

Body (Electrical System)

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GENERAL

GENERAL TROUBLESHOOTING INFORMATION

EC8BAD9

BEFORE TROUBLESHOOTING

1. Check applicable fuses in the appropriate fuse/relay box.
2. Check the battery for damage, state of charge, and clean and tight connections.

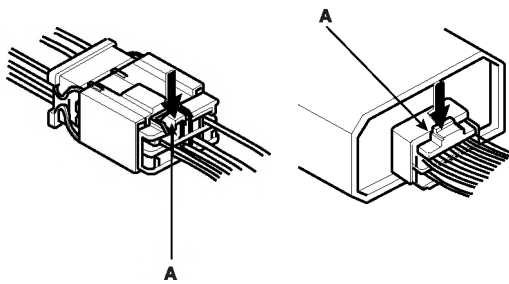
 **NOTE**

- Do not quick-charge a battery unless the battery ground cable has been disconnected, otherwise you will damage the alternator diodes.
- Do not attempt to crank the engine with the battery ground cable loosely connected or you will severely damage the wiring.

3. Check the alternator belt tension.

HANDLING CONNECTORS

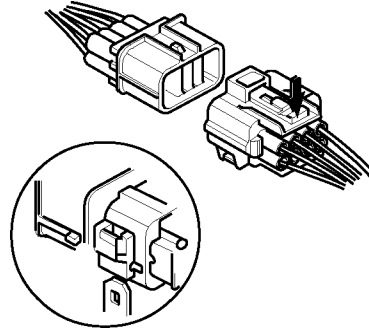
1. Make sure the connectors are clean and have no loose wire terminals.
2. Make sure multiple cavity connectors are packed with grease (except watertight connectors).
3. All connectors have push-down release type locks (A).



ETKD150A

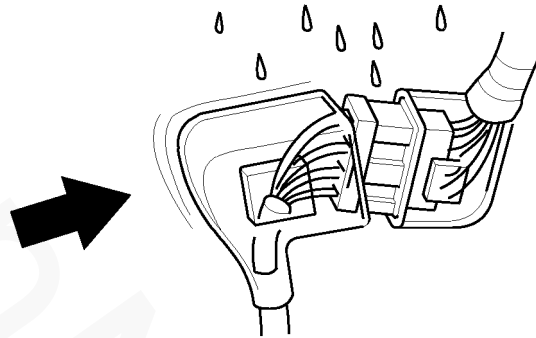
4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.

5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).



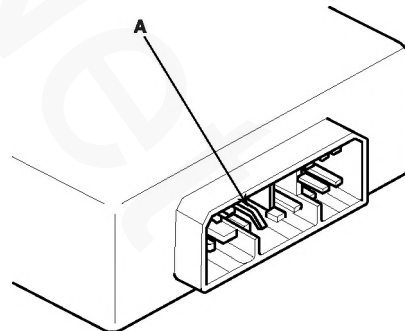
ETKD150B

6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.
7. Always reinstall plastic covers.



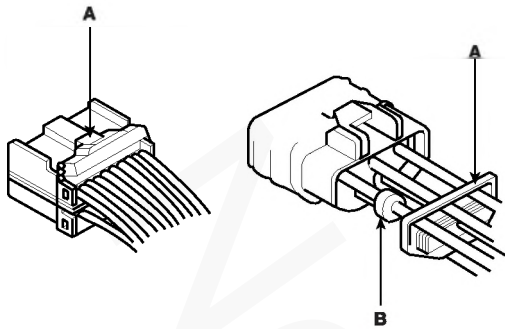
ETKD150C

8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



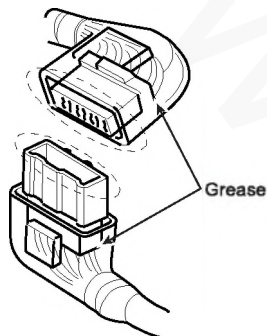
ETKD150D

9. Check for loose retainer (A) and rubber seals (B).



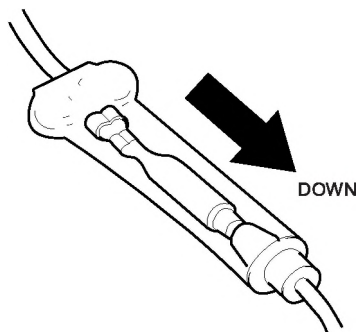
ETKD150E

10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease is contaminated, replace it.



ETKD150F

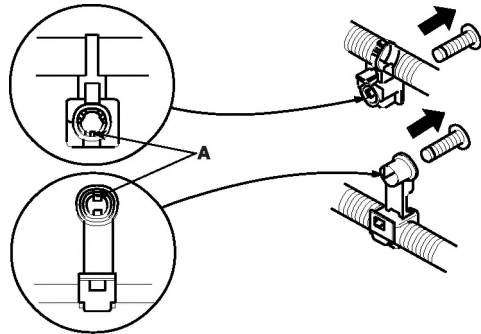
11. Insert the connector all the way and make sure it is securely locked.
12. Position wires so that the open end of the cover faces down.



ETKD150G

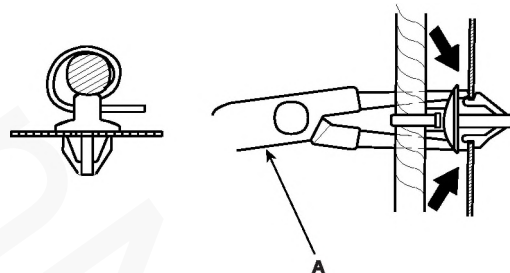
HANDLING WIRES AND HARNESSSES

1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.
2. Remove clips carefully; don't damage their locks (A).



ETKD150H

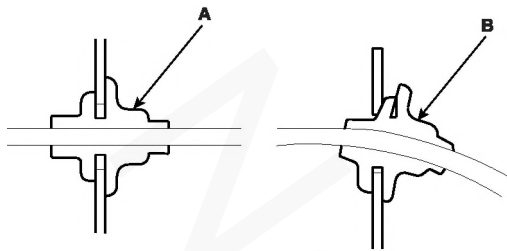
3. Slip pliers(A) under the clip base and through the hole at an angle, then squeeze the expansion tabs to release the clip.



ETKD150I

4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.

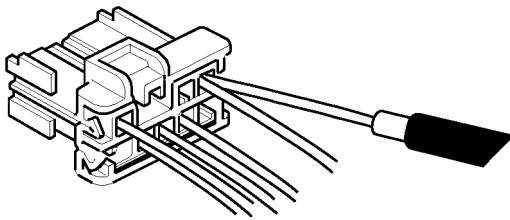
6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).



ETKD150J

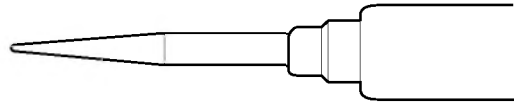
TESTING AND REPAIRS

1. Do not use wires or harnesses with broken insulation. Replace them or repair them by wrapping the break with electrical tape.
2. After installing parts, make sure that no wires are pinched under them.
3. When using electrical test equipment, follow the manufacturer's instructions and those described in this manual.
4. If possible, insert the probe of the tester from the wire side (except waterproof connector).



ETKD150K

5. Use a probe with a tapered tip.



ETKD150L

FIVE-STEP TROUBLESHOOTING

1. **Verify the complaint**
Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the problem area.
2. **Analyze the schematic**
Look up the schematic for the problem circuit. Determine how the circuit is supposed to work by tracing the current paths from the power feed through the circuit components to ground. If several circuits fail at the same time, the fuse or ground is a likely cause. Based on the symptoms and your understanding of the circuit operation, identify one or more possible causes of the problem.
3. **Isolate the problem by testing the circuit**
Make circuit tests to check the diagnosis you made in step 2. Keep in mind that a logical, simple procedure is the key to efficient troubleshooting. Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.
4. **Fix the problem**
Once the specific problem is identified, make the repair. Be sure to use proper tools and safe procedures.
5. **Make sure the circuit works**
Turn on all components in the repaired circuit in all modes to make sure you've fixed the entire problem. If the problem was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the original problem does not recur.

SPECIFICATIONS EACDF8CD**MULTIFUNCTION SWITCH**

Items	Specifications
Rated Voltage	DC 12V
Operating temperature range	-30°C ~ +80°C (-22 ~ +176°F)
Rated load Dimmer & passing switch Lighting switch Turn signal & lane change switch Wiper switch Wiper mist switch Washer switch Variable intermittent wiper volume switch Rear wiper & washer switch Horn switch	High : 1A (Relay load) Low : 1A (Relay load) Passing : 1A (Relay load) Lighting : 1A (Relay load) 6.6 ± 0.5A (Lamp load) Low, High : 4.5A (Motor load) Int. : 0.22 ± 0.05A (Relay load) Lock : Max. 28A (Motor load) 4.5A (Motor load) 4A (Motor load) Max. 25mA Rear wiper : 0.2A (Relay load) Rear washer : 4A (Motor load) 1A (Relay load)

INSTRUMENTS AND WARNING SYSTEM

Warning lamps	Bulb wattage (W)	Color
High beam	LED	Blue
Low fuel	LED	Amber
Turn signal (LH, RH)	LED	Green
Battery (charge)	LED	Red
Oil pressure	LED	Red
Air bag	Bulb (1.4W)	Red
Parking brake	LED	Red
Seat belt	LED	Red
Check engine	Bulb (1.4W)	Amber
ABS	LED	Amber
Door ajar	LED	Red
Trunk lid open	LED	Red
Cruise	LED	Green
TCS	LED	Amber
TCS OFF	LED	Amber

INDICATORS AND GAUGES

Items	Specifications																																																																																				
<p>Speedometer</p> <p>Type</p> <p>Input spec.</p> <p>Indication</p> <p>Standard values</p>	<ul style="list-style-type: none"> o Cross-coil type o Hall IC type : 4 pulses/rev. o Km/h : 637rpm x 4 pulses/rev. indicates 60Km/h o MPH : 1026 rpm x 4 pulses/rev. indicates 60MPH <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Velocity (Km/h)</td> <td>20</td> <td>40</td> <td>60</td> <td>80</td> <td>100</td> <td>120</td> <td>140</td> </tr> <tr> <td>Tolerance (Km/h)</td> <td>20-24.4</td> <td>40-43</td> <td>60-64.4</td> <td>80-85.5</td> <td>100-105.5</td> <td>120.5-126</td> <td>140.5-146</td> </tr> <tr> <td>Tolerance (Km/h)</td> <td>20-24.4</td> <td>40-44.4</td> <td>60-65.4</td> <td>81-86.5</td> <td>102-107.5</td> <td>123-128.5</td> <td>144-149.5</td> </tr> <tr> <td>Velocity (Km/h)</td> <td>160</td> <td>180</td> <td>200</td> <td>220</td> <td>240</td> <td colspan="2" style="text-align: center;">Area</td> </tr> <tr> <td>Tolerance (Km/h)</td> <td>160.5-166</td> <td>181-186.5</td> <td>201-206.5</td> <td>221-226.7</td> <td>241-246.7</td> <td colspan="2" style="text-align: center;">Others</td> </tr> <tr> <td>Tolerance (Km/h)</td> <td>165-170.5</td> <td>186-191.5</td> <td>207-212.5</td> <td>227.7-233.5</td> <td>248.5-254.3</td> <td colspan="2" style="text-align: center;">EEC & General</td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Velocity (MPH)</td> <td>10</td> <td>20</td> <td>40</td> <td>60</td> <td>80</td> </tr> <tr> <td>Tolerance (MPH)</td> <td>10-14.4</td> <td>20-23</td> <td>40-44.4</td> <td>60-65.5</td> <td>80-85.5</td> </tr> <tr> <td>Tolerance (MPH)</td> <td>8.5-11.5</td> <td>18.5-21.5</td> <td>38.5-41.5</td> <td>58.3-61.7</td> <td>78.3-81.7</td> </tr> <tr> <td>Velocity (MPH)</td> <td>100</td> <td>120</td> <td>140</td> <td>160</td> <td>Area</td> </tr> <tr> <td>Tolerance (MPH)</td> <td>100.5-106</td> <td>120.5-126</td> <td>140.5-147</td> <td>160.5-167</td> <td>Except U.S.A</td> </tr> <tr> <td>Tolerance (MPH)</td> <td>98.3-101.7</td> <td>118.3-121.7</td> <td>138.1-141.9</td> <td>158.1-161.9</td> <td>U.S.A</td> </tr> </table>	Velocity (Km/h)	20	40	60	80	100	120	140	Tolerance (Km/h)	20-24.4	40-43	60-64.4	80-85.5	100-105.5	120.5-126	140.5-146	Tolerance (Km/h)	20-24.4	40-44.4	60-65.4	81-86.5	102-107.5	123-128.5	144-149.5	Velocity (Km/h)	160	180	200	220	240	Area		Tolerance (Km/h)	160.5-166	181-186.5	201-206.5	221-226.7	241-246.7	Others		Tolerance (Km/h)	165-170.5	186-191.5	207-212.5	227.7-233.5	248.5-254.3	EEC & General		Velocity (MPH)	10	20	40	60	80	Tolerance (MPH)	10-14.4	20-23	40-44.4	60-65.5	80-85.5	Tolerance (MPH)	8.5-11.5	18.5-21.5	38.5-41.5	58.3-61.7	78.3-81.7	Velocity (MPH)	100	120	140	160	Area	Tolerance (MPH)	100.5-106	120.5-126	140.5-147	160.5-167	Except U.S.A	Tolerance (MPH)	98.3-101.7	118.3-121.7	138.1-141.9	158.1-161.9	U.S.A
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<p>Tachometer</p> <p>Type</p> <p>Standard values</p>	<ul style="list-style-type: none"> o Tap the speedometer to prevent hysteresis effects during inspection. o Cross-coil type (4cyl : 2pulses/rev, 6cyl : 3pulses/rev) <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Revolution (RPM)</td> <td>1,000</td> <td>2,000</td> <td>3,000</td> <td>4,000</td> <td>5,000</td> <td>6,000</td> <td>7,000</td> <td>8,000</td> </tr> <tr> <td>Tolerance (RPM)</td> <td>±100</td> <td>±125</td> <td>±150</td> <td>±150</td> <td>±150</td> <td>±180</td> <td>±210</td> <td>±240</td> </tr> </table>	Revolution (RPM)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	Tolerance (RPM)	±100	±125	±150	±150	±150	±180	±210	±240																																																																		
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<p>Fuel gauge</p> <p>Type</p> <p>Standard values</p>	<ul style="list-style-type: none"> o Tap the tachometer to prevent hysteresis effects during inspection. o Cross - coil type (Fixed point type : Pointer should not fall into the "E" point but indicate remaining fuel level when the ignition is off) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Level</th> <th colspan="2">Gauge</th> </tr> <tr> <th>Resistance (Ω)</th> <th>Gauge angle (°)</th> </tr> </thead> <tbody> <tr> <td>E (Empty)</td> <td style="text-align: center;">97</td> <td style="text-align: center;">-45 ± 2.5</td> </tr> <tr> <td>1/2</td> <td style="text-align: center;">32.5</td> <td style="text-align: center;">0 ± 5.0</td> </tr> <tr> <td>F (Full)</td> <td style="text-align: center;">6</td> <td style="text-align: center;">45 ± 2.5</td> </tr> </tbody> </table> <ul style="list-style-type: none"> o Inspection order : E → F → E The level must be reached within 7 minutes after the resistance is set for Full or Empty. o Point stability tolerance : Within ±6° Apply power for 10 minutes. Then turn off the power for an hour and read the position of the pointer. 	Level	Gauge		Resistance (Ω)	Gauge angle (°)	E (Empty)	97	-45 ± 2.5	1/2	32.5	0 ± 5.0	F (Full)	6	45 ± 2.5																																																																						
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Items	Specifications																				
Temperature gauge Type Standard values	o Cross - coil type <table border="1" data-bbox="464 539 1409 685"> <thead> <tr> <th>Temperature</th> <th>Angle (°)</th> <th>Assembled tolerance (°)</th> </tr> </thead> <tbody> <tr> <td>60°C</td> <td>0</td> <td>-</td> </tr> <tr> <td>85°C ~ 110°C</td> <td>38</td> <td>+2 -3</td> </tr> <tr> <td>Red zone (over 125°C)</td> <td>90</td> <td>+7 -4</td> </tr> </tbody> </table>							Temperature	Angle (°)	Assembled tolerance (°)	60°C	0	-	85°C ~ 110°C	38	+2 -3	Red zone (over 125°C)	90	+7 -4		
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85°C ~ 110°C	38	+2 -3																			
Red zone (over 125°C)	90	+7 -4																			
Resistance of temperature sender (NTC)	o Inspection order : OFF → C → H <table border="1" data-bbox="464 752 1409 824"> <thead> <tr> <th>Temperature (°C)</th> <th>60</th> <th>85</th> <th>110</th> <th>125</th> </tr> </thead> <tbody> <tr> <td>Resistance (Ω)</td> <td>143.4±2</td> <td>58.1±2</td> <td>26.9±2</td> <td>17.5±2</td> </tr> </tbody> </table>							Temperature (°C)	60	85	110	125	Resistance (Ω)	143.4±2	58.1±2	26.9±2	17.5±2				
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Resistance (Ω)	143.4±2	58.1±2	26.9±2	17.5±2																	
Torque gauge Type Input spec. Standard values	o Stepper motor o ISO CAN 2.0A 500Kbps <table border="1" data-bbox="464 965 1409 1037"> <tbody> <tr> <td>Indication (N.m)</td> <td>0</td> <td>50</td> <td>100</td> <td>150</td> <td>200</td> <td>~400</td> </tr> <tr> <td>Tolerance (N.m)</td> <td>±5</td> <td>±5</td> <td>±5</td> <td>±5</td> <td>+20 -5</td> <td>±20</td> </tr> </tbody> </table>							Indication (N.m)	0	50	100	150	200	~400	Tolerance (N.m)	±5	±5	±5	±5	+20 -5	±20
Indication (N.m)	0	50	100	150	200	~400															
Tolerance (N.m)	±5	±5	±5	±5	+20 -5	±20															
Instantaneous fuel consumption gauge Type Input spec. Standard values	o Stepper motor o Speed input (Hall IC) Injection input from EMS. <table border="1" data-bbox="464 1223 1409 1294"> <tbody> <tr> <td>Indication (MPG)</td> <td>0</td> <td>10</td> <td>20</td> <td>30</td> <td>~Max.</td> <td>At idle</td> </tr> <tr> <td>Tolerance (MPG)</td> <td>±2</td> <td>±2</td> <td>±2</td> <td>+5 -2</td> <td>±10</td> <td>Indicate "0"</td> </tr> </tbody> </table>							Indication (MPG)	0	10	20	30	~Max.	At idle	Tolerance (MPG)	±2	±2	±2	+5 -2	±10	Indicate "0"
Indication (MPG)	0	10	20	30	~Max.	At idle															
Tolerance (MPG)	±2	±2	±2	+5 -2	±10	Indicate "0"															
Voltage gauge Type Input spec. Standard values	o Stepper motor o Battery input voltage <table border="1" data-bbox="464 1424 1409 1496"> <tbody> <tr> <td>Indication (V)</td> <td>Below 8.5V</td> <td>10</td> <td>12</td> <td>14</td> <td>16</td> <td>Above 16V</td> </tr> <tr> <td>Tolerance (V)</td> <td>Indicate "Min."</td> <td>±0.5</td> <td>±0.5</td> <td>±0.5</td> <td>±0.5</td> <td>Indicate "Max."</td> </tr> </tbody> </table>							Indication (V)	Below 8.5V	10	12	14	16	Above 16V	Tolerance (V)	Indicate "Min."	±0.5	±0.5	±0.5	±0.5	Indicate "Max."
Indication (V)	Below 8.5V	10	12	14	16	Above 16V															
Tolerance (V)	Indicate "Min."	±0.5	±0.5	±0.5	±0.5	Indicate "Max."															

GENERAL**BE -9****LIGHTING SYSTEM**

Items	Bulb wattage (W)
Head lamp	55W / 55W (High / Low beam)
Front turn signal/position lamp	28W / 8W
Front position lamp	5W
Front fog lamp	51W
Rear combination lamps	
Tail/stop lamp	8W / 27W
Back up lamp	27W
Turn signal lamp (Front/Rear)	28W/27W
Side marker lamp (Front/Rear)	8W/5W
Luggage lamp	5W
Center high mounted stop lamp	Internal type : 2.4W (LED) External spoiler type : 3.5W (LED)
Overhead console lamp	10W x 2
License plate lamp	5W x 2

AUDIO

Items	H250	H260	H280
Rated output	Max. 20W x 4	Max. 20W x 4	Max. 24W x 4
Load impedance	4Ω x 4	4Ω x 4	4Ω x 4
Band	AM/FM	AM/FM	AM/FM
Tuning type	PLL Synthesized type	PLL Synthesized type	PLL Synthesized type
Dark current	Max. 2mA	Max. 3.8mA	Max. 2mA
Frequency range / Channel	AM : 530~1710KHZ/10KHZ	AM : 530~1710KHZ/10KHZ	AM : 530~1710KHZ/10KHZ
	FM : 87.9~107.9MHZ/200KHZ	FM : 87.9~107.9MHZ/200KHZ	FM : 87.9~107.9MHZ/200KHZ

WINDSHIELD WIPER AND WASHER

Items	Specifications
Wiper motor Rated voltage Operating voltage range Insulation resistance Speed/current at 1Nm load test Speed/current at 4Nm load test Torque/current when parking	DC 12V DC 10~15V Min. 1M Ω Low : 44~52 rpm / 3.5A or less High : 64~78 rpm / 4.5A or less Low : 39~47 rpm / 5.5A or less High : 56~68 rpm / 7.0A or less Low : 28Nm / 24A or less High : 23Nm / 28A or less
Windshield washer Motor type Pump type Rated voltage Discharge pressure Flow rate Current Overload capacity (Continuous operation) With water Without water (Racing)	DC ferrite magnet Centrifugal 12V 1.8kg/cm ² or more 1,450cc/min. or more 5.0A or less 60sec. or less 20sec. or less
Rear wiper motor Speed/current at no load test Speed/current at 1Nm load test Torque/current when parking Wiping angle at no load	35rpm/2.2A or less 30~40rpm/3.5A or less 8Nm/14A or less 170° \pm 3°

TROUBLESHOOTING E5CEBAC5

INSTRUMENTS AND WARNING SYSTEM

Symptom	Possible cause	Remedy
Tachometer does not operate	No.17 fuse (10A) blown Tachometer faulty Wiring faulty	Check for short and replace fuse Check tachometer Repair if necessary
Fuel gauge does not operate	No.17 fuse (10A) blown Fuel gauge faulty Fuel sender faulty Wiring faulty	Check for short and replace fuse Check gauge Check fuel sender Repair if necessary
Low fuel warning lamp does not light	No.17 fuse (10A) blown Bulb burned out Fuel level sensor faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check sensor Repair if necessary
Water temperature gauge does not operate	No.17 fuse (10A) blown Water temperature gauge faulty Water temperature sender faulty Wiring or ground faulty	Check for short and replace fuse Check gauge Check sender Repair if necessary
Oil pressure warning lamp does not light	No.17 fuse (10A) blown Bulb burned out Oil pressure sender faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check sender Repair if necessary
Low brake fluid warning lamp does not light	No.17 fuse (10A) blown Bulb burned out Brake fluid level warning switch faulty Parking brake switch faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check switch Check switch Repair if necessary
Open door warning lamp does not light	No.18 fuse (10A) blown Bulb burned out Door switch faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check switch Repair if necessary
Seat belt warning lamp does not light	No.17 fuse (10A) blown Bulb burned out Buckle switch faulty Wiring or ground faulty	Check for short and replace fuse Replace bulb Check switch Repair if necessary

LIGHTING SYSTEM

Symptom	Possible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out Socket, wiring or ground faulty	Replace bulb Repair if necessary
Head lamps do not light	Bulb burned out Head lamp fuse (15A) blown No.21 fuse (10A) blown Head lamp relay faulty Lighting switch faulty Wiring or ground faulty	Replace bulb Replace fuse and check for short Check for short and replace fuse Check relay Check switch Repair if necessary
Tail lamps and license plate lamps do not light	No.9, No.14 fuse (10A) blown Battery fusible link (50A) blown Tail lamp relay faulty Lighting switch faulty Wiring or ground faulty	Replace fuse and check for short Replace the fusible link Check relay Check switch Repair if necessary
Stop lamps do not light	No.13 fuse (15A) blown Stop lamp switch faulty Wiring or ground faulty	Replace fuse and check for short Adjust or replace switch Repair if necessary
Stop lamps stay on	Stop lamp switch faulty	Adjust or replace switch
Instrument lamps do not light (Tail lamps light)	Rheostat faulty Wiring or ground faulty	Check rheostat Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out Turn signal switch faulty Wiring or ground faulty	Replace bulb Check switch Repair if necessary
Turn signal lamps do not operate	No.7 fuse (10A) blown Body control module faulty Hazard relay faulty Turn signal switch faulty Wiring or ground faulty	Replace fuse and check for short Check body control module Replace relay Check switch Repair if necessary
Hazard warning lamps do not operate	No.7 fuse (10A) blown Body control module faulty Hazard switch faulty Hazard relay faulty Wiring or ground faulty	Replace fuse and check for short Check body control module Check switch Replace relay Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified Defective body control module	Replace lamps Check body control module
Back up lamps do not light up	No.3 fuse (10A) blown Back up lamp switch faulty Wiring or ground faulty	Replace fuse and check for short Check switch Repair if necessary
Overhead console lamp does not light up	No.18 fuse (10A) blown Wiring or ground faulty	Replace fuse and check for short Repair if necessary

AUDIO

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

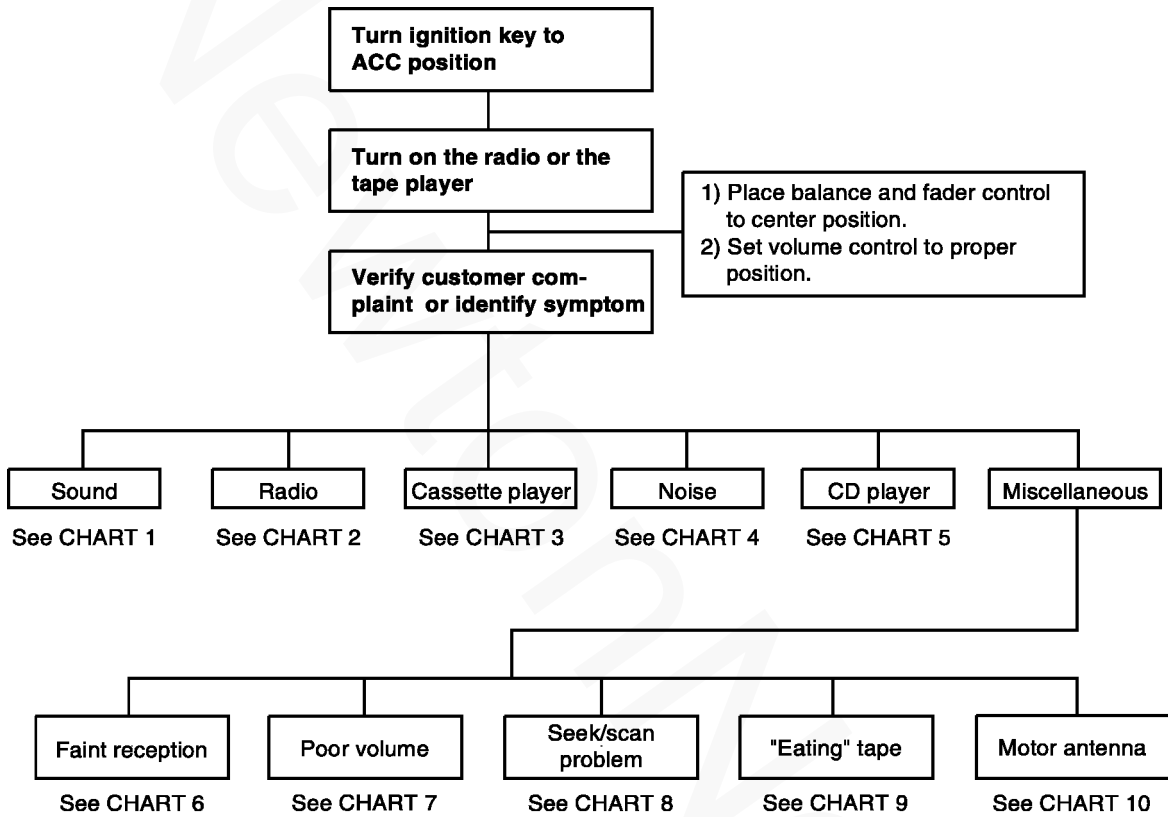
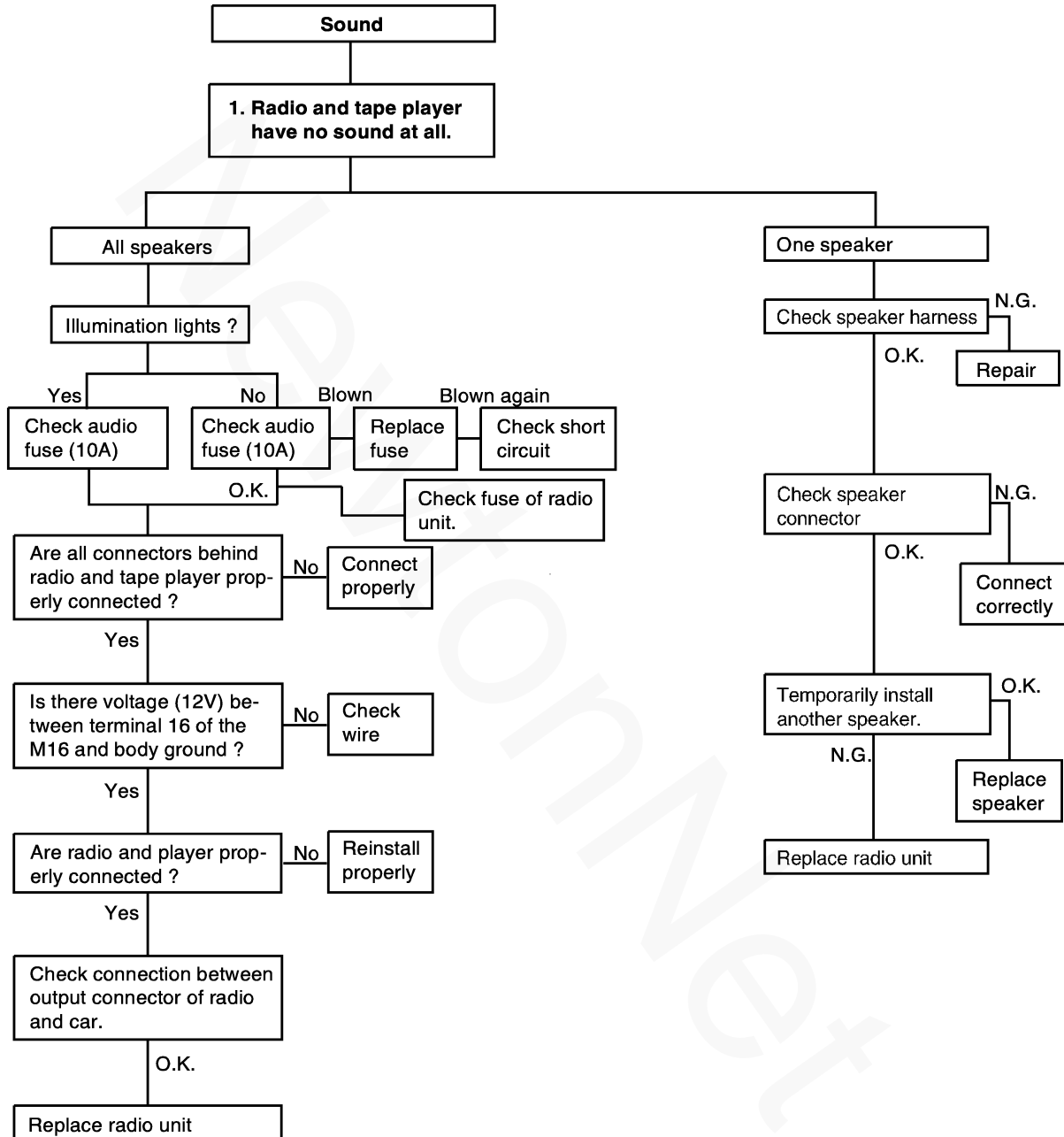
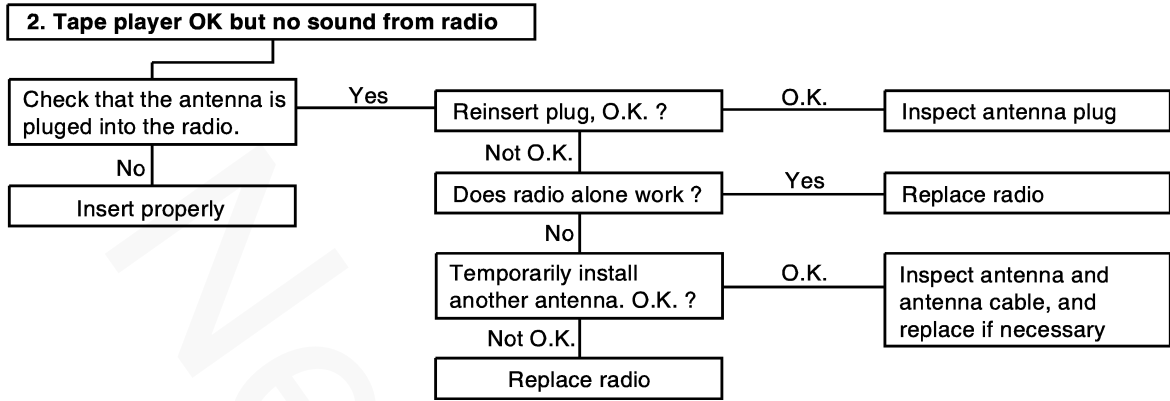


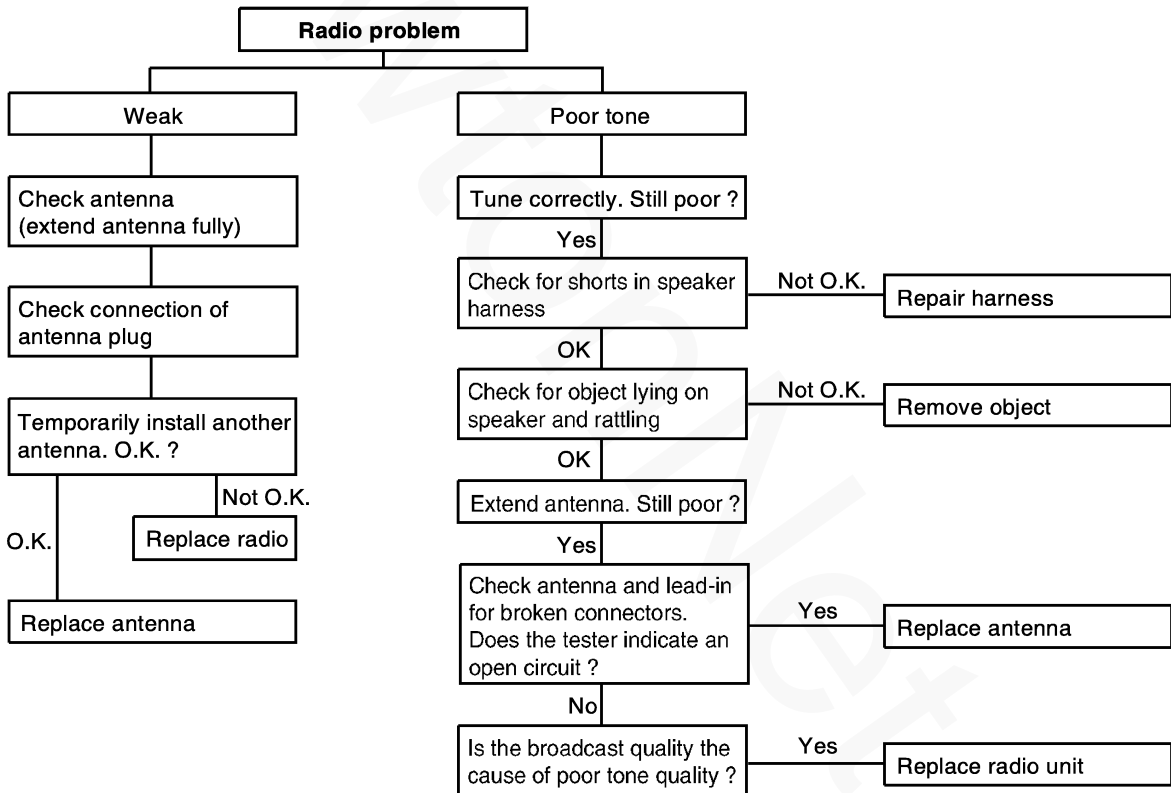
CHART 1





ETA9010C

CHART 2



ETA9010D

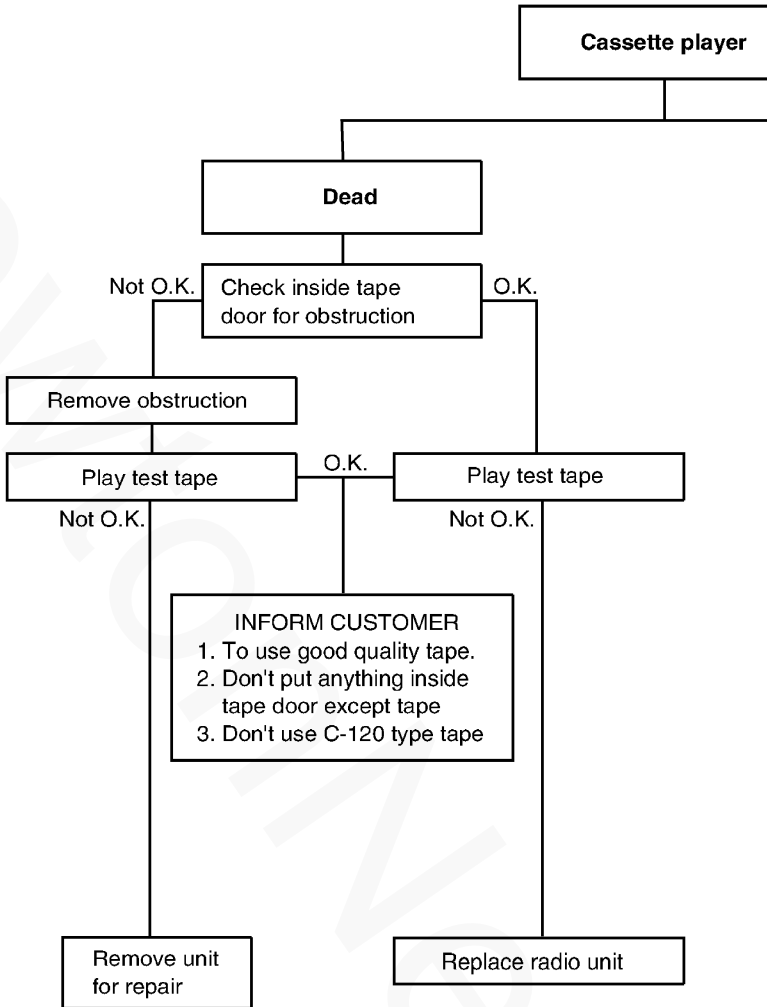


CHART 3

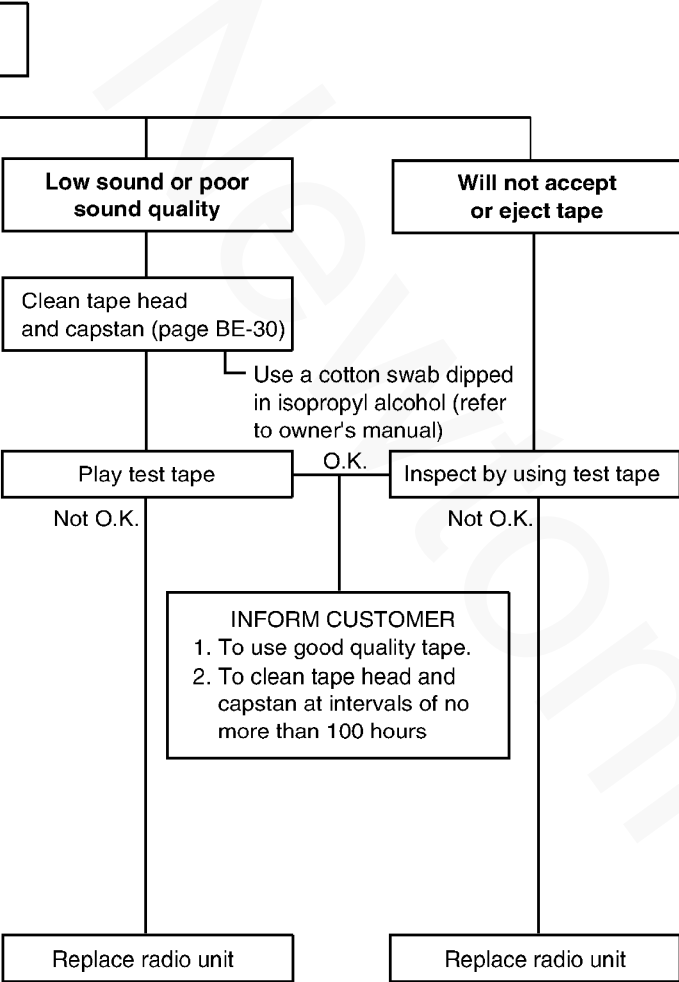
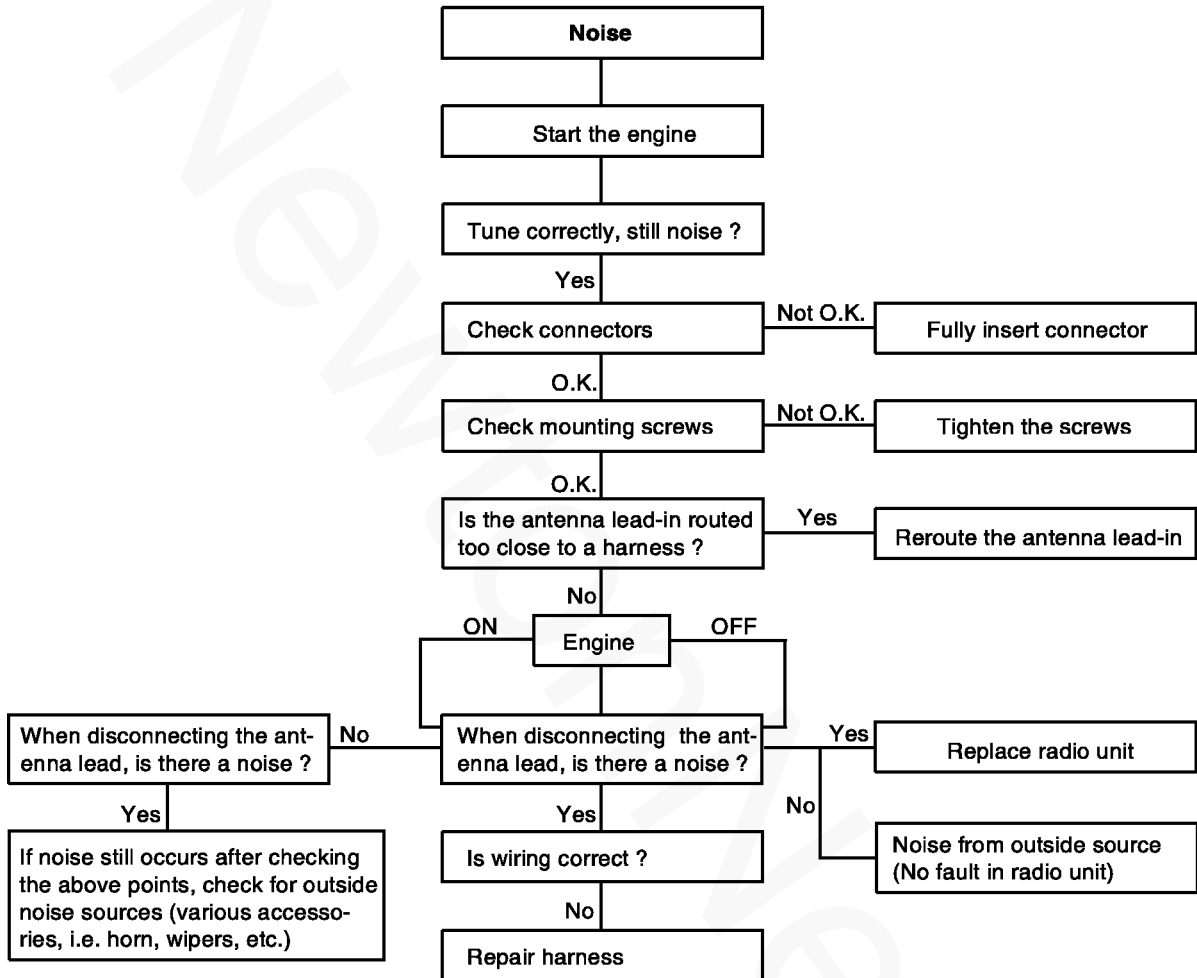
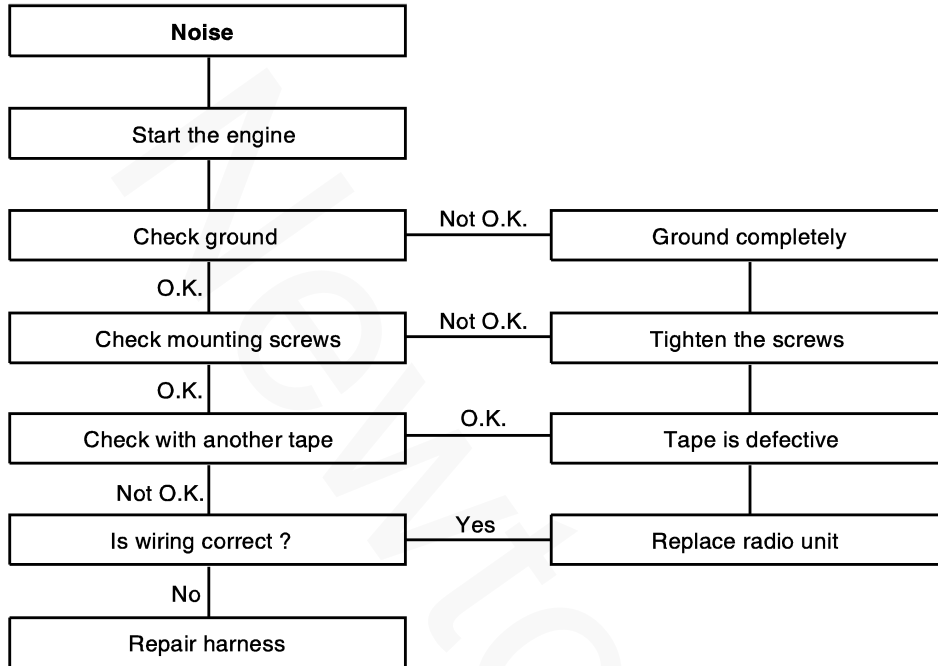


CHART 4

1. RADIO



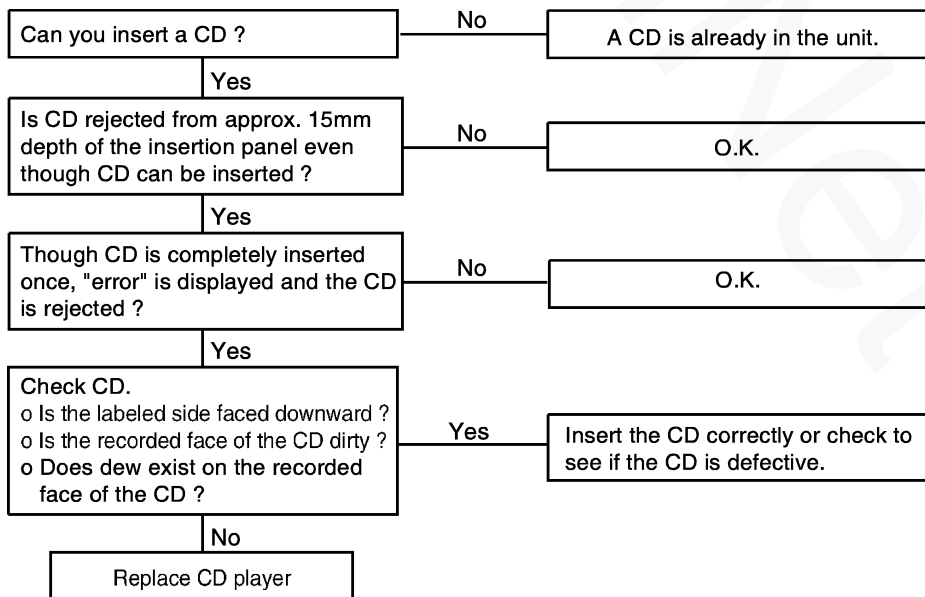
2. TAPE



ETA9010G

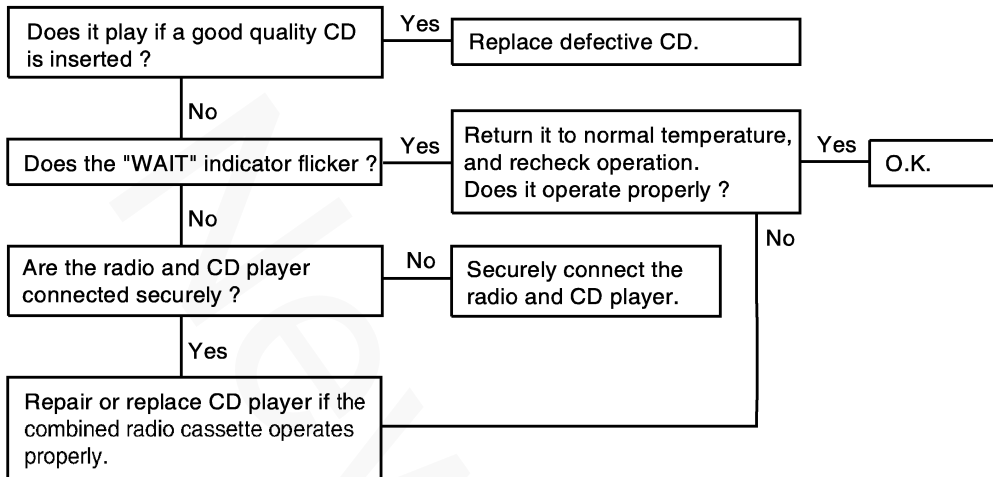
CHART 5

1. CD WILL NOT BE ACCEPTED



ETA9010H

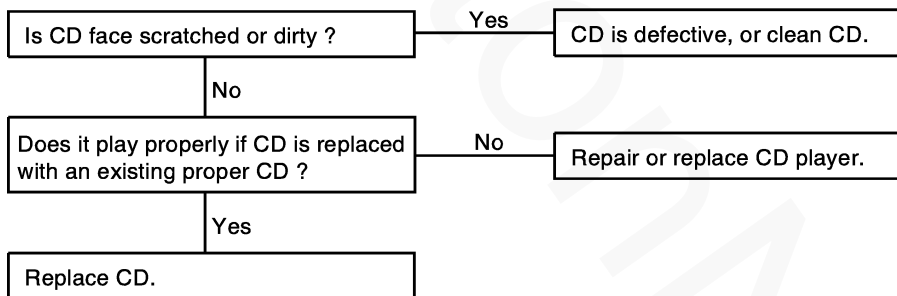
2. NO SOUND



ETA90100

3. CD SOUND SKIPS

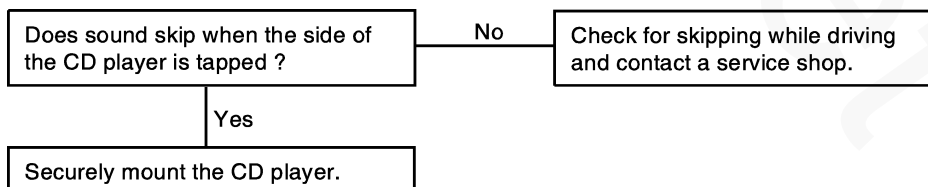
1. Sound sometimes skips when parking.



2. Sound sometimes skips when driving.

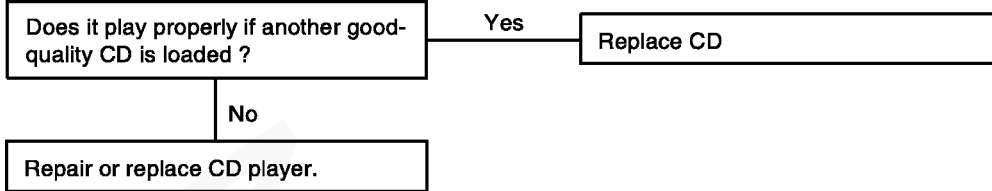
(Stop vehicle, and check it.)

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

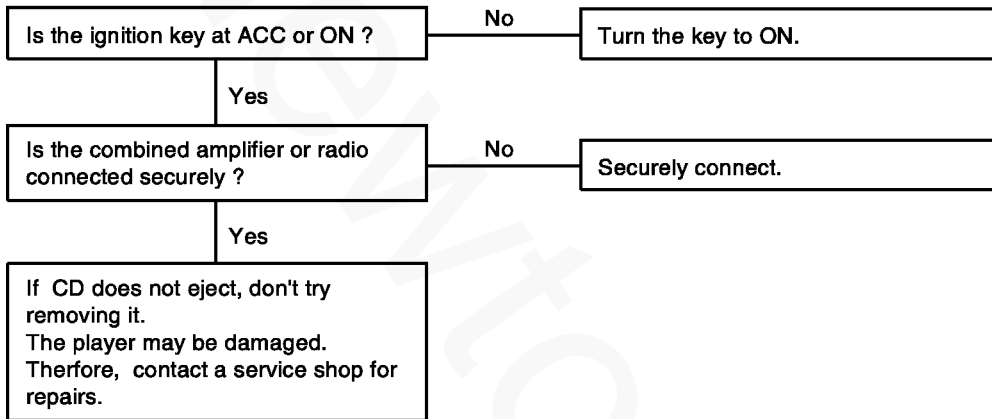


ETA90101

4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT



6. NO SOUND FROM ONE SPEAKER

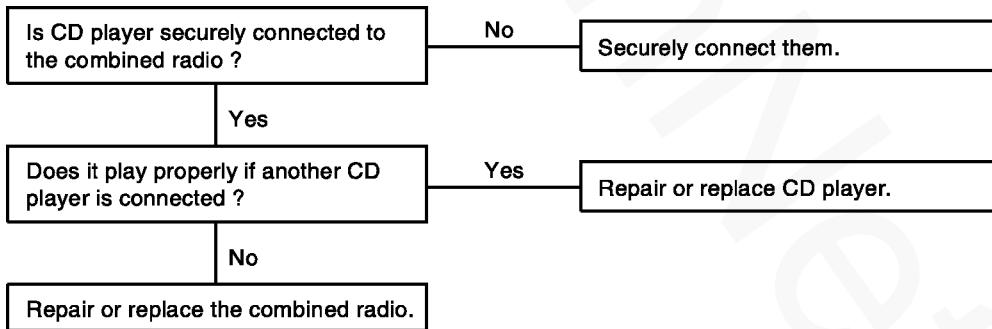
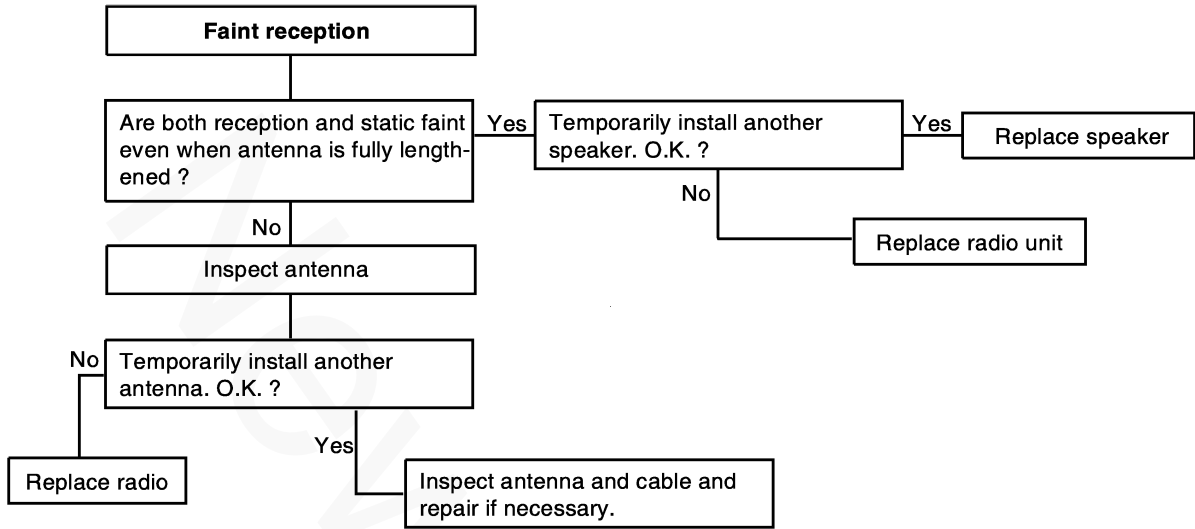
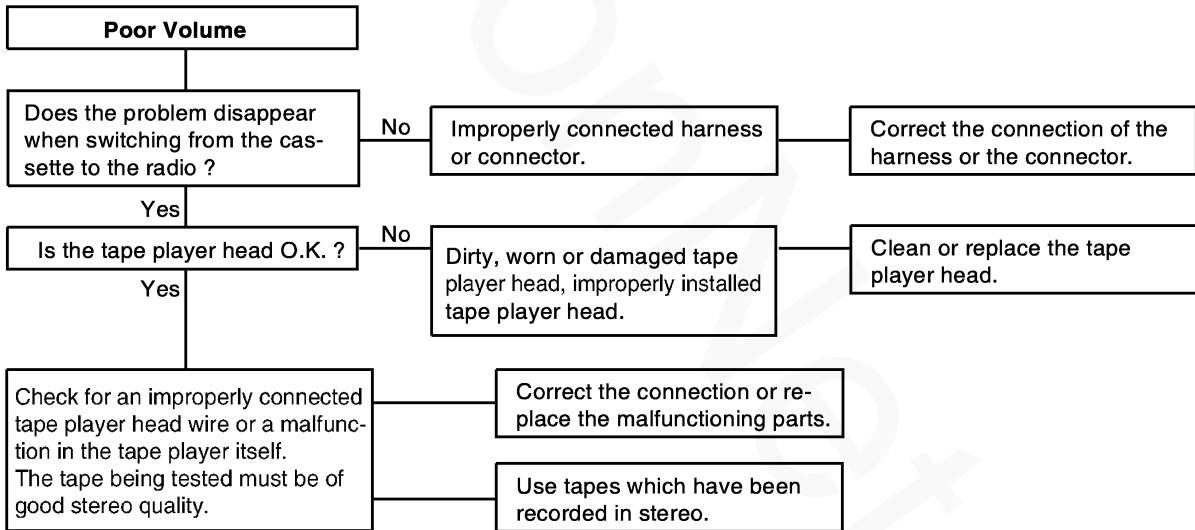


CHART 6



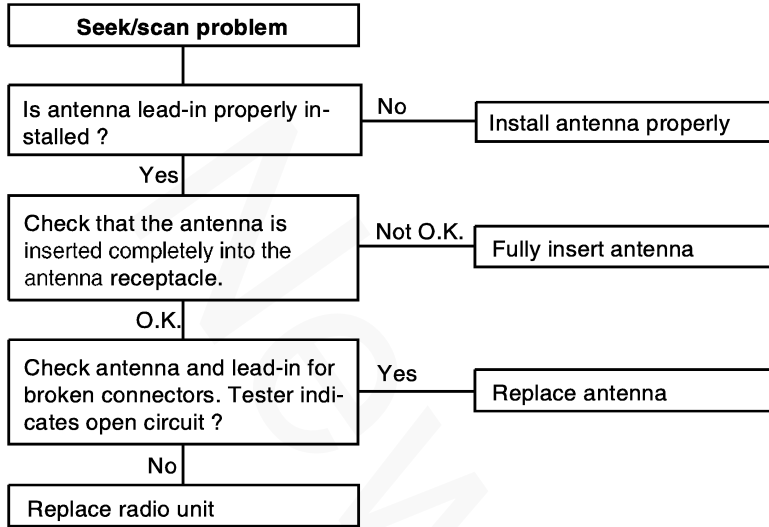
ETA9010K

CHART 7



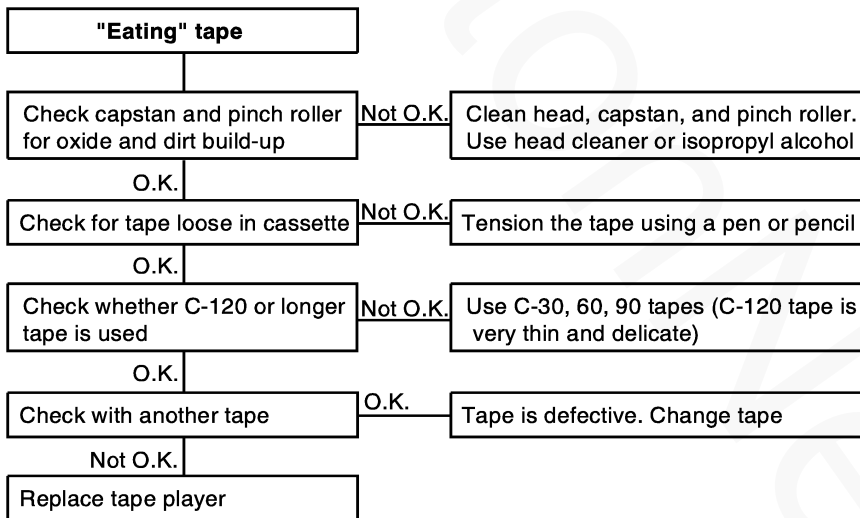
ETA9010L

CHART 8



ETA9010M

CHART 9

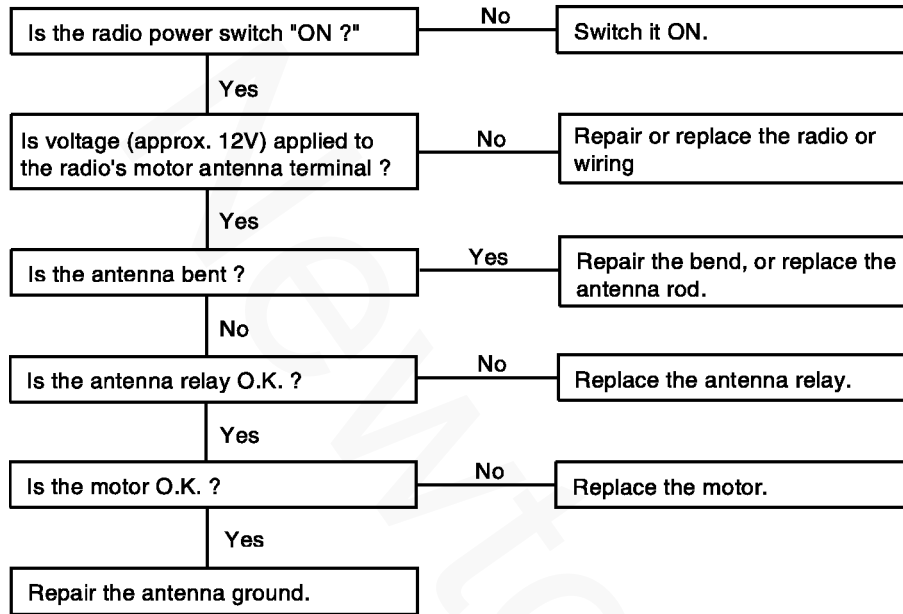


ETA9010N

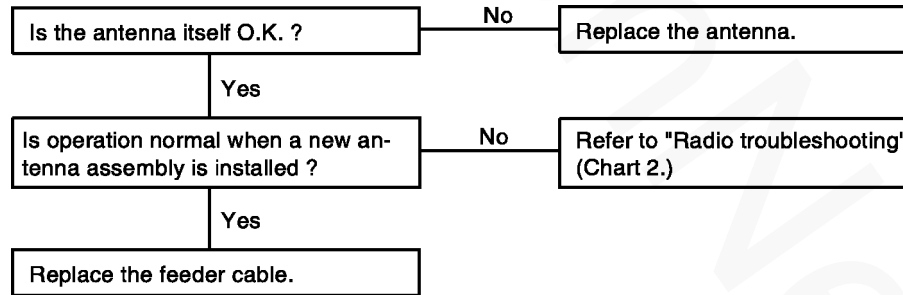
CHART 10

1. MOTOR ANTENNA WON'T EXTEND OR RETRACT

Clean and polish the surface of the antenna rod.



2. MOTOR ANTENNA EXTENDS AND RETRACTS BUT DOES NOT RECEIVE



ETAA010P

WINDSHIELD WIPER

Symptom	Possible cause	Remedy
Wipers do not operate or return to off position	No.27 Wiper fuse (15A) blown Wiper motor faulty Wiper switch faulty Wiring or ground faulty	Check for short and replace fuse Check motor Check switch Repair if necessary
Wipers do not operate in INT position	Body control module faulty Wiper switch faulty Wiper motor faulty Wiring or ground faulty	Check body control module Check switch Check motor Repair if necessary

POWER WINDOW

Symptom	Possible cause	Remedy
No windows operate from the main switch on the driver's door	No.19 fuse (30A) blown Poor ground Defective power window main switch Open circuit in wires or loose or disconnected connector	Check for short and replace fuse Clean and retighten the ground terminal mounting bolt Check the switch Replace if necessary Repair or replace
Driver's side window does not operate	Defective power window main switch Defective motor or circuit breaker Open circuit in wires or loose or disconnected connector	Check for driver's window switch Replace the motor Check the harness and the connector
Passenger's side window does not operate	Defective power window sub switch Defective motor or circuit breaker Wiring faulty or disconnected connector	Replace the switch Replace the motor Repair if necessary

POWER DOOR MIRROR

Symptom	Possible cause	Remedy
No mirrors operate	No.23 fuse (15A) blown Poor ground Defective mirror switch Open circuit in wires or loose or disconnected connector	Check the circuit and replace fuse Clean and retighten the ground terminal mounting bolt Check the switch Replace if necessary Repair or replace
One mirror does not operate	Defective mirror switch Defective mirror actuator Open circuit wires or loose or disconnected connector	Check the switch Replace if necessary Replace the actuator Repair or replace

BURGLAR ALARM SYSTEM

Symptom	Possible cause	Remedy
The system is not armed (The siren doesn't sound)	Transmitter faulty Body control module faulty Damaged or disconnected wiring of door switch input circuit	Replace the transmitter Check the body control module Repair the harness
The siren sounds in error when a door or tailgate is unlocked with the key while the system is armed	Damaged or disconnected wiring of a door key cylinder and tailgate key cylinder switch input circuit Body control module faulty	Repair the harness or replace a door key cylinder and the tailgate key cylinder switch Replace the body control module
Engine does not start in disarm state	Burglar alarm relay faulty Damage or disconnected wiring of burglar alarm relay activation circuit Malfunction of the body control module	Replace the burglar alarm relay Repair the harness Replace the body control module

Symptom	Possible cause	Remedy
There is no alarm when, as an alarm test, a door is opened without using the key (The arming and disarming are normal, and the alarm is activated when the tailgate or hood is opened)	Damaged or disconnected wiring of door switch (all doors) input circuit Malfunction of the door switch Malfunction of the body control module	Repair the harness or replace the door switch Check the door switch Replace the body control module
There is no alarm when, as an alarm test, the tailgate is opened without using the key (The alarm is activated, however, by opening a door or the hood)	Damaged or disconnected wiring of luggage compartment light switch input circuit Malfunction of the tailgate switch Malfunction of the body control module	Repair the harness or replace the luggage compartment light switch Check the tailgate switch Replace the body control module
There is no alarm when, as an alarm test the hood is opened from within the vehicle (The alarm is activated, however, by opening a door or tailgate)	Damaged or disconnected wiring of hood switch input circuit Malfunction of the hood switch Malfunction of the body control module	Repair the harness or replace the hood switch Check the hood switch Replace the body control module

KEYLESS ENTRY SYSTEM

Symptom	Possible cause	Check	Remedy
Operation range is unstable	Discharged transmitter battery	Check the transmitter, red lamp blinking upon pressing the transmitter switch	Replace the battery
	Transmitter or receiver faulty		Replace the transmitter or the receiver
Central locking device operates but keyless entry does not work	Discharged transmitter battery	Check the transmitter, red lamp blinking upon pressing the transmitter switch	Replace the battery
	Faulty signal code registration		Ensure normal door opening/closing by using the door key and register the code again
	Faulty keyless entry circuit	Check the BCM connector, and the harness between the BCM and the door lock actuator	Repair the connector or the harness
	Faulty receiver	Check the receiver output using the oscilloscope	Replace the receiver
	Faulty body control module		Replace the faulty control unit and module

 **NOTE**

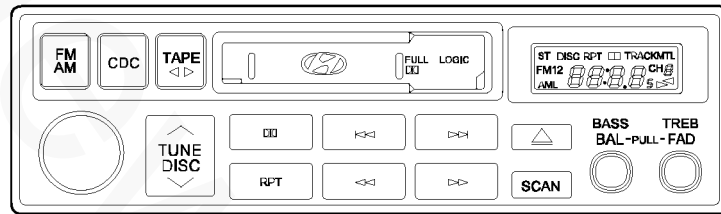
*If central lock and keyless entry do not operate simultaneously, systems other than the keyless entry may be considered faulty.
Then check related systems.*

AUDIO SYSTEM

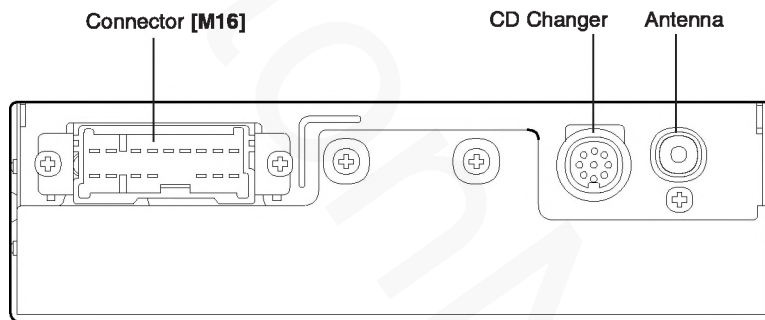
AUDIO UNIT

COMPONENTS EB42B3D1

< H250 >



KTOB001B

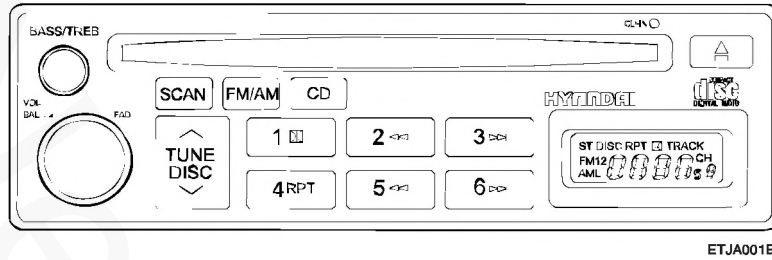


KTOB001A

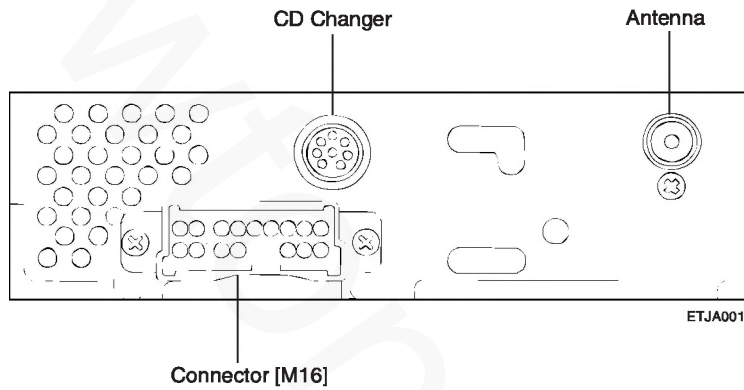
Connector[M16]	Terminal	Description
<p>[M16] ETJA001C</p>	1	Antenna
	2	Rear left speaker(-)
	3	Front left speaker(-)
	4	Front right speaker(-)
	5	Rear right speaker(-)
	6	Illumination(-)
	7	ACC(+)
	8	Ground
	9	Rear left speaker(+)
	10	Front left speaker(+)
	11	N.C.
	12	N.C.
	13	Front right speaker(+)
	14	Rear right speaker(+)
	15	Illumination(+)
	16	Battery(+)

Connector	Terminal	Description
<p>(CD Changer) ETJA001G</p>	1	R
	2	CD ON
	3	BUS
	4	B+
	5	M. Ground
	6	N.C.
	7	L
	8	A.Ground

<H260>



ETJA001E

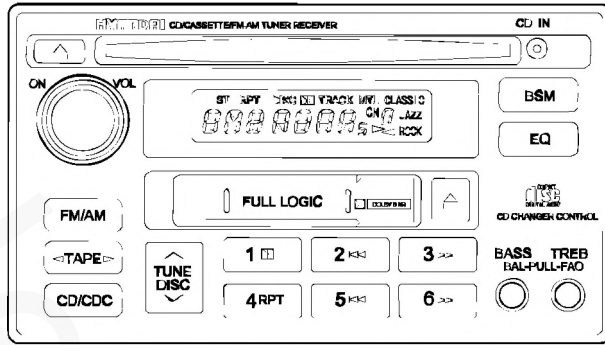


ETJA001D

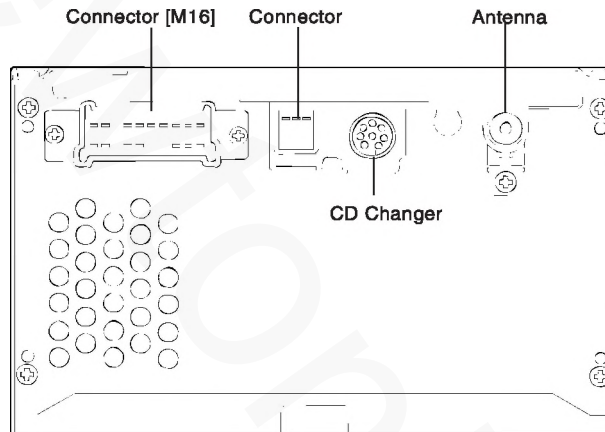
Connector[M16]	Terminal	Description
<p>[M16] ETJA001C</p>	1	Antenna
	2	Rear left speaker(-)
	3	Front left speaker(-)
	4	Front right speaker(-)
	5	Rear right speaker(-)
	6	Illumination(-)
	7	ACC(+)
	8	Ground
	9	Rear left speaker(+)
	10	Front left speaker(+)
	11	N.C.
	12	N.C.
	13	Front right speaker(+)
	14	Rear right speaker(+)
	15	Illumination(+)
	16	Battery(+)

Connector	Terminal	Description
<p>(CD Changer) ETJA001G</p>	1	R
	2	CD ON
	3	BUS
	4	B+
	5	M. Ground
	6	N.C.
	7	L
	8	A.Ground

<H280>



ETJA001



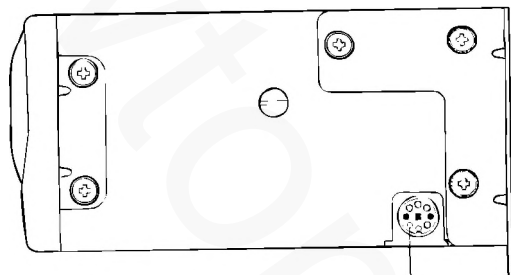
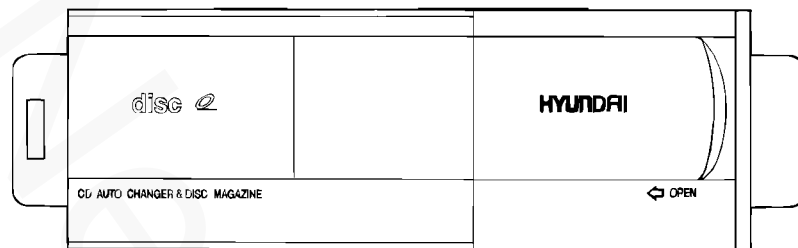
ETJA001H

Connector[M16]	Terminal	Description
<p>[M16]</p> <p>ETJA001C</p>	1	Antenna
	2	Rear left amp(-)
	3	Front left amp(-)
	4	Front right amp(-)
	5	Rear right amp(-)
	6	Illumination(-)
	7	ACC(+)
	8	Ground
	9	Rear left amp(+)
	10	Front left amp(+)
	11	N.C.
	12	Amp remote
	13	Front right amp(+)
	14	Rear right amp(+)
	15	Illumination(+)
	16	Battery(+)

Connector	Terminal	Description
<p>ETJA001K</p>	1	Ground
	2	Signal
	3	Ground

Connector	Terminal	Description
<p>(CD Changer)</p> <p>ETJA001G</p>	1	R
	2	CD ON
	3	BUS
	4	B+
	5	M. Ground
	6	N.C.
	7	L
	8	A.Ground

[AUTO CD CHANGER]

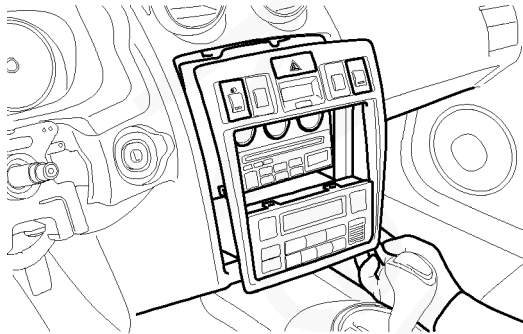


8 pin connector

8P connector	Terminal	Description
	1	R-CH
	2	CD-ON
	3	BUS
	4	B+
	5	D.Ground
	6	N.C.
	7	L-CH
	8	A.Ground

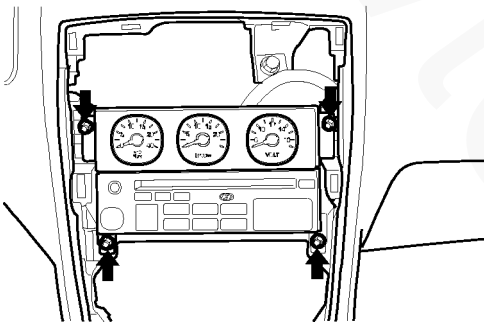
REMOVAL E37F3FCD

1. Disconnect the negative(-) battery terminal.
2. Remove the center facia panel and disconnect the wire connectors.



KTOB004A

3. Remove the 4 screws holding the audio and multi-gauge unit then remove the audio assembly.

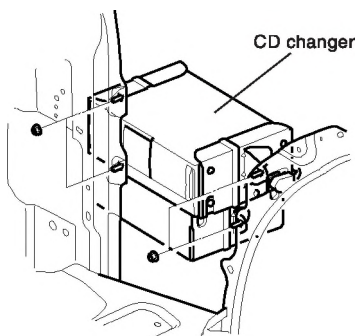


KSOB150C

4. Installation is the reverse of removal.

AUTO CD CHANGER

1. Remove the right side quarter trim.
2. Remove the auto CD changer from the right side quarter panel.

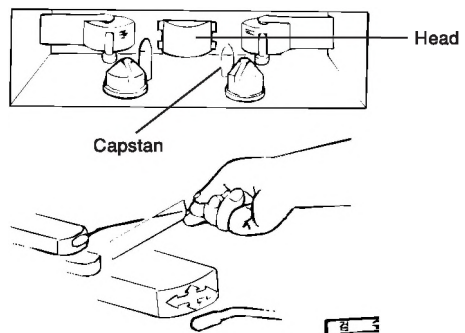


KTOB004D

INSPECTION E548CEC2

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.



ETA9035A

AUDIO FAULT CODE EBBB2DC8

If you see any error indication in the display while using the CD or Tape mode, find the cause in the chart below.

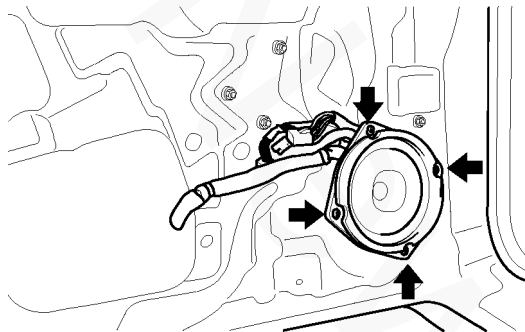
INDICATION	CAUSE	SOLUTION
Er2	CDP deck mechanical error (eject error, loading error)	After resetting the audio, push the eject button. If disc is not ejected, consult your hyundai dealer.
Er3	Focus error Data read error	Make sure the disc is not scratched or damaged. Press the eject button and pull out the disc. Then insert a normal CD disc.
Er6	Disc error	Check if the disc is inserted correctly in the CD player. Make sure the disc is not scratched or damaged.
Er8	Tape deck error Tape eject error	After resetting the audio, push the eject button. If tape is not ejected, consult your hyundai dealer.
HHH	Temperature is too high	Fault code will reset automatically when the temperature returns to normal.
no CD	No disc in magazine No CD magazine in the auto change	Insert disc in magazine or insert CD magazine in the auto changer.

 **NOTE**

In order to reset the audio, pull out the audio fuse (10A) in the body control module after waiting at least 10 seconds, then insert the audio fuse.

SPEAKERS**REMOVAL** EECDD2D7**FRONT SPEAKER**

1. Remove the front door trim panel and remove the front speaker.

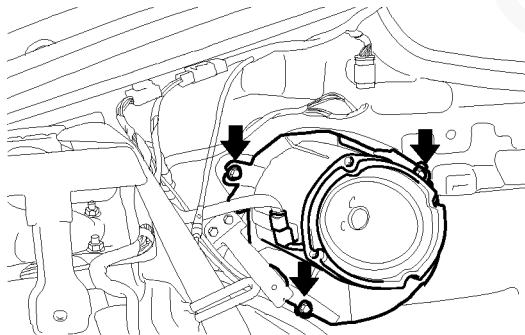


KTOB004B

2. Installation is the reverse of removal.

REAR SPEAKER

1. Remove the quarter trim and remove the rear speaker.

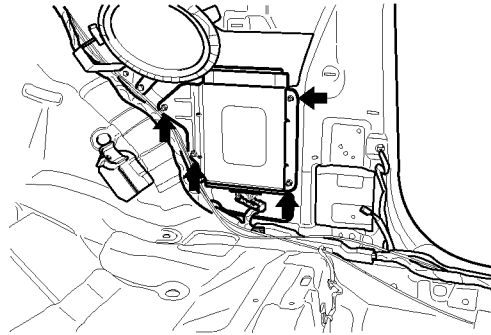


KTOB004C

2. Installation is the reverse of removal.

AMP

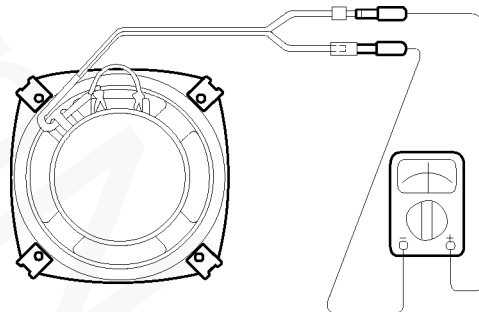
1. Remove the quarter trim.
2. Remove the amp from the left side quarter panel.



KTOB112A

INSPECTION EBD6A052

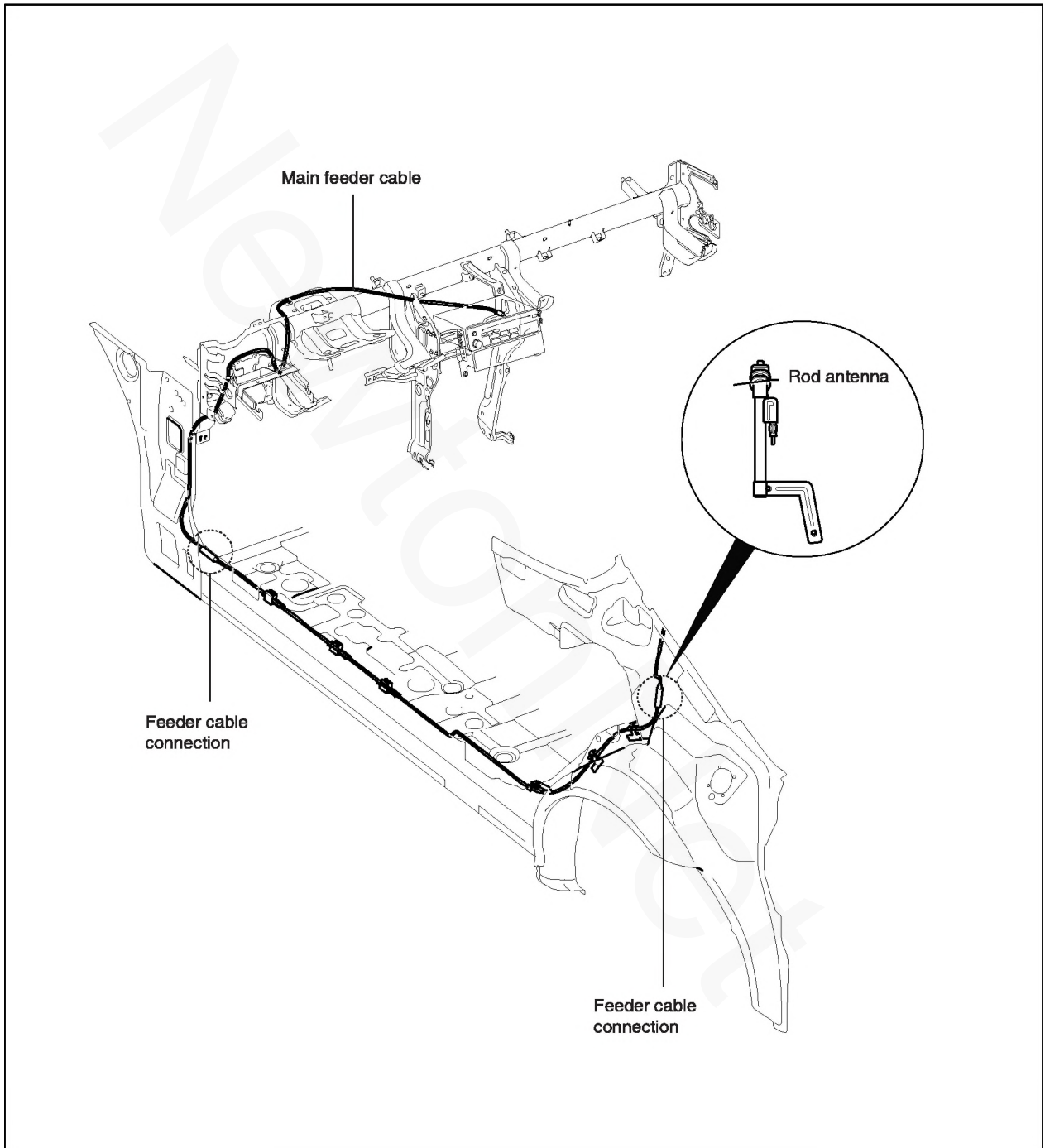
1. Check the speaker with an ohmmeter. If an ohmmeter indicates the correct impedance of the speaker when checking between the speaker (+) and speaker (-) of the same channel, the speaker is ok.



KTMB060A

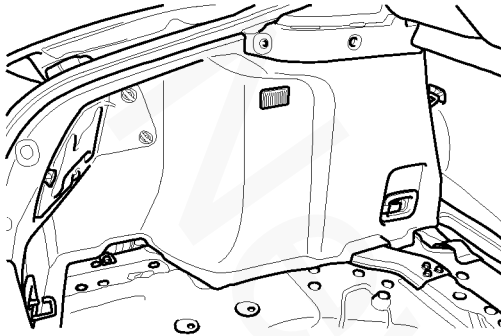
ANTENNA

COMPONENTS EED4E76B



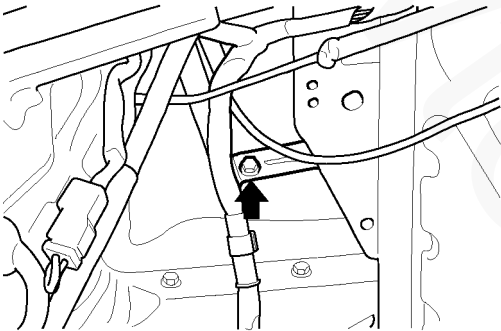
REMOVAL E190F5E6

1. Disconnect the negative (-) battery terminal.
2. Remove the left side rear luggage trim.



ETOC711C

3. Remove the antenna mounting nut and disconnect the antenna feeder cable.



ETOC711B

4. Installation is the reverse of removal.

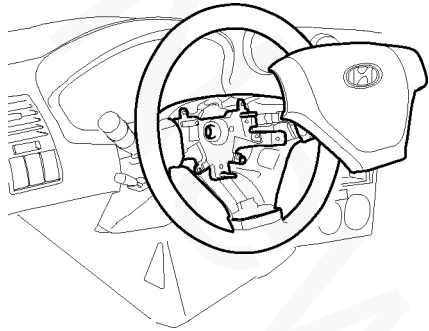
AUDIO REMOTE CONTROL

INSPECTION E9C8C6EF

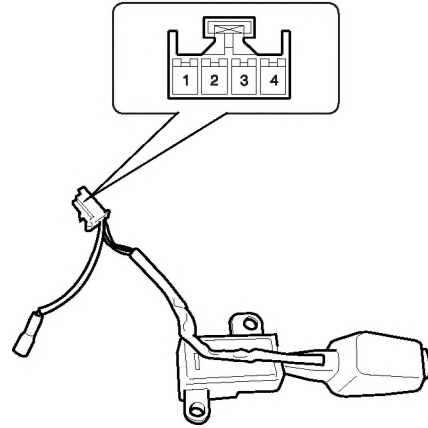
REPLACEMENT EC9CE3AE

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

1. Remove the driver airbag module. (Refer to the airbag group)

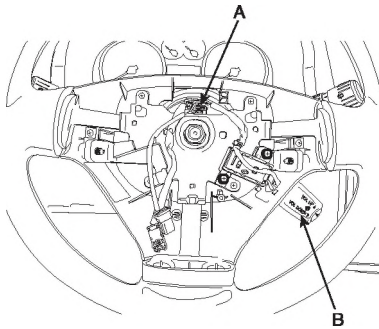


KROB210B



KTOF451D

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

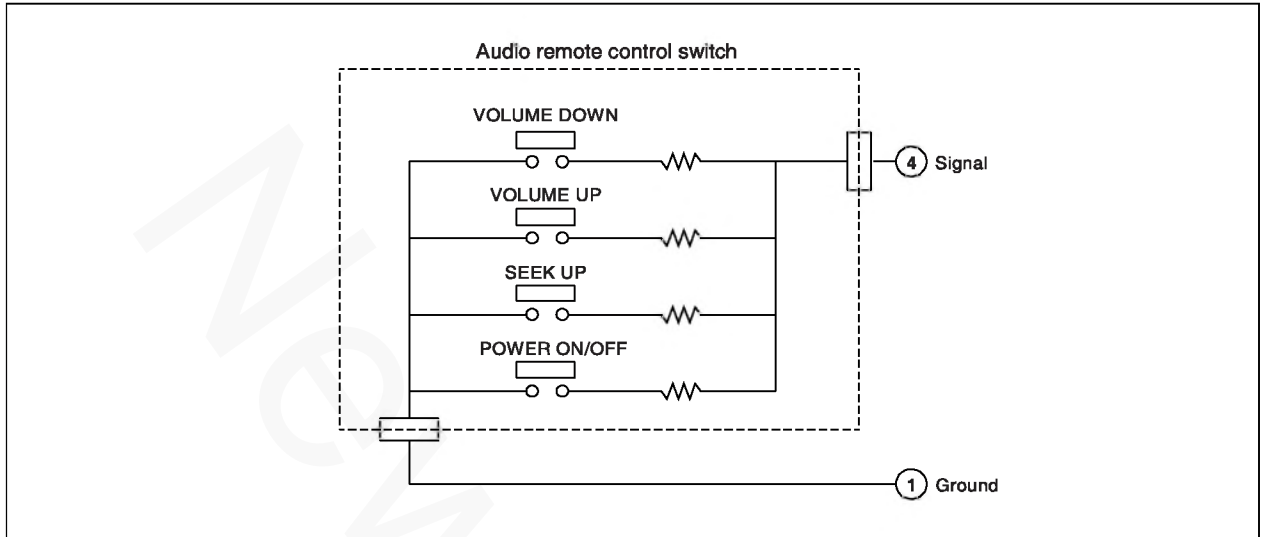


KTOF452A

Switch	Connector terminal	Resistance (±5%)
VOLUME DOWN	1 - 4	6.81 kΩ
VOLUME UP	1 - 4	4.61 kΩ
SEEK UP	1 - 4	430 Ω
POWER ON/OFF	1 - 4	100 Ω

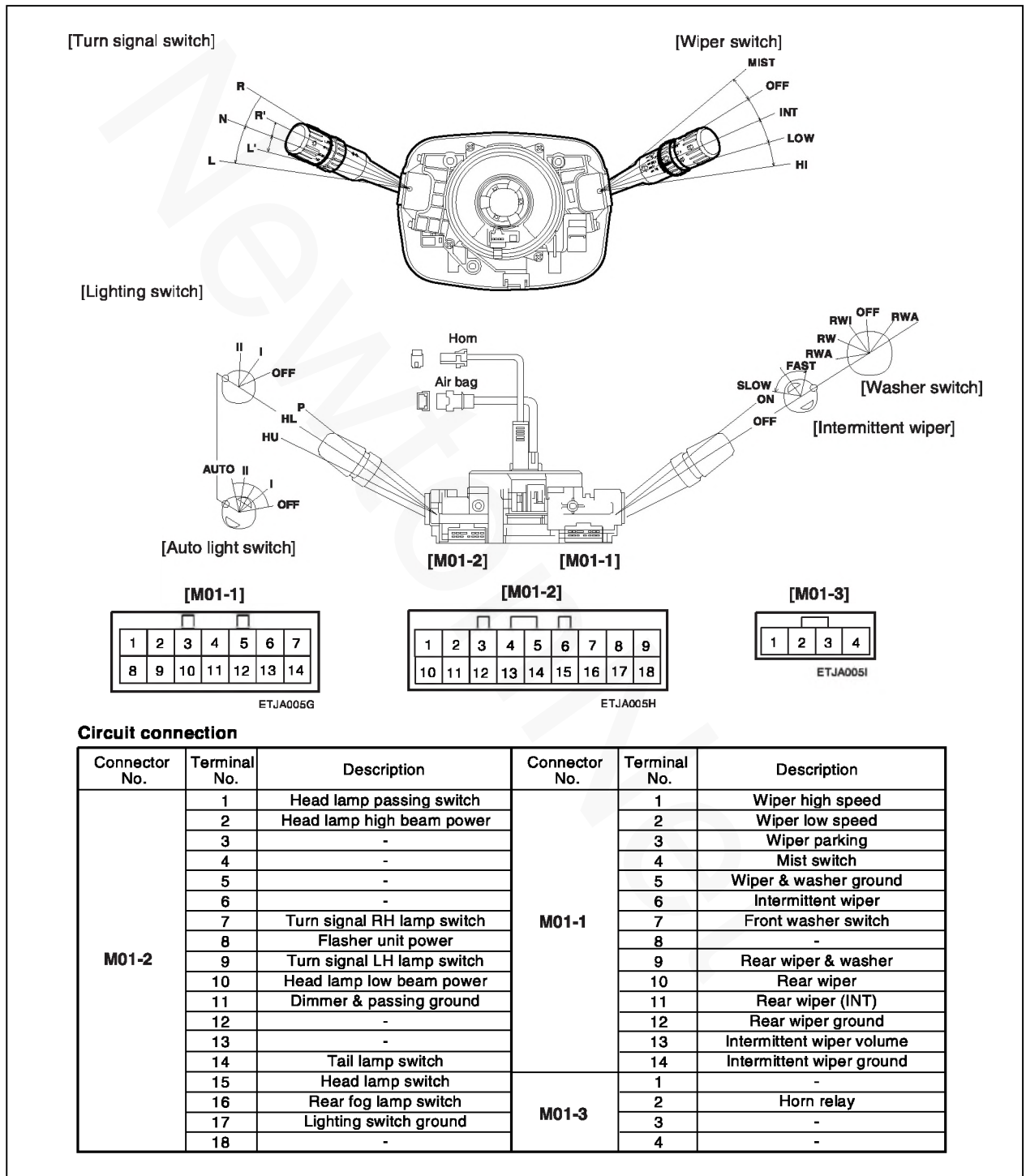
3. Installation is the reverse of removal.

CIRCUIT DIAGRAM EDA8D10A



MULTI FUNCTION SWITCH

COMPONENTS EDCB4EF0



MULTI FUNCTION SWITCH

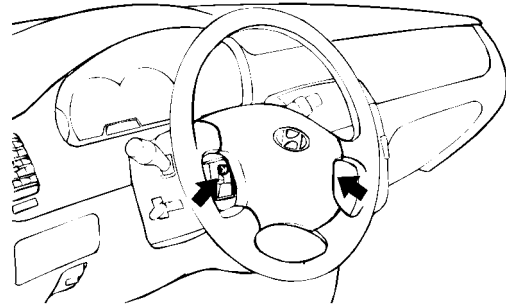
REMOVAL ED242375

Prior to removing of the multi function switch assembly in vehicles equipped with air bags, be careful to follow the following:

⊗ WARNING

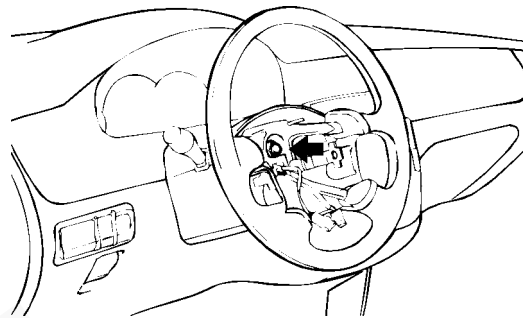
- Never attempt to disassemble or repair the air bag module or clock spring. If faulty, replace it.
- Do not drop the air bag module or clock spring or allow contact with water, grease or oil. Replace if a dent, crack, deformation or rust is detected.
- The air bag module should be stored on a flat surface and placed so that the pad surface is facing upward. Do not place anything on top of it.
- Do not expose the air bag module to temperatures over 93°C(200°F).
- After deployment of an air bag, replace the clock spring with a new one.
- Wear gloves and safety glasses when handling an air bag that has been deployed.
- An undeployed air bag module should only be disposed of in accordance with the procedures mentioned in the restraints section.
- When you disconnect the air bag module-clock spring connector, take care not to apply excessive force.
- The removed air bag module should be stored in a clean, dry place.
- Prior to installing the clock spring, align the mating mark and "NEUTRAL" position indicator of the clock spring, and after turning the front wheels to the straight-ahead position, install the clock spring to the column switch. If the mating mark of the clock spring is not properly aligned, the steering wheel may not completely rotate during a turn, or the flat cable within the clock spring may be broken obstructing normal operation of the SRS and possibly leading to serious injury to the vehicle's driver. To inspect the clock spring, refer to the restraints section.

1. Remove the air bag module.



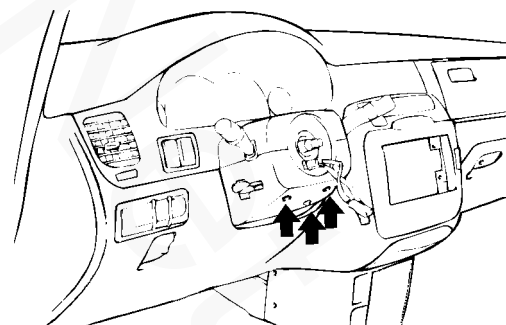
ESHA040M

2. Remove the steering wheel.



ESHA040N

3. Remove the steering column upper shroud and steering column lower shroud.

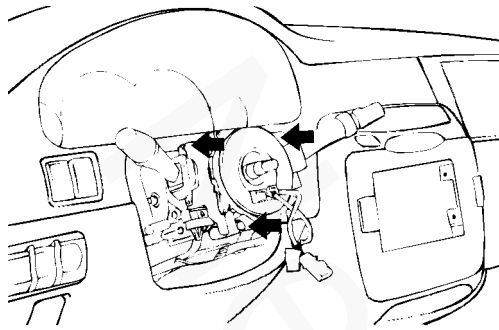


ESHA040O

MULTI FUNCTION SWITCH

BE -39

- Remove the 3 screws holding the multi function switch and disconnect the connectors. Remove the multi function switch assembly.



ESHA040P

- Installation is the reverse of removal.

INSPECTION EACCE0EF

Check the continuity between the terminals while operating the switch.

LIGHTING SWITCH [M01-2]

Terminal Position	14	15	16	17
OFF				
I	○	—	○	○
II	○	○	○	○
AUTO			○	○

ETOC080A

DIMMER AND PASSING SWITCH [M01-2]

Terminal Position	1	2	10	11
HU		○	—	○
HL			○	○
P	○	○	—	○

HU : Head lamp high beam

HL : Head lamp low beam

P : Head lamp passing switch

KTDA040B

TURN SIGNAL AND LANE CHANGE SWITCH [M01-2]

Terminal		7	8	9
		Turn signal switch		
Hazard switch	OFF		○	○
	L			
	R	○	○	

KTDA040C

WIPER AND INTERMITTENT VOLUME SWITCH [M01-1]

Terminal Position	1	2	3	4	5	6	13	14
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○	—	○				
HI	○	—	○					

ETNC050B

WASHER SWITCH [M01-1]

Terminal Position	5	7
OFF		
ON	○	○

ETNC050C

REAR WIPER AND WASHER SWITCH [M01-1]

Terminal Position	9	10	11	12
WASHER	○	—	○	○
OFF				
INT			○	○
ON		○	—	○
WASHER	○	—	○	○

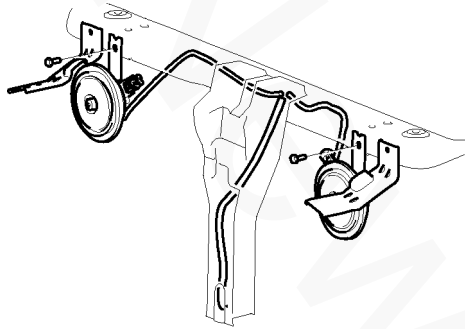
ETNC050D

HORNS

HORN

REMOVAL ECA6BD9E

1. Remove the bolt holding the horn and remove the horn assembly.



KTOB080A

2. Installation is the reverse of removal.

INSPECTION E7C9DB0D

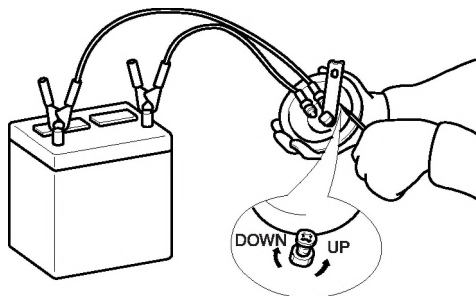
1. Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.
2. The horn should make a sound. If the horn fails to make a sound, replace it.

ADJUSTMENT

Operate the horn, and adjust the tone to a suitable level by turning the adjusting screw.

NOTE

After adjustment, apply a small amount of paint around the screw head to keep it from loosening.

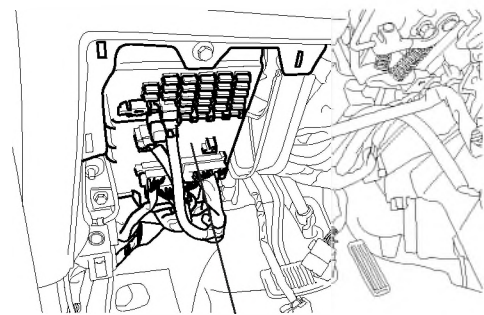


ETDA050A

ETACS (ELECTRONIC TIME AND ALARM CONTROL SYSTEM)

DESCRIPTION E25AAAAA

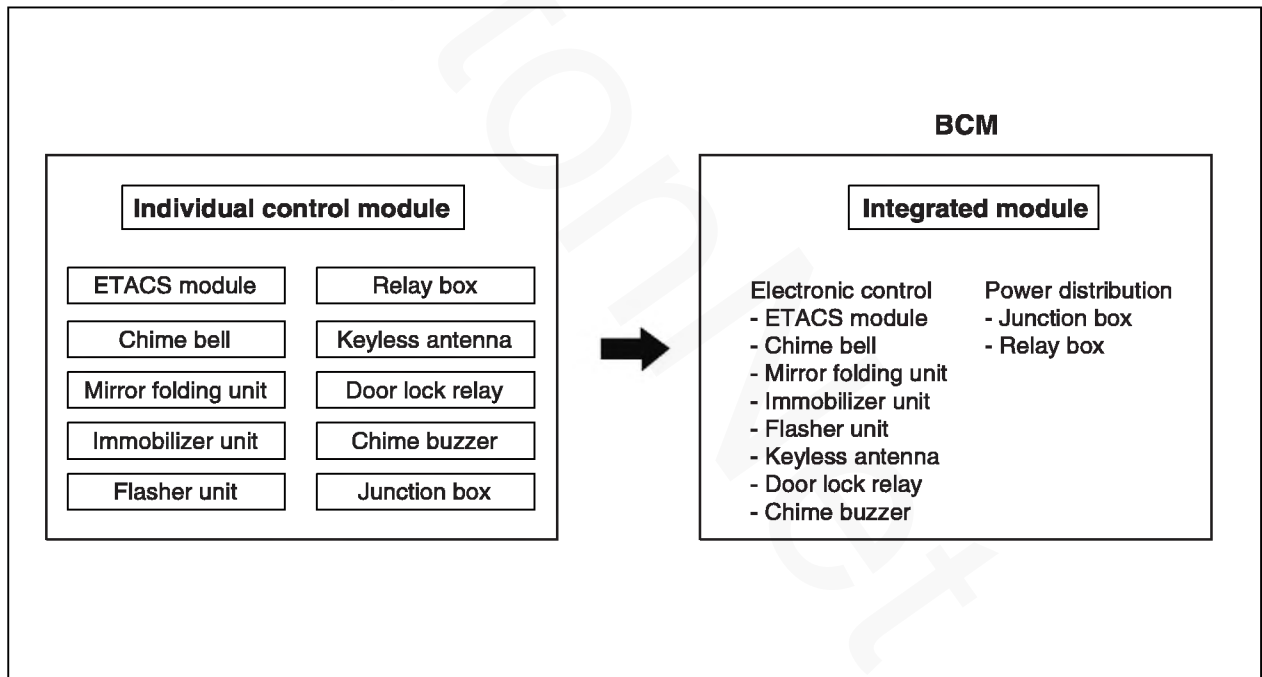
Body Control Module (BCM) unify the functions of ETACS module, mirror folding unit, immobilizer unit, flasher unit, door lock relay, chime bell and keyless antenna. BCM practices diagnosis with hi-scan to find out input or output error.



Body Control Module (BCM)

ETOC070A

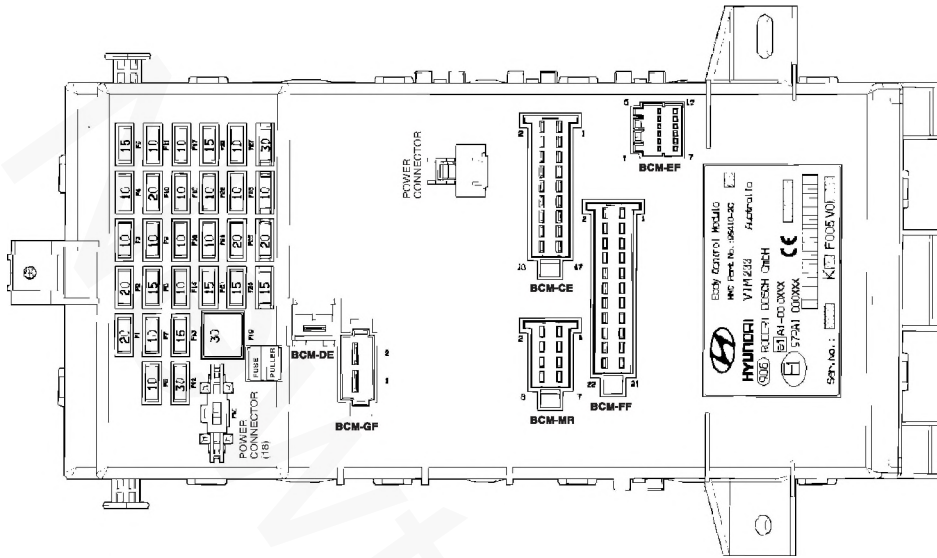
BCM BLOCK DIAGRAM



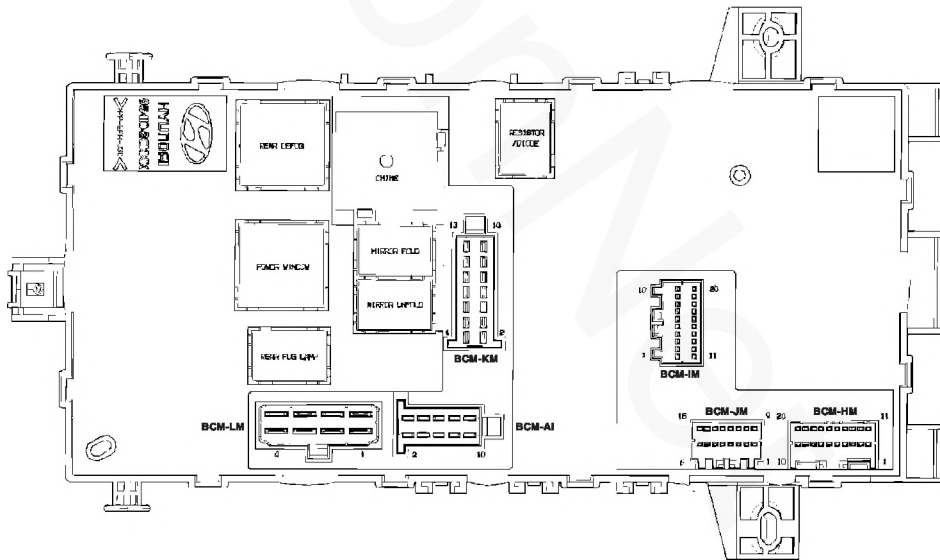
ETOC075A

BODY CONTROL MODULE (BCM) E2E70D7B

[FRONT]



[REAR]



BCM CONNECTOR TERMINAL

Connector	Pin	Description
BCM-AI	1	-
	2	-
	3	-
	4	ESPS (IG1)
	5	RH seat belt buckle
	6	LH seat belt buckle
	7	Crash signal
	8	-
	9	Airbag diagnosis (From ESPS)
	10	Airbag warning lamp
BCM-CE	1	Head lamp low relay (S2)
	2	DRL unit NO 12
	3	Front wiper relay control
	4	Front fog relay (S1)
	5	Turn signal lamp (FR)
	6	Tail auto cut to DRL
	7	DRL unit (11)
	8	Front wiper relay (IG2)
	9	Turn signal lamp (FL)
	10	Position lamp (RH)
	11	Position lamp (LH)
	12	ABS module (IG1)
	13	ALT 'L'
	14	Fuse & relay box (IG2)
	15	Wiper park output
	16	Washer motor
	17	-
	18	-
BCM-DE	1	B+50A

Connector	Pin	Description
BCM-EF	1	Assist door key switch
	2	Tail gate lock switch
	3	Assist door lock switch
	4	Assist door switch
	5	Folding switch
	6	Tail gate open switch
	7	Driver door key unlock switch
	8	Driver door lock switch
	9	Driver door switch
	10	Seat belt switch
	11	-
	12	-
BCM-FF	1	Rear fog lamp relay
	2	Back up lamp
	3	-
	4	Outside mirror
	5	Tail lamp (RH)
	6	Door lock feed
	7	-
	8	Door unlock feed
	9	-
	10	Tail lamp (LH)
	11	4 Door switch
	12	Mirror unfolding/Ass door unlock feed
	13	Turn signal (RL)
	14	-
	15	Luggage lamp
	16	-
	17	Turn signal (RR)
	18	AMP
	19	Outside mirror heater
	20	Mirror folding
	21	Rear wiper motor (IG2)
	22	Tail gate open switch
BCM-GF	1	Rear window defogger
	2	Power window switch

Connector	Pin	Description
BCM-HM	1	Immobilizer antenna 1
	2	2 Stage unlock GND
	3	Turn signal switch (RH)
	4	Door warning switch
	5	Tail lamp switch
	6	Rear fog lamp switch
	7	Code saver
	8	-
	9	Hood switch
	10	-
	11	Immobilizer antenna 2
	12	Export ground
	13	Turn signal lamp switch
	14	Auto light switch input
	15	-
	16	Head lamp switch
	17	Front fog lamp switch
	18	Hazard lamp switch
	19	Rear defogger switch
	20	Rear fog lamp indicator

Connector	Pin	Description
BCM-IM	1	Air conditioner switch
	2	Cluster battery charge
	3	-
	4	ESP switch (IG1)
	5	Cluster (IG1)
	6	Cluster (IG2)
	7	Cluster (Turn sig LH out)
	8	ECU (IG1)
	9	Cluster (Turn sig RH out)
	10	RR HTD switch
	11	Cluster (Airbag indicator)
	12	Diagnostic tool (B+)
	13	Digital clock (ACC)
	14	Immobilizer indicator
	15	External tail lamp (RH)
	16	Diagnostic tool (A/bag)
	17	Air conditioner (IG2)
	18	Auto light ground
	19	Diagnosis & code saving
	20	Immobilizer
BCM-JM	1	Multifunction switch- Intermittent wiper ground
	2	Siren control
	3	Key hole illumination
	4	Speed sensor
	5	Interior illumination
	6	Cluster (A/BAG warning indicator)
	7	DCT
	8	Door open indicator
	9	Multifunction INT
	10	Multifunction INT (T)
	11	Auto light signal
	12	Seat belt indicator
	13	Over speed ground
	14	-
	15	Auto light supply
	16	Tail gate open indicator

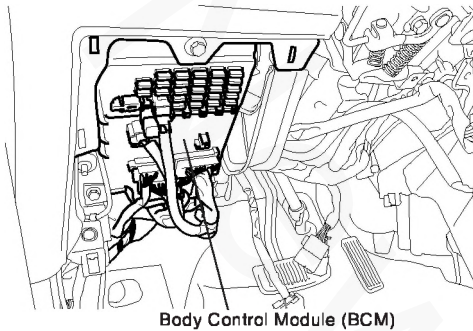
Connector	Pin	Description
BCM-KM	1	Cigar lighter
	2	Wiper low
	3	Wiper high
	4	Back up switch
	5	ACC
	6	Washer switch
	7	Back up lamp switch
	8	Start inhibit relay
	9	Seat heater switch (IG2)
	10	Joint main 3 (B+)
	11	Stop switch (B+)
	12	Ignition coil
	13	-
	14	Wiper parking
BCM-LM	1	Ground 1
	2	-
	3	Blower motor
	4	Ignition switch (IG1)
	5	Ground 2
	6	Wiper switch power
	7	Ignition switch (ACC)
	8	Ignition switch (IG2)
BCM-MR	1	Sunroof (IG2)
	2	Roof lamp (B+)
	3	Roof lamp decay control
	4	ECM
	5	-
	6	Sunroof & room lamp GND
	7	ECM mirror
	8	Sunroof (B+)

FUSE

NO.	CAPACITY	DESCRIPTION
1	20A	Ignition coil (2.7L), Electronic chrome mirror
2	20A	AMP
3	10A	Back-up lamp switch, Transaxle range switch, Stop lamp switch
4	10A	Instrument cluster (Airbag indicator)
5	15A	Airbag control module , Seat belt buckle switch
6	10A	Mirror defogger
7	10A	Hazard lamp relay
8	15A	Rear wiper motor, Rear intermittent wiper relay
9	10A	Right tail lamps, Glove box lamp
10	20A	Front wiper motor, Front wiper relay
11	10A	Blower relay, Blower motor
12	30A	Defogger relay
13	15A	Stop lamp switch, Folding /unfolding relay, Burglar alarm horn relay
14	10A	Left tail lamps
15	10A	A/C control module, Blower relay
16	10A	ECM, Multi gauge unit, TCM, Vehicle speed sensor
17	10A	Instrument cluster(Power), Alternator resistor, DRL Control module, Pre-excitation resistor
18	10A	Room lamp, Clock, Audio, Data link connector, Multi gauge unit
19	30A	Power window relay
20	15A	Trunk lid switch
21	10A	AQS sensor, Head lamp relay, DRL Control module
22	-	-
23	15A	Cigar lighter, Outside mirror switch
24	15A	Sunroof , Power door lock/unlock relay
25	20A	Seat heater
26	10A	ESP/ABS control module
27	10A	Audio, Clock

REMOVAL EBFCADB4

1. Disconnect the negative (-) battery terminal
2. Remove the lower crash pad panel.
3. Remove the BCM after removing the bolt and disconnect the wire connectors.



Body Control Module (BCM)

ETOC070A

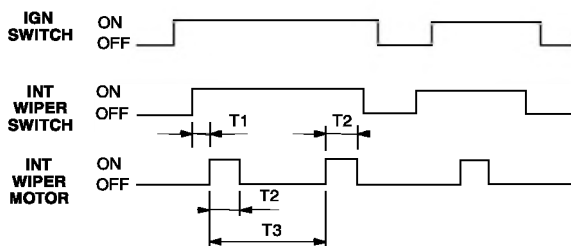
4. Installation is the reverse of removal.

INSPECTION E51E32B3

While operating the components, check whether the operations are normal with timing chart.

BCM FUNCTION

1. **Vehicle speed sensing intermittent wiper**
 Vehicle speed is determined by number of speed sensor pulses input in one second. The current speed and the previous speed for the vehicle is to be compared. The higher of the two values is to be used in the intermittent time calculation. The previous value is updated every second.
 When Ignition 2 is on and the wiper switch is in the intermittent position, the wiper shall operate with speed dependant intermittent time. A single wipe is achieved by driving the wiper relay until the park switch is able to take over unless the dwell time between wipes is too short. In this case it would be on all the time. This avoids unnecessary clicking of the wiper relay.



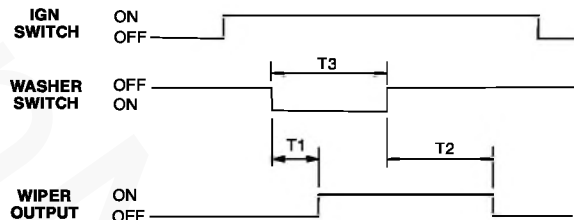
ETHA115C

Time specification

- T1 : Max. 0.5 sec.
- T2 : 0.6~0.7 sec. (Time of wiper motor 1 rotation)
- T3 : At vehicle speed = 0km/h.
 2.6±0.7 sec. (VR=0kΩ)~18.0±1sec (VR=50KΩ)
 At vehicle speed = 100km/h or more.
 1.0±0.2sec (VR=0kΩ)~10.0±1sec (VR=50KΩ)

2. **Washer linkage wiper**

IG2 must be on for this function to operate. When the washer switch is on for more than 0.3 sec, the wiper output is activated immediately. The length of time the washer switch is held for is then evaluated to determine the number of swipes required. If the washer switch is on for more than 0.2 but less than 0.6 sec, then wiper performs a single swipe. Alternatively, if the washer switch is held for more than 0.6s then the wipers must finish the current swipe then perform another two swipes. If washer switch is on less than 0.2 seconds make no wiper action. During intermittent wiping, a washer linkage wipe has higher priority. During start condition (IG1 on and IG2 off) washer input to be ignored. This is to prevent quality problem of single wipe occurring during starting of car.



ETHA115D

- a. Time specification
 T1 : 0.3 sec.
 T2 : 0.6~0.8 sec.
 (Time to complete current swipe only)
 T3 : 0.2 - 0.6 sec.
- b. Time specification
 T1 : 0.3 sec.
 T2 : 2.5~3.8 sec.
 (Time to complete current swipe plus 2 swipes)
 T3 : 0.6 sec. or more

3. Snow build up wiper bounce prevention (snow mode)

Without this feature, as snow builds up at the base of the windscreen, it becomes more difficult for the wiper arms to completely reach the park position. Once the wipers have been turned off and the wipers have returned to the park position, the compacted snow is able to drive the wiper arms back up and reactivate the park switch. This, in turn, drives the wiper arms towards park again and the cycle repeats itself. This feature is required to prevent wiper bounce from happening when snow has accumulated on the windscreen.

Detection of wiper bounce

If the BCM detects that the wipers have parked more than a maximum amount times within a time period then wiper bounce is detected. The maximum amount of times can be set in EEPROM using the variable wipe snow parks. The time can also be set in EEPROM using the variable wipe snow time. The units of wipe snow time is milliseconds.

Bounce prevention

If wiper bounce has been detected then the wiper bounce prevention relay is driven to open circuit. The wiper bounce relay is in series with the park switch and thus can prevent automatic parking. This relay is normally closed.

Termination of bounce prevention

Termination is achieved by ceasing to drive the wiper bounce relay to open circuit. Bounce prevention can be terminated in the following ways:

- Ignition off. The power source for the wiper motor is derived from IG2, thus there will be no drive to park with ignition off. As such bounce prevention is not required.
- The wiper stalk has moved from the OFF position.

4. Wiper motor stall protection

This feature offers some protection to the wiper motor if ice has frozen the wiper blades to the windscreen or the wipers have jammed for some other reason. During low and high wiper selection, no protection is offered since the stalk drives the wiper motor directly.

If the wiper motor has not parked within wipe stall time, then wiper motor is considered to have stalled. In this case, the wiper bounce relays driven to open circuit until either of the following events occurs:

- The ignition has been switched to the off position.
- The wipers have returned the park position by a manual operation (Low or high speed selected)
- The wiper stalk has moved from the OFF position.

Wipe stall time can be set in EEPROM and it's units are 100ms.

During INT operation, if the time between initiating and concluding a wipe is greater than Wipe stall time then the wiper motor is also considered to have stalled. In this case, the current wipe is terminated and INT operation is cancelled until either of the following events occurs:

- The wiper stalk has moved from the OFF position.
- The ignition has been switched off.

5. Central locking

1) Knob activated central locking

If the driver door lock switch is moved from the locked position to the unlocked position:

The driver door lock actuator is activated in the unlock direction - A. The assist door lock is not activated. - B

If the assist door lock switch is moved from the locked position to the unlocked position:

The driver and assist door lock motors are activated in the unlock direction. - C

If either the driver or assist door lock switch is moved from the unlocked position to the locked position:

The driver and assist door lock motors are activated in the lock direction. - A, B, C

2) **Switch Activated Central Locking**

In the disarmed state, each time the central locking switch is pressed, the door lock and unlock outputs will operate for 0.5 ± 0.1 seconds in the direction - G, H. The number of central door locking presses is reset to zero when the vehicle is disarmed.

This function is disabled in the Armed State. - I

3) **2-Stage Unlocking**

If the driver door key switch is activated once: The driver door is unlock via the mechanical linkage and is assisted by activation of the door lock motor in the unlock direction. - D. The system enters the disarm state

If a subsequent driver door key switch is activated within 4 seconds: The driver and assist door lock motors are activated in the unlock direction. - D

If a subsequent driver door key switch is activated after 4 seconds: The driver door lock motor is activated in the unlock direction. - E

If the assist door key switch is activated:

The driver and assist door lock motors are activated in the unlock direction. - F. The system enters the disarm state.

During alarming, if the tail gate is opened by the key switch, the system enters the disarm state.

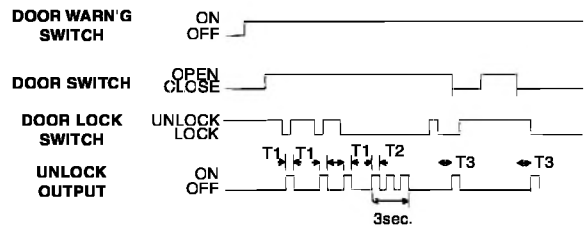
4) **Ignition key reminder (Locking of key in vehicle prevention)**

If the key is in the ignition and the driver's door or assist door is open and the vehicle is locked using driver's knob or assist knob, then the central locking system will issue an unlock pulse of duration 1 second to the all doors thus preventing locking of the vehicle.

If a Knob remains locked, then the central locking shall issue a maximum of 3 pulses of 0.5 second duration to unlock the vehicle. If during these pulses, the door lock knob becomes unlocked, stop the next pulse.

If vehicle speed is greater than 3 km/h, ignition key reminder function is disabled.

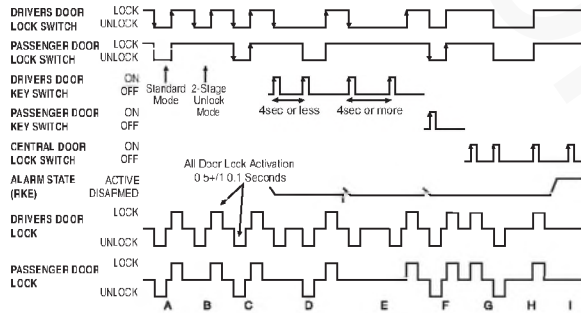
If door warning switch is off and ignition input is on then ignition key reminder function is disabled.



ETNC090A

Time specification

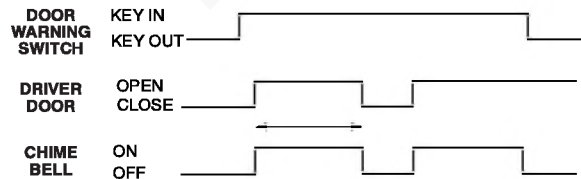
- T1 : 1 sec.
- T2 : 0.5 sec.
- T3 : Max. 0.5 sec.



ETOF116A

6. **Key operated warning (key in ignition reminder chime)**

If the key is in ignition key cylinder and the drivers door is opened, the chime bell sounds. This tone is the same as the seatbelt warning chime and over speed warning chime. The chime sound is generated with a 800Hz drive, amplitude modulated with an exponentially decaying envelope of time constant 1 ± 0.25 seconds. If the door is closed or the key is removed, the chime stops immediately.

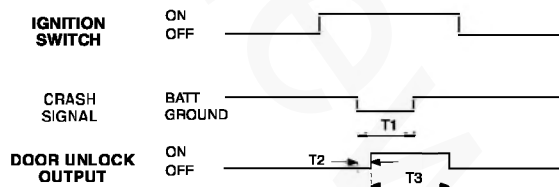


ETOC100E

7. **Crash detection - Unlock**

If IG1 is on and a crash signal is received, send an unlock pulse to the door locks. Unlock signal must occur within 12 ± 5 msec after crash signal is received. Unlock pulse is 5 sec period. If crash unlock is not used in a particular variant then the crash input is to be left floating.

The crash sensor is normally high. A crash signal is defined as when voltage is below 1.5V. Crash input signal characteristic: Normal hi & 200msec period ground after crash. Only one crash unlock can occur during one ignition on cycle.



ETOC100F

Time specification

- T1 : 200 msec.
- T2 : 12 ± 5 msec.
- T3 : 5 sec.

8. **Auto light control**

Lights must be turned on 500 ± 100 msec. after the input light to the light sensor has been received. Lights must be turned off 3 ± 1 sec. after the input light to the light sensor has been removed. Head lamps must be turned off 300msec before the tail lamps are switched off. When the headlight switch is in the auto position and light intensity fulfilling the table below is detected, the tail lamp and the head lamps will be turned on. These figures are based upon the use of untinted solar glass.

The headlamps must remain on when the headlamp switch is rotated from the ON to the AUTO position until such time that the light sensor input is evaluated as per the following table.

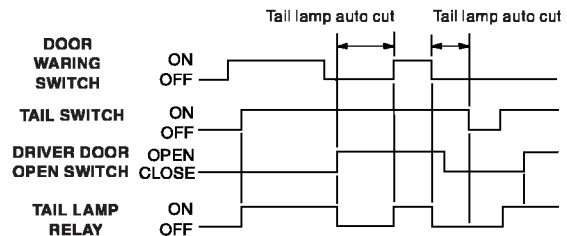
If the option select input is grounded, both the headlamps and the tail lamps shall illuminate when the voltage drops below the tail lamp threshold. When the voltage rises above the tail lamp threshold, both the headlamps and the tail lamps shall extinguish.

	Tail lamp	Head lamp
ON	$1.77 \pm 0.08V$	$0.61 \pm 0.06V$
OFF	$3.47 \pm 0.10V$	$1.00 \pm 0.06V$

9. **Tail lamp auto cut**

When key is in the ignition key cylinder and tail lamp switch is on, followed by removing key from ignition and then opening of the drivers doors will turn off the tail lamp relay. If driver door is opened first, followed by removing key from ignition, then tail lamp is switched off.

If tail lamps have been cut automatically, and then the tail lamp switch is turned off and on, then tail lamp is switched on and auto cut function is cancelled. If tail lamps have been cut automatically, and the ignition-key is inserted, then tail lamps are turned on.

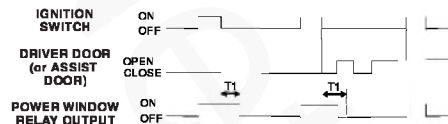


ETOC100G

10. **Power window timer**

When Ignition 2 is on, the power window relay output is turned on.

When Ignition 2 is turned off the power window feed is maintained on for 30 seconds and then turned off. If the driver door or assist door is opened during 30 sec interval the output shall be turned off immediately. If doors are open and ignition 2 is then turned on, the output shall be turned on immediately. If doors are open and ignition 2 is then turned off, the output shall be turned off immediately.



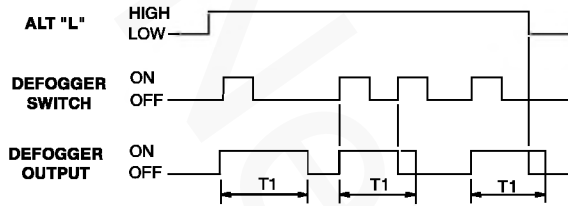
ETOC100H

Time specification

- T1 : 30 ± 3 sec.

11. Rear defog control (Rear demister control)

When the engine is running (Alternator "L" is high) a contact of the rear defog switch (momentary action) will switch the relay output on for 20 minutes duration. If the rear defog switch is pressed again during this time, or if the engine stops, the rear defog relay is immediately switched off.

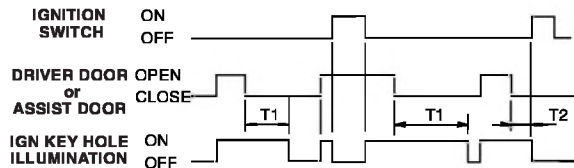


ETOC100I

Time specification
T1 : 20±1 min.

12. Ignition key hole illumination

When the drivers door is open, the ignition key illumination is turned on. When driver door is closed, illumination is on for 10 sec., then off. When the assist door is open, the ignition key illumination is turned on. When assist door is closed, illumination is on for 10 sec., then off. The key illumination is extinguished immediately when the ignition 1 comes on. Locking of the vehicle from the transmitter (arm state) shall extinguish ignition key illumination.



ETOC100J

Time specification
T1 : 10±1 sec.
T2 : 0~10 sec.

13. Decayed room lamp (Illuminated entry with fade out)

When the first door (driver, or assist) is opened, the interior light shall brighten to full intensity in less than 0.5 seconds.

When the last door is closed, the room lamp will drop to 75% intensity then fade out over 5.5±0.5 seconds. If the ignition 2 is switched on when room light is fading out, the room lights switch off immediately.

If the door open signal is on for less than 0.1 seconds, then no illumination occurs.

Lamps must not flicker during fade operation, If a door open or ignition on.

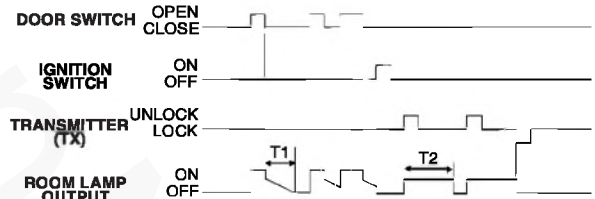
When transmitter (TX) unlock is received, room lamps are turned on in less than 0.5 second for maximum 30 seconds.

While room lamp is on due to TX unlock, if another TX unlock is received, then room lamp is again on for 30 sec.

When TX lock (arm state) is received during 30 second from TX unlock, lamp is turned off immediately.

If TX lock (arm state) is received during fade out, the room lamp is switched off immediately.

Door locking functions should not be influenced by room lamp decay functions.



ETOC100K

Time specification
T1 : 5.5±0.5 sec.
T2 : 30 sec.

14. Seat belt warning

1) **Seat belt warning indicator**

Whenever the ignition 1 is turned on the seat belt warning indicator is illuminated for total time 6 seconds, with period 0.6 sec and duty rate 50%. It is not extinguished if the seat belt is sensed as fastened.

If ignition 1 is already on and the seat belt is removed, the indicator is illuminated for total time 6 seconds, with period 0.6 sec and duty rate 50%.

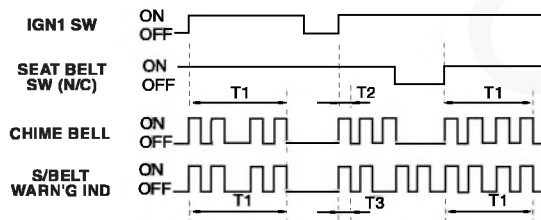
If ignition 1 is switched off in while the indicator is illuminated, the illumination is switched off immediately.

2) **Seat belt warning chime**

Whenever the ignition 1 is turned on the seat belt warning chime is sounded for total time 6 seconds, with period 0.9 sec and duty rate 50%. It is silenced immediately if the seat belt is sensed as fastened.

If ignition 1 is already on and the seat belt is removed, the chime is sounded for total time 6 seconds, with period 0.9 sec and duty rate 50%.

If ignition 1 is switched off in while the chime is sounding, the chime is switched off immediately.



ETOC100L

Time specification

T1 : 6 ± 1 sec.

T2 : 0.45 ± 0.1 sec.

T3 : 0.3 ± 0.1 sec.

ANTI-THEFT FUNCTION

1. Arm function

Pressing the remote key lock button will result in a 0.5-second pulse issued to lock all doors. Pressing the remote keypad unlock button once will result in a 0.5-second unlock pulse issued to unlock all doors.

As part of the arming sequence the alarm first enters a pre-armed state before falling into the armed state. During this pre-armed state alarm triggers are ignored. Pre-armed state can be reached from the alarmed state, the start inhibit state or the disarmed state. Pre-Arming of the alarm can be achieved by a press of the lock button on the remote key.

In the pre-armed state the visible and audible warnings are disabled.

This system enters the armed state if it is in the pre-armed state and, after 0.6 sec, check actuator lock and each door, hood and tail gate close, and no door warning switch (no key in ignition).

On entering the arm state, a single flash of the hazard lamps is given, period of cycle 2 second, duty rate 50%.

If TX lock signal is received when a door, tail gate or hood is open, then lock output is given and a flash of hazard is not given.

After the armed state is entered, if a lock signal is received then a single flash of the hazard lamps is given, period of cycle 2 second, duty rate 50%.

The armed state cannot be reached by locking the car with the keys.

2. Disarm function

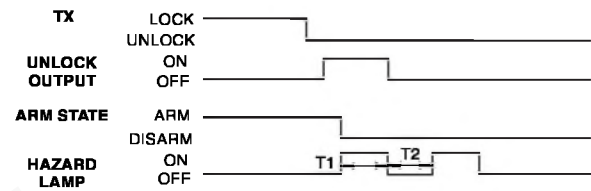
Disarming can be performed while the alarm is armed, or alarming, or after alarming. The alarm can be disarmed by the following methods:

- Pressing the unlock button on the TX key. The hazard lamps shall be flashed twice for 1sec period (of cycle), 50% duty rate.
- If door warning switch is on, IGN1 and IGN2 are on in arm state, then arm state should be immediately cancelled. This means that the driver is inside the vehicle before pushing TX lock, so system should not arm.

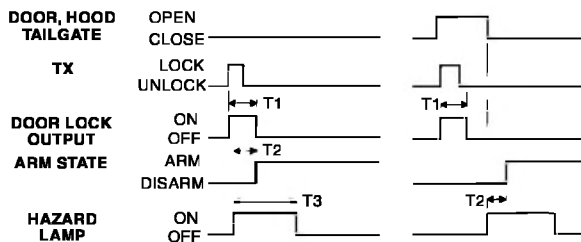
In the disarm state the visible and audible warnings are disabled and start is enabled.

In the disarm state, if TX key unlock command is received, then the hazard lamps shall be flashed twice for period of cycle 1 sec, 50% duty rate.

Disarm state cannot be reached using the door locks by key.



ETHA115R



ETHA115Q

Time specification
 T1 : 0.5sec.
 T2 : Max 2sec.
 T3 : 1.0±0.2sec.

Time specification

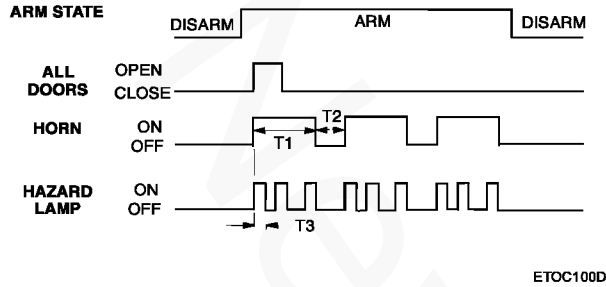
T1, T2 : 0.5±0.1sec.

3. Alarm function

Once armed, should any door, hood or the tailgate be opened, then:

- Start relay drive output is disabled, so starting is inhibited.
- Audible (horn) and visual (hazard lamp) warnings are issued, for three cycles, each cycle 27±1 sec. duration on, 10±1 sec. off. The horn warning is continuously occurring during the on period. The hazard lamps operate with 1 sec period, 50 % duty rate during the on period.

The alarm is given in the case where a door is opened with a key.
 After this time, the system maintains the start inhibit state, where no audible and visual warnings are issued but engine starting is not possible.



Time specification
 T1 : 27±2 sec.
 T2 : 10±1 sec.
 T3 : 0.5±0.1 sec.

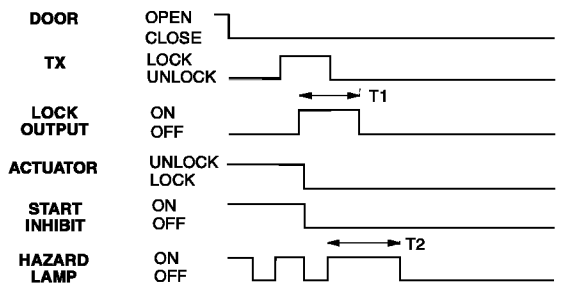
4. Operation during alarm conditions

1) Cancelling audible alarm with the remote transmitter

CASE 1 : Door closed

During or after alarming and then closing all doors and a TX lock signal is received Then

- The lock command is executed with 0.5 sec. ON
- Horn and start inhibition are OFF
- Hazard lamp is flashed one time (period : 2 sec., duty: 50%, within 2 sec.)
- The state goes to arming mode (after a lock state check)
- The start is enabled



Time specification
 T1 : 0.5 sec.
 T2 : 1.0±0.2 sec.

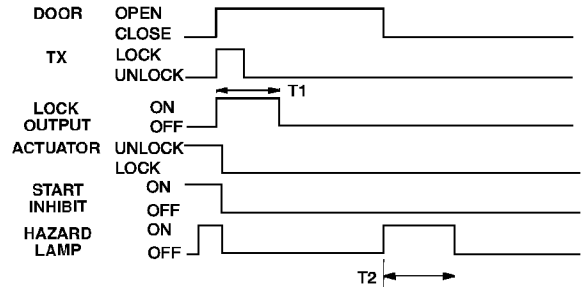
CASE 2 : Door Open

During or after alarming, with a door open and a TX lock signal is received Then

- The lock command is executed with 0.5 sec. ON
- Horn is disabled and start is enabled after confirmation of actuator lock

At this time, when the door is closed,

- Hazard lamp is flashed one time (period : 2 sec., duty 50%)
- The state goes to arming mode



Time specification
 T1 : 0.5 sec.
 T2 : 1.0±0.2 sec.

2) New alarm conditions

Second alarm condition during alarming.

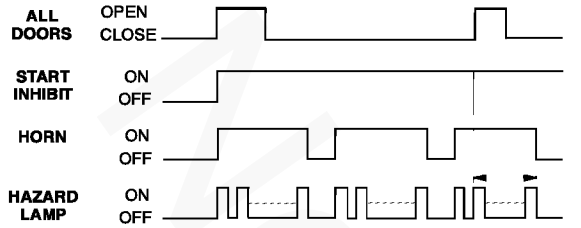
When another alarm occurs during alarming, the starting is disabled, and the alarm continues to sound for the remained time of warning signal. The alarm continues to sound after the second alarm condition is removed.

New alarm condition occurs after alarming (with all entrances closed)

If any entrance is opened again then

- The horn is ON 3 times (EC area : one time for 27sec.)
- Start is disabled
- Hazard lamps flash during the ON time of horn

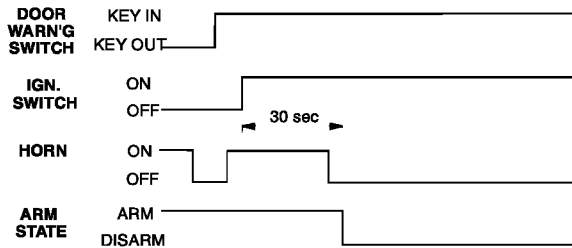
New alarm condition occur after alarming (with any entrance open).
If another entrance is opened, the BCM keeps start disabled and there is no horn output.



ETOC100N

3) Key operation during alarm
After the alarm state or start inhibit state are entered, if door warning switch on (key in ignition) & IGN 2 ON, if IGN 2 state is changed to OFF within 30sec, remain in alarm state.

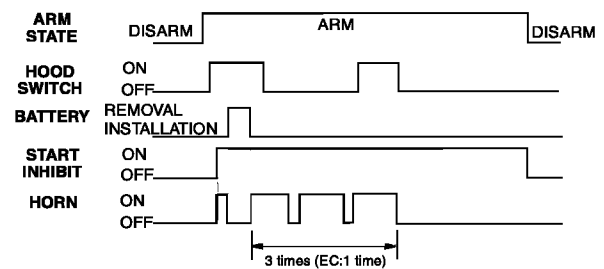
4) Disarming using the key
During alarming, in case that door warning switch (key in) is ON and then IGN1 and IGN2 are both ON for 30 sec continuously, the alarm is cancelled, and the system enters the disarm state. After alarming, in case that door warning switch (key in) is ON and then IGN1 and IGN2 are both ON for 30 sec continuously, the alarm is cancelled, and the system enters the disarm state.



ETOC1000

5. Alarm state in power down
If the battery is disconnected to the BCM in the following states:
• Alarm
• After alarming

Upon restoring the battery, the alarm state shall be entered and the alarm cycle shall restarted (timer reset to 0).
If the battery is disconnected in arm state, upon restoring the battery, arm state is resumed.



ETHA115Z

6. Automatic relocking
If either:
a. Car is unlocked but all doors closed, or
b. Car is closed and locked by keys, or
c. Car is closed, locked and in armed state.

Then if an unlock command sent from the TX key is received by the BCM, and within 30 seconds no door, hood or tail gate has been opened or TX lock received, then the BCM will instigate a lock doors function and enter arm state. A single flash of the hazard lamps is given, period of cycle 2 second, duty rate 50%.
If another unlock command is sent within this time then reset timer.
If a door is already open and an unlock command is received, then the auto relocking function shall be disabled. Even in the case where the doors closed within 30 seconds.

7. Tail gate alarm triggers
During the armed state, if the tail gate is opened by the key switch, the car remains in the armed state and does not enter the alarm state. Whilst the tailgate is open, the hood, drivers and passenger doors are still armed and capable of causing an alarm trigger. Once the tail gate is closed, the tailgate trigger rearms after two seconds. If the interior tailgate release switch is pressed whilst the car is armed and the tailgate has been closed and armed, the alarm state will be entered.
If the tailgate is unlocked and not opened within 25 seconds, the tailgate section will once again be armed and capable of trigger.

8. PANIC

If the BCM alarm has not been triggered, pressing the remote keypad panic button once will result in audible (horn) and visual (hazard lamp) warnings for 30 seconds.

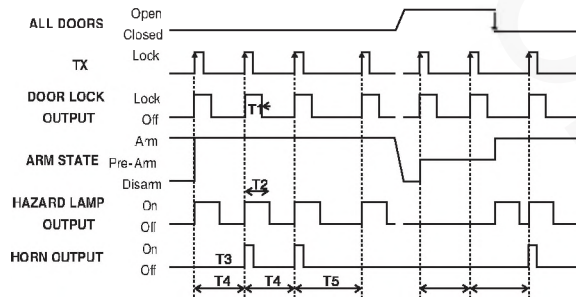
The horn sounding is synchronized to the indicator flash.

The sounding is immediately cancelled by the following conditions:

- A press of the Transmitter, Panic button
- A press of the Transmitter, lock button
- A press of the Transmitter, unlock button
- Automatic re-locking
- Key in ignition
- Alarm triggered
- Door unlocked with driver or passenger door key switch
- Tailgate unlock with tailgate key switch

9. Horn answer back

If transmitter lock signal is received and then a subsequent press of the remote key lock button within 4 seconds will result in a horn sounding for 20ms ± 10ms duration. The function is disabled in the pre-arm state.



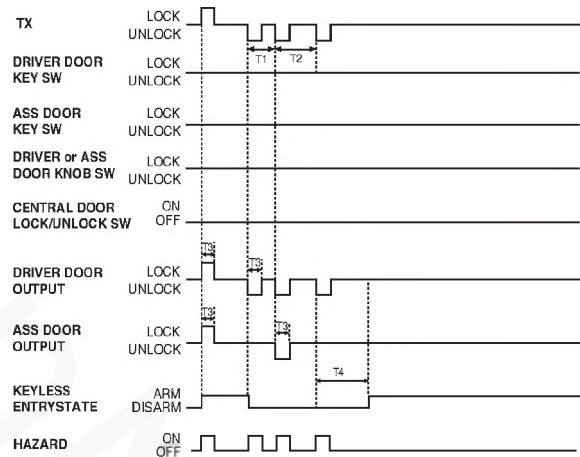
ETOF116B

- T1 : 0.5 ± 0.1 sec.
- T2 : 1 ± 0.2 sec.
- T3 : 0.02 ± 0.01 sec.
- T4 : Less than 4 sec.
- T5 : More than 4 sec.

10. 2-Stage unlocking

Pressing the remote key lock button will result in a 0.5-second lock pulse issued to lock all doors, and the system enters the arm state then a single flash of the hazard lamps is given, period of cycle 2 second, duty rate 50%.

Pressing the remote keypad unlock button will result in a 0.5-second unlock pulse issued to unlock the drivers door, and the system enters the disarm state. The hazard lamps shall be flashed twice for 1sec period (of cycle), 50% duty rate. All doors are unlocked by a subsequent press of the remote key unlock button within 4 seconds. Pressing the remote key unlock button after 4 seconds will result in a 0.5-second unlock pulse issued to unlock the drivers door. A hazard flash will also follow.



ETOF116C

- T1 : Less than 4 sec.
- T2 : More than 4 sec.
- T3 : 0.5 ± 0.1 sec.
- T4 : 30 sec. (Auto relock)

TROUBLESHOOTING E84EF711

BCM practices input/output actuation test with the hi-scan to find out input/output errors.

INPUT/OUTPUT MONITORING

	INPUT / OUTPUT	NAME	DISPLAY	CONDITION
POWER	INPUT	Battery voltage	Voltage	
	INPUT	Key warning switch	Key removal Key insert	
	INPUT	Accessory switch	OFF ON	
	INPUT	IGN1 switch	OFF ON	
	INPUT	IGN2 switch	OFF ON	
	INPUT	Alternator voltage	Voltage	
	OUTPUT	Start inhibitor	Enable Disable	
FLASHER	INPUT	Turn signal switch (LH)	OFF ON	
	INPUT	Turn signal switch (RH)	OFF ON	
	OUTPUT	Turn signal lamp (LH)	OFF ON	
	OUTPUT	Turn signal lamp (RH)	OFF ON	
	INPUT	Hazard switch	OFF ON	
	INPUT	Hazard detection current	Current	

	INPUT / OUTPUT	NAME	DISPLAY	CONDITION
LAMP	INPUT	Tail lamp switch	OFF ON	
	OUTPUT	Tail lamp	OFF ON	
	INPUT	Head lamp switch	OFF ON	
	INPUT	Auto light area option	Domestic Export	
	INPUT	Auto light sensor	Voltage	Control the head lamp at the auto light mode
	OUTPUT	Head lamp	OFF ON	
	INPUT	Front fog lamp switch	OFF ON	
	INPUT	Rear fog lamp switch	OFF ON	
	OUTPUT	Rear fog lamp	OFF ON	
DOOR	INPUT	Driver's door switch	CLOSE OPEN	
	INPUT	Assist door switch	CLOSE OPEN	
	INPUT	All door switch	CLOSE OPEN	
	OUTPUT	Key hole illumination	OFF ON	The key hole illumination is turned off when the ignition switch is turned on.
	OUTPUT	Room lamp	OFF ON	
	INPUT	Hood switch	CLOSE OPEN	
	INPUT	Tailgate switch	CLOSE OPEN	
	INPUT	Tailgate key unlock switch	OFF ON	When open the tailgate with other key.

ETACS (ELECTRONIC TIME AND ALARM CONTROL SYSTEM)**BE -59**

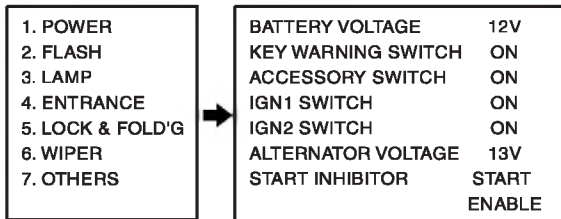
	INPUT / OUTPUT	NAME	DISPLAY	CONDITION
LOCK & FOLING	INPUT	Driver's door lock switch	LOCK UNLOCK	
	INPUT	Assist door lock switch	LOCK UNLOCK	
	OUTPUT	Lock output	OFF ON	
	OUTPUT	Unlock output	OFF ON	
	INPUT	Folding switch	OFF ON	
	OUTPUT	Folding output	OFF ON	
	OUTPUT	Unfolding output	OFF ON	
WIPER	INPUT	Front washer switch	OFF ON	
	INPUT	Intermittent wiper switch	OFF ON	
	OUTPUT	Intermittent wiper relay	OFF ON	
	INPUT	Intermittent wiper resistance	Resistance	
	INPUT	Low/high wiper input	OFF ON	
	INPUT	Wiper parking switch	Motor operation Parking position	
	OUTPUT	Snow safe relay	OFF ON	Snow safety operation

	INPUT / OUTPUT	NAME	DISPLAY	CONDITION
OTHERS	OUTPUT	Power window power	OFF ON	
	INPUT	Seat belt switch	Seat belt removal Seat belt installation	
	OUTPUT	Seat belt indicator	OFF ON	
	OUTPUT	Chime bell	OFF ON	
	INPUT	Over speed signal	OFF ON	When the vehicle speed is over 120km
	INPUT	Rear window defogger switch	OFF ON	
	OUTPUT	Rear window defogger	OFF ON	On starting state
	INPUT	Crash sensor	OFF ON	On crash state
	OUTPUT	Burglar alarm horn	OFF ON	

The components which is on and off as like turn signal lamp, seat belt indicator, burglar alarm horn, chime bell and front wiper relay are displayed "ON"while controlling.

MENU COMPOSITION

1. INPUT/OUTPUT MONITORING



ETOC101A

- 2. INPUT ACTUATION TEST
- 3. OUTPUT ACTUATION TEST

INPUT SIGNAL ACTUATION TEST

NUMBER	INPUT / OUTPUT	NAME	OPERATION	CONDITION
1	INPUT	Turn signal switch (LH)	Turn signal lamp (LH)	
2	INPUT	Turn signal switch (RH)	Turn signal lamp (RH)	
3	INPUT	Hazard switch	Hazard lamp	
4	INPUT	Turn signal lamp detection current	Double flash	Turn signal lamp switch ON
5	INPUT	Tail lamp switch	Tail lamp	
6	INPUT	Auto light switch	Tail/head lamp	
7	INPUT	Auto light sensor voltage		Auto light switch ON
8	INPUT	Rear fog lamp switch	Rear fog lamp	Tail lamp and front fog lamp ON or head lamp ON
9	INPUT	Driver's door lock switch	Door lock/unlock output	
10	INPUT	Assist's door lock switch	Door lock/unlock output	
11	INPUT	Folding switch	Mirror folding/unfolding	
12	INPUT	Front washer switch	Front wiper relay	
13	INPUT	Intermittent wiper switch	Front wiper relay	
14	INPUT	Seat belt switch	Seat belt indicator	
15	INPUT	Over speed signal	Chime	
16	INPUT	Crash sensor	Door unlock output	Only one time when IGN ON
17	INPUT	Rear window defogger switch	Rear window defogger output	Starting state

Actuation test is turned off under the following conditions.

1. When the [STOP] switch is pressed.
2. When the [ESC] switch is pressed.
3. When the hi-scan is turned off.
4. When the hi-scan is disconnected.
5. When the actuation test is turned off by the hi-scan timer.

OUTPUT SIGNAL ACTUATION TEST

NUMBER	INPUT / OUTPUT	NAME	OPERATION	CONDITION
1	OUTPUT	Start inhibitor	Starting disable	Timer (15 sec.)
2	OUTPUT	Turn signal lamp (LH)	Turn signal lamp (LH)	
3	OUTPUT	Turn signal lamp (RH)	Turn signal lamp (RH)	
4	OUTPUT	Tail lamp	Tail lamp	
5	OUTPUT	Head lamp	Head lamp	
6	OUTPUT	Rear fog lamp	Rear fog lamp	
7	OUTPUT	Key hole illumination	Key hole illumination	
8	OUTPUT	Room lamp	Room lamp	
9	OUTPUT	Door lock output	Door lock	
10	OUTPUT	Door unlock output	Door unlock	
11	OUTPUT	Folding output	Mirror folding	
12	OUTPUT	Unfolding output	Mirror unfolding	
13	OUTPUT	Intermittent wiper relay	Wiper output	
14	OUTPUT	Snow safe relay	Wiper not operating	
15	OUTPUT	Power window power	Power window power	
16	OUTPUT	Rear window defogger	Rear window defogger	
17	OUTPUT	Burglar alarm horn	Burglar alarm horn	

Actuation test is turned off under the following conditions.

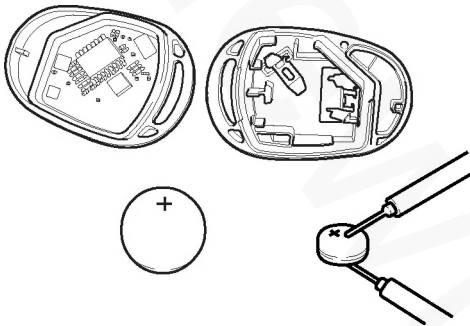
1. When the [STOP] switch is pressed.
2. When the [ESC] switch is pressed.
3. When the hi-scan is turned off.
4. When the hi-scan is disconnected.
5. When the actuation test is turned off by the hi-scan timer.

TRANSMITTER

INSPECTION E11906B9

1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.
2. Remove the battery and check voltage if the red light doesn't flicker.

Standard voltage : 3V



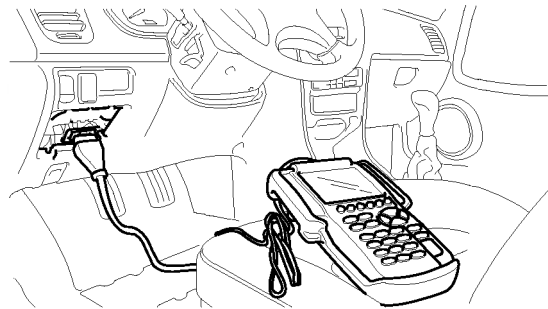
KTOF028A

3. Replace the transmitter battery with a new one, if voltage is below 3V then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the door lock still does not operate, register the transmitter code, then try to lock and unlock the doors.
5. If the door lock still does not operate, replace the transmitter.

TRANSMITTER CODE

REGISTRATION E7F8EA0A

1. Connect the DLC cable of hi-scan to the data link connector (16 pins) in driver side crash pad lower panel, turn the power on hi-scan.



KTOB211A

2. Select the vehicle model and then do "CODE SAVING".

1. HYUNDAI VEHICLE DIAGNOSIS	
MODEL :	ALL
02. ENGINE	
03. AUTOMATIC TRANSAXLE	
04. ANTI-LOCK BRAKE SYSTEM	
:	
:	
:	
07. CODE SAVING	

ETOF211B

3. After selecting "CODE SAVING" menu, button "ENTER" key, then the screen will be shown as below.

KEYLESS ENTRY CODE SAVING
<ol style="list-style-type: none">1. REMOVE THE IG.KEY FROM KEY CYLINDER.2. CONNECT THE DLC CABLE TO THE 16 PIN DATA LINK CONNECTOR.3. AFTER PRESSING [ENTER], FINISH CODE SAVING WITHIN 10 SECONDS.4. PRESS [ENTER], IF YOU ARE READY!

ETQF065M

4. After removing the ignition key from key cylinder, push "ENTER" key to proceed to the next mode for code saving. Follow steps 1 to 3 and then code saving is completed.

KEYLESS ENTRY CODE SAVING
<ol style="list-style-type: none">1. PRESS THE TRANSMITTER [LOCK] BUTTON FOR 1 SECOND.2. IF SAVE ONE MORE PRESS OTHER TRANSMITTER [LOCK] BUTTON FOR 1 SECOND.3. PRESS [ESC] AND DISCONNECT DLC CABLE FROM VEHICLE AND CHECK THE KEYLESS ENTRY SYSTEM.

ETQF065N

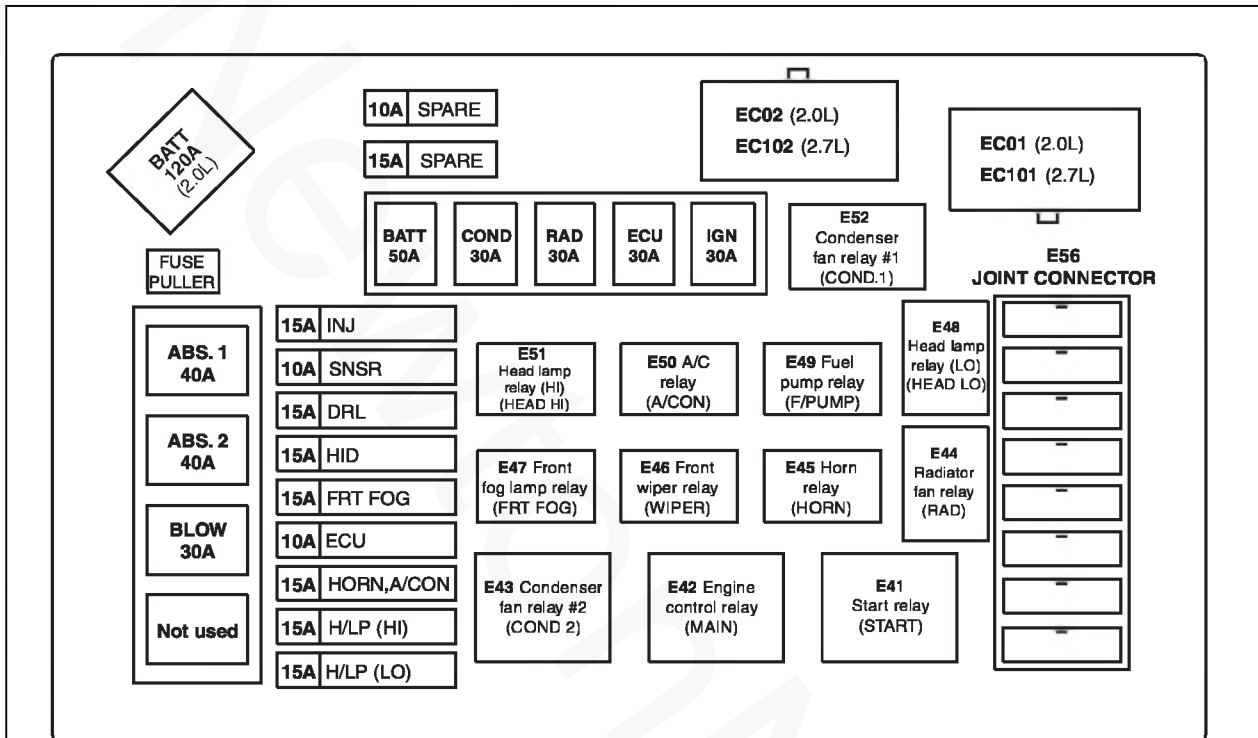
**CAUTION**

Take care when you remove the diagnostic tool connector. Don't remove it with holding the wiring by hand. Please hold the body of it.

FUSES AND RELAYS

RELAY BOX (ENGINE COMPARTMENT)

COMPONENTS E6AA4BEA



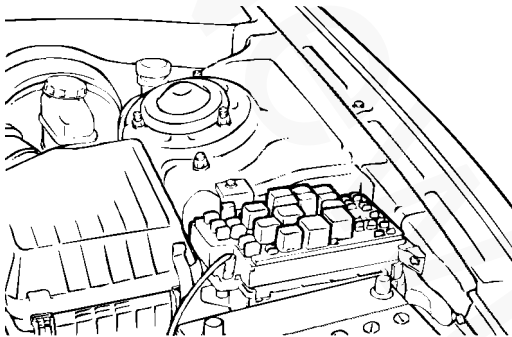
	NO.	Amperages(A)	Circuit Protected
FUSIBLE LINK	BATT	120A	Generator (2.0L)
	BATT	50A	BCM BOX (Tail lamp relay, Power connector, Fuse (2,7,12,13,19,20,24))
	COND	30A	Condenser fan relay
	RAD	30A	Radiator fan relay
	ECU	30A	Engine control relay, Fuel pump relay, A/T control relay, Generator, ECM (2.7L), PCM (2.0L)
	IGN	30A	Ignition switch, Start relay
	ABS. 1	40A	ABS/ESP control module, ESP Air bleeding connector
	ABS. 2	40A	ABS/ESP control module, ESP Air bleeding connector
	BLOW	30A	Blower relay
FUSE	INJ	15A	Injector
	SNSR	10A	Oxygen sensor, Camshaft position sensor, Crankshaft position sensor, Idle speed control actuator
	DRL	15A	DRL control module
	HID	15A	-
	FRT FOG	15A	Front fog lamp relay
	ECU	10A	TCM (2.7L), ECM (2.7L)
	HORN, A/CON	15A	Horn relay, A/C relay
	H/LP (HI)	15A	Head lamp relay (High)
	H/LP (LO)	15A	Head lamp relay (Low)

INSPECTION E12B9A8D

1. Check for a blown fusible link with an ohmmeter.
2. If a fusible link burns out, there is a short or some other problem in the circuit. Carefully determine the cause and correct it before replacing the fusible link.

 **CAUTION**

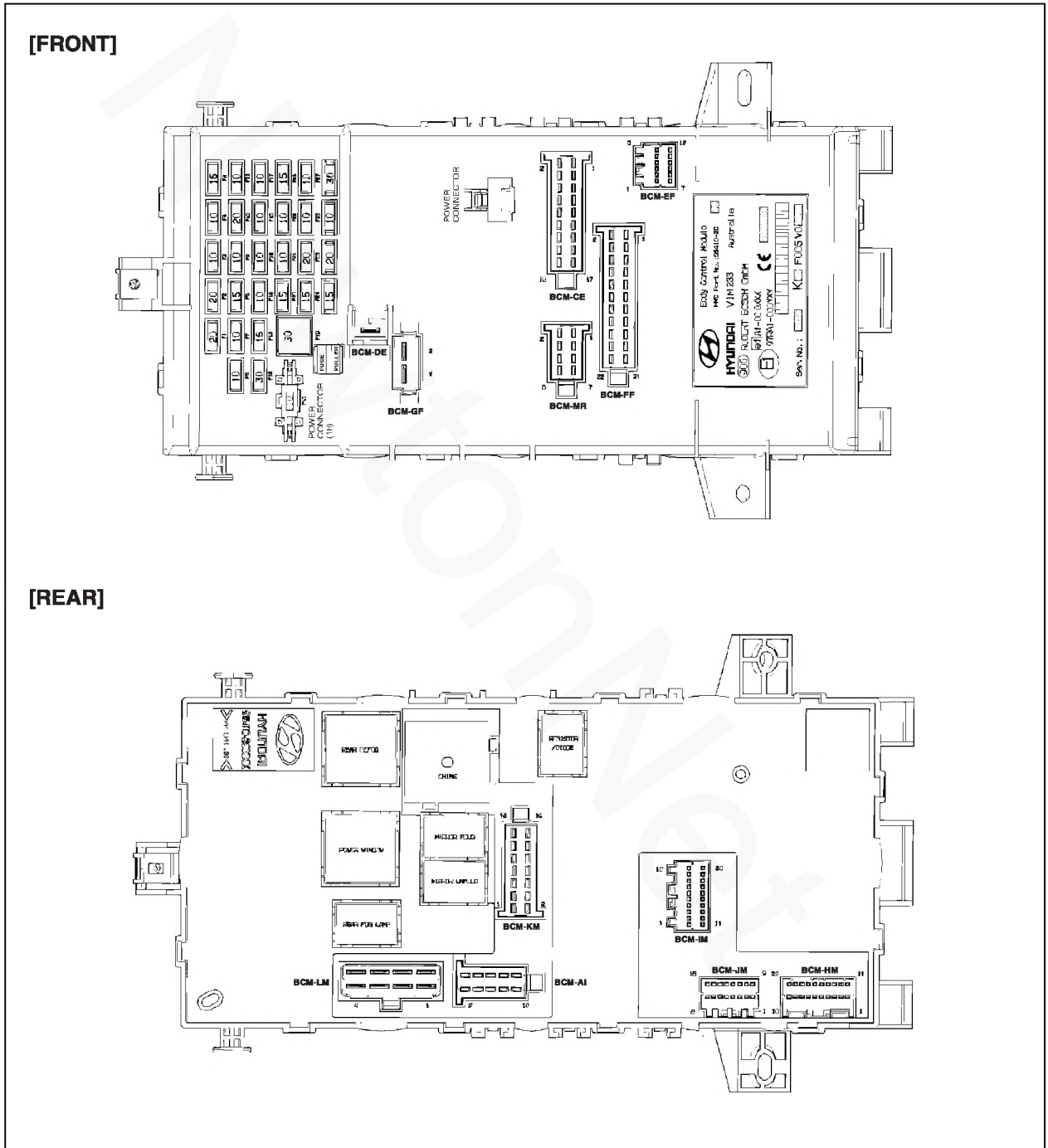
The fusible link will burn out within 15 seconds if a higher than specified current flows through the circuit.



KTMB51.0A

RELAY BOX (PASSENGER COMPARTMENT)

COMPONENTS E7B86786

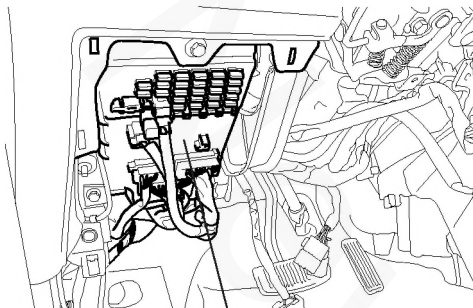


FUSE

NO.	CAPACITY	DESCRIPTION
1	20A	Ignition coil (2.7L), Electronic chrome mirror
2	20A	AMP
3	10A	Back-up lamp switch, Transaxle range switch, Stop lamp switch
4	10A	Instrument cluster (Airbag indicator)
5	15A	Airbag control module , Seat belt buckle switch
6	10A	Mirror defogger
7	10A	Hazard lamp relay
8	15A	Rear wiper motor, Rear intermittent wiper relay
9	10A	Right tail lamps, Glove box lamp
10	20A	Front wiper motor, Front wiper relay
11	10A	Blower relay, Blower motor
12	30A	Defogger relay
13	15A	Stop lamp switch, Folding /unfolding relay, Burglar alarm horn relay
14	10A	Left tail lamps
15	10A	A/C control module, Blower relay
16	10A	ECM, Multi gauge unit, TCM, Vehicle speed sensor
17	10A	Instrument cluster(Power), Alternator resister, DRL Control module, Pre-excitation resistor
18	10A	Room lamp, Clock, Audio, Data link connector, Multi gauge unit
19	30A	Power window relay
20	15A	Trunk lid switch
21	10A	AQS sensor, Head lamp relay, DRL Control module
22	-	-
23	15A	Cigar lighter, Outside mirror switch
24	15A	Sunroof , Power door lock/unlock relay
25	20A	Seat heater
26	10A	ESP/ABS control module
27	10A	Audio, Clock

INSPECTION EA6D7DF9

1. Check for a burnt relay with an ohmmeter.
2. If a relay burns out, there is a short or some other problem in the circuit. Carefully determine the cause and correct it before replacing the relay.



Passenger compartment fuse & relay box

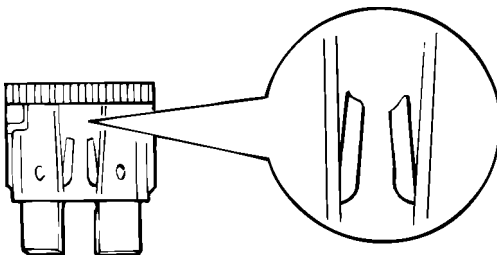
ETOE070A

INSPECTION OF FUSES

When a fuse is blown, there are two probable causes. The two causes can easily be determined by a visual check after removing the fuses.

1. **Fuse blown due to over-current.**
Prior to replacing the fuse with a new one, check the circuit for a short and the related parts for abnormal conditions. Only after the correction of a short or replacement of abnormal parts, should a fuse with the same ampererating be installed.

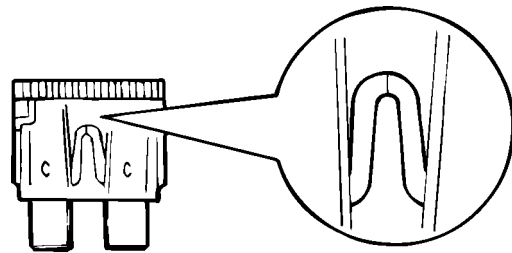
Blown fuse due to overcurrent



ETDA086A

2. **Fuse blown due to repeated on-off current.**
Normally, this type of problem occurs after a fairly long period of use, and is less frequent than #1 above. In this case, you may simply replace with a new fuse of the same capacity.

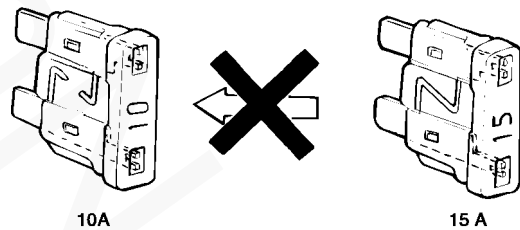
Blown fuse due to thermal fatigue



ETDA086B

CAUTION

A blade type fuse is identified by the numbered value in amperes. If the fuse is blown, be sure to replace a fuse with the same ampere rating. If a fuse of higher capacity than specified is used, parts may be damaged and a danger of fire exists. To remove or insert a fuse, use the fuse puller in the fuse box.

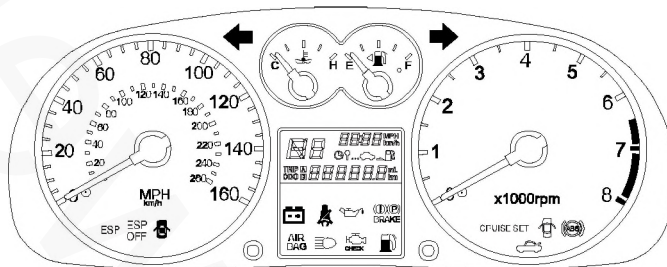


ETDA086C

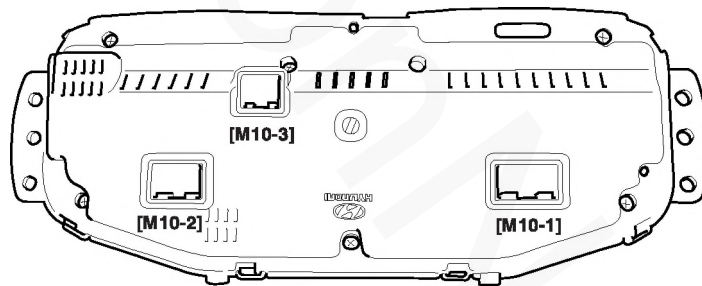
INDICATORS AND GAUGES

INSTRUMENT CLUSTER

COMPONENTS EF2D8BA



KTOE001J



KTOB004F

[M10-3]

1	2	3	4
5	6	7	8

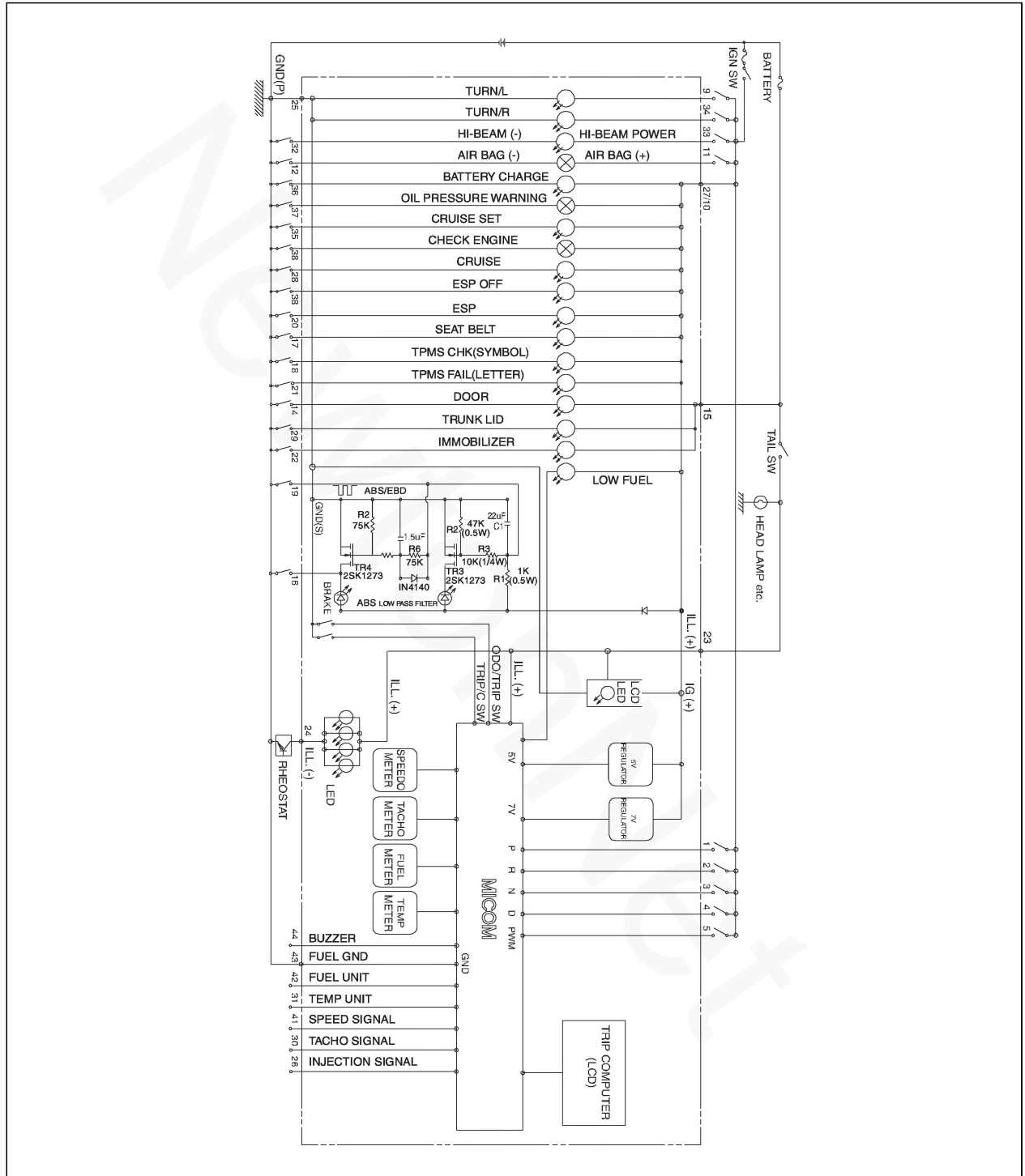
[M10-2]

9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24

[M10-1]

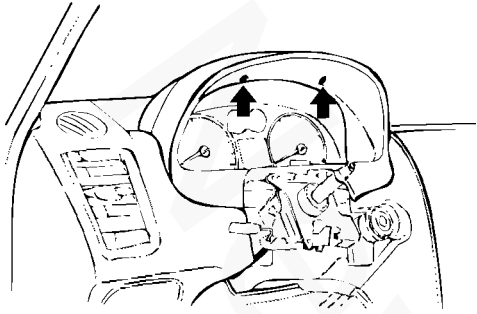
25	26	27	28	29	30	31	32	33	34
35	36	37	38	39	40	41	42	43	44

CIRCUIT DIAGRAM E2E11D29



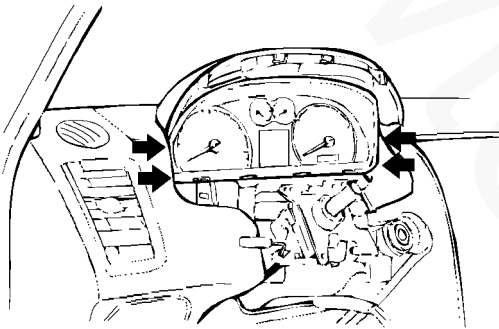
REMOVAL E3CE3906

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster housing after removing 2 screws.



KSMB008I

3. Remove the 4 screws holding the cluster and remove the instrument cluster.



KSMB008J

4. Installation is the reverse of removal.

INSPECTION E5FEB7AC

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.

Velocity (Km/h)	20	40	60	80	100	120	140
Tolerance (Km/h)	20~24.4	40~43	60~64.4	80~85.5	100~105.5	120.5~126	140.5~146
Tolerance (Km/h)	20~24.4	40~44.4	60~65.4	81~86.5	102~107.5	123~128.5	144~149.5
Velocity (Km/h)	160	180	200	220	240	Area	
Tolerance (Km/h)	160.5~166	181~186.5	201~206.5	221~226.7	241~246.7	Others	
Tolerance (Km/h)	165~170.5	186~191.5	207~212.5	227.7~233.5	248.5~254.3	EEC & General	

Velocity (MPH)	10	20	40	60	80
Tolerance (MPH)	10~14.4	20~23	40~44.4	60~65.5	80~85.5
Tolerance (MPH)	8.5~11.5	18.5~21.5	38.5~41.5	58.3~61.7	78.3~81.7
Velocity (MPH)	100	120	140	160	Area
Tolerance (MPH)	100.5~106	120.5~126	140.5~147	160.5~167	Except U.S.A
Tolerance (MPH)	98.3~101.7	118.3~121.7	138.1~141.9	158.1~161.9	U.S.A

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.

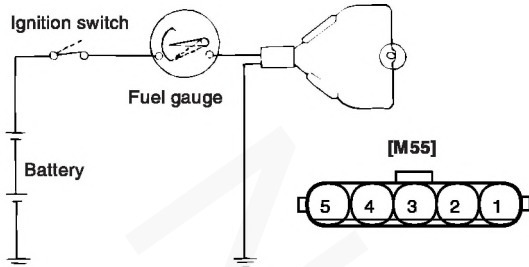
 **CAUTION**

1. *Reversing the connections of the tachometer will damage the transistor and diodes inside.*
2. *When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.*

Revolution (RPM)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000
Tolerance (RPM)	±100	±125	±150	±150	±150	±180	±210	±240

FUEL GAUGE

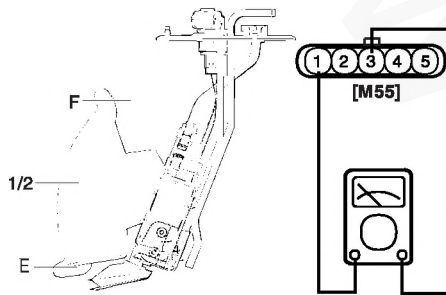
1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 watt, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



ETOC150A

FUEL SENDER

- Using an ohmmeter, measure the resistance between terminals 1 and 3 at each float level.



- 1. Gauge (-)
- 2. Gauge (+)
- 3. Pump (-)
- 4. Pump (+)
- 5. Pump (+)

ETOE070G

- Also check that the resistance changes smoothly when the float is moved from "E" to "F".

Position	Gauge Angle(°)	Resistance (Ω)
Sender (E)	-47.5	110.0 ± 2
Gauge (E)	-45.0	97.0 ± 1
Warning lamp	-43.0	89.4 ± 1
1/2	0	32.5 ± 1
Gauge (F)	45.0	6.0 ± 1
Sender (F)	47.5	3.0 ± 2

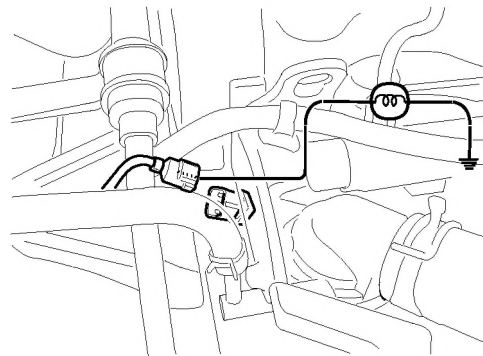
- If the resistance is unsatisfied, replace the fuel sender as an assembly.

CAUTION

After completing this test, wipe the sender dry and reinstall it in the fuel tank.

ENGINE COOLANT TEMPERATURE GAUGE

- Disconnect the wiring connector from the engine coolant temperature sender in the engine compartment.
- Turn the ignition switch ON. Check that the gauge needle indicates cool. Turn the ignition switch OFF.
- Connect a 12V, 3.4 watt test bulb between the harness side connector terminal 2 and ground.



ETRF282C

- Turn the ignition switch ON.
- Verify that the test bulb flashes and that the indicator moves to HOT.

If operation is not as specified, replace the sender. Then recheck the system.

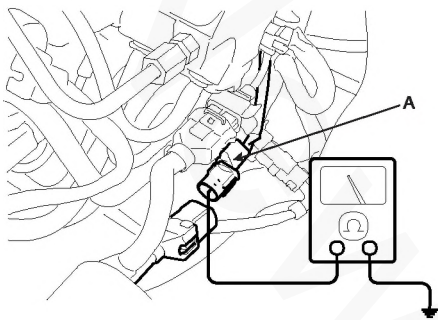
ENGINE COOLANT TEMPERATURE SENDER

- Using an ohmmeter, measure the resistance between the terminal 2 and ground.
- If the resistance value is not as shown in the table, replace the temperature sender.

Temperature(°C)	60	85	110	125
Resistance (Ω)	143.4	58.1	26.9	17.5

OIL PRESSURE SWITCH

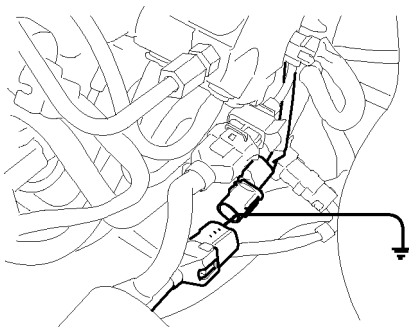
1. Check that there is continuity between the switch's terminal and ground with the engine stopped.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.



KTQE530A

OIL PRESSURE WARNING LAMP

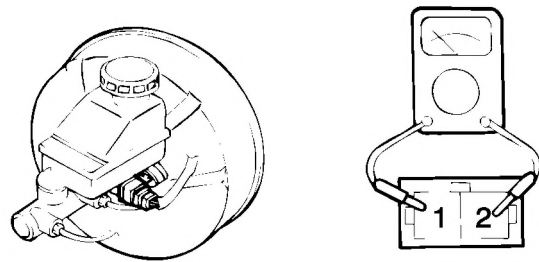
1. Disconnect the connector from the warning switch and ground the terminal on the wire harness side connector.
2. Turn the ignition switch ON. Check that the warning lamp lights up. If the warning lamp doesn't light, test the bulb or inspect wire harness.



KTQE530B

BRAKE FLUID LEVEL WARNING SWITCH

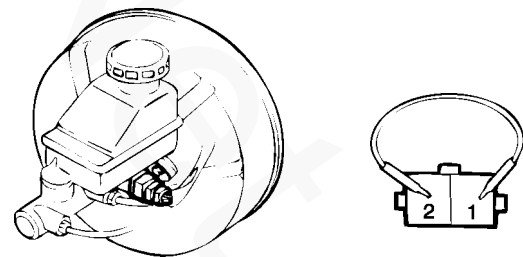
1. Remove the connector from the switch located at the brake fluid reservoir.
2. Verify that continuity exists between switch terminals 1 and 2 while pressing down the switch (float) with a rod.



V5BE060M

BRAKE FLUID LEVEL WARNING LAMP

1. Start the engine.
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.



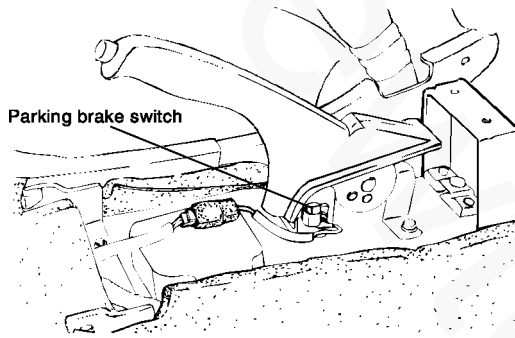
V5BE060N

PARKING BRAKE SWITCH

The parking brake switch is a push type located under the parking brake lever. To adjust, move the switch mount up and down with the parking brake lever released all the way.

1. Check that there is continuity between the terminal and switch body with the switch ON (Lever is pulled).
2. Check that there is no continuity between the terminal and switch body with the switch OFF (Lever is released).

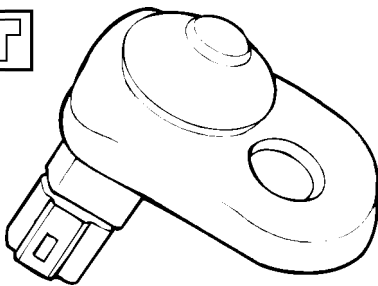
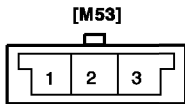
If continuity is not as specified, replace the switch or inspect its ground connection.



V5BE0800

DOOR SWITCH

Remove the door switch and check for continuity between the terminals.



KTOB150C

Terminal Position	1	2	3
Free (Door open)	○	○	○
Push(Door close)			

ETNC150A

SEAT BELT SWITCH

1. Remove the connector from the switch.
2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive ($\infty \Omega$)
Not fastened	Conductive(0Ω)

SEAT BELT WARNING LAMP

With the ignition switch turned ON, verify that the lamp glows.

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

MULTI GAUGE

SPECIFICATIONS

DESCRIPTION EEA4DB28

Multi-gauge unit is located at the upper portion of audio system and it indicates engine torque, instantaneous fuel consumption, and battery voltage.

1. Engine torque gauge

It indicates the instantaneous torque variation according RPM of the vehicle. Driver can notice the instantaneous torque variation with oscillation and outrunning speed, recently a lot of consumers want their sports car with performance tuning. They can discern the torque level easily. Engine torque gauge indicates the engine torque value by communicating CAN signals from engine ECU.

2. Instantaneous fuel consumption gauge

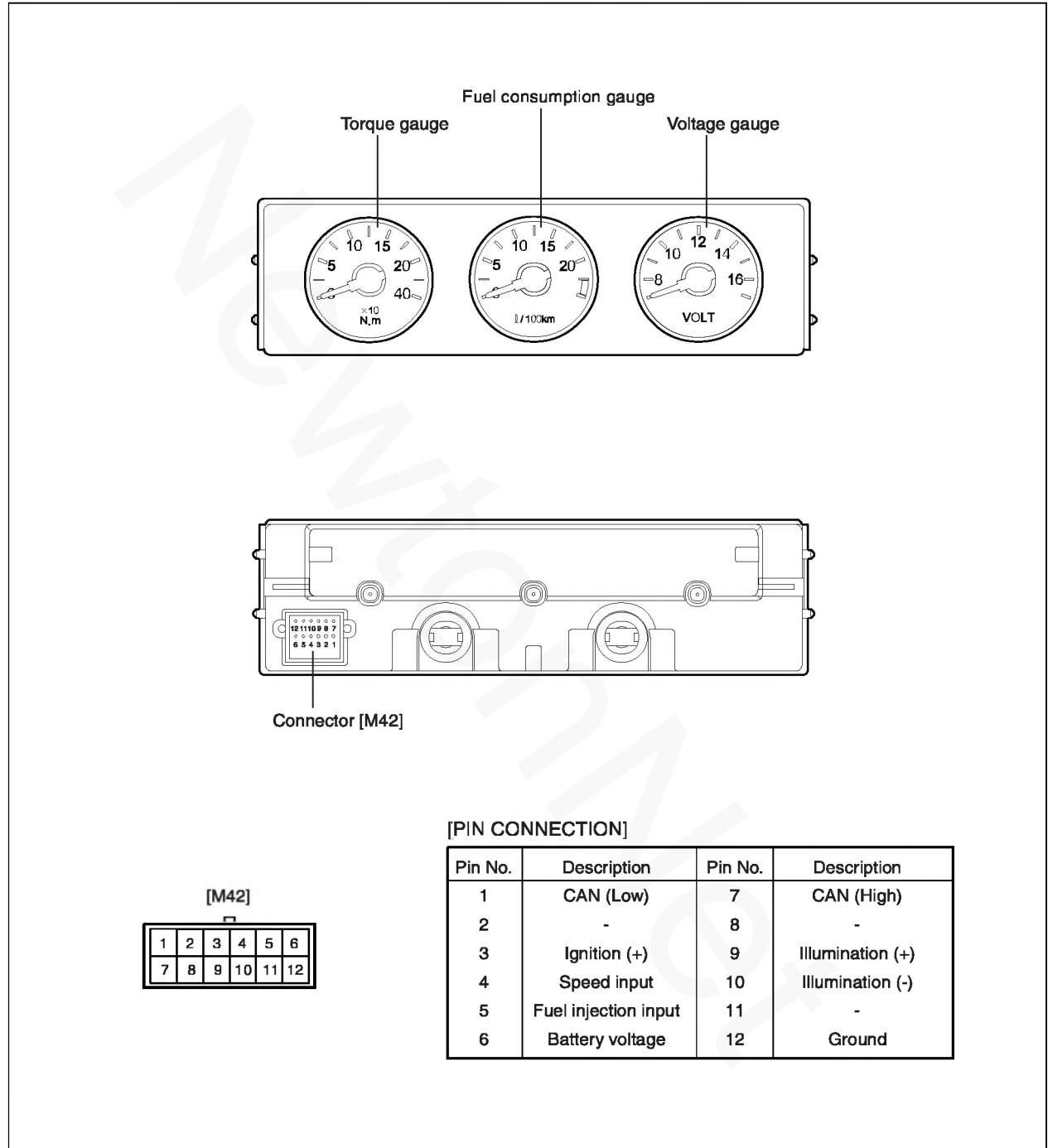
It indicates instantaneous fuel consumption according the driving condition.
 Instantaneous fuel consumption gauge inputs the speed signal and fuel injection signal.
 Speed signal comes directly from the speed sensor and fuel injection signal is from the engine ECU.
 Multi-gauge reads the two signals for 500msec. and calculates the instantaneous fuel consumption. If the vehicle speed is increasing by constant fuel quantity per hour, the gauge indicates the value increasingly. It doesn't show the average fuel consumption but only the instantaneous one.

3. Volt gauge

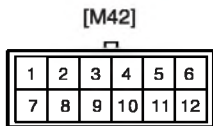
Volt gauge makes a driver properly response during low voltage, informing the vehicle voltage.
 Before ignition turned on, when the key is inserted into "ignition switch on" position, it displays the battery voltage, after ignition key turned on, it displays the ignition voltage(battery voltage).
 If the voltage is at 8.5V or below, the pointer of the gauge moves to the lower than 8V and if it is at 16V or more, it moves to the lower than 16V.
 If the input value is between 8.5V and 16V, the volt gauge points the battery voltage (ignition voltage is displayed during the ignition key turned on).

Items	Display range	Input signal	Gauge operating type
Engine torque	0~400 Nm	ECU engine torque (CAN communication)	Stepper motor
Instantaneous fuel consumption	0~30 MPG	Speed signal, Fuel injection signal (CAN communication)	Stepper motor
Battery voltage	8~16V	Battery voltage	Stepper motor

COMPONENTS EB150AB3

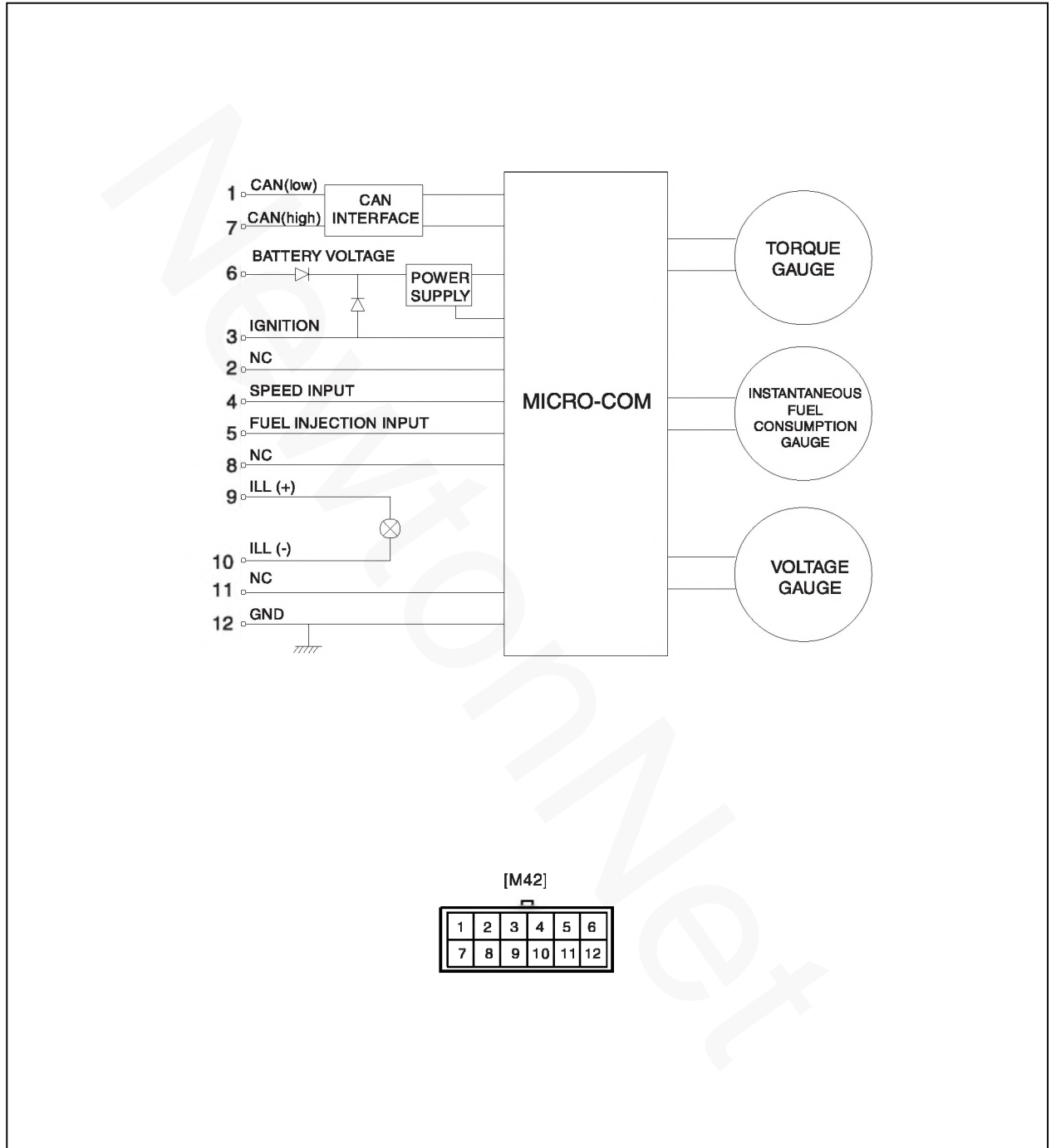


[PIN CONNECTION]



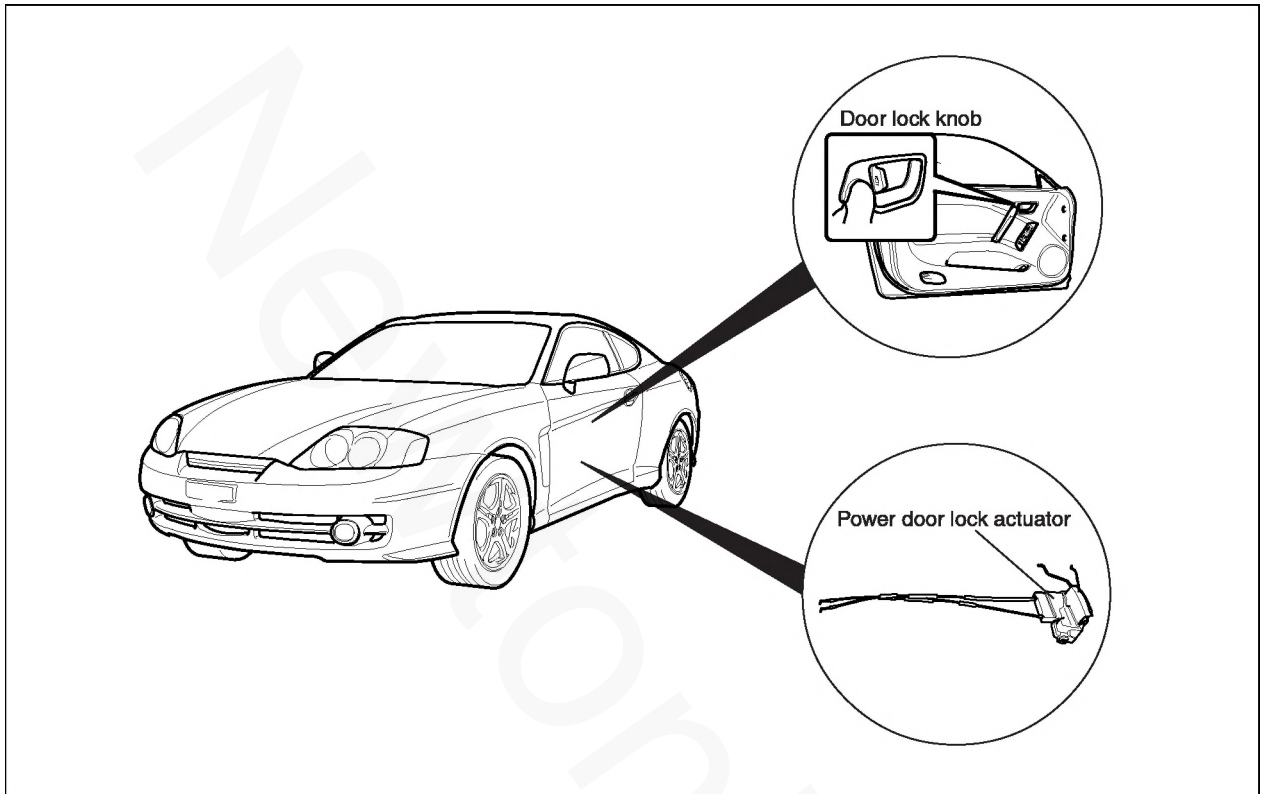
Pin No.	Description	Pin No.	Description
1	CAN (Low)	7	CAN (High)
2	-	8	-
3	Ignition (+)	9	Illumination (+)
4	Speed input	10	Illumination (-)
5	Fuel injection input	11	-
6	Battery voltage	12	Ground

CIRCUIT DIAGRAM EE0BE7CC



POWER DOOR LOCKS

COMPONENTS E1DFFDCE

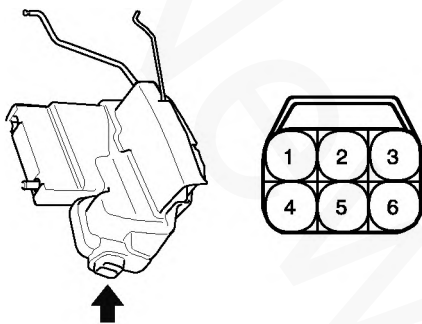


POWER DOOR LOCK ACTUATORS

INSPECTION E910F2D9

DOOR LOCK ACTUATOR INSPECTION

1. Remove the door trim panel.
2. Disconnect the 6P connector from the actuator.



ETOC175C

3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position		Terminal	4	6
Front left [D09]	Lock		⊖	⊕
	Unlock		⊕	⊖
Front right [D19]	Lock		⊕	⊖
	Unlock		⊖	⊕

ETOC175A

DOOR LOCK SWITCH INSPECTION

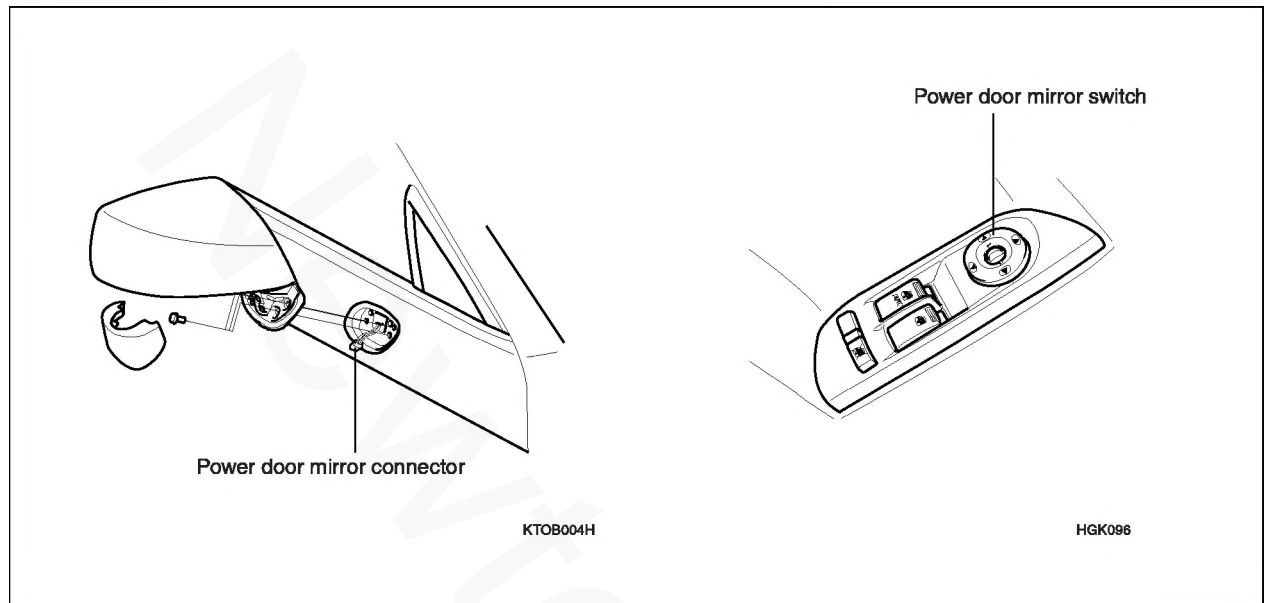
1. Remove the door trim panel.
2. Disconnect the 6P connector from the actuator.
3. Check for continuity between the terminals in each switch position according to the table.

Position		Terminal	1	2	3
Front left [D09]	Lock		○	—	○
	Unlock		○	—	○
Front right [D19]	Lock		○	—	○
	Unlock			○	—

ETOC175B

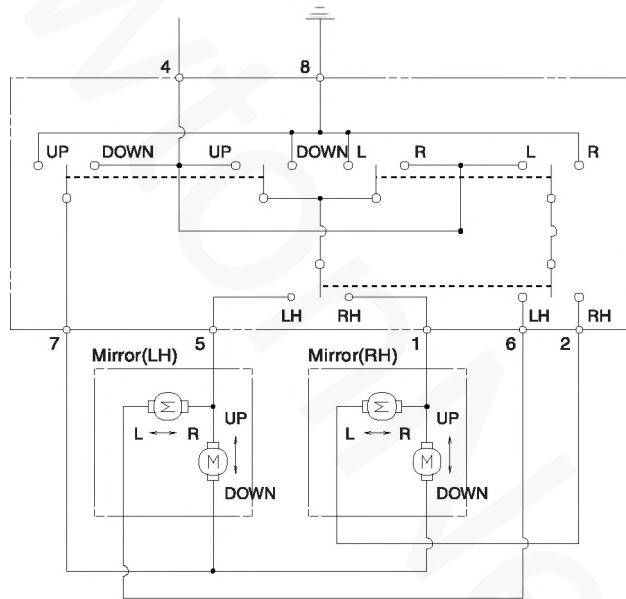
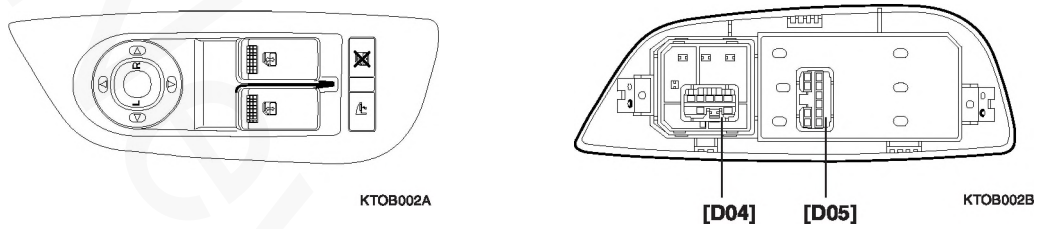
POWER DOOR MIRRORS

COMPONENTS E4B0496C



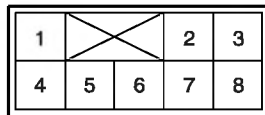
POWER DOOR MIRROR SWITCH

CIRCUIT DIAGRAM EC6C25EE



KTOB002H

[D04]

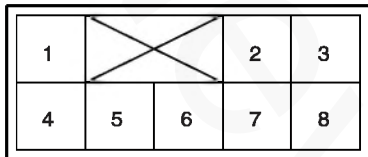


KTOB002G

INSPECTION E6F0C761

1. Remove the power door mirror switch from the door trim panel.
2. Check for continuity between the terminals in each switch position according to the table.
If continuity is not as specified, replace the power door mirror switch.

[D04]



KTOB177A

[D04]

Class	Terminal								
	Direction	1	2	3	4	5	6	7	8
LEFT HAND	UP				○	○		○	○
	DOWN				○			○	○
	OFF								
	LEFT				○		○		○
	RIGHT				○	○		○	○
RIGHT HAND	UP	○			○			○	○
	DOWN	○			○			○	○
	OFF								
	LEFT	○	○		○				○
	RIGHT	○	○		○				○

ETOC185A

POWER DOOR MIRROR ACTUATOR

[D06]

INSPECTION E79EDB7E

1. Disconnect the power door mirror connector from the harness.
2. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.

Terminal Direction	3	4
R1	⊖	⊕
R2	⊕	⊖

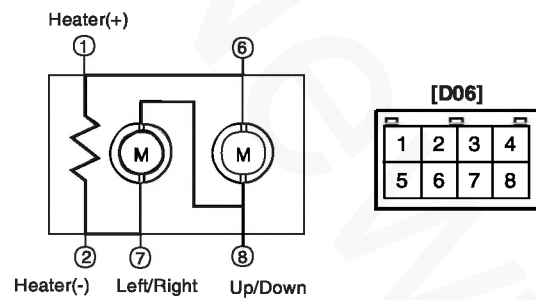
ETOC195C

MIRROR HEATER INSPECTION

[D06]

Terminal Position	1	2
Heater	○	○

ETOC195D



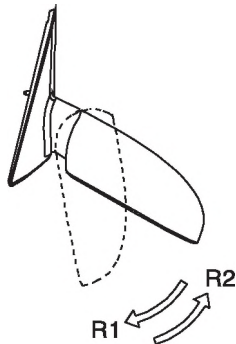
ETOC195A

[D06]

Terminal Position	6	7	8
UP	⊖	⊕	⊕
DOWN	⊕	⊖	⊖
OFF	⊖	⊕	⊕
LEFT	⊖	⊕	⊖
RIGHT	⊕	⊖	⊕

ETOC195B

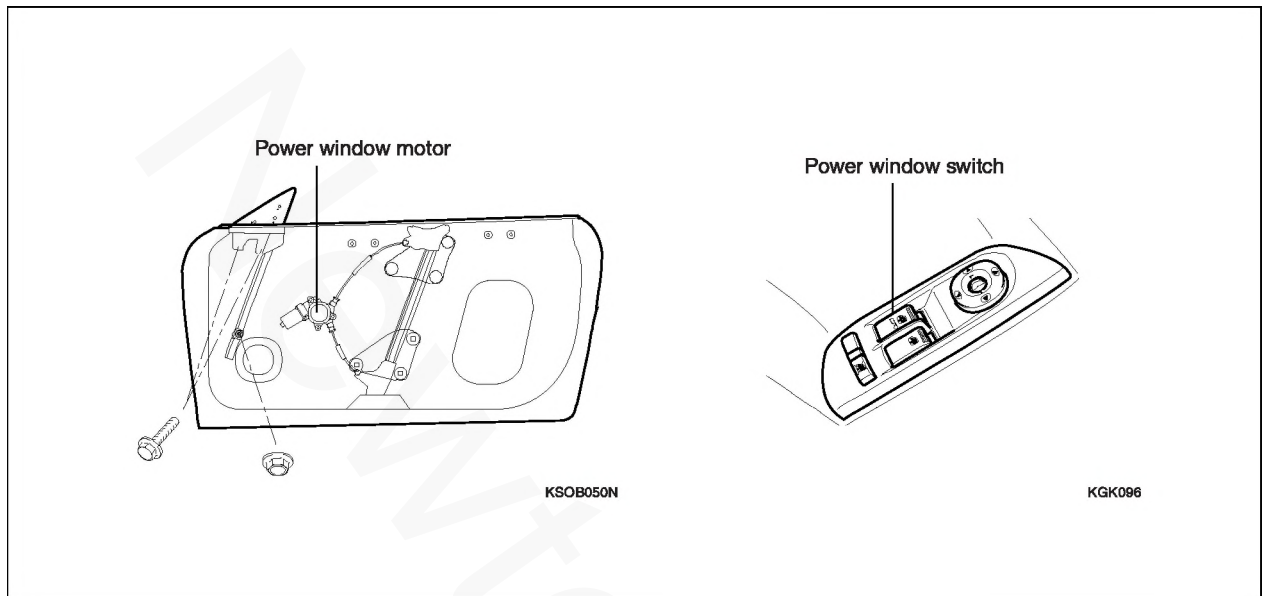
MIRROR FOLDING INSPECTION



ETJA055B

POWER WINDOWS

COMPONENTS E2AFA0F1

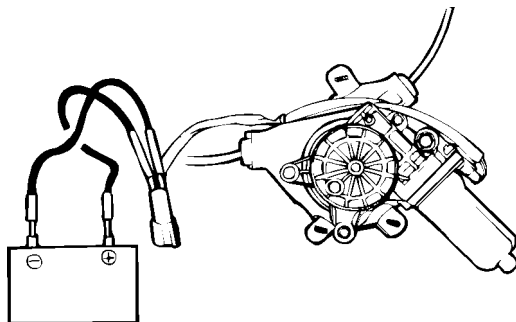


ETOC200A

POWER WINDOW MOTOR

INSPECTION EF95EEF2

Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

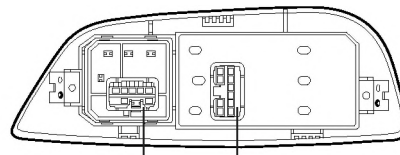
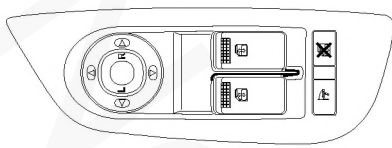


ETDA135A

POWER WINDOW SWITCH

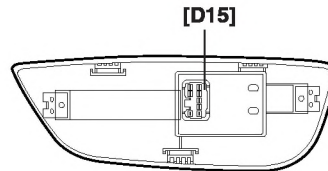
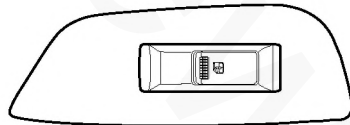
CIRCUIT DIAGRAM EB95101E

[POWER WINDOW MAIN SWITCH]

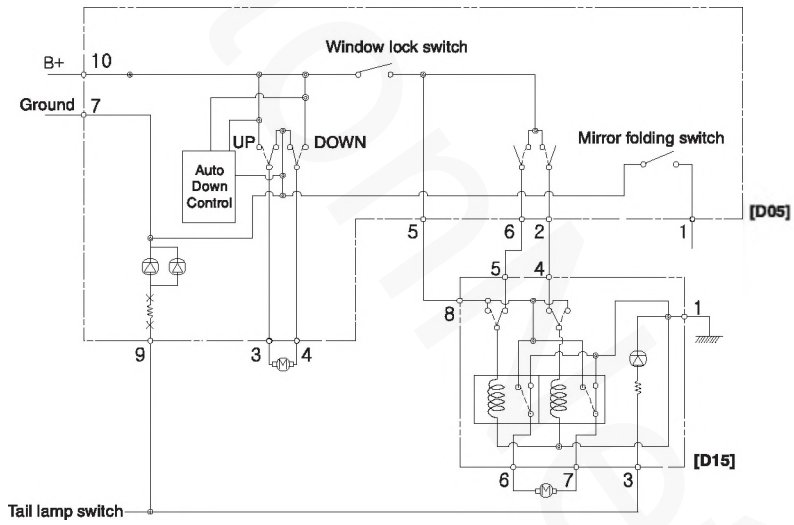


[D04] [D05]

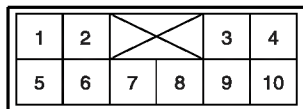
[POWER WINDOW SUB SWITCH]



[D15]

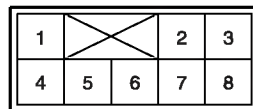


[D05]



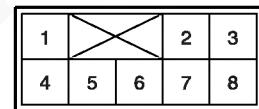
KTOB002F

[D04]



KTOB002G

[D15]



KTOB002G

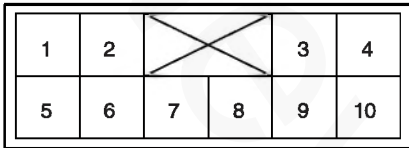
INSPECTION EAC2FD95

POWER WINDOW SUB SWITCH

POWER WINDOW MAIN SWITCH

1. Remove the switch from the door trim panel.
2. Check for continuity between the terminals. If continuity is not as specified in the table, replace the power window switch.

[D05]



KTOB002F

[D05]

Terminal Position	FRONT LEFT				FRONT RIGHT			
	3	10	4	7	6	10	2	7
UP	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○
OFF	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○
DOWN	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○

ETOC210D

WINDOW LOCK SWITCH

[D05]

Terminal Position	5	10
NORMAL	○—○	○—○
LOCK		

ETOC210A

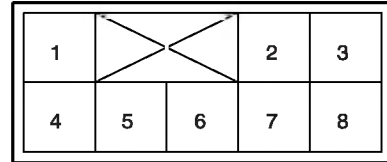
MIRROR FOLDING SWITCH

[D05]

Terminal Position	1	7
FOLD	○—○	○—○
UNFOLD		

ETOC210B

[D15]



KTOB002G

[D15]

Terminal Position	6	8	7	1
UP	○—○	○—○	○—○	○—○
OFF	○—○	○—○	○—○	○—○
DOWN	○—○	○—○	○—○	○—○

ETOC210C

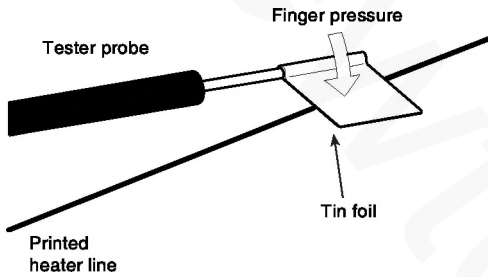
REAR WINDOW DEFOGGER

REAR WINDOW DEFOGGER PRINTED HEATER

INSPECTION EEAD778B

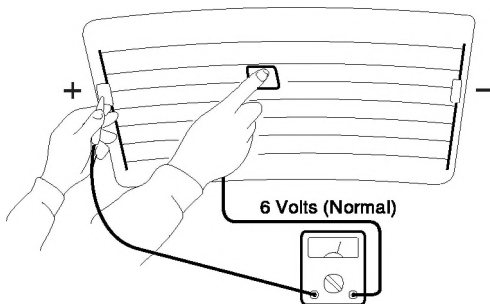
CAUTION

Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



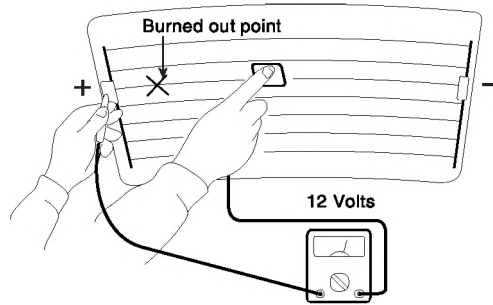
ETA9165A

1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



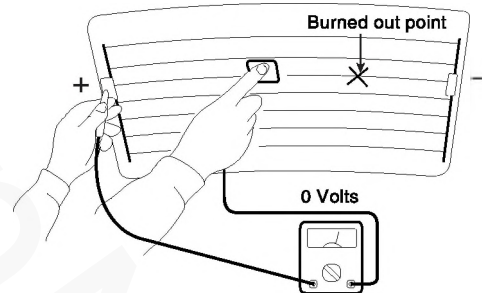
ETA9165B

2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



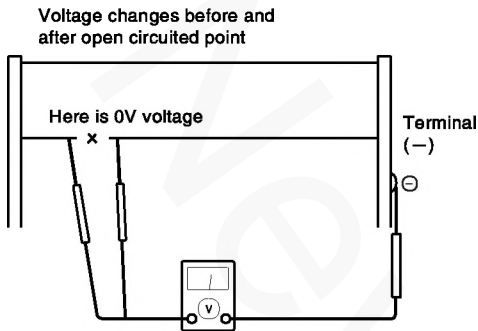
ETA9165C

3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



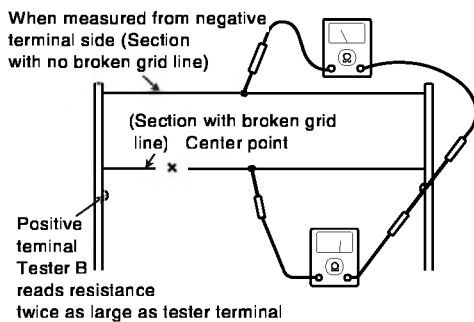
ETA9165D

- To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



ETA9165E

- Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.

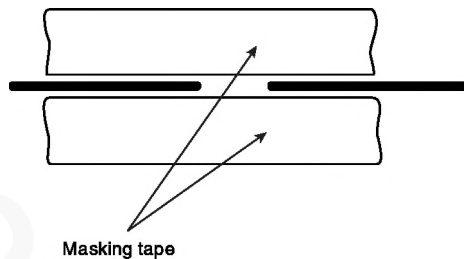


ETA9165F

REPAIR OF BROKEN HEATER LINE

Prepare the following items:

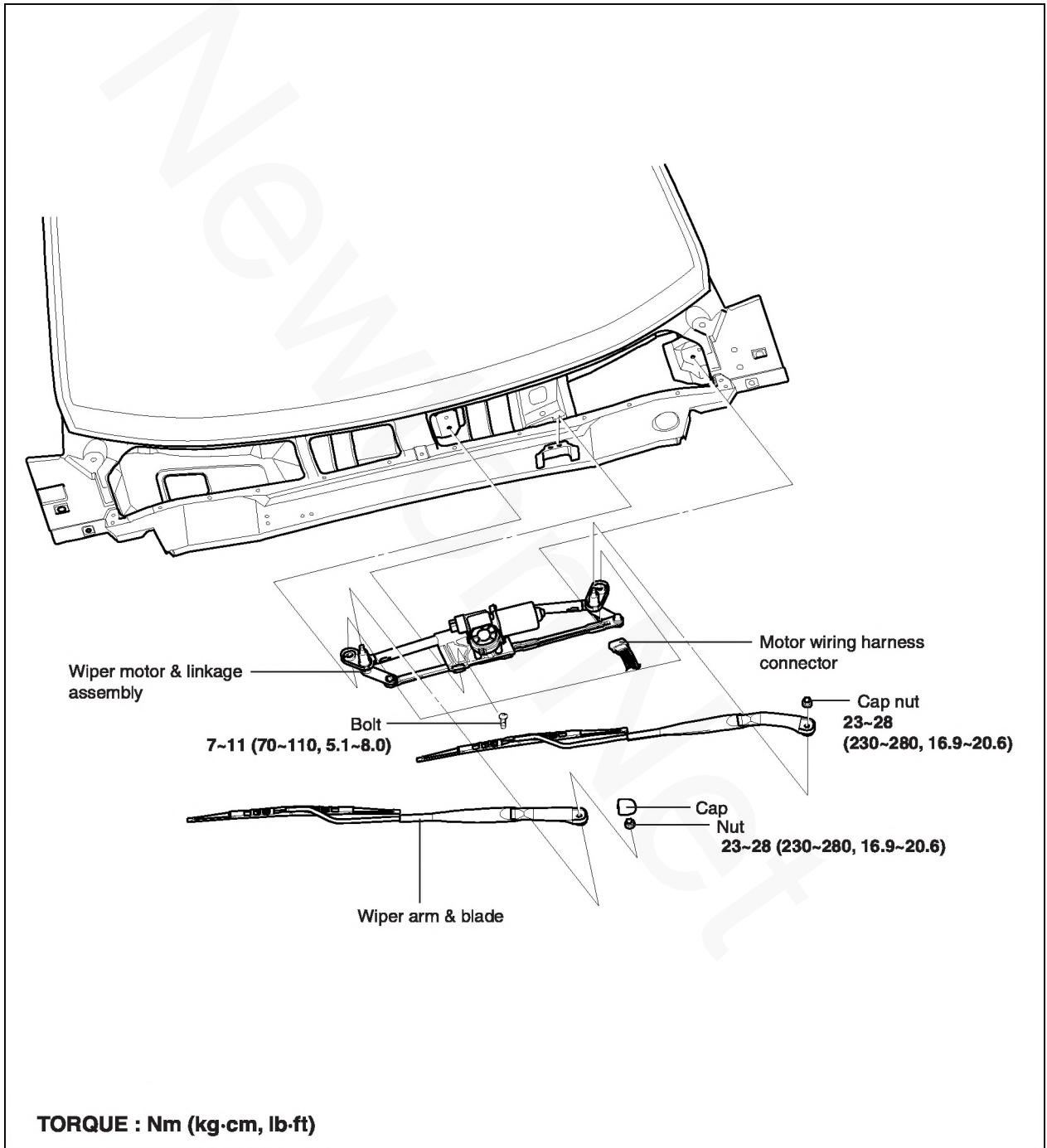
- Conductive paint.
- Paint thinner.
- Masking tape.
- Silicone remover.
- Using a thin brush :
Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).



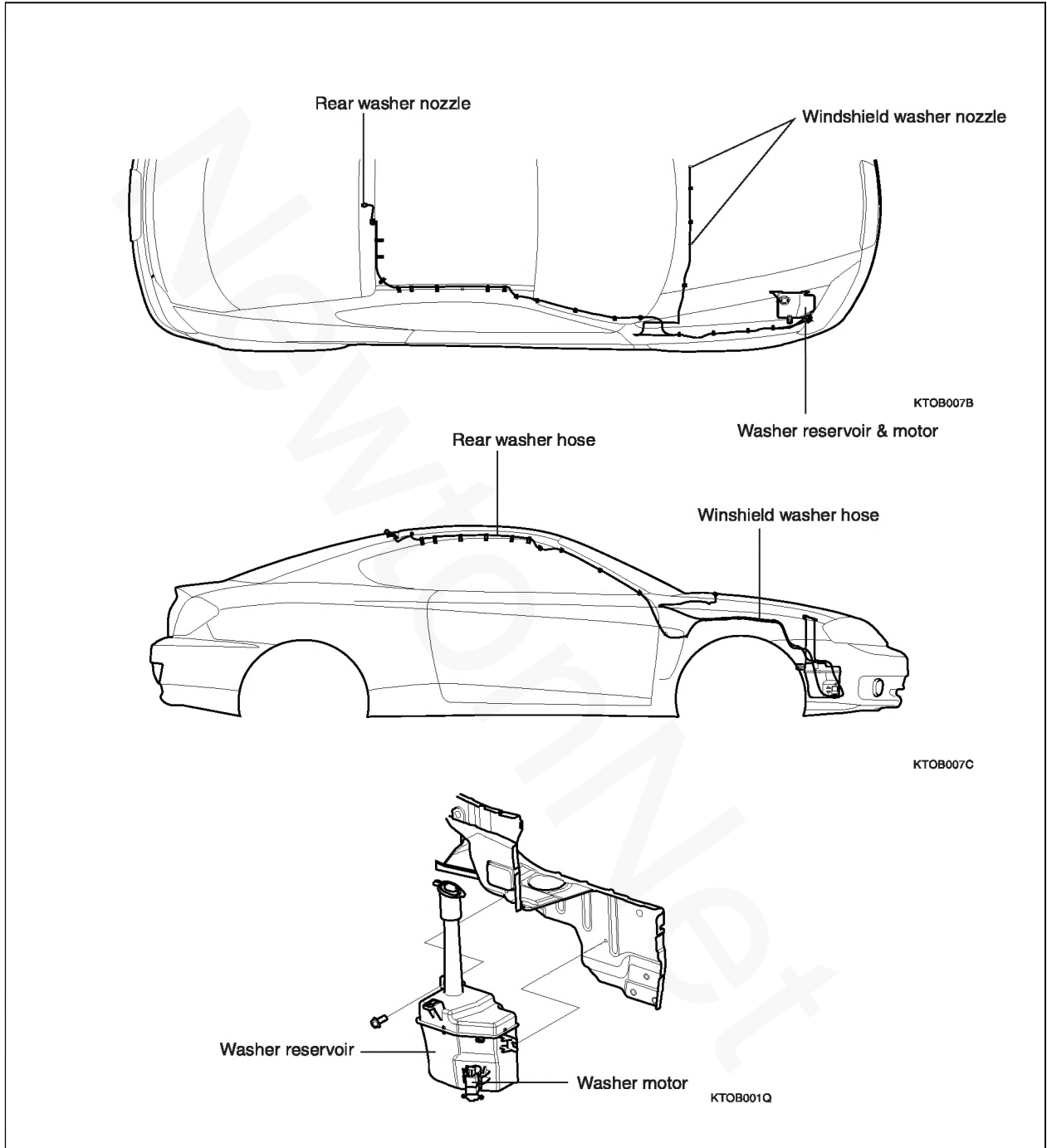
ETA9165G

WINDSHIELD WIPER / WASHER

COMPONENTS EB083DB2



WINDSHIELD WASHER INSTALLATION

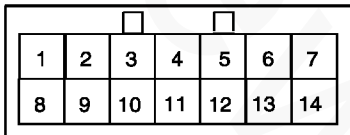


WINDSHIELD WIPER / WASHER SWITCH

INSPECTION E0E7BB4F

Remove the multifunction switch and disconnect the wire connectors.
 Check the switch for continuity between the terminals.
 If continuity is not as specified, replace the wiper and washer switch.

[M01-1]



ETNC195A

WIPER AND INTERMITTENT VOLUME SWITCH [M01-1]

Terminal Position	1	2	3	4	5	6	13	14
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○	○	○	○			
HI	○	○	○	○	○			

ETNC050B

WASHER SWITCH [M01-1]

Terminal Position	5	7
OFF		
ON	○	○

ETNC050C

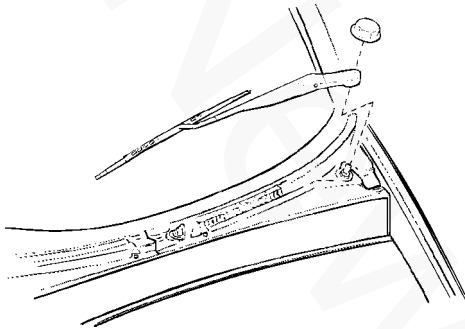
FRONT WIPER MOTOR

REMOVAL E4AA6F4E

1. Remove the wiper arm.

 **NOTE**

Care must be taken not to scratch the engine hood.

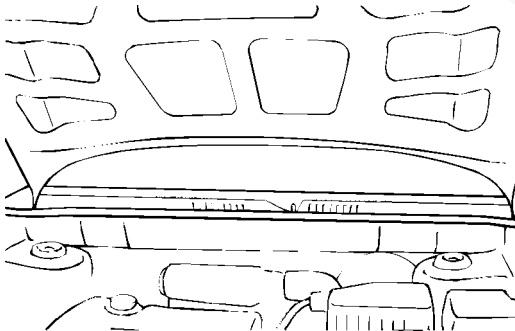


KTNB012J

Tightening torque

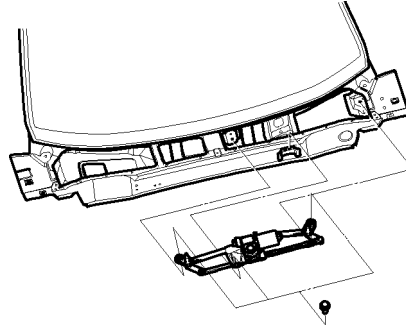
23~28 Nm (230~280 kg-cm, 16.9~20.6 lb-ft)

2. Remove the weatherstrip and cowl top cover after removing the retainers.



ETJA060G

3. Disconnect the windshield wiper motor connector and remove the 3 bolts holding the windshield wiper motor and linkage assembly.



KTOB007A

Tightening torque

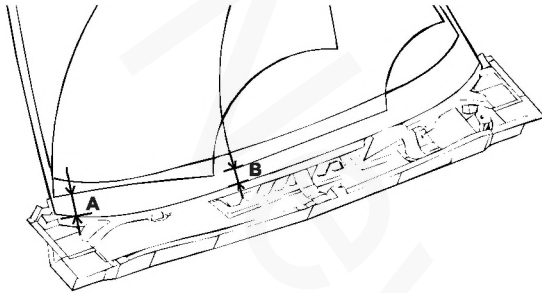
7~11 Nm (70~110 kg-cm, 5.1~8.0 lb-ft)

4. Installation is the reverse of removal.

INSTALLATION E92A1ED2

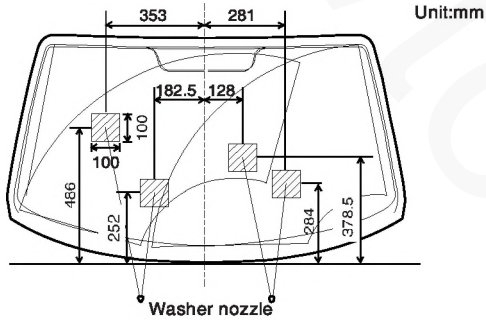
1. Install the wiper arm to the specified position.

Specified position	A	B
Distance (mm)	30~40	30~40



ETJA060I

2. Set the washer nozzle on the specified spray position.



ETOC230A

INSPECTION E5B8846B

SPEED OPERATION CHECK

1. Remove the connector from the wiper motor.
2. Attach the positive (+) lead from the battery to terminal 3 and the negative (-) lead to terminal 4.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 3 and the negative (-) lead to terminal 5.
5. Check that the motor operates at high speed.

[C07]



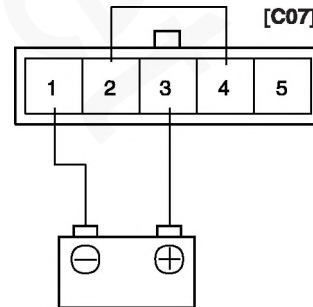
- | | |
|------------|---------|
| 1. Ground | 4. Low |
| 2. Parking | 5. High |
| 3. IGN+ | |

ETOC235A

AUTOMATIC STOP OPERATION CHECK

1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 4.
3. Connect terminals 2 and 4.
4. Connect the positive (+) lead from the battery to terminal 3 and the negative (-) lead to terminal 1.
5. Check that the motor stops running at the off position.

[C07]

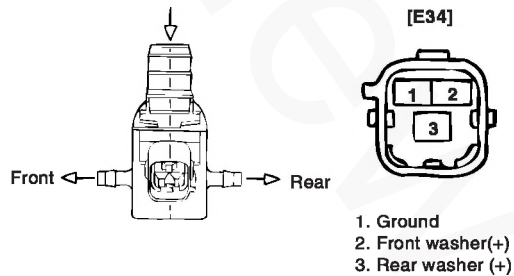


KTOB220B

FRONT WASHER MOTOR

INSPECTION EE6D9BD6

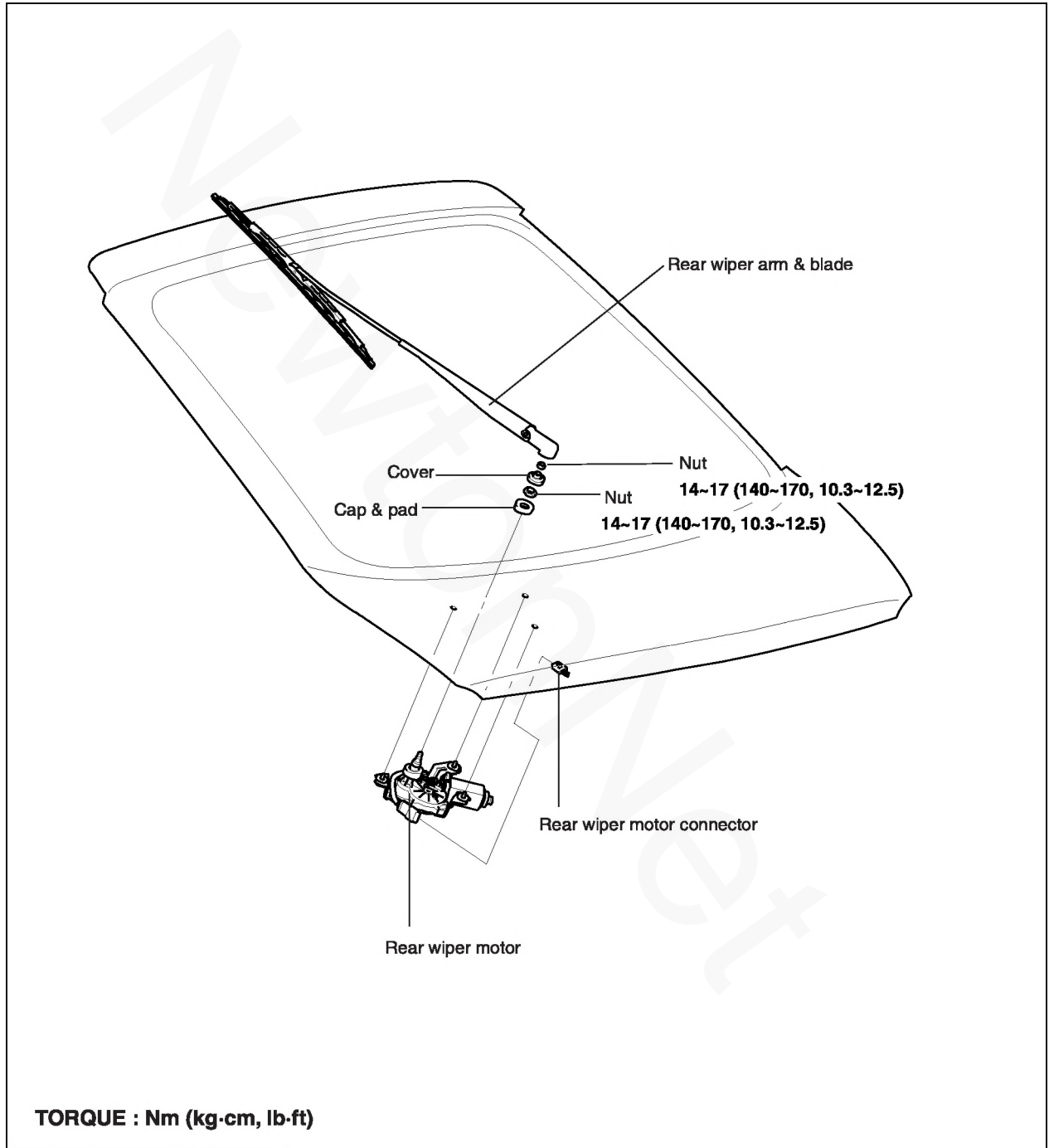
1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Connect positive (+) and negative (-) battery cables to terminals 2 and 1 respectively to see that the washer motor runs and water sprays from the front nozzles.
3. Check that the motor operates normally.



ETOC240A

REAR WIPER / WASHER

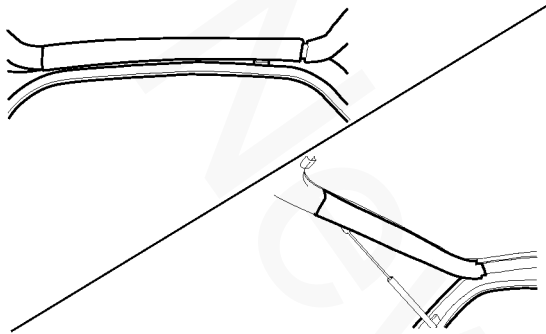
COMPONENTS E298B0E5



REAR WIPER MOTOR

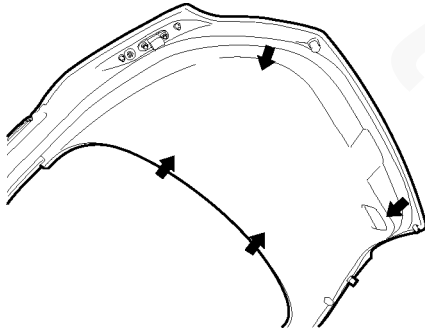
REMOVAL E7A9777F

1. Remove the upper and side trim from the tailgate frame.



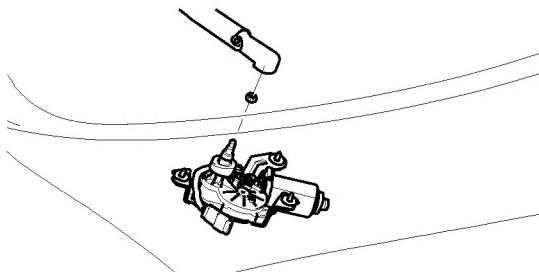
KTOB240A

2. Remove the tailgate trim panel after removing 4 screws.



KSOB030C

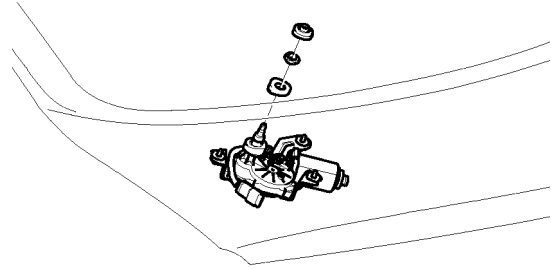
3. Remove the rear wiper arm after removing a nut.



KTOB004I

Tightening torque
14~17 Nm (140~170 kg-cm, 10.3~12.5 lb-ft)

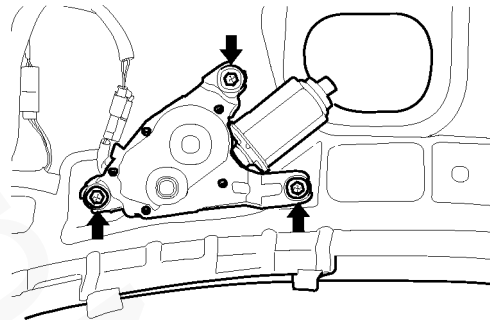
4. Remove the hexagonal nut after removing pivot cover.



KTOB004J

Tightening torque
14~17 Nm (140~170 kg-cm, 10.3~12.5 lb-ft)

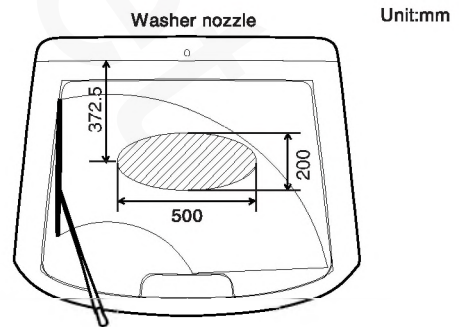
5. Remove the rear wiper motor after removing 3 bolts, and disconnect the motor's connector.



KSOB030I

INSTALLATION ECFD458A

1. Installation is the reverse of removal.
2. Set the washer nozzle on the specified spray position.



ETOC255A

INSPECTION E0E03B9E

1. Remove the connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 3 and 4 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.

[R13]

1	2	3	4

- | | |
|-------------|-----------|
| 1. IGN (B+) | 3. Switch |
| 2. Parking | 4. Ground |

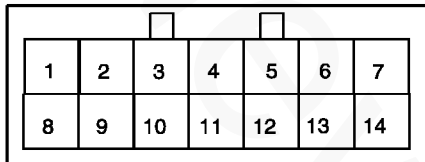
ETNC230A

REAR WASHER SWITCH

INSPECTION ECA46F9D

1. Disconnect the connector from the rear wiper and washer switch.
2. Check for continuity between the terminals.

[M01-1]



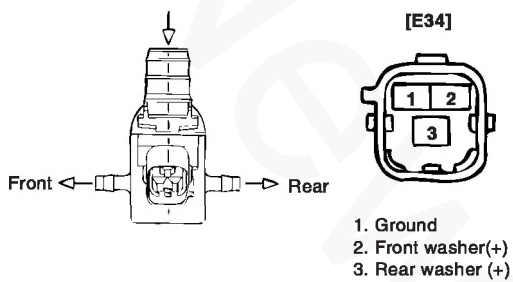
KTNB250A

Terminal Position	9	10	11	12
WASHER	○	—	—	○
OFF				
INT			○	○
ON		○	—	○
WASHER	○	—	—	○

ETNC235A

REAR WASHER MOTOR**INSPECTION** EF142EAA

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Connect positive(+) and negative(-) battery cables to terminals 3 and 1 respectively to see that the washer motor runs and water is pumped.

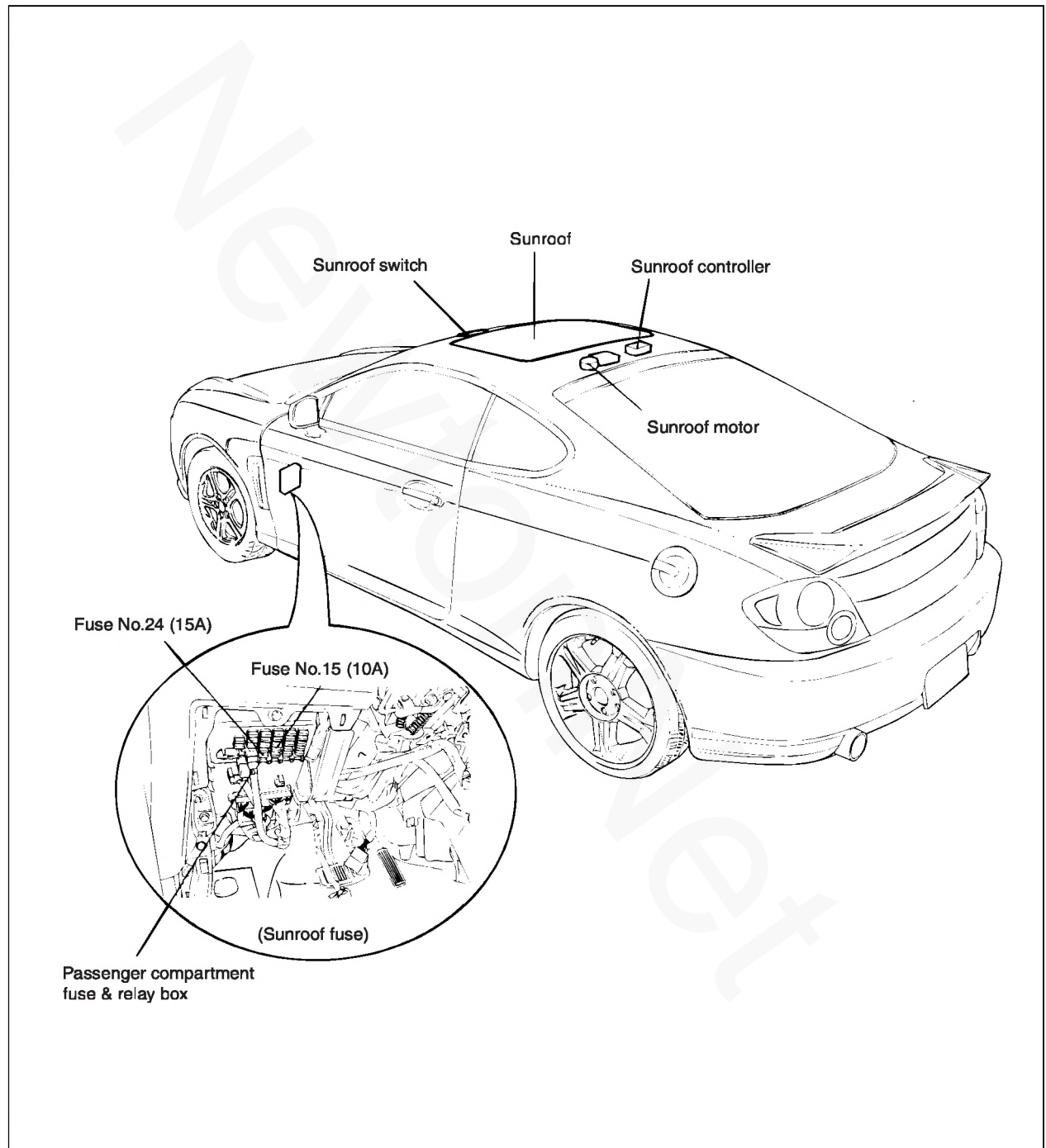


ETOC240A

3. Check that the motor operates normally.
Replace the motor if it operates abnormally.

SUNROOF

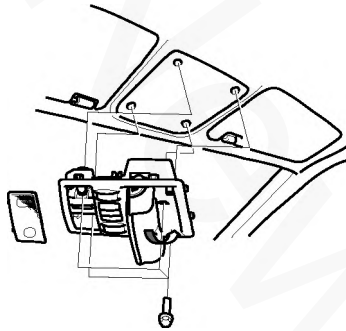
COMPONENTS EE98FE27



SUNROOF SWITCH

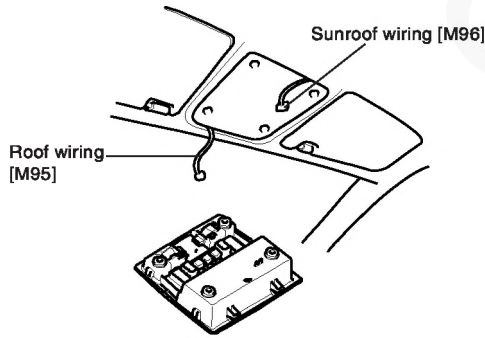
INSPECTION EB74BDA7

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens then remove the mounting screws (2EA) and open the overhead console case cover then remove the mounting screws (2EA).



KTOB007K

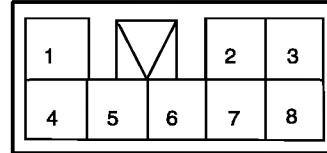
3. After disconnecting the roof wiring and sunroof wiring connector then remove the overhead console lamp assembly from the headliner.



ETOE280A

4. Using an ohmmeter, check for continuity between the terminals.
If the continuity is not as specified, replace the sun roof switch.

[M96]



(Sunroof switch side connector)

ETOE270A

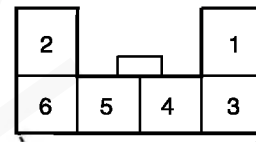
[M96]

Terminal		Position				
		1	2	3	7	8
Slide switch	Open	○	—	○		
	Close	○	○			
Tilt switch	Up	○	—	—	○	
	Down	○	—	—	—	○

ETOC280B

5. Verify power and ground continuity between the M95 and M96 terminals.

[M95]



(Roof wire harness side connector)

ETOE270B

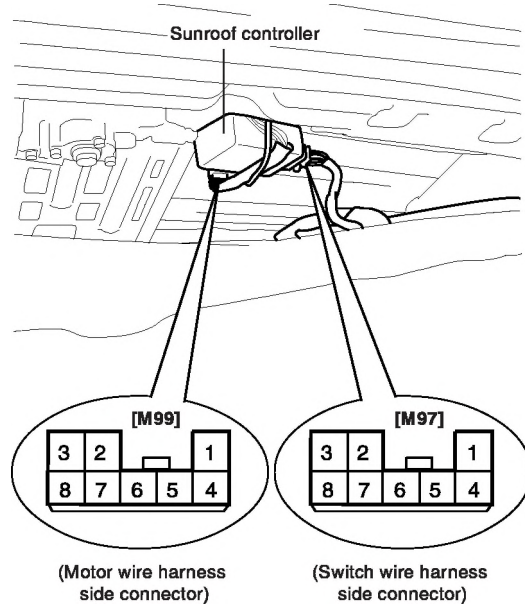
Function	M95 Pin	M96 Pin
Ground	6 ○	○ 1
IGN2	2 ○	○ 6
Battery (+)	3 ○	○ 4

ETOE270C

SUNROOF CONTROLLER

INSPECTION E8DF0B1C

1. Pull down the rear headliner.
2. Disconnect the sunroof switch side connector from the sunroof controller.



ETOE285A

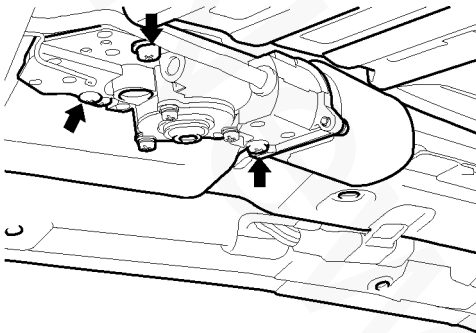
3. Inspect the connectors on the wire harness side from the controller, as shown in the table.

Connector	Tester connection	Condition	Specified condition
M97	1-Ground	Constant	Continuity
	2-Ground	Sunroof switch is in the close position	Continuity
	3-Ground	Sunroof switch is in the open position	Continuity
	4-Ground	Constant	Battery voltage
	6-Ground	Ignition switch ON	Battery voltage
	7-Ground	Sunroof switch is in the tilted up position	Continuity
	8-Ground	Sunroof switch is in the tilted down position	Continuity
M99	3-Ground	Constant	Continuity
	1(+) ~ 2(-)	Apply the battery voltage to the terminal No.1 and ground to terminal No.2	Motor turns clockwise
	1(-) ~ 2(+)	Apply the battery voltage to the terminal No.2 and ground to terminal No.1	Motor turns counter-clockwise

SUNROOF MOTOR

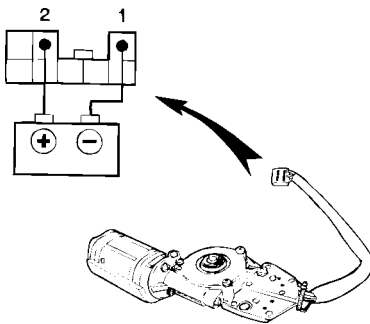
INSPECTION EBEBCABB

1. Pull down the rear headliner.
2. Disconnect the motor side connector from the sunroof controller.
Remove the sunroof motor after removing 3 screws.



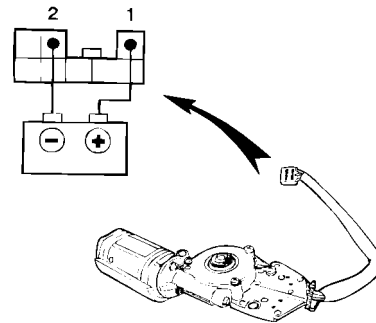
KSOB060P

3. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 1, check that the motor turns counterclockwise (moves toward the close and down position).



ETOC280H

4. Reverse the polarity, check that the motor turns clockwise (moves toward the up and open position).
If operation is not as specified, replace the motor.



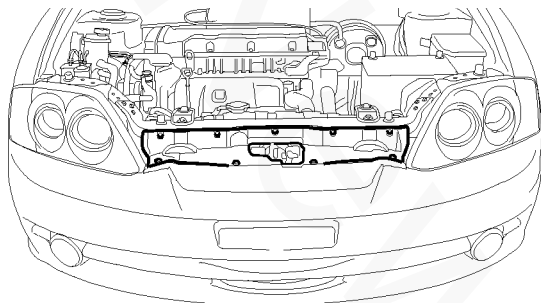
ETOC280I

LIGHTING SYSTEM

REPLACEMENT OF LAMPS E4F9D43E

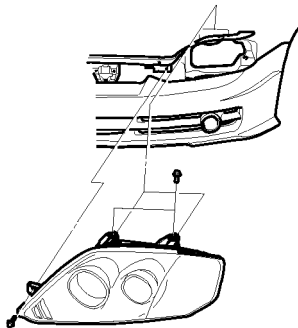
HEAD LAMP/TURN SIGNAL LAMP

1. Disconnect the negative battery terminal.
2. Remove the front bumper upper cover.

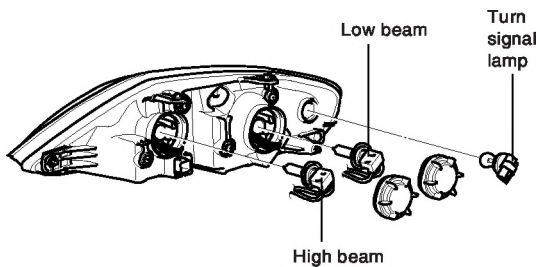


KTOB007G

3. Remove the head lamp and turn signal lamp mounting bolts (3EA) and remove the lamp assembly.



KTOB007F

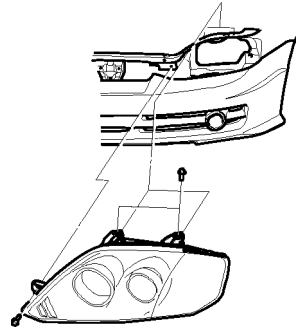


ETOC300A

4. Installation is the reverse of removal.

FRONT FOG LAMP

1. Disconnect the negative battery terminal.
2. Remove the turn signal lamp and head lamp assembly.



KTOB007F

3. Remove the front bumper cover (Refer to BD group). Disconnect the wire connector and remove the front fog lamp.

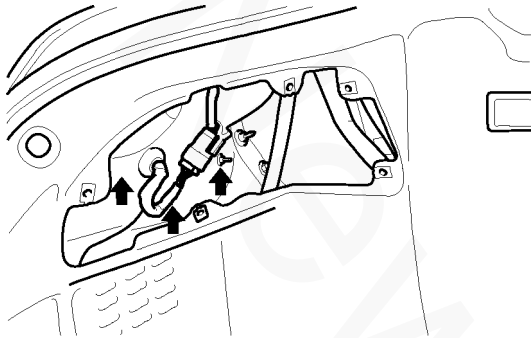


KTOB007H

4. Installation is the reverse of removal.

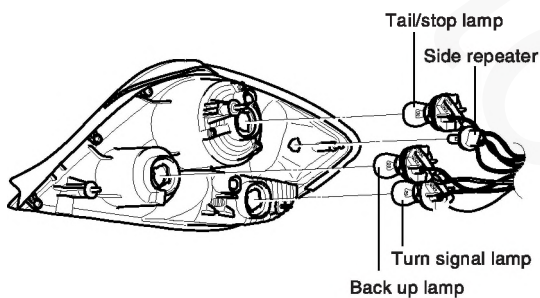
REAR COMBINATION LAMP

1. Disconnect the negative battery terminal.
2. Remove the luggage trim side cover.
3. Remove the 3 screws holding the rear combination lamp and disconnect the wire connectors.



KTOB007I

4. Remove the rear combination lamp assembly.



ETOC300B

5. Installation is the reverse of removal.

CENTER HIGH MOUNTED STOP LAMP

1. Disconnect the negative battery terminal.
2. Remove the rear spoiler after removing 4 nuts. (External spoiler type)
3. Remove the center high mounted stop lamp assembly.
4. Installation is the reverse of removal.

LICENSE PLATE LAMP

1. Disconnect the negative battery terminal.
2. Remove the mounting screws and disconnect the lamp connector.
3. Installation is the reverse of removal.

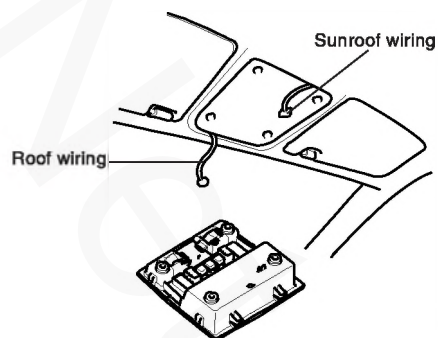
OVERHEAD CONSOLE LAMP

1. Disconnect the negative battery terminal.
2. Detach the map lamp lens from the lamp assembly with a flat-tip screwdriver.
3. Detach the lamp assembly from the headliner after removing the 4 screws.



KTOB007K

4. Disconnect the wiring connectors from the headliner.

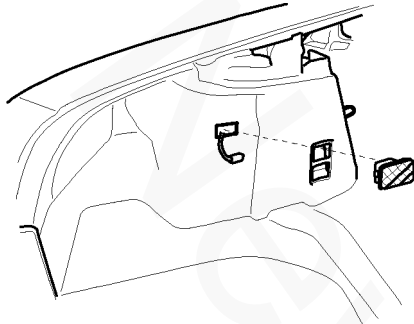


ETOC280A

5. Installation is the reverse of removal.

LUGGAGE LAMP

1. Disconnect the negative battery terminal.
2. Detach the luggage lamp assembly from the luggage side trim with a flat-tip screwdriver.



KTOB007J

3. Installation is the reverse of removal.

INSPECTION OF COMPONENTS EE36EBC1

HEAD LAMP RELAY

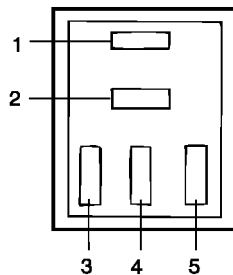
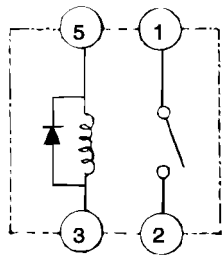
1. Remove the head lamp relay from the relay box in the engine compartment.
2. Check for continuity between terminals on the relay.

Terminal Position	1	2	3	5
When de-energized			○ — ○	
When energized	○ — ○		⊖ — ⊕	

NOTE:

1. ○ — ○: Indicates that there is continuity between the terminals.
2. ⊖ — ⊕: Indicates that power is supplied.

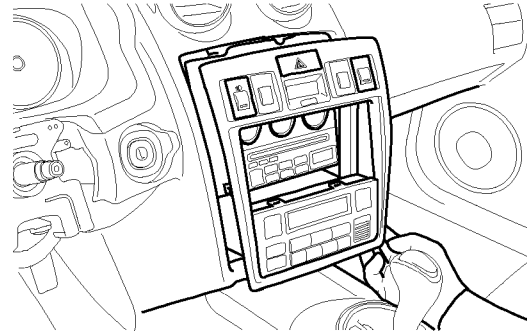
ETMB275A



KTMB365B

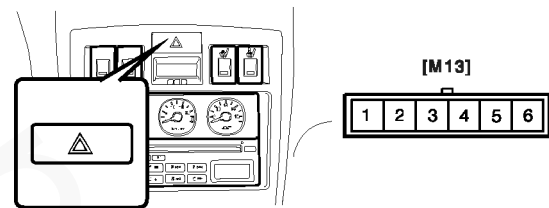
HAZARD SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel with a flat-tip screwdriver.



KTOB004A

3. Detach the hazard lamp switch from the center facia panel.



KTOB280A

4. Operate the switch and check for continuity between terminals with an ohmmeter.

[M13]

Terminal Position	1	2	3	4	5	6
OFF						
ON	○ — ○	⊖ — ⊕				○ — ○

ETOC305A

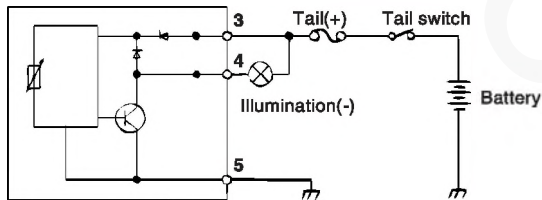
RHEOSTAT

1. Disconnect the negative (-) battery terminal.
2. Disconnect the rheostat connector from the crash pad panel.



KTOB290H

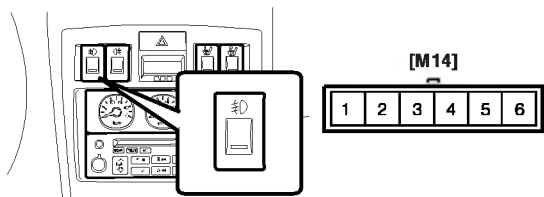
3. Check for intensity. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.



ETNC260B

FRONT FOG LAMP SWITCH

1. Disconnect the negative (-) battery terminal.
2. Detach the switch connector from the center facia panel.



KTOB290J

3. Operate the switch and check for continuity between the terminals with an ohmmeter.

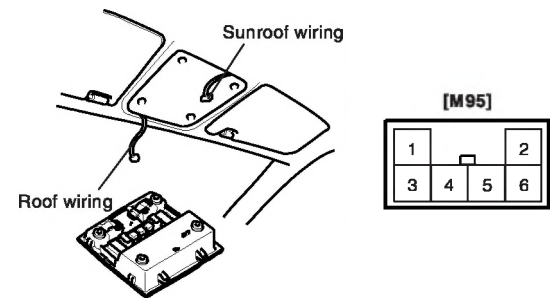
[M14]

Terminal Position	1	2	3	4	5	6
ON			○	○	○	○
OFF	○	○				

ETOC305B

MAP LAMP SWITCH

Remove the overhead console assembly and check for continuity between terminals.



ETOC305C

[M95]

Terminal Position	4	5	6
ON		○	○
DOOR	○	○	
OFF			

ETOC305D

HEAD LAMPS

ADJUSTMENT E58EEFC3

HEAD LAMP AIMING

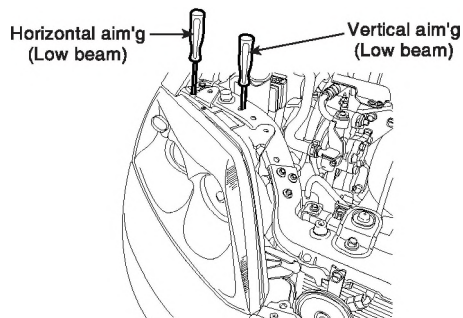
The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

 **NOTE**

If there are any regulations pertinent to the aiming of headlamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

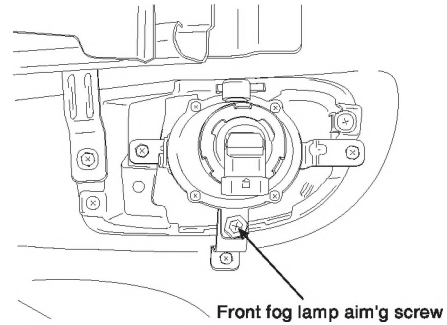
Alternately turn the adjusting gear to adjust the headlamp aiming. If beam-setting equipment is not available, proceed as follows:

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 headlamp centers) and a horizontal line (Horizontal line passing through center of headlamps) on the screen.
4. With the headlamp and battery in normal condition, aim the headlamps so the brightest portion falls on the horizontal and vertical lines. Make vertical and horizontal adjustments to the lower beam using the adjusting wheel.

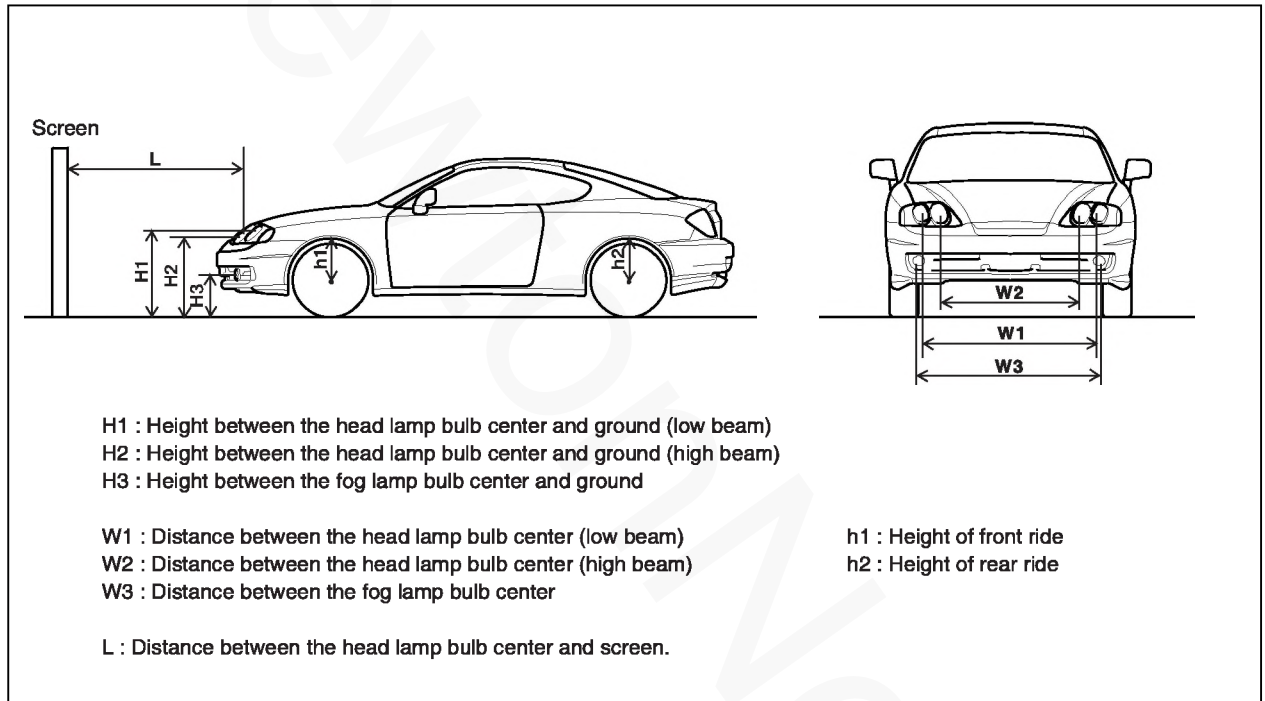


FRONT FOG LAMP

The front fog lamps should be aimed in the same manner as the head lamps.
 With the front fog lamps and battery normal condition, aim the front fog lamps by using the adjusting wheel.



ETOF100B



ETOF310B

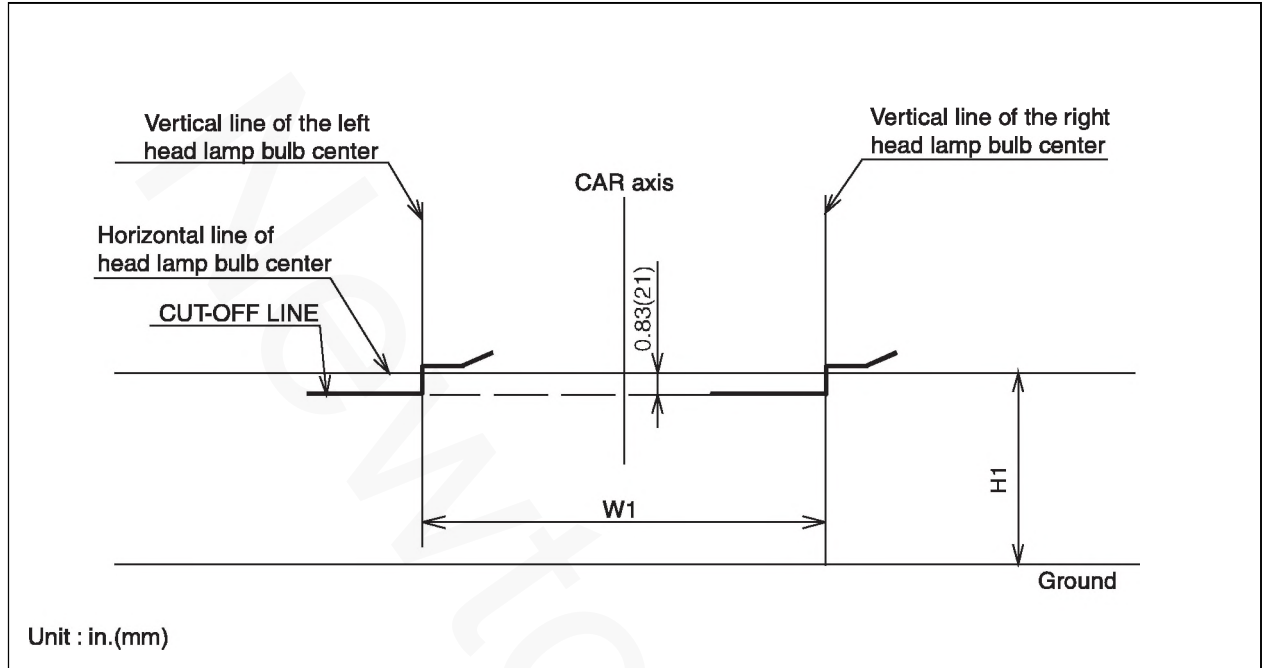
HEAD LAMP AND FOG LAMP AIMING POINT

Unit : mm

Vehicle condition	H1	H2	H3	h1	h2	W1	W2	W3	L
Without driver	679	672	354	368	365	1,202	966	1,240	3,000
With driver	673	666	348	-	-				

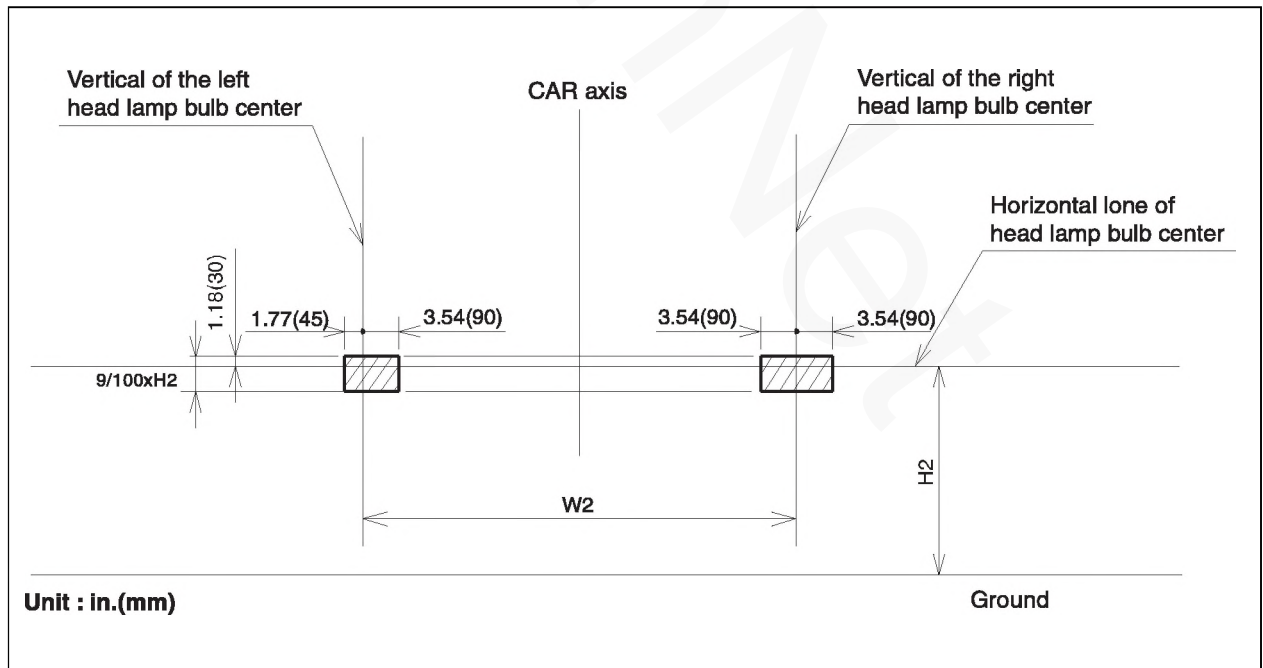
ETOF310G

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



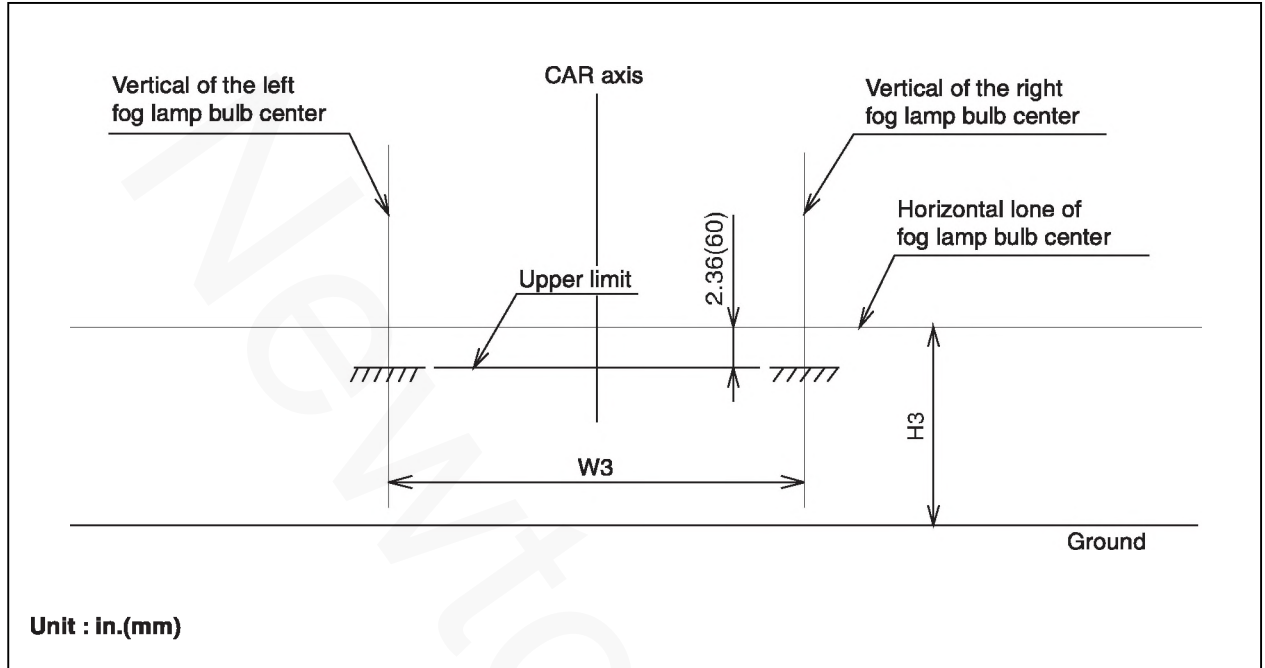
ETOF310H

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



ETOF310E

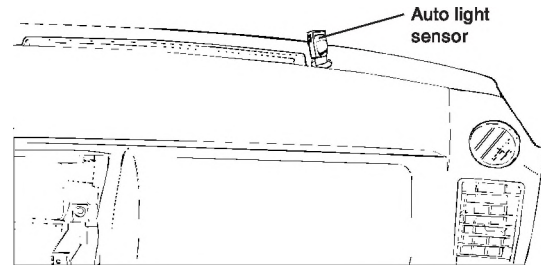
- 3. Turn the front fog lamp on without driver aboard.
The cut-off line should be projected in the allowable range (shaded region).



AUTO LIGHTING CONTROL SYSTEM

DESCRIPTION E0AE2758

The auto light control system operates by using the auto light switch and the auto light sensor detect the illumination then turns the head lamp and tail lamp on or off automatically in accordance with the detection illumination.

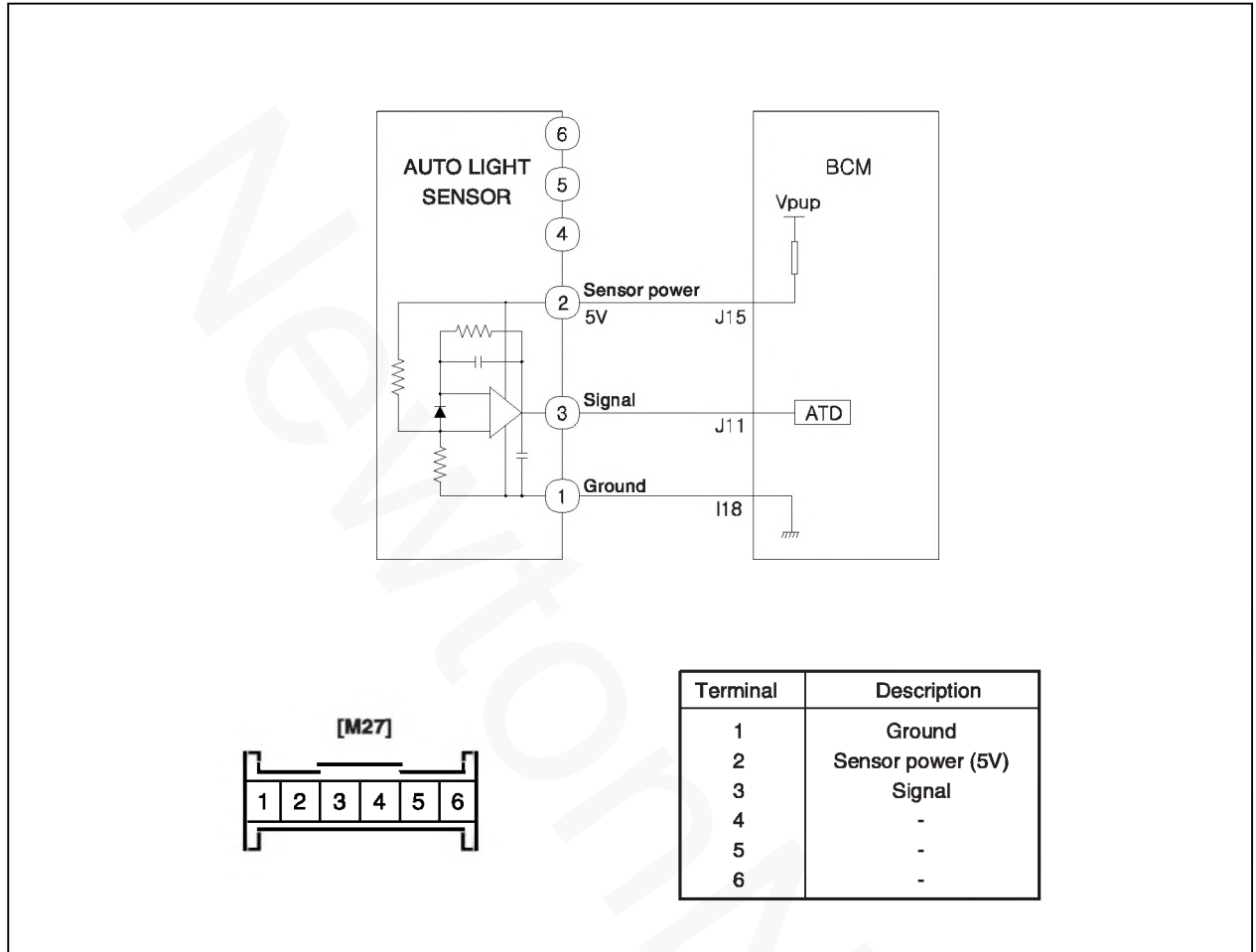


ETOC315A

SPECIFICATIONS

Items		Specifications
Rated voltage		DC 5V
Operating current		Max. 1mA
Detection illumination	Tail lamp	ON : 23.1 ± 3.4 (Lux), 1.77 ± 0.08 (V) OFF : 48.0 ± 3.4 (Lux), 3.47 ± 0.10 (V)
	Head lamp	ON : 6.2 ± 1.4 (Lux), 0.63 ± 0.06 (V) OFF : 12.0 ± 1.4 (Lux), 1.02 ± 0.06 (V)

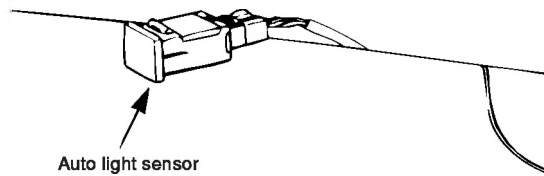
CIRCUIT DIAGRAM EFC1AB6B



ETOC320A

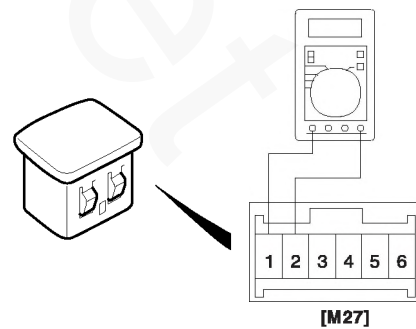
INSPECTION E2EE25DD

1. Detach the auto light sensor in the upper crash pad.



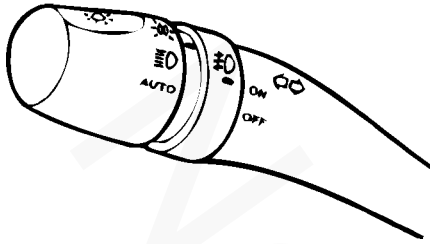
ETOC325A

2. Check the continuity between terminal 2(+) and terminal 1 (-).



ETOC325B

3. Check the continuity between the terminals while operating the switch.



ETB9010E

AUTO LIGHT SWITCH [M01-2]

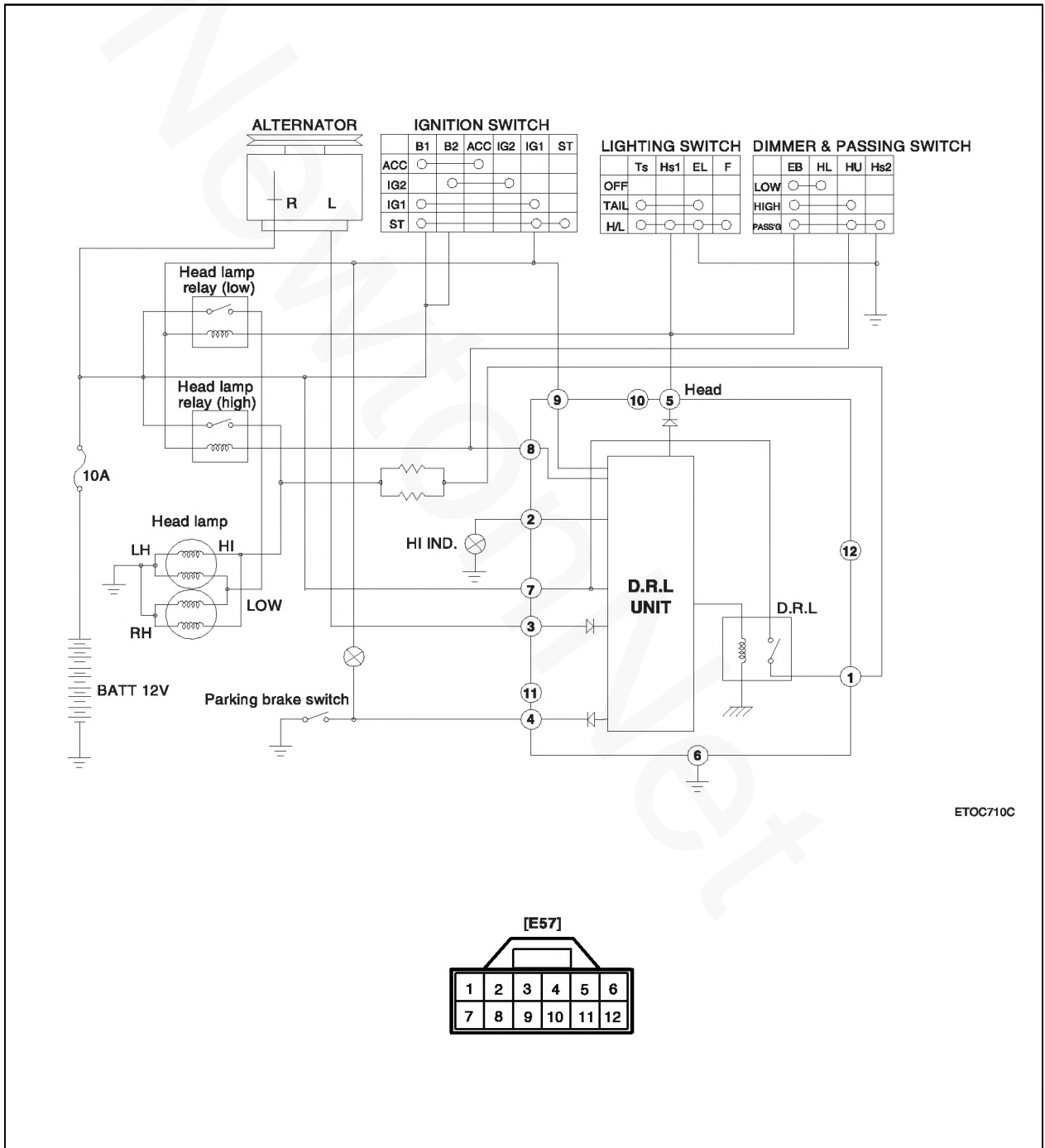
Terminal Position	14	15	16	17
OFF				
I	○	—————	—————	○
II	○	○	○	○
AUTO			○	○

ETOC060A

DAYTIME RUNNING LIGHTS

DRL CONTROL MODULE

CIRCUIT DIAGRAM EF85FEED

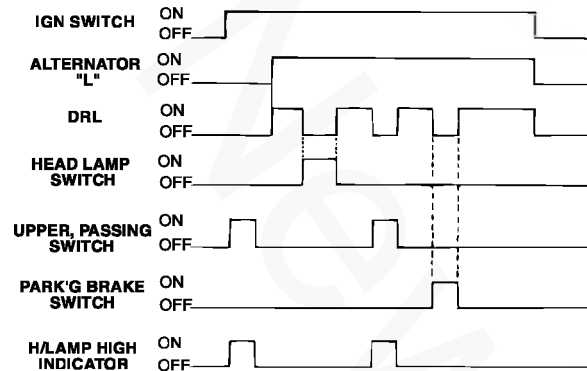


ETOC710C

INSPECTION ECE5CA7A

OPERATION CHECK

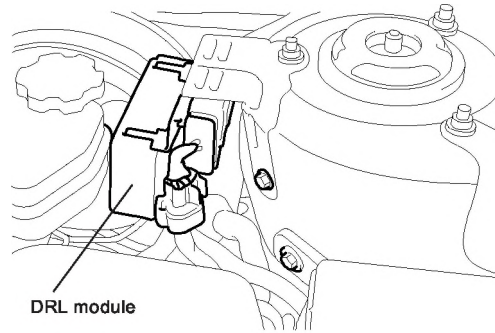
Check that the lights operate according to the following timing chart.



ETOE010M

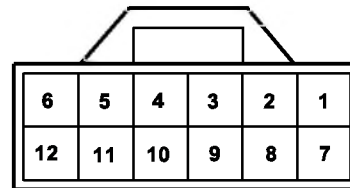
INSPECT CIRCUITS FOR DAYTIME RUNNING LIGHT SYSTEM

1. Disconnect the wire connector to DRL module from engine compartment.



ETOC711A

2. Inspect the connector on wire harness side as shown.



(DRL module harness side connector)

ETOE275A

Check For	Test Connect	Condition	Test Specification		
Continuity	4-Ground	Parking brake switch	OFF (Released) ON (Pull up)	No continuity Continuity	
		5-Ground	Head lamp switch	OFF ON	No continuity Continuity
	6-Ground			Constant	Continuity
	9-Ground	Dimmer&passing switch	Head light ON Head light OFF	Continuity No continuity	
			Voltage	9-Ground	Ignition switch
	5-Ground	Ignition switch			
7-Ground				Constant	Battery voltage
3-Ground	Engine	Stop Running		No voltage Battery voltag	

3. If circuit is not as specified, refer to schematic diagram and inspect for short circuits.

IMMOBILIZER CONTROL SYSTEM

DESCRIPTION EC7BE4F6

There are two types of immobilizer functions available on the Body Control Module (BCM). The first is a "SMARTRA (SMART TRansponder Antenna)" type and the second is a "stand alone" type that will emulate the system known as the "SCE immobilizer". The hardware to support both types of immobilizer systems in the BCM is identical. The selection of immobilizer type within the BCM is effected by setting the appropriate EEPROM byte.

All communications between the BCM and the ECM (Engine Control Module) for the purposes of immobilization will be over the W line.

The diagnostics communication for the SMARTRA system will be performed by communicating with the ECM on it's K line. The ECM will then perform diagnostics on the BCM via the W line.

At the time of Transponder validation, the BCM devotes 100% processing power to the validation process in order to respond in the required time. During transponder validation, other BCM functions may be influenced.

1. SMARTRA type immobilizer

The "SMARTRA" type immobilizer system is applied to the 2.0β engine.

The immobilizer system consists of a passive challenge-response (mutual authentication) transponder inside the key head, a stand alone antenna, the BCM unit and the ECM. The BCM unit shall emulate the original SMARTRA immobilizer as closely as possible. In this document, the BCM emulating the original SMARTRA shall just be known as SMARTRA.

In the SMARTRA system, the immobilizer is contained within the ECM. The BCM shall provide the low-level routines and hardware necessary to communicate with the transponder.

2. Stand alone type immobilizer

The "Stand alone" type immobilizer system is applied to the 2.7δ engine.

The immobilizer system consists of a passive challenge-response (mutual authentication) transponder inside the key head, a stand alone antenna, the BCM unit and the ECM. The BCM unit shall emulate the original SCE type immobilizer to ECM protocol as closely as possible.

In the Stand alone immobilizer system, the immobilizer is contained within the BCM. The ECM shall request the BCM for permission to start the vehicle. The BCM shall perform the immobilisation functions and reply "start" or no start" permission to the ECM.

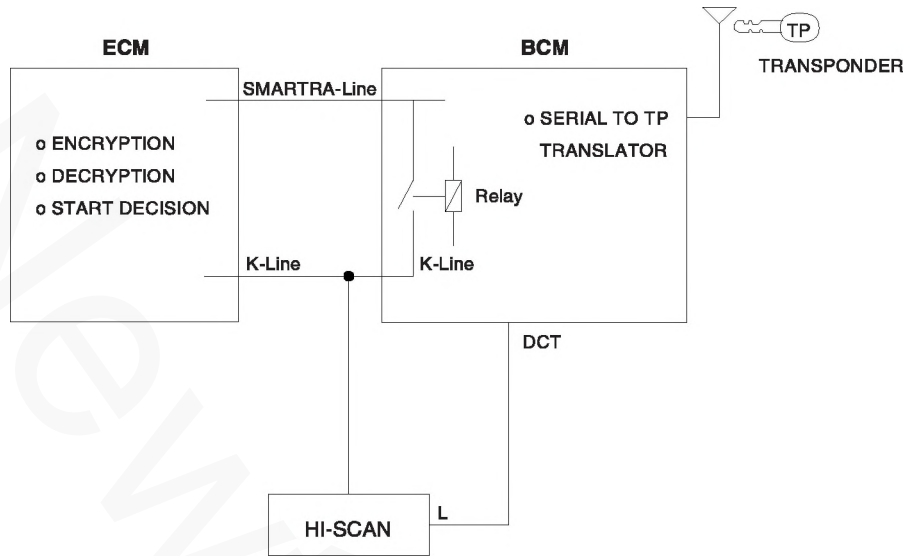
SYSTEM BLOCK DIAGRAM

The source of diagnostics commands for immobilizer equipped BCM's is different depending upon the type of immobilizer used. The diagnostics communication for the SMARTRA system will be performed by communicating with the ECM on its K line.

In the case of a BCM that has an immobilizer, the detection of a tester being present will cause the K-line enable relay to close and the Diag pull up to be switched off. This mode of the diagnostics interface is called "Diagnostics" mode. This will then remain the case until the tester is disconnected. When the K-line enable relay is off and the diag pull up is enabled, this mode is called "immobilizer" mode.

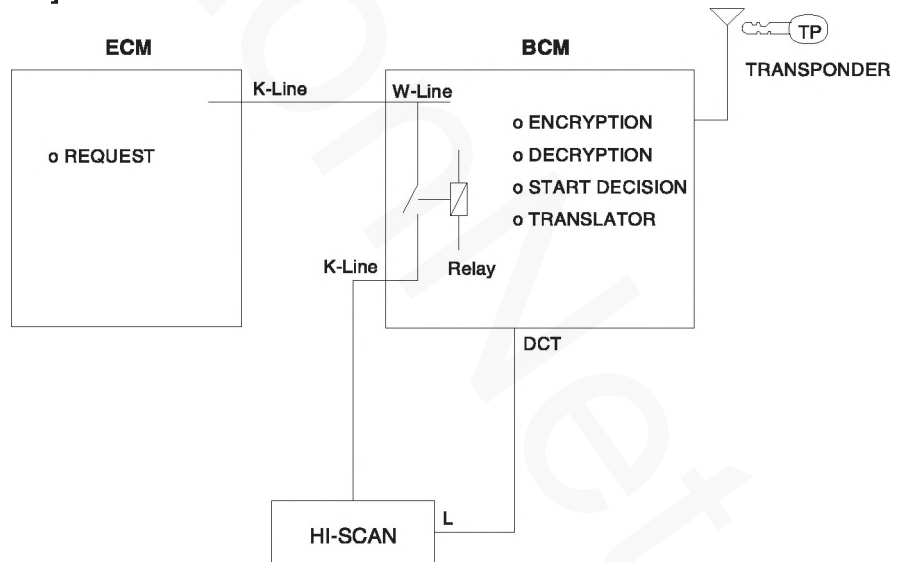
[SMARTRA TYPE]

- 2.0β Engine

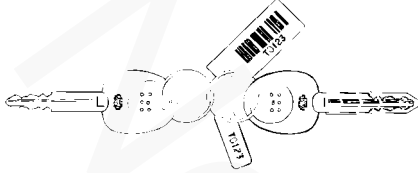
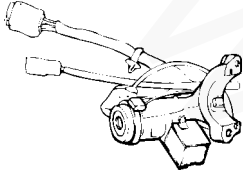
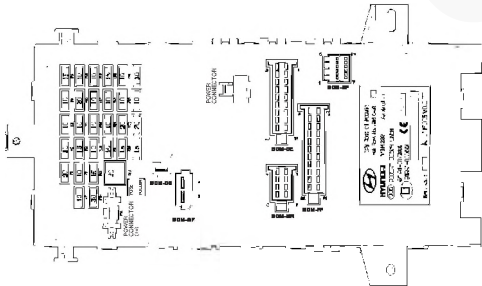
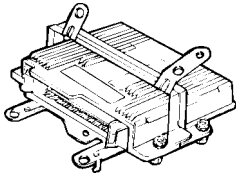


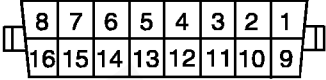

[STAND ALONE TYPE]

- 2.7δ Engine



COMPONENTS EADC1AFE

COMPONENT	DESCRIPTION
<p data-bbox="347 501 687 528">TRANSPONDER (Built-in keys)</p>  <p data-bbox="746 842 823 860">ETKA470C</p>	<p data-bbox="842 528 1342 607">When ignition is ON, the coil supplies energy to the transponder, which in turn accumulates energy in the condenser.</p> <p data-bbox="842 611 1406 689">Once the energy supplied from the coil has stopped, using the stored energy in the condenser, the transponder transmits the secret data.</p> <p data-bbox="842 694 1437 721">The transponder has an advanced encryption algorithm.</p> <p data-bbox="842 725 1433 804">During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory.</p> <p data-bbox="842 808 1449 857">The write procedure is once only ; therefore, the contents of the transponder can never be modified or changed.</p>
<p data-bbox="427 875 608 902">COIL ANTENNA</p>  <p data-bbox="746 1122 823 1140">B6BE225C</p>	<p data-bbox="842 902 1230 929">Supplies energy to the transponder.</p> <p data-bbox="842 934 1251 960">Receives signal from the transponder.</p> <p data-bbox="842 965 1256 992">Sends transponder signal to the BCM.</p>
<p data-bbox="328 1155 707 1182">BODY CONTROL MODULE (BCM)</p>  <p data-bbox="746 1547 823 1565">ETOF352A</p>	<p data-bbox="842 1182 1449 1406">The BCM carries out communication with the built - in transponder in the ignition key. This wireless communication runs on RF (Radio Frequency). The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the BCM. And, the received messages from the ECM are converted into an RF signal, which is transmitted to the transponder by the antenna.</p> <p data-bbox="842 1411 1422 1489">In case of "SMARTRA" type immobilizer system the BCM does not carry out the validity check of the transponder or the calculation of encryption algorithm.</p> <p data-bbox="842 1494 1430 1572">This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the ECM and vice versa.</p>
<p data-bbox="316 1583 719 1610">ENGINE CONTROL MODULE (ECM)</p>  <p data-bbox="746 1827 823 1845">B6BE710E</p>	<p data-bbox="842 1612 1433 1720">In case of "SMARTRA" type immobilizer system the ECM carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the ECM simultaneously.</p> <p data-bbox="842 1724 1406 1803">Only if the results are equal can the engine be started. The data of all transponders, which are valid for the vehicle, are stored in the ECM.</p>

<p>DATA LINK CONNECTOR (DLC)</p>  <p style="text-align: right;">B6BE710F</p>	<p>By connecting the voltmeter or Hi-scan, the control module diagnostic code can be read.</p>
<p>DIAGNOSTIC TESTER</p>  <p style="text-align: right;">ETHB001T</p>	<p>Has the function BCM, ECM, and key diagnosis and change.</p>

IMMOBILIZER STATES E7BAEBFF

The ECM has three defined states. These are described below.

1. Engine Control Module (ECM) States

State	Description
Virgin State	<ul style="list-style-type: none"> • The ECM is delivered to HMC in virgin state • There is no Vehicle Identification Number (VIN) stored in the ECM • It can only be in virgin state once • The ECM will allow starting on the second cycle of ignition • Virgin state is exited when a VIN has successfully been taught by the BCM
Learnt State	Engine start is possible only when the received VIN from the BCM matches that stored in the ECM
Neutral State	<ul style="list-style-type: none"> • VIN has been deleted • Same as virgin state except engine starting not possible on the second cycle of ignition • Neutral state is entered if the BCM changes to neutral state

2. Body Control Module (BCM) states

The Body Control Module (BCM) has three defined states. These are described below.

State	Description
Virgin State	<ul style="list-style-type: none"> • The BCM is set to virgin state during manufacture • The BCM can be set back to virgin state by issuing an 'Initiate BCM' command • The diagnostics password is set to the default • No VIN is stored • Virgin state is exited only after the VIN been learned
Learnt State	The BCM contains a VIN
Neutral State	<ul style="list-style-type: none"> • The BCM is set to neutral state by issuing a 'Teaching ECM' command • The purpose of the neutral state is to allow the ECM to be set to neutral state • The BCM neutral state expires 10 seconds after an ignition ON→OFF cycle

TEACHING PROCEDURES**1. Key Teaching Procedure**

Key teaching must be done after replacing a defective ECM or when providing additional keys to the vehicle owner.

The procedure starts with an ECM request for vehicle specific data from the tester. The "virgin" ECM stores the vehicle specific data and the key teaching can be started. The "learnt" ECM compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can proceed.

If incorrect vehicle specific data have been sent to the ECM three times, the ECM will reject the request of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After reconnecting the battery, the timer starts again for one hour.

The key teaching is done by ignition on with the key and additional tester commands. The ECM stores the relevant data in the EEPROM and in the transponder. Then the ECM runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.

If the key is already known to the ECM from a previous teaching, the authentication will be accepted and the EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder).

The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognized by the ECM. This rejects the key and a message is sent to the tester.

The ECM rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the ECM detects different authenticators of a transponder and an ECM, the key is considered to be invalid.

The maximum number of taught keys is 4.

If an error occurs during the Immobilizer Service Menu, the ECM status remains unchanged and a specific fault code is stored.

If the ECM status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at ECM.

2. User Password Teaching Procedure

The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits.

User password teaching is only accepted by a "learnt" ECM. Before first teaching of user password to an ECM, the status of the password is "virgin". No limp home function is possible.

The teaching is started by ignition on, with a valid key and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt".

The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the ECM requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.

If incorrect user passwords or wrong vehicle specific data have been sent to the ECM three times, the ECM will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.

THE USER PASSWORD CAN BE IN THE STATUS**00. Not yet checked**

The status is stored in the EEPROM. In case of incorrect or no plausible data from this circuit, the ECM cannot check the status and the ECM sends 00.

01. Learnt

The password has been taught successfully to the ECM.

02. Virgin

This is the status at the end of the ECM production line before delivery to the final customer.

04. Locked by timer

After a certain number of incorrect inputs, the ECM is locked for one hour and no inputs are accepted during this time.

05. Teaching not accepted

This status is set if, for example, the ECM is in neutral status.

LIMP HOME FUNCTION

Limp home mode allows the driver to start a car when the immobiliser system has failed but the BCM is still able to communicate with the ECM. When the limp home mode is activated, the BCM will send the data back to the ECM. This is irregardless of the values of the VIN, MIN, Transponder or Random number stored within the BCM. Limp home mode is activated by "entering" the limp home password of the system via activations of the ignition key. The timing for entering the password are shown below in timing chart.

The password is stored in EEPROM. The password is also stored in RAM. If both the EEPROM and RAM copy match then the vehicle is allowed to start once upon the next cycle of ignition. After the vehicle has been allowed to start once, the RAM copy is cleared thus preventing further starting.

At the dealer, the new owner is asked to choose a password which is 4 digit (2 bytes) in length. All digits chosen by the user must be between zero and nine. This password is placed within the BCM EEPROM using the Hiscan command.

If limp home mode is required, the owner enters the password via the ignition key. The password is decoded by the BCM then placed in RAM for comparison with the EEPROM copy. The password may also be placed directly in RAM using the Hi Scan. However, the tester must be still connected at the time of starting.

If the user forgets the password, the dealer shall use the forgotten password menu on the HiScan. The HiScan will prompt the dealer to enter the pin code as obtained from the HMC database for the vehicle in question.

 **NOTE**

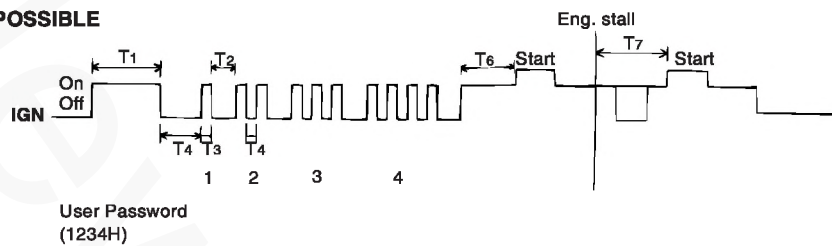
The password and the pin code are not the same. Pin code is scanned from a bar code at the End Of Line (EOL). The password is a number chosen by the owner for the purposes of limp starting.

[SMARTRA TYPE]

o NORMAL CONDITION

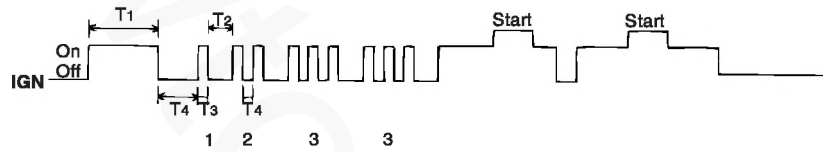


o START POSSIBLE



User Password (1234H)

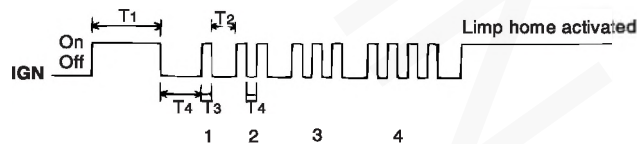
o START IMPOSSIBLE



User Password (1234H)

[STAND ALONE TYPE]

o START POSSIBLE



User Password (1234H)

- NOTE**
- T₁ > 5 sec
 - 3 sec < T₂ < 10 sec
 - 0.2 sec < T₃ < 5 sec
 - 0.2 sec < T₄ < 3 sec
 - T₅ < 5 sec
 - T₆ < 30 sec
 - T₇ < 8 sec

1. By tester

If the ECM detects the fault of the BCM or transponder, the ECM will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the ECM before. This password can be selected by the vehicle owner and is programmed at the service station.

The user password can be sent to the ECM via the hi-scan menu.

In case of "SMARTRA" type immobilizer system, only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, will the ECM be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.

But the ECM unlock timer (30 sec.) is not necessary in the "Stand alone" type immobilizer system.

If the wrong user password is sent, the ECM will reject the request of limp home for one hour. Disconnecting the battery or any other action cannot reduce this time. After reconnecting the battery to the ECM, the timer starts again for one hour.

2. By ignition key

The limp home can be activated also by the ignition key. The user password can be input to the ECM by a special sequence of ignition on/off.

Limp home code entry is enabled after the key has been in the ignition position for greater than 5 seconds. If the ignition is turned on for longer than five seconds during the sequence, the sequence is then restarted and all timers cleared. If the ignition is off for longer than three seconds during the entry, the code number for that digit of the limp home password is determined. If the ignition is turned off for longer than 10 seconds at any time before during or after code entry, all timers are cleared and limp home mode is deactivated. The number "0" is represented by 10 cycles of the ignition key.

Only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, will the ECM be unlocked for a period of time (30 sec.). The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.

But in case of "Standard alone" type immobilizer system, the engine start is possible after the time (30 sec.) has elapsed.

After ignition off, the ECM is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.

But in case of "Standard alone" type immobilizer system, the ECM is locked instantly after ignition off.

DIAGNOSIS OF IMMOBILIZER

FAULTS EEDC6E92

The diagnosis monitors :

- Communication between the ECM and the BCM
- Function of the BCM and the transponder, and
- Data (stored in the ECM) related to the immobilizer function.

There are four different faults that are assigned to the immobilizer system. Every fault is broken down into four different types (circuit malfunction, circuit range / performance problem, low input, high input). The following table shows the assignment of immobilizer related faults to each type :

Type	Diasnostic Codes	Immobilizer Related Faults	Fault Types
SMARTRA (2.0β ENGINE)	P1610	BCM fault	No answer from the BCM Invalid message from BCM to ECM
	P1800		Antenna error
	P1803		Invalid request from ECM or corrupted data
	P1801	Transponder fault	Invalid transponder data Passive mode invalid Programming error
	P1805	EEPROM	Inconsistent data of EEPROM Invalid write operation to EEPROM
ECM fault		No valid data from ECM after 3 attempts by ECM Invalid tester message or unexpected requests by tester	
STAND ALONE (2.7δ ENGINE)	01	Untaught transponder	Untaught transponder
	02	Transponder communication error	Transponder error due to a wrong code or bad read (wrong transponder in field, or more than one transponder in the field).
	03	ECM communication error	ECM error due to bad Service ID (SID), Bad Message ID (MID) or protocol errors
	04	Immobilizer antenna - open	Open Immobilizer antenna
	05	BCM internal fault or EEPROM	BCM internal fault (smart driver failure) or BCM EEPROM error
	06	ECM not detected	ECM not detected

REPLACEMENT OF ECM AND BCM

In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be programmed into the new ECM. Keys, which are not programmed into the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.

In case of a defective BCM, there is no special procedure required. A new BCM simply replaces the old one. There are no transponder - related data stored in this device.

NEUTRALISING ECM

The ECM can be set to the "neutral" status by a tester.

A valid ignition key is inserted and after ignition on is recorded, the ECM requests the vehicle specific data from the tester. The communication messages are described at " Neutral Mode". After successfully receiving the data, the ECM is neutralized.

The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the ECM.

The teaching of keys follows the procedure described for the virgin ECM. The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.