

# Body Electrical System

## **AUDIO SYSTEM**

AUDIO UNIT  
SPEAKERS  
ANTENNA  
AUDIO REMOTE CONTROL

SEAT WARMER

## **LIGHTING SYSTEM**

HEAD LAMPS  
TURN SIGNAL LAMP

## **BCM (BODY CONTROL MODULE)**

## **IMMOBILIZER CONTROL SYSTEM**

## **INDICATORS AND GAUGES**

INSTRUMENT CLUSTER

## **TRIP COMPUTER**

## **SEAT WARMER**

SEAT WARMER SWITCH

## **BACK WARNING SYSTEM**

BACK WARNING CONTROL MODULE  
ULTRASONIC SENSOR  
BUZZER

## AUDIO SYSTEM

### SPECIFICATION EE7AAA28

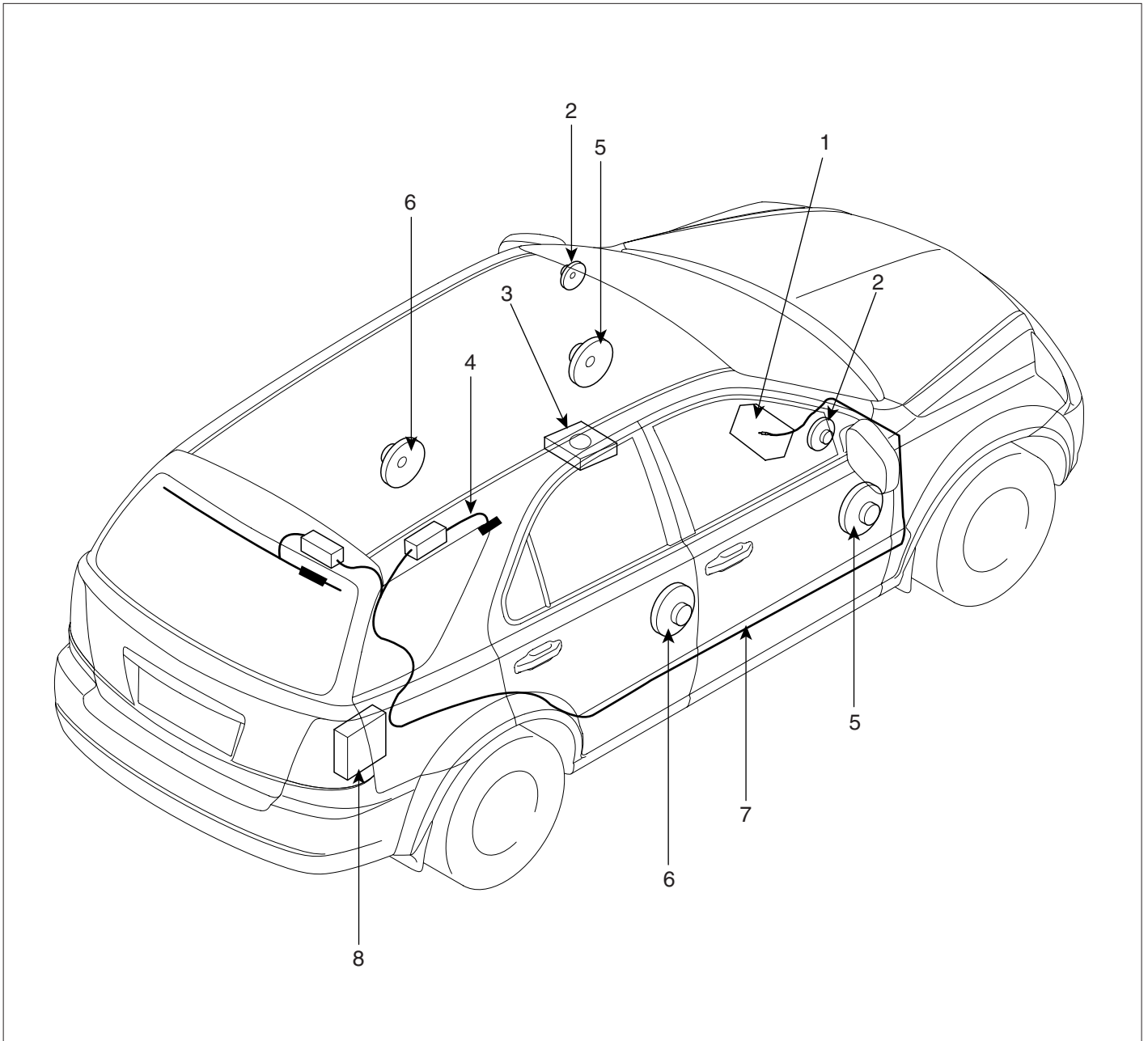
#### AUDIO

Item		Specification	
Model		RADIO/TAPE/CD/MP3 (M455)	RADIO/TAPE/6CDC (M465)
Power supply		DC 14.4V	
Rated output		Max 43W x 4	3.2Vrms
Speaker impedance		4Ω x 4	10Ω
Antenna		80PF 75Ω	
Tuning type		PLL synthesized type	
Amplifier		Internal amplifier	External amplifier
Frequency range / Channel space	FM	87.5~108 MHz / 100KHz (General), 50KHz(Europe)	
	AM	531~1602 KHz / 9KHz (General)	
	MW	522~1620 KHz / 9KHz (Europe)	
	LW	153~279 KHz / 1KHz (Europe)	

#### SPEACKER

Item		M455	M465
Input Power (W)	Front	43 (1WAY)	55 (2WAY)
	Rear	45 (2WAY)	45 (2WAY)
	Tweeter	30	30
Speaker Impedance(Ω )	Front	4.0 ± 0.6 (1WAY)	4.0 ± 0.6 (2WAY)
	Rear	4.0 ± 0.6 (2WAY)	4.0 ± 0.6 (2WAY)
	Tweeter	4.0 ± 0.6	4.0 ± 0.6
Speaker Number		6	6

COMPONENT LOCATION EACDA4AB



- 1. Audio unit
- 2. Tweeter speaker
- 3. External amplifier
- 4. Glass antenna

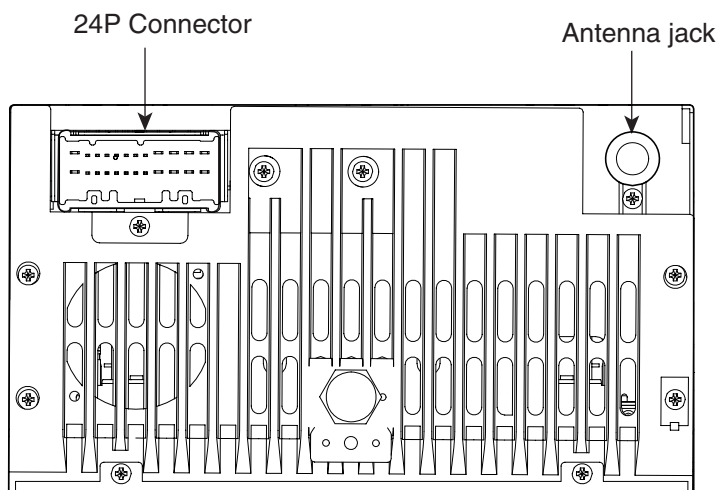
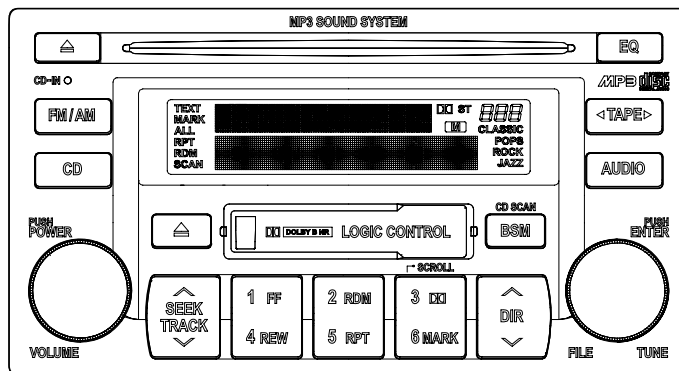
- 5. Front door speaker
- 6. Rear door speaker
- 7. Antenna feeder cable
- 8. Tuner unit

SBLBE6001L

**AUDIO UNIT**

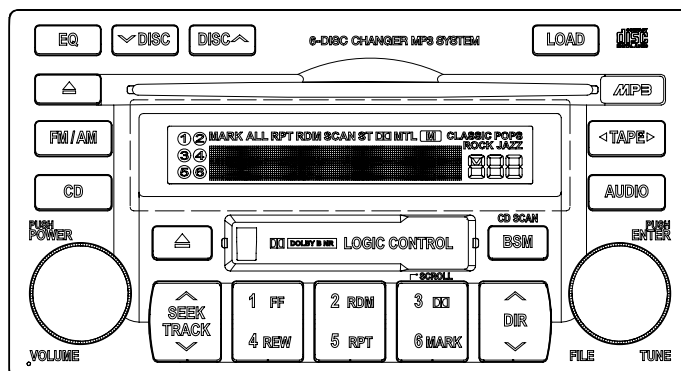
**COMPONENTS** EB9F63C9

[MP3 (M455)]



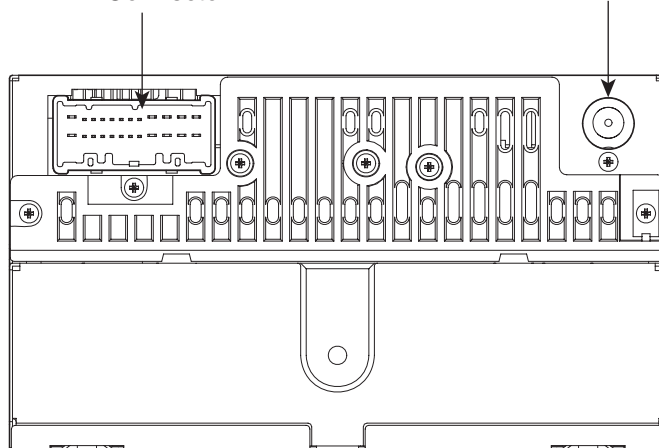
24P Connector	Pin	Name	Pin	Name
	1	Front left speaker (+)	13	Front left speaker (-)
	2	Front right speaker (+)	14	Front right speaker (-)
	3	Rear right speaker (+)	15	Rear right speaker (-)
	4	Rear left speaker (+)	16	Rear left speaker (-)
	5	Illumination (+)	17	Illumination (-)
	6	Steering remote control-	18	Remote control ground
	7	-	19	MUTE
	8	-	20	Ground
	9	-	21	-
	10	-	22	-
	11	ACC	23	Antenna B+
	12	Battery	24	Ground

[6CDC (M465)]



24P Connector

Antenna jack

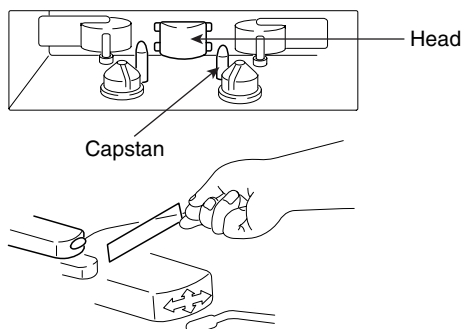


24P Connector	Pin	Name	Pin	Name
	1	Front left speaker (+)	13	Front left speaker (-)
	2	Front right speaker (+)	14	Front right speaker (-)
	3	Rear right speaker (+)	15	Rear right speaker (-)
	4	Rear left speaker (+)	16	Rear left speaker (-)
	5	Illumination (+)	17	Illumination (-)
	6	Steering remote control-	18	Remote control ground
	7	-	19	MUTE
	8	-	20	Ground
	9	-	21	-
	10	-	22	-
	11	ACC	23	Antenna B+
	12	Battery	24	Ground

**INSPECTION** ECC2A625

**TAPE HEAD AND CAPSTAN CLEANING**

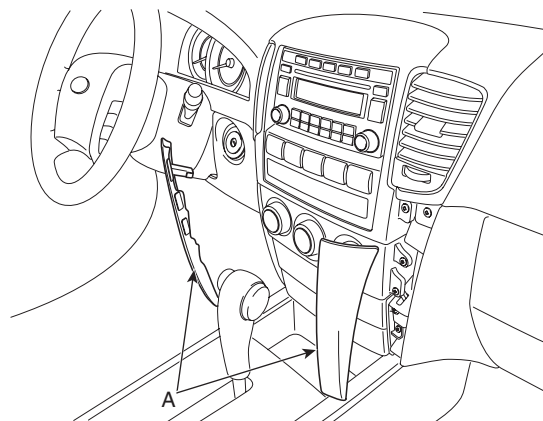
1. To obtain optimum performance, clean the head, and capstan as often as necessary, depending on frequency of use and tape cleanness.
2. To clean the tape head and capstan, use a cotton swab dipped in ordinary rubbing alcohol. Wipe the head and capstan.



LTAC005A

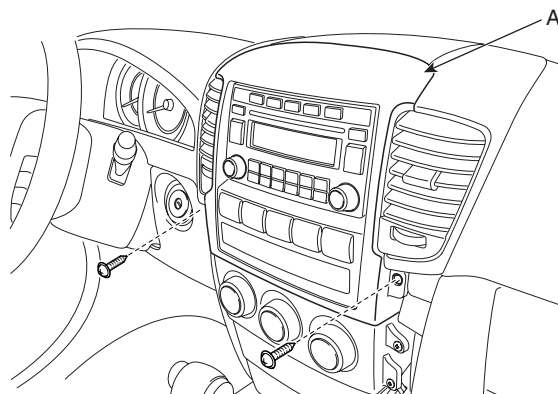
**REMOVAL** E106BA6F

1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia lower panel (A). (Refer to the Crash pad in BD group.) after pulling it by using regular screw driver (-) at part (A). Take care of fixing clips (B).



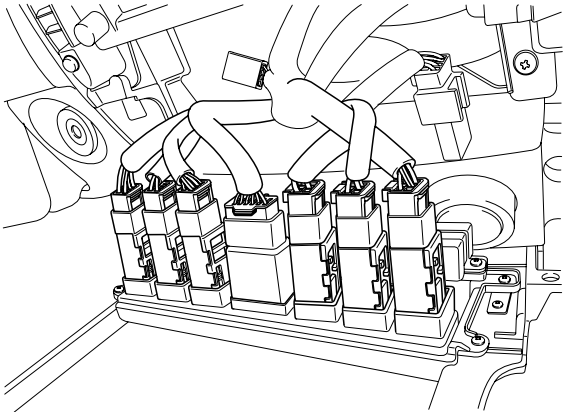
SBLBE6015D

3. Remove the center fascia panel (A) after loosening the screws. Avoid damaging retaining clips.



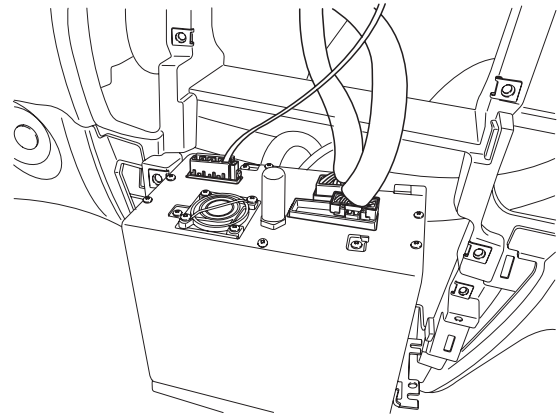
SBLBE6010D

4. Remove the connectors of center fascia panel.



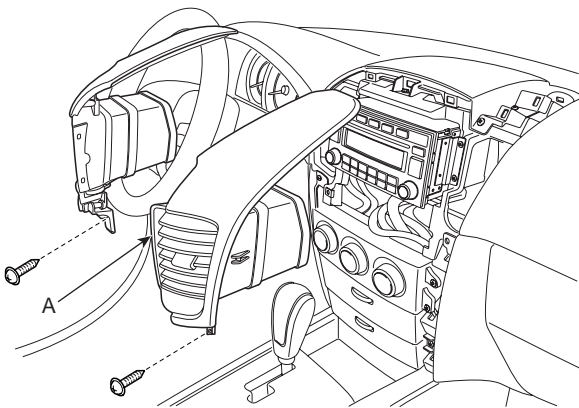
SBLBE6014D

7. Remove the audio unit after disconnecting the audio connectors and cable.



SBLBE6013D

5. Remove the mounting screws then remove the center air vent (A).



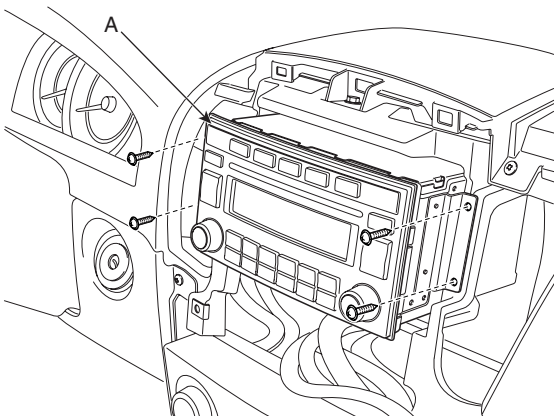
SBLBE6011D

**INSTALLATION**

EDBAD1C5

1. Connect the audio connectors and cable to the audio unit
2. Fasten the audio mounting screws.
3. Reassemble the center air vent (A).
4. Reassemble the center fascia panel after connecting the connectors.
5. Reassemble the center fascia lower panel.
6. Connect the negative (-) battery terminal and then check the audio working.

6. Remove the mounting screws then remove the audio unit (A).



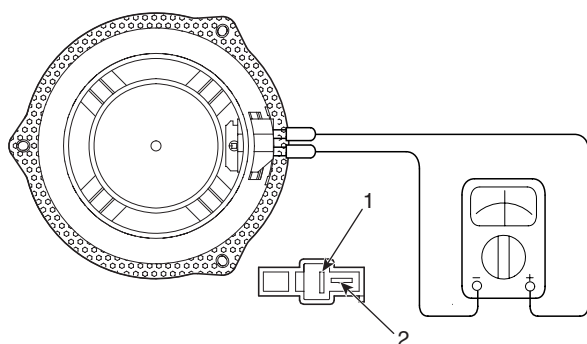
SBLBE6012D

## SPEAKERS

### INSPECTION E3EDC26E

1. Check the speaker with an ohmmeter. If an ohmmeter indicates the correct impedance of the speaker when checking between the speaker (+) and speaker (-) of the same channel, the speaker is OK.
2. If a clicking sound is emitted from the speaker when the ohmmeter is connected to the speaker terminals, the speaker is OK.

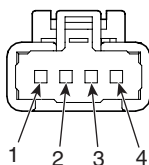
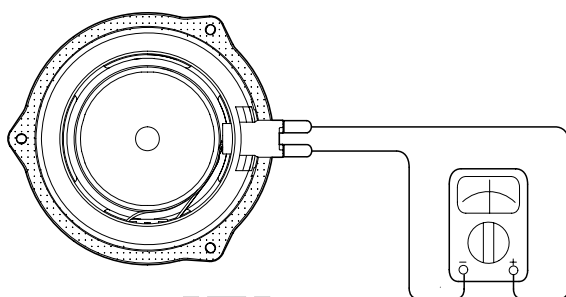
#### [1 WAY]



1. Speaker (-)
2. Speaker (+)

SBLBE6020L

#### [2 WAY]



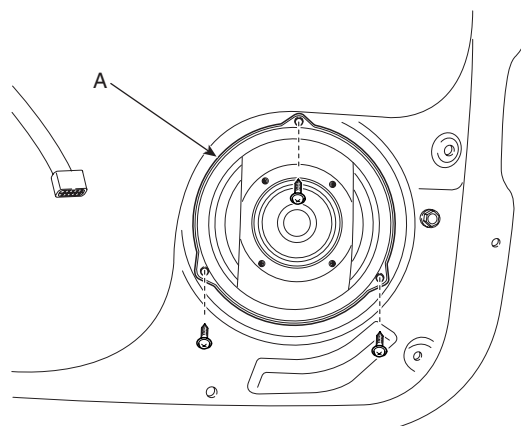
1. MID (-)
2. MID (+)
3. Woofer (-)
4. Woofer (+)

SBLBE6021L

### REMOVAL EBCB442F

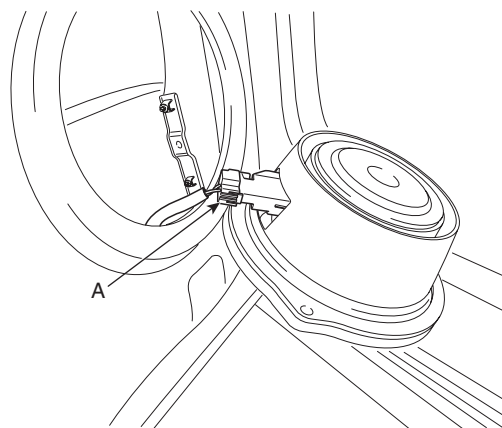
#### FRONT SPEAKER

1. Remove the front door trim panel (Refer to the Front door in BD group).
2. Remove the front speaker (A) after removing 3 screws.



SBLBE6022D

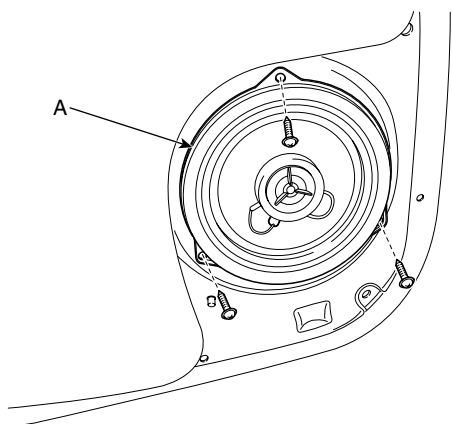
3. Remove the connector (A).



SBLBE6025D

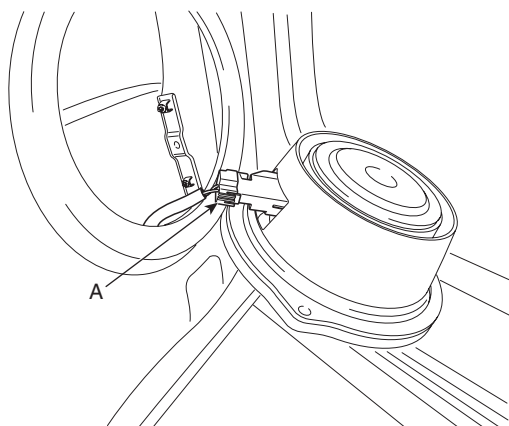
**REAR SPEAKER**

1. Remove the rear door trim panel (Refer to the Rear door in BD group).
2. Remove the rear speaker (A) after removing 3 screws rivets.



SBLBE6024D

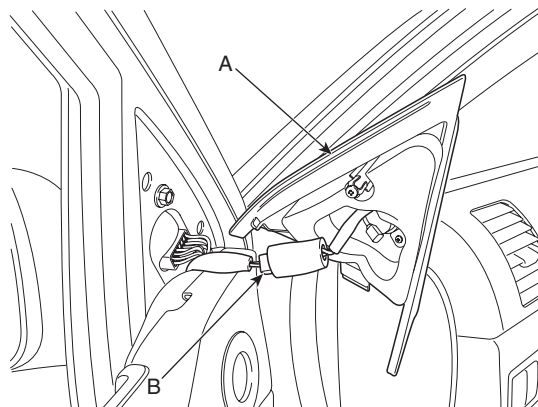
3. Disconnect the connector(A).



SBLBE6025D

**TWEETER SPEAKER**

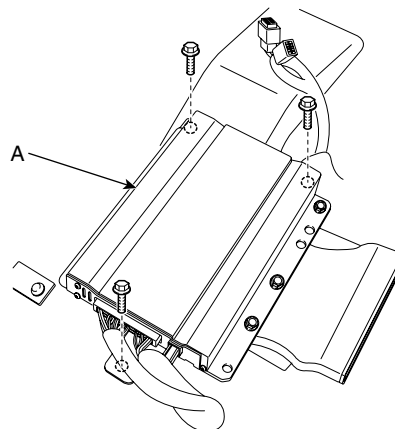
1. Remove the tweeter speaker cover (A) and then disconnect the connector (B) (Refer to the Front door in BD group).



SBLBE6026D

**EXTERNAL AMPLIFIER**

1. Remove the driver seat. (Refer to the Front seats in BD group.)
2. Remove the external amplifier (A) from the driver seat floor inner panel (A) after removing 3 bolts.



SBLBE6027D

**INSTALLATION** E374AFD2

**FRONT SPEAKER**

1. Connect the connectors to the front speaker.
2. Reassemble the front speaker.
3. Reassemble the front door trim panel.

**REAR SPEAKER**

1. Connect the connectors to the rear speaker.
2. Reassemble the rear speaker.
3. Reassemble the rear door trim panel.

**TWEETER SPEAKER**

1. Connect the connectors and then reassemble the tweeter speaker.

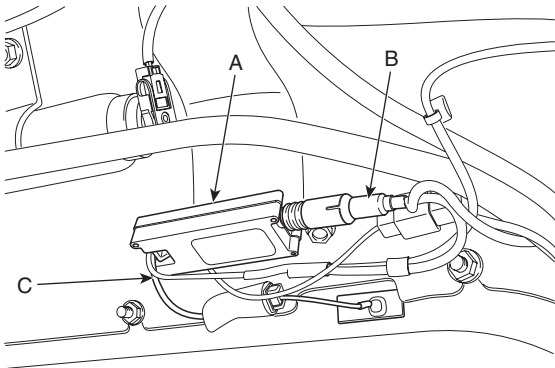
**EXTERNAL AMPLIFIER**

1. Reassemble the external amplifier on the driver seat floor
2. Reassemble the driver seat after connecting the connectors.

**ANTENNA**

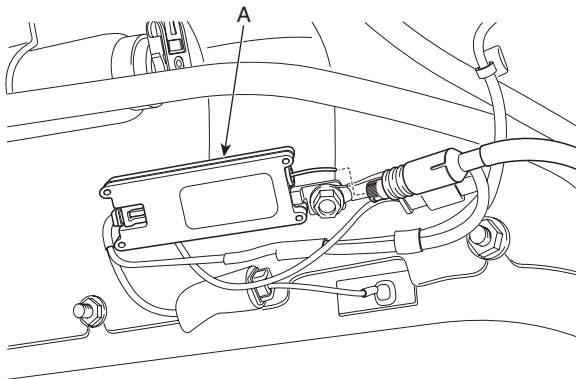
**REMOVAL** E57651F8

1. Remove the rear right quarter trim.
2. Remove the radio feeder cable (B) and amplifier wiring (C) from the glass antenna radio amplifier (A).



SBLBE6030D

3. Remove the glass antenna radio amplifier (A) after removing fixing bolt(1EA).



SBLBE6031D

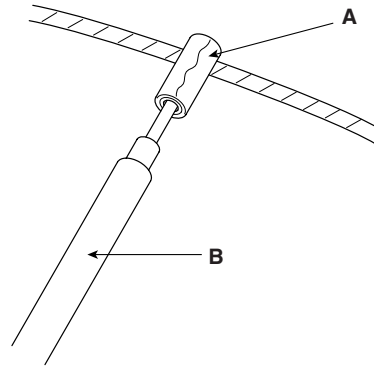
**INSTALLATION** EB339BD5

1. Reassemble the glass antenna radio amplifier
2. Connect the feeder cable and connector.
3. Reassemble the rear right quarter trim.

**INSPECTION** EB7C02F1

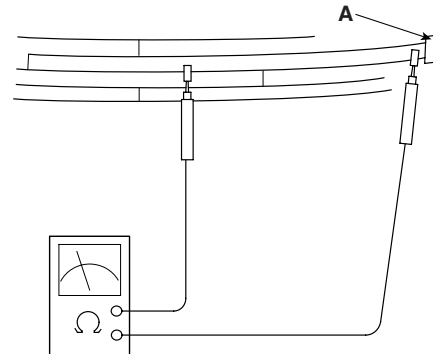
**GLASS ANTENNA TEST**

1. Wrap aluminum foil (A) around the tip of the tester probe (B) as shown.



ETKD003A

2. Touch one tester probe to the glass antenna terminal (A) hear, and move the other tester probe along the antenna wires to check that continuity exists.



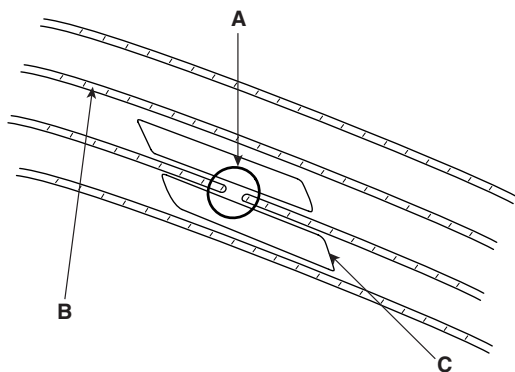
ETKD004A

**GLASS ANTENNA REPAIR**

**NOTE**

To make an effective repair, the broken section must be no longer than one inch.

1. Lightly rub the area around the broken section (A) with fine steel wool, and then clean it with alcohol.

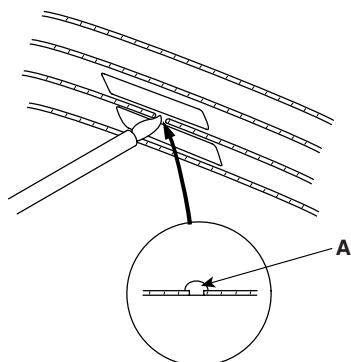


ETKD004K

2. Carefully mask above and below the broken portion of the glass antenna wire (B) with cellophane tape (C).
3. Using a small brush, apply a heavy coat of silver conductive paint (A) extending about 1/8" on both sides of the break. Allow 30 minutes to dry.

**NOTE**

Thoroughly mix the paint before use.



ETKD006Z

4. Check for continuity in the repaired wire.
5. Apply a second coat of paint in the same way. Let it dry three hours before removing the tape.

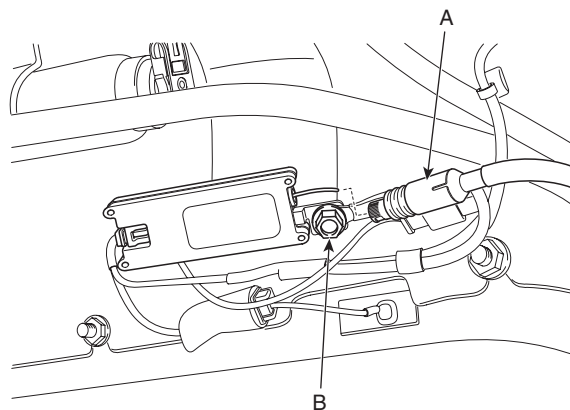
**RADIO AMPLIFIER INSPECTION**

1. Remove the radio feeder cable from the radio amp after removing the rear right quarter trim panel.
2. Turn the radio ON. Measure the voltage between radio amp feeder cable (A) and body ground (B).

---

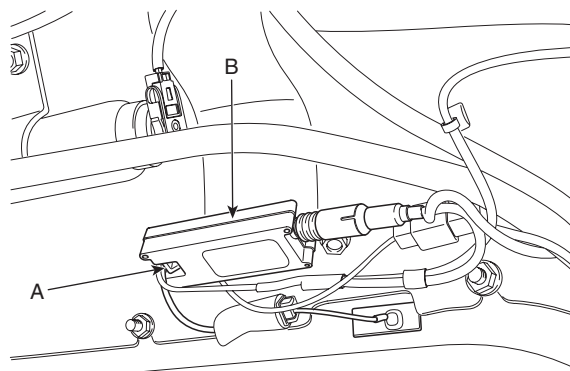
OK : approximately 12V (ACC+)

---



SBLBE6032D

3. Check for continuity between grid wire connector (A) and radio amp (B) rightly.

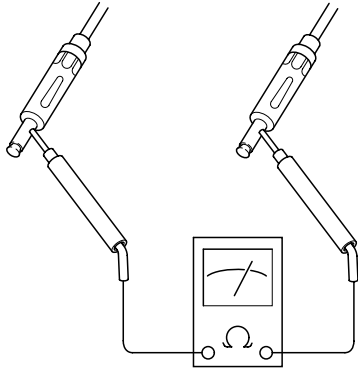


SBLBE6033D

4. Check the grid lines for continuity.
5. When a poor radio reception is not repaired through the above inspection methods, replace the amp. If the radio reception is still poor, check the radio cable for short and radio head unit for failure.

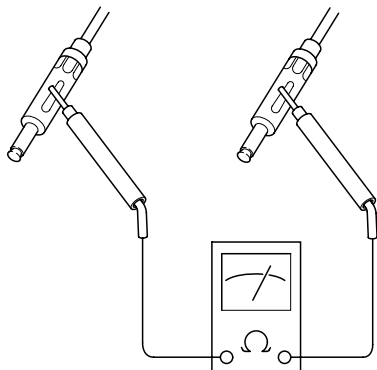
**ANTENNA CABLE**

1. Remove the antenna jack from the audio unit and antenna.
2. Check for continuity between the center poles of antenna cable.



ATJF023C

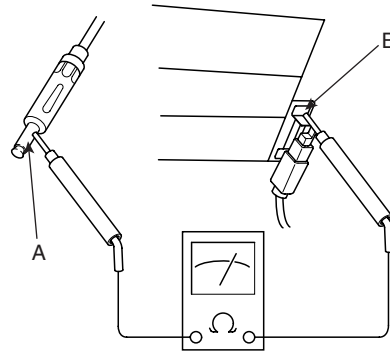
3. Check for continuity between the outer poles of antenna cable. There should be continuity.



ATJF023D

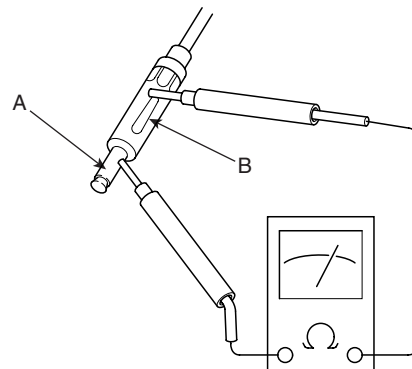
4. If there is no continuity, replace the antenna cable.

5. Check for continuity between the center pole (A) of antenna cable and terminal of glass antenna (B). There should be continuity.



ATJF023E

6. If there is no continuity, replace the antenna amplifier.
7. Check for continuity between the center pole (A) and outer pole (B) of antenna cable. There should be no continuity.

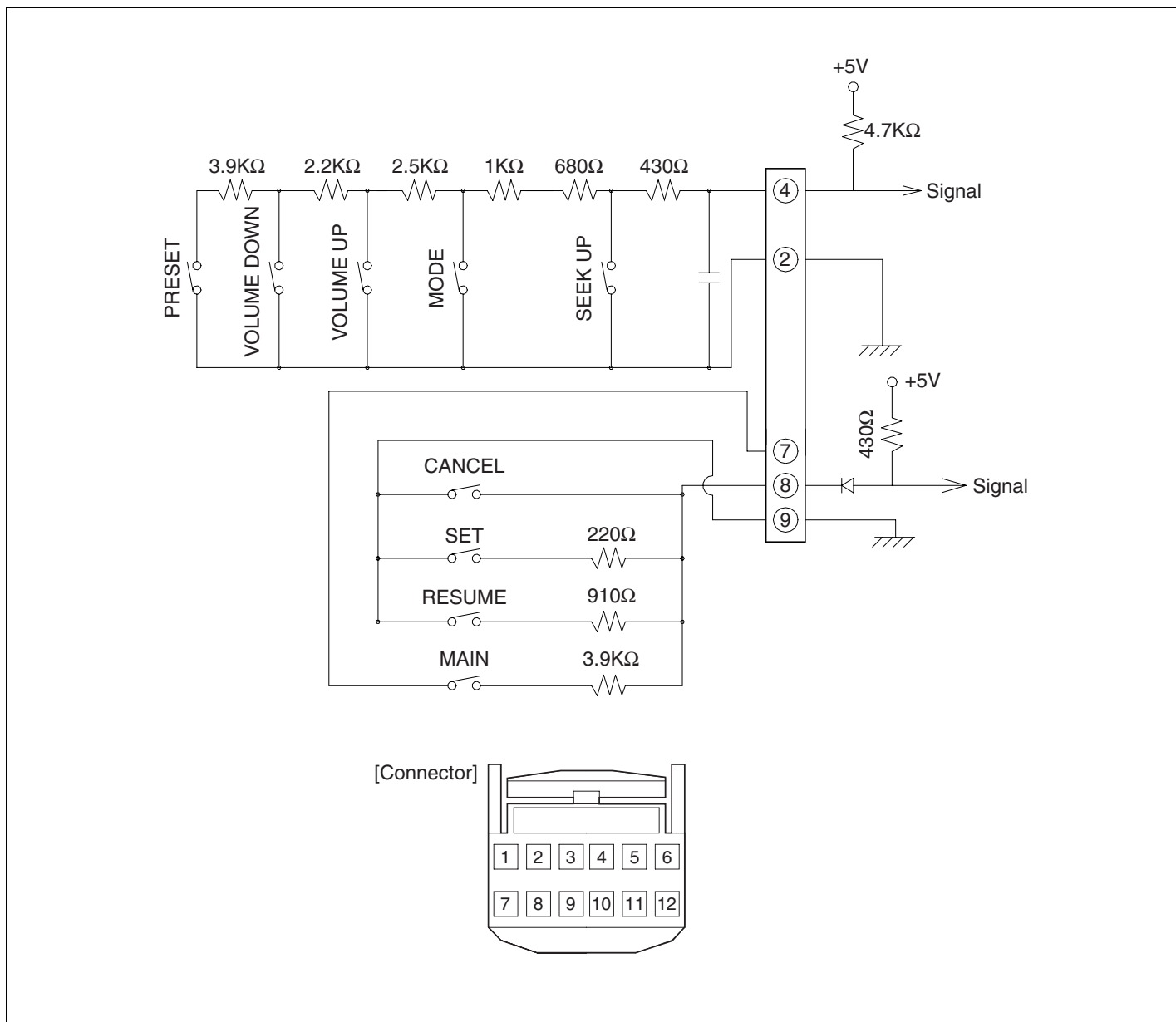


ATJF023F

8. If there is continuity, replace the antenna cable.

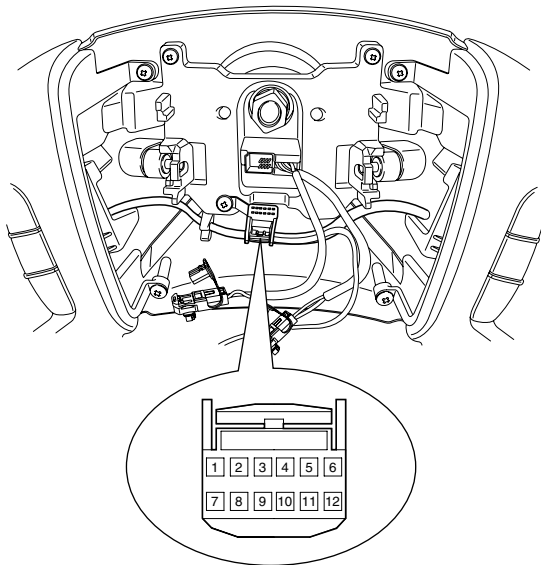
# AUDIO REMOTE CONTROL

## CIRCUIT DIAGRAM E0EC330A



**INSPECTION** E5403C8F

1. Check for resistance between No.2 and No.4 terminals in each switch position.

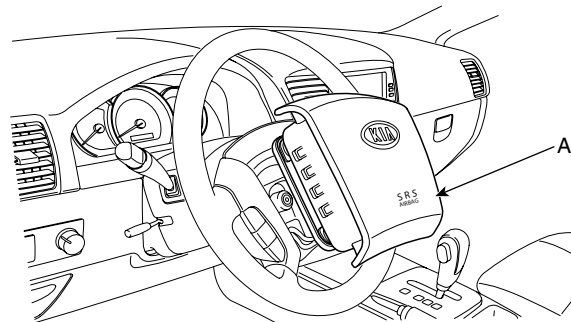


SBLBE6036D

Switch name	Connector terminal	Resistance (±5%)
VOLUME DOWN	2 - 4	6.81 kΩ
VOLUME UP	2 - 4	4.61 kΩ
MODE	2 - 4	2.11 kΩ
SEEK UP	2 - 4	430 Ω
PRESET	2 - 4	10.71 kΩ

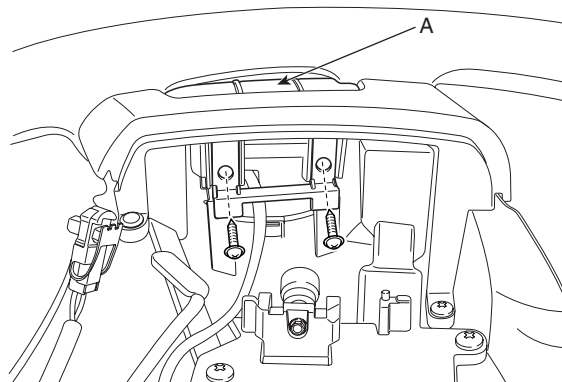
**REMOVAL** ED43DCAE

1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module (A). (Refer to the airbag group)



SBLBE6034D

3. Remove the audio remote control switch (A) after remove the steering wheel remote control switch connector and 2 screws.



SBLBE6035D

**INSTALLATION** EF4F87C0

1. Reassemble the audio remote control switch.
2. Connect the remote control switch connector.
3. Reassemble the driver airbag module and the negative (-) battery terminal.

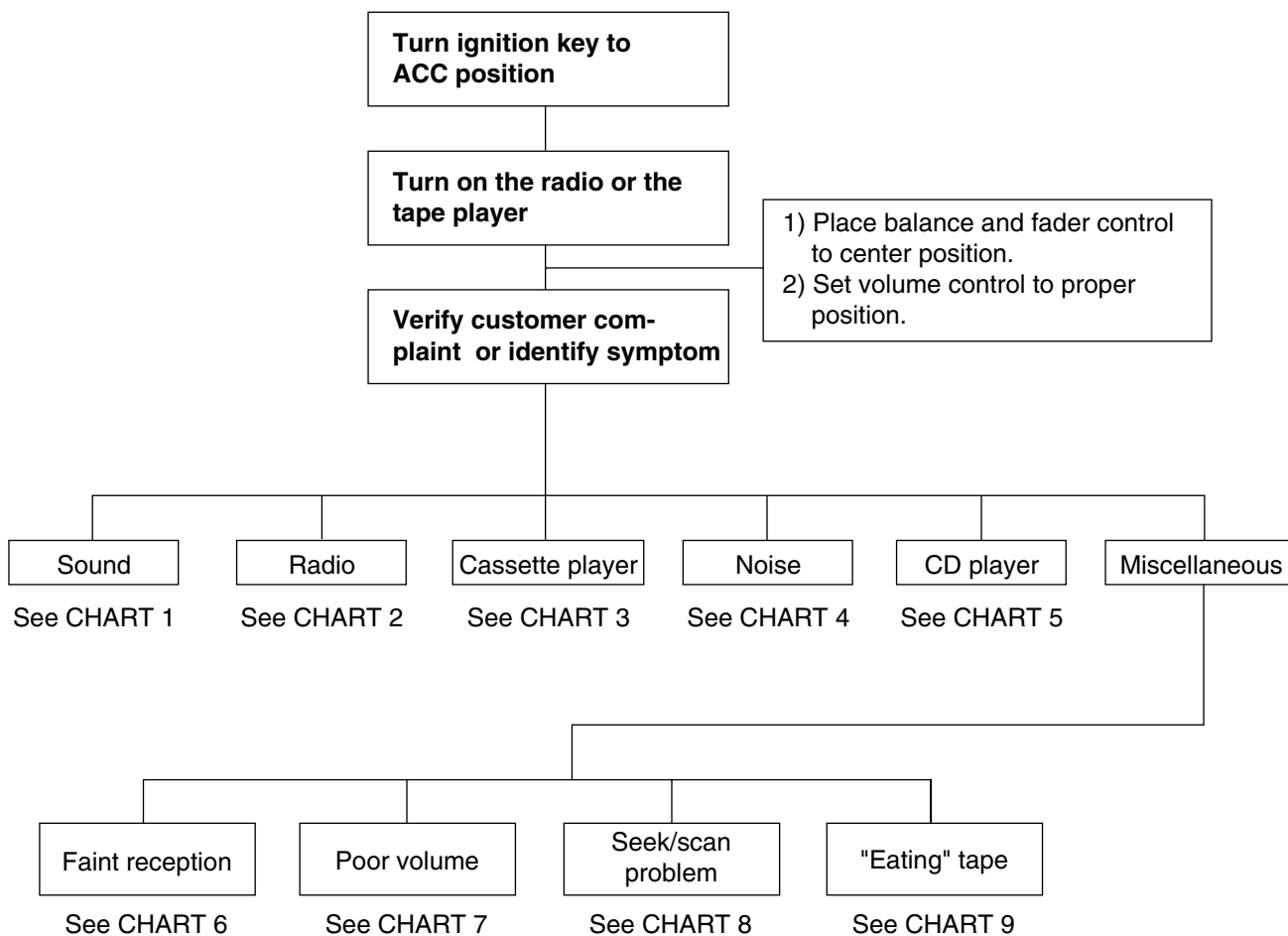
**TROUBLESHOOTING** EF3AEBCC

**CUSTOMER COMPLAINT ANALYSIS CHECK SHEET**

<b>TROUBLE IN</b>	<input type="checkbox"/> ALL <input type="checkbox"/> AM <input type="checkbox"/> FM <input type="checkbox"/> TAPE <input type="checkbox"/> CD <input type="checkbox"/> MP3 <input type="checkbox"/> CD changer <input type="checkbox"/> AMP <input type="checkbox"/> Others
<b>TROUBLE OCCURS</b>	<input type="checkbox"/> Always <input type="checkbox"/> Engine start <input type="checkbox"/> Engine Running <input type="checkbox"/> Cold <input type="checkbox"/> Warm <input type="checkbox"/> Sometimes <input type="checkbox"/> Most of the time <input type="checkbox"/> Engine off
<b>TYPE OF TROUBLE</b>	<input type="checkbox"/> Will not play <input type="checkbox"/> Tape speed not proper <input type="checkbox"/> Weak <input type="checkbox"/> Squealing noise <input type="checkbox"/> Eats tape <input type="checkbox"/> Display/illumination poor <input type="checkbox"/> CD skips & jumps <input type="checkbox"/> Tape/CD will not eject or insert <input type="checkbox"/> Others (Describe) :
<b>OTHERS</b>	<p>▶ Customer complaint contents :</p> <p>▶ Have you checked customer's defects :</p>
<p>* Using the customer complaint analysis check sheet for reference, ask the customer for as much detail as possible about the problem.</p>	

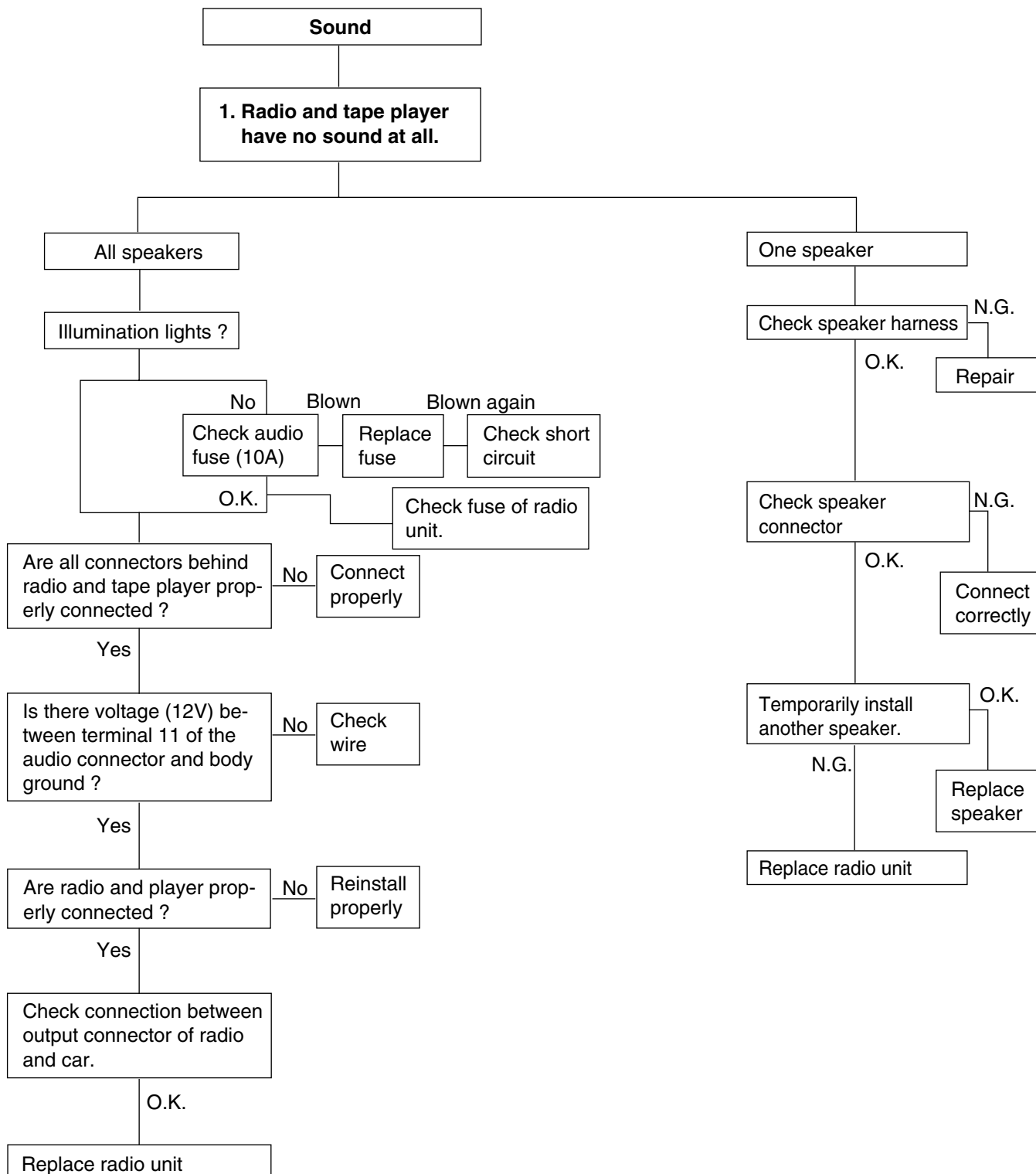
BT1G001A

There are six areas where a problem can occur: wiring harness, the radio, the cassette tape deck, the CD player, and speaker. Troubleshooting enables you to confine the problem to a particular area.



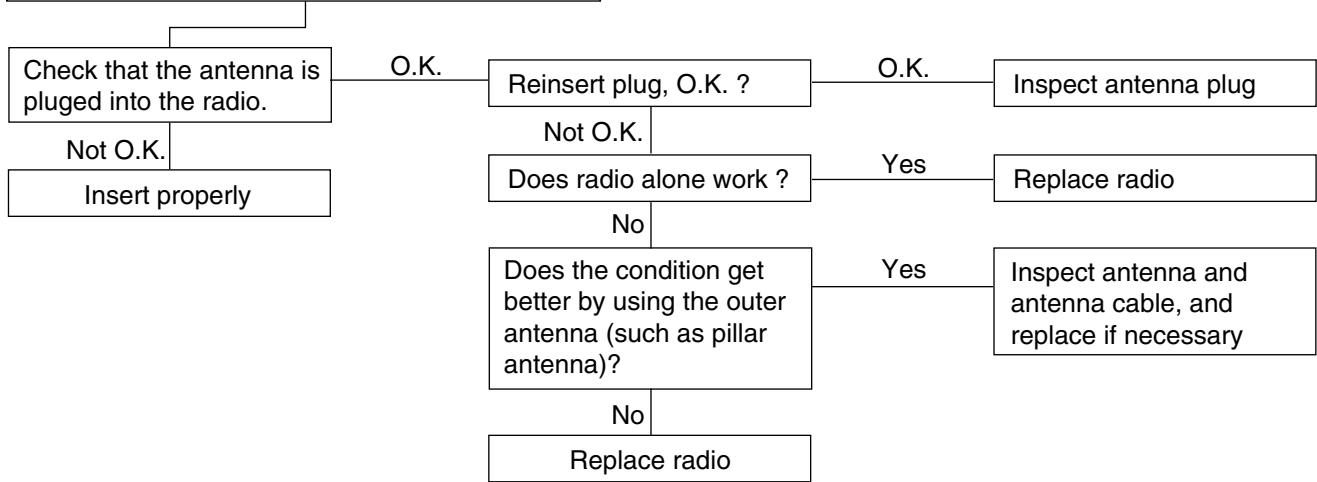
LTIF001A

CHART 1



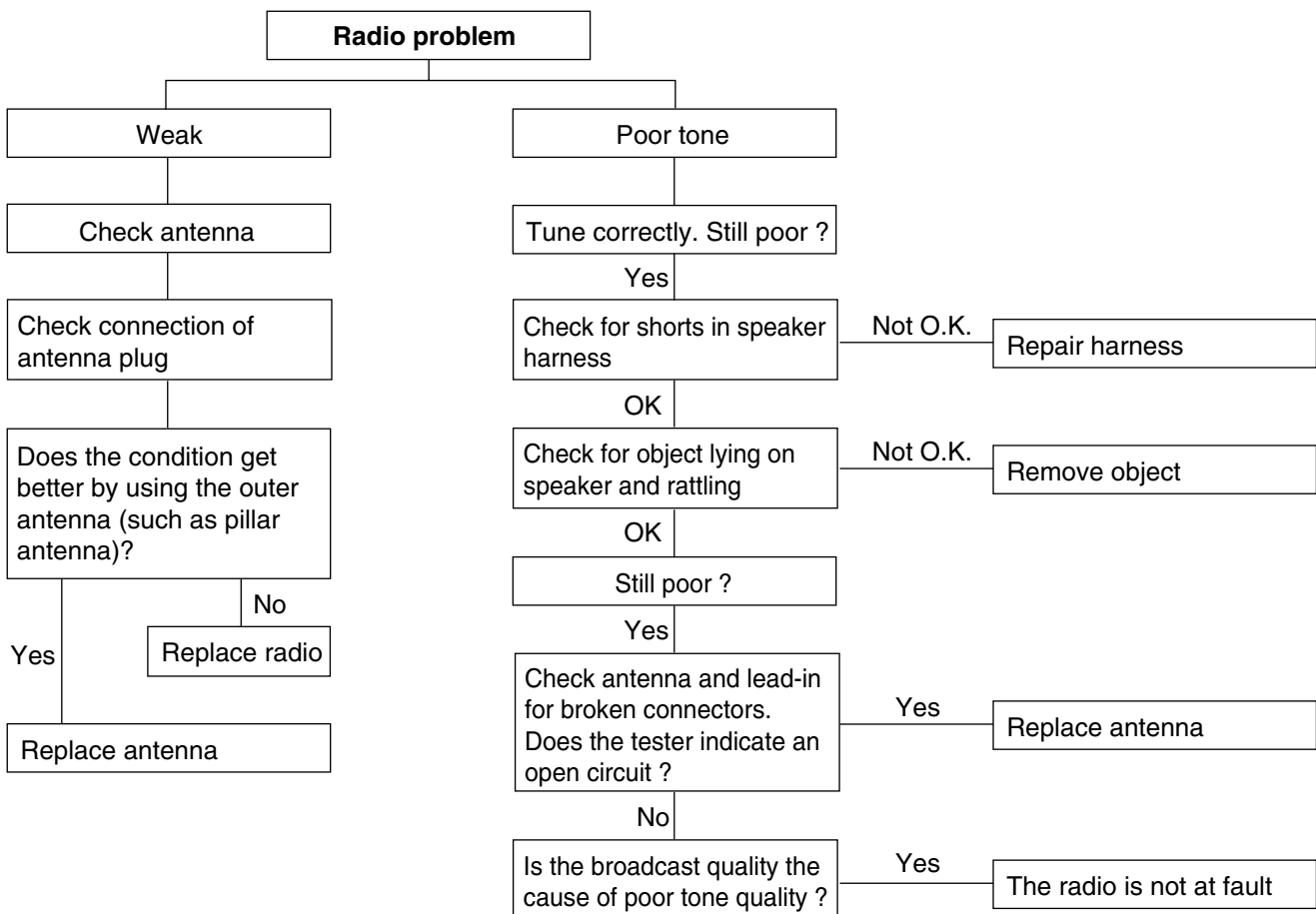
LTJF001B

**2. Tape player OK but no sound from radio**



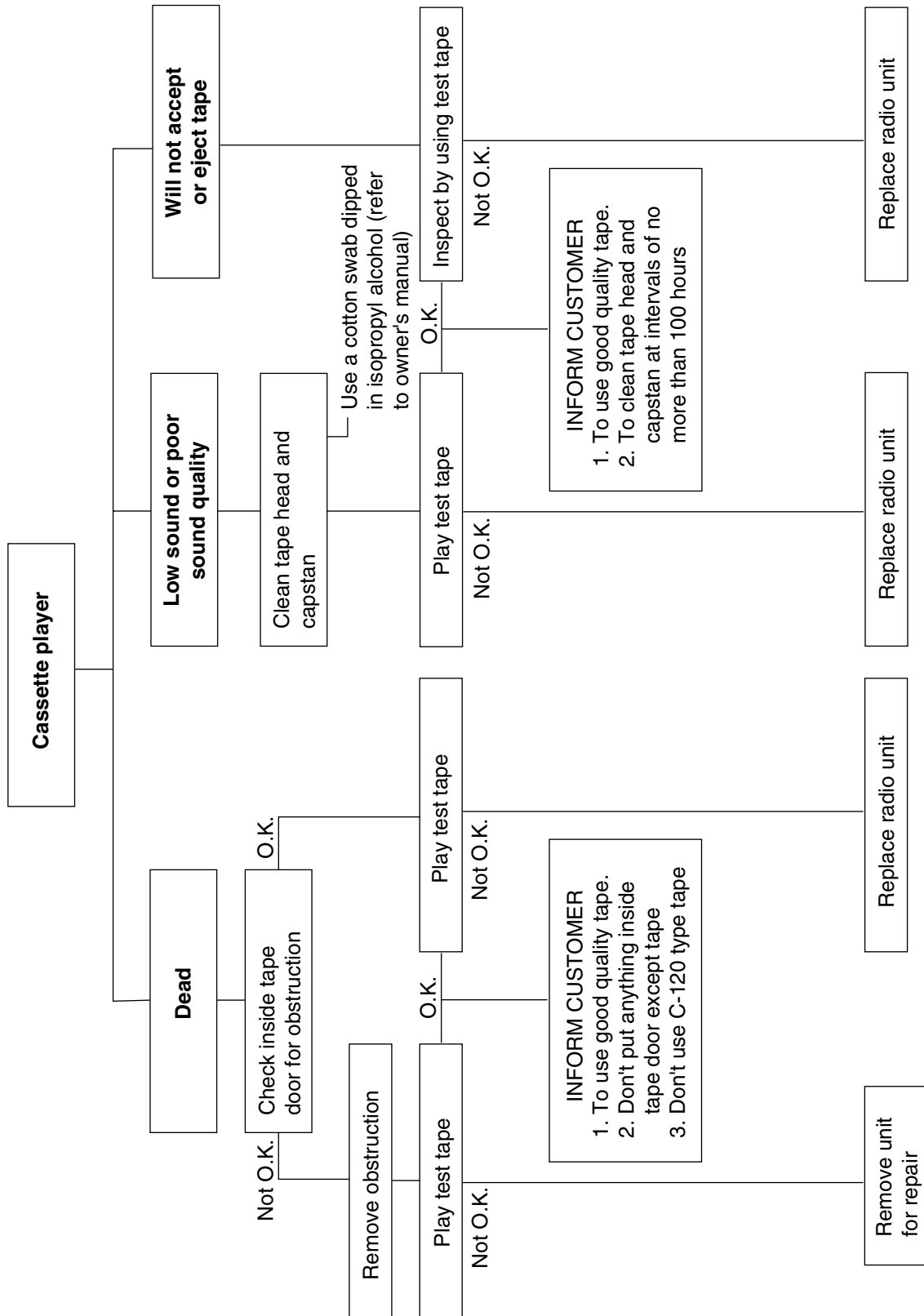
LTIF001C

**CHART 2**



BTIF001D

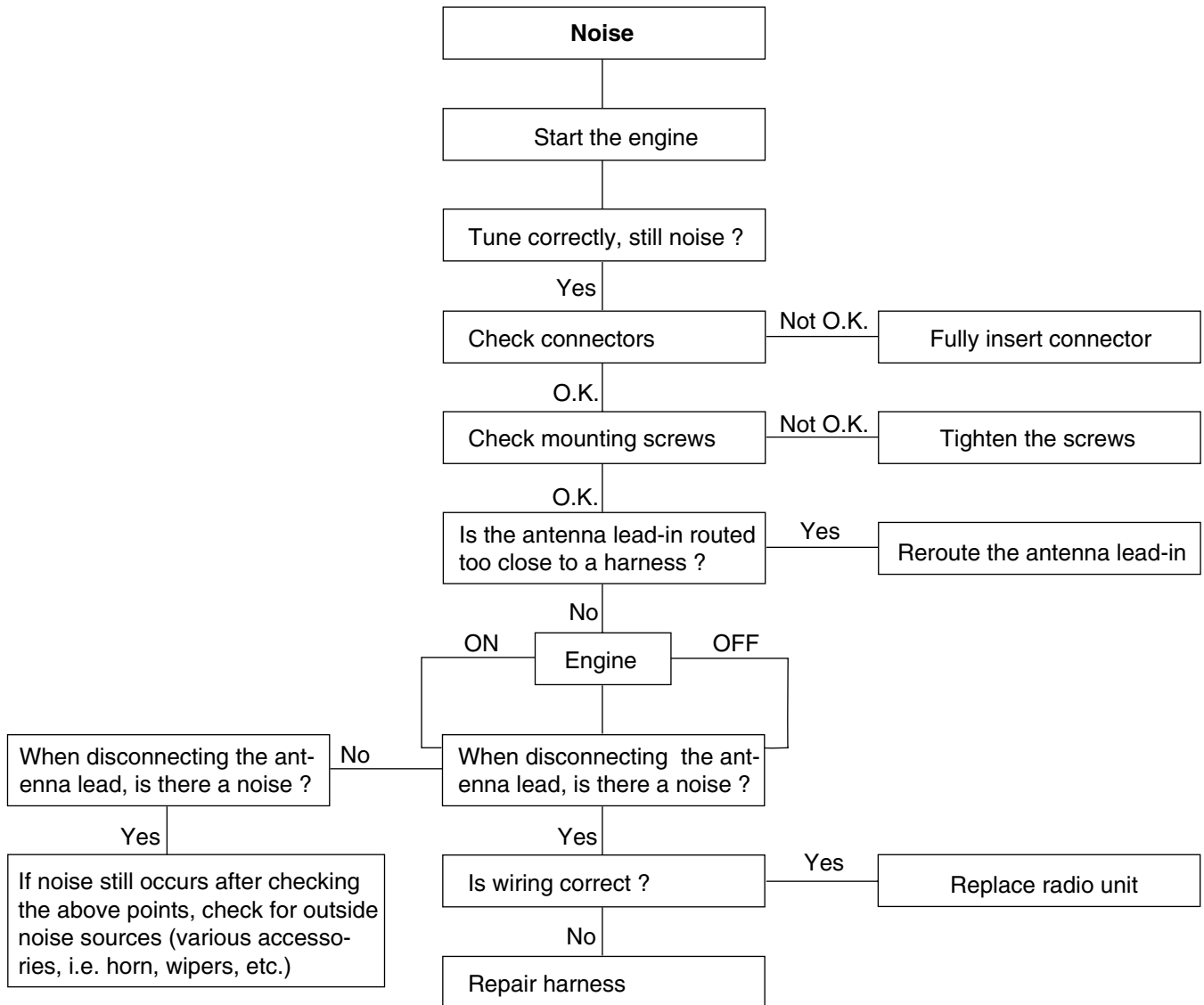
CHART 3



ETBF001E

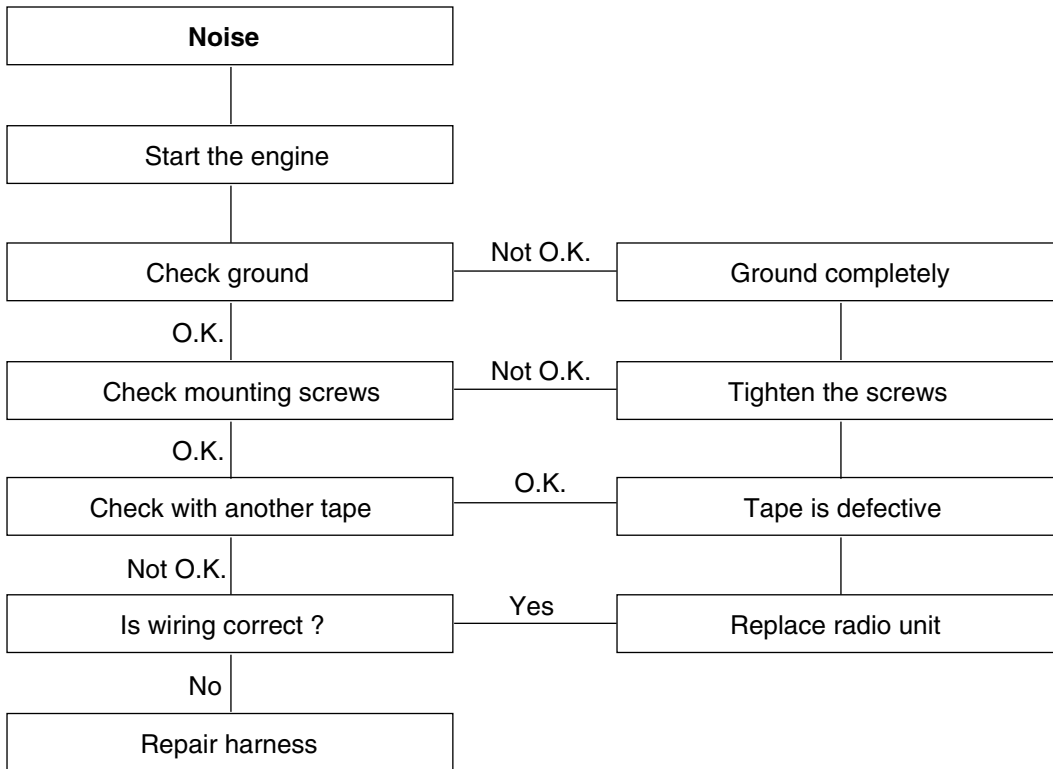
CHART 4

1. RADIO



LTIF001F

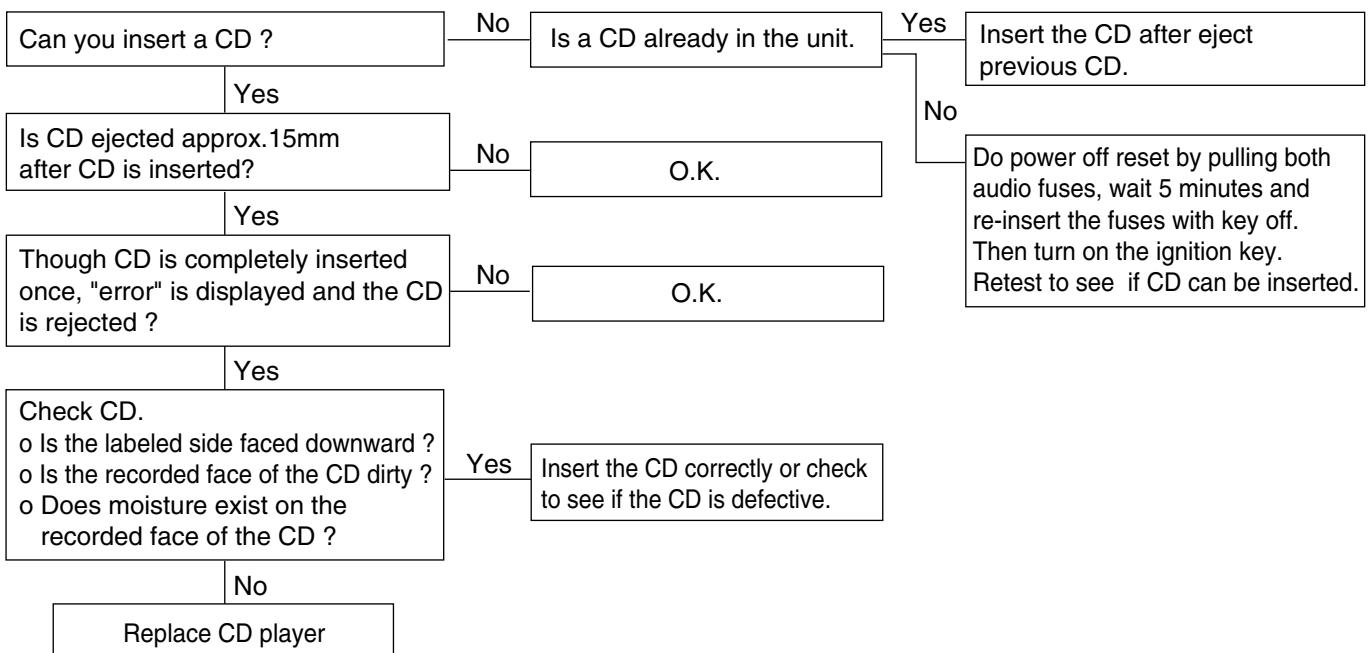
2. TAPE



LTIF001G

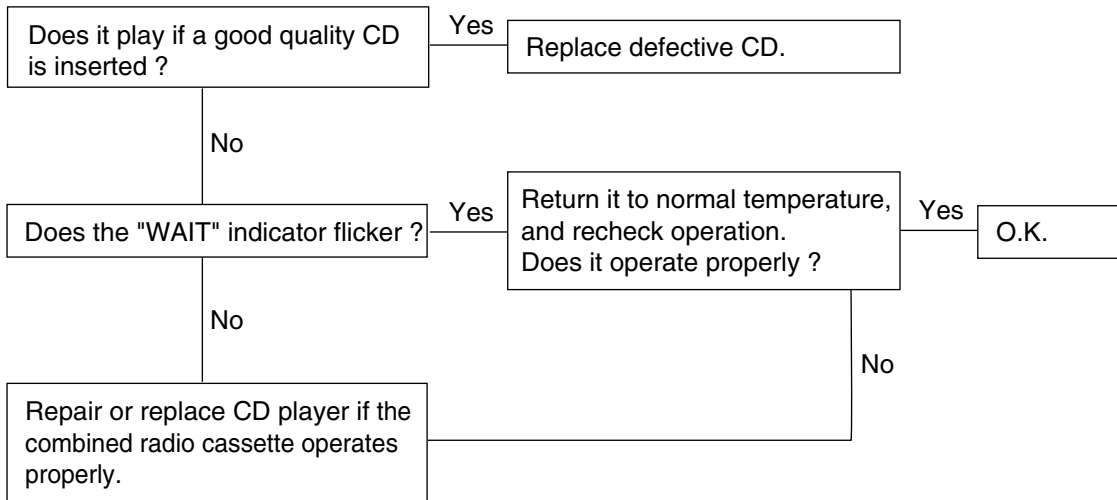
CHART 5

1. CD WILL NOT BE ACCEPTED



LTIF001H

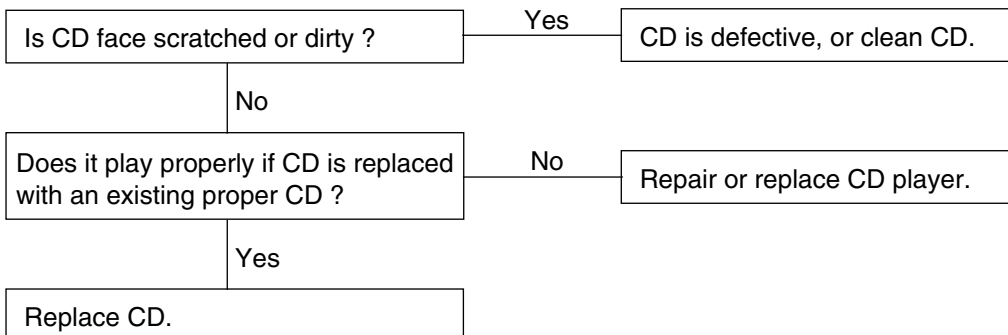
2. NO SOUND



LTIF0011

3. CD SOUND SKIPS

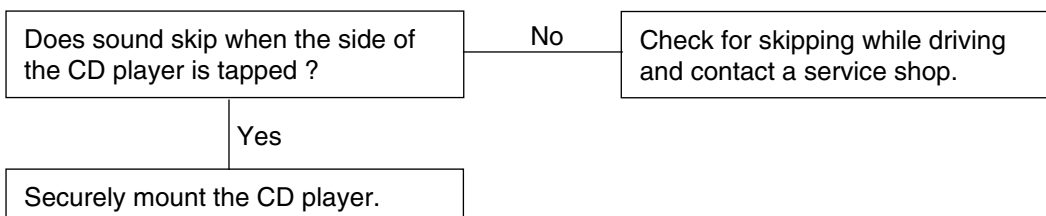
1) Sound sometimes skips when parking.



2) Sound sometimes skips when driving.

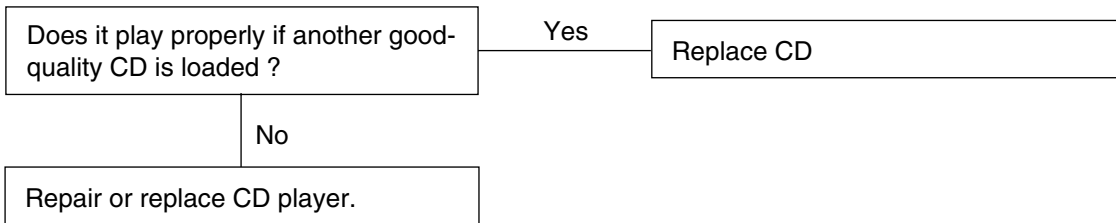
(Stop vehicle, and check it.)

(Check by using a CD which is free of scratches, dirt or other damage.)

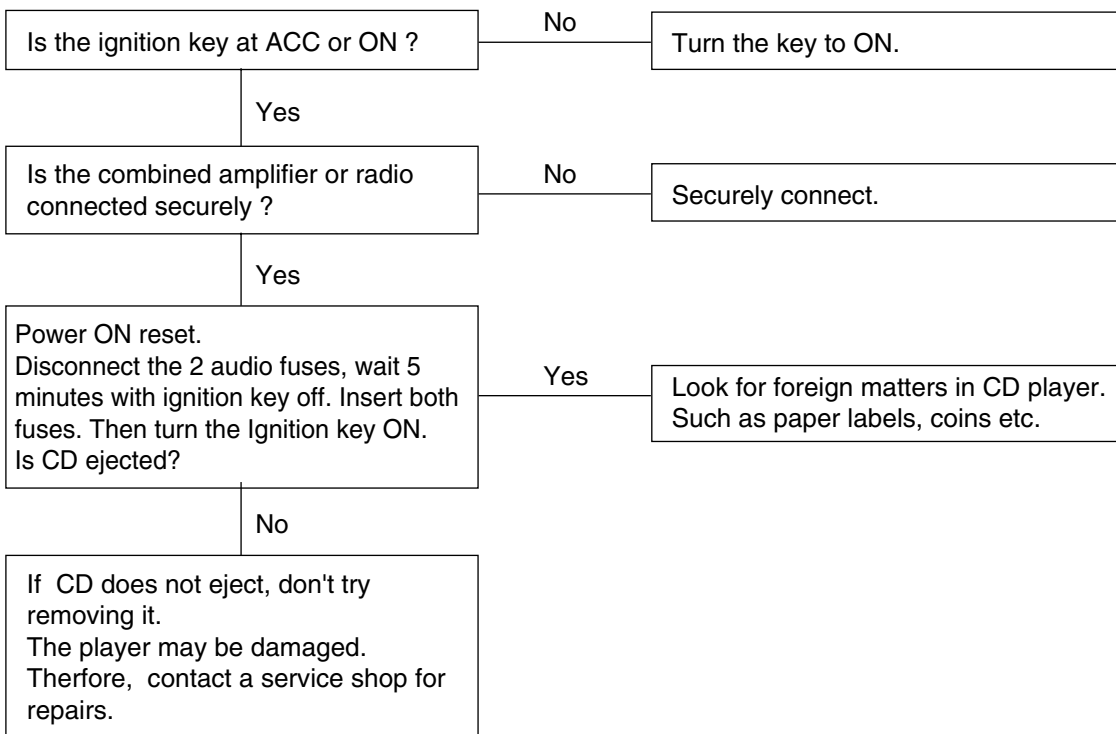


LTIF001J

4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT



6. NO SOUND FROM ONE SPEAKER

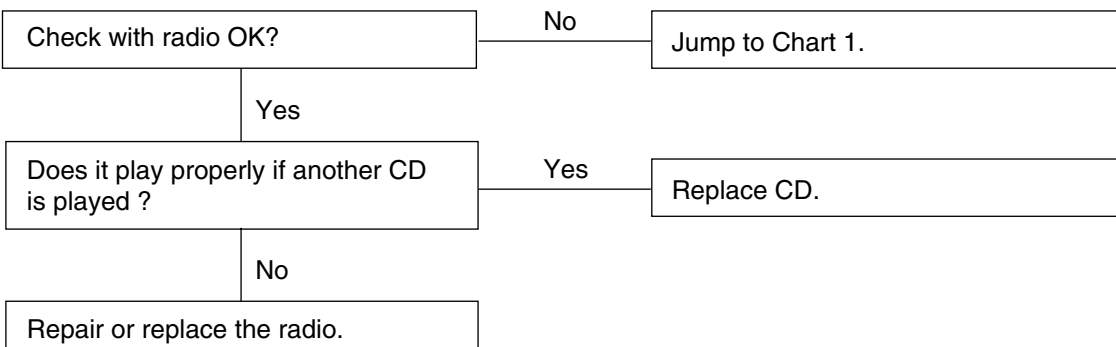
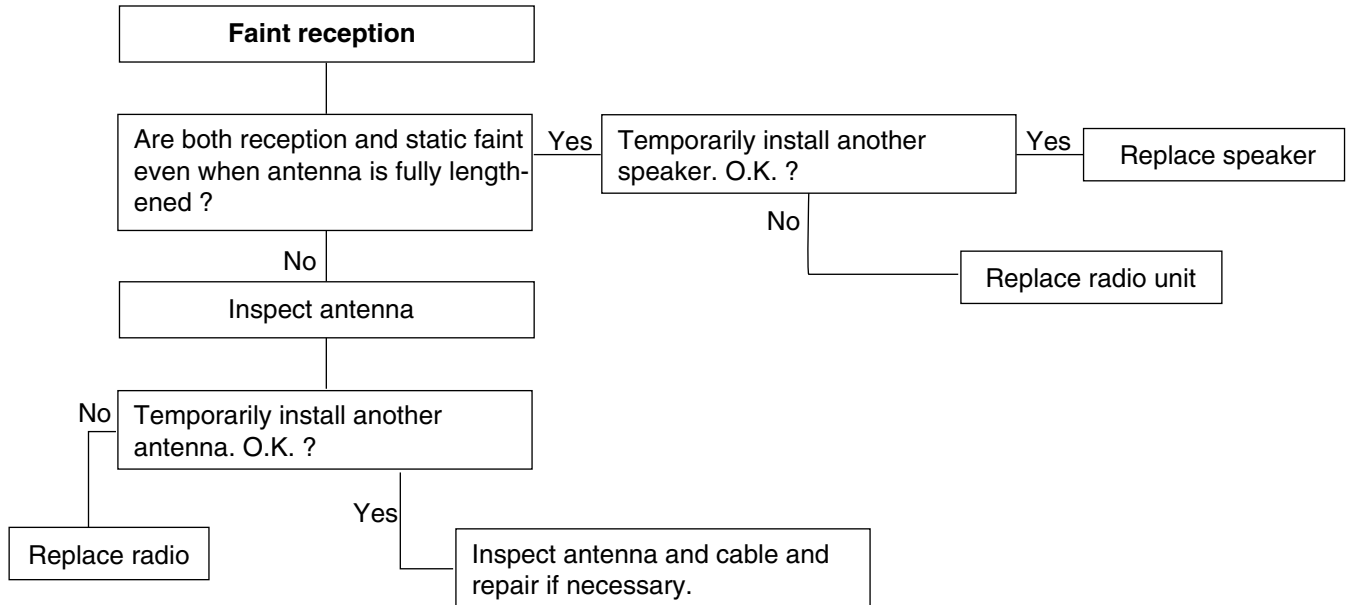
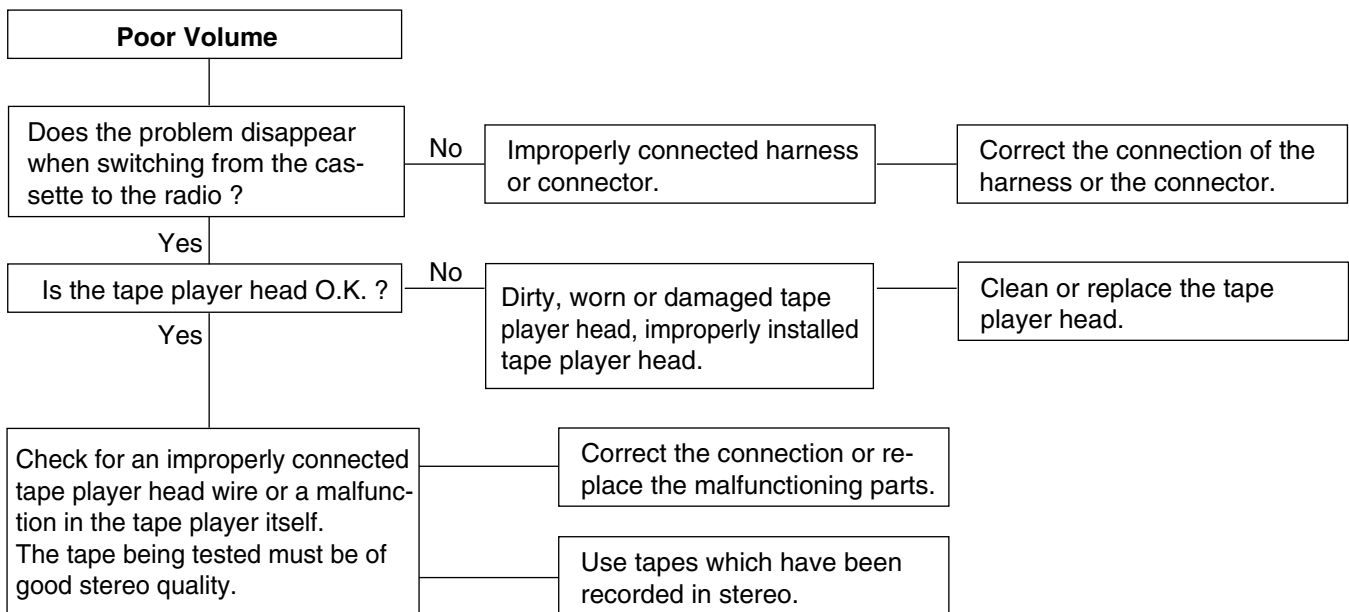


CHART 6



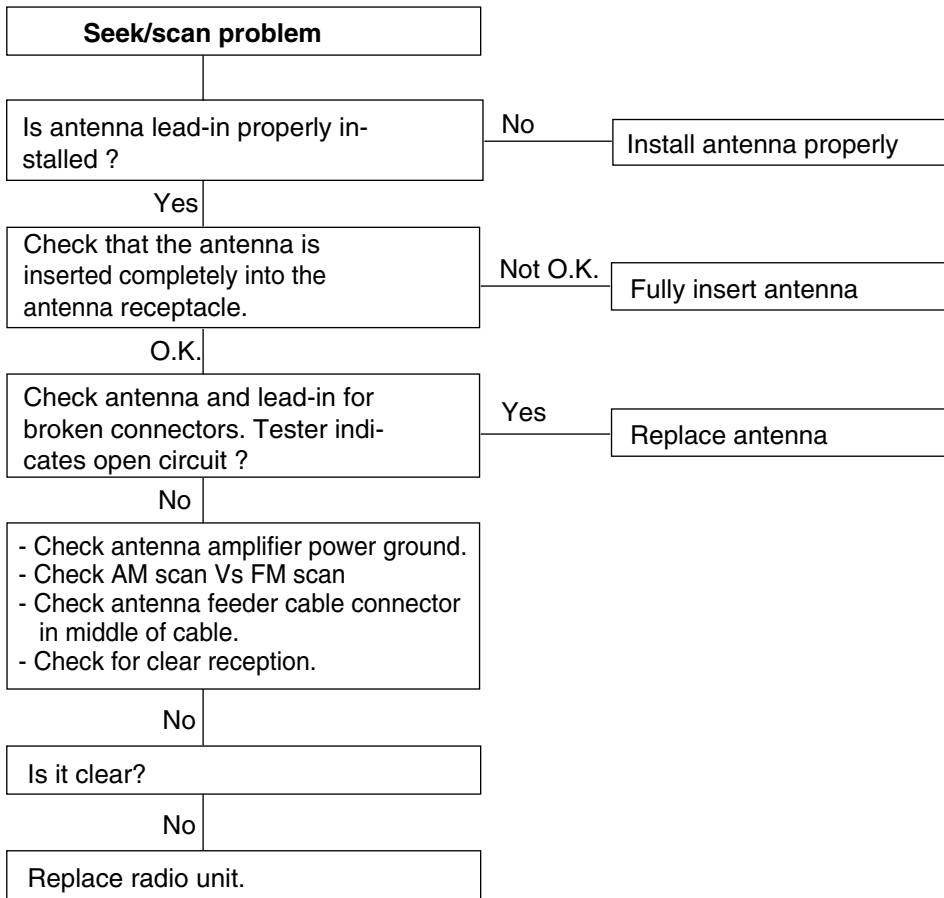
LTIF001L

CHART 7



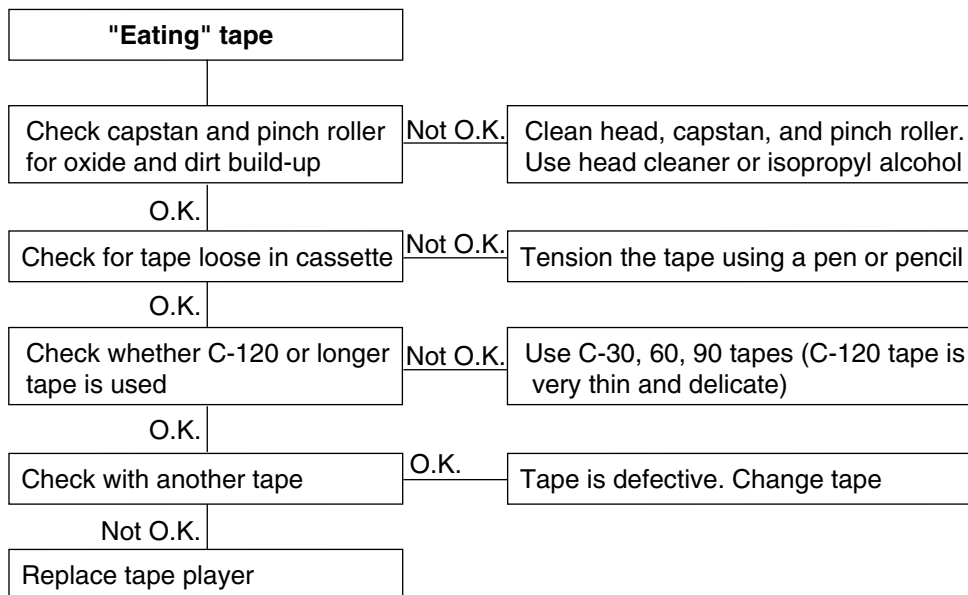
LTIF001M

CHART 8



LTIF001N

CHART 9



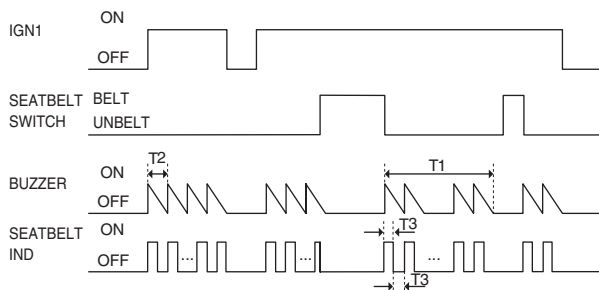
LTIF001O

# BCM (BODY CONTROL MODULE)

## OPERATION E060A4F0

### 1. SEAT BELT WARNING TIMER (except for Europe AND Australia)

- 1) In state of not wearing SEAT BELT, when IGN1 SWITCH is ON, the warning light is outputting for 0.6s and the alarm is outputting for 6s by 1s cycle.
- 2) In state of not wearing SEAT BELT, after IGN1 SWITCH is ON and IGN1 SWITCH is OFF within 6s, OFF the warning light and alarm output.
- 3) In state of not wearing SEAT BELT, after IGN1 SWITCH is ON and wearing SEAT BELT within 6s, and then OFF the alarm output immediately and output the warning light for the remained time only.
- 4) In wearing SEAT BELT, when IGN1 SWITCH is ON, the warning light is outputting for 6s by 0.6s cycles and the alarm is not outputting.



SBLBE6100L

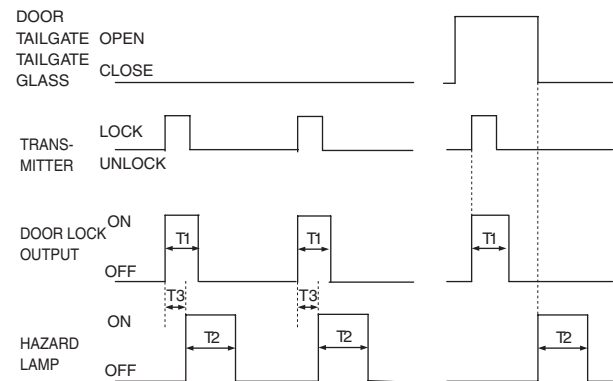
T1 : 6 ± 1 sec,  
 T2 : 1 ± 0.1 sec,  
 T3 : 0.3 ± 0.1 sec.

### 2. REMOTE KEYLESS ENTRY control Operate LOCK / UNLOCK of DOOR and TAIL GATE GLASS, PANIC by REMOCON.

- Operate in state of KEY IN SWITCH OUT & ACC SWITCH OFF & IGN1 SWITCH OFF & IGN2 SWITCH OFF.
- By receiving LOCK, UNLOCK, TAIL GATE GLASS, PANIC signal from transmitter, output LOCK / UNLOCK of DOOR and TAIL GATE GLASS OPEN, PANIC.

#### 1) TRANSMITTER LOCK FUNCTION

- a. In state of removing IGN KEY from CYLINDER and all Door is CLOSE, when receiving TRANSMITTER LOCK signal, start the operation of LOCK output and after T3 from the starting point of operation and then checking the state of LOCK SWITCH, ON the output of HAZARD LAMP for 1s one time.
- b. In state of any of DOOR, TAIL GATE, TAIL GATE GLASS is OPEN, when receiving TRANSMITTER LOCK signal, output LOCK only, don't output HAZARD LAMP.
- c. After b), in case of OPEN > CLOSE, ON the output of HAZARD LAMP one time.
- d. In state of Driver and Assist(North America ONLY) DOOR LOCK, when receiving TRANSMITTER LOCK signal, output HAZARD LAMP for 1s one time after re-outputting LOCK.



SBLBE6102L

T1 : 0.5 ± 0.1 sec,  
 T2 : 1.0 ± 0.2 sec,  
 T3 : 0.2 ± 0.04 sec.

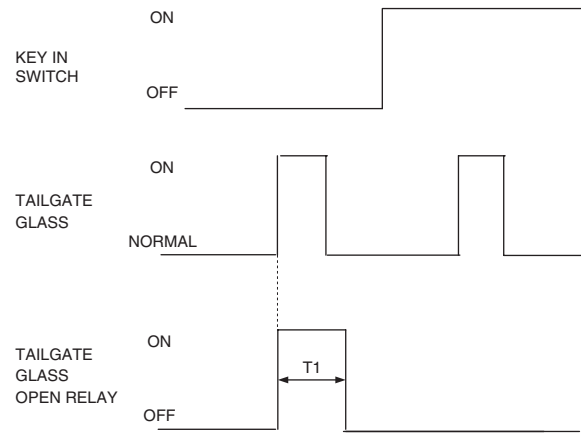
2) TRANSMITTER UNLOCK FUNCTION

- a. When receiving TRANSMITTER UNLOCK signal, output UNLOCK and ON the output of HAZARD LAMP as cycles of 0.5s and 0.5s (ON/OFF) two times.
- b. In state of Driver and Assist(North America ONLY) DOOR UNLOCK, when receiving TRANSMITTER UNLOCK, ON the output of HAZARD LAMP as cycles of 0.5s and 0.5s (ON/OFF) two times after outputting UNLOCK.
- c. After TRANSMITTER UNLOCK and then there are no inputs of Entering (DOOR, TAIL GATE, TAIL GATE GLASS) OPEN within 30s, lock them automatically and ON the output of HAZARD LAMP for 1s one time. And in case of TRANSMITTER UNLOCK within 30s once more, extend the time for about 30s. (regardless the state of KNOB within 30s)

But, after TRANSMITTER UNLOCK and then insetting KEY within 30s, cancel 30s TIMER. (After the initial TRANSMITTER UNLOCK without LOCK, HAZARD output, and after keeping the output of ROOM LAMP for 30s, turn out the light 2s)

3) TRANSMITTER TAIL GATE GLASS OPEN FUNCTION

- a. In state of removing IGN KEY from CYLINDER and inputting TAIL GATE GLASS OPEN signal of TRANSMITTER, ON the output of TAIL GATE GLASS OPEN RELAY for 0.5s.
- b. In state of TAIL GATE GLASS OPEN, turn on TAIL GATE WARNING LAMP and ROOM LAMP.

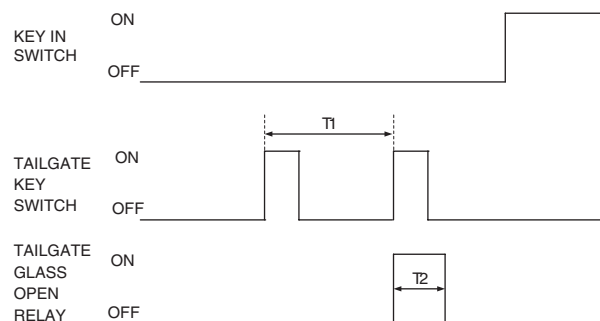


SBLBE6104L

T1 : 0.5 ± 0.1 sec.

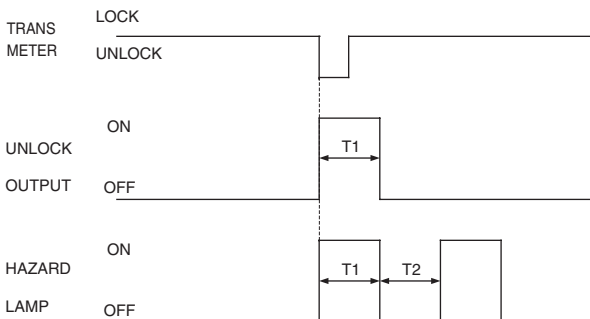
4) TAIL GATE GLASS OPEN FUNCTION (NON-RKE)

- a. In state of removing IGN KEY from CYLINDER and INPUT of TAIL GATE KEY SWITCH is inputting within T1 2 times, ON the output of TAIL GATE GLASS OPEN RELAY for 0.5s.
- b. In state of TAIL GATE GLASS OPEN, turn on TAIL GATE WARNING LAMP and ROOM LAMP.



SBLBE6105L

T1 : 3.0 ± 0.5 sec,  
T2 : 0.5 ± 0.1 sec.

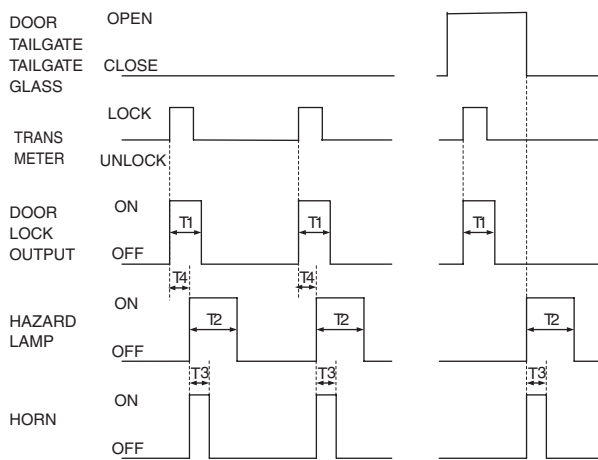


SBLBE6103L

T1, T2 : 0.5 ± 0.1 sec.

5) TRANSMITTER LOCK OPERATION SOUND FUNCTION (DOMESTIC)

- a. In state of removing IGN KEY from CYLINDER and all Door is CLOSE, when receiving TRANSMITTER LOCK signal, start the operation of LOCK output and after T3 from the starting point of operation and then checking the state of LOCK SWITCH, ON the output of HAZARD LAMP for 1s one time and output HORN one time(30msec).
- b. In state of any of DOOR, TAIL GATE is OPEN, when receiving TRANSMITTER LOCK signal, output LOCK only, don't output HAZARD LAMP or HORN.
- c. After (2), in case of OPEN > CLOSE, ON the output of HAZARD LAMP or HORN one time (30msec).
- d. In state of Driver and Assist(North America ONLY) DOOR LOCK, after re-outputting LOCK by TRANSMITTER, output HAZARD LAMP or HORN for one time (30msec).
- e. After receiving UNLOCK signal by TRANSMITTER and there is no DOOR OPEN for 30s, output LOCK & HAZARD & HORN(30ms) one time.

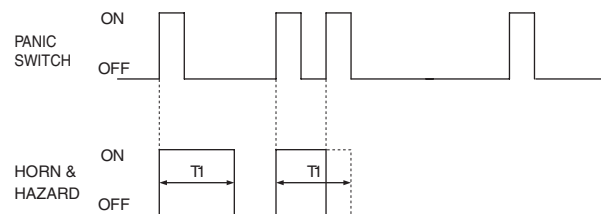


SBLBE6106L

- T1 : 0.5 ± 0.1 sec,
- T2 : 1.0 ± 0.2 sec,
- T3 : 30.0 ± 5 msec,
- T4 : 0.2 ± 0.04 sec.

6) PANIC ALARM

- a. When receiving TRANSMITTER PANIC signal, ON the PANIC ALARM by using HORN and HAZARD for T1.
- b. During PANIC alarm, when receiving (TRANSMITTER LOCK / TRANSMITTER UNLOCK / TRANSMITTER PANIC / TRANSMITTER TAIL GATE GLASS OPEN / KEY IN / DRIVER KEY UNLOCK, DRIVER KEY LOCK) signal, OFF PANIC Alarm.
- c. During PANIC alarm, even if receiving the other TRANSMITTER registered, regard it as the same TRANSMITTER.
- d. After RELOCKING by TRANSMITTER UNLOCK, when all the door (4DOOR, TAIL GATE, TAIL GATE GLASS) is closed and all KNOB is LOCK, OFF PANIC Alarm.

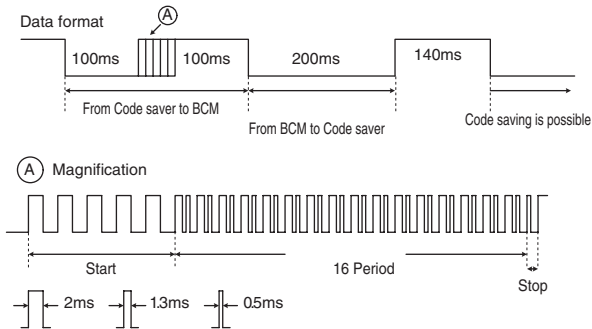


SBLBE6107L

T1 : 30 ± 3 sec.

3. RKE CODE SAVE function

1) CODE SAVER COMMUNICATION SPEC



SBLBE6111L

2) CODE SAVING PROCEDURE

- a. Open Door
- b. Connect the power of Code Saver (B+), GND, signal line.
- c. If connecting normally, the communication line becomes activate and RED LED becomes ON.
- d. If SW of Code Saver is ON, transfer the data of 3.8.1 through the communication line.
- e. If BCM has received the data of 3.8.1 from Code Saver, it returns to Code Save mode and sends Code Save Start signal through the communication line.
- f. If Code Saver has received Code Save Start signal, Green LED becomes ON.
- g. When pushing LOCK button or UNLOCK button of transmission, BCM is saving Code.
- h. If the transmission to save Code is two, register them by performing (7) term.
- i. If Code Saver SW is off or the connection is CUT, Code Saving mode is ended.

3) CODE SAVING METHOD

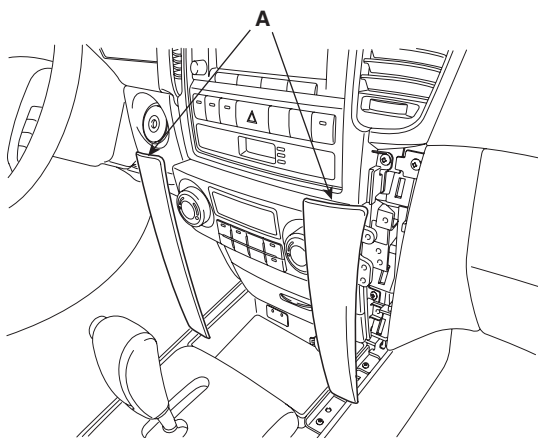
No.	Current saved code	Code to register	Changed code
1	A	C	C (delete A)
2	A, B,C,D	E	E (delete A, B,C,D)
3	A, B	C, D, E	C, D
4	A, B	C, C, D	C

## BCM (BODY CONTROL MODULE)

BE -31

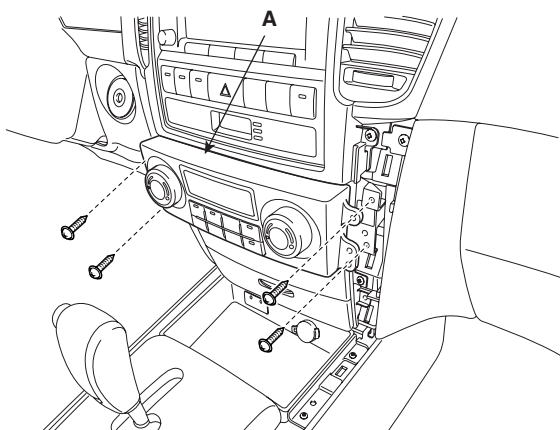
### REMOVAL ED60350B

1. Disconnect the negative (-) battery terminal.
2. Remove the side pannel (A).  
(Refer to the Body group - Crash pad)



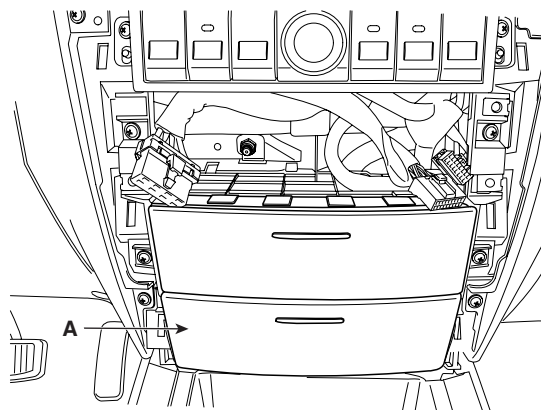
SBLBE6018L

3. Remove the heater control unit (A) after loosening the 4 screws.



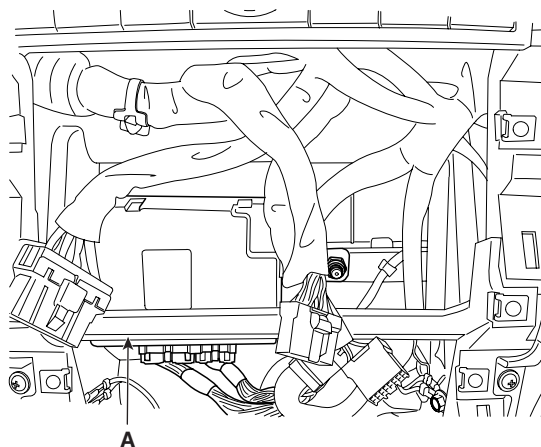
SBLBE6019L

4. Remove the center panel (A) after loosening the 6 screws.



SBLBE6016L

5. Remove the BCM (A) after loosening the 2 nuts and disconnecting the connector.



SBLBE6017L

### INSTALLATION EBAB6DD4

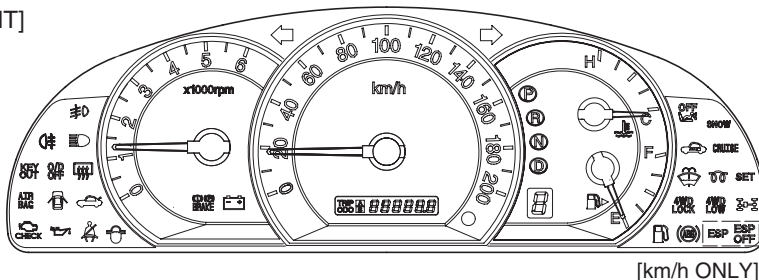
1. Connect the connector and reassemble the BCM.
2. Reassemble the center panel, heater control unit and side pannel.

# INDICATORS AND GAUGES

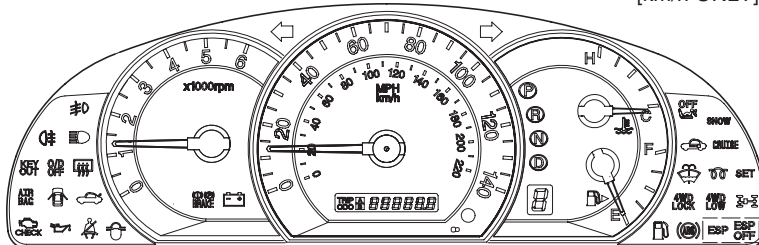
## INSTRUMENT CLUSTER

### COMPONENTS E85AF835

[FRONT]

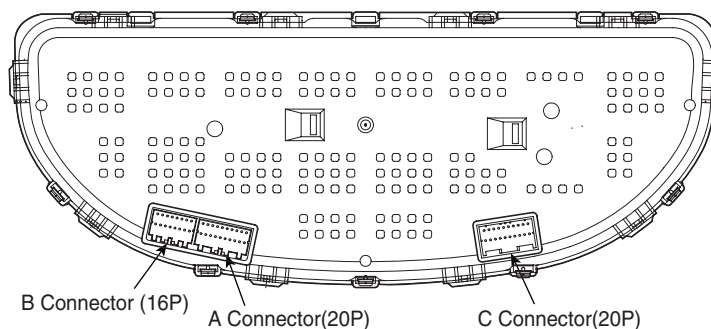


[km/h ONLY]



[MPH & km/h]

[REAR]

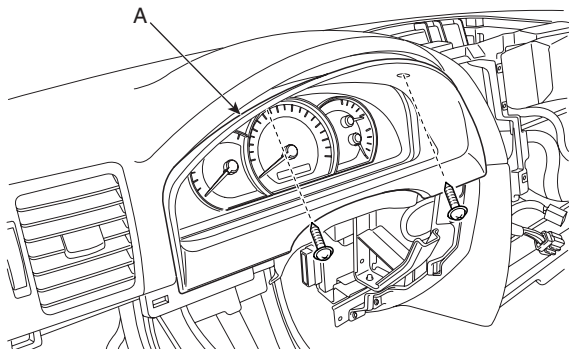


B Connector (16P)      A Connector(20P)      C Connector(20P)

 Connector A		 Connector B		 Connector C	
NO.	CONNECTION	NO.	CONNECTION	NO.	CONNECTION
1	IG+	1	CHECK ENGINE	1	SNOW
2	TEMP INPUT	2	WATER SEPARATOR	2	PAB
3	FUEL INPUT	3	O/D OFF	3	CRUISE
4	FUEL GND	4	TRUNK OPEN	4	4WD LOW
5	ILL (-)	5	Rr-FOG	5	4WD
6	ILL (+)	6	HIGH BEAM GND	6	ESP
7	-	7	HIGH BEAM INPUT (+)	7	ESP OFF
8	OVER SPEED WARN'G	8	FRONT FOG	8	SET
9	-	9	CHARGE	9	VAS OUT
10	-	10	PARKING BRAKE	10	TURN-R
11	B+	11	SEAT BELT	11	GLOW
12	TURN-L	12	OIL PRESSURE	12	4WD LOCK
13	SIGNAL GND	13	AIR BAG SUPPLY(+)	13	ABS
14	TACHO INPUT	14	AIR BAG INPUT	14	WASHER LOW
15	SPEED INPUT	15	DOOR OPEN	15	IMMO
16	4P OUT	16	Rr-DEF	16	D
17	-			17	N
18	KEY OUT (PIC)			18	R
19	PWM SIGNAL			19	P
20	EBD			20	POWER GND

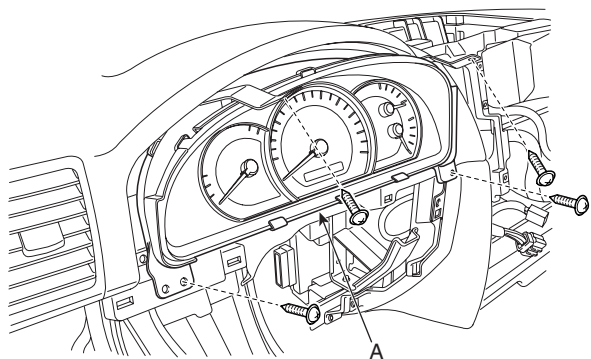
**REMOVAL** ECDB2CCE

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster fascia panel (A) after loosening 2 screws (Refer to Body group - Crash pad)



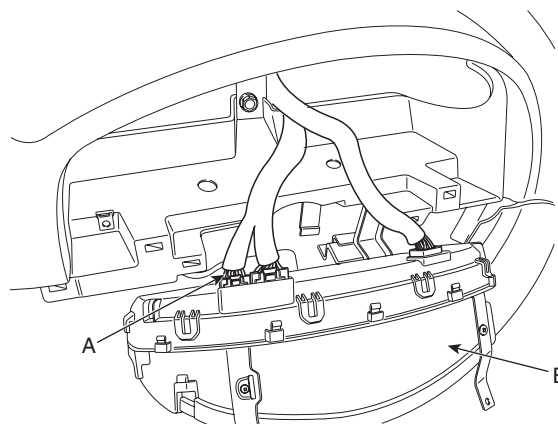
SBLBE6223D

3. Pull out the cluster (A) from the housing after removing 4 screws.



SBLBE6224D

4. Disconnect the cluster connector (A) and then remove the cluster (B).



SBLBE6225D

**INSTALLATION** E89B7B9E

1. Reassemble the cluster after connecting the cluster connector.
2. Reassemble the cluster housing.
3. Reassemble the cluster fascia panel.

**INSPECTION** E382D5D2

**SPEEDOMETER**

1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks as appropriate.
3. Check if the speedometer indicator range is within the standard values.

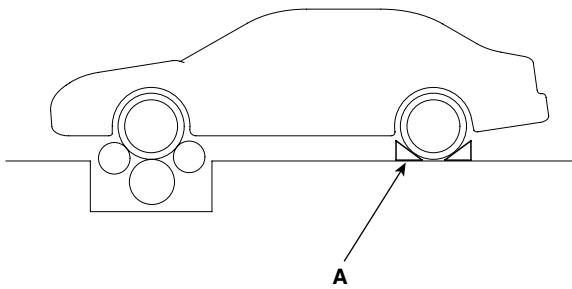
**CAUTION**

**Do not operate the clutch suddenly or increase/decrease speed rapidly while testing.**

**NOTE**

*Tire wear and tire over or under inflation will increase the indication error.*

- When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.



ETKE100E

**[KM/H]**

Velocity (km/h)	20	40	60	80	100	120
Tolerance (km/h)	+4 +1	+4.3 +1.3	+6 +2	+6.5 +2.5	+7 +3	+8 +4
Velocity (km/h)	140	160	180	200	220	-
Tolerance (km/h)	+9 +5	+10.5 +5.5	+11 +6	+12.5 +6.5	+11 +6	-

**[MPH]**

Velocity (km/h)	10	20	40	60
Tolerance (km/h)	+2.8 +0.3	+3.0 +0.5	+3.8 +3.0	+4.0 +1.0
Velocity (km/h)	80	100	120	140
Tolerance (km/h)	+4.5 +1.5	+6.5 +2.5	+7.0 +3.0	+7.5 +3.5

**TACHOMETER**

1. Connect the scan tool to the diagnostic link connector or install a tachometer.
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

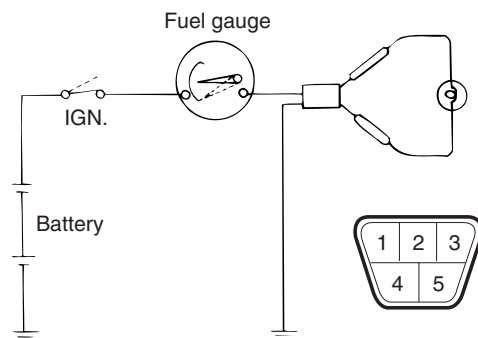
**CAUTION**

- Reversing the connections of the tachometer will damage the transistor and diodes inside.

Revo-lution (rpm)	1,000	2,000	3,000	4,000	Engine
Toler-ance (rpm)	±100	±125	±150	±150	Gasoline
Toler-ance (km/h)	+6 -12	±6	±5	±4.5	Diesel
Revo-lution (rpm)	5,000	6,000	7,000	8,000	Engine
Toler-ance (rpm)	±150	±180	±210	-	Gasoline
Toler-ance (km/h)	±4.2	±4.2	-	-	Diesel

**FUEL GAUGE**

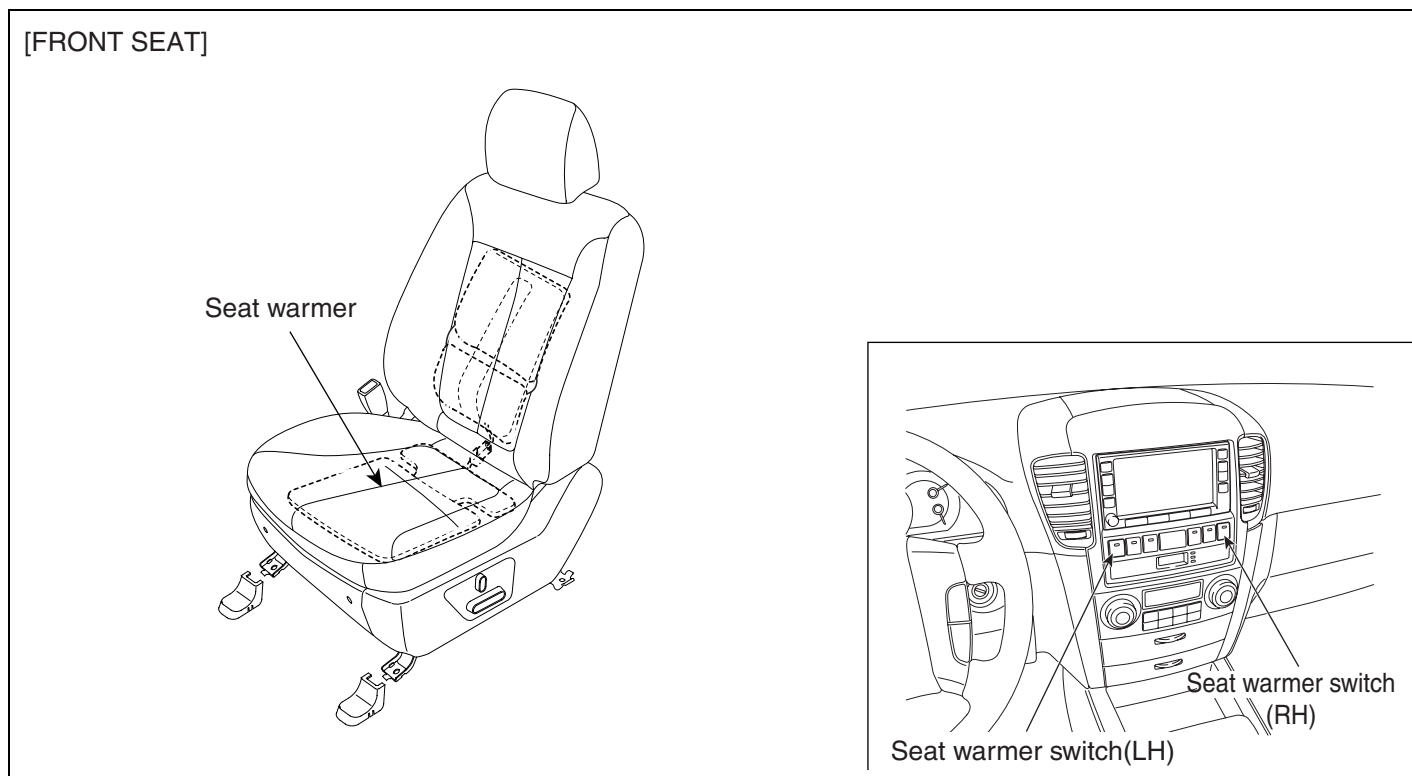
1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 wattages, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



SCMBE6226L

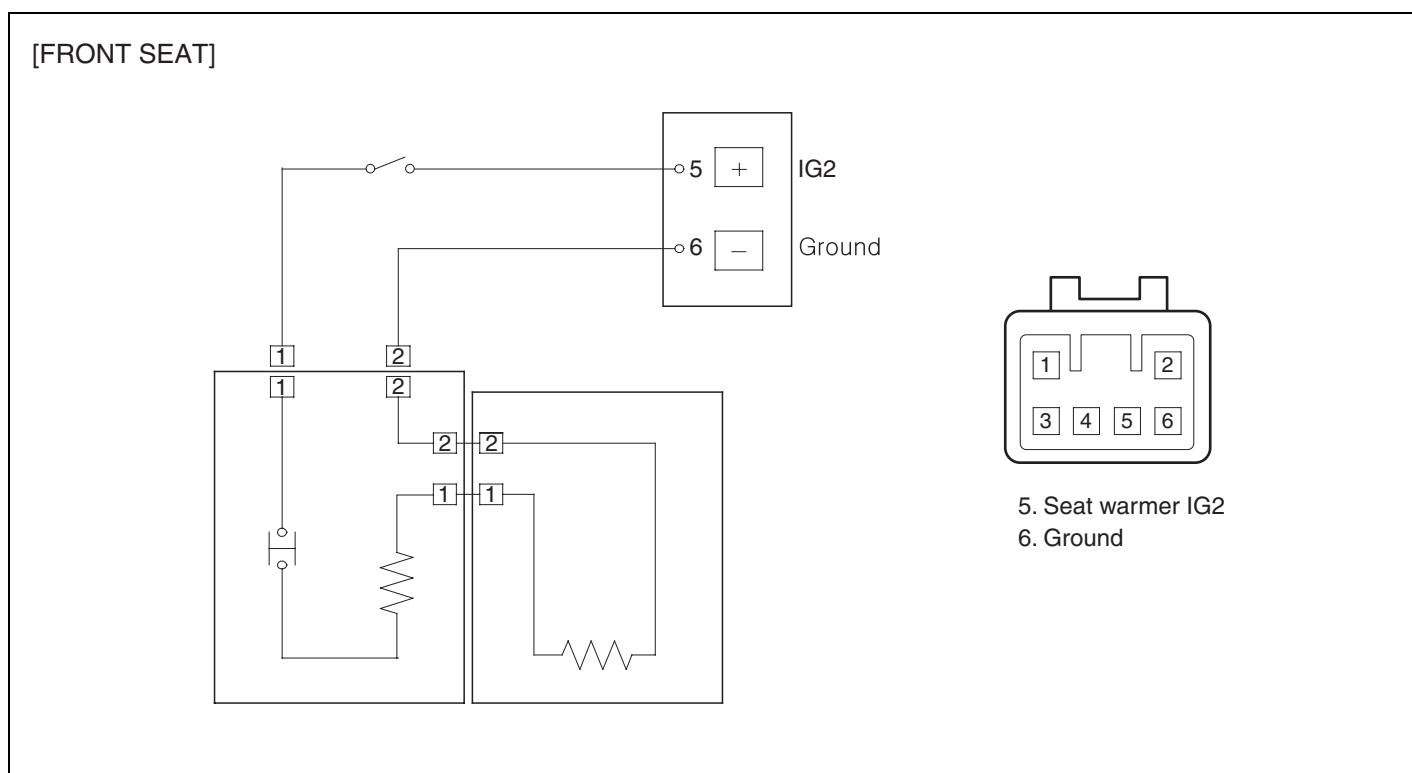
# SEAT WARMER

## COMPONENT LOCATION E3DE0ACE



SBLBE6380L

## CIRCUIT DIAGRAM EE9A6DAA



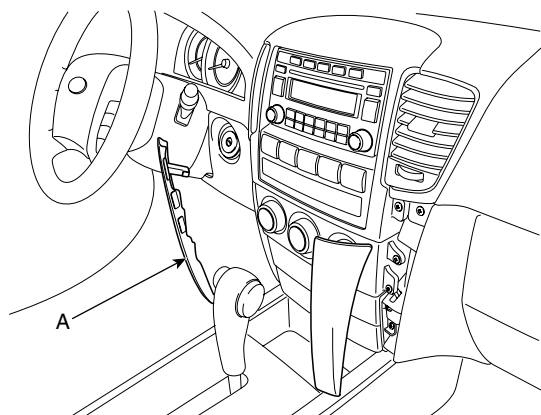
SBLBE6382L

## SEAT WARMER SWITCH

### INSPECTION E2144E90

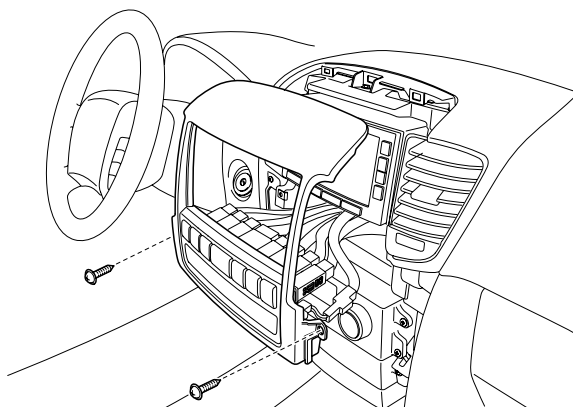
#### FRONT SEAT WARMER SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia panel (A) after loosening the screws. Avoid damaging retaining clips.



SBLBE6385D

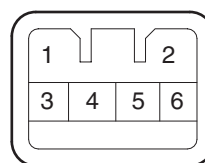
3. Remove the center fascia panel.



SBLBE6386D

4. Check for continuity between the terminals in each switch position according to the table.

P T	ON (PUSH)	OFF	REMARK
1			Relay
4			Ground
3			LAMP (+)
6			ILL(+)
2			ILL(-)



SBLBE6383L

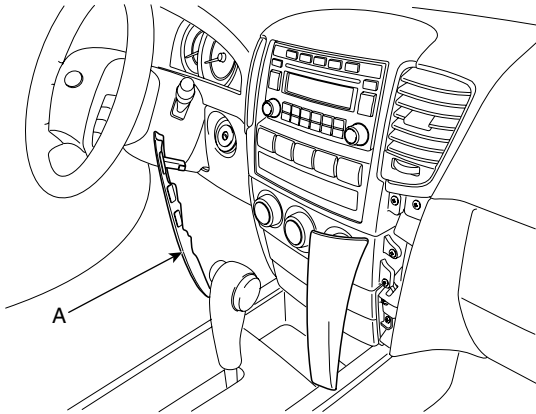
## SEAT WARMER

BE -37

### REMOVAL EC28EA17

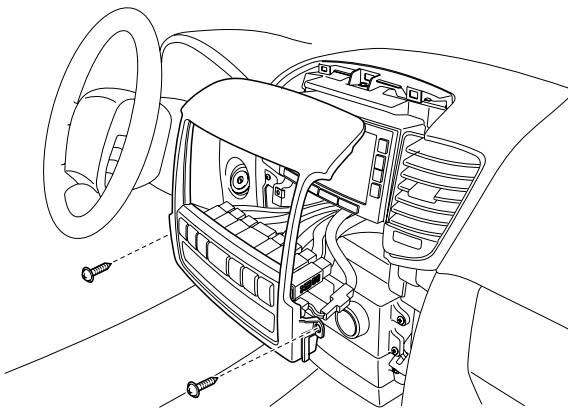
#### FRONT SEAT WARMER SWITCH

1. Disconnect the negative (-) battery terminal
2. Remove the center fascia panel (A) after loosening the 2 screws.



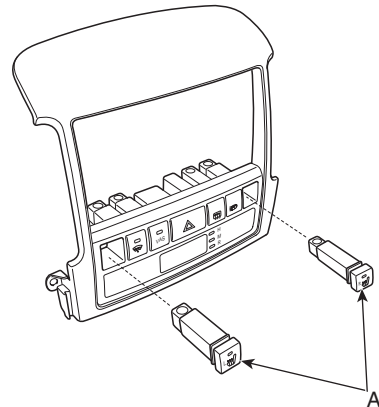
SBLBE6385D

3. Remove the front seat heater switch connector from the center fascia panel.



SBLBE6386D

4. Remove the front seat heater switch (A).



SBLBE6392D

### INSTALLATION E072CE2F

#### FRONT SEAT WARMER SWITCH

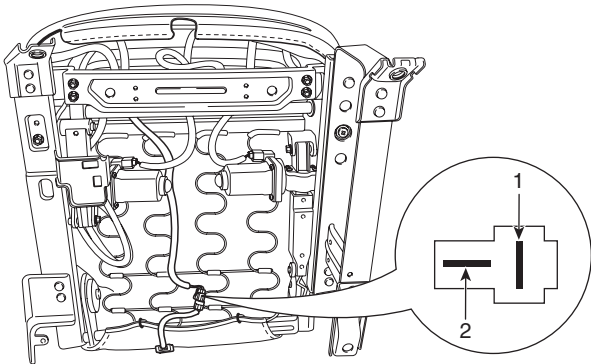
1. Reassemble the front seat warmer switch.
2. Connect the front seat warmer switch connector to the center fascia panel.
3. Reassemble the center fascia panel.

## SEAT WARMER

### INSPECTION E9E2B4BC

#### FRONT SEAT

1. Check for continuity and measure the resistance between No.1 and NO.2 terminals.

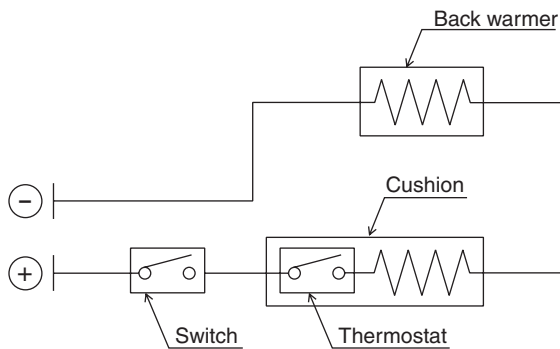


SBLBE6389D

Standard value:

LEATHER (Cushion:  $3.04\Omega \pm 10\%$ , Back:  $3.04\Omega \pm 10\%$ )

CLOTH (Cushion:  $3.04\Omega \pm 10\%$ , Back:  $3.04\Omega \pm 10\%$ )



SBLBE6432L

2. Operate the seat warmer after connecting the 2P connector, and then check the thermostat by measuring the temperature of seat surface.
3. Check for continuity between the terminals after disconnecting the 2P connector.

Standard value :

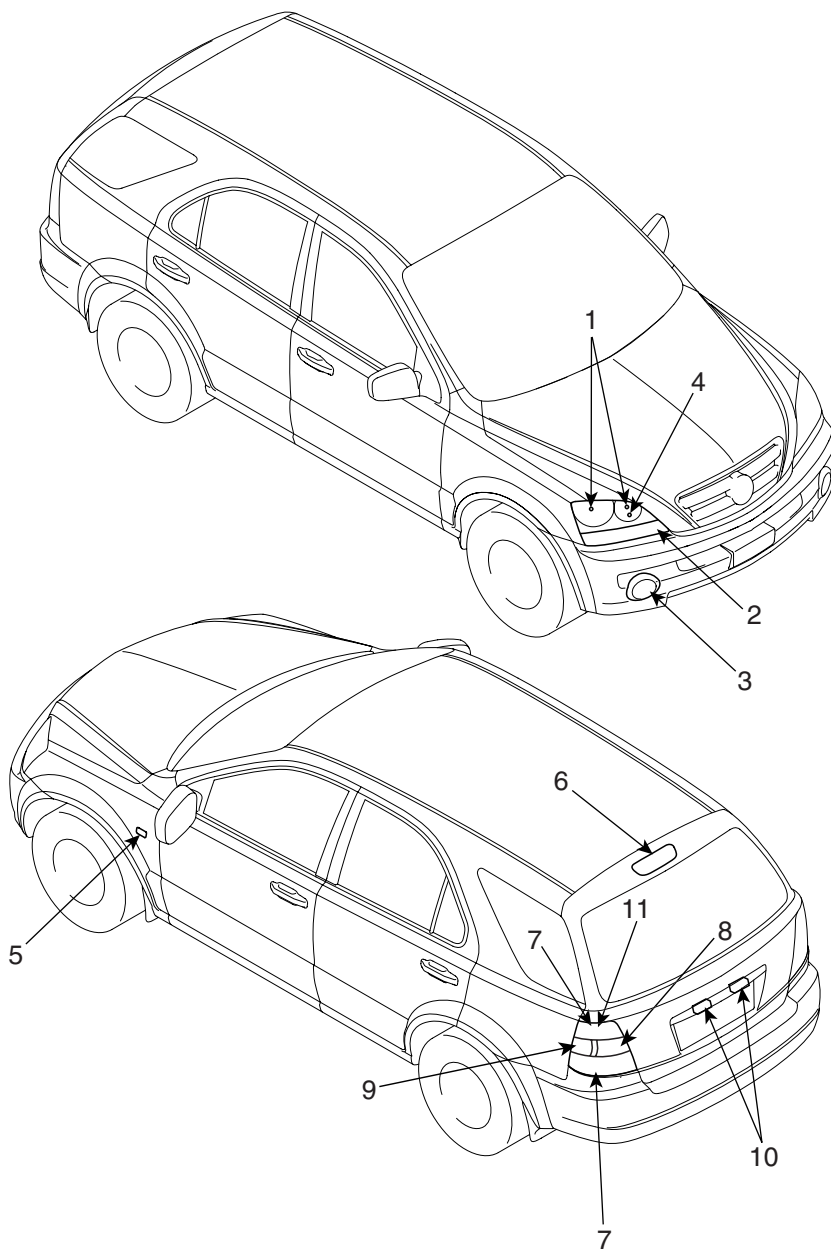
$28 \pm 3.0^{\circ}\text{C}$ (Continuity),  $37 \pm 3.0^{\circ}\text{C}$ (Short)

## LIGHTING SYSTEM

### SPECIFICATION E2383B9A

	Items	Bulb Wattage (W)
FRONT	Head lamp (High)	55
	Head lamp (Low)	55
	Front turn signal lamp	21
	Front position lamp	5
	Front fog lamp	27
REAR	Rear stop/tail lamp (Outside)	21/5
	Back up lamp	16
	Rear turn signal lamp	21
	License plate lamp	5
INTERIOR	Room lamp	10 x 2
	Overhead console lamp	10 x 2
	Luggage lamp	5
	Door courtesy lamp	5

COMPONENT LOCATION E39CF53C



- 1. Head lamp (Low/High)
- 2. Front turn signal lamp
- 3. Front fog lamp
- 4. Front position lamp
- 5. Side turn signal lamp

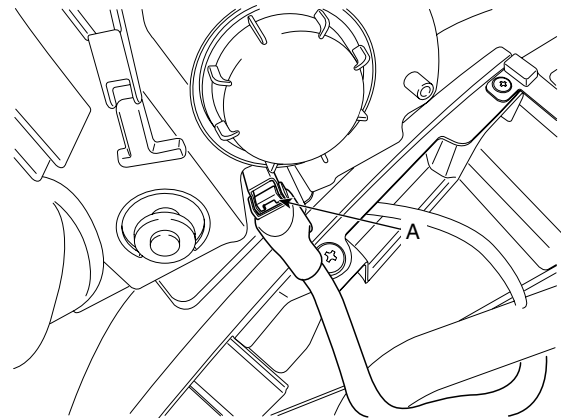
- 6. High mounted stop lamp
- 7. Tail lamp
- 8. Back up lamp
- 9. Rear turn signal lamp
- 10. License plate lamp
- 11. Stop lamp

SBLBE6430L

## HEAD LAMPS

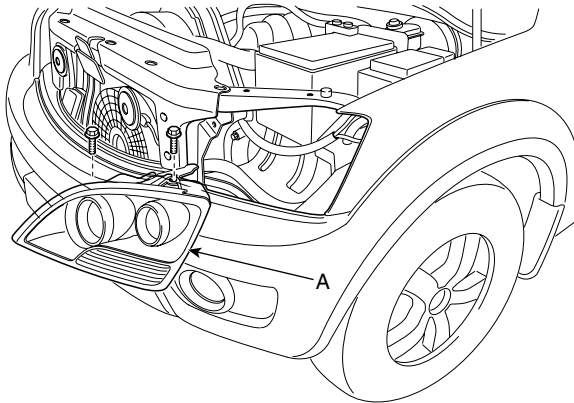
### REMOVAL ECC33CAA

1. Disconnect the negative (-) battery terminal.
2. Loosen the mounting bolts (3EA). And remove the head lamp assembly (A) after disconnecting the lamp connectors.



SBLBE6434D

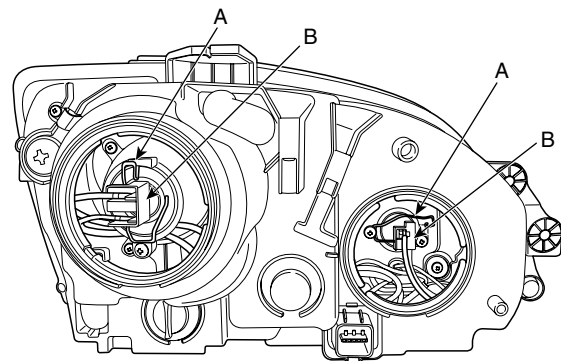
4. Remove the fixing spring (A) and bulb connector (B) after loosening the cover.



SBLBE6431D

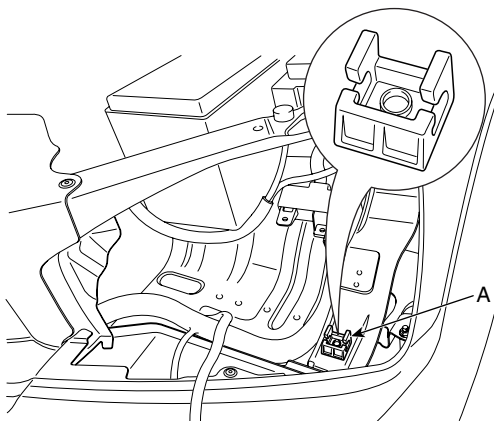
### NOTE

Take care that retaining clip (A) is not to be damaged.



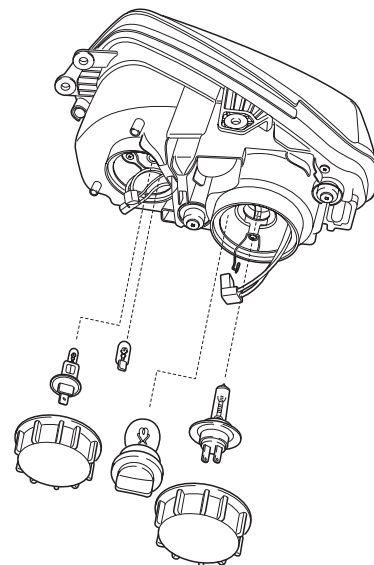
SBLBE6435D

5. Remove the head lamp bulb.



SBLBE6433D

3. Remove the power connector (A) of lamp assembly.



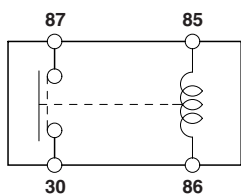
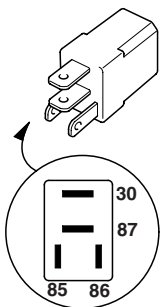
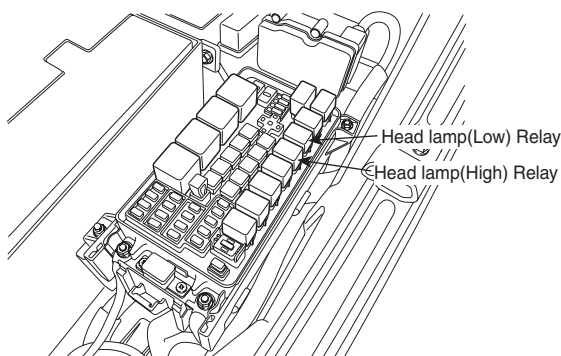
SBLBE6436D

**INSTALLATION** E89DC42E

1. Reassemble the head lamp bulb.
2. Connect the bulb connector and fixing spring.
3. Connect the power connector to the lamp assembly
4. Reassemble the head lamp assembly to retaining clip.

**HEAD LAMP RELAY INSPECTION** E3B3F2E8

1. Check for continuity between the terminals of head lamp relay.
2. There should be continuity between the No.86 and No.85 terminals when power and ground are connected to the No.87 and No.30 terminals.
3. There should be continuity between the No.87 and No.30 terminals when power is disconnected.



SBLBE6437L

Terminal	30	87	85	86
Power				
Disconnected			○ — ○	
Connected	○ — ○		—	+

SCMBE6195L

**HEAD LAMP AIMING**

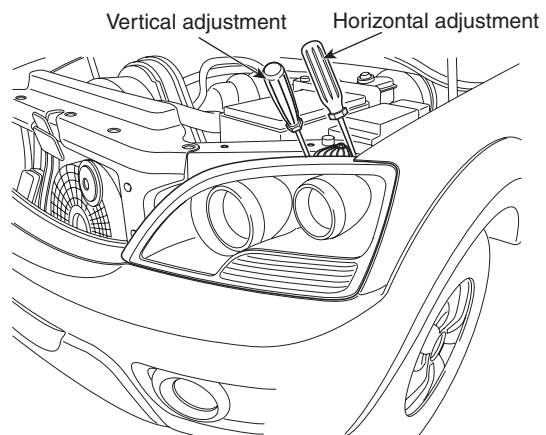
**INSTRUCTIONS** EABFB216

The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

**NOTE**

*If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust so as to meet those requirements. Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows :*

1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and tools.
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen
4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the horizontal and vertical lines. Make vertical and horizontal adjustments to the lower beam using the adjusting wheel.



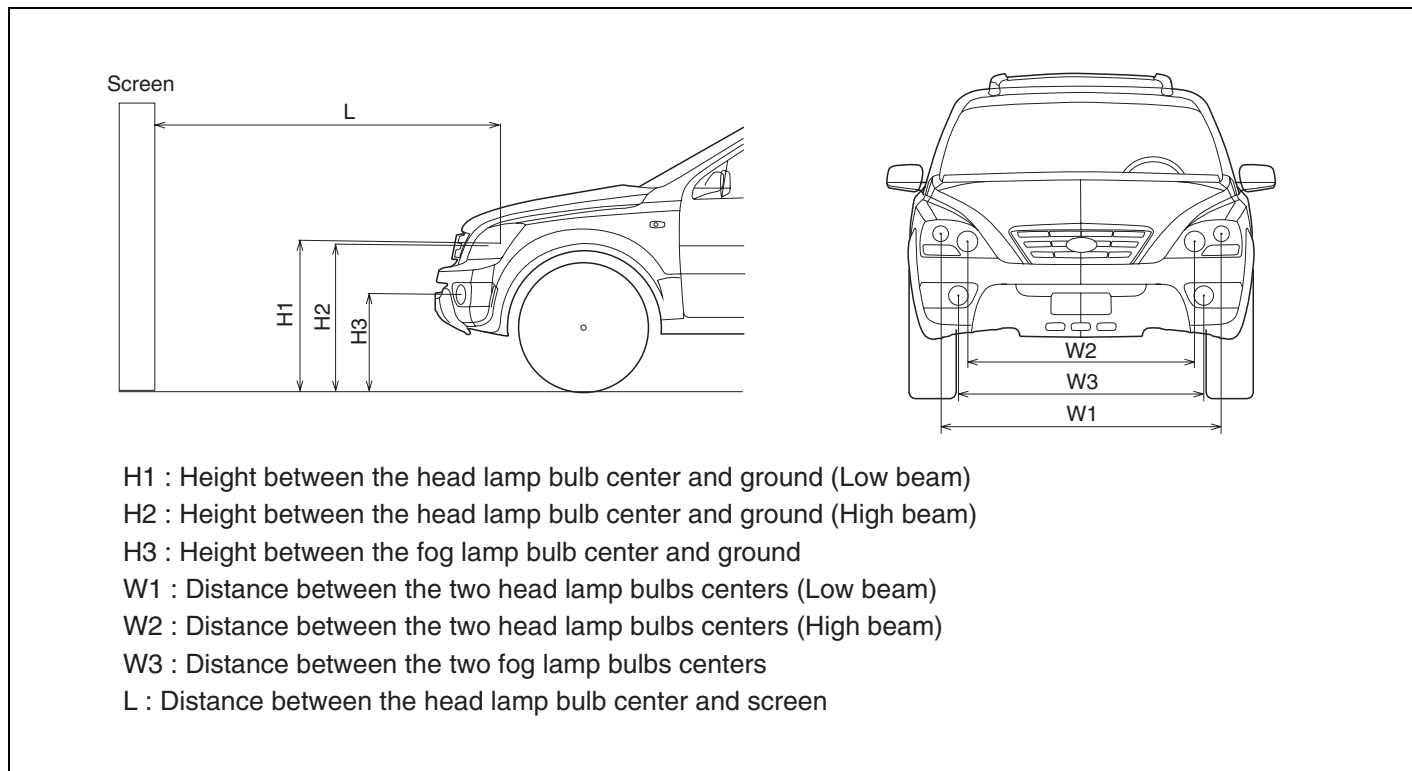
SBLBE6440L

**FRONT FOG LAMP AIMING**

The front fog lamps should be aimed as the same manner of the head lamps aiming.

With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear.

**HEAD LAMP AND FOG LAMP AIMING POINT**



SBLBE6443L

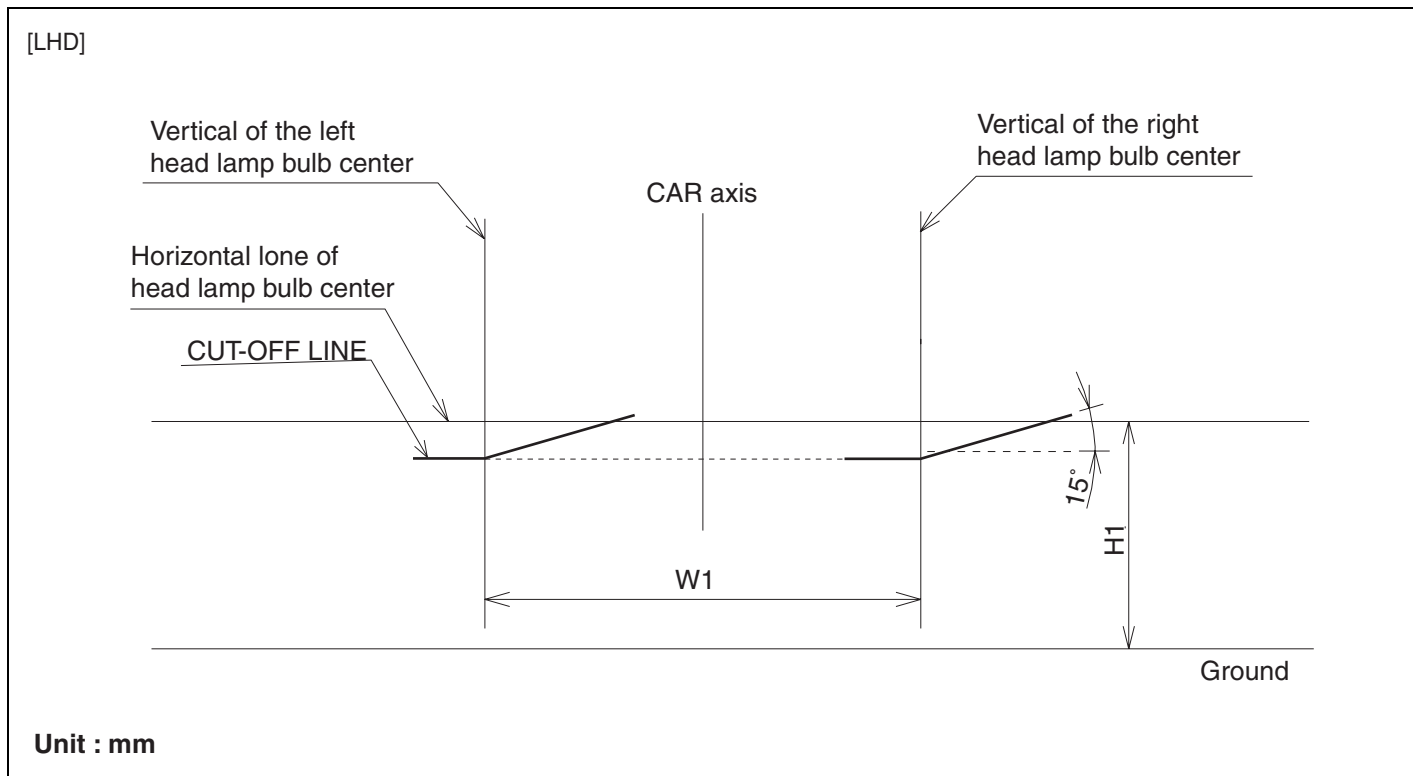
Unit : mm

Vehicle condition	H1	H2	H3	W1	W2	W3	L
Without driver	891	849	546	1,490	1,207	1,310	3,000
With driver	876	834	531				

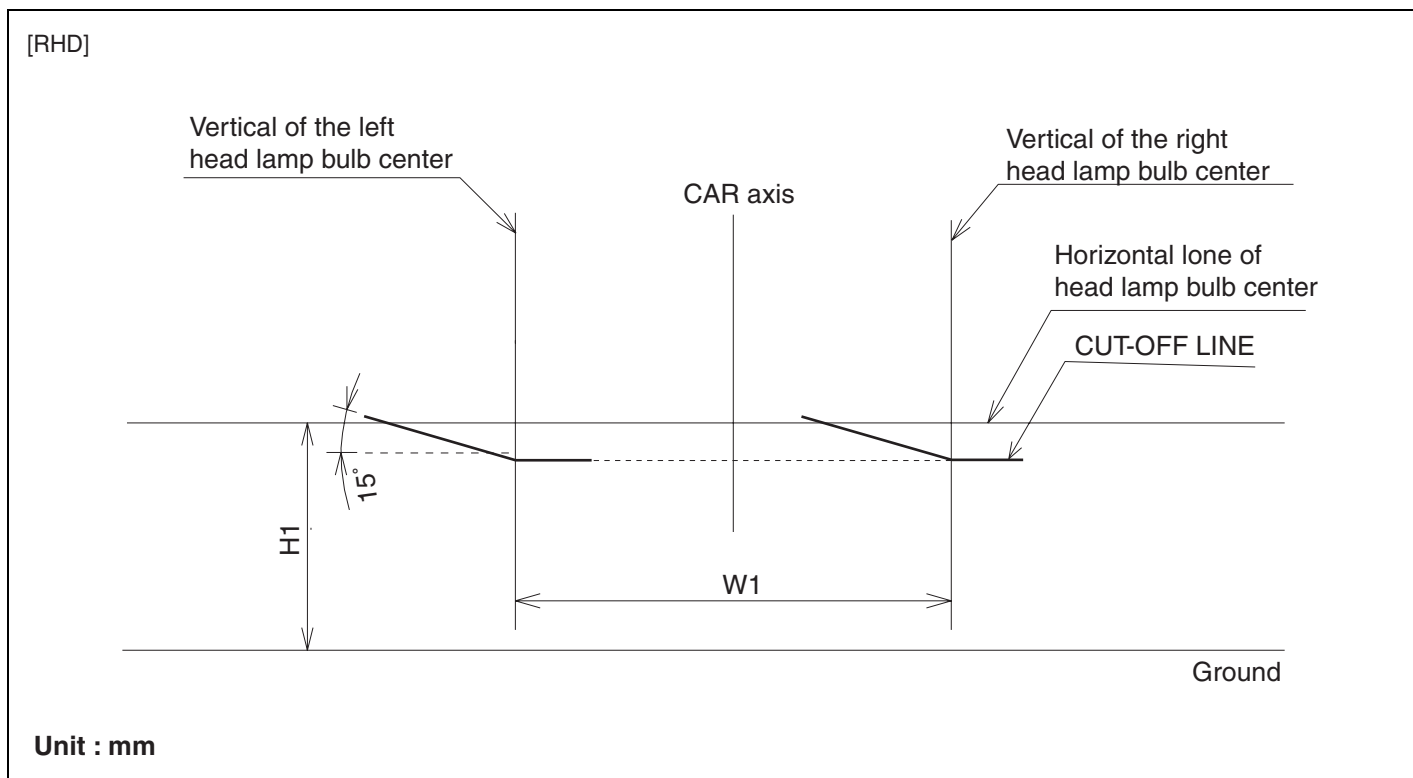
SBLBE6444L

1. Turn the low beam on without the driver aboard.  
The cut-off line should be projected in the allowable range (shaded region).  
In case of equipping with the manual leveling device, set the leveling device switch on the "O" position.

In case of equipping with the auto leveling device, set the initialization by using the diagnostic tool before aiming.  
\* In case of high beam, head lamp do not need aiming with proper beam-setting equipment.

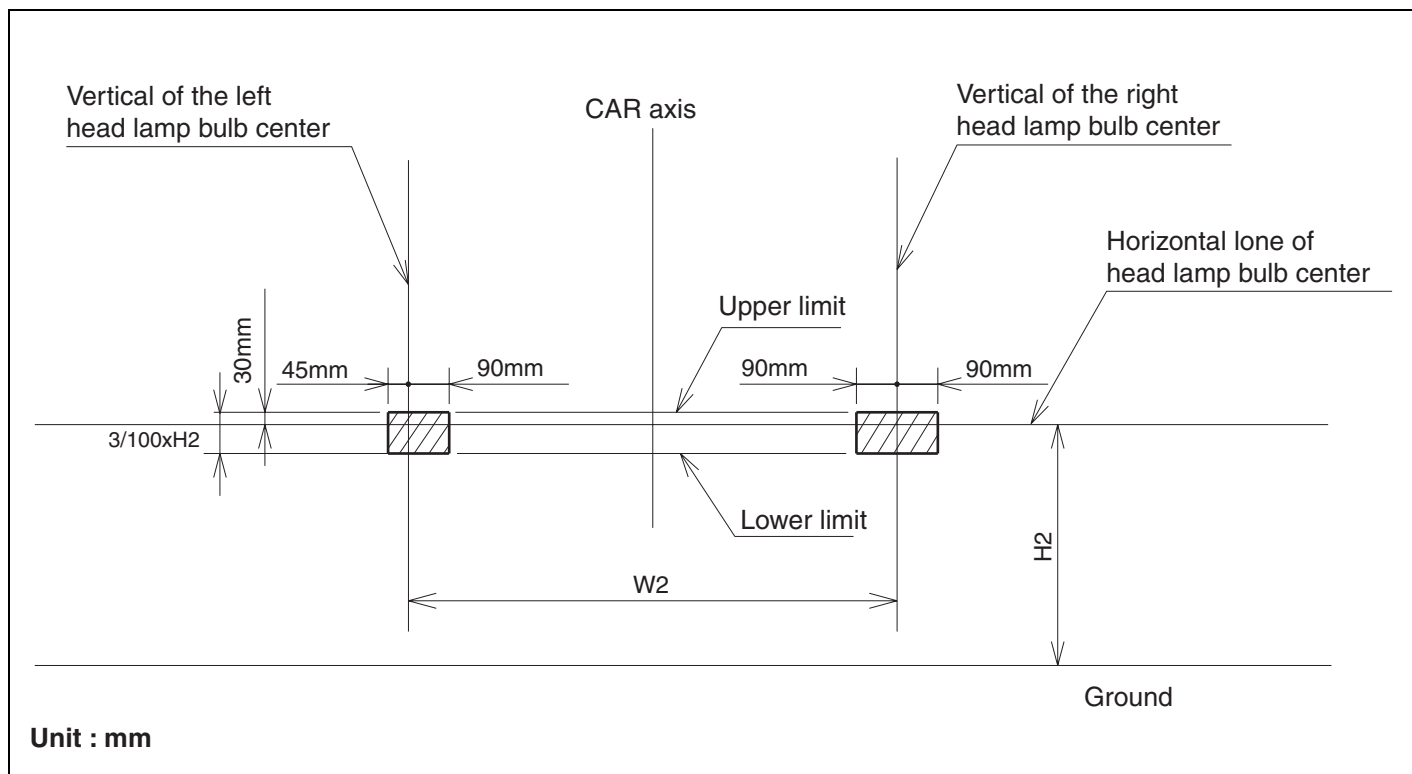


SBLBE6445L



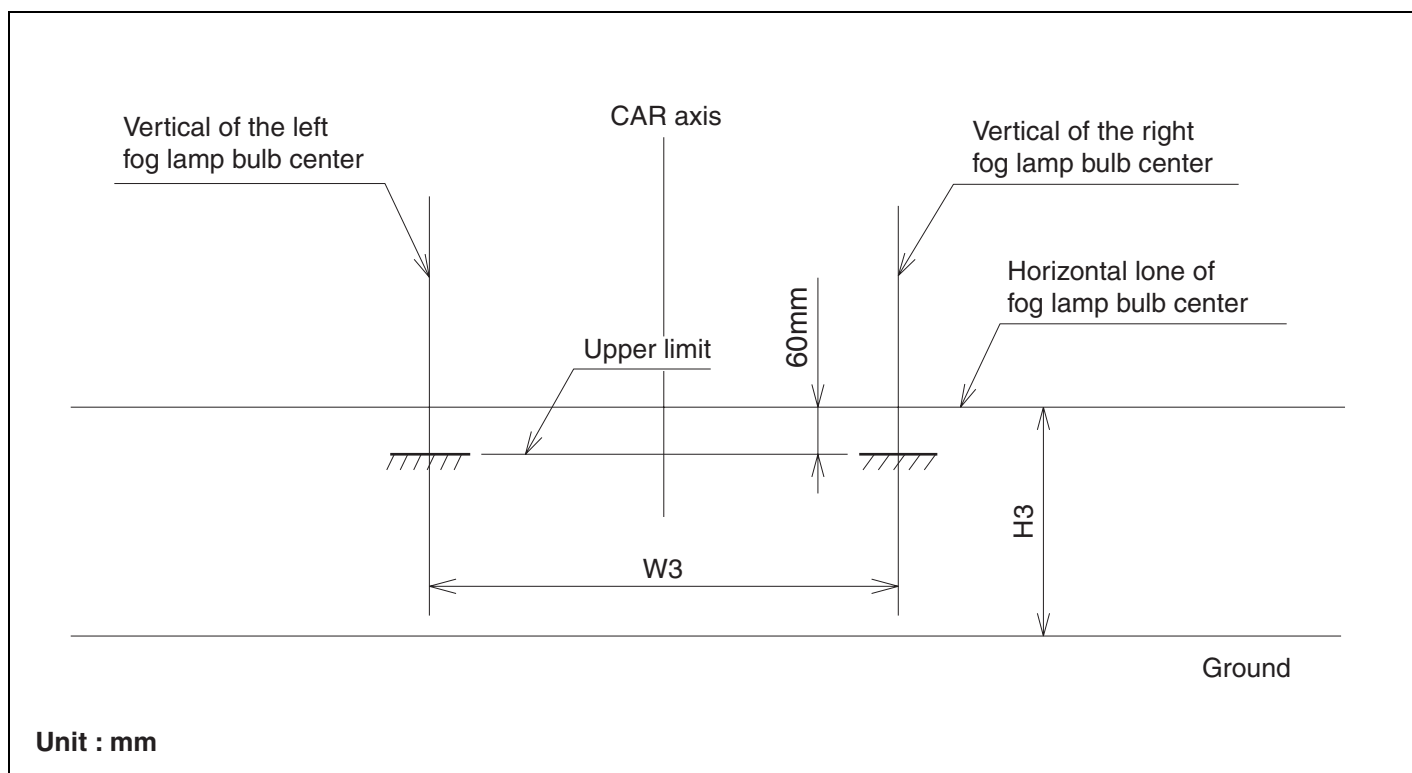
SBLBE6448L

2. Turn the high beam on without the driver aboard.  
The cut-off line should be projected in the allowable range (shaded region).



SBLBE6446L

3. Turn the front fog lamp on without the driver aboard.  
The cut-off line should be projected in the allowable range (shaded region)



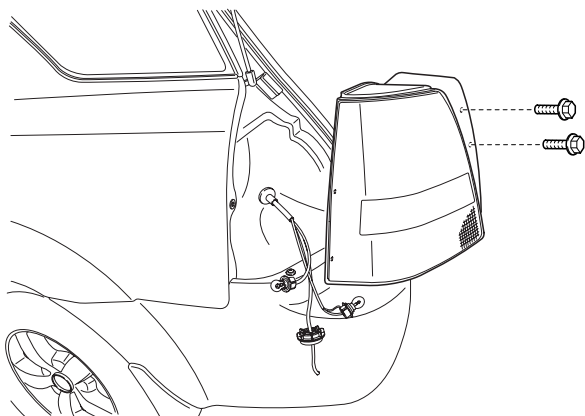
SBLBE6447L

## TURN SIGNAL LAMP

### REMOVAL E0B60439

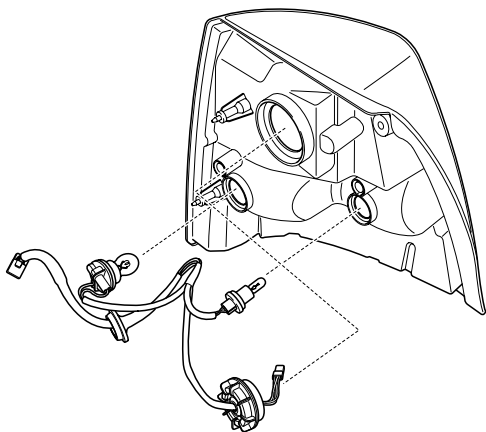
#### REAR LAMP

1. Disconnect the negative (-) battery terminal.
2. Loosen the 2 screws holding the rear combination lamp then disconnect the connector. And then remove the outside rear combination lamp assembly.



SBLBE6449D

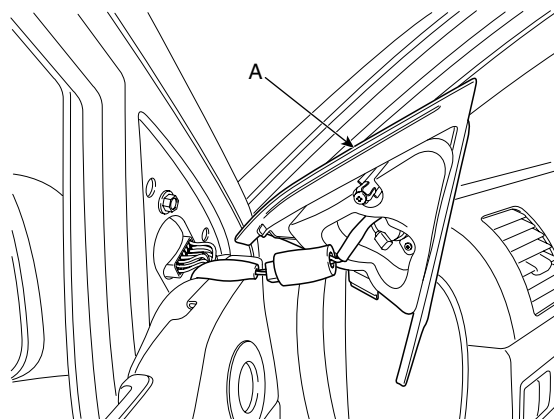
3. Remove the bulbs from the rear combination lamp assembly.



SBLBE6450D

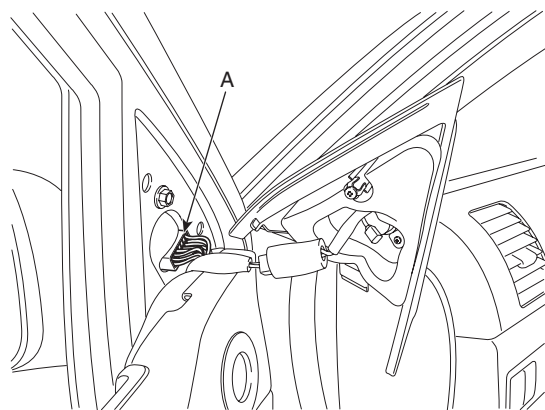
#### TURN SIGNAL LAMP(DOOR MIRROR)

1. Disconnect the negative (-) battery terminal.
2. Remove the tweeter speaker cover (A). (Refer to the Front Door in BD Group)



SBLBE6451D

3. Disconnect the door mirror connector (A).



SBLBE6452D

4. Loosen the 3 bolts then remove the door mirror.

#### CAUTION

*Turn signal lamp of door mirror is used LED (Light-emitting Diode).*

### INSTALLATION E724B155

#### REAR LAMP

1. Connect the bulbs to the rear combination lamp assembly.
2. Connect the rear combination lamp connector.
3. Reassemble the rear combination lamp assembly.

#### TURN SIGNAL LAMP(DOOR MIRROR)

1. Reassemble the door mirror to the door.
2. Connect the door mirror connector.
3. Reassemble the tweeter speaker.

# IMMOBILIZER CONTROL SYSTEM

- Function of the SMARTRA and the transponder.
- Data (stored in the ECM related to the immobilizer function).

## DIAGNOSIS OF IMMOBILIZER FAULTS

EEE9CD73

The following table shows the assignment of immobilizer related faults to each type:

- Communication between the ECM and the SMARTRA.

Immobilizer Related Faults	Fault types	Diagnostic codes
SMARTRA fault	<ol style="list-style-type: none"><li>1. No response from SMARTRA</li><li>2. Antenna coil error</li><li>3. Communication line error (Open/Short etc.)</li><li>4. Invalid message from SMARTRA to PCM(ECM)</li></ol>	P1690 (SMARTRA no response)
Immobilizer indicator lamp fault	<ol style="list-style-type: none"><li>1. Immobilizer indicator lamp error (Cluster)</li></ol>	P1692 (Immobilizer lamp error)
Transponder key fault	<ol style="list-style-type: none"><li>1. Corrupted data from transponder</li><li>2. More than one transponder in the magnetic field (Antenna coil)</li><li>3. No transponder (Key without transponder) in the magnetic field (Antenna coil)</li></ol>	P1693 (Transponder no response error/invalid response)
EMS internal permanent memory fault	<ol style="list-style-type: none"><li>1. EMS internal permanent memory fault</li><li>2. Invalid write operation to permanent memory</li></ol>	P1695 (EMS memory error)
Invalid key fault	<ol style="list-style-type: none"><li>1. Virgin transponder at PCM(ECM) status "Learnt" Learnt (Invalid) Transponder at PCM(ECM) status "Learnt"(Authentication fail)</li></ol>	P1696 (Authentication fail)
Hi-Scan fault	<ol style="list-style-type: none"><li>1. Hi-Scan message error</li></ol>	P1697
Transponder invalid	<ol style="list-style-type: none"><li>1. Invalid transponder</li></ol>	P1698

## IMMOBILIZER (SMARTRA) DTC LIST

No.	Fault code	Monitor strategy description	Gasoline	Diesel
1	P1690	SMARTRA no response	O	O
2	P1692	Immobilizer lamp error	-	O
3	P1693	Transponder no response error / Invalid response	O	O
4	P1695	EMS memory error	O	O
5	P1696	Authentication fail	O	O
6	P1697	HI-SCAN message error	O	O
7	P1698	Transponder Invalid	O	O

**DTC P1690 SMARTRA NO RESPONSE**

**GENERAL DESCRIPTION** EE46AEE6

The SMARTRA carries out communication with the built-in transponder of the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted at the ignition lock close to the antenna coil for RF transmission and receiving. The RF signal from the transponder received by the antenna coil is converted into messages for serial communication by the SMARTRA device. And the received messages from the ECM are converted into an RF signal, which is transmitted to the transponder by the antenna. The SMARTRA does not carry out the validity check of transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to ECM and vice versa.

\* SMARTRA : SMARt TRansponder Antenna

**DTC DESCRIPTION** EC2DECE1

The ECM sets DTC P1690 if there's No Response from SMARTRA.

**DTC DETECTING CONDITION** E1AB4FCA

Item	Detecting Condition	Possible Cause
DTC Strategy		<ul style="list-style-type: none"><li>• Open Circuit in signal harness</li><li>• Short Circuit in signal harness</li><li>• Faulty SMARTRA</li></ul>
Enable Conditions	<ul style="list-style-type: none"><li>• IG ON</li></ul>	
Threshold value		
Detecting time		
FAIL SAFE		

## IMMOBILIZER CONTROL SYSTEM

### MONITOR DTC STATUS EFFDC6E5

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Monitor the "KEY STATUS" and "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

1.1 CURRENT DATA	
01. NO. OF LEARNT KEY	1
02. ECU STATUS	LEARNT
03. KEY STATUS	LEARNT

FIX    SCRN    FULL    PART    GRPH    HELP

Fig 1

Fig 1) The current data in abnormal state

SCMBE6752L

4. Are "KEY STATUS" and "ECU STATUS' Parameter within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Inspection & Repair" procedure.

### TERMINAL AND CONNECTOR INSPECTION EC246D0E

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 Vehicle Repair" procedure.

**NO**

Go to "W/Harness Inspection" procedure .

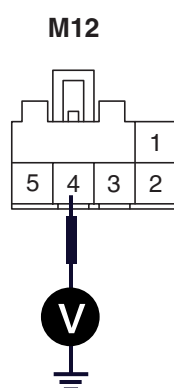
**POWER SUPPLY CIRCUIT INSPECTION** E40FAE7B

1. Check for open in harness
  - 1) Ignition "OFF"
  - 2) Disconnect SMARTRA.
  - 3) Ignition "ON" & Engine "OFF"
  - 4) Measure voltage value between terminal "4" of SMARTRA and chassis ground.

---

Specification : 9~16V

---



1. Coil antenna
2. Coil antenna
3. Ground
- 4. Power**
5. Signal

SBLBE6753L

- 5) Is the measured voltage within specifications?

**YES**

Go to "Signal circuit Inspection" procedure

**NO**

Check for open or short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

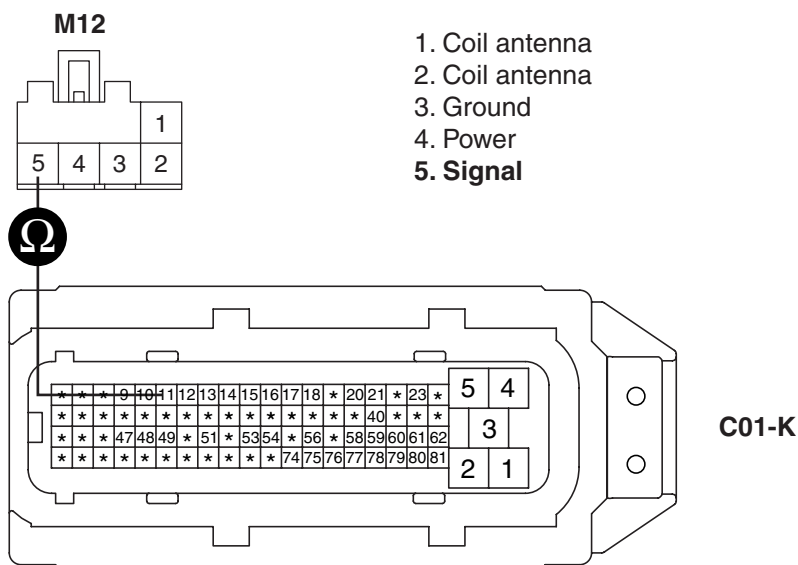
**IMMOBILIZER CONTROL SYSTEM**

**SIGNAL CIRCUIT INSPECTION** EF0C12DE

1. Check for open in harness
  - 1) Ignition "OFF"
  - 2) Disconnect SMARTRA.
  - 3) Measure resistance between terminal "5" of SMARTRA and terminal C01-K-11(WGT) or C02-K-47(VGT) or C144-A-45(GSL)

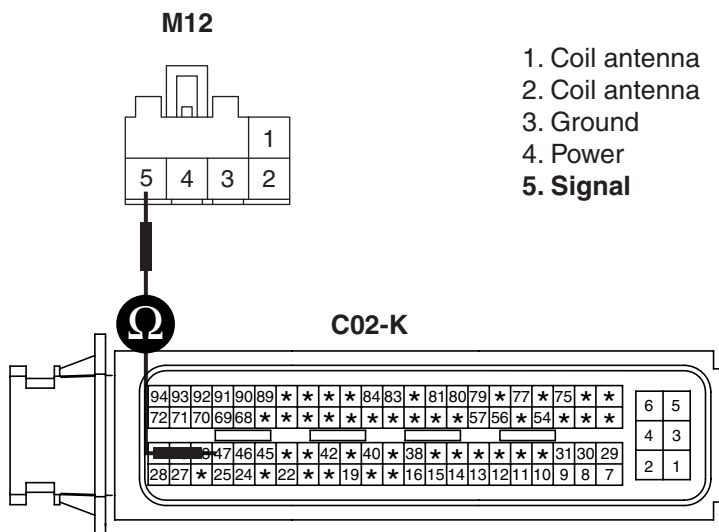
Specification : 1 Ω or less

[WGT]



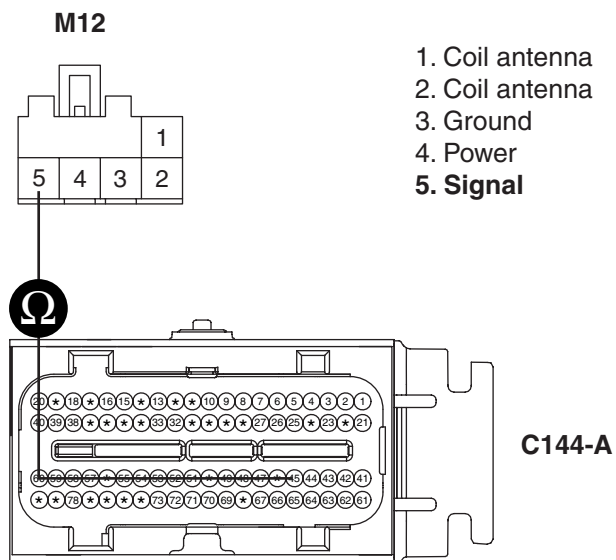
SBLBE6754L

[VGT]



SBLBE6755L

[GSL]



SBLBE6759L

4) Is the measured resistance within specifications?

**YES**

Go to "Check for short in harness" procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short in harness

- 1) Ignition "OFF"
- 2) Disconnect SMARTRA.
- 3) Ignition "ON" & Engine "OFF"
- 4) Measure voltage value between terminal "5" of SMARTRA and chassis ground.

Specification :Approx. 5.48V



SBLBE6756L

## IMMOBILIZER CONTROL SYSTEM

BE -53

5) Is the measured voltage within specifications?

**YES**

Go to "Signal circuit Inspection" procedure

**NO**

Check for short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## GROUND CIRCUIT INSPECTION E036E618

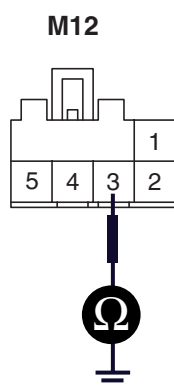
1. Check for open in ground harness

- 1) Ignition "OFF"
- 2) Disconnect SMARTRA.
- 3) Measure resistance between terminal "3" of SMARTRA and chassis ground.

---

Specification : 1  $\Omega$  or less

---



1. Coil antenna
2. Coil antenna
- 3. Ground**
4. Power
5. Signal

SBLBE6757L

4) Is the measured resistance within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**VERIFICATION OF VEHICLE REPAIR** EAE05C0C

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

**DTC P1692 IMMOBILIZER LAMP ERROR**

**GENERAL DESCRIPTION** EAA1D43B

When driver inserts key and IGN "ON", Immobilizer informs status of system and result of Authentication by blinking of immobilizer lamp on instrument cluster. through Authentication procedure immobilizer lamp keep lighting up till engine starts. In normal status. Immobilizer lamp lights up for 30sec Right after ignition "ON". If there's any fault in immobilizer system or in Authentication, lamp blinks 5 times after ignition "ON".

**DTC DESCRIPTION** E8A838F8

The ECM sets DTC P1692 if there's short circuit in immobilizer lamp circuit.

**DTC DETECTING CONDITION** EB66D8E7

Item	Detecting Condition	Possible Cause
DTC Strategy		<ul style="list-style-type: none"><li>• Short Circuit in immobilizer lamp circuit.</li><li>• Open/Short in control harness</li><li>• Faulty ECM</li></ul>
Enable Conditions	<ul style="list-style-type: none"><li>• IG ON</li></ul>	
Threshold value		
Detecting time		
FAIL SAFE		

**MONITOR DTC STATUS** E0D0A0B8

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Selet "Diagnostic Trouble Codes(DTCs)"mode and monitor "DTC Status" parameter
4. Is the DTC B1692 present?

**YES**

Go to "Inspection & Repair" procedure

**NO**

Fault is intermittent caused by poor contact in SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**TERMINAL AND CONNECTOR INSPECTION** EDB459B6

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 Vehicle Repair" procedure

**NO**

Go to "W/Harness Inspection" procedure

**CONTROL CIRCUIT INSPECTION** E8FB4A56

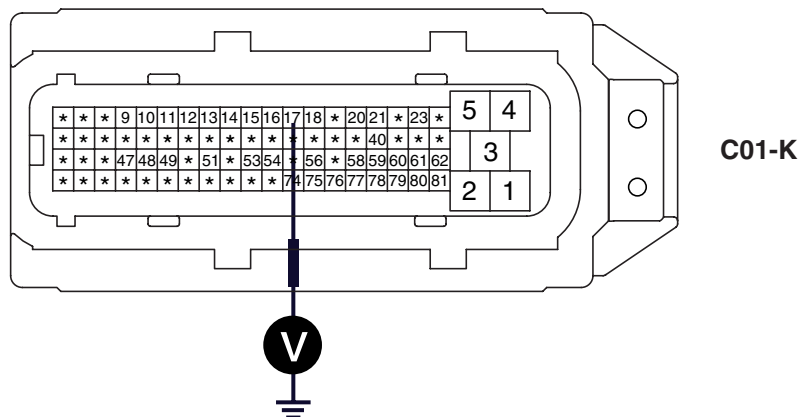
1. Check for open in harness
  - 1) Ignition "OFF"
  - 2) Disconnect SMARTRA.
  - 3) Ignition "ON" & Engine "OFF"
  - 4) Measure voltage value between terminal C01-K-17(WGT) or C02-K-92(VGT) or C144-A-72(GSL) and chassis ground.

---

Specification : Approx. 11V

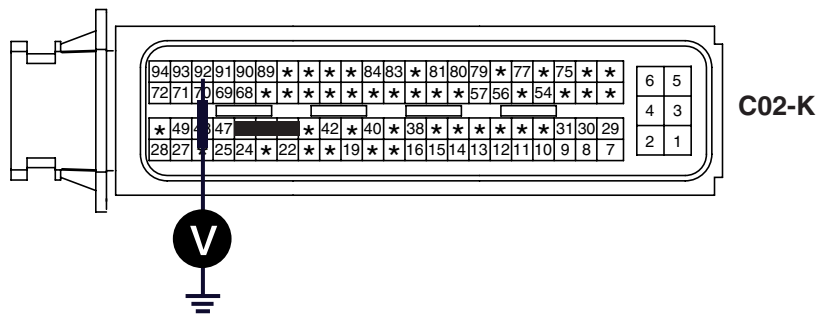
---

[WGT]



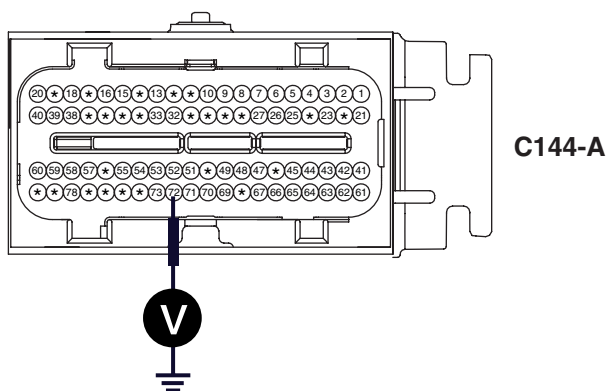
SBLBE6760L

[VGT]



SBLBE6761L

[GSL]



SBLBE6762L

5) Is the measured voltage within specifications?

**YES**

Go to "Component Inspection" procedure

**NO**

Check for open or short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

**VISUAL / PHYSICAL INSPECTION** EE478DE7

1. Check immobilizer lamp circuit.
  - 1) Ignition "ON" & Engine "OFF"
  - 2) Check if immobilizer lamp operates properly.

**NOTE**

Right after ignition "ON", Immobilizer lamp lights up for 30sec.  
If lamp blinks 5 times after ignition "ON", there's any fault in immobilizer system.

- 3) Is immobilizer lamp operates properly?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Component Inspection" procedure

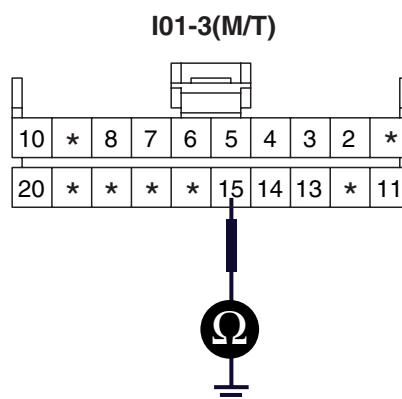
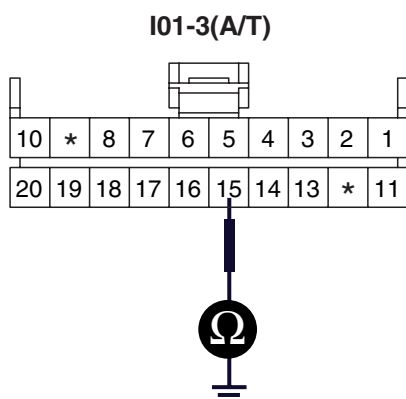
**COMPONENT INSPECTION** EC6B260E

1. Check immobilizer lamp.
  - 1) Ignition "OFF"
  - 2) Disconnect ECM.
  - 3) Ground terminal "15" of immobilizer lamp.
  - 4) Ignition "ON" and Monitor operation of immobilizer lamp.

---

Specification : Immobilizer lamp "ON"

---



5) Is the Immobilizer lamp "ON"?

**YES**

Substitute with a known-good ECM and check for proper operation.  
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

**NOTE**

*ECM substituted for old one must be in "Virgin" or "Neutral" status and Pin code is required to Neutralize ECM and to Register transponder key*

**NO**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.  
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**VERIFICATION OF VEHICLE REPAIR** EBD9A0EB

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

**DTC P1693 TRANSPONDER NO RESPONSE ERROR / INVALID RESPONSE**

**GENERAL DESCRIPTION** E92214B8

During the key teaching procedure the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is unique; therefore the content of transponder can never be modified or changed. The data are a string of 9 bytes defined by vehicle manufacturer.

The transponder memory is split into two strings called authenticator and key password. After this programming the transponder memory is locked and the data (PIN code) cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt". Additionally every transponder includes a unique IDE (Identifier number) of 32 bit.

Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value. The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.

For teaching of keys and special purposes the ECM is connected to the tester device.

When IG is ON, the coil supplies energy to the transponder which in turn accumulates energy in the condenser. Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

**DTC DESCRIPTION** E06B68B9

The ECM sets DTC P1693 if there's abnormal response from transponder.

**DTC DETECTING CONDITION** EDA7E7A

Item	Detecting Condition	Possible Cause
DTC Strategy		<ul style="list-style-type: none"><li>• Corrupted data from Transponder</li><li>• More than one TP in the magnetic field</li><li>• No TP(Key without TP) in the magnetic field</li></ul>
Enable Conditions	<ul style="list-style-type: none"><li>• IG ON</li></ul>	
Threshold value		
Detecting time		
FAIL SAFE		

COMPONENT INSPECTION EEBECFD2

1. Check transponder and ECU status
  - 1) IGN "ON" & Engine "OFF"
  - 2) Monitor the "KEY STATUS" and "ECU STATUS" Parameter on the Scantool.

---

Specification : 'LEARNT'

---

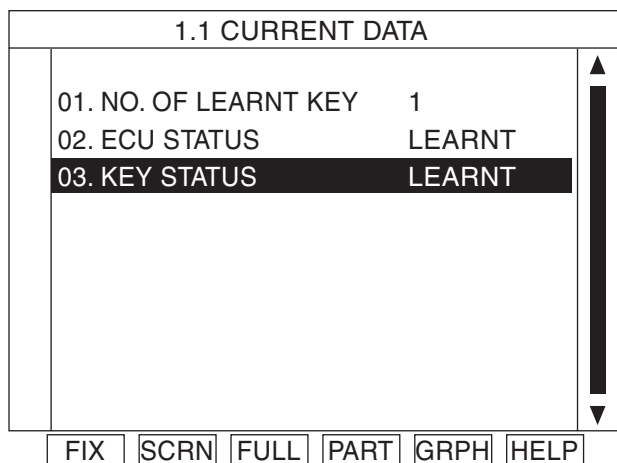


Fig 1

Fig 1) The current data in abnormal state

SCMBE6752L

- 3) Are "KEY STATUS" and "ECU STATUS" Parameter within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Check transponder" procedure.

2. Check transponder
  - 1) IGN "ON" & Engine "OFF"
  - 2) Neutralize ECM and Register transponder key by scantool.

**NOTE**

*Pin code is required to Neutralize ECM and to Register transponder key*

- 3) Are Neutralizing and Registering completed normally?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good transponder and check for proper operation. If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

**VERIFICATION OF VEHICLE REPAIR** E5B3CB0C

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

**DTC P1695 EMS MEMORY ERROR**

**GENERAL DESCRIPTION** EED231EB

The relevant data for the immobilizer function are stored at permanent memory (EEPROM or Flash etc.). The immobilizer data are stored by three independent entries. The data from EEPROM are evaluated by "2 of 3 decision". That means all three entries are read and the content is compared before authentication process. If the contents of all entries are equal, the authentication will run without additional measures. If only the contents of two entries are equal, the authentication will run and fault code "EEPROM defective" is stored at ECM. If the contents of all three entries are different from each other, no authentication will be possible and the fault code "EEPROM defective" will be stored. The limp home function cannot be activated. The ECM shall be replaced if the EEPROM related fault occurs again after new teaching of all keys.

**DTC DESCRIPTION** EEE30417

The ECM sets DTC P1694 if there's any fault in EMS internal permanent memory (EEPROM or Flash etc.)

**DTC DETECTING CONDITION** EAF6F7E7

Item	Detecting Condition	Possible Cause
DTC Strategy		• Faulty EMS
Enable Conditions	• IG ON	
Threshold value		
Detecting time		
FAIL SAFE		

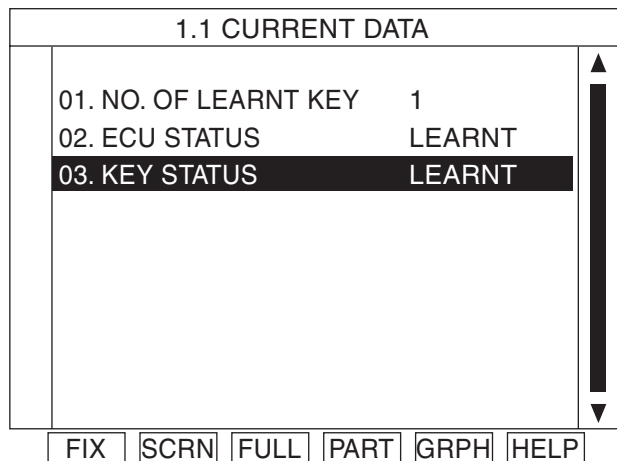
**COMPONENT INSPECTION** E0F9E5E6

1. Check transponder and ECU status
  - 1) IGN "ON" & Engine "OFF"
  - 2) Monitor the "KEY STATUS" and "ECU STATUS" Parameter on the Scantool.

---

Specification : 'LEARNT'

---



**Fig 1**

Fig 1) The current data in abnormal state

SCMBE6752L

- 3) Are "KEY STATUS" and "ECU STATUS" Parameter within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Go to "Check transponder" procedure

2. Check ECM

- 1) IGN "ON" & Engine "OFF"
- 2) Neutralize ECM and Register transponder key by scantool.

**NOTE**

*Pin code is required to Neutralize ECM and to Register transponder key*

- 3) Are Neutralizing and Registering completed normally?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good ECM and check for proper operation.  
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

**NOTE**

*ECM substituted for old one must be in "Virgin" or "Neutral" status and Pin code is required to Neutralize ECM and to Register transponder key*

**VERIFICATION OF VEHICLE REPAIR** EEDCC139

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

**DTC P1696 AUTHENTICATION FAIL**

**GENERAL DESCRIPTION** E2EF3E5E

During the key teaching procedure the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is unique; therefore the content of transponder can never be modified or changed. The data are a string of 9 bytes defined by vehicle manufacturer.

The transponder memory is split into two strings called authenticator and key password After this programming the transponder memory is locked and the data(PIN code) cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt". Additionally every transponder includes a unique IDE (Identifier number) of 32 bit.

Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value. The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.

For teaching of keys and special purposes the ECM is connected to the tester device.

When IG is ON, the coil supplies energy to the transponder which in turn accumulates energy in the condenser. Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

**DTC DESCRIPTION** EF510E45

The ECM sets DTC P1696 if invalid key is inserted into key hole for Authentication.

**DTC DETECTING CONDITION** EC8BD3DF

Item	Detecting Condition	Possible Cause
DTC Strategy		<ul style="list-style-type: none"><li>• Virgin TP at EMS status "Learnt"</li><li>• Learnt(Invalid) TP at EMS status "Learnt"</li></ul>
Enable Conditions	<ul style="list-style-type: none"><li>• IG ON</li></ul>	
Threshold value		
Detecting time		
FAIL SAFE		

**COMPONENT INSPECTION** EDDDE33B

1. Check transponder and ECU status
  - 1) IGN "ON" & Engine "OFF"

2) Monitor the "KEY STATUS" and "ECU STATUS" Parameter on the Scantool.

Specification : 'LEARNT'

1.1 CURRENT DATA	
01. NO. OF LEARNT KEY	1
02. ECU STATUS	LEARNT
03. KEY STATUS	LEARNT

FIX    SCRN    FULL    PART    GRPH    HELP

Fig 1

Fig 1) The current data in abnormal state

SCMBE6752L

3) Are "KEY STATUS" and "ECU STATUS" Parameter within specifications?

**YES**

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

Register as necessary and then go to "Verification of Vehicle Repair" procedure.

CASE 1. KEY STATUS "VIRGIN" : Register transponder key now inserted

CASE 2. KEY STATUS "INVAILD" : Register all transponder key

## VERIFICATION OF VEHICLE REPAIR E6CD6BCB

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

**DTC P1697 HI-SCAN MESSAGE ERROR**

**GENERAL DESCRIPTION** E036FDC3

In immobilizer system, scantool is mainly used for diagnosis. besides this, registration of key and neutralization of ECM is executed by scantool. For ECM communicate with other components such as SMARTRA and scantool by changing type of communication through just one line, K-line communication between scantool and ECM is unavailable while communication between ECM and SMARTRA is in progress.

**DTC DESCRIPTION** E29ABB1D

The ECM sets DTC P1696 if Request from Tester is Invalid.

**DTC DETECTING CONDITION** E6DB0ACF

Item	Detecting Condition	Possible Cause
DTC Strategy		<ul style="list-style-type: none"><li>• Invalid request<ul style="list-style-type: none"><li>- Protocol layer violation</li><li>- Check sum error</li></ul></li></ul>
Enable Conditions	<ul style="list-style-type: none"><li>• IG ON</li></ul>	
Threshold value		
Detecting time		
FAIL SAFE		

**MONITOR DTC STATUS** EEBBC90D

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Selet "Diagnostic Trouble Codes(DTCs)" mode and monitor "DTC Status" parameter
4. Is the DTC B1697 present?

**YES**

Go to "Inspection & Repair" procedure.

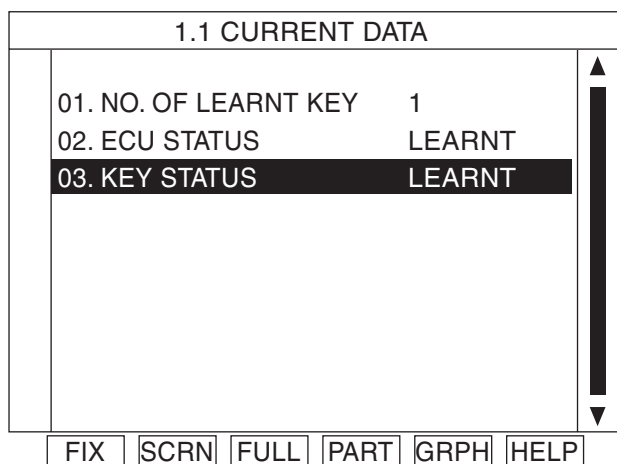
**NO**

Fault is intermittent caused by poor contact in SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**COMPONENT INSPECTION** EBA0A88E

1. Check communication between ECM and scantool
  - 1) IGN "ON" & Engine "OFF"
  - 2) Connect scantool to Data Link Connector(DLC).

- 3) Erase the DTC and Monitor Parameter of immobilizer on the Scantool.
  - ※ Try one more time from "select car model " even if "Communication error" is present on the scantool.



**Fig 1**

Fig 1) The current data in abnormal state

SCMBE6752L

- 4) Is the communication between ECM and scantool normal?

**YES**

If ECM is in "Locked by Timer" status. Keep "KEY ON" status for 1 hours to withdraw "Locked by Timer" status. Then repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

**NO**

Substitute with a known-good scantool and check for proper operation.  
If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

**VERIFICATION OF VEHICLE REPAIR** E1C7EA4D

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

- 1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
- 2. Operate the vehicle and monitor the DTC on the scantool.
- 3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

**NO**

System is performing to specification at this time.

**DTC P1698 INVALID TP (TP HAS DIFFERENT PIN)**

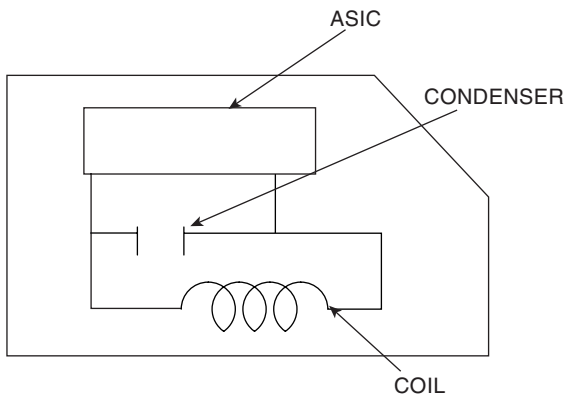
**GENERAL DESCRIPTION** E2E81A0A

A transponder is incorporated in the head section of the key. The antenna coil supplies energy to the transponder. The transponder accumulates energy in the condenser. Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

When Ignition is set 'ON' the ICM receives a request signal from the ECM and starts ID Code registering sequence. If the ID code format from the transponder is not correct, the ICM repeatedly performs the registering sequence.

When the correct ID code format is registered, the code is verified by the ICM. If the code is not verified, the registering sequence is repeated a maximum of 5 times which is equivalent to 1 second duration.

Once the correct ID code is registered and verified after Ignition is turned ON, the registering sequence is not reperformed until Ignition is turned OFF.



LTIF743K

**DTC DESCRIPTION** EBE3440D

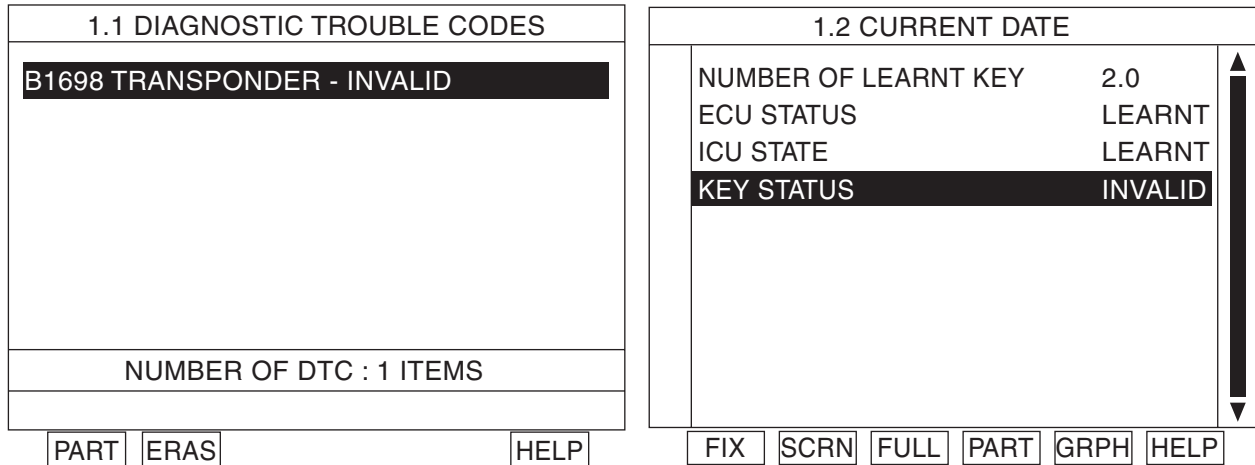
This DTC is defined as Invalid(virgin or invalid) Transponder Data.

**DTC DETECTING CONDITION** EF3301BE

Item	Detecting Condition	Possible cause
Enable Condition	<ul style="list-style-type: none"><li>IG ON</li></ul>	<ul style="list-style-type: none"><li>Faulty TP(Virgin or Invalid)</li></ul>
Detecting factors	<ul style="list-style-type: none"><li>Invalid TP</li></ul>	
Detecting Criteria	<ul style="list-style-type: none"><li>Virgin TP at EMS STATUS "Learnt"</li><li>Learnt(Invalid) TP at EMS status "Learnt"(Authentication fail)</li></ul>	

MONITOR SCANTOOL DATA EDAB0F6B

1. Ignition "ON" & Engine "OFF"
2. After connecting Scantool, Monitor the DTCs and CURRENT DATA to check key status.



LTIF743G

3. Are DTSs and CURRENT DATA displayed as above?

**YES**

If key status is "invalid" is displayed, check transponder(key) and then go to "Verification of Vehicle Repair" procedure.

**NOTE**

1. Be sure that P1698 is displayed, when transponder(key) is unintentionally exchanged with another key.
2. Be sure that P 1698 is displayed, when using virgin transponder(key) with lernt ICU.
3. Be sure that P1698 is displayed by arbnormal stop when key theaching is performed by learnt key(with same PIN code)

**NO**

Fault is intermittent caused by poor contact in the ICU and/or the antenna coil connector or was repaired and ICU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**VERIFICATION OF VEHICLE REPAIR** E8386910

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

**YES**

Go to the applicable troubleshooting procedure.

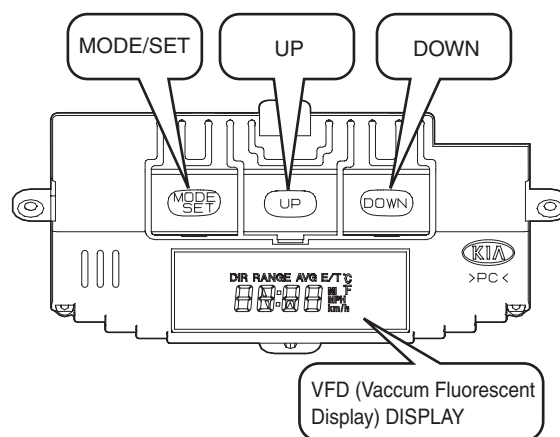
**NO**

System is performing to specification at this time.

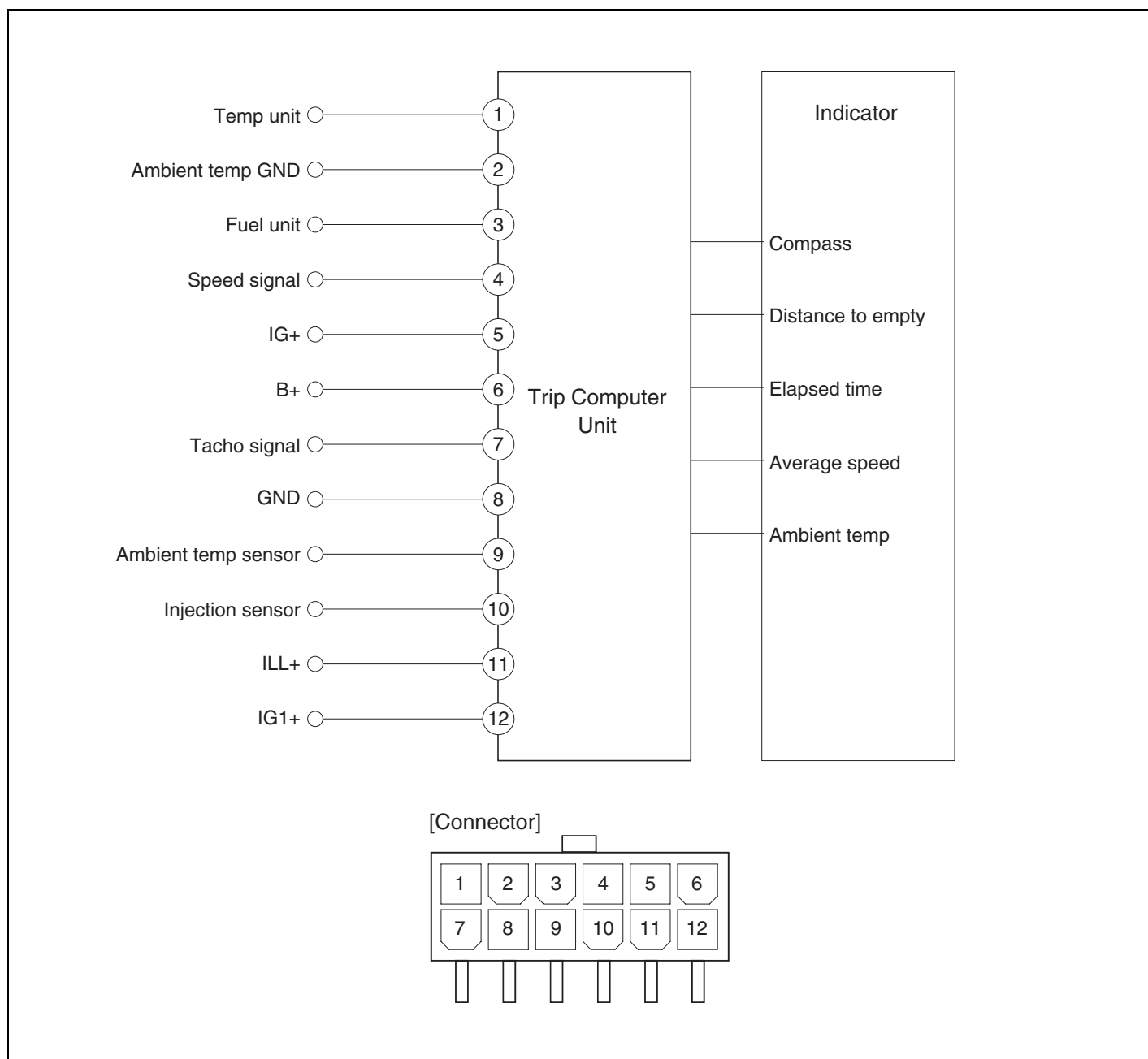
# TRIP COMPUTER

## DESCRIPTION EE2EB426

The trip computer displays information related to driving, including compass, distance to empty, elapsed time, average fuel consumption and outside temperature on the display. To change the function as described below, push the MODE/SET button lesser than 2 sec. Distance to empty → elapsed time → average fuel consumption → outside temperature → OFF.



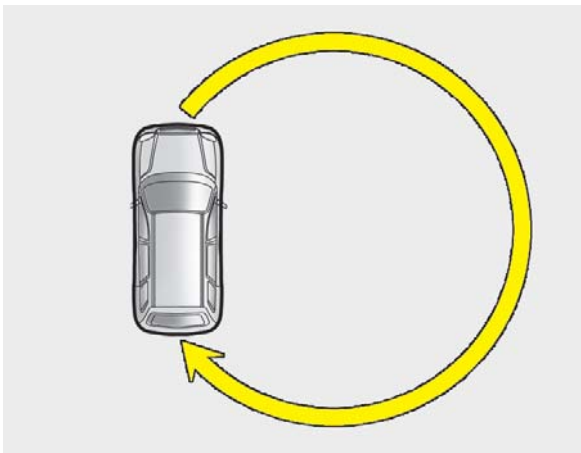
SBLBE6460L



SBLBE6461L

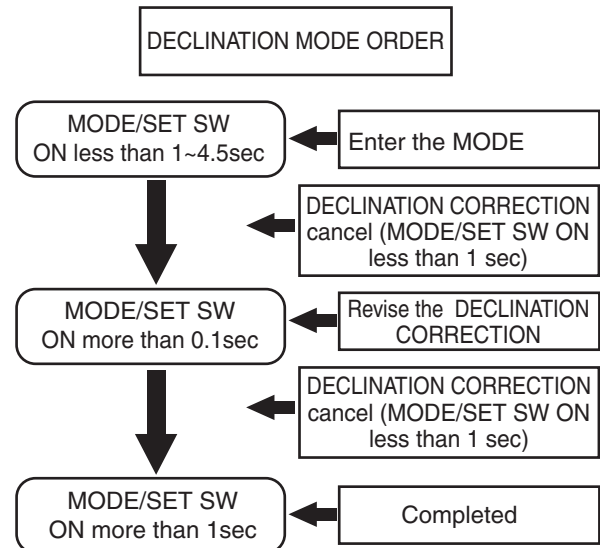


- 2) Slowly (about 5km/h, 3mph) rotate the vehicle one turn(360 degree) within 128 seconds. The rotation could be made at any direction(left or right) in an open space.
  - The correction data is updated if the automatic correction data is better than the present correction data
  - Turning direction is not important
  - If the correction process is not finished after the vehicle turns 360°, turn the vehicle some more degree.



ETJF241D

2. DECLINATION CORRECTION (VARIANT REGION CHANGE MODE)  
Change the "Declination Setting Value" according to the regional declination to synchronize the true north and vehicle's north.
  - 1) Push the mode button longer than 4.5 Sec to enter the declination correction mode. ('DIR' is blinking 4 times)



SBLBE6466L

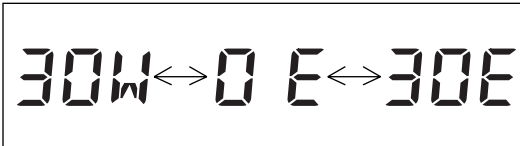
- 3) When the rotation is finished, the azimuth compass indicator (DIR) will stop blinking and the error correction is completed. If the indicator continues to blink, rotate the vehicle a bit more until the blinking stops.

- Screen after blinking 4 times.



SBLBE6467D

- 2) Push the UP or DOWN button longer than 0.1 Sec to change the declination setting Value (Steps by 5° to East or WEST ; After East 30, wraps to West 30)



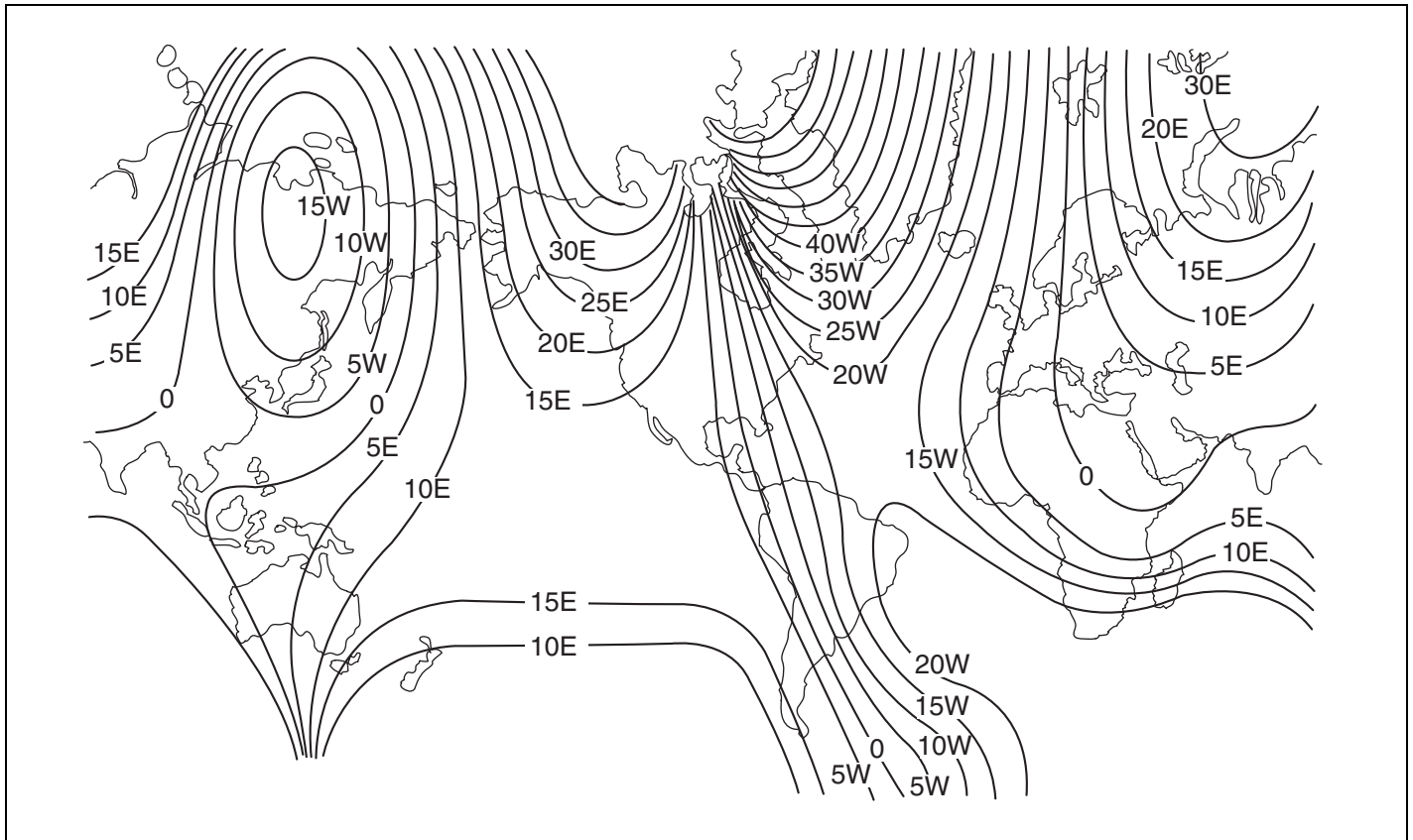
SBLBE6468D

- 3) Cancellation conditions of Declination correction
  - a. If you push the MODE/SET switch and hold for more than 0.1 and less than 45 seconds.
  - b. Without any effective input for 30 seconds.

**CAUTION**

- Do not install a ski rack, antenna, etc. that are attached to the vehicle using a magnet as anything attached to the roof of the vehicle with a magnet will effect compass operation.
- If the compass deviates from the correct indication soon after repeated adjustment, have the compass checked at an authorized dealer.
- The compass may not indicate the correct compass point in tunnels or while driving up or down a steep hill. (The compass returns to the correct compass point when the vehicle moves to an area where the geomagnetism is stabilized.)
- Declination correction and correction setting value is not deleted during the B(+) OFF.

**THE CONTOUR LINE MAP FOR TERRESTRIAL DEVIATION ANGLE CORRECTION**



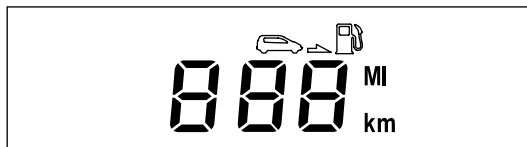
SBLBE6469D

## TRIP COMPUTER

BE -77

### DISTANCE TO EMPTY

This mode indicates the estimated distance to empty from the current fuel in the fuel tank.



SBLBE6470D

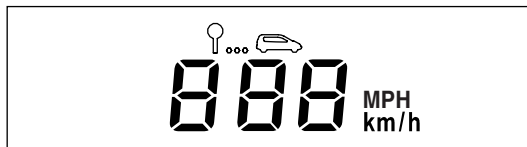
1. When the remaining distance is below 50 km (30 miles), a blinking "---" symbol will be displayed.
2. If you press the "DOWN" switch for more than 5 seconds, the distance unit would transfer to "Km" from "MI (mile)" or "MI" from "Km".

#### CAUTION

*The figure of distance to empty is estimated driving distance, so it can be different from the driving distance really is.*

### AVERAGE SPEED

This mode indicates the average speed from the starting of the vehicle to the ignition key "OFF".

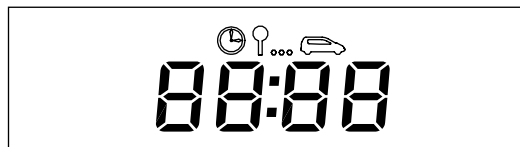


SBLBE6471D

1. When the ignition key is "OFF", it will initialize to 0 km/h (0 mph).
2. If you press the "DOWN" switch for more than 5 seconds, the speed unit would transfer to "Km/h" from "MPH" or "MPH" from "Km/h".

### ELAPSED TIME

This mode indicates the total time from the starting of the vehicle to the ignition key "OFF" after resetting.

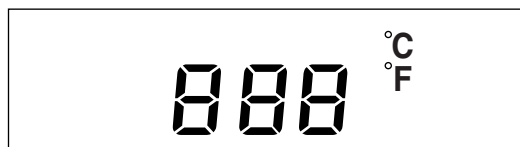


SBLBE6472D

1. Push "MODE/SET" for more than 1.5 seconds to initialize the displayed information such as average speed and driving time.

### OUTSIDE AMBIENT TEMPERATURE

This mode indicates the current ambient temperature. The meter's working range -30°C (-40°F) to 65°C (149°F).



SBLBE6473D

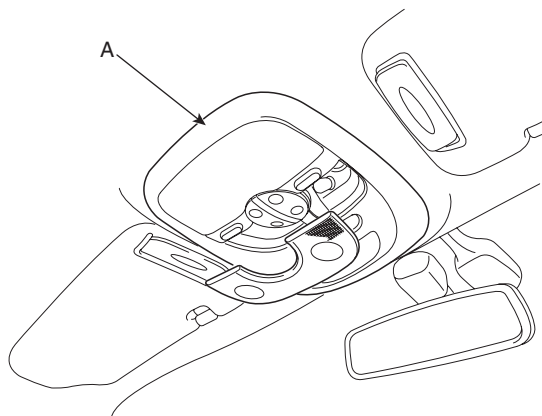
1. If you press the "DOWN" switch for more than 5 seconds, the temperature unit would transfer to "°C" from "°F" or "°F" from "°C".

**BE -78**

**BODY ELECTRICAL SYSTEM**

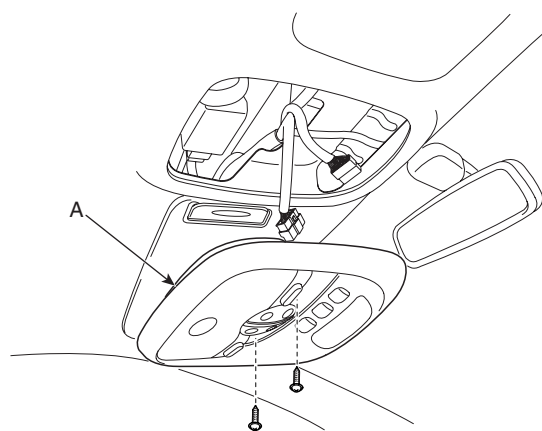
**REMOVAL** E6D489DE

1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console lamp cover(A).



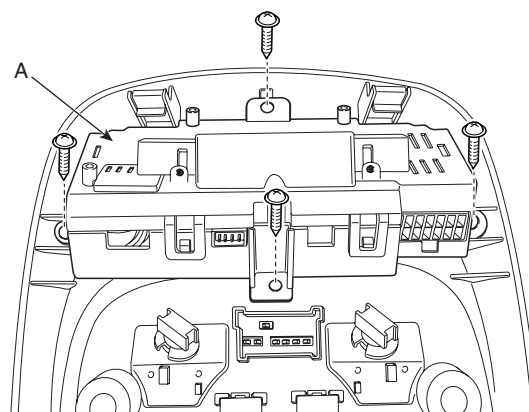
SBLBE6481D

3. Disconnect the sunroof switch connector and trip computer connector after loosening the screws (2EA) and then remove the overhead console lamp (A) from the head lining.



SBLBE6482D

4. Remove the trip computer (A) from overhead console after removing the fixing screws (4EA).



SBLBE6483D

**INSTALLATION** EEAC554B

1. Reassemble trip computer to the overhead console.
2. Connect the sunroof switch connector and trip computer connector.
3. Reassemble the overhead console.

## BACK WARNING SYSTEM

### SPECIFICATION EB12B950

Item		Specification
Back warning control unit	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 600 mA
	Operation frequency	40 ± 5 KHz
	Detective method	Direct and indirect detection
Ultrasonic sensor	Voltage rating	DC 8 V
	Detecting range	40 cm ~ 120 cm
	Operation voltage	DC 7.5~8.5 V
	Operation current	MAX 20 mA
	Operation temperature	-30°C ~ + 80°C
	Conservation temperature	-40°C ~ + 85°C
	Operation frequency	40 ± 5 KHz
Number of sensors	4 (Rear Left, Right, Side Left, Right)	
Piezo buzzer	Voltage rating	DC 12 V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 60 mA
	Sound, tone	Oscillation frequency : 2.2±0.5 KHz
Sound level : 70 dB (DC 13V, 1m)		

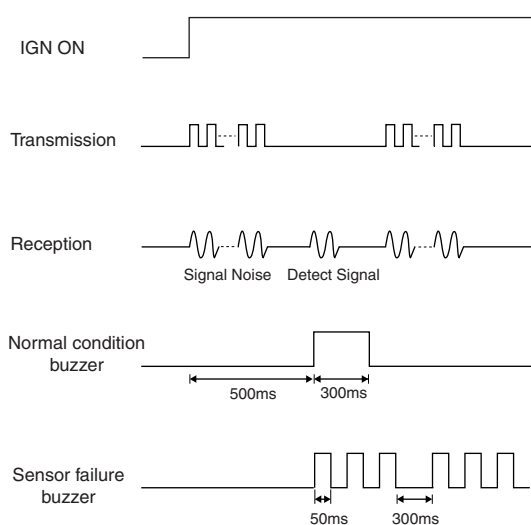
## BACK WARNING CONTROL MODULE

### DIAGNOSIS E0F29F3F

#### 1. DIAGNOSIS

Turn the ignition switch ON, then shift the transaxle lever to 'R'. The Back Warning System is then checked.

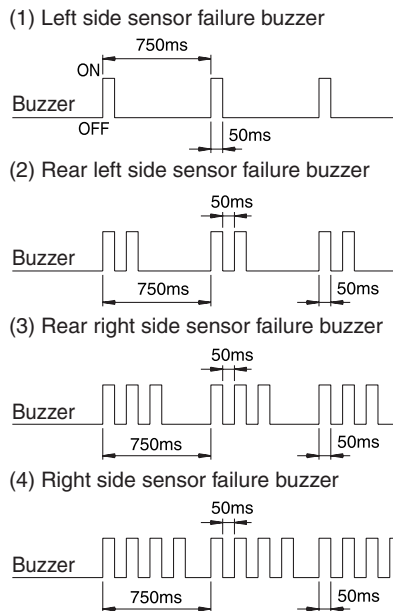
If no trouble, it generates buzzer alarm sound for 0.3 seconds after 0.5 seconds from power approval. In case of system failure, buzzer alarm is generated 3 times continuously with the interval of 0.3 seconds.



LTKG760B

#### 2. DIAGNOSIS MODE

Switch on diagnosis mode upon system failure. In case of system failure, then it indicates the failed point as follows.

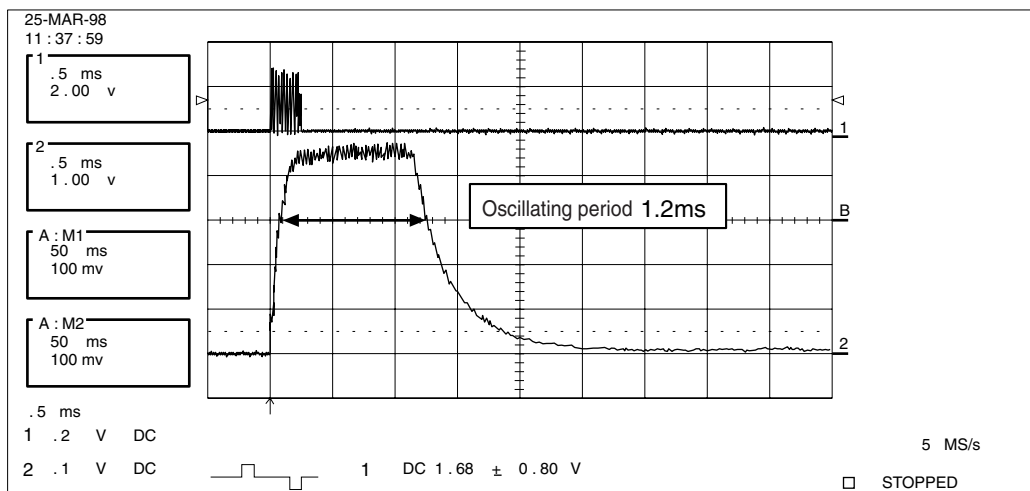


LTKG760C

### SENSOR CONNECTION CHECKING

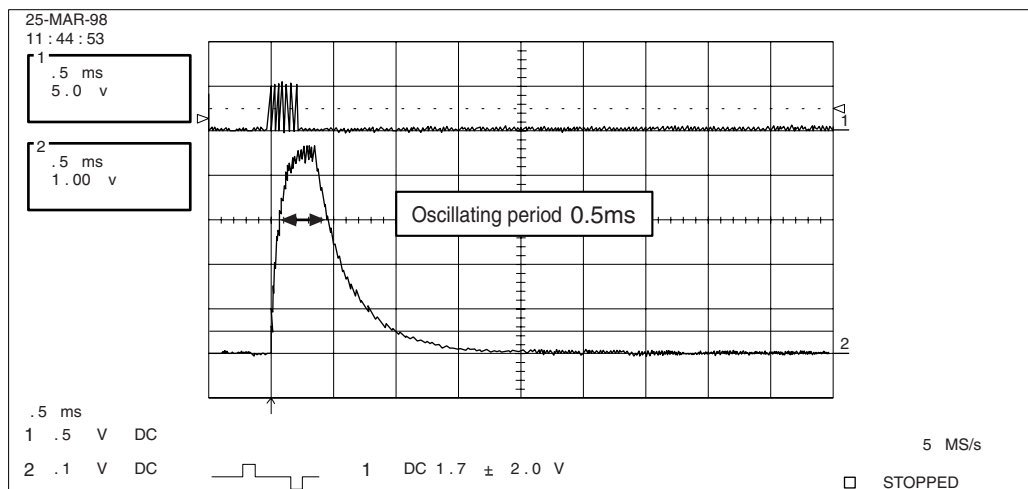
Transmit ultrasonic wave to the sensors, boost input signal, and detect wave. Waveform will be found, oscillating for a certain period of time.

1. Waveform for a normal sensor connection



BTKG230F

2. Waveform for a failed sensor connection



BTKG230G

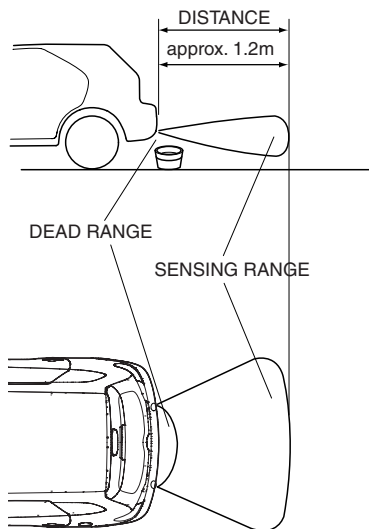
**NOTE**

Sensor connection will be checked for oscillating period of input signal 3V. If oscillating period is more than 0.8ms, it is normal.

- a. Left sensor failure : beep-beep-beep
- b. Right sensor failure : beep beep-beep beep-beep beep
- c. Rear-right sensor failure : beep beep beep-beep beep beep-beep beep beep
- d. Right side sensor failure : beep beep beep beep-beep beep beep beep beep-beep beep beep beep

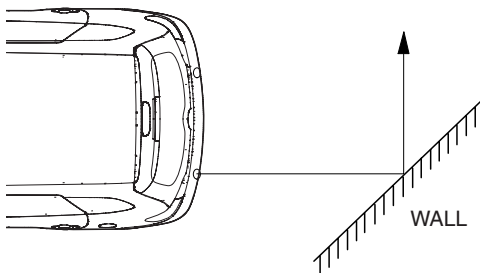
**WARNING**

1. Range detected by back sensors is limited. Watch back before reversing
2. There is a blind spot below the bumper. Low objects (for example boundary barrier) may be detected from minimum 1.5m away unable to detect at nearer.
3. Besides there are some materials unable to be detected even in detection range as follows.
  - 1) Needles, ropes, rods, or other thin objects.
  - 2) Cotton, snow and other material absorbing ultra-sonic wave (for example, fire extinguisher device covered with snow)



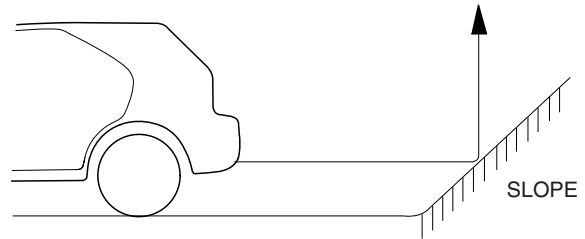
SBLBE6524L

- 3) Reversing toward the sloped walls.



SBLBE6525L

- 4) Reversing toward the sloped terrain.



SBLBE6526L

4. False alarm may operate in the following condition: irregular road surface, gravel road, sloped road and grass. Upon alarm generation by grass the alarm may be generated by rock behind grass. Always visually check the area behind the vehicle before backing up. The sensors cannot discriminate between materials.
5. Sensors may not operate correctly in the below conditions. Ensure sensors are clean from mud or dirt
  - 1) When spraying the bumper, the sensor opening is covered with something in order not to be contaminated. If sensor opening is contaminated with mud, snow, or dirt, detection range will be reduced and alarm may not be generated under the crash condition. Dirt accumulated on the sensor opening shall be removed with water. Do not wipe or scrape sensor with a rod or a hard object.
  - 2) If the sensor is frozen, alarm may not operate until sensor thaws.
  - 3) If a vehicle stays under extremely hot or cold environment, the detection range may be reduced. It will be restored at the normal temperature.
  - 4) When heavy cargo is loaded in rear cargo area, it changes the vehicle balance, which reduces the detection range.
  - 5) When other vehicle's horn, motor cycle engine noise, or other ultra-sonic wave sources are near.
  - 6) Under heavy rain.

- 7) When reversing towards a vertical wall and the gap between the vehicle and the wall is 15cm. (Alarm may sound despite the absence of a barrier)
- 8) If radio antenna is installed at the rear.
- 9) If the vehicle rear wiring is re-routed or electrical component is added at the rear part.
- 10) Vehicle balance is changed due to the replacement of the rear spring.
- 11) The unit will operate normally when the vehicle speed is 5km/h or less.  
Above this speed, the unit may not operate normally
6. Check the rear bumper for installation condition and deformation. If installed improperly or the sensor orientation is deviated, it may cause malfunction.
7. Be careful not to apply shock during sensor installation on the transmission or reception unit.
8. When adding electrical devices or modifying harness at the rear body of the vehicle, ensure not to change the transmission and reception unit wiring. Tagging the transmission side and reception side, it may cause malfunction.
9. High power radio transmitter (above 10W) may cause malfunction. Do not install it on the vehicle.
10. Be careful that excessive heat or sharp objects shall not touch ultrasonic sensor surface.  
Do not cover the sensor opening or press the sensor.

**DESCRIPTION** EEFEDDE5

When reversing, the driver is not easy to find objects in the blind spots and to determine the distance from the object. In order to provide the driver safety and convenience, back warning system will operate upon shifting to "R" Ultrasonic sensor will emit ultrasonic wave rearward and detect the reflected wave. Control unit will calculate distance to the object using the sensor signal input and output buzzer alarm in three steps (first, second and third alarm).

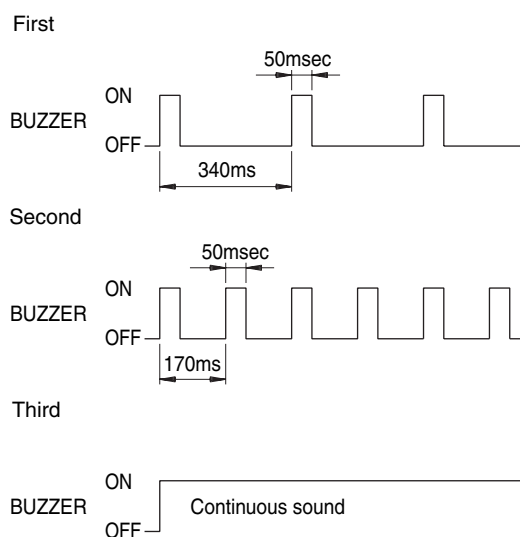
**ALARM RANGE** E376A6F5

Upon detecting an object at each range out of 3 ranges as stated below within the operation range, it will generate alarm.

First alarm : Object comes near to the sensor located at the rear of vehicle, within 81-120cm  $\pm$  15cm

Second alarm : Object comes near to the sensor located at the rear of vehicle, within 41-80cm  $\pm$  10cm

Third alarm : Object comes near to the sensor located at the rear of vehicle, within 40cm  $\pm$  10cm

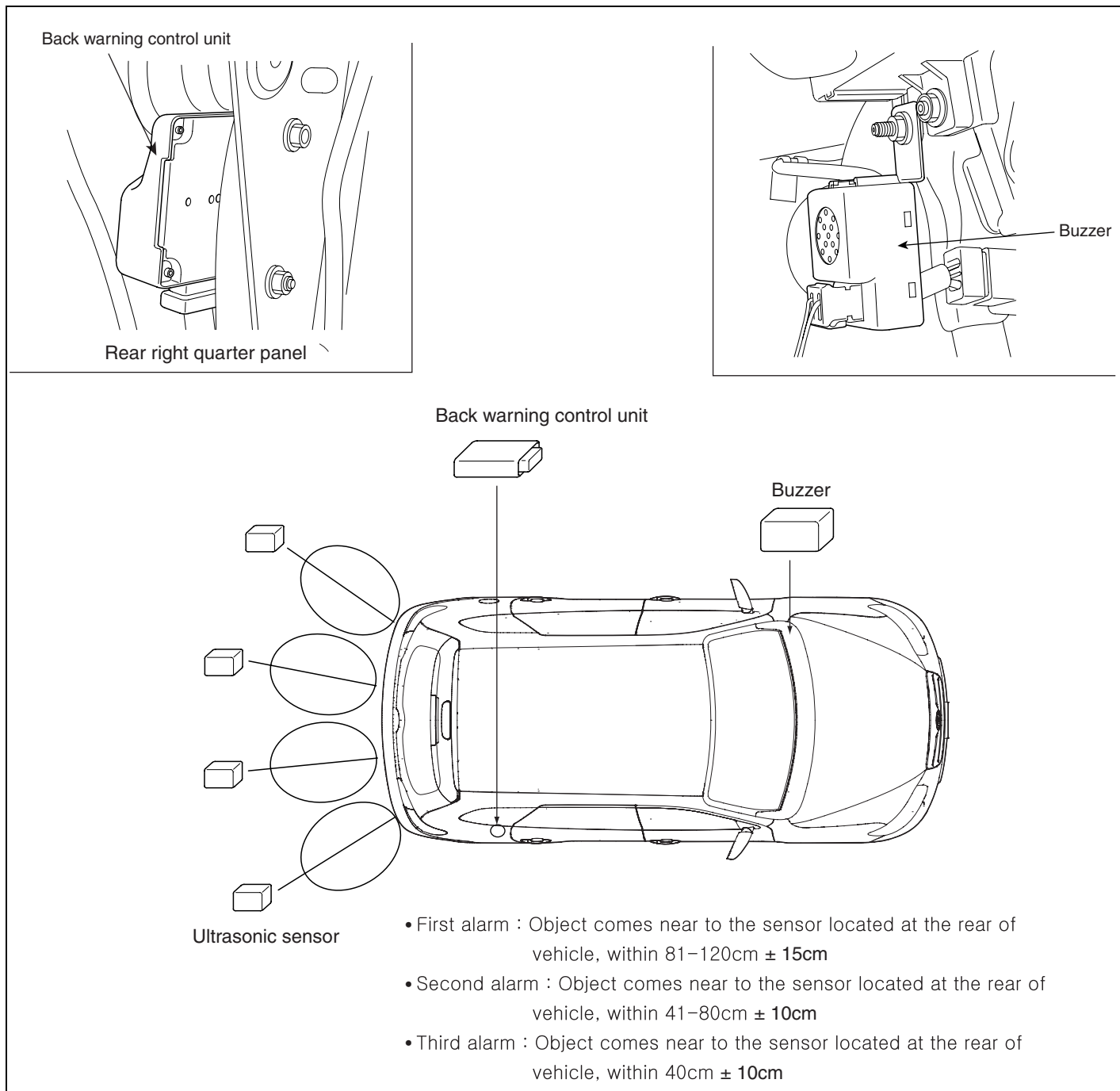


LTKG976C

**NOTE**

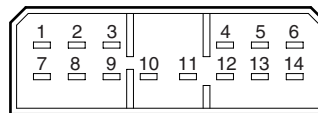
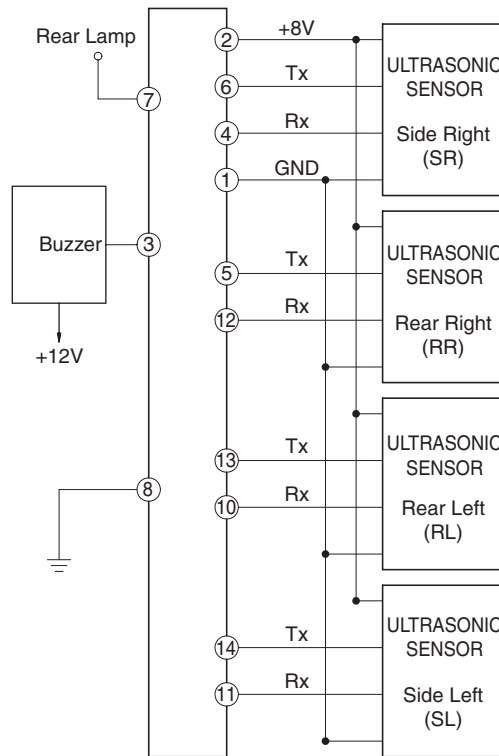
1. Time tolerance of the above waveform : Time  $\pm$  10%
2. At nearer distance than 40cm, detection may not occur.
3. Alarm will be generated with vehicle reversing speed 10km/h or less.  
For moving target, maximum operation speed shall be target approach speed of 10km/h.
4. When the vehicle or the target is moving, sequential alarm generation or effective alarm may be failed.
5. False alarm, or failure of the alarm to trigger may occur in the following conditions.
  - Irregular road surface, gravel road, reversing toward grass.
  - Horn, motor cycle engine noise, large vehicle air brake, or other object generating ultrasonic wave is near.
  - When a wireless transmitter is used near to the sensor.
  - Dirt on the sensor.
  - Sequential alarm may not occur due to the reversing speed or the target shape.

COMPONENT LOCATION EEC96CB2



SBLBE6520L

CIRCUIT DIAGRAM E72D773F



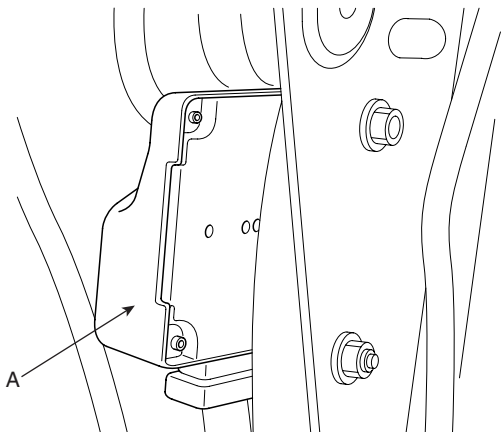
(Connector)

단자점검

Pin No.	Signal	Test : Desired result
1	GND SENSOR	0V
2	+8V SENSOR	8V (While operating)
3	PIEZO BUZZER	0V (While operating)
4	RX-SR SENSOR	0~1V Voltage change (Inspect waveform)
5	TX-RR SENSOR	0~3V Voltage change (Inspect waveform)
6	TX-SR SENSOR	0~3V Voltage change (Inspect waveform)
7	BACK UP LAMP POWER	12V (While shifting to "R")
8	GND	0V
10	N.C	0~1V Voltage change (Inspect waveform)
11	RX-RL SENSOR	0~1V Voltage change (Inspect waveform)
12	RX-SL SENSOR	0~1V Voltage change (Inspect waveform)
13	TX-RL SENSOR	0~3V Voltage change (Inspect waveform)
14	TX-SL SENSOR	0~3V Voltage change (Inspect waveform)

**REPLACEMENT** EED95FFE

1. Remove the right quarter trim of the trunk (Refer to the Interior trim in the BD group.)
2. Loosen the mounting nuts (2EA) and remove the back warning control unit (A) from the quarter panel.



KTRE761A

## ULTRASONIC SENSOR

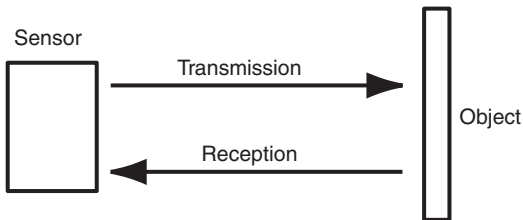
### OPERATION PRINCIPLE E8D3E46B

The sensor emits ultrasonic wave to the objects, and it measures the time until reflected wave returns, and calculates the distance to the object.

### DISTANCE DETECTION TYPE

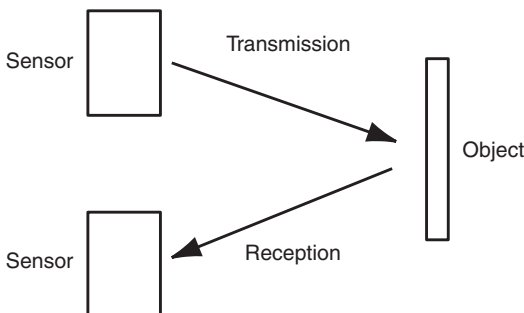
Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

1. Direct detection type: One sensor transmits and receives signals to measure the distance.



ETRF762A

2. Indirect detection type: One sensor transmits signals and the other sensor receives the signals to measure the distance.



ETRF762B

### MEASUREMENT PRINCIPLE

Back warning system (BWS) is a complementary device for reversing. BWS detects objects behind vehicle and provides the driver with buzzer alarm finding objects in a certain area, using ultrasonic wave propagation speed and time.

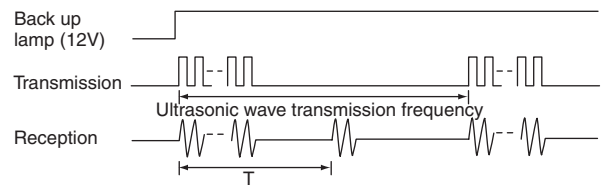
The propagation speed formula of ultrasonic wave in air is following :

$$v=331.5 + 0.6t \text{ (m/s)}$$

v=ultrasonic wave propagation speed

t=ambient temperature

The basic principle of distance measurement using ultrasonic wave is :



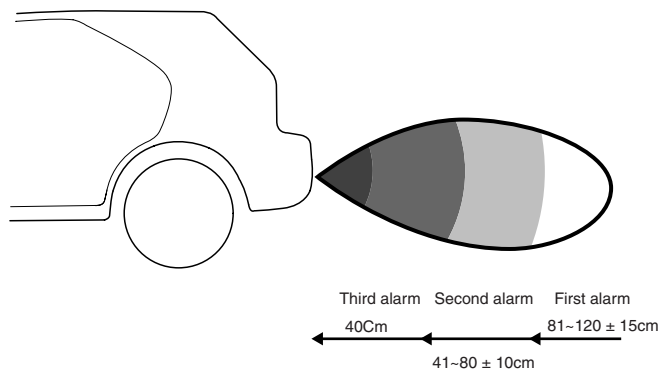
$$D = (T \times V) / 2 [m]$$

D = Distance to object      V = Ultrasonic wave speed [340m/s]  
T = Ultrasonic wave propagation time

ETRF762C

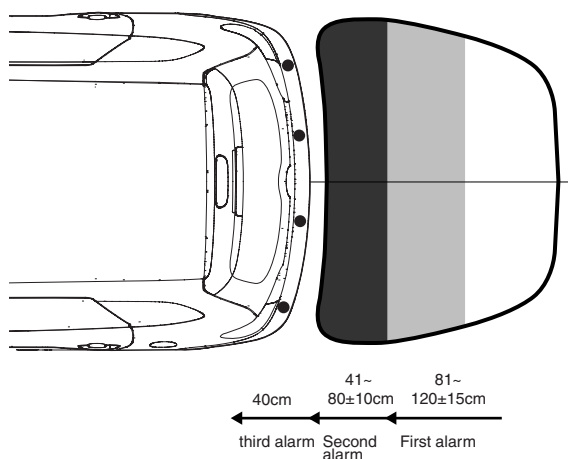
SENSOR DETECTION RANGE

[Vertical range]



1. Distance tolerance(Measured at the front of sensor)
  - 81~120cm :  $\pm 15$ cm
  - 41~80cm :  $\pm 10$ cm
  - 40cm :  $\pm 10$ cm
2. Detection tolerance
  - At 40cm :  $45^\circ \pm 15^\circ$
  - At 80cm :  $30^\circ \pm 15^\circ$
  - At 120cm :  $20^\circ \pm 15^\circ$
3. At nearer distance than 40cm detection may occur.
4. Measurement condition : Room temperature (20°C), 90mm diameter, 3m length rod.

[Horizontal range]



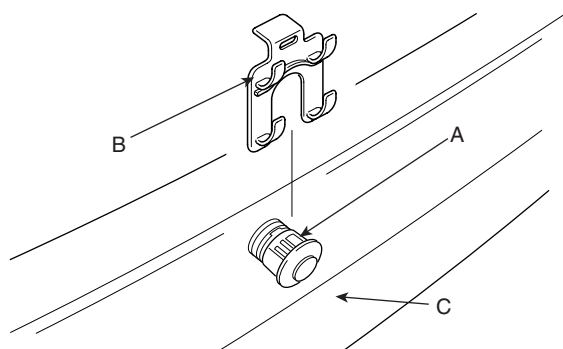
1. Distance tolerance(Measured at the front of sensor)
  - 81~120cm :  $\pm 15$ cm
  - 41~80cm :  $\pm 10$ cm
  - 40cm :  $\pm 10$ cm
2. Detection tolerance
  - At 80cm :  $90^\circ \pm 20^\circ$
  - At 120cm :  $10^\circ \pm 20^\circ$
3. At nearer distance than 40Cm detection may occur.
4. Measurement condition : Room temperature (20°C), 90mm diameter, 3m length rod.

**NOTE**

1. 14cm (Diameter) plastic rod is used for the test target.
2. The test result may differ by a different target object.
3. Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.
4. The following object may not be detected.
  - Sharp object or thin object like rope.
  - Cotton, sponge, snow or other materials absorbing sonic wave.
  - Smaller objects than 14cm (Diameter), 1m length.

**REMOVAL** EF1C9417

1. Remove the rear bumper ( Refer to the Rear bumper in the BD group)
2. Disconnect the sensor connector at the inside of the rear bumper (C), and then remove the sensor (B) from the housing (A).



LTJF762E

**INSTALLATION** ED023E95

1. Reassemble the sensor to the rear bumper, and then connect the connector.
2. Reassemble the rear bumper.

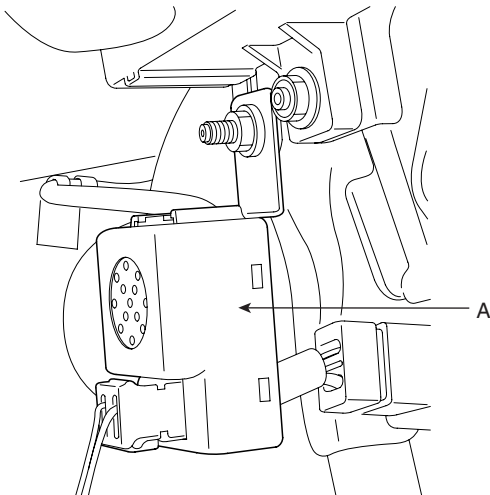
## BUZZER

### INSPECTION ED8E0FBF

Test the buzzer by connecting battery voltage to terminal 1, and ground terminal 2.  
The buzzer should make a sound. If the buzzer fails to make a sound, replace it.

### REMOVAL E8162830

1. Disconnect the negative (-) battery terminal.
2. Remove the audio unit. (Refer to the audio in this group).
3. Remove the buzzer (A) after loosening the bolt and disconnecting the connector.



KTRE763A

### INSTALLATION E20ECC6B

1. Reassemble the buzzer after connecting the connector.
2. Reassembly the audio unit.
3. Connect the negative(-) battery terminal.