

2007 TRANSMISSION

Automatic Transaxle (F21) - Veracruz

GENERAL

SPECIFICATION

GENERAL SPECIFICATIONS

Transmission type		F21
Engine model		Gasoline 3.8L
Driving system		2WD (4WD option)
Stall torque ratio		1.96
Stall revolution (rpm)		2279
Oil pump system		Trochoid pump (Engine drive)
Gear ratio	1st	4.148
	2nd	2.370
	3rd	1.556
	4th	1.155
	5th	0.859
	6th	0.686
	Reverse	3.394
	Counter	0.980
	Differential	3.533
Clutch	C1	1 flange, 7 disks, 7 plates
	C2	1 flange, 4 disks, 4 plates
	C3	1 flange, 4 disks, 4 plates
Brake	B1	1 band
	B2	2 flanges, 7 disks, 6 plates
One-way clutch	F1	Roller type
Solenoid	3-way	2 solenoids [S1, S2]
	Linear	6 Solenoids [SLC1, SLC2, SLC3, SLB1, SLT, SLU]
Line pressure (Idling)	D	372~432 kPa
	R	580~695 kPa
Transmission oil (ATF)		JWS-3309

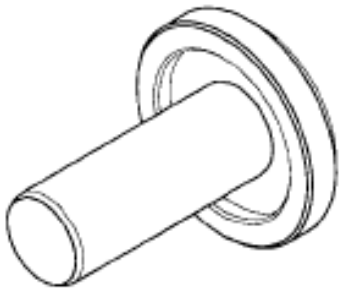
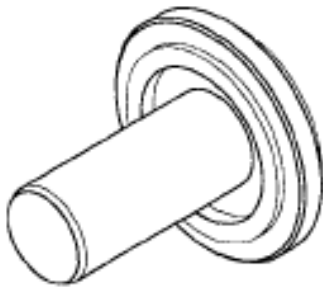
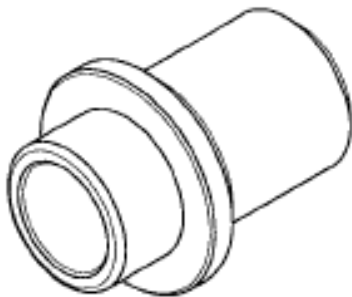
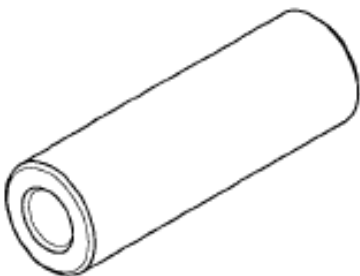
SPECIAL SERVICE TOOLS

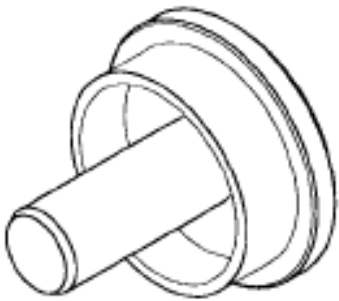
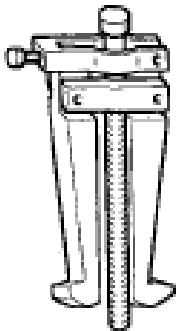
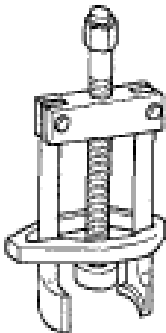
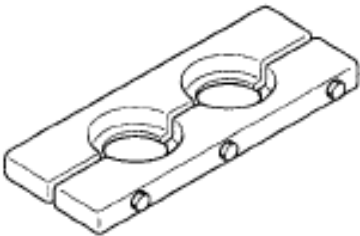
SPECIAL SERVICE TOOLS REFERENCE CHART

Number and Name	Illustration	Use

2007 Hyundai Veracruz Limited

2007 TRANSMISSION Automatic Transaxle (F21) - Veracruz

09452-3J000 Oil seal installer	 SENAT7105D	Installing oil seal (Transmission housing side) (2WD)
09452-3J100 Oil seal installer	 SENAT7106D	Installing oil seal (Transmission case side)
09453-3J000 Oil seal installer	 SENAT7107D	Installing oil seal (Oil pump)
09459-3J000 Oil seal installer	 SENAT7108D	Installing oil seal (Manual shaft)
09473-3J000		Installing oil seal (Transmission housing side)

Oil seal installer	 SENAT7109D	(4WD)
09455-32200 Oil seal puller	 UMQG010A	Removing oil seal
09455-21000 Bearing & gear puller	 UMQG010B	Removing taper roller bearing
09432-33200 Plate	 D3233200	Supporting when removing oil seal

AUTOMATIC TRANSAXLE SYSTEM

DESCRIPTION

F21 FEATURES

1. Easy-to-install FF 6-speed automatic transaxle

The F21 is a compact, lightweight, next-generation electronically controlled FF 6-speed automatic transaxle that employs a ravigneaux-type planetary gear. It employs a high-precision clutch hydraulic control system for smooth, highly responsive gear shift feel.

2. Adoption of centrifugal hydraulic pressure cancel clutch

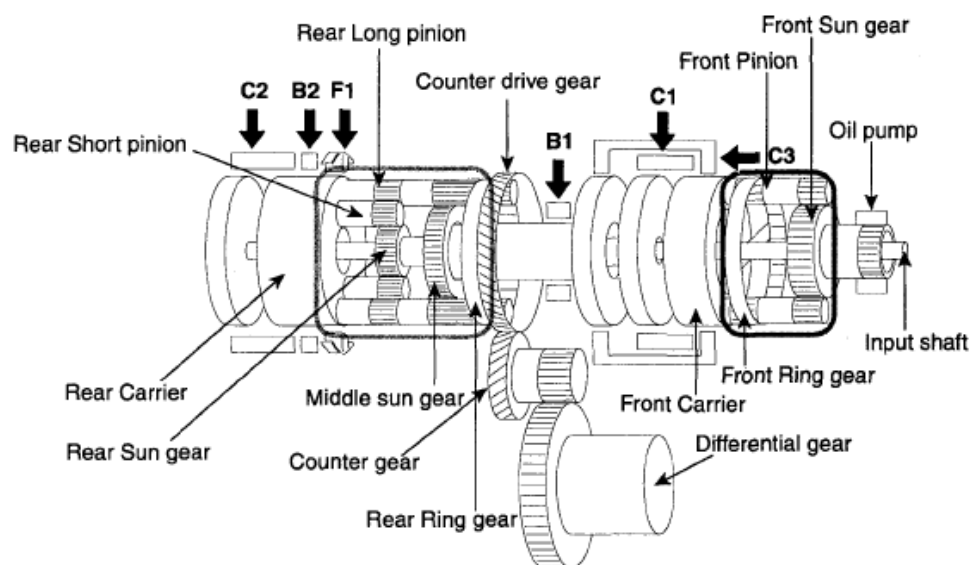
When the rotation of the clutch increases, centrifugal force operations on the oil inside the clutch, hydraulic pressure increases, and the timing of clutch engagement becomes earlier. This cause, a difference in rotation between the input shaft and the output shaft, and shift shock may occur. To solve this, an additional chamber has been provided opposite the piston hydraulic pressure chamber. This causes centrifugal hydraulic pressure to operate in the opposite direction with the same force as the piston, counteracting the pressure of the piston hydraulic pressure chamber.

3. Adoption of integrated position sensor with TCU

The adoption of the integrated oil cooler has the following advantages:

1. It allows the number of parts to be decreased (the wire harness can be simplified).
2. Reliability is enhanced because there is no harness circuit between the TCU and shift position sensor.

OPERATION



SENAT7050L

Fig. 1: Sectional View Of Automatic Transaxle
Courtesy of HYUNDAI MOTOR CO.

LIST OF OPERATING COMPONENTS

LIST OF OPERATING COMPONENTS

Clutch/Brake		Operation
C1	C1 Clutch	Connects front planetary carrier to rear planetary rear sun gear
C2	C2 Clutch	Connects intermediate shaft to rear planetary carrier
C3	C3 Clutch	Connects front planetary carrier to rear planetary middle sun gear
B1	B1 Brake	Locks rear planetary middle sun gear
B2	B2 Brake	Locks rear planetary carrier
F1	One-way Clutch	Locks counterclockwise rotation of rear planetary carrier

OPERATION OF COMPONENTS

OPERATION OF COMPONENTS

Shift position		Solenoid (o : ON, -: OFF)						Clutch			Brake		One-way clutch
		SLC1	SLC2	SLC3	SLB1	S1	S2	C1	C2	C3	B1	B2	F1
P		o	o	o	o	-	-	-	-	-	-	-	-
R	V<11	o	o	-	o	-	-	-	-	o	-	o	-
	V>11	o	o	o	o	o	o	-	-	-	-	-	-
N		o	o	o	o	-	-	-	-	-	-	-	-
D	1st	-	o	o	o	-	-	o	-	-	-	-	o
	E/GB	-	o	o	o	o	o	o	-	-	-	o	o
	2nd	-	o	o	-	-	-	o	-	-	o	-	-
	3rd	-	o	-	o	-	-	o	-	o	-	-	-

4th	-	-	o	o	-	-	o	o	-	-	-	-
5th	o	-	-	o	-	-	-	o	o	-	-	-
6th	o	-	o	-	-	-	-	o	-	o	-	-

* 1) Clutch, Brake, One-way clutch; o : Operating, -: not operating

2) Lock up control: operating only in between 3th-6th

PROCEDURE OF OPERATING EACH GEAR

1. "D"-1st gear

- Power transmission pathway [Operating components: C1, F1] Operating components:

C1, F1 (counterclockwise rotation is locked), B2 (ON when engine brake is operating)

PLANETARY GEAR UNIT DESCRIPTION

Planetary gear unit	Input, Locked, Output
Front	Input: Ring gear, Locked: Sun gear, Output: Carrier
Rear	Input: Rear sun gear, Locked: Carrier, Output: Ring gear

1. Input shaft (rotates clockwise) [same revolutions as the torque converter's turbine runner]
2. Front planetary ring gear (rotates clockwise) [same revolutions as the input shaft]
3. Front planetary pinion gear (rotates clockwise on its axis, orbits clockwise)

[because the front planetary sun gear is locked by the oil pump, it is pressed against the front planetary ring gear and orbits the sun gear while rotating on its axis (because the front planetary ring gear has internal gears, the rotational direction does not change)]

4. Front planetary carrier (rotates clockwise)

[reduction: same revolution as the front planetary pinion gear orbit revolution]

5. C1 -CLUTCH (rotates clockwise) [connects the front planetary carrier and the rear planetary sun gear]
6. Rear planetary sun gear (rotates clockwise) [same revolution as the front planetary carrier]
7. Rear planetary short pinion gear (rotates counterclockwise on its axis)

[the rear planetary carrier tries to rotate counterclockwise, but the counterclockwise rotation is locked by one-way clutch F1.]

8. Rear planetary long pinion gear (rotates clockwise on its axis)

[the rear planetary middle sun gear rotates counterclockwise (idling)]

9. Rear planetary ring gear (rotates clockwise) [the rear planetary ring gear is rotated by the rear planetary long pinion gear (because the rear planetary ring gear has internal gears, the rotational

direction does not change)]

10. Counter drive gear (rotates clockwise) [because the rear planetary ring gear is installed on the counter drive gear, the rotational direction and the revolution are the same as the rear planetary ring gear]
11. Counter driven gear (rotates counterclockwise)
12. Differential ring gear (rotates clockwise)

- Engine brake

When the engine brake is operating, driving force is transmitted from the tires.

2. "D" -2nd gear

- Power transmission pathway [Operating components: C1, B1]

PLANETARY GEAR UNIT DESCRIPTION

Planetary gear unit	Input, Locked, Output
Front	Input: Ring gear, Locked: Sun gear, Output: Carrier
Rear	Input: Rear Sun gear, Locked: Middle Sun gear, Output: Ring gear

1. Input shaft (rotates clockwise) [same revolutions as the torque converter's turbine runner]
2. Front planetary ring gear (rotates clockwise) [same revolution as the input shaft]
3. Front planetary pinion gear (rotates clockwise on its axis, orbits clockwise)

[because the front planetary sun gear is locked by the oil pump, it is pressed against the front planetary ring gear and orbits the sun gear while rotating on its axis (because the front planetary ring gear has internal gears, the rotational direction does not change)]

4. Front planetary carrier (rotates clockwise) [reduction: same revolution as the front planetary pinion gear orbit revolution]
5. C1-CLUTCH (rotates clockwise) [connects the front planetary carrier and the rear planetary sun gear]
6. Rear planetary sun gear (rotates clockwise) [same revolution as the front planetary carrier]
7. Rear planetary middle sun gear is locked by B1-BRAKE
8. Rear planetary short pinion gear (rotates counterclockwise on its axis, orbits clockwise)
9. Rear planetary long pinion gear (rotates clockwise on its axis, orbits clockwise)
10. Rear planetary ring gear (rotates clockwise) [the rear planetary ring gear is rotated by the rear planetary long pinion gear (because the rear planetary ring gear has internal gears, the rotational direction does not change)]
11. Counter drive gear (rotates clockwise)

[because the rear planetary ring gear is installed on the counter drive gear, the rotational direction and the revolution are the same as the rear planetary ring gear]

12. Counter driven gear (rotates counterclockwise)
 13. Differential ring gear (rotates clockwise)
3. "D"-3rd gear
- Power transmission pathway [Operating components: C1, C3]

PLANETARY GEAR UNIT DESCRIPTION

Planetary gear unit	Input, Locked, Output
Front	Input: Ring gear, Locked: Sun gear, Output: Carrier
Rear	Input: Rear Sun gear, Middle Sun gear, Locked: -, Output: Ring gear

1. Input shaft (rotates clockwise) [same revolution as the torque converter's turbine runner]
2. Front planetary ring gear (rotates clockwise) [same revolution as the input shaft]
3. Front planetary pinion gear (rotates clockwise on its axis, orbits clockwise)

[because the front planetary sun gear is locked by the oil pump, it is pressed against the front planetary ring gear and orbits the sun gear while rotating on its axis (because the front planetary ring gear has internal gears, the rotational direction does not change)]

4. Front planetary carrier (rotates clockwise)

[reduction: same revolution as the front planetary pinion gear orbit revolution]

5. C1-CLUTCH (rotates clockwise) [connects the front planetary carrier and the rear planetary sun gear]
6. C3-CLUTCH (rotates clockwise) [connects the front planetary carrier and the rear planetary middle sun gear]
7. Rear planetary gear assembly (rotates clockwise)

[because the rear planetary short pinion gear and the rear planetary long pinion gear are engaged, both the pinion gears are locked due to the difference in the rotational directions, and kinematic energy of the rear planetary sun gear and rear planetary middle sun gear is transmitted to the rear planetary ring gear]

8. Rear planetary ring gear (rotates clockwise) [same revolution as the rear planetary carrier]
9. Counter drive gear (rotates clockwise)

[because the rear planetary ring gear is installed on the counter drive gear, the rotational direction and the revolution are same as the rear planetary ring gear]

10. Counter driven gear (rotates counterclockwise)
 11. Differential ring gear (rotates clockwise)
4. "D"-4th gear

- Power transmission pathway [Operating components: C1, C2]

PLANETARY GEAR UNIT DESCRIPTION

Planetary gear unit	Input, Locked, Output
Front	Input: Ring gear, Locked: Sun gear, Output: Carrier
Rear	Input: Rear Sun gear, Carrier, Locked: -, Output: Ring gear

1. Input shaft (rotates clockwise) [same revolution as the torque converter's turbine runner]
2. Front planetary ring gear (rotates clockwise) [same revolution as the input shaft]
3. Front planetary pinion gear (rotates clockwise on its axis, orbits clockwise)

[because the front planetary sun gear is locked by the oil pump, it is pressed against the front planetary ring gear and orbits the sun gear while rotating on its axis (because the front planetary ring gear has internal gears, the rotational direction does not change)]

4. Front planetary carrier (rotates clockwise)

[reduction: same revolution as the front planetary pinion gear orbit revolution]

5. C1-CLUTCH (rotates clockwise) [connects the front planetary carrier and the rear planetary sun gear]
6. Intermediate shaft (rotates clockwise) [same revolution as the input shaft]]
7. C2-CLUTCH (rotates clockwise) [same revolution as the intermediate shaft]
8. Rear planetary carrier (rotates clockwise) [same revolution as the intermediate shaft]
9. Rear planetary short pinion gear (rotates clockwise on its axis, orbits clockwise) [because the rear planetary carrier rotates faster than the rear planetary sun gear]
10. Rear planetary long pinion gear (rotates counterclockwise on its axis, orbits clockwise)
11. Rear planetary ring gear (rotates clockwise)

[because the rear planetary long pinion gear's rotation is subtracted from the rear planetary carrier revolution, the rear planetary ring gear revolution is slower than those of the rear planetary carrier]

12. Counter drive gear (rotates clockwise)

[because the rear planetary ring gear is installed on the counter drive gear, the rotational direction and the revolution is the same as the rear planetary ring gear]

13. Counter driven gear (rotates counterclockwise)
 14. Differential ring gear (rotates clockwise)
5. "D"-5th gear

- Power transmission pathway [Operating components: C2, C3]

PLANETARY GEAR UNIT DESCRIPTION

Planetary gear unit	Input, Locked, Output
Front	Input: Ring gear, Locked: Sun gear, Output: Carrier
Rear	Input: Carrier, Middle Sun gear, Locked: -, Output: Ring gear

1. Input shaft (rotates clockwise) [same revolutions as torque converter's turbine runner]
2. Front planetary ring gear (rotates clockwise) [same revolution as the input shaft]
3. Front planetary pinion gear (rotates clockwise on its axis, orbits clockwise)

[because the front planetary sun gear is locked by the oil pump, it is pressed against the front planetary ring gear and orbits the sun gear while rotating on its axis (because the front planetary ring gear has internal gears, the rotational direction does not change)]

4. Front planetary carrier (rotates clockwise)

[reduction: same revolution as the front planetary pinion gear orbit revolution]

5. C3-CLUTCH (rotates clockwise) [connects the front planetary carrier and the rear planetary middle sun gear]
6. Rear planetary middle sun gear (rotates clockwise)

[same revolution as C3-CLUTCH (decelerates by the front planetary gear, so the revolutions are slower than the input shaft)]

7. Intermediate shaft (rotates clockwise) [same revolution as the input shaft]
8. C2-CLUTCH (rotates clockwise) [same revolution as the intermediate shaft]
9. Rear planetary carrier (rotates clockwise) [same revolutions as intermediate shaft]
10. Rear planetary long pinion gear (rotates clockwise on its axis, orbits clockwise)

[because the rear planetary carrier rotates faster than the rear planetary middle sun gear, the rear planetary middle pinion gear is pushed out by the speed difference, and orbits clockwise while rotating clockwise on its axis.]

11. Rear planetary ring gear (rotates clockwise)

[because the rear planetary long pinion gear's rotation is added to the rear planetary carrier revolutions, rear planetary ring gear revolution is faster than those of the rear planetary carrier]

12. Counter drive gear (rotates clockwise)

[because the rear planetary ring gear is installed on the counter drive gear, the rotational direction and revolution is the same as the rear planetary ring gear]

13. Counter driven gear (rotates counterclockwise)
14. Differential ring gear (rotates clockwise)

6. "D"-6th gear

- Power transmission pathway [Operating components: B1, C2]

PLANETARY GEAR UNIT DESCRIPTION

Planetary gear unit	Input, Locked, Output
Front	-
Rear	Input: Carrier, Locked: Middle Sun gear, Output: Ring gear

1. Input shaft (rotates clockwise) [same revolution as the torque converter's turbine runner]
2. Intermediate shaft (rotates clockwise) [same revolution as the torque converter's turbine runner]
3. B1-BRAKE [locks the rear planetary middle sun gear]
4. C2-CLUTCH [connects the intermediate shaft and the rear planetary carrier]
5. Rear planetary carrier (rotates clockwise) [same revolution as the intermediate shaft]
6. Rear planetary long pinion gear (rotates clockwise on its axis, orbits clockwise)

[because the rear planetary middle sun gear is locked, it is always in a speed increasing condition]

7. Rear planetary ring gear (rotates clockwise)

[because the rear planetary long pinion gear's rotation is added to the rear planetary carrier revolution, the rear planetary ring gear revolution is faster than those of the rear planetary carrier]

8. Counter drive gear (rotates clockwise)

[because the rear planetary ring gear is installed on the counter drive gear, the rotational [because the rear planetary ring gear is installed on the counter drive gear, the rotational

9. Counter driven gear (rotates counterclockwise)

10. Differential ring gear (rotates clockwise)

7. "R"-Reverse gear

- Power transmission pathway [Operating components: C3, B2]

PLANETARY GEAR UNIT DESCRIPTION

Planetary gear unit	Input, Locked, Output
Front	Input: Ring gear, Locked: Sun gear, Output: Carrier
Rear	Input: Middle Sun gear, Locked: Carrier, Output: Ring gear

1. Input shaft (rotates clockwise) [same revolution as the torque converter's turbine runner]
2. Front planetary ring gear (rotates clockwise) [same revolution as the input shaft]
3. Front planetary pinion gear (rotates clockwise on its axis, orbits clockwise)

[because the front planetary sun gear is locked by the oil pump, it is pressed against the front planetary ring gear and orbits the sun gear while rotating on its axis (because the front planetary ring gear has internal gears, the rotational direction does not change)]

4. Front planetary carrier (rotates clockwise)

[reduction: same revolution as the front planetary pinion gear orbit revolution]

5. C3-CLUTCH (rotates clockwise) [connects the front planetary carrier and the rear planetary middle sun gear]
6. Rear planetary middle sun gear (rotates clockwise)

[same revolutions as the C3-CLUTCH (rotates slower than the input shaft)]

7. B2-BRAKE [locks the rear planetary carrier]
8. Rear planetary long pinion gear (rotates counterclockwise)
9. Rear planetary ring gear (rotates counterclockwise)

[the rear planetary ring gear is rotated by the rear planetary long pinion gear (because the rear planetary ring gear has internal gears, the rotational direction does not change)]

10. Counter drive gear (rotates counterclockwise)

[because the rear planetary ring gear is installed on the counter drive gear, the rotational direction and revolution are the same as the rear planetary ring gear]

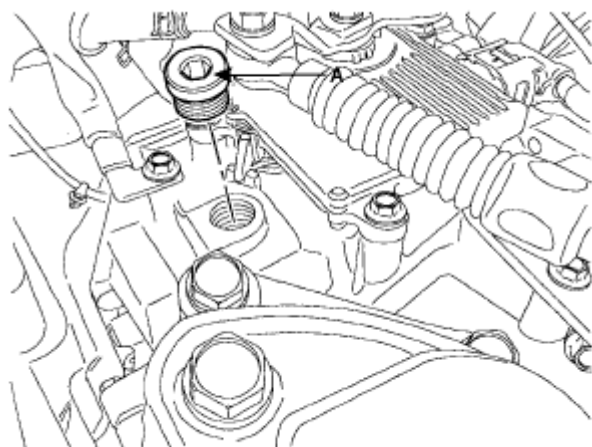
11. Counter driven gear (rotates clockwise)
12. Differential ring gear (rotates counterclockwise)

INSPECTION AND ADJUSTMENT

PROCEDURE OF ATF LEVEL CONFIRMING

1. Remove the filler plug (A) and the O-ring by using Torx wrench (T55) then add 400cc of ATF from the oil filling hole.

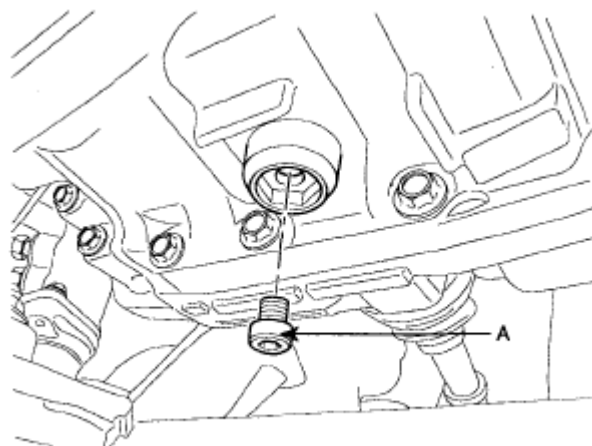
NOTE: In case, remove the air cleaner assembly.



SENAT7061D

Fig. 2: Identifying Filler Plug And O-Ring
Courtesy of HYUNDAI MOTOR CO.

2. Start the engine.
3. Shift from "P" to "D", then from "D" to "P", keeping each shift position "N", "R" more than 2 seconds with foot braking.
4. Repeat 2 times above procedure "3".
5. Remove the overflow plug (A) and the O-ring by using Torx wrench (T40) when ATF temperature on CAN signal rises up to 50~60°C at stabilized idle speed condition.



SENAT7060D

Fig. 3: Identifying Overflow Plug And O-Ring
Courtesy of HYUNDAI MOTOR CO.

6. Oil level is correct if ATF drain volume is in the range in the figure below.

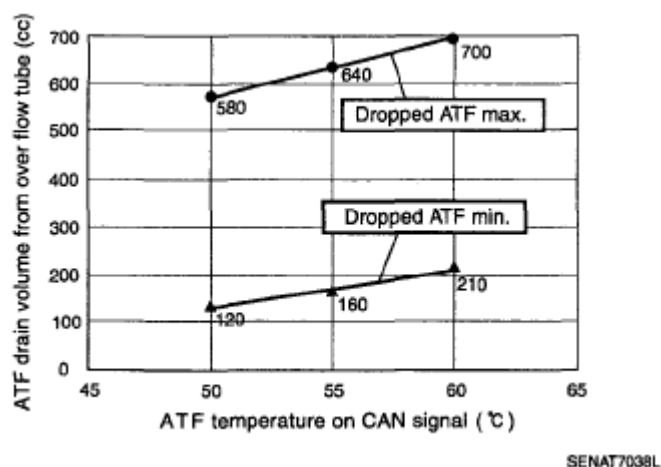


Fig. 4: ATF Temperature On CAN Signal Graph
 Courtesy of HYUNDAI MOTOR CO.

7. If the thin oil stream becomes drop by drop, fix the overflow plug with a new O-ring.

O-ring size: inner dia.-6.07mm, thickness-1.78mm

8. Tighten the overflow plug by using Torx (T40) wrench with the specified torque.

TORQUE : 6-9 Nm (0.6-0.9 kgf.m, 4.3-6.5 lb.ft)

9. Fix the filler plug with a new O-ring.

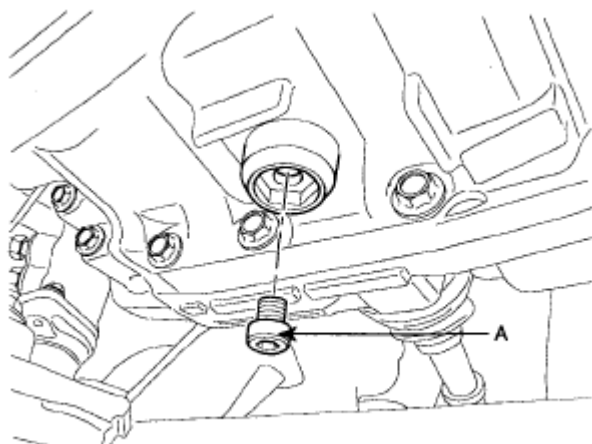
O-ring size: inner dia.-15.41 mm, thickness-2.21mm

10. Tighten the filler plug by using Torx (T55) wrench with the specified torque.

TORQUE : 24-56 Nm (2.4-5.6 kgf.m, 17.4-40.5 lb.ft)

PROCEDURE OF ATF LEVEL ADJUSTING

1. Park the vehicle on a flat road and lock the tires.
2. Shift the shift lever to the "P" range.
3. Remove the overflow plug (A) and the O-ring by using a torx wrench (T40).

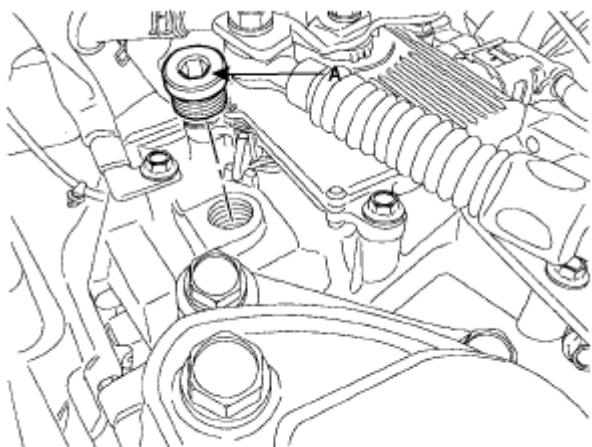


SENAT7060D

Fig. 5: Identifying Overflow Plug And O-Ring
Courtesy of HYUNDAI MOTOR CO.

4. Remove the filler plug (A) and the O-ring by using a torx wrench (T55).

NOTE: In case, remove the air cleaner assembly.



SENAT7061D

Fig. 6: Identifying Filler Plug And O-Ring
Courtesy of HYUNDAI MOTOR CO.

5. Check if ATF drops from the overflow hole. If ATF does not drop, add ATF until it drops.
6. Fix the overflow plug with the used O-ring by using Torx wrench (T40).
7. Add 600cc of ATF from the oil filling hole.
8. Coat the new O-ring with ATF, and install it to the filler plug.

O-ring size: inner dia.-15.41 mm, thickness-2.21 mm

9. Tighten the filler plug by using Torx (T55) wrench with the specified torque.

TORQUE : 24-56 Nm (2.4-5.6 kgf.m, 17.4-40.5 lb.ft)

10. Start the engine.
11. Raise ATF temperature on CAN signal up to 50~60°C at stabilized idle speed condition.
12. Shift from "P" to "D", then from "D" to "P", keeping each shift position "N", "R" more than 2 seconds with foot braking.
13. Repeat 2 times above procedure "3".
14. Remove the overflow plug and the O-ring by using Torx wrench (T40).
15. Check If the thin oil stream becomes drop by drop when ATF temperature on CAN signal is at 50~60°C.
16. Coat the new O-ring with ATF, and install it to the overflow plug.

O-ring size: inner dia.-15.41mm, thickness-2.21 mm

17. Tighten the overflow plug by using Torx (T40) wrench with the specified torque.

TORQUE : 6-9 Nm (0.6-0.9 kgf.m, 4.3-6.5 lb.ft)

NOTE: Be sure to wipe off spilled ATF completely after tightening the overflow plug.

OIL SEAL (MANUAL VALVE LEVER) REPLACEMENT

1. Remove the TCU. (refer to **REMOVAL**)

CAUTION: Be careful not to damage the terminals.

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

CAUTION:

- Tape the screwdriver tip before use.
- Be careful not to damage the transmission case.
- Be careful not to damage the manual valve lever.

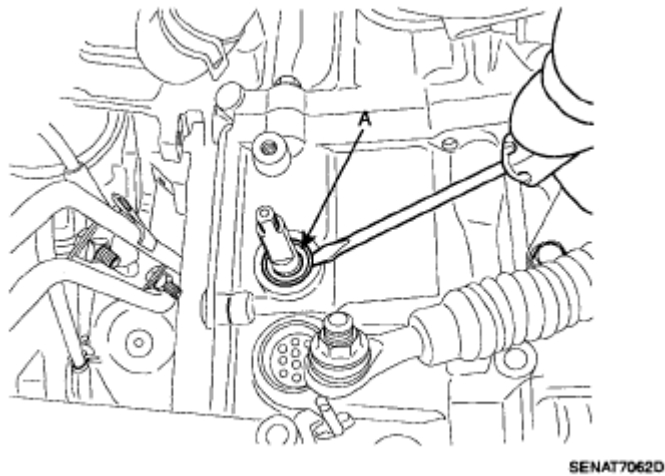


Fig. 7: Removing Oil Seal
Courtesy of HYUNDAI MOTOR CO.

- Using the special tool (09459-3J000) and a hammer, install the new oil seal to the T/A case.

Specification: $0+0.4/-0.3\text{mm}$

(From end of transmission case)

CAUTION: Be careful not to damage the oil seal.

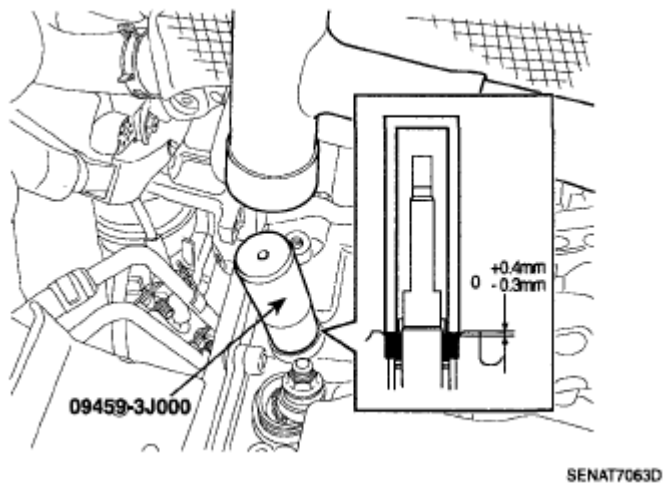


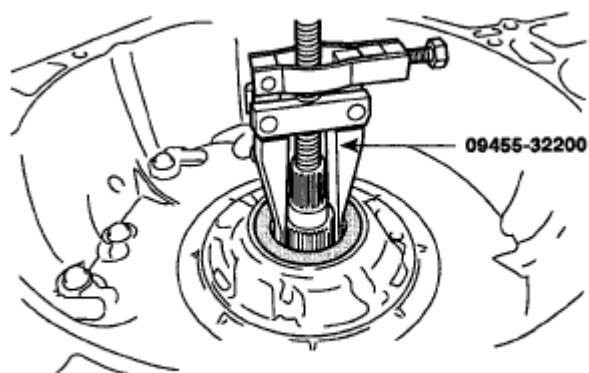
Fig. 8: Installing Oil Seal To T/A Case
Courtesy of HYUNDAI MOTOR CO.

- Install the TCU. (refer to **INSTALLATION**)

OIL SEAL (OIL PUMP) REPLACEMENT

1. Drain the ATF by removing the overflow plug and the filler plug.
2. Remove the transmission (refer to **AUTOMATIC TRANSAXLE'S REMOVAL**)
3. Take off the torque converter assembly from the transmission.
4. Using the special tool (09455-32200), remove the oil seal (A) from the oil pump assembly.

CAUTION: Be careful not to damage the bushing on the oil pump body.

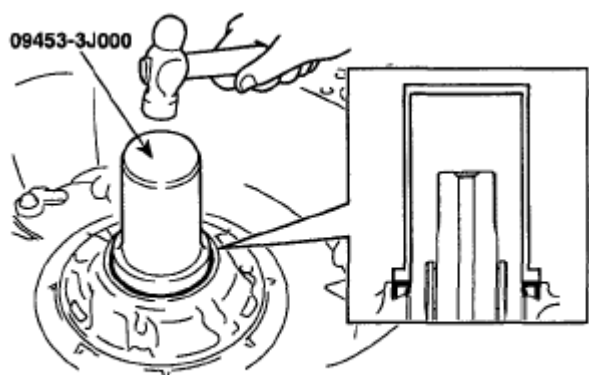


SENAT7064D

Fig. 9: Identifying Oil Seal And Oil Pump Assembly
Courtesy of HYUNDAI MOTOR CO.

5. Using the special tool (09453-3J000) and a hammer, install the new oil seal to the oil pump body.

Specification: 0 ± 0.2 mm (From end of oil pump)



SENAT7065D

Fig. 10: Installing Oil Seal To Oil Pump Body
Courtesy of HYUNDAI MOTOR CO.

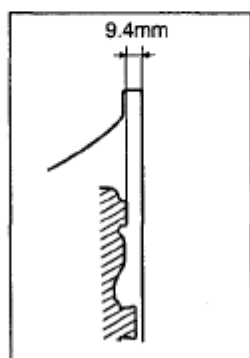
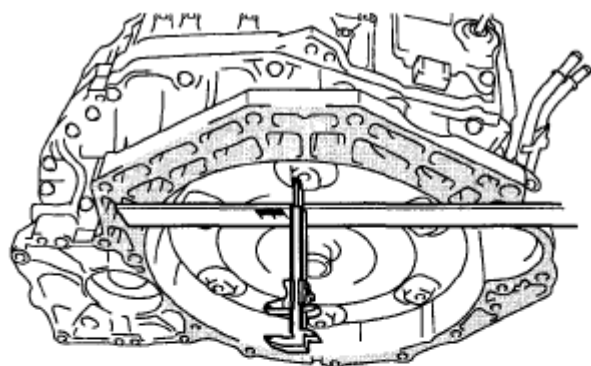
6. Using a screwdriver, position the drive gear on the oil pump assembly in the center. Then install the torque converter assembly on the transmission.

CAUTION: Be careful not to damage the oil seal.

7. Check that the torque converter assembly is installed properly.

Specification: approx. 9.4 mm

(From end of transmission housing)



SENAT7066N

Fig. 11: Checking Torque Converter Assembly
Courtesy of HYUNDAI MOTOR CO.

8. Install the transmission. (refer to **AUTOMATIC TRANSAXLE'S INSTALLATION**)
9. Refill the ATF. (refer to **PROCEDURE OF ATF LEVEL ADJUSTING**)

OIL SEAL (TRANSMISSION CASE SIDE) REPLACEMENT

1. Drain the ATF by removing the overflow plug and the filler plug.
2. Disconnect the left drive shaft assembly, (refer to **DRIVESHAFT**)
3. Insert a screwdriver between the differential case and the oil seal lip and pry the screwdriver to remove the oil seal.

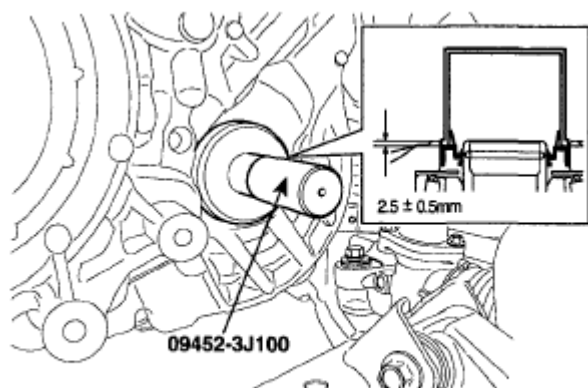
CAUTION: • **Tape the screwdriver tip before use.**

- Be careful not to damage the transmission case.
- Be careful not to damage the differential case.

4. Using the specified tool (09452-3J100) and a hammer, install the new oil seal to the T/A case.

Specification: 2.5 ± 0.5 mm (From end of transmission case)

CAUTION: Be careful not to damage the oil seal.



SENAT7067D

Fig. 12: Installing Oil Seal To T/A Case
Courtesy of HYUNDAI MOTOR CO.

5. Connect the left drive shaft assembly, (refer to **DRIVE-SHAFT**)
6. Refill the ATF. (refer to **PROCEDURE OF ATF LEVEL ADJUSTING**)

OIL SEAL (TRANSMISSION HOUSING SIDE) REPLACEMENT

1. Drain the ATF by removing the overflow plug and the filler plug.
2. Disconnect the right drive shaft assembly, (refer to **DRIVESHAFT**)
3. In case of 4WD, remove the transfer case assembly, (refer to **TRANSFER CASE'S REMOVAL**)
4. Insert a screwdriver between the differential case and the oil seal lip and pry the screwdriver to remove the oil seal.

CAUTION:

- Tape the screwdriver tip before use.
- Be careful not to damage the transmission housing.
- Be careful not to damage the differential case.

5. Using the specified tool (09452-3J000[2WD] or 09473-3J000[4WD]) and a hammer, install the new oil seal to the transmission housing.

Specification: (From end of transmission housing)

18.0±0.5mm (2WD), 23.1±0.5mm (4WD)

CAUTION: Be careful not to damage the oil seal.

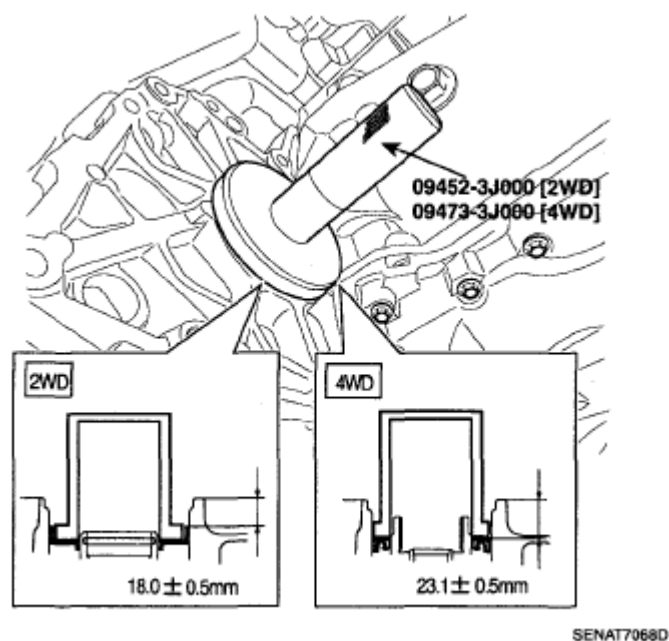


Fig. 13: Identifying Oil Seal To Transmission Housing
Courtesy of HYUNDAI MOTOR CO.

6. In case of 4WD, install the transfer case assembly, (refer to **TRANSFER CASE'S INSTALLATION**)
7. Connect the right drive shaft assembly, (refer to **DRIVE-SHAFT**)
8. Refill the ATF. (refer to **PROCEDURE OF ATF LEVEL ADJUSTING**)

TROUBLESHOOTING

HOW TO PERFORM N POSITION LEARNING

If the automatic transmission or the TCU is replaced, be sure to initialize the learned values and perform N position learning.

1. Stop the vehicle by shifting the shift lever to the P range and chock the tires. Turn the ignition switch to the ON position

CAUTION: Check that the vehicle is stationary before operation.

2. Release the shift lock, and shift the shift lever to the N range.
3. Check that the TCU N position mark is correct.
4. Check that the N position is correctly displayed on the High-Scan Pro.

CAUTION: The command cannot be input unless the ignition switch is on, the shift lever is in the N range, the engine is stopped, and the vehicle speed is 0 km/h.

- Input NG is indicated: Check again that the N position mark is correct. If it is incorrect, adjust it.
 - Input OK is indicated: Turn the ignition switch off after releasing the shift lock and shift the shift lever to the P range. Turn the ignition switch on after 5 seconds.
5. Shift the shift lever from the P to the D position, then check that the indicator displays the correct position.
 - Display is correct: Check the trouble code.
 - Display is incorrect: Perform the initial learning.

HOW TO PERFORM INITIAL LEARNING

If the automatic transmission or the TCU are replaced, or the TCU software is overwritten, be sure to initialize the learned values and perform initial learning.

1. Warm-up

Raise the ATF temperature by leaving the vehicle idling or performing a city drive. Check the ATF temperature using the special tester and make sure it is between 66 and 110°C. If the oil temperature is outside this range, work to bring it inside the range.

CAUTION: Do not attempt to raise the oil temperature by stalling the engine.

NOTE: If the oil temperature is not between 66 and 110°C, initial learning cannot be performed. Before learning, check for shift shock or variable speed shock.

2. Garage shift learning

With the vehicle stationary, depress the brake and keep the shift lever in N for 3 seconds. Then, shift from N into D, and maintain this condition for 3 seconds. Repeat this procedure 5 times. Then repeat 5 times in the same way for R.

3. Gear shift control learning

In D, with the throttle opening angle between 25 and 35%, drive until 6th gear and a vehicle speed of 110 km/h or higher is reached. Then, release the accelerator pedal and coast, and bring the vehicle to a stop within 60 seconds. Repeat this procedure 10 times.

4. Check learning results

Check that variable speed shock and shift shock have decreased compared to the conditions before learning.

INSPECTION CHART FOR DIAGNOSIS TROUBLE CODES (DTC)

INSPECTION CHART FOR DIAGNOSIS TROUBLE CODES

No.	Code	Items	MIL
1	<u>P0601</u>	Internal Control Module Memory Check Sum Error	•
2	<u>P0603</u>	Internal Control Module Keep Alive Memory (KAM) Error	•
3	<u>P0604</u>	Internal Control Module Random Access Memory (RAM) Error	•
4	<u>P0706</u>	Transmission Range Sensor Circuit Range/Performance	•
5	<u>P0707</u>	Transmission Range Sensor Circuit Low Input	•
6	<u>P0708</u>	Transmission Range Sensor Circuit High Input	•
7	<u>P0711</u>	Transmission Fluid Temperature Sensor "A" Circuit Range/Performance	•
8	<u>P0712</u>	Transmission Fluid Temperature Sensor "A" Circuit Low Input	•
9	<u>P0713</u>	Transmission Fluid Temperature Sensor "A" Circuit High Input	•
10	<u>P0717</u>	Input/Turbine Speed Sensor "A" Circuit No Signal	•
11	<u>P0722</u>	Output Speed Sensor Circuit No Signal	•
12	<u>P0729</u>	Gear 6 Incorrect Ratio	•
13	<u>P0730</u>	Incorrect Gear Ratio	•

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14	<u>P0731</u>	Gear 1 Incorrect Ratio	•
15	<u>P0732</u>	Gear 2 Incorrect Ratio	•
16	<u>P0733</u>	Gear 3 Incorrect Ratio	•
17	<u>P0734</u>	Gear 4 Incorrect Ratio	•
18	<u>P0735</u>	Gear 5 Incorrect Ratio	•
19	<u>P0741</u>	Torque Converter Clutch Circuit Stuck Off	•
20	<u>P0742</u>	Torque Converter Clutch Circuit Stuck On	•
21	<u>P0780</u>	Shift Error	•
22	<u>P0882</u>	TCM Power Input Signal Low	-
23	<u>P0883</u>	TCM Power Input Signal High	-
24	<u>P0942</u>	Neutral Condition at D Range-Valve stick (SLC1)	•
25	<u>P0961</u>	Pressure Control Solenoid "A" Control Circuit Range/Performance (SLT)	•
26	<u>P0962</u>	Pressure Control Solenoid "A" Control Circuit Low (SLT)	•
27	<u>P0963</u>	Pressure Control Solenoid "A" Control Circuit High (SLT)	•
28	<u>P0973</u>	Shift Solenoid "A" Control Circuit Low (S1 Solenoid)	•
29	<u>P0974</u>	Shift Solenoid "A" Control Circuit High (S1 Solenoid)	•
30	<u>P0976</u>	Shift Solenoid "B" Control Circuit Low (S2 Solenoid)	•
31	<u>P0977</u>	Shift Solenoid "B" Control Circuit High (S2 Solenoid)	•
32	<u>P0978</u>	Shift Solenoid "C" Control Circuit Range/Performance (SLC1)	•
33	<u>P0979</u>	Shift Solenoid "C"	•

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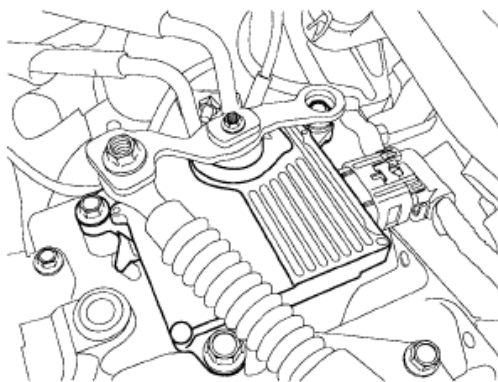
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		Control Circuit Low (SLC1)	
34	<u>P0980</u>	Shift Solenoid "C" Control Circuit High (SLC1)	•
35	<u>P0981</u>	Shift Solenoid "D" Control Circuit Range/Performance (SLC2)	•
36	<u>P0982</u>	Shift Solenoid "D" Control Circuit Low (SLC2)	•
37	<u>P0983</u>	Shift Solenoid "D" Control Circuit High (SLC2)	•
38	<u>P0984</u>	Shift Solenoid "E" Control Circuit Range/Performance (SLC3)	•
39	<u>P0985</u>	Shift Solenoid "E" Control Circuit Low (SLC3)	•
40	<u>P0986</u>	Shift Solenoid "E" Control Circuit High (SLC3)	•
41	<u>P0997</u>	Shift Solenoid "F" Control Circuit Range/Performance (SLB1)	•
42	<u>P0998</u>	Shift Solenoid "F" Control Circuit Low (SLB1)	•
43	<u>P0999</u>	Shift Solenoid "F" Control Circuit High (SLB1)	•
44	<u>P1750</u>	Wheel Speed Front Left Signal Undefined	•
45	<u>P1751</u>	Wheel Speed Front Right Signal Undefined	•
46	<u>P1752</u>	Wheel Speed Rear Left Signal Undefined	•
47	<u>P1753</u>	Wheel Speed Rear Right Signal Undefined	•
48	<u>P1760</u>	"Valve Stick (SLC3 Stick) - Neutral Condition	-

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		at R range	
49	<u>P2762</u>	Torque Converter Clutch Pressure Control Solenoid Control Circuit Range/Performance (SLU)	•
50	<u>P2763</u>	Torque Converter Clutch Pressure Control Solenoid Control Circuit High (SLU)	•
51	<u>P2764</u>	Torque Converter Clutch Pressure Control Solenoid Control Circuit Low (SLU)	•
52	<u>U0001</u>	High Speed CAN Communication Bus	•
53	<u>U0100</u>	Lost Communication With ECM/PCM "A"	•
54	<u>U0121</u>	Lost Communication With Anti-Lock Brake System (ABS) Control Module	•
55	<u>U0122</u>	Lost Communication With Electronic Control Suspension (ESP) Module	•

DTC P0601 EEPROM-CHECK SUM ERROR**COMPONENT LOCATION**

SENAT7201D

Fig. 14: Identifying Control Module Location
Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

This method is for fault detection in order to maintain for optimum condition.

DTC DESCRIPTION

TCU set this code, When input data is not available or ROM I.D is changed.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	Check the changes of signal	TCM
Enable Conditions	6V < Battery voltage < 15.5V - System is normal	
Threshold value	Stuck signal	
Diagnostic Time	More than 0.1 sec x more than 2times	
Fail Safe	- Self learning control is inhibited - Locked in 3rd gear	

COMPONENT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
3. Using a scantool, Clear DTC.
4. IG OFF <--> IG ON (Repeat 2~3 times), and then Monitor the "DTC"
5. Is DTC Re-displayed?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. And Go to **COMPONENT INSPECTION** procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE.**

NO:

- System performing to specification at this time.

DTC P0603 EEPROM AND CONFIGURATION-DATA SET ERROR

COMPONENT LOCATION

Refer to **DTC P0601.**

GENERAL DESCRIPTION

This method is for fault detection in order to maintain for optimum condition.

DTC DESCRIPTION

TCU set this code, When input data is not available or ROM I.D is changed.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the communication	• TCM
Enable Conditions	• "IG KEY" ON	
Threshold value	• Different value of RAM calculated with EEPROM	
Diagnostic Time	• Detected more than 1time	
Fail Safe	• Use the initial value of EEPROM	

COMPONENT INSPECTION

Refer to **DTC P0601.**

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0601**.

DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

COMPONENT LOCATION

Refer to **DTC P0601**.

GENERAL DESCRIPTION

This method is for fault detection in order to maintain for optimum condition.

DTC DESCRIPTION

TCU set this code, When input data is not available or ROM I.D is changed.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the communication	• TCM
Enable Conditions	• "IG KEY" ON	
Threshold value	• When the Detected abnormal data from RAM	
Diagnostic Time	• Detected more than 1time	
Fail Safe	• Locked in 3rd gear	

COMPONENT INSPECTION

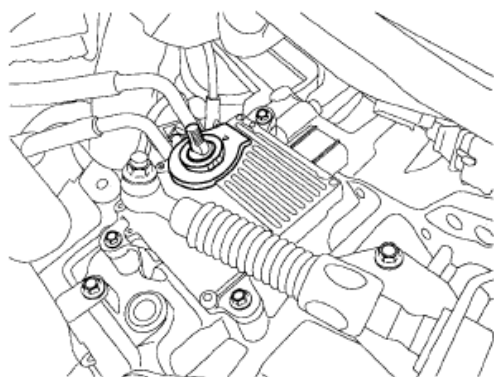
Refer to **DTC P0601**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0601**.

DTC P0706 TRANSMISSION RANGE SENSOR CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION



SENAT7202D

Fig. 15: [Identifying Control Module Location]
Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

The Transaxle Range Switch sends the shift lever position information to the TCM (PCM) using hall-sensor signal. The TCM (PCM) judges the shift lever position by reading all signals, for the Transaxle Range Switch, simultaneously.

DTC DESCRIPTION

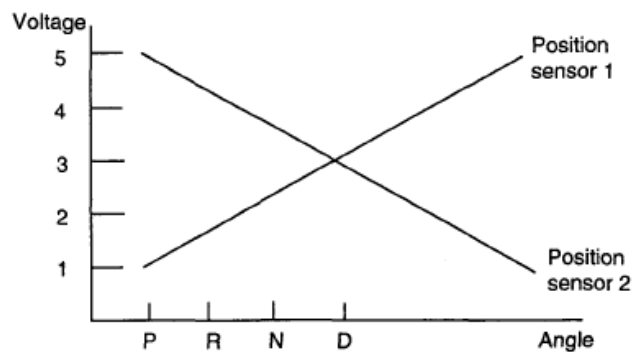
The TCU set this code, When the signal is stuck from shift lever switch.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Detect signal of change	• TCU
Enable Conditions	• 6V < Battery voltage < 15.5V • System is normal	
Threshold value	• Detect stuck signal	
Diagnostic Time	• More than 0.1 sec x more than 2times	
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear	

SIGNAL WAVEFORM



SENAT203L

Fig. 16: A/T Signal Waveform Graph
Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the "SELECT LEVER SWITCH and SHIFT GEAR POSITION" parameter on the scan tool.
4. Shift selector lever from "P" range to "D" range.

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Select Lever Switch	P,N	-
☒ Shift Gear Position	P,N,R	-

FIG.1)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Select Lever Switch	R	-
☒ Shift Gear Position	P,N,R	-

FIG.2)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Select Lever Switch	D	-
☒ Shift Gear Position	1	-

FIG.3)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Select Lever Switch	SPORT	-
☒ Shift Gear Position	2	-

FIG.4)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Select Lever Switch	SPORT	-
☒ Shift Gear Position	3	-

FIG.5)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Select Lever Switch	SPORT	-
☒ Shift Gear Position	4	-

FIG.6)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Select Lever Switch	SPORT	-
☒ Shift Gear Position	5	-

FIG.7)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Select Lever Switch	SPORT	-
☒ Shift Gear Position	6	-

FIG.8)

FIG.1) "P,N" Range

FIG.2) "R" Range

FIG.3) "D" Range 1st gear

FIG.4) "D" Range 2nd gear

FIG.5) "D" Range 3rd gear

FIG.6) "D" Range 4th gear

FIG.7) "D" Range 5th gear

FIG.8) "D" Range 6th gear

SENAT7204N

Fig. 17: Scan Tool Display - "SELECT LEVER SWITCH And SHIFT GEAR POSITION"
 Courtesy of HYUNDAI MOTOR CO.

5. Does "TRANSAXLE RANGE SWITCH" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**COMPONENT INSPECTION**" procedure.

COMPONENT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
3. Using a scantool, Clear DTC.
4. IG OFF <-> IG ON (Repeat 2~3 times), and then Monitor the "DTC"
5. Is DTC Re-displayed?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. And Go to **COMPONENT INSPECTION** procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to 'HOW TO PERFORM N POSITION LEARNING' and 'HOW TO PERFORM INITIAL LEARNING')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the APPLICABLE TROUBLESHOOTING PROCEDURE.

NO:

- System performing to specification at this time.

DTC P0707 TRANSAXLE RANGE SWITCH - LOW INPUT

COMPONENT LOCATION

Refer to DTC P0706.

GENERAL DESCRIPTION

Refer to DTC P0706.

DTC DESCRIPTION

The TCU set this code, When detected lower voltage than standard value from shift lever switch.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the voltage range	• TCU
Enable Conditions	• 6V < Battery voltage < 15.5V • System is normal	
Threshold value	• Voltage of Position sensor 1, 2 < 0.127V	
Diagnostic Time	• More than 0.1 sec x more than 2times	

Fail Safe

- Self learning control is inhibited
- Locked in 3rd gear

SIGNAL WAVEFORM

Refer to **DTC P0706**.

MONITOR SCANTOOL DATA

Refer to **DTC P0706**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0706**.

COMPONENT INSPECTION

Refer to **DTC P0706**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0706**.

DTC P0708 TRANSAXLE RANGE SWITCH - HIGH INPUT**COMPONENT LOCATION**

Refer to **DTC P0706**.

GENERAL DESCRIPTION

Refer to **DTC P0706**.

DTC DESCRIPTION

The TCU set this code, When detected higher voltage than standard value from shift lever switch.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the voltage range	• TCU
Enable Conditions	• 6V < Battery voltage < 15.5V • System is normal	
Threshold value	• Voltage of Position sensor 1, 2 > 4.87V	

Diagnostic Time	• More than 0.1 sec x more than 2times	
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear	

SIGNAL WAVEFORM

Refer to **DTC P0706**.

MONITOR SCANTOOL DATA

Refer to **DTC P0706**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0706**.

COMPONENT INSPECTION

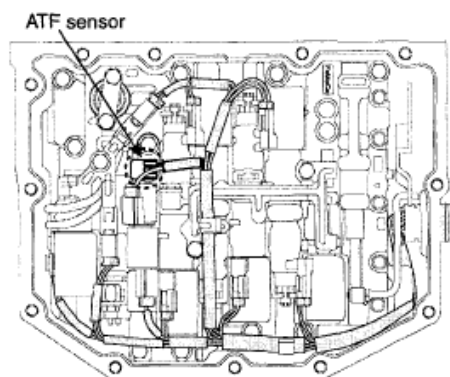
Refer to **DTC P0706**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0706**.

DTC P0711 TRANSAXLE FLUID TEMPERATURE SENSOR RATIONALITY

COMPONENT LOCATION



SENAT7205L

Fig. 18: Identifying ATF Sensor Location
 Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

The automatic TRANSAXLE fluid (ATF) temperature sensor is installed in the Valve Body. This sensor uses a thermistor whose resistance changes according to the temperature changes. The TCM supplies a 5V reference

voltage to the sensor, and the output voltage of the sensor changes when the ATF temperature varies. The automatic TRANSAXLE fluid (ATF) temperature provides very important data for the TCM's control of the Torque Converter Clutch, and is also used for many other purposes.

DTC DESCRIPTION

This DTC code is set when the ATF temperature output voltage is not changed for 15minutes. The TCM regards the ATF temperature as fixed at a value of 80°C (176°F).

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	Check the voltage range	- Faulty in harness. - Faulty in ATF sensor - Faulty in TCU
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - System is normal 200°C > ATF Temperature > -43°C - Shift lever switch = normal	
Threshold value	Be not changed ATF temperature	
Diagnostic Time	More than 15 minutes	
Fail Safe	- Self learning control is inhibited. - Locked in 3rd gear	

SPECIFICATION

TEMPERATURE SPECIFICATIONS

ATF temperature [°C (°F)]	Resistance (Kohms)
10 (50)	5.62 ~ 7.31
25 (77)	3.5
110 (230)	0.22 ~ 0.27

SCHEMATIC DIAGRAM

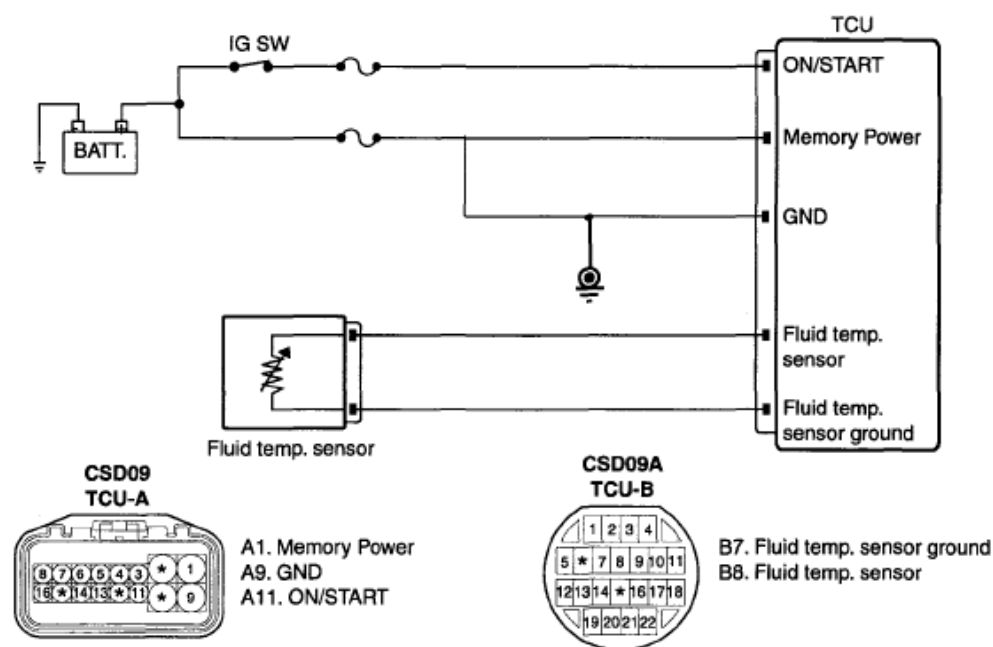


Fig. 19: Automatic/Transaxle - Schematic Diagram
Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "OIL TEMPERATURE SENSOR" parameter on the scan tool.

Specification : Increasing Gradually

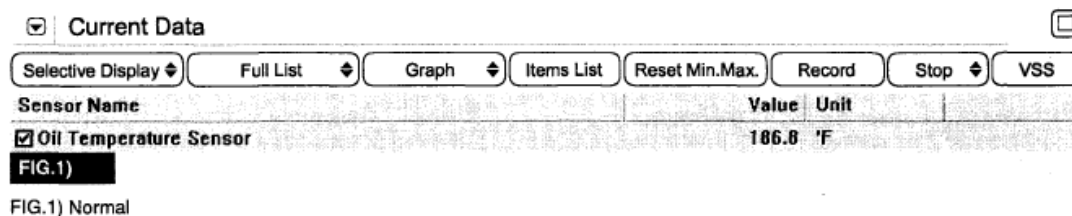


Fig. 20: Scan Tool Display - "OIL TEMPERATURE SENSOR"
Courtesy of HYUNDAI MOTOR CO.

4. Does "OIL TEMPERATURE SENSOR" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness,

poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Perform the continuity test between ATF sensor terminal and chassis-ground.

Specification : Not continuity

4. Is resistance within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.

3. Measure the resistance for "TRANSAXLE FLUID TEMPERATURE SENSOR".

Specification : Refer to a table

TEMPERATURE SPECIFICATIONS

ATF temperature [°C (°F)]	Resistance (Kohms)
10 (50)	5.62 ~ 7.31
25 (77)	3.5
110 (230)	0.22 ~ 0.27

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0712 FLUID (OIL) TEMPERATURE SENSOR CIRCUIT - LOW

COMPONENT LOCATION

Refer to **DTC P0711**.

GENERAL DESCRIPTION

Refer to **DTC P0711**.

DTC DESCRIPTION

This DTC code is set when the ATF temperature output voltage is lower than a value generated by thermistor resistance, in a normal operating range, for approximately 1 second or longer. The TCM regards the ATF temperature as fixed at a value of 80°C (176°F).

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	Check the voltage range	- Faulty in harness. - Faulty in ATF sensor - Faulty in TCU
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - System is normal	
Threshold value	ATF temperature > 200°C	
Diagnostic Time	More than 30times x more than 10seconds	
Fail Safe	- Self learning control is inhibited. - Locked in 3rd gear	

SPECIFICATION

Refer to **DTC P0711**.

SCHEMATIC DIAGRAM

Refer to **DTC P0711**.

MONITOR SCANTOOL DATA

Refer to **DTC P0711**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0711**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0711**.

COMPONENT INSPECTION

Refer to **DTC P0711**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0711**.

DTC P0713 FLUID (OIL) TEMPERATURE SENSOR CIRCUIT - HIGH

COMPONENT LOCATION

Refer to **DTC P0711**.

GENERAL DESCRIPTION

Refer to **DTC P0711**.

DTC DESCRIPTION

This DTC code is set when the ATF temperature output voltage is higher than a value generated by thermistor resistance, in a normal operating range, for an extended period of time. The TCM regards the ATF temperature as fixed at a value of 80°C (176°F).

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the voltage range	• Faulty in harness. • Faulty in ATF sensor • Faulty in TCU
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • System is normal • Engine coolant temp. > 50°C • Shift lever switch = normal	
Threshold value	• ATF temperature < -43°C	
Diagnostic Time	• More than 30times x more than 10 seconds	
Fail Safe	• Self learning control is inhibited. • Locked in 3rd gear	

SPECIFICATION

Refer to **DTC P0711**.

SCHEMATIC DIAGRAM

Refer to **DTC P0711**.

MONITOR SCANTOOL DATA

Refer to **DTC P0711**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0711**.

SIGNAL CIRCUIT INSPECTION

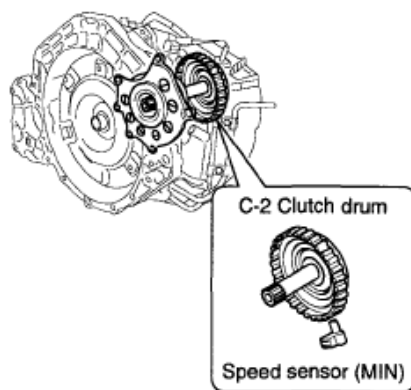
Refer to **DTC P0711**.

COMPONENT INSPECTION

Refer to **DTC P0711**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0711**.

DTC P0717 INPUT SPEED SENSOR CIRCUIT - NO SIGNAL**COMPONENT LOCATION**

SENAT7211L

Fig. 21: Identifying Input Speed Sensor Location
Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

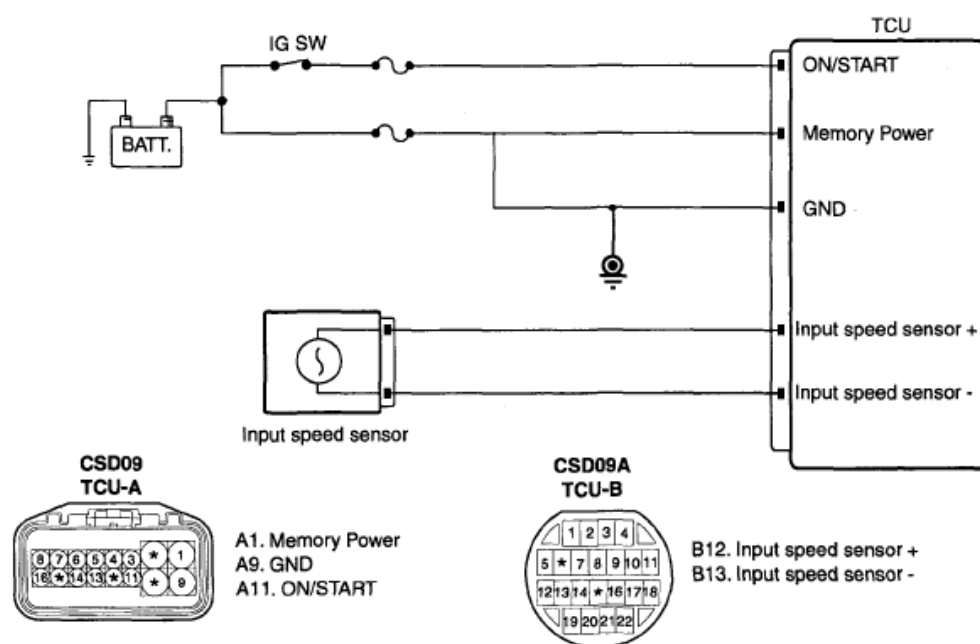
The input (turbine) speed sensor outputs pulse-signals according to the revolutions of the input shaft of the transmission. The TCM determines the input shaft speed by counting the frequency of the pulses. This value is mainly used to control the optimum fluid pressure during shifting.

DTC DESCRIPTION

The TCM sets this code if an output pulse-signal is not detected, from the input speed sensor, when the Output pulse signal is detected over the 24 pulse. The Fail-Safe function will be set by the TCM if this code is detected.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	Check the speed range	- Faulty INPUT SPEED SENSOR. - Faulty PCM/TCM - Signal circuit is open or short
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - System is normal - TCU communication = normal - Shift lever switch = normal	
Threshold value	To detect no pulse while detecting output revolution sensor signal 24 pulses	
Diagnostic Time	More than 500times x more than 1 sec	
Fail Safe	- Self learning control is inhibited - Locked in 3rd gear	

SCHEMATIC DIAGRAM

SENAT7212L

Fig. 22: Input Speed Sensor - Schematic Diagram

Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scan tool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "INPUT SPEED SENSOR" parameter on the scantool.
4. Driving at speed of over 19 Mile/h (30 Km/h).

Specification : Increasing Gradually

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Input Speed(PG-A)	680	RPM
☒ Engine Speed	699	RPM
☒ Select Lever Switch	P,N	-
☒ Shift Gear Position	P,N,R	-

FIG.1)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Input Speed(PG-A)	791	RPM
☒ Engine Speed	834	RPM
☒ Select Lever Switch	R	-
☒ Shift Gear Position	P,N,R	-

FIG.2)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Input Speed(PG-A)	862	RPM
☒ Engine Speed	900	RPM
☒ Select Lever Switch	D	-
☒ Shift Gear Position	1	-

FIG.3)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Input Speed(PG-A)	2097	RPM
☒ Engine Speed	2098	RPM
☒ Select Lever Switch	D	-
☒ Shift Gear Position	6	-

FIG.4)

FIG.1) "P,N" Range

FIG.2) "R" Range

FIG.3) "D" range Vehicle speed = 0

FIG.4) "D"range 6th gear

SENAT7213N

Fig. 23: Scan Tool Display - "INPUT SPEED SENSOR"

Courtesy of HYUNDAI MOTOR CO.

5. Does "Input speed sensor" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system may be caused from poor harness and terminal condition. These faults can be caused by interference from other electrical systems and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Perform the continuity test between "INPUT SPEED SENSOR" sensor terminal and chassis ground.

Specification : Not continuity

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and Go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

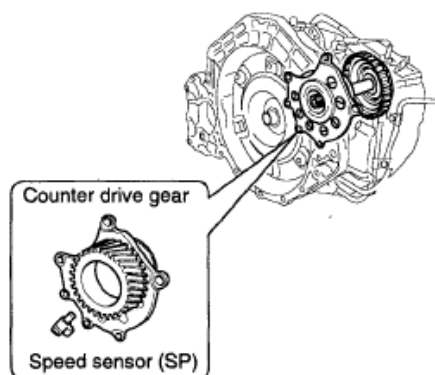
1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scan tool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Is resistance within specification ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0722 OUTPUT SPEED SENSOR CIRCUIT - NO SIGNAL**COMPONENT LOCATION**

SENAT7214L

Fig. 24: Identifying Output Speed Sensor Location
Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

The Output Speed Sensor outputs pulse-signals according to the revolutions of the output shaft of the transmission. The Output Speed Sensor is installed inside transmission. This value, together with the throttle position data, is mainly used to decide the optimum gear position.

DTC DESCRIPTION

The TCM sets this code if the calculated value of the pulse-signal is noticeably different from the value calculated, using the Vehicle Speed Sensor output. The TCM will initiate the fail safe function if this code is detected.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the speed range	• Faulty OUTPUT SPEED SENSOR. • Faulty PCM/TCM • Signal circuit is open or short
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • System is normal • TCU communication = normal • Shift lever switch = normal	
Threshold value	• To detect no pulse while detecting input revolution sensor signal 16 pulses	
Diagnostic Time	• More than 500 times x more than 1 sec	
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear	

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

- Specification : Increasing Gradually

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Output Speed[PG-B]	0	RPM
☒ Vehicle Speed Sensor	0	MPH
☒ Engine Speed	714	RPM
☒ Select Lever Switch	P,N	-
☒ Shift Gear Position	P,N,R	-

FIG.1)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Output Speed[PG-B]	246	RPM
☒ Vehicle Speed Sensor	5	MPH
☒ Engine Speed	880	RPM
☒ Select Lever Switch	R	-
☒ Shift Gear Position	P,N,R	-

FIG.2)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Output Speed[PG-B]	210	RPM
☒ Vehicle Speed Sensor	4	MPH
☒ Engine Speed	917	RPM
☒ Select Lever Switch	D	-
☒ Shift Gear Position	1	-

FIG.3)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Output Speed[PG-B]	3058	RPM
☒ Vehicle Speed Sensor	73	MPH
☒ Engine Speed	2098	RPM
☒ Select Lever Switch	SPORT	-
☒ Shift Gear Position	6	-

FIG.4)

FIG.1) "P,N" Range

FIG.2) "R" Range

FIG.3) "D" range 1st gear

FIG.4) "D" range 6th gear

SENAT7216N

Fig. 26: Scan Tool Display - "OUTPUT SPEED SENSOR"

Courtesy of HYUNDAI MOTOR CO.

5. Does "output speed sensor" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system may be caused from poor harness and terminal condition. These faults can be caused by interference from other electrical systems and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Perform the continuity test between "OUTPUT SPEED SENSOR" sensor terminal and chassis ground.

Specification : Not continuity

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scan tool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Is resistance within specification ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE.**

NO:

- System performing to specification at this time.

DTC P0729 GEAR 6 INCORRECT RATIO**GENERAL DESCRIPTION**

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 6th gear ratio, while the transaxle is engaged in the 6th gear. For example, if the output speed is 1,000 rpm and the 6th gear ratio is 0.686, then the input speed is 686 rpm.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 6th gear ratio, while the transaxle is engaged in 6th gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• 6th gear incorrect ratio	• C2 clutch • B1 brake • Valve-body (C2, B1 pressure system) • TCU • Line pressure solenoid valve (SLT)
Enable Conditions	• ATF temp. > 20°C • Output speed > 500rpm • TCU communication = normal • TPS >10% • Shift lever switch = "D" range • Shift gear = 6th gear	
Threshold value	• Input speed/6th gear ratio - output speed > or = 200rpm	

Diagnostic Time	• More than 12 times x more than 1 sec	• Shift control solenoid valve (SLC1, SLC2)
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear • Adaptive control is inhibited	

MONITOR SCANTOOL DATA

* It is difficult to "STALL TEST" in 6th gear, so that Go to "**SIGNAL CIRCUIT INSPECTION**" procedure

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 6th gear.

Specification : INPUT SPEED - (OUTPUT SPEED x GEAR RATIO) < or = 200 RPM

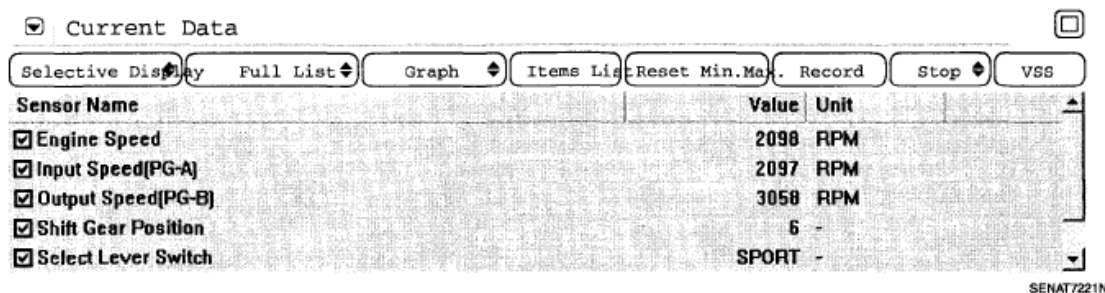


Fig. 27: Scan Tool Display - "INPUT & OUTPUT SPEED SENSOR"
Courtesy of HYUNDAI MOTOR CO.

5. Does "INPUT & OUTPUT SPEED SENSOR" follow the reference data?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

SHIFT LEVER	SOLENOID VALVE						CLUTCH			BRAKE		OneWay Clutch
	SLC1	SLC2	SLC3	SLB1	S1	S2	C1	C2	C3	B1	B2	F1
P	●	●	●	●								
R	Vehicle speed <11Km	●	●	●					●		●	
	Vehicle speed >11Km	●	●	●							●	
N	●	●	●	●	●	●						
D	1st gear		●	●			●					●
	1st gear-engine brake		●	●	●	●	●				●	●
	2nd gear		●	●			●			●		
	3rd gear		●		●		●		●			
	4th gear			●	●		●	●				
	5th gear	●			●			●	●			
	6th gear	●		●				●		●		

● Solenoid valve : ON

● Clutch & Brake : Working

S1 : Shift solenoid valve A
S2 : Shift solenoid valve B
SLC1 : Shift solenoid valve C
SLC2 : Shift solenoid valve D

SLC3 : Shift solenoid valve E
SLB1 : Shift solenoid valve F
SLT : Pressure solenoid valve

SENAT7222L

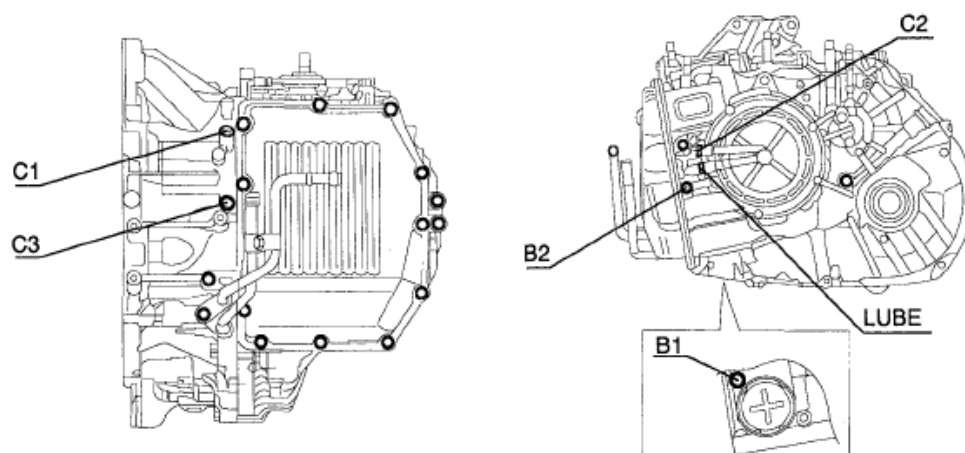
Fig. 28: Identifying Shift Lever And Engine Speed Gear Position
Courtesy of HYUNDAI MOTOR CO.

1. Connect Oil pressure gauge to "C2" port.
2. Engine "ON".
3. Drive a car with gear position "6".
4. Compare it with reference data as below.

Specification : refer to Standard Oil Pressure Table as below

OIL PRESSURE CHART

STANDARD PRESSURE			
SHIFT LEVER POSITION	ENGINE STATUS	ELEMENT	SPECIFICATION (Kg/cm ²)
"D" RANGE	IDLE	C1 CLUTCH	3.8 ~ 4.4
"R" RANGE	IDLE	C3 CLUTCH	5.9 ~ 7.1



SENAT7223D

Fig. 29: Identifying Oil Pressure Gauge To C2 Port
Courtesy of HYUNDAI MOTOR CO.

5. Is oil pressure value within specifications?

YES:

- Repair AUTO TRANSAXLE (Clutch or Brake) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0730 INCORRECT GEAR RATIO**GENERAL DESCRIPTION**

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 1st gear ratio, while the transaxle is engaged in the 1st gear. For example, if the output speed is 1,000 rpm and the 1st gear ratio is 4.418, then the input speed is 4418 rpm.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 1st gear ratio, while the transaxle is engaged in 1st gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• 1st gear incorrect ratio	• C1 clutch • B2 brake • Valve-body (C1, B2 pressure system) • TCU • Line pressure solenoid valve (SLT) • Shift control solenoid valve (SLC1, SLC2, SLB1) • S1,S2 solenoid valve
Enable Conditions	• ATF temp. > 20°C • Output speed > 500rpm • TCU communication = normal • TPS >10% • Shift lever switch = "D" range • Shift gear = 1st gear	
Threshold value	• Input speed/1st gear ratio - output speed > or = 200rpm	
Diagnostic Time	• More than 12 times x more than 1 sec	
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear • Adaptive control is inhibited	

MONITOR SCANTOOL DATA

1. Connect scan tool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scan tool.

4. Perform the "STALL TEST" with gear position "1"

Specification : 2000~2500 engine rpm

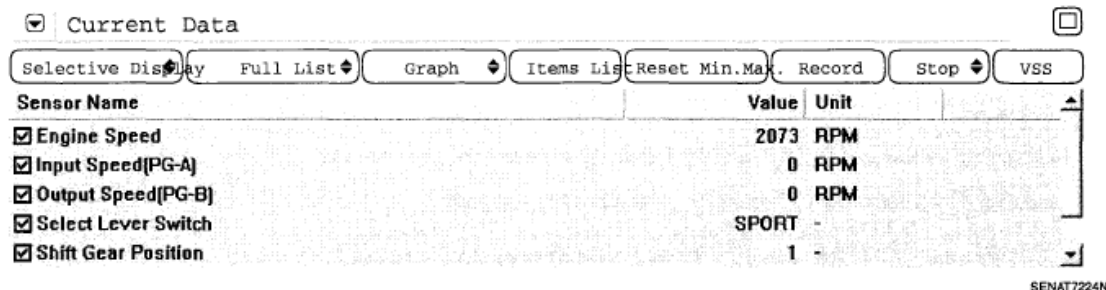


Fig. 30: Scan Tool Display - "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION"

Courtesy of HYUNDAI MOTOR CO.

Stall test procedure in D1 and reason

Procedure

1. Warm up the engine.
2. After positioning the select lever in "D", depress the foot brake pedal fully after that, depress the accelerator pedal to the maximum.

* The slippage of 1st gear operating parts can be detected by stall test in D

Reason for stall test

1. If there is no mechanical defaults in A/T, all slippages occurs in torque converter.
 2. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
 3. If 1st gear operating part has faults, input speed revolution will be out.
 4. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.
5. Is "STALL TEST" within specification?

YES:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

NO:

- Go to "**COMPONENT INSPECTION**" procedure.

- CAUTION:**
1. Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
 2. Check the A/T fluid level and temperature and the engine coolant temperature.
 - Fluid level: At the hot mark on the oil level gauge.
 - Fluid temperature : 176°F ~ 212 °F (80~100°C).
 - Engine coolant temperature: 176°F ~ 212°F (80~100°C).
 3. Chock both rear wheel (left and right).
 4. Pull the parking brake lever on with the brake pedal fully depressed.
 5. The throttle should not be left fully open for more than eight second.
 6. If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 1st gear.

Specification : INPUT SPEED - (OUTPUT SPEED x GEAR RATIO) < or = 200 RPM

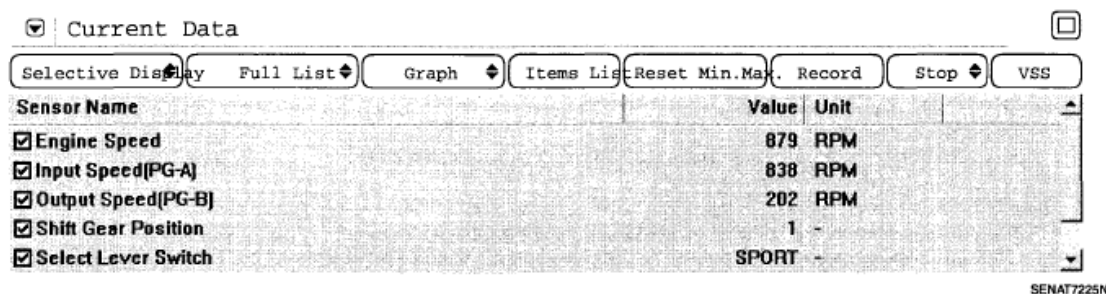


Fig. 31: Scan Tool Display - "INPUT & OUTPUT SPEED SENSOR"
Courtesy of HYUNDAI MOTOR CO.

5. Does "INPUT & OUTPUT SPEED SENSOR" within specifications?

YES:

- Go to "COMPONENT INSPECTION" procedure.

NO:

- Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

SHIFT LEVER	SOLENOID VALVE						CLUTCH			BRAKE		OneWay Clutch
	SLC1	SLC2	SLC3	SLB1	S1	S2	C1	C2	C3	B1	B2	F1
P	●	●	●	●								
R	Vehicle speed <11Km	●	●		●				●		●	
	Vehicle speed >11Km	●	●	●	●						●	
N	●	●	●	●	●	●						
D	1st gear		●	●	●		●					●
	1st gear-engine brake		●	●	●	●	●				●	●
	2nd gear		●	●			●			●		
	3rd gear		●		●		●		●			
	4th gear			●	●		●	●				
	5th gear	●			●			●	●			
	6th gear	●		●				●		●		

● Solenoid valve : ON

● Clutch & Brake : Working

S1 : Shift solenoid valve A
S2 : Shift solenoid valve B
SLC1 : Shift solenoid valve C
SLC2 : Shift solenoid valve D

SLC3 : Shift solenoid valve E
SLB1 : Shift solenoid valve F
SLT : Pressure solenoid valve

SENAT7222L

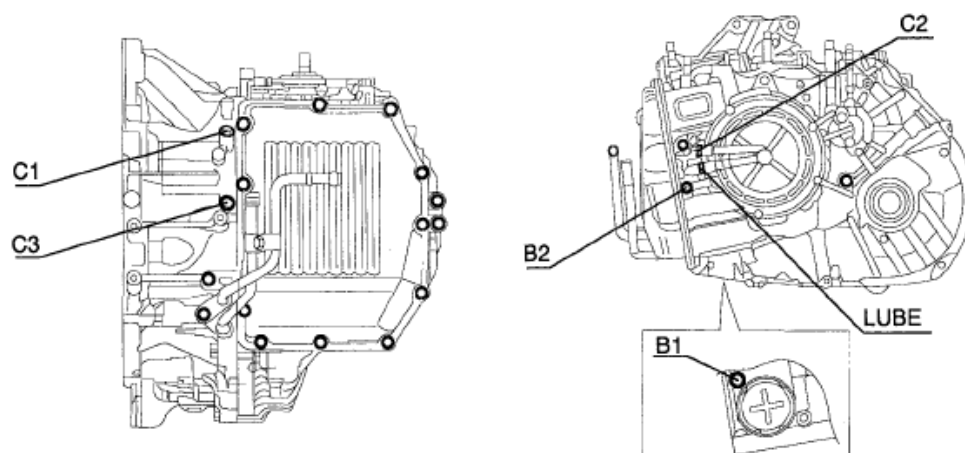
Fig. 32: Identifying Shift Lever And Engine Speed Gear Position
Courtesy of HYUNDAI MOTOR CO.

1. Connect Oil pressure gauge to "C1" port.
2. Engine "ON".
3. Drive a car with gear position 1 in "SPORTS MODE".
4. Compare it with reference data as below.

Specification : refer to Standard Oil Pressure Table as below

OIL PRESSURE CHART

STANDARD PRESSURE			
SHIFT LEVER POSITION	ENGINE STATUS	ELEMENT	SPECIFICATION (Kg/cm ²)
"D" RANGE	IDLE	C1 CLUTCH	3.8 ~ 4.4
"R" RANGE	IDLE	C3 CLUTCH	5.9 ~ 7.1



SENAT7223D

Fig. 33: Identifying Oil Pressure Gauge To C2 Port
 Courtesy of HYUNDAI MOTOR CO.

5. Is oil pressure value within specifications?

YES:

- Repair AUTO TRANSAXLE (Clutch or Brake) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0731 GEAR 1 INCORRECT RATIO**GENERAL DESCRIPTION**

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 1st gear ratio, while the transaxle is engaged in the 1st gear. For example, if the output speed is 1,000 rpm and the 1st gear ratio is 4.418, then the input speed is 4418 rpm.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 1st gear ratio, while the transaxle is engaged in 1st gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• 1st gear incorrect ratio	• C1 clutch • B2 brake • Valve-body (C1, B2 pressure system) • TCU • Line pressure solenoid valve (SLT) • Shift control solenoid valve (SLC1, SLC2, SLB1) • S1,S2 solenoid valve
Enable Conditions	• ATF temp. > 20°C • Output speed > 500rpm • TCU communication = normal • TPS >10% • Shift lever switch = "D" range • Shift gear = 1st gear	
Threshold value	• 1- (Input/Output)/2nd gear ratio < 4% • 1- (Input/Output)/3rd gear ratio < 4% • 1- (Input/Output)/4th gear ratio < 4%	
Diagnostic Time	• More than 12 times x more than 1sec	
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear • Adaptive control is inhibited	

MONITOR SCANTOOL DATA

1. Connect scan tool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scan tool.
4. Perform the "STALL TEST" with gear position "1"

Specification : 2000~2500 engine rpm

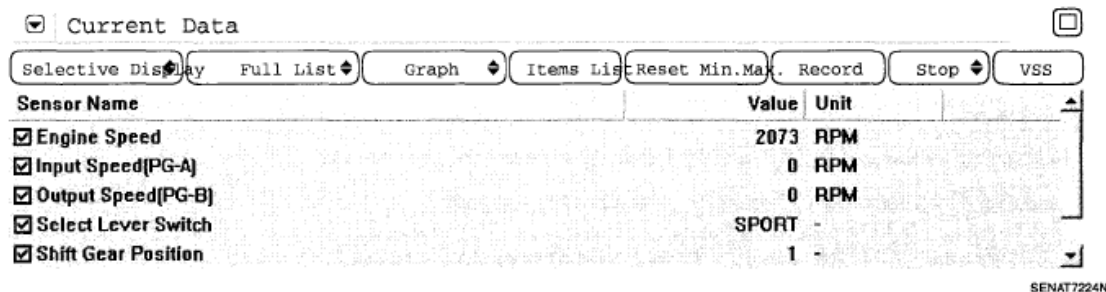


Fig. 34: Scan Tool Display - "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION"

Courtesy of HYUNDAI MOTOR CO.

Stall test procedure in D1 and reason

Procedure

1. Warm up the engine.
2. After positioning the select lever in "D", depress the foot brake pedal fully after that, depress the accelerator pedal to the maximum.

* The slippage of 1st gear operating parts can be detected by stall test in D

Reason for stall test

1. If there is no mechanical defaults in A/T, all slippages occurs in torque converter.
2. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
3. If 1st gear operating part has faults, input speed revolution will be out.
4. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.
5. Is "STALL TEST" within specification?

YES:

- Go to "SIGNAL CIRCUIT INSPECTION" procedure.

NO:

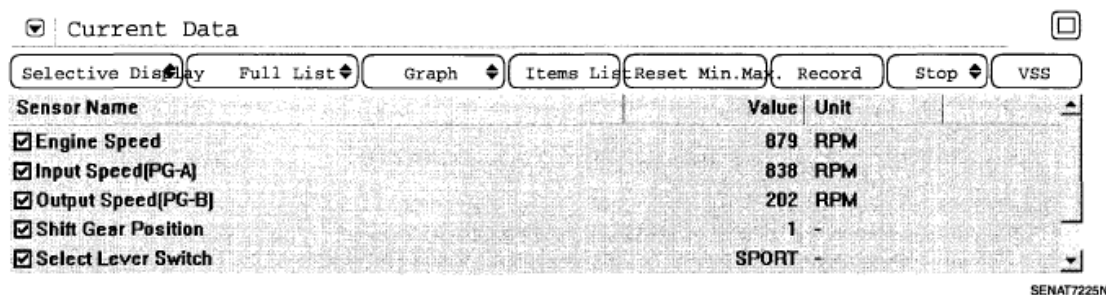
- Go to "**COMPONENT INSPECTION**" procedure.

- CAUTION:**
- Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
 - Check the A/T fluid level and temperature and the engine coolant temperature.
 - Fluid level: At the hot mark on the oil level gauge.
 - Fluid temperature : 176°F ~ 212°F (80~100°C).
 - Engine coolant temperature : 176°F ~ 212°F (80 ~ 100°C).
 - Chock both rear wheel (left and right).
 - Pull the parking brake lever on with the brake pedal fully depressed.
 - The throttle should not be left fully open for more than eight second.
 - If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent.

SIGNAL CIRCUIT INSPECTION

- Connect Scantool.
- Engine "ON".
- Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
- Accelerate the Engine speed until about 2000 rpm in the 1st gear.

Specification : $\text{INPUT SPEED} - (\text{OUTPUT SPEED} \times \text{GEAR RATIO}) < \text{or} = 200 \text{ RPM}$



The image shows a scan tool interface with a 'Current Data' tab selected. Below the tab are several buttons: 'Selective Display', 'Full List', 'Graph', 'Items List', 'Reset Min.Max.', 'Record', 'Stop', and 'VSS'. A table displays the following data:

Sensor Name	Value	Unit
☒ Engine Speed	879	RPM
☒ Input Speed(PG-A)	838	RPM
☒ Output Speed(PG-B)	202	RPM
☒ Shift Gear Position	1	-
☒ Select Lever Switch	SPORT	-

SENAT7225N

Fig. 35: Scan Tool Display - "INPUT & OUTPUT SPEED SENSOR"
Courtesy of HYUNDAI MOTOR CO.

- Does "INPUT & OUTPUT SPEED SENSOR" within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

SHIFT LEVER		SOLENOID VALVE						CLUTCH			BRAKE		OneWay Clutch
		SLC1	SLC2	SLC3	SLB1	S1	S2	C1	C2	C3	B1	B2	F1
P		●	●	●	●								
R	Vehicle speed <11Km	●	●		●					●		●	
	Vehicle speed >11Km	●	●	●	●							●	
N		●	●	●	●	●	●						
D	1st gear		●	●	●			●					●
	1st gear-engine brake		●	●	●	●	●	●				●	●
	2nd gear		●	●				●			●		
	3rd gear		●		●			●		●			
	4th gear			●	●			●	●				
	5th gear	●			●				●	●			
6th gear		●		●					●		●		

● Solenoid valve : ON

● Clutch & Brake : Working

S1 : Shift solenoid valve A
S2 : Shift solenoid valve B
SLC1 : Shift solenoid valve C
SLC2 : Shift solenoid valve D

SLC3 : Shift solenoid valve E
SLB1 : Shift solenoid valve F
SLT : Pressure solenoid valve

SENAT7222L

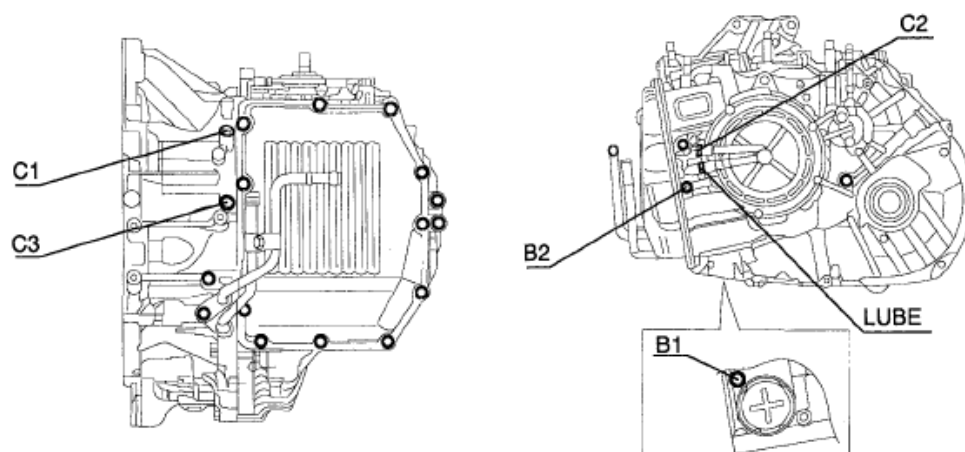
Fig. 36: Identifying Shift Lever And Engine Speed Gear Position
Courtesy of HYUNDAI MOTOR CO.

- Connect Oil pressure gauge to "C1" port.
- Engine "ON".
- Drive a car with gear position 1 in "SPORTS MODE".
- Compare it with reference data as below.

Specification : refer to Standard Oil Pressure Table as below

OIL PRESSURE CHART

STANDARD PRESSURE			
SHIFT LEVER POSITION	ENGINE STATUS	ELEMENT	SPECIFICATION (Kg/cm ²)
11D" RANGE	IDLE	C1 CLUTCH	3.8 ~ 4.4
"R" RANGE	IDLE	C3 CLUTCH	5.9 ~ 7.1



SENAT7223D

Fig. 37: Identifying Oil Pressure Gauge To C2 Port
Courtesy of HYUNDAI MOTOR CO.

5. Is oil pressure value within specifications?

YES:

- Repair AUTO TRANSAXLE (Clutch or Brake) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0732 GEAR 2 INCORRECT RATIO**GENERAL DESCRIPTION**

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 2nd gear ratio, while the transaxle is engaged in the 2nd gear. For example, if the output speed is 1000 rpm and the 2nd gear ratio is 2.370, then the input speed is 2370 rpm.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 2nd gear ratio, while the transaxle is engaged in 2nd gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• 2nd gear incorrect ratio	• C1 clutch • B1 brake • Valve-body (C1, B1 pressure system) • TCU • Line pressure solenoid valve (SLT) • Shift control solenoid valve (SLC1, SLC2, SLB1) • S1,S2 solenoid valve
Enable Conditions	• ATF temp. > 20°C • Output speed > 500rpm • TCU communication = normal • TPS >10% • Shift lever switch = "D" range • Shift gear = 2nd gear	
Threshold value	• input speed/2st gear ratio - output speed > or = 200rpm	
Diagnostic Time	• More than 12 times x more than 1 sec	
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear • Adaptive control is inhibited	

MONITOR SCANTOOL DATA

1. Connect scan tool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scan tool.
4. Perform the "STALL TEST" with gear position "2"

Specification : 2000~2500 engine rpm

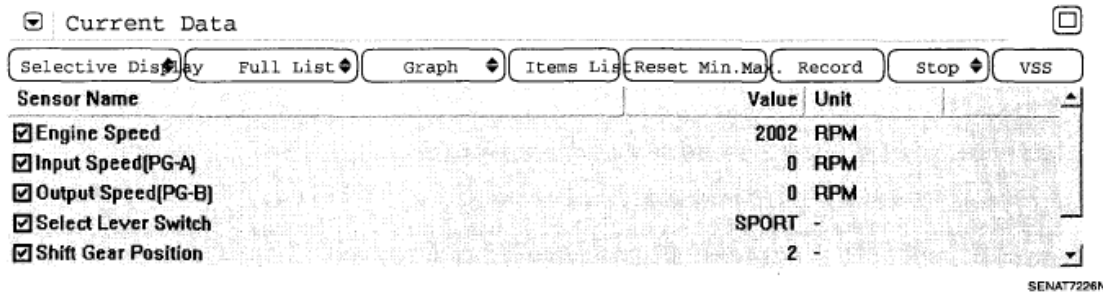


Fig. 38: Scan Tool Display - "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION"

Courtesy of HYUNDAI MOTOR CO.

Stall test procedure in D2 and reason

Procedure

1. Warm up the engine.
2. After positioning the select lever in "D" or "ON" of the HOLD SW (Operate UP SHIFT in case of "SPORTS MODE"), depress the foot brake pedal fully after that, depress the accelerator pedal to the maximum.

* The slippage of 2nd gear operating parts can be detected by stall test in D2.

Reason for stall test

1. If there is no mechanical defaults in A/T, all slippages occurs in torque converter.
2. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
3. If 2nd brake system (2nd gear operating part) has faults, input speed revolution will be out.
4. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.
5. Is "STALL TEST" within specification?

YES:

- Go to "SIGNAL CIRCUIT INSPECTION" procedure.

NO:

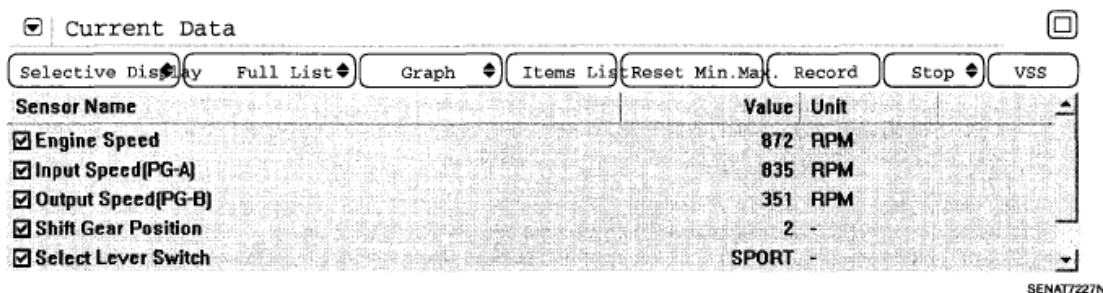
- Go to "**COMPONENT INSPECTION**" procedure.

- CAUTION:**
1. Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
 2. Check the A/T fluid level and temperature and the engine coolant temperature.
 - Fluid level: At the hot mark on the oil level gauge.
 - Fluid temperature: 176°F ~ 212°F (80~100°C).
 - Engine coolant temperature: 176°F ~ 212°F (80~100°C).
 3. Chock both rear wheel (left and right).
 4. Pull the parking brake lever on with the brake pedal fully depressed.
 5. The throttle should not be left fully open for more than eight second.
 6. If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 1st gear.

Specification : $\text{INPUT SPEED} - (\text{OUTPUT SPEED} \times \text{GEAR RATIO}) < \text{or} = 200 \text{ RPM}$



The image shows a scan tool interface with a 'Current Data' window. It contains a table with sensor names, values, and units. The sensors listed are Engine Speed (872 RPM), Input Speed (PG-A) (835 RPM), Output Speed (PG-B) (351 RPM), Shift Gear Position (2), and Select Lever Switch (SPORT). The interface also includes buttons for 'Selective Display', 'Full List', 'Graph', 'Items List', 'Reset Min.Max.', 'Record', 'Stop', and 'VSS'.

Sensor Name	Value	Unit
☒ Engine Speed	872	RPM
☒ Input Speed(PG-A)	835	RPM
☒ Output Speed(PG-B)	351	RPM
☒ Shift Gear Position	2	-
☒ Select Lever Switch	SPORT	-

SENAT7227N

Fig. 39: Scan Tool Display - "INPUT & OUTPUT SPEED SENSOR"
Courtesy of HYUNDAI MOTOR CO.

5. Does "INPUT & OUTPUT SPEED SENSOR" within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

SHIFT LEVER	SOLENOID VALVE						CLUTCH			BRAKE		OneWay Clutch
	SLC1	SLC2	SLC3	SLB1	S1	S2	C1	C2	C3	B1	B2	F1
P	●	●	●	●								
R	Vehicle speed <11Km	●	●	●					●		●	
	Vehicle speed >11Km	●	●	●							●	
N	●	●	●	●	●	●						
D	1st gear		●	●	●		●					●
	1st gear-engine brake		●	●	●	●	●				●	●
	2nd gear		●	●			●			●		
	3rd gear		●		●		●		●			
	4th gear			●	●		●	●				
	5th gear	●			●			●	●			
	6th gear	●		●				●		●		

● Solenoid valve : ON

● Clutch & Brake : Working

S1 : Shift solenoid valve A
S2 : Shift solenoid valve B
SLC1 : Shift solenoid valve C
SLC2 : Shift solenoid valve D

SLC3 : Shift solenoid valve E
SLB1 : Shift solenoid valve F
SLT : Pressure solenoid valve

SENAT7222L

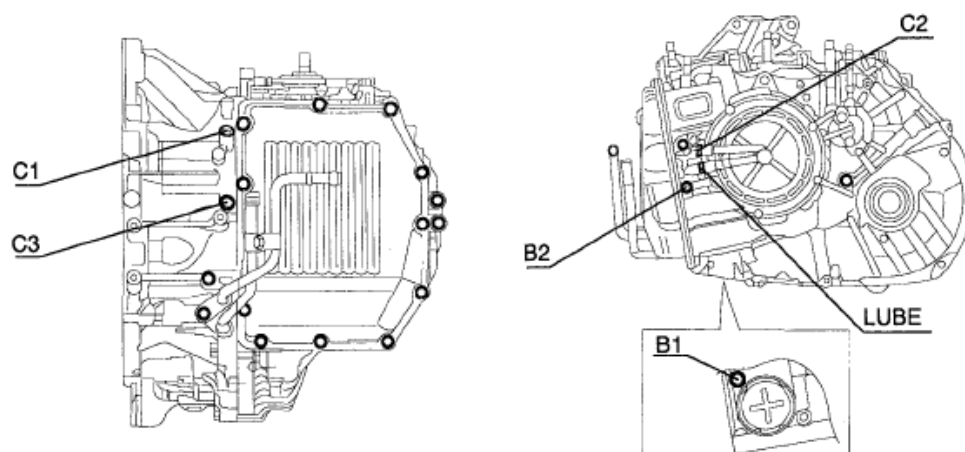
Fig. 40: Identifying Shift Lever And Engine Speed Gear Position
Courtesy of HYUNDAI MOTOR CO.

- Connect Oil pressure gauge to "C1" port.
- Engine "ON".
- Drive a car with gear position 2 in "SPORTS MODE".
- Compare it with reference data as below.

Specification : refer to Standard Oil Pressure Table as below

OIL PRESSURE CHART

STANDARD PRESSURE			
SHIFT LEVER POSITION	ENGINE STATUS	ELEMENT	SPECIFICATION (Kg/cm ²)
"D" RANGE	IDLE	C1 CLUTCH	3.8 ~ 4.4
"R" RANGE	IDLE	C3 CLUTCH	5.9 ~ 7.1



SENAT7223D

Fig. 41: Identifying Oil Pressure Gauge To C2 Port
Courtesy of HYUNDAI MOTOR CO.

5. Is oil pressure value within specifications?

YES:

- Repair AUTO TRANSAXLE (Clutch or Brake) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE.**

NO:

- System performing to specification at this time.

DTC P0733 GEAR 3 INCORRECT RATIO**GENERAL DESCRIPTION**

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 3rd gear ratio, while the transaxle is engaged in the 3rd gear. For example, if the output speed is 1000 rpm and the 3rd gear ratio is 1.556, then the input speed is 1556 rpm.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 3rd gear ratio, while the transaxle is engaged in 3rd gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

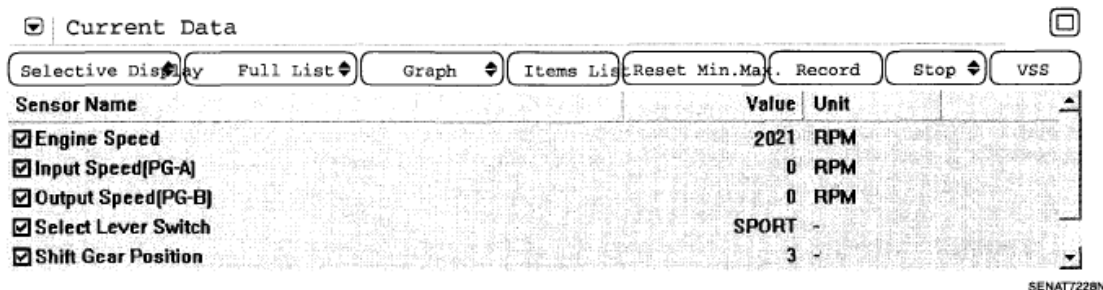
DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• 3rd gear incorrect ratio	• C1 clutch • C3 clutch • Valve-body (C1, C3 pressure system) • TCU • Line pressure solenoid valve (SLT) • Shift control solenoid valve (SLC1, SLC2, SLB1) • S1,S2 solenoid valve
Enable Conditions	• ATF temp. > 20°C • Output speed > 500rpm • TCU communication = normal • TPS >10% • Shift lever switch = "D" range • Shift gear = 3rd gear	
Threshold value	• Input speed/3rd gear ratio - output speed > or = 200rpm	
Diagnostic Time	• More than 12 times x more than 1 sec	
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear • Adaptive control is inhibited	

MONITOR SCANTOOL DATA

1. Connect scan tool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scan tool.
4. Disconnect the solenoid valve connector and perform the "STALL TEST".

Specification : 2000~2500 engine rpm



The image shows a scan tool interface with a 'Current Data' tab selected. Below the tab are buttons for 'Selective Display', 'Full List', 'Graph', 'Items List', 'Reset Min.Max.', 'Record', 'Stop', and 'VSS'. A table displays the following data:

Sensor Name	Value	Unit
☒ Engine Speed	2021	RPM
☒ Input Speed(PG-A)	0	RPM
☒ Output Speed(PG-B)	0	RPM
☒ Select Lever Switch	SPORT	-
☒ Shift Gear Position	3	-

SENAT7228N

Fig. 42: Scan Tool Display - "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION"

Courtesy of HYUNDAI MOTOR CO.

Stall test procedure in D3 and reason

Procedure

1. Warm up the engine.
2. After making 3rd gear hold by disconnecting the solenoid connector, and Then depress the foot brake pedal fully After that, step on the accelerator pedal to the maximum.

* The slippage of 3rd gear operating parts can be detected by stall test in D3.

Reason for stall test

1. If there is no mechanical defaults in A/T, all slippages occurs in torque converter.
2. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
3. If OD clutch system (3rd gear operating part) has faults, input speed revolution will be output.
4. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.
5. Is "STALL TEST" within specification?

YES:

- Go to "SIGNAL CIRCUIT INSPECTION" procedure.

NO:

- Go to "**COMPONENT INSPECTION**" procedure.

- CAUTION:**
1. Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
 2. Check the A/T fluid level and temperature and the engine coolant temperature.
 - Fluid level: At the hot mark on the oil level gauge.
 - Fluid temperature : 176°F ~ 212°F (80~100°C).
 - Engine coolant temperature: 176°F ~ 212°F (80~100°C).
 3. Chock both rear wheel (left and right).
 4. Pull the parking brake lever on with the brake pedal fully depressed.
 5. The throttle should not be left fully open for more than eight second.
 6. If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 3rd gear.

Specification : INPUT SPEED (OUTPUT SPEED x GEAR RATIO) < or = 200 RPM

Current Data			
Selective Display	Full List	Graph	Items List
Reset Min.Max.	Record	Stop	VSS
Sensor Name	Value	Unit	
☒ Engine Speed	846	RPM	
☒ Input Speed[PG-A]	796	RPM	
☒ Output Speed[PG-B]	511	RPM	
☒ Shift Gear Position	3	-	
☒ Select Lever Switch	SPOINT	-	

SENAT7229N

Fig. 43: Scan Tool Display - "INPUT & OUTPUT SPEED SENSOR"
Courtesy of HYUNDAI MOTOR CO.

5. Does "INPUT & OUTPUT SPEED SENSOR" within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

SHIFT LEVER		SOLENOID VALVE						CLUTCH			BRAKE		OneWay Clutch
		SLC1	SLC2	SLC3	SLB1	S1	S2	C1	C2	C3	B1	B2	F1
P		●	●	●	●								
R	Vehicle speed <11Km	●	●		●					●		●	
	Vehicle speed >11Km	●	●	●	●							●	
N		●	●	●	●	●	●						
D	1st gear		●	●	●			●					●
	1st gear-engine brake		●	●	●	●	●	●				●	●
	2nd gear		●	●				●			●		
	3rd gear		●		●			●		●			
	4th gear			●	●			●	●				
	5th gear	●			●				●	●			
	6th gear	●		●					●		●		

- Solenoid valve : ON
- Clutch & Brake : Working

S1 : Shift solenoid valve A
S2 : Shift solenoid valve B
SLC1 : Shift solenoid valve C
SLC2 : Shift solenoid valve D

SLC3 : Shift solenoid valve E
SLB1 : Shift solenoid valve F
SLT : Pressure solenoid valve

SENAT7222L

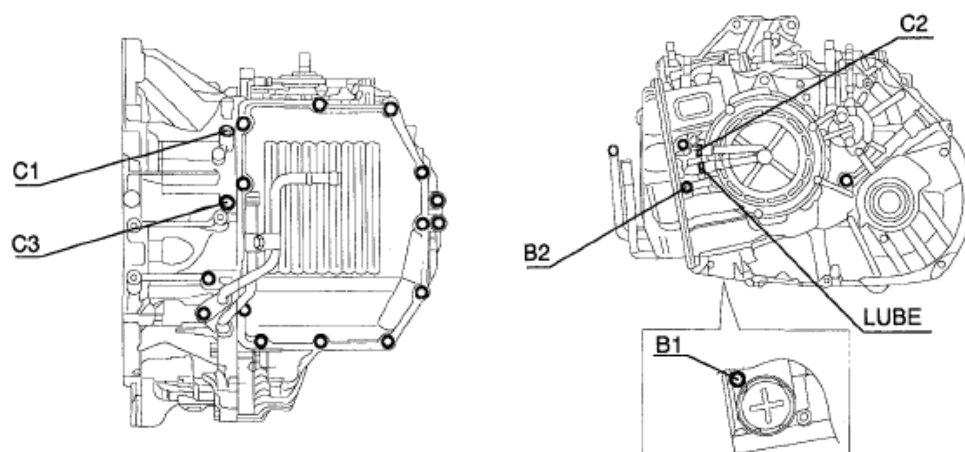
Fig. 44: Identifying Shift Lever And Engine Speed Gear Position
Courtesy of HYUNDAI MOTOR CO.

- Connect Oil pressure gauge to "C1" and "C3" port.
- Engine "ON".
- Drive a car with gear position 3 in "SPORTS MODE".
- Compare it with reference data as below.

Specification : refer to Standard Oil Pressure Table as below

OIL PRESSURE CHART

STANDARD PRESSURE			
SHIFT LEVER POSITION	ENGINE STATUS	ELEMENT	SPECIFICATION (Kg/cm ²)
"D" RANGE	IDLE	C1 CLUTCH	3.8 ~ 4.4
"R" RANGE	IDLE	C3 CLUTCH	5.9 ~ 7.1



SENAT7223D

Fig. 45: Identifying Oil Pressure Gauge To C2 Port
Courtesy of HYUNDAI MOTOR CO.

5. Is oil pressure value within specifications?

YES:

- Repair AUTO TRANSAXLE (Clutch or Brake) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0734 GEAR 4 INCORRECT RATIO

GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 4th gear ratio, while the transaxle is engaged in the 4th gear. For example, if the output speed is 1000 rpm and the 4th gear ratio is 1.115, then the input speed is 1115 rpm.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 4th gear ratio, while the transaxle is engaged in 4th gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• 4th gear incorrect ratio	• C1 clutch • C2 clutch • Valve-body (C1, C2 pressure system) • TCU • Line pressure solenoid valve (SLT) • Shift control solenoid valve (SLC1, SLC2, SLB1) • S1,S2 solenoid valve
Enable Conditions	• ATF temp. > 20°C • Output speed > 500rpm • TCU communication = normal • TPS >10% • Shift lever switch = "D" range • Shift gear = 4th gear	
Threshold value	• Input speed/4th gear ratio - output speed > or = 200rpm	
Diagnostic Time	• More than 12 times x more than 1 sec	
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear • Adaptive control is inhibited	

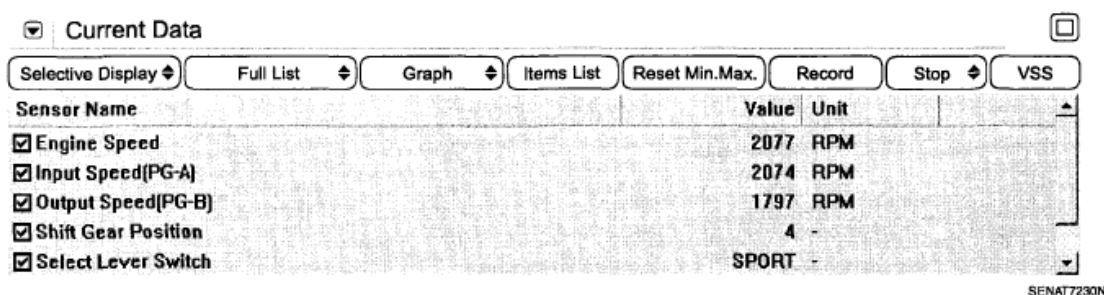
MONITOR SCANTOOL DATA

* It is difficult to "STALL TEST" in 4th gear, therefore Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 4th gear.

Specification : INPUT SPEED (OUTPUT SPEED x GEAR RATIO) < or = 200 RPM



Sensor Name	Value	Unit
☒ Engine Speed	2077	RPM
☒ Input Speed(PG-A)	2074	RPM
☒ Output Speed(PG-B)	1797	RPM
☒ Shift Gear Position	4	-
☒ Select Lever Switch	SPORT	-

Fig. 46: Scan Tool Display - "INPUT & OUTPUT SPEED SENSOR"
Courtesy of HYUNDAI MOTOR CO.

5. Does "INPUT & OUTPUT SPEED SENSOR" within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

SHIFT LEVER		SOLENOID VALVE						CLUTCH			BRAKE		OneWay Clutch
		SLC1	SLC2	SLC3	SLB1	S1	S2	C1	C2	C3	B1	B2	F1
P		●	●	●	●								
R	Vehicle speed <11Km	●	●		●					●		●	
	Vehicle speed >11Km	●	●	●	●							●	
N		●	●	●	●	●	●						
D	1st gear		●	●	●			●					●
	1st gear-engine brake		●	●	●	●	●	●				●	●
	2nd gear		●	●				●			●		
	3rd gear		●		●			●		●			
	4th gear			●	●			●	●				
	5th gear	●			●				●	●			
	6th gear	●		●					●		●		

● Solenoid valve : ON

● Clutch & Brake : Working

S1 : Shift solenoid valve A
S2 : Shift solenoid valve B
SLC1 : Shift solenoid valve C
SLC2 : Shift solenoid valve D

SLC3 : Shift solenoid valve E
SLB1 : Shift solenoid valve F
SLT : Pressure solenoid valve

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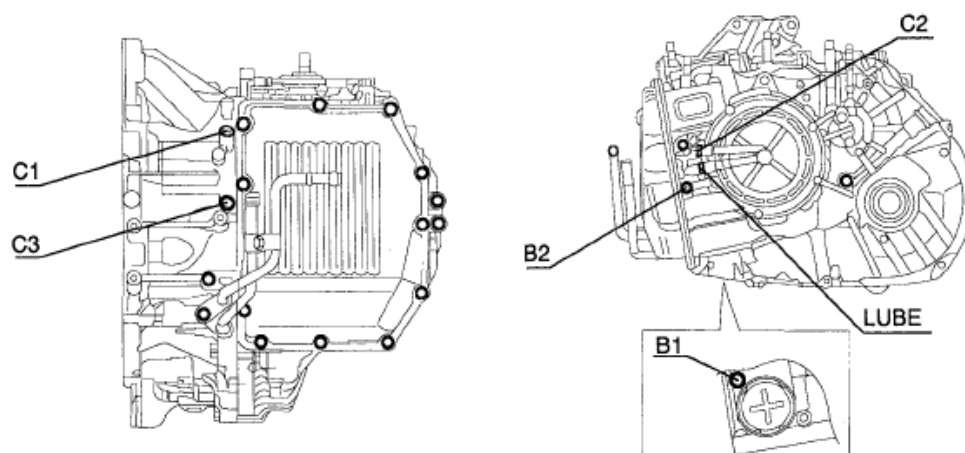
Fig. 47: Identifying Shift Lever And Engine Speed Gear Position
Courtesy of HYUNDAI MOTOR CO.

1. Connect Oil pressure gauge to "C1" port.
2. Engine "ON".
3. Drive a car with gear position 4 in "SPORTS MODE".
4. Compare it with reference data as below.

Specification : refer to Standard Oil Pressure Table as below

OIL PRESSURE CHART

STANDARD PRESSURE			
SHIFT LEVER POSITION	ENGINE STATUS	ELEMENT	SPECIFICATION (Kg/cm ²)
"D" RANGE	IDLE	C1 CLUTCH	3.8 ~ 4.4
"R" RANGE	IDLE	C3 CLUTCH	5.9 ~ 7.1



SENAT7223D

Fig. 48: Identifying Oil Pressure Gauge To C2 Port
 Courtesy of HYUNDAI MOTOR CO.

5. Is oil pressure value within specifications?

YES:

- Repair AUTO TRANSAXLE (Clutch or Brake) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0735 GEAR 5 INCORRECT RATIO**GENERAL DESCRIPTION**

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 5th gear ratio, while the transaxle is engaged in the 5th gear. For example, if the output speed is 1000 rpm and the 5th gear ratio is 0.859, then the input speed is 859 rpm.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 5th gear ratio, while the transaxle is engaged in 5th gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• 5th gear incorrect ratio	• C2 clutch • C3 clutch • Valve-body (C2, C3 pressure system) • TCU • Line pressure solenoid valve (SLT) • Shift control solenoid valve (SLC1 ,SLC2, SLB1) • S1,S2 solenoid valve
Enable Conditions	• ATF temp. > 20°C • Output speed > 500rpm • TCU communication = normal • TPS >10% • Shift lever switch = "D" range • Shift gear = 5th gear	
Threshold value	• Input speed/5th gear ratio - output speed > or = 200rpm	
Diagnostic Time	• More than 12 times x more than 1 sec	
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear • Adaptive control is inhibited	

MONITOR SCANTOOL DATA

* It is difficult to "STALL TEST" in 5th gear, therefore Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 rpm in the 5th gear.

Specification : $\text{INPUT SPEED} - (\text{OUTPUT SPEED} \times \text{GEAR RATIO}) < \text{or} = 200 \text{ RPM}$

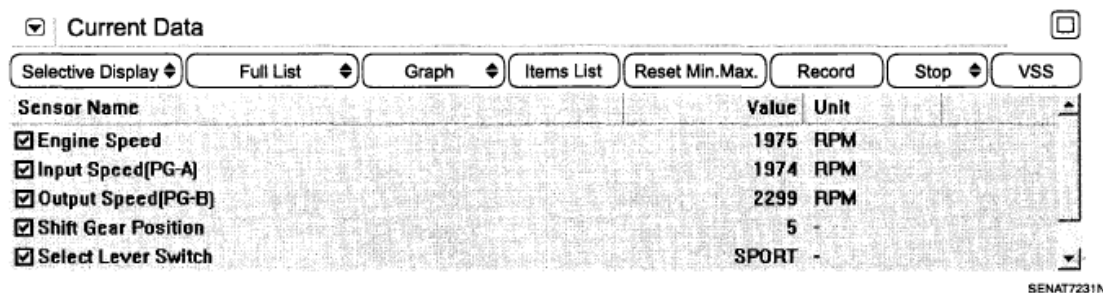


Fig. 49: Scan Tool Display - "INPUT & OUTPUT SPEED SENSOR"
 Courtesy of HYUNDAI MOTOR CO.

5. Does "INPUT & OUTPUT SPEED SENSOR" within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

SHIFT LEVER		SOLENOID VALVE						CLUTCH			BRAKE		OneWay Clutch
		SLC1	SLC2	SLC3	SLB1	S1	S2	C1	C2	C3	B1	B2	F1
P		●	●	●	●								
R	Vehicle speed <11Km	●	●		●					●		●	
	Vehicle speed >11Km	●	●	●	●							●	
N		●	●	●	●	●	●						
D	1st gear		●	●	●			●					●
	1st gear-engine brake		●	●	●	●	●	●				●	●
	2nd gear		●	●				●			●		
	3rd gear		●		●			●		●			
	4th gear			●	●			●	●				
	5th gear	●			●				●	●			
	6th gear	●		●					●		●		

● Solenoid valve : ON

● Clutch & Brake : Working

S1 : Shift solenoid valve A
S2 : Shift solenoid valve B
SLC1 : Shift solenoid valve C
SLC2 : Shift solenoid valve D

SLC3 : Shift solenoid valve E
SLB1 : Shift solenoid valve F
SLT : Pressure solenoid valve

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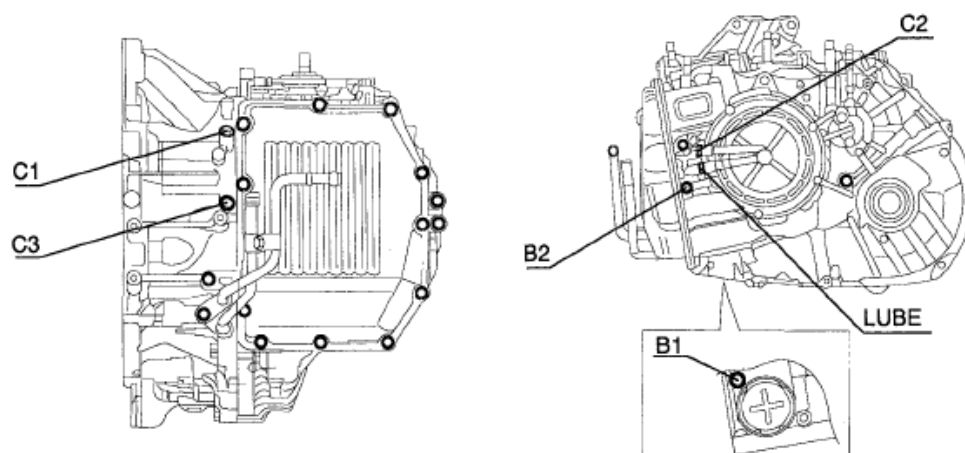
Fig. 50: Identifying Shift Lever And Engine Speed Gear Position
Courtesy of HYUNDAI MOTOR CO.

1. Connect Oil pressure gauge to "C1" port.
2. Engine "ON".
3. Drive a car with gear position 5 in "SPORTS MODE".
4. Compare it with reference data as below.

Specification : refer to Standard Oil Pressure Table as below

OIL PRESSURE CHART

STANDARD PRESSURE			
SHIFT LEVER POSITION	ENGINE STATUS	ELEMENT	SPECIFICATION (Kg/cm ²)
"D" RANGE	IDLE	C1 CLUTCH	3.8 ~ 4.4
"R" RANGE	IDLE	C3 CLUTCH	5.9 ~ 7.1



SENAT7223D

Fig. 51: Identifying Oil Pressure Gauge To C2 Port
Courtesy of HYUNDAI MOTOR CO.

5. Is oil pressure value within specifications?

YES:

- Repair AUTO TRANSAXLE (Clutch or Brake) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT - STUCK OFF**GENERAL DESCRIPTION**

The PCM/TCM controls the locking and unlocking of the Torque Converter Clutch (or Damper Clutch), to the input shaft of the transmission, by applying hydraulic pressure. The main purpose of T/C clutch control is to save fuel by decreasing the hydraulic load inside the T/C. The PCM/TCM outputs duty pulses to control the Damper Clutch Control Solenoid Valve (DCCSV) and hydraulic pressure is applied to the DC according to the DCC duty ratio value. When the duty ratio is high, high pressure is applied and the Damper Clutch is locked. The normal operating range of the Damper Clutch Control duty ratio value is from 30% (unlocked) to 85% (locked).

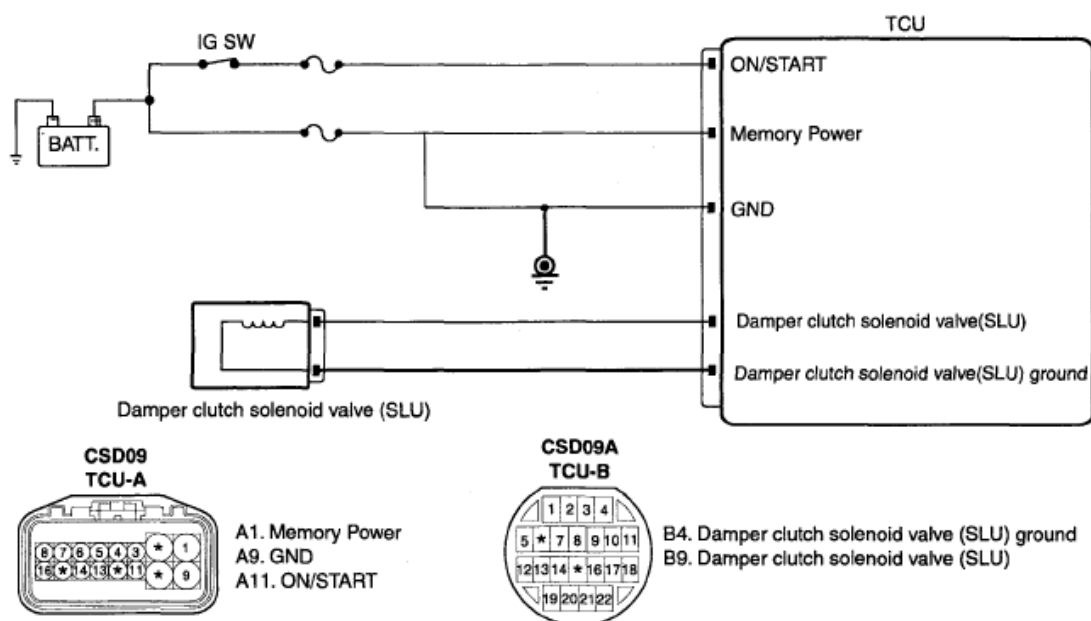
DTC DESCRIPTION

The PCM/TCM increases the duty ratio to engage the Damper Clutch by monitoring slip rpms (difference value between engine speed and turbine speed). To decrease the slip of the Damper Clutch, the PCM/TCM increases the duty ratio by applying more hydraulic pressure. When slip rpm does not drop with 100% duty ratio, the PCM/TCM determines that the Torque Converter Clutch is stuck OFF and sets this code.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the Input speed	• TCC solenoid valve (SLU) • Torque convertor • Valve-body (TCC pressure system) • TCU
Enable Conditions	• TCC solenoid valve (SLU) = normal • TCC solenoid valve (SLU) OFF command • ATF temp. > 20°C • TCU communication = normal • Shift lever switch = "D" range and Engine speed > 4000rpm	
Threshold value	• Engine speed - Input speed > 100 rpm	
Diagnostic Time	• More than 6 times x more than 2 sec	
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear • Adaptive control is inhibited	

SCHEMATIC DIAGRAM



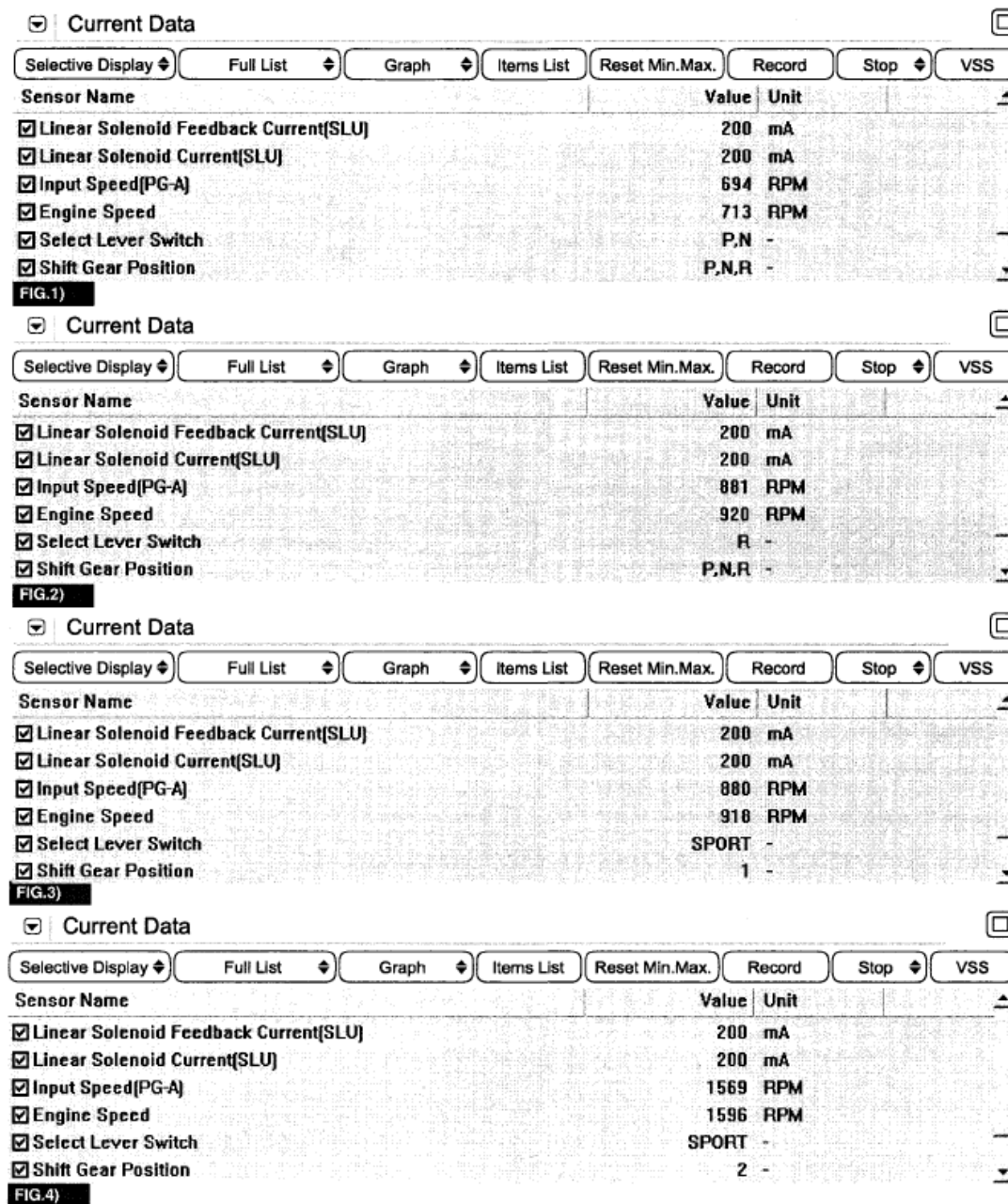
SENAT7241L

Fig. 52: TCC Solenoid Valve (SLU) - Schematic Diagram
Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Select "D RANGE" and drive vehicle.
4. Monitor the "TORQUE CONVERTER (DAMPER) CLUTCH" parameter on the scantool.

Specification : TCC SLIP < 160RPM (In condition that TCC SOL. DUTY > 80%)



SENAT7242N

Fig. 53: Scan Tool Display - "TORQUE CONVERTER (DAMPER) CLUTCH" (1 Of 2)
 Courtesy of HYUNDAI MOTOR CO.

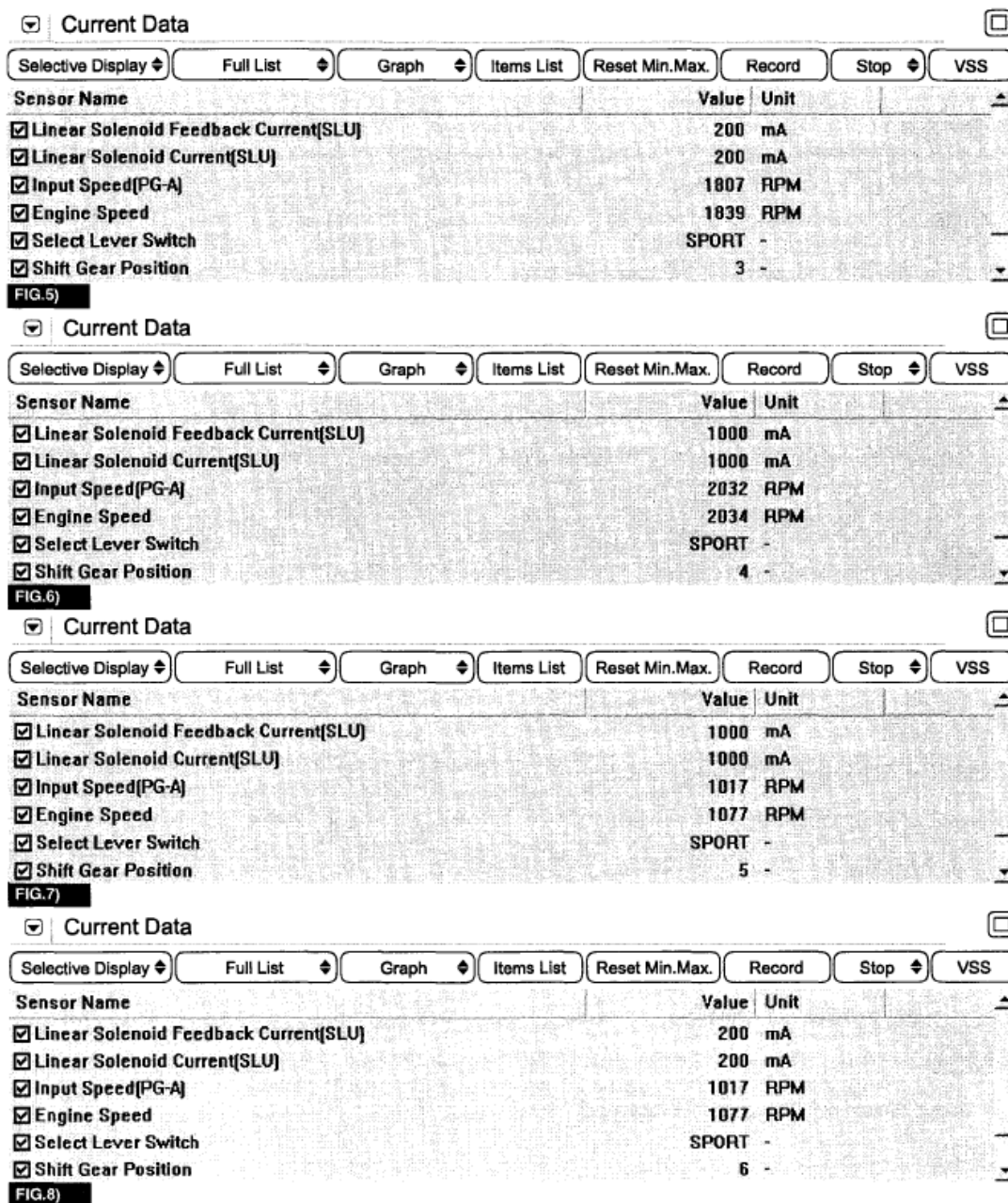


FIG.1) P, N

FIG.2) R

FIG.3) "D 1st" gear

FIG.4) "2nd" gear

FIG.5) "3rd" gear

FIG.6) "4th" gear

FIG.7) "5th" gear

FIG.8) "6th" gear

SENAT7249N

Fig. 54: Scan Tool Display - "TORQUE CONVERTER (DAMPER) CLUTCH" (2 Of 2)
 Courtesy of HYUNDAI MOTOR CO.

5. Does "TCCSV" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between "TCCSV (SLU)" terminal and chassis ground.

Specification : Not continuity

4. Is resistance within specifications?

YES:

- Go to "**GROUND CIRCUIT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

GROUND CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between Ground terminal of "TCCSV (SLU)" and chassis ground.

Specification : Continuity

4. Is resistance within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Measure resistance both terminal of "TCCSV".

Specification : Approx. 5.0~5.6ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace "TCCSV" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE.**

NO:

- System performing to specification at this time.

DTC P0742 TORQUE CONVERTER CLUTCH CIRCUIT - STUCK ON

GENERAL DESCRIPTION

Refer to **DTC P0741.**

DTC DESCRIPTION

The PCM/TCM increases the duty ratio to engage the Damper Clutch by monitoring slip rpms (difference value between engine speed and turbine speed). To decrease the slip of the Damper Clutch, the PCM/TCM increases the duty ratio by applying more hydraulic pressure. When slip rpm does not drop with 100% duty ratio, the PCM/TCM determines that the Torque Converter Clutch is stuck OFF and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the Input speed	• TCC solenoid valve (SLU) • Torque convertor • Valve-body (TCC pressure system) • TCU
Enable Conditions	• TCC solenoid valve (SLU) = normal • TCC solenoid valve (SLU) OFF command • ATF temp. > 20°C • TCU communication = normal • Shift lever switch = "D" range	
Threshold value	• Engine speed - Input speed < 100rpm	
Diagnostic Time	• More than 6 times x more than 2 sec	
Fail Safe	• Self learning control is inhibited • Locked in 3rd gear • Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0741**.

MONITOR SCANTOOL DATA

Refer to **DTC P0741**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0741**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0741**.

GROUND CIRCUIT INSPECTION

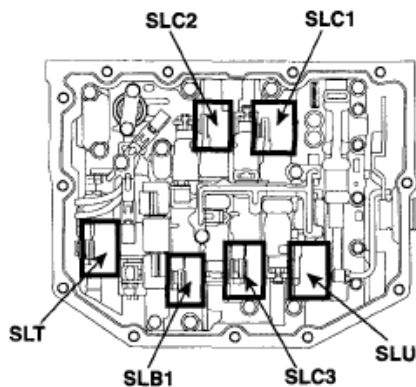
Refer to **DTC P0741**.

COMPONENT INSPECTION

Refer to **DTC P0741**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0741**.

DTC P0780 SHIFT ERROR**COMPONENT LOCATION**

SENAT7243D

Fig. 55: Identifying Control Module Solenoid-Valve To Gear Shift Location
Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

The TCU is control each solenoid-valve in order to maintain optimum gear shift.

DTC DESCRIPTION

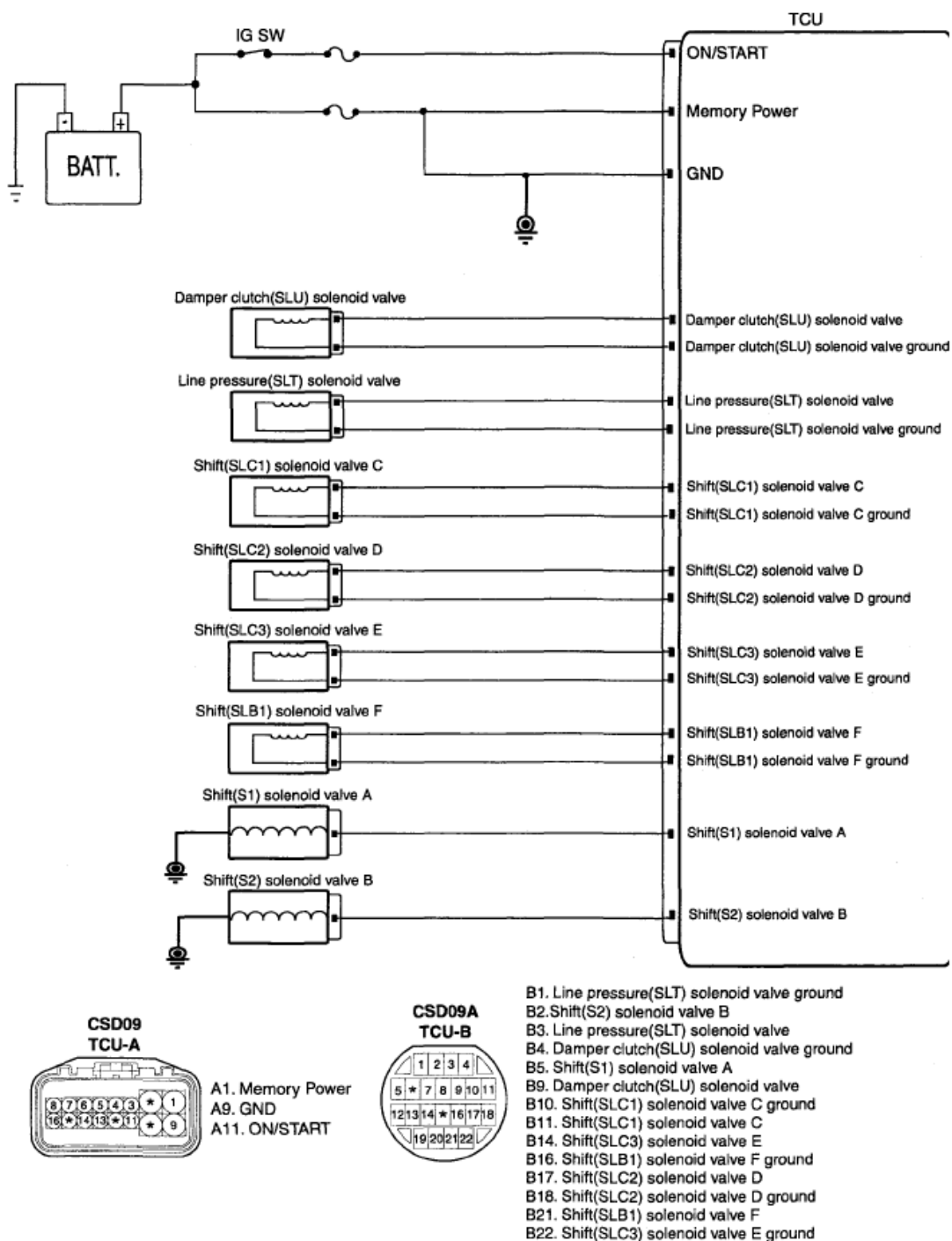
The TCU set this code, when the abnormal code is happened.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the shift signal	• S1,S2 solenoid-valve • TCU • Line pressure solenoid-valve (SLT) • Shift solenoid-valve (SLC1, SLC2, SLC3, SLB1)
Enable Conditions	• ATF temp. > 65°C • TCU communication = normal • Shift lever switch = "D" range • Output speed > 300rpm	
Threshold value	• Detect abnormal shifting	
Diagnostic Time	• More than 20 times x more than 1sec	
Fail Safe	• Self learning control is inhibited. • Adaptive control is inhibited	

SCHEMATIC DIAGRAM



SENAT7244L

Fig. 56: TCC Solenoid Valve (SLU) - Schematic Diagram
Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".

3. Monitor the all solenoid-valve parameters on the scan tool.
4. Shift gear at each position.

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	1000	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	970	mA
☒ Shift Control Solenoid Valve Signal	Start Lock Solen...	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.1)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	100	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	1000	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	1000	mA
☒ Shift Control Solenoid Valve Signal	-	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.2)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	690	mA
☒ Shift Control Solenoid Valve Signal	Shift Solenoid #1	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.3)

SENAT7245N

Fig. 57: Scan Tool Display - "SOLENOID DUTY" (1 Of 3)
 Courtesy of HYUNDAI MOTOR CO.

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	900	mA
☒ Shift Control Solenoid Valve Signal	-	-
☐ Linear Solenoid Feedback Current(SLB1)	100	mA
☐ Linear Solenoid Feedback Current(SLB1)	100	mA

FIG.4)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	100	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	880	mA
☒ Shift Control Solenoid Valve Signal	-	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.5)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	100	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	1000	mA
☒ Linear Solenoid Current(SLT)	850	mA
☒ Shift Control Solenoid Valve Signal	Shift Solenoid #2	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.6)

SENAT7250N

Fig. 58: Scan Tool Display - "SOLENOID DUTY" (2 Of 3)
 Courtesy of HYUNDAI MOTOR CO.

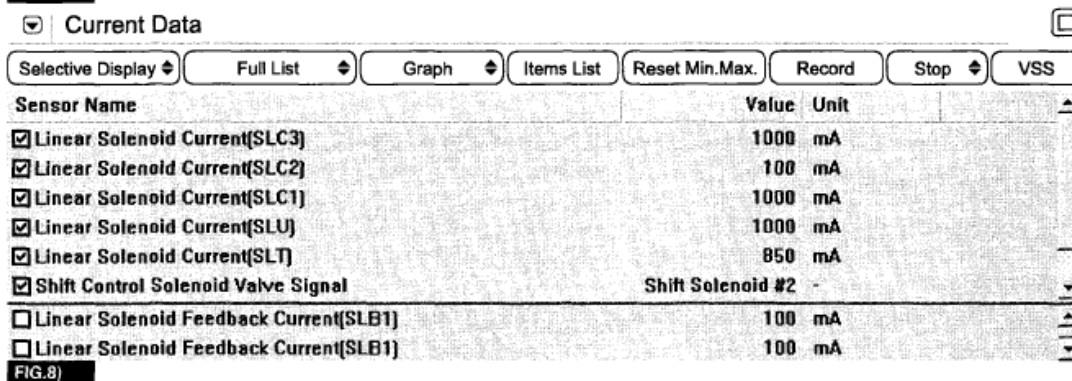
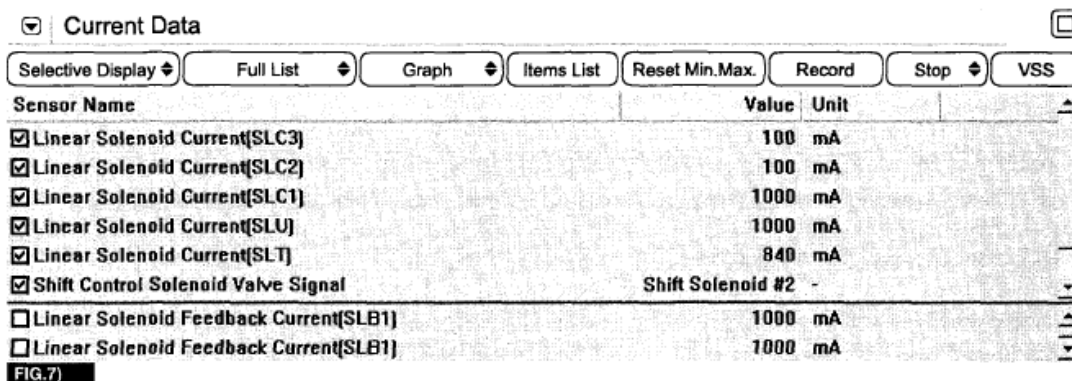


FIG.1) P, N

FIG.2) R

FIG.3) "D 1st" gear

FIG.4) "2nd" gear

FIG.5) "3rd" gear

FIG.6) "4th" gear

FIG.7) "5th" gear

FIG.8) "6th" gear

SENAT7251N

Fig. 59: Scan Tool Display - "SOLENOID DUTY" (3 Of 3)

Courtesy of HYUNDAI MOTOR CO.

5. Does all "SOLENOID DUTY" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NO:

- Go to **"COMPONENT INSPECTION 1"** procedure.

COMPONENT INSPECTION 1

- IG KEY OFF.
- Remove the TCU.
- Measure the resistance between "S1" solenoid-valve terminal and ground terminal of "S1" solenoid-valve.

4. Measure the resistance between "S2" solenoid-valve terminal and ground terminal of "S2" solenoid-valve.

Specification: Approx. 11~15ohms (20°C)

5. Is resistance within specifications?

YES:

- Go to "**COMPONENT INSPECTION 2**" procedure.

NO:

- Replace solenoid-valve as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION 2

1. IG KEY OFF.
2. Remove the TCU.
3. Measure the resistance of "SLC1" "SLC2" "SLC3" "SLB1" solenoid-valves.

Specification : Approx. 5.0 ~ 5.6ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace solenoid-valve as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.

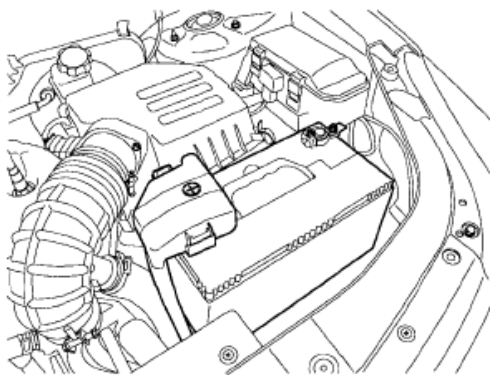
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE.**

NO:

- System performing to specification at this time.

DTC P0882 TCM POWER INPUT SIGNAL LOW**COMPONENT LOCATION**

SENAT246D

Fig. 60: Identifying TCM Location
 Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

TCU check the Battery voltage, in order to maintain optimum condition of each sensors and solenoid-valve.

DTC DESCRIPTION

TCU set this code, when input lower voltage than specified value.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the voltage range	• Battery • Alternator
Enable Conditions	• IG "ON" • Input speed > 800rpm	
Threshold value	• Battery voltage > 9V	

Diagnostic Time	• More than 20 times x more than 1sec	• TCU • Wiring harness
Fail Safe	• Self learning control is inhibited • Adaptive control is inhibited	

SCHEMATIC DIAGRAM

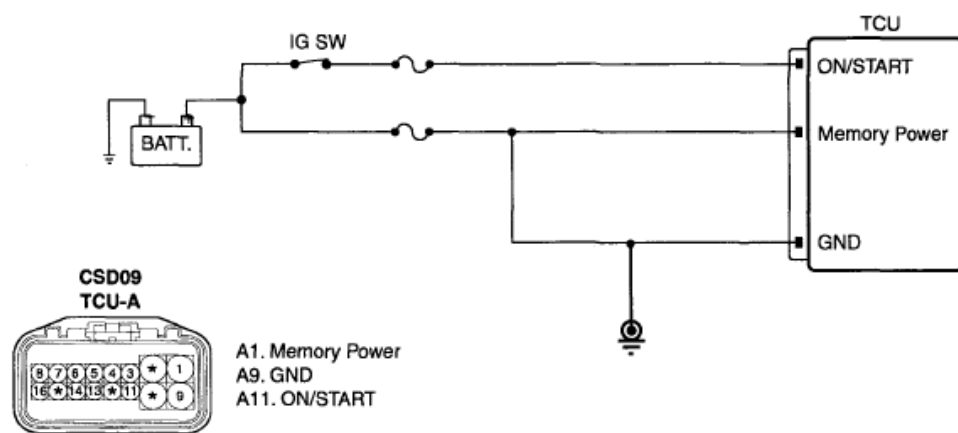


Fig. 61: TCM Power Input Signal Low - Schematic Diagram
Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "A/T RELAY VOLTAGE" parameter on the scan tool.

Specification : Battery voltage (Approx. 10~14V)

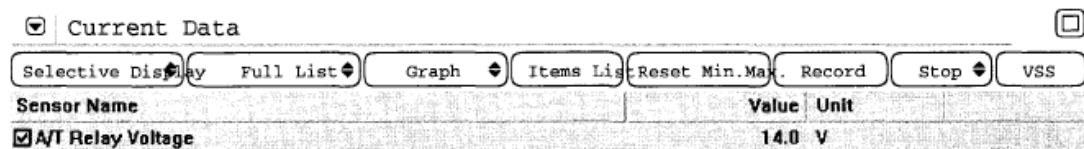


Fig. 62: Scan Tool Display - "A/T RELAY VOLTAGE"
Courtesy of HYUNDAI MOTOR CO.

4. Is "A/T RELAY VOLT" within specification?

YES:

- Go to "**IG POWER INSPECTION**" procedure.

NO:

- Repair "Fuse and Battery and relation part" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

IG POWER INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Measure the voltage between terminal of "IG power" and chassis ground.

Specification: Battery voltage (Approx. 10~14V)

4. Is "VOLTAGE" within specification?

YES:

- Go to "**IG GROUND INSPECTION**" procedure.

NO:

- Repair "Fuse and Battery and relation part" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

IG GROUND INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between "IG power" terminal and chassis ground.

Specification : Not continuity

4. Is resistance within specifications?

YES:

- Go to "**BATTERY POWER INSPECTION**" procedure.

NO:

- Repair "Fuse and Battery and relation part" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

BATTERY POWER INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Measure the voltage between Battery power (B+) terminal of wiring harness and ground terminal.

Specification : Battery voltage (Approx. 10~14V)

4. Is "VOLTAGE" within specification?

YES:

- Go to "**BATTERY GROUND INSPECTION**" procedure.

NO:

- Repair "Fuse and Battery and relation part" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

BATTERY GROUND INSPECTION 1

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Measure the voltage between Battery power (B+) terminal of wiring harness and chassis ground.

Specification: Battery voltage (Approx. 10~14V)

4. Is "VOLTAGE" within specification?

YES:

- Go to "**BATTERY GROUND INSPECTION 2**" procedure.

NO:

- Repair "Fuse and Battery and relation part" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

BATTERY GROUND INSPECTION 2

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between "Ground" terminal of wiring harness side and chassis ground.

Specification : Continuity

4. Is resistance within specifications?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as

necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Repair "Fuse and Battery and relation part" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0883 TCM POWER INPUT SIGNAL HIGH

COMPONENT LOCATION

Refer to **DTC P0882**.

GENERAL DESCRIPTION

TCU check the Battery voltage, in order to maintain optimum condition of each sensors and solenoid-valve.

DTC DESCRIPTION

TCU set this code, when input higher voltage than specified value.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the voltage range	• Battery • Alternator
Enable Conditions	• IG "ON" • Input speed > 800rpm	

Threshold value	Battery voltage < 18V	- TCU - Wiring harness
Diagnostic Time	More than 20 times x more than 1sec	
Fail Safe	- Self learning control is inhibited. - Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0882**.

MONITOR SCANTOOL DATA

Refer to **DTC P0882**.

IG POWER INSPECTION

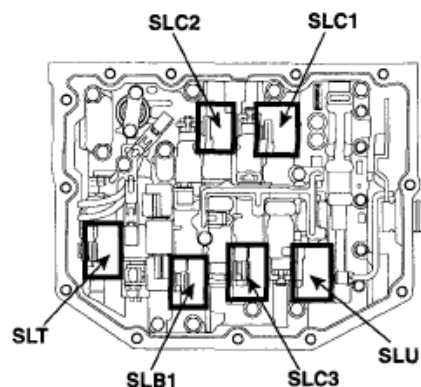
Refer to **DTC P0882**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0882**.

DTC P0942 NEUTRAL CONDITION AT D RANGE-VALVE STICK (SLC1)

COMPONENT LOCATION



SENAT7243D

Fig. 63: Identifying Control Module Solenoid-Valve To Gear Shift Location
Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

TCU monitors status of "SHIFT SOLENOID-VALVE C (SLC1) in order to maintain optimum gear shift.

DTC DESCRIPTION

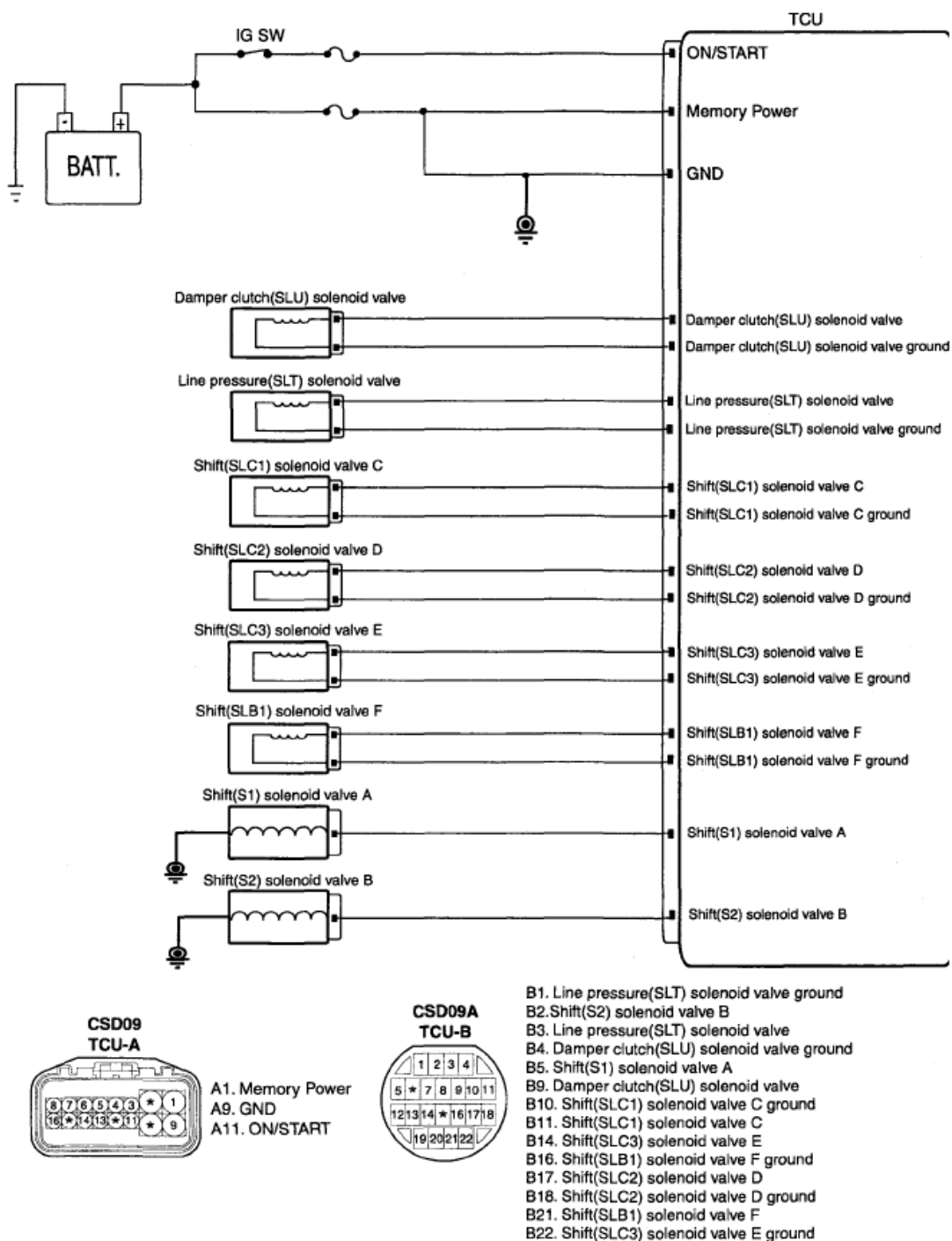
TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the speed range	• C1 Clutch • Valve-body (C1 pressure system) • TCU • Shift solenoid valve (SLC1) • S1, S2 solenoid valve
Enable Conditions	• Shift lever switch = "D" range • Output speed < 500rpm • Gear shift > 1st gear	
Threshold value	• Engine speed - Input speed < 150rpm	
Diagnostic Time	• More than 0.1 sec	
Fail Safe	• Self learning control is inhibited • Locked in 5th gear. • Adaptive control is inhibited	

SCHEMATIC DIAGRAM



SENAT7244L

Fig. 64: TCC Solenoid Valve (SLU) - Schematic Diagram
Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".

3. Monitor the all solenoid-valve parameters on the scan tool.
4. Shift gear at each position.

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	1000	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	970	mA
☒ Shift Control Solenoid Valve Signal	Start Lock Solen...	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.1)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	100	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	1000	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	1000	mA
☒ Shift Control Solenoid Valve Signal	-	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.2)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	690	mA
☒ Shift Control Solenoid Valve Signal	Shift Solenoid #1	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.3)

SENAT7245N

Fig. 65: Scan Tool Display - "SOLENOID DUTY" (1 Of 3)
 Courtesy of HYUNDAI MOTOR CO.

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	900	mA
☒ Shift Control Solenoid Valve Signal	-	-
☐ Linear Solenoid Feedback Current(SLB1)	100	mA
☐ Linear Solenoid Feedback Current(SLB1)	100	mA

FIG.4)

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	100	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	880	mA
☒ Shift Control Solenoid Valve Signal	-	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.5)

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	100	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	1000	mA
☒ Linear Solenoid Current(SLT)	850	mA
☒ Shift Control Solenoid Valve Signal	Shift Solenoid #2	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.6)

SENAT7250N

Fig. 66: Scan Tool Display - "SOLENOID DUTY" (2 Of 3)
 Courtesy of HYUNDAI MOTOR CO.

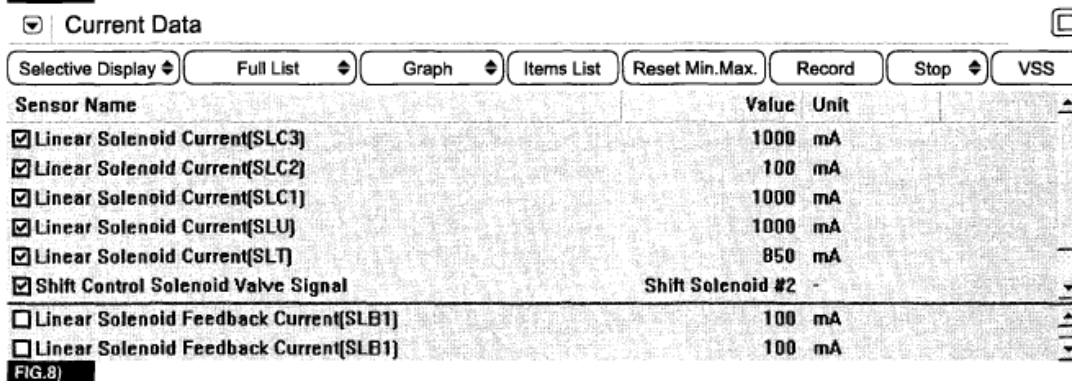
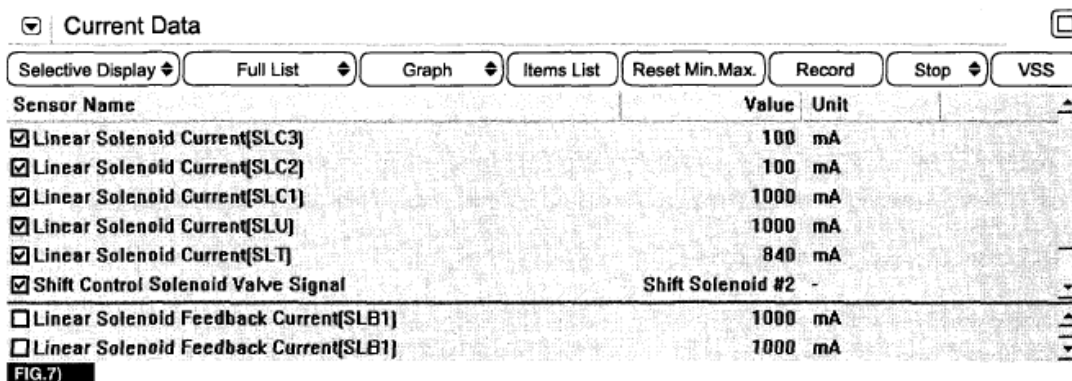


FIG.1) P, N

FIG.2) R

FIG.3) "D 1st" gear

FIG.4) "2nd" gear

FIG.5) "3rd" gear

FIG.6) "4th" gear

FIG.7) "5th" gear

FIG.8) "6th" gear

SENAT7251N

Fig. 67: Scan Tool Display - "SOLENOID DUTY" (3 Of 3)

Courtesy of HYUNDAI MOTOR CO.

5. Does all "SOLENOID DUTY" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**COMPONENT INSPECTION 1**" procedure.

COMPONENT INSPECTION 1

- IG KEY OFF.
- Remove the TCU.
- Measure the resistance between "S1" solenoid-valve terminal and ground terminal of "S1" solenoid-valve.

4. Measure the resistance between "S2" solenoid-valve terminal and ground terminal of "S2" solenoid-valve.

Specification: Approx. 11~15ohms (20°C)

5. Is resistance within specifications?

YES:

- Go to "**COMPONENT INSPECTION 2**" procedure.

NO:

- Replace solenoid-valve as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION 2

1. IG KEY OFF.
2. Remove the TCU.
3. Measure the resistance of "SLC1" "SLC2" "SLC3" "SLB1" solenoid-valves.

Specification : Approx. 5.0 ~ 5.6ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace solenoid-valve as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.

3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES:

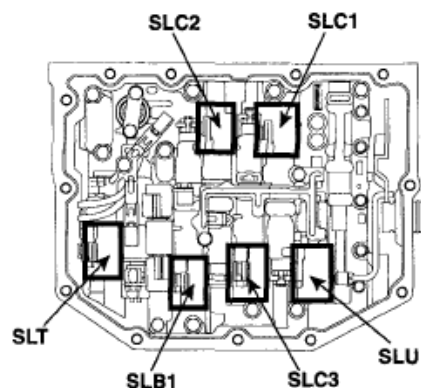
- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE.**

NO:

- System performing to specification at this time.

DTC P0961 PRESSURE CONTROL SOLENOID "A" CONTROL CIRCUIT RANGE/PERFORMANCE (SLT)

COMPONENT LOCATION



SENAT7243D

Fig. 68: Identifying Control Module Solenoid-Valve To Gear Shift Location
 Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

TCU monitors status of "PCSV-A (SLT)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the current range	
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V	

	TCU communication = normal	
Threshold value	Detect not available current	- Line pressure solenoid valve (SLT) - Wiring harness (SLT) - TCU
Diagnostic Time	More than 2 times	
Fail Safe	- Self learning control is inhibited - Adaptive control is inhibited	

SCHEMATIC DIAGRAM

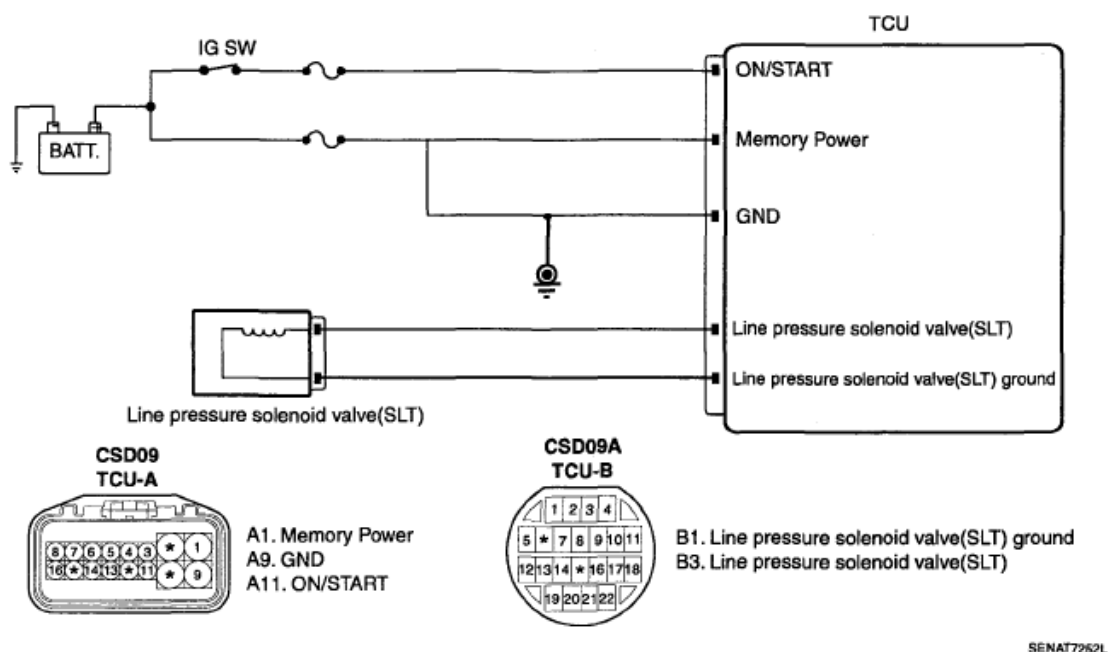


Fig. 69: Line Pressure Solenoid Valve (SLT) - Schematic Diagram
 Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "LINE PRESSURE SOLENOID VALVE (SLT)" parameters on the scan tool.
4. Shift gear at each position.

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current{SLT}	970	mA
☒ Linear Solenoid Current{SLT}	970	mA
☒ Select Lever Switch	P,N	-
☒ Shift Gear Position	P,N,R	-

FIG.1)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current{SLT}	1000	mA
☒ Linear Solenoid Current{SLT}	1000	mA
☒ Select Lever Switch	R	-
☒ Shift Gear Position	P,N,R	-

FIG.2)

☒ Current Data ☐

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current{SLT}	690	mA
☒ Linear Solenoid Current{SLT}	690	mA
☒ Select Lever Switch	S,P,O,R	-
☒ Shift Gear Position	1	-

FIG.3)

☒ Current Data ☐

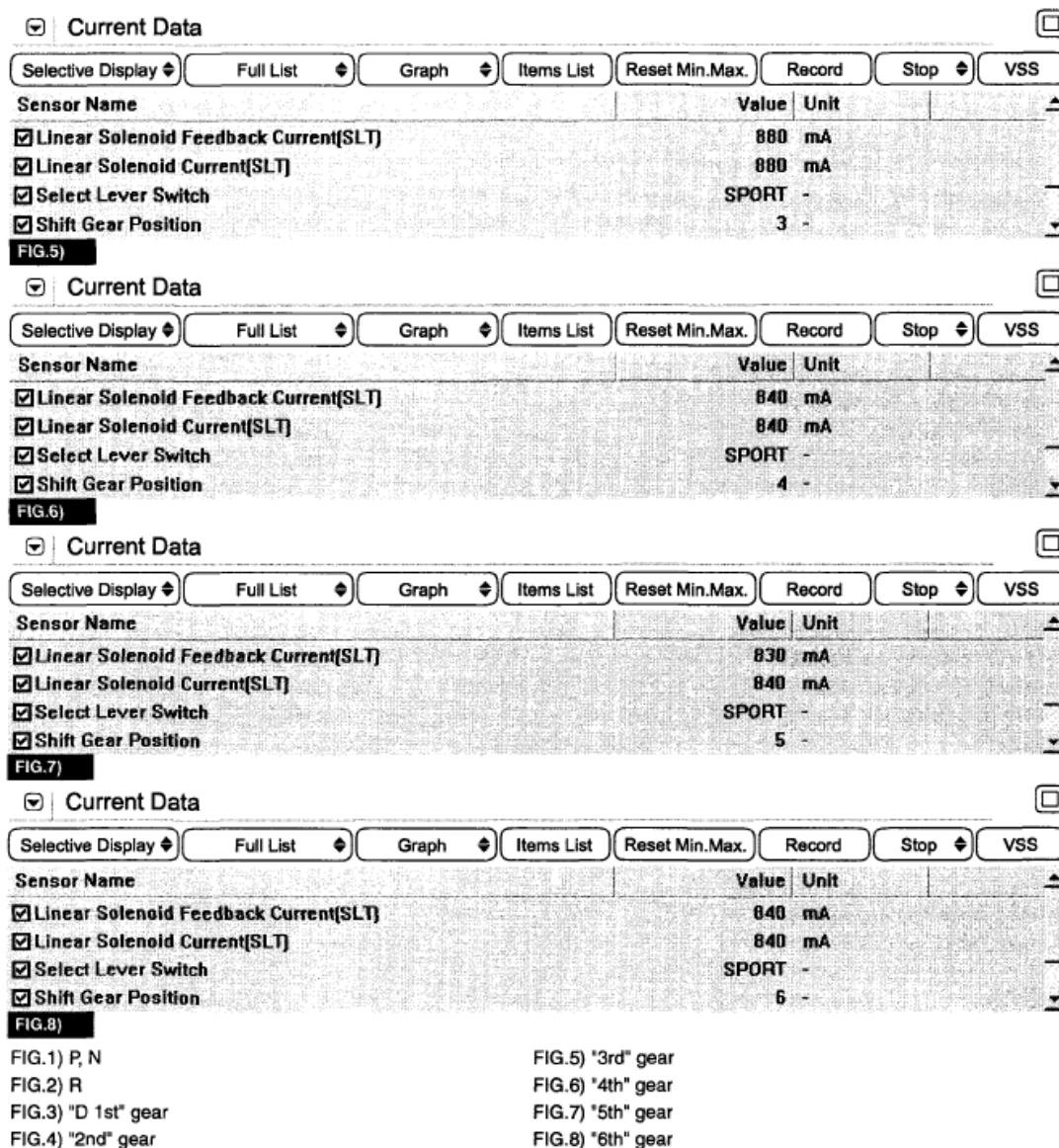
Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current{SLT}	880	mA
☒ Linear Solenoid Current{SLT}	880	mA
☒ Select Lever Switch	S,P,O,R	-
☒ Shift Gear Position	2	-

FIG.4)

SENAT7270N

Fig. 70: Scan Tool Display - "LINE PRESSURE SOLENOID VALVE (SLT)" (1 Of 2)
 Courtesy of HYUNDAI MOTOR CO.



SENAT7271N

Fig. 71: Scan Tool Display - "LINE PRESSURE SOLENOID VALVE (SLT)" (2 Of 2)
 Courtesy of HYUNDAI MOTOR CO.

5. Does the "LINE PRESSURE SOLENOID VALVE (SLT)" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between "LINE PRESSURE SOLENOID VALVE (SLT)" terminal and chassis ground.

Specification : Not continuity

4. Is resistance within specifications?

YES:

- Go to "**GROUND CIRCUIT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

GROUND CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between Ground terminal of "LINE PRESSURE SOLENOID VALVE (SLT)" and chassis ground.

Specification : Continuity

4. Is resistance within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Measure resistance both terminal of "LINE PRESSURE SOLENOID VALVE (SLT)".

Specification : Approx. 5.0~5.6ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace "LINE PRESSURE SOLENOID VALVE (SLT)" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0962 PRESSURE CONTROL SOLENOID "A" CONTROL CIRCUIT LOW (SLT)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "PCSV-A (SLT)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the current range	• Line pressure solenoid valve (SLT) • Wiring harness (SLT) • TCU
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • TCU communication = normal	
Threshold value	• Feed back current < 20mA	
Diagnostic Time	• More than 5 times x more than 0.1 sec	
Fail Safe	• Self learning control is inhibited • Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0961**.

MONITOR SCANTOOL DATA

Refer to **DTC P0961**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0961**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0961**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P0961**.

COMPONENT INSPECTION

Refer to **DTC P0961**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0961**.

DTC P0963 PRESSURE CONTROL SOLENOID "A" CONTROL CIRCUIT HIGH (SLT)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "PCSV-A (SLT)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	Check the current range	- Line pressure solenoid valve (SLT) - Wiring harness (SLT) - TCU
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - TCU communication = normal	
Threshold value	Feed back current > 1358mA	
Diagnostic Time	More than 5 times x more than 0.1 sec	
Fail Safe	- Self learning control is inhibited - Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0961**.

MONITOR SCANTOOL DATA

Refer to **DTC P0961**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0961**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0961**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P0961**.

COMPONENT INSPECTION

Refer to **DTC P0961**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0961**.

DTC P0973 SHIFT SOLENOID "A" CONTROL CIRCUIT LOW (S1 SOLENOID)

COMPONENT LOCATION

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-A (S1)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

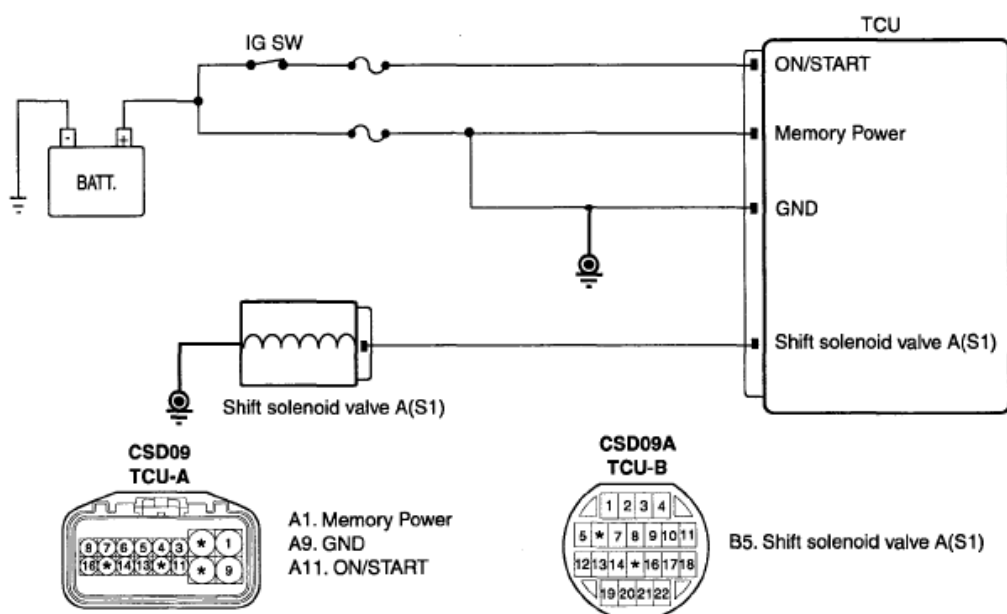
DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the signal	
Enable	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V	

Conditions	- TCU communication = normal - S1 output "ON" signal	
Threshold value	To detect "OFF" signal (0V) of the S1 monitor, when S1 drive output "ON" signal (12V)	- Solenoid valve (S1) - Wiring harness (S1) - TCU
Diagnostic Time	More than 5 times x more than 0.1 sec	
Fail Safe	- Self learning control is inhibited - Adaptive control is inhibited	

SCHEMATIC DIAGRAM



SENAT7256L

Fig. 72: Shift Solenoid Valve A (S1) - Schematic Diagram
 Courtesy of HYUNDAI MOTOR CO.

TERMINAL AND CONNECTOR INSPECTION

- Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**COMPONENT INSPECTION**" procedure.

COMPONENT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Measure the resistance between Shift Solenoid "A" (S1) and chassis ground.

Specification : Approx 11~15 ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace Shift Solenoid "A" (S1) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0974 SHIFT SOLENOID "A" CONTROL CIRCUIT HIGH (S1 SOLENOID)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-A (S1)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the signal	• Solenoid valve (S1) • Wiring harness (S1) • TCU
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • TCU communication = normal • S1 output "ON" signal	
Threshold value	• To detect "ON" signal (12V) of the S1 monitor, when S1 drive output "OFF" signal (0V)	
Diagnostic Time	• More than 5 times x more than 0.1 sec	
Fail Safe	• Self learning control is inhibited • Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0973**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0973**.

COMPONENT INSPECTION

Refer to **DTC P0973**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0973**.

DTC P0976 SHIFT SOLENOID "B" CONTROL CIRCUIT LOW (S2 SOLENOID)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

Monitors status of "SCSV-B (S2)" in order to maintain optimum gear shift.

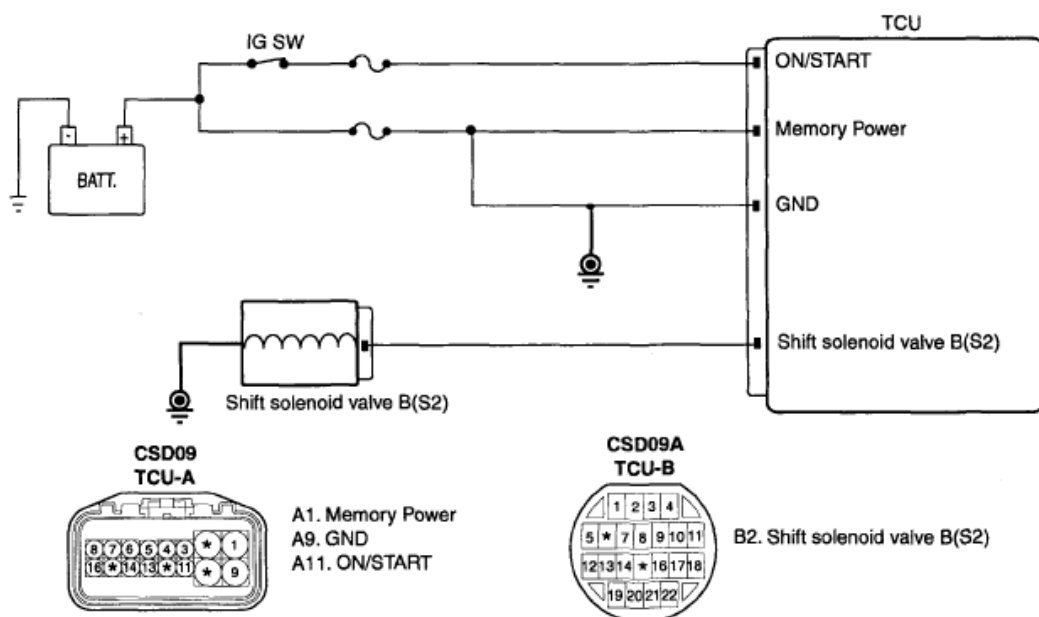
DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the signal	• Solenoid valve (S2) • Wiring harness (S2) • TCU
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • TCU communication = normal • S2 output "ON" signal	
Threshold value	• To detect "OFF" signal (0V) of the S2 monitor, when S2 drive output "ON" signal (12V)	
Diagnostic Time	• More than 5 times x more than 0.1 sec	
Fail Safe	• Self learning control is inhibited • Adaptive control is inhibited	

SCHEMATIC DIAGRAM



SENAT7256L

Fig. 73: Shift Solenoid Valve B (S2) - Schematic Diagram
 Courtesy of HYUNDAI MOTOR CO.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**COMPONENT INSPECTION**" procedure.

COMPONENT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Measure the resistance between Shift Solenoid "B" (S2) and chassis ground.

Specification : Approx 11~15 ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace Shift Solenoid "B" (S2) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0977 SHIFT SOLENOID "B" CONTROL CIRCUIT HIGH (S2 SOLENOID)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

Monitors status of "SCSV-B (S2)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	Check the signal	- Solenoid valve (S2) - Wiring harness (S2) - TCU
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - TCU communication = normal - S2 output "ON" signal	
Threshold value	To detect "ON" signal (12V) of the S2 monitor, when S2 drive output "OFF" signal (0V)	
Diagnostic Time	More than 5 times x more than 0.1 sec	
Fail Safe	- Self learning control is inhibited - Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0976**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0976**.

COMPONENT INSPECTION

Refer to **DTC P0976**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0976**.

DTC P0978 SHIFT SOLENOID "C" CONTROL CIRCUIT RANGE/PERFORMANCE (SLC1)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-C (SLC1)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	Check the current range	- Solenoid valve (SLC1) - Wiring harness (SLC1) - TCU
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - TCU communication = normal	
Threshold value	Detect not available current	
Diagnostic Time	More than 2 times	
Fail Safe	- Self learning control is inhibited - Adaptive control is inhibited	

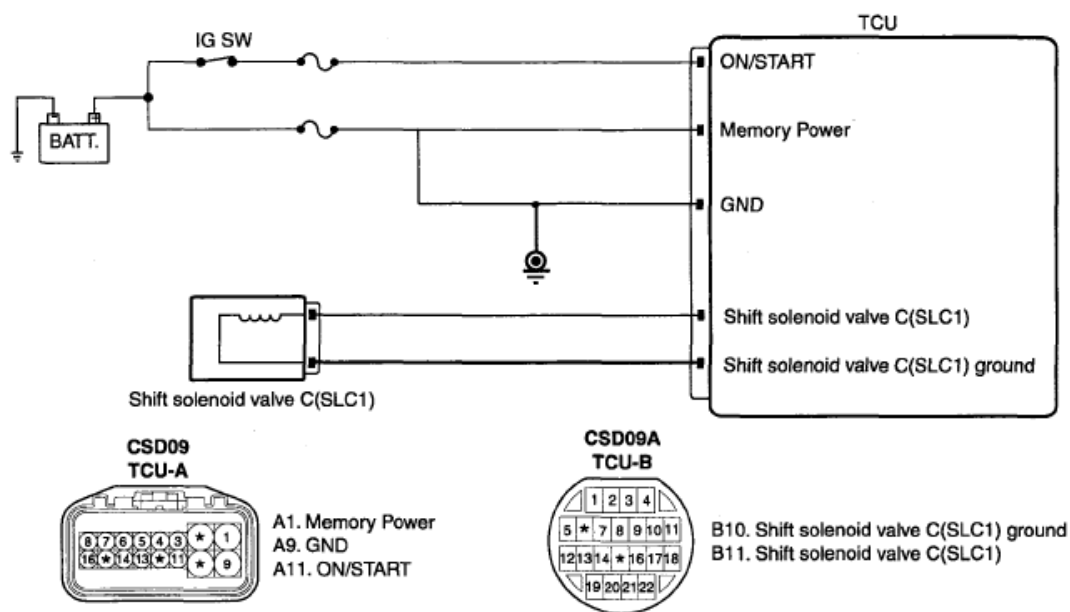
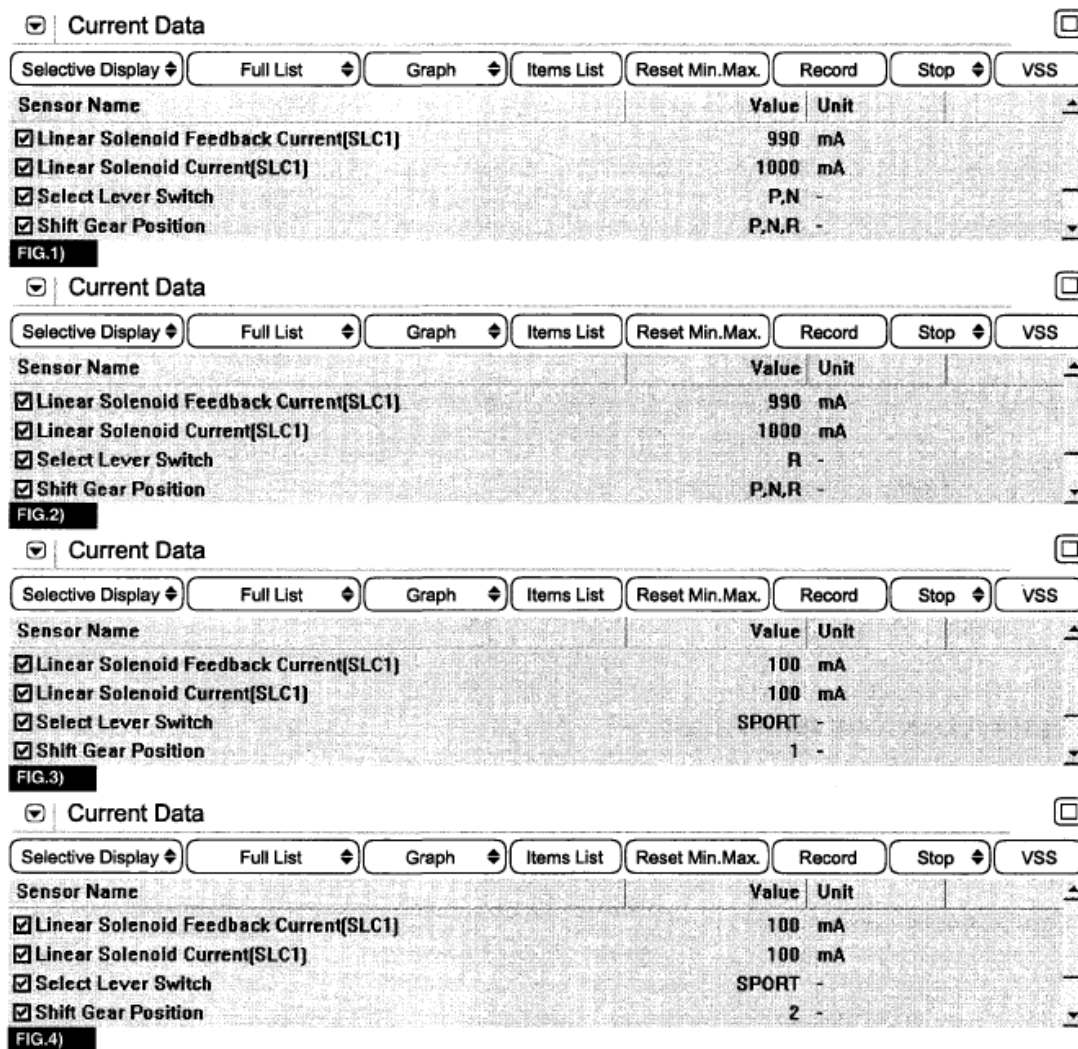
SCHEMATIC DIAGRAM

Fig. 74: Shift Solenoid Valve C (SLC1) - Schematic Diagram
 Courtesy of HYUNDAI MOTOR CO.

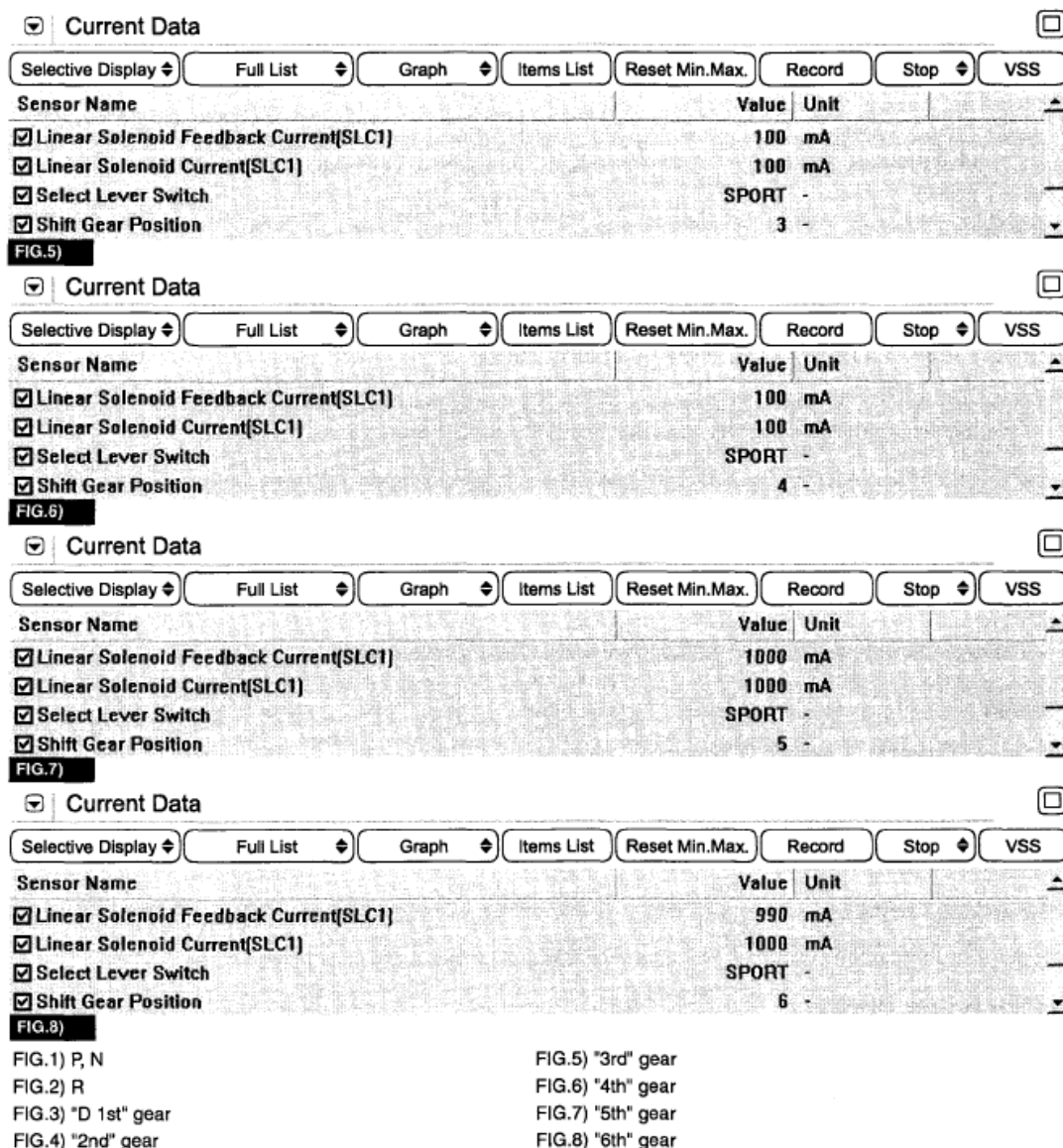
MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the Shift Solenoid "C" (SLC1) parameters on the scan tool.
4. Shift gear at each position.



SENAT7272N

Fig. 75: Scan Tool Display - Shift Solenoid "C" (SLC1) (1 Of 2)
 Courtesy of HYUNDAI MOTOR CO.



SENAT7273N

Fig. 76: Scan Tool Display - Shift Solenoid "C" (SLC1) (2 Of 2)
 Courtesy of HYUNDAI MOTOR CO.

5. Does the Shift Solenoid "C" (SLC1) follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between Shift Solenoid "C" (SLC1) terminal and chassis ground.

Specification : Not continuity

4. Is resistance within specifications?

YES:

- Go to "**GROUND CIRCUIT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

GROUND CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between Ground terminal of Shift Solenoid "C" (SLC1) and chassis ground.

Specification : Continuity

4. Is resistance within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Measure resistance both terminal of Shift Solenoid "C" (SLC1).

Specification : Approx. 5.0~5.6ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace Shift Solenoid "C" (SLC1) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0979 SHIFT SOLENOID "C" CONTROL CIRCUIT LOW (SLC1)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-C (SLC1)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the current range	• Solenoid valve (SLC1) • Wiring harness (SLC1) • TCU
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • TCU communication = normal	
Threshold value	• Feed back current < 20mA	
Diagnostic Time	• More than 5 times x more than 0.1 sec	
Fail Safe	• Self learning control is inhibited • Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0978**.

MONITOR SCANTOOL DATA

Refer to **DTC P0978**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0978**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0978**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P0978**.

COMPONENT INSPECTION

Refer to **DTC P0978**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0978**.

DTC P0980 SHIFT SOLENOID "C" CONTROL CIRCUIT HIGH (SLC1)

COMPONENT LOCATION

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-C (SLC1)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	Check the current range	- Solenoid valve (SLC1) - Wiring harness (SLC1) - TCU
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - TCU communication = normal	
Threshold value	Feed back current > 1358mA	
Diagnostic Time	More than 5 times x more than 0.1 sec	
Fail Safe	- Self learning control is inhibited - Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0978**.

MONITOR SCANTOOL DATA

Refer to **DTC P0978**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0978**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0978**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P0978**.

COMPONENT INSPECTION

Refer to **DTC P0978**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0978**.

DTC P0981 SHIFT SOLENOID "D" CONTROL CIRCUIT RANGE/PERFORMANCE (SLC2)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-D (SLC2)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the current range	• Solenoid valve (SLC2) • Wiring harness (SLC2)
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • TCU communication = normal	

Threshold value	• Detect not available current	• TCU
Diagnostic Time	• More than 2 times	
Fail Safe	• Self learning control is inhibited • Adaptive control is inhibited	

SCHEMATIC DIAGRAM

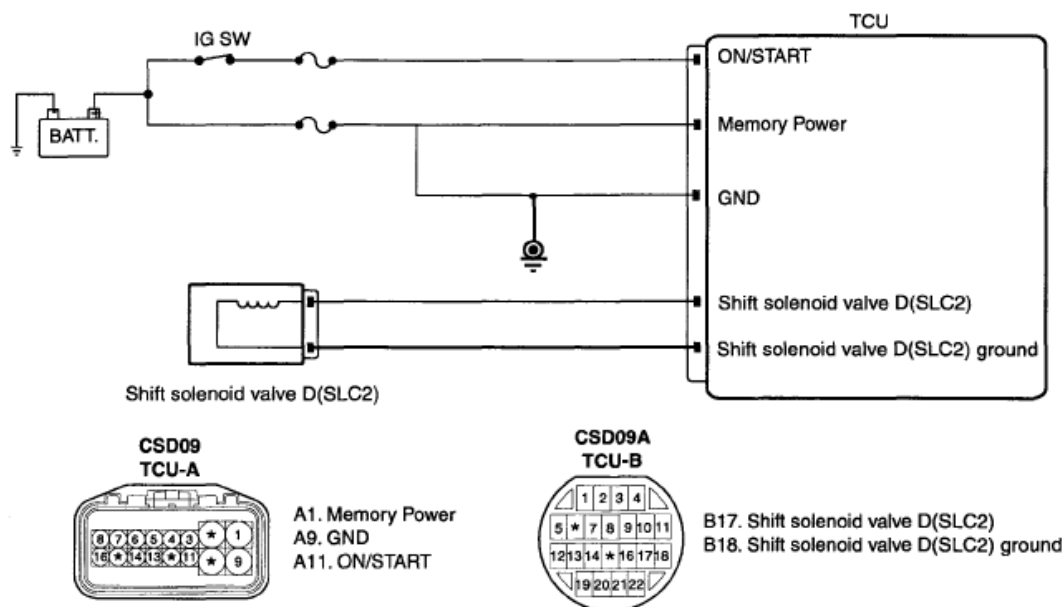


Fig. 77: Shift Solenoid Valve D (SLC2) - Schematic Diagram
Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the Shift Solenoid "D" (SLC2) parameters on the scan tool.
4. Shift gear at each position.

☒ Current Data ☐

Selective Display ☒ Full List ☒ Graph ☒ Items List ☐ Reset Min.Max. ☐ Record ☐ Stop ☒ VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Select Lever Switch	P,N	-
☒ Shift Gear Position	P,N,R	-

FIG.1)

☒ Current Data ☐

Selective Display ☒ Full List ☒ Graph ☒ Items List ☐ Reset Min.Max. ☐ Record ☐ Stop ☒ VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Select Lever Switch	R	-
☒ Shift Gear Position	P,N,R	-

FIG.2)

☒ Current Data ☐

Selective Display ☒ Full List ☒ Graph ☒ Items List ☐ Reset Min.Max. ☐ Record ☐ Stop ☒ VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Select Lever Switch	SPOINT	-
☒ Shift Gear Position	1	-

FIG.3)

☒ Current Data ☐

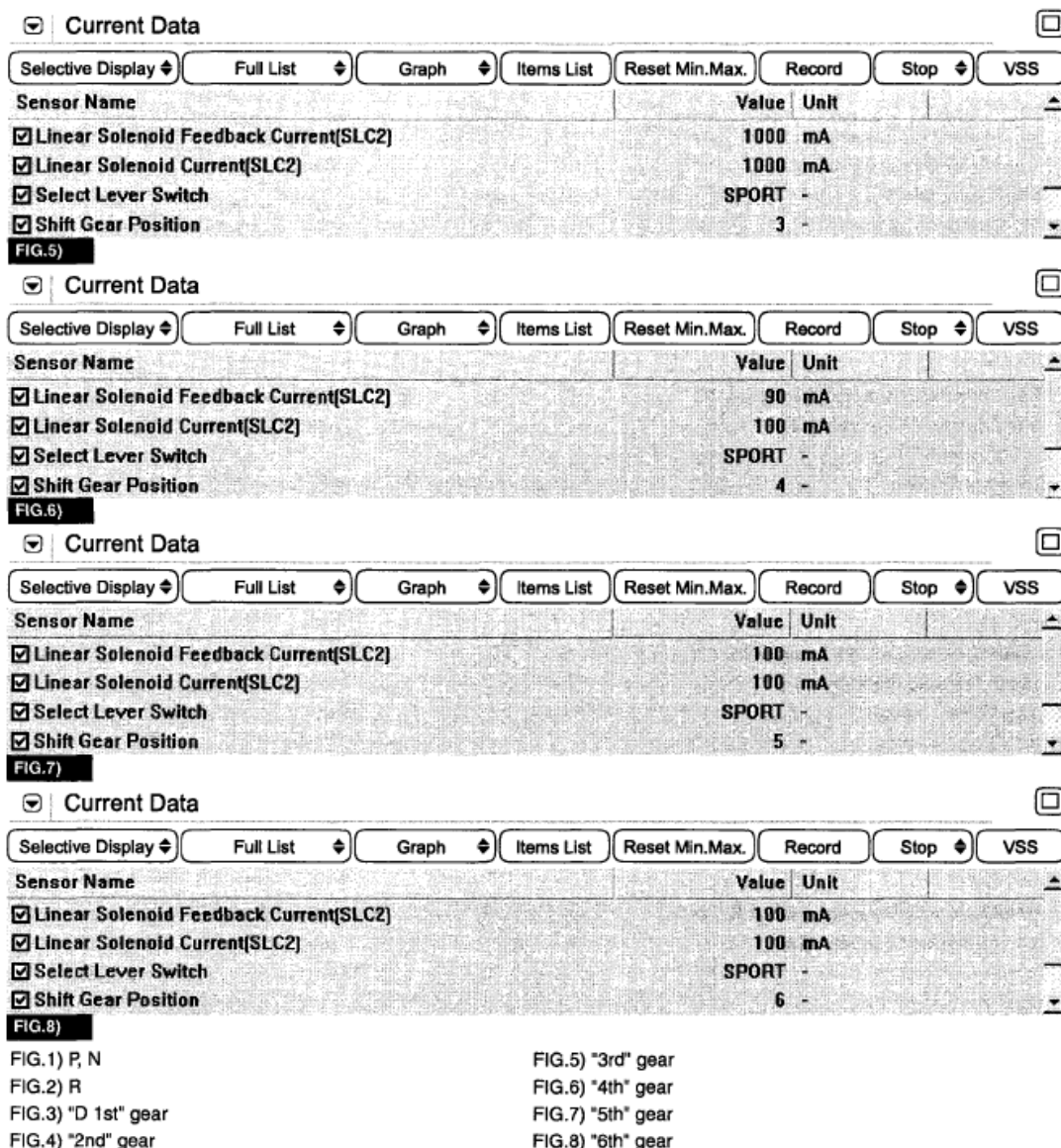
Selective Display ☒ Full List ☒ Graph ☒ Items List ☐ Reset Min.Max. ☐ Record ☐ Stop ☒ VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLC2)	990	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Select Lever Switch	SPOINT	-
☒ Shift Gear Position	2	-

FIG.4)

SENAT7274N

Fig. 78: Scan Tool Display - Shift Solenoid "D" (SLC2) (1 Of 2)
 Courtesy of HYUNDAI MOTOR CO.



SENAT7276N

Fig. 79: Scan Tool Display - Shift Solenoid "D" (SLC2) (2 Of 2)
 Courtesy of HYUNDAI MOTOR CO.

5. Does the Shift Solenoid "D" (SLC2) follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU. Perform
3. Perform the continuity test between Shift Solenoid "D" (SLC2) terminal and chassis ground.

Specification : Not continuity

4. Is resistance within specifications?

YES:

- Go to "**GROUND CIRCUIT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

GROUND CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between Ground terminal of Shift Solenoid "D" (SLC2) and chassis ground.

Specification : Continuity

4. Is resistance within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Measure resistance both terminal of Shift Solenoid "D" (SLC2).

Specification : Approx. 5.0~5.6ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace Shift Solenoid "D" (SLC2) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0982 SHIFT SOLENOID "D" CONTROL CIRCUIT LOW (SLC2)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-D (SLC2)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the current range	• Solenoid valve (SLC2) • Wiring harness (SLC2) • TCU
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • TCU communication = normal	
Threshold value	• Feed back current < 20mA	
Diagnostic Time	• More than 5 times x more than 0.1 sec	
Fail Safe	• Self learning control is inhibited • Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0981**.

MONITOR SCANTOOL DATA

Refer to **DTC P0981**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0981**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0981**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P0981**.

COMPONENT INSPECTION

Refer to **DTC P0981**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0981**.

DTC P0983 SHIFT SOLENOID "D" CONTROL CIRCUIT HIGH (SLC2)

COMPONENT LOCATION

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-D (SLC2)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	Check the current range	- Solenoid valve (SLC2) - Wiring harness (SLC2) - TCU
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - TCU communication = normal	
Threshold value	Feed back current > 1358mA	
Diagnostic Time	More than 5 times x more than 0.1 sec	
Fail Safe	- Self learning control is inhibited - Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0981**.

MONITOR SCANTOOL DATA

Refer to **DTC P0981**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0981**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0981**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P0981**.

COMPONENT INSPECTION

Refer to **DTC P0981**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0981**.

DTC P0984 SHIFT SOLENOID "E" CONTROL CIRCUIT RANGE/PERFORMANCE (SLC3)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-E (SLC3)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	Check the current range	- Solenoid valve (SLC3) - Wiring harness (SLC3)
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - TCU communication = normal	

Threshold value	Detect not available current	TCU
Diagnostic Time	More than 2 times	
Fail Safe	- Self learning control is inhibited - Adaptive control is inhibited	

SCHEMATIC DIAGRAM

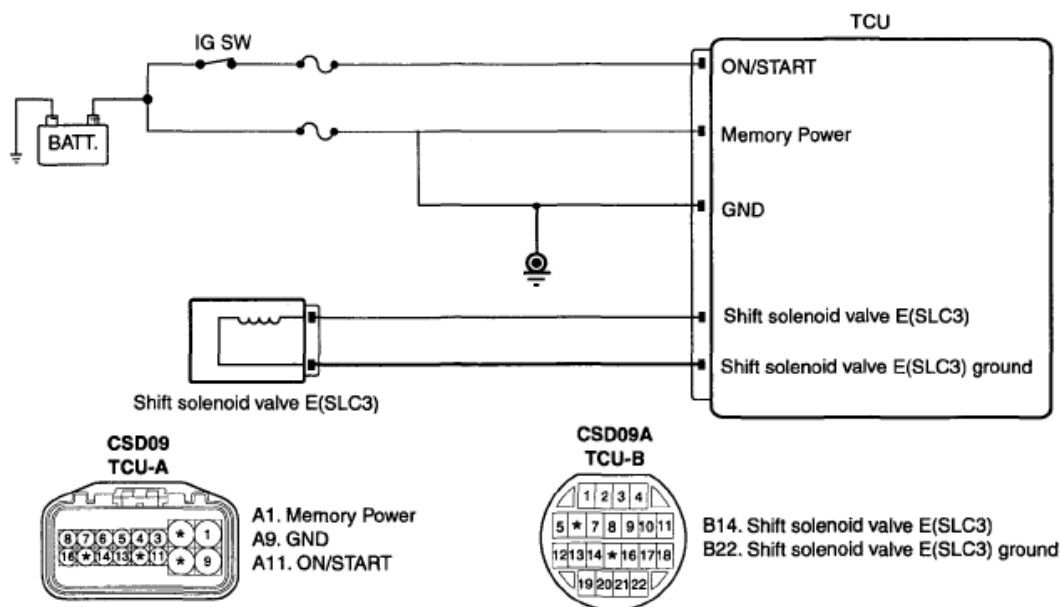


Fig. 80: Shift Solenoid Valve E (SLC3) - Schematic Diagram

Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the Shift Solenoid "E" (SLC3) parameters on the scan tool.
4. Shift gear at each position.

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Select Lever Switch	P,N	-
☒ Shift Gear Position	P,N,R	-

FIG.1)

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLC3)	100	mA
☒ Linear Solenoid Current(SLC3)	100	mA
☒ Select Lever Switch	R	-
☒ Shift Gear Position	P,N,R	-

FIG.2)

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Select Lever Switch	SPOINT	-
☒ Shift Gear Position	1	-

FIG.3)

☒ Current Data ☐

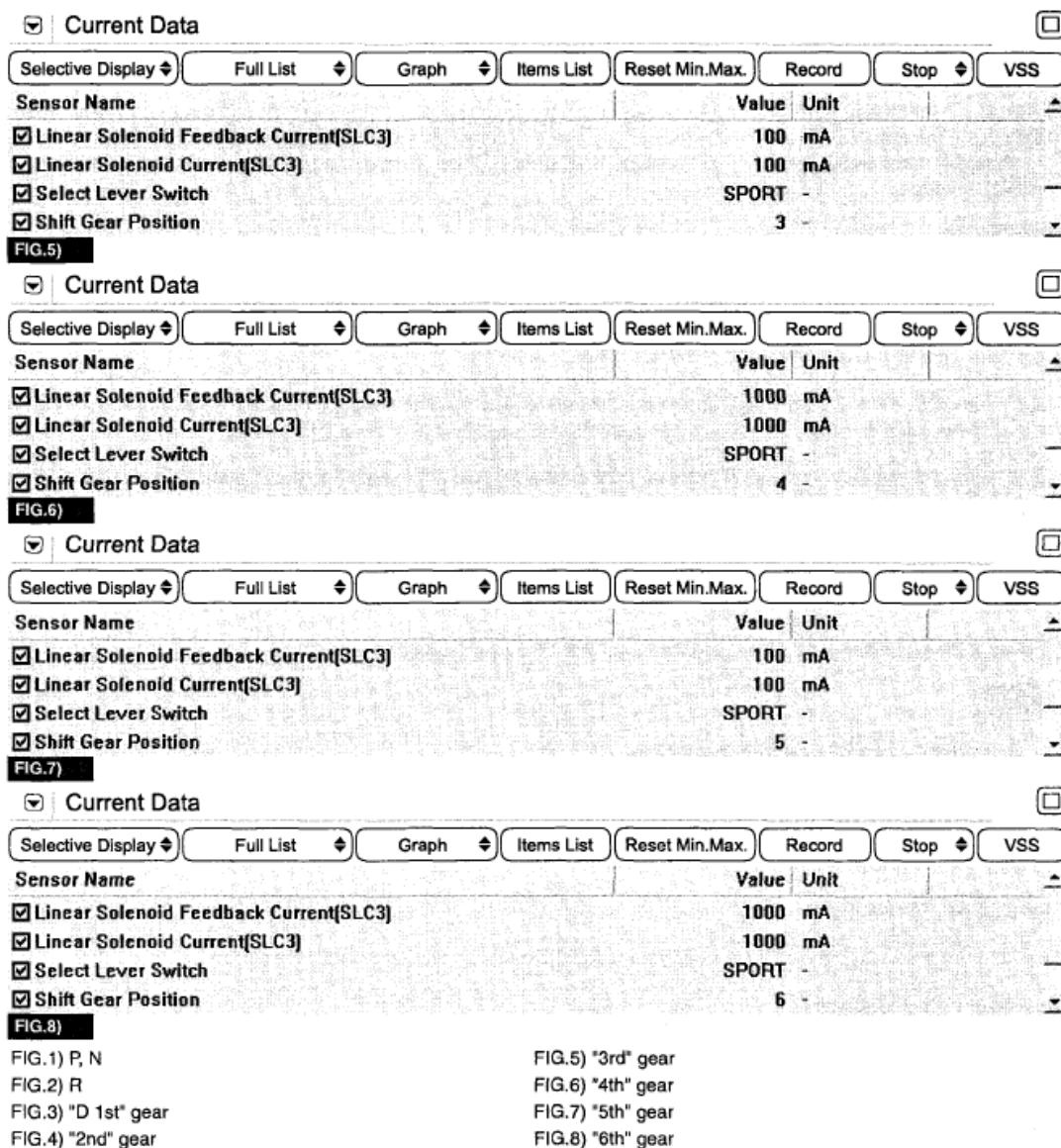
Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Select Lever Switch	SPOINT	-
☒ Shift Gear Position	2	-

FIG.4)

SENAT7276N

Fig. 81: Scan Tool Display - Shift Solenoid "E" (SLC3) (1 Of 2)
 Courtesy of HYUNDAI MOTOR CO.



SENAT7277N

Fig. 82: Scan Tool Display - Shift Solenoid "E" (SLC3) (2 Of 2)

Courtesy of HYUNDAI MOTOR CO.

5. Does the Shift Solenoid "E" (SLC3) follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between Shift Solenoid "E" (SLC3) terminal and chassis ground.

Specification : Not continuity

4. Is resistance within specifications?

YES:

- Go to "**GROUND CIRCUIT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

GROUND CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between Ground terminal of Shift Solenoid "E" (SLC3) and chassis ground.

Specification : Continuity

4. Is resistance within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Measure resistance both terminal of Shift Solenoid "E" (SLC3).

Specification : Approx. 5.0-5.6ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace Shift Solenoid "E" (SLC3) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0985 SHIFT SOLENOID "E" CONTROL CIRCUIT LOW (SLC3)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-E (SLC3)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the current range	• Solenoid valve (SLC3) • Wiring harness (SLC3) • TCU
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • TCU communication = normal	
Threshold value	• Feed back current < 20mA	
Diagnostic Time	• More than 5 times x more than 0.1 sec	
Fail Safe	• Self learning control is inhibited • Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0984**.

MONITOR SCANTOOL DATA

Refer to **DTC P0984**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0984**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0984**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P0984**.

COMPONENT INSPECTION

Refer to **DTC P0984**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0984**.

DTC P0986 SHIFT SOLENOID "E" CONTROL CIRCUIT HIGH (SLC3)

COMPONENT LOCATION

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-E (SLC3)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	Check the current range	- Solenoid valve (SLC3) - Wiring harness (SLC3) - TCU
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - TCU communication = normal	
Threshold value	Feed back current > 1358mA	
Diagnostic Time	More than 5 times x more than 0.1 sec	
Fail Safe	- Self learning control is inhibited - Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0984**.

MONITOR SCANTOOL DATA

Refer to **DTC P0984**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0984**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0984**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P0984**.

COMPONENT INSPECTION

Refer to **DTC P0984**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0984**.

DTC P0997 SHIFT SOLENOID "F" CONTROL CIRCUIT RANGE/PERFORMANCE (SLB1)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-F (SLB1)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the current range	• Solenoid valve (SLB1) • Wiring harness (SLB1)
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • TCU communication = normal	

Threshold value	• Detect not available current	• TCU
Diagnostic Time	• More than 2 times	
Fail Safe	• Self learning control is inhibited • Adaptive control is inhibited	

SCHEMATIC DIAGRAM

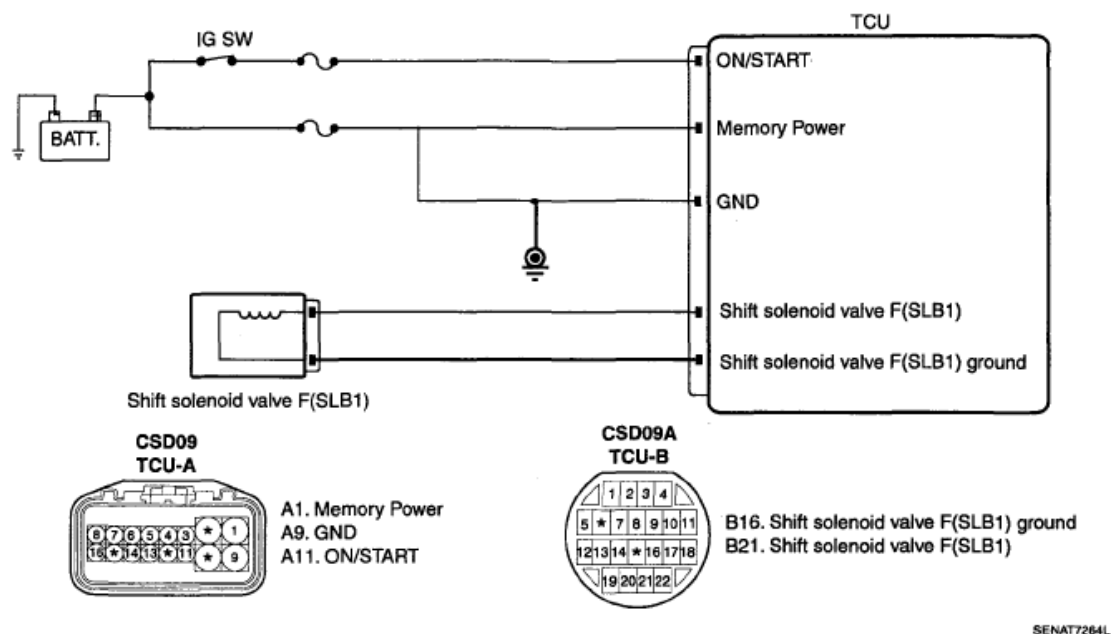


Fig. 83: Shift Solenoid Valve F (SLB1) - Schematic Diagram
 Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the Shift Solenoid "F" (SLB1) parameters on the scan tool.
4. Shift gear at each position.

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLB1)	1000	mA
☒ Linear Solenoid Feedback Current(SLB1)	1000	mA
☒ Select Lever Switch	P,N	-
☒ Shift Gear Position	P,N,R	-

FIG.1)

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLB1)	1000	mA
☒ Linear Solenoid Feedback Current(SLB1)	1000	mA
☒ Select Lever Switch	R	-
☒ Shift Gear Position	P,N,R	-

FIG.2)

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLB1)	1000	mA
☒ Linear Solenoid Feedback Current(SLB1)	1000	mA
☒ Select Lever Switch	SPOINT	-
☒ Shift Gear Position	1	-

FIG.3)

☒ Current Data ☐

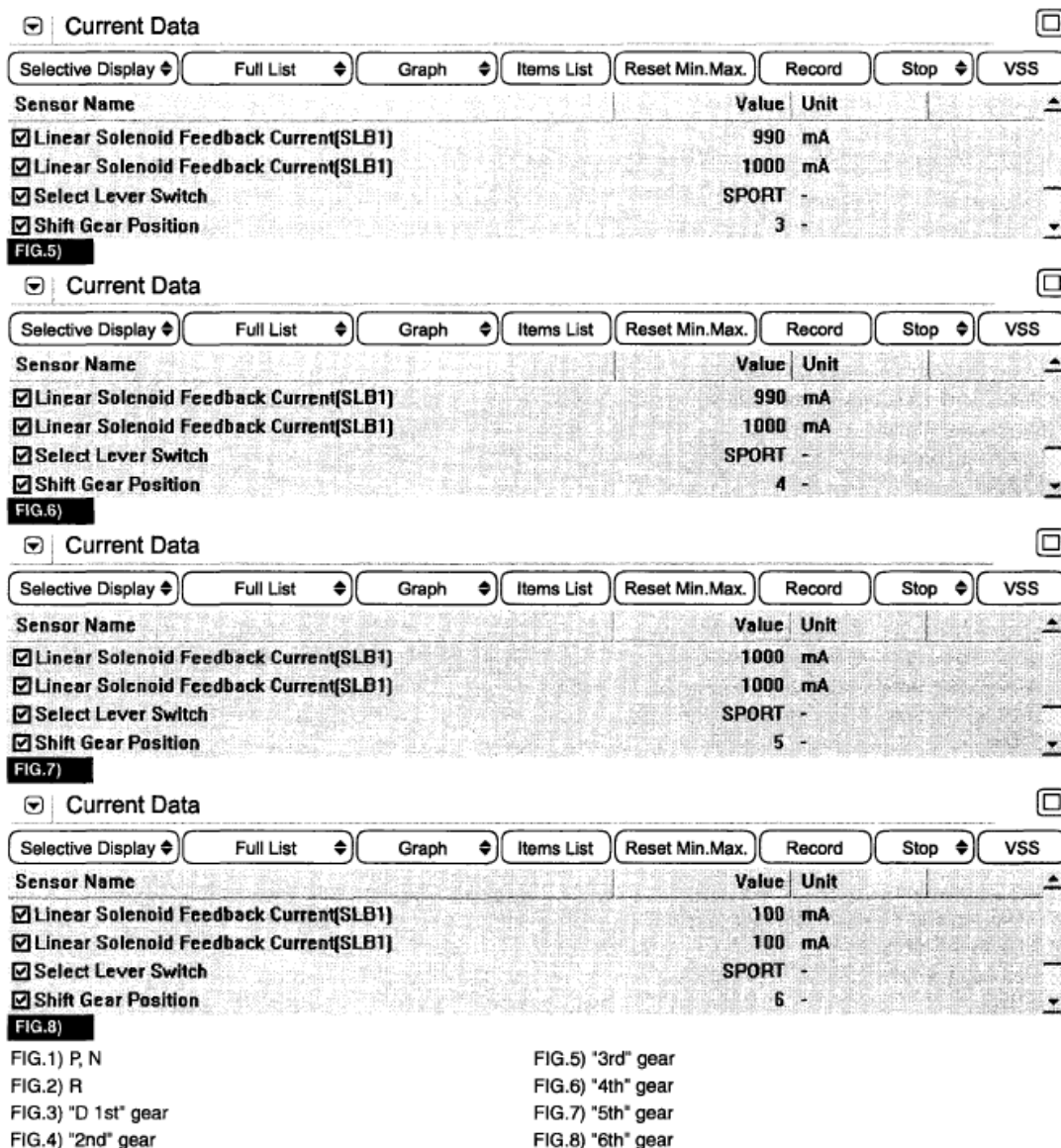
Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Feedback Current(SLB1)	100	mA
☒ Linear Solenoid Feedback Current(SLB1)	100	mA
☒ Select Lever Switch	SPOINT	-
☒ Shift Gear Position	2	-

FIG.4)

SENAT7278N

Fig. 84: Scan Tool Display - Shift Solenoid "F" (SLB1) (1 Of 2)
 Courtesy of HYUNDAI MOTOR CO.



SENAT7279N

Fig. 85: Scan Tool Display - Shift Solenoid "F" (SLB1) (2 Of 2)
 Courtesy of HYUNDAI MOTOR CO.

5. Does the Shift Solenoid "F" (SLB1) follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU. Perform
3. Perform the continuity test between Shift Solenoid "F" (SLB1) terminal and chassis ground.

Specification : Not continuity

4. Is resistance within specifications?

YES:

- Go to "**GROUND CIRCUIT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

GROUND CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between Ground terminal of Shift Solenoid "F" (SLB1) and chassis ground.

Specification : Continuity

4. Is resistance within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Measure resistance both terminal of Shift Solenoid "F" (SLB1).

Specification : Approx. 5.0~5.6ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace Shift Solenoid "F" (SLB1) as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P0998 SHIFT SOLENOID "F" CONTROL CIRCUIT HIGH (SLB1)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-F (SLB1)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the current range	• Solenoid valve (SLB1) • Wiring harness (SLB1) • TCU
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • TCU communication = normal	
Threshold value	• Feed back current < 20mA	
Diagnostic Time	• More than 5 times x more than 0.1 sec	
Fail Safe	• Self learning control is inhibited • Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0997**.

MONITOR SCANTOOL DATA

Refer to **DTC P0997**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0997**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0997**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P0997**.

COMPONENT INSPECTION

Refer to **DTC P0997**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0997**.

DTC P0999 SHIFT SOLENOID "F" CONTROL CIRCUIT HIGH (SLB1)

COMPONENT LOCATION

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SCSV-F (SLB1)" in order to maintain optimum gear shift.

DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	Check the current range	- Solenoid valve (SLB1) - Wiring harness (SLB1) - TCU
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - TCU communication = normal	
Threshold value	Feed back current > 1358mA	
Diagnostic Time	More than 5 times x more than 0.1 sec	
Fail Safe	- Self learning control is inhibited - Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0997**.

MONITOR SCANTOOL DATA

Refer to **DTC P0997**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P0997**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0997**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P0997**.

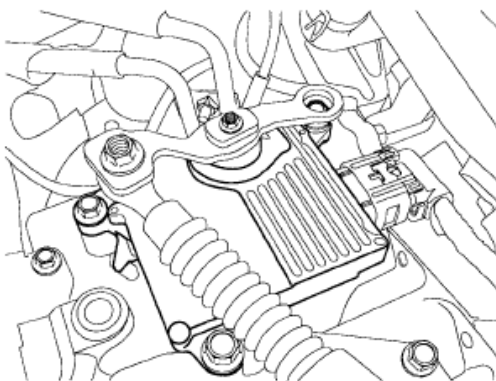
COMPONENT INSPECTION

Refer to **DTC P0997**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0997**.

DTC P1750 FRONT LEFT SPEED SENSOR (FL)-WITH ESP, ABS; DTC P1751 FRONT RIGHT SPEED SENSOR (FR)-WITH ESP, ABS; DTC P1752 WHEEL SPEED REAR LEFT SIGNAL UNDEFINED; DTC P1753 WHEEL SPEED REAR RIGHT SIGNAL UNDEFINED

COMPONENT LOCATION

SENAT7201D

Fig. 86: Identifying Control Module Location
Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

The TCM can either receive data from the Engine Control Module or ABS control module, or it can send data

to the ECM and ABS/CM by using CAN communication. The CAN communication is one of the vehicle communications method, which is now widely used to transfer the vehicle data.

DTC DESCRIPTION

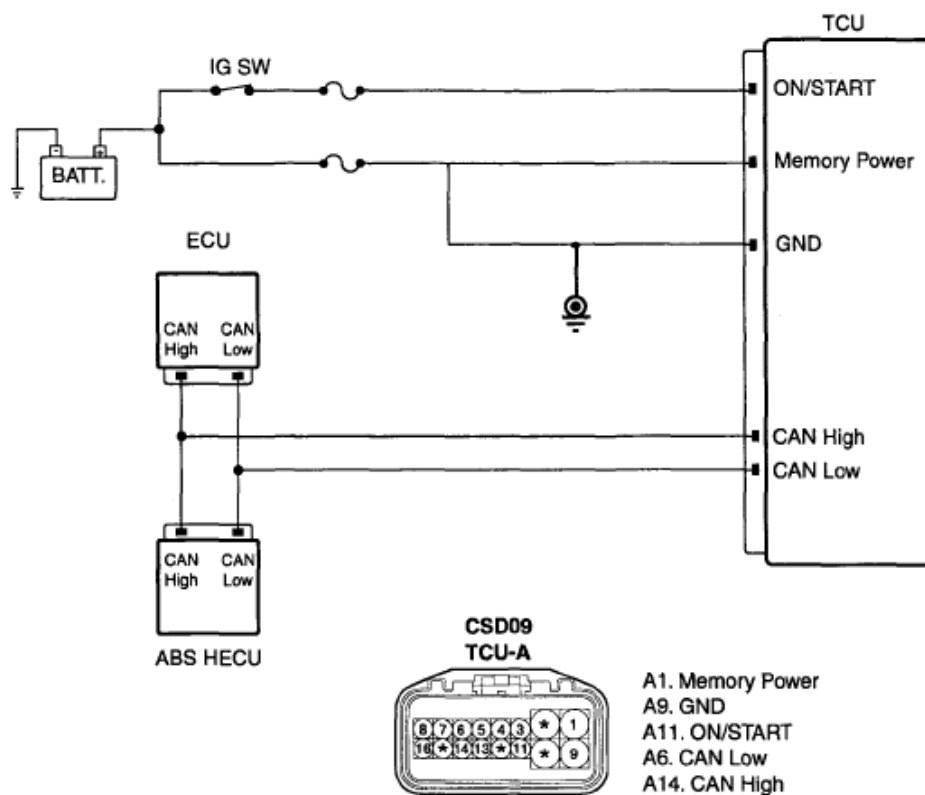
When the TCM cannot read the data from the ABS ECU through the CAN-BUS line, the TCM sets this code. CAN-BUS circuit malfunctioning or ABS ECU can be a possible cause of this DTC.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the communication	• Short or Open in CAN communication circuit. • Faulty in ECU
Enable Conditions	• 10.2V < Battery voltage < 15.5V • TCU communication = normal • No fail in System	
Threshold Value	• Detect abnormal signal	
Diagnostic Time	• More than 0.25 sec	
Fail Safe	• Keep data before failure detection. • Self learning control is inhibited	

SCHEMATIC DIAGRAM



SENAT7266L

Fig. 87: ABS HECU Control Module - Schematic Diagram
Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "CAN COMMUNICATION SERVICE DATA (ENGINE RPM, VEHICLE SPEED SENSOR, THROTTLE P. SENSOR)" parameters on the scan tool.

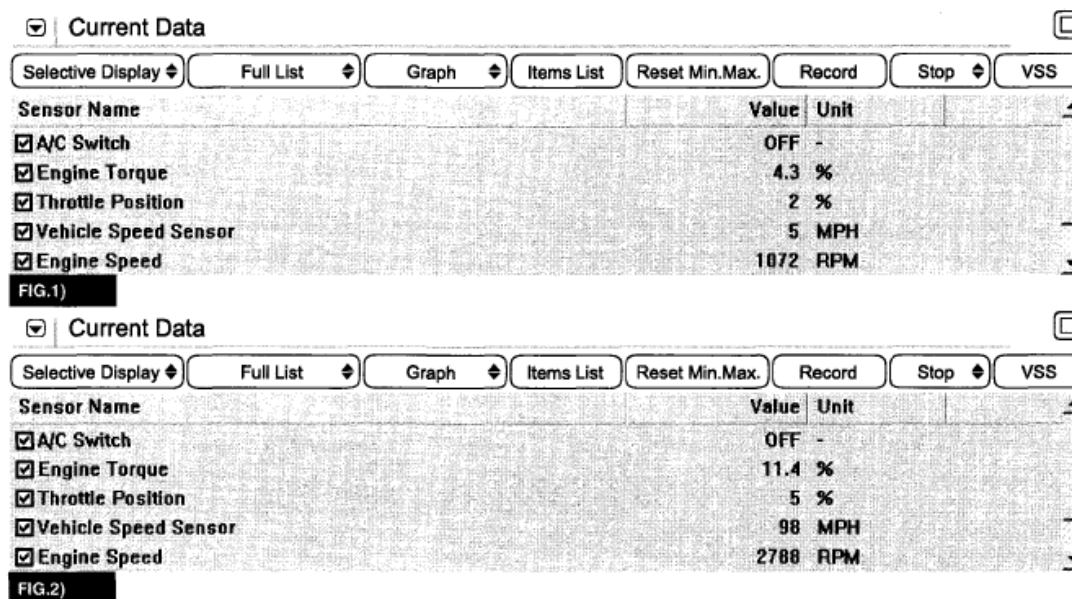


FIG.1) Low-RPM

FIG.2) High-RPM

SENAT7267N

Fig. 88: Scan Tool Display - "CAN COMMUNICATION SERVICE DATA (ENGINE RPM, THROTTLE P. SENSOR)"

Courtesy of HYUNDAI MOTOR CO.

4. Does "CAN BUS LINE DATA" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

- Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF" & Engine "OFF".
2. Disconnect the "ECU" connector.
3. Measure Resistance between "CAN HIGH" terminal and "CAN LOW" terminal.

Specification : Approx. 120±10ohms

4. Is measured resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage of ECM and then Repair or replace Resistance for CAN communication as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P1760 VALVE STICK (SLC3 STICK) - NEUTRAL CONDITION AT R RANGE**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

TCU monitors status of "SHIFT SOLENOID-VALVE C (SLC3)" in order to maintain optimum gear shift.

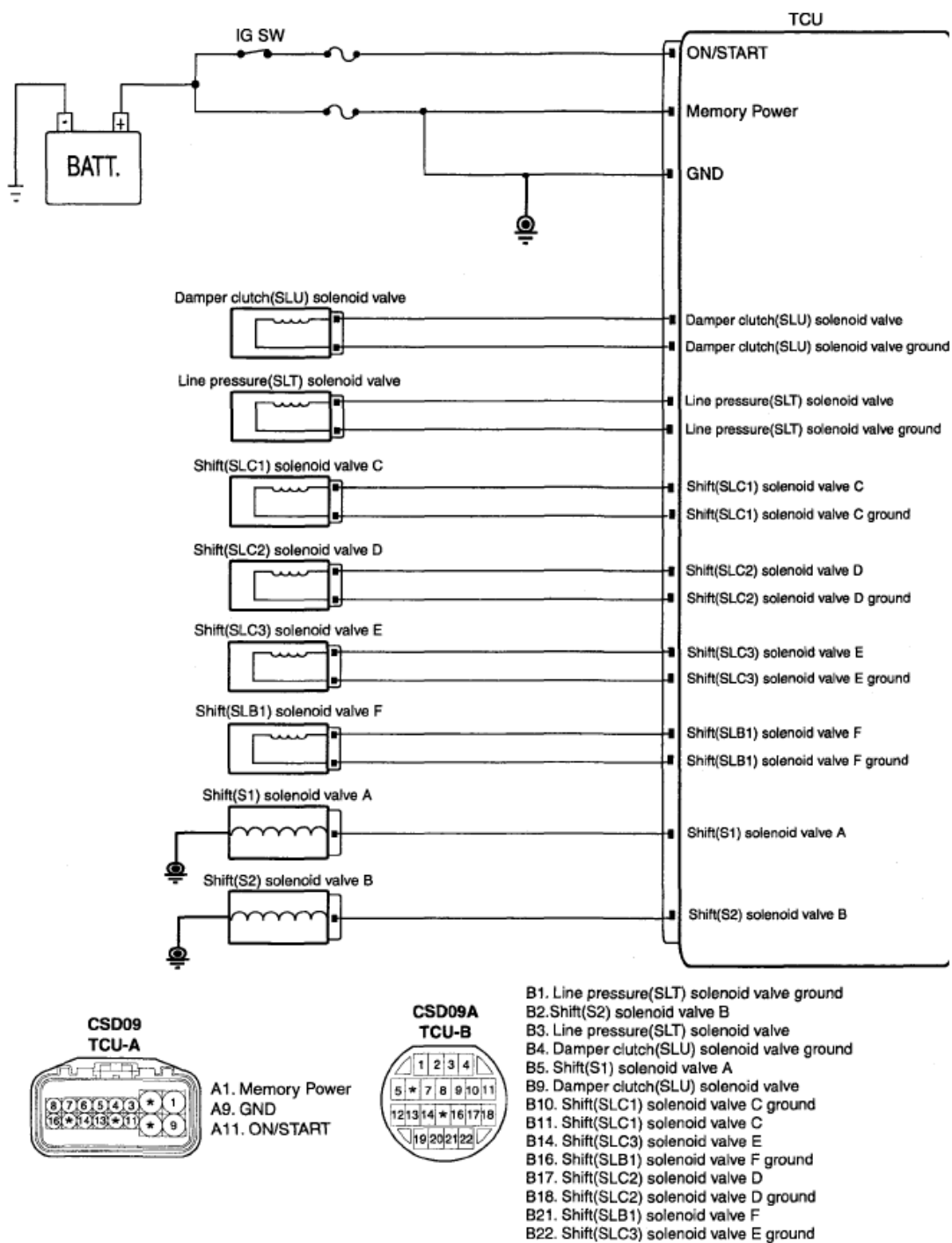
DTC DESCRIPTION

TCU set this code, When Solenoid-valves are not working normally.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the speed range	• C3 Clutch • B2 Brake • Valve-body (C3, B2 pressure system) • TCU • Solenoid valve (SLC3) • S1, S2 solenoid valve
Enable Conditions	• Shift lever switch = "R" range • Output speed < 500rpm • Gear position > Reverse • Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • No fail in system • ATF temp. > 0°C • Not N-->D, N-->R shifting	
Threshold Value	• Engine speed - Input speed < 150rpm	
Diagnostic Time	• More than 0.1 sec	
Fail Safe	• Self learning control is inhibited • Locked in 5th gear. • Adaptive control is inhibited	

SCHEMATIC DIAGRAM



SENAT7244L

Fig. 89: TCC Solenoid Valve (SLU) - Schematic Diagram
 Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".

3. Monitor the all solenoid-valve parameters on the scan tool.
4. Shift gear at each position.

Current Data

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	1000	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	970	mA
☒ Shift Control Solenoid Valve Signal	Start Lock Solen...	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.1)

Current Data

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	100	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	1000	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	1000	mA
☒ Shift Control Solenoid Valve Signal	-	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.2)

Current Data

Selective Display

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	690	mA
☒ Shift Control Solenoid Valve Signal	Shift Solenoid #1	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.3)

SENAT7245N

Fig. 90: Scan Tool Display - "SOLENOID DUTY" (1 Of 3)
 Courtesy of HYUNDAI MOTOR CO.

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	900	mA
☒ Shift Control Solenoid Valve Signal	-	-
☐ Linear Solenoid Feedback Current(SLB1)	100	mA
☐ Linear Solenoid Feedback Current(SLB1)	100	mA

FIG.4)

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	100	mA
☒ Linear Solenoid Current(SLC2)	1000	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	200	mA
☒ Linear Solenoid Current(SLT)	880	mA
☒ Shift Control Solenoid Valve Signal	-	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.5)

☒ Current Data ☐

Selective Display Full List Graph Items List Reset Min.Max. Record Stop VSS

Sensor Name	Value	Unit
☒ Linear Solenoid Current(SLC3)	1000	mA
☒ Linear Solenoid Current(SLC2)	100	mA
☒ Linear Solenoid Current(SLC1)	100	mA
☒ Linear Solenoid Current(SLU)	1000	mA
☒ Linear Solenoid Current(SLT)	850	mA
☒ Shift Control Solenoid Valve Signal	Shift Solenoid #2	-
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA
☐ Linear Solenoid Feedback Current(SLB1)	1000	mA

FIG.6)

SENAT7250N

Fig. 91: Scan Tool Display - "SOLENOID DUTY" (2 Of 3)
 Courtesy of HYUNDAI MOTOR CO.

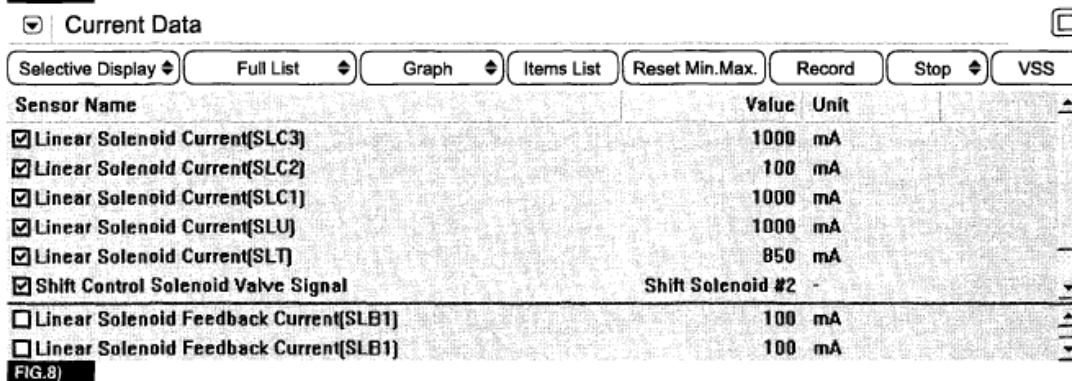
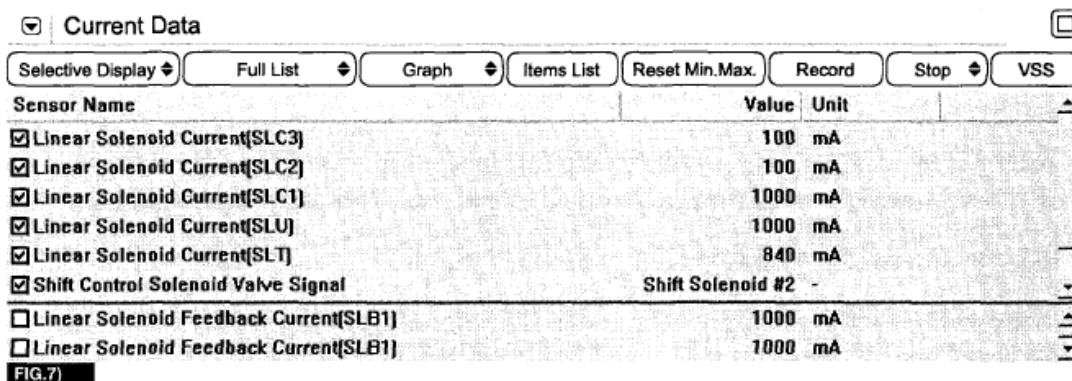


FIG.1) P, N

FIG.2) R

FIG.3) "D 1st" gear

FIG.4) "2nd" gear

FIG.5) "3rd" gear

FIG.6) "4th" gear

FIG.7) "5th" gear

FIG.8) "6th" gear

SENAT7251N

Fig. 92: Scan Tool Display - "SOLENOID DUTY" (3 Of 3)

Courtesy of HYUNDAI MOTOR CO.

5. Does all "SOLENOID DUTY" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**COMPONENT INSPECTION 1**" procedure.

COMPONENT INSPECTION 1

- IG KEY OFF.
- Remove the TCU.
- Measure the resistance between "S1" solenoid-valve terminal and ground terminal of "S1" solenoid-valve.

4. Measure the resistance between "S2" solenoid-valve terminal and ground terminal of "S2" solenoid-valve.

Specification: Approx. 11~15ohms (20°C)

5. Is resistance within specifications?

YES:

- Go to "**COMPONENT INSPECTION 2**" procedure.

NO:

- Replace solenoid-valve as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION 2

1. IG KEY OFF.
2. Remove the TCU.
3. Measure the resistance of "SLC1" "SLC2" "SLC3" "SLB1" solenoid-valves.

Specification : Approx. 5.0 ~ 5.6ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace solenoid-valve as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.

3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC P2762 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT RANGE/PERFORMANCE (SLU)

COMPONENT LOCATION

Refer to **DTC P0961**.

GENERAL DESCRIPTION

The PCM/TCM controls the locking and unlocking of the Torque Converter Clutch (or Damper Clutch), to the input shaft of the transmission, by applying hydraulic pressure. The main purpose of T/C clutch control is to save fuel by decreasing the hydraulic load inside the T/C. The PCM/TCM outputs duty pulses to control the Damper Clutch Control Solenoid Valve (DCCSV) and hydraulic pressure is applied to the DC according to the DCC duty ratio value. When the duty ratio is high, high pressure is applied and the Damper Clutch is locked. The normal operating range of the Damper Clutch Control duty ratio value is from 30% (unlocked) to 85% (locked).

DTC DESCRIPTION

The PCM/TCM increases the duty ratio to engage the Damper Clutch by monitoring slip rpms (difference value between engine speed and turbine speed). To decrease the slip of the Damper Clutch, the PCM/TCM increases the duty ratio by applying more hydraulic pressure. When slip rpm does not drop with 100% duty ratio, the PCM/TCM determines that the Torque Converter Clutch is stuck OFF and sets this code.

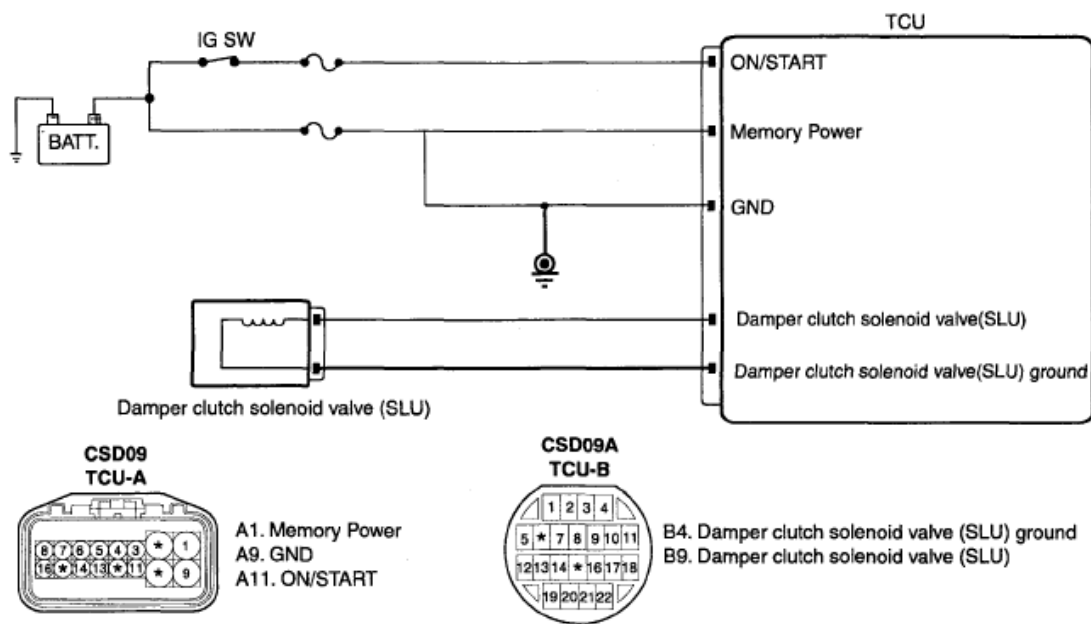
DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the current range	• Solenoid valve (SLU) • Wiring harness (SLU) • TCU
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • TCU communication = normal	
Threshold value	• Detect not available current	
Diagnostic Time	• More than 2 times	

Fail Safe

- Self learning control is inhibited
- Adaptive control is inhibited

SCHEMATIC DIAGRAM

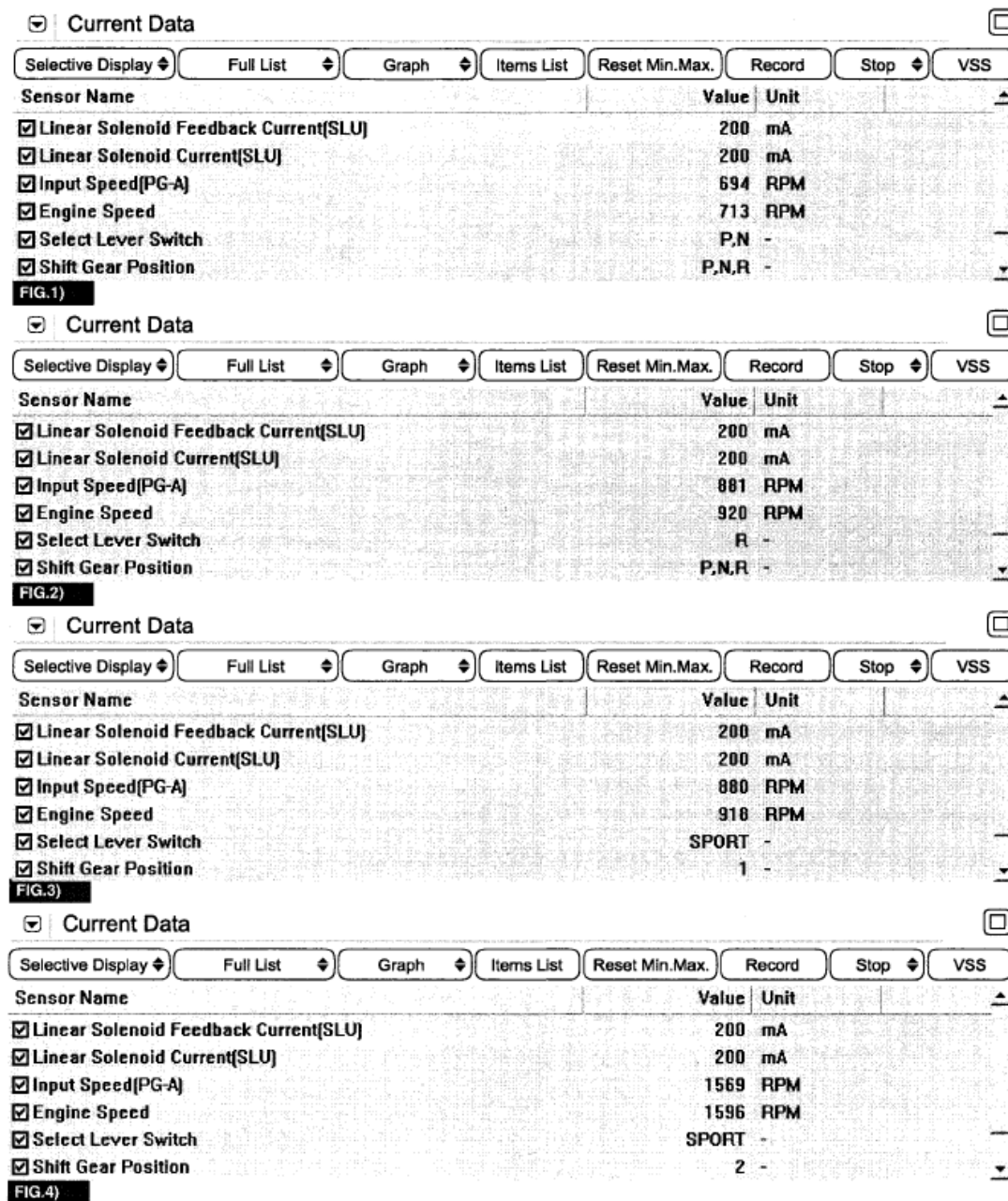
SENAT7241L

Fig. 93: TCC Solenoid Valve (SLU) - Schematic Diagram
 Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Select "D RANGE" and drive vehicle.
4. Monitor the "TORQUE CONVERTER (DAMPER) CLUTCH" parameter on the scantool.

Specification : TCC SLIP < 160RPM (In condition that TCC SOL. DUTY > 80%)



SENAT7242N

Fig. 94: Scan Tool Display - "TORQUE CONVERTER (DAMPER) CLUTCH" (1 Of 2)
 Courtesy of HYUNDAI MOTOR CO.

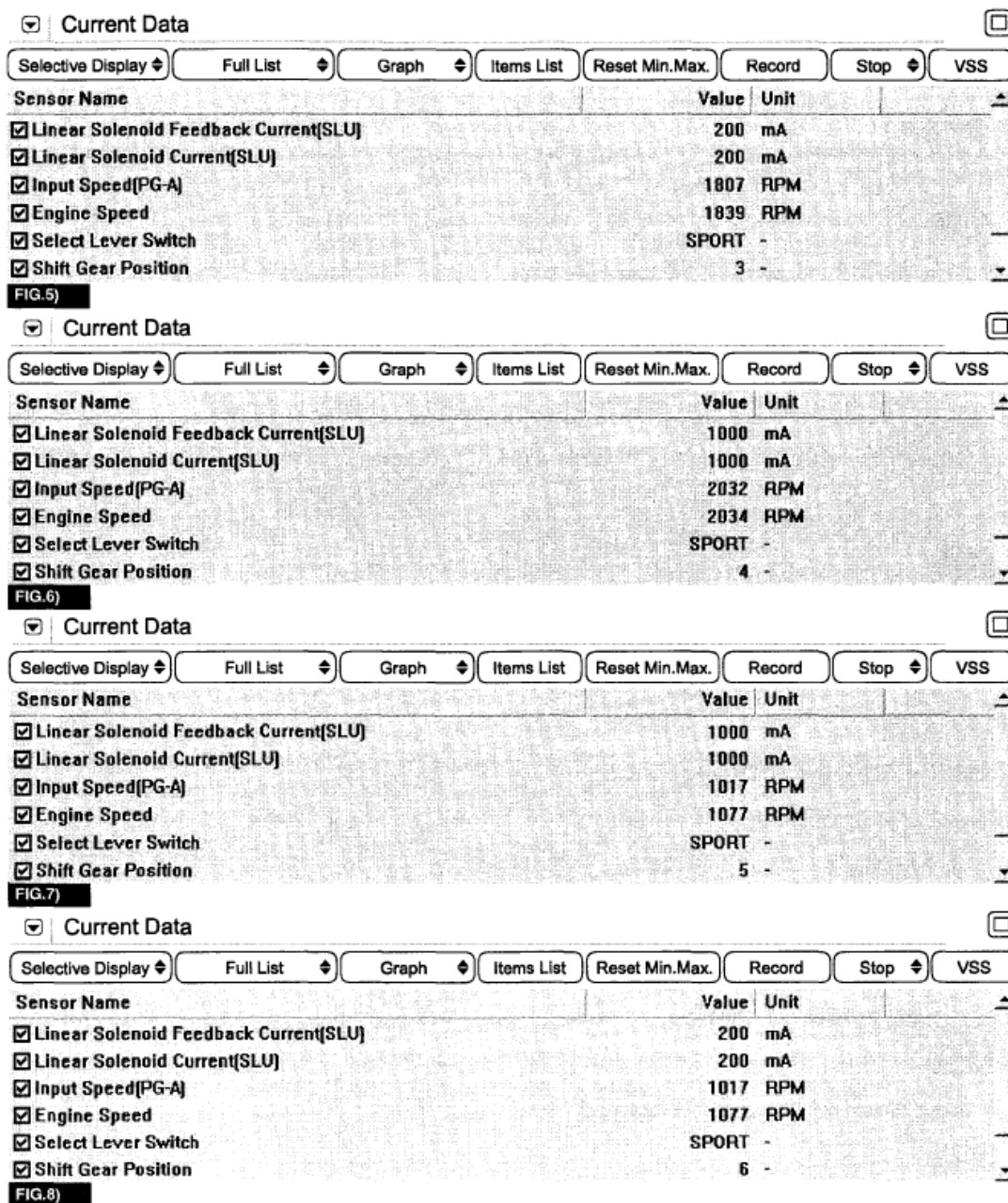


FIG.1) P, N

FIG.2) R

FIG.3) "D 1st" gear

FIG.4) "2nd" gear

FIG.5) "3rd" gear

FIG.6) "4th" gear

FIG.7) "5th" gear

FIG.8) "6th" gear

SENAT7249N

Fig. 95: Scan Tool Display - "TORQUE CONVERTER (DAMPER) CLUTCH" (2 Of 2)
 Courtesy of HYUNDAI MOTOR CO.

5. Does "TCCSV" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between "TCCSV (SLU)" terminal and chassis ground.

Specification : Not continuity

4. Is resistance within specifications?

YES:

- Go to "**GROUND CIRCUIT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

GROUND CIRCUIT INSPECTION

1. Engine "OFF" IG KEY "ON".
2. Remove the TCU.
3. Perform the continuity test between Ground terminal of "TCCSV (SLU)" and chassis ground.

Specification : Continuity

4. Is resistance within specifications?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for short to ground in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. Engine "OFF" IG KEY "OFF".
2. Remove the TCU.
3. Measure resistance both terminal of "TCCSV".

Specification : Approx. 5.0~5.6ohms (20°C)

4. Is resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Replace "TCCSV" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE.**

NO:

- System performing to specification at this time.

DTC P2763 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT HIGH (SLU)

COMPONENT LOCATION

Refer to **DTC P0961.**

GENERAL DESCRIPTION

The PCM/TCM controls the locking and unlocking of the Torque Converter Clutch (or Damper Clutch), to the input shaft of the transmission, by applying hydraulic pressure. The main purpose of T/C clutch control is to save fuel by decreasing the hydraulic load inside the T/C. The PCM/TCM outputs duty pulses to control the Damper Clutch Control Solenoid Valve (DCCSV) and hydraulic pressure is applied to the DC according to the DCC duty ratio value. When the duty ratio is high, high pressure is applied and the Damper Clutch is locked. The normal operating range of the Damper Clutch Control duty ratio value is from 30% (unlocked) to 85% (locked).

DTC DESCRIPTION

The PCM/TCM increases the duty ratio to engage the Damper Clutch by monitoring slip rpms (difference value between engine speed and turbine speed). To decrease the slip of the Damper Clutch, the PCM/TCM increases the duty ratio by applying more hydraulic pressure. When slip rpm does not drop with 100% duty ratio, the PCM/TCM determines that the Torque Converter Clutch is stuck OFF and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the current range	• Solenoid valve (SLU)
Enable Conditions	• Engine speed > 400rpm • 10.2V < Battery voltage < 15.5V • TCU communication = normal	

Threshold value	• Feed back current < 20mA	• Wiring harness (SLU) • TCU
Diagnostic Time	• More than 5 times x more than 0.1 sec	
Fail Safe	• Self learning control is inhibited • Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P2762**.

MONITOR SCANTOOL DATA

Refer to **DTC P2762**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P2762**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P2762**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P2762**.

COMPONENT INSPECTION

Refer to **DTC P2762**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P2762**.

DTC P2764 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT LOW (SLU)**COMPONENT LOCATION**

Refer to **DTC P0961**.

GENERAL DESCRIPTION

The PCM/TCM controls the locking and unlocking of the Torque Converter Clutch (or Damper Clutch), to the input shaft of the transmission, by applying hydraulic pressure. The main purpose of T/C clutch control is to save fuel by decreasing the hydraulic load inside the T/C. The PCM/TCM outputs duty pulses to control the Damper Clutch Control Solenoid Valve (DCCSV) and hydraulic pressure is applied to the DC according to the DCC duty ratio value. When the duty ratio is high, high pressure is applied and the Damper Clutch is locked.

The normal operating range of the Damper Clutch Control duty ratio value is from 30% (unlocked) to 85% (locked).

DTC DESCRIPTION

The PCM/TCM increases the duty ratio to engage the Damper Clutch by monitoring slip rpms (difference value between engine speed and turbine speed). To decrease the slip of the Damper Clutch, the PCM/TCM increases the duty ratio by applying more hydraulic pressure. When slip rpm does not drop with 100% duty ratio, the PCM/TCM determines that the Torque Converter Clutch is stuck OFF and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	Check the current range	- Solenoid valve (SLU) - Wiring harness (SLU) - TCU
Enable Conditions	- Engine speed > 400rpm 10.2V < Battery voltage < 15.5V - TCU communication = normal	
Threshold value	Feed back current > 1358mA	
Diagnostic Time	More than 5 times x more than 0.1 sec	
Fail Safe	- Self learning control is inhibited - Adaptive control is inhibited	

SCHEMATIC DIAGRAM

Refer to **DTC P2762**.

MONITOR SCANTOOL DATA

Refer to **DTC P2762**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P2762**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P2762**.

GROUND CIRCUIT INSPECTION

Refer to **DTC P2762**.

COMPONENT INSPECTION

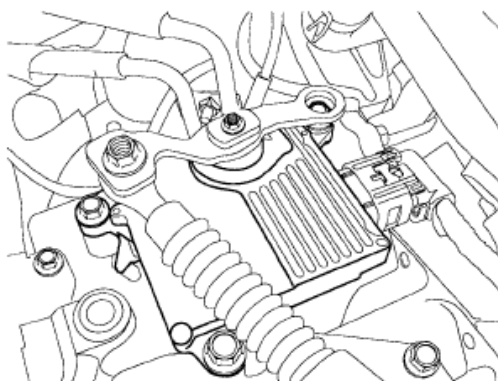
Refer to **DTC P2762**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P2762**.

DTC U0001 CAN COMMUNICATION MALFUNCTION

COMPONENT LOCATION



SENAT7201D

Fig. 96: Identifying Control Module Location
Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

The TCM can either receive data from the Engine Control Module or ABS control module, or it can send data to the ECM and ABSCM by using CAN communication. The CAN communication is one of the vehicle communications method, which is now widely used to transfer the vehicle data.

DTC DESCRIPTION

When the TCM cannot read the data from the ECU through the CAN-BUS line, the TCM sets this code. CAN-BUS circuit malfunctioning or ECU can be a possible cause of this DTC.

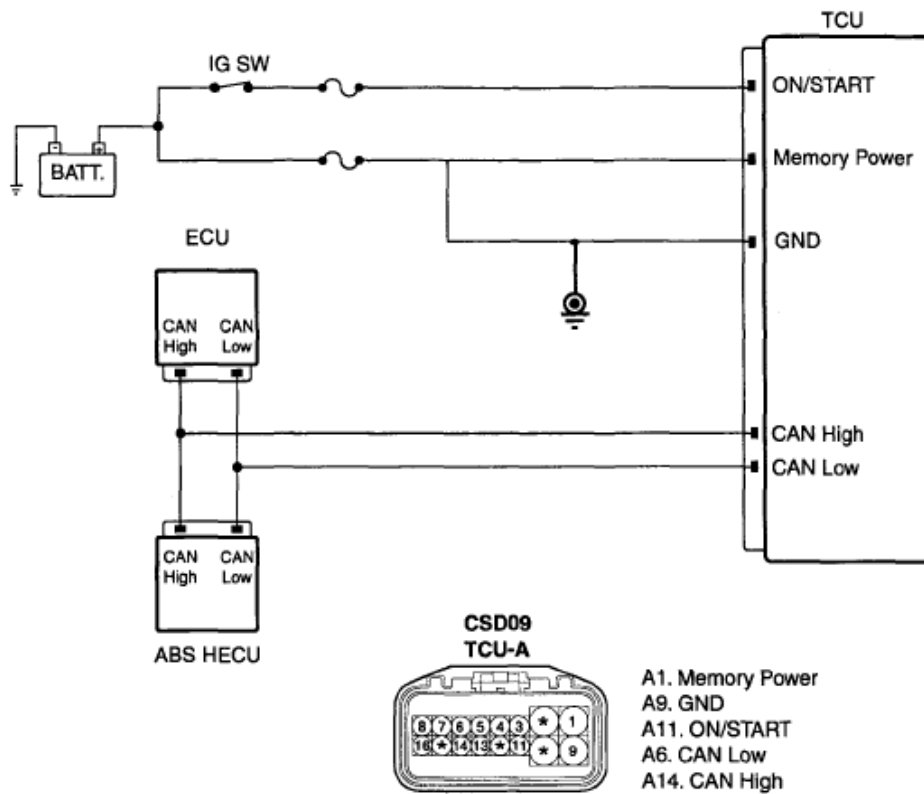
DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible cause
DTC Strategy	Check the communication	
Enable Conditions	- IG ON 10.2V < Battery voltage < 15.5V - No fail in system	
Threshold Value	Detect CAN BUS OFF signal	

Diagnostic Time		
Fail Safe	• Self learning control is inhibited. • Adaptive control is inhibited • Engine speed = 7000rpm • Accelerator = 0% • Engine torque = maximum • Gear position = 3rd gear • Kick-down = "OFF" • Brake switch = "ON" • Wheel speed = Output speed • Engine coolant temp. = 80°C	• Short or Open in CAN communication circuit. • Faulty in ECU • Faulty in TCU

SCHEMATIC DIAGRAM



SENAT7266L

Fig. 97: ABS HECU Control Module - Schematic Diagram
Courtesy of HYUNDAI MOTOR CO.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).

2. Engine "ON".
3. Monitor the "CAN COMMUNICATION SERVICE DATA (ENGINE RPM, VEHICLE SPEED SENSOR, THROTTLE P. SENSOR)" parameters on the scan tool.

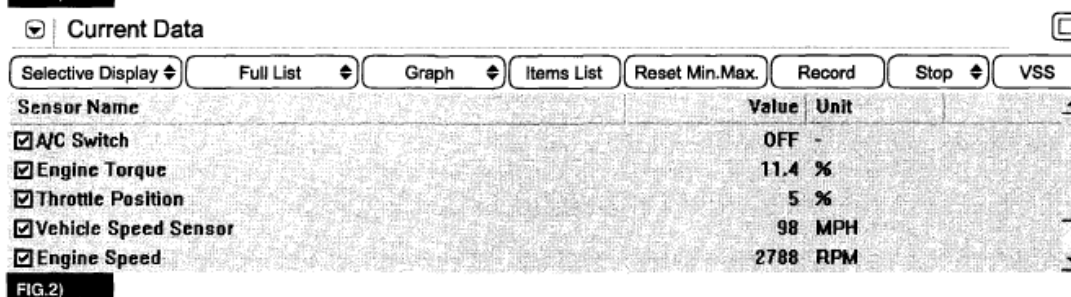
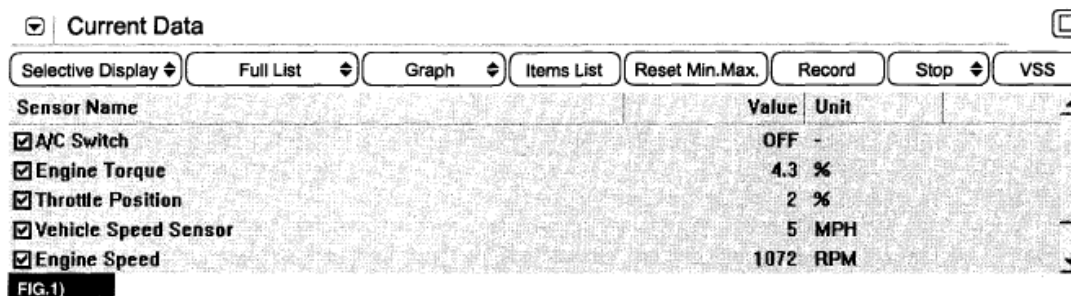


FIG.1) Low-RPM

FIG.2) High-RPM

SENAT7267N

Fig. 98: Scan Tool Display - "CAN COMMUNICATION SERVICE DATA (ENGINE RPM, THROTTLE P. SENSOR)"

Courtesy of HYUNDAI MOTOR CO.

4. Does "CAN BUS LINE DATA" follow the reference data?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or TCM (PCM)'s connector or was repaired and TCM (PCM) memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**TERMINAL AND CONNECTOR INSPECTION**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminal condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF" & Engine "OFF".
2. Disconnect the "ECU" connector.
3. Measure Resistance between "CAN HIGH" terminal and "CAN LOW" terminal.

Specification : Approx. 120±10ohms

4. Is measured resistance within specifications?

YES:

- Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage of ECM and then Repair or replace Resistance for CAN communication as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NOTE: When replacing the TCU, must perform the N position learning and the Initial learning, (refer to '**HOW TO PERFORM N POSITION LEARNING**' and '**HOW TO PERFORM INITIAL LEARNING**')

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System performing to specification at this time.

DTC U0100 FAULTS IN CAN A TRANSMIT MESSAGES**COMPONENT LOCATION**

Refer to **DTC U0001**.

GENERAL DESCRIPTION

Refer to **DTC U0001**.

DTC DESCRIPTION

When the TCM cannot read the data from the ECU through the CAN-BUS line, the TCM sets this code. CAN-BUS circuit malfunctioning or ECU can be a possible cause of this DTC.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	• Check the communication	• Short or Open in CAN communication circuit. • Faulty in ECU • Faulty in TCU
Enable Conditions	• IG ON • 10.2V < Battery voltage < 15.5V • No fail in system	
Threshold Value	• TCU cannot receive EMS1	
Diagnostic Time	• More than 2 times x more than 0.25 sec	
Fail Safe	• Self learning control is inhibited. • Adaptive control is inhibited • Engine speed = 7000rpm • Accelerator = 0% • Engine torque = maximum • Gear position = 3rd gear • Kick-down = "OFF" • Brake switch = "ON" • Wheel speed = Output speed • Engine coolant temp. = 80°C	

SCHEMATIC DIAGRAM

Refer to **DTC U0001**.

MONITOR SCANTOOL DATA

Refer to **DTC U0001**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC U0001**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC U0001**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC U0001**.

DTC U0121 CAN COMMUNICATION MALFUNCTION (ECM/PCM - ABS)**COMPONENT LOCATION**

Refer to **DTC U0001**.

GENERAL DESCRIPTION

Refer to **DTC U0001**.

DTC DESCRIPTION

When the TCM cannot read the data from the ECU through the CAN-BUS line, the TCM sets this code.

CAN-BUS circuit malfunctioning or ECU can be a possible cause of this DTC.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause
DTC Strategy	Check the communication	- Short or Open in CAN communication circuit. - Faulty in ABS HECU
Enable Conditions	- TCU communication is normal with ABS HECU 10.2V < Battery voltage < 15.5V - No fail in system	
Threshold	TCU cannot receive ABS	

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2007 TRANSMISSION Automatic Transaxle (F21) - Veracruz

Value		Faulty in TCU
Diagnostic Time	More than 2 times x more than 0.25 sec	
Fail Safe	- Self learning control is inhibited. - Wheel speed = Output speed	

SCHEMATIC DIAGRAMRefer to **DTC U0001**.**MONITOR SCANTOOL DATA**Refer to **DTC U0001**.**TERMINAL AND CONNECTOR INSPECTION**Refer to **DTC U0001**.**SIGNAL CIRCUIT INSPECTION**Refer to **DTC U0001**.**VERIFICATION OF VEHICLE REPAIR**Refer to **DTC U0001**.**DTC U0122 CAN COMMUNICATION MALFUNCTION (ECM/PCM - ESP)****COMPONENT LOCATION**Refer to **DTC U0001**.**GENERAL DESCRIPTION**Refer to **DTC U0001**.**DTC DESCRIPTION**

When the TCM cannot read the data from the ECU through the CAN-BUS line, the TCM sets this code.

CAN-BUS circuit malfunctioning or ECU can be a possible cause of this DTC.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible cause

DTC Strategy	• Check the communication	
Enable Conditions	• TCU communication is normal with ESP HECU • 10.2V < Battery voltage < 15.5V • No fail in system	
Threshold Value	• TCU cannot receive ABS	
Diagnostic Time	• More than 2 times x more than 0.25 sec	
Fail Safe	• Self learning control is inhibited. • Wheel speed = Output speed	• Short or Open in CAN communication circuit. • Faulty in ESP HECU • Faulty in TCU

SCHEMATIC DIAGRAM

Refer to **DTC U0001**.

MONITOR SCANTOOL DATA

Refer to **DTC U0001**.

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC U0001**.

SIGNAL CIRCUIT INSPECTION

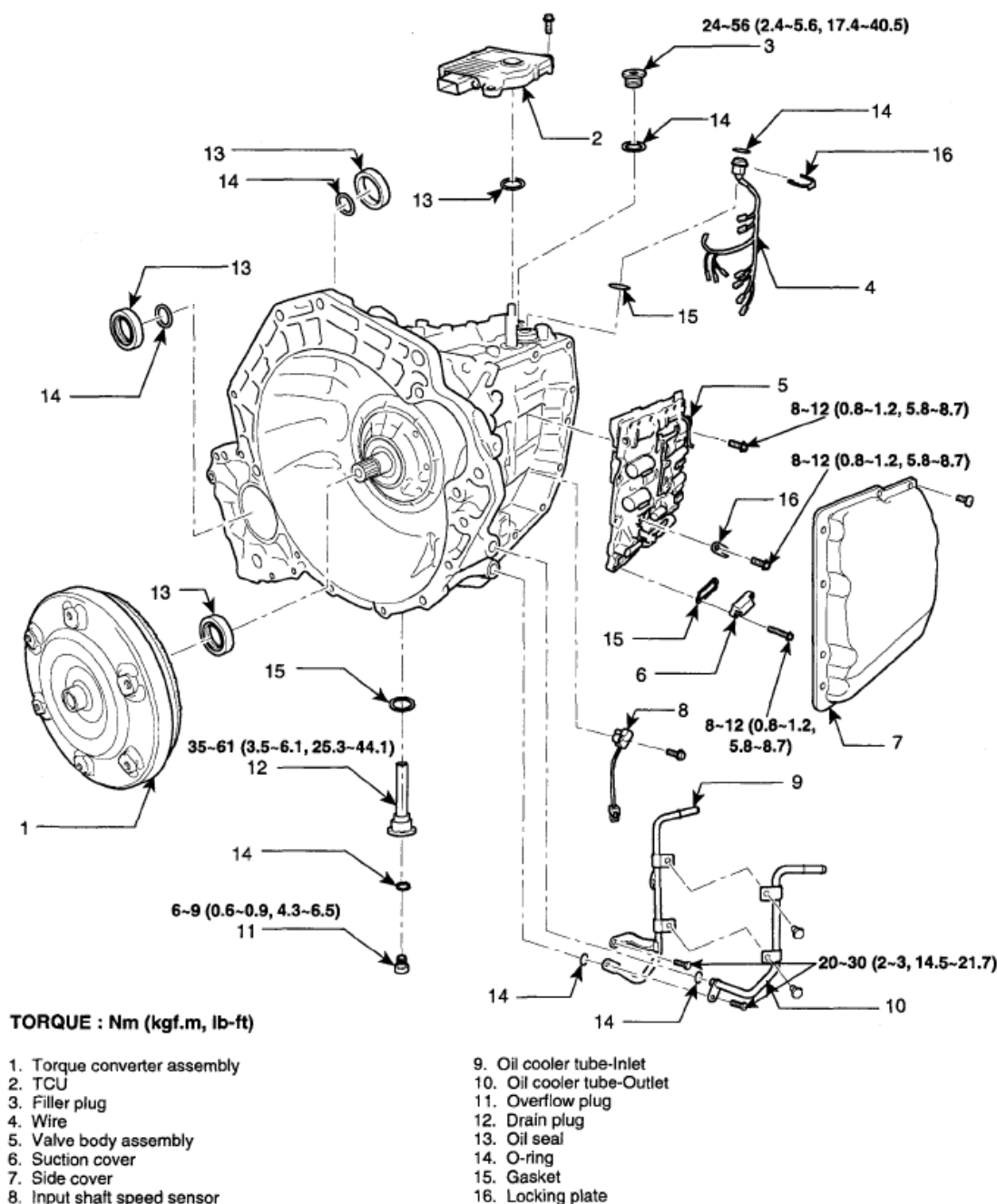
Refer to **DTC U0001**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC U0001**.

AUTOMATIC TRANSAXLE

COMPONENTS



SENAT7051L

Fig. 99: Exploded View Of Automatic Transaxle With Torque Specification
 Courtesy of HYUNDAI MOTOR CO.

REMOVAL

CAUTION: Please pay attention to the following when installing or removing A/T.

- Electronic parts

1. When replacing an electronic part, be sure to switch the ignition off and disconnect the battery from the negative (-) terminal before servicing the system.
2. When disconnecting a connector, pull out the connector after releasing a lock. [DO NOT PULL ON THE HARNESS.]
3. When connecting a connector, insert the connector until it is locked completely. (Make sure a click sound is made)
4. Do not jar electronic parts. If a part is dropped or shocked, replace it with a new one.

• Caution for handling ATF

1. Do not drain ATF while it is still hot. (Service the system after it cools down)
 2. Be sure to use JWS-3309 (T-IV) type ATF.
1. Remove the engine cover, (refer to **ENGINE AND TRANSAXLE ASSEMBLY**)
 2. Remove the battery after removing the three nuts (A,B,C) in order.

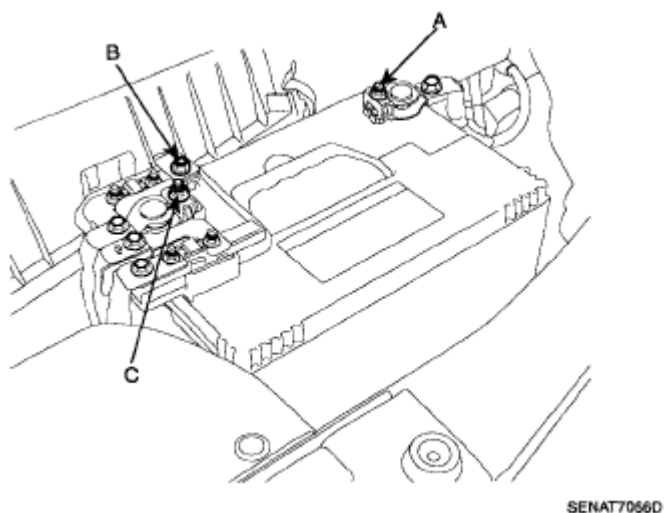


Fig. 100: Identifying Battery And Nuts
Courtesy of HYUNDAI MOTOR CO.

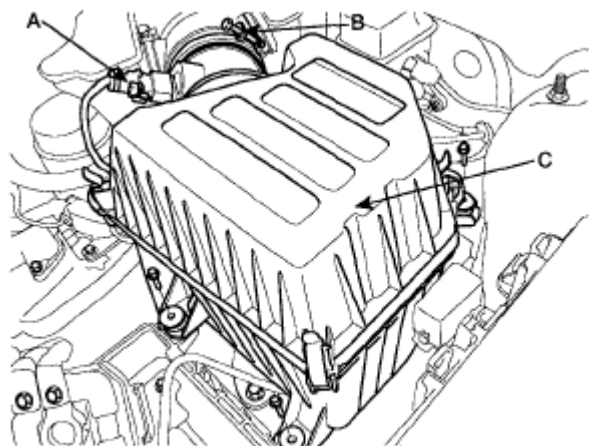
3. Remove the air duct (A).



SENAT7001L

Fig. 101: Identifying Air Duct
Courtesy of HYUNDAI MOTOR CO.

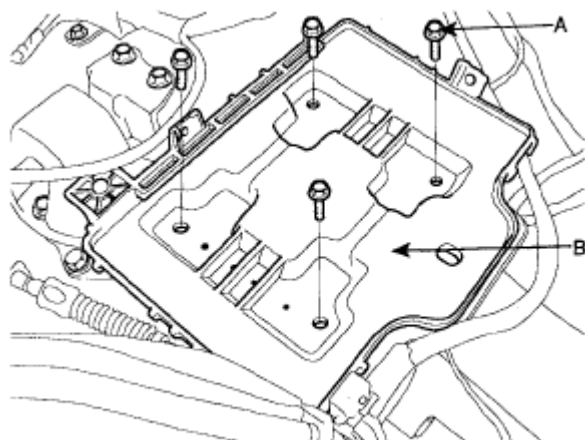
4. Remove the air cleaner assembly (C) by disconnecting the AFS (Air Flow Sensor) connector (A) and loosening the clamp (B).



SENAT7002L

Fig. 102: Identifying Air Cleaner Assembly And Clamp
Courtesy of HYUNDAI MOTOR CO.

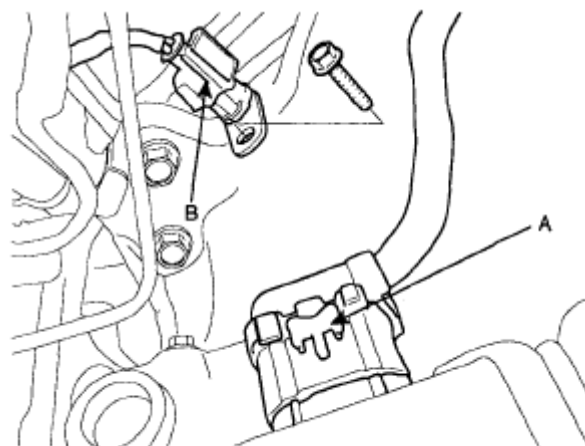
5. Remove the battery tray (B) by removing the four bolts (A).



SENAT7003L

Fig. 103: Identifying Battery Tray And Bolts
Courtesy of HYUNDAI MOTOR CO.

6. Disconnect the TCU connector (A) and remove the CKP sensor (B).



SENAT7006D

Fig. 104: Identifying TCU Connector And CKP Sensor
Courtesy of HYUNDAI MOTOR CO.

7. Remove the ground cable from transaxle (A).

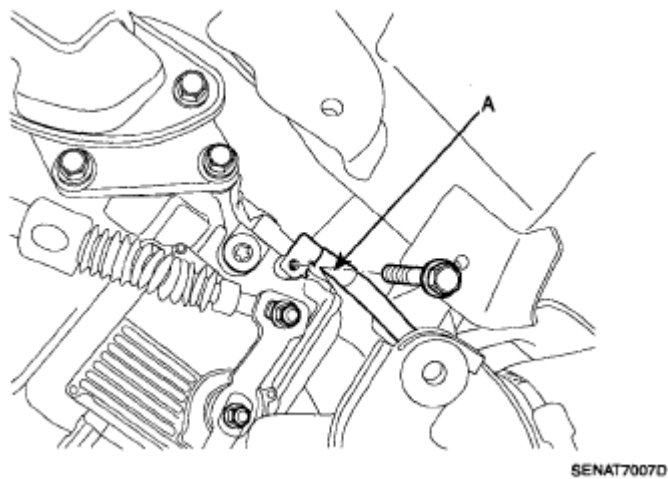


Fig. 105: Identifying Ground Cable From Transaxle
Courtesy of HYUNDAI MOTOR CO.

8. Remove the shift cable assembly (A).

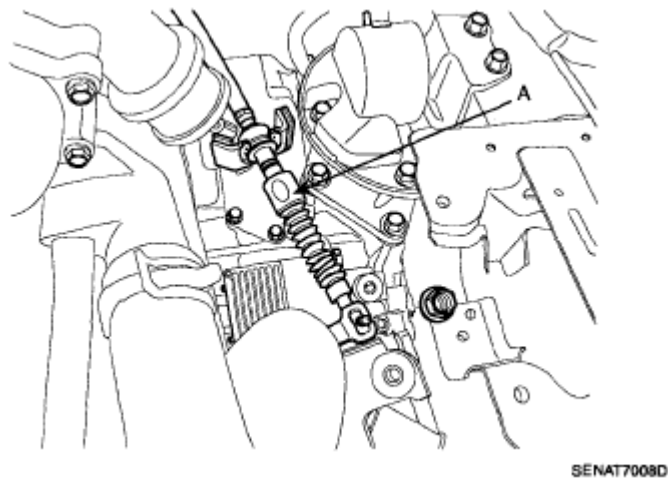


Fig. 106: Identifying Shift Cable Assembly
Courtesy of HYUNDAI MOTOR CO.

9. Install the special tools (09200-38001), the engine support fixture and the adapter on the engine assembly.

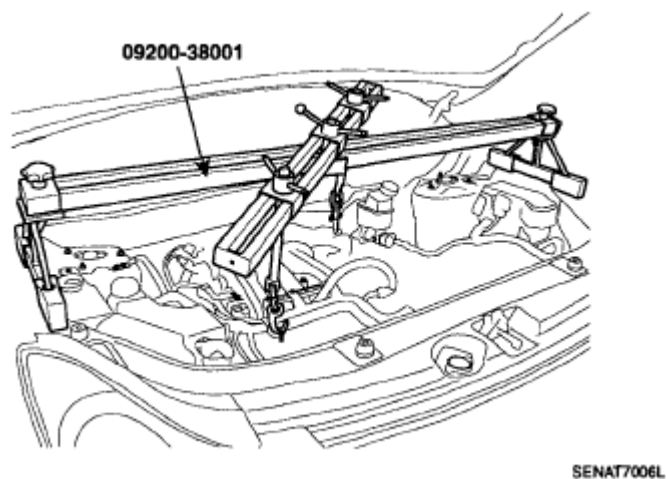


Fig. 107: Identifying Special Tools (09200-38001)
Courtesy of HYUNDAI MOTOR CO.

10. Remove the four transaxle upper mounting bolts (A) and the starter motor mounting bolt (B).

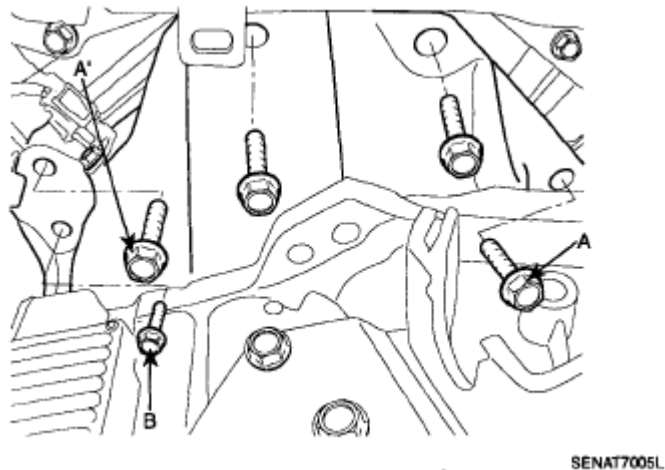
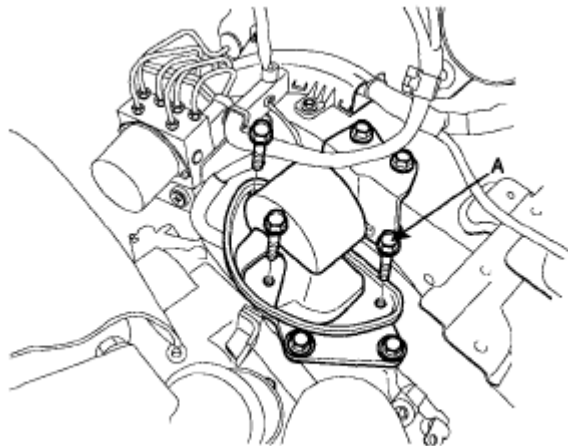


Fig. 108: Identifying Transaxle Upper Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

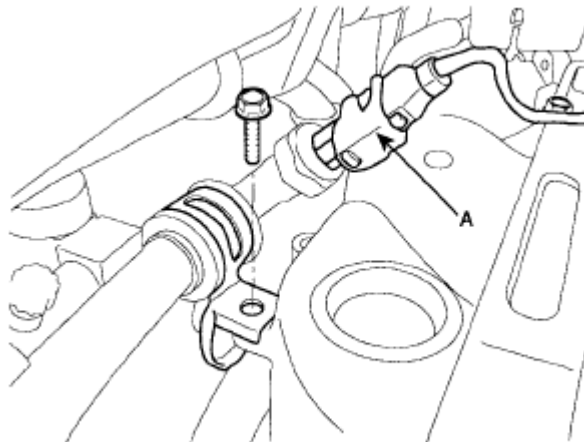
11. After removing the three bolts (A), take the transaxle support bracket off.



SENAT7011D

Fig. 109: Identifying Transaxle Support Bracket And Bolts
Courtesy of HYUNDAI MOTOR CO.

12. Disconnect the power steering pressure sensor (A).



SENAT7007L

Fig. 110: Identifying Power Steering Pressure Sensor
Courtesy of HYUNDAI MOTOR CO.

13. Remove the front wheels and tires, (refer to **DRIVE-SHAFT**)
14. Lift up the vehicle.
15. Remove the under shield cover (A).

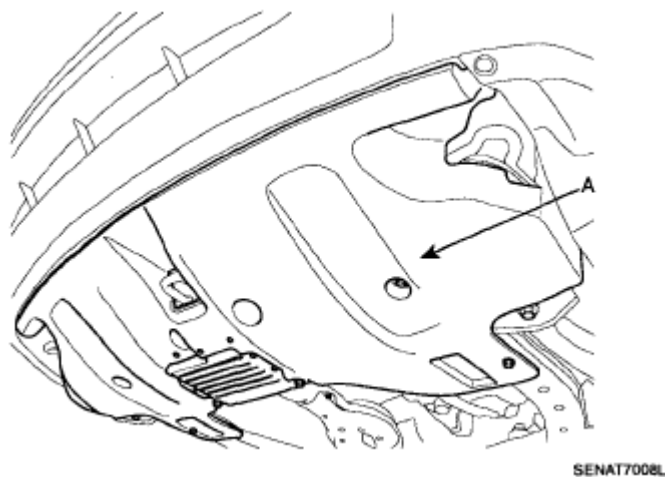


Fig. 111: Identifying Under Shield Cover
Courtesy of HYUNDAI MOTOR CO.

16. Remove the steering joint bolt (A).

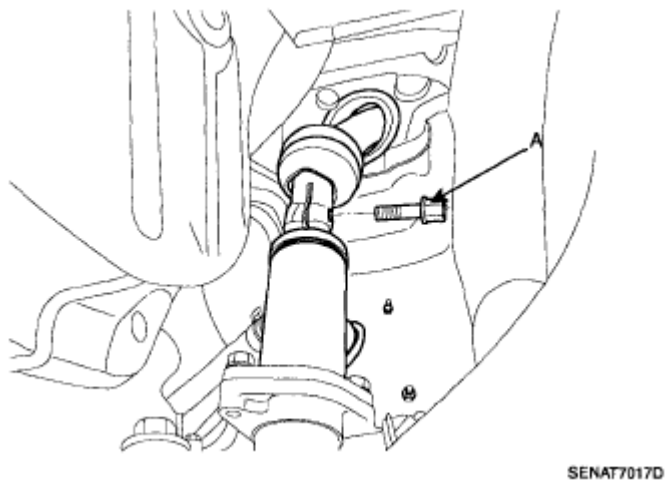
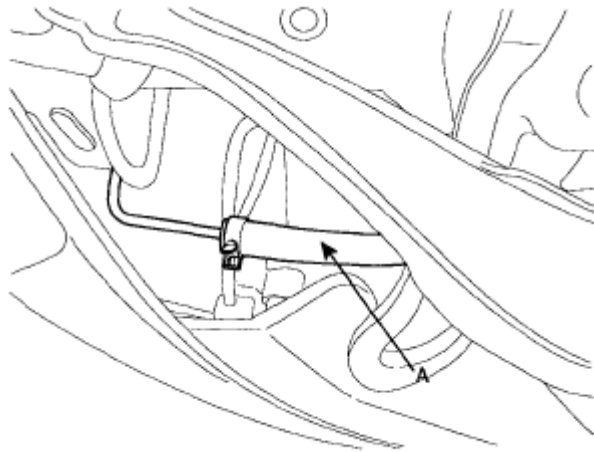


Fig. 112: Identifying Steering Joint Bolt
Courtesy of HYUNDAI MOTOR CO.

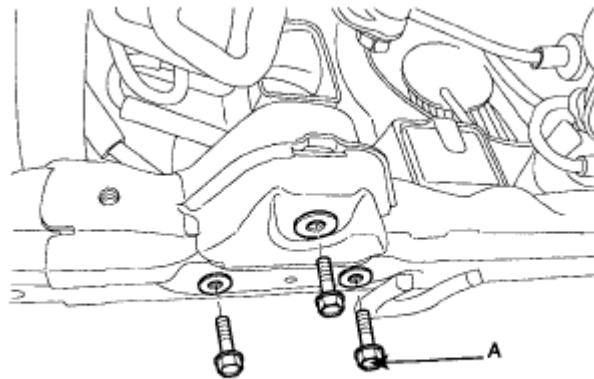
17. Drain the powersteering fluid through the return hose (A) by loosening the clamp.



SENAT7014D

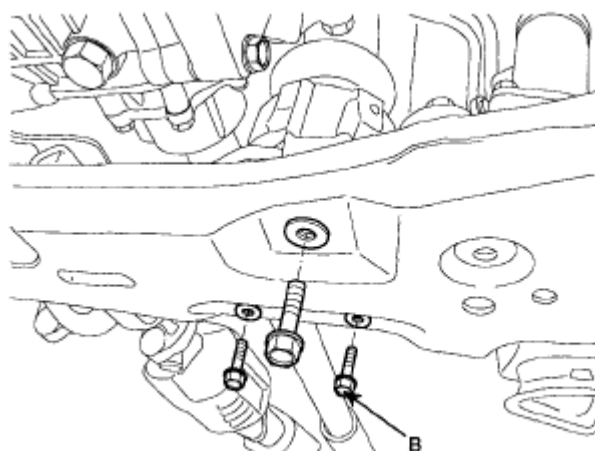
Fig. 113: Identifying Drain Powersteering Fluid Hose And Clamp
 Courtesy of HYUNDAI MOTOR CO.

18. Remove the lower arm ball joint mounting nut, the stabilizer link mounting nut, and the tie rod end mounting nut from the front knuckles, (refer to **FRONT SUSPENSION SYSTEM**)
19. Remove the roll stopper mounting bolts (A, B).



SENAT7015D

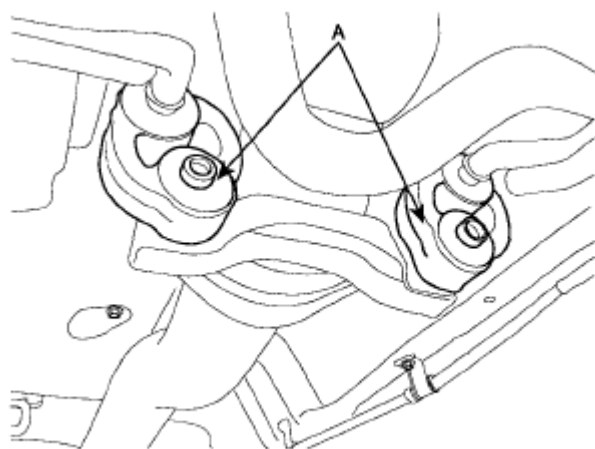
Fig. 114: Identifying Roll Stopper Mounting Bolts (1 Of 2)
 Courtesy of HYUNDAI MOTOR CO.



SENAT7016D

Fig. 115: Identifying Roll Stopper Mounting Bolts (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

20. Remove the muffler hanger rubber (A).



SENAT7009L

Fig. 116: Identifying Muffler Hanger Rubber
Courtesy of HYUNDAI MOTOR CO.

21. Supporting the sub frame with a jack and the Special tool (09624-38000), remove the mounting bolts.
(refer to **FRONT STABILIZER BAR** or **REAR STABILIZER BAR**)
22. Remove the powersteering pressure tube (A) from the powersteering oil pump by removing the l-type bolt.

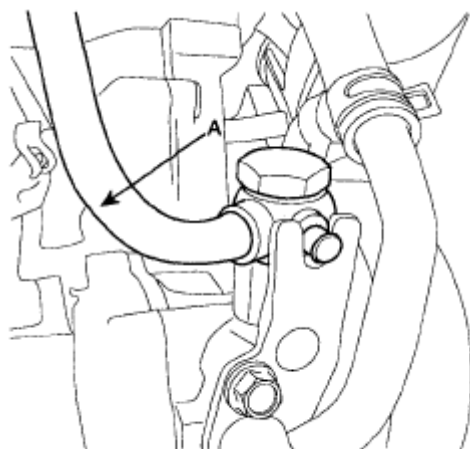


Fig. 117: Identifying Powersteering Pressure Tube And L-Type Bolt
Courtesy of HYUNDAI MOTOR CO.

23. Remove the subframe.
24. Remove the front muffler (A).

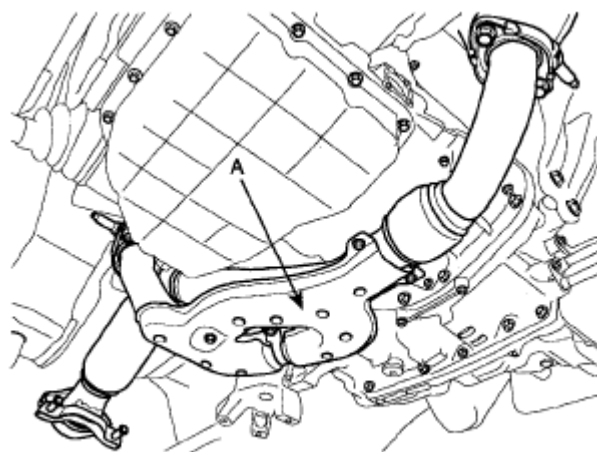
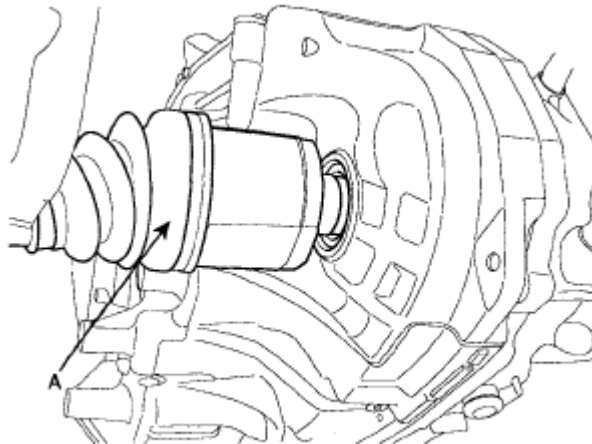


Fig. 118: Identifying Front Muffler
Courtesy of HYUNDAI MOTOR CO.

25. Disconnect the left driveshaft (A) from the transaxle.

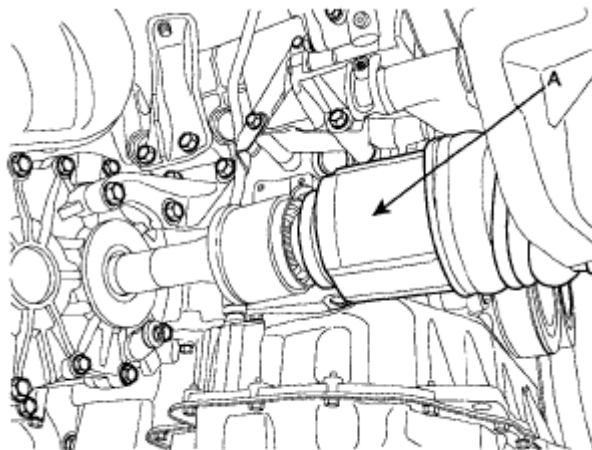


SENAT7019D

Fig. 119: Identifying Left Driveshaft To Transaxle
Courtesy of HYUNDAI MOTOR CO.

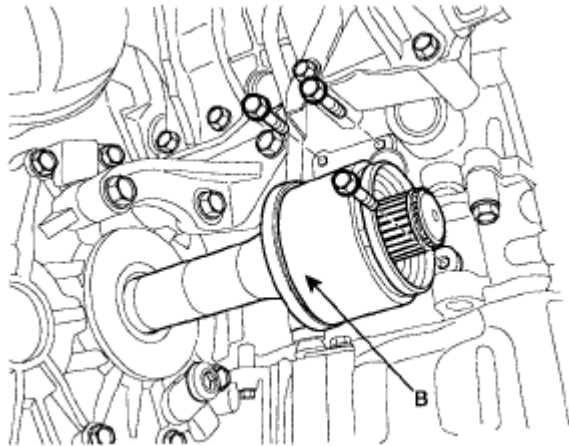
26. Disconnect the right driveshaft (A) from the inner shaft and remove the inner shaft (B) by removing the three mounting bolts.

NOTE: In case of 2WD, remove the inner shaft and the right driveshaft as an assembly after removing the inner shaft bracket bolt.



SENAT7020D

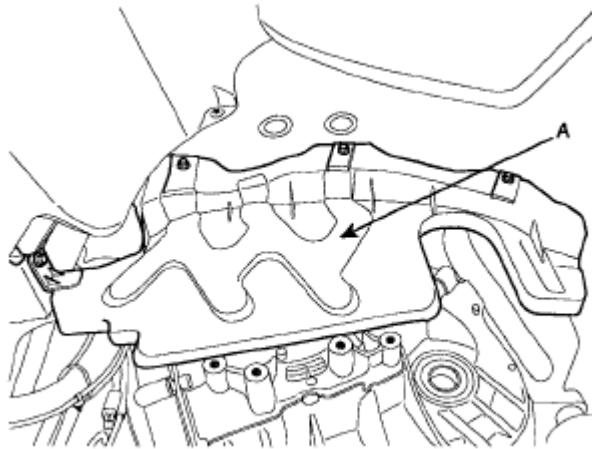
Fig. 120: Identifying Right Driveshaft From Inner Shaft And Mounting Bolts (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



SENAT7021D

Fig. 121: Identifying Right Driveshaft From Inner Shaft And Mounting Bolts (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

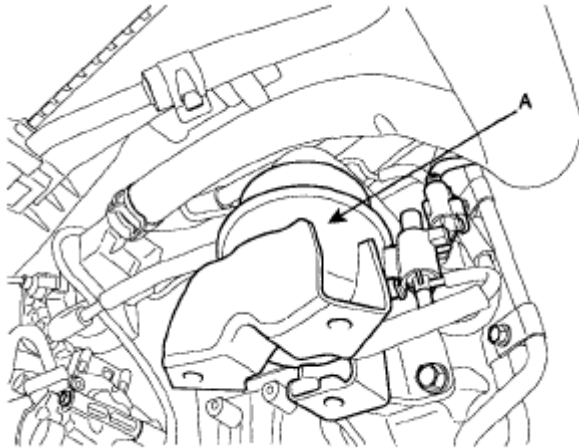
27. In case of 4WD, remove the transfer case assembly, (refer to TRANSFER CASE'S REMOVAL)
28. Remove the side mud cover (A).



SENAT7022D

Fig. 122: Identifying Side Mud Cover
Courtesy of HYUNDAI MOTOR CO.

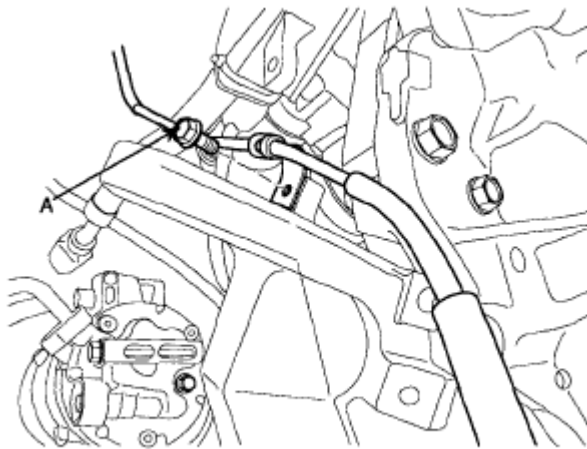
29. After disconnecting the vacuum tube and the connector, remove the front roll mounting bracket assembly (A).



SENAT7024D

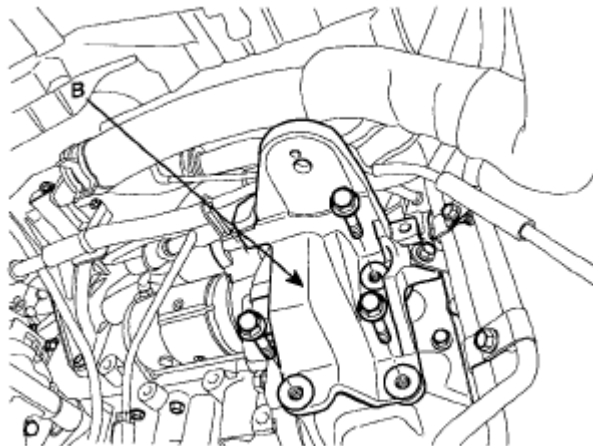
Fig. 123: Identifying Front Roll Mounting Bracket Assembly
Courtesy of HYUNDAI MOTOR CO.

30. After removing the vacuum tube mounting bolt (A), remove the front mounting bracket (B) by removing the three bolts.



SENAT7027D

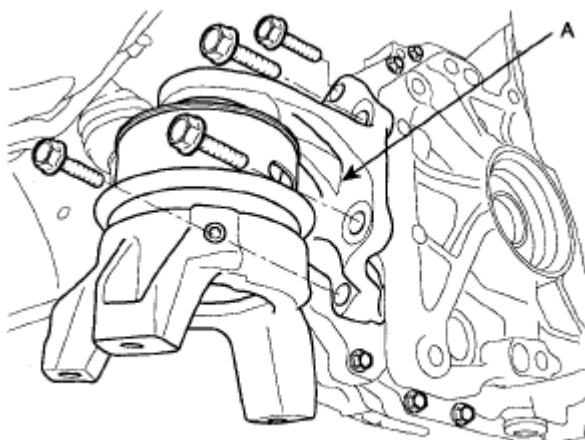
Fig. 124: Identifying Vacuum Tube Mounting Bolt
Courtesy of HYUNDAI MOTOR CO.



SENAT7025D

Fig. 125: Identifying Front Mounting Bracket Bolts
Courtesy of HYUNDAI MOTOR CO.

31. Remove the rear roll mounting bracket assembly (A) by removing the four bolts.



SENAT7015L

Fig. 126: Identifying Rear Roll Mounting Bracket Assembly
Courtesy of HYUNDAI MOTOR CO.

32. Remove the transaxle oil cooler hose (A).

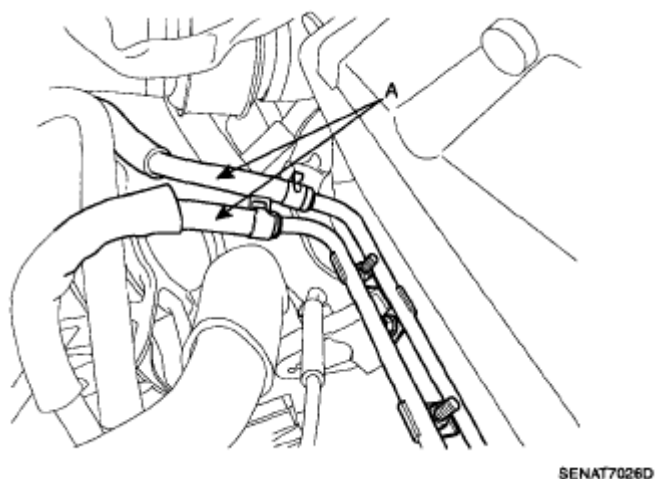


Fig. 127: Identifying Transaxle Oil Cooler Hose
Courtesy of HYUNDAI MOTOR CO.

33. Remove the transaxle mounting bolt near the drive-shaft hole from engine side.
34. Remove the dust cover (A).

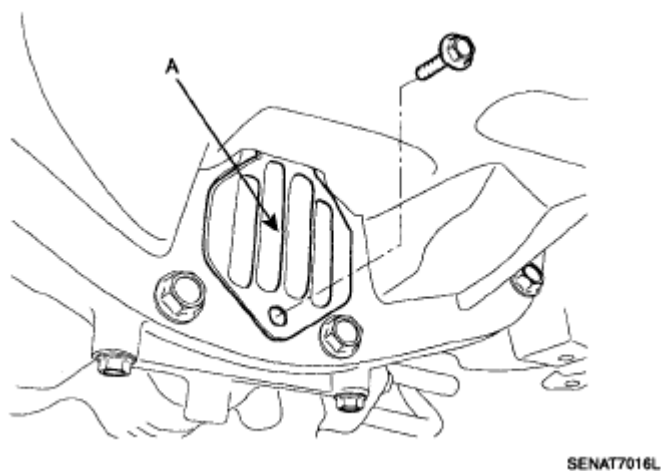
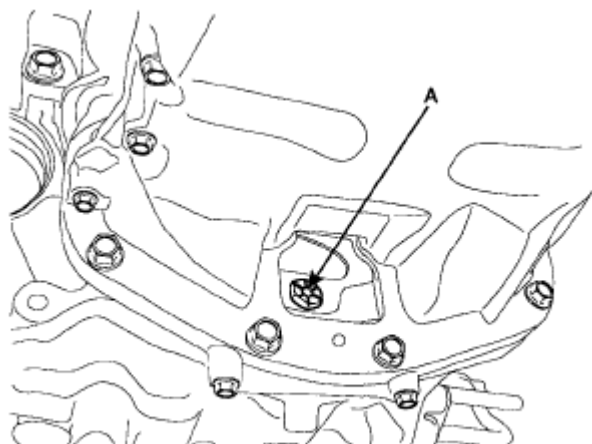


Fig. 128: Identifying Dust Cover
Courtesy of HYUNDAI MOTOR CO.

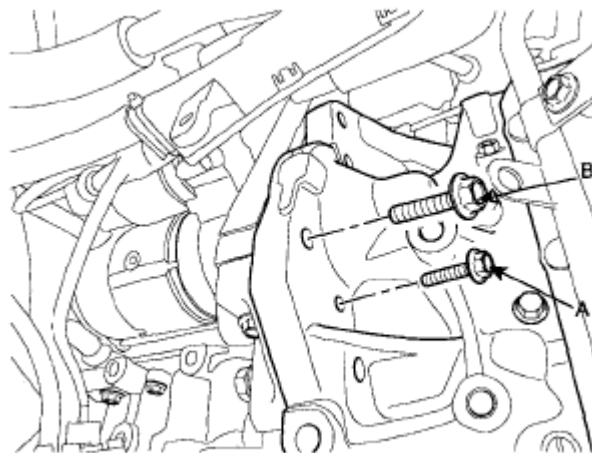
35. Remove the six drive plate mounting bolts (A) by rotating the timing gear.



SENAT7017L

Fig. 129: Identifying Drive Plate Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

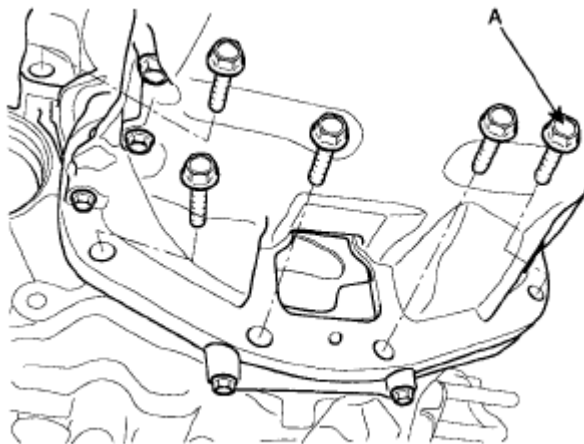
36. Remove the starter motor mounting bolt (A) and the transaxle mounting bolt (B).



SENAT7035D

Fig. 130: Identifying Starter Motor Mounting Bolt
Courtesy of HYUNDAI MOTOR CO.

37. Supporting the transaxle with a jack, remove the five transaxle lower mounting bolts (A).



SENAT7018L

Fig. 131: Identifying Five Transaxle Lower Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

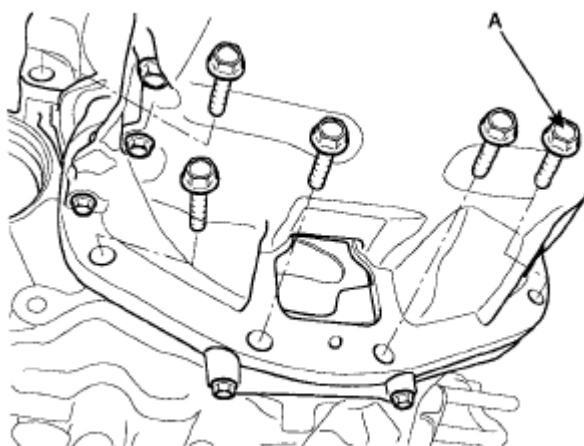
38. Lowering the jack slowly, remove the transaxle assembly.

CAUTION: When removing the transaxle assembly, be careful not to damage any surrounding parts or body components.

INSTALLATION

1. After fitting the transaxle assembly into the engine assembly by using a jack, install the five transaxle lower mounting bolts (A).

TORQUE: 40-47 Nm (4.0-4.7 kgf.m, 28.9-34.0 lb-ft)



SENAT7018L

Fig. 132: Identifying Five Transaxle Lower Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

2. Install the starter motor mounting bolt (A) and the transaxle mounting bolt (B).

TORQUE:

[A] : 33-50 Nm (3.3-5.0 kgf.m, 23.9-36.1 lb-ft)

[B]: 80-100 Nm (8-10 kgf.m, 57.9-72.3 lb-ft)

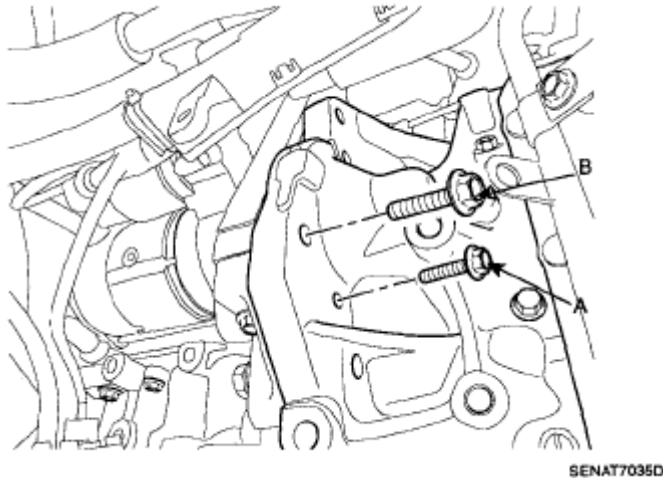


Fig. 133: Identifying Starter Motor Mounting Bolt
Courtesy of HYUNDAI MOTOR CO.

3. Install the six drive plate mounting bolts (A) by rotating the timing gear.

TORQUE: 46-53 Nm (4.6-5.3 kgf.m, 33.3-38.3 lb-ft)

CAUTION: Be sure to tighten the bolts with the specified torque.

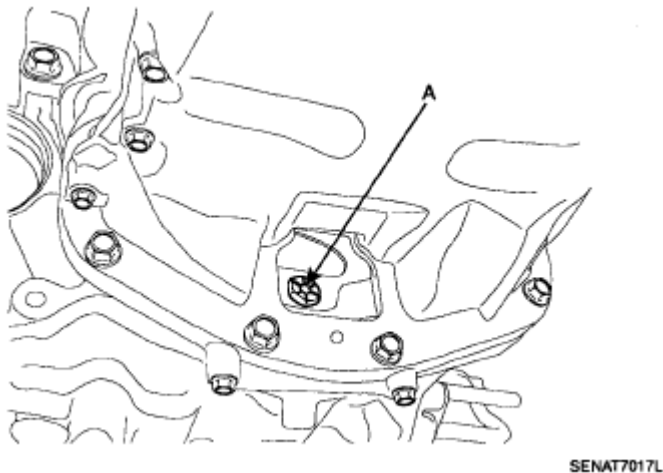


Fig. 134: Identifying Drive Plate Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Install the dust cover (A).

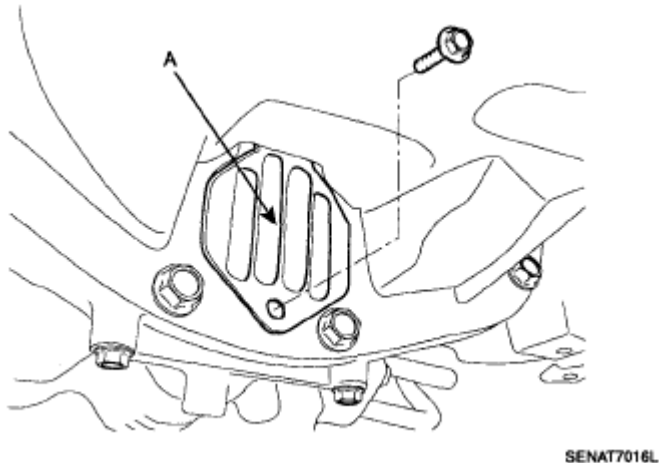


Fig. 135: Identifying Dust Cover
Courtesy of HYUNDAI MOTOR CO.

5. Install the transaxle mounting bolt near the driveshaft hole from engine side.

TORQUE : 80-100 Nm (8-10 kgf.m, 57.9-72.3 lb-ft)

6. Install the side mud cover (A).

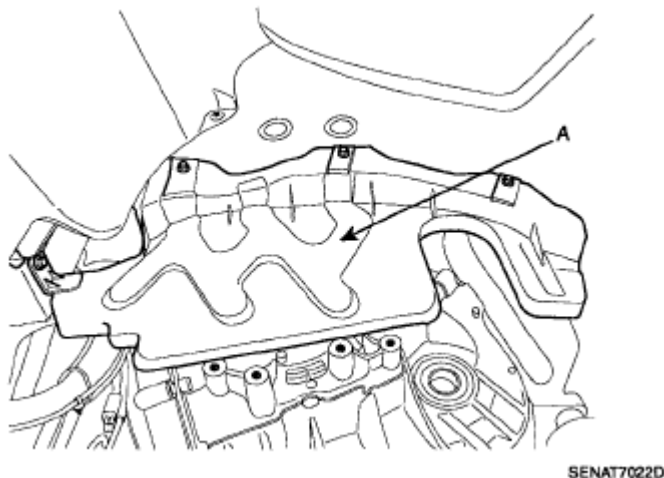
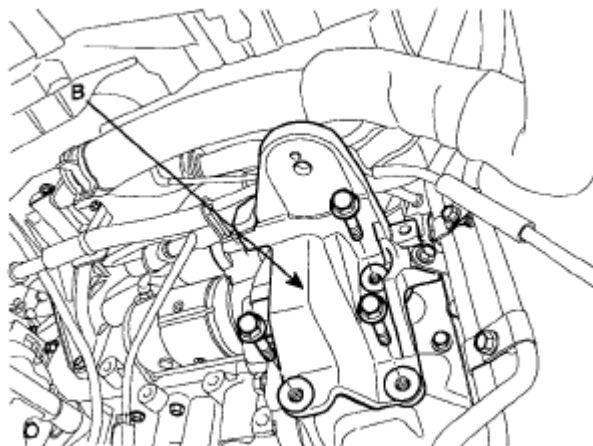


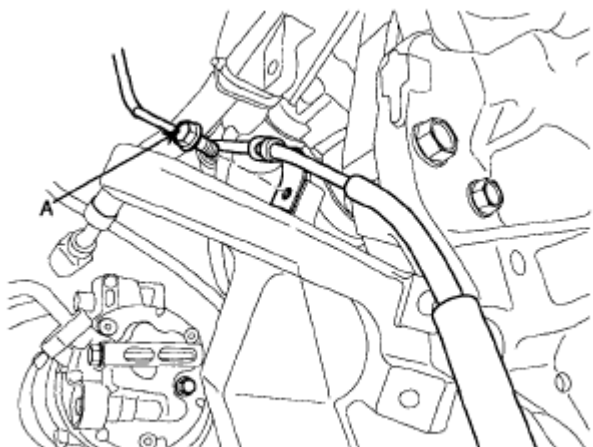
Fig. 136: Identifying Side Mud Cover
Courtesy of HYUNDAI MOTOR CO.

7. After installing the front mounting bracket (B) by removing the three bolts, install the vacuum tube mounting bolt (A).



SENAT7025D

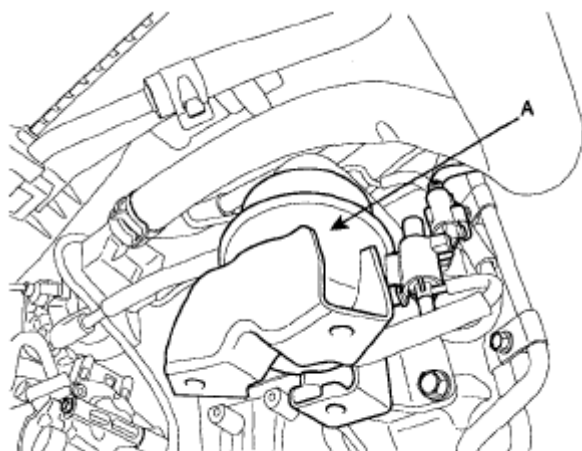
Fig. 137: Identifying Front Mounting Bracket Bolts
Courtesy of HYUNDAI MOTOR CO.



SENAT7027D

Fig. 138: Identifying Vacuum Tube Mounting Bolt
Courtesy of HYUNDAI MOTOR CO.

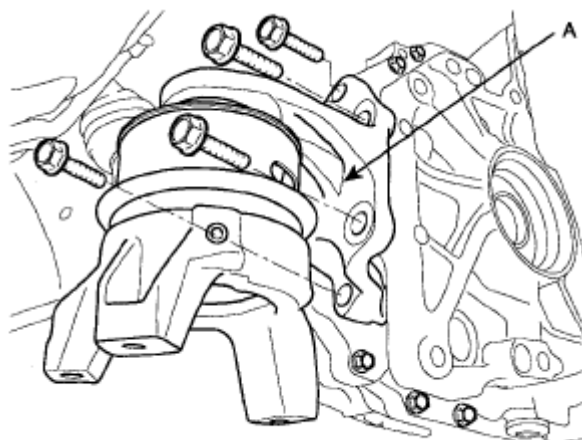
8. After installing the front roll mounting bracket assembly (A), connect the vacuum tube and the connector.



SENAT7024D

Fig. 139: Identifying Front Roll Mounting Bracket Assembly
Courtesy of HYUNDAI MOTOR CO.

9. Install the rear roll mounting bracket assembly (A) by installing the four bolts.



SENAT7015L

Fig. 140: Identifying Rear Roll Mounting Bracket Assembly
Courtesy of HYUNDAI MOTOR CO.

10. Install the transaxle oil cooler hose (A).

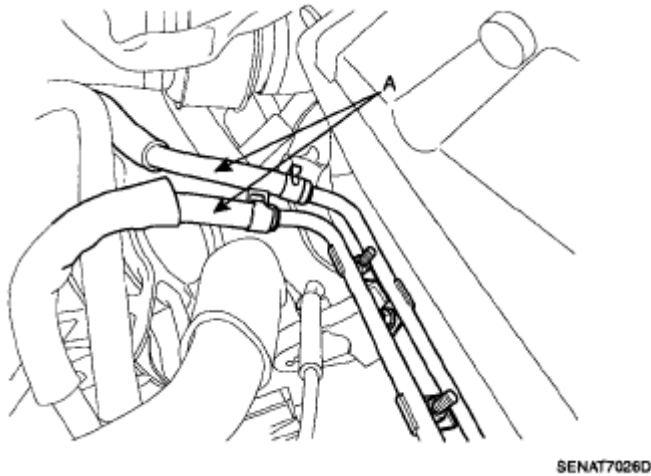


Fig. 141: Identifying Transaxle Oil Cooler Hose
Courtesy of HYUNDAI MOTOR CO.

11. In case of 4WD, install the transfer case assembly, (refer to **TRANSFER CASE'S INSTALLATION**)
12. Connect the left driveshaft (A) to the transaxle.

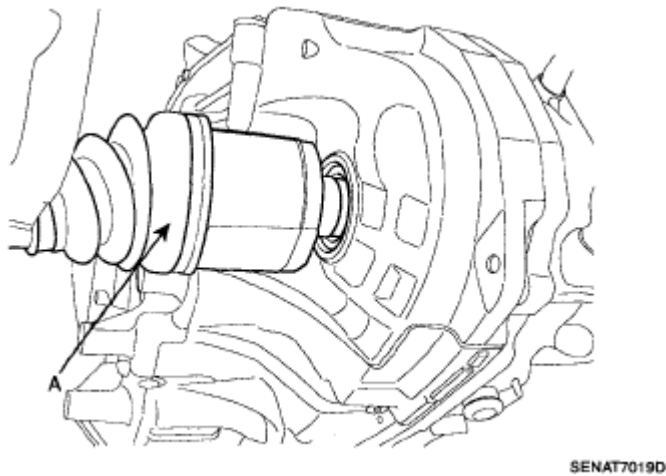
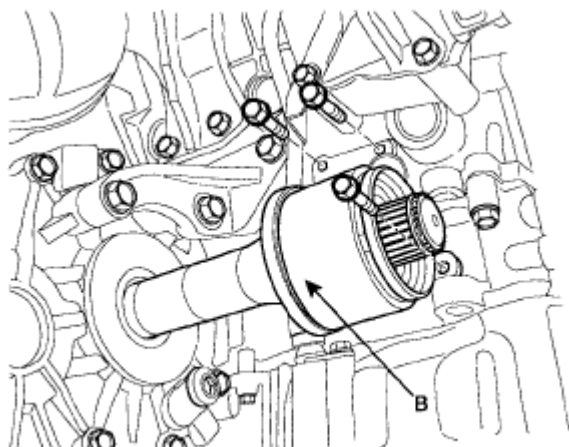


Fig. 142: Identifying Left Driveshaft To Transaxle
Courtesy of HYUNDAI MOTOR CO.

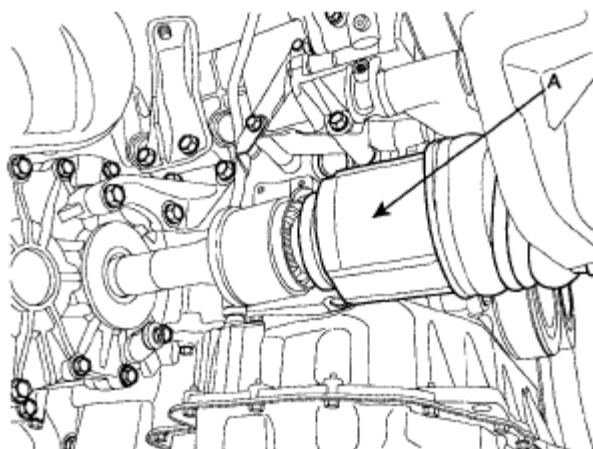
13. Install the inner shaft (B) by installing the three mounting bolts and connect the right driveshaft (A) into the inner shaft.

NOTE: In case of 2WD, install the inner shaft and the right driveshaft as an assembly.



SENAT7021D

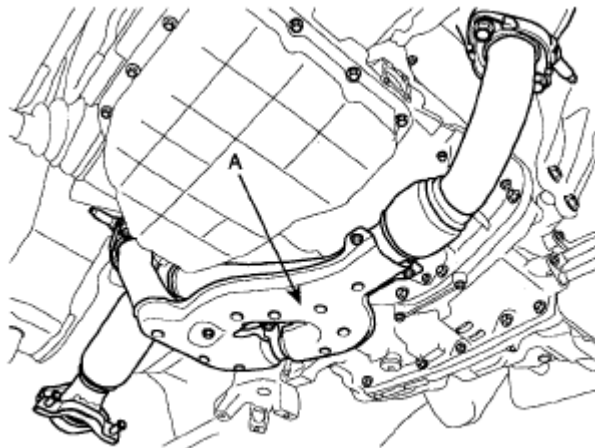
Fig. 143: Identifying Right Driveshaft From Inner Shaft And Mounting Bolts (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



SENAT7020D

Fig. 144: Identifying Right Driveshaft From Inner Shaft And Mounting Bolts (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

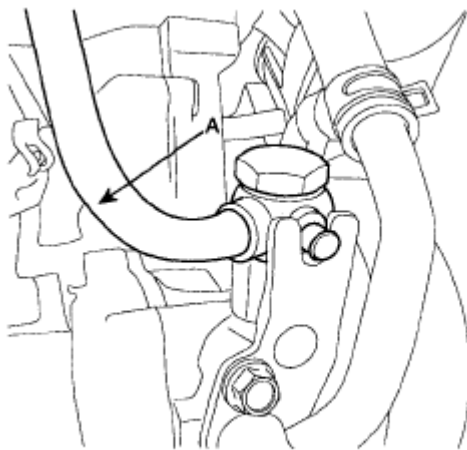
14. Install the front muffler (A).



SENAT7011L

Fig. 145: Identifying Front Muffler
Courtesy of HYUNDAI MOTOR CO.

15. Support the subframe with a jack and the Special tool (09624-38000).
16. Install the powersteering pressure tube (A) to the powersteering oil pump by installing the l-type bolt.

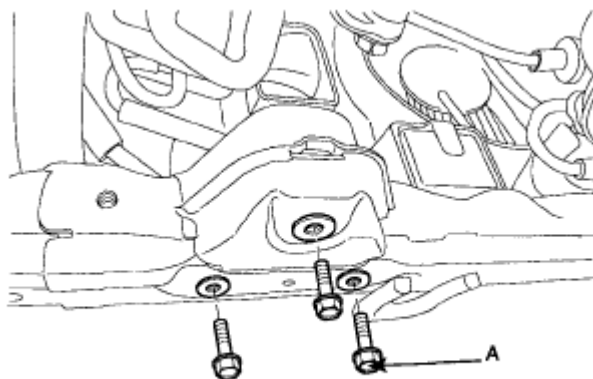


SENAT7010L

Fig. 146: Identifying Powersteering Pressure Tube And L-Type Bolt
Courtesy of HYUNDAI MOTOR CO.

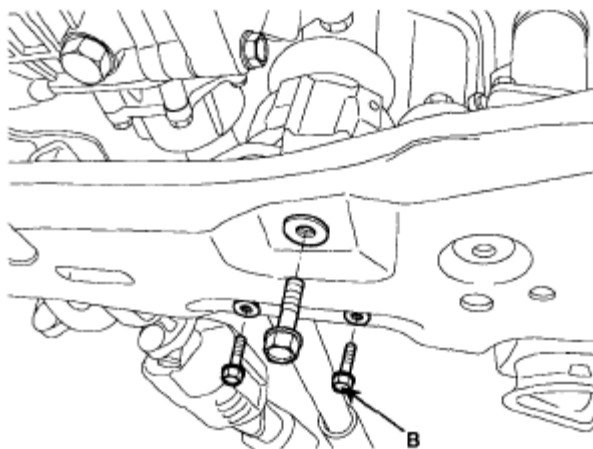
17. Install the mounting bolts. (refer to **FRONT STABILIZER BAR** or **REAR STABILIZER BAR**)
18. Remove the roll stopper mounting bolts (A, B).

TORQUE : 90-110 Nm (9-11 kgf.m, 65.1-79.5 lb-ft)



SENAT7015D

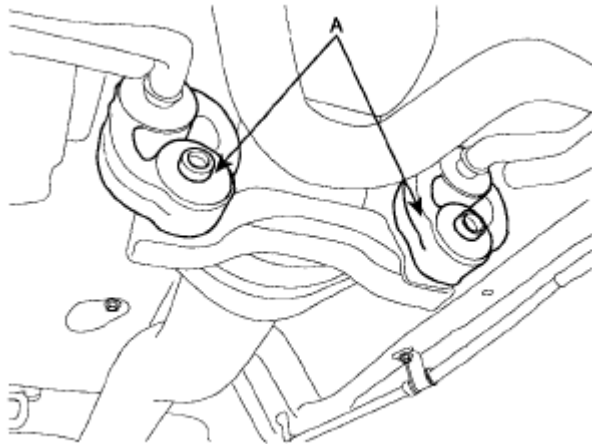
Fig. 147: Identifying Roll Stopper Mounting Bolts (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



SENAT7016D

Fig. 148: Identifying Roll Stopper Mounting Bolts (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

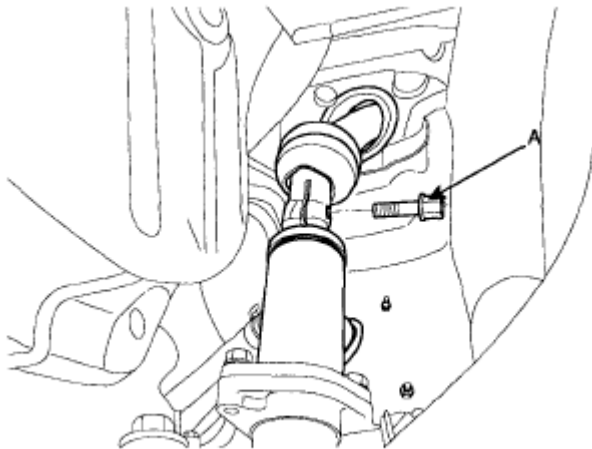
19. Remove the muffler hanger rubber (A).



SENAT7009L

Fig. 149: Identifying Muffler Hanger Rubber
Courtesy of HYUNDAI MOTOR CO.

20. Remove the lower arm ball joint mounting nut, the stabilizer link mounting nut, and the tie rod end mounting nut from the front knuckles, (refer to **FRONT SUSPENSION SYSTEM**)
21. Install the steering joint bolt (A).



SENAT7017D

Fig. 150: Identifying Steering Joint Bolt
Courtesy of HYUNDAI MOTOR CO.

22. Connect the return hose (A) to the tube by tightening the clamp.

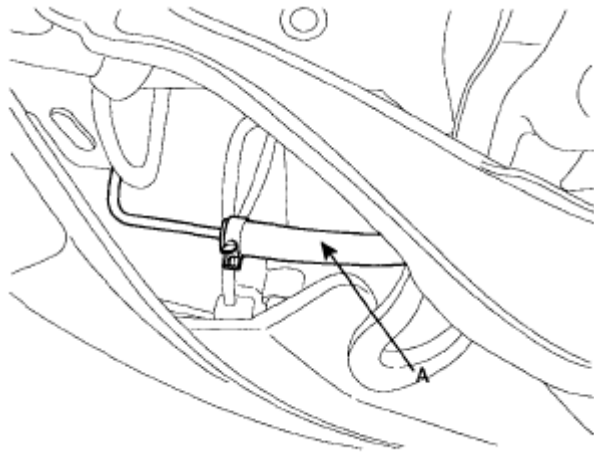


Fig. 151: Identifying Drain Powersteering Fluid Hose And Clamp
Courtesy of HYUNDAI MOTOR CO.

23. Install the under shield cover (A).

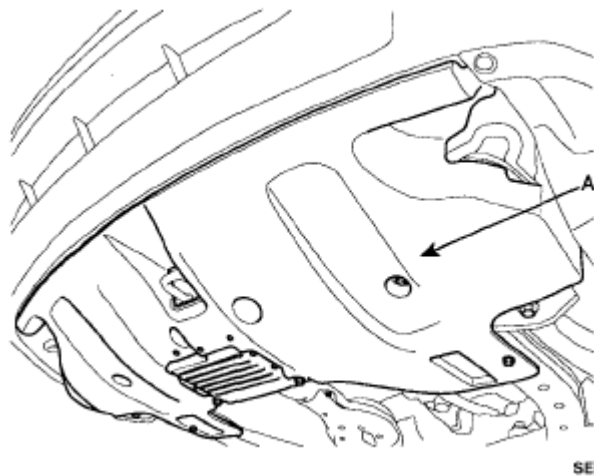


Fig. 152: Identifying Under Shield Cover
Courtesy of HYUNDAI MOTOR CO.

24. Lower the vehicle.
25. Install the front wheels and tires, (refer to **DRIVESHAFT**)
26. Connect the power steering pressure sensor (A).

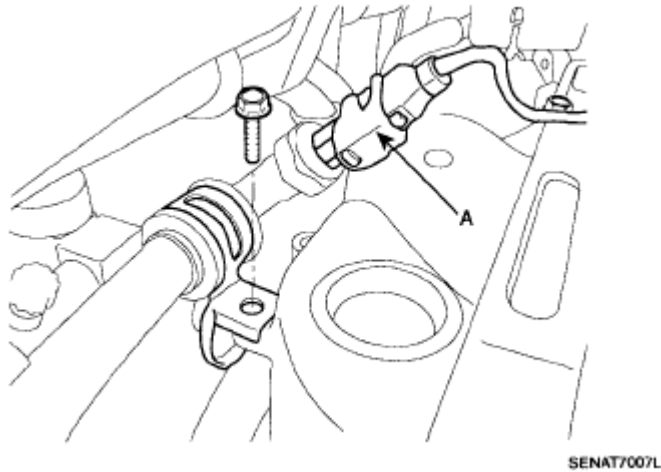


Fig. 153: Identifying Power Steering Pressure Sensor
 Courtesy of HYUNDAI MOTOR CO.

27. Install the transaxle support bracket bolts (A).

TORQUE : 90-110 Nm (9-11 kgf.m, 65.1-79.5 lb-ft)

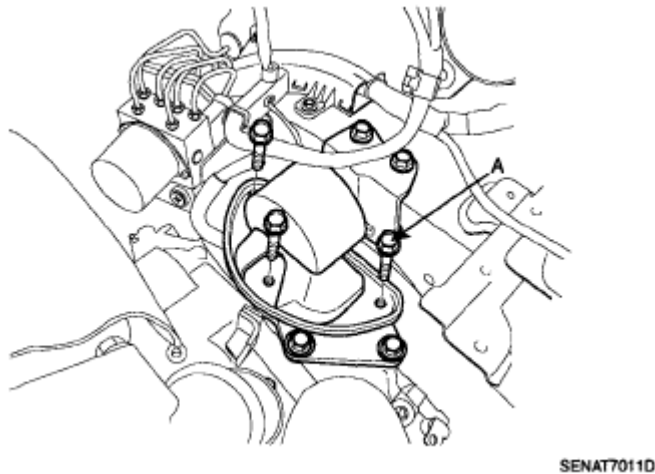


Fig. 154: Identifying Transaxle Support Bracket And Bolts
 Courtesy of HYUNDAI MOTOR CO.

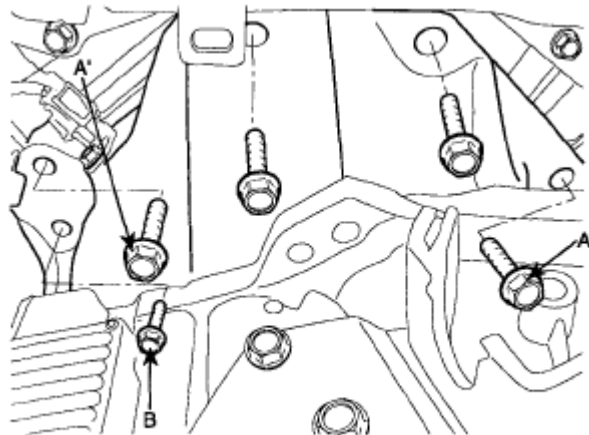
28. Install the four transaxle upper mounting bolts (A) and the starter motor mounting bolt (B).

TORQUE:

[A]: 65-85 Nm (6.5-8.5 kgf.m, 47.0-61.5 lb-ft)

[A']: 43-55 Nm (4.3-5.5 kgf.m, 31.1-39.8 lb-ft)

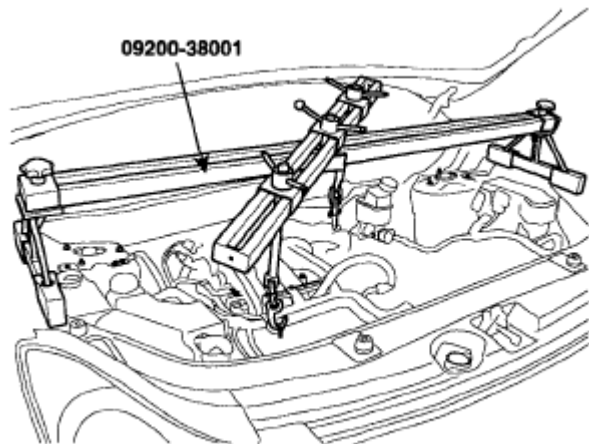
[B]: 43-55 Nm (4.3-5.5 kgf.m, 31.1-39.8 lb-ft)



SENAT7005L

Fig. 155: Identifying Transaxle Upper Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

29. Remove the special tool (09200-38001).



SENAT7006L

Fig. 156: Identifying Special Tools (09200-38001)
Courtesy of HYUNDAI MOTOR CO.

30. Install the shift cable assembly (A).

TORQUE : 8-12 Nm (0.8-1.2 kgf.m, 5.8-8.7 lb-ft)

NOTE: Adjust the shift cable referring to ADJUSTING THE SHIFT CABLE.

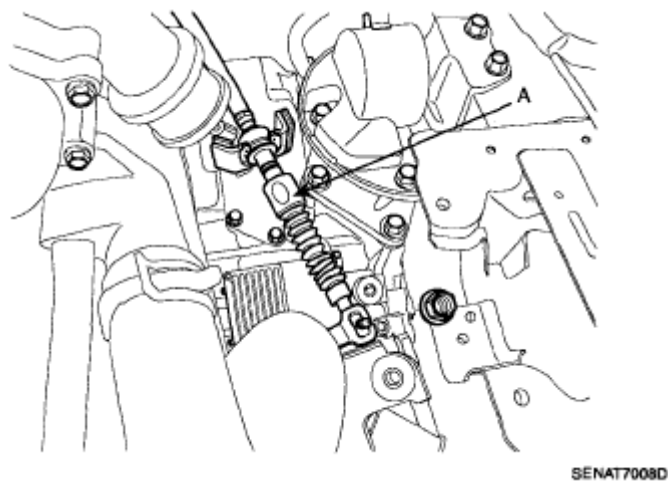


Fig. 157: Identifying Shift Cable Assembly
Courtesy of HYUNDAI MOTOR CO.

31. Install the ground cable (A) to transaxle.

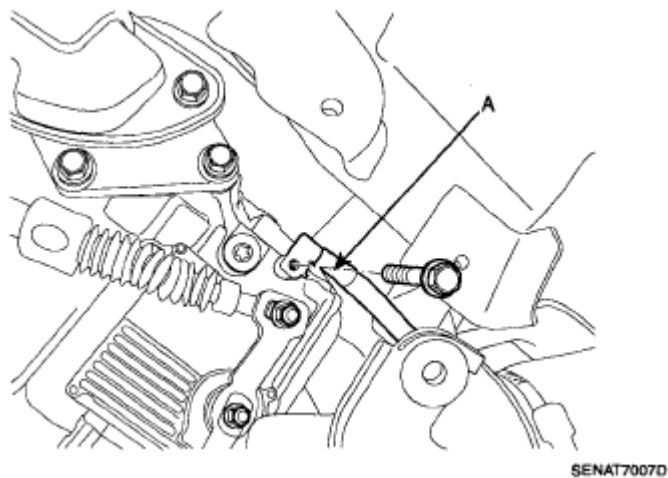


Fig. 158: Identifying Ground Cable From Transaxle
Courtesy of HYUNDAI MOTOR CO.

32. Connect the TCU connector (A) and install the CKP sensor (B).

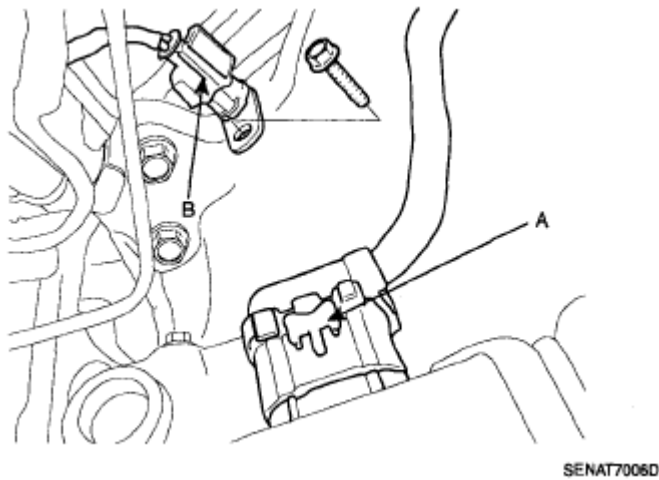


Fig. 159: Identifying TCU Connector And CKP Sensor
Courtesy of HYUNDAI MOTOR CO.

33. Install the battery tray (B) by installing the four bolts (A).

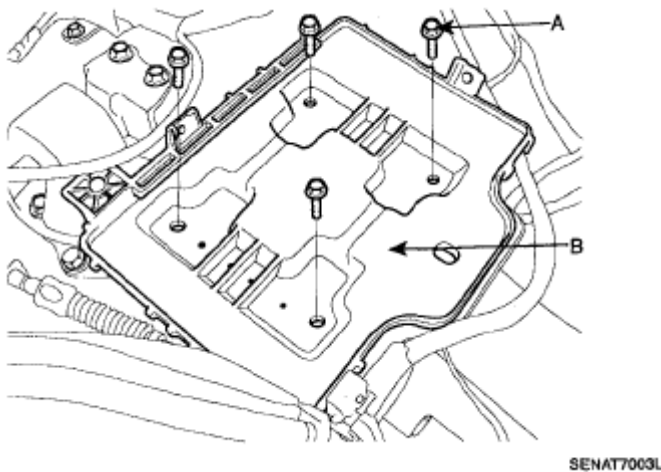
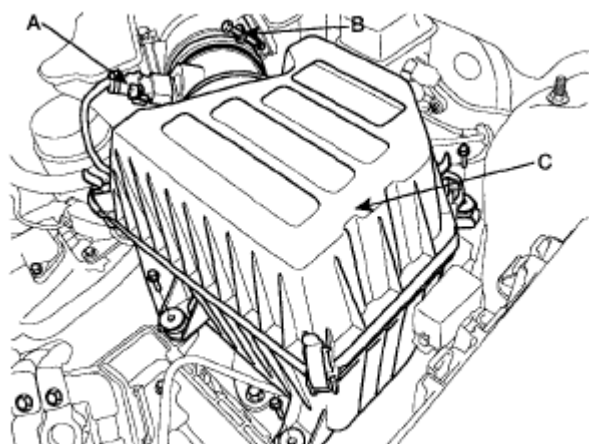


Fig. 160: Identifying Battery Tray And Bolts
Courtesy of HYUNDAI MOTOR CO.

34. Installing the air cleaner assembly (C) by connecting the AFS (Air Flow Sensor) connector (A) and tightening the clamp (B).



SENAT7002L

Fig. 161: Identifying Air Cleaner Assembly And Clamp
Courtesy of HYUNDAI MOTOR CO.

35. Install the air duct (A).



SENAT7001L

Fig. 162: Identifying Air Duct
Courtesy of HYUNDAI MOTOR CO.

36. Install the battery after installing the three nuts (A, B, C) in order.

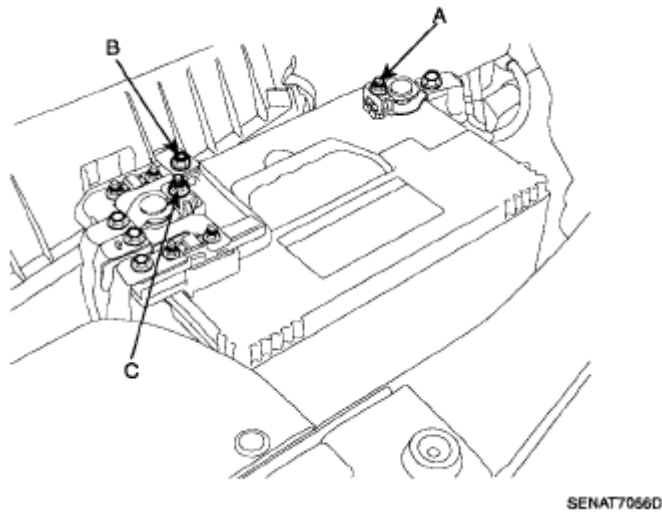


Fig. 163: Identifying Battery And Nuts
Courtesy of HYUNDAI MOTOR CO.

37. Install the engine cover. (refer to ENGINE AND TRANSAXLE ASSEMBLY)
38. Refill the automatic transaxle fluid, (refer to INSPECTION AND ADJUSTMENT)
39. Refill the powersteering fluid, (refer to POWER STEERING GEAR BOX)
40. When replacing the automatic transaxle assembly, after initializing the TCU, perform N position learning and initial learning, (refer to 'HOW TO PERFORM N POSITION LEARNING' and 'HOW TO PERFORM INITIAL LEARNING'))

AUTOMATIC TRANSAXLE CONTROL SYSTEM

SPECIFICATION OF BOLTS

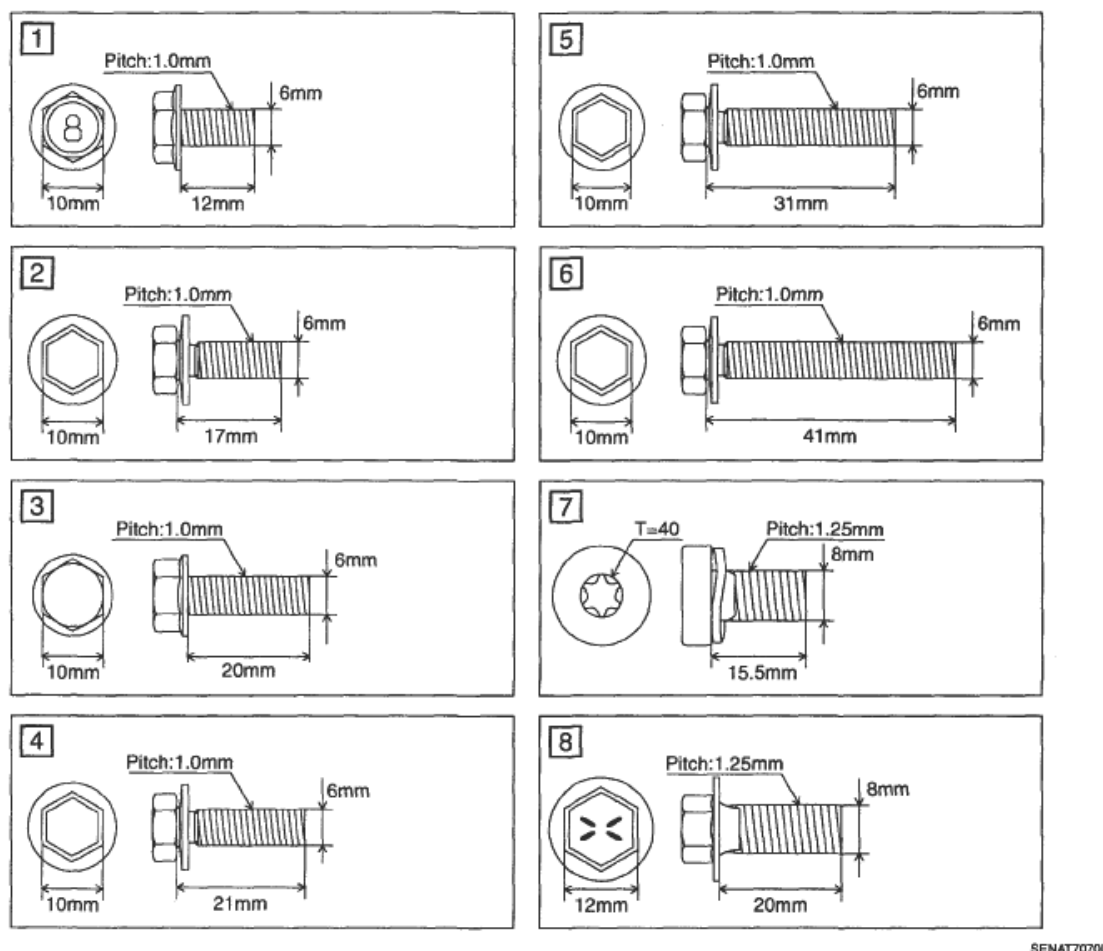


Fig. 164: Identifying Bolts Length
Courtesy of HYUNDAI MOTOR CO.

VISUAL IDENTIFICATION

Please pay attention to the following when installing or removing transaxle.

- Handling with care for electronic parts

1. When replacing an electronic part, be sure to switch the ignition off and disconnect the battery from the negative (-) terminal before servicing the system.
2. Do not jar electronic parts. If a part is dropped or shocked, replace it with a new one.

- Prevention of foreign substances

1. Be sure to remove dust, sand, etc. thoroughly from A/T when removing an associated part from it.
2. Protect the removed part from dust by covering it with a plastic bag, etc.
3. Perform the service procedures using plastic gloves, and do not use work gloves or a rag.

- Prevention of part damage

1. When separating an attached surface of the case, etc., tap with a plastic hammer to take the parts apart.
[DO NOT PRY PARTS OFF WITH A SCREWDRIVER, ETC.]
2. Do not pull out the valve, etc. with excessive force.

- Cleaning of parts

1. All parts have to be thoroughly cleaned, dried by blown air and coated with the specified oil.
2. Do not clean aluminum parts and rubber parts with alkaline chemicals.
3. Do not clean rubber parts with washing oil (white gasoline).

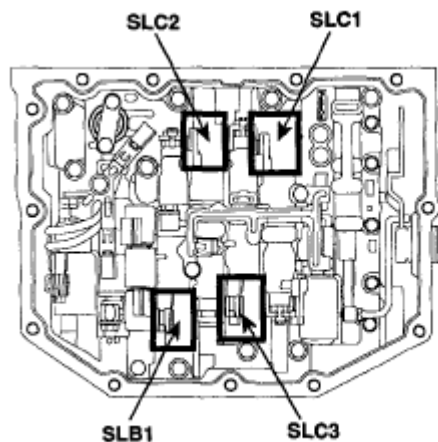
- Caution for handling ATF

1. Do not drain ATF while it is still hot. (Service the system after it cools down.).
2. Be sure to use JWS-3309 (T-IV) type ATF.

SOLENOID VALVE

DESCRIPTION

SOLENOID LOCATION



SENAT7100D

Fig. 165: Identifying Solenoid Valve Location
Courtesy of HYUNDAI MOTOR CO.

FUNCTION OF EACH SOLENOID

1. 3-way solenoids (S1, S2)

The 3-way solenoids (S1, S2) are installed on the front valve body. The solenoids turn ON and OFF in response to signals output from the TCU. According to the ON or OFF status of S1 or S2, the 1st gear engine brake operates or a gear shift occurs. As a fail-safe function, if any shift solenoid abnormality

occurs, the TCU will disable the current to the solenoids.

2. Shift control solenoids (SLC1, SLC2, SLC3, SLB1)

The shift control solenoids (SLC1, SLC2, SLC3, SLB1) are installed on the front valve body. The solenoids linearly control hydraulic pressure in response to signals output from the TCU. Through this, it controls hydraulic pressure to the clutches (C1, C2, C3) and brake (B1) for smooth shifting. According to each shift control solenoid, the transaxle shifts from 1st gear into 6th gear and vice versa. As a fail-safe function, if any shift control solenoid occurs, the TCU will shut off the current to the solenoids.

3. Line pressure control solenoid (SLT)

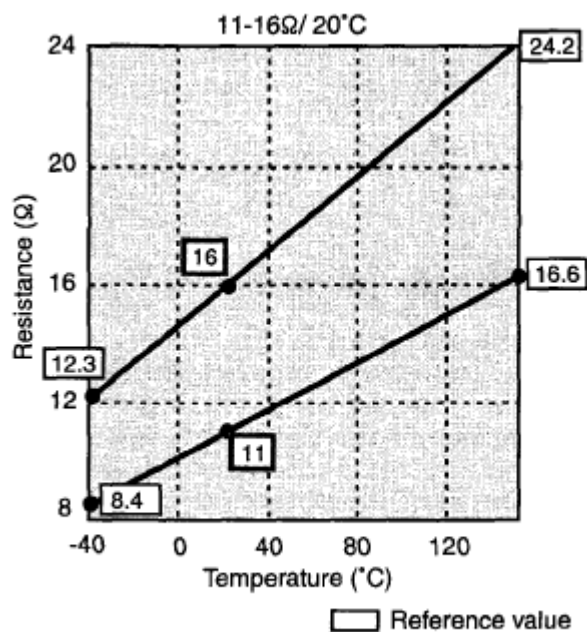
The line pressure control solenoid (SLT) is installed on the front valve body. In accordance with the value decided in the TCU based on throttle opening signals and engine torque, line hydraulic pressure is controlled by linearly changing the comparable throttle pressure. Through this, The TCU controls hydraulic pressure to the clutch and brakes for smooth shifting. As a fail-safe function, if any abnormality occurs in the line pressure control solenoid (SLT), then the TCU will shut off the current to the line pressure control solenoid. (The line pressure is maximized, If the line pressure control solenoid current is shut off when any abnormality of the SLT other than valve stuck occurs.)

4. Lock-up control solenoid (SLU)

The lock-up control solenoid (SLU) is installed on the front valve body. It linearly controls lock-up clutch hydraulic pressure based on engine rpm, throttle opening degree signals, input speed sensor (NIN) signals, and output speed sensor (SP) signals. This results in control of lock-up. As a fail-safe function, if any abnormality occurs in the lock-up control solenoid (SLU), then the TCU will shut off the current to the solenoid.

SPECIFICATION OF EACH SOLENOID

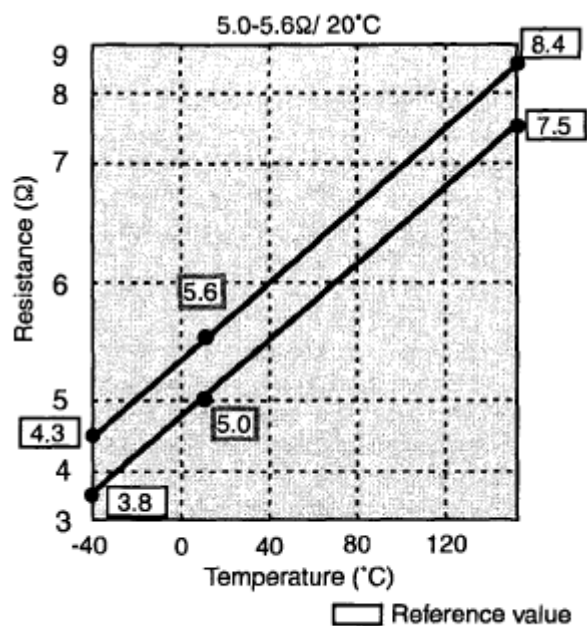
3-WAY SOLENOID (S1, S2)



SENAT7101L

Fig. 166: [Solenoid Valve Resistance And Temperature Graph]
Courtesy of HYUNDAI MOTOR CO.

SHIFT CONTROL SOLENOID



SENAT7102L

Fig. 167: [Solenoid Valve Resistance And Temperature Graph]
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

CAUTION: Do not apply impact to the solenoid. Do not damage the terminals.

3-WAY SOLENOID (S1, S2)

1. Remove the side cover.
2. Remove the 3-way solenoid (S1, S2).

CAUTION: Do not apply impact to the solenoid.

3. With a tester, measure the resistance between the solenoid terminal and solenoid body.

SPEC: 11~15ohms (at 20°C [68°F])

4. Check that solenoid operates when connecting the battery positive terminal to the solenoid terminal and the battery negative terminal to the solenoid body.

SHIFT CONTROL SOLENOID (SLC1, SLC2, SLC3, SLB1)

1. Remove the side cover.
2. Remove the shift control solenoid. (SLC1, SLC2, SLC3, SLB1)

CAUTION:

- The shift pressure control valve and the spring may be taken off when removing the solenoid.
- Do not apply impact to the solenoid.

3. With a tester, measure the resistance between terminal 1 and terminal 2 of each solenoid.

SPEC: 5.0~5.6ohms (at 20°C [68°F])

4. Connect the battery positive terminal to each terminal 1 of the solenoid via a bulb (12-21W), and then check that each solenoid operates when connecting the battery negative terminal to terminal 2.

REMOVAL

1. Drain the oil by removing the overflow plug and the O-ring using a torx wrench (T40), and the drain plug (A) and the gasket by using a hexagon wrench (17mm).

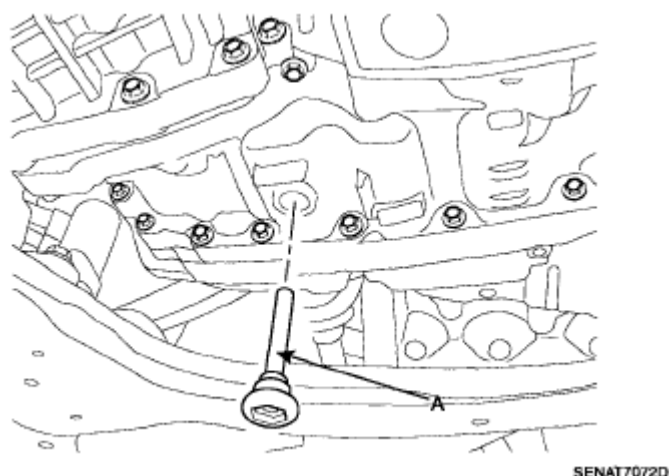


Fig. 168: Identifying Drain Plug
Courtesy of HYUNDAI MOTOR CO.

2. Disconnect the oil cooler hoses from the tubes.
3. Remove the 2 bolts to remove the oil cooler tubes (A) and the O-rings.

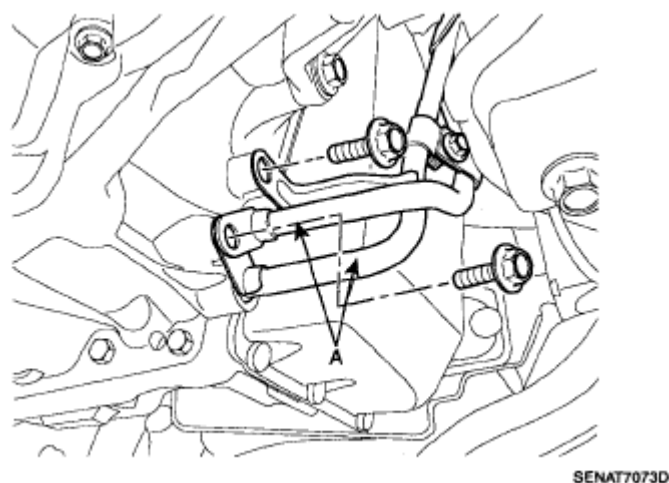
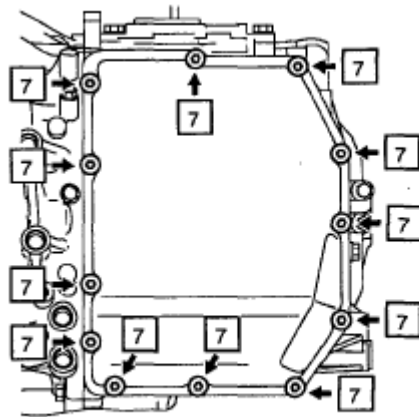


Fig. 169: Identifying Oil Cooler Tubes And Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Using a torx wrench, remove the 12 seal bolts. Using a plastic hammer, tap the transaxle side cover to remove it.

CAUTION:

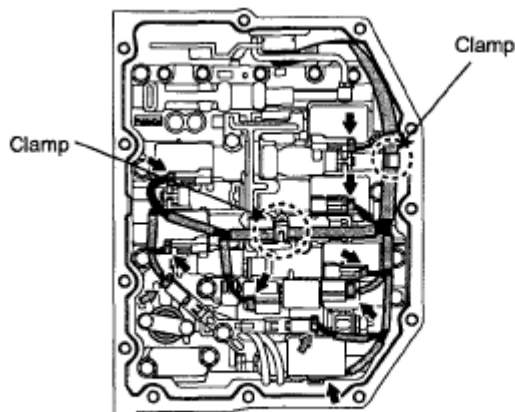
- Be careful not to damage the fitting surface of the transaxle case and the transaxle side cover.
- Be careful not to deform the transaxle side cover.



SENAT7074D

Fig. 170: Identifying Seal Bolts
Courtesy of HYUNDAI MOTOR CO.

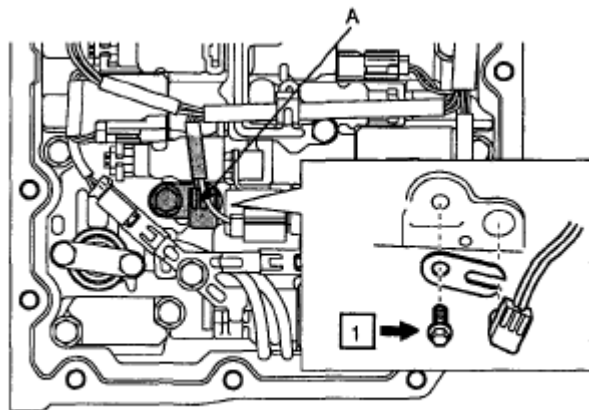
5. Disconnect the 8 solenoid connectors and the 2 speed sensor connectors. Disconnect the wire from the 2 clamps.



SENAT7088L

Fig. 171: Identifying Clamps
Courtesy of HYUNDAI MOTOR CO.

6. Remove the bolt and the lock plate, and pull out the oil temperature sensor (A) and the O-ring from the valve body assembly.

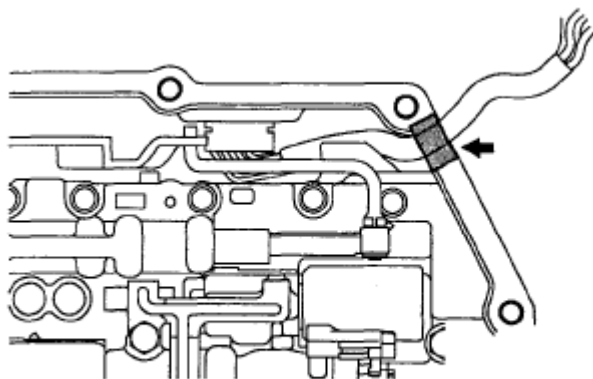


SENAT7075D

Fig. 172: Identifying Oil Temperature Sensor And O-Ring
Courtesy of HYUNDAI MOTOR CO.

7. Fix the wire with tape to the transaxle case as shown in the figure.

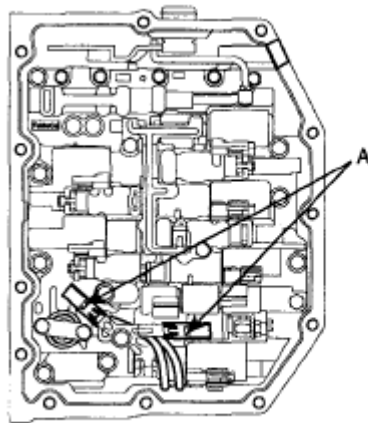
NOTE: Be sure to secure the wire with tape so that it will not interfere with the valve body assembly.



SENAT7076D

Fig. 173: Locating Fix Wire With Tape To Transaxle Case
Courtesy of HYUNDAI MOTOR CO.

8. Remove the 2 speed sensor wires (A) from the solenoid clamp.

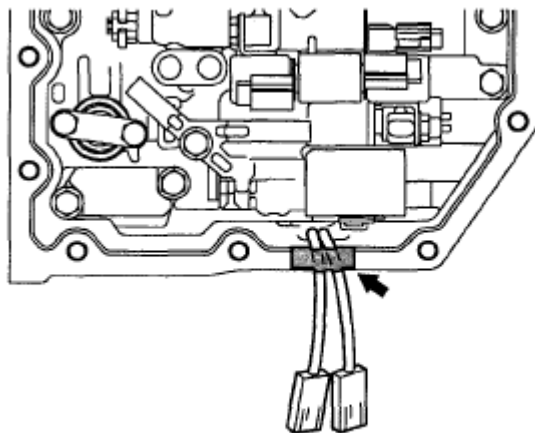


SENAT7071D

Fig. 174: Identifying Speed Sensor Wires From Solenoid Clamp
Courtesy of HYUNDAI MOTOR CO.

9. Fix the 2 speed sensor wires with tape to the transaxle case as shown in the figure.

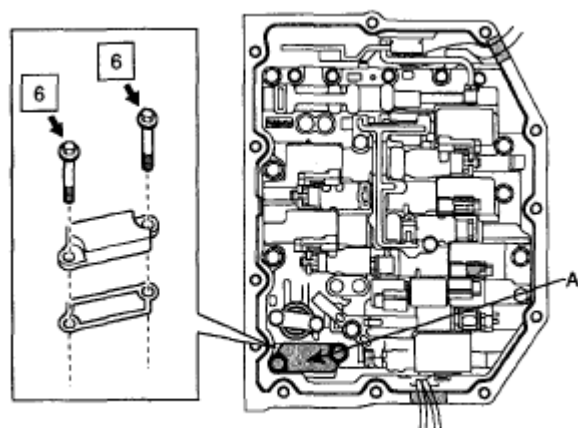
NOTE: Be sure to secure the 2 speed sensor wires with tape so that they will not interfere with the valve body assembly.



SENAT7077D

Fig. 175: Locating Fix Speed Sensor Wires With Tape To Transaxle Case
Courtesy of HYUNDAI MOTOR CO.

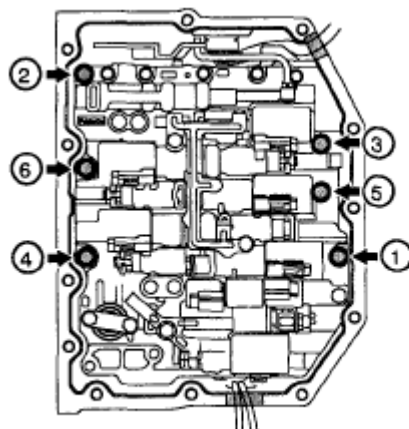
10. Remove the 2 bolts to remove the suction cover (A) and the gasket.



SENAT7078D

Fig. 176: Identifying Suction Cover And Gasket To Bolts
Courtesy of HYUNDAI MOTOR CO.

11. Remove the 6 bolts as shown in the figure.

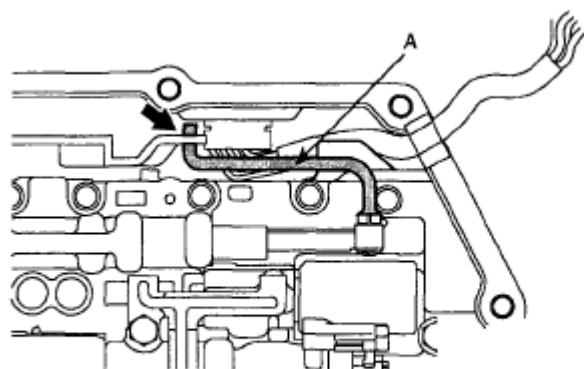


SENAT7079D

Fig. 177: Identifying Bolts
Courtesy of HYUNDAI MOTOR CO.

12. Disconnect the manual valve link (A) and remove the valve body assembly.

CAUTION: Be careful not to drop the valve body assembly.



SENAT7080D

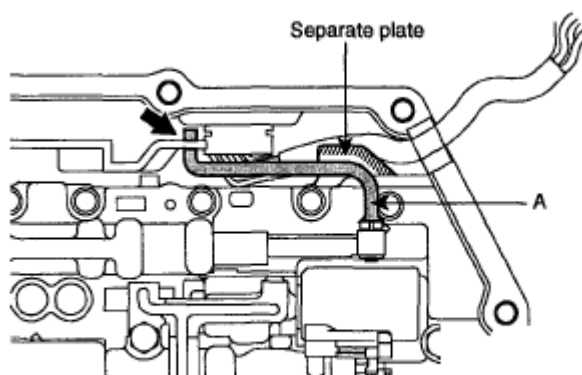
Fig. 178: Identifying Manual Valve Link And Valve Body Assembly
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

1. Connect the manual valve link (A) and install the valve body assembly.

CAUTION:

- When installing the valve body assembly, be sure to put the wire in the open space of the separate plate in the valve body assembly.
- Do not pinch the wire between the separate plate and the valve body assembly.



SENAT7089L

Fig. 179: Separating Plate In Valve Body Assembly
Courtesy of HYUNDAI MOTOR CO.

2. Temporarily install the valve body assembly with the 6 bolts.

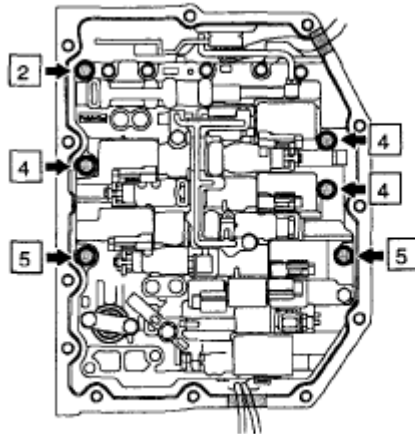
Bolt size:

(5) :M6x1.0x31mm

(4) :M6x1.0x21mm

(2) :M6x1.0x17mm

NOTE: Aligning the bolt holes, temporarily tighten the 6 bolts by hand.

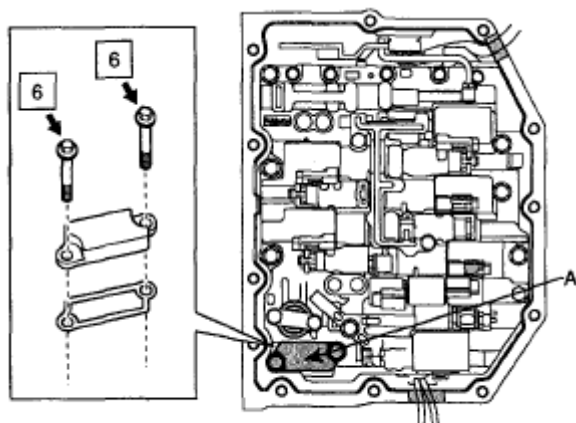


SENAT7090D

Fig. 180: Identifying Bolts In Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.

3. Temporarily install the suction cover (A) and a new gasket with the 2 bolts.

Bolt size (6) : M6x1.0x41 mm

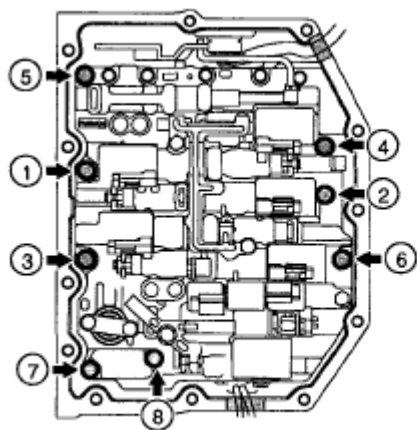


SENAT7078D

Fig. 181: Identifying Suction Cover And Gasket To Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Tighten the 8 bolts in the order shown in the figure.

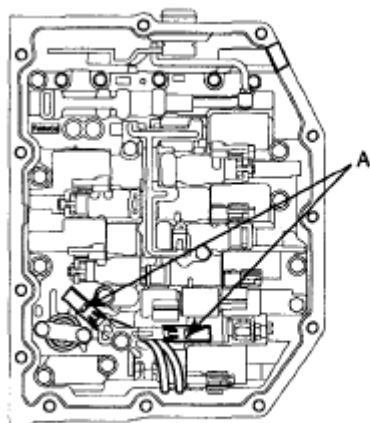
TORQUE : 8-12 Nm (0.8-1.2 kgf.m, 5.8-8.7 lb-ft)



SENAT7091D

Fig. 182: Identifying Bolts In Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.

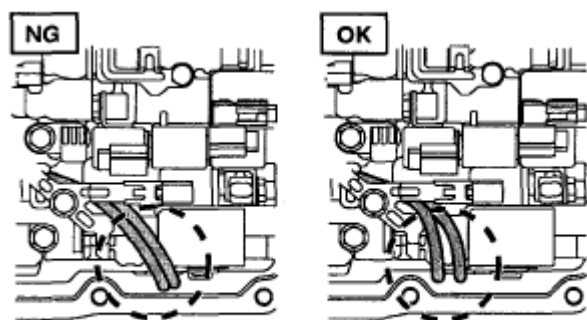
5. Install the connectors of the 2 speed sensor wires (A) to the solenoid clamp.



SENAT7071D

Fig. 183: Identifying Speed Sensor Wires From Solenoid Clamp
Courtesy of HYUNDAI MOTOR CO.

CAUTION: Install sensor as instructed as shown figure so that speed sensor wires cannot be stuck to solenoid.



SENAT7081L

Fig. 184: Identifying Speed Sensor Wires And Stuck To Solenoid
 Courtesy of HYUNDAI MOTOR CO.

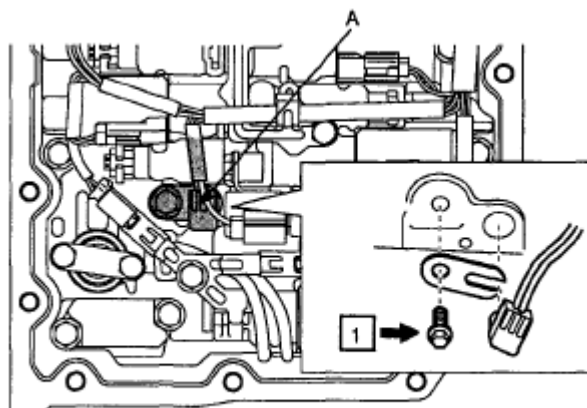
6. Coat the new "O" ring with ATF, and install it to the oil temperature sensor.

O-ring size: inner dia.-11.57mm, thickness-1.98mm

7. Install the oil temperature sensor (A) with the lock plate and the bolt to the valve body assembly as shown in the figure.

TORQUE : 8-12 Nm (0.8-1.2 kgf.m, 5.8-8.7 lb-ft)

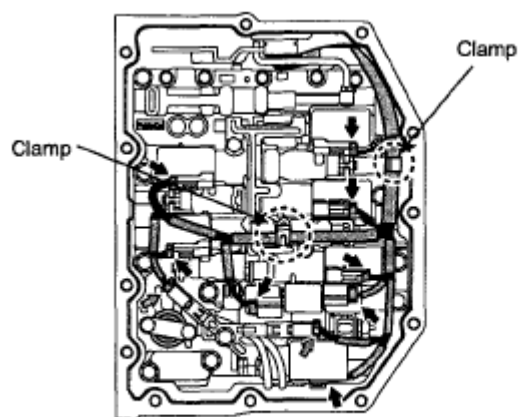
Bolt size (1) : M6x1.0x12mm



SENAT7075D

Fig. 185: Identifying Oil Temperature Sensor And O-Ring
 Courtesy of HYUNDAI MOTOR CO.

8. Connect the 8 solenoid connectors and the 2 speed sensor connectors, and the T/M wire to the 2 clamps.



SENAT7088L

Fig. 186: Identifying Clamps

Courtesy of HYUNDAI MOTOR CO.

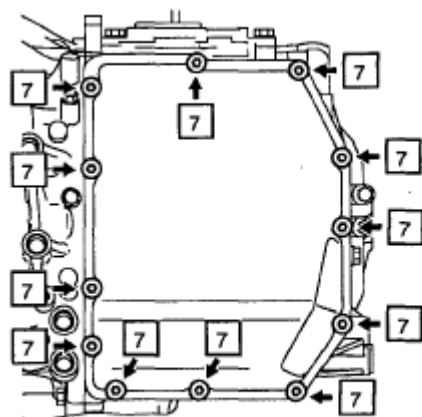
9. Clean oil off the contact surface of the new transaxle side cover with the transaxle case.

NOTE: Completely remove oil with white gasoline or similar products.

10. Apply sealant (FIPG) to the new transaxle side cover.
11. Install the transaxle side cover with 12 new seal bolts.

TORQUE : 10-16 Nm (1.0-1.6kgf.m, 7.2-11.6 lb-ft)

Bolt size (7): M8x1.25x15.5mm (Seal bolt)



SENAT7074D

Fig. 187: Identifying Seal Bolts

Courtesy of HYUNDAI MOTOR CO.

12. Coat the new O-rings with ATF, and install it to the oil cooler tubes (A). Install the oil cooler tubes with the 2 bolts.

O-ring size: inner dia.-11.6mm, thickness-2.35mm

TORQUE : 20-30 Nm (2.0-3.0 kgf.m, 14.5-21.7 lb-ft)

Bolt size (8) : M8x1.25x20mm

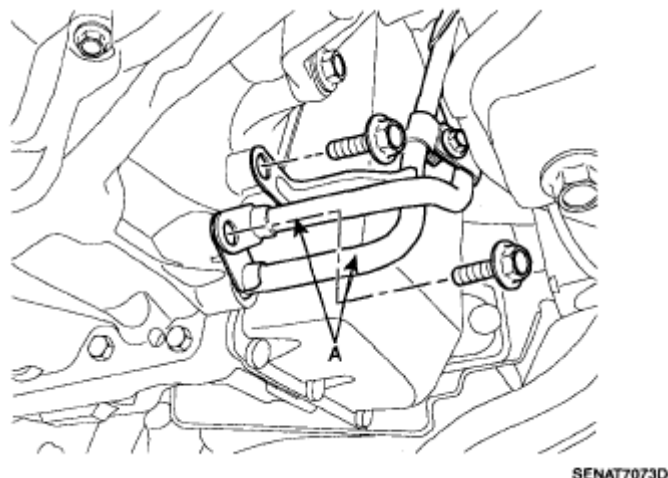


Fig. 188: Identifying Oil Cooler Tubes And Bolts
Courtesy of HYUNDAI MOTOR CO.

13. Connect the oil cooler hoses from the tubes.
14. Install the drain plug (A) and the gasket by using a hexagon wrench (17mm).

TORQUE : 35-61 Nm (3.5-6.1 kgf.m, 25.3-44.1 lb-ft)

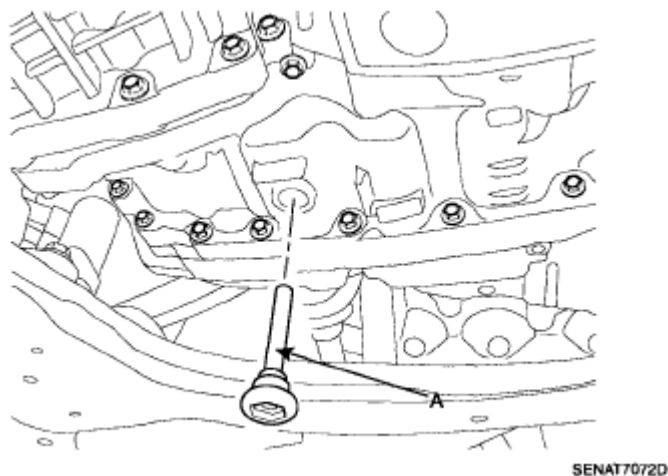


Fig. 189: Identifying Drain Plug
Courtesy of HYUNDAI MOTOR CO.

15. Refill the ATF. (refer to **PROCEDURE OF ATF LEVEL ADJUSTING**)

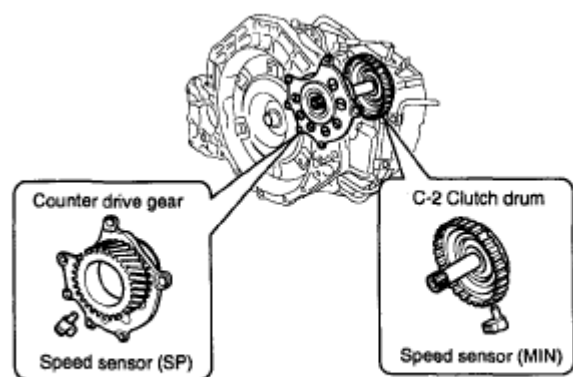
INPUT SPEED SENSOR

DESCRIPTION

The input speed sensor (NIN) is installed in the transaxle case.

This sensor detects the number of revolutions of the intermediate shaft's C2 drum as input shaft speed.

This signal is transmitted to the TCU. Based on those signals, the TCU controls engine torque, shift timing, and lock-up.



SENAT7082L

Fig. 190: Identifying Input Speed Sensor (NIN) In Transaxle Case
Courtesy of HYUNDAI MOTOR CO.

SPECIFICATION

INPUT SPEED SENSOR SPECIFICATIONS

	Signal	Current
Input speed sensor	HIGH	12-16 mA
	LOW	4-8 mA

REMOVAL

1. Drain the oil by removing the overflow plug and the O-ring using a torx wrench (T40), and the drain plug (A) and the gasket by using a hexagon wrench (17mm).

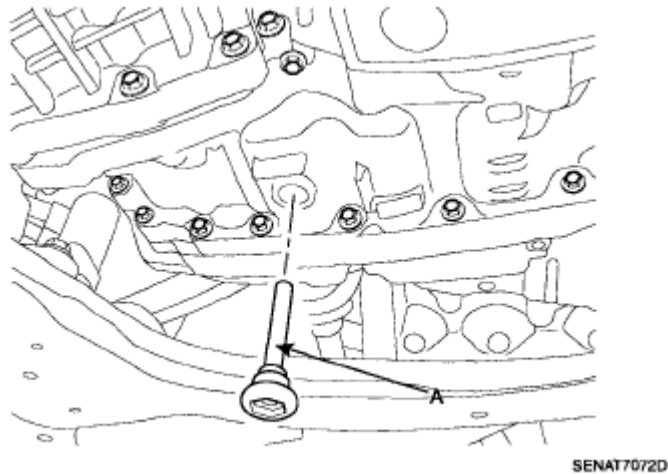


Fig. 191: Identifying Drain Plug
Courtesy of HYUNDAI MOTOR CO.

2. Disconnect the oil cooler hoses from the tubes.
3. Remove the 2 bolts to remove the oil cooler tubes (A) and the O-rings.

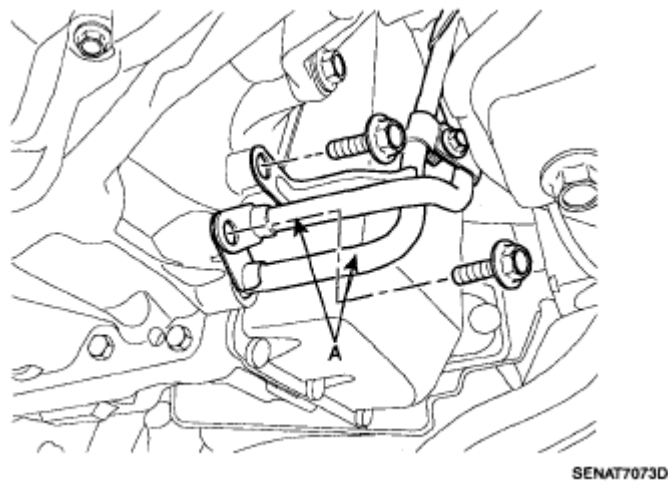
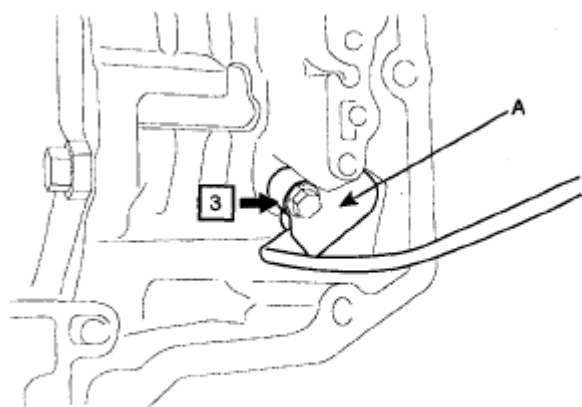


Fig. 192: Identifying Oil Cooler Tubes And Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Remove the transaxle side cover and the valve body assembly, (refer to **REMOVAL**)

CAUTION: Be careful not to drop the valve body assembly.

5. Remove the input speed sensor (A).



SENAT7083D

Fig. 193: Identifying Input Speed Sensor
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

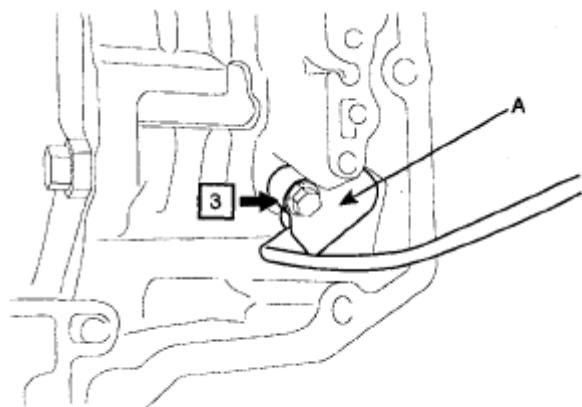
- CAUTION:**
- Do not damage the input speed sensor (NIN).
 - Do not damage the terminals.

1. Connecting terminal 2 to a battery positive terminal, connect the battery negative terminal to terminal 1 through resistance of 100ohms and ammeter.
2. Measure currenxy value when shaking metal shards (magnetic material) back and forthwith a top of input speed sensor (NIN) (less than 5mm).

Specification [mA] : 12-16 (HIGH), 4-8 (LOW)

INSTALLATION

1. Install the input speed sensor (A).



SENAT7083D

Fig. 194: Identifying Input Speed Sensor

Courtesy of HYUNDAI MOTOR CO.

2. Install the transaxle side cover and the valve body assembly, (refer to **INSTALLATION**)

CAUTION: Be careful not to drop the valve body assembly.

3. Coat the new O-rings with ATF, and install it to the oil cooler tubes (A). Install the oil cooler tubes with the 2 bolts.

O-ring size: inner dia.-11.6mm, thickness-2.35mm

TORQUE : 20-30 Nm (2.0-3.0 kgf.m, 14.5-21.7 lb-ft)

Bolt size (8) : M8x1.25x20mm

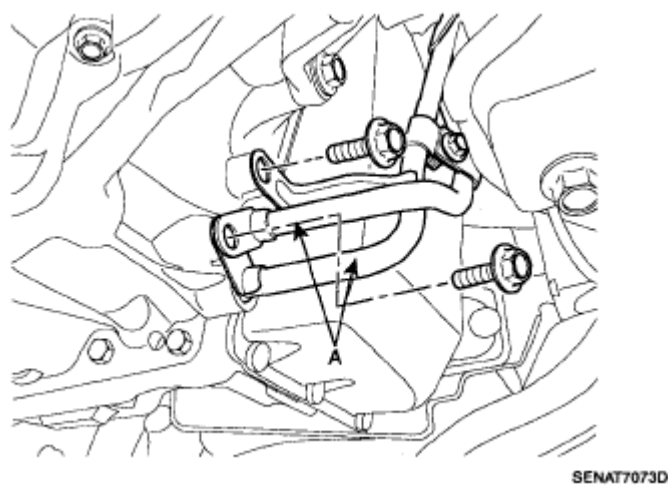


Fig. 195: Identifying Oil Cooler Tubes And Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Connect the oil cooler hoses from the tubes.
5. Install the drain plug (A) and the gasket by using a hexagon wrench (17mm).

TORQUE : 35-61 Nm (3.5-6.1 kgf.m, 25.3-44.1 lb-ft)

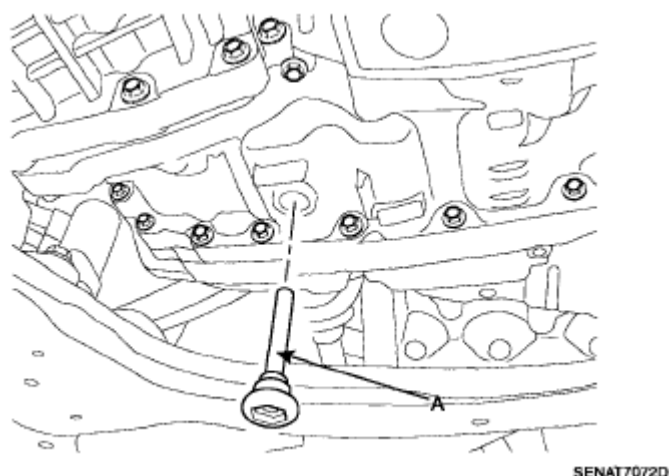


Fig. 196: Identifying Drain Plug
Courtesy of HYUNDAI MOTOR CO.

6. Refill the ATF. (refer to **PROCEDURE OF ATF LEVEL ADJUSTING**)

OUTPUT SPEED SENSOR

DESCRIPTION

The output speed sensor (SP) is installed in the transaxle case.

This sensor detects the number of revolutions of the counter drive gear as output shaft speed.

This signal is transmitted to the TCU. Based on those signals, the TCU controls engine torque, shift timing, and lock-up.

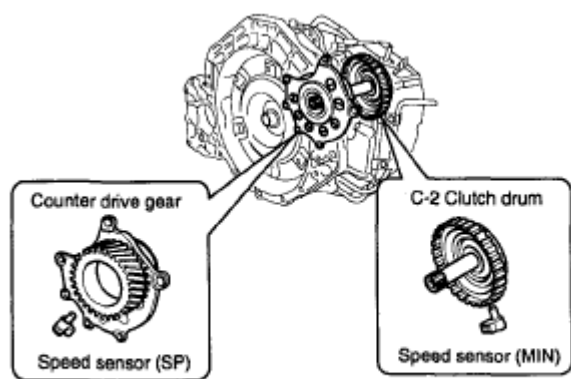


Fig. 197: Identifying Input Speed Sensor (NIN) In Transaxle Case
Courtesy of HYUNDAI MOTOR CO.

SPECIFICATION

OUTPUT SPEED SENSOR SPECIFICATIONS

	Signal	Current
Output speed sensor	HIGH	12-16 mA
	LOW	4-8 mA

INSPECTION

NOTE: Refer to **REMOVAL & INSTALLATION** in order to inspect the output speed sensor (SP).

CAUTION:

- Do not damage the output speed sensor (SP).
- Do not damage the terminals.

1. Connecting terminal 2 to a battery positive terminal, connect the battery negative terminal to terminal 1 through resistance of 100ohms and ammeter.
2. Measure currenxy value when shaking metal shards (magnetic material) back and forthwith a top of input speed sensor (NIN) (less than 5mm).

Specification [mA] : 12-16 (HIGH), 4-8 (LOW)

TRANSMISSION CONTROL MODULE (TCM)**DESCRIPTION****ADOPTION OF INTEGRATED POSITION SENSOR WITH TCU**

The shift position sensor is integrated in TCU. TCU indicates a shift position by reading a voltage difference between output voltages (Pos1, Pos2) from the shift position sensor.

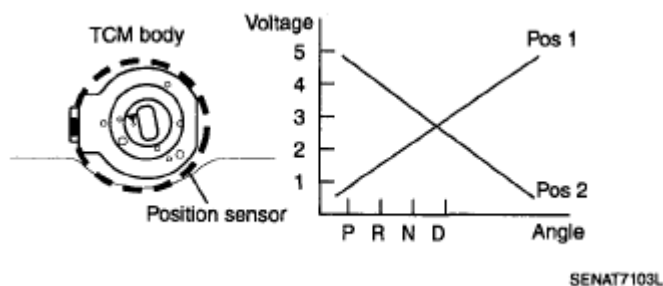


Fig. 198: Identifying Shift Position Sensor And Output Voltages
Courtesy of HYUNDAI MOTOR CO.

FUNCTION OF TCU

1. Automatic gear shift control

In automatic gear shift control, based on each gear shift pattern, S1 and S2 turn on or off and SLC1,

SLC2, SLC3, and SLB1 are operated linearly according to information that includes vehicle speed, Throttle valve opening degree, and brake signals.

2. Lock-up control

Based on rpm signals, signals from the engine control unit (engine rpm and throttle opening) and vehicle speed, smooth lock-up control is achieved through linear control of the lock-up control solenoid (SLU). (However, this assumes that JWS-3309 is used.)

3. Garage shift control

When the shift lever is moved from N to D or from N to R, after the engine is started, a shift control solenoid (SLC1, SLC3) is used for the oil pressure required by C1 clutch or C3 clutch and appropriately regulated oil pressure is supplied to the clutch, engaging smoothly without shock.

NOTE:

- When the engine is cold, the first piston stroke resistance increases, creating a time lag in shift operation. In order to reduce the time lag, control is not performed.
- By controlling the oil pressure according to the piston stroke, smooth engagement without shock becomes possible.

4. Reverse control

If the shift lever is moved from N to R while the vehicle is traveling and the transmission shifts into reverse, the wheels may be locked, which is extremely dangerous. In order to avoid this, TCU inhibits the transmission from shifting into reverse while traveling.

NOTE:

- Even when the shift lever is moved from N to R, the transmission does not shift into reverse if the vehicle speed is 11 km/h or more.
- When this control is activated, the C3 clutch is released without operating the shift control solenoid (SLC3) so that the transmission does not shift into reverse.
- Reverse control takes precedence over N-R shift control.

5. Self-diagnosis function

The TCU monitors the communication status of each sensor, electronic component and ECU including the engine control unit. If any malfunction should occur, the TCU functions to warn the driver and stores the malfunction as a diagnosis code.

6. Fail-safe

With the fail-safe function, if any malfunction should occur in the automatic transmission system, the TCU will output a control signal, and control will be performed to make traveling a minimum distance possible. If shift solenoid malfunction, the TCU will cancel the output of control signals to the solenoid.

If this happens, automatic transmission gear shifting will be controlled by oil pressure circuits only and the gears will shift as shown in the chart below.

SHIFT POSITION AND GEAR POSITION

Shift position	Gear position
R	Reverse
D	3rd gear (5th gear in case of SLC1 failure)

7. Driver adaptive shift control

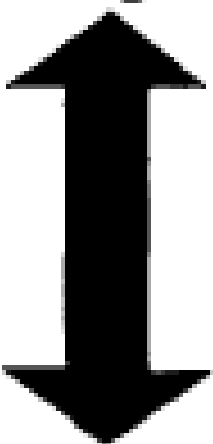
The F21 for HMC does not have a driving mode selection switch that allows drivers to select a mode themselves. The vehicle is ordinarily in economy mode. However, when specific conditions are met, the TCU selects a shifting pattern appropriate to driving conditions from all of the shifting patterns and switches automatically.

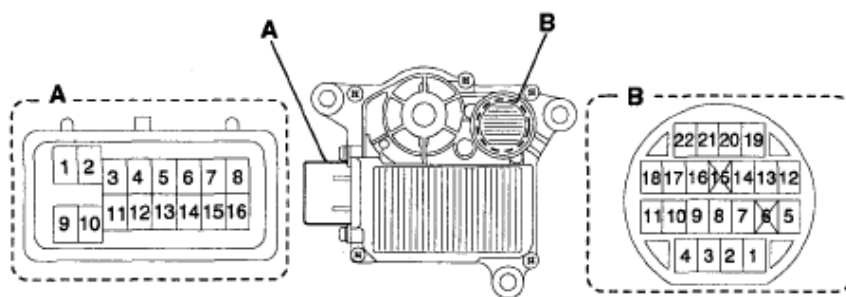
MODE DESCRIPTION

Mode	Description
ECONOMY	Used during normal driving. ECONOMY mode is basic shift schedule and the ideal shift schedule to be consistent with fuel economy and acceleration performance. This mode is normally selected where no other higher priority shift mode is activated. Full shift schedule map is available including lockup for this mode.
HIGH OIL TEMPERATURE (HOT)	This mode is protect the gearbox from the overheating. This mode is activated where the T/M oil temperature is too high, and will prevent the T/M oil temperature increasing by torque converter slipping. HOT shift schedule maps is available including lockup depending on the T/M oil temperature area for this mode.
MANUAL SHIFT MODE	The manual shift mode is activated where the driver put the shifter into manual gate. The gear position is manually changed according to the driver shift demand. The automatic down shift function in decelerating and automatic up shift function for engine over revolution protection are available. The allowable vehicle speed for up shifting at low vehicle speed and down shifting at high speed set be TCU parameters.
UP-SLOPE (US1, 2)	The UP-SLOPE1, 2 mode detect up hill road condition and change the shift map to powerful map to avoid busy shifting at up hill condition. When start condition of up slope mode is detected, shift map is changed upslope1 or upslope2 map depending on slope gradient if no higher priority mode is activated.
AUTO CRUISE CONTROL (ACC)	The AUTO CRUISE CONTROL detects "ACC ON" signal and use specific point to prevent shift hunting during ACC ON. When cruise control is ON, gears are fixed to perform smooth driving.
GEAR HOLD	The GEAR HOLD according to the request by ESP in order to support the vehicle stability. This function can be activated in every shift mode except for MANUAL SHIFT MODE. When start condition is fulfilled, gear is held to current gear. The gear hold is performed after shift control finished if start condition is fulfilled during shifting.

MODE PRIORITY ON CURRENT IMPLEMENTATION

MODE PRIORITY ON CURRENT IMPLEMENTATION

Mode priority	Shift mode
High  Low SENAT7080L	MANUAL SHIFT MODE
	GEAR HOLD
	HOT
	UP-SLOPE 2
	UP-SLOPE 1
	AUTO CRUISE CONTROL
	ECONOMY

INFORMATION OF TCU CONNECTOR

SENAT7084D

Fig. 199: Identifying TCU Connector Terminals
 Courtesy of HYUNDAI MOTOR CO.

TCU CONNECTOR TERMINALS DESCRIPTION

Terminal No.	Mark	Terminal Name	Terminal No.	Mark	Terminal Name
A1	+B	Battery voltage	B4	SLUG	Lock-up control solenoid [SLU-]
A2	-	-	B5	S1	3-way solenoid [S1]
A3	TOP UP	Tiptronic input signal up	B6	-	-

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A4	TIP DOWN	Tiptronic input signal down	B7	OTG	Oil temperature sensor [OT-]
A5	STLK	Start lock output signal	B8	OT	Oil temperature sensor [OT+]
A6	CANL	CAN communication L line (Low)	B9	SLU	Lock-up control solenoid [SLU+]
A7	TIP M	Tiptronic input signal Manual	B10	SLC1G	Shift control solenoid [SLC1-]
A8	-	-	B11	SLC1	Shift control solenoid [SLC1+]
A9	GND	TCU ground	B12	NIN+	Input speed sensor [NIN+]
A10	-	-	B13	NIN-	Input speed sensor [NIN-]
A11	IG	Ignition switch input signal	B14	SLC3	Shift control solenoid [SLC3+]
A12	-	-	B15	-	-
A13	RVS	Reverse lamp output signal	B16	SLB1G	Shift control solenoid [SLB1-]
A14	CAN H	CAN communication H line (High)	B17	SLC2	Shift control solenoid [SLC2+]
A15	-	-	B18	SLC2G	Shift control solenoid [SLC2-]
A16	SFL	Shift lock output signal	B19	SP+	Output speed sensor [SP+]
B1	SLTG	Line pressure control solenoid [SLT-]	B20	SP-	Output speed sensor [SP-]
B2	S2	3-way solenoid [S2]	B21	SLB1	Shift control solenoid [SLB1+]
B3	SLT	Line pressure control solenoid [SLT+]	B22	SLC3G	Shift control solenoid [SLC3-]

REMOVAL

1. Disconnect the (-) terminal from the battery.
2. Remove the air cleaner assembly.
3. Remove the turbocharger tube, (diesel engine only)
4. Remove the shift cable (A), the manual lever (B), and the connector (C).

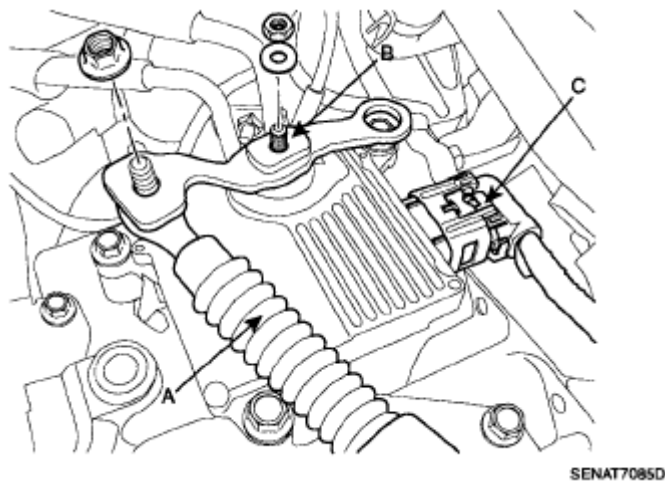


Fig. 200: Identifying Shift Cable, Manual Lever And Connector
Courtesy of HYUNDAI MOTOR CO.

5. Remove the 3 bolts to remove the TCU (A).

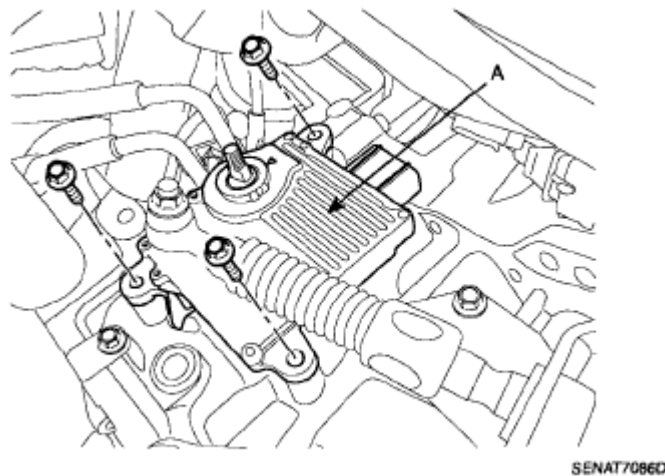
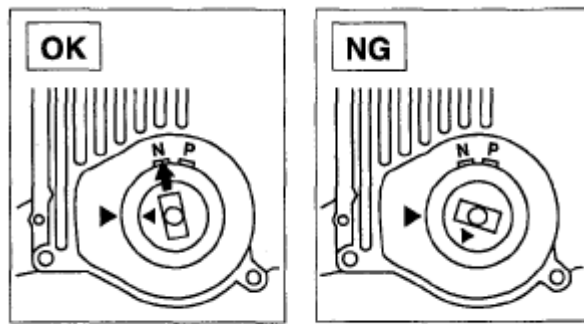


Fig. 201: Identifying TCU And Bolts
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

1. Check the condition of the connector pin of the A/T (foreign material, bent pins, broken pins etc.) and "O" ring after the TCU is removed.
2. Be sure to match the position of the TCU marking.

CAUTION: Do not turn more than 60 degrees from the marking.



SENAT7092L

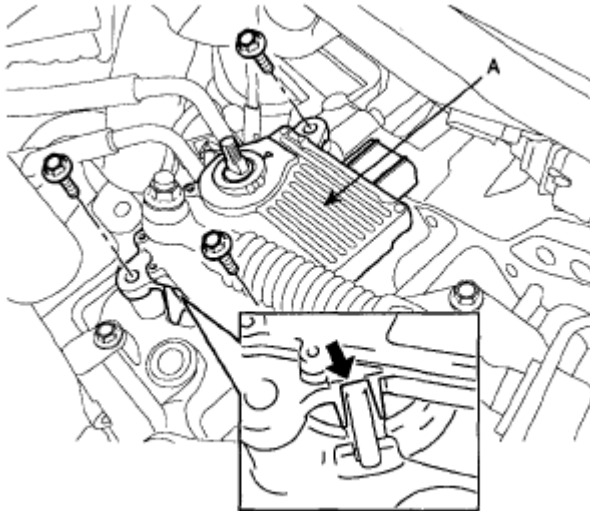
Fig. 202: Checking Connector Pin
Courtesy of HYUNDAI MOTOR CO.

3. Install the TCU (A) with the 3 bolts.

TORQUE : 20-30 Nm (2.0-3.0 kgf.m, 14.5-21.7 lb-ft)

Bolt size (8) : M8x1.25x20mm

NOTE: Make sure the correct positions of the TCU and wire.



SENAT7095D

Fig. 203: Identifying TCU With Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Install the shift cable (A), the manual lever (B), and the connector (C).

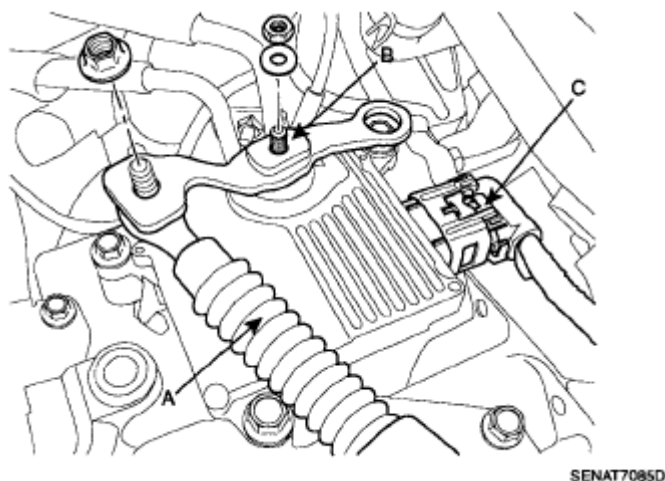


Fig. 204: Identifying Shift Cable, Manual Lever And Connector
Courtesy of HYUNDAI MOTOR CO.

5. Install the air cleaner assembly.
6. Connect the (-) terminal to the battery.
7. Perform N position learning, (refer to '[HOW TO PERFORM N POSITION LEARNING](#)')
8. Perform initial learning, (refer to Troubleshooting's '[HOW TO PERFORM INITIAL LEARNING](#)')

TRANSAXLE OIL TEMPERATURE SENSOR

DESCRIPTION

- The transmission wires are installed on the transaxle case as the grouped connectors of the oil temperature sensor, speed sensors, and solenoids.
- The oil temperature sensor (A), which is integrated with the transmission wires, is installed on the front valve body. It directly detects the oil temperature within the hydraulic pressure control circuit and transmits a signal based on that temperature to the TCU. In response to changes in oil temperature, the TCU controls gear shifting for smooth shifting across a wide range of temperatures.

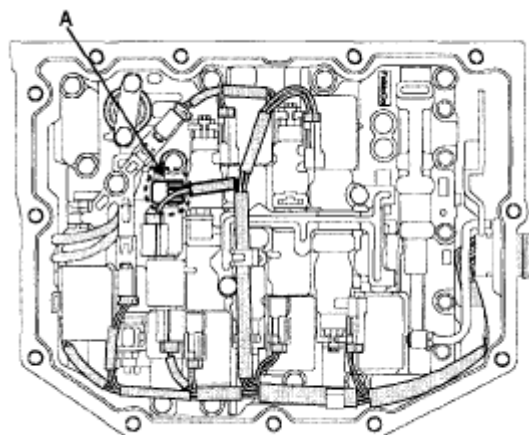


Fig. 205: Identifying Oil Temperature Sensor
Courtesy of HYUNDAI MOTOR CO.

SPECIFICATION

SIGNAL SPECIFICATIONS

	Signal	Specification
Oil temperature sensor	10°C	5.62-7.31 kohms
	25°C	3.5kohms
	110°C	0.22-0.27kohms

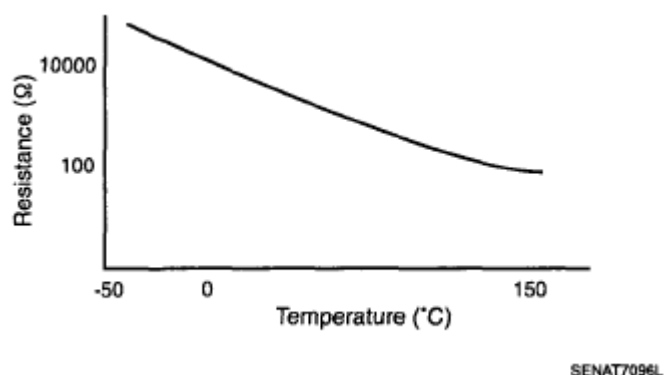


Fig. 206: Oil Temperature Sensor Signal Graph
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Remove the TCU.

CAUTION: Do not touch the terminals.

2. Drain the oil by removing the overflow plug and the O-ring using a torx wrench (T40), and the drain plug (A) and the gasket by using a hexagon wrench (17mm).

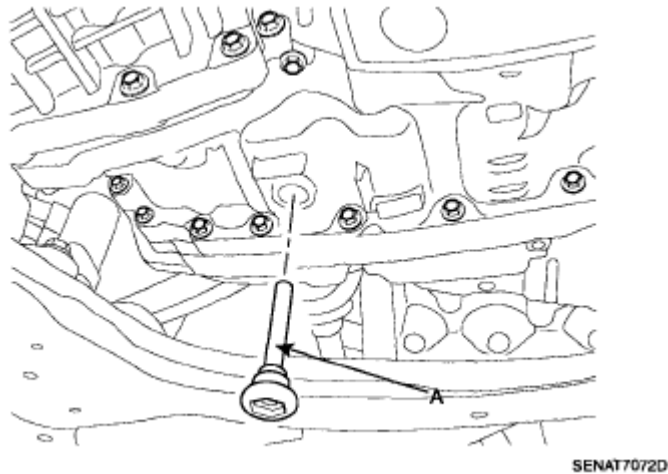


Fig. 207: Identifying Drain Plug
Courtesy of HYUNDAI MOTOR CO.

3. Disconnect the oil cooler hoses from the tubes.
4. Remove the 2 bolts to remove the oil cooler tubes (A) and the O-rings.

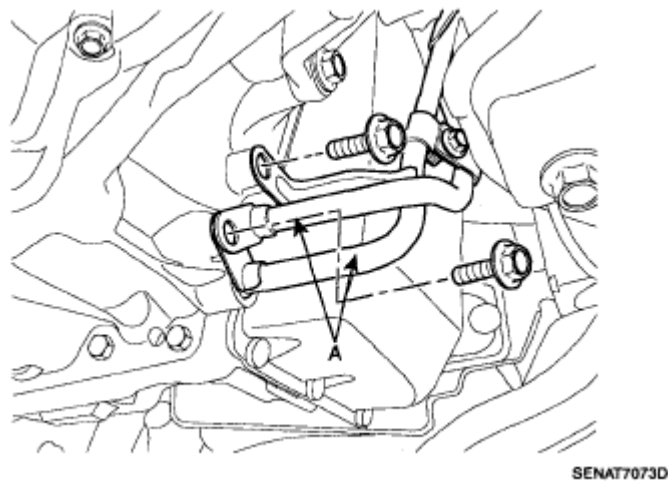


Fig. 208: Identifying Oil Cooler Tubes And Bolts
Courtesy of HYUNDAI MOTOR CO.

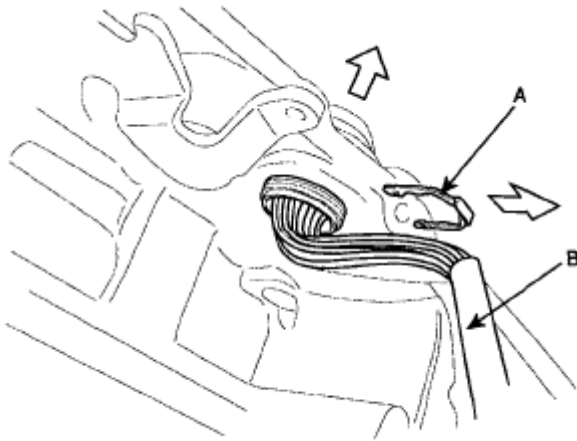
5. Remove the transaxle side cover and the valve body assembly, (refer to **REMOVAL**))

CAUTION: Be careful not to drop the valve body assembly.

6. After removing the wire lock plate (A), remove the wire (B) from the transaxle case.

CAUTION: • **Be careful not to damage the harness.**

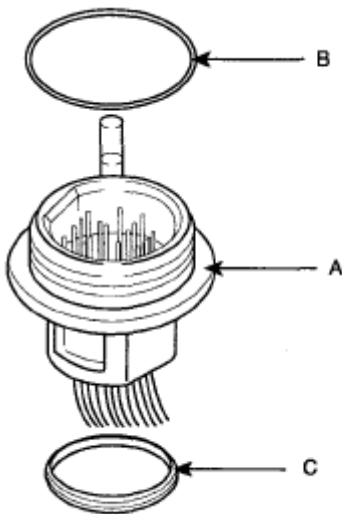
- Be careful not to pull the harness forcibly.



SENAT7087D

Fig. 209: Identifying Wire Lock Plate And Transaxle Case
Courtesy of HYUNDAI MOTOR CO.

7. Remove the O-ring (B) and the gasket (C) from the wire (A).

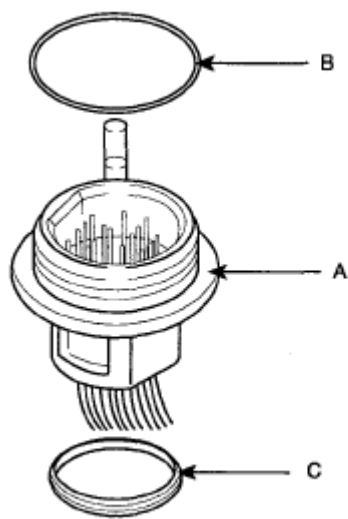


SENAT7093D

Fig. 210: Identifying O-Ring And Gasket From Wire
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

1. After coating a new gasket (C) with ATF, install it to the wire (A).



SENAT7093D

Fig. 211: Identifying O-Ring And Gasket From Wire
Courtesy of HYUNDAI MOTOR CO.

2. Install a new O-ring (B) to the wire.

O-ring size: inner dia.-27.3mm, thickness-2.4mm

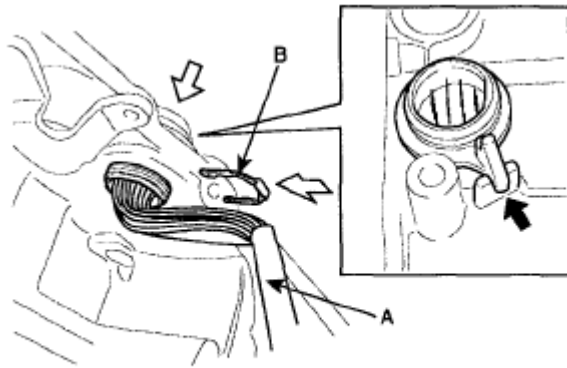
CAUTION: Do not coat ATF to the O-ring.

3. Install the wire (A) to the transaxle case.

CAUTION:

- Be careful not to apply too much force to the wire.
- Be careful not to damage the T/M wire.

NOTE: Install the wire to the transaxle case by engaging its claw.



SENAT7097D

Fig. 212: Identifying Wire To Transaxle Case
Courtesy of HYUNDAI MOTOR CO.

4. Install a new wire lock plate (B).
5. Install the transaxle side cover and the valve body assembly, (refer to **INSTALLATION**)

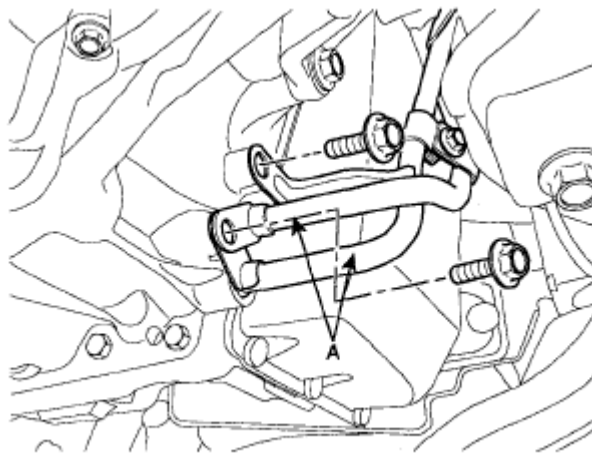
CAUTION: Be careful not to drop the valve body assembly.

6. Coat the new O-rings with ATF, and install it to the oil cooler tubes (A). Install the oil cooler tubes with the 2 bolts.

O-ring size: inner dia.-11.6mm, thickness-2.35mm

TORQUE : 20-30 Nm (2.0-3.0 kgf.m, 14.5-21.7 lb-ft)

Bolt size (8) : M8x1.25x20mm



SENAT7073D

Fig. 213: Identifying Oil Cooler Tubes And Bolts

Courtesy of HYUNDAI MOTOR CO.

7. Connect the oil cooler hoses from the tubes.
8. Install the drain plug (A) and the gasket by using a hexagon wrench (17mm).

TORQUE : 35-61 Nm (3.5-6.1 kgf.m, 25.3-44.1 lb-ft)

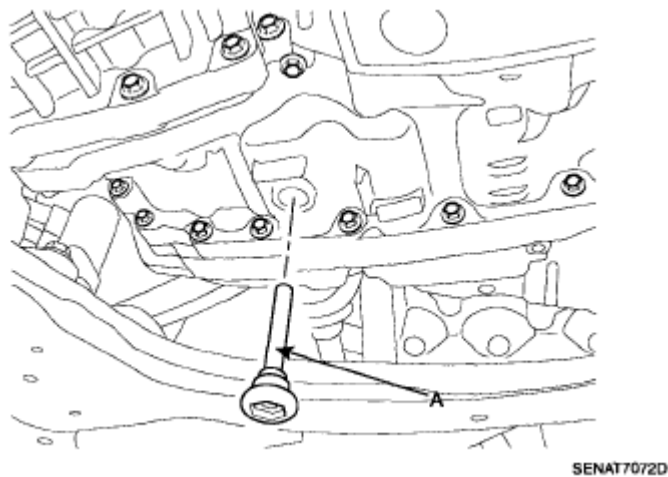


Fig. 214: Identifying Drain Plug
Courtesy of HYUNDAI MOTOR CO.

Install the TCU.

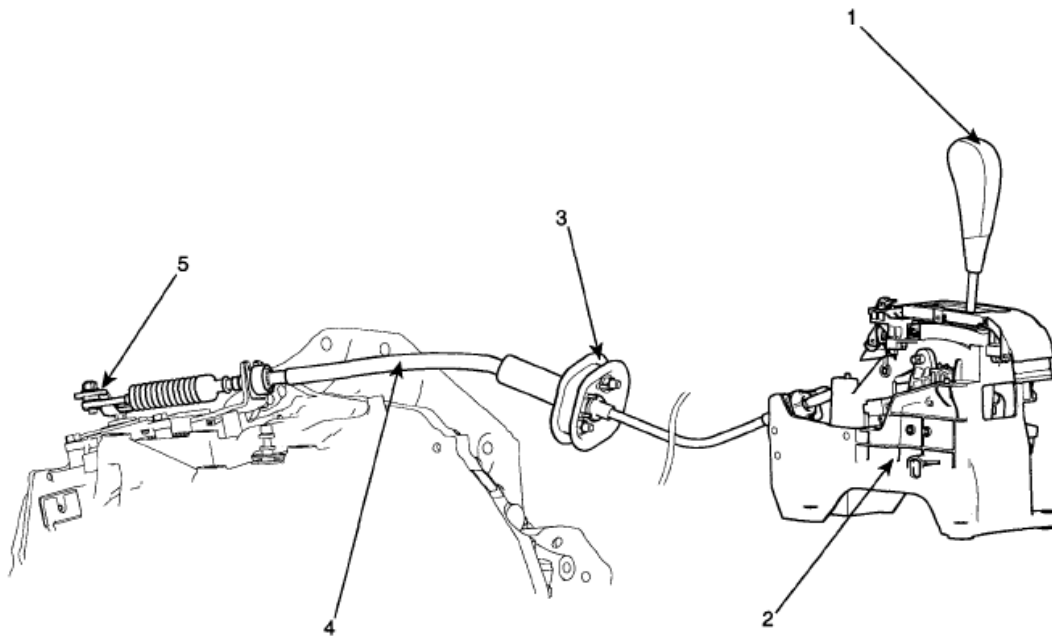
TORQUE : 20-30 Nm (2.0-3.0 kgf.m, 14.5-21.7 lb-ft)

Bolt size (8) : M8x1.25x20mm

9. Refill the ATF. (refer to **PROCEDURE OF ATF LEVEL ADJUSTING**)
10. Perform N position learning, (refer to **'HOW TO PERFORM N POSITION LEARNING'**)
11. Perform initial learning, (refer to Troubleshooting's **'HOW TO PERFORM INITIAL LEARNING'**)

SHIFT LEVER

COMPONENTS

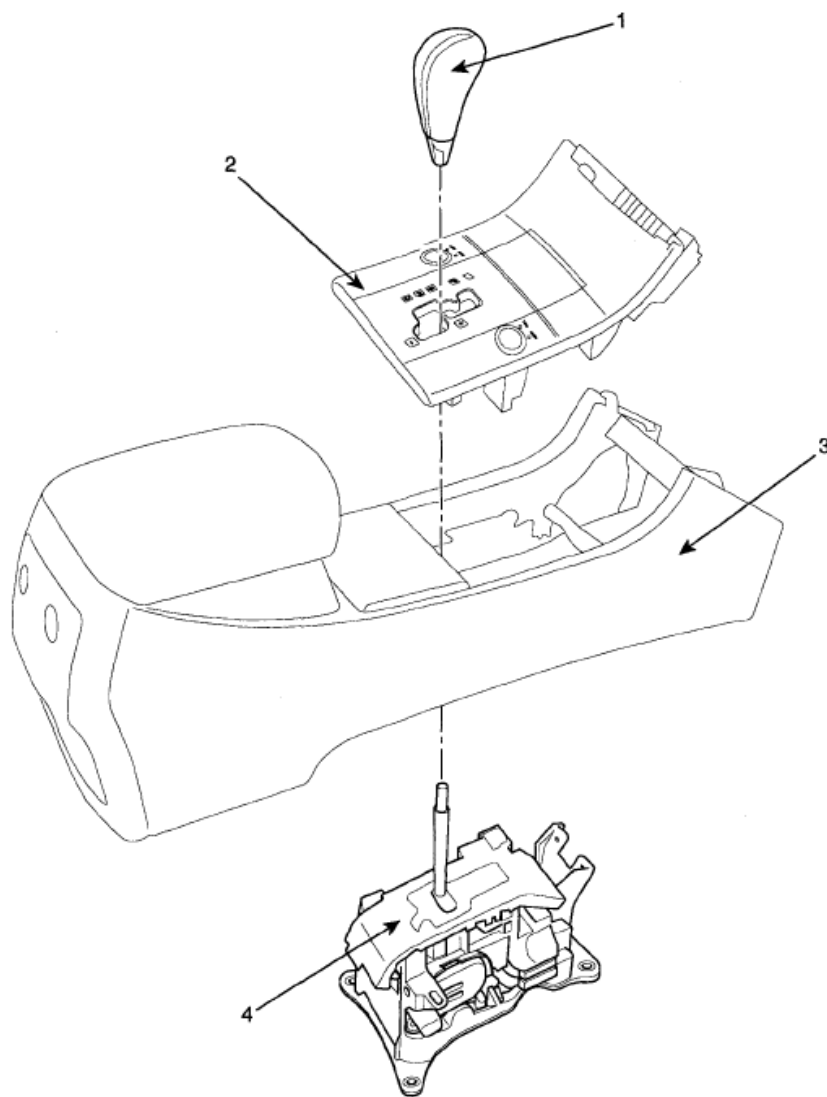


- 1. Shift lever knob
- 2. Shift lever assembly
- 3. Retainer

- 4. Shift cable assembly
- 5. Manual lever

SENAT7040L

Fig. 215: Identifying Shift Lever Components (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



- 1. Shift lever knob
- 2. Indicator assembly

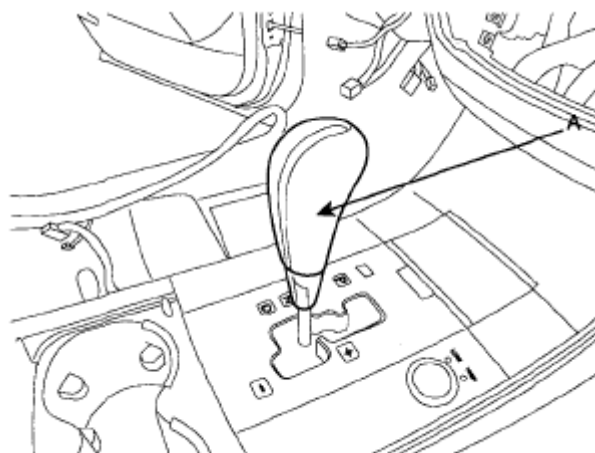
- 3. Center console
- 4. Shift lever assembly

SENAT7041L

Fig. 216: Identifying Shift Lever Components (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

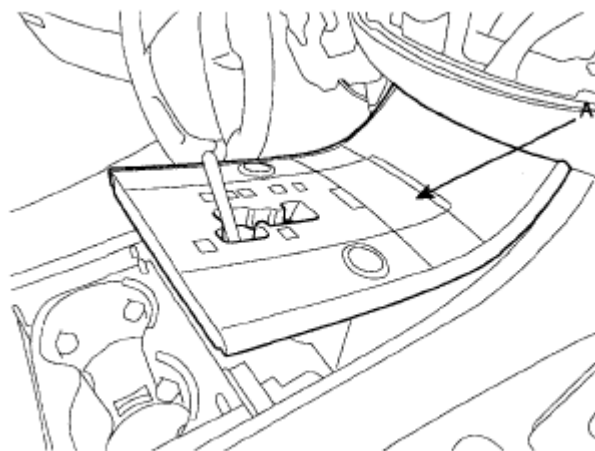
1. Remove the shift lever knob (A).



SENAT7042D

Fig. 217: Identifying Shift Lever Knob
Courtesy of HYUNDAI MOTOR CO.

2. Remove the center console cover (A).



SENAT7043D

Fig. 218: Identifying Center Console Cover
Courtesy of HYUNDAI MOTOR CO.

3. Remove the center console, (refer to **CONSOLE**)
4. Remove the shift cable assembly (C) by removing the clamp (A) and the snap pin (B).

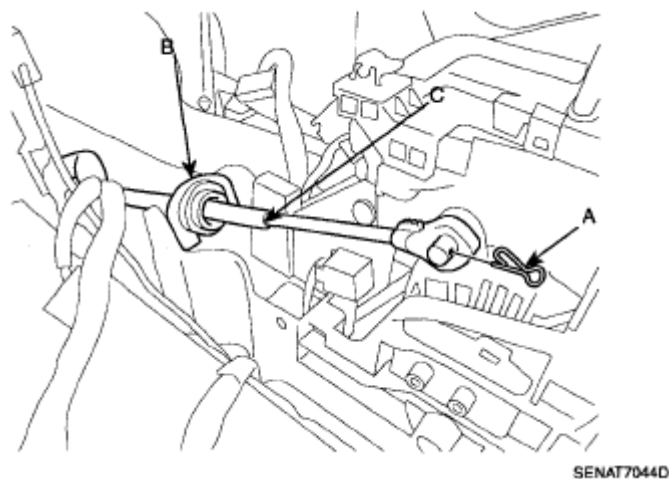


Fig. 219: Identifying Shift Cable Assembly And Snap Pin
Courtesy of HYUNDAI MOTOR CO.

5. Disconnect the interlock switch connector (A).

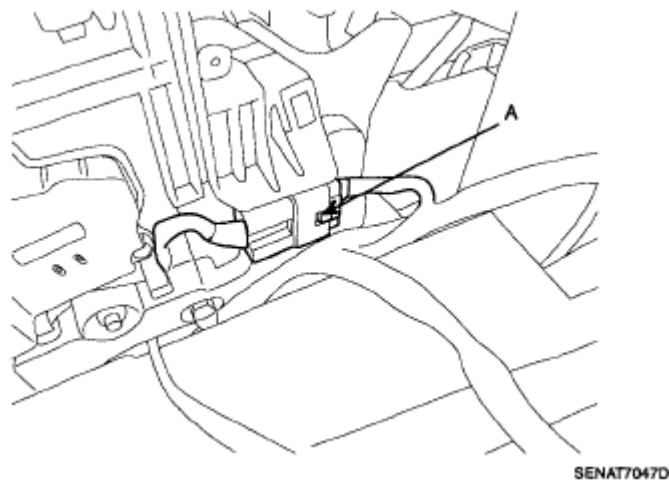


Fig. 220: Identifying Interlock Switch Connector
Courtesy of HYUNDAI MOTOR CO.

6. Remove the shift lever assembly (A).

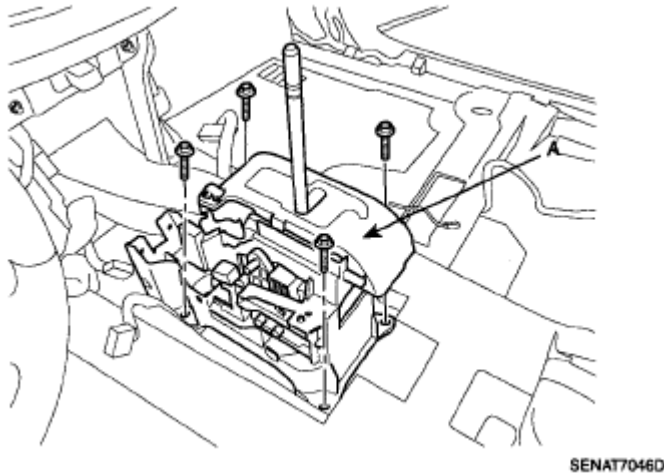


Fig. 221: Identifying Shift Lever Assembly
Courtesy of HYUNDAI MOTOR CO.

7. Remove the retainer (A) and nuts (B).

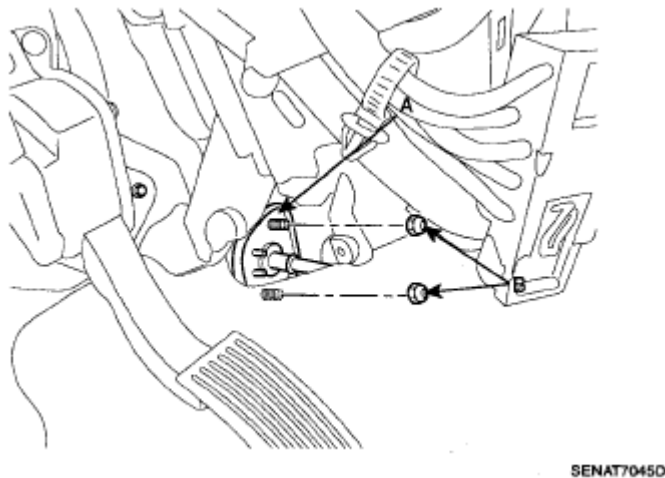


Fig. 222: Identifying Retainer And Nuts
Courtesy of HYUNDAI MOTOR CO.

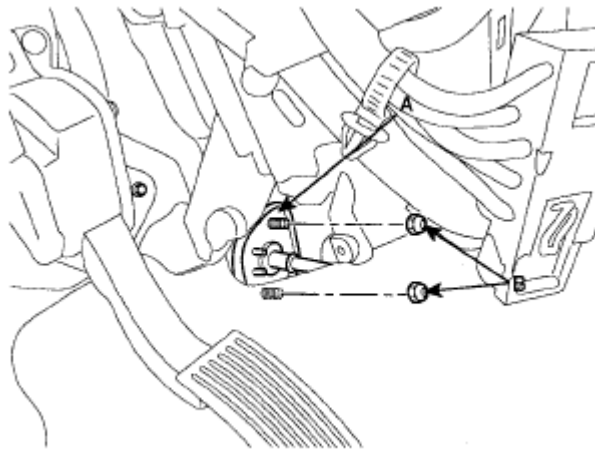
NOTE: In case, remove the crash pad and cowl cross bar. (refer to CRASH PAD and HEATER UNIT)

8. Remove the shift cable assembly from the transaxle. (refer to AUTOMATIC TRANSAXLE'S REMOVAL)
9. Remove the shift cable assembly.

INSTALLATION

1. Install the retainer (A) and nuts (B).

TORQUE : 12-15 Nm (1.2-1.5 kgf.m, 8.7-10.8 lb-ft)



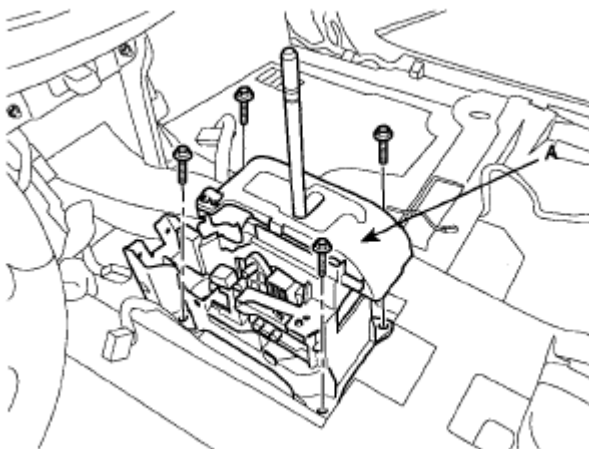
SENAT7045D

Fig. 223: Identifying Retainer And Nuts
Courtesy of HYUNDAI MOTOR CO.

NOTE: In case, install the crash pad and cowl cross bar. (refer to CRASH PAD and HEATER UNIT)

2. Install the shift lever assembly (A).

TORQUE : 9-14 Nm (0.9-1.4kgf.m, 6.5-10.1 lb-ft)



SENAT7046D

Fig. 224: Identifying Shift Lever Assembly
Courtesy of HYUNDAI MOTOR CO.

3. Connect the interlock switch connector (A).

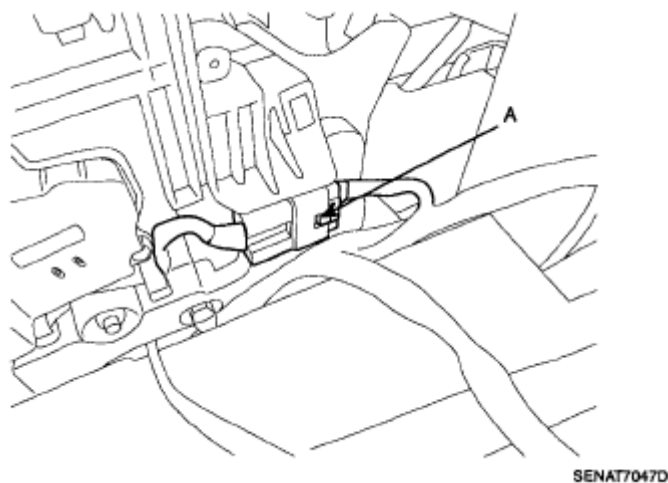


Fig. 225: Identifying Interlock Switch Connector
Courtesy of HYUNDAI MOTOR CO.

4. Install the shift cable assembly (C) by installing the clamp (A) and the snap pin (B).

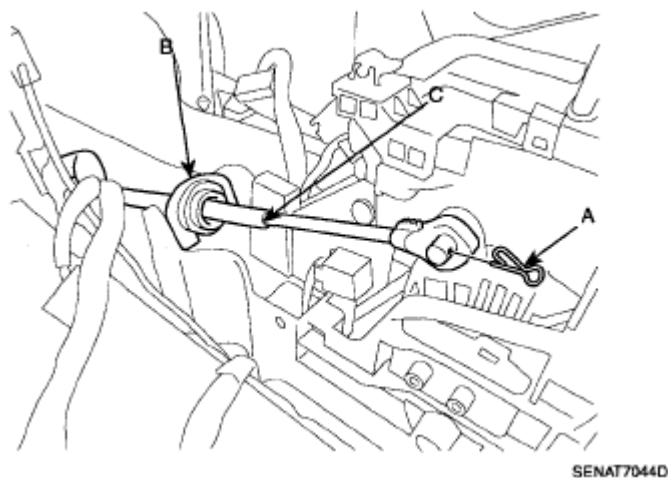


Fig. 226: Identifying Shift Cable Assembly And Snap Pin
Courtesy of HYUNDAI MOTOR CO.

5. Install the center console, (refer to **CONSOLE**)
6. Install the center console cover (A).

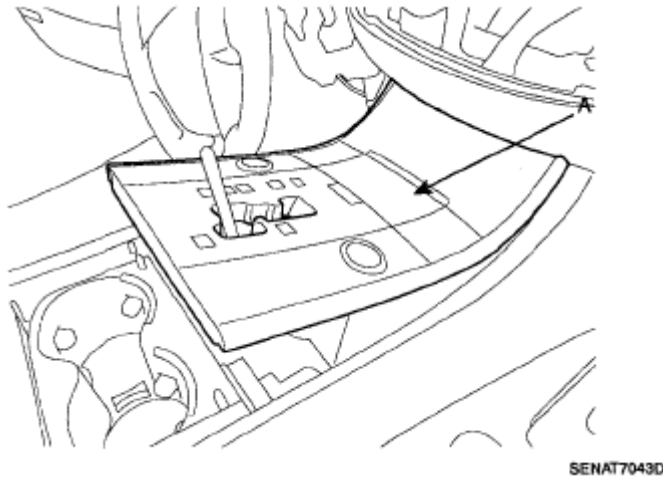


Fig. 227: Identifying Center Console Cover
Courtesy of HYUNDAI MOTOR CO.

7. Install the shift lever knob (A).

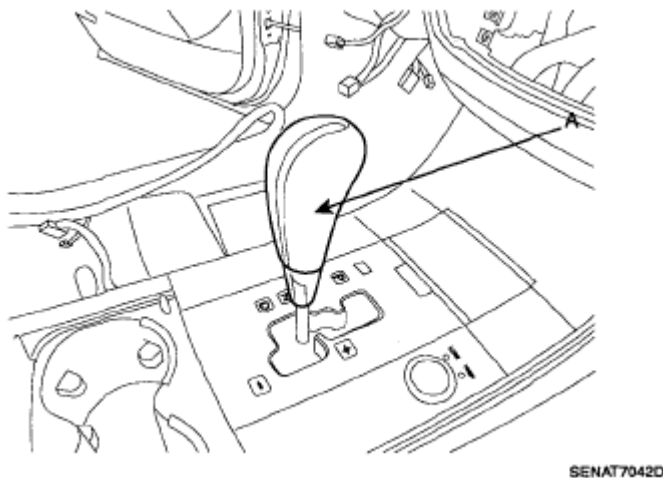


Fig. 228: Identifying Shift Lever Knob
Courtesy of HYUNDAI MOTOR CO.

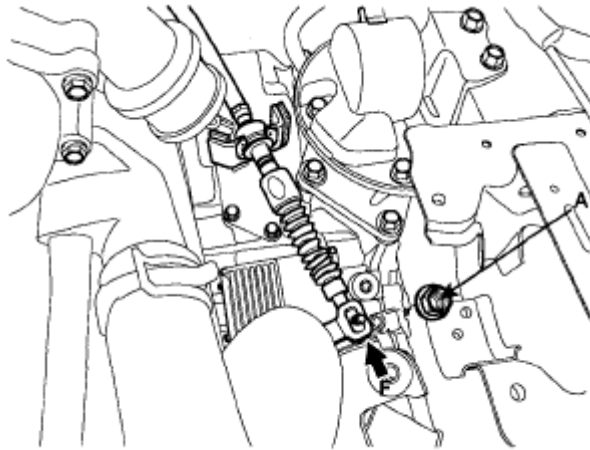
NOTE: Before completing installation, adjust the shift cable referring to **ADJUSTMENT**.

8. Install the shift cable assembly to transaxle. (refer to **INSTALLATION**)

ADJUSTMENT

ADJUSTING THE SHIFT CABLE

1. Set the room side lever and the manual lever to "N" position.
2. Push the shift cable lightly to "F" direction shown to eliminate the free play.



SENAT7048D

Fig. 229: Identifying Shift Cable And Nut
Courtesy of HYUNDAI MOTOR CO.

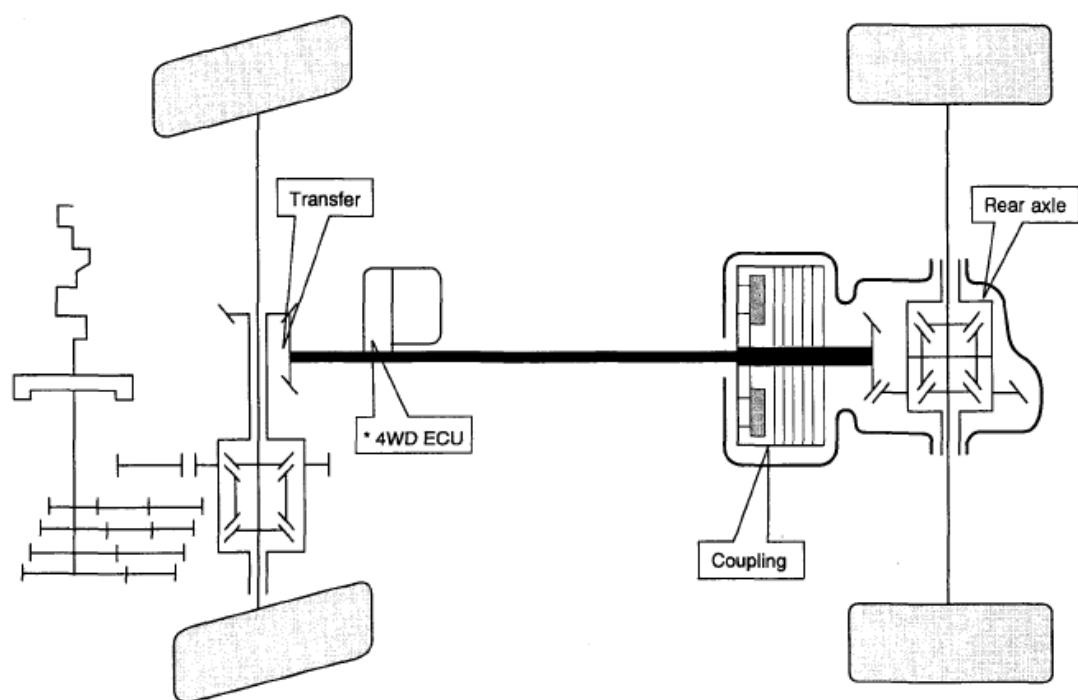
3. Tighten the adjusting nut (A).

TORQUE : 8-12 Nm (0.8-1.2 kgf.m, 5.8-8.7 lb-ft)

4. Check that this part operates surely at each range of the manual lever corresponding to each position of the room lever.

TRANSFER CASE ASSEMBLY

COMPONENT LOCATION



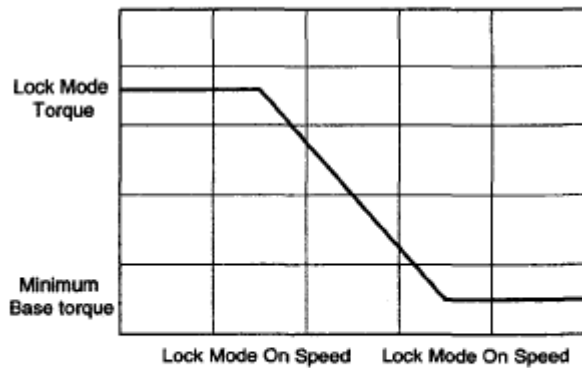
* 4WD ECU is located under a select lever bracket

SENMT7000N

Fig. 230: Identifying Transfer Case Assembly Component Location
Courtesy of HYUNDAI MOTOR CO.

DESCRIPTION

- Based on a driver request for lock mode, the system will supply a fixed torque to the ITCC (Intelligent Torque Controlled Couplings) clutch.
- When the vehicle exceeds 30KPH the system will begin to disable lock mode by ramping down the ITCC clutch torque. When the vehicle exceeds 40 KPH the ITCC clutch is reduced to its minimum torque value. Lock mode is re-enabled following the same speed-to-torque map.
- Lock mode is activated based on part number.



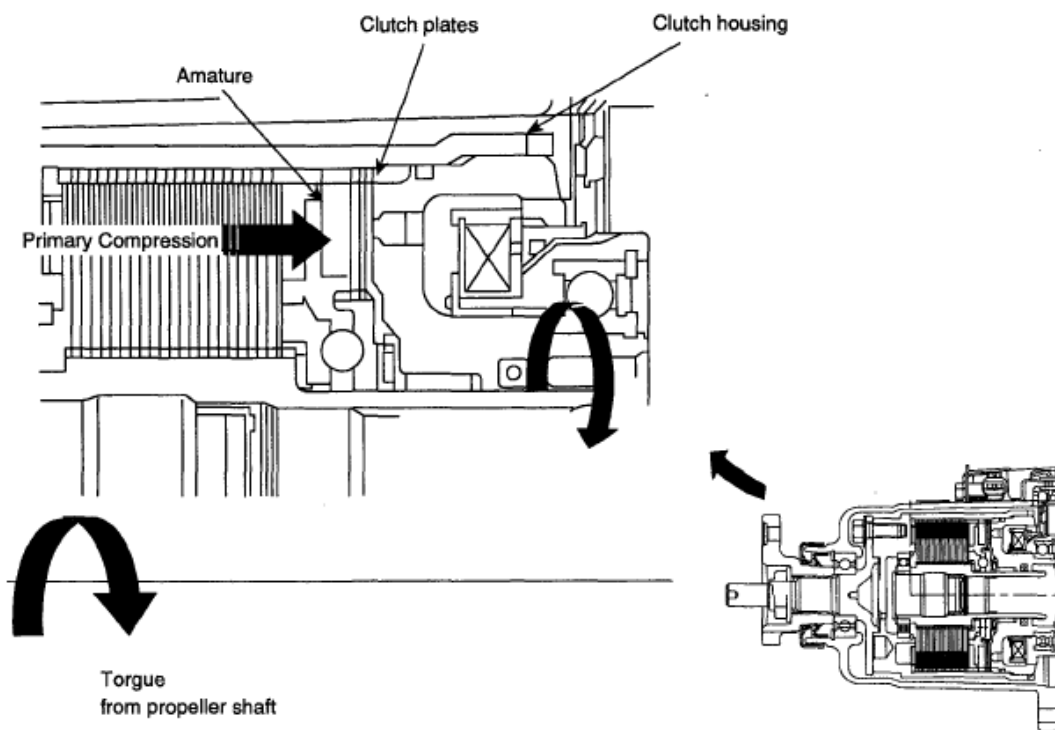
ELQE5011

Fig. 231: Lock Mode Speed Sensor Signal Graph
Courtesy of HYUNDAI MOTOR CO.

- Lock mode will override all other system requests except for during an ABS event. During an ABS event the ITCC clutch is turned off.
- If there is a speed sensor signal fault, the speeds are no longer considered reliable and lock mode will be disabled.

POWER FLOW MECHANISM

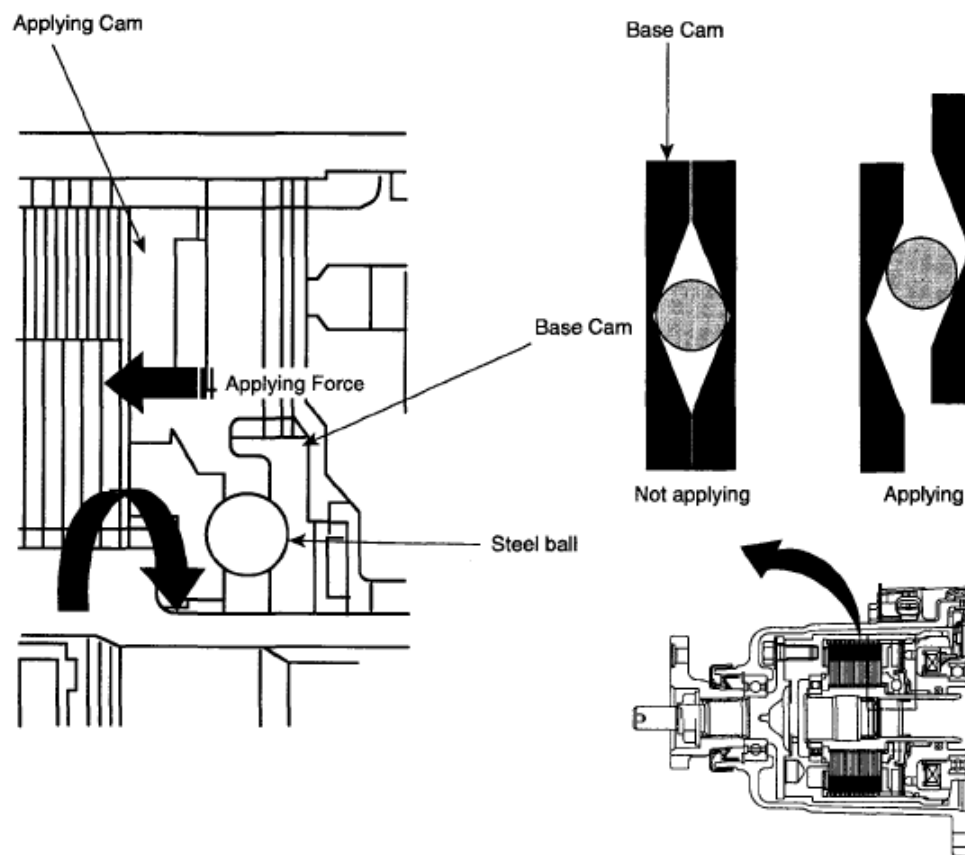
- Normal driving situation: 2WD base driving
 - 4WD driving in driving situations (rapid activation, cornering etc.)
1. Input the information from each sensor in vehicle
 - Input torque (Throttle position sensor)
 - Vehicle speed and different wheel speed front & rear (Wheel speed sensor)
 - Braking situation (Brake signal and ABS signal)
 2. Distributed the required driving force after 4WD ECU operates.
 3. ECU (Electric Control Unit) operates the primary clutch.



SENMT7000L

Fig. 232: Power Flow Mechanism For Driving Situation
 Courtesy of HYUNDAI MOTOR CO.

4. Control the cam's opening gap by operation of primary clutch.

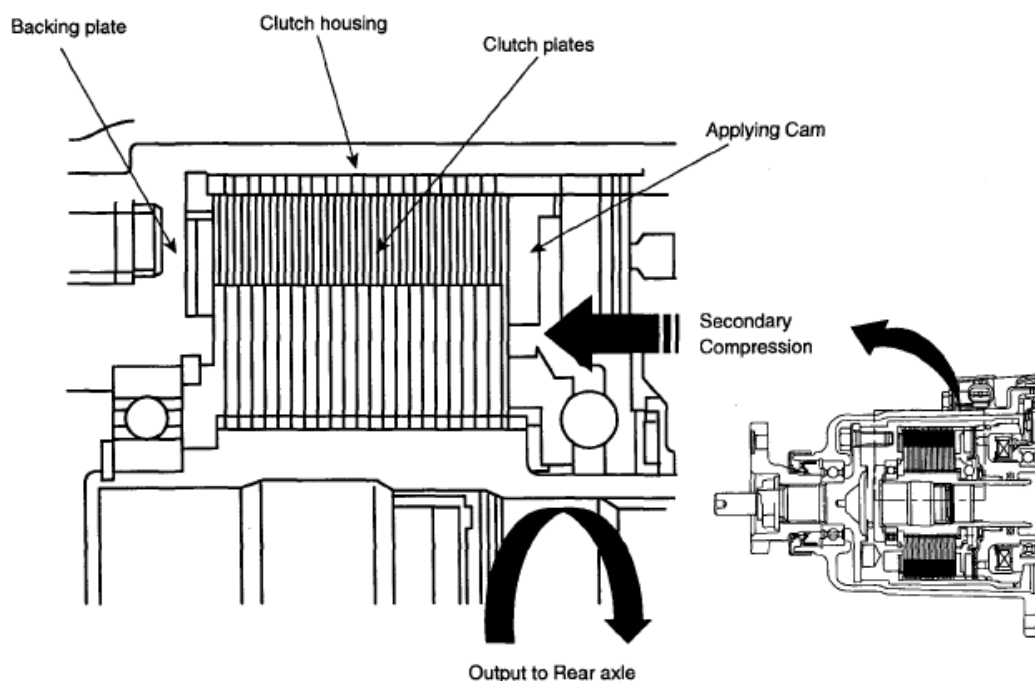


SENMT7001L

Fig. 233: Power Flow Mechanism For Primary Clutch
 Courtesy of HYUNDAI MOTOR CO.

5. Control the slip of inner & outer plate.

Control variably the driving force distribution to optimize front & rear driving force.



SENMT7002L

Fig. 234: Power Flow Mechanism For Control Variably Driving Force Distribution
 Courtesy of HYUNDAI MOTOR CO.

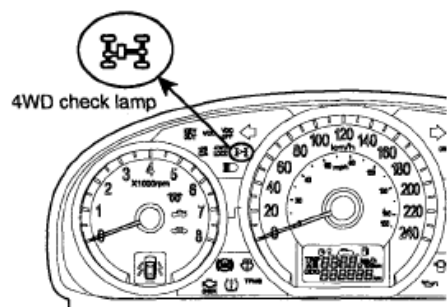
DTC TROUBLESHOOTING

4WD ECM DTC INDEX

4WD ECM DTC INDEX

No.	DTC No.	DESCRIPTION	4WD MIL
1	<u>P0605</u>	ECU EEPROM Error	•
2	<u>P1755</u>	EMC Over Current	•
3	<u>P1756</u>	EMC Internal Error	•
4	<u>P1757</u>	EMC PWM Out of Range	•
5	<u>U0001</u>	High Speed CAN Communication Bus (CAN Bus Off)	•
6	<u>U0100</u>	Lost Communication With ECM/PCM "A" (Accelerator Pedal Position signal error)	•
7	<u>U0121</u>	Lost Communication With Anti-Lock Brake System (ABS) Control	•

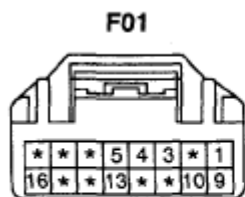
		Module (wheel speed signal error)	
8	U0122	Lost Communication With Vehicle Dynamics Control Module (Wheel speed signal error)	•



SENMT7003L

Fig. 235: Identifying 4WD Check Lamp
Courtesy of HYUNDAI MOTOR CO.

4WD ECM PIN DESCRIPTION



EENS075278D

Fig. 236: Identifying F01 Connector Terminals
Courtesy of HYUNDAI MOTOR CO.

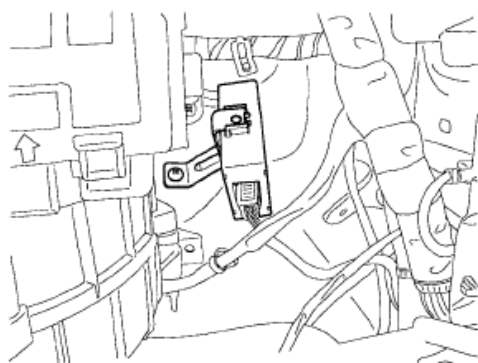
4WD ECM PIN DESCRIPTION

Terminal Number	Description	Remark
1	EMC (+)	
2	-	
3	Battery	
4	ON/START	
5	CAN HIGH	
6	-	
7	-	
8	-	
9	EMC (-)	

10	Ground	
11	-	
12	-	
13	CAN LOW	
14	-	
15	-	
16	Lock mode switch	

DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

COMPONENT LOCATION



SENMT7100D

Fig. 237: Identifying Internal Control Module
Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

ITCC (Intelligent Torque Control Coupling) 4WD:

Though CAN communication, ECM and TCM hold engine RPM, APS, step of transmission, decreasing of torque in common and perform the active control. ITCC system has 4WD-LOCK function that can make driving force to 50:50 by compulsion according to driver's intention.

DTC DESCRIPTION

This DTC is set when inappropriate 4WD-ECM is detected (EEPROM checksum). If failure is detected "4WD-ECM" prohibits the "ITCC" control and vehicle is controlled with 2WD by intercepting EMC current.

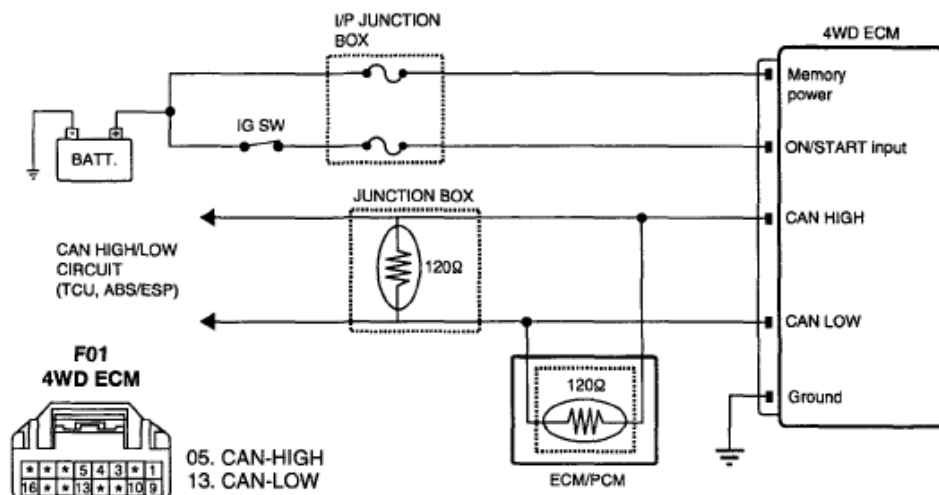
DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible Cause
DTC Strategy	EEPROM Error	Connector looseness and poor

Threshold Value	Can't read from EEPROM, can't write to EEPROM. Maintained 3 times.	terminal to wire connection.
Fail Safe	Change into 2WD mode.	Faulty 4WD-ECM.

SCHEMATIC DIAGRAM



SENMT7200L

Fig. 238: Transfer Case Assembly Schematic Diagram
 Courtesy of HYUNDAI MOTOR CO.

SIGNAL WAVEFORM AND DATA

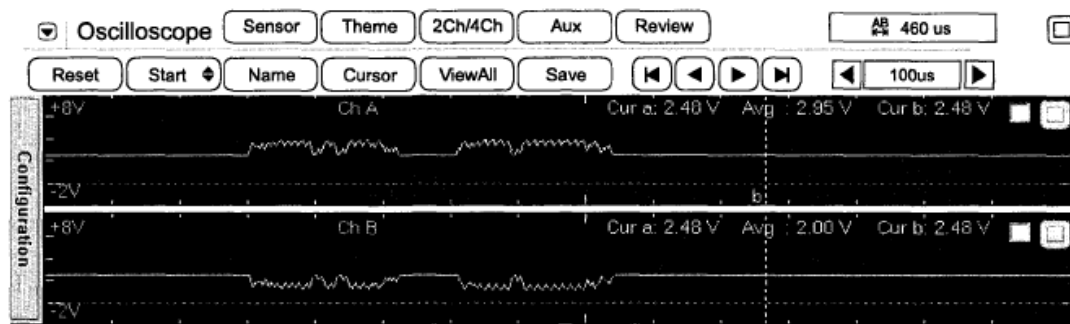


FIG.1) CAN Signal : high & low

SENMT7200N

Fig. 239: Signal Waveform And Data
 Courtesy of HYUNDAI MOTOR CO.

FIG.1) CAN Signal: high & low

MONITOR DTC STATUS

1. Connect scantool to Data Link Connector (DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor DTC (Diagnostics Trouble Code) on the scantool.

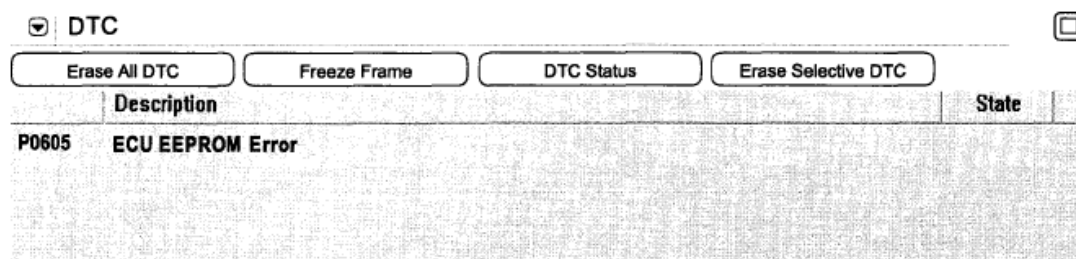


Fig. 240: Identifying Monitor Diagnostics Trouble Code On Scantool
 Courtesy of HYUNDAI MOTOR CO.

4. Is the same DTC displayed again?

YES:

- Substitute with a known-good "4WD-ECM" and check for proper operation. If the problem is corrected, replace "4WD-ECM" and then go to "VERIFICATION OF VEHICLE REPAIR" procedure.

NO:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "VERIFICATION OF VEHICLE REPAIR" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

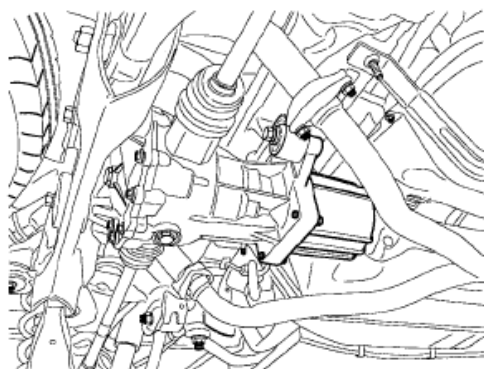
- Go to the APPLICABLE TROUBLESHOOTING PROCEDURE.

NO:

- System is performing to specification at this time.

DTC P1755 EMC OVER CURRENT

COMPONENT LOCATION



SENMT7103D

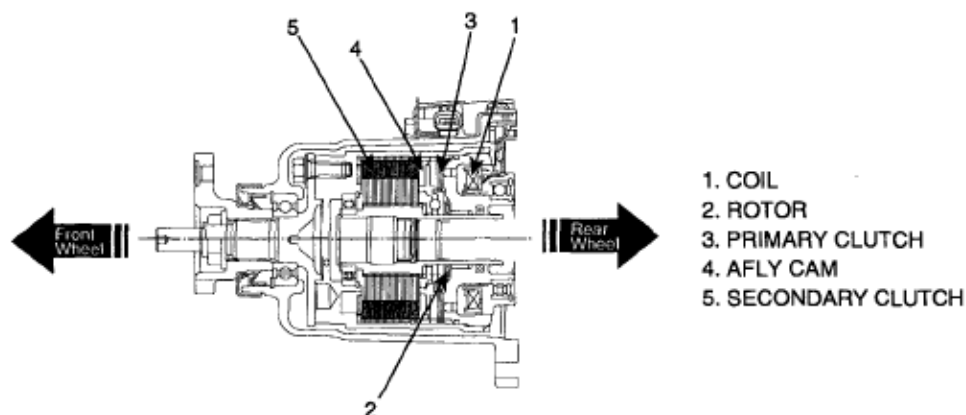
Fig. 241: Identifying Electric Magnetic Clutch
Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

ITCC (Intelligent Torque Control Coupling) 4WD:

Vehicle uses 2WD (2 wheel drive) for driving at normal speed, but sometimes it uses 4WD (4 wheel drive) according to driving condition, (cornering or acceleration)

EMC (Electric Magnetic Clutch) distributes proper torque to front wheel by controlling amount of current inside EMC coil. That time power pressing the multi plate clutch by apply cam is changed by a rate of EMC duty, after multi plate clutch start slip the force for acceleration at front/rear wheel is controlled at a range of 100:0 ~ 50 : 50.



SENMT7201L

Fig. 242: Identifying Electric Magnetic Clutch Function
Courtesy of HYUNDAI MOTOR CO.

DTC DESCRIPTION

This DTC is related to the EMC and is set If control harness has an short or short to ground.

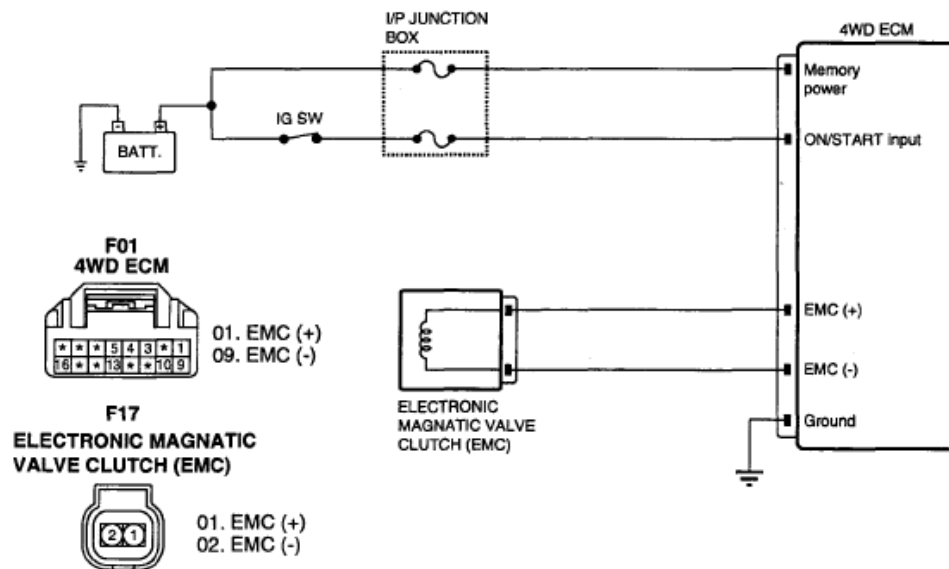
If failure is detected "4WD-ECM" prohibits the "ITCC" control and vehicle is controlled with 2WD by intercepting EMC current.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible Cause
DTC Strategy	• EMC Over Current	• Connector looseness and poor terminal to wire connection. • EMC circuit short/short to ground. • Faulty 4WD-ECM.
Threshold Value	• Supply voltage lowering flag not set (0), Coil current was more than 6A and maintained over 0.1 sec.	
Fail Safe	• Change into 2WD mode.	

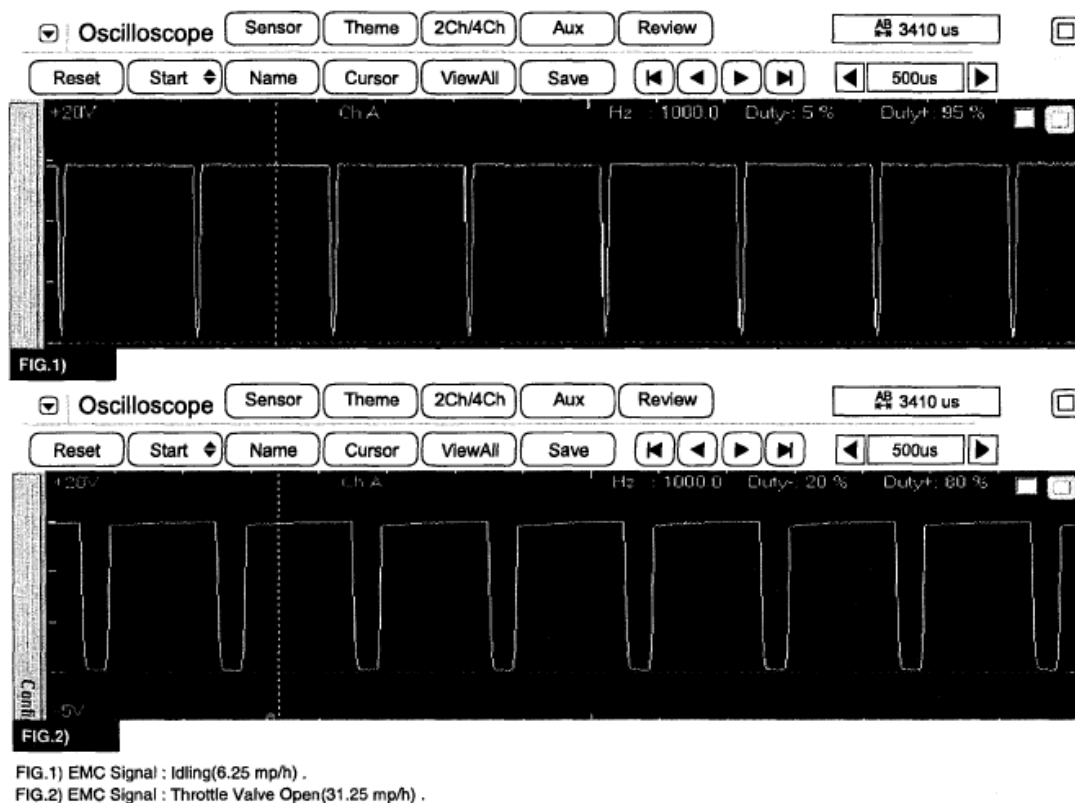
SCHEMATIC DIAGRAM



SENMT7202L

Fig. 243: Electric Magnetic Clutch Schematic Diagram
Courtesy of HYUNDAI MOTOR CO.

SIGNAL WAVEFORM AND DATA



SENMT7202N

Fig. 244: Electric Magnetic Clutch Signal Waveform And Data
Courtesy of HYUNDAI MOTOR CO.

MONITOR DTC STATUS

1. Connect scantool to Data Link Connector (DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor DTC (Diagnostics Trouble Code) on the scantool.

DTC		
Erase All DTC	Freeze Frame	DTC Status
Erase Selective DTC		
Description	State	
P1755 EMC Over Current		

SENMT7203N

Fig. 245: Identifying Monitor Diagnostics Trouble Code On Scantool
Courtesy of HYUNDAI MOTOR CO.

4. Is the same DTC displayed again?

YES:

- Go to Inspection/Repair procedure.

NO:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION-EMC (-)**" procedure.

SIGNAL CIRCUIT (+) INSPECTION**SIGNAL CIRCUIT INSPECTION-EMC (-)**

1. IG KEY: OFF.
2. 4WD ECM, EMC : Connect.
3. IG KEY : ON, Engine : ON.
4. Monitor signal waveform between EMC (-) terminal of 4WD-ECM harness connector and chassis ground.
5. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or less (6mph or less)

Specification : Signal Waveform & Data

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

6. Is "Signal display" near the specified value?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT GROUND SHORT INSPECTION-EMC (+)**" procedure.

GROUND CIRCUIT INSPECTION

SIGNAL CIRCUIT GROUND SHORT INSPECTION-EMC (+)

1. Ignition OFF.
2. 4WD ECM : Connect, EMC connector: Disconnect.
3. Measure resistance between EMC (+) terminal of EMC harness connector and chassis ground.

Specification : Infinity

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

4. Is "resistance" display near the specified value?

YES:

- Go to "**SIGNAL CIRCUIT SHORT INSPECTION-EMC (+,-)**" procedure.

NO:

- Check for short to ground in EMC harness.
- Repair as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

SIGNAL CIRCUIT SHORT INSPECTION-EMC (+,-)

1. Ignition OFF.
2. 4WD ECM : Connect, EMC : Disconnect.
3. Measure resistance between EMC (+) terminal of EMC harness connector and EMC (-) terminal of EMC harness connector.

Specification : Infinity

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

4. Is "resistance" display near the specified value?

YES:

- Go to "**COMPONENT INSPECTION**" procedure.

NO:

- Check for short in EMC harness.
- Repair as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION**CHECK EMC**

1. Ignition OFF.
2. 4WD ECM : Connect, EMC : Disconnect.
3. Measure resistance between EMC (+) terminal of EMC harness connector and EMC (-) terminal of EMC harness connector. (Component side)

Specification : Approx 1.8 ~ 2.2 ohms

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

4. Is "resistance" display near the specified value?

YES:

- Substitute with a known-good "4WD-ECM" and check for proper operation.

If the problem is corrected, replace "4WD-ECM" and then go to "**VERIFICATION OF VEHICLE**

REPAIR" procedure.

NO:

- Substitute with a known-good "EMC" and check for proper operation.

If the problem is corrected, replace "EMC" and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System is performing to specification at this time.

DTC P1756 EMC INTERNAL ERROR

COMPONENT LOCATION

Refer to **DTC P1755**.

GENERAL DESCRIPTION

Refer to **DTC P1755**.

DTC DESCRIPTION

Refer to **DTC P1755**.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible Cause
DTC Strategy	• EMC Internal Error	

Threshold Value	Supply voltage lowering flag not set (O), And No over current error. PWM DUTY?90% and Coil current?0.1A or PWM DUTY?10%and Coil current?3.0A	- Connector looseness and poor terminal to wire connection. - EMC circuit short to battery. - Faulty 4WD-ECM.
Fail Safe	Change into 2WD mode.	

SCHEMATIC DIAGRAM

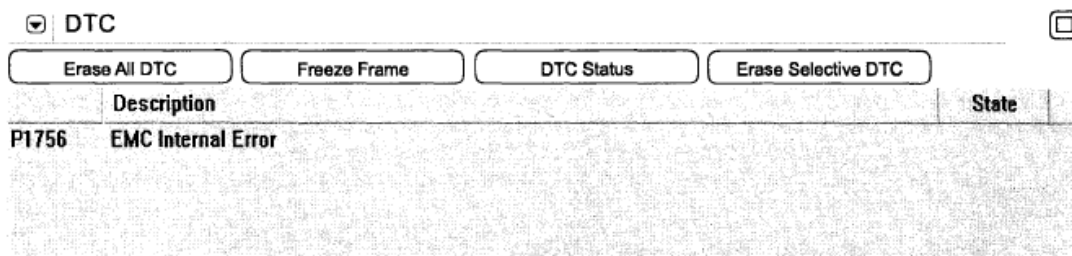
Refer to **DTC P1755**.

SIGNAL WAVEFORM AND DATA

Refer to **DTC P1755**.

MONITOR DTC STATUS

1. Connect scantool to Data Link Connector (DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor DTC (Diagnostics Trouble Code) on the scantool.



SENMT7204N

Fig. 246: Identifying Monitor Diagnostics Trouble Code On Scantool
Courtesy of HYUNDAI MOTOR CO.

4. Is the same DTC displayed again?

YES:

- Go to Inspection/Repair procedure.

NO:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination,

deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P1755**.

SIGNAL CIRCUIT (+) INSPECTION

SIGNAL CIRCUIT INSPECTION-EMC (-)

1. IG KEY: OFF.
2. 4WD ECM, EMC : Connect.
3. IG KEY : ON, Engine : ON.
4. Monitor signal waveform between EMC (-) terminal of 4WD-ECM harness connector and chassis ground.
5. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or less (6mph or less)

Specification : Signal Waveform & Data

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

6. Is "Signal display" near the specified value?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT BATTERY SHORT INSPECTION**" procedure.

POWER SUPPLY CIRCUIT INSPECTION

SIGNAL CIRCUIT BATTERY SHORT INSPECTION

1. Ignition OFF.

2. 4WD ECM : Connect, EMC : Disconnect.
3. Ignition "ON".
4. Measure voltage between EMC (+) terminal of EMC harness connector and chassis ground.

Specification : 1 V below

CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.

5. Is "voltage" display near the specified value?

YES:

- Go to "**SIGNAL CIRCUIT SHORT INSPECTION-EMC (+,-)**" procedure.

NO:

- Check for short to battery in EMC harness.
- Repair as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P1755**.

COMPONENT INSPECTION

Refer to **DTC P1755**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P1755**.

DTC P1757 EMC PWM OUT OF RANGE

COMPONENT LOCATION

Refer to **DTC P1755**.

GENERAL DESCRIPTION

Refer to **DTC P1755**.

DTC DESCRIPTION

Refer to **DTC P1755**.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible Cause
DTC Strategy	• EMC PWM Out of Range	• Connector looseness and poor terminal to wire connection. • EMC circuit open. • Faulty 4WD-ECM.
Threshold Value	• When an internal error detected on startup, it was maintained for more than one second.	
Fail Safe	• Change into 2WD mode.	

SCHEMATIC DIAGRAM

Refer to **DTC P1755**.

SIGNAL WAVEFORM AND DATA

Refer to **DTC P1755**.

MONITOR DTC STATUS

1. Connect scantool to Data Link Connector (DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor DTC (Diagnostics Trouble Code) on the scantool.

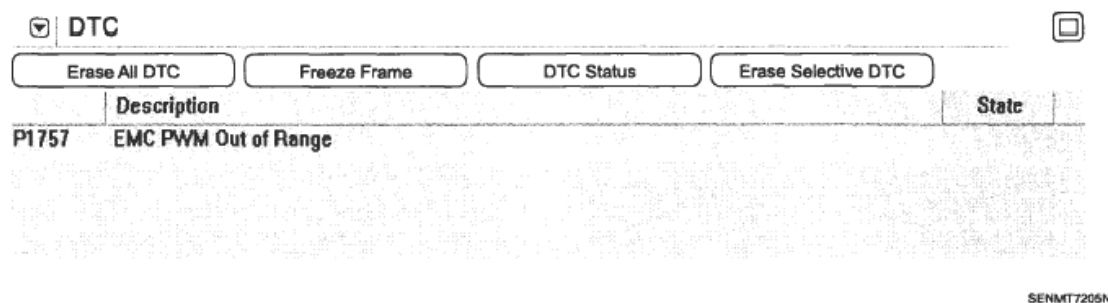


Fig. 247: Identifying Monitor Diagnostics Trouble Code On Scantool
 Courtesy of HYUNDAI MOTOR CO.

4. Is the same DTC displayed again?

YES:

- Go to Inspection/Repair procedure.

NO:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure

TERMINAL AND CONNECTOR INSPECTION

Refer to **DTC P1755**.

SIGNAL CIRCUIT (+) INSPECTION**SIGNAL CIRCUIT INSPECTION-EMC (-)**

1. IG KEY: OFF.
2. 4WD ECM, EMC : Connect.
3. IG KEY : ON, Engine : ON.
4. Monitor signal waveform between EMC (-) terminal of 4WD-ECM harness connector and chassis ground.
5. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or less (6mph or less)

Specification : Signal Waveform & Data

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

6. Is "Signal display" near the specified value?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT OPEN INSPECTION-EMC (+)**" procedure.

SIGNAL CIRCUIT OPEN INSPECTION-EMC (+)

1. Ignition OFF.
2. 4WD ECM, EMC connector: Disconnect.

3. Measure resistance between EMC (+) of EMC harness connector and EMC (+) of 4WD-ECM harness connector.

Specification : 1ohms below

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

4. Is "resistance" display near the specified value?

YES:

- Go to "**SIGNAL CIRCUIT OPEN INSPECTION-EMC (-)**" procedure.

NO:

- Check for open circuit of EMC (+) control harness.
- Repair as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT (-) INSPECTION

SIGNAL CIRCUIT OPEN INSPECTION-EMC (-)

1. Ignition OFF.
2. 4WD ECM, EMC connector: Disconnect.
3. Measure resistance between EMC (-) of EMC harness connector and EMC (-) of 4WD-ECM harness connector.

Specification : 1ohms below

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

4. Is "resistance" display near the specified value?

YES:

- Go to "**SIGNAL CIRCUIT SHORT INSPECTION-EMC (+,-)**" procedure.

NO:

- Check for open circuit of EMC (-) ground harness.
- Repair as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION**SIGNAL CIRCUIT SHORT INSPECTION-EMC (+,-)**

1. Ignition OFF.
2. 4WD ECM : Connect, EMC : Disconnect.
3. Measure resistance between EMC (+) terminal of EMC harness connector and EMC (-) terminal of EMC harness connector.

Specification : Infinity

CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.

4. Is "resistance" display near the specified value?

YES:

- Go to "**COMPONENT INSPECTION**" procedure

NO:

- Check for short in EMC harness.
- Repair as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

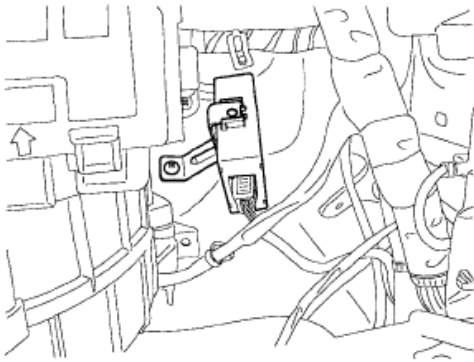
COMPONENT INSPECTION

Refer to **DTC P1755**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P1755**.

DTC U0001 CAN COMMUNICATION MALFUNCTION**COMPONENT LOCATION**



SENMT7100D

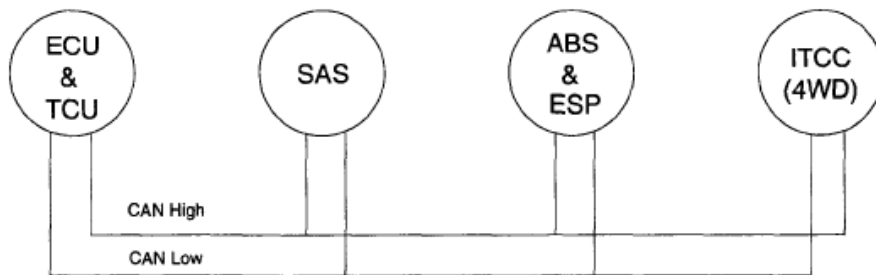
Fig. 248: [Identifying Can Communication System]
Courtesy of HYUNDAI MOTOR CO.

GENERAL DESCRIPTION

CAN communication is a parallel circuit to interchange information among each units.

CAN communication can share much information with units more faster and more efficiently by using specified language. CAN-High line is twisted with CAN-Low line as a purpose in preventing from a noise.

The operating duty of EMC is maintained at 100 : 0 (2WD) for guaranteeing stabilized driving force, accuracy of the control during inside ABS, FTCS, ESP control.



SENMT7207L

Fig. 249: Driving Force For ABS, FTCS, ESP Control
Courtesy of HYUNDAI MOTOR CO.

DTC DESCRIPTION

This code related to communication line between ECM (PCM, ABS, ESP) and "4WD-ECM" is set when CAN signal from ECM (PCM, ABS, ESP) can't received for more than 1sec or ECU internal error occur.

If failure is detected "4WD-ECM" prohibits the "ITCC" control and cuts the current to control coil.

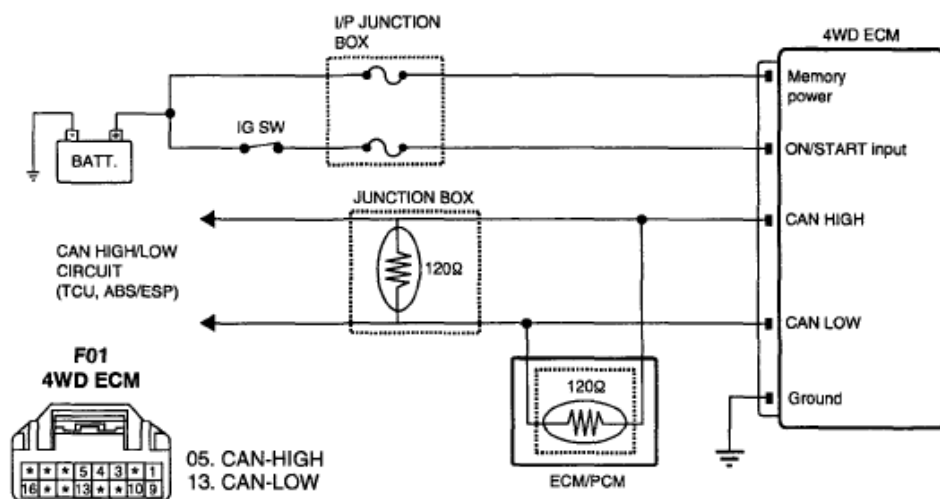
DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible Cause
------	---------------------	----------------

DTC Strategy	CAN Bus Off	- Connector looseness and poor terminal to wire connection. - CAN HIGH/LOW circuit open/short. - Faulty CAN MODULE. - Faulty 4WD-ECM.
Threshold Value	CAN Transmit counter exceeds 255 will reset CAN module, (reset cycle 1 sec)	
Fail Safe	Change into 2WD mode.	

SCHEMATIC DIAGRAM



SENMT7200L

Fig. 250: CAN Communication System Schematic Diagram
Courtesy of HYUNDAI MOTOR CO.

SIGNAL WAVEFORM & DATA

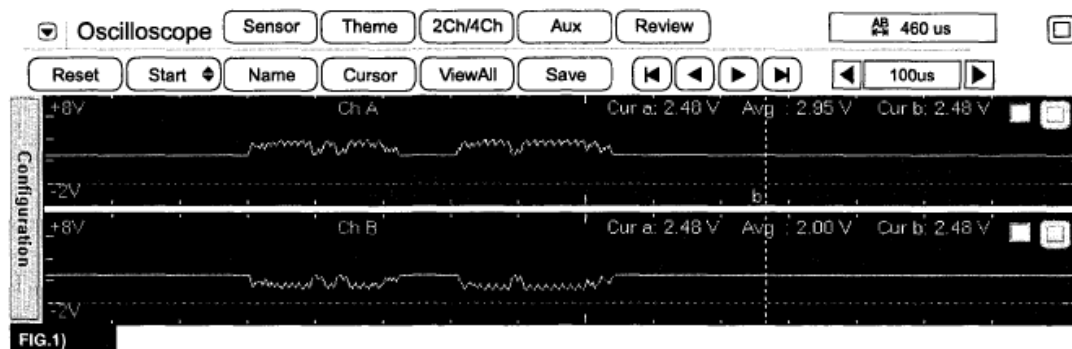


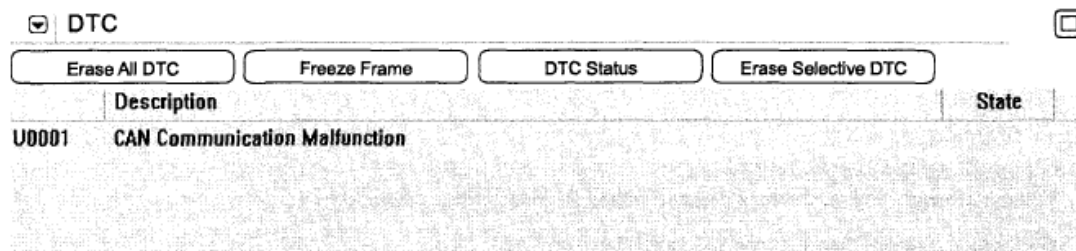
FIG.1) CAN Signal : high & low

SENMT7200N

Fig. 251: CAN Communication System Signal Waveform And Data
Courtesy of HYUNDAI MOTOR CO.

MONITOR DTC STATUS

1. Connect scantool to Data Link Connector (DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor DTC (Diagnostics Trouble Code) on the scantool.



SENMT7206N

Fig. 252: Identifying Monitor Diagnostics Trouble Code On Scantool
 Courtesy of HYUNDAI MOTOR CO.

4. Is the same DTC displayed again?

YES:

- Go to Inspection/Repair procedure.

NO:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**CAN COMM, LINE INSPECTION (OPEN/SHORT)**" procedure.

CONTROL CIRCUIT INSPECTION**CAN COMM, LINE INSPECTION (OPEN/SHORT)**

1. Ignition OFF.
2. 4WD ECM : Disconnect.
3. Measure resistance between CAN (HIGH) terminal of 4WD ECM harness connector and CAN (LOW) terminal of 4WD ECM harness connector.

Specification : Approx. 60ohms

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

4. Is "resistance" display near the specified value?

YES:

- Fault is intermittent caused by open or short in CAN signal harness or was repaired and "4WD-ECM" memory was not cleared.

Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- Check for open or short in TCCU communication circuit.
- Check PCM, ABS, ESP or their signal.
- Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES:

- Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- System is performing to specification at this time.

DTC U0100 FAULTS IN CAN A TRANSMIT MESSAGES**COMPONENT LOCATION**

Refer to **DTC U0001**.

GENERAL DESCRIPTION

Refer to **DTC U0001**.

DTC DESCRIPTION

This code related to communication line between ECM (PCM) and "4WD-ECM" is set when CAN signal from ECM (PCM) can't received for more than 1sec or ECU internal error occur.

If failure is detected "4WD-ECM" prohibits the "ITCC" control and cuts the current to control coil.

DTC DETECTING CONDITION**DTC DETECTING CONDITION AND POSSIBLE CAUSE**

Item	Detecting Condition	Possible Cause
DTC Strategy	• Accelerator Pedal Position Signal error	• Connector looseness and poor terminal to wire connection. • CAN HIGH/LOW circuit open/short. • Faulty CAN MODULE. (ECM/PCM) • Faulty 4WD-ECM.
Threshold Value	• Condition1: Accelerator Pedal Position signal receiving value is invalid (over 99.603%), and maintained over 0.5 sec. • Conditon2: Data can't be received in 0.5 sec.	
Fail Safe	• Change into 2WD mode.	

SCHEMATIC DIAGRAM

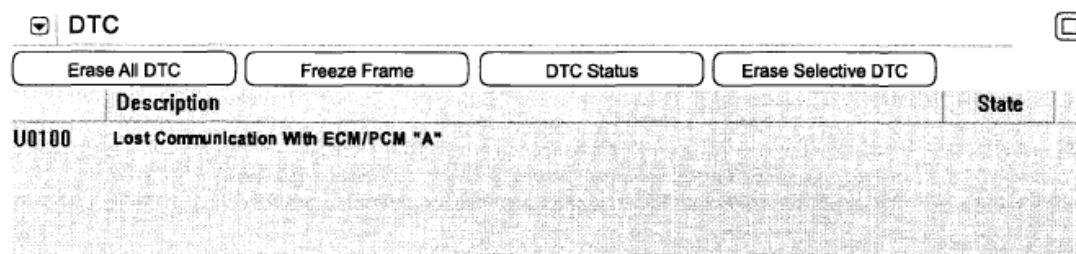
Refer to **DTC U0001**.

SIGNAL WAVEFORM & DATA

Refer to **DTC U0001**.

MONITOR DTC STATUS

1. Connect scantool to Data Link Connector (DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor DTC (Diagnostics Trouble Code) on the scantool.



SENMT7207N

Fig. 253: Identifying Monitor Diagnostics Trouble Code On Scantool
 Courtesy of HYUNDAI MOTOR CO.

4. Is the same DTC displayed again?

YES:

- Go to Inspection/Repair procedure.

NO:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION-CAN**" procedure.

SIGNAL CIRCUIT INSPECTION

SIGNAL CIRCUIT INSPECTION-CAN

1. IG KEY: OFF.
2. 4WD ECM, EMC connector: Connect.
3. IG KEY : ON, Engine : ON.
4. Monitor signal waveform between CAN (HIGH, LOW) of "4WD-ECM" harness connector and chassis ground.
5. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or less (6mph or less)

Specification : Signal Waveform & Data

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

6. Is "Signal display" near the specified value?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**CAN COMM, LINE INSPECTION (OPEN/SHORT)**" procedure.

CONTROL CIRCUIT INSPECTION

CAN COMM, LINE INSPECTION (OPEN/SHORT)

1. Ignition OFF.
2. 4WD ECM : Disconnect.
3. Measure resistance between CAN (HIGH) terminal of 4WD ECM harness connector and CAN (LOW) terminal of 4WD ECM harness connector.

Specification : Approx. 60ohms

CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.

4. Is "resistance" display near the specified value?

YES:

- Fault is intermittent caused by open or short in CAN signal harness or was repaired and "4WD-ECM" memory was not cleared.

Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- Check for open or short in TCCU communication circuit.
- Check ECM/PCM or their signal.
- Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC U0001**.

DTC U0121 CAN COMMUNICATION MALFUNCTION (ECM/PCM - ABS)

COMPONENT LOCATION

Refer to **DTC U0001**.

GENERAL DESCRIPTION

Refer to **DTC U0001**.

DTC DESCRIPTION

This code related to communication line between HECU (ABS) and "4WD-ECM" is set when CAN signal from HECU (ABS) can't received for more than 1sec or ECU internal error occur.

If failure is detected "4WD-ECM" prohibits the "ITCC" control and cuts the current to control coil.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible Cause

DTC Strategy	Wheel Speed Signal error	- Connector looseness and poor terminal to wire connection. - CAN HIGH/LOW circuit open/short. - Faulty CAN MODULE. (ABS) - Faulty 4WD-ECM.
Threshold Value	Condition1: Wheel speed signal value is invalid (over 511.875km/h), and maintained over 0.5 sec. (over 99.603%), and maintained over 0.5 sec. Conditon2: Data can' t be received in 0.5 sec. Condition3: No receiving of data for 0.5 sec after ignition is turned ON.	
Fail Safe	Change into 2WD mode.	

SCHEMATIC DIAGRAM

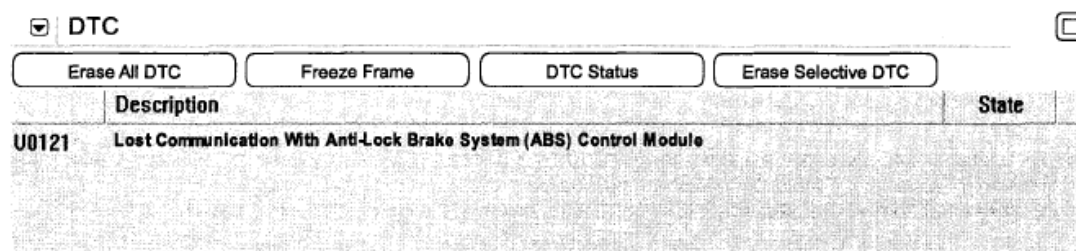
Refer to **DTC U0001**.

SIGNAL WAVEFORM & DATA

Refer to **DTC U0001**.

MONITOR DTC STATUS

1. Connect scantool to Data Link Connector (DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor DTC (Diagnostics Trouble Code) on the scantool.



SENMT7208N

Fig. 254: Identifying Monitor Diagnostics Trouble Code On Scantool
Courtesy of HYUNDAI MOTOR CO.

4. Is the same DTC displayed again?

YES:

- Go to Inspection/Repair procedure.

NO:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION-CAN**" procedure.

SIGNAL CIRCUIT INSPECTION

SIGNAL CIRCUIT INSPECTION-CAN

1. IG KEY : OFF.
2. 4WD ECM, EMC connector: Connect.
3. IG KEY : ON, Engine : ON.
4. Monitor signal waveform between CAN (HIGH, LOW) of "4WD-ECM" harness connector and chassis ground.
5. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or less (6mph or less)

Specification : Signal Waveform & Data

CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.

6. Is "Signal display" near the specified value?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**CAN COMM, LINE INSPECTION (OPEN/SHORT)**" procedure.

CONTROL CIRCUIT INSPECTION**CAN COMM, LINE INSPECTION (OPEN/SHORT)**

1. Ignition OFF.
2. 4WD ECM : Disconnect.
3. Measure resistance between CAN (HIGH) terminal of 4WD ECM harness connector and CAN (LOW) terminal of 4WD ECM harness connector.

Specification : Approx. 60ohms

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

4. Is "resistance" display near the specified value?

YES:

- Fault is intermittent caused by open or short in CAN signal harness or was repaired and "4WD-ECM" memory was not cleared.

Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

- Check for open or short in TCCU communication circuit.
- Check HECU (ABS) or their signal.
- Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC U0001**.

DTC U0122 CAN COMMUNICATION MALFUNCTION (ECM/PCM - VDC)

COMPONENT LOCATION

Refer to **DTC U0001**.

GENERAL DESCRIPTION

Refer to **DTC U0001**.

DTC DESCRIPTION

This code related to communication line between HECU (ESP) and "4WD-ECM" is set when CAN signal from HECU (ESP) can't received for more than 1sec or ECU internal error occur.

If failure is detected "4WD-ECM" prohibits the "ITCC" control and cuts the current to control coil.

DTC DETECTING CONDITION

DTC DETECTING CONDITION AND POSSIBLE CAUSE

Item	Detecting Condition	Possible Cause
DTC Strategy	Wheel Speed Signal error	- Connector looseness and poor terminal to wire connection. - CAN HIGH/LOW circuit open/short. - Faulty CAN MODULE. (ESP) - Faulty 4WD-ECM.
Threshold Value	- Conditions Wheel speed signal value is invalid (over 511.875km/h), and maintained over 0.5 sec. (over 99.603%), and maintained over 0.5 sec. - Conditon2: Data can' t be received in 0.5 sec. - Condition3: No receiving of data for 0.5 sec after ignition is turned ON.	
Fail Safe	Change into 2WD mode.	

SCHEMATIC DIAGRAM

Refer to **DTC U0001**.

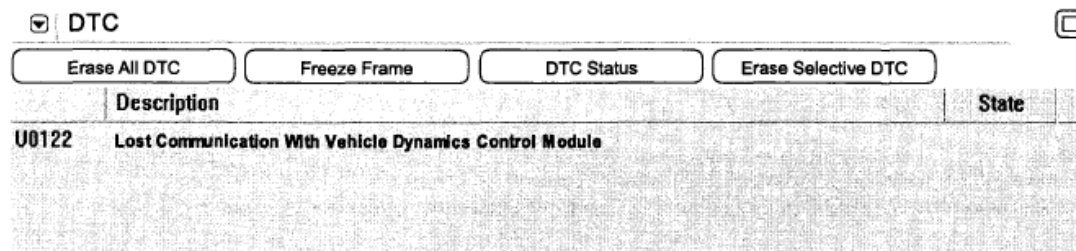
SIGNAL WAVEFORM & DATA

Refer to **DTC U0001**.

MONITOR DTC STATUS

1. Connect scantool to Data Link Connector (DLC).

2. Warm up the engine to normal operating temperature.
3. Monitor DTC (Diagnostics Trouble Code) on the scantool.



SENMT7209N

Fig. 255: Identifying Monitor Diagnostics Trouble Code On Scantool
 Courtesy of HYUNDAI MOTOR CO.

4. Is the same DTC displayed again?

YES:

- Go to Inspection/Repair procedure.

NO:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES:

- Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**SIGNAL CIRCUIT INSPECTION-CAN**" procedure.

SIGNAL CIRCUIT INSPECTION

SIGNAL CIRCUIT INSPECTION-CAN

1. IG KEY : OFF.
2. 4WD ECM, EMC connector: Connect.
3. IG KEY : ON, Engine : ON.
4. Monitor signal waveform between CAN (HIGH, LOW) of "4WD-ECM" harness connector and chassis ground.
5. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or less (6mph or less)

Specification : Signal Waveform & Data

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

6. Is "Signal display" near the specified value?

YES:

- Fault is intermittent caused by poor contact in the sensor's and/or "4WD-ECM"s connector or was repaired and "4WD-ECM" memory was not cleared.

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO:

- Go to "**CAN COMM, LINE INSPECTION (OPEN/SHORT)**" procedure.

CONTROL CIRCUIT INSPECTION

CAN COMM, LINE INSPECTION (OPEN/SHORT)

1. Ignition OFF.
2. 4WD ECM : Disconnect.
3. Measure resistance between CAN (HIGH) terminal of 4WD ECM harness connector and CAN (LOW) terminal of 4WD ECM harness connector.

Specification : Approx. 60ohms

**CAUTION: The above value is only for reference.
The actual value may differ from it according to various engine condition.**

4. Is "resistance" display near the specified value?

YES:

- Fault is intermittent caused by open or short in CAN signal harness or was repaired and "4WD-ECM" memory was not cleared.

Go to the **APPLICABLE TROUBLESHOOTING PROCEDURE**.

NO:

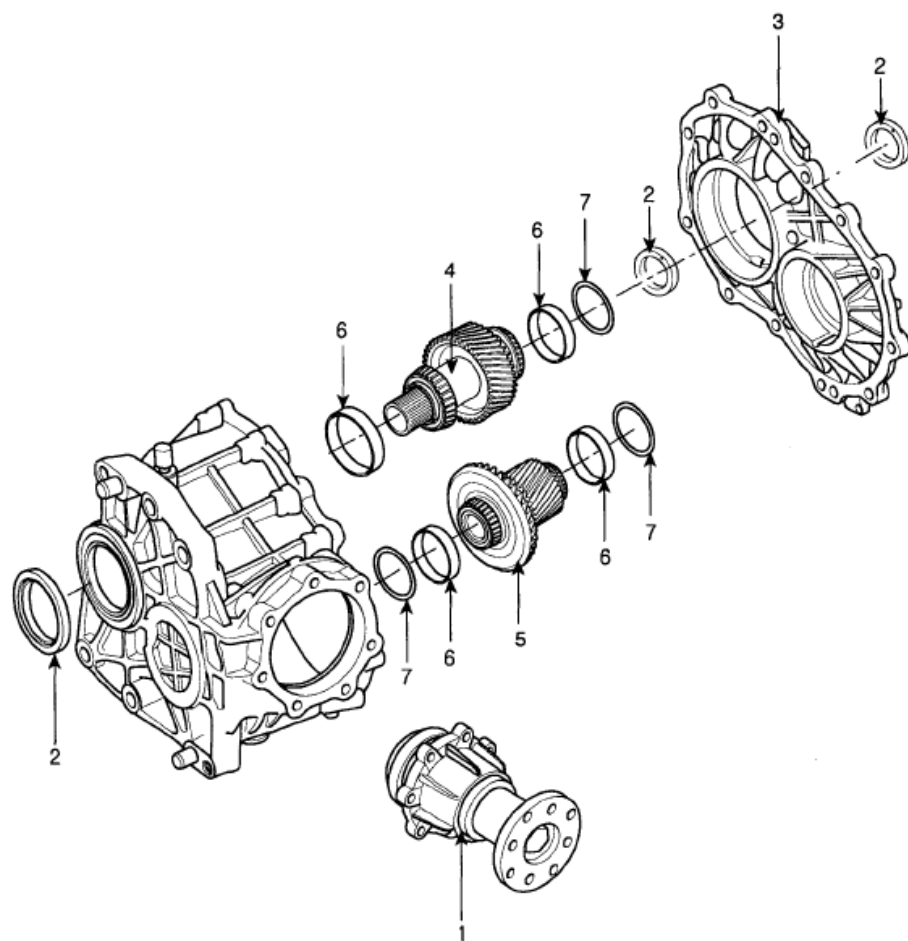
- Check for open or short in TCCU communication circuit.
- Check HECU (ESP) or their signal.
- Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC U0001**.

TRANSFER CASE

COMPONENTS



- 1. Pinion assembly
- 2. Oil seal
- 3. Transfer cover

- 4. Transfer drive gear assembly
- 5. Hypoid gear shaft assembly
- 6. Bearing outer race
- 7. Spacer

SCMMT6021L

Fig. 256: Identifying Transfer Case Components
Courtesy of HYUNDAI MOTOR CO.

BASIC INSPECTION

TRANSFER OIL INSPECTION

Check and refill the transfer oil every 24 months.

TRANSFER OIL REPLACEMENT

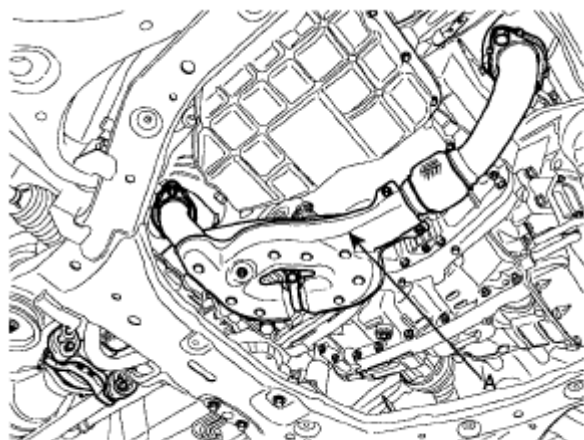
1. Replace the oil every 120,000km (74,564 miles) in a general condition and every 45,000km (27,962 miles) in severe usage conditions.

NOTE: Severe usage is defined as

- a. Frequent driving on rough road (Bumpy road, gravel road, snowy road, unpaved road. Etc.)
- b. Frequent driving on mountain road, ascent/descent.
- c. Police, taxi, commercial type operation or trailer towing. Etc.)

REMOVAL

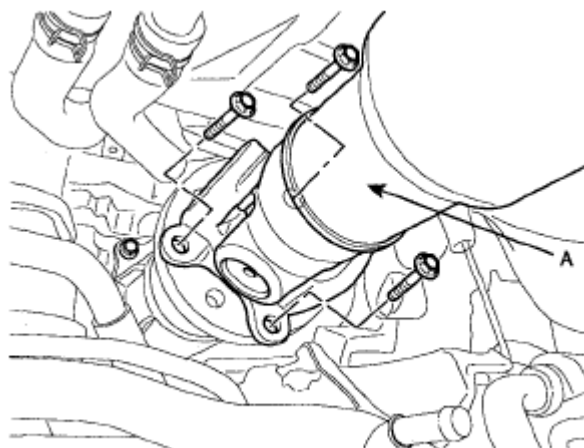
1. Disconnect the (-) terminal from the battery.
2. Lift up the vehicle.
3. Remove the front muffler (A), (refer to **INTAKE AND EXHAUST SYSTEM**)



SENMT7202D

Fig. 257: Identifying Front Muffler
Courtesy of HYUNDAI MOTOR CO.

4. Disconnect the propeller shaft (A) by removing the three bolts.

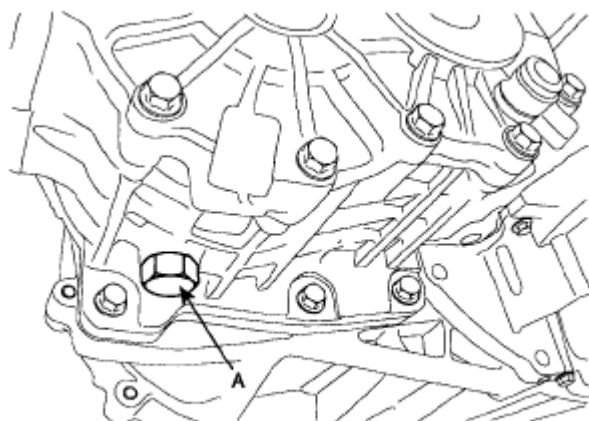


SENMT7203D

Fig. 258: Identifying Propeller Shaft

Courtesy of HYUNDAI MOTOR CO.

5. Disconnect the right driveshaft from the transfer case, (refer to **DRIVE SHAFT**)
6. Drain the fluid by removing the oil drain plug (A).



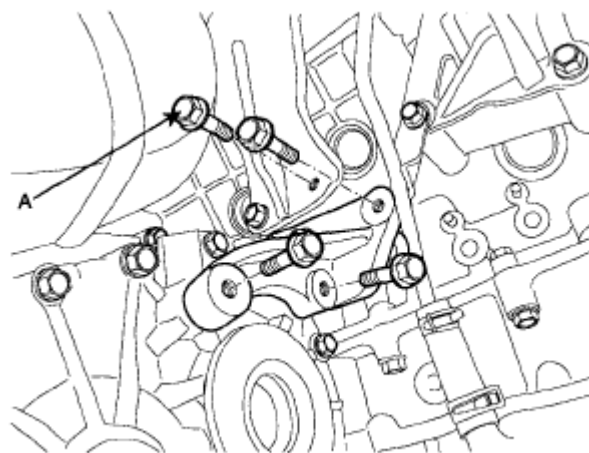
SCMMT8062D

Fig. 259: Identifying Oil Drain Plug
Courtesy of HYUNDAI MOTOR CO.

7. After completing draining the fluid, install the oil drain plug.

Torque : 40-60 Nm (4.0-6.0 kgf.m, 28.9-43.4 lb-ft)

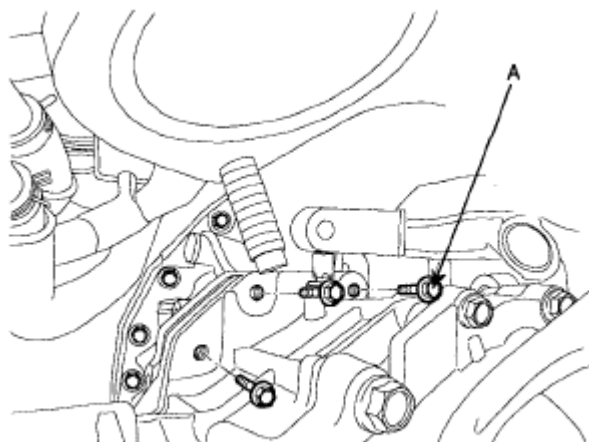
8. Remove the four mounting bolts (A) of transfer case bracket.



SENMT7204D

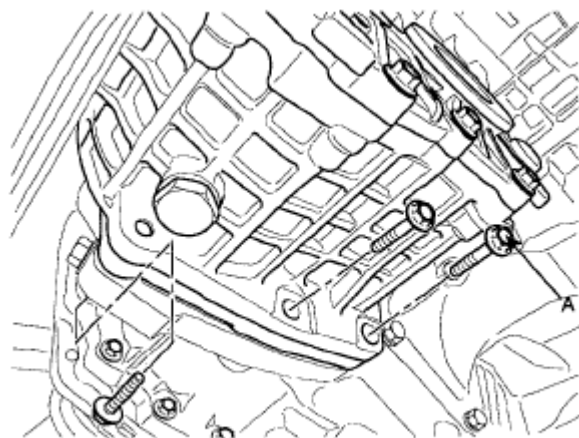
Fig. 260: Identifying Transfer Case Bracket Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

9. Remove the transfer case assembly by removing the six mounting bolts (A).



SENMT7205D

Fig. 261: Identifying Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.



SENMT7211D

Fig. 262: Identifying Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Drain the transfer oil through drain plug hole.
2. Remove the pinion assembly mounting bolts (7EA) and then remove the pinion assembly (A).

NOTE: This assembly can be removed with a propeller shaft assembly in 'REMOVAL step.

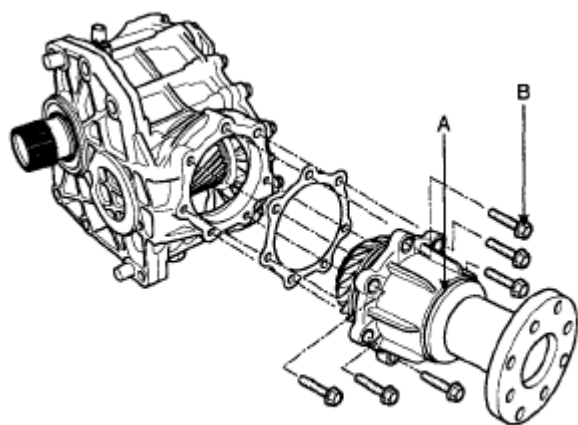


Fig. 263: Identifying Pinion Assembly Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

3. Remove the dust cover (A).

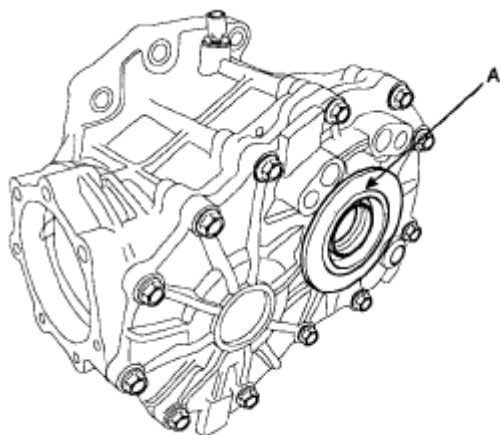
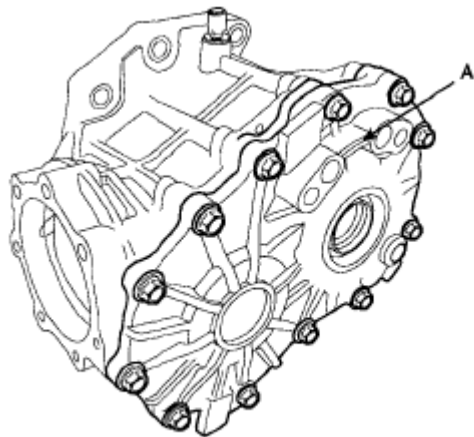


Fig. 264: Identifying Dust Cover
Courtesy of HYUNDAI MOTOR CO.

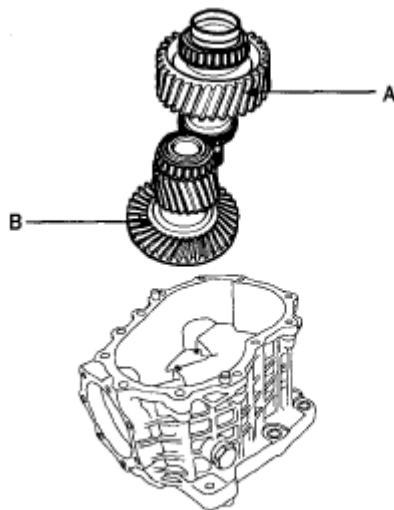
4. Remove the transfer cover (A).



SCMMT6077D

Fig. 265: Identifying Transfer Cover
Courtesy of HYUNDAI MOTOR CO.

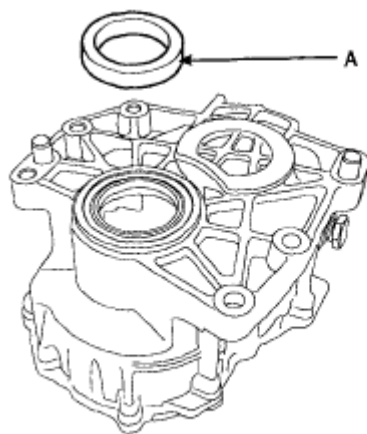
5. Remove the transfer drive gear assembly (A) and the hypoid gear shaft assembly (B) from the transfer housing.



SCMMT6072D

Fig. 266: Identifying Transfer Drive Gear Assembly And Hypoid Gear Shaft Assembly
Courtesy of HYUNDAI MOTOR CO.

6. Remove the oil seal (A) (transfer drive gear left hand side).

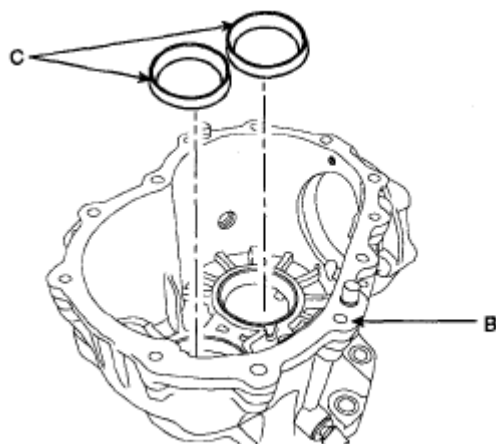


SCMMT6073D

Fig. 267: Identifying Oil Seal

Courtesy of HYUNDAI MOTOR CO.

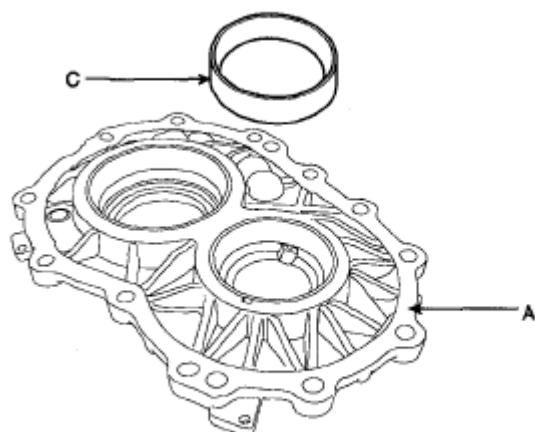
7. Using a sliding hammer, remove the taper roller bearing outer races (C) from the transfer cover (A) and housing (B).



SCMMT6074D

Fig. 268: Identifying Housing And Taper Roller Bearing Outer Races

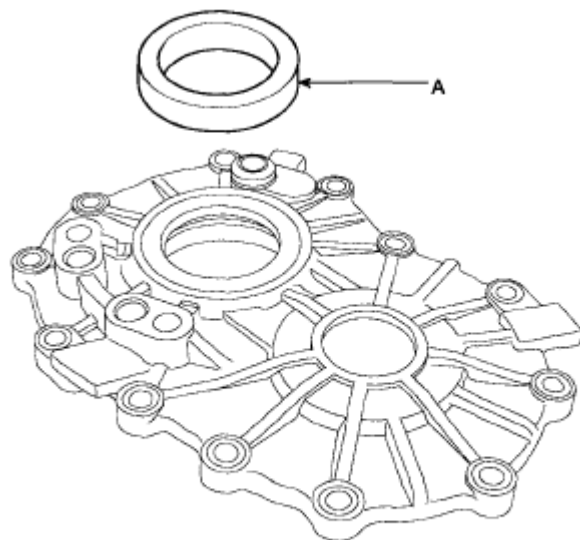
Courtesy of HYUNDAI MOTOR CO.



SCMMT6075D

Fig. 269: Identifying Transfer Cover And Taper Roller Bearing Outer Race
Courtesy of HYUNDAI MOTOR CO.

8. Remove the oil seal (A) from the transfer cover.



SCMMT6076D

Fig. 270: Identifying Oil Seal On Transfer Cover
Courtesy of HYUNDAI MOTOR CO.

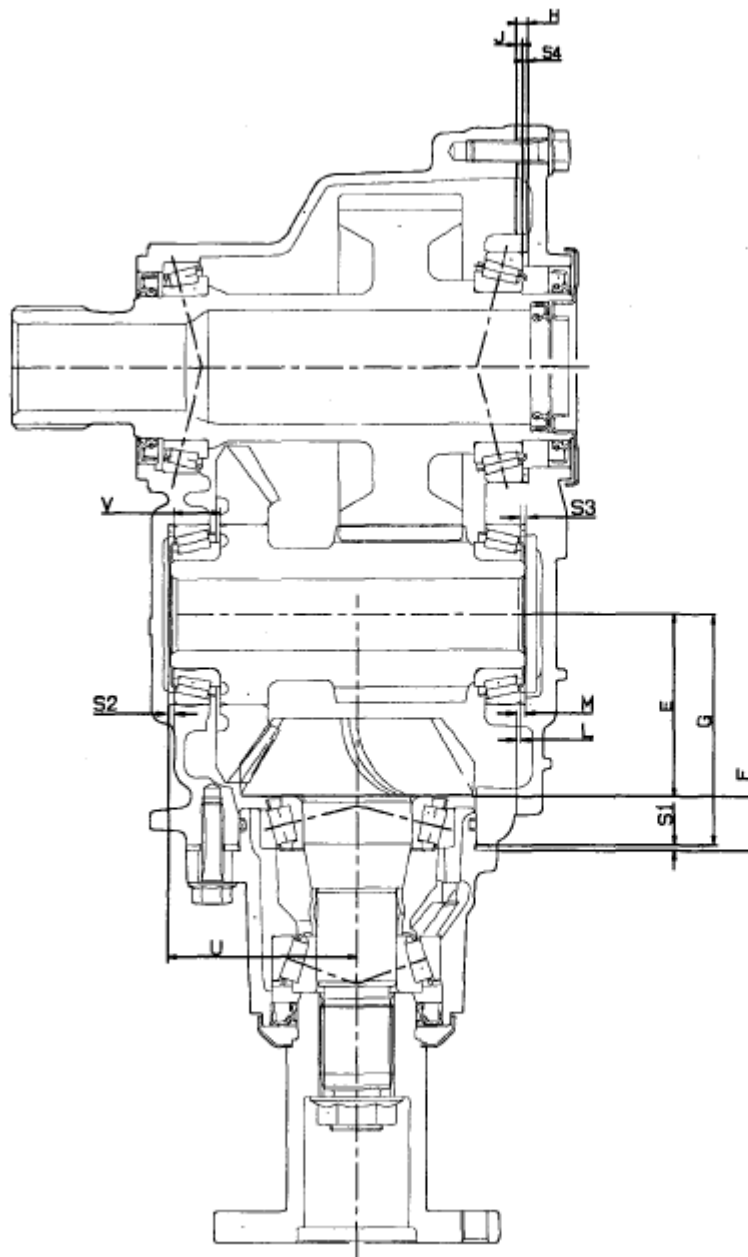
REASSEMBLY

NOTE:

1. Clean all parts except the taper roller bearings. Be careful about the direction of seals.
2. Oil bearings with hypoid gear oil API GL5.
3. Smear involute splines all covering with high pressure grease "Klueber

microlube GNY202".

- 4. Measuring temperature: $2^{\circ} \pm 5^{\circ}\text{C}$.**
- 5. O-ring has to be dipped into hypoid gear oil API GL5. Allow excess oil to drain.**
- 6. Contact surface of the transfer housing to be coated with "SEALANT 732" or equivalent (silicon type sealing agent) prior to mounting. Coating thickness: 0.1mm MIN. Prior to coating, mating surfaces must be clean and free from oil and grease.**
- 7. Transfer oil specification : Hypoid gear oil "API GL5, SAE 75W/90 SHELL SPIRAX X EQUIVALENT". Filled up to lower filler plug thread level (Approx. 0.8L)**
- 8. The hypoid gear set must be managed as a pair. Whenever installing or replacing a hypoid gear shaft assembly (47308-24000/24010) or a pinion shaft (47311-39300/39310). Make sure to install or replace as a pair.**
- 9. In reassembling, refer to the two figures below.**



SCMMT6042D

Fig. 271: [Sectional View Of Pinion Shaft]
Courtesy of HYUNDAI MOTOR CO.

1. Install the transfer drive gear with the taper roller bearings (47366-39000 and 47465-39000) into transfer housing.
2. Applying the preload (100 to 200N) to bearings, measure the dimension J.
3. Measure the dimension H on transfer cover (47314-24000).
4. Select the spacer thickness from the chart below. Thickness $S4 = H - J + K$. (K: Bearing preload = 0.07 to 0.11mm.)

Corresponding preload torque (measured without seals) : 120 to 180Ncm.

SPACER THICKNESS

Part number	Spacer thickness (mm)
47383-39152	1.520-1.539
47383-39154	1.540-1.559
47383-39156	1.560-1.579
47383-39158	1.580-1.599
47383-39160	1.600-1.619
47383-39162	1.620-1.639
47383-39164	1.640-1.659
47383-39166	1.660-1.679
47383-39168	1.680-1.699
47383-39170	1.700-1.719
47383-39172	1.720-1.739
47383-39174	1.740-1.759
47383-39176	1.760-1.779
47383-39178	1.780-1.779
47383-39180	1.800-1.819
47383-39182	1.820-1.839
47383-39185	1.85-1.88
47383-39189	1.89-1.92
47383-39193	1.93-1.96
47383-39197	1.97-2.00
47383-39201	2.01-2.04
47383-39205	2.05-2.08
47383-39209	2.09-2.12
47383-39213	2.13-2.16
47383-39217	2.17-2.20
47383-39221	2.21-2.24
47383-39225	2.25-2.28
47383-39229	2.29-2.32
47383-39233	2.33-2.36

5. Reassemble the selected spacer above.
6. Measure the dimension U and V.

U.... Finished dimension of transfer housing.

V.... Distance from back of the hypoid gear to bearing measured under 100 to 200N preload.

7. Select the spacer thickness from the chart below. Thickness $S2=U-(V + \text{mounting distance } 52.0 \text{ mm})$.

SPACER THICKNESS

Part number	Spacer thickness (mm)
47384-39130	1.300-1.319
47384-39134	1.340-1.359
47384-39138	1.380-1.399
47384-39142	1.420-1.439
47384-39146	1.460-1.479
47384-39148	1.480-1.499
47384-39150	1.500-1.519
47384-39152	1.520-1.539
47384-39154	1.540-1.559
47384-39156	1.560-1.579
47384-39158	1.580-1.599
47384-39160	1.600-1.619
47384-39162	1.620-1.639
47384-39164	1.640-1.659
47384-39166	1.660-1.679
47384-39168	1.680-1.699
47384-39170	1.700-1.719
47384-39174	1.740-1.759
47384-39178	1.780-1.799
47384-39182	1.820-1.839
47384-39186	1.860-1.879
47384-39190	1.900-1.919
47384-39194	1.940-1.959
47384-39198	1.980-1.999
47384-39200	2.000-2.019
47384-39202	2.020-2.039
47384-39204	2.040-2.059
47384-39206	2.060-2.079
47384-39208	2.080-2.099
47384-39210	2.100-2.119

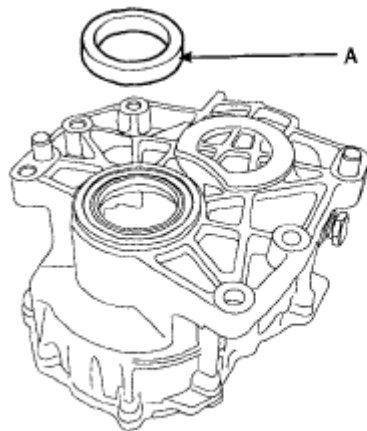
8. Install the spacer selected above, the taper roller bearings and the hypoid gear shaft assembly (47308-24000/24010). And preload the assembly without the spacer (Hypoid gear shaft assembly-Transfer cover side) with 100 to 200N.
9. Measure the dimension L after 10 rotations.
10. Measure the dimension M on transfer cover (47314-24000).
11. Select the spacer thickness from the chart below. Thickness $S3=M-L + (0.09 \text{ to } 0.12\text{mm})$ preload.

SPACER THICKNESS

Part number	Spacer thickness (mm)
--------------------	------------------------------

47388-24130	1.300-1.319
47388-24132	1.320-1.339
47388-24134	1.340-1.359
47388-24136	1.360-1.379
47388-24138	1.380-1.399
47388-24140	1.400-1.419
47388-24142	1.420-1.439
47388-24144	1.440-1.459
47388-24146	1.460-1.479
47388-24148	1.480-1.499
47388-24150	1.500-1.519
47388-24152	1.520-1.539
47388-24154	1.540-1.559
47388-24156	1.560-1.579
47388-24158	1.580-1.599
47388-24160	1.600-1.619
47388-24162	1.620-1.639
47388-24164	1.640-1.659
47388-24166	1.660-1.679
47388-24168	1.680-1.699
47388-24170	1.700-1.719
47388-24172	1.720-1.739
47388-24174	1.740-1.759
47388-24176	1.760-1.779
47388-24178	1.780-2.799
47388-24180	1.800-2.819
47388-24182	1.820-2.839
47388-24184	1.840-2.859
47388-24186	1.860-2.879
47388-24250	2.50-2.53

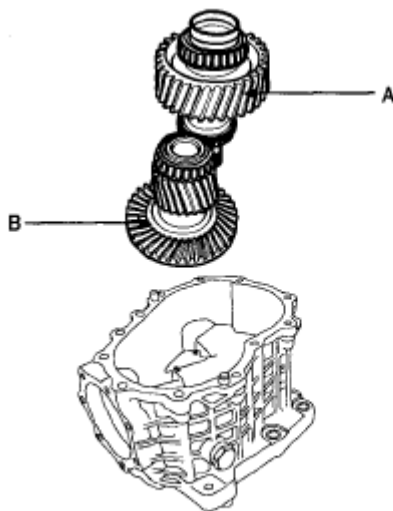
12. Install the spacer selected above.
13. Install the taper roller bearing outer races to the transfer housing and cover.
14. Install a new oil seal (A) in the transfer housing.



SCMMT6073D

Fig. 272: Identifying Oil Seal In Transfer Housing
 Courtesy of HYUNDAI MOTOR CO.

15. Install the transfer drive gear shaft assembly (A) and the hypoid gear assembly (B) in the transfer housing.



SCMMT6072D

Fig. 273: Identifying Transfer Drive Gear Shaft Assembly And Hypoid Gear Assembly
 Courtesy of HYUNDAI MOTOR CO.

16. Measure the dimension F.

F.... Assembled dimension of pinion assembly.

G.... Finished dimension of transfer housing. (=88.0mm)

E.... Mounting distance (=69.500 ± deviation).

17. Select the spacer thickness from the chart below. Thickness $S1=E+F-G$

NOTE: If it is not possible to reach the exact mounting distance, select the next thinner spacer S1.

SPACER THICKNESS

Part number	Spacer thickness (mm)
47386-39125	1.25-1.28
47386-39129	1.29-1.32
47386-39133	1.33-1.36
47386-39137	1.37-1.40
47386-39141	1.41-1.44
47386-39145	1.45-1.48
47386-39149	1.49-1.52
47386-39153	1.53-1.56
47386-39157	1.57-1.60
47386-39161	1.61-1.64
47386-39165	1.65-1.68
47386-39169	1.69-1.72
47386-39172	1.720-1.739
47386-39174	1.740-1.759
47386-39176	1.760-1.779
47386-39178	1.780-1.799
47386-39180	1.800-1.819
47386-39182	1.820-1.839
47386-39184	1.840-1.859
47386-39186	1.860-1.879
47386-39188	1.880-1.899
47386-39190	1.900-1.919
47386-39192	1.920-1.939
47386-39194	1.940-1.959
47386-39196	1.960-1.979
47386-39198	1.980-1.999
47386-39200	2.000-2.019
47386-39202	2.020-2.039
47386-39204	2.040-2.059
47386-39233	2.33-2.36

18. Install the pinion assembly with the selected spacer above and measure the circumference backlash on pinion.

(Measuring diameter, backlash and permissible deviations for measurement on pinion, see table below). If

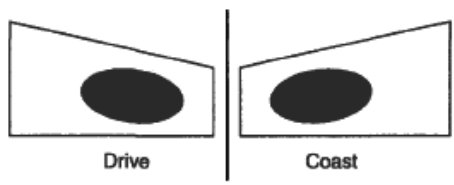
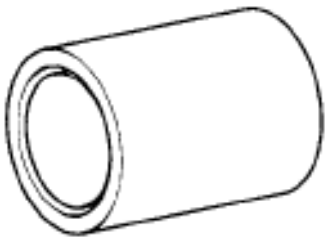
the result is out of permissible range, change the spacer thickness S2, then start again with the step 8~12).

TIPS FOR SPACER ADJUSTMENT FOR HYPOID GEAR BACKLASH AND CONTACT PATTERN

TIPS FOR SPACER ADJUSTMENT FOR HYPOID GEAR BACKLASH AND CONTACT PATTERN

ITEM	SYMPTOM	REMEDY
Backlash	When more than the standard value (0.16 ~ 0.21mm)	Adjust backlash by installing the spacer S1 using a thinner one and gradually installing a thicker one.
	When less than the standard value (0.16 ~ 0.21 mm)	Adjust backlash by installing the spacer S1 using a thicker one and gradually installing a thinner one.

SYMPTOM DESCRIPTION

ITEM	SYMPTOM	REMEDY
Hypoid gear tooth contact pattern	 Drive Coast UMQG004D	• Normal state • Standard tooth pattern ◦ Both drive and coast surfaces are in center in lateral direction and slightly incline to TOE side in vertical direction • If the pattern deviates from the standard, adjust it by following procedure
	 EK,JA006A	• Abnormal state • The drive surface inclines to TOE and TOP and the coast surface inclines to HEEL and TOP The tooth contact pattern can be moved to the arrow direction by installing the spacer S2 using a thinner one and gradually installing a thicker one.

- Remove the pinion assembly. With the spacer S3 and transfer cover mounted, combined preload torque for the hypoid gear shaft assembly and transfer gear (measured on transfer gear) should be 2.7 to 3.8Nm. The spacer S3 has to be changed, if the preload torque is not within the permissible range.
- Tighten the pinion assembly mounting bolts (B-7EA) to install the pinion assembly (A).

TORQUE:

37~40 Nm (3.7~4.0 kgf.m, 14.5~21.7 lb-ft)

NOTE:

- Before installing the pinion assembly, check the pinion O-ring and apply the oil to the O-ring.

2. To make the installation of the pinion to the transfer easier, tap the pinion using a plastic hammer after aligning the bolt holes.

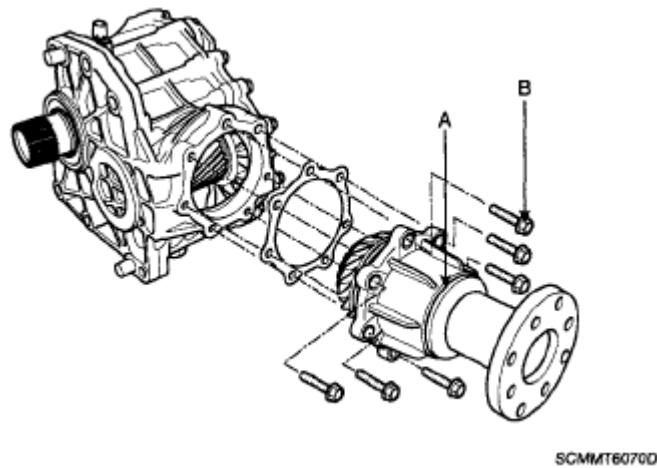


Fig. 274: Identifying Pinion Assembly Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

CAUTION: Must use a new O-ring (47354-39300).

1. Temporarily install the transfer case assembly to the transaxle and then tighten the six mounting bolts (A).

Torque : 62-67 Nm (6.2-6.7 kgf.m, 44.8-48.5 lb-ft)

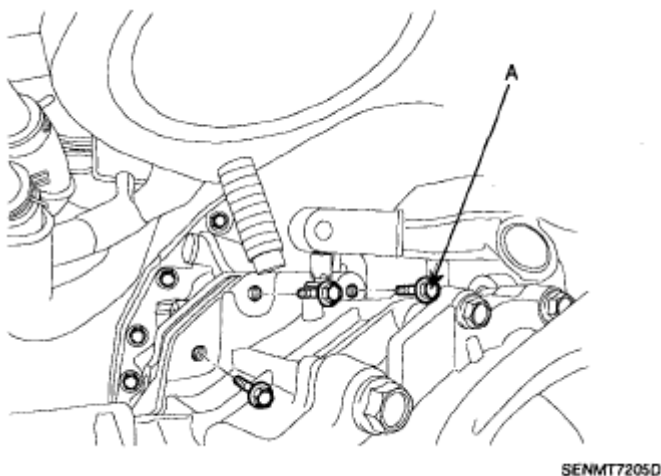
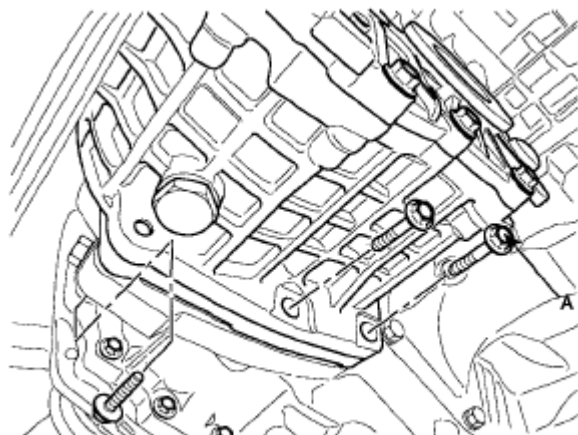


Fig. 275: Identifying Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

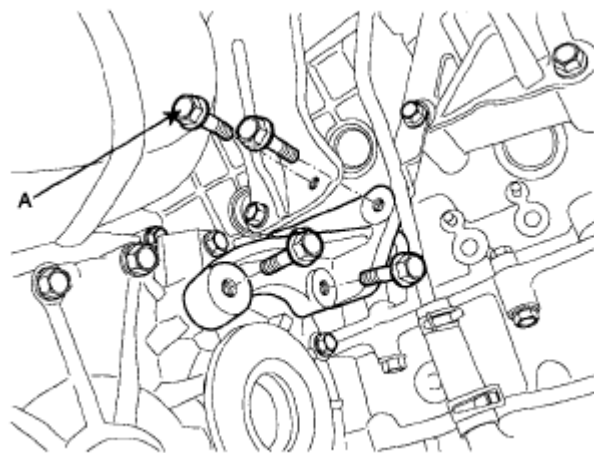


SENMT7211D

Fig. 276: Identifying Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

2. Install the four mounting bolts (A) of the transfer case bracket.

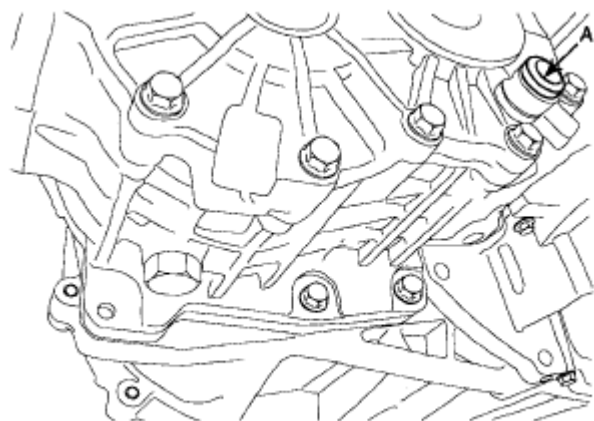
Torque : 47-51 Nm (4.7-5.1 kgf.m, 34.0-36.9 lb-ft)



SENMT7204D

Fig. 277: Identifying Transfer Case Bracket Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

3. Remove the filler plug (A).



SENMT7207D

Fig. 278: Identifying Filler Plug
Courtesy of HYUNDAI MOTOR CO.

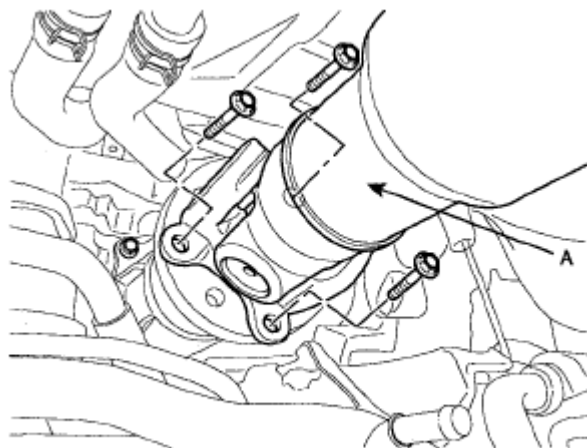
4. After refilling the fluid amount of the specified, tighten the filler plug.

Specification : API GL-5, SAE 75W/90

Quantity : Approx 0.8L

5. Install the right driveshaft to the transfer case, (refer to **DRIVE SHAFT**)
6. Install the propeller shaft (A) to the transfer case.

Torque : 50-70 Nm (5.0-7.0 kgf.m, 36.2-50.6 lb-ft)



SENMT7203D

Fig. 279: Identifying Propeller Shaft
Courtesy of HYUNDAI MOTOR CO.

7. Install the front muffler (A), (refer to **INTAKE AND EXHAUST SYSTEM**)

Torque : 40-60 Nm (4.0-6.0 kgf.m, 28.9-43.4 lb-ft)

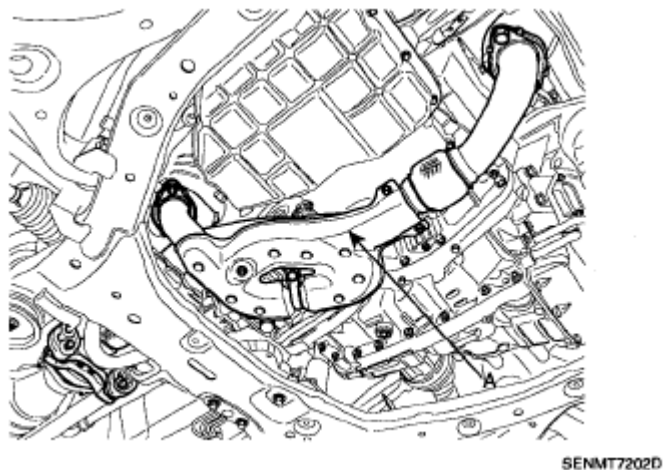
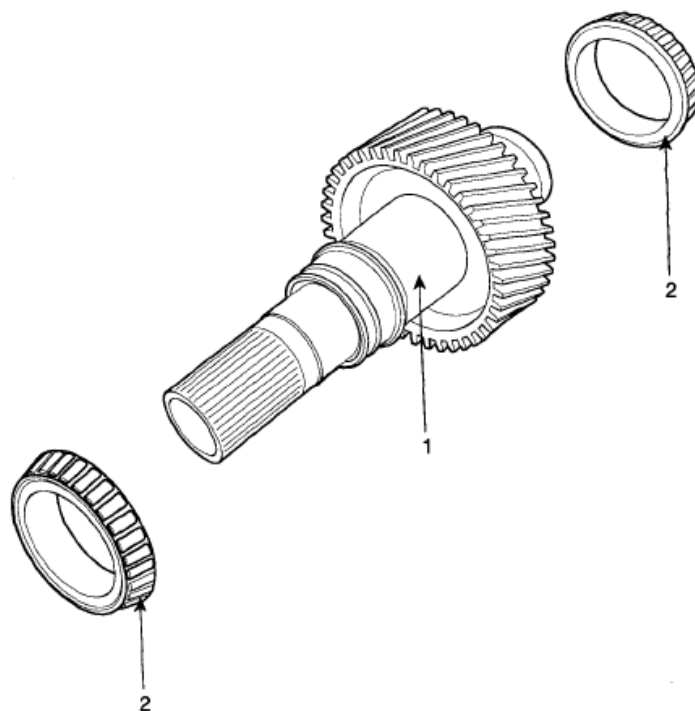


Fig. 280: Identifying Front Muffler
Courtesy of HYUNDAI MOTOR CO.

8. Connect the (-) terminal to the battery.

TRANSFER DRIVE GEAR

COMPONENTS



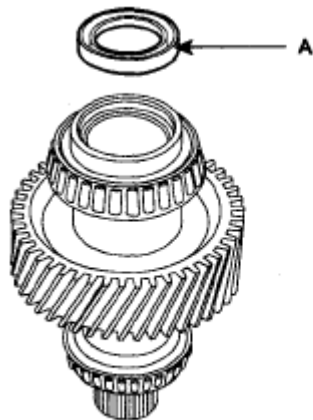
- 1. Transfer drive gear
- 2. Taper roller bearing

SCMMT6013L

Fig. 281: Identifying Transfer Drive Gear Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

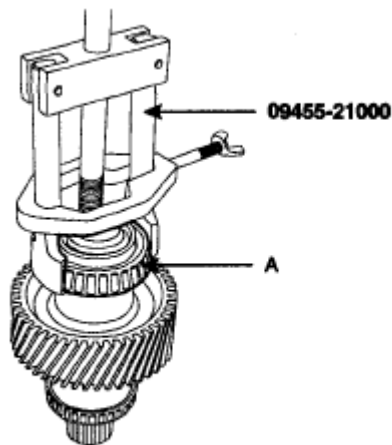
1. Remove the oil seal (A) (47352-39300) from the transfer drive gear.



UMQG008B

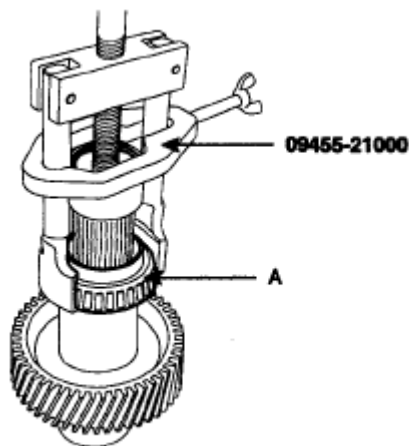
Fig. 282: Identifying Oil Seal On Transfer Drive Gear
Courtesy of HYUNDAI MOTOR CO.

- Using the Special tool (09455-21000), remove the taper roller bearings (A) from the both sides of the transfer drive gear assembly.



UMQG008C

Fig. 283: Identifying Taper Roller Bearings
Courtesy of HYUNDAI MOTOR CO.



UMQG008D

Fig. 284: Identifying Taper Roller Bearings
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

- Using a press machine, install the taper roller bearings (A) to the transfer drive gear.

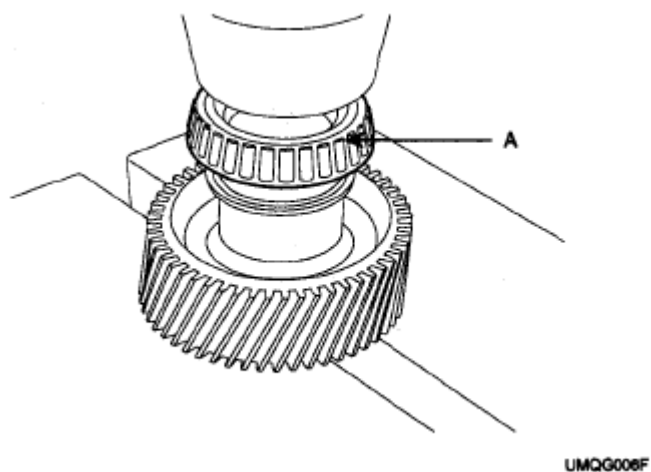
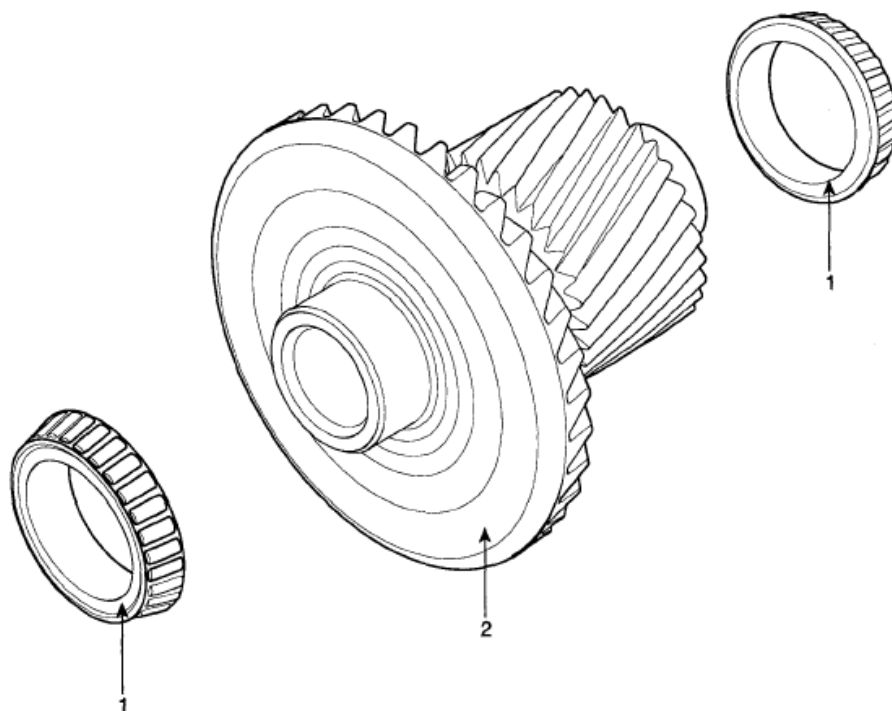


Fig. 285: Identifying Taper Roller Bearings On Transfer Drive Gear
Courtesy of HYUNDAI MOTOR CO.

HYPOID GEAR

COMPONENTS

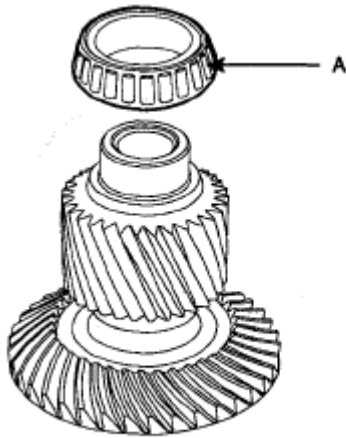


- 1. Taper roller bearing
- 2. Hypoid gear

Fig. 286: Identifying Hypoid Gear Components
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

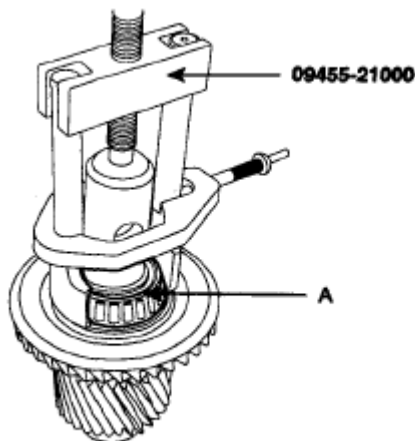
1. Using the SST (09455-21000), remove the taper roller bearing (A) from the hypoid gear shaft assembly.



UMQG007C

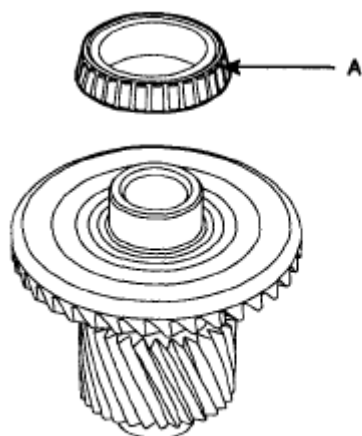
Fig. 287: Identifying SST (09455-21000)
Courtesy of HYUNDAI MOTOR CO.

2. Using the SST (09455-21000), remove the other taper roller bearing (A) from the hypoid gear shaft assembly.



UMQG007D

Fig. 288: Identifying Taper Roller Bearing On Hypoid Gear Shaft Assembly
Courtesy of HYUNDAI MOTOR CO.

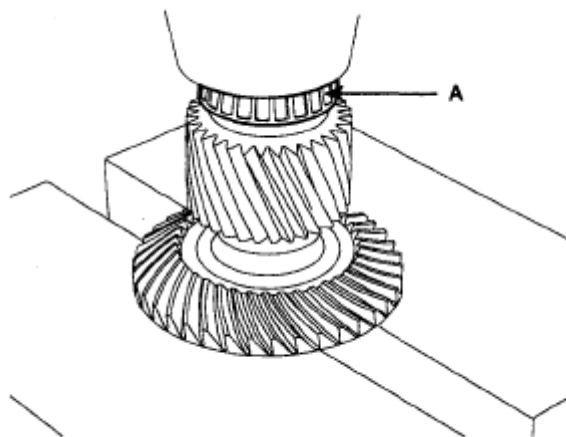


UMQG007E

Fig. 289: Identifying Taper Roller Bearing On Hypoid Gear Shaft Assembly
Courtesy of HYUNDAI MOTOR CO.

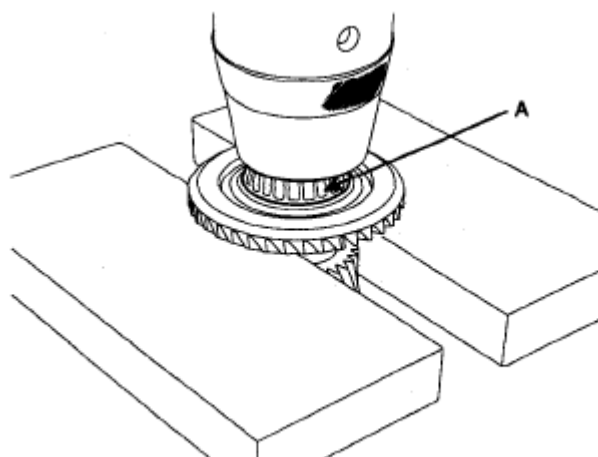
REASSEMBLY

1. Using a press machine, install the taper roller bear-ings (A) to the hypoid gear shaft assembly.



UMQG007F

Fig. 290: Identifying Taper Roller Bear-IngS On Hypoid Gear Shaft Assembly
Courtesy of HYUNDAI MOTOR CO.

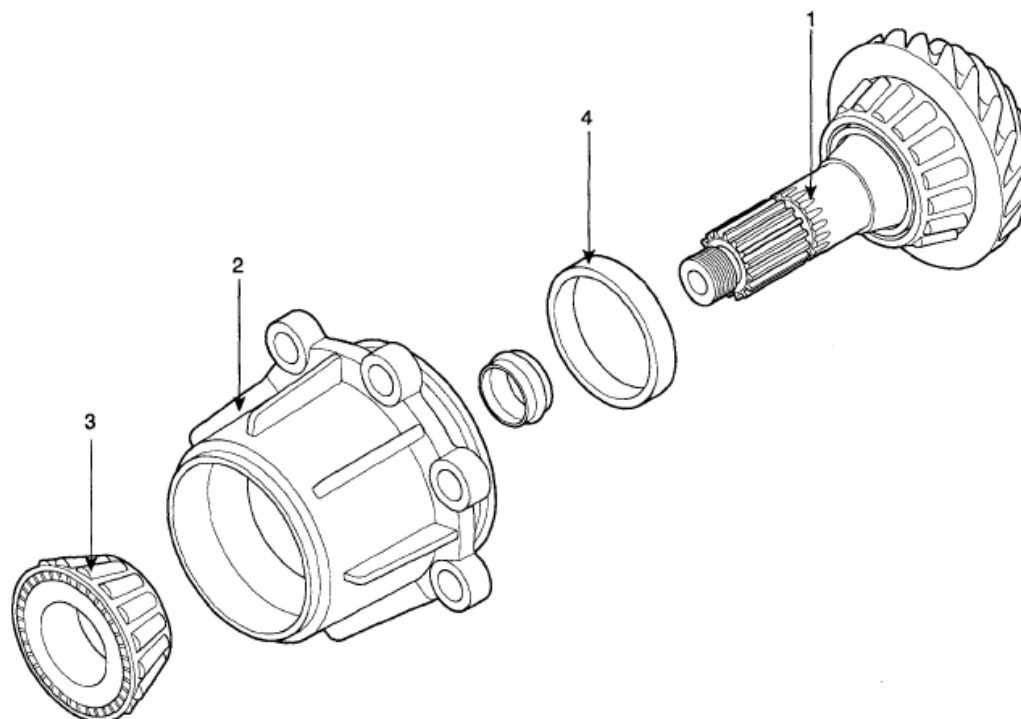


UMQG007G

Fig. 291: Identifying Taper Roller Bearing
Courtesy of HYUNDAI MOTOR CO.

PINION SHAFT AND CASE

COMPONENTS



1. Pinion shaft
2. Pinion case

3. Taper roller bearing
4. Taper roller bearing outer race

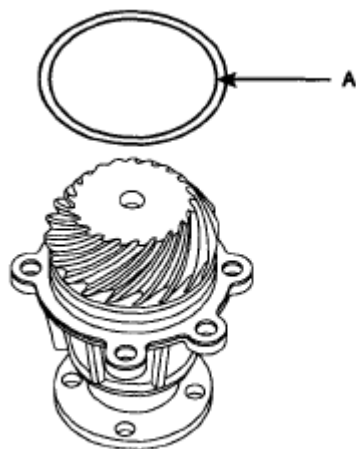
UMQG005A

Fig. 292: Identifying Pinion Shaft And Case Components

Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

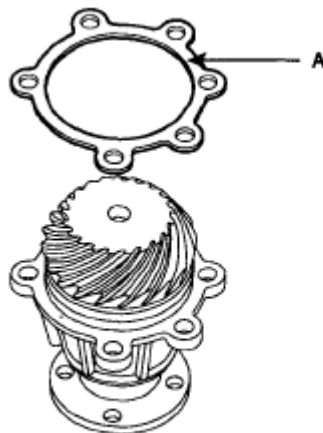
1. Remove the O-ring (A) from the pinion shaft and case assembly.



UMQG005B

Fig. 293: Identifying O-Ring On Pinion Shaft And Case Assembly
Courtesy of HYUNDAI MOTOR CO.

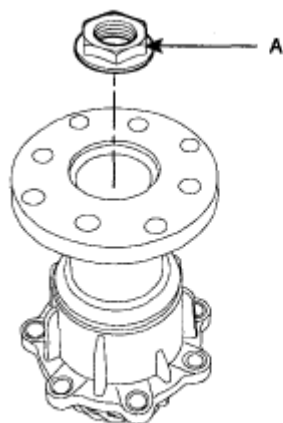
2. Remove the spacer (A).



UMQG005C

Fig. 294: Identifying Spacer
Courtesy of HYUNDAI MOTOR CO.

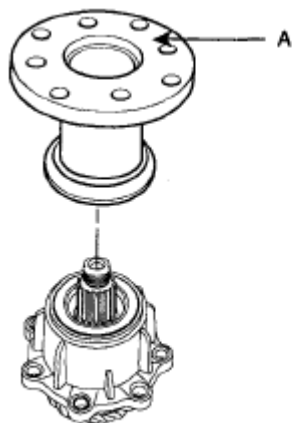
3. Loosen the HEX lock nut (A).



SCMMT6080D

Fig. 295: Identifying HEX Lock Nut
Courtesy of HYUNDAI MOTOR CO.

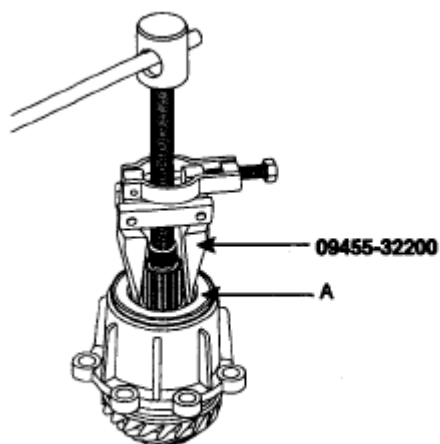
4. Remove the rear flange assembly (A).



SCMMT6081D

Fig. 296: Identifying Rear Flange Assembly
Courtesy of HYUNDAI MOTOR CO.

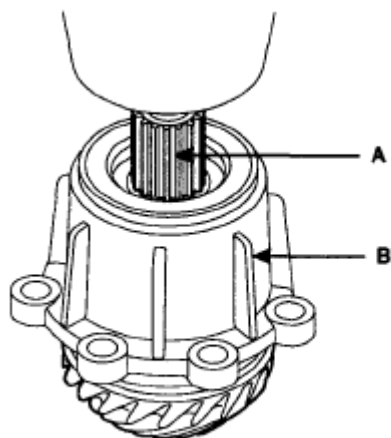
5. Using the SST (09455-32200), remove the oil seal (A) from the pinion case.



UMQG005F

Fig. 297: Identifying Oil Seal On Pinion Case
Courtesy of HYUNDAI MOTOR CO.

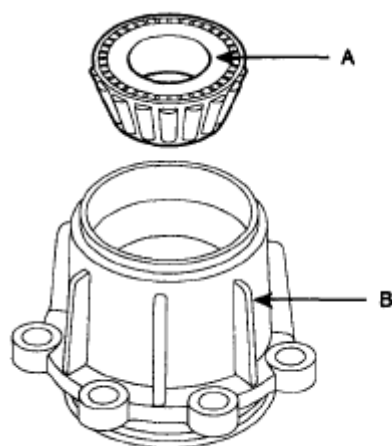
6. Using a press machine, remove the pinion shaft (A) from the pinion case (B).



UMQG005G

Fig. 298: Identifying Pinion Shaft On Pinion Case
Courtesy of HYUNDAI MOTOR CO.

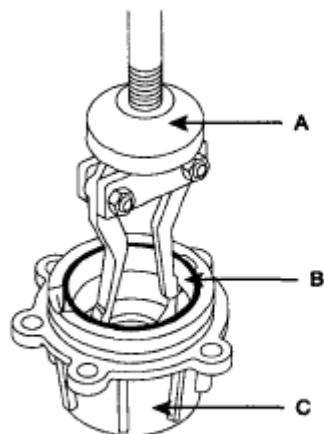
7. Take out the taper roller bearing (A) from the pinion case (B).



UMQG005H

Fig. 299: Identifying Taper Roller Bearing And Pinion Case
Courtesy of HYUNDAI MOTOR CO.

8. Using a sliding hammer (A), remove the taper roller bearing outer race (B) from the pinion case (C).

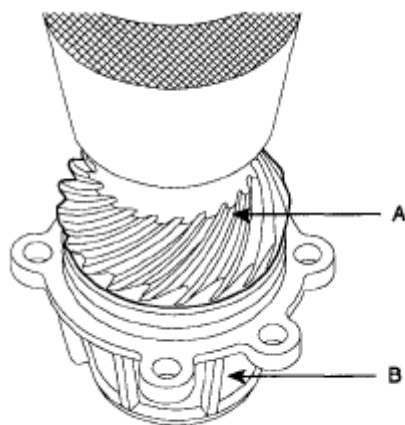


UMQG005I

Fig. 300: Identifying Taper Roller Bearing Outer Race And Pinion Case
Courtesy of HYUNDAI MOTOR CO.

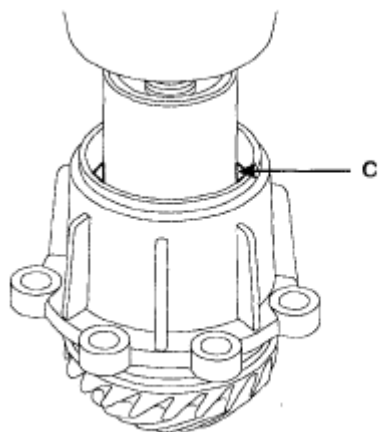
REASSEMBLY

1. Assemble the taper roller bearing outer races.
2. Using a press machine, install the taper roller bearing (C) and the pinion shaft (A) in the pinion case (B).



UMQG005J

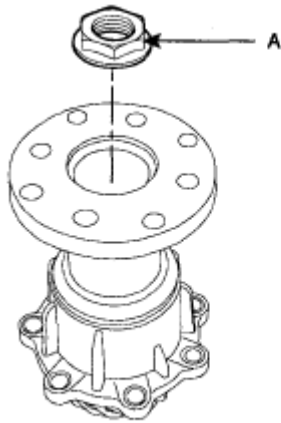
Fig. 301: Identifying Pinion Shaft In Pinion Case
 Courtesy of HYUNDAI MOTOR CO.



UMQG005K

Fig. 302: Identifying Pinion Case
 Courtesy of HYUNDAI MOTOR CO.

3. Install the oil seal and the rear flange assembly as shown below and screw down the hex lock nut (A) until an axial clearance B of 0.25mm to 0.75mm between pinion and pinion case results.

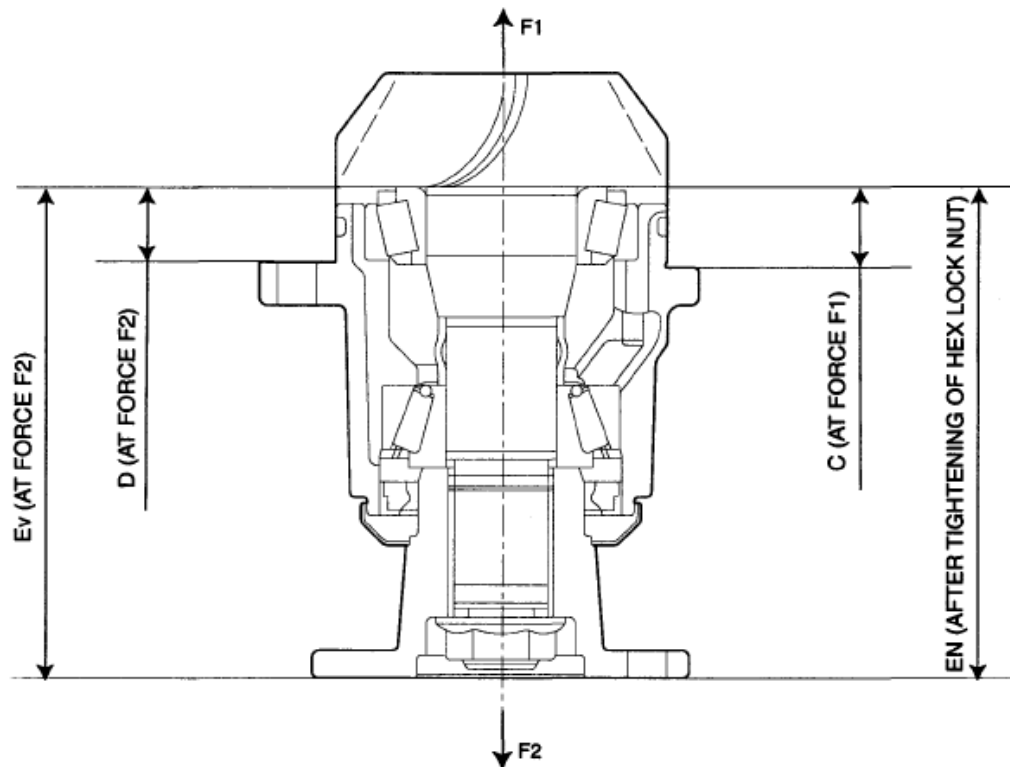


SCMMT6080D

Fig. 303: Identifying Hex Lock Nut
Courtesy of HYUNDAI MOTOR CO.

1. Measurement of B

- Apply an additional 200N tension load F1 to the pinion head according to arrangement Y. Rotate the pinion 10 times and measure dimension C.
- Apply a 200N load F2 to the rear flange. Rotate the pinion 10 times and measure dimension D. $B = C - D$



UMQG005L

Fig. 304: Identifying Dimensions For Pinion

Courtesy of HYUNDAI MOTOR CO.

2. Measure dimension Ev.
3. Tighten HEX lock nut.
4. Measure the drag torque of the pinion assembly. Target is 180-210Ncm. To achieve the target preload torque, it is permissible to gradually increase the tightening torque.

CAUTION: If the permissible preload torque of 210Ncm is exceeded, it is not allowed to loosen Hex lock nut. Disassemble the whole pinion assembly. Replace the collapsible spacer and repeat the mounting procedure.

5. Measure dimension En.
6. Check preload. A preload torque of 180 to 210 Ncm corresponds to a bearing preload of 0.12 to 0.16mm.

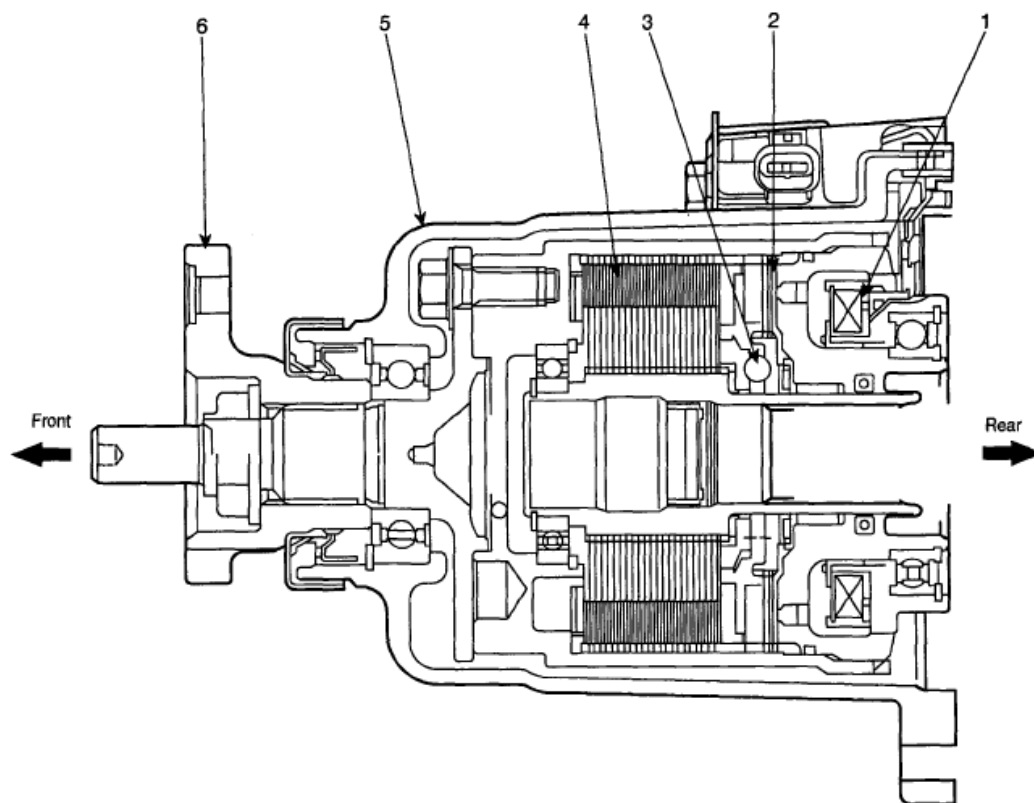
Ev-En-B=0.12 to 0.16mm

CAUTION: Twice use of collapsible spacer is not permitted (Permanent deformation).

4. Assemble the O-ring and select the proper spacer later when reassembling the transfer case.

COUPLING ASSEMBLY

COMPONENTS



1. Magnetic Clutch
2. Pilot clutch
3. Cam

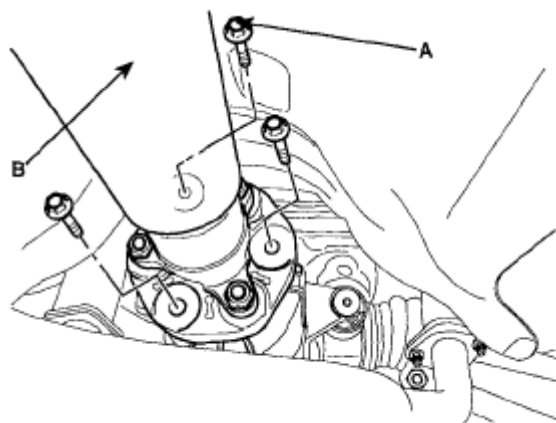
4. Main clutch
5. Housing
6. Flange

SENMT7001N

Fig. 305: Identifying Coupling Assembly Components
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

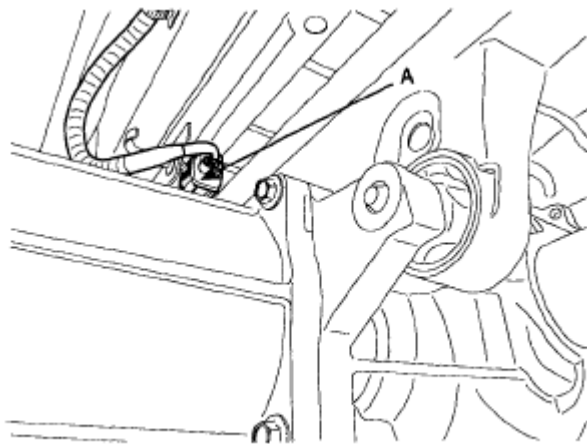
1. Remove the 4WD coupling assembly bolts (A-3ea) mounted to the rear propeller shaft (B).



SENMT7206D

Fig. 306: Identifying Rear Propeller Shaft
Courtesy of HYUNDAI MOTOR CO.

2. Using a flat tool, separate the propeller shaft from 4WD coupling assembly.



SENMT7208D

Fig. 307: Identifying Connector
Courtesy of HYUNDAI MOTOR CO.

3. Remove the 4WD coupling assembly mounting bolts (A-4ea).

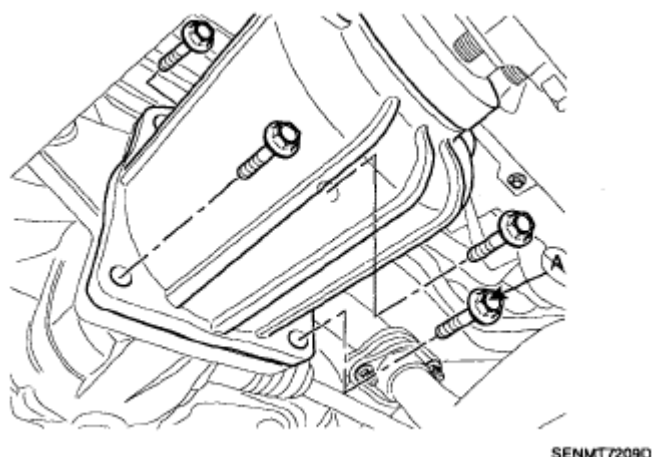


Fig. 308: Identifying Coupling Assembly Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Using a flat tool, separate the 4WD coupling assembly from the rear differential carrier assembly.

INSTALLATION

1. Temporarily install the 4WD coupling assembly to the rear differential carrier and then tighten the four mounting bolts (A).

Torque : 60-65 Nm (6.0-6.5 kgf.m, 43.4-47.0 lb-ft)

NOTE: Grease the drive gear of the differential carrier assembly.

High pressure grease : KLUBER MICROLUBE GNY 202 (or equivalent) or GREASE-TRANSMISSION (MS511-55, TMG-2)

After greasing the contacting surface, temporarily install the 4WD coupling assembly to the differential carrier assembly within 3 minutes.

Sealant: FIPG (Formed in Place Gaskets)-B (MS721-40) or equivalent to LT5702

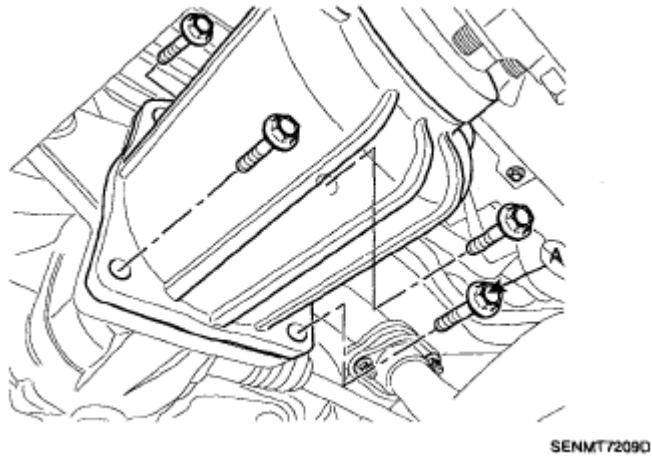


Fig. 309: Identifying Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

2. Install the 4WD coupling assembly to the rear propeller shaft (B) by tightening the three bolts (A).

Torque : 50-70 Nm (5.0-7.0 kgf.m, 36.2-50.6 lb-ft)

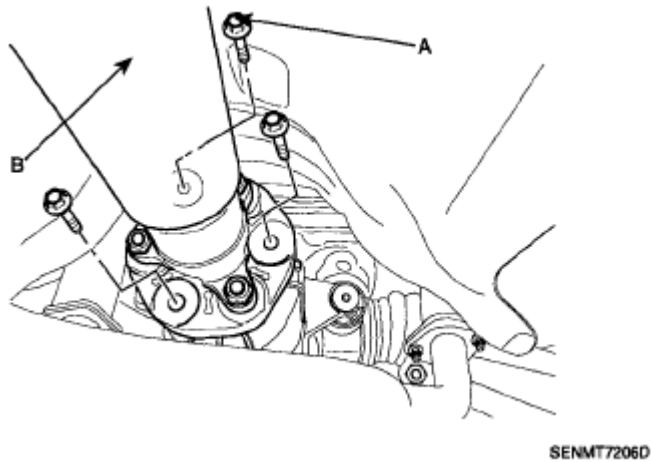
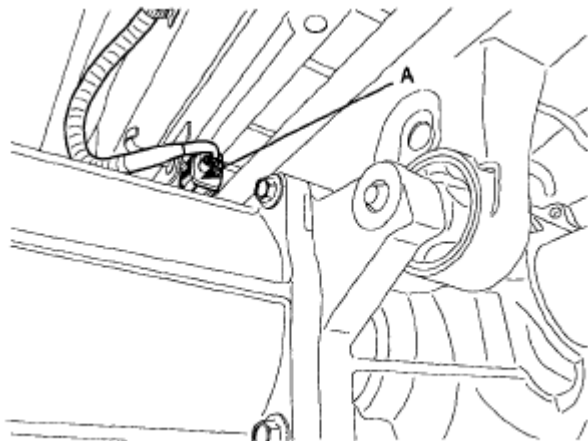


Fig. 310: Identifying Rear Propeller Shaft Bolts
Courtesy of HYUNDAI MOTOR CO.

3. Connect the electric magnetic clutch connector (A).



SENMT7208D

Fig. 311: Identifying Electric Magnetic Clutch Connector
Courtesy of HYUNDAI MOTOR CO.