

Body Electrical System

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GENERAL

SPECIFICATIONS ETNC0050

MULTIFUNCTION SWITCH

Items	Specifications
Rated Voltage	DC 12V
Operating temperature range	-30°C - +80°C (-22 - +176°F)
Rated load	
Dimmer & passing switch	High : 15A (Lamp load) Low : 10A (Lamp load) Passing : 15A (Lamp load) Lighting : 1A (Relay load) 6.6 ± 0.5A (Lamp load)
Lighting switch	Low, High : 4.5A (Motor load) Int. : 0.22 ± 0.05A (Relay load)
Turn signal & lane change switch	Lock : Max. 28A (Motor load)
Wiper switch	4.5A (Motor load) 4A (Motor load) Max. 25mA
Wiper mist switch	Rear wiper : 0.2A (Relay load)
Washer switch	Rear washer : 4A (Motor load)
Variable intermittent wiper volume switch	0.25A (Relay load)
Rear wiper & washer switch	
Horn switch	

INSTRUMENTS AND WARNING SYSTEM

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

Warning lamps	Bulb wattage (W)	Color
Immobilizer	1.4	Amber
A/T		
P	1.4	Green
R	1.4	Amber
N	1.4	Green
D	1.4	Green
2	1.4	Green
L	1.4	Green

SERVICE SPECIFICATIONS

ETNC0100

INDICATORS AND GAUGES

Items	Specifications												
Speedometer													
Type	o Cross-coil type												
Input spec.	o Hall IC type : 4 pulses/rev.												
Indication	o Km/h : 637rpm x 4 pulses/rev. indicates 60Km/h												
Standard values	o MPH : 1026 rpm x 4 pulses/rev. indicates 60MPH												
	Velocity (Km/h)	20	40	60	80	100	120						
	Tolerance (Km/h)	20-24.1	40-43	60-64.1	80-85.2	100-105.2	120.5-126.3						
	Tolerance (Km/h)	20.8-25.4	40-44	60.8-65.4	81.4-86.8	102.6-108.2	123.5-129.6						
	Velocity (Km/h)	140	160	180	200	Area							
	Tolerance (Km/h)	140.5-146.7	160.5-167.5	181-188.4	201-209.1	Others							
	Tolerance (Km/h)	144.4-151	165.4-172.4	186.3-193.8	207.2-215.2	EEC & General							
	Velocity (MPH)	10	20	40	60								
	Tolerance (MPH)	10-12.5	20-22.5	40-42.6	60-63.4								
	Velocity (MPH)	80	100	120	Area								
	Tolerance (MPH)	80.3-84.1	100.3-104.7	120.3-125.3	EEC & General								
	o Tap the speedometer to prevent hysteresis effects during inspection.												
Tachometer													
Type	o Cross-coil type (4cyl : 2pulses/rev (MPI DOHC engine), 4cyl : 4pulses/rev (D-engine))												
Standard values	Revolution (RPM)	1,000	2,000	3,000	4,000	5,000	6,000						
	Tolerance (RPM)	±100	±125	±150	±150	±180	±210						
	o Tap the speedometer to prevent hysteresis effects during inspection.												
Fuel gauge													
Type	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)												
Standard values	Level	Gauge			Tolerance assembled with fuel sender (°)								
		Resistance (Ω)											
	E (Empty)	95			-40 ± 2.5								
	1/2	32.5			0 ± 4.0								
	F (Full)	7			40 ± 2.5								
	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.												

ETNC010A

Items	Specifications															
Temperature gauge																
Type	o Cross - coil type (Intermedia stability type).															
Indication standard	<table border="1"> <thead> <tr> <th>Temperature</th> <th>Angle (°)</th> <th>Assembled tolerance (°)</th> </tr> </thead> <tbody> <tr> <td>60°C</td> <td>-40</td> <td>-</td> </tr> <tr> <td>85°C ~ 110°C</td> <td>-7 ⁺² ₋₃</td> <td>⁺³ ₋₂</td> </tr> <tr> <td>Red zone (over 125°C)</td> <td>35 ± 5</td> <td>⁺⁷ ₋₄</td> </tr> </tbody> </table>				Temperature	Angle (°)	Assembled tolerance (°)	60°C	-40	-	85°C ~ 110°C	-7 ⁺² ₋₃	⁺³ ₋₂	Red zone (over 125°C)	35 ± 5	⁺⁷ ₋₄
Temperature	Angle (°)	Assembled tolerance (°)														
60°C	-40	-														
85°C ~ 110°C	-7 ⁺² ₋₃	⁺³ ₋₂														
Red zone (over 125°C)	35 ± 5	⁺⁷ ₋₄														
Resistance of temperature sender (NTC)	o Inspection order : OFF → C → H															
	<table border="1"> <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>122</td> <td>47.4</td> <td>24.3</td> <td>15.9</td> </tr> </tbody> </table>				Temperature (°C)	60	85	110	125	Resistance (Ω)	122	47.4	24.3	15.9		
Temperature (°C)	60	85	110	125												
Resistance (Ω)	122	47.4	24.3	15.9												

ETNC010B

LIGHTING SYSTEM

Items	Bulb wattage(W)
Head lamp	60W / 55W (High / Low beam)
Front turn signal / Front position lamp	21W / 5W
Front fog lamp	55W
Rear combination lamps	
Tail/stop lamp	5W / 21W
Back up lamp	21W
Turn signal lamp	21W
Rear fog lamp	21W
Side repeater lamp	5W
Room lamp	10W
Luggage lamp	10W
Center high mounted stop lamp	27W / 5.7W (LED)
Overhead console lamp	10W
License plate lamp	5W

AUDIO

Items	H220 (H210)	H260	H280
Rated output	Max. 20W x 2	Max. 25W x 4	Max. 20W x 4
Load impedance	4Ω x 2 (4Ω x 4)	4Ω x 4	4Ω x 4
Band	AM/FM, LW/MW/FM	AM/FM, LW/MW/FM	AM/FM, LW/MW/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 : 531~1602KHZ/9KHZ	AM : 531~1602KHZ/9KHZ	AM : 531~1602KHZ/9KHZ
	FM : 87.5~108MHZ/100KHZ	FM : 87.5~108MHZ/100KHZ	FM : 87.5~108MHZ/100KHZ
	LW : 153~279KHZ/1KHZ	LW : 153~279KHZ/1KHZ	LW : 153~279KHZ/1KHZ
	MW : 531~1602KHZ/9KHZ	MW : 531~1602KHZ/9KHZ	MW : 531~1602KHZ/9KHZ
	FM : 87.5~108MHZ/50KHZ	FM : 87.5~108MHZ/50KHZ	FM : 87.5~108MHZ/50KHZ

WINDSHIELD WIPER AND WASHER

Items	Specifications
Wiper motor Speed/current at 2Nm load test Speed/current at 7Nm load test Torque/current when parking	Low : 43-51rpm/4.0A or less High : 65-79rpm/5.0A or less Low : 37-45rpm/7.0A or less High : 53-65rpm/9.0A or less Low : 38Nm/35A or less High : 32Nm/37A or less
Windshield washer Motor type Pump type Rated voltage Discharge pressure Flow rate Overload capacity (Continuous operation) With water Without water	DC ferrite magnet Centrifugal 12V 1.7kg/cm ² or more 1,450cc/min. or more 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° ± 3°

TROUBLESHOOTING

ETNC0150

INSTRUMENTS AND WARNING SYSTEM

Symptom	Possible cause	Remedy
Tachometer does not operate	Turn signal lamp fuse (10A) blown Tachometer faulty Wiring faulty	Check for short and replace fuse Check tachometer Repair if necessary
Fuel gauge does not operate	Turn signal lamp 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	Turn signal lamp 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	Turn signal lamp 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	Turn signal lamp 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	Turn signal lamp 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	Room lamp 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	Turn signal lamp 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 Head lamp relay faulty Lighting switch faulty Wiring or ground faulty	Replace bulb Replace fuse and check for short Check relay Check switch Repair if necessary
Tail lamps and license plate lamps do not light	Tail lamp fuse (10A) blown Tail lamp relay faulty Lighting switch faulty Wiring or ground faulty	Replace fuse and check for short Check relay Check switch Repair if necessary

Symptom	Possible cause	Remedy
Stop lamps do not light	Stop lamp fuse (10A) blown Stop lamp switch faulty Wiring or ground faulty Stop lamp relay faulty	Replace fuse and check for short Adjust or replace switch Repair if necessary Replace relay
Stop lamps stay on	Stop lamp switch faulty Stop lamp relay faulty	Adjust or replace switch Replace relay
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	Turn signal lamp fuse (10A) blown Flasher faulty Turn signal switch faulty Wiring or ground faulty	Replace fuse and check for short Check flasher Check switch Repair if necessary
Hazard warning lamps do not operate	Hazard lamp fuse (10A) blown Flasher faulty Hazard switch faulty Wiring or ground faulty	Replace fuse and check for short Check flasher Check switch Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified Defective flasher	Replace lamps Replace flasher
Back up lamps do not light up	ECU fuse (15A) 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	Room lamp 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.

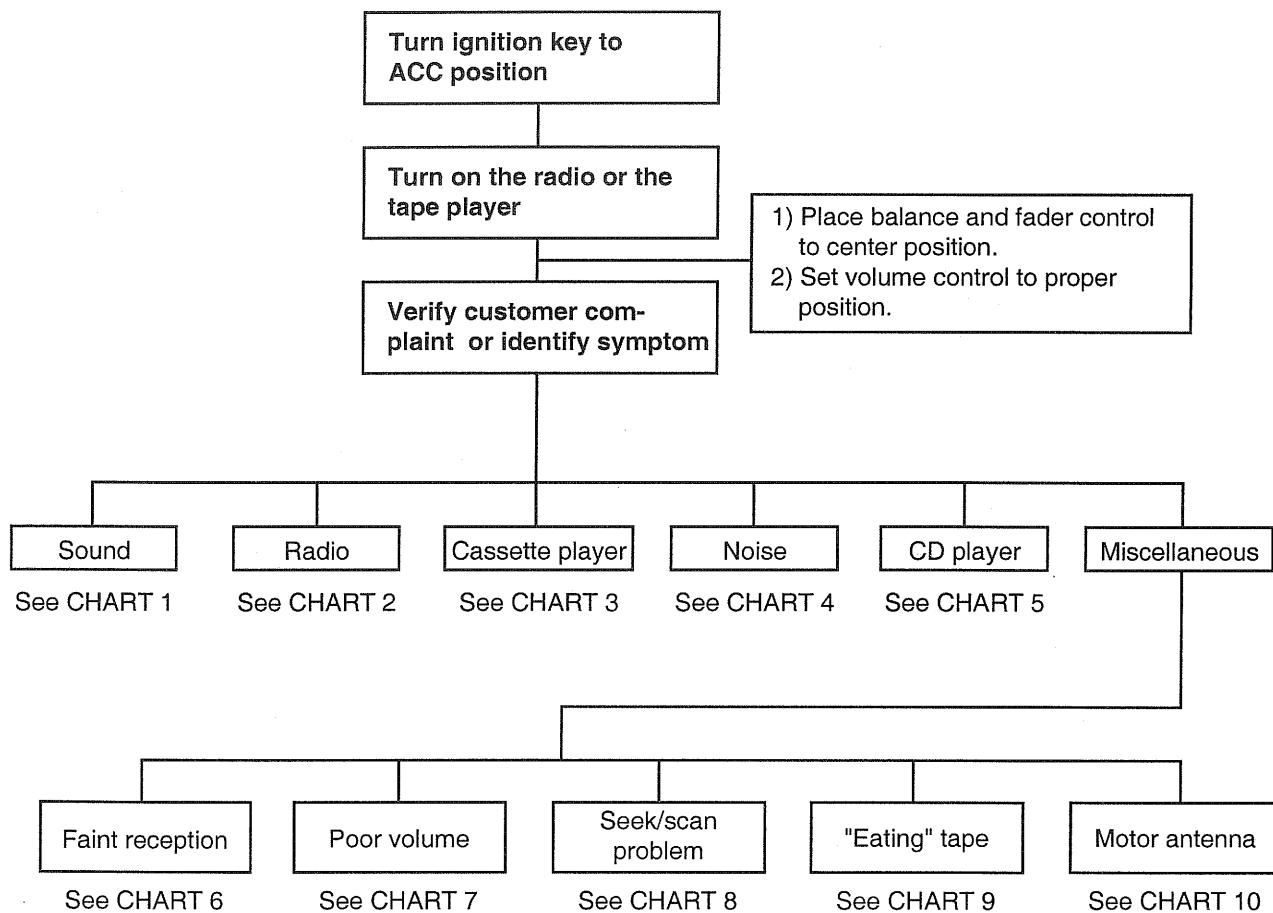
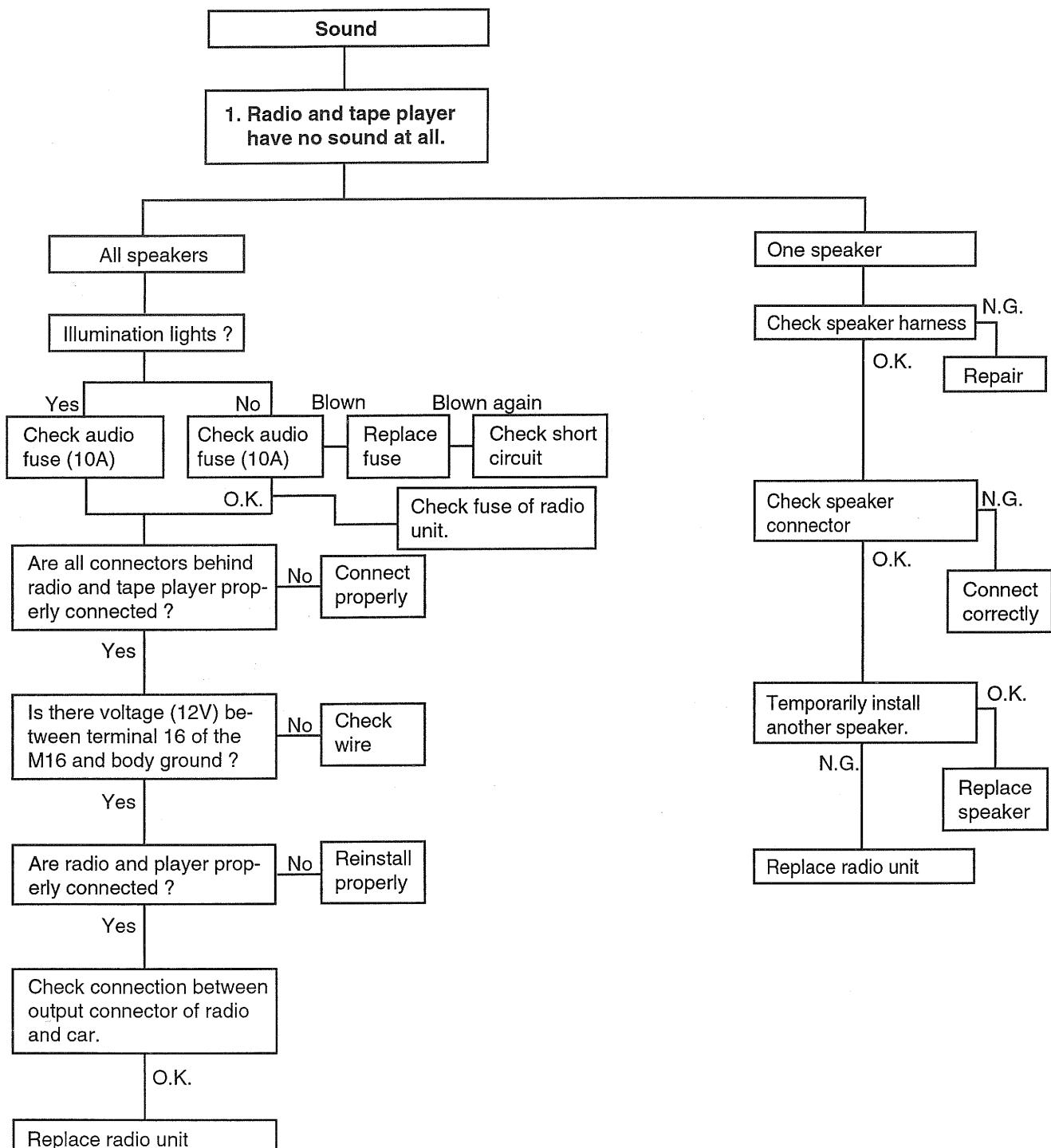
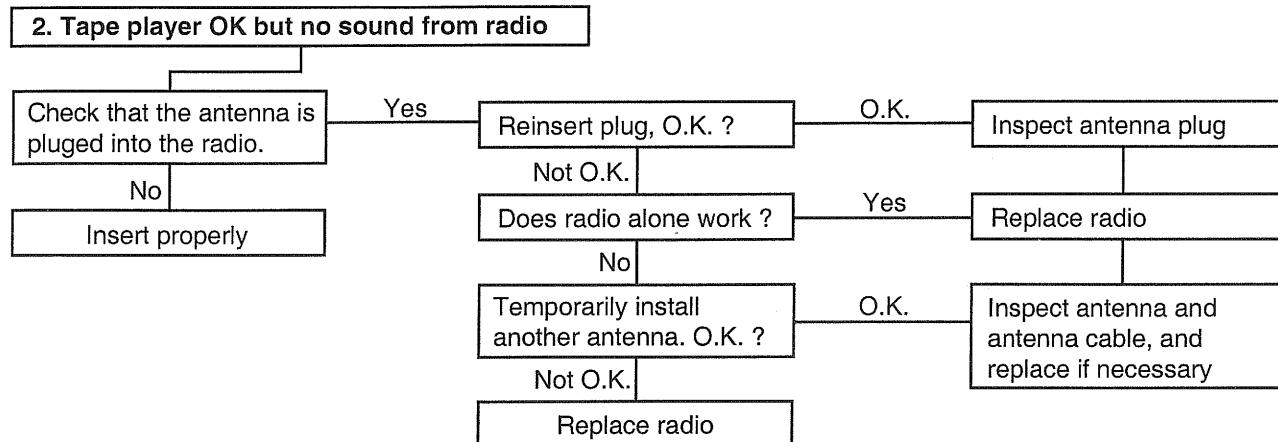


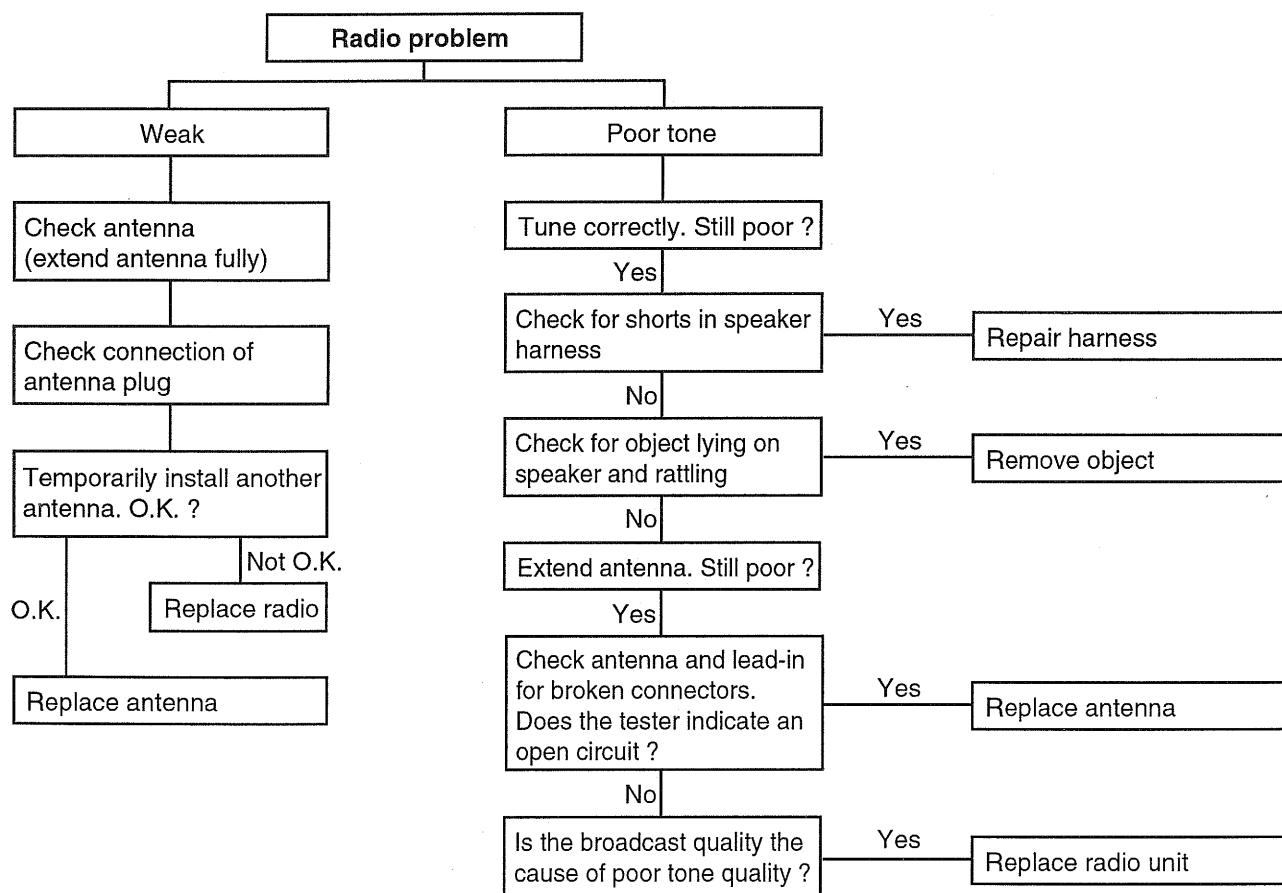
CHART 1





ETA9010C

CHART 2



ETA9010D

CHART 3

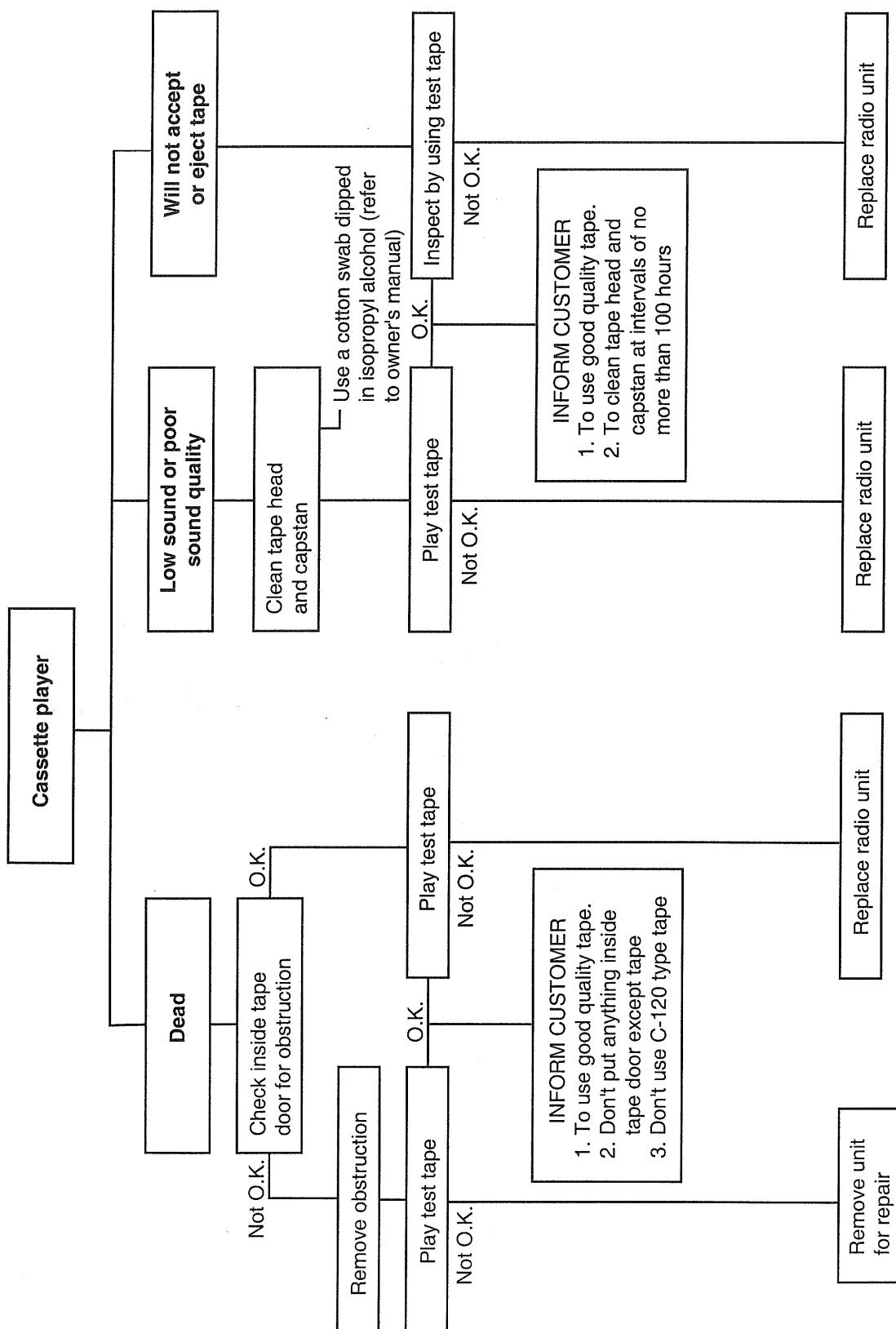
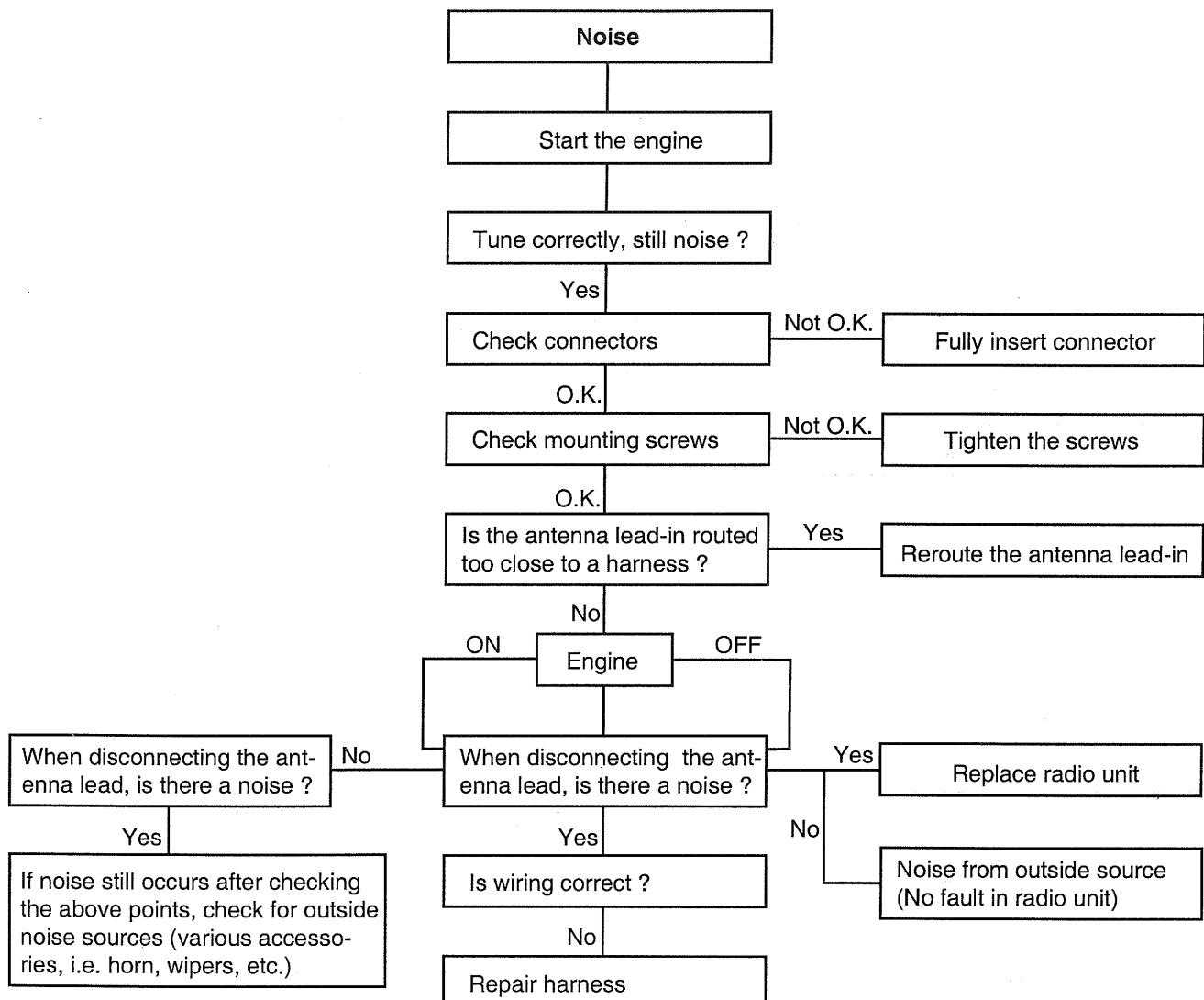
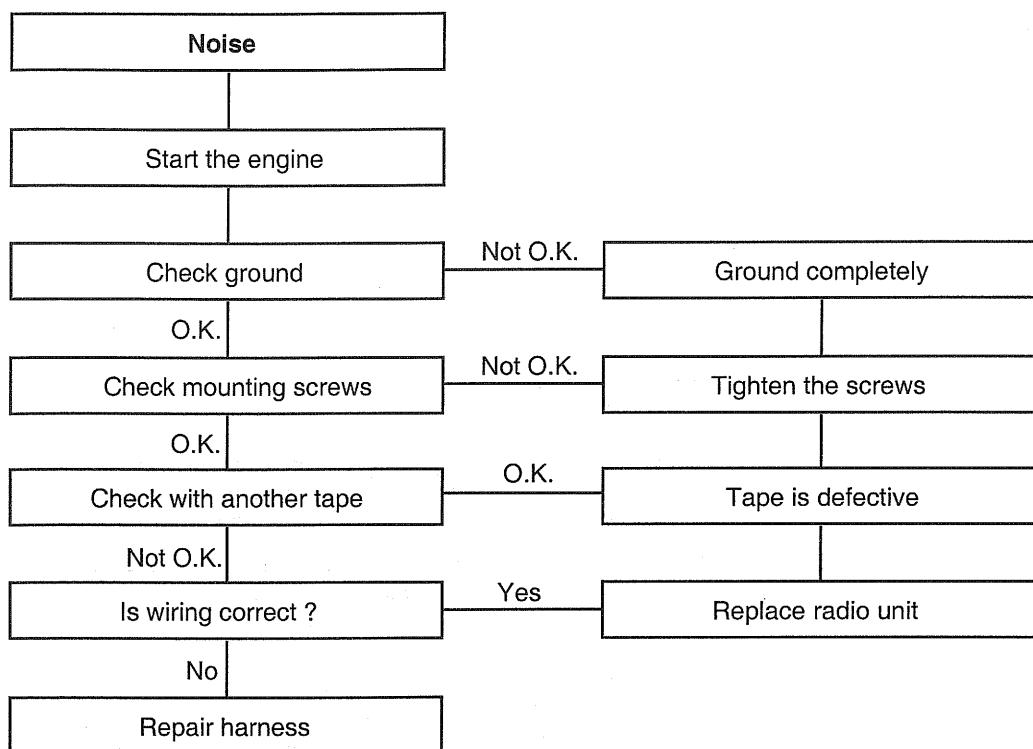


CHART 4

1. RADIO



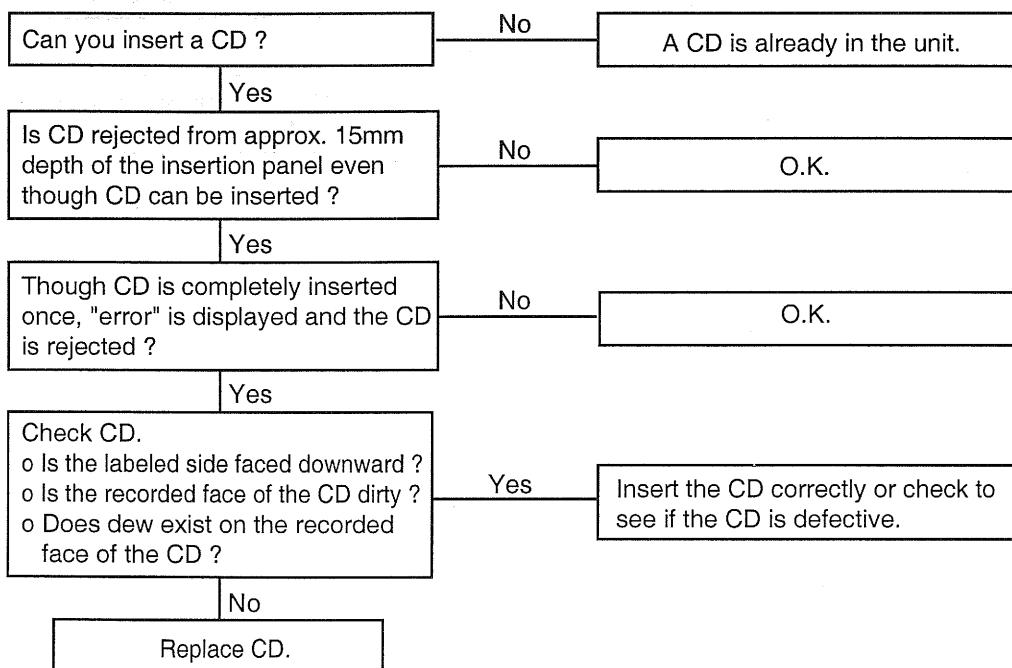
2. TAPE



ETA9010G

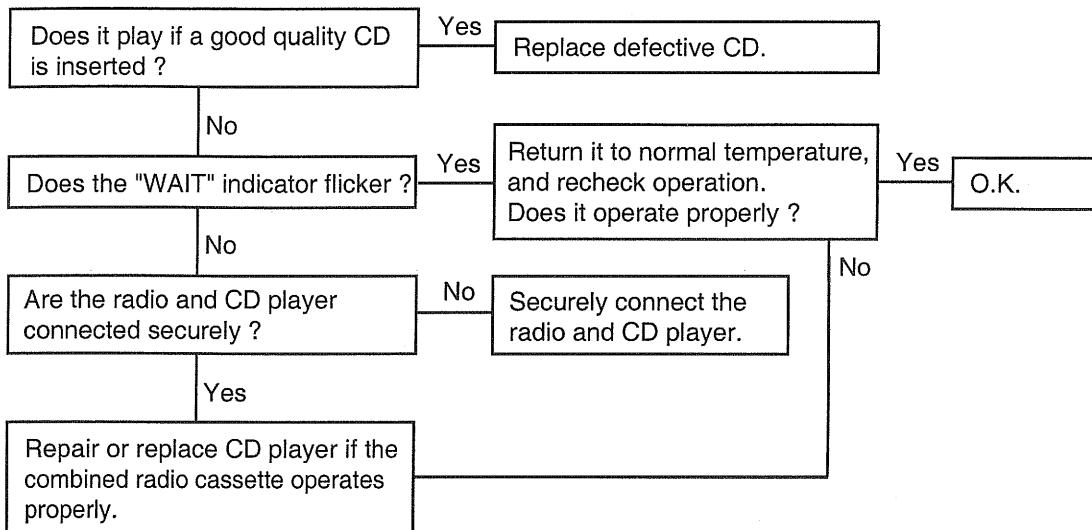
CHART 5

1. CD WILL NOT BE ACCEPTED



ETA9010H

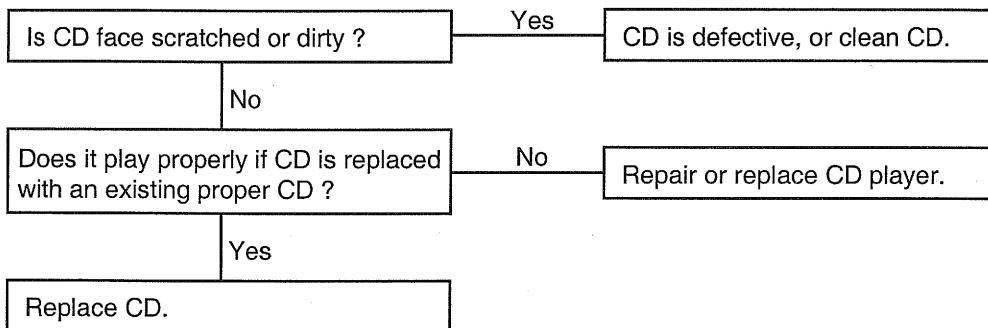
2. NO SOUND



ETA90100

3. CD SOUND SKIPS

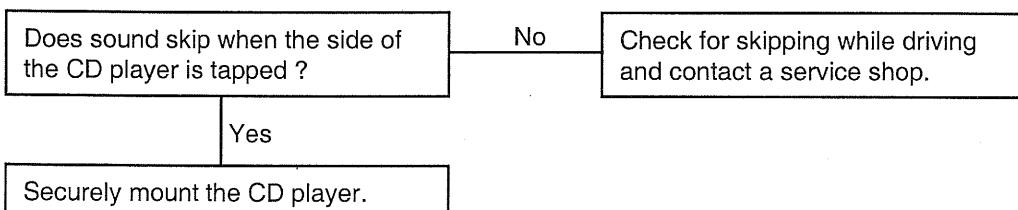
1. Sound sometimes skips when parking.



2. Sound sometimes skips when driving.

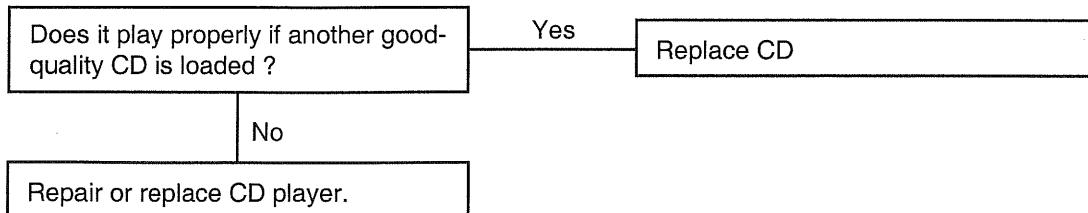
(Stop vehicle, and check it.)

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

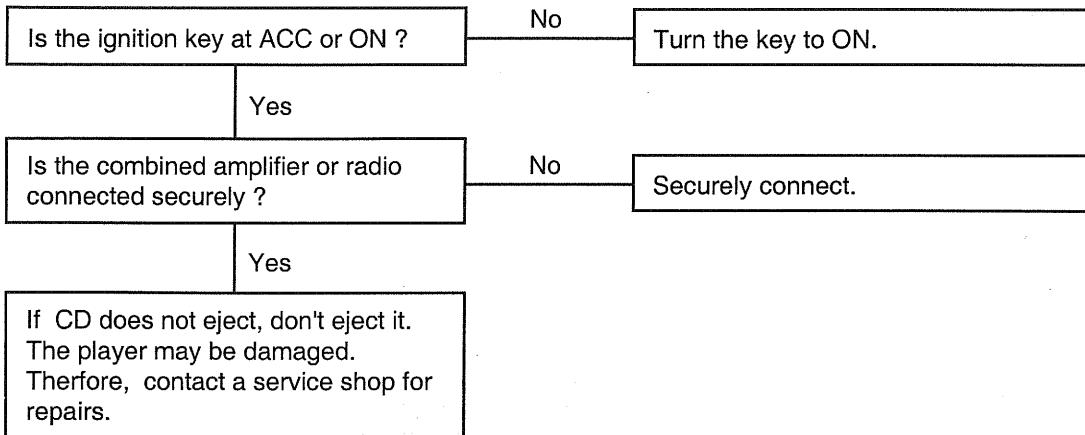


ETA90101

4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT



6. NO SOUND FROM ONE SPEAKER

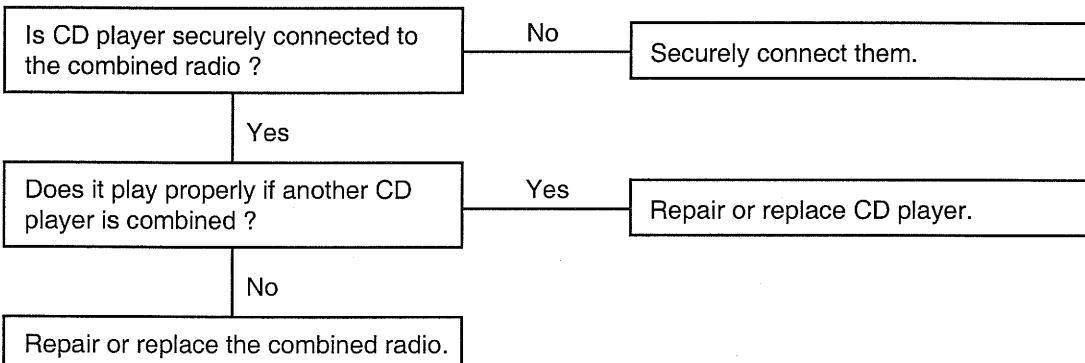
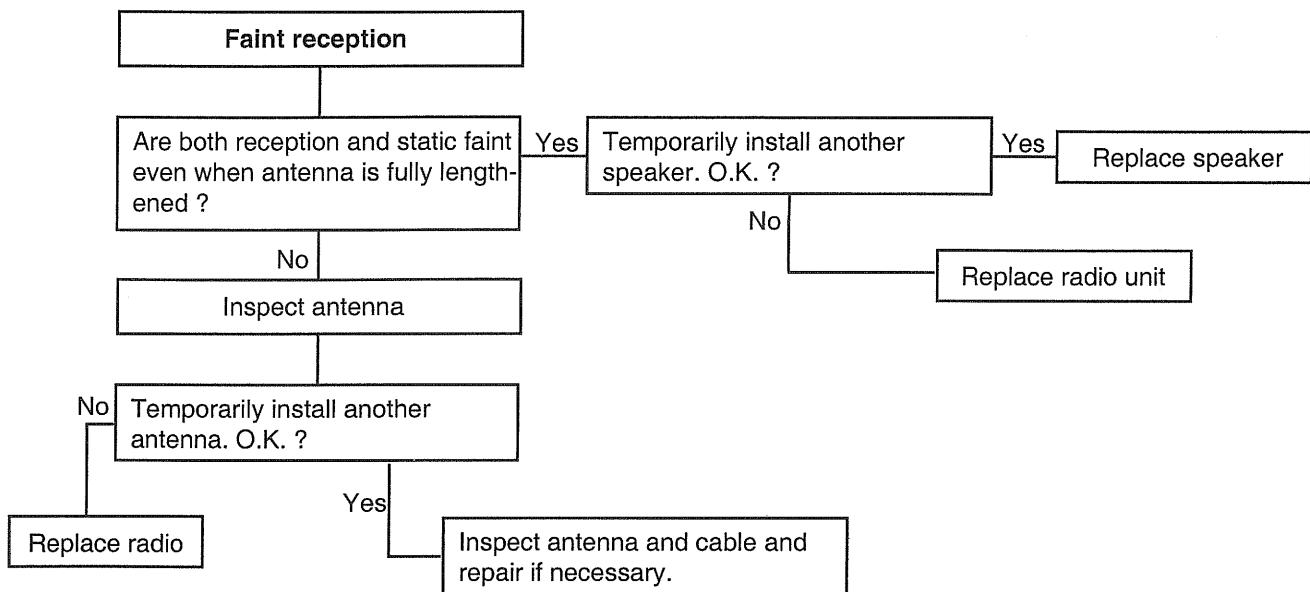
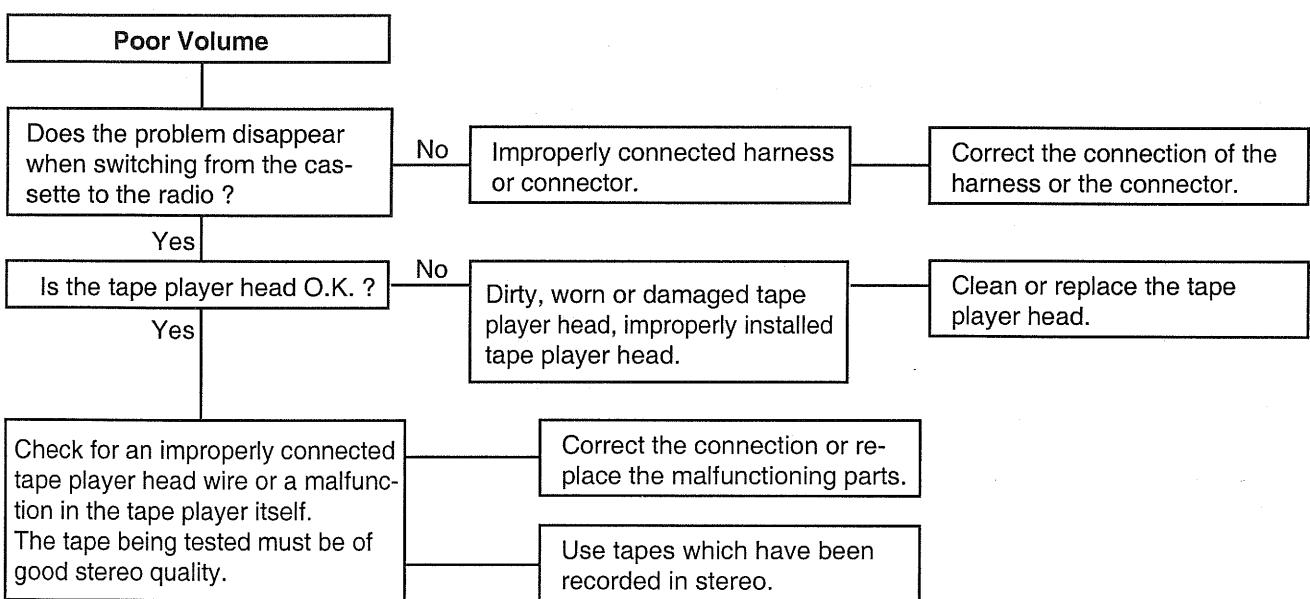


CHART 6



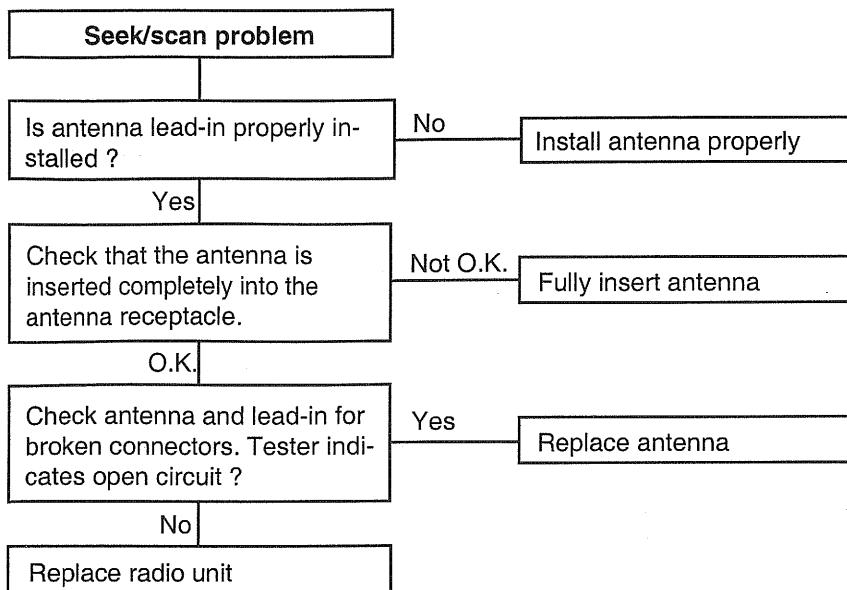
ETA9010K

CHART 7



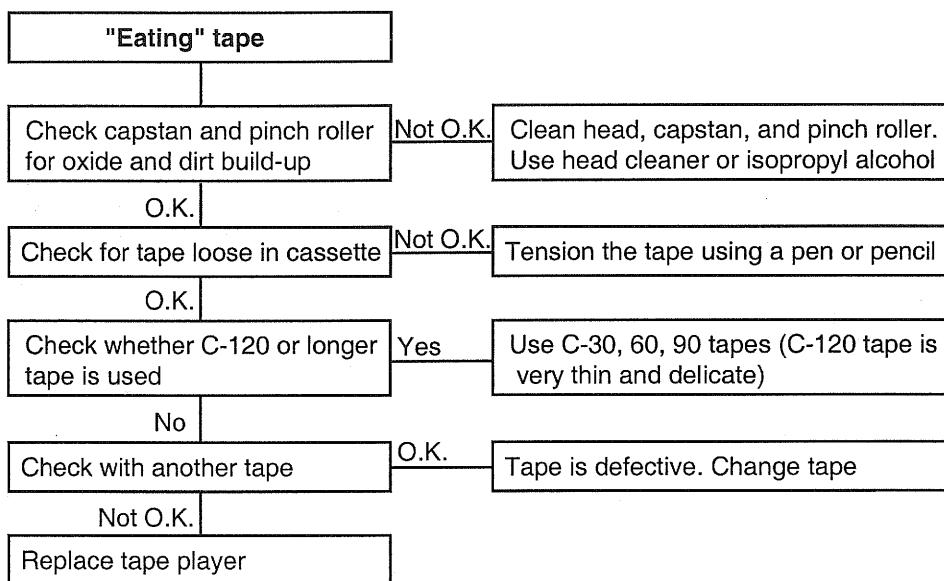
ETA9010L

CHART 8



ETA9010M

CHART 9

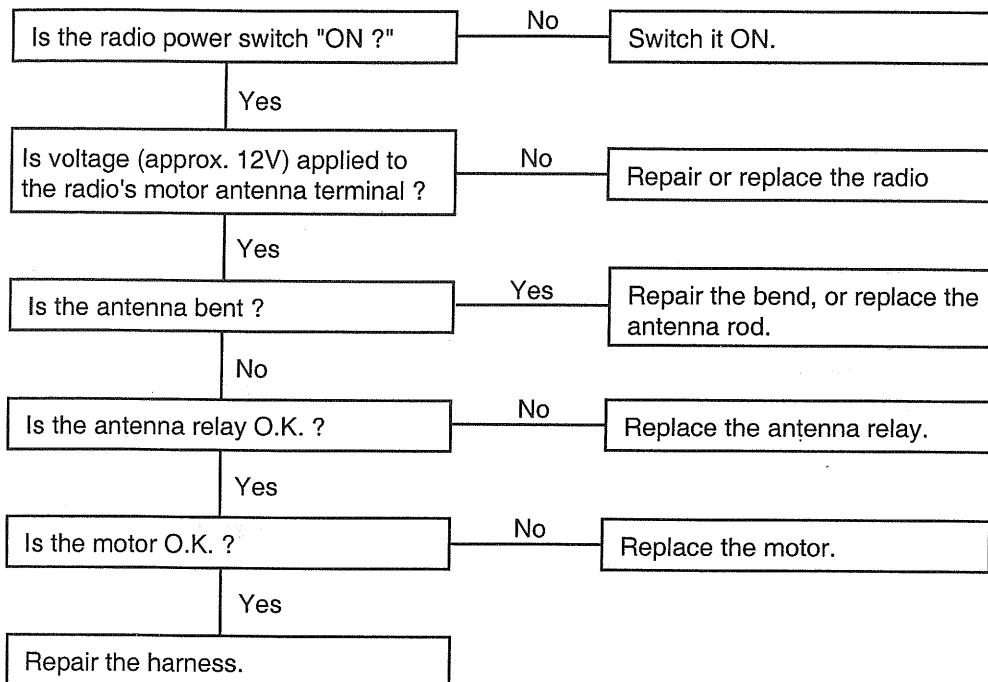


ETA9010N

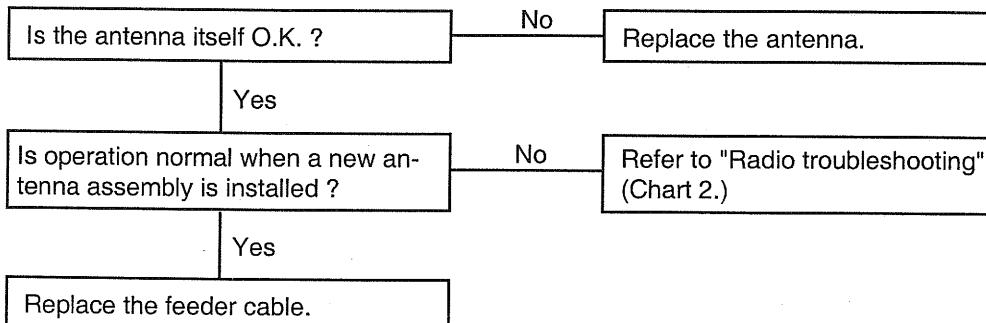
CHART 10

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.	Wiper fuse (20A) 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	ETACS CM faulty Wiper switch faulty Wiper motor faulty Wiring or ground faulty	Check ETACS CM 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	Fusible link (30A for P/Window) blown Poor ground Defective power window main switch Open circuit in wires or loose or disconnected connector	Replace the fusible link 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 subswitch 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	Rear fog lamp fuse (10A) 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

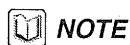
ETACS

Symptom	Possible cause	Remedy
The system is not armed (The siren doesn't sound)	Transmitter faulty Receiver faulty Damaged or disconnected wiring of door switch input circuit ETACS module faulty	Replace the transmitter Replace the receiver Repair the harness Replace the ETACS module
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 ETACS module faulty	Repair the harness or replace a door key cylinder and the tailgate key cylinder switch Replace the ETACS 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 ETACS module	Replace the burglar alarm relay Repair the harness Replace the ETACS 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 ETACS module	Repair the harness or replace the door switch Check the door switch Replace the ETACS 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 ETACS module	Repair the harness or replace the luggage compartment light switch Check the tailgate switch Replace the ETACS 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 ETACS module	Repair the harness or replace the hood switch Check the hood switch Replace the ETACS 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 receiver 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 ETACS connector, and the harness between the ETACS and the door lock relay	Repair the connector or the harness
	Faulty receiver	Check the receiver output using the oscilloscope	Replace the receiver
	Faulty control unit and door 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.

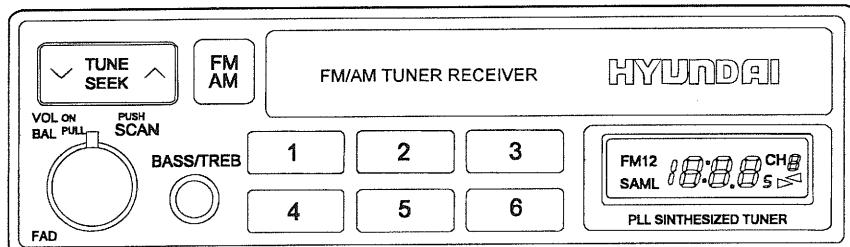
AUDIO SYSTEM

AUDIO UNIT

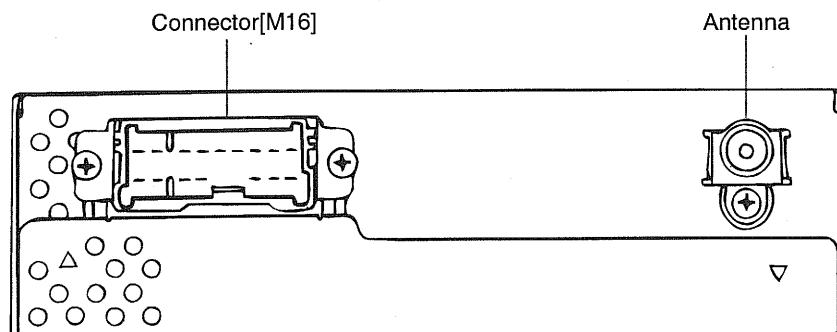
COMPONENTS

ETNC0200

<H210>



ETJA001W

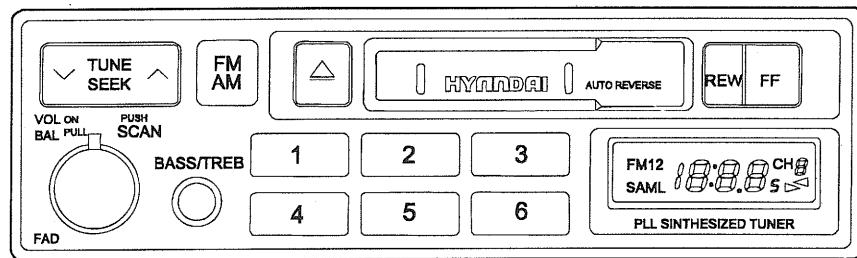


ETJA001X

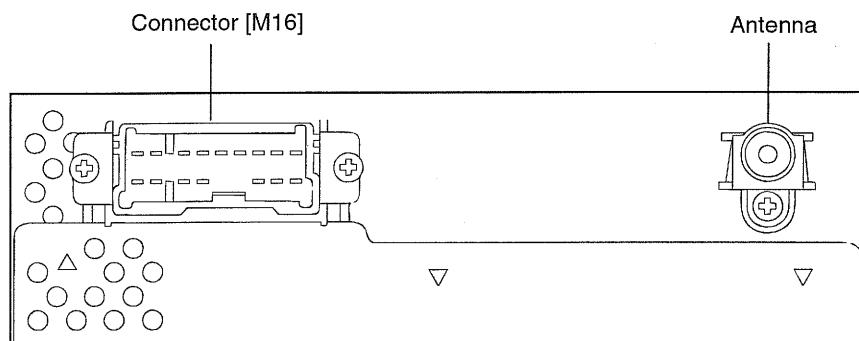
Connector[M16]	Terminal	Description
[M16]		
ETJA001C		
1	Antenna	
2	Rear left speaker(-)	
3	Front left speaker(-)	
4	Front right speaker(-)	
5	Rear right speaker(-)	
6	Illumination(-)	
7	ACC(+)	
8	Ground	
9	Rear left speaker(+)	
10	Front left speaker(+)	
11	N.C.	
12	N.C.	
13	Front right speaker(+)	
14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

ETKA520A

<H220>



ETKA010A

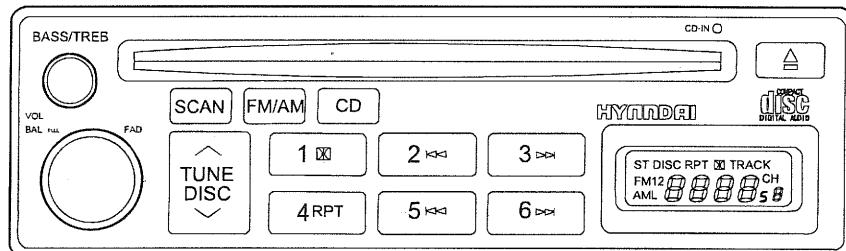


ETKA010B

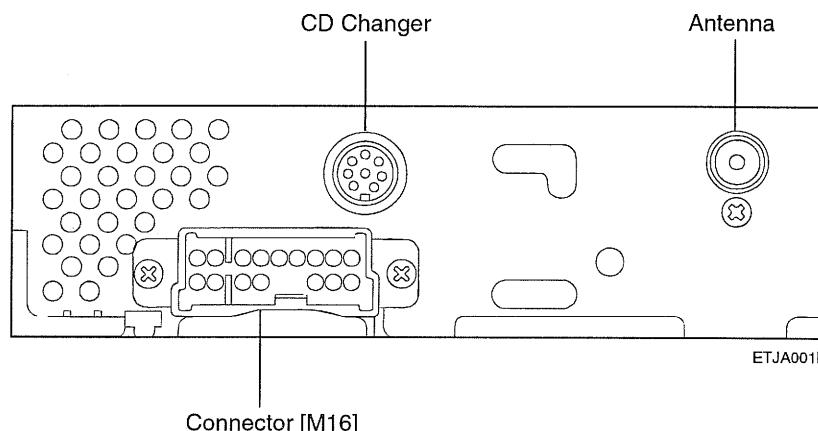
Connector [M16]	Terminal	Description
[M16]	1	Antenna
	2	Rear left speaker(-)
	3	Front left speaker(-)
	4	Front right speaker(-)
	5	Rear right speaker(-)
	6	Illumination(-)
	7	ACC(+)
	8	Ground
	9	Rear left speaker(+)
	10	Front left speaker(+)
	11	N.C.
	12	N.C.
	13	Front right speaker(+)
	14	Rear right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

ETNC020A

<H260>



ETJA001E



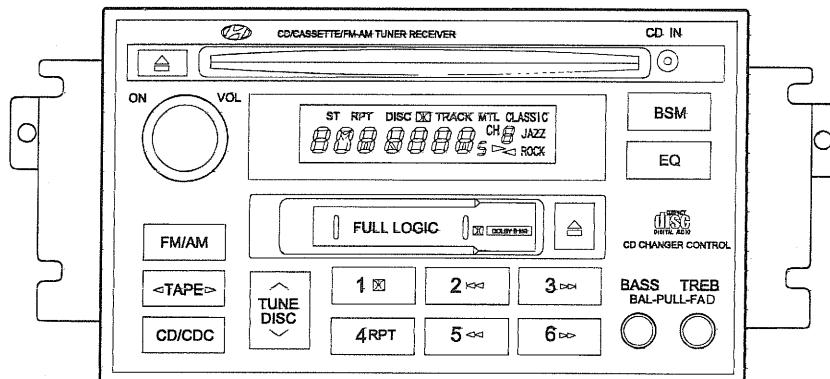
ETJA001D

Connector[M16]	Terminal	Description
[M16]		
(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16)		
ETJA001C		
	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(+)

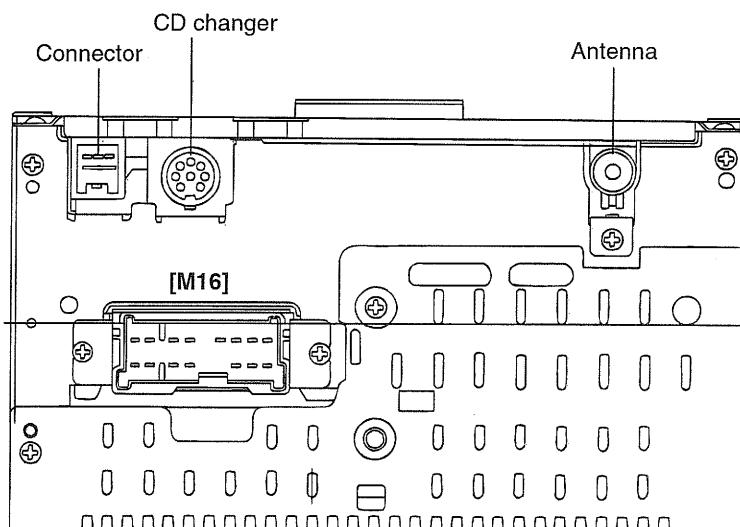
Connector	Terminal	Description
(CD Changer)	1	R
	2	CD ON
	3	BUS
	4	B+
	5	M. Ground
	6	N.C.
	7	L
	8	A.Ground

ETNC020B

<H280>



KTMB001M



KTMB001L

Connector [M16]	Terminal	Description
[M16]		
ETJA001C		
	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	Voice ON
	12	N.C.
	13	Front right speaker(+)
	14	Rear right speaker(+)
	15	Illumination(+)
	16	Battery(+)

Connector	Terminal	Description
ETHA005F		

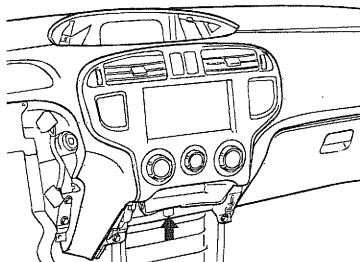
Connector	Terminal	Description
(CD Changer)		
ETJA001G		
	1	R
	2	CD ON
	3	BUS
	4	B+
	5	M. Ground
	6	N.C.
	7	L
	8	A.Ground

ETNC020C

REMOVAL AND INSTALLATION

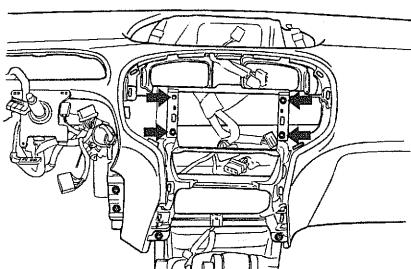
ETNC0250

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



KSNB008J

3. Remove the 4 screws holding the audio unit then remove the audio assembly.

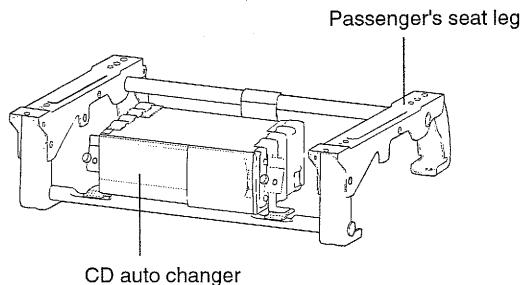


KSNB008I

4. Installation is the reverse of removal.

CD AUTO CHANGER

Remove the CD auto changer from the passenger's side seat leg.



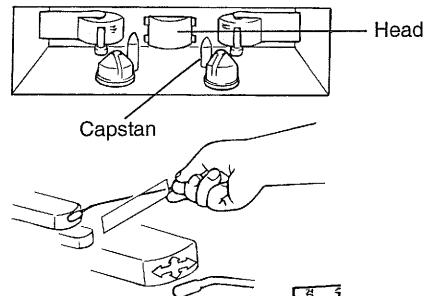
ETNC025A

SERVICE INSTRUCTIONS

ETHA0750

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 cleanliness.
2. To clean the tape head and capstan, use a cotton swab dipped in ordinary rubbing alcohol. Wipe the head and capstan.



ETA9035A

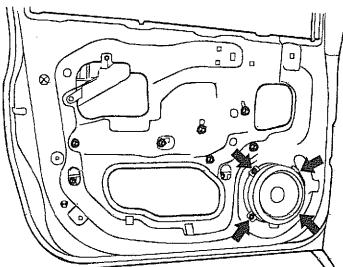
SPEAKERS

REMOVAL AND INSTALLATION

ETNC0300

FRONT SPEAKER

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

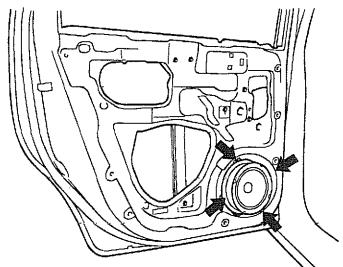


KSNB007B

2. Installation is the reverse of removal.

REAR SPEAKER

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



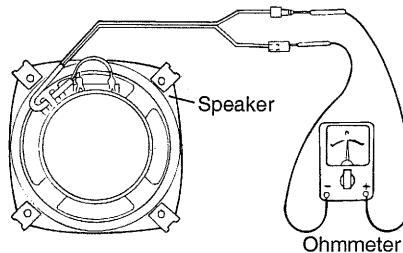
KSNB006K

2. Installation is the reverse of removal.

SPEAKER CHECKING

ETA90400

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

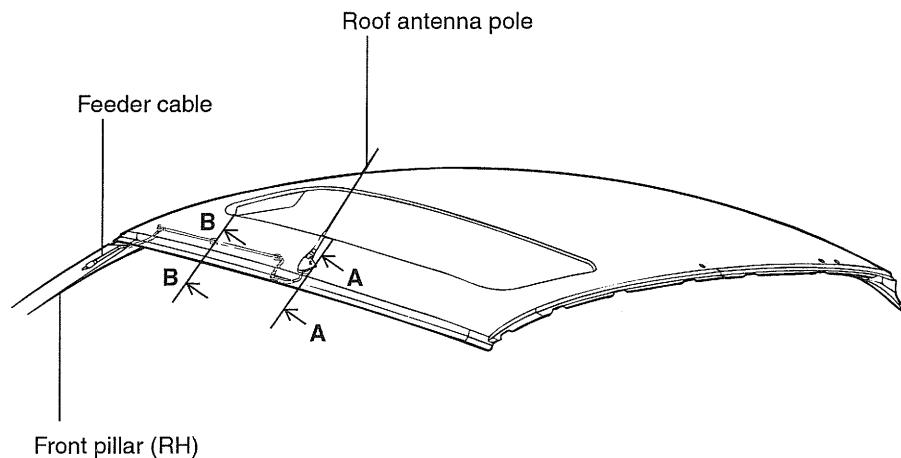


ETA9040A

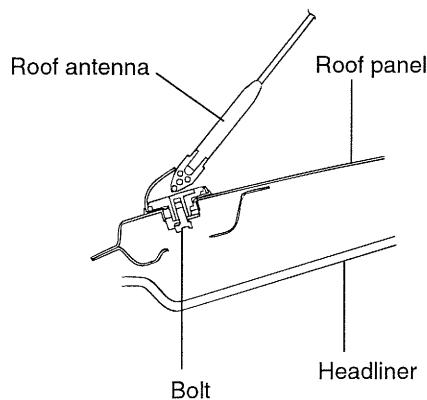
ANTENNA

ROOF ANTENNA

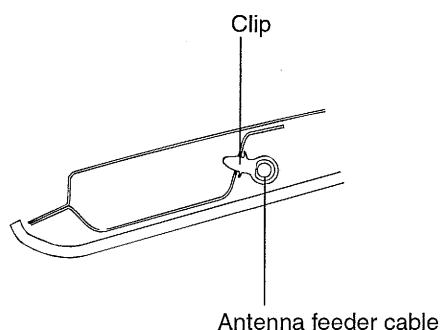
ETNC0350



KSNB002A



[SECT. A-A]



[SECT. B-B]

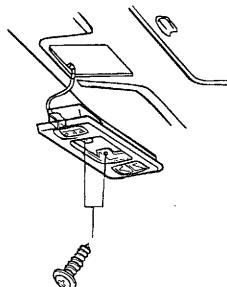
KSNB002B

KSNB002C

ETNC035A

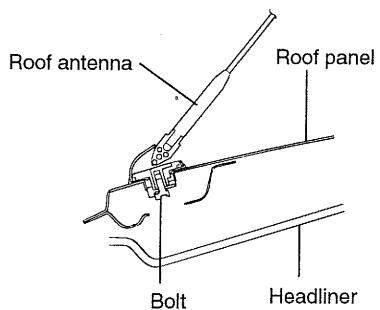
REMOVAL ETNC0400

1. Remove the overhead console lamp after removing 2 tapping screws.



KTNB001S

2. Remove the roof antenna after removing a bolt.



ETNC040A

3. Remove the sun visor and the assist grip then pull the headliner down and remove the antenna feeder cable.
4. Installation is the reverse of removal.

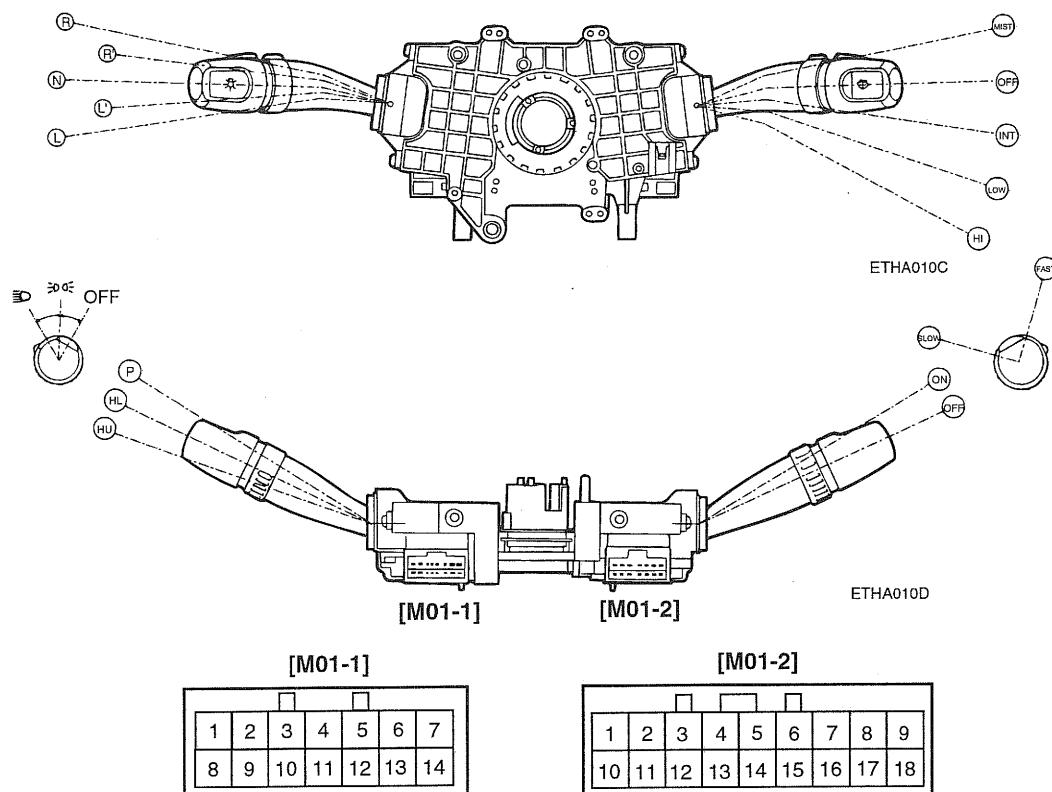
MULTI FUNCTION SWITCH

MULTI FUNCTION SWITCH

COMPONENTS

ETNC0450

[WITHOUT AIR BAG]

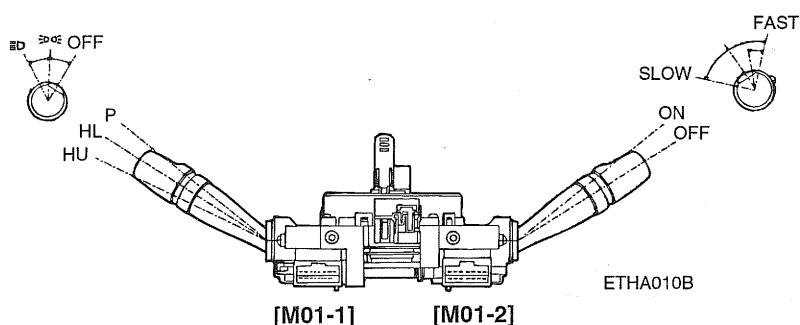
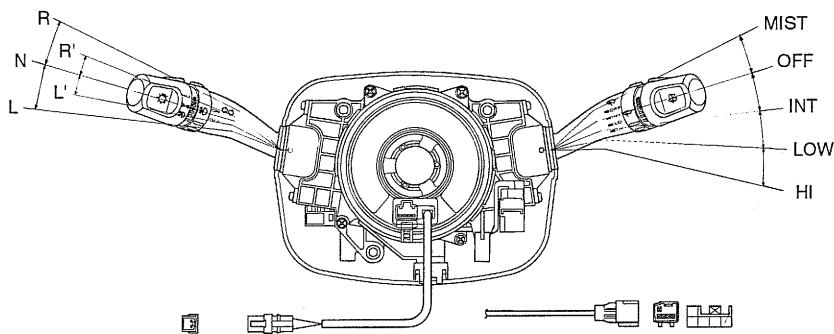


Circuit connection

Connector No.	Terminal No.	Description	Connector No.	Terminal No.	Description
M01-2	1	Head lamp passing switch	M01-1	1	Wiper high speed
	2	Head lamp high beam power		2	Wiper low speed
	3	-		3	Wiper parking
	4	-		4	Mist switch
	5	-		5	Wiper & washer ground
	6	-		6	Intermittent wiper
	7	Turn signal RH lamp switch		7	Front washer switch
	8	Flasher unit power		8	Horn relay
	9	Turn signal LH lamp switch		9	Rear wiper & washer
	10	Head lamp low beam power		10	Rear wiper
	11	Dimmer & passing ground		11	Rear wiper (INT)
	12	-		12	Rear wiper ground
	13	-		13	Intermittent wiper volume
	14	Tail lamp switch		14	Intermittent wiper ground
	15	Head lamp switch			
	16	Rear fog lamp switch			
	17	Lighting switch ground			
	18	-			

ETNC045A

[WITH AIR BAG]



[M01-1]

1	2	3	4	5	6	7
8	9	10	11	12	13	14

[M01-2]

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

[M01-3]

1	2	3	4
---	---	---	---

Circuit connection

Connector No.	Terminal No.	Description	Connector No.	Terminal No.	Description
M01-2	1	Head lamp passing switch	M01-1	1	Wiper high speed
	2	Head lamp high beam power		2	Wiper low speed
	3	-		3	Wiper parking
	4	-		4	Mist switch
	5	-		5	Wiper & washer ground
	6	-		6	Intermittent wiper
	7	Turn signal RH lamp switch		7	Front washer switch
	8	Flasher unit power		8	-
	9	Turn signal LH lamp switch		9	Rear wiper & washer
	10	Head lamp low beam power		10	Rear wiper
	11	Dimmer & passing ground		11	Rear wiper (INT)
	12	-		12	Rear wiper ground
	13	-		13	Intermittent wiper volume
	14	Tail lamp switch		14	Intermittent wiper ground
	15	Head lamp switch	M01-3	1	-
	16	Rear fog lamp switch		2	Horn relay
	17	Lighting switch ground		3	-
	18	-		4	-

REMOVAL AND INSTALLATION

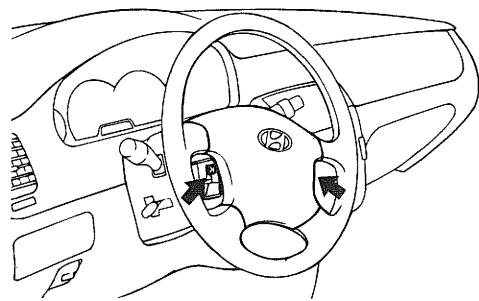
ETAC0400

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

CAUTION

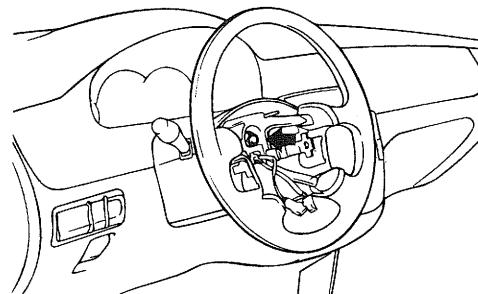
- **Never attempt to disassemble or repair the air bag module or clock spring. If faulty, replace it.**
- **Do not drop the air bag module or clock spring or allow contact with water, grease or oil. Replace if a dent, crack, deformation or rust is detected.**
- **The air bag module should be stored on 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.



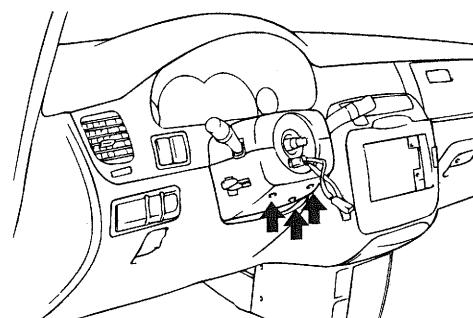
ESHA040M

2. Remove the steering wheel.



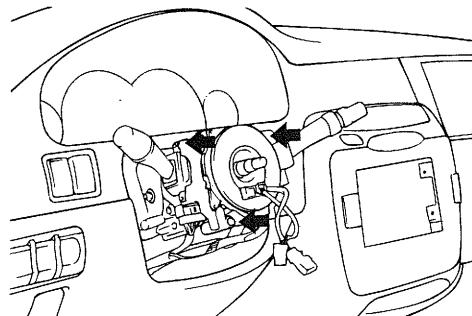
ESHA040N

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



ESHA040O

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



ESHA040P

5. Installation is the reverse of removal.

INSPECTION ETNC0500

Check the continuity between the terminals while operating the switch.

LIGHTING SWITCH [M01-2]

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

ETNC050A

WIPER AND INTERMITTENT VOLUME SWITCH [M01-1]

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

ETNC050B

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]

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

KTDA040C

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	○			○

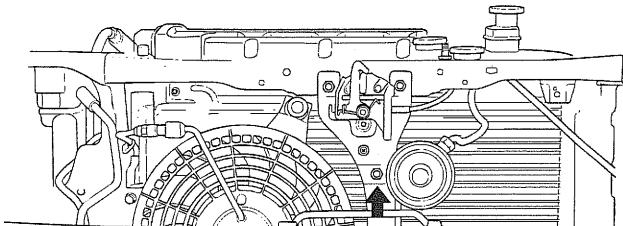
ETNC050D

HORNS

REMOVAL AND INSTALLATION

ETNC0550

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



KTNB013C

2. Installation is the reverse of removal.

INSPECTION

ETHA1200

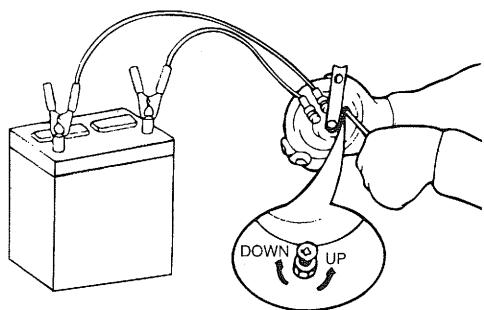
1. Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.
2. The horn should make a sound. If the horn fails to make a sound, replace it.

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.



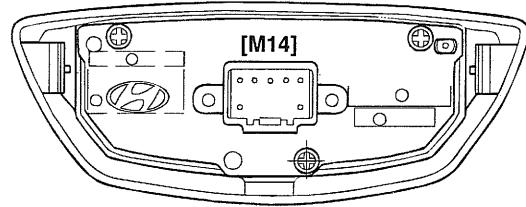
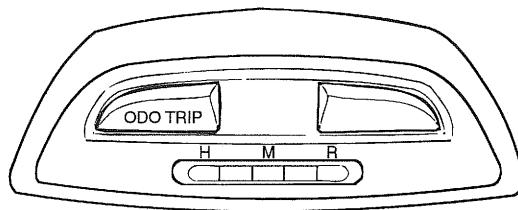
ETDA050A

CLOCK

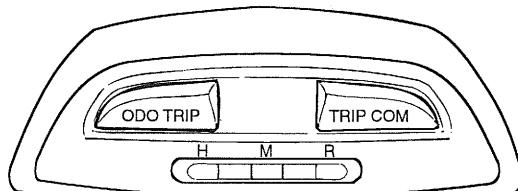
COMPONENTS

ETNC0600

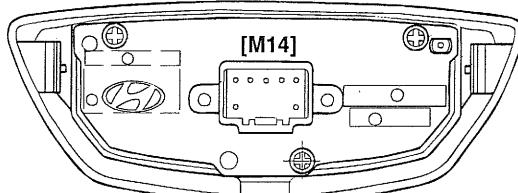
[WITHOUT TRIP COMPUTER]



[WITH TRIP COMPUTER]



KTNB002G



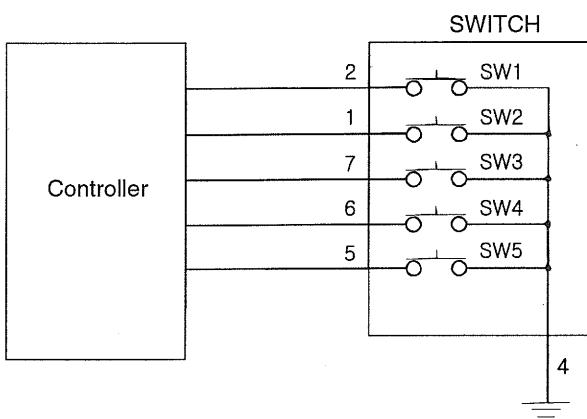
KTNB002H

ETNC060A

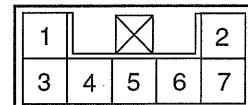
CIRCUIT DIAGRAM

ETNC0650

[WITHOUT TRIP COMPUTER]



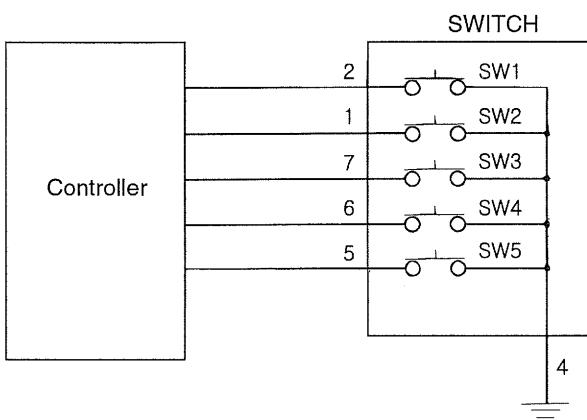
[M14]



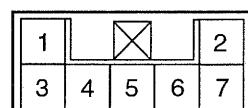
PIN CONNECTION

PINS	DESCRIPTION
1	-
2	Odo/Trip select & reset switch
4	Ground
5	Clock minute select switch
6	Clock hour select switch
7	Clock reset switch

[WITH TRIP COMPUTER]



[M14]



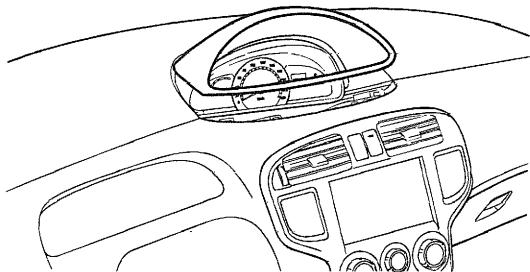
PIN CONNECTION

PINS	DESCRIPTION
1	Trip computer select & reset switch
2	Odo/Trip select & reset switch
4	Ground
5	Clock minute select switch
6	Clock hour select switch
7	Clock reset switch

REMOVAL

ETNC0700

1. Disconnect the negative(-) battery terminal.
2. Pry the cluster facia panel loose then disconnect the clock and trip computer switch connector.

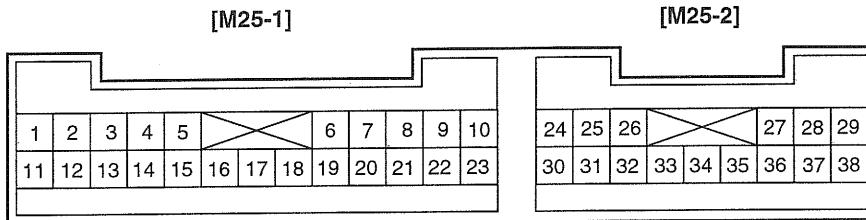


KSNB008R

ETACS (ELECTRONIC TIME AND ALARM CONTROL SYSTEM)

ETACS CM PIN CONNECTION

ETNC0750

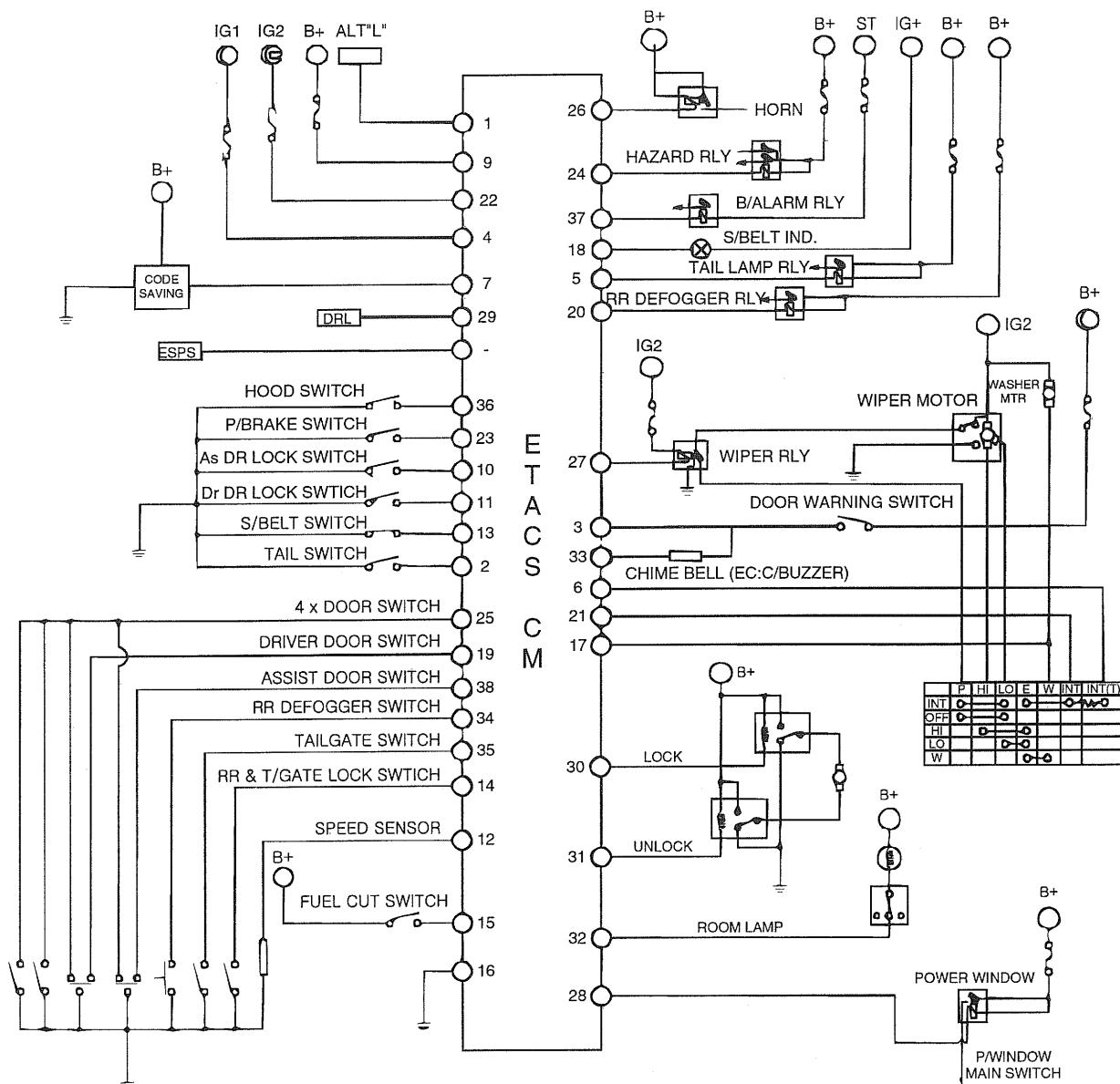


ETNC075A

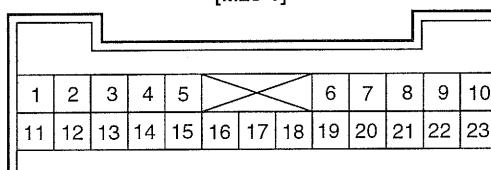
Terminal No.	Description	Terminal No.	Description
1	Alternator "L"	21	Intermittent wiper switch
2	Tail lamp switch	22	Ignition 2
3	Door warning switch	23	Parking brake switch
4	Ignition 1	24	Hazard relay
5	Tail lamp relay	25	Door switch
6	Intermittent wiper volume switch	26	Horn
7	Code saver	27	Wiper relay
8	-	28	Power window relay
9	Battery (+)	29	DRL
10	Assist door lock switch	30	Door lock relay
11	Driver door lock switch	31	Door unlock relay
12	Speed sensor	32	Room lamp
13	Seat belt switch	33	Chime bell
14	Rear door lock switch	34	Rear defogger switch
15	Fuel cut switch	35	Tailgate switch
16	Ground	36	Hood switch
17	Washer switch	37	Burglar alarm relay
18	Seat belt warning indicator	38	Assist door switch
19	Driver door switch		
20	Rear defogger relay		

CIRCUIT DIAGRAM

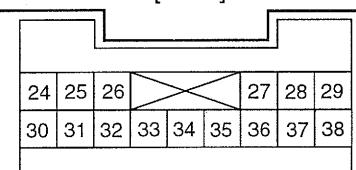
ETNC0800



[M25-1]



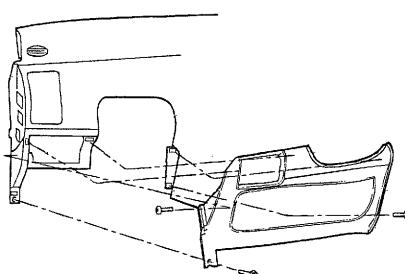
[M25-2]



REMOVAL AND INSTALLATION

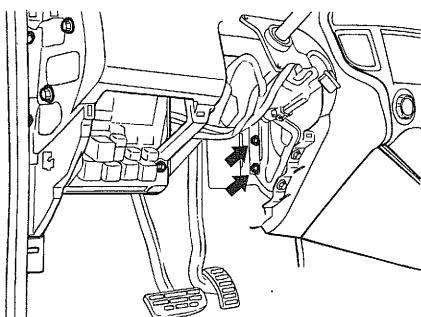
ETNC0850

1. Disconnect the negative (-) battery terminal
2. Remove the lower crash pad panel.



KSNB008D

3. Remove the ETACS CM after removing 2 bolts and disconnect the wire connectors.



KTNB105A

4. Installation is the reverse of removal.

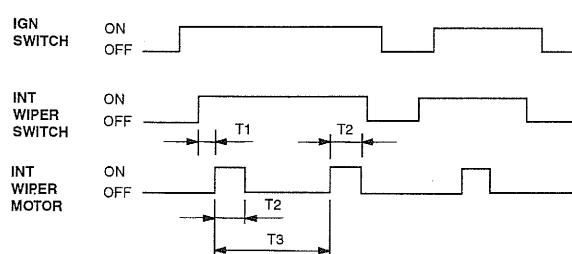
INSPECTION

ETNC0900

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

ETACS FUNCTION

1. Vehicle speed sensing intermittent wiper



ETHA115C

Time specification

T1 : Max. 0.5 sec.

T2 : 0.6~0.7 sec. (Time of wiper motor 1 rotation)

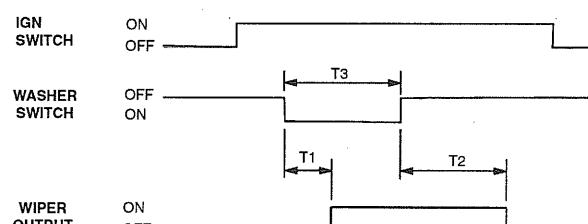
T3 : At vehicle speed = 0km/h.

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



ETHA115D

a. Time specification

T1 : 0.3 sec.

T2 : 0.6 - 0.8 sec.

T3 : 0.2 - 0.6 sec.

b. Time specification

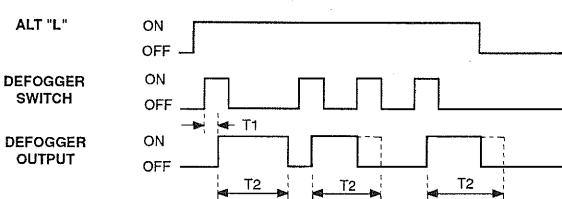
T1 : 0.3 sec.

T2 : 2.5 - 3.8 sec.

T3 : 0.6 sec. or more

c. This function should be operated preferentially even though the variable intermittent wiper is operating.

3. Rear window defogger



ETJA020B

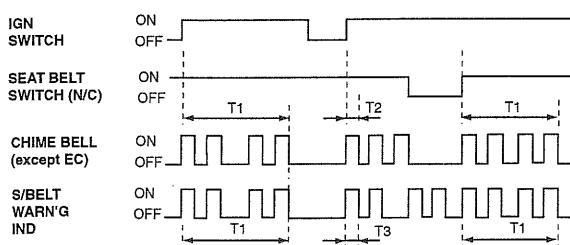
Time specification

T1 : 60 msec

T2 : 20±1min.

ETHA115C

4. Seat belt warning

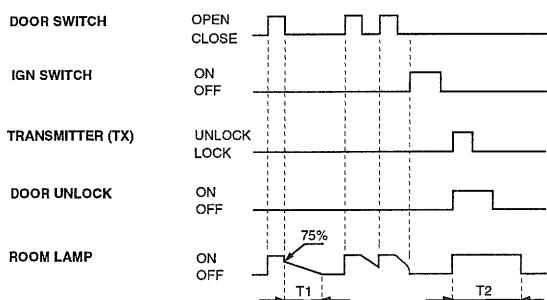


ETHA115F

Time specification

T1 : 6 ± 1 sec.T2 : 0.45 ± 0.1 sec.T3 : 0.3 ± 0.1 sec.

5. Decayed out room lamp&keyless unlock timer

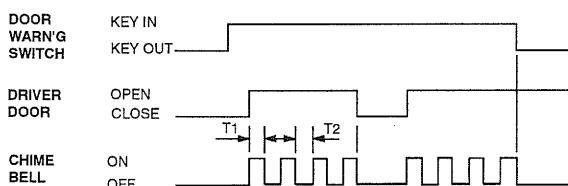


ETJA020C

Time specification

T1 : 5.5 ± 0.5 sec.T2 : 30 ± 3 sec.

6. Key operated warning (except EC area)

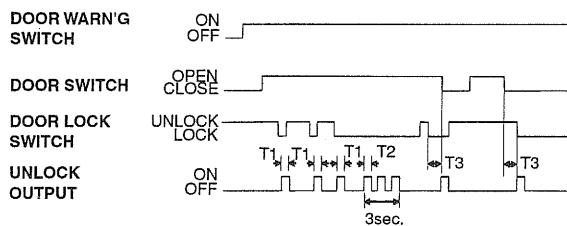


ETHA115L

Time specification

T1, T2 : 0.45 ± 0.1 sec.

7. Ignition key reminder



ETNC090A

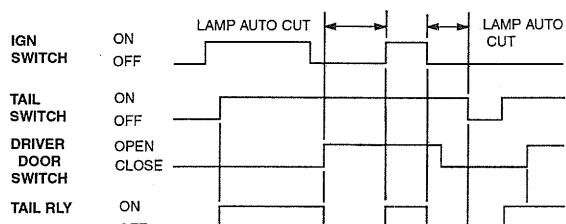
Time specification

T1 : 1 sec.

T2 : 0.5 sec.

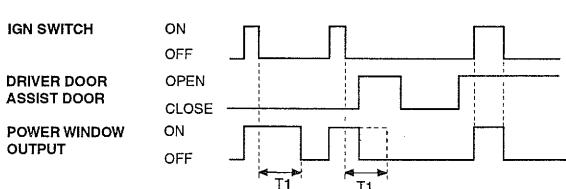
T3 : Max. 0.5 sec.

8. Tail lamp auto cut



ETHA115M

9. Power window timer

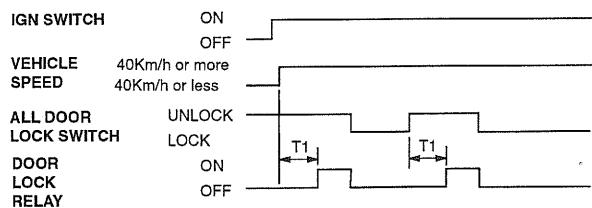


ETJA020E

Time specification

T1 : 30 ± 3 sec.

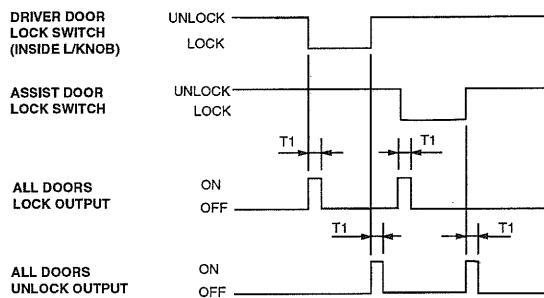
10. Auto door lock(except EC area)



ETHA115N

Time specification
T1 : 2.5 ± 0.5 sec.

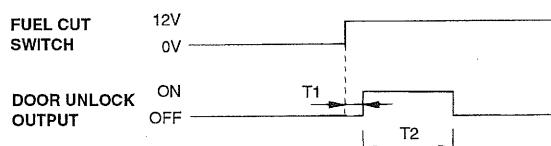
11. Central door lock/unlock



ETHA115H

Time specification
T1 : 0.5 ± 0.1 sec.

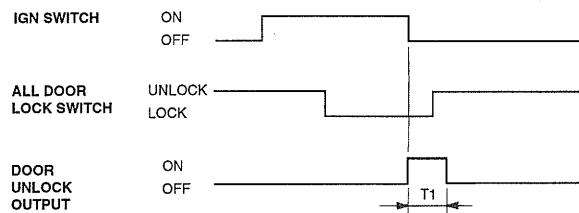
12. Crash door unlock



ETNC090B

Time specification
T1 : 40msec
T2 : 5 ± 0.5 sec.

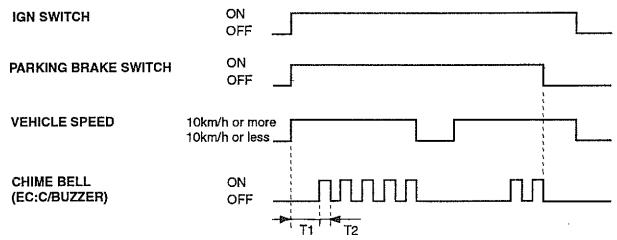
13. Ignition key off unlock(except EC area)



ETHA115P

Time specification
T1 : 0.5 ± 0.1 sec.

14. Parking start warning

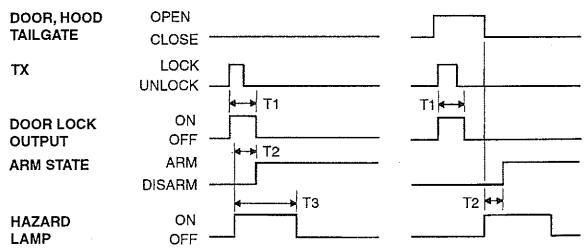


ETNC090C

Time specification
T1 : 2.5 ± 0.5 sec.
T2 : 0.3 ± 0.1 sec.

ANTI-THEFT FUNCTION

1. Arm function

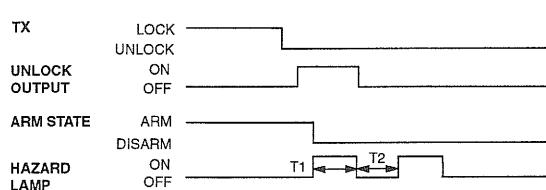


ETHA115Q

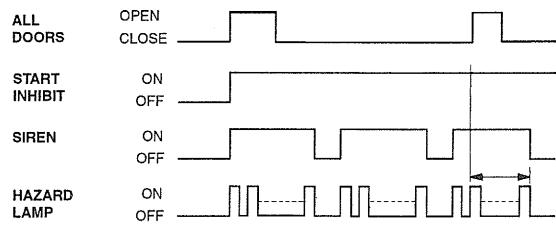
Time specification
T1 : 0.5sec.
T2 : Max 2sec.
T3 : 1.0 ± 0.2 sec.

2. Disarm function

c. New alarm occurs while the alarm is sounding.



ETHA115R

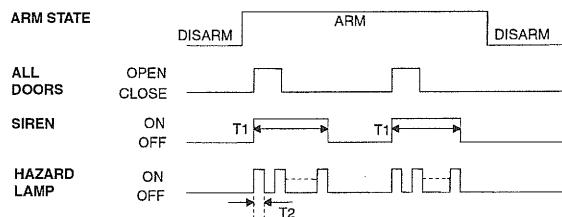


ETHA115T

Time specification
T1, T2 : 0.5 ± 0.1 sec.

3. Alarm function

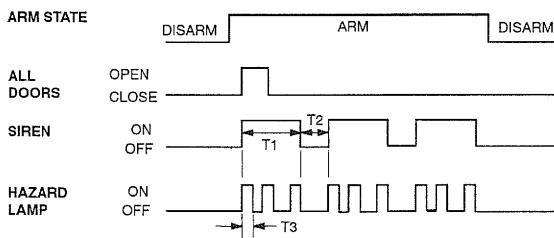
a. Only EC area



ETHA120F

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

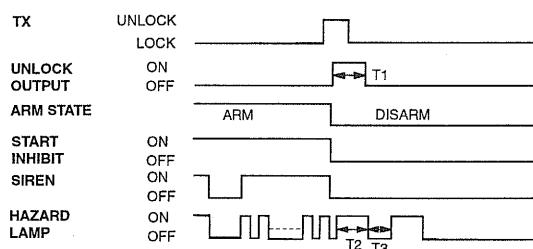
b. Except EC area



ETHA115S

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

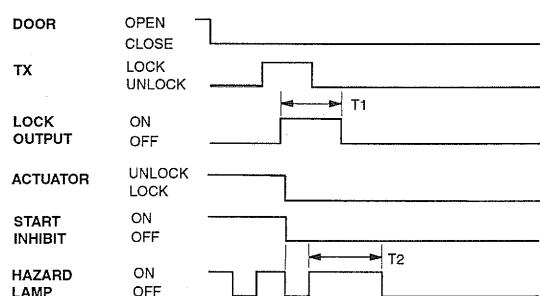
d. Disarmed with TX (Transmitter) while the alarm is sounding.



ETHA115U

Time specification
T1, T2, T3 : 0.5 ± 0.1 sec.

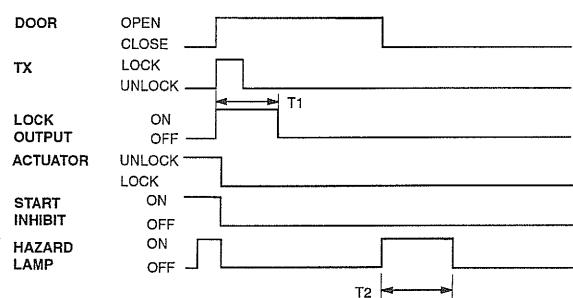
e. TX (Transmitter) lock button pressed when the door closed while the alarm is sounding.



ETHA115V

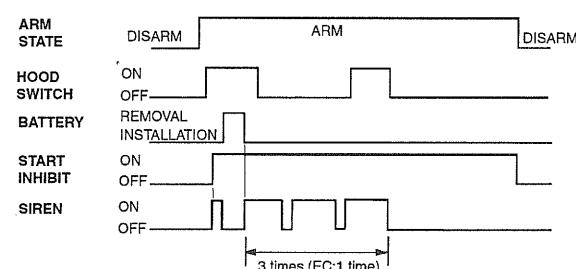
Time specification
T1 : 0.5sec.
T2 : 1.0 ± 0.2 sec.

f. TX (Transmitter) lock button pressed when the door opened while the alarm is sounding.



ETHA115W

i. Battery is disconnected during the alarm state.



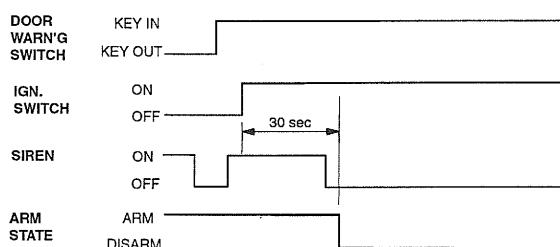
ETHA115Z

Time specification

T1 : 0.5sec.

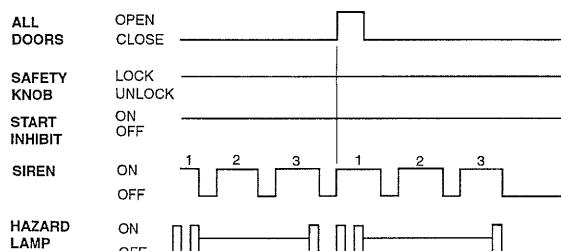
T2 : 1.0±0.2sec.

g. Disarmed after 30 sec when the ignition switch is turned on while the alarm is sounding.



ETHA115X

h. Start inhibit is "ON" regardless of door latch lock state.



ETHA115Y

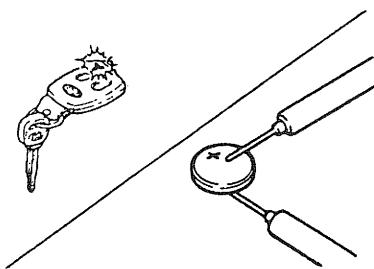
TRANSMITTER

INSPECTION

ETNC0950

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

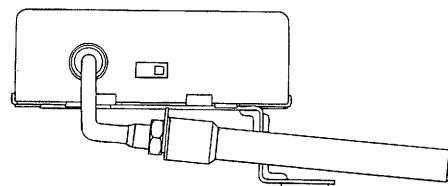
Standard voltage : 3V



KTAB195A

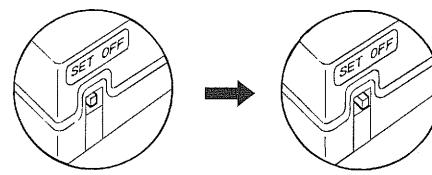
3. Replace the battery if voltage is below 3V and replace the remote control switch if it is inoperable after replacing the battery.

Battery : Lithium CR2032 (3V, 220mA/h)



ETDA085R

3. Return the code saving switch of the ETACS control module from "SET" to "OFF".

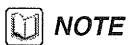
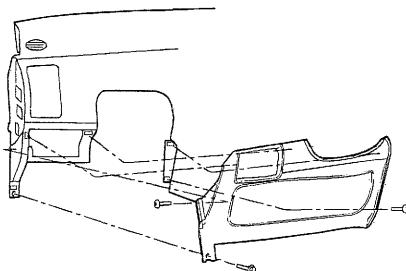


SET

OFF

ETHA120D

4. Install the lower dash panel.

**NOTE***Don't disconnect the negative (-) battery terminal.*

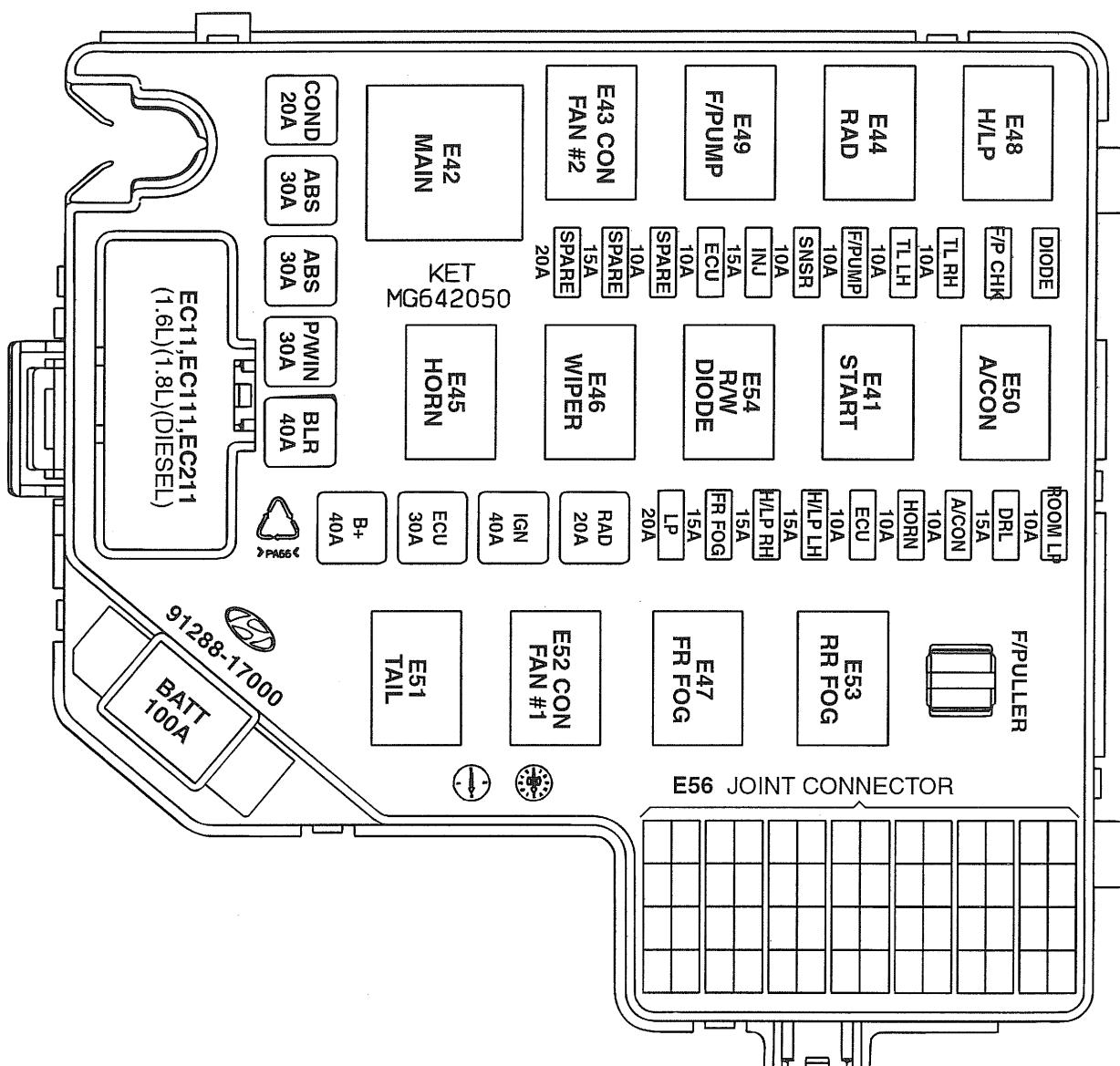
KSNB008D

FUSES AND RELAYS

RELAY BOX (ENGINE COMPARTMENT)

SPECIFICATIONS

ETNC1050



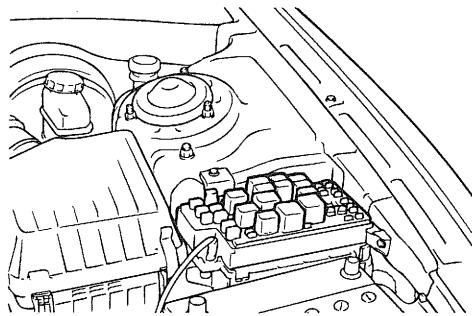
INSPECTION

ETMB1000

1. Check for a burnt 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.



KTMB510A

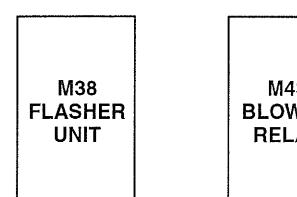
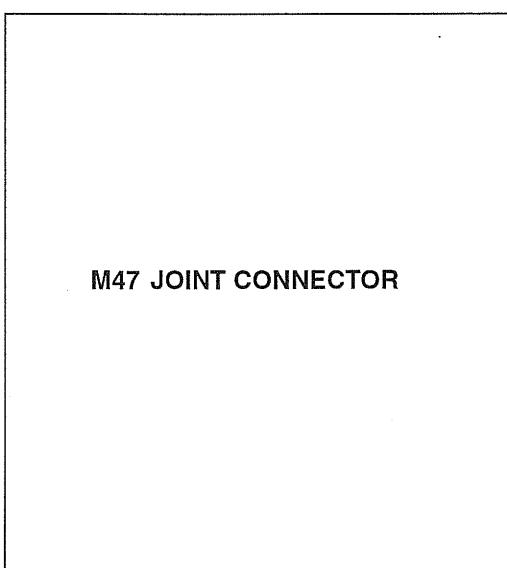
RELAY BOX (PASSENGER COMPARTMENT)

SPECIFICATIONS

ETNC1100

Not used	Not used	Not used	
Not used	Not used	Not used	SPARE 25A
HAZARD 10A	ETACS 10A	RR FOG 10A	
D/LOCK 15A	ECU 15A	IG2 10A	SPARE 15A
STOP 10A	T/SIG 10A	P/OUTLET 25A	
RR HTD 30A	A/B IND 10A	S/HTD 15A	SPARE 10A
A/CON 10A	A/B 10A	FRT WPR 20A	
HTD IND 10A	C/LIGHT 15A	START 10A	F/PULLER
H/LP IND 10A	AUDIO 10A	RR WPR 10A	

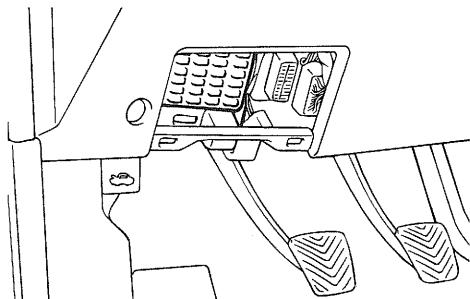
LHD



ETNC110A

INSPECTION ETNC1150

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.



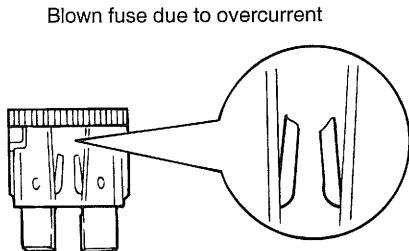
ETJA075E

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 ampere rating be installed.

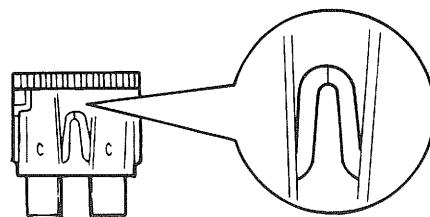


ETDA086A

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.

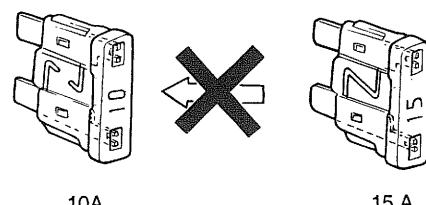
Blown fuse due to thermal fatigue



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.



10A

15 A

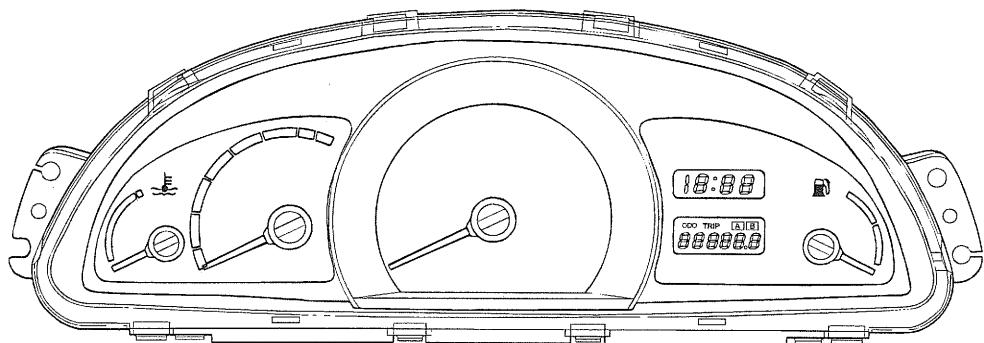
ETDA086C

INDICATORS AND GAUGES

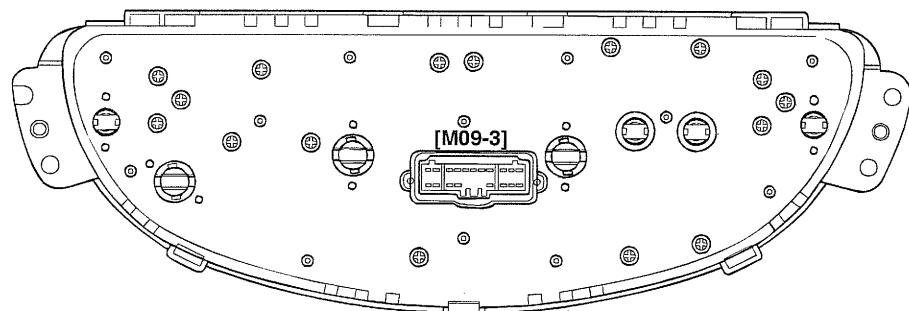
INSTRUMENT CLUSTER

COMPONENTS

ETNC1200



KTNB001M



KTNB001N

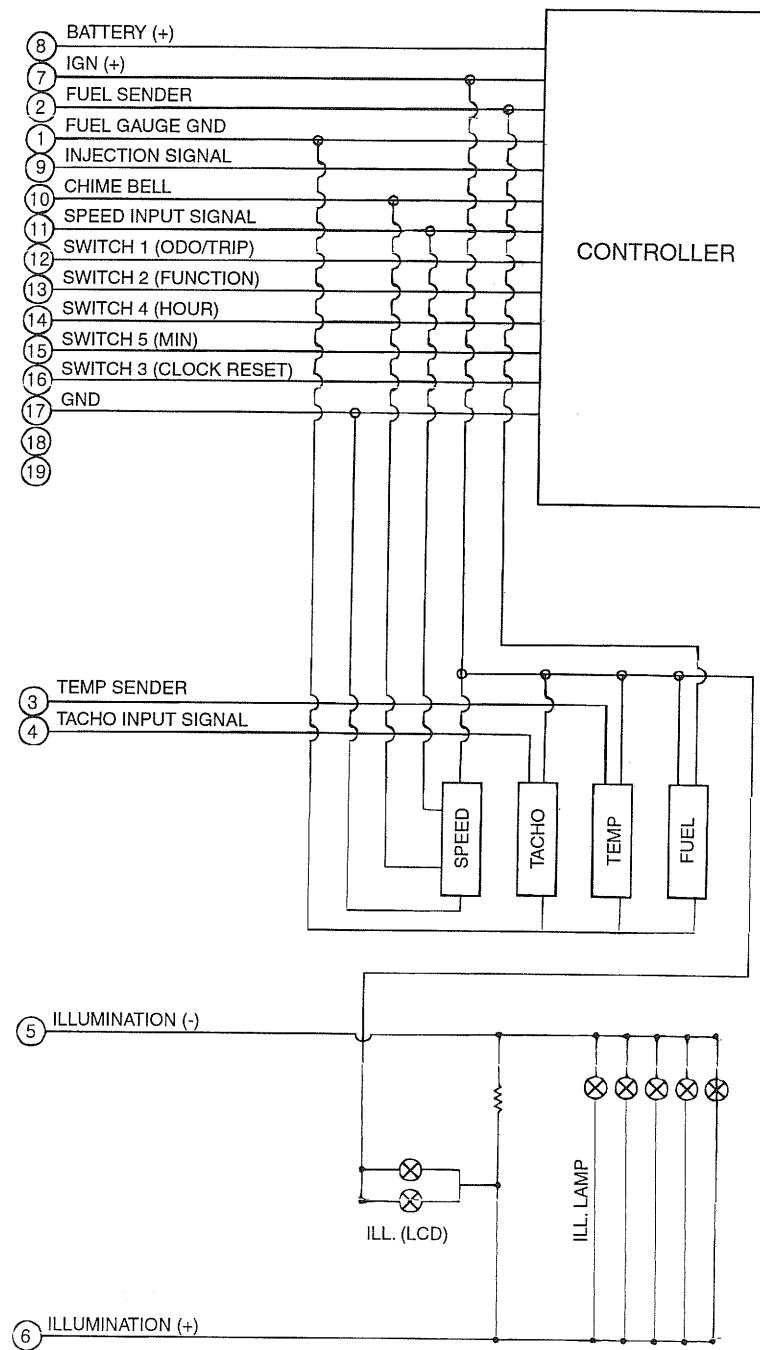
[M09-3]

1	2	3	4	<input checked="" type="checkbox"/>	5	6	7	8
9	10	11	12	13	14	15	16	17
					18	19		

KTNB140A

CIRCUIT DIAGRAM

ETNC1250

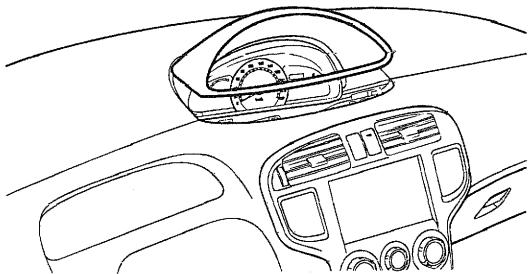


ETNC125A

REMOVAL AND INSTALLATION

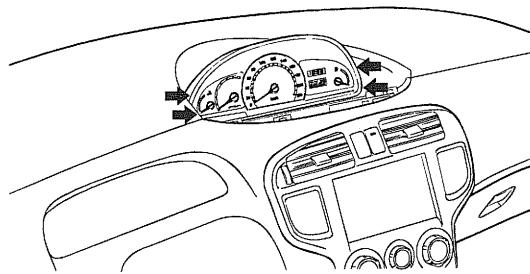
ETNC1300

1. Disconnect the negative (-) battery terminal.
2. Pry the cluster facia panel loose and disconnect the clock switch connector.



KSNB008R

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

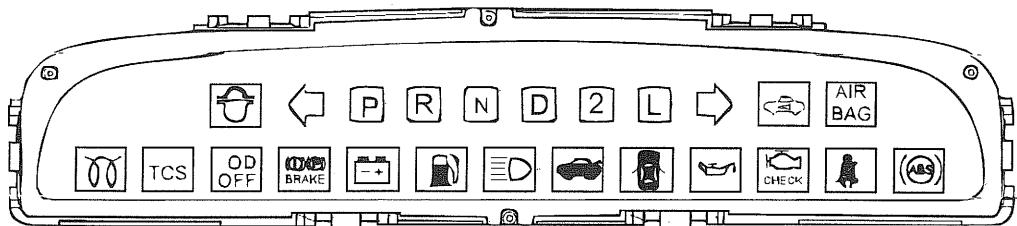


KSNB008F

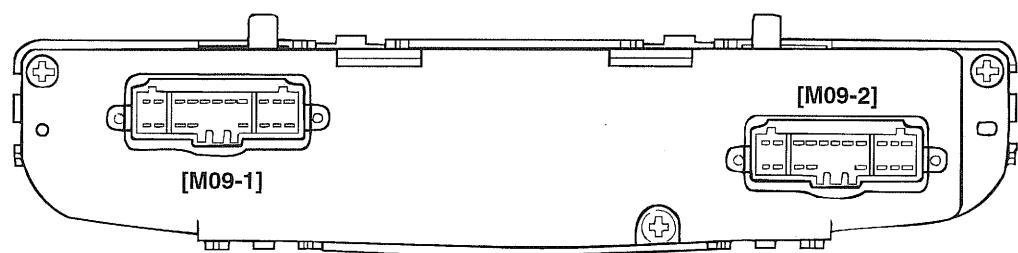
4. Installation is the reverse of removal.

TELL-TALE LAMP

ETNC1350



KTNB001P



KTNB001Q

[M09-1]

1	2	3	4	☒	5	6	7	8
9	10	11	12	13	14	15	16	17

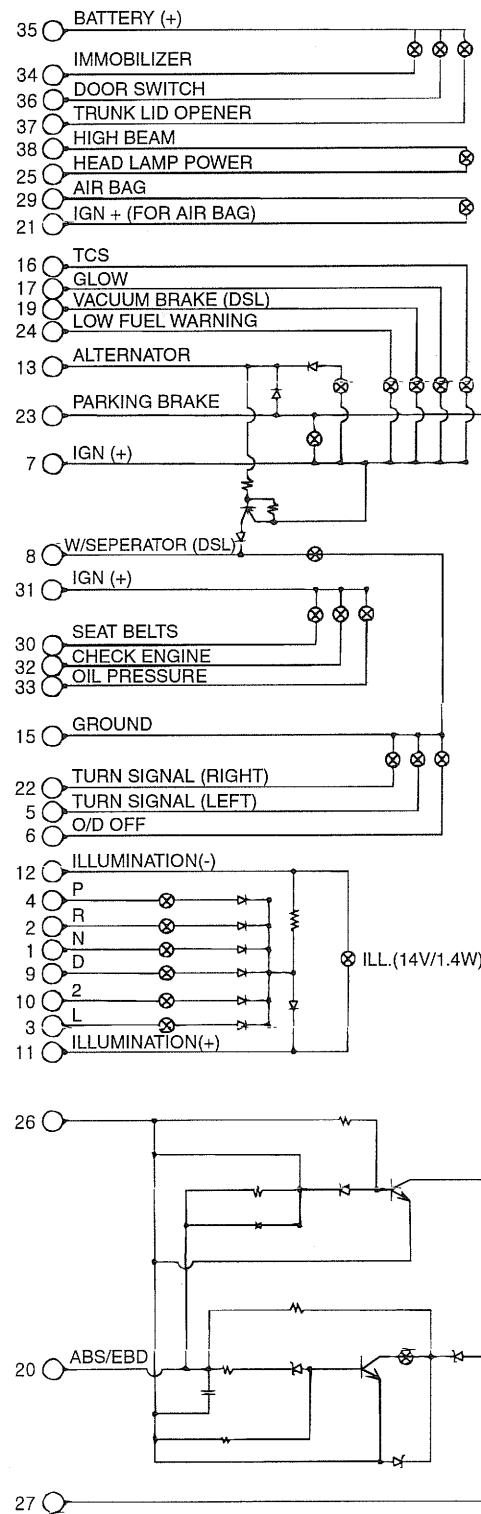
[M09-2]

20	21	22	23	☒	24	25	26	27
28	29	30	31	32	33	34	35	36

KTNB155A

CIRCUIT DIAGRAM

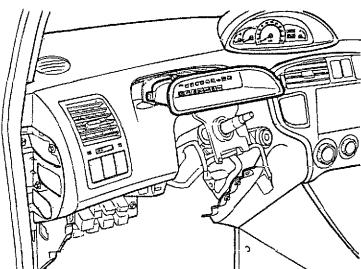
ETNC1400



ETNC140A

REMOVAL ETNC1450

1. Disconnect the negative (-) battery terminal.
2. Remove the tell-tale lamp assembly with a flat-tip screwdriver and disconnect the wire connector.



KSNB008E

3. Installation is the reverse of removal.

Velocity (Km/h)	20	40	60	80	100	120
Tolerance (Km/h)	20-24.1	40-43	60-64.1	80-85.2	100-105.2	120.5-126.3
Tolerance (Km/h)	20.8-25.4	40-44	60.8-65.4	81.4-86.8	102.6-108.2	123.5-129.6
Velocity (Km/h)	140	160	180	200	Area	
Tolerance (Km/h)	140.5-146.7	160.5-167.5	181-188.4	201-209.1	Others	
Tolerance (Km/h)	144.4-151	165.4-172.4	186.3-193.8	207.2-215.2	EEC & General	

Velocity (MPH)	10	20	40	60
Tolerance (MPH)	10-12.5	20-22.5	40-42.6	60-63.4
Velocity (MPH)	80	100	120	Area
Tolerance (MPH)	80.3-84.1	100.3-104.7	120.3-125.3	EEC & General

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.*

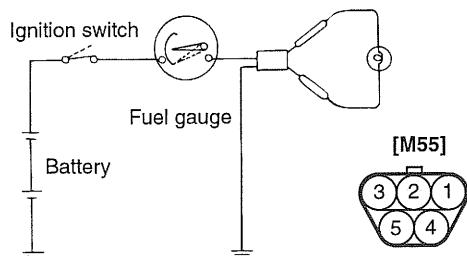
Revolution (RPM)	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Tolerance (RPM)	±100	±125	±150	±150	±150	±180	±210

FUEL GAUGE

OPERATION CHECK

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 watt, 12V test bulb to terminals 2 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.



ETNC150B

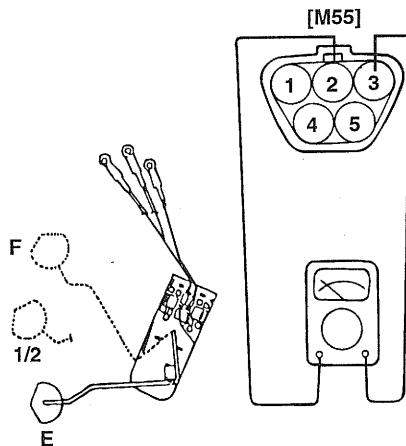
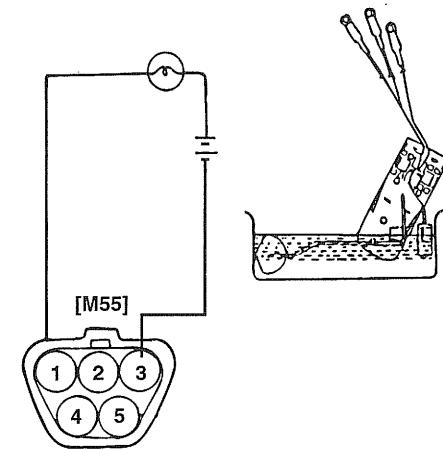
CAUTION

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

FUEL SENDER

1. Using an ohmmeter, measure the resistance between terminals 2 and 3 at each float level.

Float position	F	1/2	E
Resistance (Ω)	4.0	32.5	110



1. Thermister
2. Fuel gauge
3. Ground

ETNC150C

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

LOW FUEL LEVEL SENSOR

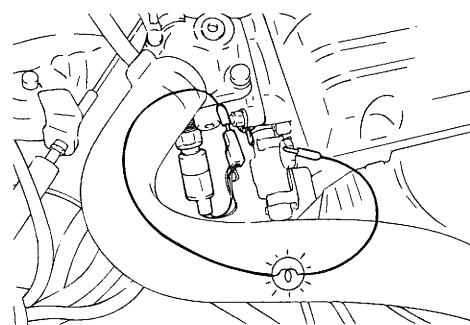
1. Connect a test lamp (12V, 3.4W) and the battery to the sender. Immerse the sender in water.
2. The lamp should be off while the thermister is submerged in the water, and should illuminate when the sender is taken out of the water.

NOTE

If there is a malfunction, replace the fuel sender as an assembly.

ENGINE COOLANT TEMPERATURE GAUGE

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



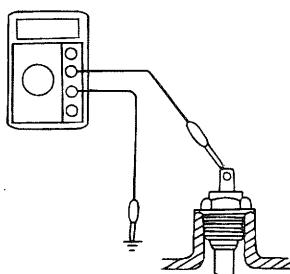
ETLA605D

4. Turn the ignition switch ON.
5. 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

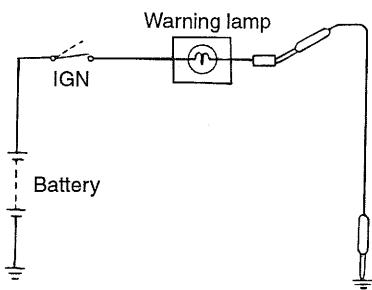
1. Using an ohmmeter, measure the resistance between the terminal and ground.



ETLA605E

2. If the resistance value is not as shown in the table, replace the temperature sender.

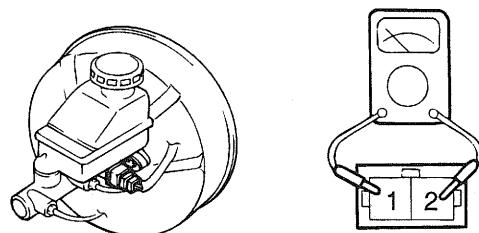
Temperature (°C)	60	85	110	125
Resistance (Ω)	122	47.4	24.3	15.9



ETMB140D

BRAKE FLUID LEVEL WARNING SWITCH

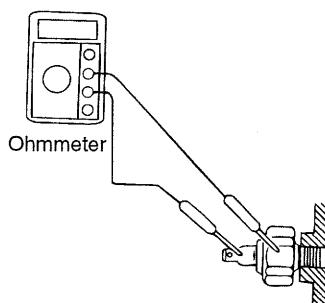
1. Remove the connector from the switch located at the brake fluid reservoir.
2. Verify that continuity exists between switch terminals 1 and 2 while pressing down the switch (float) with a rod.



V5BE060M

OIL PRESSURE SWITCH

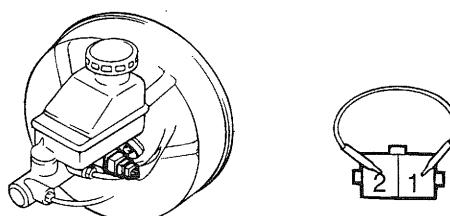
1. Check that there is continuity between the switch's terminal and ground with the engine stopped.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.



ETMB140C

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.



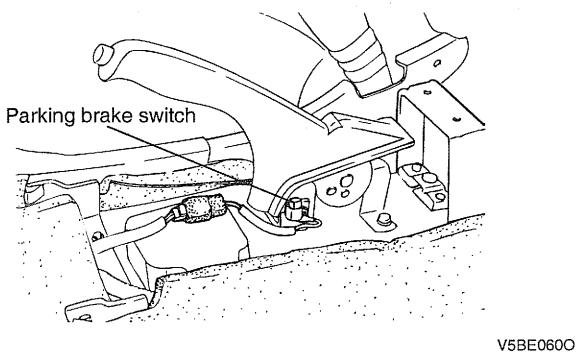
V5BE060N

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.

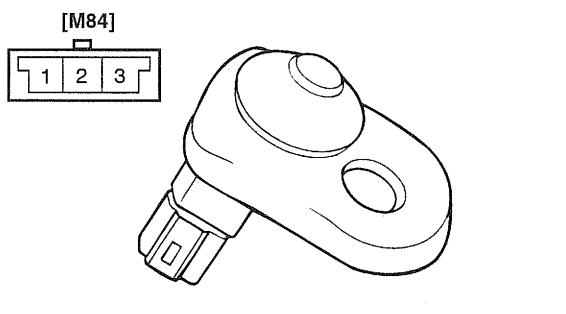
1. Check that there is continuity between the terminal and switch body with the switch ON (Lever is pulled).
2. Check that there is no continuity between the terminal and switch body with the switch OFF (Lever is released).

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



DOOR SWITCH

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



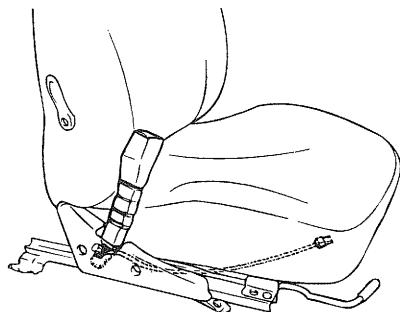
Terminal Position	1	2	3
Free (Door open)	○	○	○
Push(Door close)			

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(0 Ω)



V5BE060Q

SEAT BELT WARNING LAMP

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

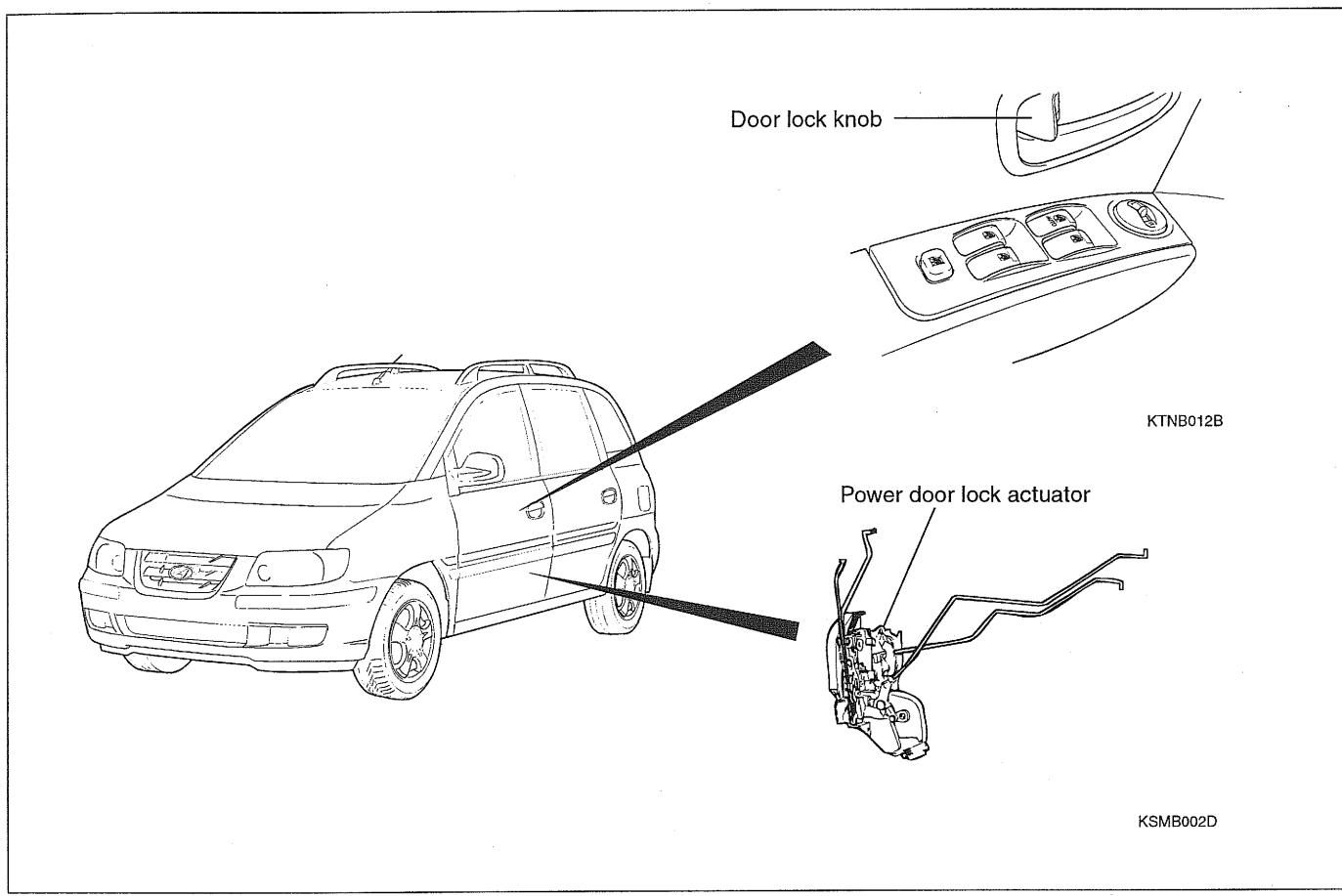
Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

POWER DOOR LOCKS

POWER DOOR LOCK ACTUATORS

COMPONENTS

ETNC1550

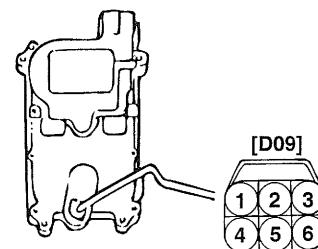


ETNC155A

INSPECTION

ETKA1300

1. Disconnect the actuator connector from the wiring harness.
2. Apply battery voltage (12V) to each terminal as shown in the table and verify that the actuator operates correctly.



ETKA330A

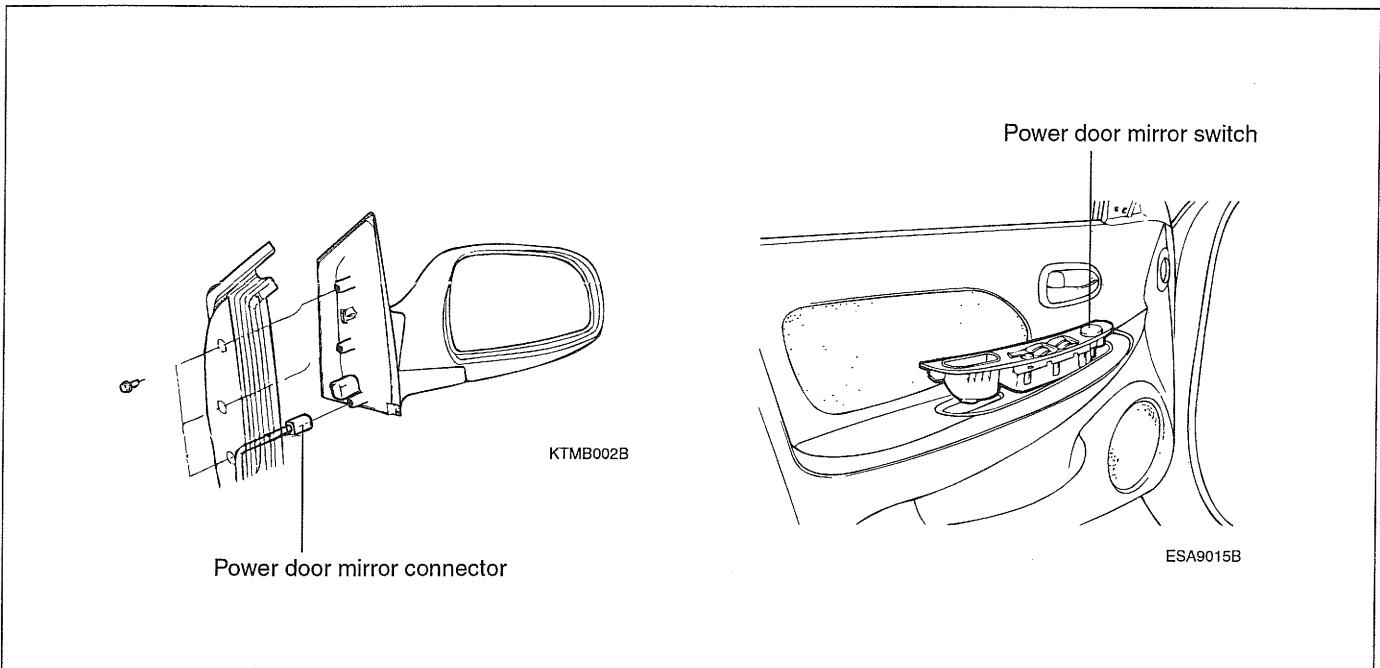
Terminal Position	4	6
Unlock	⊕	⊖
Lock	⊖	⊕

ETKA330B

POWER DOOR MIRRORS

COMPONENTS

ETNC1600



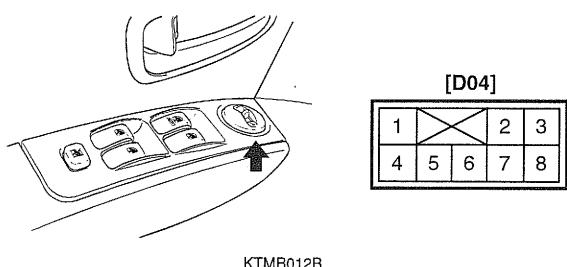
ETNC160A

POWER DOOR MIRROR SWITCH

INSPECTION

ETNC1650

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.



KTMB012B

KTNB185A

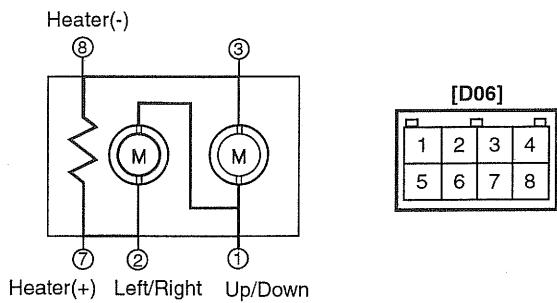
Class	Terminal Direction	1	2	3	4	5	6	7	8
LEFT HAND	UP	○				○			○
	DOWN	○			○			○	
	OFF								
	LEFT		○		○			○	
	RIGHT		○		○			○	
RIGHT HAND	UP	○				○		○	
	DOWN	○				○		○	
	OFF								
	LEFT					○		○	
	RIGHT					○		○	

ETNC165A

POWER DOOR MIRROR ACTUATOR

INSPECTION ETNC1700

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.



ETNC170A

[D06]

Terminal Position	1	2	3
UP	⊕	⊕	⊖
DOWN	⊖	⊖	⊕
OFF	⊕	⊕	⊖
LEFT	⊖	⊕	⊖
RIGHT	⊕	⊖	⊕

ETNC170B

MIRROR HEATER INSPECTION

[D06]

Terminal Position	7	8
Heater	No polarity	

ETNC170C

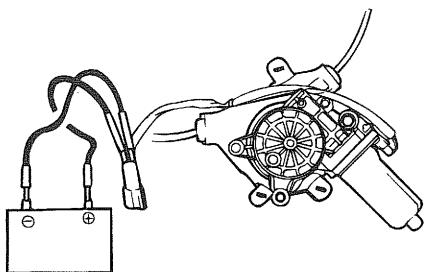
POWER WINDOWS

POWER WINDOW MOTOR

INSPECTION

ETJA1200

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.

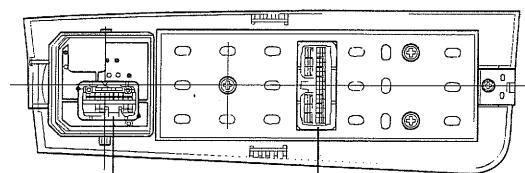
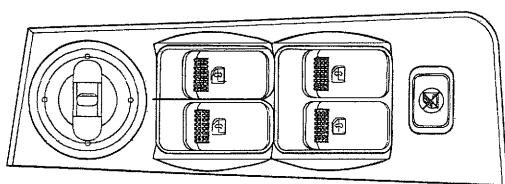


ETDA135A

POWER WINDOW SWITCH

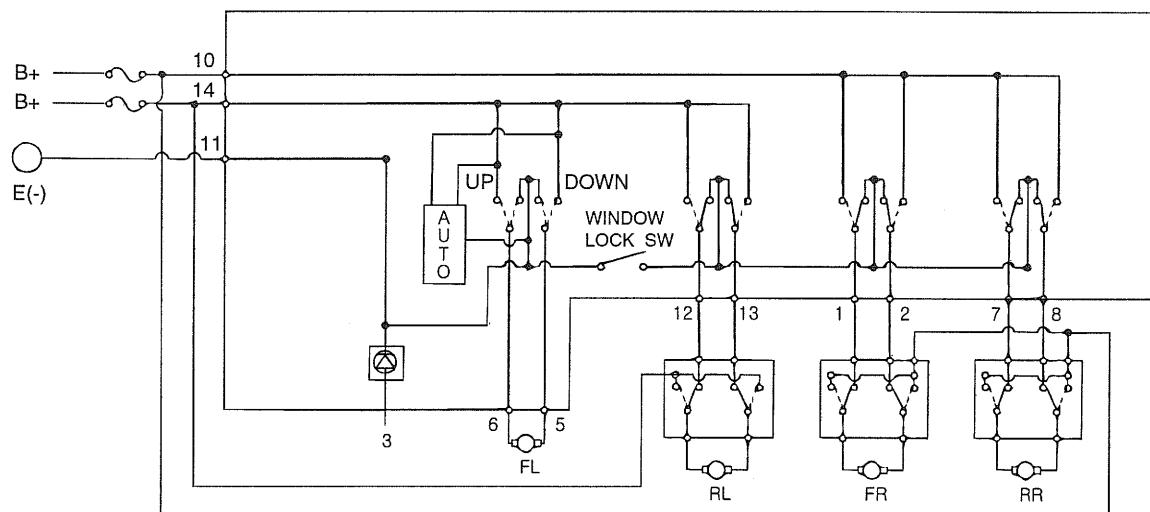
CIRCUIT DIAGRAM ETNC1750

[POWER WINDOW MAIN SWITCH]



KTNB012C

KTNB012D



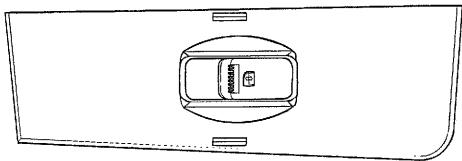
[D05]

KTNB001K

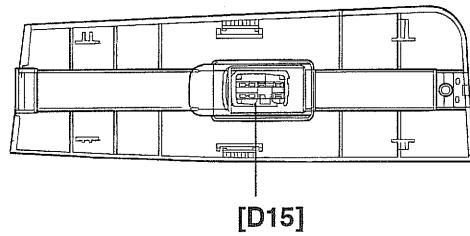
1	2	3	<input checked="" type="checkbox"/>	4	5	6
7	8	9	10	11	12	13

ETNC175A

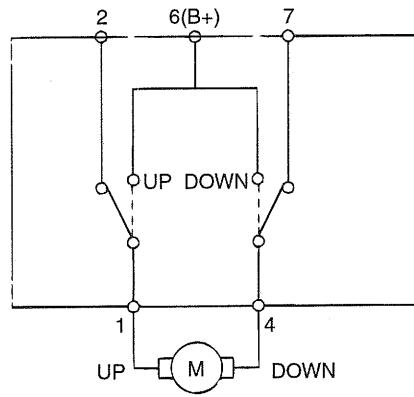
[POWER WINDOW SUB SWITCH]



KTNB012E

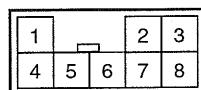


KTNB012F



KTNB001K

[D15]

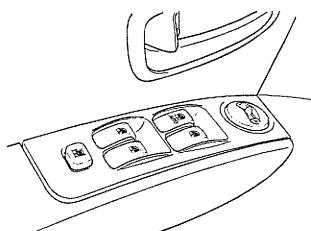


ETNC175B

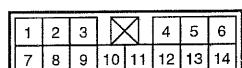
INSPECTION ETNC1800

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]



KTNB012B

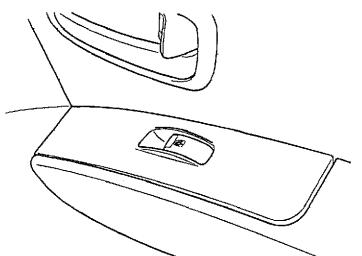
KTNB200B

[D05]

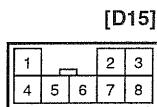
Terminal Position	FRONT LEFT				FRONT RIGHT				REAR LEFT				REAR RIGHT			
	5	6	11	14	1	2	10	11	11	12	13	14	7	8	10	11
UP	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
OFF	○	○	○		○	○		○	○	○	○		○	○	○	○
DOWN	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

ETNC180A

POWER WINDOW SUB SWITCH



KTNB012G



KTNB200C

[D15]

Terminal Position	1	2	4	6	7
UP	○		○	○	○
OFF	○	○	○		○
DOWN	○	○	○	○	

ETNC180B

REAR WINDOW DEFOGGER

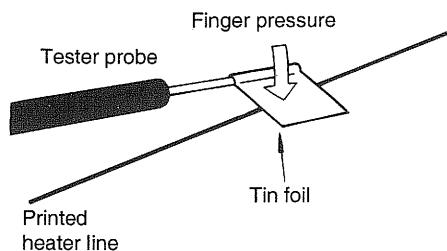
REAR WINDOW DEFOGGER PRINTED HEATER

INSPECTION

ETA91650

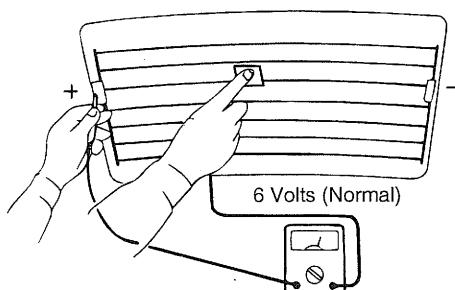


CAUTION
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



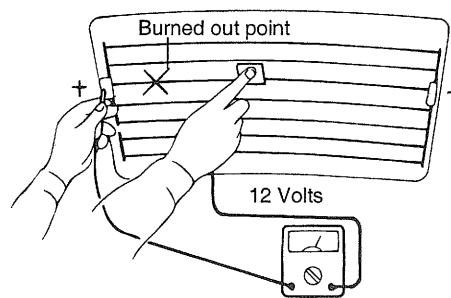
ETA9165A

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.



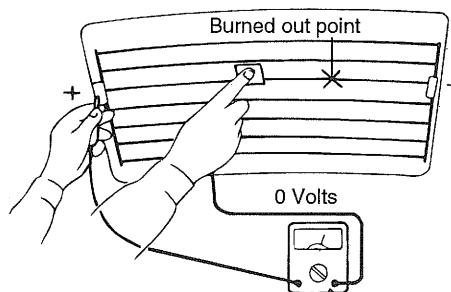
ETA9165B

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



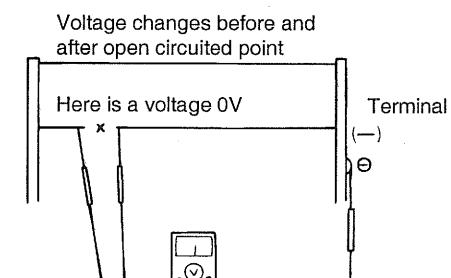
ETA9165C

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



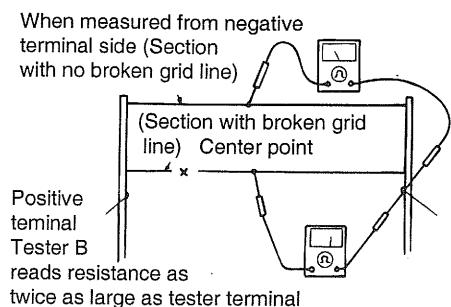
ETA9165D

4. 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

5. 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

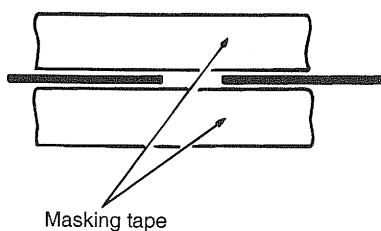
Prepare the following items:

1. Conductive paint.
2. Paint thinner.
3. Masking tape.
4. Silicone remover.
5. 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).

CAUTION

After repairing, clean the glass with a soft dry cloth or wipe along the grid line with a slightly moistened cloth.



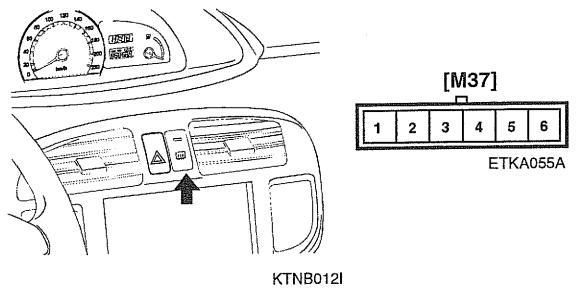
ETA9165G

REAR WINDOW DEFOGGER SWITCH

INSPECTION

ETNC1850

1. Disconnect the negative(-) battery terminal.
2. Remove the rear window defogger switch from the center facia panel.



KTNB205A

3. Check the switch for continuity between the terminals. If continuity is not as specified in the table, replace the switch.

[M37]

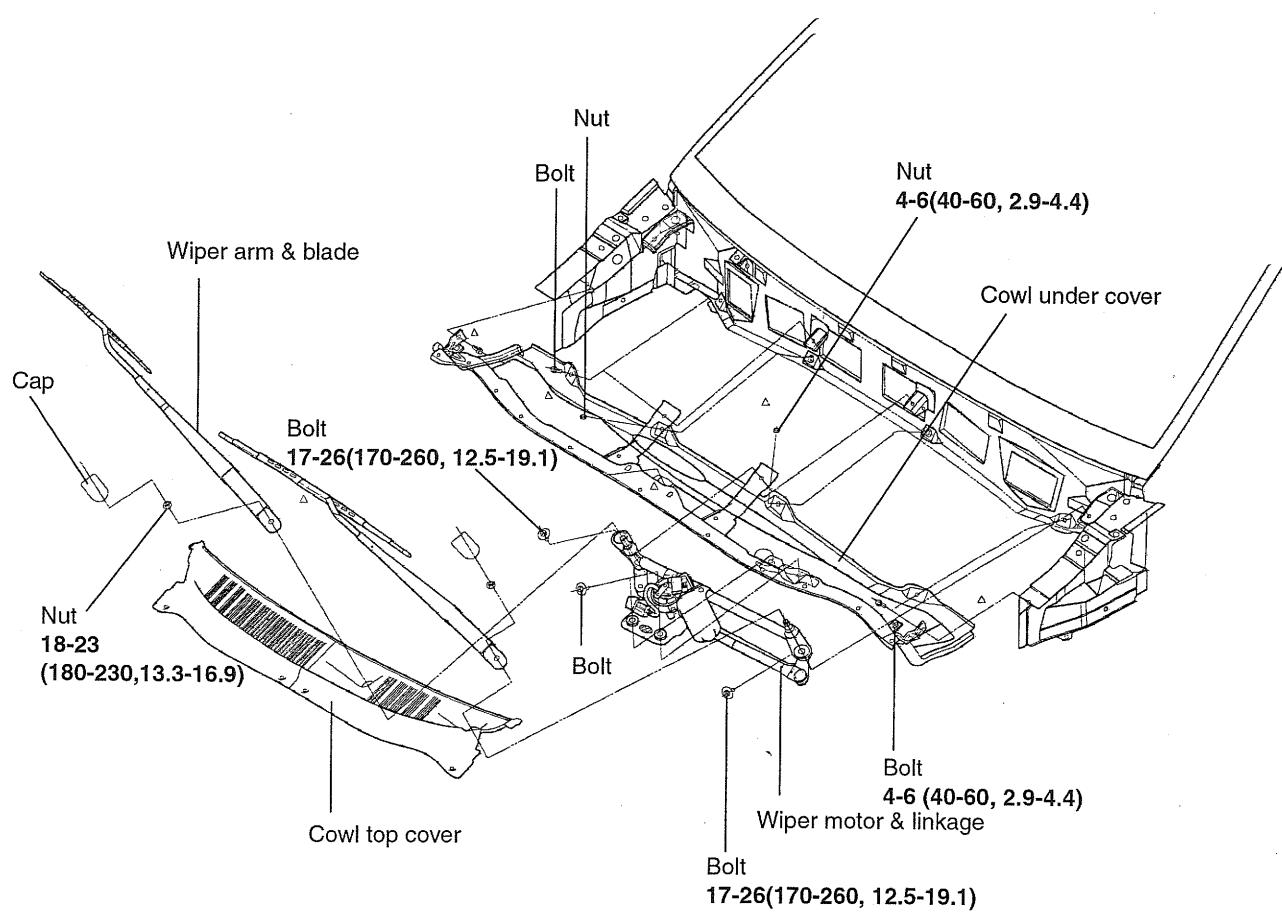
Terminal Position	1	2	3	4	5	6
ON			○	○	○	○
OFF	○	○				

ETNC185A

WINDSHIELD WIPER/WASHER

COMPONENTS

ETNC1900

**TORQUE : Nm (kg·cm, lb·ft)**

ETNC190A

WINDSHIELD WIPER/WASHER SWITCH

INSPECTION

ETNC1950

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]

1	2	3	4	5	6	7	
8	9	10	11	12	13	14	

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

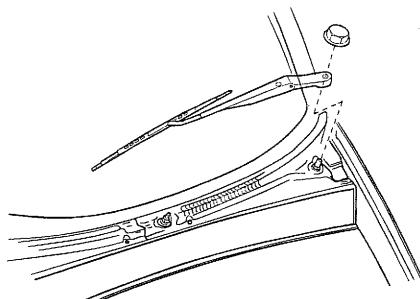
REMOVAL

ETNC2000

1. Remove the wiper arm.

 NOTE

Care must be taken not to scratch the engine hood.

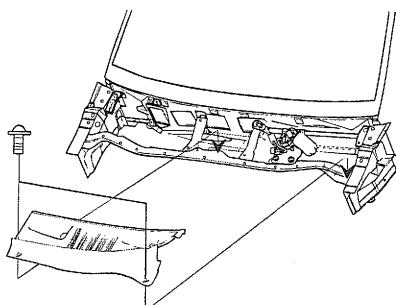


KTNB012J

Tightening torque

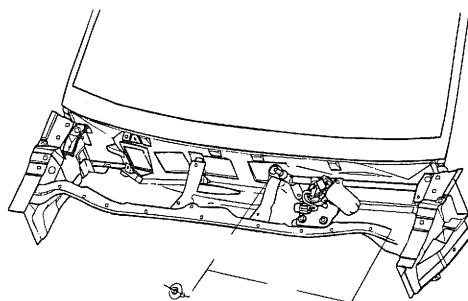
18-23 Nm (180-230 kg·cm, 13.3-16.9 lb·ft)

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



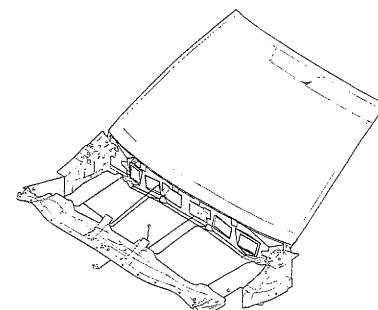
KTNB012K

3. Disconnect the windshield wiper motor connector and remove the 2 bolts holding the windshield wiper motor assembly.



KTNB012L

4. Remove the cowl under cover after removing 7 bolts and 2 nuts.



KTNB012M

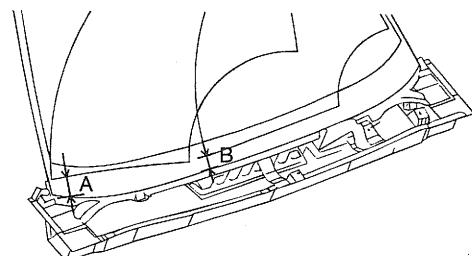
5. Installation is the reverse of removal.

INSTALLATION

ETNC2050

1. Install the wiper arm to the specified position.

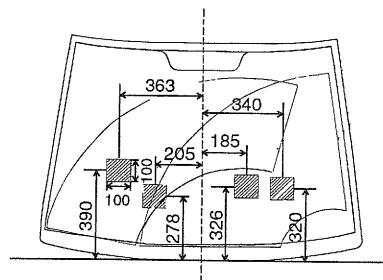
Specified position	A	B
Distance (mm)	30-40	30-40



ETJA060I

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

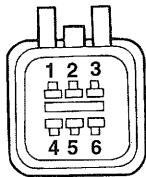
Unit:mm



ETNC205A

INSPECTION ETAC1900**SPEED OPERATION CHECK**

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

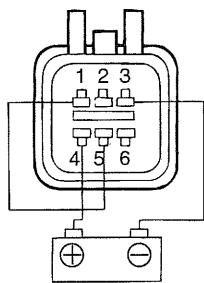


1. Low	4. IGN+
2. High	5. Parking
3. Ground	6. Blank

ETAC190A

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 1.
3. Connect terminals 1 and 5.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 3.
5. Check that the motor stops running at the off position.



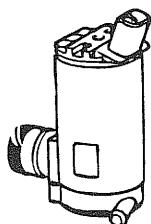
ETAC190B

FRONT WASHER MOTOR

INSPECTION

ETNC2100

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 3 respectively to see that the washer motor runs and water sprays from the front nozzles.
3. Check that the motor operates normally.



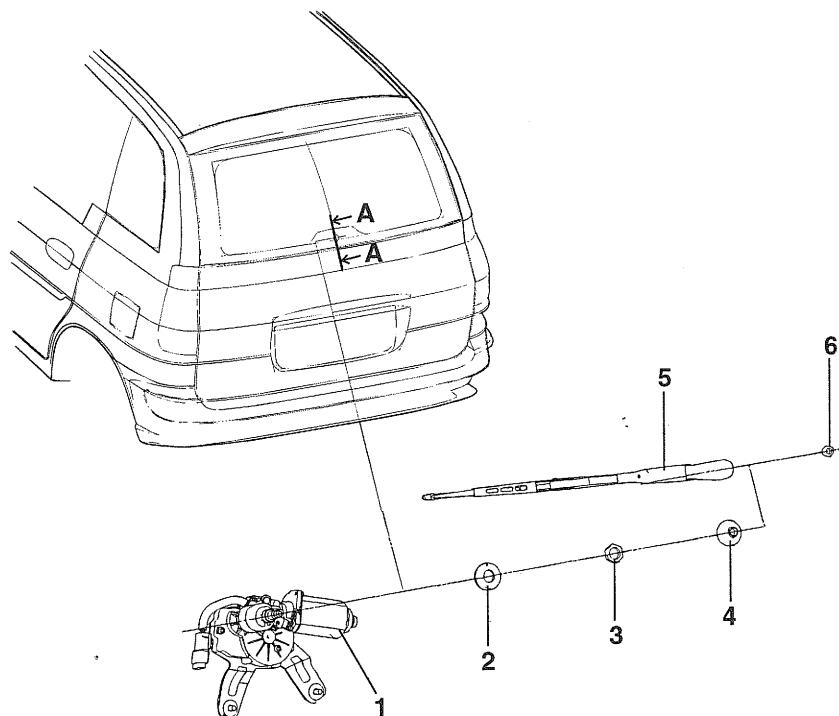
1. Blank
2. IGN (+)
3. Windshield washer (-)

ETNC210A

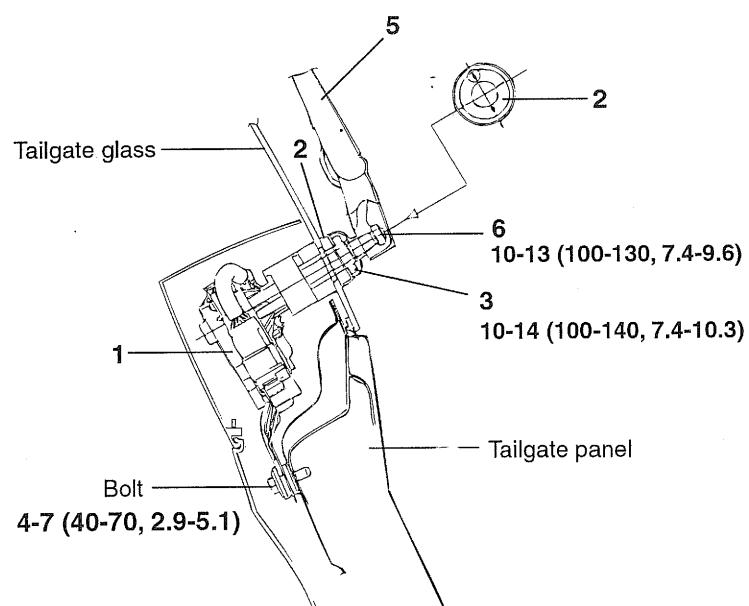
REAR WIPER/WASHER

COMPONENTS

ETNC2150



KTNB001A



KTNB001C

1. Rear wiper motor assembly
2. Cap & pad
3. Nut
4. Cover
5. Rear wiper arm & blade
6. Nut

4-7 (40-70, 2.9-5.1)

[SECT. A-A]

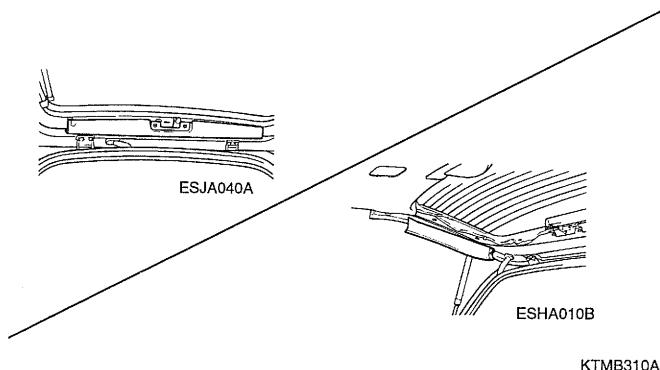
TORQUE : Nm (kg·cm, lb·ft)

ETNC2150

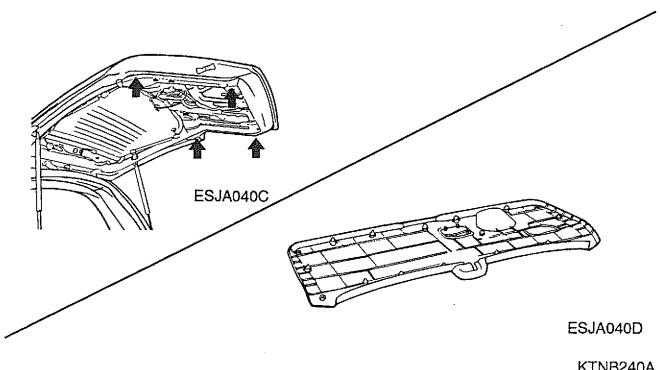
REAR WIPER MOTOR

REMOVAL ETNC2200

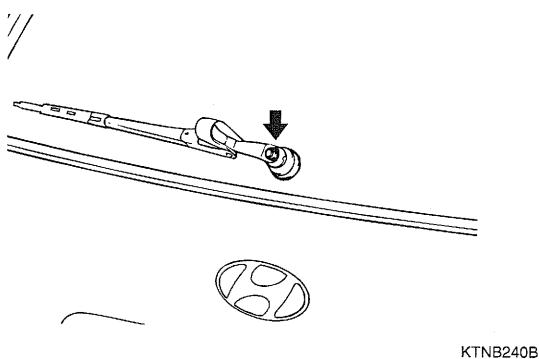
1. Remove the center high mounted stop lamp then pry the upper and side trim from the tailgate frame.



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



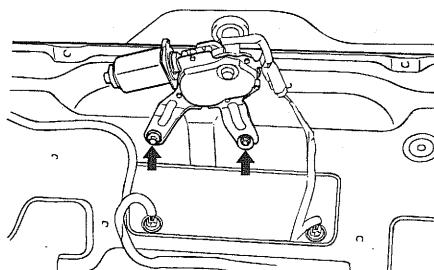
3. Remove the mounting nut and the rear wiper assembly.



Tightening torque

10-13 Nm (100-130 kg·cm, 7.4-9.6 lb·ft)

4. Remove the rear wiper motor after removing 2 bolts then disconnect the wire connector.

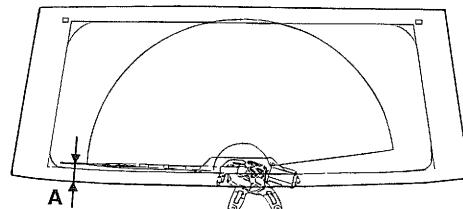


5. Installation is the reverse of removal.

INSTALLATION ETNC2250

1. After replacing all the removed components, install the rear wiper arm to the specified stop position.

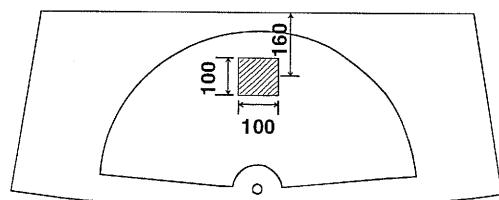
Specified position	A
Distance (mm)	45 - 55mm



KTNB001B

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

Unit : mm



ETNC225A

INSPECTION ETNC2300

1. Remove the connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 1 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

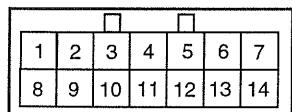
REAR WASHER SWITCH

INSPECTION

ETNC2350

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	○			○

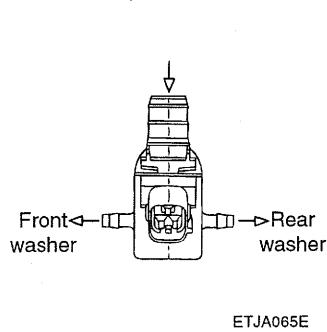
ETNC235A

REAR WASHER MOTOR

INSPECTION

ETNC2400

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 is pumped.



1. Rear washer (-)
2. IGN (+)
3. Front washer (-)

ETJA065F

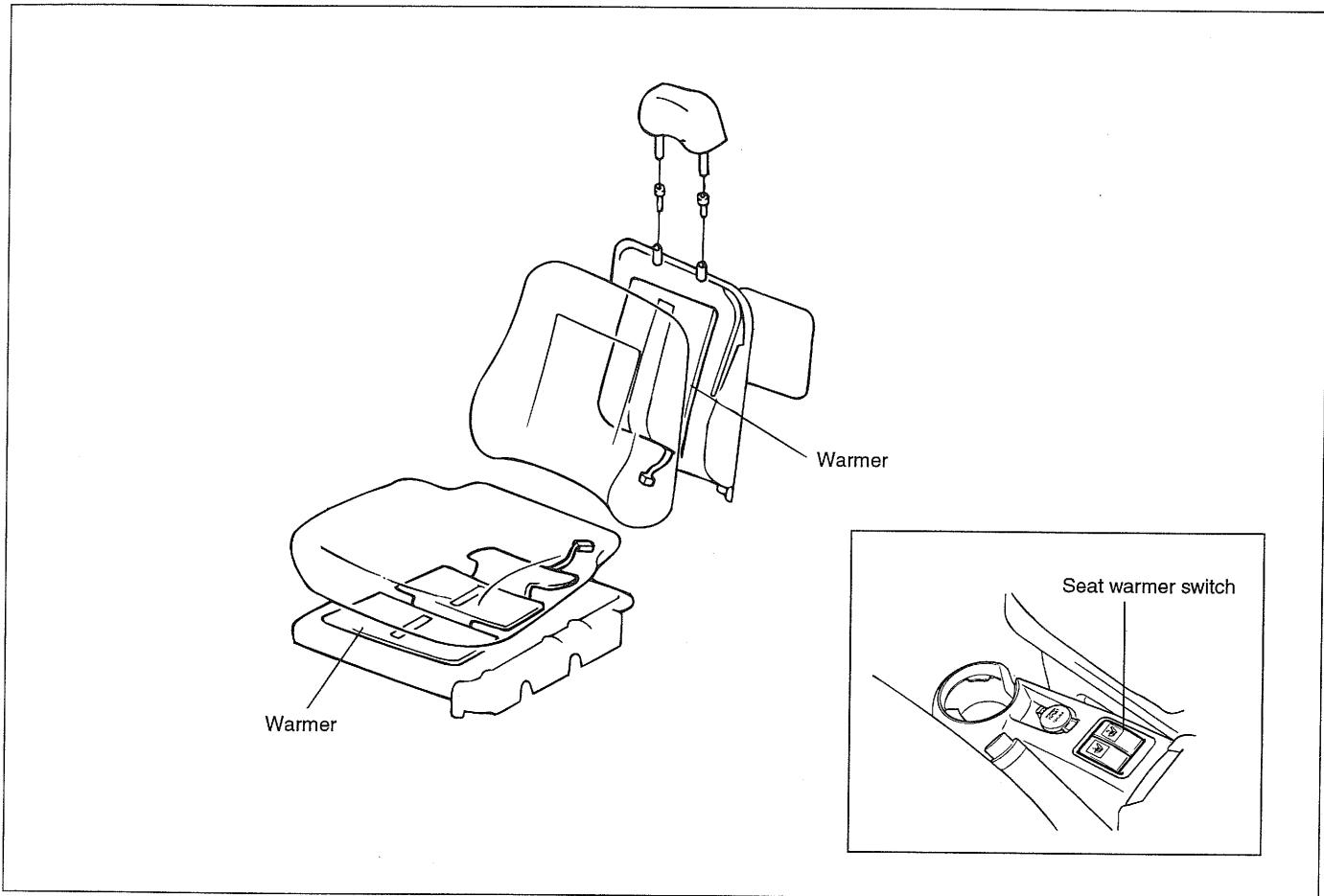
ETNC240A

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

SEAT WARMER

COMPONENTS

ETNC2410



ETNC241A

SEAT WARMER SWITCH

3. Check for continuity between the terminals.

INSPECTION

ETNC2450

1. Disconnect the negative(-) battery terminal.
2. Remove the seat warmer switch from the floor console upper cover.

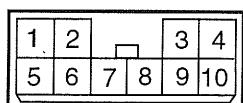
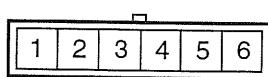
[M70/M69]

Terminal Position	2	1	3	4	5
ON	<input type="circle"/>				
OFF	<input type="circle"/>				

ETNC245A

[LH:M70]

[RH:M69]



ETNC245B

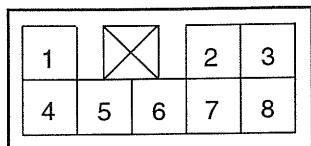
SUN ROOF

SUN ROOF SWITCH

INSPECTION

ETAC2200

1. Using an ohmmeter, check for continuity between the terminals.
2. If the continuity is not as specified, replace the switch.



Connector No : M97

ETAC220A

[M97]

Terminal		1	2	3	4	5	6	7
Position								
Slide switch	Open		○	○			○	
	Off		○				○	
	Close		○		○		○	
Tilt switch	Up		○		○			○
	Off		○				○	
	Down		○	○	○			○

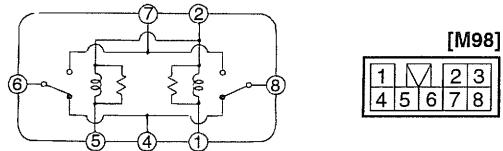
ETAC220B

SUN ROOF RELAY

INSPECTION

ETNC2500

Check for continuity between the terminals.



ETNC250A

Position \ Terminal	1	2	3	4	5	6	7	8
Battery voltage not supplied (coils not energized)	○	○			○			○
Battery voltage supplied (coils energized)		⊕	---	⊖			○	○

⊕-⊖ Indicates battery connection

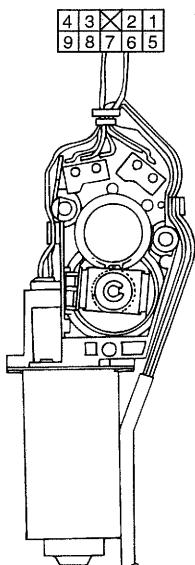
ETNC250B

SUN ROOF MOTOR

INSPECTION

ETMB2650

1. Remove the overhead console.
2. Disconnect the motor connector from sun roof harness.
3. After applying DC 12V to the terminal 8, apply the terminal 3 to the ground.
4. Check that the motor turns in the direction of the sunroof when tilted down and is open.
5. Reverse the connections and check that the motor turns in the direction when the sunroof is closed and tilted up.



KTMB343A

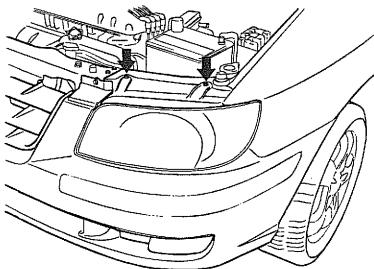
LIGHTING SYSTEM

REPLACEMENT OF LAMPS

ETNC2550

HEAD LAMP/TURN SIGNAL LAMP

1. Disconnect the negative battery terminal.
2. Remove the head lamp and turn signal lamp mounting bolts (2EA) and remove the lamp assembly.

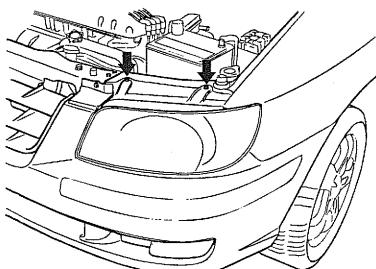


KSNB009B

3. Installation is the reverse of removal.

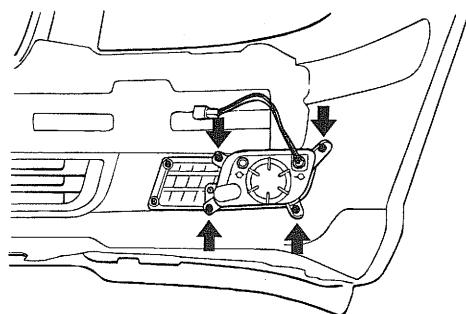
FRONT FOG LAMP

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



KSNB009B

3. Remove the front bumper cover (Refer to BD group). Disconnect the wire connector and remove the front fog lamp (4 screws).

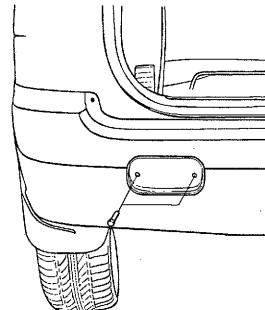


KTNB013B

4. Installation is the reverse of removal.

REAR FOG LAMP

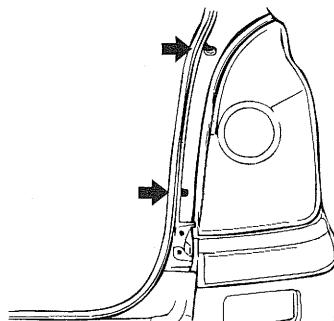
1. Disconnect the negative battery terminal.
2. Remove the 2 screws holding the rear fog lamp and disconnect the wire connector.



KTNB012Y

REAR COMBINATION LAMP

1. Disconnect the negative battery terminal.
2. Remove the 2 screws holding the rear combination lamp and disconnect the wire connectors.

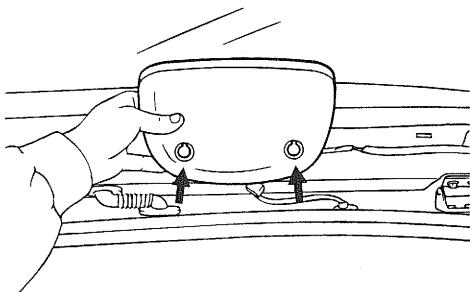


KTMB350A

3. Remove the rear combination lamp assembly.
4. Installation is the reverse of removal.

CENTER HIGH MOUNTED STOP LAMP

1. Disconnect the negative battery terminal.
2. Remove the two mounting bolts and disconnect the wire connector.

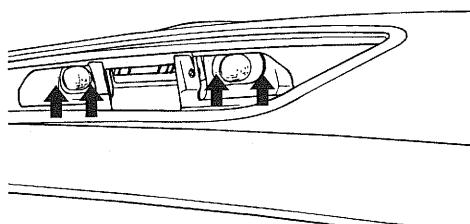


ESJA040N

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 tailgate garnish after removing 4 nuts.
3. Remove the mounting screws and disconnect the lamp connector.

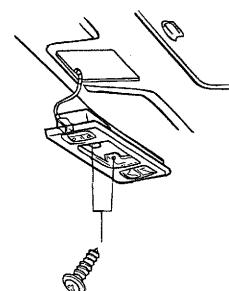


KSNB006B

4. 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 2 screws.

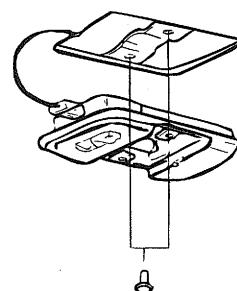


KTNB001S

4. Installation is the reverse of removal.

ROOM LAMP

1. Disconnect the negative battery terminal.
2. Using a flat-tip screwdriver detach the room lamp lens.
3. Detach the lamp assembly from the headliner after removing the 2 screws.



KTNB001T

4. Disconnect the connector from the roof harness.
5. Installation is the reverse of removal.

INSPECTION OF COMPONENTS

ETNC2600

HEAD LAMP RELAY

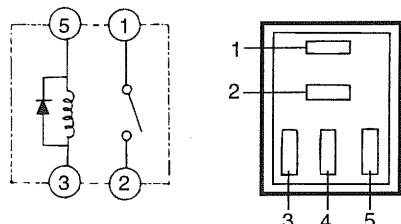
1. Remove the headlamp relay from the relay box in the engine compartment.
2. Check for continuity between terminals on the relay.

Position	Terminal	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.

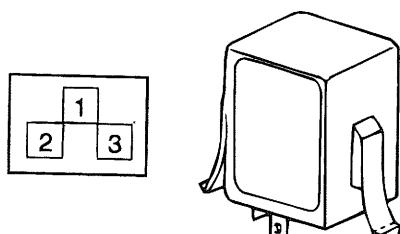
ETMB275A



KTMB385B

FLASHER UNIT

1. Remove the flasher unit from the relay box in the passenger compartment.
2. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 3.



KTDA212A

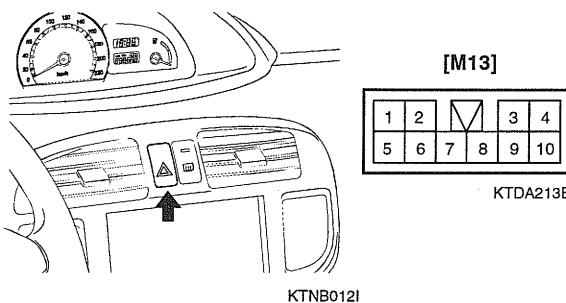
3. Connect the two turn signal lamps in parallel to terminals 2 and 3. Check that the bulbs turn on and off.

NOTE

The turn signal lamps should flash 60 to 120 times per minute. If one of the front or rear turn signal lamps has an open circuit, the number of flashes will be more than 120 per minute. If operation is not as specified, replace the flasher unit.

HAZARD SWITCH

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



KTNB270C

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

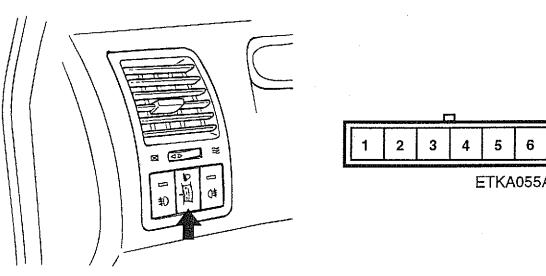
[M13]

Terminal	1	3	4	6	7	8	9	10
OFF						○—○		○
ON	○	○	○		○		○	○

ETNC260A

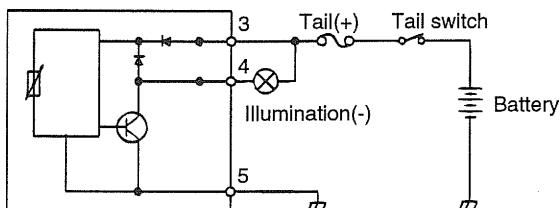
RHEOSTAT

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



ETNC260K

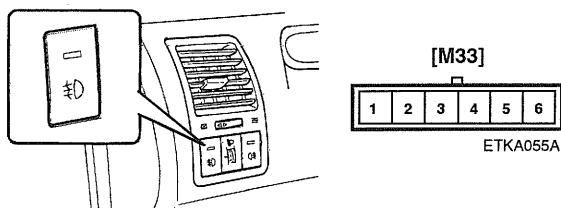
3. Check for intensity. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.



ETNC260B

FRONT FOG LAMP SWITCH

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



KTNB012T

KTNB270A

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

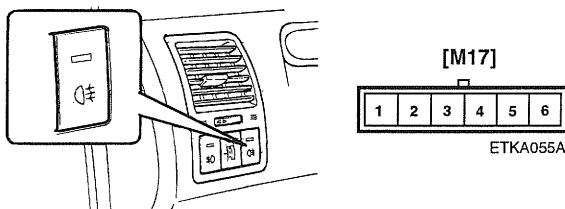
[M33]

Terminal Position	1	2	3	4	5	6
ON						
OFF						

ETNC260C

REAR FOG LAMP SWITCH

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



KTNB012H

KTNB270B

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

[M17]

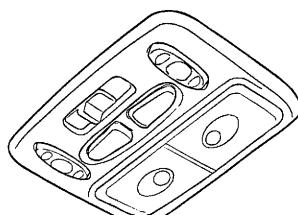
Terminal Position \ Position	1	2	3	4	5	6
ON						
OFF						

ETNC260D

MAP LAMP

Remove the map lamp assembly and check for continuity between terminals.

[WITH SUN ROOF]



[M97]

1	✓	2	3
4	5	6	7

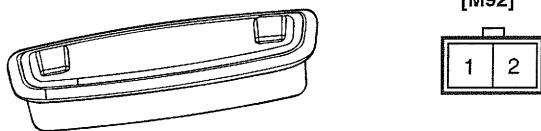
KTNB270F

[M97]

Sort Position \ Position	Map lamp switch			
	LH		RH	
Terminal	ON	OFF	ON	OFF
3				
8				

ETNC260E

[WITHOUT SUN ROOF]



KTNB270G

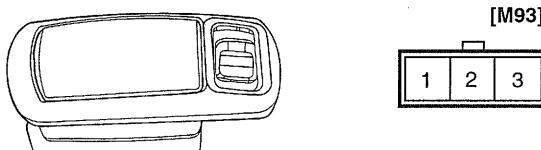
[M92]

Position	Map lamp switch			
	LH		RH	
Terminal	ON	OFF	ON	OFF
1	○		○	
2	○		○	

ETNC260F

ROOM LAMP

Remove the room lamp and check for continuity between terminals.



KTNB270H

[M93]

Position	1	2	3
ON		○	○
DOOR	○	○	○
OFF			

ETNC260G

HEAD LAMPS

HEAD LAMP AIMING

INSTRUCTIONS

ETNC2650

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

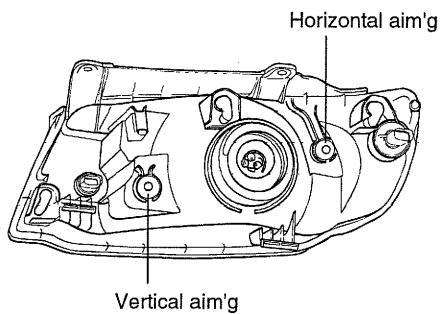


NOTE

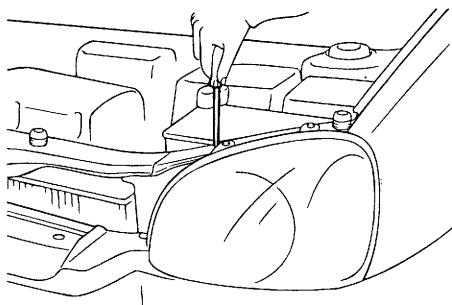
If there are any regulations pertinent to the aiming of headlamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

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.



ETNC265A

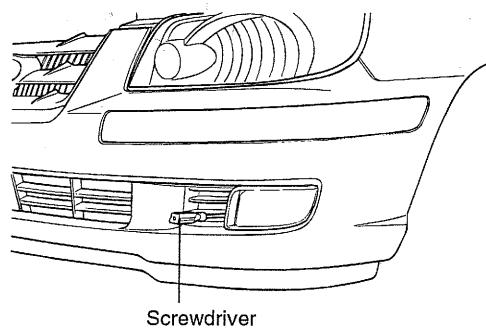


ETJA010F

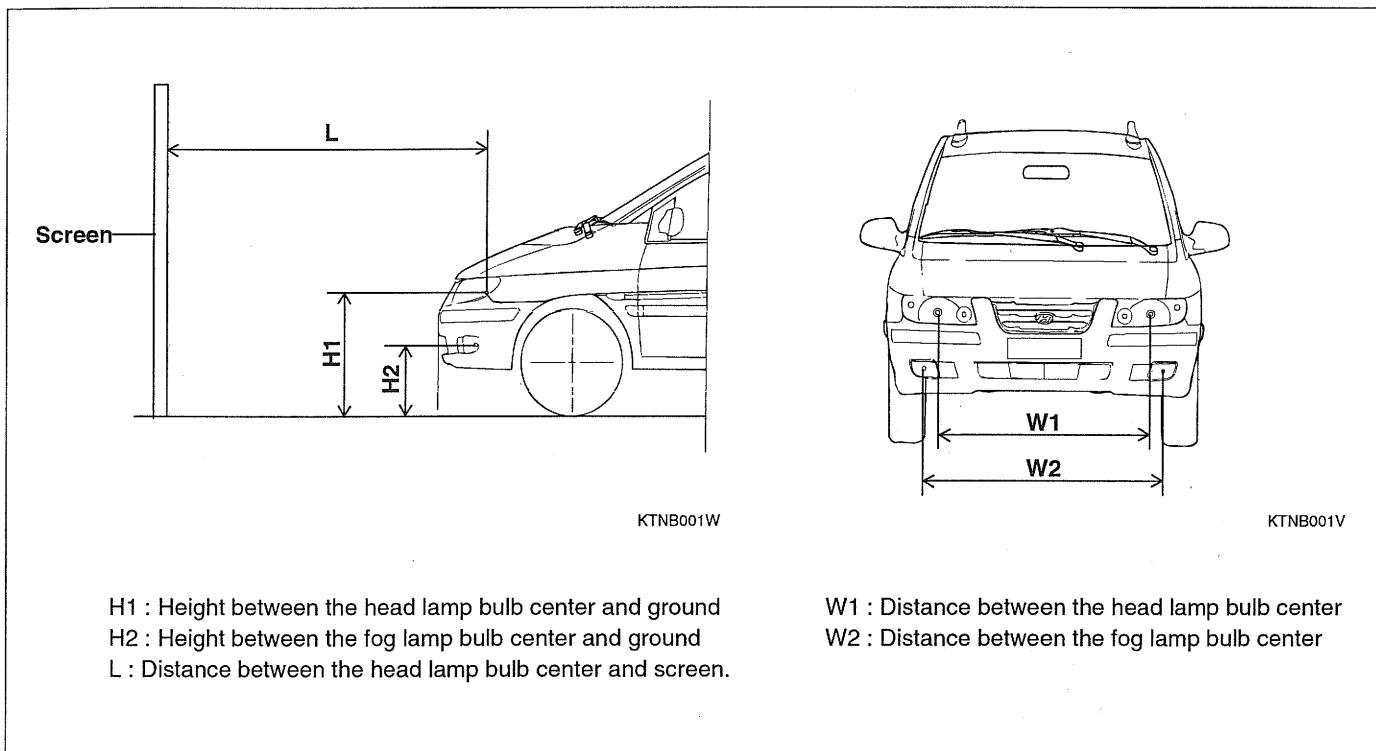
FRONT FOG LAMP

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

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



ETNC265B



KTNB001W

KTNB001V

H1 : Height between the head lamp bulb center and ground

H2 : Height between the fog lamp bulb center and ground

L : Distance between the head lamp bulb center and screen.

W1 : Distance between the head lamp bulb center

W2 : Distance between the fog lamp bulb center

ETNC265C

HEAD LAMP AND FOG LAMP AIMING POINT

Unit : mm

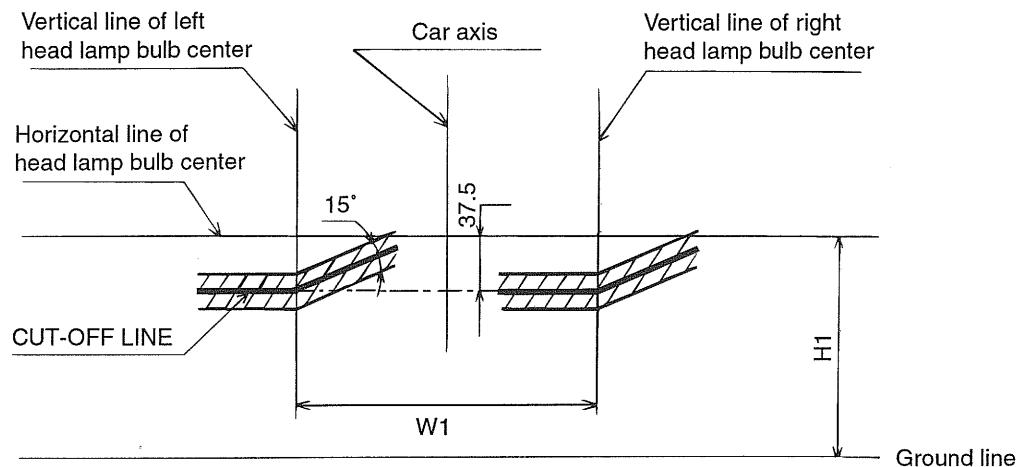
Vehicle condition	H1	H2	W1	W2	L
Without driver	656	363	1,164	1,304	3,000
With driver	648	355			

ETNC265D

- Turn the low beam on without driver aboard.

The cut-off line should be projected in the allowable range (shaded region).

Unit : mm

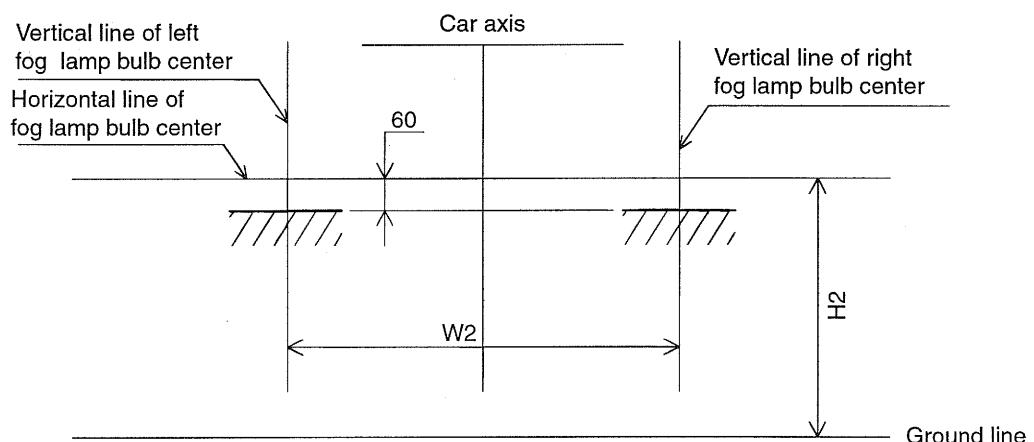


ETNC265E

- Turn the front fog lamp on without the driver aboard.

The cut-off line should be projected in the allowable range (shaded region).

Unit : mm



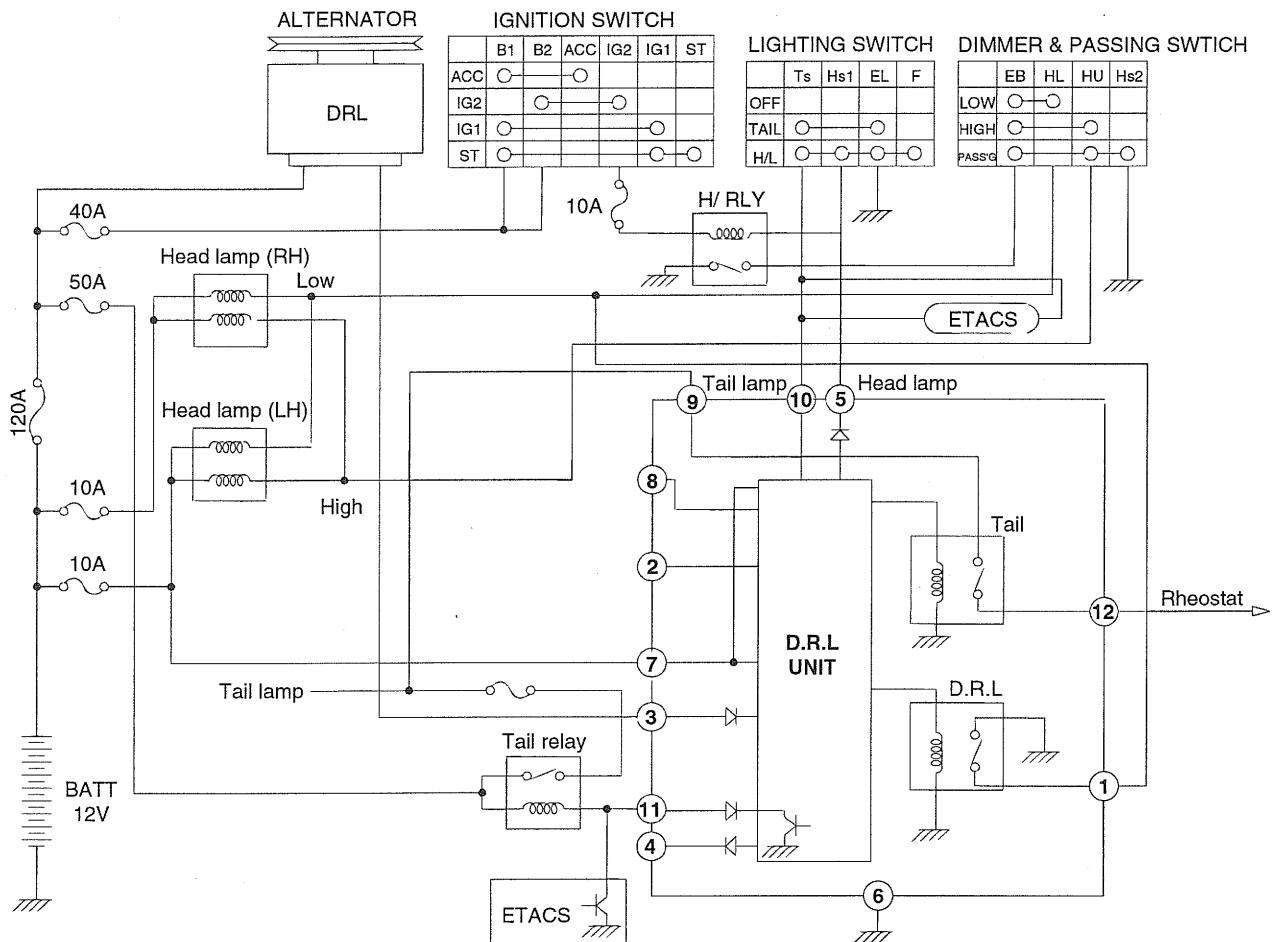
ETNC265F

DAYTIME RUNNING LIGHTS

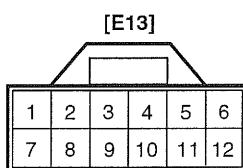
DRL CONTROL MODULE

CIRCUIT DIAGRAM ETNC2700

[SWEDEN]

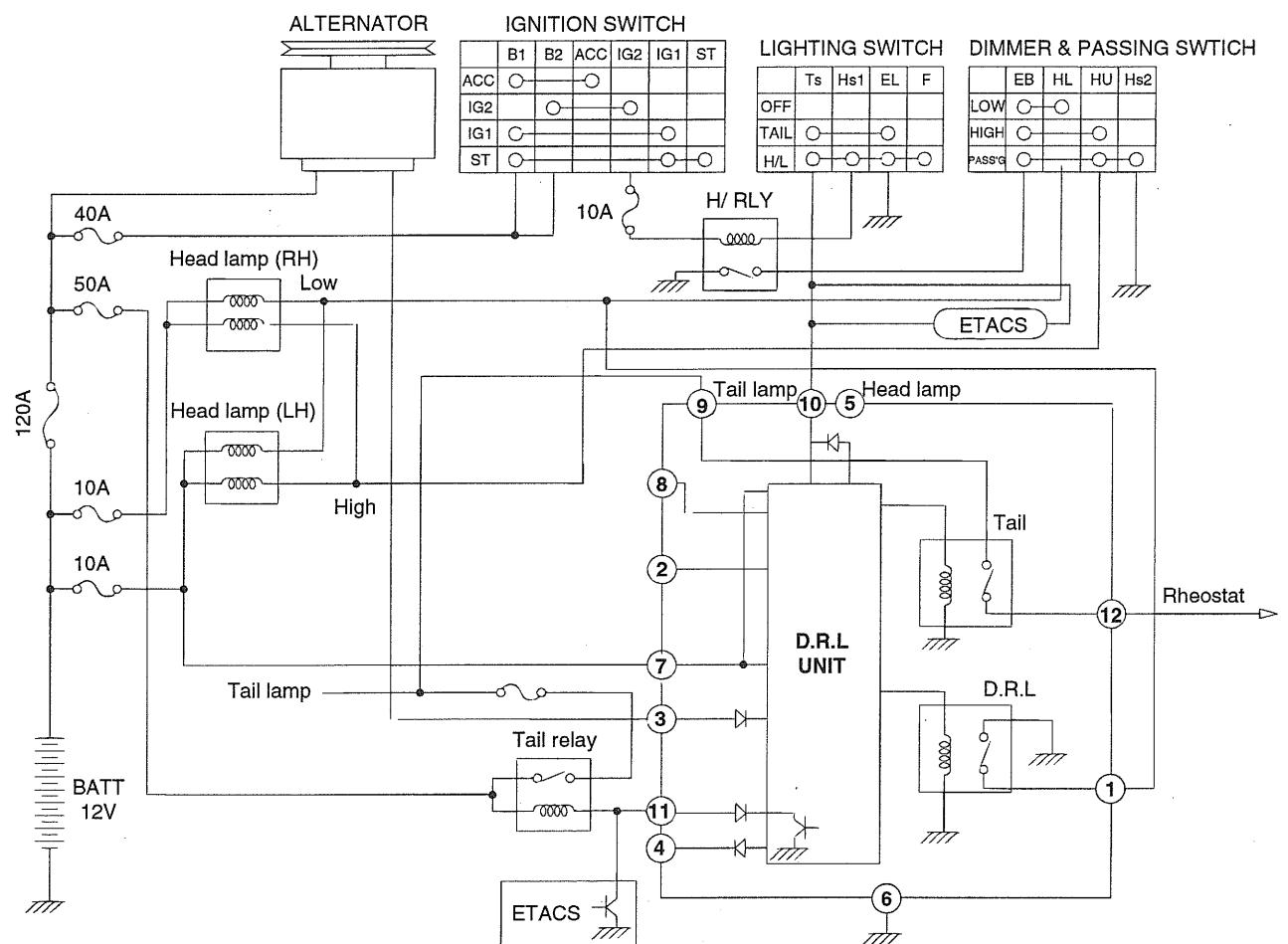


ETNB333A

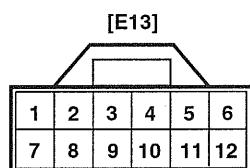


ETNC270A

[NORWAY]



ETNB333B

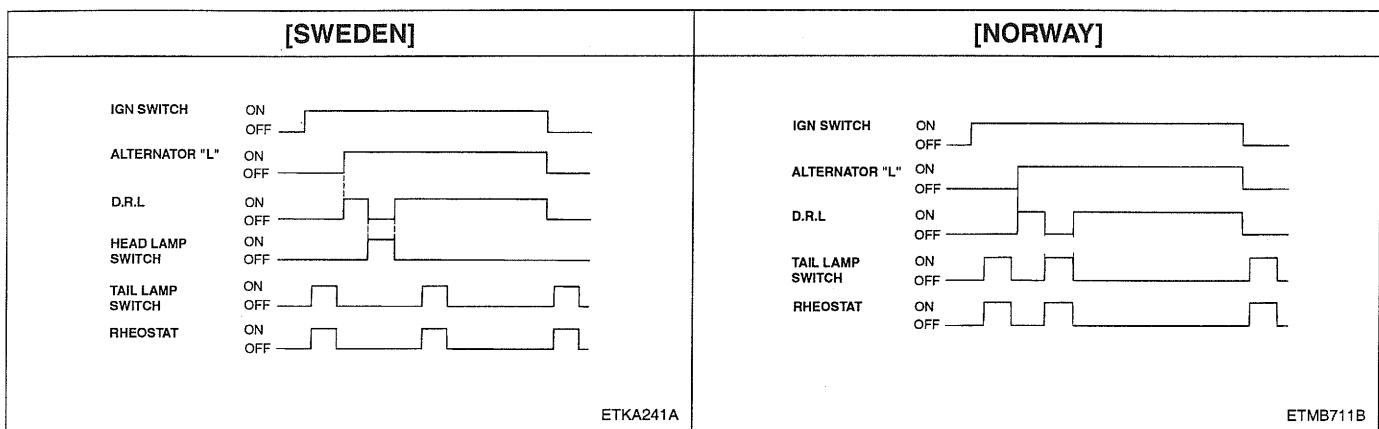


ETNC270B

INSPECTION ETNC2750

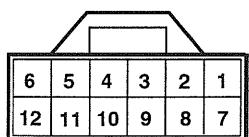
OPERATION CHECK

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



INSPECT CIRCUITS FOR DAYTIME RUNNING LIGHT SYSTEM

1. Disconnect the wire connector to DRL module from engine compartment.
2. Inspect the connector on wire harness side as shown.



Harness side

ETNC275A

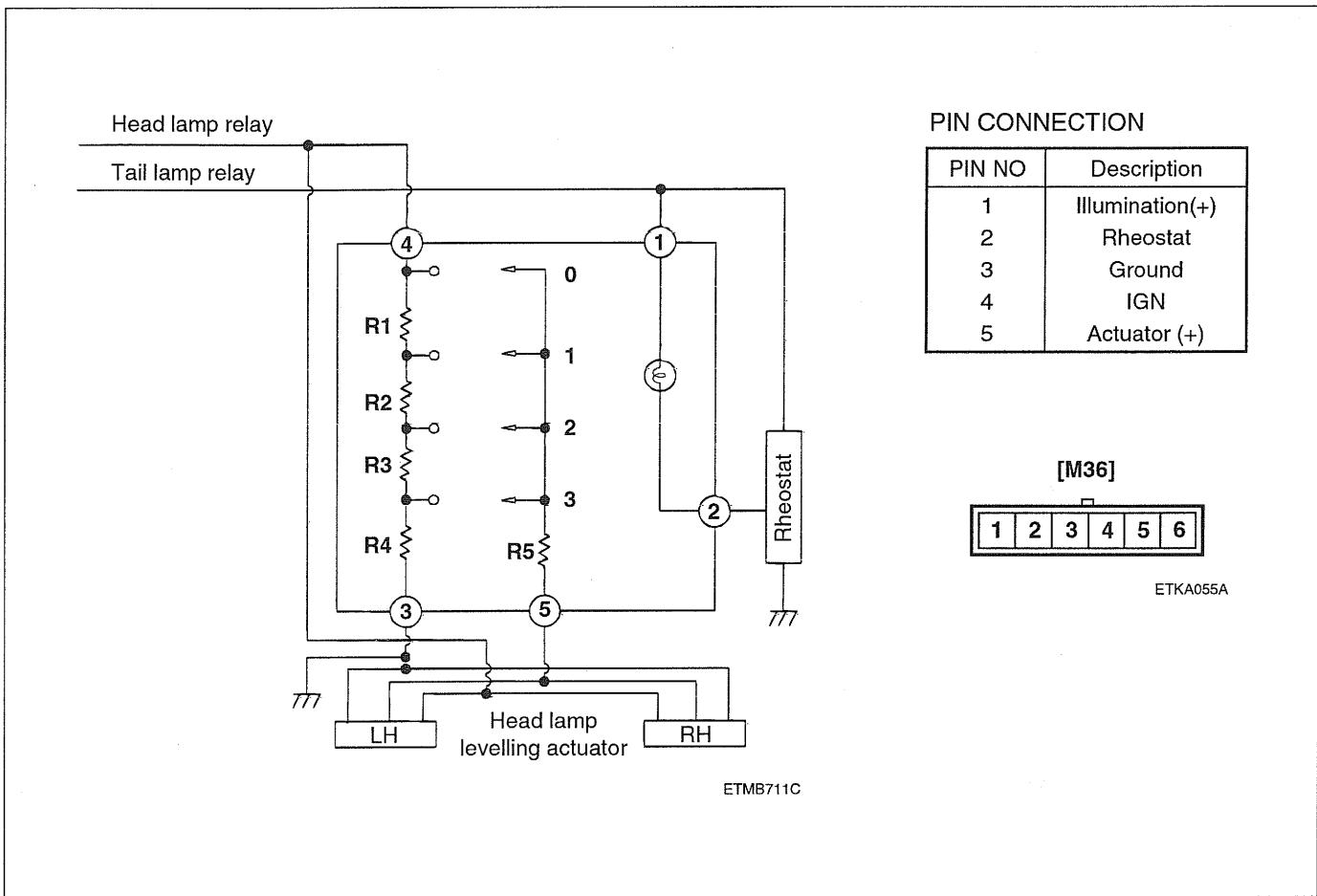
3. If circuit is not as specified, refer to schematic diagram and inspect short or circuits.

HEAD LAMP LEVELLING DEVICE

HEAD LAMP LEVELLING SWITCH

CIRCUIT DIAGRAM

ETNC2800



INSPECTION

ETNC2850

1. Disconnect the switch connector from the crash pad lower panel.



ETNC285B

ETNC285A

2. Connect the battery voltage between terminals 3 and 4 (Reference voltage = V_B).
3. Measure the voltage between terminals 3 and 5 (V).

4. Check the percent ratio($V/V_B \times 100\%$) between voltages V_B and V at each position.

Position No.	Rotation	Ratio($\pm 5\%$)	Voltage(V)
0	0°	85%	11.05 \pm 0.5V
1	30°	80%	10.4 \pm 0.5V
2	60°	76.6%	9.96 \pm 0.5V
3	90°	70%	9.1 \pm 0.5V

5. If the voltage is not as specified, replace the head lamp levelling switch.

IMMOBILIZER CONTROL SYSTEM

GENERAL

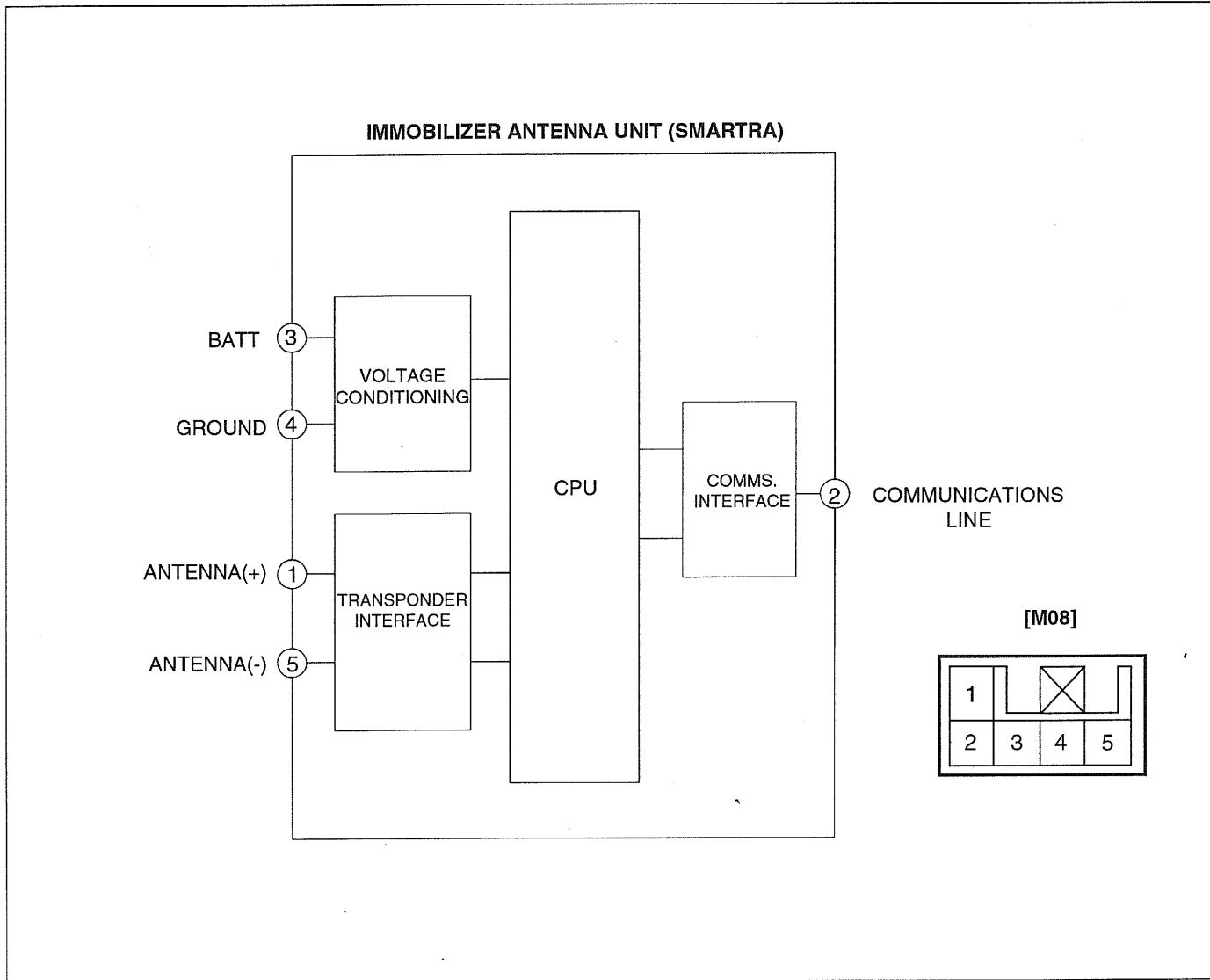
ETNC2900

The immobilizer system consists of a passive challenge-response (mutual authentication) transponder inside the key head and the SMARTRA (SMART TRAnsponder Antenna) unit.

The SMARTRA unit contains an integrated inductive antenna and electronics. The SMARTRA communicates to the ECM (Engine Control Module) via a dedicated communications line.

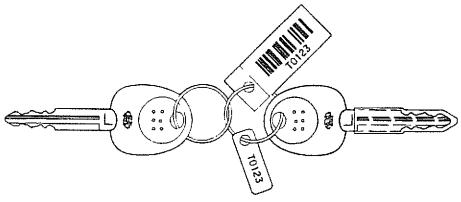
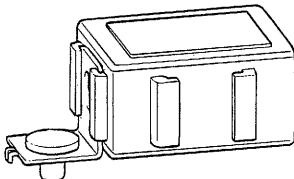
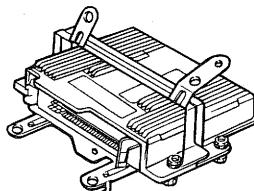
Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit to control the SMARTRA.

SYSTEM BLOCK DIAGRAM



ETNC290A

COMPONENT

A. TRANSPONDER KEY	B. IMMOBILIZER ANTENNA UNIT (SMARTRA)
	
C. ENGINE CONTROL MODULE	
	

DESCRIPTION

The vehicle immobilizer system consists of the ECM, the SMARTRA and ignition keys with built-in TRANSPONDER.

COMPONENT	DESCRIPTION
ECM	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. 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.
SMARTRA	The SMARTRA carries out communication with the built - in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted around the ignition lock close to the antenna coil for RF transmission and receiving. The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the ECM are converted into an RF signal, which is transmitted to the transponder by the antenna. The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the ECM and vice versa.
TRANSPONDER (built-in keys)	The transponder has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only ; therefore, the contents of the transponder can never be modified or changed.

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

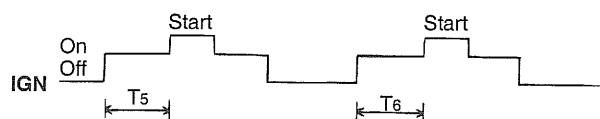
After a certain number of incorrect inputs, the ECM is locked for one hour and no inputs are accepted during this time.

05. Teaching not accepted

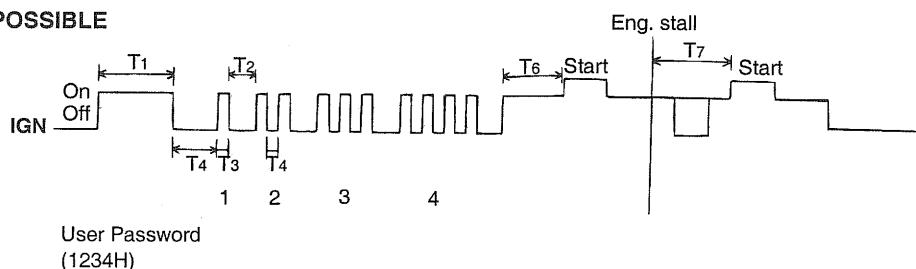
This status is set if, for example, the ECM is in neutral status.

LIMP HOME FUNCTION

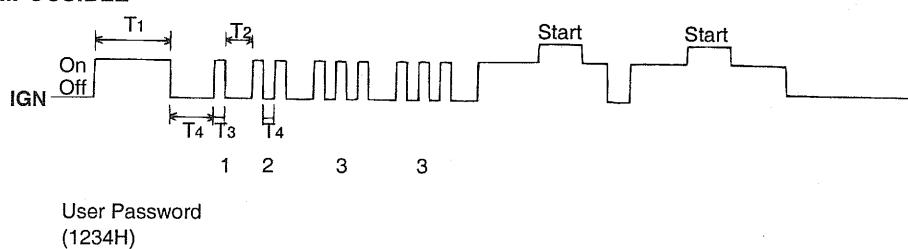
o NORMAL CONDITION



o START POSSIBLE



o START IMPOSSIBLE



NOTE

$T_1 > 5$ sec

3 sec $< T_2 > 10$ sec

0.2 sec $< T_3 > 5$ sec

0.2 sec $< T_4 > 3$ sec

$T_5 < 5$ sec

$T_6 < 30$ sec

$T_7 < 8$ sec

ETKA470A

1. By tester

If the ECM detects the fault of the SMARTRA 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 special tester menu.

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.

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.

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.

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.

DIAGNOSIS OF IMMOBILIZER RELATED FAULTS

The diagnosis monitors :

- Communication between the ECM and the SMARTRA
- Function of the SMARTRA 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 :

Immobilizer Related Faults	Fault types	Diagnostic Codes
Transponder Fault	Invalid transponder data	P1801
	Passive mode invalid	P1801
	Programming error	P1801
SMARTRA Fault	Antenna error	P1800
	Invalid request from ECM or corrupted data	P1803
	No answer from SMARTRA	P1610
	Invalid message from SMARTRA to ECM	P1610
EEPROM	Inconsistent data of EEPROM	P1805
	Invalid write operation to EEPROM	P1805

Immobilizer Related Faults	Fault types	Diagnostic Codes
ECM Fault	No valid data from SMARTRA after 3 attempts by ECM	P1805
	Invalid tester message or unexpected requests by tester	P1805

REPLACEMENT OF ECM AND SMARTRA

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 SMARTRA, there is no special procedure required. A new SMARTRA device 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.