

NOTICE: O/D INH refers to shifting from 4th to 3rd or from 3rd to 4th gears with the O/D (Overdrive) switch turned off.

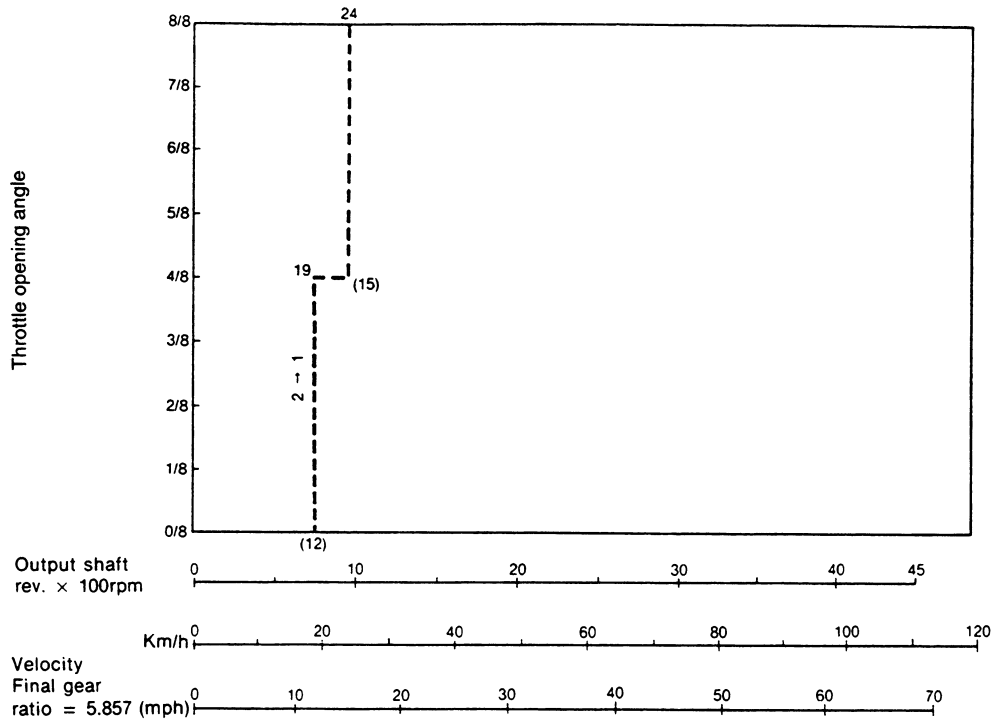
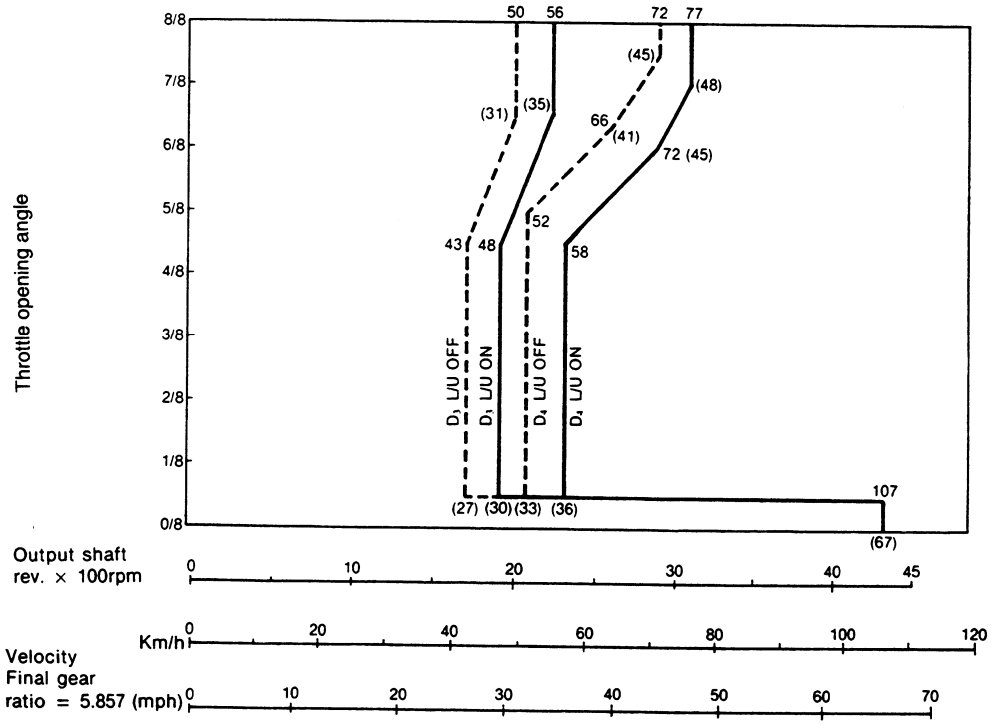
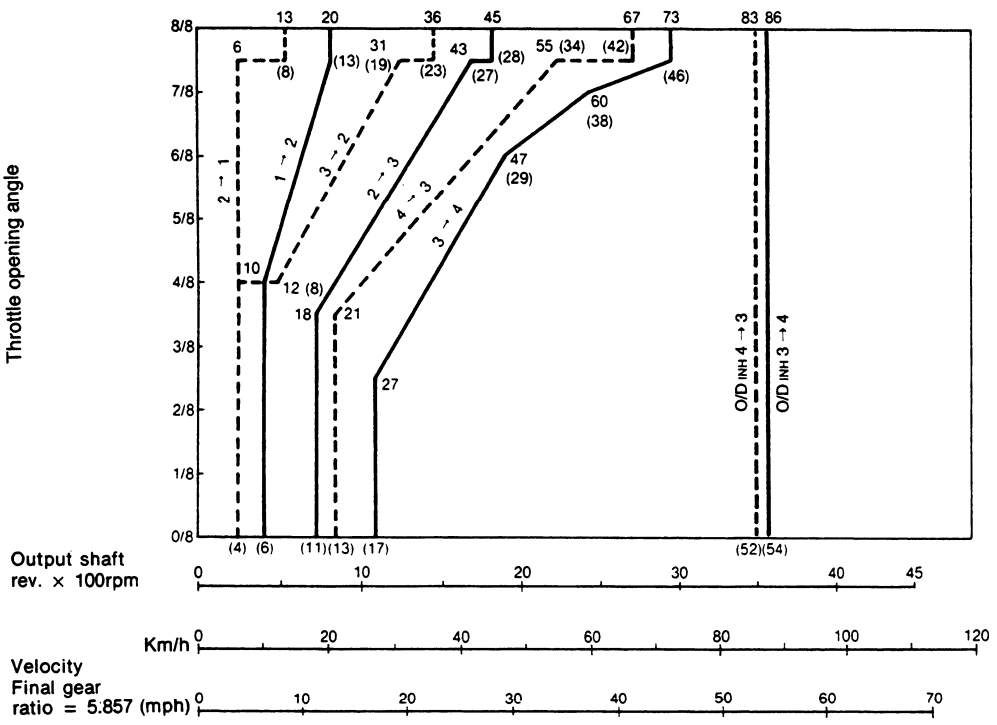
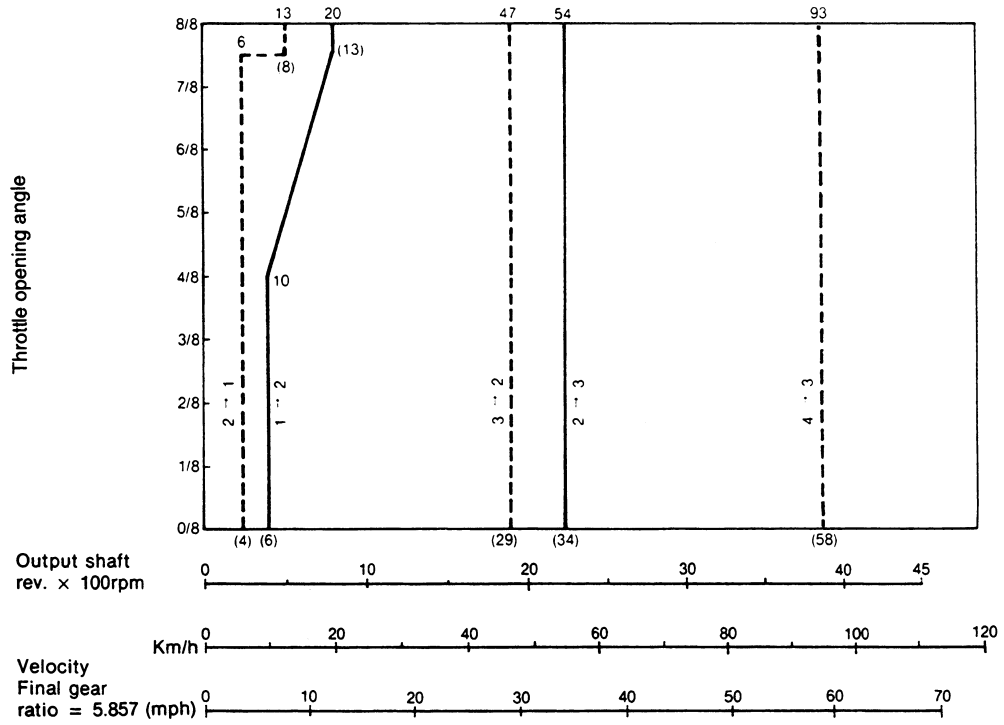
Diagram / Range	Shift Point Diagram
"1"	

Diagram / Range	Lock-up Point Diagram
"D"	

Normal Pattern

Range \ Diagram	Shift Point Diagram
"D"	
"2"	

NOTICE: O/D INH refers to shifting from 4th to 3rd or from 3rd to 4th gears with the O/D (Overdrive) switch turned off.

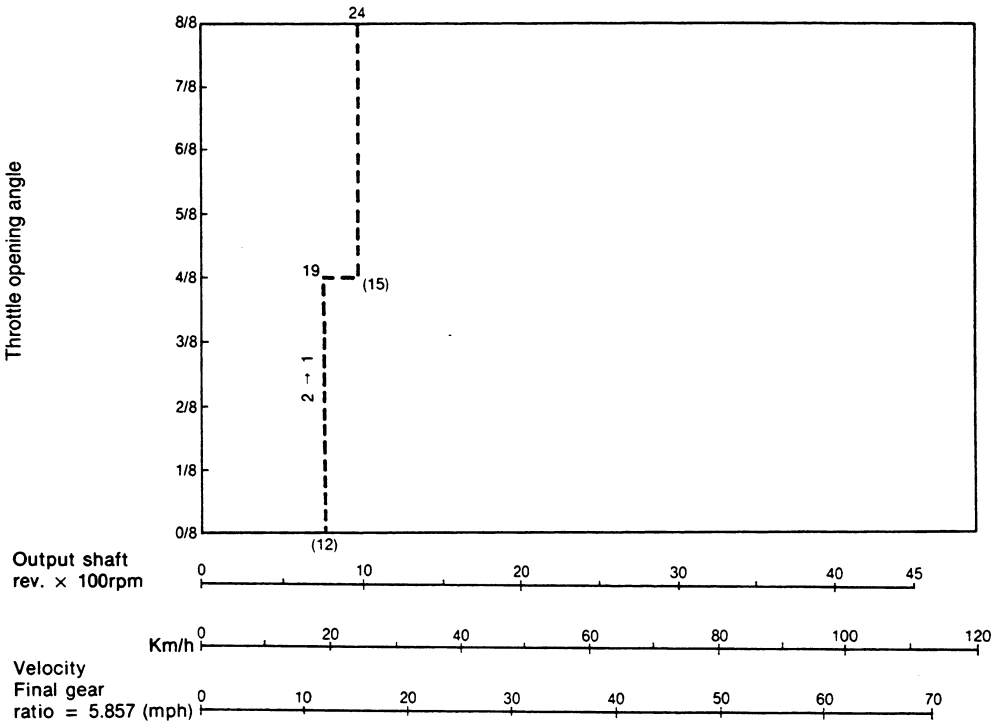
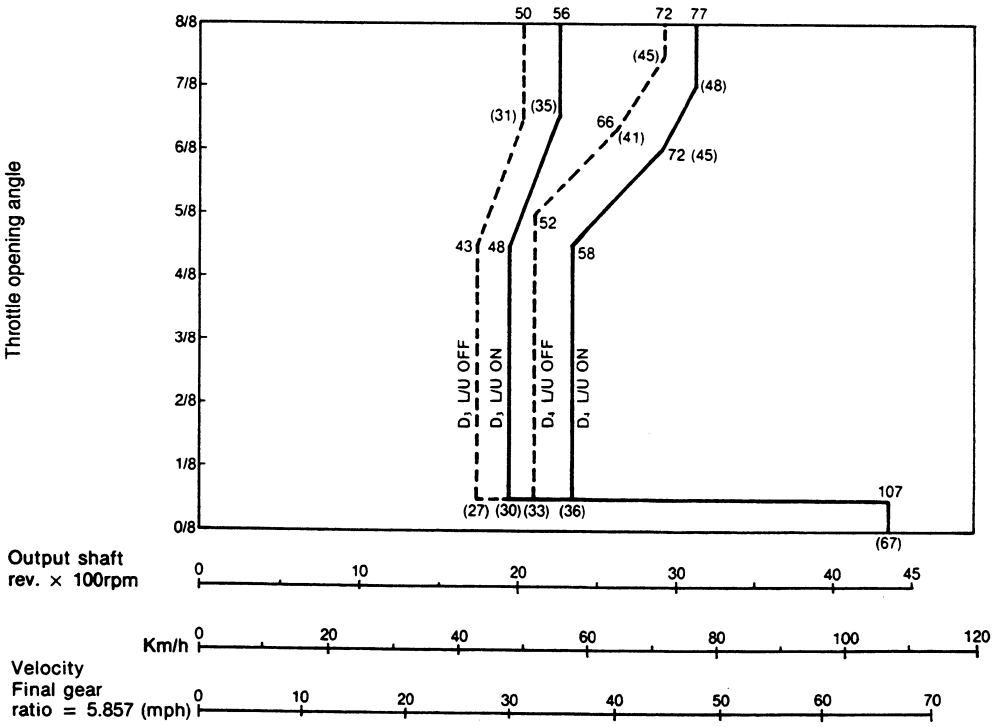
Diagram / Range	Shift Point Diagram
"1"	

Diagram / Range	Lock-up Point Diagram
"D"	

VEHICLE CONDITION DIAGNOSIS

This section is divided into eleven sub-sections.

1. Abnormal gear change
2. Slippage
3. Excessive shock when changing gears
4. Abnormal braking
5. Lock-up device malfunction
6. Abnormal transmission noise
7. Abnormal creepage
8. Hard engine starting
9. Engine stalling
10. Vehicle movement
11. Overheating/white smoke/abnormal smell/low maximum speed/poor acceleration

Note: Numbers in the chart show the inspection sequence

Inspection Item / Vehicle Condition	On-Vehicle Inspection																			
	ATF level and contamination	Control linkage	Inhibitor switch	Throttle position sensor	Vehicle speed sensor	Engine speed sensor	Engine idling speed	Line pressure	Shift solenoid A	Shift solenoid B	Line pressure solenoid	Lock-up solenoid	Overrun clutch solenoid	ATF thermosensor	Starter circuit	Overdrive switch	Exhaust brake switch	Idle switch	Kick-down switch	Economy drive switch
1. ABNORMAL GEAR CHANGE																				
Does not downshift from 4th to 3rd	1			2					4		5		3							
Does not downshift from 4th to 2nd	1			2					3	4										
Does not downshift from 3rd to 2nd	1			2					3	4										
Does not downshift from 3rd to 1st	1			2					3	4										
Does not downshift from 2nd to 1st	1			2					3	4										
Does not downshift from 4th to a lower gear when the accelerator pedal is fully depressed and the vehicle speed is not exceeding the kick-down range limit.				1	2				3	4										
Does not downshift from 3rd to 2nd when the selector is moved from the "D" range to the "2" range		5	1	2						4			3							
Upshifts from 2nd to 3rd when the selector is in the "2" range			1																	
Upshifts from 1st to 2nd when the selector is in the "1" range			1																	
Does not downshift from 2nd to 1st when the selector is moved from the "2" range to the "1" range			1		2				3											
Does not upshift from 1st to 2nd when the selector is in the "D" range		2	1		4				3											
Does not upshift from 2nd to 3rd when the selector is in the "D" range		2	1		4					3										

ATF: Automatic Transmission Fluid

Note: Numbers in the chart show the inspection sequence

Vehicle Condition \ Inspection Item	On-Vehicle Inspection																			
	ATF level and contamination	Control linkage	Inhibitor switch	Throttle position sensor	Vehicle speed sensor	Engine speed sensor	Engine idling speed	Line pressure	Shift solenoid A	Shift solenoid B	Line pressure solenoid	Lock-up solenoid	Overrun clutch solenoid	ATF thermosensor	Starter circuit	Overdrive switch	Exhaust brake switch	Idle switch	Kick-down switch	Economy drive switch
1. ABNORMAL GEAR CHANGE (CONT.)																				
Does not upshift from 3rd to 4th when the selector is in the "D" range		2	1		4				3					5		6				
Shifts from 1st to 3rd (missing 2nd) when the selector is in the "D" range	1				2															
All upshift points too high				1	4				5	6								2	3	
All downshift points too high				1	4													2	3	
Downshifts from 4th to a lower gear when the accelerator pedal is fully depressed with the vehicle speed exceeding the kick-down limit, causing engine overrunning				2	1				5	6								3	4	
2. SLIPPAGE																				
Slippage when upshifting from 1st to 2nd	1			2				5										3	4	
Slippage when upshifting from 2nd to 3rd	1			2				5										3	4	
Slippage when upshifting from 3rd to 4th	1			2				5										3	4	
Fully depressing the accelerator pedal causes the transmission to downshift from 4th to 3rd, but the engine races and slippage occurs	1			2				5			6							3	4	
Fully depressing the accelerator pedal causes the transmission to downshift from 4th to 2nd, but the engine races and slippage occurs	1			2				5	7		6							3	4	

ATF: Automatic Transmission Fluid

Note: Numbers in the chart show the inspection sequence

Vehicle Condition / Inspection Item	On-Vehicle Inspection																			
	ATF level and contamination	Control linkage	Inhibitor switch	Throttle position sensor	Vehicle speed sensor	Engine speed sensor	Engine idling speed	Line pressure	Shift solenoid A	Shift solenoid B	Line pressure solenoid	Lock-up solenoid	Overrun clutch solenoid	ATF thermosensor	Starter circuit	Overdrive switch	Exhaust brake switch	Idle switch	Kick-down switch	Economy drive switch
2. SLIPPAGE (CONT.)																				
Fully depressing the accelerator pedal causes the transmission to downshift from 3rd to 2nd, but the engine races and slippage occurs	1			2				5			6		7					3	4	
Fully depressing the accelerator pedal causes the transmission to downshift from 4th or 3rd to 1st, but the engine races and slippage occurs	1			2				5			6							3	4	
Slippage felt during initial acceleration	1	2		3				6			7							4	5	
3. EXCESSIVE SHOCK WHEN CHANGING GEARS																				
Excessive shock when upshifting from 2nd to 3rd with the selector in the "D" range				1				4										2	3	
Excessive shock when upshifting from 3rd to 4th with the selector in the "D" range				1				4										2	3	
Excessive shock when the selector is moved to the "1" range from the "2" range or the "D" range																	1			
Excessive shock when the selector is moved from the "N" range to the "D" range				2		7	1	5			8			6				3	4	
Shock is felt when the accelerator pedal is released and the vehicle begins to slow down				1				4					5					2	3	
Excessive shock when upshifting from 1st to 2nd with the selector in the "D" range				1				4						5				2	3	

ATF: Automatic Transmission Fluid

Note: Numbers in the chart show the inspection sequence

Vehicle Condition \ Inspection Item	On-Vehicle Inspection																			
	ATF level and contamination	Control linkage	Inhibitor switch	Throttle position sensor	Vehicle speed sensor	Engine speed sensor	Engine idling speed	Line pressure	Shift solenoid A	Shift solenoid B	Line pressure solenoid	Lock-up solenoid	Overrun clutch solenoid	ATF thermosensor	Starter circuit	Overdrive switch	Exhaust brake switch	Idle switch	Kick-down switch	Economy drive switch
4. ABNORMAL BRAKING																				
Brake functions when upshifting from 1st to 2nd in the "D" range	1																			
Brake functions when upshifting from 2nd to 3rd in the "D" range	1																			
Brake functions when upshifting from 3rd to 4th in the "D" range	1																			
Engine brake does not function with the selector in the "1"		2	1	3	6				7				8				9	4	5	
Brake functions abruptly when the selector is moved to the "R" range from the "N" range or the "P" range	1	2						3			4									
5. LOCK-UP DEVICE MALFUNCTION																				
Lock-up device does not function			5	1	4	6		8				9		7				2	3	
Lock-up piston slippage	1			2				5			7	6						3	4	
Lock-up point too high or too low				1	4							5						2	3	
Excessive lock-up shock				1	4							5						2	3	
6. ABNORMAL TRANSMISSION NOISE																				
Noisy at idling when vehicle is stationary	1			3	5	6		2										4		
Transmission noisy in all drive ranges	1																			

ATF: Automatic Transmission Fluid

Note: Numbers in the chart show the inspection sequence

Vehicle Condition \ Inspection Item	On-Vehicle Inspection																			
	ATF level and contamination	Control linkage	Inhibitor switch	Throttle position sensor	Vehicle speed sensor	Engine speed sensor	Engine idling speed	Line pressure	Shift solenoid A	Shift solenoid B	Line pressure solenoid	Lock-up solenoid	Overrun clutch solenoid	ATF thermosensor	Starter circuit	Overdrive switch	Exhaust brake switch	Idle switch	Kick-down switch	Economy drive switch
7. ABNORMAL CREEPAGE																				
Excessive creepage							1													
No creepage	1							2												
8. ENGINE STARTING PROBLEM																				
Engine will not start in either the "P" range or the "N" range		2	3												1					
Engine starts in one of the drive ranges		1	2																	
Vehicle moves when shifting with the selector in the "N" range		1																		
9. ENGINE STALL																				
Engine stalls when vehicle stopped with foot brake	1																			
Engine stalls when the selector is moved from the "N" or "P" range to one of the drive ranges							1					2								
10. VEHICLE MOVEMENT																				
Vehicle will not move when the selector is in the "D" range (Vehicle moves in other drive ranges)		1																		
Vehicle will not move in either the "D" range or the "2" range (Vehicle moves in other drive ranges)	1							2			3									

ATF: Automatic Transmission Fluid

Note: Numbers in the chart show the inspection sequence

Vehicle Condition / Inspection Item	On-Vehicle Inspection																				
	ATF level and contamination	Control linkage	Inhibitor switch	Throttle position sensor	Vehicle speed sensor	Engine speed sensor	Engine idling speed	Line pressure	Shift solenoid A	Shift solenoid B	Line pressure solenoid	Lock-up solenoid	Overrun clutch solenoid	ATF thermosensor	Starter circuit	Overdrive switch	Exhaust brake switch	Idle switch	Kick-down switch	Economy drive switch
10. VEHICLE MOVEMENT (CONT.)																				
Severe slippage and poor acceleration in either the "D" range or the "2" range (No problem in other drive ranges)	1							2			3									
Vehicle will not move in the "R" range (Vehicle moves in other drive ranges)		1						2			3									
Severe slippage in the "R" range (No problem in other drive ranges)								1			2									
Vehicle will not move in any of the drive ranges	1	2		3				4			5									
Vehicle moves when the selector lever is in the "P" range		1																		
Parking gear does not release when the selector lever is moved from the "P" range		1																		
11. OVERHEATING/WHITE SMOKE/ABNORMAL SMELL/LOW MAXIMUM SPEED/POOR ACCELERATION																				
A/T unit overheating	1			3			2	4			5									
ATF escaping from breather pipe during vehicle operation	1																			
Abnormal smell from fluid charge pipe	1																			
Low maximum speed and/or poor acceleration	1		2						3	4										

A/T: Automatic Transmission ATF: Automatic Transmission Fluid

Note: Numbers in the chart show the inspection sequence

Inspection Item / Vehicle Condition	Unit Inspection																
	Torque converter	Oil pump	Reverse clutch	High clutch	Forward clutch	Forward one-way clutch	Overrun clutch	Low one-way clutch	Low and reverse brake	Brake band (include servo)	Parking linkage	Valve body assembly	Accumulator (N-D)	Accumulator (1-2)	Accumulator (2-3)	Accumulator (3-4)
1. ABNORMAL GEAR CHANGE																
Does not downshift from 4th to 3rd							3		2			1				
Does not downshift from 4th to 2nd				2						3		1				
Does not downshift from 3rd to 2nd				2						3		1				
Does not downshift from 3rd to 1st				3				2		4		1				
Does not downshift from 2nd to 1st				3				2		4		1				
Does not downshift from 4th to a lower gear when the accelerator pedal is fully depressed and the vehicle speed is not exceeding the kick-down range limit																
Does not downshift from 3rd to 2nd when the selector is moved from the "D" range to the "2" range							3			2		1				
Upshifts from 2nd to 3rd when the selector is in the "2" range																
Upshifts from 1st to 2nd when the selector is in the "1" range																
Does not downshift from 2nd to 1st when the selector is moved from the "2" range to the "1" range							2		3			1				
Does not upshift from 1st to 2nd when the selector is in the "D" range										2		1				
Does not upshift from 2nd to 3rd when the selector is in the "D" range				3						2		1				

Note: Numbers in the chart show the inspection sequence

Inspection Item / Vehicle Condition	Unit Inspection															
	Torque converter	Oil pump	Reverse clutch	High clutch	Forward clutch	Forward one-way clutch	Overrun clutch	Low one-way clutch	Low and reverse brake	Brake band (include servo)	Parking linkage	Valve body assembly	Accumulator (N-D)	Accumulator (1-2)	Accumulator (2-3)	Accumulator (3-4)
1. ABNORMAL GEAR CHANGE (CONT.)																
Does not upshift from 3rd to 4th when the selector is in the "D" range										1						
Shifts from 1st to 3rd (missing 2nd) when the selector is in the "D" range										2				1		
All upshift points too high																
All downshift points too high																
Downshifts from 4th to a lower gear when the accelerator pedal is fully depressed with the vehicle speed exceeding the kick-down limit, causing engine overrunning																
2. SLIPPAGE																
Slippage when upshifting from 1st to 2nd										3		2		1		
Slippage when upshifting from 2nd to 3rd				3						4		2			1	
Slippage when upshifting from 3rd to 4th				3						4		2				1
Fully depressing the accelerator pedal causes the transmission to downshift from 4th to 3rd, but the engine races and slippage occurs				2	3							1				
Fully depressing the accelerator pedal causes the transmission to downshift from 4th to 2nd, but the engine races and slippage occurs					3					2		1				

Note: Numbers in the chart show the inspection sequence

Inspection Item / Vehicle Condition	Unit Inspection															
	Torque converter	Oil pump	Reverse clutch	High clutch	Forward clutch	Forward one-way clutch	Overrun clutch	Low one-way clutch	Low and reverse brake	Brake band (include servo)	Parking linkage	Valve body assembly	Accumulator (N-D)	Accumulator (1-2)	Accumulator (2-3)	Accumulator (3-4)
2. SLIPPAGE (CONT.)																
Fully depressing the accelerator pedal causes the transmission to downshift from 3rd to 2nd, but the engine races and slippage occurs				5	4					3		1			2	
Fully depressing the accelerator pedal causes the transmission to downshift from 4th or 3rd to 1st, but the engine races and slippage occurs					2	3		4				1				
Slippage felt during initial acceleration	7	6	4		3				5			1	2			
3. EXCESSIVE SHOCK WHEN CHANGING GEARS																
Excessive shock when upshifting from 2nd to 3rd with the selector in the "D" range				3						4		2			1	
Excessive shock when upshifting from 3rd to 4th with the selector in the "D" range							3			4		2				1
Excessive shock when the selector is moved to the "1" range from the "2" range or the "D" range									2			1				
Excessive shock when the selector is moved from the "N" range or the "D" range					3							2	1			
Shock is felt when the accelerator pedal is released and the vehicle begins to slow down												1				
Excessive shock when upshifting from 1st to 2nd with the selector in the "D" range										3		2		1		

Note: Numbers in the chart show the inspection sequence

Inspection Item / Vehicle Condition	Unit Inspection																
	Torque converter	Oil pump	Reverse clutch	High clutch	Forward clutch	Forward one-way clutch	Overrun clutch	Low one-way clutch	Low and reverse brake	Brake band (include servo)	Parking linkage	Valve body assembly	Accumulator (N-D)	Accumulator (1-2)	Accumulator (2-3)	Accumulator (3-4)
4. ABNORMAL BRAKING																
Brake functions when upshifting from 1st to 2nd in the "D" range			1	3				4	2							
Brake functions when upshifting from 2nd to 3rd in the "D" range										1						
Brake functions when upshifting from 3rd to 4th in the "D" range			3			2	1									
Engine brake does not function with the selector in the "1"							2		3			1				
Brake functions abruptly when the selector is moved to the "R" range from the "N" range or the "P" range				2	4		5			3		1				
5. LOCK-UP DEVICE MALFUNCTION																
Lock-up device does not function	2											1				
Lock-up piston slippage	2											1				
Lock-up point too high or too low												1				
Excessive lock-up shock	2											1				
6. ABNORMAL TRANSMISSION NOISE																
Noisy at idling when vehicle is stationaly	2	1														
Transmission noisy in all drive ranges	1															

Note: Numbers in the chart show the inspection sequence

Inspection Item / Vehicle Condition	Unit Inspection															
	Torque converter	Oil pump	Reverse clutch	High clutch	Forward clutch	Forward one-way clutch	Overrun clutch	Low one-way clutch	Low and reverse brake	Brake band (include servo)	Parking linkage	Valve body assembly	Accumulator (N-D)	Accumulator (1-2)	Accumulator (2-3)	Accumulator (3-4)
7. ABNORMAL CREEPAGE																
Excessive creepage																
No. creepage	4	3			2							1				
8. ENGINE STARTING PROBLEM																
Engine will not start in either the "P" range or the "N" range																
Engine starts in one of the drive ranges																
Vehicle moves when shifting with the selector in the "N" range			2		1		3									
9. ENGINE STALL																
Engine stalls when vehicle stopped with foot brake																
Engine stalls when the selector is moved from the "N" or "P" range to one of the drive ranges	2											1				
10. VEHICLE MOVEMENT																
Vehicle will not move when the selector is in the "D" range (Vehicle moves in other drive ranges)																
Vehicle will not move in either the "D" range or the "2" range (Vehicle moves in other drive ranges)								1								

Note: Numbers in the chart show the inspection sequence

Vehicle Condition / Inspection Item	Unit Inspection															
	Torque converter	Oil pump	Reverse clutch	High clutch	Forward clutch	Forward one-way clutch	Overrun clutch	Low one-way clutch	Low and reverse brake	Brake band (include servo)	Parking linkage	Valve body assembly	Accumulator (N-D)	Accumulator (1-2)	Accumulator (2-3)	Accumulator (3-4)
10. VEHICLE MOVEMENT (CONT.)																
Severe slippage and poor acceleration in either the "D" range or the "2" range (No problem in other drive ranges)								1								
Vehicle will not move in the "R" range (Vehicle moves in other drive ranges)			2	3	4		5		6			1				
Severe slippage in the "R" range (No problem in other drive ranges)			2	3	4		5		6			1				
Vehicle will not move in any of the drive ranges	5	1		2					4	3	6					
Vehicle moves when the selector lever is in the "P" range											1					
Parking gear does not release when the selector lever is moved from the "P" range											1					
11. OVERHEATING/WHITE SMOKE/ABNORMAL SMELL/LOW MAXIMUM SPEED/POOR ACCELERATION																
A/T unit overheating	9	2	3	4	6		7		8	5		1				
ATF escaping from breather pipe during vehicle operation			1	2	4		5		6	3						
Abnormal smell from fluid charge pipe	1	2	3	4	6		7		8	5						
Low maximum speed and/or poor acceleration	7	6	2	3					5	4		1				

A/T: Automatic Transmission ATF: Automatic Transmission Fluid

SELF DIAGNOSIS

SELF DIAGNOSIS PROCEDURE

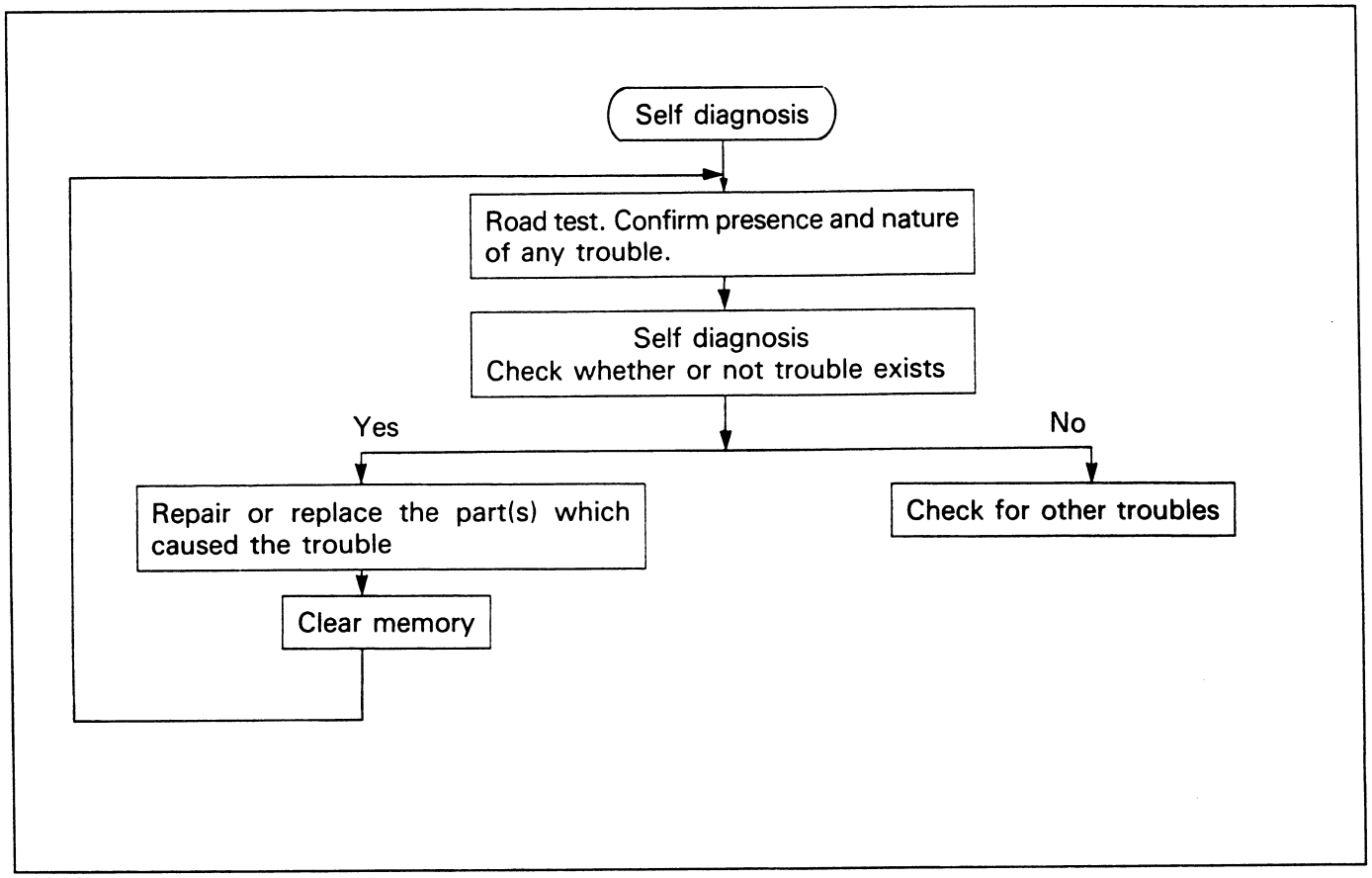


Figure 1. Self diagnosis procedure

SELF DIAGNOSIS INFORMATION

The transmission control module of this system has the function of self diagnosis. If any trouble occurs in this system, the economy drive indicator light functions to inform operator of possible troubles related to the following 10 components.

1. Vehicle speed sensor-1 (Installed on the Transmission)
2. Vehicle speed sensor-2 (Built in the speedometer)
3. Throttle position sensor
4. Shift solenoid A
5. Shift solenoid B
6. Overrun clutch solenoid
7. Lock-up solenoid
8. Automatic transmission fluid thermosensor or battery back-up voltage
9. Engine speed sensor
10. Line pressure solenoid

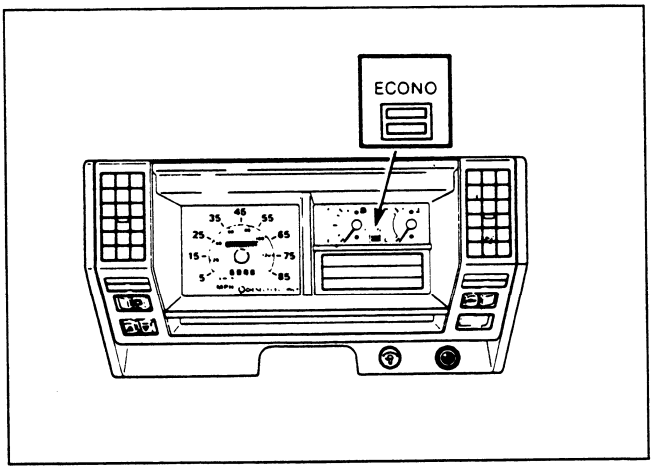


Figure 2. Economy Drive Indicator Light

Indication of the Indicator Light with the Key Switch Turned On (User Mode)

When the throttle position sensor, vehicle speed sensor, solenoid, etc., starts to malfunction when the vehicle is running (the key switch turned on), the economy drive indicator light blinks to warn the driver (figure 3).

- The indicator begins to blink as soon as a problem occurs during driving, and keeps blinking until it is corrected.
- The diagnostic trouble code registered in memory cannot be reset by turning the key switch off and on until removing the fuse No. 11 or battery cable.

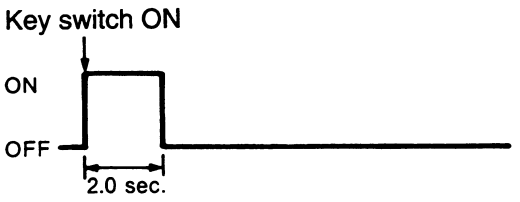
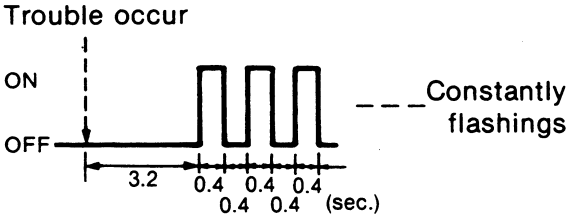
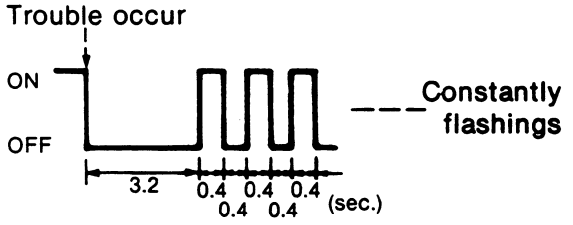
Condition	Economy drive indicator light display	
	Economy drive switch "Normal" position	Economy drive switch "Economy" position
Normal		
Abnormal		

Figure 3. Economy Drive Indicator Light Display

Indication of the Indicator Light During Self-Diagnosis (Dealer Mode)

To help the mechanic locate the problem more easily, the indicator light blinks in different cycles. Each cycle represents one of the ten possible sources of problem.

Indication of Self-Diagnostic Results

The diagnostic trouble code registered in memory can be displayed by connecting data link connector of the transmission control module.
The data link connector is located under the brake and clutch fluid tank (figure 4). The white, two-pin connector has a yellow/black wire and a black wire.

- When no problem exists, the display flashes "1" repeatedly (figure 5-A).
- When a malfunction exists, the appropriate diagnostic trouble code is displayed three times repeatedly (figure 5-B).
- When two or more diagnostic trouble codes are registered, they are all displayed three times repeatedly, one at a time, starting with the lowest code number (figure 5-C).

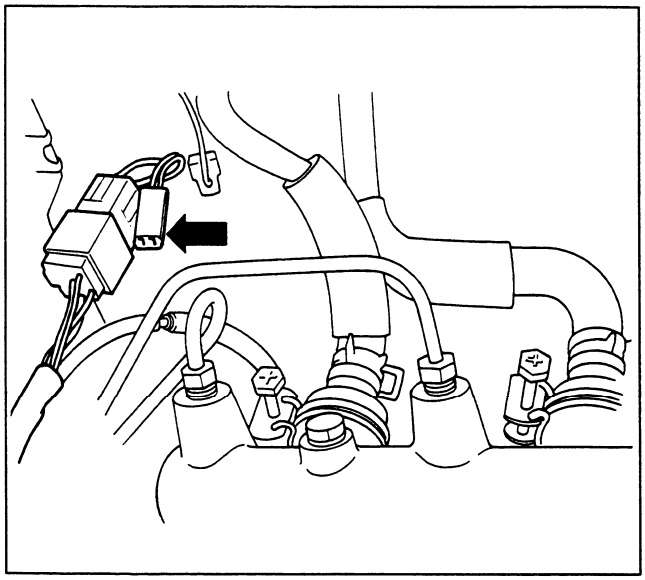


Figure 4. Data Link Connector

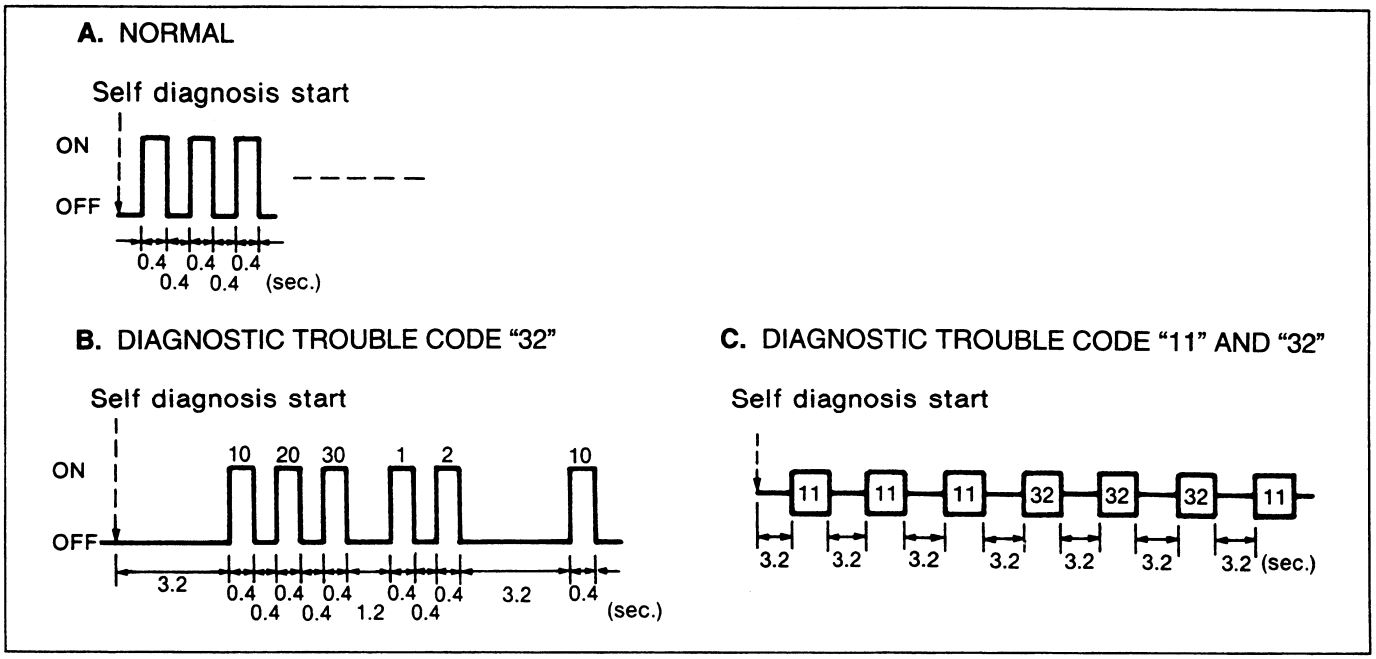


Figure 5. Self Diagnosis Display

Diagnostic Trouble Codes (DTC)

DTC No.	DIAGNOSIS ITEM	DIAGNOSED CONTENT
11	Vehicle speed sensor "1"	Vehicle speed sensor 1 circuit open or shorted
24	Vehicle speed sensor "2"	Vehicle speed sensor 2 circuit open or shorted
13	Engine speed sensor	Engine speed sensor circuit open or shorted
15	ATF thermosensor or battery back-up voltage	ATF thermosensor circuit open or a voltage drop
17	Inhibitor switch	Inhibitor switch circuit open or shorted
21	Throttle position sensor	Throttle position sensor circuit open or shorted
31	Shift solenoid A	Solenoid circuit open or shorted
32	Shift Solenoid B	
33	Over-run clutch solenoid	
34	Lock-up duty solenoid	
35	Line pressure duty solenoid	

ATF: Automatic Transmission Fluid

CLEARING MEMORY

1) Clear the memory in transmission control module (TCM) by removing Fuse No. 11 or Battery – cable for about 10 seconds, after repairing.
   Otherwise, self diagnosis system continues to display the same trouble as before repairing (figure 6).

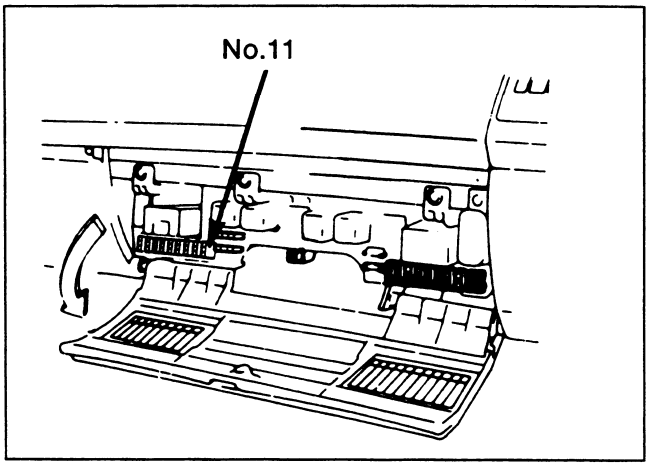


Figure 6. Clearing Memory

2) Perform the self diagnosis input steps, before road test.
   The first flashing pattern after clearing the memory is rapid flashing ("ON" – 0.1 25 sec, "OFF" – 0.125 sec) (figure 7).
3) After the road test is completed, confirm the normal flashing pattern by performing self diagnosis input steps.

NOTICE: If the above short flashing pattern is displayed again, by the self diagnosis after the road test, check the circuit for Fuse No. 11

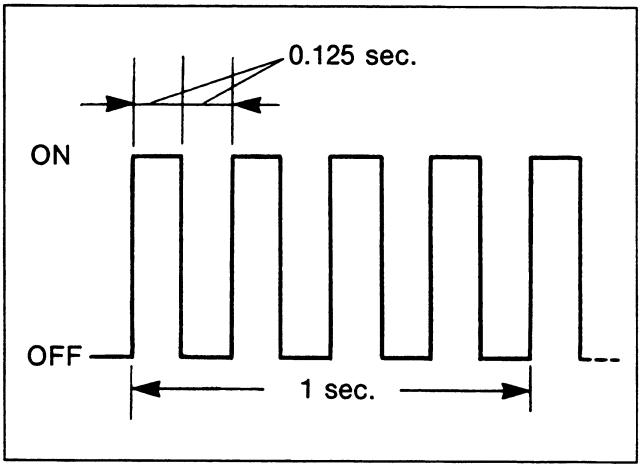
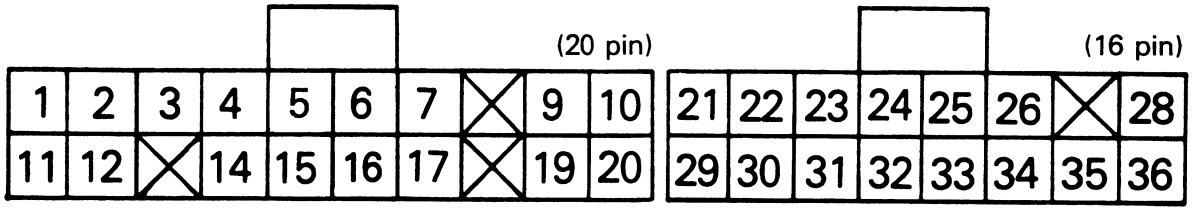


Figure 7. First Flashing Pattern After Clearing Memory

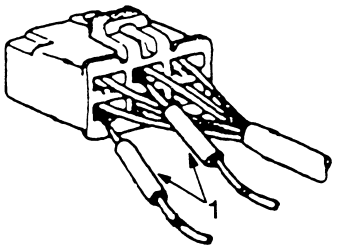
TRANSMISSION CONTROL MODULE (TCM) CONNECTOR PIN LAYOUT



Pin No.	Function
1.	2 range switch
2.	1 range switch
3.	Exhaust brake signal
4.	Idle switch
5.	Data link connector
6.	Overdrive switch
7.	Kick-down switch
8.	—
9.	Economy drive switch
10.	Throttle position sensor voltage (5V out)
11.	Throttle position sensor
12.	ATF Thermosensor
13.	—
14.	Idle switch voltage
15.	Throttle position sensor ground
16.	Vehicle speed sensor 1
17.	Full throttle switch
18.	—
19.	Nutral range switch
20.	D range switch
21.	Overrun clutch solenoid
22.	Lock-up duty solenoid
23.	Economy drive indicator
24.	Vehicle speed sensor 2
25.	Engine speed sensor
26.	Reverse range switch
27.	—
28.	Battery back-up voltage
29.	Ignition voltage
30.	Ignition voltage
31.	Ground
32.	Ground
33.	Duty solenoid (Dropping register)
34.	Duty solenoid (Line pressure)
35.	Shift solenoid A
36.	Shift solenoid B

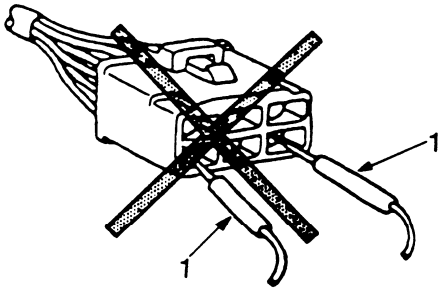
ATF: Automatic Transmission Fluid

Figure 8. TCM Connector Pin Layout



1. Test Probe

Figure 9. Connector Inspection



1. Test Probe

Figure 10. Connector Inspection

Connector Inspection

Use circuit tester to check the connector for continuity. Insert the test probes (1) from the connector wire side (figure 9).

CAUTION: Never insert the circuit tester test probes (1) into the connector open side to test the continuity (figure 10).
Broken or open connector terminals will result.

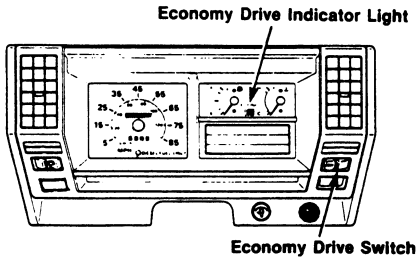
DIAGNOSIS

This section is divided into four-sections, in which the diagnosing of the following phenomena is explained.

1. Economy drive indicator light does not light with the economy drive switch in the "ECONOMY" position.
2. Gear change control malfunction.
   1) Transmission does not downshift when the accelerator is quickly pressed to the floor in the "D" range.
   2) Transmission does not upshift during gradual acceleration in the "D" range.
3. Lock-up control malfunction (Lock-up does not occur at the specified vehicle speed)
4. Abnormal throttle signal (Input signal to TCM No. 11)

TCM : Transmission Control Module

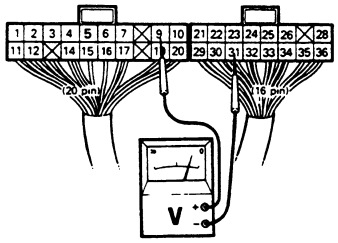
ECONOMY DRIVE INDICATOR LIGHT DOES NOT LIGHT WITH THE ECONOMY DRIVE SWITCH IN THE "ECONOMY" POSITION



Key switch "ON"

Check for input signal to TCM terminal No. 9 with economy drive switch in "ECONOMY" position
Specified voltage is less than 1.0V

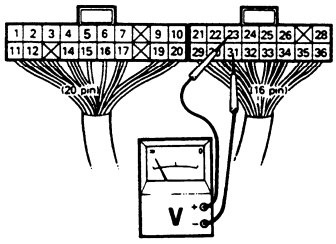
No → Economy drive switch or wiring defective



Yes

Check for output signal for TCM terminal No. 23 with economy drive switch in "ECONOMY" position
Specified voltage is less than 1.0V

Yes → Indicator light or wiring defective



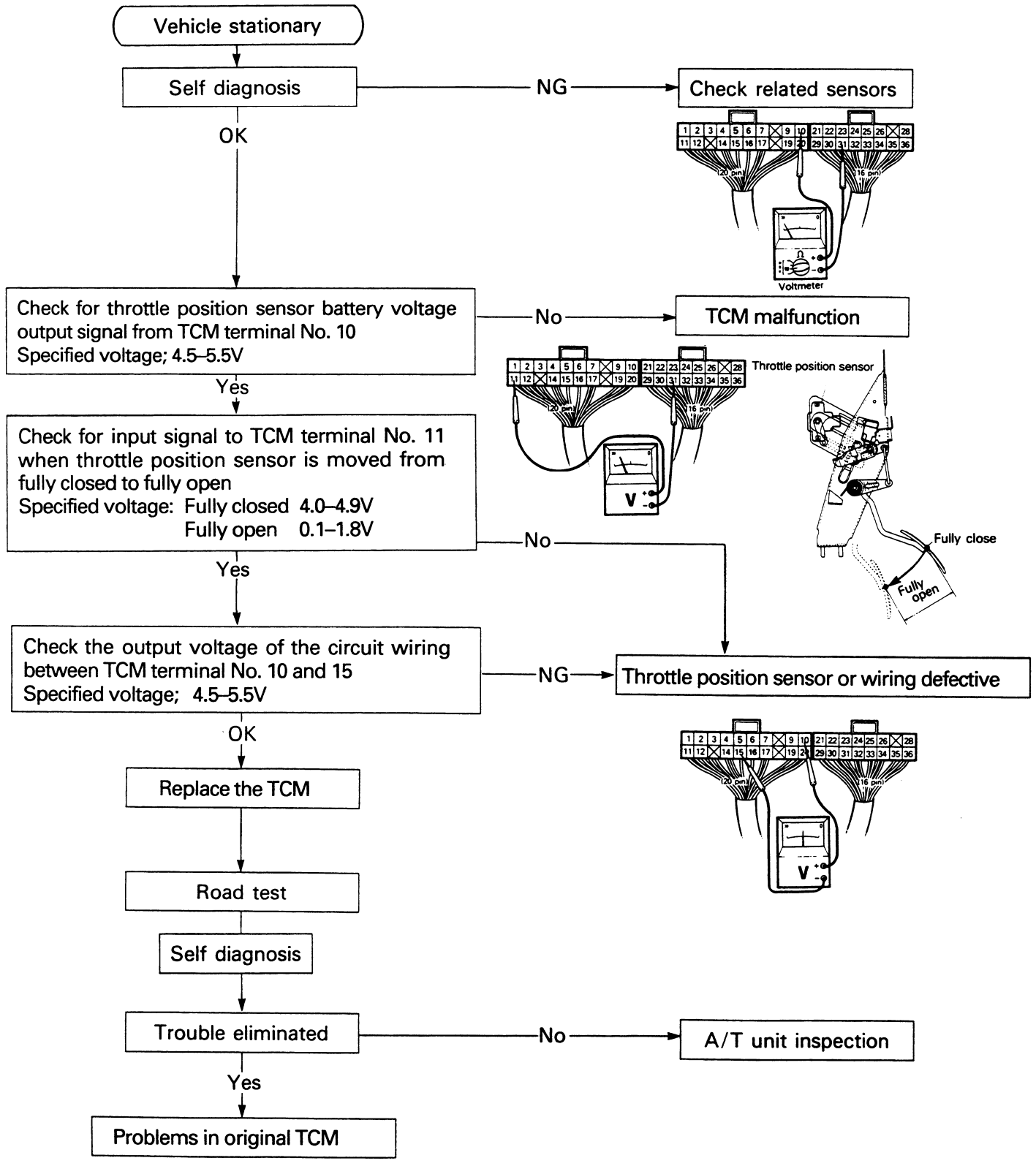
No

TCM malfunction

GEAR CHANGE CONTROL MALFUNCTION

A/T : Automatic Transmission
TCM: Transmission Control Module

1. Transmission does not downshift when the accelerator is quickly pressed to the floor in the "D" range.



2. Transmission does not upshift during gradual acceleration in the "D" range.

AC : Alternating Current
ATF : Automatic Transmission Fluid
TCM: Transmission Control Module

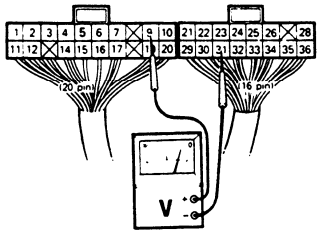
Vehicle stationary

Self diagnosis — NG → Check related sensors

OK

Warm-up engine
Raise ATF temperature to more than 40°C (104°F)

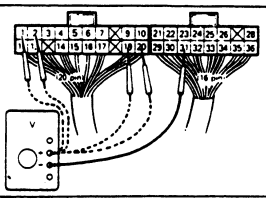
Stop engine
Key switch "ON"
Economy drive switch in "ECONOMY" position



Check for input signal to TCM terminal No. 9
Specified voltage: less than 1.0V — No → Defective economy drive switch or wiring

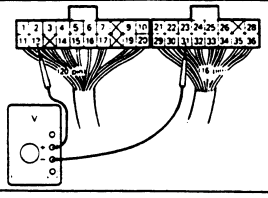
Yes

Check for input signal to TCM terminal No. 1, No. 2, No. 19, and No. 20 with inhibitor switch positioned at each range
Specified voltage; 12–15V — No → Defective inhibitor switch or wiring



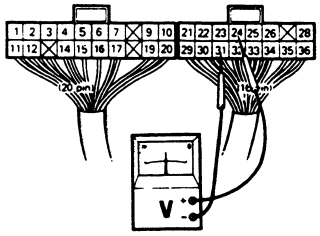
Yes

Check for ATF thermosensor input signal to TCM terminal No. 12
Specified voltage; Approx. 10°C (50°F): 1.8V
Approx. 40°C (104°F): 1.1V — No → Defective ATF thermosensor or wiring



Yes

Check for vehicle speed sensor-2 input signal to TCM terminal No. 24 (Vehicle speed sensor-2 is installed to the meter assembly)
Specified voltage; 1–5V (Intermittent AC) — No → Defective vehicle speed sensor-2 or wiring



Yes

Key switch "OFF"
Raise vehicle

Start engine
Selector in "D" range
Tires rotating

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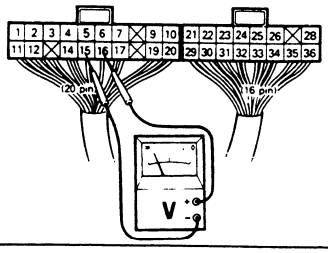
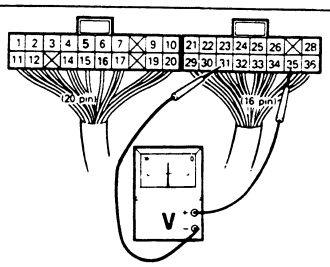
Continued from the previous page

AC : Alternating Current
A/T : Automatic Transmission
TCM: Transmission Control Module



Check for AC voltage between negative TCM terminal No. 15 and positive TCM terminal No. 16
- Stop the tire rotation by depressing the brake pedal. (Vehicle speed is 0 mph): 0V
- Vehicle speed at 15 mph (24 km/h): More than 1V
- Vehicle speed slowly increasing: Voltage should rise with vehicle speed

No → Defective vehicle speed sensor-1 (installed to the A/T unit) Connector or wiring detective



Yes ↓

Check for output signal from TCM terminal No. 35 and No. 36 with shift solenoids A and B in both the "ON" and "OFF" positions
Specified voltage: Shift solenoid
"ON" 12–15V
"OFF" less than 1V

No → TCM malfunction

TCM terminal	Solenoid \ Gear Position	D_1	D_2	D_3	D_4
35	Shift Solenoid A	ON	OFF	OFF	ON
36	Shift Solenoid B	ON	ON	OFF	OFF

Yes ↓

Key switch "OFF"
Down the vehicle

↓

Check for continuity between solenoids A and B

No → Defective solenoid connectors or wiring

Yes ↓

Replace the TCM

↓

Road test

↓

Check for normal gear change control

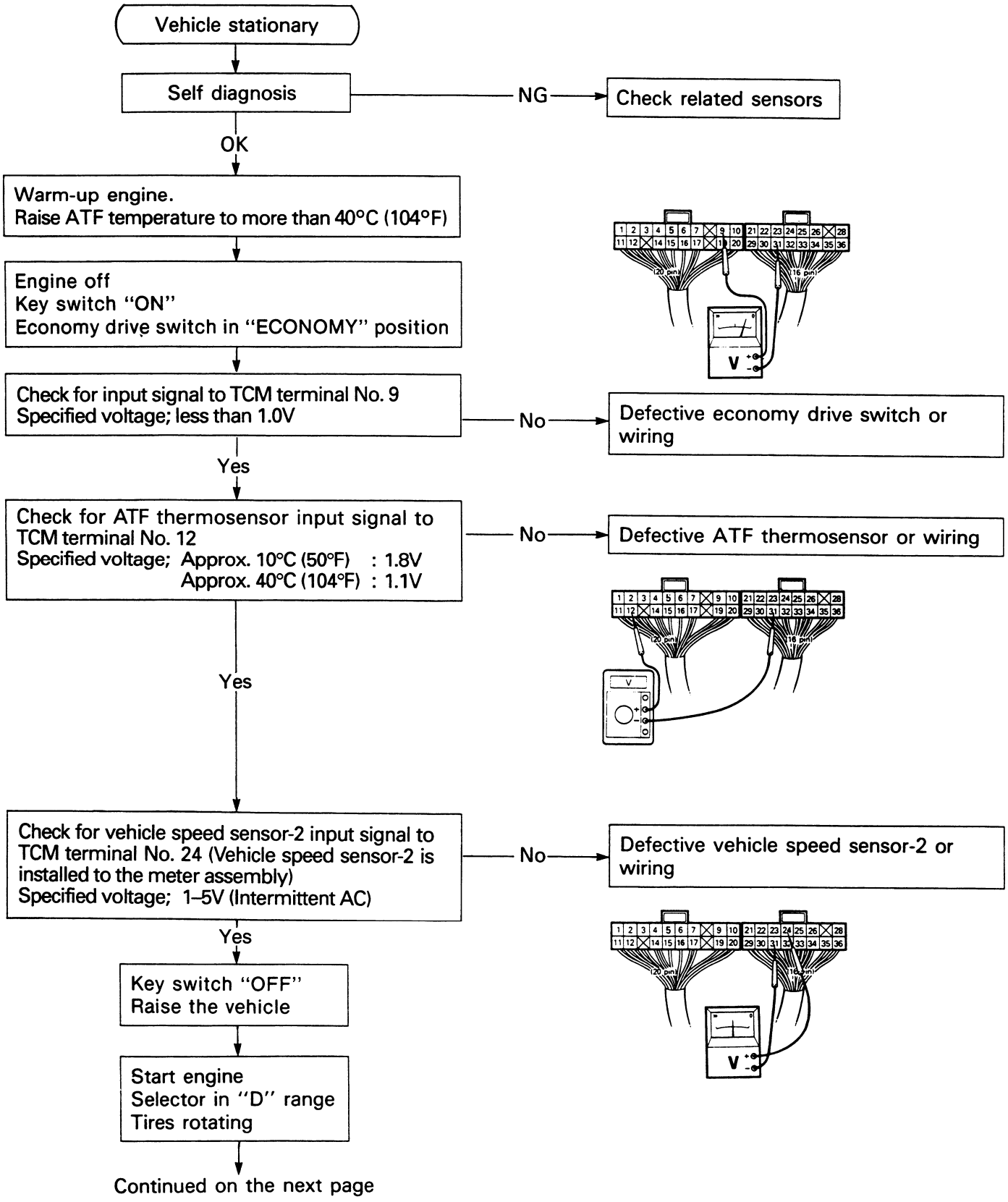
No → A/T unit inspection

Yes ↓

Problems in original TCM

LOCK-UP CONTROL MALFUNCTION (LOCK-UP DOES NOT OCCUR AT THE SPECIFIED VEHICLE SPEED)

AC : Alternating Current
ATF : Automatic Transmission Fluid
TCM: Transmission Control Module



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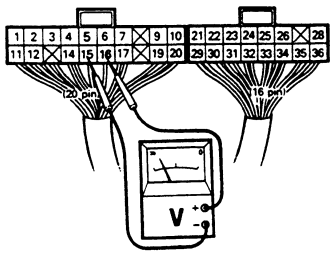
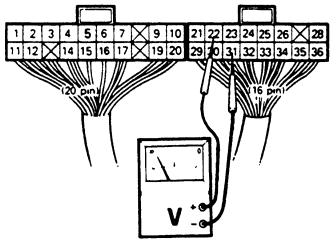
AC : Alternating Current
A/T : Automatic Transmission
TCM: Transmission Control Module



Check for AC voltage between negative TCM terminal No. 15 and positive TCM terminal No. 16
- Stop the tire rotation by depressing the brake pedal. (Vehicle speed is 0 mph): 0V
- Vehicle speed at 15 mph (24 km/h): More than 1V
- Vehicle speed slowly increasing: Voltage should rise with vehicle speed

No → Defective vehicle speed sensor-1 (installed to the A/T unit) or wiring



Yes

Check for output signal from TCM terminal No. 22 with lock-up solenoid in "ON" position
Specified voltage; 8–15V

No → TCM malfunction

Yes

Starter switch "OFF"
Down the vehicle

Note:
- ***Selector in "D" range.***
- ***If the vehicle speed is more than about 37mph (59km/h) — 1/2 throttle, lock-up solenoid should be "ON" position.***
- ***Refer to LOCK-UP POINT DIAGRAM in detail (see page 7A1-4, 7A1-6).***

Check lock-up solenoid, connector, and wiring continuity

No → Defective lock-up solenoid, connectors or wiring

Yes

Replace the TCM

Road test

Check for normal lock-up speed

No → A/T unit inspection

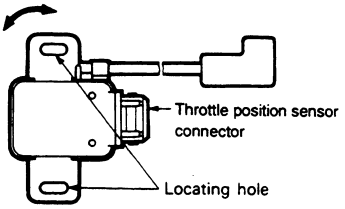
Yes

Problems in original TCM

ABNORMAL THROTTLE SIGNAL (INPUT SIGNAL TO TCM TERMINAL NO. 11)

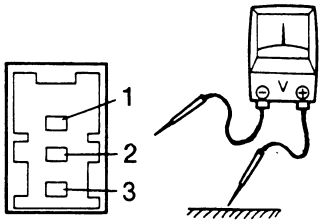
TCM: Transmission Control Module

Abnormal input signal to TCM terminal No. 11



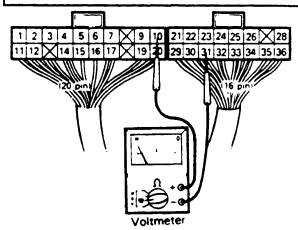
Check the throttle position sensor installation condition — NG → Improper installation condition

Yes



Check for throttle position sensor terminal No. 2 output voltage
Specified voltage with the throttle fully closed: 4.0–4.9V
Specified voltage with the throttle fully open: 0.1–1.8V
— Yes → Defective wiring

No



Check for throttle position sensor terminal No. 1 input voltage
Specified voltage: 4.5–5.5V
— No → Check for TCM terminal No. 10 output voltage
Specified voltage: 4.5–5.5V
— No → Defective wiring
— Yes → Defective throttle position sensor or wiring

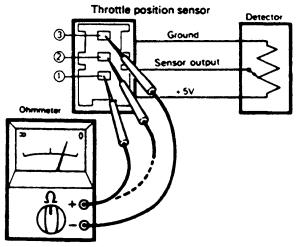
Yes

Disconnect throttle position sensor connector

Check for throttle position sensor resistance between terminal No. 1 and No. 3
Specified resistance: 12kΩ
— No →

Yes

Check for throttle position sensor resistance between No. 2 and No. 3
Specified resistance with the throttle fully closed: 8.7–12.0kΩ
Specified resistance with the throttle fully open: 0.22–4.8kΩ
— No →



Yes

Check for throttle position sensor continuity between No. 1 and the body. It should be no continuity.
— Yes → Defective throttle position sensor

No

Defective wiring

CONTROL SIGNAL INSPECTION

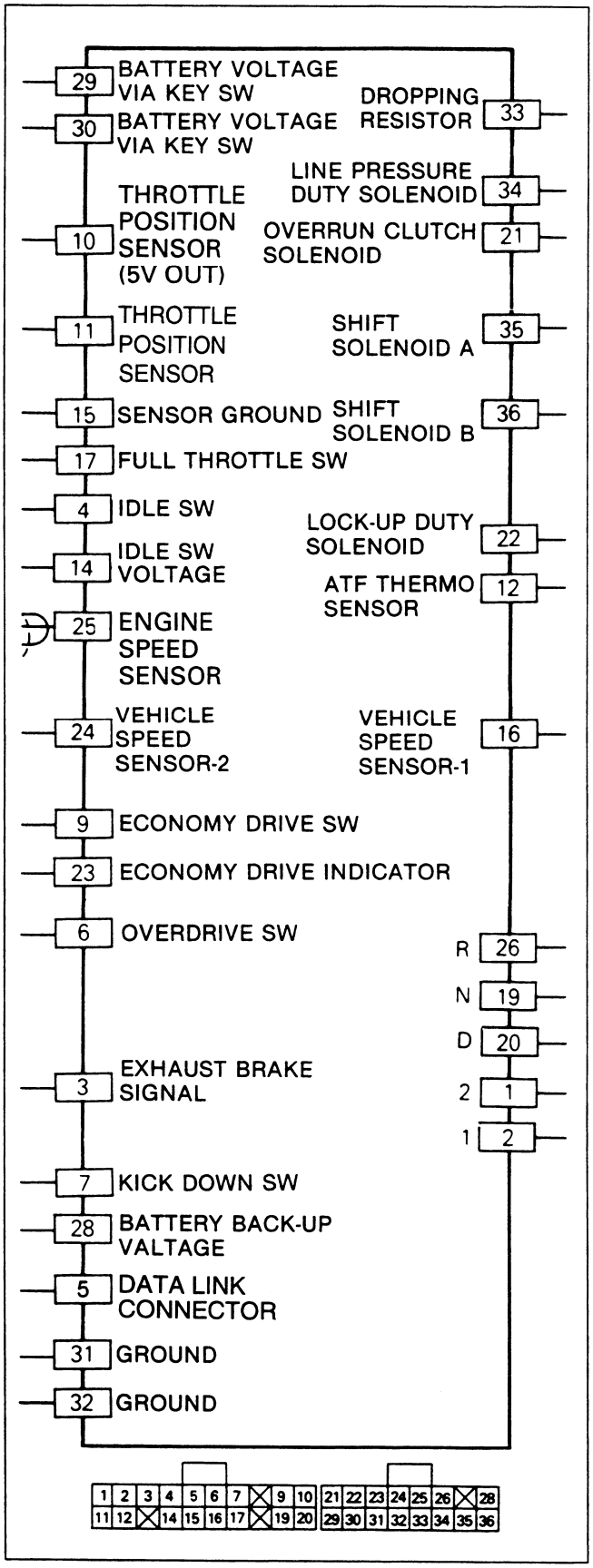


Figure 11. TCM connection

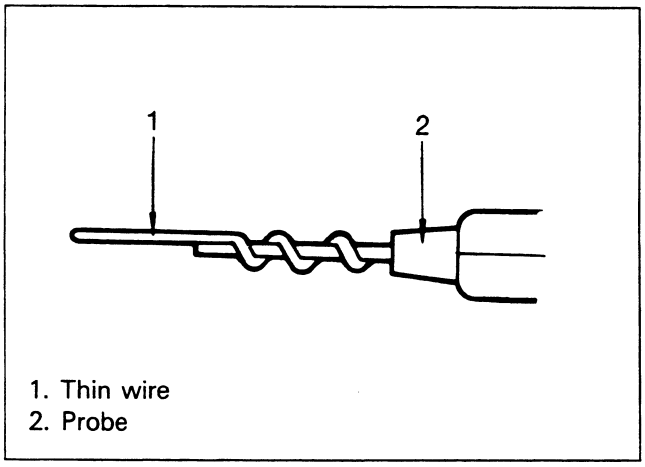
Control signal inspection is done to check for transmission and transmission control module (TCM) problems which cannot be detected by self diagnosis.
Additionally, it serves as a back-up check for self diagnosis.

Measure the voltage drop and make a continuity test for each of the sensors, solenoids, and switches.

If the voltage is within the specified range and continuity exists, that particular area of the TCM and automatic transmission assembly is normal.

If voltage deviation or lack of continuity is discovered, disconnect the applicable parts and check each of them individually.

This will allow you to determine the trouble location (TCM, automatic transmission unit, or another area of the vehicle).



1. Thin wire
2. Probe

Figure 12. Inspection Tool

Inspection Tool

Use a circuit fester to measure voltage and circuit continuity.

Refer to the following table for the specified voltage ranges.

TCM terminals are extremely small.

Wrap a piece of thin wire (1) around the probe of tester (2) (figure 12).

This will make measurement easier.

TCM Terminal No.		Standard Voltage	Inspection Procedure	Signal Type	Signal Name
Tester (–)	Tester (+)				
(31) or (32)	(29)	12–15	Key switch "ON"	Source	Battery voltage
	(30)	12–15	Key switch "ON"	Source	Battery voltage
	(28)	12–15		Source	Battery back-up
(15)	(10)	4.5–5.5		Source	Throttle position sensor
(31) or (32)	(26)	12–15	Selector "R" range	Input	"R" range switch
		Less than 1.0	Selector all ranges except "R"	Input	"R" range switch
	(19)	12–15	Selector "N" or "P" range	Input	"N" range switch
		Less than 1.0	Selector all ranges except "N" and "P"	Input	"N" range switch
	(20)	12–15	Selector "D" range	Input	"D" range switch
		Less than 1.0	Selector all ranges except "D"	Input	"D" range switch
	(1)	12–15	Selector "2" range	Input	"2" range switch
		Less than 1.0	Selector all ranges except "2"	Input	"2" range switch
	(2)	12–15	Selector "1" range	Input	"1" range switch
		Less than 1.0	Selector all ranges except "1"	Input	"1" range switch
	(3)	12–15	Exhaust brake switch "ON"	Input	Exhaust brake signal
		Less than 1.0	Exhaust brake switch "OFF"	Input	Exhaust brake signal
	(4)	8–15	Accelerator pedal released	Input	Idle switch
		Less than 1.0	Accelerator pedal depressed	Input	Idle switch
	(17)	8–15	Accelerator pedal more than 1/2 depressed	Input	Full throttle switch
		Less than 1.0	Accelerator pedal released	Input	Full throttle switch
	(6)	12–15	Overdrive switch "ON"	Input	Overdrive switch
		Less than 1.0	Overdrive switch "OFF"	Input	Overdrive switch
	(7)	3–8	Accelerator pedal released	Input	Kick-down switch
		Less than 1.0	Accelerator pedal fully depressed	Input	Kick-down switch

TCM: Transmission Control Module

TCM Terminal No.		Standard Voltage	Inspection Procedure	Signal Type	Signal Name
Tester (–)	Tester (+)				
(31) or (32)	(9)	3–8	Economy drive switch in "NORMAL" position	Input	Economy drive switch
	(24)	Less than 1.0 Throttle full position	Economy drive switch in "ECONOMY" positionInput	Input	Economy drive switch
		1–5 (Intermittent AC)	Vehicle moved at slowest possible speed at least one meter	Input	Vehicle speed sensor-2
	(5)	3–8	Self diagnosis OFF	Input	Data link connector
		Less than 1.0	Self diagnosis ON	Input	Data link connector
(15)	(11)	4.0–4.9 (Fully closed) 0.1–1.8 (Fully opened)	Measure the throttle position sensor voltage at two position	Input	Throttle position sensor
	(12)	1.8 (ATF temp. approx. 10°C/50°F) 1.1 (ATF temp. approx. 40°C/104°F)	Measure the throttle position sensor voltage at each specified temperature	Input	ATF thermosensor
	(16)	More than 1 (AC) (Vehicle speed 24 km/h 15 mph)	Measure the vehicle speed sensor- 1 voltage at vehicle stop and 24 km/h (15 mph)	Input	Vehicle speed sensor-1
		0 (Vehicle stopped)		Input	Vehicle speed sensor-1
	(25)	More than 1	Check at an engine speed of approximately 2,000 RPM	Input	Engine speed sensor
(31) or (32)	(23)	12–25	Economy drive switch in "NORMAL" position	Input	Economy drive indicator
		Less than 1.0	Economy drive switch in "ECONOMY" position	Input	Economy drive indicator
	(14)	8–15	Key switch "ON"	Output	Idle switch full throttle switch

AC: Alternating Current TCM: Transmission Control Module ATF: Automatic Transmission Fluid

TCM Terminal No.		Standard Voltage	Inspection Procedure	Signal Type	Signal Name
Tester (–)	Tester (+)				
(31) or (32)	(35)	12–15	Driving at "D_1" and "D_4" (Solenoid "ON")	Output	Shift solenoid "A"
		Less than 1.0	Driving at "D_2" and "D_3" (Solenoid "OFF")	Output	Shift solenoid "A"
	(36)	12–25	Driving at "D_1" and "D_2" (Solenoid "ON")	Output	Shift solenoid "B"
		Less than 1.0	Driving at "D_3" and "D_4" (Solenoid "OFF")	Output	Shift solenoid "B"
	(21)	12–15	Overrun clutch solenoid "ON", ("D" range, at vehicle stop).	Output	Overrun clutch solenoid
		Less than 1.0	Overrun clutch solenoid "OFF", ("D" range, vehicle speed 40km/h / 25 mph)	Output	Overrun clutch solenoid
	(33)	5–14	Engine warmed up and stopped, throttle fully closed, key switch "ON"	Output	Droppong resistor
		Less than 0.5	Engine warmed up and stopped, throttle fully opened, key switch "ON"	Output	Dropping resistor
	(34)	1.5–2.5	Engine warmed up and stopped, throttle fully closed, key switch "ON"	Output	Line pressure solenoid
		Less than 0.5	Engine warmed up and stopped, throttle fully opened, key switch "ON"	Output	Line pressure solenoid
	(22)	8–15	Lock-up "ON"	Output	Lock-up solenoid
		Less than 1.0	Lock-up "OFF"	Output	Lock-up solenoid

TCM: Transmission Control Module

LINE PRESSURE TEST

The line pressure test checks oil pump and control valve pressure regulator valve function. It will also detect oil leakage.

Line Pressure Test Procedure

1. Check the level of the engine coolant, the engine oil, and the automatic transmission fluid. Replenish if required.
2. Set the parking brake.
3. Place chocks at the front and rear of each tire.
4. Remove the pressure detection plug at the bottom of the converter housing (figure 13).
5. Set a pressure gage (1) to the pressure detection plug hole (figure 14).

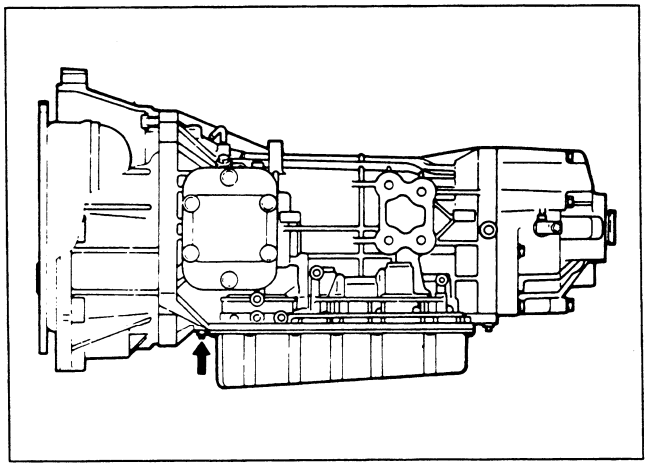


Figure 13. Detection Plug Hole

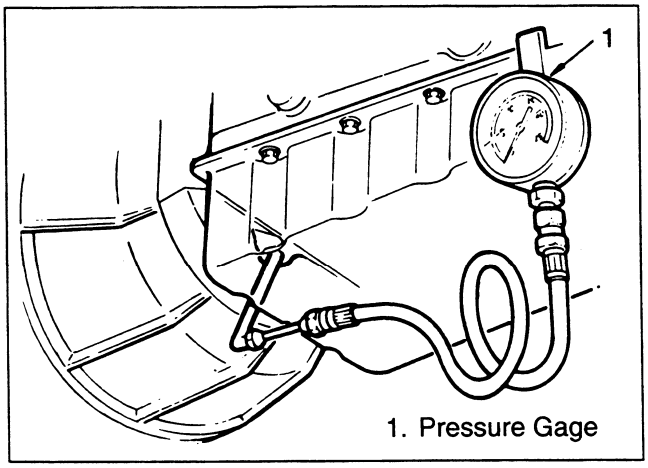


Figure 14. Setting Pressure Gage

6. Start the engine and allow it to idle until the engine coolant temperature reaches 70–80°C (158–176°F).
7. Hold the brake pedal down as far as it will go.
8. Place the selector in the "D" range.
9. Note the pressure gage reading with the engine idling.
10. Gradually push the accelerator pedal to the floor. The throttle will fully open.
    Note the pressure gage reading with the accelerator pedal fully depressed.

Measure

- Line Pressure kPa (psi)

	Engine Speed	
Rnage	Idling	Wide Open Throttle
D, 2 & 1	294.2–460.9 (42.7–66.8)	921.8–1098.3 (133.7–159.3)
R	470.7–627.6 (68.3–91.0)	1225.8–1520.0 (177.8–220.4)

11. Release the accelerator pedal.
12. Place the selector in the "N" range.
13. Run the engine at 1,200 RPM for one minute. This will cool the transmission fluid.
14. Repeat Steps 7–13 for the "2", "1 ", and "R" ranges.
15. Install a new pressure detection plug to the converter housing.
16. Tighten the pressure detection plug.

Tighten

- Detection Plug 7 N·m (61 lb·in)

Engine and Transmission Condition	Line Pressure Test Results	Probable Trouble Area
At idle	Line pressure is below the specified limit in all ranges	• Worn oil pump • Defective control piston • Sticking pressure regulator valve, plug, or worn spring • Fluid leakage from fluid line (Oil strainer → oil pump → pressure regulator valve)
	Line pressure is below the specified limit in one or more ranges	Fluid delivered from the manual valve in a given range(s) Oil leakage from device(s) related to the given range(s) Example: Leakage from Low and reverse brake lines 1. "R" and "1" range line pressure below the specified limit 2. All other ranges have normal line pressure
	Line pressure is above the specified limit in all ranges	• Poorly adjusted throttle position sensor • Defective ATF thermosensor • Line pressure solenoid malfunction 1. Solenoid sticking at "OFF" position 2. Clogged filter 3. Open circuit • Sticking pressure modifier valve • Sticking pressure regulator valve and/or plug
At stall	Fluid pressure at stall is the same as fluid pressure at idle	• Poorly adjusted throttle position sensor • Control unit malfunction • Line pressure solenoid malfunction 1. Solenoid sticking in "ON" position 2. Short circuit • Sticking pressure regulator valve and/or plug • Sticking pressure modifier valve • Sticking pilot valve and/or clogged pilot filter
	Fluid pressure at stall is higher than at idle, but is below the specified range	• Poorly adjusted throttle position sensor • Defective control piston • Line pressure solenoid malfunction 1. Sticking solenoid 2. Clogged filter • Sticking pressure regulator valve and/or plug • Sticking pressure modifier valve and/or worn valve spring • Sticking pilot valve and/or clogged pilot filter

ATF: Automatic Transmission Fluid

STALL TEST

The stall test allows you to check the transmission for internal abrasion and the one-way clutch for slippage. Torque converter performance can also be evaluated.

The stall test results together with the road test results will identify transmission components requiring servicing or adjustment.

CAUTION: When the clutch appears to be slipping in a road test, etc., or when the line pressure does not reach a preset value in a line pressure test, do not proceed to a stall test.

Stall Test Procedure

1. Set the parking brake.
2. Place chocks at the front and rear of each tire.
3. Check the level of the engine coolant, the engine oil, and the automatic transmission fluid. Replenish if required.
4. Start the engine and allow it to idle until the engine coolant temperature reaches 70–80°C (158–176°F).
5. Set a tachometer to the engine.
6. Hold the brake pedal down as far as it will go.
7. Place the selector in the "D" range.
8. Gradually push the accelerator pedal to the floor.
   The throttle will fully open.
   Note the engine speed at which the tachometer needle stabilizes.

   Measure

   - Stall speed 1,800 $^{+150}_{-300}$ RPM

9. Release the accelerator pedal.
10. Place the selector in the "N" range.
11. Run the engine at 1,200 RPM for one minute. This will cool the transmission fluid.
12. Repeat Steps 6-11 for the "2", "1 ", and "R" ranges.

    CAUTION: Do not continuously run this test longer than 5 seconds so the transmission does not become overheated.

Stall Test Results	Road Test Results	Probable Trouble Area
Stall speed in all gear ranges exceeds the specified limit		Line pressure too low
Stall speed exceeds the specified limit in "D" range only	Does not start in "D" range	Forward clutch or forward one-way clutch is slipping
Stall speed exceeds the specified limit in "D" and "2" range	Starts normally in "1" range but does not start in "D" or "2" range	Low one-way clutch is slipping
Stall speed exceeds the specified limit in "D", "2" and "1" ranges	Starts nomally in "R" range but does not start or accelerate in forward ranges	• Both the forward clutch and over-run clutch are slipping • Both the forward one-way clutch and over-run clutch are slipping
Stall speed in "R" range exceeds the specified limit	• Engine brake does not function in the "1" range	Low and reverse brake slippage
	• Engine brake functions in the "1" range	Reverse clutch slippage
Stall speed within specifications	• Vehicle speed will not exceed 80km/h (50mph) This condition will cause very high ATF temperature	Torque converter one-way clutch seizure
Stall speed within specifications	• Slippage in "D" range 3rd and 4th gears	High clutch slippage
	• Slippage in "D" range 2nd and 4th gears	Brake band slippage
Stall speed below the specified limit	• Poor initial acceleration	Torque converter one-way clutch slippage

ATF: Automatic Transmission Fluid