خدمات پس از فروش ایران خودرو

معاونت فنی و مهندسی

مدیریت آموزش فنی

جزوه آموزشی

سیستم گیربکس اتوماتیک

سوزوکی گراند ویتارا

کلید مدرک : ۱۴۹۵۱

زمستان ۱۳۹۲

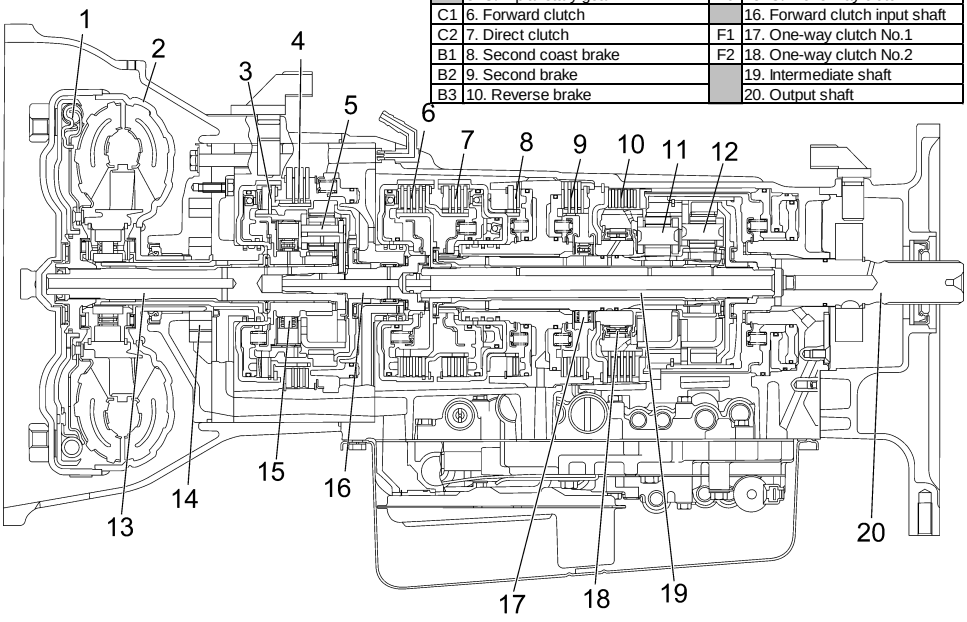
SECTION 5A1

AUTOMATIC TRANSMISSION (4 A/T)

CONTENTS

1.Description

	1. Torque converter clutch (TCC)		11. Front planetary gear
	2. Torque converter		12. Rear planetary gear
C0	3. O/D clutch		13. O/D input shaft
B0	4. O/D brake		14. Oil pump
	5. O/D planetary gear	F0	15. O/D one-way clutch
C1	6. Forward clutch		16. Forward clutch input shaft
C2	7. Direct clutch	F1	17. One-way clutch No.1
B1	8. Second coast brake	F2	18. One-way clutch No.2
B2	9. Second brake		19. Intermediate shaft
B3	10. Reverse brake		20. Output shaft



2.Specification

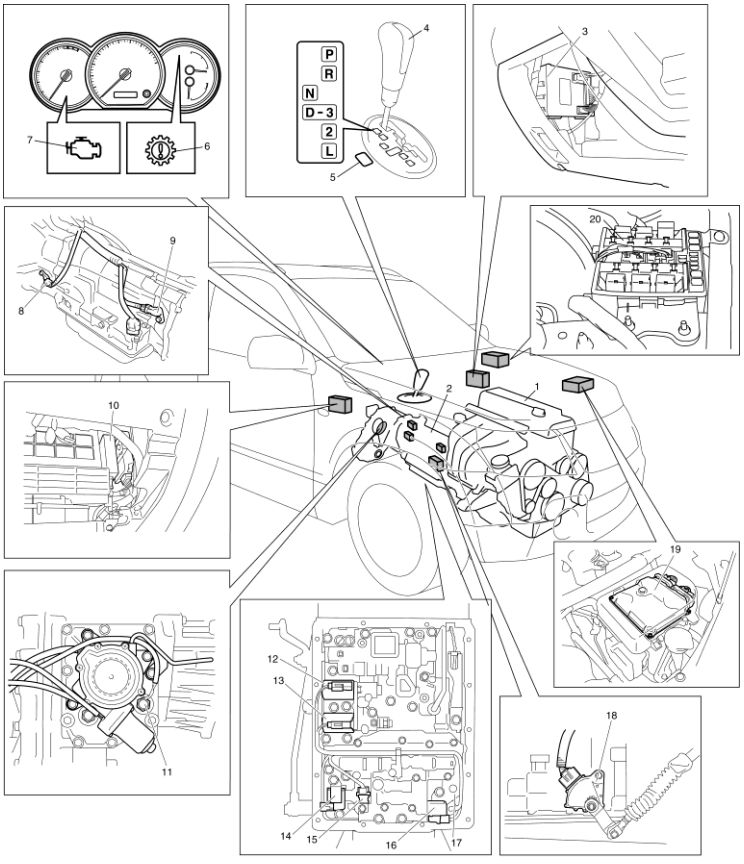
Type				03-72LS		
Torque converter	Type			3-element, 1-step, 2-phase with lock-up mechanism		
	Stall torque ratio			2.0		
	Stall speed			2800 +/- 150 rpm		
Transmission	Type			Forward 4-speed, reverse 1-speed, planetary gear		
	Gear ratio	1st		2.826	Overdrive sun gear	27
		2nd		1.493	Overdrive pinion gear	23
		3rd		1.000	Overdrive ring gear	73
		4th		0.688	Front sun gear	27
		Rev		2.703	Front pinion gear	23
					Front ring gear	73
					Rear sun gear	36
					Rear pinion gear	19
					Rear ring gear	73
	Control components			Wet type multi-plate clutch	3 sets	
				Wet type multi-plate brake	4 sets	
				One way clutch	3 sets	
Shift mechanism	Type			Direct cable shifting		
	Position	P		Neutral, output shaft fixed, engine start		
		R		Reverse		
		N		Neutral, output shaft free, engine start		
		D	4H	Forward 1st <--->2nd<--->3rd<--->4th automatic shift		
			4L	Forward 1st <--->2nd<--->3rd automatic shift		
		3	4H	Forward 1st <--->2nd<--->3rd (<---4th) automatic shift		
			4L	Forward 1st <--->2nd<--->3rd automatic shift		
		2		NORMAL	Forward 1st <--->2nd(<---3rd) automatic shift	
				POWER	Forward 2nd(<---3rd) fixed	
		L		Forward 1st (<---2nd) fixed		
Cooling type				Radiator-assisted cooling (water cooling)		
Oil pump	Type			Trochoid		
	Drive			Engine-driving		
Lubrication	Type			Forced pumping type by oil pump		
	Lubricant	Type		SUZUKI ATF 3317 or MOBIL ATF 3309		
		Capacity		6.9 litres (total)		

3.Operation Table

		S1	S2	ST	C0	C1	C2	C3	B0	B1	B2	B3	F1	F2
		Shift solenoid valve No.1	Shift solenoid valve No.2	TCC solenoid valve	O/D clutch	Forward clutch	Direct clutch	Reverse clutch	O/D brake	2nd coast brake	2nd brake	1st & reverse brake	One-way clutch No.1	One-way clutch No.2
P		O	O	X	O	X	X	X	X	X	X	X	X	X
R		O	O	X	O	X	X	O	X	X	X	O	X	X
N		O	O	X	O	X	X	X	X	X	X	X	X	X
D	1st	O	O	X	O	O	X	X	X	X	X	X	X	O
	2nd	O	X	X	O	O	X	X	X	X	O	X	O	X
	3rd	X	X	+	O	O	O	X	X	X	O	X	X	X
	4th	X	O	+	X	X	O	X	O	O	O	X	X	X
3	1st	O	O	X	O	O	X	X	X	X	X	X	X	O
	2nd	O	X	X	O	O	X	X	X	X	O	X	O	X
	3rd	X	X	+	O	O	O	X	X	X	O	X	X	X
2	1st	O	O	O	O	O	X	X	X	X	X	X	X	O
	2nd	O	X	X	O	O	X	X	X	O	O	X	O	X
L	1st	O	O	O	O	O	X	X	X	X	X	O	X	O

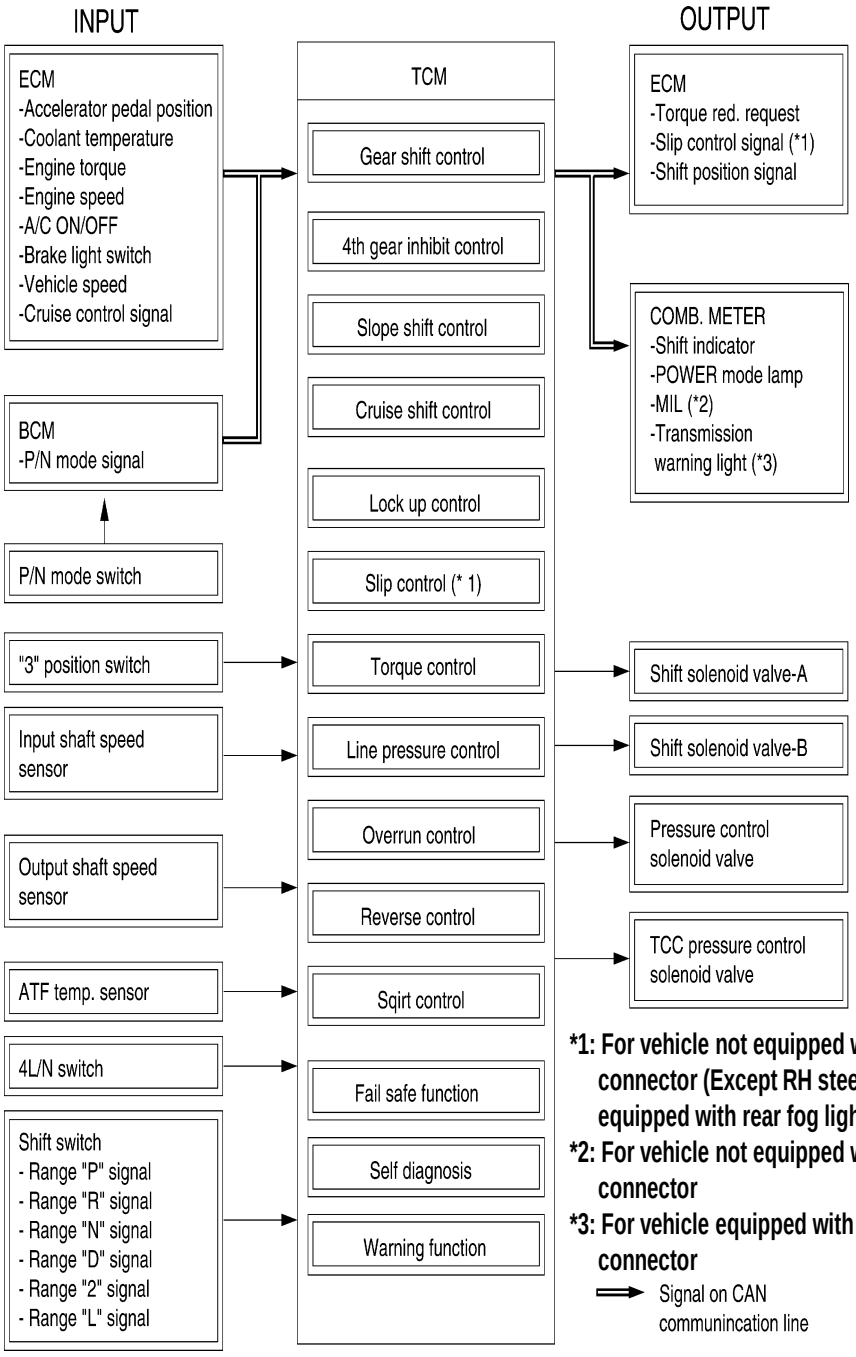
	Solenoid	Brake / Clutch / OWC
O	ON	Engaged
X	OFF	Free
+	ON only when TCC is operating	

4. Component Location



1. Engine
2. Transmission
3. BCM
4. Selector lever assembly including “3” position switch
5. P/N mode switch
6. Transmission warning light (vehicle is equipped with engine diagnosis connector)
7. MIL (vehicle is not equipped with engine diagnosis connector)
8. Input shaft speed sensor
9. Output shaft speed sensor
10. TCM
11. 4L/N low switch
12. Pressure control solenoid valve
13. TCC pressure control solenoid valve
14. Shift solenoid valve-A
15. Transmission fluid temperature sensor
16. Shift solenoid valve-B
17. Valve body assembly
18. Transmission range sensor
19. ECM
20. AT relay included power integration No.2 in main fuse box

5.Input/Output Flow Chart

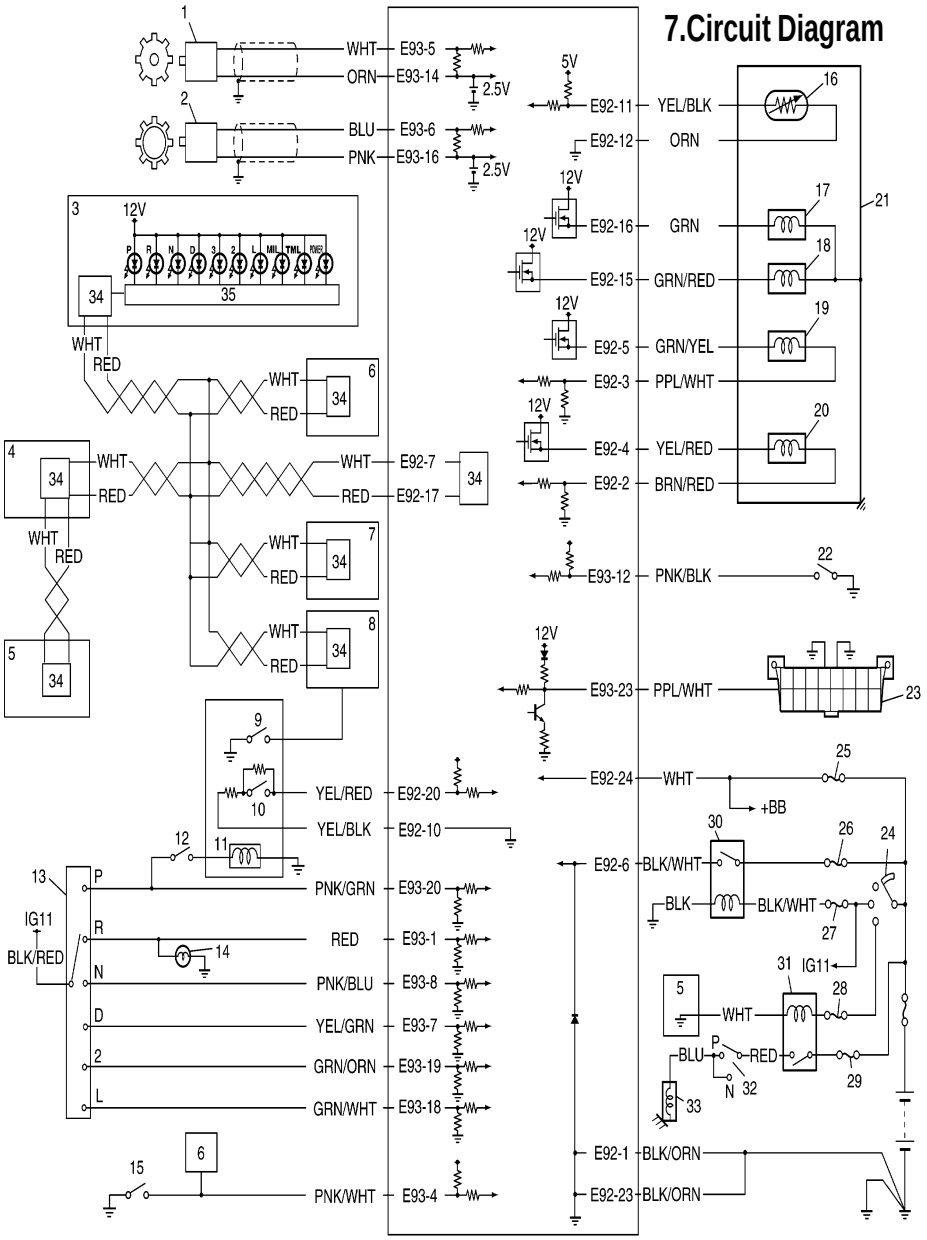


6.Input/Output Table

INPUT / OUTPUT \ CONTROL		Gear Shift control	4th gear inhibit control	Slope shift control	Cruise shift control	Lock-up control	Slip control	Line pressre control	Torque control	Overrun control	Reverse control	Squirt control	Speed meter indicate
Input	Accelerator effective position	○		○	○	○	○	○	○				
	Throttle position				○								
	Coolant temperature		○			○	○						
	Engine torque			○				○	○				
	Engine speed						○	○	○				
	A/C ON/OFF						○						
	Brake light switch	○		○		○							
	Vehicle speed												○
	Cruise control signal				○								
	P/N mode switch	○			○								
	"3" position switch	○								○			
	Input shaft speed sensor					○	○	○	○				
	Output shaft speed sensor	○		○	○	○	○	○	○	○	○	○	
	ATF temperature sensor	○					○	○				○	
	4L/N switch	○		○	○	○							
	Shift switch	○		○	○	○	○	○		○	○	○	
Output	Torque reduction request								○				
	Slip control signal *1						○						
	Shift solenoid valve-A	○	○	○	○					○	○	○	
	Shift solenoid valve-B	○	○	○	○					○	○	○	
	Pressure control solenoid valve							○					
	TCC pressure control solenoid valve				○	○	○						

***1: For vehicle not equipped with engine diagnosis connector (Except RH steering vehicle not equipped with rear fog light)**

7.Circuit Diagram



1. Output shaft speed sensor
2. Input shaft speed sensor
3. Combination meter
4. ABS hydraulic unit / control module
5. ECM
6. 4WD control module
7. Keyless start control module (if equipped)
8. BCM
9. P/N mode switch
10. “3” position switch
11. Shift lock solenoid
12. Brake light switch
13. Transmission range switch
14. Back-up light
15. 4L/N switch
16. Transmission fluid temperature sensor
17. Shift solenoid valve-A
18. Shift solenoid valve-B
19. TCC pressure control solenoid valve
20. Pressure control solenoid valve
21. Valve body assembly
22. Monitor connector (if equipped)
23. DLC
24. Ignition switch
25. “DOME” fuse
26. “AT” fuse
27. “IG COIL” fuse
28. “ST SIG” fuse
29. “ST” fuse
30. AT relay included in integration relay No.2 in main fuse box
31. Starting motor relay
32. Inhibit switch
33. Starting motor
34. CAN driver
35. Meter driver

8. CAN

				ECM	BCM	Combination Meter	4WD control module
TCM	Transmit	DATA	Torque reduction request	○			
			Slip control signal	○			
			Transmission malfunction indication ON	○ *1		○ *1	
			Transmission emissions related malfunction active	○ *2		○ *2	
			Transmission gear selector position	○	○	○	○
			Transmission diagnostic troub le codes			○	

				ECM	BCM
TCM	Receive	DATA	Engine torque signal	○	
			Acceler ator pedal position	○	
			Engine speed	○	
			4th gear inhibit	○	
			Torque con verter clutch control inhibit	○	
			Lock up/ slip control inhibit signal	○	
			Throttle position	○	
			Stand b y to engage air conditioning compressor	○	
			Engine coolant temper ature	○	
			Cruise control signal (if equipped with cruise control system)	○	
			Vehicle speed	○	
			Brake pedal switch active	○	
			AT mode status		○
			Air conditioning compressor clutch engaged (if equipped with A/C)	○	

***1: Vehicle is equipped with engine diagnosis connector only.**
***2: Vehicle is not equipped with engine diagnosis connector only.**

9.Electronic Control

1. Gear Shift Control
2. Overdrive Inhibit Control
3. Slope Shift Control
4. Lock Up Control
5. Slip Control
6. Line Pressure Control
7. Torque Control
8. Overrun Control
9. Reverse Control
10. Squirt Control

9-1. Gear Shift Control

Gear shift control is performed according to the gear shift schedule shown in the Service Manual.

[Take off at 2nd gear]
If the following conditions are met, vehicle takes off at 2nd.
-A/T select mode switch is at “POWER”.
-A/T selector lever is at “2” range.

9-2. Overdrive Inhibit Control

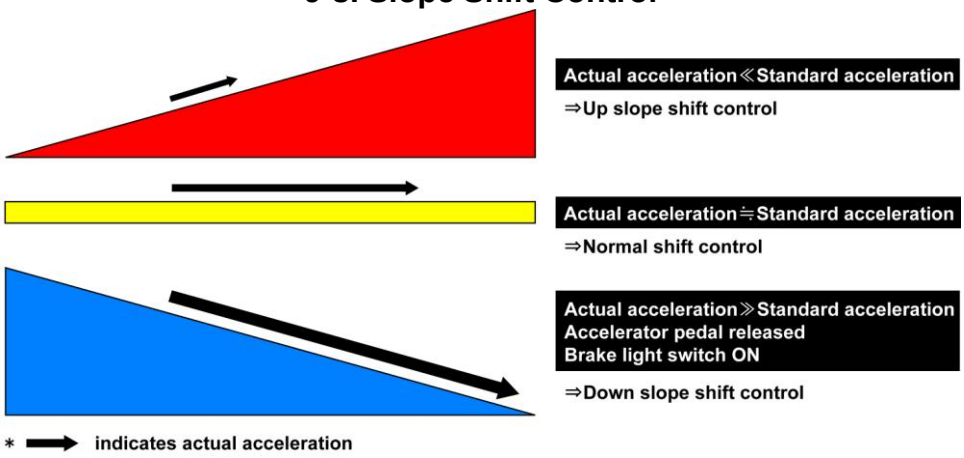
[1.Low temperature]
Overdrive is inhibited at low temperature.
(Engine coolant or ATF)

--->For a faster warming up

[2.At “L”, “2” or “3” range]
Overdrive is inhibited at “L”, “2” or “3” range

[3.Transfer is at 4LL or N]
Transfer shift position is at 4L-lock or N.

9-3. Slope Shift Control



[On up slope]
Gear shift point is moved to higher speed side so that shift up is made at a higher speed.
[On down slope]
Gear shift point is moved to higher speed side so that engine brake becomes effective (3rd and 4th speed).

9-4. Lock Up Control

[Lock-Up OK condition]
The following conditions are all met.
- Gear position is at 3rd or 4th.
- Throttle position and vehicle speed in a lock-up range at “D” or “3” range.
- Engine coolant and ATF temperatures are above specified values.
- Stop lamp switch is OFF
- Transfer is at 4H or 4H-lock.

[Lock-Up NG condition]
One of the conditions above is not met.

9-5. Slip Control (EURO IV)

Slip : Partial engagement of torque converter clutch (lock up clutch) although TP-VSS state is out of "lock-up zone".

[Purpose]

1.During Acceleration
To raise the power transmission efficiency
--->To reduce fuel consumption

2.During deceleration
To raise the power transmission efficiency
To increase the fuel cut zone
--->To reduce fuel consumption

Caution:
Use specified ATF
SUZUKI 3317 or MOBIL 3309

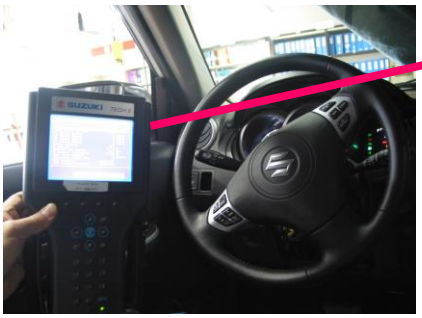
9-5. Slip Control (cont.)

[Slip control condition]

1.During Acceleration
- **Gear position is at 3rd or 4th.**
- **Throttle position and vehicle speed are in slip control zone**
- **Throttle position and vehicle speed are out of lock up zone**
- **ATF temperature is within a specified range**
- **Not driving on an up slope**

2.During deceleration
- **Gear position is at 3rd or 4th.**
- **Throttle position and vehicle speed are in slip control zone**
- **Throttle position and vehicle speed are out of lock up zone**
- **ATF temperature is within a specified range**
- **Engine coolant temperature is above a specified value**
- **Not applying hard braking**

9-5. Slip Control (cont.)



Tech 2 New Parameter
“SLIP RPM”
This parameter indicates slipping rotation in the torque converter (difference between input shaft rotation and engine rotation)

A. When the lock up clutch solenoid duty is 100 %
“SLIP RPM” will be 0 rpm.
B. When the slip control is performed
“SLIP RPM” will be increased, compared with “A” shown above.
C. When the lock up clutch solenoid duty is 0 %
“SLIP RPM” will be increased, compared with “B” shown above.

9-6. Line Pressure Control

TCM controls pressure control solenoid with duty signal according to the following signals:

-Engine speed signal (from ECM)
-Throttle position signal (from ECM)
-ATF temperature signal
-Input shaft speed signal
-Output shaft speed signal

9-7. Torque Control

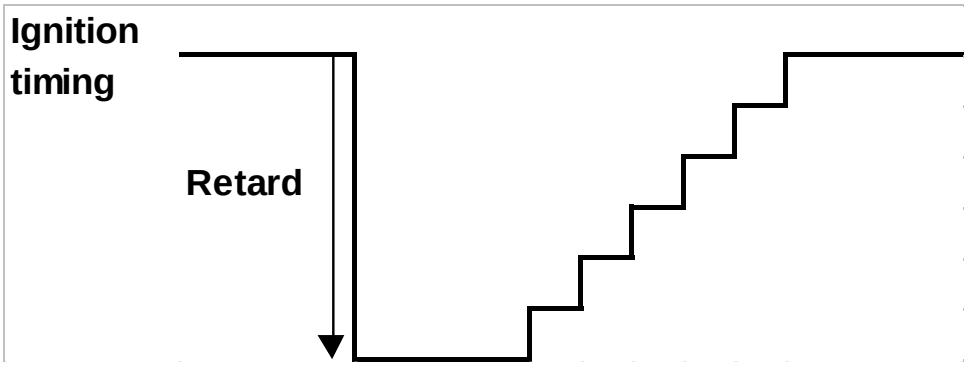
During shifting, engine torque will fluctuate and this will cause a shock.

TCM sends torque reduction request signal to ECM when shifting starts.

ECM retards the ignition timing to reduce the engine torque.

9-7. Torque Control (cont.)

[How to reduce engine torque]



9-9. Reverse Control

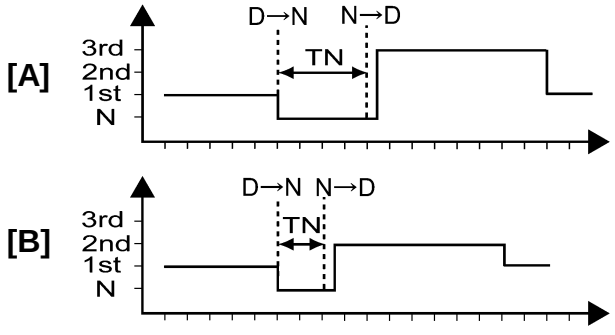
When shifting the A/T select lever from “D”,”3”,”2”,”L” to “R” at 7 km/h or faster, reverse gear is not engaged to protect the automatic transmission.

9-10. Squirt Control

Gear is shifted to 2nd or 3rd for a very short period and then to 1st when shifting from N to D to reduce a shock.

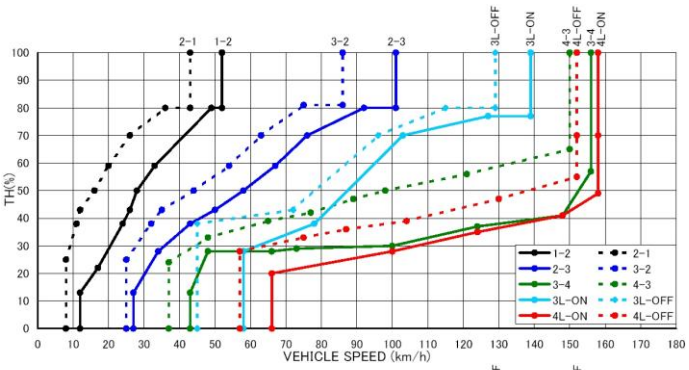
[Conditions] All shown below are met:

- **Engine idle**
- **“P”, “R” or “N” to “D” is detected**
- **Brake switch is ON**
- **Output shaft speed is less than 250rpm.**
- **ATF temperature is higher than 20°C.**



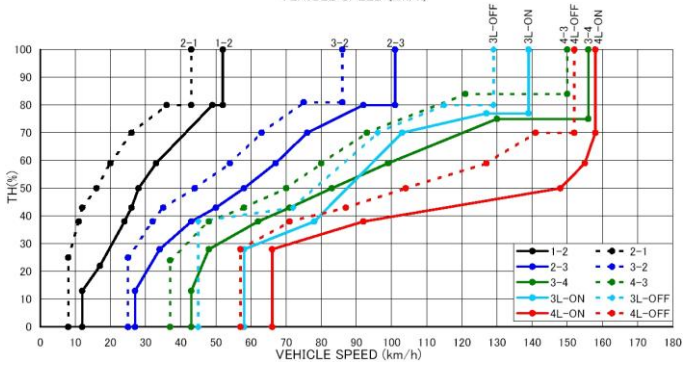
9-11. Cruise Shift Point Control

Normal Mode cruise OFF

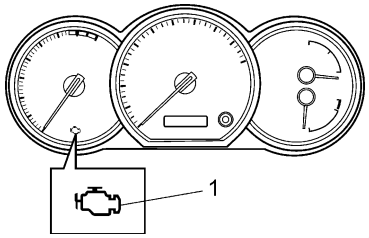


Special 3rd - 4th shifting and lock up schedule is applied during cruise control

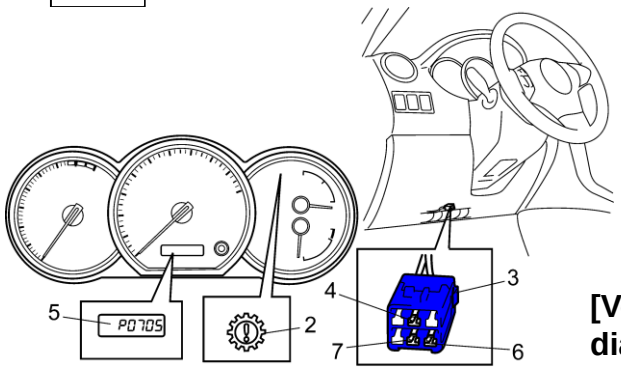
Normal Mode cruise ON



10. OBD



[Vehicle without engine diagnosis connector]



1.Malfunction indicator light
2.A/T warning light
3.A/T diagnosis connector (if equipped)
4.A/T diag switch terminal
5.Odometer showing A/T DTC
6.4WD diag switch terminal
7.ABS diag switch terminal

[Vehicle with engine diagnosis connector]

11. DTC

DTC No.	Detecting item	Detecting condition (DTC will set when detecting)	A	B
0000	No malfunction is detected	—	—	—
P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	Multiple signals are inputted simultaneously.	1driving cycle	1driving cycle
P0707	Transmission Range Sensor Circuit Low	No sensor signal is inputted.	2 driving cycles	2 driving cycles
P0712	Transmission Fluid Temperature Sensor "A" Circuit Low	Sensor output voltage is too low.	1driving cycle	1driving cycle
P0713	Transmission Fluid Temperature Sensor "A" Circuit High	Sensor output voltage is too high.	1driving cycle	1driving cycle
P0717	Input / Turbine Speed Sensor Circuit No Signal	No sensor signal is detected although output speed sensor signal is inputted.	1driving cycle	1driving cycle
P0722	Output Speed Sensor Circuit No Signal	No sensor signal is inputted although input speed sensor signal is inputted.	1driving cycle	1driving cycle
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	Difference in revolution between engine and input shaft is too large although TCM is commanding TCC pressure control solenoid to turn ON.	2 driving cycles	2 driving cycles *2
P0742	Torque Converter Clutch Circuit Stuck On	Difference in revolution between engine and input shaft is too small although TCM is commanding TCC pressure control solenoid to turn OFF.	2 driving cycles	2 driving cycles *2
P0751	Shift Solenoid "A" Performance or Stuck Off	The gear commanded by TCM does not match the actual gear when driving.	2 driving cycles	2 driving cycles *2
P0752	Shift Solenoid "A" Stuck On	The gear commanded by TCM does not match the actual gear when driving.	2 driving cycles	2 driving cycles *2
P0756	Shift Solenoid "B" Performance or Stuck Off	The gear commanded by TCM does not match the actual gear when driving.	2 driving cycles	2 driving cycles *2
P0757	Shift Solenoid "B" Stuck On	The gear commanded by TCM does not match the actual gear when driving.	2 driving cycles	2 driving cycles *2
P0962	Pressure Control Solenoid "A" Control Circuit Low	No electric flow is detected on pressure control solenoid circuit.	1driving cycle	1driving cycle
P0963	Pressure Control Solenoid "A" Control Circuit High	Too much electric flow is detected on pressure control solenoid circuit.	1driving cycle	1driving cycle
P0973	Shift Solenoid "A" Control Circuit Low	Voltage of shift solenoid terminal is low although TCM is commanding shift solenoid to turn ON.	1driving cycle	1driving cycle
P0974	Shift Solenoid "A" Control Circuit High	Voltage of shift solenoid terminal is high although TCM is commanding shift solenoid to turn OFF.	1driving cycle	1driving cycle

***1: MIL does not light although DTC is detected and stored.**

***2: Transmission warning light does not light although DTC is detected and stored.**

A: Driving cycles when MIL lighting and storing DTC in TCM memory for vehicle not equipped with engine diag connector.

B: Driving cycles when transmission warning light lighting and storing DTC in TCM memory for vehicle equipped with engine diag connector.

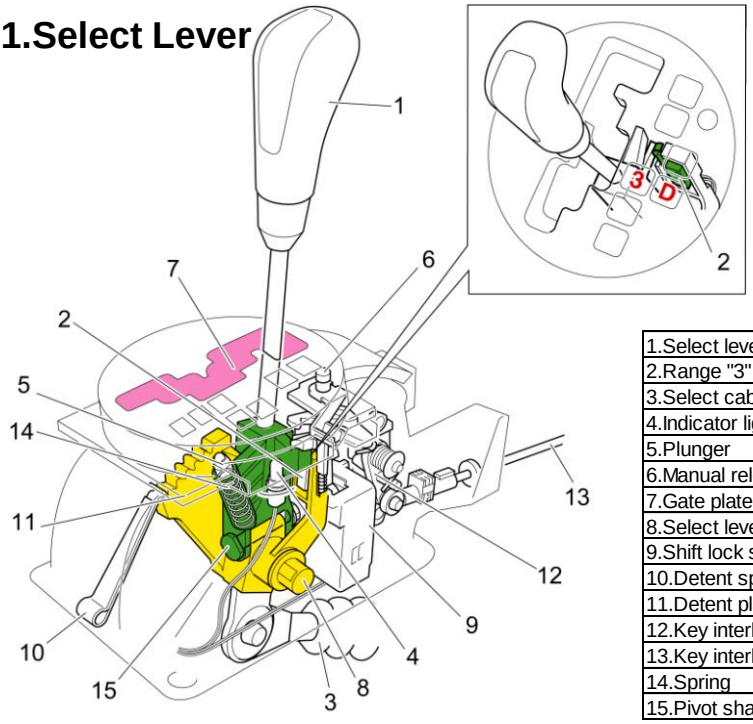
DTC No.	Detecting item	Detecting condition (DTC will set when detecting)	A	B
P0976	Shift Solenoid “B” Control Circuit Low	Voltage of shift solenoid terminal is low although TCM is commanding shift solenoid to turn ON.	1driving cycle	1driving cycle
P0977	Shift Solenoid “B” Control Circuit High	Voltage of shift solenoid terminal is high although TCM is commanding shift solenoid to turn OFF.	1driving cycle	1driving cycle
P1702	Internal Control Module Memory Check Sum Error	Calculation of current data stored in TCM is not correct comparing with pre-stored checking data in TCM.	1driving cycle	1driving cycle
P1703	CAN Invalid Data- TCM	TCM receives malfunction signal of throttle position, engine coolant temperature, engine revolution and engine torque from ECM.	1driving cycle *1	1driving cycle *2
P1723	Range Select Switch Malfunction	3 position switch signal is inputted out of specified value.	1driving cycle *1	1driving cycle *2
P1774	Control Module Communication Bus OFF	Transmitting error detected to TCM for specified time continuously.	1driving cycle	1driving cycle
P1777	TCM Lost Communication with ECM (Reception Error)	Receiving error from ECM detected to TCM for specified time continuously.	1driving cycle	1driving cycle
P1778	TCM Lost Communication with BCM (Reception Error)	Receiving error from BCM detected to TCM for specified time continuously.	1driving cycle *1	1driving cycle *2
P1874	4L switch circuit malfunction (Short)	Actual transfer position is 4H although transfer low signal is inputted.	1driving cycle	1driving cycle *2
P1875	4L switch circuit malfunction (Open)	Actual transfer position is 4L or N although transfer low signal is not inputted.	1driving cycle	1driving cycle *2
P1878	Torque Converter Clutch Shudder	Variation in the output revolution speed of the specified amplitude and specified cycle is detected under slip lock-up condition.	20driving cycle *1	—
P2763	Torque Converter Clutch Circuit High	Too much electric flow is detected on TCC pressure control solenoid circuit.	1driving cycle	1driving cycle
P2764	Torque Converter Clutch Circuit Low	No electric flow is detected on TCC pressure control solenoid circuit.	1driving cycle	1driving cycle

***1: MIL does not light although DTC is detected and stored.**
***2: Transmission warning light does not light although DTC is detected and stored.**
A: Driving cycles when MIL lighting and storing DTC in TCM memory for vehicle not equipped with engine diag connector.
B: Driving cycles when transmission warning light lighting and storing DTC in TCM memory for vehicle equipped with engine diag connector.

12.Select Mechanism

1.Select Lever
2.Key Interlock System

12-1.Select Lever

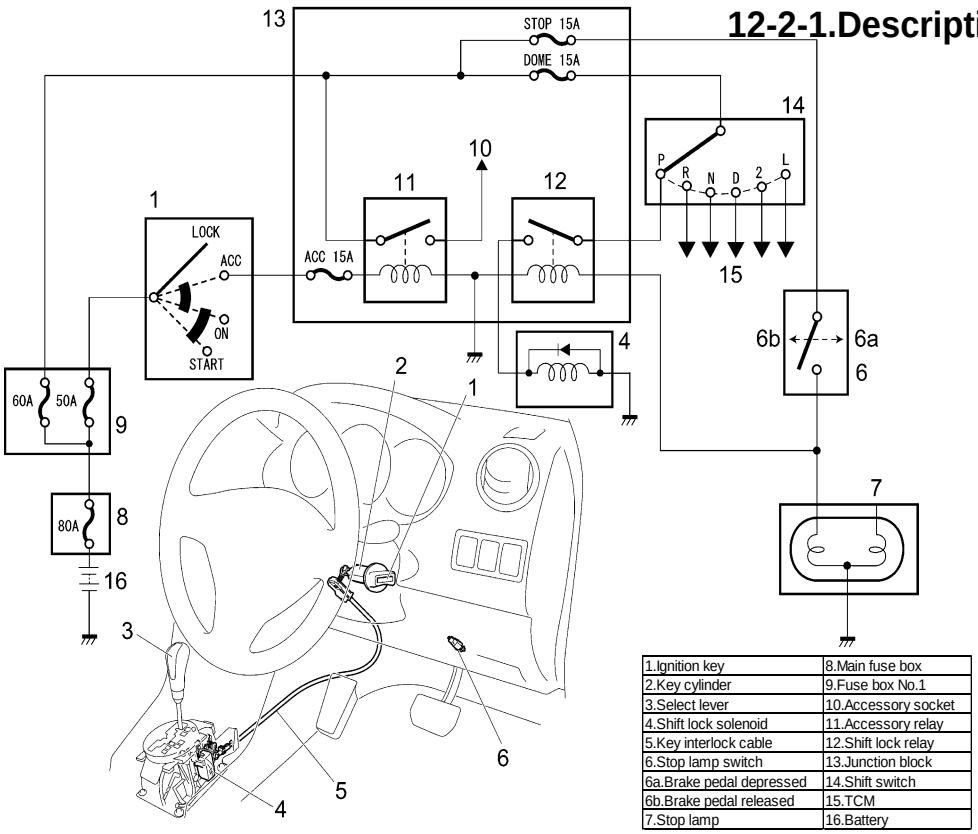


1.Select lever
2.Range "3" switch
3.Select cable
4.Indicator light
5.Plunger
6.Manual release button
7.Gate plate
8.Select lever pivot
9.Shift lock solenoid
10.Detent spring
11.Detent plate
12.Key interlock lever
13.Key interlock cable
14.Spring
15.Pivot shaft

12-2.Key Interlock Mechanism

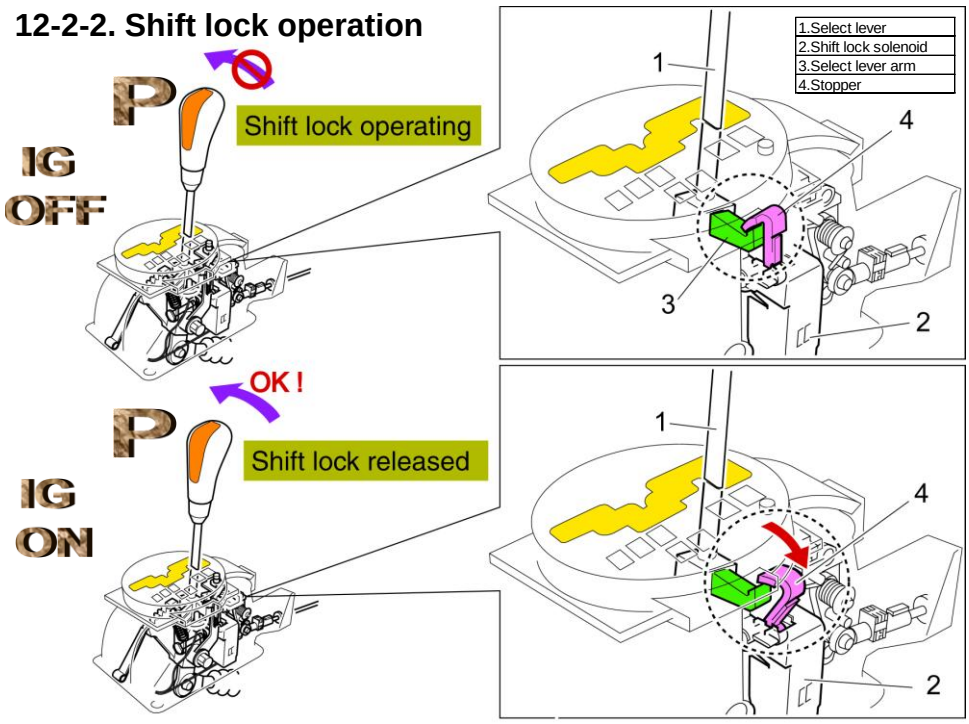
1.Description
2.Shift lock operation
3.Shift lock manual release
4.Key interlock operation

12-2-1.Description

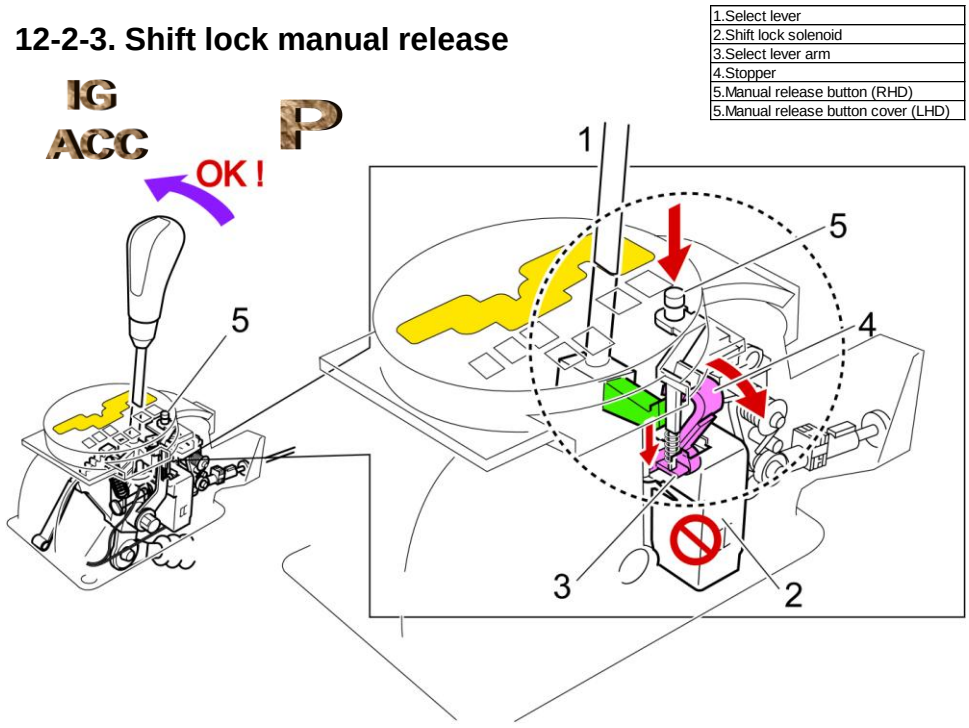


1.Ignition key	8.Main fuse box
2.Key cylinder	9.Fuse box No.1
3.Select lever	10.Accessory socket
4.Shift lock solenoid	11.Accessory relay
5.Key interlock cable	12.Shift lock relay
6.Stop lamp switch	13.Junction block
6a.Brake pedal depressed	14.Shift switch
6b.Brake pedal released	15.TCM
7.Stop lamp	16.Battery

12-2-2. Shift lock operation



12-2-3. Shift lock manual release



12-2-4. Key Interlock Operation

1.Ignition key	7.Key interlock arm
2.Key cylinder	7a. Convex part of "7"
3.Cam	8.Key interlock cable
4.Interlock pin	9.Detent plate
5.Slide piece	10.Key interlock lever
6.Hole	11.Return spring