INDEX

GENERAL INFORMATION

1. MAJOR DIMENSION..... 2
2. VEHICLE IDENTIFICATION..... 2
3. EXTERIOR LAMP SYSTEM LAYOUT.... 3
4. INTERIOR LAMP SYSTEM LAYOUT..... 5
5. SWITCH SYSTEM LAYOUT..... 6
6. CAN COMMUNICATION CONFIGURATION..... 7

ELECTRIC DEVICE GENERAL INFORMATION

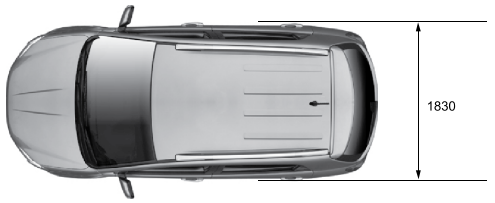
1. HOW TO READ ELECTRICAL WIRING DIAGRAM..... 8
2. HOW TO CHECK TERMINAL NUMBER OF CONNECTOR..... 10
3. PART LOCATION ACCORDING TO CONNECTOR NUMBER..... 11

Downloaded from www.Manualslib.com manuals search engine

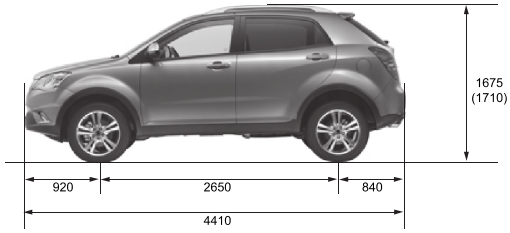
GENERAL INFORMATION

1. MAJOR DIMENSION

Top View



Side View



Front view

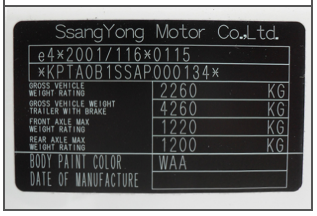
Rear view

2. VEHICLE IDENTIFICATION

1) The engine number (671 950 0 2 5000001) is stamped on the lower area of cylinder block in exhaust manifold side.

2) The chassis number (KPTA0B1SSAP012345) is stamped on the right side in the engine compartment (passenger side).

3) The certification label is affixed on the bottom of driver side B-pillar. (30 psi)

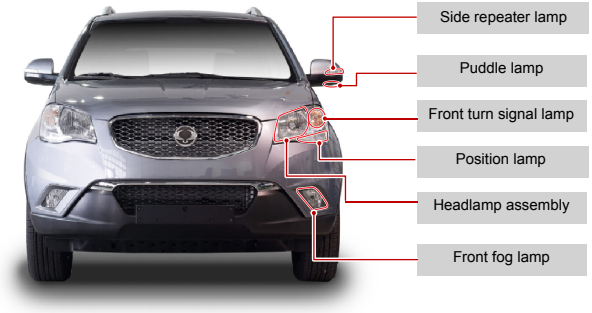


Modification basis	
Application basis	
Affected VIN	

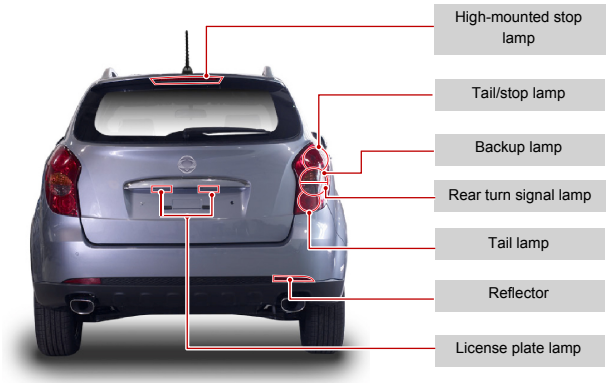
Downloaded from www.Manualslib.com manuals search engine

3. EXTERIOR LAMP SYSTEM LAYOUT

Front view



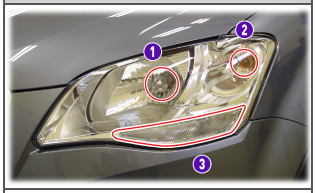
Rear view



Modification basis	
Application basis	
Affected VIN	

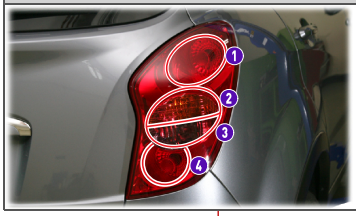
Downloaded from www.Manualslib.com manuals search engine

Headlamp



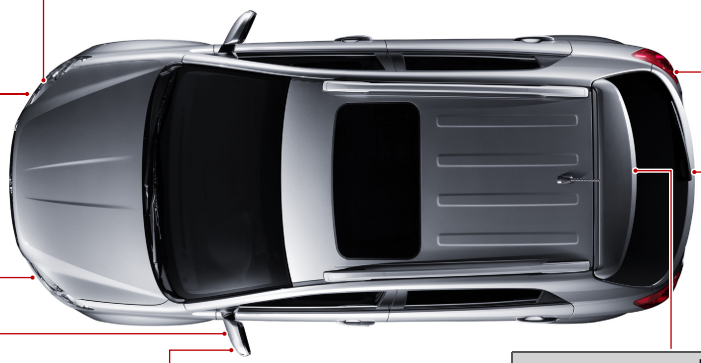
1. High-beam/low-beam
2. Turn signal lamp
3. Position lamp

Rear combination lamp

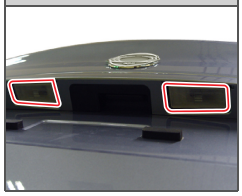


1. Stop lamp and tail lamp
2. Turn signal lamp
3. Backup lamp
4. Stop lamp (For Korea)
   Rear fog lamp

Front fog lamp



License plate lamp



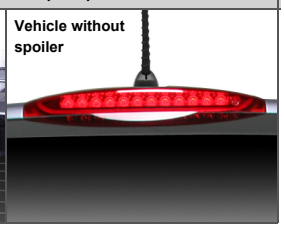
Puddle (approach) lamp

Side repeater lamp

High mounted stop lamp

Vehicle with spoiler

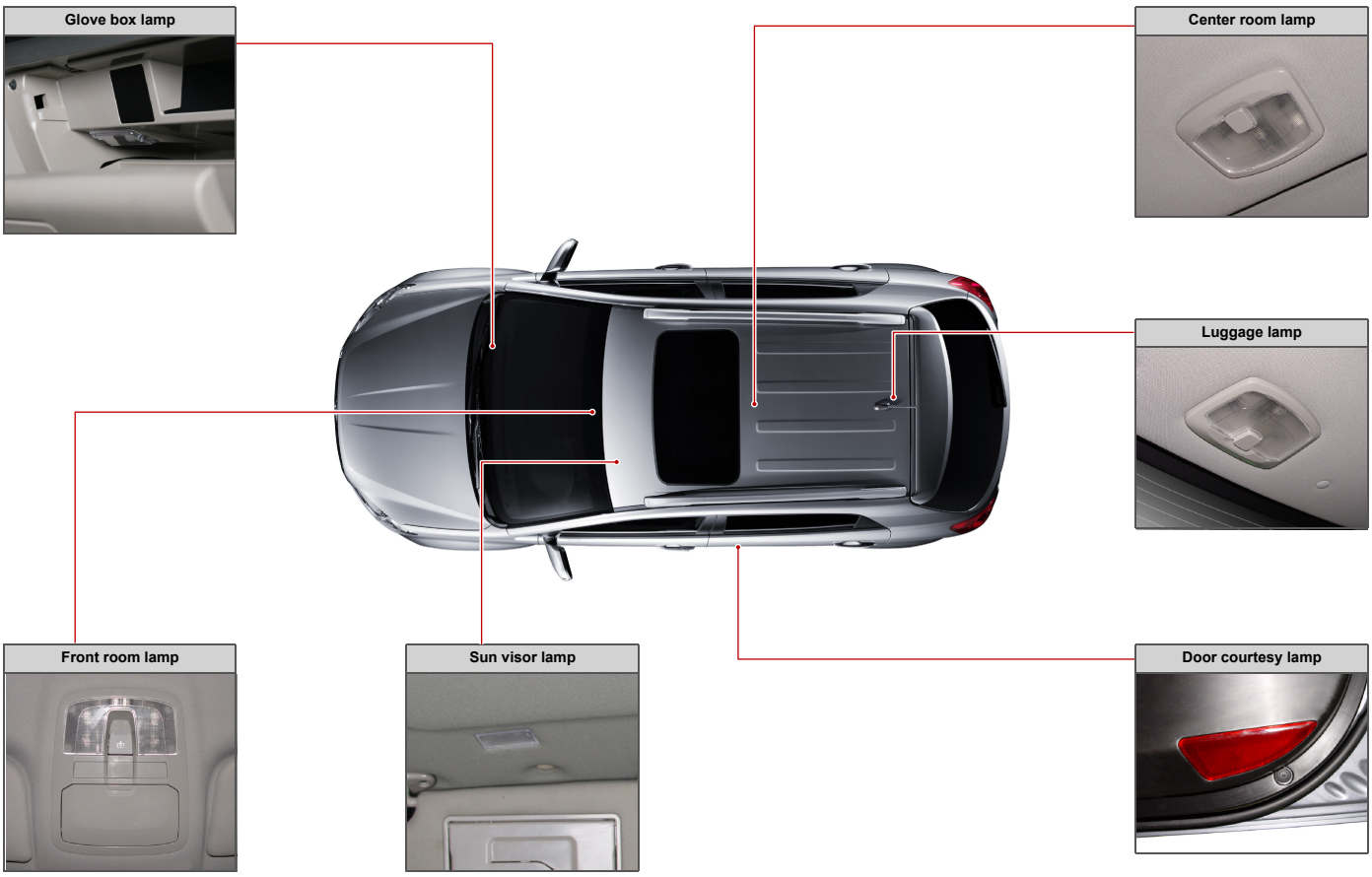
Vehicle without spoiler



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4. INTERIOR LAMP SYSTEM LAYOUT



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

5. SWITCH SYSTEM LAYOUT

Steering wheel remote control switch

Overhead console switch

Passenger door switch

Front seat heated wire switch (DLX)

Front seat heated wire switch (STD)

Rear door switch (RH)

Cruise control switch

Center room lamp switch

Multifunction switch

Luggage lamp switch

Lower main panel switch

Tailgate switch

Drive door main switch & Outside rear view mirror switch

FATC switch

Hazard warning switch and bezel assembly

Driver power seat switch

Rear door switch (LH)

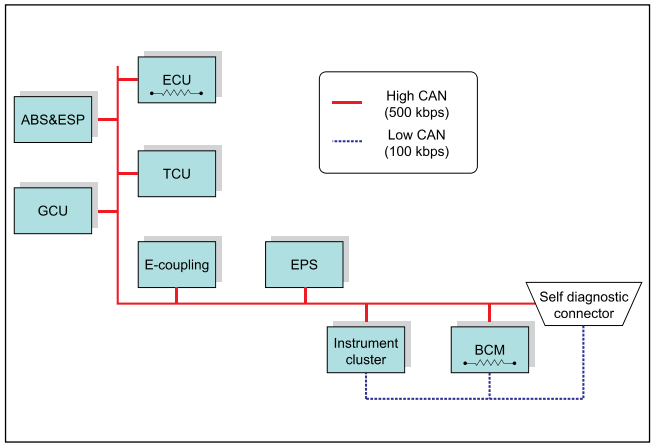
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

6. CAN COMMUNICATION CONFIGURATION

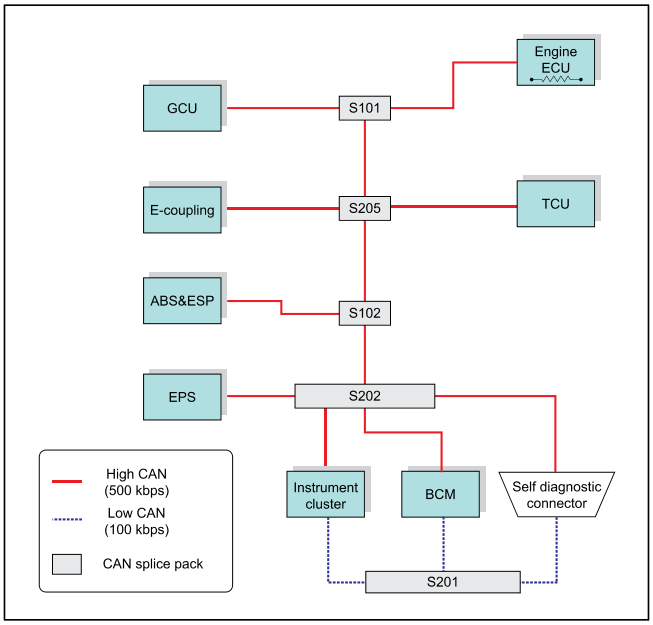
There are two types (P-CAN and B-CAN) of communication according to the communication speed. The instrument cluster and BCM (Body Control Module) communicate through both P-CAN and B-CAN at the same time.

1) CAN Configurations (P-CAN/B-CAN)



Abbreviations	Meaning	Function
GCU	Glow Control Unit	Glow control unit
EPS	Electronic Power Steering Unit	Electrically driven power steering unit
BCM	Body Control Module	Body control module

2) CAN Communication Wiring Diagram



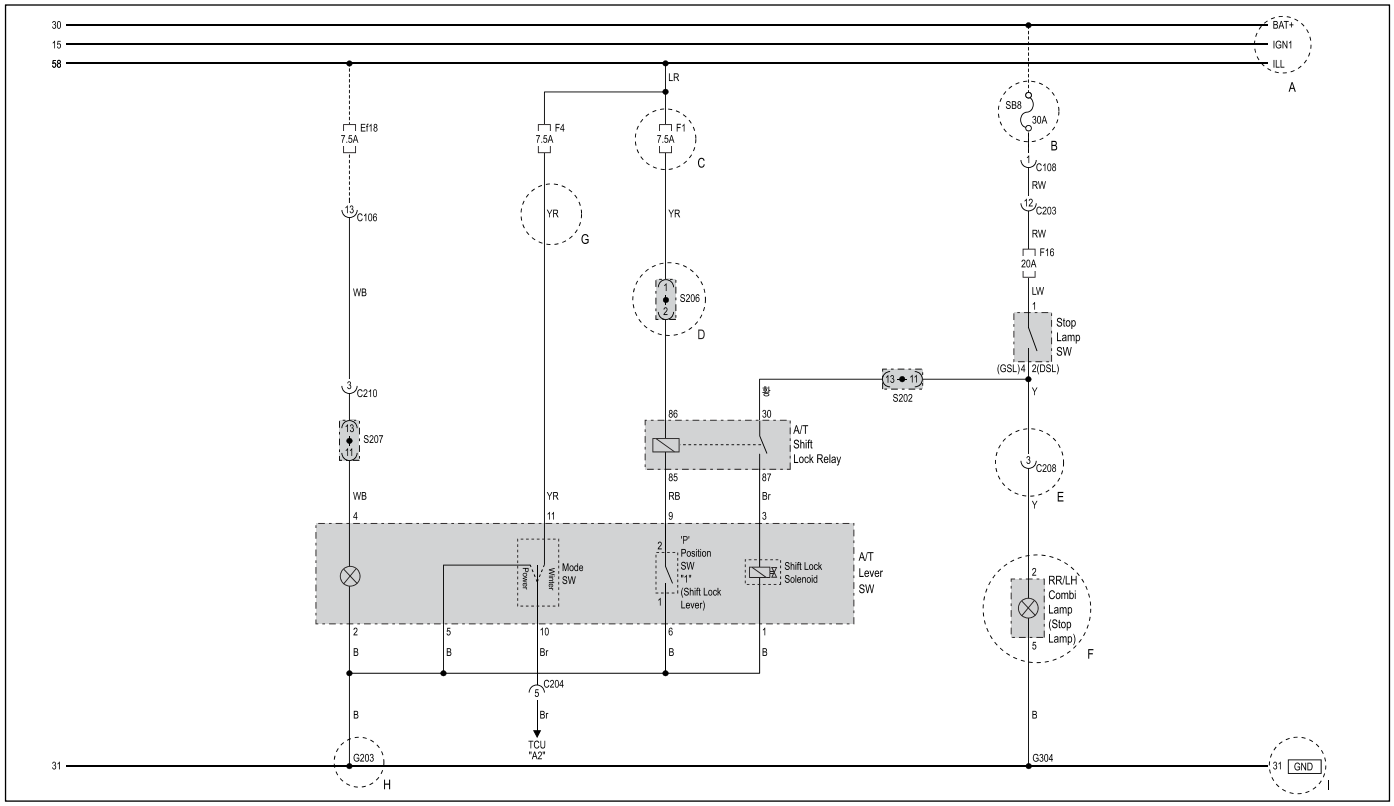
Splice pack	Wiring	Location
S101	Floor wiring (LH)	Under fuse and relay box in engine compartment
S102	Floor wiring (RH)	Inside of right fender
S201	Main wiring	Behind the instrument cluster (cowl cross member)
S202	Main wiring	Behind the instrument cluster (cowl cross member)
S205	Floor wiring (LH)	Under driver door scuff

Downloaded from www.Manualslib.com manuals search engine

ELECTRIC DEVICE GENERAL INFORMATION

1. HOW TO READ ELECTRICAL WIRING DIAGRAM

(1) HOW TO READ ELECTRICAL WIRING DIAGRAM



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(2) CONTENTS OF ELECTRICAL WIRING DIAGRAM(CIRCUIT)

Position	Emplanation
A	A top of horizontal line means Power supply and it is separated depending on condition of power supply. (For more information, please refer to the Function of power supply No.appendix)
B	This means Blow-slow Fuse No.8 in an Engine Room Fuse-Box and it is Main Fuse which supplies the power to each Fuse.
C	These mean both a Fuse No. and a Fuse location. And' Ef' means an Engine Room Fuse," F" means an indoor Fuse. 7.5A means Fuse capacity.
D	"S" means Splice Pack and' 206' means Splice Pack Number.
E	"C" means Connector and '208' means Connector Number.
F	This means inner circuit and it is displayed one-point-center-line.
G	This means wiring color, so at the head of character 'Y 'means background color of wiring and the rear character 'R 'means middle color of wiring.
H	"G" means Ground and ' 203' means Ground Number.
I	Below horizontal line means Ground. -Ground position (G101~G401) -B : Body Ground

(3) CIRCUIT IDENTIFICATION SYMBOL

Identification Symbol	Meaning
C	Connector
D	Diode
Ef	Fuse in Engine room Fuse & Relay Box
F	Indoor Fuse Box
G	Ground
S	Splice pack (Junction connector)
SB1 ~ SB10	Slow Blow Fuse (Engine room fuse & relay Box)

(4) FUNCTION OF POWER SUPPLY LINE(NUMBER)

Power supply NO.	Power supply condition
15	Battery Voltage (B+) Supply in Ignition Switch " ON" and" ST" (IGN 1)
15A	Battery Voltage (B+) Supply in Ignition Switch " ON" (IGN 2)
15C	Battery Voltage (B+) Supply in Ignition Switch " ACC" (ACC)
30	Battery Voltage (B+) Supply directly regardless of Ignition Switch
31	Ground Connnected to Battery(-)
50	Battery Voltage (B+) Supply in Ignition Switch" ST"
58	Battery Voltage (B+) Supply in Head Lamp Switch 1st and 2nd step(Illumination circuit)

(5) WIRING HARNESS COLOR IDENTIFICATION

Abbreviation	Color	Abbreviation	Color
Br	Brown	Sb	Sky Blue
G	Green	R	Red
V	Violet	L	Blue
P	Pink	Y	Yellow
W	White	Gr	Gray
O	Orange	B	Black
Lg	Light Green		

Downloaded from www.Manualslib.com manuals search engine

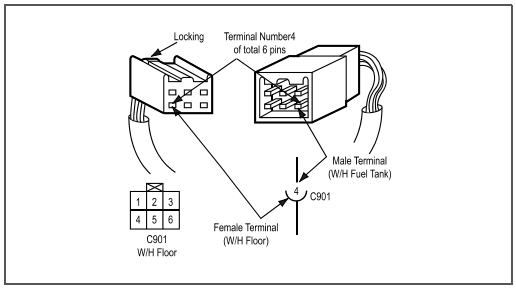
(6) ELECTRIC SYMBOLS

Items	Symbols	Items	Symbols
Resistance		Lamp	
Rheostat		Single Bulb	
Coil, Inductance		Double Bulb	
Condenser, Capacitor		Transistor : PNP type	
Ground, Earth		Transistor : NPN type	
Diode		~Meter, ~Gauge	
Zener Diode		Voltmeter	V
Photo Diode		Amperemeter	A
Light Emitting Diode		Switch	
Battery		Thermistor	
Disconnected Wire		Junction Point	
Fuse		Fusible Link	
Motor	M	Connector	No.
Speaker		Horn	

2. HOW TO CHECK TERMINAL NUMBER OF CONNECTOR

▶ **Terminal number is given based on Female Terminal Male Connector**

- ex) Terminal Number 4 of C901 connection



▶ **Terminal number of Connector**

- Generally, the Connector terminal number is given from left to right direction of Locking upper position through the Female Terminal.
- Exceptionally, Control unit such as Engine ECU, TCU and Instrument Cluster was used a specific number which marked on the draft.
- If a lot of connectors was connected to one parts, the connector was marked as A, B, C in front of terminal number.
- In case of terminal number was carved into connector or each parts, we will use the carved number exceptionally.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. PART LOCATION ACCORDING TO CONNECTOR NUMBER

▶ **C : Symbol Character for Connector ex) C102**

Symbol Character	Description
C	Connector (Connecting part that connects two wiring harness)
D	Diode
G	Ground
S	Splice pack (Joint connector that connects various wiring harness)

▶ **1 : Connector location Number**

▶ **Connector Number according to locating Section**

Connector Number	Location
□1□□	Engine Compartment
□2□□	Instrument panel
□3□□	In Door
□4□□	Tail Gate
□9□□	Under Body

- In the locating section, the assignment for part number startsfrom left bottom and proceeds clockwise.
- In the fuse and relay box or the instrument panel, the partnumber is assigned from left top to light bottom.

▶ **02 : Connector Numbering Order**

Downloaded from www.Manualslib.com manuals search engine

CONNECTOR/GROUND

1413-02/8210-00/8210-01/8211-01/8212-01/8212-02
/8213-03/8213-04/8213-06/8213-09/8213-108810-22/8810-23

WIRING HARNESS

8210-00 WIRING HARNESS, COMPONENTS LOCATION..... 2
8210-00 CONNECTOR, GROUND / SPLICE PACK..... 4

CONNECTOR/GROUND

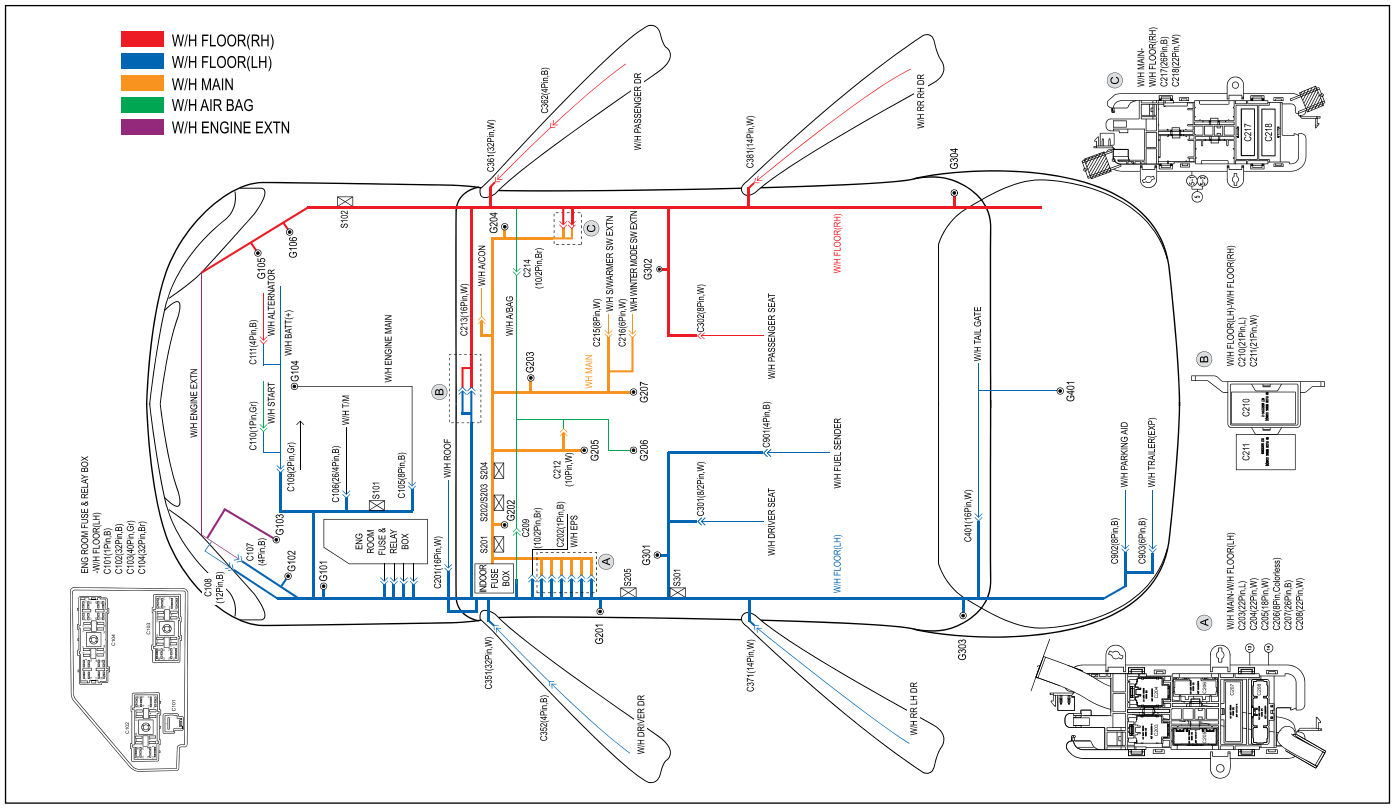
8210-01 W/H MAIN..... 11
8212-01 W/H FLOOR(LH)..... 13
8212-02 W/H FLOOR(RH)..... 15
1413-02 W/H ENGINE MAIN..... 16
8211-01 W/H ENGINE EXTN..... 17
8213-09 W/H ROOF..... 18
8810-22 W/H AIR BAG..... 19
8810-23 W/H AIR BAG EXTN..... 19
8213-03 W/H DRIVER DOOR..... 20
8213-04 W/H PASSENGER DOOR..... 20
8213-06 W/H REAR DOOR..... 21
8213-10 W/H TAIL GATE..... 21

Downloaded from www.Manualslib.com manuals search engine

WIRING HARNESS

8210-00 WIRING HARNESS, COMPONENTS LOCATION

(1) WIRING HARNESS



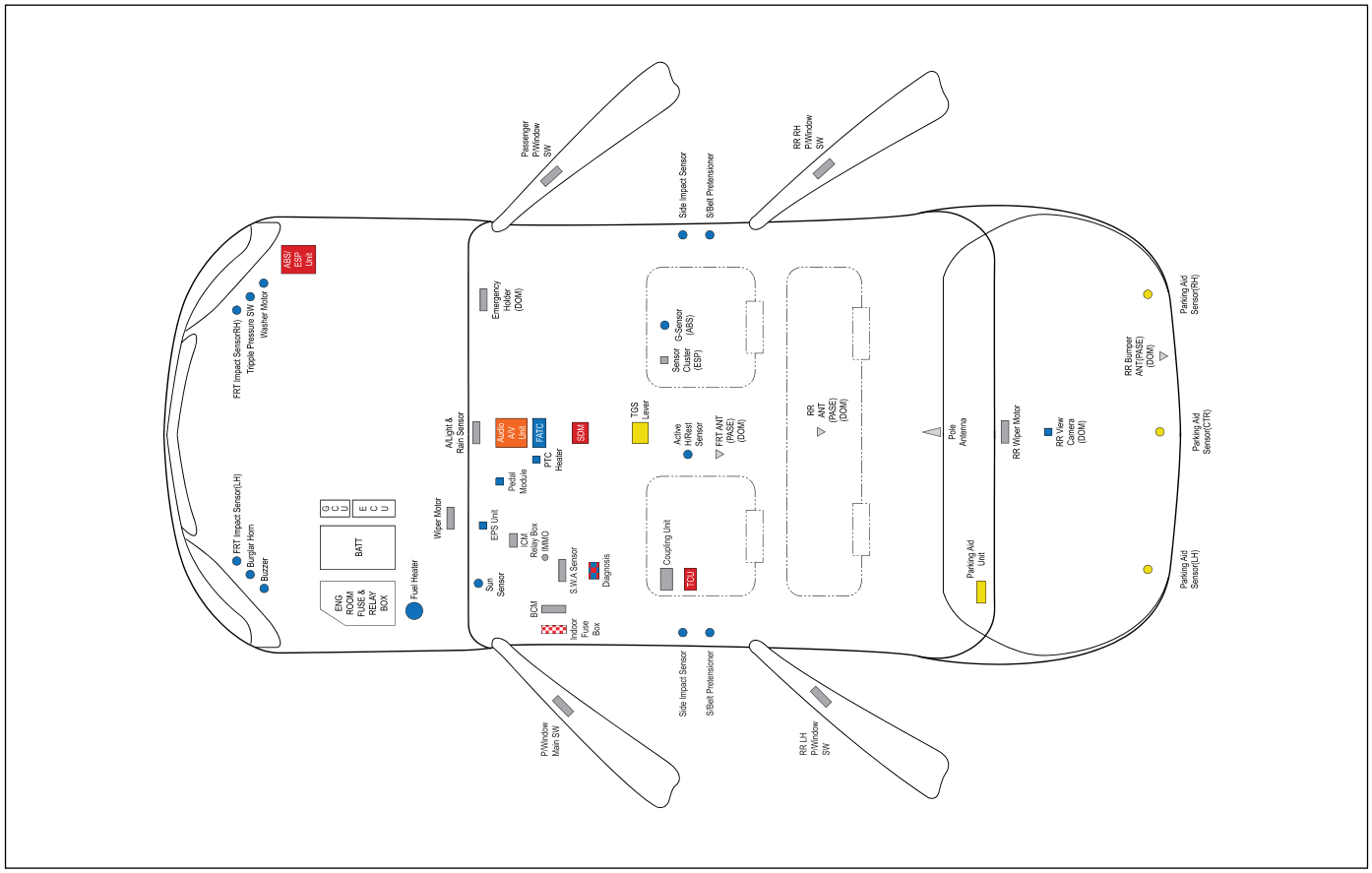
CONNECTOR/GROUND

undefined

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(2) COMPONENTS LOCATION



Modification basis	
Application basis	
Affected VIN	

CONNECTOR/GROUND
undefined

Downloaded from www.Manualslib.com manuals search engine

8210-00 CONNECTOR, GROUND / SPLICE PACK

(1) CONNECTOR, GROUND, SPLICE PACK

▶ CONNECTOR

Connector Number (Pin Number/Color)			Connecting Wiring Harness	Connector Position	Remark
C101	1	Black	W/H Floor(LH) - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C102	32	Black	W/H Floor(LH) - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C103	40	Gray	W/H Floor(LH) - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C104	32	Brown	W/H Floor(LH) - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105	8	Black	W/H Floor(LH) - W/H Eng	Upper BATT Tray(Beside Fuel Heater)	
C106	26	Black	W/H Floor(LH) - W/H T/M	Upper T/M(Under BATT Tray)	A/T
	4	Black	W/H Floor(LH) - W/H T/M	Upper T/M(Under BATT Tray)	M/T
C107	4	Black	W/H Floor(LH) - W/H Eng EXTN	Inside FRT Bumper(Behind LH Fog Lamp)	
C108	12	Black	W/H Floor(LH) - W/H Eng EXTN	Inside FRT Bumper(Behind LH Fog Lamp)	
C109	2	Gray	W/H Floor(LH) - W/H BATT(+)	Lower Air Cleaner Duct	
C110	1	Gray	W/H BATT(+) - Start Solenoid	Beside Starter Motor	
C111	4	Black	W/H BATT(+) - Alternator	Beside Alternator	
C201	16	White	W/H Floor(LH) - W/H Roof	Upper Driver Cowl Side Connector Holder	
C202	1	Black	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	EPS
C203	22	Blue	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C204	22	White	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C205	18	White	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C206	8	Colorless	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C207	26	Black	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C208	22	White	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C209	10	Brown	W/H Air Bag - W/H Air Bag EXTN	Driver Cowl Side Connector Holder	Curtain/Side A/Bag
	2	Brown	W/H Air Bag - W/H Air Bag EXTN	Driver Cowl Side Connector Holder	
C210	21	Blue	W/H Floor(LH) - W/H Floor(RH)	Upper CTR Dash PNL	
C211	21	White	W/H Floor(LH) - W/H Floor(RH)	Upper CTR Dash PNL	
C212	10	White	W/H Main - W/H Air Bag	Inside I.P (Upper Driver LegRoom)	
C213	16	White	W/H Main - W/H Air Con	Inside I.P (Upper CTR Cowl Cross Member)	
C214	10	Brown	W/H Air Bag - W/H Air Bag EXTN	Passenger Cowl Side Connector Holder	Curtain/Side A/Bag
	2	Brown	W/H Air Bag - W/H Air Bag EXTN	Passenger Cowl Side Connector Holder	
C215	8	White	W/H Main - W/H Seat Warmer switch EXTN	Inside Console	A/T
C216	6	White	W/H Main - W/H Winter Mode switch EXTN	Inside Console	A/T
C217	26	Black	W/H Main - W/H Floor(RH)	Passenger Cowl Side Connector Holder	
C218	22	White	W/H Main - W/H Floor(RH)	Passenger Cowl Side Connector Holder	
C301	8	White	W/H Floor(LH) - W/H Driver Seat	Under Driver Seat	S/Warmer, Active
	2	White	W/H Floor(LH) - W/H Driver Seat	Under Driver Seat	
C302	8	White	W/H Floor(RH) - W/H Passenger Seat	Under Passenger Seat	
C351	32	White	W/H Floor(LH) - W/H Driver DR	Under LH A Pillar	
C352	4	Black	W/H Driver DR - W/H Smart Key	Inside Driver DR	Smart Key(DOM)
C361	32	White	W/H Floor(RH) - W/H Passenger DR	Under RH A Pillar	
C362	4	Black	W/H Passenger DR - W/H Smart Key	Inside Passenger DR	Smart Key(DOM)
C371	14	White	W/H Floor(LH) - W/H RR LH DR	Under LH B Pillar	
C381	14	White	W/H Floor(RH) - W/H RR RH DR	Under RH B Pillar	
C401	16	White	W/H Floor(LH) - W/H Tail Gate	Upper Tail Gate LH	
C901	4	Black	W/H Floor(LH) - W/H Fuel Sender	FRT Fuel Tank	
C902	8	Black	W/H Floor(LH) - W/H RR Bumper	Under RR LH Bumper	PAS
C903	6	Black	W/H Floor(LH) - W/H Trailer	Under RR LH Bumper	

▶ GROUND

Connector Number	Connecting Wiring Harness	Connector Position	Remark
G101	W/H Floor(LH)	Behind LH Head Lamp	
G102	W/H Floor(LH)	Under BATT Tray	ECU
G103	W/H Eng EXTN	Under BATT Tray	
G104	W/H Eng Main	FRT Intake Valve	
G105	W/H Floor(RH)	Behind RH Head Lamp	
G106	W/H Floor(RH)	Beside ABS/ESP Unit	ABS/ESP
G201	W/H Floor(LH)	Under Driver Cowl Side Connector Holder	
G202	W/H Main	Backside Cluster(LH Cowl Cross Member)	AUDIO
G203	W/H Main	Backside Audio(CTR Cowl Cross Member)	
G204	W/H Main	Inside I.P(RH Glove Box)	
G205	W/H Main	Left Side I.P(Beside CTR Support BRKT)	PTC
G206	W/H Main	Left Under TGS Lever	AIR BAG
G207	W/H Main	Right Under TGS Lever	EPS
G301	W/H Floor(LH)	Under Driver Seat	
G302	W/H Floor(RH)	Under Passenger Seat	
G303	W/H Floor(LH)	Driver QTR PNL	
G304	W/H Floor(RH)	Passenger QTR PNL	
G401	W/H Tail Gate	CTR Under Tail Gate	

▶ SPLICE PACK

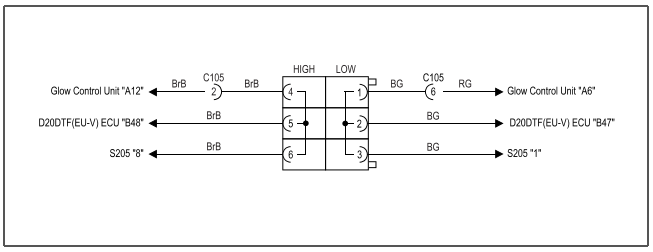
Connector Number (Pin Number/Color)		Connecting Wiring Harness	Connector Position	Remark
S101	6	W/H Floor(LH)	Under Eng Room Fuse & Relay Box	HS-CAN
S102	6	W/H Floor(RH)	Inside RH Fender	HS-CAN
S201	8	W/H Main	Backside Cluster(LH Cowl Cross Member)	LS-CAN
S202	20	W/H Main	Backside Cluster(LH Cowl Cross Member)	HS-CAN
S203	20	W/H Main	Backside Cluster(LH Cowl Cross Member)	ILL +
S204	20	W/H Main	Backside Cluster(Upper ICM Relay Box)	GND
S205	14	W/H Floor(LH)	Lower Driver DR Scuff(CTR)	HS-CAN
S301	14	W/H Floor(LH)	Under Driver Seat	

Modification basis	
Application basis	
Affected VIN	

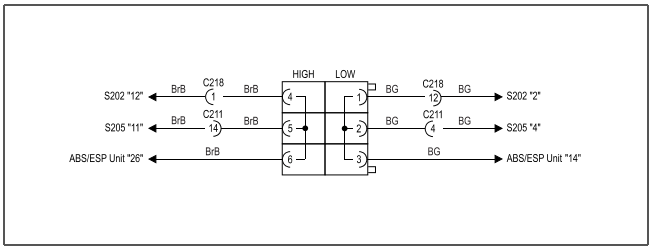
Downloaded from www.Manualslib.com manuals search engine

(2) SPLICE PACK CIRCUIT

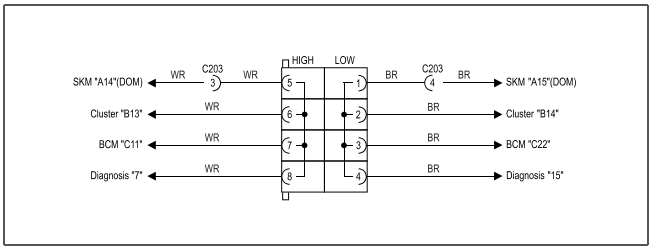
1) S101 (HS-CAN)



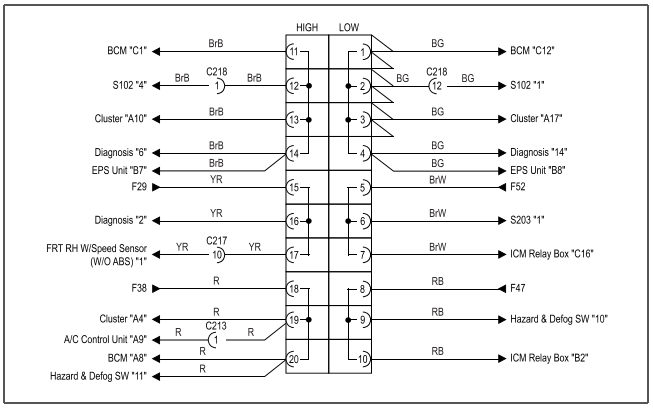
2) S102 (HS-CAN)



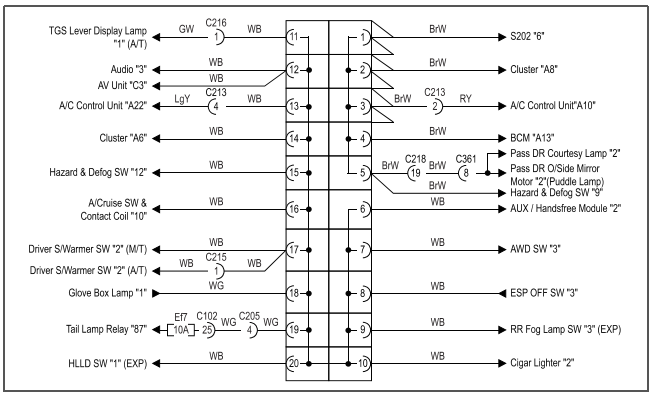
3) S201 (LS-CAN)



4) S202 (HS-CAN)



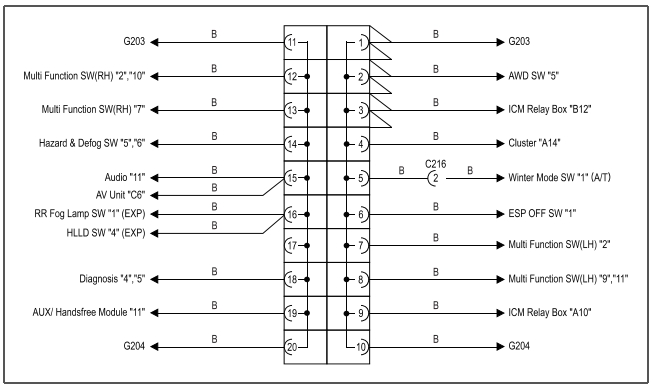
5) S203 (ILL+)



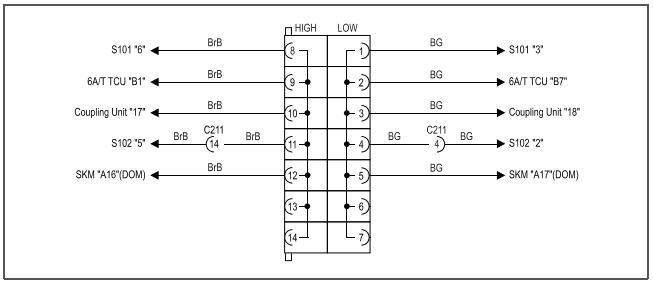
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

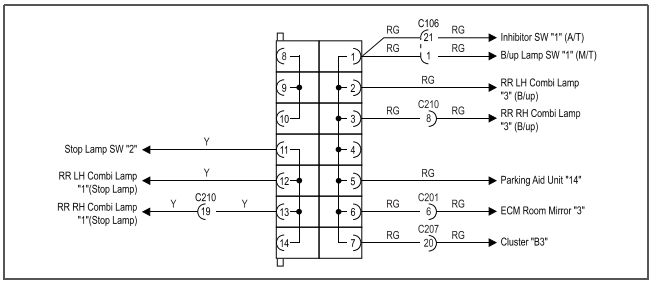
6) S204 (GND)



7) S205 (HS-CAN)



8) S301



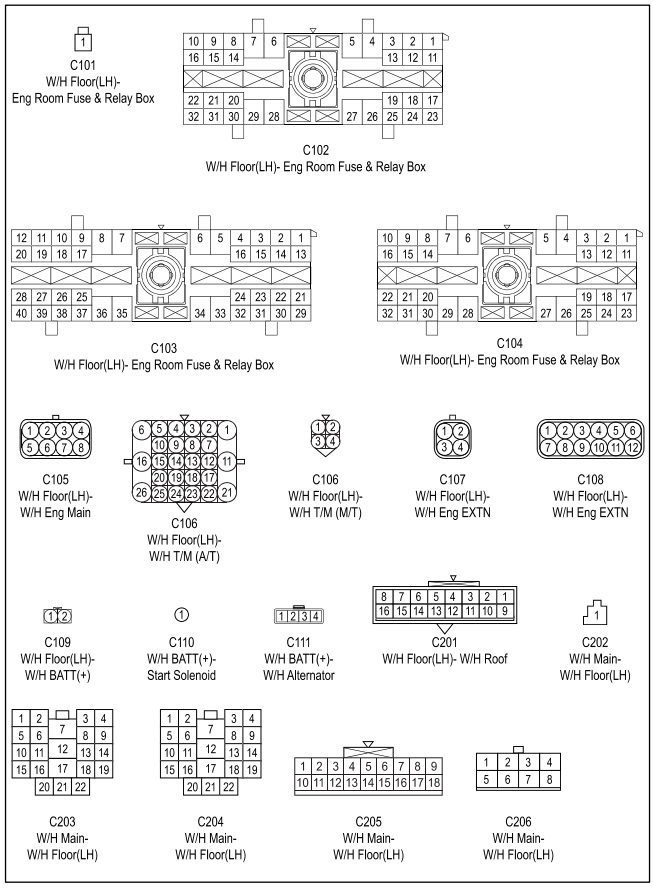
CONNECTOR/GROUND

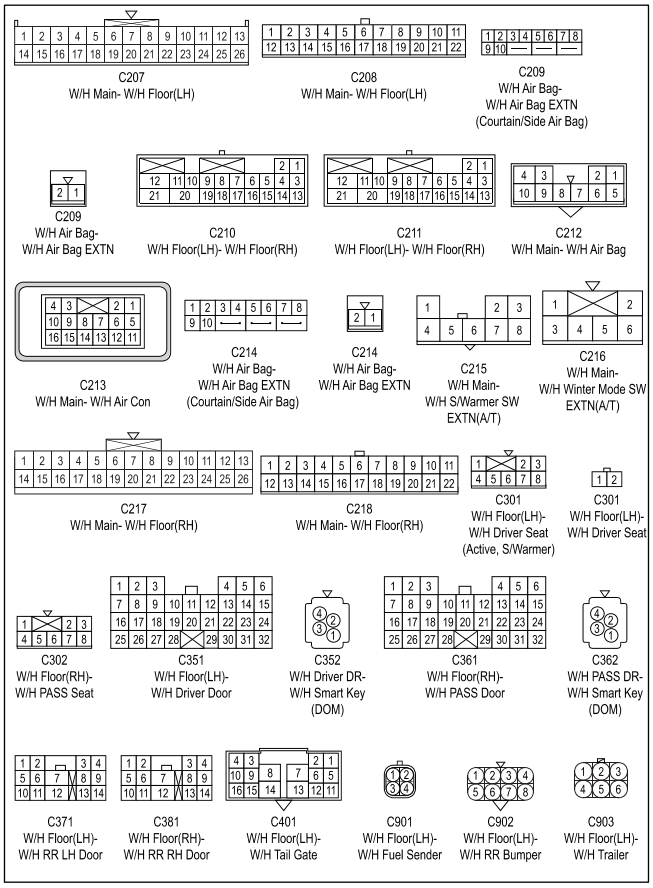
undefined

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(3) WIRING CONNECTOR PARTS SHAPE / NUMBERING



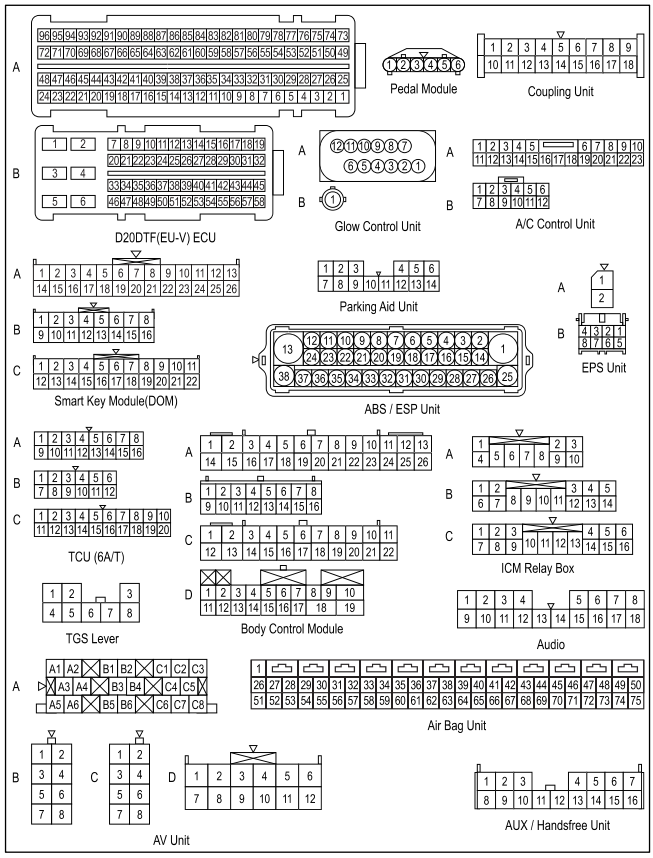


Modification basis	
Application basis	
Affected VIN	

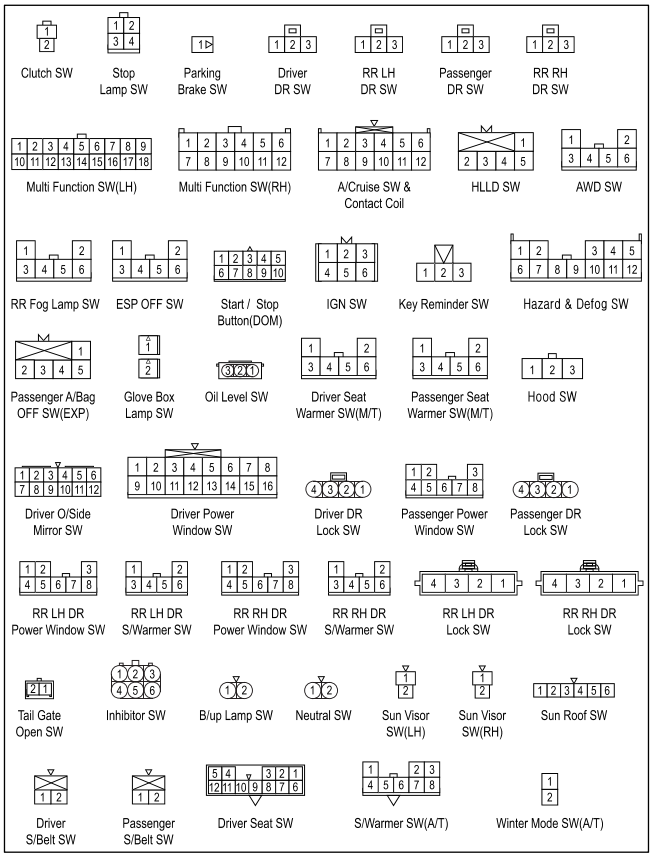
Downloaded from www.Manualslib.com manuals search engine

(4) THE OTHERS PARTS SHAPE / NUMBERING

▶ **UNIT PART**



▶ **SWITCH PART**



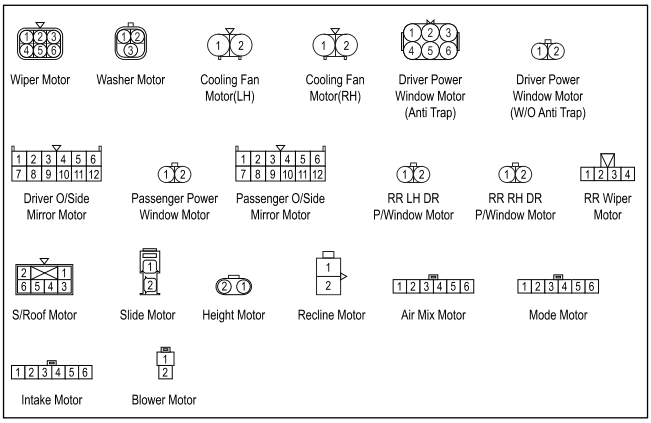
CONNECTOR/GROUND

undefined

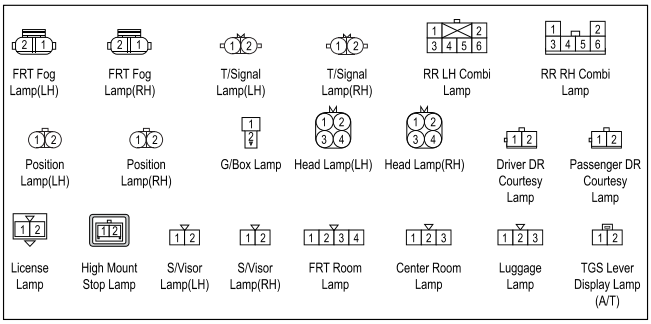
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

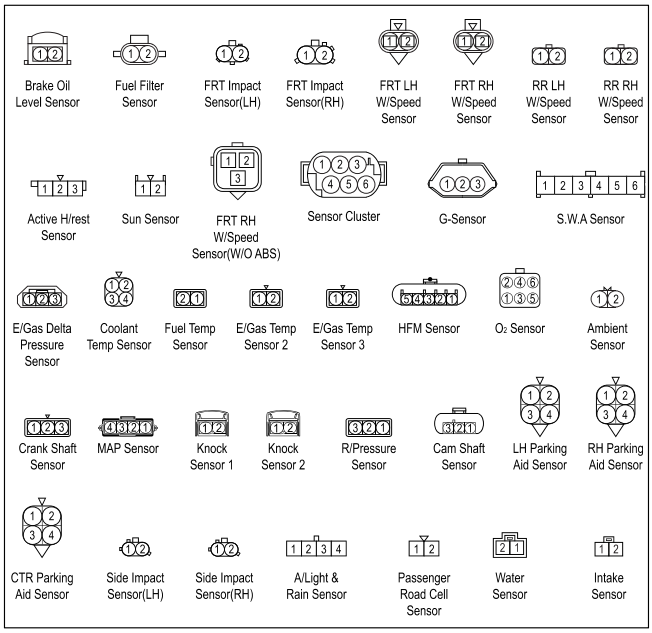
▶ MOTOR PART



▶ LAMP PART



▶ SENSOR PART



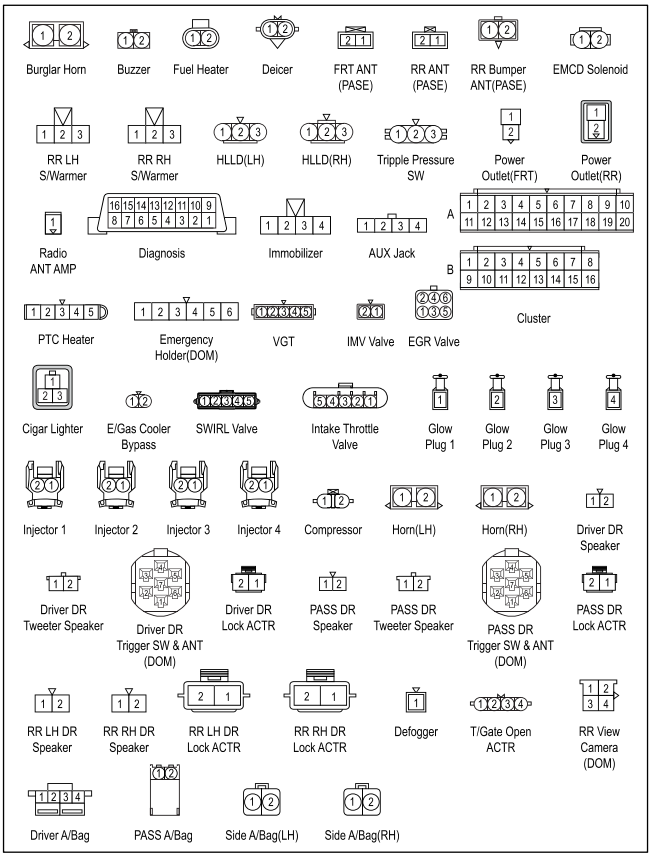
Modification basis	
Application basis	
Affected VIN	

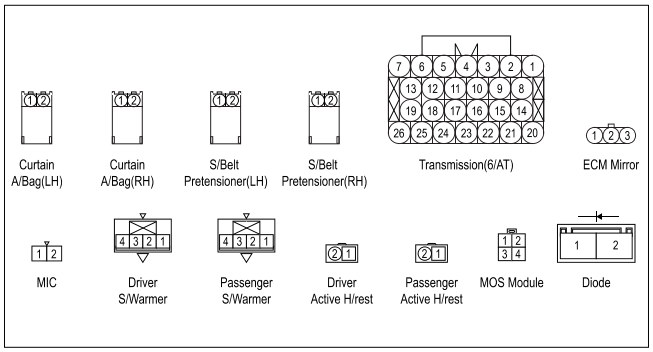
CONNECTOR/GROUND

undefined

Downloaded from www.Manualslib.com manuals search engine

▶ **THE OTHER PART**





CONNECTOR/GROUND

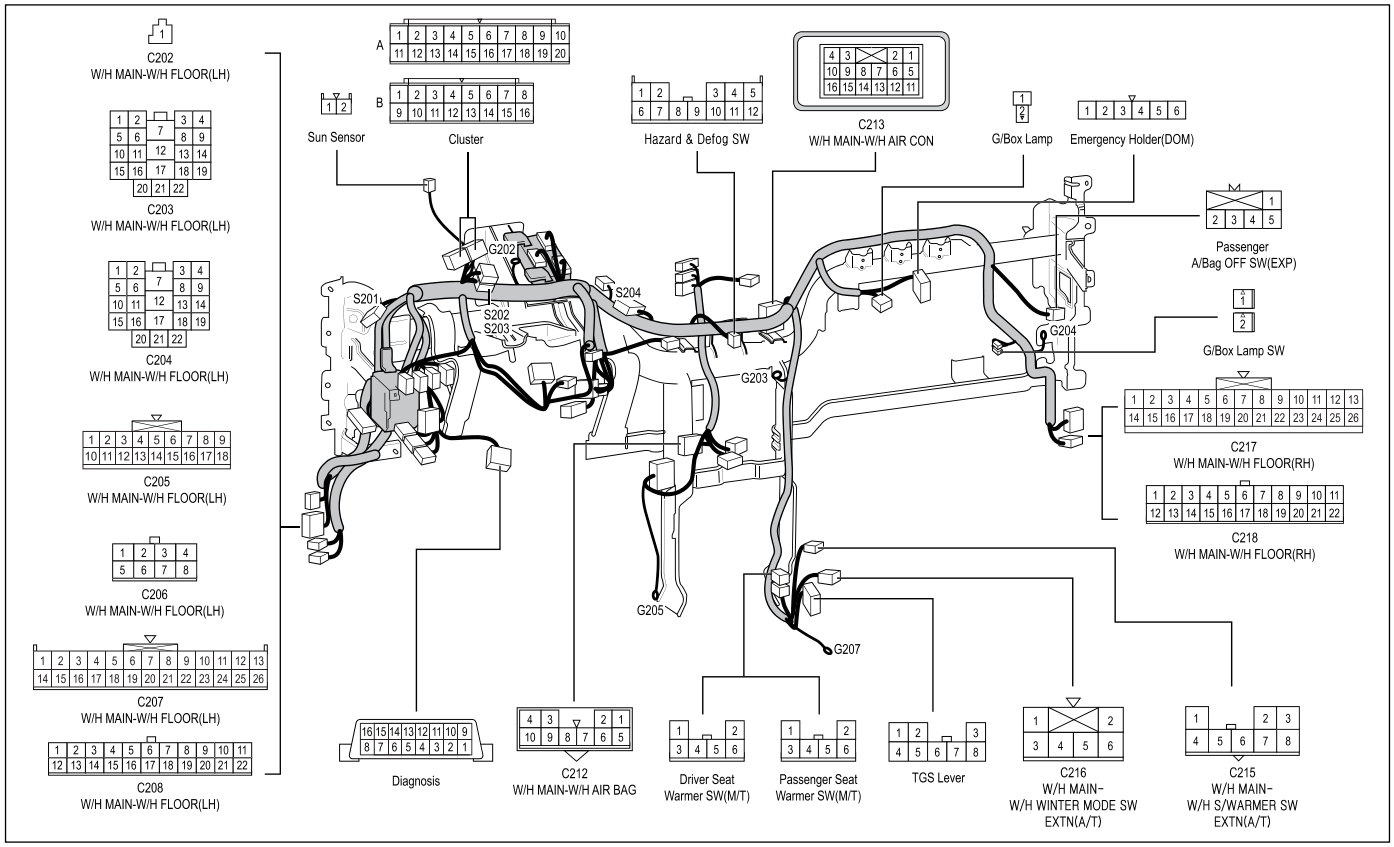
undefined

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

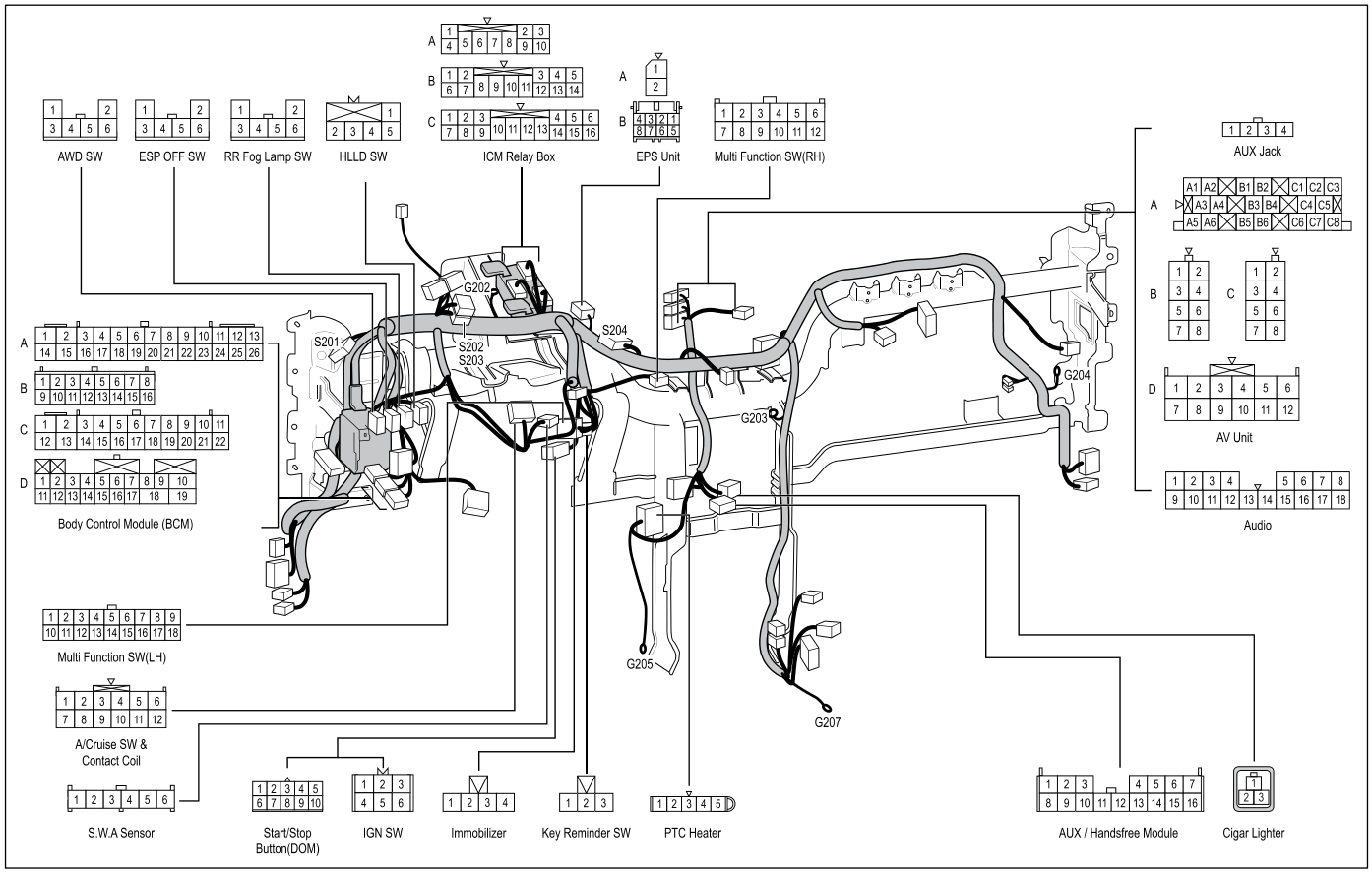
CONNECTOR/GROUND

8210-01 W/H MAIN



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



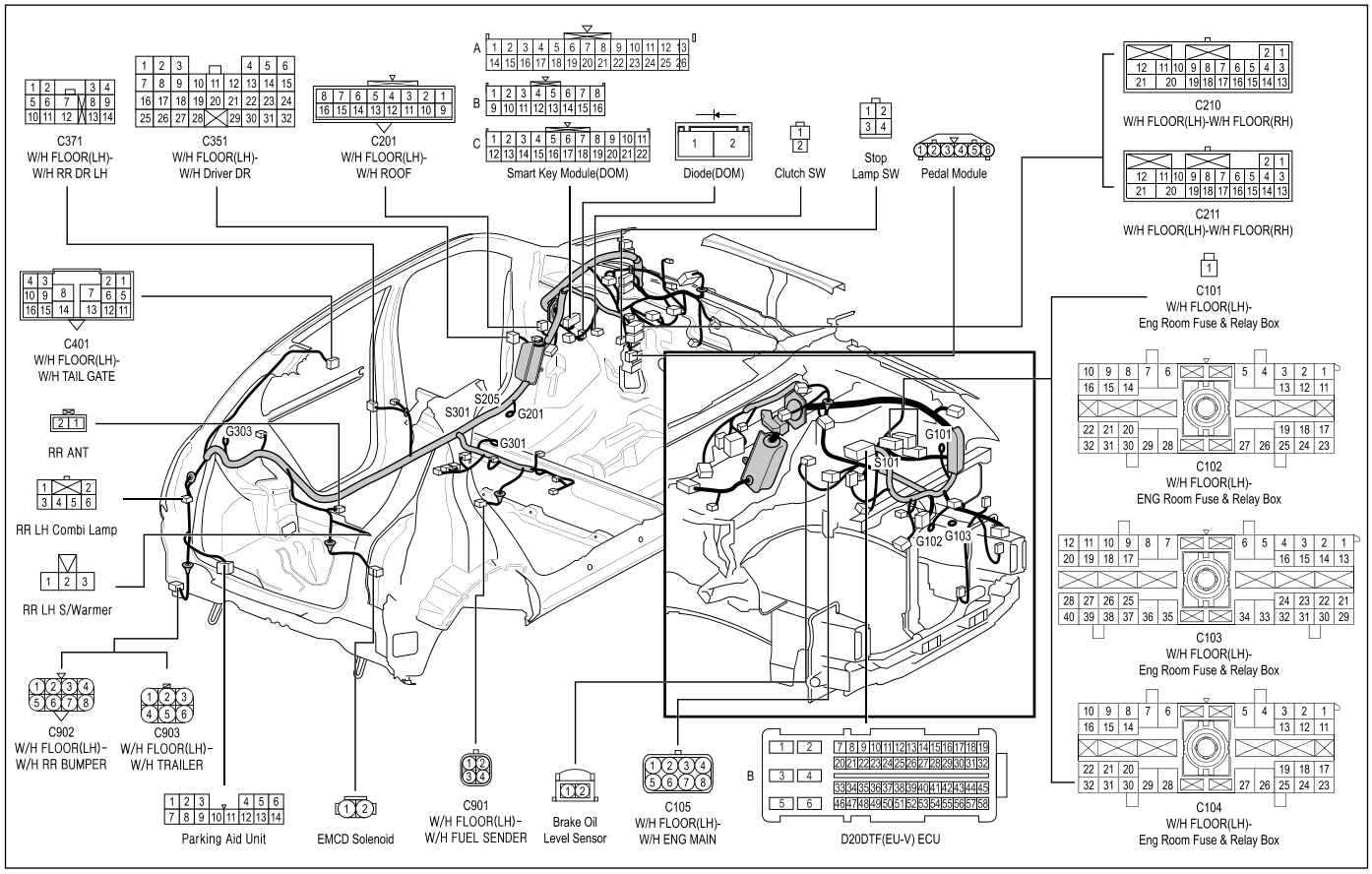
CONNECTOR/GROUND

undefined

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8212-01 W/H FLOOR(LH)

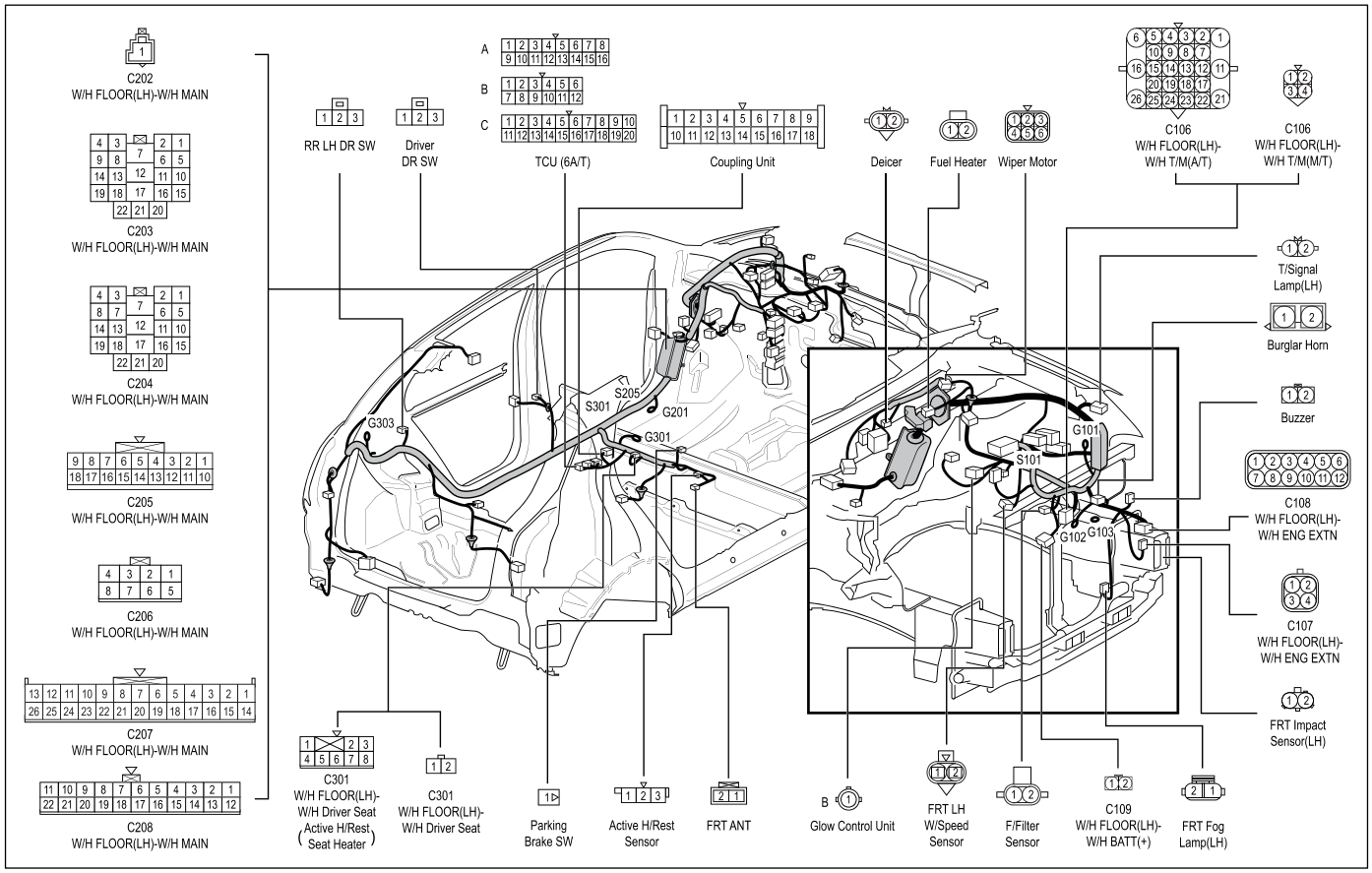


Modification basis	
Application basis	
Affected VIN	

CONNECTOR/GROUND

undefined

Downloaded from www.Manualslib.com manuals search engine



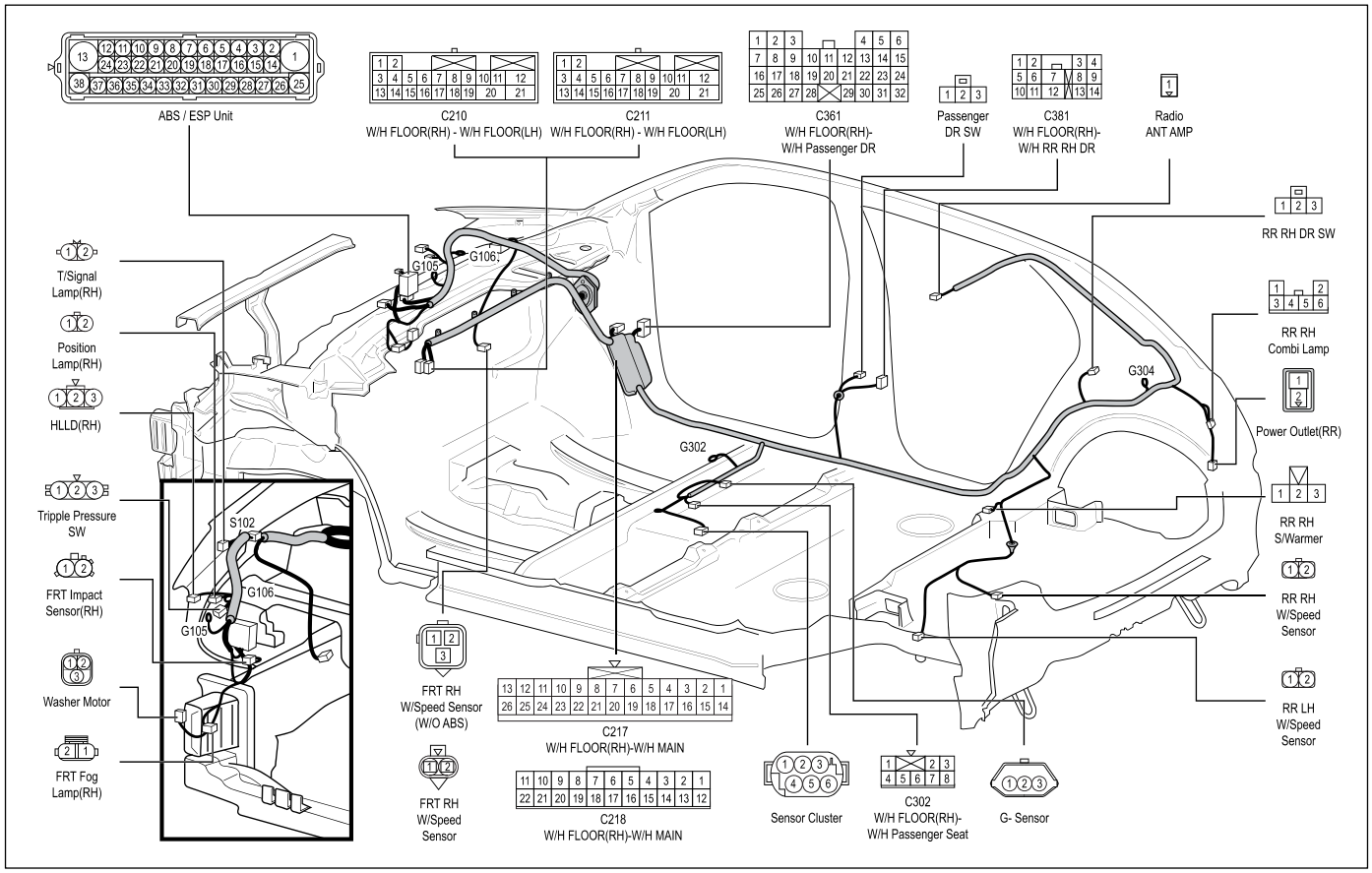
CONNECTOR/GROUND

undefined

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8212-02 W/H FLOOR(RH)



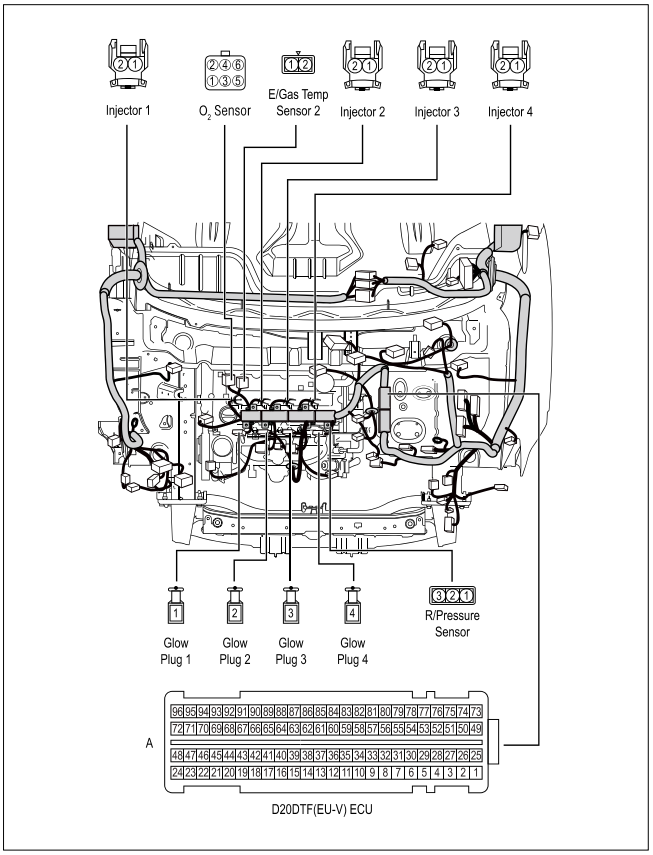
Modification basis	
Application basis	
Affected VIN	

CONNECTOR/GROUND
undefined

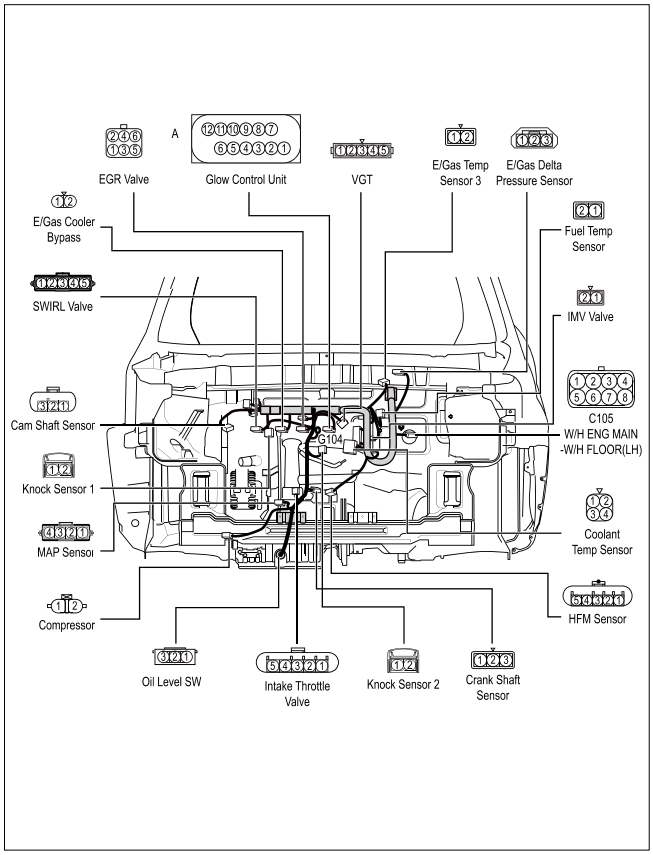
Downloaded from www.Manualslib.com manuals search engine

1413-02 W/H ENGINE MAIN

▶ TOP VIEW



▶ FRONT VIEW



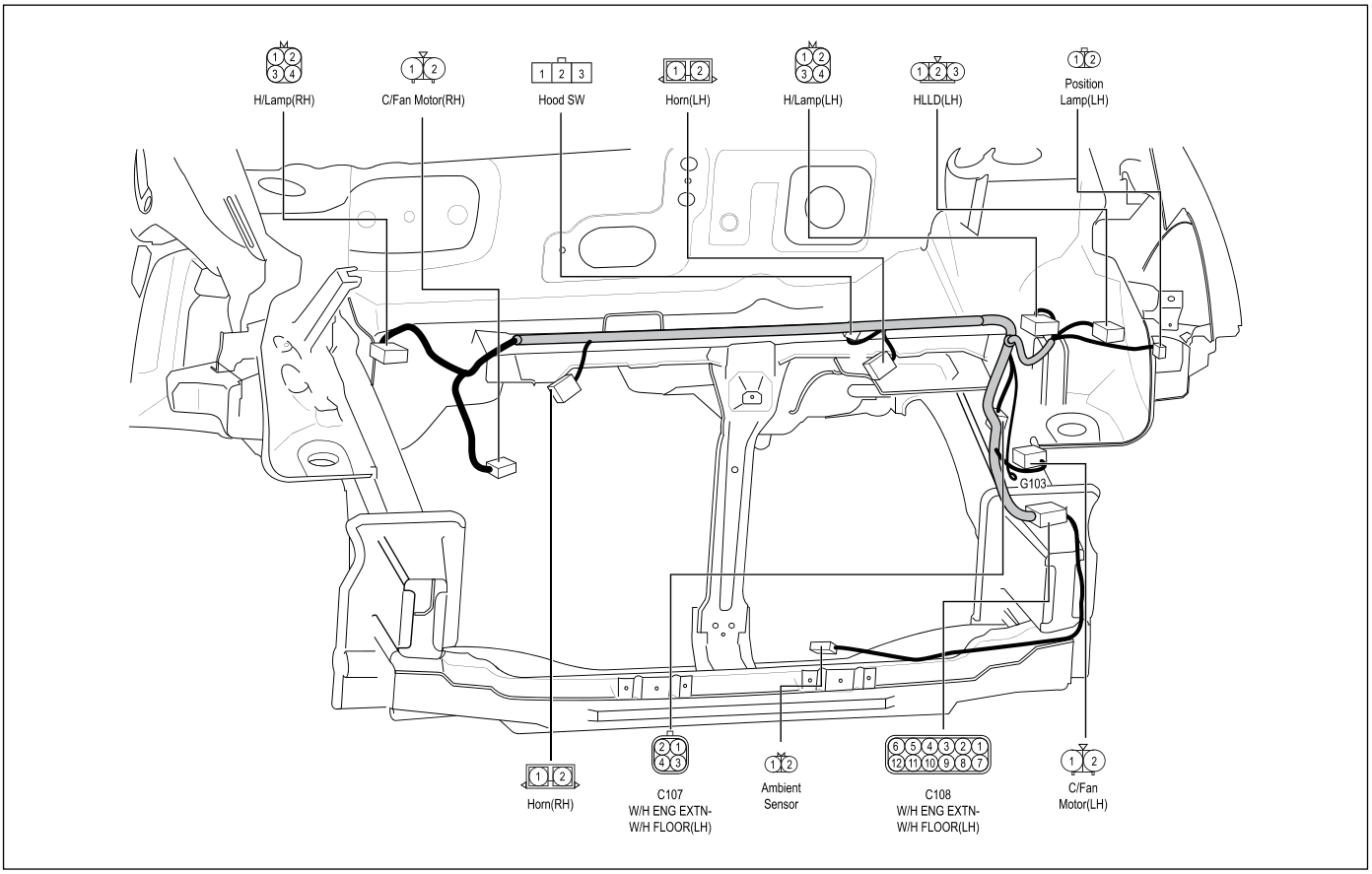
CONNECTOR/GROUND

undefined

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8211-01 W/H ENGINE EXTN

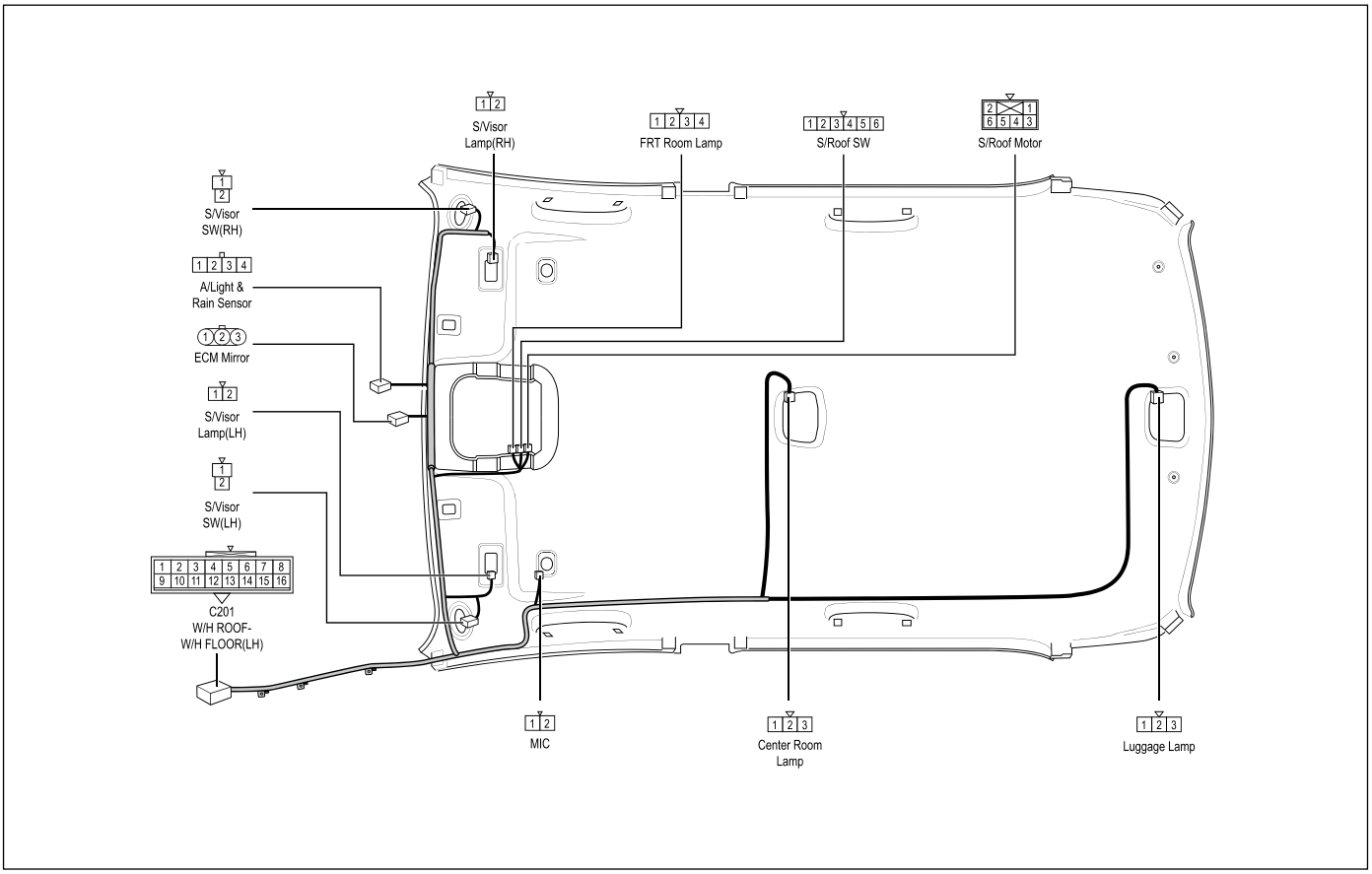


Modification basis	
Application basis	
Affected VIN	

CONNECTOR/GROUND
undefined

Downloaded from www.Manualslib.com manuals search engine

8213-09 W/H ROOF



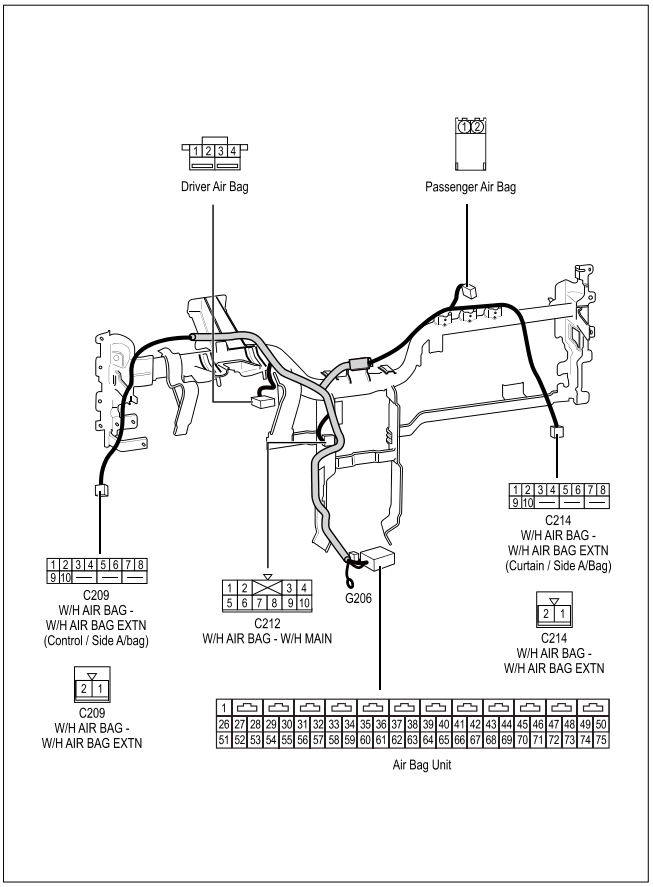
CONNECTOR/GROUND

undefined

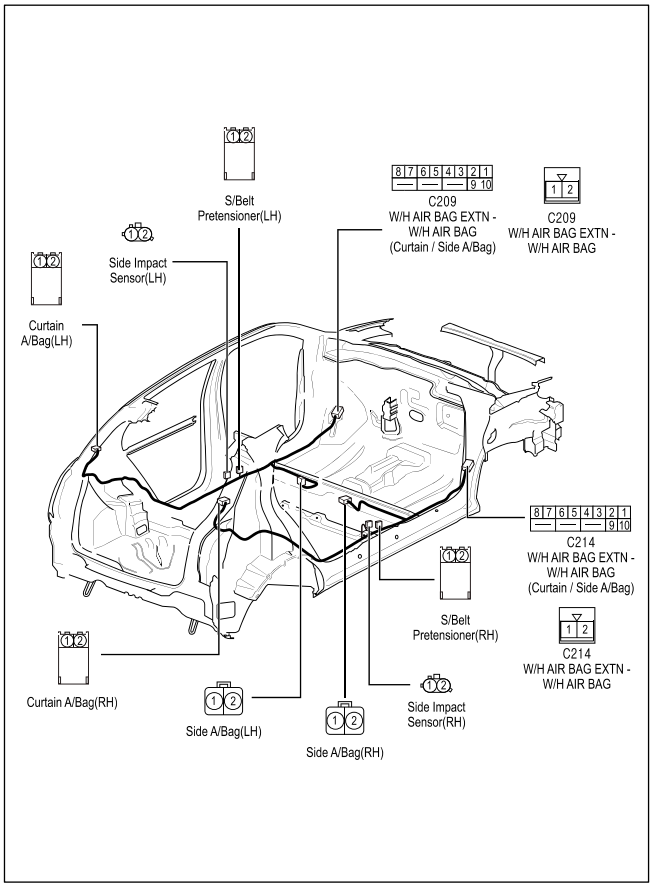
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8810-22 W/H AIR BAG



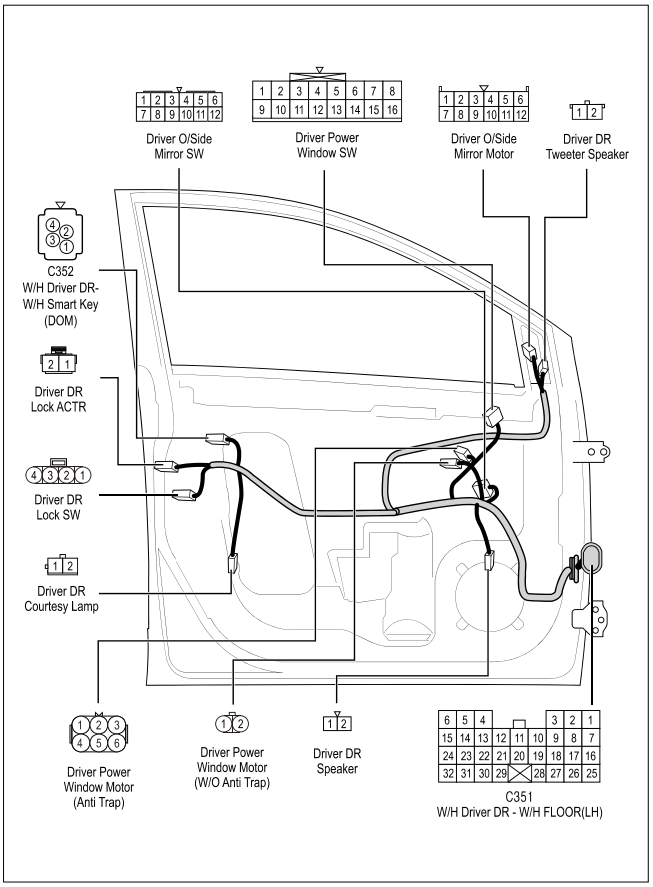
8810-23 W/H AIR BAG EXTN



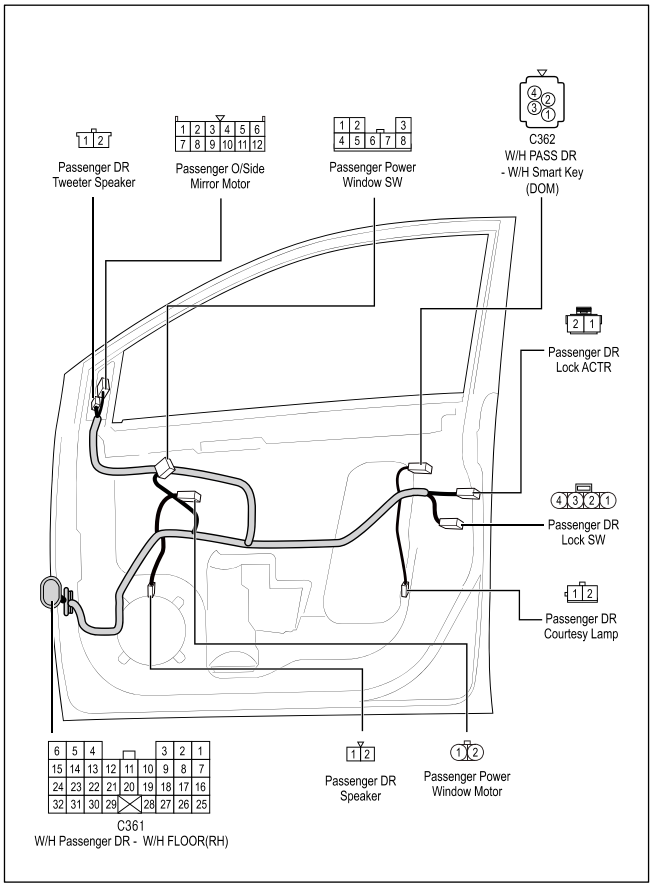
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8213-03 W/H DRIVER DOOR



8213-04 W/H PASSENGER DOOR



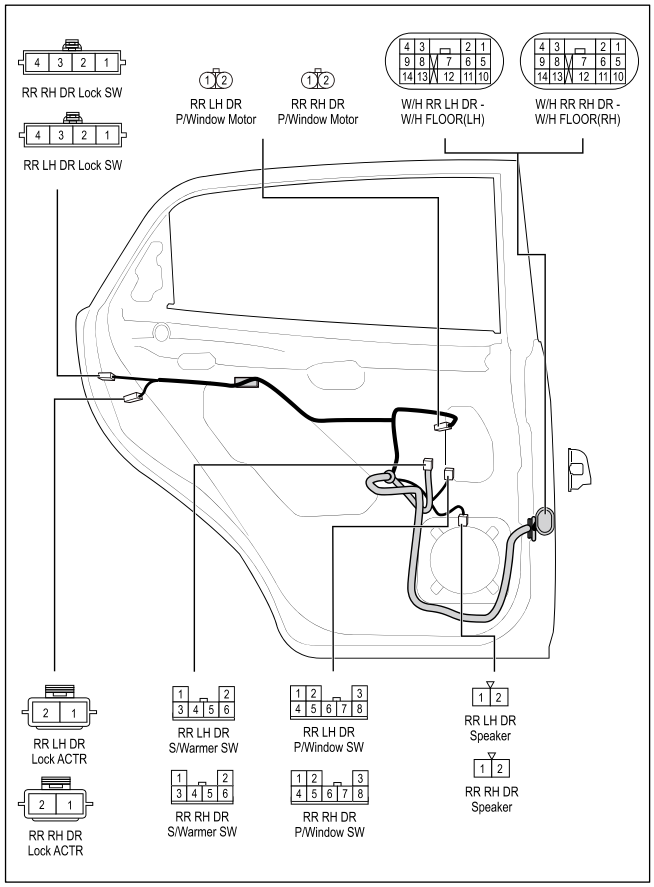
CONNECTOR/GROUND

undefined

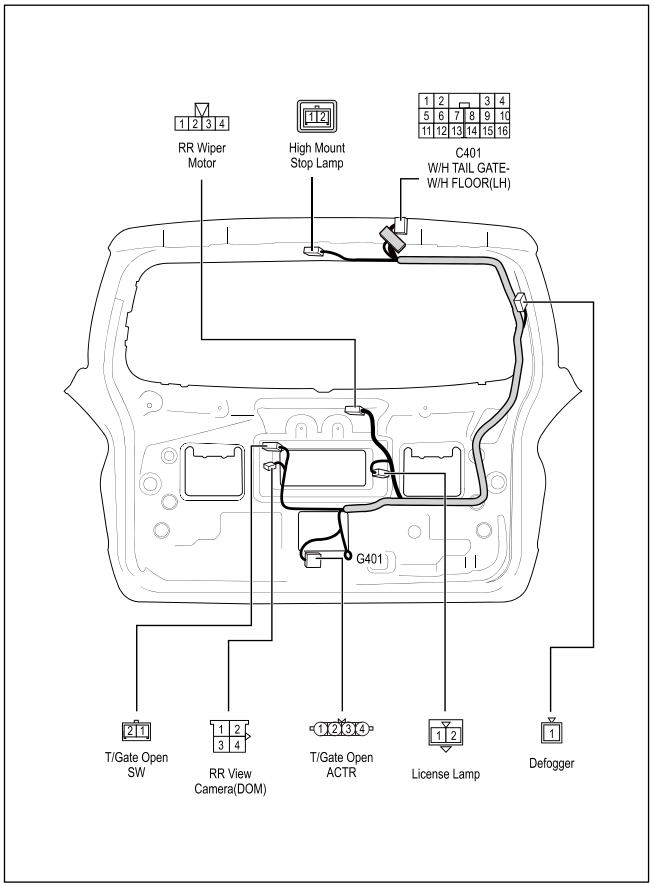
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8213-06 W/H REAR DOOR



8213-10 W/H TAIL GATE



Modification basis	
Application basis	
Affected VIN	

CONNECTOR/GROUND
undefined

Downloaded from www.Manualslib.com manuals search engine

POWER DISTRIBUTION

8210-00/8410-04/8410-05

INDEX POWER DISTRIBUTION

FUSE

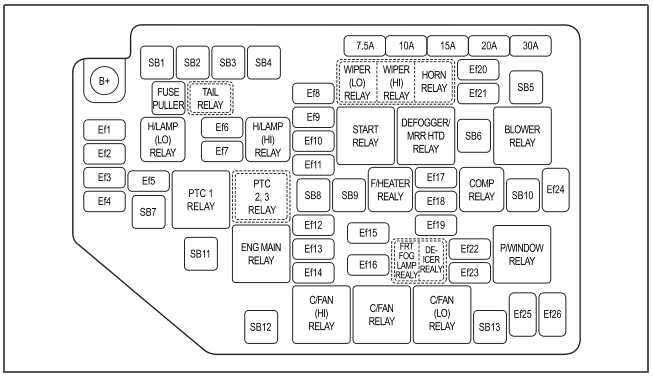
8210-00 ENGINE ROOM FUSE / RELAY BOX..... 2
8410-04 INDOOR FUSE BOX..... 9
8410-05 ICM RELAY BOX..... 14

Downloaded from www.Manualslib.com manuals search engine

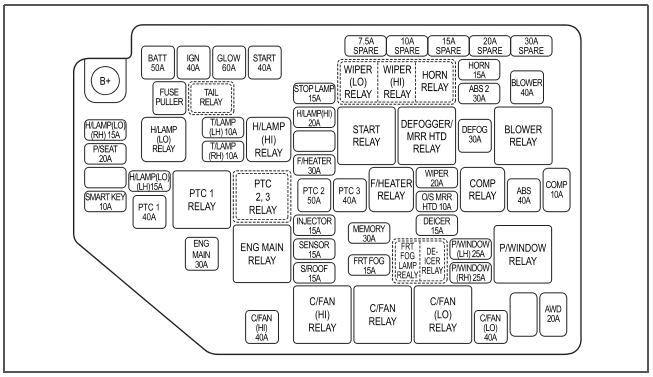
FUSE

8210-00 ENGINE ROOM FUSE / RELAY BOX

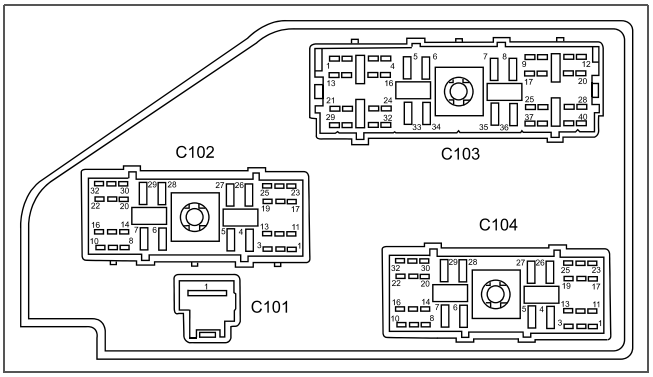
(1) ENGINE ROOM FUSE / RELAY BOX -TOP VIEW



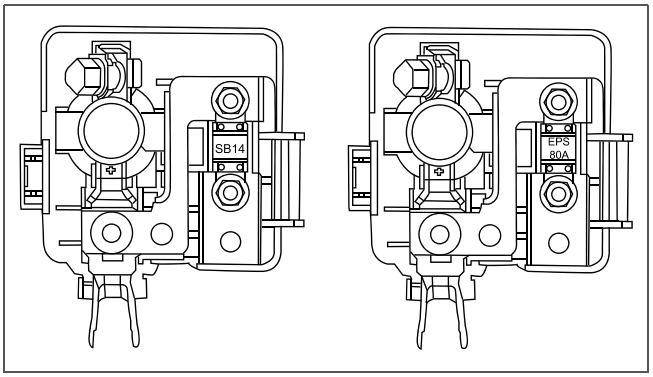
(3) ENGINE ROOM FUSE / RELAY BOX LOCATION



(2) ENG ROOM FUSE / RELAY BOX -UNDER VIEW



(4) BATTERY FUSE BOX LOCATION



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(5) USAGE OF FUSE IN ENGINE ROOM FUSE BOX

Fuse NO.	Capacity	Usage	Fuse NO.	Capacity	Usage
SB1	50A	BATT	Ef7	10A	Tail Lamp(RH)
SB2	40A	IGN SW	Ef8	15A	Stop Lamp
SB3	60A	Glow	Ef9	20A	Head Lamp(HI)
SB4	40A	Start	Ef10	-	-
SB5	40A	Blower	Ef11	30A	Fuel Heater
SB6	30A	Defogger	Ef12	15A	Injector
SB7	40A	PTC 1	Ef13	15A	Sensor
SB8	50A	PTC 2	Ef14	15A	Sun Roof
SB9	40A	PTC 3	Ef15	30A	Memory
SB10	40A	ABS	Ef16	15A	FRT Fog Lamp
SB11	30A	ENG Main	Ef17	20A	Wiper
SB12	40A	Cooling Fan(HI)	Ef18	10A	O/Side Mirror HTD
SB13	40A	Cooling Fan(LO)	Ef19	15A	Deicer
SB14	80A	EPS	Ef20	15A	Horn
Ef1	15A	Head Lamp LO(RH)	Ef21	30A	ABS 2
Ef2	20A	Power Seat	Ef22	25A	Power Window(LH)
Ef3	-	-	Ef23	25A	Power Window(RH)
Ef4	10A	Smart Key(DOM)	Ef24	10A	Compressor
Ef5	15A	Head Lamp LO(LH)	Ef25	-	-
Ef6	10A	Tail Lamp(LH)	Ef26	20A	AWD

(6) ENGINE ROOM FUSE BOX CONNECTOR NUMBER

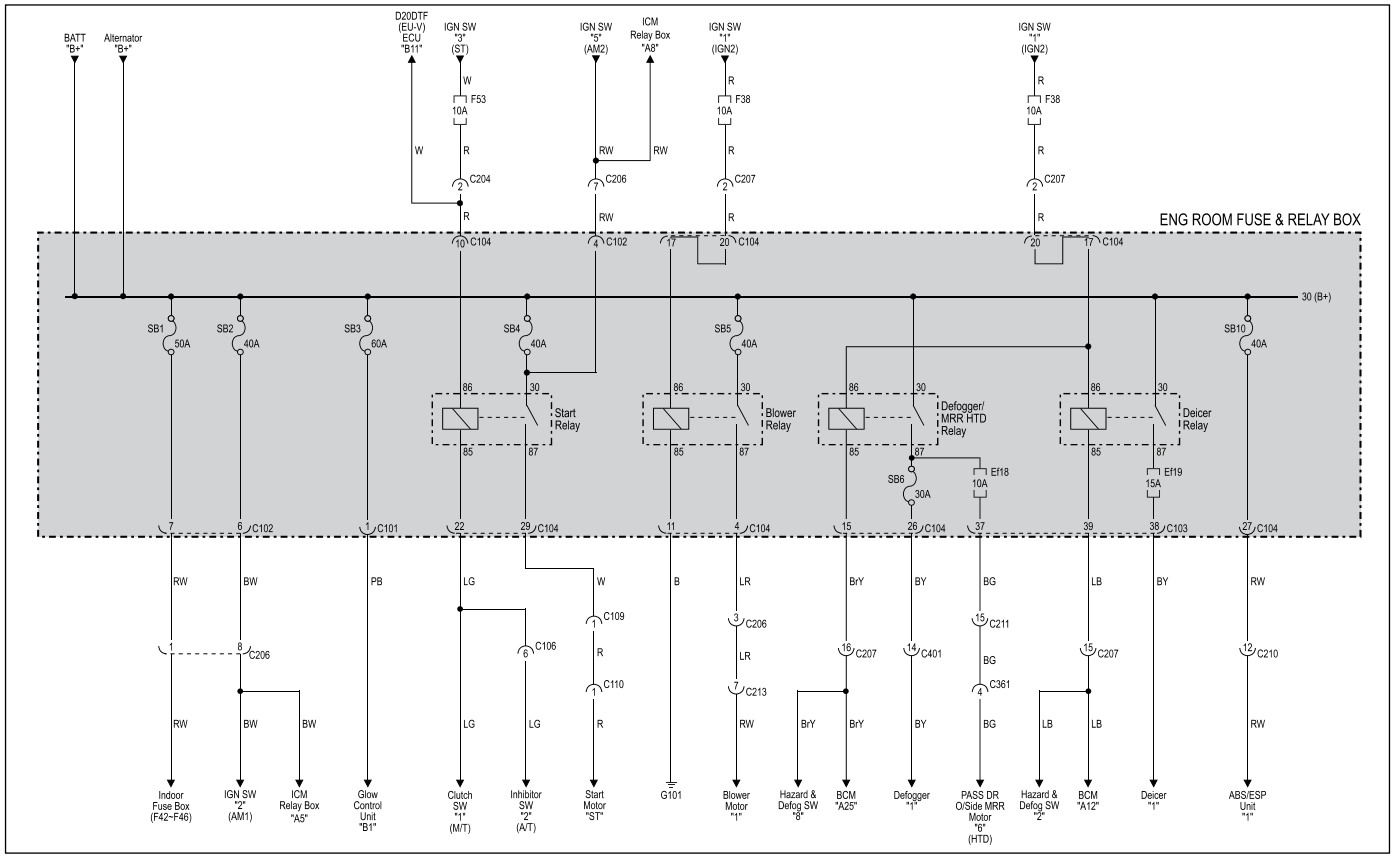
Connector NO.	Pin NO.	Connector Color
C101	1	Black
C102	32	Black
C103	40	Gray
C104	32	Brown

Memo

Downloaded from www.Manualslib.com manuals search engine

(7) ENGINE ROOM FUSE / RELAY BOX CIRCUIT

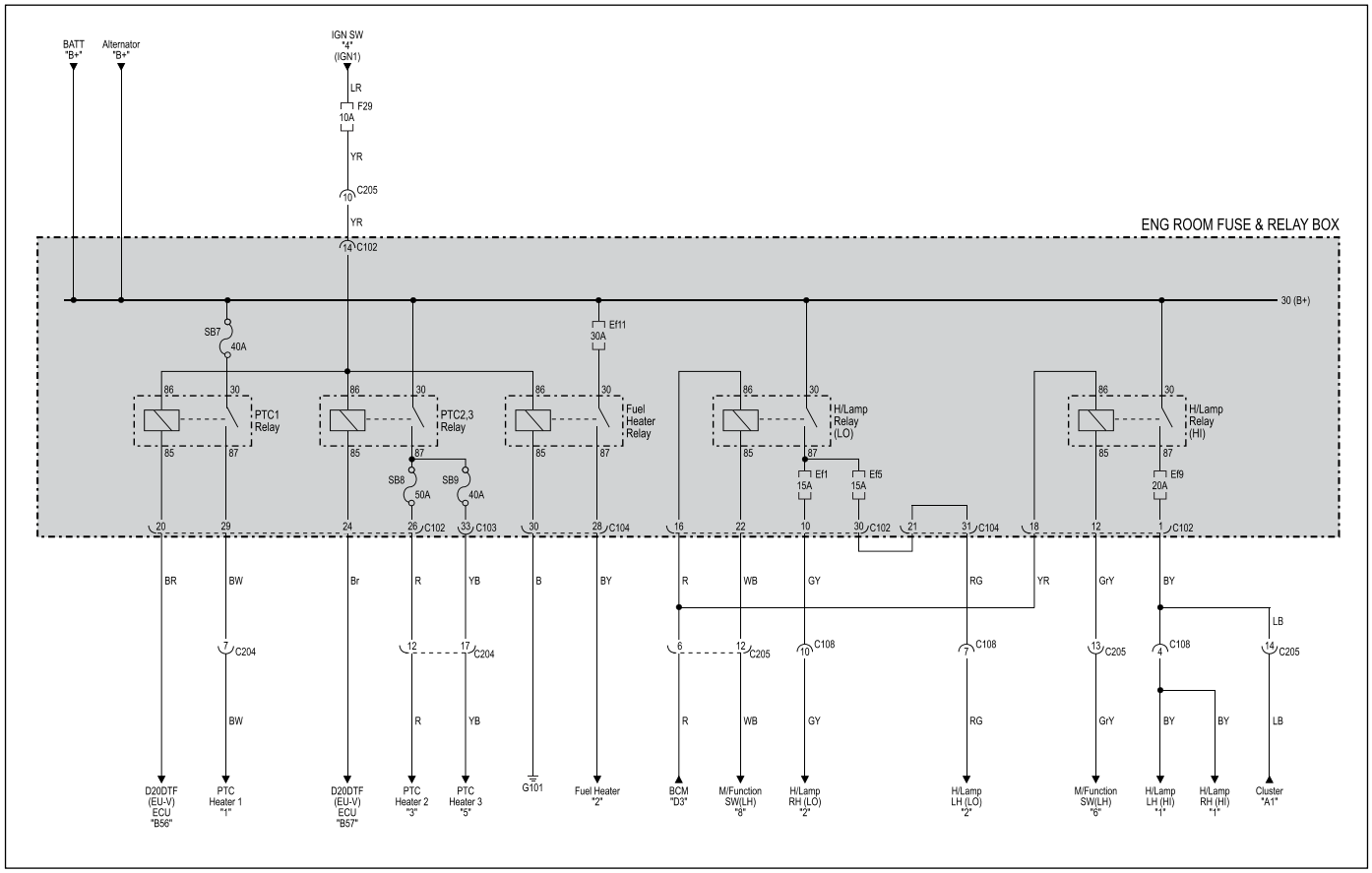
▶ **SB1~SB6, SB10, Ef18~Ef19, START RELAY, BLOWER RELAY, DEFOGGER RELAY, DEICER RELAY**



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

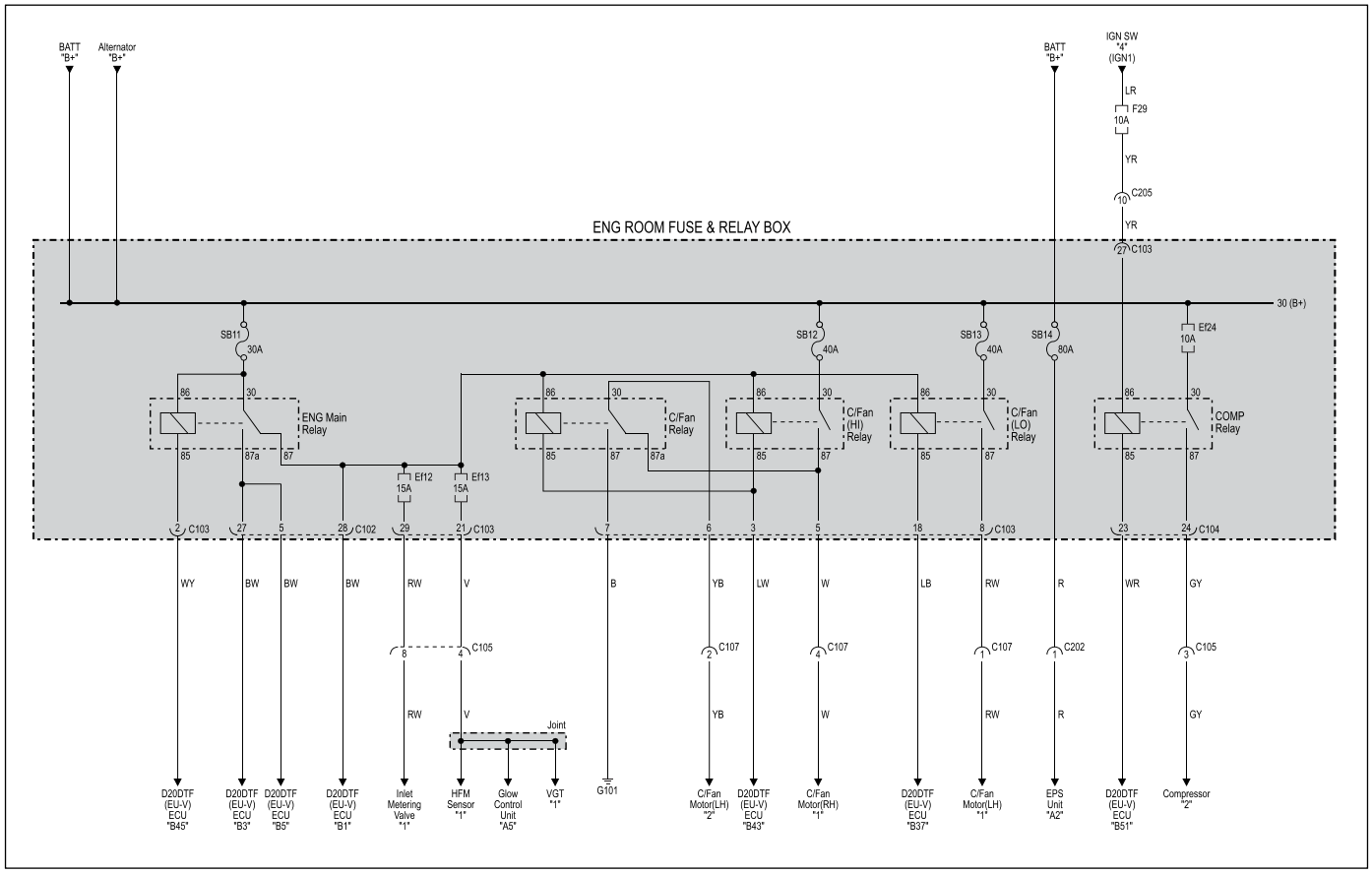
▶ **SB7~SB9, Ef1, Ef5, Ef9, Ef11, PTC RELAY, FUEL HEATER RELAY, HEAD LAMP RELAY(HI, LO)**



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

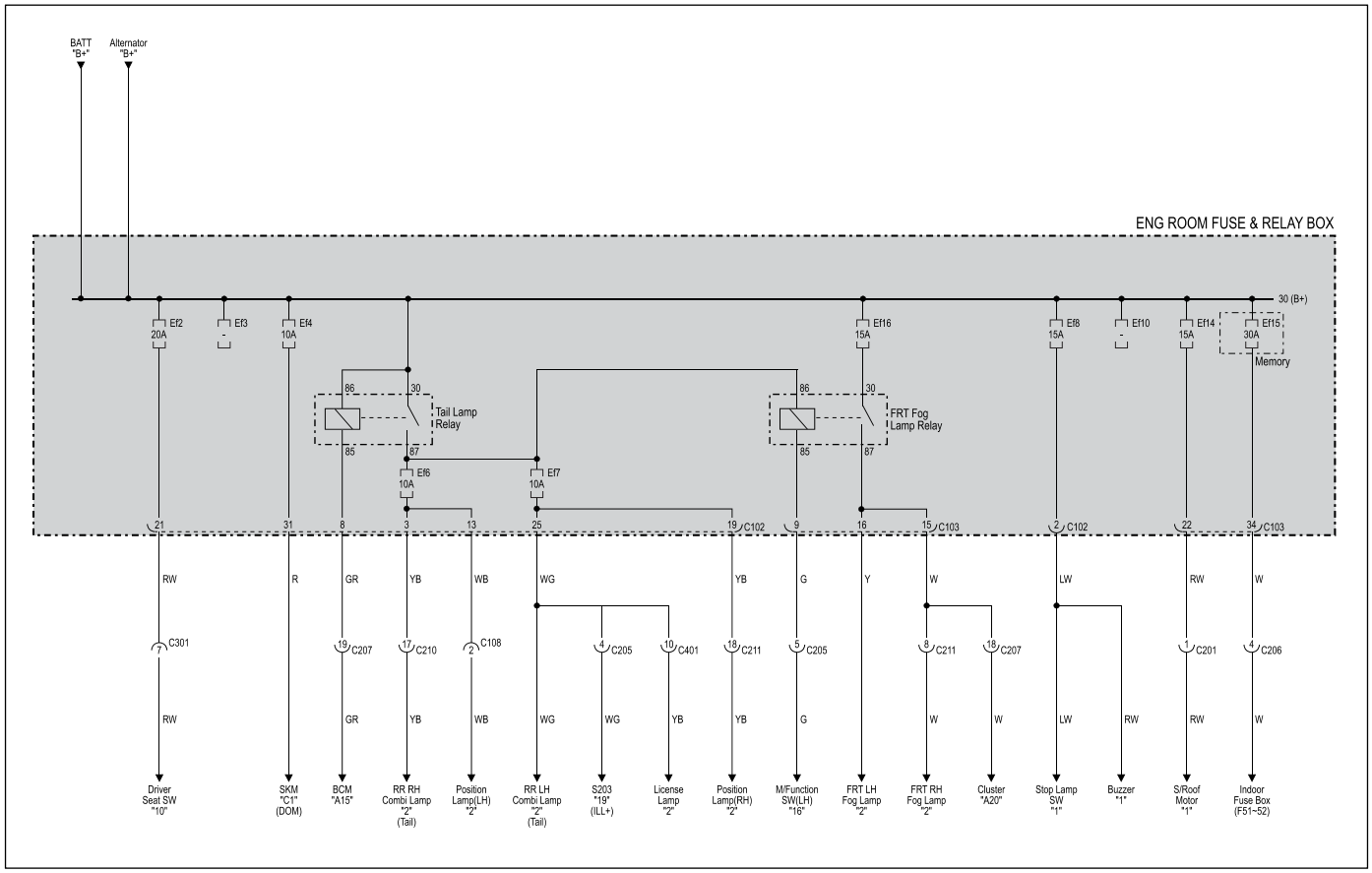
▶ **SB11~SB14, Ef12~Ef13, Ef24, ENG MAIN RELAY, C/FAN RELAY, C/FAN RELAY(HI, LO), COMP RELAY**



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

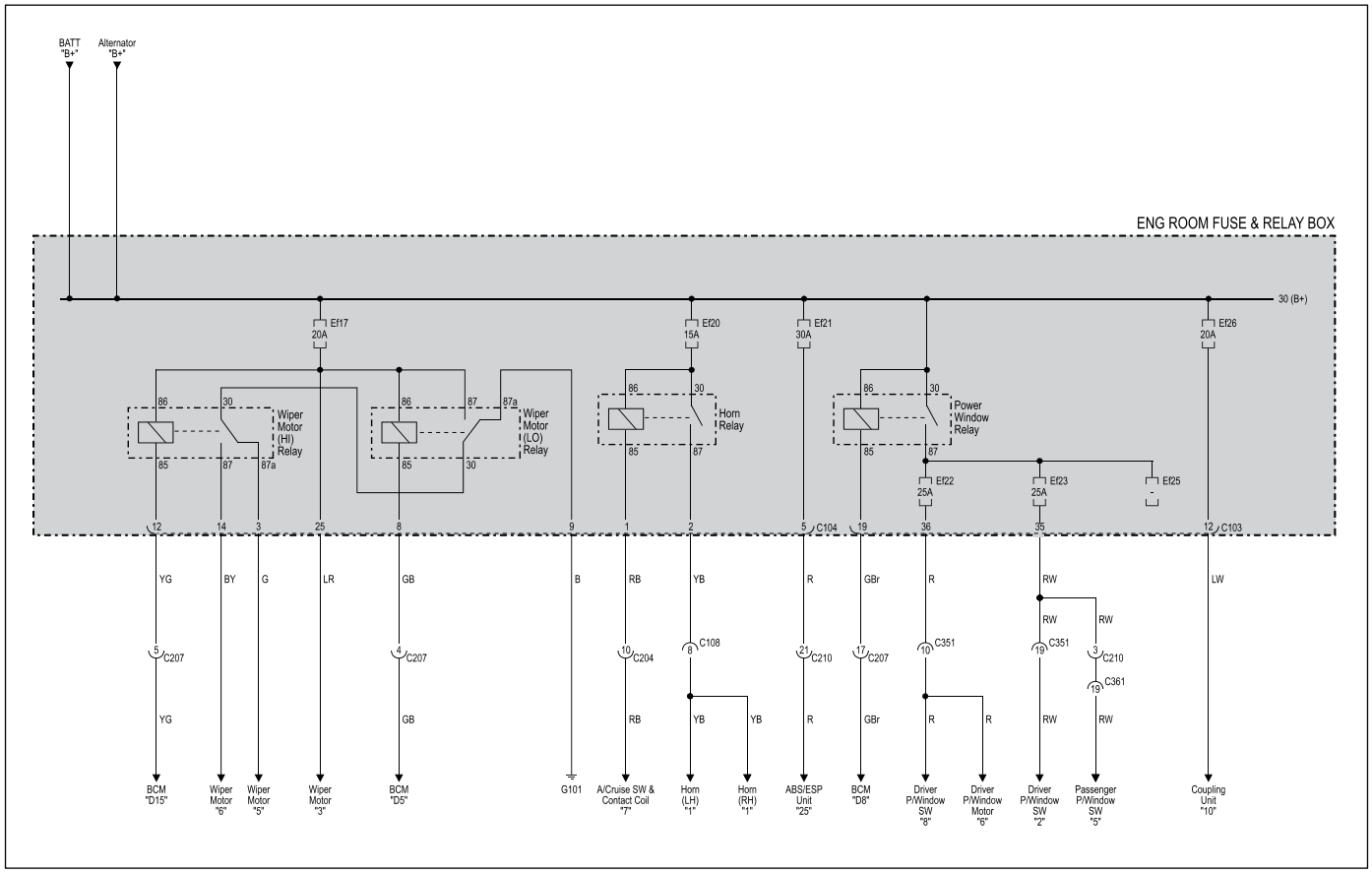
▶ **Ef2~Ef4, Ef6~Ef8, Ef10, Ef14~Ef16, TAIL LAMP RELAY, FRT FOG LAMP RELAY**



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ **Ef17, Ef20~Ef23, Ef25~Ef26, WIPER MOTOR RELAY(HI, LO), HORN RELAY, POWER WINDOW RELAY**

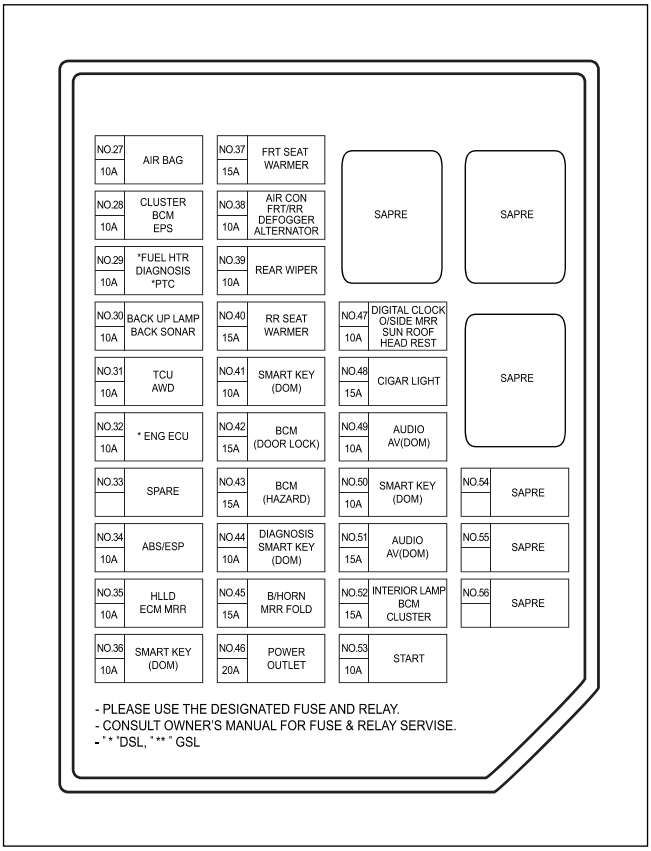


Modification basis	
Application basis	
Affected VIN	

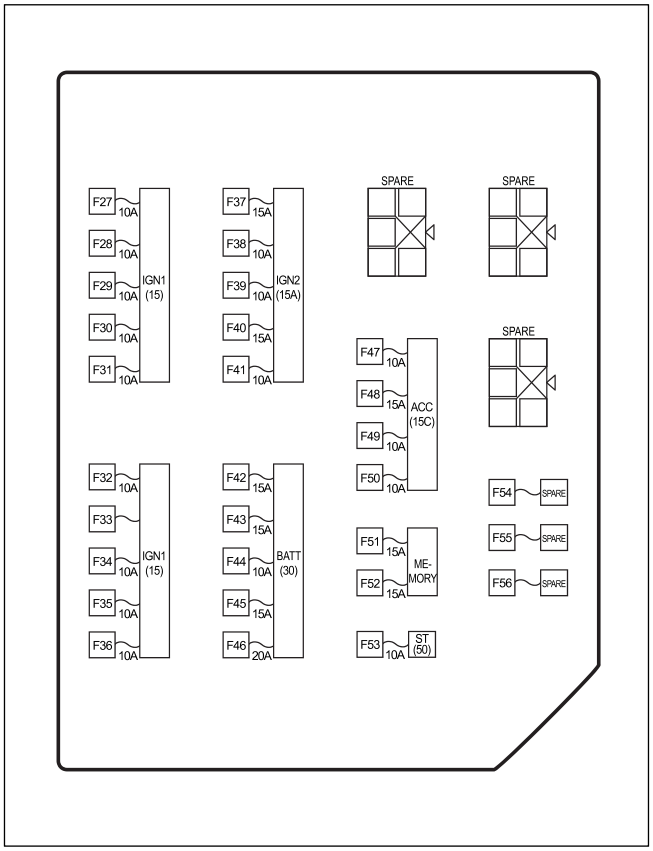
Downloaded from www.Manualslib.com manuals search engine

8410-04 INDOOR FUSE BOX

(1) INDOOR FUSE BOX



(2) POWER SUPPLY

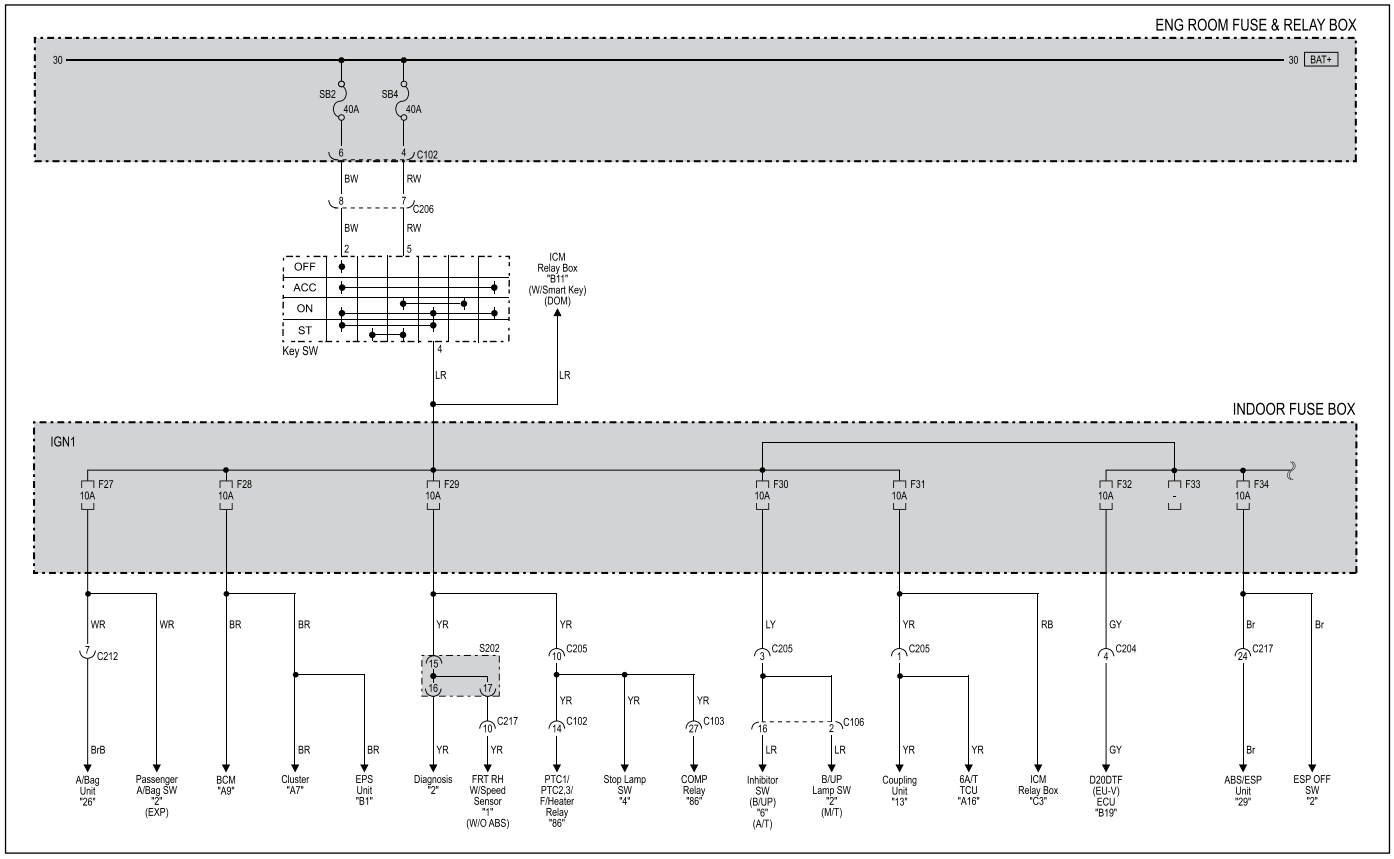


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(3) INDOOR FUSE BOX CIRCUIT

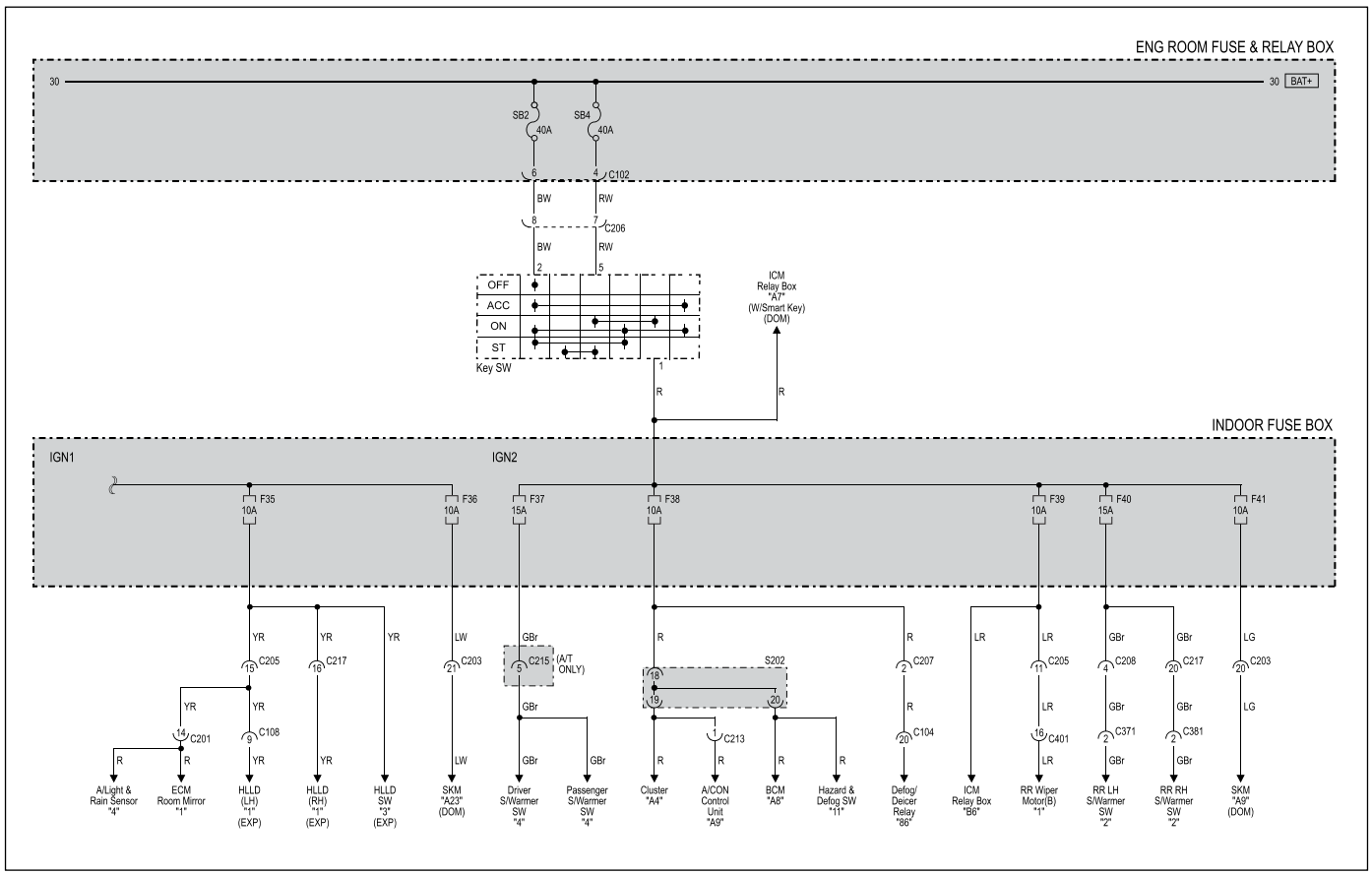
▶ F27~F34



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

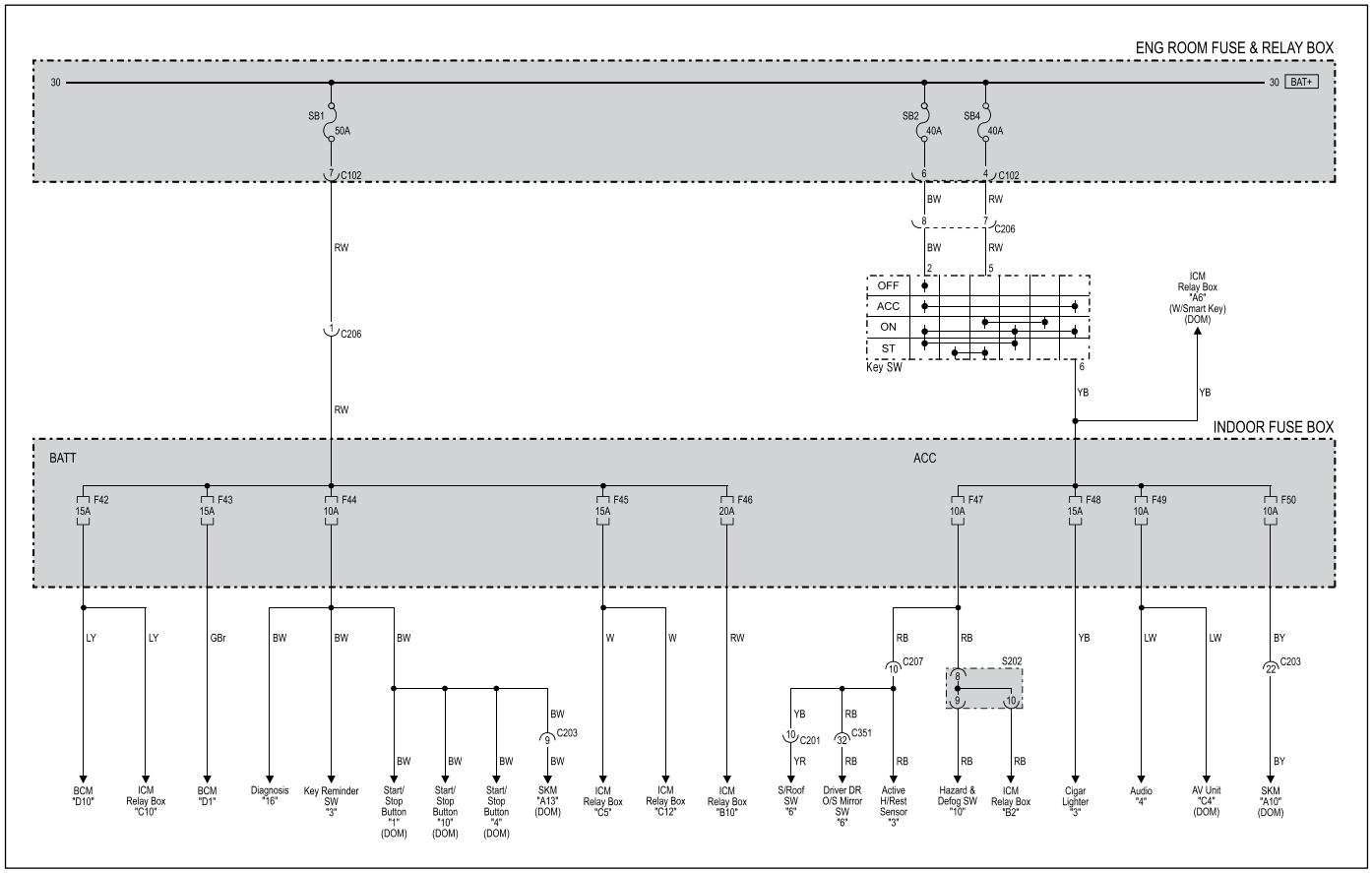
▶ F35~F41



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

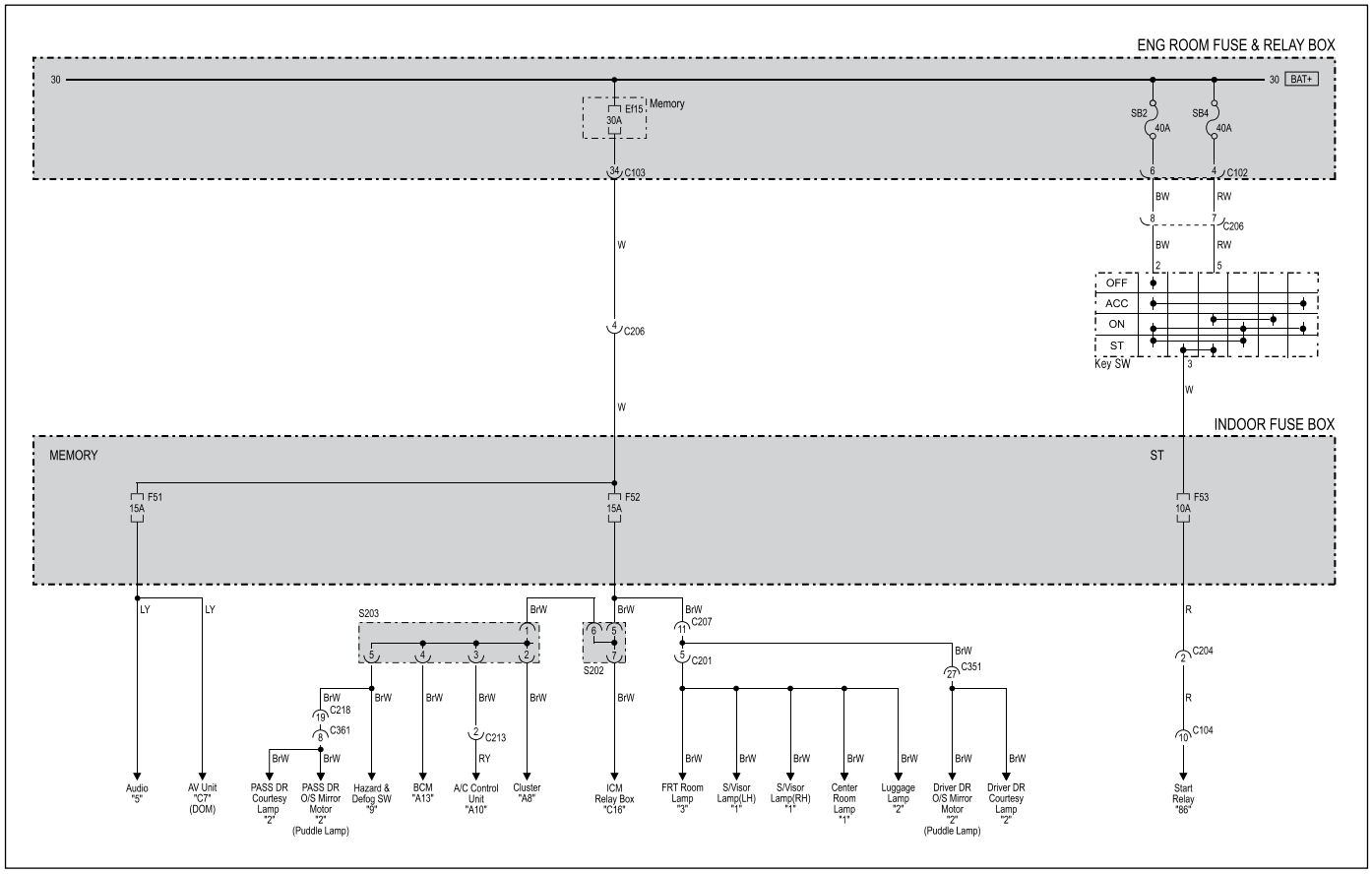
▶ F42~F50



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ F51~F53

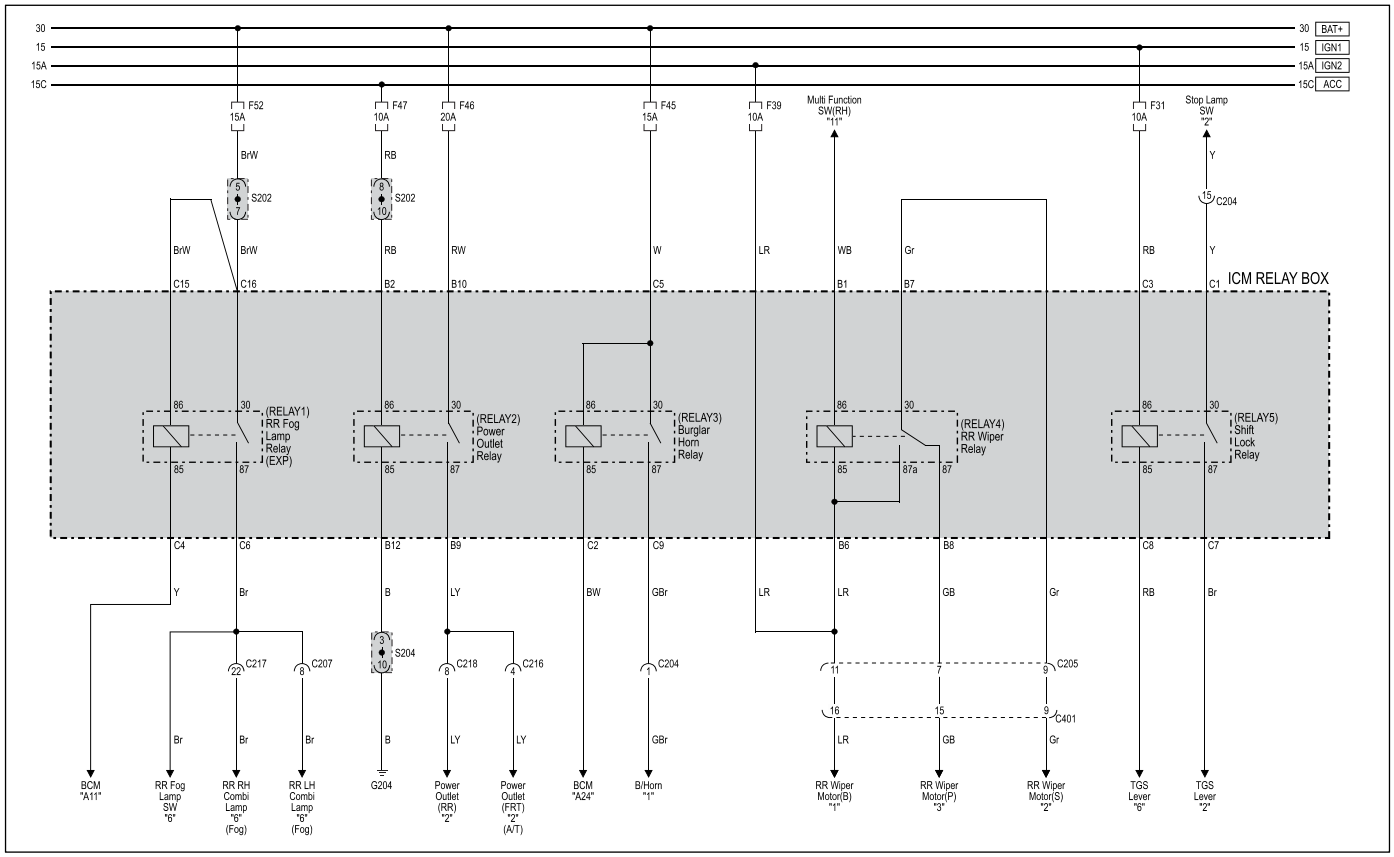


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8410-05 ICM RELAY BOX

▶ **RR FOG LAMP RELAY, POWER OUTLET RELAY, BURGLAR HORN RELAY, RR WIPER RELAY, SHIFT LOCK RELAY**



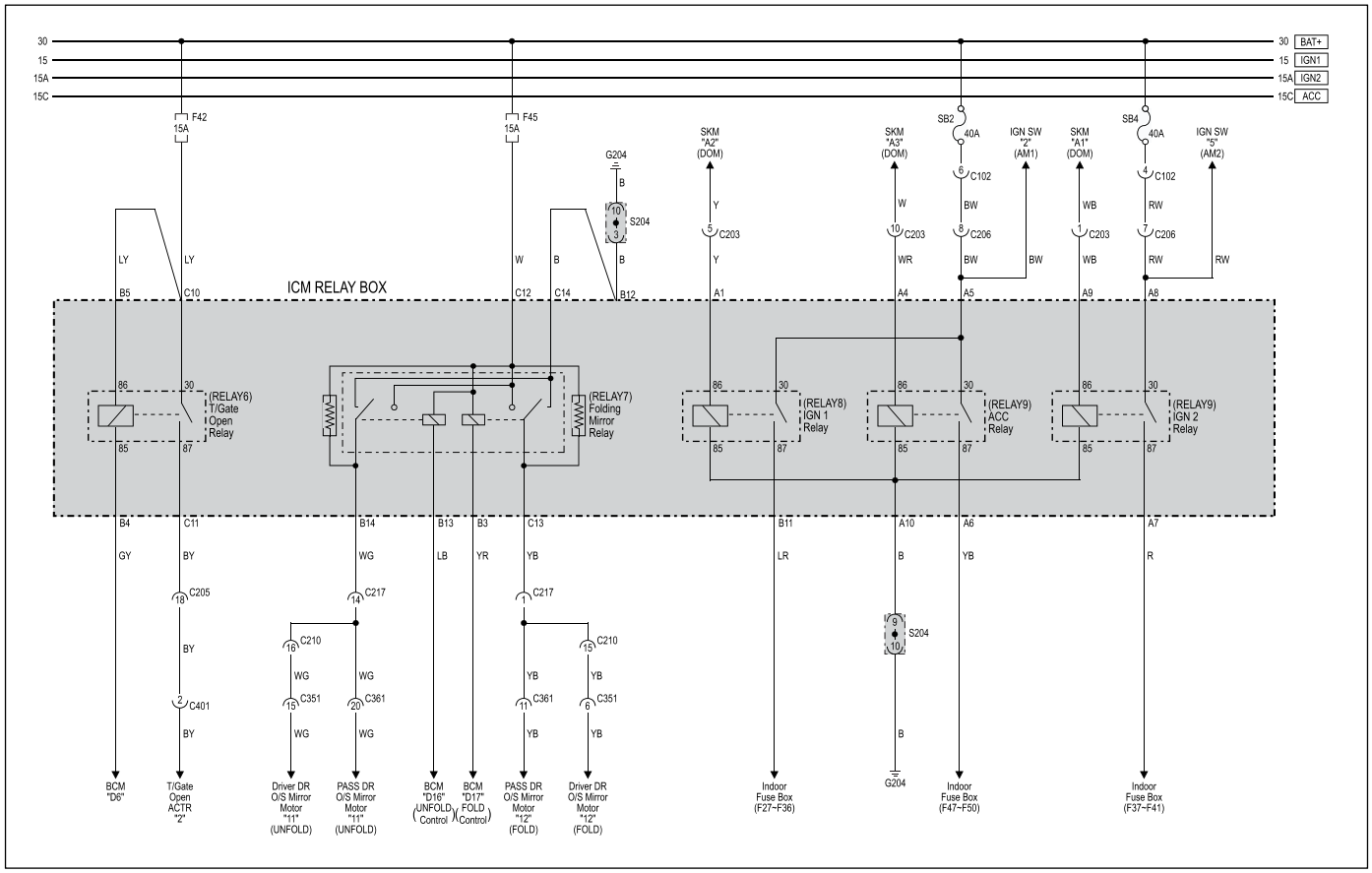
POWER DISTRIBUTION

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ **T/GATE OPEN RELAY, FOLDING MIRROR RELAY, IGN 1 RELAY, ACC RELAY, IGN 2 RELAY**



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1461-01/1491-01/2112-02/2820-01/3110-17/3110-01/4610-04/4810-08/4892-01/6810-20/6810-15/7340-03/7410-02/7632-16/7770-02
/7810-01/7840-01/8010-01/8210-03/8210-01/8210-01/8310-10/8310-01/8310-01/8320-01/8510-52/8510-48/8510-05/8610-06/8620-01
/8710-03/8712-03/8790-01/8810-01/8930-40/8930-03/8930-01

INDEX CIRCUIT

ENGINE

1461-01 STARTING / CHARGING..... 2
2820-01 GLOW CONTROL UNIT..... 3
1491-01 ECU(D20DTF EU-V)..... 4
6810-15 PTC HEATER..... 6
8210-01 DIAGNOSIS CONNECTOR..... 7

CHASSIS

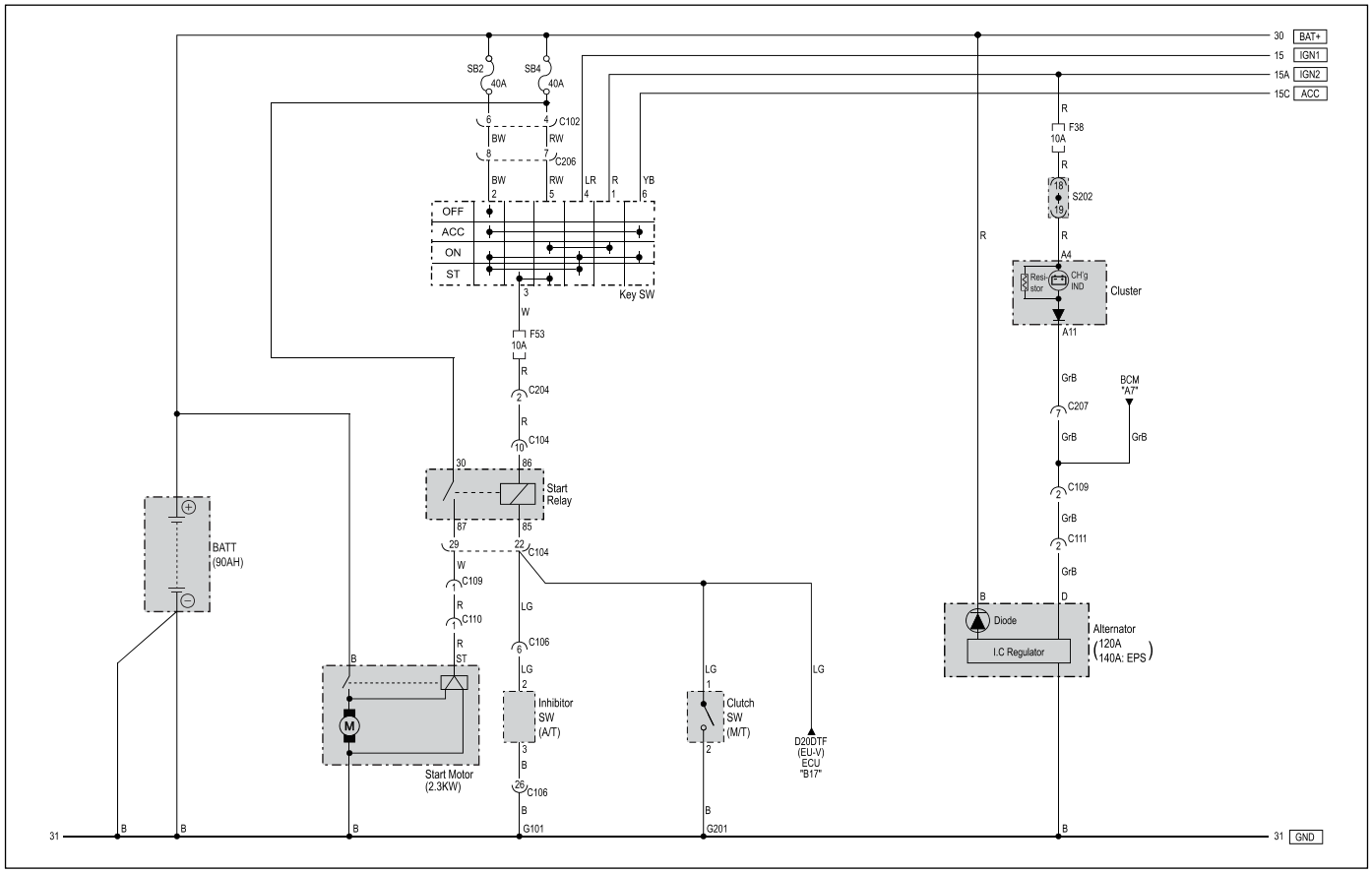
3110-01 TCU(6-A/T)..... 8
3110-17 AWD COUPLING UNIT..... 9
4892-01 ABS/ESP..... 10

ELECTRICAL SYSTEM

8810-01 AIR BAG (DUAL/SIDE/CURTAIN) SYSTEM..... 11
8010-01 CLUSTER..... 12
4610-04 EPS..... 13
7410-02 POWER SEAT / FRT SEAT WARMER..... 14
8510-48 REAR SEAT WARMER..... 15
8620-01 BCM(BODY CONTROL MODULE) 16
8510-05 POWER WINDOW..... 18
8510-52 OUTSIDE MIRROR..... 19
7810-01 FRT(RR) WIPER / WASHER..... 20
8610-06 HORN..... 21
7632-16 CIGAR LIGHTER / POWER OUTLET..... 22
7840-01 DEFOGGER / DEICER..... 23
8710-03 DOOR LOCK CIRCUIT..... 24
7340-03 SUN ROOF..... 25
8310-01 HEAD LAMP..... 26
8310-01 HEAD LAMP LEVEL 'G DEVICE(EXP)..... 27
8320-01 TAIL LAMP..... 28
8310-01 TURN SIGNAL LAMP / HAZARD LAMP..... 29
8210-03 TRAILER LAMP(EXP)..... 30
8310-10 FRT FOG LAMP(DOM)..... 31
8310-10 FRT / RR FOG LAMP(EXP)..... 32
4810-08 STOP LAMP..... 33
7770-02 INTERIOR / DOOR LAMP..... 34
8790-01 PARKING AID / BACK UP LAMP / ECM MIRROR..... 35
8930-03 AUDIO..... 36
8930-40 AUX / HANDSFREE MODULE..... 37
8930-01 AV SYSTEM(DOM)..... 38
6810-20 AIR CONDITIONER SYSTEM..... 39
2112-02 COOLING FAN SYSTEM..... 40
8210-01 CAN..... 41
8712-03 SKM(SMART KEY MODULE)(DOM)..... 42

Downloaded from www.Manualslib.com manuals search engine

1461-01 STARTING / CHARGING



CIRCUIT

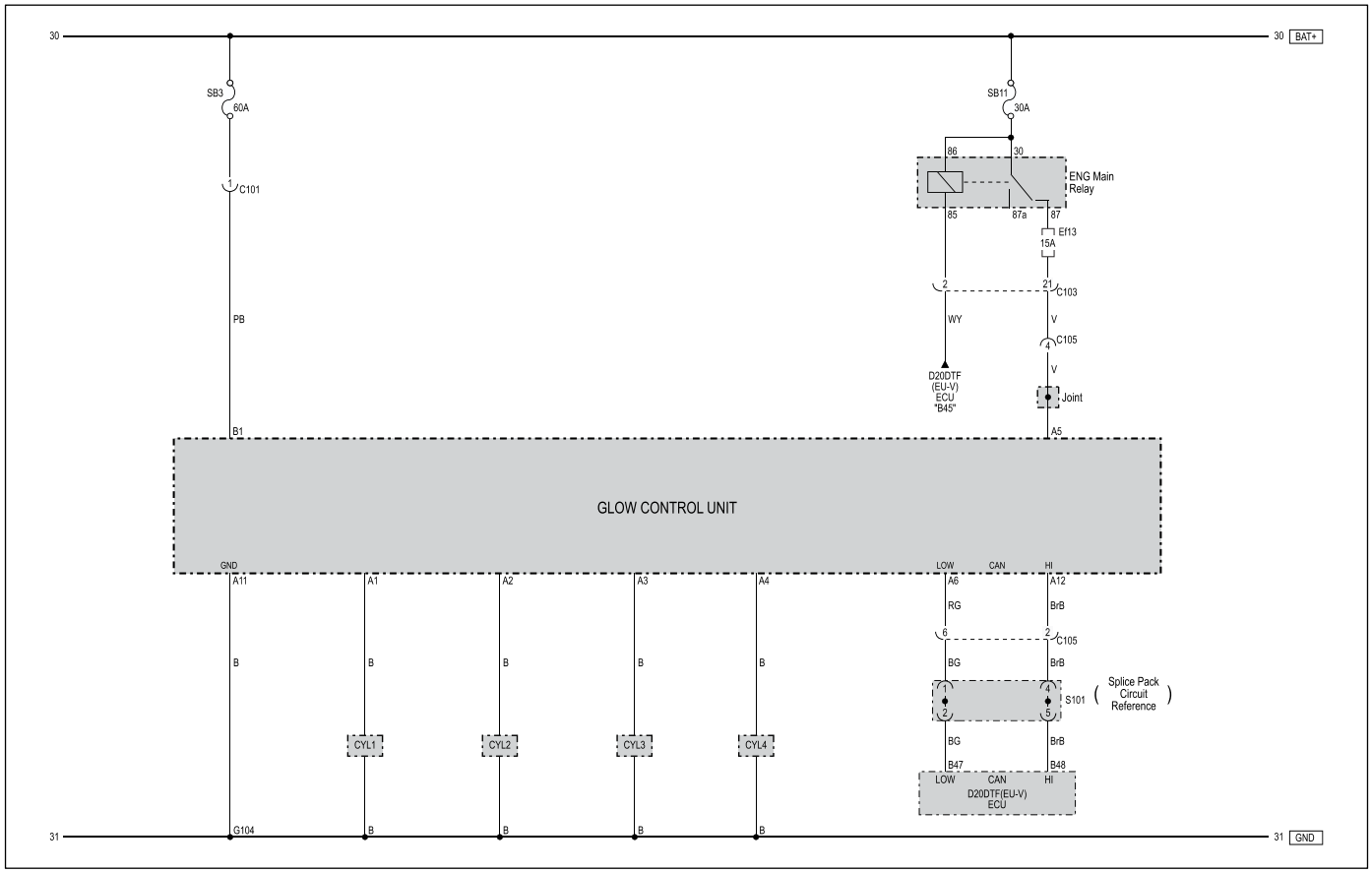
korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

ENGINE
CHASSIS
ELECTRICAL

2820-01 GLOW CONTROL UNIT

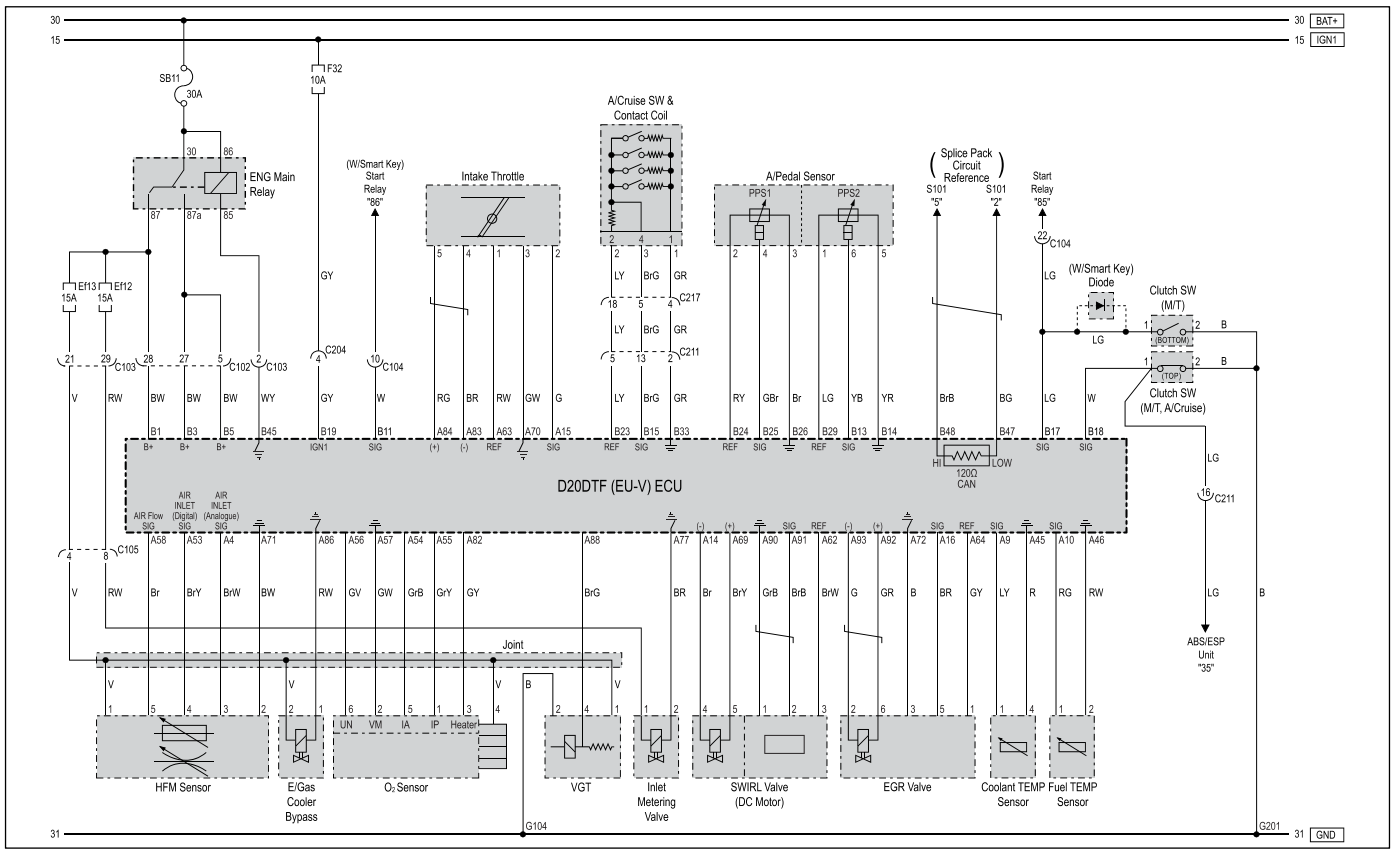


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N 1491-01 ECU(D20DTF EU-V -ENGINE CONTROL UNIT)

(1) ENG MAIN RELAY, PEDAL MODULE, VALVE(THROTTLE, INLET METERING, EGR), SENSOR(HFM, O2, COOLANT TEMP, FUEL TEMP)



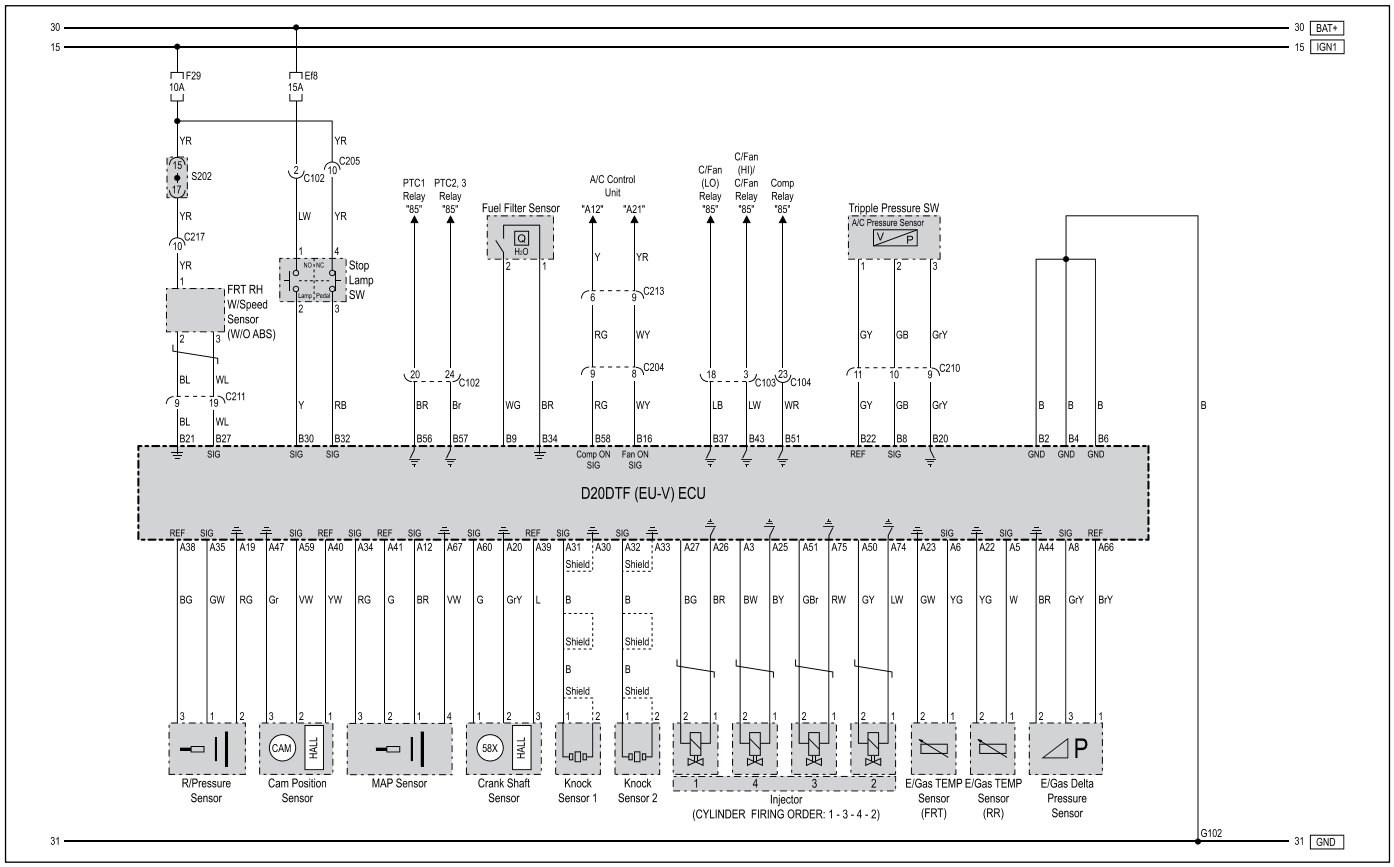
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

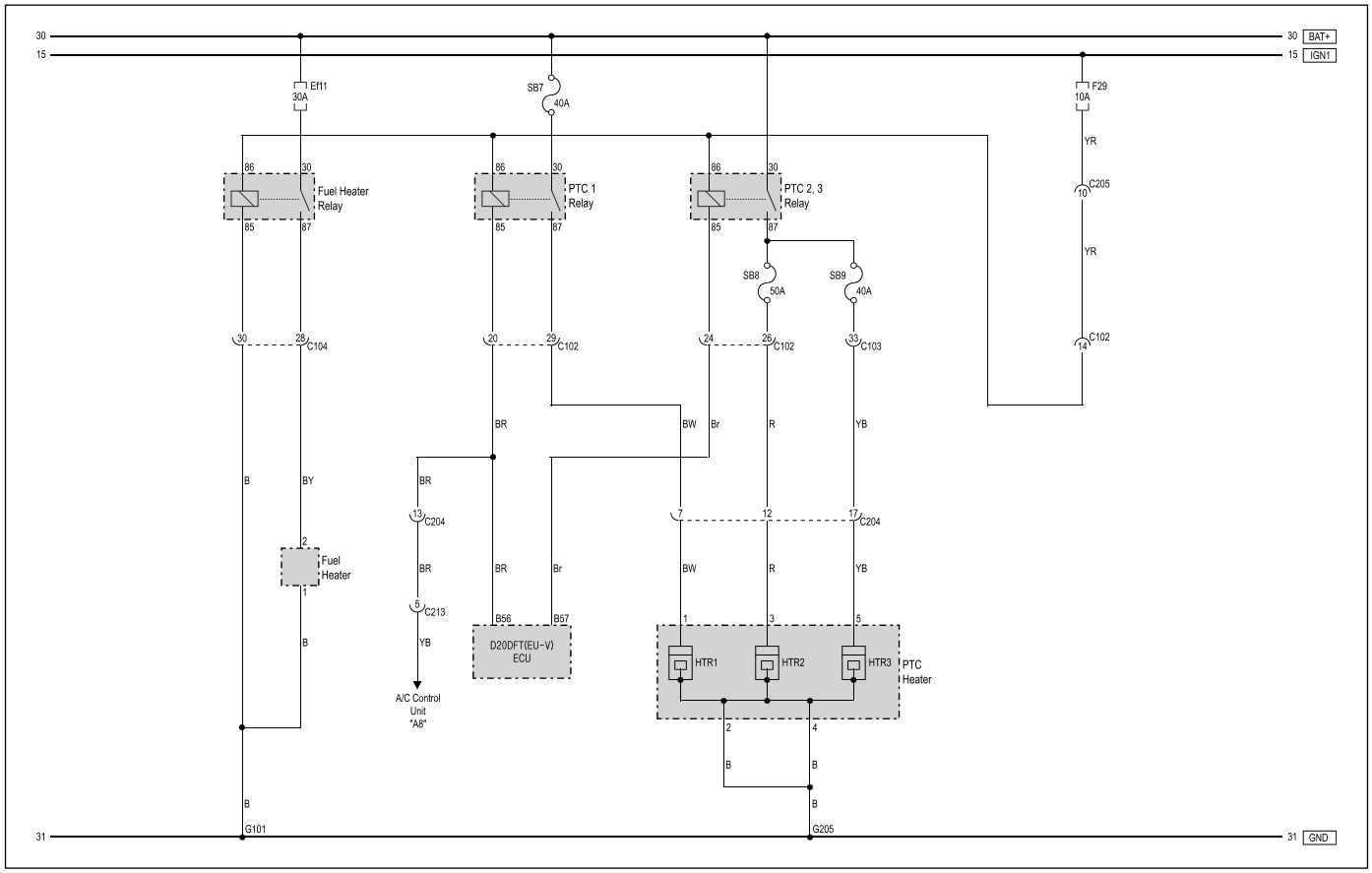
(2) STOP LAMP, W/SPEED SENSOR, T/PRESSURE SW, INJECTOR, SENSOR(FUEL FILTER, R/PRESSURE, CAM POSITION, MAP, KNOCK, E/GAS TEMP)



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

6810-15 PTC HEATER



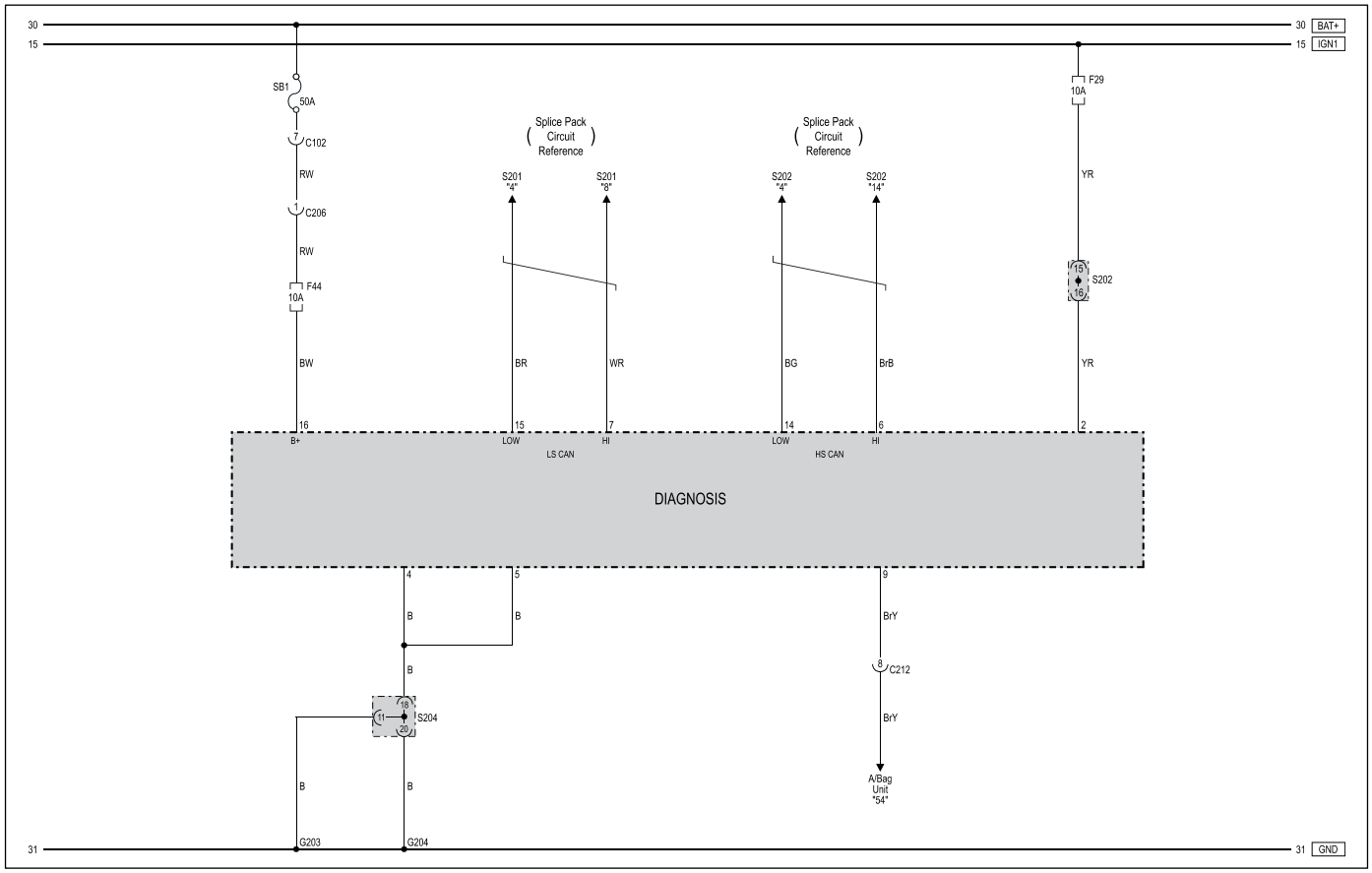
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

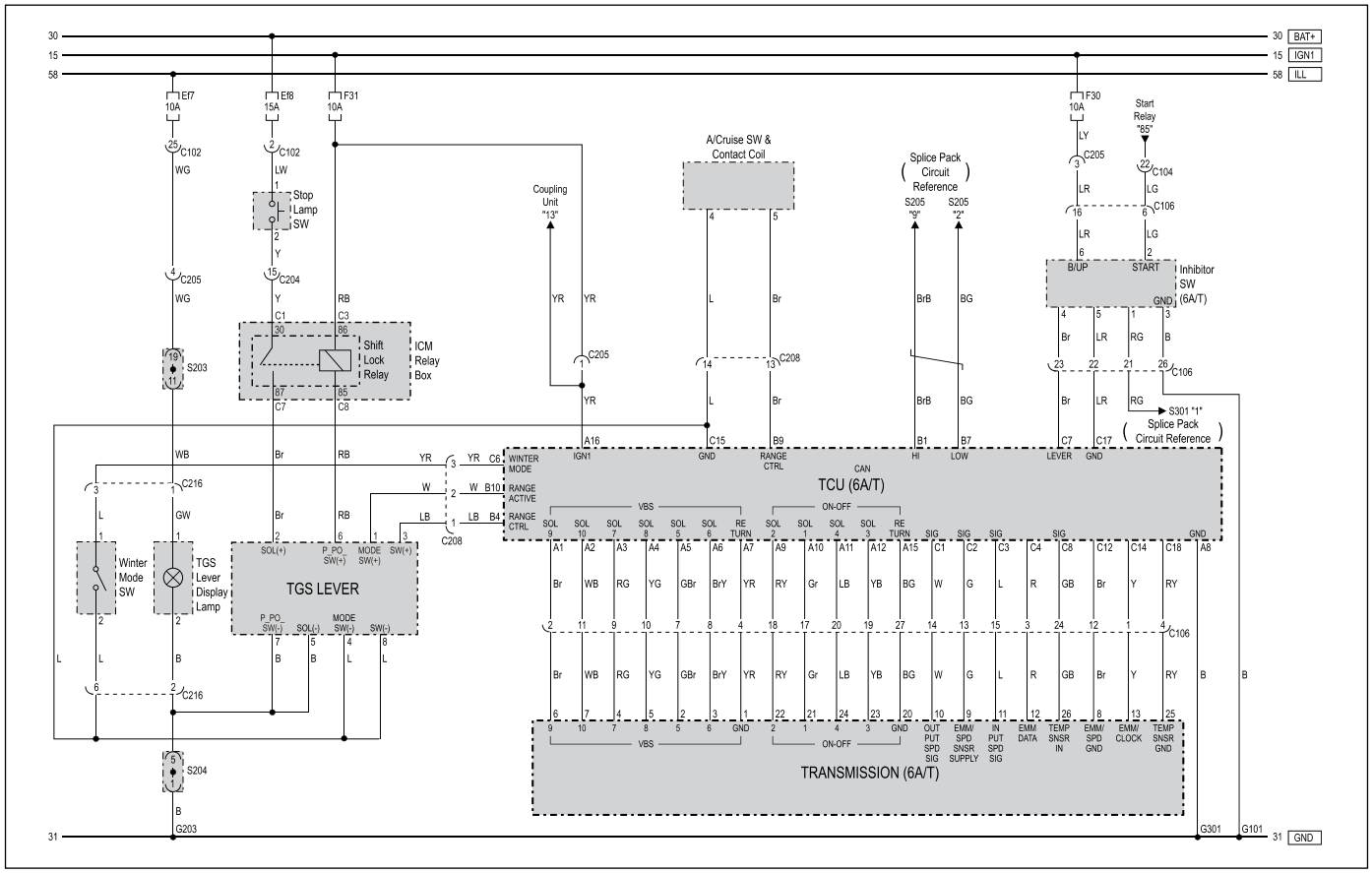
8210-01 DIAGNOSIS CONNECTOR



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3110-01 TCU(6-A/T)



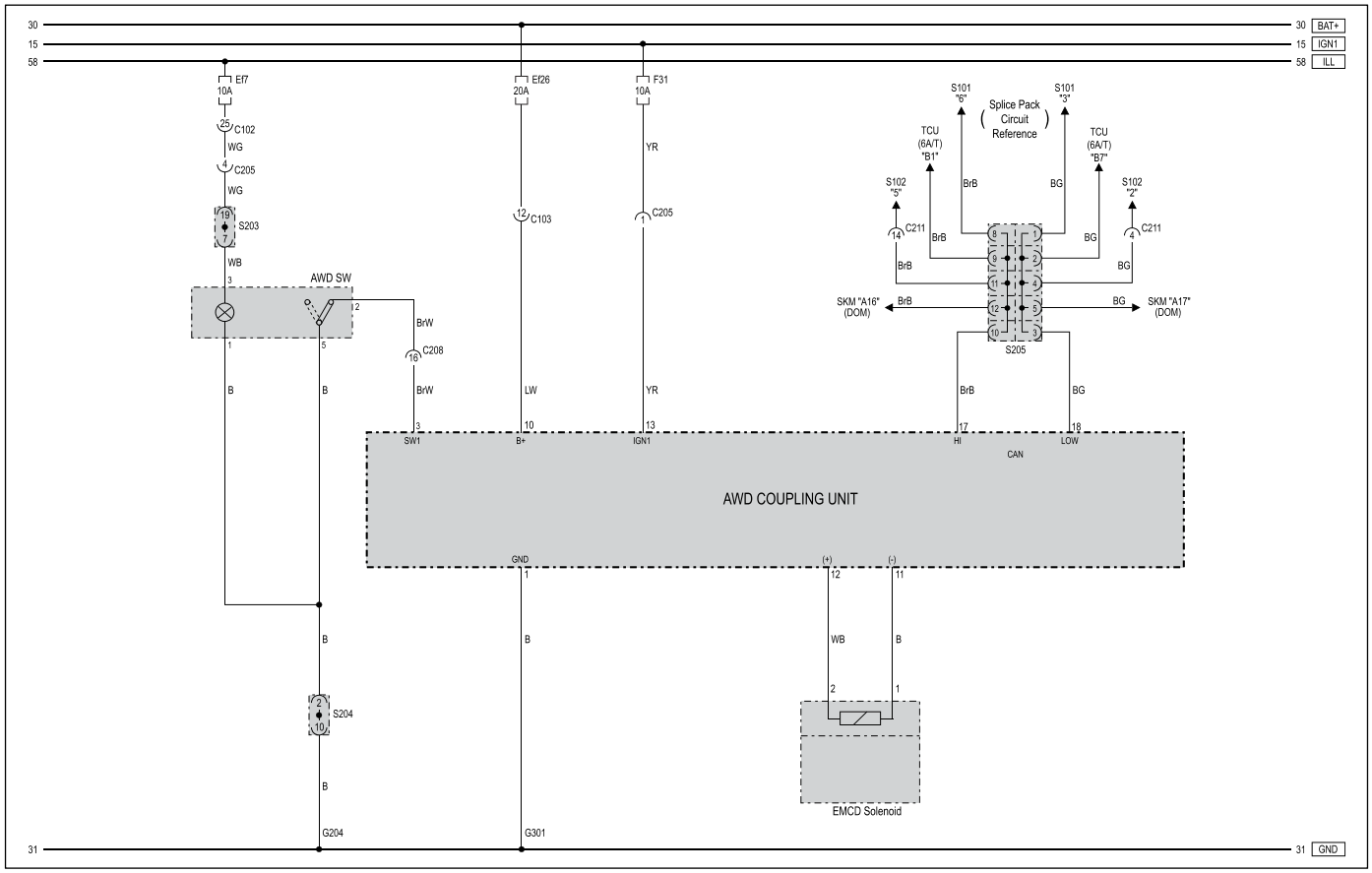
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

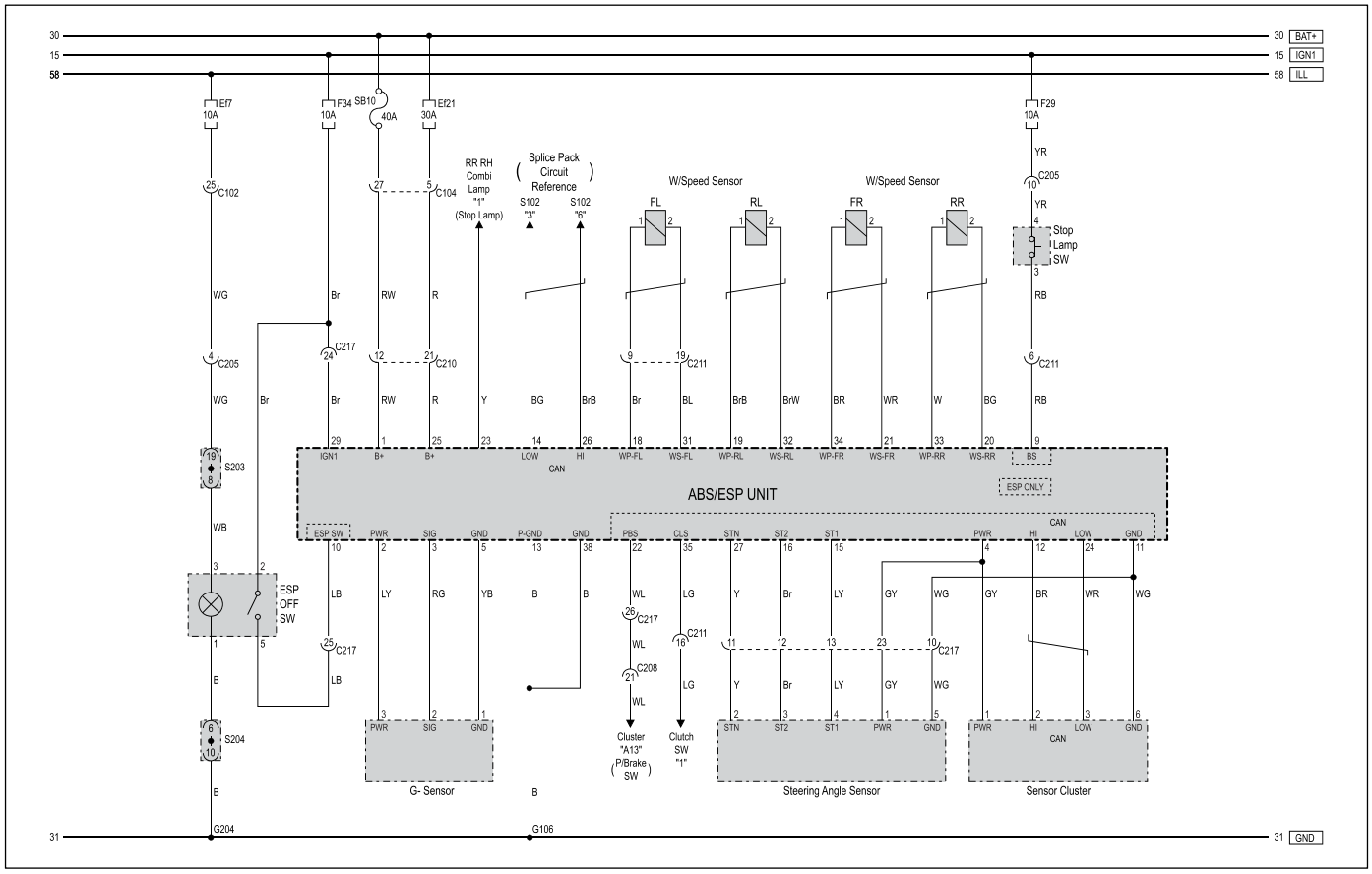
3110-17 AWD COUPLING UNIT



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4892-01 ABS/ESP



CIRCUIT

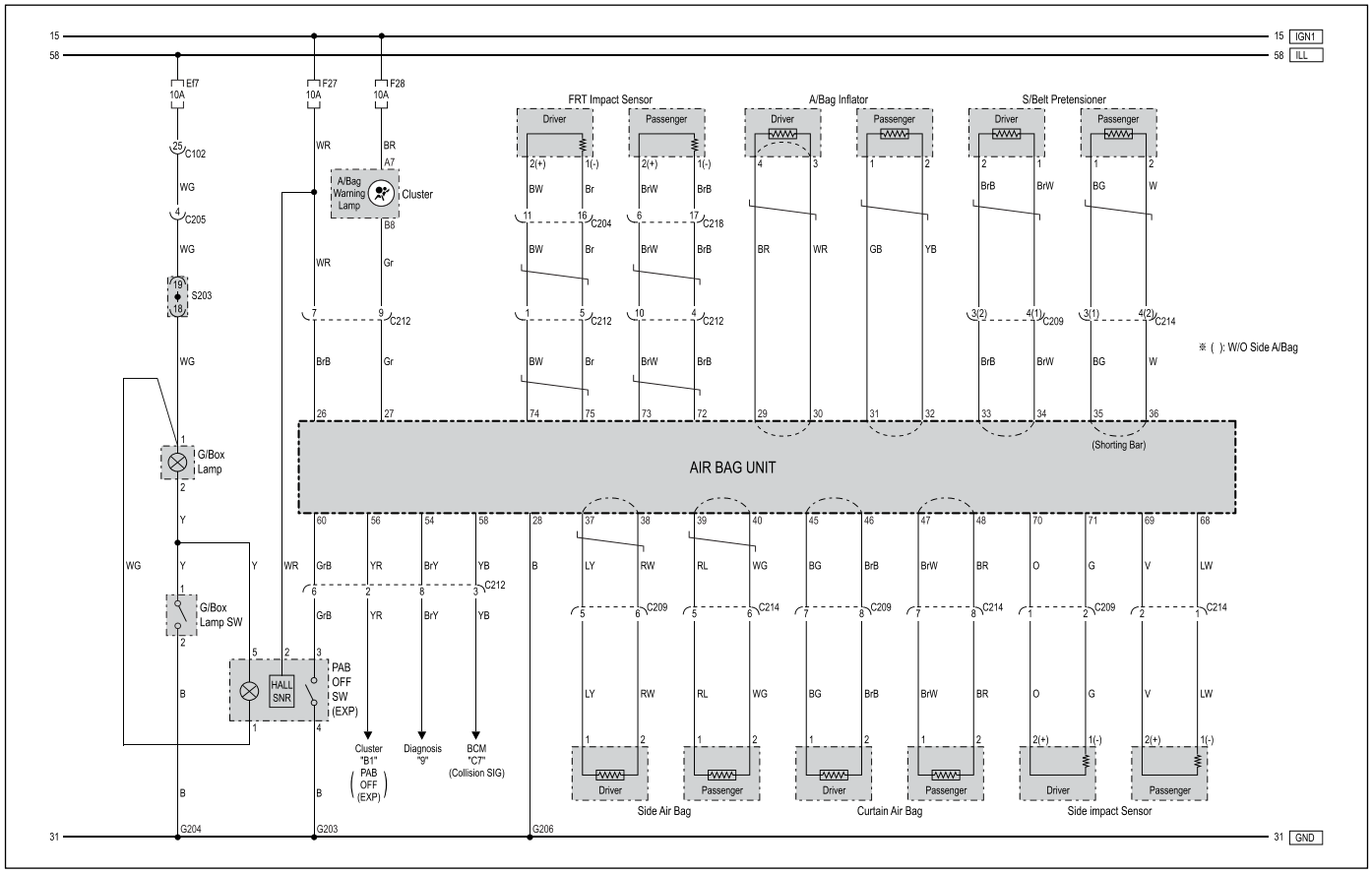
korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

ENGINE
CHASSIS
ELECTRICAL

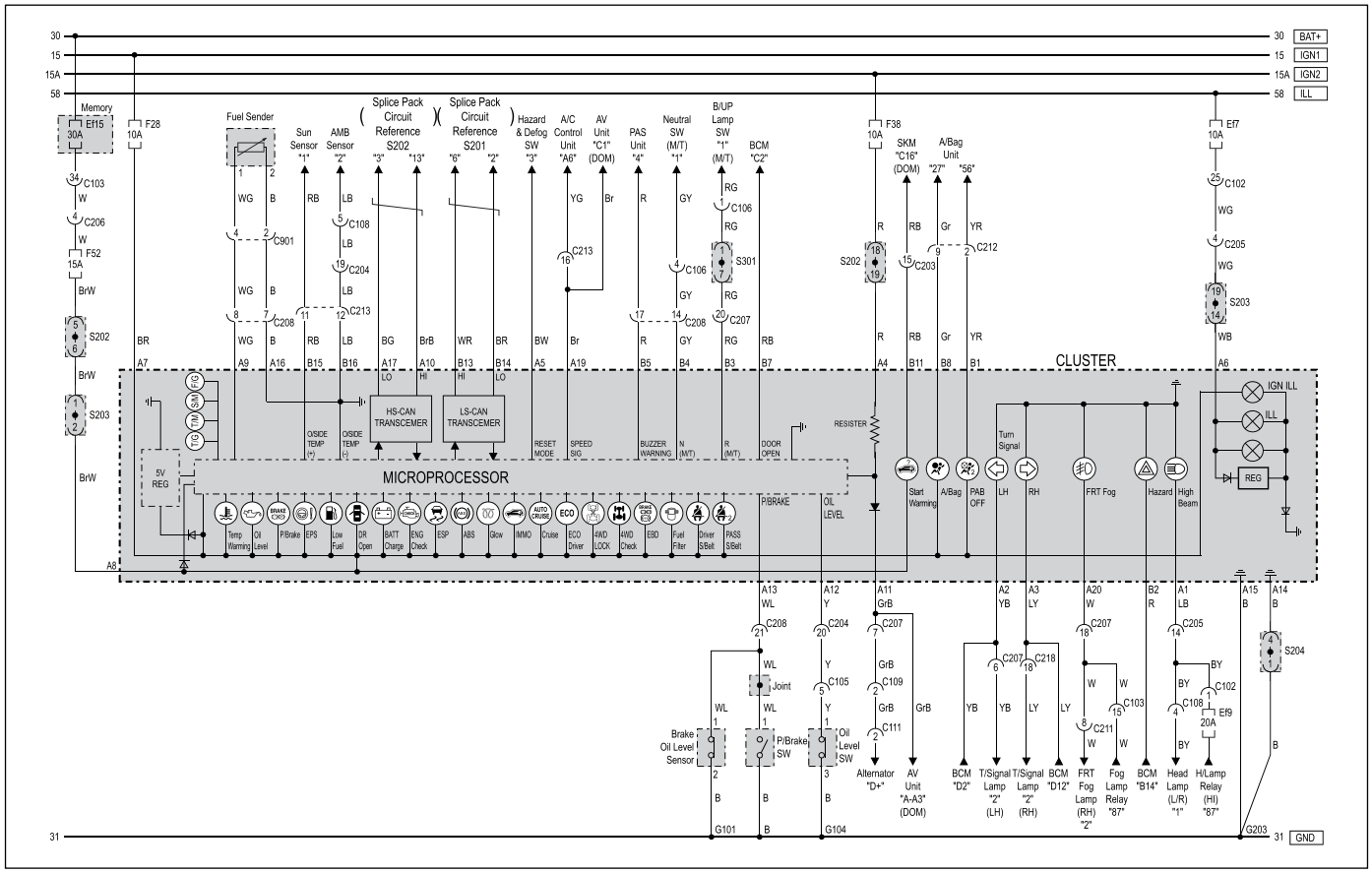
8810-01 AIR BAG (DUAL/SIDE/CURTAIN) SYSTEM



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8010-01 CLUSTER



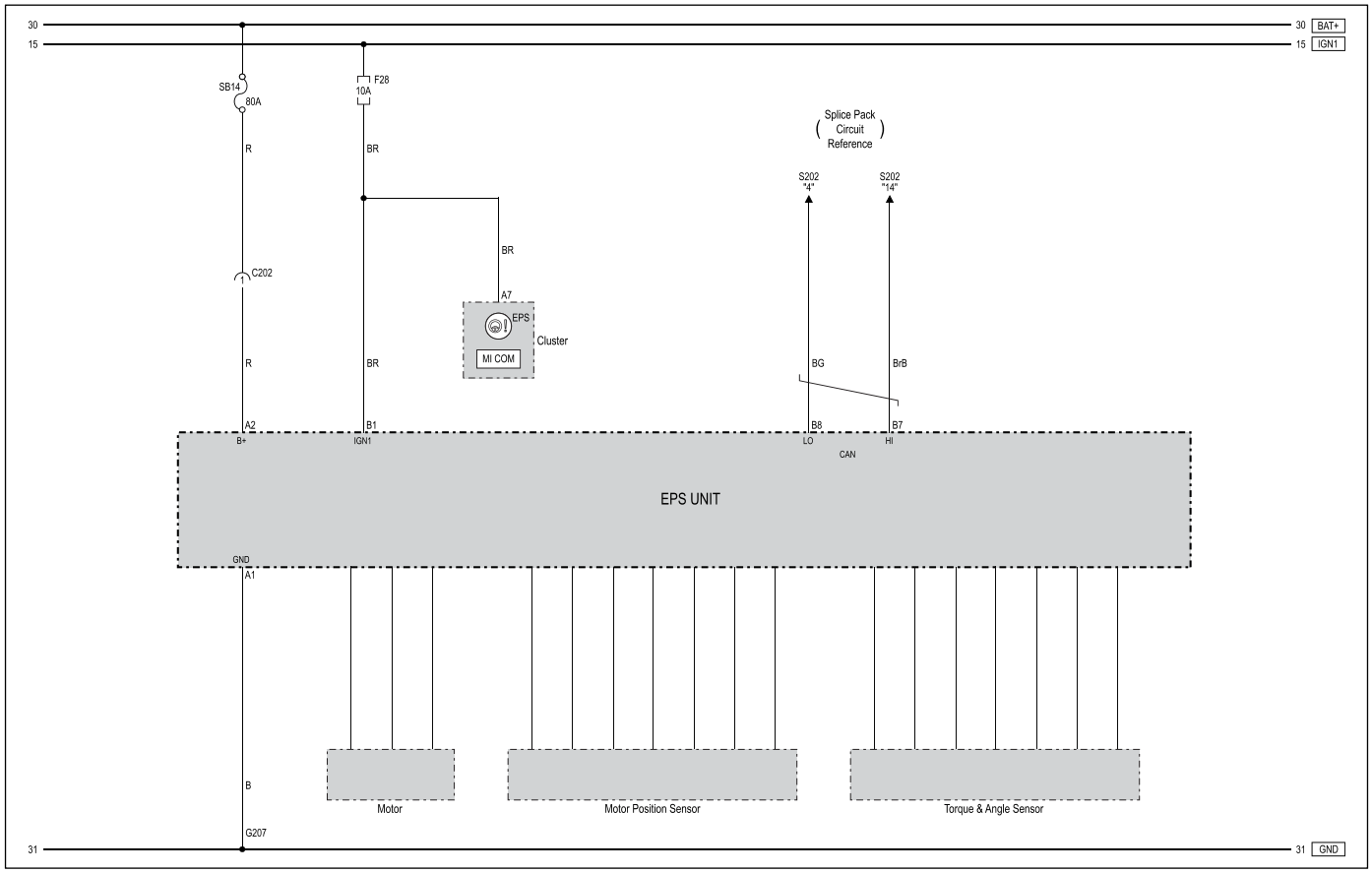
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

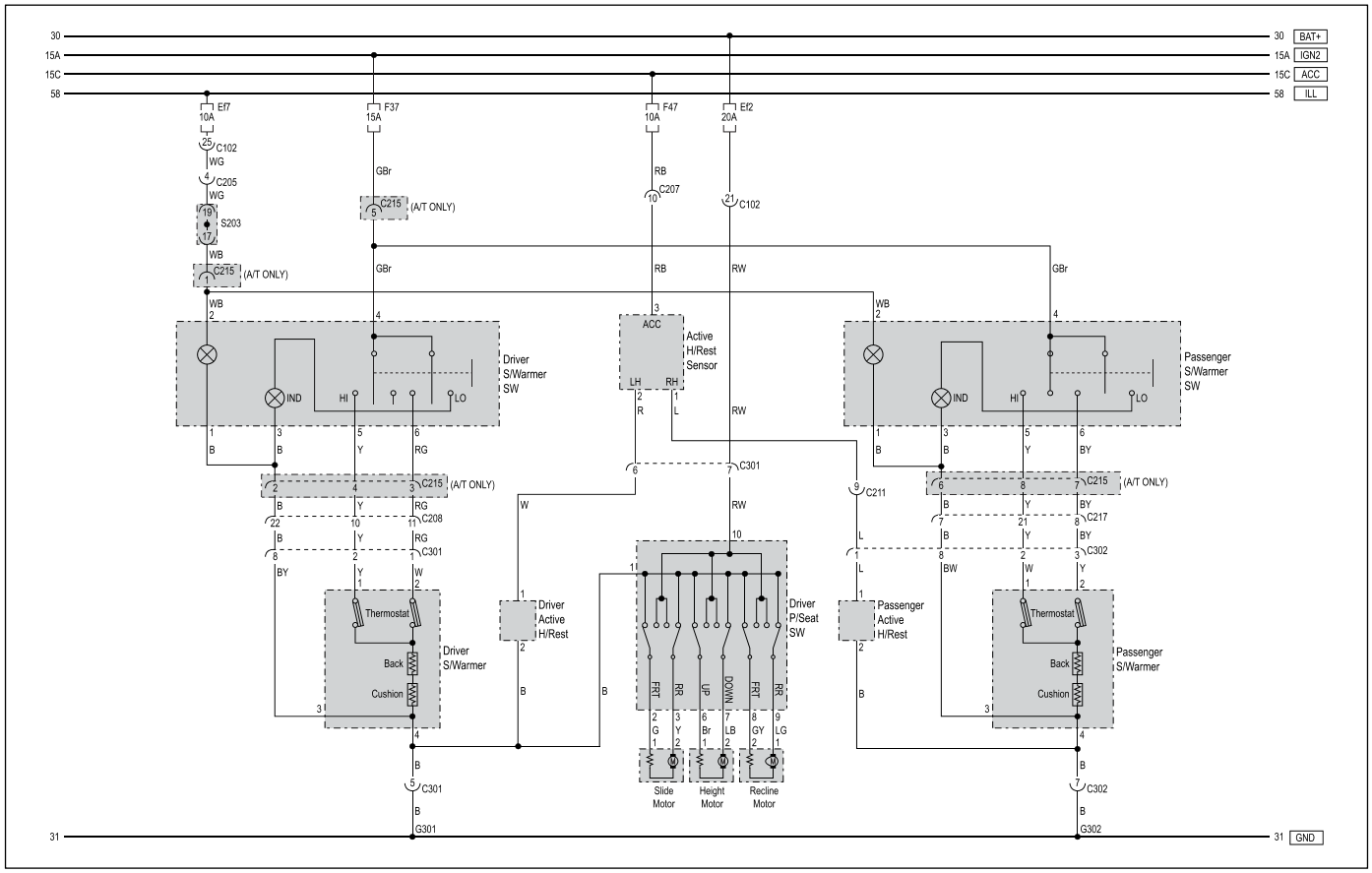
4610-04 EPS



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

7410-02 POWER SEAT / FRT SEAT WARMER



CIRCUIT

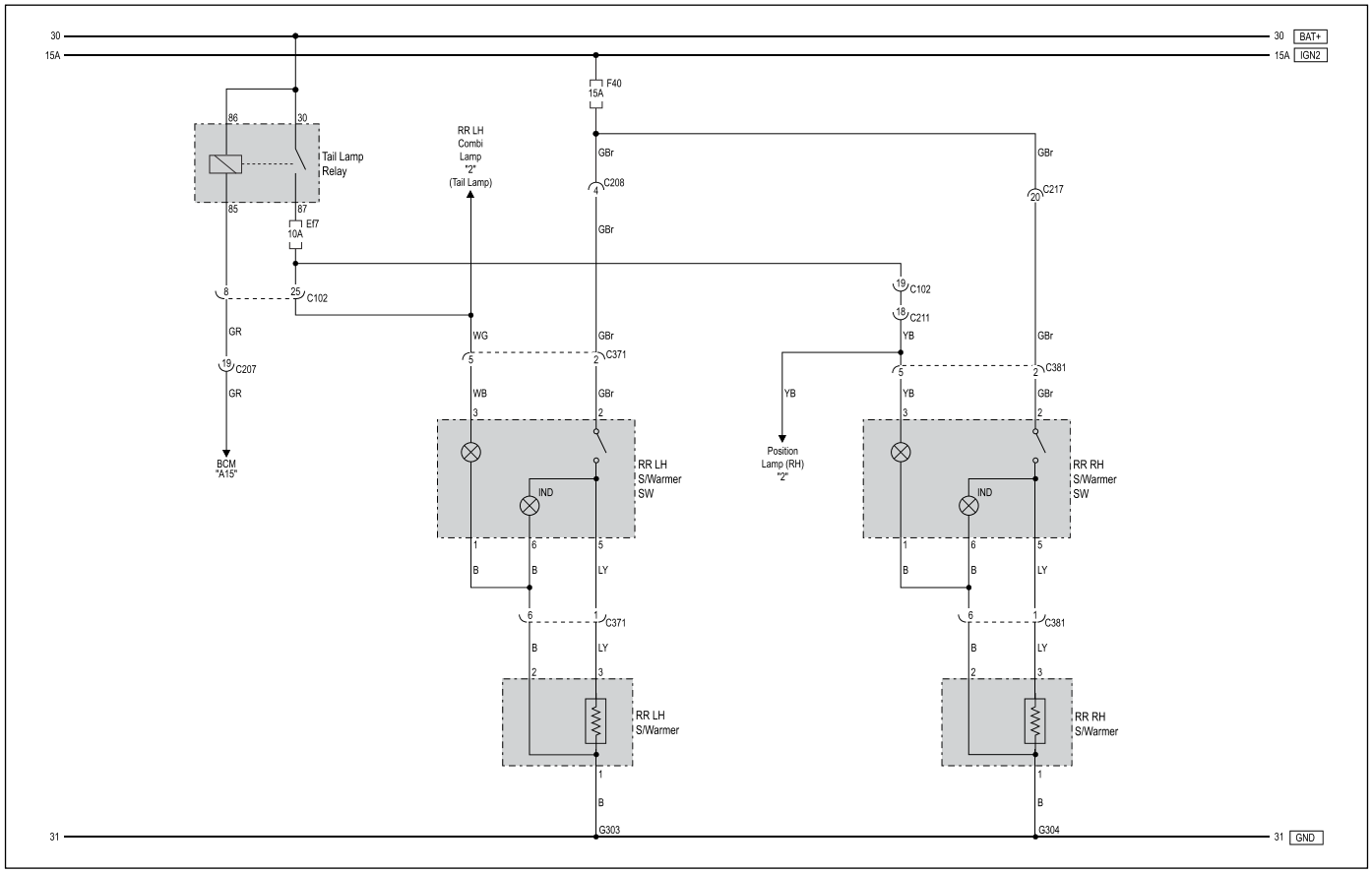
korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

ENGINE
CHASSIS
ELECTRICAL

8510-48 REAR SEAT WARMER

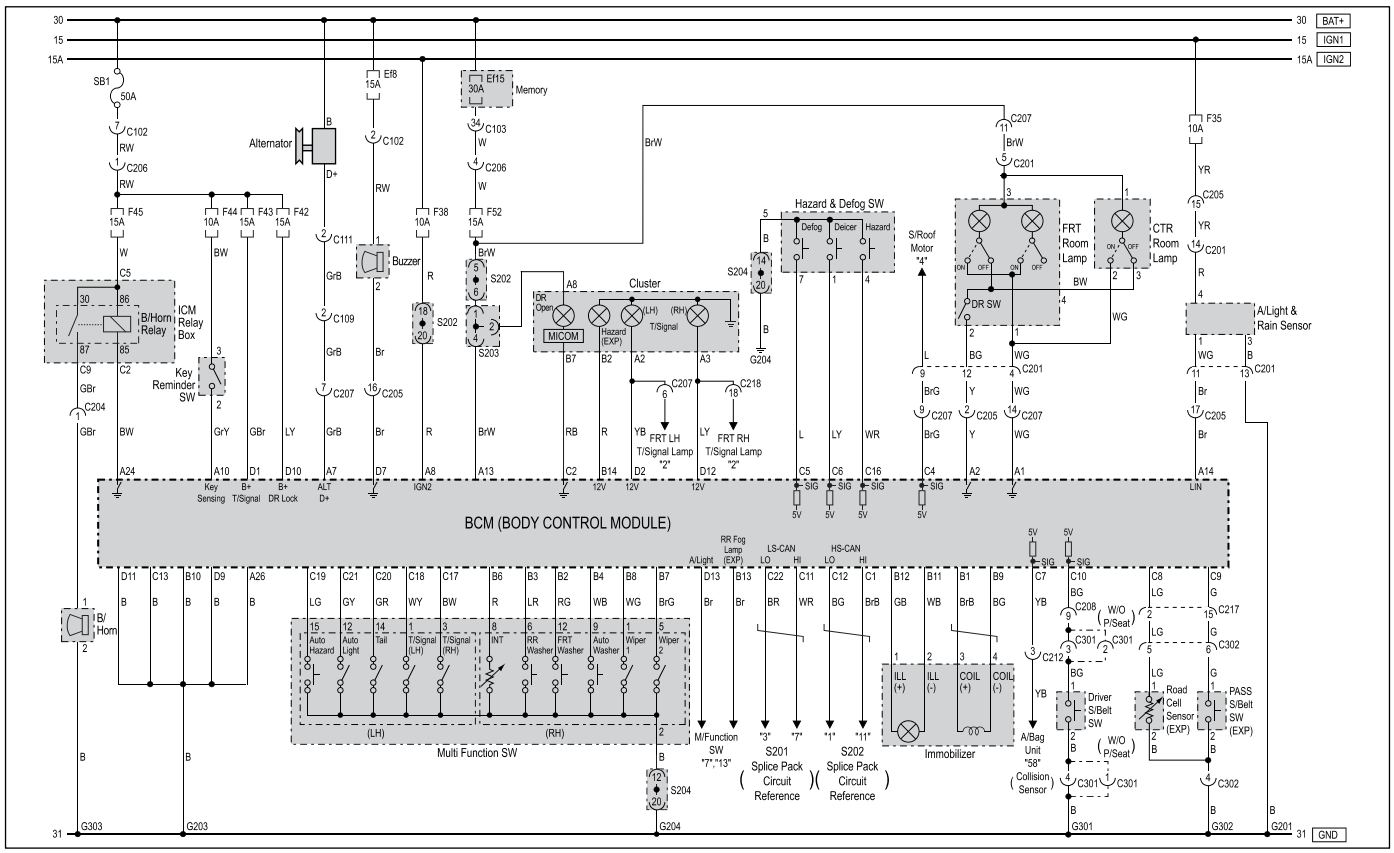


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8620-01 BCM(BODY CONTROL MODULE)

(1) POWER/GROUND, B/HORN, BUZZER, CLUSTER, HAZARD, ROOM LAMP, M/FUNCTION SW, IMMO, A/LIGHT



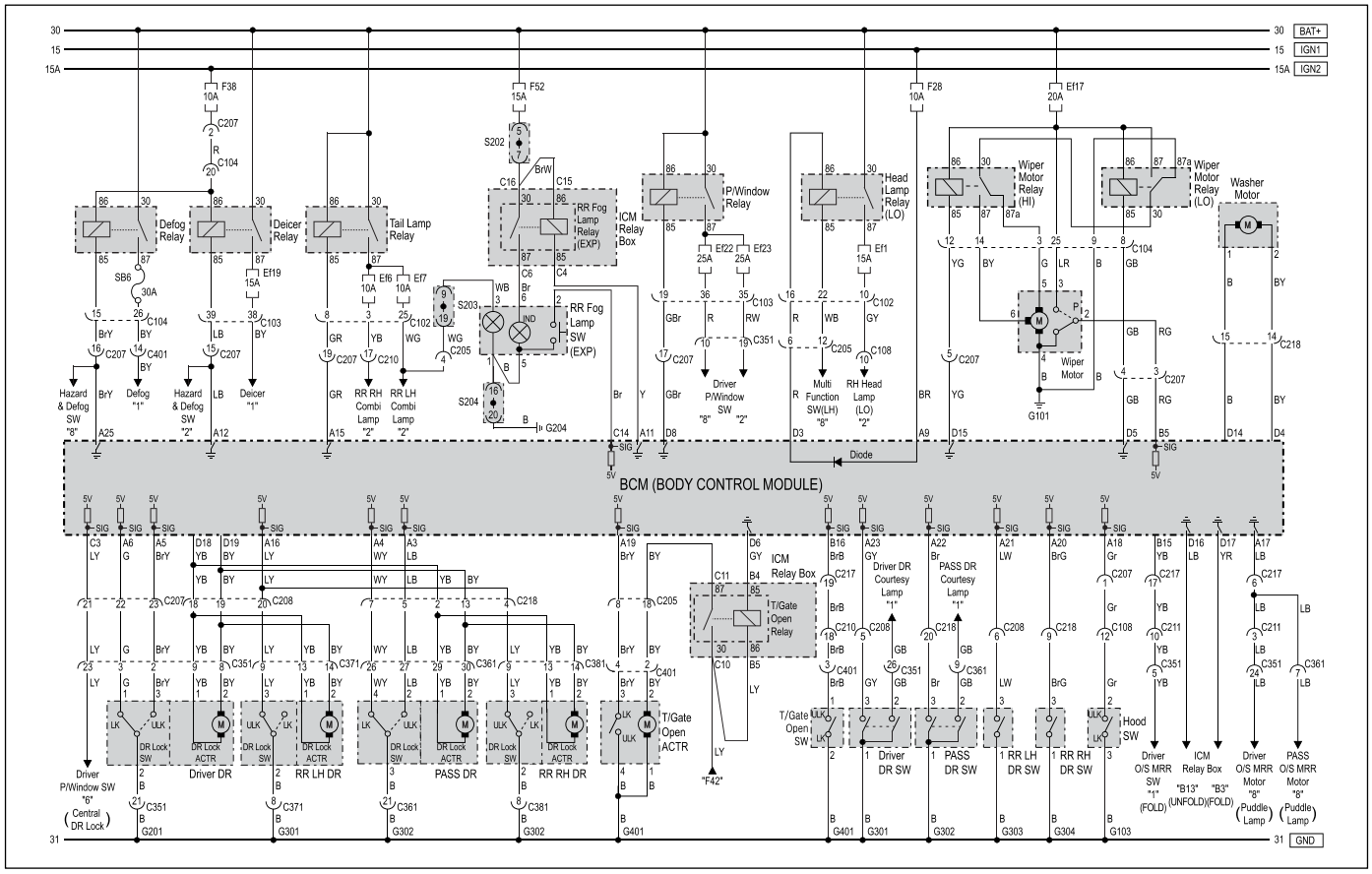
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(2) DR LOCK, FOLDING, DEFOG/DEICER, P/WINDOW, WIPER/WASHER, DR SWITCH

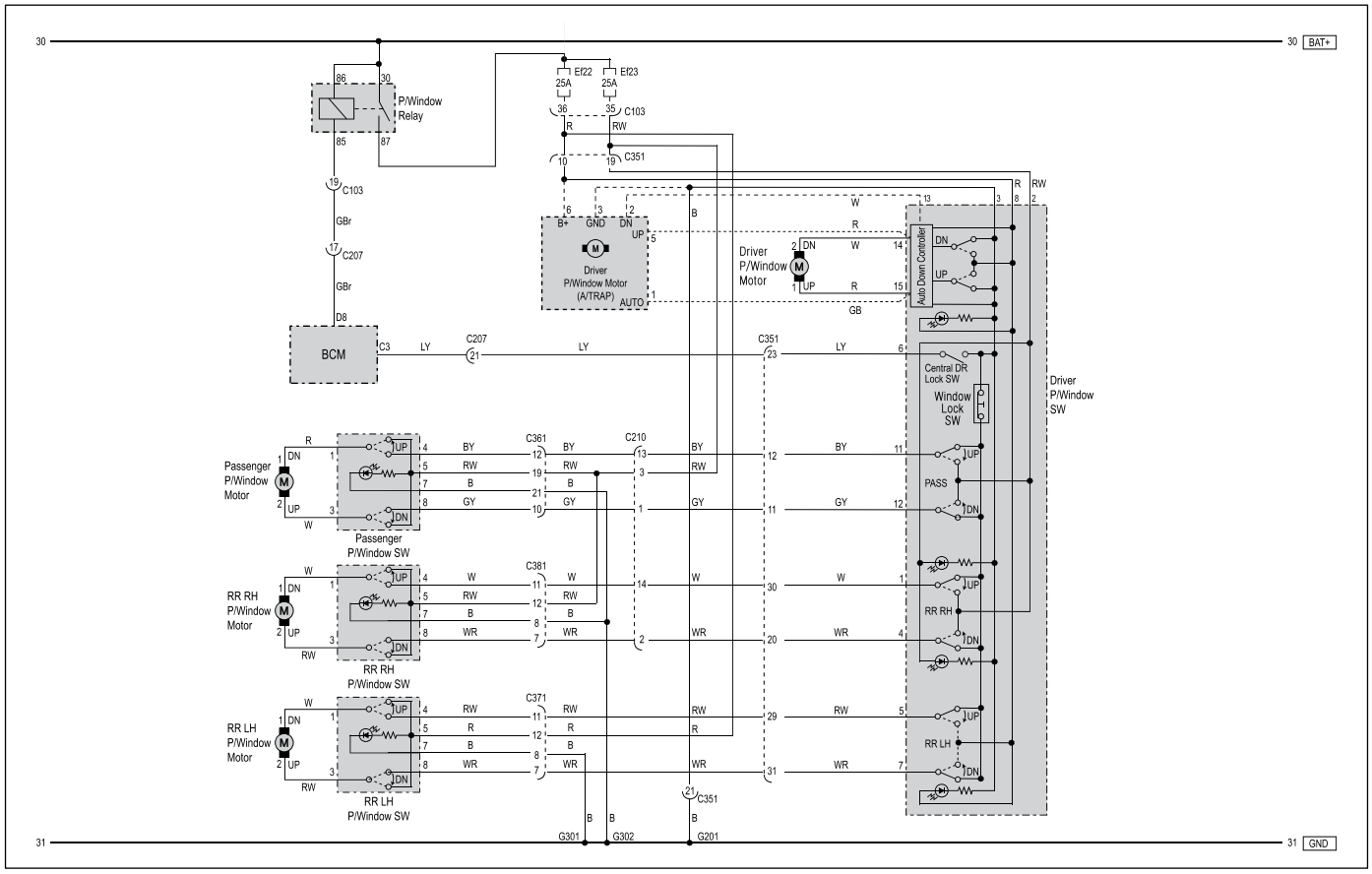


Modification basis	
Application basis	
Affected VIN	

CIRCUIT
korando 2010.10

Downloaded from www.Manualslib.com manuals search engine

8510-05 POWER WINDOW



CIRCUIT

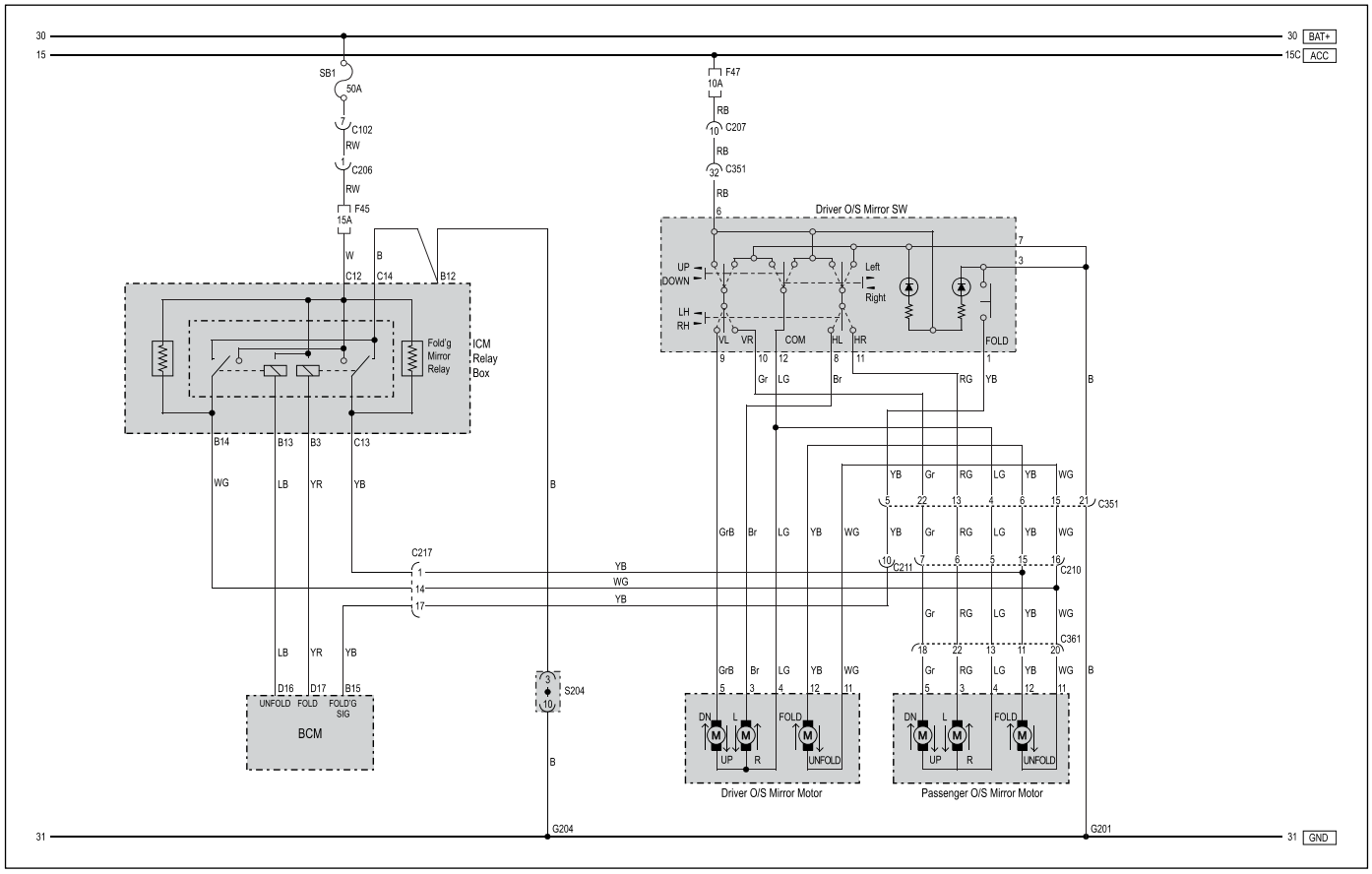
korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

ENGINE
CHASSIS
ELECTRICAL

8510-52 OUTSIDE MIRROR

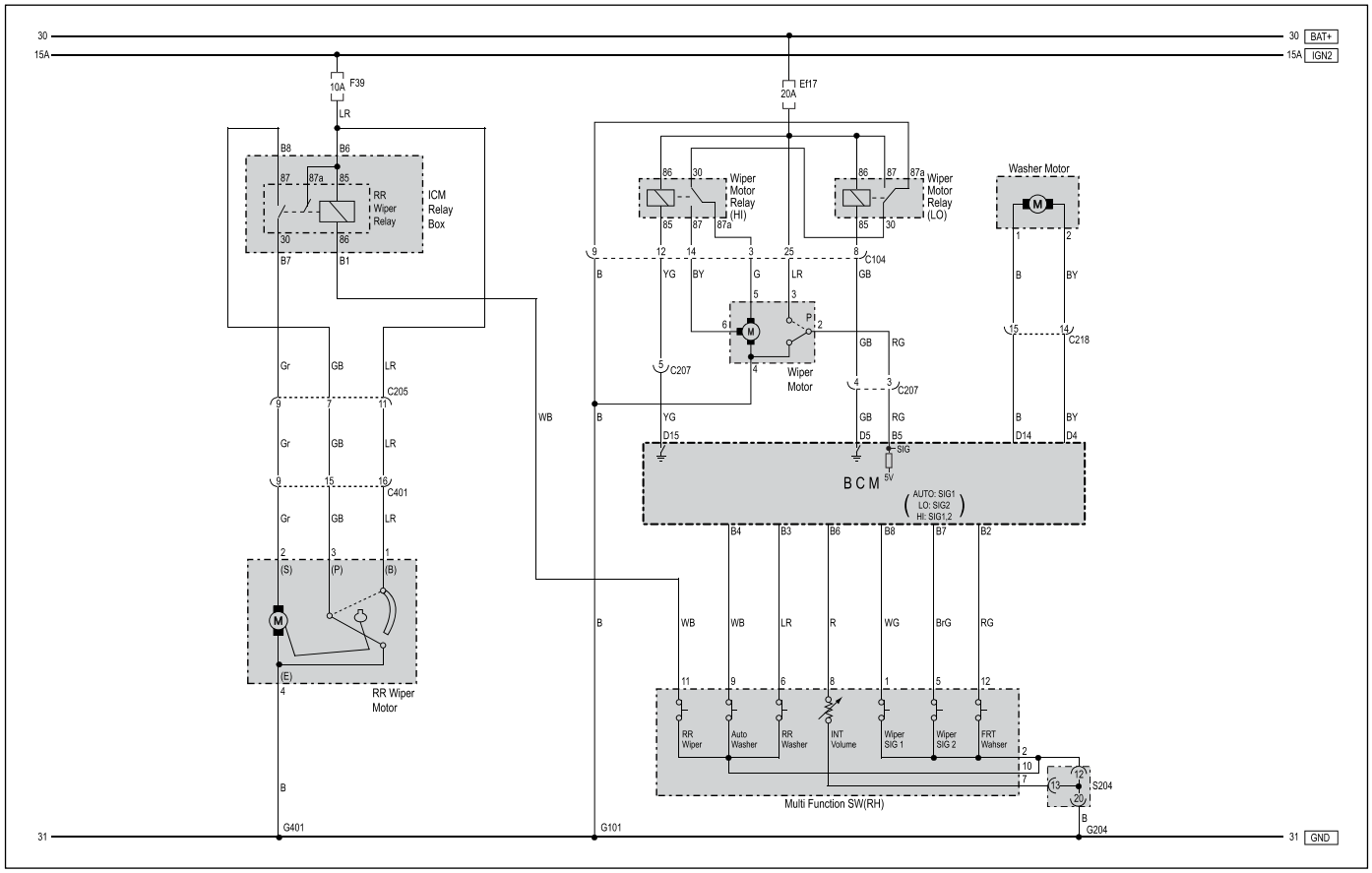


Modification basis	
Application basis	
Affected VIN	

CIRCUIT
korando 2010.10

Downloaded from www.Manualslib.com manuals search engine

7810-01 FRT(RR) WIPER / WASHER



CIRCUIT

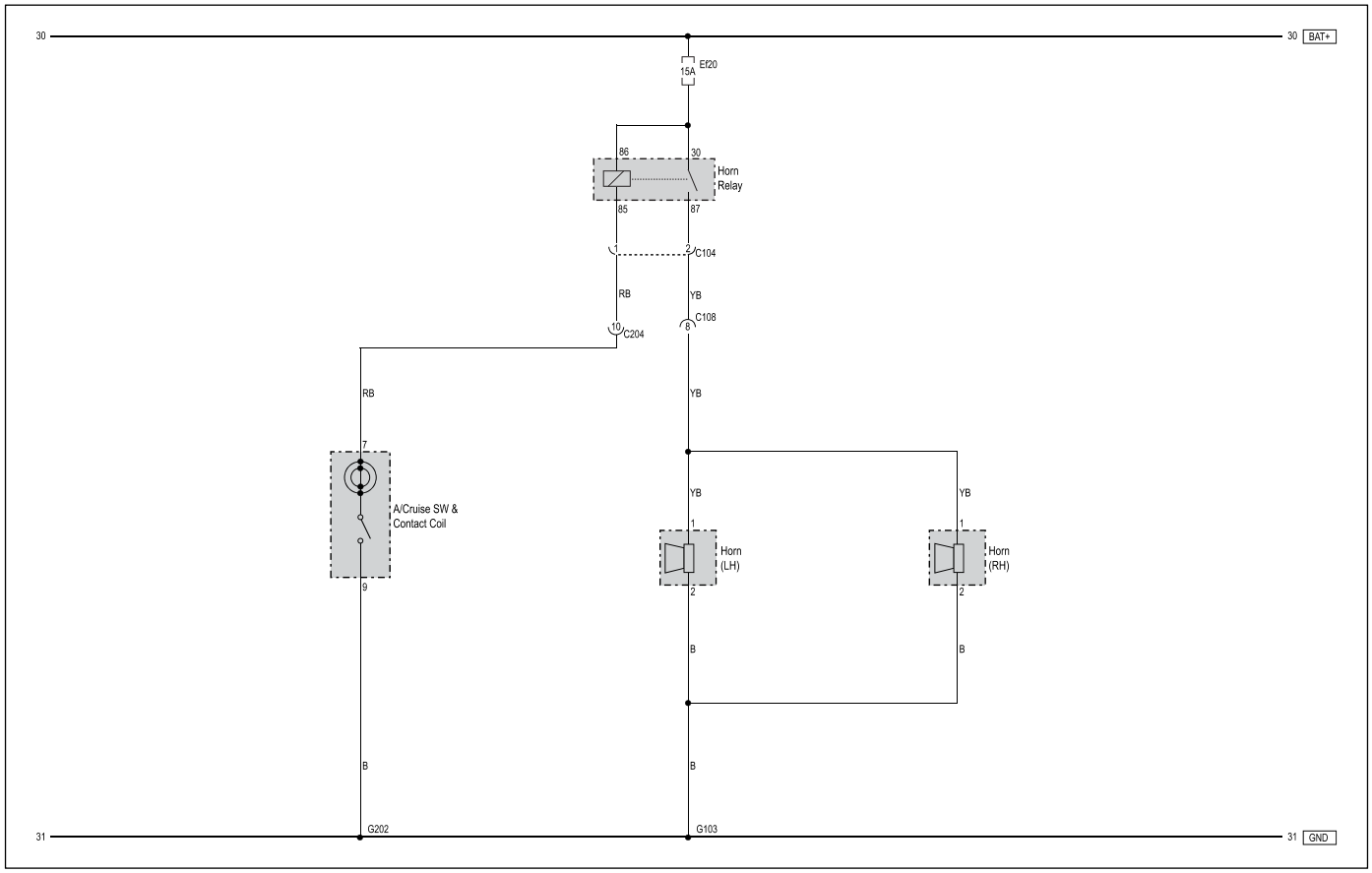
korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

ENGINE
CHASSIS
ELECTRICAL

8610-06 HORN

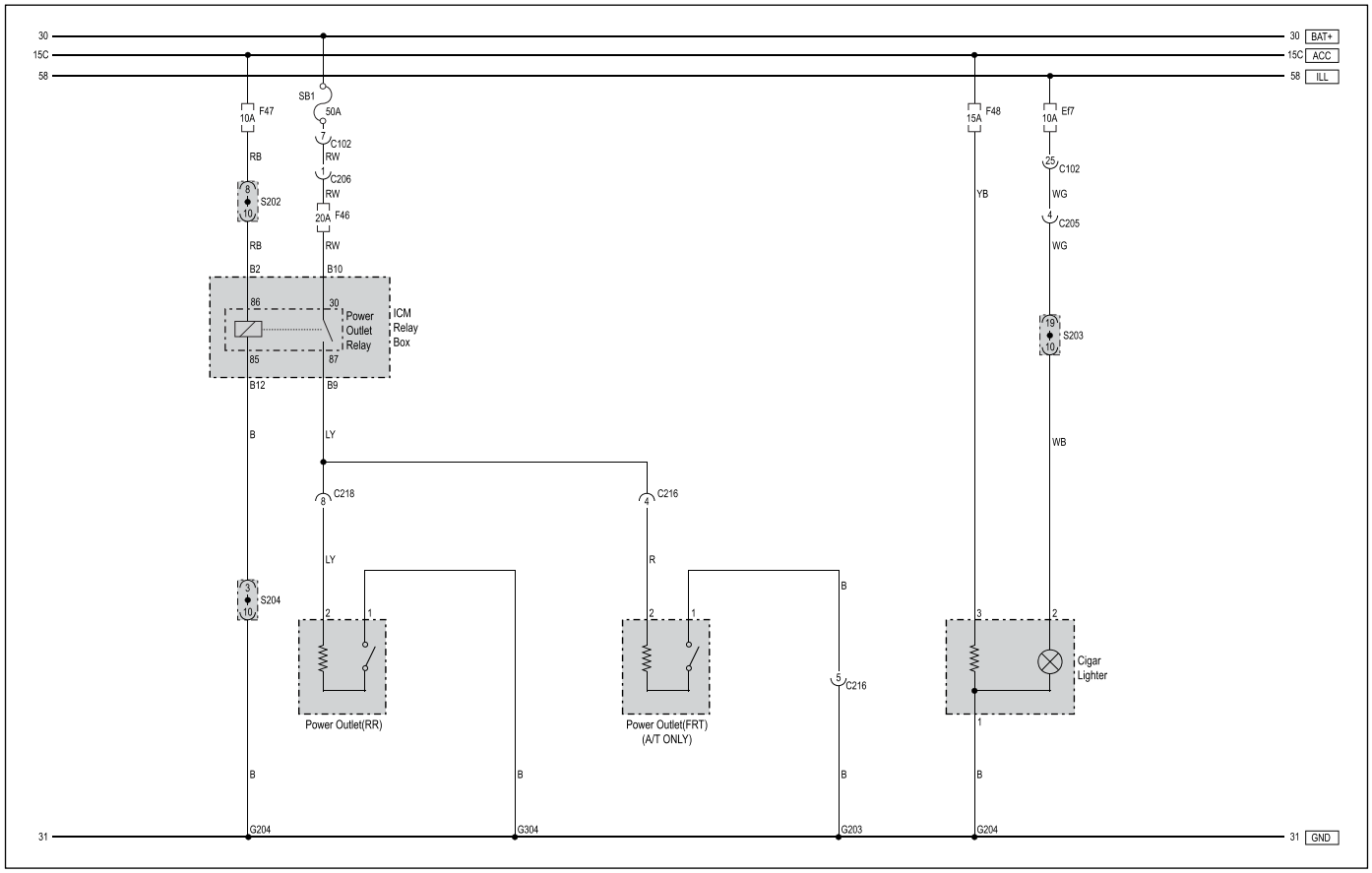


Modification basis	
Application basis	
Affected VIN	

CIRCUIT
korando 2010.10

Downloaded from www.Manualslib.com manuals search engine

7632-16 CIGAR LIGHTER / POWER OUTLET



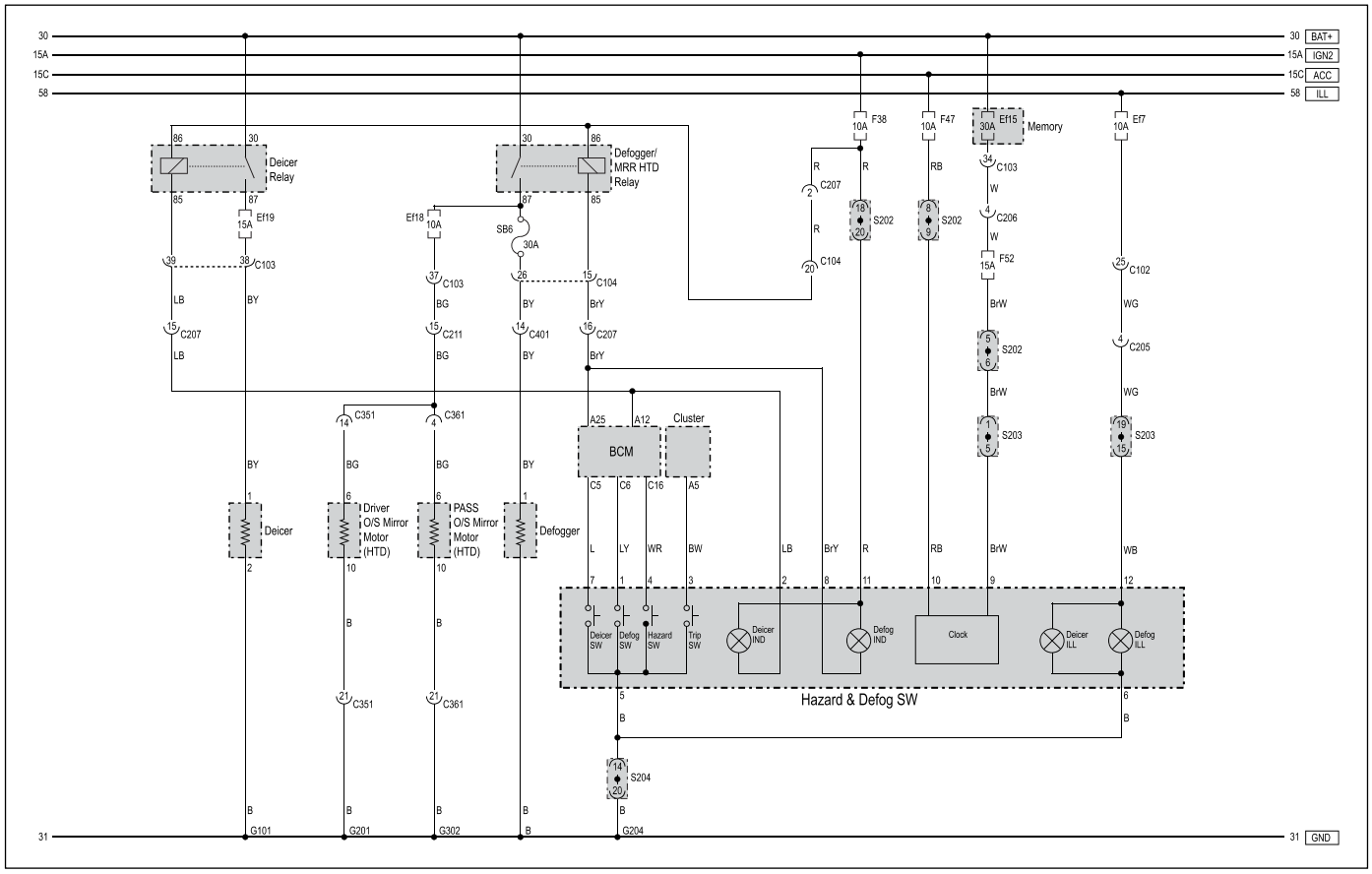
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

7840-01 DEFOGGER / DEICER

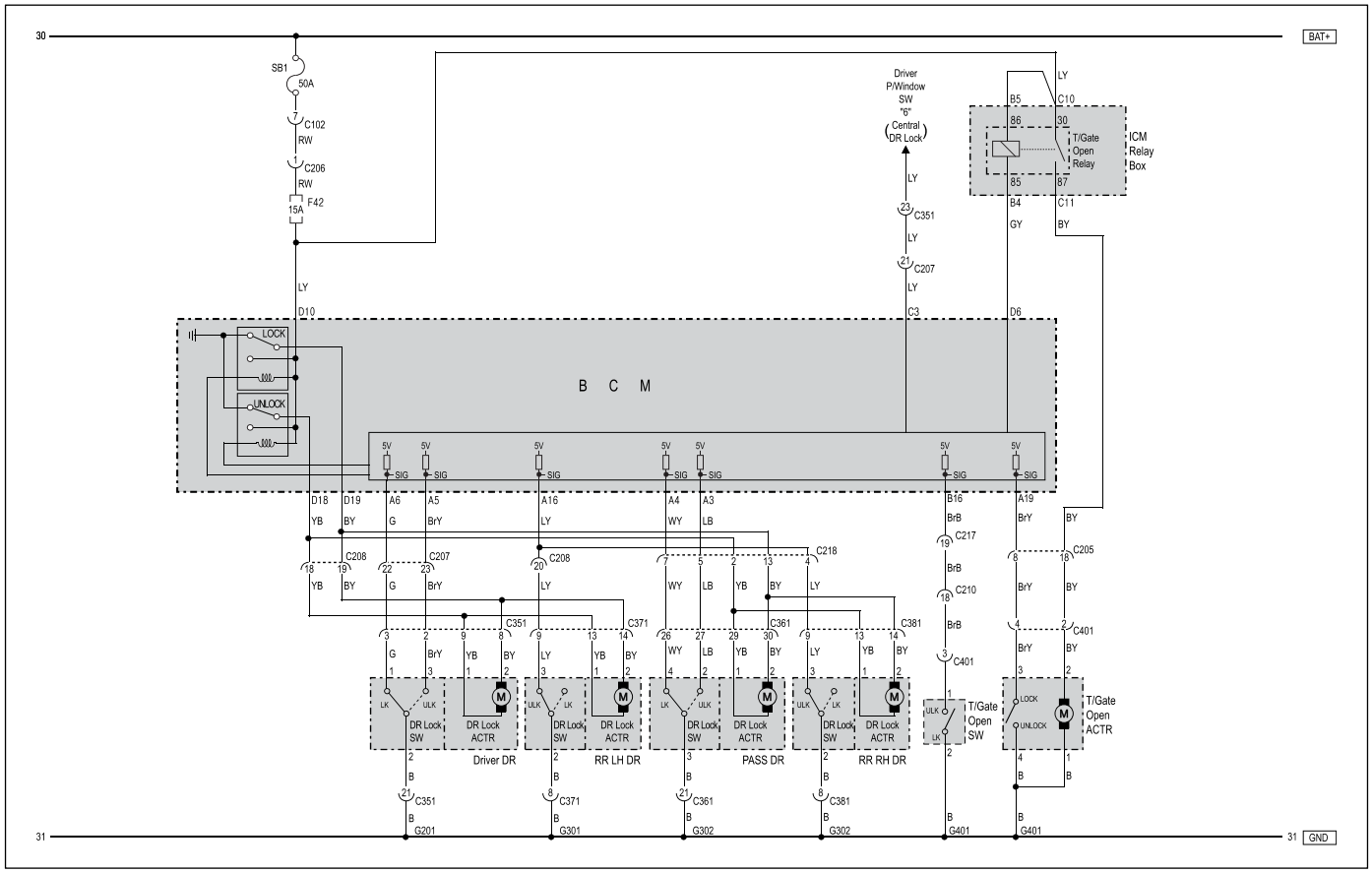


Modification basis	
Application basis	
Affected VIN	

CIRCUIT
korando 2010.10

Downloaded from www.Manualslib.com manuals search engine

8710-03 DOOR LOCK CIRCUIT



CIRCUIT

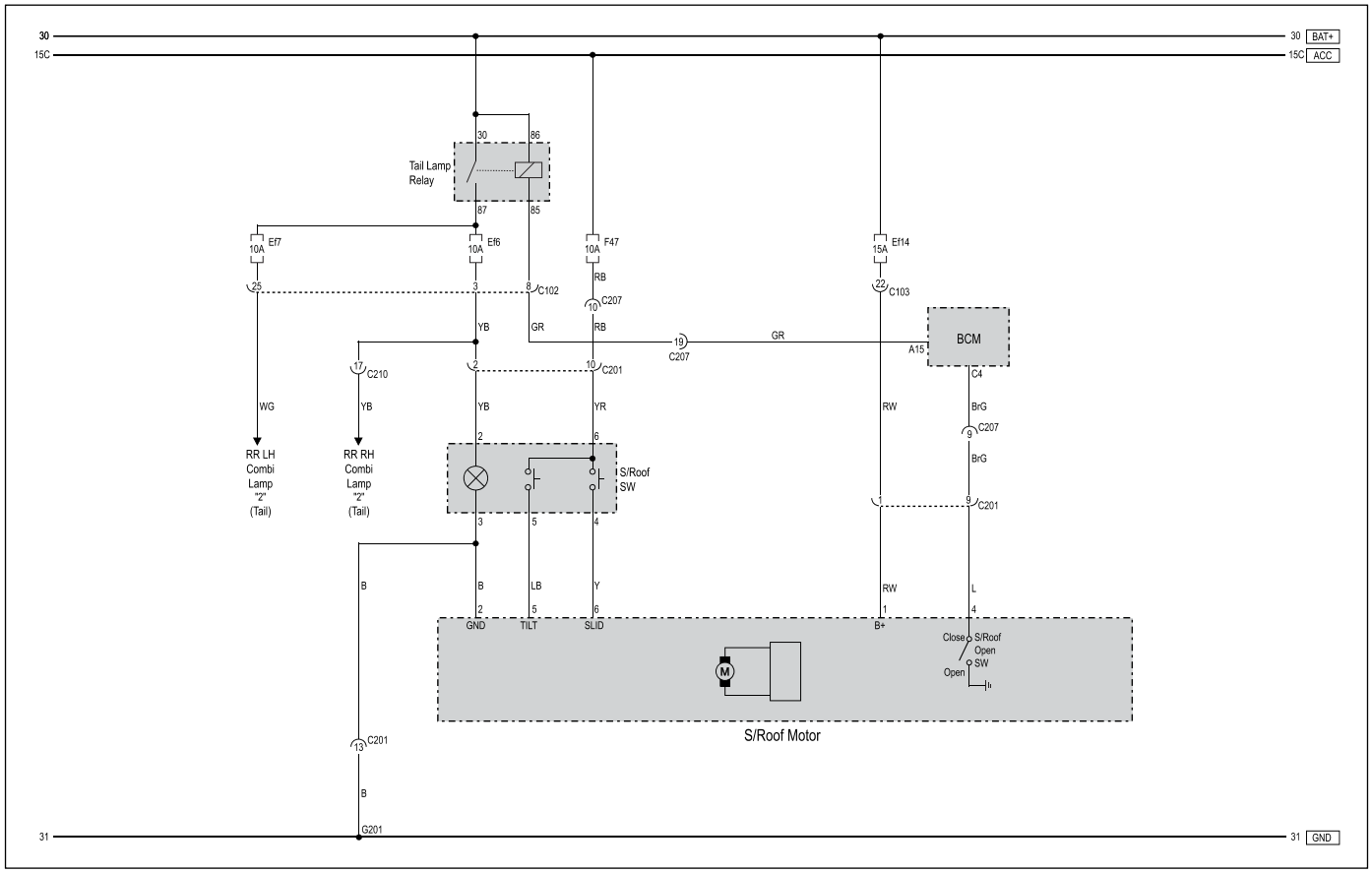
korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

ENGINE
CHASSIS
ELECTRICAL

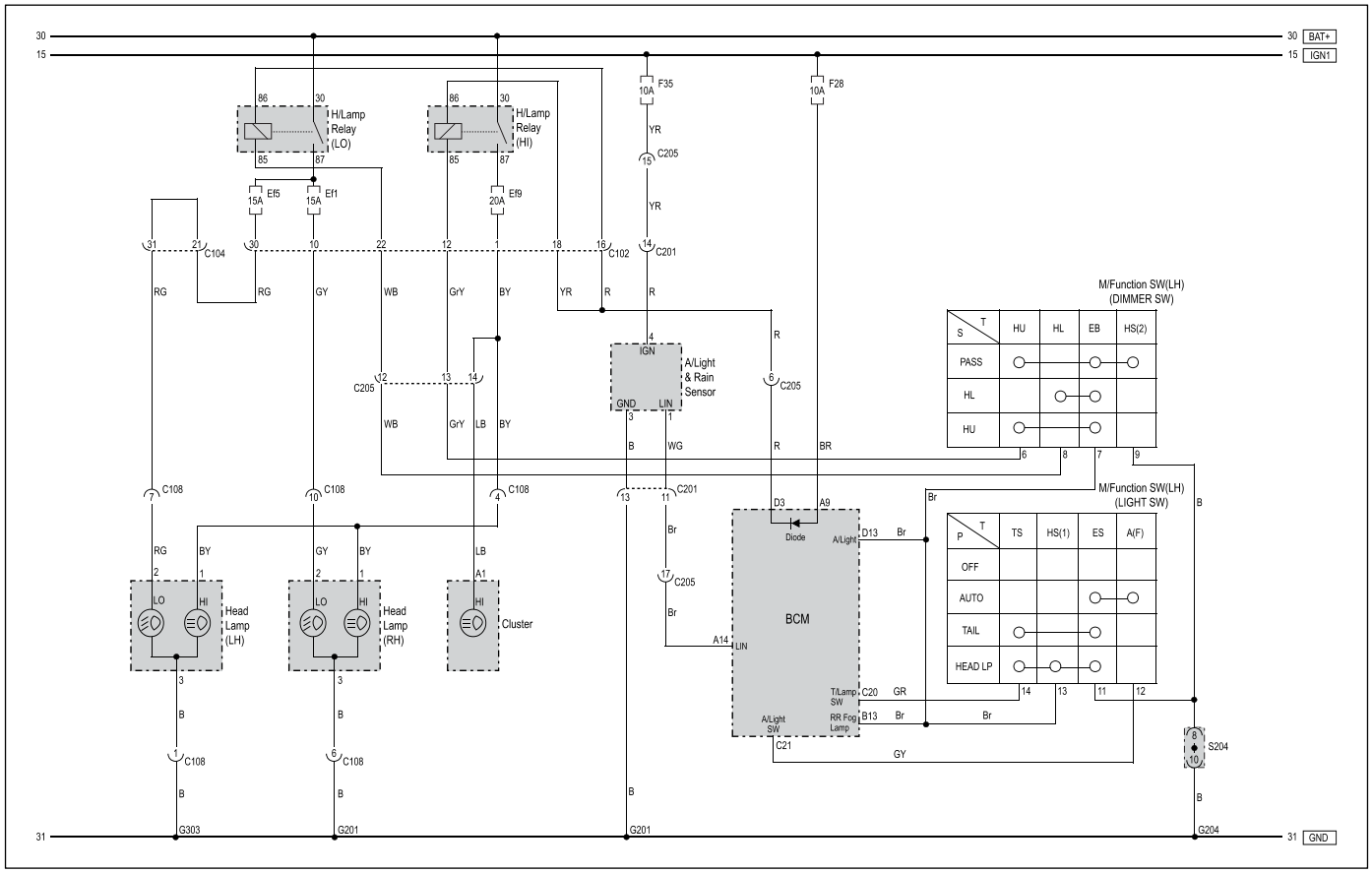
7340-03 SUN ROOF



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8310-01 HEAD LAMP



CIRCUIT

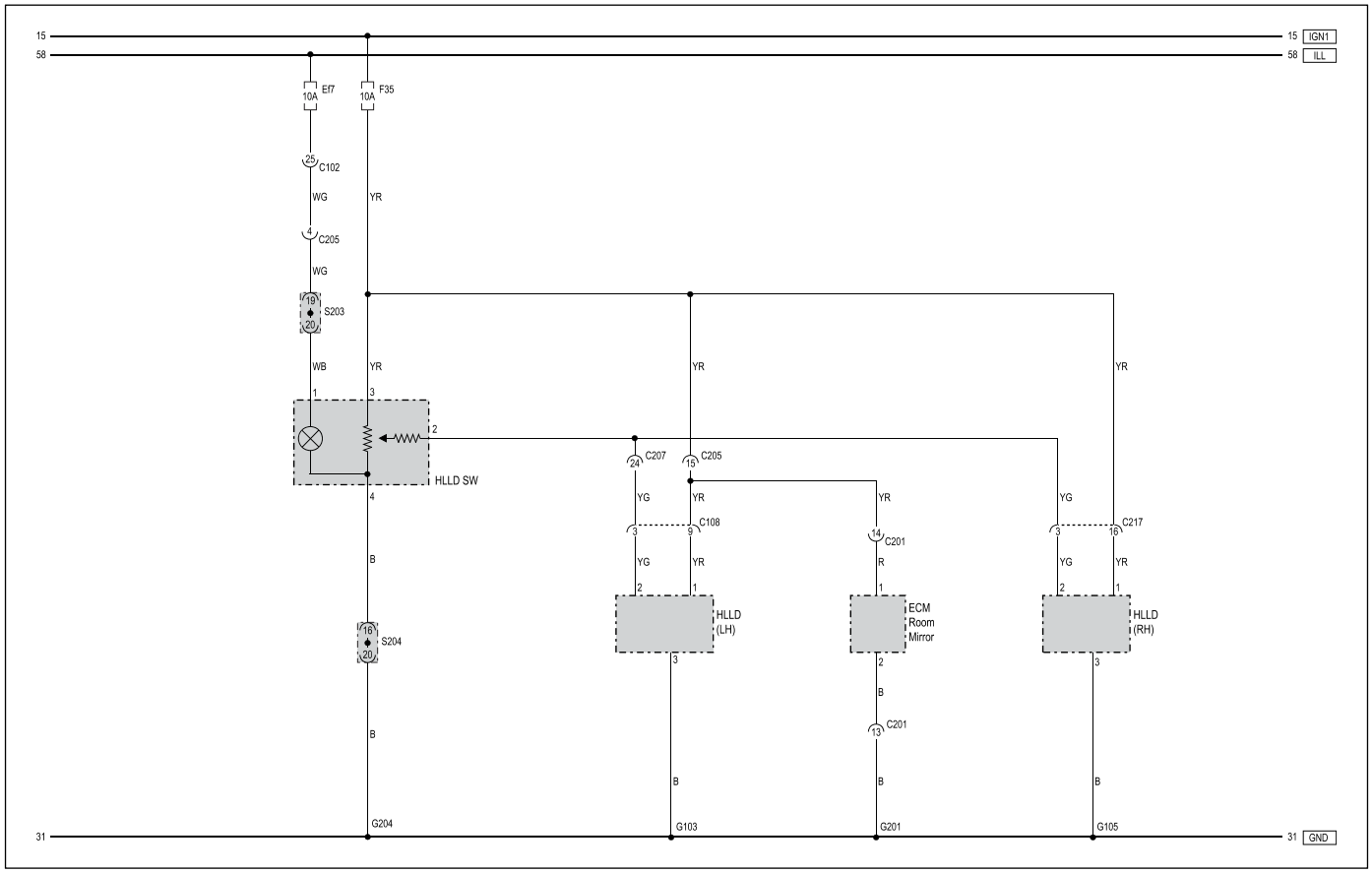
korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

ENGINE
CHASSIS
ELECTRICAL

8310-01 HEAD LAMP LEVEL'G DEVICE(EXP)

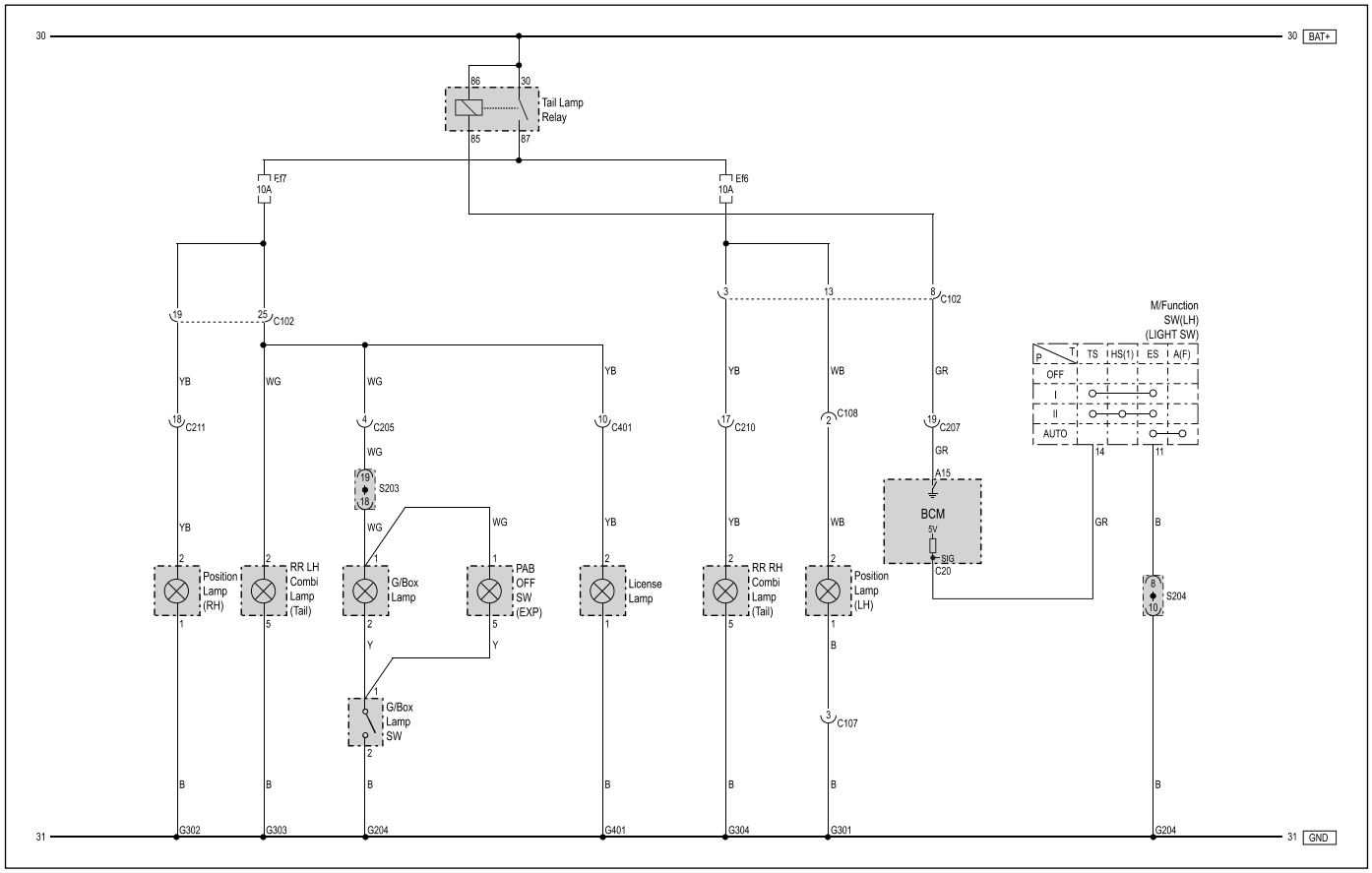


Modification basis	
Application basis	
Affected VIN	

CIRCUIT
korando 2010.10

Downloaded from www.Manualslib.com manuals search engine

8320-01 TAIL LAMP



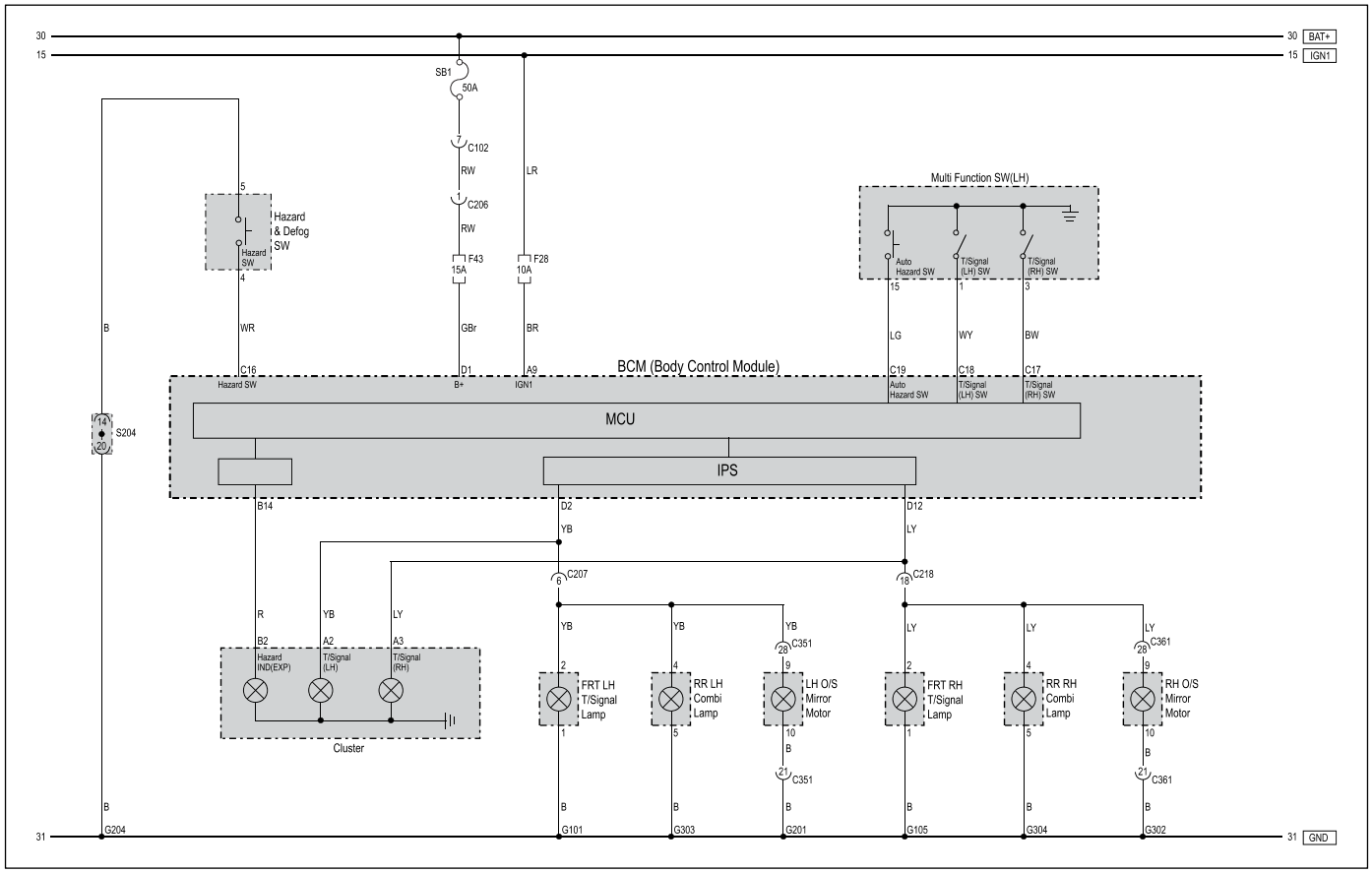
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8310-01 TURN SIGNAL LAMP / HAZARD LAMP

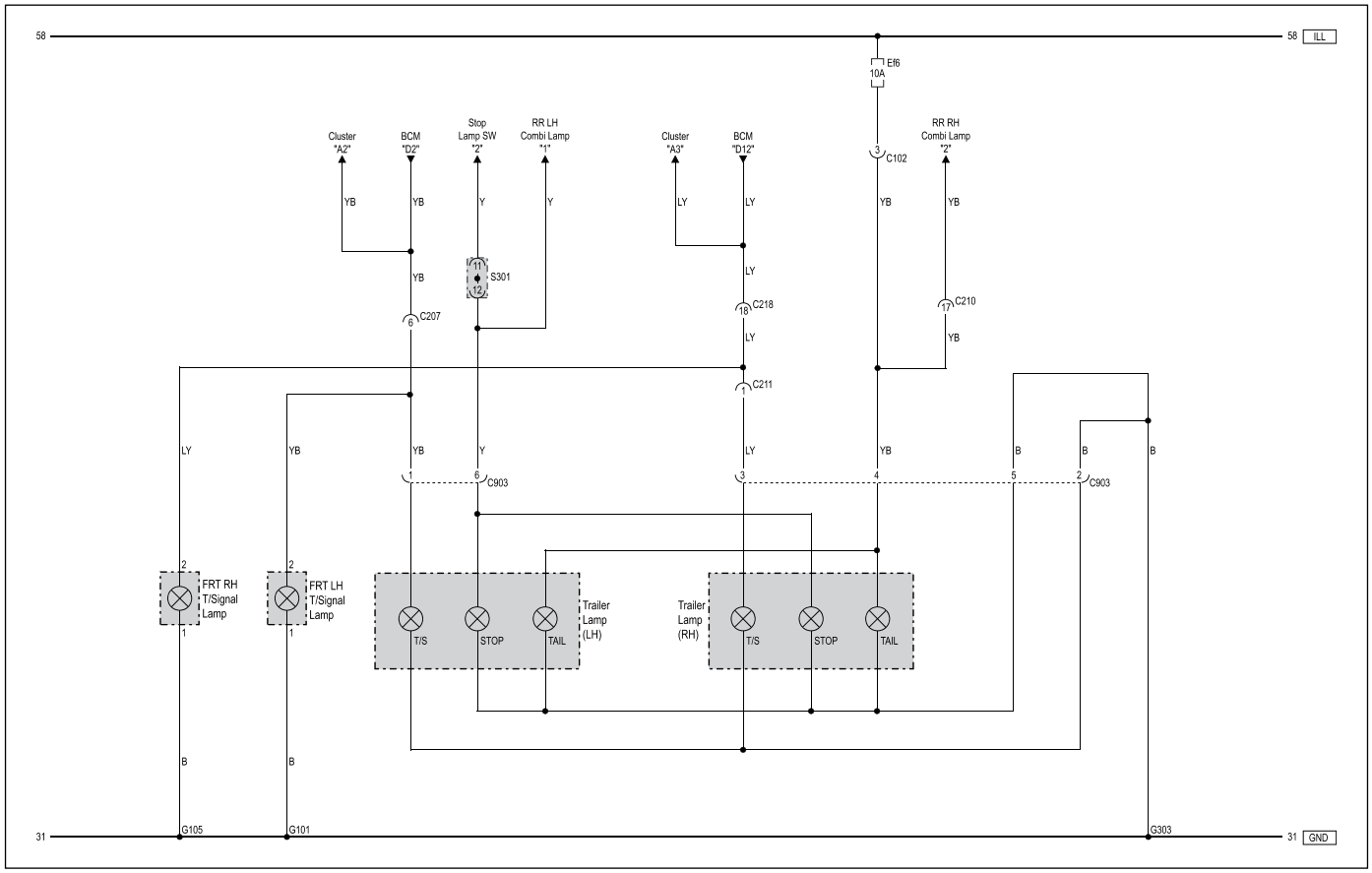


Modification basis	
Application basis	
Affected VIN	

CIRCUIT
korando 2010.10

Downloaded from www.Manualslib.com manuals search engine

8210-03 TRAILER LAMP(EXP)



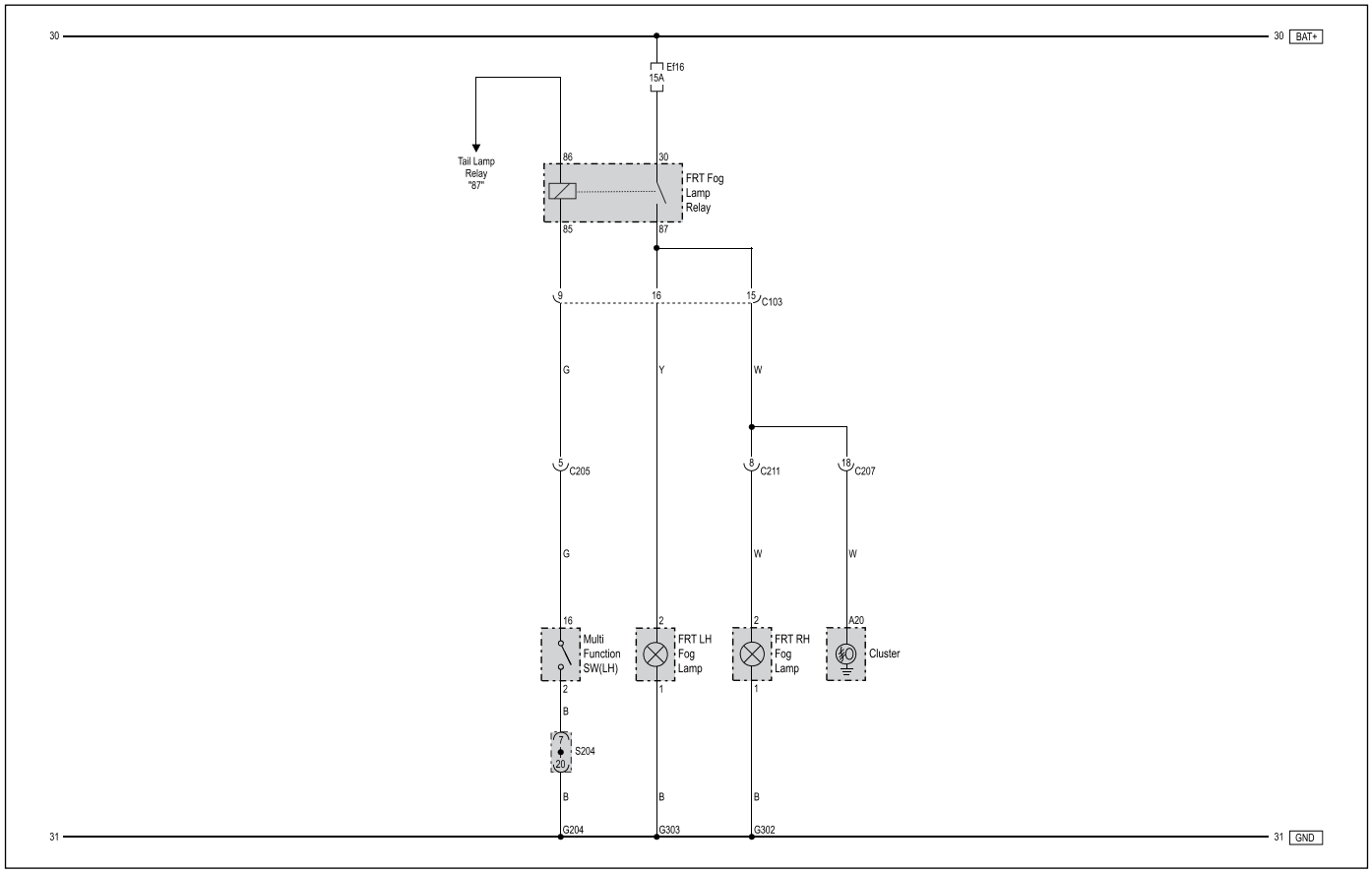
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

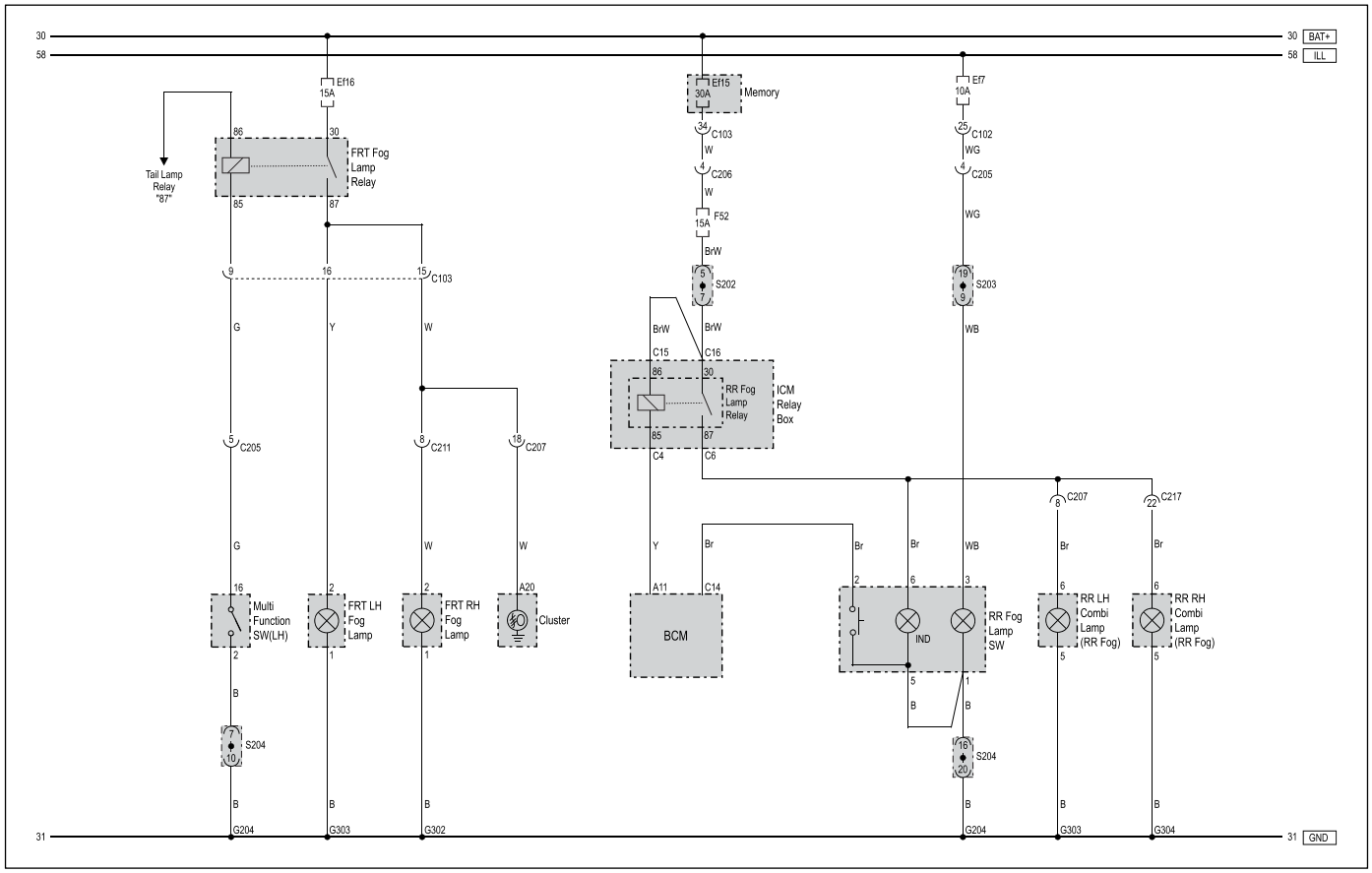
8310-10 FRT FOG LAMP(DOM)



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8310-10 FRT / RR FOG LAMP(EXP)



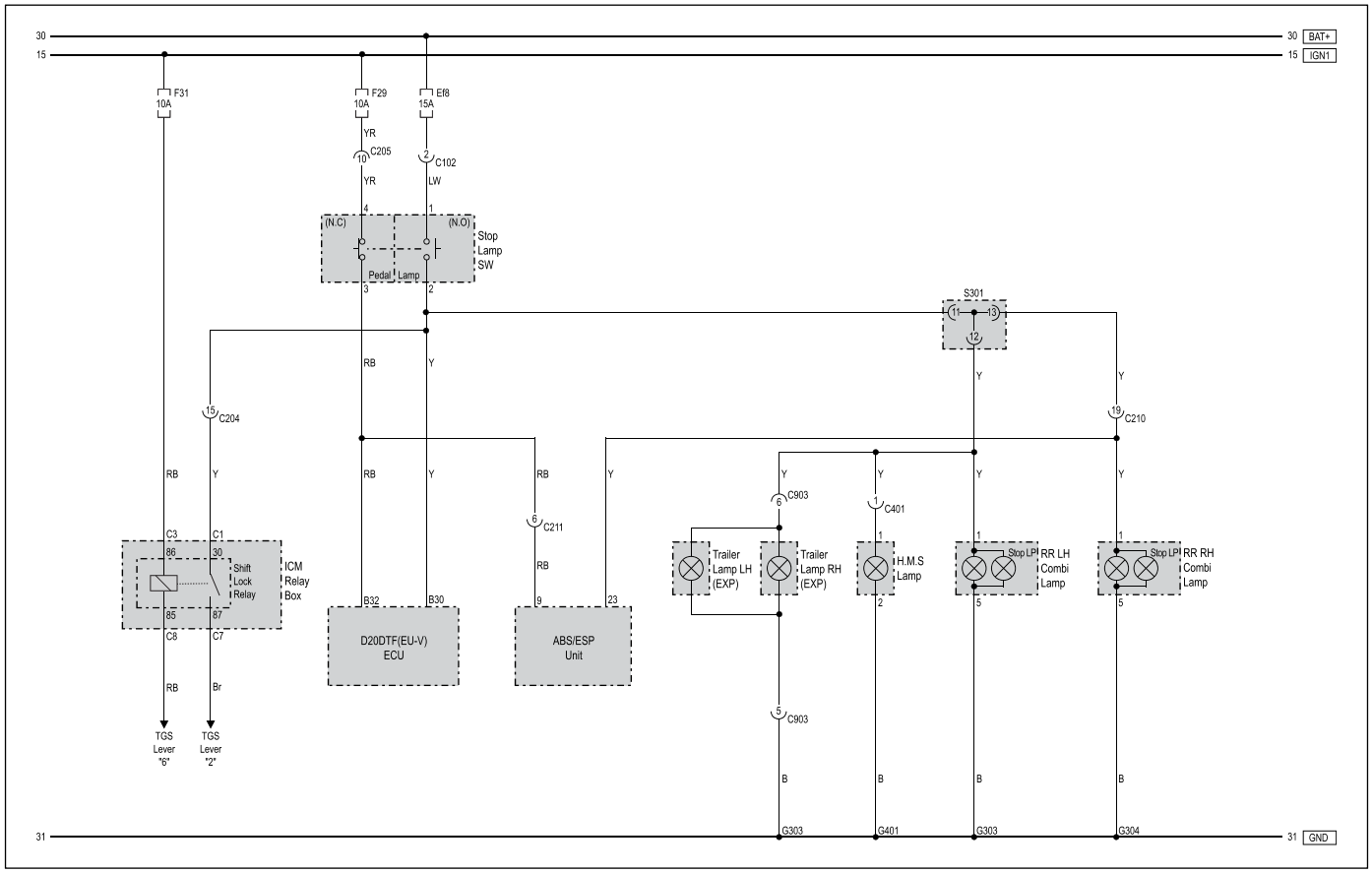
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

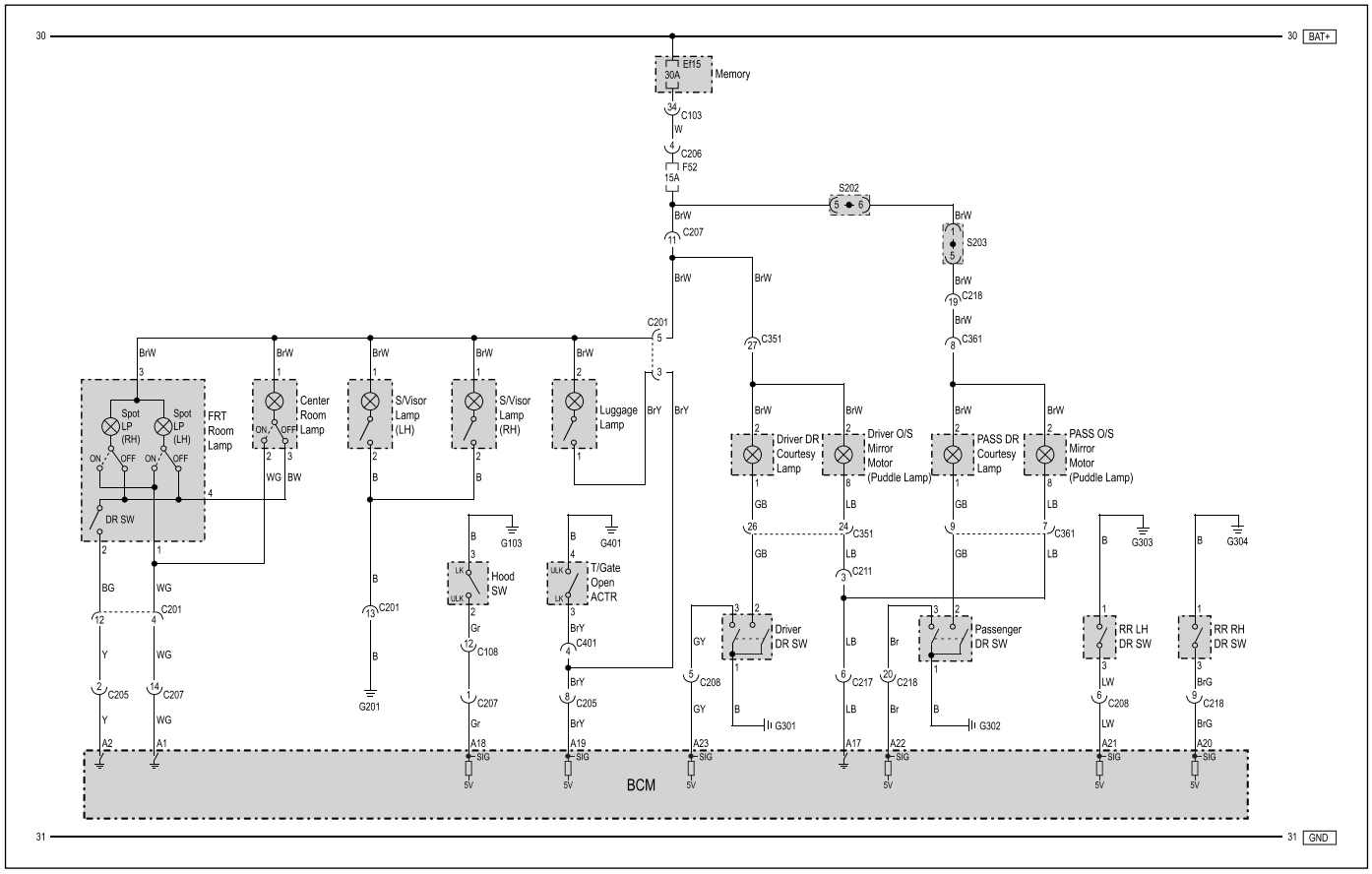
4810-08 STOP LAMP



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

7770-02 INTERIOR / DOOR LAMP



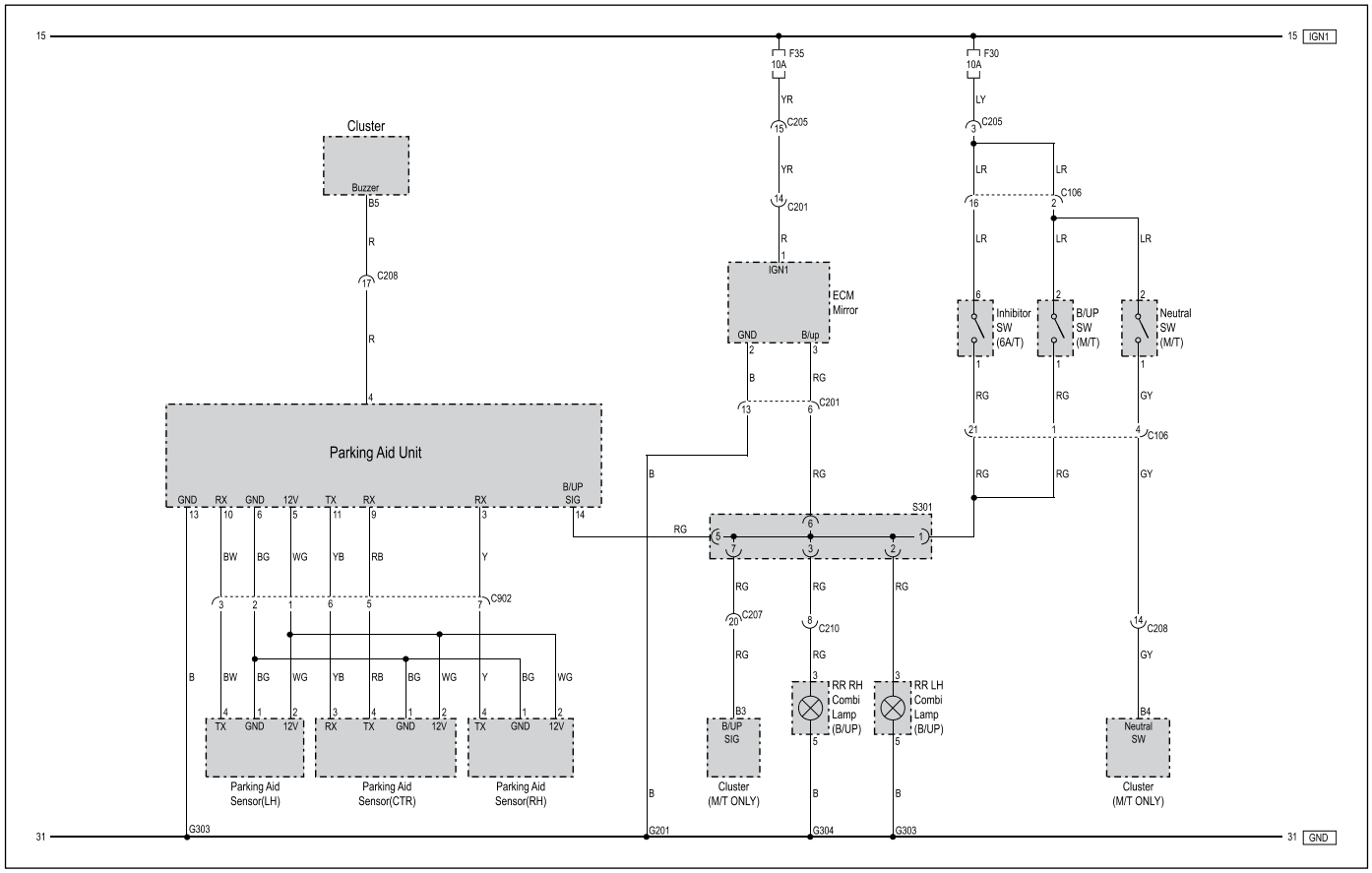
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

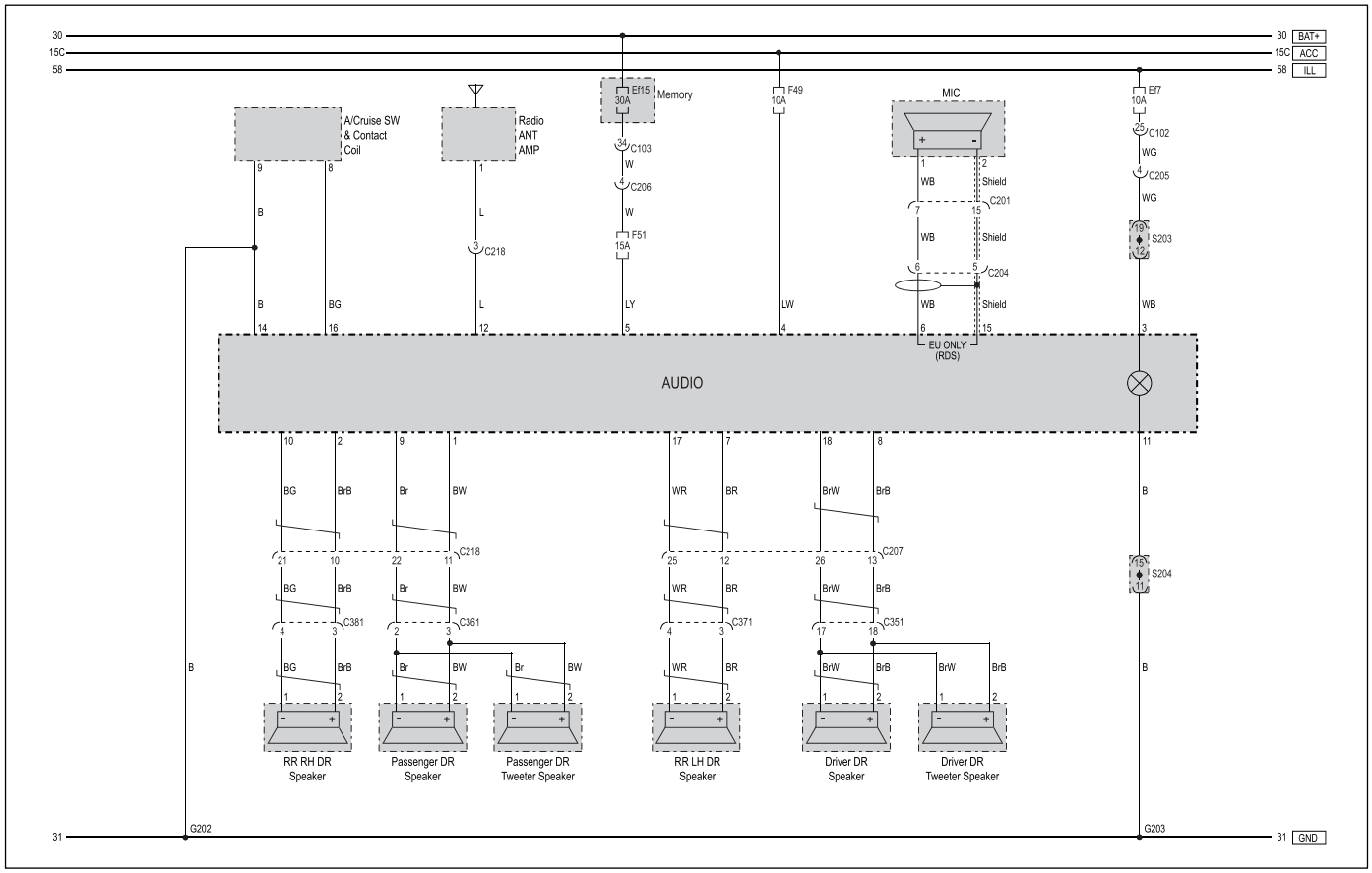
8790-01 PARKING AID / BACK UP LAMP / ECM MIRROR



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8930-03 AUDIO



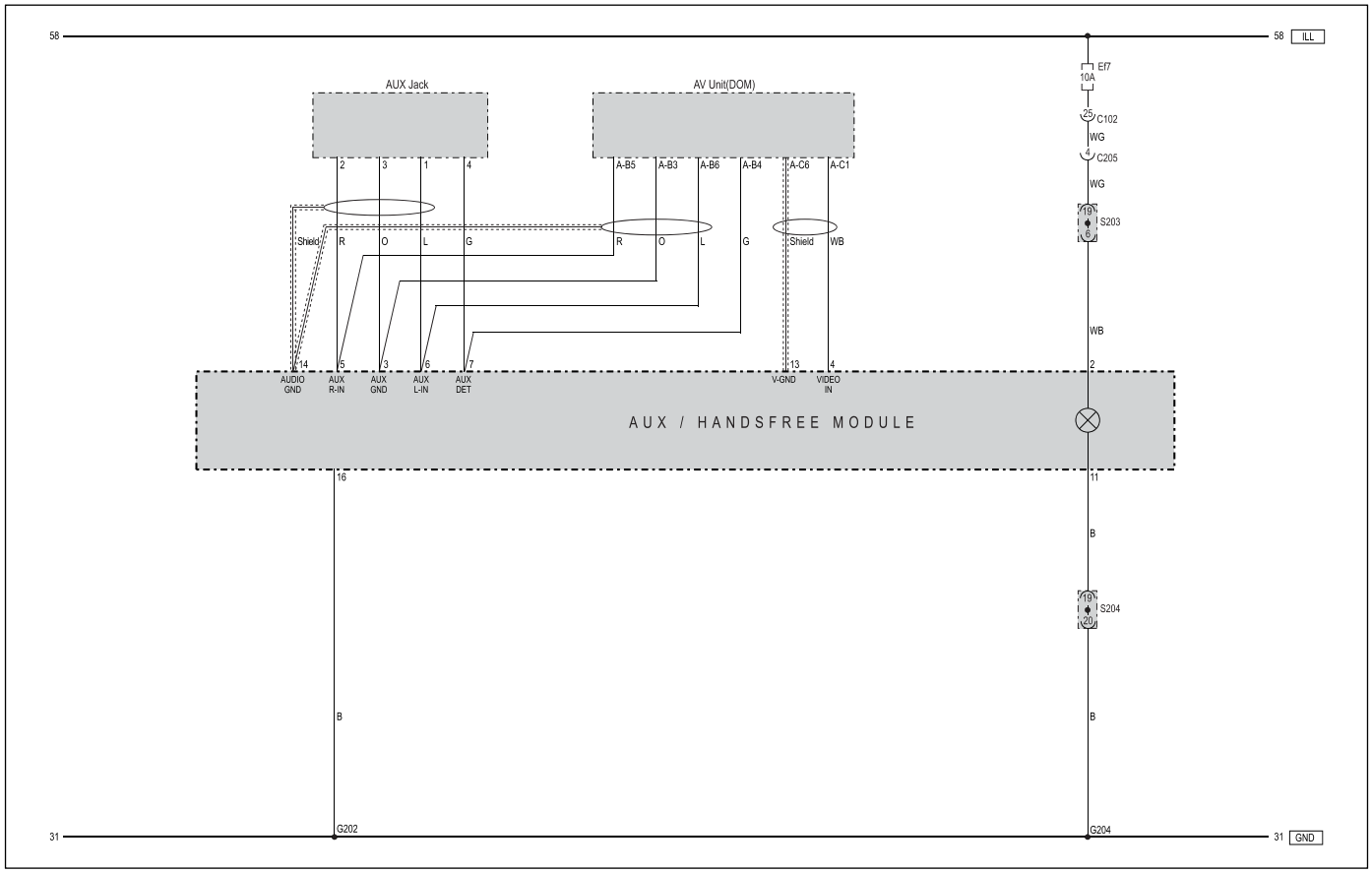
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

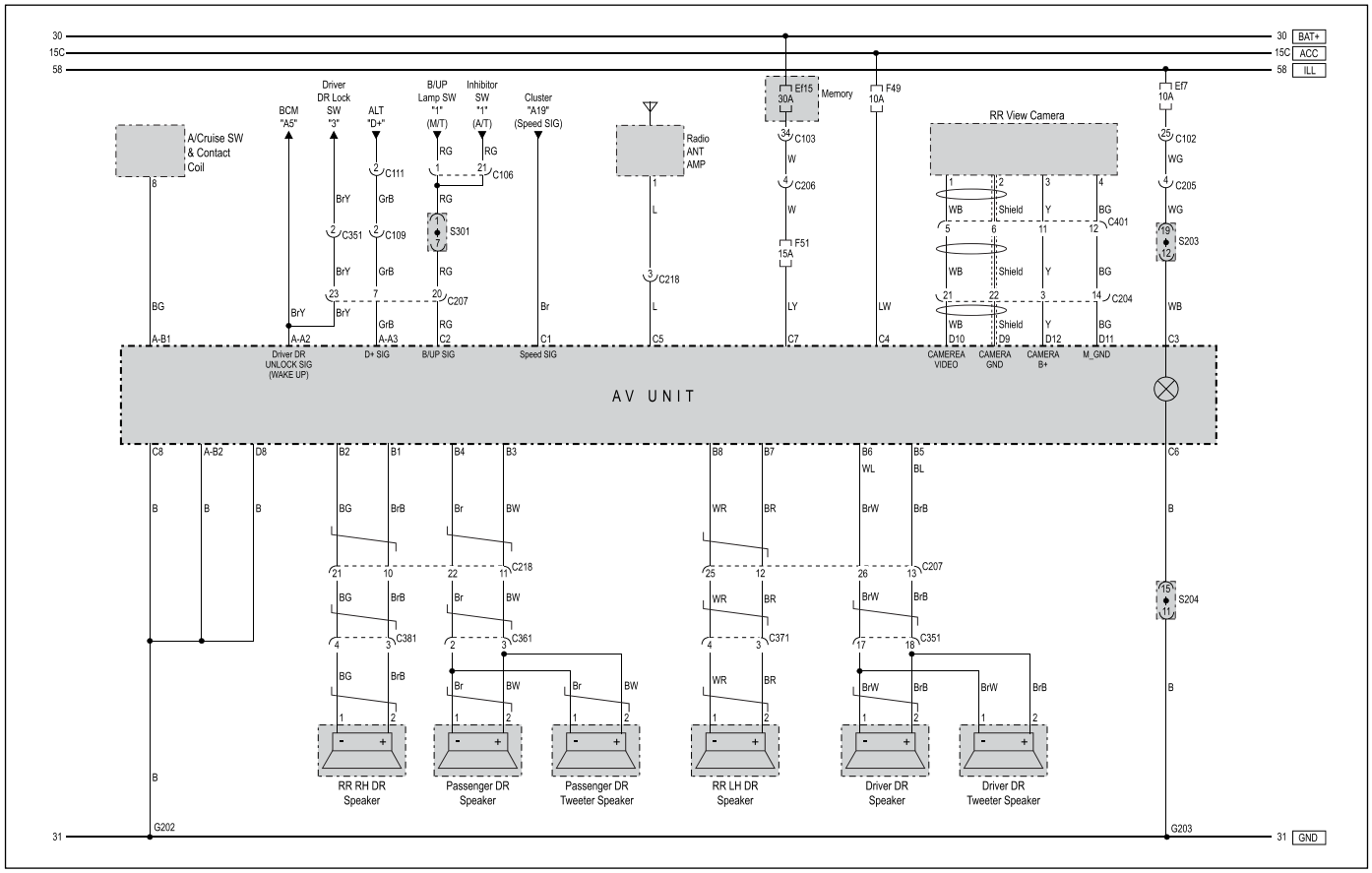
8930-40 AUX / HANDSFREE MODULE



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8930-01 AV SYSTEM(DOM)



CIRCUIT

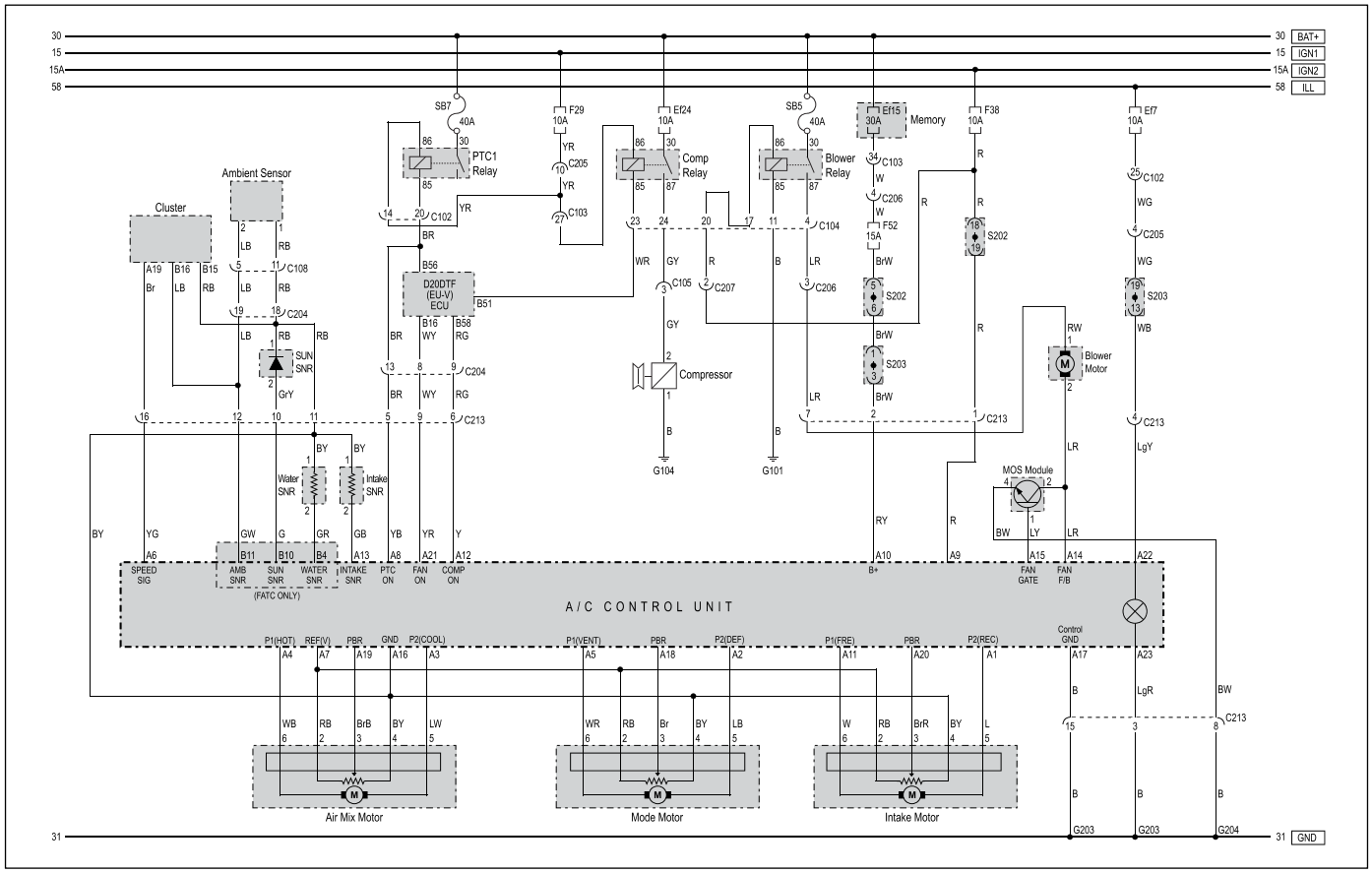
korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

ENGINE
CHASSIS
ELECTRICAL

6810-20 AIR CONDITIONER SYSTEM

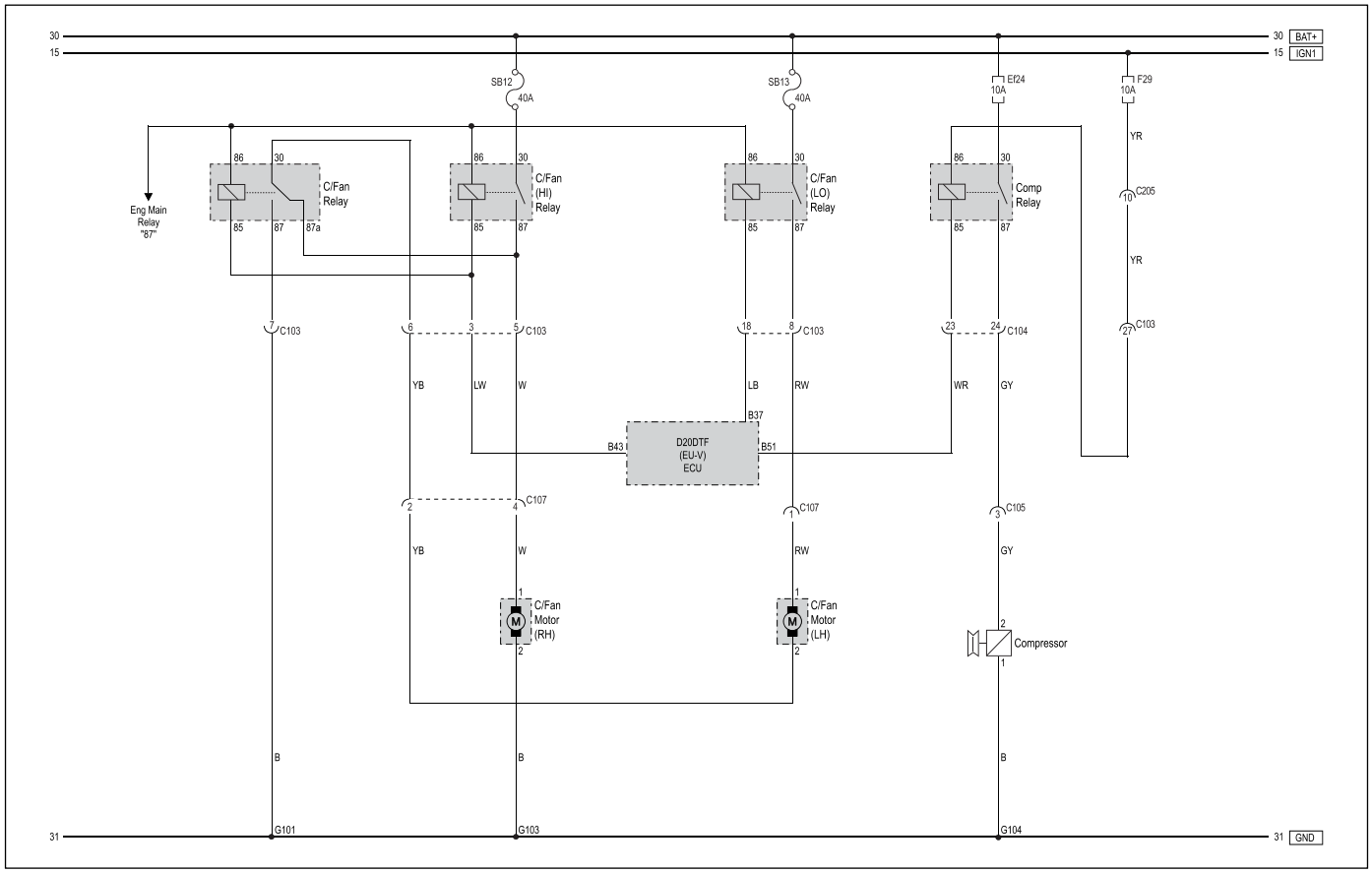


Modification basis	
Application basis	
Affected VIN	

CIRCUIT
korando 2010.10

Downloaded from www.Manualslib.com manuals search engine

2112-02 COOLING FAN SYSTEM



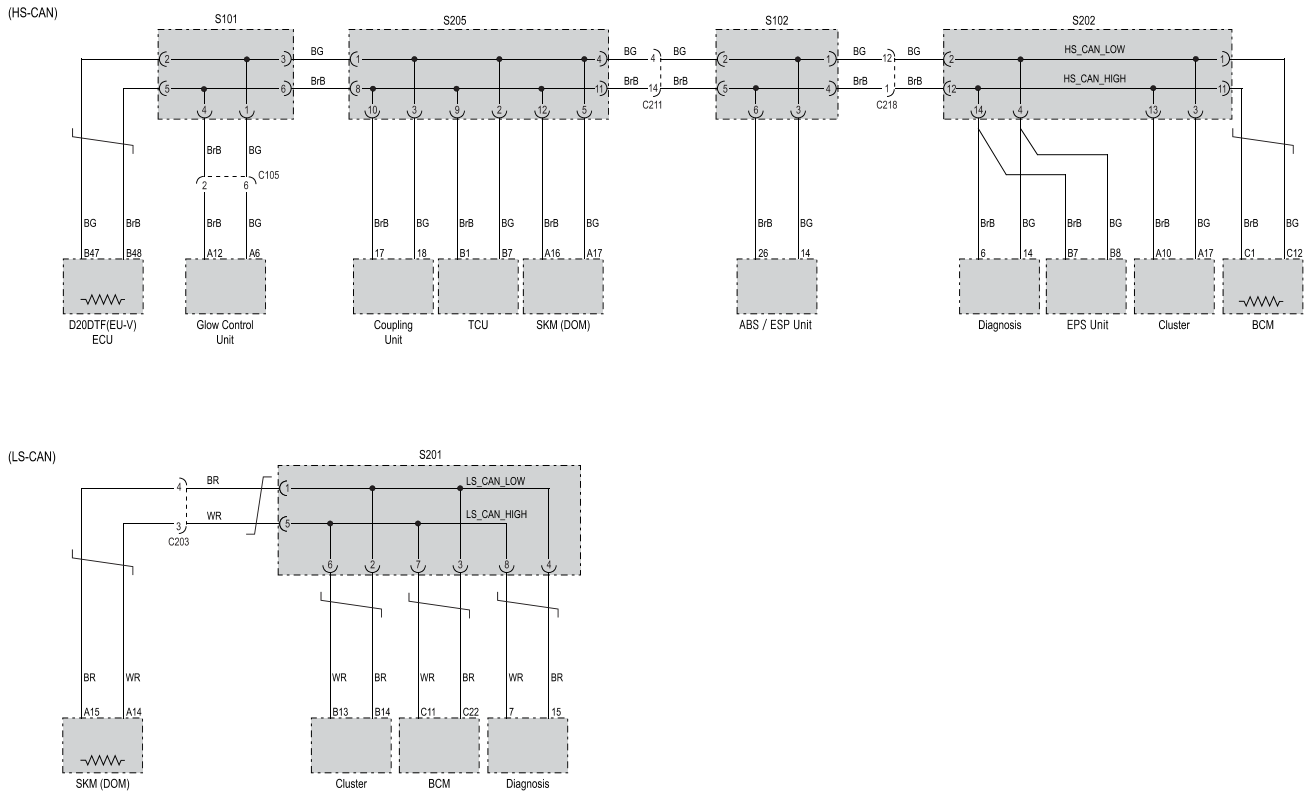
CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

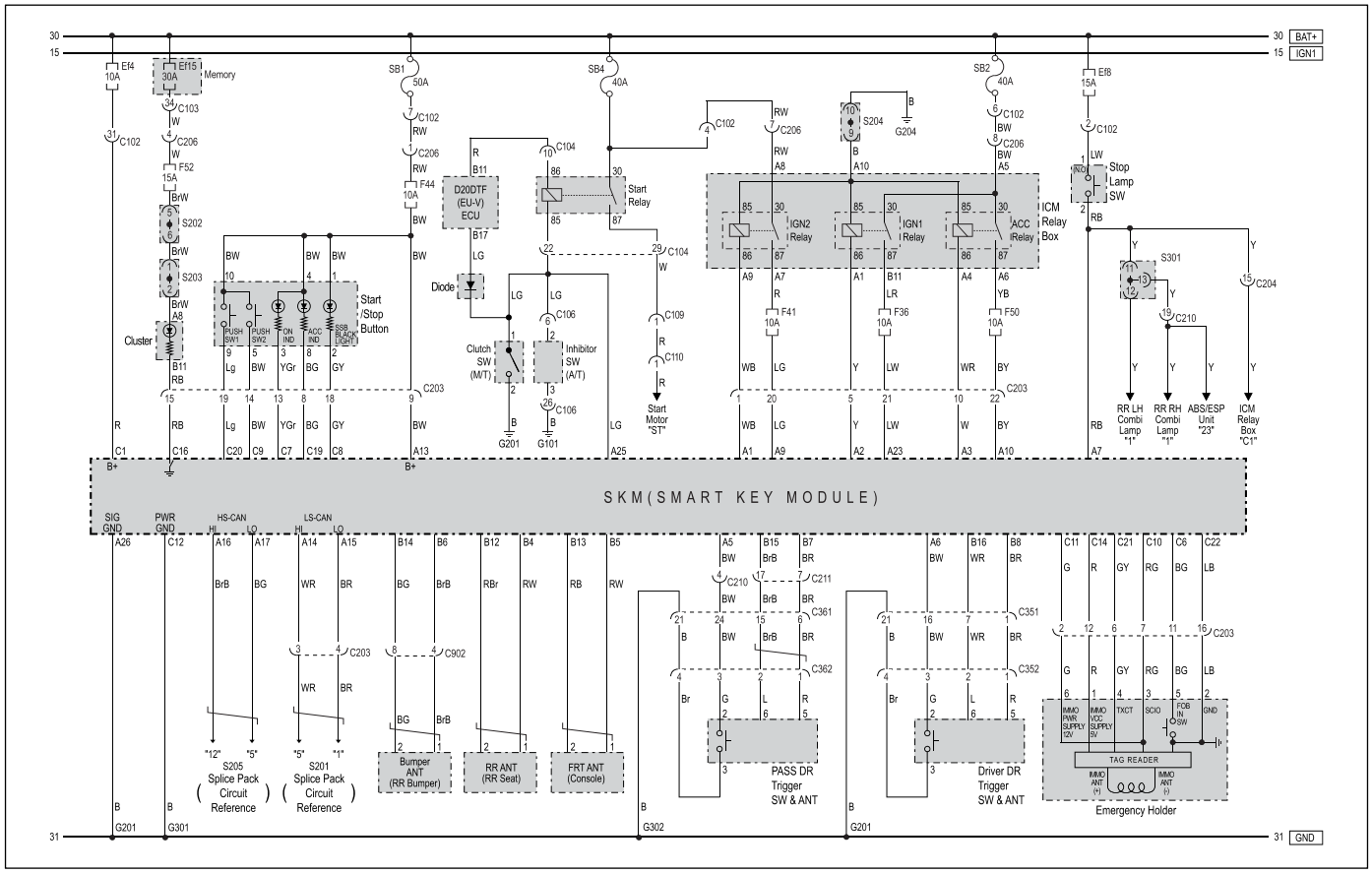
8210-01 CAN



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8712-03 SKM(SMART KEY MODULE)(DOM)



CIRCUIT

korando 2010.10

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

VEHICLE GENERAL

0000-00

SPECIFICATIONS AND CHECK ITEMS

1. VEHICLE IDENTIFICATION..... 3
2. SPECIFICATION..... 5
3. OIL SPECIFICATIONS AND CAPACITY. 7

Downloaded from www.Manualslib.com manuals search engine

Downloaded from www.Manualslib.com manuals search engine

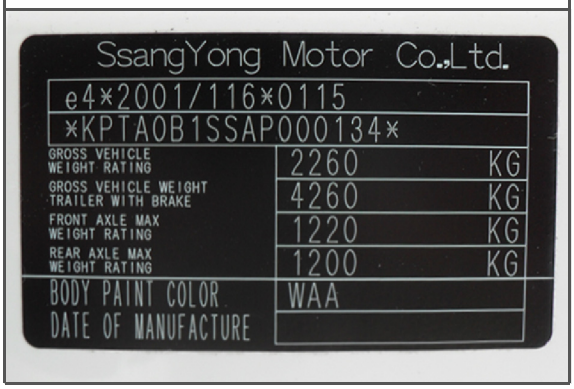
SPECIFICATIONS AND CHECK ITEMS

1. VEHICLE IDENTIFICATION

1) The engine number (671 950 0 2 5000001) is stamped on the lower area of cylinder block in exhaust manifold side.

2) The chassis number (KPTA0B1SSAP012345) is stamped on the right side in the engine compartment (passenger side).

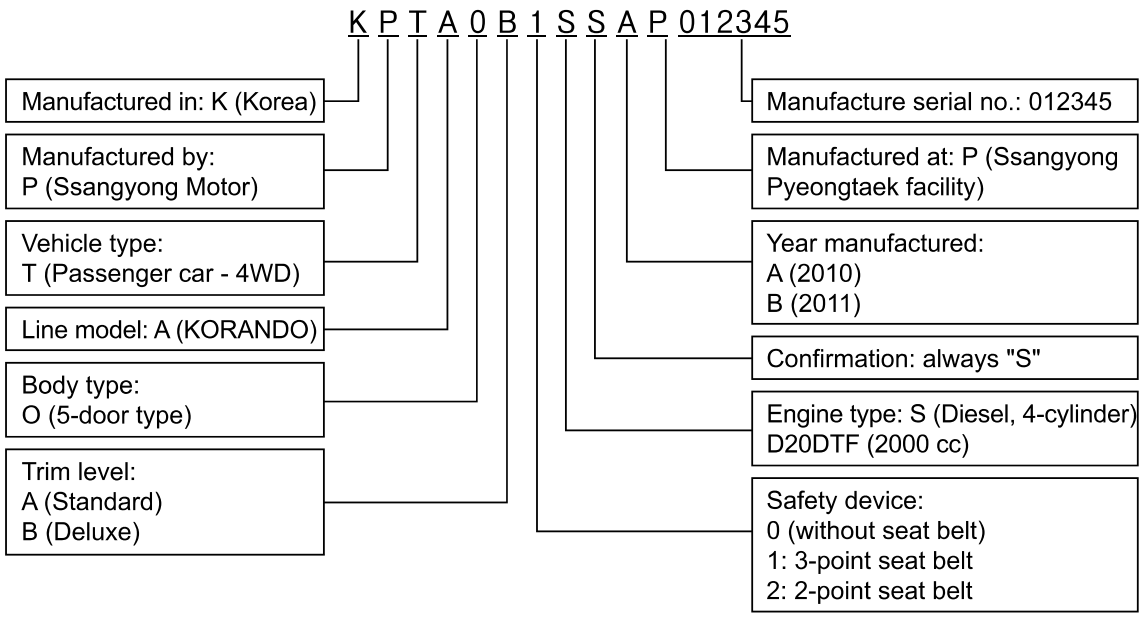
3) The certification label is affixed on the bottom of driver side B-pillar. (30 psi)



Downloaded from www.Manualslib.com manuals search engine

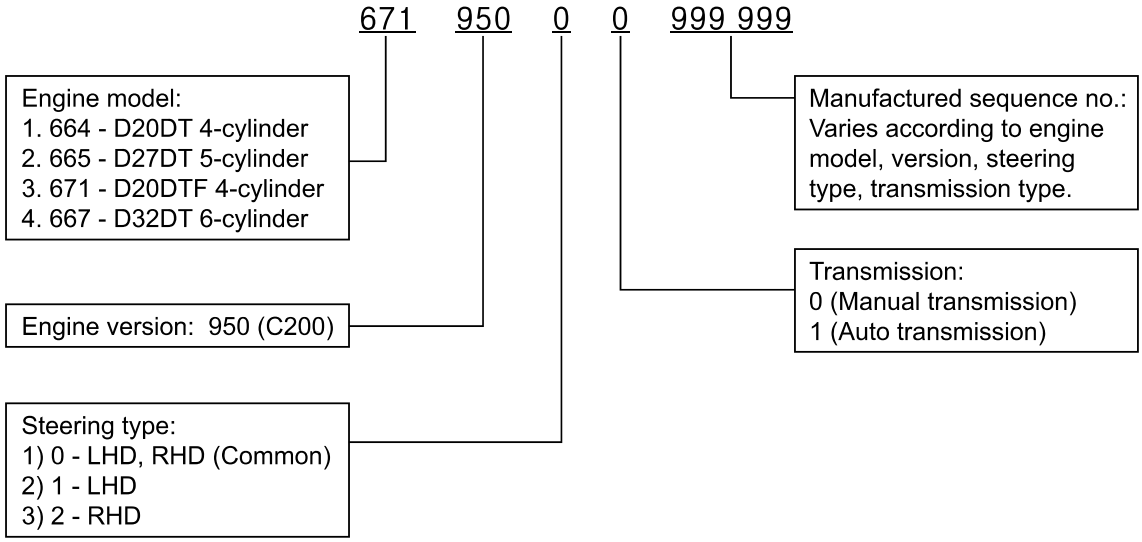
▶ VIN number

5) VIN no.



▶ Engine number

5) Engine no.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. SPECIFICATION

Descriptions			Diesel 2.0 Engine (4WD)	Diesel 2.0 Engine (2WD)
General	Overall length (mm)		4,410	←
	Overall width (mm)		1,830	←
	Overall height (mm)		1,675 (1,710: including roof rack)	←
	Gross vehicle weight (kg)		2,260	2,180
	Curb vehicle weight (kg)	A/T	1,692	1,611
		M/T	1,672	1,591
	Fuel		Diesel	←
	Fuel tank capacity (ℓ)		57	←
Engine	Engine		D20DTF	←
	Number of cylinders/ Compression ratio		4 / 16.5:1	←
	Total displacement (cc)		1,998	←
	Camshaft arrangement		DOHC	←
	Max. power		175 ps / 4,000 rpm	←
	Max. torque		360 Nm / 2,000~3,000 rpm	←
	Idle speed	A/T	780 ± 20 rpm	←
		M/T	750 ± 20 rpm	←
	Cooling system		Water-cooled / forced circulation	←
	Coolant capacity (ℓ)		8.5	←
	Lubrication type		Gear pump, forced circulation	←
	Max. oil capacity (ℓ) (when shipping)		6.0	←
	Turbocharger and cooling type		Turbocharger, water-cooled	←

Downloaded from www.Manualslib.com manuals search engine

Descriptions			Diesel 2.0 Engine (4WD)	Diesel 2.0 Engine (2WD)
Manual Transaxle	Operating type		Floor change type	←
	Gear ratio	1st	3.538	←
		2nd	1.909	←
		3rd	1.179	←
		4th	0.814	←
		5th	0.734	←
		6th	0.628	←
		Reverse	3.910	←
Automatic Transaxle	Model		Electronic 6-speed	←
	Operating type		Floor change type	←
	Gear ratio	1st	4.156	←
		2nd	2.375	←
		3rd	1.522	←
		4th	1.144	←
		5th	0.859	←
		6th	0.676	←
		Reverse	3.178	←
Transfer Case	Model		AWD	-
	Type		On demand type	-
Clutch (M/T)	Operating type		Hydraulic type	←
	Disc type		Dry single diaphragm type	←
Power Steering	Type		Rack and pinion (EPS, HPS)	←
	Steering angle	Inner	39.0°	←
		Outer	31.24°	←

* ( ) Optional

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Descriptions			Diesel 2.0 Engine (4WD)	Diesel 2.0 Engine (2WD)
Rear Axle	Drive shaft type	Rigid axle	-	Semi-floating type
		Independent suspension	Ball joint type	-
	Axle housing type		Build-up type	←
Brake	Master cylinder type		Tandem type	←
	Booster type		Vacuum assisted booster type	←
	Brake type	Front wheel	Disc	←
		Rear wheel	Disc	←
	Parking brake		Mechanical type	←
Suspension	Front suspension		MacPherson + Coil spring	←
	Rear suspension		Multi link + Coil spring	←
Air Conditioner	Refrigerant (capacity)		R-134a (430 ± 30g)	←
Electrical	Battery type / Capacity (V-AH)		MF / 12 - 90	←
	Starter capacity (V-KW)		12 - 2.3	←
	Alternator capacity (V-A)		12V - 140A (EPS), 120A (HPS)	←

* ( ) Optional

Downloaded from www.Manualslib.com manuals search engine

3. OIL SPECIFICATIONS AND CAPACITY

Descriptions			Descriptions	Specifications
Engine Oil	Diesel Engine	D20DTF	≒ 6.0 ℓ	Quality class: Ssangyong genuine engine oil (Total Quartz INEO ECS 5W 30, SK ZIC SY 5W 30) or oil Approved by MB Sheet 229.51
Engine Coolant	Diesel Engine	D20DTF	≒ 8.5 ℓ	Ssangyong genuine coolant Anti-Freeze: SYC-1025
Automatic Transaxle Fluid			≒ 9.5 ℓ	Ssangyong genuine oil (FUCHS TITAN ATF 3292)
Manual Transaxle Fluid			≒ 1.6 ℓ	Ssangyong genuine oil (SAE 75W/85, API GL-4)
Transfer Case (PTU) Fluid		AWD	≒ 0.58 ℓ	Ssangyong genuine oil (IDEMITSU LW 80W/90)
Rear Axle Oil		AWD	≒ 0.7 ℓ	Ssangyong genuine oil (SAE 80W/90, API GL-5)
Brake / Clutch Fluid			As required	Ssangyong genuine oil (DOT4)
Power Steering Fluid			≒ 1.0 ℓ	Ssangyong genuine oil (ATF DEXRON II) * TOTAL FLUIDE DA (Extreme cold condition only)

Downloaded from www.Manualslib.com manuals search engine

D20DTF ENGINE INFORMATION

0000-00

INDEX

ENGINE GENERAL INFORMATION

GENERAL INFORMATION

1. ENGINE LAYOUT..... 3
2. MAJOR COMPONENTS..... 4

DURING SERVICE WORK

1. GUIDELINES FOR SERVICE WORK SAFETY..... 6
2. JACK-UP POINTS..... 11
3. STANDARD BOLTS SPECIFICATIONS.. 12

SPECIAL TOOL

1. NEW SPECIAL TOOLS..... 13
2. NORMAL EQUIPMENTS..... 14

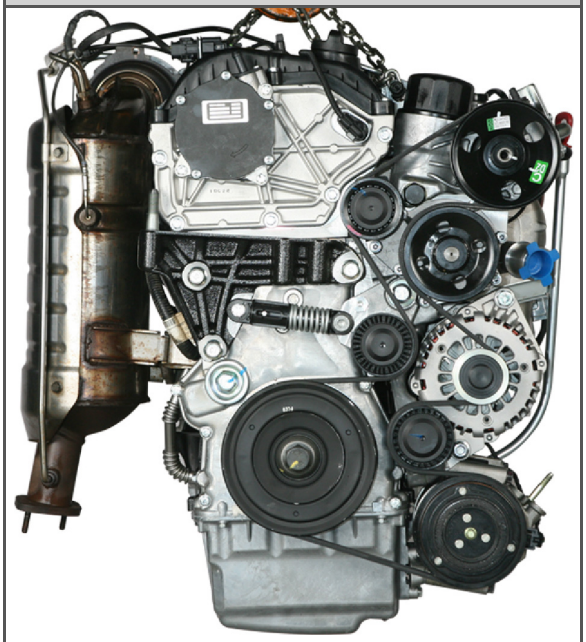
Downloaded from www.Manualslib.com manuals search engine

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

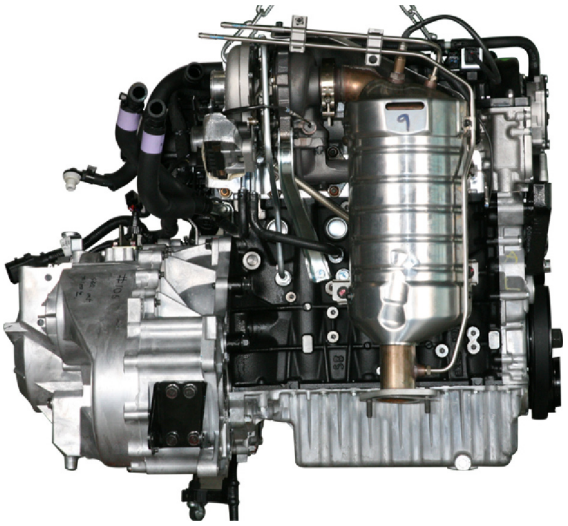
1. ENGINE LAYOUT

Front view

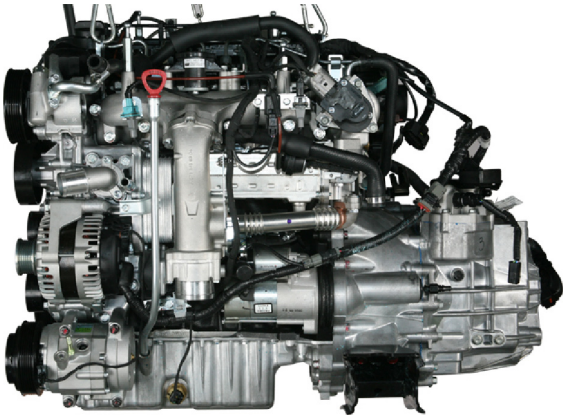


Rear view

Right view



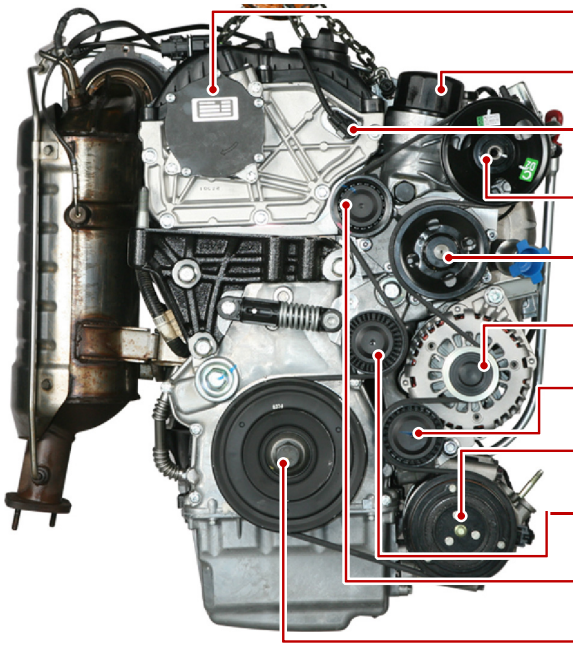
Left view



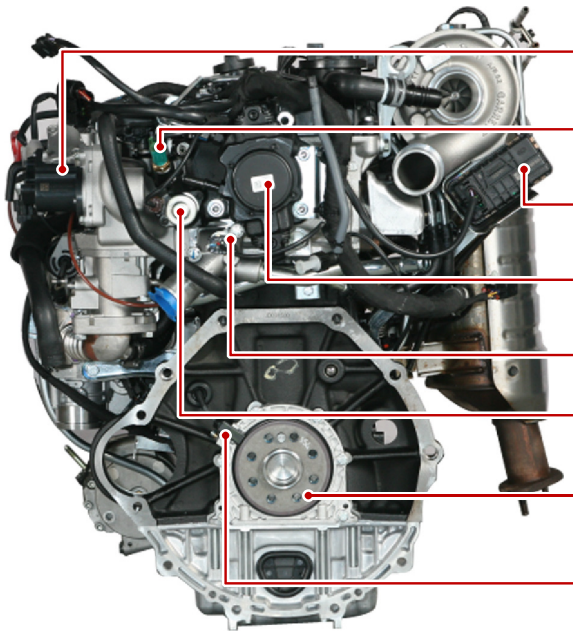
Downloaded from www.Manualslib.com manuals search engine

2. MAJOR COMPONENTS

▶ **Front view**



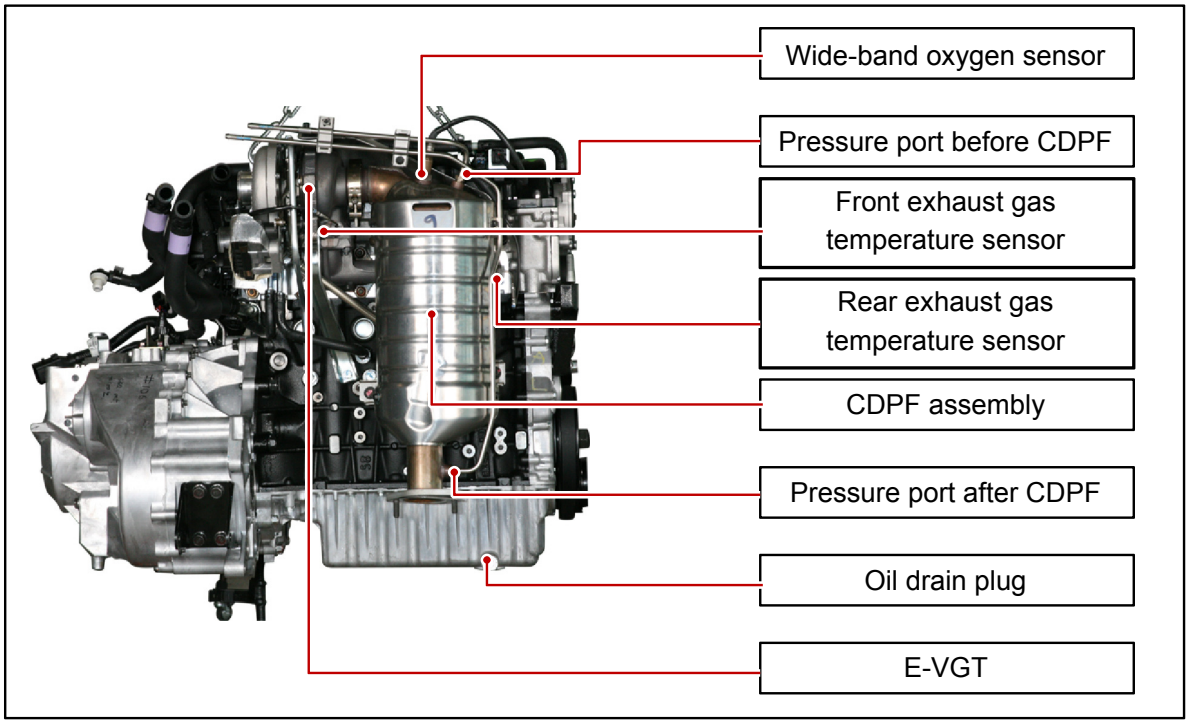
▶ **Rear view**



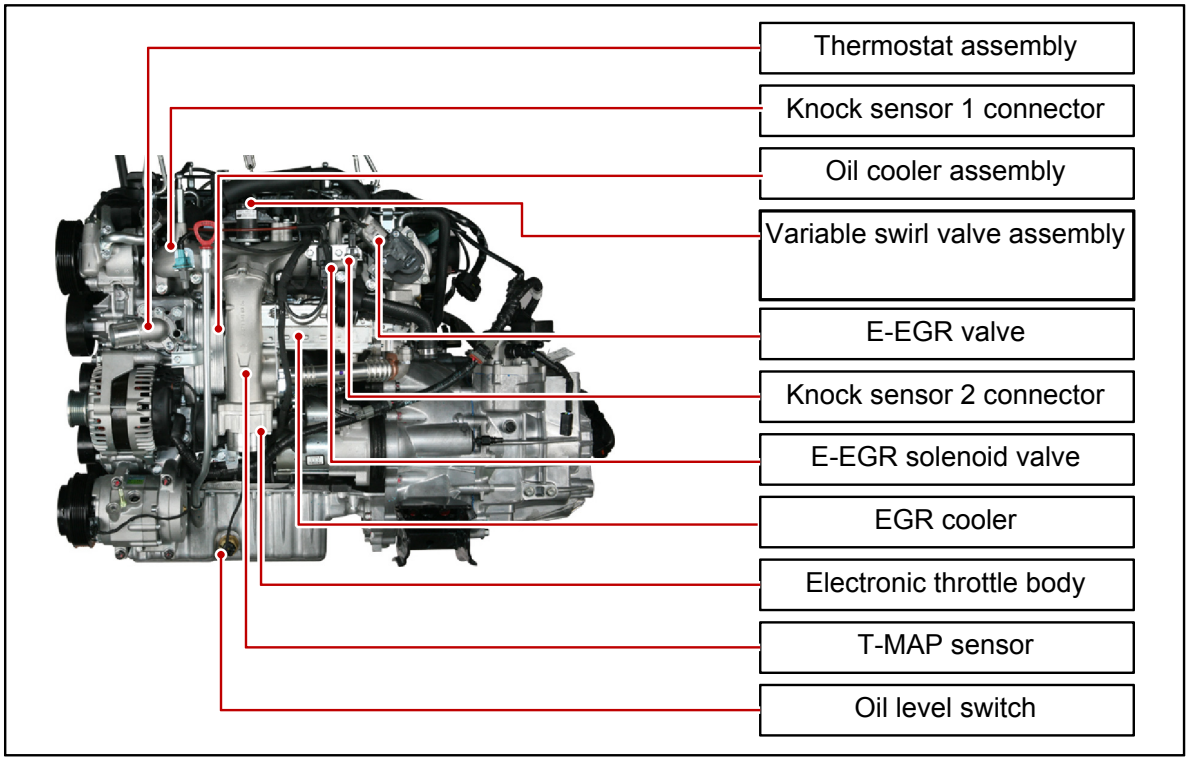
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Right view



▶ Left view



Downloaded from www.Manualslib.com manuals search engine

DURING SERVICE WORK

1. GUIDELINES FOR SERVICE WORK SAFETY

1) For Safety

To maintain and operate the vehicle under optimum state by performing safe service works, the service works should be done by following correct methods and procedures.
Accordingly, the purpose of this manual is to prevent differences that can be caused by personal working method, skill, ways and service procedures and to allow prompt/correct service works.
While using this manual, there are a lot of Note or Notice having below meaning.

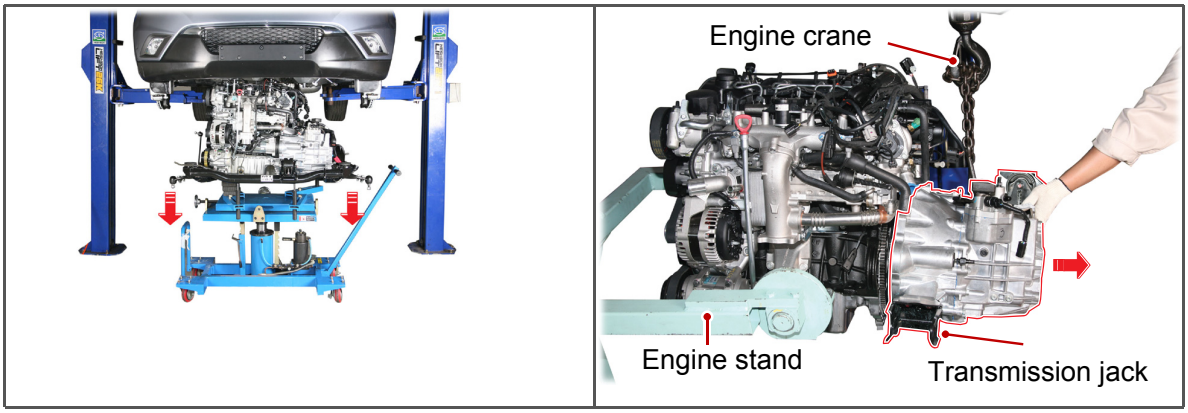
NOTE
Note means detailed description of supplementary information on work procedure or skill.

CAUTION
Notice means precautions on tool/device or part damages or personal injuries that can occur during service works.

However, above references and cautions cannot be inclusive measures, so should have habits of taking concerns and cautions based on common senses.

2) Equipment

- Korando C is FF (Front Engine Front Drive) type vehicle, and engine and powertrain system are integrated into the engine compartment. Thus 2-post lift and general equipment are needed when working on the engine and transmission.
- Major dedicated equipment: Engine and transmission jack (use the one for Chairman W), Engine stand, Engine crane, transmission jack, Engine hanger



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Lower the engine and transmission (transaxle) at the same time.

- Manual transmission: Can be removed and installed after lowering with the engine and sub frame at the same time.
- Automatic transmission: Only transmission can be removed and installed after removing the sub frame.

3) During Service Work

(1) Before lifting up the vehicle with lift, correctly support the lifting points and lift up.
(2) When using a jack, park the vehicle on the level ground and place wheel chocks underneath the tires. Position the jack under the frame and lift up the vehicle and then support with chassis stand before service work.
(3) Before service work, be sure to disconnect battery negative (-) terminal to prevent damages by bad wire and short.
(4) If service from interior of the vehicle, use protection cover to prevent damage and contamination of seat and floor.
(5) Brake fluid and anti-freeze can damage painted surface of body. So carefully handle them during service work.
(6) Use recommended and specified tools to increase efficiency of service work.
(7) Use only genuine spare parts.
(8) Never reuse cotter pin, gasket, O-ring, oil seal, lock washer and self-locking nut. Replace them with new.
(9) If reused, normal functions cannot be maintained.
(10) Align the disassembled parts in clean according to disassembling order and group for easy assembling.
(11) According to installing positions, the bolts and nuts have different hardness and design. So be careful not to mix removed bolts and nuts each other and align them according installing positions.
(12) To inspect and assemble, clean the parts. Securely clean the parts that related with oil not to be affected by viscosity of oil.
(13) Coat oil or grease on the driving and sliding surfaces before installing parts. Use sealer or gasket to prevent leakage if necessary.
(14) Tighten every bolt and nut with specified torque.
(15) When service work is completed, check finally whether the work is performed properly or the problem is solved.

Downloaded from www.Manualslib.com manuals search engine

4) Basic Inspection

(1) Horn operation

- Listen for horn sound by operating the horn.

(2) Brake operation

- Check if there is any abnormal noise, braking distance is increased or the braking force is applied to the only one wheel. If the brake warning lamp is not turned off or flashing, recheck the brake system because there is a fault in the brake system.
- Check the brake pipes and hoses for connection, oil leak, crack or interference after changing tire location. When replacing tires check the brake disc for surface condition and wear, too.
- Check the parking brake cable and brake operation. Inspect the brakes more often if habit or conditions result in frequent braking.

(3) Exhaust system

- Be alert to any changes in the sound of the system or the smell of the fumes. These are signs that the system may be leaking or overheating. Have the system inspected and repaired immediately.
- Inspect the complete system (including the catalytic converter if equipped). Inspect the body near the exhaust system. Look for broken, damaged, missing, or out-of position parts as well as open seams, holes, loose connections, or other conditions which could cause heat buildup in the floor pan or could let exhaust fumes seep into the trunk or passenger compartment.

(4) Tires

- Be alert to any vibration of the steering wheel or the seats at normal highway speeds. This may mean a wheel needs to be balanced. Also, a pull right or left on a straight, level road may show the need for a tire pressure adjustment or a wheel alignment.

(5) Steering and suspension system

- Inspect the front and rear suspension and the steering system for damaged, loose or missing parts, signs of wear or lack of lubrication. Inspect the power steering line and the hoses for proper hookup, binding, leaks, cracks, chafing, etc. Clean and inspect the drive axle boot and seals for damage, tears or leakage. Replace the seals if necessary.

(6) Engine oil

- Check the oil level and add oil if necessary. The best time to check the engine oil level is when the oil is warm.

Downloaded from www.Manualslib.com manuals search engine

(7) Coolant

- Check the coolant level in the coolant reservoir and coolant condition (contamination, foreign material), coolant hose damage or leakage. Replace or add Ssangyong genuine coolant, if needed.

(8) Engine drive belt

- Check all drive belts of the engine for wear, crack, looseness, tension. Retighten or replace the belt, if needed.

5) Guidelines on Engine Service

To prevent personal injuries and vehicle damages that can be caused by mistakes during engine and unit inspection/repair and to secure optimum engine performance and safety after service works, basic cautions and service work guidelines that can be easily forgotten during engine service works are described in.

(1) Cautions before service works

- Before work on engine and each electrical equipment, be sure to disconnect battery negative (-) terminal.
- Before service works, be sure to prepare the works by cleaning and aligning work areas.
- Always position the ignition switch to OFF if not required. If not, there can be electrical equipment damages or personal injuries due to short-circuit or ground by mistake.
- There should be no leak from fuel injection system (HP pump, fuel hose, high pressure pipe) of the engine. So they should be protected from foreign materials.
- While removing the engine, use the dedicated equipments, such as, jack for engine and transmission, engine stand, engine crane, etc.

(2) Engine and accessories

Engine has a lot of precise portions so tightening torque should be correct during disassembly/assembly and removal/installation and service work should be done in clean ways during disassembly/assembly.
Maintaining working area clean and cautious service administration is essential element of service works while working on the engine and each section of the vehicle. So the mechanics should well aware of it.

- While removing the engine, related parts (bolts, gaskets, etc.) should be aligned as a group.
- While disassembling/assembling internal components of the engine, well aware of disassembly/assembly section in this manual and clean each component with engine oil and then coat with oil before installation.
- While removing engine, drain engine oil, coolant and fuel in fuel system to prevent leakage.
- During service work of removal/installation, be sure to check each connected portions to engine not to make interference.

Downloaded from www.Manualslib.com manuals search engine

(3) Electrical equipment

Electrical equipment should be handled more carefully. Currently, the engine is equipped with a lot of electrical equipments so there can be engine performance drops, incomplete combustion and other abnormalities due to short and poor contact. Mechanics should well aware of vehicle's electrical equipment.

- When working on the electrical equipment, be sure to disconnect battery negative (-) terminal and position the ignition switch to off, except when required.
- When replacing electrical equipment, use the same genuine part and be sure to check whether ground or connecting portions are correctly connected during installation. If ground or connecting portion is loosened, there can be vehicle fire or personal injury.

(4) Fuel and lubrication system

Painted surface of the body can be damaged or rubber products (hoes) can be corroded if engine oil and fuel are spilled over. If spilled over engine, foreign materials in air can be accumulated on the engine damaging fuel system.

- If work on the fluid system such as fuel and oil, working area should be well ventilated and mechanic should not smoke.
- Gasket or seal on the fuel/lubrication system should be replaced with new and bolts and nuts should be tightened as specified.
- After removal/installation works, be sure to check whether there is leak on the connecting section.

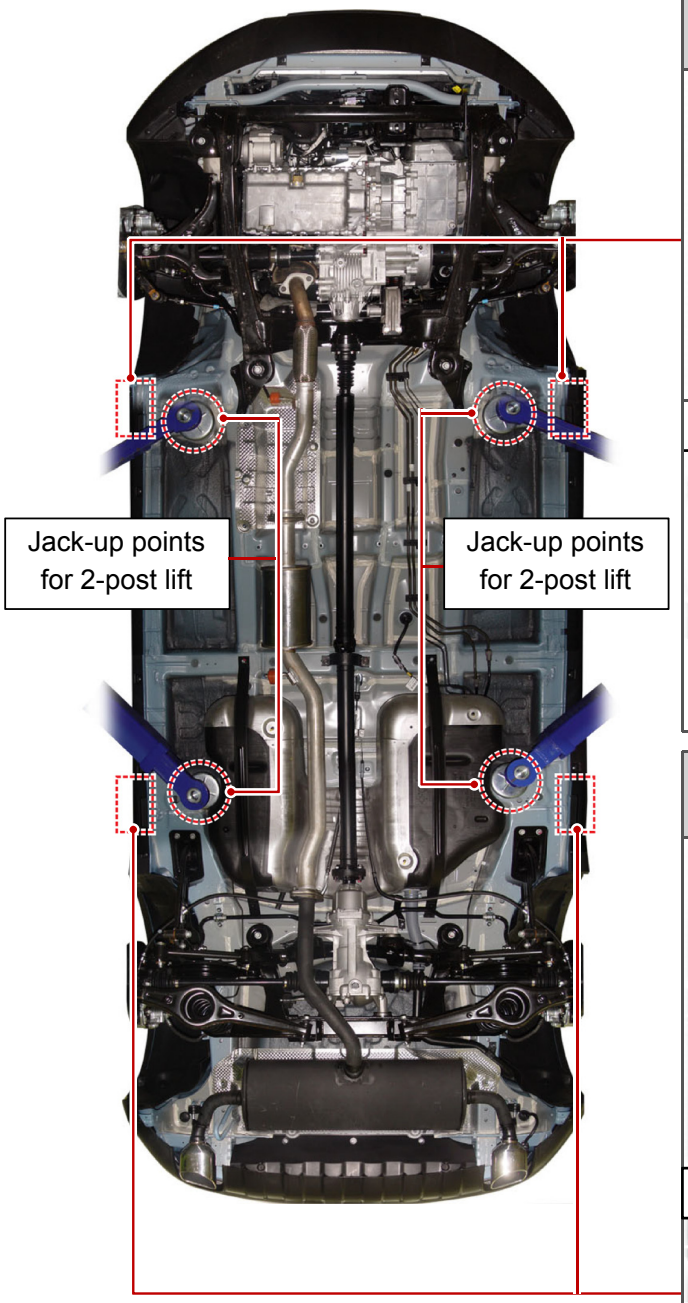
NOTE

1. If fine dust or foreign material enters into DI engine's fuel system, there can be serious damages between HP pump and injectors. So, be sure to cover removed fuel system components with cap and protect removed parts not to be contaminated with dirt. (Refer to cleanness in this manual while working on DI engine fuel system)
2. When working on the fuel line between priming pump and injector (including return line), always plug the openings with caps to prevent foreign materials or dust from entering to the openings and connections.
3. The HP fuel supply pipe (HP pump to fuel rail) and HP fuel pipe (Fuel rail to injector) should be replaced with new ones when removed.

Downloaded from www.Manualslib.com manuals search engine

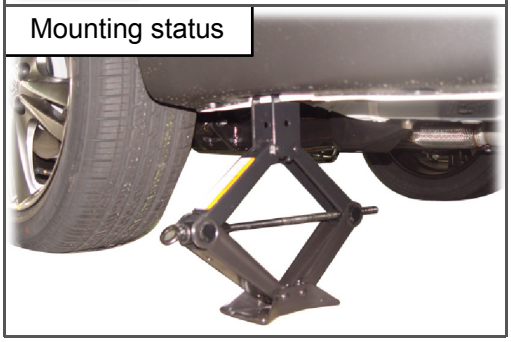
2. JACK-UP POINTS

▶ **Stand jack-up points and installation status (front side)**

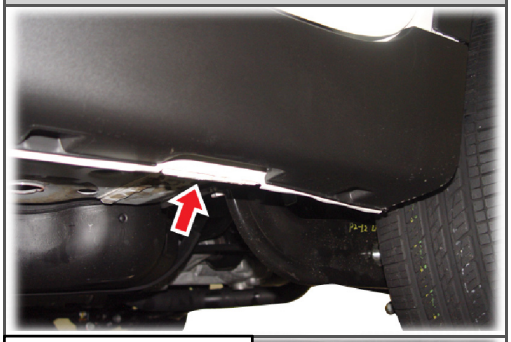


Stand jack-up points and installation status (front side)

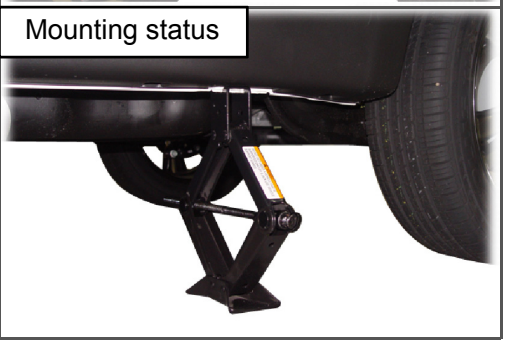
Mounting status



Stand jack-up points and installation status (rear side)



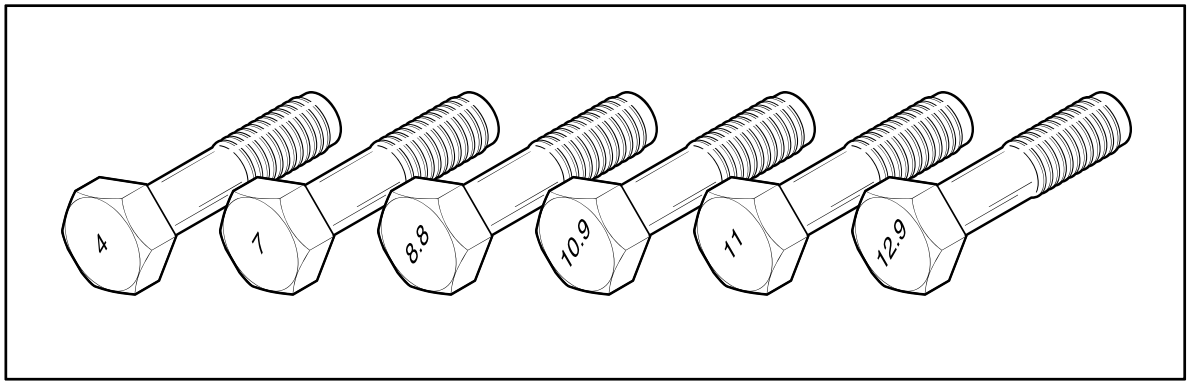
Mounting status



Downloaded from www.Manualslib.com manuals search engine

3. STANDARD BOLTS SPECIFICATIONS

Bolt	Pitch	Tightening torque(kgf.cm)					
		Standard			Limit		
		4T	7T	9T	4T	7T	9T
M3	0.5	5	9	13	7	12	17
M4	0.7	12	20	30	16	27	40
M5	0.8	24	40	57	32	53	77
M6	1.0	41	68	99	55	91	130
M8	1.25	88	160	230	130	210	310
M10	1.25	190	330	470	260	430	620
	1.5	190	310	450	250	420	600
M12	1.25	350	580	840	460	770	1,100
	1.75	330	550	790	440	730	1,000
M14	1.5	550	910	1,300	730	1,200	1,900
M16	1.5	830	1,100	2,000	1,100	1,900	2,700
M18	1.5	1,200	2,000	2,900	1,600	2,700	3,800
M20	1.5	1,700	2,800	4,000	2,200	3,700	5,300
M22	1.5	2,300	3,800	5,400	3,000	5,000	7,200
M24	1.5	2,900	4,900	7,000	3,900	6,500	9,400
	2.0	2,800	4,700	6,800	3,800	6,300	9,100



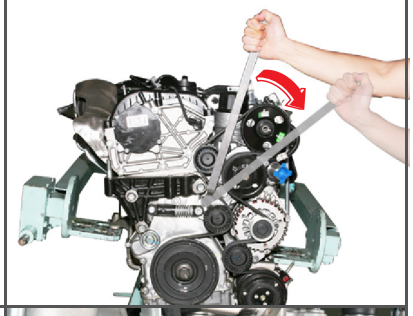
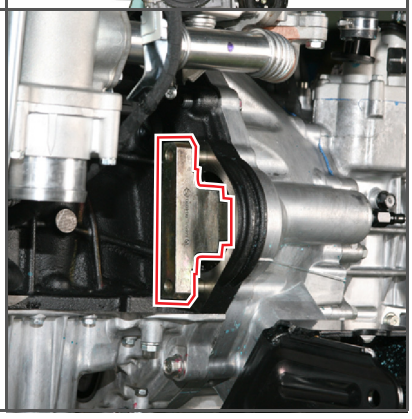
1) Metric bolt strength is embossed on the head of each bolt. The strength of bolt can be classified as 4T, 7T, 8.8T, 10.9T, 11T and 12.9T in general.
2) Observe standard tightening torque during bolt tightening works and can adjust torque to be proper within 15 % if necessary. Try not to over max. allowable tightening torque if not required to do so.
3) Determine extra proper tightening torque if tightens with washer or packing.
4) If tightens bolts on the below materials, be sure to determine the proper torque.
   - Aluminum alloy: Tighten to 80 % of above torque table.
   - Plastics: Tighten to 20 % of above torque table.

Downloaded from www.Manualslib.com manuals search engine

SPECIAL TOOL

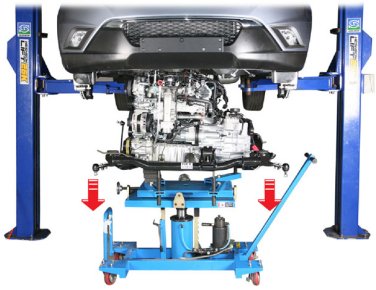
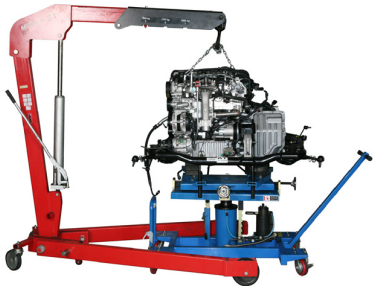
1. NEW SPECIAL TOOLS

To repair Korando C, new special tools which are developed for new engine and systems, normal equipments and conventional tools are used.

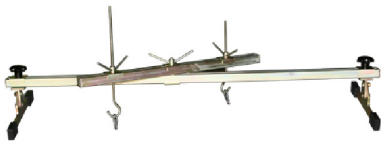
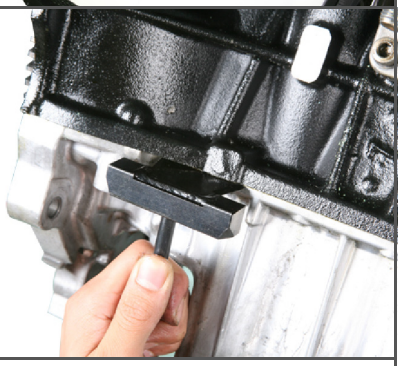
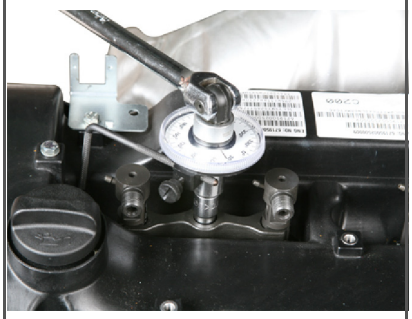
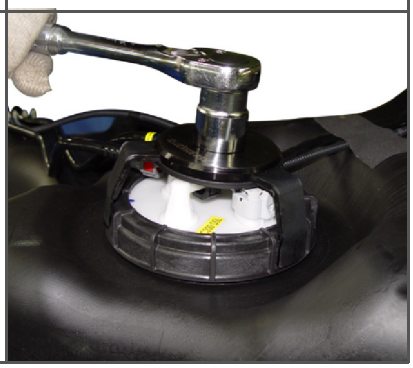
Name and Part Number	Special tool	Use (Vehicle)
Part number: T99410010A Name: Belt tension adjuster Use: Used to release tension without removing belt when replacing pulley or pump.		 **Use (Engine)** 
Part number: T99110010A Name: Flywheel fixing device Use: Used to fix flywheel or drive shaft to prevent engine from rotating when removing crankshaft pulley.		

Downloaded from www.Manualslib.com manuals search engine

2. NORMAL EQUIPMENTS

Name and Part Number	Tool	Use
Name: Engine and transmission jack Use: High load jack dedicated for Chairman W, but can be used for Korando C to support module when lowering engine and transmission mounted to sub frame at the same time (replacing manual transmission).		
Name: Engine stand (1 tone or more) Use: Used to fix the removed engine or engine and transmission (transaxle) and can support at least 1 tone.		
Name: Engine crane (1 tone or more) Use: Used to move engine module (including transaxle) to working space or engine stand, and can support at least 1 tonne.		

Downloaded from www.Manualslib.com manuals search engine

Name and Part Number	Tool	Use
Name: Engine holder for C200 Use: Used to hold engine to prevent it from dropping when removing engine mounting (RH) insulator or sub frame.		
Name: Oil pan gasket remover Use: Used to separate oil pan and minimize damage when removing oil pan.		
Name: Torque angle gauge Use: Used to angle-tighten correctly after torque-tightening		
Name: Fuel sender cover remover/installer		

Downloaded from www.Manualslib.com manuals search engine

Memo

Downloaded from www.Manualslib.com manuals search engine

D20DTF ENGINE

0000-00

GENERAL INFORMATION

1. SPECIFICATION

Unit	Description		Specification	Remark
Cylinder head	Height		142.9 to 143.1 mm	
	Flatness		below 0.1 mm	
	Valve protrusion	Intake valve	0.1 to 0.7 mm	
		Exhaust valve	0.1 to 0.7 mm	
	Flatness on manifold side	Intake manifold	0.08 mm	
		Exhaust manifold	0.08 mm	
Mass Balance Unit (MBU)	Backlash		0.05 to 0.15 mm	
Connecting rod	End play		0.5 to 1.5 mm	
Camshaft	Axial end play	Intake	0.1 to 0.35 mm	
		Exhaust	0.1 to 0.35 mm	
Camshaft position sensor	Distance between Camshaft position sensor and sprocket		0.20 to 1.80 mm	
Valve	Clearance between valve and piston	Intake	Approx. 0.7 mm	
		Exhaust	Approx. 0.8 mm	
	Valve recess	Intake	0.1 to 0.7 mm	
		Exhaust		
Cylinder block	Piston protrusion		0.541 to 0.649 mm	
Piston ring	TOP ring end gap		0.20 to 0.35 mm	
	2nd ring end gap		0.35 to 0.50 mm	
	3rd ring end gap		0.2 to 0.40 mm	
	Offset		0.3 mm	
Head gasket	Piston protrusion	0.475~0.540	1.2t	
		0.541 to 0.649	1.3t	
		0.650 to 0.745	1.4t	

Downloaded from www.Manualslib.com manuals search engine

2. TIGHTENING TORQUE

Component	Size	Bolt Quantity	Specified torque (Nm)	Remark (Total torque)
Main bearing cap	M11×62 (small) M11×67 (large)	10	55±5 Nm, 130°+10°	80 to 130 Nm
Connecting rod cap	M9×52	8	40±5 Nm, 90°+10°	50 to 80 Nm
Rear cover	M6×20	6	10 ± 1 Nm	
Timing gear cover	M6×55	3	10 ± 1 Nm	
	M6×45	8	10 ± 1 Nm	
Oil pump	M8×35SOC	3	25 ± 2.5 Nm	
Flywheel	M10×22	8	45 ± 5 Nm, 90°+10°	60 to 100 Nm
Crankshaft center bolt	M18×50	1	200 ± 20 Nm, 180°+20°	660 to 720 Nm
Oil pan	M6×20	18	10 ± 1 Nm	
	M6×35	2	10 ± 1 Nm	
	M6×85	2	10 ± 1 Nm	
	M6×120	2	10 ± 1 Nm	
	M8×40	2	25 ± 2.5 Nm	
HP pump main nut	M14×1.5-8-1	1	65 ± 5 Nm	
HP pump bolt	M8×55	3	25 ± 2.5 Nm	
Cylinder head	M12×177	12	85 ± 8.5 Nm + 270° ± 10°	
Camshaft cap	M6×	16	10 ± 1 Nm	
	M8×	4	25 ± 2.5 Nm	
Exhaust stud bolt		10	40 ± 4 Nm	
Exhaust sprocket bolt	M11×40	1	30 ± 3 Nm	
Screw bolt	M24	1	25 ± 2.5 Nm	
Coolant temperature sensor		1	20 ± 2.0 Nm	
Auto tensioner	M7×45 (Low)	1	25 ± 2.5 Nm	
	M12×90 (Up)	1	55 ± 5.5 Nm	
Coolant pump	M6×50	7	10 ± 1.0 Nm	

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Component	Size	Bolt Quantity	Specified torque (Nm)	Remark (Total torque)
Hot water inlet pipe	M6×12	2	10 ± 1 Nm	
Alternator	M10×90	1	25 ± 2.5 Nm	
	M10×116	1	46 ± 4.6 Nm	
A/C bracket	M8×25	4	7.8 to 11.8 Nm	
A/C sub bracket	M6×14	4	10 ± 1 Nm	
Intake manifold	M8×35	2	25 ± 2.5 Nm	
	M8×110	6	25 ± 2.5 Nm	
Oil cooler			25 ± 2.5 Nm	
Knock sensor	M8×28	2	20 ± 5 Nm	
Cam position sensor	M8×14	1	10 to 14 Nm	
Booster pressure sensor	M6×20	2	10 ± 1 Nm	
Exhaust manifold	M8	10	40 ± 4 Nm	
Turbocharger	M8	3	25 ± 2.5 Nm	
Support bolt		1	25 ± 2.5 Nm	
Support nut	M8	1	25 ± 2.5 Nm	
T/C oil supply pipe	M6 (block side)	1	10 ± 1.0 Nm	
	M6 (turbo side)	1	17 ± 2.0 Nm	
T/C oil return pipe	M6×16 (turbo side)	2	10 ± 1 Nm	
	M6×16 (block side)	2	10 ± 1 Nm	
EGR valve	M8×22	2	25 ± 2.5 Nm	
EGR pipe bolt (Intake side)	M8×16	2	25 ± 2.5 Nm	
EGR pipe bolt (EGR cooler side)	M8×16	2	25 ± 2.5 Nm	
EGR combination bolt	M6×16	4	10 ± 1 Nm	
	M8×16	16	25 ± 2.5 Nm	
Tensioner pulley		1	45 ± 4.5 Nm	
Glow plug	M5	4	20 ± 2 Nm	
Vacuum pump	M8×25	3	25 ± 2.5 Nm	

Downloaded from www.Manualslib.com manuals search engine

Component	Size	Bolt Quantity	Specified torque (Nm)	Remark (Total torque)
Cooling fan bracket	M6×25	5	10 ± 1 Nm	
	M6×60	1	10 ± 1 Nm	
	M6×85	3	10 ± 1 Nm	
Cylinder head cover	M6×35	21	10 ± 1 Nm	
Oil gauge tube	M6×16	1	10 ± 1 Nm	
Oil filter	M8×35SOC	1	25 ± 2.5 Nm	
Fuel rail	M8×35SOC	2	25 ± 2.5 Nm	
Injector clamp bolt	M6×60	2	10 ± 1 Nm, 120°+10°	
High pressure pipe (between HP pump and fuel rail)	M17	1	30 ± 3 Nm	
High pressure pipe (between fuel rail and injector)	M17	4	30 ± 3 Nm	
Crank position sensor	M5×14	1	8 ± 0.4 Nm	
Main wiring	M6×16	5	10 ± 1 Nm	
Intake duct bracket	M8×16	3	25 ± 2.5 Nm	
Power steering pump	M8×100	3	25 ± 2.5 Nm	

Downloaded from www.Manualslib.com manuals search engine

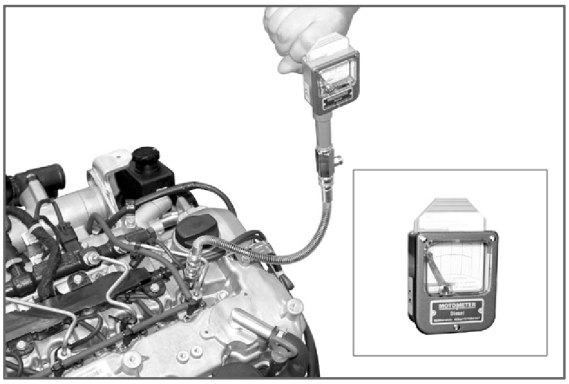
3. CHECK AND INSPECTION

1) Cylinder

(1) Compression pressure test

▶ **Specified value**

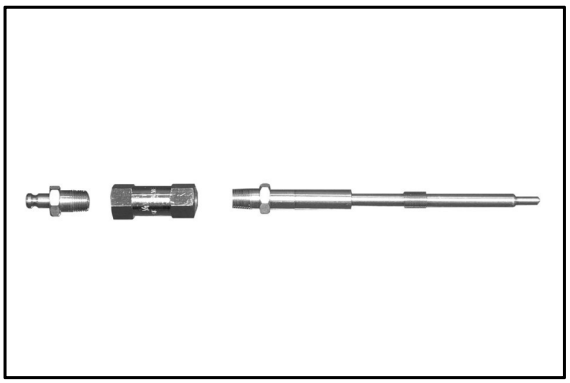
Compression ratio		16.5 : 1
Test condition		at normal operating temperature (80°C)
Compression pressure	**Standard**	32 bar
	Minimum	18 bar
Differential limit between cylinders		Maximum 3 bar



The compression pressure test is to check the conditions of internal components (piston, piston ring, intake and exhaust vale, cylinder head gasket). This test provides current engine operating status.

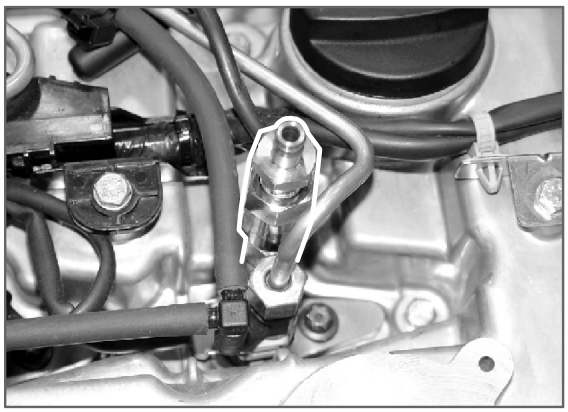
CAUTION

- Before cranking the engine, make sure that the test wiring, tools and persons are keeping away from moving components of engine (e.g., belt and cooling fan).
- Park the vehicle on the level ground and apply the parking brake.
- Do not allow anybody to be in front of the vehicle.

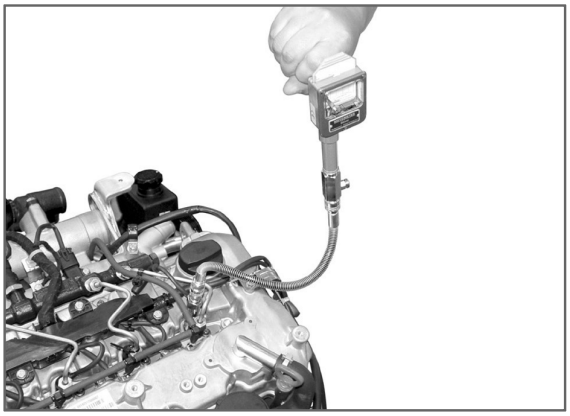


1. Warm the engine up to normal operating temperature (80°C).
2. Disconnect the fuel rail pressure sensor connector to cut off the fuel injection.
3. Place the diagram sheet to compression pressure tester.

Downloaded from www.Manualslib.com manuals search engine



4. Remove the glow plugs and install the compression pressure tester into the plug hole.

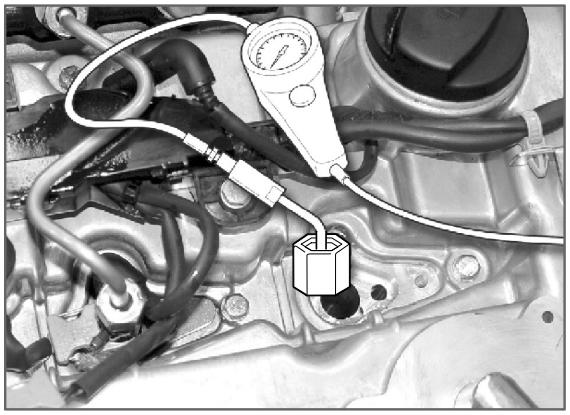


5. Crank the engine for approx. 10 seconds by using the start motor.
6. Record the test result and measure the compression pressure of other cylinders with same manner.
7. If the measured value is out of specified value, perform the cylinder pressure leakage test.

(2) Cylinder pressure leakage test

▶ **Specified value**

Test condition: normal engine operating temperature (80°C)	**Specified value**
Whole engine	below 25%
at valve and cylinder head gasket	below 10%
at piston ring	below 20%



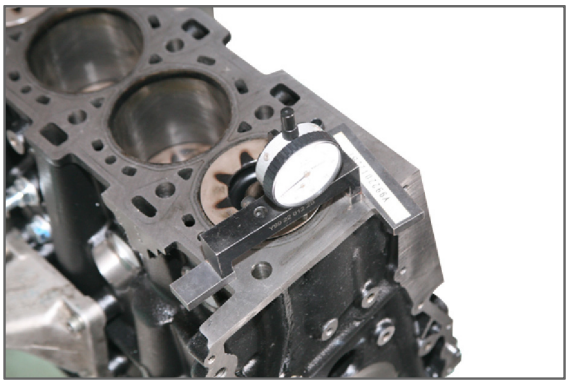
If the measured value of the compression pressure test is not within the specifications, perform the cylinder pressure leakage test.

CAUTION

- Perform this test in the sequence of firing order.
- Do not test the cylinder pressure leakage with wet type test procedure. (do not inject the engine oil into the combustion chamber)

Downloaded from www.Manualslib.com manuals search engine

(3) Piston protrusion check



Position the piston at TDC and measure the piston protrusion from crank case mating surface.

Specified value	0.541 to 0.649 mm

CAUTION
- Measure it at both ends of crankshaft.

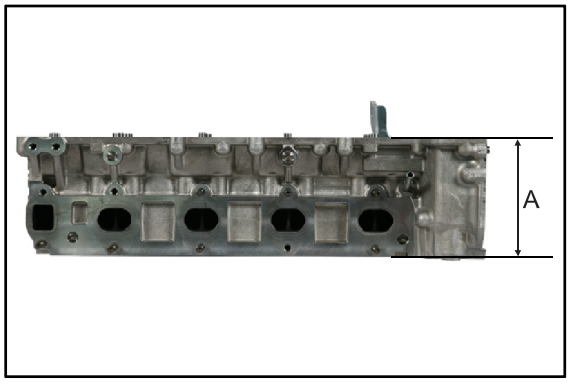
Downloaded from www.Manualslib.com manuals search engine

2) Cylinder Head

(1) Cylinder head mating surface check

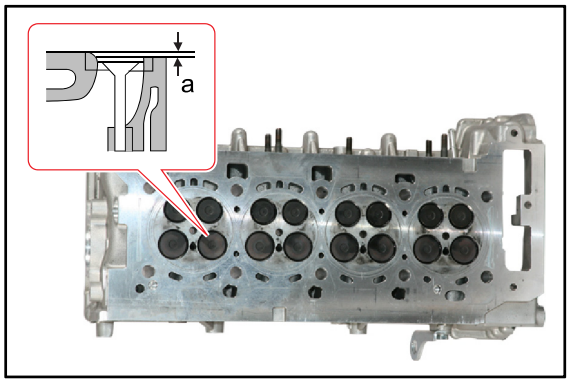
▶ **Specified value**

Total height "A"		142.9 to 143.1 mm
Minimum height after machining		142.4 mm
Flatness	**Longitudinal direction**	0.08 mm
	Transverse direction	0.0 mm
Parallel deviation of cylinder head		below 0.1 mm
Peak-to valley of surface		0.004 mm
valve recess "a"	**Intake valve**	0.1 to 0.7 mm
	Exhaust valve	0.1 to 0.7 mm



1. Measure the cylinder head height "A".

CAUTION
- If the height is less than the limit, the cylinder head must be replaced.



2. Insert the valves into the valve guides and measure the recesses.

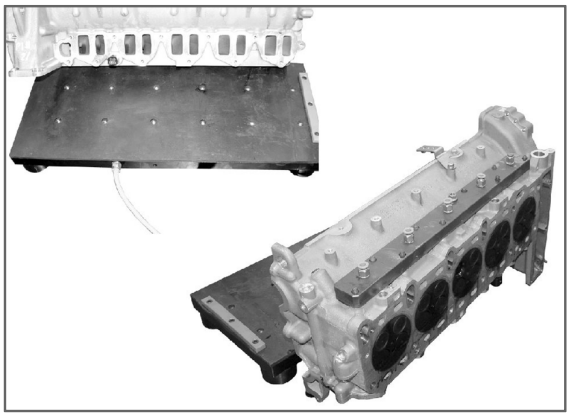
Valve recess “a	0.1 to 0.7 mm

CAUTION
- If the measured value is out of the specified range, machine the valve seat as much as necessary until the specified value is achieved.

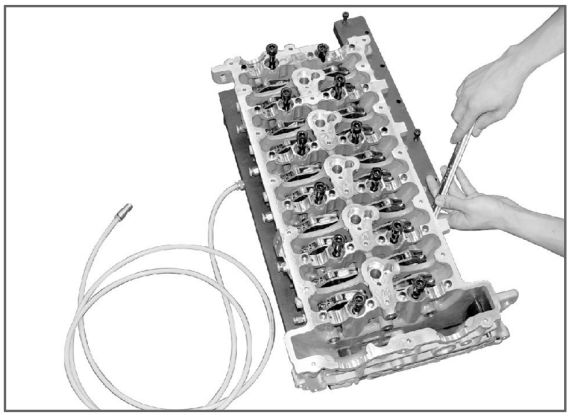
Downloaded from www.Manualslib.com manuals search engine

(2) Cylinder head pressure Leak test

Preceding work
- Removal of cylinder head
- Removal of intake and exhaust manifold
- Removal of valves



1. Place the pressure plate on a flat-bed work bench.



2. Install the cylinder head on the pressure plate.

Tightening torque **60 Nm**

3. Immerse the cylinder head with the pressure plate into warm water (approx. 60°C) and pressurize with compressed air to 2 bar.

CAUTION
- Examine the cylinder head for air bubbling. If the air bubbles are seen, replace the cylinder head.

Downloaded from www.Manualslib.com manuals search engine

4. GUIDELINES ON ENGINE SERVICE

To prevent personal injuries and vehicle damages that can be caused by mistakes during engine and unit inspection/repair and to secure optimum engine performance and safety after service works, basic cautions and service work guidelines that can be easily forgotten during engine service works are described in.

▶ Cautions before service works

- D20DTF engine is for FF (Front Engine Front Drive) type vehicle. Therefore, there are some deferent maintenance and repair works compared to the engine for FR (Front Engine Rear Drive) type vehicle.
  For safe and correct works, you must observe the working procedures and instructions in this manual. And, use the designated tools as follow:
  : Power train mounting stand / Engine hanger / Engine stand / Heavy duty engine jack
  Before work on engine and each electrical equipment, be sure to disconnect battery negative (-) terminal.
- Before service works, be sure to prepare the works by cleaning and aligning work areas.
- Always position the ignition switch to OFF if not required. If not, there can be electrical equipment damages or personal injuries due to short-circuit or ground by mistake.
- There should be no leak from fuel injection system (HP pump, fuel hose, high pressure pipe) of the D20DTF engine. So they should be protected from foreign materials.
- While removing the engine, do not position the jack and others under the oil pan or engine. To secure the safety, use only safety hook on the engine.
- When removing the engine, use only the safety hook on engine and engine hanger. Do not support it with jack under the oil pan.

▶ Engine and accessories

Engine has a lot of precise portions so tightening torque should be correct during disassembly/assembly and removal/installation and service work should be done in clean ways during disassembly/assembly. Maintaining working area clean and cautious service administration is essential element of service works while working on the engine and each section of the vehicle. So the mechanics should well aware of it.

- While removing the engine, related parts (bolts, gaskets, etc.) should be aligned as a group.
- While disassembling/assembling internal components of the engine, well aware of disassembly/assembly section in this manual and clean each component with engine oil and then coat with oil before installation.
- While removing engine, drain engine oil, coolant and fuel in fuel system to prevent leakage.
- During service work of removal/installation, be sure to check each connected portions to engine not to make interference.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Fuel and lubrication system

Painted surface of the body can be damaged or rubber products (hose) can be corroded if engine oil and fuel are spilled over. If spilled over engine, foreign materials in air can be accumulated on the engine damaging fuel system.

- If work on the fluid system such as fuel and oil, working area should be well ventilated and mechanic should not smoke.
- Gasket or seal on the fuel/lubrication system should be replaced with new and bolts and nuts should be tightened as specified.
- After removal/installation works, be sure to check whether there is leak on the connecting section.

If fine dust or foreign material enters into DI engine's fuel system, there can be serious damages between HP pump and injectors. So, be sure to cover removed fuel system components with cap and protect removed parts not to be contaminated with dirt. (Refer to cleanness in this manual while working on DI engine fuel system)

▶ Electrical equipment

Electrical equipment should be handled more carefully.
Currently, the engine is equipped with a lot of electrical equipments so there can be engine performance drops, incomplete combustion and other abnormal symptoms due to short and poor contact. Mechanics should well aware of vehicle's electrical equipment.

- If have to work on the electrical equipment, be sure to disconnect battery negative (-) terminal and position the ignition switch to off if not required.
- When replacing electrical equipment, use the same genuine part and be sure to check whether ground or connecting portions are correctly connected during installation.
  If ground or connecting portion is loosened, there can be vehicle fire or personal injury.

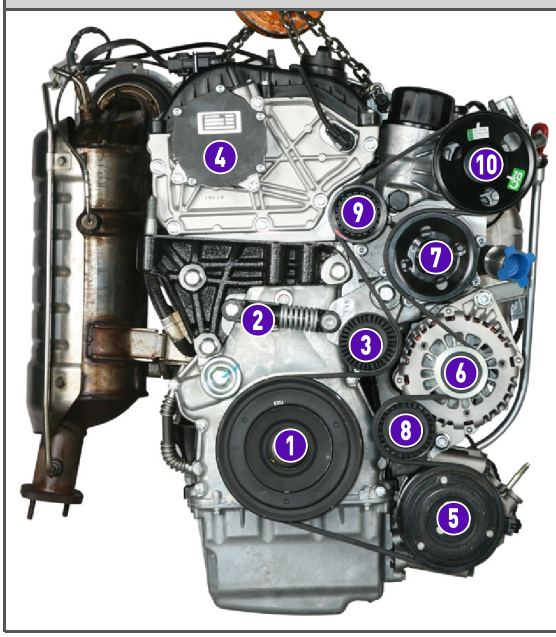
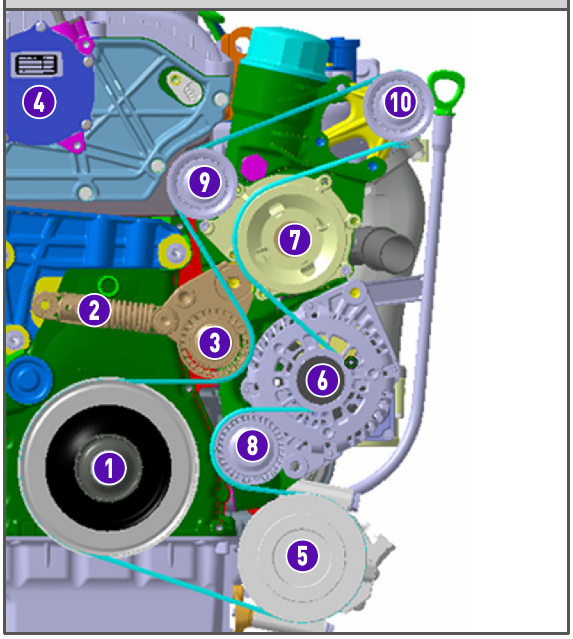
Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. BELT SYSTEM

The belt system is a single belt drive system which uses single belt and has components on the oil filter housing as FEAD (Front End Accessories Drive) type.

▶ **Components**

with HPS (hydraulic power steering)	with EPS (electric power steering)
	

	HPS	EPS
1	Crankshaft pulley (DDU)	←
2	Auto tensioner	←
3	Tensioner pulley	←
4	Vacuum pulley	←
5	A/C compressor pulley	←
6	Alternator pulley	←
7	Water pump pulley	←
8	NO. 1 idler pulley	←
9	NO. 2 idler pulley	←
10	Power steering pump	NO. 3 idler pulley

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

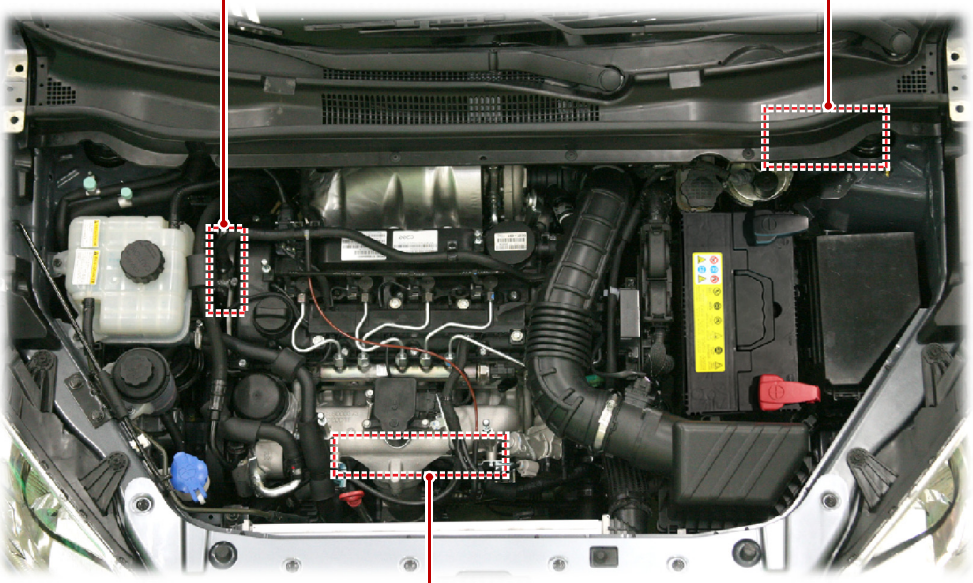
2. VACUUM PUMP

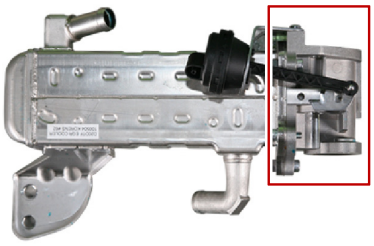
Vacuum pump generates the vacuum pressure and supplies it to EGR cooler bypass solenoid. This pump is single vane type and displacement is 210 cc/rev. The lubrication oil is supplied through the hole in hollow shaft.

▶ **Components**

Vacuum pump	
	Pump capacity: 210 cc/rev Speed: 700 to 6,000 rpm Lubrication temperature: −40 to 155°C Oil: 5W30 Drive type: Driven by exhaust Camshaft sprocket

Brake booster



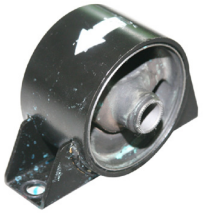
EGR cooler bypass valve	
	Exhaust gas goes to combustion chamber without through EGR cooler in engine cooled, and the valve is closed by vacuum pressure.

Downloaded from www.Manualslib.com manuals search engine

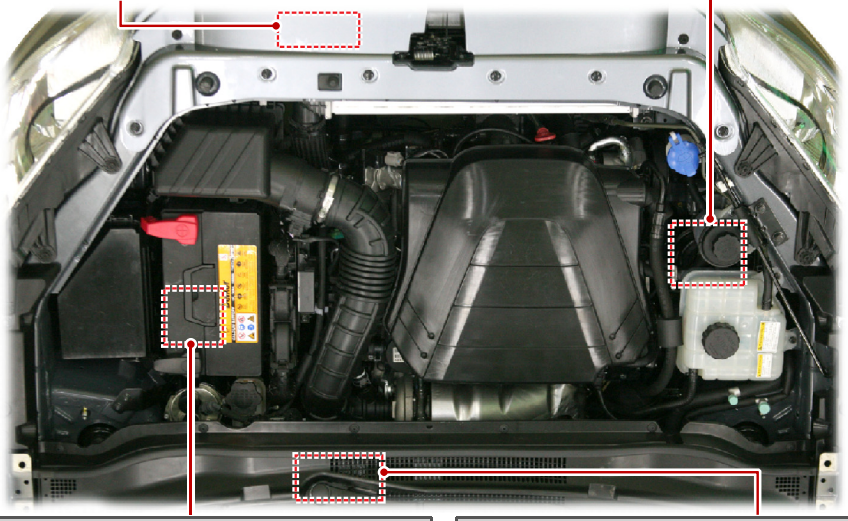
3. ENGINE MOUNTINGS

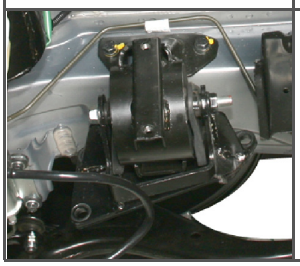
D20DTF engine mounting is 4-point mounting type and supports the engine and transaxle. Front and rear mountings are rubber type and support the torque reaction. Left and right mountings support the power train rods and torque reaction. Additionally, left mounting is hydraulic type and supports the engine vibration.

▶ **Components**

Front mounting assembly Location: Front side of transfer axle housing and front side of sub frame	
Location	Front mounting
	

Right mounting assembly Location: Engine block side and body side member	
Location	Right mounting



Left mounting assembly Location: Upper side of transfer axle housing and body side member	
Location	Left mounting
	

Rear mounting assembly Location: Rear side of transfer axle housing and front side of sub frame	
Location	Rear mounting

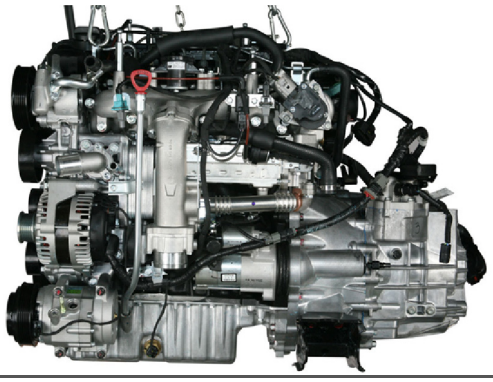
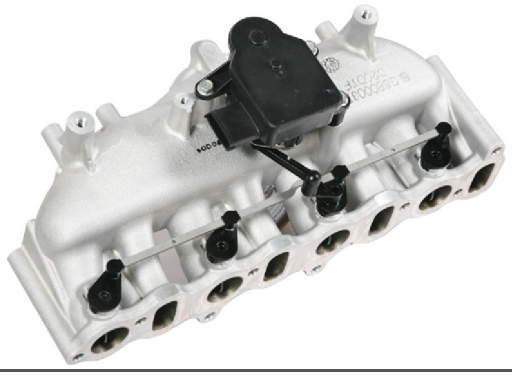
Downloaded from www.Manualslib.com manuals search engine

4. INTAKE/EXHAUST SYSTEM

1) Intake Manifold

Intake manifold is installed on the cylinder head with 8 bolts. The variable swirl valve is introduced to improve the EGR gas mixture and turbulence in combustion chamber and to decrease the exhaust gas.

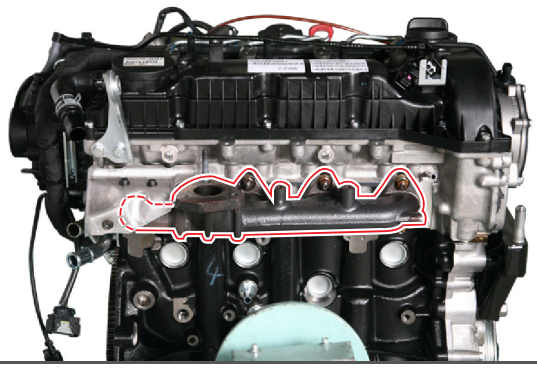
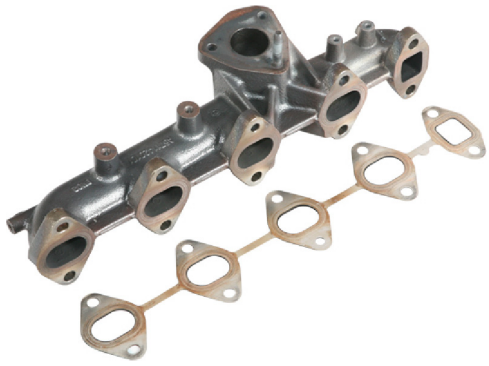
▶ **Components**

Intake manifold	
	

2) Exhaust Manifold

Exhaust manifold is installed on the cylinder head with 10 stud bolts and nuts. EGR port is integrated in cylinder head.

▶ **Components**

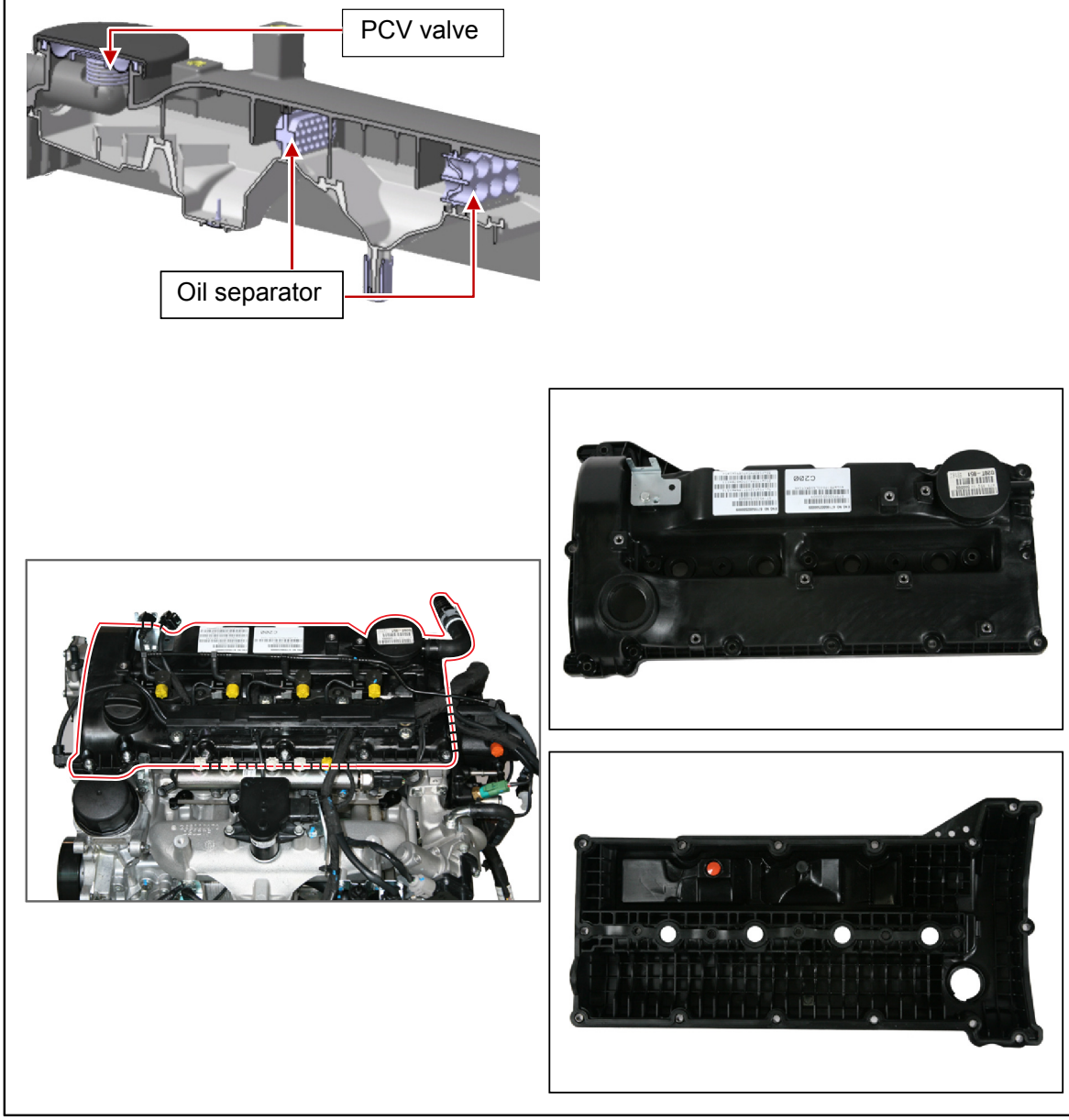
Exhaust manifold	
	

Downloaded from www.Manualslib.com manuals search engine

5. CYLINDER HEAD COVER AND OIL SEPARATOR

The cylinder head cover is made by high strength plastic to reduce the weight. The multi twist type oil separator improves the oil consumption.

▶ Components

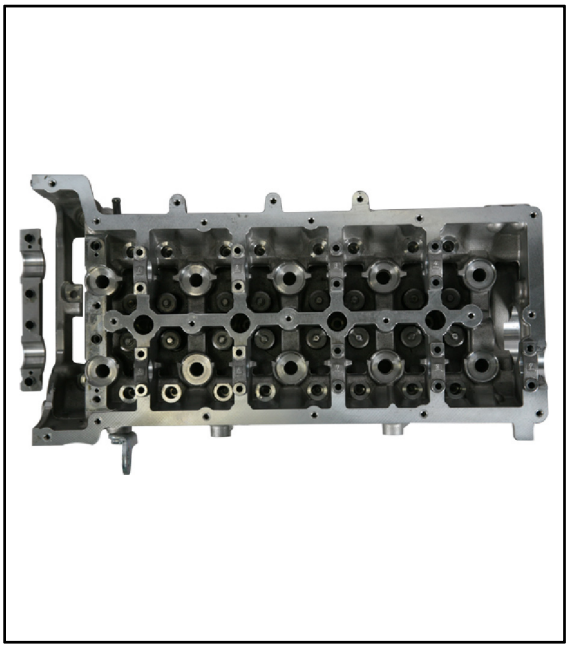


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

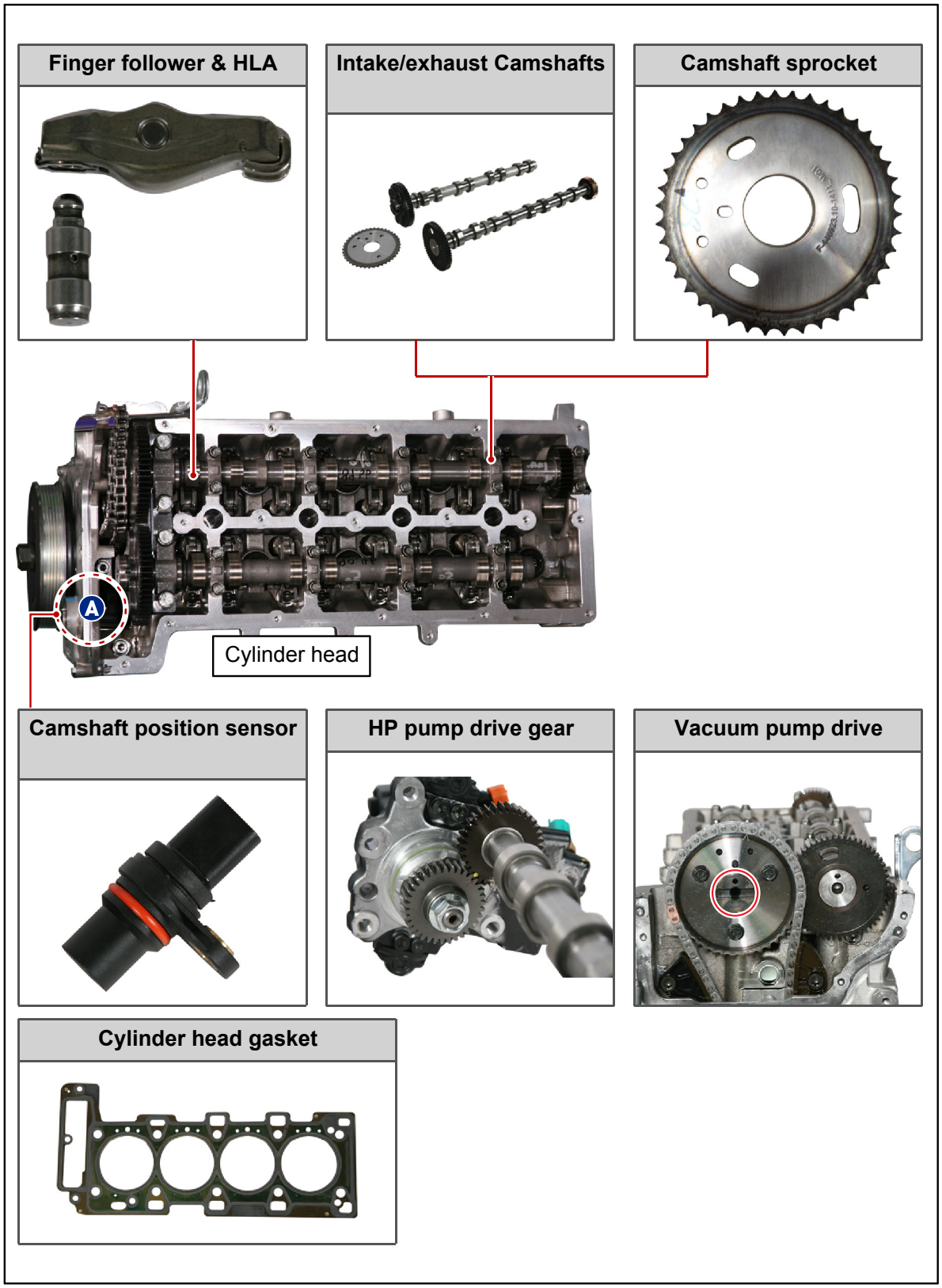
6. CYLINDER HEAD

Cylinder head contains cam position sensor, vacuum pump, intake manifold, exhaust manifold and valve assembly. Vacuum pump and the high pressure (HP) pump are driven by Camshaft and valves are install in vertical direction. This enables the compact layout in cylinder head assembly.



Downloaded from www.Manualslib.com manuals search engine

▶ Components



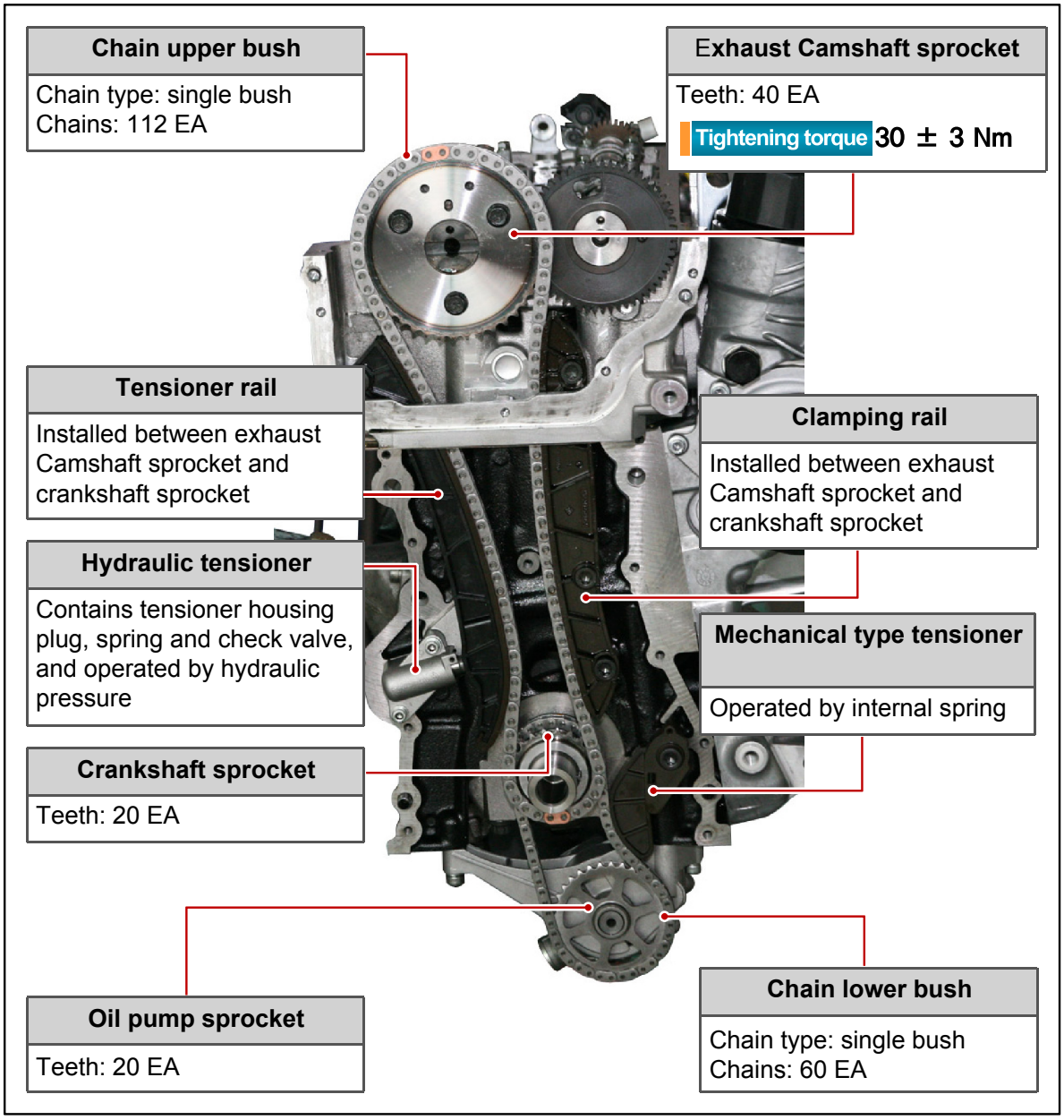
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

7. CHAIN AND GEAR DRIVE SYSTEM

D20DTF engine uses single stage chain drive system. Timing chain drives the exhaust side and gear drive the intake side. Timing chain is single bush type. Upper chain drives HP pump connected to intake Camshaft by driving exhaust cam shift sprocke, and lower chain drives oil pump to lubricate the engine. And, MBU (Mass Balance shaft Unit) drive gear drives MBU.

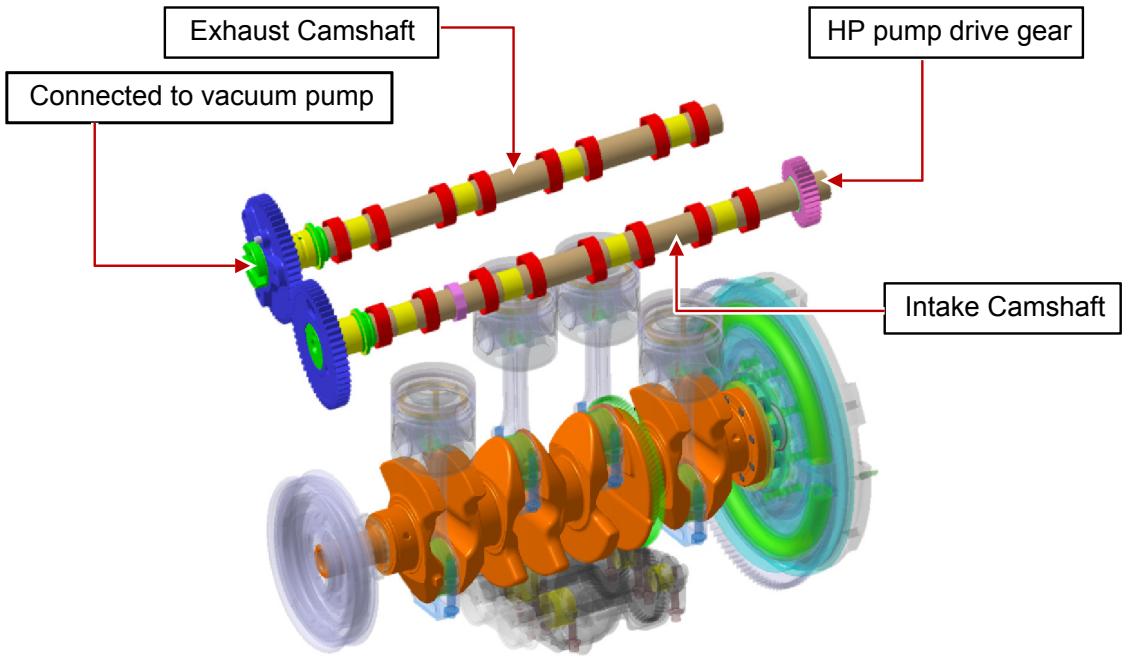
▶ **Components**

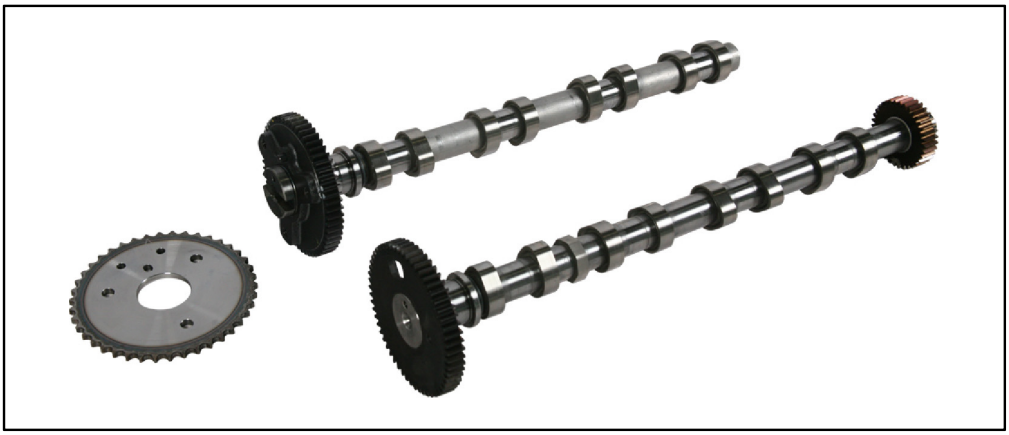


Downloaded from www.Manualslib.com manuals search engine

▶ Components

Intake/exhaust Camshaft assembly

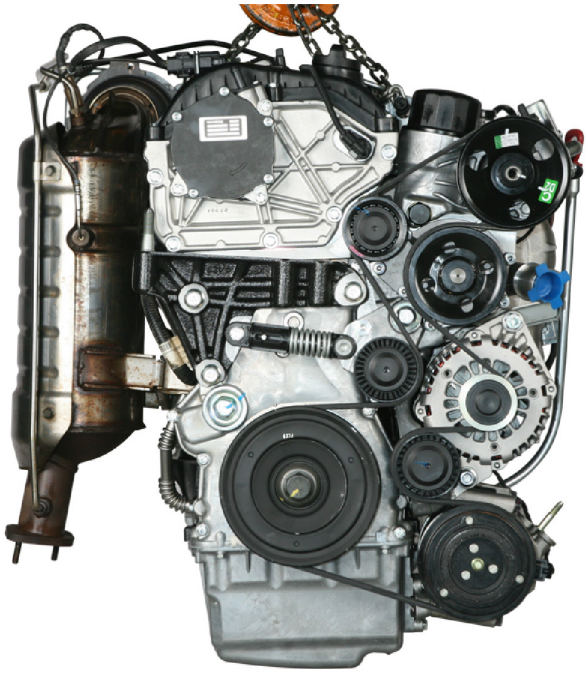




Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Timing gear cover case (TGCC)



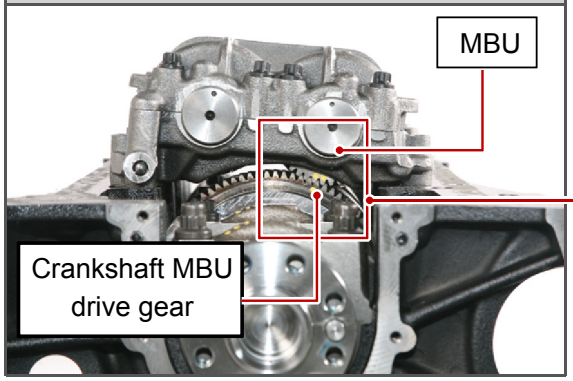
TGCC

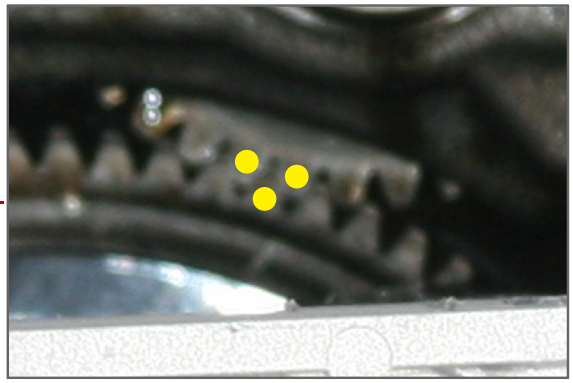
Oil seal

Screw plug

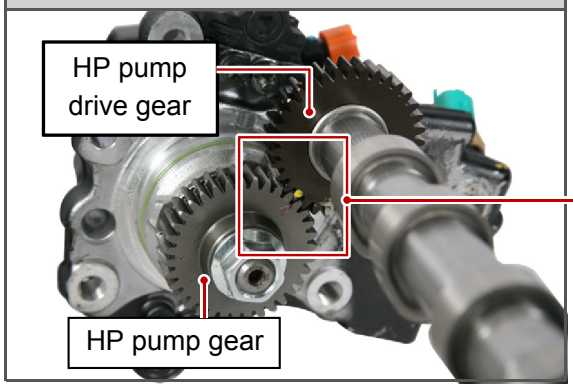
Downloaded from www.Manualslib.com manuals search engine

Mass Balance Unit (MBU)





Fuel HP pump



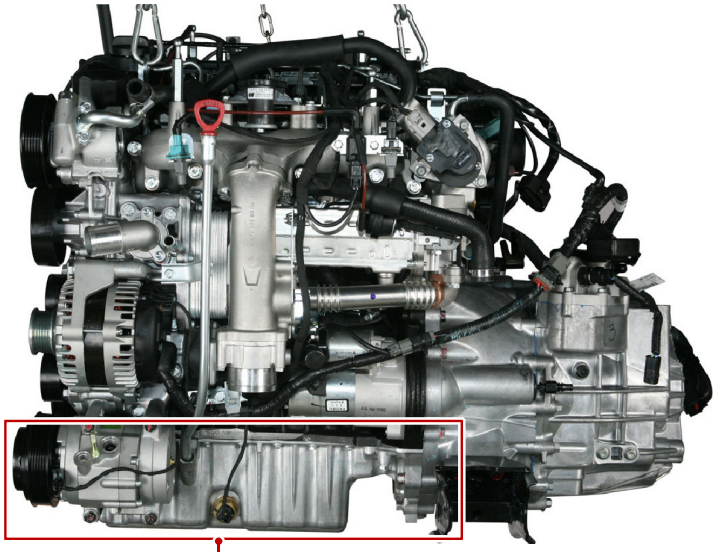
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

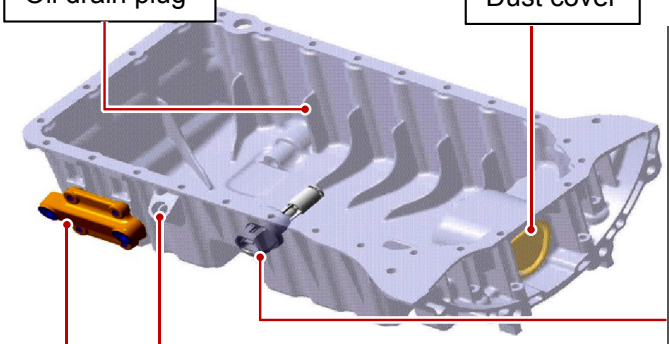
8. OIL PAN

The oil pan in D20DTF engine improves the noise and vibration. Especially, the oil drainage is very easier than before. The oil level sensor in oil pan monitors the oil level and turns on the oil level warning lamp on the meter cluster when the oil level goes down below the specified value. And, A/C compressor bracket and the oil dipstick tube are mounted on the oil pan.

▶ Components



Oil pan assembly



Oil level sensor

For details, refer to Chapter "Engine Control"

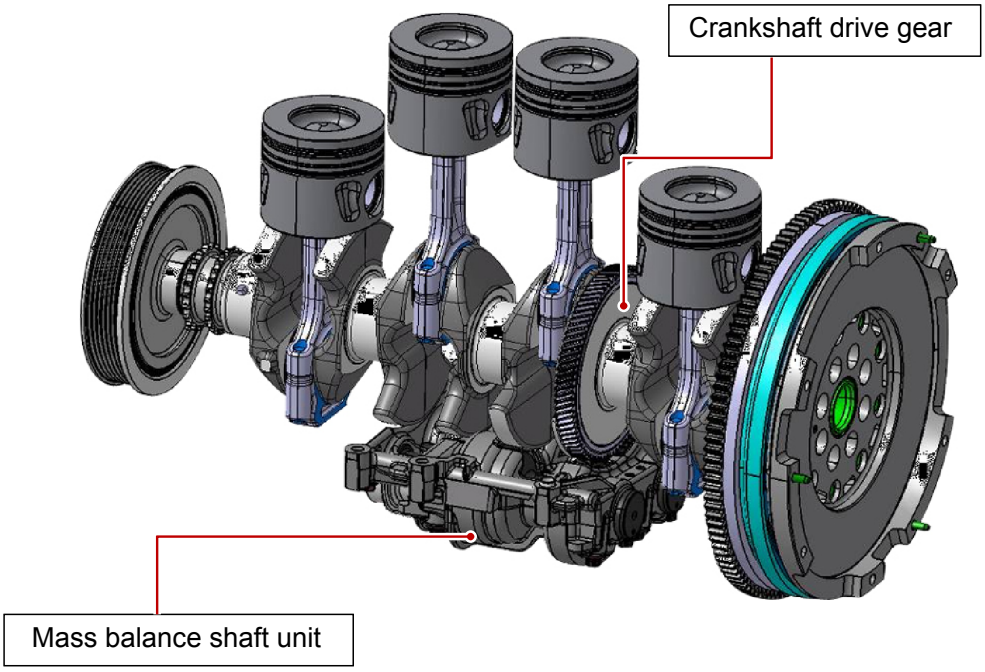
Modification basis	
Application basis	
Affected VIN	

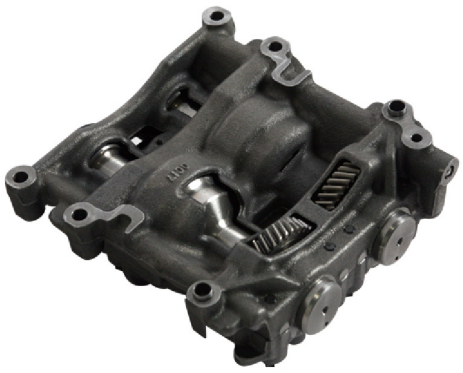
Downloaded from www.Manualslib.com manuals search engine

9. MASS BALANCE SHAFT UNIT (MBU)

The balance shaft in MBU (Mass Balance shaft Unit) improves the NVH performance by decreasing the unbalanced force.

▶ **Components**



Mass balance shaft unit


Modification basis	
Application basis	
Affected VIN	

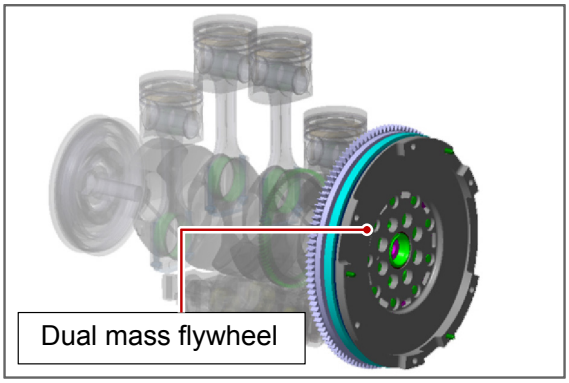
Downloaded from www.Manualslib.com manuals search engine

10. FLYWHEEL AND DRIVE PLATE

1) DMF (Dual Mass Flywheel)

The dual mass flywheel, or DMF, eliminates excessive transmission gear rattle, reduces gear change/shift effort, and increases fuel economy. There is a friction ring located between the inner and outer flywheel that allows the inner and outer flywheel to slip. This feature is designed to alleviate any damage to the transmission when torque loads exceed the vehicle rating of the transmission. The friction ring is the weak spot in the system and can wear out if excessive engine torque loads are applied through it. The system also has a center support bearing that carries the load between the inner and outer flywheel, and is fitted with damper springs to absorb shocks.

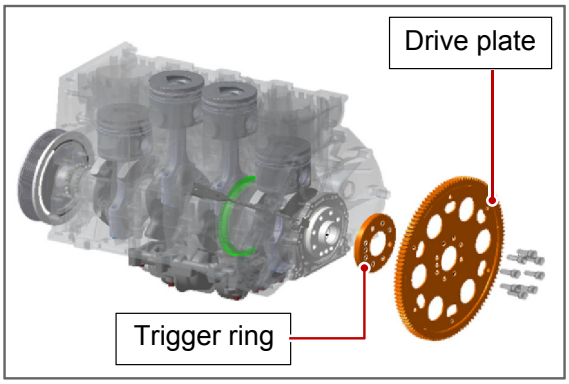
▶ **Components**



2) Drive Plate

Drive plate receives the power from the start motor when starting the engine. With this, the drive plate initially drives the power train system. And, it is connected to the torque converter to transfer the engine torque to the power train system.

▶ **Components**

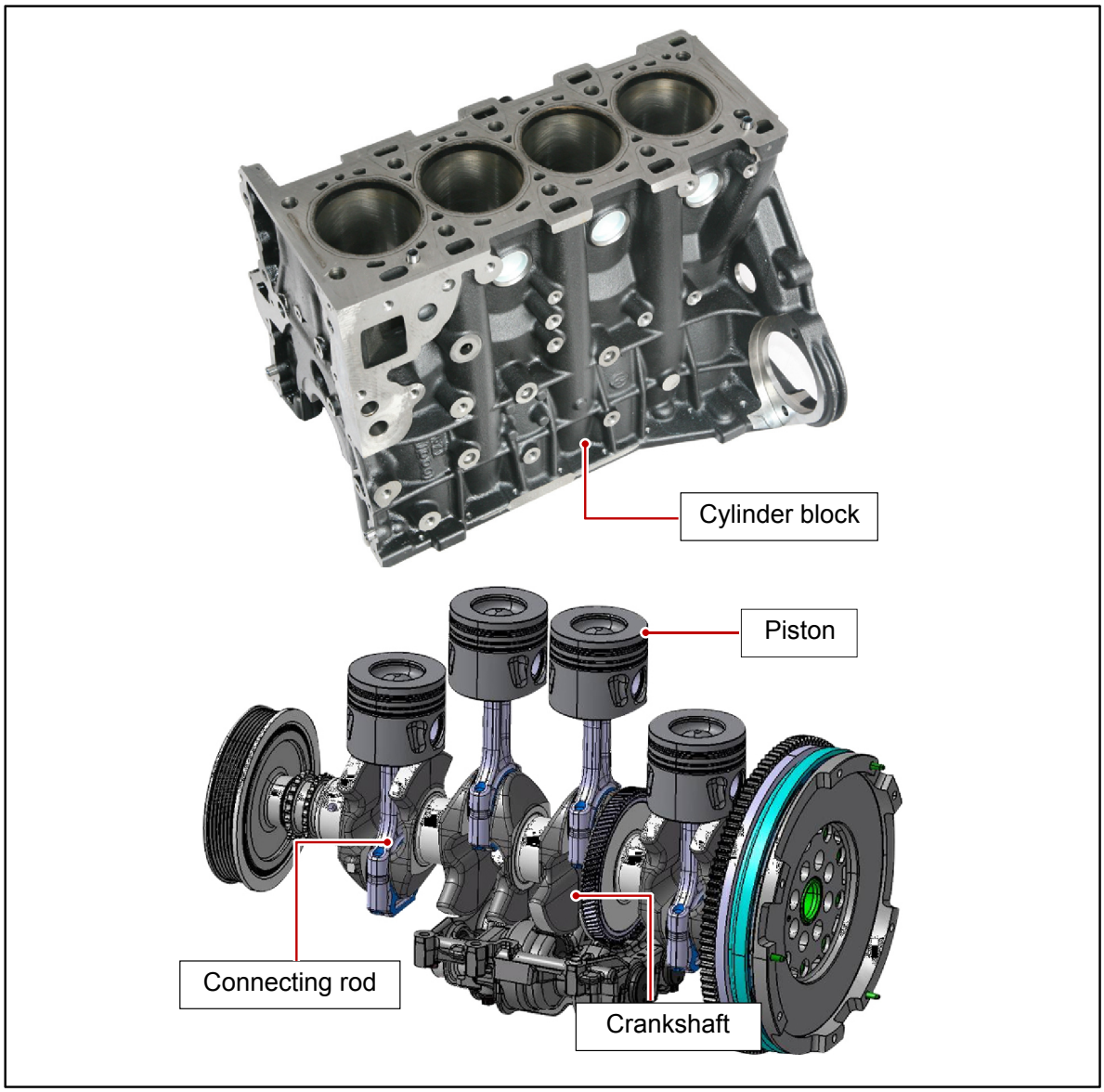


Downloaded from www.Manualslib.com manuals search engine

11. PISTON/CRANKSHAFT/CYLINDER BLOCK

This vehicle is FF driving type and the engine is installed in lateral direction. The crankshaft and the cylinder block convert the compression pressure to the rotating energy.

▶ **Components**



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Description		Specification
Fuel		Diesel
Fuel filter	Type	Fuel heater + priming pump + water separator integrated type
	Filter type	Changeable filter element type
	Change interval	every 50,000 km
	Water separation interval	every 20,000 km
	Water accumulating capacity	200 cc
	Heater capacity	250W 13.5V
Injector	System pressure	1800 bar
High pressure fuel pump	Type	Eccentric cam/Plunger type
	Operating type	Gear driven type
	Normal operating temperature	−40 ~ 125℃
	Operating pressure	1800 bar
	Operating temperature	−30℃ ~ 120℃
Low pressure fuel pump	Type	Vane type
	Gear ratio (pump/engine)	0.5 : 1
	Pressure	6 bar
Fuel tank	Capacity	60 L
	Material	Plastic
	Fuel sender	Dual sender type

Downloaded from www.Manualslib.com manuals search engine

2. MAINTENANCE AND INSPECTION

1) Maintenance Procedures for DI Engine Fuel System

1. Always keep the workshop and lift clean (especially, from dust).
2. Always keep the tools clean (from oil or foreign materials).
3. Wear a clean vinyl apron to prevent the fuzz, dust and foreign materials from getting into fuel system. Wash your hands and do not wear working gloves.

NOTE

Follow the below procedures before starting service works for fuel system.

Carefully listen the symptoms and problems from customer.

↓

Visually check the leaks and vehicle appearance on the wiring harnesses and connectors in engine compartment.

↓

Perform the diagnosis proceee with SCAN tool

↓

Locate the fault. If the cause is from fuel system (from priming pump to injector, including return line), follow the step 1 through step 3 above.

↓

4. If the problem is from HP pump, fuel supply line or injector, prepare the clean special tools and sealing caps to perform the diagnosis for DI engine fuel system in this manual. At this point, thoroughly clean the related area in engine compartment.

CAUTION

Clean the engine compartment before starting service works.

Tool kit for high pressure line	Took kit for low pressure line

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

5. Follow the job procedures. If you find a defective component, replace it with new one.

Disconnect the negative battery cable.

↓

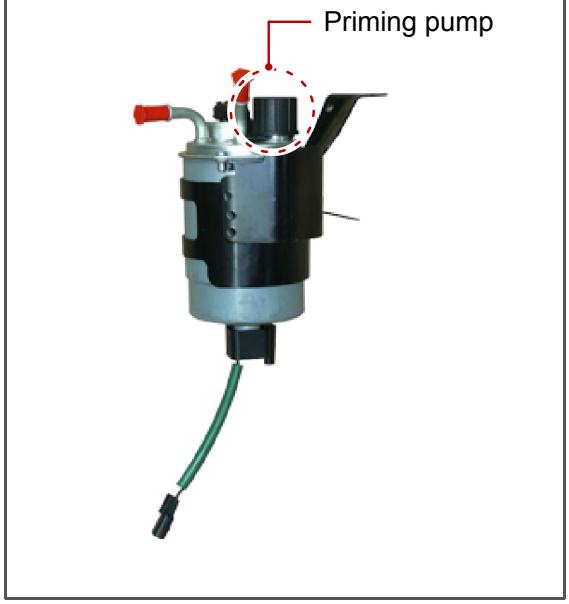
Use special tools and torque wrench to perform the correct works.

Once disconnected, the fuel pipes between HP pump and fuel rail and between fuel rail and each injector should be replaced with new ones. The pipes should be tightened tospecified tightening torques during installation. Over or under torques out of specified range may cause damages and leaks at connections. Once installed, the pipes have been deformed according to the force during installation, therefore they are not reusable. The copper washer on injector should be replaced with new one. The injector holder bolt should be tightened to specified tightening torque as well. If not, the injection point may be deviated from correct position, and it may cause engine disorder.

Plug the disconnected parts with sealing caps, and remove the caps immediately before replacing the components.

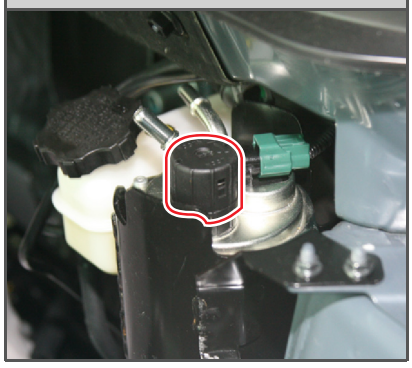
6. Plug the removed components with clean and undamaged sealing caps and store it into the box to keep the conditions when it was installed.

Fuel filter assembly



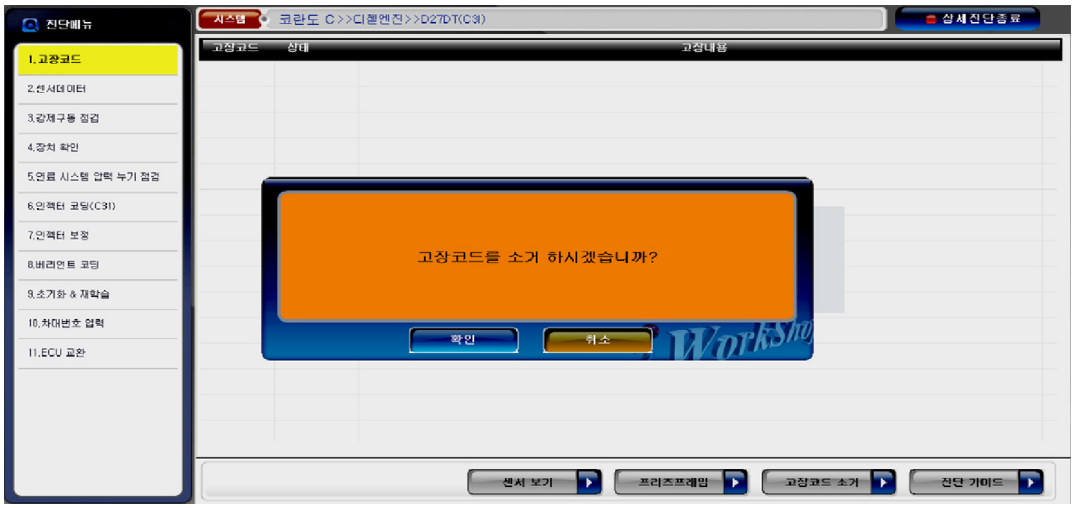
7. To supply the fuel to transfer line of HP pump press the priming pump until it becomes hard.

Priming pump cap



Downloaded from www.Manualslib.com manuals search engine

8. Check the installed components again and connect the negative battery cable. Start the engine and check the operating status.
9. With Scan Tool, check if there are current faults and erase the history faults.



Modification basis	
Application basis	
Affected VIN	

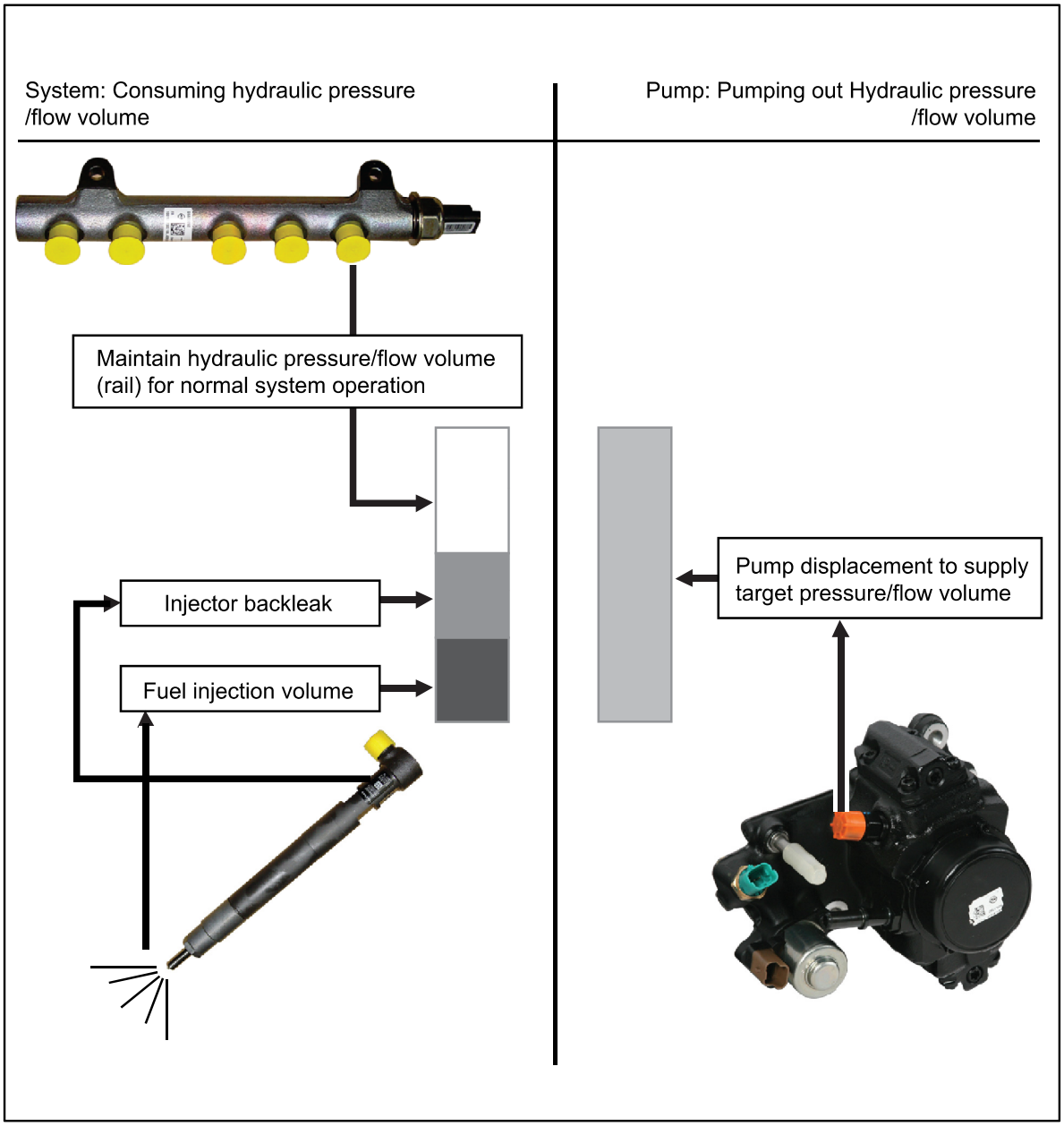
Downloaded from www.Manualslib.com manuals search engine

2) Diagnostic Test for Engine Fuel System

(1) Overview

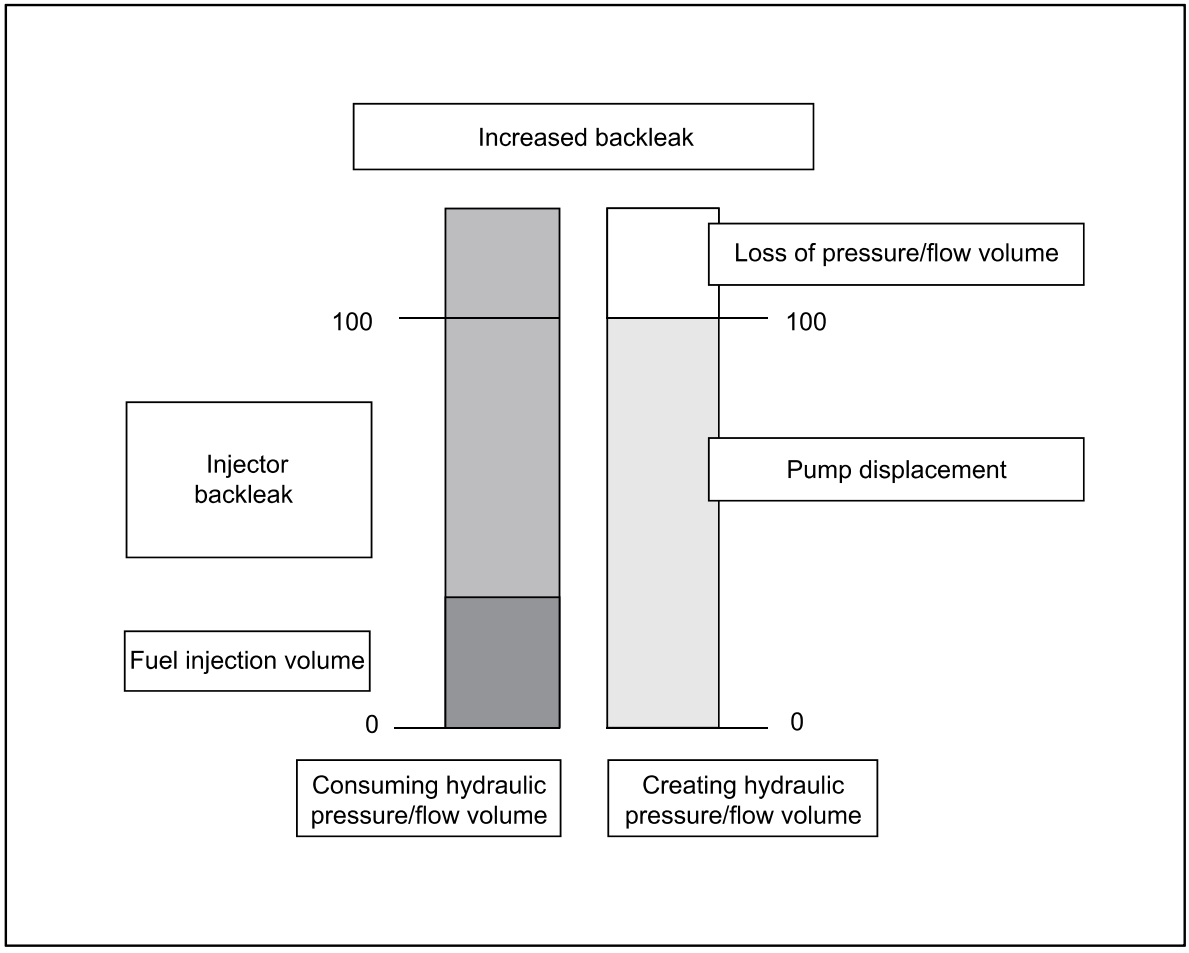
If a DTC is displayed on the diagnostic device, check the low pressure- and high pressure fuel systems before removing the components.
To run the system properly, the electric system must be intact but for the DI engine, the fuel pressure should be measured also when there is a malfunction even after the diagnostic test with a diagnostic device.

(2) Hydraulic system



Downloaded from www.Manualslib.com manuals search engine

(3) Excessive backleak of injector



▶ **Excessive injector backleak**

Occurs when the injector control valve is not sealed due to the entry of the foreign materials.

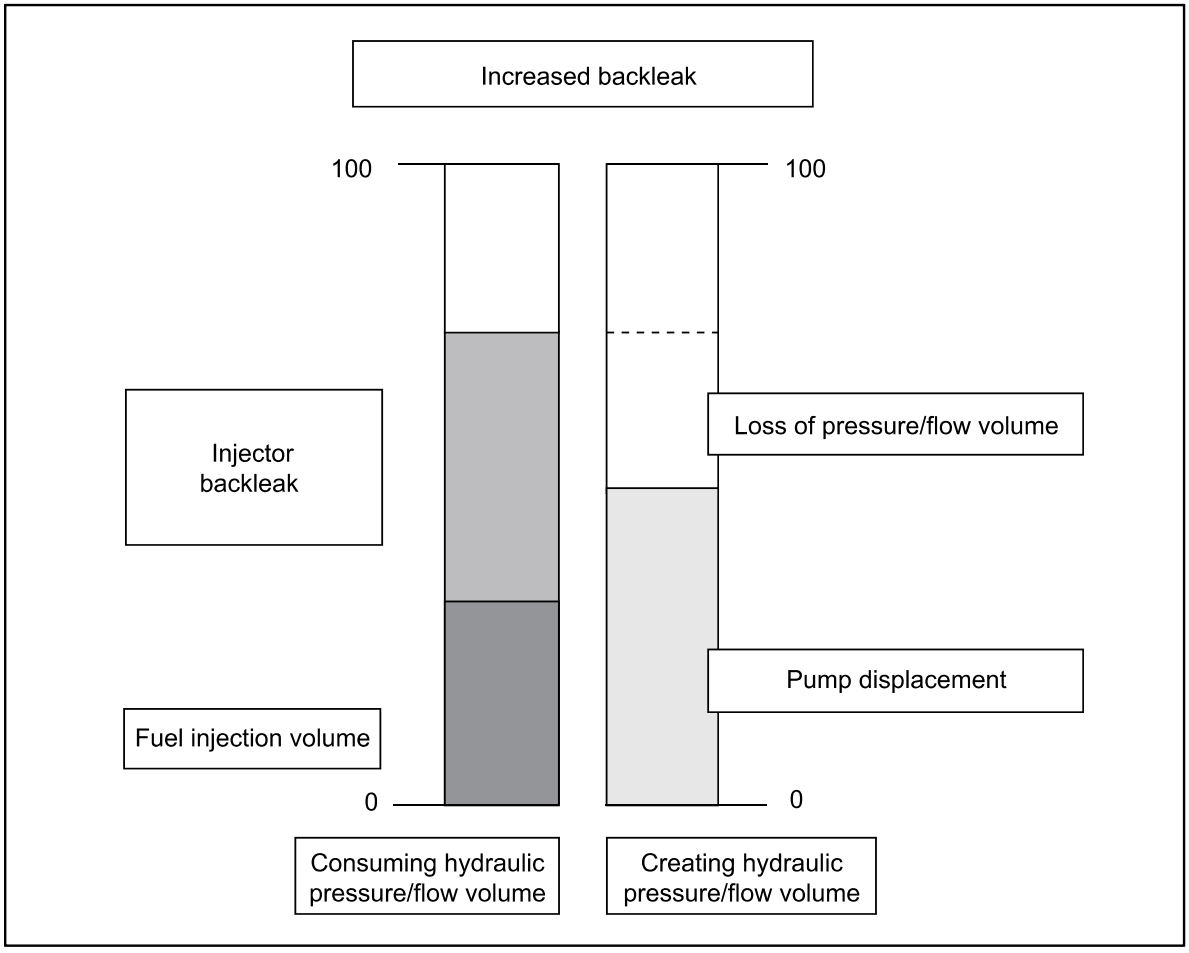
▶ **Example:**

- Entry of foreign materials
- Burned out and worn HP pump
- Mechanical damage inside the injector

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(4) Loss of pump pressure/flow



▶ Loss of HP pump pressure/flow

Faulty fuel supply line, or damaged or worn pump causes the lack of flow pressure and flow volume

▶ Example:

- Air in fuel supply line
- Excessive load on fuel supply line (←400 mBar)
- Burned out and mechanical worn pump
- High temperature of fuel supply (> 85℃)

Downloaded from www.Manualslib.com manuals search engine

3) DI Engine Fuel System Pressure Test

(1) Test device (Tool kit)

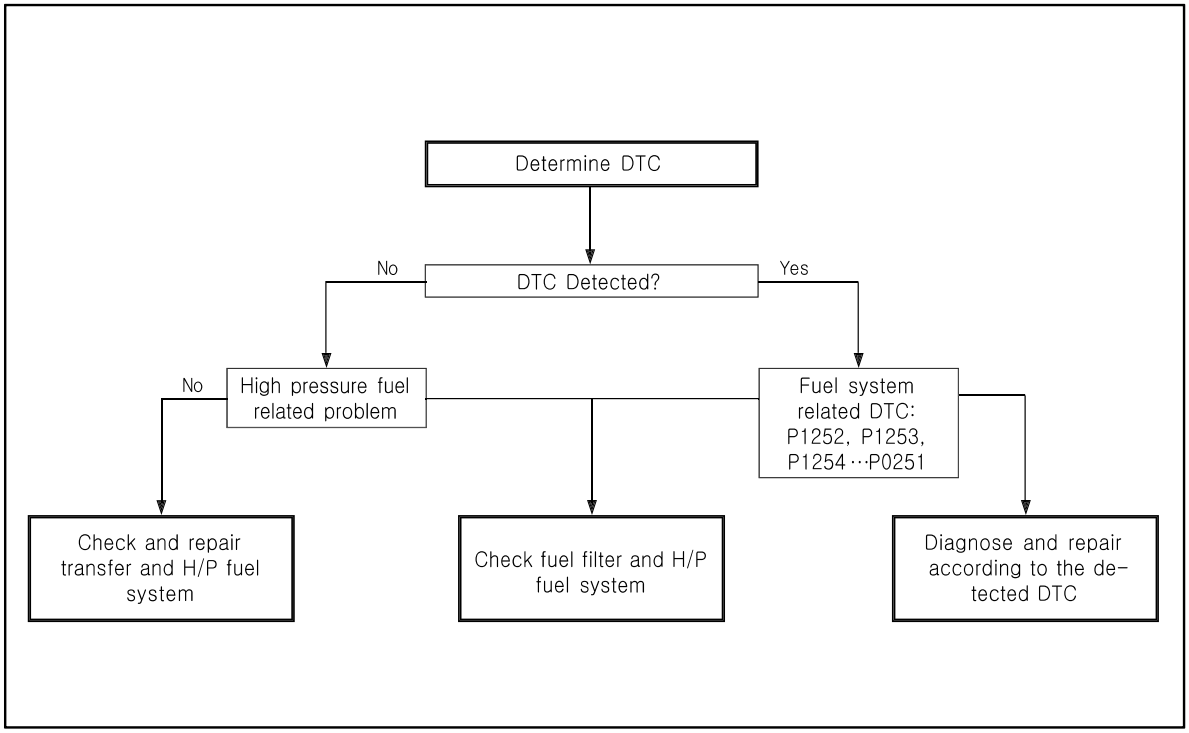
Device for high pressure
Device for low pressure

(2) Pre-check

- Check-tighten fuel supply line
- Check fuel level in fuel tank
- Check air in fuel supply line (bubble in fuel supply line or fuel)
- Check fuel supply line for leaks (low pressure and high pressure)
- Check that specified fuel is used
- Check fuel filter for contamination

Downloaded from www.Manualslib.com manuals search engine

(3) DI Engine Fuel System Check Procedure

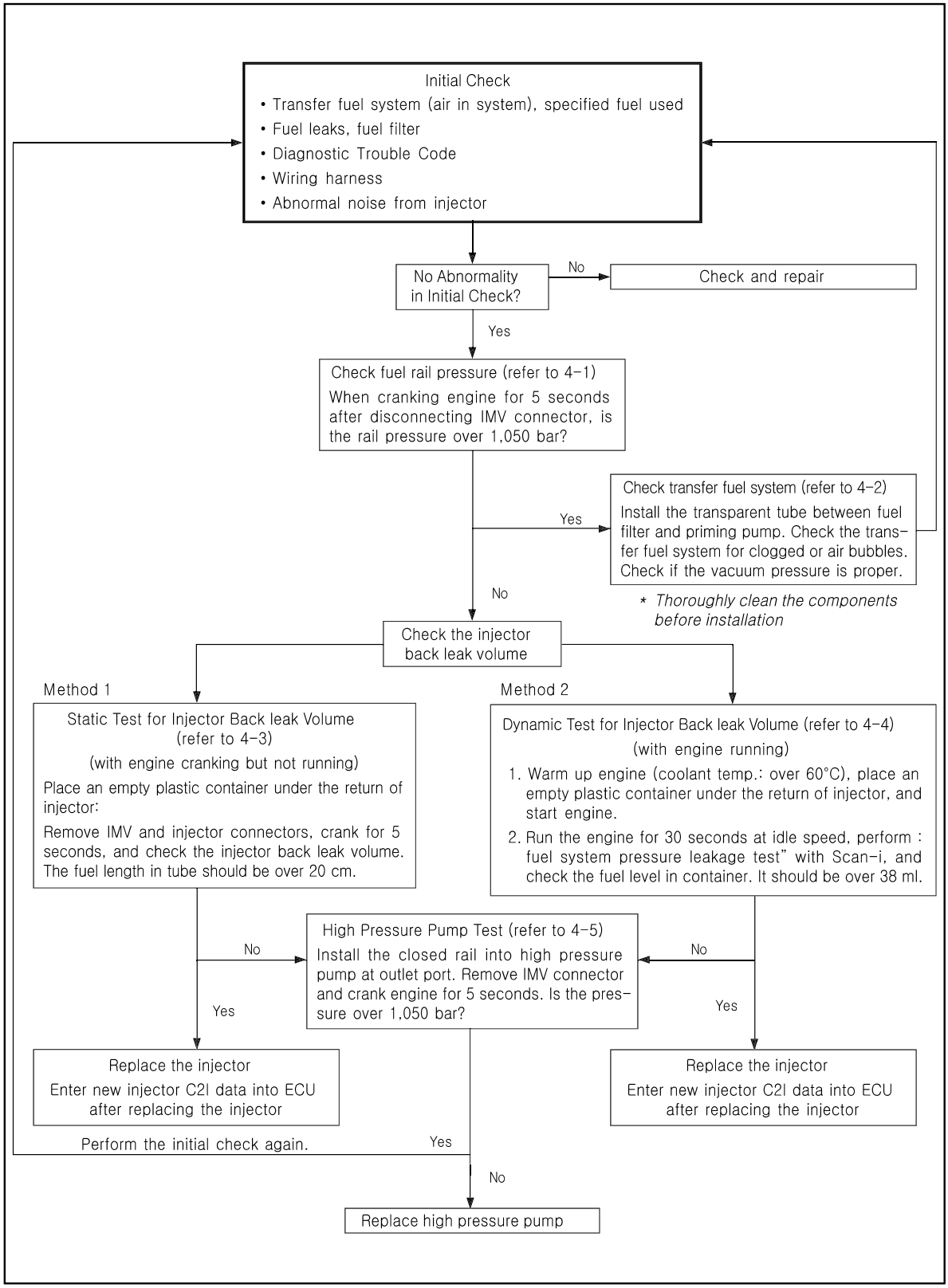


CAUTION

If several DTCs are output simultaneously, check the electric wiring for open or short circuit. Check the low pressure fuel system and fuel filter and confirm that there are no abnormalities. Carry out the high pressure fuel system check.

Downloaded from www.Manualslib.com manuals search engine

(4) Fuel System Check Procedure

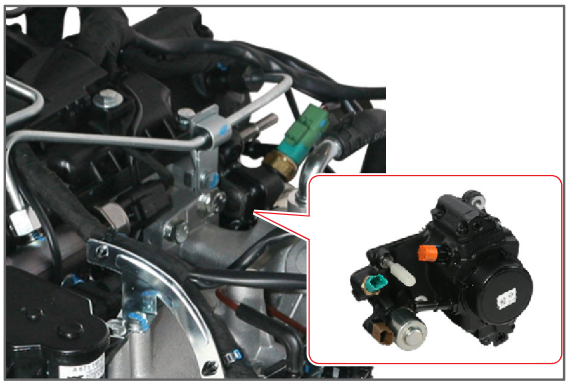


Modification basis	
Application basis	
Affected VIN	

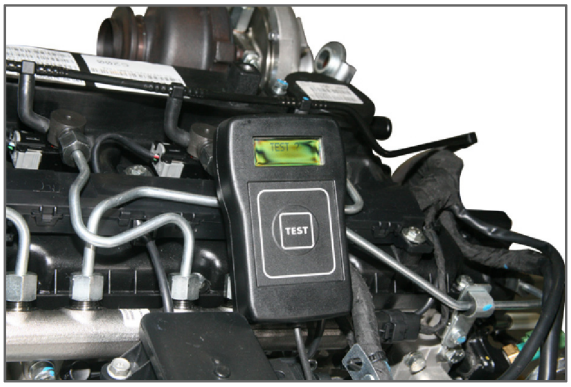
Downloaded from www.Manualslib.com manuals search engine

(5) High Pressure System Pressure Test

▶ **Fuel rail pressure test**



1. Disconnect the fuel rail pressure sensor connector and then IMV connector.



2. Connect the pressure tester to the fuel rail pressure sensor connector.

3. Crank the engine 2 times for 5 seconds.
   - Read the highest pressure value displayed on the tester display.
   - If the highest pressure value is 1,050 bar or less, refer to the section "Fuel System Check Process".

Downloaded from www.Manualslib.com manuals search engine

▶ How To Use Pressure Tester

1. Press the "TEST" button on the tester to check if the message "TEST?" is displayed.
2. If the button is pressed again at 4 seconds after starting engine cranking, the highest pressure is displayed on the tester.

NOTE

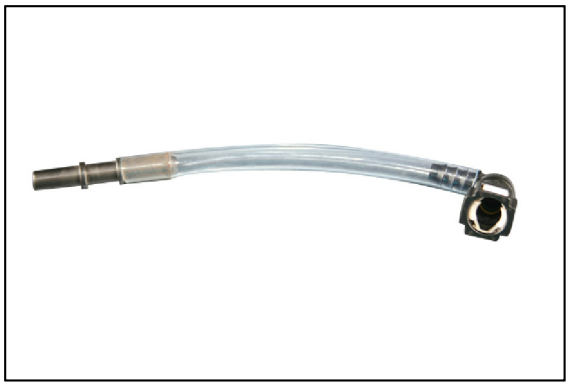
The fuel rail pressure value can be checked using a diagnostic device.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

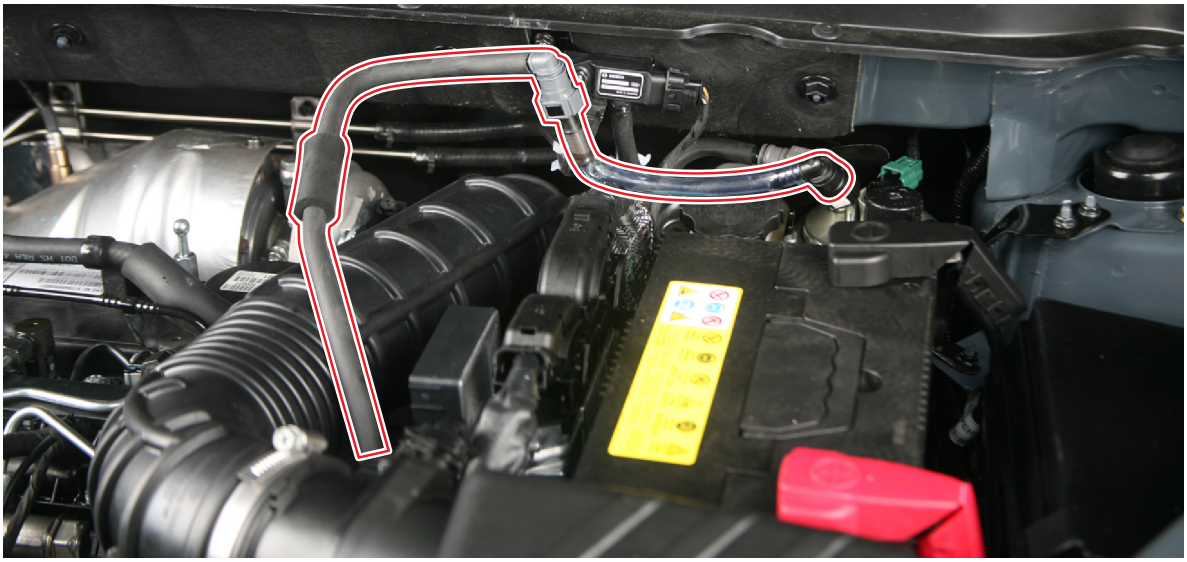
(6) Low Pressure System Pressure Test

▶ **Inspection procedure**



1. All wirings/connectors and fuel lines should be connected and the engine should work properly.
2. Prepare a special tool for low pressure test and clean it thoroughly to prevent foreign materials from entering.

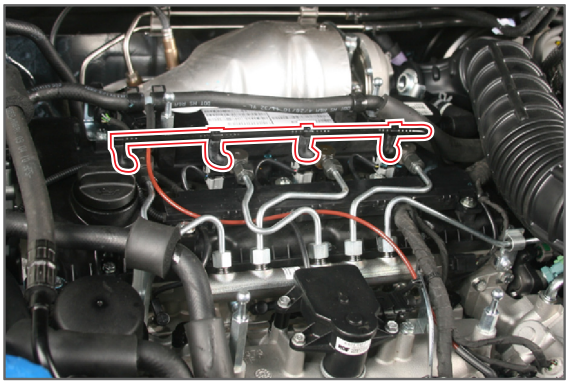
3. Disconnect the key connector for fuel filter connection, and connect both connectors to the fuel filter and hose.



4. Start the engine and check visually for clogged low pressure fuel system, excessive air or air entry.
5. If the fuel flow is not sufficient or air is in the fuel, repair the leak area.

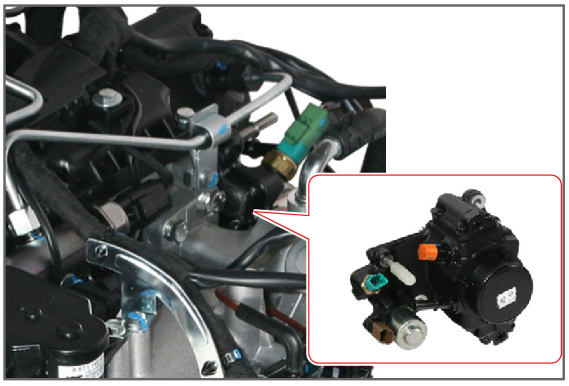
Downloaded from www.Manualslib.com manuals search engine

▶ Static test for backleak of injector



1. Disconnect the injector return hose and cover the openings with caps shaped screw (included in the special tool).

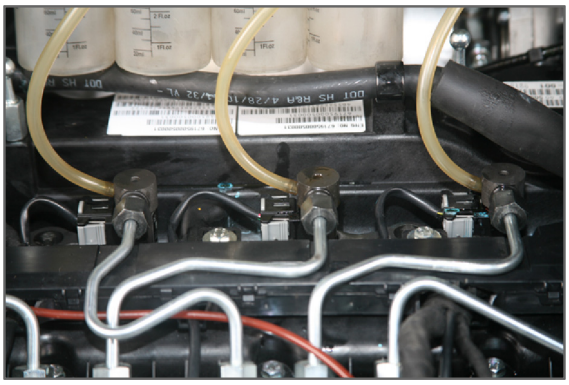
2. Connect the hose of the container for measuring backleak to the return nipple of the injector.
(prevent air entry to the low pressure line)



3. Disconnect the IMV connector of the high pressure pump and then fuel pressure sensor connector.

CAUTION

The connector of the injector can be easily contaminated. Always keep it clean.



4. Crank the engine 2 times for 5 seconds.
5. Check the time for flow if injector backleak and confirm that it is within the specified range.

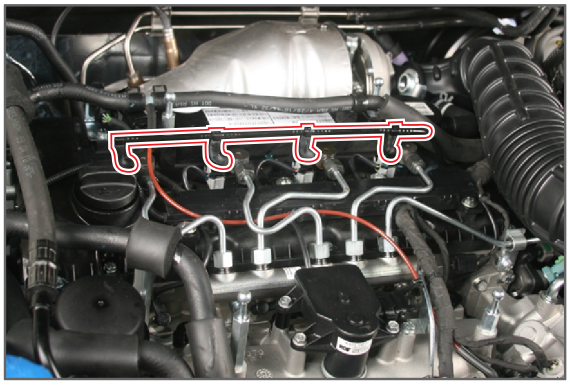
Specification	Below 20 sec.

NOTE

If the value is out of the specified range, replace the injector.

Downloaded from www.Manualslib.com manuals search engine

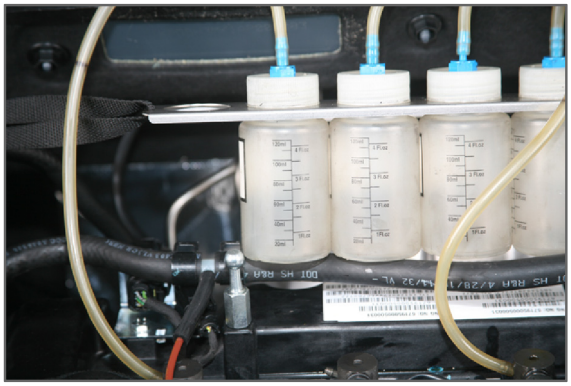
▶ Dynamic test for backleak of injector



1. Warm up the engine so that the engine coolant temperature be over 80℃ and star the engine again.
2. Disconnect the injector return hose and cover the openings with caps shaped screw (included in the special tool).

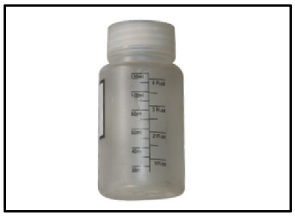
3. Connect the hose of the container for measuring backleak to the return nipple of the injector.
4. Start the engine again and let the engine idle for 30 seconds.
5. Perform backleak test of fuel system with a diagnostic device after 30 seconds.

This test consists of 4 cycles, and the engine rpm reaches 3,500 rpm for 18 seconds in each cycle.



6. Check the amount of backleak collected into the container and confirm that it is within the specified range.

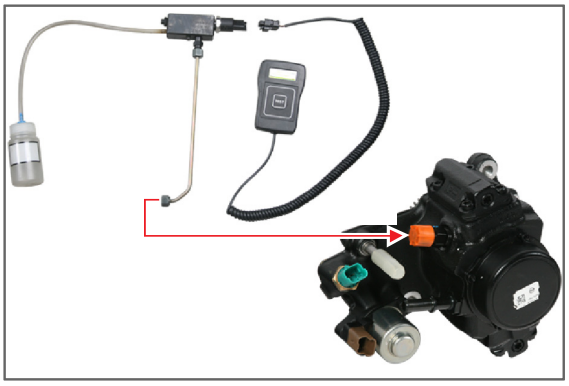
Specification	38 ml or less



Downloaded from www.Manualslib.com manuals search engine

▶ HP pump pressure test

1. Prepare a special tool for high pressure test and clean it thoroughly to prevent foreign materials from entering.



2. Disconnect the high pressure fuel supply pipe on the HP pump and install the close rail in the tool kit.

Tightening torque 30 Nm

3. Connect the other end of the close rail to the fuel rail for test.

Tightening torque 30 Nm

4. Disconnect the return hose for HP pump and connect the clear hose and connect its the other end to the return port of the fuel rail for test.

5. Connect the digital tester connector to the sensor connector of the fuel rail for test.
6. Crank the engine 2 times for 5 seconds after removing the IMV connector and fuel rail pressure sensor connector.
7. Read the pressure value displayed on the tester display is within the specified range.

Specification	1,050 bar or more

Downloaded from www.Manualslib.com manuals search engine

3. CAUTIONS FOR DI ENGINE

1) Cautions for DI Engine

This chapter describes the cautions for DI engine equipped vehicle. This includes the water separation from engine, warning lights, symptoms when engine malfunctioning, causes and actions.

1. DI Engine

Comparatively conventional diesel engines, DI engine controls the fuel injection and timing electrically, delivers high power and reduces less emission.

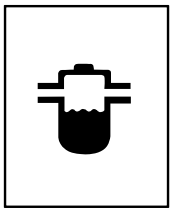
2. System Safety Mode

When a severe failure has been occurred in a vehicle, the system safety mode is activated to protect the system. It reduces the driving force, restricts the engine speed (rpm) and stops engine operation. Refer to "Diagnosis" section in this manual.

3. Engine CHECK Warning Lamp

The Engine CHECK warning lamp on the instrument cluster comes on when the fuel or major electronic systems of the engine are not working properly. As a result, the engine's power output may decrease or the engine may stall.

4. Water Separator Warning Lamp



When the water level inside water separator in fuel filter exceeds a certain level (approx. 45 cc), this warning light comes on and buzzer sounds.
Also, the driving force of the vehicle decreases (torque reduction). If these conditions occur, immediately drain the water from fuel filter.

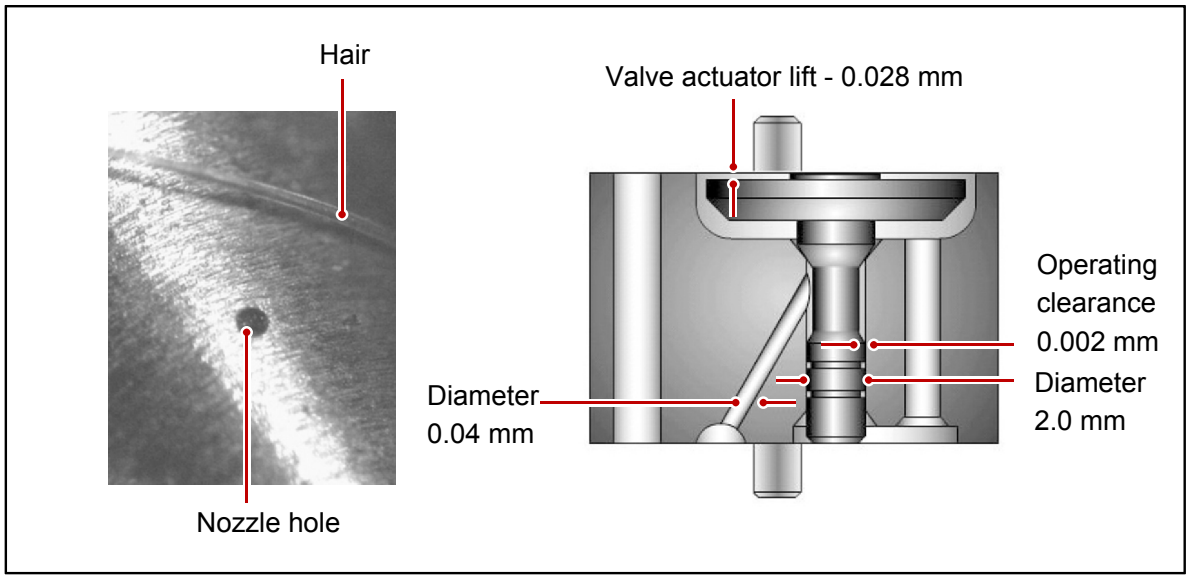
Downloaded from www.Manualslib.com manuals search engine

2) Cleanness

(1) Cleanness of DI engine fuel system

▶ Cleanness of DI engine fuel system and service procedures

The fuel system for DI engine consists of transfer (low pressure) line and high pressure line.
Its highest pressure reaches over 1,600 bar.
Some components in injector and HP pump are machined at the micrometer 100 μm of preciseness.
The pressure regulation and injector operation are done by electric source from engine ECU.
Accordingly, if the internal valve is stuck due to foreign materials, injector remains open.
Even in this case, the HP pump still operates to supply high pressurized fuel. This increases the pressure to combustion chamber (over 250 bar) and may cause fatal damage to engine.
You can compare the thickness of injector nozzle hole and hair as shown in below figure (left side). The below figure shows the clearance between internal operating elements.



The core elements of fuel system has very high preciseness that is easily affected by dust or very small foreign material. Therefore, make sure to keep the preliminary works and job procedures in next pages. If not, lots of system problems and claims may arise.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(2) Di engine and its expected problems and remedies can be caused by water in fuel

▶ System supplement against paraffin separation

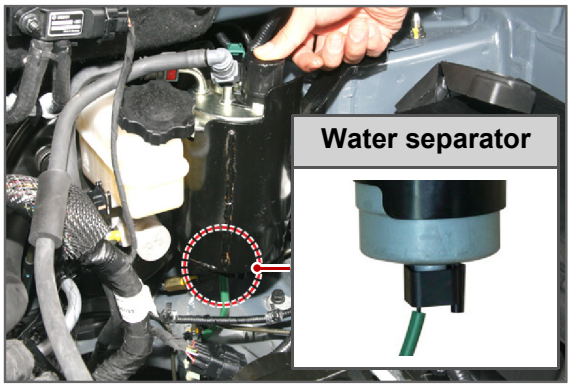
In case of Diesel fuel, paraffin, one of the elements, can be separated from fuel during winter and then can stick on the fuel filter blocking fuel flow and causing difficult starting finally. Oil companies supply summer fuel and winter fuel by differentiating mixing ratio of kerosene and other elements by region and season. However, above phenomenon can be happened if stations have poor facilities or sell improper fuel for the season. In case of DI engine, purity of fuel is very important factor to keep internal preciseness of HP pump and injector.
Accordingly, more dense mesh than conventional fuel filter is used. To prevent fuel filter internal clogging due to paraffin separation, SYMC is using fuel line that high pressure and temperature fuel injected by injector returns through fuel filter to have an effect of built-in heater (see fuel system).

▶ System supplement and remedy against water in fuel

As mentioned above, some gas stations supply fuel with excessive than specified water. In the conventional IDI engine, excessive water in the fuel only causes dropping engine power or engine hunting. However, fuel system in the DI engine consists of precise components so water in the fuel can cause malfunctions of HP pump due to poor lubrication of pump caused by poor coating film during high speed pumping and bacterization (under long period parking). To prevent problems can be caused by excessive water in fuel, water separator is installed inside of fuel filter. When fuel is passing filter, water that has relatively bigger specific gravity is accumulated on the bottom of the filter.

▶ Water drain from water separator

If water in the separator on the fuel filter exceeds a certain level, it will be supplied to HP pump with fuel, so the engine ECU turns on warning lamp on the meter cluster and buzzer if water level is higher than a certain level.
Due to engine layout, a customer cannot easily drain water from fuel filter directly, so if a customer checks in to change engine oil, be sure to perform water drain from fuel filter.

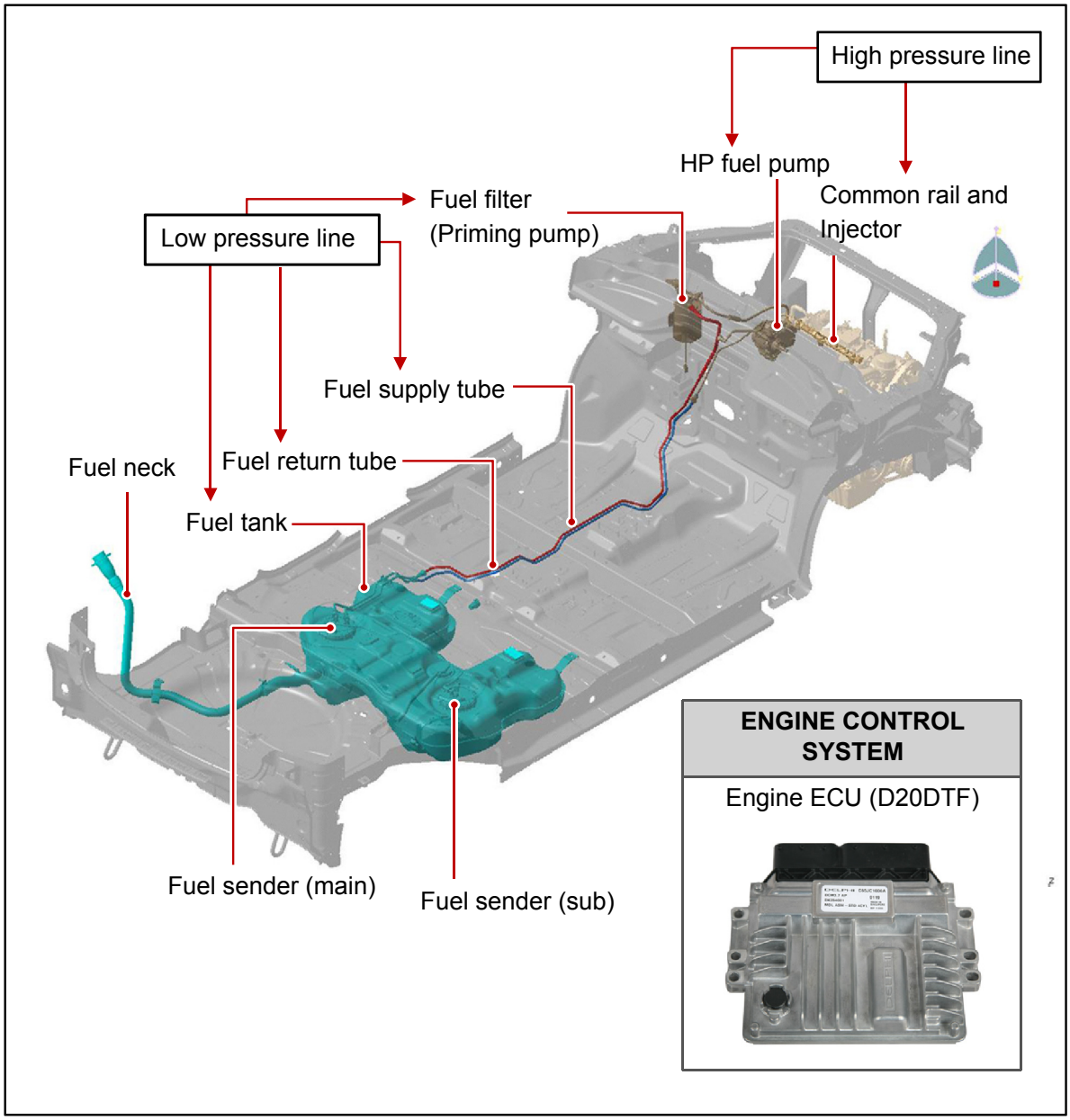


Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

The components in the fuel system supply fuel and generate high pressure to inject fuel to each injector. They are controlled by the engine ECU.
The common rail fuel injection system consists of fuel tank, fuel line, low pressure line which supplies low pressure fuel to the low pressure pump (includes high pressure pump), high pressure line which connected to the injector and the engine control unit (ECU) which calculates the accelerator pedal position and controls the overall performance of vehicle based on the input signals from various sensors.



Modification basis	
Application basis	
Affected VIN	

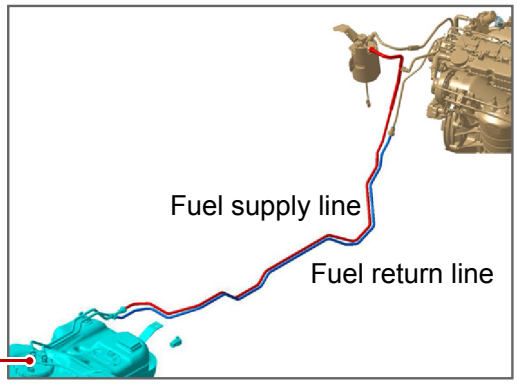
Downloaded from www.Manualslib.com manuals search engine

2. SYSTEM LAYOUT AND OPERATION

1) Layout

NOTE

For sensor and actuator control logic, refer to Chapter "ENGINE CONTROL".

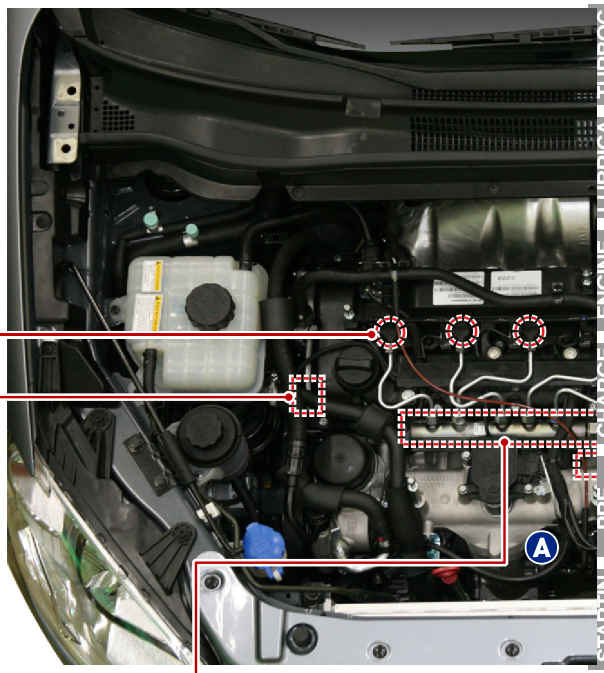


Fuel tank

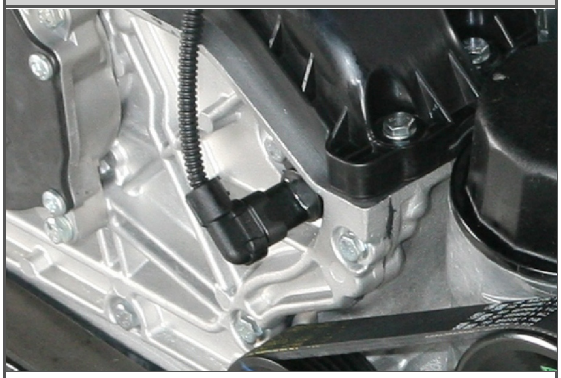
Fuel metering by dual sender. Supply the fuel in main fuel tank and sub fuel tank through fuel inlet tube

Injector (C3I)

Pre-injection, main injection, after-injection by signals from ECU

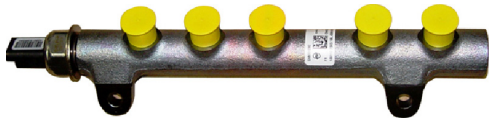


Camshaft position sensor



Determines the injection order.

Fuel rail assembly



Relieves the pulsation.
Measures the fuel pressure.
Distributes the fuel to injectors.

Downloaded from www.Manualslib.com manuals search engine

High pressure pump

Plunger type HP pump (1,800 bar)

Vane type transfer pump (6bar)

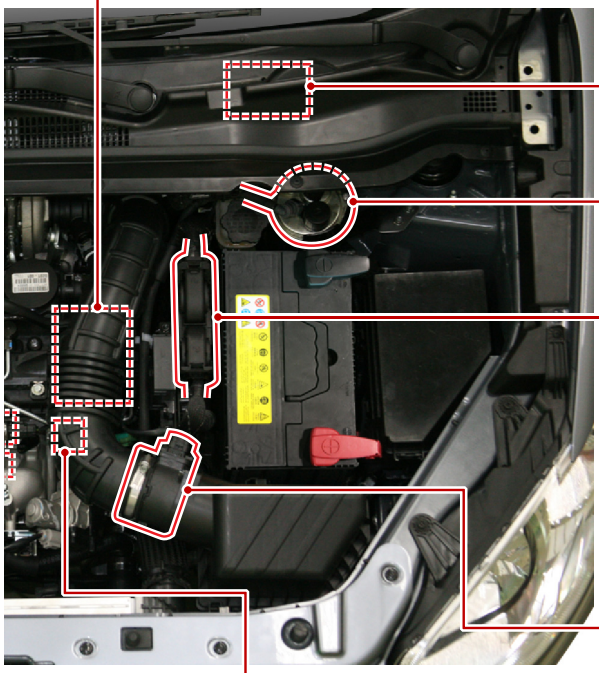
Generates the high pressurized fuel and supply it.

Accelerator pedal position sensor

Detects driver's intention for speed up/down

Fuel filter assembly

Supply clean fuel/fuel heating/water separation by priming pump



Engine ECU (D20DTF)

Engine control by various signals

Crankshaft position sensor

Measuring engine rpm

T-MAP sensor

Measuring booster pressure and temperature

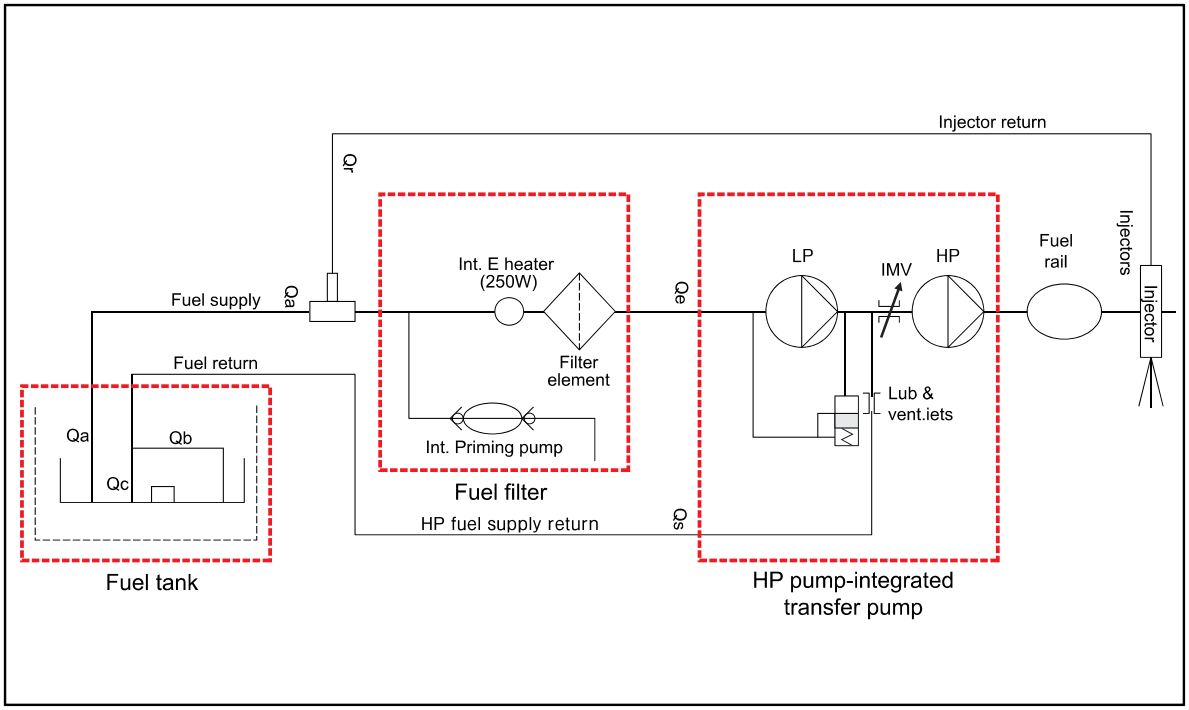
HFM

Measuring intake air mass and temperature

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

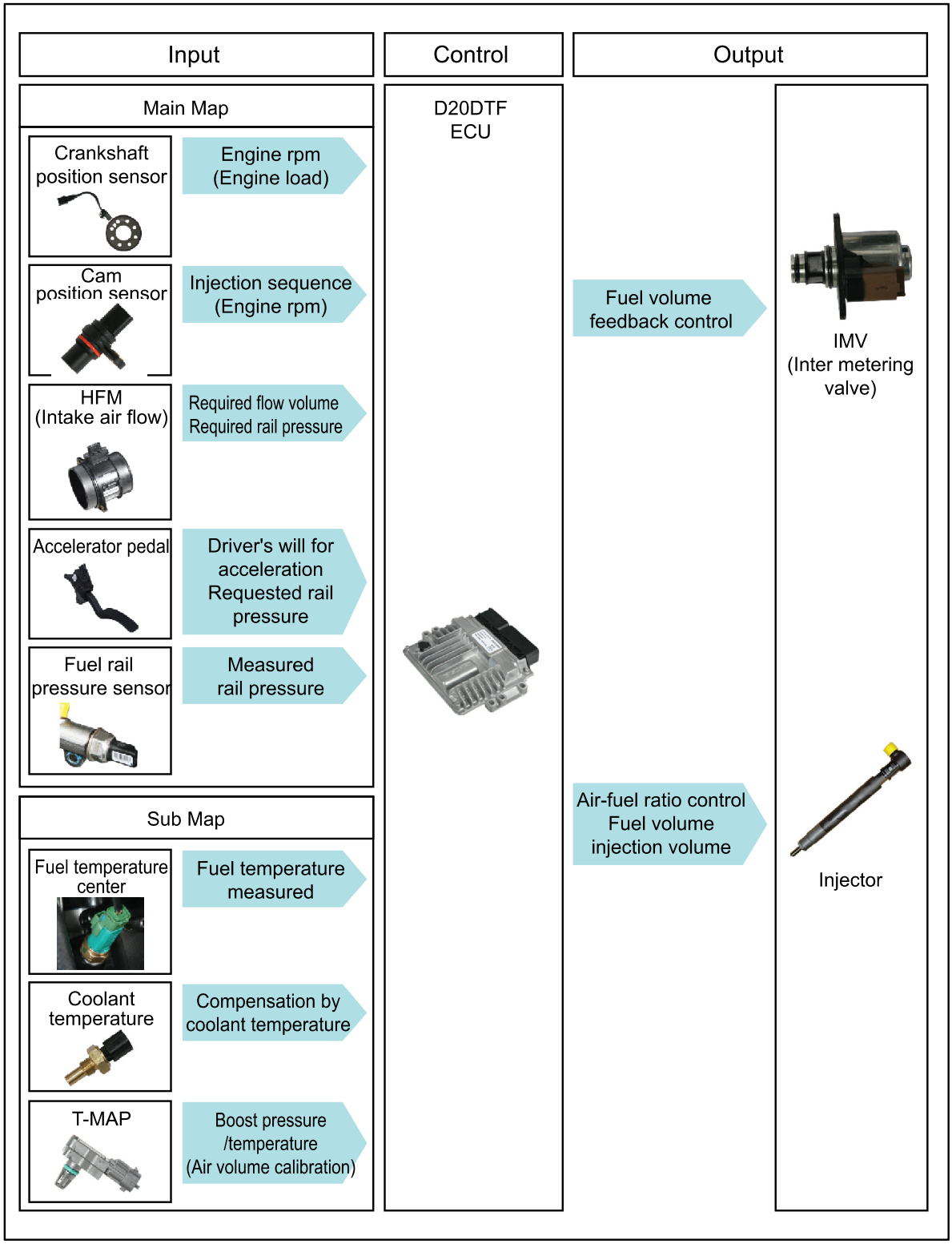
2) Fuel System Flow Diagram



The fuel from the fuel tank is supplied to the fuel heater of fuel filter/priming pump and then low pressure generated by the low pressure pump (built into HP pump) is transmitted to the HP pump.
The fuel pressure at the HP pump is controlled by the IMV valve, and the maximum allowed pressure is 1,800 bar. The compressed fuel at the fuel pump is delivered to the rail, and injected by the injectors according to the injection signals. The injection method is the same with the conventional method; Fuel return by backleak which operates the needle valve.
The major difference is that the fuel return line is connected to the fuel filter inlet port, not the HP pump venturi.
The pressure from the high pressure pump is increased to 1,800 bar from 1,600 bar, and the pump is now installed to the cylinder head (cylinder block for previous model). The fuel pressure is generated by the operation of intake camshaft and gears. The specifications for the IMV valve and the fuel temperature sensor are not changed.

Downloaded from www.Manualslib.com manuals search engine

3) Input/Output devices



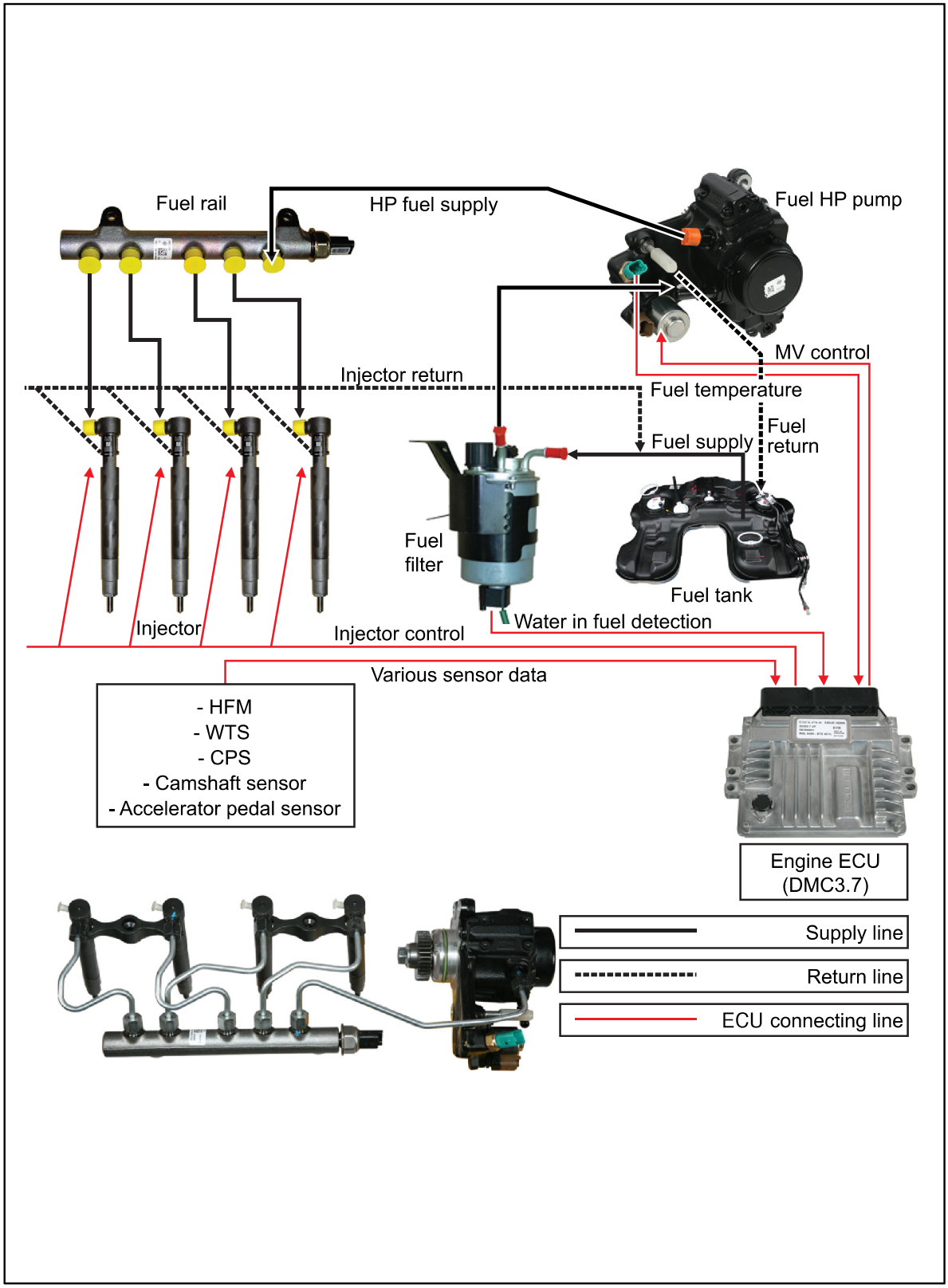
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

The engine ECU calculates the accelerator pedal based on the input signals from various sensors, and controls the overall operation of the vehicle.
The ECU receives the signals from various sensor through data line, and performs effective air-fuel ratio control based on these signals.
The crankshaft speed (position) sensor measures the engine speed, and the camshaft speed (position) sensor determines the order of injections, and the ECU detects the amount of the accelerator pedal depressed (driver's will) by receiving the electrical signals from the accelerator pedal sensor.
The mass air flow sensor detects the volume of intake air and sends the value to the ECU.
The major function of the ECU is controlling air-fuel ratio to reduce the emission level (EGR valve control) by detecting instantaneous air flow change with the signals from the mass air flow sensor.
Also, the ECU uses the signals from the coolant temperature & air temperature sensors, booster pressure sensor, atmospheric pressure sensor to: a) determine injection starting point and set value for pilot injection, and b) deal with various operations and variable conditions.

Downloaded from www.Manualslib.com manuals search engine

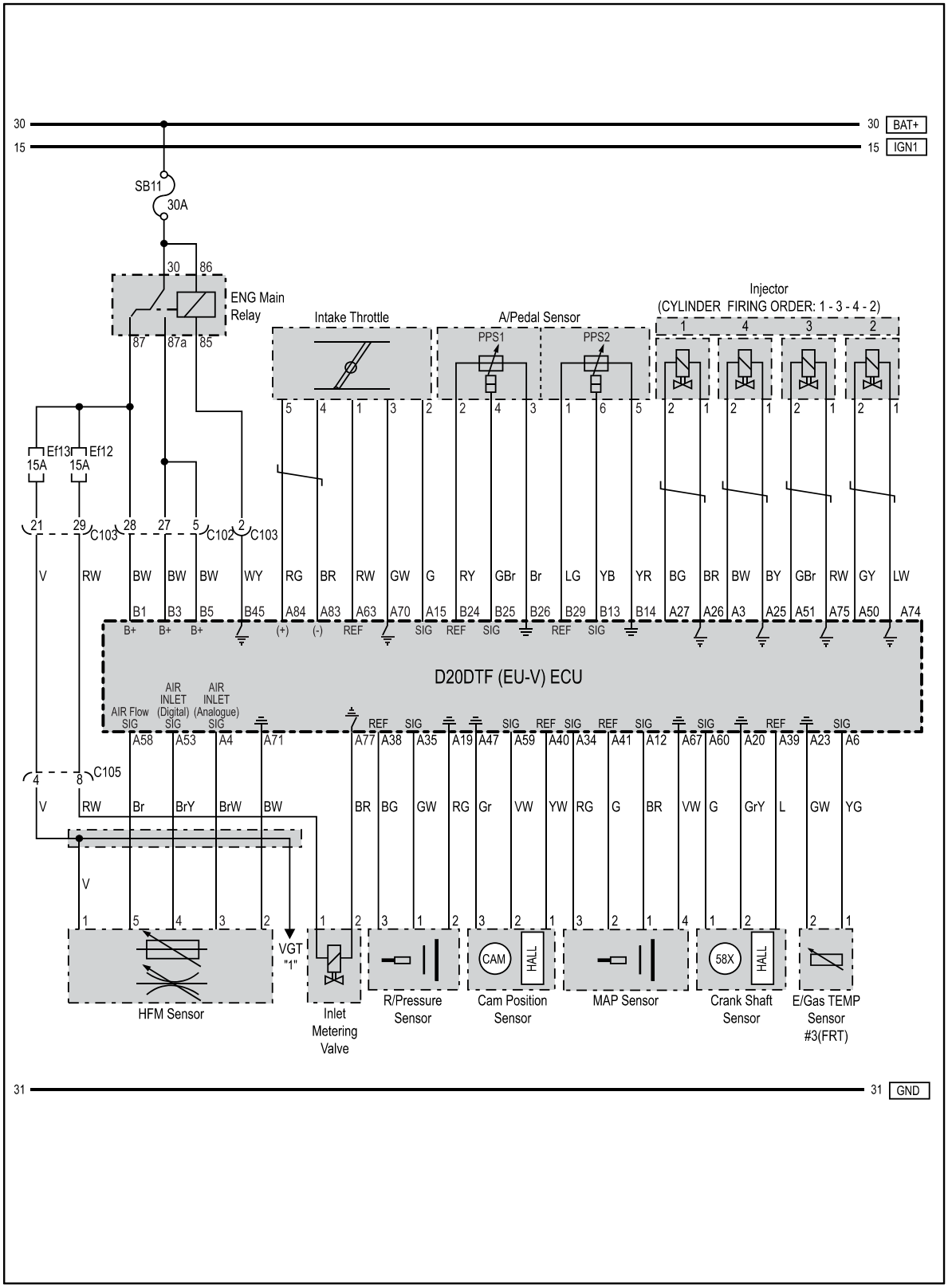
4) Flow Diagram of Fuel Supply System



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

5) Circuit Diagram of Duel Supply System



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

INTAKE SYSTEM 1719-00

GENERAL INFORMATION

1. SPECIFICATION

Component	Item	Specification	
Air cleaner element	Filter type	Dry, filter element	
	Filter area	0.64 m²	
	Replace interval	EU	change every 20000 km or 12months (But, shorten the service interval under severe conditions)
		GEN	change every 15000 km or 12months (But, shorten the service interval under severe conditions)
Air cleaner assembly	Weight	1.13 kg	
	Operating temperature	−30 ~ 100℃	
	Capacity	6.5 L	
Intercooler	Core material	Aluminum	
	Size	510 x 110 x 70 (W x H x T)	
	Core size	510 x 110 x 63 (W x H x T)	
	Tank material	Plastic (Molding)	
	Efficiency	80%	

* Shorten the service interval under severe conditions such as driving on a dusty road or off-road.

Downloaded from www.Manualslib.com manuals search engine

Component	Item	Specification	
Air cleaner element	Filter type	Dry, filter element	
	Filter area	0.64 m²	
	Replace interval	EU	change every 20000 km or 12months (But, shorten the service interval under severe conditions)
		GEN	change every 15000 km or 12months (But, shorten the service interval under severe conditions)
		Change at every 30,000 km of driving.	
Air cleaner assembly	Weight	1.13 kg	
	Operating temperature	−30 ~ 100℃	
	Capacity	6.5 L	
Intercooler	Core material	Aluminum	
	Size	510 x 110 x 70 (W x H x T)	
	Core size	510 x 110 x 63 (W x H x T)	
	Tank material	Plastic (Molding)	
	Efficiency	80%	

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. INSPECTION

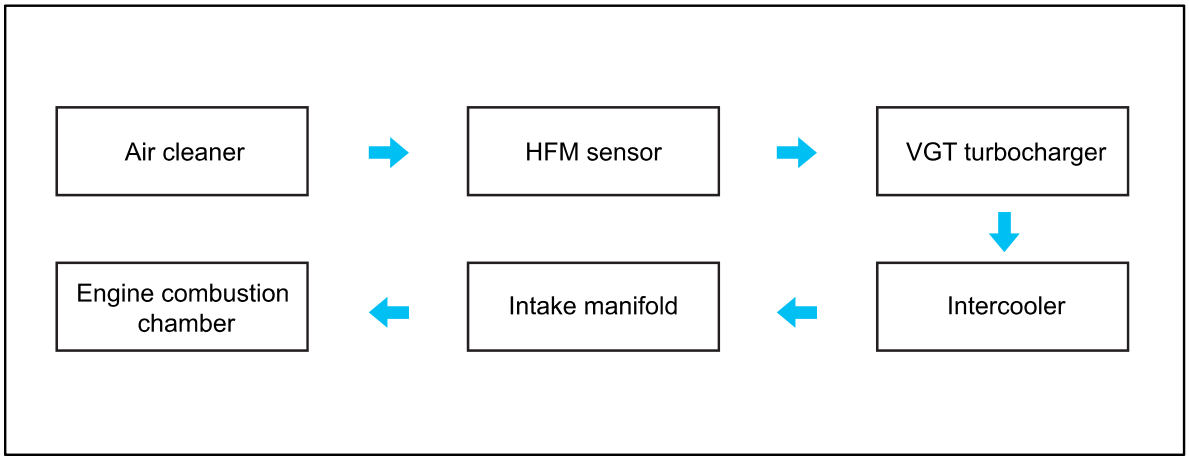
1) Troubleshooting

▶ **When Abnormal Noises are Heard from the Engine Room**

CAUTION

For the vehicle equipped with DI engine, if a learning noise occurs in each range or other noises occur, the major cause of it is a faulty turbocharger assembly. But an interference issue, poor tightness or loose in the intake and exhaust system also can cause those noises. This is mainly because the operator didn't follow the instruction exactly when reconnecting the intake hoses and pipes which were disconnected to check the system or replace the air cleaner. If the intake system is free of any faults, check the EGR and PCV oil separator connected to the intake system.
The figure may be different from the actual engine. Therefore, read thoroughly below before replacing the parts.

2) Abnormal Noise Caused by Poor Tightness of Intake System



When the DI engine is running, the air entered into the engine flows in the sequence as shown above. If high intake pressure is applied to the loose or damaged part, a whistling noise may occur, the intake air volume is measured incorrectly or the engine power is derated.

Downloaded from www.Manualslib.com manuals search engine

3) Troubleshooting Sequence

The basic checks for intake system are as follows:

▶ Basic Checks for Intake System

- Check if any abnormal noise occurs in each range while the vehicle is driven.
- Check if the engine warning lamp is illuminated or any DTC is displayed on the diagnostic device.
- Check the hoses for loose connections, or the clamps for deformation.
- Check tightness of the air cleaner housing by shaking it.
- Check the turbocharger and the intake/exhaust system for interferences in each range.
- Check the vacuum system and the hoses connected.

Make sure to replace or clean the air cleaner element periodically. Otherwise, engine will be derated or work abnormally because of low intake air volume.
Unlike the fuel system, which is a closed circuit, the intake system is an open circuit system. Therefore any malfunction may occur due to dust and dirt.
Most of the connections consist of hoses so the system cannot withstand high temperature and pressure. Also it can be deformed or loosened easily because it is a clamp mounting system. Thus, when checking the engine, basic inspections, such as tightened status check and visual inspection for hose, etc., should be carried out in advance.

▶ Other Checks for Intake System

- Check the EGR system (vacuum circuit, electrical circuit of modulator, mechanical movements of EGR valve).
- Check the PCV oil separator.

If the intake system is free of any faults, check for EGR and PCV oil separator.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

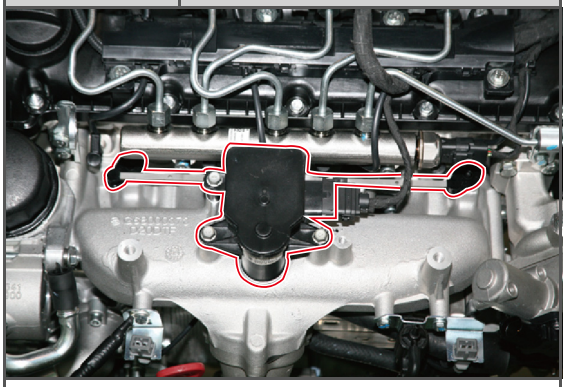
OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

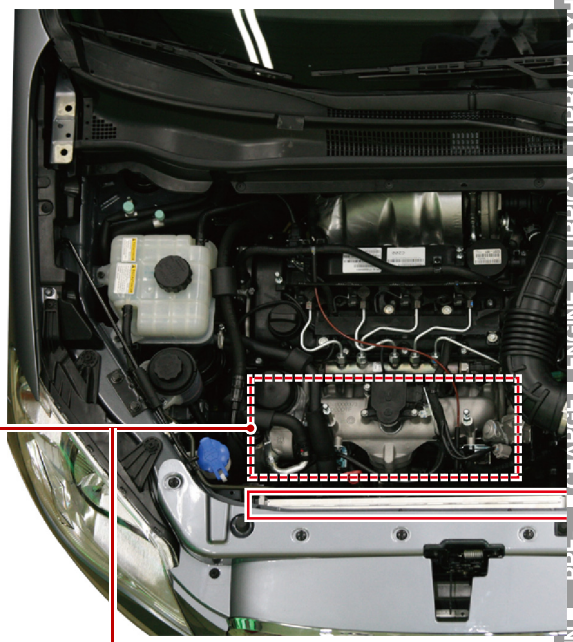
The intake system for D20DTF engine is equipped with a throttle body which includes a flap. This flap is controlled by an electrical signal to cut off the intake air entering to the engine when the ignition switch is turned off. Because of this, the shape of the intake manifold has been changed and improved HFM sensor is newly adopted to control the intake air volume more precisely.

2. COMPONENT

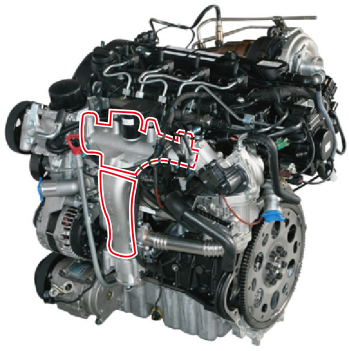
1719-02	Swirl control valve



Works variably in accordance with the engine load and rpm.
* For more information, refer to "Engine Control" section.

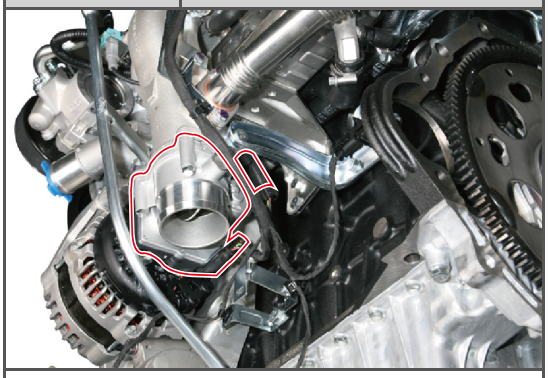


1719-01	Intake manifold



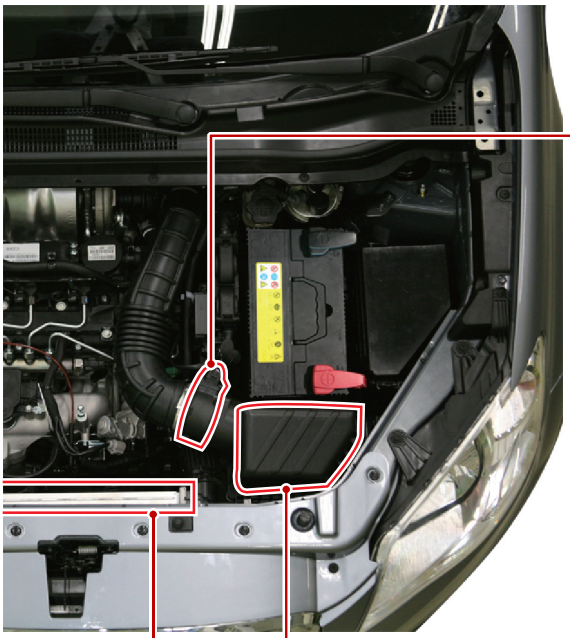
Passage for variable swirl valve and for intake air

1719-16	Electric throttle body



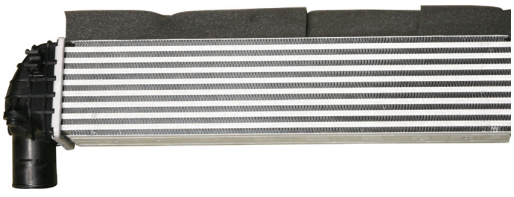
* For more information, refer to "Engine Control" section.

Downloaded from www.Manualslib.com manuals search engine



2313-15	HFM sensor
HFM sensor, version 6 * For more information, refer to "Engine Control" section.	

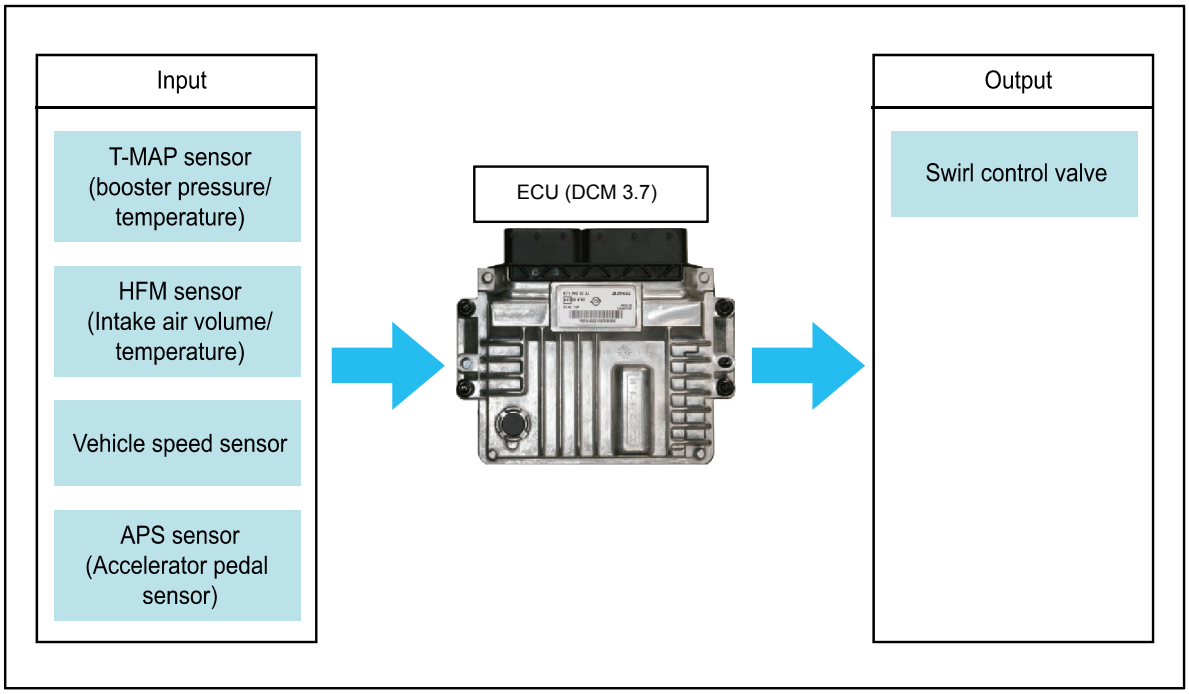
2313-01	Air cleaner assembly and resonator

2330-01	Intercooler assembly
	

Modification basis	
Application basis	
Affected VIN	

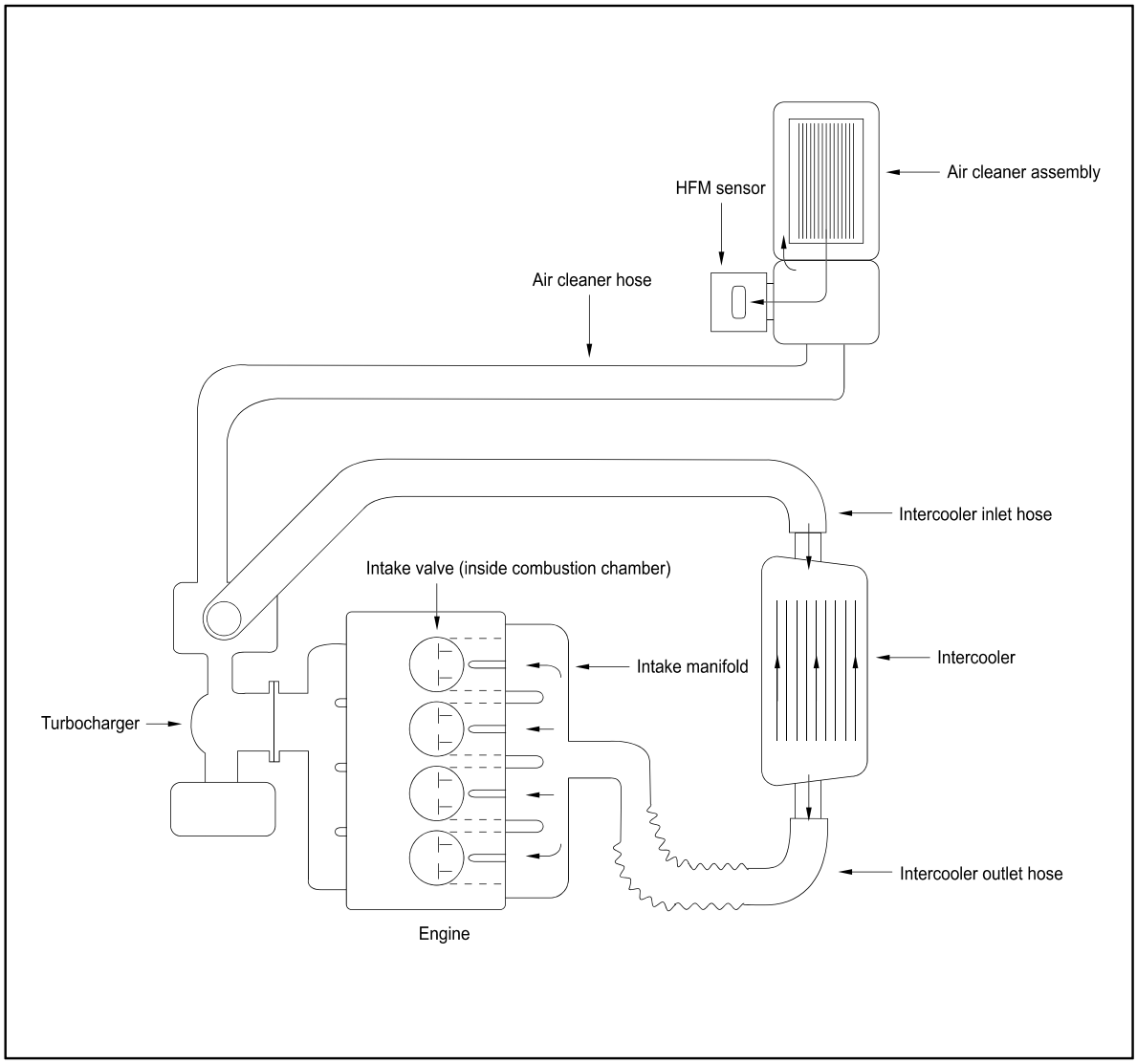
Downloaded from www.Manualslib.com manuals search engine

3. INPUT/OUTPUT DEVICES

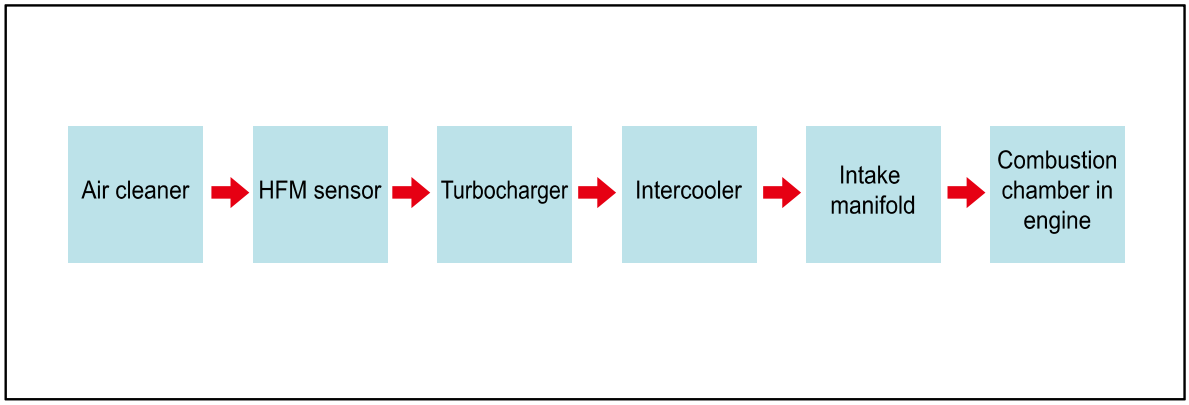


Downloaded from www.Manualslib.com manuals search engine

4. OPERATING PROCESS



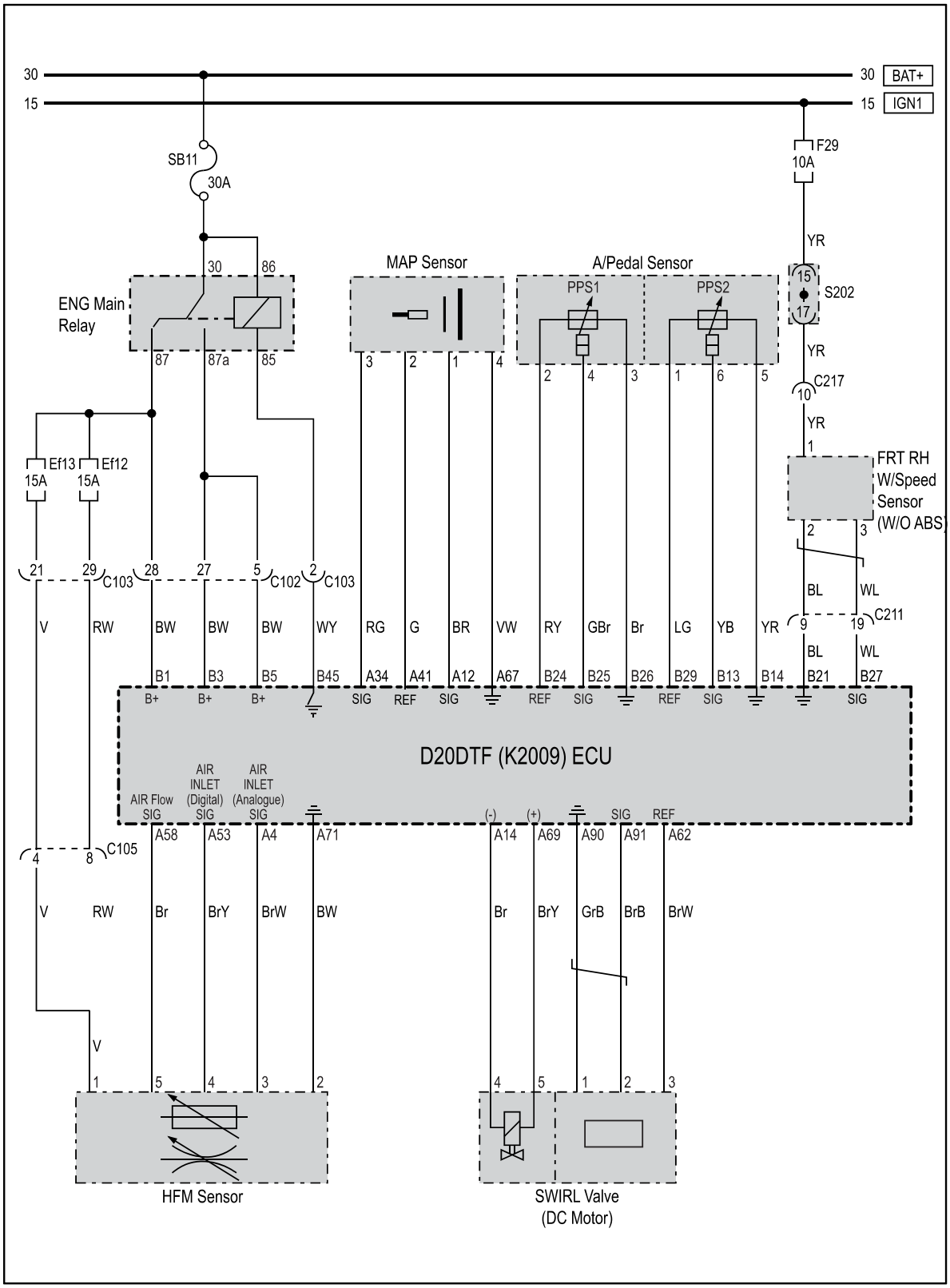
▶ Work Flow



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

5. WIRING DIAGRAM



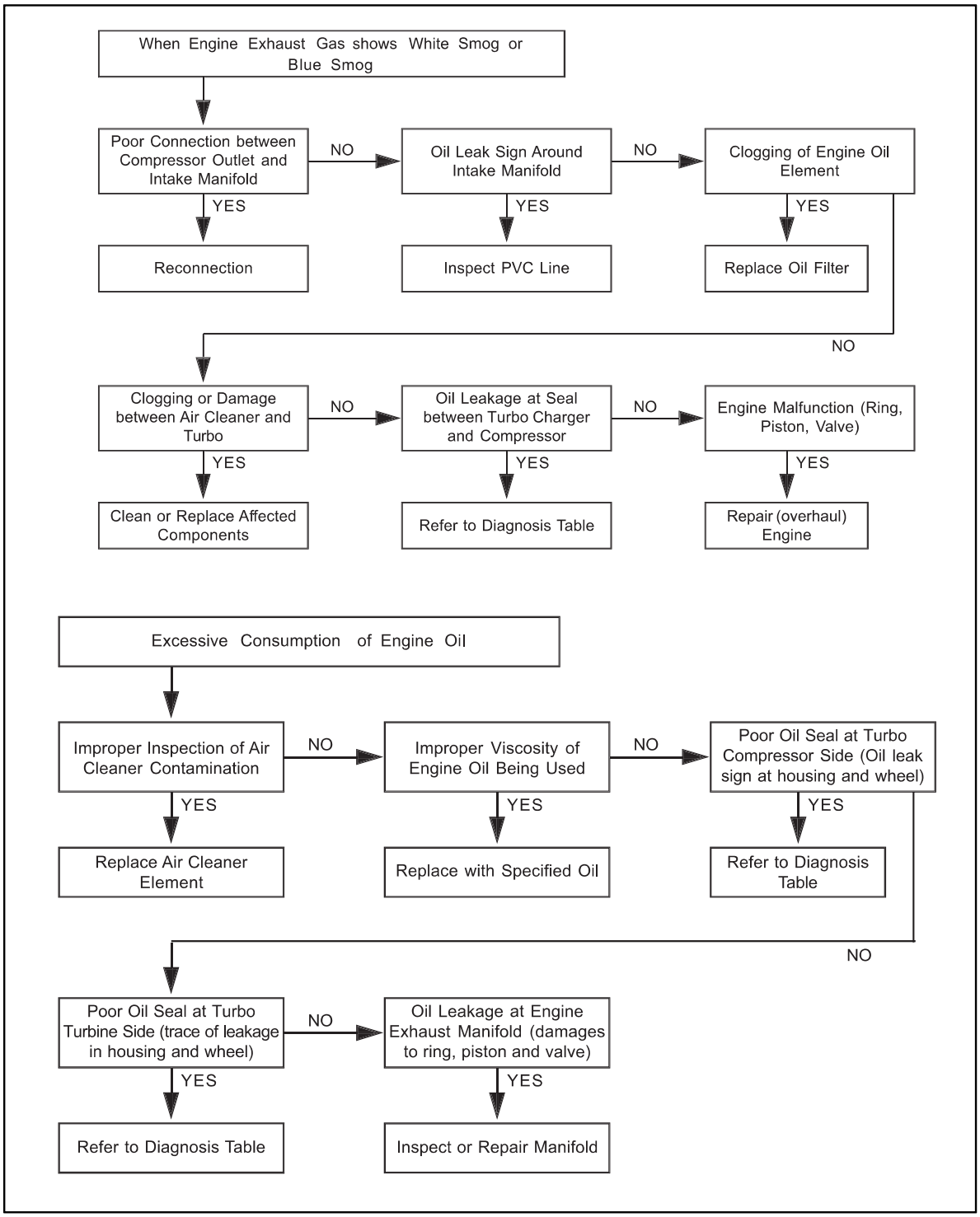
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. TROUBLESHOOTING

1) Work Flow



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. CAUTIONS

- Do not park the vehicle on flammable materials, such as grass, leaves and carpet.
- Do not touch the catalyst or the exhaust gas ignition system when the engine is running.
- If a misfire occurs in the combustion chamber or the emission of pollutant exceeds the specified level, the catalyst can be damaged.
- When servicing or replacing components of the exhaust system, makes sure that the components are positioned at regular intervals from all other parts of the under body.
- Be careful not to damage the exhaust system when lifting the vehicle from its side.
- All components and body parts of the engine exhaust system should be inspected for crack, damage, air hole, part loss and incorrect mounting location. Also check for any deformation which can result in exhaust gas drawn into the vehicle.
- Make sure that the exhaust pipe is cooled down sufficiently before working on it because it is still hot right after the engine is stopped.
- Wear protective gloves when removing the exhaust pipe.

Modification basis	
Application basis	
Affected VIN	

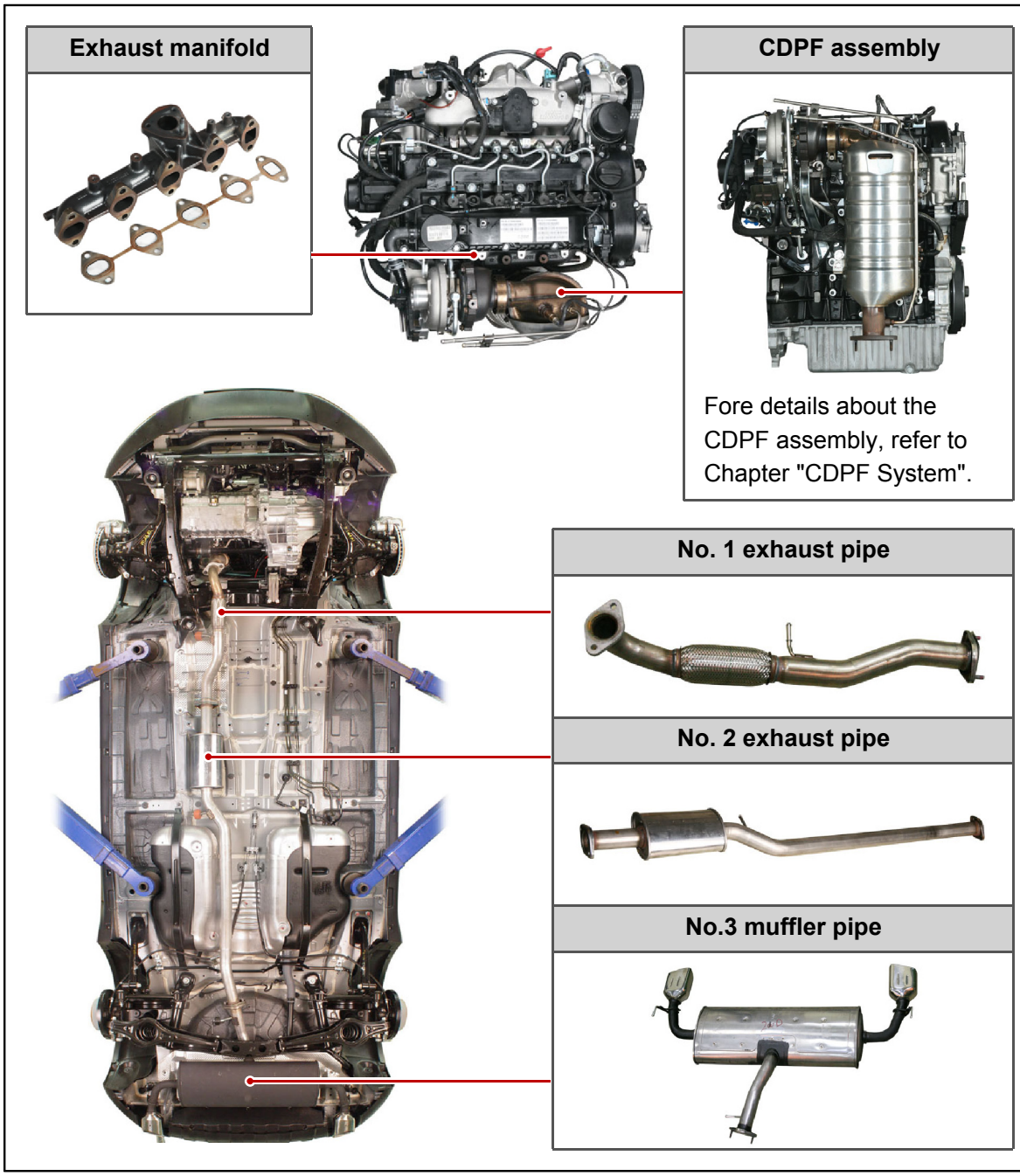
Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

This system purifies the exhaust gas generated by the combustion in the engine to reduce the pollutants and noise during that arise during combustion.

2. COMPONENT

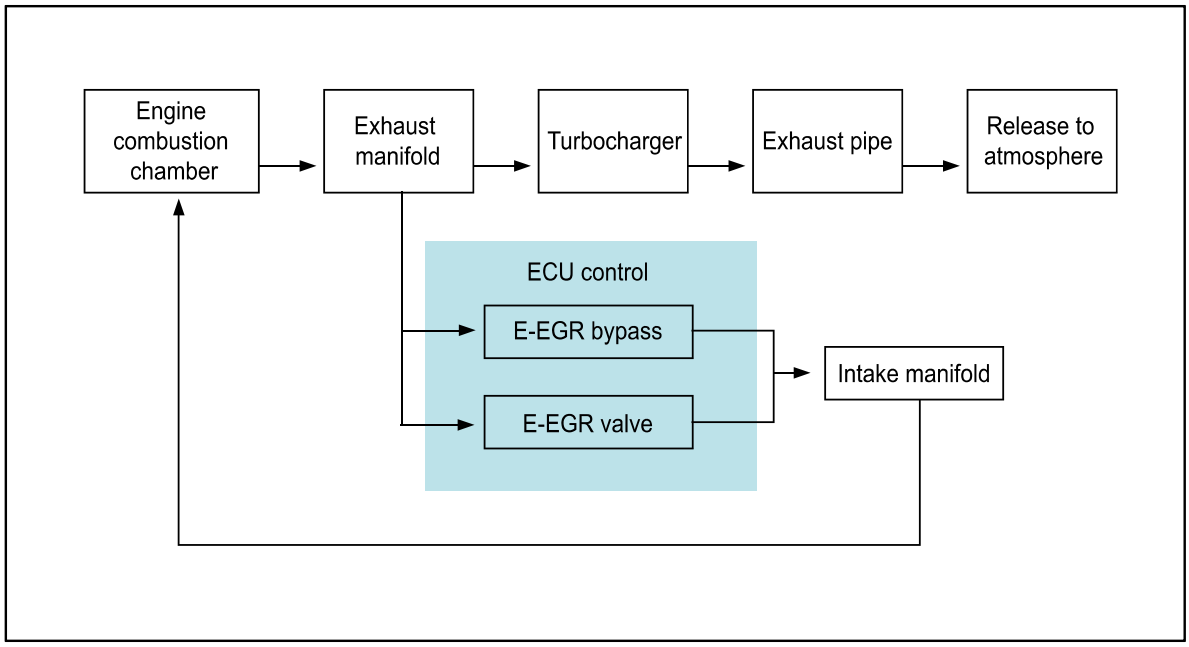


Modification basis	
Application basis	
Affected VIN	

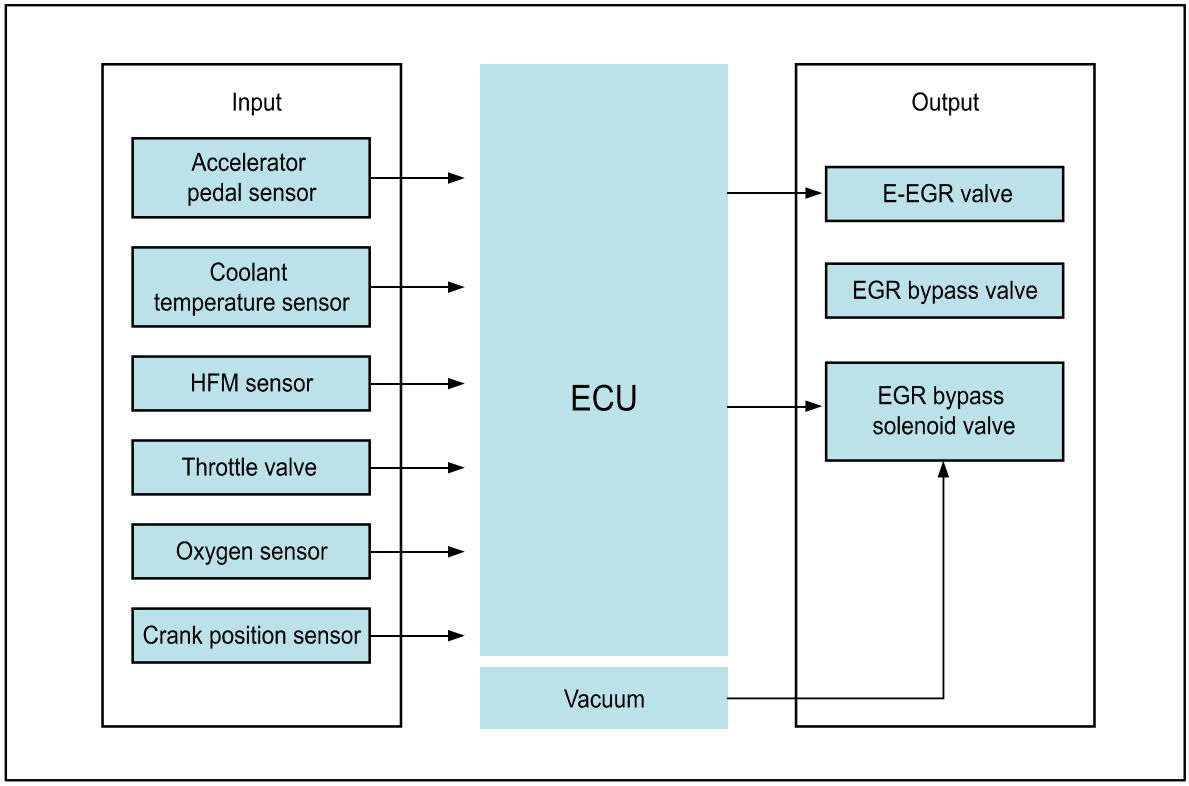
Downloaded from www.Manualslib.com manuals search engine

3. OPERATING PROCESS

1) Exhaust Gas Flow



2) Input & Output Devices



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Component	Item	Specification
Turbocharger	Max. expansion coefficient	5.0
	Max. turbine speed	213,000 rpm
	Max. temperature of turbine housing	830 ℃
	Weight	7.2 kg
E-Actuator	Operation duty cycle	300 Hz

Downloaded from www.Manualslib.com manuals search engine

2. INSPECTION

1) Cautions During Driving

The following lists cautions to take during test drive and on the turbocharger vehicle, which must be considered during the operation.

1. It's important not to drastically increase the engine rpm starting the engine. It could make rotation at excessive speed even before the journal bearing is lubricated and when the turbocharger rotates in poor oil supply condition, it could cause damage of bearing seizure within few seconds.
2 If the engine is running radically after replacing the engine oil or oil filter brings poor oil supply condition. To avoid this, it's necessary to start off after idling the engine for about 1 minute allowing oil to circulate to the turbocharger after the replacement.
3. When the engine is stopped abruptly after driving at high speed, the turbocharger continues to rotate in condition where the oil pressure is at '0'. In such condition, an oil film between the journal bearing and the housing shaft journal section gets broken and this causes abrasion of the journal bearing due to the rapid contact. The repeat of such condition significantly reduces life of the turbocharger. Therefore, the engine should be stopped possibly in the idle condition.

CAUTION

After string for long period of time during winter season or in the low temperature condition where the fluidity of engine oil declines, the engine, before being started, should be cranked to circulate oil and must drive after checking the oil pressure is in normal condition by idling the engine for few minutes.

Downloaded from www.Manualslib.com manuals search engine

2) Inspection of Turbocharger

When problem occurs with the turbocharger, it could cause engine power decline, excessive discharge of exhaust gas, outbreak of abnormal noise and excessive consumption of oil.

1. On-board Inspection
   - Check the bolts and nuts foe looseness or missing
   - Check the intake and exhaust manifold for looseness or damage
   - Check the oil supply pipe and drain pipe for damages
   - Check the housing for crack and deterioration
2. Inspection of turbine

Remove the exhaust pipe at the opening of the turbine and check, with a lamp, the existence of interference of housing and wheel, oil leakage and contamination (at blade edge) of foreign materials.

- Interference: In case where the oil leak sign exists, even the small traces of interferences on the turbine wheel mean, most of times, that abrasion has occurred on the journal bearing. Must inspect after overhauling the turbocharger.
- Oil Leakage: Followings are the reasons for oil leakage condition
  * Problems in engine: In case where the oil is smeared on inner wall section of the exhaust gas opening.
  * Problems in turbocharger: In case where the oil is smeared on only at the exhaust gas outlet section.

CAUTION

Idling for long period of time can cause oil leakage to the turbine side due to low pressure of exhaust gas and the rotation speed of turbine wheel. Please note this is not a turbocharger problem.

- Oil Drain Pipe Defect
  In case where oil flow from the turbocharger sensor housing to the crank case is not smooth would become the reason for leakage as oil builds up within the center housing. Also, oil thickens (sludge) at high temperature and becomes the indirect reason of wheel hub section. In such case, clogging and damage of the oil drain pipe and the pressure of blow-by gas within the crank case must be inspected.
- Damages due to Foreign Materials
  When the foreign materials get into the system, it could induce inner damage as rotating balance of the turbocharger gets out of alignment.

Downloaded from www.Manualslib.com manuals search engine

3) Inspection of Turbine

Thoroughly check the followings.

CAUTION

Must absolutely not operate the turbocharger with the compressor outlet and inlet opened as it could damage the turbocharger or be hazardous during inspection.

- Interference: In case where is trace of interference or smallest damage on the compressor wheel means, most of times, that abrasion has occurred on the journal bearing. Must inspect after the overhaul.
- Oil Leakage: The reason for oil leakage at the compressor section is the air cleaner, clogged by substances such as dust, causes the compressor inlet negative pressure.
  a. Rotating in high speed at no-load for extended period of time can cause oil leakage to the compressor section as oil pressure within the center housing gets higher than pressure within the compressor housing.
  b. Overuse of engine break (especially in low gear) in down hill makes significantly low exhaust gas energy compared to the time where great amount of air is required during idling conditions of the engine. Therefore, amount of air in the compressor inlet increases but the turbocharge pressure is not high, which makes negative pressure at the compressor section causing the oilleakage within the center housing.

CAUTION

No problem will occur with the turbocharger if above conditions are found in early stage but oil leaked over long period of time will solidify at each section causing to breakout secondary defects.

Damages by foreign materials: In case where the compressor wheel is damaged by foreign materials requires having an overhaul. At this time, it's necessary to check whether the foreign materials have contaminated intake/exhaust manifold or inside of engine.

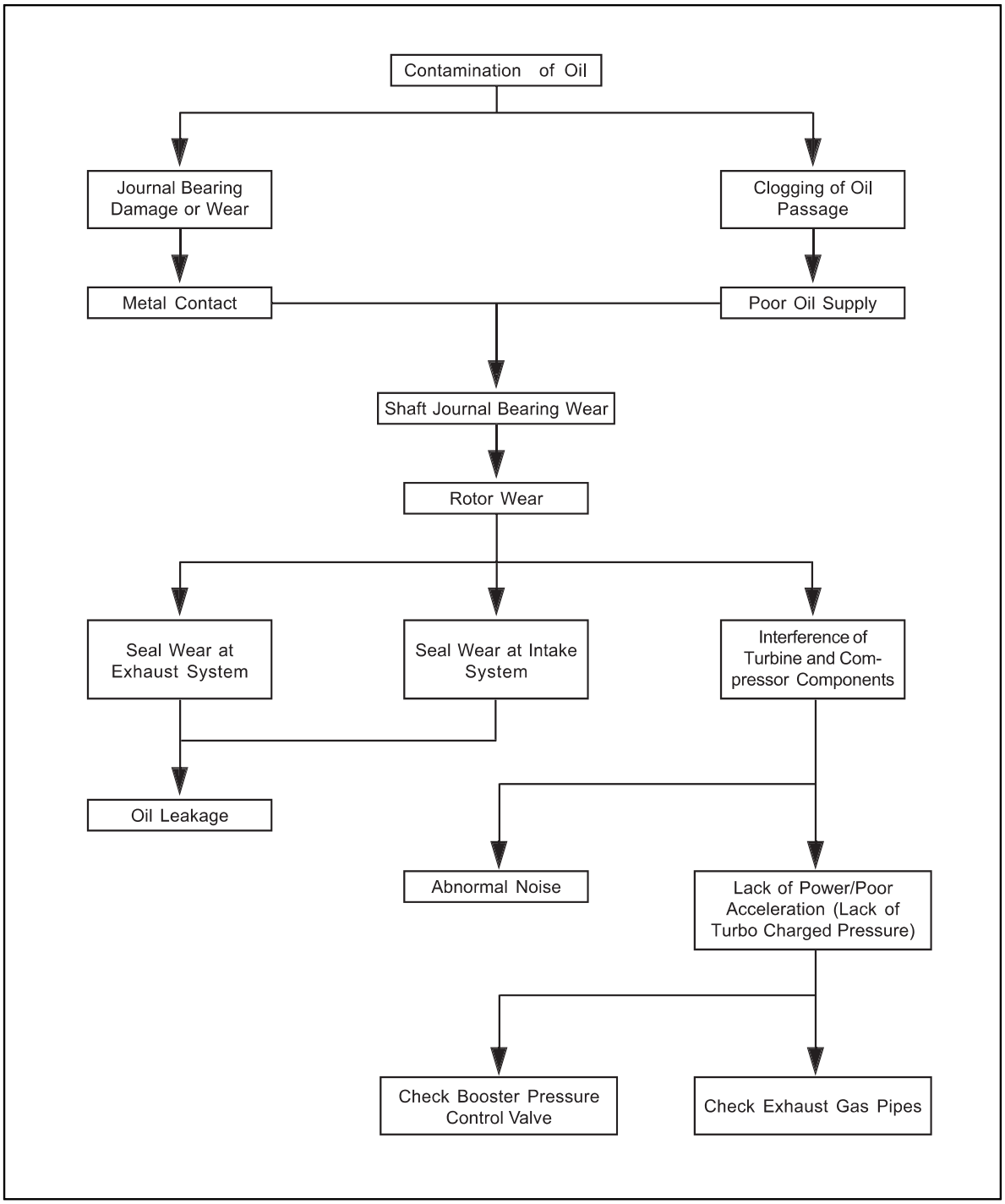
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4) Possible Causes of Defect

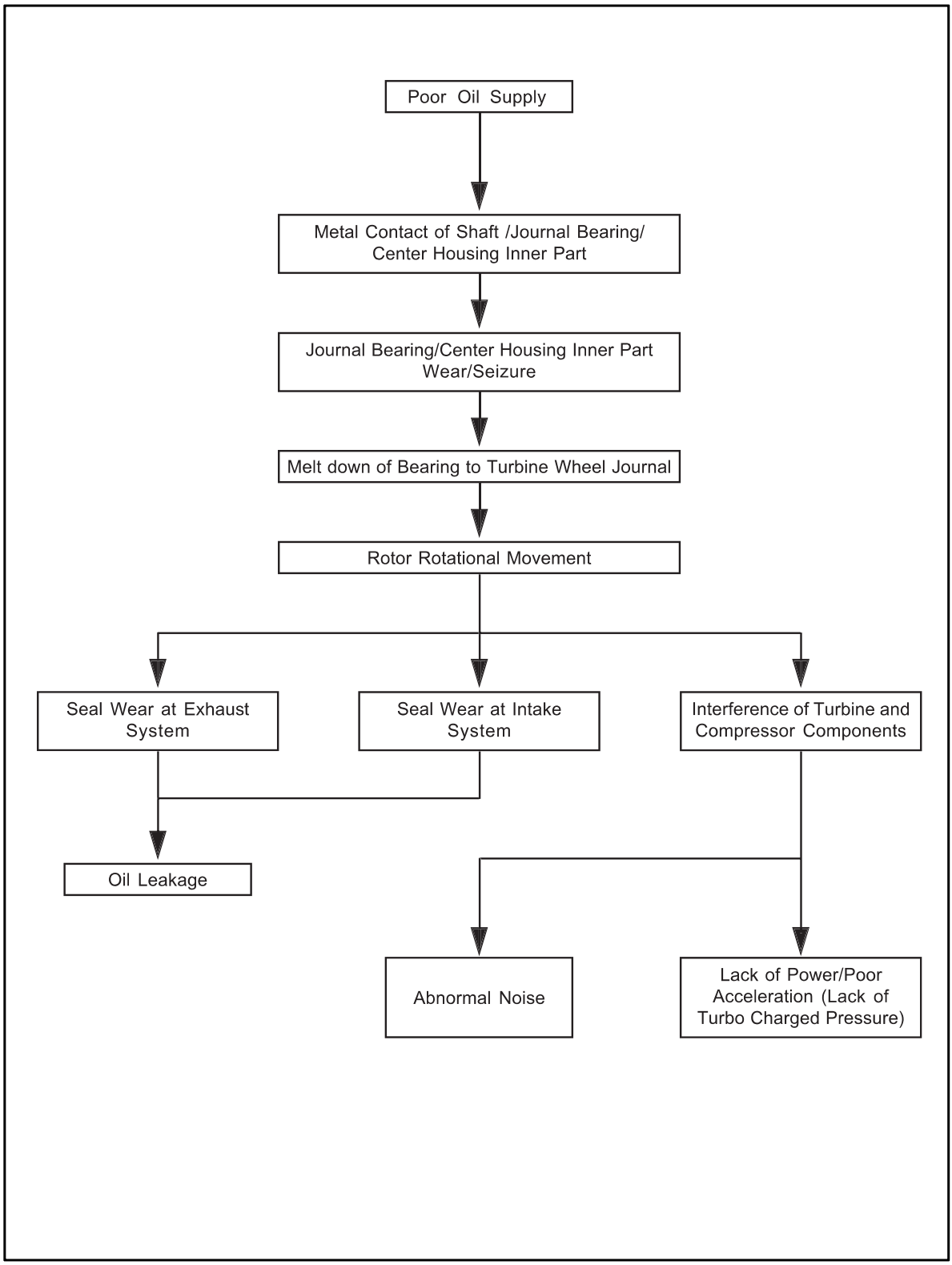
The following tries to understand the defects that can occur with vehicle installed with the turbocharger and to manage the reasons of such defects.

1. In case where oil pan/oil pipe has been contaminated, oil filter is defected and where adhesive of gaskets has been contaminated into the oil line.



Downloaded from www.Manualslib.com manuals search engine

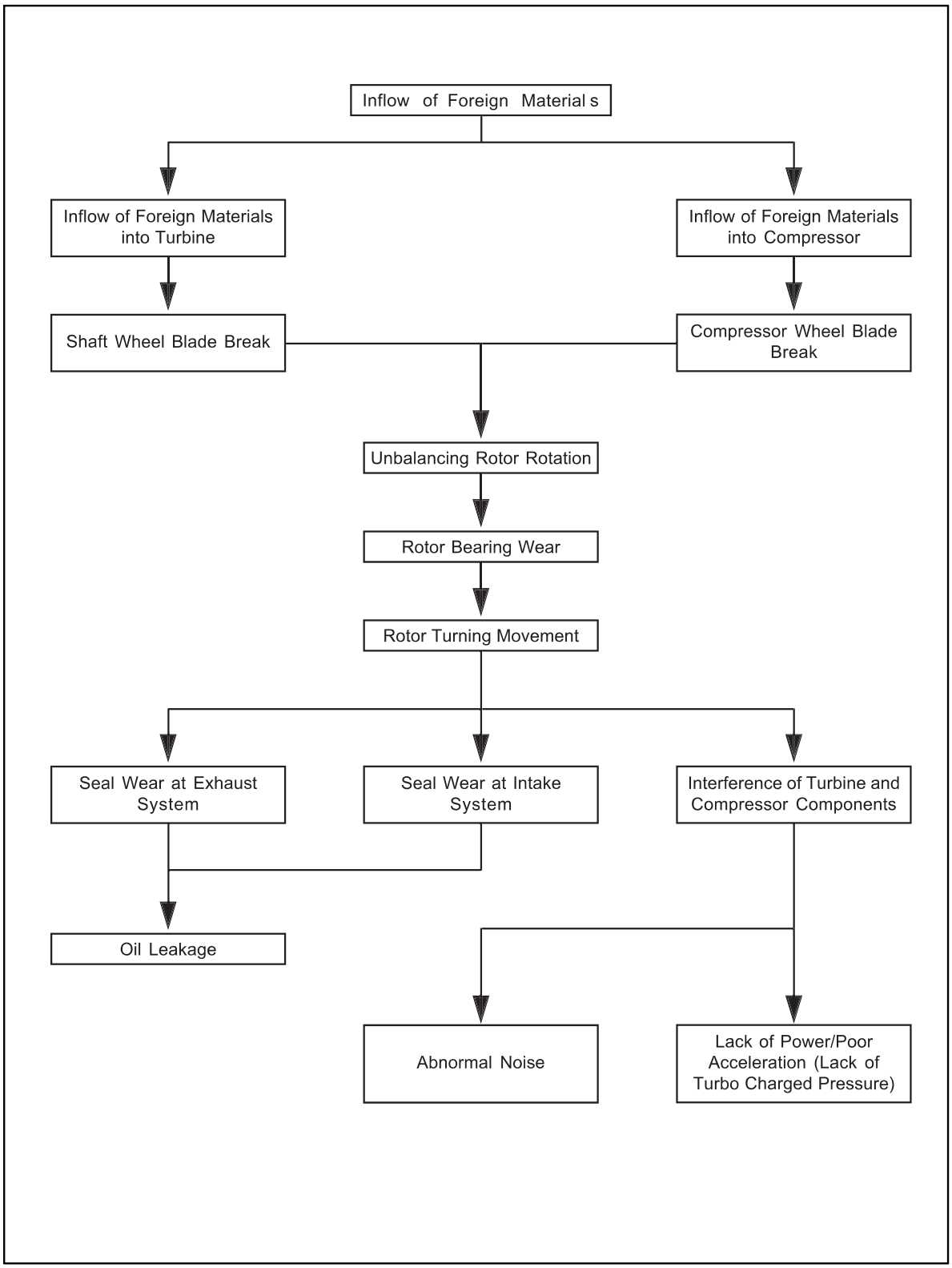
2. Oil Pump Defect: Rapid over-loaded driving after replacing oil filter and oil and clogging of oil line.



Modification basis	
Application basis	
Affected VIN	

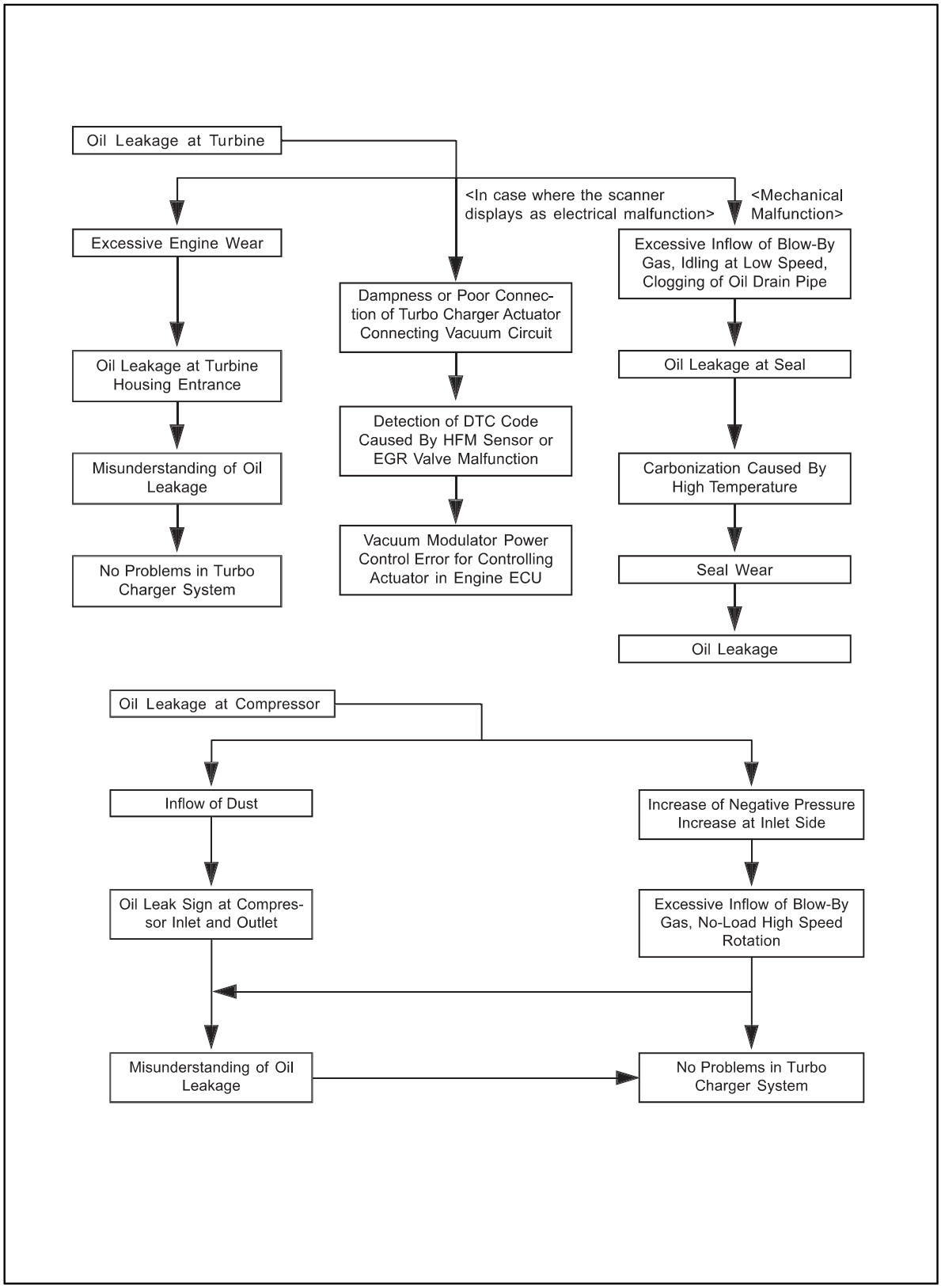
Downloaded from www.Manualslib.com manuals search engine

3. Turbine Side: Inflow of foreign materials from engine
   Compressor Side: such as air filter, muffler and nut



Downloaded from www.Manualslib.com manuals search engine

4. Defects caused by reasons other than that of the turbocharger.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. TROUBLESHOOTING

The followings are cautions to take in handling defects of turbocharger, which must be fully aware of.

1) Cautions

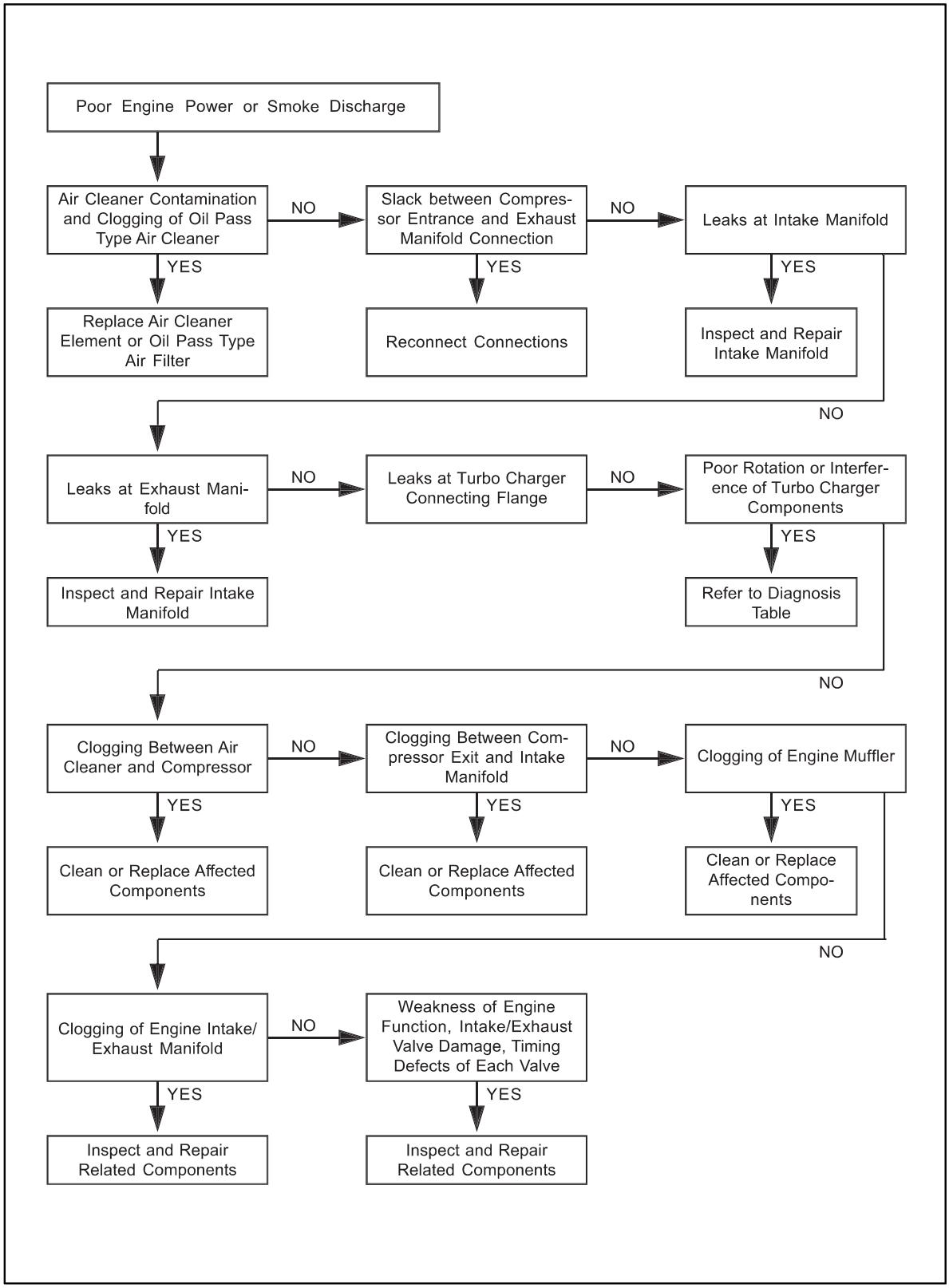
1. After stopping the engine, check whether the bolts on pipe connecting section are loose as well as the connecting condition of vacuum port and modulator, which is connected to the actuator.
2. During idling of the engine, check for leakage in the connecting section of pipe (hoses and pipes, duct connections, after the turbocharger) by applying soap water. The leakage condition in the engine block and turbine housing opening can be determined by the occurrence of abnormal noise of exhaust.
3. By running the engine at idle speed, abnormal vibration and noise can be checked. Immediately stop the engine when abnormal vibration and noise is detected and make thorough inspection whether the turbocharger shaft wheel has any damages as well as checking the condition of connections between pipes.
4. In case where the noise of engine is louder than usual, there is possibility of dampness in the areas related with air cleaner and engine or engine block and turbocharger. And it could affect the smooth supply of engine oil and discharge.
5. Check for damp condition in exhaust gas when there is sign of thermal discoloration or discharge of carbon in connecting area of the duct.
6. When the engine rotates or in case where there is change in noise level, check for clogging of air cleaner or air cleaner duct or if there is any significant amount of dust in the compressor housing.
7. During the inspection of center housing, inspect inside of the housing by removing the oil drain pipe to check for sludge generation and its attachment condition at shaft area or turbine side.
8. Inspect or replace the air cleaner when the compressor wheel is damaged by inflow of foreign materials.
9. Inspect both side of the turbocharger wheel after removing inlet and outlet pipe of the turbocharger.
   - Is the rotation smooth when the rotor is rotated by hand?
   - Is the movement of bearing normal?
   - Inspect whether there has been any signs of interference between two wheels.

CAUTION

It's important not to drive the engine when the intake manifold hose has been removed.

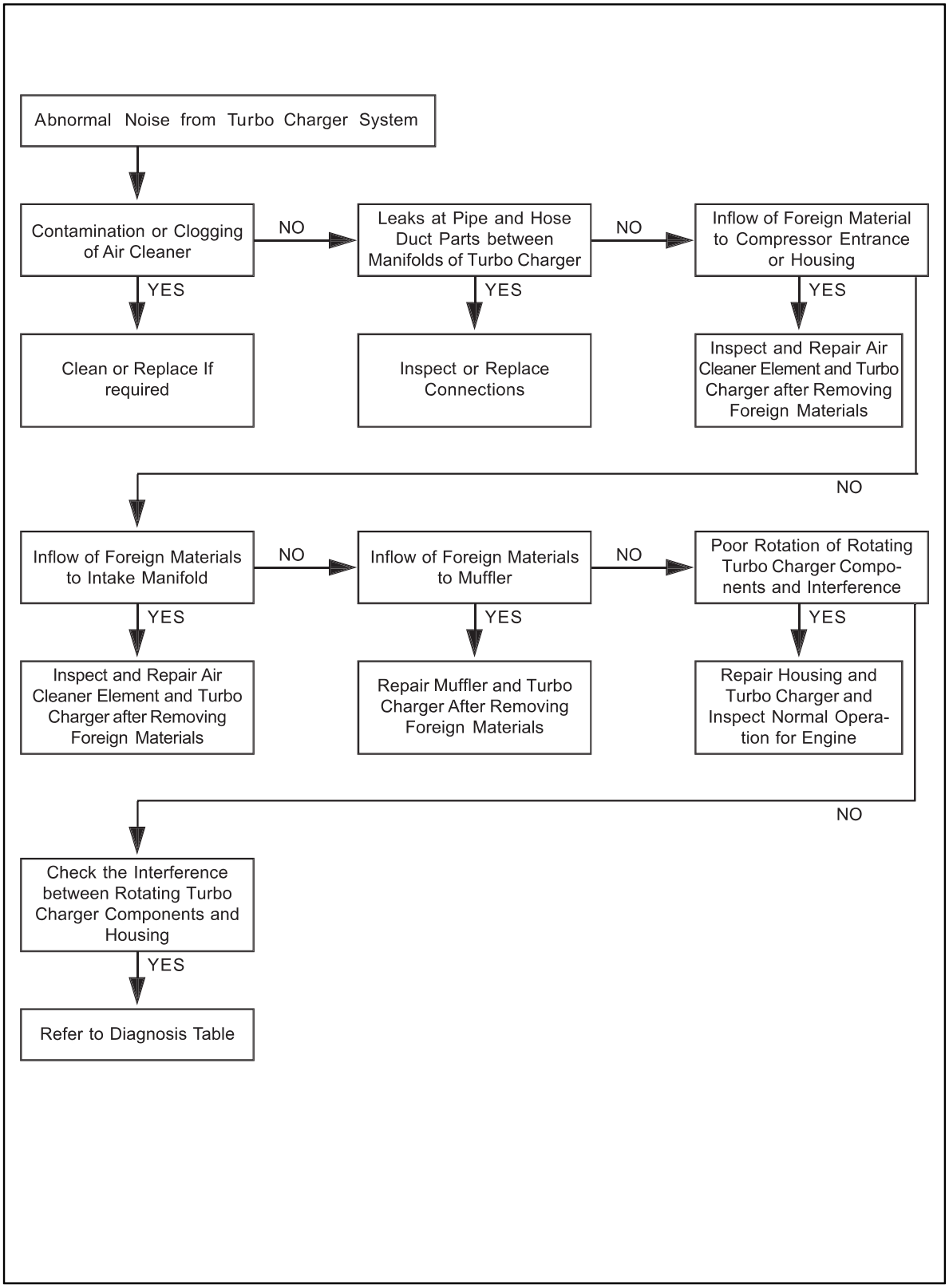
Downloaded from www.Manualslib.com manuals search engine

2) Work Flow for Troubleshooting



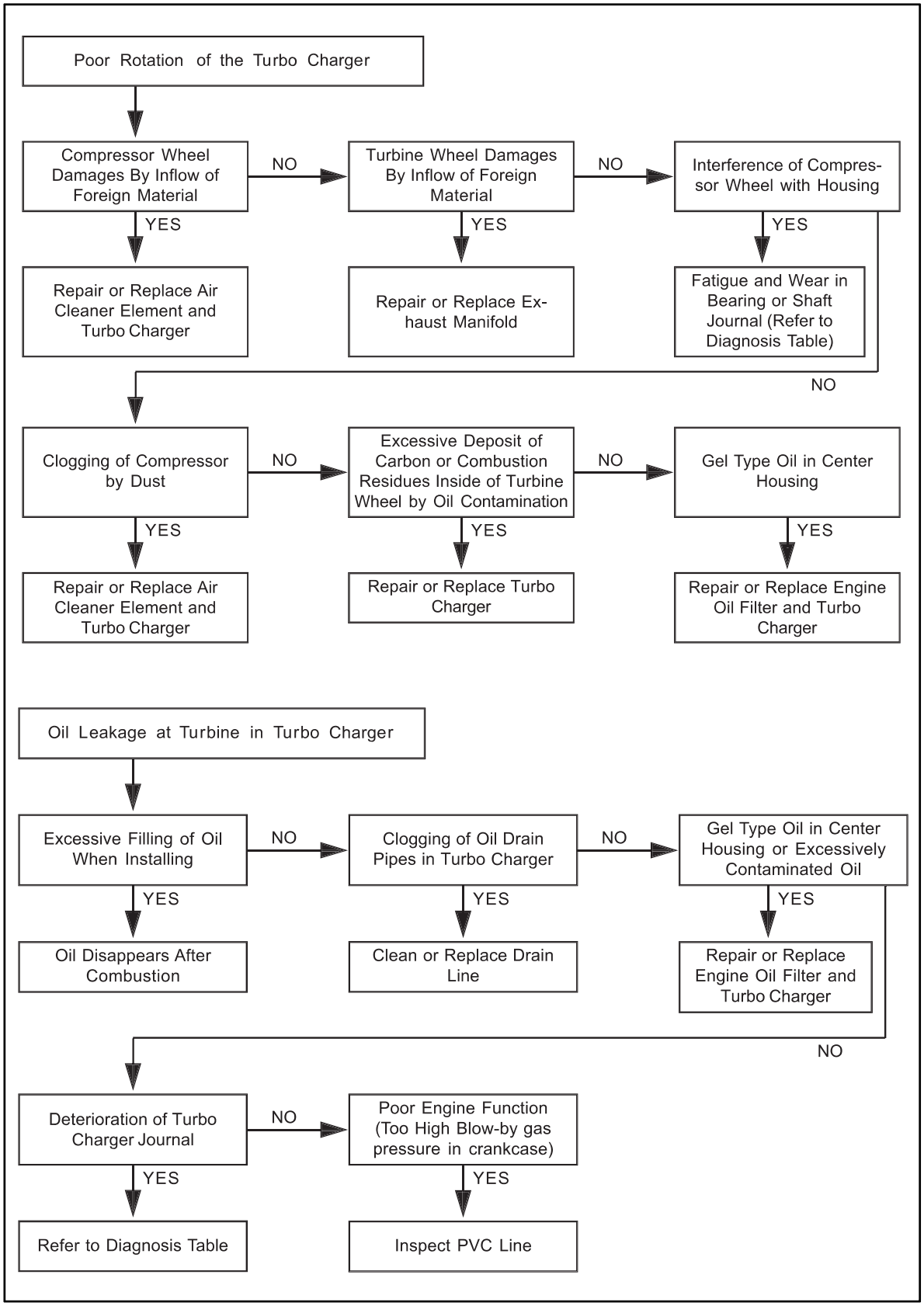
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



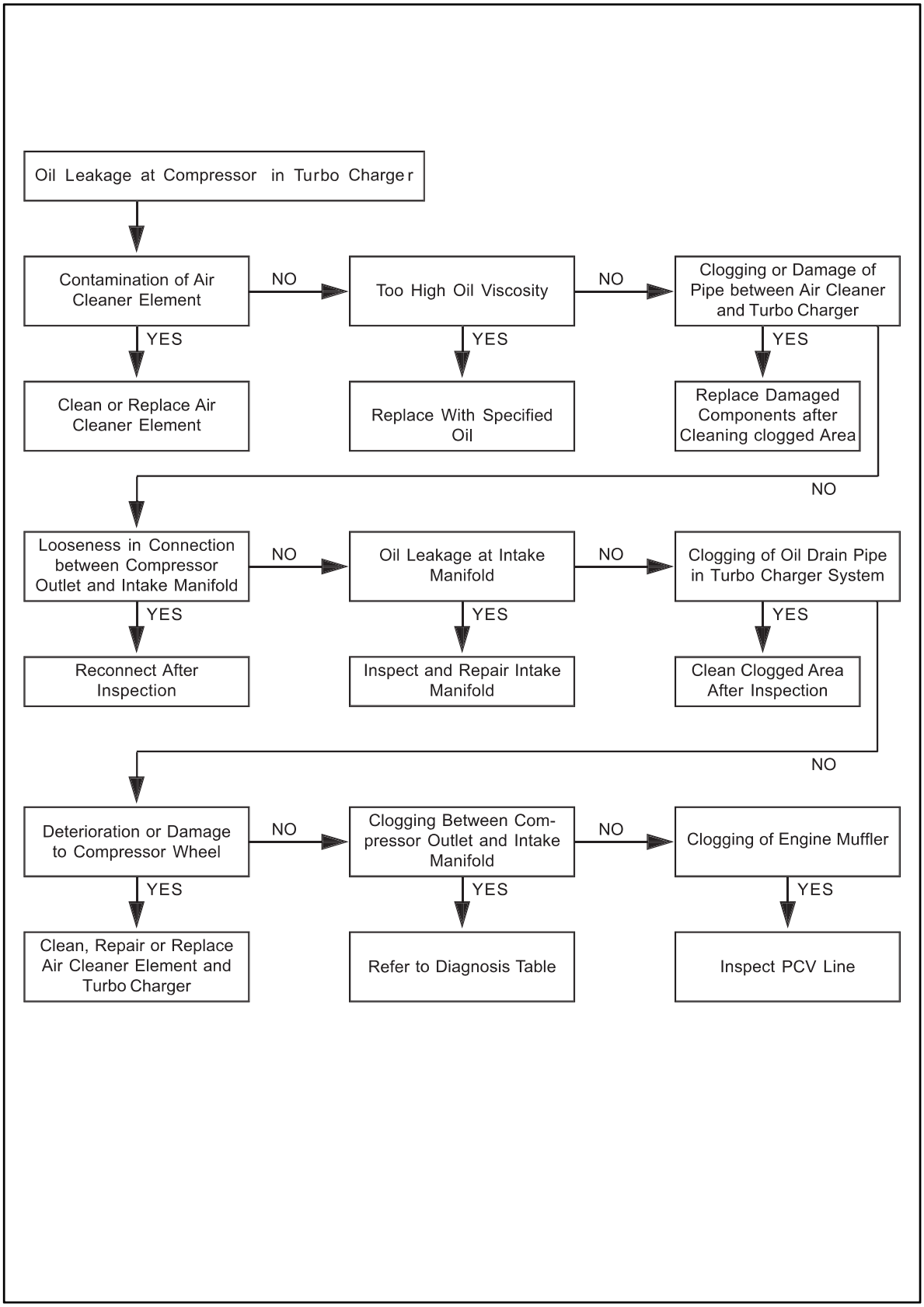
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



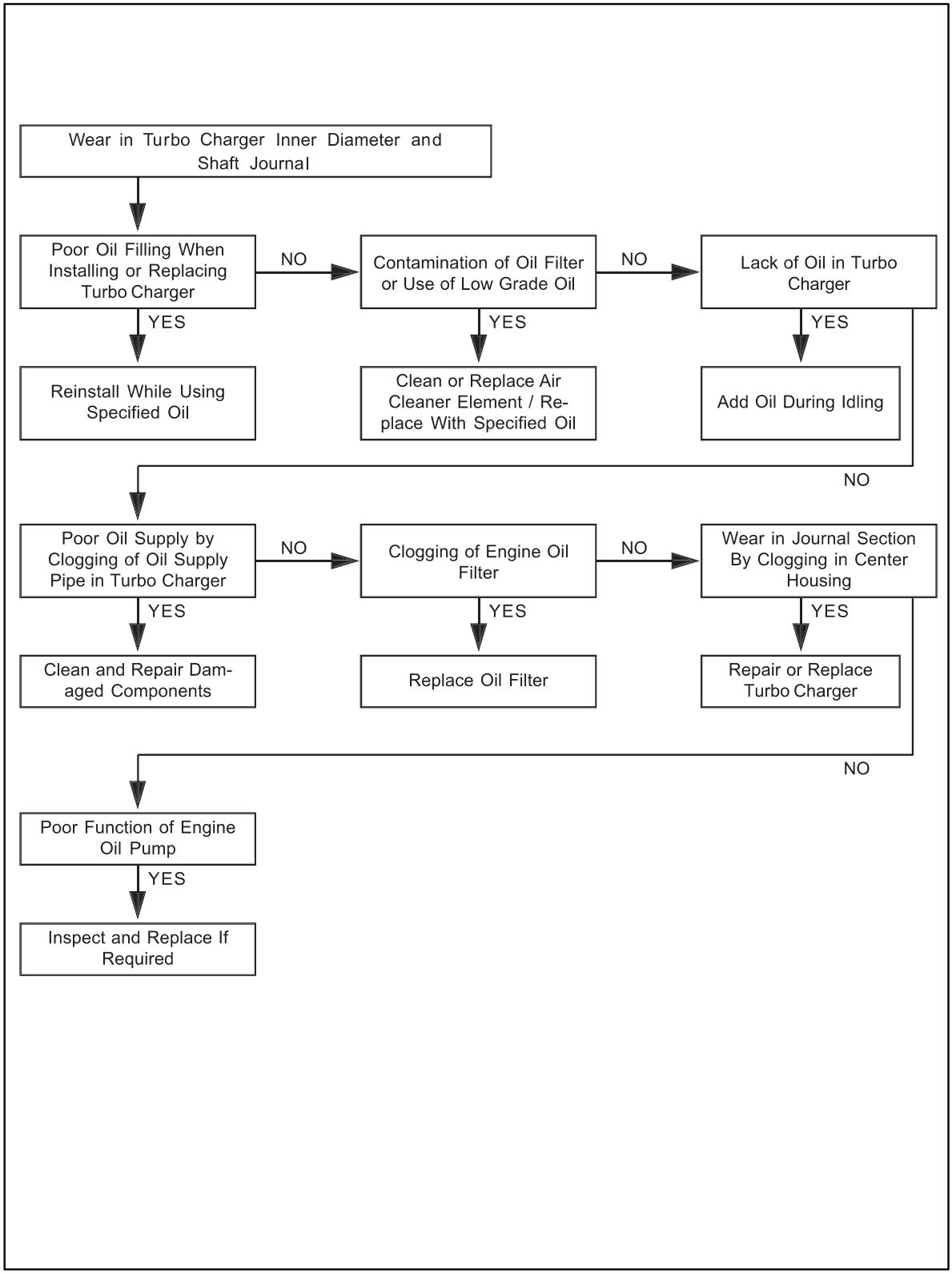
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. SYSTEM DESCRIPTION OF E-VGT (Electric-Variable Geometry Turbine)

1) Overview

The turbocharger has one shaft where at each ends are installed with two turbines having different angles to connect one end of housing to the intake manifold and the other end to the exhaust manifold. As the turbine, at exhaust end, is rotated by exhaust gas pressure the impeller, at intake end, gets rotated to send air around center of the impeller, being circumferentially accelerated by the centrifugal force, into the diffuser. The air, which has been introduced to the diffuser having a passage with big surface, transforms its speed energy into the pressure energy while being supplied to the cylinder improving the volume efficiency.
Also, the exhaust efficiency improves as the exhaust turbine rotates. The turbocharger is often referred to as the exhaust turbine turbocharger.
Diffuser: With the meaning of spreading out it is a device that transforms fluid's speed energy into the pressure energy by enlarging the fluid's passage to slow down the flow.

The E-VGT system installed to the D20DTF engine variably controls the passages of the turbine housing to regulate the flow rate of the exhaust gas. The actuator of E-VGT is a DC motor actuator (E-Actuator) which controls more quickly and precisely than the previous vacuum type actuator.
The engine ECU controls the E-Actuator electronically as follows:
- At low speed: Narrows the flow passage for the exhaust gas, resulting in increasing the flow speed of the exhaust gas and running the turbine quickly and powerfully.
- At high speed: Expands the flow passage for the exhaust gas, resulting in increasing the mass flow of the exhaust gas and running the turbine more powerfully.

Downloaded from www.Manualslib.com manuals search engine

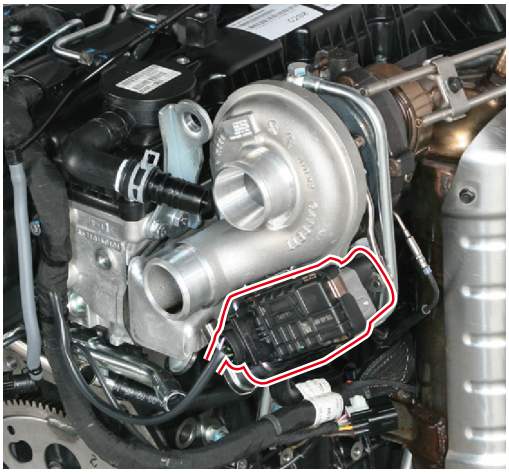
2) Features

(1) Performance (for EURO V)

1. Enhanced emmission control: By temperature control with CDPF system
   - Target temperature and airflow control

(2) Rotary Type Electric-Actuator

1. Optimizes the exhaust gas flow rate by controlling the vanes inside the turbine housing with the E-Actuator.
   - Maximizes the intake air charging efficiency (Approx. 15%)
2. Has a faster response time than the conventional vacuum actuator.
   - Improved low speed torque, high speed power and fuel economy.
   - Improved acceleration performance with rapid response time of vane.



Features	- Folding and unfolding of the vane is controlled electrically - Easy to get low speed air volume - Rapid response time - Electric control
Benefits	- Improved low speed torque and power - Reduced exhaust gas - Improved fuel consumption - Improved acceleration performance

Modification basis	
Application basis	
Affected VIN	

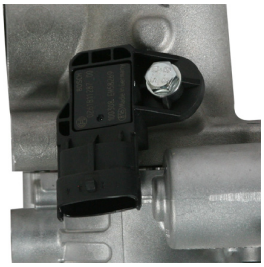
Downloaded from www.Manualslib.com manuals search engine

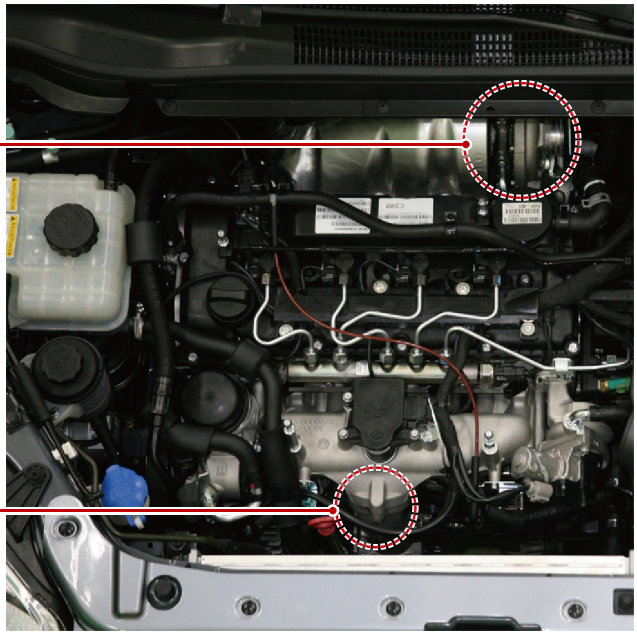
Memo

Downloaded from www.Manualslib.com manuals search engine

2. COMPONENT

E-VGT
For more information about control logic, refer to "Engine Control".
Improves engine power

T-MAP sensor

For more information about control logic, refer to "Engine Control".
Booster pressure and temperature



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Accelerator pedal sensor

For more information about control logic, refer to "Engine Control".

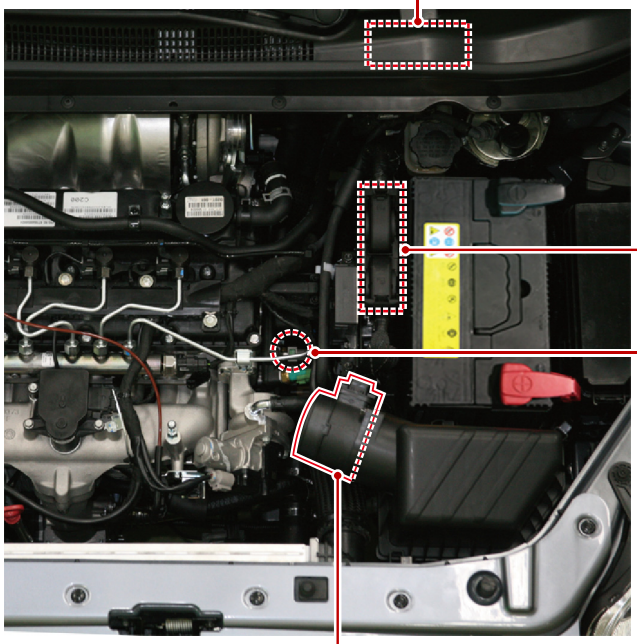
Transfers driver's will to accelerate to ECU

Engine ECU DCM 3.7

For more information about control logic, refer to "Engine Control".

Atmospheric pressure, RPM signal

E-VGT duty control



E-VGT

For more information about control logic, refer to "Engine Control".

Operates VGT by determining warming up of engine

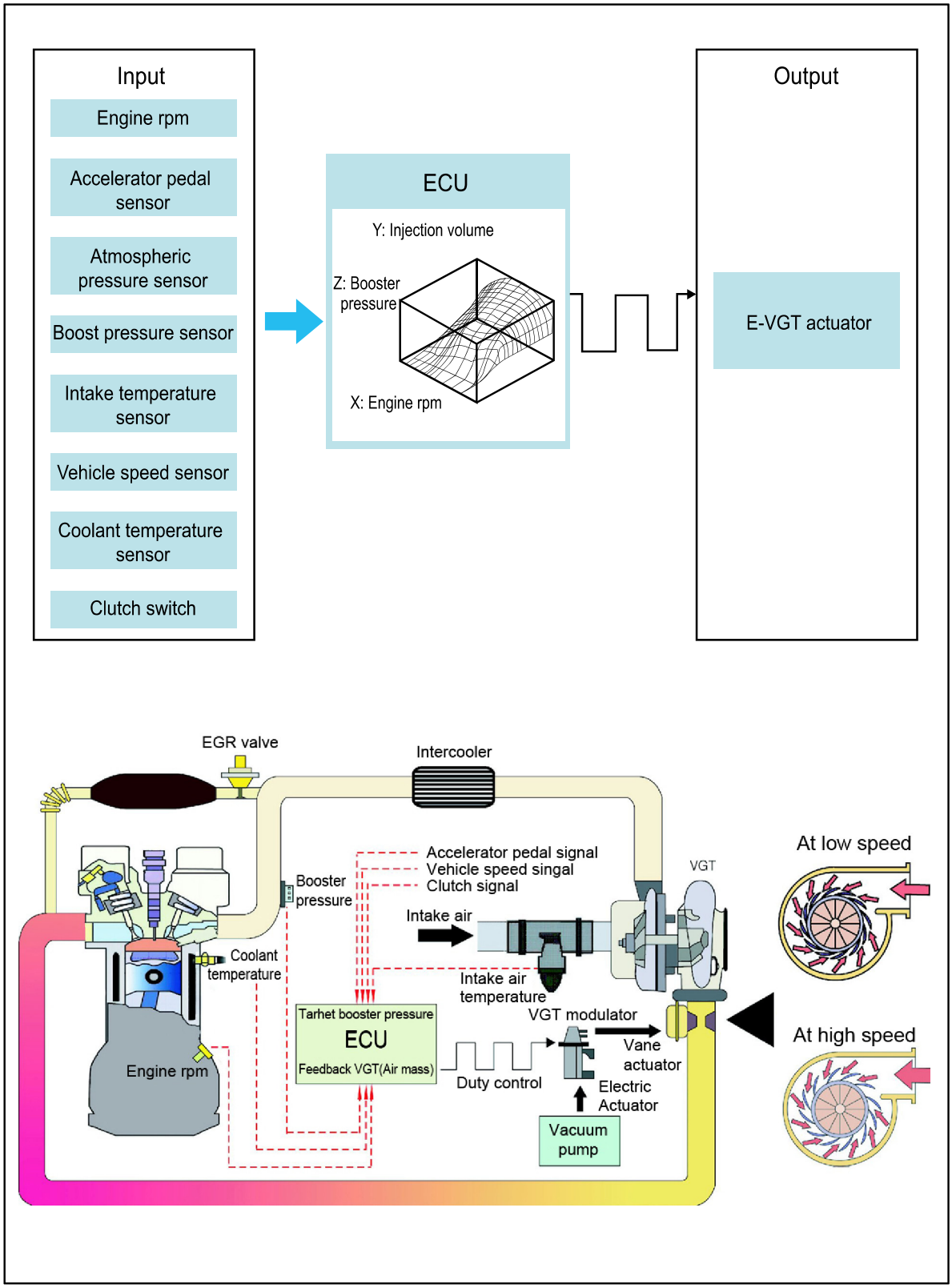
E-VGT

For more information about control logic, refer to "Engine Control".

Improves engine power

Downloaded from www.Manualslib.com manuals search engine

3. INPUT/OUTPUT DEVICES



Modification basis	
Application basis	
Affected VIN	

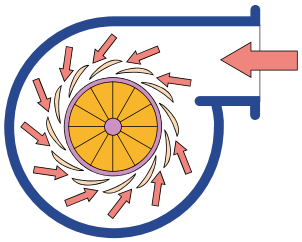
Downloaded from www.Manualslib.com manuals search engine

4. OPERATING PRINCIPLES

The E-VGT is designed to get more improved engine power in all ranges by controlling the turbine as follows:

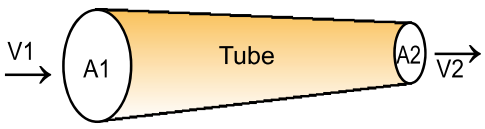
1) How it Works at Low Speed

Normal turbocharger cannot get the turbo effect because the amount of exhaust gas is not enough and the flow speed is slow in a low speed zone, but VGT allows the flow passage of exhaust to narrow, resulting in increasing the flow speed of exhaust gas and running the turbine quickly and powerfully. Therefore, as VGT can intake more air than normal turbocharger, it can give the benefit of the increased output even in a low speed zone.

Control range	Turbocharger driving mechanism	Control method	Effect	Improved performance
At low speed		Narrows the flow passage for the exhaust gas by folding the vanes	The flow rate is increased as the exhaust gas passes the narrow passage → Increased turbine & impeller speed, Increased compressive force	Improved low speed torque

※ **Basic principle at low speed**

At low speed, it utilizes the principle of venturi. For example, when air flows through the venturi tube, the flow speed is faster and the pressure is lower at the point "A". In this case, if the inner diameter of venturi is more narrowed, the flow speed is so much faster (refer to the equation).



V1 x A1 = V2 x A2 = Constant

NOTE

Turbocharger lag

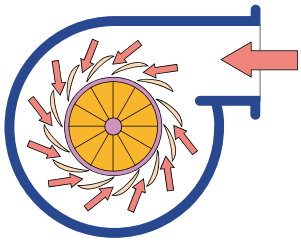
The turbocharger is at idle speed when there is no load or it is in the normal driving condition. During this period, the amount of exhaust gas passing through the turbine is not enough to turn the compressor wheel (impeller) fast. Therefore, the intake air is not compressed as needed.

Because of this, it takes time for turbocharger to supply the additional power after the accelerator pedal is depressed. This is called "turbocharger lag".

Downloaded from www.Manualslib.com manuals search engine

2) How it Works at High Speed

In a high speed zone, the amount of exhaust gas increases and it is accompanied with a great force. Therefore, if the inner diameter of venturi is more widened, the turbine in the turbocharger by the releasing force of abundant exhaust gas can deliver a more increased energy to the compressor. The output will increase in submission to the increase of intake air volume.

Control range	Turbocharger driving mechanism	Control method	Effect	Improved performance
At high speed		Expands the flow passage for the exhaust gas by unfolding the vanes	The flow rate is increased due to the expanded passage→ Increased turbine & impeller speed, Increased compressive force	Improved maximum power

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Item			Specifications
Oil pump	Lubrication system		Gear pump, forced circulation
	Type		Inscribed gear
	Oil pump capacity		74 L at 4,000 rpm, 3 bar
	Relief pressure		6.3 bar ± 0.3 bar
Oil filter	Type		Full flow/Paper element
Engine oil	Specified oil		SAE 5W30 (approved by MB SHEET 229.51)
	Oil capacity (L)		Min.: 4.5 L Max.: 6.0 L
	Replacement interval	EU	Change every 20,000 km or 12 months (But, shorten the service interval under severe condition)
		GEN	Change every 15,000 km or 12 months (But, shorten the service interval under severe condition)
Oil injection nozzle	Type		1.5 bar
	Operating pressure		1.5 bar
	Closing pressure		1.0 bar
	Oil flow		4 l/min

CAUTION

The engine oil filter element should be changed at the same time with the engine oil.

- Regularly check the engine oil level and add the engine oil if necessary.
- Remember to check the engine oil level and shorten the cycle to replace the engine oil under severe driving conditions.

Severe Driving Condition

- Frequent stop-and-go traffic, extended idling, short driving distance below 6 km, driving distance below 16 km when the outside temperature remains below freezing
- Driving in a hilly or mountainous terrain, sandy, or dusty area
- High load driving such as trailer towing
- Taxi, patrol service or delivery service (extended idling and excessive driving with low speed)

Downloaded from www.Manualslib.com manuals search engine

2. MAINTENANCE

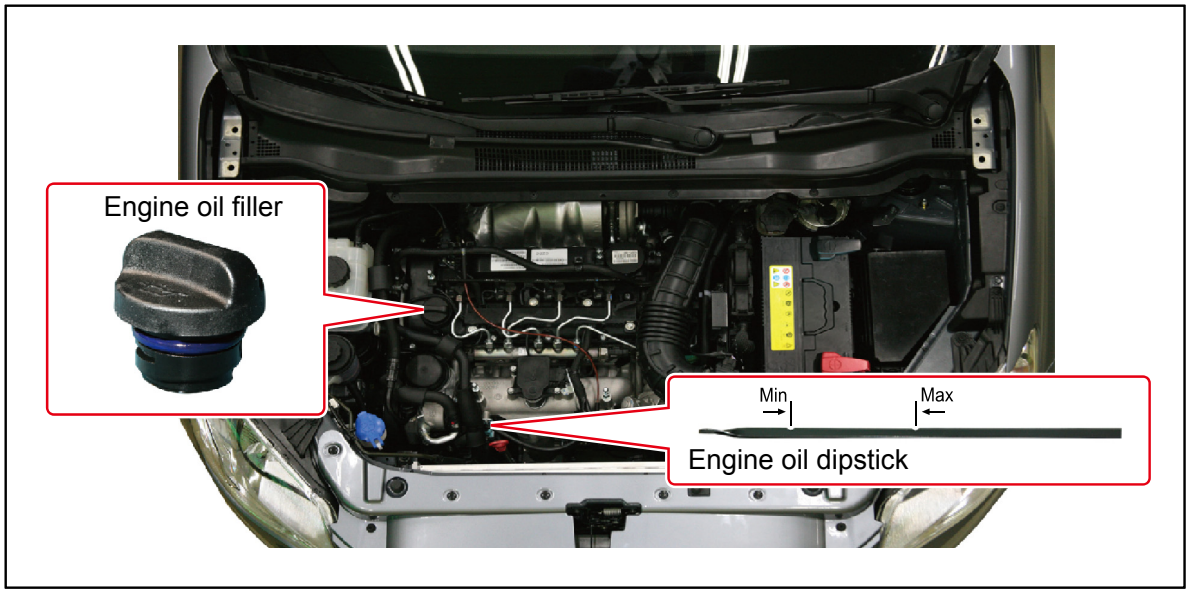
1) Level Check

Park the vehicle on a level ground and apply the parking brake. Stop the engine and wait more than 5 minutes.

- Pull out the dipstick and wipe it with a clean cloth. Reinsert it all the way.
- Pull out it again and check the oil level.
- The oil level should be between the maximum (Max) mark and minimum (Min) mark on the oil dipstick. Oil should be replenished before the level goes below the minimum mark.

WARNING

Operating vehicle with insufficient amount of oil can damage the engine. Make sure the engine oil level is correct and add oil if necessary.



2) Replenishment

If the level gets to the lower point, open the filler cap on top of the cylinder block and add the genuine oil without exceeding the level of the upper mark.
Recheck the oil level after 5 minutes.

CAUTION

- Regularly check the engine oil level and add Ssangyong genuine engine oil if necessary.
- Clean the dipstick with clean cloth so that any foreign materials cannot get into the engine.
- The oil should not go above the upper mark on the dipstick.
- The engine oil may be consumed more if the engine is new.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

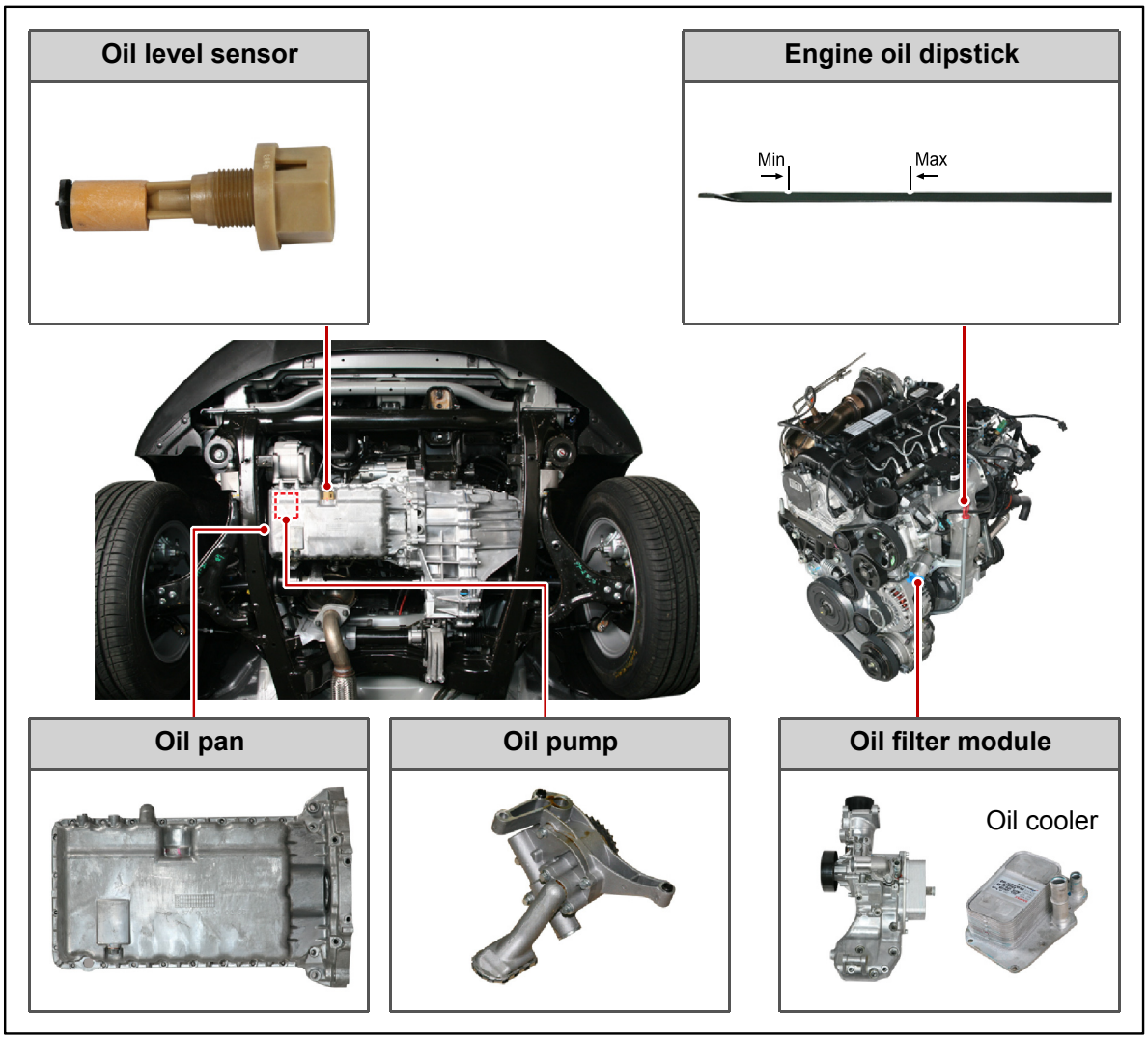
OVERVIEW AND OPERATING PROCESS

1. SYSTEM DESCRIPTION

1) Overview

The lubrication system supplies oil to each lubrication section to prevent friction and wear and to remove heat from the friction part. As the engine runs, frictional heat is generated on each lubrication section. If this condition persists, the bearing can be burned and stuck.
In other words, it creates an oil film on each sliding surface to convert solid friction to liquid friction in order to minimize wear and prevent temperature increasing on the friction part.
For the D20DTF engine with no oil pressure switch, the engine ECU receives the low engine oil level signal from the oil level sensor and communicates with the instrument cluster through the CAN communication to turn on the warning lamp.

2) Component

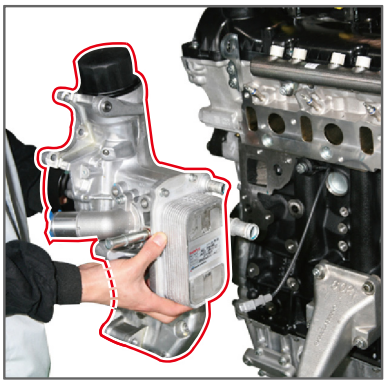


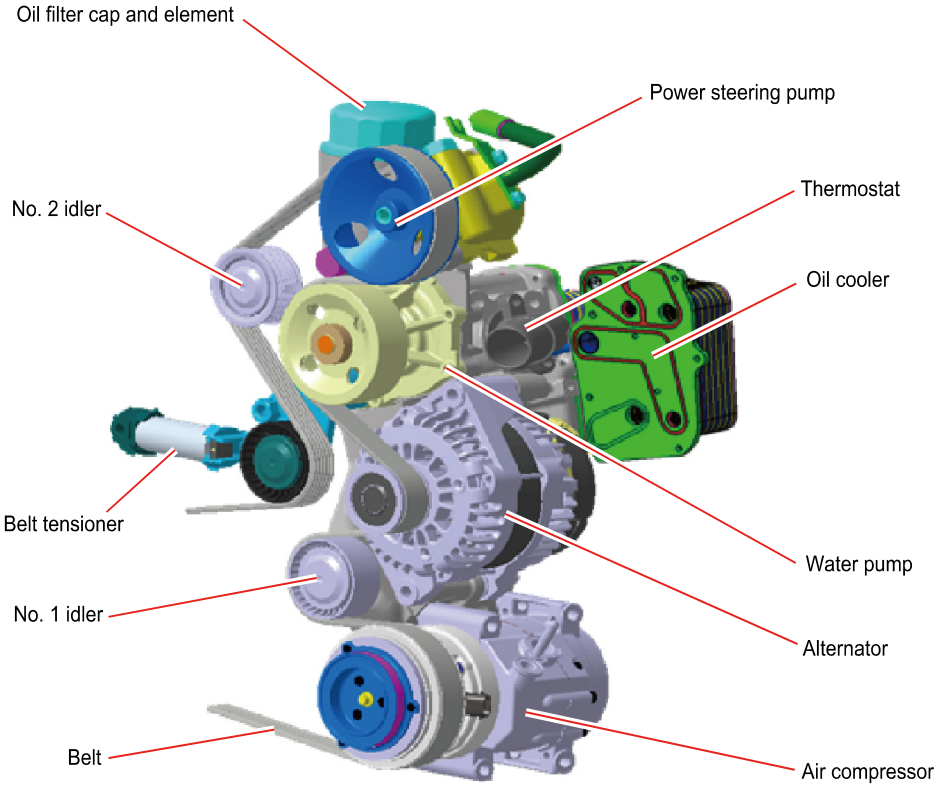
Downloaded from www.Manualslib.com manuals search engine

3) Oil Filter Module

The oil filter module consists of lubrication system, cooling system and some mechanical devices as below.

System	Components
Supplementary devices	Power steering pump (HPS), Alternator, A/C compressor
Belt drive	Belt tensioner, Idle pulley
Cooling	Water pump, Thermostat, Cooler housing and Pipes
Lubrication	Oil filter, Oil cooler (except coolant pipes)



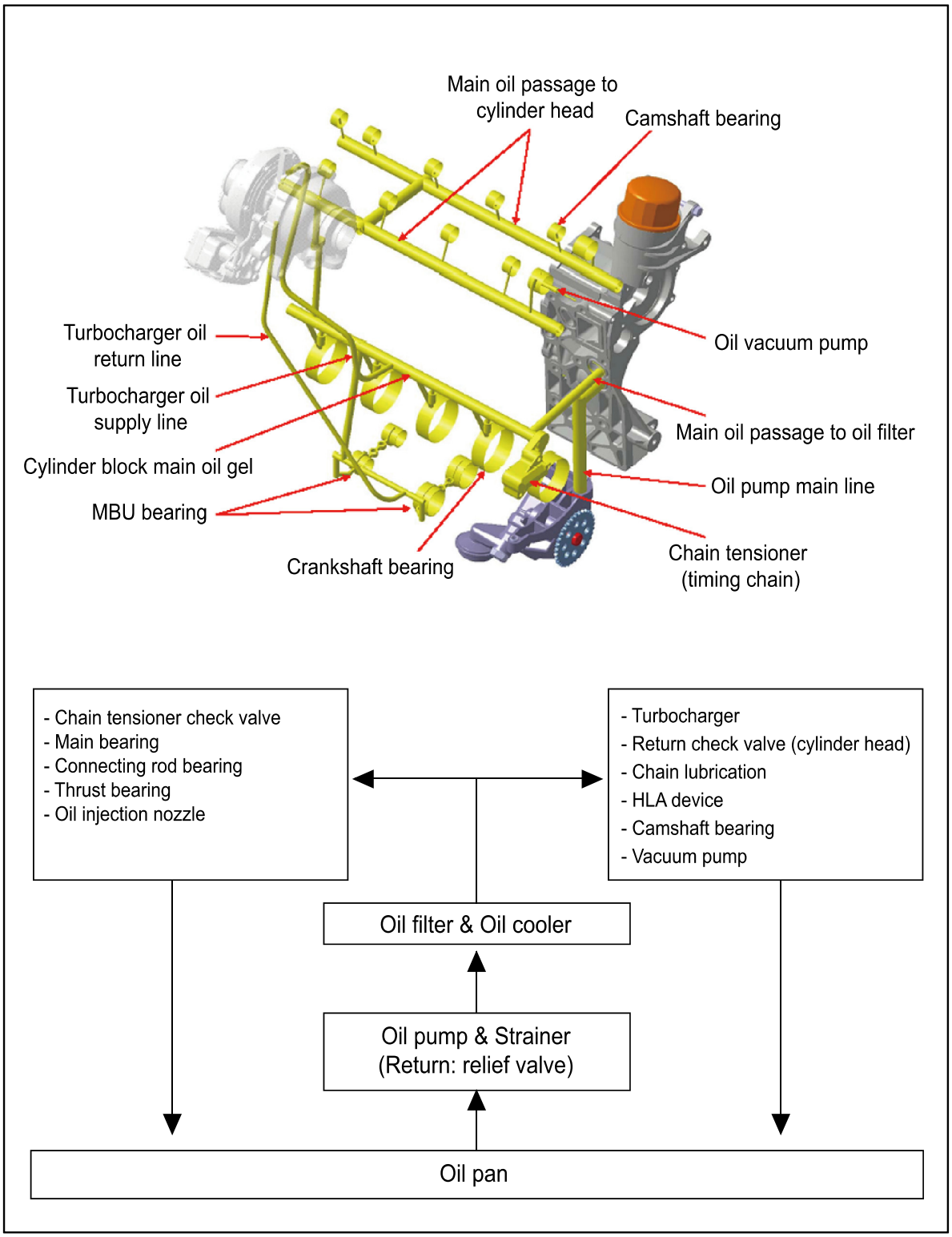


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. OPERATING PROCESS

1) Operation Flow



Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Description		Specification
Cooling system	Type	Water cooling, forced circulation
Coolant	Capacity	11.3L
Radiator	Core size	740W X 380H X 27t (over 281,200㎟)
	Flow type	Cross flow
	Min. cooling capacity	over 68,000kcal/h
Antifreeze	Type	Long life coolant
	Mixing ratio (water:antifreeze)	50 : 50
Cooling fan module	Type	Electric
	Capacity	220W (Ø360) + 150W (Ø360)
	Control type	Series: low speed, Parallel: high speed
Coolant reservoir	Capacity	over 2.2L
	Circulation	Closed roof type
	Pressure cap	Screw type, 1.4bar
	Vacuum valve	Screw type, 1.4bar
Thermostat	Type	Wax pallet type
	Opening temperature	90℃
	Fully open temperature	100℃
	Valve lift	8mm

Downloaded from www.Manualslib.com manuals search engine

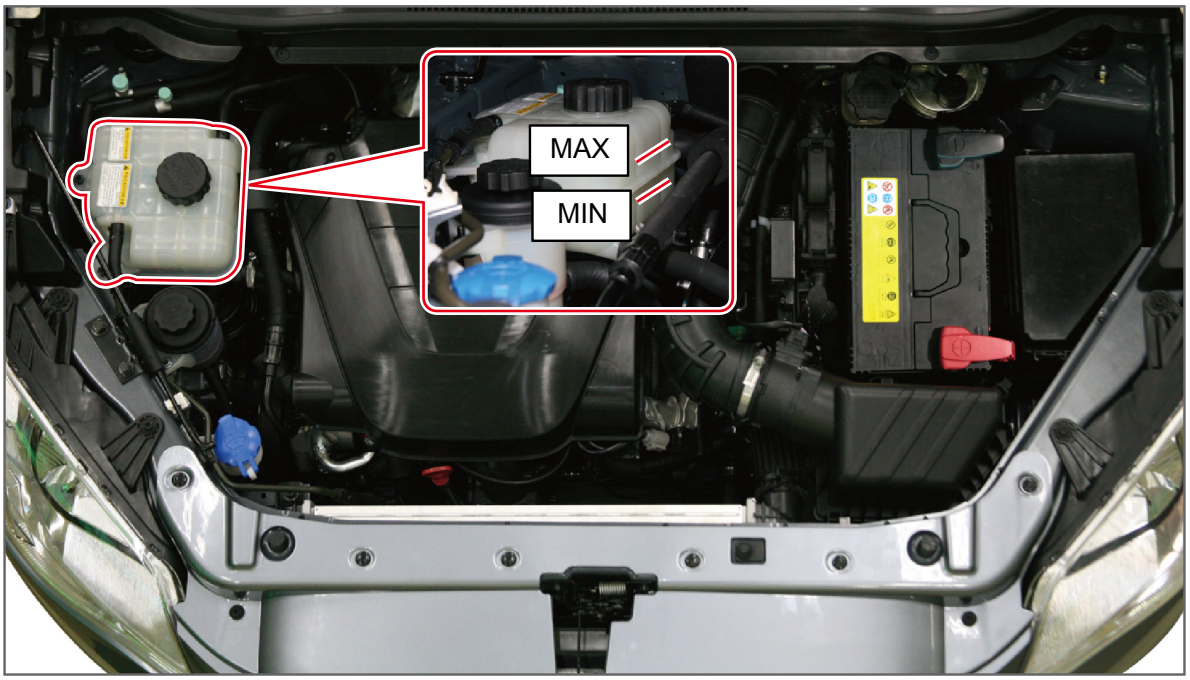
2. INSPECTION

Problem	Possible Cause	Action
Coolant level is too low	- Leak from the radiator - Leak from the coolant auxiliary tank - Leak from the heater core	- Change the radiator - Change the coolant auxiliary tank - Change the heater
	- Leak from the coolant hose connections - Damaged coolant hose	- Reconnect the hose or replace the clamp - Change the hose
	- Leak from the water pump gasket - Leak from the water pump internal seal	- Change the gasket - Change the water pump
	- Leak from the water inlet cap - Leak from the thermostat housing	- Change the water inlet cap gasket - Change the thermostat sealing
	- Incorrect tightening torque of the cylinder head bolts - Damaged cylinder head gasket	- Tighten the bolts to the specified torque - Change the cylinder head gasket
Coolant temperature is too high	- Coolant leakage (Coolant level is low) - Improper coolant mixture ratio - Kinked coolant hose	- Add coolant - Check the coolant concentration (Anti-freeze) - Repair or replace the hose
	- Defective thermostat - Defective water pump - Defective radiator - Defective coolant auxiliary tank or tank cap	- Change the thermostat - Change the water pump - Change the radiator - Change the coolant auxiliary tank or tank cap
	- Cracks on the cylinder block or cylinder head - Clogged coolant passages in the cylinder block or cylinder head	- Change cylinder block or cylinder head - Clean the coolant passage
	- Clogged radiator core	- Clean the radiator core
	- Improper operation of cooling fan	- Replace the cooling fan or repair the related circuit
	- Defective temperature sensor or faulty wiring	- Replace the sensor or repair the related wiring
Coolant temperature is too low	- Thermostat is stuck open	- Change the thermostat
	- Improper operation of cooling fan	- Replace the cooling fan or repair the related circuit
	- Defective temperature sensor or faulty wiring	- Replace the sensor or repair the related wiring

Downloaded from www.Manualslib.com manuals search engine

1) Coolant Level Check

1. Park the vehicle on level ground and apply the parking brake. Stop the engine and wait until it is cooled down.
   The coolant level should be between the MAX and MIN mark on the coolant reservoir.
2. Check the coolant level. If the level is below the "MIN" mark, immediately add coolant.



CAUTION

- Scalding hot coolant and steam could be blown out under pressure, which could cause serious injury. Never remove the coolant reservoir cap when the engine and radiator are hot.
- Avoid any direct contact of the coolant to the painted body of the vehicle.

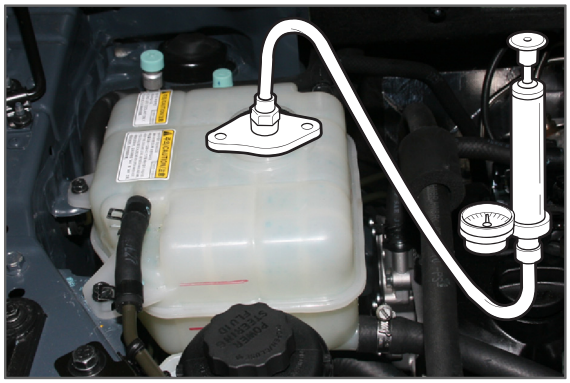
Downloaded from www.Manualslib.com manuals search engine

2) Leak Test

1. Release the pressure in the system by loosening the pressure cap of the coolant reservoir slightly. Then, remove the pressure cap completely.

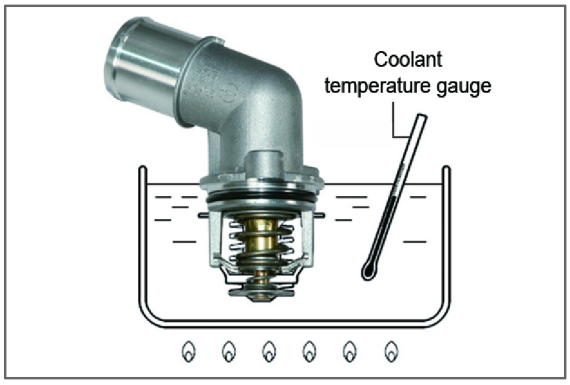
CAUTION

Never open the cap until the coolant temperature becomes under 90℃ to prevent any burn.



2. Add the coolant so that the coolant level is between MAX and MIN mark on the coolant auxiliary tank.
3. Connect the tester to the tank filler and apply pressure (1.4 bar).
4. Check all the coolant hoses, pipes and connections for leaks when the pressure of the tester drops, and replace or tighten, if necessary.

3) Thermostat



Immerse the thermostat into the water. Heat the water and check the valve opening temperature.

Valve opening temperature	90±2℃

Downloaded from www.Manualslib.com manuals search engine

3. CAUTIONS

CAUTION

- If 100% of anti-freeze is added, the water pump vane can be damaged and thermal conductivity can be decreased resulting in poor circulation in the cooling system which leads to overheated engine.
- Use of non-recommended coolant could cause damage to the cooling system and overheating of the engine.
- Opening the coolant reservoir cap while the engine is running or hot can cause burns by hot steam or water.
- To open the coolant reservoir cap, wrap the cap with a wet towel or thick cloth after the engine is cooled down sufficiently.
- If cool water is added to the heated engine, the engine or radiator can be deformed.
- The anti-freeze in the coolant can damage the painted surface, so avoid the contact of the coolant to the painted body.
- The anti-freeze and water should be mixed in proper mixture ratio. Never add only water when adding coolant.
- If the anti-freeze content is too low, the coolant can be frozen while the engine can be overheated if anti-freeze content is too high.

Downloaded from www.Manualslib.com manuals search engine

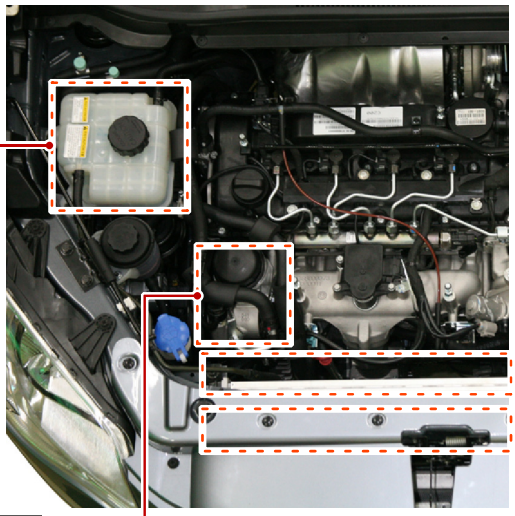
OVERVIEW AND OPERATING PROCESS

1. SYSTEM DESCRIPTION

1) Overview

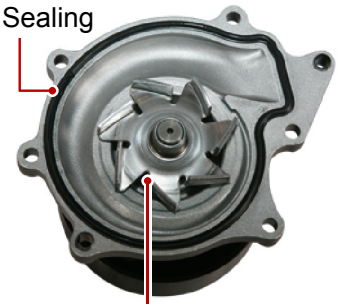
Coolant reservoir

Long life coolant is used.



Water pump

Water pump pulley



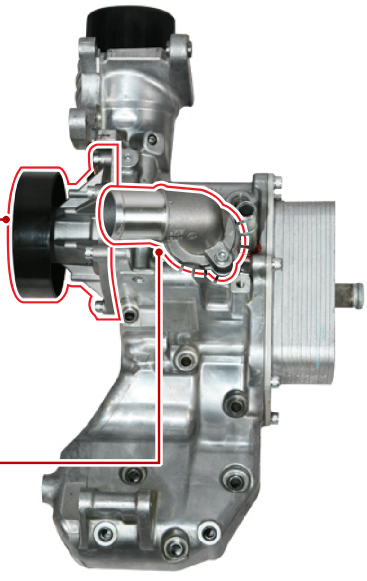
Impeller vane

The water pump is driven by the engine drive belt and supplies the coolant to each area of the engine.

Thermostat

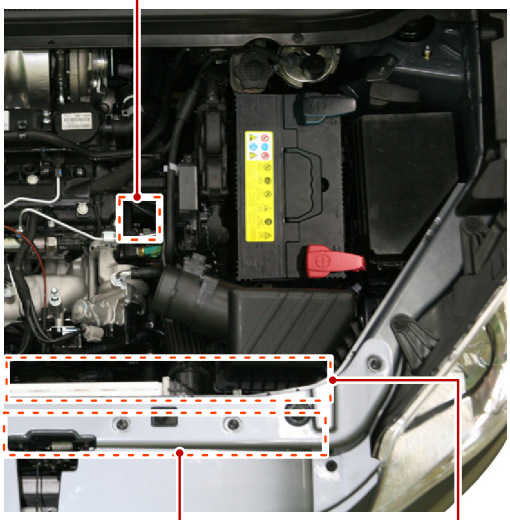
When the engine coolant reaches 90℃, the thermostat starts to open (fully open at 100℃) and lets the coolant flow to the radiator to maintain the engine temperature.

Oil filter module



Modification basis	
Application basis	
Affected VIN	

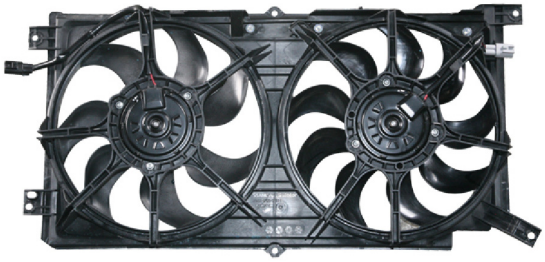
Downloaded from www.Manualslib.com manuals search engine



Coolant temperature sensor

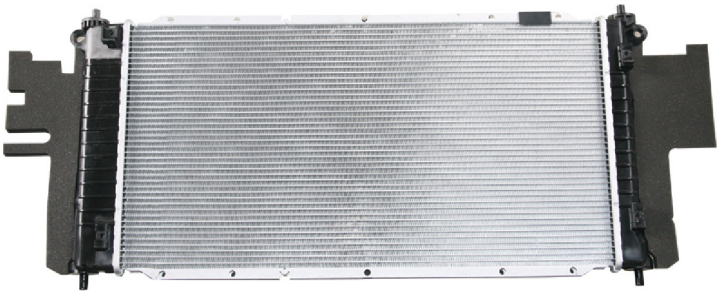
Measures the coolant temperature and sends the result to the engine ECU.

Electric fan



Circulates the fresh air forcibly to exchange heat with the radiator core fin.

Radiator

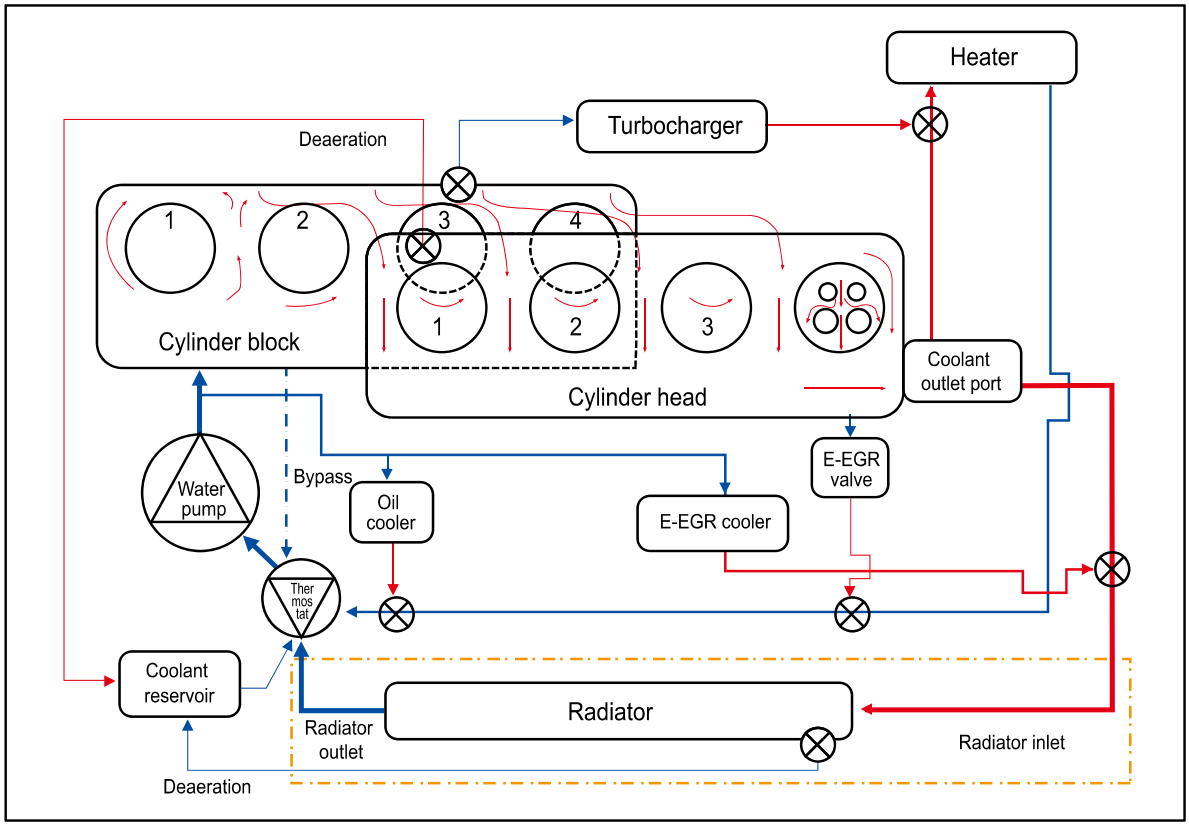


Releases heat through fins and cools down the hot coolant as the coolant passes through the tube of the radiator core.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Schematic Diagram



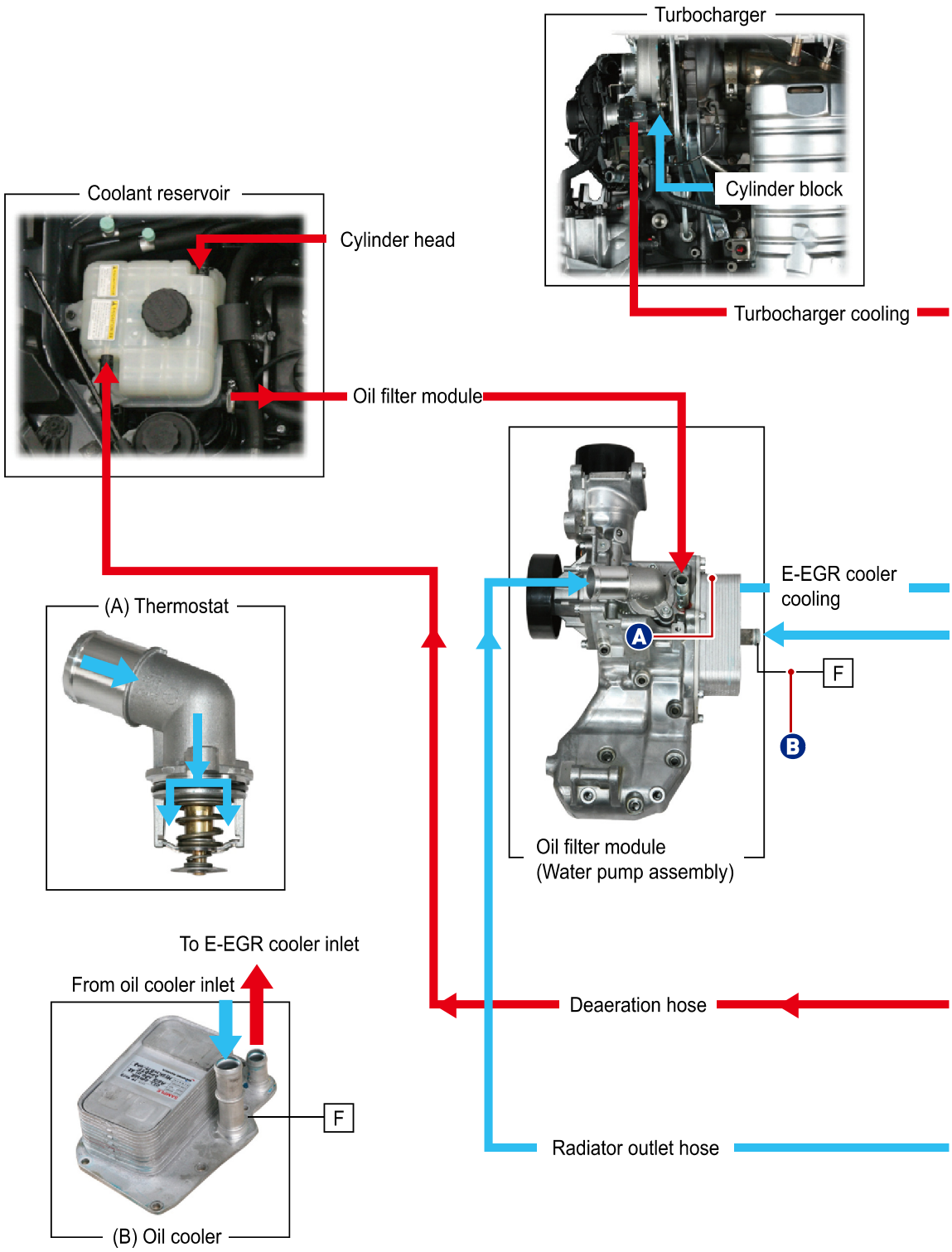
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Memo

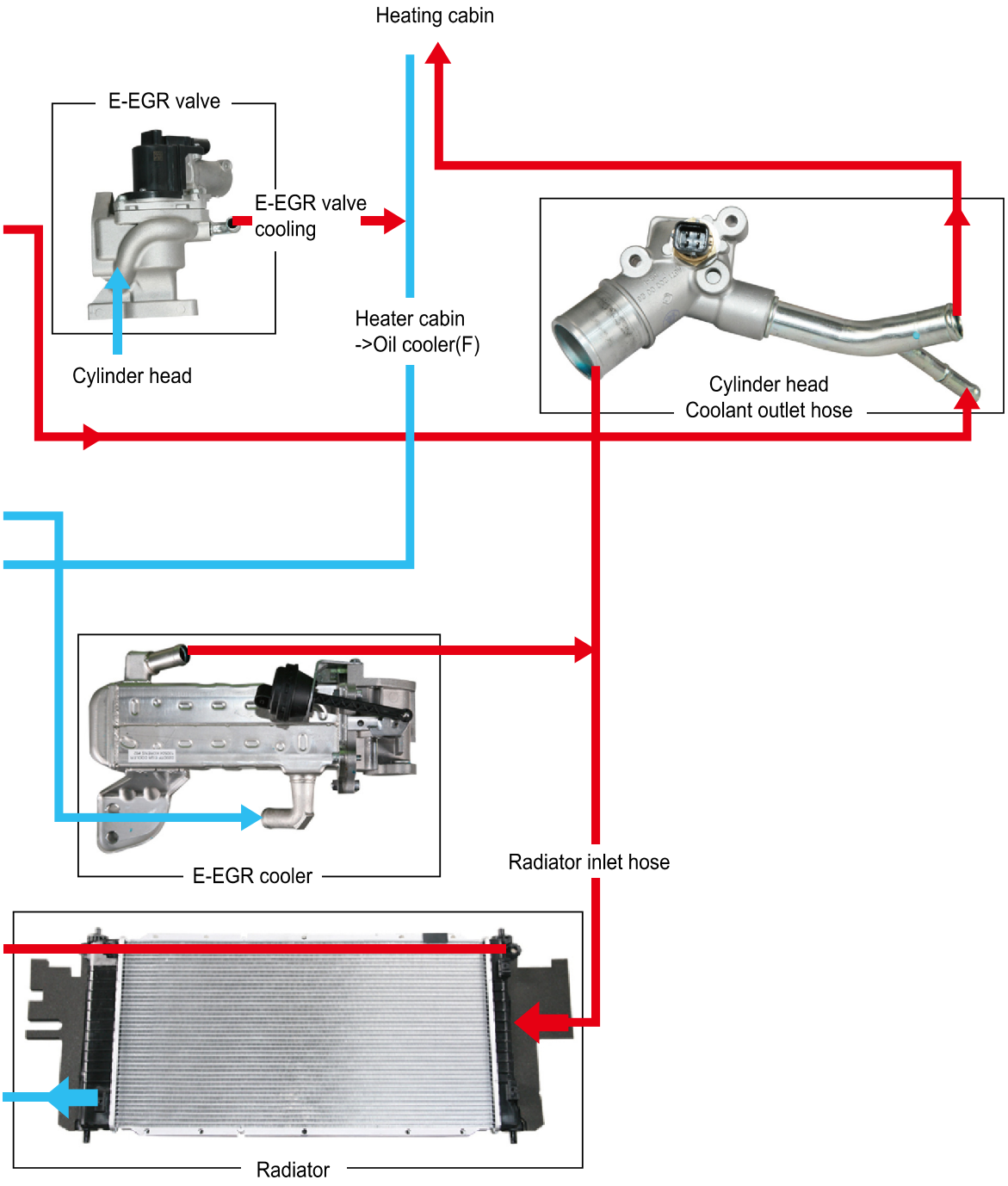
Downloaded from www.Manualslib.com manuals search engine

3) System Layout



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Alternator	Typ.		HPS	EPS
	Capacity		120 A	140 A
	Normal output		70/120 A at 1,800/6,500 rpm	76/140 A at 1,800/6,500 rpm
	Regulator voltage		14.6 V	←
	Brush	Length	12.5 mm	←
		Wear limit	7 mm	←
Battery	Typ.		Maintenance Free	←
	Capacity		90 AH	←

Downloaded from www.Manualslib.com manuals search engine

2. INSPECTION

1) Alternator Output Test

Item	How to check	DTC set value / Action
Output current	1. Disconnect the cable connected to the B terminal on the alternator. Connect one end of the ammeter to the B terminal and the other end to the cable connected to the B terminal. 2. Measure the maximum output value. (Maintain the engine speed between 2,500 and 3,000 rpm.) (Turn the headlamp and all the electrical switches on.)	- Pass: If the measured current is 45 A or higher. - Fail: If the measured current is less than 45 A. - Check the current of the B terminal.
B terminal current	1. Move the gear selector lever to the neutral position. 2. Maintain the engine speed at 2,500 rpm with the vehicle unloaded. (Turn all the electrical switches off.)	- Open circuit: If the measured current is 5 A or higher.
Rotor coil resistance	1. Disconnect the negative cable from the battery. 2. Remove the B terminal and turn off the ignition switch. 3. Measure the resistance between the L and F terminals with an ohmmeter.	- Pass: If the measured resistance is between 3 and 6 Ω. - Faulty rotor coil or slip ring: If the measured resistance is less than 3 Ω or greater than 6 Ω.
L terminal voltage	1. Connect the B terminal wiring. 2. Measure the voltage with the engine running.	- Specification: 12.5 V to 14.5 V - Faulty IC regulator or field coil: If the measured voltage is 14.5 V or higher.

CAUTION
- Disconnect the negative battery cable.
- Connect the negative cable again after connecting the ammeter.

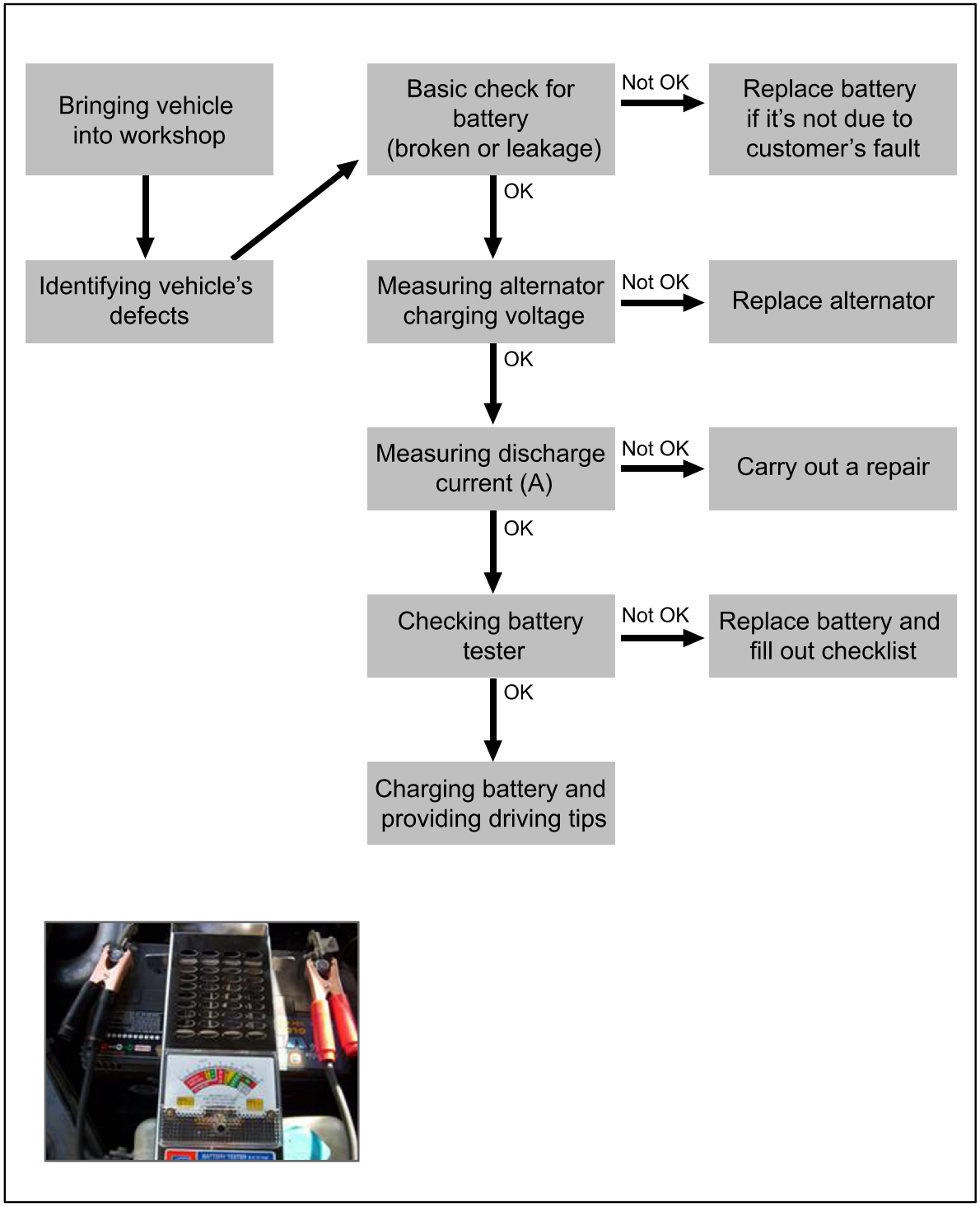
Downloaded from www.Manualslib.com manuals search engine

2) Troubleshooting for Alternator

Item	Cause	Action
Overcharged battery	Defective alternator voltage regulator	Replace the alternator
	Defective voltage detection wiring	Repair or replace
Discharged battery	Loose alternator drive belt	Adjust the belt tension or replace
	Poor connection of related circuit or open circuit	Retighten the loose connection or repair open circuit
	Defective alternator voltage regulator	Replace the alternator
	Terminated battery	Replace the battery
	Defective ground	Repair
Charge warning lamp does not come on when turning on ignition switch with engine stopped	Defective alternator voltage regulator	Replace the alternator
	Open circuit in charge warning lamp, fuse or wiring	Replace or repair the charge warning lamp or fuse
	Defective ignition switch	Replace the ignition switch
	Defective ground of alternator circuit	Repair
Charge warning lamp is not turned off after starting engine	Defective alternator voltage regulator	Replace the alternator
	Corroded or worn battery cable	Repair or replace the battery cable
	Loose alternator drive belt	Replace the batteryAdjust the belt tension or replace the belt
	Defective wiring harness	Repair or replace

Downloaded from www.Manualslib.com manuals search engine

3) Checking Battery



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(1) Checking

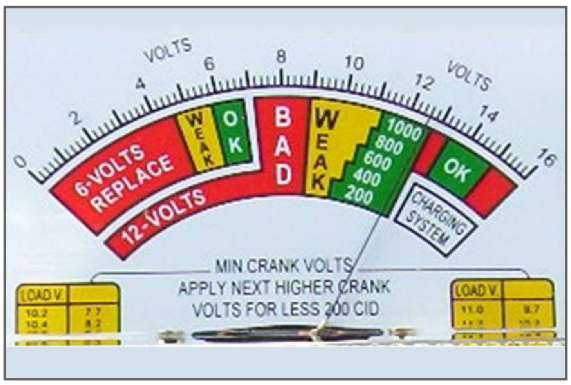
▶ **Using battery tester**

- PASS (11.0 V or more): Explain to the customer that the battery is reusable.
- Need to be charged (9.0 to 11.0 V): Charge the battery with a charger and reinstall it. Explain it to the customer.
- Need to be replaced (9.0 V or more): The battery should be replaced due to overdischarging.

(2) How to use battery tester

▶ **How it works and How to use it**

- Determine battery capacity by fixing current (load capacity) and time and varying voltage.
- Determine battery capacity based on the amount of voltage drop when discharging a fixed load capacity (120 A) for 5 seconds.
- Connect the tester to the battery and read the display while applying a load for 5 seconds.



▶ **How to read display**

- Red area (①): overdischarge or faulty battery
- Yellow area (②): Need to be charged (using a vehicle alternator and a battery charger)
- Green area (③): Normal
- Red area on the left-hand side of OK (④ Impossible to charge with an alternator
- Green area with OK (⑤): Normally charged
- Red area on the right-hand side of OK (⑥): Overcharged by an alternator

Downloaded from www.Manualslib.com manuals search engine

(3) Starting with jumper cable

If the battery is weak or terminated, the battery from another vehicle can be used with jumper cables to start the engine.

▶ Connecting order

1. The positive (+) terminal of the discharged battery
2. The positive (+) terminal of the booster battery
3. The negative (-) terminal of the booster battery
4. Connect one end of the other jumper cable to the body of the discharged vehicle, such as the engine block or a front towing hook.

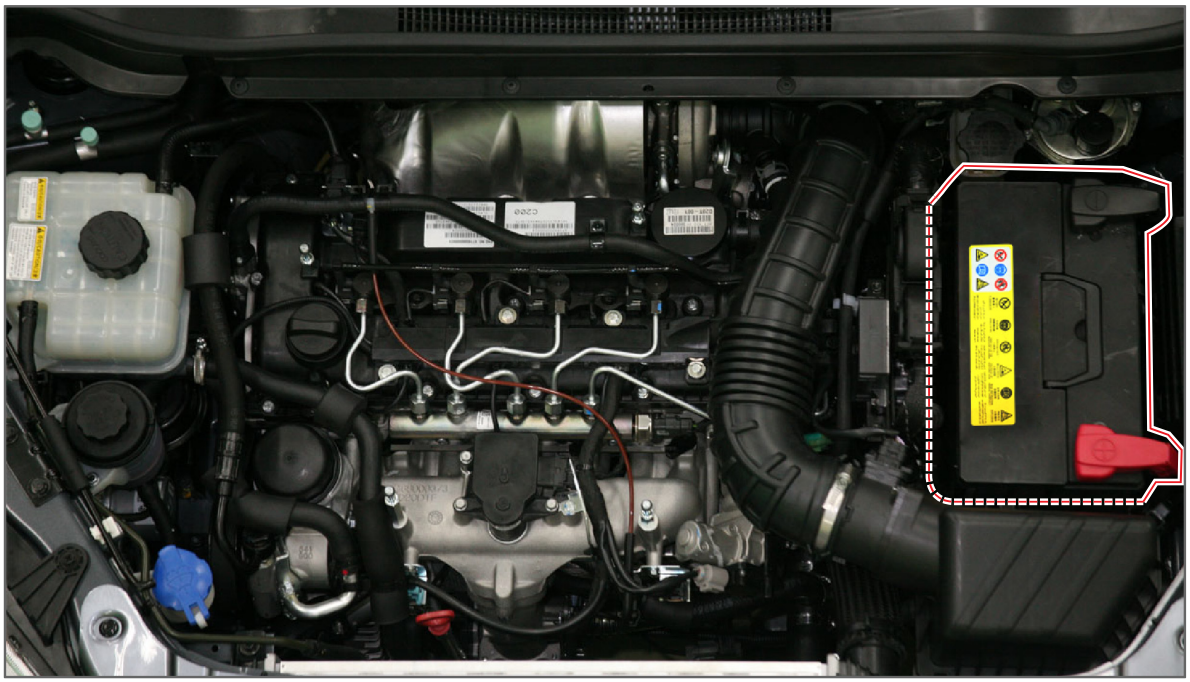
▶ Starting

1. Prepare a set of jumper cables.
2. Place another vehicle that has the same 12 V of power near to the discharged vehicle.
3. Switch off all electrical accessories for the discharged vehicle.
4. Apply the parking brake and shift the transaxle to the P position (automatic transaxle) or neutral (N) position (manual transaxle).
5. Connect the jumper cables.
6. Try to start the discharged vehicle while accelerating the engine rpm in the booster vehicle.
7. Attempt to start the engine with the discharged battery.
8. After starting the engine, carefully disconnect the jumper cables in the reverse sequence of connection.

Downloaded from www.Manualslib.com manuals search engine

(4) Maintenance

If the charge warning lamp ( ) on the instrument cluster comes on while driving, there is a malfunction in the charge system including the battery. Therefore, carrying out the system check is needed.



- Make sure that the battery cables are firmly connected.
- If the terminals are corroded, clean them with a wire brush or sandpapers.
- Always disconnect the battery cables with the ignition key removed. When disconnecting the battery cables with the ignition key turned to ON or ACC position, several electric units can be damaged due to sudden voltage change.
- Check the battery for crack, damage or fluid leaks. Replace it if necessary.
  Wipe out the battery fluid on the battery surface using a rubber glove and a clean cloth wetted with soapy water.

Downloaded from www.Manualslib.com manuals search engine

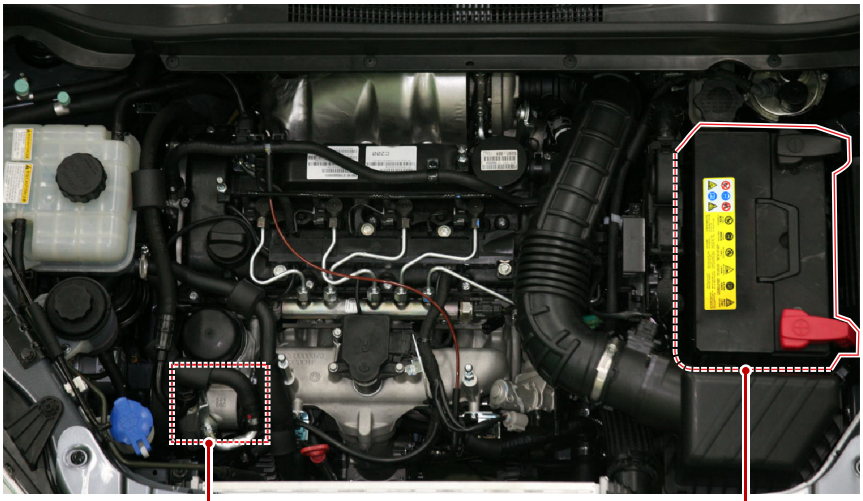
OVERVIEW AND OPERATING PROCESS

1. SYSTEM DESCRIPTION

1) Overview

The charge system is designed to supply electrical energy to the vehicle while driving, and supplies a constant direct current voltage by converting mechanical rotational movement to electrical energy.
The voltage regulator on the back of the alternator controls the generated voltage in all rotating ranges and adjusts the system voltage according to the electric load and ambient temperature change.

2) System Layout (Locations)

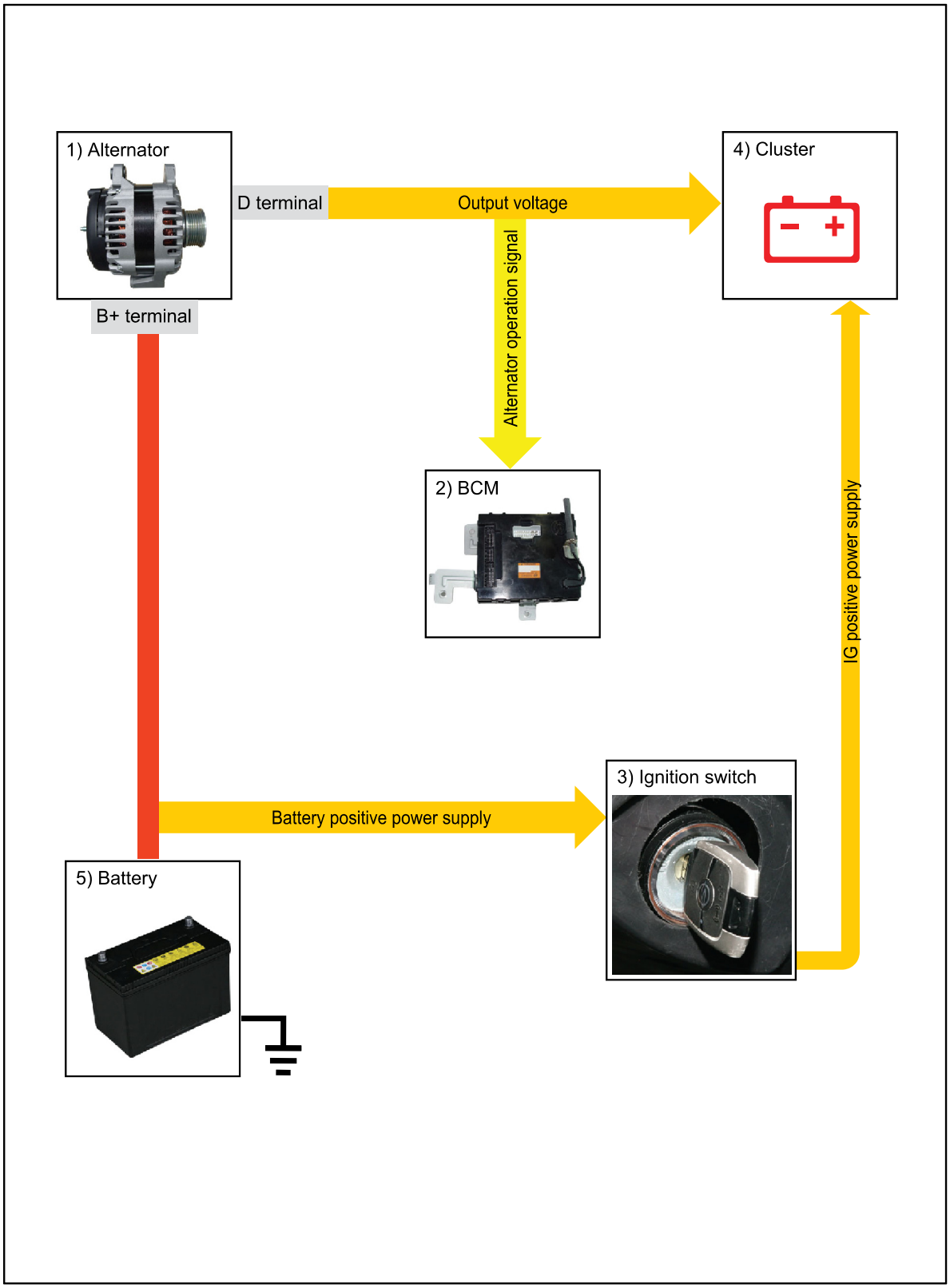


Alternator	Battery
The alternator charges the battery and supplies power to each electric unit by converting the mechanical energy to the electrical energy.	It converts the chemical energy to the electrical energy and supplies power to the corresponding electric units when starting the engine.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

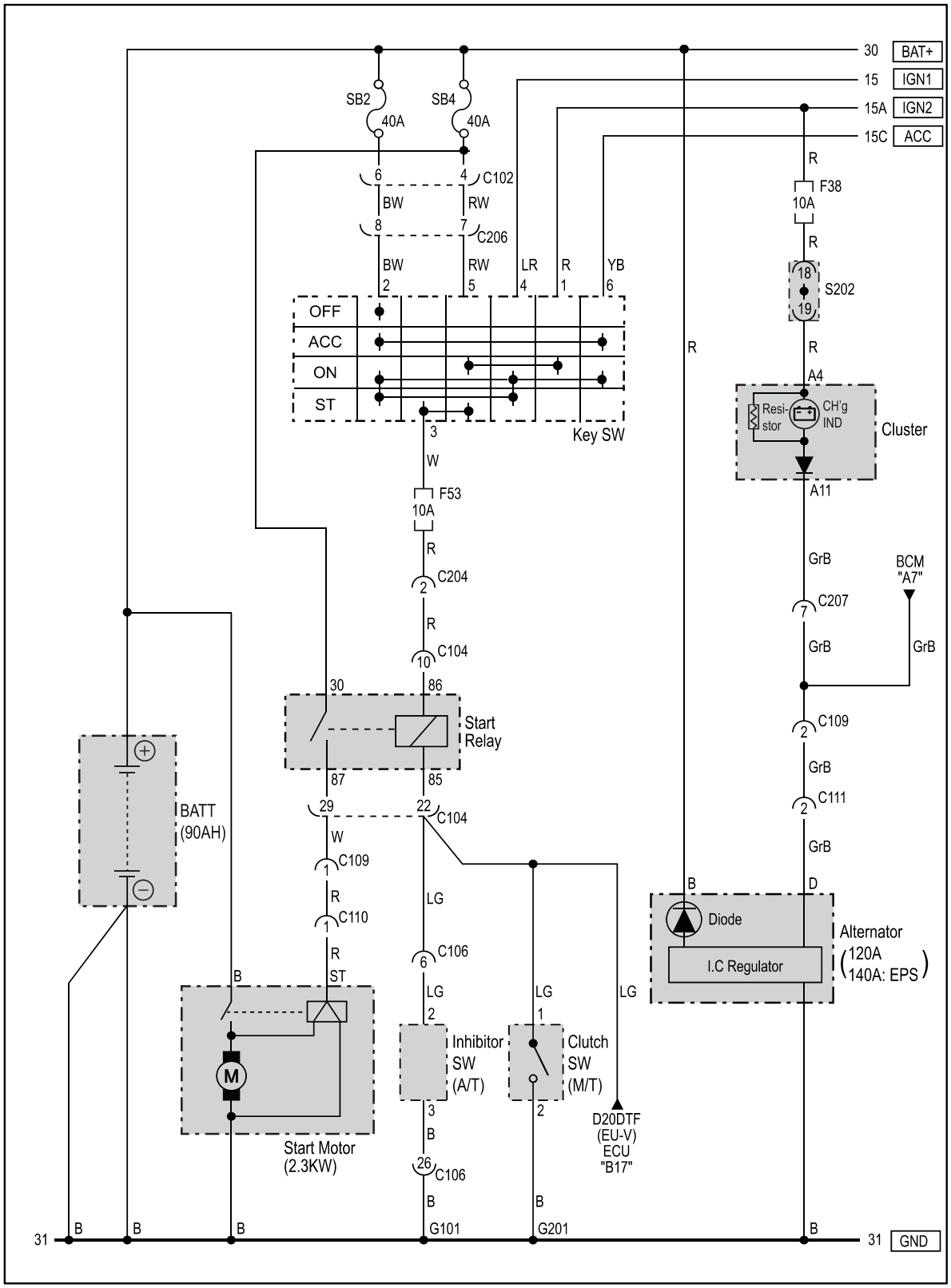
2. OPERATING PROCESS



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

D20DTF PRE-HEATING 1114-00

GENERAL INFORMATION

1. SPECIFICATION

Description		Specification
Glow plug	Rated voltage	12 V
	Operating voltage	6 to 16 V
	Maximum temperature	1,300°C
	Operating temperature	1,100°C
Glow plug control unit	EMS operating voltage	6 to 16 V
	Operating temperature	−40°C to 110°C
	Dark current	Max. 1 mA

Downloaded from www.Manualslib.com manuals search engine

2. TIGHTENING TORQUE

No.	Name	Tightening torque	
1	Glow plug	20 ± 2 Nm	
2	Glow plug control unit bolt		

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

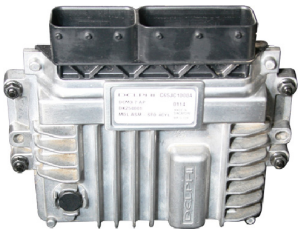
OVERVIEW AND OPERATING PROCESS

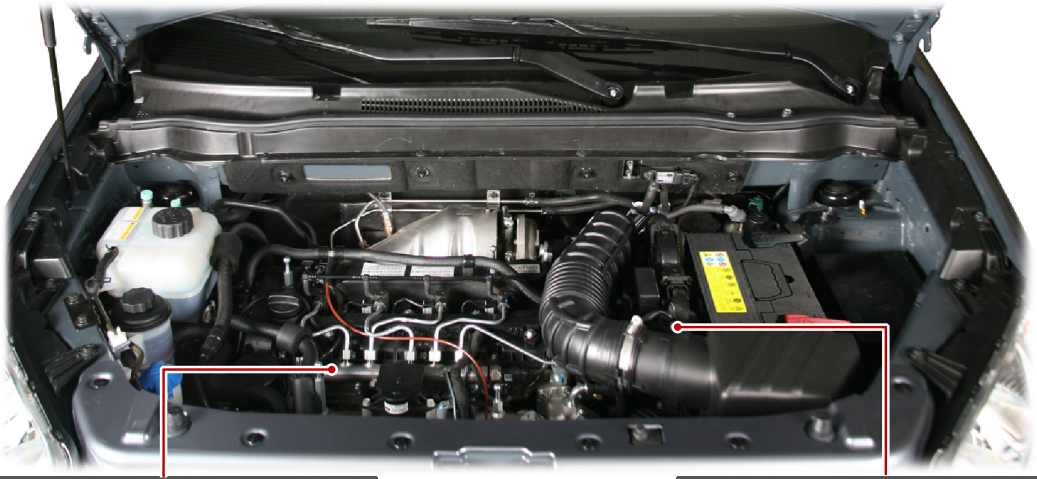
1. Overview

The pre-heating system for D20DTF engine has the glow plug to the cylinder head (combustion chamber), and improves the cold start performance and reduces the emission level.
The pre-heating resistor (air heater) is used to heat the intake air.
This enables the diesel fuel to be ignited in low temperature condition.
The ECU receives the information such as, engine rpm, coolant temperature, engine torque, etc., through CAN communication during pre-heating process; and the pre-heating control unit controls the pre-heating, heating during cranking and post-heating by the PWM control.

Glow indicator

Engine ECU (D20DTF)





Glow plug

Tightening torque 20 ± 2.0 Nm

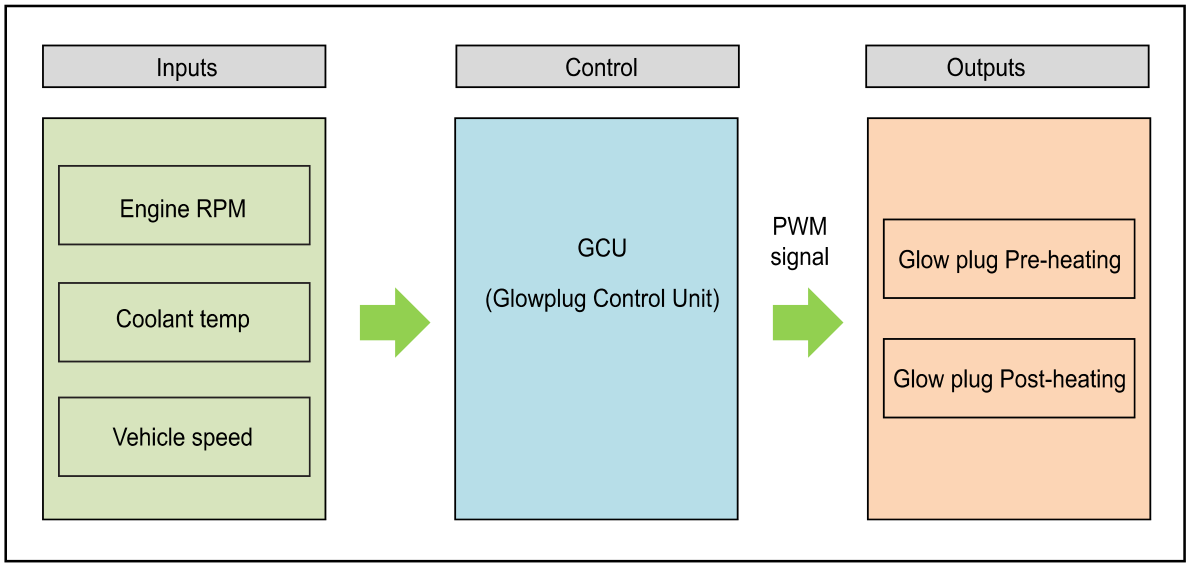
Glow plug control unit (GCU)

Modification basis	
Application basis	
Affected VIN	

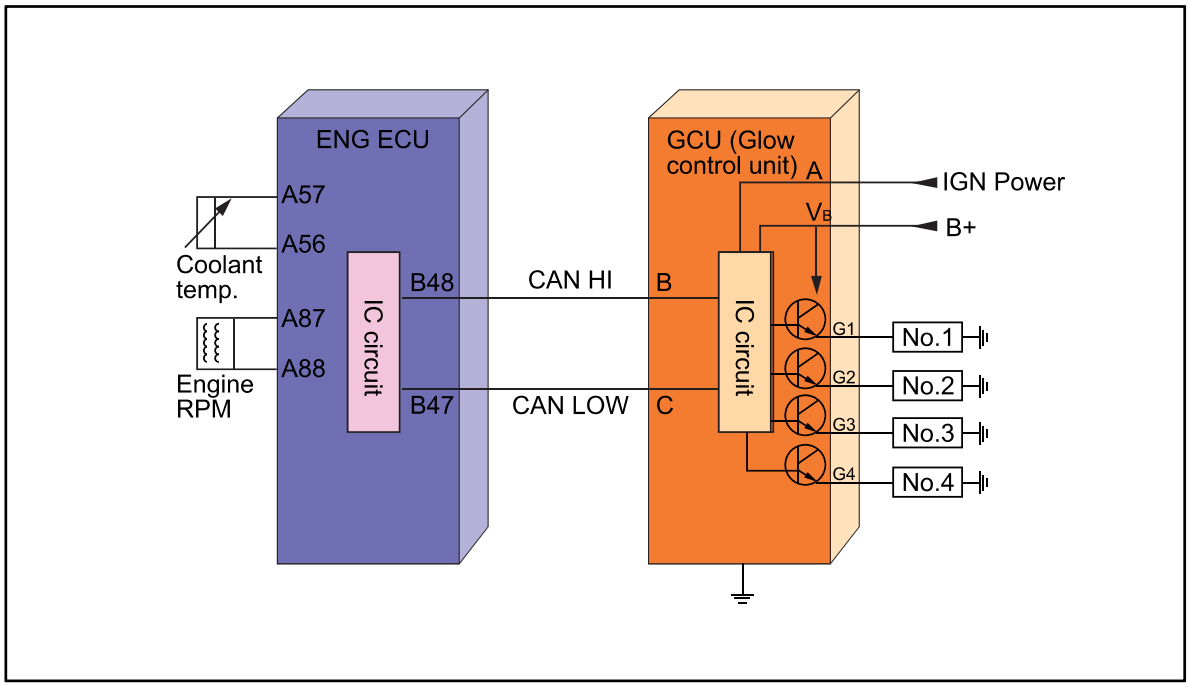
Downloaded from www.Manualslib.com manuals search engine

2. SYSTEM OPERATION

1) Input/Output Diagram of Glow Plug Control Unit



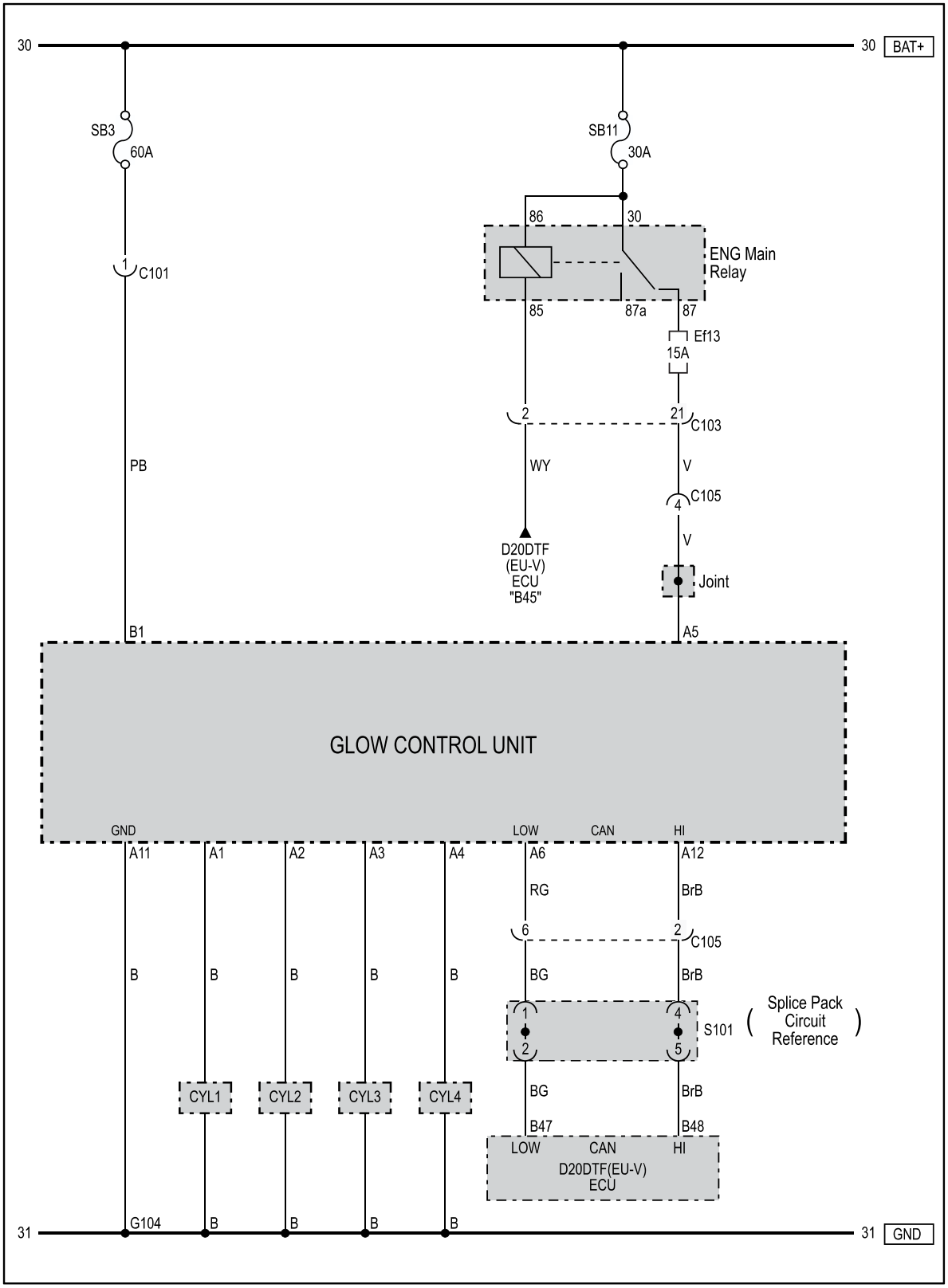
2) System Diagram



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Circuit Diagram



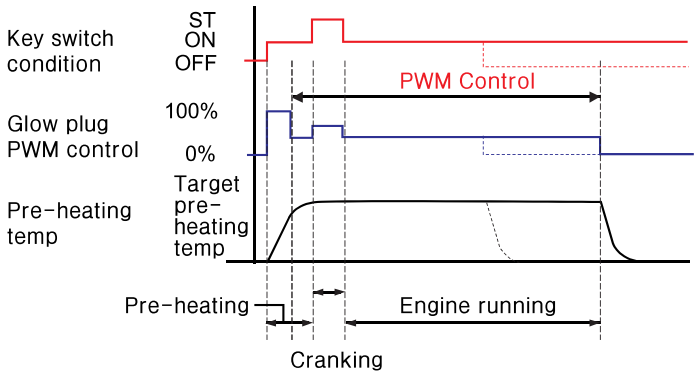
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4) Operation

Glow plug is installed in the cylinder head. It enhances the cold starting performance and reduces the exhaust gas during cold starting.

(1) Operation



1. Duty control area:
   Between 5 and 100%
2. Frequency: 20 Hz
3. Duty ratio = $\frac{(\text{RMS voltage})^2}{(\text{Battery voltage})^2}$

▶ **Pre-Glow: Step 1**

If normal communication with the ECU is established 2 seconds after the power is supplied to the IGN terminal from the battery, the GCU supplies the battery power to raise the temperature of the glow plug to 1000℃ by the pre-heating request from the engine ECU before starting.

- The time for pre-heating is controlled by the ECU.

Pre-heating	**Coolant temperature**	−30°C	−25°C	−20°C	−10°C	−5°C	0°C	20°C
	Operating time	28 s	25 s	15 s	5 s	2 s	2 s	0 s
	Operating conditions	- IGN: ON - B+: below 15.2 V			**Stop conditions**	- Time-out - IGN: OFF - when engine cranking		

1. If the input power (VB) is 11.5 V or less, the GCU supplies the battery power for arrival time (T1).
2. If the input power (VB) is greater than 11.5 V, the GCU supplies the voltage of 11.5 V for arrival time (T1).

NOTE

The time for pre-heating by coolant temperature can vary slightly depending on e.g. other vehicle operation elements.

The total time for pre-heating should be 30 seconds or less. If this time is over, the resistor goes OFF until the post-heating is started. If the starting is failed and the engine is stopped, the start key should be turned OFF and then ON to initialize the pre-heating process.

Downloaded from www.Manualslib.com manuals search engine

▶ During cranking: Step 2 and step 3

1. Step 2: If the ECU receives the cranking signal after pre-heating (step 1), the GCU supplies the voltage of 6.8 V for 1 sec to raise the temperature to 1,100℃.
2. Step 3: The GCU supplies the voltage of 5.1 V to keep the temperature at 1,000°C.

* Under fixed temperature: The AQGS unit supplies power for 30 seconds (Step 1 + Step 3) if no cranking signal is received after the step 1.

* At cranking: The step 3 is started after the step 2.

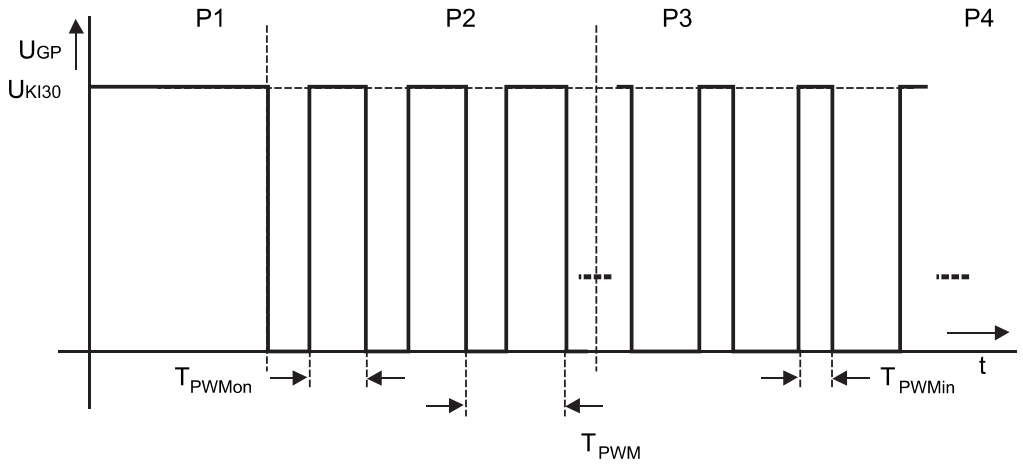
▶ Post-glow: Step 4:

The post-heating is for reducing HC/CO after the engine is started. If the time for post-heating exceeds 180 sec., the GCU unit cuts off the power to each glow plug even if there is pre-heating request from the engine ECU.

Post-heating	**Coolant temperature (approx.)**	−20°C	−10°C	0°C	20°C	80°C
	Operating time (approx.)	100 s	50 s	25 s	10 s	10 s

▶ Emergency glow

If no CAN signal is received for 4 seconds from the engine ECU after the IGN ON signal is input, the GCU performs emergency preheat (Step 3) for 30 seconds.



P1 to P2: Pre glow
P3 to P4: Post glow

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Capacity	12V, 2.3kW
Engagement	Meshed type
Rotating direction	Clockwise
Pinion gear manufacturing	Cooled forging
Solenoid operating voltage	Max. 8 V
Weight	2.5 kg
Bracket manufacturing	Aluminum die casting

Downloaded from www.Manualslib.com manuals search engine

2. TROUBLESHOOTING

Problem	Possible Cause	Action
Engine will not crank	Low battery voltage	Charge or replace
	Loose, corroded or damaged battery cable	Repair or replace
	Faulty starter or open circuit	
	Faulty ignition switch or blown fuse	Repair or replace
	Poor engine ground	Repair
Engine cranks too slow	Low battery voltage	Charge or replace
	Loose, corroded or damaged battery cable	Repair or replace
	Faulty starter	
Starter does not stop	Faulty starter	
	Faulty ignition switch	Replace
Engine cranks normally, but does not start	Broken pinion gear or faulty starter	Replace the starter
	Broken flywheel ring gear	Replace
	Open circuit	Repair

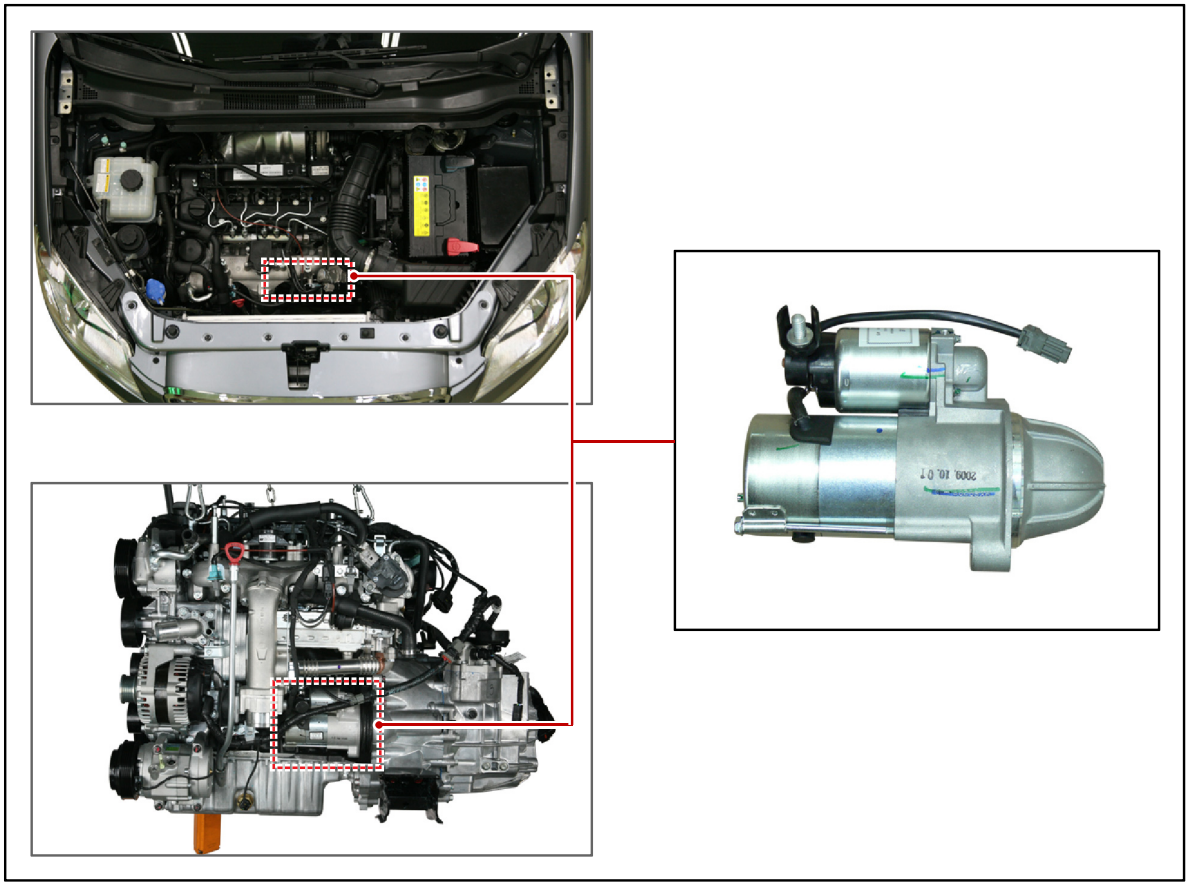
Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. SYSTEM DESCRIPTION

The starter (start motor) starts the engine with rotational power by converting the electric energy to the mechanical energy.
When the engine is cranking, the pinion gear meshes with the ring gear. If the ring gear overruns, the pinion gear clutch overruns to protect the pinion gear.

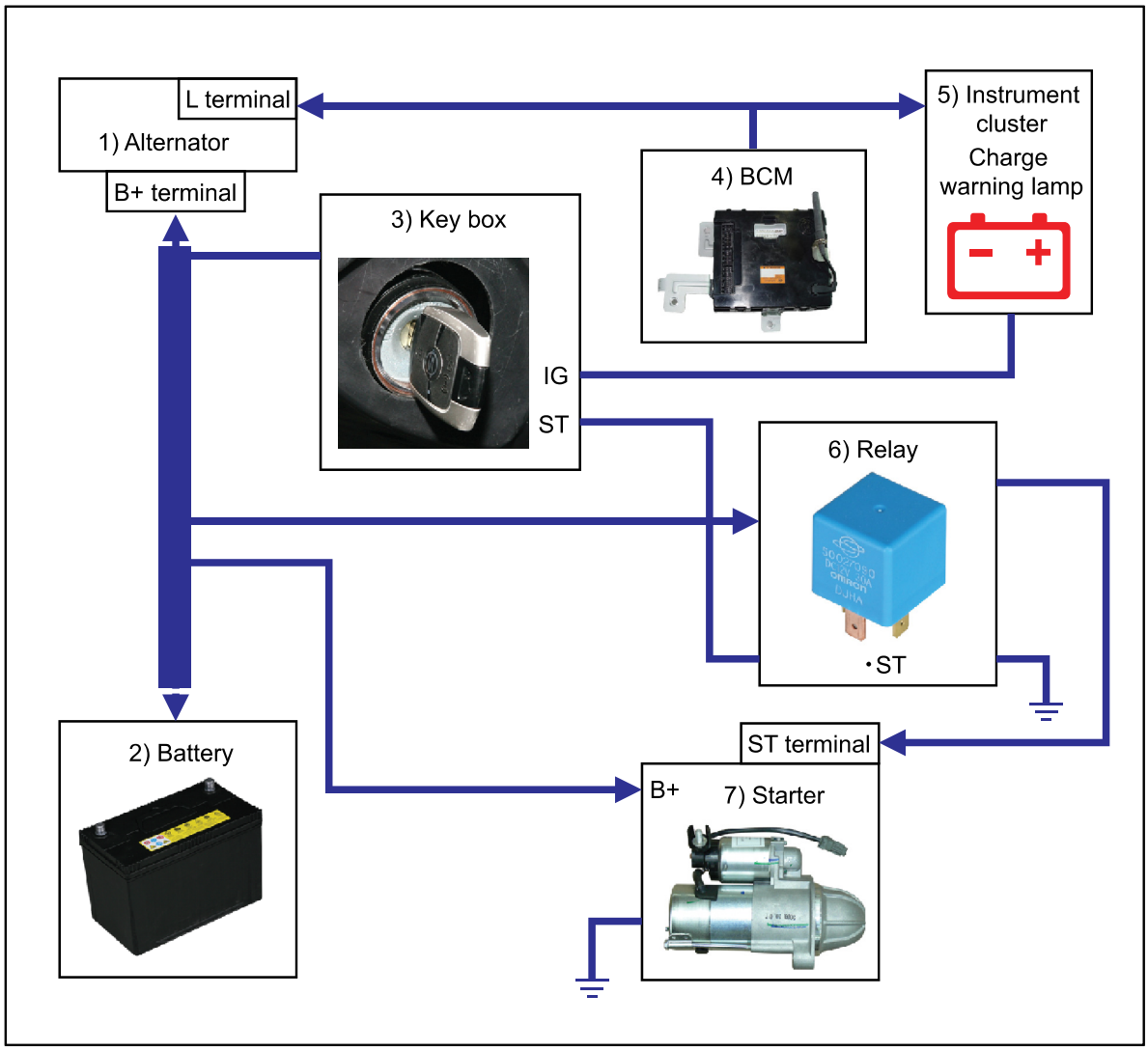
▶ System Configuration



Downloaded from www.Manualslib.com manuals search engine

2. OPERATING PROCESS

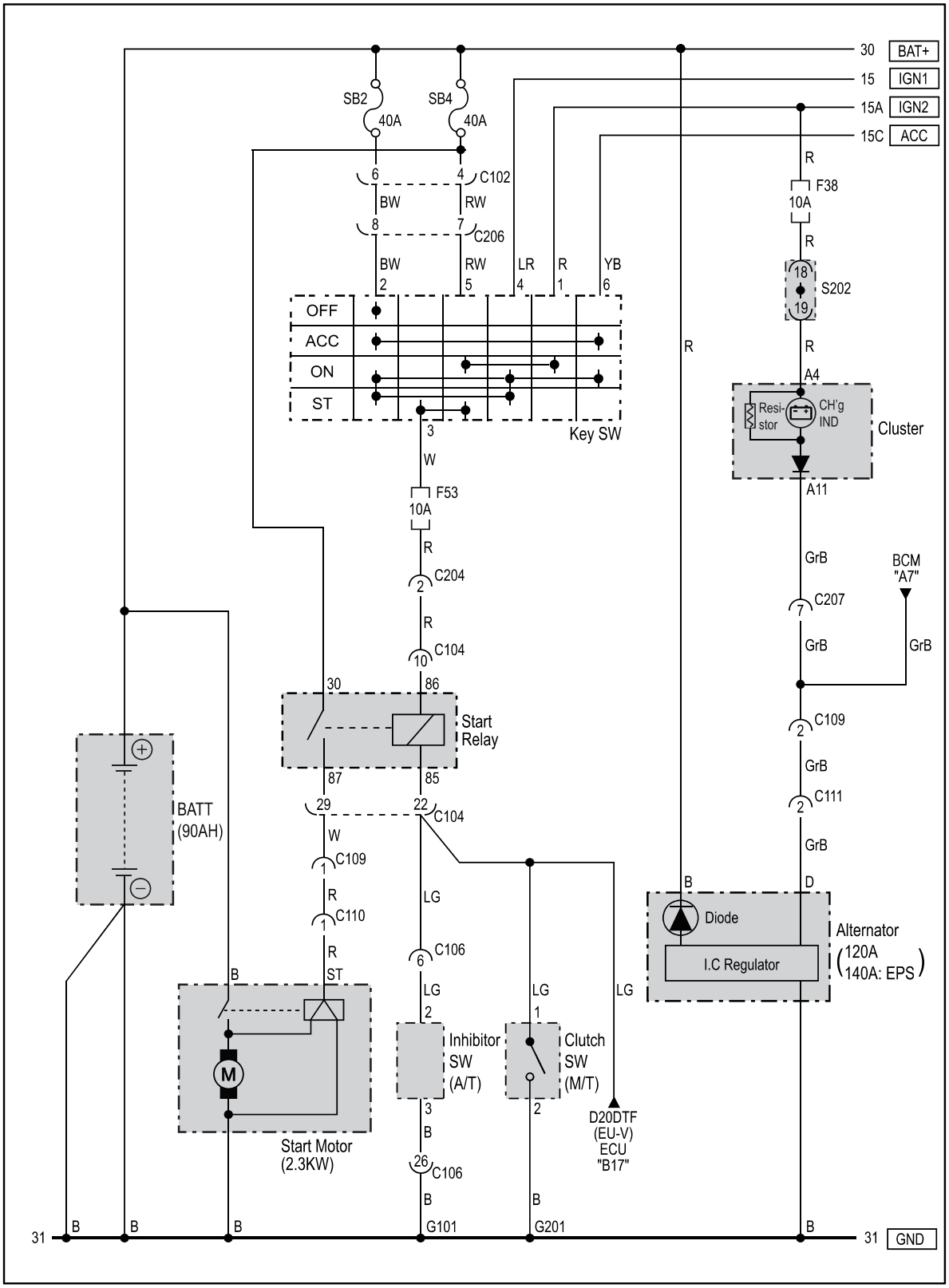
1) System Layout



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Circuit Diagram



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

1) System Description

The cruise control is an automatic speed control system that maintains a desired driving speed without using the accelerator pedal.
The vehicle speed must be greater than 38 km/h to engage the cruise control. This feature is especially useful for motorway driving.

CAUTION

The cruise control system is a supplementary system, which helps the driver to drive the vehicle at a desired speed without using the accelerator pedal under the traffic condition where the vehicle-to-vehicle distance meets the legal requirement.

Downloaded from www.Manualslib.com manuals search engine

2) Traffic Conditions for Using Cruise Control

Use the cruise control system only when the traffic is not jammed, driving on motorways or highways where there is no sudden change in the driving condition due to traffic lights, pedestrian, etc.

WARNING

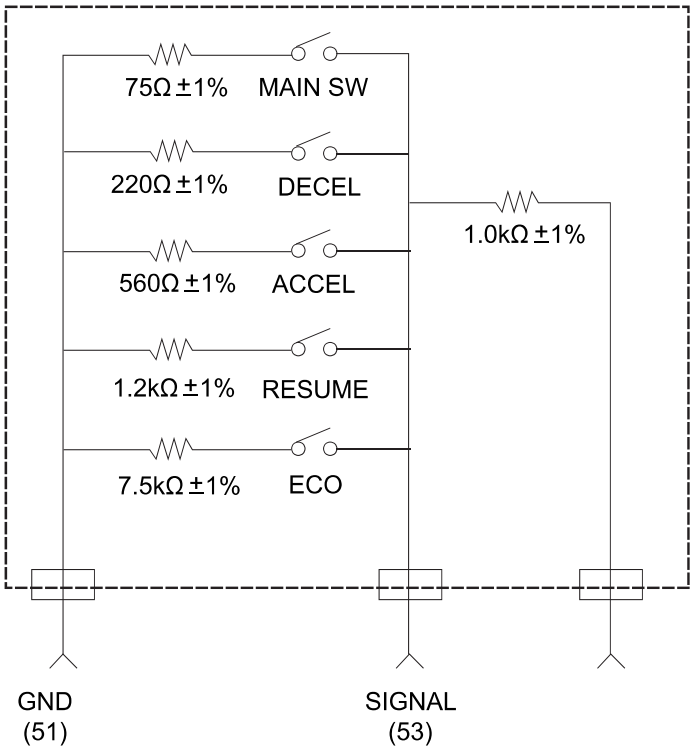
Improper use of the cruise control could be dangerous.
- Do not use on winding roadsyy .
- Do not use in heavy traffic.
- Do not use on slippery, wet roads.

This could result in a loss of control, collision, and/or personal injuries.

Downloaded from www.Manualslib.com manuals search engine

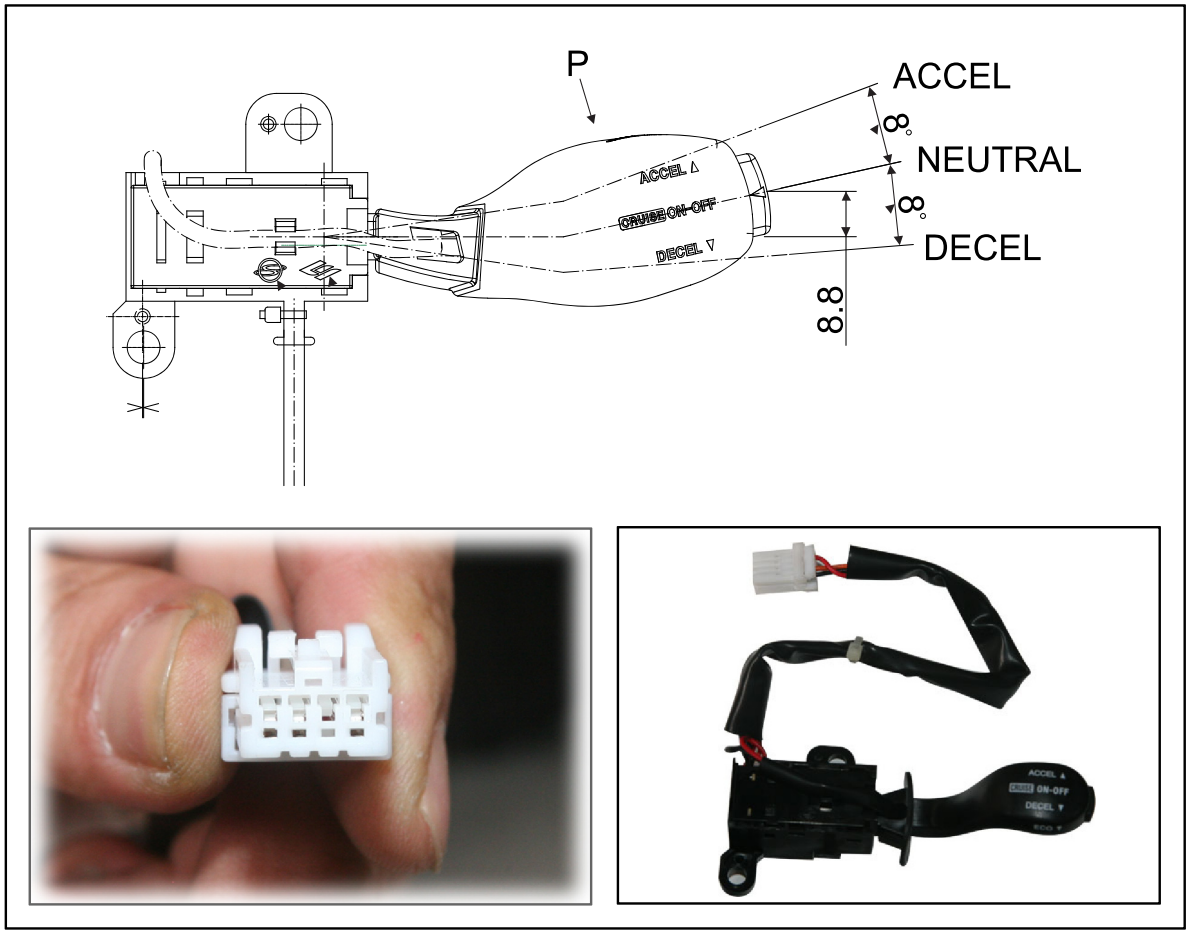
2. CONFIGURATION

1) Circuit Diagram



Downloaded from www.Manualslib.com manuals search engine

2) Configuration

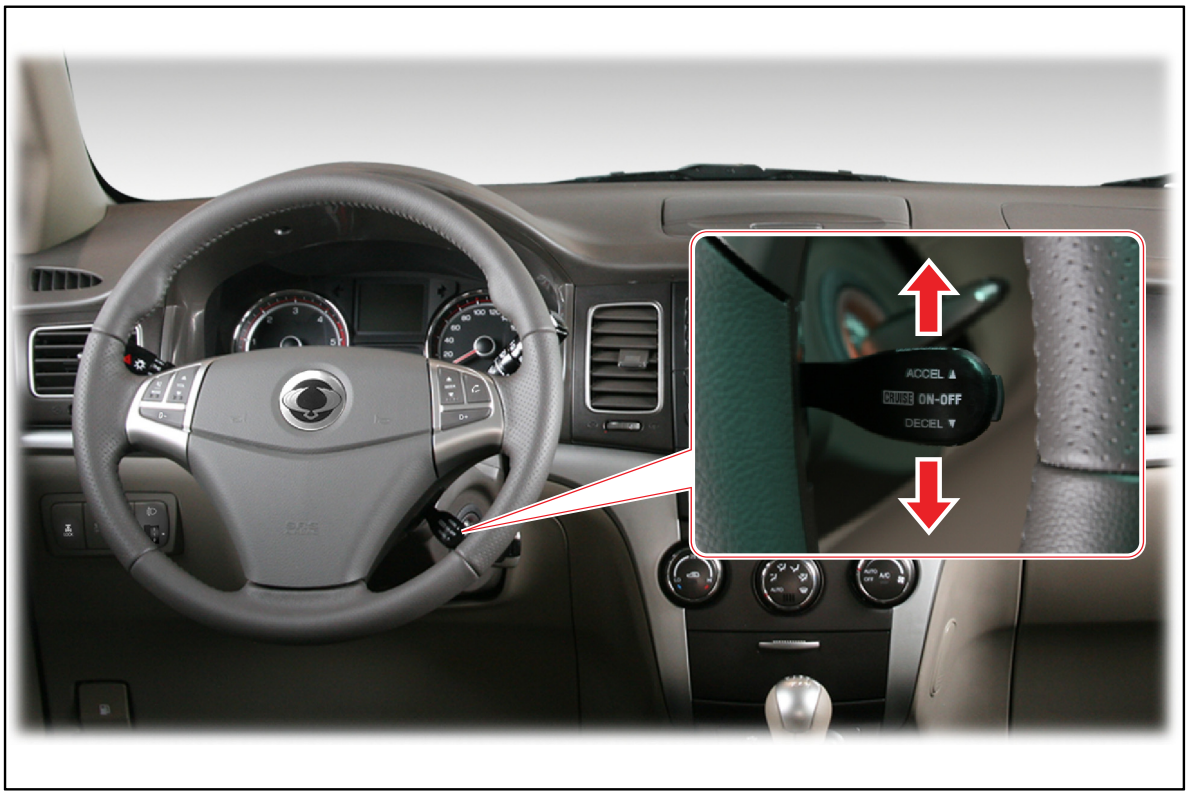


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. HOW IT WORKS

1) Setting a Desired Speed



1. To operate the cruise control, accelerate to the desired speed, which must be more than 38 km/h (24 MPH) and less than 150 km/h (90 MPH).
2. When the desired speed is reached, push up the ACCEL switch of the cruise control lever or push down the DECEL switch for 1 second per one switching and then release the accelerator pedal slowly.
3. Now, the vehicle is cruised by this system with the set speed. You don't need to use the accelerator pedal.
4. Refer to the following pages for details of operation.

CAUTION

Never use the cruise control system until you get used to it.
Improper use or not fully aware of this function could result in collision and/or personal injuries.

Downloaded from www.Manualslib.com manuals search engine

2) Accelerating with the Cruise Control System

(1) While the cruise control system is running

1. Push up the ACCEL switch of the cruise control lever and hold it until the desired speed is reached without an accelerator pedal intervention.
2. When the desired speed is reached, release the lever.

(2) When the cruise control system is not running

To increase the speed with the cruise control system while the system is not running, follow the procedures below.

1. Accelerate using the accelerator pedal over 38 km/h.
   Push up the ACCEL switch of the cruise control lever and hold it. And then release the accelerator pedal slowly.
2. When the desired speed is reached, release the lever.

(3) Tap-up while the cruise control system is running

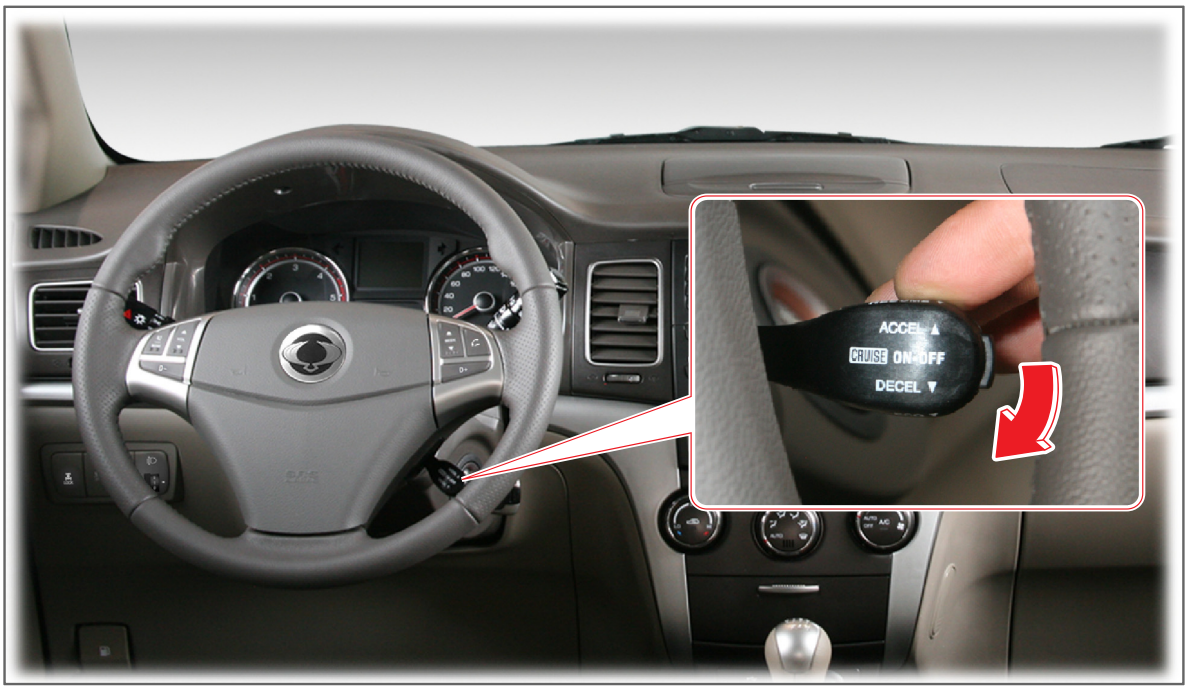
To increase the vehicle speed in stages while the cruise control system is running, follow the procedures below.

1. Push up the ACCEL switch of the cruise control lever less than 0.5 second per one switching while the cruise control system is running. This is a tap-up switching. When you operate a tap-up switching, the vehicle is accelerated for 1 km/h over the previous set speed.
2. If you want to accelerate for 10 km/h, operate the tap-up switching ten times without accelerating with the cruise control system.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Decelerating with the Cruise Control System



(1) While the cruise control system is running

1. Push down the DECEL switch of the cruise control lever and hold it until the desired speed is reached without a brake pedal intervention. But the cruise control system cannot maintain the cruise function at less than 38 km/h.
2. When the desired speed is reached, release the lever.

(2) When the cruise control system is not running

To decrease the vehicle speed with the cruise control system when the system is not running, follow the procedures below.

1. Push down the cruise control switch lever to DECEL side and hold it until the desired speed is reached while the vehicle speed is over 40 km/h.
2. And then release the accelerator pedal slowly.
3. When the desired speed is reached, release the lever. But the cruise control system cannot maintain the cruise function at less than 38 km/h.

Downloaded from www.Manualslib.com manuals search engine

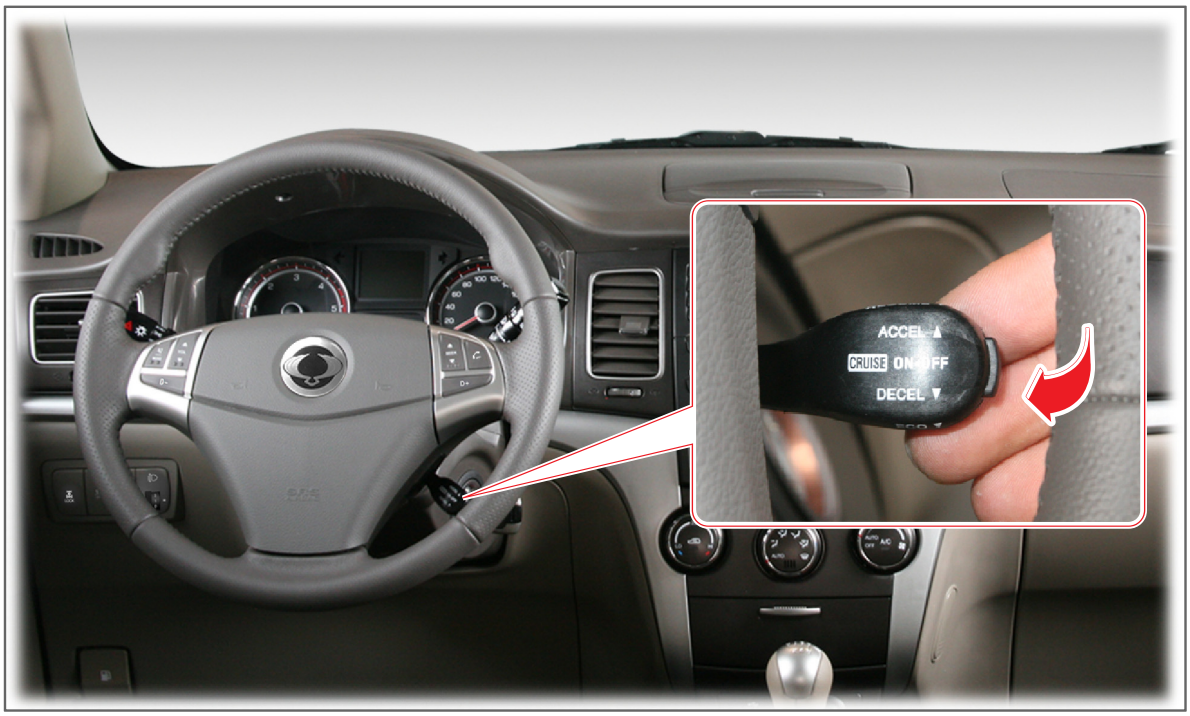
(3) Tap-down while the cruise control system is running

To decrease the vehicle speed in stages while the cruise control system is running, follow the procedures below.

1. Push down the DECEL switch of the cruise control lever less than 0.5 second per one switching while the cruise control system is running. This is a tap-down switching. When you operate a tap-down switching, the vehicle is decelerated for 1 km/h below the previous set speed.
2. If you want to decelerate for 10 km/h, operate the tap-down switching ten times without the brake pedal intervention.

Downloaded from www.Manualslib.com manuals search engine

4) Recovery of Set Speed (RESUME)



Even if the cruise control is cancelled, the previous set cruise speed can be recovered by pulling up the cruise control lever when the current vehicle speed is over 38 km/h without an acceleration intervention. But if you turn off the ignition switch, the memorized set speed is cleared and you cannot recover the previous set speed.

CAUTION

But the driver should know the previous set speed to react to the changed vehicle speed properly. If the vehicle speed increases abruptly, depress the brake pedal to adjust the vehicle speed properly.

Downloaded from www.Manualslib.com manuals search engine

5) Recovery of Set Speed (ECO)

Even if the cruise control is cancelled, the previous set cruise speed can be recovered by pushing down the cruise control lever when the current vehicle speed is over 38 km/h without an acceleration intervention. In this operation, the smooth acceleration to the set cruise speed can be achieved by optimized fuel consumption.
When this mode is activated, ECO indicator comes on.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

6) Normal Cancellation of the Cruise Control

The cruise control system will be canceled when one or more items of the following conditions are applied;

1. When the brake pedal is depressed.
2. When the cruising speed is downed less than 38 km/h.
3. When pushing the ON-OFF switch of the cruise control lever.
4. When ESP is activated.
5. When applying the parking brake when driving.
6. When using the clutch in order to shift (M/T only).
   And the cruise control system can be operated again in driving state.

CAUTION

Keep the main cruise control switch in the neutral position when not using the cruise control.

Downloaded from www.Manualslib.com manuals search engine

7) Abnormal Cancellation of the Cruise Control

1. When the rapid deceleration is applied without braking.
   When the rapid acceleration is applied without acceleration pedal intervention.
2. When the cruise control lever is faulty.
3. When the brake switch and the brake light switch input signal are implausible.

When the cruise control function is cancelled abnormally or intermittent problems occur, stop the vehicle and turn off the ignition switch and remove the key to reset the system. After a while, turn on the ignition switch again to operate the cruise control system.

CAUTION

1. Do not move the shift lever to Neutral position while driving with the cruise control turned on. Otherwise, it may result in system malfunction or accidents.
2. Always be prepared to use the brake or accelerator pedal for safe driving while the cruise control system is running.
3. The actual speed can be different from the set speed momentarily when driving on a uphill or downhill. So, it is recommended to disable the cruise control function on a uphill or downhill. hen driving on a steep hill use the engine brake and foot brake properly to protect the vehicle system and for a safe driving.
4. Ensure that the safe distance is maintained and use the brake pedal if needed.

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Item			
E-EGR valve	Motor	EGR response time	50 ms
		Driven by	DC motor
	Valve	EGR gas flow rate	120 kg/h
E-EGR cooler		Cooling capacity	8.3 kW or more
		Cooling fin type	Wavy fin
		Cooler type	U-shaped
E-EGR bypass valve	Solenoid valve	Drivien by	Vacuum (Solenoid valve)

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

1) E-EGR Valve

The E-EGR (Electric-Exhaust Gas Recirculation) valve recirculates some of the exhaust gas to the intake system, and it lowers the combustion temperature by increasing the CO2 content in the intake air to reduce the emission of NOx.

▶ **Benefits of E-EGR valve**

- Improved accuracy and response through electric control
- Feedback function (Potentiometer)
- Preventing chattering of EGR valve and improved durability
- Self-cleaning function

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

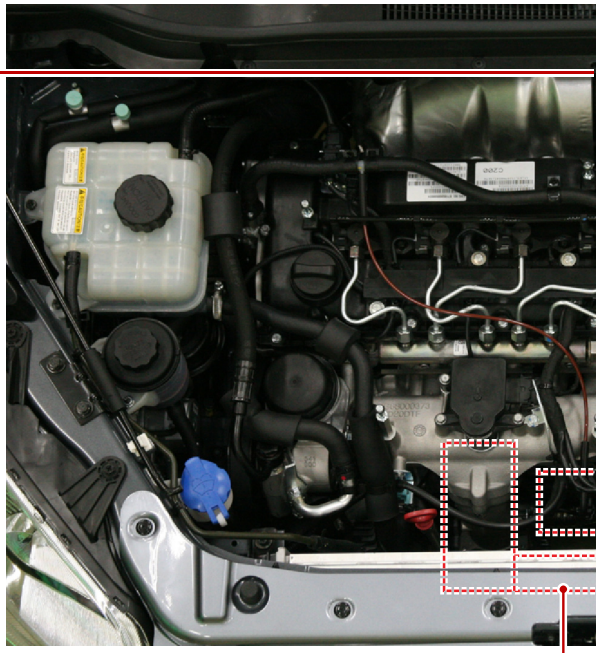
Memo

Downloaded from www.Manualslib.com manuals search engine

2) Component

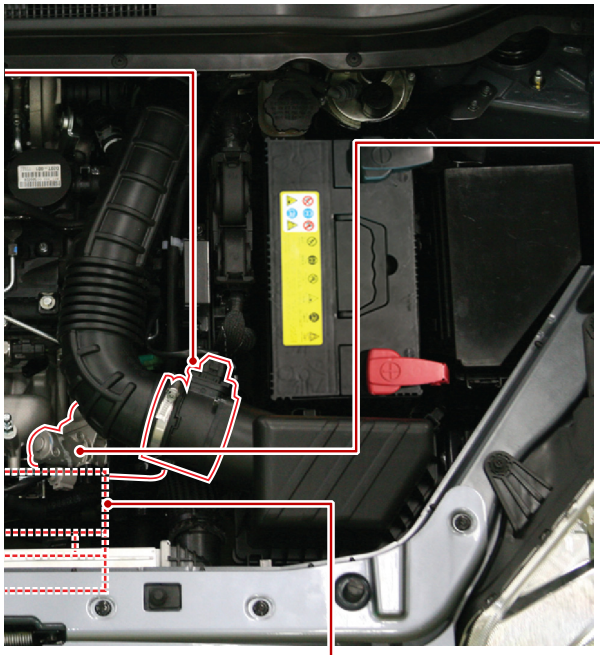
HFM sensor
 For the control logic of HFM sensor, refer to "Engine Control" section.
Used as a main map value to control the EGR. The coolant temperature, engine rpm, engine load, intake air temperature (HFM: decreased at 60℃ or more), atmospheric pressure (atmospheric pressure sensor: altitude compensation) are used as auxiliary map values.

EGR pipe
Transports the exhaust gas from the EGR cooler and EGR bypass valve to the intake duct.



Modification basis	
Application basis	
Affected VIN	

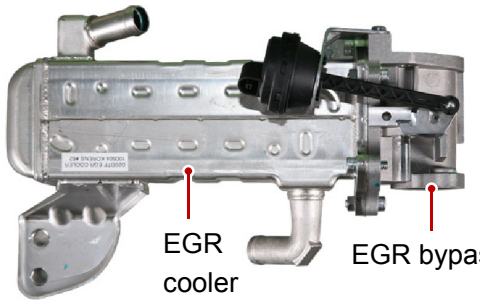
Downloaded from www.Manualslib.com manuals search engine



E-EGR valve

Receives the electric signal from the ECU to control the valve.

E-EGR cooler and bypass valve

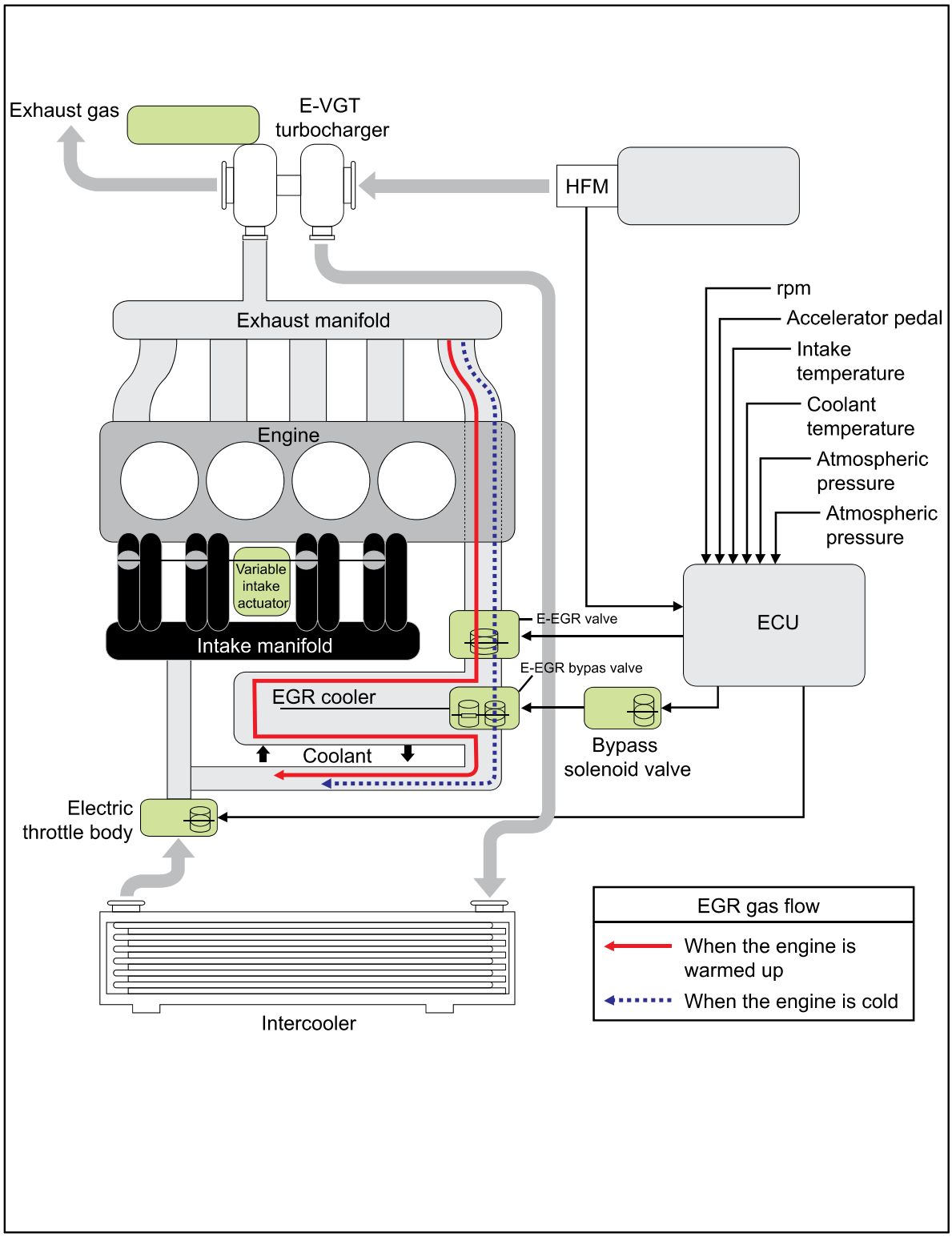


The cooler lowers the high temperature of the exhaust gas and the bypass valve directly supplies the exhaust gas to the intake duct without passing through the EGR cooler to reduce the emission of exhaust gas before warming up the engine.

Downloaded from www.Manualslib.com manuals search engine

2. OPERATING PROCESS

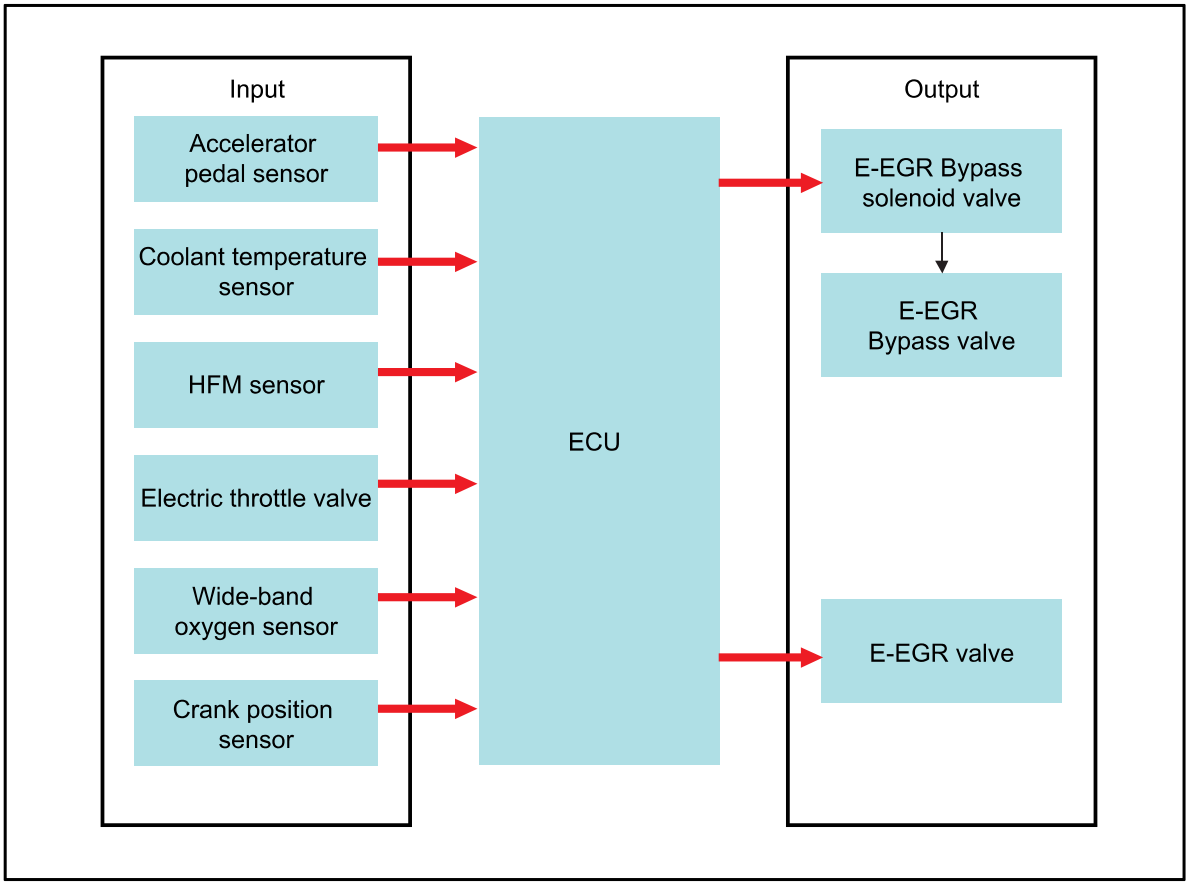
1) Schematic Diagram



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Input/Output Devices



3) Control Logic

The EGR system controls the EGR amount based on the map values shown below:

※ Main map value: Intake air volume

※ Auxiliary map value:

- Compensation by the coolant temperature
- Compensation by the atmospheric pressure: Altitude compensation
- Compensation by the boost pressure deviation (the difference between the requested value and the measured value of boost pressure)
- Compensation by the engine load: During sudden acceleration
- Compensation by the intake air temperature

The engine ECU calculates the EGR amount by adding main map value (intake air volume) and auxiliary map value and directly drives the solenoid valve in the E-EGR to regulate the opening extent of the EGR valve and sends the feedback to the potentiometer.

Downloaded from www.Manualslib.com manuals search engine

(1) Operating conditions

- Intake air temperature: between -10 and 50℃
- Atmospheric pressure: 0.92 bar or more
- Engine coolant temperature: between 0 and 100°C
- When there is no fault code related to EGR

(2) Shut off conditions

- Abrupt acceleration: with engine speed of 2600 rpm or more
- When the engine is idling for more than 1 minute
- Vehicle speed: 100 km/h or more
- Engine torque: 380 Nm or more

Downloaded from www.Manualslib.com manuals search engine

Memo

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

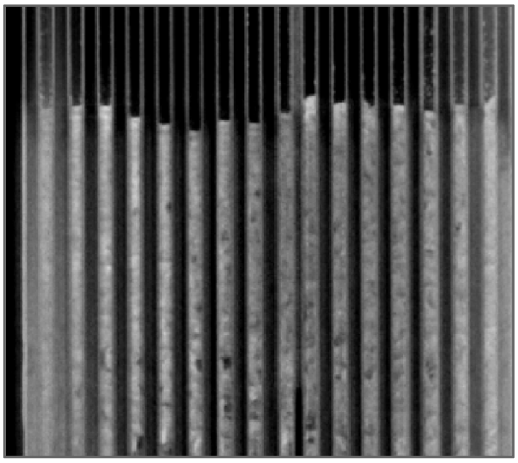
Emission Regulation		Euro-V
Front Area		182.41㎠
Size	DOC	124 X 158 X 78L
	DPF	124 X 158 X 194 (mm)
CDPF Canister	Shell	SUS430J1L X 1.5t
	End Cone	SUS430J1L X 2.0t (Single)
CDPF	Catalyst Capacity	4.2 L
	Material of Filter	AT (Aluminum-Titanium Alloy)

Downloaded from www.Manualslib.com manuals search engine

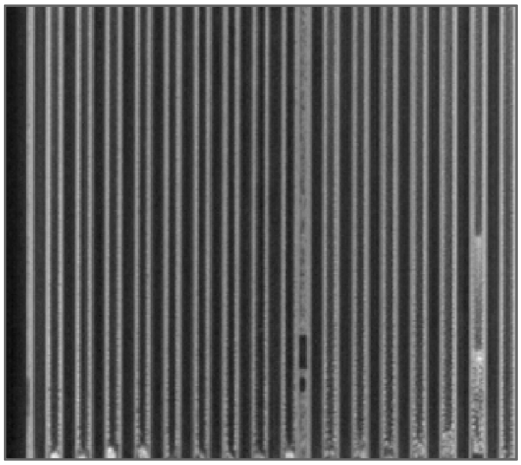
2. CAUTIONS

▶ **Standard pattern of soot accumulation**

(1) Abnormal Soot Accumulation



(2) Normal Soot Combustion



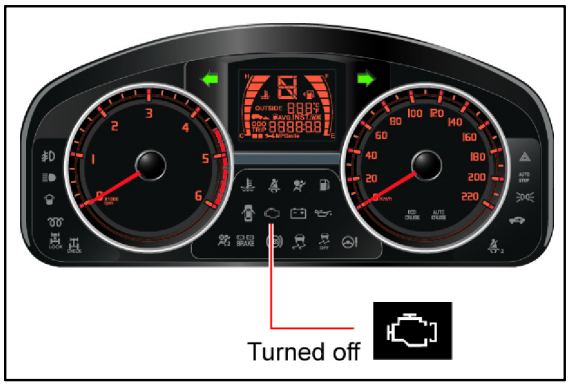
▶ **Cautions to protect the catalyst filter**

- Use the designated fuel only.
- Observe the recommended service intervals of engine oil.
- Check the engine oil level frequently and add if necessary.
- Do not idle the vehicle unnecessarily.
- Do not turn off the engine while the vehicle is running.
- Do not shift the gear selector lever to neutral when going downhill.
- Do not use improper engine oil or fuel additives.
- Do not drive for a long time when the warning lamp is illuminated.
- Make sure no flammable material, such as dry grass or tissue paper, contacts with the catalyst filter while the vehicle is parked.
- For the vehicles used in urban traffic, driving on the expressways for more than 1 hour at least once per week is needed so that the PM inside CDPF isn't collected to one side only.

Downloaded from www.Manualslib.com manuals search engine

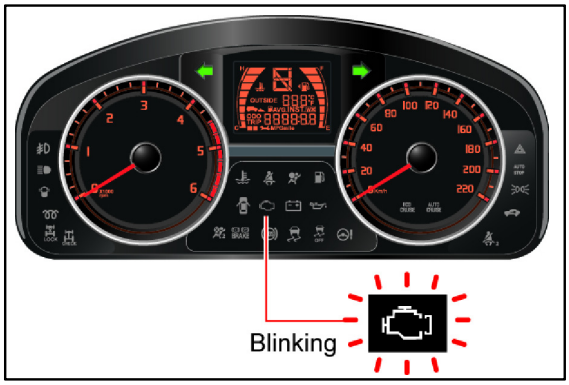
(3) Warning Lamp Related to CDPF

▶ CDPF regeneration process (warning lamp NOT illuminated)



The CDPF system enters the regeneration mode when the driving distance becomes approx. 600 to 1,200 km (may differ by the driving condition and driving style). Then, the engine ECU performs the CDPF regeneration operation. However, the driver is not informed with this operation by any engine warning lamp or vehicle signal, so he/she may not detect this operation. The control logic at the post-injection dur-ing the regeneration process is to increase the fuel injection volume and control the intake air volume (by the throttle body) in order to increase the temperature of the exhaust gas. The driver may not feel any particular difference from the vehicle.

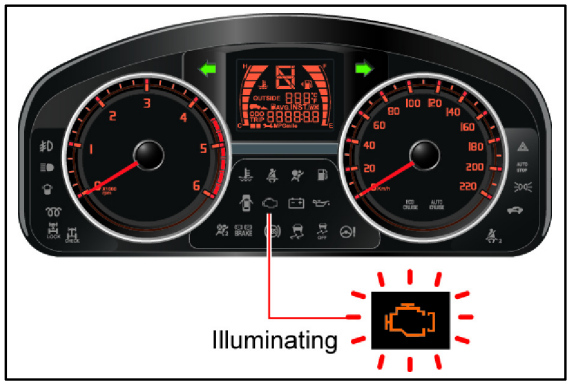
▶ Overload of CDPF (warning lamp blinking)



1. If the CDPF cannot reach the regeneration temperature due to low speed driving or other reason during the regeneration process, the soot is continuously accumulated in the CDPF. When this condition continues and the CDPF is overloaded with soot, the engine warning lamp blinks to inform this situation to the driver.
2. In order to solve this problem, drive the vehicle at a speed of approx. 80 km/h for 15 to 20 minutes to perform the CDPF regeneration process.
3. If the engine warning lamp on the instrument cluster blinks, the CDPF is overloaded. In this case, perform the step 2.

Downloaded from www.Manualslib.com manuals search engine

▶ **Excessive overload of CDPF (warning lamp illuminated)**



1. If the vehicle is driven at a speed of 5 to 10 km/h for an extended period of time, the soot accumulated in the CDPF cannot be burned as the CDPF cannot reach the regeneration temperature. Then, an excessive amount of soot can be accumulated in the CDPF.
2. This case is much worse than the simple over-load of the CDPF. To inform this to the driver, the engine warning lamp comes on and the engine power is decreased to protect the system.
3. To solve this problem, blow soot between the engine and exhaust system several times and erase the related DTC. Then, check if the same DTC is regenerated again. If so, check the DTC related to the differential pressure sensor.

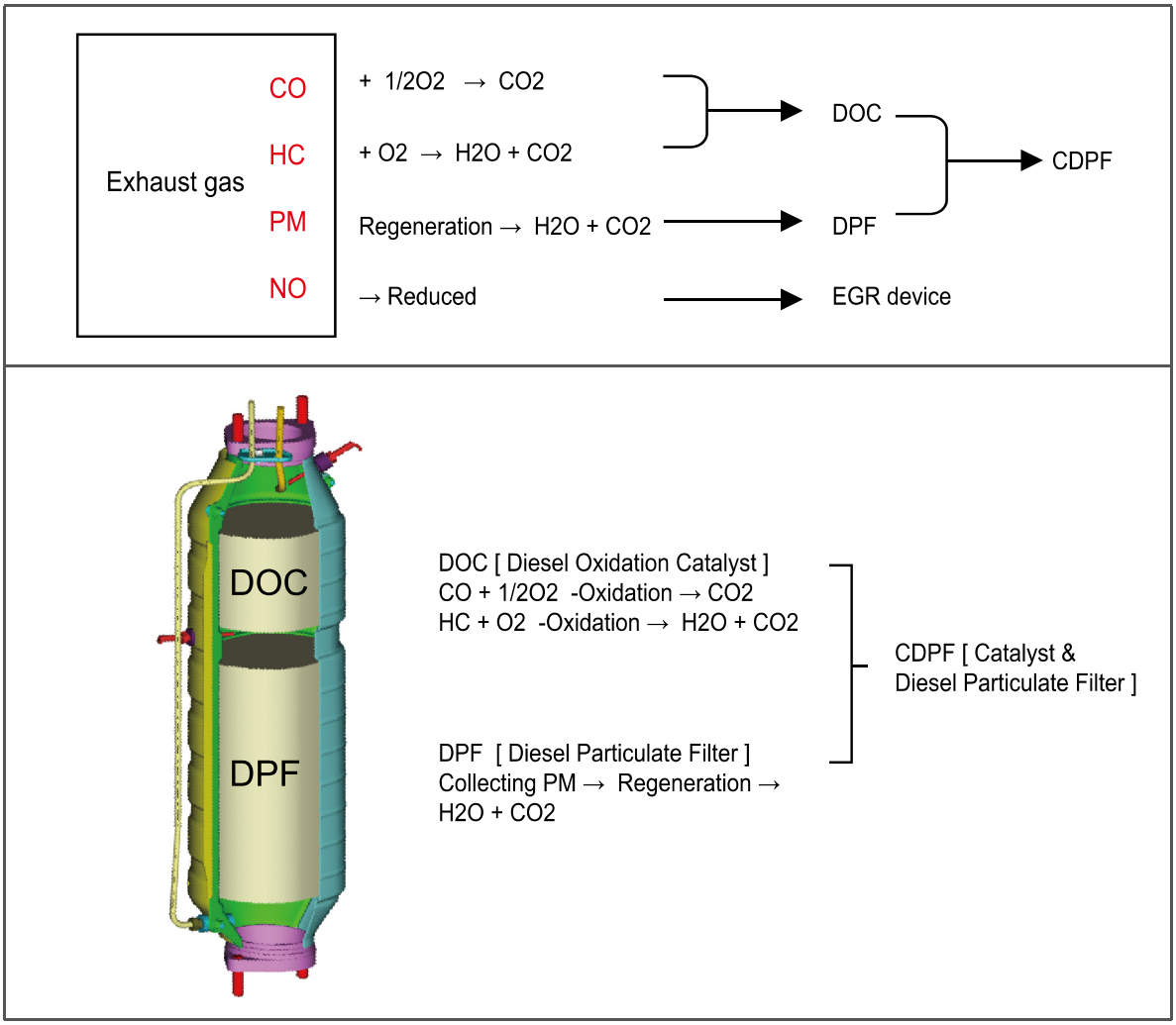
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

The DOC (Diesel Oxidation Catalyst) generates CO2 and H2O which are harmless through the oxidation process of CO and HC. And the DPF (Diesel Particulate Filter) collects PM (Particle Matter) and is regenerated to reduce the quantity of particulates, HC and CO. But there is a limitation in reducing the emission of exhaust gas for each system, so the CDPF which combines these two system is applied.



Downloaded from www.Manualslib.com manuals search engine

2. COMPONENT

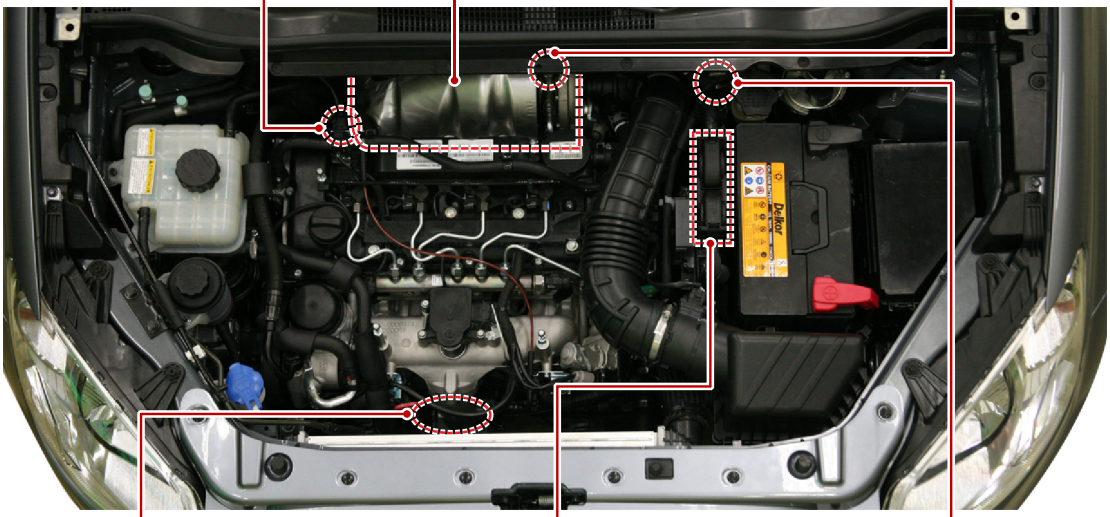
Rear temperature sensor

Measures the temperature of fuel combustion.

CDPF DOC+DPF

Front temperature sensor

Protects the turbocharger.



Throttle valve

Regulates the rate of air intake.

Engine ECU DCM 3.7

Post-injection

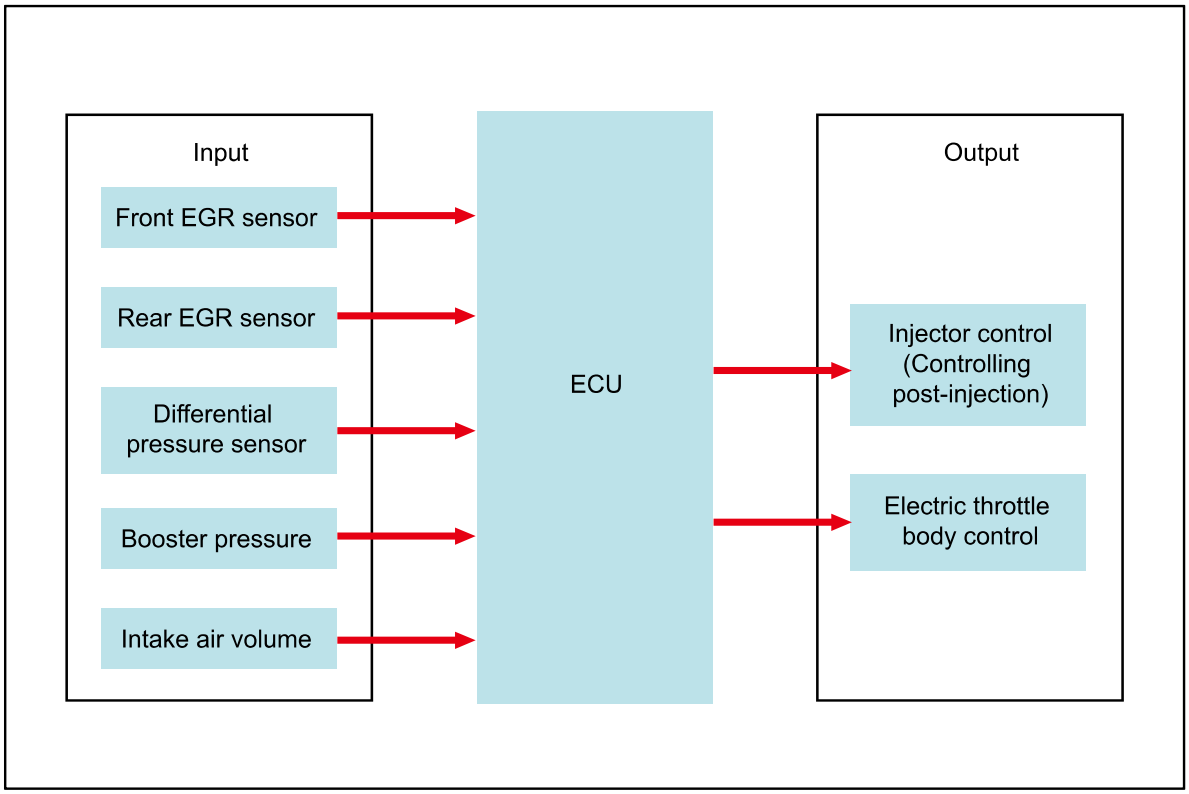
Differential pressure sensor

Calculates the amount of PM collected by reading the pressure difference between before and after the CDPF.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. INPUT/OUTPUT DEVICES



1. Front temperature sensor: This sensor is installed at the inlet of DOC and detects whether the DOC can burn (oxidize) the post-injected fuel or not.
2. Rear temperature sensor: This sensor is installed at the inlet of DPF and monitors that the temperature of the exhaust gas is kept at 600℃.

- If the temperature exceeds 600℃, the life of CDPF can be reduced. So the amount of fuel post-injection is decreased.
- If the temperature drops under 600℃, the rate of regeneration can be decreased. So the amount of fuel post-injection is increased.

3. Differential pressure sensor: This sensor checks the amount of PM collected by calculating the pressure difference between before and after the CDPF.
4. Electric throttle valve: This valve reduces the intake air flow to raise the temperature of the exhaust gas when the CDPF is operating during idling.

Downloaded from www.Manualslib.com manuals search engine

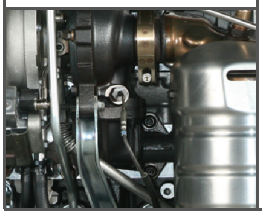
4. POST-INJECTION AND AIR MASS CONTROL

A DPS (Differential Pressure Sensor) measures the pressure difference between before and after the CDPF and detects whether the soot is collected in the CDPF or not. If PM is collected in the CDPF (In this case the pressure difference between before and after the CDPF exceeds the specified value. Normally, the system sends the signal when the driving distance becomes approx. 600 to 1,200 km), the temperature of exhaust gas is increased and the post-injection is started for regeneration. The amount of fuel post-injection is controlled by the exhaust gas temperature measured by the rear temperature sensor. If the temperature is less than 600℃, the amount of post-injection is increased to increase the regeneration temperature. Otherwise, the fuel injection amount is decreased or the fuel is not injected.
When the engine is running with low load, the intake air amount is also controlled as well as fuel injection amount. This function is used to increaser the combustion temperature by increasing the amount of fuel post-injection with the lowest air amount within the specified control logic.

Modification basis	
Application basis	
Affected VIN	

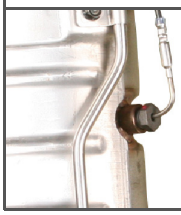
Downloaded from www.Manualslib.com manuals search engine

Front EGT sensor : Measures the temperature of DOC.



The DOC performs the redox reaction at between 300 and 500℃ and the front EGT sensor monitors the temperature of DOC.

Rear EGT sensor : Measures the temperature of DPF.



The DPF burns the soot with hot exhaust gases (regeneration) at around 600℃ and the rear EGT sensor monitors the temperature of DPF.

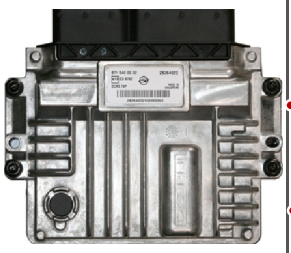
Differential pressure sensor : Measures the pressure values of before and after the CDPF.

The pressure difference between before and after the CDPF is measured by the differential pressure sensor (If PM is collected in the CDPF, the pressure difference between before and after the CDPF exceeds the specified value).

HFM sensor

Intake air volume

ECU (DCM 3.7)



Injector : Controls the post-injection.

Post-injection

Intake air volume Control

Boost pressure/temperature

Detecting excess of PM amount limit

Electric throttle body: Controls the intake air volume.

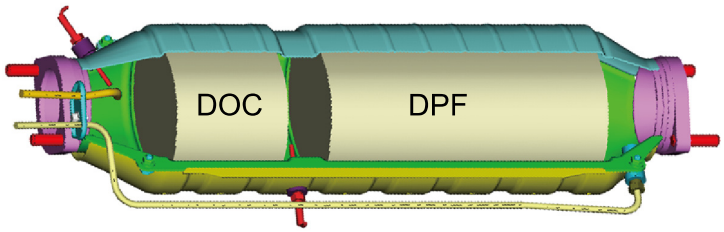
T-MAP sensor

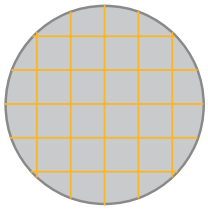
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

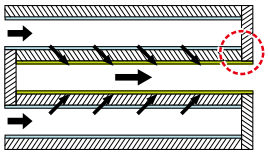
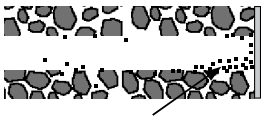
5. OPERATING PROCESS

[Configuration and principle of operation]





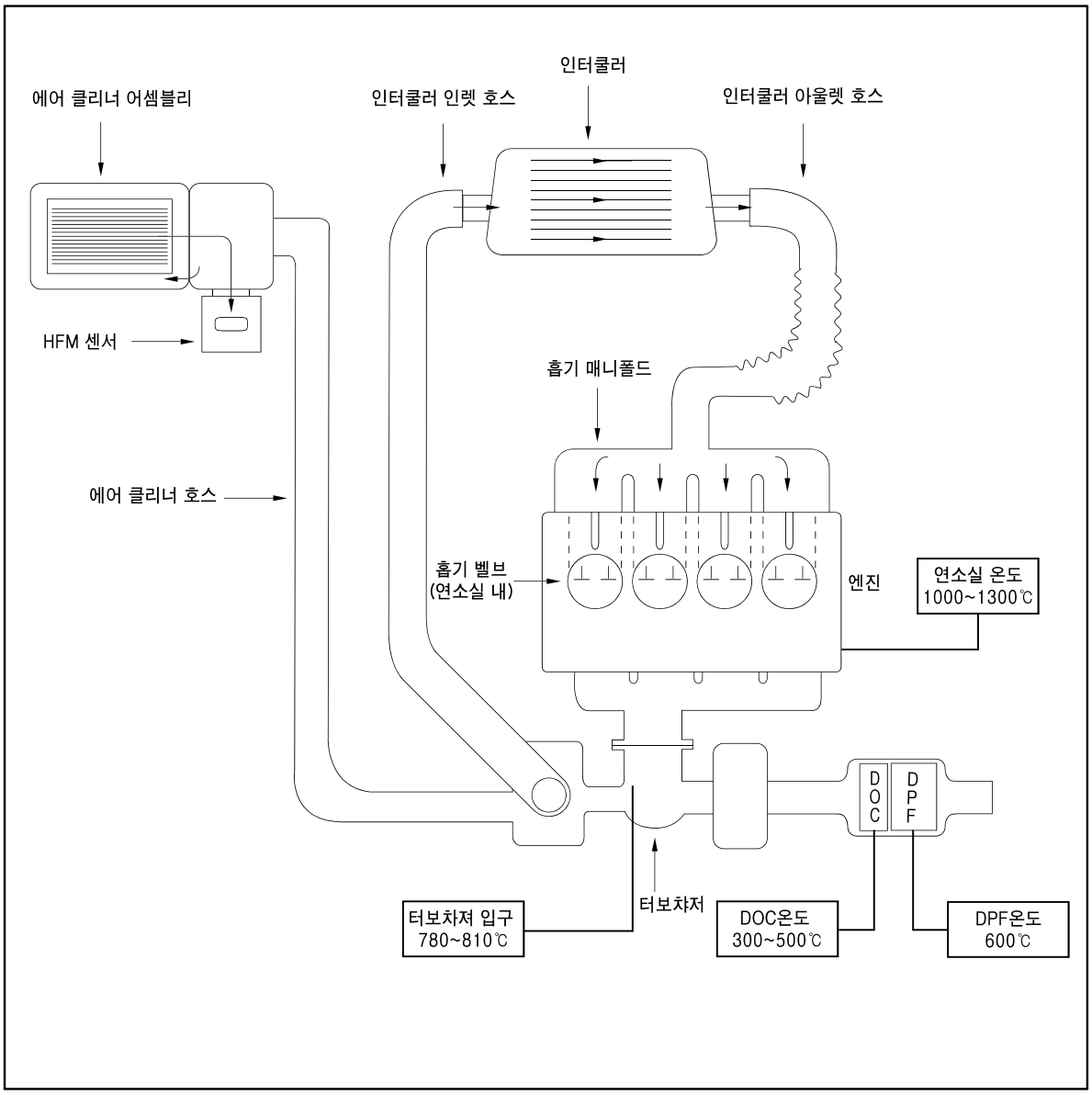
The exhaust gas passed through the exhaust manifold enters into the CDPF assembly (at approx 250℃).

Oxidation (DOC)	Collecting PM → Regeneration
	
When the exhaust gas enters into the CDPF assembly, its CO, HC and PM are reduced by the redox reaction of the DOC. The remaining PM is filtered and collected in CDPF, and the temperature of the exhaust gas is increased to between 450 and 500°C.	The engine ECU detects the amount of PM collected by the information from the temperature sensors and differential pressure sensor. When the soot is accumulated, the engine ECU performs post-injection to increase the exhaust gas temperature and burns the collected PM at approx. 600°C.

Modification basis	
Application basis	
Affected VIN	

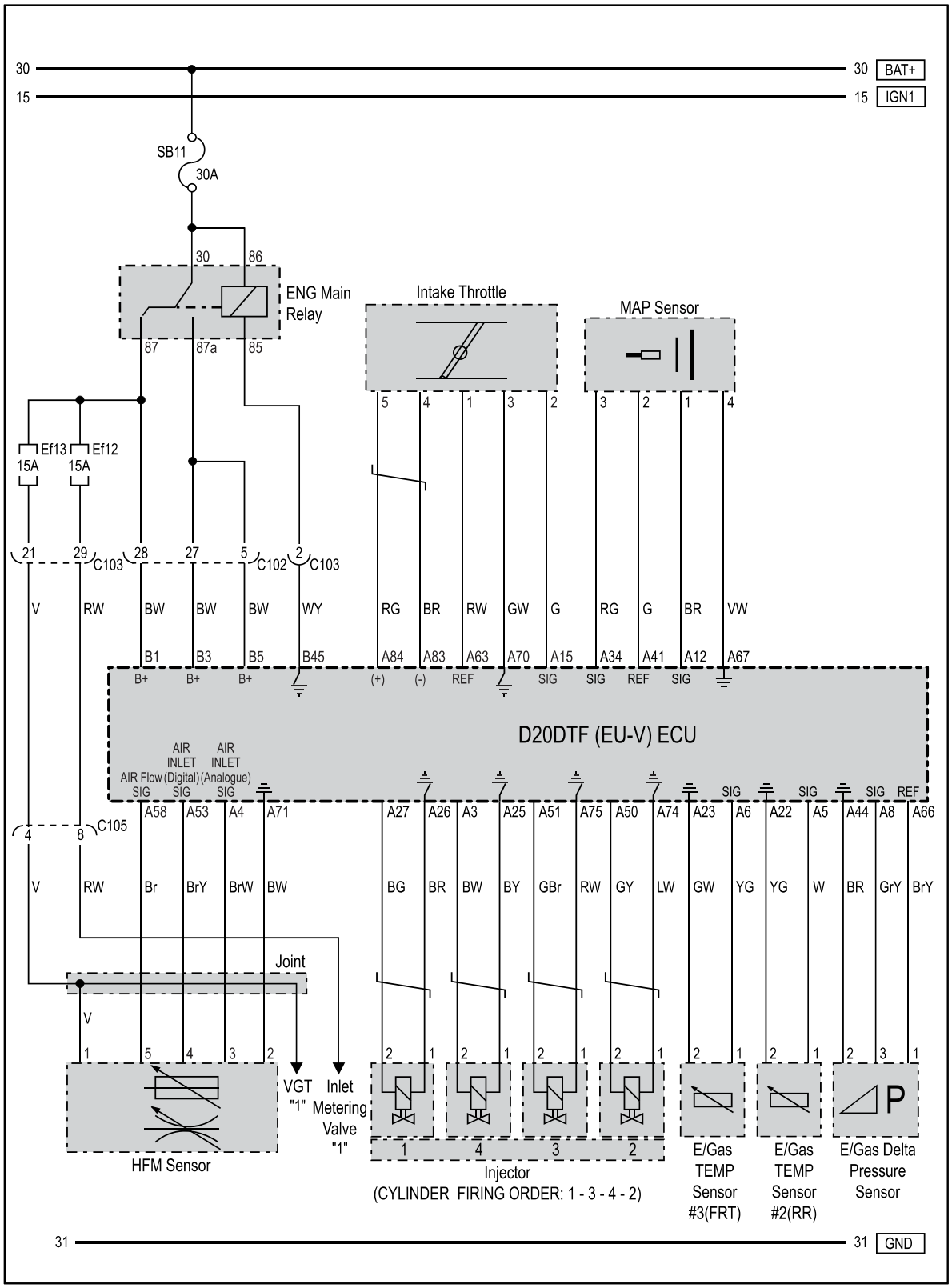
Downloaded from www.Manualslib.com manuals search engine

6. OPERATING TEMPERATURE



Downloaded from www.Manualslib.com manuals search engine

7. ELECTRIC CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

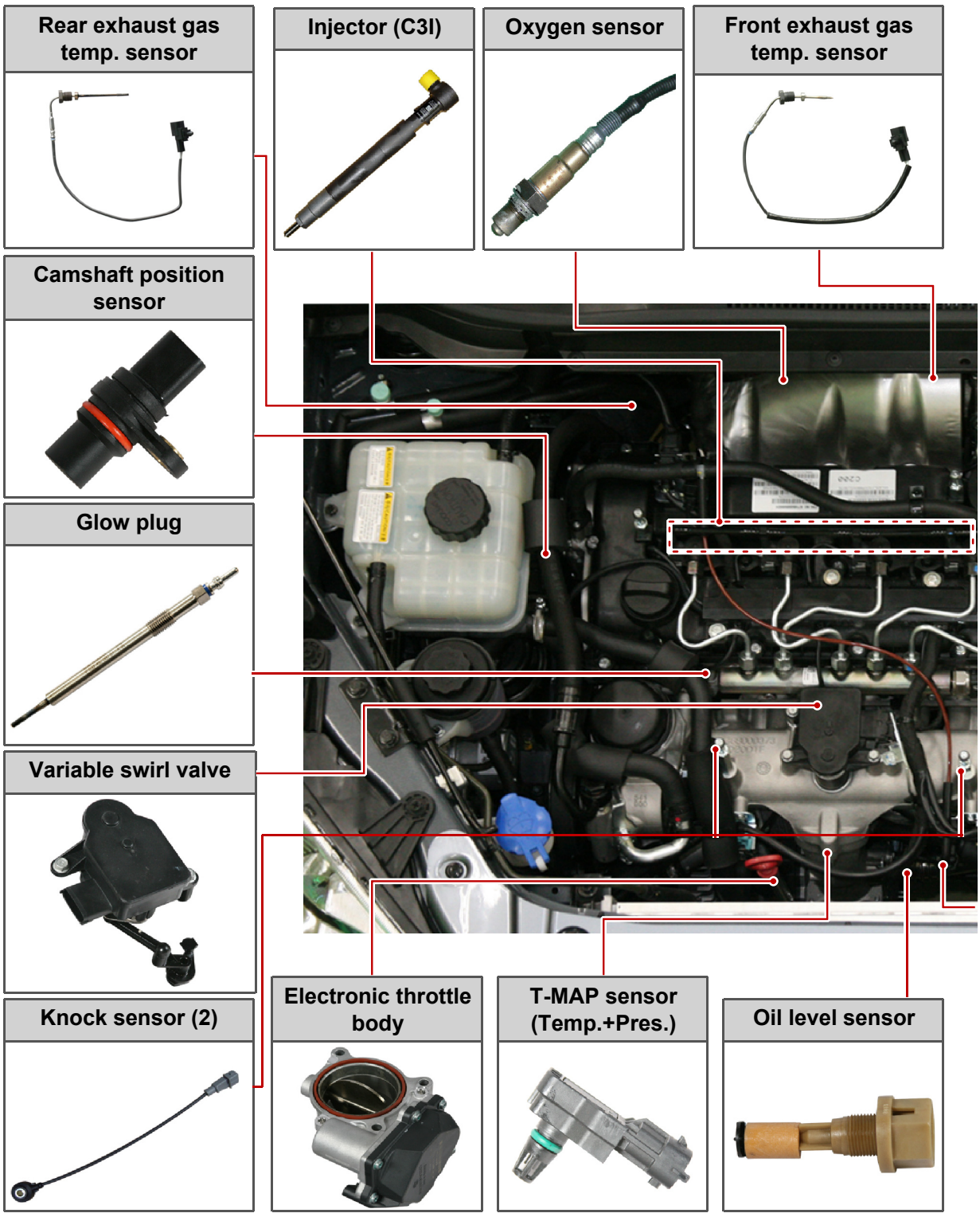
1. ENGINE DATA LIST

Data	Unit		Value
Coolant temperature	℃		0.436 V (130℃) to 4.896 V (-40℃)
Intake air temperature	℃		-40 to 130℃ (varies by ambient air temperature or engine mode)
Idle speed	rpm	A/T	780 ± 20
		M/T	750 ± 20
Engine load	%		18~25%
Mass air flow	kg/h		16 to 25 kg/h
Throttle position angle	°TA		0° (Full Open) to 78° (Close)
Engine torque	Nm		varies by engine conditions
Injection time	ms		3 to 5ms
Battery voltage	V		13.5 V to 14.1 V
Accelerator pedal position 1	V		04. to 4.8V
Accelerator pedal position 2	V		0.2 to 2.4 V
Throttle position 1	V		0.3 to 4.6 V
Throttle position 2	V		0.3 to 4.6 V
Oxygen sensor	mV		0 to 5 V
A/C compressor switch	1=ON / 0=OFF		-
Full load	1=ON / 0=OFF		-
Gear selection (A/T)	1=ON / 0=OFF		-
Knocking control	1=ON / 0=OFF		-
Brake switch	1=ON / 0=OFF		-
Cruise control	1=ON / 0=OFF		-

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

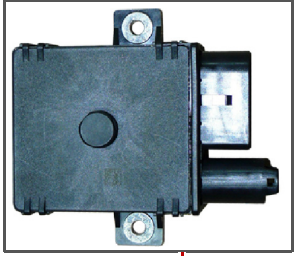
1. MAJOR COMPONENT



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

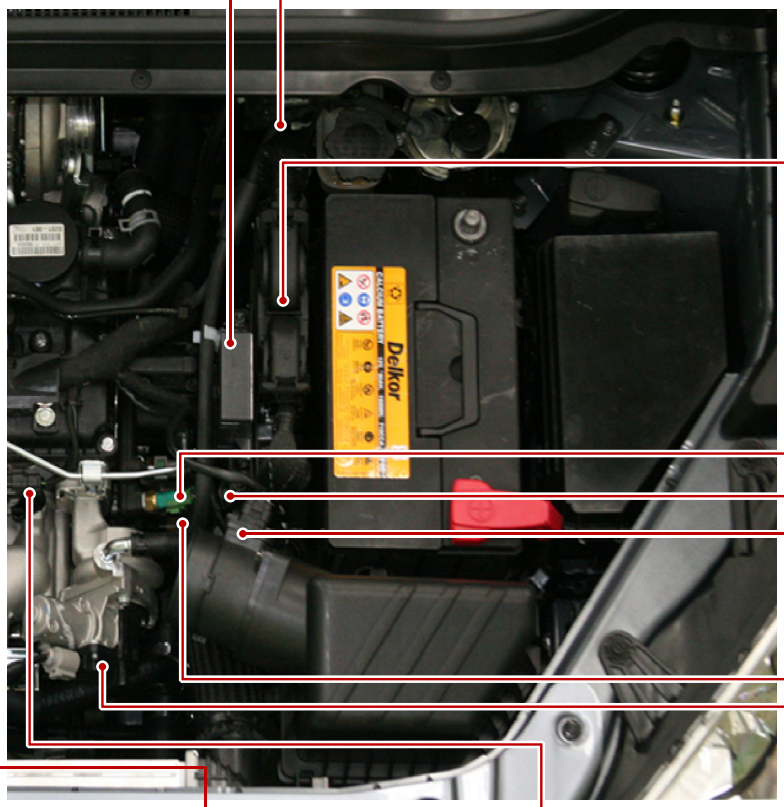
GCU (Glow plug control unit)



Differential pres. sensor

D20DTF ECU

Fuel temp. sensor



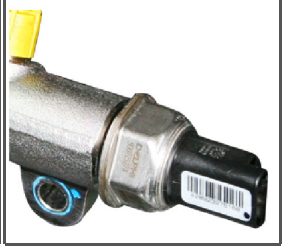
Coolant temp. sensor

HFM (air mass/temperature)

IMV

E-EGR bypass valve

Fuel rail pres. sensor



E-EGR valve

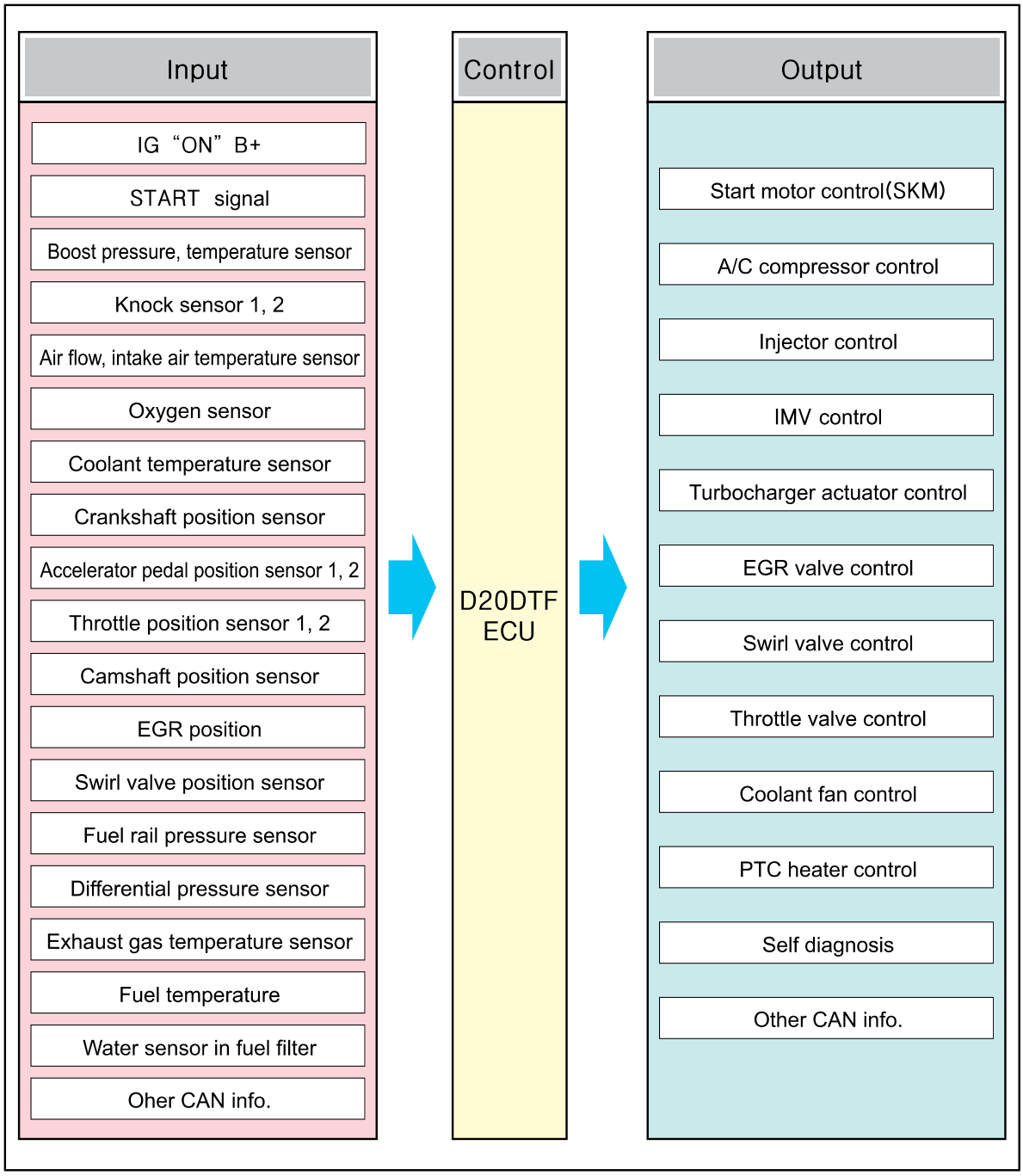
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. SYSTEM OPERATION

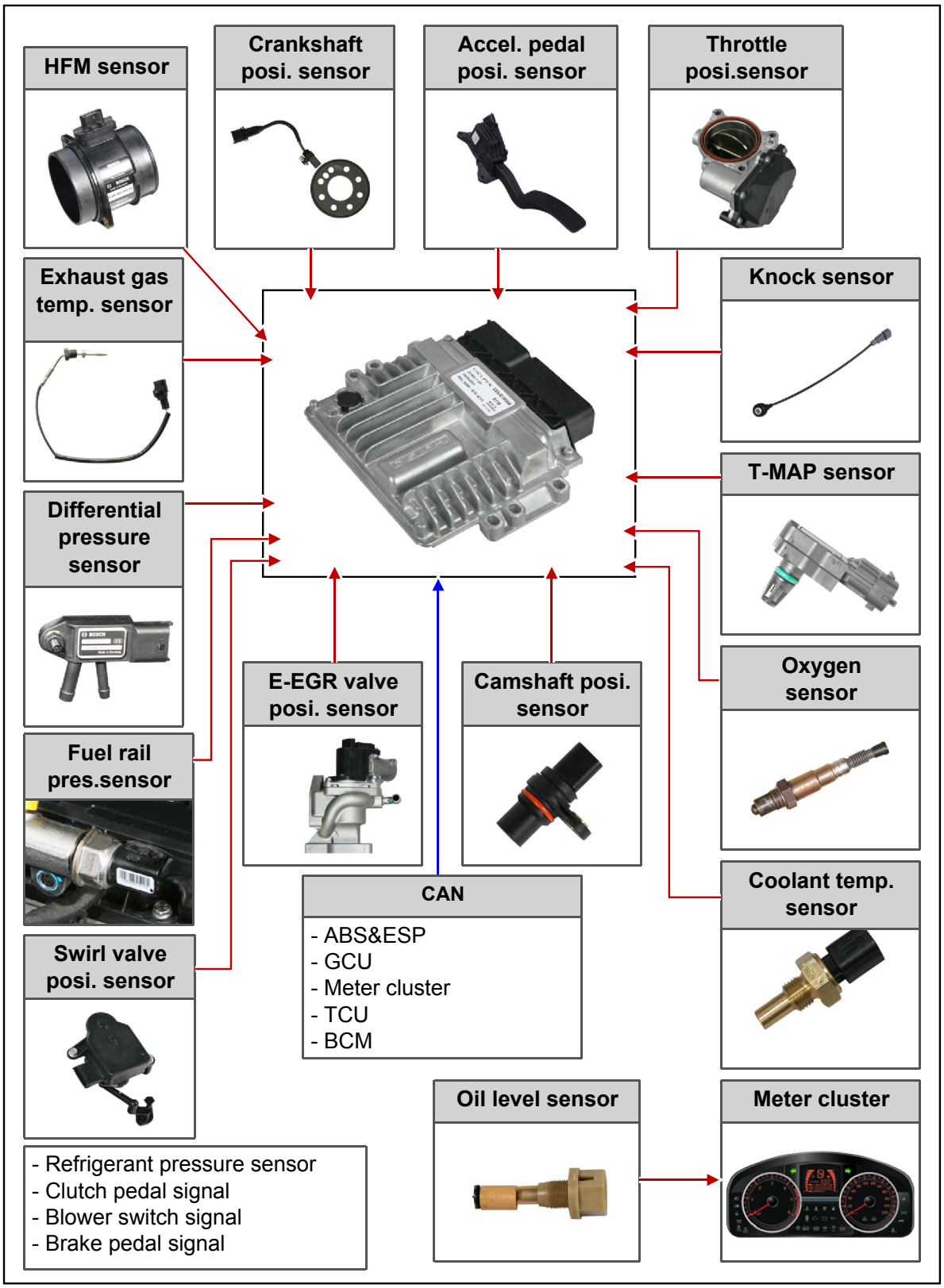
1) Input/Output of ECU

(1) ECU Block diagram



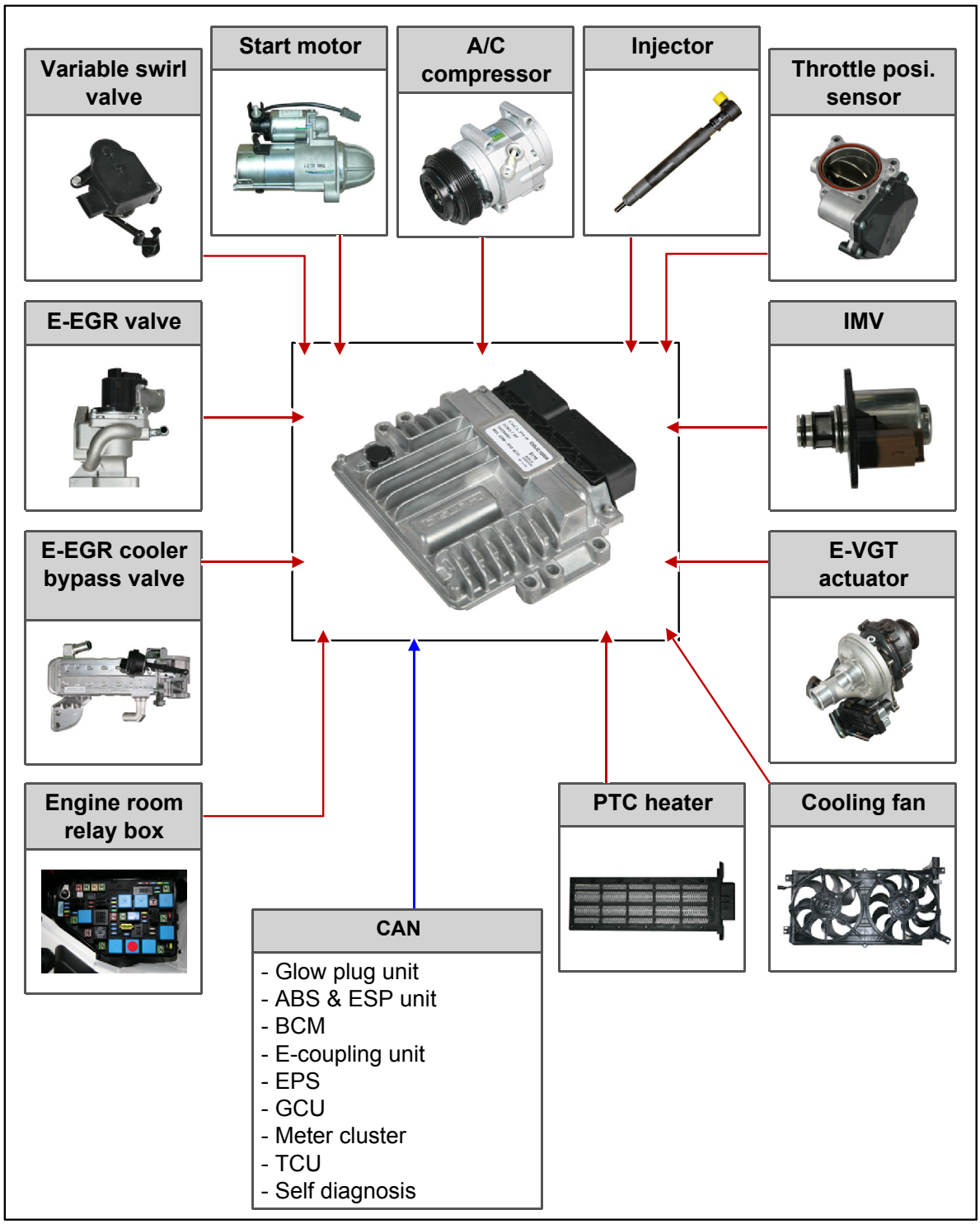
Downloaded from www.Manualslib.com manuals search engine

(2) Components for ECU Input



Downloaded from www.Manualslib.com manuals search engine

(3) Components for ECU Input



Downloaded from www.Manualslib.com manuals search engine

2) ECU Control

(1) Function

a. ECU Function

ECU receives and analyzes signals from various sensors and then modifies those signals into permissible voltage levels and analyzes to control respective actuators.
ECU microprocessor calculates injection period and injection timing proper for engine piston speed and crankshaft angle based on input data and stored specific map to control the engine power and emission gas.
Output signal of the ECU microprocessor drives pressure control valve to control the rail pressure and activates injector solenoid valve to control the fuel injection period and injection timing; so controls various actuators in response to engine changes. Auxiliary function of ECU has adopted to reduce emission gas, improve fuel economy and enhance safety, comforts and conveniences. For example, there are EGR, booster pressure control, autocruise (export only) and immobilizer and adopted CAN communication to exchange data among electrical systems (automatic T/M and brake system) in the vehicle fluently. And Scanner can be used to diagnose vehicle status and defectives.
Operating temperature range of ECU is normally −40 to +85°C and protected from factors like oil, water and electromagnetism and there should be no mechanical shocks.
To control the fuel volume precisely under repeated injections, high current should be applied instantly so there is injector drive circuit in the ECU to generate necessary current during injector drive stages.
Current control circuit divides current applying time (injection time) into full-in-current-phase and hold-current-phase and then the injectors should work very correctly under every working condition.

b. Control Function

- Controls by operating stages
  To make optimum combustion under every operating stage, ECU should calculate proper injection volume in each stage by considering various factors.
- Starting injection volume control
  During initial starting, injecting fuel volume will be calculated by function of temperature and engine cranking speed. Starting injection continues from when the ignition switch is turned to ignition position to till the engine reaches to allowable minimum speed.
- Driving mode control
  If the vehicle runs normally, fuel injection volume will be calculated by accelerator pedal travel and engine rpm and the drive map will be used to match the drivers inputs with optimum engine power.

Downloaded from www.Manualslib.com manuals search engine

(2) Fuel Control

a. Fuel Pressure Control Elements

Pressure control consists of 2 principles.

- Determines rail pressure according to engine operating conditions.
- Controls IMV to make the rail pressure to reach to the required value.

Pressure in the fuel rail is determined according to engine speed and load on the engine.

- When engine speed and load are high
  The degree of turbulence is very great and the fuel can be injected at very high pressure in order to optimize combustion.
- When engine speed and load are low
  The degree of turbulence is low. If injection pressure is too high, the nozzle's penetration will be excessive and part of the fuel will be sprayed directly onto the sides of the cylinder, causing incomplete combustion. So there occurs smoke and damages engine durability.

Fuel pressure is corrected according to air temperature, coolant temperature and atmospheric pressure and to take account of the added ignition time caused by cold running or by high altitude driving. A special pressure demand is necessary in order to obtain the additional flow required during starts. This demand is determined according to injected fuel and coolant temperature.

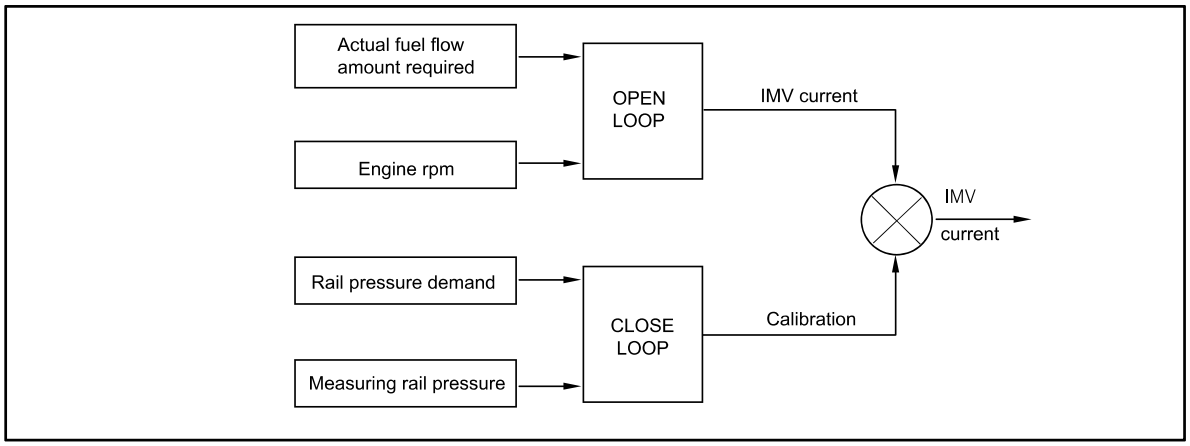
b. Fuel Pressure Control

Rail pressure is controlled by closed loop regulation of IMV.

▶ Open loop determines the current which needs to be sent to the actuator in order to obtain the flow demanded by the ECU.

▶ Closed loop will correct the current value depending on the difference between the pressure demand and the pressure measured.

- If the pressure is lower than the demand, current is reduced so that the fuel sent to the high pressure pump is increased.
- If the pressure is higher than the demand, current is increased so that the fuel sent to the high pressure pump is reduced.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

c. Fuel Injection Control

Injection control is used in order to determine the characteristics of the pulse which is sent to the injectors.
Injection control consists as below.

- Injection timing
- Injection volume
- Translating fuel injection timing and injection volume into values which can be interpreted by the injector driver.

▶ Main injection timing control

The pulse necessary for the main injection is determined as a function of the engine speed and of the injected flow.
The elements are:

- A first correction is made according to the air and coolant temperatures.
  This correction makes it possible to adapt the timing to the operating temperature of the engine. When the engine is warm, the timing can be retarded to reduce the combustion temperature and polluting emissions (NOx). When the engine is cold, the timing advance must be sufficient to allow the combustion to begin correctly.
- A second correction is made according to the atmospheric pressure.
  This correction is used to adapt the timing advance as a function of the atmospheric pressure and therefore the altitude.
- A third correction is made according to the coolant temperature and the time which has passed since starting.
  This correction allows the injection timing advance to be increased while the engine is warming up (initial 30 seconds). The purpose of this correction is to reduce the misfiring and instabilities which are liable to occur after a cold start.
  A fourth correction is made according to the pressure error.
  This correction is used to reduce the injection timing advance when the pressure in the rail is higher than the pressure demand.
  A fifth correction is made according to the rate of EGR.
- This correction is used to correct the injection timing advance as a function of the rate of exhaust gas recirculation.
  When the EGR rate increases, the injection timing advance must in fact be increased in order to compensate for the fall in termperature in the cylinder.

During starting, the injection timing must be retarded in order to position the start of combustion close to the TDC. To do this, special mapping is used to determine the injection timing advance as a function of the engine speed and of the water temperature.

Downloaded from www.Manualslib.com manuals search engine

▶ **Pilot injection timing control**

The pilot injection timing is determined as a function of the engine speed and of the total flow. The elements are:

- A first correction is made according to the air and coolant temperatures. This correction allows the pilot injection timing to be adapted to the operating temperature of the engine.
- A second correction is made according to the atmospheric pressure. This correction is used to adapt the pilot injection timing as a function of the atmospheric pressure and therefore the altitude.

d. Fuel Control

1. Main Flow Control

The main flow represents the amount of fuel injected into the cylinder during the main injection. The pilot flow represents the amount of fuel injected during the pilot injection.

The total fuel injected during 1 cycle (main flow + pilot flow) is determined in the following manner.

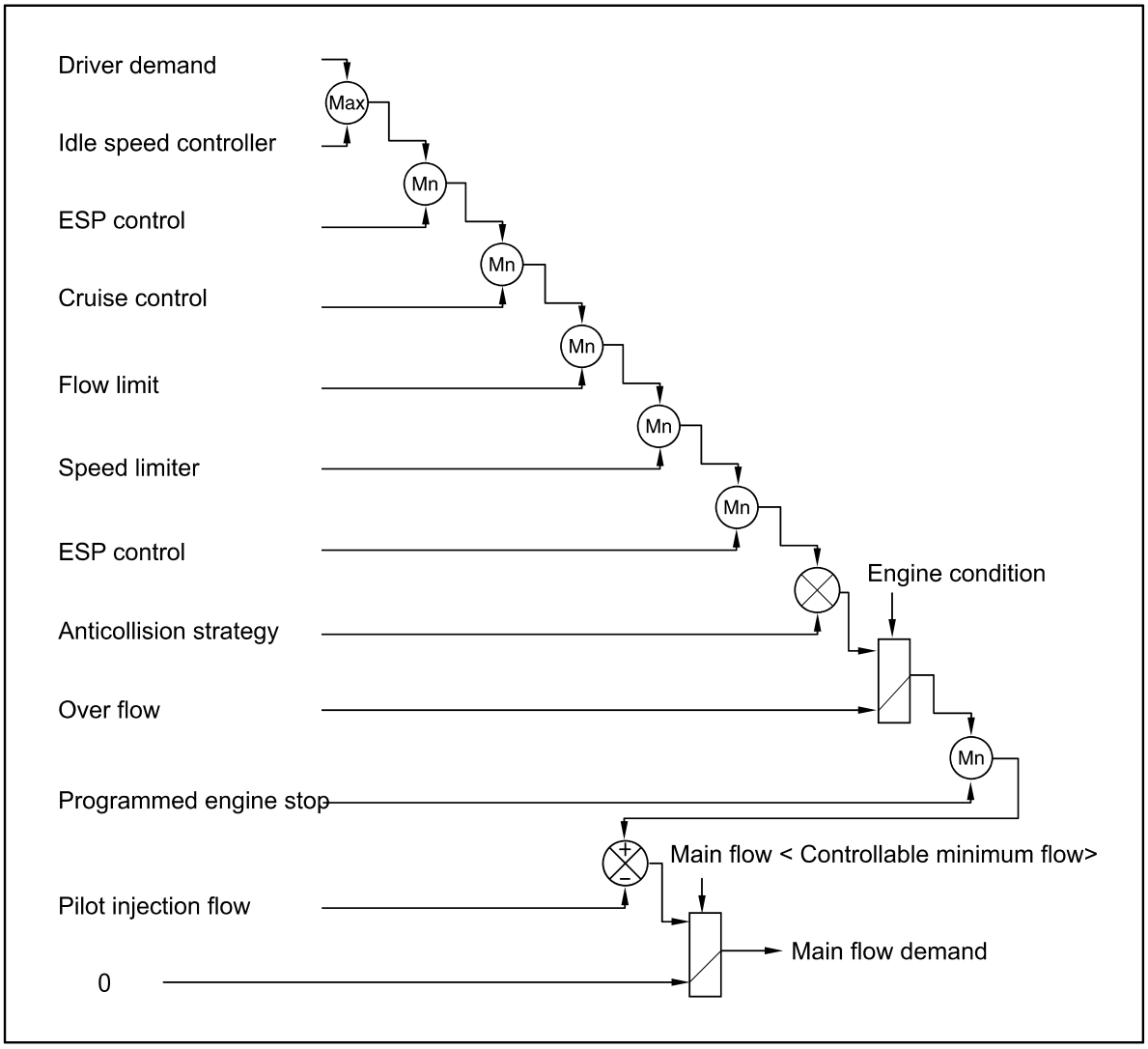
▶ When the driver depress the pedal, it is his demand which is taken into account by the
▶ system in order to determine the fuel injected.
When the driver release the pedal, the idle speed controller takes over to determine the minimum fuel which must be injected into the cylinder to prevent the enigne from stalling.

It is therefore the greater of these 2 values which is retained by the system. This value is then compared with the lower flow limit determined by the ESP system.
As soon as the injected fuel becomes lower than the flow limit determined by the ESP system, the antagonistic torque (engine brake) transmitted to the drive wheels exceeds the adherence capacity of the vehicle and there is therefore a risk of the drive wheels locking.
The system thus chooses the greater of these 2 values (main flow & pilot flow) in order to prevent any loss of control of the vehicle during a sharp deceleration.
As soon as the injected fuel becomes higher than the fuel limit determined by the ASR trajectory control system, the engine torque transmitted to the wheels exceeds the adhesion capacity of the vehicle and there is a risk of the drive wheels skidding. The system therefore chooses the smaller of the two values in order to avoid any loss of control of the vehicle during accelerations.
The anti-oscillation strategy makes it possible to compensate for fluctuations in engine speed during transient conditions. This strategy leads to a fuel correction which is added to the total fuel of each cylinder.
A switch makes it possible to change over from the supercharge fuel to the total fuel according to the state of the engine.

- Until the stating phase has finished, the system uses the supercharged fuel.
- Once the engine changes to normal operation, the system uses the total fuel.

The main fuel is obtained by subtracting the pilot injection fuel from the total fuel.
A mapping determines the minimum fuel which can control an injector as a function of the rail pressure. As soon as the main fuel falls below this value, the fuel demand changes to 0 because in any case the injector is not capable of injecting the quantity demand.

Downloaded from www.Manualslib.com manuals search engine



2. Driver Demand

The driver demand is the translation of the pedal position into the fuel demand. It is calculated as a function of the pedal position and of the engine speed. The driver demand is filtered in order to limit the hesitations caused by rapid changes of the pedal position. A mapping determines the maximum fuel which can be injected as a function of the driver demand and the rail pressure. Since the flow is proportional to the injection time and to the square root of the injection pressure, it is necessary to limit the flow according to the pressure in order to avoid extending the injection for too long into the engine cycle. The system compares the driver demand with this limit and chooses the smaller of the 2 values. The driver demand is then corrected according to the coolant temperature. This correction is added to the driver demand.

Downloaded from www.Manualslib.com manuals search engine

3. Idle Speed Controller

The idle speed controller consists of 2 principal modules:

- The first module determines the required idle speed according to:
  * The operating conditions of the engine (coolant temperature, gear engaged)
  * Any activation of the electrical consumers (power steering, air conditioning, others)
  * The battery voltage
  * The presence of any faults liable to interface with the rail pressure control or the injection control. In this case, increase the idle speed to prevent the engine from stalling.
- The second module is responsible for providing closed loop control of the engine's idle speed by adapting the minimum fuel according to the difference between the required idle speed and the engine speed.

4. Flow Limitation

The flow limitation strategy is based on the following strategies:

- The flow limitation depending on the filling of the engine with air is determined according to the engine speed and the air flow. This limitation allows smoke emissions to be reduced during stabilized running.
- The flow limitation depending on the atmospheric pressure is determined according to the engine speed and the atmospheric pressure. It allows smoke emissions to be reduced when driving at altitude.
- The full load flow curve is determined according to the gear engaged and the engine speed. It allows the maximum torque delivered by the engine to be limited.
- A performance limitation is introduced if faults liable to upset the rail pressure control or the injection control are detected by the system. In this case, and depending on the gravity of the fault, the system activates:

  Reduced fuel logic 1: Guarantees 75 % of the performance without limiting the engine speed.
  Reduced fuel logic 2: Guarantees 50 % of the performance with the engine speed limited to 3,000 rpm.
  Reduce fuel logic 3: Limits the engine speed to 2,000 rpm.

The system chooses the lowest of all values.
A correction depending on the coolant temperature is added to the flow limitation. This correction makes it possible to reduce the mechanical stresses while the engine is warming up. The correction is determined according to the coolant temperature, the engine speed and the time which has passed since starting.

Superchager Flow Demand

The supercharge flow is calculated according to the engine speed and the coolant temperature. A correction depending on the air temperature and the atmospheric pressure is made in order to increase the supercharge flow during cold starts. It is possible to alter the supercharge flow value by adding a flow offset with the aid of the diagnostic tool.

Downloaded from www.Manualslib.com manuals search engine

5. Pilot Flow Control

The pilot flow represents the amount of fuel injected into the cylinder during the pilot injection. This amount is determined according to the engine speed and the total flow.

- A first correction is made according to the air and water temperature.
  This correction allows the pilot flow to be adapted to the operating temperature of the engine. When the engine is warm, the ignition time decreases because the end-of-compression temperature is higher. The pilot flow can therefore be reduced because there is obviously less combustion noise when the engine is warm.
- A second correction is made according to the atmospheric pressure.

During starting, the pilot flow is determined on the basis of the engine speed and the coolant temperature.

6. Cylinder Balancing Strategy

▶ Balancing of the point to point flows

The pulse of each injector is corrected according to the difference in instantaneous speed measured between 2 successive injectors.

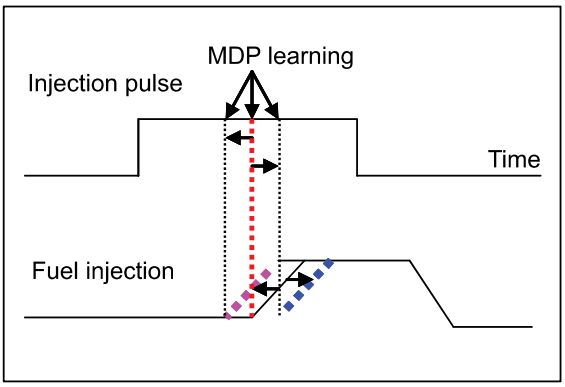
The instantaneous speeds on two successive injections are first calculated.
The difference between these two instantaneous speeds is then calculated.
Finally, the time to be added to the main injection pulse for the different injectors is determined.
For each injector, this time is calculated according to the initial offset of the injector and the instantaneous speed difference.

▶ Detection of an injector which has stuck closed

The cylinder balancing strategy also allows the detection of an injector which has stuck closed. The difference in instantaneous speed between 2 successive injections then exceeds a predefined threshold. In this case, a fault is signaled by the system.

Downloaded from www.Manualslib.com manuals search engine

e. MDP Learning Control



MDP (Minimum Drive Pulse) refers to the minimum power supply pulse for injection which the injector can perform. It is possible to control the fuel volume for each injector accurately through correct learning for the MDP value. The basic process of MDP learning is that the pulse slightly higher than MDP is supplied and then (b) the vibration generated from the cylinder is detected. The knock sensor detects the vibration from the engine after a small volume of fuel is injected. And the time interval between the points of injection and vibration is measured so that MDP can be learned. MDP learning is helpful to prevent engine vibration, high emission and power reduction through performing calibration for the old injectors. During MDP learning, a little vibration and noise can be occur for a while. This is because the fuel pressure is increased instantaneously and the exact injection value is not input, so that the exact engine vibration timing can be detected.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

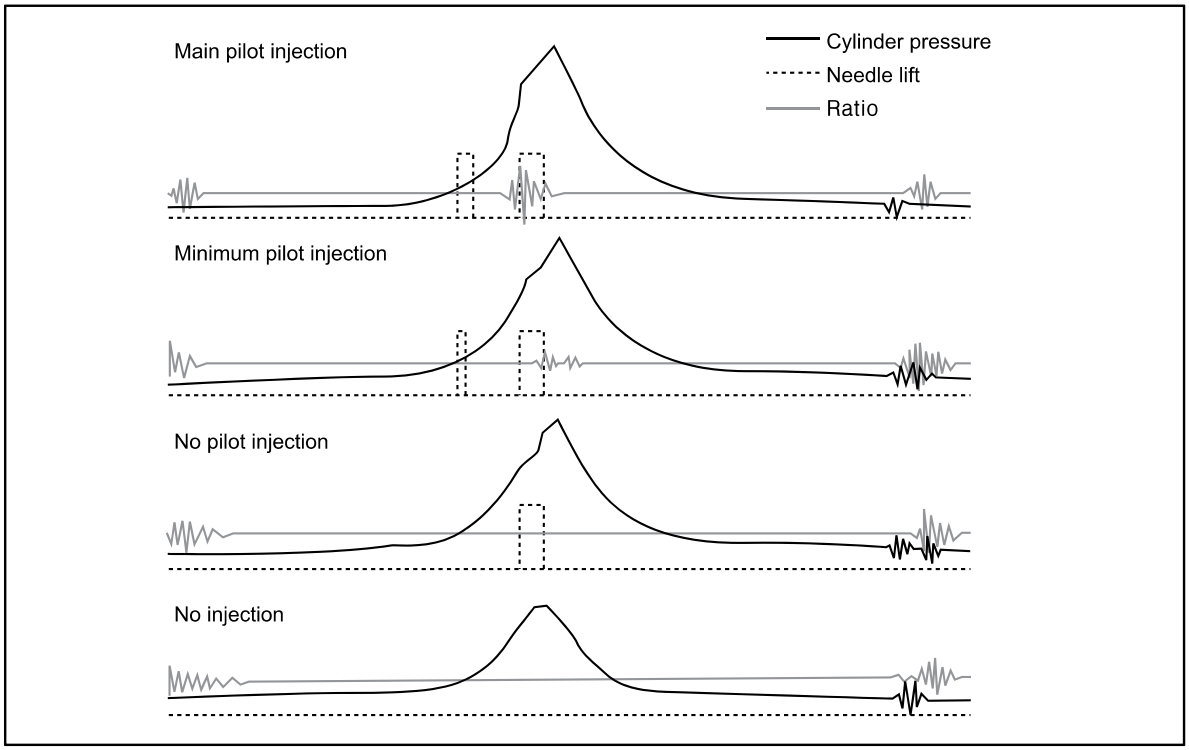
(3) Accelerometer Control

a. Resetting the pilot injection

The accelerometer is used to reset the pilot injection flow in closed loop for each injector. This method allows the correction of any injector deviations over a period of time. The principle of use of the accelerometer is based on the detection of the combustion noises.
The sensor is positioned in such a way as to receive the maximum signal for all the cylinders. The raw signals from the accelerometer are processed to obtain a variable which quantifies the intensity of the combustion. This variable, known as the ratio, consists of the ratio between the intensity of the background noise and the combustion noise.

1. A first window is used to establish the background noise level of the accelerometer signal for each cylinder. This window must therefore be positioned at a moment when there cannot be any combustion.
2. The second window is used to measure the intensity of the pilot combustion. Its position is such that only the combustion noises produced by the pilot injection are measured . It is therefore placed just before the main injection.

The accelerometer does not allow any evaluation of the quantity injected. However, the pulse value will be measured when the injector starts injection and this pulse value is called the MDP (Minimum Drive Pulse). On the basis of this information, it is possible to efficiently correct the pilot flows. The pilot injection resetting principle therefore consists of determining the MDP, in other words the pulse corresponding to the start of the increase in value of the ratio (increase of vibration due to fuel combustion).



Downloaded from www.Manualslib.com manuals search engine

This is done periodically under certain operating conditions. When the resetting is finished, the new minimum pulse value replaces the value obtained during the previous resetting. The first MDP value is provided by the C3I. Each resetting then allows the closed loop of the MDP to be updated according to the deviation of the injector.

b. Detection of leaks in the cylinders

The accelerometer is also used to detect any injector which may have stuck open. The detection principle is based on monitoring the ratio. If there is a leak in the cylinder, the accumulated fuel self-ignites as soon as the temperature and pressure conditions are favorable (high engine speed, high load and small leak).
This combustion is set off at about 20 degrees before TDC and before main injection.
The ratio therefore increases considerably in the detection window. It is this increase which allows the leaks to be detected. The threshold beyond which a fault is signaled is a percentage of the maximum possible value of the ratio.
Because of the severity of the recovery process (engine shut-down), the etection must be extremely robust.
An increase in the ratio can be the consequence of various causes:

- Pilot injection too much
- Main combustion offset
- Fuel leak in the cylinder

If the ratio becomes too high, the strategy initially restricts the pilot injection flow and retards the main injection. If the ratio remains high despite these interventions, this shows that a real leak is present, a fault is signaled and the engine is shut down.

c. Detection of an accelerometer fault

This strategy permits the detection of a fault in the sensor or in the wiring loom connecting the sensor to the ECU.
It is based on detection of the combustion. When the engine is idling, the detection window is set too low for the combustion caused by the main injection. If the ratio increases, this shows that the accelerometer is working properly, but otherwise a fault is signaled to indicate a sensor failure. The recovery modes associated with this fault consist of inhibition of the pilot injection and discharge through the injectors.

Downloaded from www.Manualslib.com manuals search engine

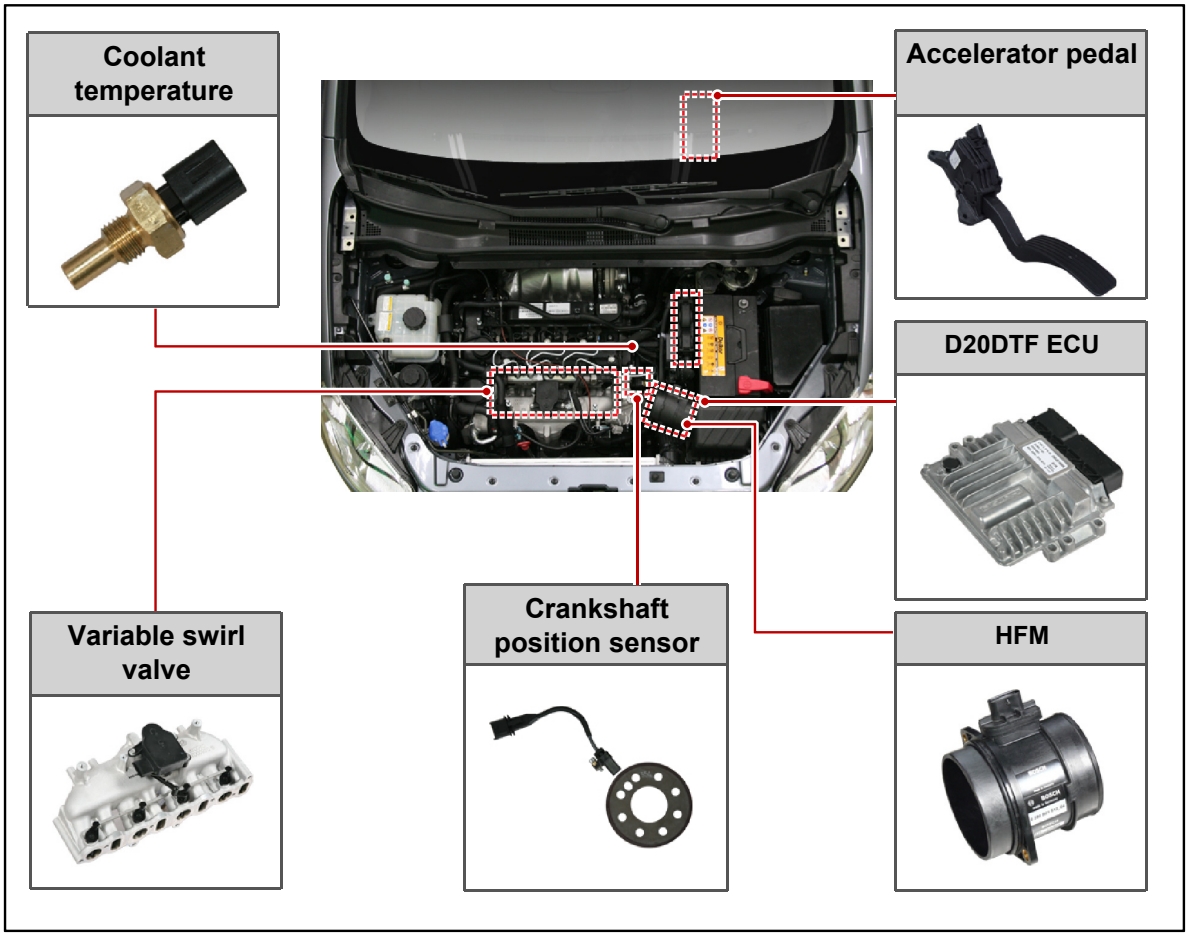
(4) Swirl control

a. Overview

- Variable swirl valve

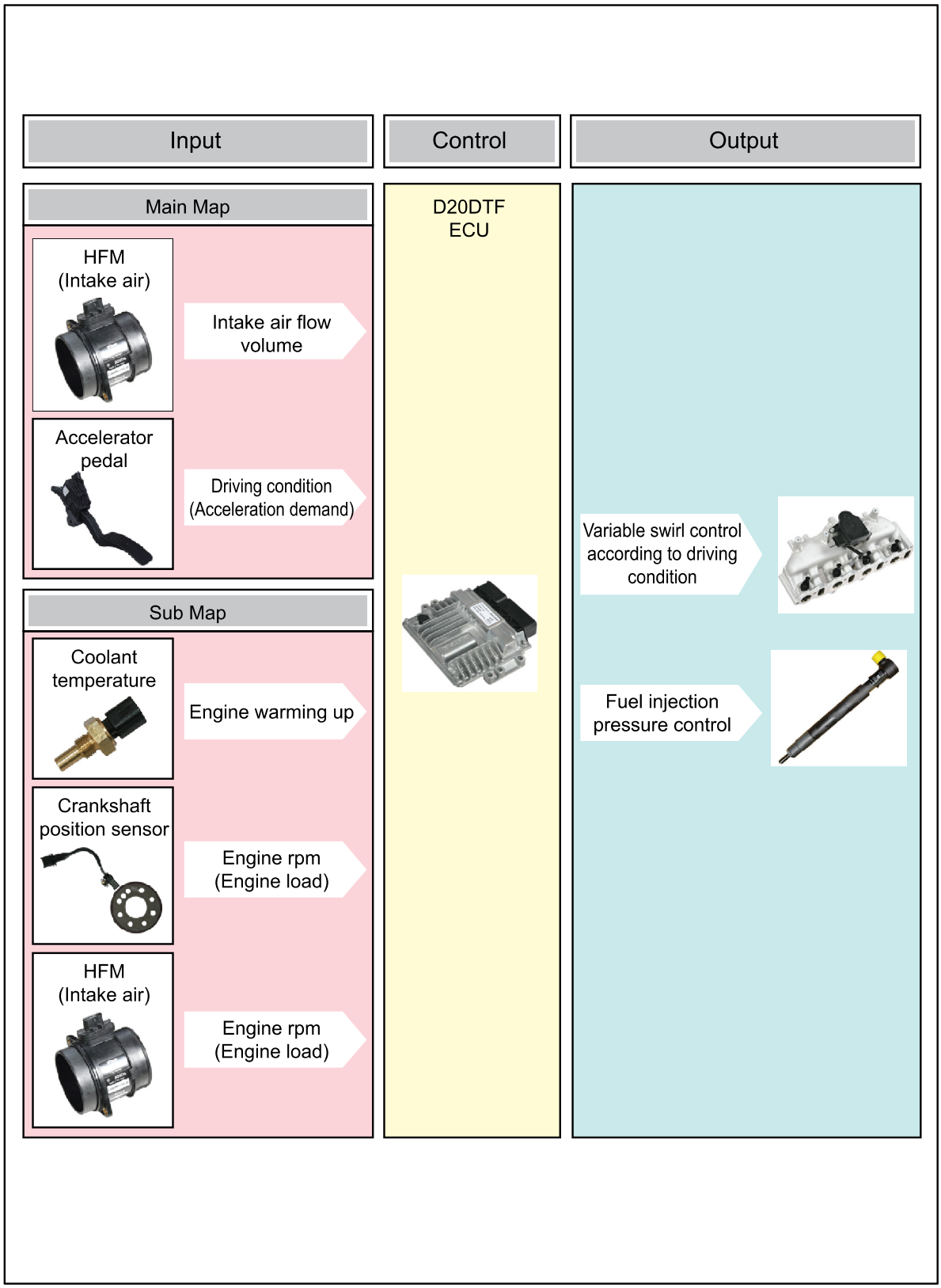
The strong swirl caused by intake air is important element for anti-locking function in diesel engine. The swirl control valve partially closes the intake port to generate the swirl according to the engine conditions. When the engine load is in low or medium range, the swirl could not be generated because the air flow is slow. To generate strong swirl, there are two passages in intake manifold, and one of them has the valve to open and close the passage. When the valve closes the passage, the air flow through the another passage will be faster, and the strong swirl will be generated by the internal structure of the passage. This swirl makes the better mixture of air and fuel, eventually the combustion efficiency in combustion chamber could be improved. This provides the enhanced fuel consumption, power and EGR ratio.

- Components



Downloaded from www.Manualslib.com manuals search engine

b. Input/Output for variable swirl valve

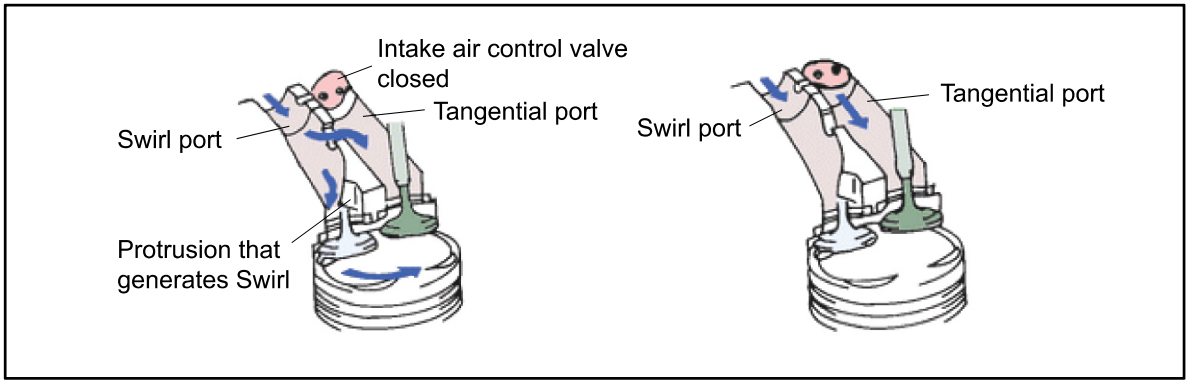


Modification basis	
Application basis	
Affected VIN	

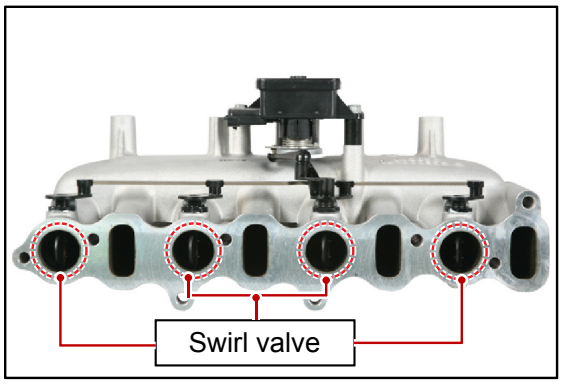
Downloaded from www.Manualslib.com manuals search engine

c. Swirl control

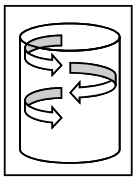
In DI type diesel engine, the liquefied fuel is injected into the cylinder directly. If the fuel is evenly distributed in short period, the combustion efficiency could be improved. To get this, there should be good air flow in cylinder. In general, there are two intake ports, swirl port and tangential port, in each cylinder. The swirl port generates the horizontal flow and the tangential port generates the longitudinal flow.
In low/mid load range, the tabgential port is closed to increase the horizontal flow. Fast flow decreases the PM during combustion and increases the EGR ratio by better combustion efficiency.



Load	Engine speed	Swirl valve	Amount of swirl	Remarks
Low speed, Low load	below 3,000 rpm	Closed	Heavy	Increased EGR ratio, better air-fuel mixture (reduce exhaust gas)
High speed, High load	over 3,000 rpm	Open	Light	Increase charge efficiency, higher engine power



The variable swirl valve actuator operates when turning the ignition switch ON/OFF position to open/close the swirl valve. In this period, the soot will be removed and the learning for swirl valve position is performed.



NOTE
Swirl: This is the twisted (radial) air flow along the cylinder wall during the intake stroke. This stabilizes the combustion even in lean air-fuel mixture condition.

Downloaded from www.Manualslib.com manuals search engine

d. Features

- Swirl and air intake efficiency
  To generate the swirl, the intake port should be serpentine design. This makes the resistance in air flow. The resistance in air flow in engine high speed decreases the intake efficiency. Eventually, the engine power is also decreased, Thus, the swirl operation is deactivated in high speed range to increase the intake efficiency.
- Relationship between swirl and EGR
  To reduce Nox, it is essential to increase EGR ratio. However, if EGR ratio is too high, the PM also could be very higher. And, the exhaust gas should be evenly mixed with newly aspired air. Otherwise, PM and CO are dramatically increased in highly concentrated exhaust gas range and EGR ratio could not be increased beyond a certain limit. If the swirl valve operates in this moment, the limit of EGR ratio will be higher.
- Relationship between swirl and fuel injection pressure
  The injector for DI engine uses the multi hole design. For this vehicle, there are 8 holes in injector. If the swirl is too strong, the injection angles might be overlapped and may cause the increased PM and insufficient engine power. Also, if the injection pressure is too high during strong swirl, the injection angles might be overlapped. Therefore, the system may decreases the fuel injection pressure when the swirl is too strong.

NOTE

* Anti-knock methods:
- Shorten the ignition timing by pilot injection, lessen the fuel injection volume during ignition delay period.
- Increase engine speed.
- Maintain intake sir temperature with intercooler or glow plug device.
- Increase intake air pressure with turbocharger.
- Warm up engine to keep the normal operating temperature.
- Increase compression ratio.
- Use the fuel with high cetane.

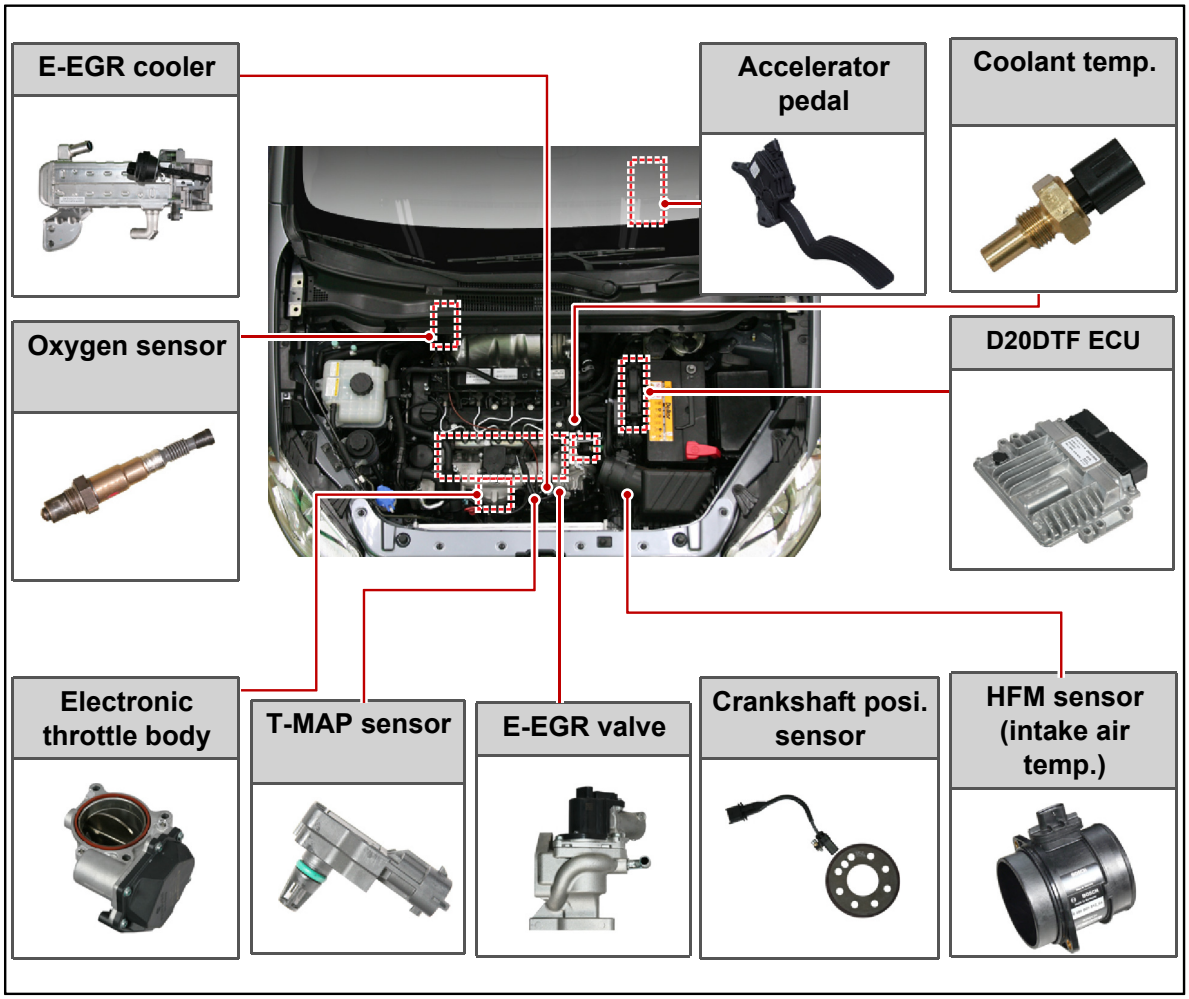
Downloaded from www.Manualslib.com manuals search engine

(5) EGR control

a. Overview

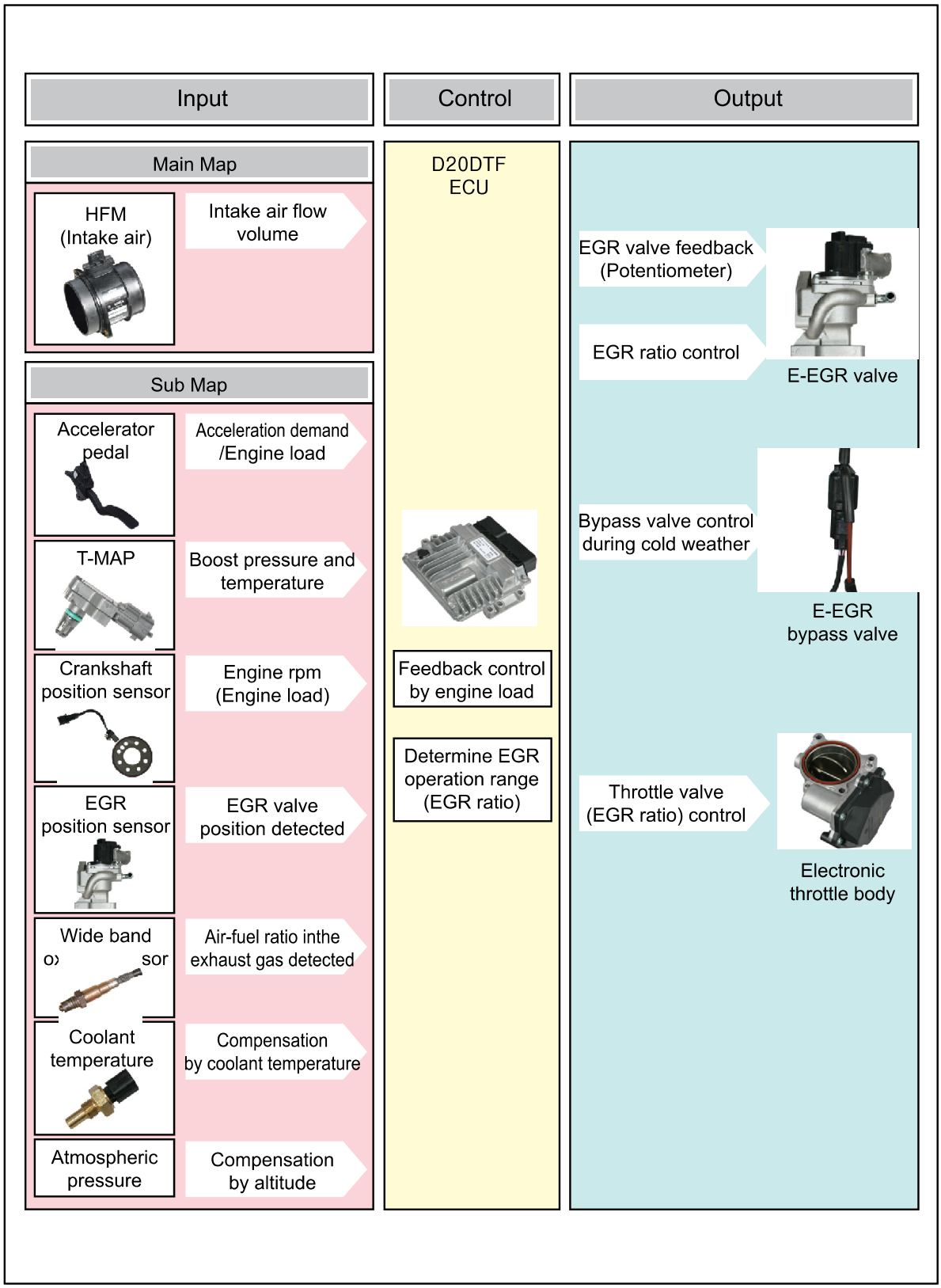
The EGR (Electric-Exhaust Gas Recirculation) valve reduces the NOx emission level by recirculating some of the exhaust gas to the intake system.
The major difference with the previous EURO 4 type, is that the DC motor with improved response rate according to the EURO 5 regulation. The solenoid type actuator is used in the conventional model, but in this new model, the DC motor type actuator with improved response rate is adopted. Also the hall sensor which provides a more stabilized signal than the potentiometer, and the EGR bypass flap which improves engine warming up efficiency are also used. The HFM sensor and the position sensor are used to feedback the amount of EGR for both EURO 4 and EURO 5.

b. Components



Downloaded from www.Manualslib.com manuals search engine

c. Input/Output of E-EGR system



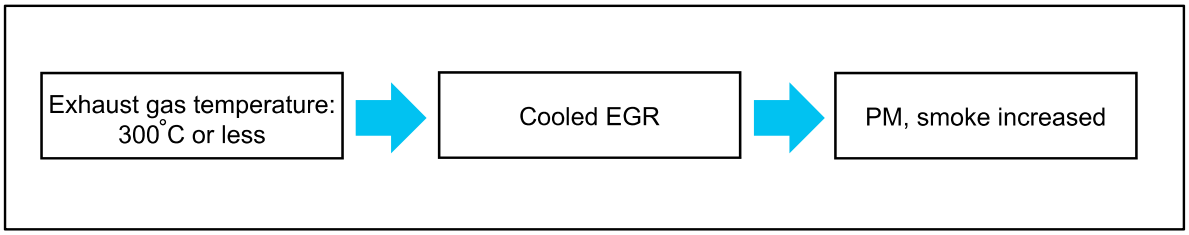
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

d. Bypass control for EGR cooler

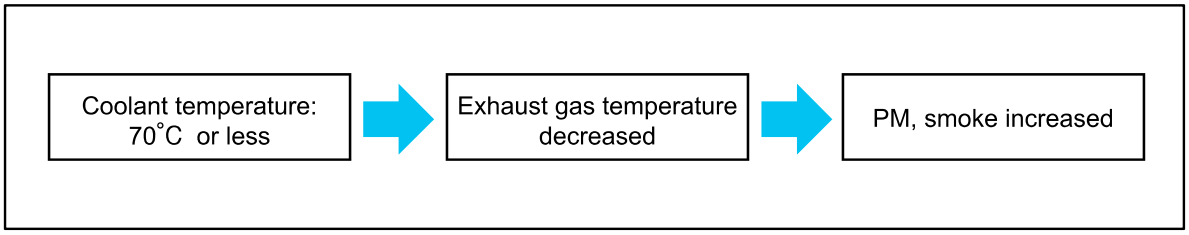
1. Cooler temperature

When the coolant temperature is below 70℃, the exhaust gas is bypassed the EGR cooler.



2. Exhaust gas temperature

When the exhaust gas temperature is below 300℃, the exhaust gas is bypassed the EGR cooler. Otherwise, PM could be increased due to too low exhaust gas temperature.

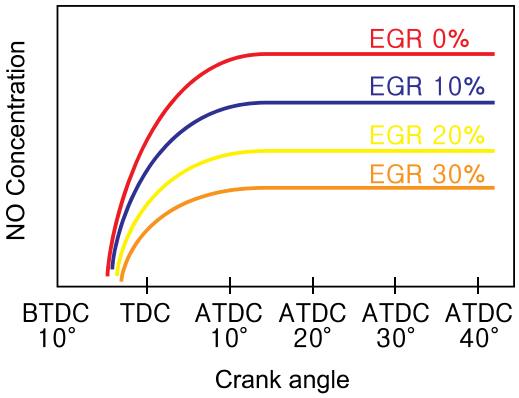


e. Control elements for EGR system

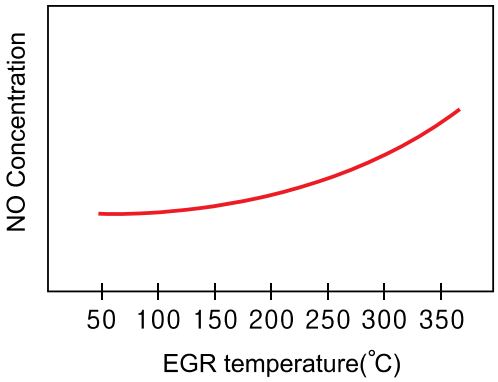
- Accelerator pedal (engine load) - Indicates the driver's intention and engine load. If the load goes up, the EGR ratio is decreased.
- T-MAP (boost pressure map stored in ECU) - Compensates the difference in boost pressure by adjusting EGR ratio.
- Engine rpm - Used as the signal for determining EGR operating range.
- Coolant temperature - When the coolant temperature is low, NOx is decreased but PM could be increased. So, to reduce PM, decrease EGR ratio when the coolant temperature is low.
- Intake air mass and temperature - HFM sensor measures the intake air mass to calculate the actual EGR volume. If the air mass is larger than programmed value in map, EGR ratio will be higher.
- EGR position sensor - Detects the actual opening angle of EGR valve and performs feedback function according to PWM control by ECU.
- Wide band oxygen sensor - Detects the oxygen volume in exhaust gas to check if the EGR ratio is proper.
- Electronic throttle body - Keeps EGR ratio to optimized level by controlling the throttle body in EGR operating range (decreasing pressure in intake manifold).

Downloaded from www.Manualslib.com manuals search engine

f. Features



As EGR ratio goes up, smoke volume will be higher. But, this lowers the combustion chamber temperature and accordingly the concentration of NOx is decreased. The point with highest NOx is immediately after TDC.



As EGR temperature goes up, the concentration of NOx will be higher. Thus, it is necessary to cool down the exhaust gas. However, during engine cooled, it may cause large amount of PM. To prevent this, the exhaust gas is bypassed the EGR cooler.

Modification basis	
Application basis	
Affected VIN	

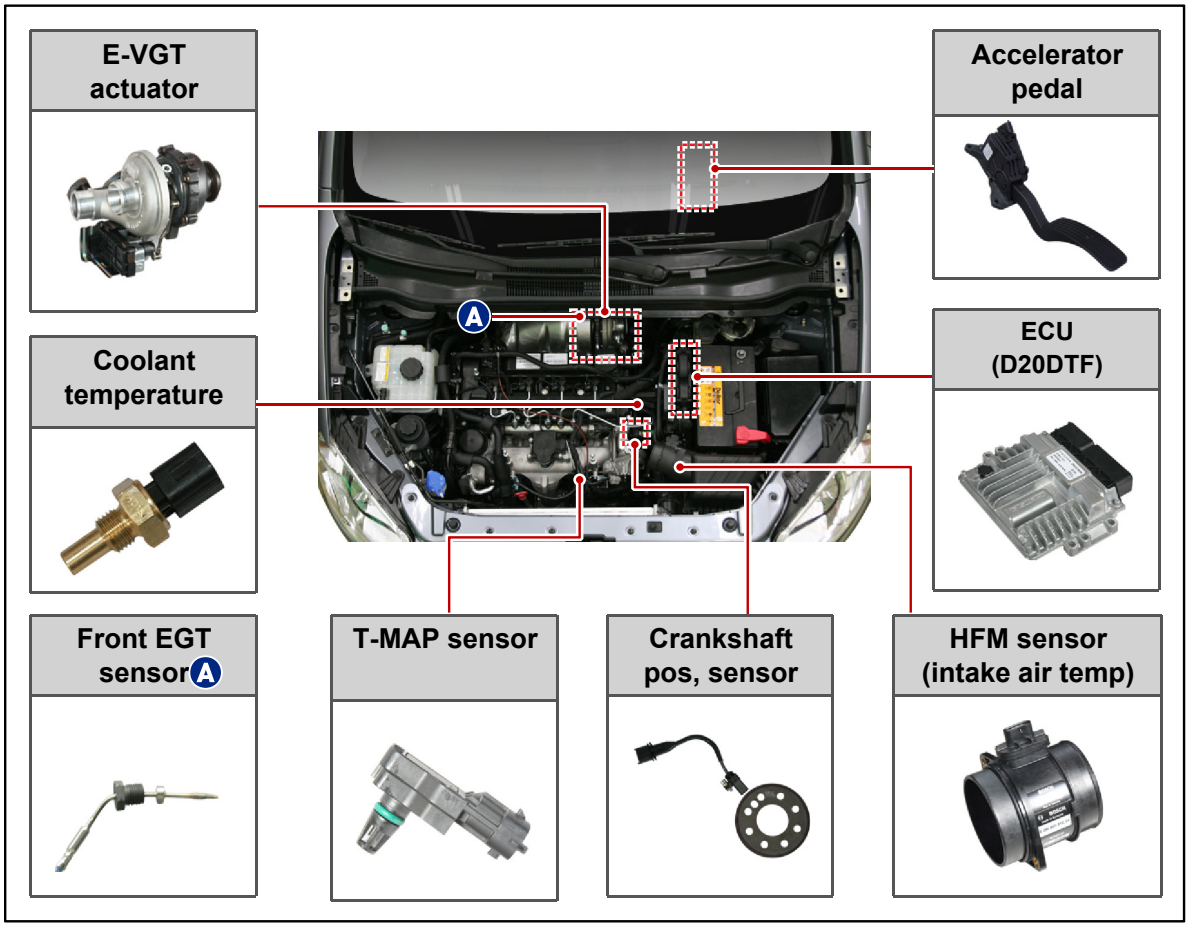
Downloaded from www.Manualslib.com manuals search engine

(6) E-VGT control

a. Overview

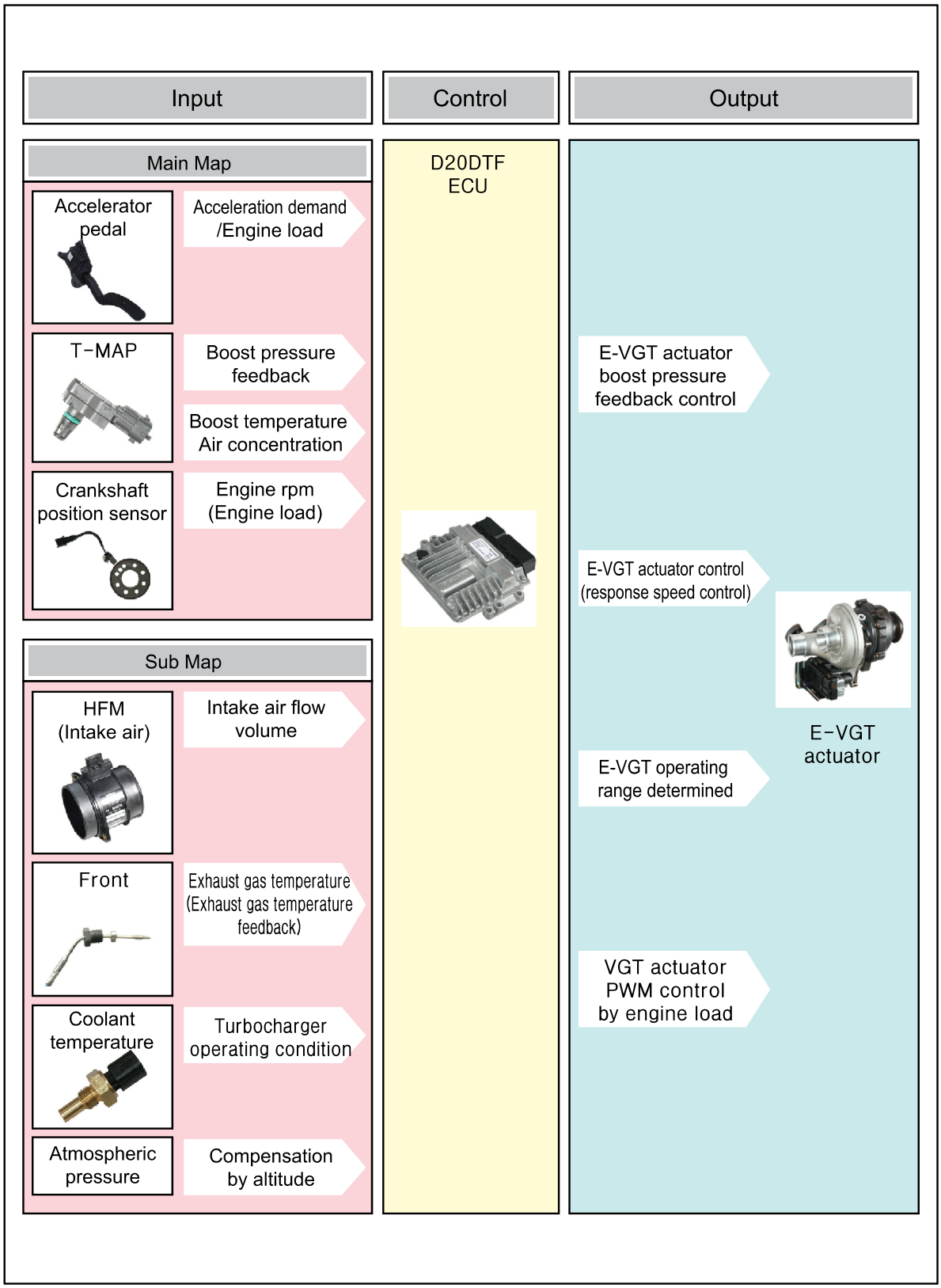
E-VGT (Electric-Variable Geometry Turbine) turbocharger system in D20DTF engine uses the venturi effect that controls the flow rate of exhaust gas by adjusting the passage in turbine housing. The newly adopted DC motor actuator (E-actuator) controls the E-VGT system more precisely and faster. To get the high operating power from turbine, the ECU reduces the exhaust gas passage In low speed range and increases it in high speed range.

b. Components



Downloaded from www.Manualslib.com manuals search engine

c. Input/Output for E-VGT system

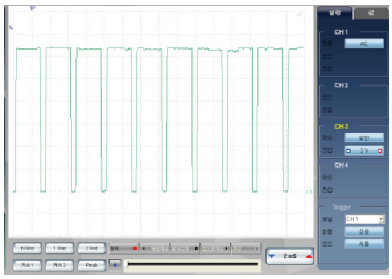
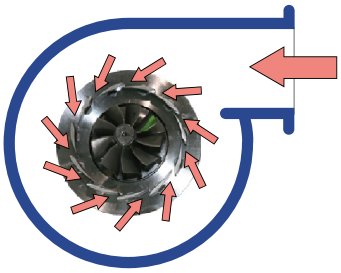
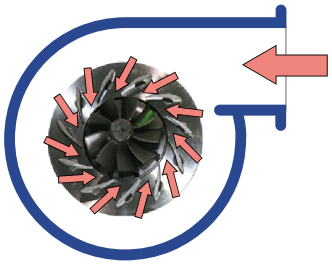


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

d. E-VGT system control

Turbocharger system operates the E-VGT actuator according to the signals for engine epm, accelerator pedal position, atmospheric pressure, T-MAP, coolant temperature and intake air temperature.
Turbocharger actuator is performed PWM control by ECU.
In general, the boost pressure feedbacks the turbocharger operation and the boost temperature is used for calculating the precise density.
E-VGT provides higher engine power with faster reaction speed compared to conventional VGT.

	Operating wave	Vane	Control
Low speed range			In low speed range: retract the vane to increase boost pressure. The vane has low (-) duty, and the unison ring moves to retract the vane in weak PWM signal.
High speed range			The unison ring moves to extend the vane in strong PWM signal. Maximum pressure is 3 bar and the system controls it according to the input signals.

Downloaded from www.Manualslib.com manuals search engine

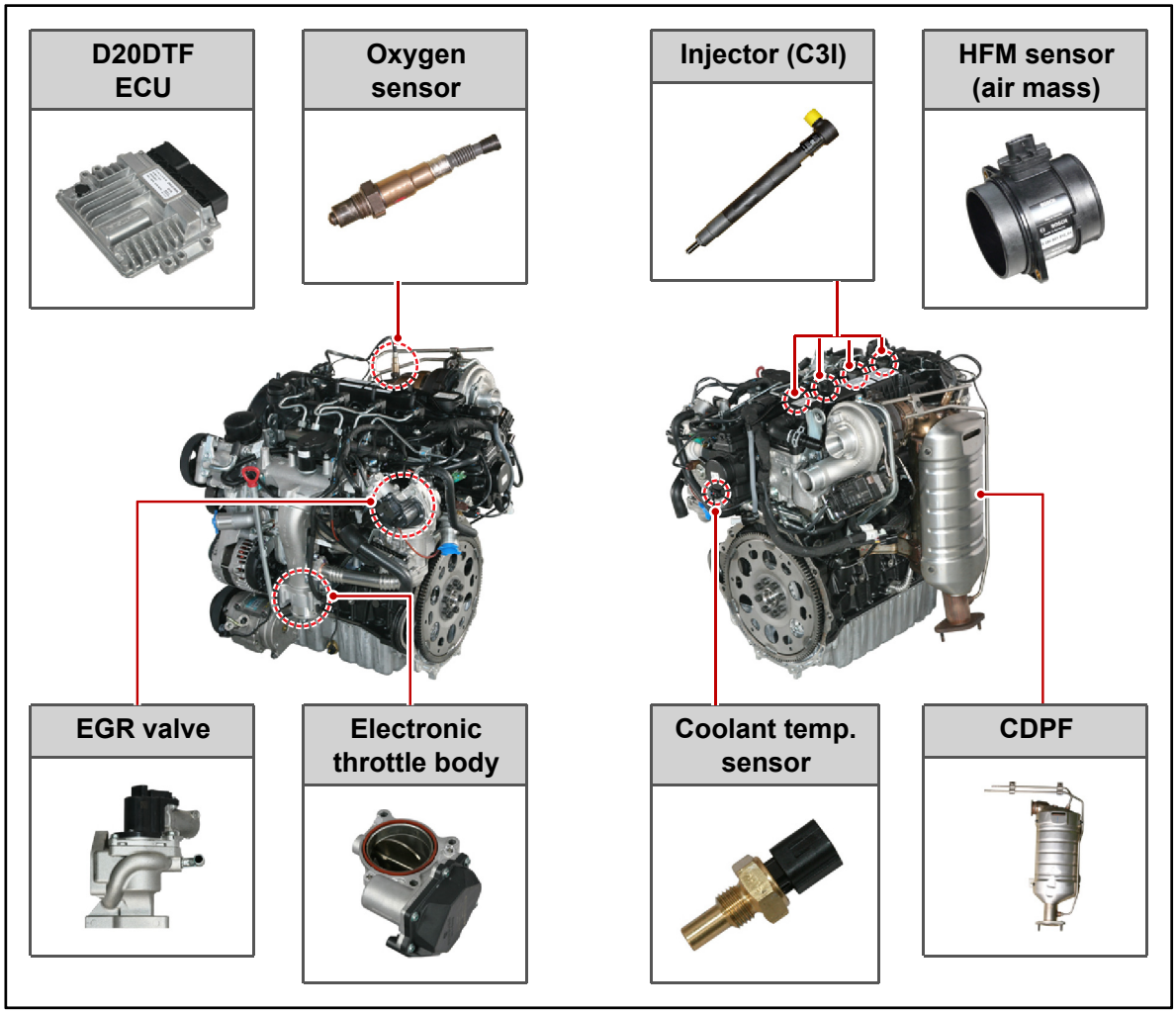
(7) Wide band oxygen sensor

a. Overview

For diesel engine, combustion is not performed at the optimum (theoretically correct) air-fuel ratio and the oxygen concentration is thin in most cases. So the wide-band oxygen sensor is used for this kind of engine, and this sensor is a little different from the one that used for gasoline engine. The combustion in diesel engine is controlled by fuel injection volume. Therefore, the wide band oxygen sensor should be used in diesel engine. This sensor measures the air-fuel ratio in very wide range, and is also called full range oxygen sensor.

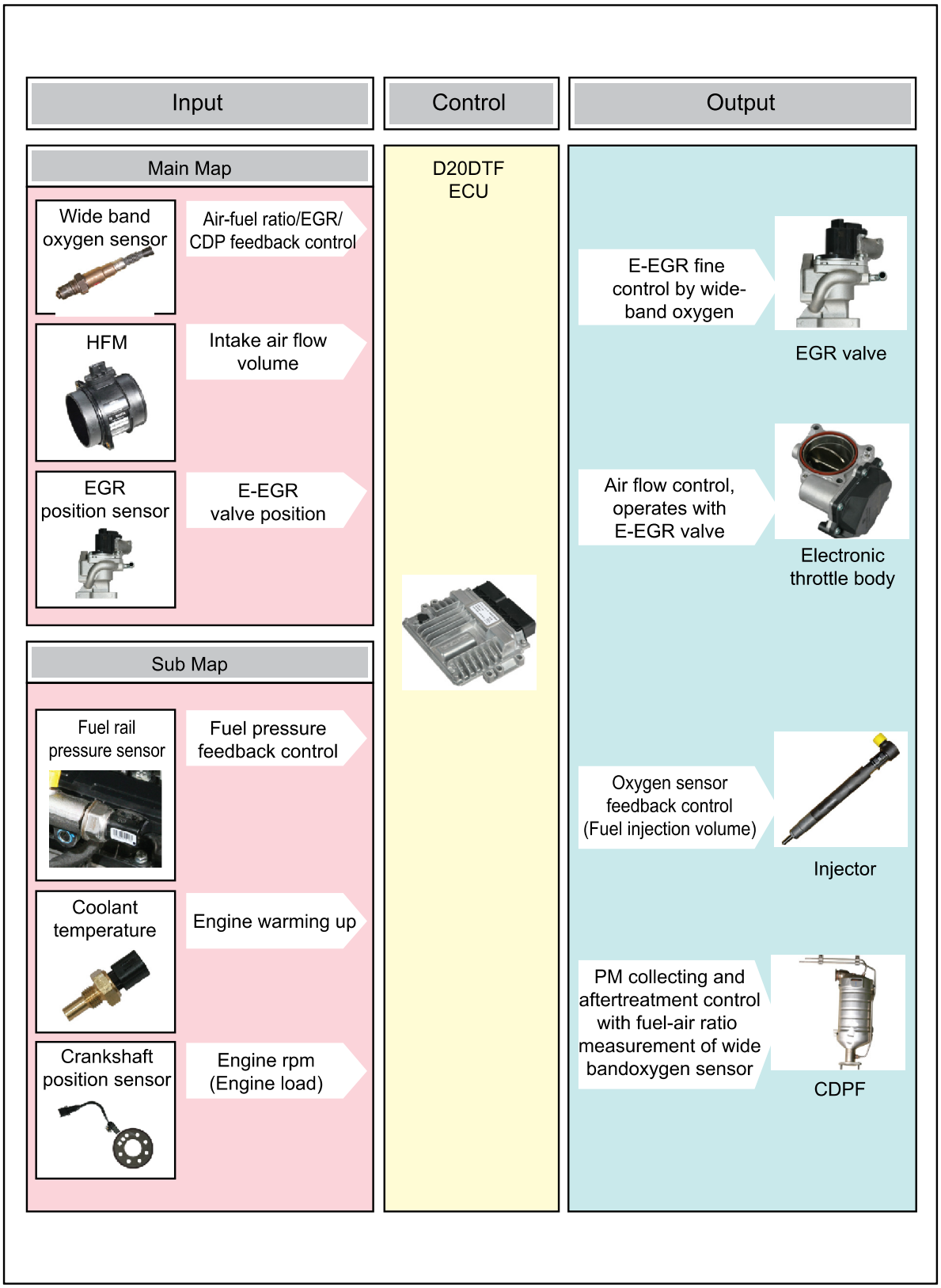
- The wide band oxygen sensor measures the oxygen density in exhaust gas and sends it to ECU to control the EGR more precisely.

b. Components



Downloaded from www.Manualslib.com manuals search engine

c. Input/Output for oxygen sensor

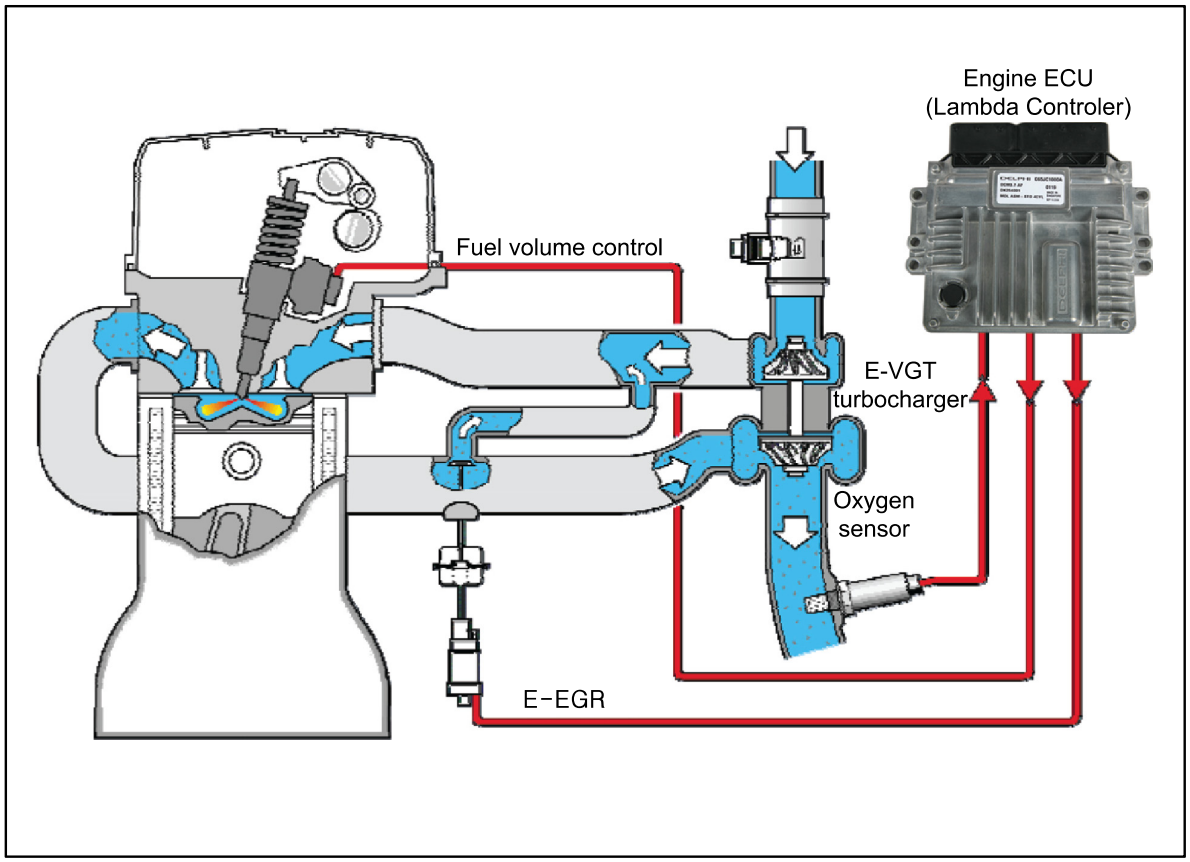


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

d. Oxygen sensor control

The wide band oxygen sensor uses ZnO2. It produces the voltage by movement of oxygen ions when there is oxygen concentration difference between exhaust gas and atmosphere.
If a certain voltage is applied to the sensor, the movement of oxygen ions occurs regardless of the oxygen density. The current generated through this flow of ions, is called pumping current (IP), and the oxygen sensor measures this value.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

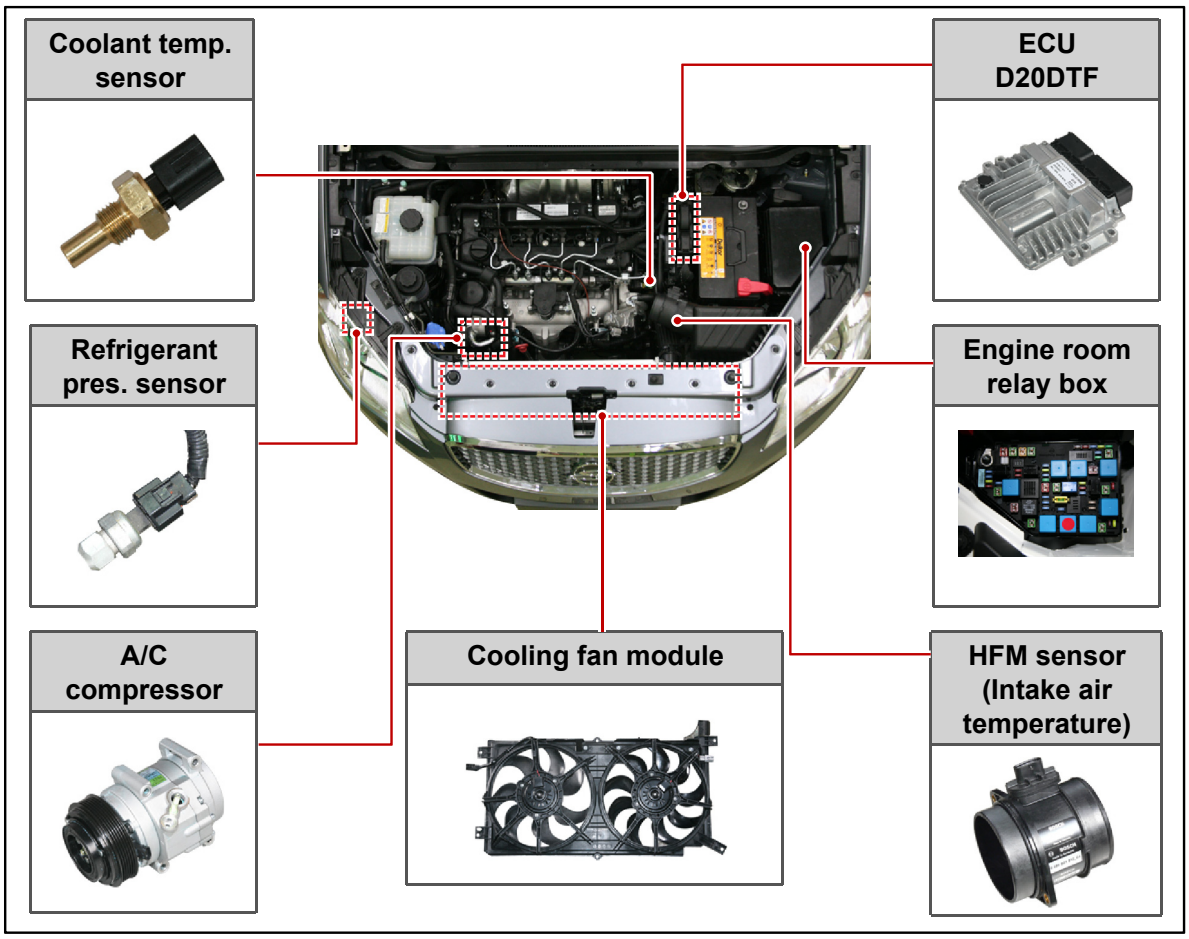
(8) Cooling fan control

a. Overview of cooling fan and A/C compressor

The cooling system maintains the engine temperature at an efficient level during all engine operating conditions. The water pump draws the coolant from the radiator. The coolant then circulates through water jackets in the engine block, the intake manifold, and the cylinder head. When the coolant reaches the operating temperature of the thermostat, the thermostat opens. The coolant then goes back to the radiator where it cools. The heat from automatic transaxle is also cooled down through the radiator by circulating the oil through the oil pump.
There are two cooling fans (200W+150W) in D20DTF engine. ECU controls the electric cooling fans with three cooling fan relays to improve the engine torque and air conditioning performance.

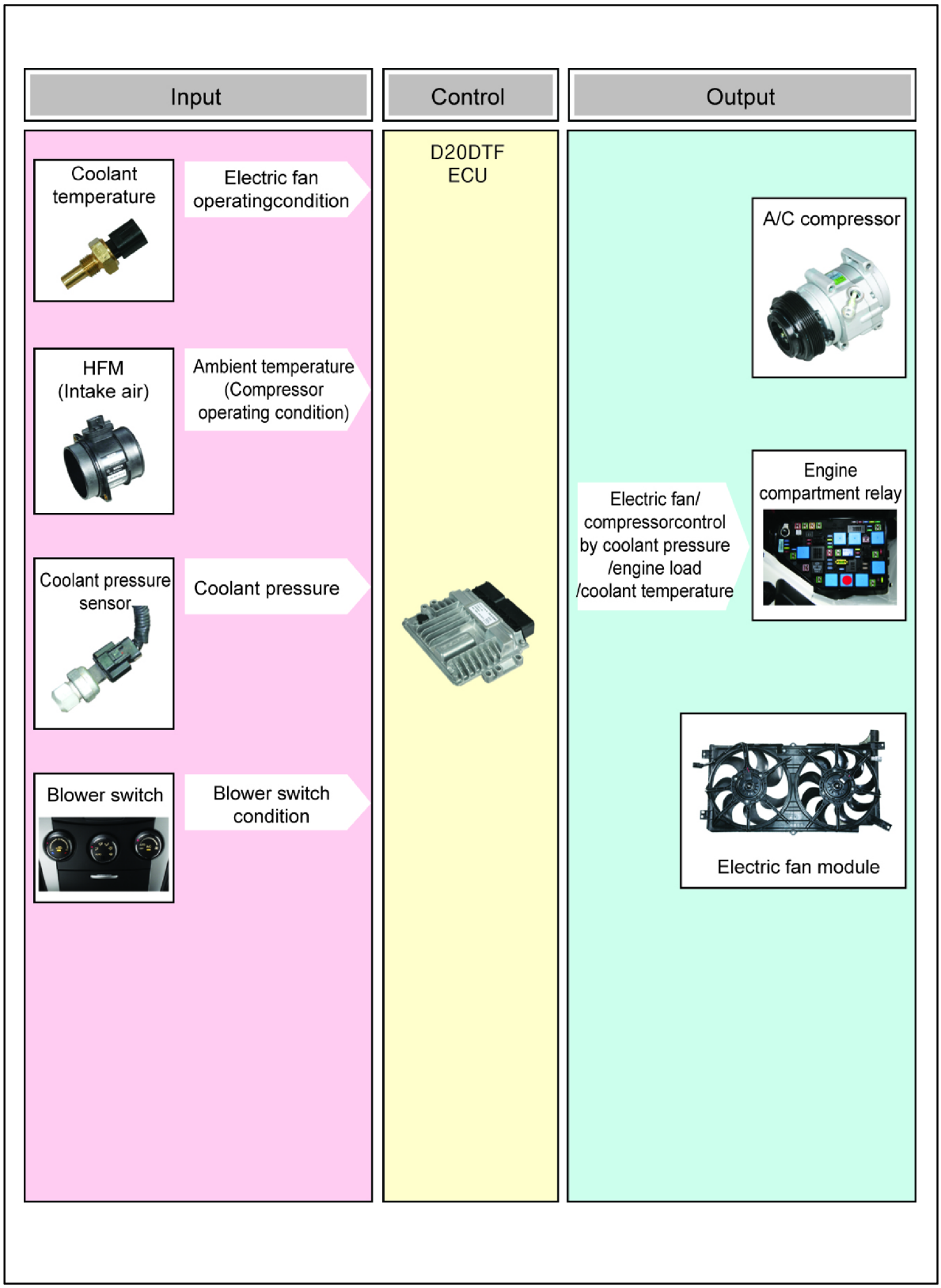
NOTE
For details about A/C compressor and refrigerant pressure sensor, refer to Chapter "Air Conditioning System" in "Body" section.

b. Components



Downloaded from www.Manualslib.com manuals search engine

c. Input/Output for cooling fan and A/C compressor



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

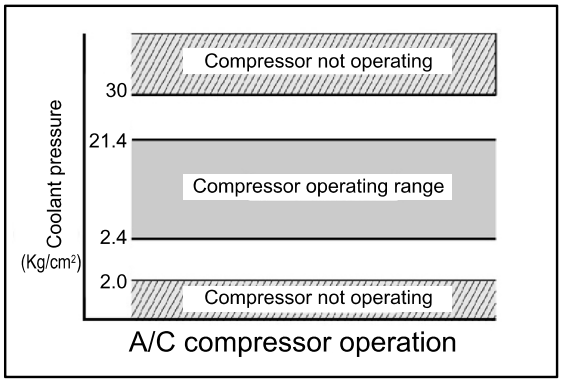
d. Cooling fan and A/C compressor control

▶ Conditions for cooling fan

The cooling fan module controls the cooling fan relay, high speed relay and low speed relay. The cooling fan is controlled by the series and parallel circuits.

A/C switch	Cooling fan	Coolant temperature	Refrigerant pressure	A/C compressor
OFF	OFF	Coolant temp. < 90℃	-	
	LO	90℃ ≤ Coolant temp. < 105℃	-	
	HI	105℃ ≤ Coolant temp.	-	
ON	LO	Coolant temp. < 105℃	Refrigerant pressure < 18 bar	ON
	HI		18 bar ≤ Refrigerant pressure	
	HI	105℃ ≤ Coolant temp. < 115℃	-	
	HI	115℃ ≤ Coolant temp.	-	OFF (cut)

▶ A/C compressor OFF conditions



A/C compressor operation

- Coolant temperature: below −20℃ or over 115℃
- Approx. 4 seconds after starting the engine
- Engine rpm: below 650 rpm or over 4500 rpm
- When abrupt acceleration
- Refrigerant pressure:
  * OFF below 2.0 kg/㎠, then ON over 2.4 kg/㎠
  * OFF over 30 kg/㎠, then ON below 21.4 kg/㎠

▶ Output voltage according to refrigerant pressure

The output voltage from refrigerant pressure sensor is 1.7 V to 3.5 V when the refrigerant pressure is 10 to 24 kgf/㎠ with A/C "ON".

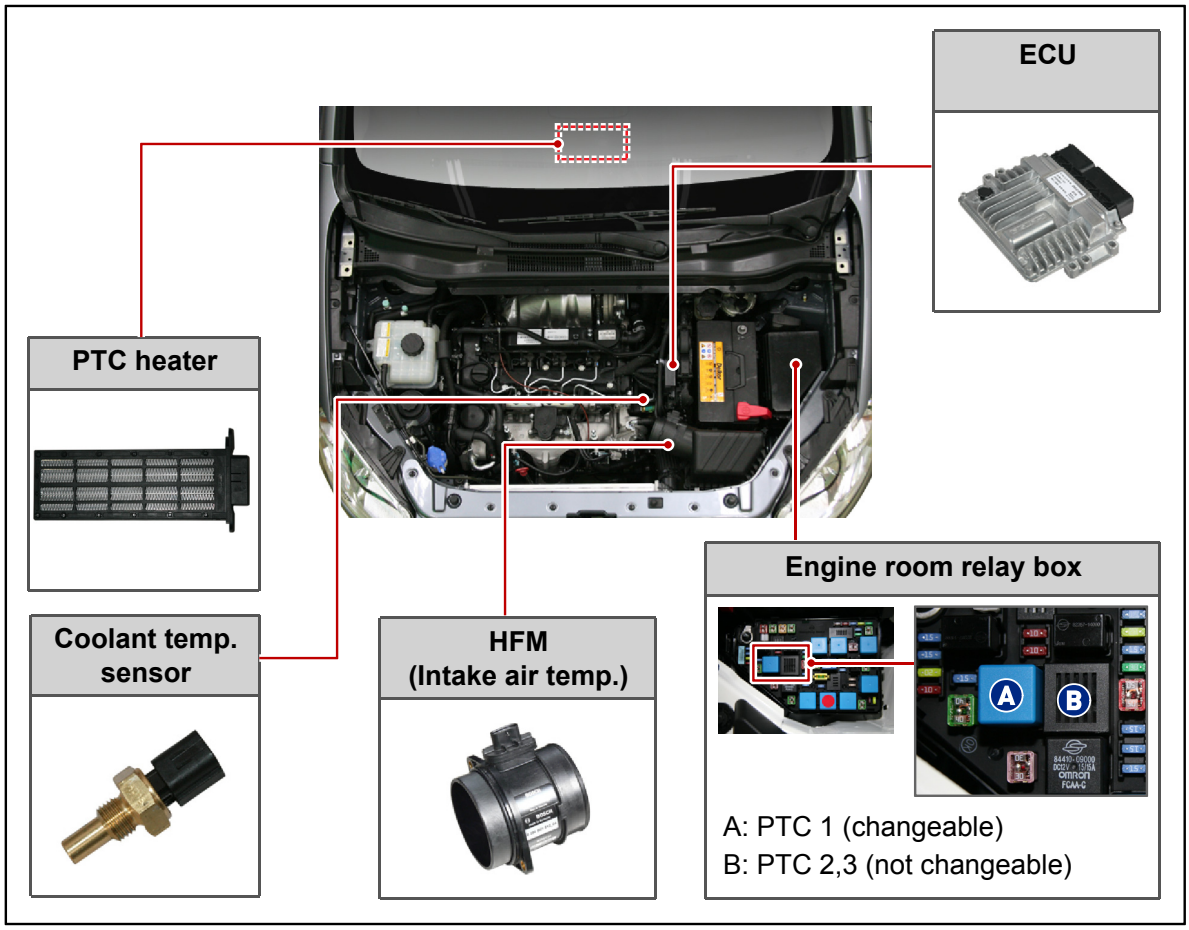
Downloaded from www.Manualslib.com manuals search engine

(9) PTC heater control

a. Overview

The supplementary electrical heater is installed in DI engine equipped vehicle as a basic equipment. The PTC system is operated according to two temperature values measured at the coolant temperature sensor and HFM sensor. This device is mounted in the heater air outlet and increase the temperature of air to the passenger compartment. Because PTC system is heated by electrical power, high capacity alternator is required. PTC does not operate during engine cranking, while the battery voltage is lower than 11 V or during preheating process of glow plugs.

b. Components



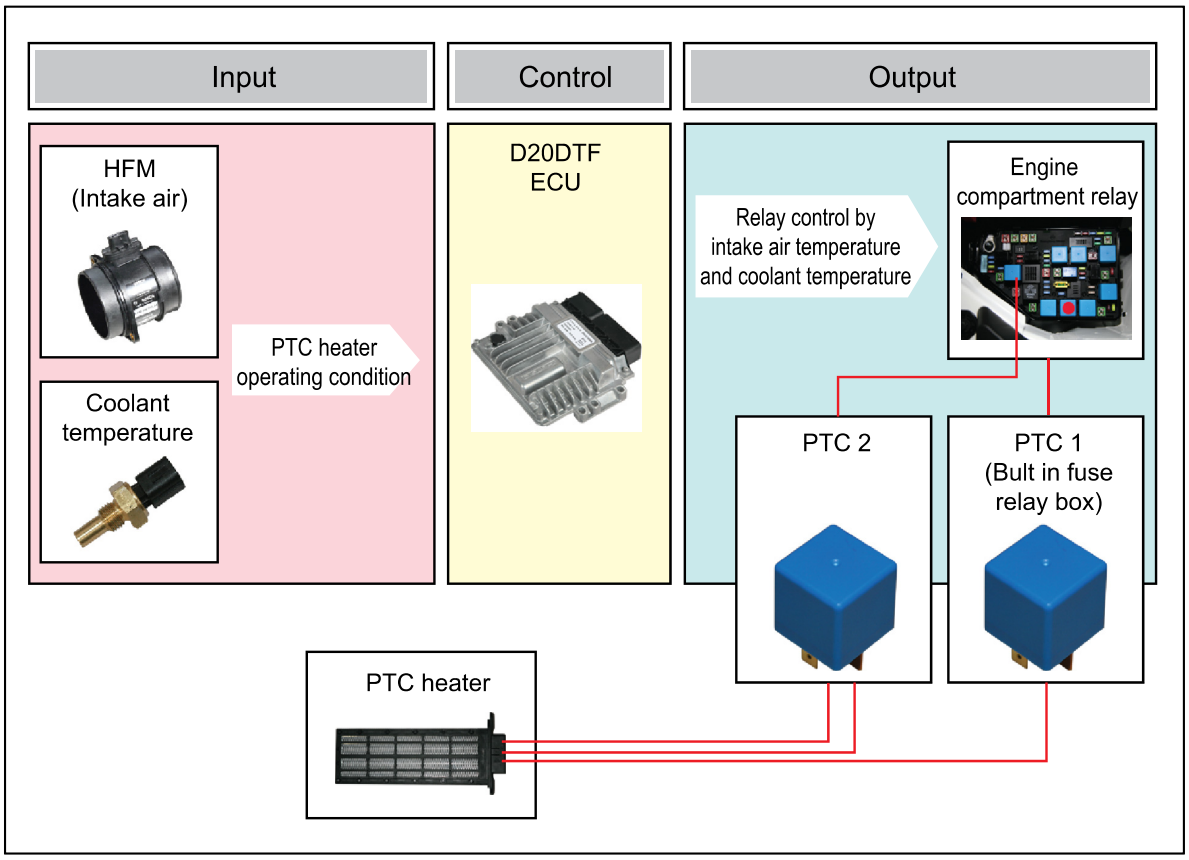
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

c. Operation process

The ceramic PTC has a feature that the resistance goes up very high at a certain temperature. There are three circuits in PTC heater. Only one circuit is connected when PTC1 relay is ON, and two circuits are connected when PTC2 relay is ON.

Operation process: reaches at a certain temperature→high resistance→low current→less heat radiation→temperature down→high resistance→high current→temperature up

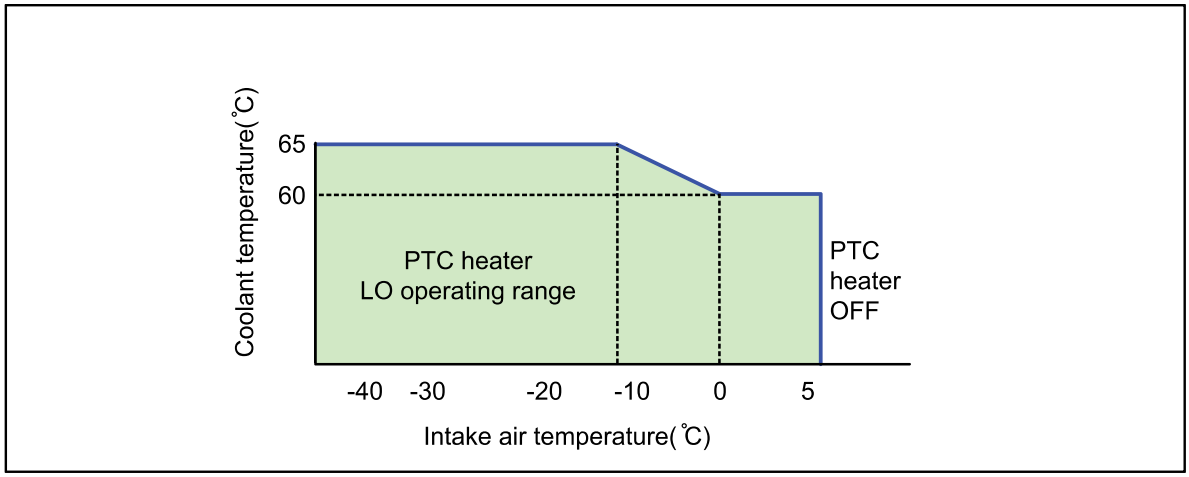


Downloaded from www.Manualslib.com manuals search engine

d. Control conditions

Operation	Operating condition	PTC Heater
HI (PTC2)	- Coolant temperature < 15℃	PTC HI ON
LO (PTC1)	- Coolant temperature 15℃ ≤ 65℃, intake air temperature ≤ -10℃ - Coolant temperature 15℃ < 65 to 60℃, intake air temperature <-10℃ to 0℃ - Coolant temperature 15℃ ≤ 60℃, intake air temperature ≤ 0℃ to 5℃	PTC LO ON
Stop	- A/C blower switch OFF - Defective ambient air temperature sensor (including open or short circuit) - Engine cranking - Low battery voltage (below 11V) - During pre-glow process (glow indicator ON)	

▶ **Operation diagram for PTC heater LO (step 2)**



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(10) Immobilizer control

a. Overview

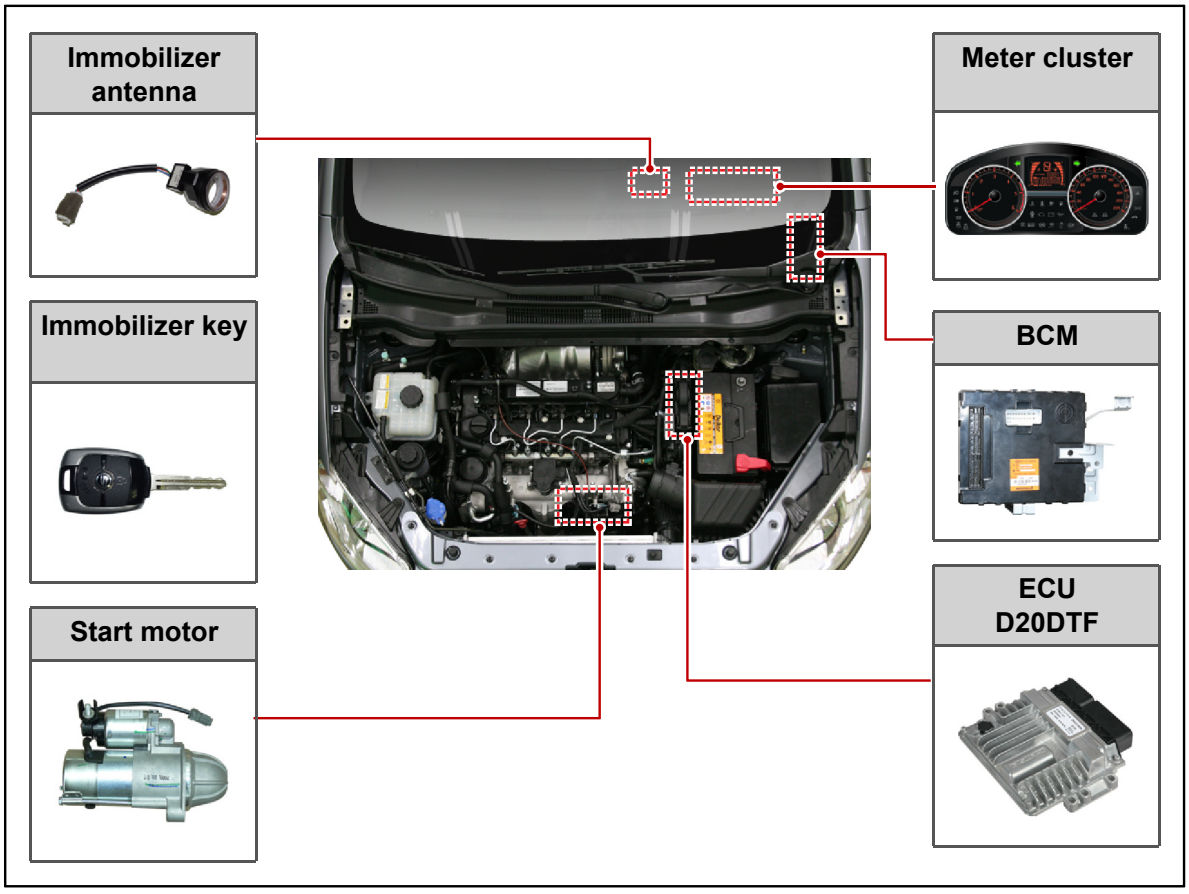
The Immobilizer System provides an additional theft deterrent to the vehicle in which it is installed and prevents it from being started by unauthorized persons. The transponder integrated in the key and the engine control unit have the same code. When the ignition key with the integrated transponder is turned to the ON position, the ECU (Engine Control Unit) checks the crypto code of the key and, if correct, allows the vehicle to start the engine.

NOTE

For details, refer to Chapter "BCM".

b. Components

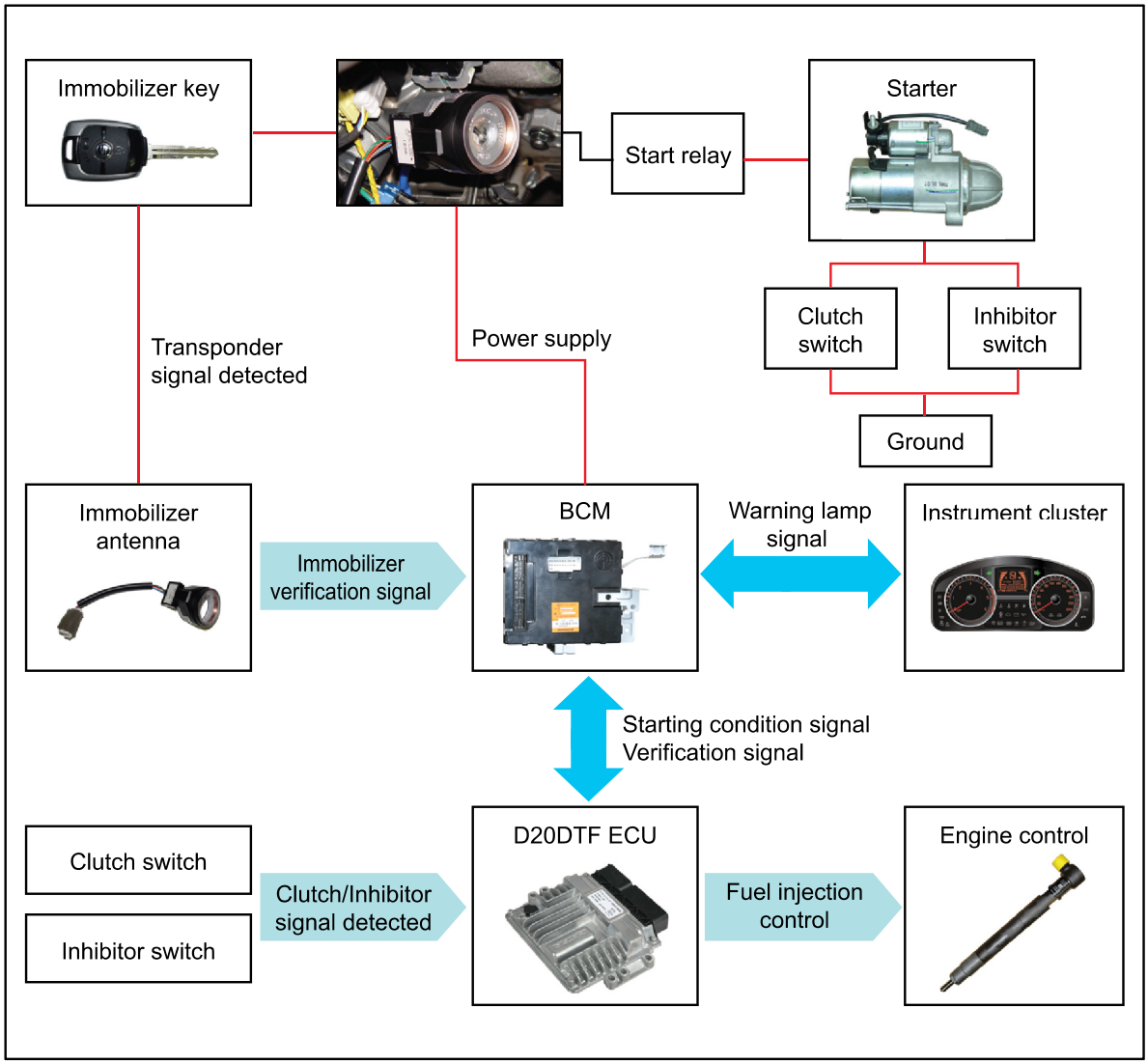
▶ **Basic components (ignition key system)**



Downloaded from www.Manualslib.com manuals search engine

▶ Key approval process

When turning the ignition switch to ON position, the power is supplied to BCM and ECU. ECU communicate with the immobilizer key to check if it is valid crypto code. If it is valid, ECU start to control the engine when turning the ignition switch to START position.
The system has 10 seconds of valid time-out period. If the engine does not start in this period, the key approval process should be done again.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(11) CDPF control

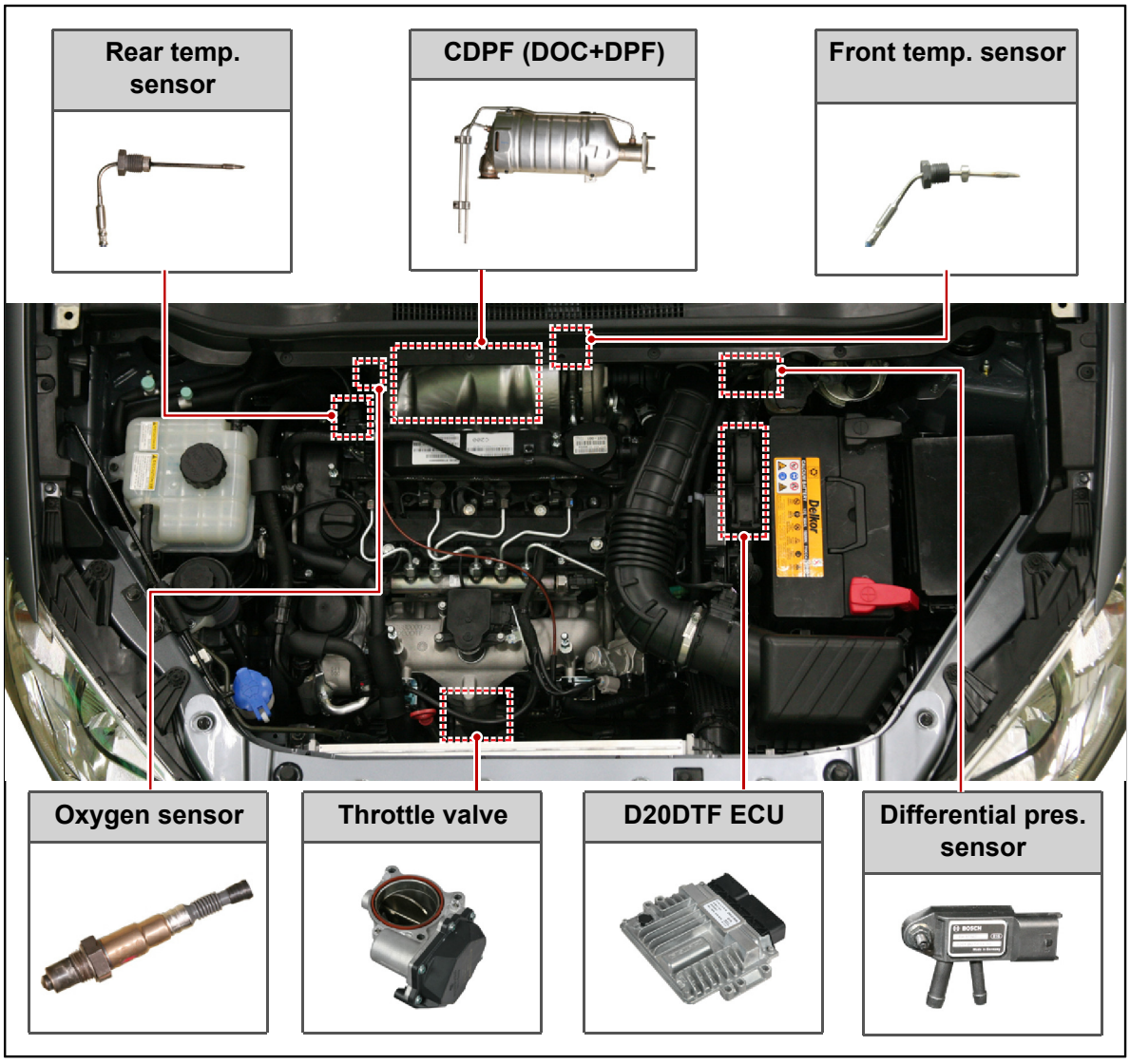
a. Overview

As the solution for environmental regulations and PM Particle Material) of diesel engine, the low emission vehicle is getting popular. This vehicle is equipped with an extra filter to collect the soot and burn it again so that the amount of PM in the exhaust gas passed through the DOC (Diesel Oxidation Catalyst) is reduced. The CDPF (Catalyst & Diesel Particulate Filter) is an integrated filter including DOC (Diesel Oxidation Catalyst) and DPF (Diesel Particulate Filter).

NOTE

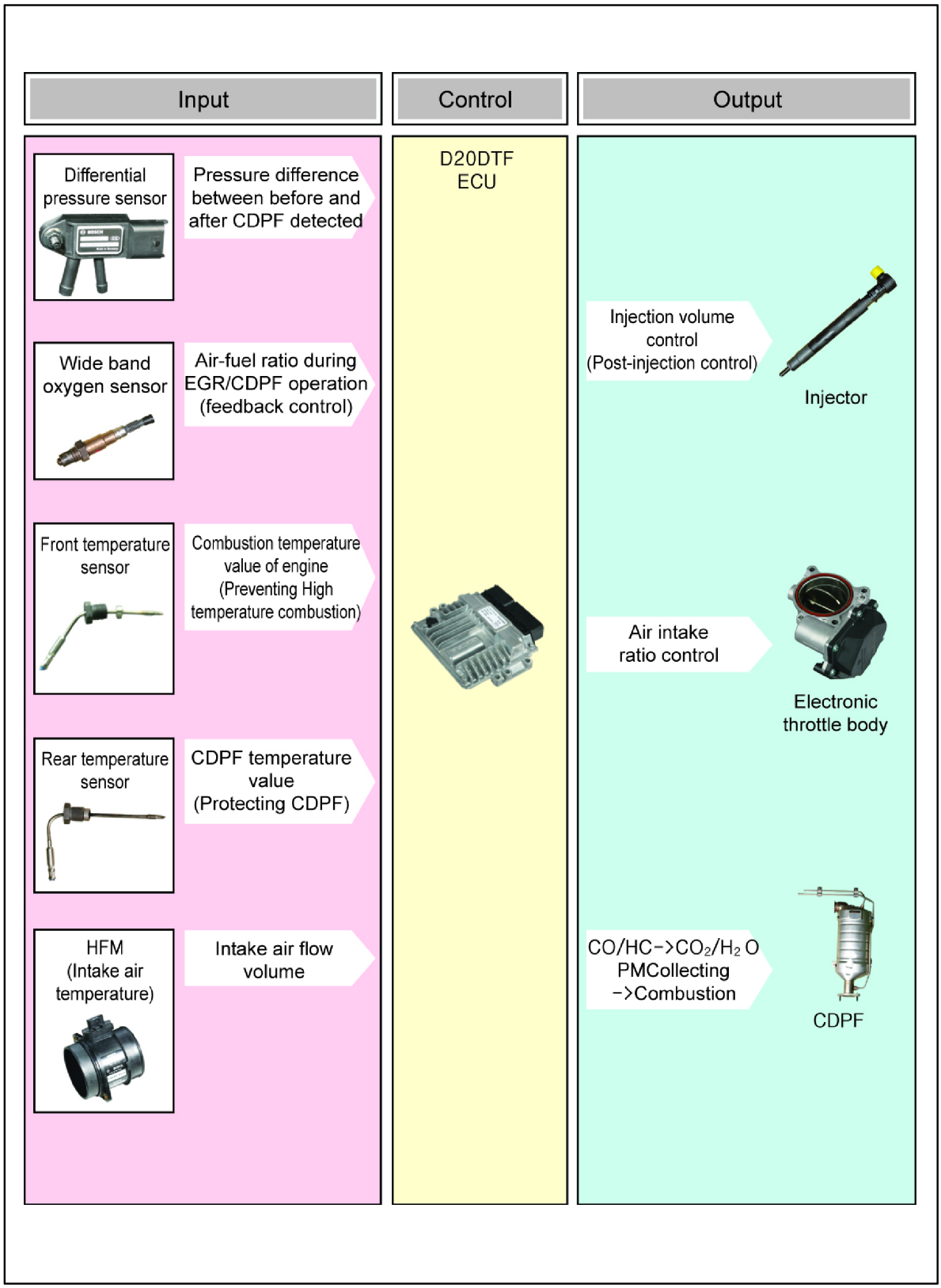
For details, refer to Chapter "CDPF".

b. Components



Downloaded from www.Manualslib.com manuals search engine

c. Input/Output for CDPF control

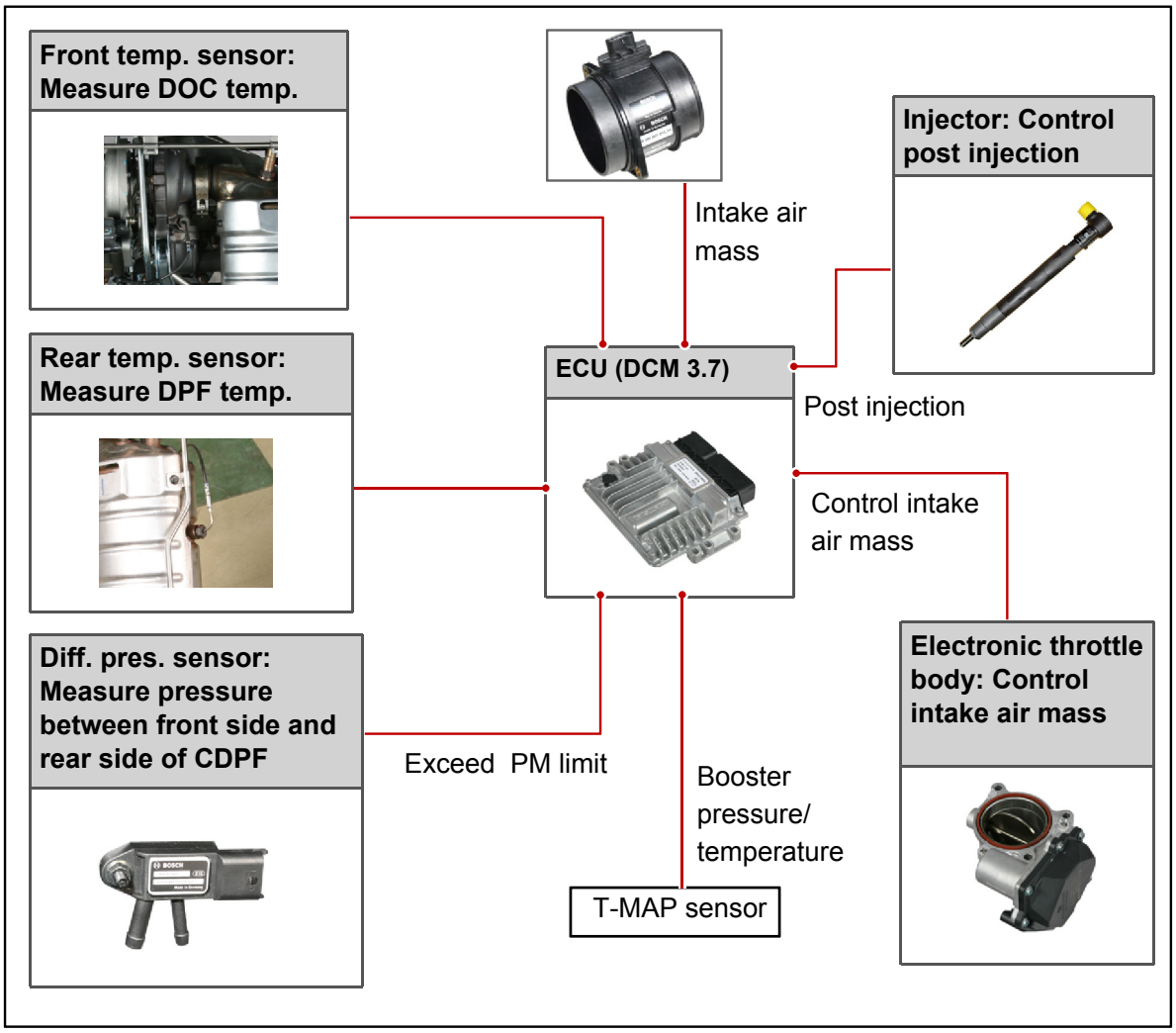


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

d. Operation process

When the differential pressure sensor detects the pressure difference between the front and the rear side of CDPF, the sensor sends signal indicating the soot is accumulated and the post injection is performed to raise the temperature of exhaust gas. The amount of fuel injected is determined according to the temperature of exhaust gas detected by the rear temperature sensor. If the temperature is below 600°C, the amount of fuel injected is increased to raise the temperature. If the temperature is over 600°C, the amount of fuel injected is decreased or not controlled. When the engine is running in low load range, the amount of post injection and the amount of intake air are controlled. It is to raise the temperature by increasing the amount of fuel while decreasing the amount of intake air.



Downloaded from www.Manualslib.com manuals search engine

e. Cautions

- Use only specified Engine Oil (approved by MB Sheet 229.51) for CDPF.

1. Use only specified engine oil (Low Ash Oil)

- The vehicle equipped with CDPF should use specific engine oil to improve the engine performance and fuel economy, and ensure the service life of CDPF.

2. Issue with normal engine oil

- Sulfur, one of the contents of engine oil is burned and generates soot that is not regenerated by the DPF. This remains on the filter as ashes and keeps accumulating. Eventually, this ashes will block the filter.

3. Benefit for specified engine oil

- Minimized the sulfur content of engine oil which reduces the service life.
- Improved fuel economy and emission level of CO2 with high performance and low viscosity.
- Increased service life of engine oil with high resistance to temperature.

4. Problems when using unspecified engine oil

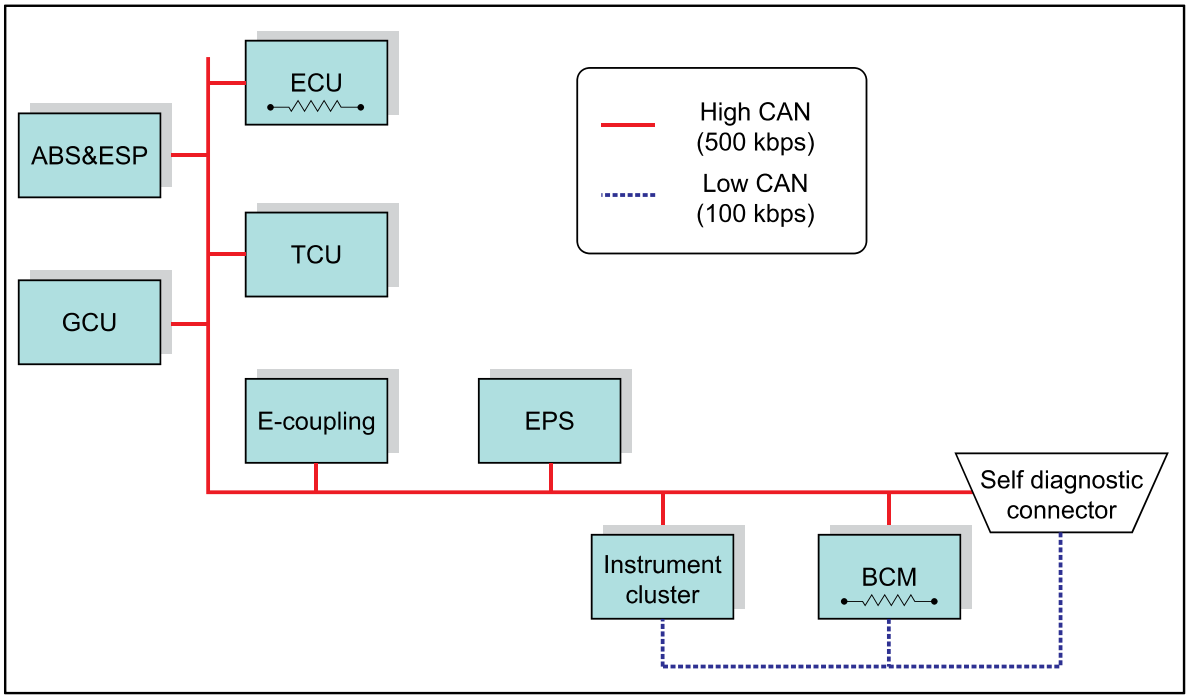
- The service life of filter may be reduced by 30% or more by the ashes accumulated on the filter.
- The fuel economy may be reduced because of engine rolling resistance, frequent regeneration of DPF.

  * These problems are also caused by oil with high sulfur content, such as tax exemption oil and heating oil, etc.

Downloaded from www.Manualslib.com manuals search engine

3) Input/Output for CAN communication

(1) Configuration of CAN (P-CAN/B-CAN)

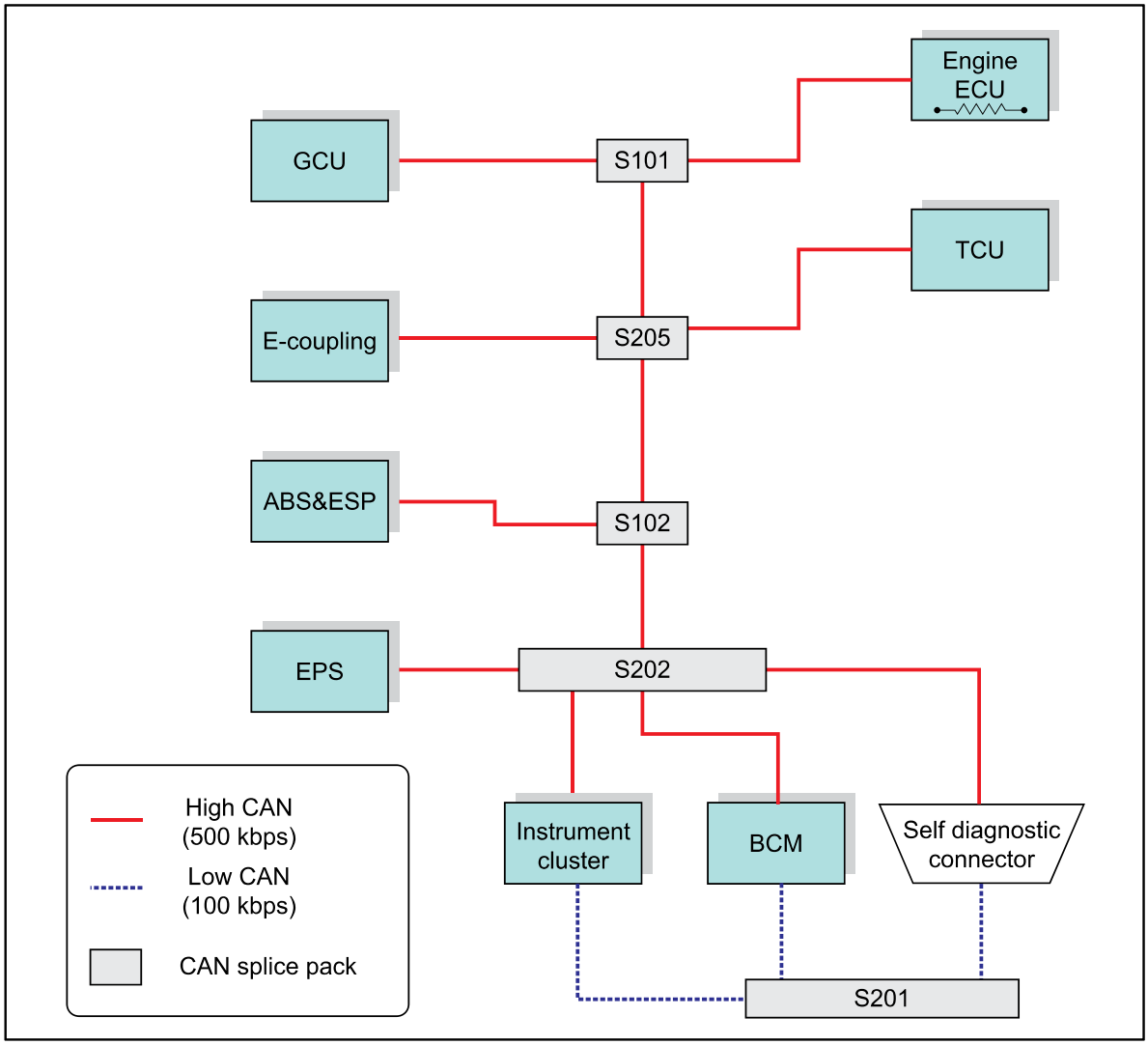


Abbreviation	Function
GCU	Glow Control Unit
EPS	Electronic Power Steering Unit
BCM	Body Control Module

CAN Topology communicate with system units. There are two types (P-CAN and B-CAN) of communication according to the communication speed. Instrument cluster, BCM and diagnostic connector use both types of communication. And, ECU, ABS & ESP, TCU, GCU, E-coupling and EPS unit use P-CAN communication because it is faster than B-CAN. The terminal resistances are installed in ECU and BCM.

Downloaded from www.Manualslib.com manuals search engine

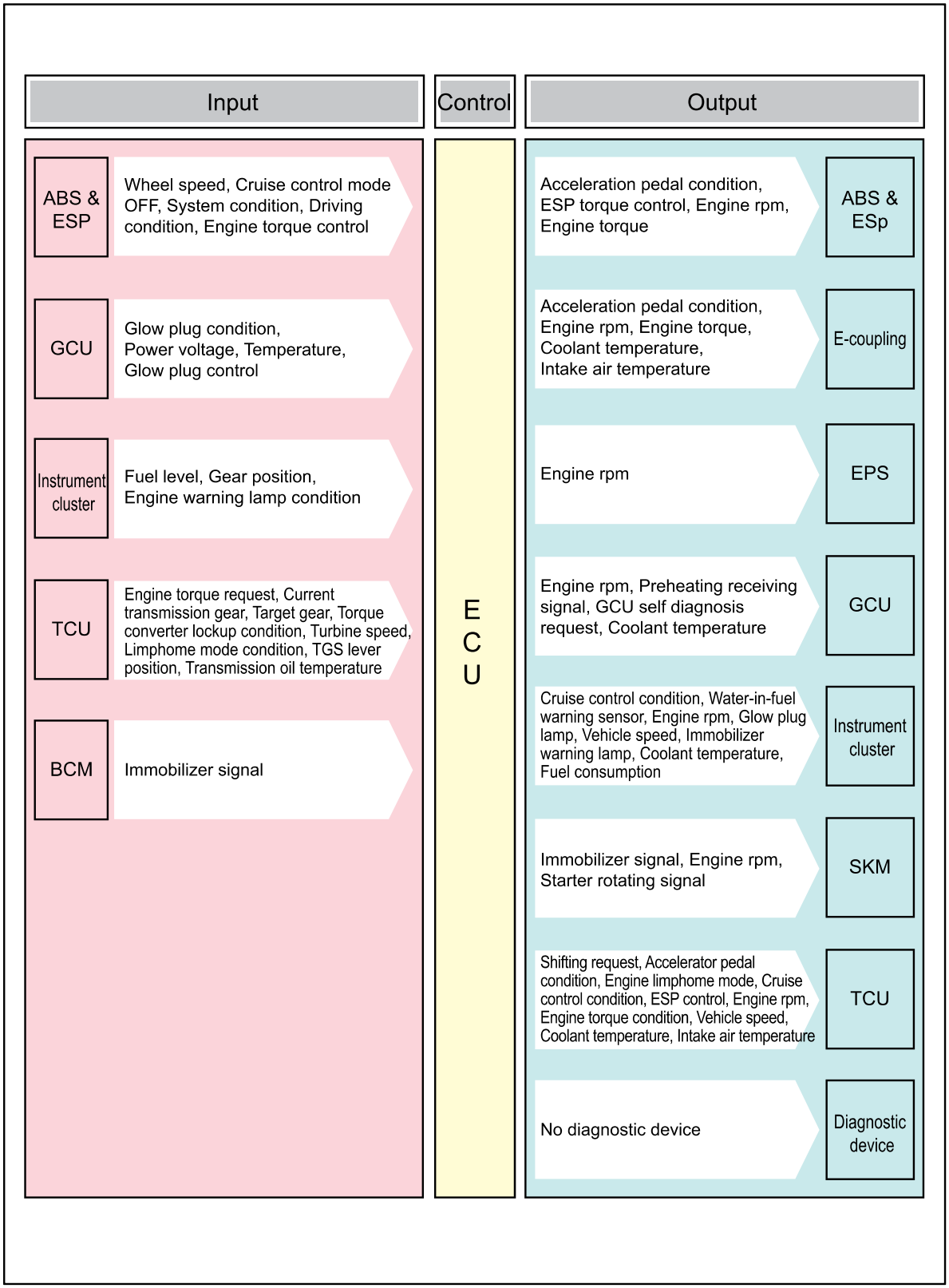
(2) CAN communication flow chart



Splice pack	Wiring harness	Location
S101	Floor wiring (LH)	Under fuse & relay box in engine compartment
S102	Floor wiring (RH)	Inside of right fender
S201	Main wiring	Behind meter cluster (cowl cross member)
S202	Main wiring	Behind meter cluster (cowl cross member)
S205	Floor wiring (LH)	Under driver's door scarf

Downloaded from www.Manualslib.com manuals search engine

(3) Input/Output for CAN communication



Downloaded from www.Manualslib.com manuals search engine

INDEX

GENERAL INFORMATION

ELECTRIC GENERAL INFORMATION

1. EXTERIOR LAMP SYSTEM LAYOUT.... 3
2. INTERIOR LAMP SYSTEM LAYOUT..... 6
3. SWITCH SYSTEM LAYOUT..... 8
4. SCHEMATIC DIAGRAM FOR WIRING AND ELECTRICAL DEVICES..... 10
5. CAN COMMUNICATION CONFIGURATION..... 14

Downloaded from www.Manualslib.com manuals search engine

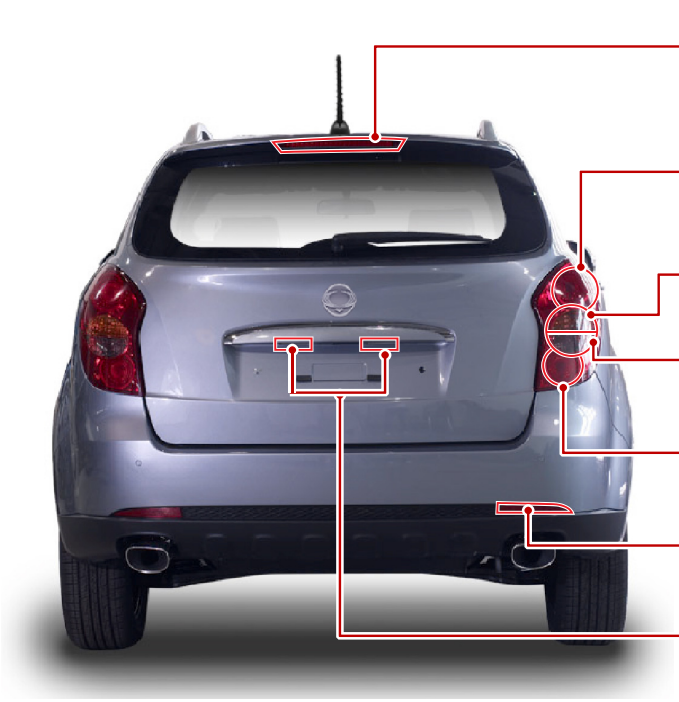
Downloaded from www.Manualslib.com manuals search engine

ELECTRIC GENERAL INFORMATION

1. EXTERIOR LAMP SYSTEM LAYOUT

Front view

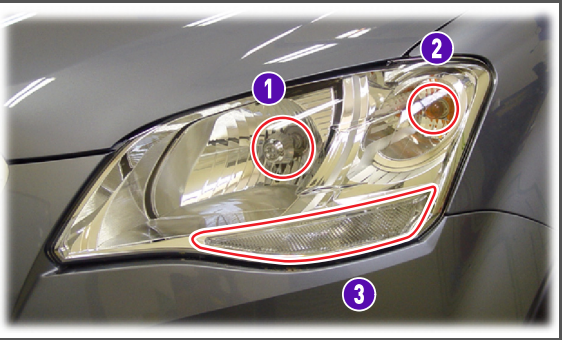
Rear view



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Headlamp



1. High-beam/low-beam
2. Turn signal lamp
3. Position lamp

Front fog lamp

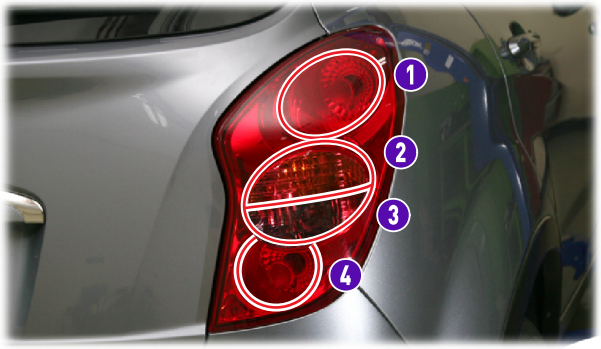
Puddle (approach) lamp

Side repeater lamp

Modification basis	
Application basis	
Affected VIN	

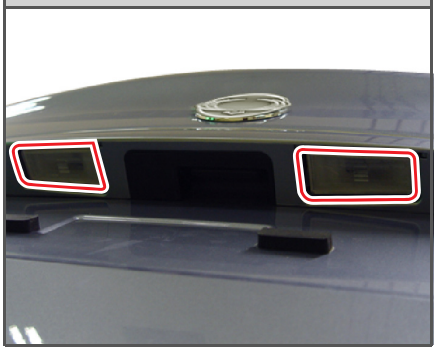
Downloaded from www.Manualslib.com manuals search engine

Rear combination lamp



1. Stop lamp and tail lamp
2. Turn signal lamp
3. Backup lamp
4. Stop lamp (For Korea)
   Rear fog lamp

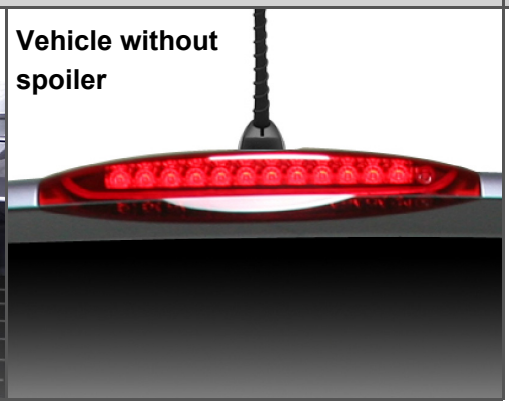
License plate lamp



High mounted stop lamp

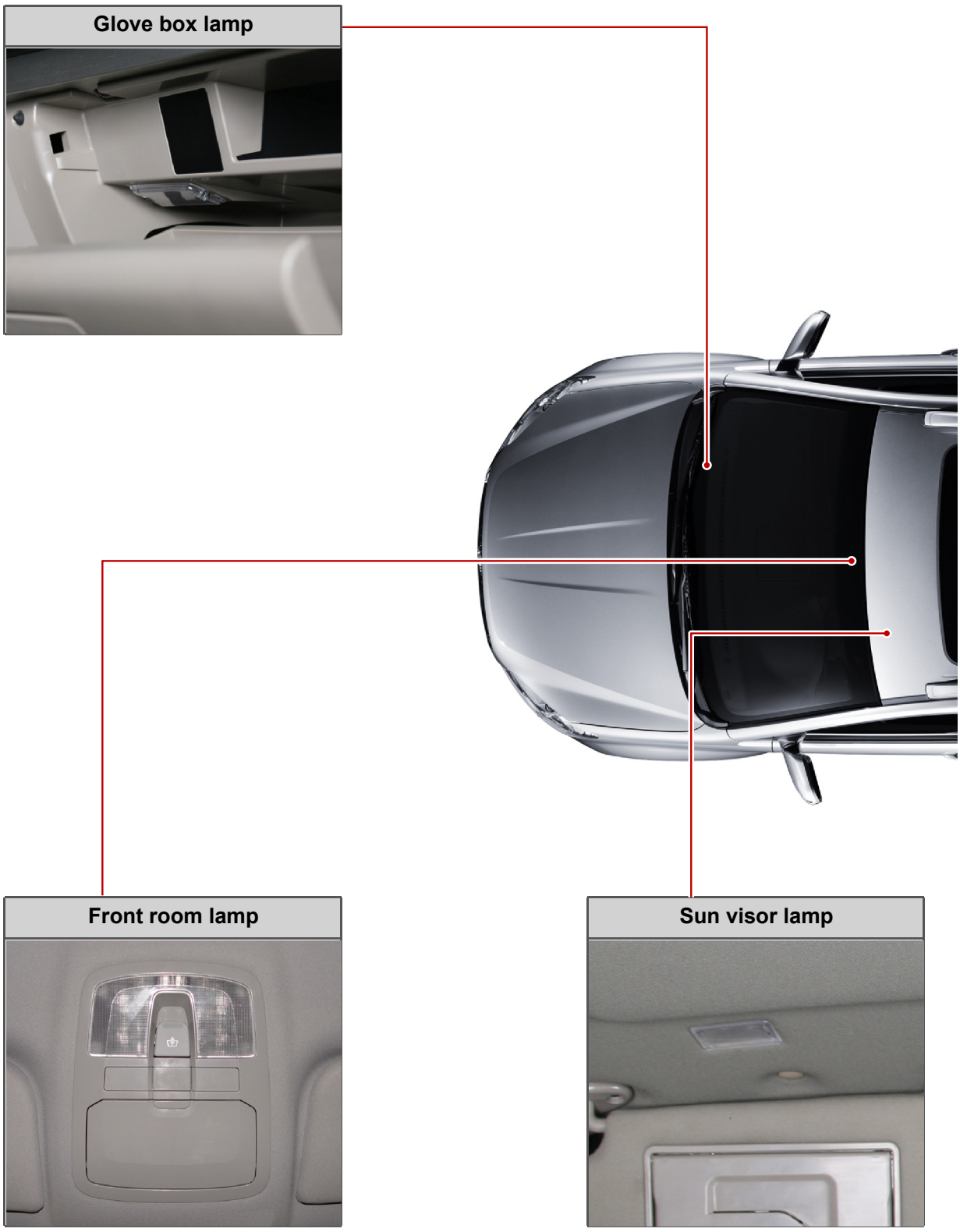
Vehicle with spoiler

Vehicle without spoiler



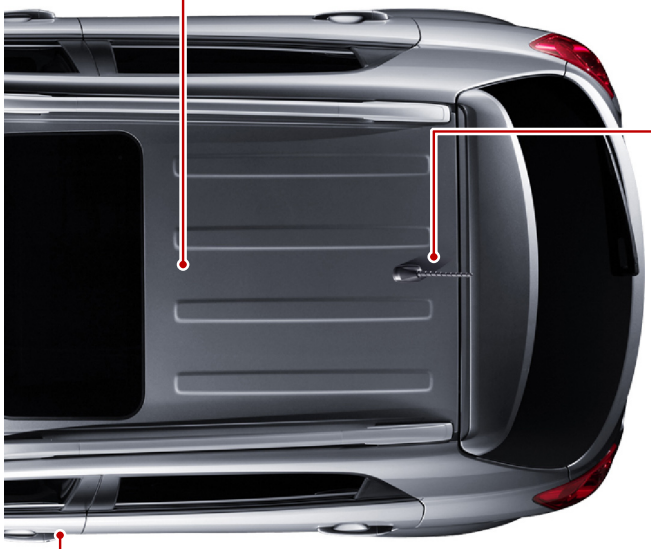
Downloaded from www.Manualslib.com manuals search engine

2. INTERIOR LAMP SYSTEM LAYOUT



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



Center room lamp

Luggage lamp

Door courtesy lamp

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. SWITCH SYSTEM LAYOUT

Steering wheel remote control switch	Overhead console switch	Passenger door switch

Cruise control switch

Multifunction switch

Lower main panel switch

FATC switch

Hazard warning switch and bezel assembly

Drive door main switch & Outside rear view mirror switch

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Front seat heated wire switch (STD)

Rear door switch (RH)

Center room lamp switch

Luggage lamp switch

Tailgate switch

Driver power seat switch

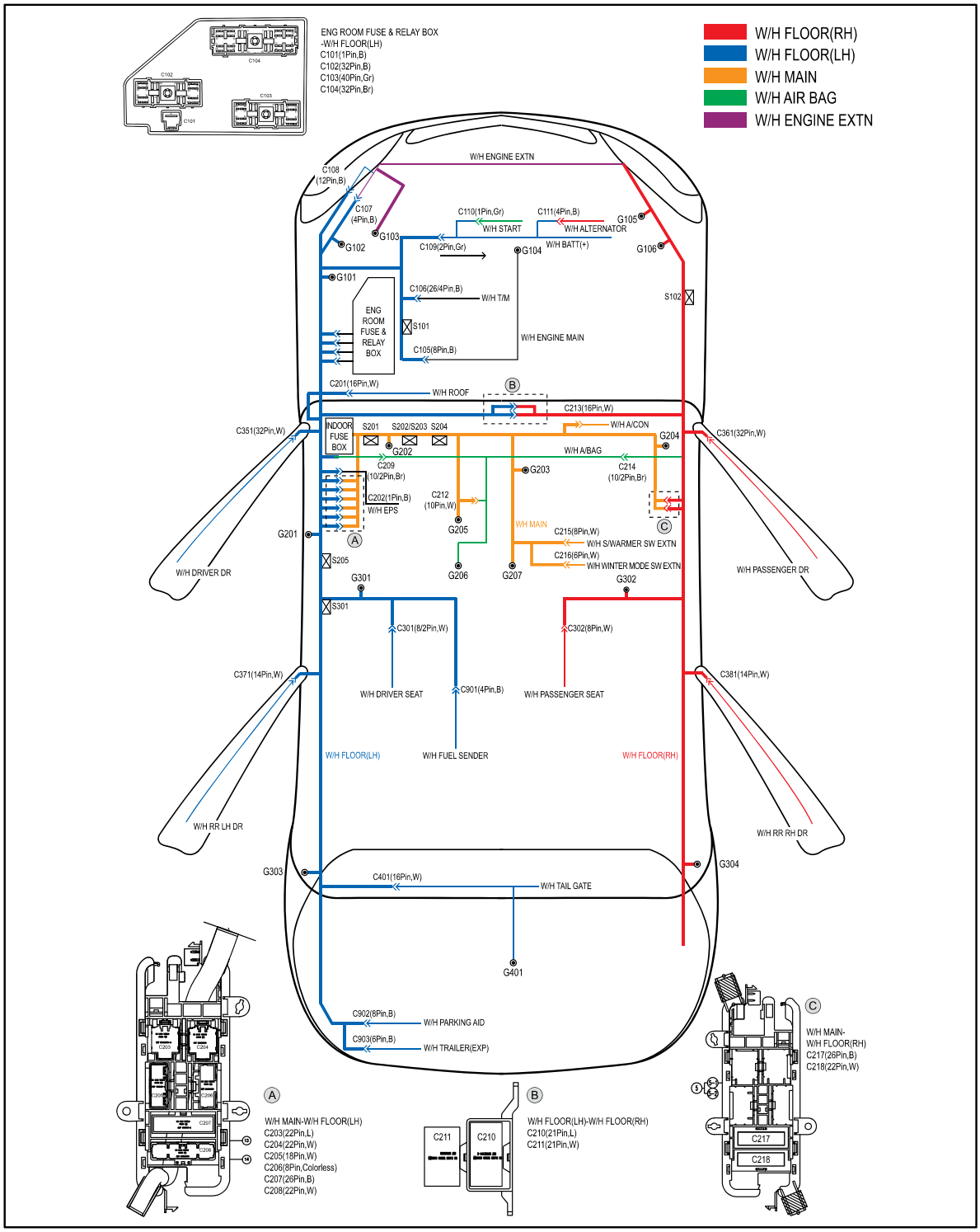
Rear door switch (LH)

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4. SCHEMATIC DIAGRAM FOR WIRING AND ELECTRICAL DEVICES

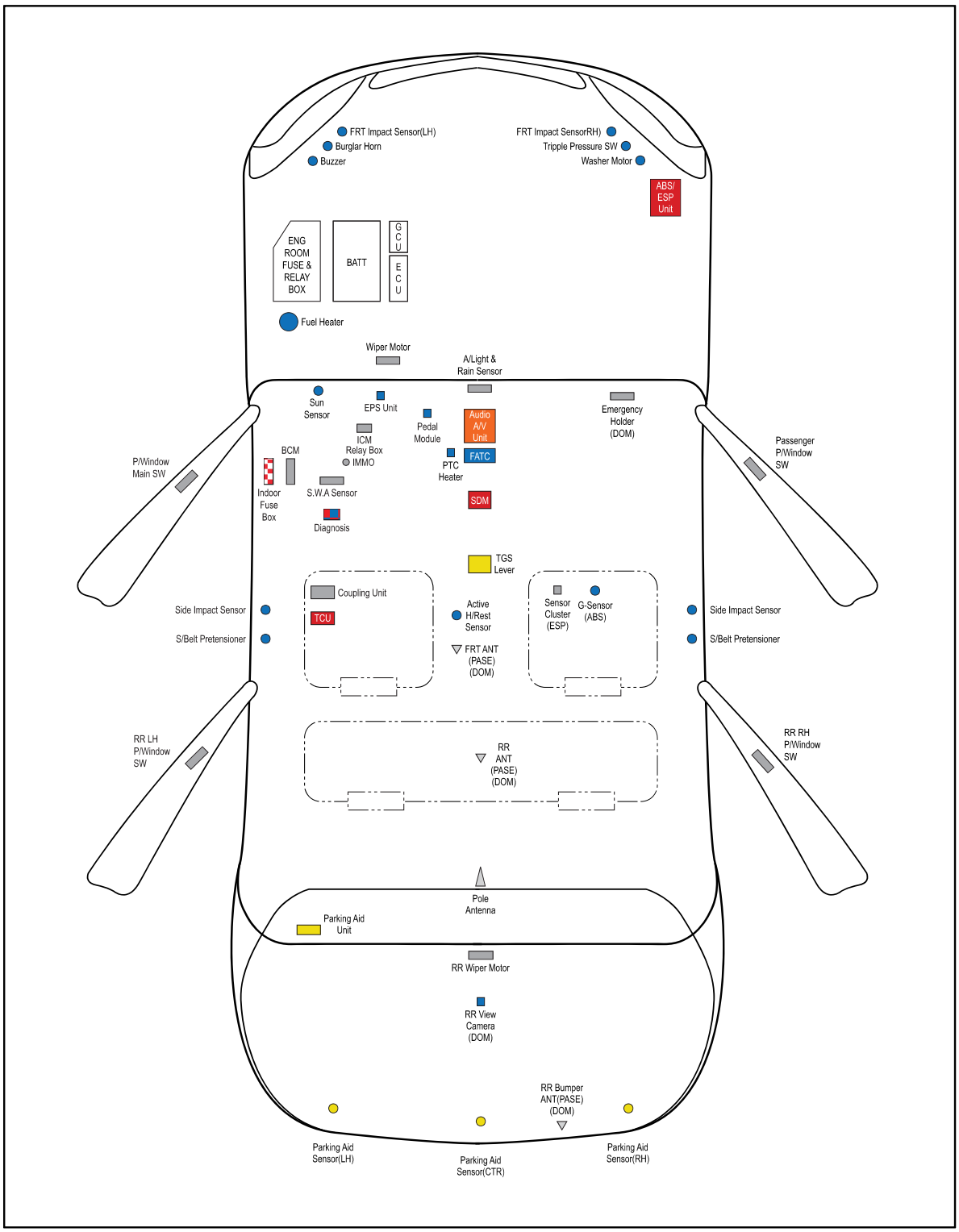
1) Wiring Harness Arrangement



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Electrical devices mounting locations



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Connector, Ground And Splice Pack

▶ Connector

Connector Number (Pin Number/Color)			Connecting Wiring Harness	Connector Position	Remark
C101	1	Black	W/H Floor(LH) - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C102	32	Black	W/H Floor(LH) - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C103	40	Gray	W/H Floor(LH) - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C104	32	Brown	W/H Floor(LH) - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105	8	Black	W/H Floor(LH) - W/H Eng	Upper BATT Tray(Beside Fuel Heater)	
C106	26	Black	W/H Floor(LH) - W/H T/M	Upper T/M(Under BATT Tray)	A/T
	4	Black	W/H Floor(LH) - W/H T/M	Upper T/M(Under BATT Tray)	M/T
C107	4	Black	W/H Floor(LH) - W/H Eng EXTN	Inside FRT Bumper(Behind LH Fog Lamp)	
C108	12	Black	W/H Floor(LH) - W/H Eng EXTN	Inside FRT Bumper(Behind LH Fog Lamp)	
C109	2	Gray	W/H Floor(LH) - W/H BATT(+)	Lower Air Cleaner Duct	
C110	1	Gray	W/H BATT(+) - Start Solenoid	Beside Starter Motor	
C111	4	Black	W/H BATT(+) - Alternator	Beside Alternator	
C201	16	White	W/H Floor(LH) - W/H Roof	Upper Driver Cowl Side Connector Holder	
C202	1	Black	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	EPS
C203	22	Blue	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C204	22	White	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C205	18	White	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C206	8	Colorless	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C207	26	Black	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C208	22	White	W/H Main - W/H Floor(LH)	Driver Cowl Side Connector Holder	
C209	10	Brown	W/H Air Bag - W/H Air Bag EXTN	Driver Cowl Side Connector Holder	Curtain/Side A/Bag
	2	Brown	W/H Air Bag - W/H Air Bag EXTN	Driver Cowl Side Connector Holder	
C210	21	Blue	W/H Floor(LH) - W/H Floor(RH)	Upper CTR Dash PNL	
C211	21	White	W/H Floor(LH) - W/H Floor(RH)	Upper CTR Dash PNL	
C212	10	White	W/H Main - W/H Air Bag	Inside I.P (Upper Driver LegRoom)	
C213	16	White	W/H Main - W/H Air Con	Inside I.P (Upper CTR Cowl Cross Member)	
C214	10	Brown	W/H Air Bag - W/H Air Bag EXTN	Passenger Cowl Side Connector Holder	Curtain/Side A/Bag
	2	Brown	W/H Air Bag - W/H Air Bag EXTN	Passenger Cowl Side Connector Holder	
C215	8	White	W/H Main - W/H Seat Warmer switch EXTN	Inside Console	A/T
C216	6	White	W/H Main - W/H Winter Mode switch EXTN	Inside Console	A/T
C217	26	Black	W/H Main - W/H Floor(RH)	Passenger Cowl Side Connector Holder	
C218	22	White	W/H Main - W/H Floor(RH)	Passenger Cowl Side Connector Holder	
C301	8	White	W/H Floor(LH) - W/H Driver Seat	Under Driver Seat	S/Warmer, Active
	2	White	W/H Floor(LH) - W/H Driver Seat	Under Driver Seat	
C302	8	White	W/H Floor(RH) - W/H Passenger Seat	Under Passenger Seat	
C351	32	White	W/H Floor(LH) - W/H Driver DR	Under LH A Pillar	
C361	32	White	W/H Floor(RH) - W/H Passenger DR	Under RH A Pillar	
C371	14	White	W/H Floor(LH) - W/H RR LH DR	Under LH B Pillar	
C381	14	White	W/H Floor(RH) - W/H RR RH DR	Under RH B Pillar	
C401	16	White	W/H Floor(LH) - W/H Tail Gate	Upper Tail Gate LH	
C901	4	Black	W/H Floor(LH) - W/H Fuel Sender	FRT Fuel Tank	
C902	8	Black	W/H Floor(LH) - W/H RR Bumper	Under RR LH Bumper	PAS
C903	6	Black	W/H Floor(LH) - W/H Trailer	Under RR LH Bumper	

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Ground

Connector Number	Connecting Wiring Harness	Connector Position	Remark
G101	W/H Floor(LH)	Behind LH Head Lamp	
G102	W/H Floor(LH)	Under BATT Tray	ECU
G103	W/H Eng EXTN	Under BATT Tray	
G104	W/H Eng Main	FRT Intake Valve	
G105	W/H Floor(RH)	Behind RH Head Lamp	
G106	W/H Floor(RH)	Beside ABS/ESP Unit	ABS/ESP
G201	W/H Floor(LH)	Under Driver Cowl Side Connector Holder	
G202	W/H Main	Backside Cluster(LH Cowl Cross Member)	AUDIO
G203	W/H Main	Backside Audio(CTR Cowl Cross Member)	
G204	W/H Main	Inside I.P(RH Glove Box)	
G205	W/H Main	Left Side I.P(Beside CTR Support BRKT)	PTC
G206	W/H Main	Left Under TGS Lever	AIR BAG
G207	W/H Main	Right Under TGS Lever	EPS
G301	W/H Floor(LH)	Under Driver Seat	
G302	W/H Floor(RH)	Under Passenger Seat	
G303	W/H Floor(LH)	Driver QTR PNL	
G304	W/H Floor(RH)	Passenger QTR PNL	
G401	W/H Tail Gate	CTR Under Tail Gate	

▶ Splice pack

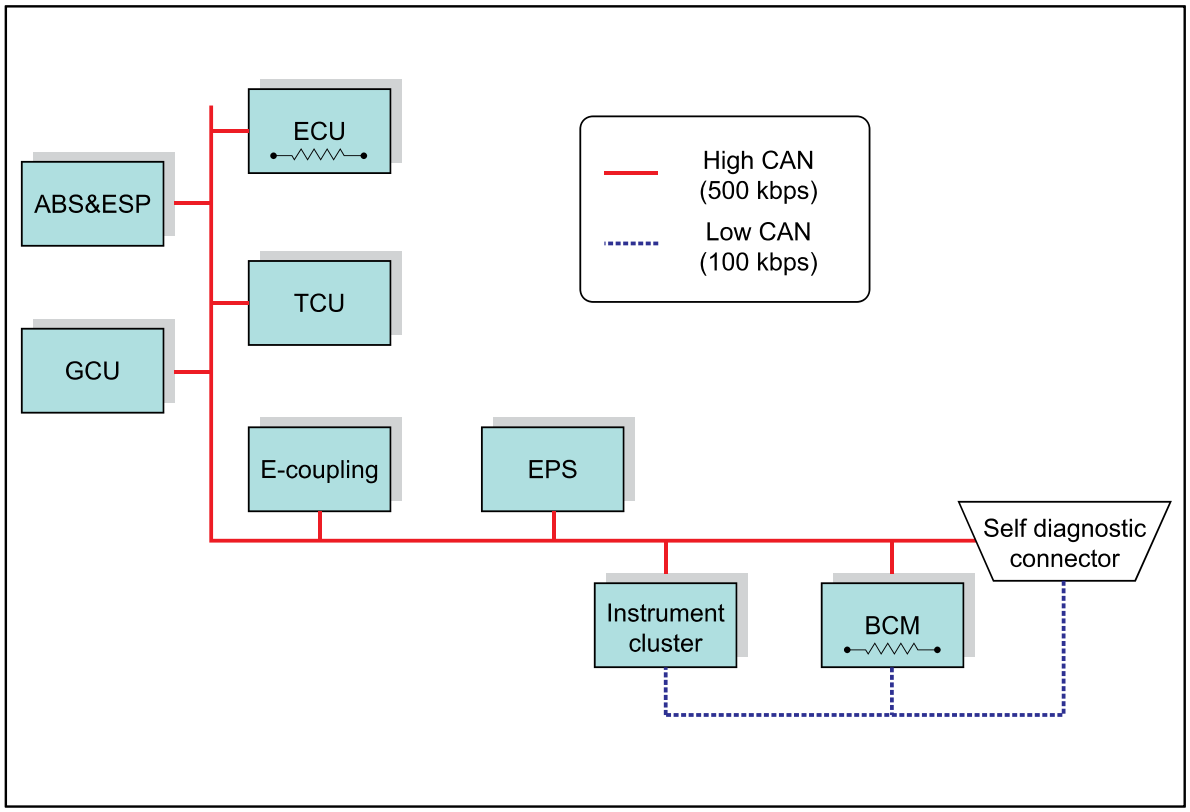
Connector Number (Pin Number/Color)		Connecting Wiring Harness	Connector Position	Remark
S101	**6**	W/H Floor(LH)	Under Eng Room Fuse & Relay Box	HS-CAN
S102	**6**	W/H Floor(RH)	Inside RH Fender	HS-CAN
S201	**8**	W/H Main	Backside Cluster(LH Cowl Cross Member)	LS-CAN
S202	**20**	W/H Main	Backside Cluster(LH Cowl Cross Member)	HS-CAN
S203	**20**	W/H Main	Backside Cluster(LH Cowl Cross Member)	ILL +
S204	**20**	W/H Main	Backside Cluster(Upper ICM Relay Box)	GND
S205	**14**	W/H Floor(LH)	Lower Driver DR Scuff(CTR)	HS-CAN
S301	**14**	W/H Floor(LH)	Under Driver Seat	

Downloaded from www.Manualslib.com manuals search engine

5. CAN COMMUNICATION CONFIGURATION

There are two types (P-CAN and B-CAN) of communication according to the communication speed. The instrument cluster and BCM (Body Control Module) communicate through both P-CAN and B-CAN at the same time.

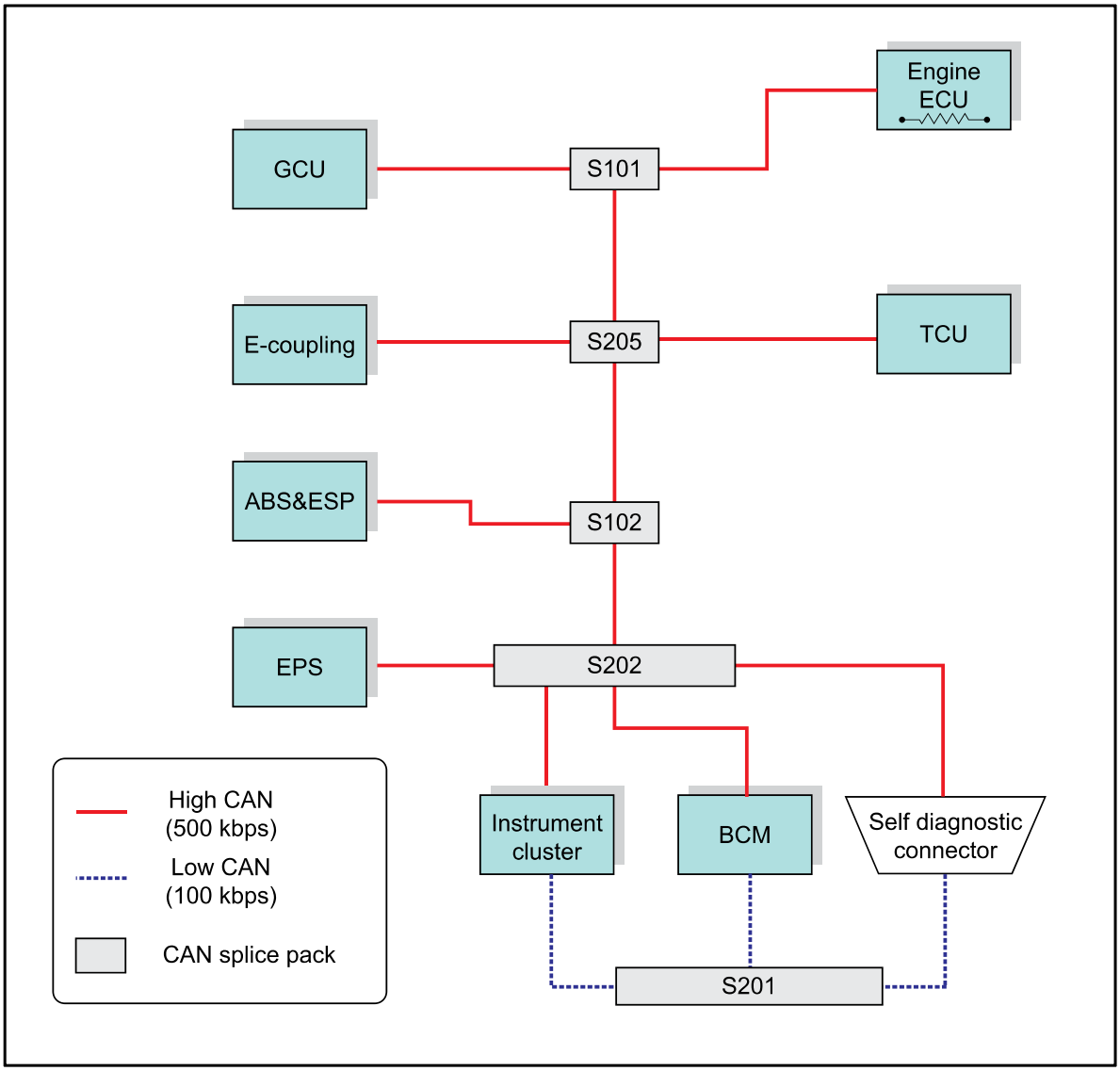
1) CAN Configurations (P-CAN/B-CAN)



Abbreviations	Meaning	Function
GCU	Glow Control Unit	Glow control unit
EPS	Electronic Power Steering Unit	Electrically driven power steering unit
BCM	Body Control Module	Body control module

Downloaded from www.Manualslib.com manuals search engine

2) CAN Communication Wiring Diagram



Splice pack	Wiring	Location
S101	Floor wiring (LH)	Under fuse and relay box in engine compartment
S102	Floor wiring (RH)	Inside of right fender
S201	Main wiring	Behind the instrument cluster (cowl cross member)
S202	Main wiring	Behind the instrument cluster (cowl cross member)
S205	Floor wiring (LH)	Under driver door scuff

Downloaded from www.Manualslib.com manuals search engine

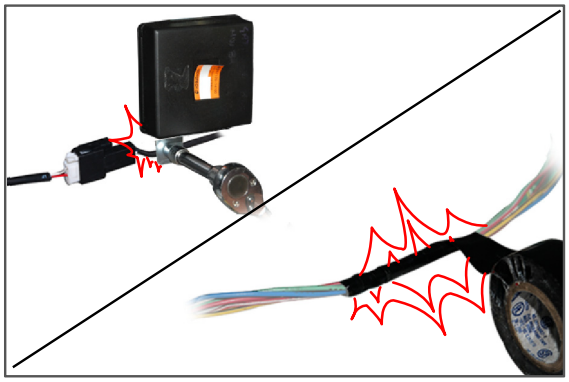
Memo

Downloaded from www.Manualslib.com manuals search engine

Fuse and relay 8410-06

GENERAL INFORMATION

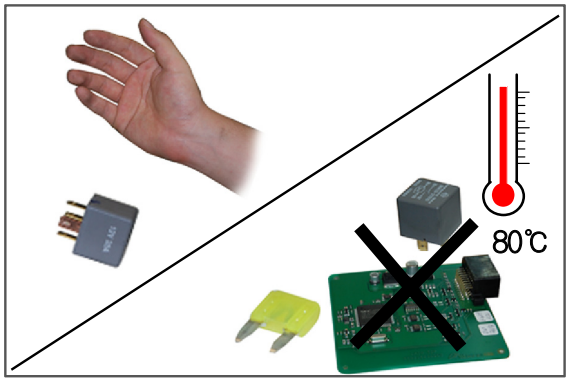
1. CAUTIONS WHEN WORKING ON ELECTRICAL UNITS



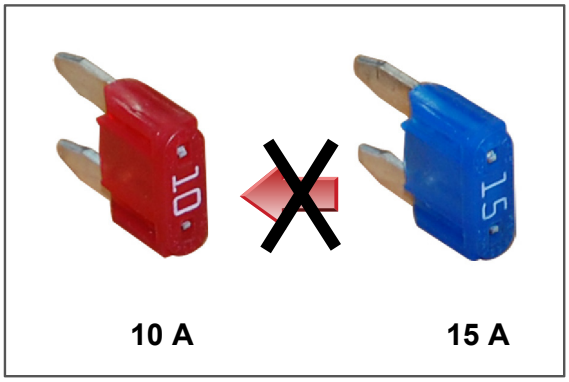
- Remove the negative battery cable from the battery in advance when working on electrical units.

CAUTION

Make sure to turn "OFF" the ignition switch and other lamp switches before disconnecting or connecting the negative battery cable. (Otherwise, semiconductor parts can be damaged.)

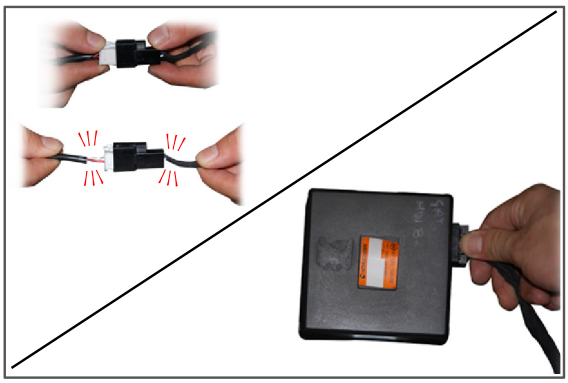


- Do not drop or apply excessive impact to sensors and relays.

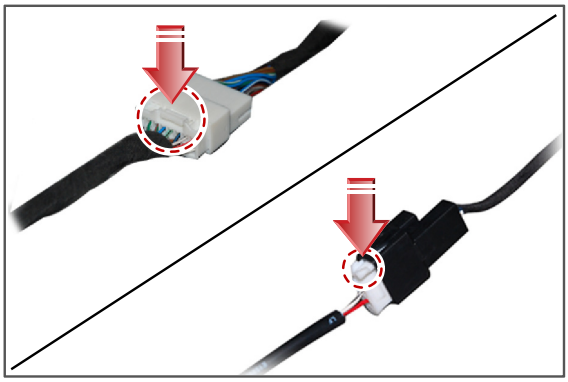


- If a fuse is blown, replace it with a rated capacity fuse. If you use a fuse with capacity higher than the specification, corresponding parts can be damaged or a fire can break out.

Downloaded from www.Manualslib.com manuals search engine



- Make sure a connector is connected securely. Loose connection results in malfunction.



- When disconnecting a connector equipped with a lock, press it down to the direction in the figure.

- When checking voltage or continuity of the connector terminal with a circuit tester, insert the tester's probe from the harness side. For a seal type connector, the probe should be inserted through the hole in the rubber cap of the wiring. At this time, take care not to damage insulation of the wires and insert the probe until it contacts with the end of the connector terminal.

CAUTION

When inspecting the airbag system, make sure to use a diagnostic device, not a circuit tester.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. CHECKING CABLES AND WIRES

- Check for loose connection or rust.
- Check terminals and wires for corrosion due to electrolyte leakage.
- Check terminals and wires for open circuit.
- Check wire insulation and coat for damage, crack or deformation.
- Check that conducting parts of the terminals do not contact with other metal parts, such as vehicle body or other parts.
- Check that the grounding part has continuity with mounting bolts and vehicle body.
- Check that wires are properly routed.
- Make sure that wires are securely fixed to avoid contact with sharp body parts and high-temperature parts, such as the exhaust manifold and exhaust pipes.
- The rotating parts, such as fan pulley and fan belt, perturbative parts and wiring should be secured tightly at regular intervals.
- Wiring between fixed parts, such as the vehicle body, and vibrating parts, such as the engine, should be fixed after making it slack to afford vibration.

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

There are 3 fuse & relay boxes in this vehicle.

1. Fuse and relay box in engine compartment
2. Interior fuse box
3. ICM (Integrated Control Module): Rear wiper, rear fog lamp, mirror folding, ACC, IGN1 & 2, horn, tailgate, power outlet, shift lock relay (A/T)

2. SYSTEM LAYOUT

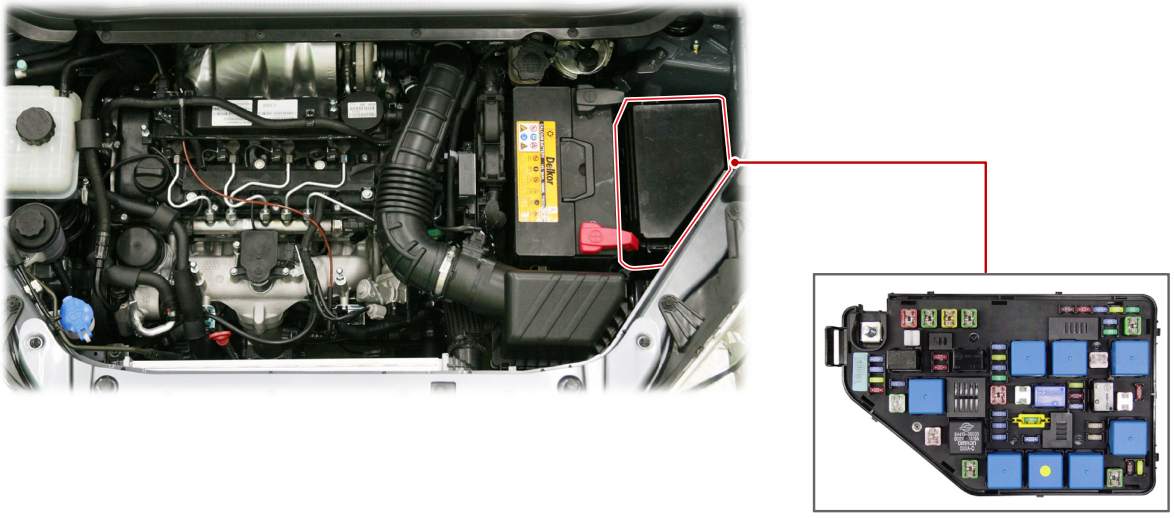
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

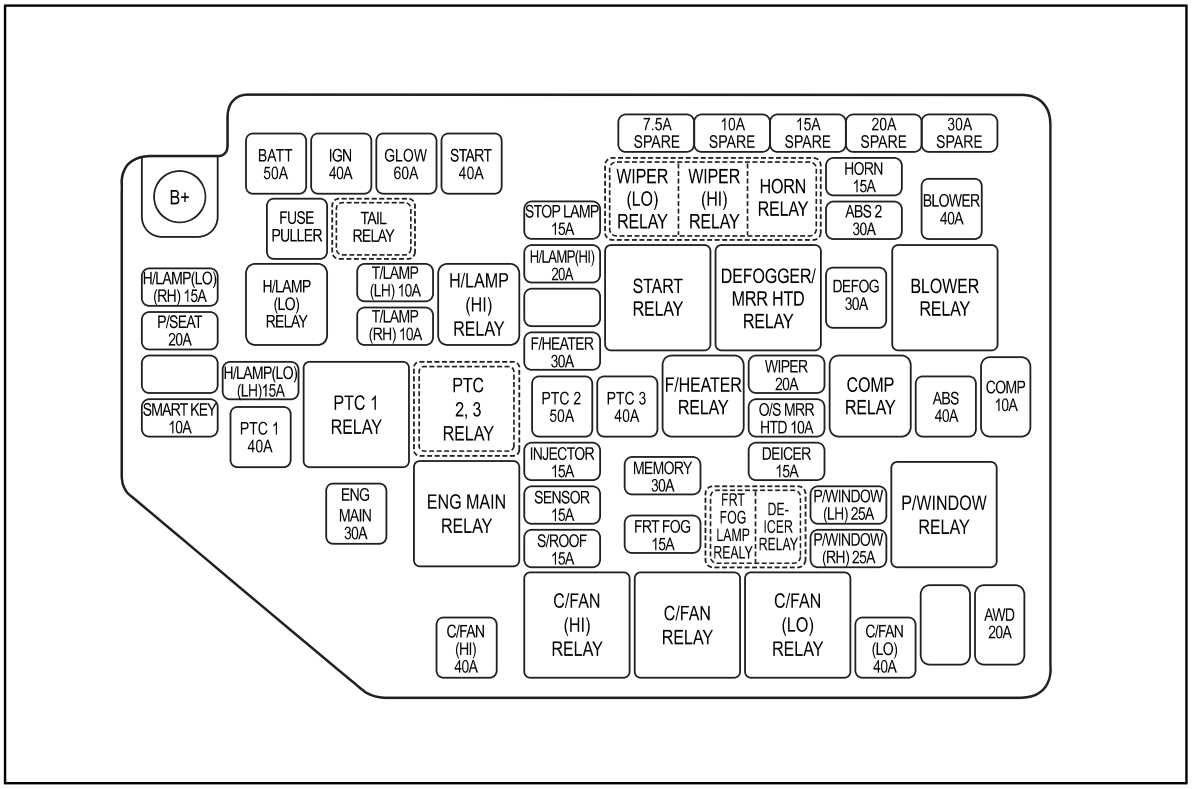
3. OPERATING PROCESS

1) Fuse & Relay Box in Engine Compartment

The fuse & relay box is located beside the battery. It contains wiper, horn, heated wire, fog lamp, tail lamp and PTC relays. the B+ is supplied from ALT+.



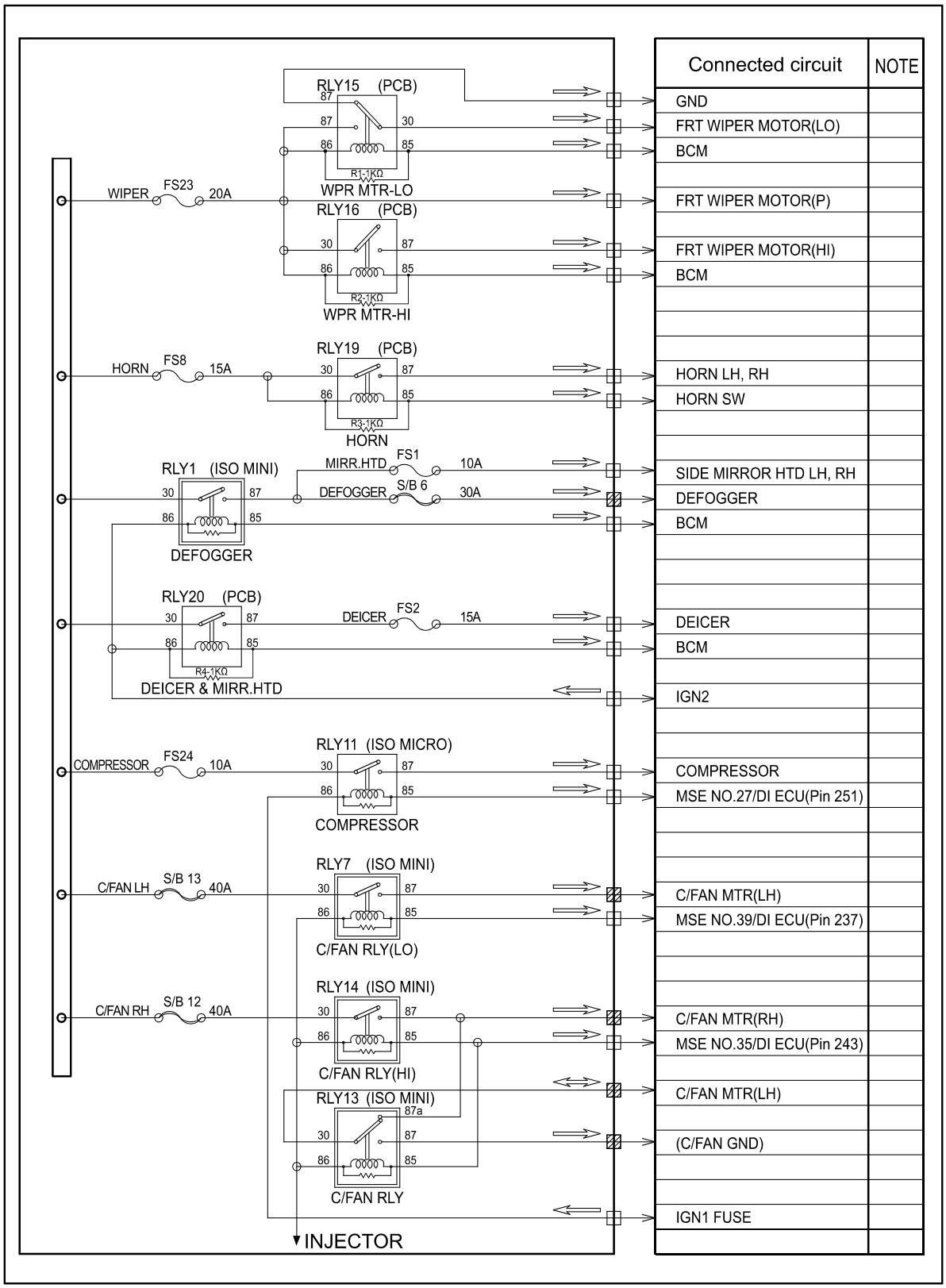
▶ **Fuse & relay**



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

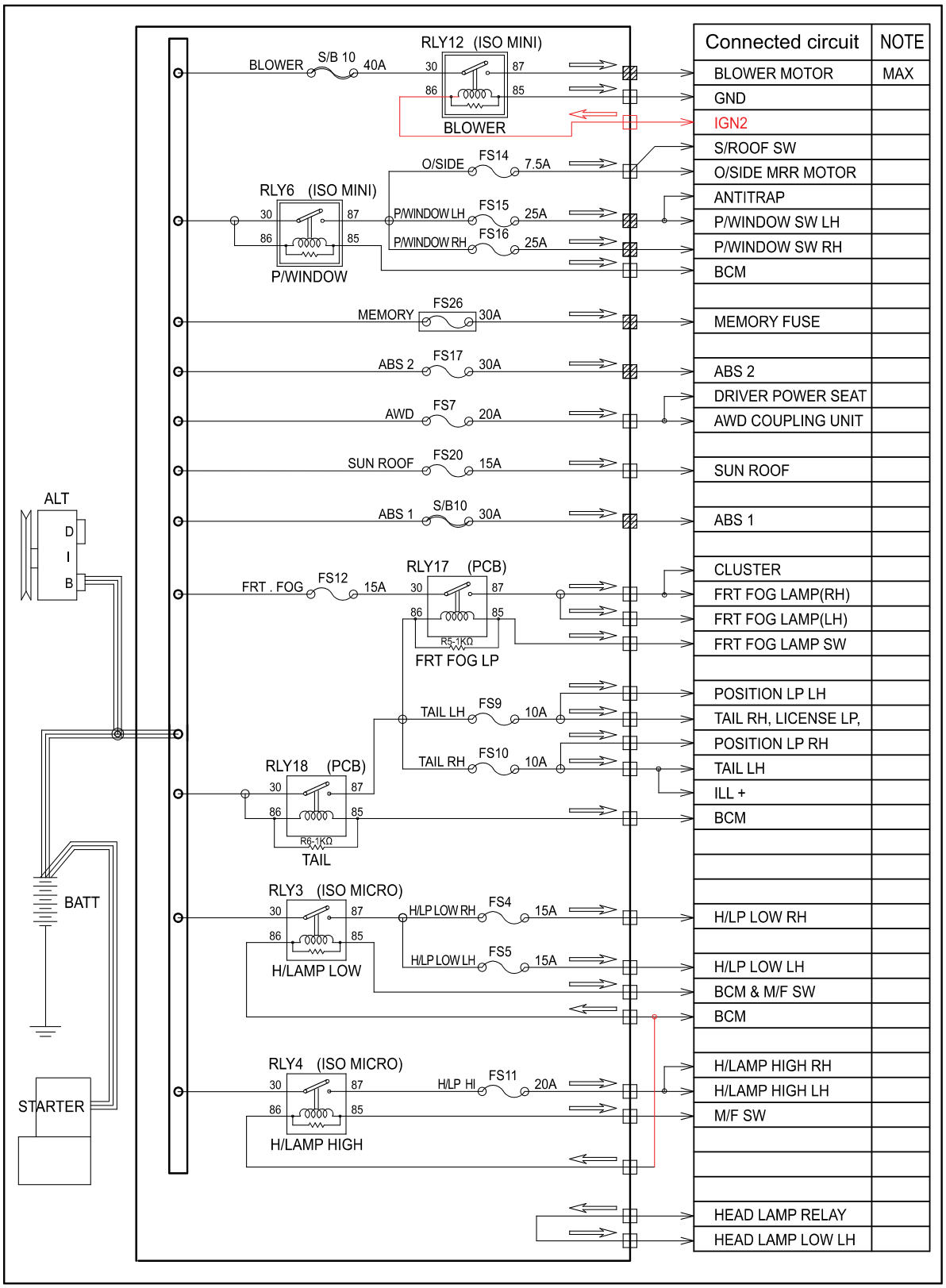
▶ Circuit diagram I



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

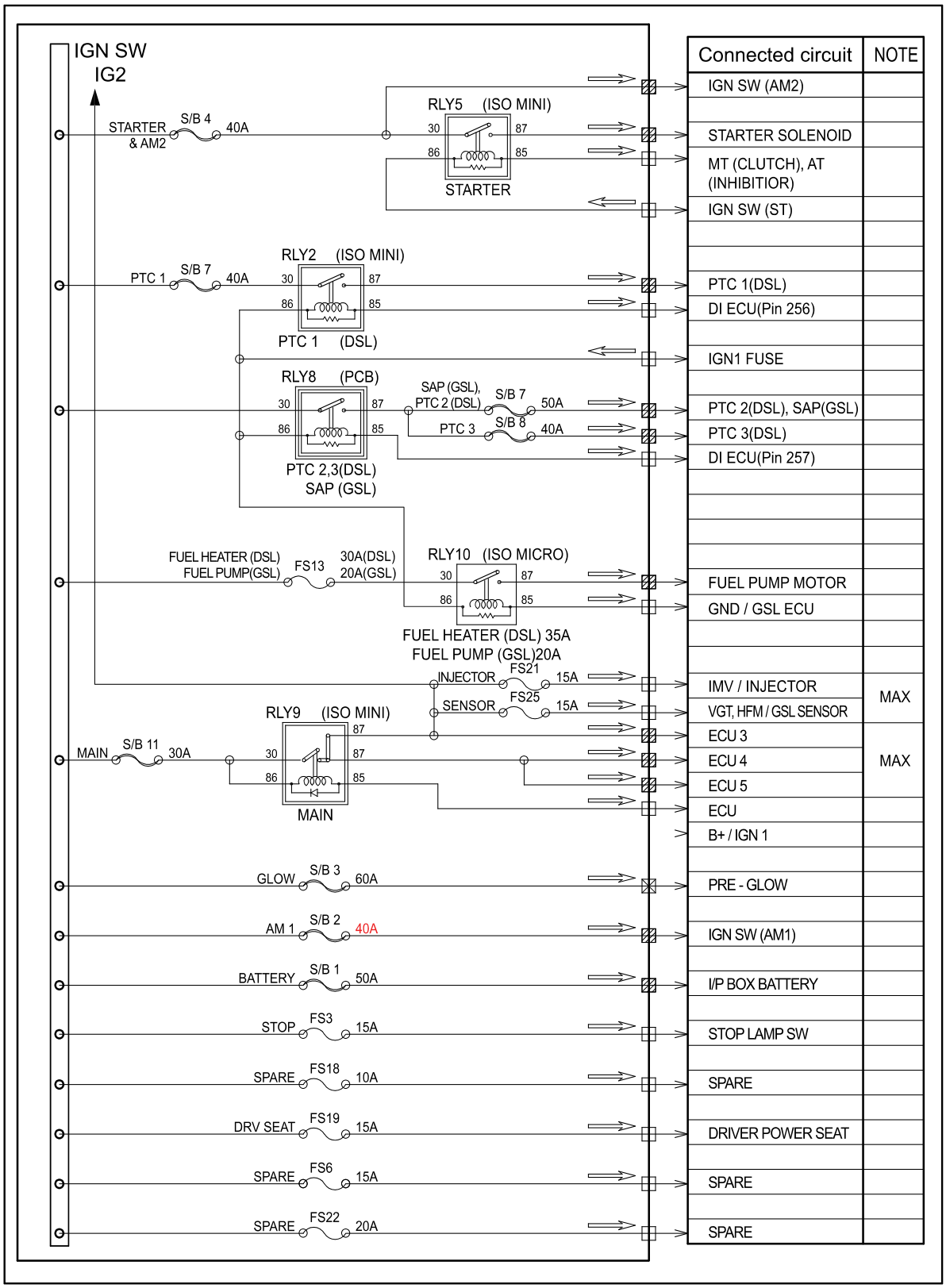
▶ Circuit diagram II



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Fuse & relay box III

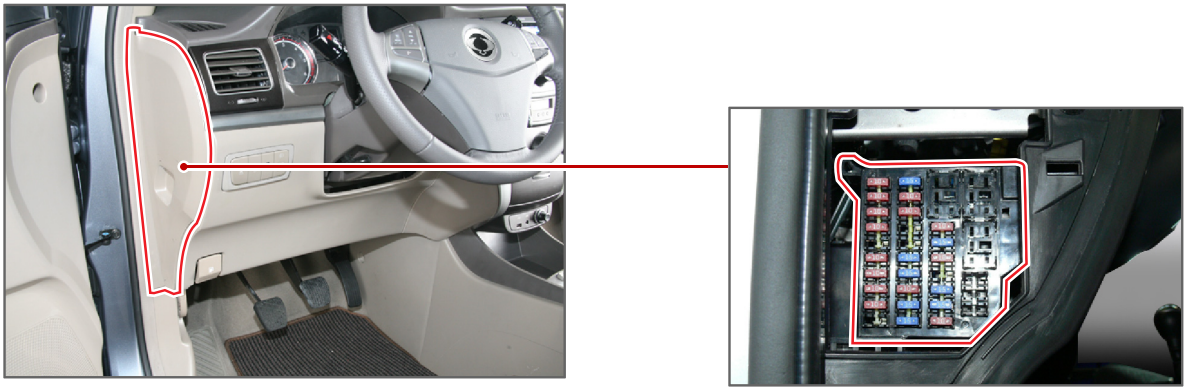


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Interior Fuse Box

This fuse box is located in the left side of instrument panel.



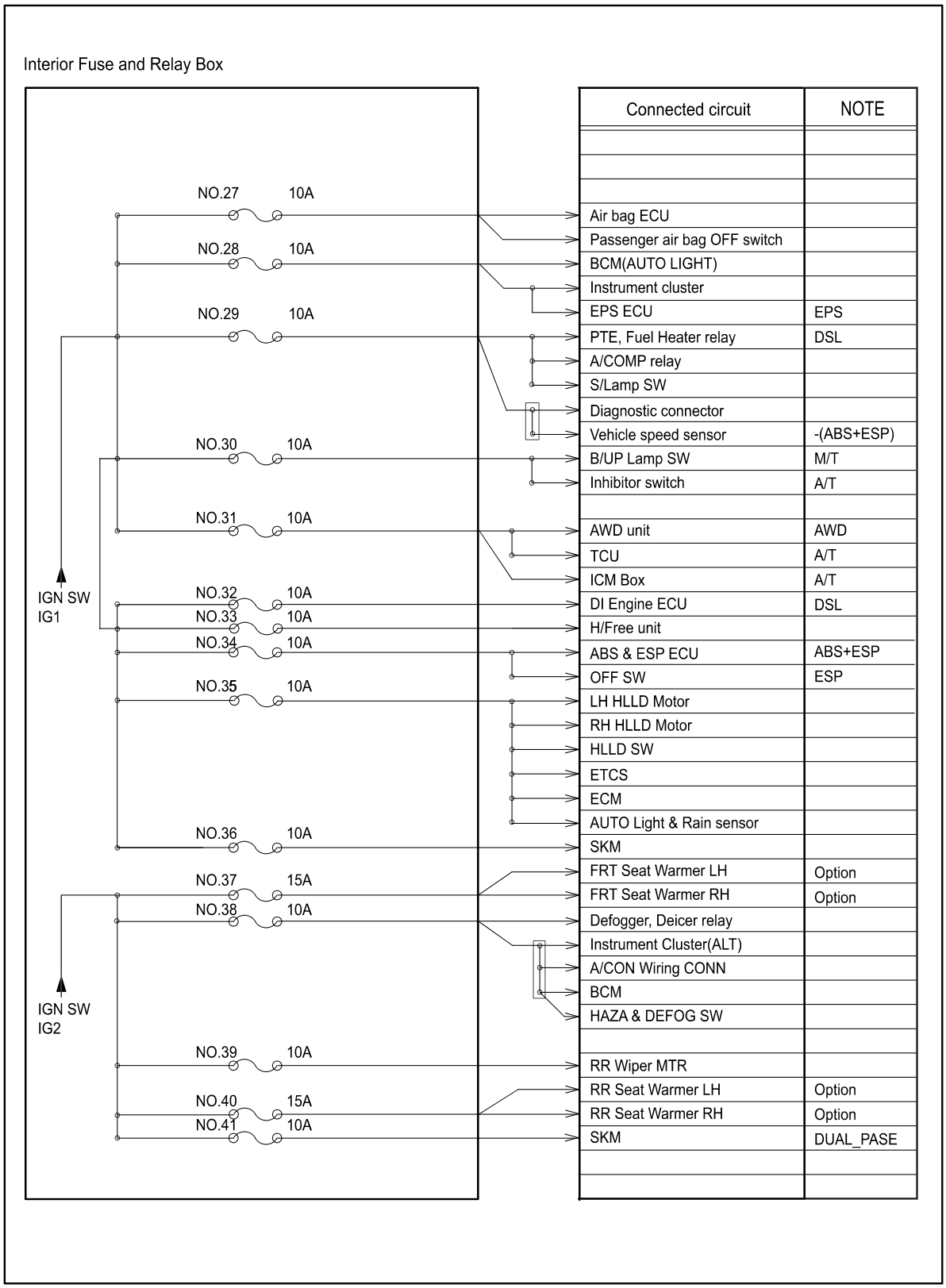
▶ Fuse & relay

NO.27 10A	AIR BAG	NO.37 15A	FRT SEAT WARMER	SAPRE		SAPRE	
NO.28 10A	CLUSTER BCM EPS	NO.38 10A	AIR CON FRT/RR DEFOGGER ALTERNATOR				
NO.29 10A	*FUEL HTR DIAGNOSIS *PTC	NO.39 10A	REAR WIPER				
NO.30 10A	BACK UP LAMP BACK SONAR	NO.40 15A	RR SEAT WARMER	NO.47 10A	DIGITAL CLOCK O/SIDE MRR SUN ROOF HEAD REST	SAPRE	
NO.31 10A	TCU AWD	NO.41 10A	SMART KEY (DOM)	NO.48 15A	CIGAR LIGHT		
NO.32 10A	* ENG ECU	NO.42 15A	BCM (DOOR LOCK)	NO.49 10A	AUDIO AV(DOM)		
NO.33	SPARE	NO.43 15A	BCM (HAZARD)	NO.50 10A	SMART KEY (DOM)	NO.54	SAPRE
NO.34 10A	ABS/ESP	NO.44 10A	DIAGNOSIS SMART KEY (DOM)	NO.51 15A	AUDIO AV(DOM)	NO.55	SAPRE
NO.35 10A	HLLD ECM MRR	NO.45 15A	B/HORN MRR FOLD	NO.52 15A	INTERIOR LAMP BCM CLUSTER	NO.56	SAPRE
NO.36 10A	SMART KEY (DOM)	NO.46 20A	POWER OUTLET	NO.53 10A	START		

- PLEASE USE THE DESIGNATED FUSE AND RELAY.
- CONSULT OWNER'S MANUAL FOR FUSE & RELAY SERVISE.
- " * "DSL, " ** " GSL

Downloaded from www.Manualslib.com manuals search engine

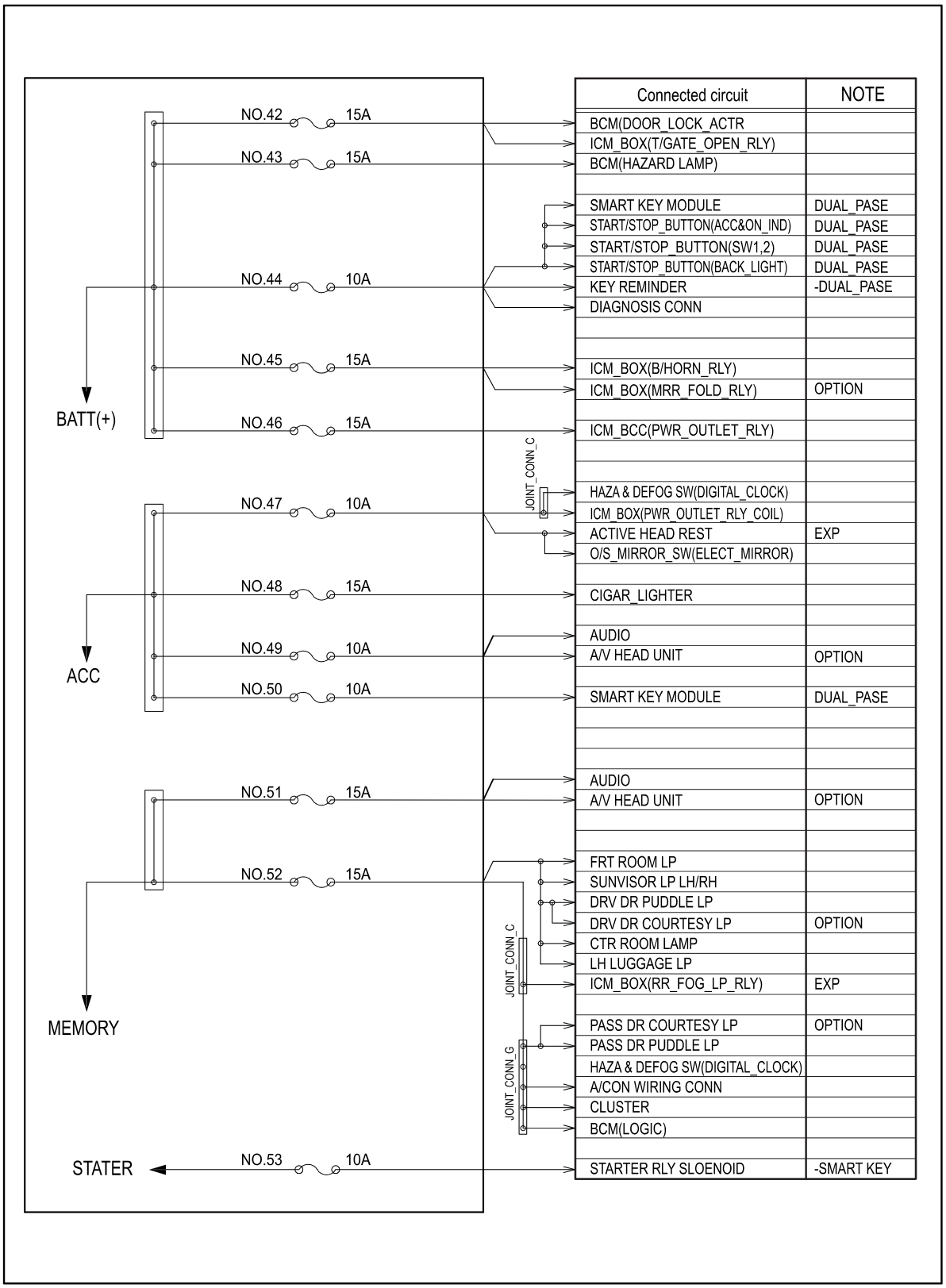
▶ Circuit diagram I



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Circuit diagram II

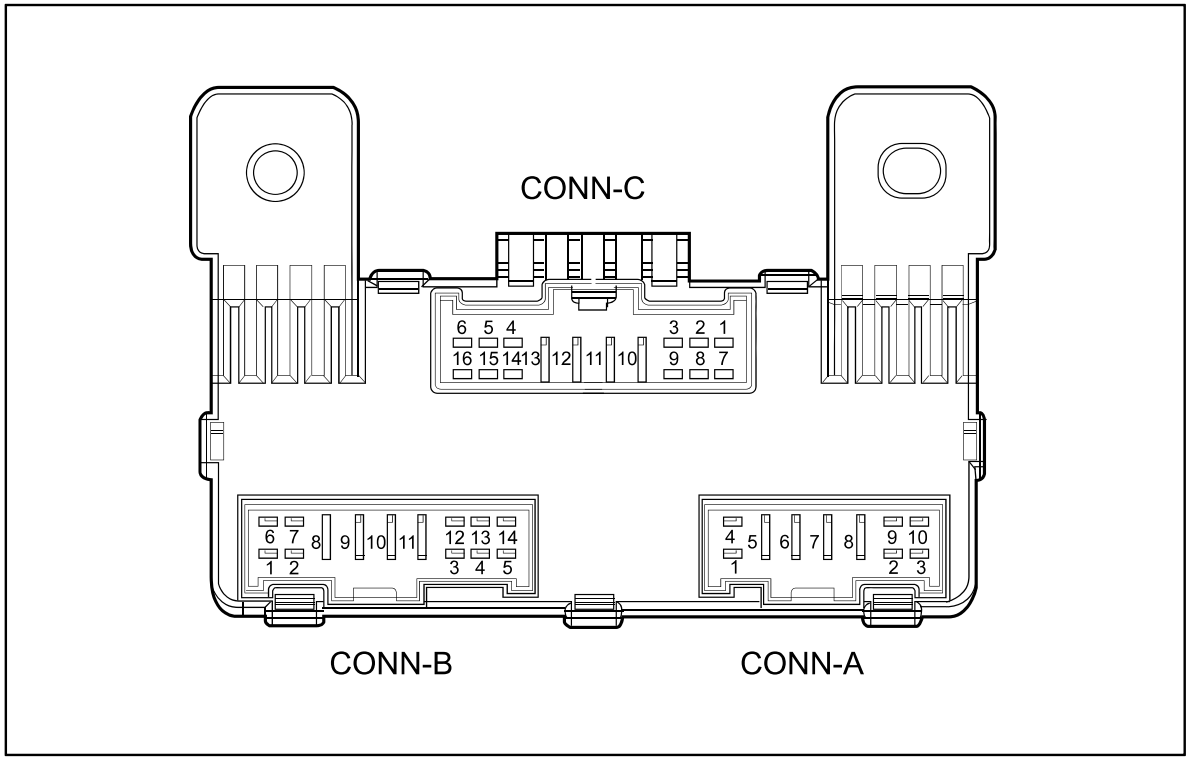


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) ICM Box

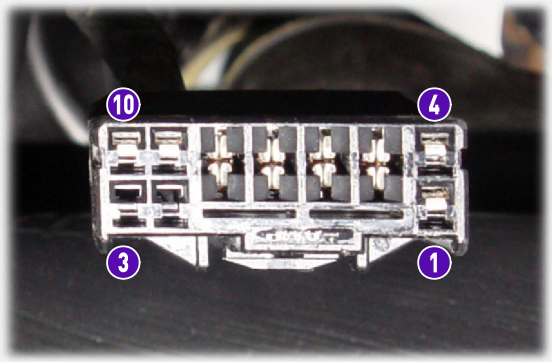
▶ **Function descriptions**

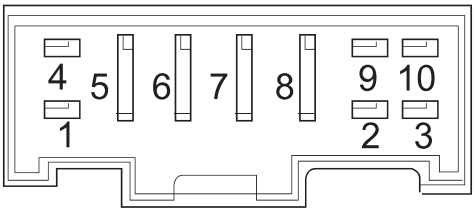


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Connector A

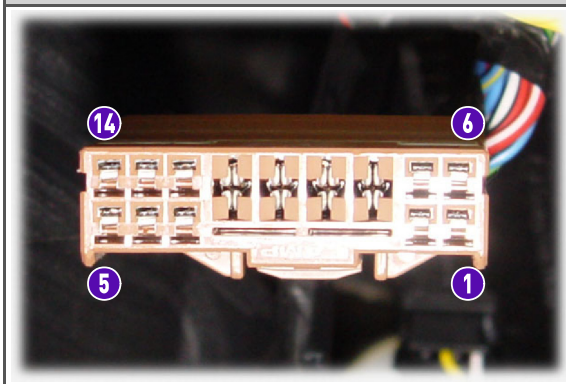


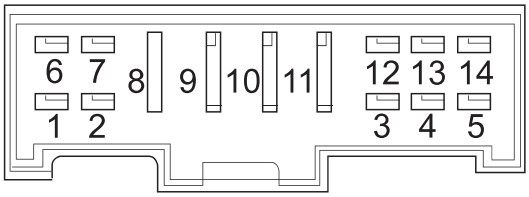


Pin No.	Function
1	-
2	-
3	-
4	-
5	B+ (CE box)

Pin No.	Function
6	Fuse box
7	Fuse box
8	B+ (CE box)
9	-
10	Ground

Connector B



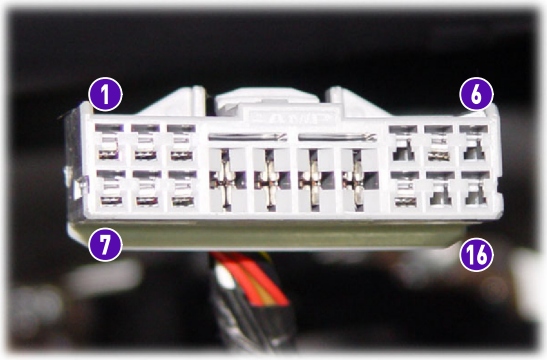


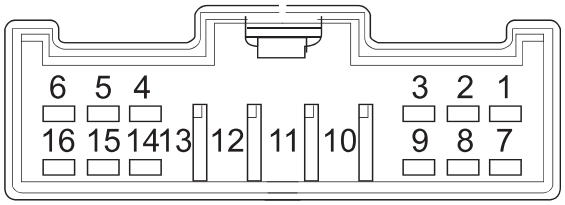
Pin No.	Function
1	Multifunction switch (RH)
2	ACC (F47)
3	BCM (Mirror folding control)
4	BCM
5	ICM "C10"
6	IGN2 (F39)
7	Rear wiper motor

Pin No.	Function
8	Rear wiper motor
9	Front & rear power outlet
10	B+ (F46)
11	Fuse box
12	Ground
13	BCM (Mirror unfolding control)
14	Mirror unfolding motor

Downloaded from www.Manualslib.com manuals search engine

Connector C





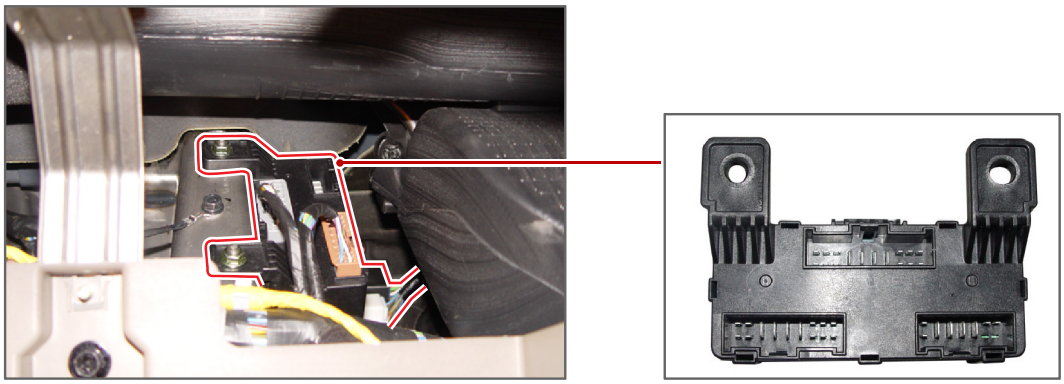
Pin No.	Function
1	Stop lamp switch
2	BCM
3	IGN (F31)
4	BCM
5	B+ (F45)
6	Rear fog lamp
7	TGS lever
8	TGS lever

Pin No.	Function
9	Warning horn
10	B+ (F42)
11	Tailgate actuator
12	B+ (F45)
13	Mirror folding motor
14	Ground
15	ICM "C16"
16	B+ (F52)

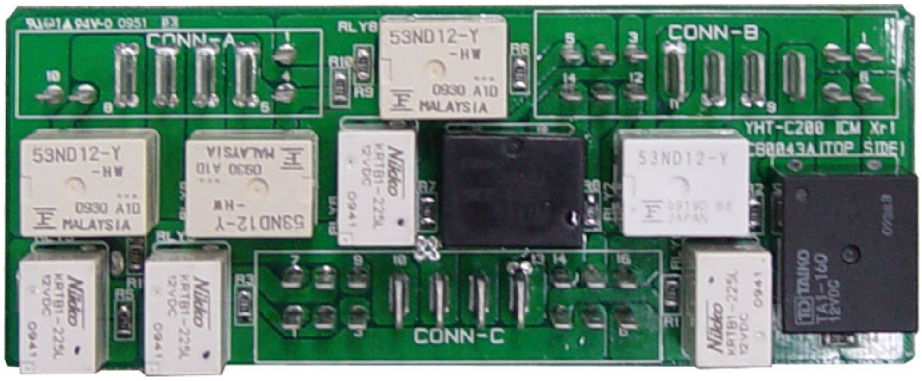
Modification basis	
Application basis	
Affected VIN	

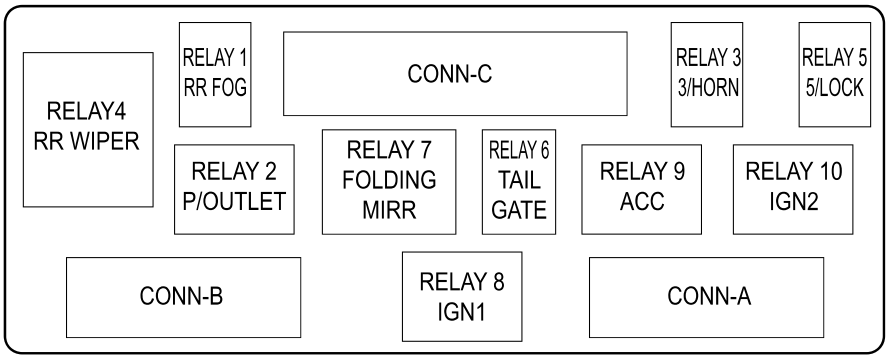
Downloaded from www.Manualslib.com manuals search engine

ICM box is located behind the instrument cluster.



▶ **Circuit board**

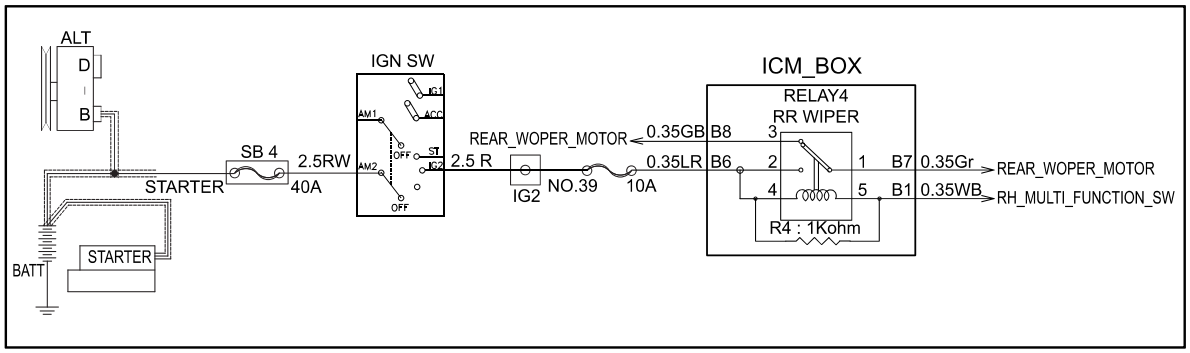




Downloaded from www.Manualslib.com manuals search engine

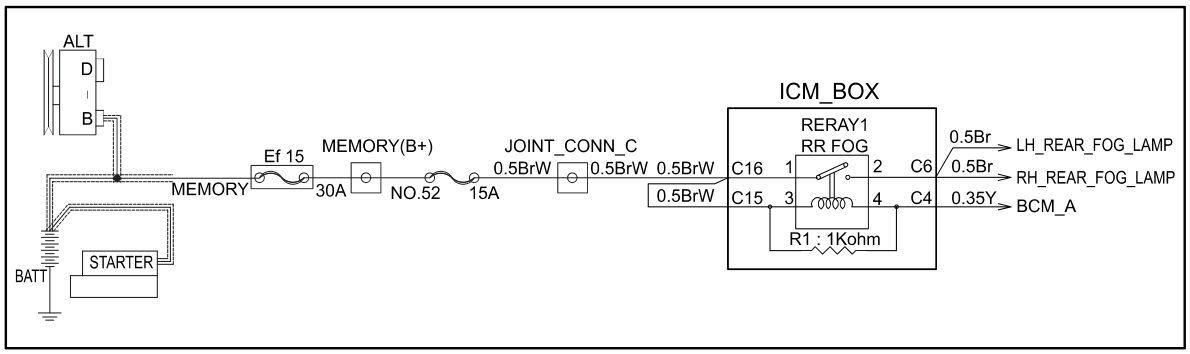
4) Operating Process by Power Supply

(1) Rear wiper relay



Power supply: SB4, No. 39, ICM B6
When turning ON/OFF the wiper switch with IGN2 ON, the rear wiper motor relay is turned ON/OFF.

(2) Rear fog lamp relay



Power supply: Memory fuse in CE box, Interior fuse box No. 52
Operating signal: BCM A11 (ON/OFF)

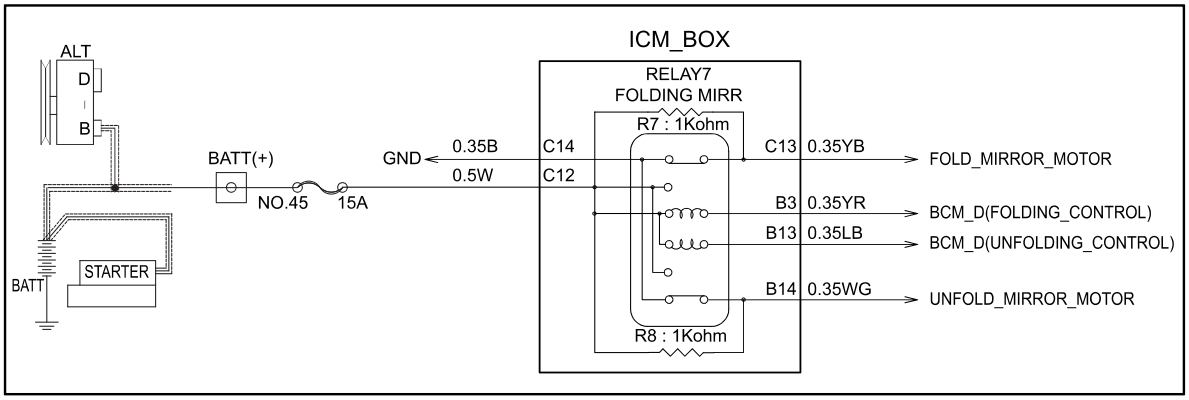
▶ **Operating conditions**

1. When pressing the rear fog lamp switch with IGN2 ON (headlamp ON condition), the rear fog lamps are turned ON.
2. When pressing the rear fog lamp switch again during the operation, the rear fog lamps are turned OFF.
3. The rear fog lamps do not come ON when the engine is not running or the light switch is
4. OFF.
   The rear fog lamps should not automatically come on again if they have been turned OFF by any other way other than the switch.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(3) Outside mirror folding/unfolding relay

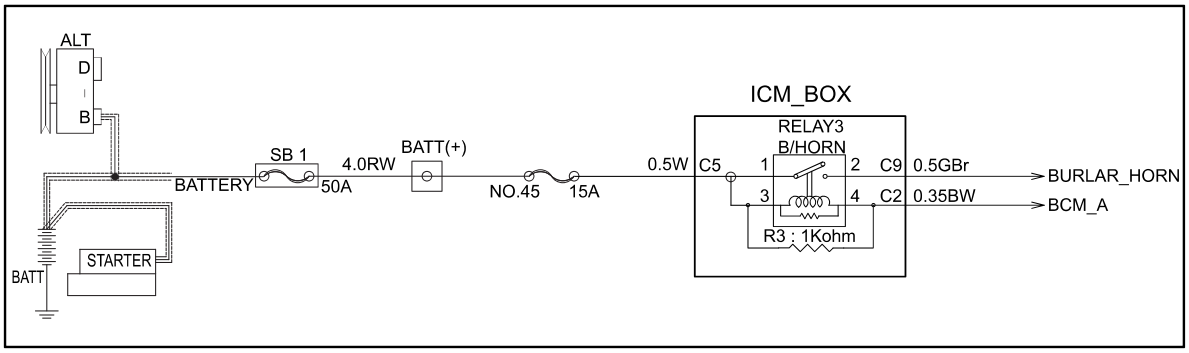


Power supply: CE box No. 45
Operating signal: BCM D16, D17 (Folding/Unfolding)

▶ **Manual operation**

When pressing the mirror folding/unfolding switch with IGN ON, the mirrors are folded or unfloded according to the mirror condition in 16±6 seconds.

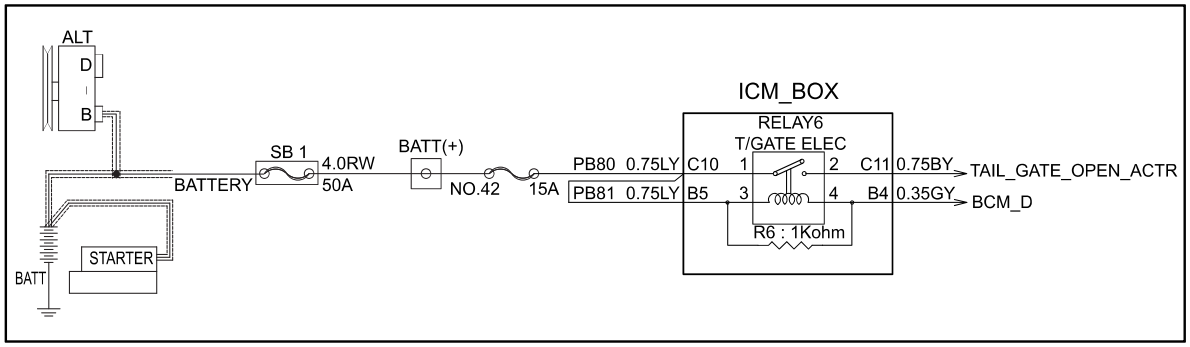
(4) Horn relay



Power supply: SB1, Interior fuse box No. 45, ICM C5
Operating signal: BCM A24 (ON/OFF)

Downloaded from www.Manualslib.com manuals search engine

(5) Tailgate relay

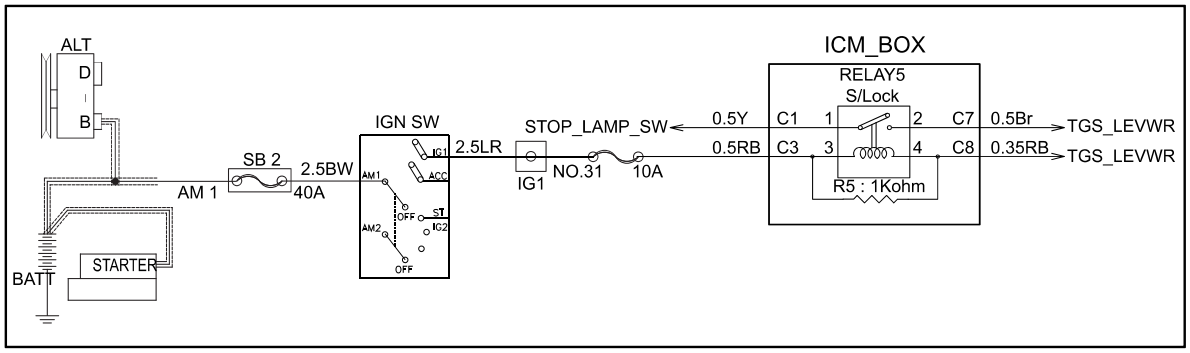


Power supply: SB1, Interior fuse box No. 42, ICM C10 and B5
Operating signal: BCM D6 (ON/OFF)

▶ **Non-operating conditions**

- The tailgate open relay is turned OFF immediately after the driver door is locked or the vehicle speed goes over 3 km/h.

(6) Shift lock relay (for A/T)

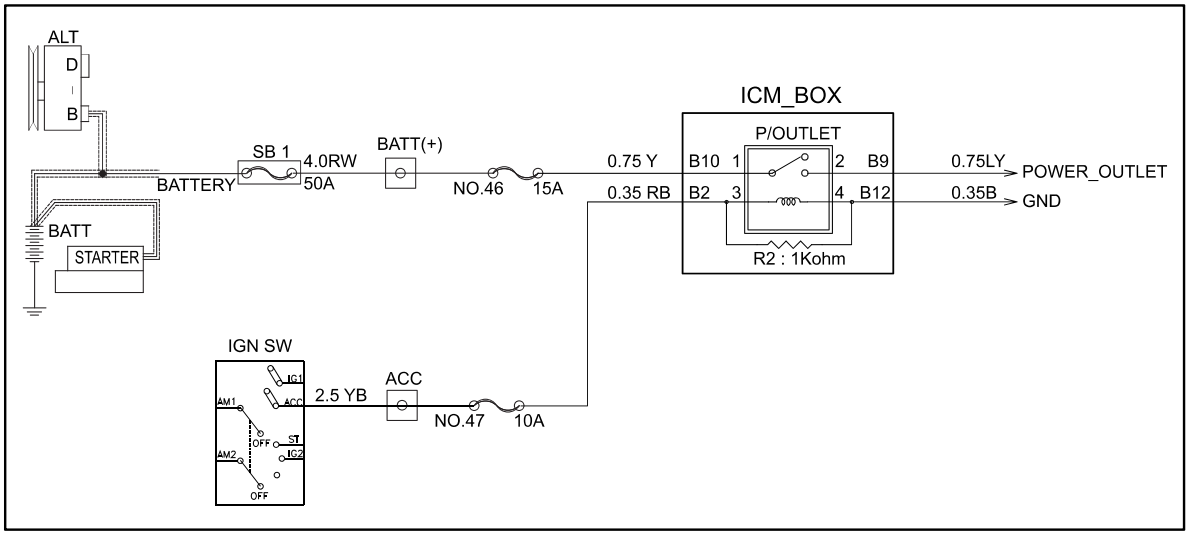


Power supply: SB2, Interior fuse box No. 31, ICM C1 (with stop lamp switch ON)
Operating signal: No. 10 in gear selector lever connector (ON/OFF)

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(7) Power outlet relay



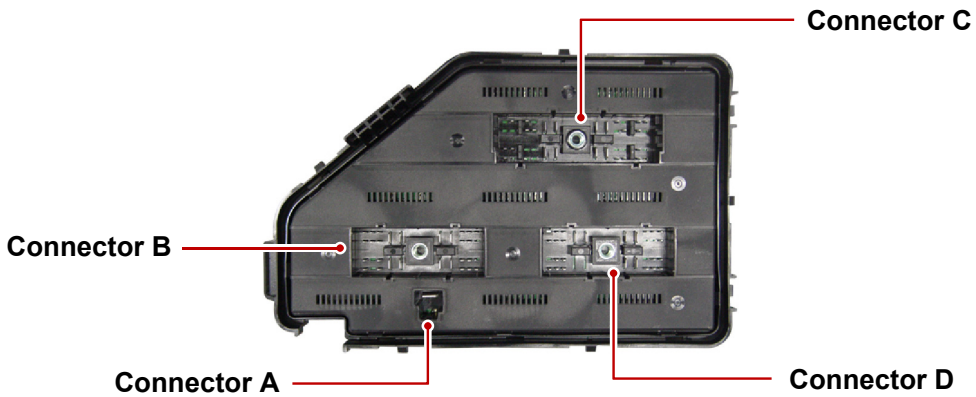
Power supply: SB1, Interior fuse box No. 46, ICM B10
Operating signal: Interior fuse box No. 47 (with key ACC), ICM B12 (grounded)

Downloaded from www.Manualslib.com manuals search engine

COMPONENT

S.G.N. 8410-02 FUSE BOX IN ENGINE COMPARTMENT

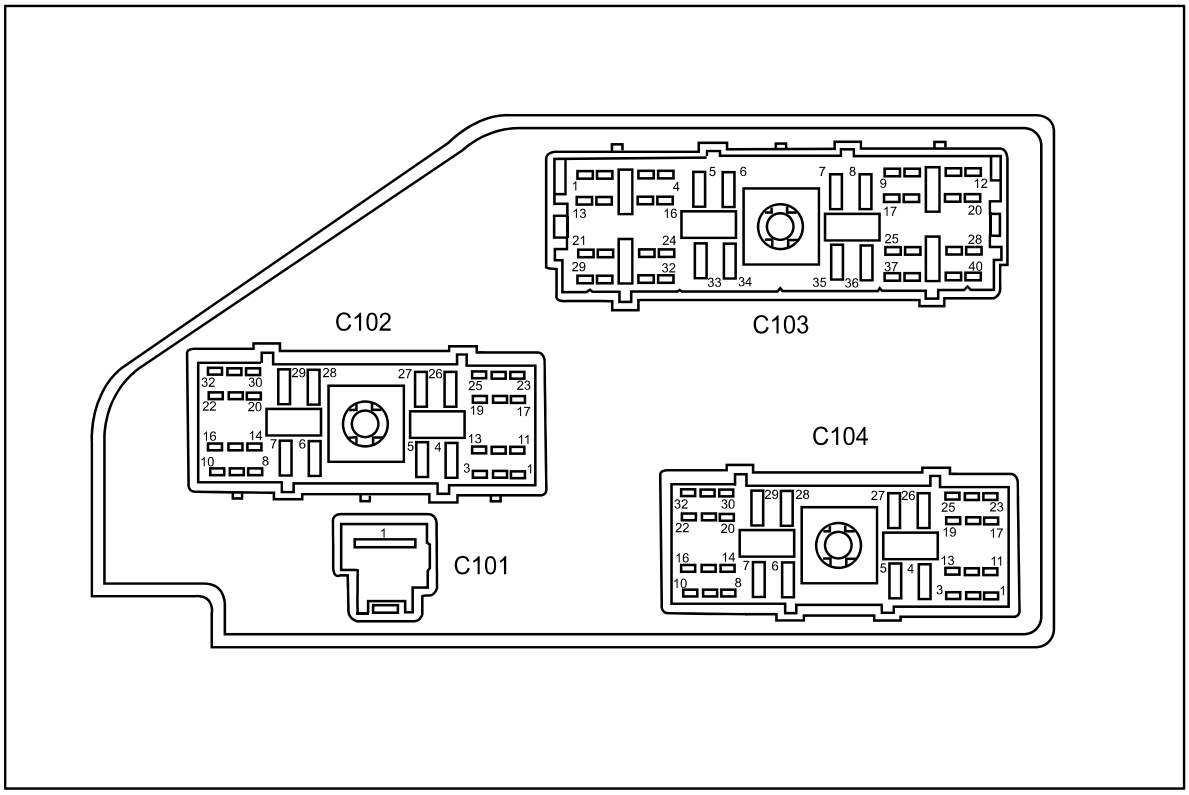
Connectors



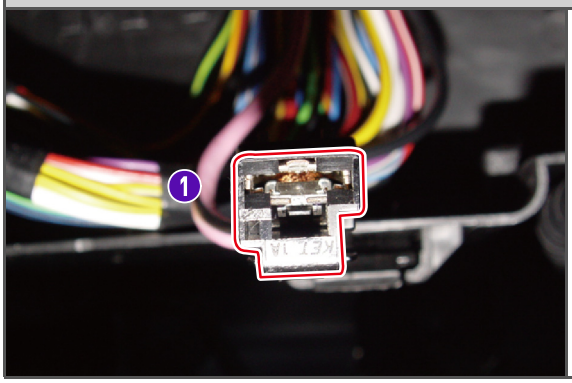
Modification basis	
Application basis	
Affected VIN	

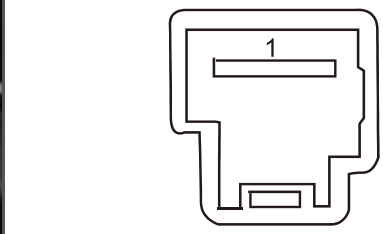
Downloaded from www.Manualslib.com manuals search engine

▶ Function descriptions of connectors



Connector A



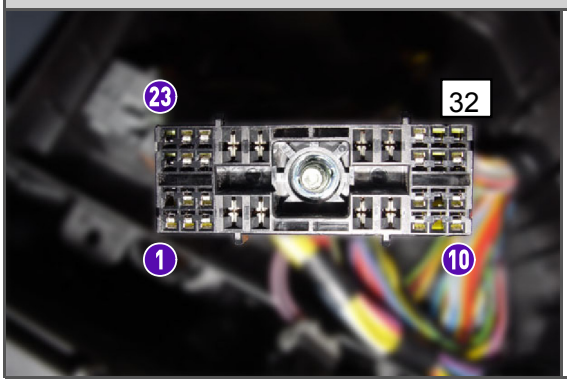


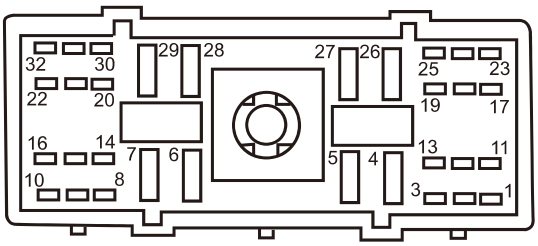
Pin No.	Function
1	Glow control

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Connector B





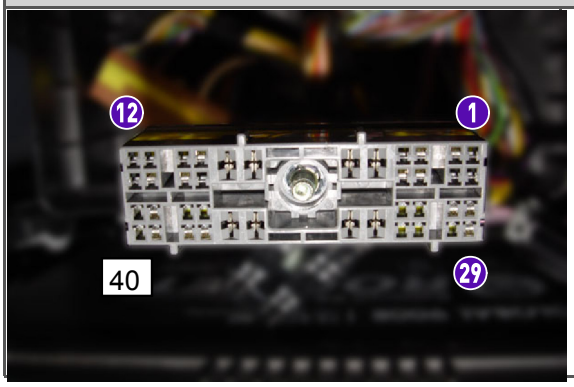
Pin No.	Function
1	High beam (LH, RH) "1", Instrument cluster "A1"
2	Stop lamp switch "1", Buzzer"1"
3	Tail lamp (RH) "2"
4	-
5	DI ECU"B5"
6	IGN switch "2", ICM "A5"
7	Interior fuse box No.42~46
8	BCM "A15"
9	-
10	TGS, Auto light
11	-
12	Light switch (High beam) "1"
13	Position lamp (LH) "2"
14	-
15	-
16	BCM "D3" (Low beam relay)

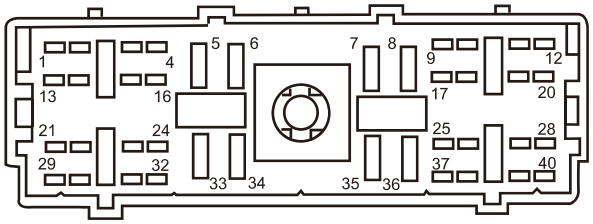
Pin No.	Function
17	-
18	BCM "D3" (High beam relay)
19	Position lamp (RH) "2"
20	DI ECU "B56"
21	Driver seat switch "10"
22	Light switch (Low beam) "8"
23	-
24	DI ECU "B57"
25	Tail lamp (LH) "2", S203 "19" (ILL+)
26	PTC heater2 "3"
27	DI ECU "B3"
28	DI ECU "B1"
29	PTC heater 1 "1"
30	C104 "21"
31	-
32	-

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Connector C





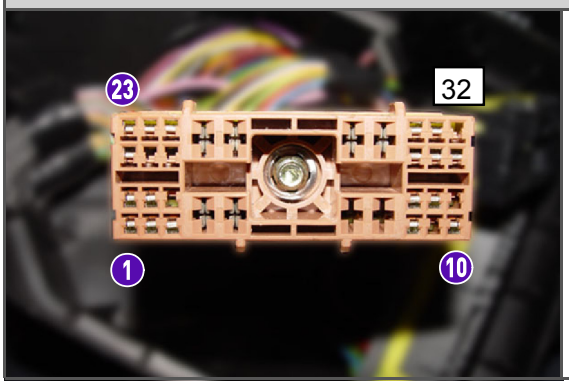
Pin No.	Function
1	-
2	DI ECU "45"
3	Di ECU "43"
4	-
5	Cooling fan (RH) "1"
6	Cooling fan (LH) "2"
7	G101
8	Cooling fan (LH) "1"
9	Light switch (Fog lamp) "16"
10	-
11	-
12	Coupling unit "10"
13	-
14	-
15	Front fog lamp (RH) "2", Instrument cluster "A20"
16	Front fog lamp (LH) "2"
17	-
18	DI ECU "B37"
19	BCM "D8" (Power window)
20	-
21	HFM "1", Glow control unit "A5", VGT "1"

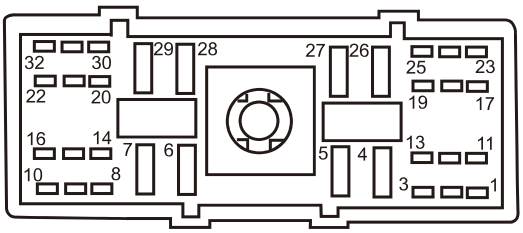
Pin No.	Function
22	Sunroof motor "1"
23	Sunroof motor "1"
24	-
25	-
26	-
27	-
28	-
29	IMV "1"
30	-
31	-
32	-
33	PTC heater 3 "5"
34	Interior fuse box (No.51~52)
35	Power window switch "2", Power window motor "5" (passenger)
36	Power window switch "8", Power window motor "6" (driver)
37	Outside mirror motor (passenger) "6"(heated wire)
38	Windshield heated wire "1"
39	BCM "A12", Hazard & glass heated wire switch "2"
40	-

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Connector D





Pin No.	Function
1	Auto cruise switch & contact coil "7"
2	Horn (LH, RH) "1"
3	Wiper motor (Hi) "5"
4	Blower motor "1"
5	ABS/ESP unit "25"
6	-
7	-
8	BCM "D5"(wiper Lo)
9	G101
10	-
11	G101
12	BCM "D15"(wiper Hi)
13	-
14	Wiper motor (Hi) "6"
15	BCM "A25", Hazard & glass heated wire switch "8"
16	-

Pin No.	Function
17	-
18	-
19	-
20	-
21	C104 "31"
22	Inhibitor switch "2" (A/T), Clutch switch "1" (M/T)
23	DI ECU "B51"
24	A/C compressor "2"
25	Wiper motor "3"
26	Rear glass heated wire "1"
27	ABS/ESP unit "1"
28	Fuel heater "2"
29	Start motor "ST"
30	G101
31	Low beam (LH) "2"
32	-

Downloaded from www.Manualslib.com manuals search engine

BCM (BODY CONTROL MODULE) 8710-01

GENERAL INFORMATION

1. SPECIFICATION

Description		Specification	Remark
Rated voltage		DC 13.5 V	
Operating voltage		DC 9.0 to 16.0 V DC 7.0 to 18.0 V (CAN)	
Operating temperature		−30 to +80°C	
Storage temperature		−40 to +85°C	
Transponder	Frequency	134.2 kHz ± 4 kHz	
	Operating temperature	−40 to +85°C	
Max. humidity		95%	
High resistant voltage		24 V	
Dark current		Below 7.0 mA	All switches OFF, key out, all doors LOCK and Sleep mode
Voltage drop		Below 1.0 V	at pin B6 and all pins for IN/OUT

Downloaded from www.Manualslib.com manuals search engine

2. FUNCTIONS

1) Functional List

Function			Applicable: O Not applicable: X
1	Wiper control	Wiper mist & washer coupled wiper	O
		Auto washer coupled wiper	O
		Auto light-rain sensor coupled wiper (LIN)	O
		Speed sensitive intermittent wiper	O
		Wiper low/high control	O
2	Key reminder warning	Key reminder warning	O
		Key reminder	O
		External buzzer control	X
		Anti-lock function when opening door	O
3	Tail lamp control	Tail lamp ON warning	O
		External lamp warning display	X
		Tail lamp auto OFF	O
4	Door ajar warning	Door status management	X
		Door ajar warning	O
5	Seat belt control	Seat belt warning	O
		Seat belt reminder	O
6	Sunroof warning	Sunroof warning control	O
		Sunroof warning display	X
7	Room lamp control	Door coupled room lamp and dimming control	O
		Room lamp OFF control	O
		Room lamp control display	X
8	Key hole illumination control	Key hole illumination	O
9	Defogger (heated wire) control	Front defogger timer	O
		Rear defogger timer	O

Downloaded from www.Manualslib.com manuals search engine

Function			Applicable: O Not applicable: X
10	Keyless entry control	Transmitter	O
		Receiver	O
		Remote door lock	O
		Remote door unlock	O
		Remote panic	O
		Remote escort	O
		Auto door lock after 30 seconds	O
11	Door lock/unlock control	Lock/unlock control by door lock switch	O
		Lock/unlock control by central door lock switch	O
		Lock/unlock control by REKES signal	O
		Auto door lock control	O
		Auto door unlock (crash signal) control	O
12	Panic alarm	Panic alarm control by REKES signal	O
13	Tailgate open control	Tailgate open control	O
14	Theft deterrent mode control	Theft deterrent mode control	O
15	Time lag power window control	Time lag power window control	O
16	System power sleep mode	System power sleep mode control	O

Downloaded from www.Manualslib.com manuals search engine

Function			Applicable: O Not applicable: X
17	Flasher (blinking) function	LH turn signal control	O
		RH turn signal control	O
		Hazard flasher switch control	O
		Hazard flasher indicator control	X
		Auto hazard flasher control	O
		Emergency hazard flasher control (w/ABS)	O
18	DRL (Daytime Running Light) control	DRL (Daytime Running Light) control	O
19	Fog lamp control	Fog lamp control	O
20	Auto light control (LIN)	Auto light control	O
21	Immobilizer function	Key coding and synchronization	O
		Challenge	O
		CAN information	O
22	Mirror folding/unfolding control	Folding/unfolding control	O
		Auto folding/unfolding control	O
23	Approach (puddle) lamp control	Approach (puddle) lamp control	O
24	Diagnosis function	Diagnostic control	O

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW & FUNCTIONS

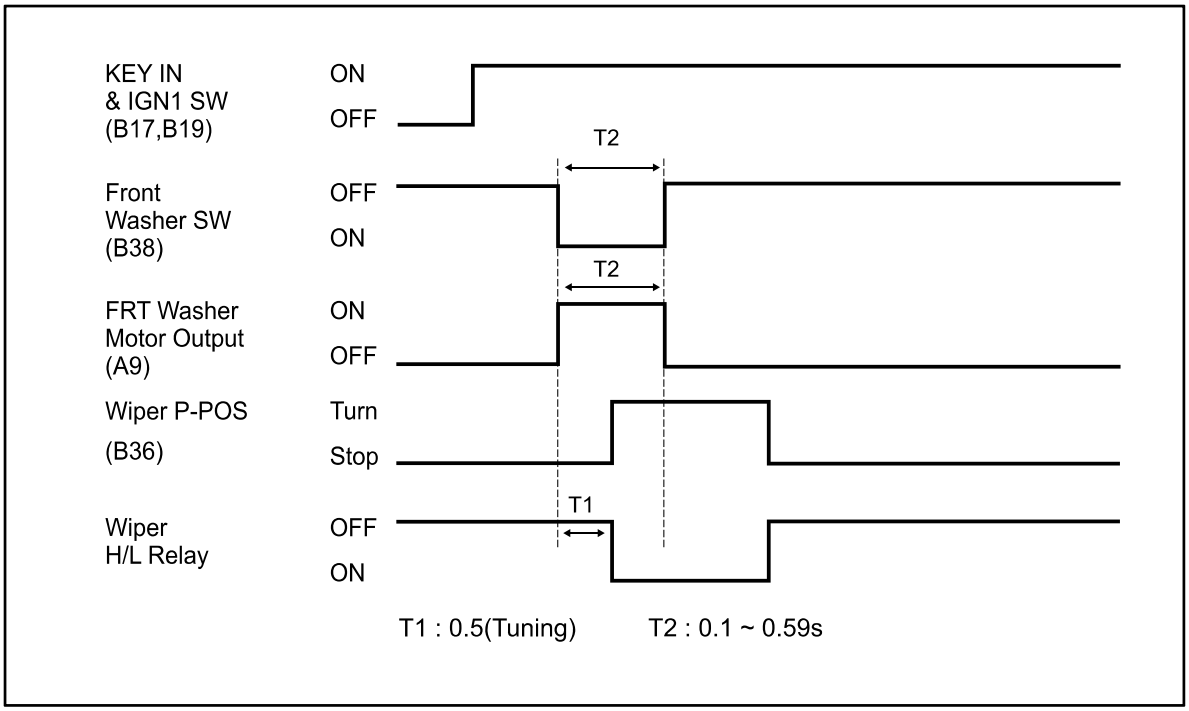
BCM (Body Control Module) controls the electric equipment on car body and outputs the control and warning signals as below.

1) Wiper Control

(1) Wiper mist & washer coupled wiper

▶ **Wiper mist**

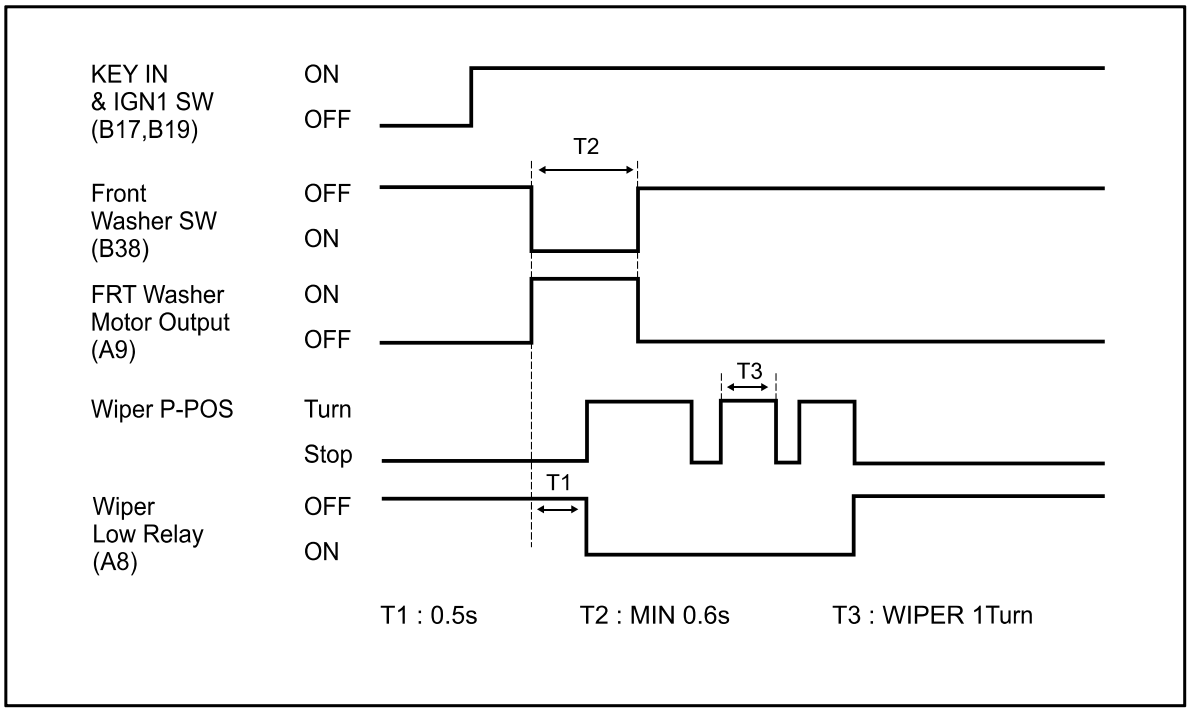
1. When turning ON the front washer switch with IGN1 ON, the front wipers operate after T1. When releasing the switch, the wipers will stop at parking positions.



Downloaded from www.Manualslib.com manuals search engine

▶ Front washer coupled wiper

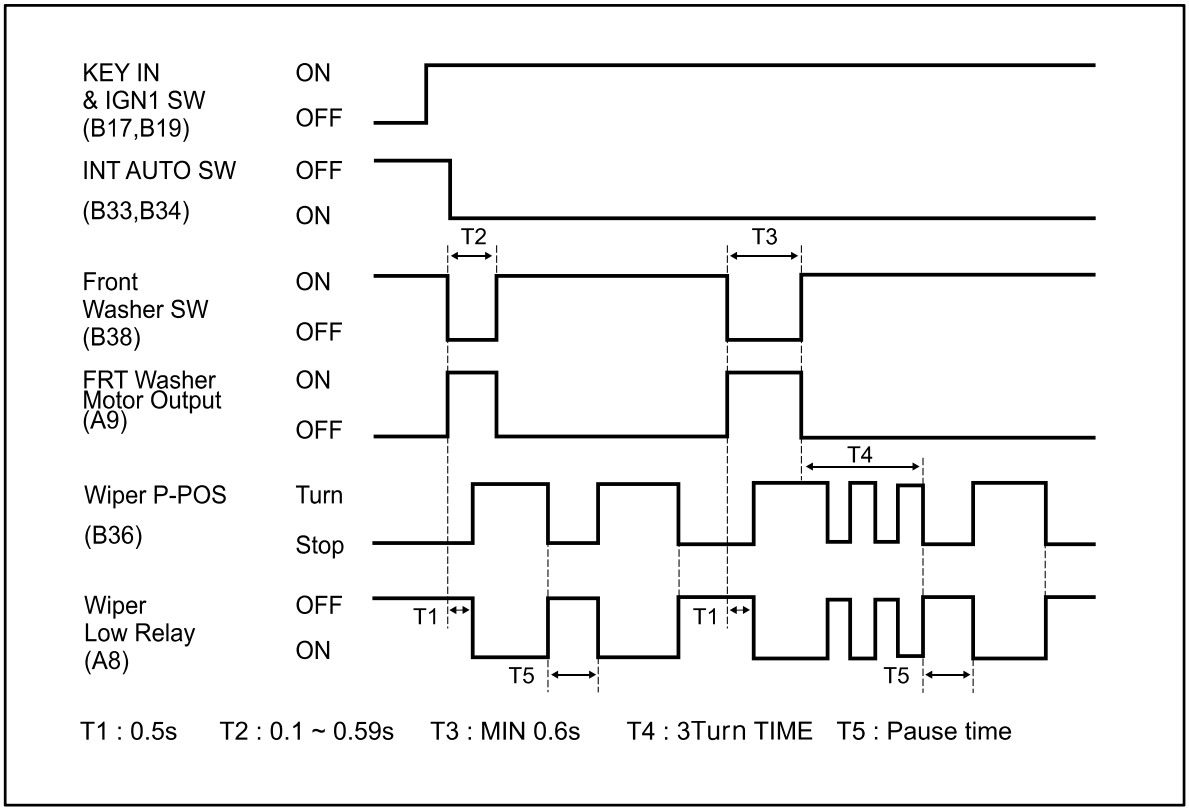
1. When holding the front washer switch at ON position for more than T2 with IGN1 ON, the washer fluid is sprayed onto the windshield glass and the wipers operate three times.



Modification basis	
Application basis	
Affected VIN	

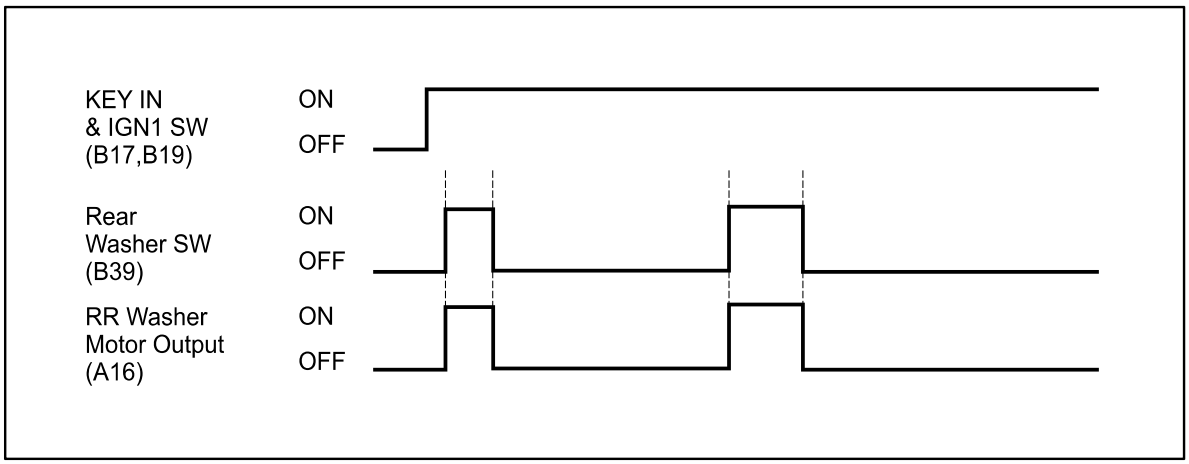
Downloaded from www.Manualslib.com manuals search engine

2. When holding the front washer switch at ON position for more than 0.6 seconds with the wiper switch AUTO, the washer fluid is sprayed onto the windshield glass and the wipers operate three times. When holding it between 0.1 and 0.59 seconds, the wiper will operate only once.



▶ Rear washer motor control

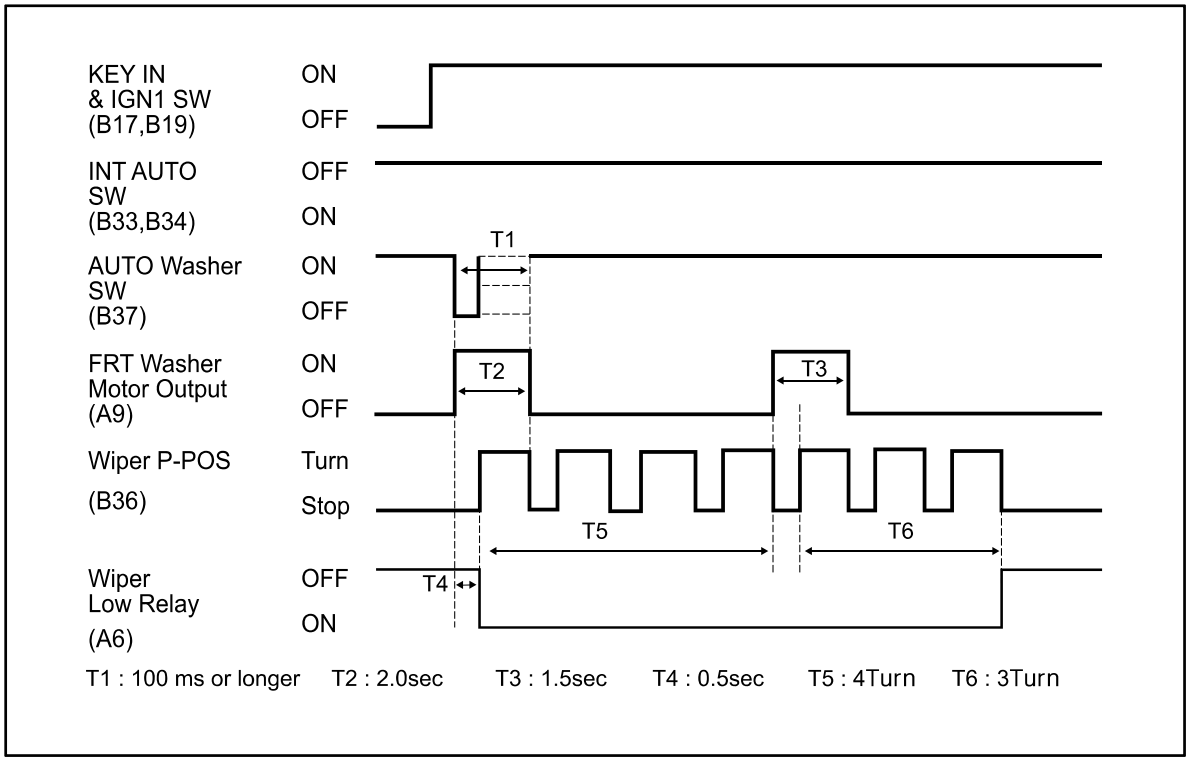
1. When turning ON the rear washer switch with key IN and IGN1 ON, the washer fluid is sprayed onto the tailgate glass.



Downloaded from www.Manualslib.com manuals search engine

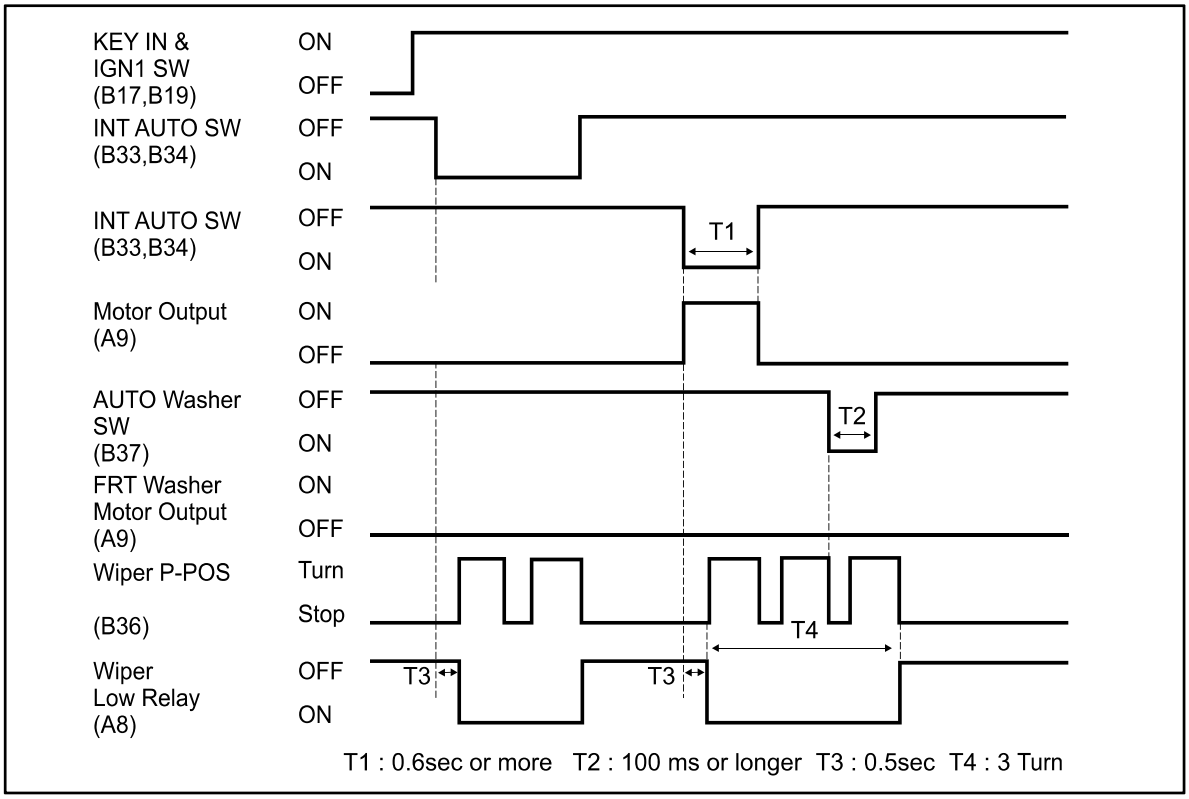
▶ Auto washer coupled wiper

1. When turning ON the auto washer switch with IGN1 ON and wiper switch OFF, the washer fluid is sprayed onto the windshield glass for 2 seconds and the wipers operate 4 times. After
2. then, additionally, the washer fluid is sprayed for 1.5 seconds and the wipers operate 3 times again.
3. The auto washer function is not available during the operation of auto washer coupled wiper. The auto washer function is not available while the wiper system is in intermittent wiping mode.
4. When turning the wiper switch to AUTO position during the operation of auto washer, the auto washer stops its operation and the intermittent wiping mode will be started.
5. The front and rear washer function are not available during the operation of auto washer.



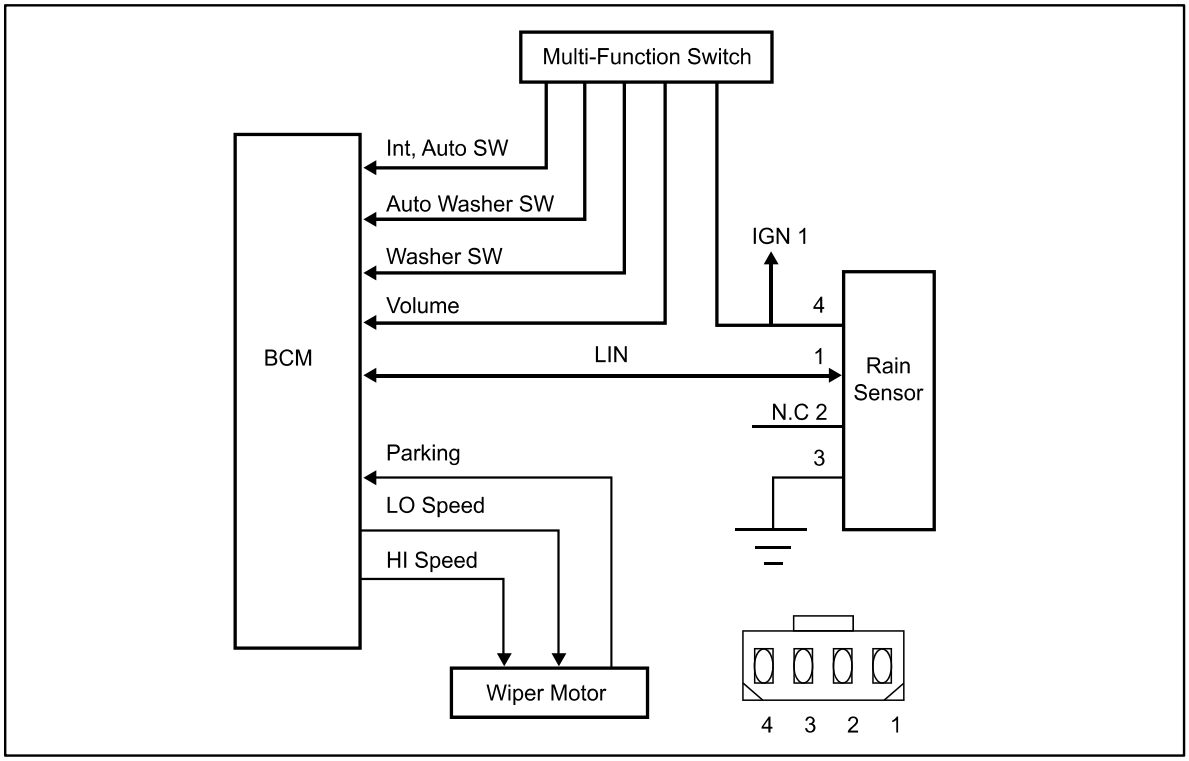
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



▶ Rain sensor coupled wiper (LIN)

1. System layout



Modification basis	
Application basis	
Affected VIN	

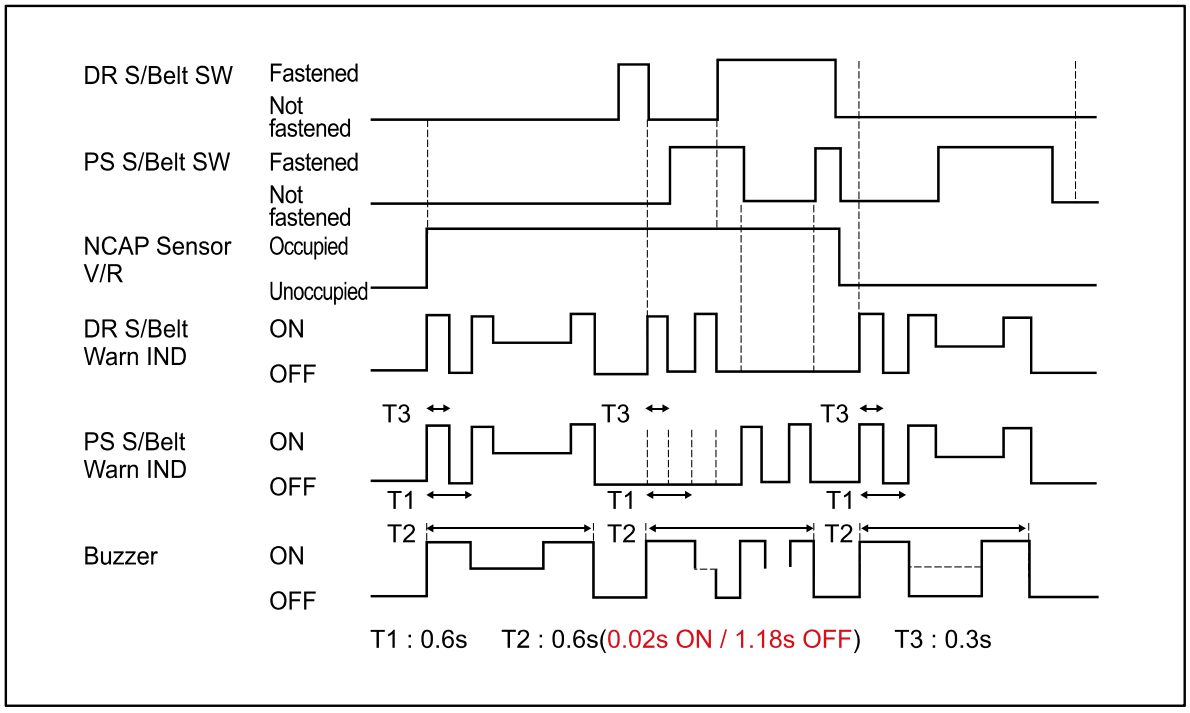
Downloaded from www.Manualslib.com manuals search engine

2. Data recognition & operation

- **Data recognition time**
  The system performs LIN communication regardless of the conditions of wiper switch her switch when the ignition switch is in ON position. If the wiper switch is in "AUTO" and the light switch is in "AUTO" position, the wiper system operates according to the LIN data.
- **Operation when recognizing data**
  No data: wiper low/high relay OFF
  S_AUTOL: low relay ON (min. one cycle ON). However, high relay is turned OFF.
  S_AUTOH: high relay ON (min. one cycle ON). However, low relay is turned ON.
  The washer function is not available when the wiper switch is in "LO" or "HI" POSITION. (The washer coupled wiper function is available only when the wiper switch is in "AUTO" position)

▶ **Power-up reminder wiper**

1. If the wiper switch is in "AUTO" position, the wiper motor does not operate even when turning the ignition switch to "ON" position.
2. When moving the wiper switch to "AUTO" from "OFF" position with IGN2 ON, the wipers operate one cycle through wiper low relay regardless of the communication with the rain sensor. Afterward, the wipers operate only when receiving S_RAIN (raining) signal from the rain sensor.

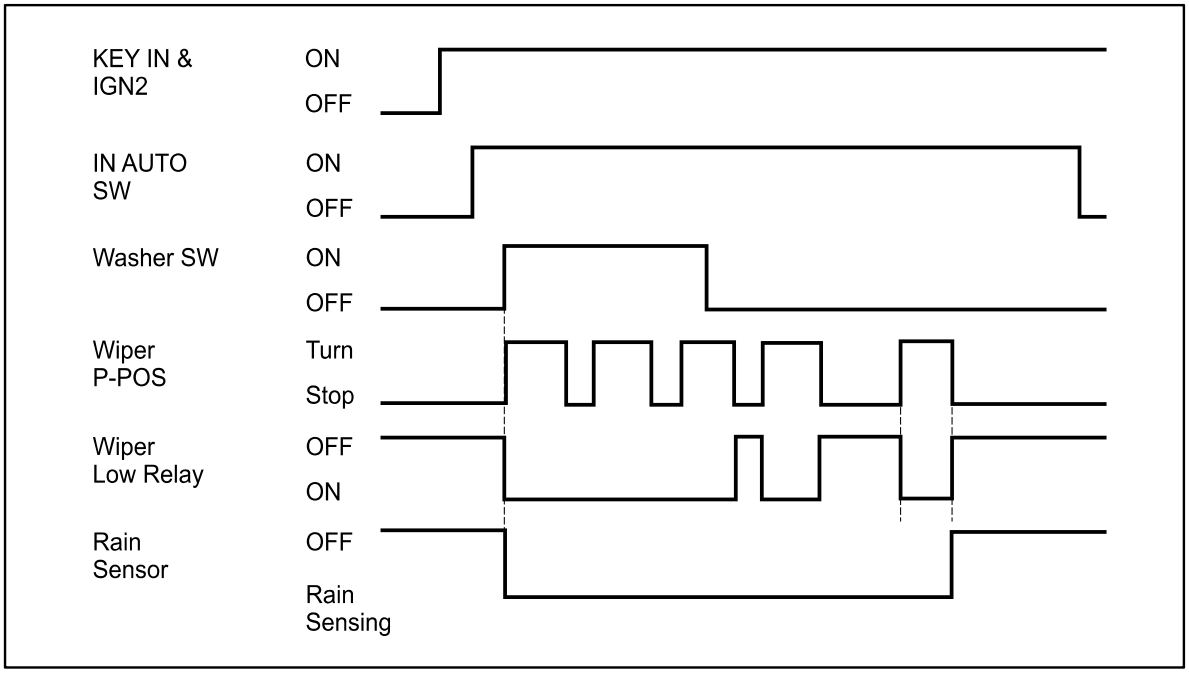


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Washer coupled wiper in rain sensing mode

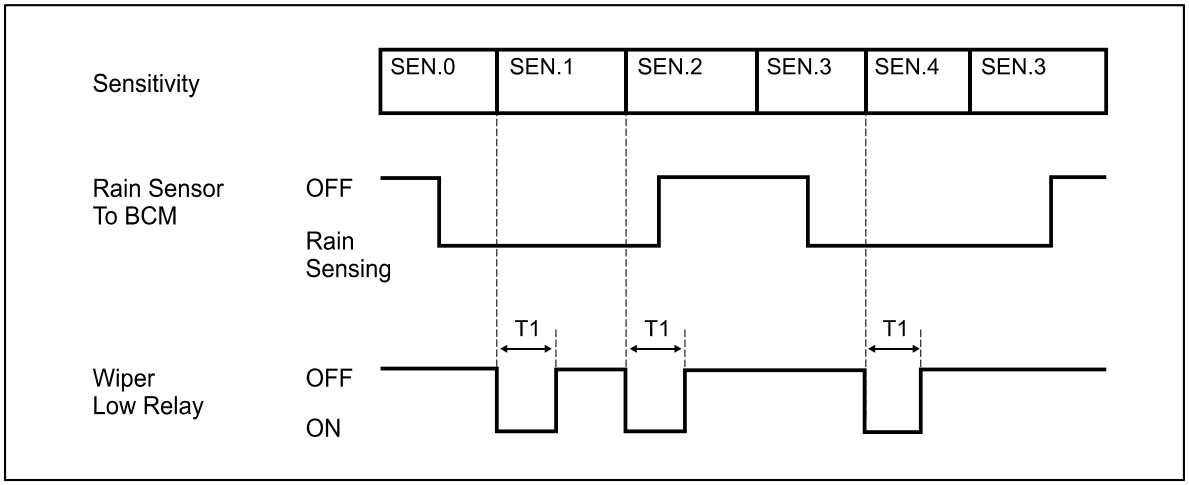
1. When turning the washer switch ON with IGN2 ON and wiper switch AUTO in rain sensing mode, the wiper operate in washer coupled mode regardless of the communication with rain sensor.
2. Even though the wiping system is in washer coupled wiper mode, the operating data are sent to rain sensor.



▶ Sensitivity adjustment

1. When increasing the wiping speed (ex: sensitivity 0 ⇒ 1) with volume dial with IGN2 ON, wiper switch AUTO and wiper motor stop (parking), the wipers operate one cycle through the low relay. (only when the signal from rain sensor is "raining")

※ If the volume sensitivity is changed within 2 seconds, the wipers operate only one cycle.

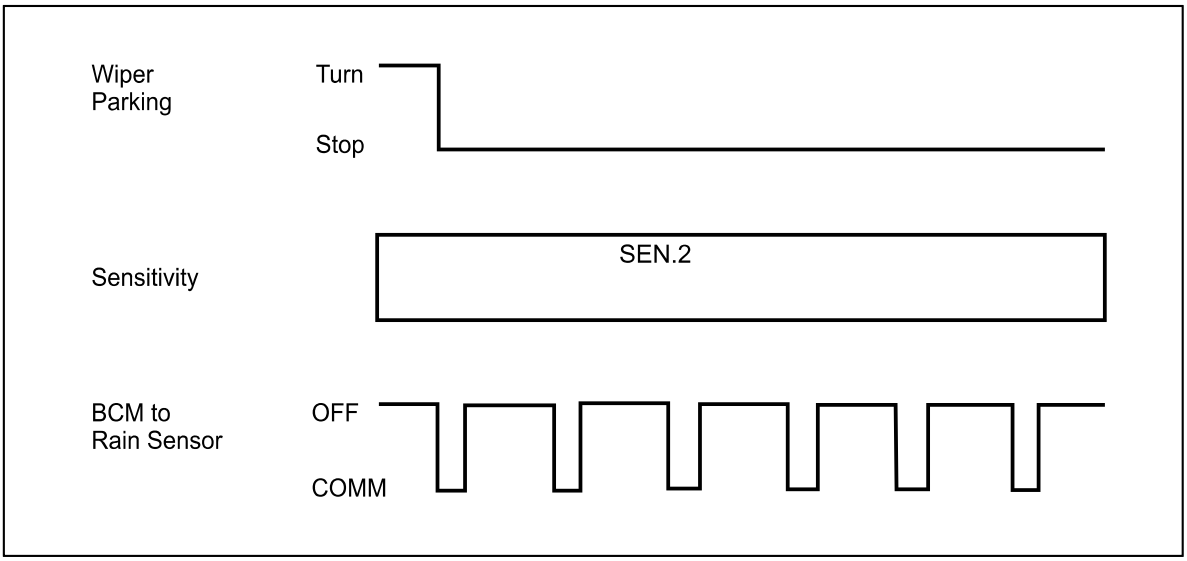


Downloaded from www.Manualslib.com manuals search engine

▶ Fault strategy for wiper parking signal

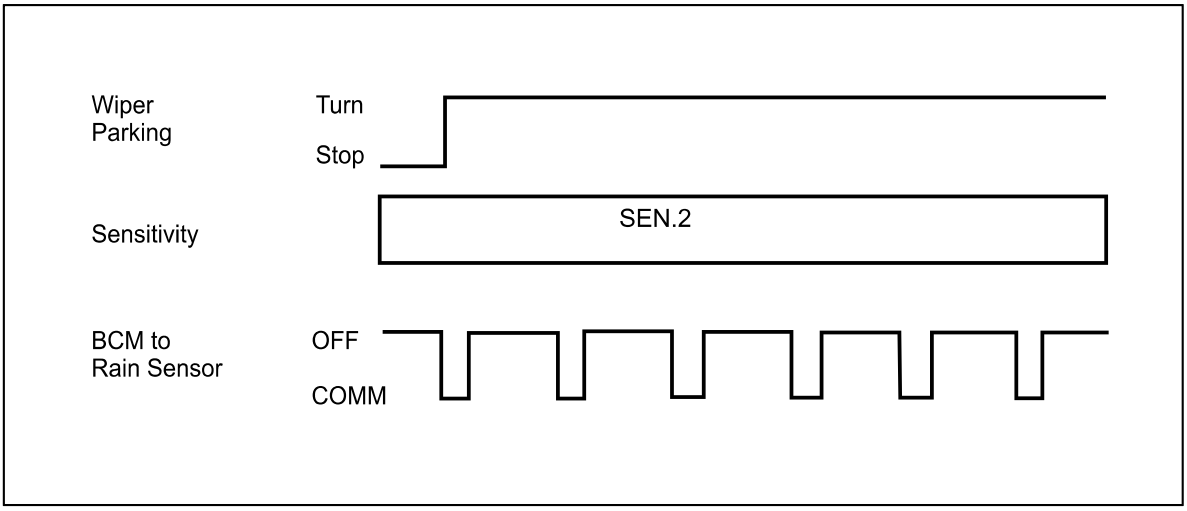
1. The wiper system continuously sends the wiper parking signal when the wiper parking terminal is grounded with IGN2 ON and wiper switch AUTO.

※ The wiper motor runs only when the rain sensor requires the wiper operation.



2. When the parking terminal is fixed at IGN (HIGH) with IGN2 ON and wiper switch AUTO, the wiper system sends the wiper operating signal for 2 seconds, then continuously sends the wiper parking signal.

※ The wiper motor runs only when the rain sensor requires the wiper operation.

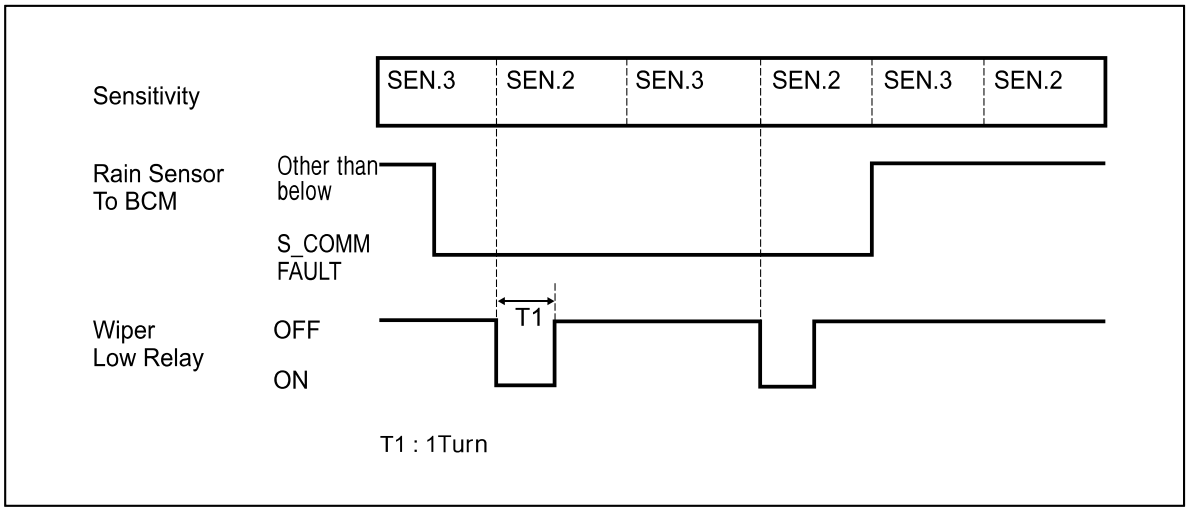


Modification basis	
Application basis	
Affected VIN	

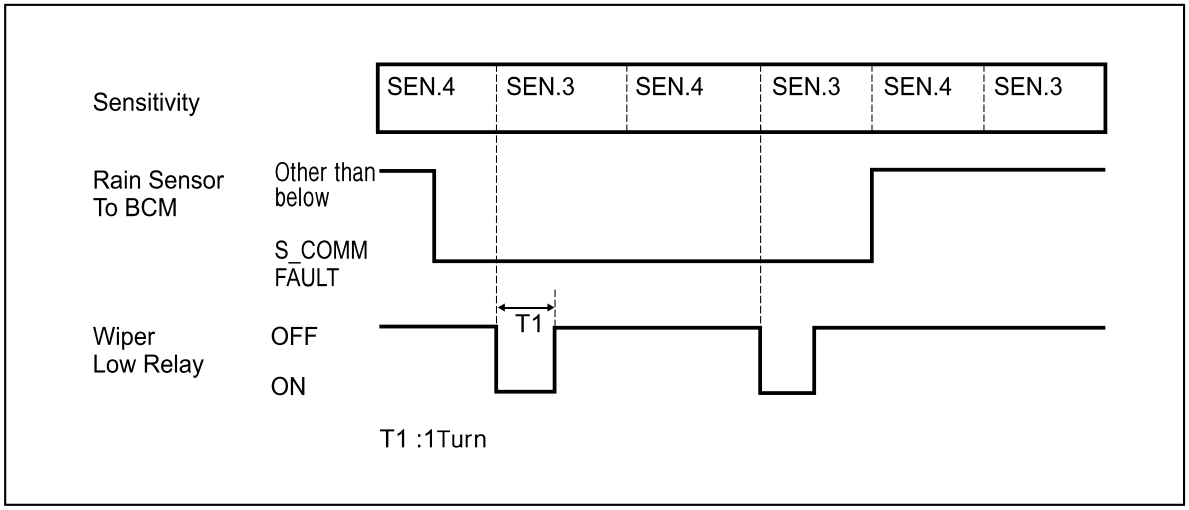
Downloaded from www.Manualslib.com manuals search engine

▶ Fault strategy for rain sensor

1. When changing the volume sensitivity to "2" from "3" with IGN2 ON and wiper switch AUTO while receiving S_RSFAULT (defective rain sensor) signal from rain sensor, the wipers operate one cycle through the low relay.



2. When changing the volume sensitivity to "3" from "4" with IGN2 ON and wiper switch AUTO while receiving S_COMMFAULT (communication error) signal from rain sensor, the wipers operate one cycle through the low relay.

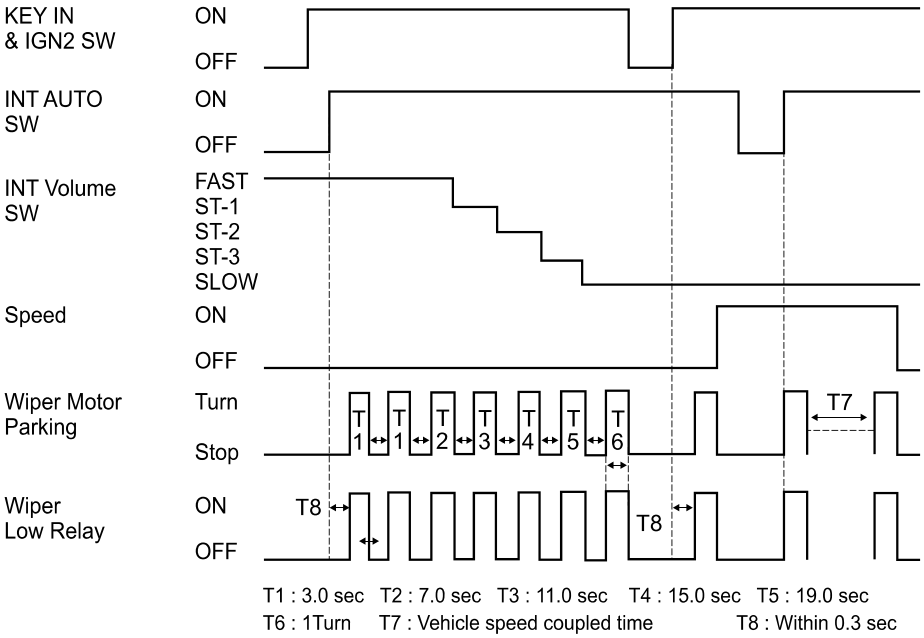


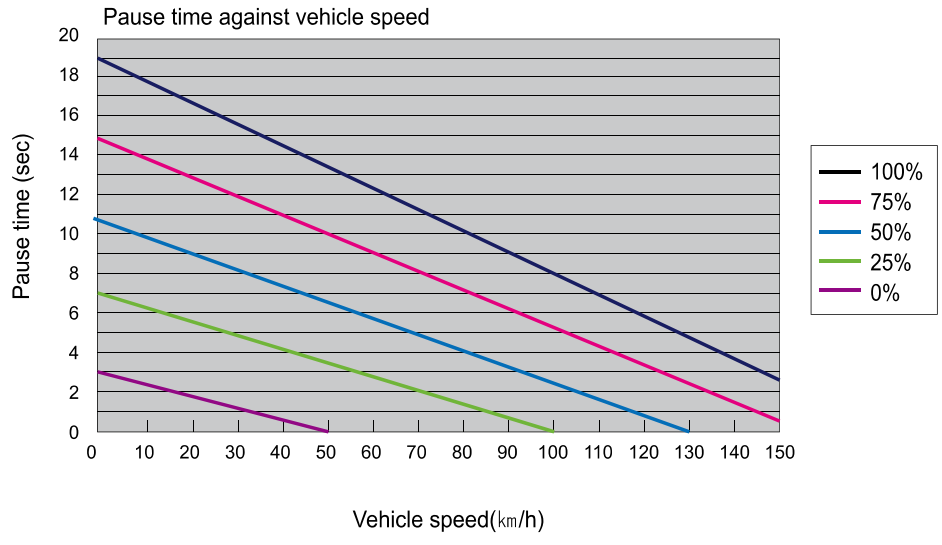
Downloaded from www.Manualslib.com manuals search engine

▶ Speed sensitive intermittent wiper

Operation for the wiping system without rain sensor

1. When turning the ignition switch to ON from OFF position with wiper switch AUTO, the wipers do not operate.
2. When moving the wiper switch to AUTO from OFF position after turning the ignition switch to ON position, the wipers operate one cycle.
3. Vehicle speed and volume sensitivity controls the intermittent wiping operation.
   - The system calculates and changes the intermittent interval by using vehicle speed and volume sensitivity with IGN2 ON and wiper switch AUTO.
   - Intermittent interval (at 0 km/h): 3±0.5 to 19±2 seconds



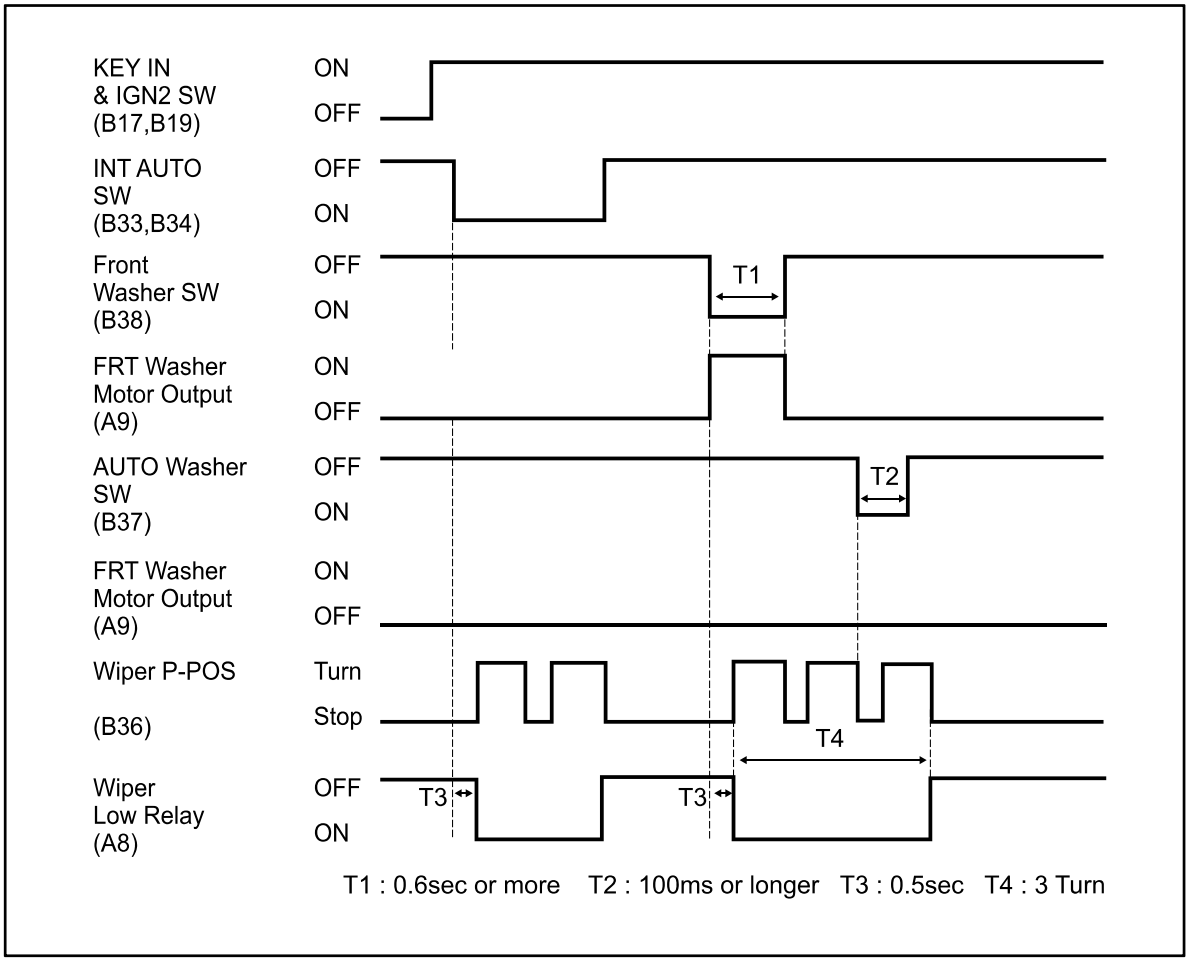


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Wiper low/high control

1. The wiper low relay is turned ON/OFF by the ON/OFF signal from wiper low switch.
2. The wiper high relay is turned ON/OFF by the ON/OFF signal from wiper high switch.
3. The wiper low relay operates all the time when the wiping system is in high speed mode (high relay + low relay).
4 The wiper motor should operate with P-POS signal even when turning off the ignition switch during wiper operation.
5. The wiper relay should stay ON during wiper operation in low/high mode even though the system does not receive P-POS signal. (In "AUTO" mode, the wiper relay should be turned OFF after 5 seconds if there is no P-POS signal for 3 seconds. - inform to car owner)
   In high/low mode, the front washer motor should operate when turning ON the front washer switch.
6. In high/low mode, the rear washer motor should operate when turning ON the rear washer switch.
7. The auto washer function is not available during high/low mode.
8. The wipers should go back to low parking position when turning off the ignition during high mode.



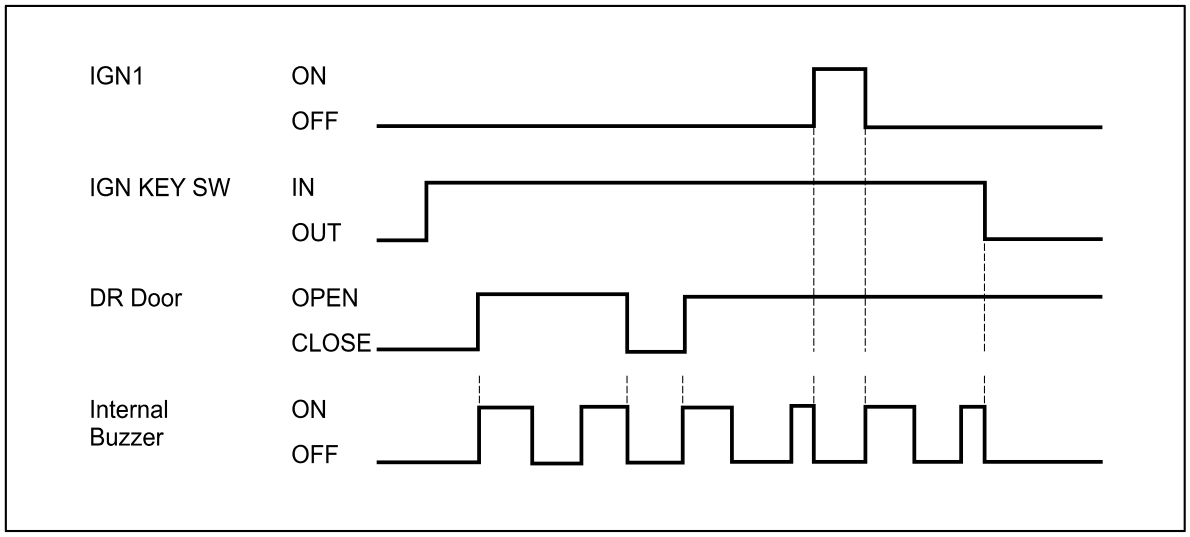
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Ignition Key Reminder Warning

▶ **Ignition key reminder warning**
(This function has priority over the "Tail lamp on warning".)

1. When opening the driver door while the ignition key is in ignition switch, the buzzer sound for 10 seconds with the interval of 0.02s ON/1.38s OFF.
2. When removing the ignition key or closing the driver door during the period, the buzzer stops its operation.
3. This function is not available when the ignition switch is in "ON" position.

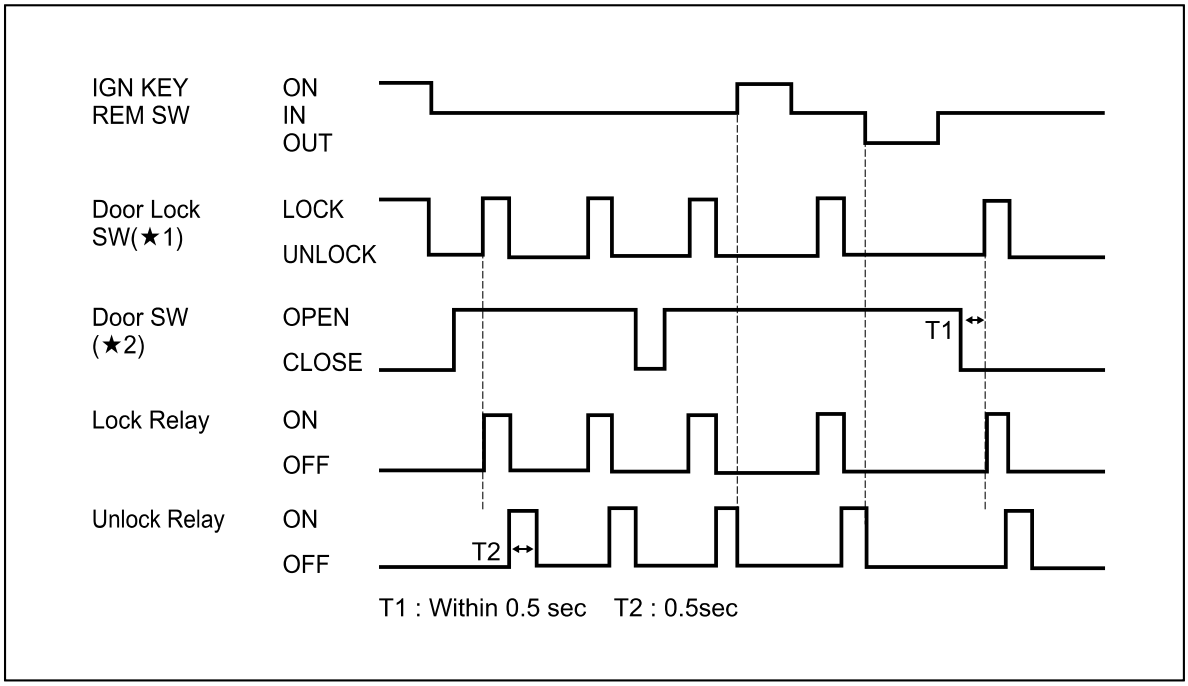


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Ignition key reminder

1. When opening a front door or turning on the door lock switch while the ignition key is in ignition switch, the doors are locked once but immediately unlocked.
2. The doors should be stayed in "UNLOCK" condition for T2 even when locking them by door lock switch in T1 after closing the opened door.
3. However, the doors should not be unlocked when removing the ignition key during the locking process by door lock switch.

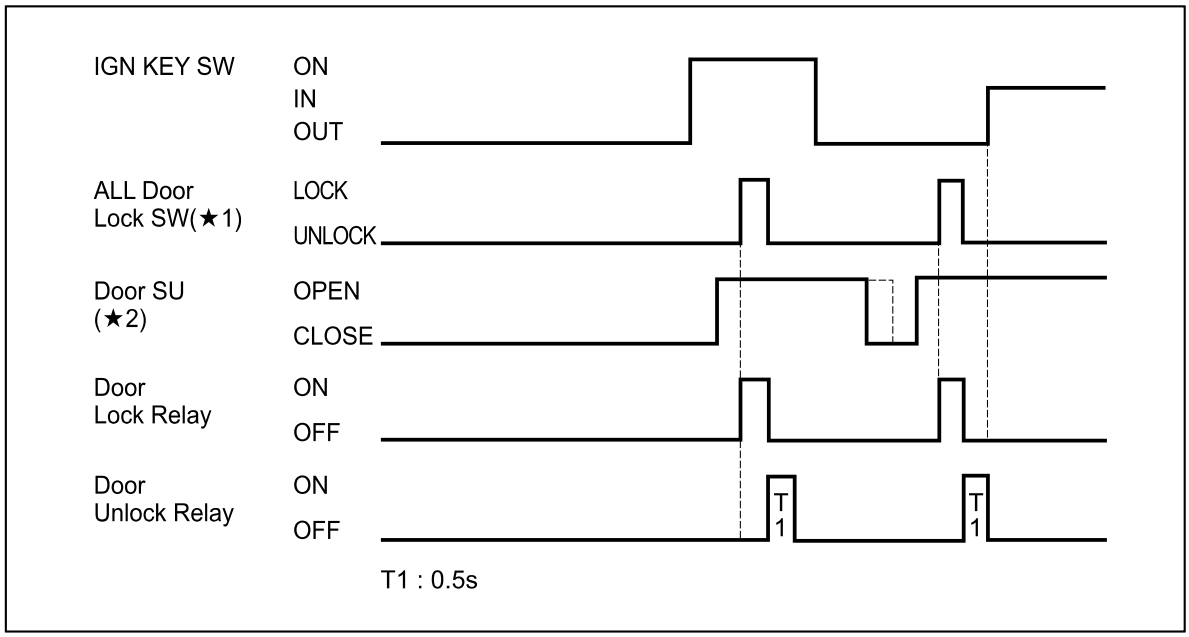


(*1) : Driver door lock switch or passenger door lock switch
(*2) : Driver door switch or passenger door switch

Downloaded from www.Manualslib.com manuals search engine

▶ **Anti-lock function when a door is open**

1. If any of doors (except tailgate and engine hood) is open, the doors are locked once but immediately unlocked when receiving the lock signal. (with key OUT and IGN ON)
2. The doors should be stayed in "UNLOCK" condition for T1 when closing the door during unlock process. (with key OUT and IGN ON)
3. The system performs the ignition key reminder function while the ignition key is in ignition switch.
4. This function is not available when the vehicle speed is over 10 km/h.



(*1) : Driver door lock switch or passenger door lock switch

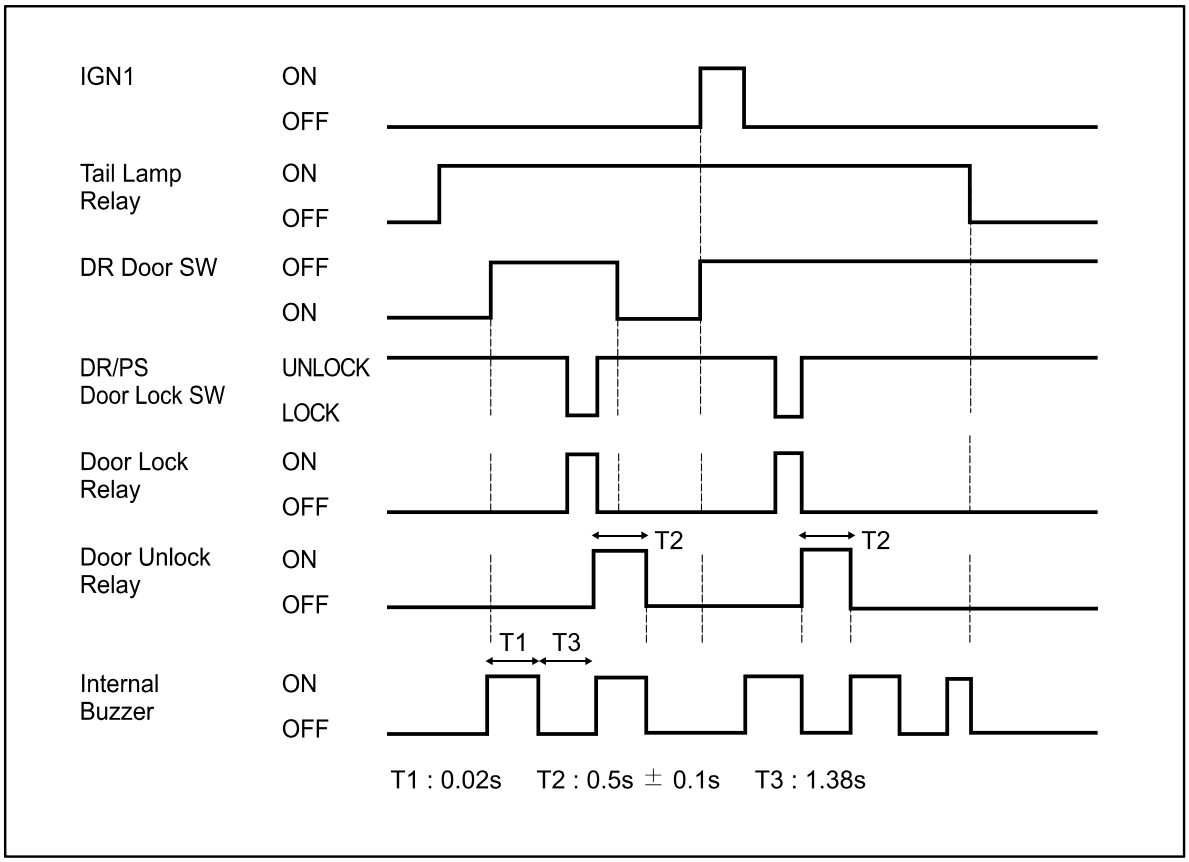
(*2) : Driver door switch or passenger door switch

Downloaded from www.Manualslib.com manuals search engine

3) Tail Lamp Control

▶ **Tail lamp left ON warning (however, sunroof and ignition key reminder functions have the priority)**

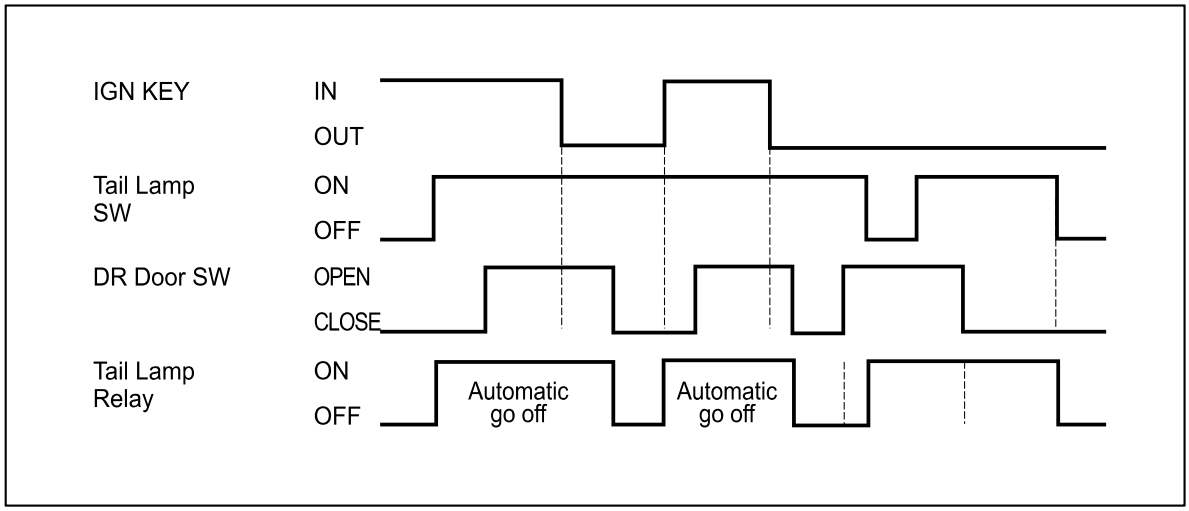
1. The buzzer sounds for 10 seconds with the interval of 0.02s ON/1.38 OFF when opening the driver door with key removed and tail lamp ON.
2. The buzzer stops its operation when turning off the tail lamp or closing the driver door during buzzer operation.
3. The buzzer stays ON when turning the tail lamp on again after turning it off during buzzer operation.
4. This function is not available when the ignition switch is in ON position.



Downloaded from www.Manualslib.com manuals search engine

▶ Tail lamp auto-cut

1. The tail lamp switch turns ON and OFF the tail lamps.
2. When opening and then closing the driver door after removing the ignition key from the ignition switch with the tail lamp ON, the tail lamps go off automatically.
3. In above conditions, the tail lamps come ON again.
4. The tail lamp should not go off when turning ON the tail lamps with key IN.
5. The tail lamps should not go off when turning OFF and then ON the tail lamp with the power Off or ACC ON.
6. The system will be reset when inserting the ignition key into key switch.



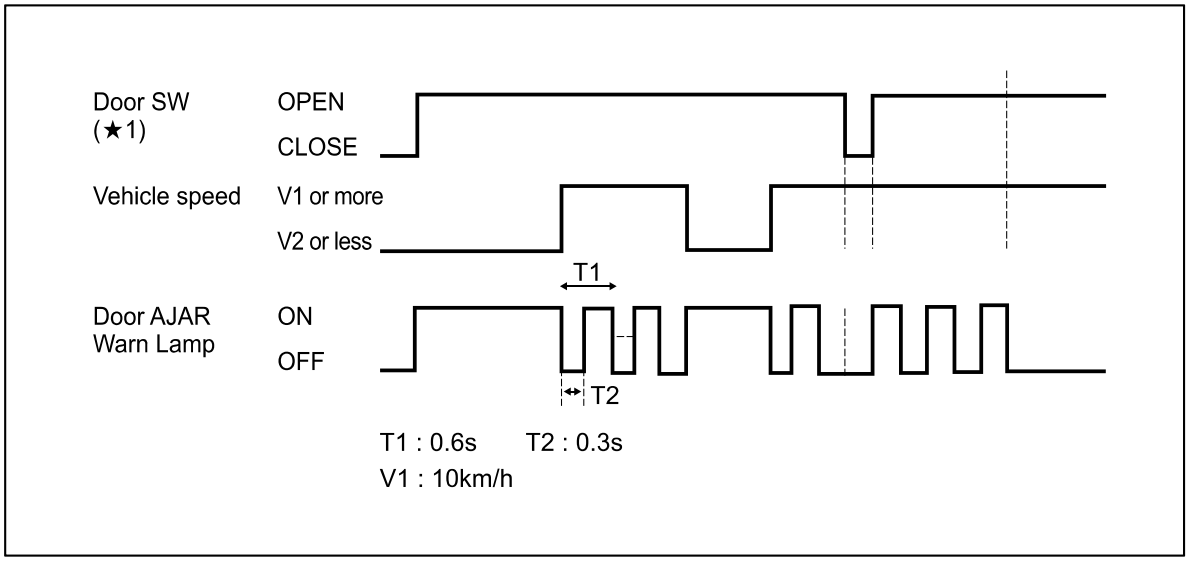
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4) Door Ajar Warning

BCM controls the door ajar warning lamp on instrument cluster. But, this control is available only when any of doors or tailgate, except engine hood, is open.

1. The instrument cluster module controls the door ajar warning lamp through the signals from BCM.
2. Also, the instrument cluster module controls the blinking function according to the vehicle speed.



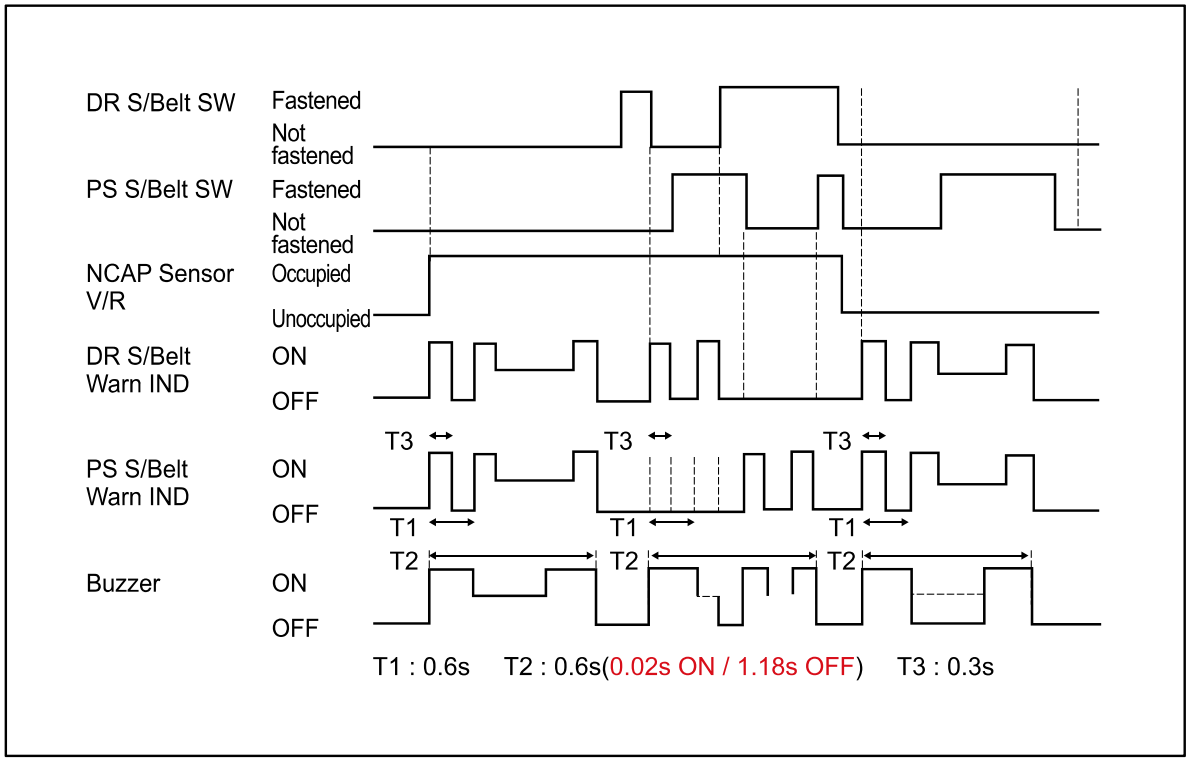
(*1) : Ajar: any of doors or tailgate is open
Closed: all doors and tailgate are closed

Downloaded from www.Manualslib.com manuals search engine

5) Seat Belt Control

▶ **Seat belt warning**

1. When turning the ignition switch to ON from OFF position, BCM sends the driver and front passenger seat belt warning signals to the instrument cluster module through CAN, and the buzzer sounds for T2 with the interval of 0.02s ON/1.18s OFF. If the seat belt switch is ON (seat belt fastened), the buzzer does not sound but the warning lamp blinks during the period. (the buzzer is controlled by BCM and the warning lamp is controlled by ICM)
2. The instrument cluster module controls the seat belt warning lamps by seat belt warning signals from BCM.
3. When turning the ignition switch to OFF position during the warning operation, the buzzer stops and the warning lamp goes off.
4. If the seat belt switch is ON (seat belt fastened) during the warning operation, the buzzer stops but the warning lamp blinks for the remaining time of the period.
5. If the seat belt switch is turned to OFF (unfastened) from ON (fastened) with IGN ON, the seat belt warning lamp comes ON and the buzzer sounds again for T2.
   But, if the seat belt reminder condition occurs during the warning operation, the warning operation stops and the seat belt reminder function is started.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Seat belt reminder

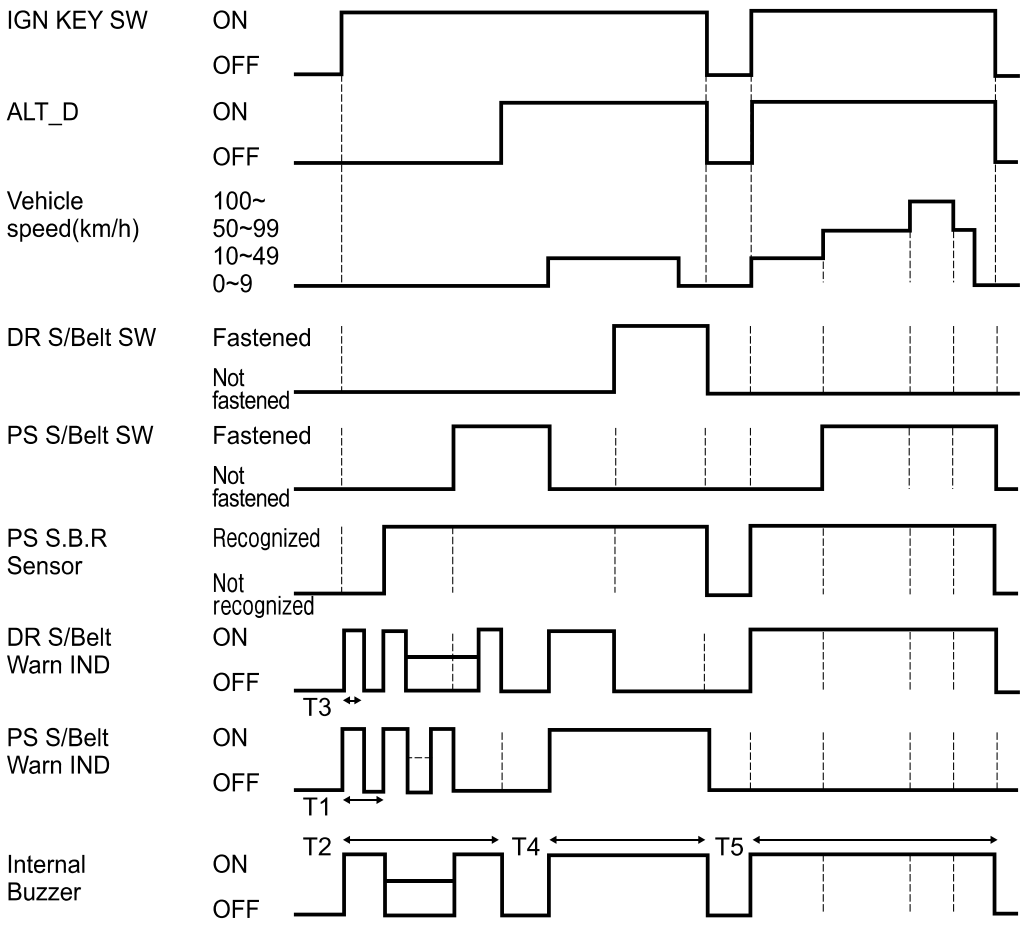
1. Operating conditions for seat belt reminder: IGN ON, engine running, vehicle speed 10 km/h, driver seat belt unfastened, passenger seat belt unfastened and passenger seat occupied. And, if the seat belt reminder has been operated in over 10 km/h of vehicle speed, it continues the operation even after decreasing the vehicle speed below 10 km/h.
2. The seat belt reminder stops its operation when fastening the seat belt, but starts the operation again if unfastening the seat belt.
3. If the seat belt reminder is initially operated due to unfastened driver seat belt, the buzzer sounds for 5 minutes with the interval of 0.02s ON/1.18s OFF, the instrument cluster module sends the driver seat belt warning signal (SBR) and the seat belt warning lamp stays on.
4. If the seat belt reminder is operated due to unfastened passenger seat belt, the instrument cluster module sends the passenger seat belt warning signal (SBR) and the seat belt warning lamp stays on.
5. The buzzer and the warning lamp are operated according to the vehicle speed as below table during the seat belt reminder operation.

Seat belt reminder operation

Function / Vehicle speed	WIPER CONTROL	INDICATOR	Remark
25 ㎞/h ~ 49 ㎞/h	0.02s ON / 1.18s OFF	Keep ON	
50 ㎞/h ~ 99 ㎞/h	0.02s ON / 1.18s OFF	Keep ON	
100 ㎞/h or longer ~	0.02s ON / 1.18s OFF	Keep ON	

6. Priority of buzzer operation: SBR ⇒ Key reminder warning ⇒ Sunroof warning ⇒ Tail lamp left ON warning ⇒ Hazard flasher ⇒ Turn signal lamp

Downloaded from www.Manualslib.com manuals search engine



T1 : 0.6s T2 : 6.0s(0.02s ON / 1.38s OFF) T3 : 0.3s
T4.T5 : See above table “1-1"

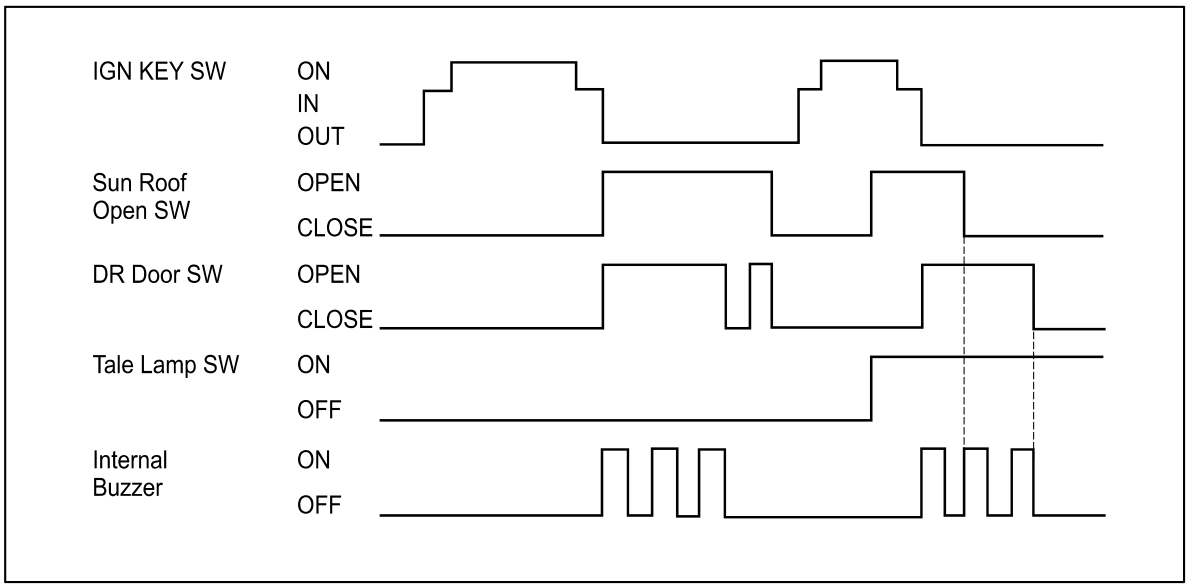
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

6) Sunroof Warning Control

▶ Sunroof warning control

1. When removing the ignition key with the sunroof open, the buzzer sounds for 10 seconds with the interval of 0.02s ON/1.58s OFF.
2. When opening and then closing the driver door or closing the sunroof during buzzer operation, the buzzer stops its operation immediately.
3. The sunroof warning has a priority over the tail lamp left On warning.



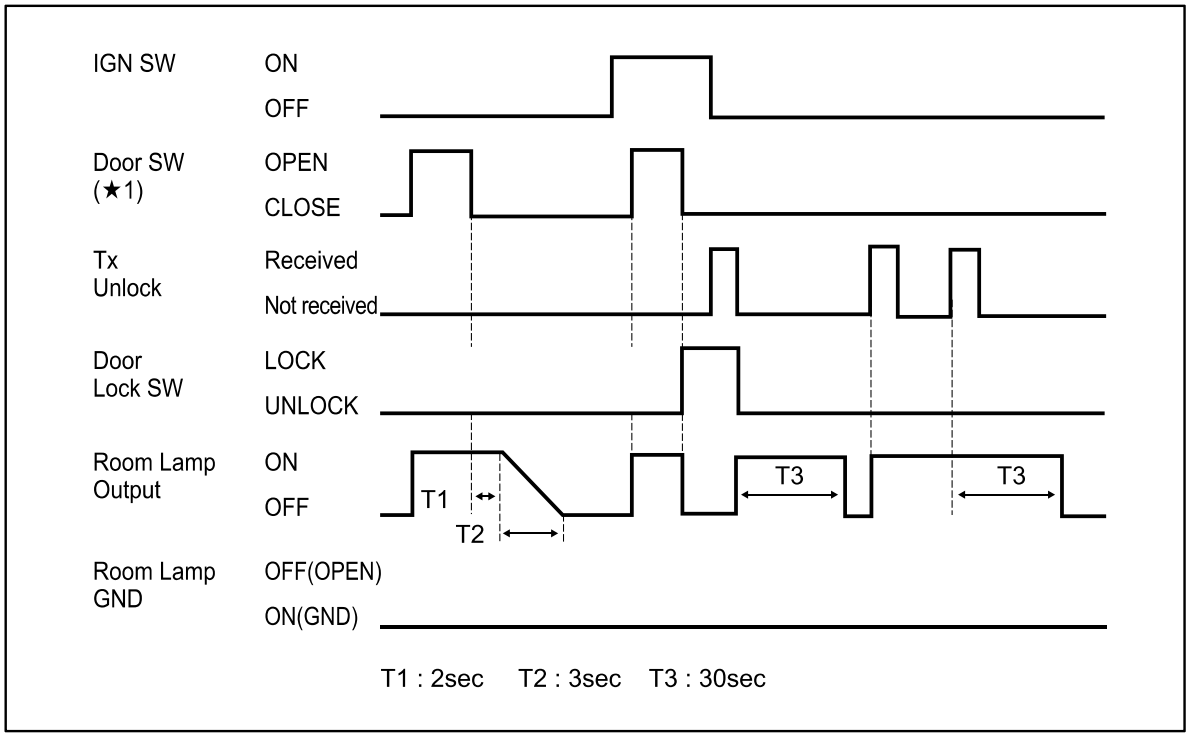
Downloaded from www.Manualslib.com manuals search engine

7) Room Lamp Control

▶ **Door coupled room lamp operation and dimming control**

When opening any of doors while the room lamp switch in overhead console is pressed in ("Door" coupled position), the front and center room lamps come on. When opening the tailgate while the luggage room lamp switch is pressed in ("Tailgate" coupled position), the luggage room lamp comes on. If the door stays open, the room lamps automatically goes off after 10 minutes.

1. When closing the door with IGN ON, the room lamps go off immediately.
2. When closing the door with IGN OFF, the room lamps stays on for T1 and are dimmed out for T2.
3. When turning the ignition switch to ON position during dimming out operation, the room lamps go off immediately.
4. When receiving the door unlock signal with IGN OFF, key OUT and door closed, the room lamps come on for T3.
5. When receiving the door unlock signal again in Step (4), the front and center room lamps stays on for T3 additionally.
6. When opening a door during the dimming operation, the room lamps stays ON. When closing it again, the system performs the operation in Step (1) and (2).
7. The room lamps go off immediately when entering into the theft deterrent mode.

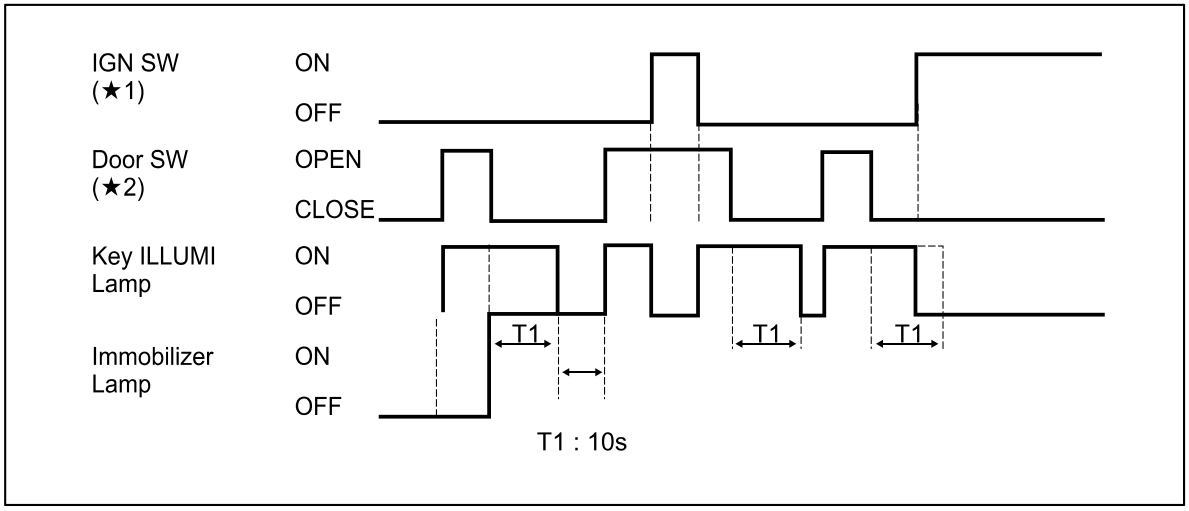


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8) Key Hole Illumination

1. When opening a front door with IGN OFF, the key hole lamp comes on.
2. When closing the door, the key hole lamp stays on for T1 and goes off.
3. When turning the ignition switch to ON position during the operation of key hole illumination, the lamp goes off.
4. When receiving the door lock signal (entering into theft deterrent mode), the lamp goes off.
5. The key hole illumination function has a priority over the immobilizer function.
6. If the immobilizer fails to get authorization, the lamp comes on for 11 seconds with the interval of 0.5s ON/0.5s OFF regardless of the operating conditions of key hole lamp.
7. When turning the ignition switch to ON position in "Vergin" condition, the lamp comes on for 8 seconds with the interval of 0.5s ON/0.5s OFF.



(*1) ON: IGN ON
OFF: IGN OFF

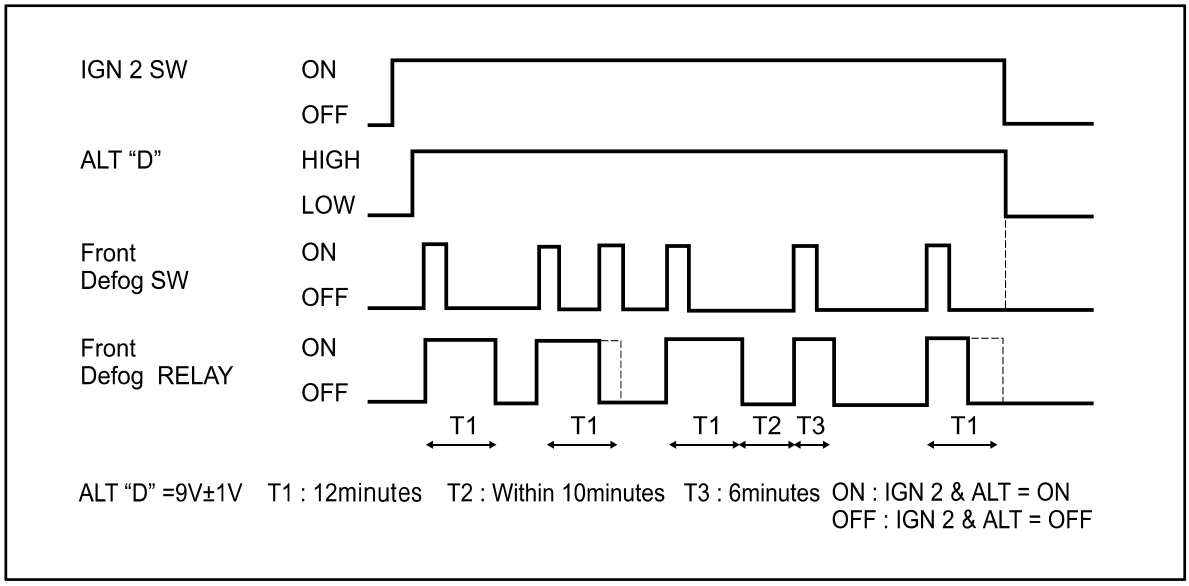
(*2) Open: driver's or passenger door is open
Close: driver and passenger door are closed

Downloaded from www.Manualslib.com manuals search engine

9) Defogger (Heated Wire) Timer

▶ **Front defogger**

1. When turning ON the front defogger switch with IGN2 ON (engine running), the front defogger operates.
2. When turning OFF the front defogger switch during the operation, the defogger stops working.
3. The defogger operates for T1. If turning ON the defogger again in T2 after completion of the first operation, the defogger additionally operates for T3. But, if the defogger has been turned off by engine stop or defogger switch, this additional operation is not available.
4. The defogger stops working when turning the ignition switch to OFF position.

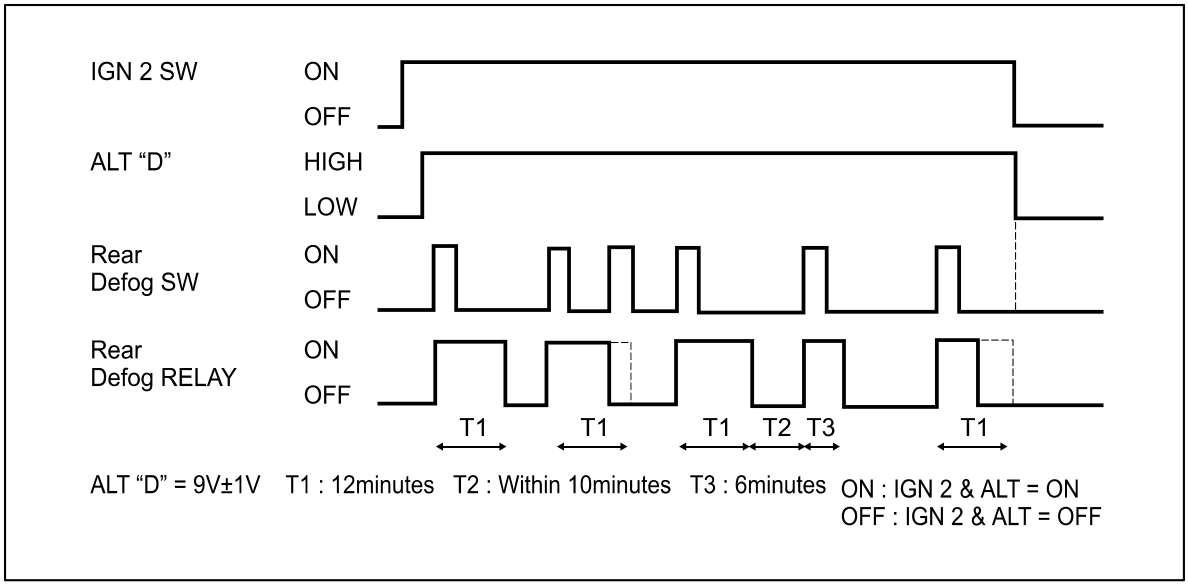


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Rear defogger

1. When turning ON the rear defogger switch with IGN2 ON (engine running), the rear defogger operates.
2. When turning OFF the rear defogger switch during the operation, the defogger stops working.
3. The defogger operates for T1. If turning ON the defogger again in T2 after completion of the first operation, the defogger additionally operates for T3. But, if the defogger has been turned off by engine stop or defogger switch, this additional operation is not available.
4. The defogger stops working when turning the ignition switch to OFF position.



Downloaded from www.Manualslib.com manuals search engine

10) Keyless Entry

▶ Transmitter (REKES key)

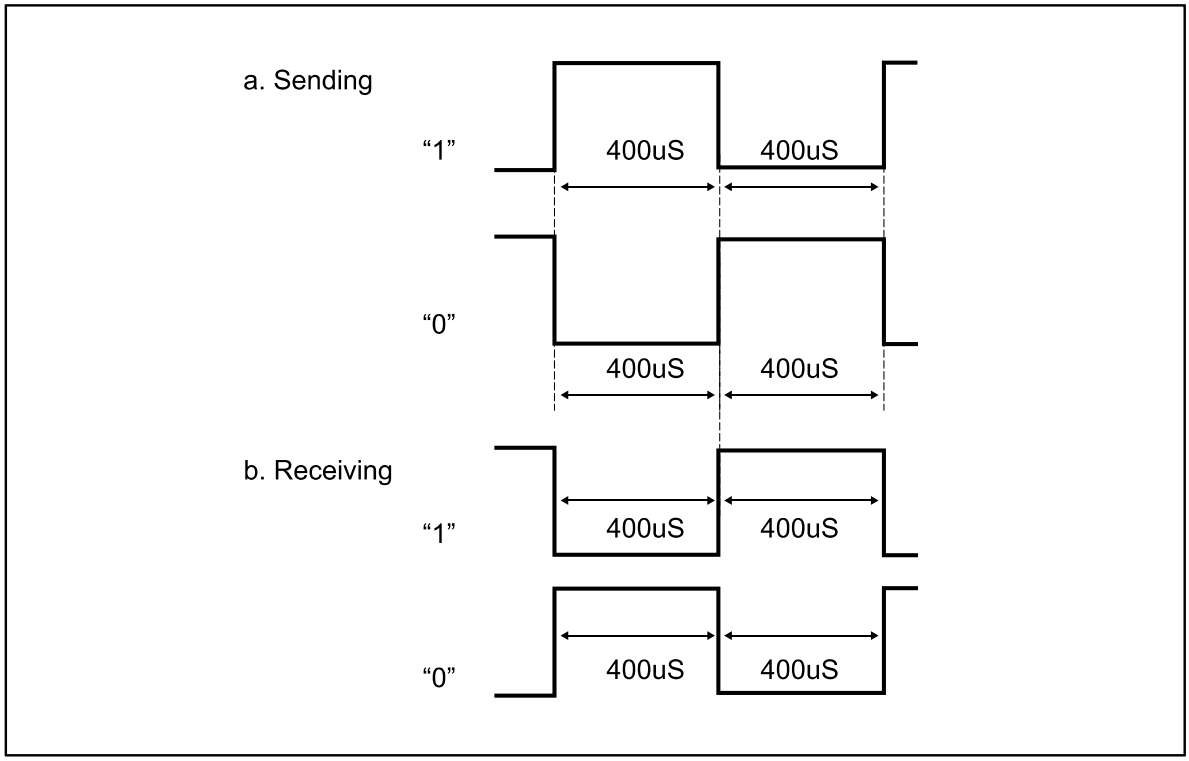
The switches on the remote control key sends some vehicle control messages.

1. Function

Remote controller switch function

Function		Switch function
Remote controller function	DOOR LOCK	Door lock switch: short press (within 0.5 sec.)
	DOO UNLOCK	Door unlock switch: Press and hold (within 2.0 sec.)
	PANIC	Door unlock switch: Press and hold (2.0 sec. or more)
	ESCORT(Only DOM)	Door lock switch: Press and hold (0.5 sec. or more)

2. Data format



Modification basis	
Application basis	
Affected VIN	

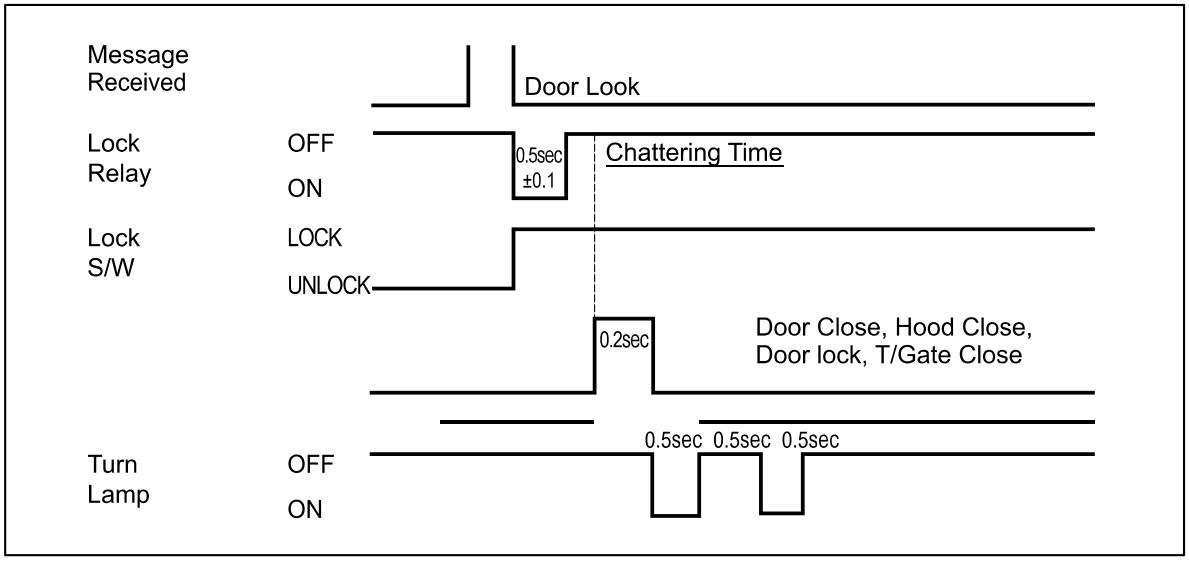
Downloaded from www.Manualslib.com manuals search engine

▶ Receiver

1. Operating condition
   - Ignition key removed from ignition switch
2. Conditions for code registration
   - The code is registered by the communication through Scan Tool.
3. How to register the transmitter ID code
   - Up to 5 ID codes of transmitter can be registered.
   - Cannot read the ID code during registration.
   - Connect the Scan Tool to the diagnostic connector.
     1) The code can be registered only by Panic signal from transmitter.
     2) (cannot be registered by other switches (lock/unlock)
        For details, refer to "coding specifications".
   - When ID code is registered successfully, the horn sounds once and the turn signal lamps flash once.
4. Code output condition
   - The available function codes are LOCK/UNLOCK/PANIC.

▶ Remote door lock

1. When briefly pressing (below 0.5s) the LOCK switch on the transmitter, the doors are locked.
2. BCM sends the door lock signal immediately after receiving the door lock message from the transmitter.
3. The REKES operation is not available when the ignition key is in the key switch. Also, it is not possible to use the switches on the remote control key for 1 second after removing the ignition key from the ignition switch to avoid unintended operation.
4. If any of doors could not be locked when pressing the LOCK switch, the system performs the unlock operation.

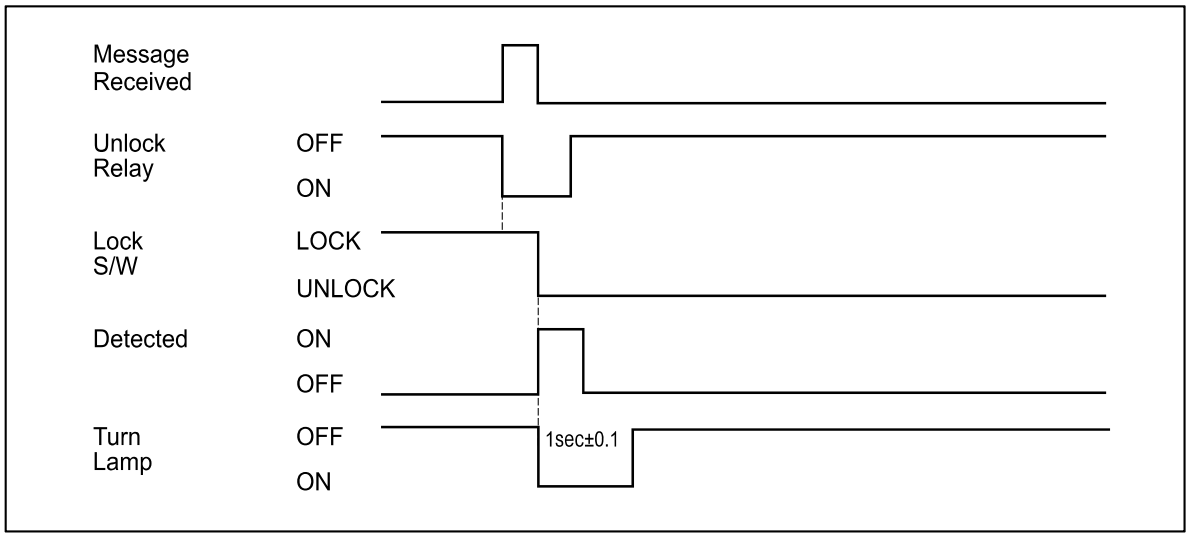


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

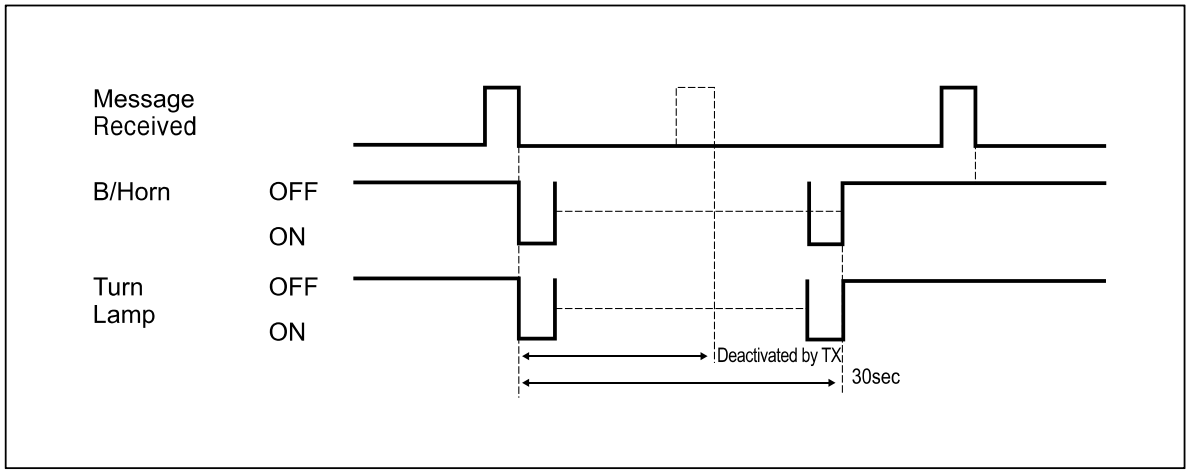
▶ Remote door unlock

1. When pressing (below 2.0s) the UNLOCK switch on the transmitter, the doors are unlocked.
2. The door unlock relay is turned ON for 0.5s when receiving the door unlock message from the transmitter.
3. The turn signal lamps blink only when all doors are successfully unlocked.
4. The REKES operation is not available when the ignition key is in the key switch. Also, it is not possible to use the switches on the remote control key for 1 second after removing the ignition key from the ignition switch to avoid unintended operation.



▶ Remote Panic

1. When pressing (over 2.0s) the PANIC switch on the transmitter, the panic alarm is activated.
2. When receiving the panic message from the transmitter, the horn sounds and the turn signal lamps blink for 30 seconds (Panic alarm).

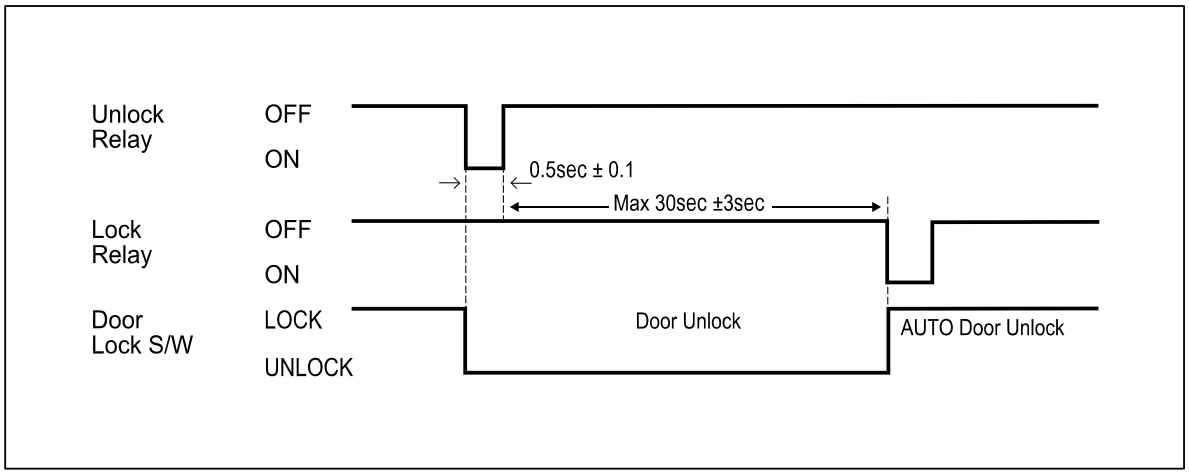


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ After 30 seconds delay auto door lock (Re-entering into theft deterrent mode)

1. If a door or tailgate is not opened within 30 seconds after unlocking the doors with remote control key in theft deterrent mode, all doors will be automatically locked again (change to theft deterrent mode). When entering into the theft deterrent mode, the turn signal lamps blink twice and the horn sounds once.

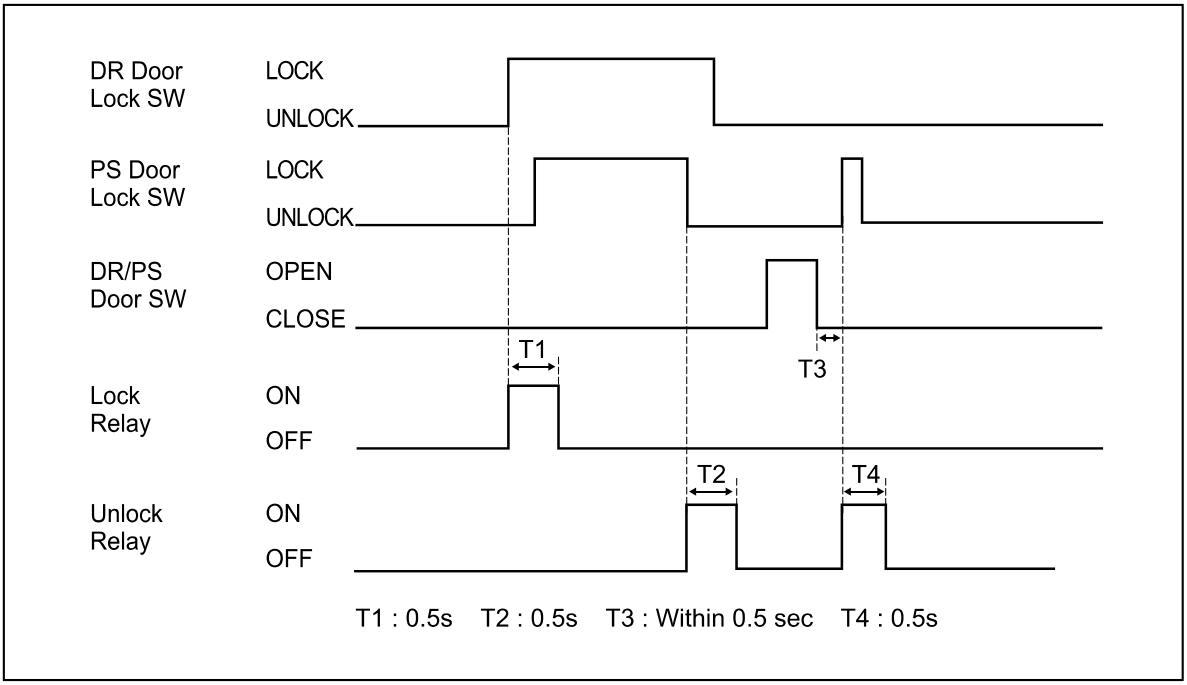


Downloaded from www.Manualslib.com manuals search engine

11) Door Lock/Unlock Control

▶ **Door lock/unlock control by door LOCK switch (knob)**

1. When moving the driver's or passenger door lock (knob) switch to LOCK from UNLOCK position, BCM sends the LOCK signal for T1.
2. When moving the driver's or passenger door lock (knob) switch to UNLOCK from LOCK position, BCM sends the UNLOCK signal for T2.
3. The LOCK (UNLOCK) operation by the door lock (knob) switch is not available when sending the LOCK (UNLOCK) signal by any other method such as remote control key.
4. When reconnecting the battery, the door lock (knob) switch is not operational before turning the ignition switch to ON position.
5. All doors stay unlocked when receiving the door lock signal in T3 after closing the doors.

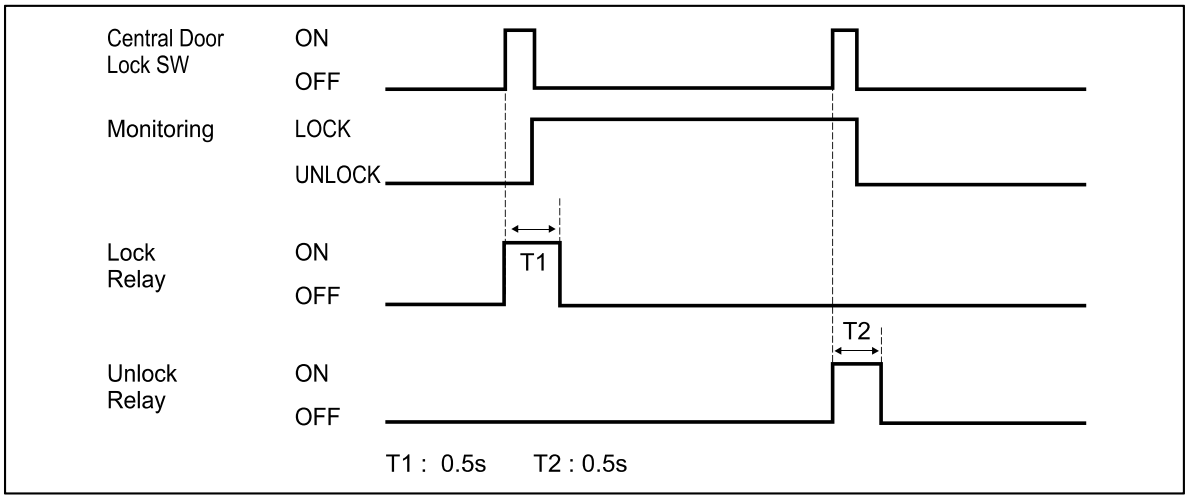


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

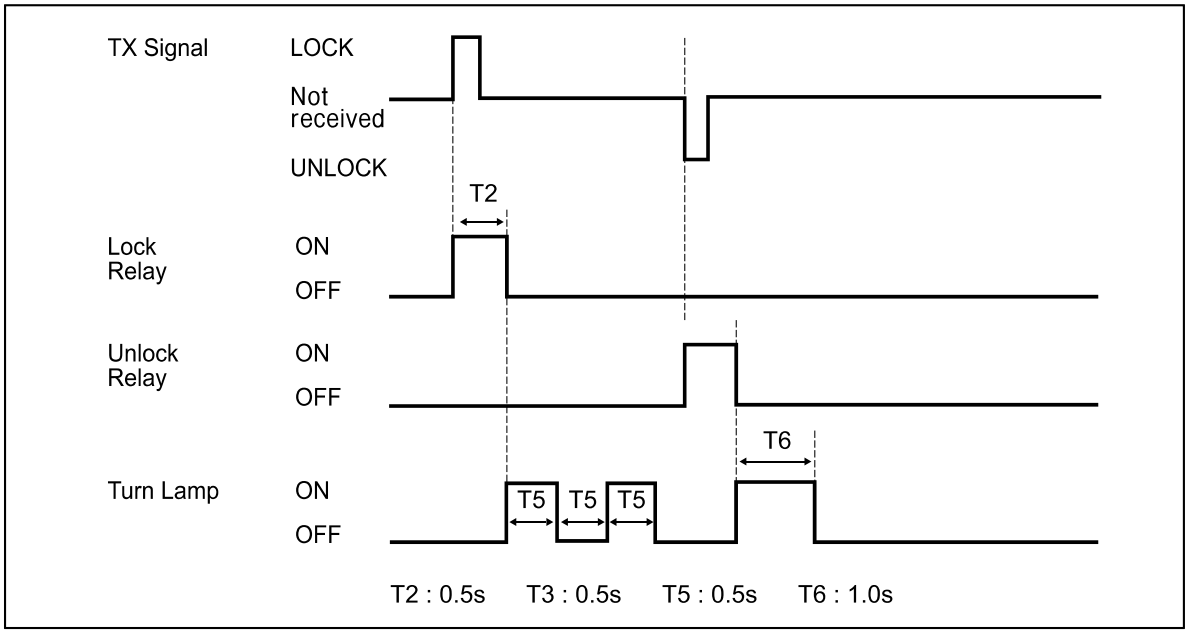
▶ Door lock/unlock control by central door lock switch

1. When pressing the central door lock/unlock switch, BCM sends the LOCK or UNLOCK signal according to the previous condition of driver door lock switch for T1.
2. The central door dock switch is not available when the system is in theft deterrent mode.
3. When stopping the engine, all doors are automatically unlocked.
4. When pressing the central door lock switch with any door open, the system unlocks the doors immediately after locking them.



▶ Door lock/unlock control by remote control switch

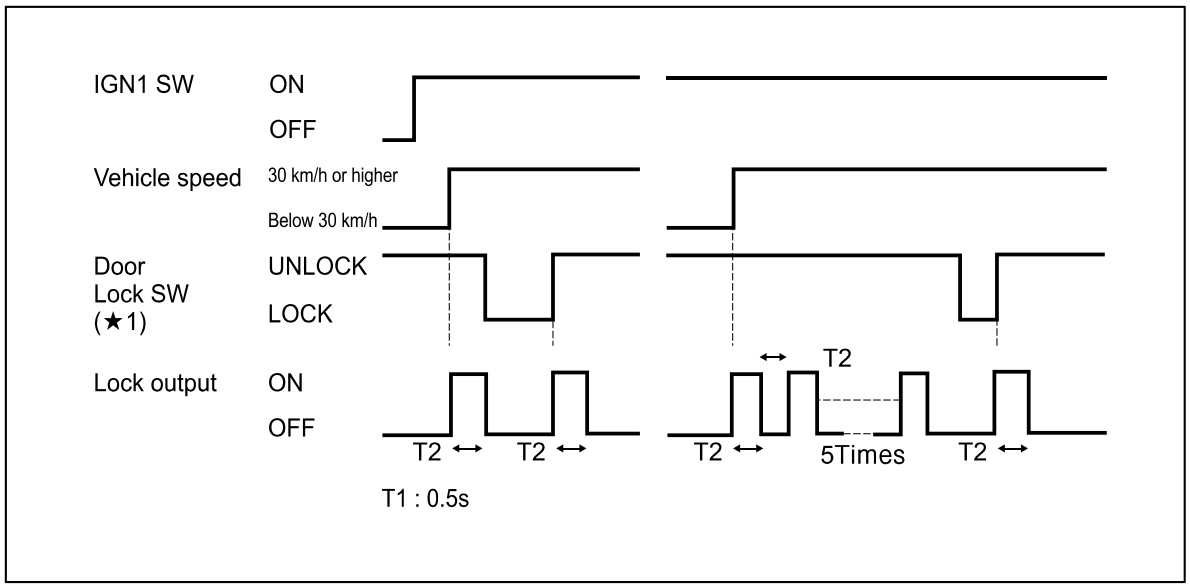
1. When pressing the LOCK switch on the remote control key, the door lock relay is turned ON for T2.
2. When pressing the UNLOCK switch on the remote control key, the door unlock relay is turned ON for T3.



Downloaded from www.Manualslib.com manuals search engine

▶ Auto door lock control

1. When the vehicle speed goes over 30 km/h, all doors are automatically locked.
2. If any of doors is not locked after Step (1), BCM sends the lock signal up to 5 times.
3. If the door is still unlocked, BCM considers the door as Fail.
4. If the door is locked, the fail record will be cleared.
5. If there is any failed door, the auto door lock function is not available.
   (Even though the vehicle speed is increased over 30 km/h again after decreased below 30 km/h, BCM does not send the auto door lock signal.)
6. When receiving the unlock signal for another door during Step (2), BCM sends the lock signal for the door up to 5 times.
7. When stopping the engine, all doors are unlocked.
8. When stopping the engine, the fail record for a door will be cleared.



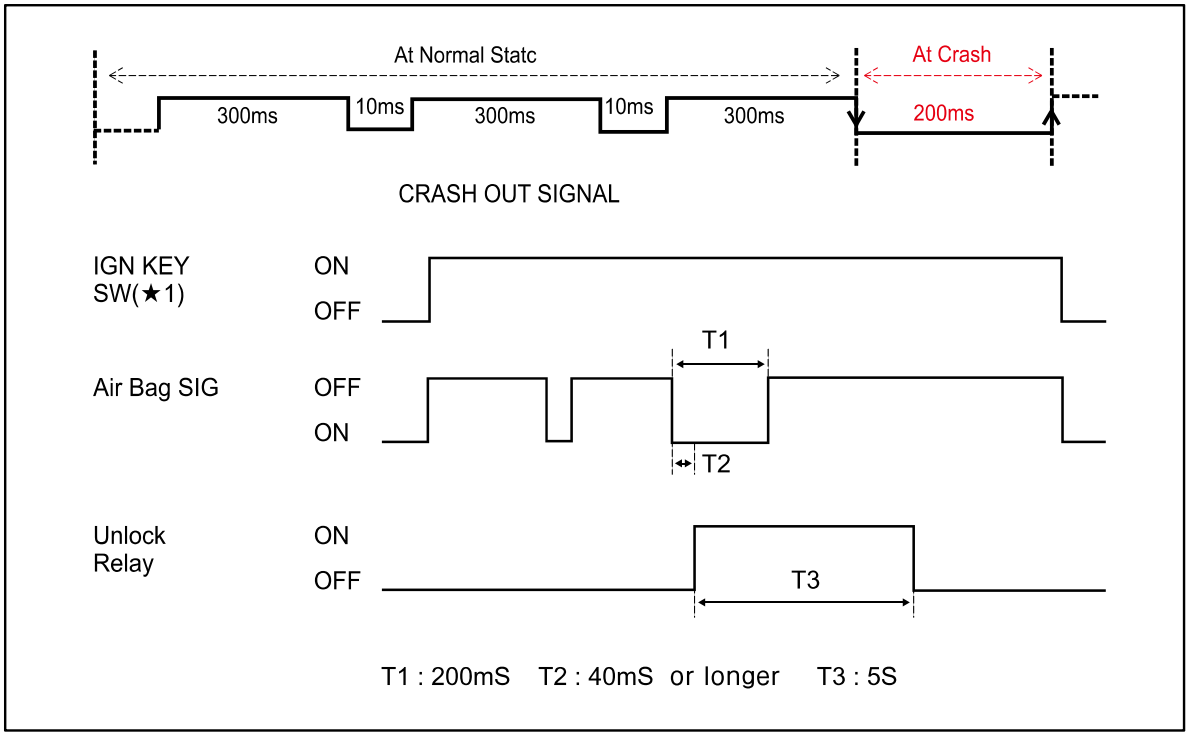
(*1) Lock: All doors including tailgate are locked.
Unlock: All doors including tailgate are unlocked.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Auto door unlock (crash unlock) control

1. The air bag signal is not available for 7 seconds after turning the ignition switch to ON position.
2. After the 7 seconds, the air bag signal is activated. If the air bag signal is turned ON (crash) from OFF, BCM sends the door unlock signal for 5 seconds after T2.
3. The unlock signal is sent for the remaining of the period even when turning OFF the ignition switch while receiving the unlock signal due to the crash.
4. The room lamps come ON when receiving the crash signal (except when the front room lamp switch is in OFF position.).
5. The turn signal lamps blink when receiving the crash signal.
6. This function is reset when disconnecting the battery.

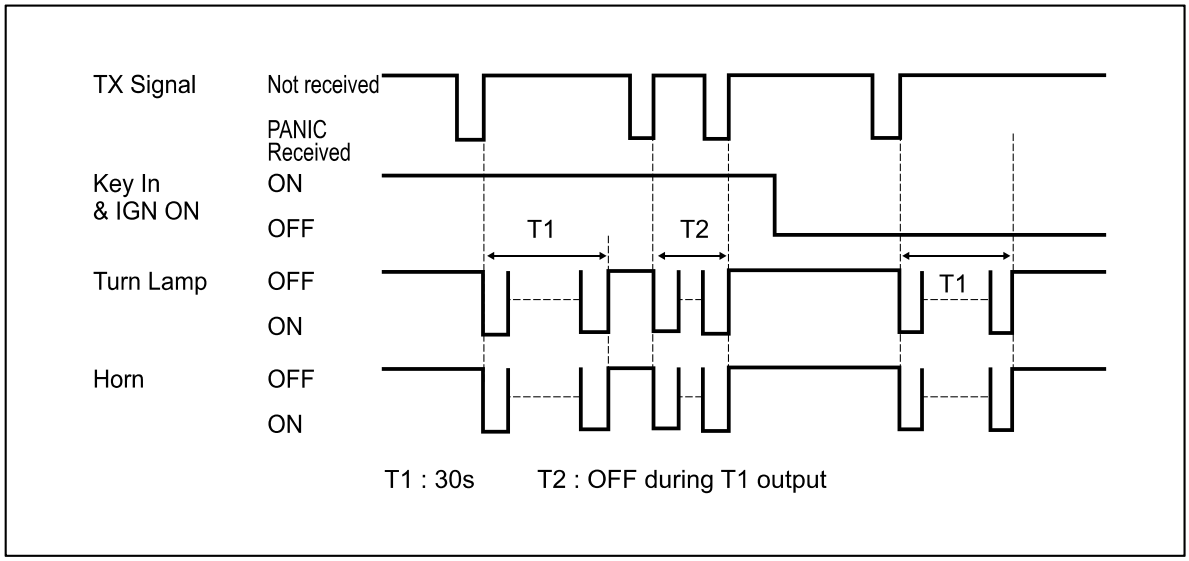


Downloaded from www.Manualslib.com manuals search engine

12) Panic Alarm

▶ **Panic alarm by REKES signal**

1. When receiving the panic signal with Power OFF, ACC and IGN ON, the horn and turn signal lamps operate for T1 with the interval of 0.5s ON/0.5s OFF.
2. When receiving the door lock or panic signal during the panic operation, the panic alarm stops.
3. The theft deterrent functions are as below:
   - The theft deterrent alarm stops when receiving the panic alarm during its operation.
   - The panic alarm stops and then the theft deterrent alarm starts its operation when occurring the theft deterrent alarm conditions during panic alarm.
4. This function should not be activated when the ignition is not in the ignition switch (EU region).

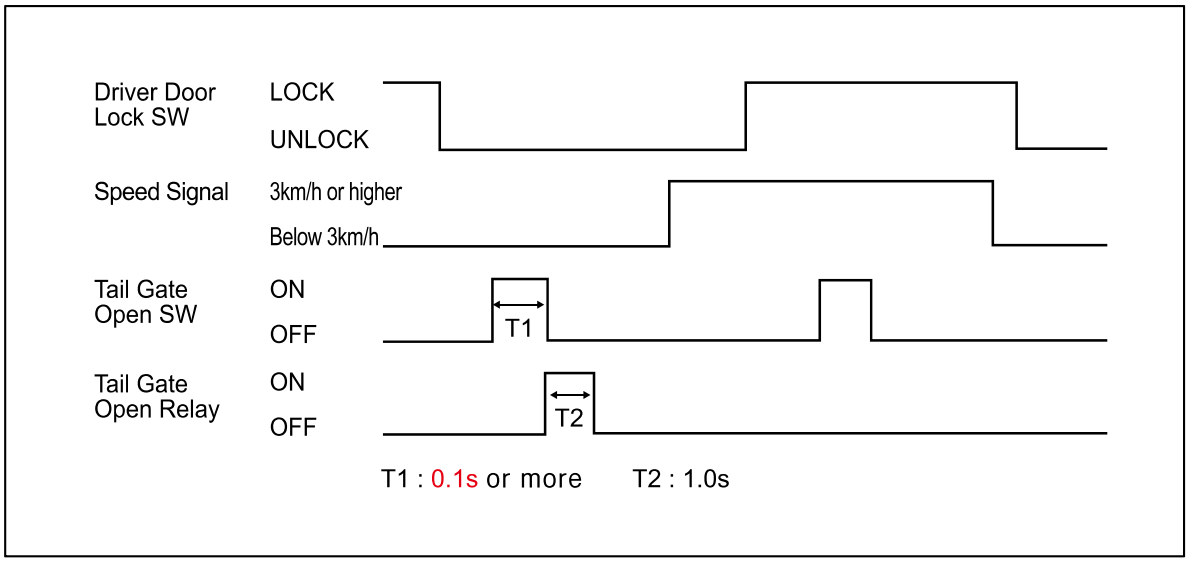


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

13) Tailgate Open Control

1. When pressing the tailgate open switch for T1 with driver door unlocked and vehicle speed below 3 (±0.1) km/h, the tailgate open relay is turned ON for T2.
2. The tailgate open relay is turned OFF immediately after the driver door is locked or the vehicle speed goes over 3 km/h.



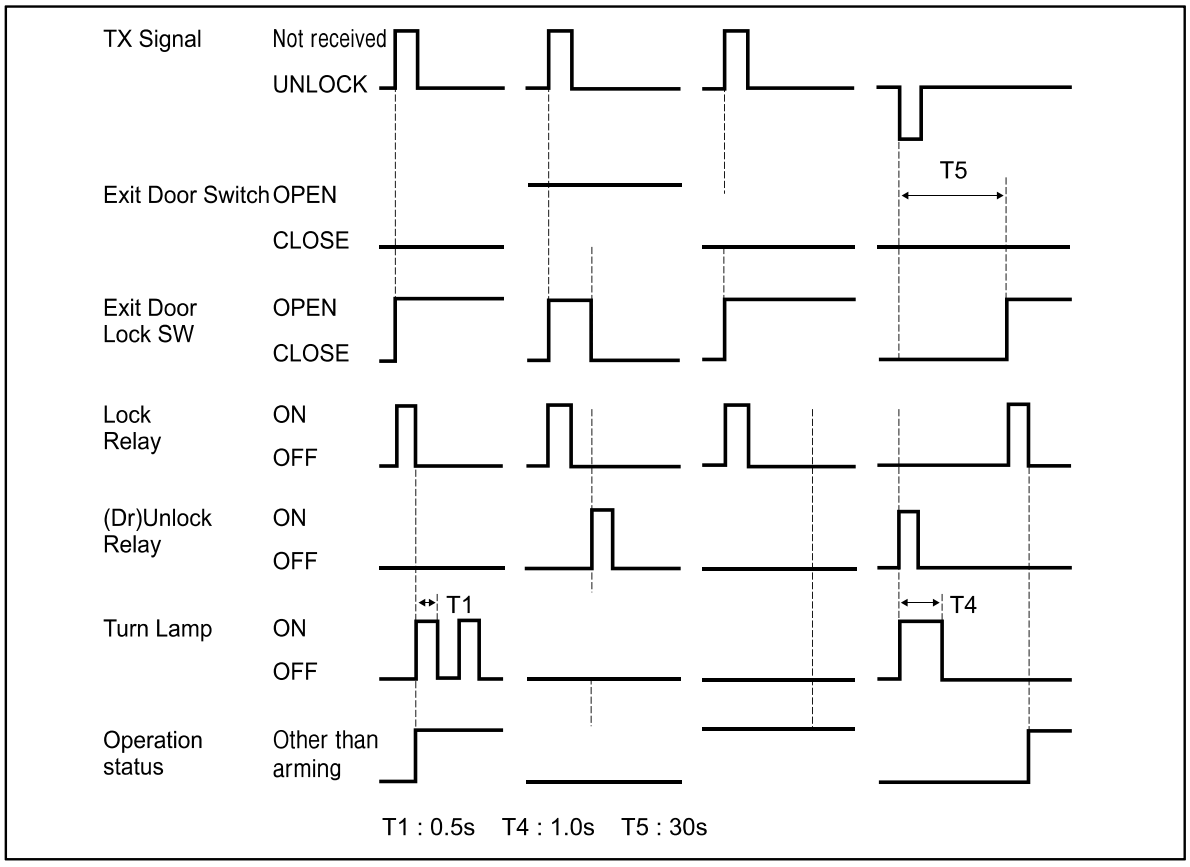
- Tailgate open: REKES unlock (disarmed deterrent mode) → Tailgate open signal → Tailgate open

Downloaded from www.Manualslib.com manuals search engine

14) Theft Deterrent Mode Control

1. Arming

- When receiving the door lock signal from REKES with key OUT, all doors including tailgate and engine hood closed, all doors are locked and the theft deterrent mode is activated. At this moment, the turn signal lamps blink twice.
  When pressing the lock switch on remote control key again in 4 seconds, the turn signal lamps blink twice and the horn sounds once in the theft deterrent mode.
  When receiving the door lock signal with any door (except tailgate and engine hood) open, the doors are unlocked immediately after locking them first.
  When receiving the door lock signal with the tailgate or engine hood open, the doors are closed if they are open, but the theft deterrent mode is not activated. However, when closing the opened tailgate or engine hood, the theft deterrent mode is activated with two blinks of turn signal lamps.
  If a door or tailgate is not opened within 30 seconds after unlocking the doors with remote control key in theft deterrent mode, all doors will be automatically locked again (change to theft deterrent mode). When entering into the theft deterrent mode, the turn signal lamps blink twice and the horn sounds once.
  The theft deterrent mode can be activated only when the above conditions are satisfied.
  Ex) The theft deterrent mode cannot be activated when locking the doors with key hole on door.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. Disarming

- When unlocking the doors or turning the ignition switch to ON position
- When receiving the door unlock signal in theft deterrent mode, all doors are unlocked and the turn signal lamps blink once (the horn does not sound).
- When receiving the door unlock signal with the theft deterrent mode disarmed, the turn signal lamps blink once (the horn does not sound).

3. In theft deterrent mode

BCM observes the conditions below continuously:

- Battery connection (B+)
- Front/rear door open
- Tailgate open
- Doors lock/unlock
- Engine hood open

4. Activation of theft deterrent alarm

- When a door, tailgate or engine hood is open,
- When unlocking the door lock switch in theft deterrent mode,
- When opening a door after completion of theft deterrent alarm (for 30 seconds),
  the horn and the turn signal lamps operate for 30 seconds with the interval of 0.5s ON/0.5s OFF.

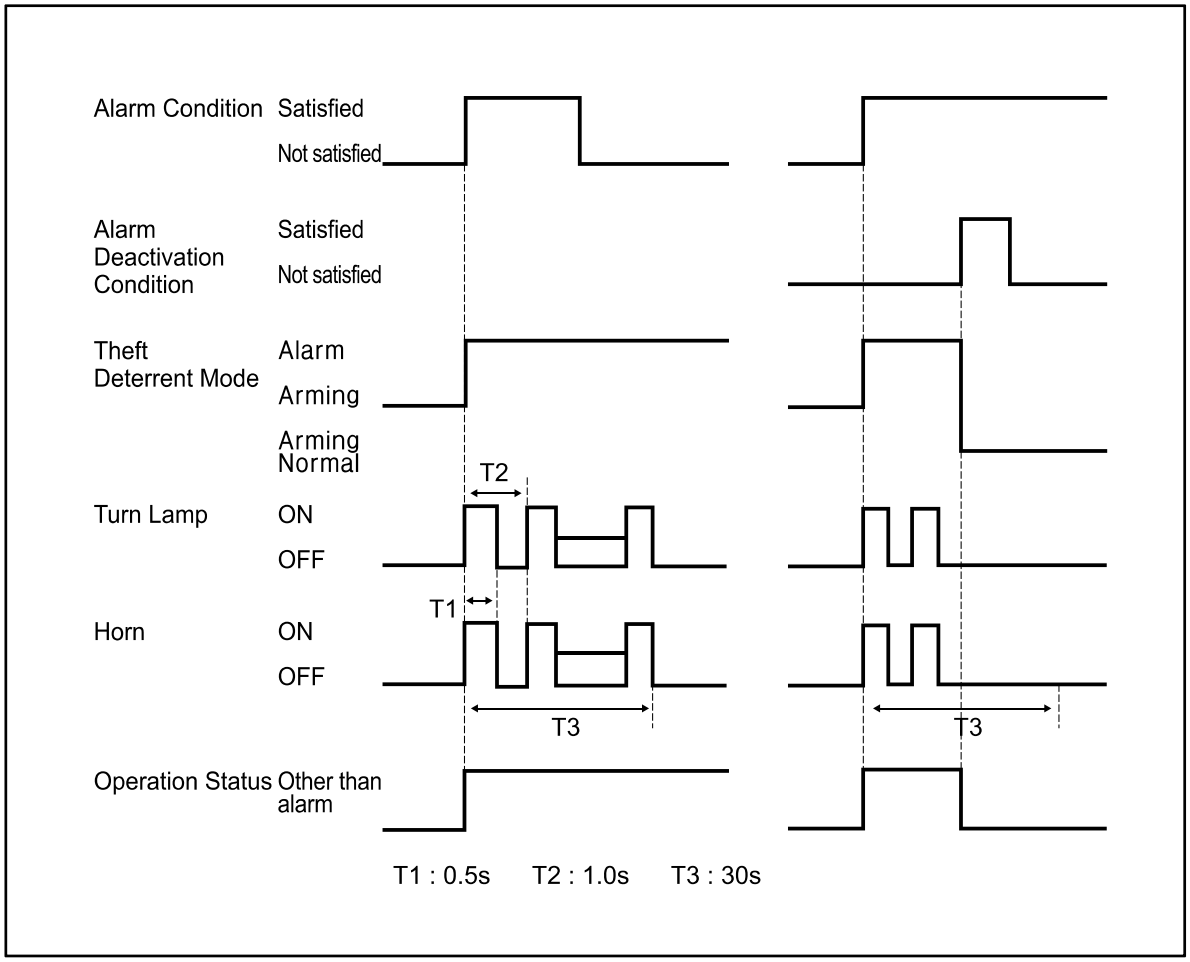
5. Disarming conditions of theft deterrent mode

- When pressing any switch (lock, unlock, panic) on the remote control key during the theft deterrent alarm, the alarm stops its operation.
- When turning the ignition switch to ON position during the theft deterrent alarm, the alarm stops its operation. (For vehicle with immobilizer system, the alarm stops after completion of authorization. For vehicle without immobilizer system, the alarm stays ON for 30 seconds)
- When turning the ignition switch to ON position during the theft deterrent alarm, the alarm stops and the theft deterrent mode is deactivated.
- If there is not any disarming commend, the alarm stays ON for 30 seconds and the theft deterrent mode continues.

6. Operation when disarming

- The horn and the turn signal lamps stop their operation.

Downloaded from www.Manualslib.com manuals search engine

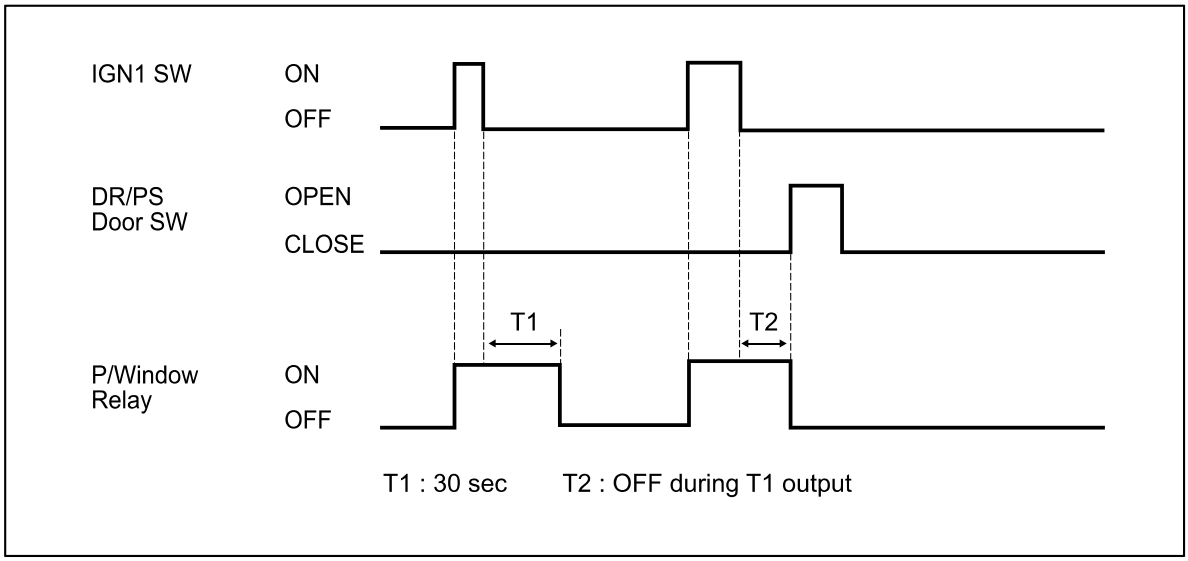


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

15) Time Lag Power Window Control

1. When turning the ignition switch to ON position, the power window relay is turned ON.
2. The power window relay keeps ON for T1 even when stopping the engine.
   However, the power window relay is turned OFF when opening a front door.
3. When locking the door with the remote control key (activation of theft deterrent mode), the power window relay is immediately turned OFF.



16) System Power Sleep Mode

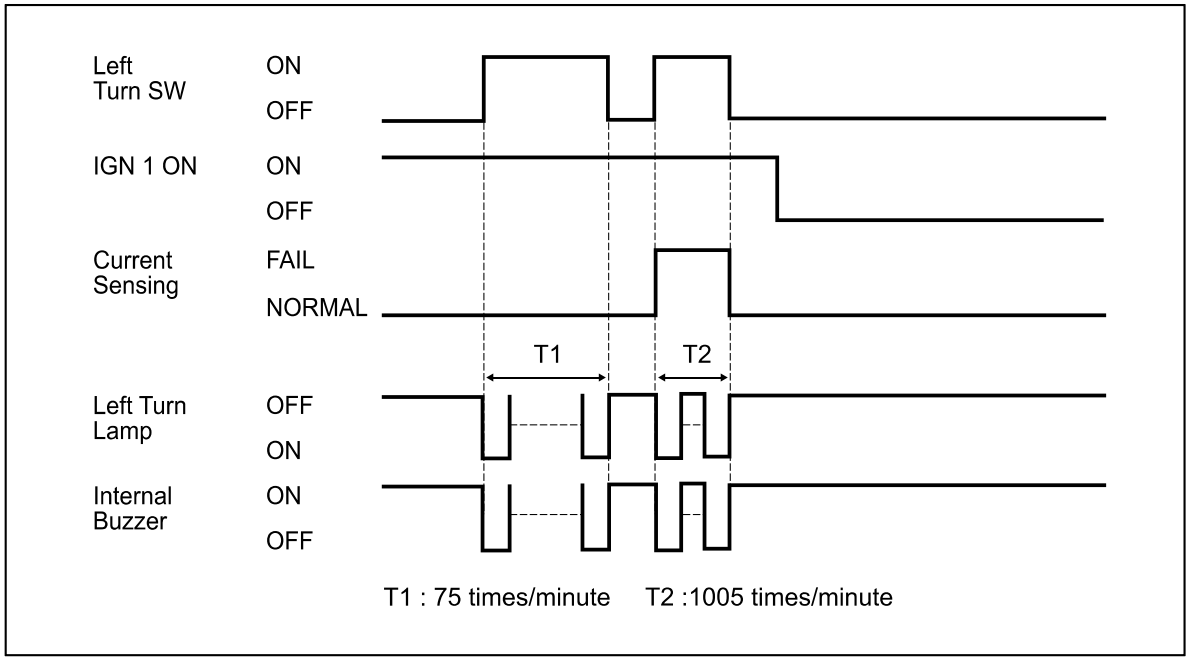
1. If the door and tailgate lock switch is not changed for 6 seconds with all doors and tailgate closed, key OUT, IGN1 and IGN2 OFF, the System Sleep Mode is activated.
2. If any of conditions in Step (1) is not satisfied, the System Wake-up mode is activated.
3. If there is not any change with all output conditions and ready conditions released, the System Sleep Mode is activated.
4. When turning on the front room lamp switch, the front room lamps come on for 10 minutes and go off, and the System Sleep Mode is activated after 6 seconds.
5. When the coming home light OFF conditions are satisfied, the System Sleep Mode is activated.
6. In this condition, when opening a door or inserting the ignition key into key hole, the System Sleep Mode is deactivated.

Downloaded from www.Manualslib.com manuals search engine

17) Flasher (Blinking) Function

▶ **Turn signal lamp control**

1. When turning ON the left/right turn signal switch, the left/right turn signal lamp blinks with the interval of 75/min and the internal horn sounds with same interval.
2. When turning OFF the turn signal switch during Step (1), the turn signal lamp and horn stop the operation.
3. The turn signal lamps are operational when IGN1 is ON.
4. If the turn signal lamp is defective during Step (1), the turn signal lamp blinks with the interval of 100/min and the internal horn sounds with same interval.
5. Defective conditions for Step (4): Open - below 3.0 A, Short - over 7.0 A
6. When turning ON the turn signal switch, the lamp blinks 3 times. When turning OFF the switch during the operation, the turn signal lamp blinks 3 times and goes off.
7. When turning OFF and then immediately ON the turn signal switch during auto blinking operation of 3 times, the turn signal lamp blinks additional 3 times.
8. When turning ON another turn signal switch during the operation, currently operated turn signal lamp stops and another turn signal lamp starts blinking.

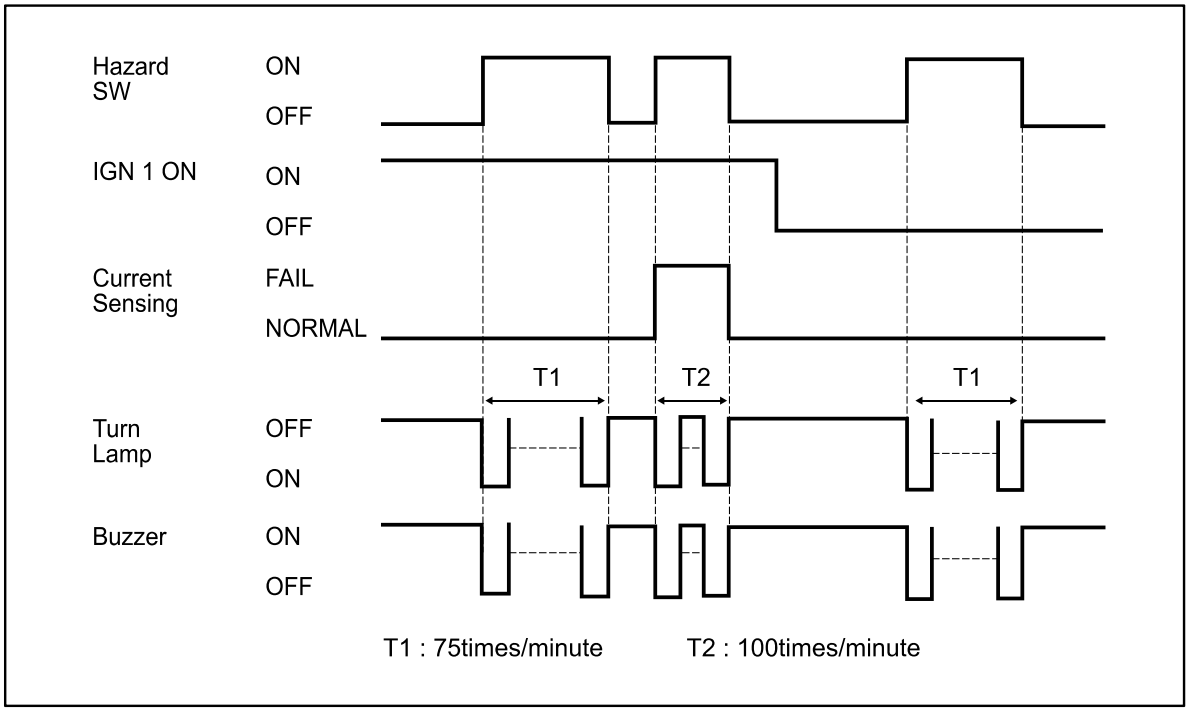


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Hazard flasher switch control

1. When pressing the hazard flasher switch, all turn signal lamps blink with the interval of 75/min and the internal horn sounds with same interval.
2. When pressing the hazard flasher switch again during Step (1), the turn signal lamps and horn stop the operation.
3. This function is available if the battery is connected (B+).
4. If the turn signal lamp is defective during Step (1), the left turn signal lamp blinks with the interval of 100/min and the internal horn sounds with same interval.
5. The tolerance between left turn signal lamp and right turn signal lamp should be below 100 ms.
6. The hazard flasher has a priority over the turn signal lamp.
7. Priority of hazard flasher: Seat belt reminder > Key reminder > Sunroof > Tail lamp > Hazard flasher > Turn signal lamp

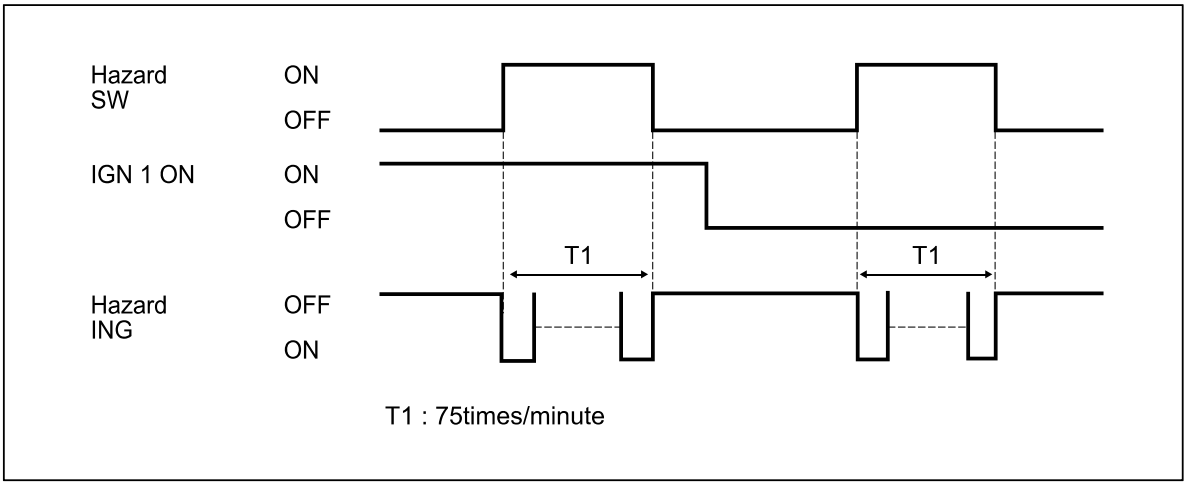


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Hazard flasher indicator control

1. When pressing the hazard flasher switch, the hazard flasher indicator on the instrument cluster blinks with the interval of 75/min.
2. When pressing the hazard flasher again switch during Step (1), the indicator stops its operation.
3. This function is available if the battery is connected (B+).

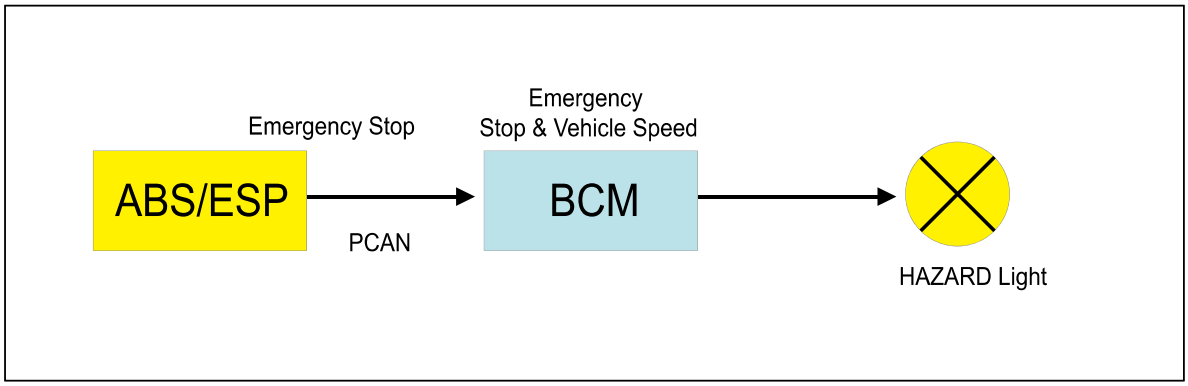


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Emergency hazard flasher control (coupled with ABS)

1. System layout



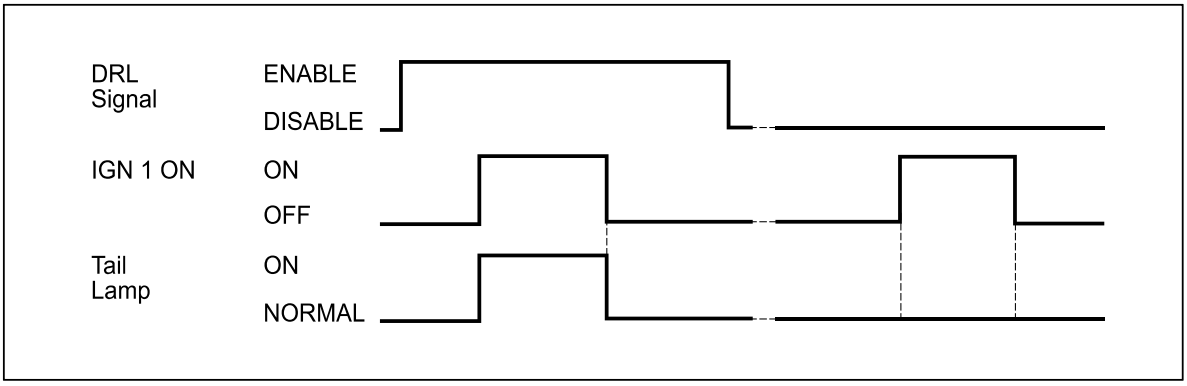
2. Operating conditions: When receiving the emergency hazard flasher ON signal from ESP and ABS.
   When receiving the emergency hazard flasher ON: blink with the interval of 4 Hz
   When receiving the emergency hazard flasher OFF: blink with the interval of 1.25 Hz (normal operating speed).
3. However, the manual operation of the switch has a priority over this function.
   OFF conditions:

- The hazard flasher blinks with the interval of 4 Hz and then lower the interval to normal operating speed
- The hazard flasher is turned OFF when pressing the hazard flasher switch during the emergency hazard flasher operation.

Downloaded from www.Manualslib.com manuals search engine

18) DRL (Daytime Running Light) Control

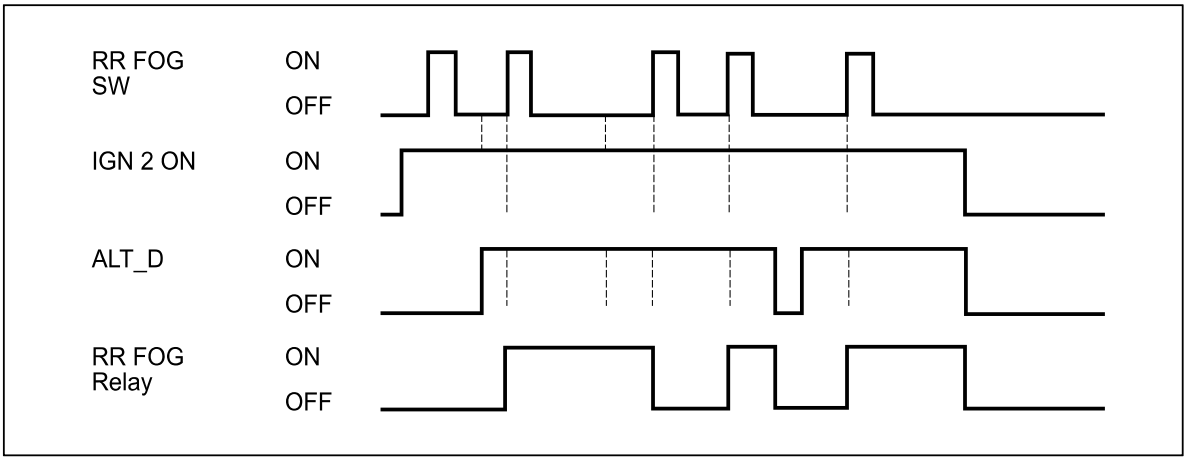
1. When receiving the DRL activation signal, the tail lamps are turned ON when turning the ignition switch to ON position, and the headlamps are turned ON when starting the engine.
2. When turning ON the tail lamp switch during engine running, the headlamps are turned OFF.
3. The headlamps do not come ON when starting the engine with the tail lamp switch ON.
4. The auto light sensor is not available in the vehicle with DRL system.
5. If there is no DRL activation signal, the light system operates in normal conditions.



19) Fog Lamp Control

(The rear fog lamp is available only for EU region.)

1. When pressing the rear fog lamp switch with IGN2 ON (headlamp ON condition), the rear fog lamps are turned ON.
2. When pressing the rear fog lamp switch again during the operation, the rear fog lamps are turned OFF.
3. The rear fog lamps do not come ON when the engine is not running or the light switch is OFF.
4. The rear fog lamps should not automatically come on again if they have been turned OFF by any other way other than the switch.

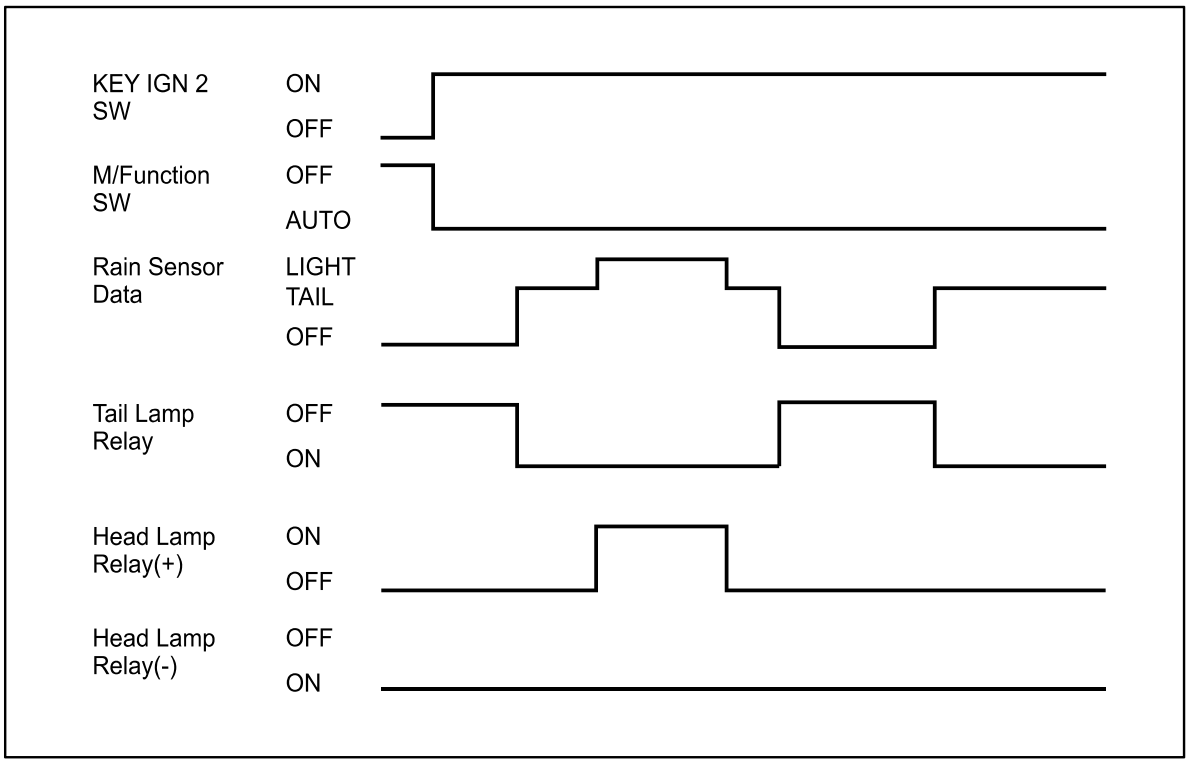


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

20) Auto Light Control (LIN)

1. BCM communicates with the rain sensor when turning the ignition switch to ON position, and controls the tail lamps and the headlamps with the light switch AUTO.
   (But, the communication with the rain sensor is possible even when the tail lamp switch is in ON position)



21) Immobilizer Function

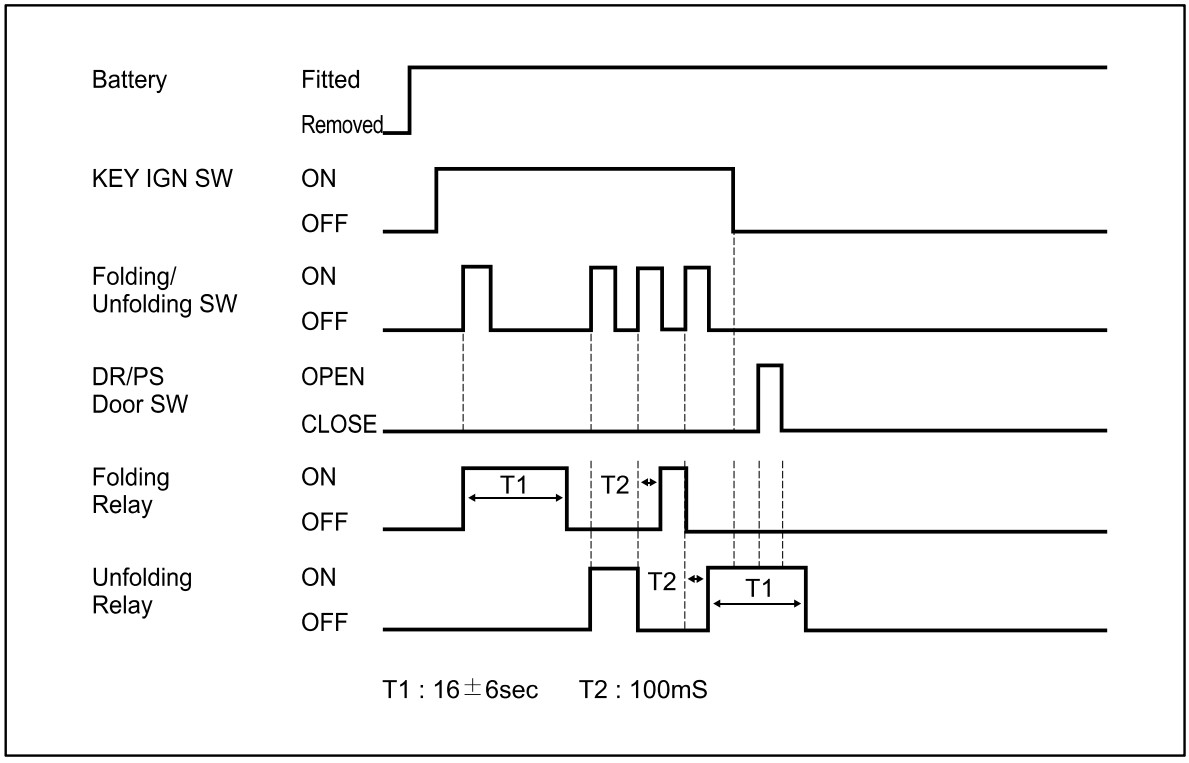
Due to the security reasons, detailed information will be supplied by seperate technical information.

Downloaded from www.Manualslib.com manuals search engine

22) Outside Mirror Folding/Unfolding Control

▶ **Folding/Unfolding control**

1. When pressing the mirror folding/unfolding switch with IGN ON, the mirrors are folded or unfolded according to the mirror condition in T1.
2. This operation time should be completed even when stopping the engine.
3. At first time pressing the mirror folding/unfolding switch after reconnecting the battery, the mirror folding operation is performed.
4. This control must be available for 30 seconds (time lag period) after turning the ignition switch to OFF from ON position.
5. When receiving the folding/unfolding signal during the mirror folding/unfolding operation, BCM stops current operation and operates the newly commended operation after 10 ms.
6. The folding/unfolding operation is performed regardless of the vehicle speed.
7. Manual operation:
   - Mirror unfolded → Mirror folding/unfolding signal from switch → Mirror folding
   - Mirror folded → Mirror folding/unfolding signal from switch → Mirror unfolding



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ **Auto folding/unfolding control**

1. Setting
   - Set auto folding function: When pressing the mirror folding switch for over 3 seconds, the auto folding function is set and the internal buzzer sounds once (ON: 100 ms, OFF: 200 ms).
   - Release auto folding function: When pressing the mirror folding switch for over 3 seconds, the auto folding function is released and the internal buzzer sounds twice (ON: 100 ms, OFF: 200 ms).

2. Auto folding sequence
   - When receiving the LOCK signal from the remote control key, the system operates in the sequence of "Door lock -> Theft deterrent mode activation -> Mirror folding".

3. When turning the ignition switch to ON position after unlocking the doors with the mirror folded, the mirrors are unfolded automatically.
4. When the auto folding function is set, the automatic unfolding is not available if the mirrors have been folded manually.
5. The factory setting is the enabling the auto folding function.

23) Approach (Puddle) Lamp Control

1. Lamp ON:
   - When receiving the UNLOCK signal from the remote control key in the theft deterrent mode, the approach lamps come ON for 30 seconds.
   - When turning the ignition switch to OFF from ON position and opening the driver door, the approach lamps come ON.

2. Lamp OFF:
   - When receiving the door lock signal with the approach lamps ON, the lamps go OFF (reactivation of theft deterrent mode).
   - When turning the ignition switch to ON position with the approach lamps ON, the lamps go OFF.
   - The approach lamps go OFF after 30 seconds.

Downloaded from www.Manualslib.com manuals search engine

24) Buzzer Control

Priority are as below:

BCM Buzzer Priority			
1	REKES lock alarm	Exterior	Lock Horn
2	REKES unlock alarm	Exterior	
3	Panic alarm	Horn	2
4	Anti-theft alarm Alarm horn	Horn	1
5	SBR alarm	Interior	3
6	SBR alarm	Interior	4
7	Sun roof alarm	Interior	6
8	Tail lamp alarm	Interior	7
9	Hazard flasher alarm	Interior	8
10	Turn signal lamp alarm	Interior	9
11	Auto folding setting	Interior	10
12	Key reminder	Interior	5

* SBR: Seat Belt Reminder

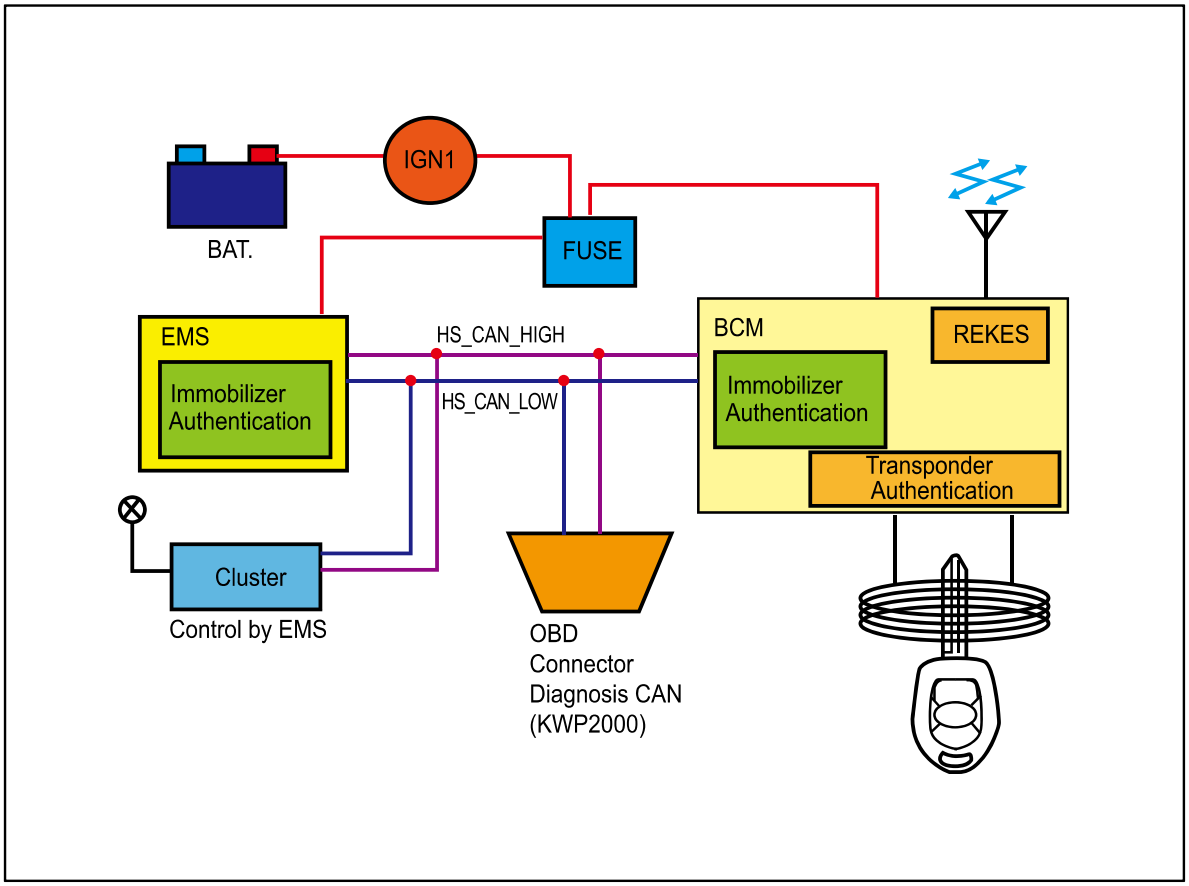
Downloaded from www.Manualslib.com manuals search engine

2. CODING FOR IMMOBILIZER/REMOTE CONTROL KEY

1) System Overview

Communication between BCM and ECU: CAN communication
Communication between Transponder and BCM: LF (Low frequency) and RF (Radio frequency)
The transponder integrated in the key and the engine control unit have the same code. When the ignition key with the integrated transponder is turned to the ON position, the ECU (Engine Control Unit) checks the crypto code of the key and, if correct, allows the vehicle to start the engine. The immobilizer indicator on the instrument cluster comes on during the communication. If there is something wrong in the system, the indicator blinks.

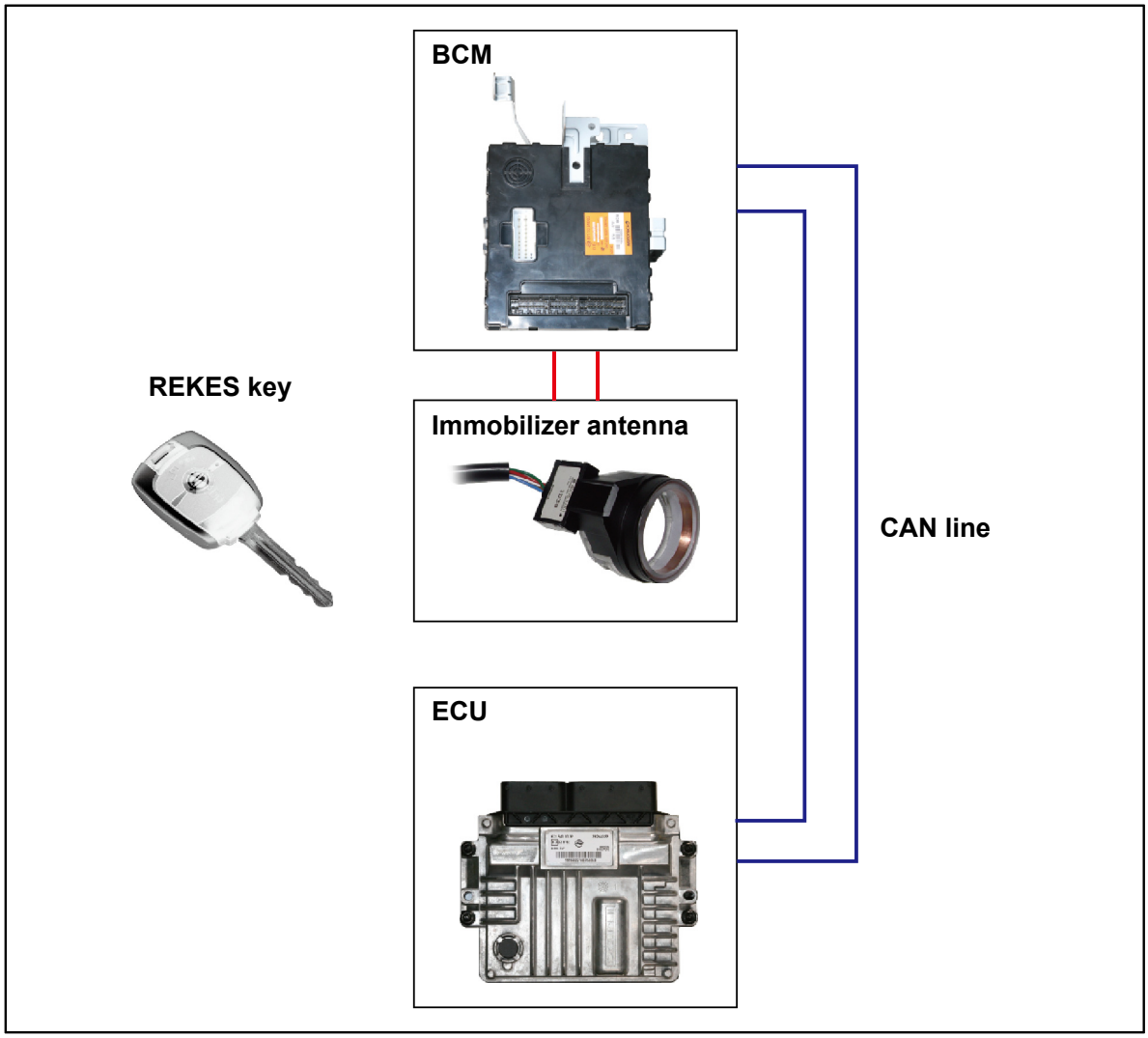
2) System Layout



Downloaded from www.Manualslib.com manuals search engine

3) Operation of Immobilizer

The Immobilizer System provides an additional theft deterrent to the vehicle in which it is installed and prevents it from being started by unauthorized persons. The transponder integrated in the key and the engine control unit have the same code. When the ignition key with the integrated transponder is turned to the ON position, the ECU (Engine Control Unit) checks the crypto code of the key and, if correct, allows your vehicle to start the engine.



CAUTION

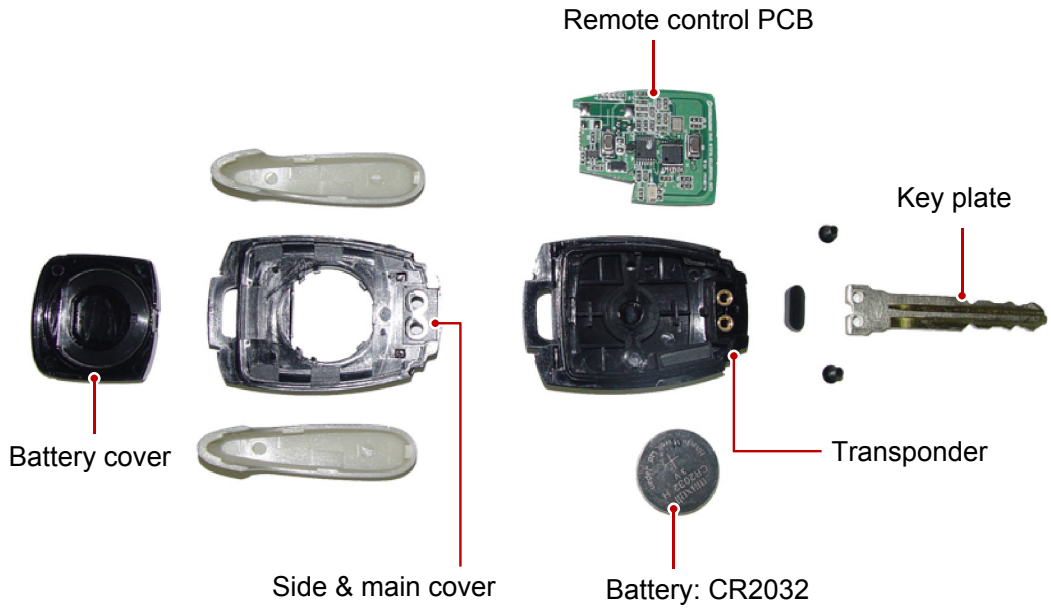
In the following cases, you may be unable to start the vehicle with the immobilizer.

- When two or more immobilizer keys come into contact with (each) other(s).
- When the key is close to any device sending or receiving electromagnetic fields or waves.
- When the key is close to any electronic or electric devices such as lighting equipment, security keys or security cards.
- When the key is close to a magnetic or metal object or a battery.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4) Components of REKES Key



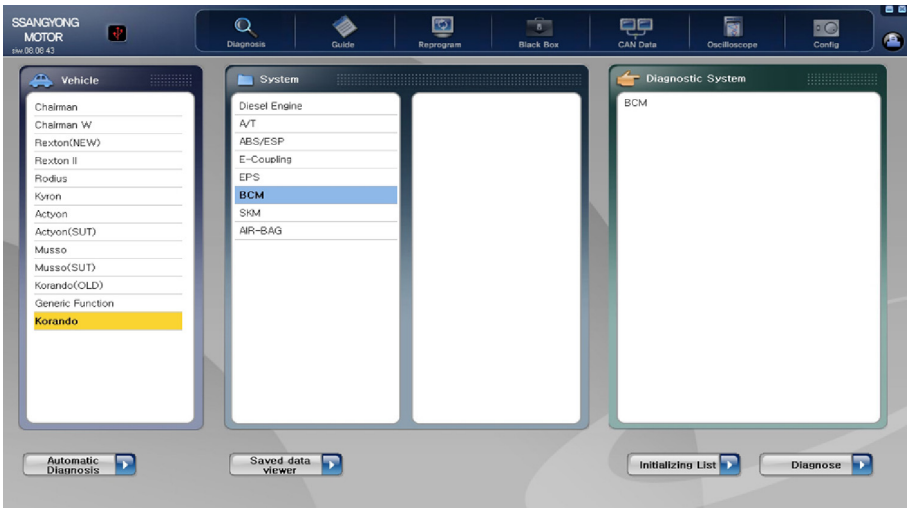
CAUTION

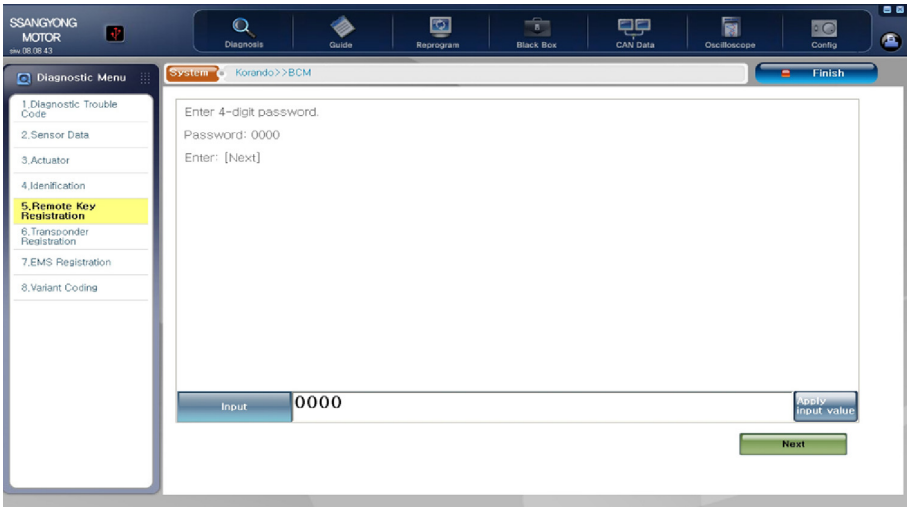
- Avoid impact to the transponder inside of the key. The transponder can be damaged.
- With a damaged transponder, the engine cannot be started.
- When an old code should be replaced or another key is added, car owner should observe the whole process.
- In any case, the immobilizer system cannot be removed from the vehicle. If you attempt to remove and damage the system, it is impossible to start the engine. So never attempt to remove, damage or modify it.
- Any remote engine starter cannot be installed to the vehicle equipped with the immobilizer system. So never install any remote engine starter.

Downloaded from www.Manualslib.com manuals search engine

5) Coding Procedure for REKES Key

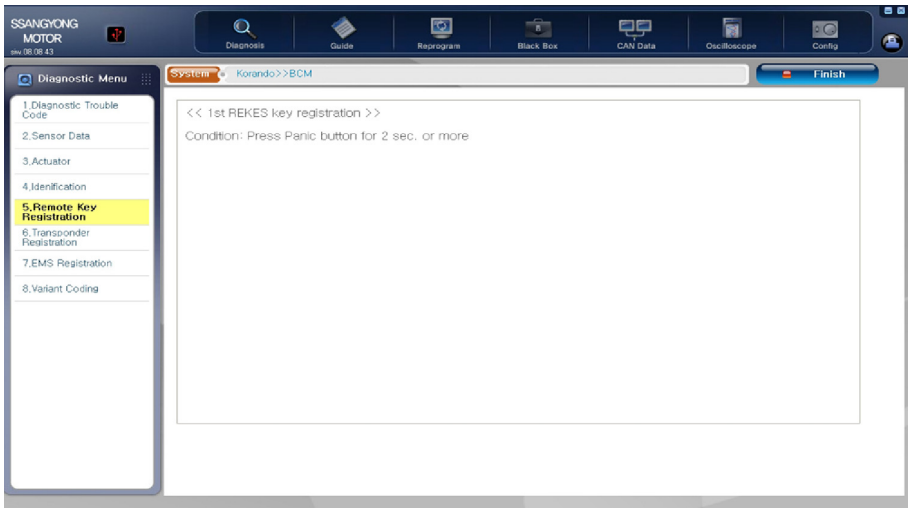
Connect the SCAN-TOOL to the vehicle and select the vehicle model and the system. Select "BCM".

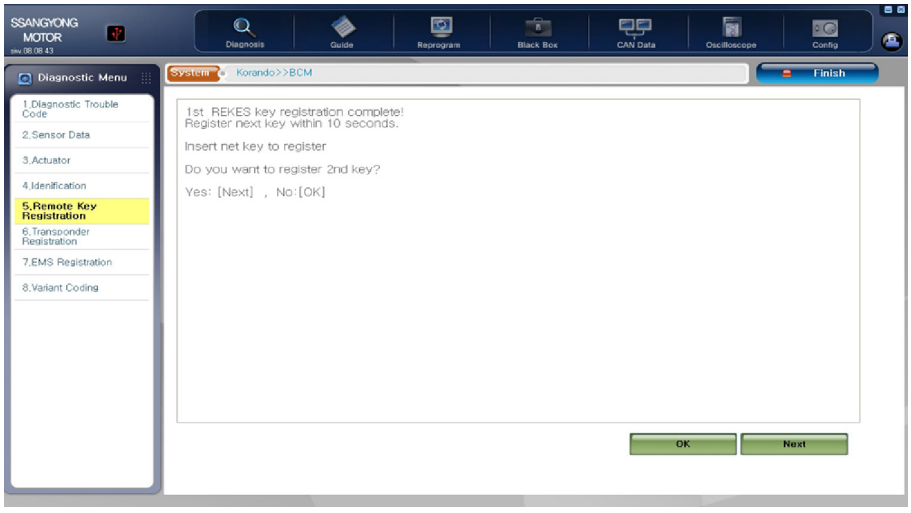




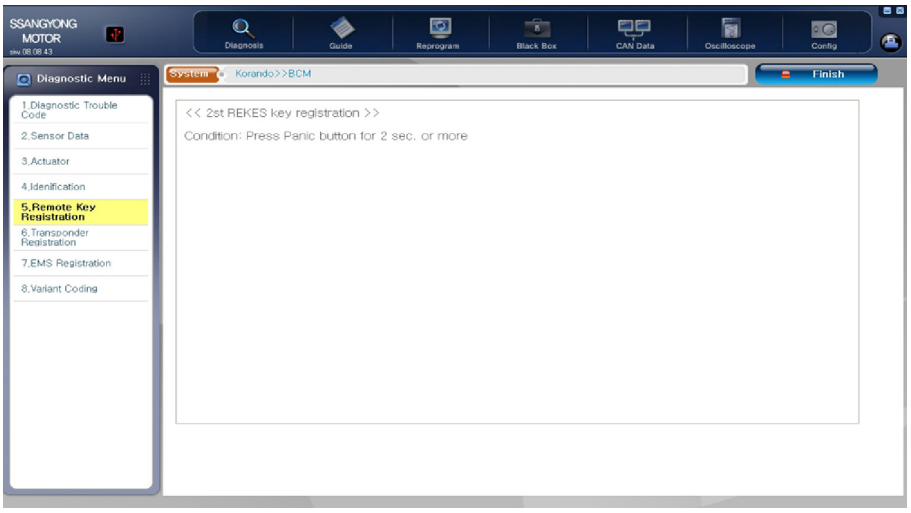
Modification basis	
Application basis	
Affected VIN	

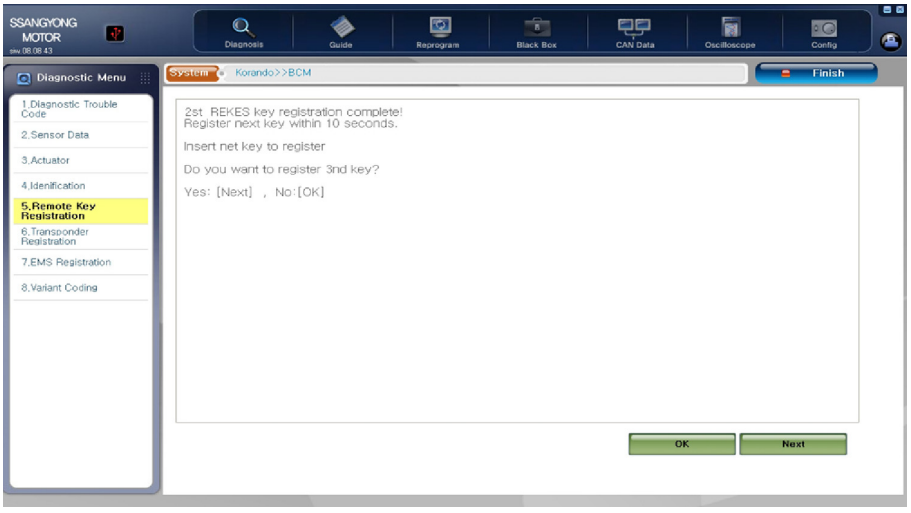
Downloaded from www.Manualslib.com manuals search engine





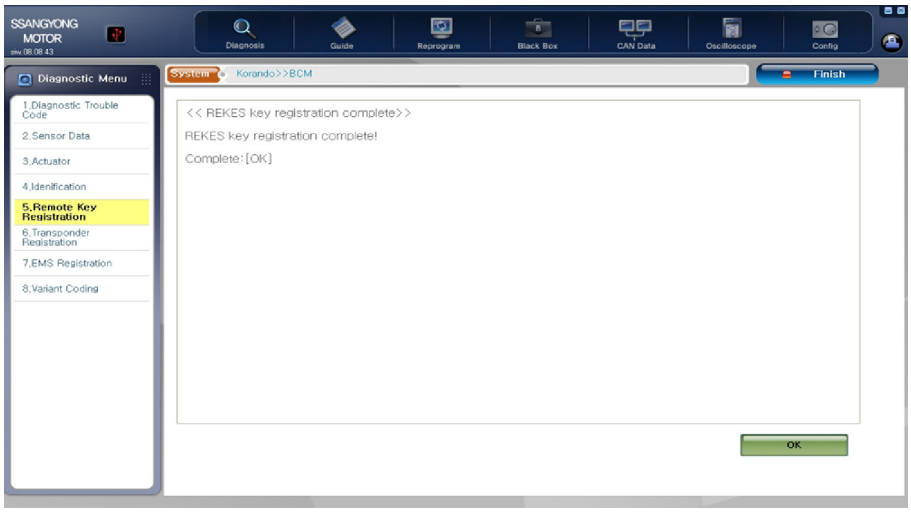
Downloaded from www.Manualslib.com manuals search engine





Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



CAUTION

When one of remote control key is lost and a new remote control key is purchased, bring the other old key to the Ssangyong Dealer or Ssangyong Authorized Service Center and have it recoded. Otherwise, the old key will not work.

Downloaded from www.Manualslib.com manuals search engine

DIAGNOSTIC GUIDE

진단 가이드 데이터 삽입

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

INSTRUMENT CLUSTER 8010-01

GENERAL INFORMATION

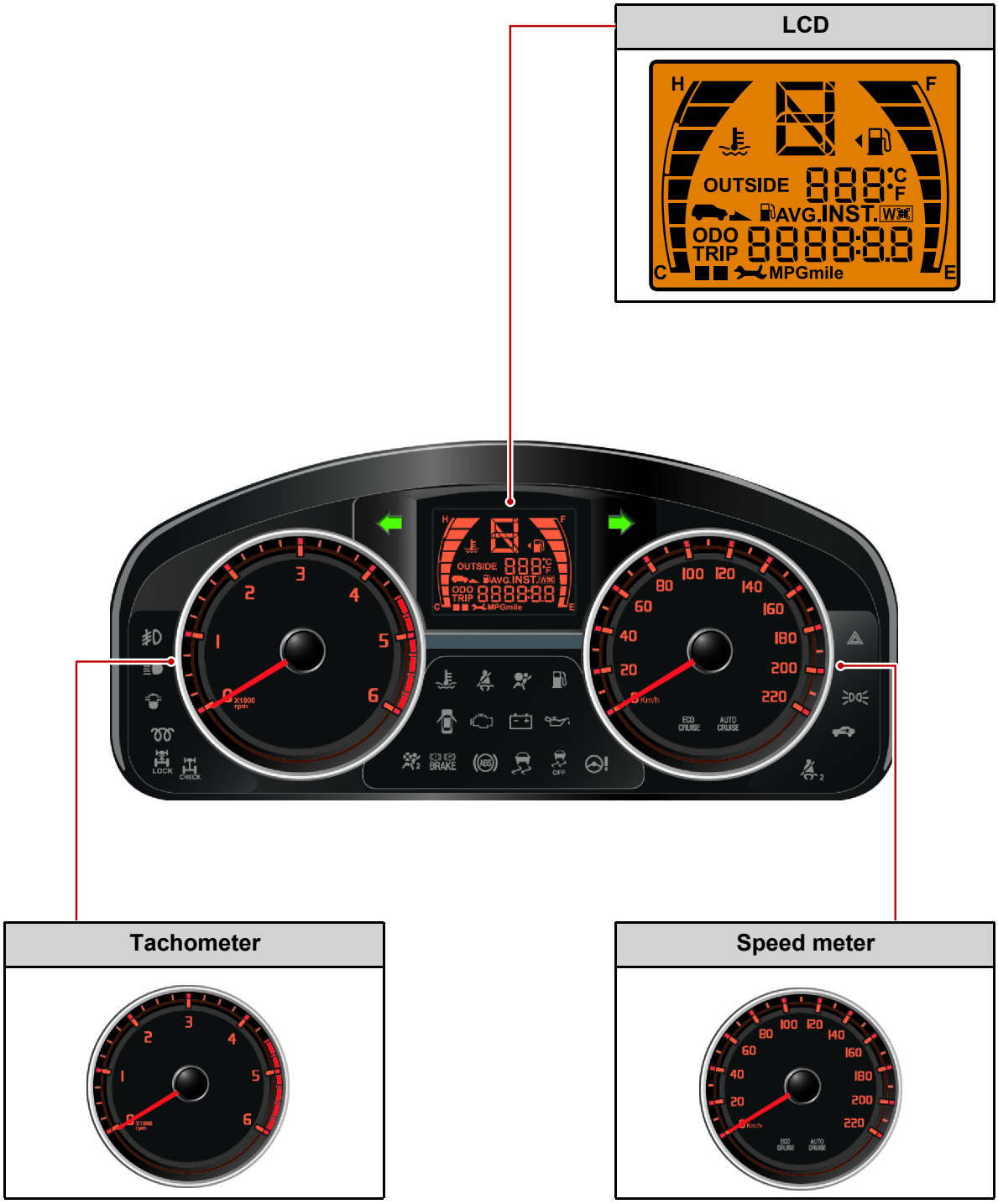
1. SPECIFICATION

Description	Specification
Rated voltage	DC 13.5 V
Operating voltage	DC 9 V to 16 V
CAN operating voltage	DC 7 V to 18 V
Inspection voltage	DC 13.5 V
Operating temperature	−30℃ to +80℃
Storage temperature	−40℃ to +90℃
Dark current	below 1 mA (12 V, 25℃)
CAN wake-up	HIGH CAN: Turn the ignition ON. (Smart key only)

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

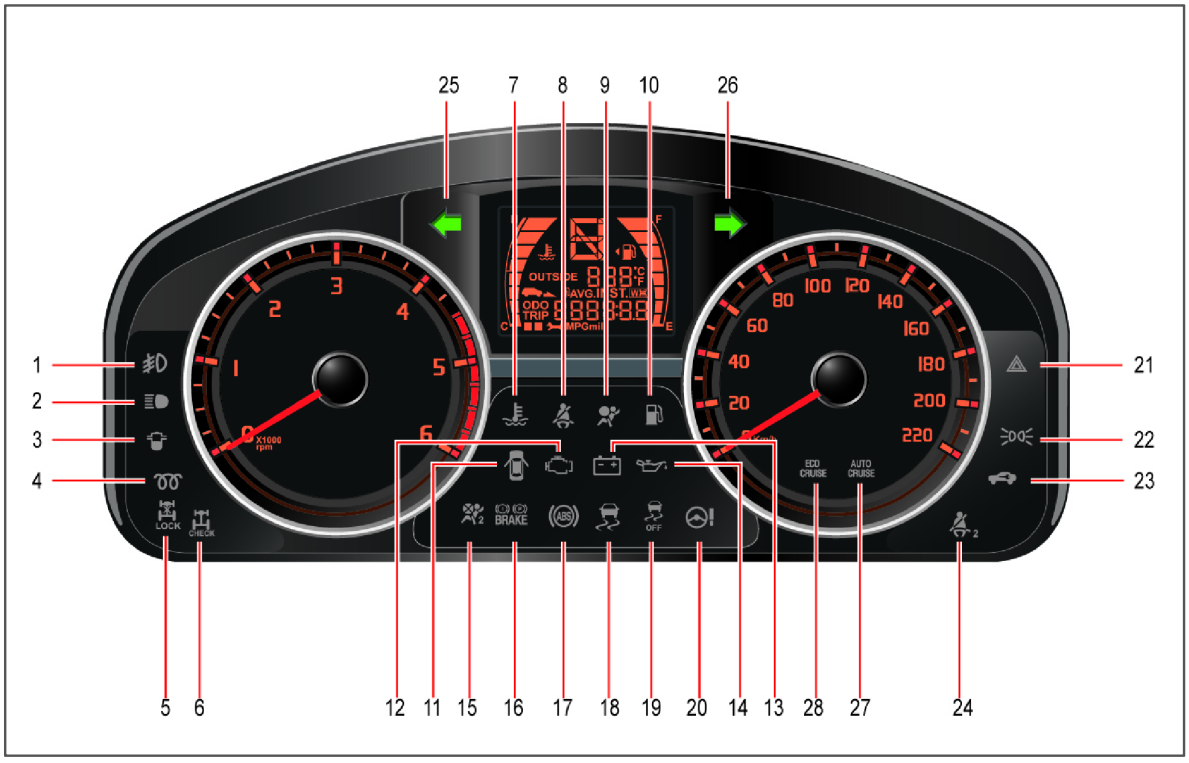
1. SYSTEM LAYOUT



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. WARNING LAMPS AND INDICATORS



STD Class

NO.	Symbol	Description	NO.	Symbol	Description	NO.	Symbol	Description	NO.	Symbol	Description
1		FRT FOG	9		AIR BAG	17		ABS	25		TURN-L
2		HIGH BEAM	10		LOW FUEL WARNING	18		ESP	26		TURN-R
3		FUEL FILTER	11		DOOR OPEN	19		ESP OFF	27	AUTO CRUISE	AUTO CRUISE
4		GLOW	12		ENGINE CHECK	20		EPS	28	ECO	ECO
5	LOCK	4WD LOCK	13		CHARGE	21		HAZARD	29		WINTER
6	CHECK	4WD CHECK	14		OIL LEVEL OIL PRESSUR	22		SIDE LIGHT			
7		TEMP HIGH	15		PADL	23		IMMOBILIZER			
8		DREVER SEAT BELT	16	BRAKE	PARKING BRAKE (BRAKE FLUIDE)	24		PASSENGER SEAT BELT			

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1) Description of Warning Lamps & Indicators

▶ High beam indicator

Blue	
	This indicator comes on when the high beam headlamp is switched on.

▶ Front fog lamp indicator

Green	
	This indicator comes on when the front fog light is switched on.

▶ Light indicator

Green	
	This indicator comes on when the tail lamp or head light is switched on.

▶ Glow indicator

Amber	
	When the ignition switch is turned to “ON”, this indicator comes on and stays for a short time or may go off right away. When the glow plugs are sufficiently heated, the light will go out.

▶ Water separator warning lamp

Red	
	When the water level inside the water separator in the fuel filter exceeds a certain level, this warning lamp comes on and a buzzer sounds.

Downloaded from www.Manualslib.com manuals search engine

▶ Low fuel level warning lamp

Amber	
	This warning lamp indicates that the fuel level in the tank is getting exhausted. The illuminating point of this warning lamp varies according to the driving conditions such as driving angle and road conditions.

▶ Engine overheated warning lamp

Red	
	When the engine coolant temperate is abnormally hot, the engine overheat warning lamp blinks and a warning buzzer sounds.

▶ Door ajar warning lamp

Red	
	This lamp comes on when a door or the tailgate is either opened or not closed completely.

▶ Seat belt reminder

Red	
	When the ignition switch is turned to the “ON” position and the driver’s seat belt is not fastened, the reminder lamp will come on and the seat belt warning chime will sound for 6 seconds.

▶ Air bag warning lamp

Red	
	When the ignition is switched on, this warning lamp illuminates and then should go off, to confirm that the air bag is operational. If it does not come on, or if it does not go off, or if it flashes or illuminates continuously while driving, it means that there is a malfunction in the system.

Downloaded from www.Manualslib.com manuals search engine

▶ ESP indicator/Warning lamp

Amber	
	This warning lamp comes on when the ignition switch is turned to "ON" and should go out if the system is normal. This indicator blinks when the ESP system is operating.

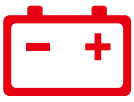
▶ ESP OFF indicator

Amber	
	This indicator comes on when pressing the ESP OFF switch to deactivate the ESP function.

▶ Engine check warning lamp

Amber	
	This warning lamp comes on when the ignition switch is turned on and it goes off when the engine is started. If the lamp stays on or comes on while driving, some of the engine control components including sensors and devices are defective.

▶ Battery charge warning lamp

Red	
	This warning lamp comes on when the ignition switch is turned on and it goes off when the engine is started. If this lamp doesn't go off after engine starting or comes on while driving, it means there is a malfunction in the system.

▶ Engine oil level warning lamp

Red	
	- This warning lamp comes on when the ignition switch is turned on and it goes off when the engine is started. - If this lamp comes on during driving, check the engine oil level and leaks.

Downloaded from www.Manualslib.com manuals search engine

▶ Brake warning lamp

Red	
	This warning lamp comes on when the parking brake is applied and/or the brake fluid level is lower than a specified level.

▶ ABS warning lamp

Amber	
	This warning lamp comes on when the ignition switch is turned to "ON" and should go out if the system is normal.

▶ Passenger air bag disable indicator

Amber	
	This indicator comes on when turning the passenger air bag disable switch to "ON" position to disable the passenger air bag.

▶ EPS warning lamp

Red	
	This warning lamp comes on when the EPS system is defective.

▶ Immobilizer indicator

Amber	
	This indicator blinks when the immobilizer system is defective.

Downloaded from www.Manualslib.com manuals search engine

▶ Hazard indicator

Red	
	This indicator blinks when the hazard warning flashers are switched on.

▶ ECO indicator

Green	
ECO	This indicator comes on when the ECO cruise system is switched on.

▶ Cruise control indicator

Green	
AUTO CRUISE	This indicator comes on when the cruise control system is switched on.

▶ 4WD LOCK indicator

Green	
	This indicator comes on when pressing the 4WD LOCK switch to use 4WD LOCK mode. This indicator goes out when pressing the switch again to release 4WD LOCK mode.

▶ 4WD warning lamp

Red	
	This warning lamp comes on when the 4WD system is defective.

Downloaded from www.Manualslib.com manuals search engine

▶ Passenger seat belt reminder

Red	When the ignition switch is turned to the "ON" position and the passenger's seat belt is not fastened, the reminder lamp will come on and the seat belt warning chime will sound for 6 seconds. This reminding operation stops when the passenger fastens the seat belt even during its operation period.

▶ Left turn signal indicator

Green	When turning on the left turn signal switch, this indicator comes on.

▶ Right turn signal indicator

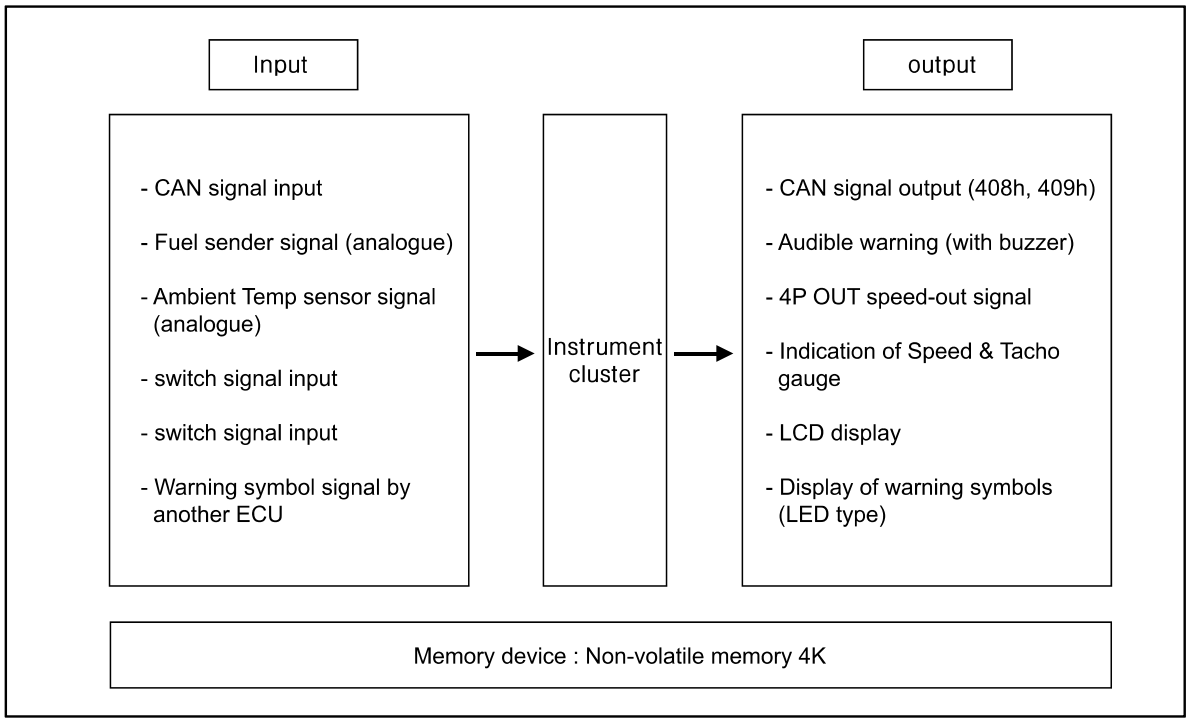
Green	When turning on the right turn signal switch, this indicator comes on.

▶ Winter mode indicator

Red	The indicator comes on when the Winter mode (W) switch near the gear selector lever is pressed. Use this mode to drive off smoothly on an icy and slippery road.

Downloaded from www.Manualslib.com manuals search engine

3. OPERATING PROCESS



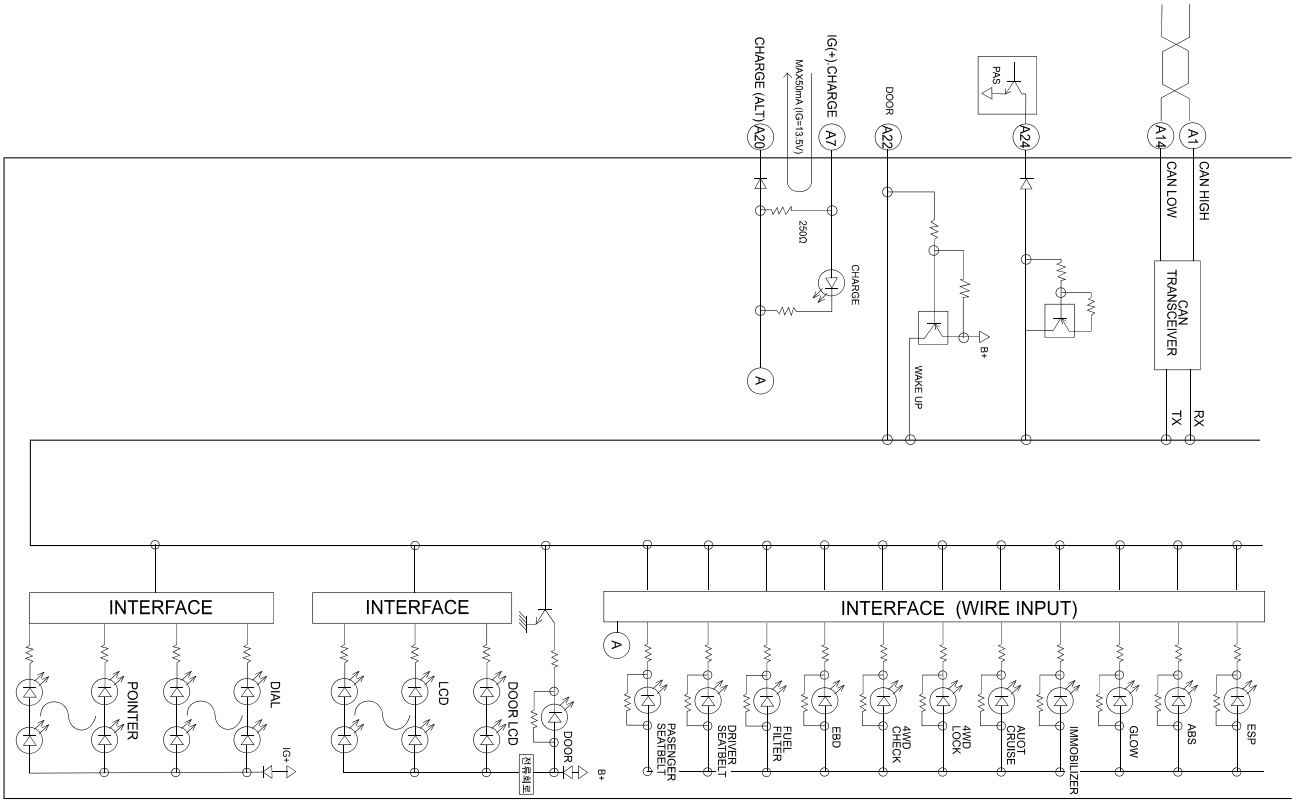
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Memo

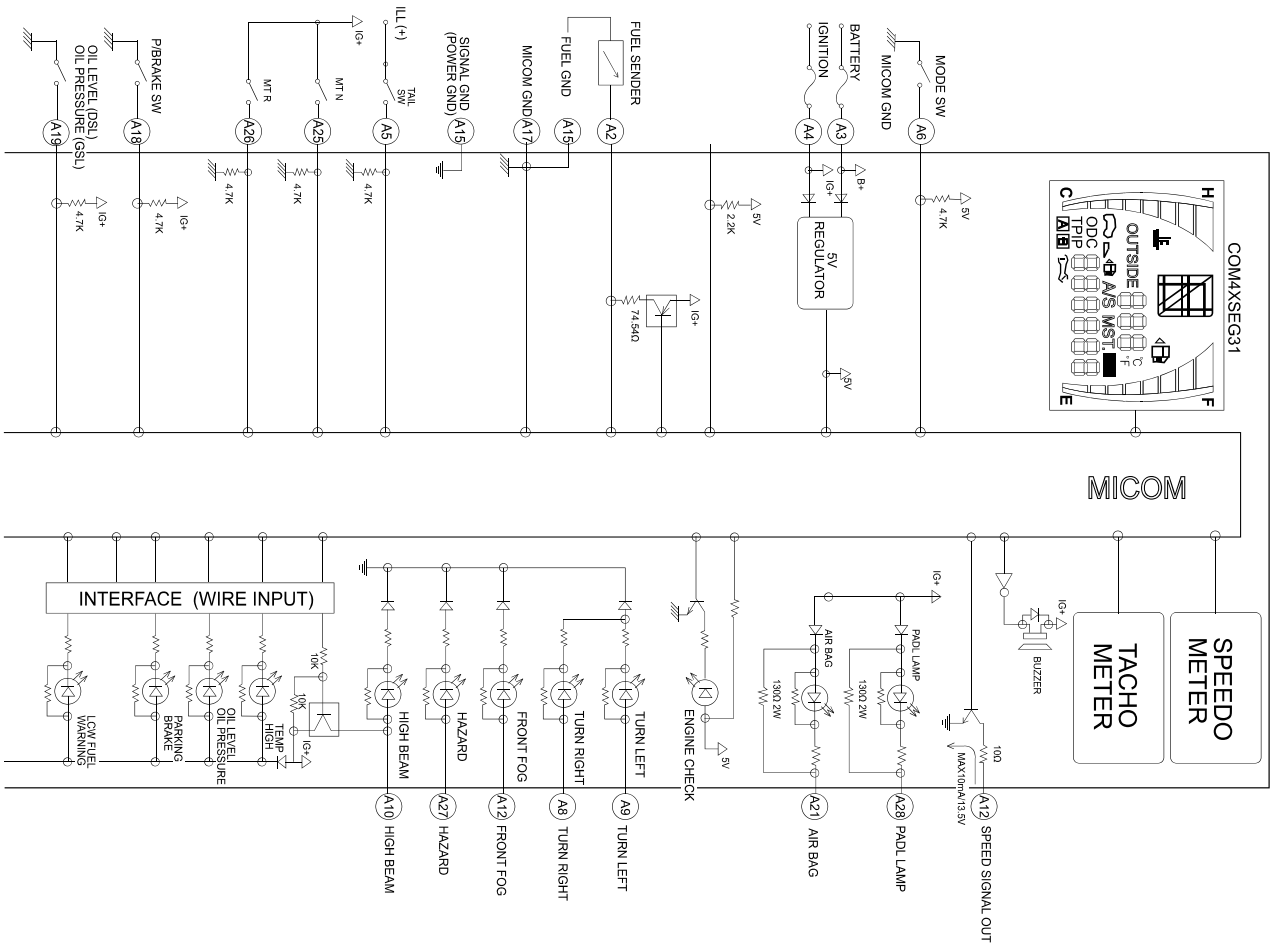
Downloaded from www.Manualslib.com manuals search engine

1) Block Diagram



Modification basis	
Application basis	
Affected VIN	

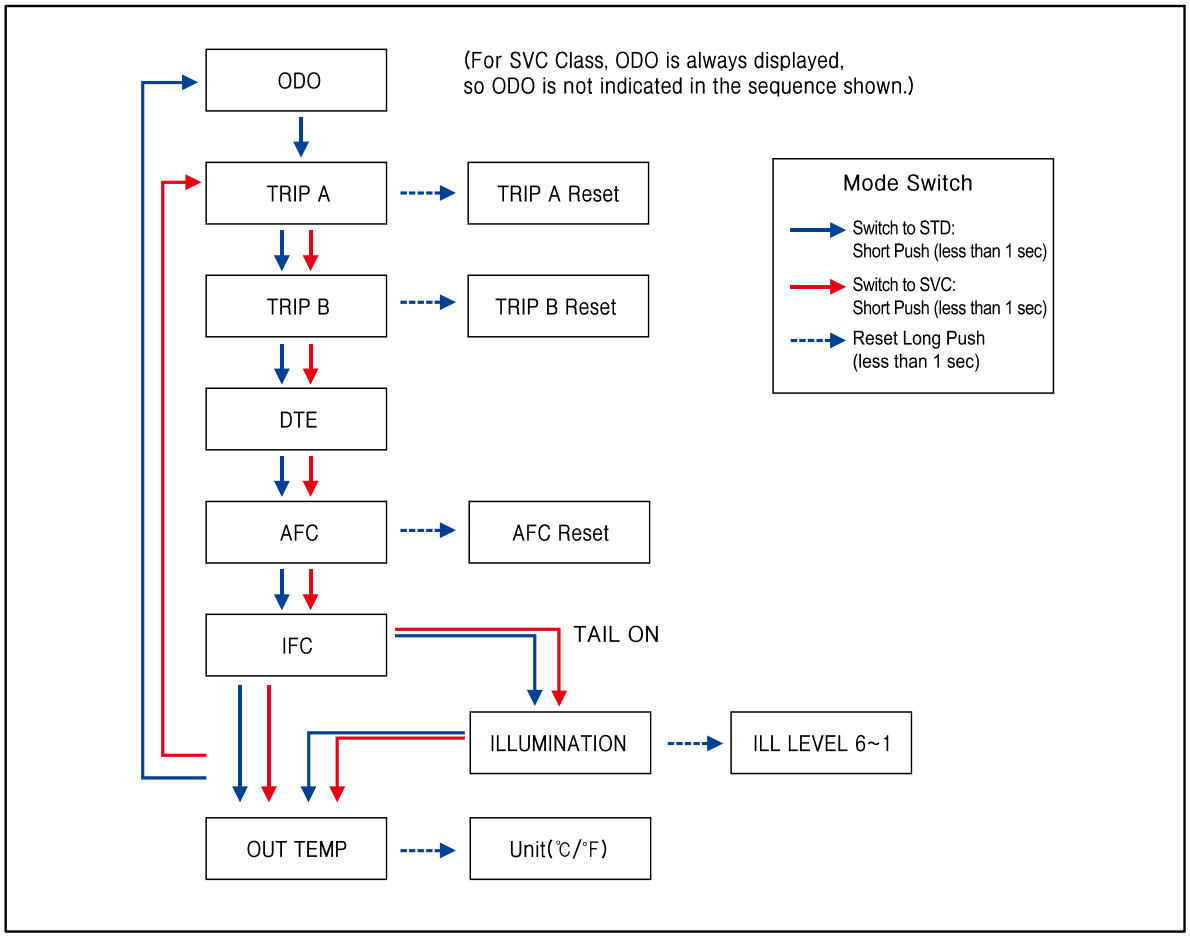
Downloaded from www.Manualslib.com manuals search engine



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Display Sequence



Operating time of Trip switch	Function
below 1 second (60 to 980 ms)	Mode change (ODO → Trip A → TRIP B → DTE → AFC → IFC → ILLUMINATION → OUT TEMP)
over 1 second	Reset function (Trip A, B, AFC) Change function (Illumination (6 to 1 level), Unit of ambient temperature (℃ ↔ °F))
over 3 seconds - Ready	Mode change (Illumination → Ambient temperature → ODO)

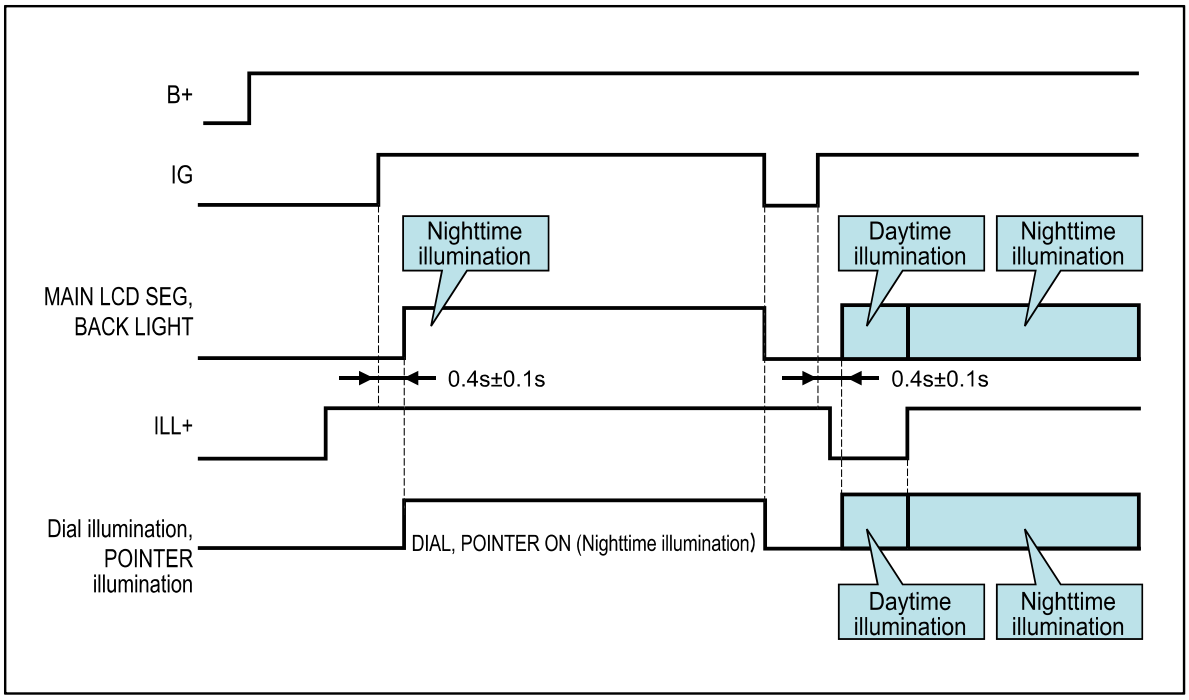
* If the Trip/Reset switch is not pressed in 3 seconds after getting into the illumination mode and the ambient air temperature mode, the LCD changes the mode to odometer mode.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Illumination

(1) Operation



The operation input before the LCD backlight is illuminated, right after the ignition is turned OFF or ON, is ignored.
The LCD backlight and other lamps are illuminated 0.4 ±0.1 second after the ignition ON is detected.
The LCD display, LCD backlight, dial lamp and indicator lamp are turned on or off by the IGN switch ON/OFF operation.

Downloaded from www.Manualslib.com manuals search engine

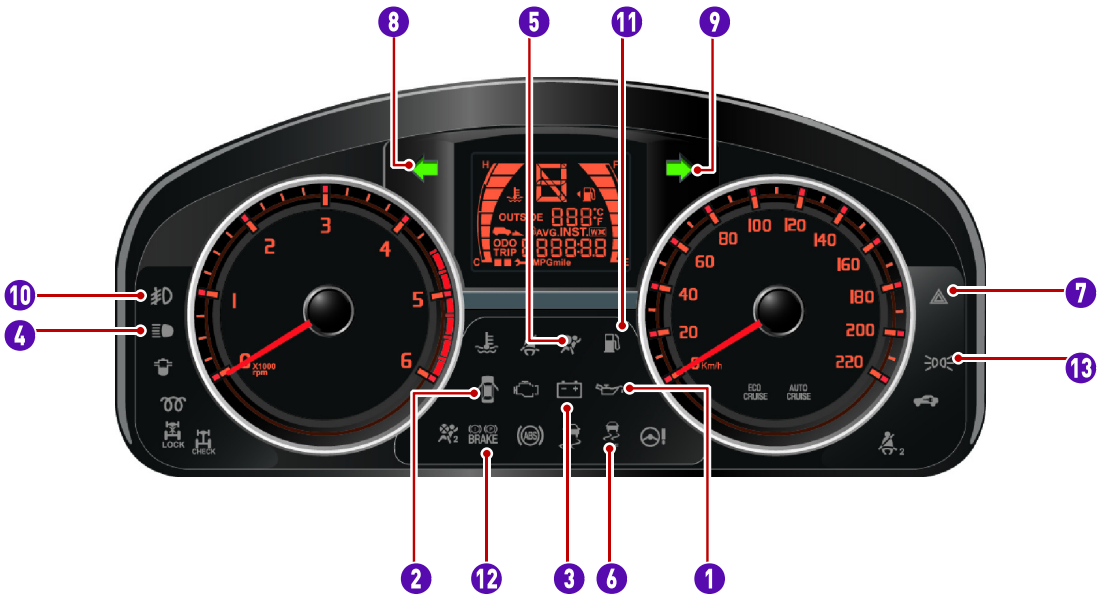
(2) Brightness

Power Supply	Illumination Level	Main LCD		Pointer	
		Day	Night	Day	Night
B+ (B-CAN Wake UP)	-	OFF	OFF	OFF	OFF
IGN1	Level 1	100%	20%	100%	20%
	Level 2	100%	30%	100%	30%
	Level 3	100%	40%	100%	40%
	Level 4	100%	50%	100%	50%
	Level 5	100%	60%	100%	60%
	Level 6	100%	70%	100%	70%

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4) System Analysis



▶ Symbol

NO	NAME / Pre-Warning	SYMBOL	COLOR	CTRL	SIGNAL SOURCE	Signal Value	Operation STATE
1	OIL LEVEL (4s±0.2s)		RED	by micom	Oil level Switch	1) OPEN for 60 sec. or longer 2) TACHO: 1000 RPM or less 3) engine coolant temperature: 50℃ or higher	IG ON
	OIL PRESSURE				Oil Pressure Switch	GROUND	IG ON
2	DOOR OPEN		RED	by micom	Door switch	GROUND	B+/IG ON
3	CHARGE		RED	By Wire Micom	Alternator & MS_320h	GROUND	IG ON
4	HIGH BEAM		BLUE	By wire	High-beam Switch	H/B(+) : HIGH	IG ON

Downloaded from www.Manualslib.com manuals search engine

NO	NAME / Pre-Warning	SYMBOL	COLOR	CTRL	SIGNAL SOURCE	Signal Value	Operation STATE
5	AIR BAG		RED	By wire	SDM	GROUND	IG ON
6	PADL		AMBER	By wire	Passenger Airbag Disable switch	GROUND	IG ON
7	HAZARD		RED	By wire	Hazard Switch	HIGH	B+/IG ON
8	TURN-L		GREEN	By micom	BCM	HIGH	B+/IG ON
9	TURN-R		GREEN	By micom	BCM	HIGH	B+/IG ON
10	FRT FOG		GREEN	By micom	Front Fog Switch	HIGH	B+/IG ON
11	LOW FUEL WARNING		AMBER	By micom	FUEL SENDER	analogue signal	IG ON
12	PARKING BRAKE (BRAKE FLUIDE) (4s±0.2s)		RED	By micom	P/BRAKE SW	HIGH	IG ON
13	SIDE LIGHT		GREEN	By micom	ILL	GROUND	IG ON

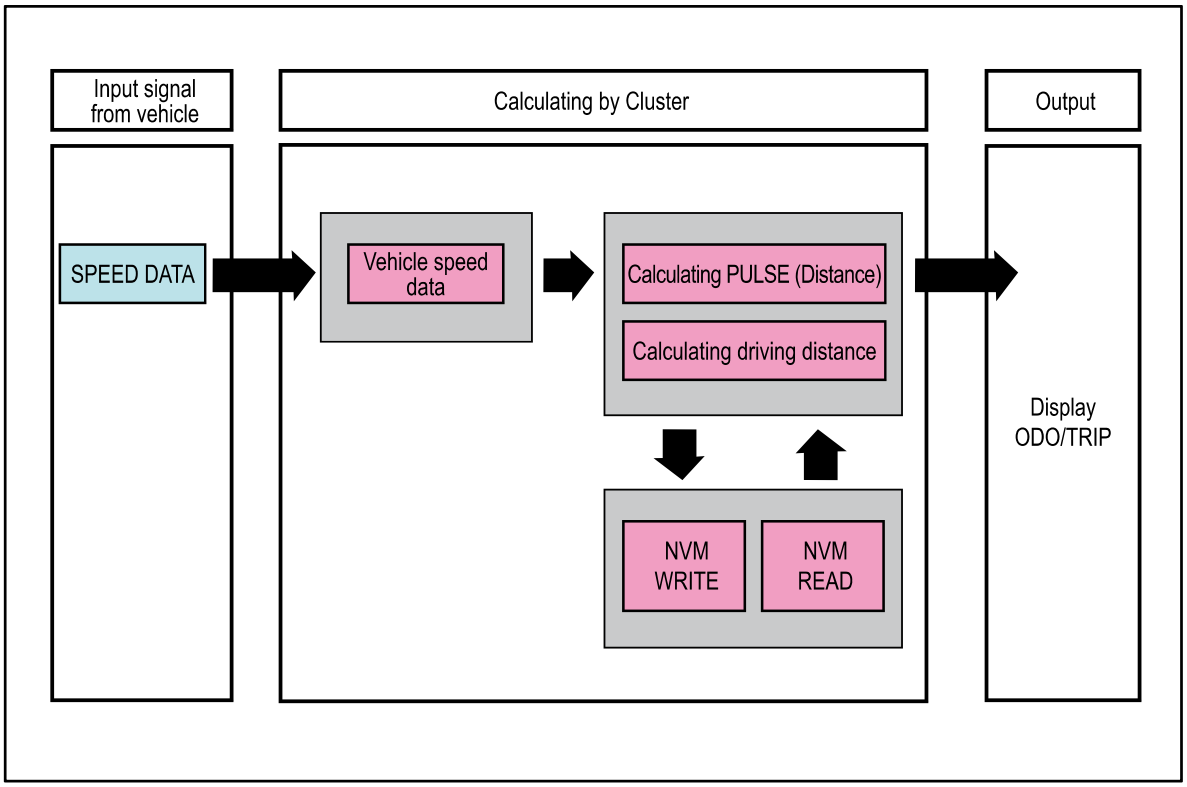
The pre-warning is performed for 4 seconds after turning the ignition switch to ON position.
BCM checks that the warning lamps (ABS, ESP, ESP OFF, 4WD CHECK, 4WD LOCK) are matched with CAN signals.
The pre-warning is performed by the variant code.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

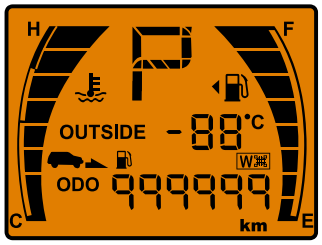
5) ODO/TRIP Meter

Total driving distance (0 ~ 999999 km or 0 ~ 999999 miles) and trip distance (0.0 ~ 999.9 km or 0.0 ~ 9999.9 miles) is calculated and displayed by programmed pulse/km in EEPROM. Applicable maximum driving speed is 300 km/h. If the vehicle speed goes over the limit, ODO and Trip meter stops the operation and the pointer indicates the maximum km/h (MPH). The pulse count information is supplied from the speed module according to CAN data corresponding vehicle frequency.

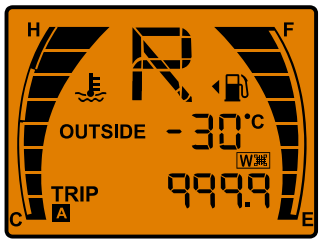
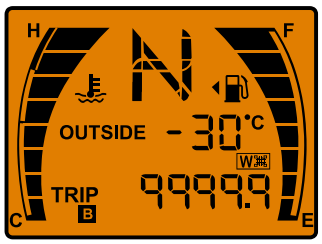


Downloaded from www.Manualslib.com manuals search engine

▶ Odo meter display

Function	Signal	Display
Input data	Speed signal	
Display type	6 digits	
Display range	0 to 999999 km (mile) Hold	
Resolution	1 km (mile)	
Maximum Odo value	Odo meter stops the operation and the pointer indicates the maximum km/h (MPH)	

▶ Trip meter display

Function	Signal	Display
Input data	Speed signal	
Display type	4 digits	
Display range	A: 0.0 to 999.9 km (mile) B: 0.0 to 9999.9 km (mile)	
Resolution	0.1 km (mile)	
Maximum trip value	A: 0.0 → 999.9 → 0.0 km B: 0.0 → 9999.9 → 0.0 km	
when IGN OFF	Previous trip distance is stored.	
Data clear	Reconnecting the battery (initial B+ ON) When pressing the Mode switch over 1 second	
Maximum Odo value	Trip meter stops the operation and the pointer indicates the maximum km/h (MPH)	

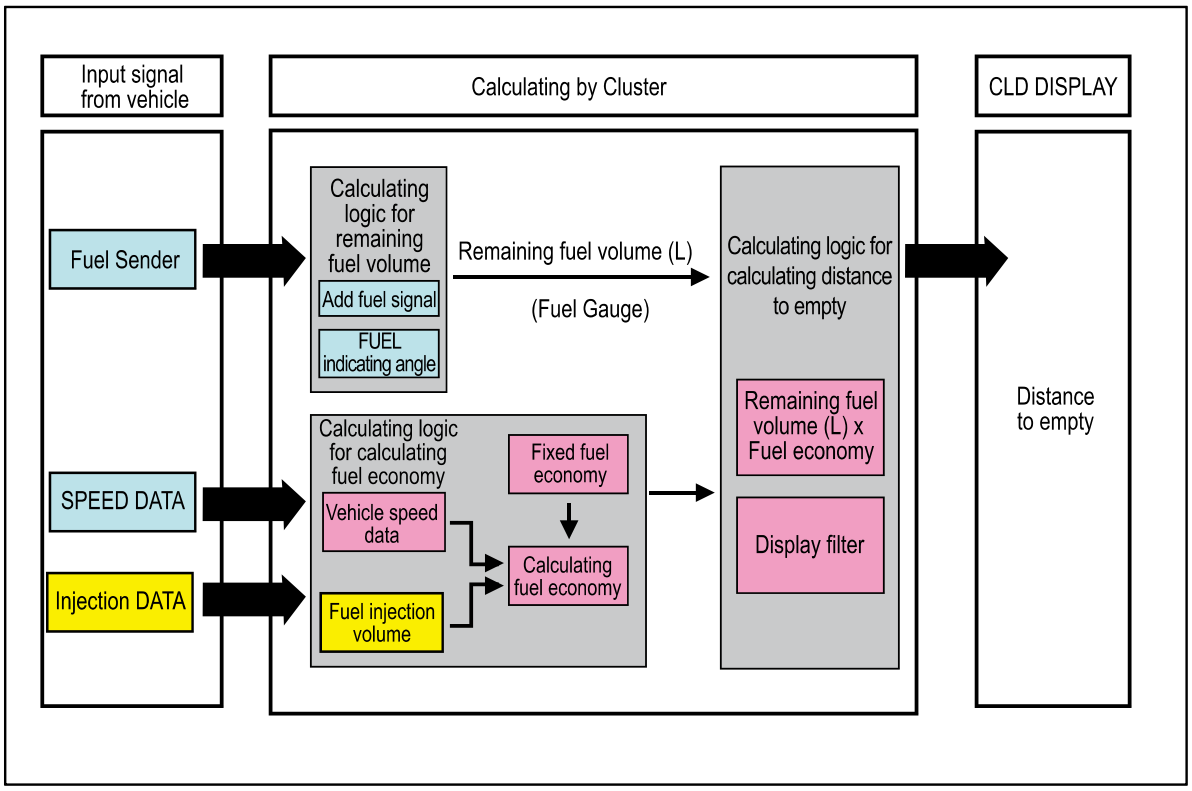
Modification basis	
Application basis	
Affected VIN	

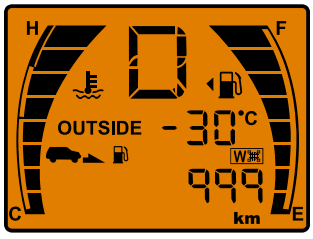
Downloaded from www.Manualslib.com manuals search engine

6) Display Mode

(1) DTE (Distance To Empty) Mode

The LCD display indicates how long drive the vehicle with current amount of fuel in fuel tank.

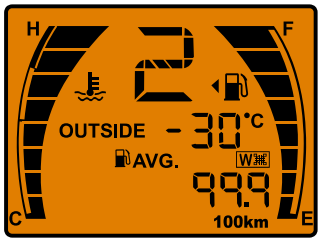


Function	Signal	Display
Display type	3 digits	
Display range	50 km to 999 km (30 miles ~ 999 miles)	
Resolution	1 km (miles)	
Display interval	every 1 second	

Downloaded from www.Manualslib.com manuals search engine

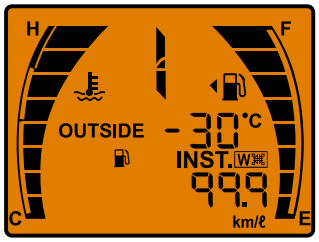
(2) Average Fuel Consumption Mode

The LCD display indicates the average fuel consumption since reset.

Function	Signal	Display
Display type	3 digits	
Display range	0.0 km to 99.9 km (0 miles to 99.9 miles)	
Resolution	0.1 km (miles)	
Display interval	every 10 seconds	

(3) Instant Fuel Consumption Mode

The LCD display indicates the instant fuel consumption at every two seconds.

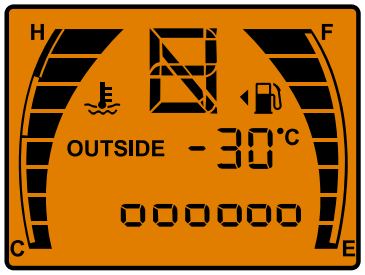
Function	Signal	Display
Display type	3 digits	
Display range	0.0 to 99.9 (MPG, ℓ/100 km, km/ℓ)	
Resolution	0.1 km (miles)	
Display interval	every 2 seconds	

Downloaded from www.Manualslib.com manuals search engine

(4) Illumination Mode

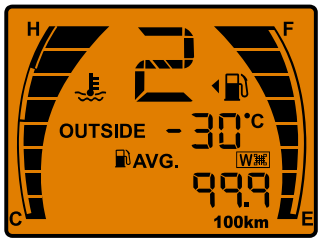
▶ **Trip (Mode/Reset) switch**

- Pressing the switch below 1 second: change to next mode
- Pressing the switch over 1 second: Enter into illumination level mode
  → Level change by 1 step up and down
  (ex. Level 4 → 5 → 6 → 5 → 4 → 3 → 2 → 1)
- If the Trip/Reset switch is not pressed in 3 seconds after getting into the illumination mode, the LCD changes the mode to odometer mode.

Display


(5) Ambient Air Temperature Mode

- The LCD display indicates the ambient air temperature (only for auto air conditioner)

Function	Signal	Display
Display type	3 digits	
Display range	- −30℃ to 90℃ (−22˚F to 194˚F) - −31℃ to −33℃ : Maintain 30℃ - 91℃ to 93℃ : Maintain 90℃	
Resolution	1℃ (1˚F)	

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

7) Buzzer

▶ **Specifications**

Function	Specification
Part name	PKM17EPP-2002-B0 (MURATA, Piezoelectric Sound Components)
Permissible input voltage	below 25VP-P
Operating temperature	−20˚C to +70˚C
Storage temperature	−30˚C to +80˚C
Sound level	70 dB/min (3 Vp-p, 2 kHz, square wave, 10 cm)

▶ **Output**

Item	Middle East	Except Middle East	Buzzer		Priority
			ON_Time	OFF_Time	
PAS	O	O	-	-	0
Over speed warning	O	X	500 ms	200 ms	1
ESP	O	O	100 ms	100 ms	2
Temperature warning	O	O	500 ms	500 ms	3
Water separator	O	O	500 ms	500 ms	4
Parking brake	O	O	2.8 s	1.5 s	5

NOTE

- Modulating frequency: 1.96 kHz
- If the signal with higher priority is activated during the operation of signal with lower priority, the current operation should be completed before starting the operation with higher priority.
- If there are multiple signals at a time, the operation should be completed by the priority.

Downloaded from www.Manualslib.com manuals search engine

8) PAS (Parking Aid System)

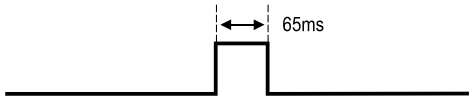
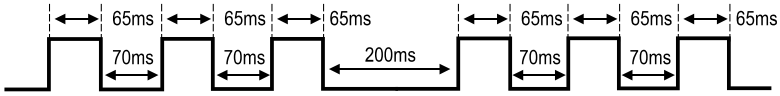
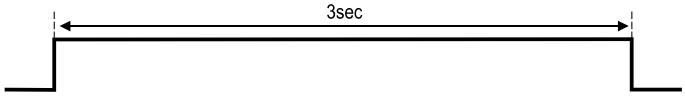
Self Diagnosis Mode

▶ Operating conditions

Self diagnosis is performed when moving the gear shift lever to "R" position. If the system is defective (Fail) due to open sensor or communication problem, the information for the failed sensor is sent to the instrument cluster.

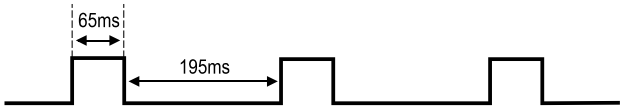
- Fail condition (However, in case that there is not any obstacle in 30 cm)
  1. When the signal line is open
  2. When the power supply line (+. -) is open

▶ Buzzer interval during self diagnosis

MODE	Alarm Interval (msec)
Normal	
LEFT	
CENTER	
RIGHT	
2 or more sensors are faulty	

Downloaded from www.Manualslib.com manuals search engine

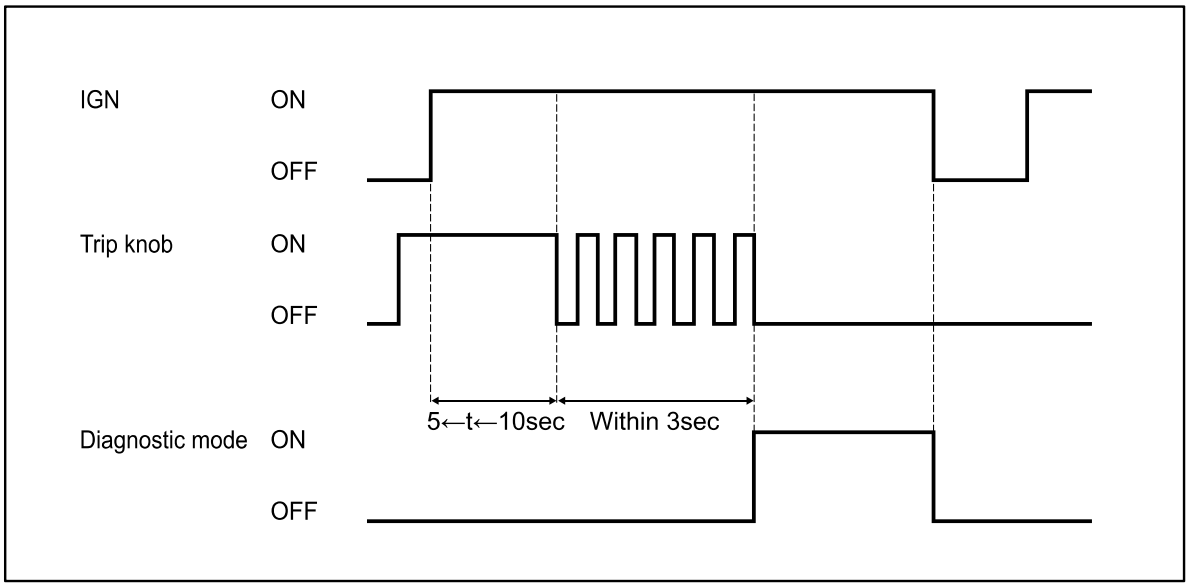
▶ Buzzer interval during reverse driving

Step	L / R	CENTER	Alarm Interval (msec)
Step 1	80~100 (cm)	80~120 (cm)	
Step 2	50~80 (cm)		
Step 3	25~50 (cm)		
Tolerance	±10 (cm)		±10 (cm)

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4. SELF DIAGNOSIS



1. Self diagnosis for instrument cluster

- Speed meter: Check the whole speed range (minimum to maximum).
- Tachometer: Check the whole rpm range (minimum to maximum).

2. Self diagnosis for symbols

- All symbols ON
  (except the wired type symbols: Air bag, Passenger air bag, Turn signal indicators, Hazard, High beam, Front fog lamp)

3. ETC

- When entering into the self diagnosis node, the dimmer Micom output will be 100%.
- Remaining segments are ON.
- If CAN messages are OK, the symbols are ON. If not, blinking.
- The mode and illumination switch inputs are overridden.

5. VARIANT CODING

- The instrument cluster enables all functions by receiving the vehicle's variant codes through CAN when turning the ignition switch to ON position.
- The systems confirmed by variant code performs the pre-warning and time-out operation. If not confirmed, all data for the systems, even exiting in CAN network, are overridden.

Downloaded from www.Manualslib.com manuals search engine

SWITCH 8510-01

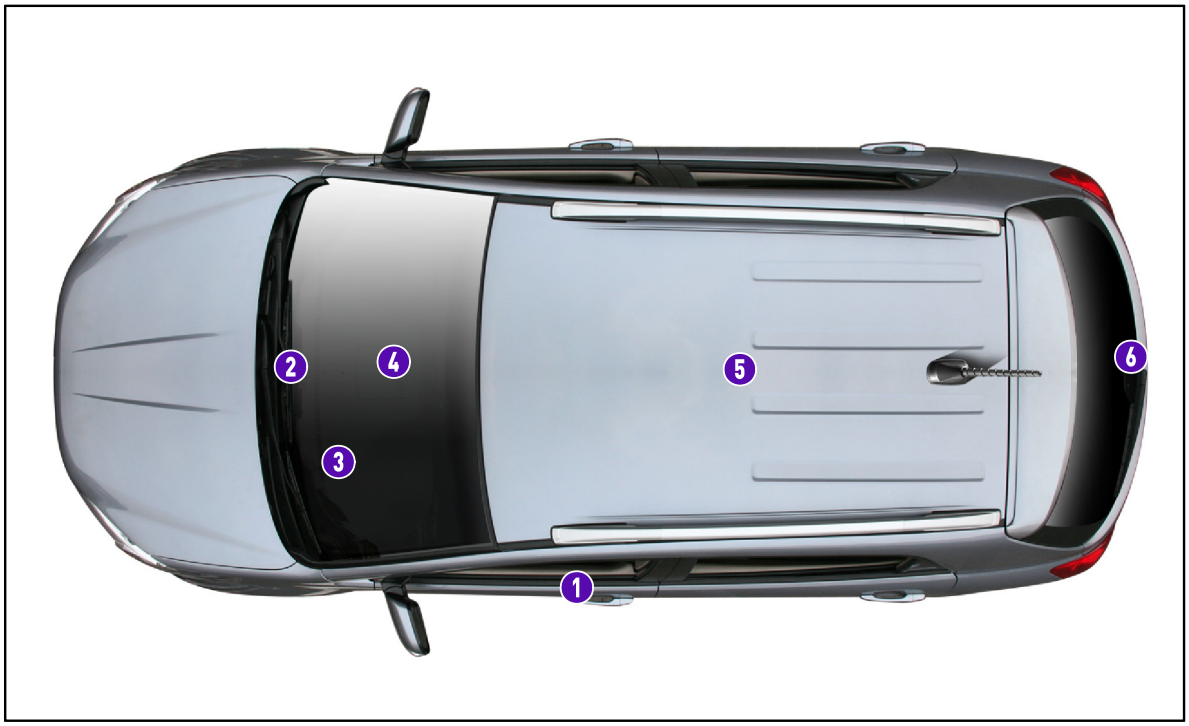
OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

Switch cluster:

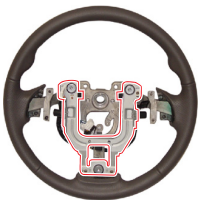
1. Door panel switch
2. Instrument panel switch
3. Steering wheel switch
4. Front console switch
5. Headlining switch
6. Trunk switch

1) Mounting Locations



Downloaded from www.Manualslib.com manuals search engine

▶ Switch layout

Steering wheel remote control switch	Front console switch	Horn switch
		

FATC switch

Driver's power seat switch

Trip/Reset switch	Lower panel switch	Multifunction switch

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Rear seat warmer switch (RH)

Center room lamp switch

Luggage room lamp switch

Cruise control switch

Trunk open switch

Power window sub switch

Rear seat warmer switch (LH)

Power window main switch

Front seat warmer switch

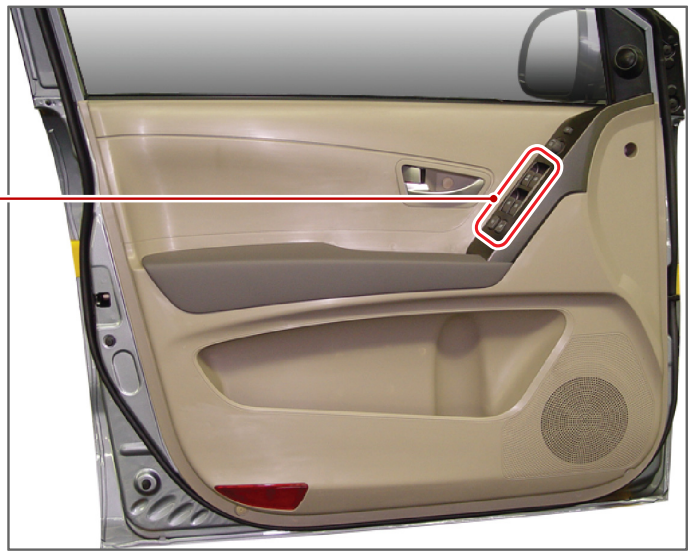
Modification basis	
Application basis	
Affected VIN	

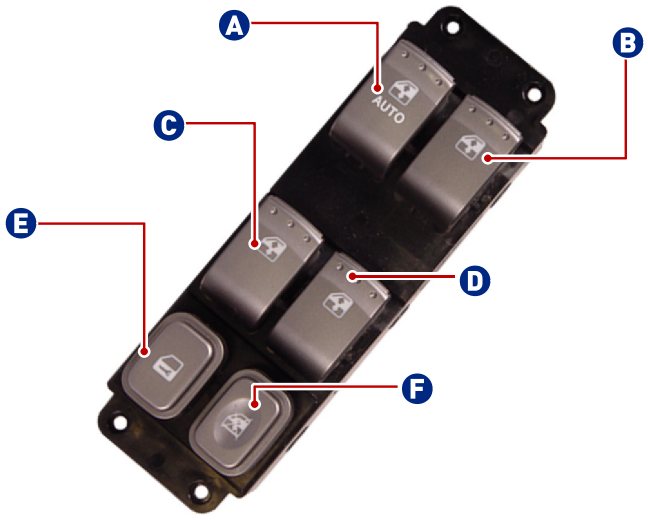
Downloaded from www.Manualslib.com manuals search engine

2. SWITCH CLUSTER ON DOOR TRIM

1) Driver Door

(1) Power window main switch



Power window main switch


A Driver door window switch	D Rear RH window switch
B Passenger door window switch	E Door lock/unlock switch
C Rear LH window switch	F Window lock switch

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Driver door window switch

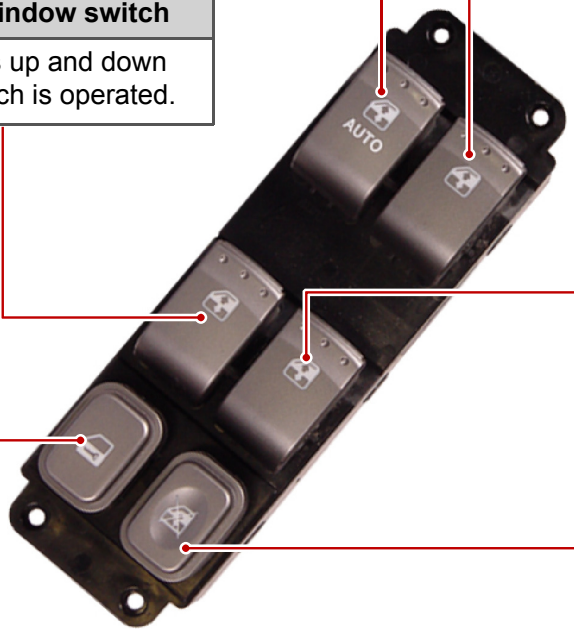
When opening the window:
When the front of the switch is lightly pressed, the window will be lowered while the switch is pressed. When pressed to its end, the window will open automatically until it is fully open. If you want to stop the window while automatic lowering, lightly press the switch again or pull the switch up.
When closing the window:
When you lightly pull the switch up, the window will move up only while the switch is being operated. When pulling the switch up to its end, the window will be fully closed (autoup operation (If equipped)). If you want to stop the auto-up function, pull up or gently press the switch again.

Rear LH window switch

The window is up and down while this switch is operated.

Passenger door window switch

The window is up and down while this switch is operated.



Rear RH window switch

The window is up and down while this switch is operated.

Door lock/unlock switch

When the door lock/unlock switch is pressed while all doors including the tailgate are locked, all doors will be unlocked. When the switch is pressed again, all doors will be locked.

Window lock switch

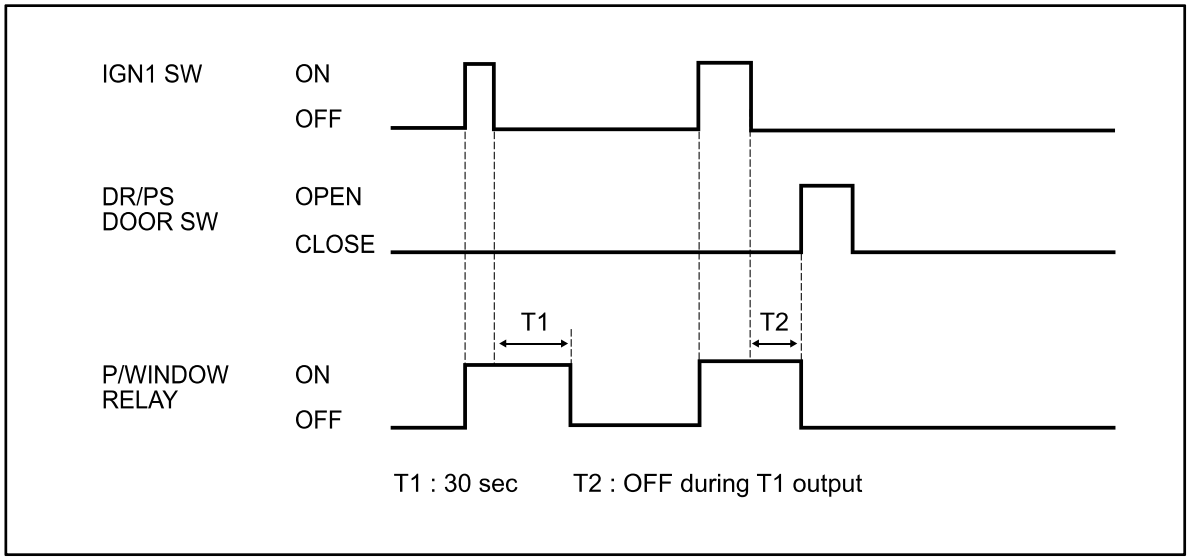
If the window lock switch is pressed down, only driver window is operative. Passenger and rear windows cannot be operated by their switches.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Time lag power window control

1. When turning the ignition switch to ON position, the power window relay is turned ON.
2. The power window relay keeps ON for T1 even when stopping the engine.
   However, the power window relay is turned OFF when opening a front door.
3. When locking the door with the remote control key (activation of theft deterrent mode), the power window relay is immediately turned OFF.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Function of door lock/unlock switch

There are 5 actuators in door lock/unlock system (including tailgate). All of them can control the corresponding door lock and unlock separately. But, the driver door lock switch can control all door locks.

Door lock/unlock switch

A Door lock/unlock switch

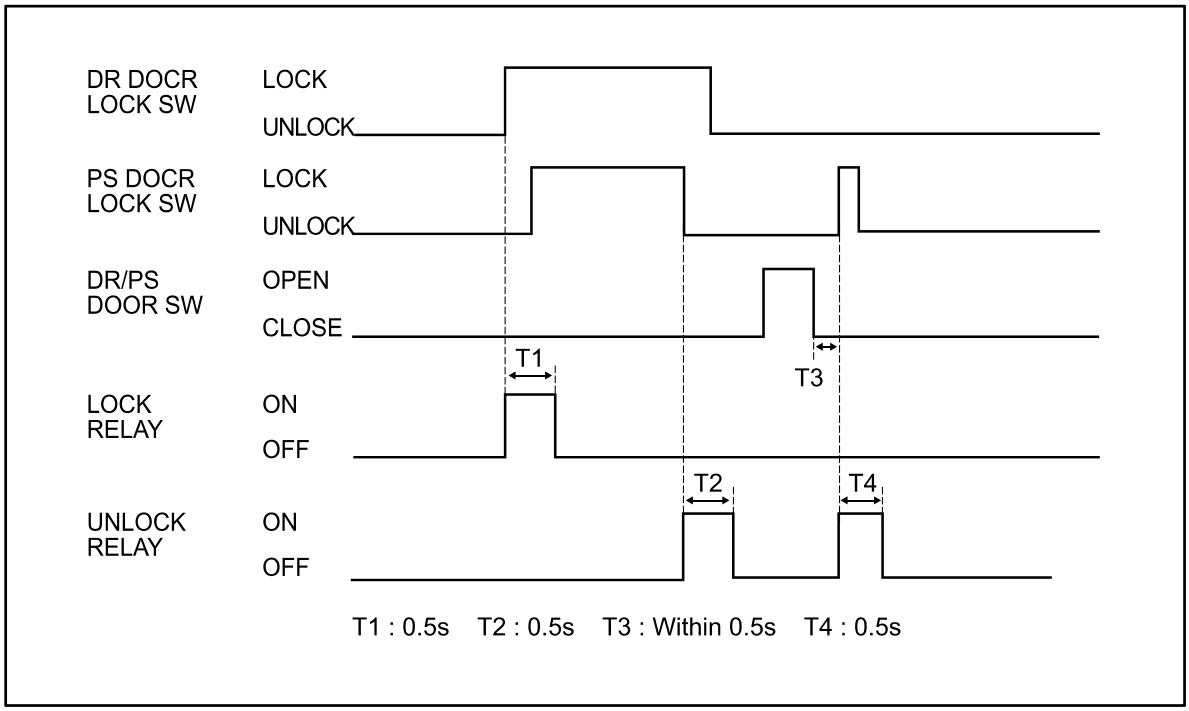
When the door lock/unlock switch is pressed while all doors including the tailgate are locked, all doors will be unlocked. When the switch is pressed again, all doors will be locked.

▶ Door lock/unlock relay (integrated in BCM)

Downloaded from www.Manualslib.com manuals search engine

▶ Door lock/unlock control by door LOCK switch (knob)

1. When moving the driver's or passenger door lock (knob) switch to LOCK from UNLOCK position, BCM sends the LOCK signal for T1.
2. When moving the driver's or passenger door lock (knob) switch to UNLOCK from LOCK position, BCM sends the UNLOCK signal for T2.
3. The LOCK (UNLOCK) operation by the door lock (knob) switch is not available when sending the LOCK (UNLOCK) signal by any other method such as remote control key.
4. When reconnecting the battery, the door lock (knob) switch is not operational before turning the ignition switch to ON position.
5. All doors stay unlocked when receiving the door lock signal in T3 after closing the doors.

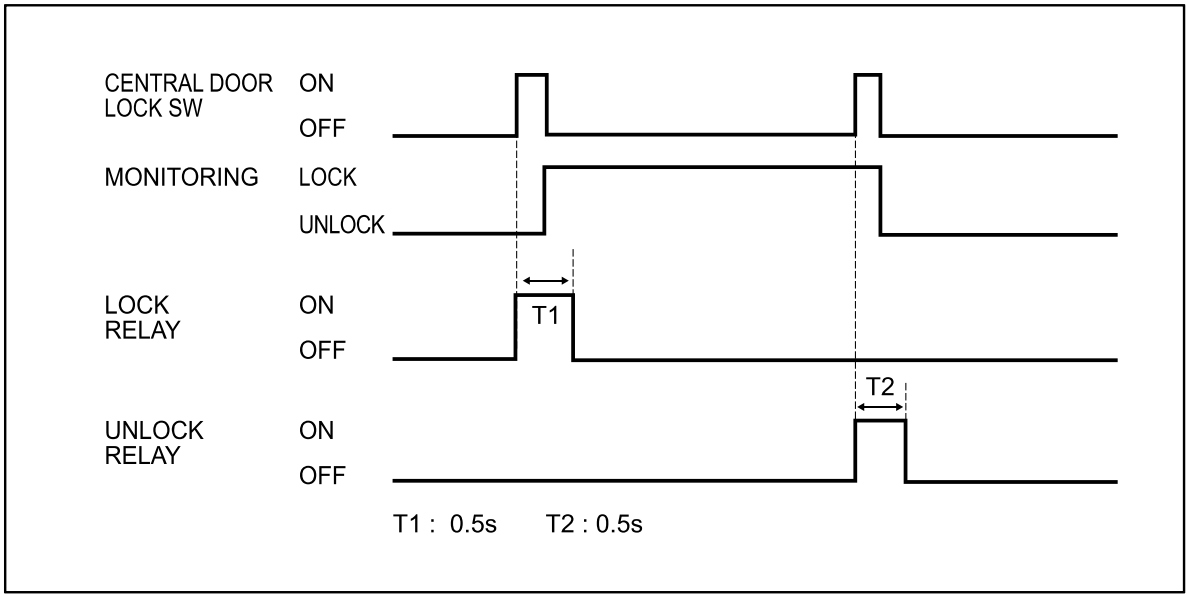


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

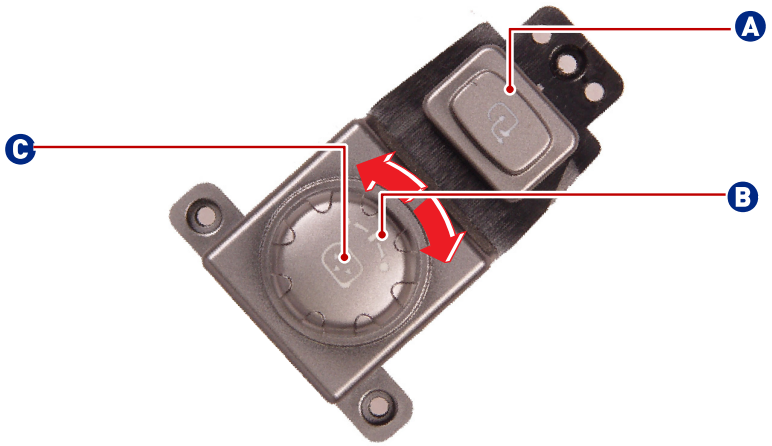
▶ Door lock/unlock control by central door lock switch

1. When pressing the central door lock/unlock switch, BCM sends the LOCK or UNLOCK signal according to the previous condition of driver door lock switch for T1.
2. The central door dock switch is not available when the system is in theft deterrent mode.
3. When stopping the engine, all doors are automatically unlocked.
4. When pressing the central door lock switch with any door open, the system unlocks the doors immediately after locking them.



Downloaded from www.Manualslib.com manuals search engine

(2) Outside Mirror Switch

Outside mirror switch


A Mirror folding/unfolding switch

To fold the outside rearview mirrors, press the switch. To unfold the mirrors, press again.

B Mirror selection switch

L": Driver side mirror
R": Passenger side mirror

C Aiming switch

Adjust the selected mirror up, down, left, or right by pressing the corresponding edges of the switch to get a desired view.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

The outside mirror folding switch is self return type and the aiming switch is seesaw and self return type.

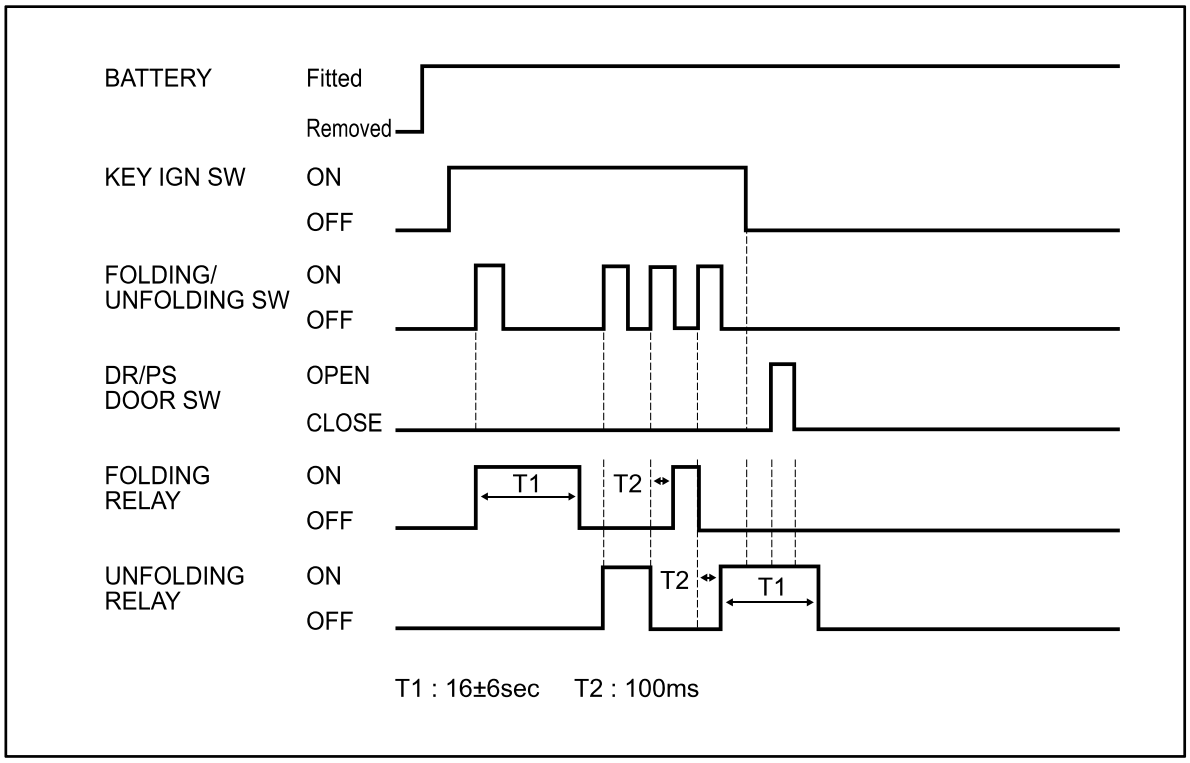
▶ Auto folding/unfolding control

1. Setting
   - Set auto folding function: When pressing the mirror folding switch for over 3 seconds, the auto folding function is set and the internal buzzer sounds once (ON: 100 ms, OFF: 200 ms).
   - Release auto folding function: When pressing the mirror folding switch for over 3 seconds, the auto folding function is released and the internal buzzer sounds twice (ON: 100 ms, OFF: 200 ms).
2. Auto folding sequence
   - When receiving the LOCK signal from the remote control key, the system operates in the sequence of "Door lock -> Theft deterrent mode activation -> Mirror folding".
3. When turning the ignition switch to ON position after unlocking the doors with the mirror folded, the mirrors are unfolded automatically.
4. When the auto folding function is set, the automatic unfolding is not available if the mirrors have been folded manually.
5. The factory setting is the enabling the auto folding function.

Downloaded from www.Manualslib.com manuals search engine

▶ Folding/unfolding control

1. When pressing the mirror folding/unfolding switch with IGN ON, the mirrors are folded or unfolded according to the mirror condition in T1.
   This operation time should be completed even when stopping the engine.
2. At first time pressing the mirror folding/unfolding switch after reconnecting the battery, the
3. mirror folding operation is performed.
4. This control must be available for 30 seconds (time lag period) after turning the ignition switch to OFF from ON position.
5. When receiving the folding/unfolding signal during the mirror folding/unfolding operation, BCM stops current operation and operates the newly commended operation after 10 ms.
6. The folding/unfolding operation is performed regardless of the vehicle speed.
7. Manual operation:
   - Mirror unfolded → Mirror folding/unfolding signal from switch → Mirror folding
   - Mirror folded → Mirror folding/unfolding signal from switch → Mirror unfolding



Modification basis	
Application basis	
Affected VIN	

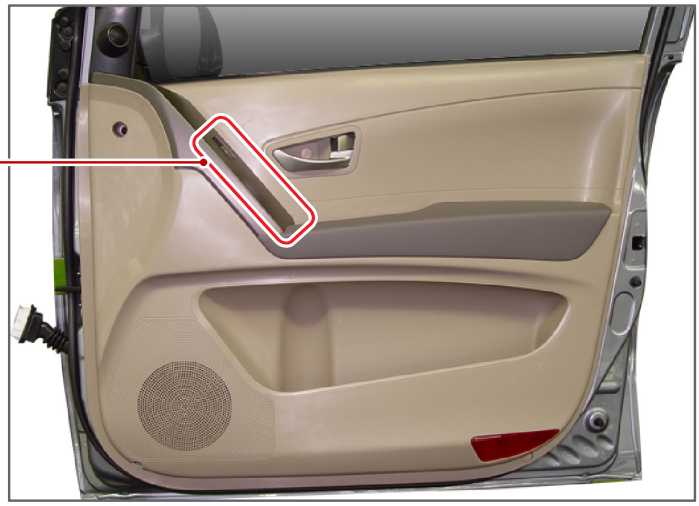
Downloaded from www.Manualslib.com manuals search engine

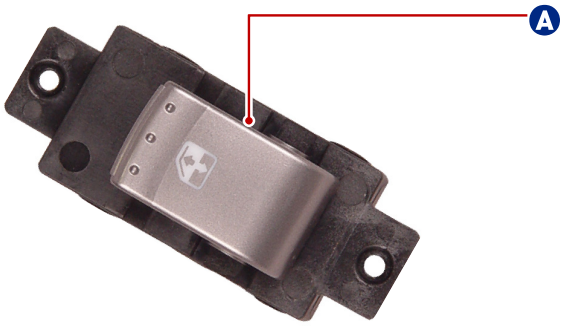
▶ Auto folding/unfolding control

1. Auto folding/unfolding setting
   - Auto folding setting: Pressing the manual folding button for 3 seconds or more, synchronized operation is set and the BCM inner buzzer is output once (ON: 100 ms, OFF: 200 ms).
   - Auto folding deactivation: Pressing the manual folding button for 3 seconds or more, synchronized operation is set and the BCM inner buzzer is output twice (ON: 100 ms, OFF: 200 ms).
2. Auto folding/unfolding operating sequence
   - For the vehicle without SKM: REKES lock signal received -> Door lock -> Theft deterrent mode -> Mirror folding
   - For the vehicle with SKM: Smart key remote controller door lock signal or outside handle switch signal received -> Door lock -> Theft deterrent mode -> Mirror folding
3. The auto unfolding after auto folding: Door unlock -> IGN ON -> Unfolding.
4. If the auto folding is set, unfolding is not performed during manual folding mode.
5. The default setting is auto folding function: activated.

Downloaded from www.Manualslib.com manuals search engine

2) Passenger Door Switch



Passenger door switch


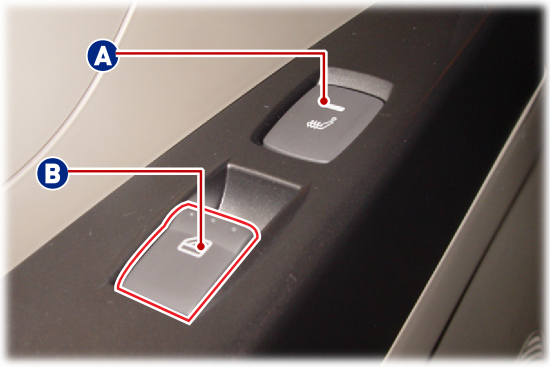
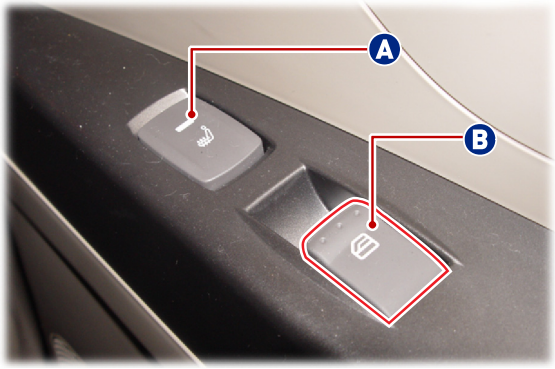
A **Power window main switch**

The window is up and down while this switch is operated.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Rear Door Switch

Rear LH door switch	Rear RH door switch
	

A **Seat warmer switch**

Press the switch to heat the seat and press again to stop the seat heating. During heating, the indicator light on the switch comes on.

B **Power window switch**

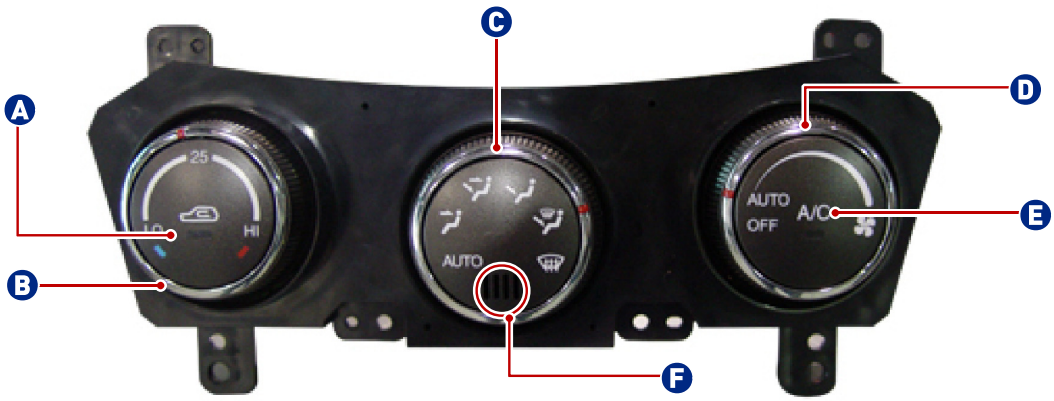
The window is up and down while this switch is operated.

Downloaded from www.Manualslib.com manuals search engine

3. SWITCH CLUSTER ON INSTRUMENT PANEL

1) FATC Switch

FATC switch



A Air circulation switch	D Fan speed dial
B Temperature dial	E Air conditioner switch
C Mode dial	F In-car temperature sensor

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Air circulation switch

When pressing this switch, recirculation indicator comes on and the system is changed into the recirculation mode.
When pressing the switch again, recirculation indicator goes out and the system is changed into the fresh air mode.

Temperature dial

- LO: Low temperature,
- HI: High temperature

Fan speed dial

- AUTO: Fan speed is automatically controlled by temperature setting.
- OFF: Fan does not operate.

Mode dial

Select the desired airflow mode by turning this dial.

Air conditioner switch

When you press this switch, the indicator comes on and the air conditioner starts to operate. When you press the switch again, the air conditioner stops operation and the indicator goes out.

Downloaded from www.Manualslib.com manuals search engine

2) Center Fascia Switch

The center fascia switch contains the hazard flasher switch, windshield heated wire switch, digital clock, rear glass heated wire switch and trip switch.

Center fascia switch

- **A** Hazard flasher switch
- **B** Trip/Reset switch
- **C** Digital clock
- **D** Rear glass & outside mirror heated wire switch
- **E** Windshield heated wire

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Hazard flasher switch

To turn on the hazard warning flashers, push this switch. All turn signal lamps will flash simultaneously with the hazard warning indicators. To turn off the hazard warning flashers, push the switch again.

Windshield heated wire switch

Press this switch to turn on the windshield heated wire. The heated wire operates for about 12 minutes. Press the switch again to stop the operation. Use this to prevent the windshield wiper blades from being frozen. The heated wire operates for about 6 minutes when the switch is pressed again within 10 minutes after completion of its first operation cycle. The indicator in the switch comes on when in use.

Trip/Reset switch

Various vehicle information of the vehicle are displayed on LCD display when pressing this switch. The LCD display shows each information according to the specified sequence when pressing the switch.

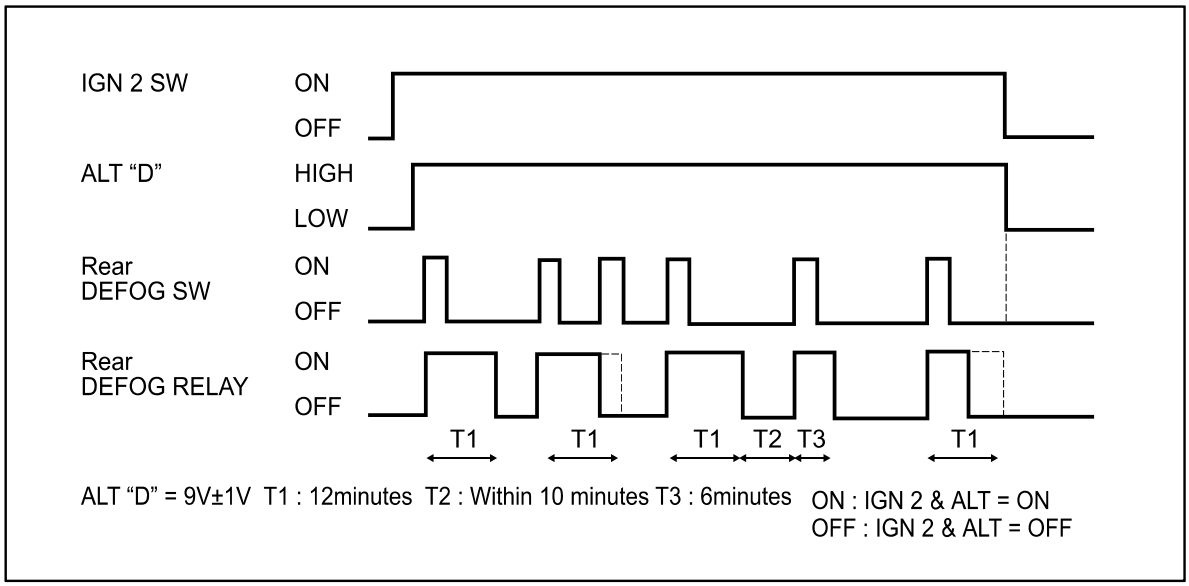
Rear glass/outside mirror heated wire switch

Press this switch to turn on the tailgate and outside rearview mirror heated wire. The heated wire operates for about 12 minutes. Press the switch again to stop the operation. This switch is designed to defrost or defog the tailgate glass and outside rearview mirrors. The heated wire operates for about 6 minutes when the switch is pressed again within 10 minutes after completion of its first operation cycle. The indicator in the switch comes on when in use.

Downloaded from www.Manualslib.com manuals search engine

(1) Rear glass/outside mirror heated wire switch

The rear glass/outside mirror heated wire is operated by BCM.
The heated wire operates for about 12 minutes. Press the switch again to stop the operation.
This switch is designed to defrost or defog the tailgate glass and outside rearview mirrors. The heated wire operates for about 6 minutes when the switch is pressed again within 10 minutes after completion of its first operation cycle.
This function is available only when the engine is running.

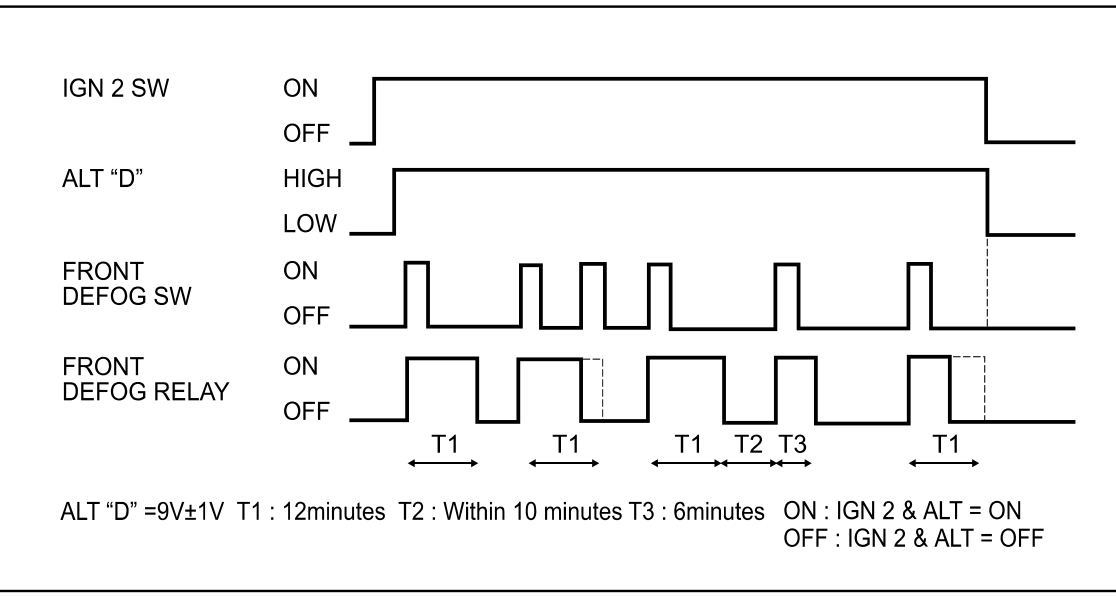


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(2) Windshield heated wire switch

The windshield glass/outside mirror heated wire is operated by BCM.
The heated wire operates for about 12 minutes. Press the switch again to stop the operation. Use this to prevent the windshield wiper blades from being frozen. The heated wire operates for about 6 minutes when the switch is pressed again within 10 minutes after completion of its first operation cycle.
This function is available only when the engine is running.



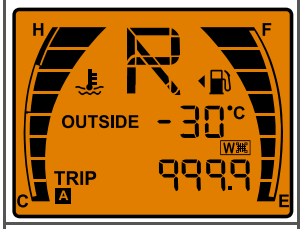
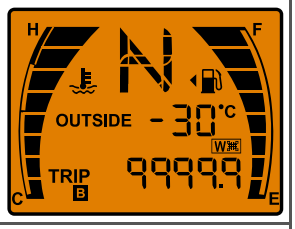
ALT "D" =9V±1V T1 : 12minutes T2 : Within 10 minutes T3 : 6minutes ON : IGN 2 & ALT = ON
OFF : IGN 2 & ALT = OFF

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(3) Trip switch

Various vehicle information of the vehicle are displayed on LCD display when pressing this switch. The LCD display shows each information according to the specified sequence when pressing the switch.

LCD display	
	
TRIP A	**TRIP B**

▶ **Description**

Mode switch	Time	Function
Briefly press	below 1 second (60 to 980 ms)	- Mode change (Odo→Trip A→Trip B→DTE→Average fuel consumption→Instant fuel consumption→Illumination level→Ambient air temperature)
Press and hold	over 1 second	- Reset (Trip A, B, DTE) - Change (Illumination level (6 to 1), Temperature unit (℃↔°F))
Not press	over 3 seconds	- Mode change (Illumination level→Ambient air temperature→Odo)

※ **Default is DTE mode.**

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Lower Switch Panel

Lower switch panel

A 4WD LOCK switch	**C** Rear fog lamp switch
B ESP OFF switch	**D** Headlamp leveling switch

Downloaded from www.Manualslib.com manuals search engine

4WD LOCK switch

Press to toggle between 4WD LOCK mode (4WD LOCK indicator ON) and 4WD AUTO mode (Indicator OFF).

Rear fog lamp switch

To turn on the rear fog light, push the rear fog light switch while the tail lamp is turned on. To turn it off, push the switch again.

ESP OFF switch

If you press the ESP OFF switch, ESP function is deactivated and the ESP OFF indicator in the instrument cluster comes on. To resume the ESP function, press this switch again. At this time, ESP OFF indicator goes out.

Headlamp leveling switch

The headlamp aiming can be adjusted by 4 steps (0 to 3) by using this switch.
Turning up the switch: Higher aiming
Turning down the switch: Lower aiming

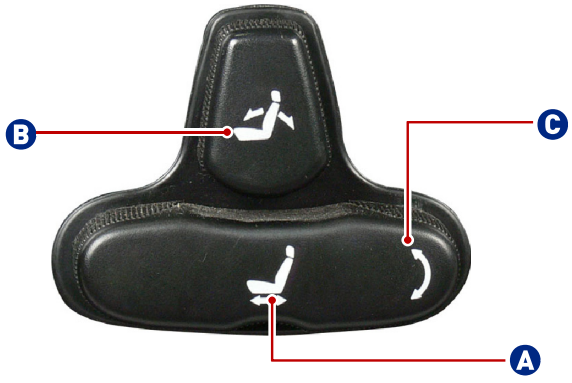
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4) Power Seat Switch Assembly

(1) Power seat switch (Driver side)

Power seat switch



A Sliding	**C** Seat height adjustment
B Seatback reclining	

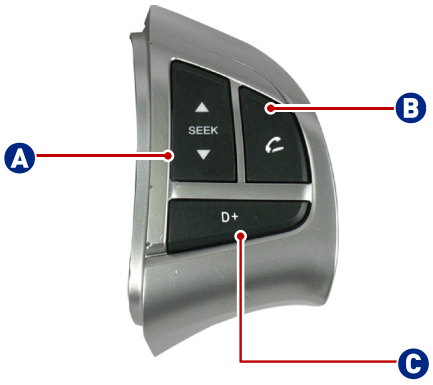
Downloaded from www.Manualslib.com manuals search engine

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4. STEERING WHEEL SWITCH

1) Audio Remote Control Switch

LH	RH
	
A MUTE & MODE switch B Volume switch C Tip switch (D-)	A SEEK switch B Bluetooth switch C Tip switch (D+)

Downloaded from www.Manualslib.com manuals search engine

MUTE & MODE switch

To turn on the audio system, briefly press this switch. To turn it off, press and hold the switch again.
To eliminate the sound (MUTE), briefly press this switch. To resume the sound, press the switch again.
To change the audio mode (AM, FM1, FM2), press and hold this switch.

SEEK switch

- In CD player mode:
  briefly press: Next/Previous track
  press and hold: Moving in same track
- In radio mode: briefly press:
  Manual search, move to selected channel press and hold: Auto search

Volume switch

Increases/decreases volume

Bluetooth switch

To receive a call in Bluetooth mode, press this switch.

Tip switch (D-)

To select the lower gear in “M” mode, press this switch.

Tip switch (D-)

To select the higher gear in “M” mode, press this switch.

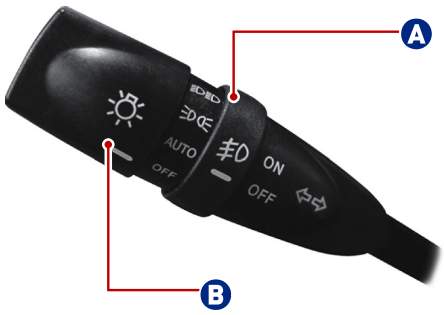
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Multifunction Switch

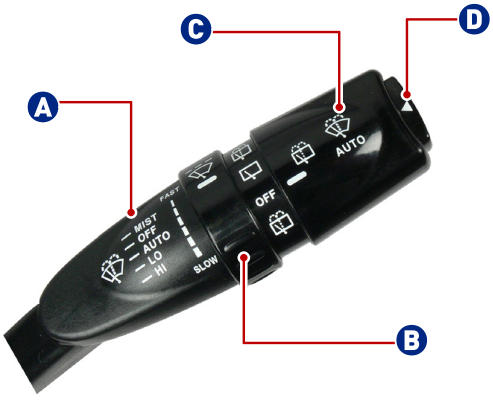
The multifunction switch contains the auto washer and wiper switch and front fog lamp switch. And, in the vehicle with air bag, the air bag spring clock is installed on the multifunction switch.

Turn signal switch



- **A** Light switch
- **B** Front fog lamp switch

Wiper switch



- **A** Front wiper switch
- **B** Wiper speed dial
- **C** Rear wiper switch
- **D** Front auto washer switch

Downloaded from www.Manualslib.com manuals search engine

▶ Light switch

Headlamps ON

Headlamp, side-marker, tail, license plate, fog, and instrument cluster lamps come on.

Tail lamps ON

Side-marker, tail, license plate, fog, and instrument cluster lamps come on.

Automatic light ON

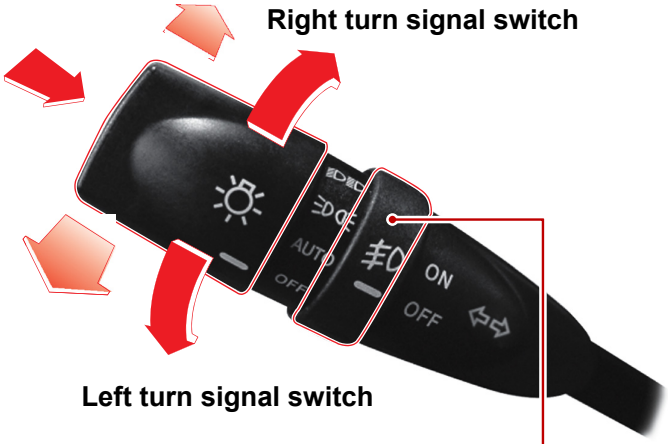
Head- and tail lamps automatically turn on or off based upon the intensity of the sunlight analyzed by the automatic light sensor.

Lights OFF

Right turn signal switch

Headlamp high beam

To turn on the headlamp high beam, push the lever towards the instrument cluster with the headlamp low beam on.



Left turn signal switch

Passing

Regardless of the position of the light switch, when holding the lever toward the steering wheel, the headlights are on high beam during the hold.

Front fog lamp switch

To turn on the fog lights, turn this switch while the tail lamps or headlamps are turned on.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Wiper switch

Auto washer switch

When the front wiper switch is off and this switch is pressed, washer fluid will be sprayed and the wiper will automatically operate 4 times. Then, the fluid will be sprayed again and the wiper will automatically operate 3 times.

MIST

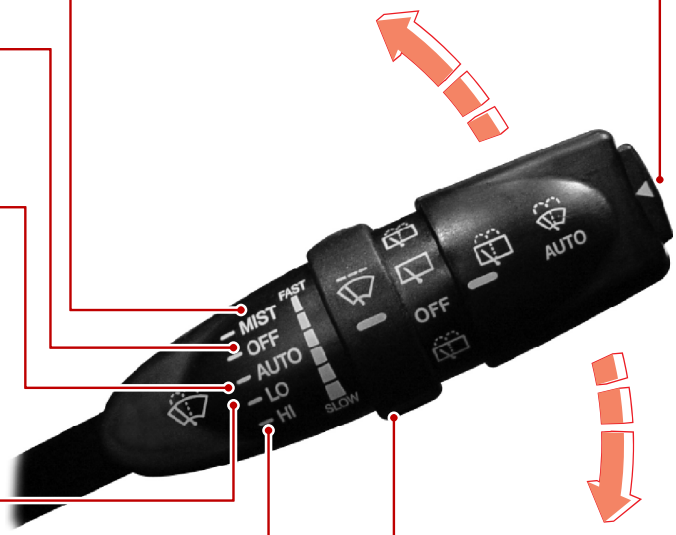
The front wipers can be operated only when you hold the switch to the "MIST" position. The lever will return to the "OFF" position when released.

OFF

Stop the operation.

AUTO

Operates automatically according to the vehicle speed or amount of rain.



LO

Continuous wipe, slow operation

HI

Continuous wipe, fast operation

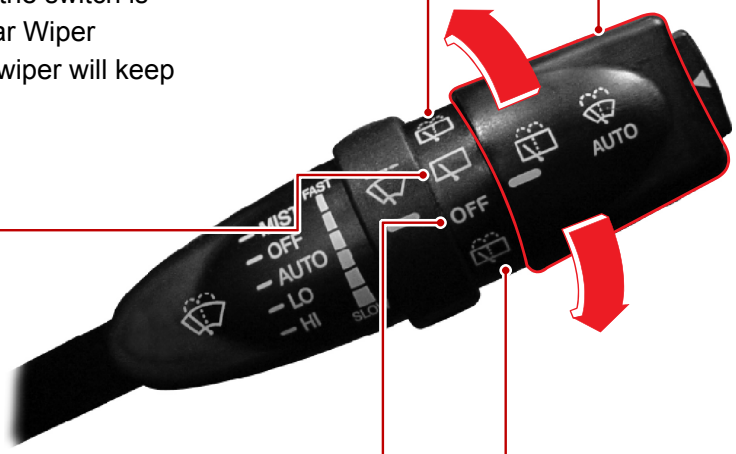
Wiper and Washer coupled operation

Pull the lever briefly (for less than 0.6 seconds):
One wiping cycle with washer spray
Pull and hold the lever for more than 0.6 seconds:
Three wiping cycles with washer spray

Downloaded from www.Manualslib.com manuals search engine

Rear wiper switch

When the switch is fully turned, washer fluid will be sprayed onto the rear window glass and the wiper will also operate. When the switch is released, it will stop in the Rear Wiper Operation mode and only the wiper will keep operating.



Rear wiper operation

OFF

Rear wiper stops

When the switch is fully turned, washer fluid will be sprayed onto the rear window glass and the wiper will also operate. When the switch is released, it will return to the “OFF” position and turn off the wiper and washer.

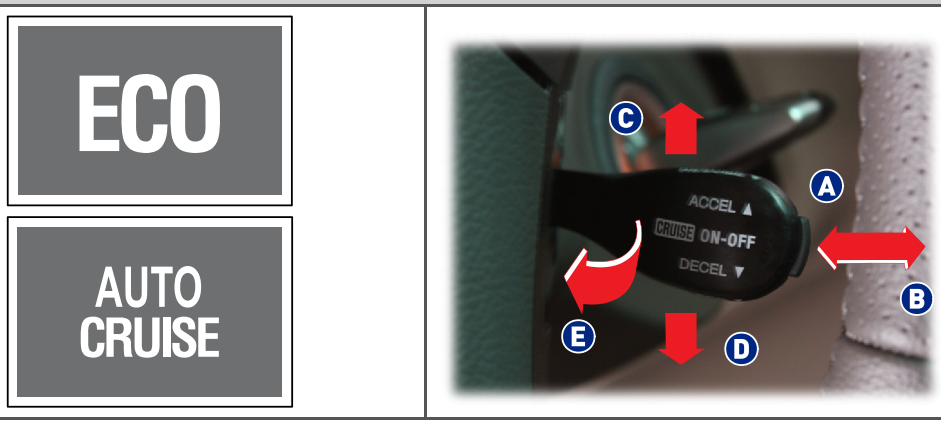
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Cruise Control Switch

The cruise control is an automatic speed control system that maintains a desired driving speed without using the accelerator pedal.
The vehicle speed must be greater than 36 km/h to engage the cruise control. This feature is especially useful for motorway driving.

Cruise control switch



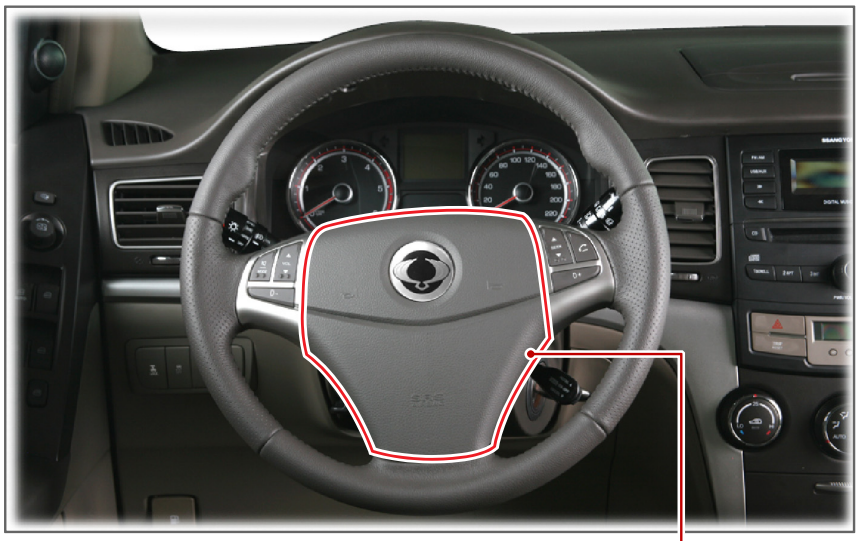
- A Cruise control (ON)
- B Cruise control (OFF)
- C Cruise control (Acceleration)
- D Cruise control (Deceleration)
- E Cruise control (Reset)

Modification basis	
Application basis	
Affected VIN	

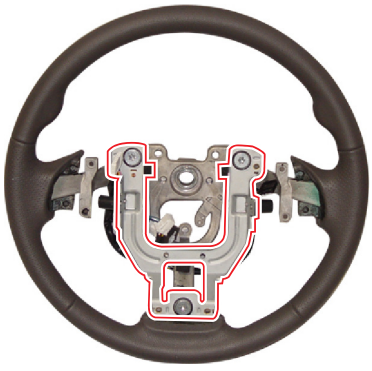
Downloaded from www.Manualslib.com manuals search engine

4) Horn Switch

Two horns are installed in the engine compartment. When pressing the horn switch in steering wheel, the horns (dual horn) sound.



Horn switch



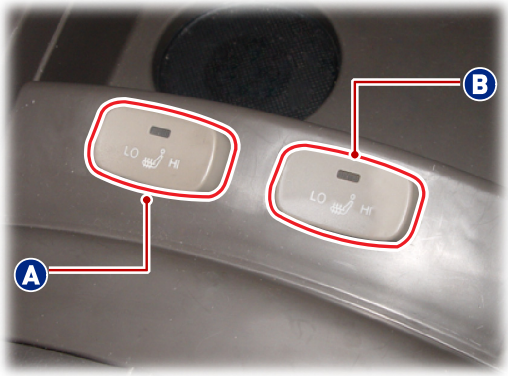
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

5. SEAT WARMER SWITCH

Press the "HI (High temperature)" or "LO (Low temperature)" on the seat heating switch to heat the seat and seatback. When the temperature reaches 40 ±5℃, the thermistor integrated in seat connects and cuts the power to keep the temperature stable. There is no seat warmer unit.

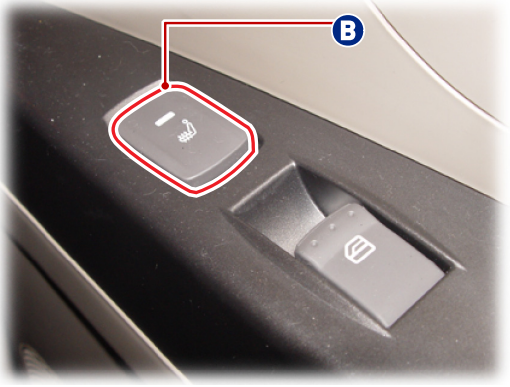
Front seat warmer switch



A Driver seat warmer switch
B Passenger seat warmer switch

Rear seat warmer switch

A Rear LH seat warmer switch



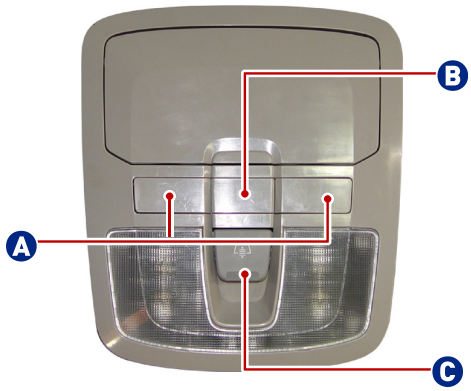
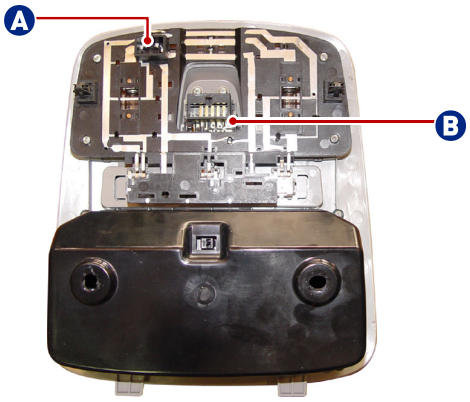
B Rear RH seat warmer switch

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

6. OVERHEAD CONSOLE SWITCH

- BCM controls the room lamps.
- The front room lamp and center room lamp come on/go out when opening/closing a door in the switch pressed in (door coupled operation mode).
- When closing the door, the lamps are dimmed out in 3 seconds.
- The front room lamp turns on when pressing in this switch.

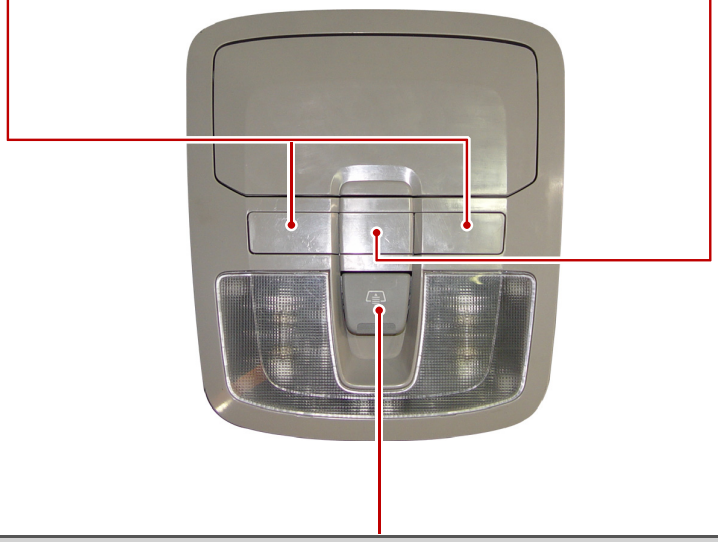
Overhead console switch	
	
A Front room lamp switch B Door coupled operation switch C Sunroof switch	A Front room lamp connector B Sunroof connector

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Front room lamp switch
The front room lamp turns on when pressing in this switch.

Door coupled operation switch
The front room lamp and center room lamp come on/go out when opening/closing a door in the switch pressed in (door coupled operation mode).



Sunroof switch

▶ **Push up the switch briefly: 2-step auto sliding open**

When pushing up the sunroof switch briefly, the sunroof is automatically opened by two third of its travel (first step). When pushing up and holding the sunroof switch again, the sunroof is completely opened (second step).

▶ **Push up and hold the switch: manual sliding open**

The sunroof is opened as long as pushing up the switch.

▶ **Pull down the switch briefly: auto sliding close**

When pulling down the sunroof switch briefly, the sunroof is automatically closed completely. To stop the sunroof, pull or push the switch at desired position while moving.

▶ **Pull down and hold the switch: manual sliding close**

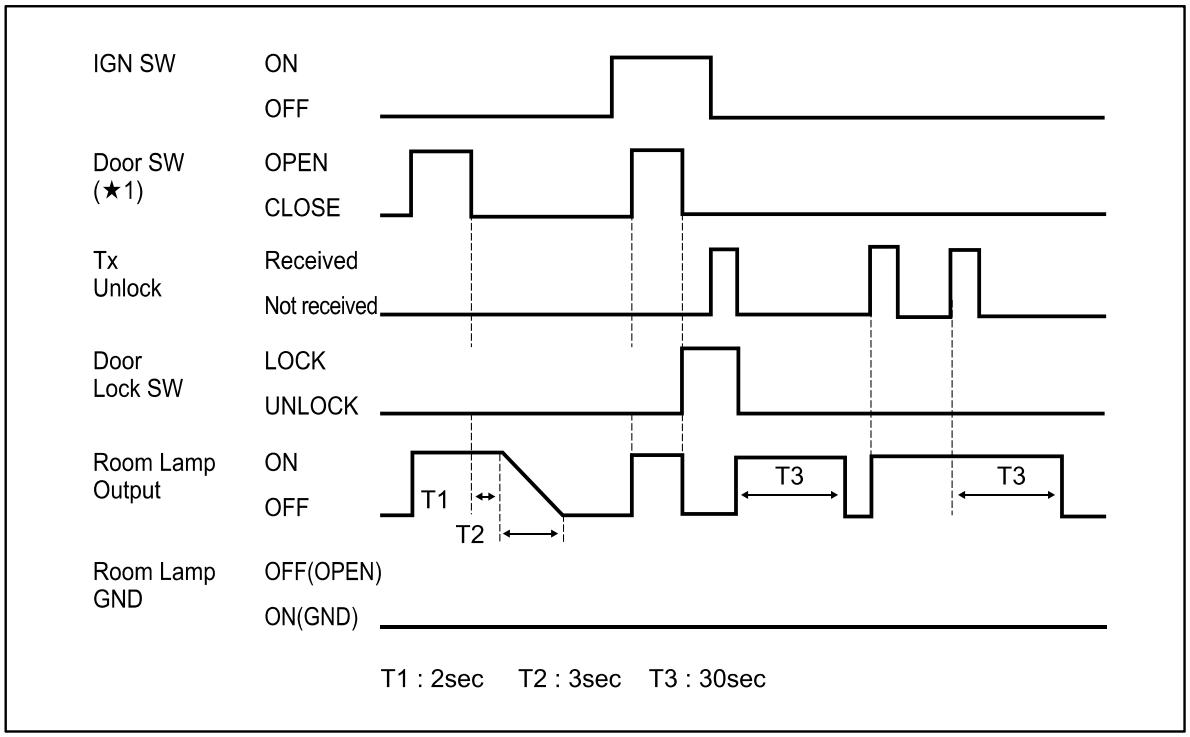
The sunroof is closed as long as pulling down the switch.

Downloaded from www.Manualslib.com manuals search engine

▶ Door coupled room lamp operation and dimming control

When opening any of doors while the room lamp switch in overhead console is pressed in ("Door" coupled position), the front and center room lamps come on. When opening the tailgate while the luggage room lamp switch is pressed in ("Tailgate" coupled position), the luggage room lamp comes on. If the door stays open, the room lamps automatically goes off after 10 minutes.

1. When closing the door with IGN ON, the room lamps go off immediately.
2. When closing the door with IGN OFF, the room lamps stays on for T1 and are dimmed out for T2.
3. When turning the ignition switch to ON position during dimming out operation, the room lamps go off immediately.
4. When receiving the door unlock signal with IGN OFF, key OUT and door closed, the room lamps come on for T3.
5. When receiving the door unlock signal again in Step (4), the front and center room lamps stays on for T3 additionally.
6. When opening a door during the dimming operation, the room lamps stays ON. When closing it again, the system performs the operation in Step (1) and (2).
7. The room lamps go off immediately when entering into the theft deterrent mode.

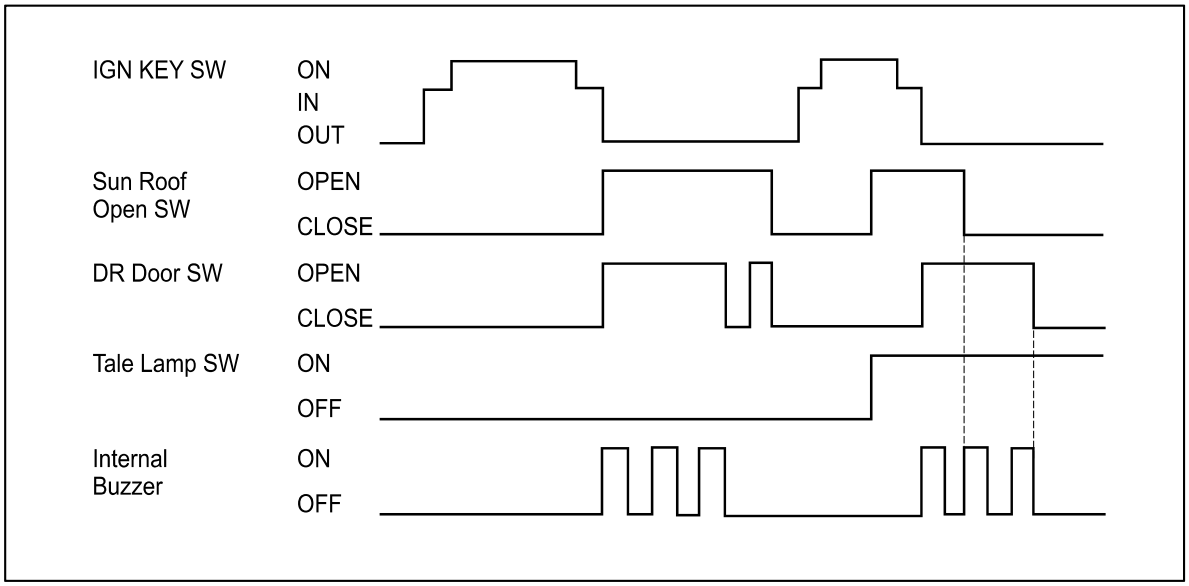


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Sunroof warning control

1. When removing the ignition key with the sunroof open, the buzzer sounds for 10 seconds with the interval of 0.02s ON/1.58s OFF.
2. When opening and then closing the driver door or closing the sunroof during buzzer operation, the buzzer stops its operation immediately.
3. The sunroof warning has a priority over the tail lamp left On warning.

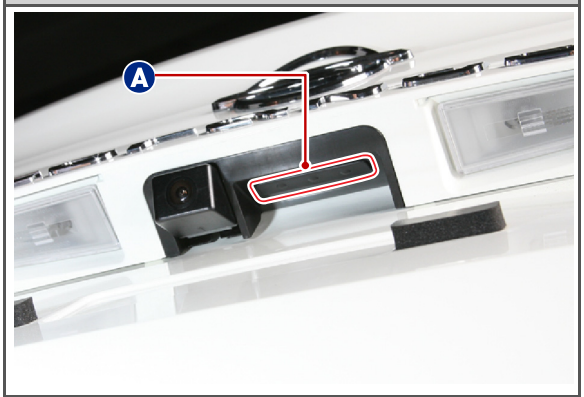


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

7. TAILGATE OPEN SWITCH

Tailgate open switch



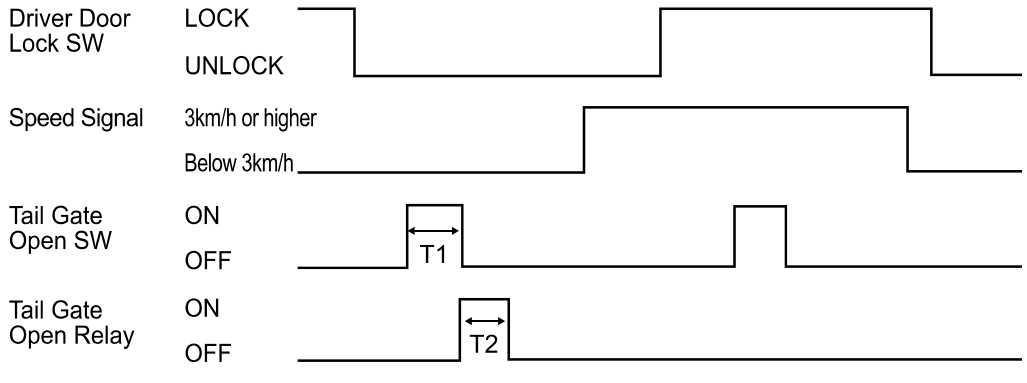
A Tailgate open switch

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Tailgate open control

1. When pressing the tailgate open switch for T1 with driver door unlocked and vehicle speed below 3 (±0.1) km/h, the tailgate open relay is turned ON for T2.
2. The tailgate open relay is turned OFF immediately after the driver door is locked or the vehicle speed goes over 3 km/h.



T1 : 0.1s or more T2 : 1.0s

- T/Gate Open : REKES Jnlock (Disarmed deterrent mode) → T/Gate Open Switch Input → T/Gate Open
- Timing : TBD

- Tailgate open: REKES unlock (disarmed deterrent mode) → Tailgate open signal → Tailgate open

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

SPECIFICATION

1) Exterior Lamps

Description		Type	Amount
Front lamp	Headlamp (high & low beam)	BULB: H4	2
	Turn signal lamp	BULB: PY21W	2
	Position lamp	BULB: W5W	2
	Fog lamp	BULB: H27W/2	2
Rear lamp	Stop & tail lamp	BULB: P21/5W	2
	Turn signal lamp	BULB: P21W	2
	Back-up lamp	BULB: P21W	2
	Fog lamp	BULB: P21W	2
	High mounted stop lamp	LED (with spoiler) (without spoiler)	 12 24
	License plate lamp	BULB: W5W	2
Side lamp	Side repeater lamp	LED	5
	Puddle lamp	LED	2

NOTE

▶ **LED**

- The LED stands for "Light Emitting Diode" or "Luminescent Diode." LED is a semiconductor diode that emits incoherent narrow-spectrum light when electrically biased in the forward direction of the P-N junction, as in the common LED circuit. In short, it is an element that converts electric signals into light signals. Yellow, blue, red and white LEDs are currently used.
  The followings are the advantages of LED.
- It is not glaring and doesn't have short circuit unlike the conventional lamps.
  It is semi-permanent and doesn't generate heat.
  Its power consumption is much lower than those of conventional bulbs.

Downloaded from www.Manualslib.com manuals search engine

2) Interior Lamps

Description	Type	Amount
Front room lamp	BULB (10W-FESTOON)	2
Center room lamp	BULB (10W-FESTOON)	1
Luggage room lamp	BULB (10W-FESTOON)	1
Sun visor lamp	BULB (5W-FESTOON)	1
Glove box lamp	BULB (5W-FESTOON)	1
Door courtesy lamp	BULB (5W-WEDGGE)	1

NOTE

▶ **Luminous intensity**

- In photometry, luminous intensity is a measure of the wavelength-weighted power emitted by a light source in a particular direction per unit solid angle, based on the luminosity function, a standardized model of the sensitivity of the human eye. The unit of luminous intensity is the candela (cd).

▶ **Brightness**

- Brightness is an attribute of visual perception in which a source appears to be radiating or reflecting light. In other words, brightness is the perception elicited by the luminance of a visual target. This is a subjective attribute/property of an object being observed. The unit of brightness is the stilb (sb) or nit (nt).

▶ **Luminance**

- The density of luminous power, also called "luminance." One lumen of luminous flux, uniformly incident on 1 square foot of area, produces an luminance of 1 footcandle; in SI units, one lumen of luminous flux, uniformly incident on 1 square meter of area, produces an luminance of 1 lux.

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. EXTERIOR LAMPS

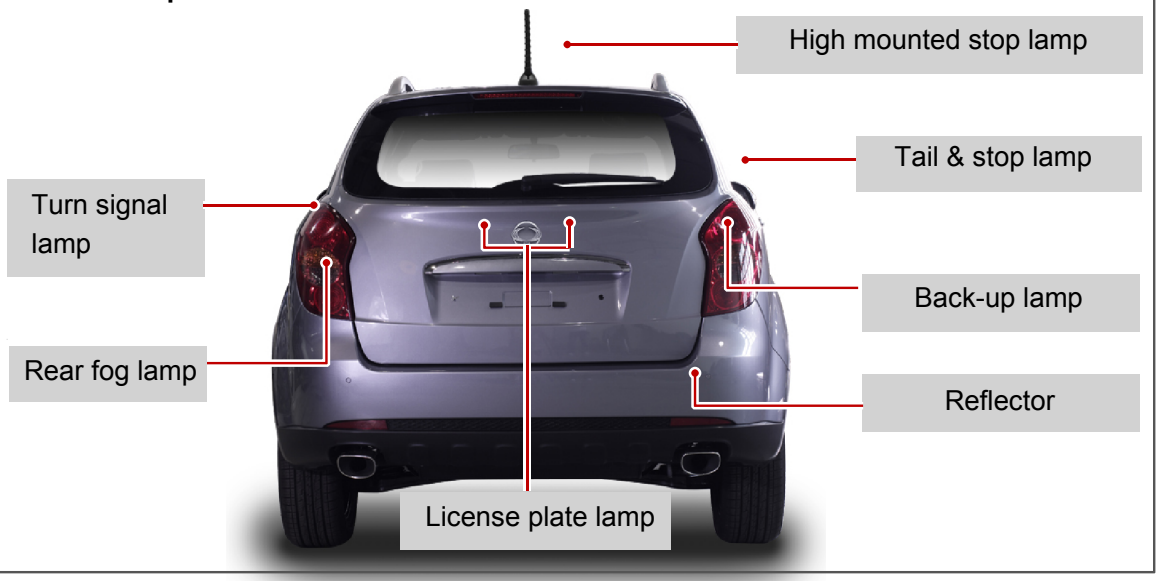
1) Overview

- ▶ **Front lamp: Headlamp, Turn signal lamp, Position lamp, Front fog lamp**
- ▶ **Rear lamp: Tail & stop lamp, License plate lamp, Back-up lamp, Turn signal lamp, Rear fog lamp, High mounted stop lamp, Reflector**
- ▶ **Side lamp: LH/RH side repeater lamp, Puddle lamp**

2) Layout

▶ **Front lamp**

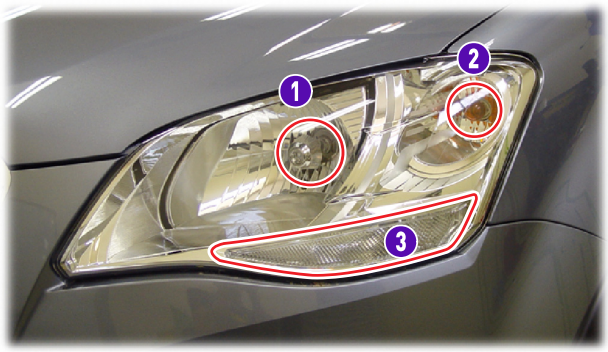
▶ **Rear lamp**



Modification basis	
Application basis	
Affected VIN	

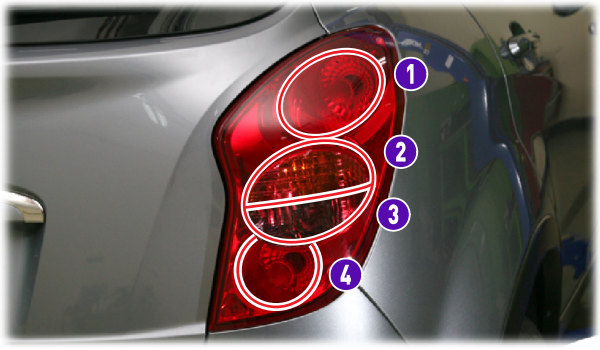
Downloaded from www.Manualslib.com manuals search engine

Headlamp



1. Low beam & high beam
2. Turn signal lamp
3. Position lamp

Rear combination lamp



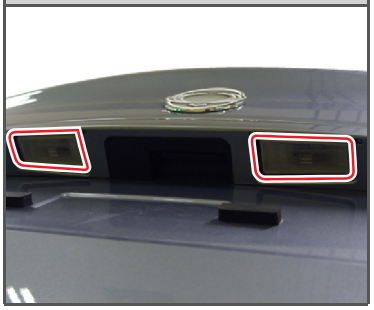
1. Tail & stop lamp
2. Turn signal lamp
3. Back-up lamp
4. Rear fog lamp

Front fog lamp

Side repeater lamp

Puddle lamp

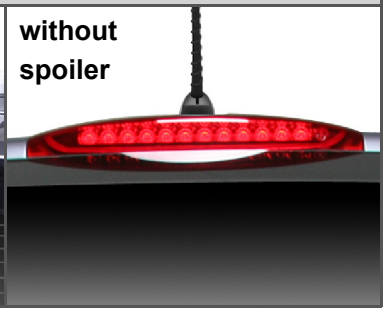
License plate lamp



High mounted stop lamp

with spoiler

without spoiler



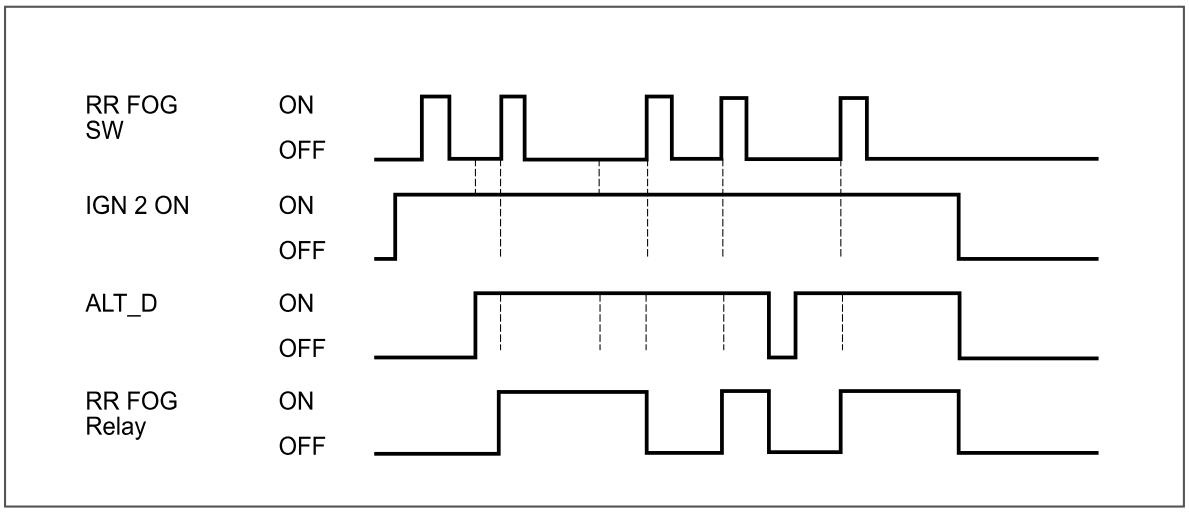
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Operating Process

(1) Fog lamp control

1. When pressing the rear fog lamp switch with IGN2 ON (headlamp ON condition), the rear fog lamps are turned ON.
2. When pressing the rear fog lamp switch again during the operation, the rear fog lamps are turned OFF.
3. The rear fog lamps do not come ON when the engine is not running or the light switch is OFF.
4. The rear fog lamps should not automatically come on again if they have been turned OFF by any other way other than the switch.

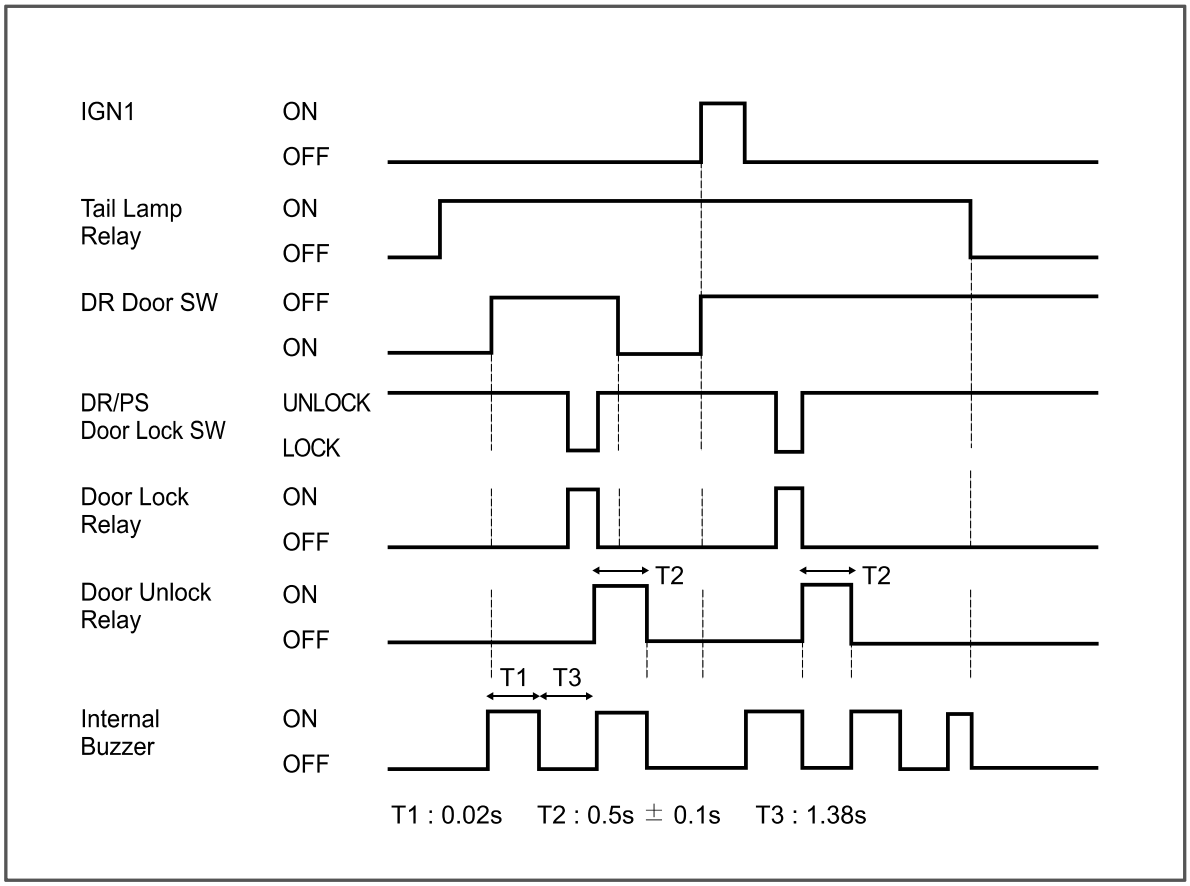


Downloaded from www.Manualslib.com manuals search engine

(2) Tail lamp control

▶ **Tail lamp left ON warning (however, sunroof and ignition key reminder functions have the priority)**

1. The buzzer sounds for 10 seconds with the interval of 0.02s ON/1.38 OFF when opening the driver's door with key removed and tail lamp ON.
2. The buzzer stops its operation when turning off the tail lamp or closing the driver's door during buzzer operation.
3. The buzzer stays ON when turning the tail lamp on again after turning it off during buzzer operation.
4. This function is not available when the ignition switch is in ON position.

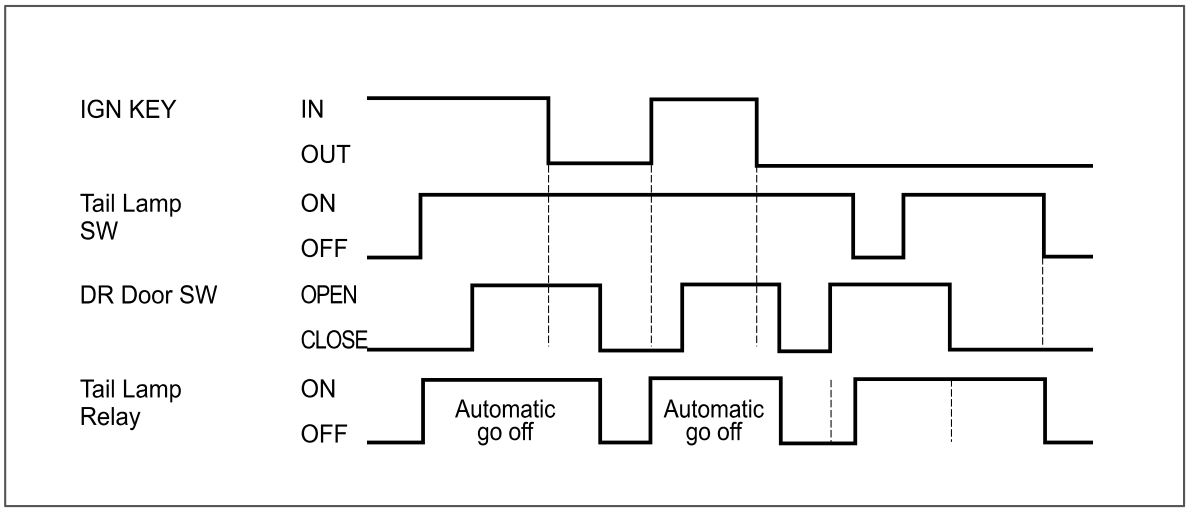


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Tail lamp auto-cut

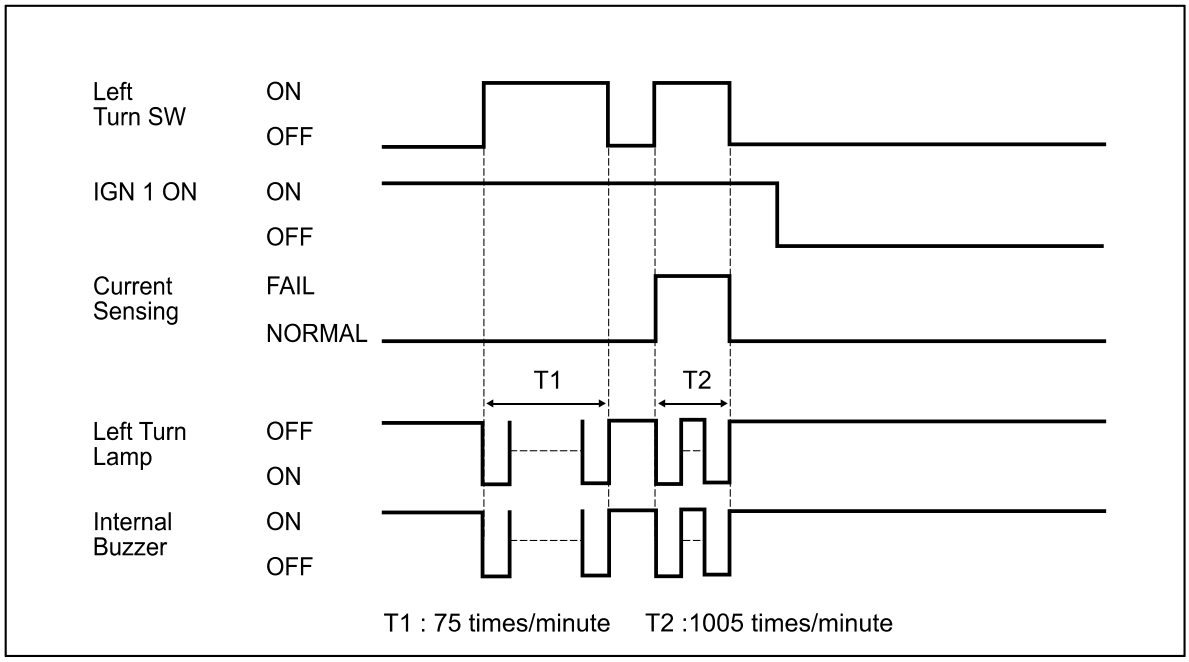
1. The tail lamp switch turns ON and OFF the tail lamps.
2. When opening and then closing the driver's door after removing the ignition key from the ignition switch with the tail lamp ON, the tail lamps go off automatically.
3. In above conditions, the tail lamps come ON again.
4. The tail lamp should not go off when turning ON the tail lamps with key IN.
5. The tail lamps should not go off when turning OFF and then ON the tail lamp with the power Off or ACC ON.
6. The system will be reset when inserting the ignition key into key switch.



Downloaded from www.Manualslib.com manuals search engine

(3) Turn signal lamp control

1. When turning ON the left/right turn signal switch, the lef/right turn signal lamp blinks with the interval of 75/min and the internal horn sounds with same interval.
2. When turning OFF the turn signal switch during Step (1), the turn signal lamp and horn stop the operation.
3. The turn signal lamps are operational when IGN1 is ON.
4. If the turn signal lamp is defective during Step (1), the turn signal lamp blinks with the interval of 100/min and the internal horn sounds with same interval.
5. Defective conditions for Step (4): Open - below 3.0 A, Short - over 7.0 A
6. When turning ON the turn signal switch, the lamp blinks 3 times. When turning OFF the switch during the operation, the turn signal lamp blinks 3 times and goes off.
7. When turning OFF and then immediately ON the turn signal switch during auto blinking operation of 3 times, the turn signal lamp blinks additional 3 times.
8. When turning ON another turn signal switch during the operation, currently operated turn signal lamp stops and another turn signal lamp starts blinking.

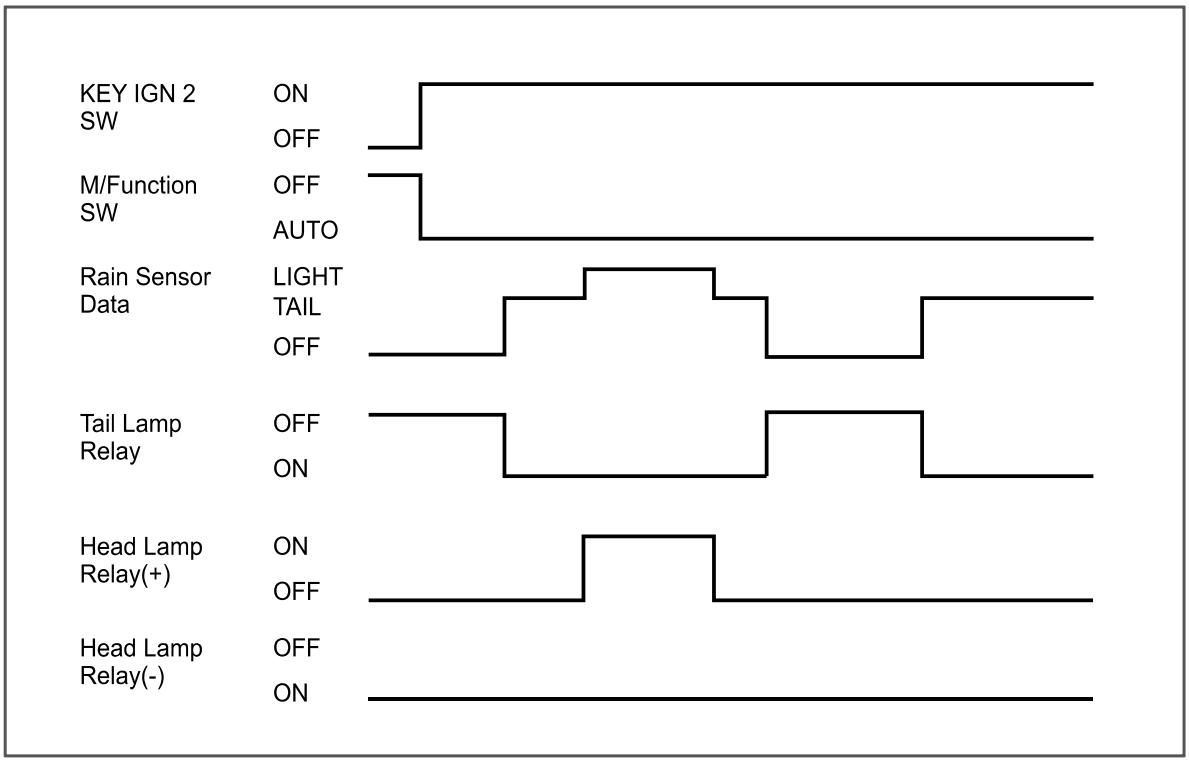


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(4) Auto light control (LIN)

1. BCM communicates with the rain sensor when turning the ignition switch to ON position, and controls the tail lamps and the headlamps with the light switch AUTO.
   (But, the communication with the rain sensor is possible even when the tail lamp switch is in ON position)



Downloaded from www.Manualslib.com manuals search engine

(5) Approach (Puddle) lamp control

1. Lamp ON:
   - When receiving the UNLOCK signal from the remote control key in the theft deterrent mode, the approach lamps come ON for 30 seconds.
   - When turning the ignition switch to OFF from ON position and opening the driver's door, the approach lamps come ON.

2. Lamp OFF:
   - When receiving the door lock signal with the approach lamps ON, the lamps go OFF (reactivation of theft deterrent mode).
   - When turning the ignition switch to ON position with the approach lamps ON, the lamps go OFF.
   - The approach lamps go OFF after 30 seconds.

Modification basis	
Application basis	
Affected VIN	

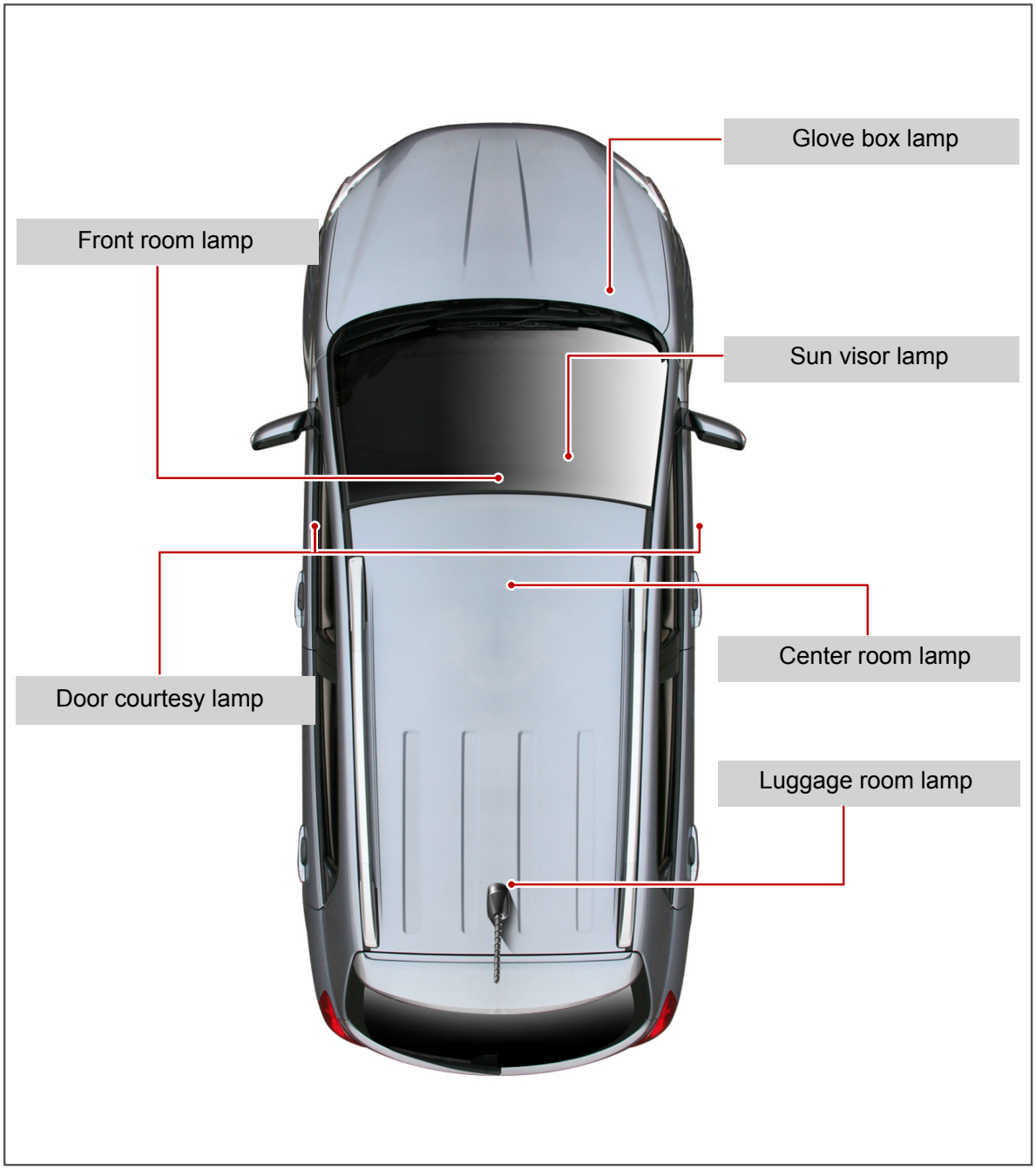
Downloaded from www.Manualslib.com manuals search engine

2. INTERIOR LAMP

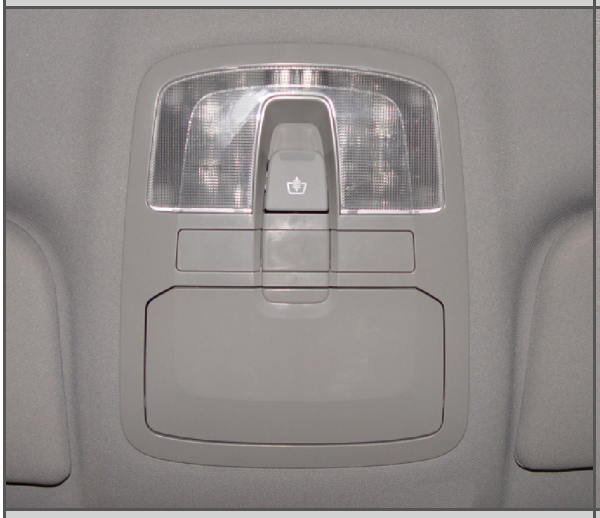
1) Overview

Front lamp, center room lamp, luggage room lamp, door courtesy lamp, sun visor lamp, glove box lamp

2) Layout



Downloaded from www.Manualslib.com manuals search engine

Front room lamp	Center room lamp
	
Luggage room lamp	**Sun visor lamp**
Glove box lamp	**Door courtesy lamp**

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

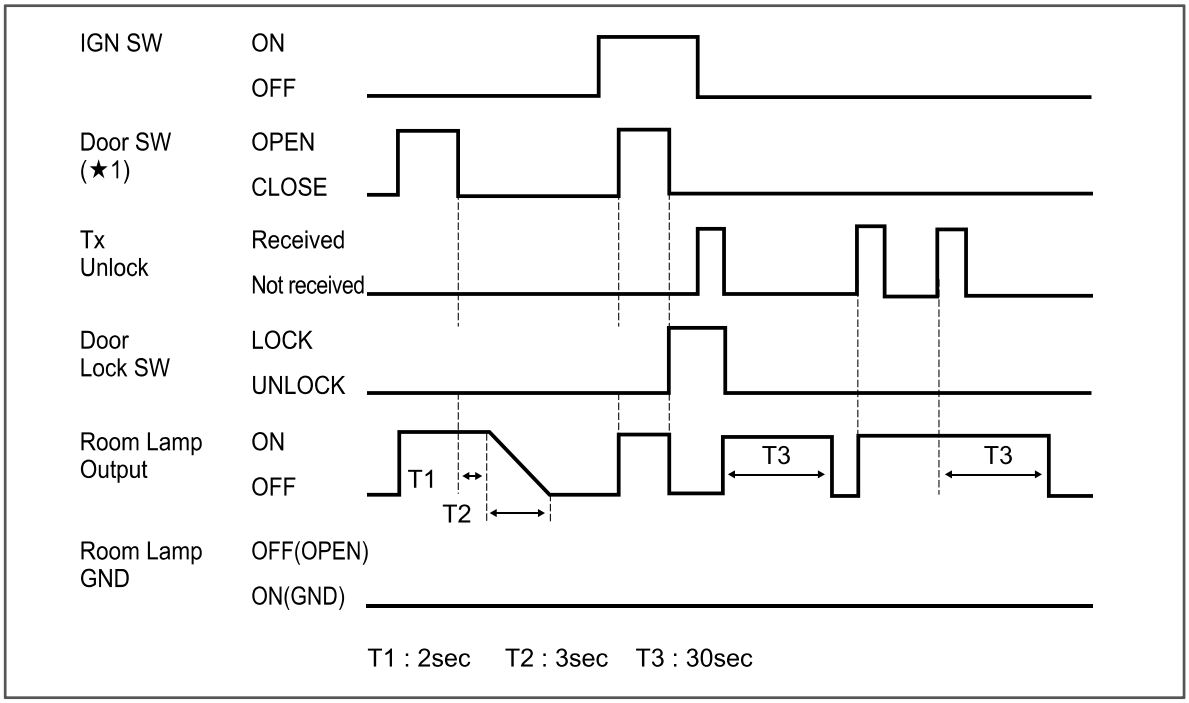
3) Operating Process

(1) Room lamp control

▶ **Door coupled room lamp operation and dimming control**

When opening any of doors while the room lamp switch in overhead console is pressed in ("Door" coupled position), the front and center room lamps come on. When opening the tailgate while the luggage room lamp switch is pressed in ("Tailgate" coupled position), the luggage room lamp comes on. If the door stays open, the room lamps automatically goes off after 10 minutes.

1. When closing the door with IGN ON, the room lamps go off immediately.
2. When closing the door with IGN OFF, the room lamps stays on for T1 and are dimmed out for T2.
3. When turning the ignition switch to ON position during dimming out operation, the room lamps go off immediately.
4. When receiving the door unlock signal with IGN OFF, key OUT and door closed, the room lamps come on for T3.
5. When receiving the door unlock signal again in Step (4), the front and center room lamps stays on for T3 additionally.
6. When opening a door during the dimming operation, the room lamps stays ON. When closing it again, the system performs the operation in Step (1) and (2).
7. The room lamps go off immediately when entering into the theft deterrent mode.



Downloaded from www.Manualslib.com manuals search engine

▶ Room lamp auto cut control

1. When the system enters into the theft deterrent mode or sleep mode, the ground for room lamp will be OFF (To prevent the battery from being discharged when the front or center room lamp switch is not in "Door" position). The room lamps will go OFF after 10 minutes from removing the ignition key.
2. When inserting the ignition key into the key switch, the ground for room lamp will be ON.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

WIPER AND WASHER SYSTEM 7810-01

GENERAL INFORMATION

1. WIPER CONTROL

- ▶ **MIST & Washer coupled wiper**
- ▶ **Auto washer coupled wiper**
- ▶ **Rain sensing wiper (LIN)**
- ▶ **Speed sensitive intermittent wiper**
- ▶ **Wiper LO/HI control**

2. CAUTIONS ON RAIN SENSOR

- When the wiper switch is in the "AUTO" position, the wiper will operate once if the initial engine start is made. This may wear the wiper blades prematurely Therefore, other than rainy days, set the switch to the "OFF" position. Especially during winter time, check if wiper blades are frozen to the windshield.
  Wiper operation with the blades frozen can damage the wiper motor.
- The wiper operation on the dry windshield can scratch the glass and wear the blade prematurely. Do not operate the wiper when the windshield is dry.
- When it does not rain, turn the wiper switch into the "OFF" position.
- Turn the wiper switch to the "OFF" position before any car wash to avoid unwanted operation of the wipers.

WARNING

When cleaning the windshield over the sensor with damp clothes, the wiper may operate suddenly. It could cause serious injury. Make sure to place the wiper switch to the "OFF" position and ignition switch "OFF" when not in use.

▶ **Irregular operation (abrupt operation)**

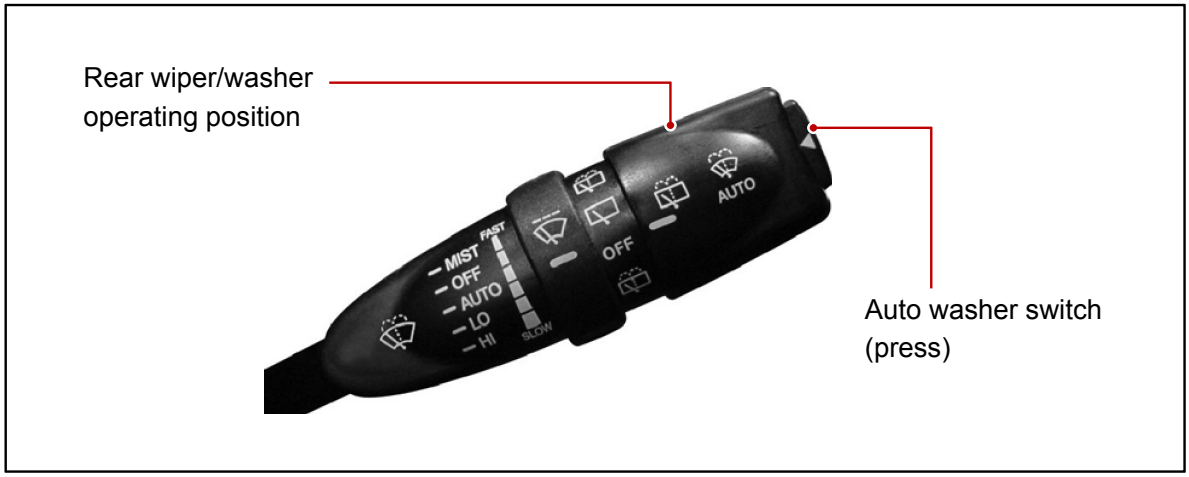
- Check if the sensor is off the position.
- Check if the rain sensor cover is securely installed.
- Check if the customer is familiar to how to control the wiper sensitivity.
  That is, check if the customer has set the wiper sensitivity to the 5th level.
- Check if the wiper blades are worn.
- If the wiper blade cannot wipe the glass uniformly and cleanly, the irregular operations could be occurred. Therefore, the wiper blade should be replaced with a new one with the same specifications.

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

1) Auto Washer Coupled Wiper



When turning ON the auto washer switch with IGN1 ON & wiper switch OFF, the washer fluid is sprayed onto the windshield glass for 2 seconds and the wipers operate 4 times. After then, additionally, the washer fluid is sprayed for 1.5 seconds and the wipers operate 3 times again.

2) Rear Washer Fluid Supply System

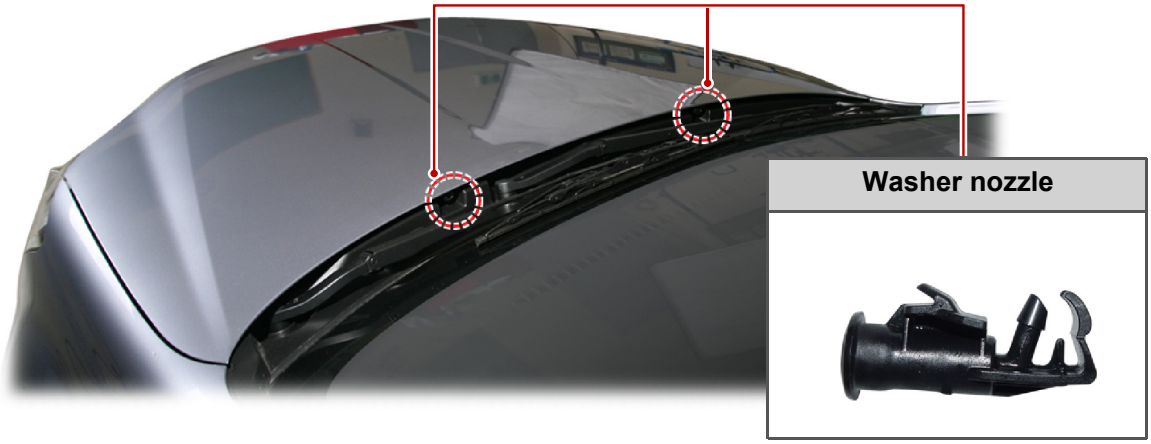
The rear washer system uses the washer fluid from front washer fluid reservoir.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

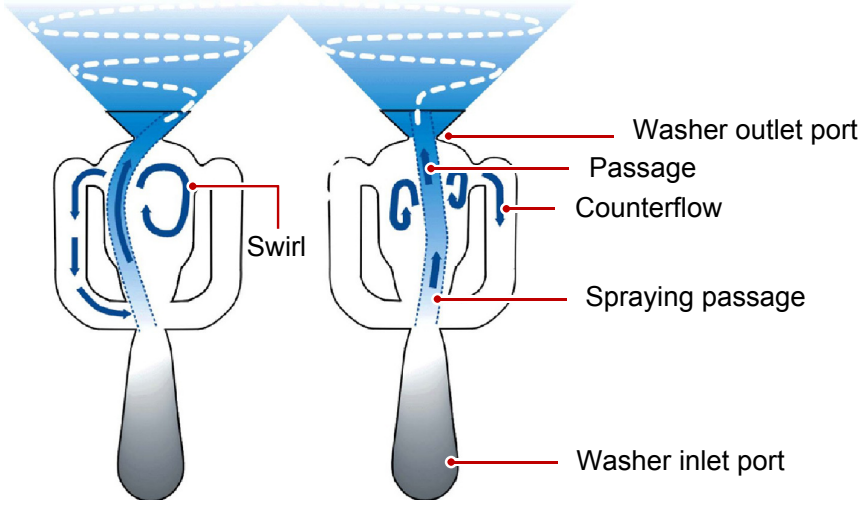
3) Fluidic Washer Nozzle

The inside of fluidic washer nozzle is designed to utilize the fluidic power during spraying.



* To prevent the water from incoming into engine compartment, thoroughly clean the glass surface before installing the washer nozzle.

The spraying shape of washer fluid is continuously changed as shown in the picture below according to the operating time.



The spraying direction is changed by swirl and counterflow in washer nozzle.

Downloaded from www.Manualslib.com manuals search engine

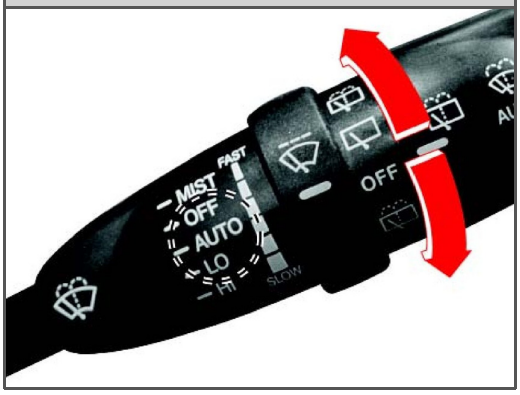
2. RAIN SENSING SYSTEM

The rain sensing unit sends only the rain drop data to BCM. The wiper and washer operation should be done by user with switches.

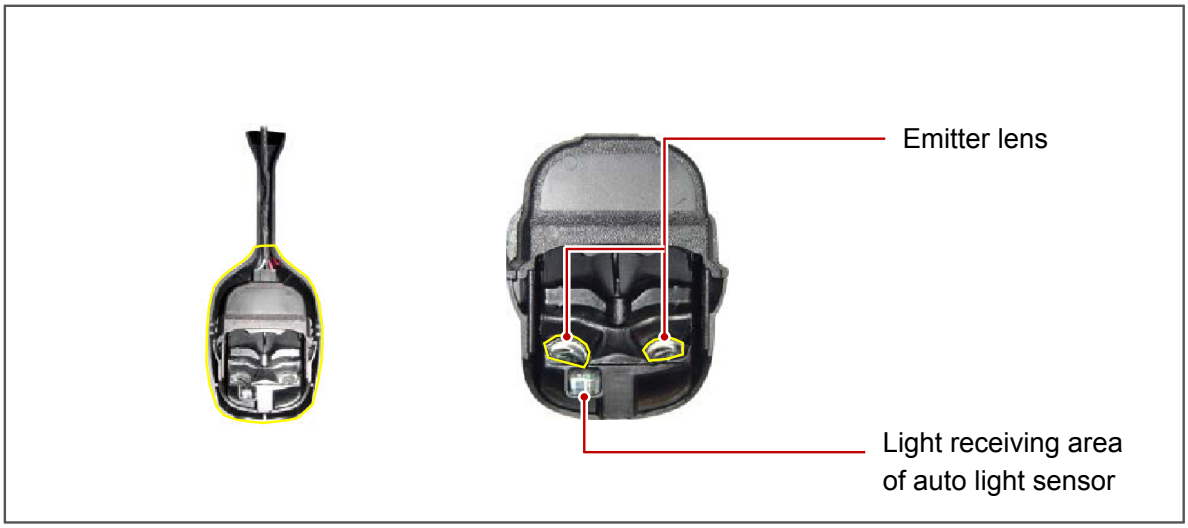
Rain sensing unit

The emitting section of the rain sensing unit emits infrared rays against the windshield and then detects the amount of rain drops by receiving reflected rays with photodiode.

Wiper "AUTO" switch and speed control switch



AUTO: automatic wiping by rain sensor
FAST <----------> SLOW:
The rain sensor controls the wiping speed by detecting the amount of rain drops.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ BCM

The rain sensing unit sends only the rain drop data to BCM. BCM controls the wiper operation. BCM also sends the data for wiper and washer operation to the rain sensor.

BCM	Fuse box for engine compartment

Downloaded from www.Manualslib.com manuals search engine

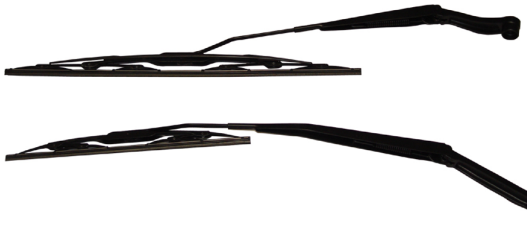
3. SYSTEM LAYOUT (INCLUDING RAIN SENSOR)

Wiper & washer switch

Rain sensor unit

Wiper

Front wiper



Rear wiper

Rear washer hose and nozzle

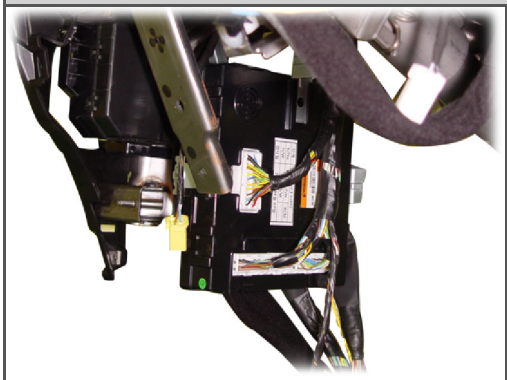
For vehicle with rear spoiler

For vehicle without rear spoiler

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

BCM



Front nozzle

Washer reservoir assembly

Modification basis	
Application basis	
Affected VIN	

WIPER AND WASHER SYSTEM

undefined

Downloaded from www.Manualslib.com manuals search engine

4. WIPER & WASHER OPERATION

1) Front Wiper Control

MIST

The front wipers can be operated only when you hold the switch to the “MIST” position. The lever will return to the “OFF” position when released.

OFF

Stop the operation.

AUTO

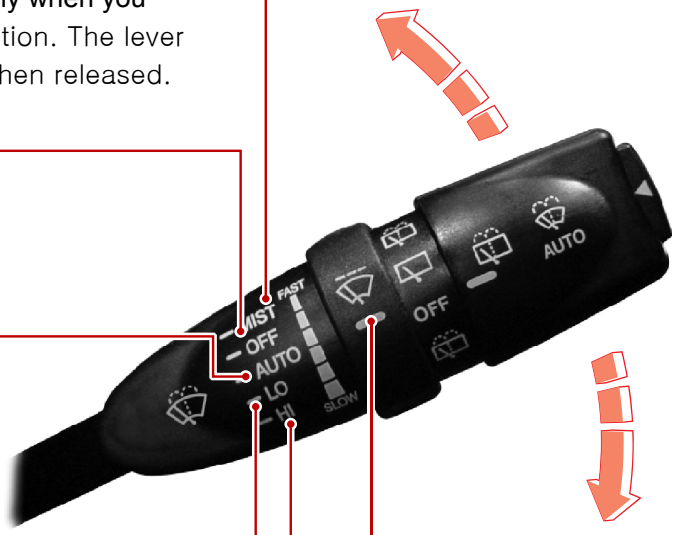
Operates automatically according to the vehicle speed or amount of rain.

LO

Continuous wipe, slow operation

HI

Continuous wipe, fast operation



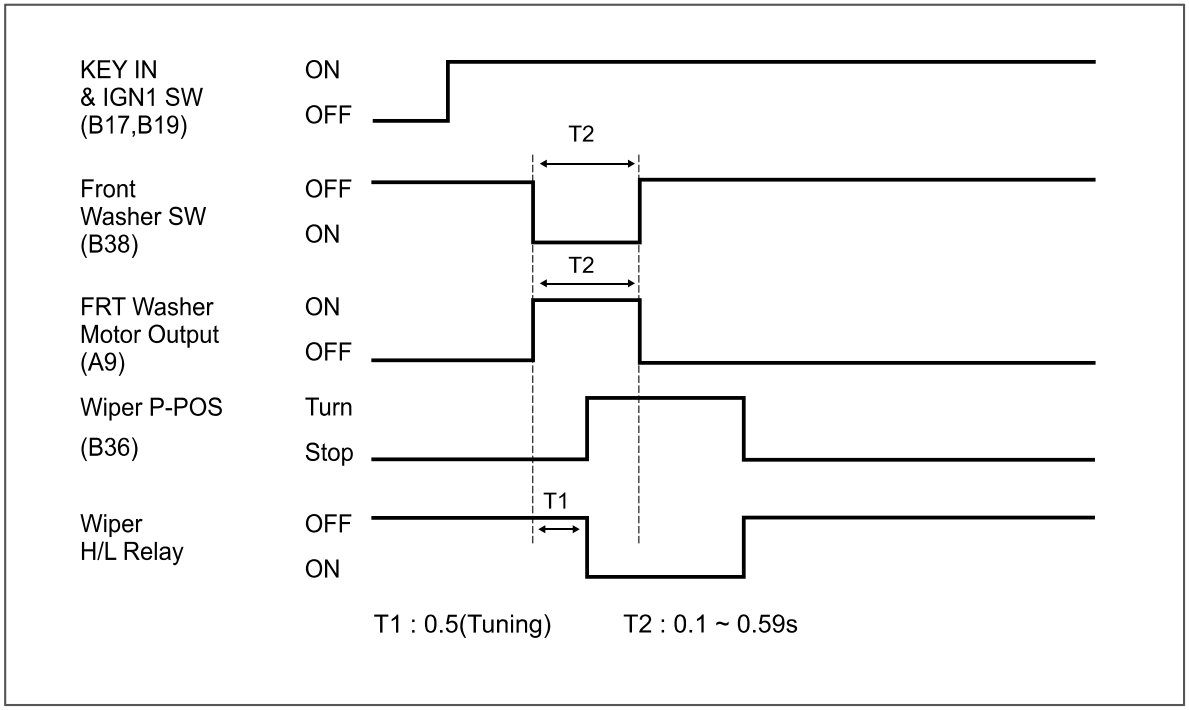
Wiper and Washer coupled operation
Pull the lever briefly (for less than 0.6 seconds):
One wiping cycle with washer spray
Pull and hold the lever for more than 0.6 seconds:
Three wiping cycles with washer spray

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(1) Wiper MIST

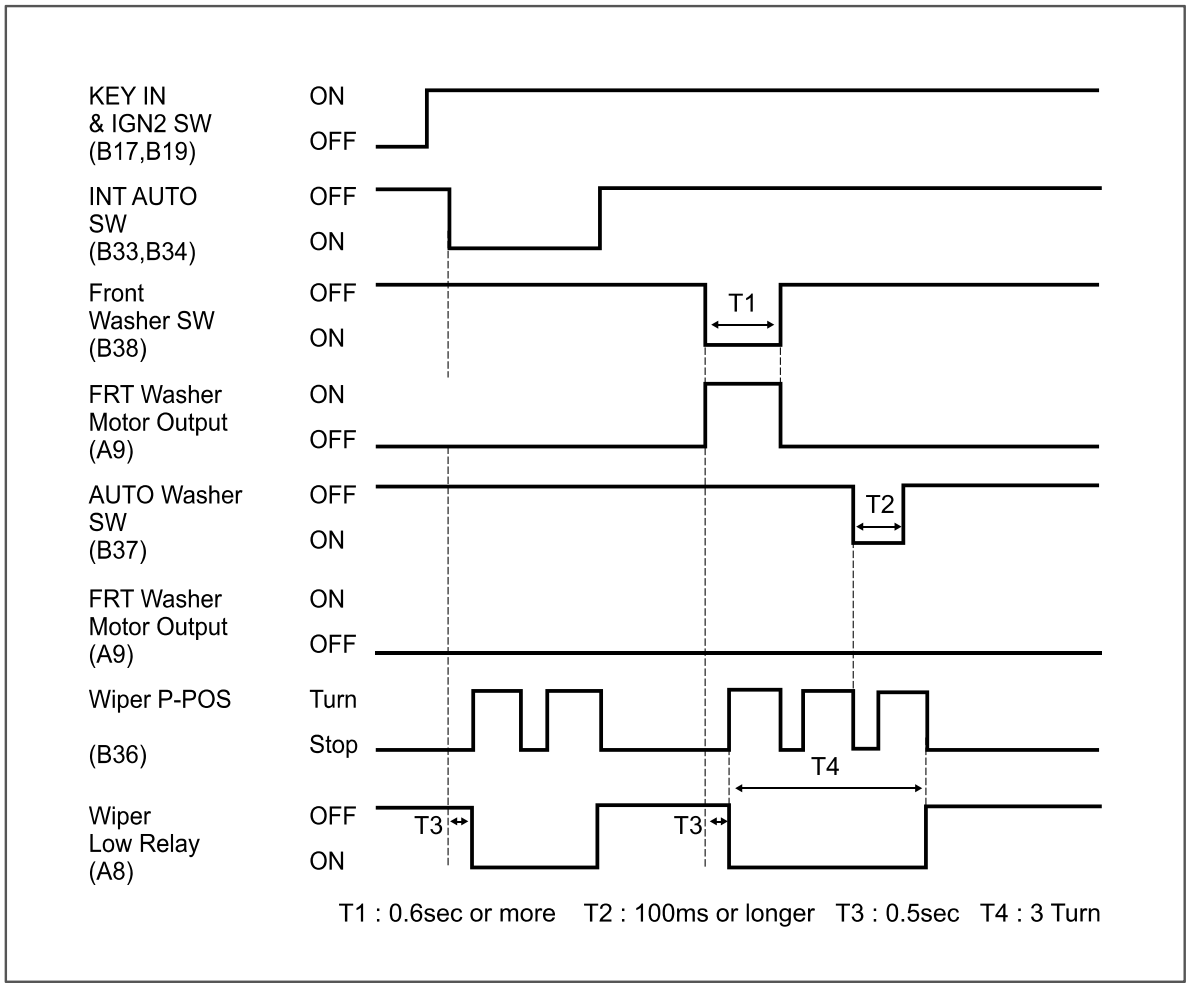
1. When turning ON the front washer switch with IGN1 ON, the front wipers operate after T1. When releasing the switch, the wipers will stop at parking positions.



Downloaded from www.Manualslib.com manuals search engine

(2) Wiper low/high control

1. The wiper low relay is turned ON/OFF by the ON/OFF signal from wiper low switch.
2. The wiper high relay is turned ON/OFF by the ON/OFF signal from wiper high switch.
   The wiper low relay operates all the time when the wiping system is in high speed mode (high relay + low relay).
3. The wiper motor should operate with P-POS signal even when turning off the ignition switch during wiper operation.
4. The wiper relay should stay ON during wiper operation in low/high mode even though the system does not receive P-POS signal. (In "AUTO" mode, the wiper relay should be turned OFF after 5 seconds if there is no P-POS signal for 3 seconds. - inform to car owner)
5. In high/low mode, the front washer motor should operate when turning ON the front washer switch.
6. In high/low mode, the rear washer motor should operate when turning ON the rear washer switch.
7. The auto washer function is not available during high/low mode.
8. The wipers should go back to low parking position when turning off the ignition during high mode.



Modification basis	
Application basis	
Affected VIN	

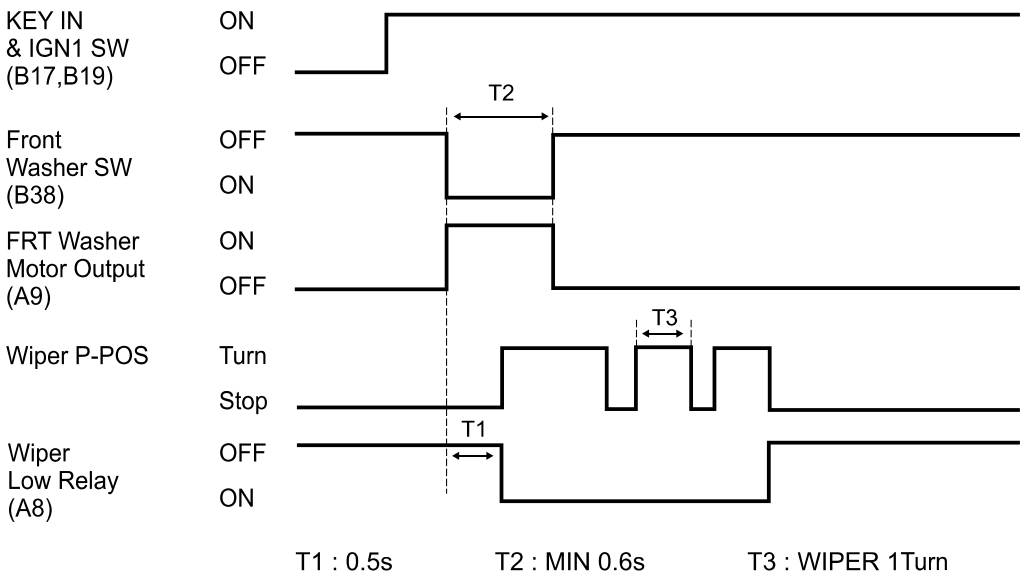
Downloaded from www.Manualslib.com manuals search engine

2) Front Washer Control

(1) Washer coupled wiper

Washer coupled wiper operation
Pull the lever briefly (for less than 0.6 seconds):
One wiping cycle with washer spray
Pull and hold the lever for more than 0.6 seconds:
Three wiping cycles with washer spray

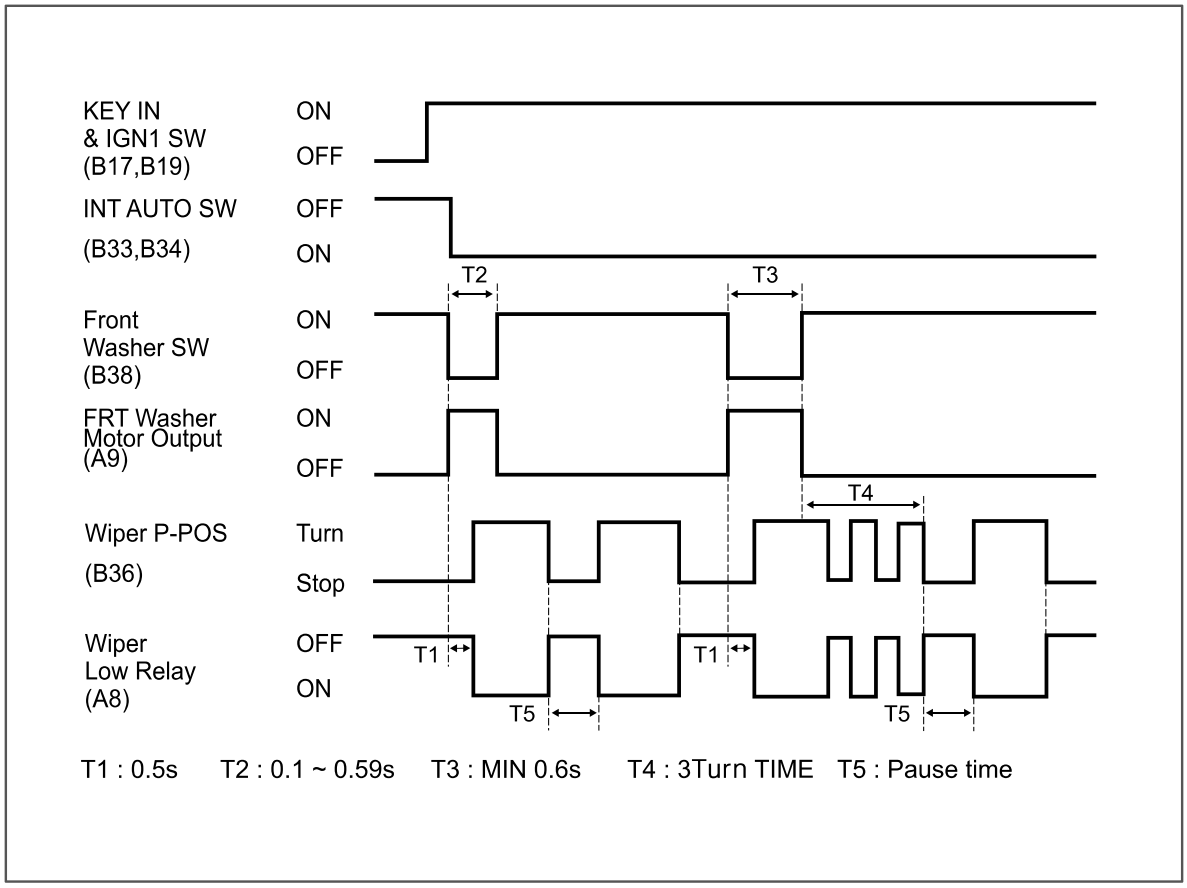
1. When holding the front washer switch at ON position for more than T2 with IGN1 ON, the washer fluid is sprayed onto the windshield glass and the wipers operate three times.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. When holding the front washer switch at ON position for more than 0.6 seconds with the wiper switch AUTO, the washer fluid is sprayed onto the windshield glass and the wipers operate three times. When holding it between 0.1 and 0.59 seconds, the wiper will operate only once.



T1 : 0.5s T2 : 0.1 ~ 0.59s T3 : MIN 0.6s T4 : 3Turn TIME T5 : Pause time

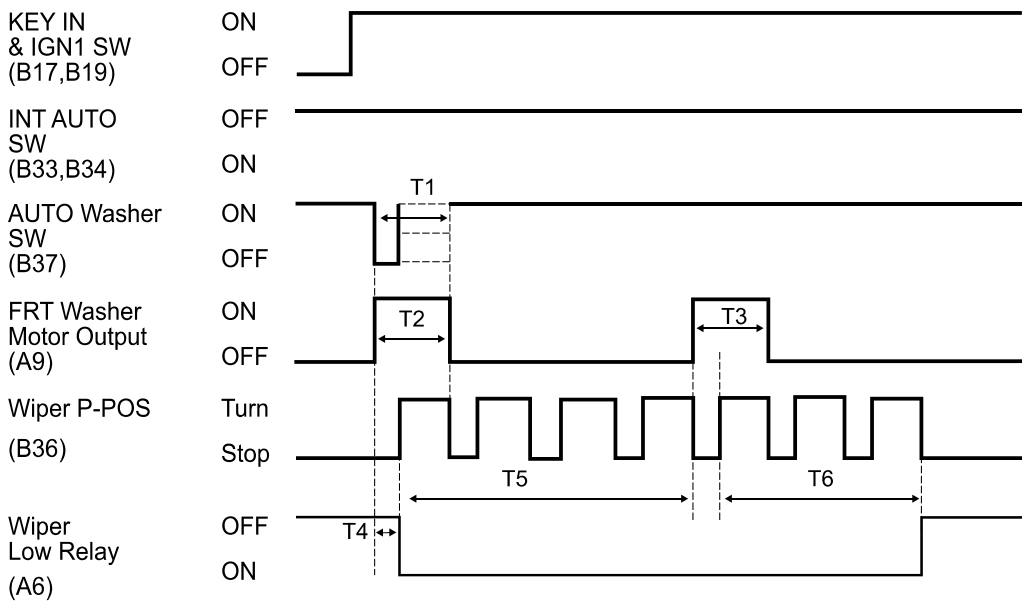
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(2) Auto washer coupled wiper

Auto washer switch
When the front wiper switch is off and this switch is pressed, washer fluid will be sprayed and the wiper will automatically operate 4 times. Then, the fluid will be sprayed again and the wiper will automatically operate 3 times.

1. When turning ON the auto washer switch with IGN1 ON & wiper switch OFF, the washer fluid is sprayed onto the windshield glass for 2 seconds and the wipers operate 4 times. After then, additionally, the washer fluid is sprayed for 1.5 seconds and the wipers operate 3 times again.
2. The auto washer function is not available during the operation of auto washer coupled wiper. The auto washer function is not available while the wiper system is in intermittent wiping
3. mode.
   When turning the wiper switch to AUTO position during the operation of auto washer, the
4. auto washer stops its operation and the intermittent wiping mode will be started.
   The front & rear washer function are not available during the operation of auto washer.
5.



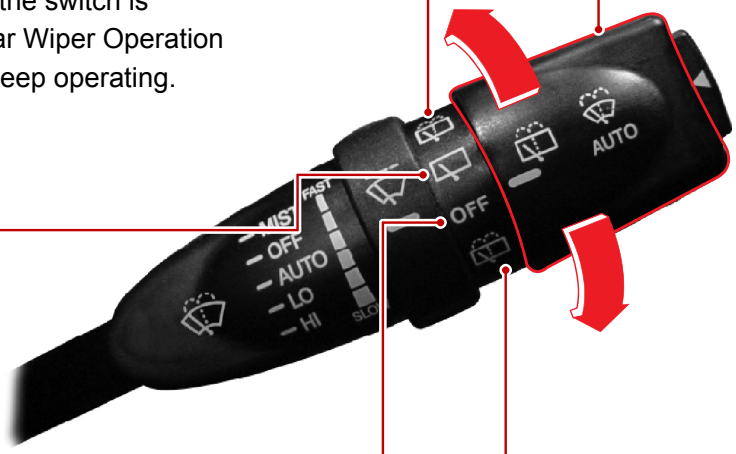
T1 : 100 ms or longer T2 : 2.0sec T3 : 1.5sec T4 : 0.5sec T5 : 4Turn T6 : 3Turn

Downloaded from www.Manualslib.com manuals search engine

3) Rear Wiper Control

Rear wiper switch

When the switch is fully turned, washer fluid will be sprayed onto the rear window glass and the wiper will also operate. When the switch is released, it will stop in the Rear Wiper Operation mode and only the wiper will keep operating.



Rear wiper operation

OFF

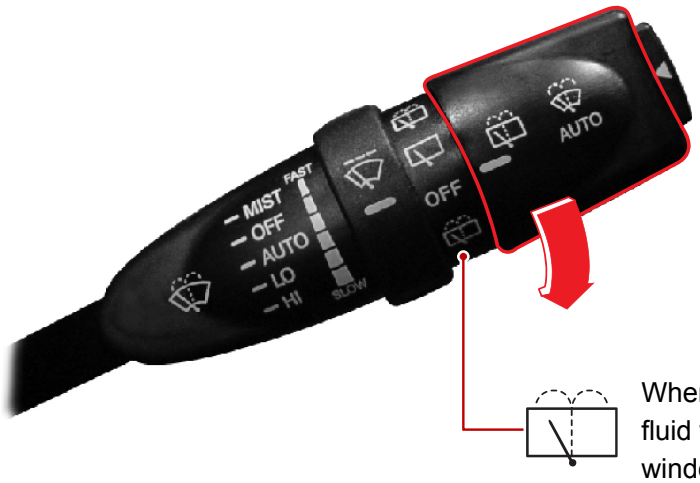
Rear wiper stops

When the switch is fully turned, washer fluid will be sprayed onto the rear window glass and the wiper will also operate. When the switch is released, it will return to the “OFF” position and turn off the wiper and washer.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

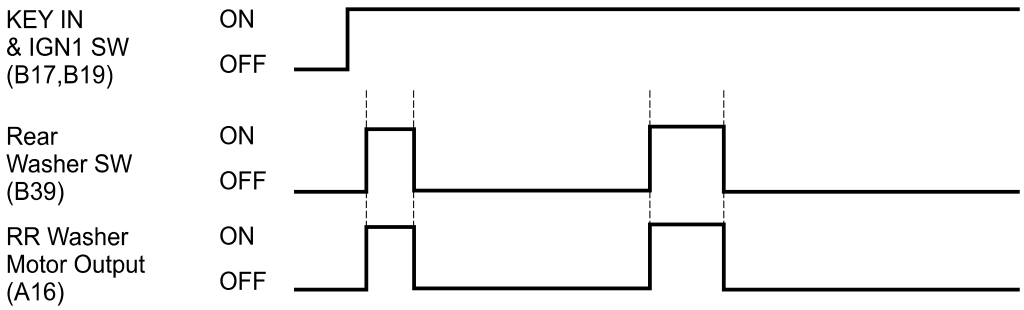
4) Rear Washer Control



When the switch is fully turned, washer fluid will be sprayed onto the rear window glass and the wiper will also operate. When the switch is released, it will return to the "OFF" position and turn off the wiper and washer.

▶ Rear washer motor control

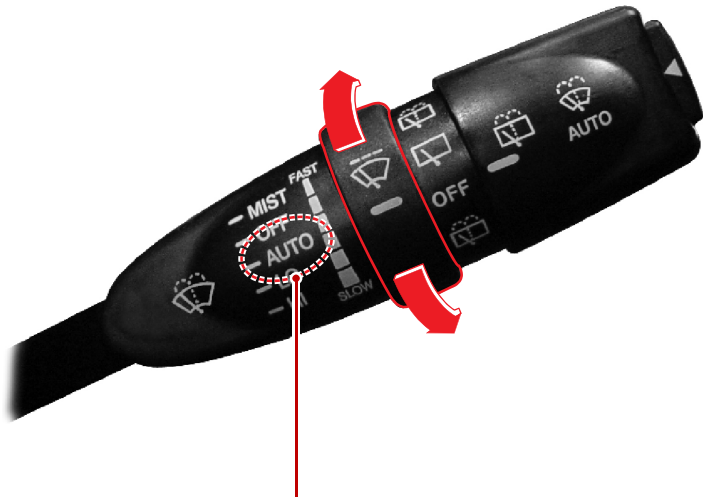
1. When turning ON the rear washer switch with key IN & IGN1 ON, the washer fluid is sprayed onto the tailgate glass.



Downloaded from www.Manualslib.com manuals search engine

5) Rain Sensor Coupled Wiper Control

"AUTO" switch and speed control switch



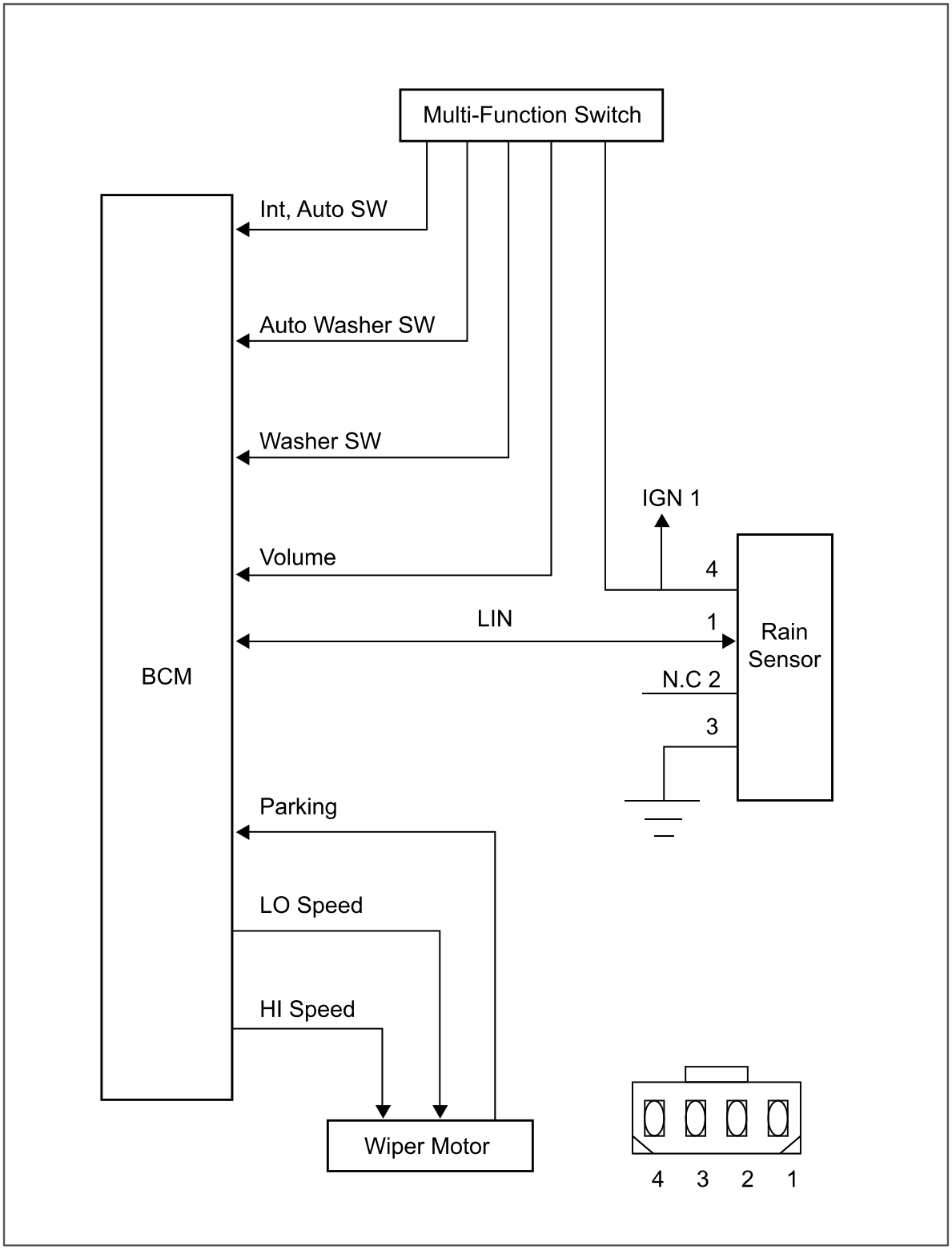
AUTO: Automatic wiping by rain sensor
FAST <----> SLOW:
Operates automatically according to the vehicle speed or amount of rain.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(1) Rain sensor coupled wiper (LIN)

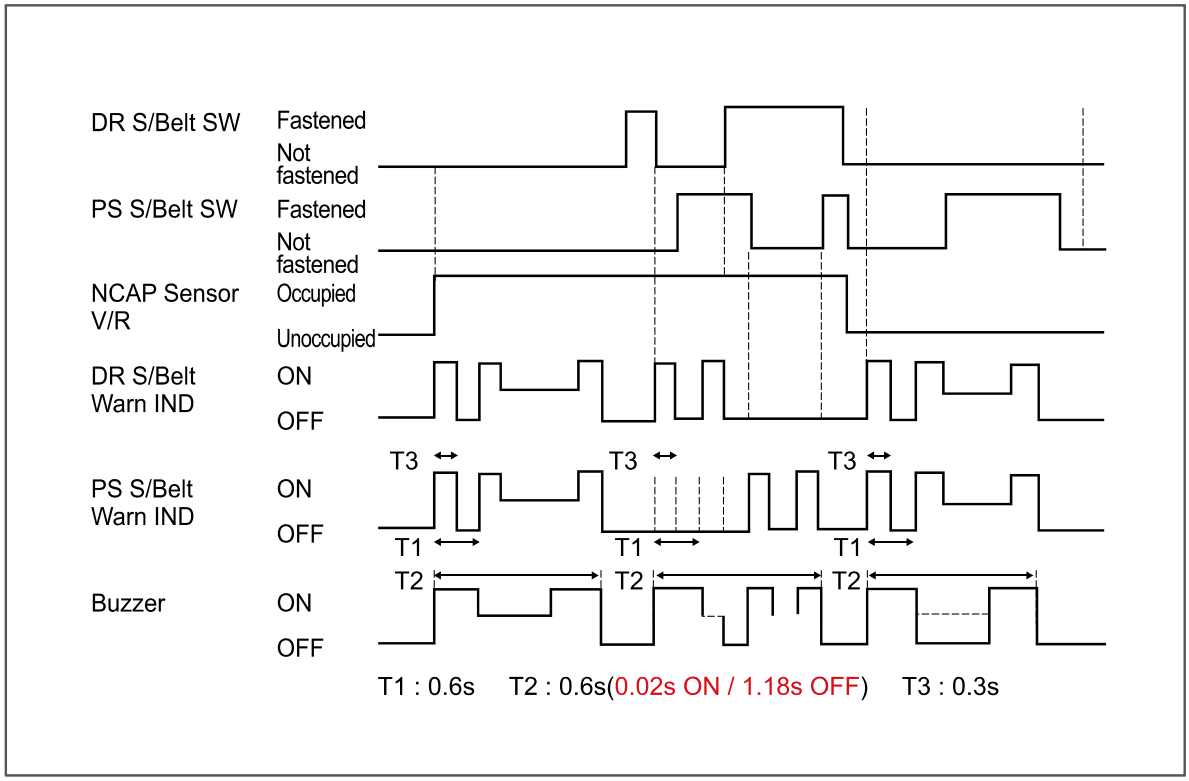
▶ **Block diagram**



Downloaded from www.Manualslib.com manuals search engine

(2) Power-up reminder wiper

1. If the wiper switch is in "AUTO" position, the wiper motor does not operate even when turning the ignition switch to "ON" position.
2. When moving the wiper switch to "AUTO" from "OFF" position with IGN2 ON, the wipers operate one cycle through wiper low relay regardless of the communication with the rain sensor. Afterward, the wipers operate only when receiving S_RAIN (raining) signal from the rain sensor.

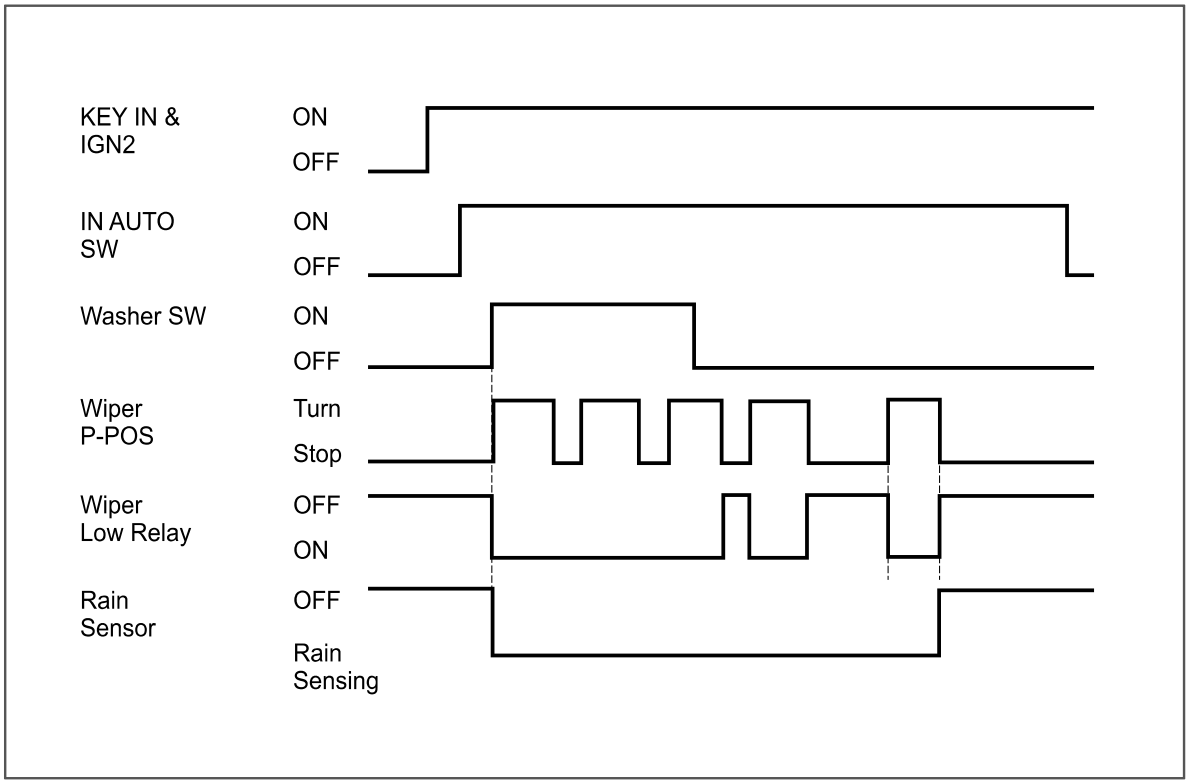


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(3) Washer coupled wiper in rain sensing mode

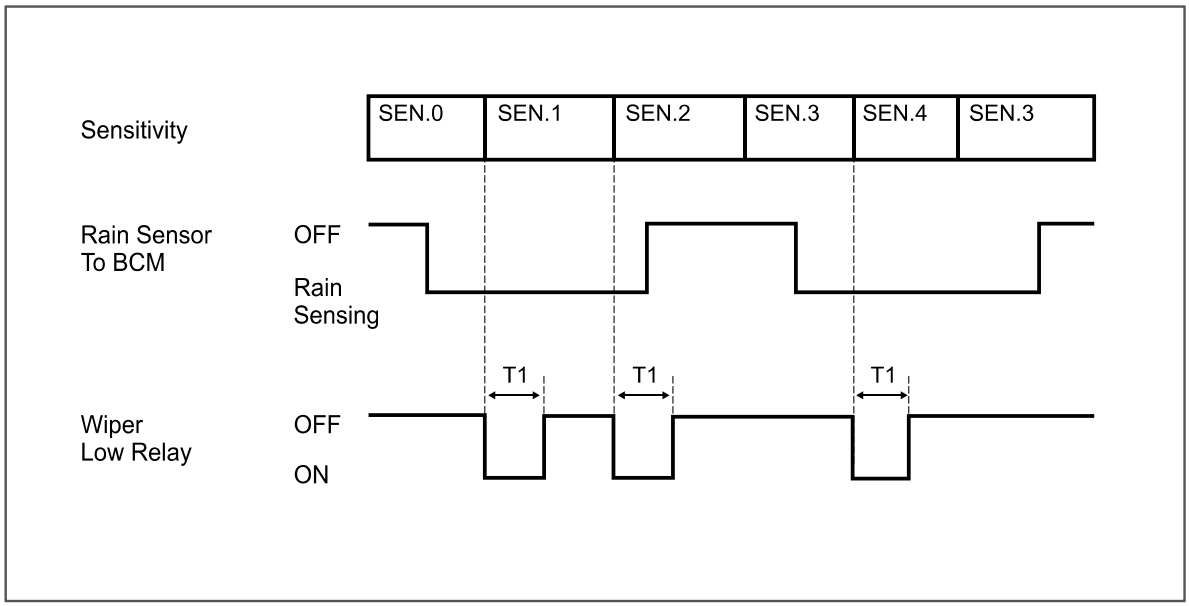
1. When turning the washer switch ON with IGN2 ON and wiper switch AUTO in rain sensing mode, the wiper operate in washer coupled mode regardless of the communication with rain sensor.
2. Even though the wiping system is in washer coupled wiper mode, the operating data are sent to rain sensor.



Downloaded from www.Manualslib.com manuals search engine

(4) Sensitivity adjustment (Instant wiping)

1. When increasing the wiping speed (ex: sensitivity 0 ⇒ 1) with volume dial with IGN2 ON, wiper switch AUTO and wiper motor stop (parking), the wipers operate one cycle through the low relay. (only when the signal from rain sensor is "raining")
   * If the volume sensitivity is changed within 2 seconds, the wipers operate only one cycle.

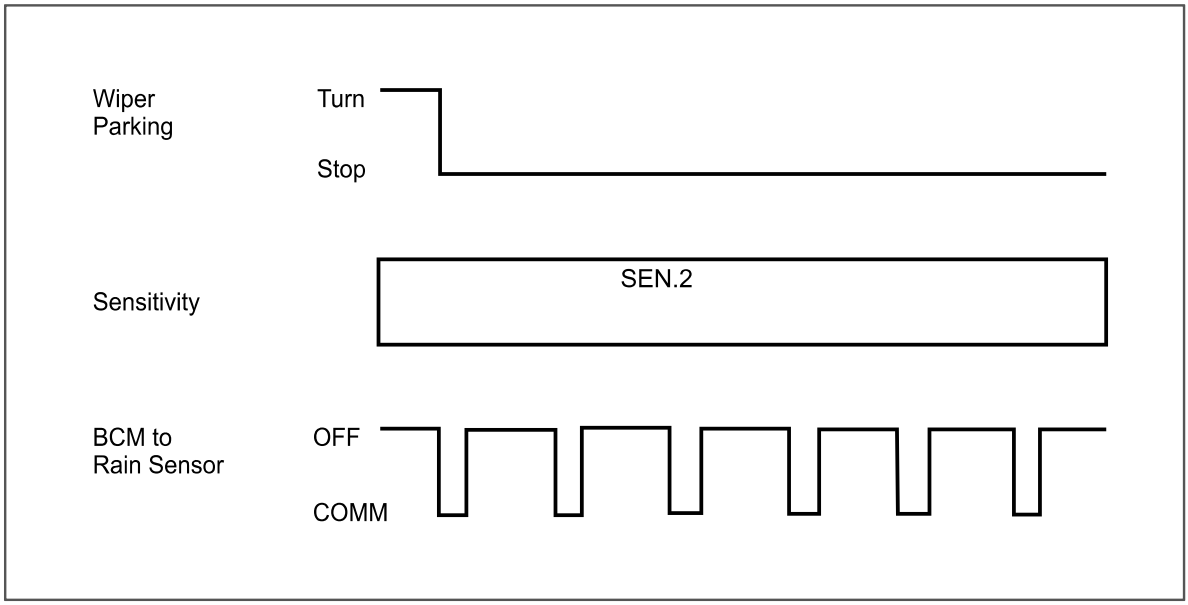


Modification basis	
Application basis	
Affected VIN	

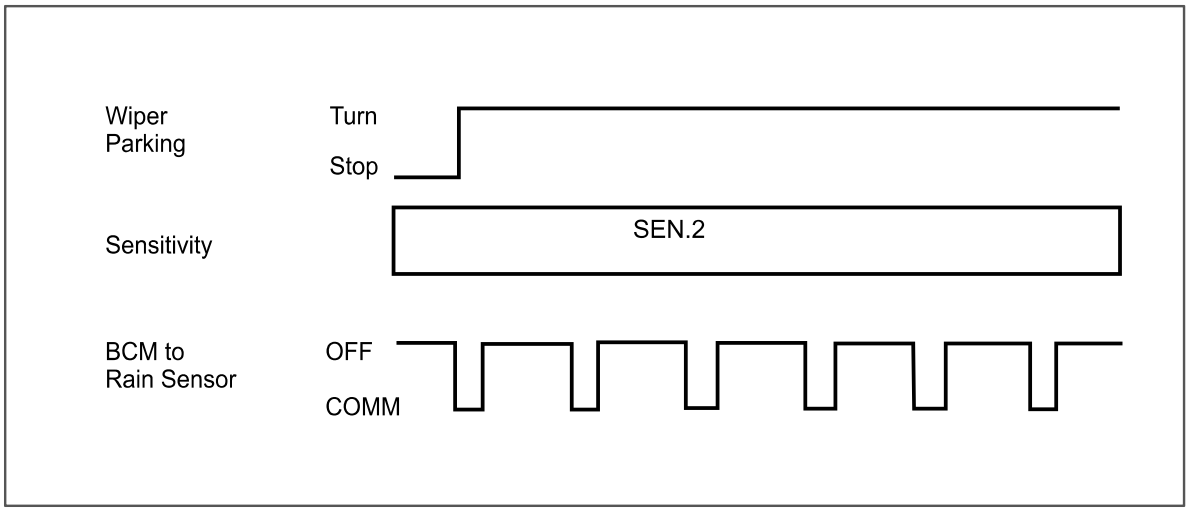
Downloaded from www.Manualslib.com manuals search engine

(5) Fault strategy for wiper parking signal

1. The wiper system continuously sends the wiper parking signal when the wiper parking terminal is grounded with IGN2 ON and wiper switch AUTO.
   * The wiper motor runs only when the rain sensor requires the wiper operation.



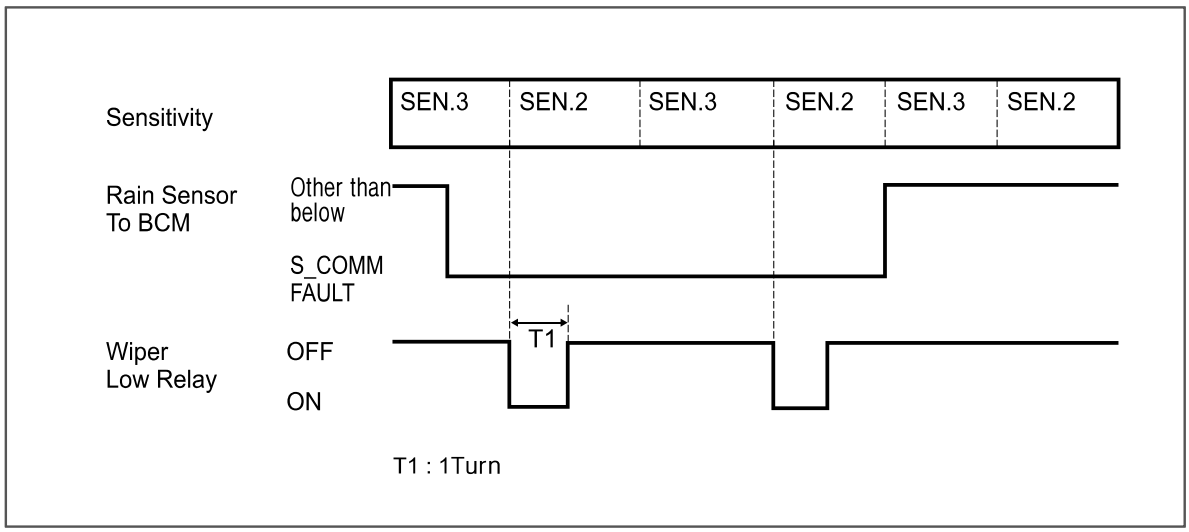
2. When the parking terminal is fixed at IGN (HIGH) with IGN2 ON and wiper switch AUTO, the wiper system sends the wiper operating signal for 2 seconds, then continuously sends the wiper parking signal.
   * The wiper motor runs only when the rain sensor requires the wiper operation.



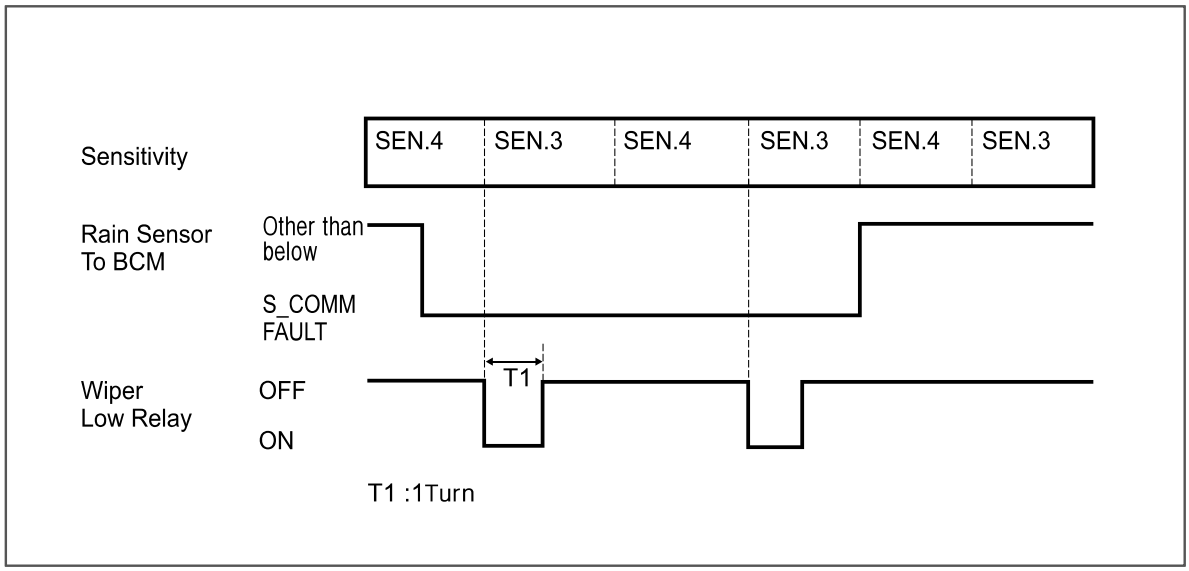
Downloaded from www.Manualslib.com manuals search engine

(6) Fault strategy for rain sensor

1. When changing the volume sensitivity to "2" from "3" with IGN2 ON and wiper switch AUTO while receiving S_RSFAULT (defective rain sensor) signal from rain sensor, the wipers operate one cycle through the low relay.



2. When changing the volume sensitivity to "3" from "4" with IGN2 ON and wiper switch AUTO while receiving S_COMMFAULT (communication error) signal from rain sensor, the wipers operate one cycle through the low relay.



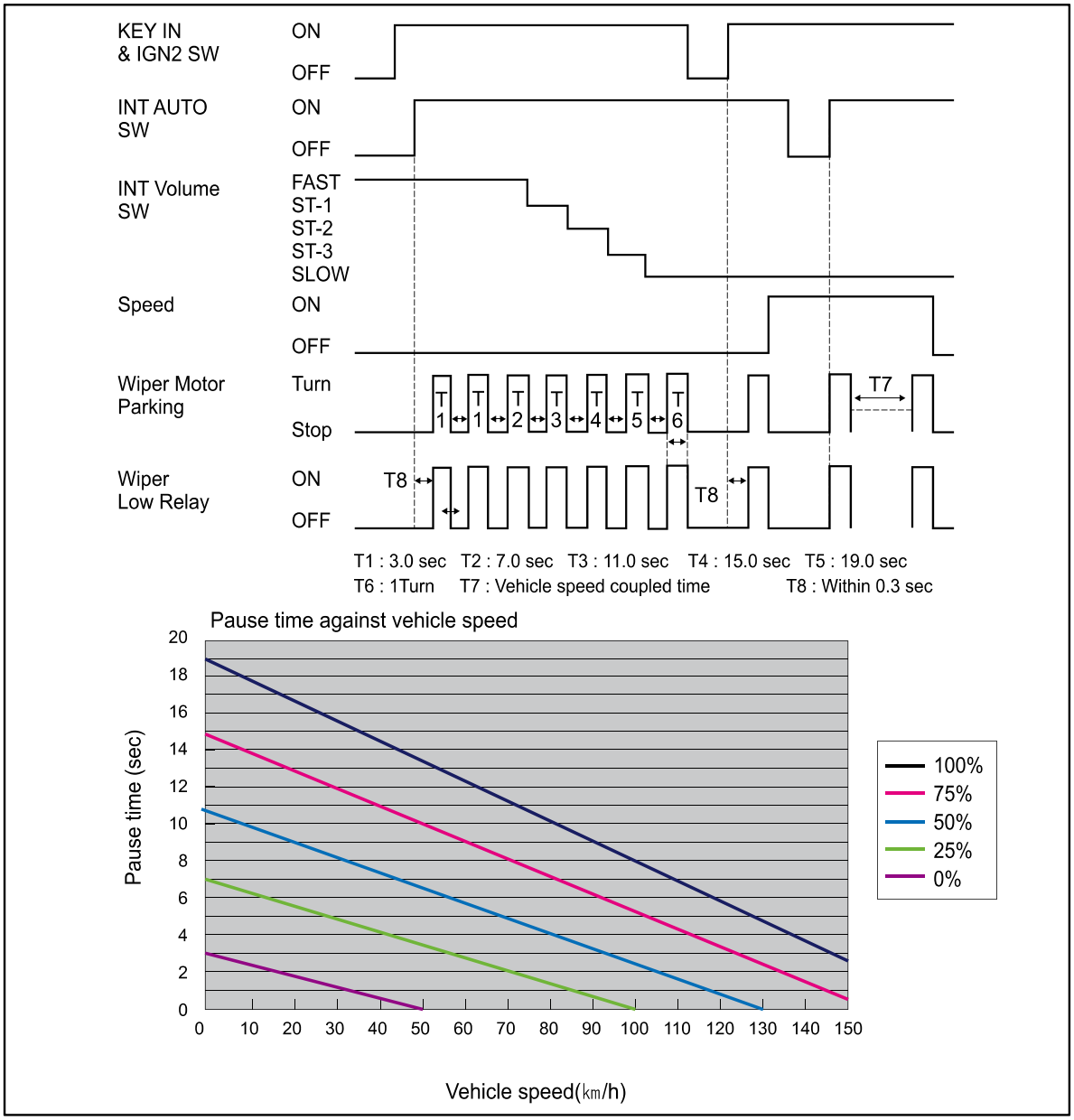
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(7) Speed sensitive intermittent wiper

Operation for the wiping system without rain sensor:

1. When turning the ignition switch to ON from OFF position with wiper switch AUTO, the wipers do not operate.
2. When moving the wiper switch to AUTO from OFF position after turning the ignition switch to
3. ON position, the wipers operate one cycle.
   Vehicle speed and volume sensitivity controls the intermittent wiping operation.
   - The system calculates and changes the intermittent interval by using vehicle speed and volume sensitivity with IGN2 ON and wiper switch AUTO.
   - Intermittent interval (at 0 km/h): 3±0.5 to 19±2 seconds

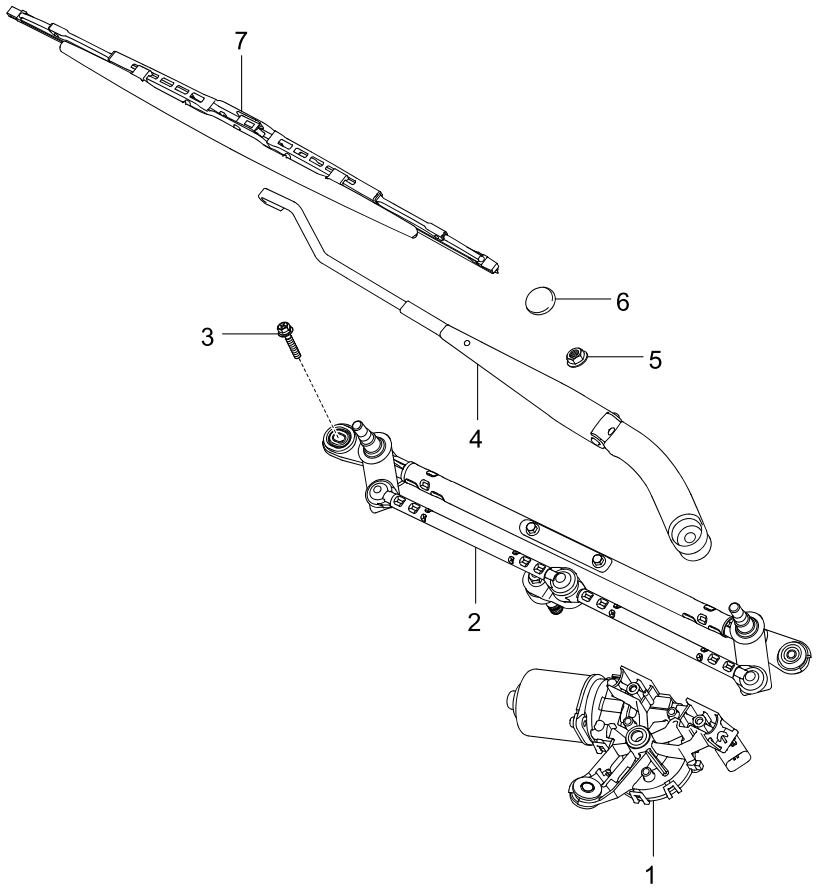


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

COMPONENT

S.G.N. 7810-00 **FRONT WIPER**

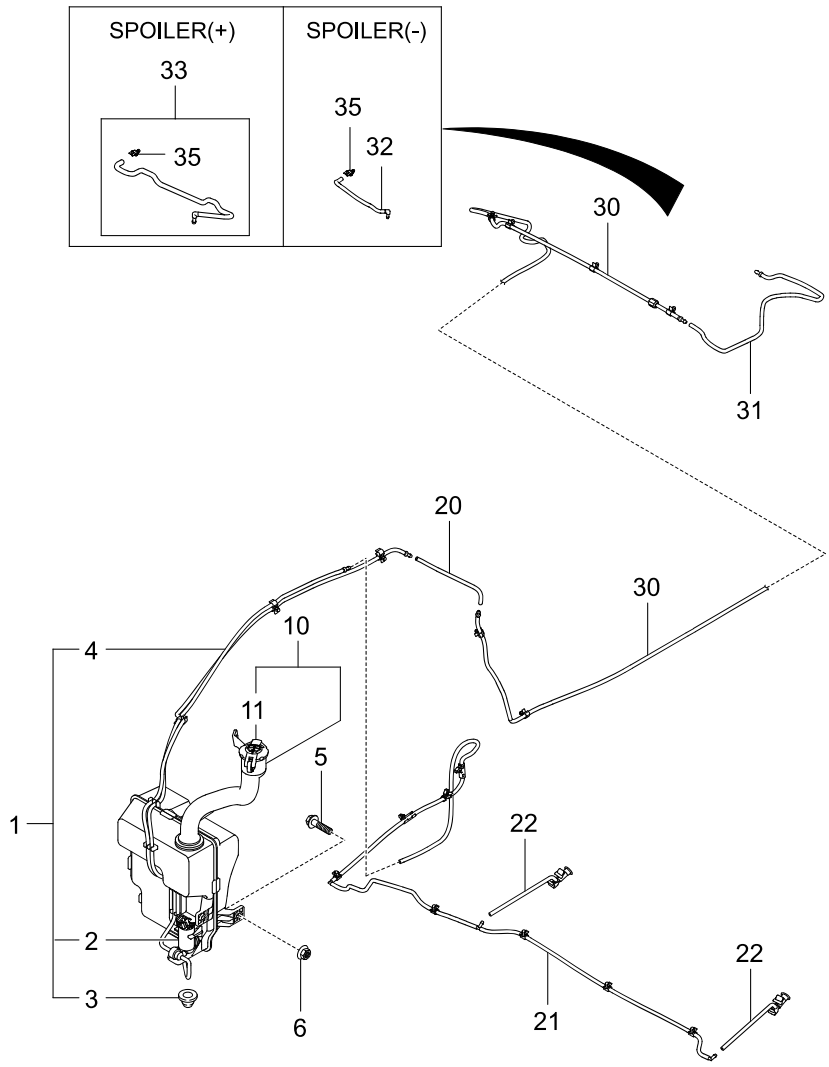


1. Motor assy - FRT wiper
2. Linkage assy - windshield wiper
3. Bolt
4. Arm assy - windshield WPR
5. Nut
6. Cap - wiper arm
7. Blade assy - windshield wiper

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

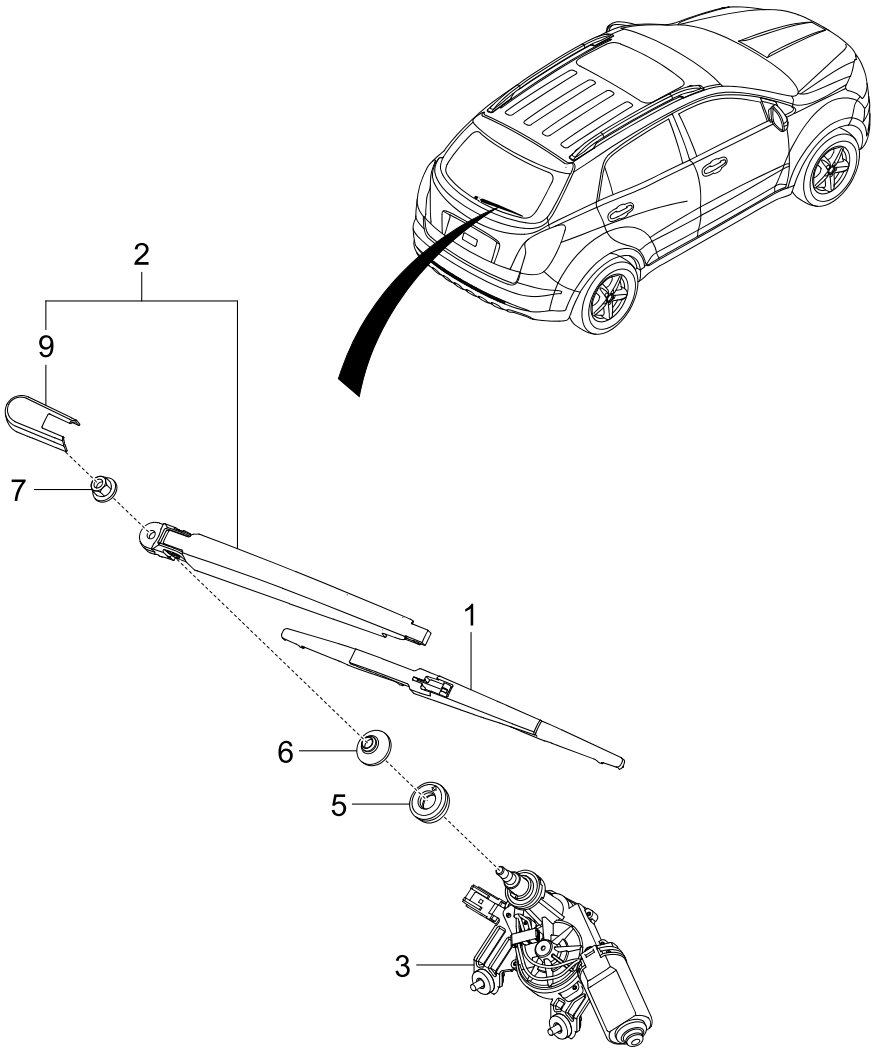
S.G.N.
7820-00 WINDSHIELD WASHER



1. Tank assy - washer reservoir
2. Motor assy - washer pump
3. Packing-pump
4. Hose assy - washer reservoir
5. Screw
6. Nut
10. Guide assy - washer reservoir
11. Cap - washer reservoir
20. Hose assy - washer
21. Hose assy - windshield washer
22. Nozzle assy - windshield washer
30. Hose assy - T/gate washer FRT
31. Hose assy - T/gate washer
32. Hose assy - T/gate washer
33. Nozzle assy - washer T/gate
35. Nozzle - washer T/gate

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7830-00 REAR WIPER



1. Blade assy - RR wiper
2. Arm assy - T/gate wiper
3. Motor assy - RR wiper
5. Spacer assy - T/gate wiper
6. Splash ring - T/gate wiper
7. Nut
9. Cap-wiper arm

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 8511-05

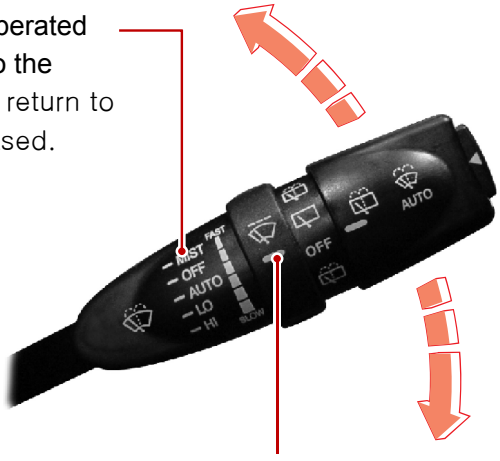
WIPER SWITCH

1) Front Wiper Switch

▶ Mounting location

▶ Front wiper switch function

MIST	The windshield wipers can be operated only when you hold the switch to the "MIST" position. The lever will return to the "OFF" position when released.
OFF	Stop the operation.
AUTO	Operates automatically according to the vehicle speed or amount of rain.
LO	Continuous wipe, slow operation
HI	Continuous wipe, fast operation



Front automatic wiping speed control switch
The interval of wiper swings can be adjusted by twisting the control knob upward or downward when the windshield wiper switch is in the AUTO position.
Fast: Fast interval
Slow: Slow interval

Downloaded from www.Manualslib.com manuals search engine

2) Front Wiper Switch

(1) Washer wiper

Wiper and washer coupled operation
Pull the lever briefly (for less than 0.6 seconds): One wiping cycle with washer spray
Pull and hold the lever for more than 0.6 seconds: Three wiping cycles with washer spray
While being held down, the wiper and washer will keep working.

Front auto washer switch
When the front wiper switch is off and this switch is
pressed, washer fl uid will be sprayed and the wiper
will automatically operate 4 times. Then, the fl uid will
be sprayed again and the wiper will automatically
operate 3 times.

Modification basis	
Application basis	
Affected VIN	

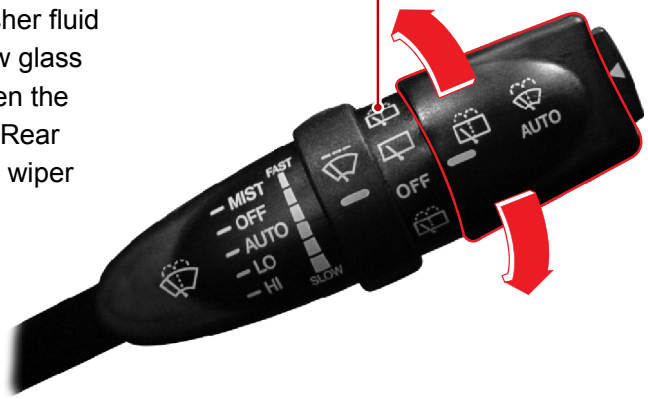
Downloaded from www.Manualslib.com manuals search engine

3) Rear Wiper Switch

▶ Mounting location

▶ Rear wiper switch function

When the switch is fully turned, washer fluid will be sprayed onto the rear window glass and the wiper will also operate. When the switch is released, it will stop in the Rear Wiper Operation mode and only the wiper will keep operating.



Rear wiper operation

OFF

Rear wiper stops

Downloaded from www.Manualslib.com manuals search engine

4) Rear Wiper Switch

When the switch is fully turned, washer fluid will be sprayed onto the rear window glass and the wiper will also operate. When the switch is released, it will return to the "OFF" position and turn off the wiper and washer.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 7810-03

WIPER MOTOR

1) Specification

▶ **Wiper motor**

Description	Specification
Rated voltage	12 V
Operating voltage	10 V to 15 V
Minimum operating voltage	Max. 8 V

2) Mounting Locations

Front wiper motor

Rear wiper motor

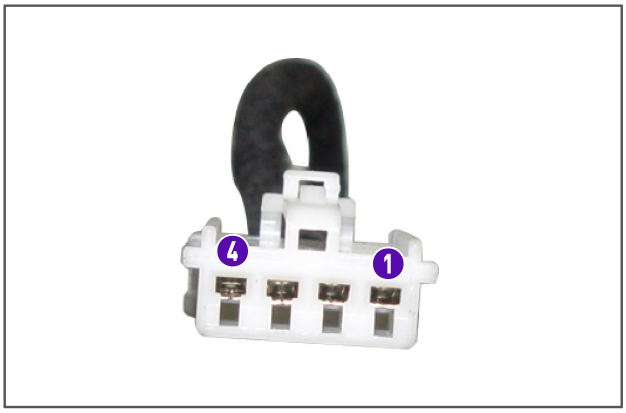
Downloaded from www.Manualslib.com manuals search engine

3) Connector

▶ **Front wiper**

Pin No.	Function
1	-
2	Wiper parking
3	B+
4	Ground
5	Wiper LOW
6	Wiper HIGH

▶ **Rear wiper**



Pin No.	Function
1	B+
2	Wiper switch
3	Wiper parking
4	Ground

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 7815-05

FRONT WIPER ARM AND BLADE

1) Mounting Locations

Front wiper

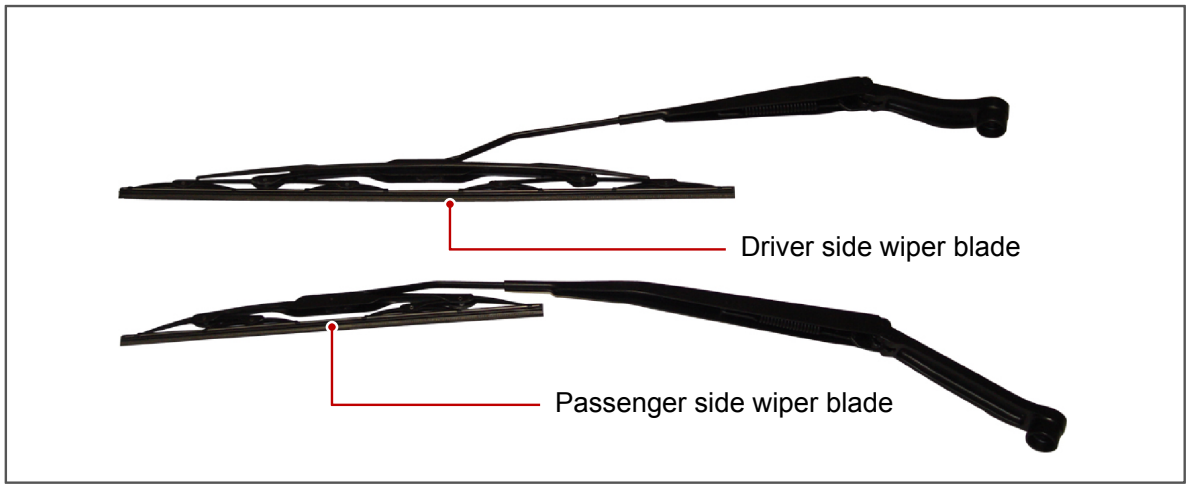
Rear wiper

Downloaded from www.Manualslib.com manuals search engine

2) Wiper Blade Size

(1) Front wiper blade

- ▶ **Driver side: 600 mm (24 in)**
- ▶ **Passenger side: 400 mm (16 in)**



(2) Rear wiper blade

- ▶ **Rear wiper blade: 350 mm (14 in)**

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 7820-01

WASHER FLUID RESERVOIR

1) Mounting Locations

Reservoir	Washer motor

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 8610-09 AUTO LIGHT AND RAIN SENSOR MODULE

The rain sensor is located in the center on the top of the windshield. The emitting section of the rain sensing unit emits infrared rays against the windshield and then detects the amount of rain drops by receiving reflected rays with photodiode. Then, the unit operates the wipers at high or low speed according to this data for the driver's convenience.

Wiper switch (AUTO operation)

Auto light and rain sensor

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

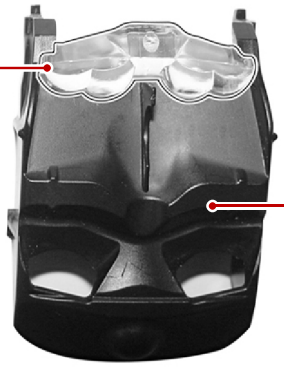
Components

Rain sensor module

Inner view of rain sensor module

Unit latch

Housing and receiver lens



PCB assembly and emitter lens

Receiver lens

The receiver lens guides the reflected infrared rays from the windshield to the photodiode.

Housing and PCB

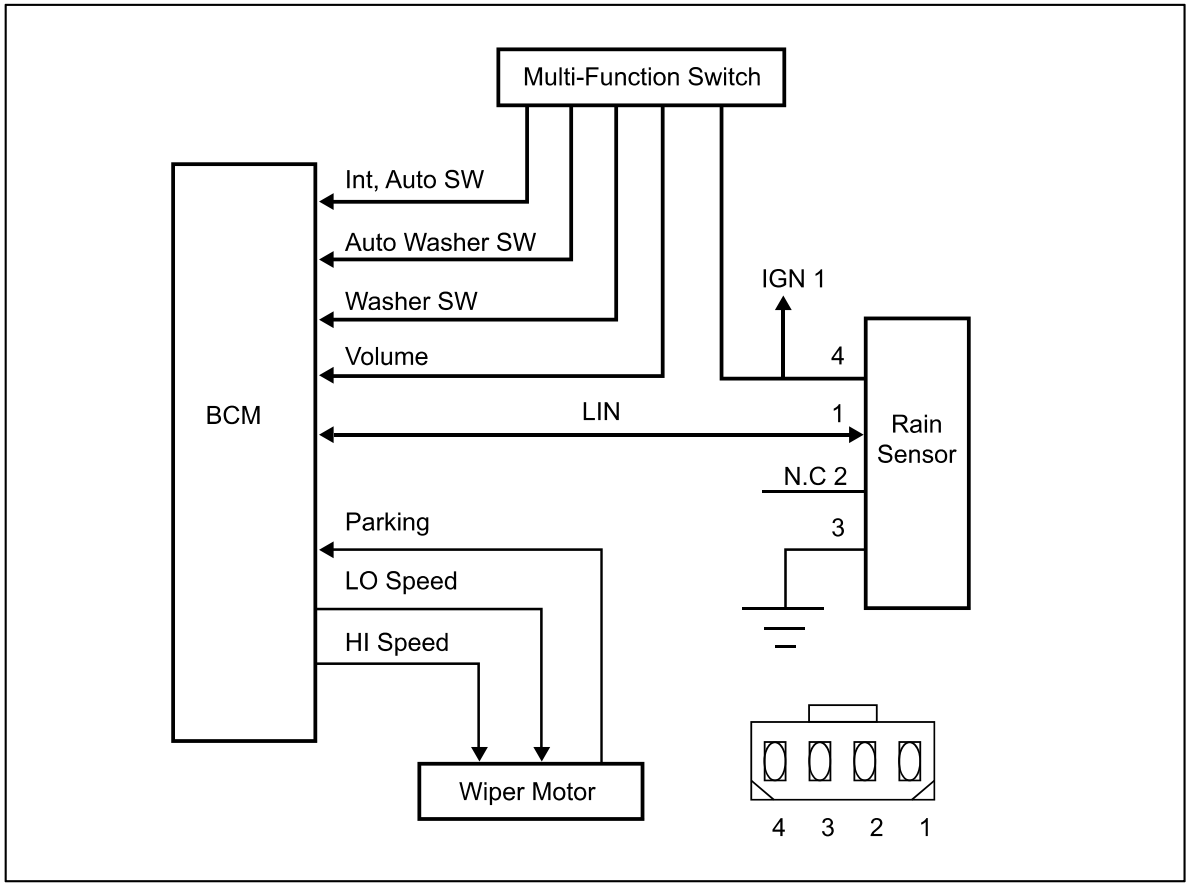
Emitter lens

The LED, which emits the infrared rays, is located at bottom and the lens guides the infrared rays to target point.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

The rain sensor has one connector with 4 pins and each pin has following function as shown in the circuit diagram. However, in this vehicle, the terminal No. 1 and No. 2 are for communications between BCM and the rain sensor; the No. 1 terminal sends the detected value from the rain sensor to BCM then the STICS drives wiper motor.
No. 2 terminal sends the wiper and washer operation information such as
washer operation mode,
wiper relay, or
multifunction wiper switch is in AUTO wiper position
to the rain sensor to recognize whether it is actual rain or it is in rain sensing wiper operation mode.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Functions and Checks for Rain Sensor

(1) Front windshield glass and coupler attachment

Check the outer windshield surface of sensing area for wear, damage and scratch. The sensor is able to compensate the wear up to a specific level. Check the coupler attached surface of windshield for porosity. If the porosity exists, the sensor cannot function properly.

NOTE

If the installed wiper brushes are out of specification (size and length), the rain sensing area cannot be fully wiped.
In this case, the rain sensor's sensitivity could be decreased and the wipers are not properly operated.

(2) Recognition of AUTO mode

1. When the engine is started with the multifunction wiper switch in "AUTO" position, the wiper operates one cycle to remind a driver that the wiper switch is in "AUTO" position.
2. When the wiper switch is turned to "AUTO" from "OFF", the wiper operates one cycle. It always operates one cycle for the initial operation, however, the wiper does not operate afterwards to prevent the wiper blade wear if not raining when turning the wiper switch to "AUTO" from "OFF". However, the wiper operates up to 5 minutes after rain stops.
3. If this function does not occur, check No. 2 terminal on the rain sensor. If any defective cannot be found, check the wiper relay (LOW) for defective.

NOTE

As described, the STICS recognizes if the wiper switch is in "AUTO" position. If there is no problem, go to diagnosis mode in STICS and check the terminal that receives signal from wiper and communication lines between rain sensor unit and BCM.

(3) Instant Wipe Function

When the variable resistance knob on the multifunction wiper switch is turned by each 1 stage from low sensitivity (S mark) to high sensitivity (F mark), the wiper operates one cycle.

NOTE

When the variable resistance knob is rotated by 4 stage from 0 stage without stopping, the wiper operates one cycle. The wiper operates one cycle when changing the wiping stage (0 → 1, 1 → 2, 2 → 3).

Downloaded from www.Manualslib.com manuals search engine

(4) Washer coupled wiper function

Check the washer coupled wiper operation by pressing the washer switch.

(5) Irregular operations (abrupt operations)

- Check the sensor for coming off.
- Check the rain sensor cover's installation status.
- Check that the customer is familiar to how to control the wiper sensitivity.
  Check that the customer can select the sensitivity by selecting the variable resistance value (stage 1 to stage 5), that is, the wiper sensitivity control value. And, also check whether the sensitivity is selected to the highest value of FAST (stage 5).
  Check the wiper blade for wear.
- If the wiper blade cannot wipe the glass uniformly and clearly, the irregular operations could be occurred. And, the wiper blade should be replaced with new one with same specifications.

(6) Self diagnosis

▶ Poor sensing

If the system receives S_RSFAULT signal from rain sensor and the volume sensitivity is changed to "2" from "3" with IGN2 ON and wiper switch AUTO, the wipers operate one cycle with LOW relay.

▶ Poor sensor

If the system receives S_COMMFAULT signal from rain sensor and the volume sensitivity is changed to "3" from "4" with IGN2 ON and wiper switch AUTO, the wipers operate one cycle with LOW relay.

Downloaded from www.Manualslib.com manuals search engine

3) Diagnosis Procedures

1. Check the glass and coupler for proper installation
2. Check the Power-up function.
3. Check the instant wiping function.
4. Check the washer coupled wiper operation.
5. Check the high speed operation.
6. Find the causes for irregular operations (abrupt operations).
7. Check the system with self diagnosis function

▶ Troubleshooting

Symptom 1. The wiper does not operate one cycle when turning the multifunction wiper switch to the "AUTO" from the "OFF" position or starting the engine while the wiper switch is in the "AUTO" position.

1. When starting the engine with the multifunction wiper switch in the "AUTO" position, the wiper operates one cycle to remind a driver that the wiper switch is in the "AUTO" position.
2. When the wiper switch is turned to "AUTO" from "OFF", the wiper operates one cycle. It always operates one cycle for the initial operation, however, the wiper does not operate afterwards to prevent the wiper blade wear if not raining when turning the wiper switch to "AUTO" from "OFF". However, the wiper operates up to 5 minutes after rain stops. If this function does not occur, check No. 8 pin. If the pin is normal, check the wiper relay related terminals.

Downloaded from www.Manualslib.com manuals search engine

Symptom 2. It rains but the system does not work in "AUTO" position.

1. Check whether the multifunction wiper switch is in the "AUTO" position.
2. Check the power to the sensor. Check the conditions of the pin 3 (Ground) and the pin 4 (IGN).
3. Check the wiper relay for defective.

Symptom 3. The wiper operates 3 or 4 times at high speed abruptly.

Check whether the variable resistance knob on the multifunction wiper switch is set in "FAST". The "FAST" is the highest stage of the sensitivity and very sensitive to small amount of rain drops. Therefore, change the knob to the low sensitivity.

Symptom 4. The wiper operates continuously even on the dry glass.

1. Check the wiper blade for wear. If the wiper blade cannot wipe the glass uniformly and clearly, this problem could be occurred. In this case, replace the wiper blade with a new one.
2. Check whether the variable resistance knob on the multifunction wiper switch is set in "FAST". The "FAST" is the highest stage of the sensitivity and very sensitive to small amount of rain drops. Therefore, change the knob to the low sensitivity.

Symptom 5. The wiper does not operate at high speed even in heavy rain.

Check if the wiper operates at high speed when grounding pin 1 and pin 2.

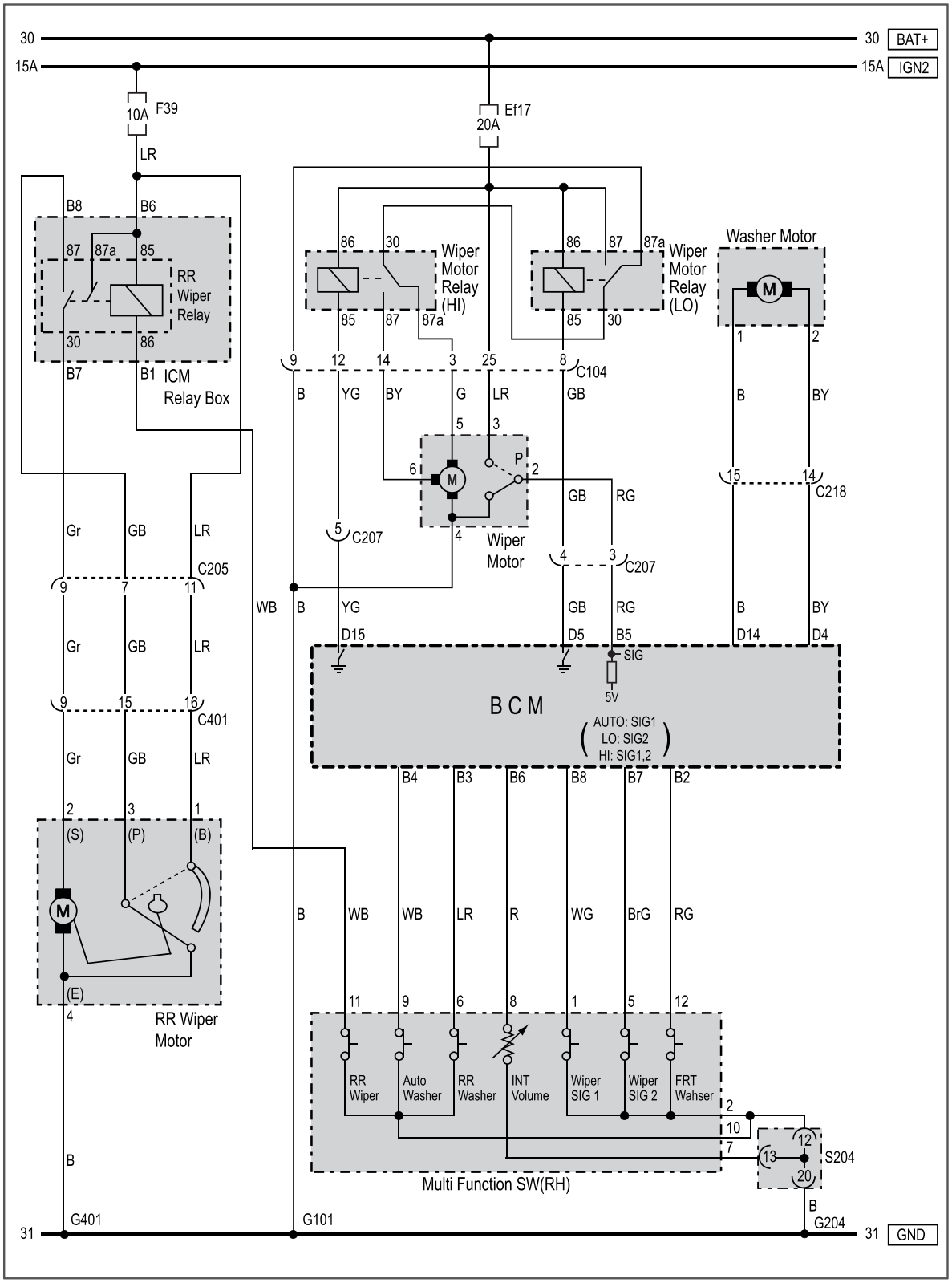
Symptom 6. The wiper responses are too fast or too slow.

Check whether the variable resistance knob on the wiper switch is set in "FAST" or "SLOW". Notify that the customer can select the sensitivity by selecting the variable resistance value. And, select a proper stage.

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 7810-01

FRONT / REAR WIPER AND WASHER



Modification basis	
Application basis	
Affected VIN	

WIPER AND WASHER SYSTEM

undefined

Downloaded from www.Manualslib.com manuals search engine

PAS 8790-04

GENERAL INFORMATION

1. SPECIFICATION

Description	Specification	Description	Specification
Rated voltage	DC 12.0 V	Insulation resistance	No heat & fire due to current leak
Operating voltage	DC 9.0 V to 16.0 V	Maximum permissible current	Unit: below 100 mA
Operating temperature	−30℃ to +80℃		Sensor: below 20 mA
Storage temperature	−40℃ to +85℃	Weight	Unit: 75.7 g ± 5 g
Maximum humidity	95%		Sensor: 38.7 g ± 5 g

2. CAUTIONS

▶ **Sensor Cannot Detect**

- When the sensing portion is frozen.
- When the sensing portion is covered by rain, water drops, snow or mud.

▶ **Not defective but improperly working**

- When driving on rough roads, gravel roads, hills, or grass.
- When the bumper height is changed due to a heavy load.
- When receiving other ultrasonic signals (metal sounds or air braking noises from heavy commercial vehicles).
- When a high-power radio is turned on.
- When there is heavy rainfall or water drops.
- When the sensor is hindered by improperly fitted accessories.

▶ **Certain obstacles that sensors cannot detect**

- Thin and narrow objects, such as wires, ropes, or chains
- Cotton, sponge, clothes, snow that absorb ultrasonic waves.
- Obstacles lower than the bumper: Drainage or puddle

▶ **Weak Sensing Scopes**

- When they are partially covered by snow or mud.
- When the ambient temperature is too high or too low.

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

When the gear selector lever is shifted into "R", the parking aid system is activated and three sensors in the rear bumper detect the distance to any obstacle. Driver can figure out the distance from the obstacle to the vehicle by the alarming sound. The alarm interval becomes faster as the vehicle approaches the obstacle.

Buzzer for PAS
Buzzer sounds according to the distance

Gear select lever

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. CONFIGURATION

Location of sensors

Parking aid unit

PAS sensor

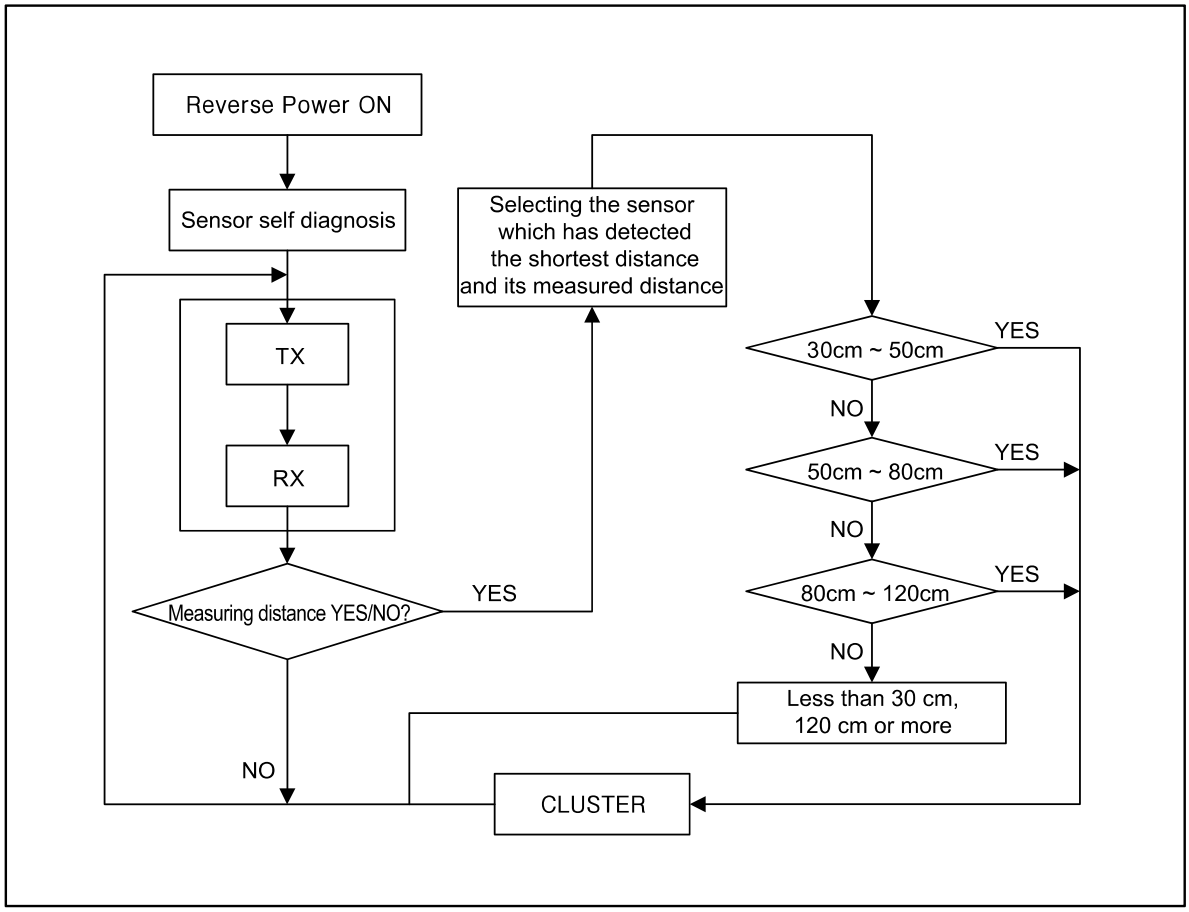
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. OPERATING PROCESS

When PAS receives "R" signal, it starts to detect the obstacles behind vehicle after self diagnosis.
If the system detects the obstacle, the buzzer sounds according to the distance.

1) Block Diagram



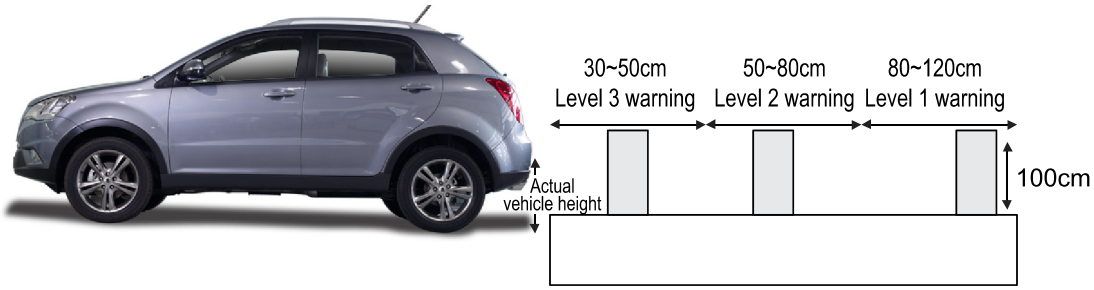
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) PAS Sensor

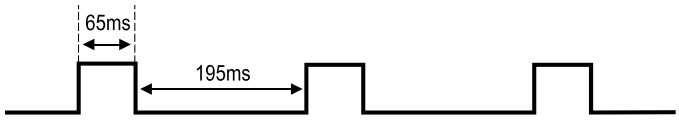
1st area: two beeps with long interval
2nd area: three beeps with short interval
3rd area: one long beep

Sensing distance



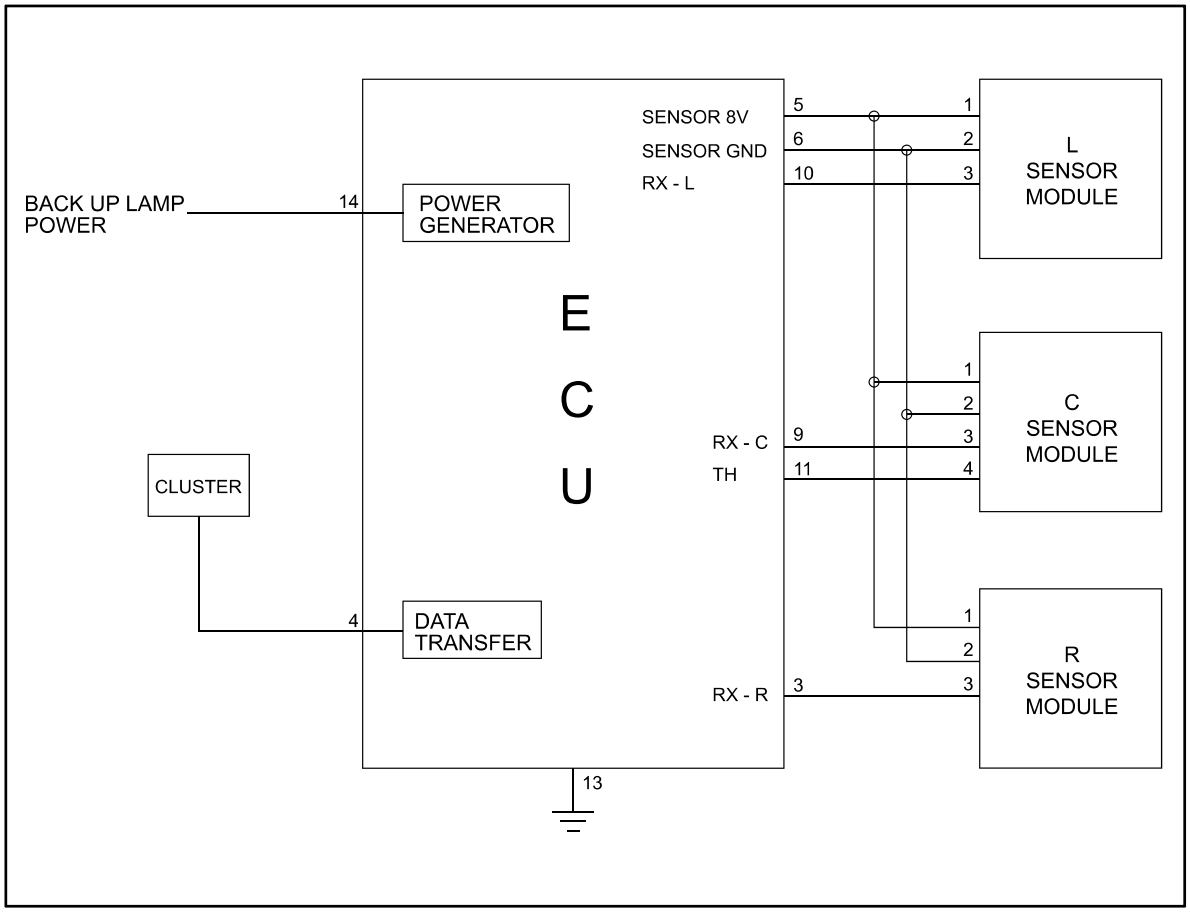
Area in 20 cm from bumper
(Objects may not be detected in this range.)

▶ Alarm interval

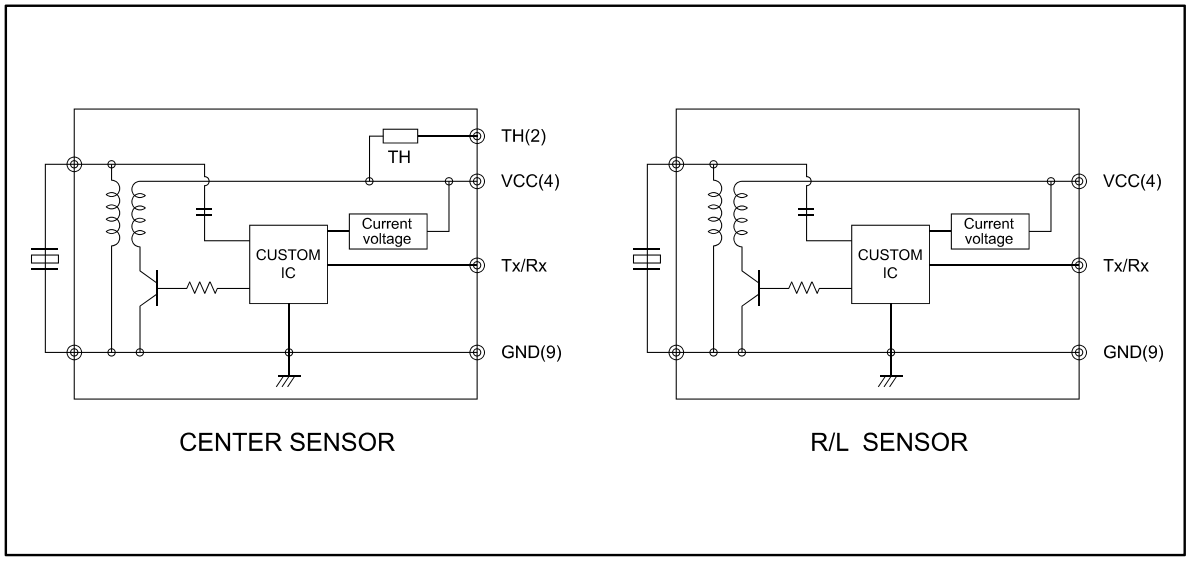
Level	L / R	CENTER	Alarm interval (msec)
Level 1	80~100 (cm)	80~120 (cm)	
Level 2	50~80 (cm)		
Level 3	30~50 (cm)		
Tolerance	±10 (cm)		±10 (cm)

Downloaded from www.Manualslib.com manuals search engine

▶ Circuit diagram of ECU



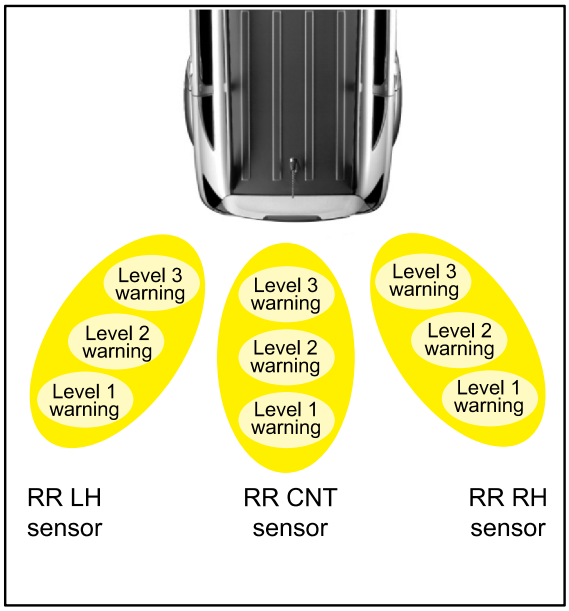
▶ Internal circuit diagram of sensors



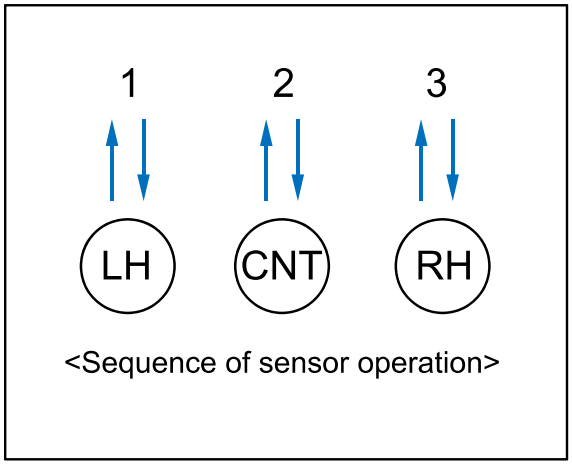
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

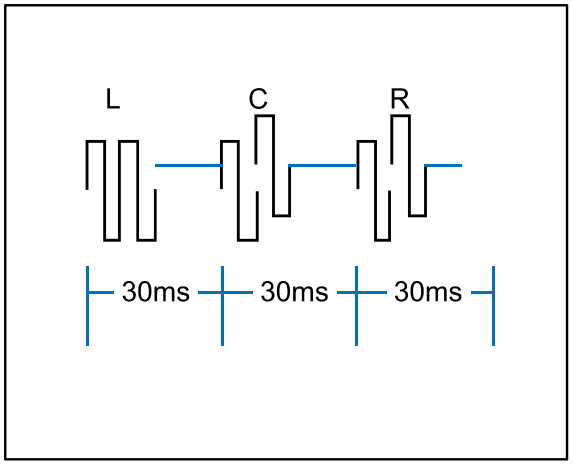
▶ Sensor operating sequence



The ultrasonic sensors on the rear bumper transmit ultrasonic waves and receive the reflected waves from an obstacle to detect it. The left sensor transmits the signal first, then the center sensor, and then the right sensor.



<Sequence of sensor operation>

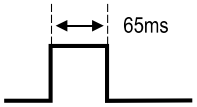
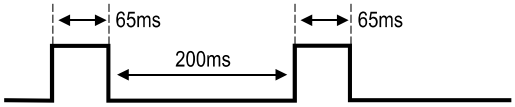
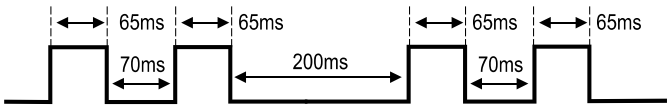
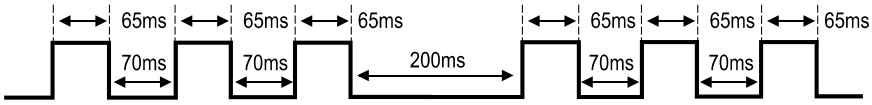
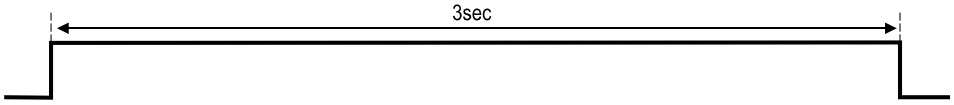


Downloaded from www.Manualslib.com manuals search engine

4. ALARM FOR SELF DIAGNOSIS

▶ Alarm interval for self diagnosis

When placing the gear select lever to "R" position, the self diagnosis is performed once. If it detects the Fail condition due to sensor defect or communication error, the buzzer sounds as shown in the picture. If the system is OK, the buzzer sounds for 65 ms.

MODE	Alarm interval (msec)
Normal	
LEFT	
CENTER	
RIGHT	
2 or more sensors	

▶ Fail conditions

- Only when there is no obstacle within 30 cm from bumper
  1. Open circuit in signal line
  2. Open circuit in power line (+, -)

Downloaded from www.Manualslib.com manuals search engine

COMPONENTS

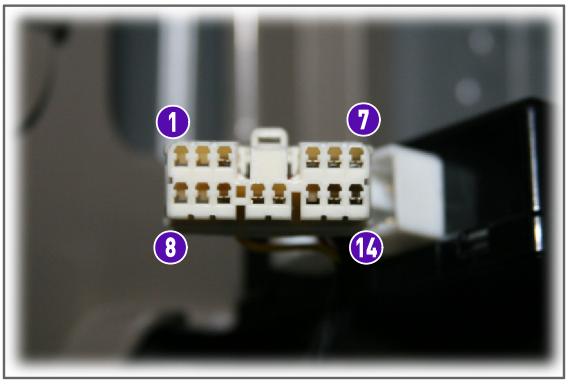
S.G.N. 8790-01 PARKING AID UNIT

1) Specifications

- **Sensing type: Ultrasonic wave**
- **Detecting area: 30 to 120 cm (linear distance from sensors)**

Description	Specification
Rated voltage	DC 12.0 V
Operating voltage	DC 9.0 V to 16.0 V
Operating temperature	−30℃ ~ +80℃
Storage temperature	−40℃ to +85℃
Maximum permissible current	below 100 mA

2) Connector



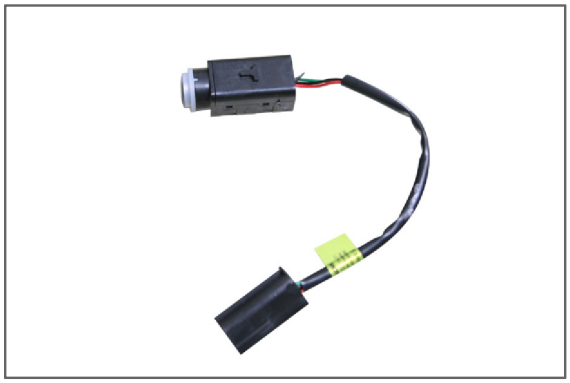
Pin No.	Function	Pin No.	Function
1	-	8	-
2	-	9	LH signal
3	-	10	Center signal
4	-	11	Temp. signal
5	RH signal	12	-
6	Ground, sensor	13	Ground
7	-	14	Power

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 8790-03

PARKING AID SENSOR

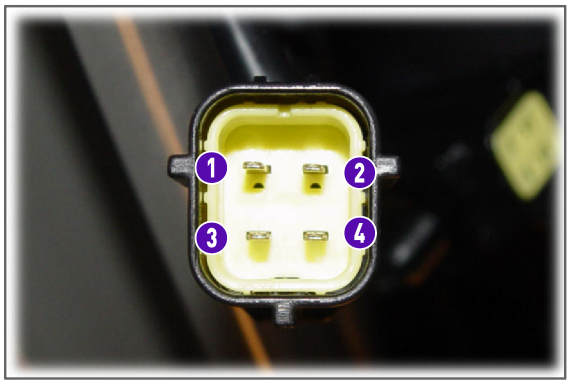
1) Specifications



- **Sensing type: Ultrasonic wave**
- Detecting area: Horizon (below 114℃ at 60 ± 5 cm), Vertical (below 51℃ at 60 ± **5 cm)**

Description	Specification
Rated voltage	DC 12.0 V
Operating voltage	DC 8.0 V
Operating temperature	−30℃ to +80℃
Storage temperature	−40℃ to +85℃
Maximum permissible current	below 20 mA
Maximum humidity	95%
Operating frequency	40 KHz ± 2 KHz

2) Connector



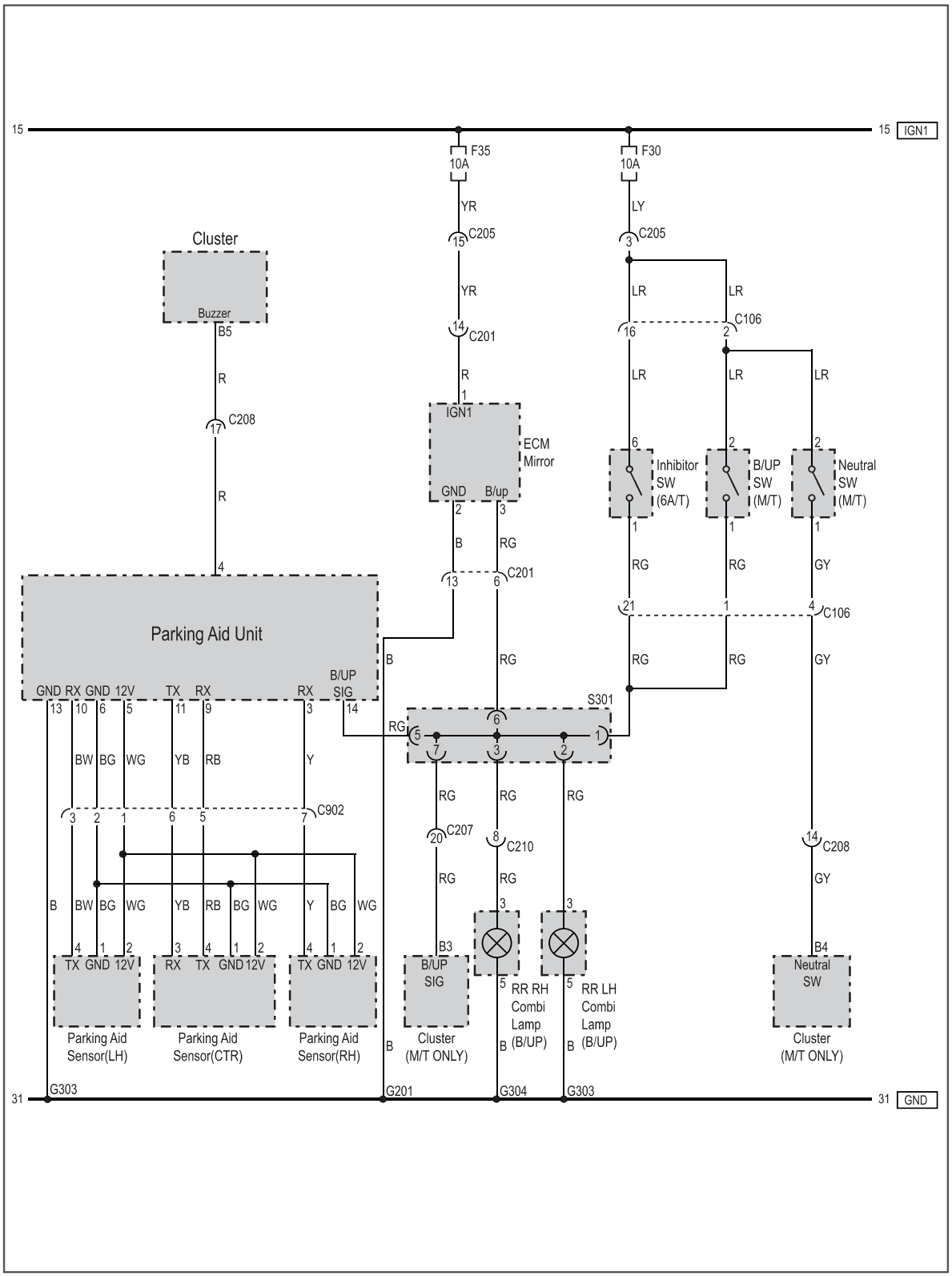
Pin No.	Function (center sensor)
1	Power, +8 V
2	Ground
3	Communication signal
4	Temperature signal

Pin No.	Function (LH/RH sensor)
1	Power, +8 V
2	Ground
3	Communication signal
4	-

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
8790-01 CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

AUDIO SYSTEM

8910-05/8530-10/8910-10/8930-11/8940-04

GENERAL INFORMATION

8910-05 RDS (RADIO DATA SYSTEM) AUDIO..... 3

OVERVIEW AND OPERATING PROCESS

1. LOCATION OF CONTROLS..... 6
2. DISPLAY WINDOW..... 7
3. CONNECTORS (AUDIO REAR VIEW)..... 8
8530-10 STEERING WHEEL AUDIO SWITCH..... 9
8910-10 USB PORT AND AUX JACK..... 12
8930-11 POLE ANTENNA..... 14

Downloaded from www.Manualslib.com manuals search engine

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

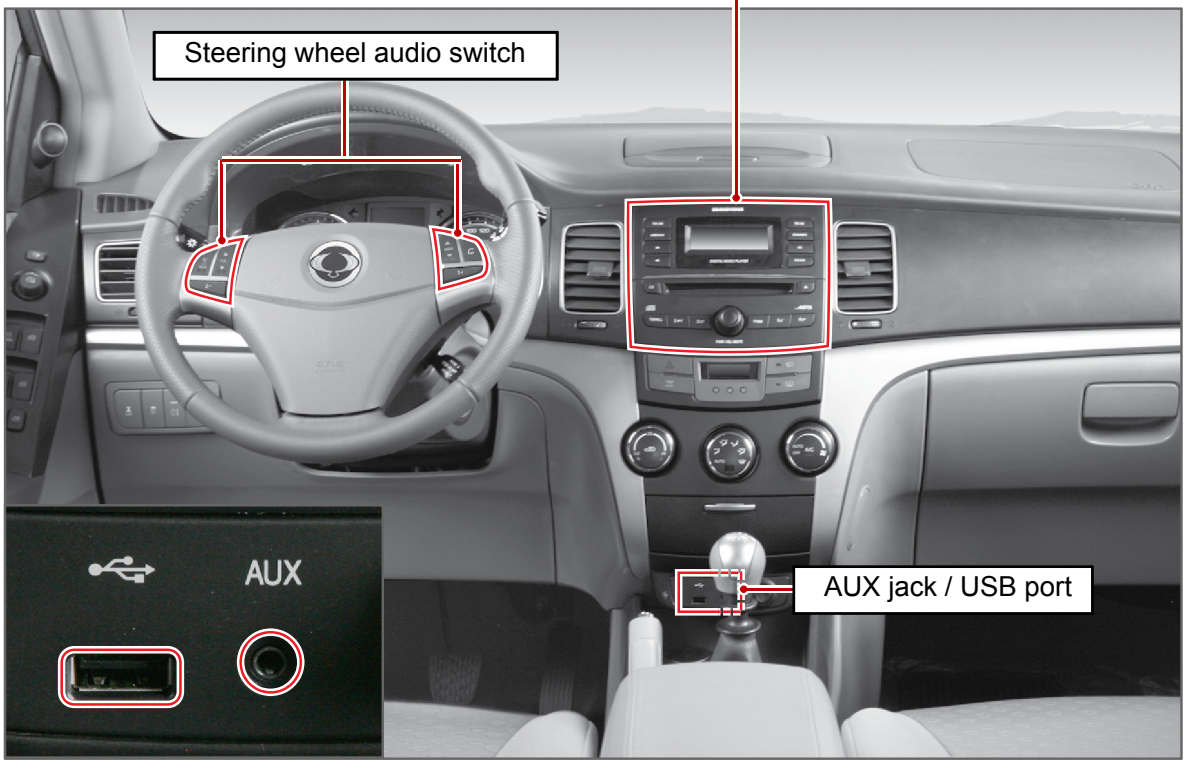
S.G.N. 8910-05 RDS (RADIO DATA SYSTEM) AUDIO

RDS (Radio Data System) is a broadcasting service which a growing number of FM stations are now providing. It allows the FM stations to send additional signals along with their regular programme signals. For example, the stations send their station names and information about what type of programme they broadcast, such as sports or music, etc.
When tuned to an FM station which provides the RDS service, the RDS indicator lights up, the station frequency (and then the station name if sent) is displayed.
Not all FM stations provide RDS service, nor do all RDS stations provide same services. If in doubt, check with local radio stations for details on RDS services in your area.
This machine can use the following RDS service.
PS (Programme Service name) / PTY (Programme Type) / TP (Traffic Program) / TA (Traffic Announcement) / AF (List of Alternative Frequencies) / RT (Radio Text)
This allows you to locate a specific type name of programme being broadcast.

Downloaded from www.Manualslib.com manuals search engine

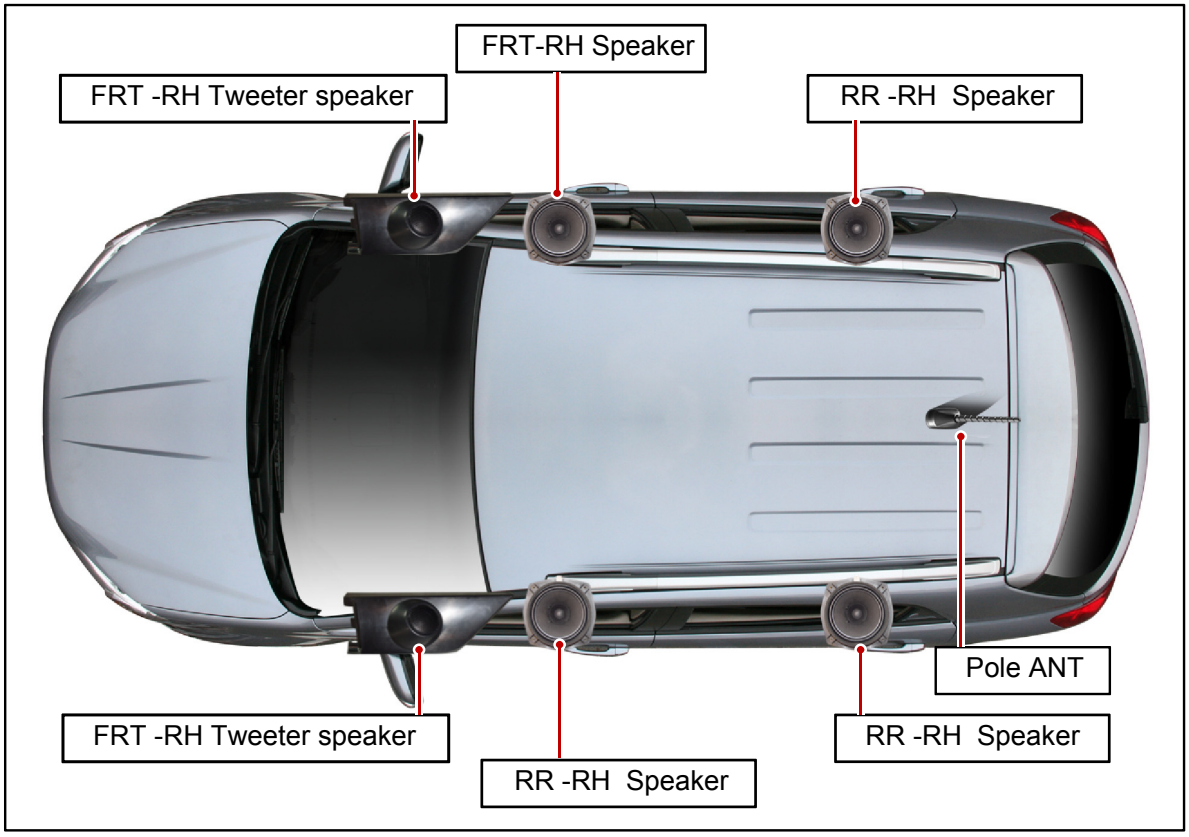
CONFIGURATION AND FUNCTIONS

Audio unit



Modification basis	
Application basis	
Affected VIN	

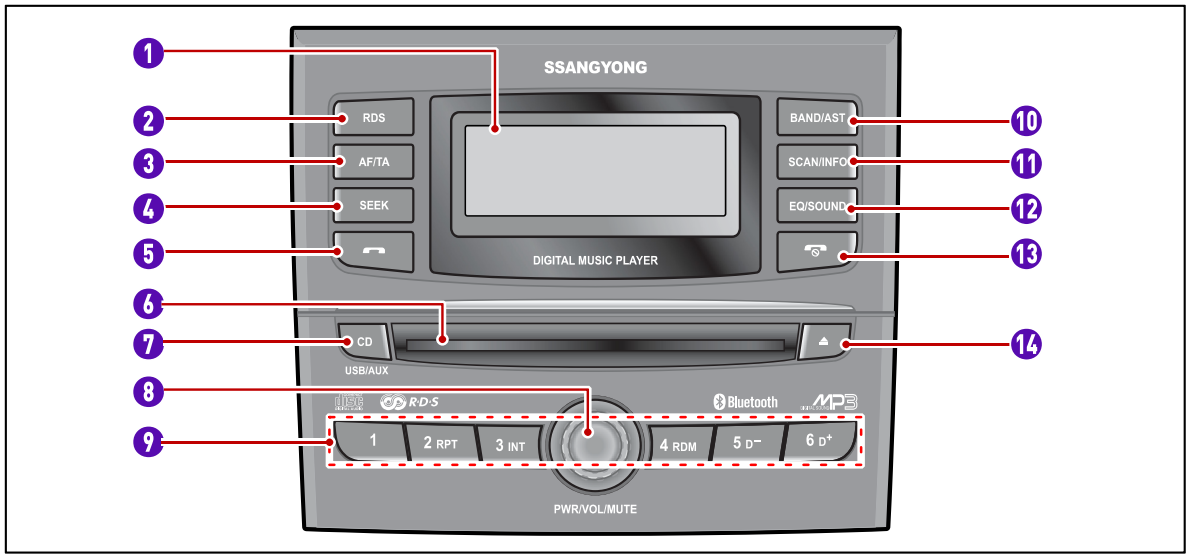
Downloaded from www.Manualslib.com manuals search engine



Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCE

1. LOCATION OF CONTROLS



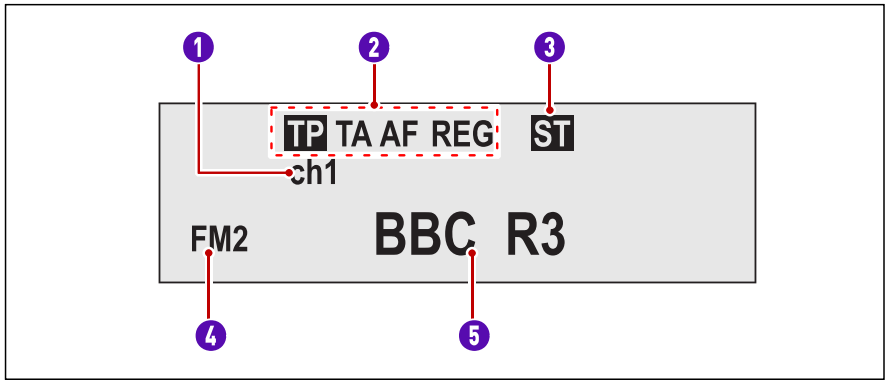
1. Display window
2. RDS button
   Enter the RDS (Radio Data System) Mode.
3. AF/TA button
   Enter the TA (Traffic Announcements) or AF (Alternative Frequency) Mode.
4. SEEK button
   To skip a track/forward, reverse a track, find a station manually/select a setting.
5. CALL [ ] button
   Making a call or received the incoming a call.
6. Disc slot
   Insert the disc (label side up), playback starts.
7. CD/AUX/USB button
   To select the CD/AUX/USB and pause playback.
8. POWER button with VOLUME dial
   To adjust the volume or sound setup items (rotate); turn on the power or mute (press) and turn off the power (press and hold)
9. Number (1 to 6) buttons
   - During radio reception
     To receive stored stations (press); to store station (press and hold).
   - During CD playback
     2 RPT: Repeat playback
     3 INT: Intro playback
     4 RDM: Random playback
     5 D-: Folder down
     6 D+: Folder up
10. BAND/AST button
    To select the radio function or band (press), to store stations automatically (press and hold)
11. SCAN / INFO button with dial
    - During radio reception: Tune in a station automatically.
    - During CD/USB playback:
      To select display item (File/Folder or ID Tag information)
12. EQ/SOUND button
    To select preset EQ mode.
13. END [ ] button
    Ends a call.
14. Disc EJECT button
    To eject the disc.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

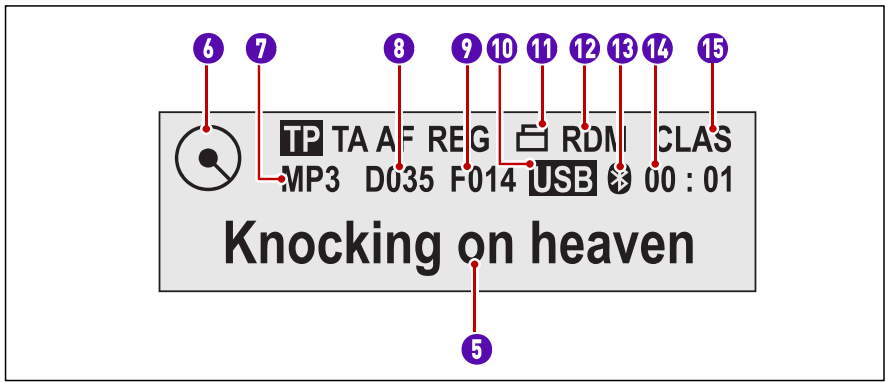
2. DISPLAY WINDOW

▶ **Radio function**



1. Preset channel number
2. RDS indicator
   - TP lights up when a TP station is tuned in.
   - TA lights up when TA (traffic announcement standby) function is on.
   - REG lights up when a REG station is tuned in.
   - AF lights up when AF (Alternative frequencies search) function is on.
3. Stereo indicator
4. Band indicator
5. Multi-function display area

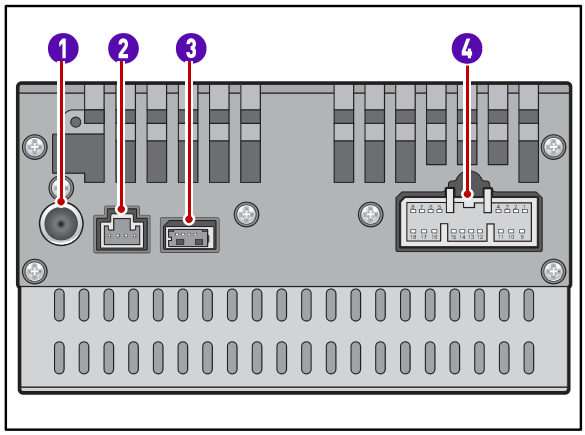
▶ **CD / MP3 / WMA function**

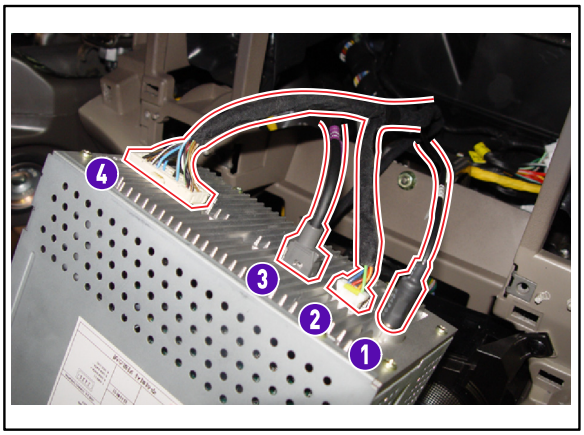


6. Disc indicator
7. Media indicator
   CDP lights up when an audio CD is loaded.
   MP3 lights up when a MP3 file is loaded.
   WMA lights up when a WMA file is loaded.
8. Current folder (directory) number
9. Current file (track) number
10. USB indicator
11. Folder select mode indicator
12. Playback mode indicators
13. RPT (Repeat), INT (Intro), RDM (Random)
    Bluetooth function indicator
14. Playing time
15. EQ (Equalizer) indicator
    POP, ROCK, CONTRY, VOICE, JAZZ, CLASSIC, EQ OFF

Downloaded from www.Manualslib.com manuals search engine

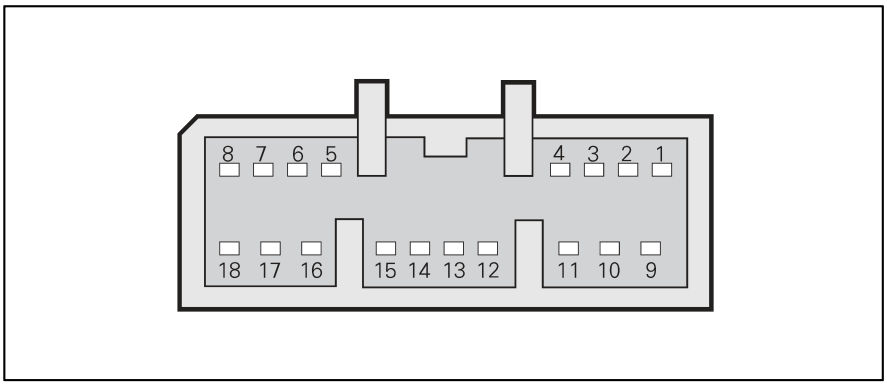
3. CONNECTORS (AUDIO REAR VIEW)





1. Antenna jack
   To plug the FM/AM antenna cable.
2. AUX In port
   To connect an AUX connector for audio device.
3. USB port
   To connect an USB connector for USB host function
4. I/O connector (18 pin)

▶ Input/Output connector (18 Pin)



1. Front right channel speaker (+)
2. Rear right channel speaker (+)
3. Illumination (+)
4. ACC.
5. Back-up (B+)
6. BT MIC+
7. Rear left channel speaker (+)
8. Front left channel speaker (+)
9. Front right channel speaker (+)
10. Rear right channel speaker (-)
11. Illumination (-)
12. Antenna power
13. Remote control ground
14. Ground
15. BT MIC-
16. Remote control front signal
17. Rear left channel speaker (-)
18. Front left channel speaker (-)

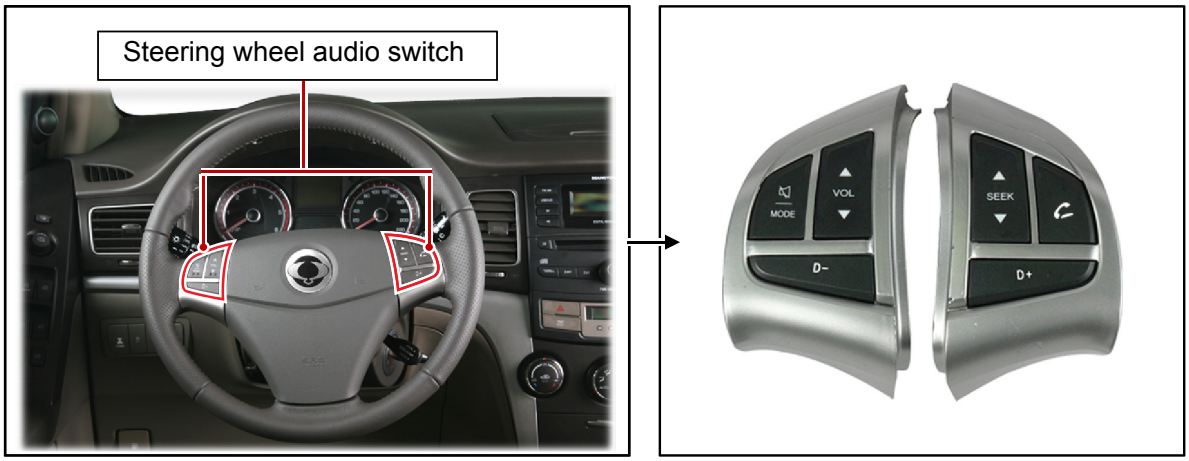
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 8530-10

STEERING WHEEL AUDIO SWITCH

If your vehicle has this feature, some audio controls can be adjusted at the steering wheel. They include the following:



▶ **MUTE [ ]**

Press: to turn the system on, to mute on/off

Press and hold: to turn the system off

▶ **MODE**

Press: to select the functions (CD → USB → AUX → RADIO)

Press and hold: to select the bands (FM1→ FM2 → MW → LW)

▶ ▲VOLUME▼

Press to increase/decrease the volume.

▶ ▲SEEK▼

When listening to a station:

Press: to go to the next/previous preset station

Press and hold: to search the next/previous radio station (The radio seeks stations only with a strong signal that are in the selected band).

When playing a CD or USB:

Press: to go to the next/previous track:

Press and hold to fast forward/backward through the tracks.

▶ **PHONE [ ]**

During the standby:

Press: to make a call via voice-activated dialing function

Press and hold: to make a call via last call dialing function

When a call comes in:

Press: to receive the incoming a call

Press and hold: to reject the incoming a call

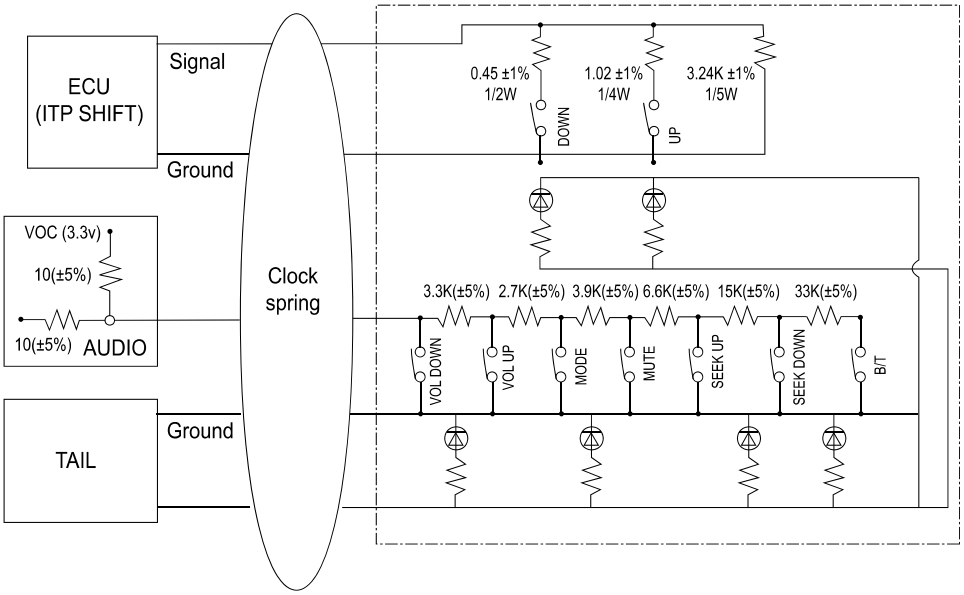
During a call

Press/Press and hold: to end a call

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Circuit diagram

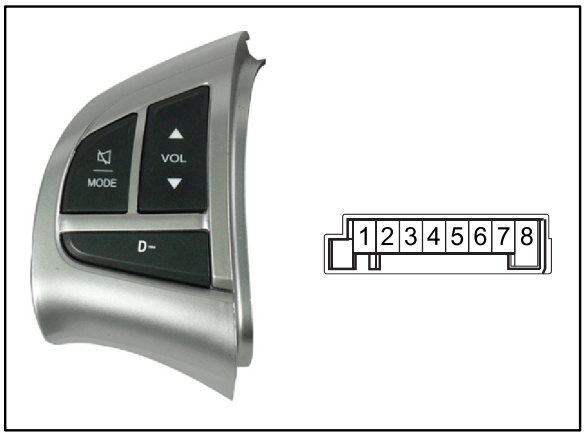


SW \ T	Function	OHM		Output voltage
1	VOL-	0 Ω	±5%	0 to 0.3 V
2	VOL+	3.3 kΩ	±5%	0.4 to 1.0 V
3	MODE	6 kΩ	±5%	1.1 to 1.4 V
4	MUTE	9.9 kΩ	±5%	1.5 to 1.8 V
5	SEEK UP	16.7 kΩ	±5%	1.9 to 2.25 V
6	SEEK DOWN	31.3 kΩ	±5%	2.26 to 2.65 V
7	TIP-	670 kΩ	±5%	-
8	TIP+	1.08 kΩ	±5%	-
9	B / T	64.7 kΩ	±5%	2.66 to 3.0 V

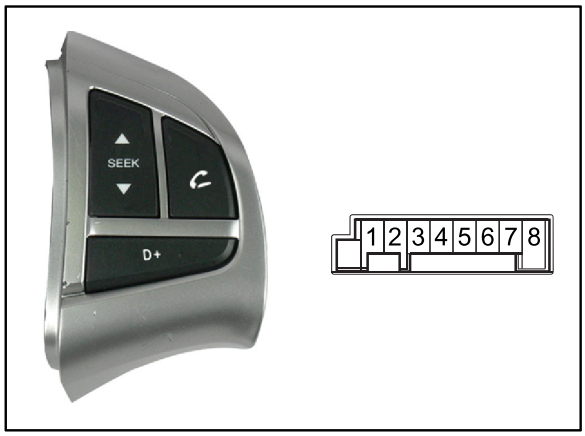
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Connectors



Pin No.	Function
1	Illumination (+)
2	Illumination (-)
3	ECU signal
4	ECU ground
5	Audio H/U (Signal IN)
6	Audio H/U (Ground)
7	Audio (Signal OUT)
8	NC

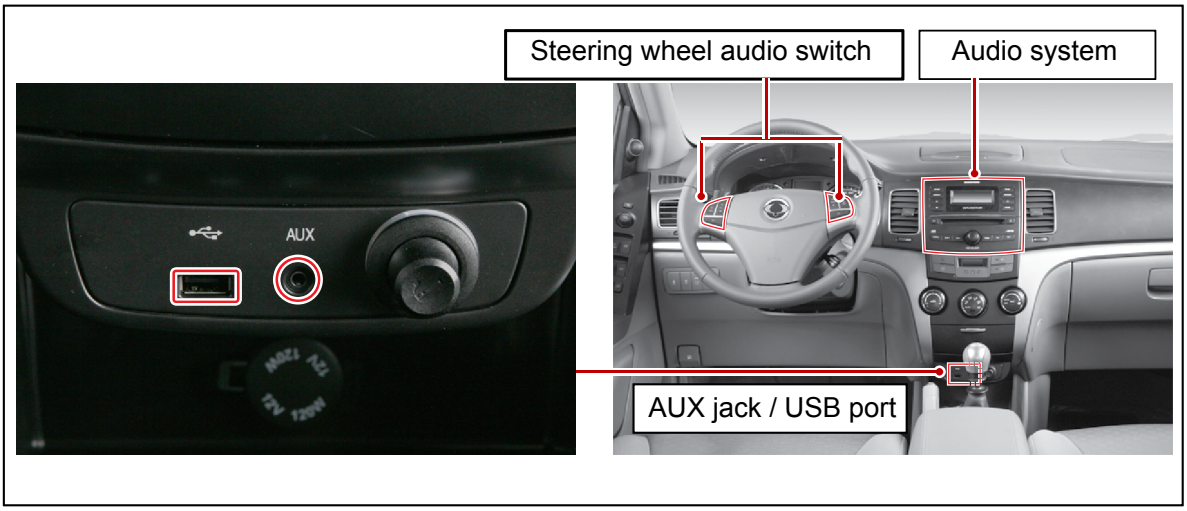


Pin No.	Function
1	Illumination (+)
2	Illumination (-)
3	ECU signal
4	ECU ground
5	Audio (Signal OUT)
6	Audio H/U (Ground)
7	NC
8	NC

Downloaded from www.Manualslib.com manuals search engine

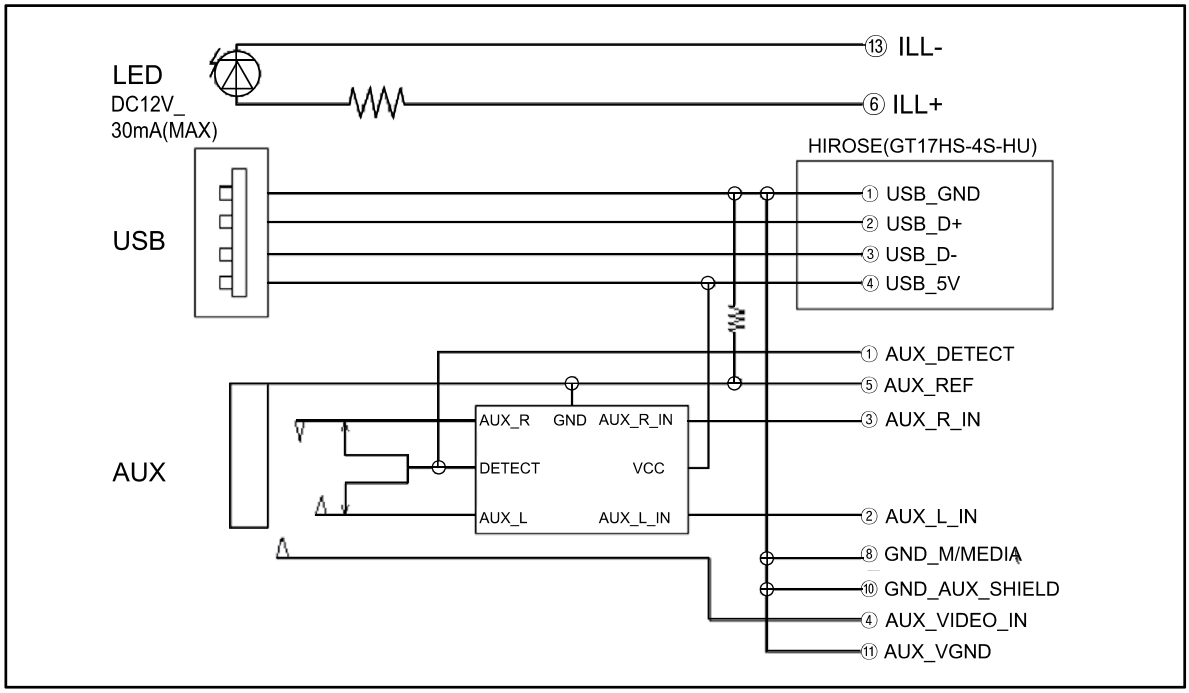
S.G.N. 8910-10 USB PORT AND AUX JACK

The USB port and AUX jack are provided.
Use them when you want to hear the music in USB memory stick or an external audio device through with the speakers in your vehicle.
For detailed information, refer to the audio operation manual provided with this manual.



CAUTION
Some USB memory sticks and external audio devices may not work in this audio system.

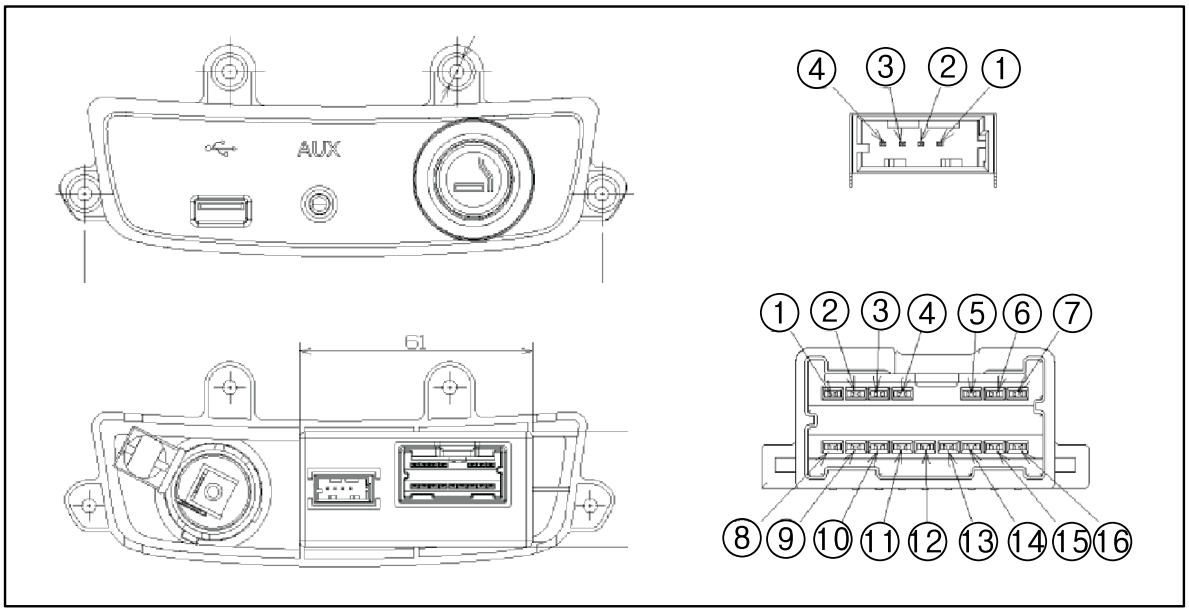
▶ Circuit diagram



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

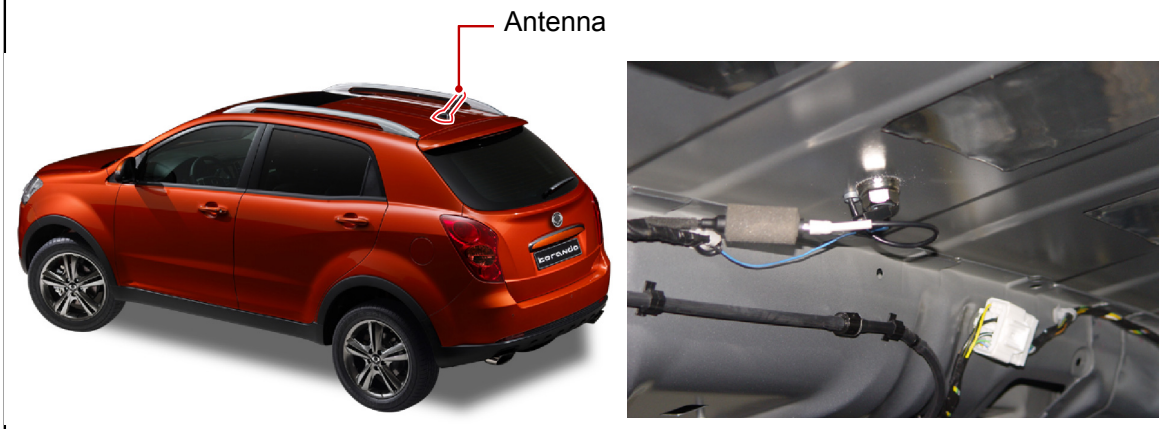
▶ Connector



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

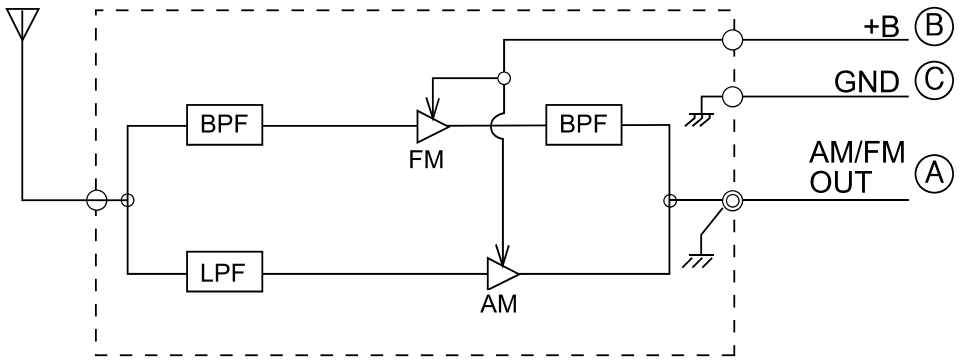
S.G.N.
8930-11 POLE ANTENNA



▶ Specification

Band	Local	Frequency	Gain [dB]
AM	GEN	531 [KHz]	1.0 ± 2
		1000 [KHz]	1.0 ± 2
		1602 [KHz]	1.0 ± 2
FM	GEN	88 [MHz]	7.0 ± 2
		98 [MHz]	7.0 ± 2
		108 [MHz]	7.0 ± 2

▶ Circuit diagram



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

CHASSIS GENERAL INFORMATION

0000-00

INDEX

MAJOR COMPONENTS

1. MOUNTING LOCATIONS (CHASSIS)..... 2
2. CHASSIS COMPONENT LAYOUT..... 4
3. SUB FRAME AND STEERING GEAR BOX LAYOUT..... 6
4. FRONT SUSPENSION COMPONENT LAYOUT..... 8
5. REAR SUSPENSION COMPONENT LAYOUT..... 10
6. BRAKE SYSTEM AND ESP SYSTEM LAYOUT..... 12
7. STEERING SYSTEM LAYOUT..... 14

DURING SERVICE WORK

1. GUIDELINES FOR SERVICE WORK SAFETY..... 16
2. JACK-UP POINTS..... 20
3. STANDARD BOLTS SPECIFICATIONS.. 21

SPECIAL TOOLS AND EQUIPMENT

1. NEW SPECIAL TOOLS..... 22
2. NORMAL EQUIPMENTS..... 23

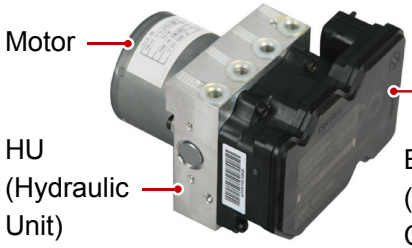
Downloaded from www.Manualslib.com manuals search engine

MAJOR COMPONENTS

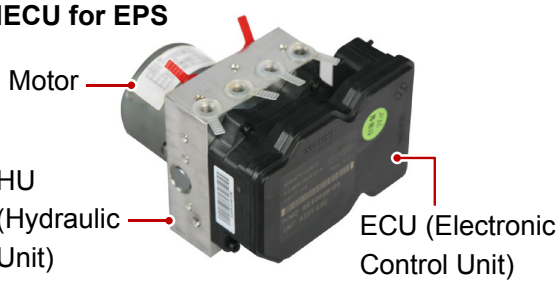
1. MOUNTING LOCATIONS (CHASSIS)

HECU (Hydraulic & Electronic Control Unit)

HECU for ABS

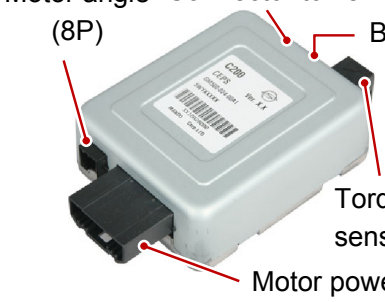


HECU for EPS

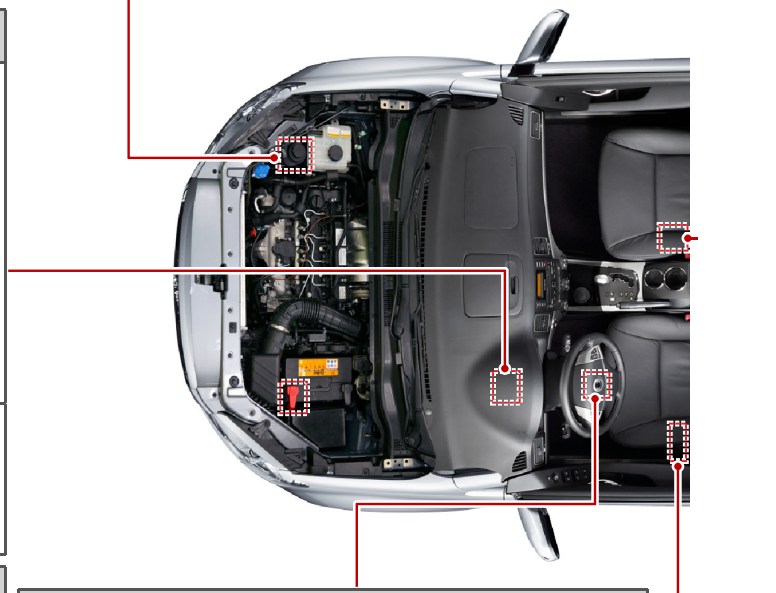


The HECU (Hydraulic & Electronic Control Unit) determines the slip conditions of vehicle wheels by calculating each wheel's speed and the increment/decrement of speed based on the information detected by the sensors, and controls the pumping and boosting/reducing/keeping pressure by operating the valve and motor of HECU.

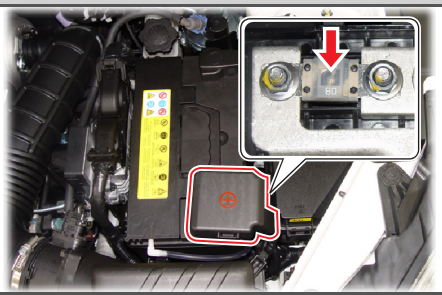
EPS unit



The ECU controls the electric power steering system depending on the driving conditions, based on the signals from the torque and angle sensor.



Fuse for vehicle with EPS



The vehicle with EPS has EPS fuse (80A) mounted to the positive (+) terminal of the battery not in the fuse box.

Steering wheel angle sensor (SWAS)

The steering wheel angle sensor is mounted between the steering column and the steering column shaft. It is commonly used by the ESP (Electronic Stability Program) system. And it receives signals of the steering wheel angle sensor from the ESP HECU (Hydraulic & Electronic Control Unit).

Modification basis	
Application basis	
Affected VIN	

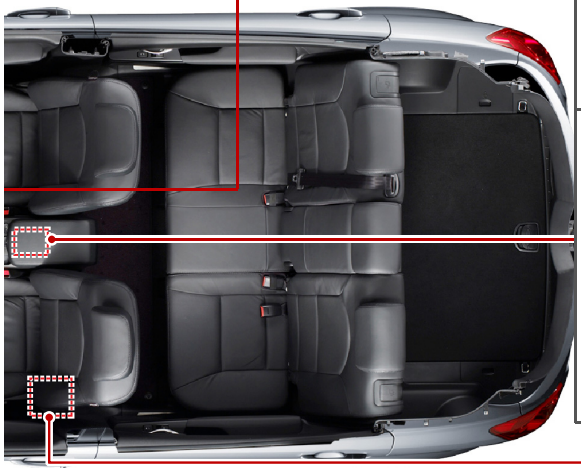
Downloaded from www.Manualslib.com manuals search engine

Sensor cluster

The sensor cluster is linked to the sensors on the unit board and CAN interface. And they are housed in one case and mounted to the body.

TGS Lever assembly

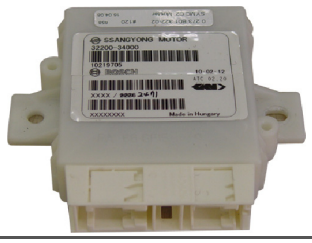
The TGS communicates with TCU (Transmission Control Unit), ECU, ESP HECU and instrument cluster to let the driver select the desired transmission gear and to maintain the desired driving condition. Also, the tip switch is installed on the lever knob and the steering wheel so that the driver select the gear manually when the shift lever is in "M".



G-sensor

For the vehicle with the ABS, a speed difference between the wheels is not noticeable as all the wheels are slipping during abrupt braking. Therefore, the vehicle needs the speed information from other sensors other than the wheel speed sensor. The longitudinal acceleration sensor (G-sensor) is used for this case. It controls the ABS by using the signals from the sensor during abrupt braking and acceleration.

E-coupling unit



The E-coupling unit is a control unit which determines the magnetic force by considering CAN signals (wheel speed, engine torque, pedal opening, ABS/ESP CAN signals, etc.) from other ECUs.

TCU unit

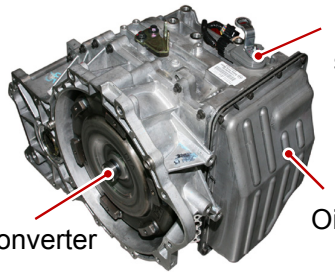
The transmission control unit (TCU) is installed under the driver seat, and controls the transmission.
The TCU is operated by the ignition power supply and receives and processes the following information from the inner sensors through CAN buses.

Downloaded from www.Manualslib.com manuals search engine

2. CHASSIS COMPONENT LAYOUT

1) 4WD Vehicle With Automatic Transmission

M11 6-speed A/T assembly

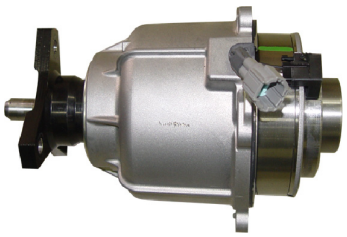


M11 6-speed automatic transmission is available as 4WD- and 2WD-type, and provides 6 speeds for forward travel and 1 reverse travel. It is also equipped with the torque converter with inner lock-up clutch and electronically controlled solenoid which controls all hydraulic functions.

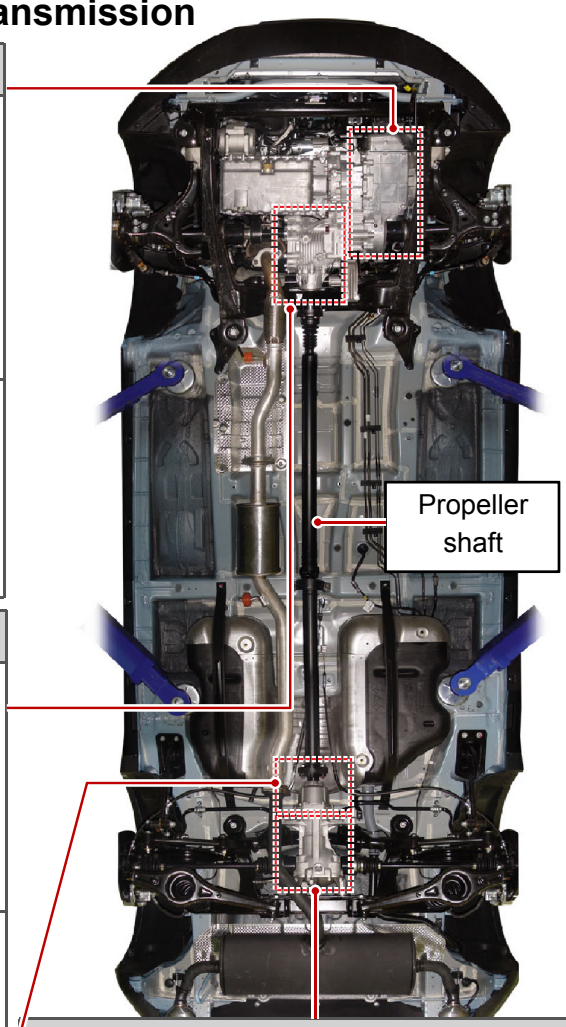
PTU (Power Transfer Unit)

The PTU is a device that transfers the power generated from the engine to the rear axle through propeller shaft and E-coupling by changing the power flow direction by 90° in the front wheel drive type 4WD vehicle.

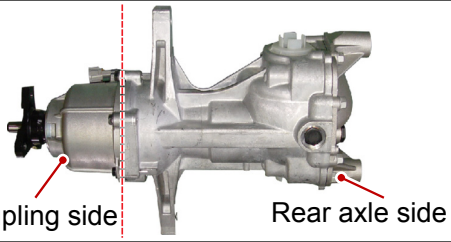
E-coupling control unit (E-Coupling ECU)



The E-coupling unit is a control unit which determines the magnetic force by considering CAN signals (wheel speed, engine torque, pedal opening, ABS/ESP CAN signals, etc.) from other ECUs.



Rear axle assembly



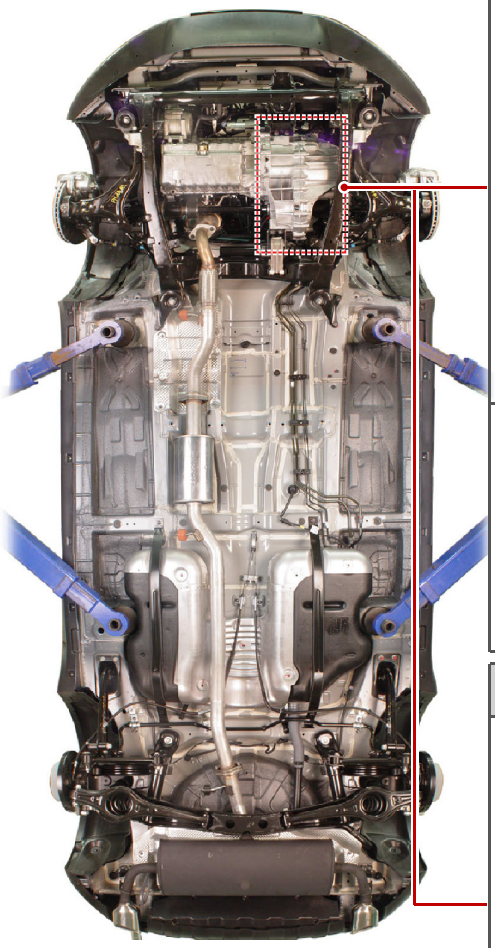
The rear axle installed in this car is a removable axle, called IRDA (Independent Rear Differential Axle). The rear differential carrier is installed directly on the sub frame, and there is an independent suspension that allows each wheel on the same axle to move vertically independently of each other with the universal joint and the slip joint.

Modification basis	
Application basis	
Affected VIN	

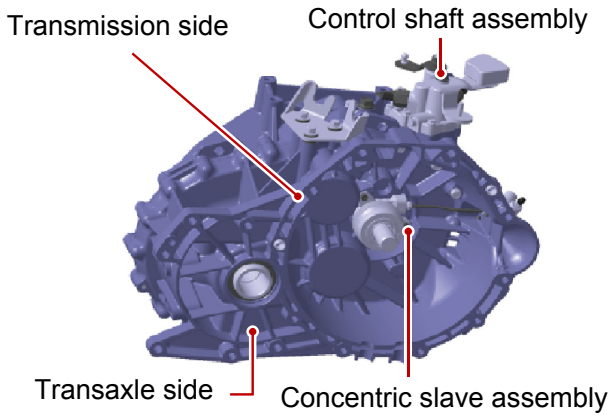
Downloaded from www.Manualslib.com manuals search engine

2) 2WD Vehicle With Manual Transmission

The 2WD vehicle with manual transmission is a front wheel drive type vehicle that doesn't have PTU, propeller shaft, E-coupling and rear axle which are applied to 4WD vehicle. Its under structure is very simple.

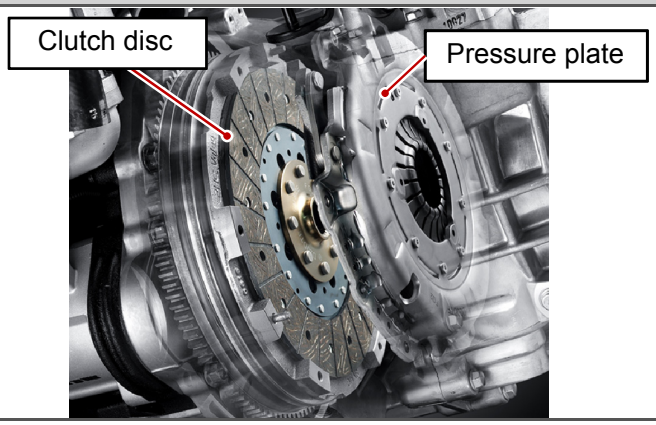


M6LF1 manual transmission



M6LF1 manual transmission is a model modified from the one that used in other vehicle so that it can be applied to FF (Front engine-Front wheel driving) type vehicle, and has an axle in one piece. The engine torque and gear ratio of this transmission have been optimized to maximize driving performance. It provides 6 speeds for forward travel and 1 reverse travel.

Clutch assembly



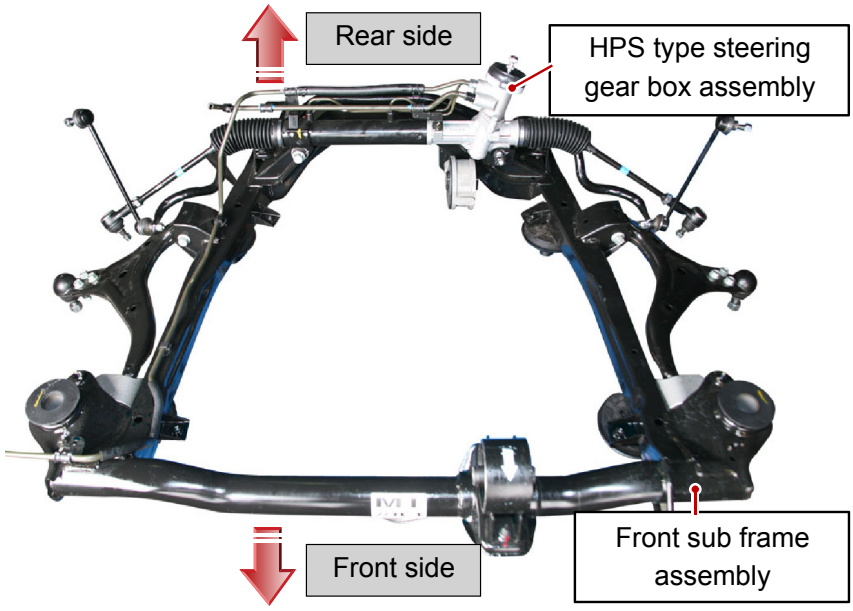
M6LF1 manual transmission is a model modified from the one that used in other vehicle so that it can be applied to FF (Front engine-Front wheel driving) type vehicle, and has an axle in one piece. The engine torque and gear ratio of this transmission have been optimized to maximize driving performance. It provides 6 speeds for forward travel and 1 reverse travel.

Manual gear selector lever

Downloaded from www.Manualslib.com manuals search engine

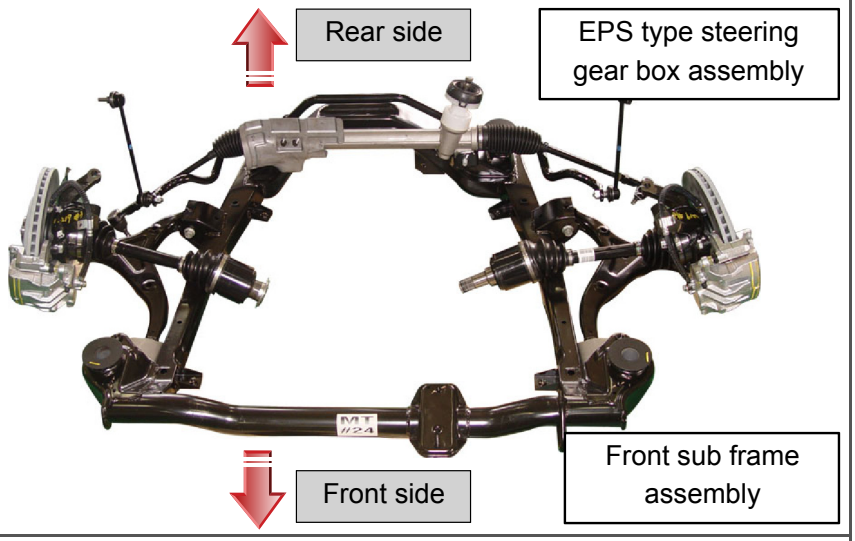
3. SUB FRAME AND STEERING GEAR BOX LAYOUT

Front sub frame with HPS type steering gear box assembly

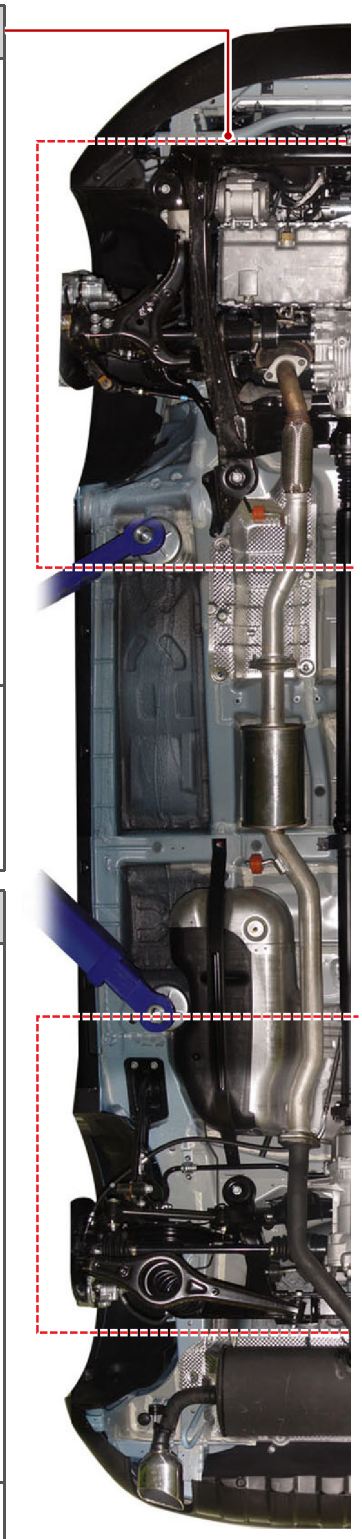


The front sub frame consists of 4 body bush mountings and 2 transmission bush mountings which reduce the vibration from the powertrain and road, and also control the torque. And the frame is equipped with hydraulic pressure pipe of the HPS type steering gear box.

Front sub frame with EPS type steering gear box assembly

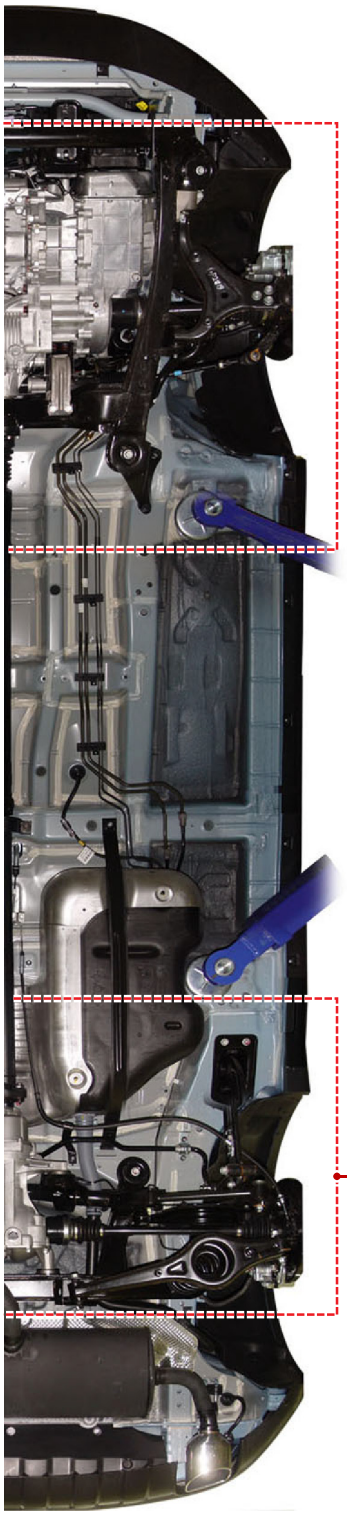


This kind of front sub frame system has the same mounting structure with the frame with HPS. But the EPS type steering gear box has no hydraulic pressure pipe since it is driven by the electric motor.

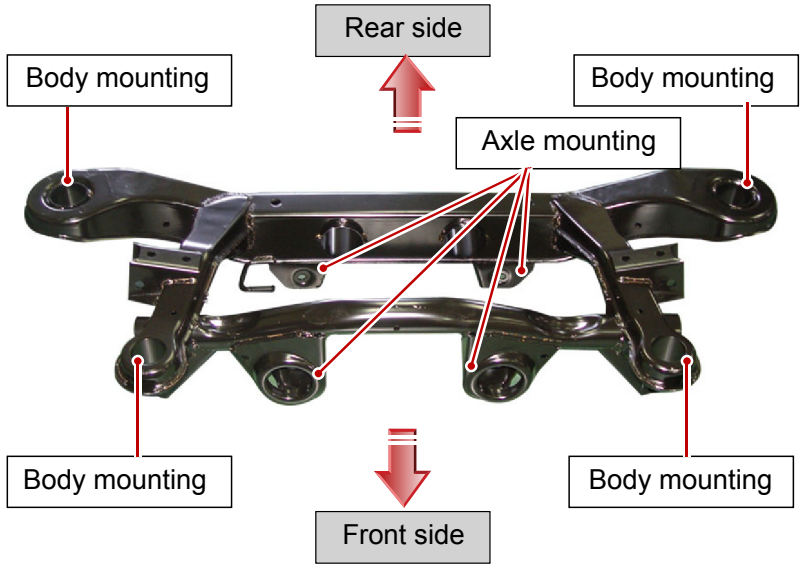


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

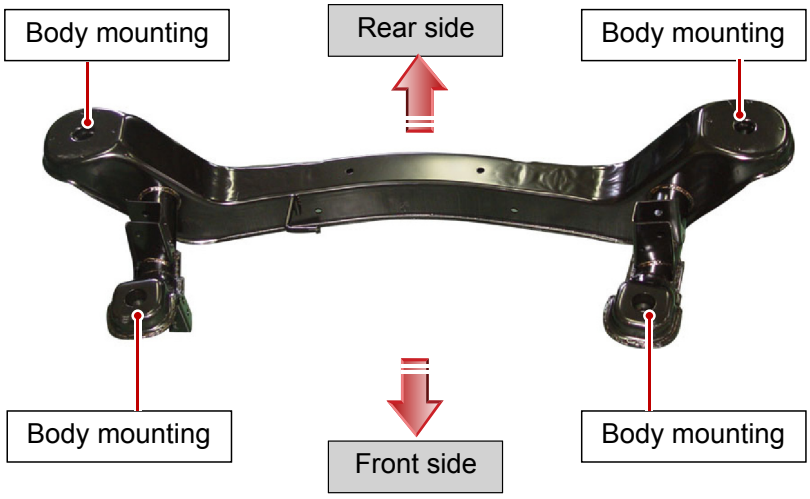


Rear sub frame assembly for 4WD



The rear sub frame for 4WD vehicle consists of 4 body (bush) mountings and 2 axle (direct) mountings which reduce the vibration from the powertrain and road, and also control the torque.

Rear sub frame assembly for 2WD



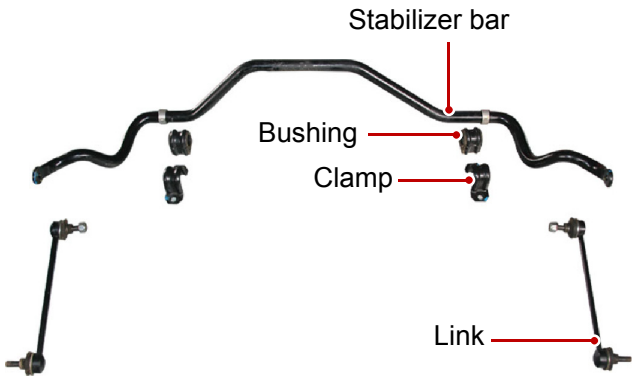
The rear sub frame for 2WD vehicle functions in the same way as the one for 4WD vehicle, but the structure is different from the one for 4WD. It consists of 4 body (bush) mountings.

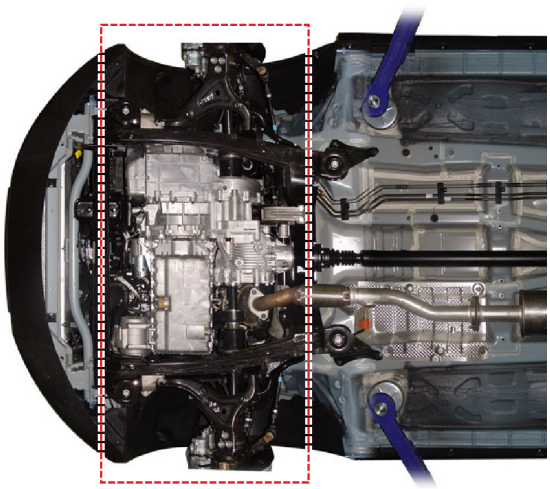
Downloaded from www.Manualslib.com manuals search engine

4. FRONT SUSPENSION COMPONENT LAYOUT

Front suspension supports the vehicle weight and absorber the vibration from tires. And, in this type of suspension, the steering linkage tie rod is mounted on the knuckle. The Macpherson Strut suspension is an independent suspension which has a spring on the strut with a built-in shock absorber. The lower arm is installed on sub frame and large strut damper is installed on the knuckle to support the tire.

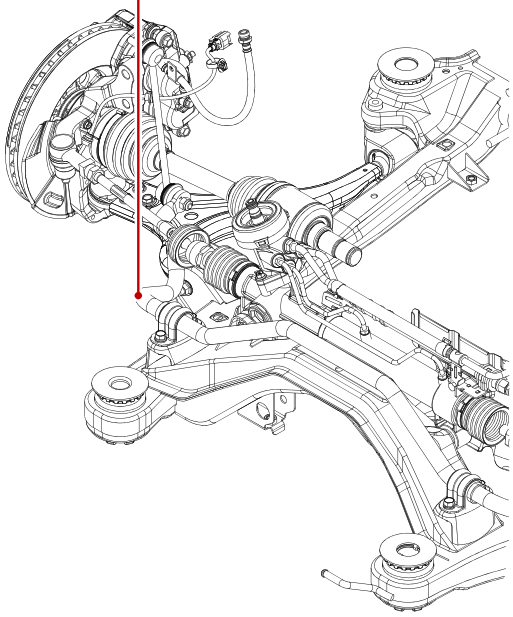
Stabilizer bar assembly





The stabilizer bar assembly is not activated if the left/right wheels move up/down simultaneously, but if both wheels move up/down differently it is activated with frame to minimize the tilting of the body.

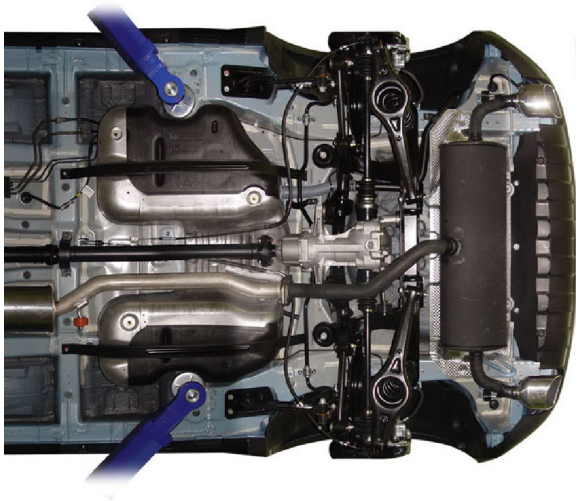
Lower arm assembly

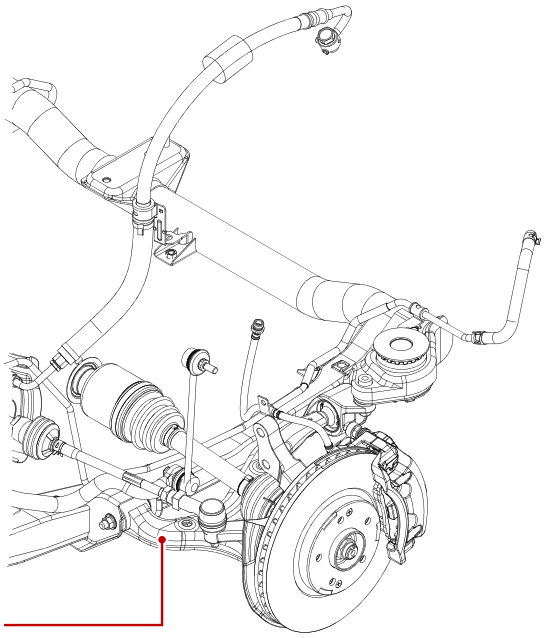


The lower arm assembly connects the frame and knuckle. It supports the load transferred to the tire knuckle, relieves the impact from the vehicle and ground conditions, and ensures driving stability.

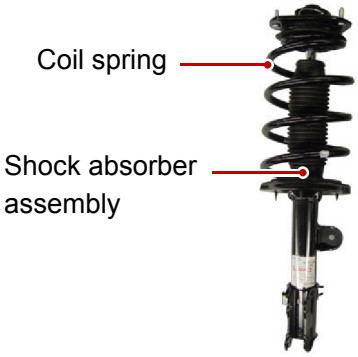
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine





Front coil spring assembly

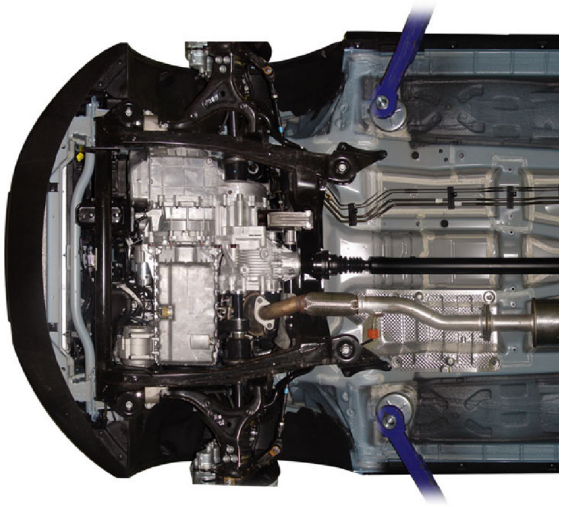


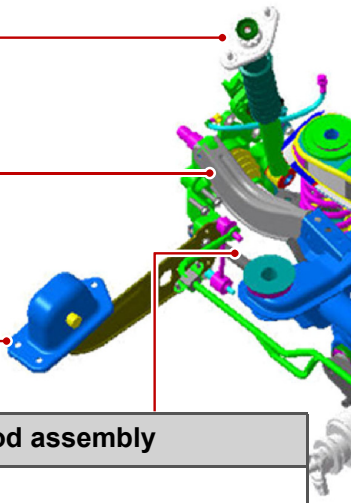
The coil spring is made by winding solid steel rod to form the coil shape. Its energy absorption rate per weight is higher than that of the leaf spring and it allows to absorb small vibration properly resulted in keeping the ride comforts. Therefore, it's difficult to make an effect on vibration damping because there is not any friction between coils.

Downloaded from www.Manualslib.com manuals search engine

5. REAR SUSPENSION COMPONENT LAYOUT

Multi-link type suspension is the independent suspension. It provides good ride comfort and drivability by reducing the coil spring weight. Also, it increases the space for passenger compartment by lowering the floor.
This type of suspension consists of multiple links such as trailing arm, upper arm, lower arm and track rod.





Shock absorber assembly

This vehicle uses the gas shock absorber. This relieves the vertical vibrations of vehicle to provide ride comforts, prevents the spring break, enhances drivability, and extends the life span of steering components.

Upper arm assembly

Upper arm is installed between knuckle and sub frame and controls the lateral load and vehicle height.

Trailing arm assembly

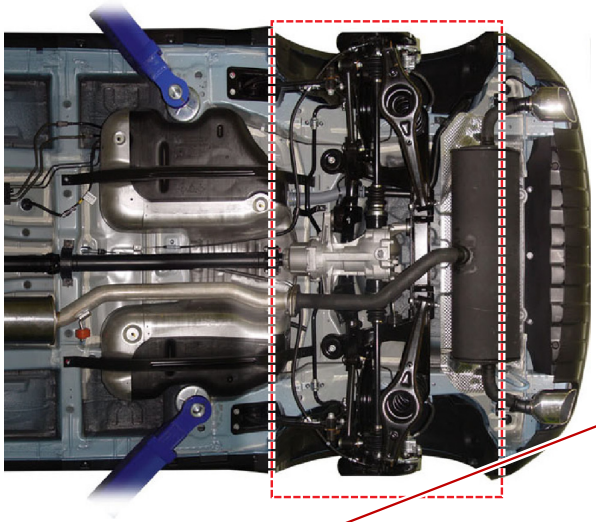
Trailing arm is installed between knuckle and vehicle body and controls the front and rear load.

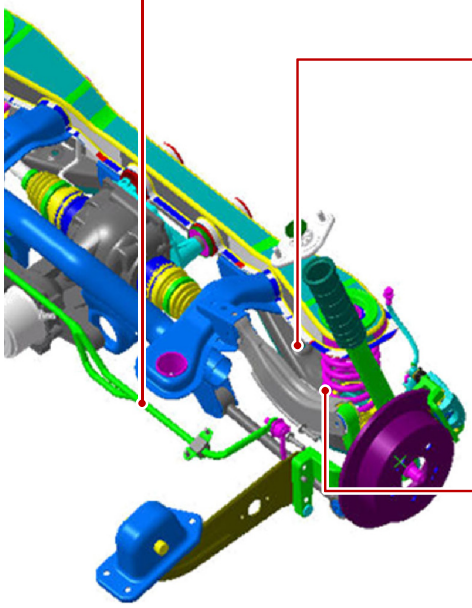
Track rod assembly

Track rod is installed between knuckle and rear sub frame and controls and compensates the lateral load.

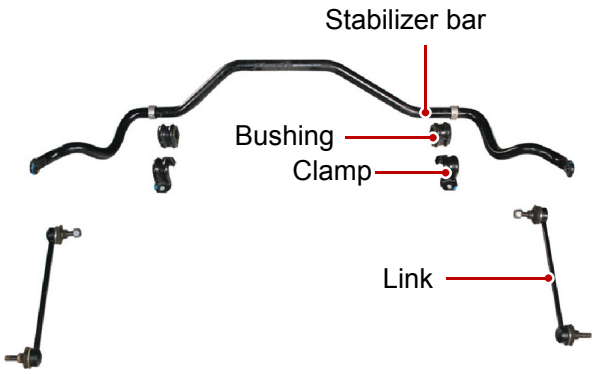
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine





Stabilizer bar assembly



The stabilizer bar assembly is not activated if the left/right wheels move up/down simultaneously, but if both wheels move up/down differently it is activated with frame to minimize the tilting of the body.

Coil spring

Coil spring is installed between the coil spring link and body frame. It relieves the vibrations and impacts from wheels to vehicle body.

Lower arm assembly

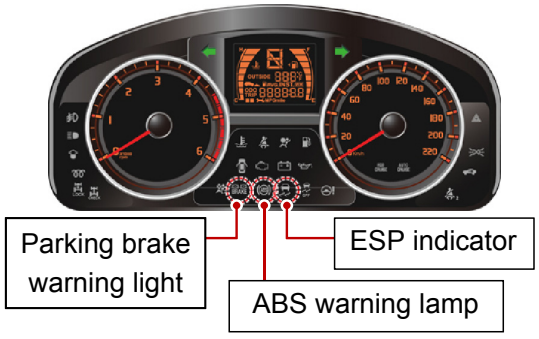
The lower arm is installed between knuckle and rear sub frame and relieves the load to coil spring from wheel. In other word, it controls the longitudinal load.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

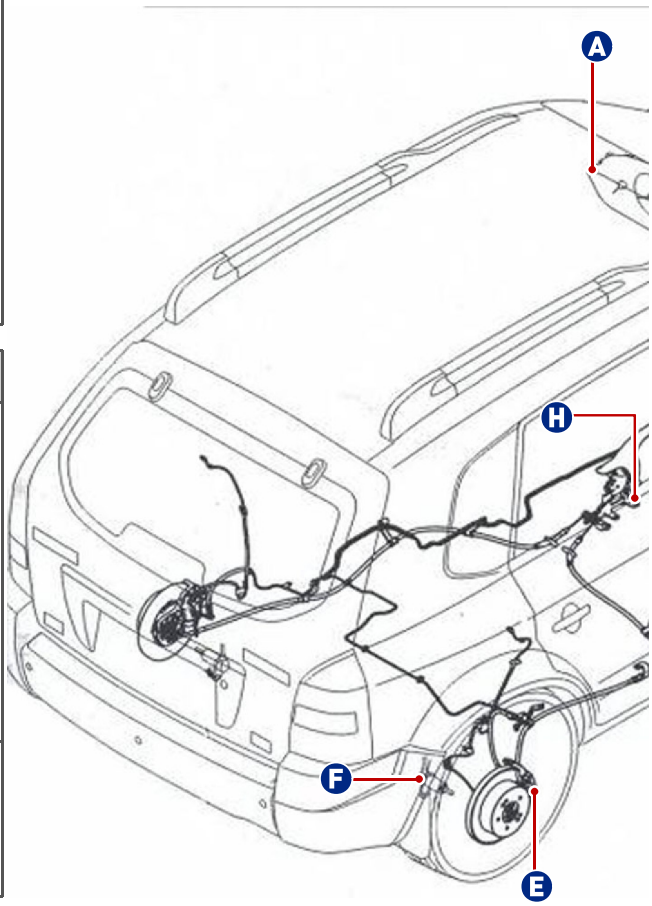
6. BRAKE SYSTEM AND ESP SYSTEM LAYOUT

A. Indicators on instrument cluster



B. Master cylinder assembly

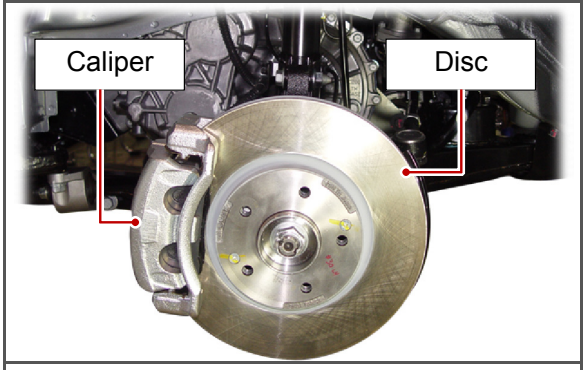
Description for master cylinder in this chapter is based on ABS/ESP equipped vehicle. For CBS, there is an extra pressure valve mounted to the master cylinder.



C. HECU assembly

The HECU assemblies for ABS and ESP have similar appearance but they have different inner structure and connector connections from each other.

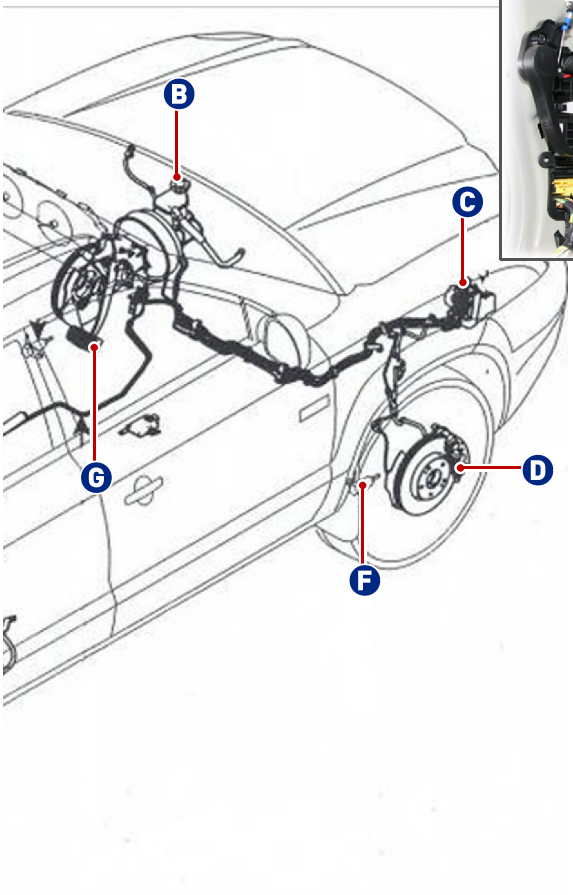
D. Front brake assembly



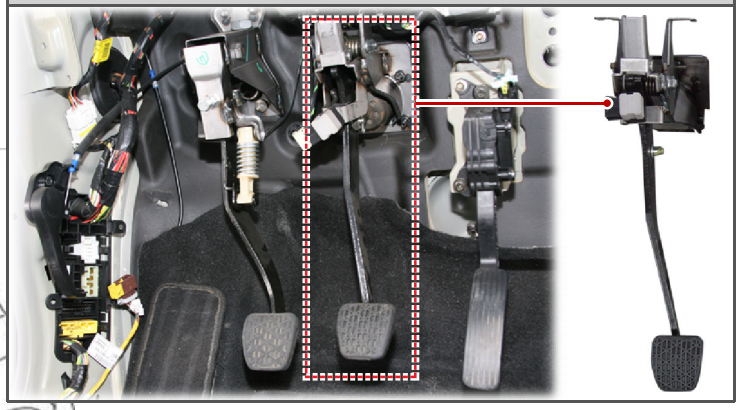
The disc brake for 4WD vehicle is the same with the one for 2WD vehicle.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



G. Brake pedal



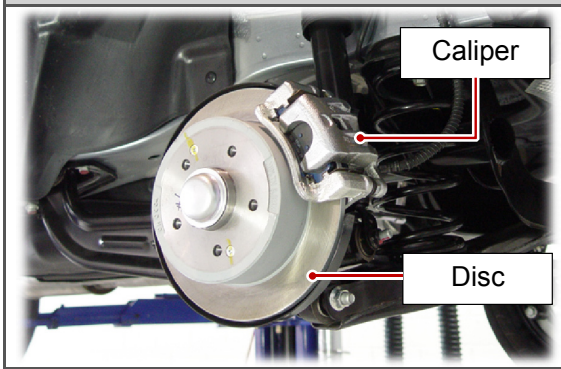
H. Parking brake

4WD and 2WD Front side

2WD Rear side

The wheel speed sensor for 4WD has the same structure and mounting location with the one for 2WD vehicle. But the rear side wheel speed sensor for 2WD vehicle has different sensor appearance and mounting status because the knuckle shape is different from the 4WD vehicle.

E. Rear brake assembly



The disc brake for 4WD vehicle has the same structure with the one for 2WD vehicle, but the appearance and knuckle shape is different from each other.

H. Parking brake

The parking brake is the mechanical device to hold the vehicle. When pulling up the lever, the parking brake cable between the lever and the rear drum brake trailing shoe pulls the parking brake lining to contact to drum.

Downloaded from www.Manualslib.com manuals search engine

7. STEERING SYSTEM LAYOUT

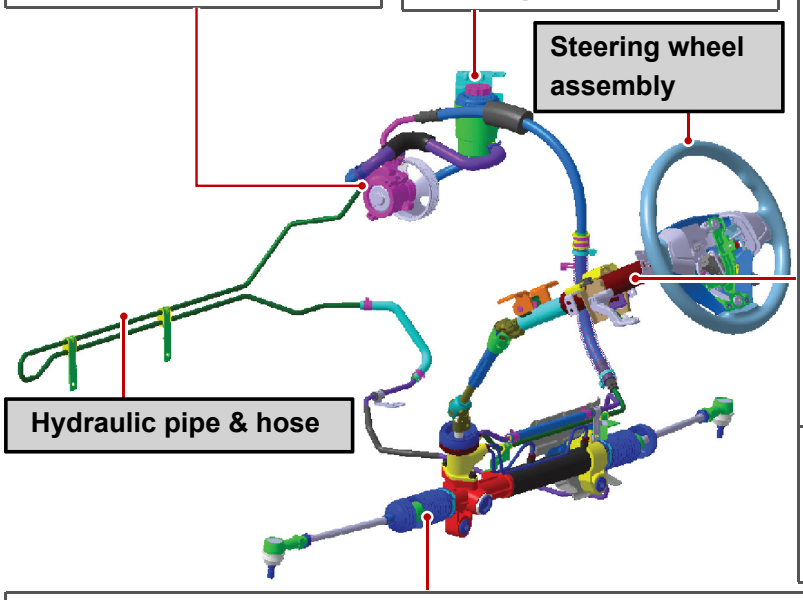
1) HPS (Hydraulic Power Steering)

The hydraulic pump is a vane type pump and consists of the flow control valve and pressure relief valve.

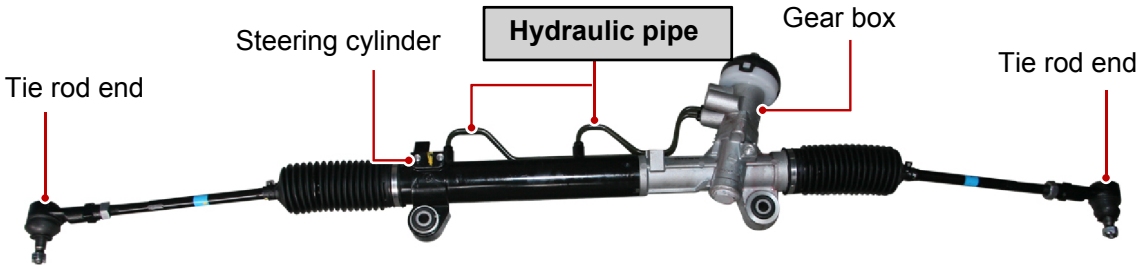
The oil reservoir sends the oil to the power steering pump and receives the oil from the power steering gear.

There is a shock absorber which is folded in the axial direction when the vehicle is crashed and a ignition switch assembly on the column shaft.

The lower shaft minimizes the torque change using a CV joint which has constant angular speed.



The steering gear box assembly consists of power cylinder and control valve. The power cylinder has a cylinder, piston and piston rod. The control valve directs the oil to one end face of the piston to enhance the steering force. There is a safety check valve which lets the driver steer manually when there is a malfunction in the hydraulic circuit.



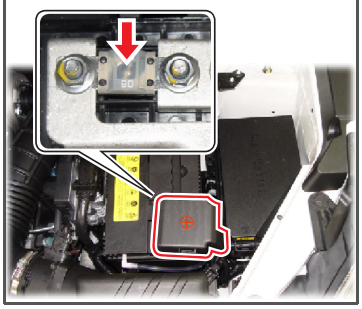
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

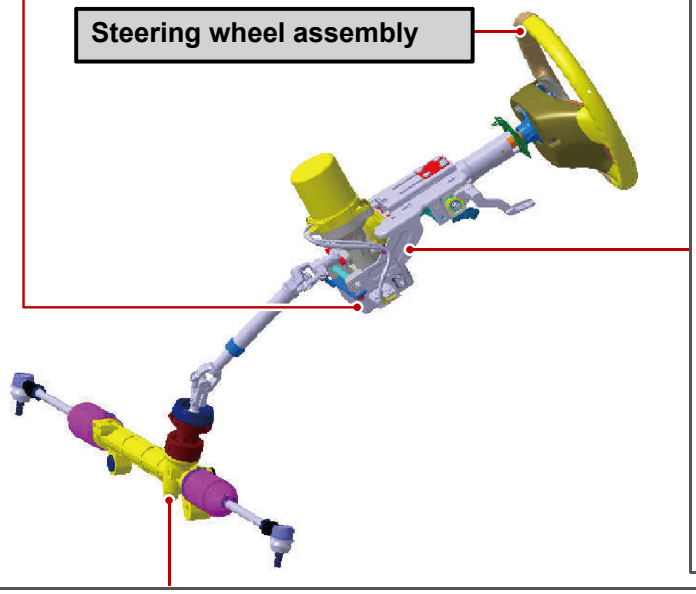
2) EPS (Electric Power Steering)

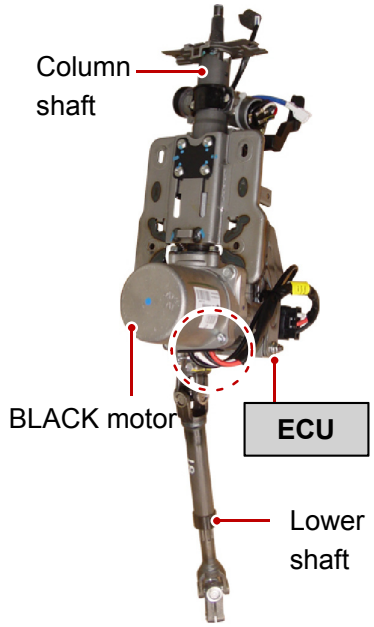
The ECU controls the electric power steering system depending on the driving conditions, based on the signals from the torque and angle sensor.

The vehicle with EPS has EPS fuse (80A) mounted to the positive (+) terminal of the battery, and this fuse supplies power to the EPS unit directly.

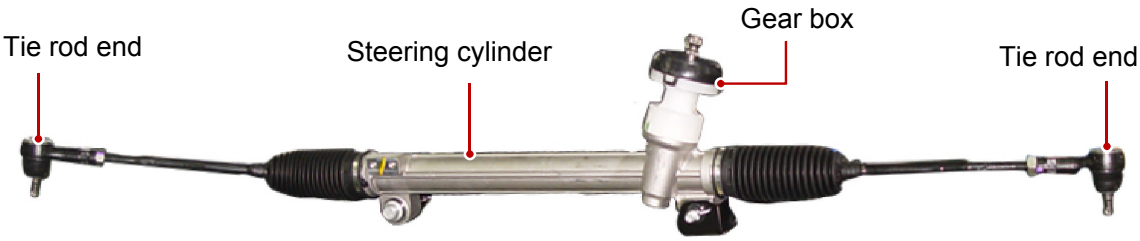


The column shaft assembly consists of BLAC motor, ECU, torque and angle sensors. The electric power steering (EPS) system uses the electric motor to assist the steering force. It functions independently regardless of whether the engine is running or not, unlike the existing hydraulic power steering. The lower shafts functions in the same way as the hydraulic type.





When the driver turns the steering wheel, a torque is generated and the torque sensor and the steering angle sensor in the EPS system detect the rotation of the steering column to run the electric motor. At this time, the worm gear connected to the motor drives the helical gear mounted to the steering column to generate the assist torque for the steering column. This allows the driver to operate the steering wheel easier.



Downloaded from www.Manualslib.com manuals search engine

DURING SERVICE WORK

1. GUIDELINES FOR SERVICE WORK SAFETY

1) For Safety

To maintain and operate the vehicle under optimum state by performing safe service works, the service works should be done by following correct methods and procedures.
Accordingly, the purpose of this manual is to prevent differences that can be caused by personal working method, skill, ways and service procedures and to allow prompt/correct service works.
While using this manual, there are a lot of Note or Notice having below meaning.

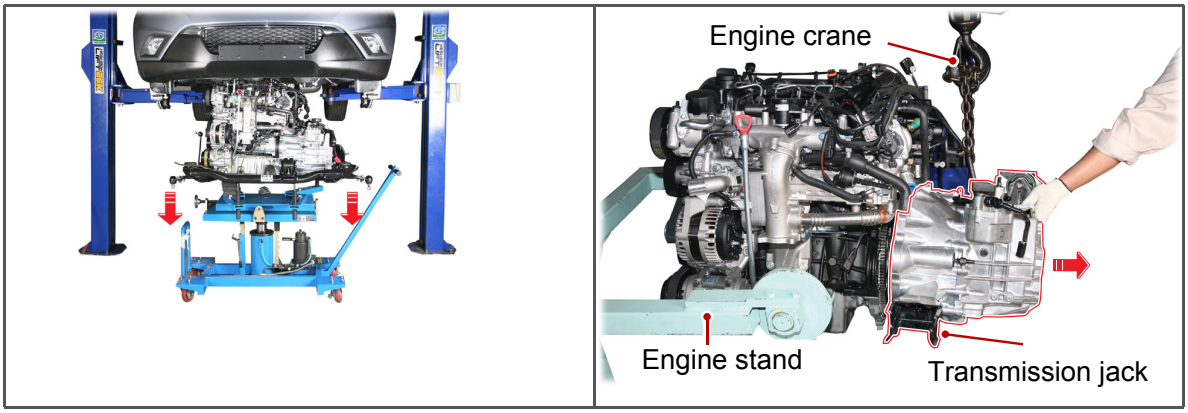
NOTE
Note means detailed description of supplementary information on work procedure or skill.

CAUTION
Notice means precautions on tool/device or part damages or personal injuries that can occur during service works.

However, above references and cautions cannot be inclusive measures, so should have habits of taking concerns and cautions based on common senses.

2) Equipment

- Korando C is FF (Front Engine Front Drive) type vehicle, and engine and powertrain system are integrated into the engine compartment. Thus 2-post lift and general equipment are needed when working on the engine and transmission.
- Major dedicated equipment: Engine and transmission jack (use the one for Chairman W), Engine stand, Engine crane, transmission jack, Engine hanger



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Lower the engine and transmission (transaxle) at the same time.

- Manual transmission: Can be removed and installed after lowering with the engine and sub frame at the same time.
- Automatic transmission: Only transmission can be removed and installed after removing the sub frame.

3) During Service Work

(1) Before lifting up the vehicle with lift, correctly support the lifting points and lift up.
(2) When using a jack, park the vehicle on the level ground and place wheel chocks underneath the tires. Position the jack under the frame and lift up the vehicle and then support with chassis stand before service work.
(3) Before service work, be sure to disconnect battery negative (-) terminal to prevent damages by bad wire and short.
(4) If service from interior of the vehicle, use protection cover to prevent damage and contamination of seat and floor.
(5) Brake fluid and anti-freeze can damage painted surface of body. So carefully handle them during service work.
(6) Use recommended and specified tools to increase efficiency of service work.
(7) Use only genuine spare parts.
(8) Never reuse cotter pin, gasket, O-ring, oil seal, lock washer and self-locking nut. Replace them with new.
(9) If reused, normal functions cannot be maintained.
(10) Align the disassembled parts in clean according to disassembling order and group for easy assembling.
(11) According to installing positions, the bolts and nuts have different hardness and design. So be careful not to mix removed bolts and nuts each other and align them according installing positions.
(12) To inspect and assemble, clean the parts. Securely clean the parts that related with oil not to be affected by viscosity of oil.
(13) Coat oil or grease on the driving and sliding surfaces before installing parts. Use sealer or gasket to prevent leakage if necessary.
(14) Tighten every bolt and nut with specified torque.
(15) When service work is completed, check finally whether the work is performed properly or the problem is solved.

Downloaded from www.Manualslib.com manuals search engine

4) Basic Inspection

(1) Horn operation

- Listen for horn sound by operating the horn.

(2) Brake operation

- Check if there is any abnormal noise, braking distance is increased or the braking force is applied to the only one wheel. If the brake warning lamp is not turned off or flashing, recheck the brake system because there is a fault in the brake system.
- Check the brake pipes and hoses for connection, oil leak, crack or interference after changing tire location. When replacing tires check the brake disc for surface condition and wear, too.
- Check the parking brake cable and brake operation. Inspect the brakes more often if habit or conditions result in frequent braking.

(3) Exhaust system

- Be alert to any changes in the sound of the system or the smell of the fumes. These are signs that the system may be leaking or overheating. Have the system inspected and repaired immediately.
- Inspect the complete system (including the catalytic converter if equipped). Inspect the body near the exhaust system. Look for broken, damaged, missing, or out-of position parts as well as open seams, holes, loose connections, or other conditions which could cause heat buildup in the floor pan or could let exhaust fumes seep into the trunk or passenger compartment.

(4) Tires

- Be alert to any vibration of the steering wheel or the seats at normal highway speeds. This may mean a wheel needs to be balanced. Also, a pull right or left on a straight, level road may show the need for a tire pressure adjustment or a wheel alignment.

(5) Steering and suspension system

- Inspect the front and rear suspension and the steering system for damaged, loose or missing parts, signs of wear or lack of lubrication. Inspect the power steering line and the hoses for proper hookup, binding, leaks, cracks, chafing, etc. Clean and inspect the drive axle boot and seals for damage, tears or leakage. Replace the seals if necessary.

(6) Engine oil

- Check the oil level and add oil if necessary. The best time to check the engine oil level is when the oil is warm.

Downloaded from www.Manualslib.com manuals search engine

(7) Coolant

- Check the coolant level in the coolant reservoir and coolant condition (contamination, foreign material), coolant hose damage or leakage. Replace or add Ssangyong genuine coolant, if needed.

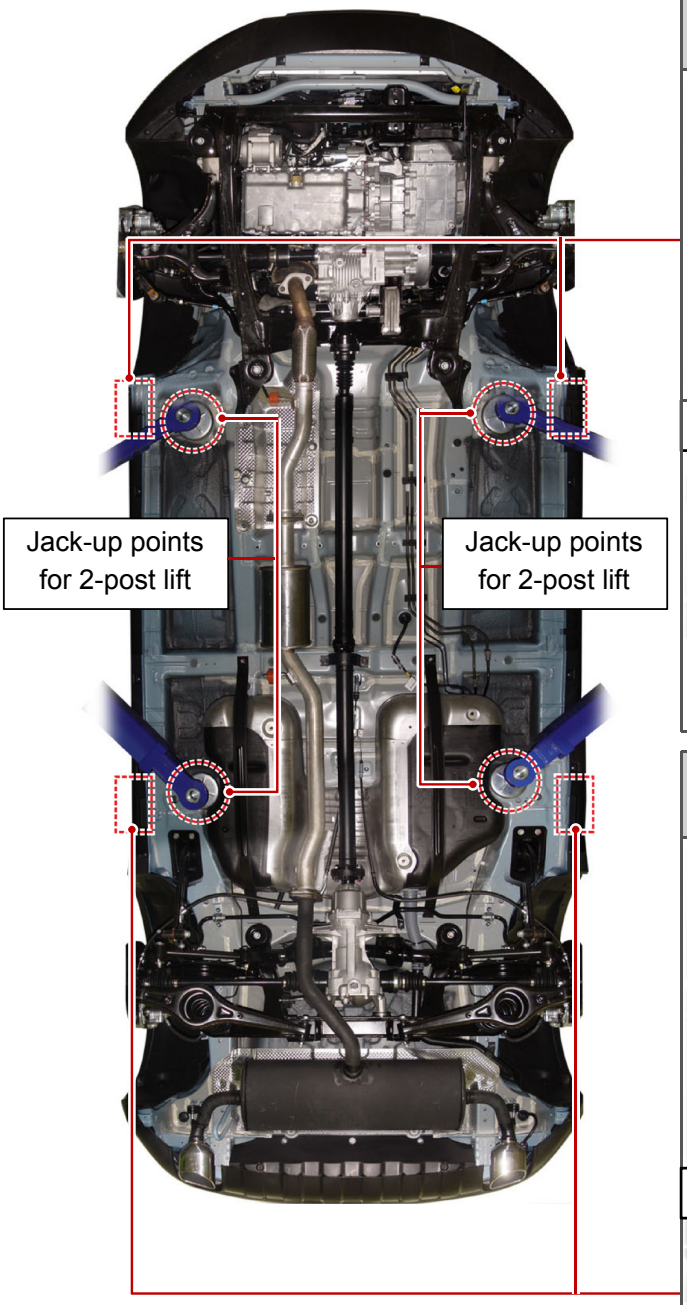
(8) Engine drive belt

- Check all drive belts of the engine for wear, crack, looseness, tension. Retighten or replace the belt, if needed.

Downloaded from www.Manualslib.com manuals search engine

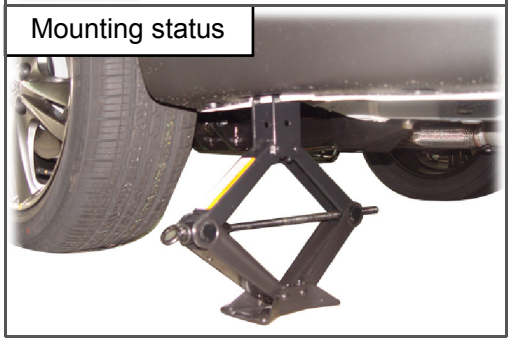
2. JACK-UP POINTS

▶ **Stand jack-up points and installation status (front side)**

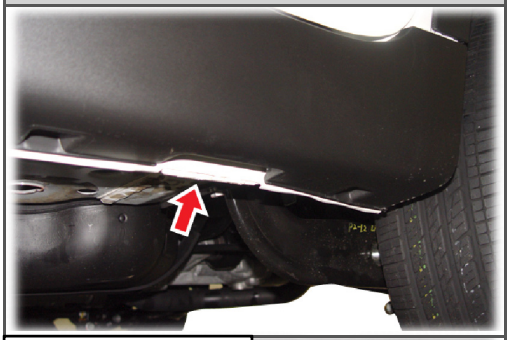


Stand jack-up points and installation status (front side)

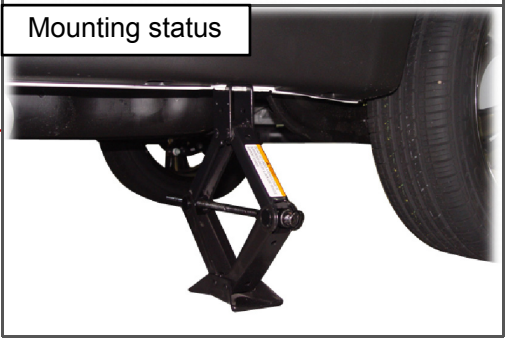
Mounting status



Stand jack-up points and installation status (rear side)



Mounting status

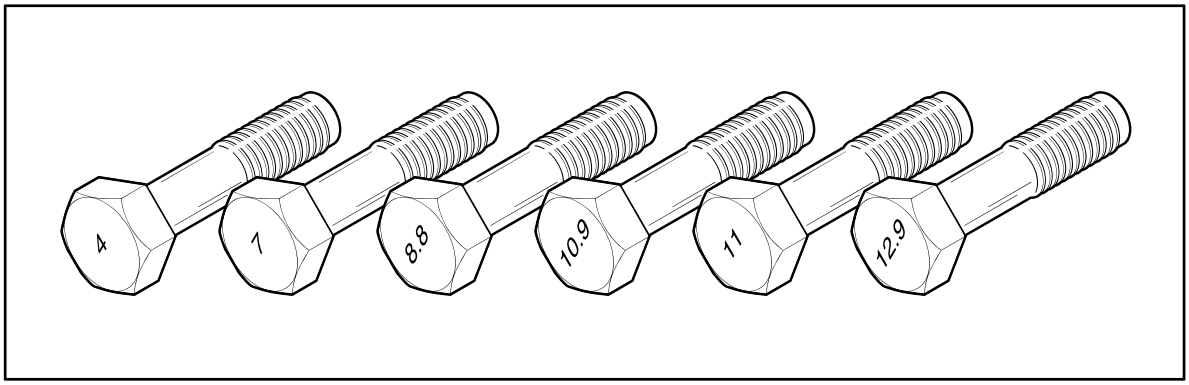


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. STANDARD BOLTS SPECIFICATIONS

Bolt	Pitch	Tightening torque(kgf.cm)					
		Standard			Limit		
		4T	7T	9T	4T	7T	9T
M3	0.5	5	9	13	7	12	17
M4	0.7	12	20	30	16	27	40
M5	0.8	24	40	57	32	53	77
M6	1.0	41	68	99	55	91	130
M8	1.25	88	160	230	130	210	310
M10	1.25	190	330	470	260	430	620
	1.5	190	310	450	250	420	600
M12	1.25	350	580	840	460	770	1,100
	1.75	330	550	790	440	730	1,000
M14	1.5	550	910	1,300	730	1,200	1,900
M16	1.5	830	1,100	2,000	1,100	1,900	2,700
M18	1.5	1,200	2,000	2,900	1,600	2,700	3,800
M20	1.5	1,700	2,800	4,000	2,200	3,700	5,300
M22	1.5	2,300	3,800	5,400	3,000	5,000	7,200
M24	1.5	2,900	4,900	7,000	3,900	6,500	9,400
	2.0	2,800	4,700	6,800	3,800	6,300	9,100



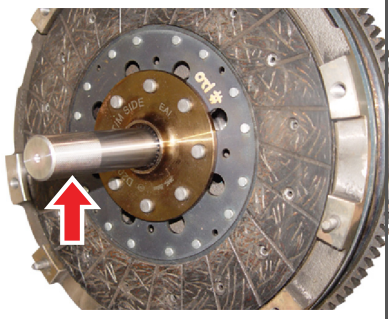
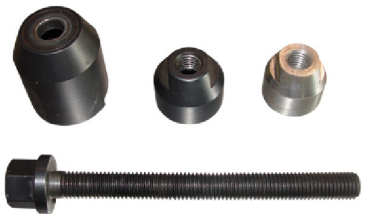
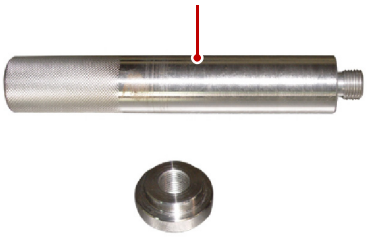
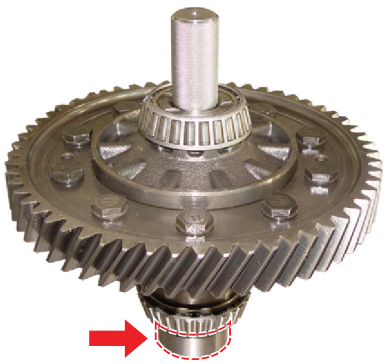
1) Metric bolt strength is embossed on the head of each bolt. The strength of bolt can be classified as 4T, 7T, 8.8T, 10.9T, 11T and 12.9T in general.
2) Observe standard tightening torque during bolt tightening works and can adjust torque to be proper within 15 % if necessary. Try not to over max. allowable tightening torque if not required to do so.
3) Determine extra proper tightening torque if tightens with washer or packing.
4) If tightens bolts on the below materials, be sure to determine the proper torque.
   - Aluminum alloy: Tighten to 80 % of above torque table.
   - Plastics: Tighten to 20 % of above torque table.

Downloaded from www.Manualslib.com manuals search engine

SPECIAL TOOLS AND EQUIPMENT

1. NEW SPECIAL TOOL

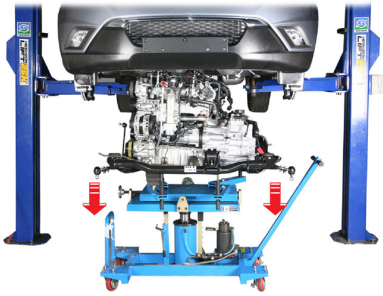
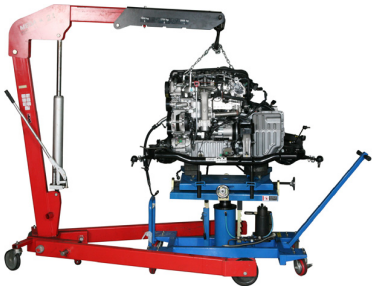
To repair Korando C, new special tools which are developed for new engine and systems, normal equipments and conventional tools are used.

Name and Part Number	Special tool	Use
Part number: T99300010A Name: Centering pin for installing clutch Use: Used when installing clutch disc and pressure plate to engine.		
Part number: T99410010A Name: Rear knuckle bushing adapter Use: Used when removing and installing rear knuckle bushing		
Part number: T99420010A Name: Differential gear oil seal installer Use: Used when installing differential side gear side (inner) oil seal with a dedicated tool for transmission.	A dedicated tool for transmission 	

Downloaded from www.Manualslib.com manuals search engine

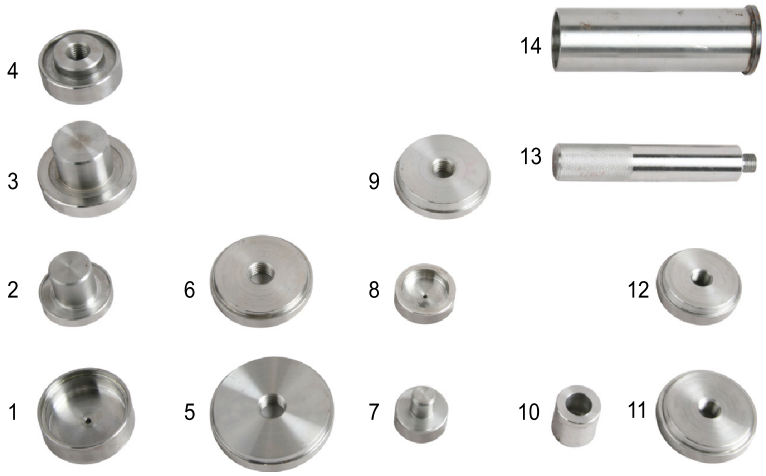
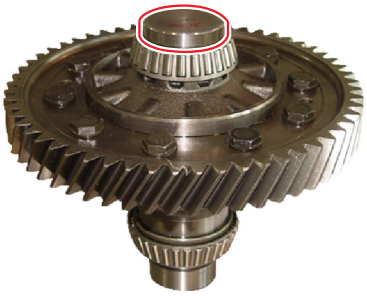
2. NORMAL EQUIPMENTS

1) Engine Assembly Removal & Installation Equipments

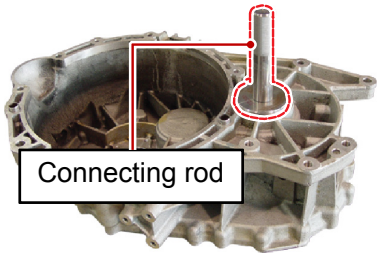
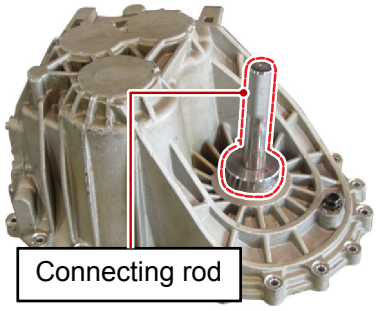
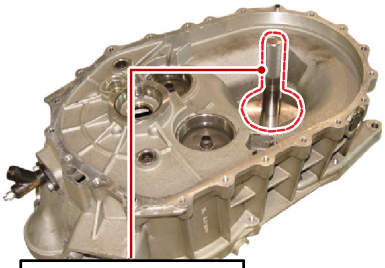
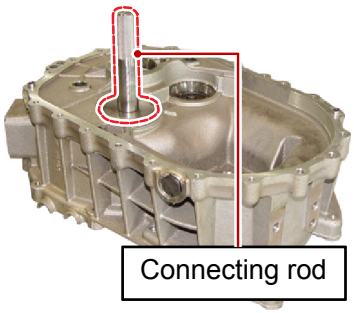
Name and Part Number	Tool	Use
Name: Engine and transmission jack Use: High load jack dedicated for Chairman W, but can be used for Korando C to support module when lowering engine and transmission mounted to sub frame at the same time (replacing manual transmission).		
Name: Engine stand (1 tone or more) Use: Used to fix the removed engine or engine and transmission (transaxle) and can support at least 1 tone.		
Name: Engine crane (1 tone or more) Use: Used to move engine module (including transaxle) to working space or engine stand, and can support at least 1 tonne.		

Downloaded from www.Manualslib.com manuals search engine

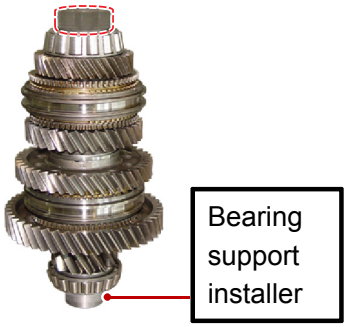
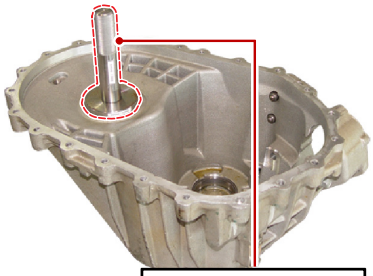
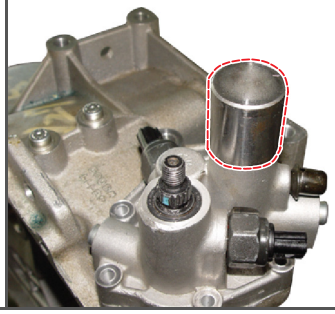
2) Tool Only For Manual Transmission

Name and Part Number	Tool	Use
Tool only for manual transmission Used when assembling manual transmission after disassembling. It consists of 14 components.		
Name: 1. Differential carrier taper roller bearing installer Use: Used when installing taper roller bearing of differential carrier.		
Name: 2. Differential carrier taper roller bearing installer Use: Used when installing taper roller bearing of differential carrier.		

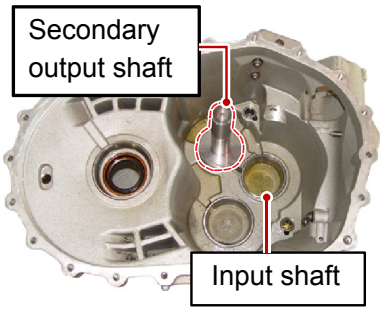
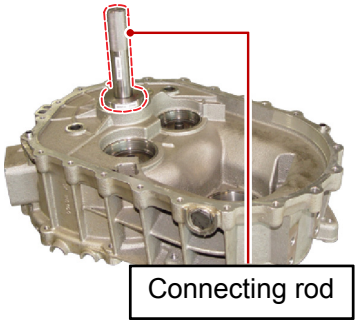
Downloaded from www.Manualslib.com manuals search engine

Name and Part Number	Tool	Use
Name: 3. Clutch housing oil seal installer Use: Used as a connecting rod (13) when installing clutch housing oil seal.		
Name: 4. Transmission housing oil seal installer Use: Used as a connecting rod (13) when installing clutch housing oil seal.		
Name: 5. Differential carrier front bearing outer race installer Use: Used as a connecting rod (13) when installing differential carrier front bearing outer race of clutch housing (outer diameter: 89 mm).		
Name: 6. Primary output shaft bearing race installer Use: Used as a connecting rod (13) when installing bearing outer race of primary output shaft (outer diameter: 79 mm).		

Downloaded from www.Manualslib.com manuals search engine

Name and Part Number	Tool	Use
Name: 7. Bearing support installer Use: Used to support bottom of shaft when installing gears and hubs to output shafts.		
Name: 8. Output shaft bearing installer Use: Used as a bearing support installer (7) when installing taper roller bearing to output shafts.		
Name: 9. Bearing outer race installer Use: Used as a connecting rod (13) when installing differential carrier bearing outer race of transmission housing (outer diameter: 75.5 mm).		
Name: 10. Control shaft oil seal installer Use: Used when installing control shaft oil seal.		

Downloaded from www.Manualslib.com manuals search engine

Name and Part Number	Tool	Use
Name: 11. Bearing outer race installer Use: Used as a connecting rod (13) when installing transmission housing input shaft and secondary output shaft bearing. (Outer diameter: 70.5 mm)		
Name: 12. Bearing outer race installer Use: Used as a connecting rod (13) when installing clutch housing input shaft bearing outer race. (Outer diameter: 64.5 mm)		
Name: 14. Synchro hub installer Use: Used as a bearing support installer (7) when installing gear and hub to output shafts.		

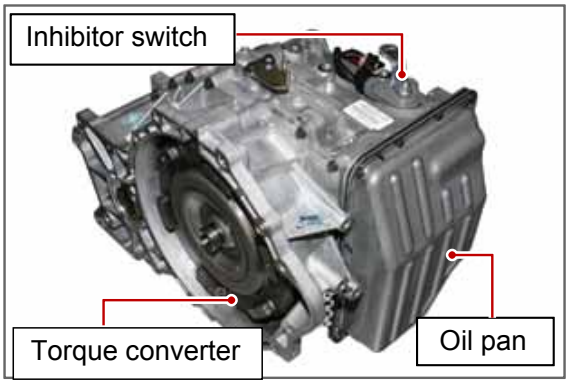
Downloaded from www.Manualslib.com manuals search engine

Memo

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. GENERAL INFORMATION

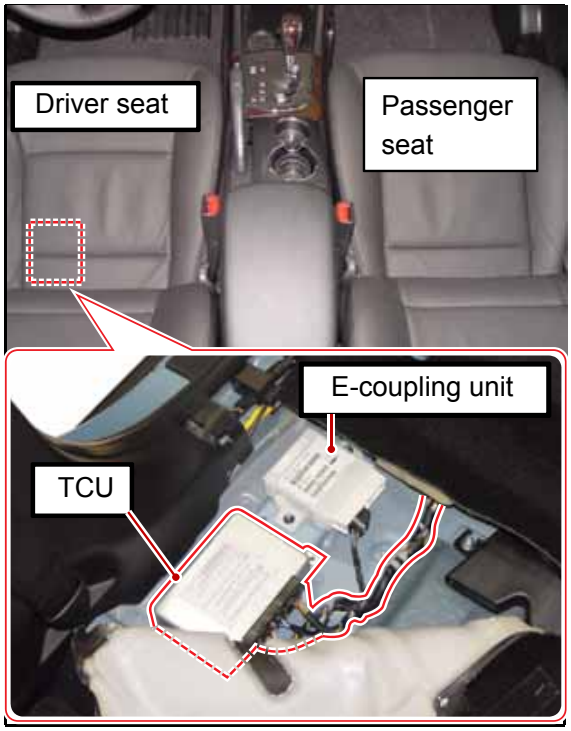


▶ Automatic transaxle (M11)

The Model 11 six speed automatic transaxle is available in two variants: four wheel drive and two wheel drive.

- Six forward speeds
- One reverse gear
- A toruqe converter with an integral converter lock-up clutch with slip control capabilities Electronic shift and pressure controls
- A single planetary gear-set
- A double planetary gear-set
- One hydraulically controlled brake bands
- Three multi-plate clutches
- One multi plate brake
- All hydraulic functions are directed by
- electronic solenoids to control:

1) Engagement feel
2) Shift feel
3) Shift scheduling
4) Modulated torque converter clutch applications



▶ TCU (located under driver's seat)

TCU is located under the driver's seat and controls the transaxle operations.
TCU is activated and deactivated by the ignition voltage, and connected to the transaxle through pin 26 in connector.
TCU receives and uses the signals from sensors and switches through CAN bus with analog and digital types.

Downloaded from www.Manualslib.com manuals search engine

▶ Tip switches on steering wheel

The shiftable gear can be adjusted by pressing the "UP (D+)" or "DOWN(D-)" switch when the gear selector lever is in "M" position.

▶ Meter cluster

This indicator shows the current position of the gear.

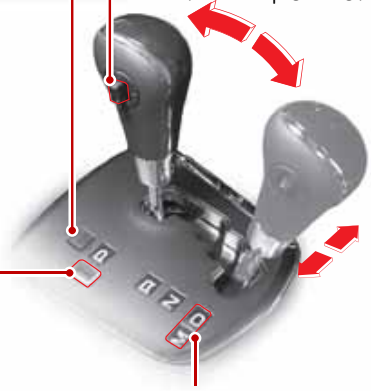
▶ Gear selector lever

Shift lock release button
If the selector lever cannot be moved from "P" or "N" position, try to move the lever while pushing down this button with finger. For safety, turn off the engine and depress the brake pedal before the attempt.

Lever positions
P : Park
R : reverse
N : Neutral
D : Drive

Mode switch
W: Winter mode (pressed "OUT")
S: Standard mode (pressed "IN")
Toggle the mode between winter mode and standard mode by pressing this switch.

Tip switch (manual shift switch)
The shiftable gear can be adjusted by moving this switch to forward and rearward when the gear selector lever is in "M" position.



Selection of Manual/Automatic Shift Function
D: Automatic shift according to the driving condition
M: Manual shift

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. SPECIFICATIONS

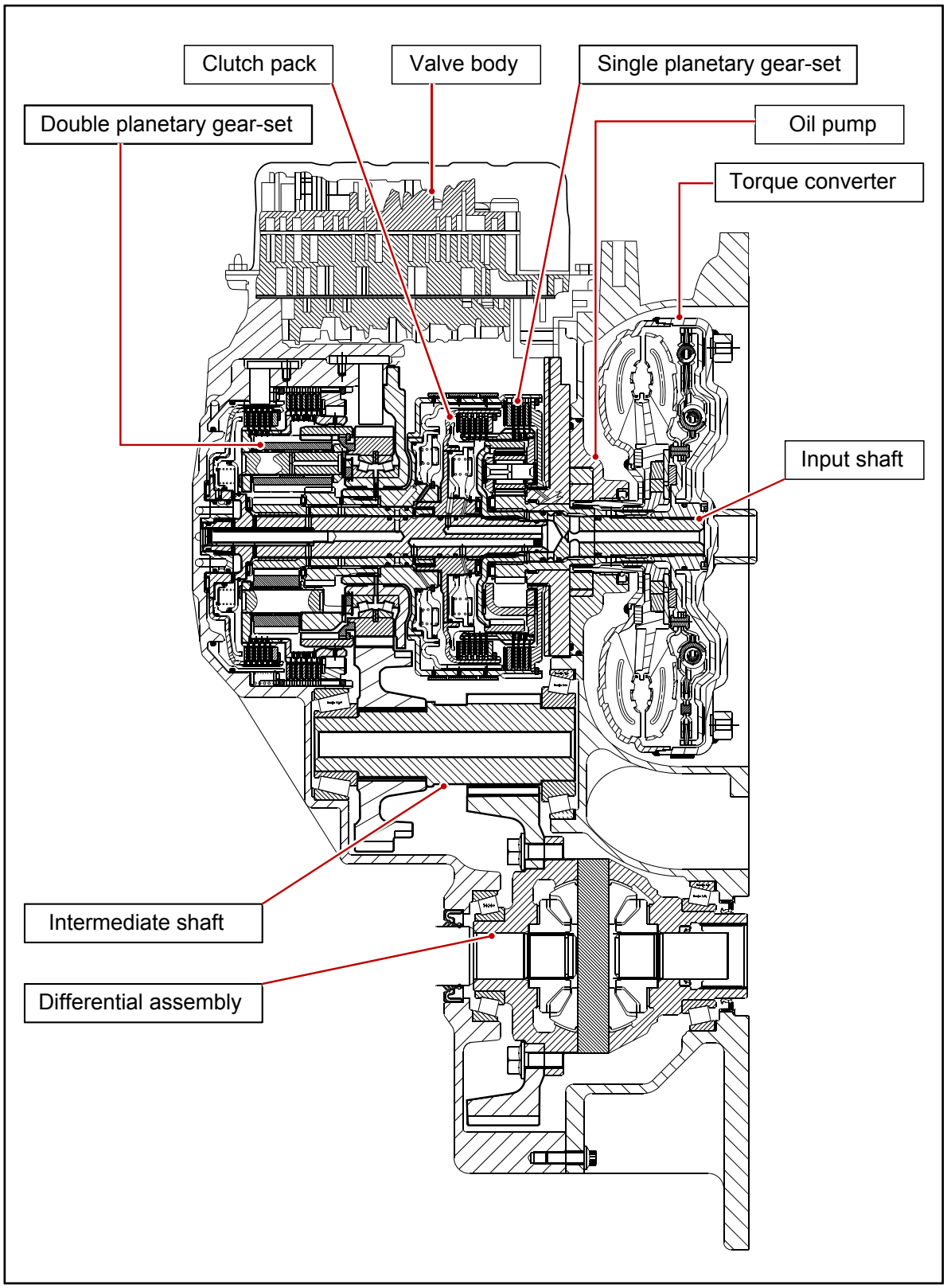
1) Specifications

Descriptions		Specification
Gear ratio	1st gear	4.156
	2nd gear	2.375
	3rd gear	1.522
	4th gear	1.144
	5th gear	0.859
	6th gear	0.676
	Reverse gear	3.178
Oil	Type	Fuchs TITAN ATF 3292
	Capacity	approx. 7.5 L
	Change interval	EU : Change every 20000 km or 12 months (But, shorten the service interval under severe condition) General : Change every 15000 km or 12 months (But, shorten the service interval under severe condition)
Resistance of oil temperature sensor	-20	430.7 to 533.9 kΩ
	0	146.8 to 175.7 kΩ
	20	56.74 to 65.86 kΩ
	100	3.201 to 3.399 kΩ
Inhibitor switch	D	2.686 kΩ ±8%
	N	5.036 kΩ ±8%
	P	8.953 kΩ ±8%
	R	16.786 kΩ ±8%

Type/Weight	M11 6-speed automatic transaxle / approx. 102 kg (including ATF)
TORQUE	400 Nm
Overall length / Center length	367 mm / 205 mm

Downloaded from www.Manualslib.com manuals search engine

2) Sectional Diagram



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. TIGHTENING TORQUE

Descriptions		Size x Numbers	Tightening torque (Nm)
Automatic transaxle	Engine side mounting bolt	17 mm X 4	85.0 to 100
	Oil pan and engine side mounting bolt	14 mm X 4	56.0 to 62.0
	Oil filler plug	16 mm	25.0 to 30.0
	Oil drain plug	Hexagon 5 mm	25.0 to 30.0
Valve body	Assembly mounting screw	T30 mm X 9	16.0
	Oil pan bolt	10 mm X 15	7.0 to 8.0
	VBS screw	T30 mm	4.0
	Valve body screw	T30 mm X 25	16.0
Torque converter	Mounting bolt	13 mm X 6	40.0 to 42.0
Cable	Link nut (switch side)	13 mm X 1	13.7 to 19.6
	Link nut (cable side)	12 mm X 1	14.7 to 22.5
	Mounting nut (floor side)	12 mm X 1	17.6 to 21.6
	Mounting nut (dash panel side)	12 mm X 2	17.6 to 21.6
TGS lever	Mounting nut	12 mm X 4	17.6 to 21.6
TCU	Mounting nut	8 mm X 2	5.0 to 6.0
Inhibitor switch	Mounting nut	12 mm X 2	3.9 to 7.8
Transaxle bracket	Left bracket	17 mm X 3	85.0 to 100
	Right bracket	17 mm X 4	85.0 to 100
	Upper bracket	17 mm X 4	85.0 to 100
Oil cooler pipe	Mounting bolt	10 mm X 2	Max.: 13.0
	Bracket mounting bolt	10 mm X 1	13.0

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

Engine power reaches the transaxle via a torque converter with integral converter lock-up clutch. The six forward gears and one reverse gear are obtained from a single planetary set, followed by a double planetary set. This type of gear-set arrangement is commonly known as Lepelletier type gear-set.
The Model M11 6 speed automatic transaxle is electronically controlled. The control system is comprised of the following components:

- External transaxle control unit (TCU)
- Internal embedded memory module (EMM)
- Input and output speed sensors
- Valve body unit comprised of four ON/OFF solenoid valves and six variable bleed solenoids (VBS)
- Torque converter

Downloaded from www.Manualslib.com manuals search engine

2. FEATURES

1) Advantages

▶ Early Downshift with Hard Braking and Skip Shifts

When heavy braking is detected, the transaxle downshifts early and skips gears to provide increased engine braking to provide gear selection for tip-in.

▶ Gear Hold going Uphill/Downhill

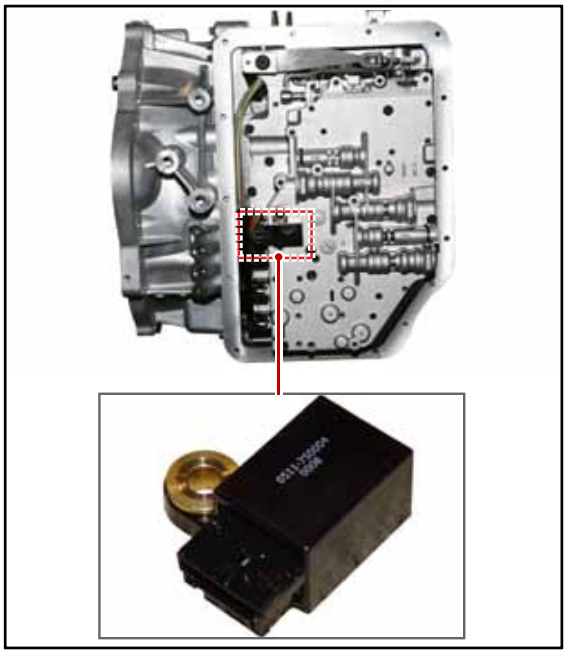
If the accelerator pedal is released when traveling uphill, upshifts are prevented to reduce busyness on grades. If the accelerator pedal is released when traveling downhill, upshifts are prevented to enhance engine braking.

▶ Drive and Reverse Engagement

A soft engagement feature avoids harsh take up of drive when selecting Drive or Reverse. This is achieved by limiting engine speed and engine torque which results in a rapid, but progressive engagement of either Drive or Reverse when moving from the Park or Neutral positions. Drive and Reverse engagements from either Park or Neutral are performed in less than 2.2 seconds. There is no drive engagement prevention strategy implemented on the transaxle system as there is sufficient engine strategy to protect the system. However, reverse engagement is prevented until engine speed is less than 1,400 rpm and the accelerator pedal position is less than 12% and vehicle speed is less than 10 km/h.

▶ Converter Clutch Lock-Up In All Gears

The transaxle features converter clutch lock-up in all gears. This feature provides improved fuel economy and vehicle performance. It also improves transaxle cooling efficiency when towing heavy loads at low speeds, e.g. in city driving or hill terrain.



▶ Embedded Memory Module (EMM)

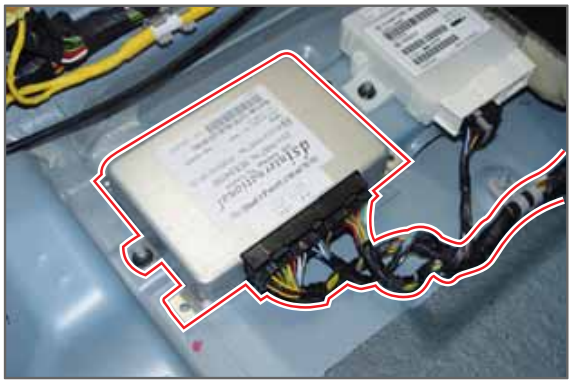
The embedded memory module (EMM) is matched to the transaxle's valve bodies during transaxle assembly to ensure refined shift quality. The EMM is used to store data such as valve body calibration data and valve body serial number.
Upon installation, the TCU will download the data from the EMM and utilize this data in the operation of the transaxle.

Downloaded from www.Manualslib.com manuals search engine

2) Transaxle Cooling

The transaxle cooling system ensures rapid warm-up and constant operating temperature resulting in reduced fuel consumption and refined shift quality.
It also includes a cooler by-pass within the hydraulic system to allow sufficient lubrication to the transaxle drivetrain in the event of a blockage in the transaxle cooler.

3) Shift Strategy



▶ Gear Change

Transaxle gear change is controlled by the TCU. The TCU receives inputs from various engine and vehicle sensors to select shift schedules and to control the shift feel and torque converter clutch (TCC) operation at each gear change.

▶ Coast down

Coast down down shifts occur at 0% pedal when the vehicle is coasting down to a stop.

▶ Torque Demand

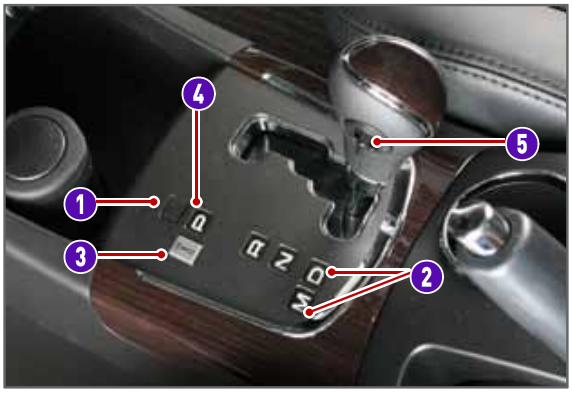
Torque demand down shifts occur (automatically) when the driver demand for torque is greater than the engine can provide at that gear ratio. If applied, the transaxle will disengage the TCC to provide added acceleration.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. MODES AND FUNCTIONS

1) Functions



1. Shift lock release button
If the selector lever cannot be moved from "P" or "N" position, try to move the lever while pushing down this button with finger. For safety, turn off the engine and depress the brake pedal before the attempt.

2. Selection of Manual/Automatic Shift Function
D: Automatic shift according to the driving condition
M: Manual shift

3. Mode switch

W: Winter mode (pressed "OUT")
S: Standard mode (pressed "IN")
Toggle the mode between winter mode and standard mode by pressing this switch.

4. Lever positions
P : Park
R : reverse
N : Neutral
D : Drive

5. Tip switch (manual shift switch)
The shiftable gear can be adjusted by moving this switch to forward and rearward when the gear selector lever is in "M" position.

2) M Mode (Manual Mode)

This allows the driver to define the highest possible gear by selecting "+" or "−" on the gear selector when the lever is in the "M" position. When the lever is first moved to the manual "M" position the transaxle will select the lowest possible gear.

Downloaded from www.Manualslib.com manuals search engine

▶ 1st Gear State

- The 1st gear state will display on the instrument cluster. Unlike the normal 1st gear, engine braking will be available in this manual 1st state.

▶ 2nd Gear State

- The 2nd gear state will display on the instrument cluster. 2-1 automatic kick-down shifts are available. 2nd gear has engine braking available.

▶ 3rd Gear State

- The 3rd gear state will display on the instrument cluster. 3-2 and 3-1 automatic kick-down shifts are available. 3rd gear has engine braking available.

▶ 4th Gear State

- The 4th gear state will display on the instrument cluster. 4-3 and 4-2 automatic kick-down shifts are available. 4th gear has engine braking available.

▶ 5th Gear State

- The 5th gear state will display on the instrument cluster. 5-4 and 5-3 automatic kick-down shift is available. 5th gear has engine braking available.

▶ 6th Gear State

- The 6th gear state will display on the instrument cluster. 6-5 and 6-4 automatic kick-down shifts are available. 6th gear has engine braking available.

Downloaded from www.Manualslib.com manuals search engine

4. LIMP HOME MODE

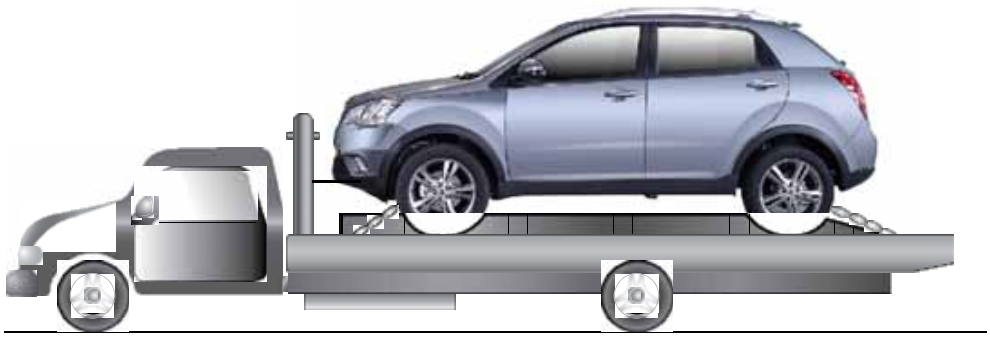
▶ When the transaxle is defective

1. In the event of a system fault, the TCU also provides for failure mode effect control (FMEC) to maintain maximum functional operation of the transaxle.
2. In the event of a total loss of control or electrical power, the basic transaxle functions (Park, Reverse, Neutral and Drive) are retained. The 4th and reverse gear ratios with the torque converter clutch in the unlocked state are the retained gear states the hydraulic system supports without any electrical assistance.
3. The TCU communicates with other vehicle electronic control modules by the controller area network (CAN). If a major fault develops, the transaxle may automatically operate in a "limp home" (failure) mode to enable the vehicle to be driven to an authorized dealer for repair.
4. The TCU also provides for transaxle diagnostics, which meet the requirements of OBD II legislation, monitoring all components which may effect vehicle emissions.

▶ When the transaxle overheats

1. Limp home mode may also be engaged if the battery charge falls below 8V.
2. If the transaxle overheats, the shift patterns will automatically change to enable improved transaxle cooling.
3. During transaxle overheat, the instrument cluster transaxle selector position display and the over temperature condition is indicated by flashing the “W(Winter)” indicator on the instrument cluster until normal transaxle operating temperature is reached.

▶ Towing the automatic transaxle equipped vehicle



CAUTION

- Flat-bed equipment is the best method of moving a disabled vehicle to avoid any damages.
- For AWD vehicle: The vehicle must be towed with a wheel lift and dollies or flatbed equipment with all the wheels off the ground.
  For 2WD vehicles: It is acceptable to tow the vehicle with the rear wheels on the ground without dollies and the front wheels off the ground. When being towed by a commercial towtruck and wheel dollies are not available, the front of the vehicle should be lifted, not the rear.

Downloaded from www.Manualslib.com manuals search engine

5. TRANSAXLE ELECTRONIC CONTROL SYSTEM

1) General Information

The transmission control unit (TCU) and its input/output network control the following transmission operations:

- Shift timing
- Line pressure
- Clutch pressure (shift feel)
- Torque converter clutch

also uses these signals when determining transaxle operating strategy. Using all of these input signals, the TCU can determine when the time and conditions are right for a shift, or when to apply or release the torque converter clutch. It will also determine the pressure needed to optimise shift feel. To accomplish this, the TCU operates six variable bleed control solenoids and four on/off solenoids to control transaxle operation.

2) TCU (Transmission Control Unit)

The transaxle control unit (TCU) is mounted under the driver's seat and controls the operation of the transaxle.
The TCU is activated and deactivated by the ignition power supply and is connected to the transaxle link harness by a 26 pin connector.
The TCU processes information received from internal sensors and signals received across the CAN bus in analogue and digital forms such as:

- Transaxle input speed
- Transaxle output speed
- Accelerator pedal position
- Gear selector position
- Engine torque
- Engine speed
- Transaxle fluid temperature
- Brake pedal status
- Engine oil temperature
- Engine coolant temperature
- Ambient air temperature
- Barometric pressure

Downloaded from www.Manualslib.com manuals search engine

This information is used by the TCU to decide which shift pattern to select and for shift energy management. Electro-hydraulic solenoid valves and variable bleed solenoids control the transaxle gear changes.
Six variable bleed solenoids and four on/off solenoids are used to direct transaxle fluid flow to control the fluid pressure within the three clutches and two bands. Separate pressure regulators are used exclusively for torque converter clutch control and main transaxle line pressure.
The TCU monitors all TCU inputs and outputs to confirm correct system operation. If a fault occurs the TCU is able to perform default action and inform the driver of the problem through the instrument cluster warning lights. Detailed information is available via trouble codes which can be read with the service tool.

Downloaded from www.Manualslib.com manuals search engine

3) Shift Map Selection

The driver can manually select between normal (S) and winter modes (W) via the mode switch. Depending on the transaxle temperature, uphill and downhill grades and altitude, shift maps will be selected by the TCU to suit the driving conditions. The following maps are available.

▶ Standard (Normal) Mode

Normal Mode is selected when the lever is in the D position with the mode switch in the normal (S) position and the transaxle is within normal temperature ranges. Shift schedule points are optimised for fuel efficiency and general driving conditions.

▶ Uphill and Downhill Mode

In this mode, depending on the load of the vehicle, adaptive shift maps are selected to progressively adjust the shift points and torque converter lock points.

▶ Altitude Mode

Shift points are automatically adjusted at higher altitudes to compensate for changes in engine torque where the torque produced by the engine is greatly reduced by the effects of reduced barometric pressure and temperature.

▶ Winter (W) Mode

When winter mode is selected, starting in second gear is facilitated and the WINTER mode indicator light is switched ON. To prevent wheel spin on slippery surfaces, the transmission will not allow first gear unless manually overridden.

▶ Warm up Schedule

Used typically when transaxle fluid temperature is below 20°C.
The torque converter will not lock-up below 20°C to assist in transaxle warm-up.

▶ Hot Mode

The hot mode is progressively applied between temperatures of 110° ~ 200°C. The torque converter lock-up is increased to prevent heat generation by the torque converter.

Above 110℃	the electrical radiator fans are switch ON
Above 130℃	the engine torque will be reduced and the W light on the instrument cluster will flash
Above 200℃	the transaxle will neutralise until the fluid temperature falls below 200°C as a final protection.

Activation of the hot mode inhibits other transmission performance features including uphill and downhill compensation and altitude compensation. Some degradation in shift feel may be experienced as the torque converter is not unlocked during shifting.

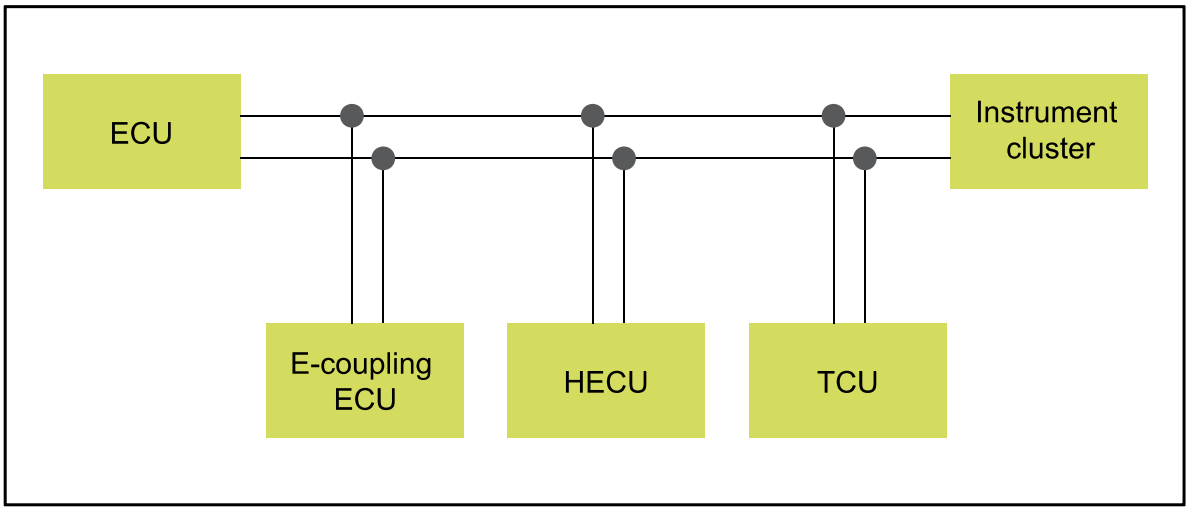
▶ Cruise Control Mode

When cruise control is activated the engine ECU may request the transaxle to downshift under trailing throttle conditions to increase engine braking.

Downloaded from www.Manualslib.com manuals search engine

6. CAN NETWORK

▶ **Schematic Diagram of Network Communication**



The TCU sends signals to be used by other vehicle systems via the CAN bus, such as:

- Selector lever position
- Selected gear state
- Manual mode activation
- Output torque
- Transaxle fluid temperature
- Engine torque reduction requests

Downloaded from www.Manualslib.com manuals search engine

7. POWER TRANSFER

Power transfer modes are as follow:

- Manual: 1st gear (position M)
- Drive: 1st gear
- Drive: 2nd gear
- Drive: 3rd gear
- Drive: 4th gear - limp home mode
- Drive: 5th gear
- Drive: 6th gear

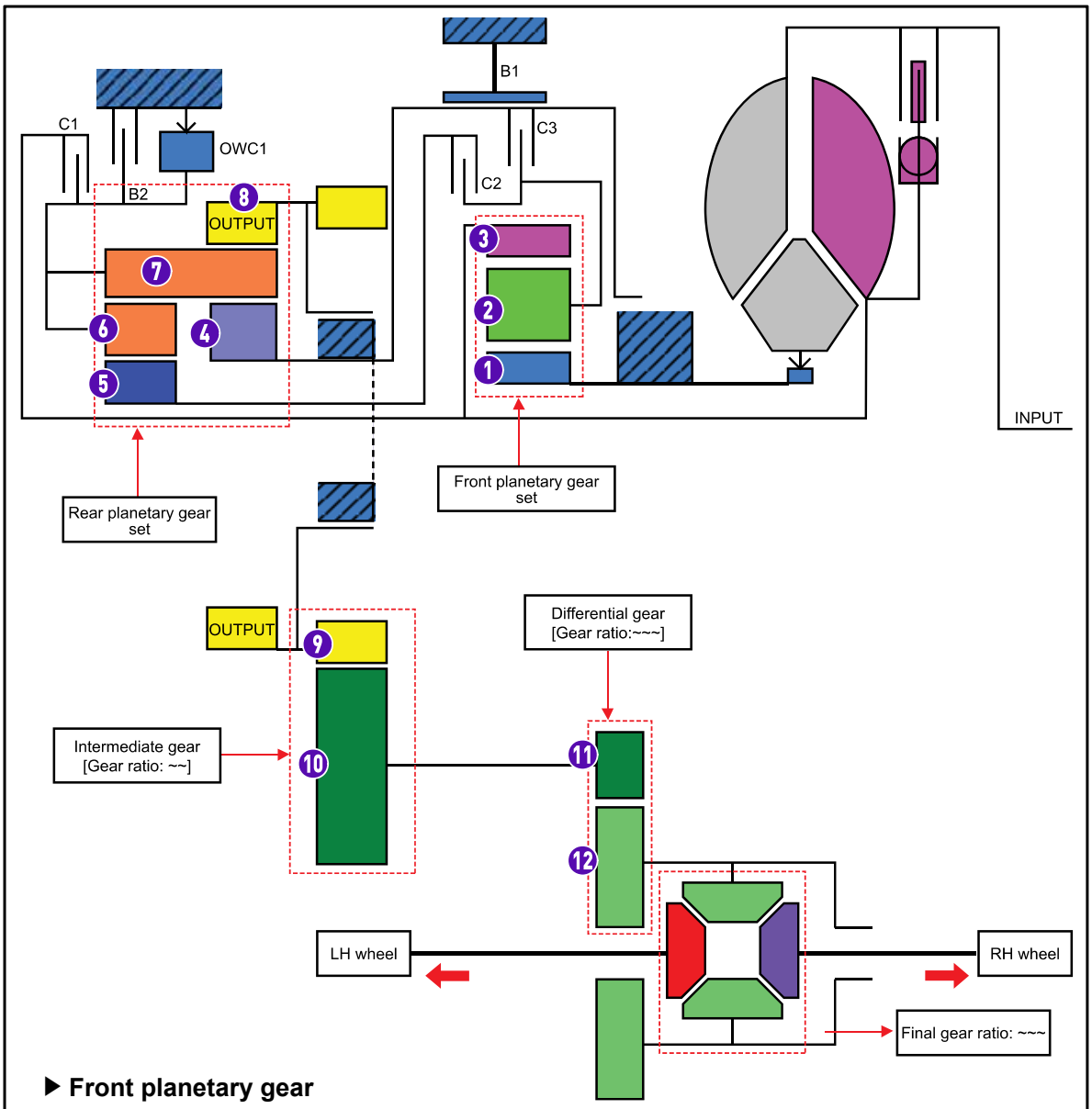
1) Gear Selection and Engagement Element

Gear	Gear ratio	Engagement element (clutch/band)					
		C1	C2	C3	B1	B2	1-2 OWC
M1	4.156		ON			ON	
1st	4.156		ON				ON
2nd	2.375		ON		ON		
3rd	1.522		ON	ON			
4th	1.144	ON	ON				
5th	0.859	ON		ON			
6th	0.676	ON			ON		
Reverse	3.178			ON		ON	

Gear	ON/OFF solenoid valve				Variable bleed solenoid valve (VBS)					
	S1	S2	S3	S4	S5(A)	S6(A)	S7(A)	S8(A)	S9(A)	S10(A)
M1	ON				1	0	1			
1st	ON				1	0			0-1	
2nd	ON			ON	1	0		1	0-1	
3rd	ON		ON		1	0	1		0-1	
4th					0	0			0-1	
5th		ON			0	1	1		0-1	
6th		ON		ON	0	1		1	0-1	
Rev.	ON	ON	ON		1	1	1		0-1	

Downloaded from www.Manualslib.com manuals search engine

2) Power Flow



▶ **Front planetary gear**

1. Front sun gear (FSG)
2. Planetary hear pinion (PP)
3. Ring gear (Internal)

▶ **Rear planetary gear**

4. Forward sun gear (FSG)
5. Reverse sun gear (RSG)
6. Short pinion (SPP)
7. Long oinion (LPP)
8. Ring gear (RG)

▶ **Intermediate gear**

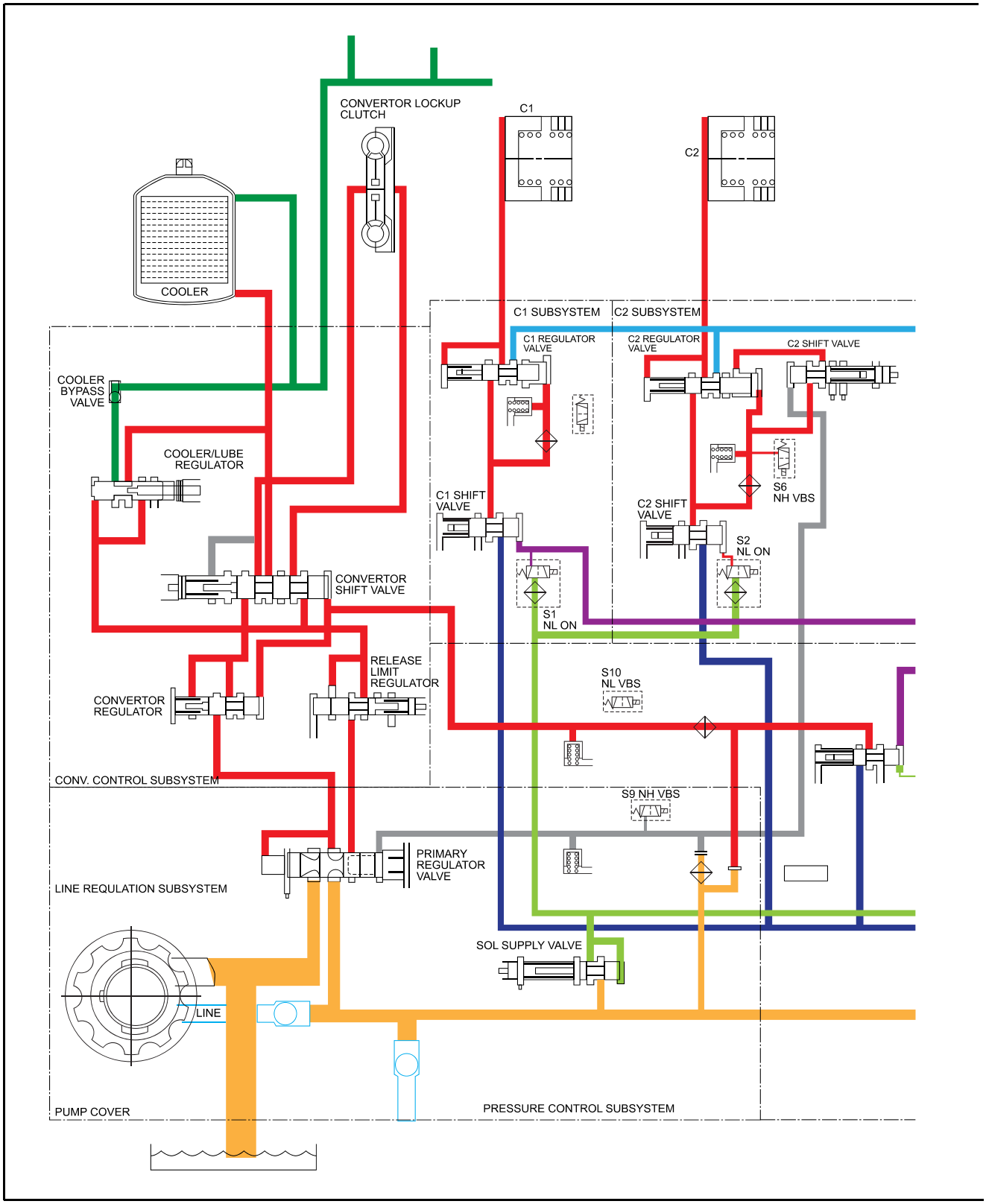
9. Drive gear
10. Driven gear

▶ **Differential gear**

11. Pinion
12. Differential

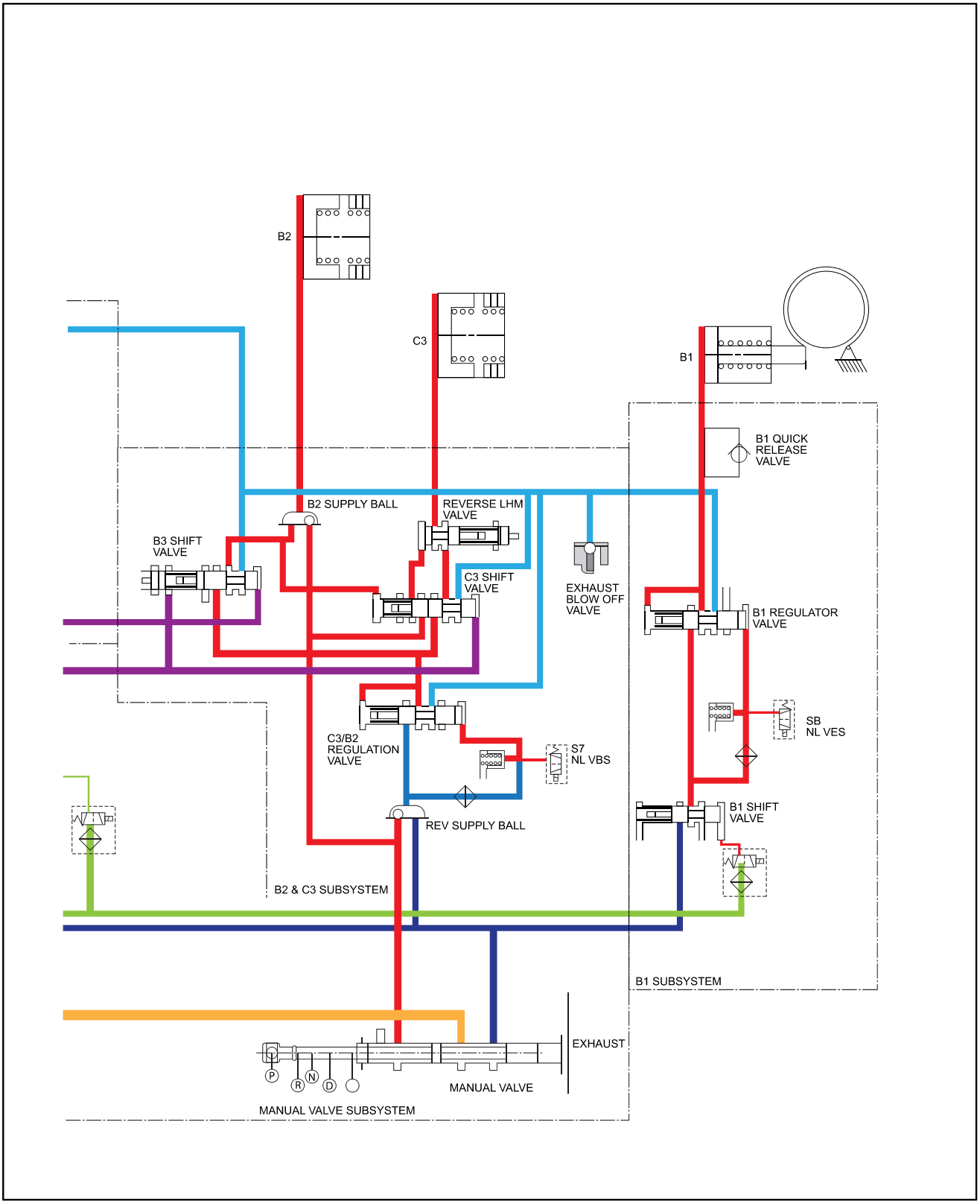
Downloaded from www.Manualslib.com manuals search engine

3) Hydraulic Circuit Diagram



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



Modification basis	
Application basis	
Affected VIN	

DSI 6 SPEED AUTO TRANSAXLE

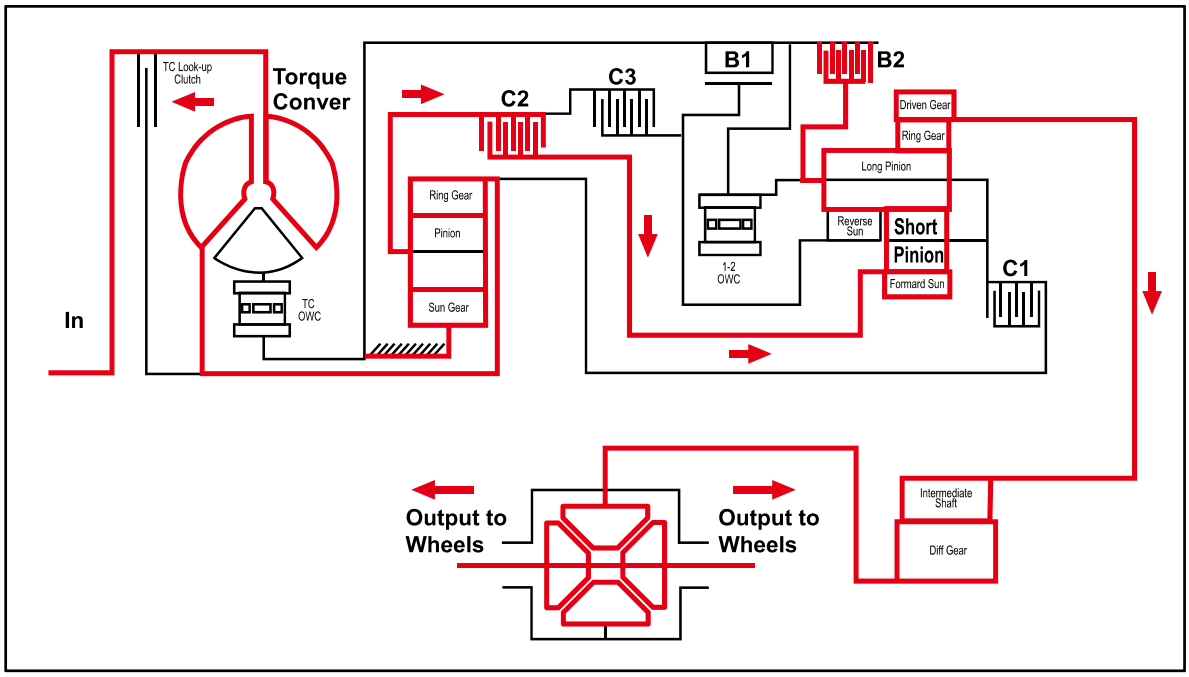
undefined

Downloaded from www.Manualslib.com manuals search engine

4) Power Transfer in Each Gear

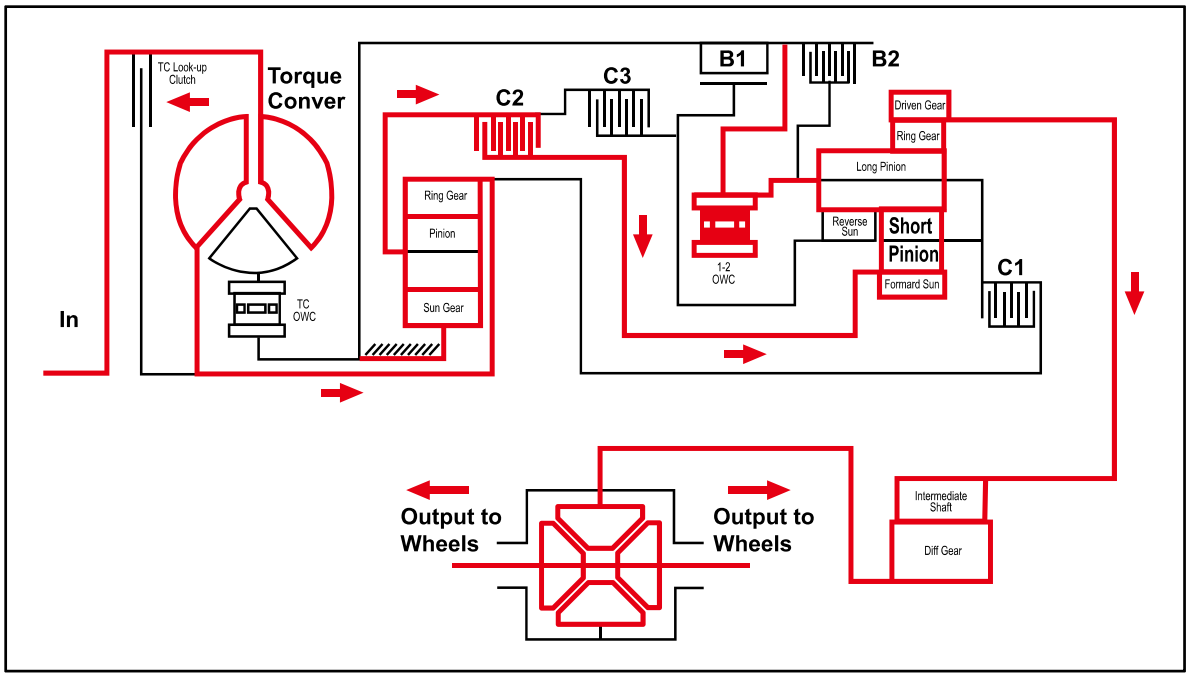
(1) Manual (position M) - 4.156 : 1

▶ **Power flow**



(2) Drive 1st Gear (1st Auto) - 4.156 : 1

▶ **Power flow**

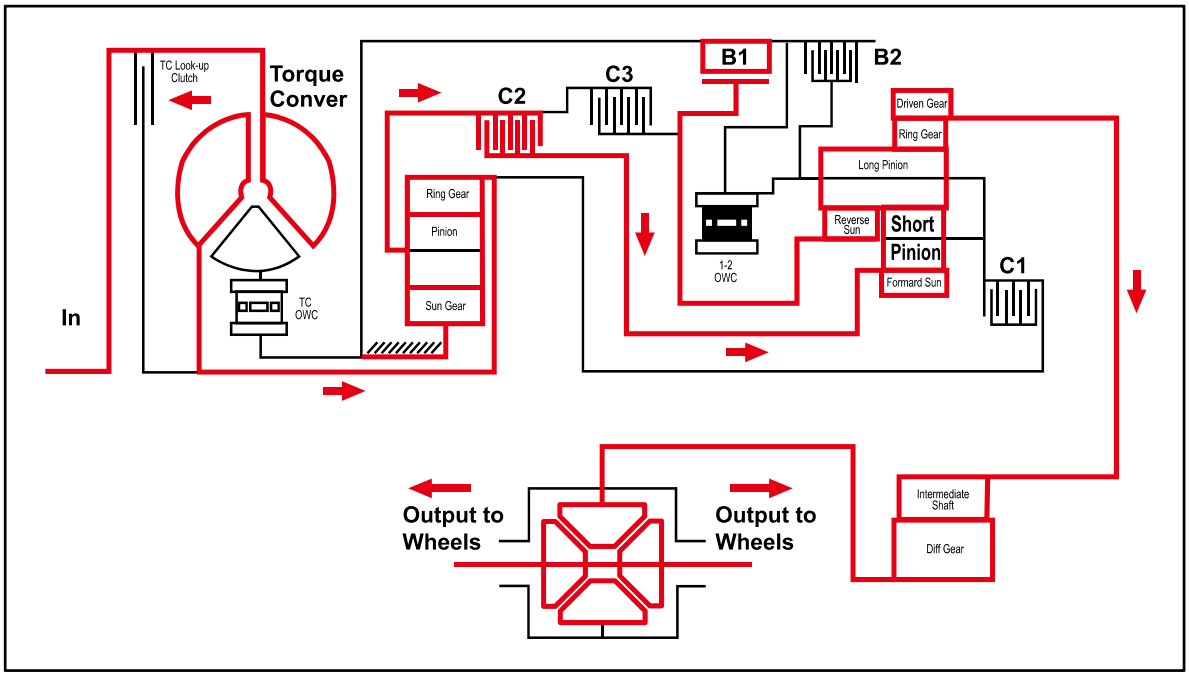


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

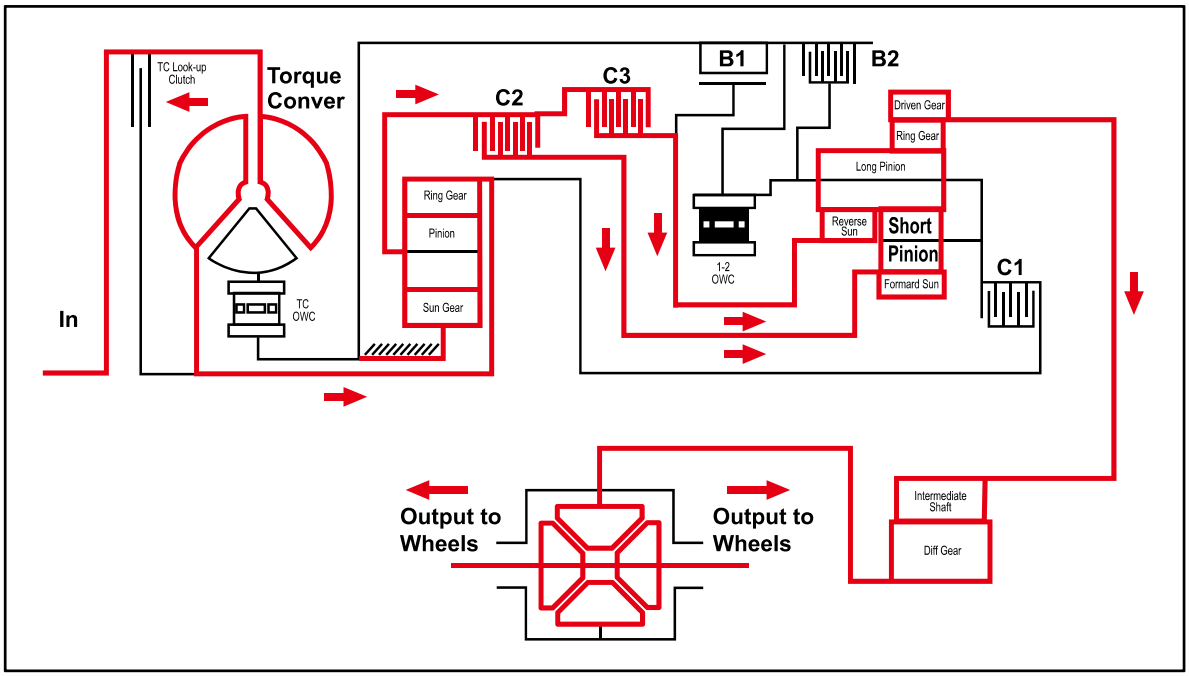
(3) Drive 2nd (2nd Auto) - 2.375 : 1

▶ **Power flow**



(4) Drive 3rd (3rd Auto) - 1.522 : 1

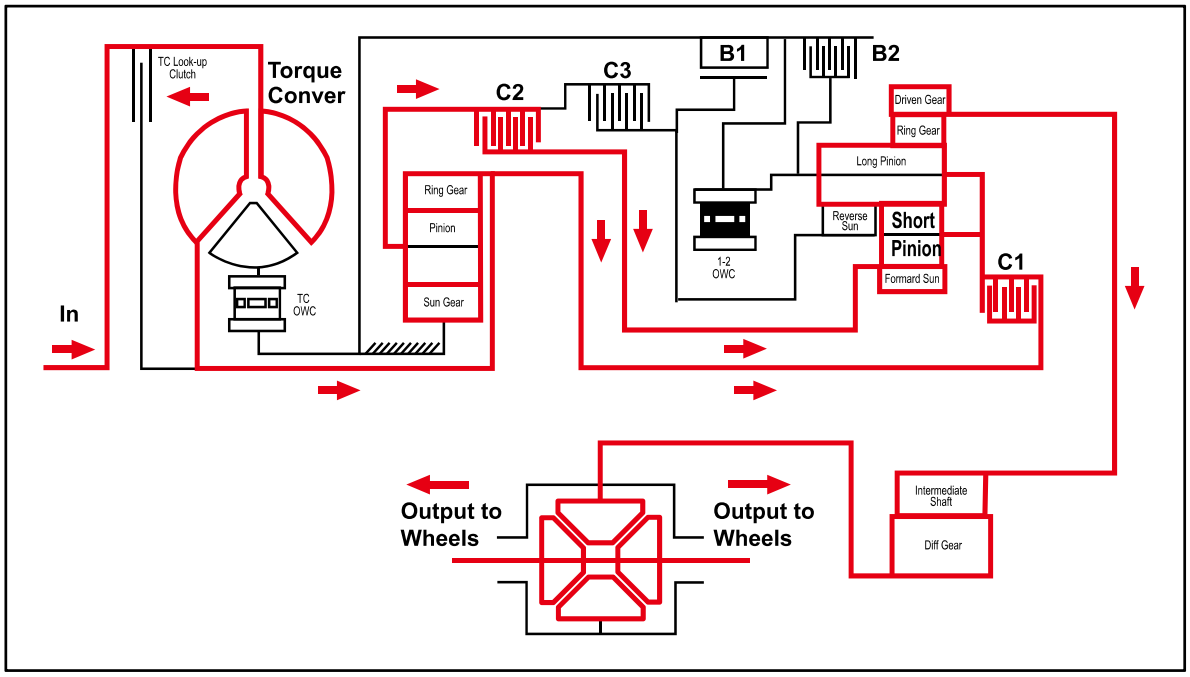
▶ **Power flow**



Downloaded from www.Manualslib.com manuals search engine

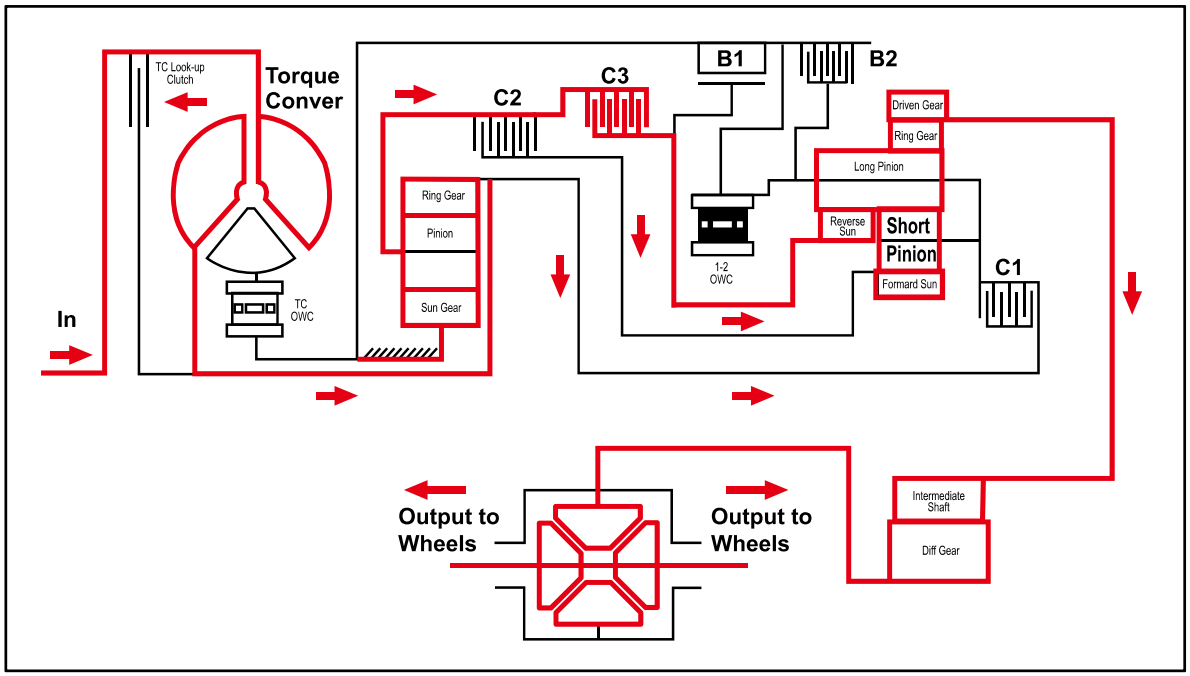
(5) Drive 4th (4th Auto) - 1.144 : 1

▶ **Power flow**



(6) Drive 5th (5th Auto) - 0.859 : 1

▶ **Power flow**

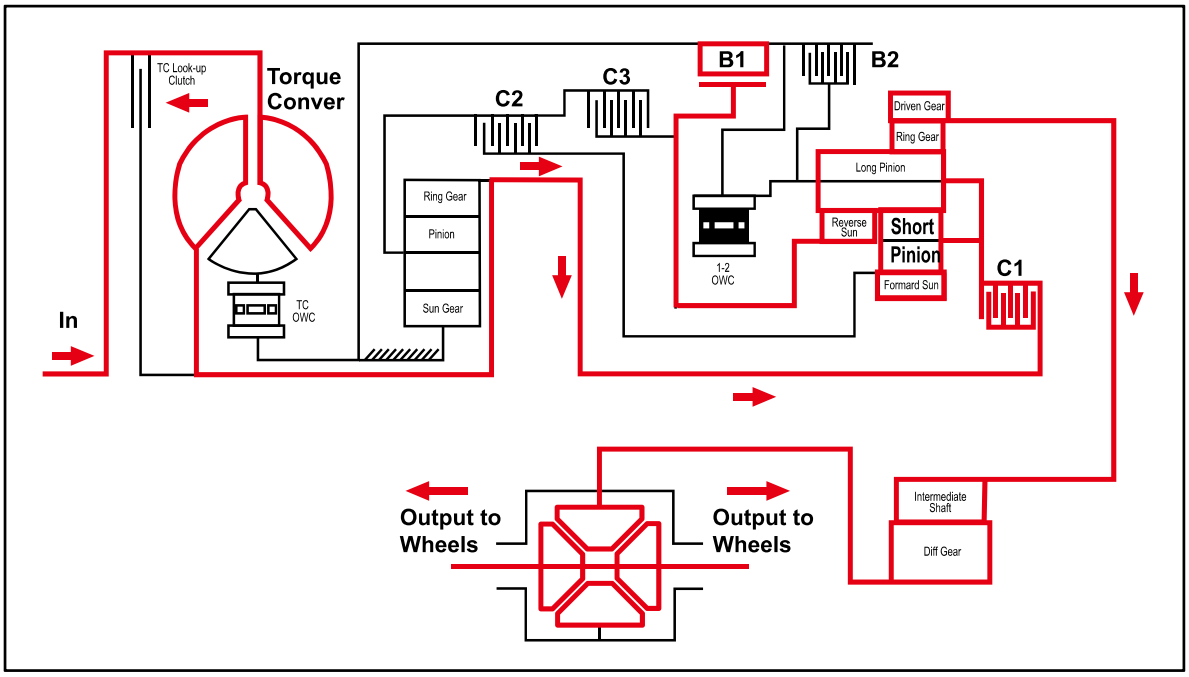


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

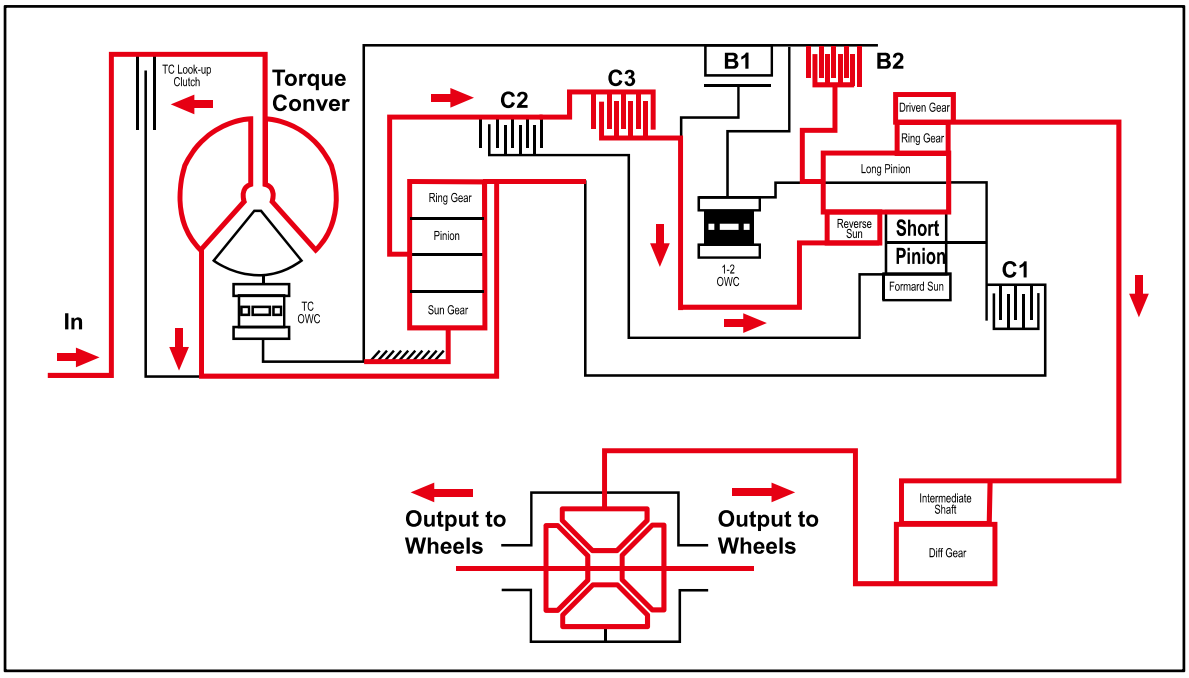
(7) Drive 6th (6th Auto) - 0.676 : 1

▶ **Power flow**



(8) Reverse - 3.178 : 1

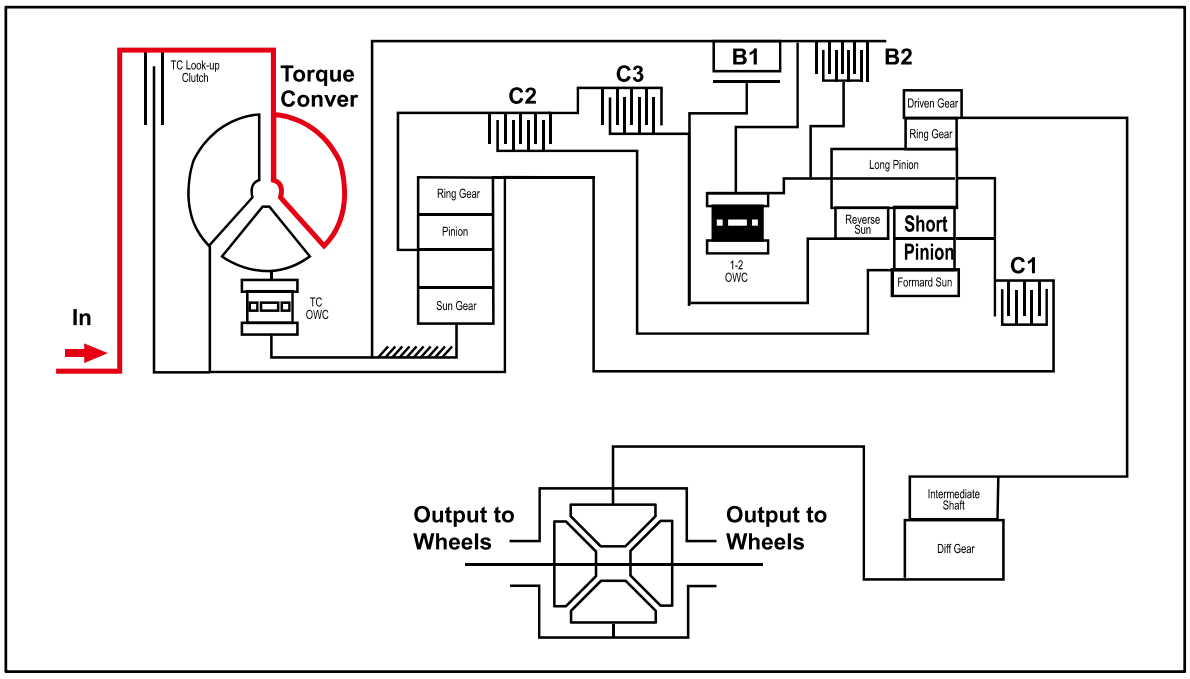
▶ **Power flow**



Downloaded from www.Manualslib.com manuals search engine

(9) Neutral / Park

▶ Power flow

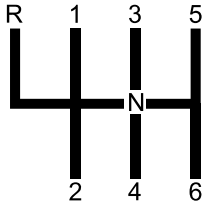


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

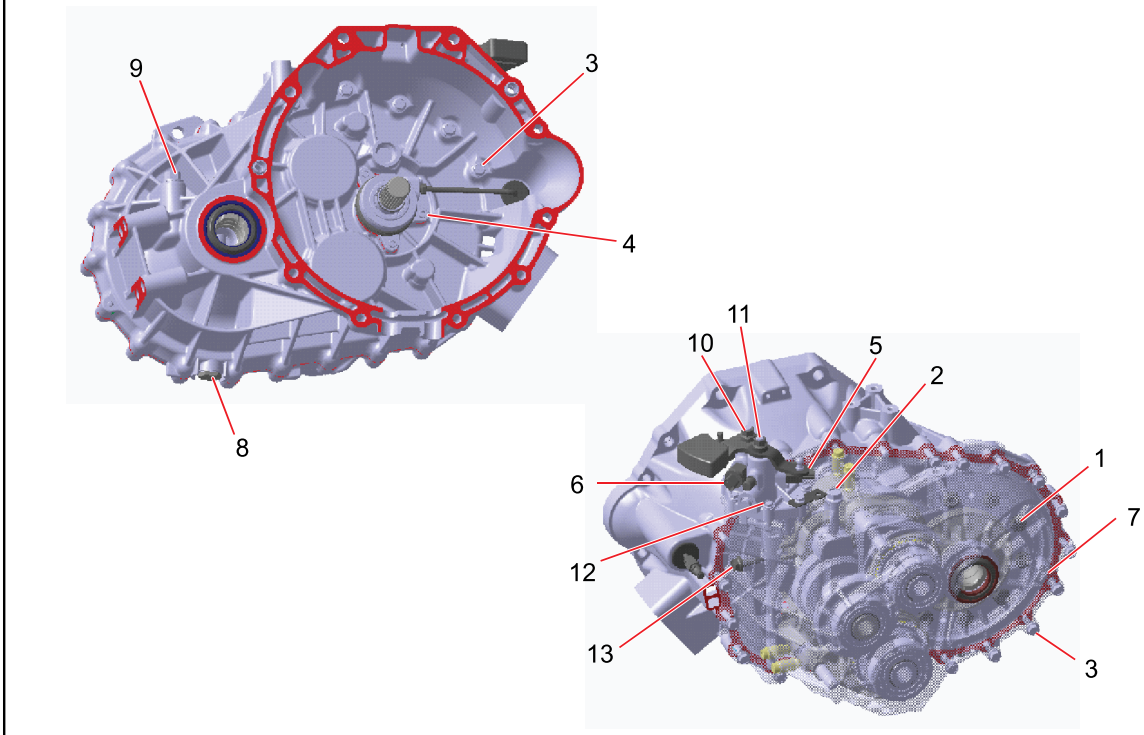
Item		Specification	Remark
Model name		WM6F1	
Overall length		370 mm	
Distance between shafts		205 mm / 70 mm	
Weight (except transmission fluid)		62 kgf (2WD) / 63 kgf (4WD)	
Gear ratio	1st	3.538	
	2nd	1.909	
	3rd	1.179	
	4th	0.814	
	5th	0.734	
	6th	0.628	
	Reverse	3.910	
Synchronizer ring type	1st	T: Triple-cone	
	2nd	T: Triple-cone	
	3rd	T: Triple-cone	
	4th	D: Double-cone	
	5th	D: Double-cone	
	6th	S: Single-cone	
	Reverse	T: Triple-cone	
Shifting	Type	Remote (Cable type)	
	Gear selector lever position		Reversing: Reverse ring pull type

Downloaded from www.Manualslib.com manuals search engine

Item			Specification	Remark
Transmission fluid	Transmission fluid		SAE 75W / 85, API GL-4	
	Capacity		1.6 L	
	Replacement interval	EU	Inspect and replenish every 60000 km (or 3 years) Normal driving condition: Fill for Life (Severe driving condition: Change every 120000 km)	
		GEN	Inspect and replenish every 60000 km (or 4 years) Normal driving condition: Fill for Life (Severe driving condition: Change every 120000 km)	

Downloaded from www.Manualslib.com manuals search engine

2. TIGHTENING TORQUE



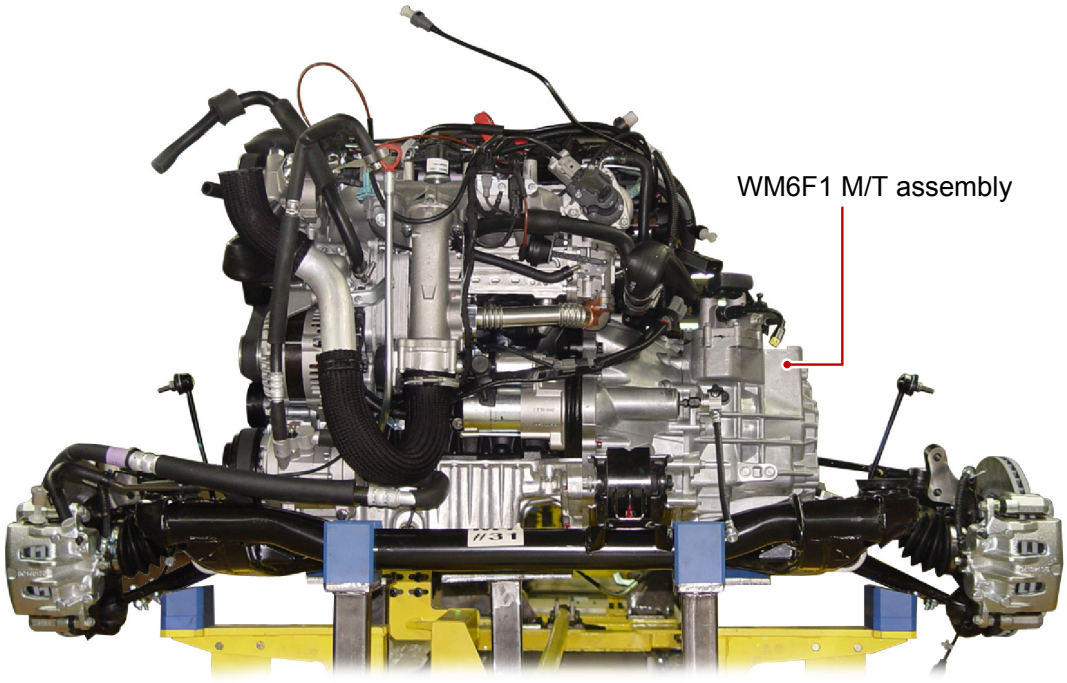
Part name	Tightening torque	Remark
1. Drive gear mounting bolt of differential carrier	166.6 to 176.4 Nm	10 EA
2. Reverse shaft mounting bolt	74.5 to 89.2 Nm	
3. Transmission case mounting bolt	19.6 to 26.5 Nm	22 EA
4. Concentric slave cylinder mounting bolt	11.8 to 14.7 Nm	3 EA
5. Backup lamp switch	29.4 to 34.3 Nm	
6. Neutral switch	29.4 to 34.3 Nm	
7. Oil filler plug	58.8 to 78.4 Nm	
8. Oil drain plug	58.8 to 78.4 Nm	
9. Oil plug	58.8 to 78.4 Nm	
10. Shift lever mounting nut	42.2 to 53.9 Nm	
11. Selector lever mounting nut	42.2 to 53.9 Nm	
12. Control shaft assembly mounting bolt	9.8 to 11.8 Nm	7 EA
13. Guide bolt	42.2 to 53.9 Nm	

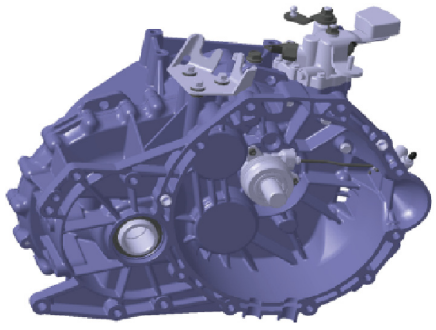
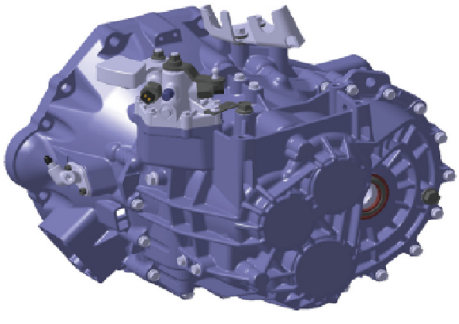
Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

This vehicle is equipped with WM6F1 M/T (Manual Transmission). This transmission is integrated with an axle and designed to maximize the driving performance by optimizing the gear ratio according to the engine torque.



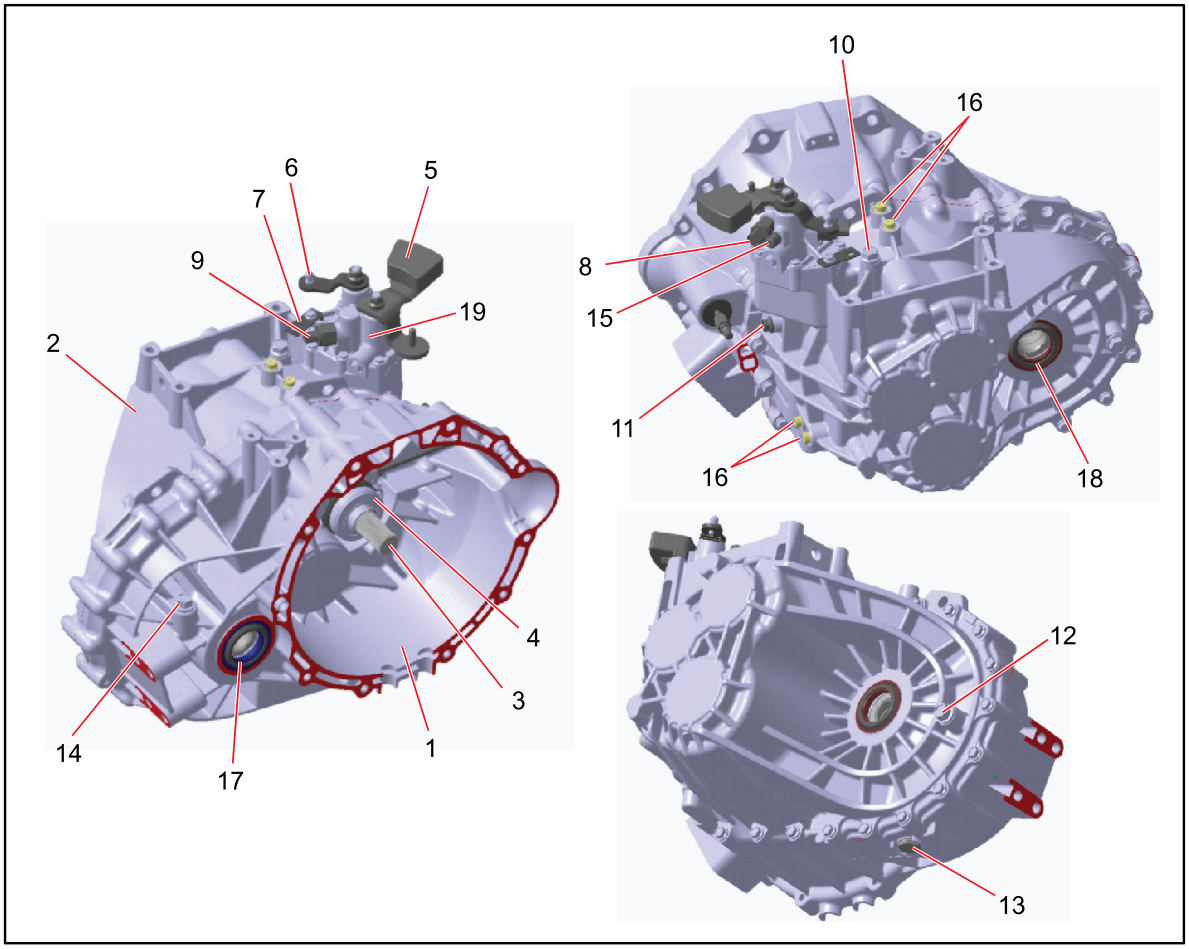
Front view	Rear view
	

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1) Characteristics of WM6F1 M/T

- Both Forward and Reverse gears use the helical gear and are made of high-strength material.
- Drives the clutch with a concentric slave cylinder mounting bolt.
- Shifting the transmission gears is performed through the remote control cable.
- A pull type clutch is used for Reverse gear shifting.
- Features triple/double/single synchronization.

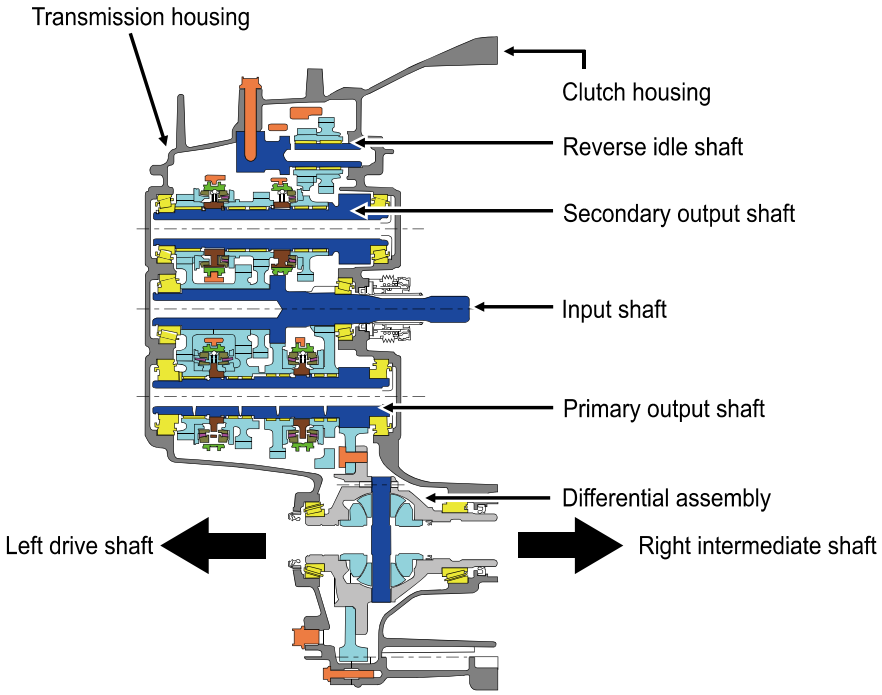


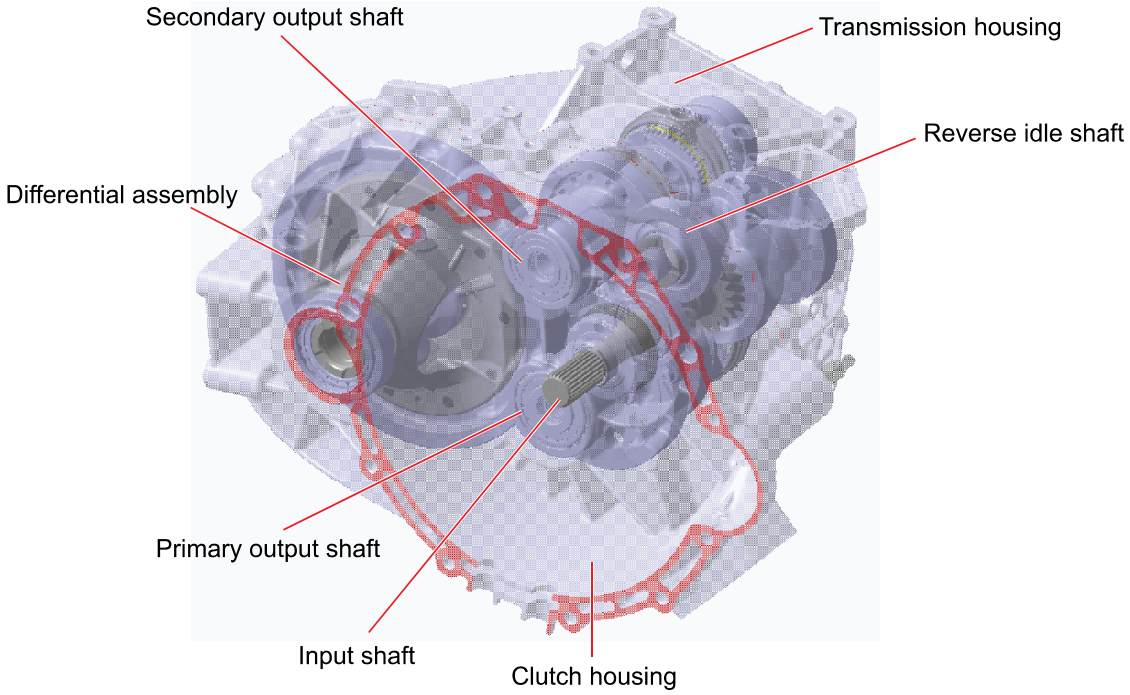
1. Clutch housing
2. Transmission case
3. Input shaft
4. Concentric slave cylinder
5. Shift lever
6. Selector lever
7. Wiring bracket
8. Neutral switch
9. Backup lamp switch
10. Reverse idle shaft mounting bolt
11. Control guide bolt
12. Oil filler plug (for servicing)
13. Oil drain plug
14. Oil filler plug (for manufacturing)
15. Air breather
16. Detent pin (for securing shift fork)
17. Oil seal (RH)
18. Oil seal (LH)
19. Control housing

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Internal Configuration

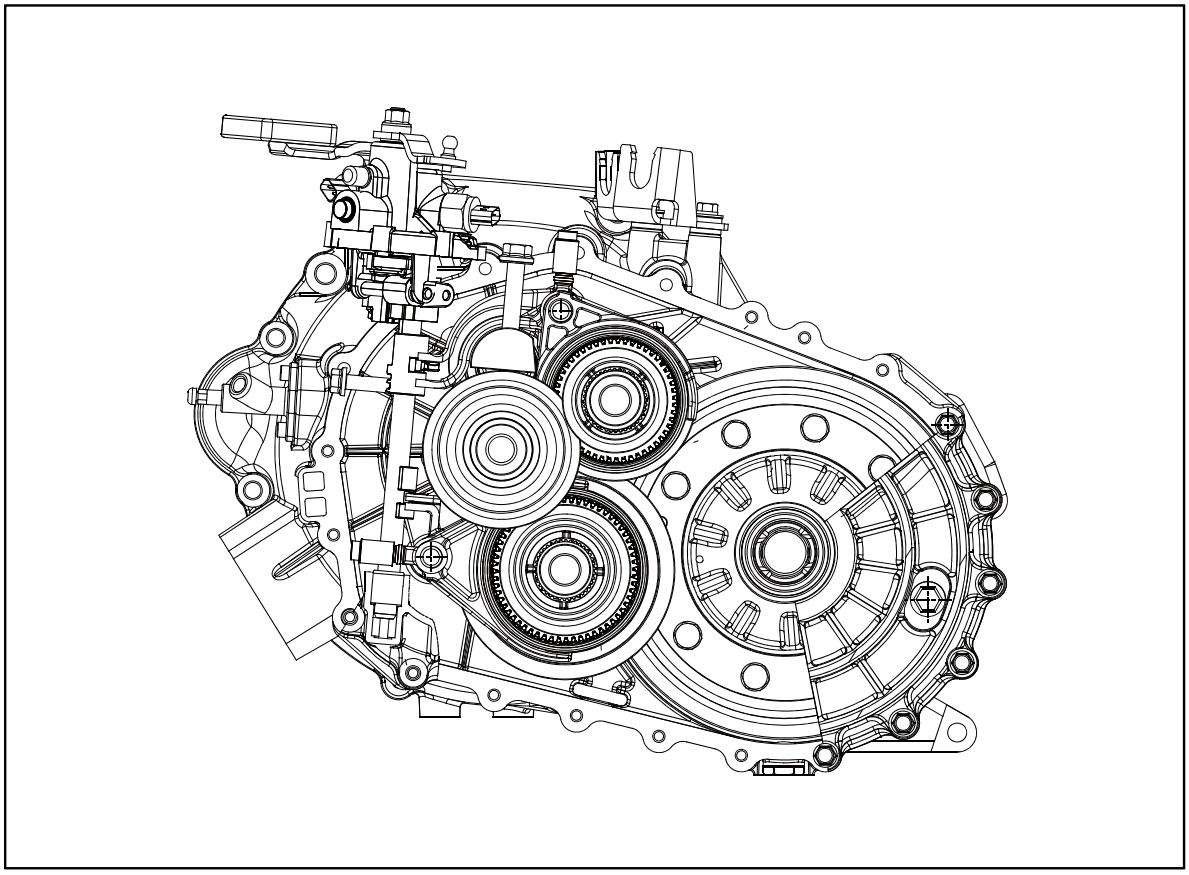




Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Schematic Diagram



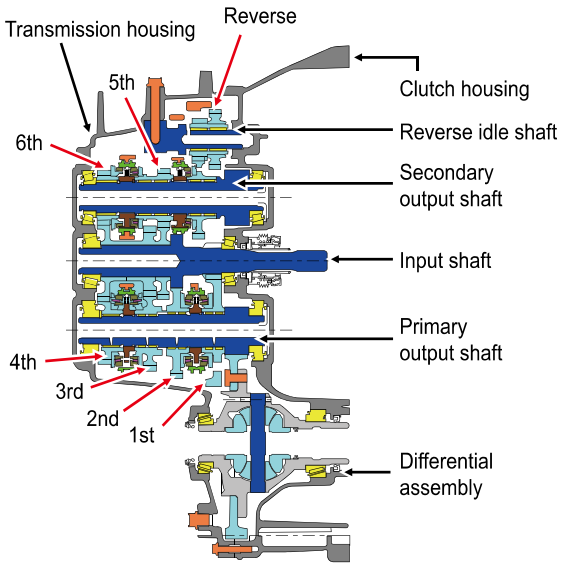
4) Gear Ratio

Item	Speed gear			Final gear			Total gear ratio
	Number of teeth		Gear ratio	Number of teeth		Gear ratio	
	Input	Output		Input	Output		
1st	13	46	3.538	13	59	4.538	16.059
2nd	22	42	1.909				8.664
3rd	28	33	1.179				5.349
4th	43	35	0.814				3.694
5th	38	28	0.737	15	59	3.933	2.898
6th	43	27	0.628				2.47
Reverse	13	17	3.91				15.377
	24	36					

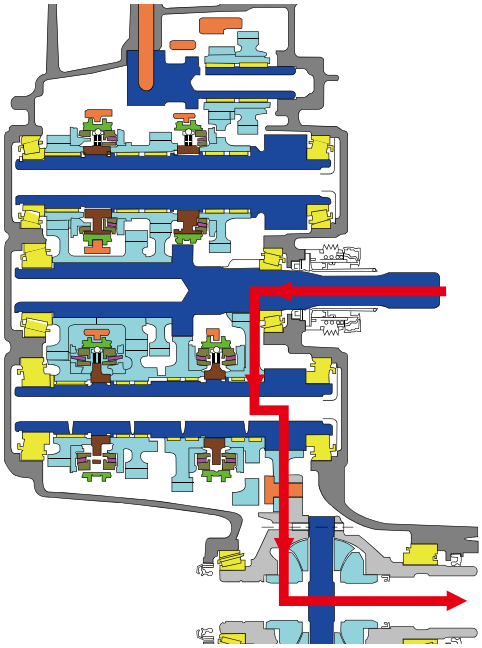
Downloaded from www.Manualslib.com manuals search engine

2. POWER FLOWS

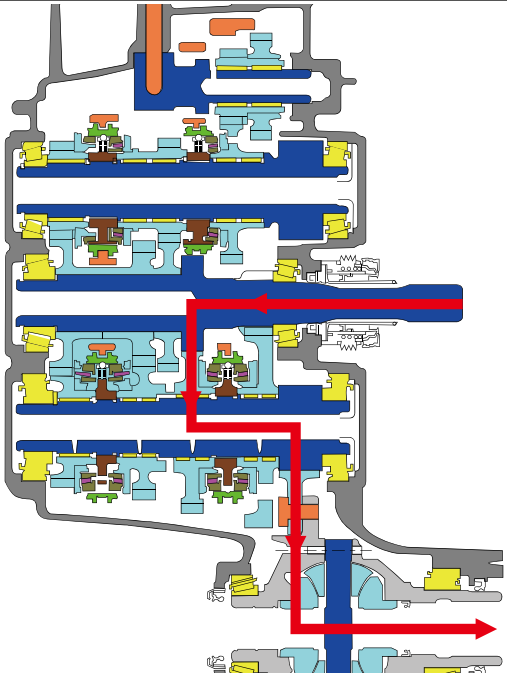
Sectional view of WM6F1 M/T



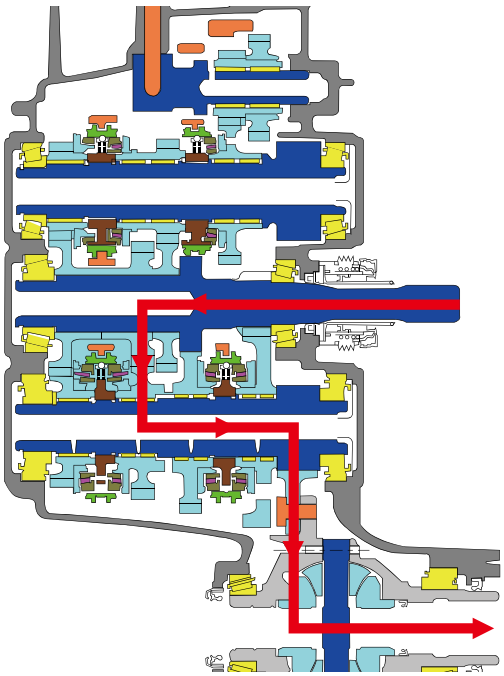
1st speed gear



2nd speed gear



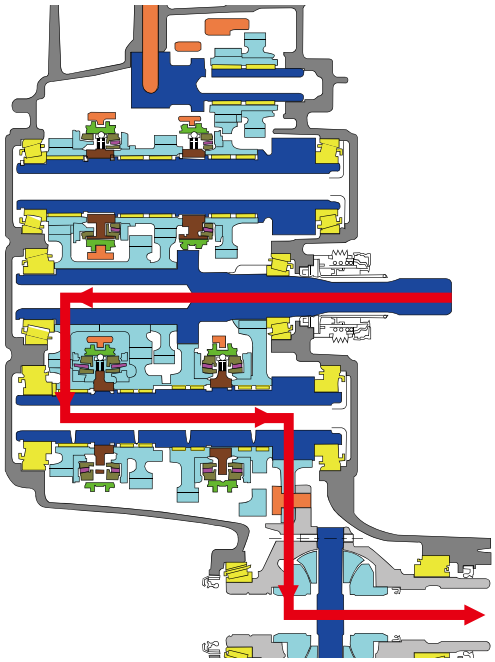
3rd speed gear



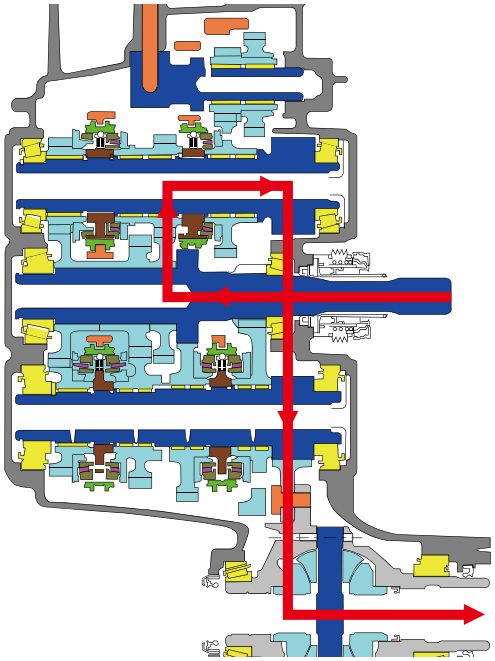
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

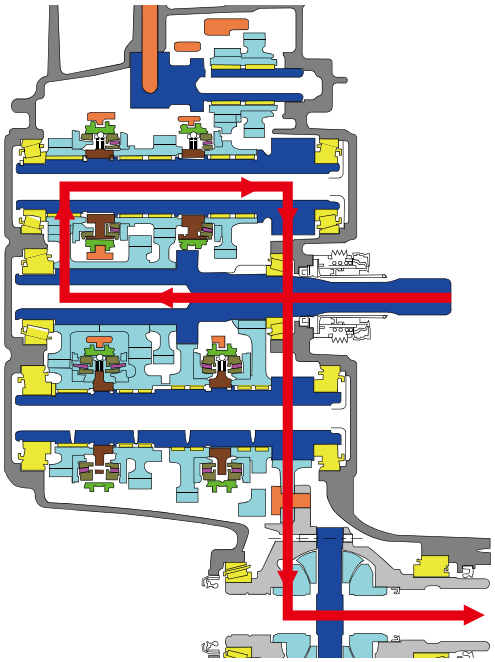
4th speed gear



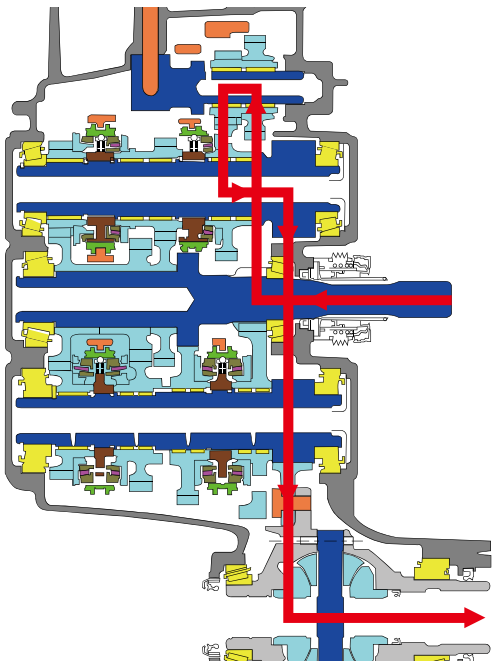
5th speed gear



6th speed gear



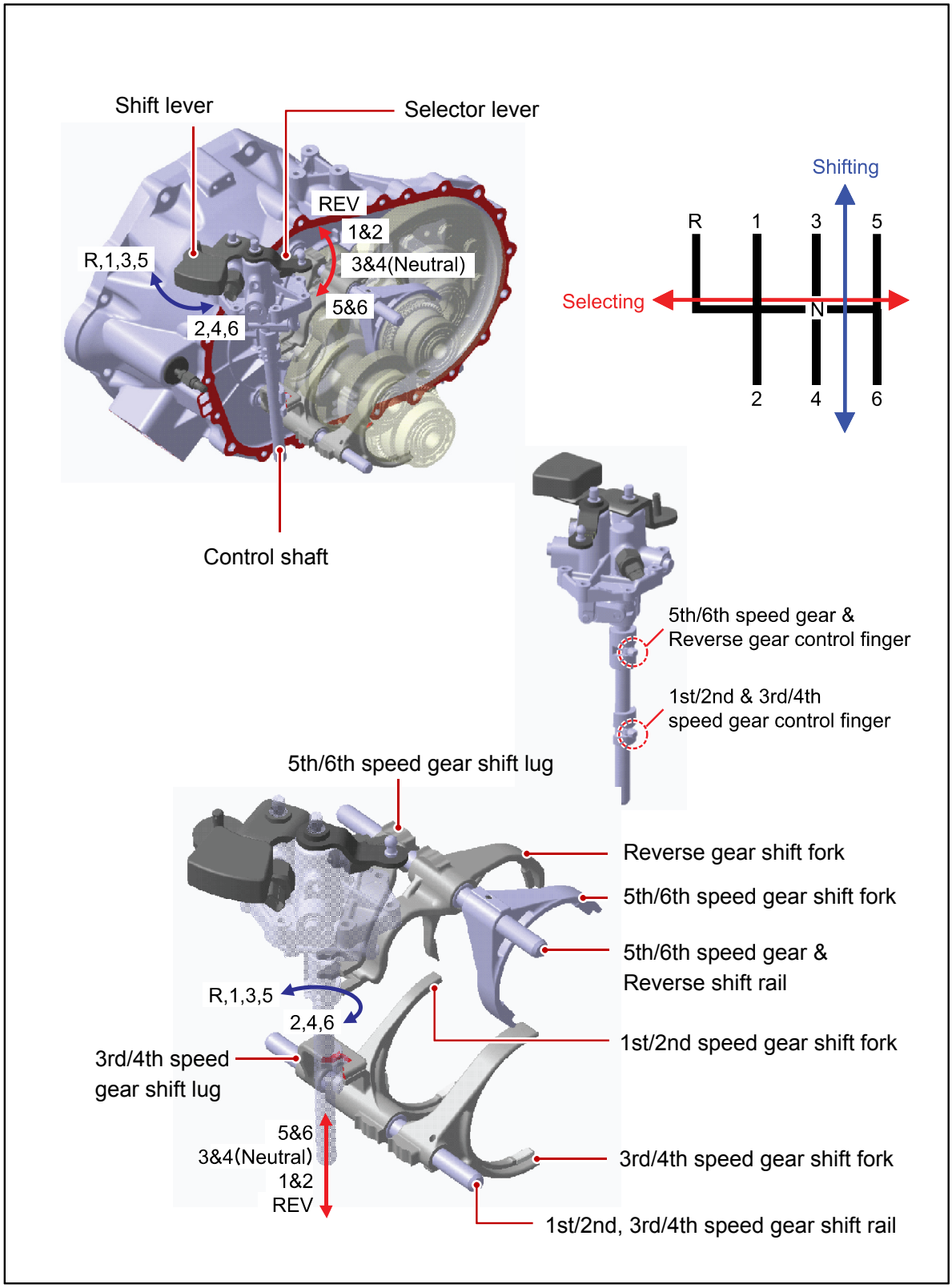
Reverse gear



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. SHIFTING MECHANISM



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Description		Specification
Operating type		Hydraulic type
Clutch cover	Type	Diaphragm spring strap
	Adjusting type	SATIC (Self Adjusting Technology with Integrated Cassette) type
Clutch pedal	Type	Suspended type
	Max. operating travel	135 ± 3 mm
	Pedal free play (Longitudinal)	7.1 ± 3 mm
	Pedal free play (Transverse)	3 mm
Clutch disc	Type	Dry type single diaphragm (Rigid type)
	Diameter of facing	Outer: 250 ± 1 mm Inner:160 ± 0.8 mm
	Thickness of disc	Free: 8.7 ± 0.3 mm
		When loaded: 8.0 ± 0.2 (at 7,800 N)
	Numbers of disc	2
	Weight	1.18 kg
	Flywheel type	DMF (Dual Mass Flywheel)
Setting load of clutch cover assembly		At least 7,800 N
Clutch master cylinder	Operating travel	30 mm
	Inner diameter	17.46 mm
Concentric slave cylinder	Maximum operating travel	12.55 mm
	Operating pressure	Maximum 50 bar
Clutch oil		DOT 3 or DOT 4

Downloaded from www.Manualslib.com manuals search engine

2. TIGHTENING TORQUE

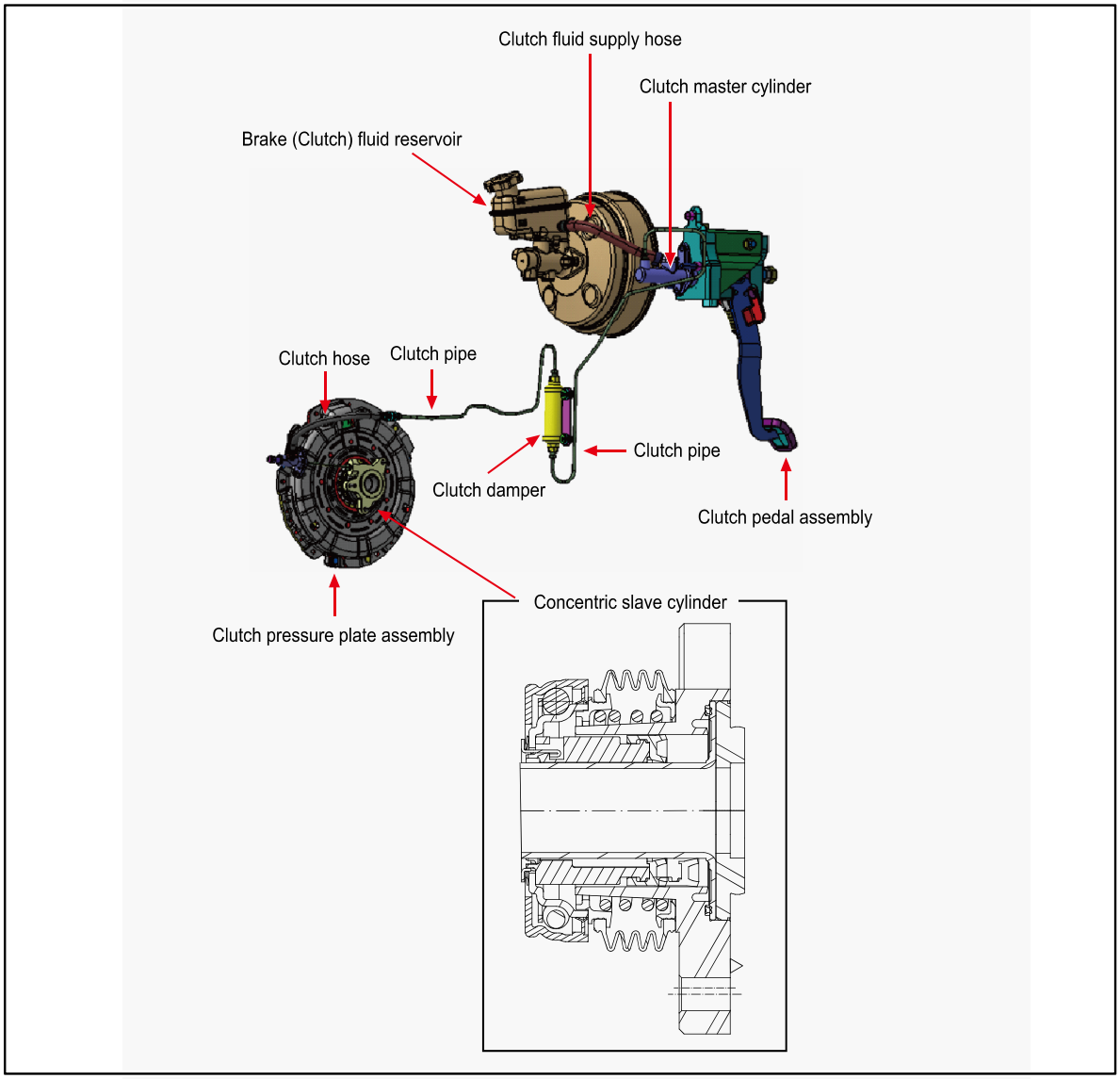
Description		Tightening torque	Amount
Clutch housing bolt	Upper (17 mm)	85.0 to 100 Nm	2
	Front (14 mm)	54.0 Nm + 20°	1
	Rear (14 mm)	51.3 to 56.7 Nm	2
	Lower (14 mm)	56.0 to 62.0 Nm	4
Pressure plate assembly bolt (Hexagon 6 mm)		21.0 to 27.0 Nm	6
Concentric slave cylinder bolt (Hexagon 5 mm)		10 to 16 Nm	3
Concentric slave cylinder oil pipe nut		24.5 to 28.4 Nm	
Master cylinder nut (12 mm)		7.8 to 17.6 Nm	
Master cylinder oil pipe nut (10 mm)		14.7 to 17.6 Nm	
Master cylinder push rod lock nut		8.8 to 13.7 Nm	
Clutch oil chamber screw and bolt (10 mm)		3.9 to 7.8 Nm	
Oil pipe nut (10 mm)		14.7 to 17.6 Nm	
Clutch pedal mounting nut (12 mm)		7.8 to 17.6 Nm	
Stopper bolt		16 to 22 Nm	

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

The hydraulic clutch transmits the force required to operate the clutch pedal to the concentric slave cylinder fitted to the clutch housing as a hydraulic pressure.
(The hydraulic pressure is transmitted in the following order: Clutch pedal - Clutch master cylinder - Clutch pipe - Clutch damper - Clutch pipe and hose - Concentric slave cylinder - Pressure plate - Flywheel.)
If a driver depress the clutch pedal, the hydraulic pressure is generated in the master cylinder. It is transmitted to the concentric slave cylinder through the pipe, resulting in the cylinder being forced out. At this time, the clutch disc is forced against the cylinder by pushing the cover. This, in turn, remove the flywheel from the pressure plate. As a consequence, the power from the engine will be cut off and the gear change can be carried out.



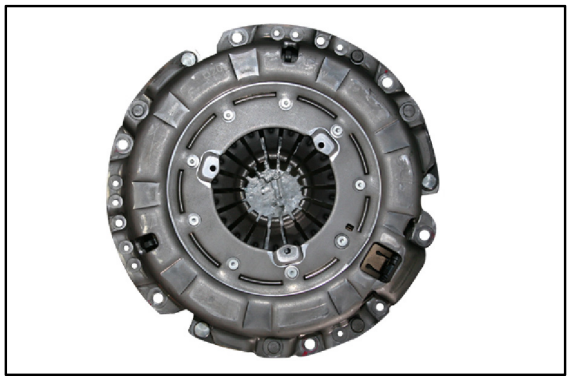
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. SATIC (SELF ADJUSTING TECHNOLOGY WITH INTEGRATED CASSETTE)

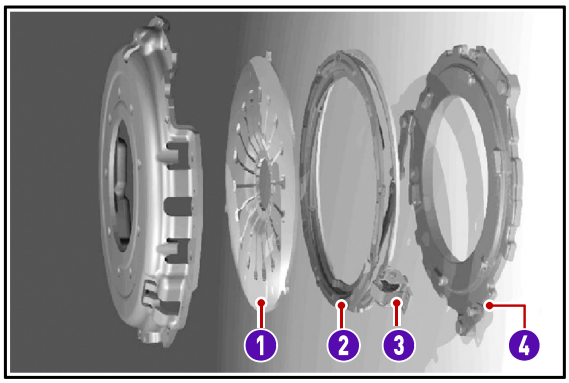
1) System Description

▶ Function

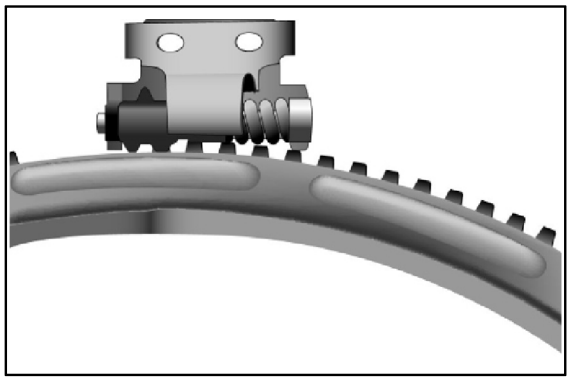


On the conventional clutch, the pedal force tends to increase in proportion to the degree of disc run-out. However, the SATIC clutch has the adjusting function which activates the cassette system inserted to the clutch cover to maintain a constant pedal force and clearance when the disc runs out. (Unlike SAT type, SATIC type does not need SST for clutch cover removal.)

▶ Operation



Diaphragm spring rotates the adjusting equipment as clutch disc is wearing and so, pressure plate is pushed to clutch disc side at the amount of wear.
Disc wear (Free play) → Diaphragm spring (1) → Adjusting equipment (2, 3) → Pressure plate (4)



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Overview

▶ Driving elements

The driving elements consist of two flat surfaces machined to a smooth finish.
One of these is the rear face of the engine flywheel and the other is the clutch pressure plate.
The clutch pressure plate is fitted into a clutch steel cover, which is bolted to the flywheel.

▶ Driven elements

The driven element is the clutch disc with a splined hub which is free to slide lengthwise along the splines of the input shaft.
The driving and driven elements are held in contact by spring pressure. This pressure is exerted by a diaphragm spring in the clutch cover pressure plate assembly.

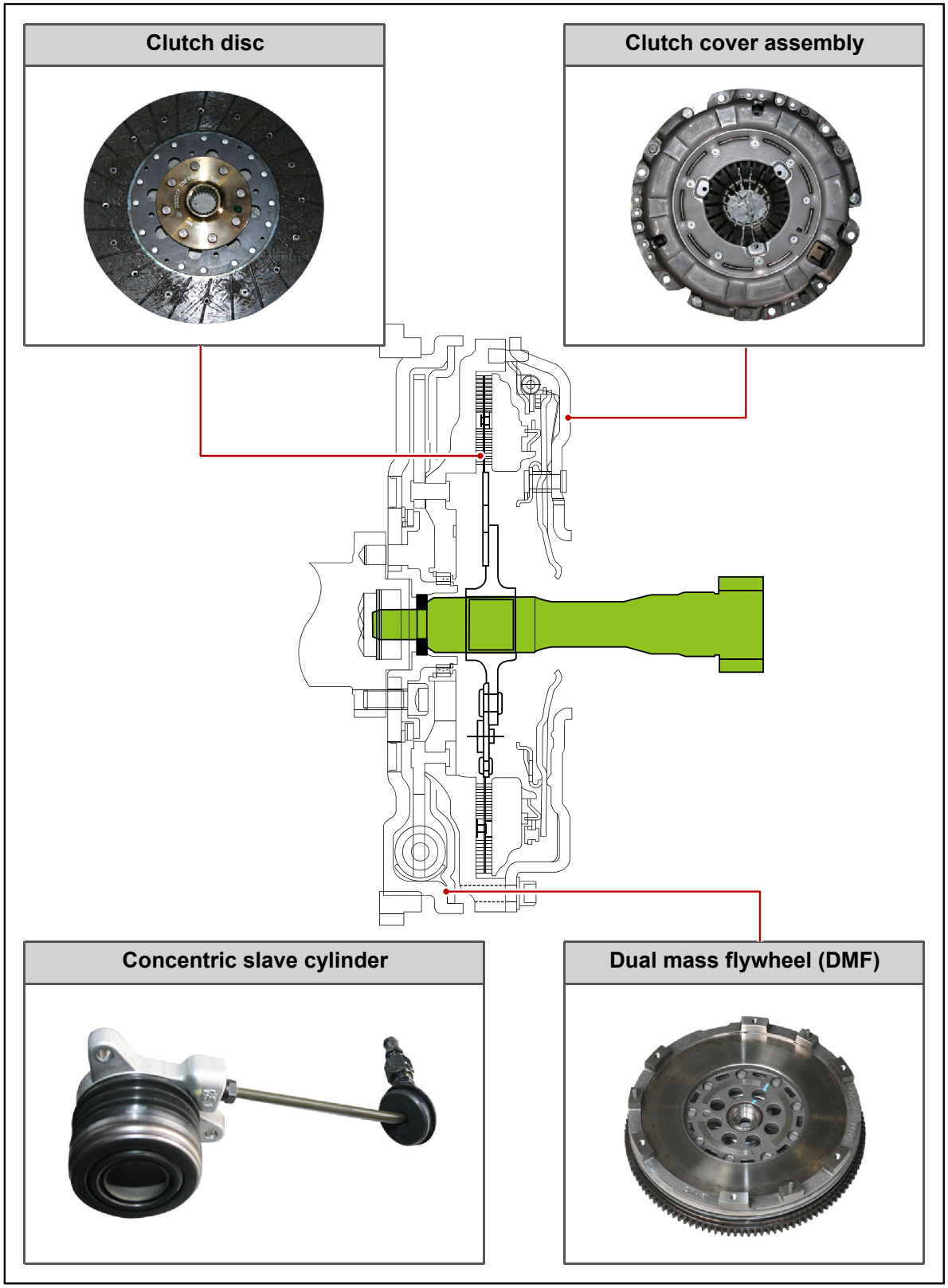
▶ Operating Elements

The clutch "release" system consists of the clutch pedal and clutch release cylinder.
This system directly releases the clutch by using hydraulic pressure while the conventional clutch system releases the clutch by using release lever and release fork. This system provides higher efficiency than conventional clutch system, and its durability is superior.

- Clutch master cylinder (mounted on clutch pedal)
- Concentric slave cylinder pipe (mounted inside of transmission)

Downloaded from www.Manualslib.com manuals search engine

3) Layout



Modification basis	
Application basis	
Affected VIN	

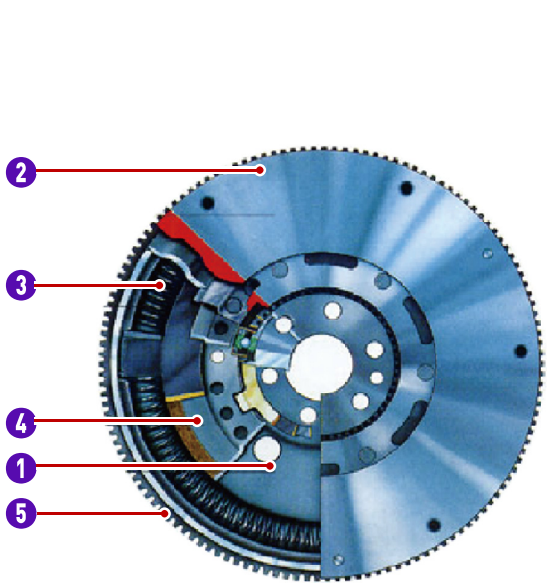
Downloaded from www.Manualslib.com manuals search engine

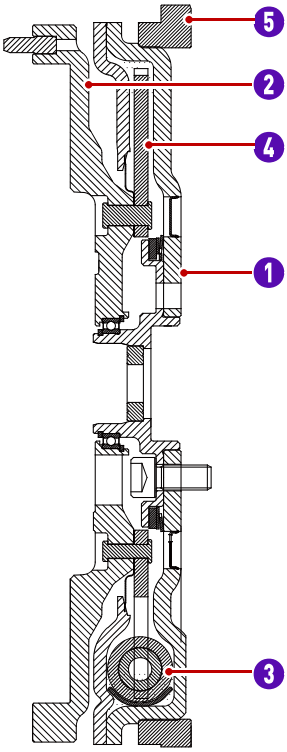
3. DUAL MASS FLYWHEEL (DMF)

The dual mass flywheel (DMF) is of having a mass divided into two halves.
While one mass is connected to the engine crankshaft, which is affected by the mass moment of inertia of the engine, the other mass is affected by one of the transmission.
The divided dual masses are connected to the coil spring and damping system internally.

▶ **The DMF has the following benefits:**

- Reducing fuel consumption by lowering engine speed
- Reducing rattling noise and vehicle vibration in all driving ranges
- Reducing synchronization wear
- Facilitating gear change
- Protecting power train parts by preventing excessive load from being delivered





1. Primary flywheel
2. Secondary flywheel
3. Arc damper spring
4. Torque limiter
5. Ring gear

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

PROPELLER SHAFT (4WD ONLY) 3310-01

GENERAL INFORMATION

1. SPECIFICATION

Description		Specification
Structure		2-piece type with CV joint, spider, and rubber coupling
Weight		below 12.0 kg
Joint type		CV joint, spider, rubber coupling
Spider	Numbers	one (installed on center bearing side)
	External diameter	Ø24 mm
	Overall size	Ø62.5 mm
Dimension (Length x Dia.)	No.1 shaft (TM to spider)	1,069 x Ø60 mm
	No. 2 shaft (spider to axle)	847.5 x Ø60 mm
Runout of tube (after installation)		0.3 mm
Unbalance		80g.mm @ 3,000rpm (second measurement: 120 g.mm)
U-joint	Starting torque	0.3 to 0.7 Nm
	Minimum starting angle	18°
Amount of grease in CV joint		210+-10g

2. TIGHTENING TORQUE

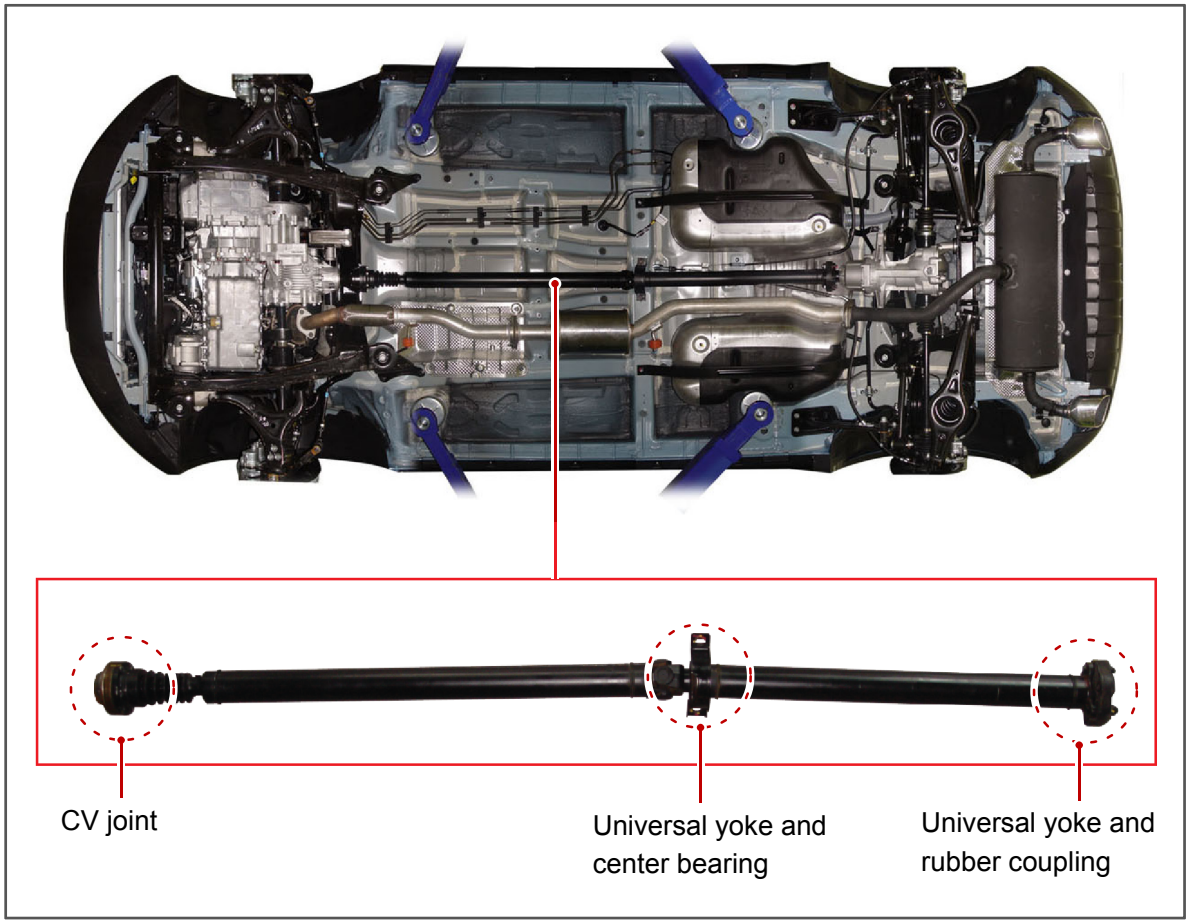
Fastener	Tightening torque
Bolt/nut for rubber coupling (rear axle side)	39.2 to 49.0 Nm
Bolt/nut for CV joint (transaxle side)	39.2 to 44.1 Nm
Mounting bolt for center bearing	58.8 to 68.6 Nm

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

The propeller shaft is a thin steel pipe which transfers the power from the transmission to the E-coupling, and has high resistance to torsion and bending.
The propeller shaft has the universal joint (cross axle) mounted on the center of the shaft and splines for the slip joint on the E-coupling side to accommodate the height and length changes which occur as the shaft rotates at high speed.
And the rubber bushing for center bearing in the center of the propeller shaft keeps the balance of the shaft and absorbs its vibration.



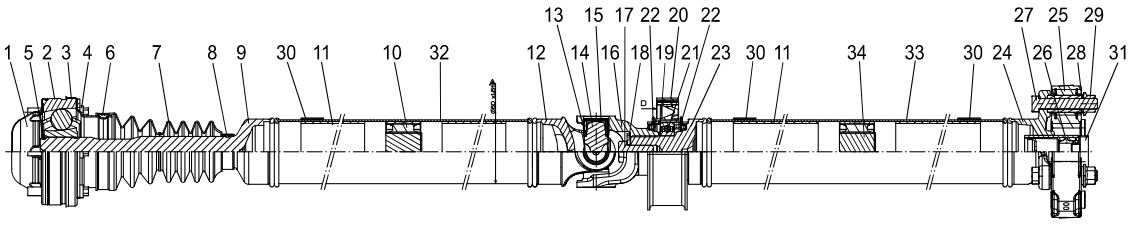
▶ **Function of propeller shaft**

- Transmits driving torque.
- Accommodates the angle change (universal joint / CV joint).
- Accommodates the axial length change (splines for the slip joint).

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. COMPONENT



1	End cap	18	Plain washer
2	VL joint assembly	19	AL washer
3	Washer	20	Center bearing assembly
4	Bolt	21	Ball bearing
5	Circlip	22	Dust shield
6	Clamp (big)	23	Intermediate shaft
7	Boot	24	Fork yoke
8	Clamp (small)	25	Rubber coupling
9	Stub shaft	26	Alignment support
10	Bending absorber	27	Bolt
11	Paper damper	28	Washer
12	Tube yoke	29	Lock nut
13	Oil seal	30	Balance weight
14	Spider	31	Protecter
15	Bearing cap	32	Tube
16	Intermediate yoke	33	Tube
17	Bolt	34	Bending absorber

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

DRIVE SHAFT AND AXLE

4110-01

GENERAL INFORMATION

1. SPECIFICATION

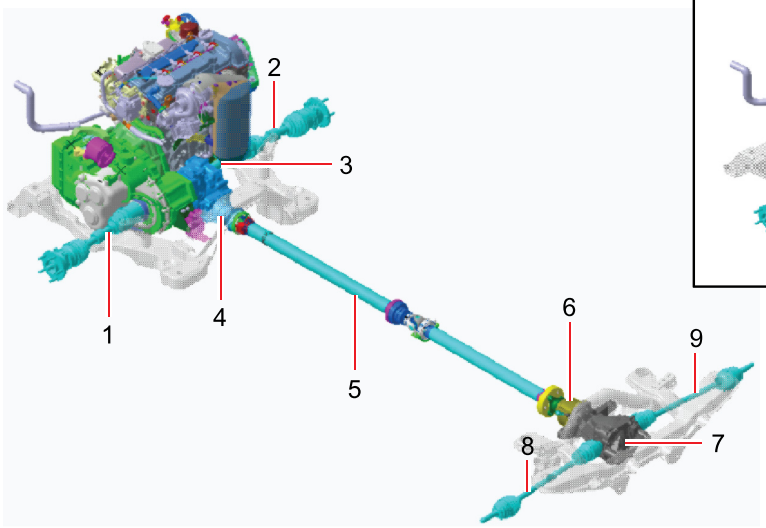
Component		Item	Specifications
2WD, 4WD	Front drive shaft	Joint type	Inside: Tripod joint Outside: Ball joint
		Max. allowed angle	Inside: 23° Outside: 46°
		To compensate the bending angle	Installation of equivalent length shaft
4WD only	Rear drive shaft	Joint type	Inside: Cross groove joint Outside: Ball joint
		Max. allowed angle	Inside: 23° Outside: 23°
	Rear differential carrier	Type	Independent Rear Drive Axle (IRDA)
		Reduction gear type	Hypoid gear
		Gear reduction ratio	2.93
		Diameter of gear	Ø152 mm
		Oil type	Hypoid gear oil (SAE 75W/90)
		Final drive gear backlash	0.10 to 0.15 mm
		Differential gear backlash	0 to 0.076 mm
	Propeller shaft	Joint type	PTU side: CV joint Rear axle side: Rubber coupling
		Sliding distance	±25 mm or more
		Unbalance	80 g.mm or less at 3,000 rpm
		Total runout	0.3 mm or less

Downloaded from www.Manualslib.com manuals search engine

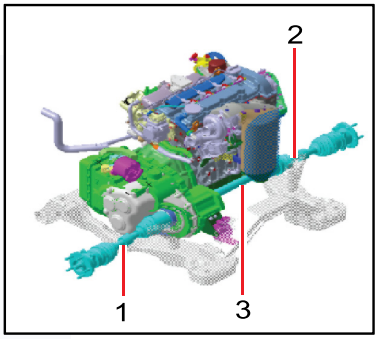
OVERVIEW AND OPERATING PROCESS

1. COMPONENT

For AWD vehicle



For 2WD vehicle



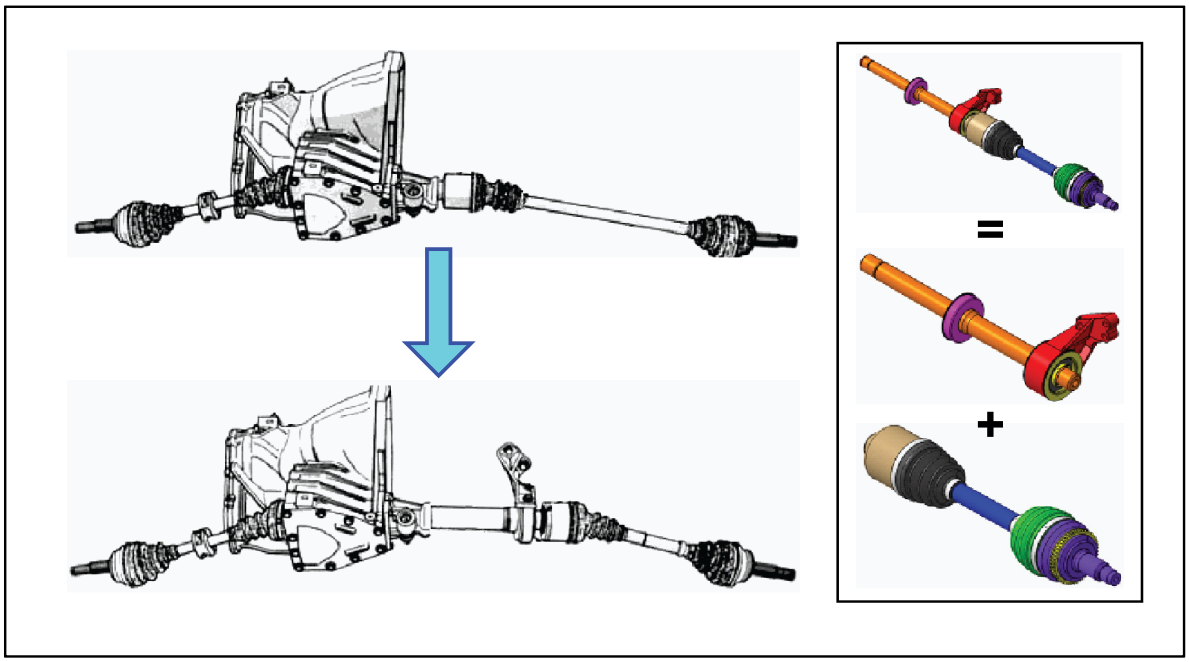
1. Front drive shaft (LH)
2. Front drive shaft (RH)
3. Intermediate shaft
4. Power transfer unit
5. Propeller shaft - 4WD
6. E-coupling
7. Rear differential carrier
8. Rear drive shaft (LH) - 4WD
9. Rear drive shaft (RH) - 4WD

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. TORQUE STEER

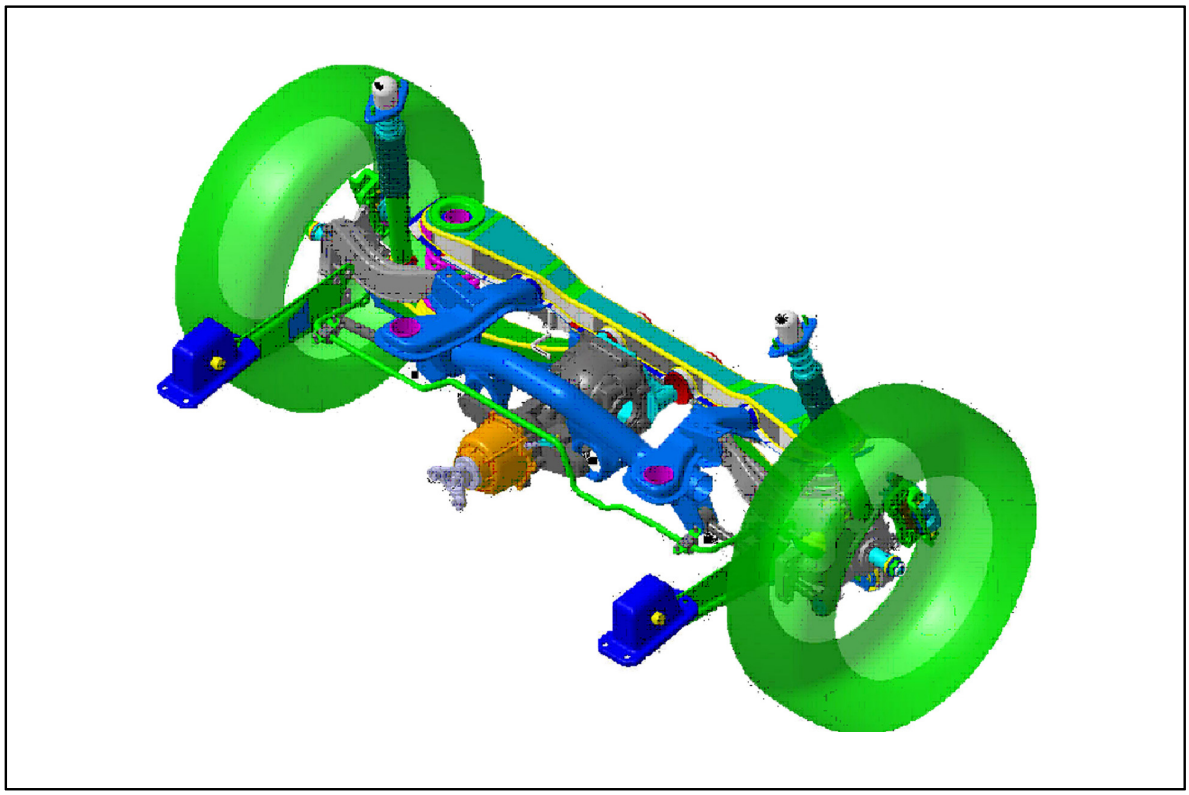
Torque steer is a condition in which a vehicle pulls to either side because of an inequality of traction between the left and right driving wheels when a large torque is applied to the front wheel of a FWD or 4WD.
Especially for a FWD vehicle, this mechanical condition can cause the steering effect because of the output torque (rotational force) produced by the gyroscope.
This rotational force is due to the difference in distance between the left/right front wheels and the transaxle which leads to the change of the shaft bending angle.
To prevent this, the intermediate shaft, called Intermediate shaft, is employed on each side so that the bending angle and the length are kept constant.



Downloaded from www.Manualslib.com manuals search engine

3. REAR AXLE

The rear axle installed in this car is a removable axle, called IRDA (Independent Rear Differential Axle). The rear differential carrier is installed directly on the sub frame, and there is an independent suspension that allows each wheel on the same axle to move vertically and independently of each other with the universal joint and the slip joint.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Unit	Description	Specification
PTU (Power Transfer Unit)	Gear ratio	2.929
	Numbers of helical gear	22/39
	Numbers of hypoid gear	23/38
	Weight	21.5 kg (with oil)
	Oil	LW 80W-90
	Oil capacity	0.6 L (600 ml)
	Operating temperature	−40 to 150°C
E-coupling	Maximum torque	1,000 Nm
	Operating temperature	−40 to 120°C
	Numbers of main clutch	Outer: 11, Inner: 11
	Numbers of pilot clutch	Outer: 4, Inner: 3
	Coil windings	240 turns
	Weight	8 kg
	Oil	ECF107 (ATF based EMCD special oil)
	Oil capacity	0.145 L (145 ml)

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

The AWD system in this vehicle is the electronic 4WD system and controls the traction to rear wheels according to the driving conditions.

1) Driving Mode

(1) AUTO mode (Normal driving mode)

Normally the vehicle is in 2WD mode.
Automatically change to this mode when the vehicle needs higher traction.

(2) LOCK mode (when pressing 4WD LOCK switch)

- This mode provides the highest traction. Use this mode when driving on unpaved, rugged, steep, sandy, wet or slippery roads.
- In 4WD LOCK mode, if the rear wheel speed exceeds 40 km/h, 4WD LOCK mode is canceled and 4WD AUTO mode is activated (Indicator OFF). If the speed is decreased below 35 km/h, 4WD LOCK mode is resumed (Indicator ON again).

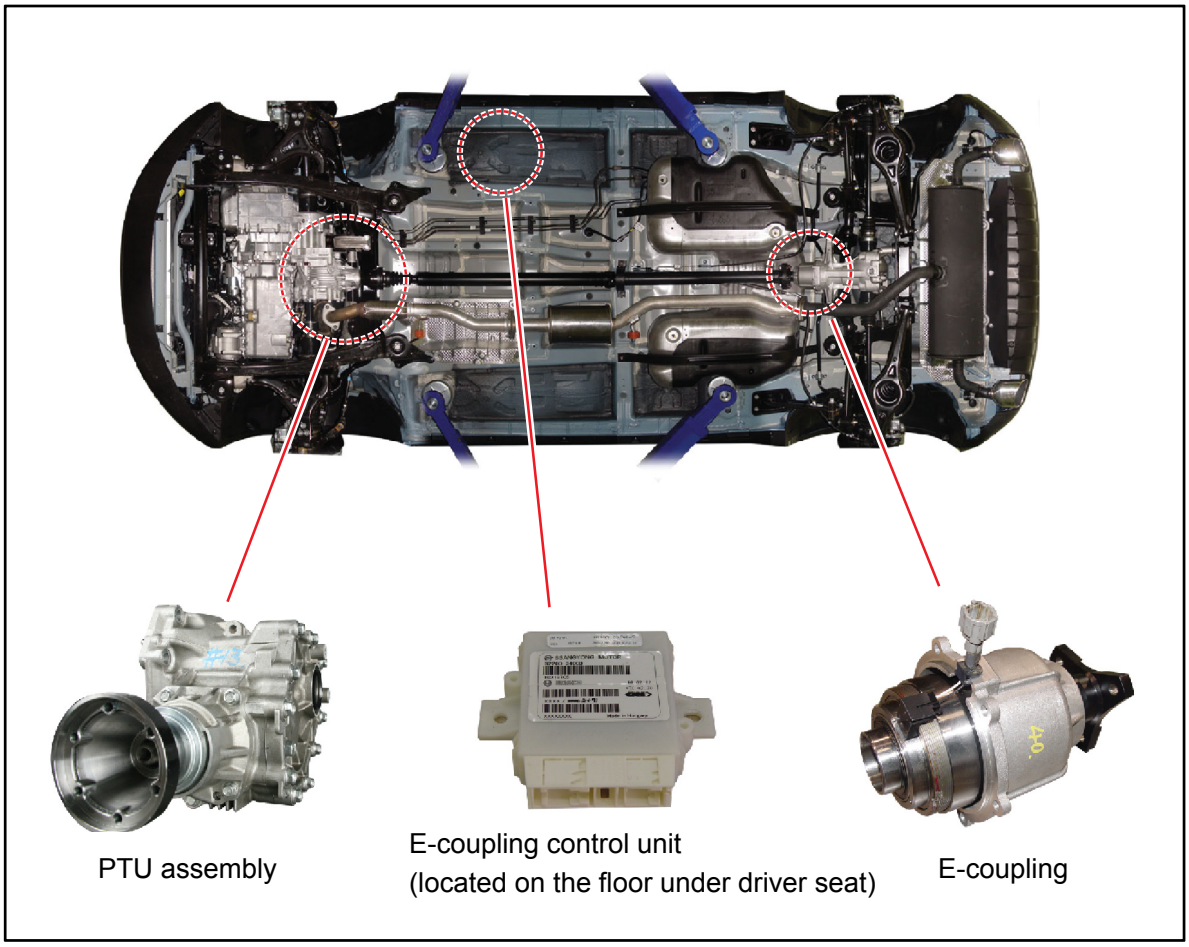
▶ **Mode table**

4WD LOCK switch	Vehicle speed	Driving mode
Not pressed (4WD AUTO)	No conditions	4WD AUTO
Pressed (4WD LOCK)	over 40 km/h	4WD AUTO
Pressed (4WD LOCK)	below 35 km/h	4WD LOCK

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. SYSTEM LAYOUT



1) Components

(1) PTU (Power Transfer Unit)

The power transfer unit in the front wheel drive model changes the angle of engine torque to 90° and transfer it to E-coupling to distribute the torque to rear wheels.

(2) E-Coupling (Electronic Coupling)

E-Coupling transfer the engine torque from PTU to rear axle and controls to distribute it between front wheels and rear wheels.

(3) E-Coupling Control Unit (ECU)

E-Coupling controls the current (clutch engagement force) of EMCD in E-Coupling according to CAN signals (wheel speed, engine torque, pedal position, ABS/ESP signals).
* EMCD: Electro-Magnetic Control Device

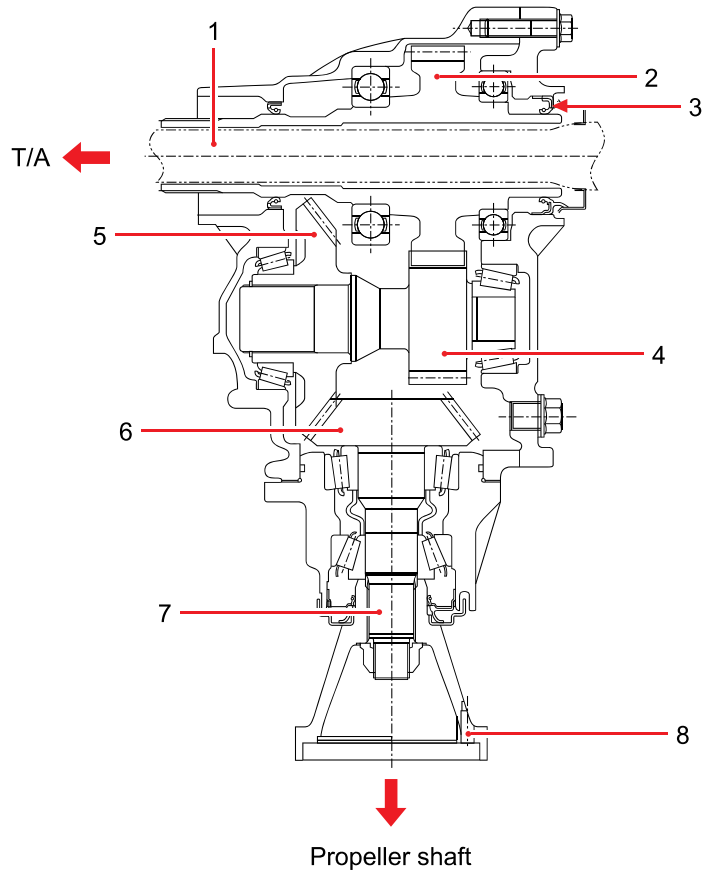
Downloaded from www.Manualslib.com manuals search engine

COMPONENT

S.G.N. 3270-01 PTU (Power Transfer Unit)

The power transfer unit in the front wheel drive model changes the angle of engine torque to 90° by combination between helical gear and hypoid gear and transfer it to E-coupling to distribute the torque to rear wheels.

1) Component

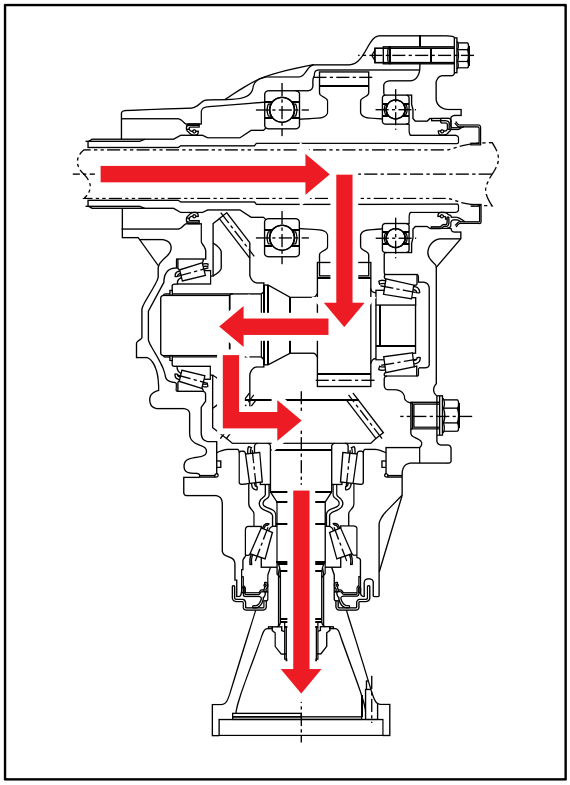


1. Input shaft
2. Helical gear
3. Dust seal
4. Helical gear
5. Hypoid gear
6. Hypoid gear
7. Output shaft
8. Companion flange

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

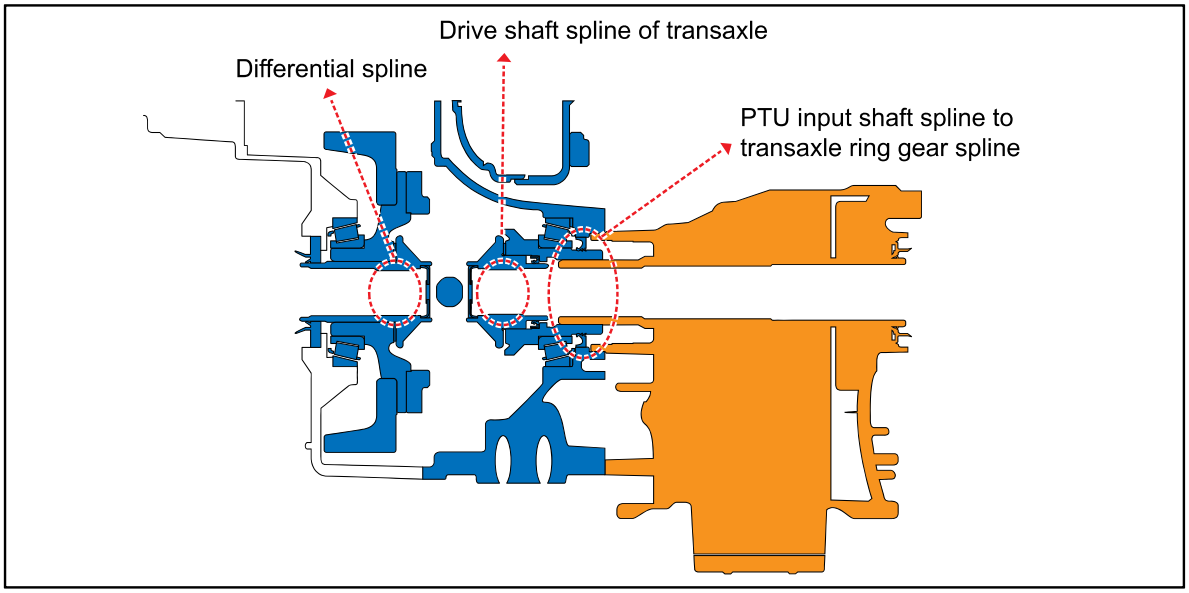
2) Torque Flow and Gear Combination



▶ PTU Gear ratio: 2.929

- 22/39 (helical gear) x 23/38 (hypoid gear) = 0.341
- PTU gear ratio = 1/0.341 = 2.929

3) Engagement of Input Shaft

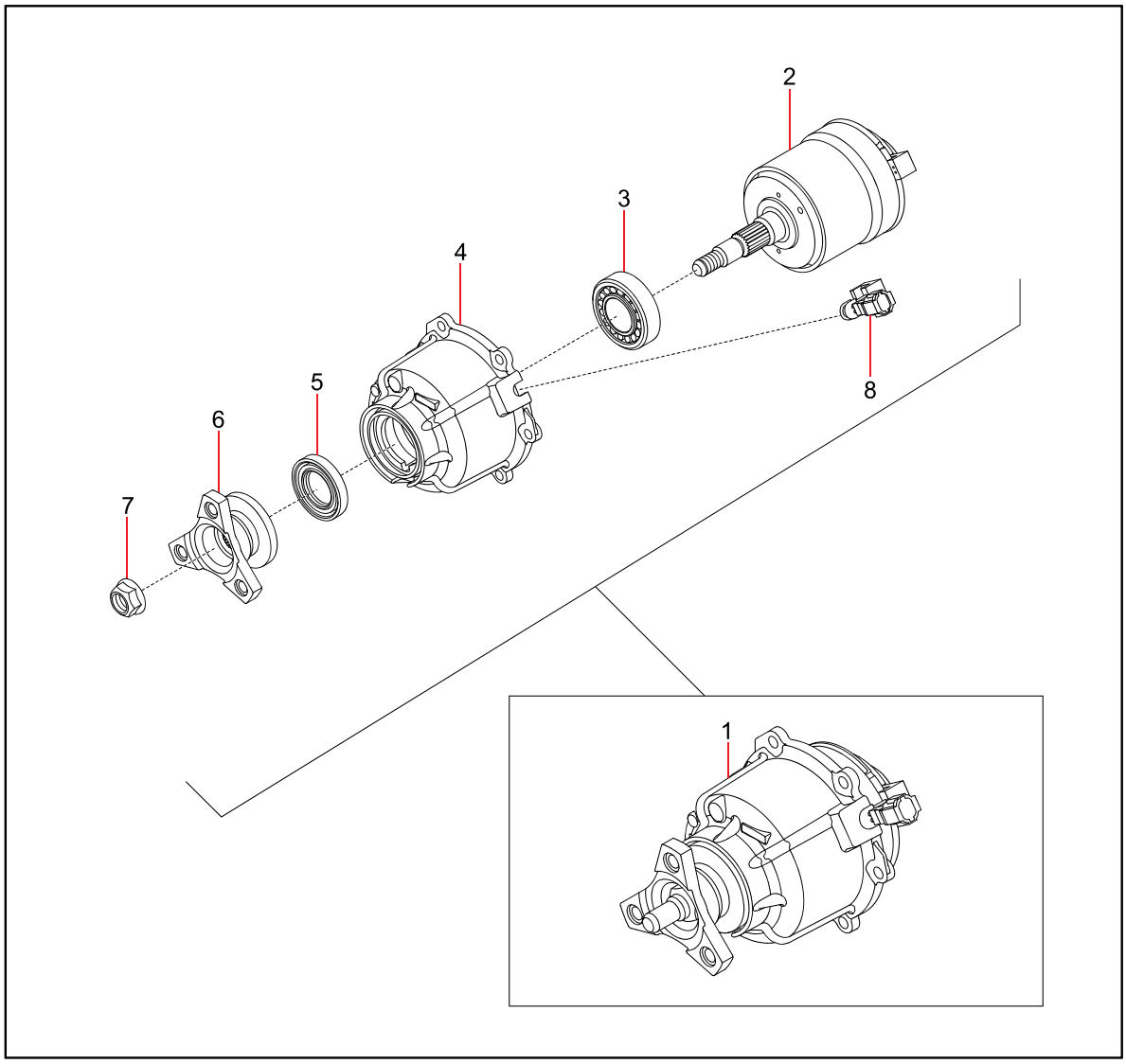


PTU is engaged with the ring gear on transaxle and always runs to rotate the propeller shaft.

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
3280-01 E-COUPLING

1) Component

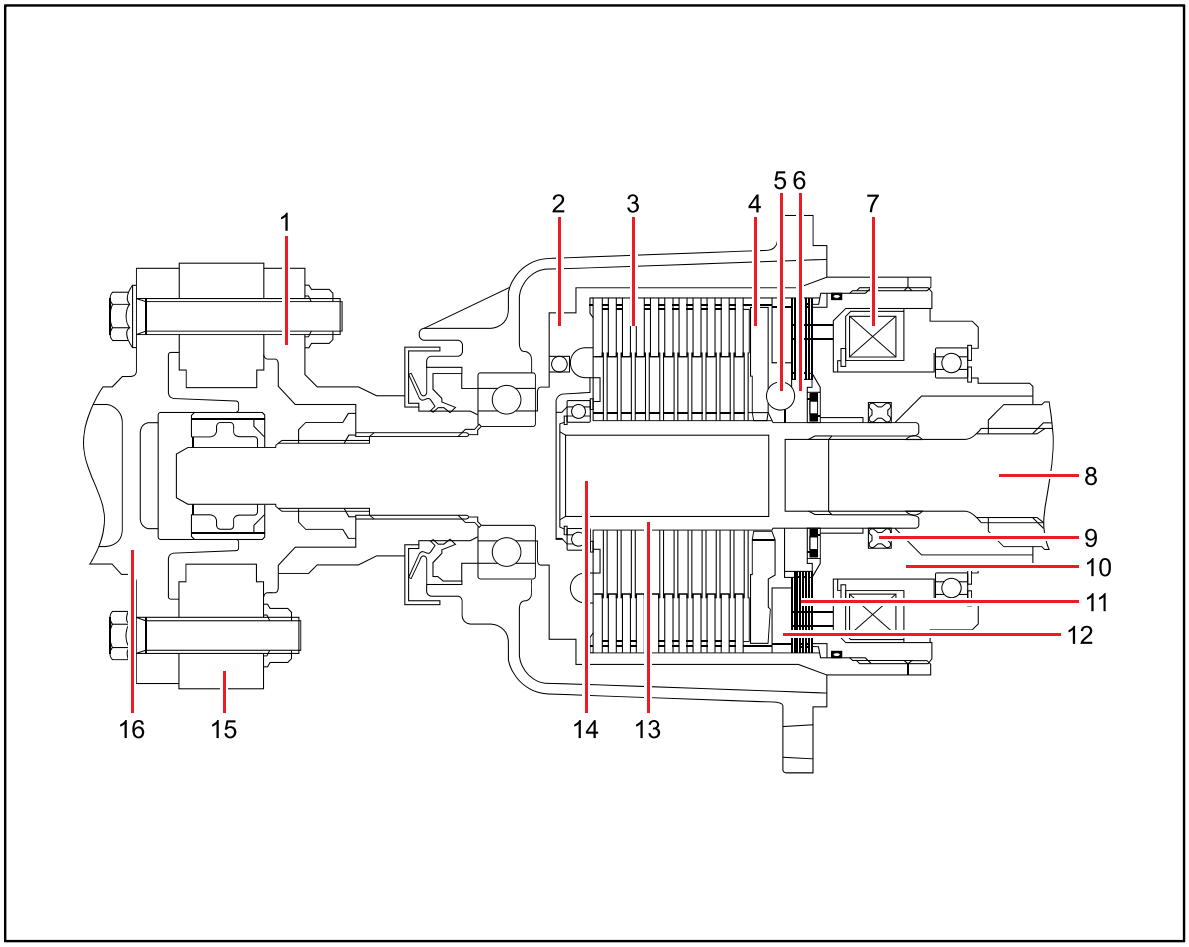


1. Coupling assy - Electric
2. Coupling - Electric
3. BRG assy - Race
4. Cover
5. Seal - Dust
6. Flange assy - Companion
7. Nut - Drive pinion
8. Wiring assy - Harness

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Sectional Diagram



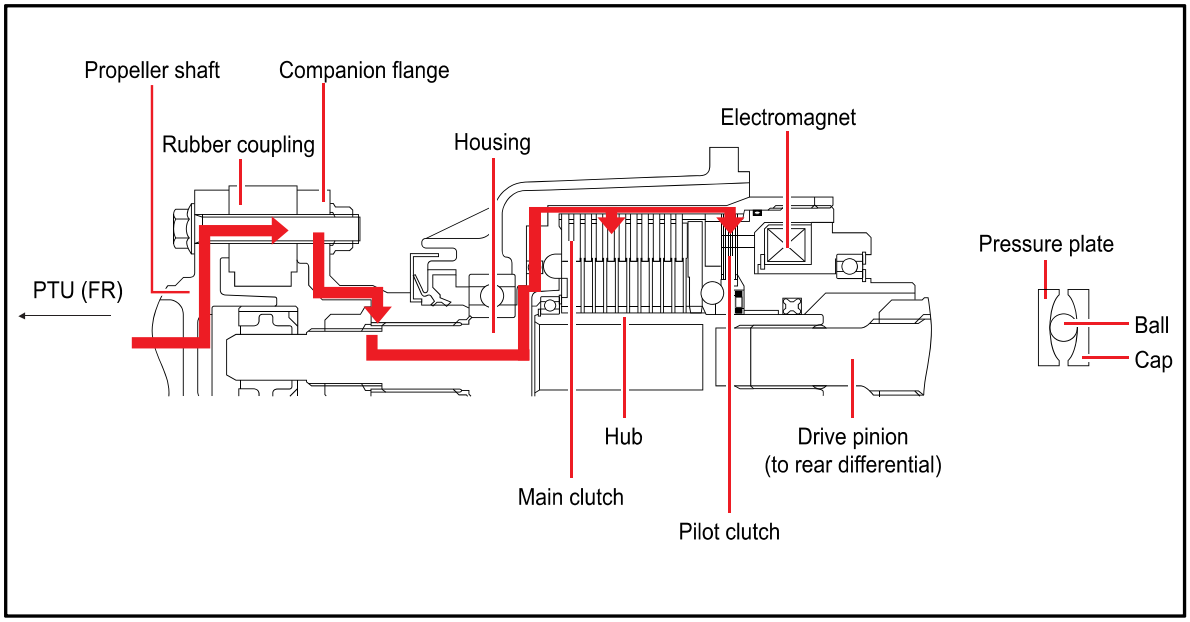
1. Companion flange
2. Housing
3. Main clutch
4. Pressure plate
5. Ball
6. Cam
7. Magnet
8. Drive pinion (to rear differential)
9. X-ring
10. Rotor clutch
11. Pilot clutch
12. Armature
13. Hub
14. Oil
15. Rubber coupling
16. Propeller shaft

- The housing is engaged with propeller shaft through companion flange and rubber coupling and turns with propeller shaft.
- The outer main clutch and the outer pilot clutch are connected to housing and the inner main clutch is connected to hub. The inner pilot clutch is connected to hub through cap, ball and pressure plate.
- E-Coupling is filled with oil.
- The hub is connected to rear axle drive pinion by spline.

Downloaded from www.Manualslib.com manuals search engine

3) Operation

(1) When E-Coupling is not operating (2WD: No current to magnet)

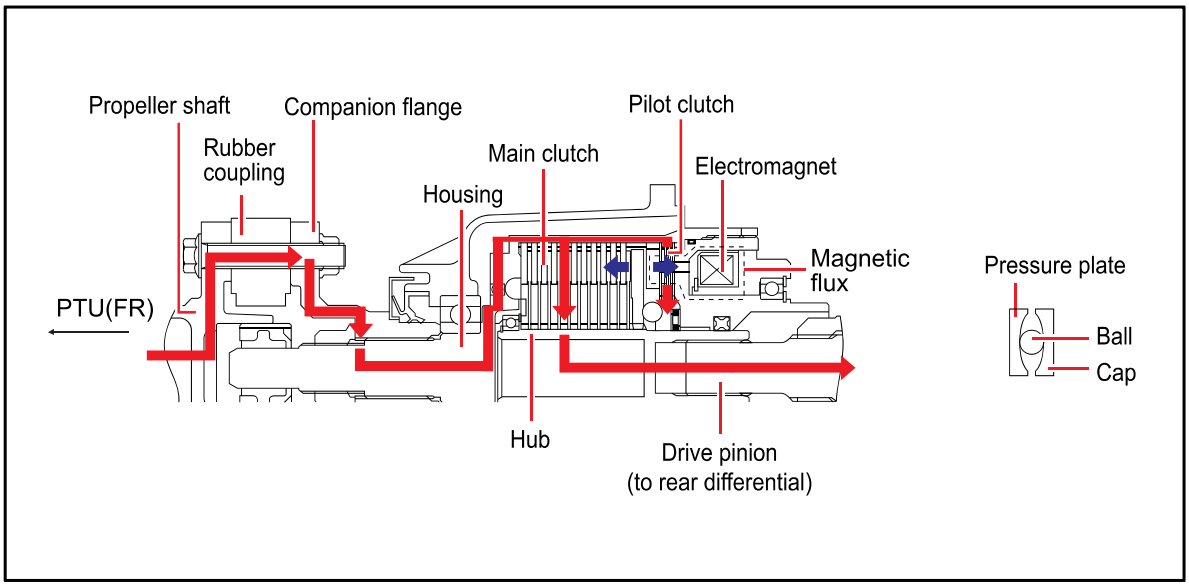


The torque from PTU is transferred to housing through propeller shaft, rubber coupling and companion flange. But, if the current is not supplied to the magnet, the pilot clutch is not engaged and the cam thrust cannot be generates. Thus, the main clutch is not engaged and the torque cannot be transferred to the companion flange.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(2) When E-Coupling is operating (AWD: supplying current to magnet)



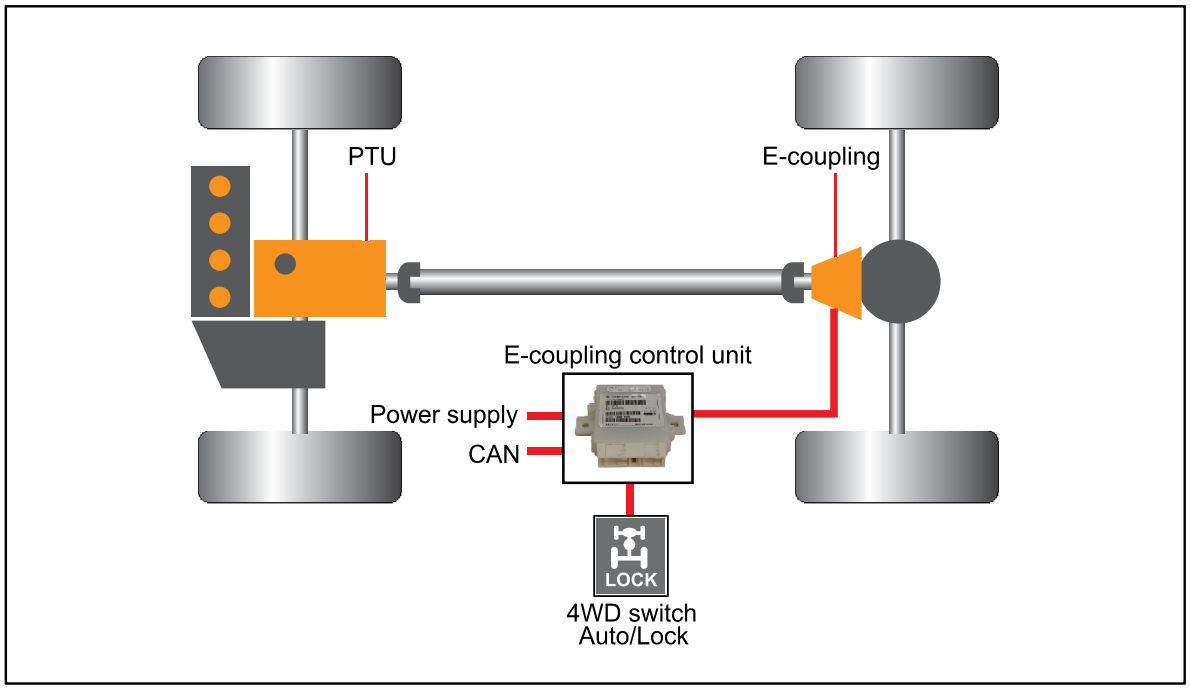
The torque from PTU is transferred to housing through propeller shaft, rubber coupling and companion flange. As soon as the current is supplied to magnet, the magnet flux is generated in rotor clutch, pilot clutch and armature according to the amount of current. The magnetic induction moves the armature and engage the pilot clutch. If there is a speed difference between front axle and rear axle, This also makes the speed difference between cam and pressure plate. This difference rotates and slides the ball on the ramp. According to this, the cam is separated from the pressure plate. Therefore, the pressure plate with cam thrust pushes the main clutch to engage between housing and hub. The driving force is transferred to the rear axle through housing, hub, drive pinion and rear differential in order.

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 3280-17

E-COUPLING CONTROL UNIT

1) System Layout



E-Coupling controls the clutch engagement force by the magnetic coil.
E-Coupling determines the clutch engagement force according to CAN signals (wheel speed, engine torque, pedal position, ABS/ESP signals).

(1) Operating mode

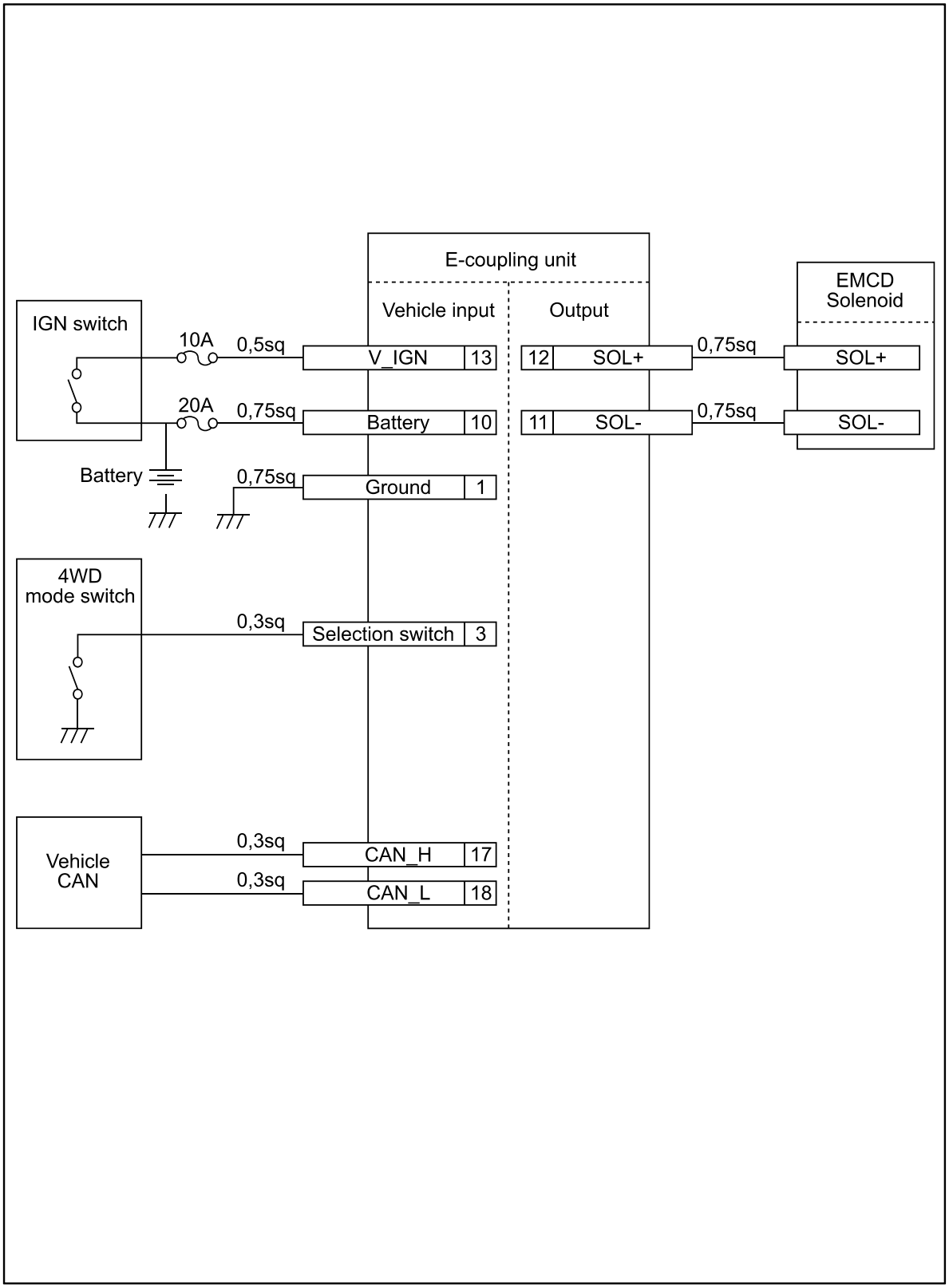
▶ **4WD AUTO/LOCK mode**

- Smart controlling according to steering angle and wheel speed
  In 4WD LOCK mode, if the rear wheel speed exceeds 40 km/h, 4WD LOCK mode is canceled and 4WD AUTO mode is activated (Indicator OFF).
- If the speed is decreased below 35 km/h, 4WD LOCK mode is resumed (Indicator ON again).

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

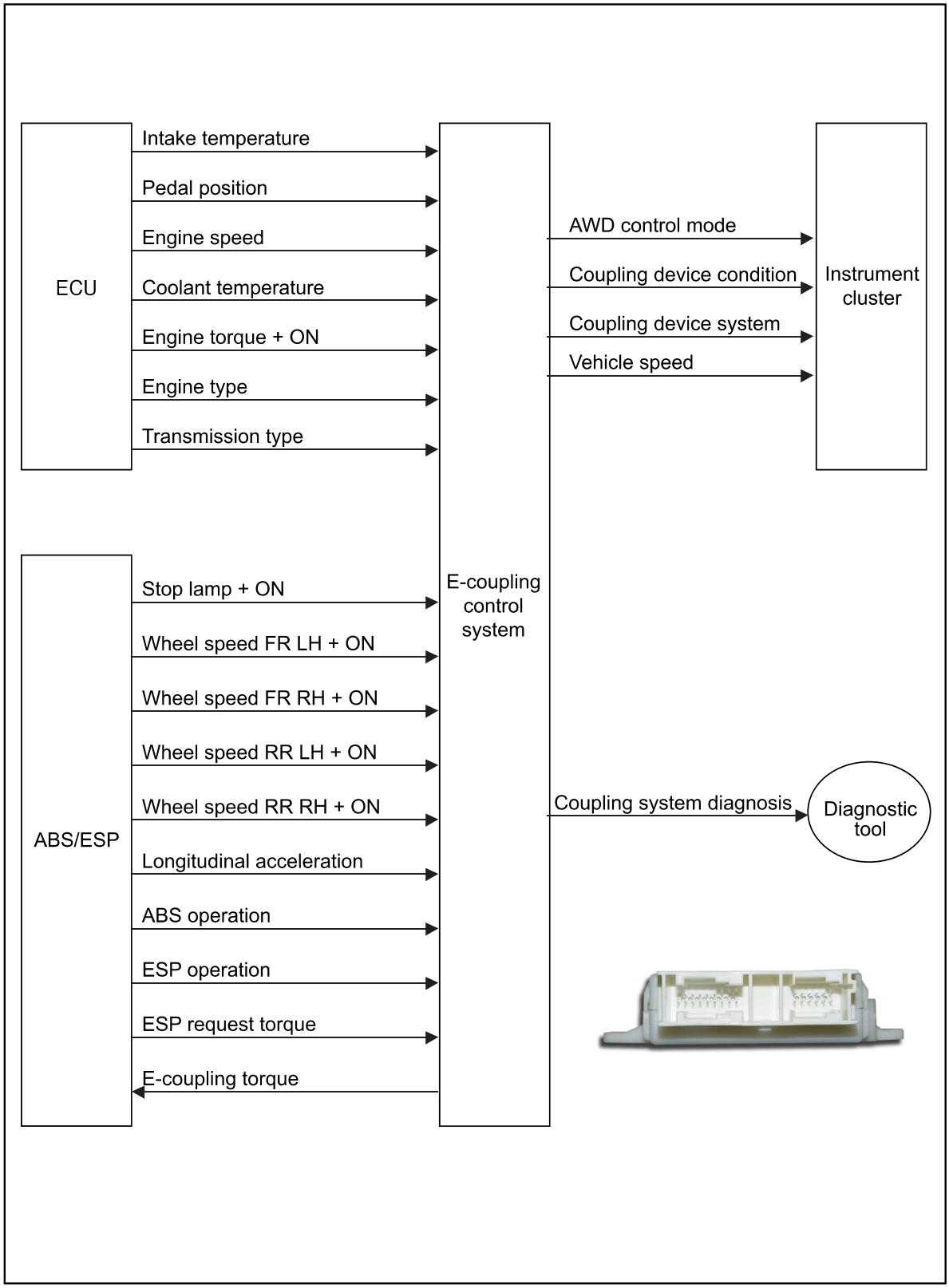
2) Circuit Diagram



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Block Diagram of Input & Output



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4) System Protection for 4WD

(1) Abnormal tire detection function

- If an abnormal tire installed, E-Coupling control unit reduces the torque to rear wheels. In this mode, E-Coupling operates as if it is in 2WD mode.
- E-Coupling control unit recognizes the abnormal tire by calculating the differences in CAN signals from wheel speed sensors.

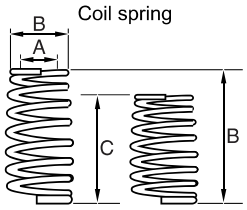
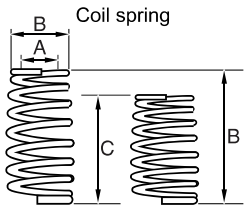
(2) E-Coupling overheat protection function

- When E-Coupling is overheated, E-Coupling control unit reduces the torque to rear wheels. In this mode, E-Coupling operates as if it is in 2WD mode.
- The oil temperature sensor for E-Coupling is not applicable.
- E-Coupling control unit recognizes the overheat condition by temperature characteristics of clutch and coil current.
- E-Coupling control unit monitors the system for 30 minutes to precisely control the torque transferring. To check this period, E-Coupling control unit monitors the engine coolant temperature and the intake air temperature.

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

System	Description		Specification	
Front suspension	Suspension type		Macperson strut type	
	Spring type		Coil spring	
	Stabilizer type		Torsion bar type	
	Shock absorber 	Type	Cylindrical reciprocation type	
		Max. length (extended)	554 mm	
		Min. length (compressed)	372 mm	
	Min. length (compressed) 	Inner diameter (A)	Upper: 84.0 mm Lower: 100.0 mm	
		Outer diameter (B)	163.1 mm	
		Free length (C)	356.1 mm	
		Installed length (D)	276.0 mm	
		Coil windings	5.32 turns	
		Winding direction	Right direction	
Rear suspension	Driving type		AWD	2WD
	Suspension type (trailing, upper, lower & track rod)		Multi-link type	←
	Spring type		Coil spring	←
	Stabilizer type		Torsion bar type	←
	Shock absorber	Type	Cylindrical reciprocation type	←
		Max. length (extended)	551 mm	←
		Min. length (compressed)	361 mm	←
	Coil spring	Diameter (A)	12.8 mm	12.6 mm
		Free length (B)	287.1 mm	291.7 mm
		Coil windings	6.64 turns	6.32
		Winding direction	Right direction	←

Downloaded from www.Manualslib.com manuals search engine

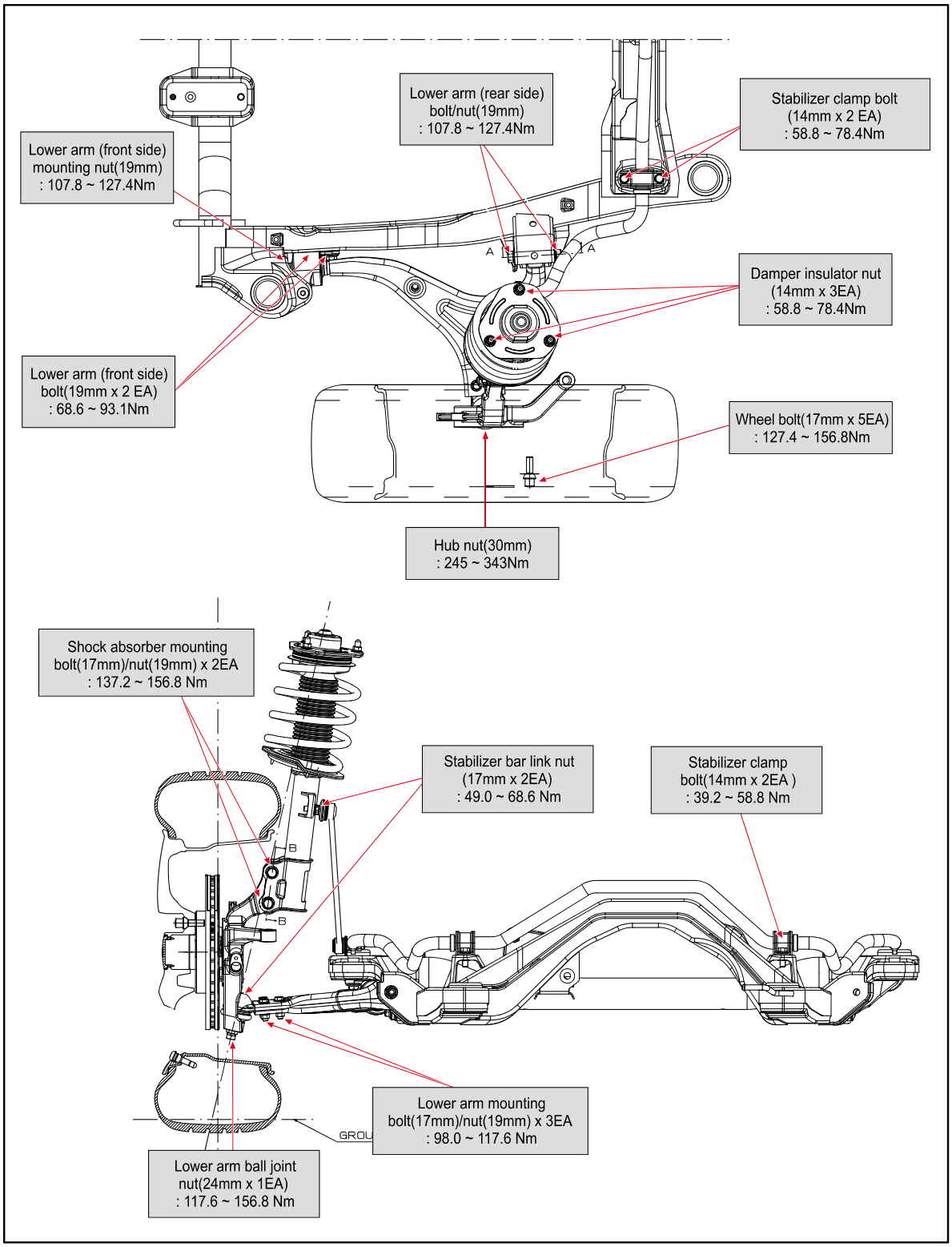
1) Wheel Alignment

System	Description	Specification
Front	Ground clearance (A)	76.8 ± 5 mm
	Trim height : wheel center ↔ Wheel house	433 mm
	Camber (maintenance free)	−0.15 ± 0.5˚
	Caster (maintenance free)	4.8 ± 0.5˚
	Total toe-in	0.0 ± 0.1˚ (adjust by tie rod)
	King pin angle	12.85˚
Rear	Ground clearance (A)	63.3 ± 5 mm
	Trim height : wheel center ↔ Wheel house	437 mm
	Camber (maintenance free)	−0.5 ± 0.5˚ [adjust by cam bolt on upper arm]
	Total toe-in	0.0 ± 0.1˚ [adjust by cam bolt on track rod]

Downloaded from www.Manualslib.com manuals search engine

2. TIGHTENING TORQUE

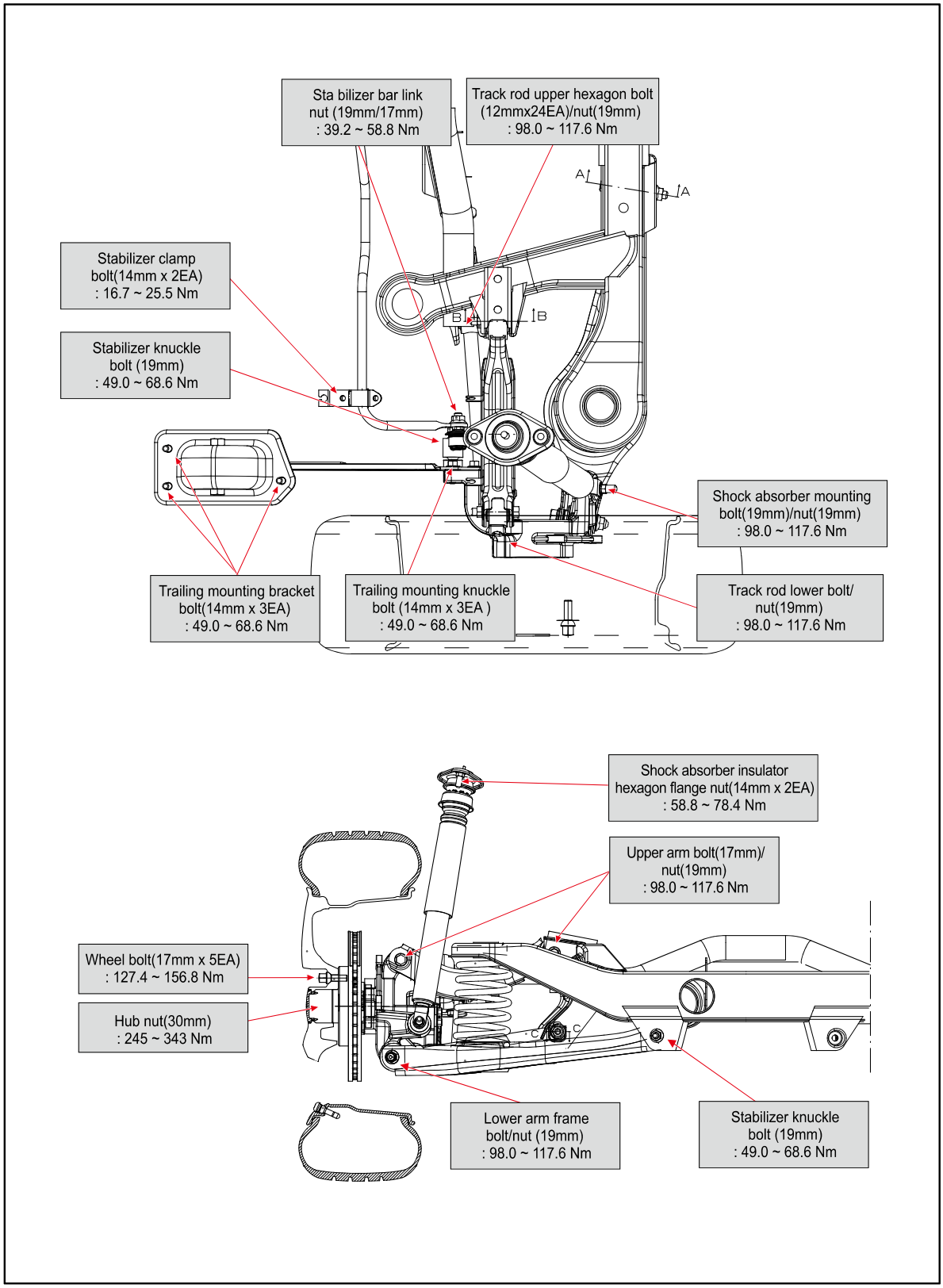
▶ **Front suspension assembly**



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Rear suspension assembly



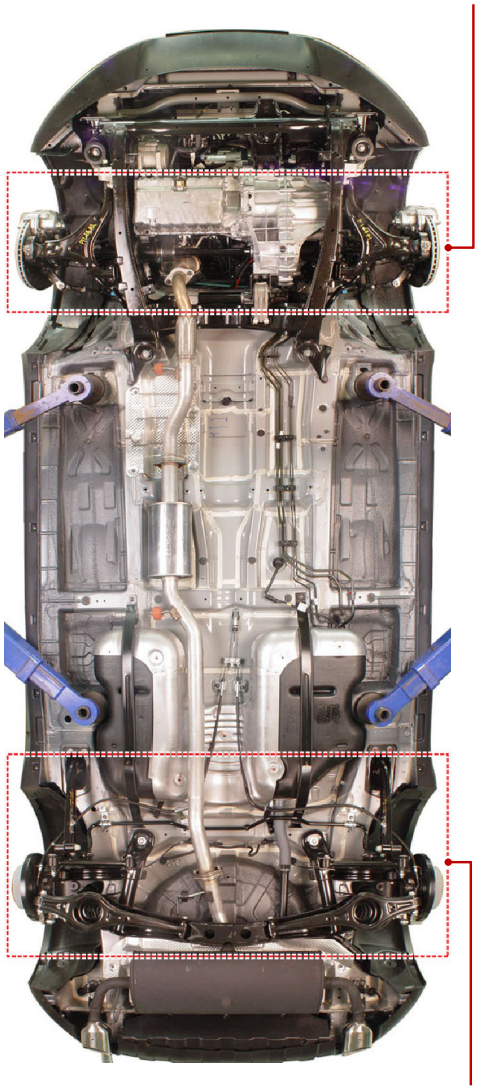
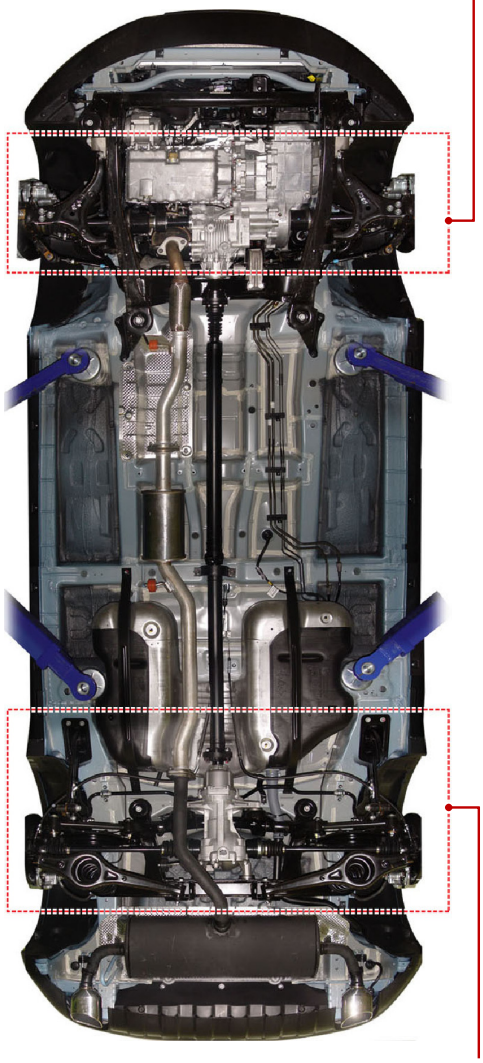
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

The suspension is the device to connect the axle and vehicle. It absorbs the vibrations and impacts from road surface, which enhances the comforts, driving force, braking force and drivability.

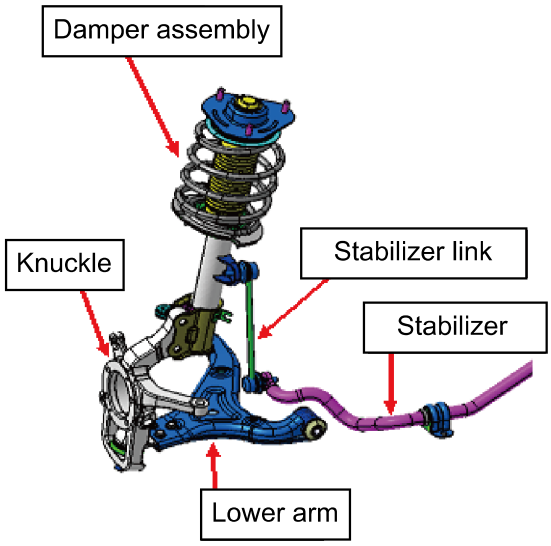
Underview of vehicle with 2WD, 6M/T	Underview of vehicle with 4WD, 6A/T
	

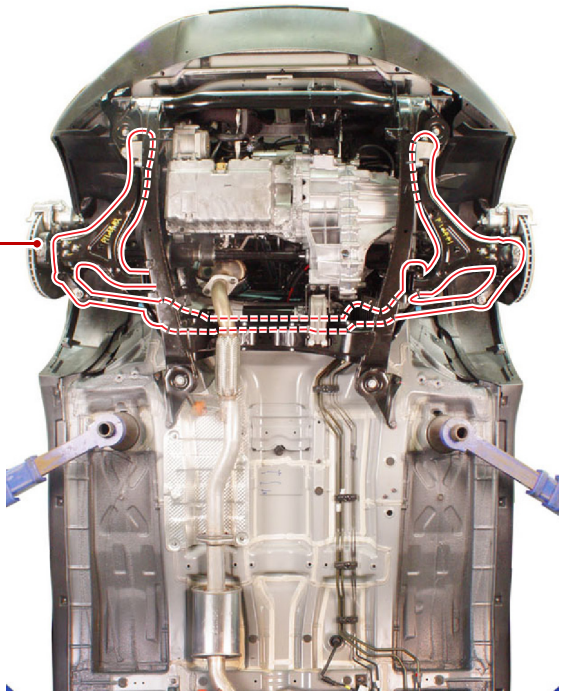
Downloaded from www.Manualslib.com manuals search engine

1) Front Suspension (Macperson Strut Type)

Front suspension supports the vehicle weight and absorber the vibration from tires. And, in this type of suspension, the steering linkage tie rod is mounted on the knuckle.

Macperson strut type suspension





Macperson strut type suspension is the independent suspension which has the spring on the strut integrated with shock absorber. The lower arm is installed on sub frame and large strut damper is installed on the knuckle to support the tire. This type of suspension is normally applied to the vehicle with monocoque body, especially on the front wheel drive type. The upper part with spring is mounted at body mount and the strut with shock absorber is linked on the steering knuckle.

▶ Advantages

1. Compact and simple design
2. Stable wheel alignment
3. Good load distribution and easy installation
4. Less effect from tire up/down movement

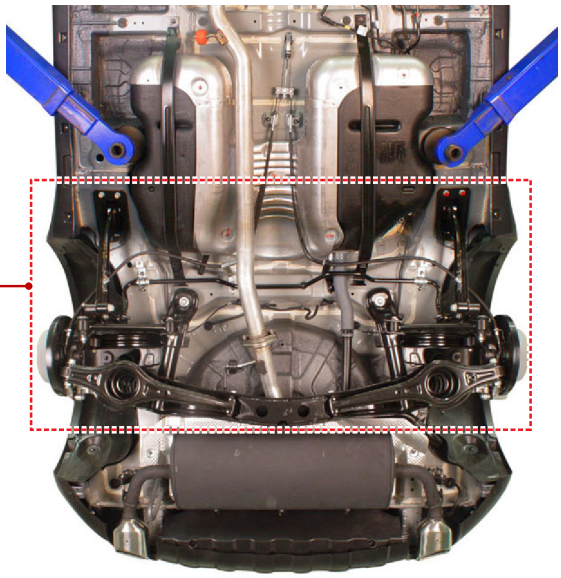
▶ Disadvantages

1. Comparatively weak to the impact from road surface and lateral shock due to long strut and single swing arm

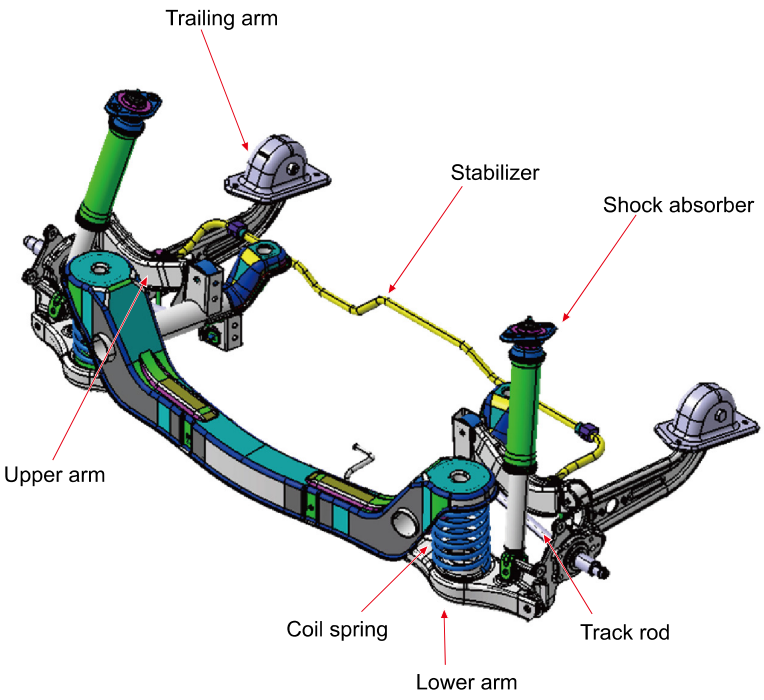
Downloaded from www.Manualslib.com manuals search engine

2) Rear Suspension (Multi-link Type)

Multi-link type suspension is the independent suspension. It provides good ride comfort and drivability by reducing the coil spring weight. Also, it increases the space for passenger compartment by lowering the floor.
This type of suspension consists of multiple links such as trailing arm, upper arm, lower arm and track rod.



Layout



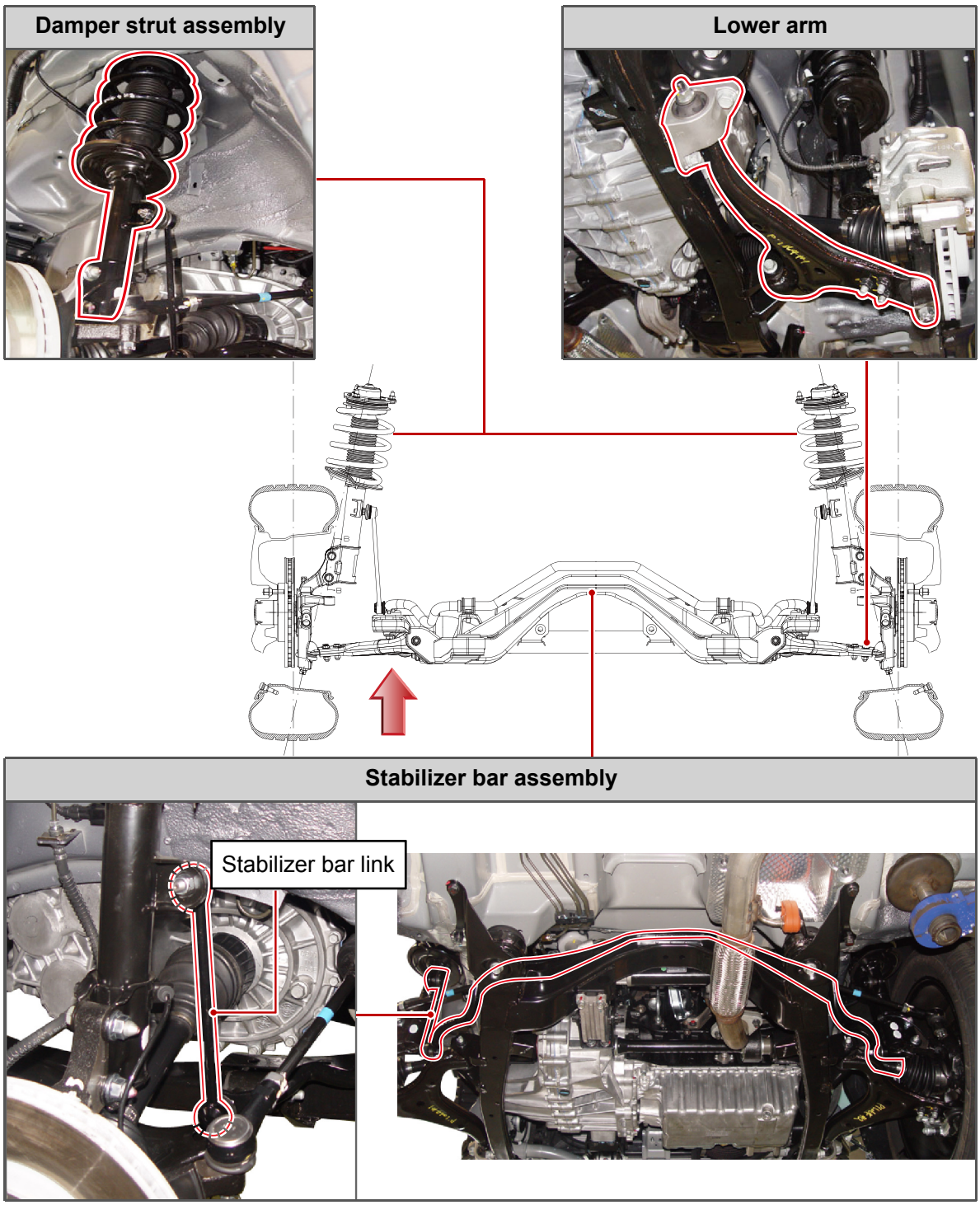
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

COMPONENT

1. SYSTEM LAYOUT

1) Front Suspension

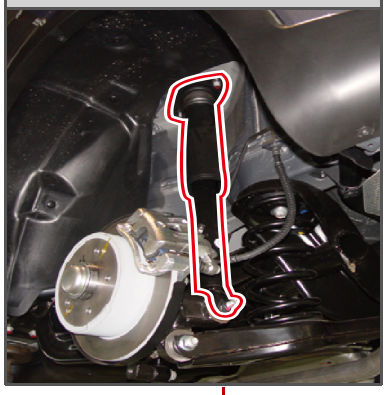


Modification basis	
Application basis	
Affected VIN	

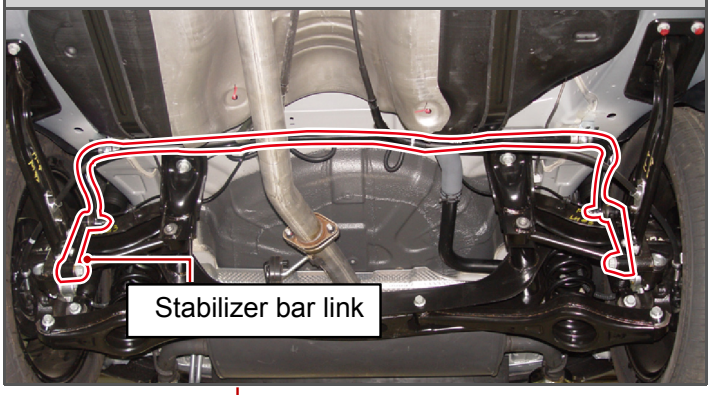
Downloaded from www.Manualslib.com manuals search engine

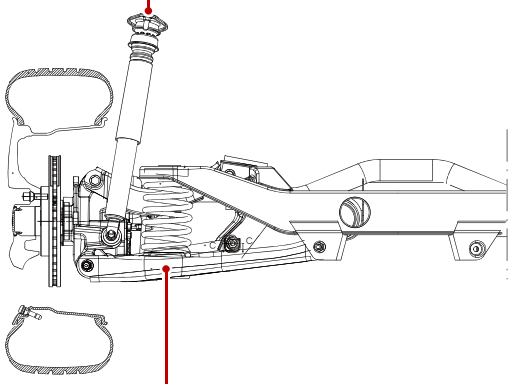
2) Rear Suspension

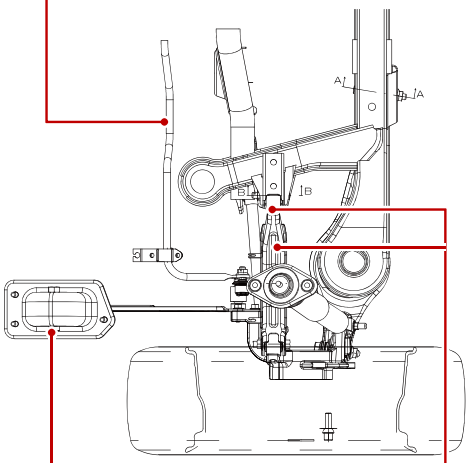
Shock absorber



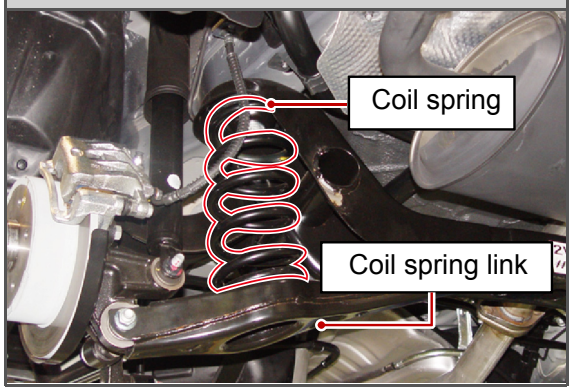
Stabilizer bar assembly



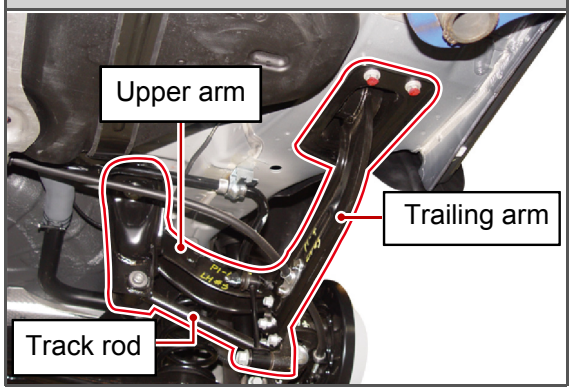




Coil spring and link



Trailing/upper arm/track rod



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

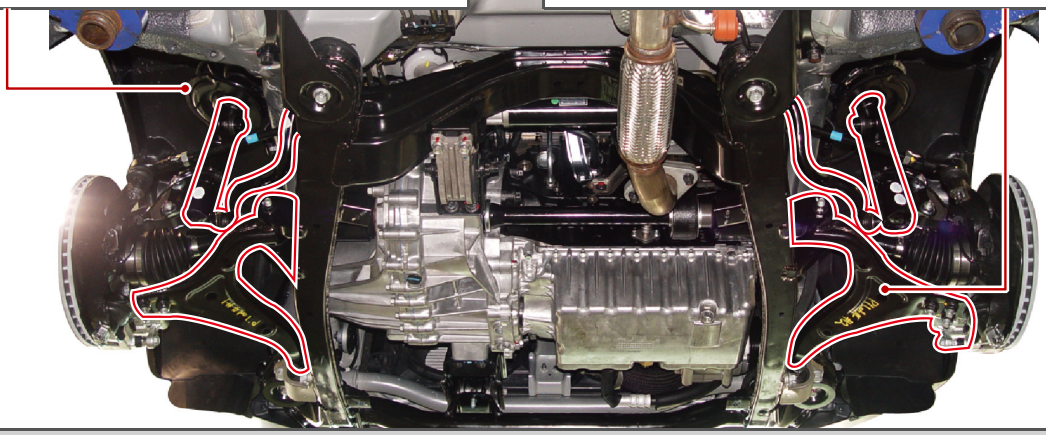
S.G.N. 4410-00 SYSTEM CONFIGURATION

Coil spring

The coil spring is made by winding solid steel rod to form the coil shape. Its energy absorption rate per weight is higher than that of the leaf spring and it allows to absorb small vibration properly resulted in keeping the ride comforts. Therefore, it's difficult to make an effect on vibration damping because there is not any friction between coils.

Lower arm

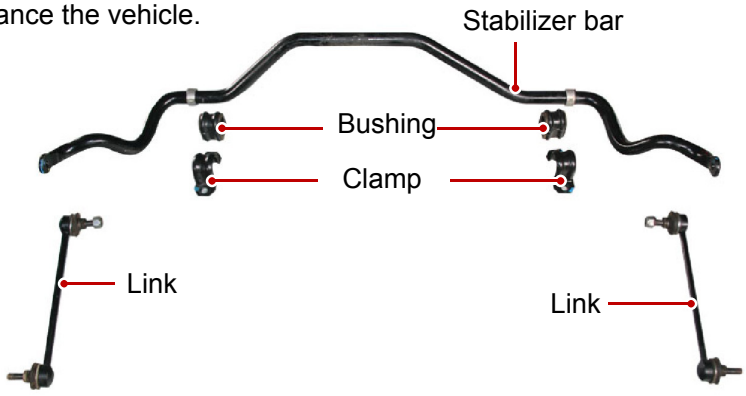
The lower arm relieves the load to knuckle. This enables to absorb the various impacts according to the load shapes and to ensure the drivability.



Stabilizer assembly

If the spring with lower spring constant is applied on the vehicle in order to increase the "ride comforts", the vehicle's slope increases on turning due to the centrifugal force. Because its trend increases for the independent suspension system, the stabilizer bar should be applied to the system in order to make a balance the vehicle.

The stabilizer bar is a certain type of torsion bar. Its both ends are connected to the control arm and the its center area is mounted to the body frame. It is not activated when both wheels are moving up or down simultaneously. However, it minimizes the vehicle's slope when each wheel moves up or down independently.

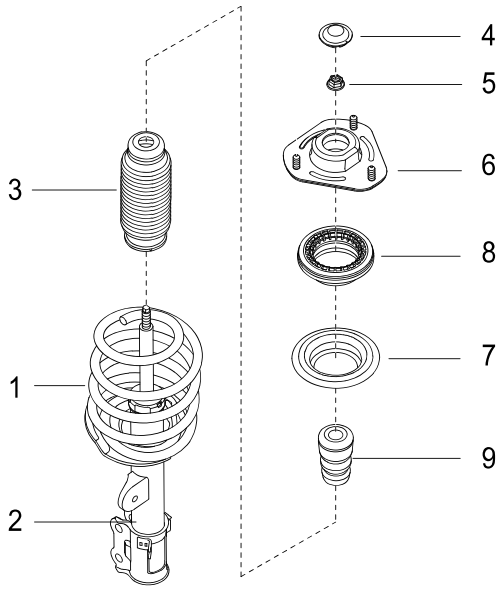


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

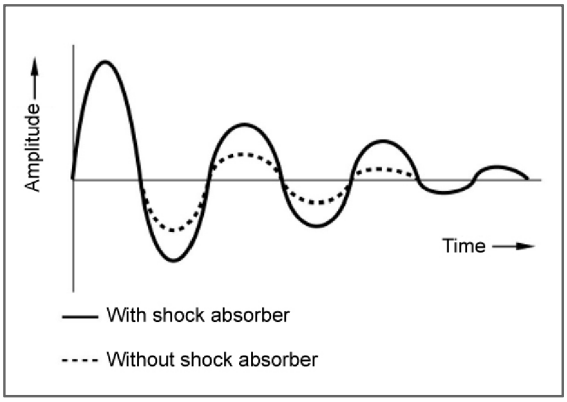
Damper/shock absorber assembly

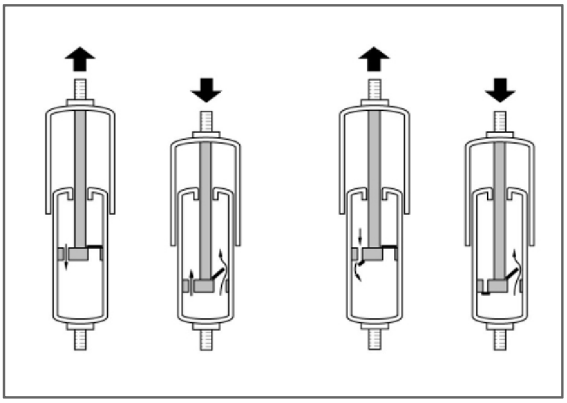
This vehicle uses the strut type shock absorber. This shock absorber is connected to the piston rod in the strut. This relieves the vertical vibrations of vehicle to provide ride comforts, prevents the spring break, enhances drivability, and extends the life span of steering components.



1. Coil spring - FRT
2. Shock absorber MTG FRT
3. Dust cover
4. Cap - Insulator
5. Nut
6. Insulator assy - damper FRT
7. Pad - Spring UPR
8. Bearing - Damper FRT
9. Bumper stopper

- The telescopic shock absorber consists of a tube with piston and rod and a cylinder tube. The piston has an orifice and valve and the cylinder is filled with oil. The double action cylindrical type shock absorber restrains the vibrations by using oil resistance. This provides better drivability even though the structure is complicated. This vehicle uses the gas shock absorber.





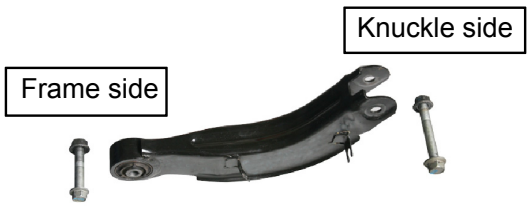
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 4520-00 REAR SUSPENSION

Upper arm

Upper arm is installed between knuckle and sub frame and controls the lateral load and vehicle height.



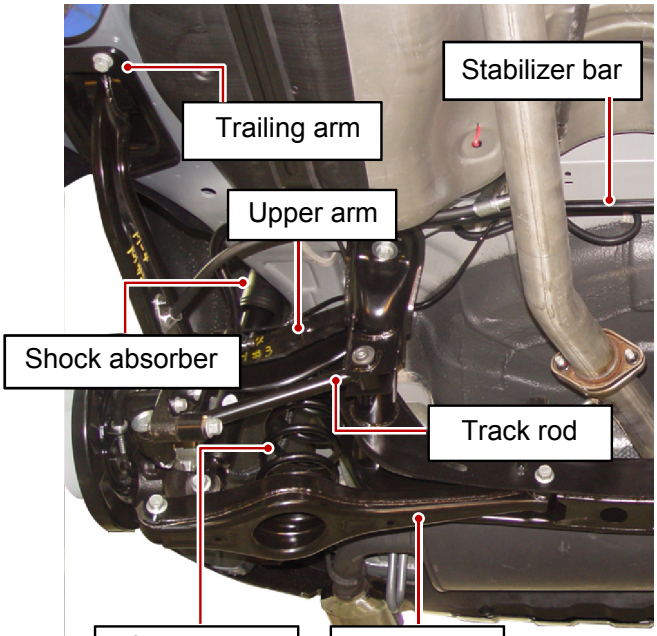
Track rod

Track rod is installed between knuckle and rear sub frame and controls and compensates the lateral load.

Coil spring

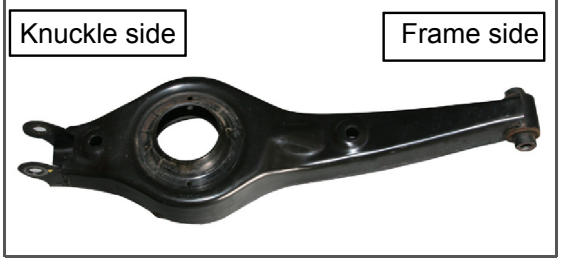
Coil spring is installed between the coil spring link and body frame. It relieves the vibrations and impacts from wheels to vehicle body.

* Symmetry design



Lower arm

Lower arm is installed between knuckle and rear sub frame and relieves the load to coil spring from wheel. In other word, it controls the longitudinal load.

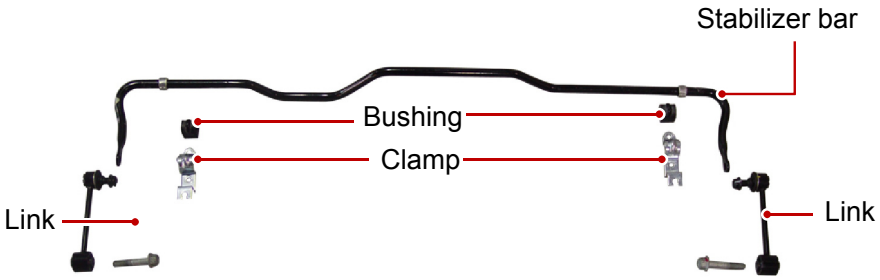


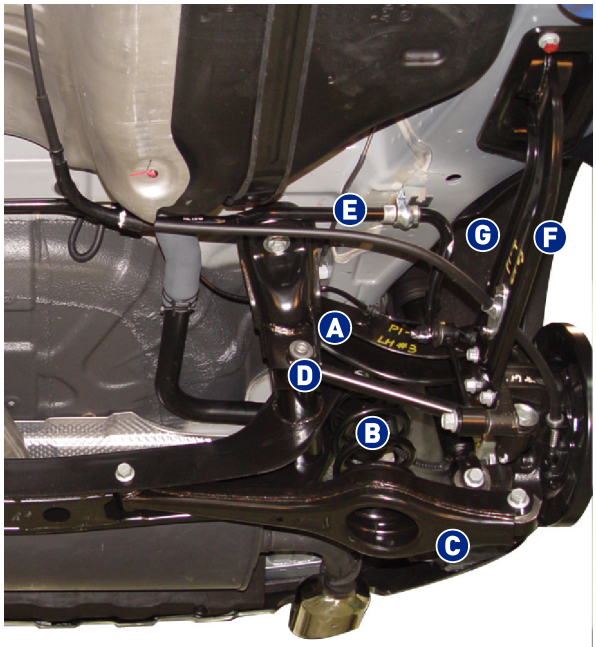
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Stabilizer bar assembly

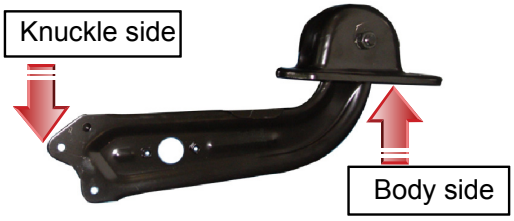
If the spring with lower spring constant is applied on the vehicle in order to increase the 'ride comforts', the vehicle's slope increases on turning due to the centrifugal force. Because its trend increases for the independent suspension system, the stabilizer bar should be applied to the system in order to make a balance the vehicle. The stabilizer bar is a certain type of torsion bar. Its both ends are connected to the control arm and the its center area is mounted to the body frame. It is not activated when both wheels are moving up or down simultaneously. However, it minimizes the vehicle's slope when each wheel moves up or down independently.





Trailing arm

Trailing arm is installed between knuckle and vehicle body and controls the front and rear load.



Shock absorber

Gas shock absorber absorbs the up and down movement of body. It provides the ride comfort and prevent the spring breakage by relieving the fatigue.

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SYSTEM OVERVIEW

1) Terms and Definition

- CBS: Conventional Brake System
- ABS: Anti-Lock Brake System
- EBD: Electronic brake-Force Distribution
- ESP: Electronic Stability Program
- ABD: Automatic Braking Differential
- ASR: Acceleration Slip Regulation
- AYC: Active Yaw Control (Understeer and Oversteer Control)
- HBA: Hydraulic Brake Assistant
- ARP: Active Rollover Protection
- HSA: Hill Start Assistant

2) Functions

<table>
<tr><th>Function</th><th>Vehicle with CBS</th><th>Vehicle with ABS/EBD</th><th>Vehicle with ESP</th></tr>
<tr><td>ABS</td><td rowspan="8">Not applied</td><td>Applied</td><td rowspan="8">Applied</td></tr>
<tr><td>EBD</td><td>Applied</td></tr>
<tr><td>ABD</td><td rowspan="7">Not applied</td></tr>
<tr><td>ASR</td></tr>
<tr><td>AYC</td></tr>
<tr><td>HBA</td></tr>
<tr><td>ARP</td></tr>
<tr><td>HSA</td></tr>
</table>

Downloaded from www.Manualslib.com manuals search engine

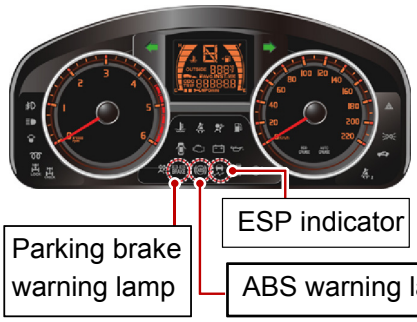
3) Parts Arrangement

Part name	Vehicle with CBS	Vehicle with ABS/EBD	Vehicle with ESP
HECU	Not applied	Applied	Applied
Front wheel speed sensor			
Rear wheel speed sensor			
ABS warning lamp			
EBD indicator			
Longitudinal G sensor		2WD: N/A, 4WD: Applied	Not applied
Sensor cluster (Yaw rate sensor, lateral/longitudinal G sensor)		Not applied	Applied
ESP indicator			
ESP OFF switch and warning lamp			
Steering wheel angle sensor			

Downloaded from www.Manualslib.com manuals search engine

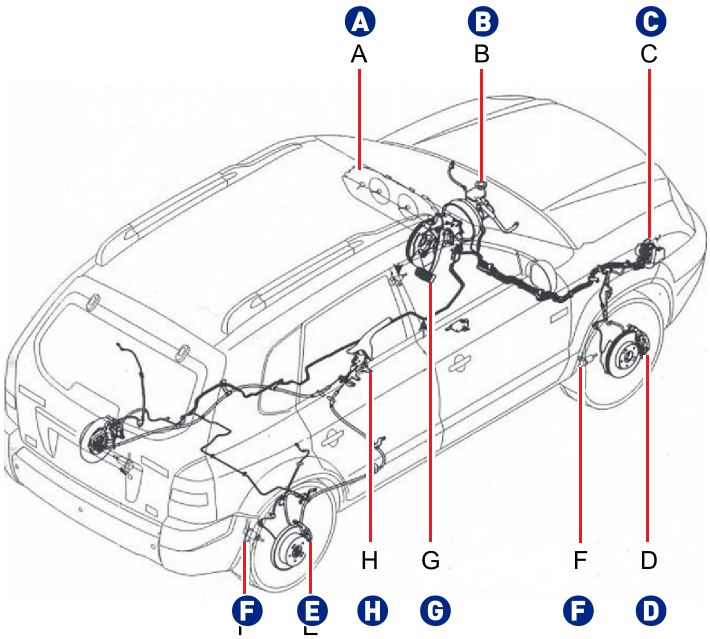
4) Component

A. Meter cluster-ABS, EBD, ESP indicator/warning lamp

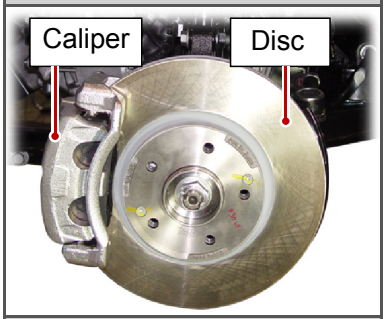


B. Master cylinder and booster

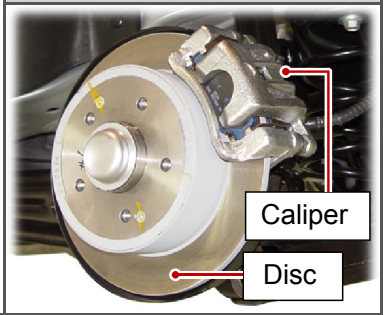
C. HECU



D. Front brake assembly



E. Rear brake assembly



F. Front/rear wheel speed sensor

Front/rear-4WD

Rear-2WD

G. Brake pedal

H. Parking brake

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. SPECIFICATION

Unit	Description	Specification
Front brake	Type	Ventilated disc
	Outer diameter of disc	Ø298 mm
	Inner diameter of caliper cylinder	Ø43.0 x 2 mm
	Thickness of disc	26 mm (wear limit: 24 mm)
	Thickness of brake pad	10.5 mm (wear limit: 2 mm)
	Pad wear indicator	Mechanical type
Rear brake	Type	Solid disc
	Outer diameter of disc	2WD: Ø262 mm, 4WD: Ø284 mm
	Thickness of disc	10 mm (wear limit: 8.4 mm)
	Thickness of brake pad	10 mm (wear limit: 2 mm)
	Pad wear indicator	Mechanical type
Brake booster	Type	Vacuum assist type
	Size	8" + 9" (Tandem)
Master cylinder	Type	Tandem (level sensor installed)
	Inner diameter of cylinder	Ø25.4 mm
Brake pedal	Maximum operating stroke	140 ± 3 mm
	Pedal ratio	3.8 : 1
	Free play	3 to 10 mm
Parking brake	Type	Mechanically expanded rear lining
	Operating type	Hand operated type
	Inner diameter of drum	2WD: Ø168 mm, 4WD: Ø190 mm
Brake oil	Specification	DOT 4
	Capacity	0.7 to 0.8 liters

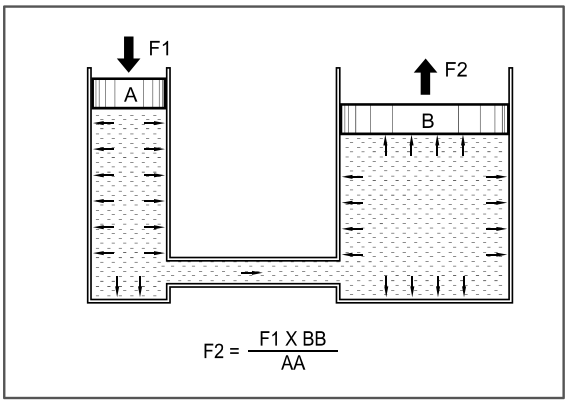
Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

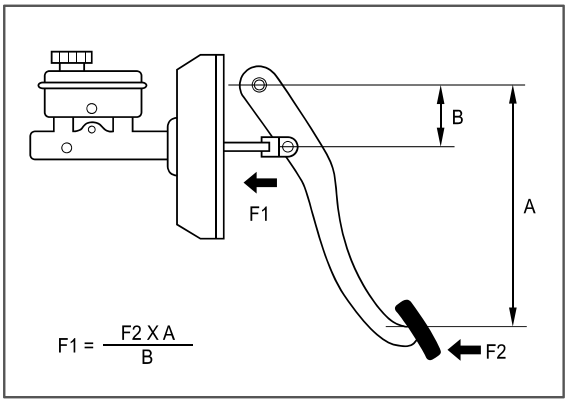
Even though a driver cuts off the power, while driving, the vehicle continues to move due to the law of inertia. Therefore, a braking device is needed to stop the vehicle. The brake system normally uses the frictional discs that converts the kinetic energy to the thermal energy by frictional operation. The brake system consists of the brake disc (front wheel), brake disc or drum (rear wheel), parking brake (mechanical type), master cylinder, booster, pedal and supply lines (pipes and hoses).

▶ Hydraulic brake



This system uses the leverage effect and Pascal's principle. When depressing the brake pedal, the pedal pressure is increased by booster and is delivered to master cylinder to generate hydraulic pressure. The hydraulic pressure generated by the master cylinder is delivered to the brake caliper through the brake pipes or hoses. This hydraulic pressure pushes the brake calipers, accordingly the caliper pads are contacted to brake disc to generate the braking force.

▶ Brake pedal

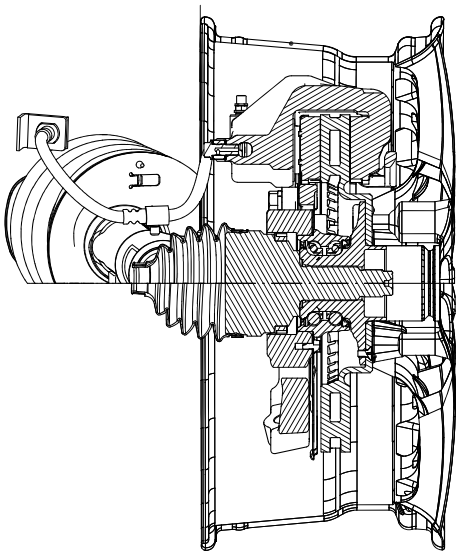


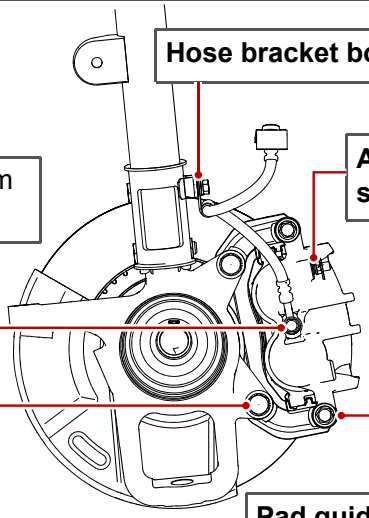
Brake pedal uses the leverage effect to apply bigger force to the brake master cylinder.

Downloaded from www.Manualslib.com manuals search engine

2. SECTIONAL DIAGRAM

▶ **Front disc brake**



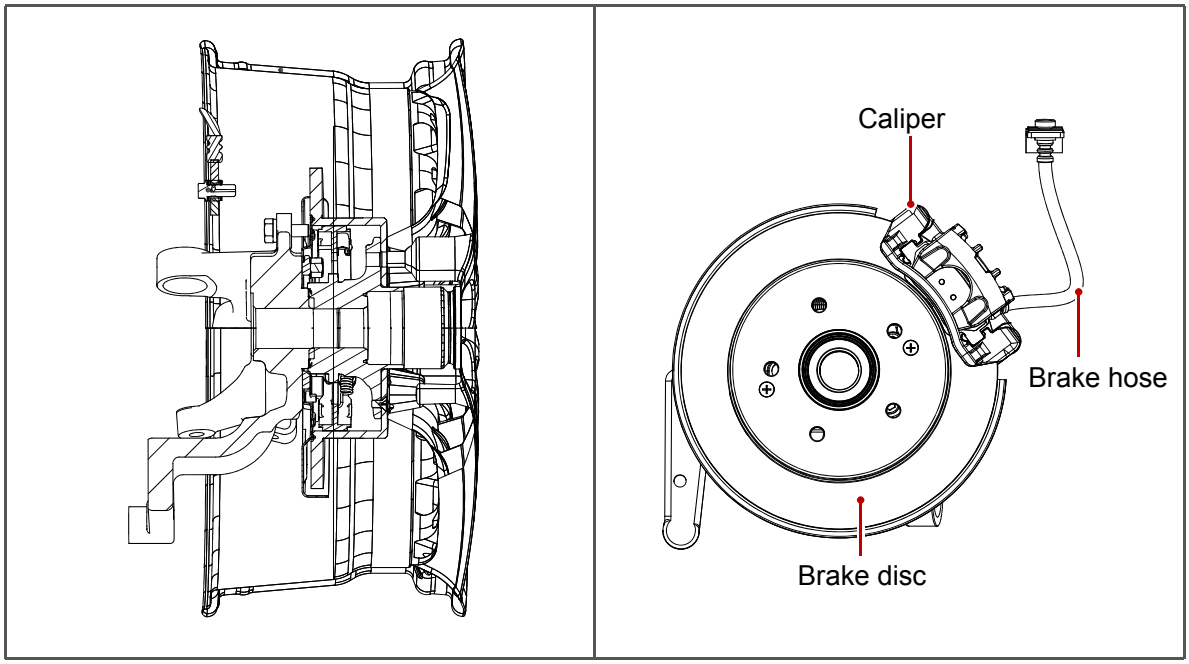


Hose bracket bolt	9.8 to 12.8 Nm
Air bleeder screw	8.8 to 10.8 Nm
Brake hose bolt	19.6 to 29.4 Nm
Pad guide bolt	25.5 to 30.4 Nm
Caliper mounting bolt	83.3 to 102.9 Nm

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Rear disc brake

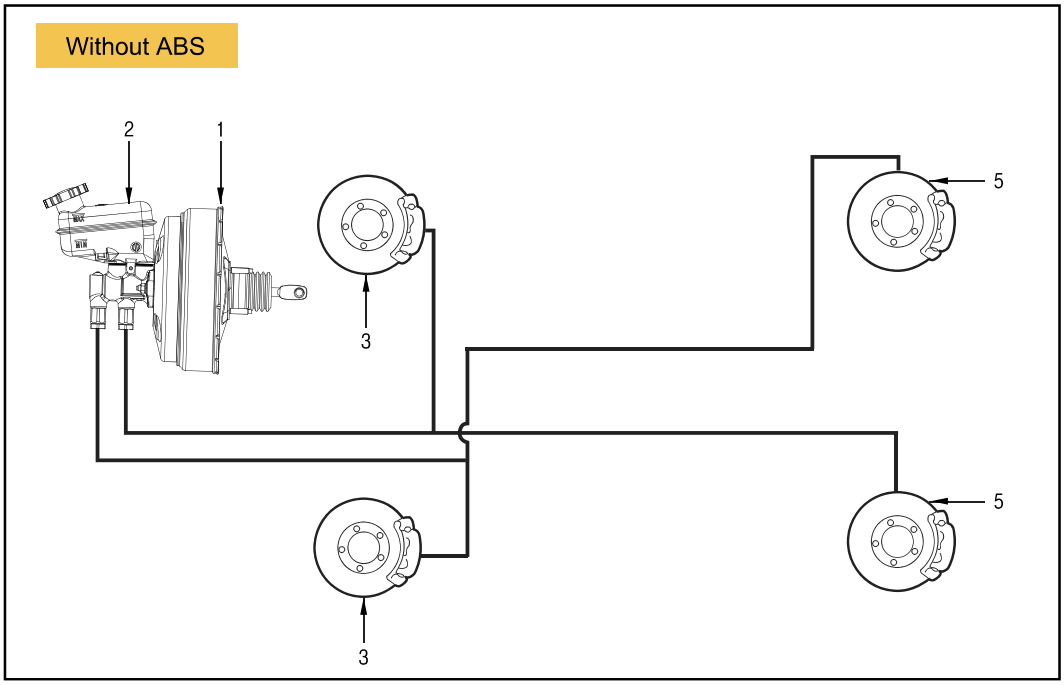


Downloaded from www.Manualslib.com manuals search engine

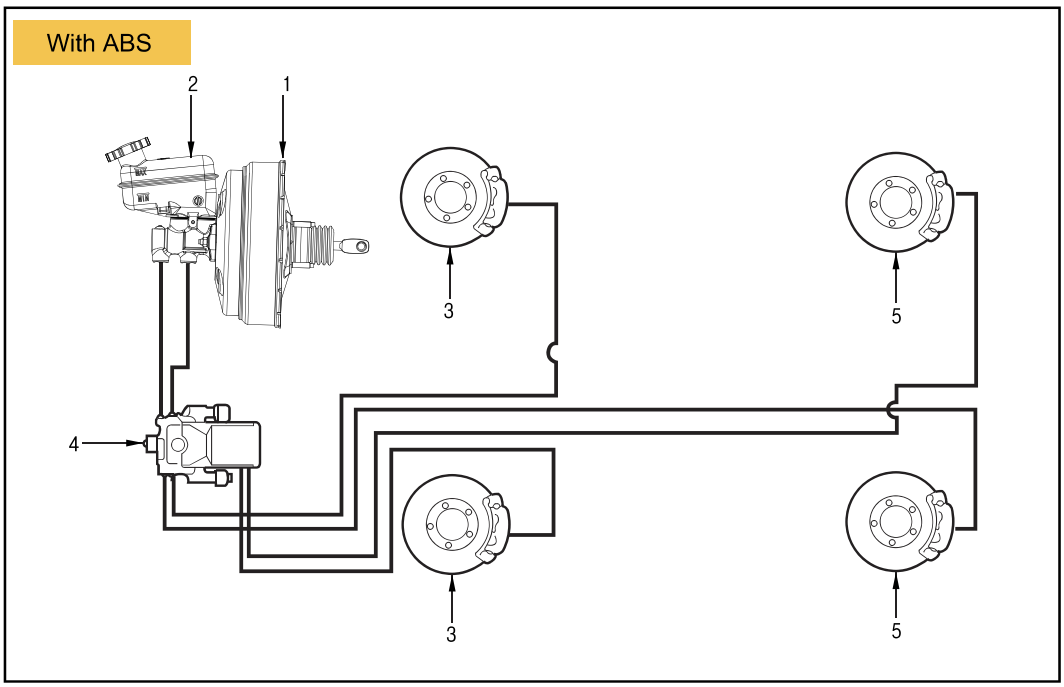
3. SYSTEM LAYOUT

▶ **Hydraulic line**

Without ABS



With ABS

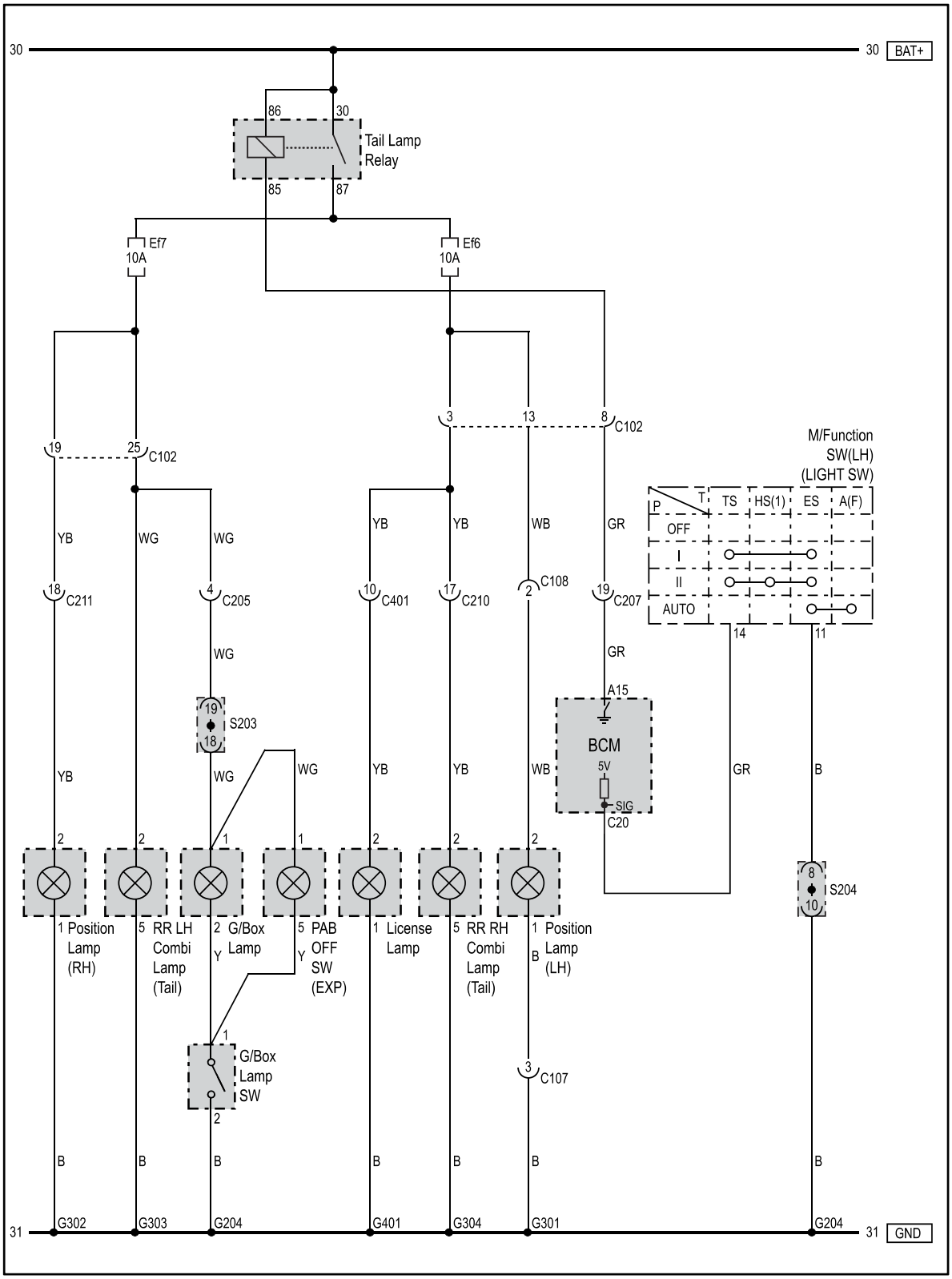


1. Brake booster
2. Brake reservoir and master cylinder
3. Front disc brake and caliper
4. HECU (Hydraulic & Electric Control Unit)
5. Rear disc brake and caliper

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4. CIRCUIT DIAGRAM OF STOP LAMP



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

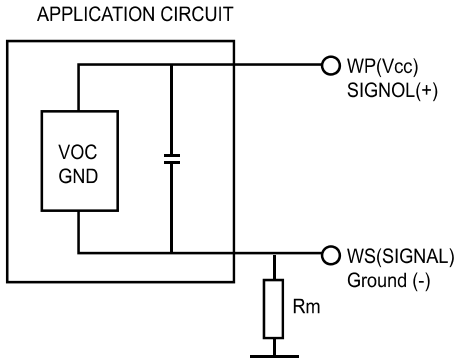
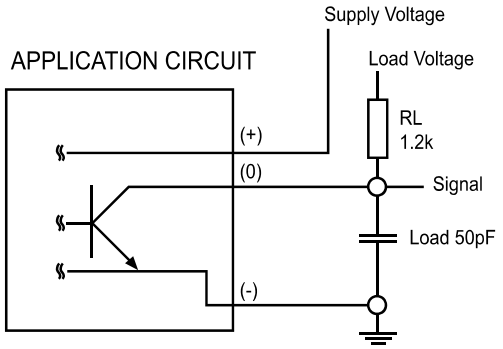
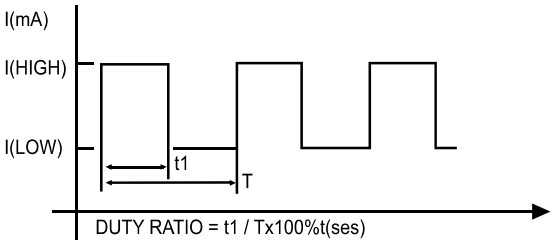
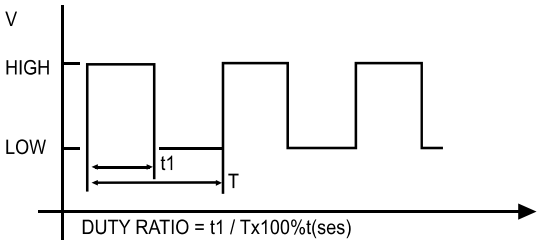
GENERAL INFORMATION

1. SPECIFICATION

Unit	Description	Specification	
		ABS	**ESP**
HECU	Clock frequency	25 MHz	40 MHz
	Memory	128 KB	512 KB
	Switch	Orifice	Orifice
Wheel speed sensor		**ABS / ESP**	**CBS**
	Operating temperature	− 40°C to 150°C	− 40°C to 150°C
		− 40°C to 115°C	− 40°C to 115°C
	Operating frequency	1 to 2,500 Hz	1 to 8,000 Hz
	Operating voltage	4.5 to 20 V	3.3 to 18 V
G-sensor		**ABS**	**CBS / ESP**
	Operating voltage	4.75 to 5.25 V	N/A
	Operating temperature	− 30°C to 85°C	
	Operating range	-1.5 to 1.5 g	
	Output voltage	0.5 to 4.5 V	

Downloaded from www.Manualslib.com manuals search engine

▶ Circuit diagram of wheel speed sensor

ABS / ESP	CBS
	
	

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

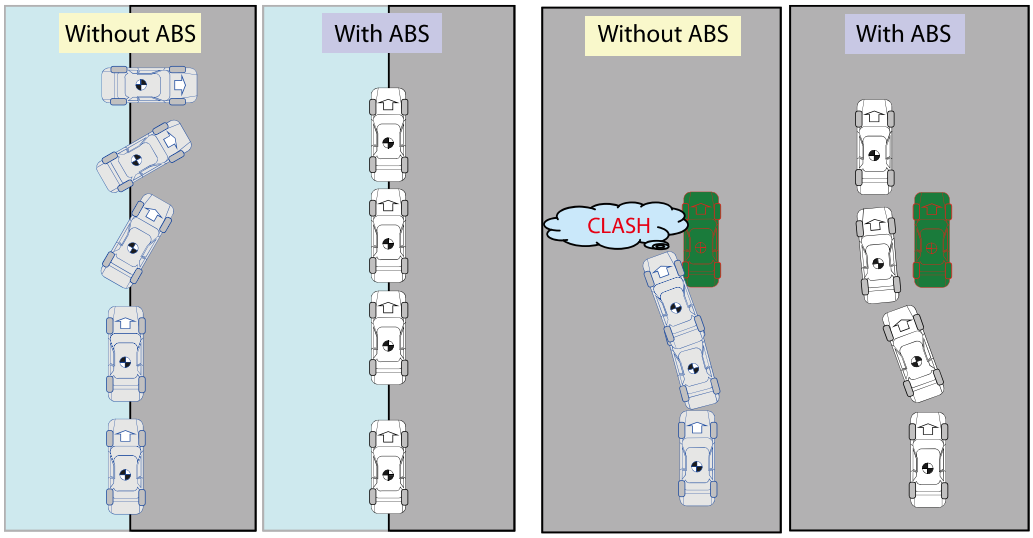
OVERVIEW AND OPERATING PROCESS

1. SYSTEM OVERVIEW

1) What is ABS?

When braking suddenly or braking on slippery roads, the vehicle keeps moving forward but the wheels are locking and not rotating. If these happen, the vehicle may lose stability or rotate resulting in an accident. ABS helps to maintain directional stability and control of the vehicle. ABS is designed to secure more safety and increase the control of steering wheel during emergency braking situation. But, ABS does not guarantee perfect safety beyond its physical limit. ABS in this vehicle contains EBD function. In normal driving conditions, the brake system operates without ABS function.

▶ **ABS effect according to braking conditions**



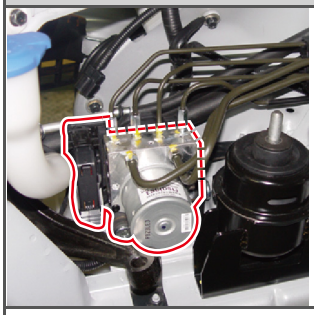
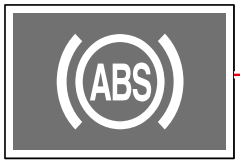
Braking on split road **Maneuvering while braking**

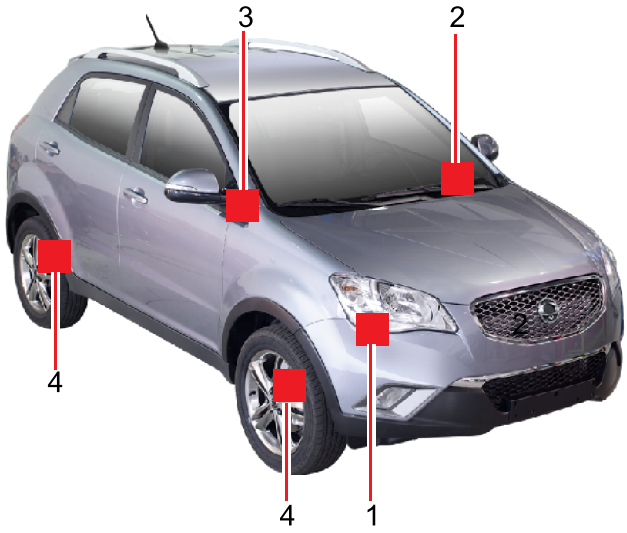
2) What is EBD (Electronic Brake-force Distribution)?

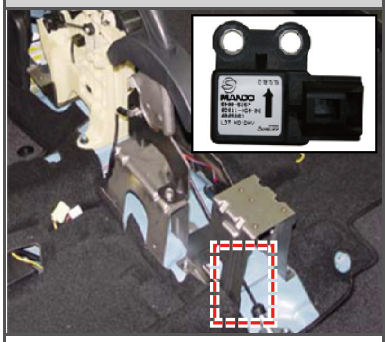
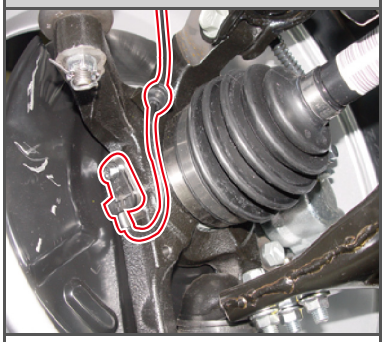
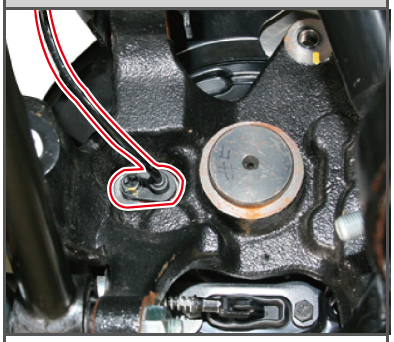
EBD is an automobile brake technology that automatically varies the amount of force applied to each of a vehicle's brakes, based on road conditions, speed, loading, etc. Always coupled with anti-lock braking systems, EBD can apply more or less braking pressure to each wheel in order to maximize stopping power whilst maintaining vehicular control. EBD does not operate when ABS is working.

Downloaded from www.Manualslib.com manuals search engine

2. COMPONENT

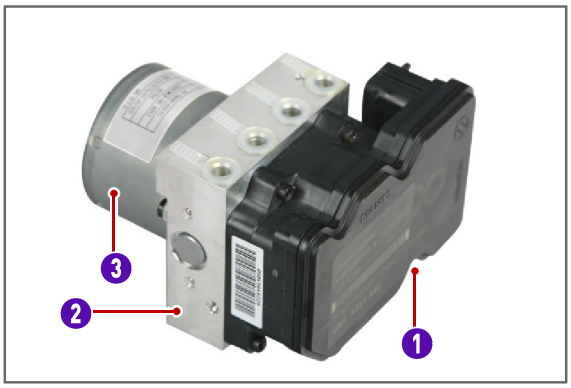
1. ABS hydraulic device and control unit	2. ABS warning lamp
 Located under the power steering fluid reservoir and contains the pressure sensor.	



3. G-sensor (for 4WD)	4. Wheel speed sensor (for 4WD)	4. Rear wheel speed sensor (for 2WD)
 Located on the floor under parking brake bracket in center console.	 Located on knuckle. The appearance of front sensor is same with rear sensor.	 Located on knuckle. The appearance is different from that for 4WD.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine



▶ HECU

1. ECU (Electronic Control Unit)

ECU calculates the wheel speed, acceleration and deceleration with the information from wheel speed sensor, and determines the wheel slip to control the valve and motor.

2. HU (Hydraulic Unit)

The hydraulic circuit contains the primary circuit and secondary circuit for ABS operation. This unit controls the hydraulic pressure to each wheel. If the system needs ABS operation, the valves in the unit operate to control HOLD, RISE and DUMP according to ECU control logic.

3. Motor

The motor is operated when ABS is activated. The cam-shaped output shaft of the motor enables the brake system to receive and supply the brake fluid during the motor operation.

4WD/2WD- Front wheel speed sensor	2WD- Rear wheel speed sensor

▶ Wheel speed sensor

Wheel speed sensor sends the data detected by tone wheel to HECU.

Downloaded from www.Manualslib.com manuals search engine

G-sensor

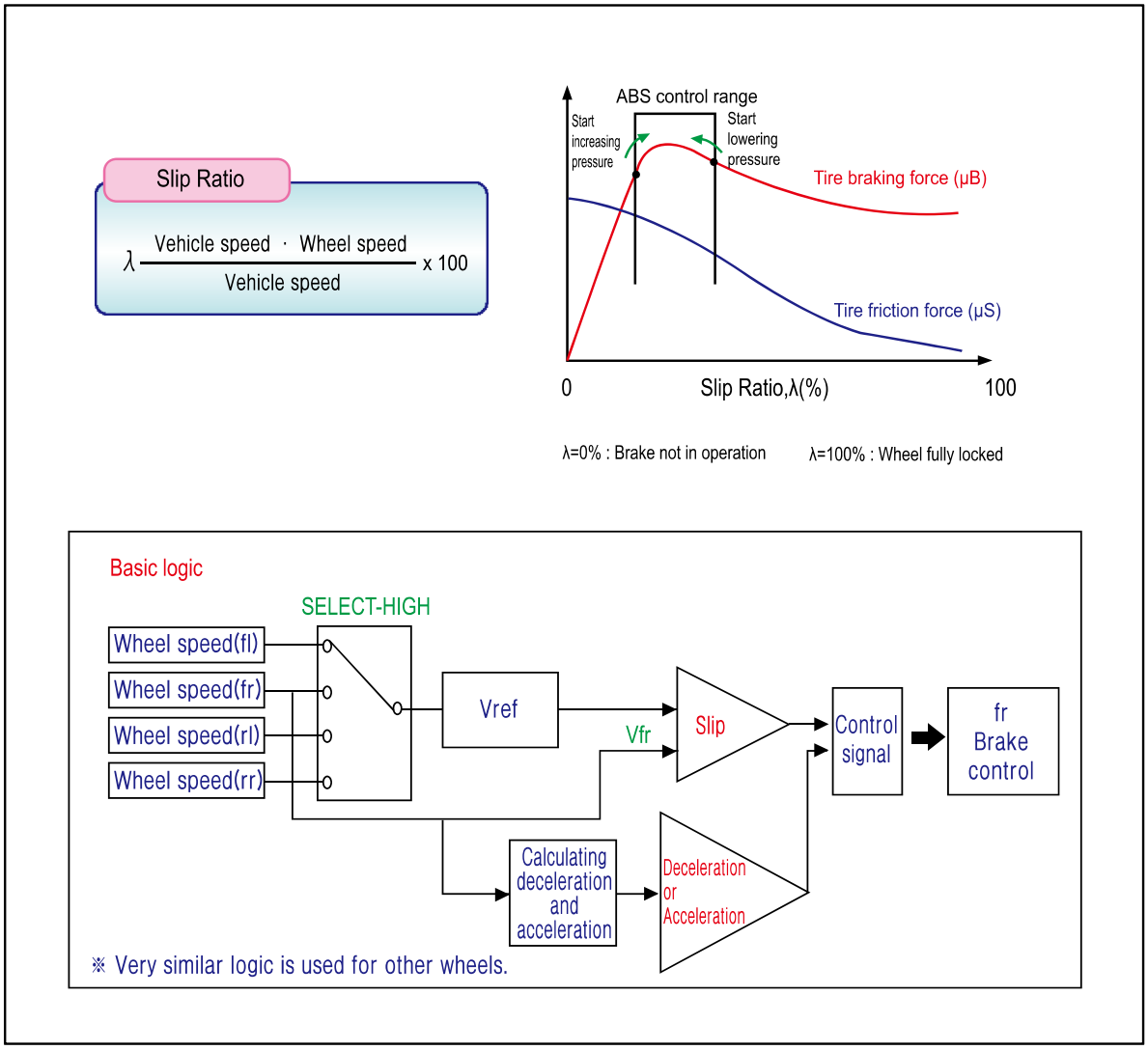
▶ G-sensor (only for 4WD)

For the vehicle with the ABS, a speed difference between the wheels is not noticeable as all the wheels are slipping during abrupt braking. Therefore, the vehicle needs the speed information from other sensors other than the wheel speed sensor. On the 2WD vehicle, there is not large difference between the vehicle speed reduction and actual wheel speed reduction in the event of braking since the driving wheels are in the front. So, the ABS HECU can control the vehicle, based on a calculation value. But, on the 4WD vehicle, if a speed reduction occurs in the front or rear of the vehicle, it affects the other side wheel. In other words, braking the rear wheels induces also a large speed reduction in the front wheels. The longitudinal acceleration sensor is used for this case. It controls the ABS by using the signals from the sensor during abrupt braking and acceleration.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. ABS CONTROL LOGIC



The principal ABS control logic is the determination of the reference speed by choosing one wheel meeting a certain condition, while sensing the speed information from 4 wheel speed sensors when the vehicle is being driven.
For example, when the comparison of the reference speed with front right wheel speed shows a slip, the control signal is determined according to whether it's deceleration or acceleration. If the control conditions are met, the brake for the front right wheel will be got under control.

Downloaded from www.Manualslib.com manuals search engine

4. WARNING LAMPS

1. ABS warning lamp
2. Brake warning lamp

1) ABS Warning Lamp

ABS warning lamp module indicates the self diagnosis and malfunction.
ABS warning lamp ON:

1. When turning the ignition switch to ON position, ABS warning lamp comes on for 3 seconds for self diagnosis and goes off if the system is OK (initialization mode).
2. When the system is defective, the warning lamp comes on.
3. When disengaging the connector, the warning lamp comes on.
4. ABS is not available during lamp ON. In this condition, Only normal brake system without ABS function is available.
5. When the communication between warning lamp CAN module in meter cluster, the warning lamp comes on.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) EBD (Electronic Brake-force Distribution) Warning Lamp (Brake Warning Lamp)

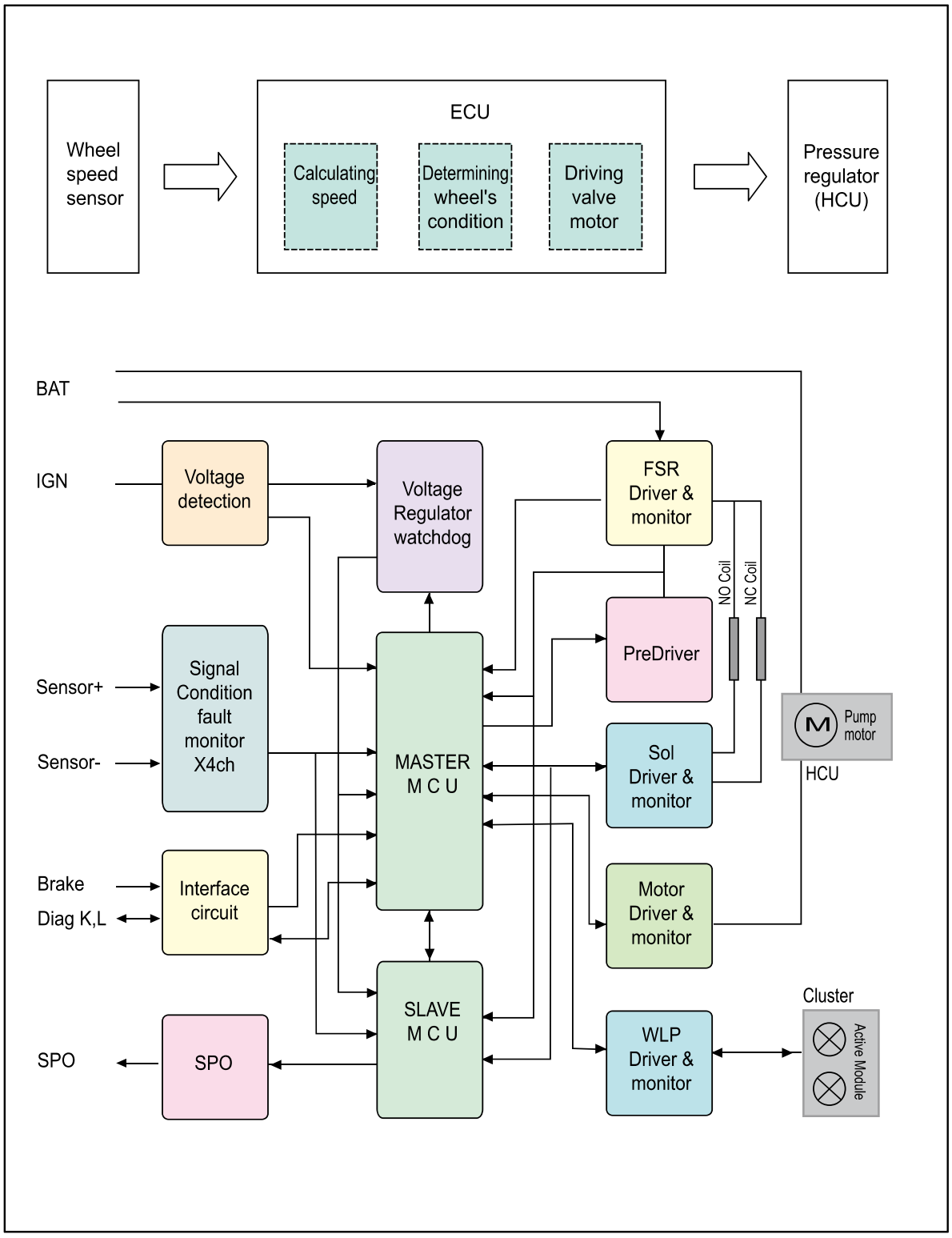
EBD warning lamp when the system performs the self diagnosis and when it detects the malfunction of EBD system. However, the brake warning lamp comes on regardless of EBD when the parking brake is applied.
EBD warning lamp ON:

1. When turning the ignition switch to ON position, ABS warning lamp and the brake warning lamp comes on for 3 seconds for self diagnosis and goes off if the system is OK (initialization mode).
2. When applying the parking brake, the brake warning lamp comes on.
3. When the brake fluid is not sufficient, the brake warning lamp comes on.
4. When disengaging the connector, the warning lamp comes on.
5. When the system is defective, ABS warning lamp and the brake warning lamp come on simultaneously.
   a. When the solenoid valve is defective
   b. When one or more wheel sensors are defective
   c. When ABS HECU is defective
   d. When the voltage is abnormal
   e. When valve relay is defective
6. When the communication between warning lamp CAN module in meter cluster, the warning lamp comes on.

Downloaded from www.Manualslib.com manuals search engine

5. SYSTEM OPERATION

1) Block Diagram of ABS HECU



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Basic Theory of ABS Function

To give you a better understanding of the tasks and functions of ABS, we will first look at the physics principles.

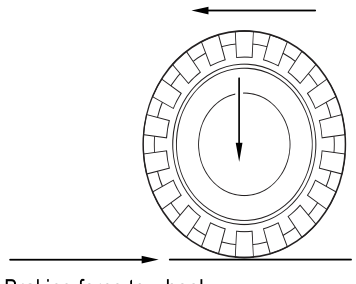
(1) Stopping distance

The stopping distance depends on the vehicle weight and initial speed when braking starts. This also applies for vehicle with ABS, where ABS always tries to set an optimum brake force on each wheel. As great forces are exerted between the tires and the carriageway when braking, even with ABS the wheels may scream and rubber is left on the road. With an ABS skid mark one may be able to clearly recognize the tire profile. The skid mark of an ABS vehicle does not however leave any hint of the speed of the vehicle in the case of an accident, as it can only be clearly drawn at the start of braking.

(2) Brake force on a wheel

The maximum possible brake force on a wheel depends on the wheel load and the adhesion coefficient between tire and carriageway. With a low adhesion coefficient the brake force, which can be obtained is very low. You are bound to know the result already from driving on winter roads. With a high adhesion coefficient on a dry road, the brake force, which can be obtained, is considerably higher. The brake force, which can be obtained, can be calculated from below formula:

▶ **Maximum brake force**



FBmax = wheel load FR x coefficient of frictionMh

The braking process cannot be described sufficiently accurately with the brake forces calculated. The values calculated only apply if the wheel is not locked. In the case of a locking wheel, the static friction turns into lower sliding friction, with the result that the stopping distance is increased. This loss of friction is termed "slip" in specialist literature.

Downloaded from www.Manualslib.com manuals search engine

▶ Slip

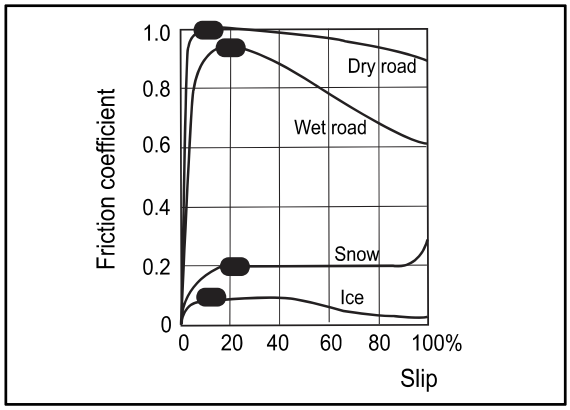
The brake slip is the difference between the vehicle speed and the wheel circumference speed. If the wheel locks, the slip is greatest, that is 100 %. If the wheel is running freely and un-braked, the slip is the lowest, equal to 0 %. Slip can be calculated from the vehicle speed Vveh and the wheel speed Vw. The equation for this is:

Vveh = 100 km/h, Vw = 70 km/h

$$\text{Slip ratio (S)} = \frac{\text{Vveh - Vw}}{\text{Vveh}} \text{ X } 100\%$$

S = 30%

▶ Typical Slip Curves

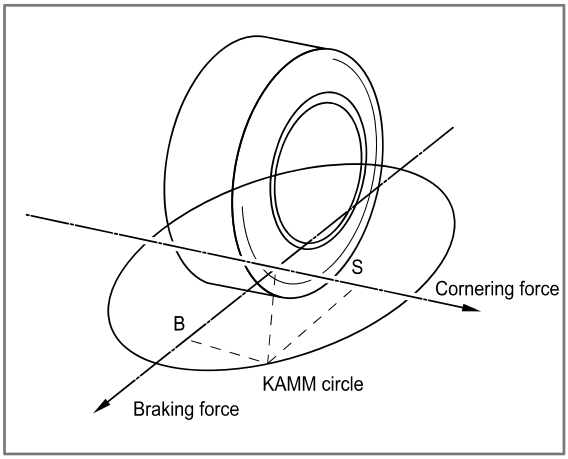


For the various road conditions, the friction coefficients were plotted. The typical course of the curves is always the same. The only special feature is shown by the curve for freshly fallen snow, for this curve increases at 100 % slip. In a vehicle without ABS, the wheel locks on braking and therefore pushes a wedge before it. This wedge of loose surface or freshly fallen snow means and increased resistance and as a result the stopping distance is shorter. This reduction in stopping distance is not possible with a vehicle with ABS, as the wheel does not lock. On these surfaces the stopping distance with ABS is longer than without ABS. The reason for this is based in physics and not in the Anti-Lock System.
However, as mentioned before, ABS is not about the stopping distance, but maneuverability and driving stability, for the vehicle with locking wheels without ABS cannot be steered.

Modification basis	
Application basis	
Affected VIN	

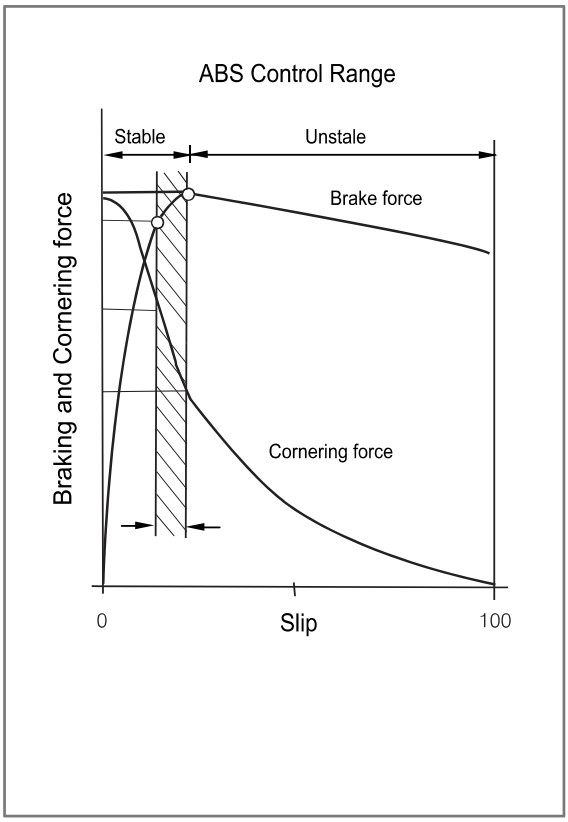
Downloaded from www.Manualslib.com manuals search engine

▶ KAMM circle



Before we go into the Kamm circle, you should know that a tire offers a maximum of 100 % transmissibility. It is all the same for the tire whether we require 100 % in the direction of braking or in the direction of the acting lateral force, e.g. when driving round curves. If we drive into a curve too fast and the tire requires 100 % transmissibility as cornering force, the tire cannot transmit any additional brake force. In spite of the ABS the car is carried out of the curve. The relationship between brake force B and cornering force S is shown very clearly in the Kamm circle. If we put a vehicle wheel in this circle, the relationship becomes even clearer. In this relationship: as long as the acting forces and the resulting force remain within the circle, the vehicle is stable to drive. If a force exceeds the circle, the vehicle leaves the road.

▶ Brake and cornering force

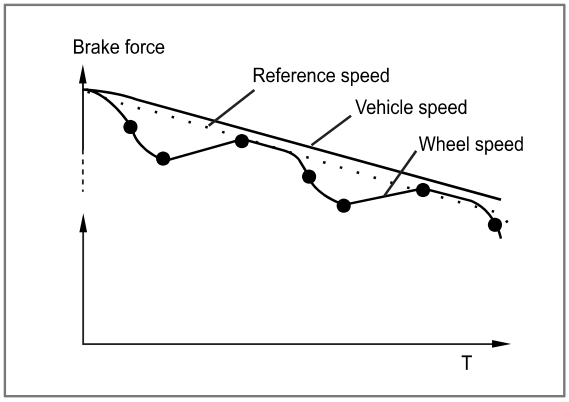


- Brake force
  When depressing the brake pedal the brake force increases to the maximum, then the brake force decreases until the wheel locks.
- Cornering force
  The cornering force is a maximum when the wheel is turning freely with zero slip. When braking the cornering force falls to zero if the wheel locks (slip 100 %).
- ABS operating range
  The operating range starts just before the maximum brake force and ends in maximum, for the unstable range then begins, in which no further modulation is possible. The ABS controls the regulation of the brake pressure so that the brake force only becomes great enough for a sufficient proportion of cornering force to remain. With ABS we remain in the Kamm circle as long as the car is driving sensibly. We will leave driving physics with these statements and turn to the braking systems with and without ABS.

Downloaded from www.Manualslib.com manuals search engine

3) Basic ABS Control

▶ Operation of ABS control unit



Applications of the ABS control unit The signals produced by the wheel sensors are evaluated in the electronic control unit. From the information received, the control unit must first compute the following variables:

- Wheel speed
- Reference speed
- Deceleration
- Slip

▶ Reference speed

The reference speed is the mean, I.e. average speed of all wheel speeds determined by simple approximation.

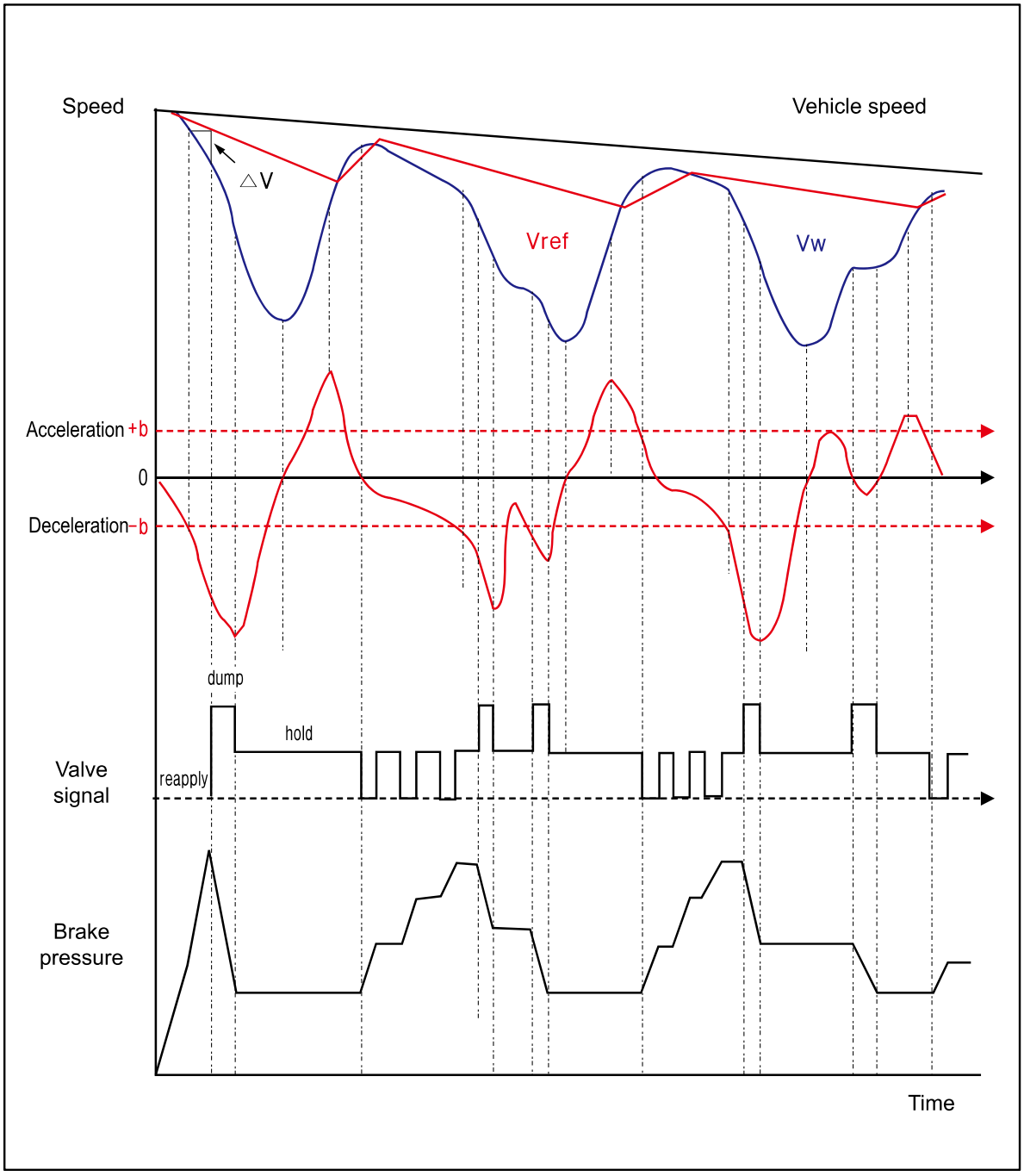
▶ Simplified ABS control

If, during braking, one wheel speed deviates from the reference speed, the ABS control unit attempts to correct that wheel speed by modulating the brake pressure until it again matches the reference speed. When all four wheels tend to lock, all four wheels speeds suddenly deviate from the previously determined reference speed. In that case, the control cycle is initiated again in order to again correct the wheel speed by modulating the brake pressure.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4) ABS Control Pattern



The ABS control is performed by comparing the reference speed with each wheel speed.
Firstly, it is determined whether the vehicle is in the deceleration or acceleration state using the wheel speed change ratio. Then, a signal is transmitted to the valve.
Finally, the brake pressure is adjusted via the signal.

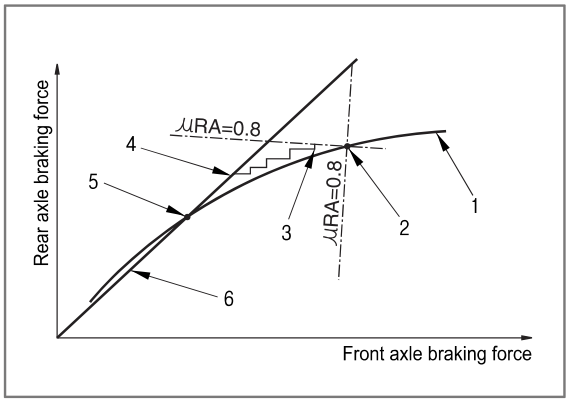
Downloaded from www.Manualslib.com manuals search engine

5) EBD (Electronic Brake Force Distribution) System

▶ System description

As an add-on logic to the ABS base algorithm, EBD works in a range in which the intervention thresholds for ABS control are not reached yet.
EBD ensures that the rear wheels are sensitively monitored for slip with respect to the front axle. If slip is detected, the inlet valves for the rear wheels are switched to pressure hold to prevent a further increase in pressure at the rear-wheel breaks, thus electronically reproducing a pressure-reduction function at the rear-wheel brakes.
ABS features an enhanced algorithm which includes control of the brake force distribution between the front and rear axles. This is called Electronic Brake Distribution. In an unloading car condition the brake efficiency is comparable to the conventional system but for a fully loaded vehicle the efficiency of the EBD system is higher due to the better use of rear axle braking capability.

▶ Advantages



- Elimination of conventional proportioning valve EBD utilizes the existing rear axle wheel speed sensor to monitor rear wheel slip.
- Based on many variables in algorithm a pressure hold, increase and/or decrease pulsetrain may be triggered at the rear wheels insuring vehicle stability.
- Vehicle approaches the ideal brake force distribution (front to rear).
- Constant brake force distribution during vehicle lifetime.
- EBD function is monitored via ABS safety logic (conventional proportioning valves are not monitorable).

Downloaded from www.Manualslib.com manuals search engine

▶ Matrix of EBD

1st fault \ 2nd fault	Power supply (6.9 V or more, 9.4 V or less)	Power supply 6.9 V or less (low voltage)	Power supply 17.4 V or more (high voltage)	Improper wheel speed sensor resistance value	Wheel speed sensor has open circuit	Faulty wheel speed sensor frequency (high frequency)	Faulty wheel speed sensor frequency (low frequency)	Two wheel speed sensors are faulty	Faulty brake switch	Faulty return pump motor	Faulty return pump motor relay	Solenoid valve relay stuck	Open circuit in solenoid valve relay	Replace mini spare tire
Power supply (6.9 V or more, 9.4 V or less)	×	×	×											
Improper wheel speed sensor resistance value														
Wheel speed sensor has open circuit														
Two wheel speed sensors are faulty														
Faulty wheel speed sensor frequency						■								
Faulty brake switch						■			×					
Faulty return pump motor										×	×			
Faulty return pump motor relay										×	×			
Solenoid valve relay stuck												×	×	

If this fault is present, Keep alive function is maintained.

▨ Can operate ABS. Cannot operate EBD

Cannot operate ABS,EBD

■ Can operate ABS,EBD

× Not Possible

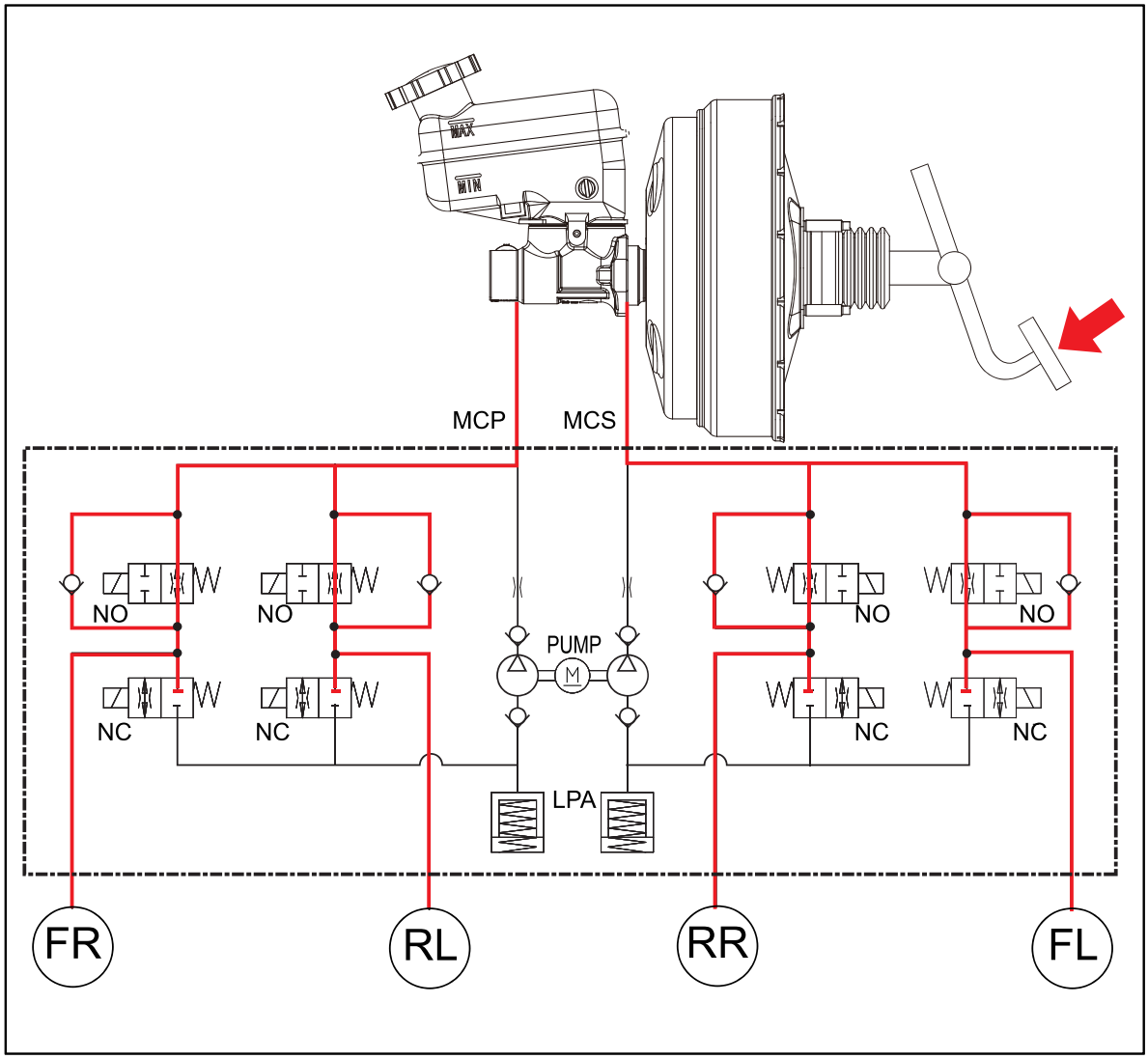
Downloaded from www.Manualslib.com manuals search engine

6. HYDRAULIC CIRCUIT OF ABS

1) Normal Brake Operation (ABS is not working) Mode

If the driver depress the brake pedal so that the ABS does not operate, the hydraulic pressure in the master cylinder increases through the vacuum booster and it is delivered to the wheel via the normal open inlet valve. At this moment, the normally-closed outlet valve is closed The speed of the wheel that hydraulic pressure is delivered reduces gradually.

Solenoid valve	Valve Open/Close	Pump motor
Inlet valve - Normal open (NO) valve	Open	OFF
Outlet valve - Normal close (NC) valve	Close	



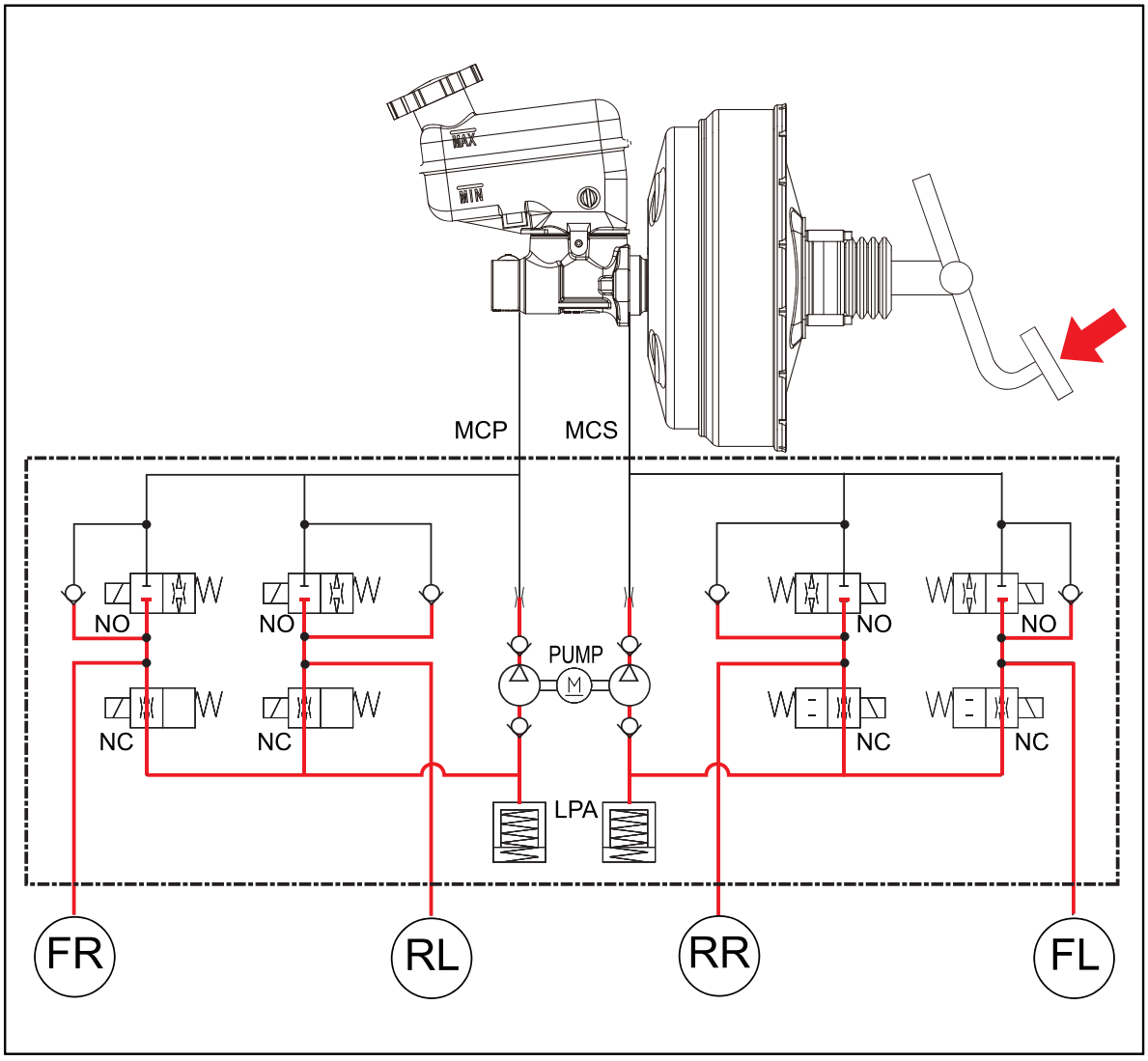
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) DUMP (ABS is working) Mode

Even when the hydraulic pressure on each circuit is constant, the wheel can be locked as the wheel speed decreases. This is when the ABS HECU detects the wheel speed and the vehicle speed and gives the optimized braking without locking the wheels. In order to prevent the hydraulic pressure from increasing, the inlet valve will be closed, the outlet valve will be opened and the oil will flow into the low pressure chamber. In addition, the ABS HECU operates the pump to circulate the oil in the low pressure chamber to the master cylinder. This may make the driver to feel the brake pedal vibration and some noises.

Solenoid valve	Valve Open/Close	Pump motor
Inlet valve - Normal open (NO) valve	Close	ON
Outlet valve - Normal close (NC) valve	Open	

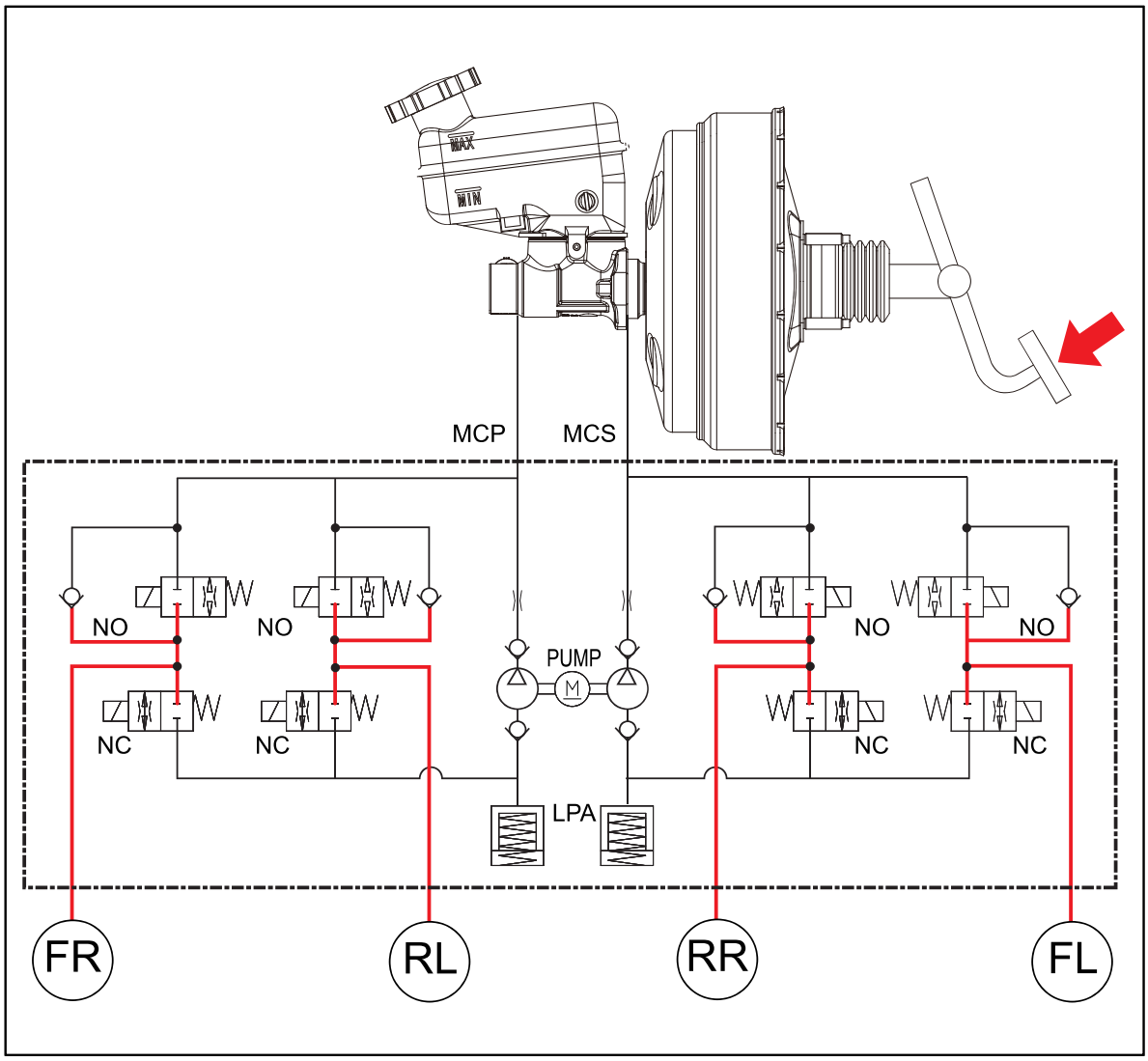


Downloaded from www.Manualslib.com manuals search engine

3) HOLD (ABS is working) Mode

As hydraulic pressure on each wheel increases, the wheel tends to lock. In order to prevent the wheel from locking, the hydraulic valve modulator operates the inlet valve control solenoid to stop increasing the hydraulic pressure by closing the inlet valve. At this moment, the outlet valve is closed. This procedure helps the wheel to maintain a constant hydraulic pressure.

Solenoid valve	Valve Open/Close	Pump motor
Inlet valve - Normal open (NO) valve	Close	OFF
Outlet valve - Normal close (NC) valve	Close	



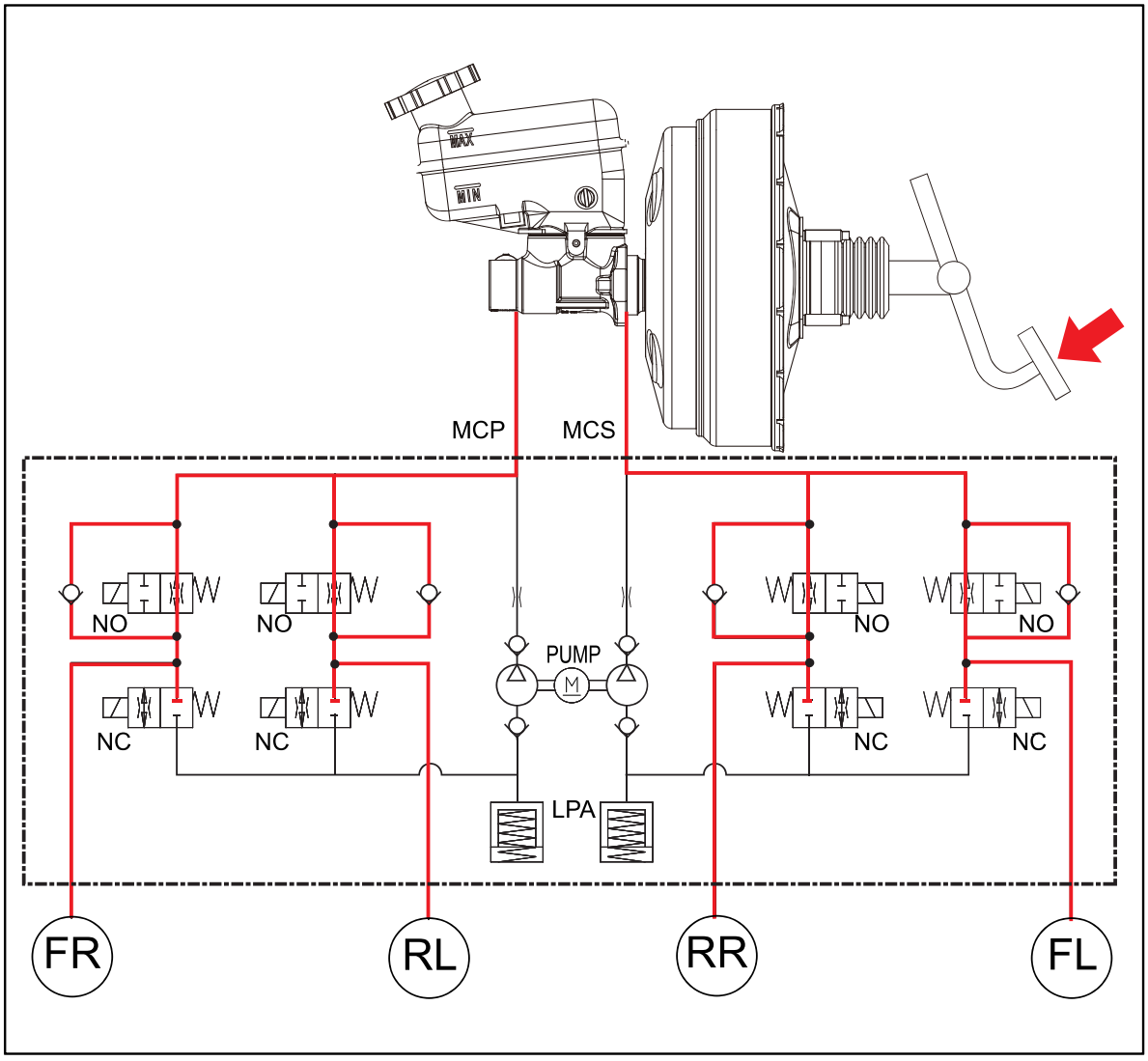
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4) RISE (ABS is working) Mode

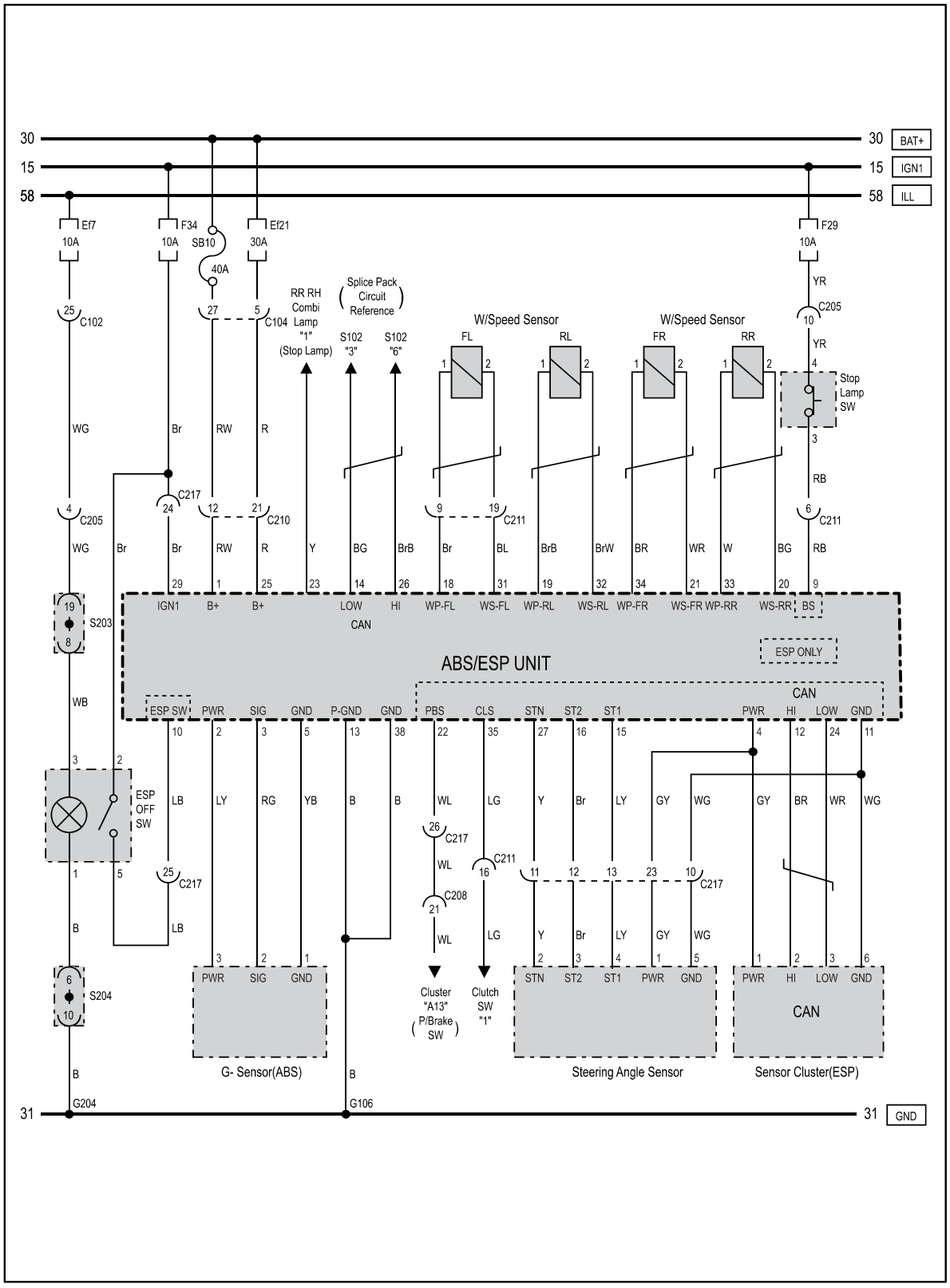
As the wheel speed increases, the inlet valve opens and the wheel's pressure increases due to the master cylinder pressure. In addition, the pump circulates the oil in the low pressure chamber to the wheel. As the hydraulic pressure to the wheel increases, the wheel speed will reduce. This operation continues repetitively until there are no signs that the ABS HECU tends to lock the wheels. Since the ABS hydraulic pressure control process takes place repeatedly for a short time, there may be some vibration and noises at the brake pedal.

Solenoid valve	Valve Open/Close	Pump motor
Inlet valve - Normal open (NO) valve	Open	ON
Outlet valve - Normal close (NC) valve	Close	



Downloaded from www.Manualslib.com manuals search engine

7. CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Unit	Description	
	ABS	ESP
HECU	Clock frequency: 25 MHz	Clock frequency: 40 MHz
	Memory: 128 KB	Memory: 512 KB
	Switch orifice	Switch orifice
Wheel speed sensor	Active type	Active type
Steering wheel angle sensor	None	Max. detection angle speed: 1500 °/Sec
		Operating voltage: 9 to 12 V
Sensor cluster	None	Yaw rate sensor + lateral G sensor + longitudinal G sensor (4WD)
Longitudinal G sensor	4WD only	None
Pressure sensor	None	HECU integrated

1) Specification of Active Wheel Sensor

Description	Specification
Supplying voltage	DC 12 V
Output current (at 2.75 km/h of vehicle speed)	7 mA (Lo) ~ 14 mA (Hi) +20%/-16%
Tightening torque	Front: 7.8 to 11.8 Nm
	Rear: 7.8 to 11.8 Nm
Operating temperature	−40 ~ 150 ℃
Operating frequency	1 ~ 2,500 Hz

Downloaded from www.Manualslib.com manuals search engine

2) Specification of Steering Wheel Angle Sensor

Description	Specification
Operating voltage	9 to 16 V
Maximum output current	10 mA
Maximum detection angle speed	±100°/Sec
Operating temperature	−30 to 75 ℃
Supplying voltage	9 to 16 V (battery voltage)
Output voltage (HI)	approx. 3.50 V (3.0 to 4.1 V)
Output voltage (LO)	approx. 1.50 V (1.3 to 2.0 V)
Pulses/rev	45 pulses/rev

3) Specification of Sensor Cluster

Description	Specification	
Supplying voltage	approx. 12 V (8 to 16 V)	
Current consumption	below 250 mA	-
Operating range	Yaw rate sensor	± 75 °/Sec
	Lateral/longitudinal sensor	± 14.7m/Sec²

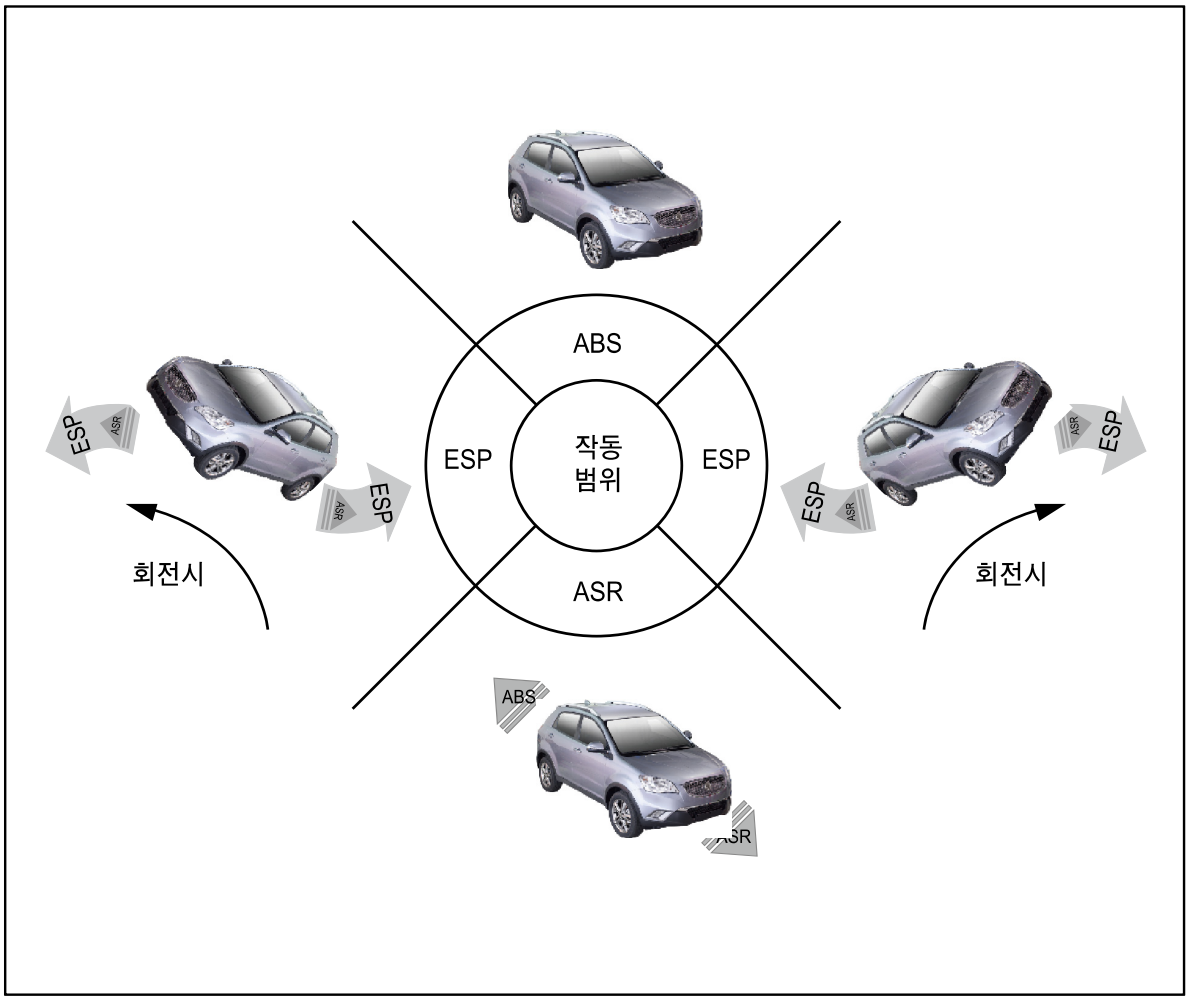
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

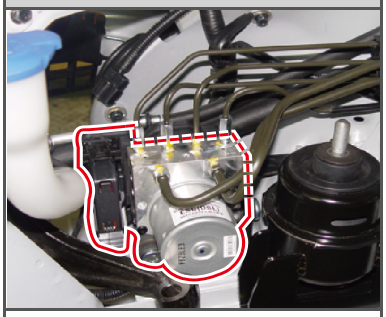
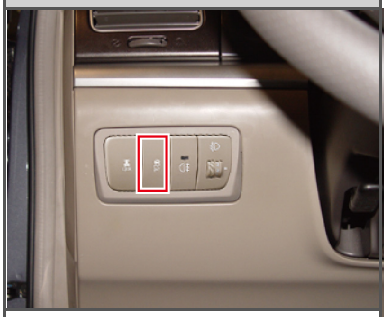
1. OVERVIEW

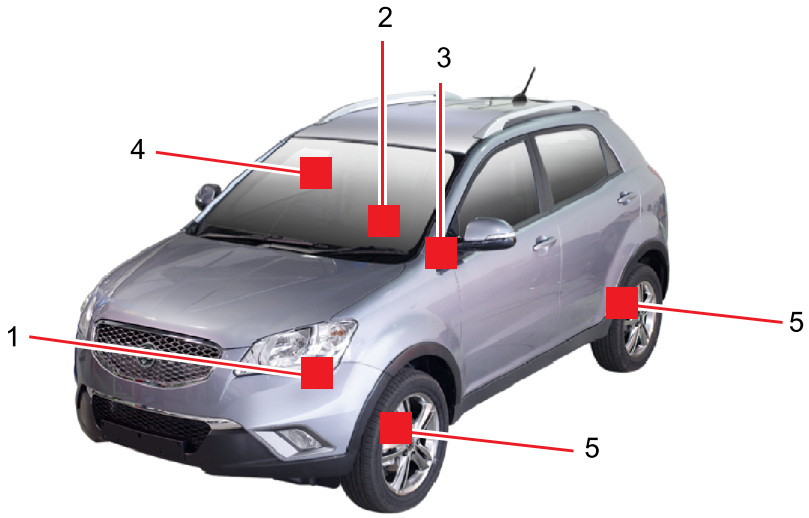
The ESP (Electronic Stability Program) has been developed to help a driver avoid danger of losing control of the vehicle stability due to understeer or oversteer during cornering. The yaw rate sensor, lateral sensor and longitudinal sensor in the sensor cluster and the steering wheel angle sensor under the steering column detect the vehicle conditions when the inner or outer wheels are spinning during oversteer, understeer or cornering. The ESP ECU controls against oversteer or understeer during cornering by controlling the vehicle stability using input values from these sensors and applying the braking force to the corresponding wheels independently. The system also controls the engine power right before the wheel spin synchronized to decelerate the vehicle automatically in order to maintain the vehicle stable during cornering.

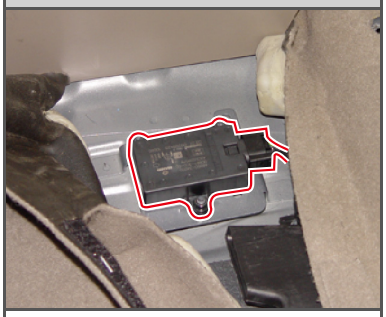
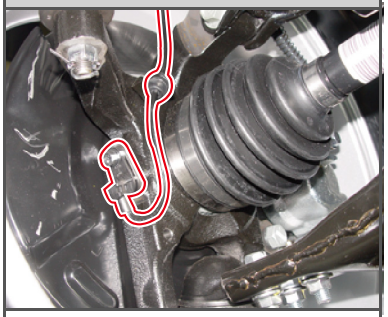
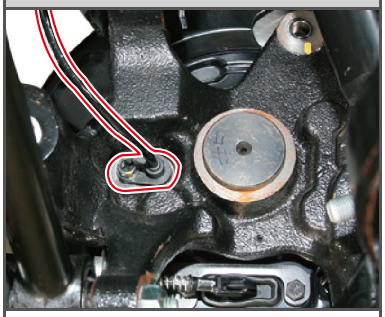


Downloaded from www.Manualslib.com manuals search engine

2. COMPONENTS

1. HECU assembly	2. Steering wheel angle sensor	3. ESP OFF switch
		
Located under the power steering fluid reservoir and contains the pressure sensor.	Located on column shaft with contact coil.	Located on the left side of instrument panel.



4. Sensor cluster	5. Wheel speed sensor (4WD/2WD-front)	6. Rear wheel speed sensor (2WD)
		
Located on the floor under front passenger seat.	Located on knuckle. the appearance of front sensor is same with rear sensor.	Located on knuckle. The appearance is different from that for 4WD.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3. PRECAUTIONS

CAUTION

The warning lamp flashes and warning beep sounds when the ESP is operating

When the ESP operates during vehicle movement, the ESP warning lamp on the instrument panel flashes and beep comes on every 0.1 second. The ESP system is only a supplementary device for comfortable driving. When the vehicle exceeds its physical limits, it cannot be controlled.

Do not rely on the system. Keep on the safe driving.

Feeling when ESP is working

When the ESP system activates, the feeling can be different depending on vehicle driving conditions.

For example, you will feel differently when the ESP system is activated during the ABS is operating with the brakes applied and when the brakes are not applied on a curve.

If the ESP system operates when the brake is applied, the brake pressure will be increased on the corresponding wheel which already has braking pressure for the ESP controls.

ARP Operation

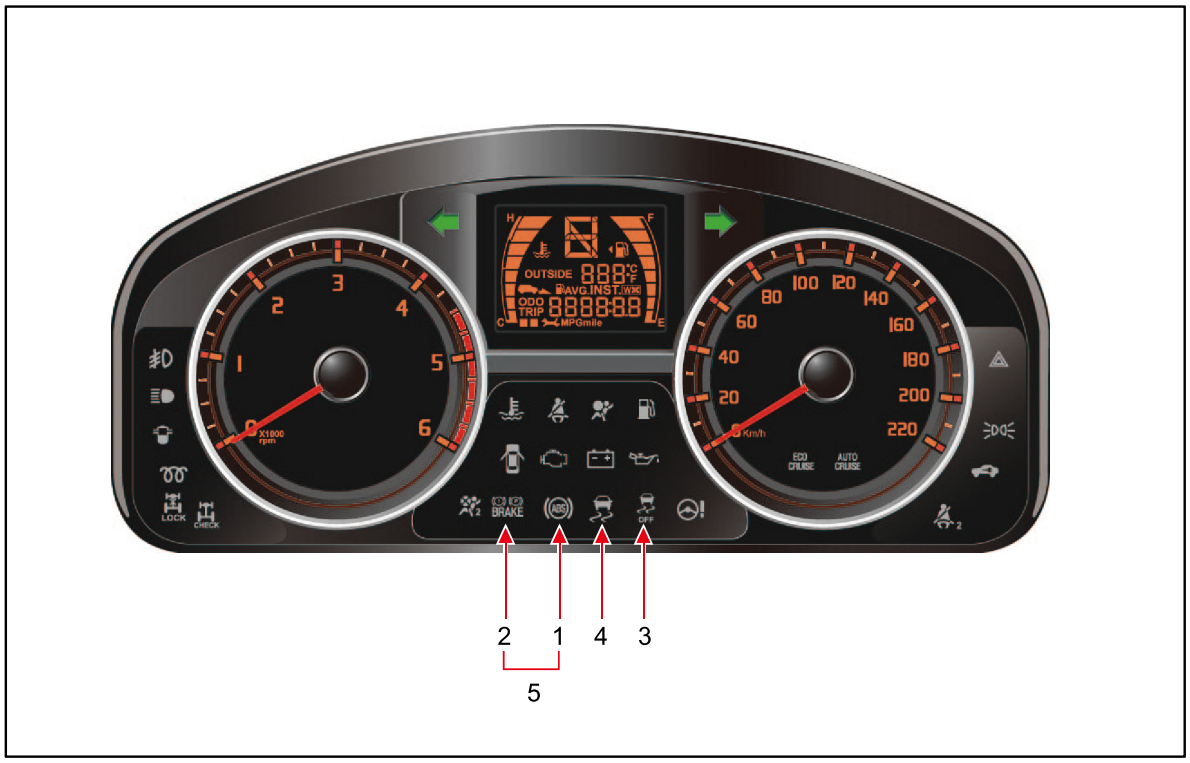
During the ARP operation, vehicle safety (rollover prevention) takes the first priority and thus, stronger engine control is in effect. Consequently, the vehicle speed decreases rapidly, so the driver must take caution for the vehicle may drift away from the lane.

Noise and vibration that driver feels when ESP system is operating

The ESP system may transfer noise and vibration to the driver due to the pressure changes caused by the motor and valve operations in a very short period of time. And, keep in mind that the output and vehicle speed could be decreased without rpm increase due to the ASR function that controls the engine power.

Downloaded from www.Manualslib.com manuals search engine

4. WARNING LAMPS



1. ABS warning lamp
2. Brake warning lamp
3. ESP OFF indicator
4. ESP warning lamp/indicator
5. EBD warning lamp

1) ABS Warning Lamp

ABS warning lamp module indicates the self diagnosis and malfunction.
ABS warning lamp ON:

1. When turning the ignition switch to ON position, ABS warning lamp comes on for 3 seconds for self diagnosis and goes off if the system is OK (initialization mode).
2. When the system is defective, the warning lamp comes on.
3. When disengaging the connector, the warning lamp comes on.
4. ABS is not available during lamp ON. In this condition, Only normal brake system without ABS function is available.
5. When the communication between warning lamp CAN module in meter cluster, the warning lamp comes on.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) EBD (Electronic Brake-force Distribution) Warning Lamp (Brake Warning Lamp)

EBD warning lamp when the system perform the self diagnosis and when it detects the malfunction of EBD system. However, the brake warning lamp comes on regardless of EBD when the parking brake is applied.
EBD warning lamp ON:

1. When turning the ignition switch to ON position, ABS warning lamp and the brake warning lamp comes on for 3 seconds for self diagnosis and goes off if the system is OK (initialization mode).
2. When applying the parking brake, the brake warning lamp comes on.
3. When the brake fluid is not sufficient, the brake warning lamp comes on.
4. When disengaging the connector, the warning lamp comes on.
5. When the system is defective, ABS warning lamp and the brake warning lamp come on simultaneously.
   a. When the solenoid valve is defective
   b. When one or more wheel sensors are defective
   c. When ABS HECU is defective
   d. When the voltage is abnormal
   e. When valve relay is defective
6. When the communication between warning lamp CAN module in meter cluster, the warning lamp comes on.

3) ESP OFF Indicator

ESP OFF indicator ON:

1. When turning the ignition switch to ON position, ESP warning lamp comes on for 3 seconds for self diagnosis and goes off if the system is OK (initialization mode).
2. When the ESP OFF switch is pressed to turn off ESP function, ESP OFF indicator comes on.

4) ESP Warning Lamp

1. ESP warning lamp ON:
2. When turning the ignition switch to ON position, ESP warning lamp comes on for 3 seconds for self diagnosis and goes off if the system is OK (initialization mode).
3. When the system is defective, the warning lamp comes on.
4. When the ESP function is activated, ESP warning lamp blinks with the interval of 2 Hz.
5. When the communication between warning lamp CAN module in meter cluster, the warning lamp comes on.

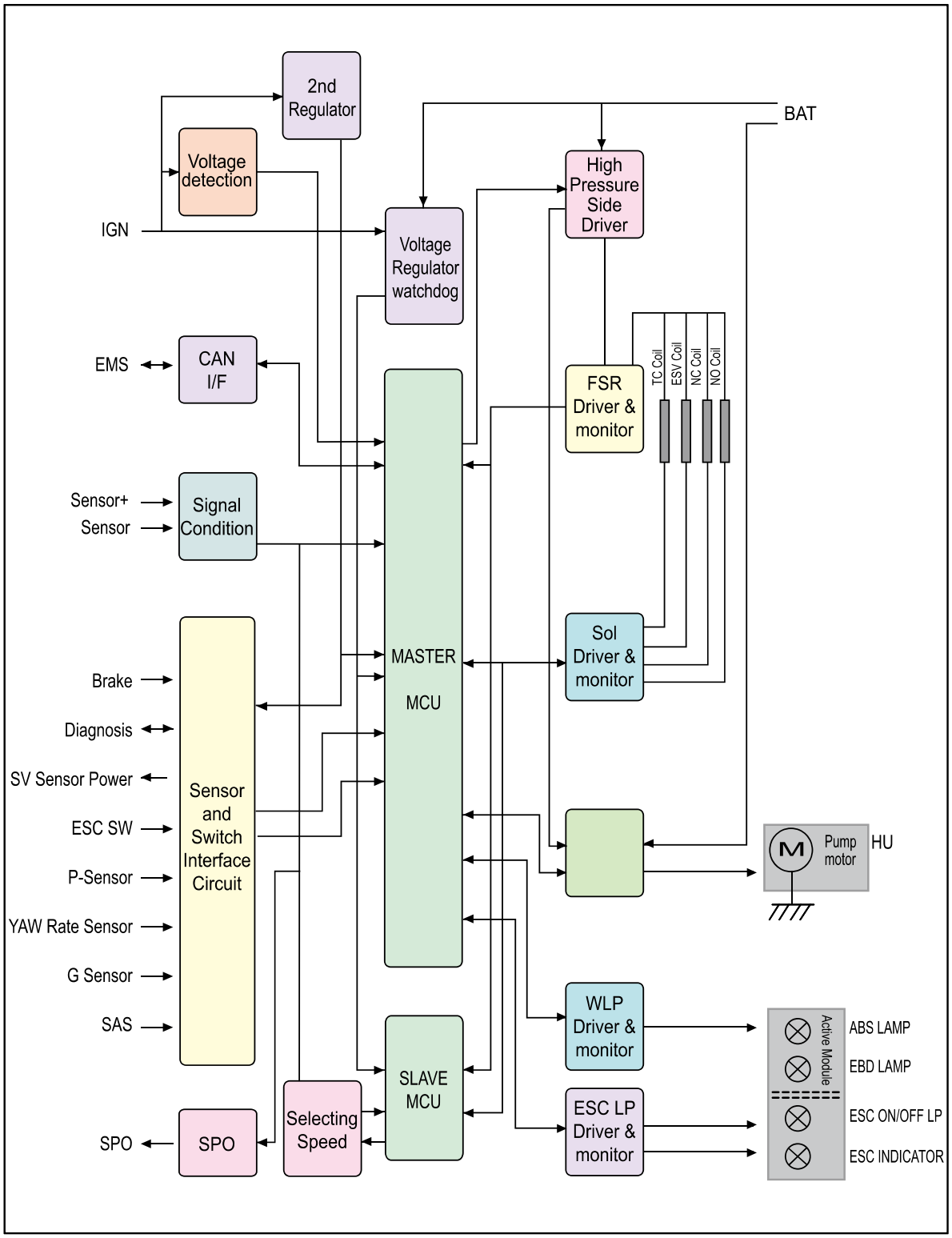
5) ESP OFF Switch

If ESP OFF switch is pressed, ESP function is deactivated and the ESP OFF indicator in the instrument cluster comes on.
To resume the ESP function, press the switch again. At this time, ESP OFF indicator goes out.

Downloaded from www.Manualslib.com manuals search engine

5. SYSTEM DESCRIPTION

1) Block Diagram of ESP HECU



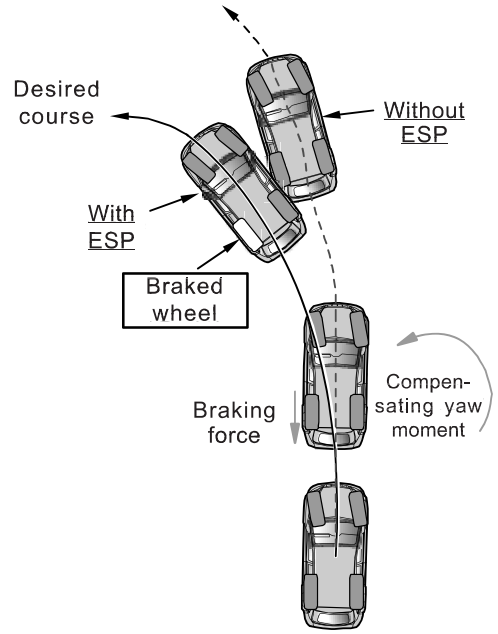
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Operation of ESP System

The ESP (Electronic Stability Program) has been developed to help a driver avoid danger of losing control of the vehicle stability due to understeer or oversteer during cornering. The yaw rate sensor, lateral sensor and longitudinal sensor in the sensor cluster and the steering wheel angle sensor under the steering column detect the vehicle conditions when the inner or outer wheels are spinning during oversteer, understeer or cornering. The ESP ECU controls against oversteer or understeer during cornering by controlling the vehicle stability using input values from these sensors and applying the braking force to the corresponding wheels independently. The system also controls the engine power right before the wheel spin synchronized with the ASR function to decelerate the vehicle automatically in order to maintain the vehicle stable during cornering.

(1) Under steering



▶ **What is understeering?**

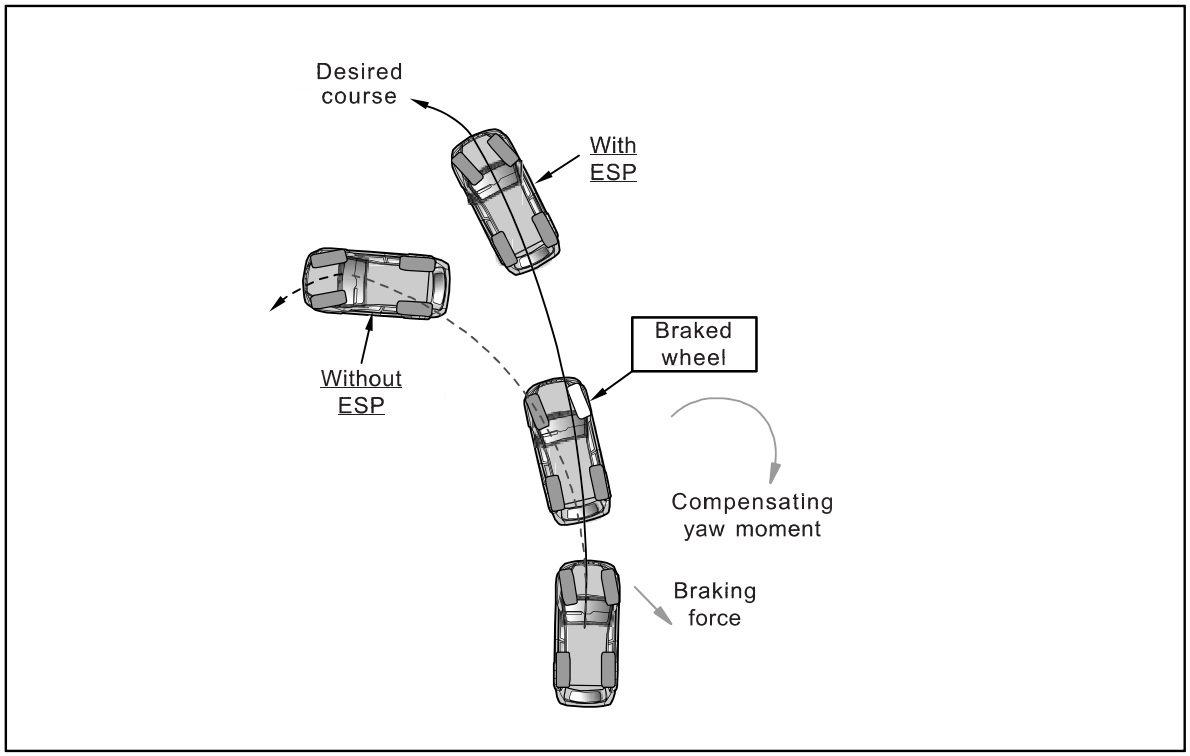
Understeer is a term for a condition in which the steering wheel is steered to a certain angle during driving and the front tires slip toward the reverse direction of the desired direction. Generally, vehicles are designed to have understeer. It is because that the vehicle can return back to inside of cornering line when the steering wheel is steered toward the inside even when the front wheels are slipped outward.
As the centrifugal force increases, the tires can easily lose the traction and the vehicle tends to slip outward when the curve angle gets bigger and the speed increases.

Downloaded from www.Manualslib.com manuals search engine

▶ **ESP controls during understeer**

The ESP system recognizes the directional angle with the steering wheel angle sensor and senses the slipping route that occurs reversely against the vehicle cornering direction during understeer with the yaw rate sensor and lateral sensor. Then, the ESP system applies the braking force to the rear inner wheel to compensate the yaw moment value. In this way, the vehicle does not lose its driving direction and the driver can steer the vehicle as intended.

(2) Over steering



▶ **What is oversteering?**

Oversteer is a term of a condition in which the steering wheel is steered to a certain angle during driving and the rear tires slip outward losing traction.
Compared to understeering vehicles, it is hard to control the vehicle during cornering and the vehicle can spin due to rear wheel moment when the rear tires lose traction and the vehicle speed increases.

▶ **ESP controls during oversteer**

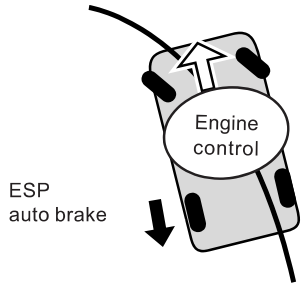
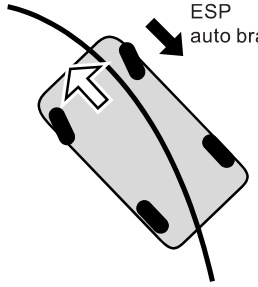
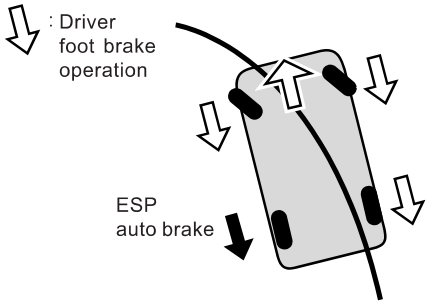
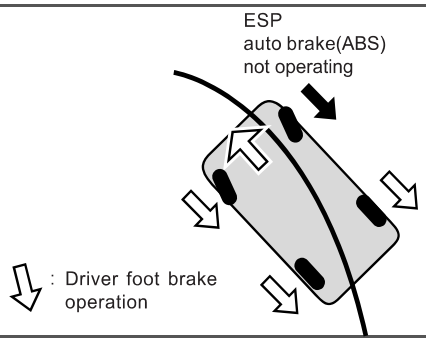
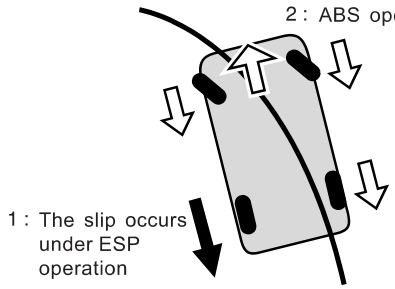
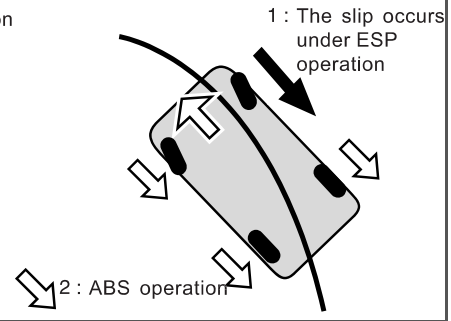
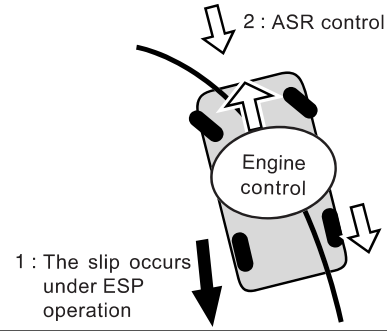
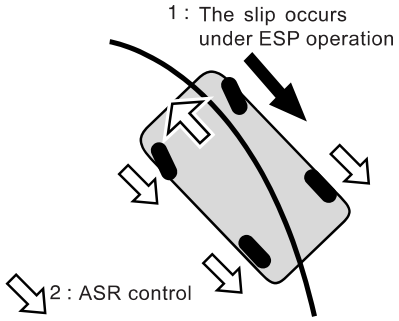
The ESP system recognizes the directional angle with the steering wheel angle sensor and senses the slipping route that occurs towards the vehicle cornering direction during oversteer with the yaw rate sensor and lateral sensor. Then the ESP system applies the braking force to the front outer wheel to compensate the yaw moment value. In this way, the vehicle does not lose its driving direction and the driver can steer the vehicle as intended.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Vehicle Control During Cornering

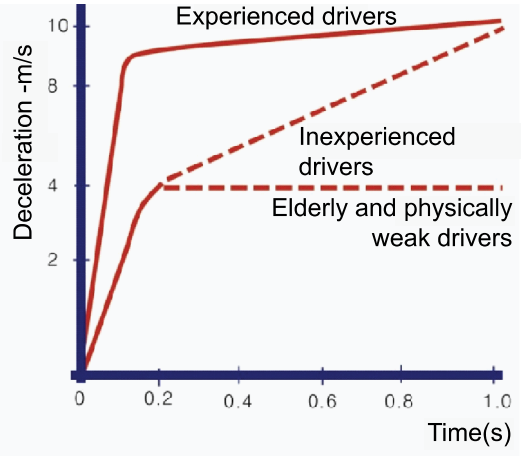
The figure below shows the vehicle controls by the ESP system under various situations such as when the brake pedal is depressed or not depressed during cornering, when the ABS is operating and when braking without the ABS. It also includes the vehicle conditions when the TCS, a part of the ESP system, is operating.

Condition	Understeer control	Oversteer control
Only ESP in operation No braking by driver		
ESP + Normal braking (no ABS operation)		
ESP + ABS brake		
ESP + ASR		

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4) HBA (Hydraulic Brake Assist System)



(1) Purpose

HBA (Hydraulic Brake Assist) system helps in an emergency braking situation when the driver applies the brake fast, but not with sufficient pressure, which leads to dangerously long braking distance. ECU recognizes the attempt at full braking and transmits the signal calling for full brake pressure from the hydraulic booster. An inexperienced, elderly or physically weak driver may suffer from the accident by not fully pressing the brake pedal when hard braking is required under emergency. The HBA System increases the braking force under urgent situations to enhance the inputted braking force from the driver. Based on the fact that some drivers depress the brake pedal too soft even under when hard braking is necessary, the HECU system is a safety supplementary system that builds high braking force during initial braking according to pressure value of the brake pressure sensor and the pressure changes of the pressure sensor intervals. When the system is designed to apply high braking force when brake pedal is depressed softly by an elderly or physically weak driver, the vehicle will make abrupt stopping under normal braking situation due to high braking pressure at each wheels.

(2) Operation

The brake pressure value and the changed value of the pressure sensor are the conditions in which the HBA System operates. There are 2 pressure sensors under the master cylinder. When the ESP ECU system determines that emergency braking is present, the pump operates, the brake fluid in the master cylinder is sent to the pump and the braking pressure is delivered to the wheels via the inlet valves . If the drive depress the brake pedal slowly, the pressure change is not high. In this case, only the conventional brake system with booster is activated.

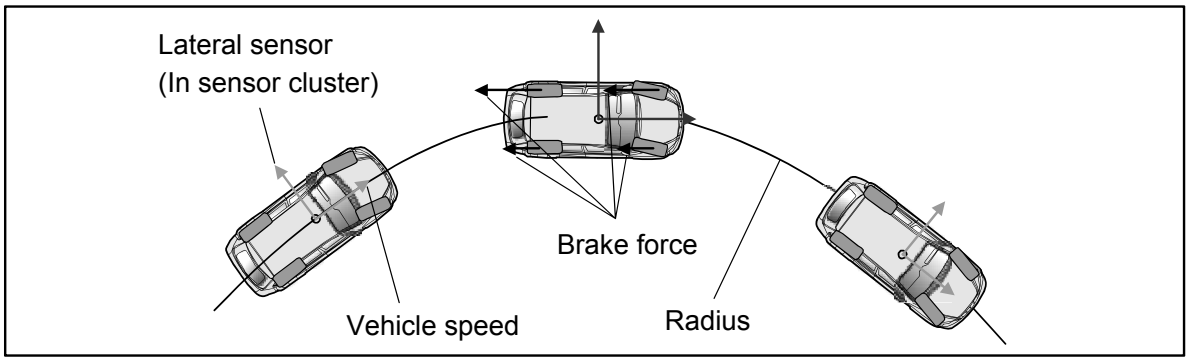
(3) Operating conditions

- Sensor pressure: over 40 bar
- Pressure changes: over 850 bar/sec
- Vehicle speed: over 30 km/h

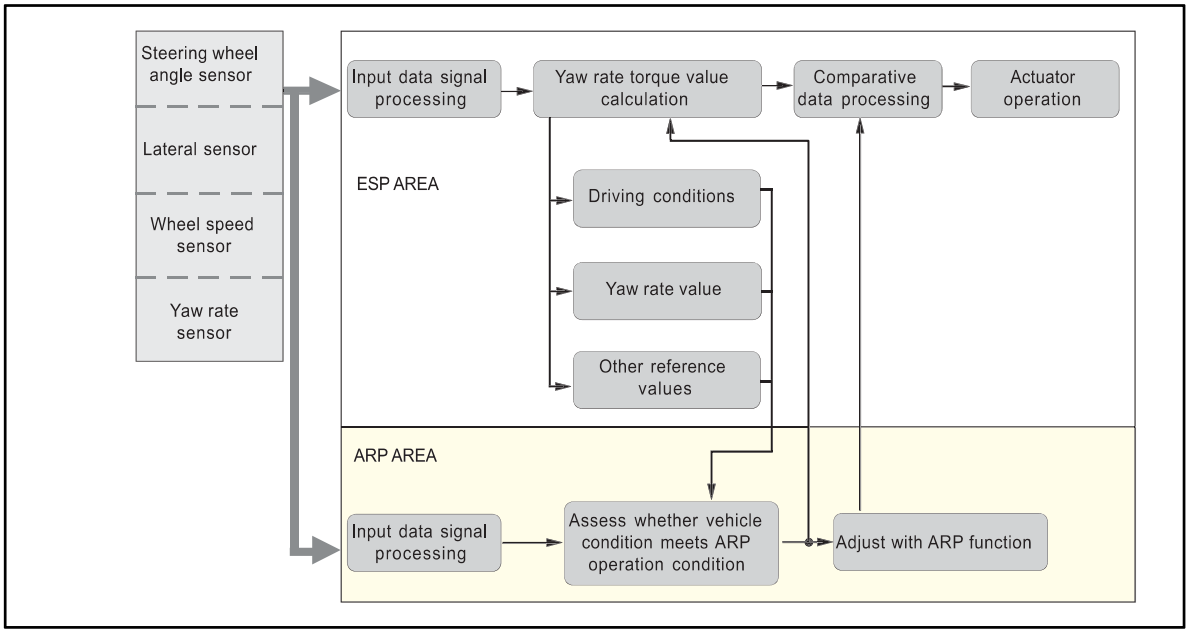
Downloaded from www.Manualslib.com manuals search engine

5) ARP (Active Roll-Over Protection)

The ARP (Active Roll-over Protection) system is a safety assistant device that minimizes, by controlling brakes and the engine, the physical tendency of the vehicle rollover during sharp lane changes or U-turns. For the system, software is added to the existing ESP system and no additional device or switch is needed. One must note that the ARP system, just as general assistant devices including the ABS, is only a safety assistant device using the ESP system and its function is useless when the situation overcomes the physical power. Following picture shows how the ARP compensates the vehicle position by varying each wheel's braking power to overcome the physical tendency of the vehicle rollover during sharp turns.



The vehicle driving condition is controlled by the internally programmed logic according to the input signals from wheel speed sensor, steering angle sensor and lateral sensor.



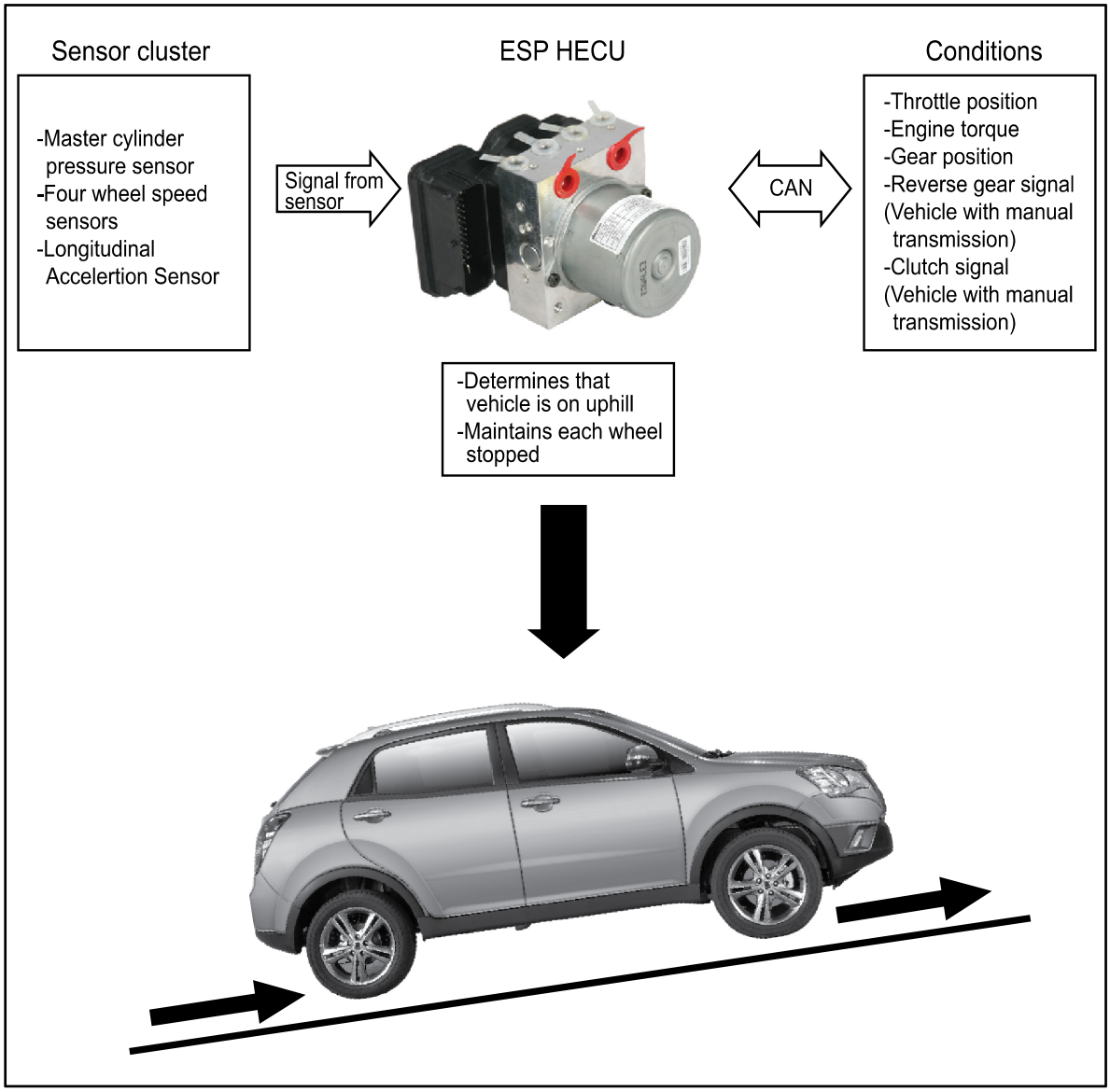
CAUTION

During the ARP operation, vehicle safety (rollover prevention) takes the first priority and thus, stronger engine control is in effect. Consequently, the vehicle speed decreases rapidly, so the driver must take caution for the vehicle may drift away from the lane.

Downloaded from www.Manualslib.com manuals search engine

6) HSA (Hill Start Assist)

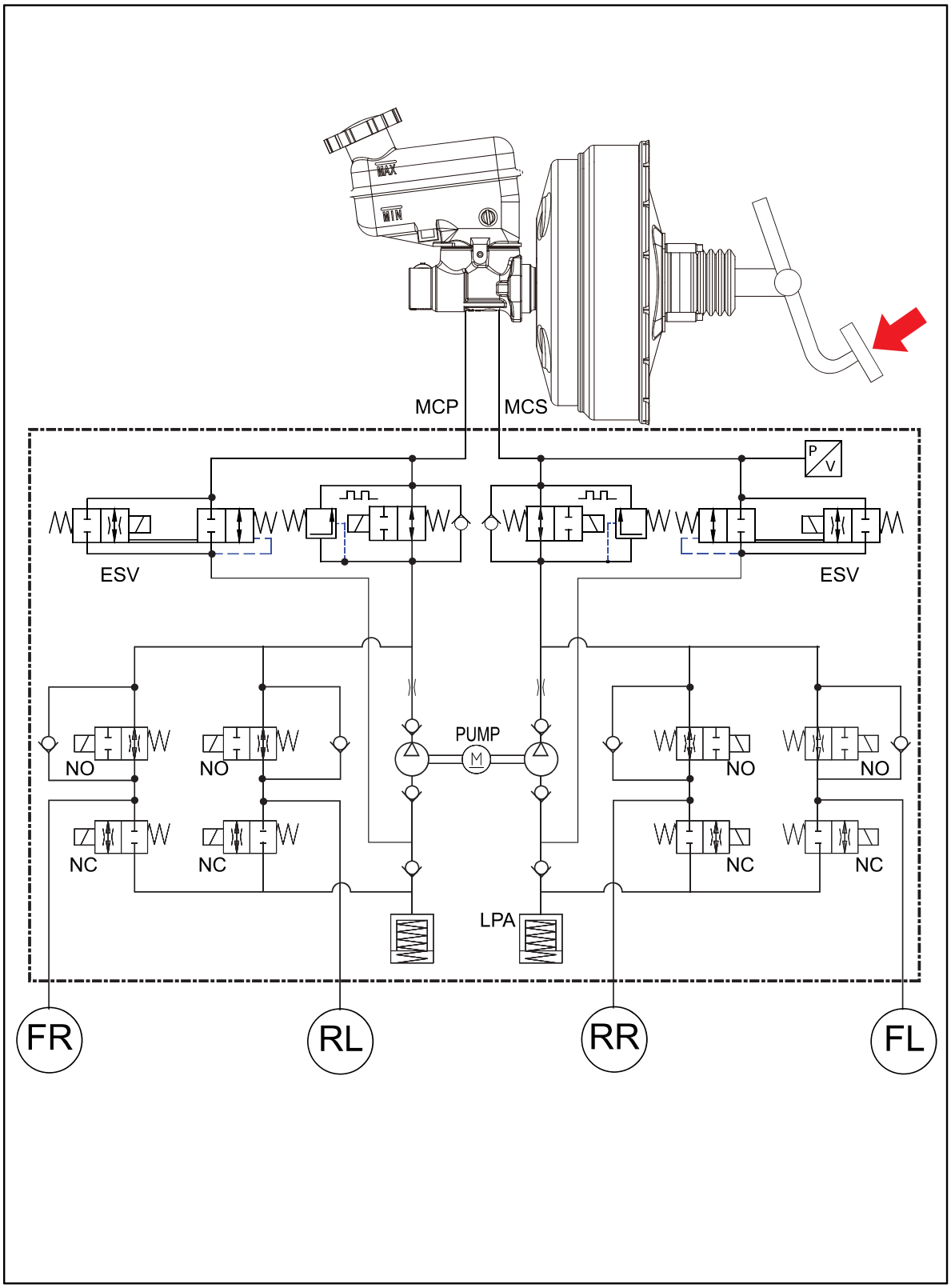
The HSA (Hill Start Assist) prevents the vehicle from rolling backward by supplying the hydraulic pressure to the wheels by the HECU after the brake pedal is released when starting off on uphill.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

6. HYDRAULIC CIRCUIT OF ESP



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Circuit description

When compared to the vehicle equipped with ABS/EBD only, the internal hydraulic circuit has a normally-open separation valve and a shuttle valve in primary circuit and in secondary circuit.
When the vehicle brakes are not applied during engine running or when applying the non-ABS operating brakes, the normally-open separation valve and the inlet valve are open, whereas the normally-closed shuttle valve and the outlet valve are closed.
When the ESP system is operating, the normally-open separation valve will be closed by the solenoid valve operation and the hydraulic circuit will be established by the shuttle valve. Then, the inlet and outlet valves will be closed or open depending on the braking pressure RISE, HOLD or DUMP conditions.

▶ Flashing warning lamp and warning sound during ESP operation

When the ESP operates while the vehicle is moving, the ESP warning lamp on the instrument panel flickers and the buzzer sounds at every 0.1 second. The ESP lamp operation is to inform a driver that the vehicle is extremely unstable.
The ESP system is just a supplementary system for the vehicle and it cannot control the vehicle over the physical limit. Do not solely rely on the system but be advised to drive the vehicle safely.

▶ Drive feeling during ESP operation

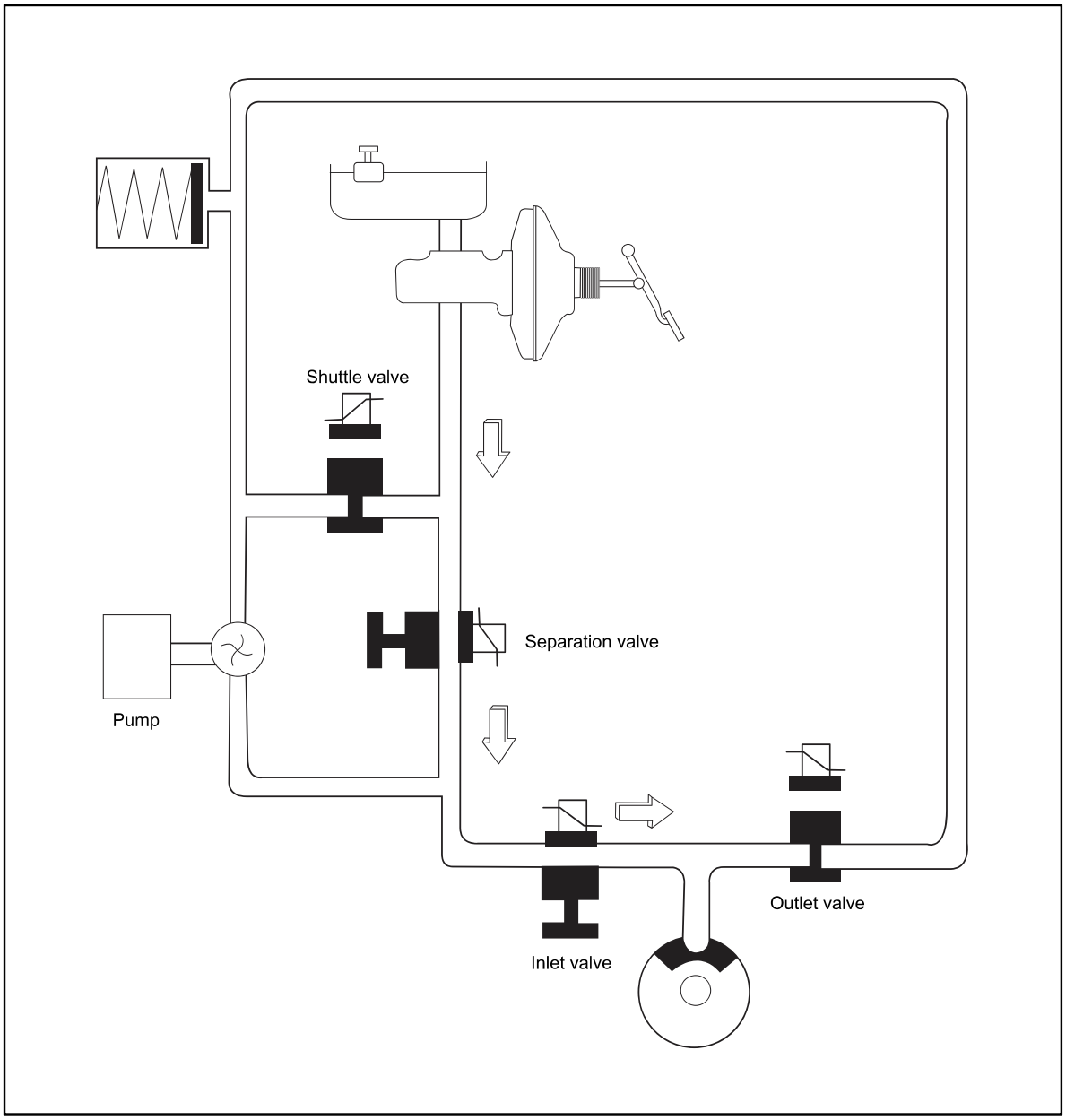
When the ESP system activates, the driving feeling can be different depending on vehicle driving conditions. For example, it will feel different when the ESP system is activated while the ABS is operated by depressing the brake pedal and when the ESP system is in control without the brake pedal depressed on the same curve.
If the ESP system operates with the brake applied, the brake pressure will be increased on the corresponding wheel which already has braking pressure for the ESP controls. In other words, the ESP system would make the driver feel more abruptly braked compared to the situation that the braking pressure is applied to wheel which had no braking force.

▶ Noise and vibration that driver senses during ESP operation

The ESP system may transfer noise and vibration to a driver due to the pressure changes caused by the motor and valve operations in a very short period of time.
Extreme cornering will trigger the ESP operation and this will make the driver sense noise and vibration due to sudden brake application.
Also, the ESP system controls the engine power. Therefore, the driver may notice the engine power decreases even when the accelerator pedal is depressed.

Downloaded from www.Manualslib.com manuals search engine

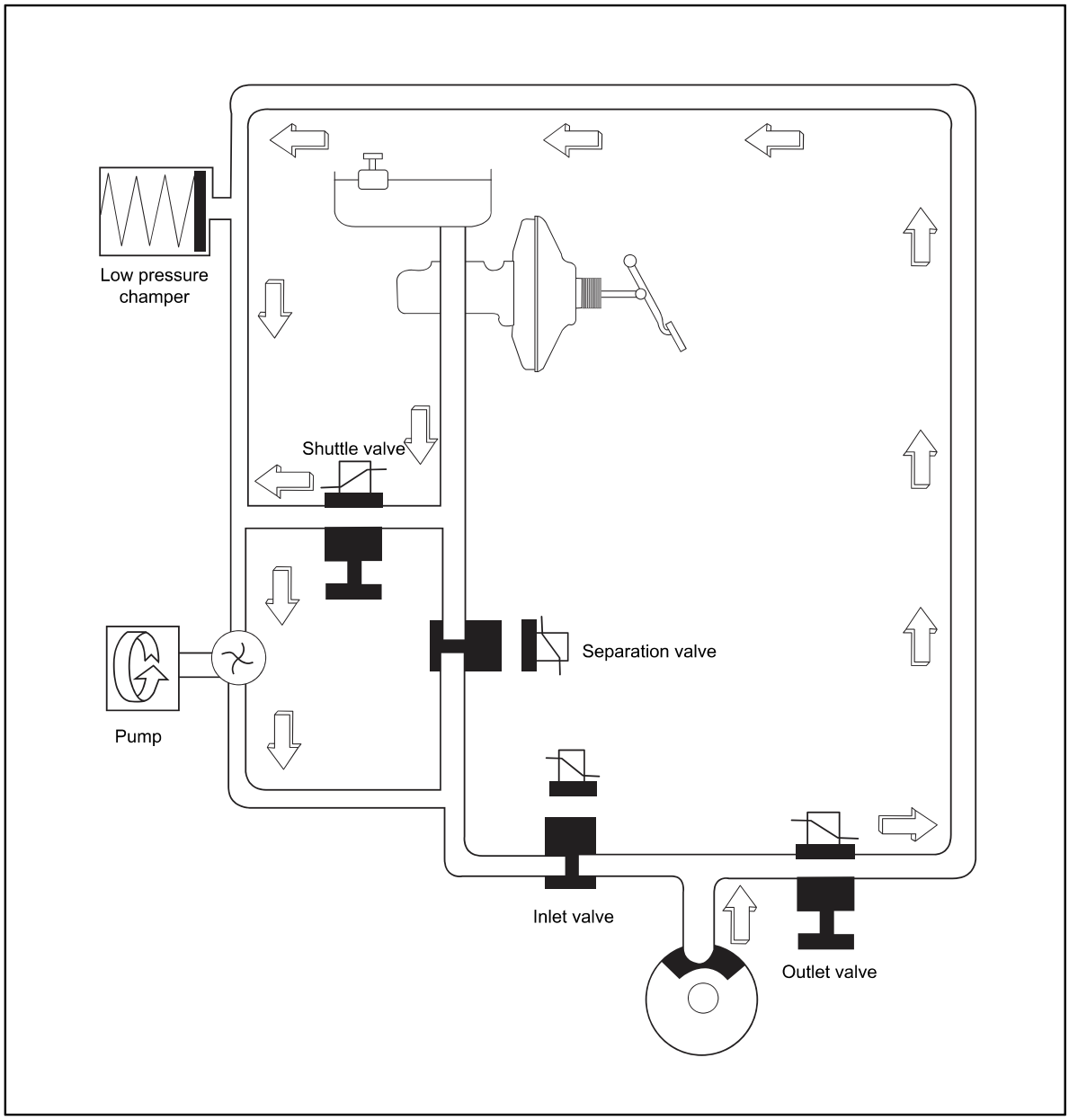
1) Idling and Normal Braking Condition



In this position, the separation valve and the inlet valve are open (normal open), the electrically operated shuttle valve and the outlet valve are closed.
When the brake is applied under these conditions, the brake fluid will be sent to each wheel via the separation valve and inlet valve.

Downloaded from www.Manualslib.com manuals search engine

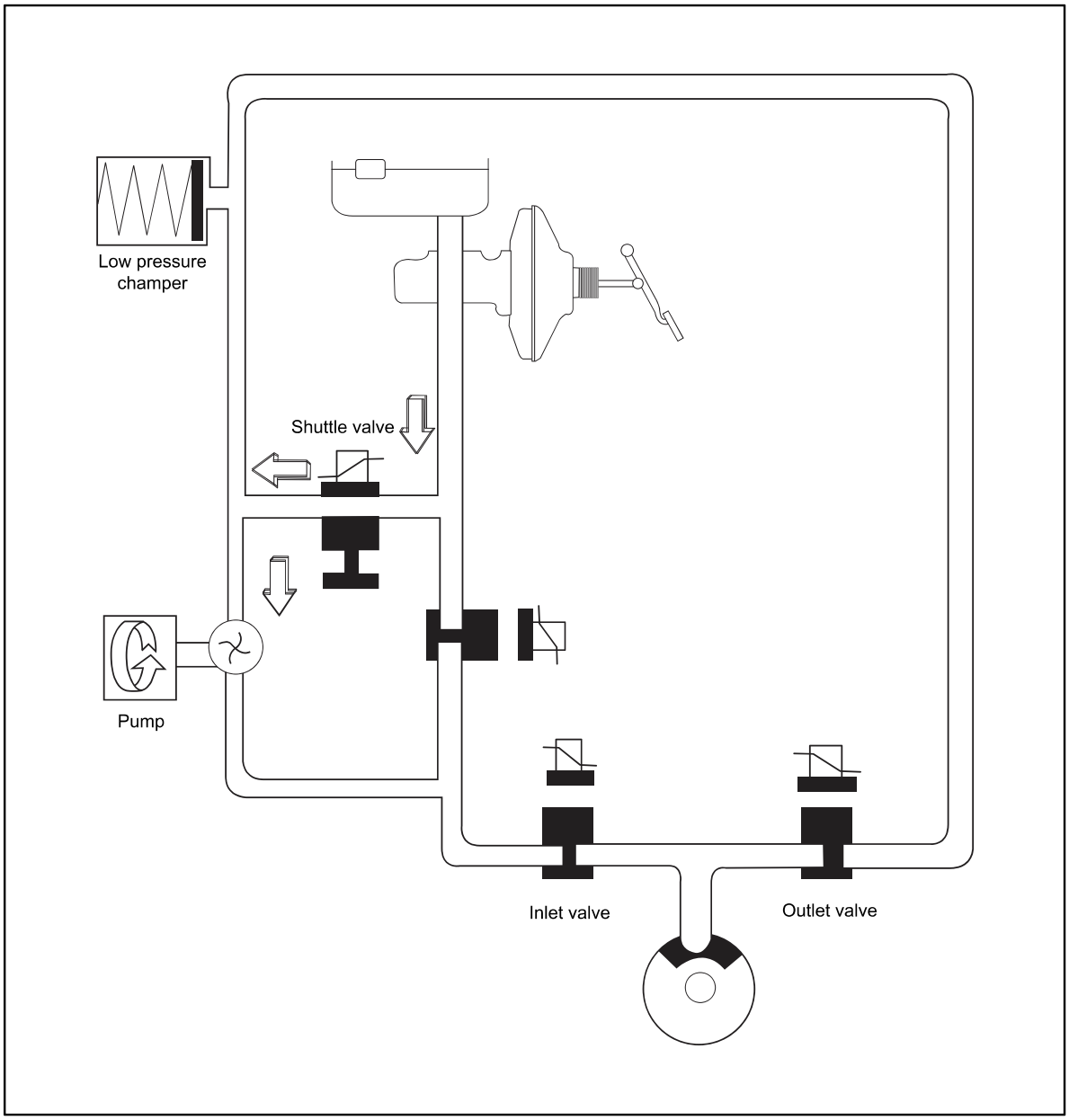
2) DUMP (ESP is working) Mode



The pressure decreases just before the wheel speed drops and the wheels are locked.
The inlet valve closes and the outlet valve opens as in the ABS HECU and the oil is gathered at the low pressure chamber while no additional oil is being supplied. Then the pump operates to allow fast oil drainage. The shuttle valve and the separation valve do not operate while decompression.

Downloaded from www.Manualslib.com manuals search engine

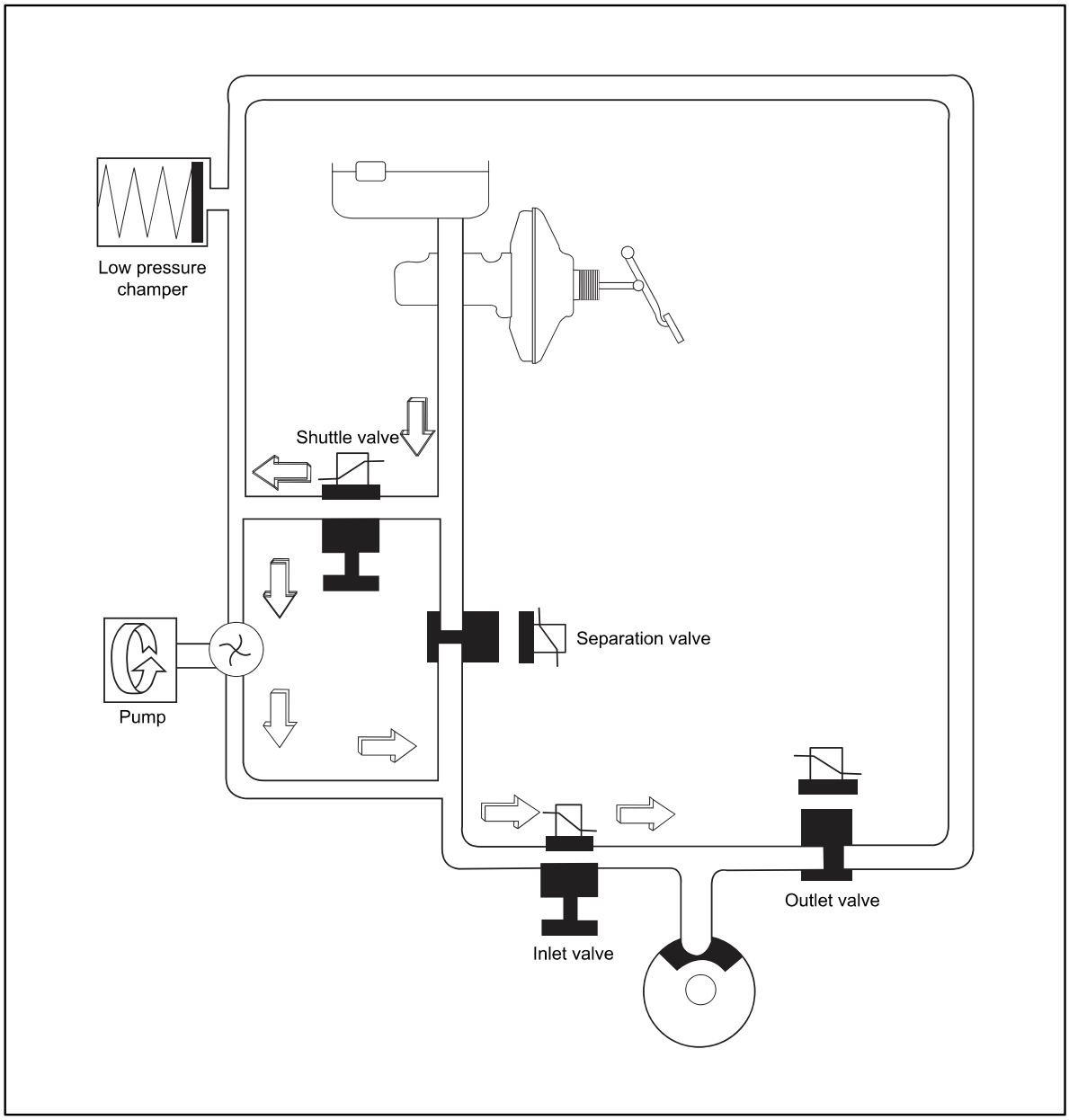
3) HOLD (ESP is working) Mode



The Inlet valve and outlet valve will be closed to maintain the pressure in the hydraulic circuit applied at the wheels. By closing the valves, the hydraulic pressure at the wheels will not be lost or supplied any more. During ESP operation, the separation valve closes and only the shuttle valve at the pump opens.

Downloaded from www.Manualslib.com manuals search engine

4) RISE (ESP is working) Mode

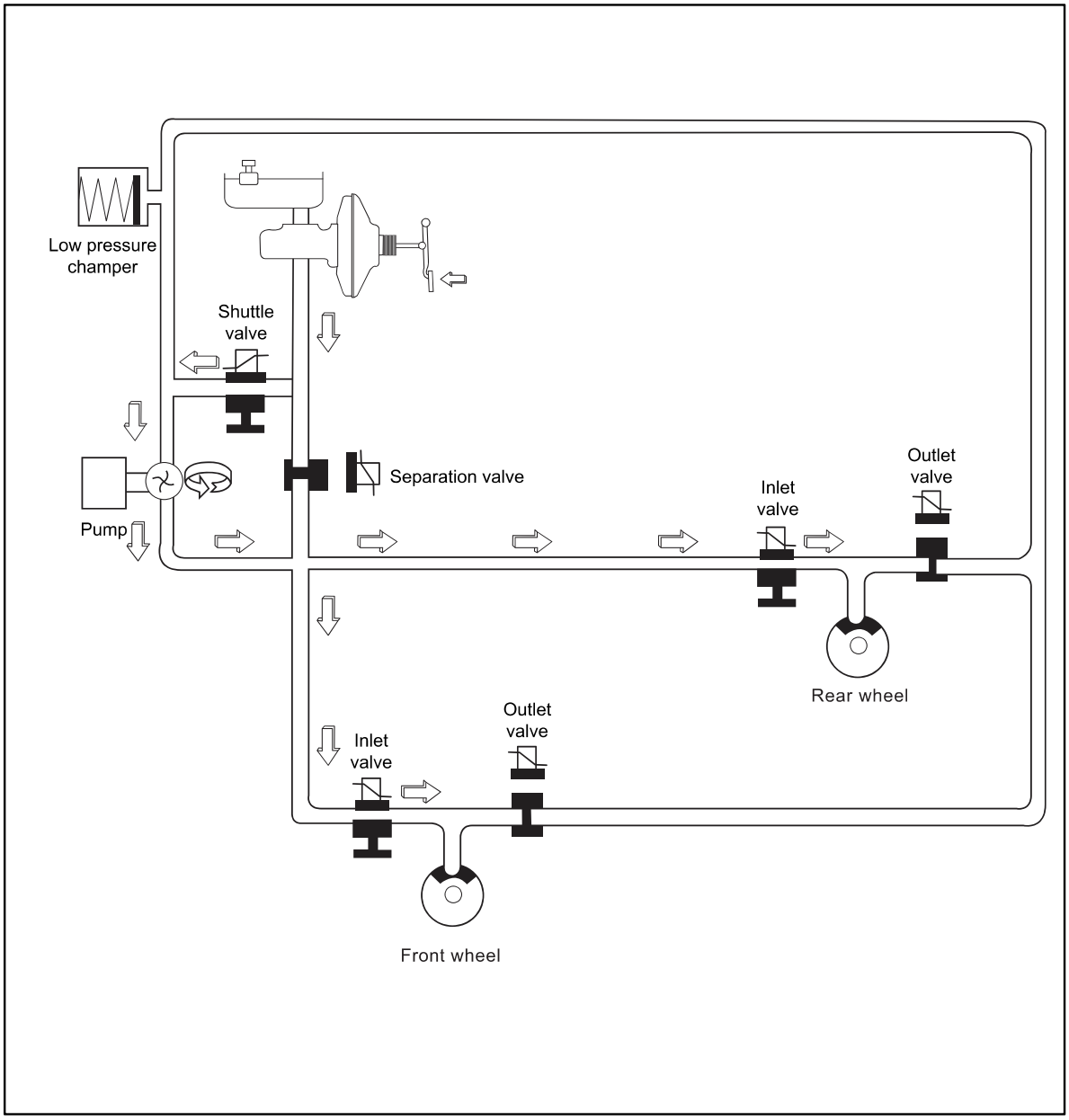


The shuttle valve and inlet valve will be open and the separation valve and outlet valve will be closed. Then, the pump is operated. When ESP operates while the ABS is operating, the pressure will be increased continuously until just before the corresponding wheel gets locked.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

5) Hydraulic Circuit of HBA

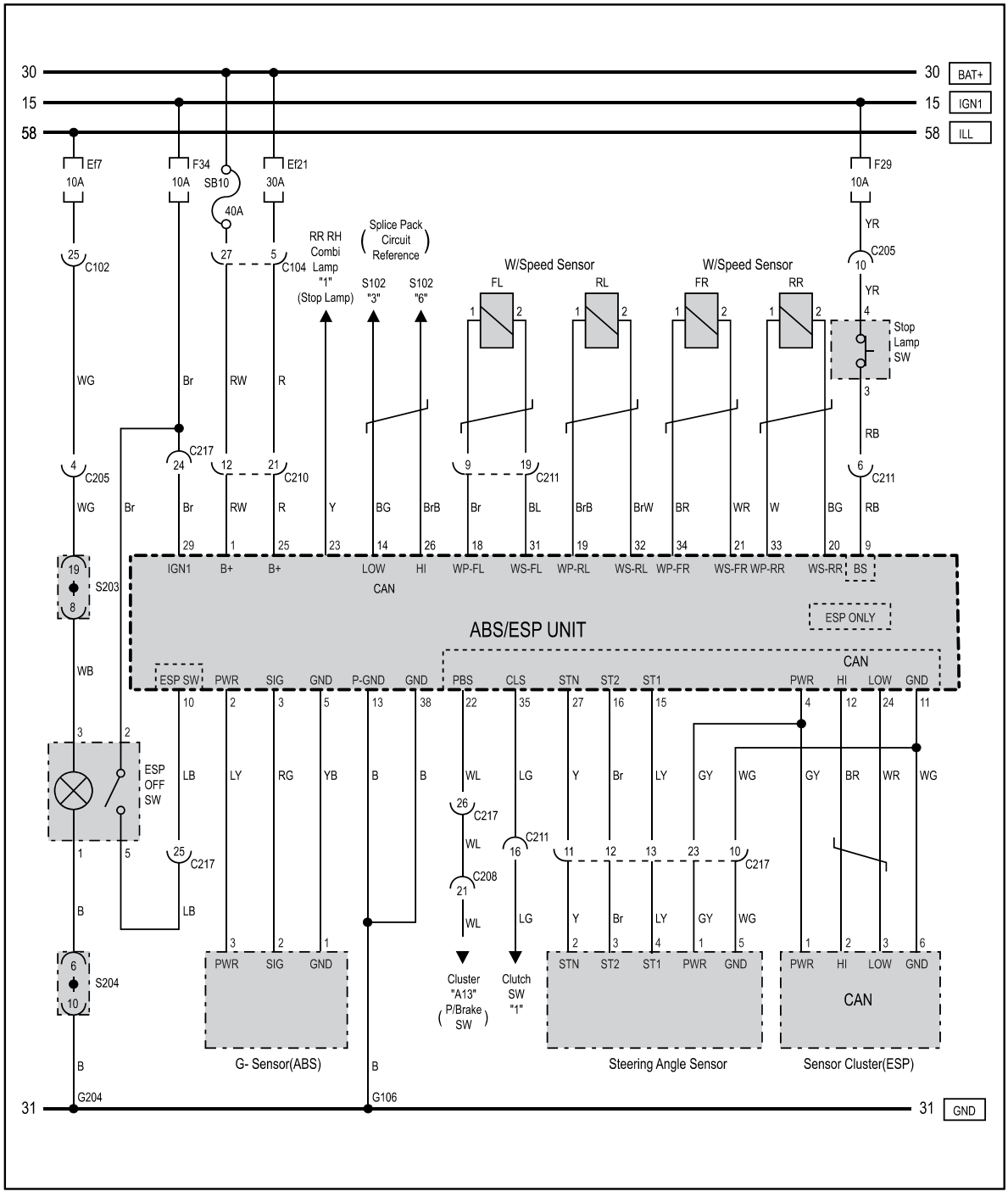


The above figure shows one front and one rear wheel and the same hydraulic circuit forms as in the ESP operation. When HECU recognizes that it is an emergency and it is required for hard braking, depending on the pressure value of the brake pressure sensor and pressure changes caused by the pressure sensor timing, it operates the pump immediately to apply the brake pressure at the wheels. Then, the pressure in the pump increases until just before the corresponding wheel gets locked. The motor still keeps rotating and the outlet valve and the separation valve will stay closed. When the wheel starts to lock, the HBA function cancels and switches to ABS operation.

Downloaded from www.Manualslib.com manuals search engine

7. CIRCUIT DIAGRAM

▶ **Wheel speed sensor, Stop lamp switch, Self diagnostic connector, Warning lamp (ABS/ESP)**



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

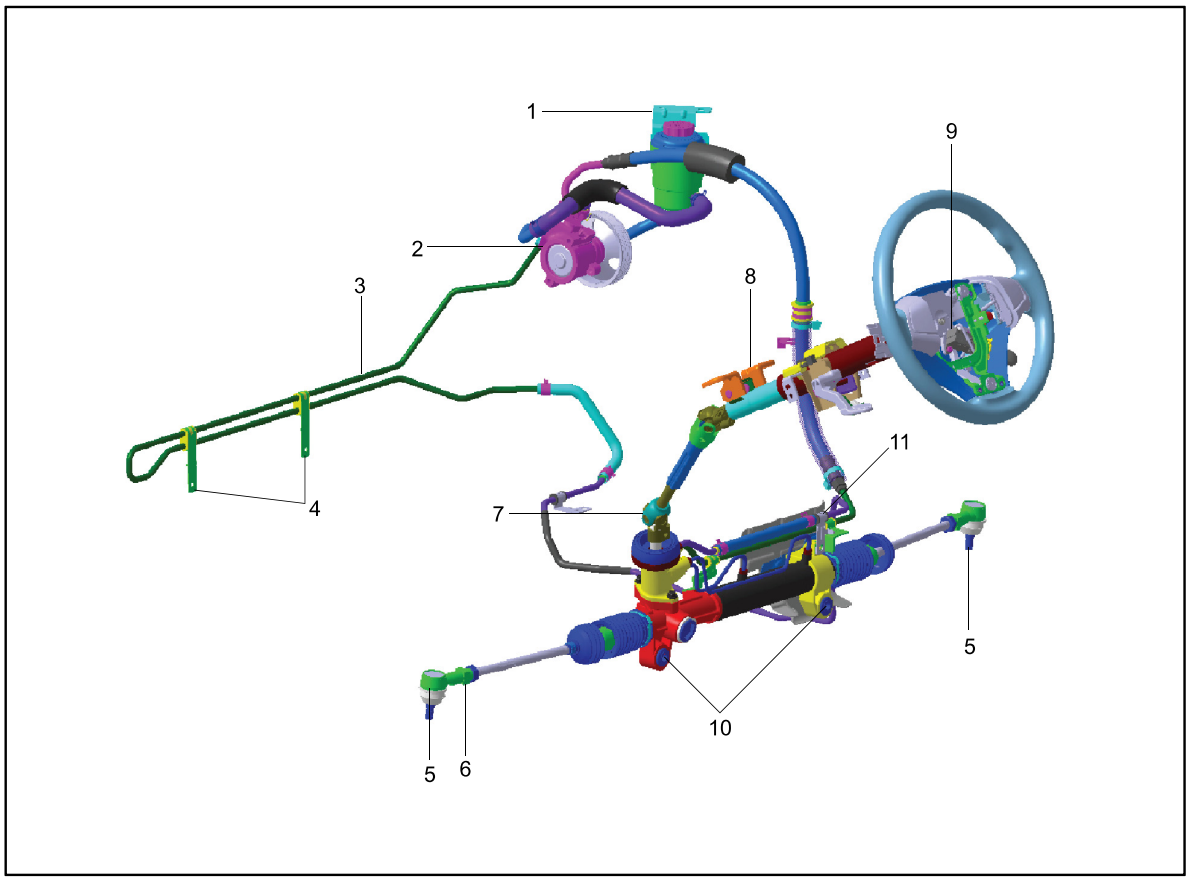
GENERAL INFORMATION

1. SPECIFICATION (HPS)

Component	Item		Specification
Steering wheel	Type		3-spoke
	Outside diameter		Φ 380 mm
	Number of revolutions		3.11 rotations
Gear box	Type		Rack and pinion
	Gear ratio		46.94
	Rack stroke		± 73 mm
Steering angle	Inner		39°
	Outer		31.24°
Wheel alignment	Toe-in		2 ± 2 mm
Oil pump	Type		Vane (removable pump and reservoir)
	Maximum pressure		100 ± 3 bar
	Displacement		6.0 to 9.75 ℓ/min
	Pulley diameter		Φ 115 mm
Steering column	Tilting angle	Up	+ 2.0
		Down	- 30
Lower shaft	Type		Ball slip
Steering oil	Oil type		ATF Dexron II or III
	Oil reservoir capacity		0.3 ℓ
	Change interval		Check and add at every 24,000 km of driving
Turning capability	Min. turning radius		5.4 m

Downloaded from www.Manualslib.com manuals search engine

2. TIGHTENING TORQUE



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Item		Tightening torque	Remark
1. Power steering reservoir mounting bolt		8.8 to 13.7 Nm	12 mm x 2 EA
2. Power steering pump	Upper mounting bolt/nut	25 ± 2.5 Nm	13 mm x 1 EA
	Lower mounting bolt	25 ± 2.5 Nm	12 mm x 2 EA
3. Oil pipe	Eye bolt (pump side)	53.9 to 63.7 Nm	22 mm
	Steering gear box side nut	31.4 to 37.2 Nm	17 mm
4. Oil pipe bracket mounting nut		6.8 to 10.8 Nm	10 mm
5. Tie rod end lock nut		44.1 to 53.9 Nm	17 mm
6. Tie rod nut		63.7 to 78.4 Nm	22 mm
7. Lower shaft	Lower mounting bolt (gear box side)	17.6 to 24.5 Nm	12 mm
	Upper mounting bolt (column side)	17.6 to 24.5 Nm	12 mm
8. Column shaft	Lower mounting bolt	19.6 to 24.5 Nm	12 mm
	Upper mounting nut	19.6 to 24.5 Nm	12 mm
9. Steering wheel nut		39.2 to 58.8 Nm	22 mm
10. Loosened gear box mounting bolt/nut		Left: 98.0 to 127.4 Nm	17 mm
		Right: 88.3 to 107.9 Nm	17 mm
11. Heat shield mounting bolt		8.8 to 13.7 Nm	12 mm x 2 EA

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. SYSTEM DESCRIPTION

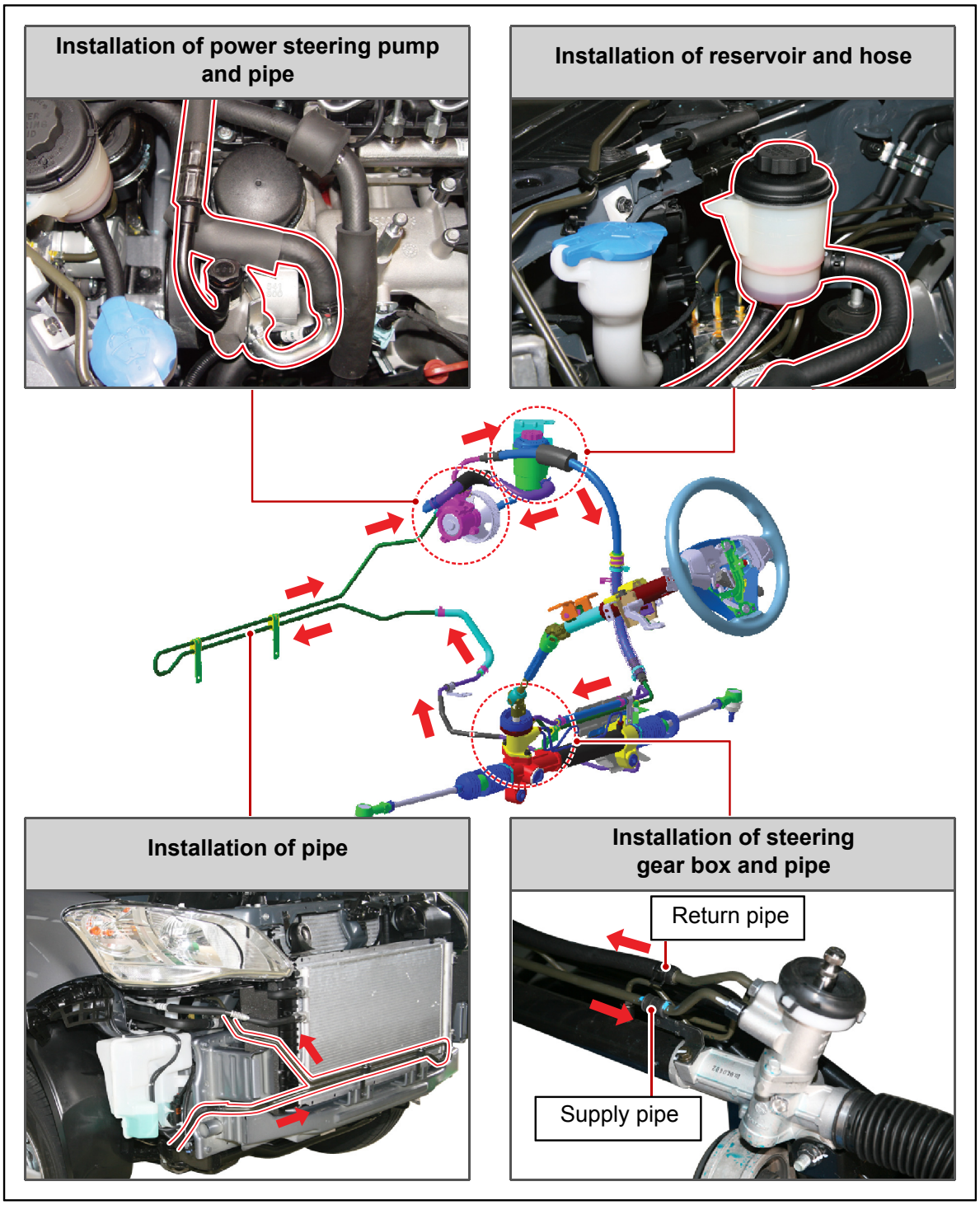
The power steering has been designed to make the wheel move more easily than in a manual steering system. The hydraulic power assists the process utilizing hydraulic fluid. The fluid increases pressure in the power steering pump and aids the movement of the steering mechanism.
The power steering system consists of pump, oil reservoir, rack and gear box.
The power steering pump is a vane type and delivers hydraulic pressure to operate the power steering system.
The pressure relief valve in the pump controls the discharging pressure.
The rotary valve in the rack and the pinion gear directs the oil from the power steering pump to one side of the rack piston. The integrated rack piston converts the hydraulic pressure to linear movement. The operating force of the rack moves the wheels through the tie rod, the tie rod end and the steering knuckle. Even though the hydraulic pressure cannot be generated, a driver can steer the vehicle without power assist but it needs very high steering force.
In this case, the operating force of the steering wheel is conveyed to the pinion, and the movement of the pinion moves the rack through the pinion gear combined to the rack gear.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. SYSTEM LAYOUT

The steering pump is driven by the engine power through a belt. This pump circulates the power steering oil from the reservoir -> steering pump -> oil supply pipe -> steering gear box -> oil return pipe -> reservoir to perform steering operations.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Description		Specification	Remark
Tire	16 inch	215 / 65R 16	Standard
	17 inch	225 / 60R 17	Optional
	18 inch	225 / 55R 18	Optional
Tire inflation pressure		32psi	-
Wheel	16 inch	6.5 J X 16	Standard
	17 inch	6.5 J X 17	Optional
	18 inch	6.5 J X 18	Optional
Balance weight		Inner: Clip-on type Outer: Adhesive type	- -
Tightening torquse of wheel bolt		127.4 ~ 156.8 Nm	17mm X 5 (Length:56.5 mm)

1) Appearance of Wheels

16 inch: 215/65R 16	17 inch: 225/60R 17	18 inch: 225/55R 18

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCE

1. OVERVIEW

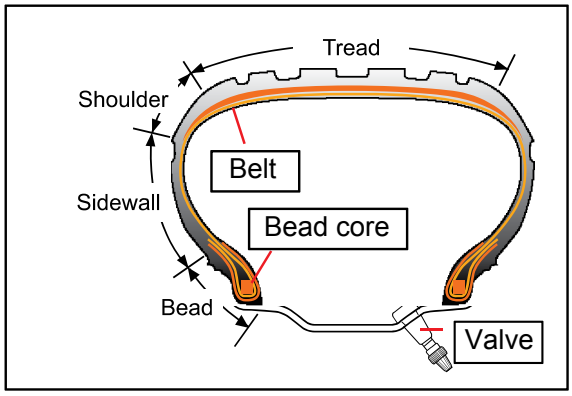
A radial tire uses a cord angle of 90 degrees. That is, the cord material runs in a radial or direct line from one bead to the other across the tread. In addition, a radial tire has a belt overwrap under the tread surface to provide greater structural stability. The belt overwrap of a radial tire distortion while the radial structure enables high speed driving.
Tire supports the weight of the vehicle, reduces the impact from the road and at the same time, transmits the power to propel, brake and steer on the road. It also functions to maintain a vehicle's movement. In order to complete such tasks, a tire must be structured to be a resilient vessel of air.
There is wear limit mark on the tire, which protrudes as a strip shape located approximately 1.6 mm from the groove bottom. This wear limit mark is not seen from the outside so there is additional "▲" mark on the shoulder to let the driver find the wear mark easily. To measure the tire groove depth, measure at any point other than the point which has a wear limit mark.
The tire is worn unevenly according to the driver's driving habit, improper servicing, low tire inflation pressure, changed tire location, etc.

1) Structure of Tire

Tread
This thick layer of rubber provides the interface between the tire and the road. Wear-resistant rubber is used to protect the carcass and belt against fractures and impacts and to deliver a long driving life.

Shoulder
Located between the tread and sidewall, the shoulder rubber is the thickest so that the design must allow for the easy diffusion of heat generated within the tire while driving.

Sidewall
The part between the shoulder and bead, the flexible sidewall protects the carcass and enhances the ride. A tire's type, size, structure, pattern, manufacturing company, product name and various characters are indicated here.



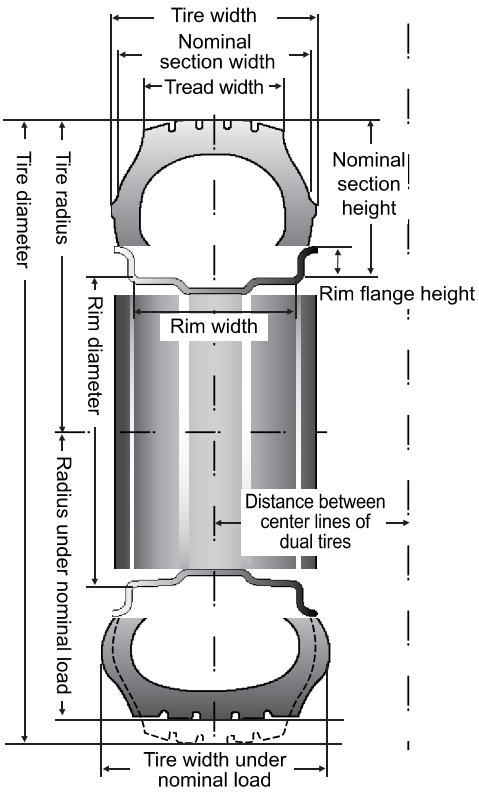
Bead
The bead attaches the tire to the rim and wraps the end of the cord fabric. Comprised of the bead wire, core, flipper and other parts, the bead is generally designed to be slightly tight around the rim so that in the case of a sudden drop in inflation pressure, the tire will not fall off the rim.

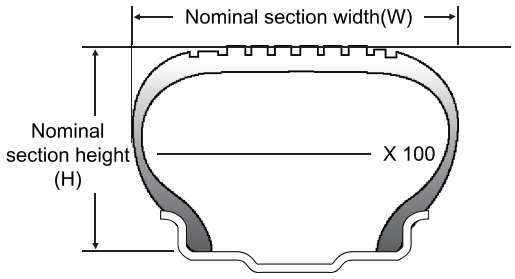
Carcass
As the most important framework of a tire, the entire inner layer of cord fabric is called the carcass. The carcass acts to support air pressure, vertical load and absorb shocks.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

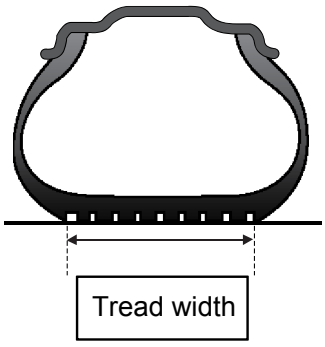
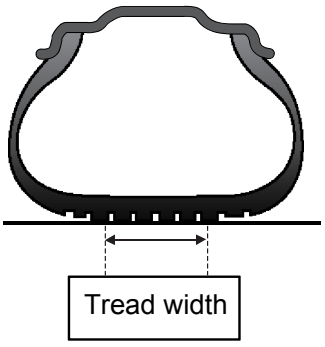
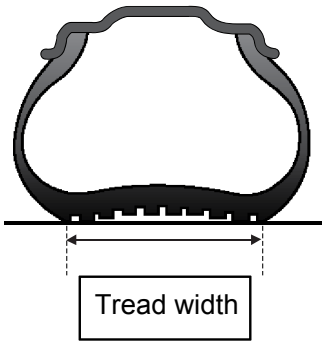
2) Tire Unit Indication





Aspect ratio (%)
= Nominal section height (H) / Nominal section width (W)
X 100

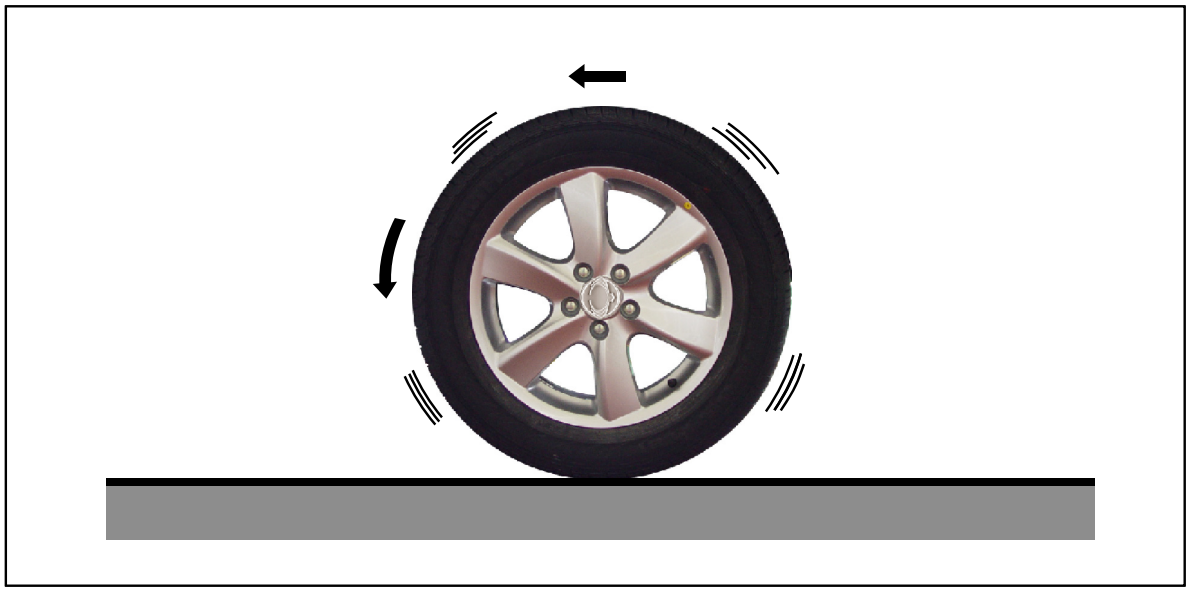
3) Tire Inflation Pressure (32 psi)

Proper inflation pressure	Excessive inflation pressure	Low inflation pressure
 Tread width	 Tread width	 Tread width
The contact area between the ground and tire faces the tread layer completely. Thus the driving force and the braking force are optimized, and the tire is worn out evenly resulting in increased life.	The contact area between the ground and tire is not enough, so the tire is worn out unevenly and the tire is vulnerability to outside influence.	The contact area between the ground and tire is excessive, so a lot of heat is generated and the tire is worn out unevenly and abnormally.

Downloaded from www.Manualslib.com manuals search engine

2. ABNORMAL TIRE SYMPTOM

1) Standing Wave

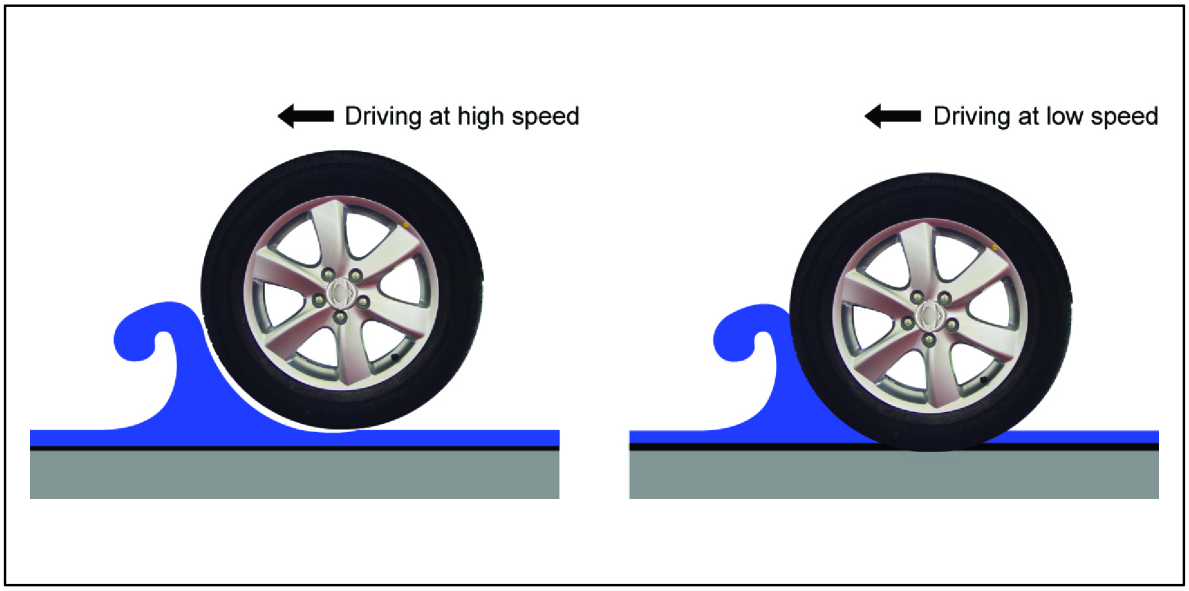


Specified tire inflation pressure	32psi

During driving, the rotating tire repeats deformation and restoring movement in is tread. This happens when the tire pressure is low in high speed driving.
However, when the wheel rotating speed is fast, the tire is deformed even before it is restored to its original shape and the trembling wave appears on the tread portion. If this symptom lasts for an extended period of time, the tire can be blown out in a short period of time.
If the standing wave symptom occurs on the tire, rubber on the tread comes off and eventually the tire can be blown out which is very dangerous. When driving at high speed, the inflation pressure should be increased to decrease heat generation due to extension and contraction motion, to decrease hydroplaning and to prevent standing wave.
To prevent this symptom, it is recommended to increase the tire pressure 10 ~ 30 % higher than the specified pressure value in high speed driving.

Downloaded from www.Manualslib.com manuals search engine

2) Hydro Planing



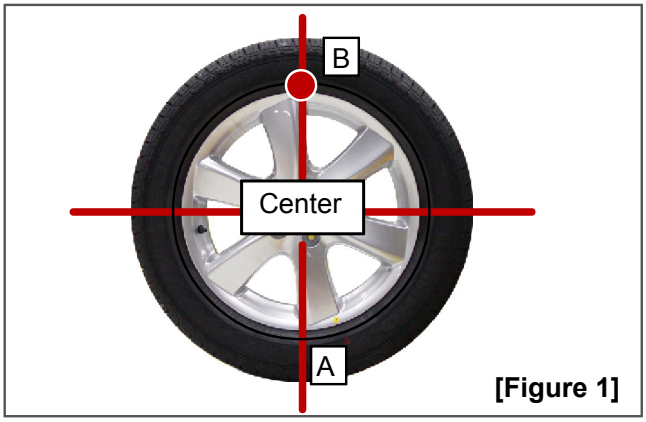
When the vehicle is driven on a road surface covered with water at high speed, tires do not contact with the road surface but rotate floating on a thin film of water.
It causes brake failure, lower traction force and losing the steering performance.
To prevent this, increase the tire inflation pressure, use tires with leaf shape tread which is not worn. However, it is a best measure to drive slowly.

Downloaded from www.Manualslib.com manuals search engine

3. WHEEL BALANCE

If weight is not equally distributed around the wheel, unbalance centrifugal force by the wheel rotation produces vibration. As the centrifugal force is produced proportional to the square of the rotating speed, the wheel weight should be balanced even at high speed. There are two types of the tire and wheel balancing: static and dynamic. Abnormal vibration may also occur due to unbalanced rigidity or size of tires.

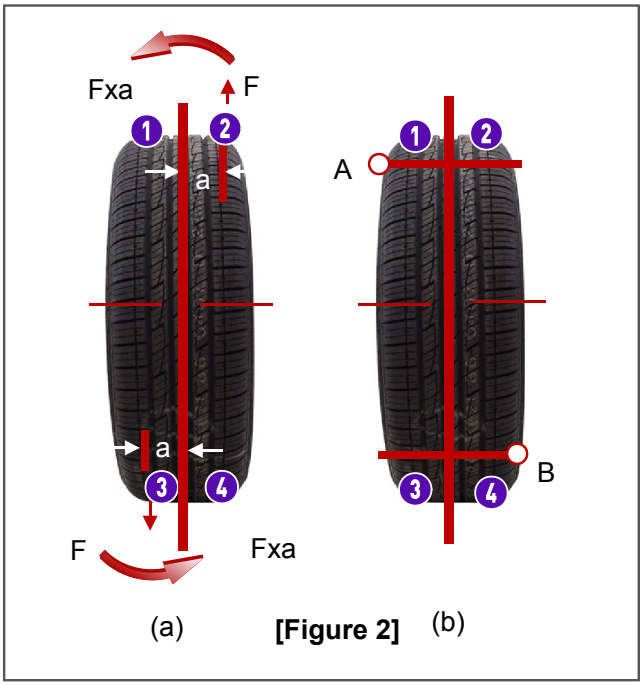
1) Static Balance



[Figure 1]

When the free rotation of the wheel is allowed, the heavier part is stopped on the bottom if the wheel weight is unbalanced and this is called "Static Unbalance". Also, the state at which tire's stop position is not same is called "Static Balance" when the wheel is rotated again. If the part A is heavier as shown in the figure 1, add the balance weight of a weight corresponding to unbalanced weight from B to A to maintain the static balance. If the static balance is not maintained, tramping, up and down vibration of the wheels, occurs.

2) Dynamic Balance



[Figure 2]

The static unbalance of the wheel creates the vibration in the vertical direction, but the dynamic unbalance creates the vibration in the lateral direction. As shown in the figure 2 (a), if two parts, (2) and (3), are heavier when the wheels are under the static balance condition, dynamic unbalance is created, resulting in shimmy, left and right vibration of the wheels, and the torque Fxa is applied in the axial direction. To correct the dynamic unbalance, add the balance weight of a same weight for two points of the circumference of the rim, A and B, as shown in the figure 2 (b), and apply the torque in the opposite direction to the torque Fxa to offset in order to ensure smooth rotation of the wheel.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

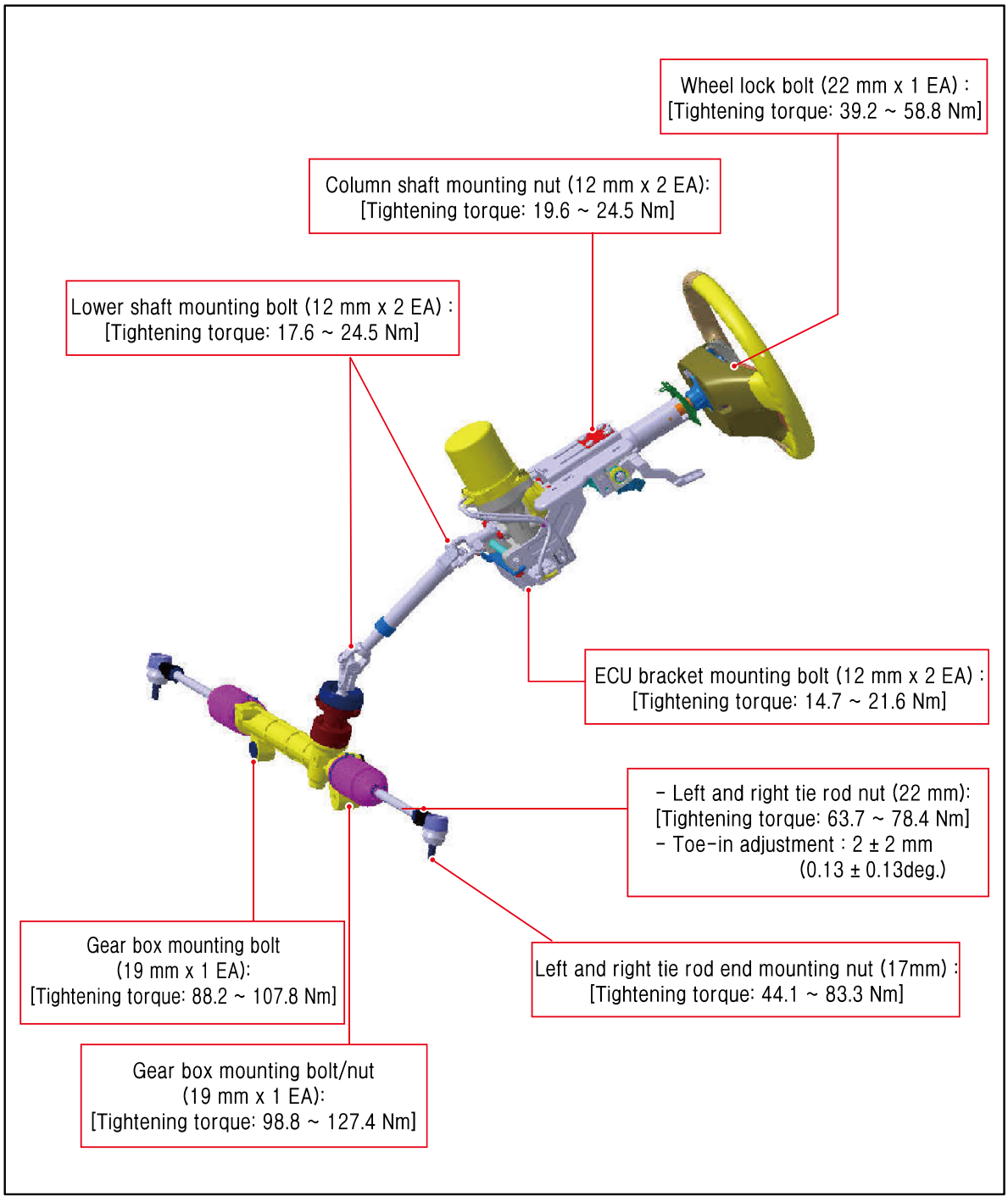
GENERAL INFORMATION

1. SPECIFICATION

Unit	Description	Specification
System operation	Operating type	Motor driven power steering system
	Operating temperature	- 40°C to 80°C
	Rated voltage	12 V
	Rated current	85 A
Operating voltage	Network	8 to 16 V
	C-EPS ECU	8 to 16 V
	Full Performance	10 to 16 V
Motor	Type	3-Phase BLAC (Brushless AC)
	Rated current/voltage	85 A / 12 V (at idle 0.5 A)
	Position sensor type	Hall sensor type
Torque & angle sensor	Type	Non-contact type
Steering column	Operating type	Manual tilting & telescoping
Lower shaft	Type	Sliding (Ball slip) type
Steering gear	Gear ratio	46.94 mm/rev
	Rack stroke	146 mm
Maximum steering angle	Inner wheel	39°
	Outer wheel	31.24°

Downloaded from www.Manualslib.com manuals search engine

2. TIGHTENING TORQUE



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. OVERVIEW

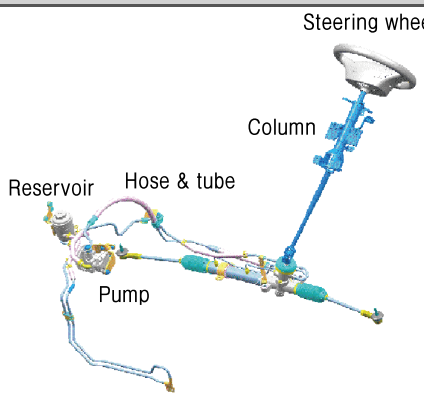
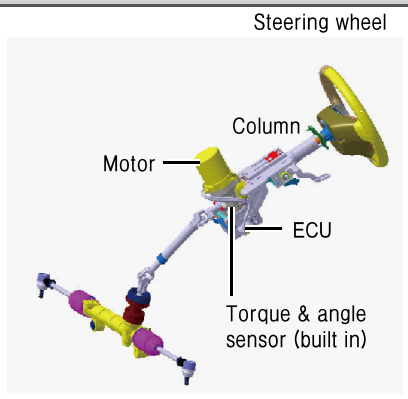
The electric power steering, EPS, does not have any belt-driven steering pump constantly running, so it is lightweight and the motor consumes energy only when the steering wheel is turned by the driver, and this leads to improvement in fuel efficiency. Also, the elimination of a belt-driven pump and its accessories greatly simplifies manufacturing and maintenance. While offering these benefits, as it does not contain any steering oil, the environment is not polluted both when the steering system is produced and discarded.
In other words, the electric power steering (EPS) system uses the electric motor to assist the steering force. It functions independently regardless of whether the engine is running or not, unlike the existing hydraulic power steering.
The EPS system generates an assist steering force variably depending on the driving conditions by controlling the motor's operation, based on the input signals from the sensors such as torque sensor and angle sensor. In turn, the EPS receives the torque signal by the driver's movements of the steering wheel, as well as the vehicle speed, and uses the motor to determine the assist torque. The EPS controls the motor for this. Another features of EPS are fail-safe function, diagnosis function, communication function between units and interface function for external diagnostic device.
The EPS system components such as the torque sensor, steering angle sensor, fail-safe relay, etc. are located in the steering column and EPS unit assembly.

▶ **Advantages:**

(1)Assurance of improved steering
- Provides optimal steering force according to the vehicle speed
- Enhanced steering stability while driving at high speed

(2)Reduced fuel consumption
- Consumes energy only when steering wheel is turned (improved by 3 to 5%)
- Energy saving (reduced by 85% compared with hydraulic power steering)
- Reduced number of parts: Elimination of steering pump, hydraulic hose, pump pulley, oil reservoir, belt, bracket, etc.

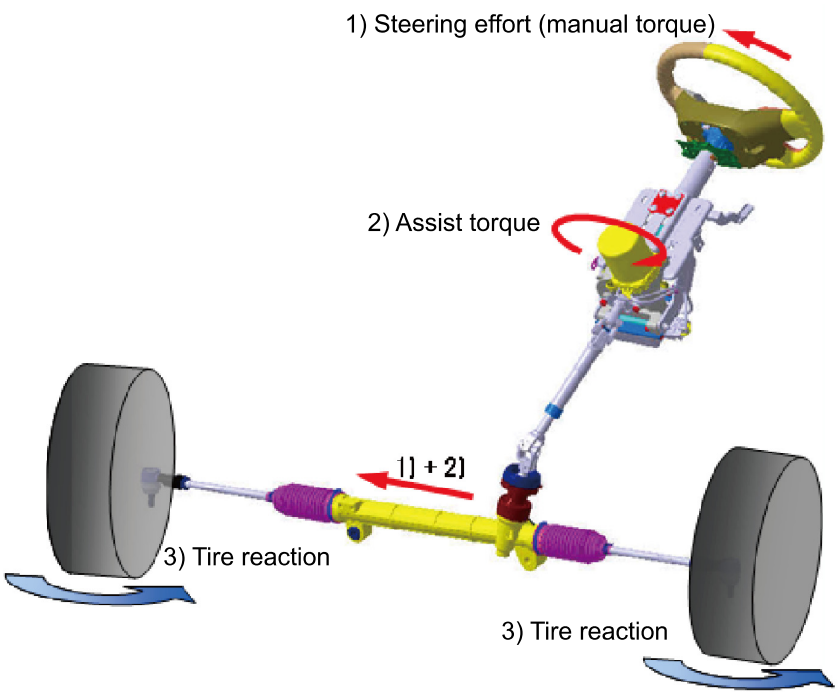
▶ **Comparison between hydraulic power steering and electric power steering (EPS)**

Hydraulic power steering	Electric power steering
	

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. OPERATION



Output torque = 1) Steering force (manual torque) + 2) Assist torque

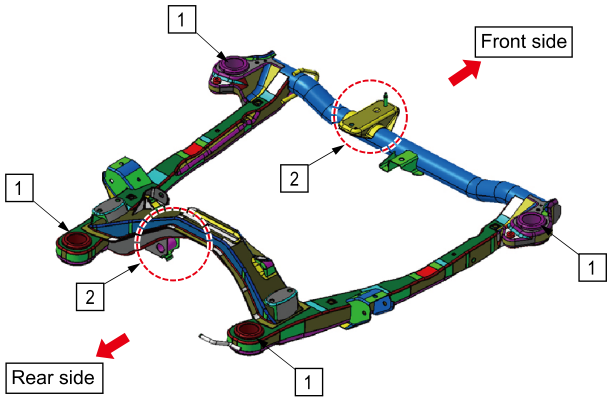
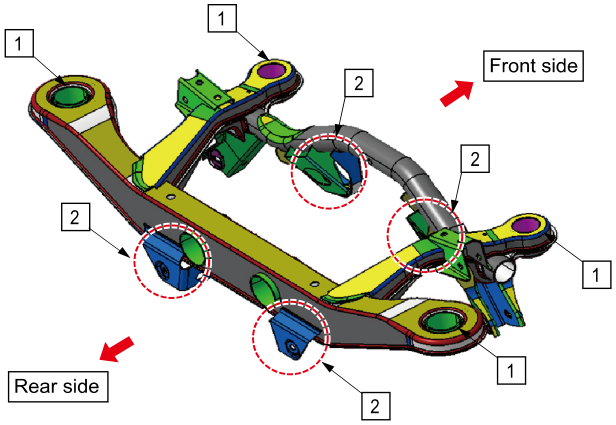
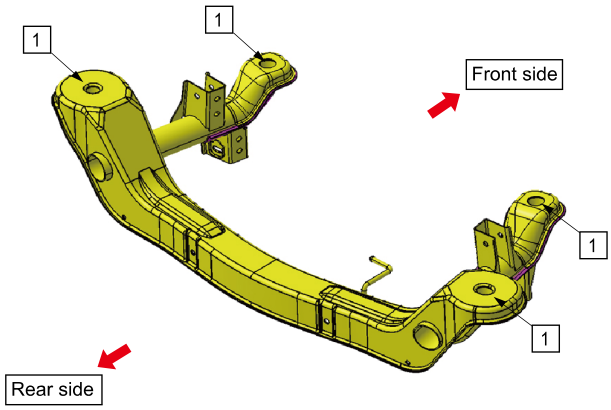
When the driver turns the steering wheel, a torque is generated and the torque sensor and the steering angle sensor in the EPS system detect the rotation of the steering column to run the electric motor. At this time, the worm gear connected to the motor drives the helical gear mounted to the steering column to generate the assist torque for the steering column. This allows the driver to operate the steering wheel easier.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

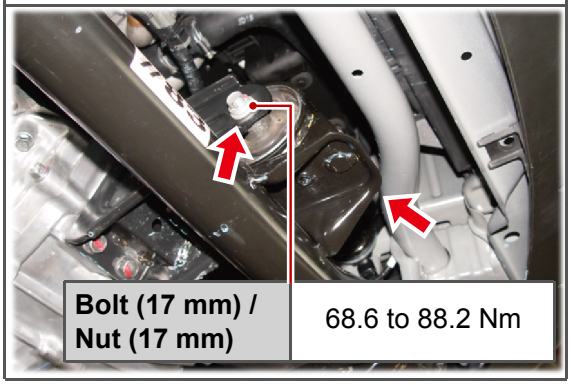
Unit	Construction	
Front sub frame	1. Body mounting: 4-points bush 2. Transaxle mounting: 2-points bush 3. Weight: 22.37 kg	
Rear sub frame (4WD)	1. Body mounting: 4-points bush 2. Axle mounting: 4-points bush 3. Weight: 16.61 kg	
Rear sub frame (2WD)	1. Body mounting: 40 points direct mounting 2. Spring link: Direct mounting without bracket on rear cross member 3. Weight: 12.74 kg	

Downloaded from www.Manualslib.com manuals search engine

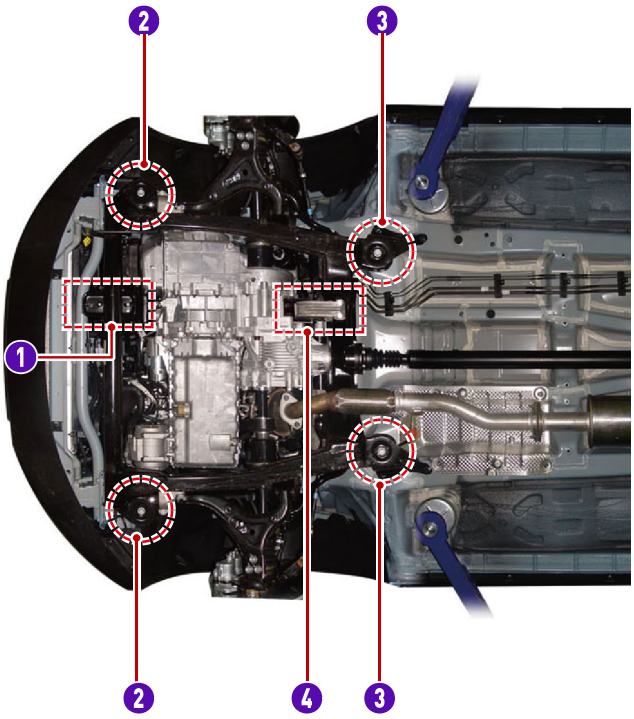
2. TIGHTENING TORQUE

▶ **Front sub frame - based on 4WD**

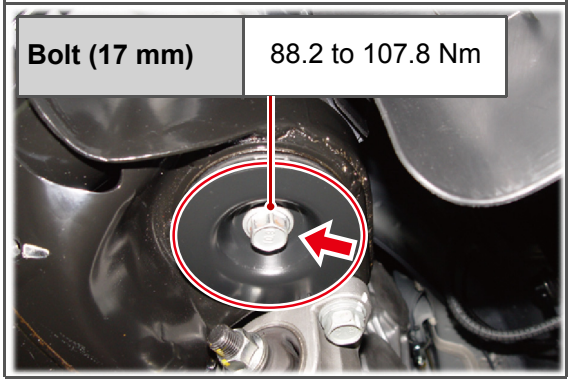
1. Transaxle mounting (Front)



Bolt (17 mm) / Nut (17 mm)	68.6 to 88.2 Nm



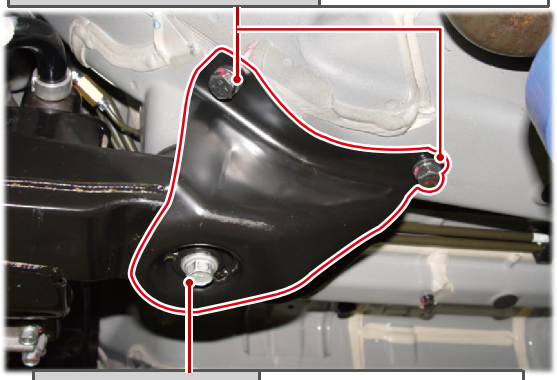
2. Front mounting (LH & RH)



Bolt (17 mm)	88.2 to 107.8 Nm

3. Rear mounting (LH & RH)

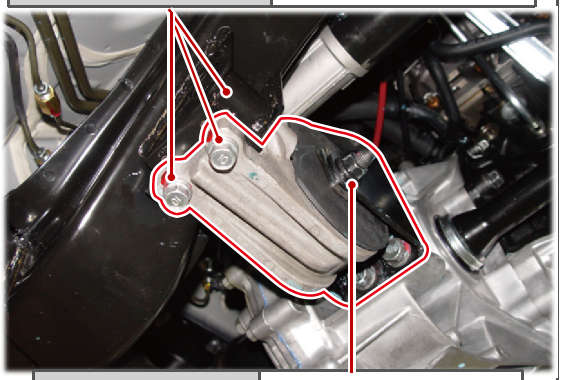
2 Bracket mounting bolts (17 mm)	88.2 to 107.8 Nm



Bolt (17 mm)	88.2 to 107.8 Nm

4. Transaxle mounting (Rear)

3 Bolts (14 mm)	29.4 to 49.0 Nm

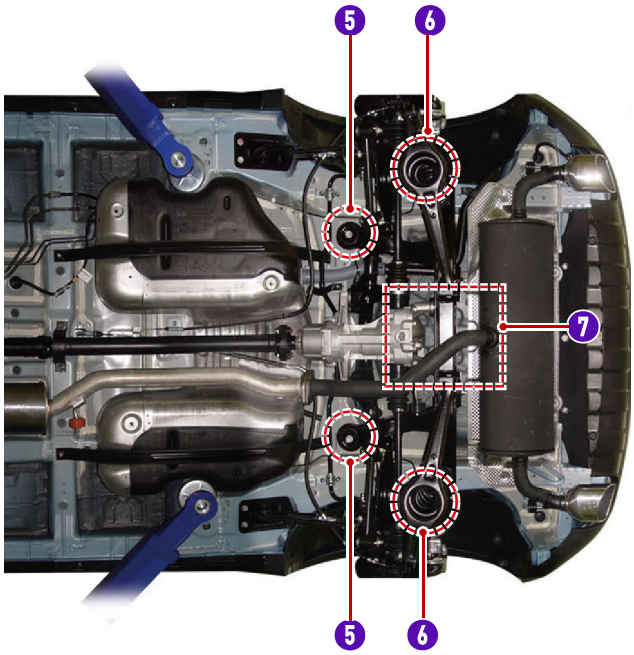


Bolt (14 mm) / Nut (14 mm)	68.6 to 88.2 Nm

Modification basis	
Application basis	
Affected VIN	

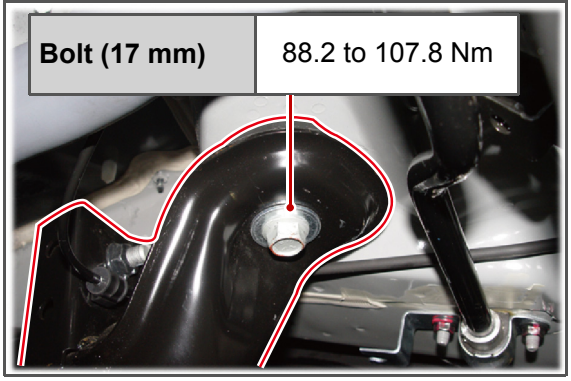
Downloaded from www.Manualslib.com manuals search engine

▶ Rear sub frame - based on 4WD



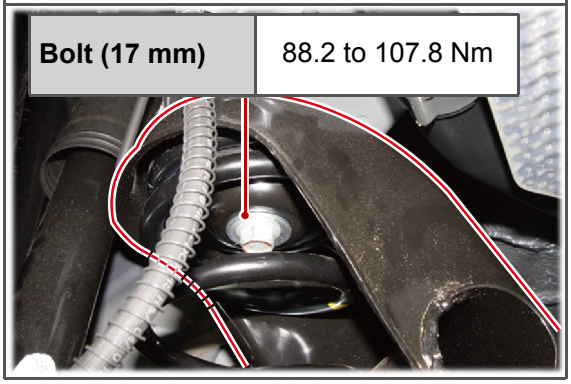
5. Front mounting (LH & RH)

Bolt (17 mm)	88.2 to 107.8 Nm



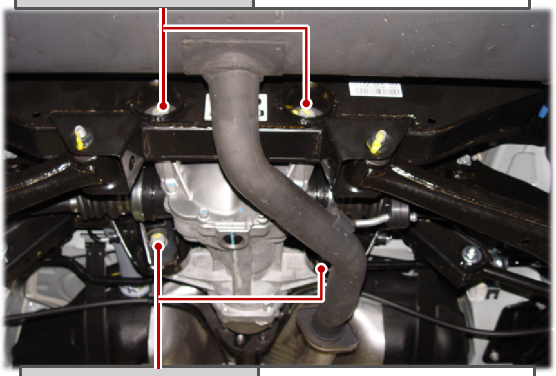
6. Rear mounting (LH & RH)

Bolt (17 mm)	88.2 to 107.8 Nm



7. Rear axle mounting

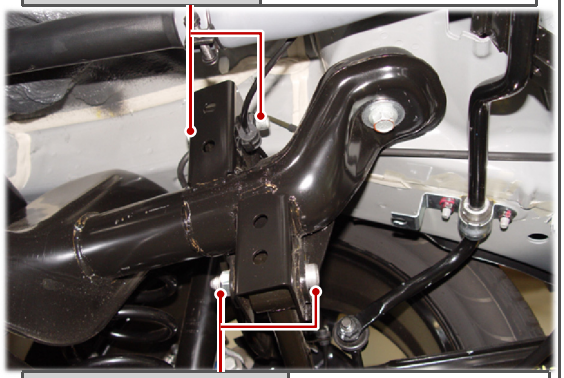
Rear mounting bolt (17 mm)	107.8 to 127.4 Nm



Rear mounting bolt (14 mm)	68.6 to 88.2 Nm

8. Other connections for rear sub frame (LH & RH)

Upper arm bolt (17 mm) / Nut (19 mm)	98.0 to 117.6 Nm

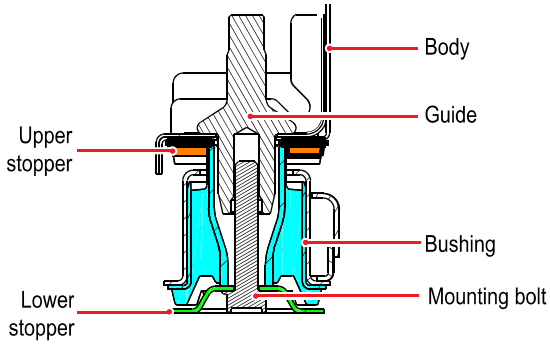
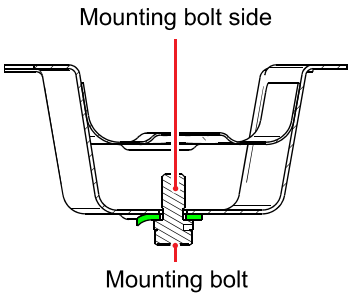
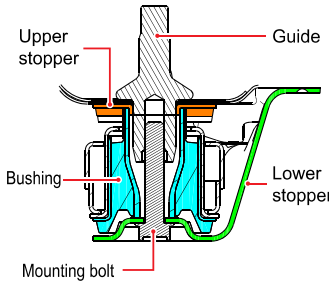
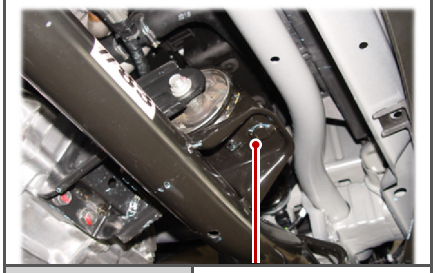
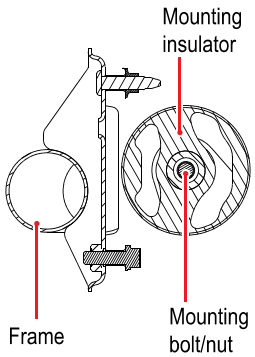
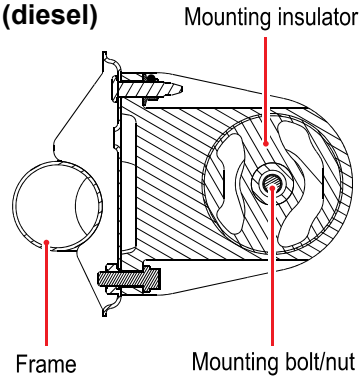
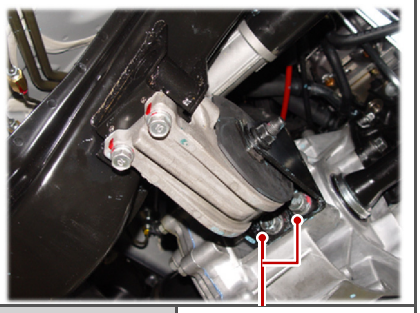
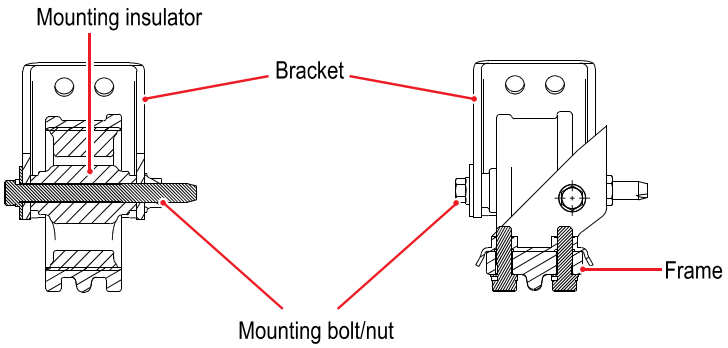


Lower arm nut/Bolt (19 mm)	98.0 to 117.6 Nm

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

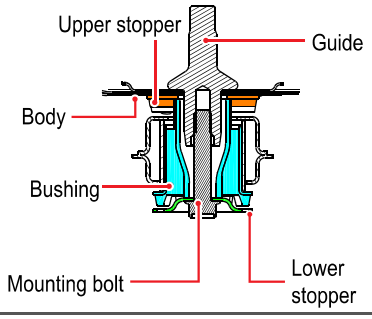
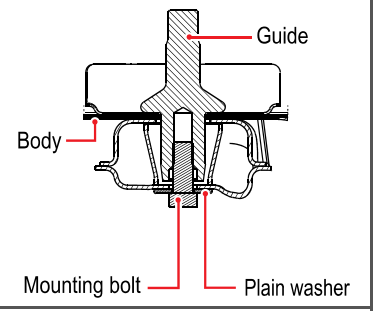
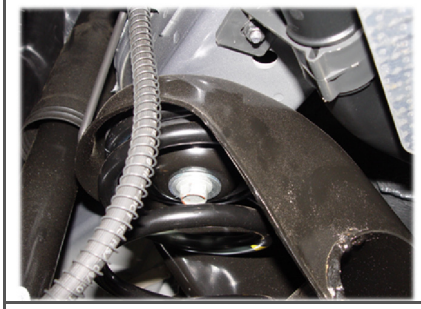
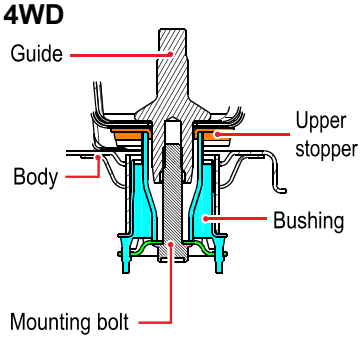
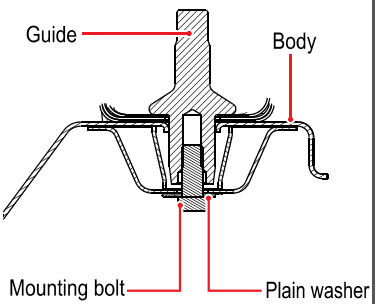
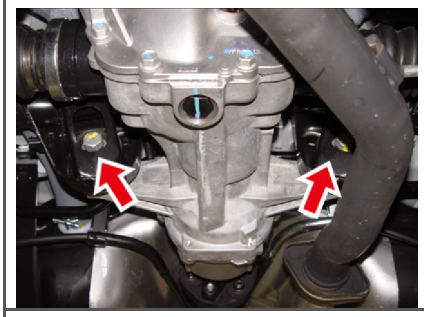
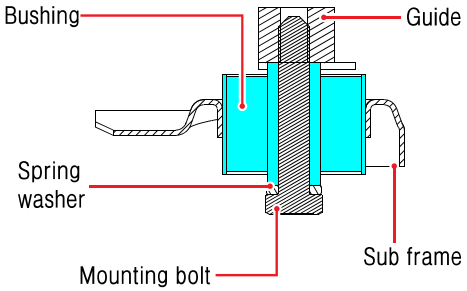
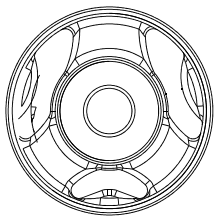
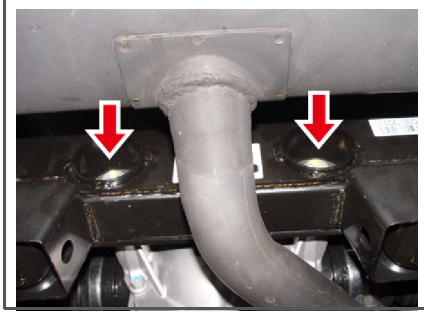
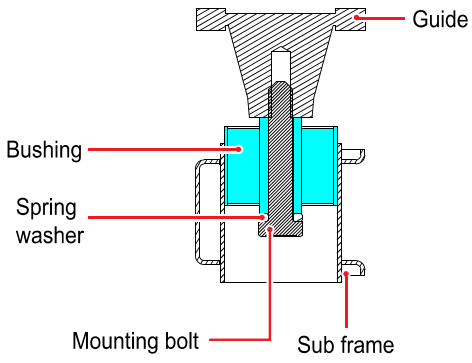
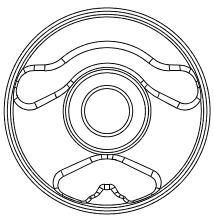
1) Sectional Diagram and Bolts for Front Sub Frame

Installation	Sectional diagram
1. Front	
2. Rear	**Mounting bracket**  **Mounting bolt** 
3. Transaxle mounting (Front)  **Mounting nut** 29.4 to 39.2 Nm	**For manual transaxle**  **For automatic transaxle (diesel)** 
4. Transaxle mounting (Rear)  **Bolt** 9.4 to 39.2 Nm	

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Sectional Diagram and Bolts for Rear Sub Frame

Installation	Sectional structure	
1. Front	**4WD** 	**2WD** 
2. Rear 	**4WD** 	**2WD** 
3. Rear axle - Front (4WD) 		
4. Rear axle - rear (4WD) 		

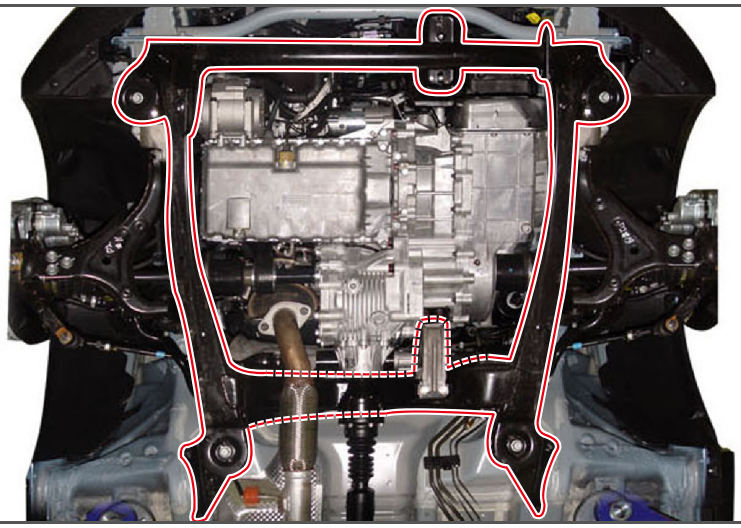
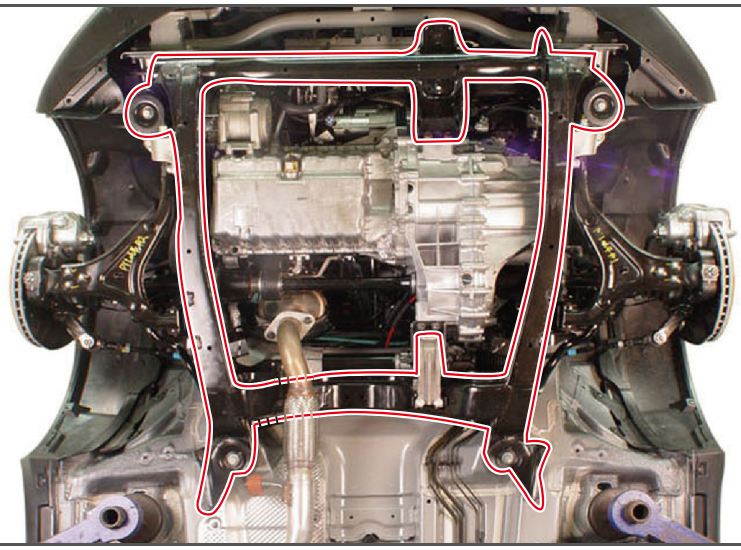
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

S.G.N. 4012-01 OVERVIEW OF FRONT SUB FRAME

The front sub frame consists of 4 body bush mountings and 2 engine bush mountings which reduce the vibration from the powertrain and road, and also control the torque. And the two engine bush mountings consist of an engine mounting which supports the engine powertrain and a transmission mounting.
The engine side and transmission side mountings are rubber mountings with brackets and insulators while the body mounting is a rubber bush mounting which is fitted to the frame.

Installation of front sub frame (4WD)	The installation of the front sub frame is the same for both automatic transmission and manual transmission. For 4WD, the PTU and the propeller shaft are installed.
	
Installation of front sub frame (2WD)	The installation of the front sub frame is the same for both automatic transmission and manual transmission.
	

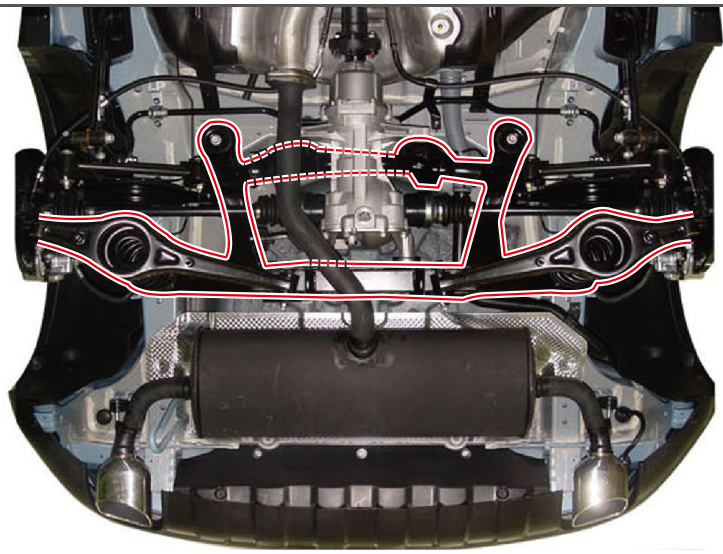
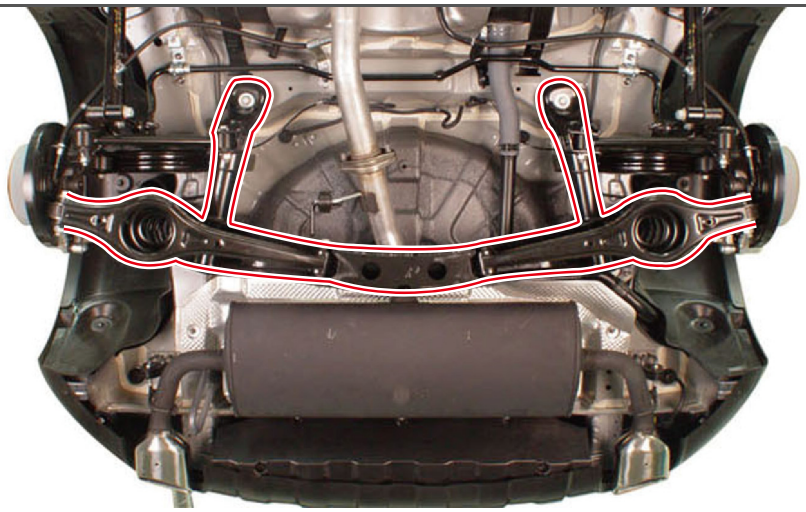
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 4015-01

OVERVIEW OF REAR SUB FRAME

The rear sub frame system consists of body bush mountings and direct mountings which reduce the vibration transmitted from the powertrain and road to the vehicle body.
For 4WD, it consists of 4 body mountings (bush mountings) and 2 axle mountings (bush mountings) and for 2WD, it consists of 4 body mountings (direct mountings).

Installation of rear sub frame (4WD)	The installation of the rear sub frame is the same for both automatic transmission and manual transmission. For 4WD, the E-coupling, propeller shaft and rear axle are installed.
	
Installation of rear sub frame (2WD)	The installation of the rear sub frame is the same for both automatic transmission and manual transmission.
	

Downloaded from www.Manualslib.com manuals search engine

AIR CONDITIONING SYSTEM 6810-20

GENERAL INFORMATION

1. SPECIFICATION

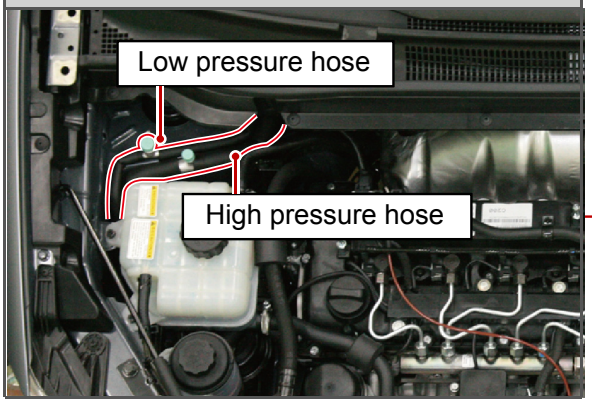
Description		Specification
Heater	Core size (㎜)	200 x 165.5 x 25
	Capacity (kcal/h)	4,800
Evaporator	Core size (㎜)	254.8 x 196.75 x 60
	Capacity (kcal/h)	4,700
Blower	Supplied power (W)	240 + 10% Max (at 12V)
	Fan speed (rpm)	2900 ± 200 Max (Rec.Mode: 420㎥/h)
PTC	Supplied power	1 kW
Condenser	Core size (㎜)	588 x 455 x 16 (2,625)
	Capacity (kcal/h)	12,000
	Capacity of receiver drier	250 cc
Compressor	Capacity	170 cc/rev
	Diameter of pulley	Ø120
	Max. speed	8,000 rpm
	Voltage	DC 12 V
	Current consumption	2.2A

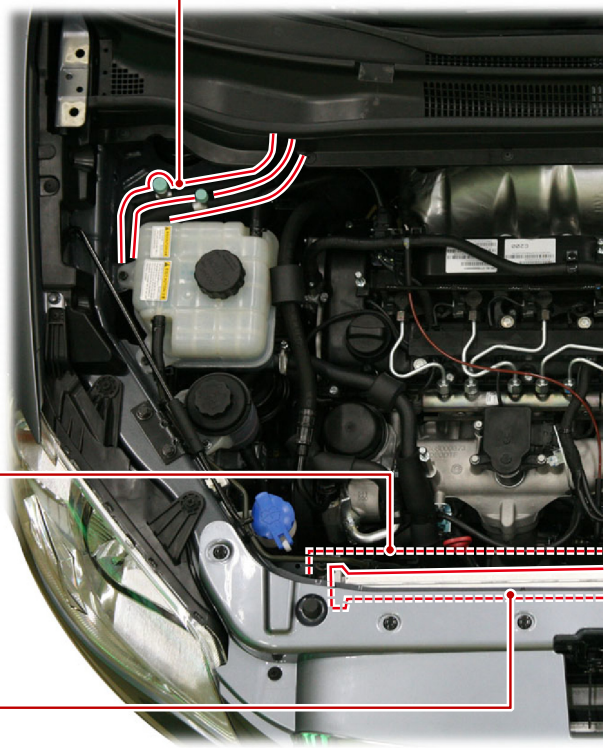
Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

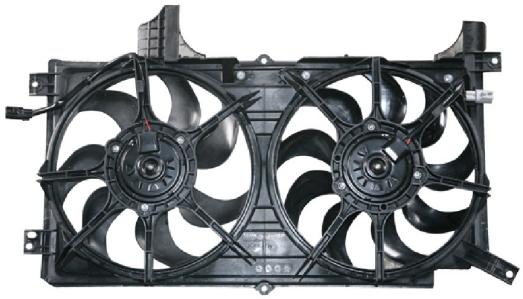
1. SYSTEM LAYOUT

Line & port

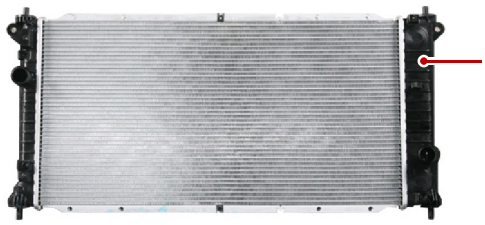




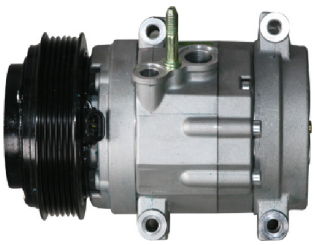
Electric fan



A/C condenser & receiver dryer

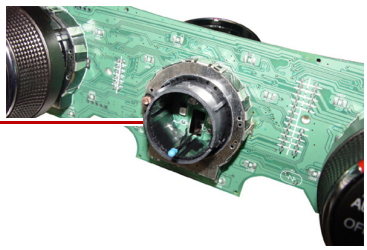


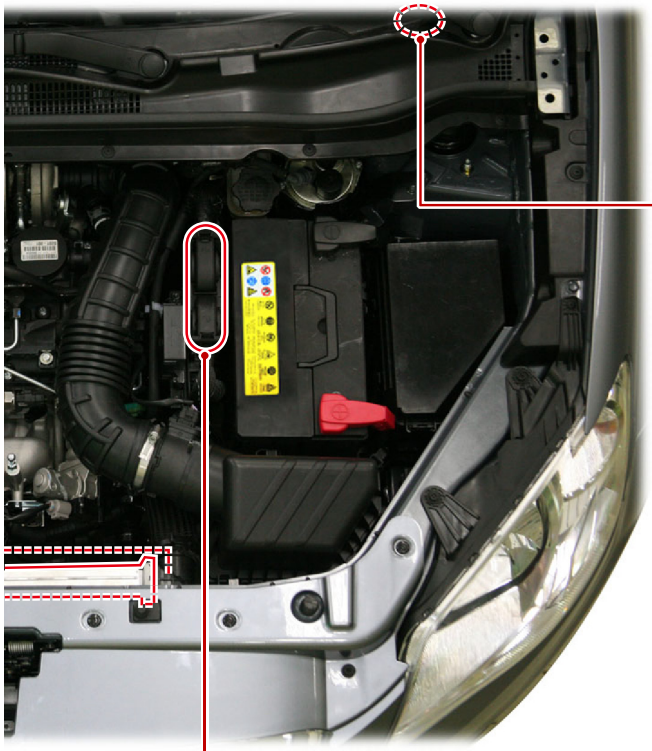
A/C compressor



Modification basis	
Application basis	
Affected VIN	

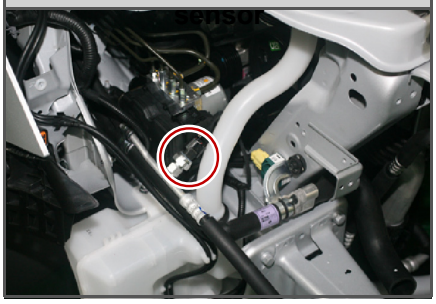
Downloaded from www.Manualslib.com manuals search engine

FATC	In-car sensor
	



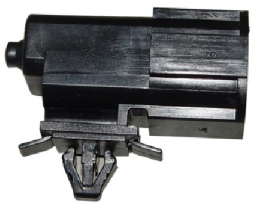
Sun-load sensor

Refrigerant pressure



Engine ECU

Ambient air temperature sensor

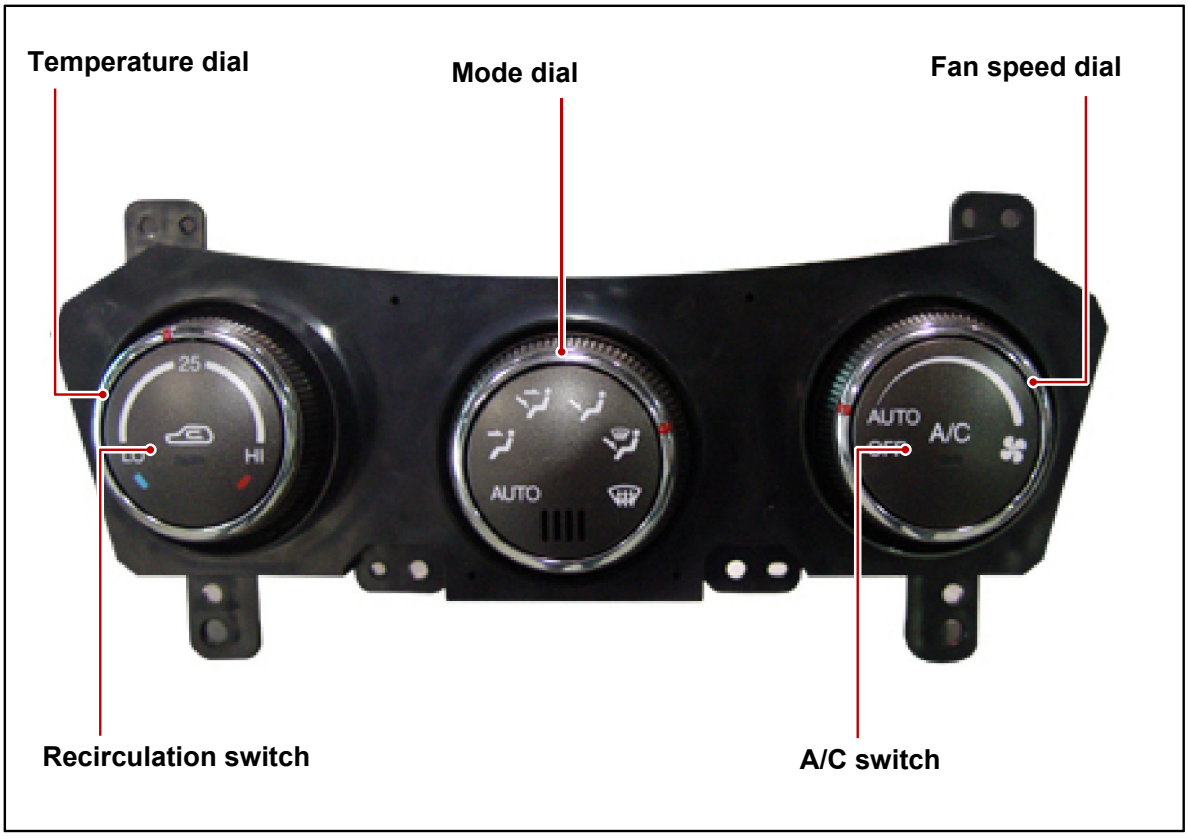


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. HEATER AND A/C CONTROL

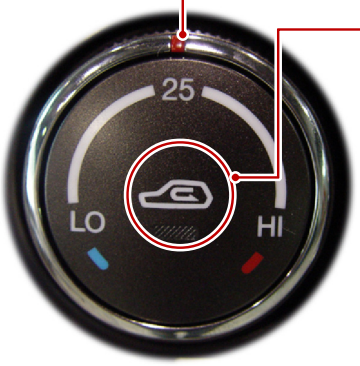
1) Full Automatic Air Conditioner



▶ Temperature dial

Temperature dial

To adjust the temperature, turn this dial as required.
- LO: Low temperature,
- HI: High temperature



Recirculation switch

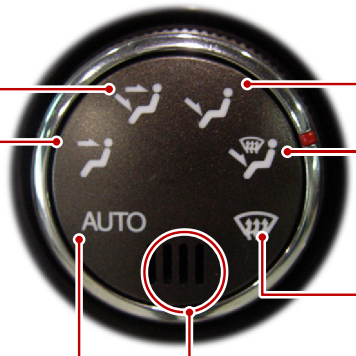
When you press this switch, recirculation indicator comes on and the system is changed into the recirculation mode.
When you press the switch again, recirculation indicator goes out and the system is changed into the fresh air mode.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Mode dial

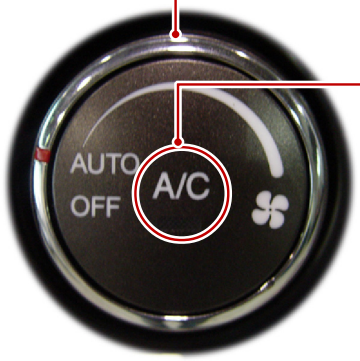
Select the desired airflow mode by turning this dial.



▶ Fan speed dial

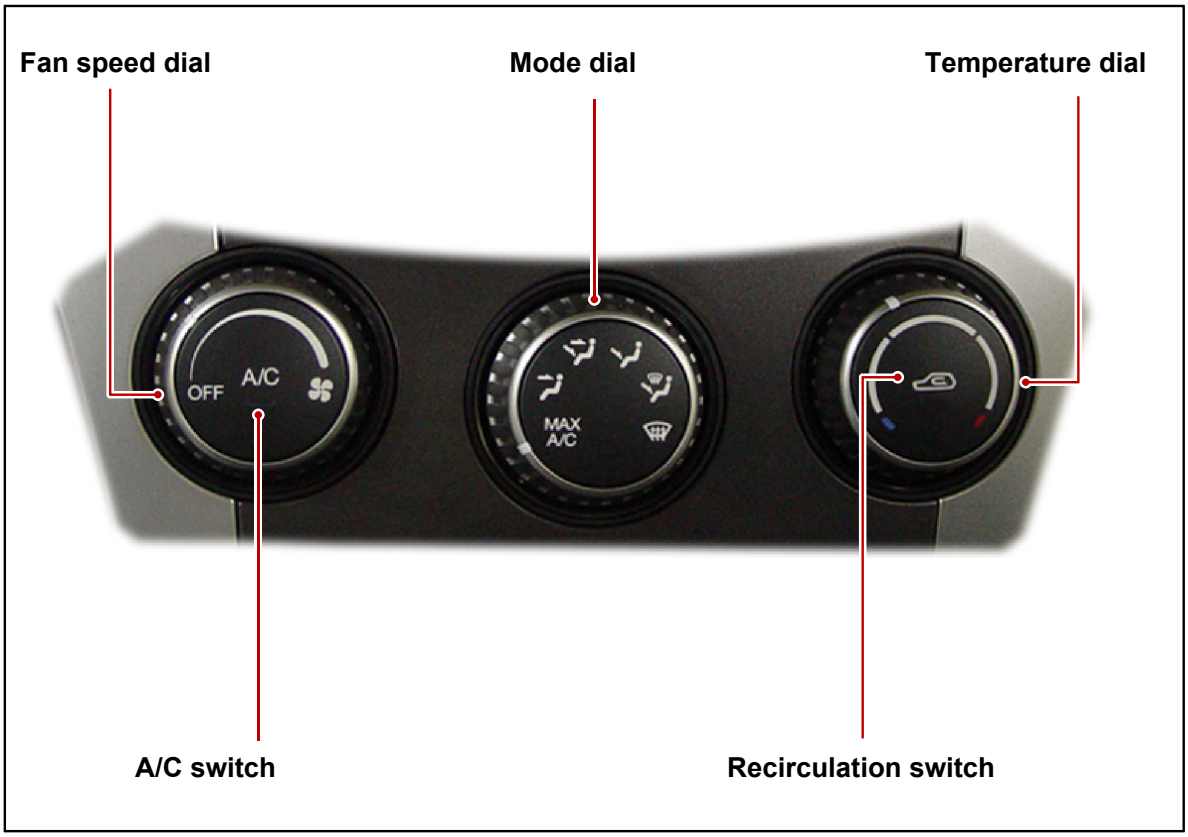
Fan speed dial

- Manual control
  Fan speed is manually controlled by this dial. The increment is 1℃.
- Auto control
  Fan speed is automatically controlled by temperature setting.



Downloaded from www.Manualslib.com manuals search engine

2) Manual A/C Control



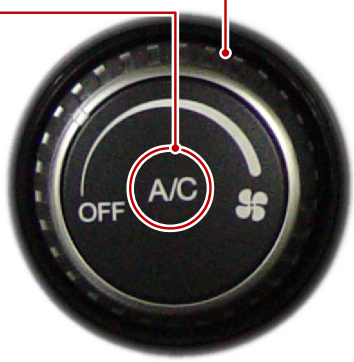
▶ **Fan speed dial**

Fan speed dial

To adjust the fan speed, turn this dial as required.
- OFF: Fan does not operate.
Fan speed level consists of 7 steps.

A/C switch

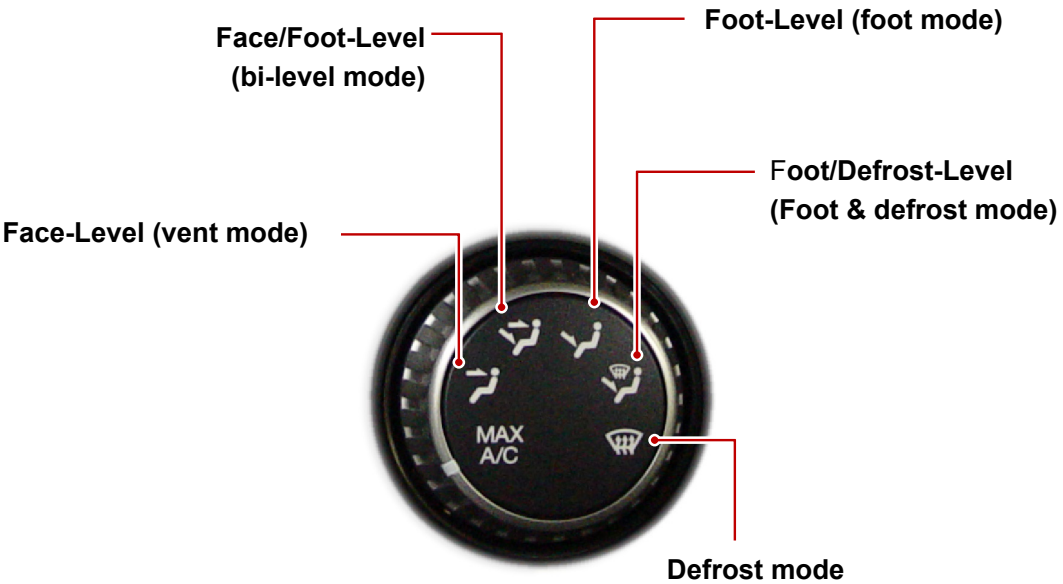
When you press this switch, the indicator comes on and the air conditioner starts to operate. When you press the switch again, the air conditioner stops operation and the indicator goes out.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Mode dial



Defrost mode

When choosing this mode, the airflow direction will be changed to the windshield and side glasses, the air conditioner operates automatically, and fresh air comes in.

▶ **Temperature dial**

Temperature dial

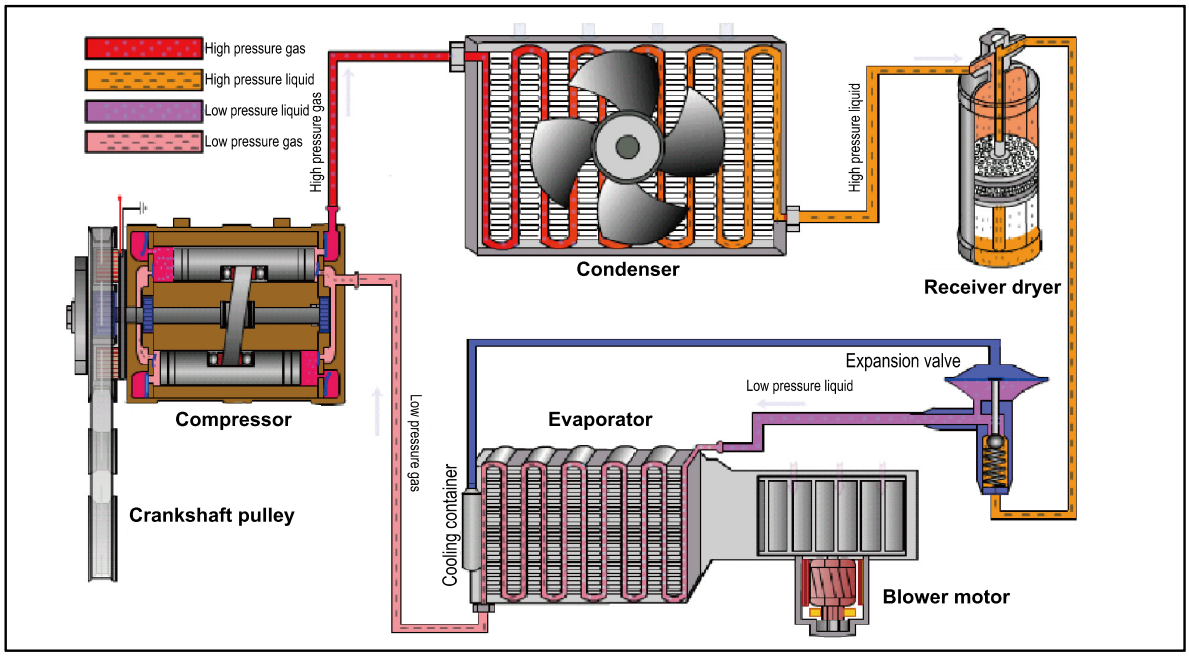
To adjust the temperature, turn this dial as required.
- Blue: Low temperature,
- Red: High temperature

Recirculation switch

When you press this switch, recirculation indicator comes on and the system is changed into the recirculation mode.
When you press the switch again, recirculation indicator goes out and the system is changed into the fresh air mode.

Downloaded from www.Manualslib.com manuals search engine

3. A/C COOLING CYCLE



1) System flow

- "Compression->Condensation->Expansion->Evaporation"

2) Functions

(1) Compressor

- Condition: Gas
- Function: Circulates the refrigerant and increases the pressure and temperature for easier evaporation.

(2) Condenser

- Condition: Gas/Liquid
- Function: Cools and condenses the refrigerant by using ambient air to liquefied it in high pressure.

(3) Receiver Dryer

- Condition: Gas/Liquid
- Function: Keeps the refrigerant dried by separating & collecting the moisture from it.

(4) Expansion Valve

- Condition: Liquid/Liquefied gas
- Function: Performs adiabatic expansion and flow control for easier evaporation.

(5) Evaporator

- Condition: Liquefied gas/Gas
- Function: Cools the air by absorbing the heat from the air around the evaporator.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Description for each cycle

(1) Compression

- The evaporated refrigerant in the evaporator enters to the compressor. And the refrigerant gas is compressed until it can be liquefied at ambient temperature.
- Thus, the low refrigerant pressure is maintained so that the liquid refrigerant can be evaporated actively at low temperature (around 0 ℃).

(2) Condensation

- The high pressure and high temperature gas (refrigerant) from the compressor is cooled down by the fresh air entered into the condenser. Then, this gas is converted to liquid and collected in the receiver drier.
  The heat generated from the high pressure refrigerant is dissipated to the ambient air, and it is called "heat of condensation".
- The heat of condensation is the summation of the heat of vaporization (heat that the refrigerant absorbs from the inside of the vehicle) and the calorific value converted from the amount of work which is needed to compress.

(3) Expansion

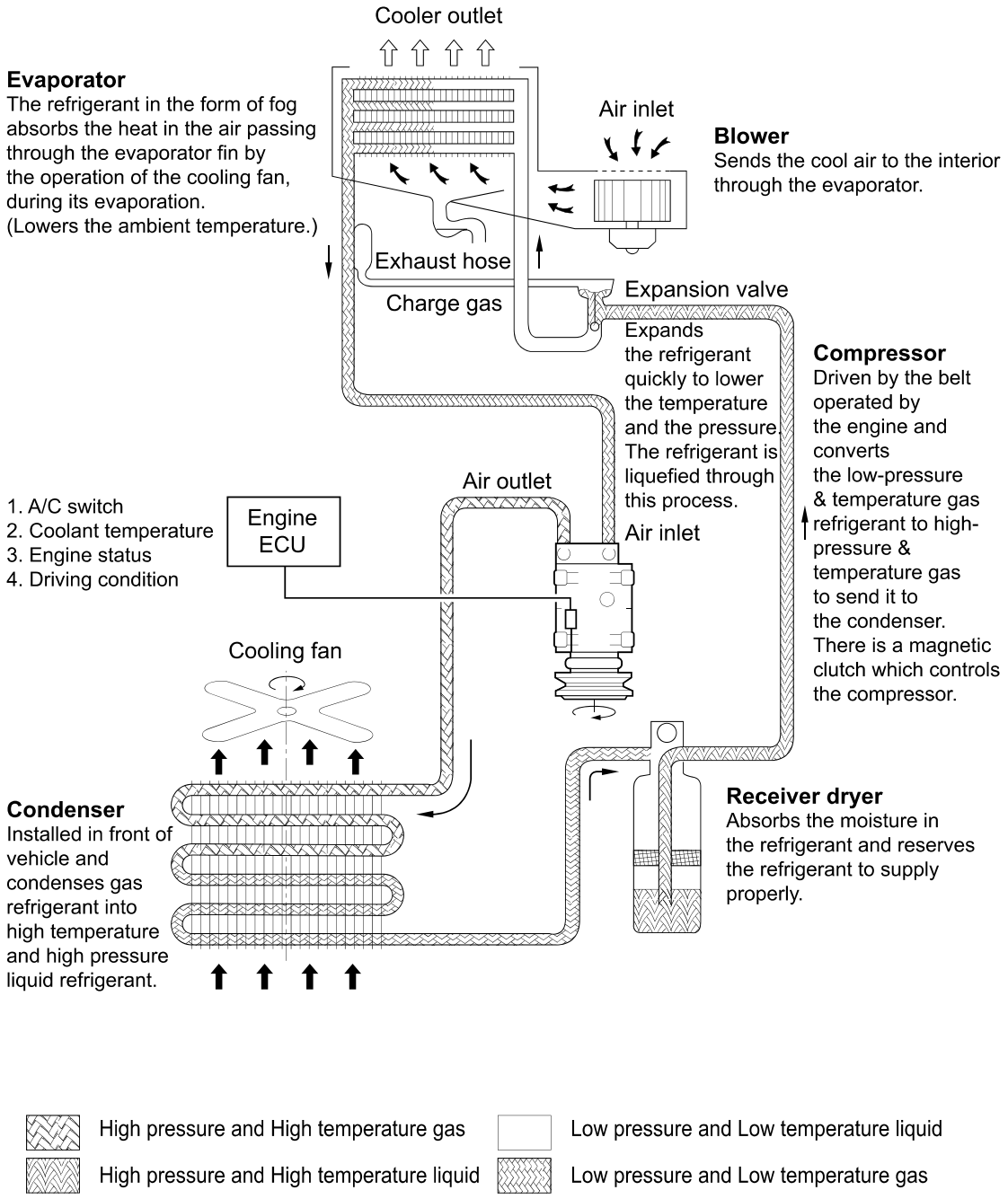
- The liquid refrigerant lowers the pressure making its evaporation easily accomplished.
- This process (lowering the pressure to the level at which evaporation easily takes place before the liquid refrigerant is sent to the evaporator) is called "Adiabatic Expansion".
- During adiabatic expansion, the expansion valve lowers the pressure of the refrigerant and determines the correct amount of refrigerant going into the air conditioning evaporator.
- That is, the amount of heat, which is needed to stop the evaporation, is determined according to the cooling load.
- The expansion valve detects this and regulate the amount of the refrigerant exactly.

(4) Evaporation

- The refrigerant is converted from liquid to gas in the evaporator.
  (The refrigerant in the form of fog in the evaporator is vaporized actively)
- At this time the refrigerant, in the form of liquid, absorbs the heat in the air which is need for evaporation (latent heat) and is cooled down. Then the blower blows the cooled air inside the vehicle to lower the temperature.
- There are liquid refrigerant from the expansion valve and evaporated refrigerant in the evaporator.
- The evaporation temperature can be predicted from the evaporation pressure (i.e. relationship between saturation pressure and saturation temperature).
- It is important to keep the pressure inside the evaporator low, so that the refrigerant is evaporated at low temperature to make sure the completely evaporated refrigerant is entered into the compressor.

Downloaded from www.Manualslib.com manuals search engine

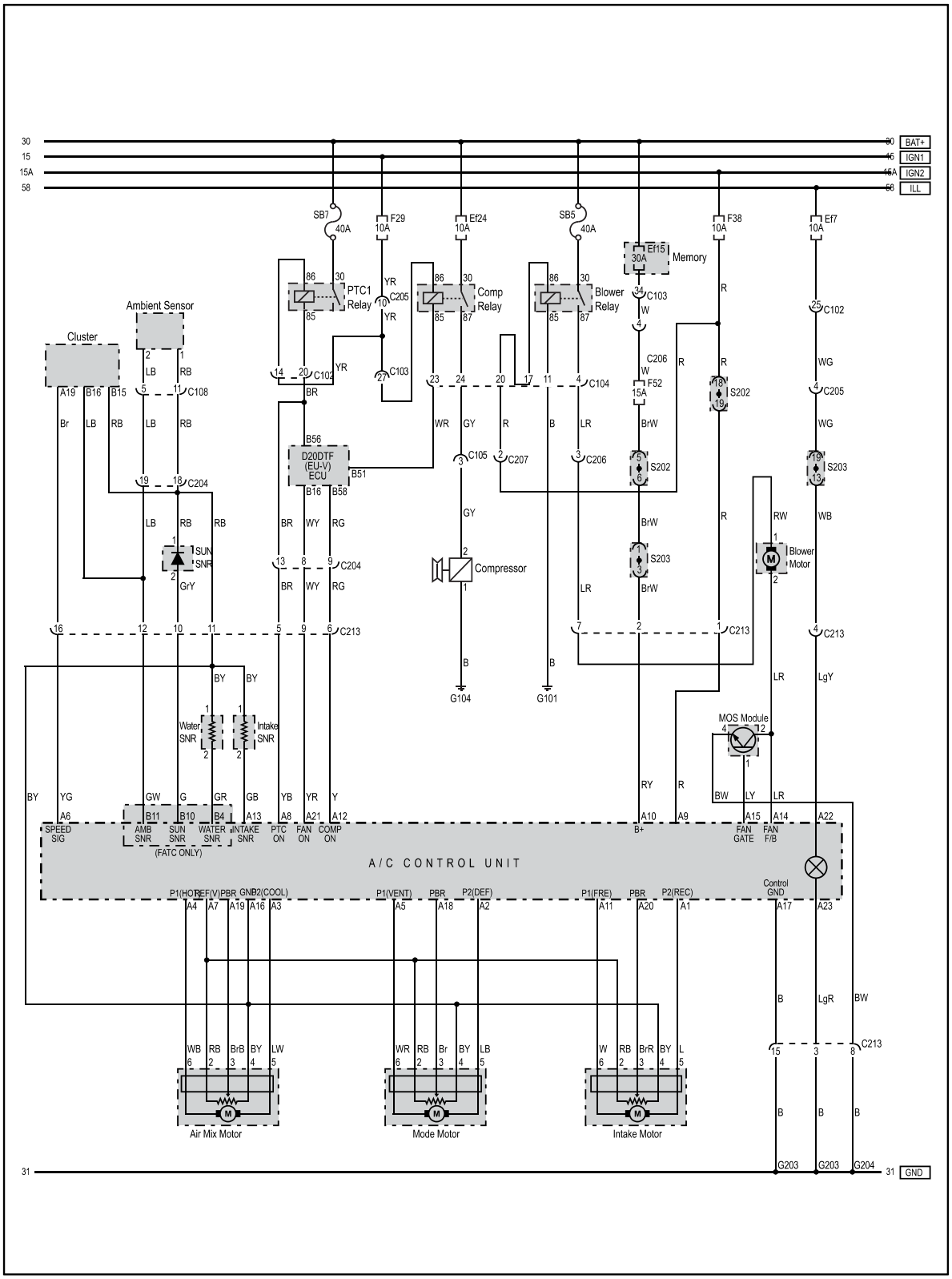
4. A/C COOLING CIRCUIT



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

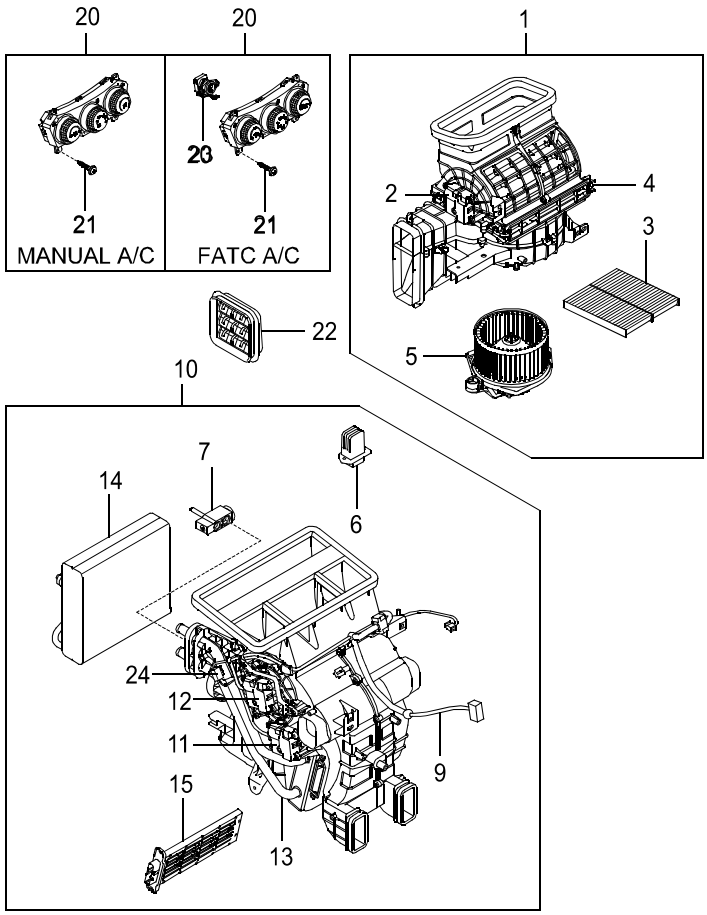
5. A/C CIRCUIT DIAGRAM



Downloaded from www.Manualslib.com manuals search engine

COMPONENT

S.G.N 6810-01 AIR CONDITIONER MODULE

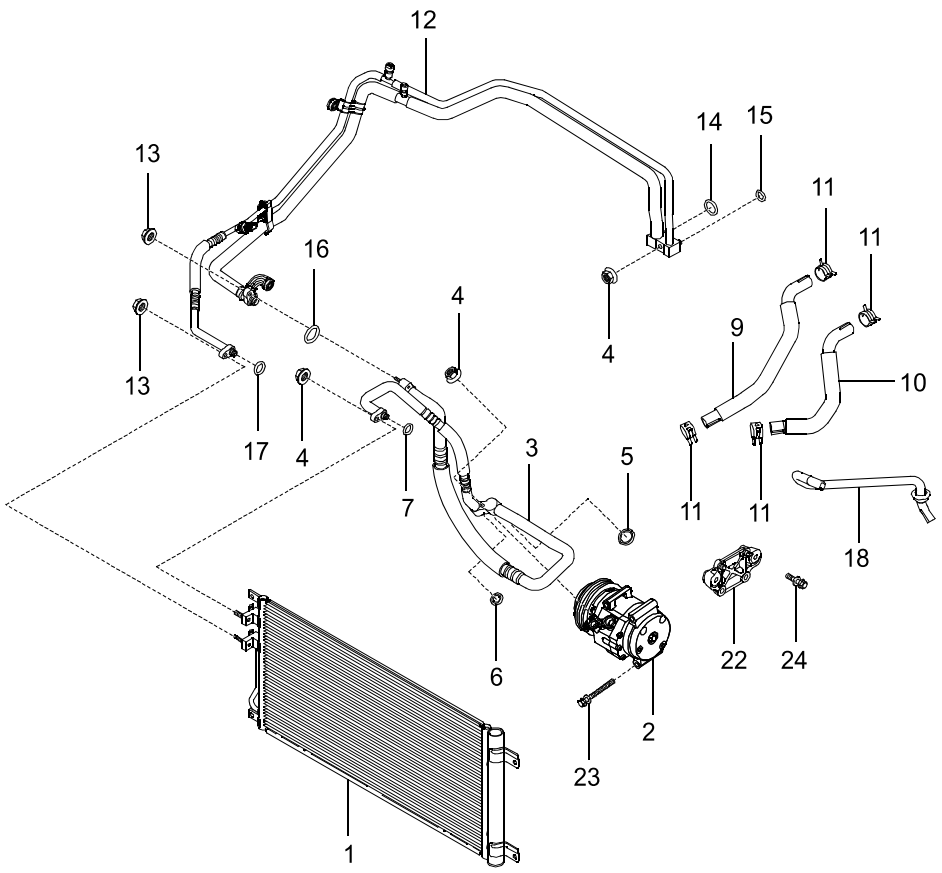


1. Blower assy
2. Actuator assy - Intake
3. Air filter assy
4. Cover - Air filter
5. Blower motor assy
6. Resistor
7. Expansion valve assy
9. Wiring assy - Heater & evaporator
10. Heater & evaporator assy
11. Actuator assy - Temp
12. Actuator assy - Mode
13. Core assy - Heater
14. Core - Evaporator
15. Heater assy - PTC
20. Control assy - Heater & A/CON
21. Screw
22. Insert assy - ventilation
23. Sensor - Incar
24. Sensor - Intake

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
6820-01 AIR CONDITIONER HOSE& PIPE

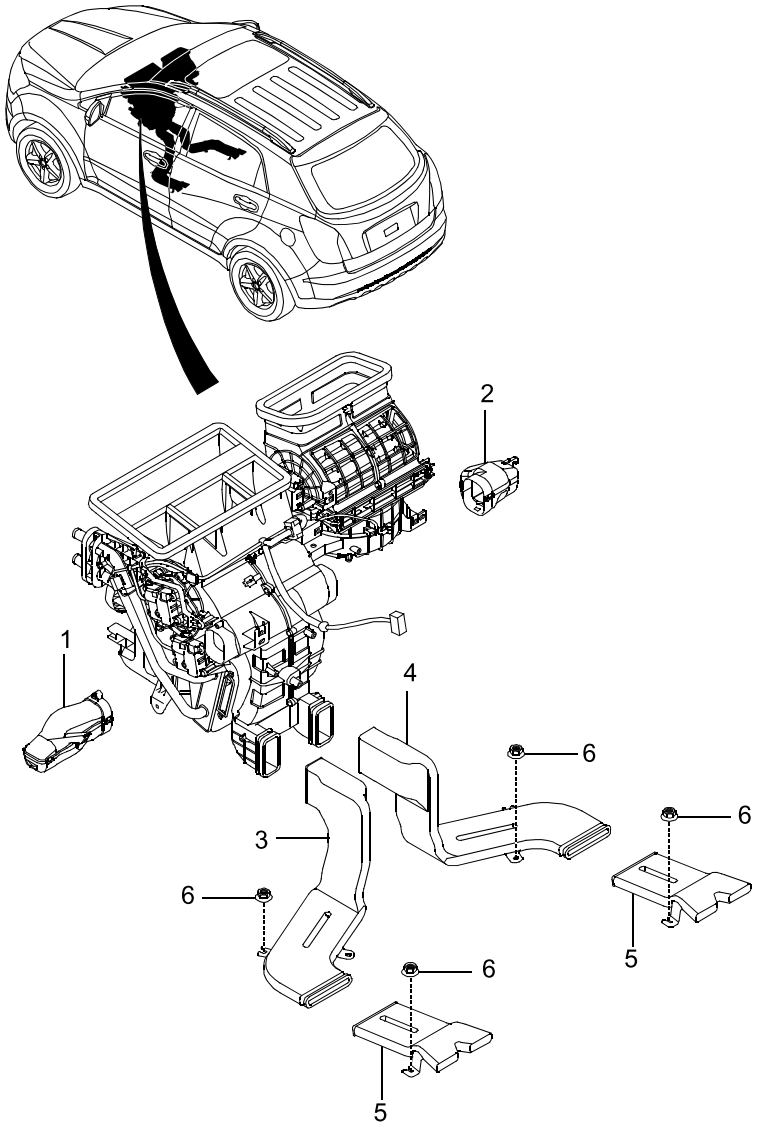


1. Condenser assy
2. Compressor assy - A/con
3. Hose assy - Discharge & suction
4. Nut
5. Oil ring - Suction
6. Oil ring - Discharge
7. Oil ring
9. Hose assy - Heater inlet
10. Hose assy - Heater outlet
11. Clamp
12. Pipe assy - Liquid & suction
13. Nut
14. Oil ring - Suction
15. Oil ring - Liquid
16. Oil ring - Suction
17. Oil ring
18. Hose - Drain
22. Brkt assy - A/con comp
23. Bolt
24. Bolt

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
6830-01 AIR DISTRIBUTOR



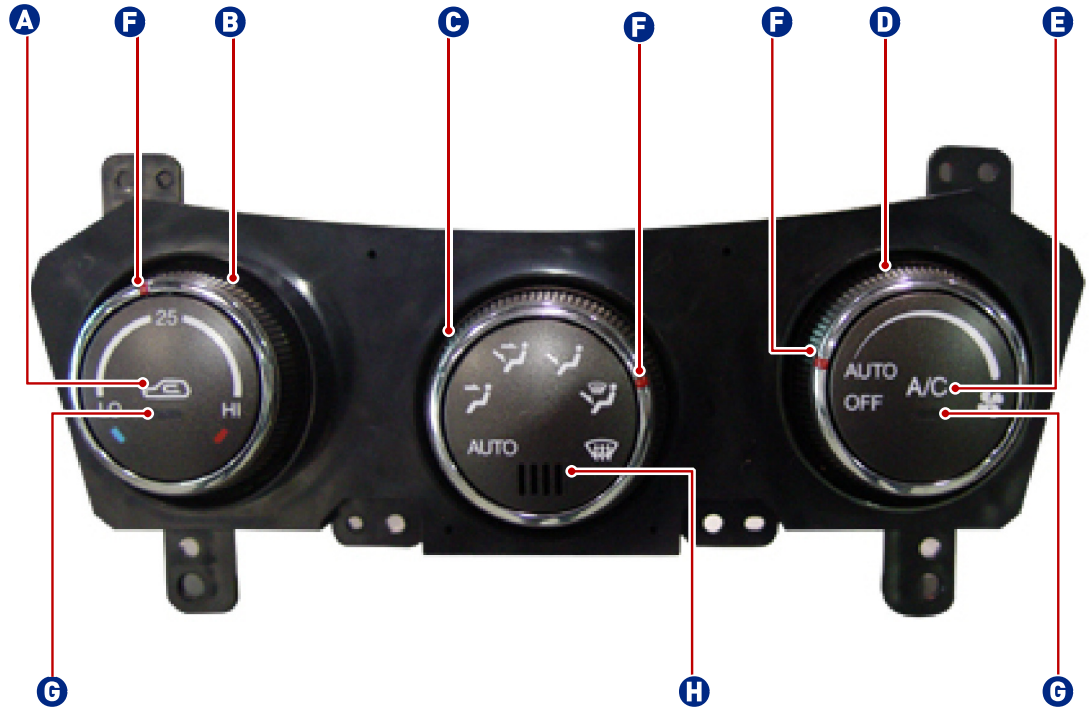
1. Duct - Foot
2. Duct - Foot
3. Duct assy - RR heating No1
4. Duct assy - RR heating No1
5. Duct assy - Rr heating No2
6. Nut

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 6810-20

HEATER AND A/C CONTROL ASSEMBLY



- A Recirculation Switch
- B Temperature Dial
- C Mode Dial
- D Fan speed Dial
- E A/C Switch
- F Dial Indicator
- G Switch Indicator
- H In-car Sensor

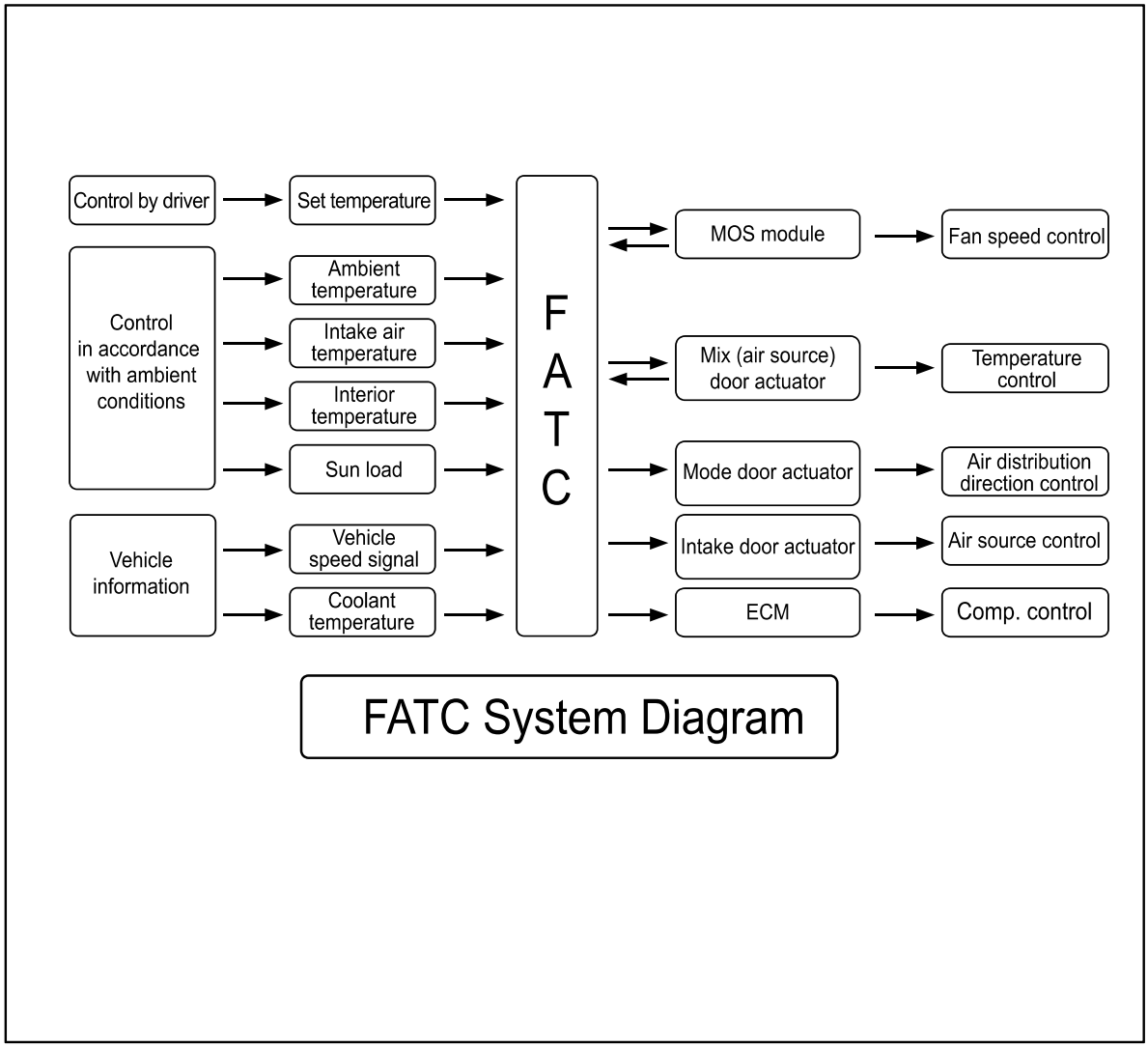
The FATC (Full Automatic Temperature Control) is a temperature control device which receives signals from various sensors (incar sensor, ambient temperature sensor, water temperature sensor, sun-load sensor) and control switches to control the blower motor and all kinds of actuator (mode door actuator, mix door actuator, intake door actuator) through micom in the FATC. Therefore the temperature of the vehicle interior is kept to the temperature which is set by a driver.

The driver can check the status of A/C through the dial indicator of FATC. The fan speed and the temperature are adjusted automatically by the input values from different sensors to keep indoor air fresh.
If the FATC system has any defect, the micom performs self diagnosis for the system to make it easier to detect the fault.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1) Input/Output Diagram



FATC System Diagram

▶ **A/C compressor control by engine ECU**

1. Coolant temperature: 20℃ or less
2. Coolant temperature: 115℃ or more
3. For approx. 4 seconds after starting the engine
4. When the engine speed is below 650 rpm
5. When the engine speed is over 4,500 rpm
6. During abrupt acceleration for the vehicle equipped with manual transmission

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

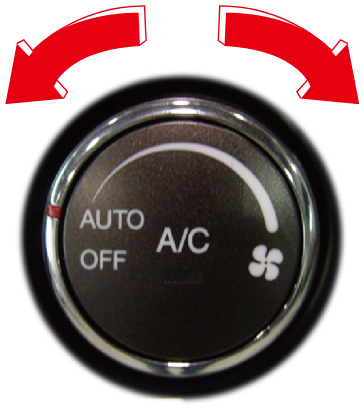
2) Major Features

(1) Temperature control

In AUTO mode, the FATC receives various input values, such as the indoor temperature, ambient temperature, engine coolant temperature, sunlight, from different sensors to control the A/C compressor, mode door, intake actuator assembly, air mix door, blower motors, etc.

(2) Blower motor (fan) speed control

In full AUTO mode, the blower motor is controlled automatically according to the set temperature. The blower motor speed can also be controlled manually.



▶ **Manual control**
The motor is manually controlled by turning the blower dial. Turning the dial clockwise or counterclockwise changes the fan speed by 1 step.

Blower step	Blower motor voltage (V)
1	4.0
2	5.0
3	6.5
4	8.5
5	10.5
6	VIGN

▶ **AUTO control**
The fan speed is controlled automatically according to the set temperature and the ambient conditions.

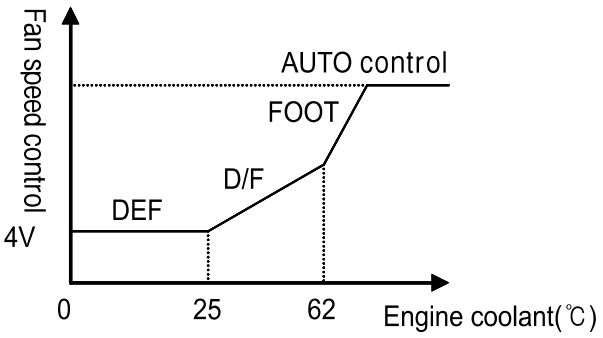
▶ **Control in relation to sun-load**
The system increases the fan speed by adding up 2.5 V of voltage in direct sunlight.

▶ **Control for defrosting**
When the defrost mode is selected with the blower dial in AUTO position, the blower motor voltage is increased by 1.5 V compared to the AUTO control voltage for a certain amount of time.

Downloaded from www.Manualslib.com manuals search engine

▶ **Heating start control**

When the engine coolant temperature is low or the wind temperature is not warmed up sufficiently, the driver might feel uncomfortable by the air flow from the vent. Therefore, the fan speed is set to the 1st stage and the cool air is sent to the windshield until the coolant temperature increases to the proper level (DEF mode).
As the engine coolant temperature goes up, the mode is changed to Defrost & Foot mode or AUTO mode to increase the speed of blower motor.
This control is cancelled when the output value of the water temperature sensor is approximately 62℃.



▶ **Cooling start control**

When the intake temperature sensor indicates over 35°C, the driver might feel uncomfortable by the air flow from the vent.
Therefore, at the initial operation stage, the hot air is discharged to the windshield (DEF mode) for about 5 seconds. And then the mode is changed to VENT mode or BI-LEVEL mode to prevent the hot air from suddenly discharging to the front passengers.

▶ **Control for defrosting**

When the defrost mode is selected with the blower dial in AUTO position, the blower motor voltage is increased by 1.5 V compared to the AUTO control voltage for a certain amount of time.

3) Fresh Air/Recirculation Control

▶ **Manual control**

The air source door can be controlled manually by pressing the recirculation switch.
The air source mode is switched between the fresh air and recirculation alternatively each time the switch is pressed.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

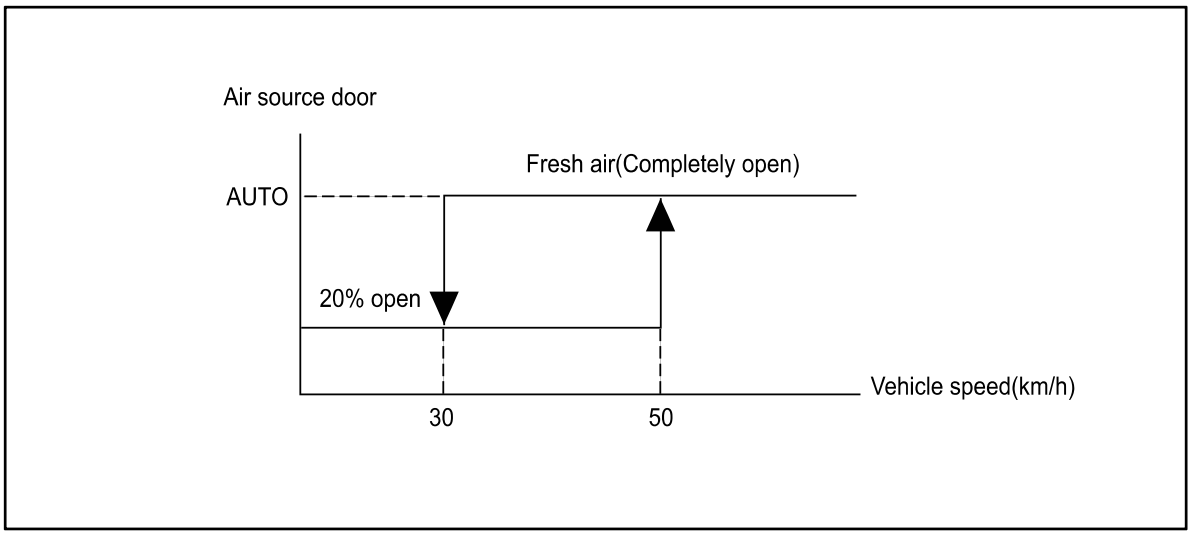
▶ **AUTO control**

In auto mode, the basic setting for the air source is fresh air. When the ambient temperature is high during cooling, the air source is changed from fresh air to recirculation to lower the temperature.

▶ **Control by vehicle speed (heating)**

When the vehicle is driven, the air source selection is controlled in accordance with the vehicle speed.
Operating conditions:

1. The air source selection switch (recirculation switch) should be in AUTO position.
2. When the vehicle speed is 30 km/h or lower in fresh air mode, the air source door is open 20% of its maximum opening. If the vehicle speed is 50 km/h or more, then the air source door is completely open.



4) Mode Control

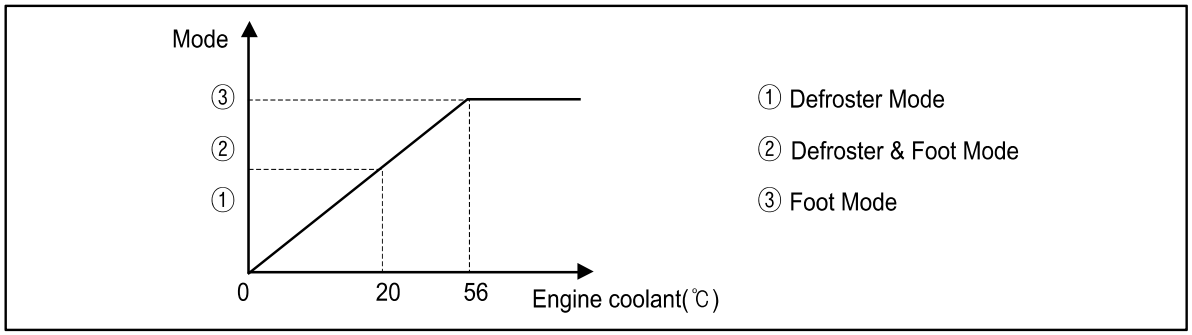
▶ **Manual control**

You can choose a desired mode from the 5 modes by turning the mode dial clockwise or counterclockwise.
The dial indicator for the selected mode comes on to inform the operator.

Downloaded from www.Manualslib.com manuals search engine

▶ **AUTO control**

The air flow mode is controlled automatically in accordance with the vehicle indoor conditions. But it is controlled as described below during initial driving (after overnight parking) in cold weather:



5) Maximum Cooling/Heating Control

If the temperature is set to the lowest level (Lo) or highest level (Hi), the system will go into the maximum cooling or maximum heating mode regardless of the sensor signals.

Set temperature	A/C compressor	Air flow mode	Air source	Blower voltage	Air source door
LO	ON	Vent	Recirculation	10.5 (V)	Max. cooling position
HI	OFF	Foot	Fresh air	10.5 (V)	Max. heating position

6) A/C control

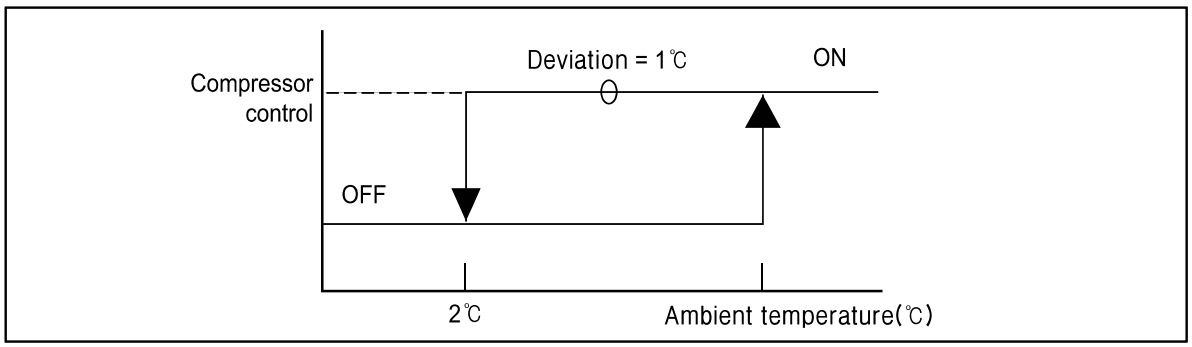
▶ **Manual control**

Pressing the A/C switch or selecting defrost mode turns on the A/C.

▶ **AUTO control**

The A/C is controlled in accordance with the inner heat of the air conditioning system and ambient temperature.

In cold weather, the compressor is turned off when the ambient temperature is low (2℃ or less) for protection against damage.

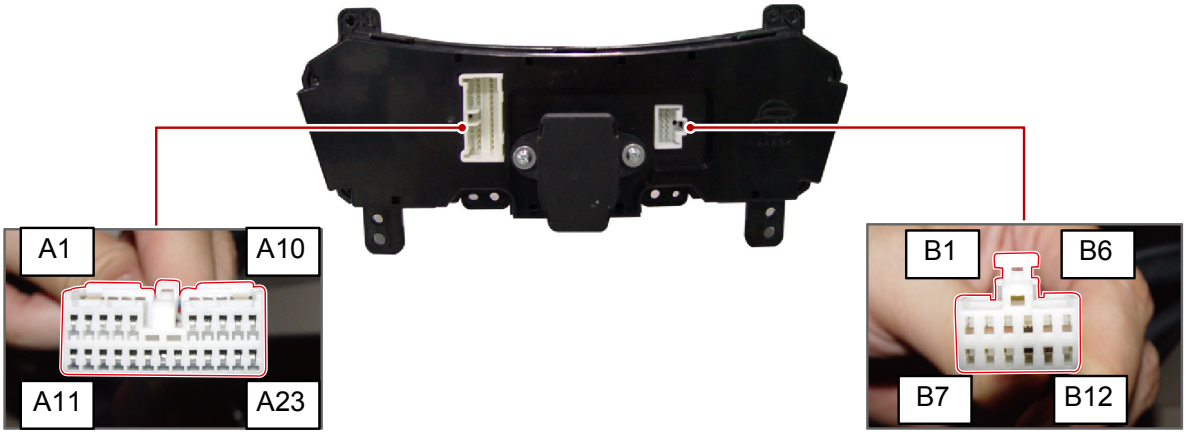


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

6) FATC Terminals

(1) Controller connector terminals



(2) Description of terminals

Pin No.	Function	Pin No.	Function
A1	P2 (Intake)	A19	PBR (Mix)
A2	P2 (Mode)	A20	PBR (Intake)
A3	P2 (Mix)	A21	Blower operating signal
A4	P1 (Mix)	A22	FATC illumination light (+)
A5	P1 (Mode)	A23	FATC illumination light (-)
A6	Vehicle speed signal	B1	-
A7	REF	B2	-
A8	PTC heater assembly	B3	-
A9	IGN ON power	B4	Water temperature sensor signal
A10	Battery power	B5	Incar sensor signal
A11	P1 (Intake)	B6	-
A12	Compressor operating signal	B7	-
A13	Intake sensor signal	B8	-
A14	Blower feedback signal	B9	-
A15	Blower motor control signal	B10	Sun-load sensor signal
A16	Sensor ground	B11	Ambient temperature sensor signal
A17	Ground (Power)	B12	-
A18	PBR (Mode)		

Downloaded from www.Manualslib.com manuals search engine

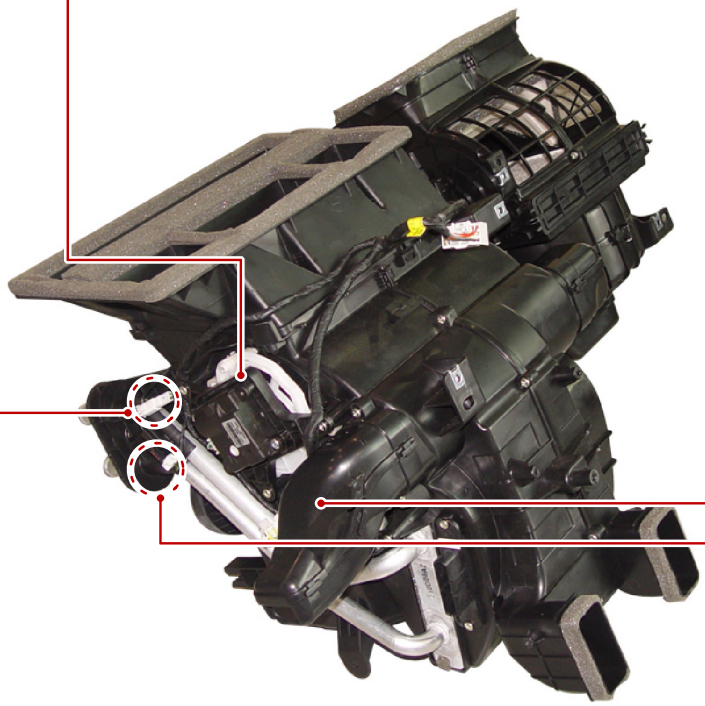
S.G.N. 6810-00

A/C MODULE

1) Sensors & Actuators

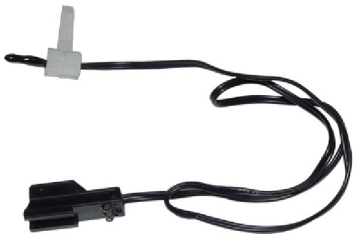
Mode actuator

Temperature actuator



Water temperature sensor

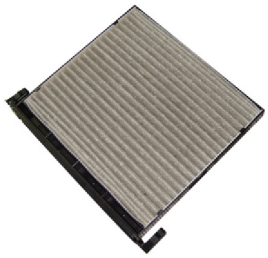
Intake sensor



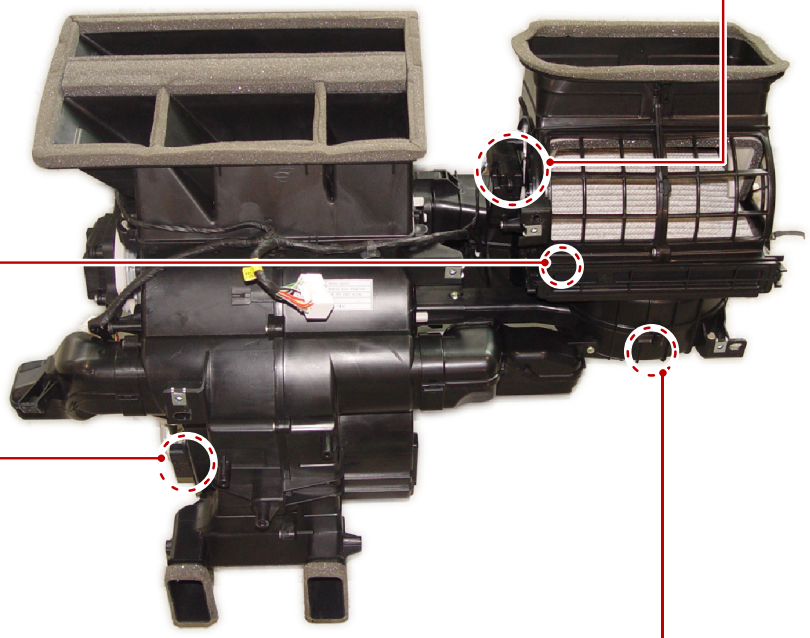
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Air filter



Intake actuator



PTC heater

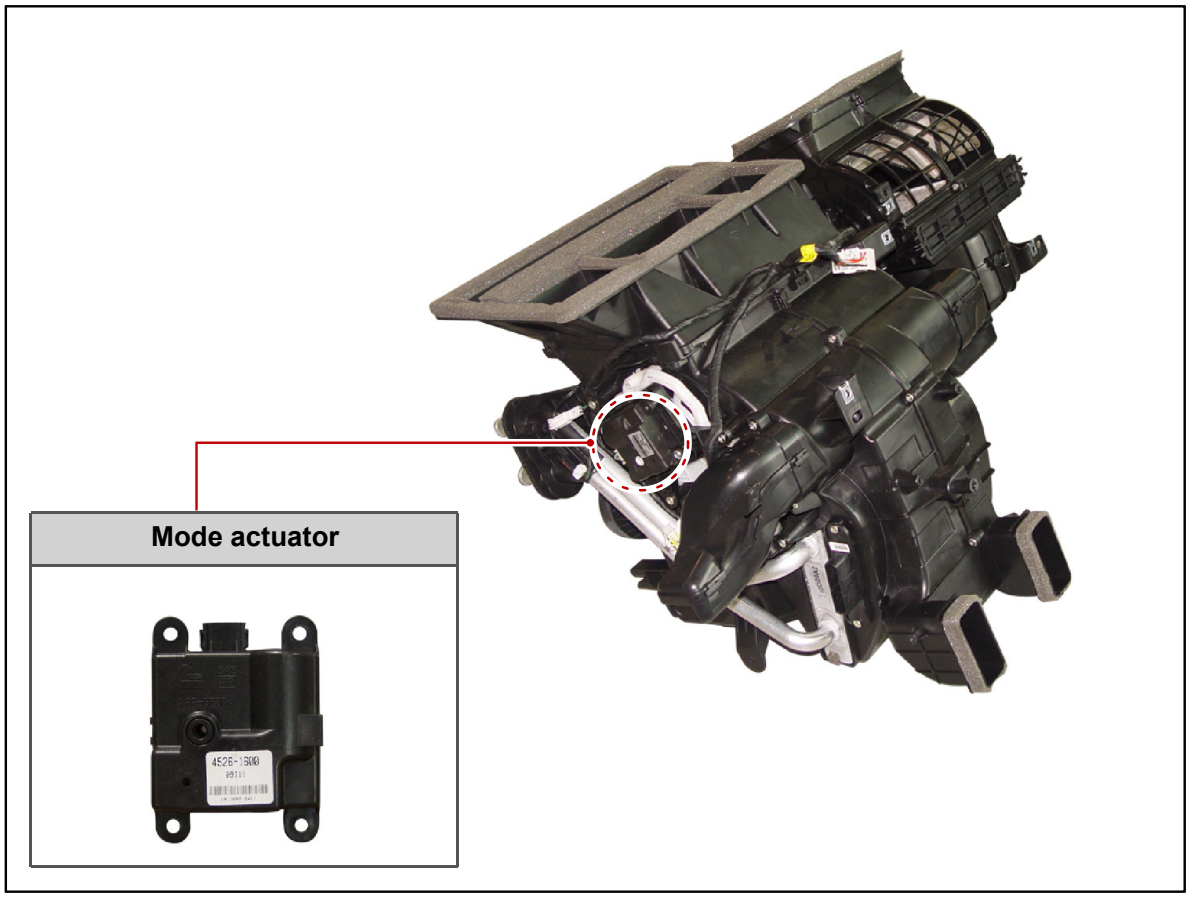
Blower motor

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Components

(1) Mode Actuator Assembly



▶ **Function**

Mode actuator assembly

Controls the vent damper by the FATC command to control the air flow mode (Vent, Vent & Foot, Foot, Defrost & Foot, Defrost).

▶ **Maintenance**

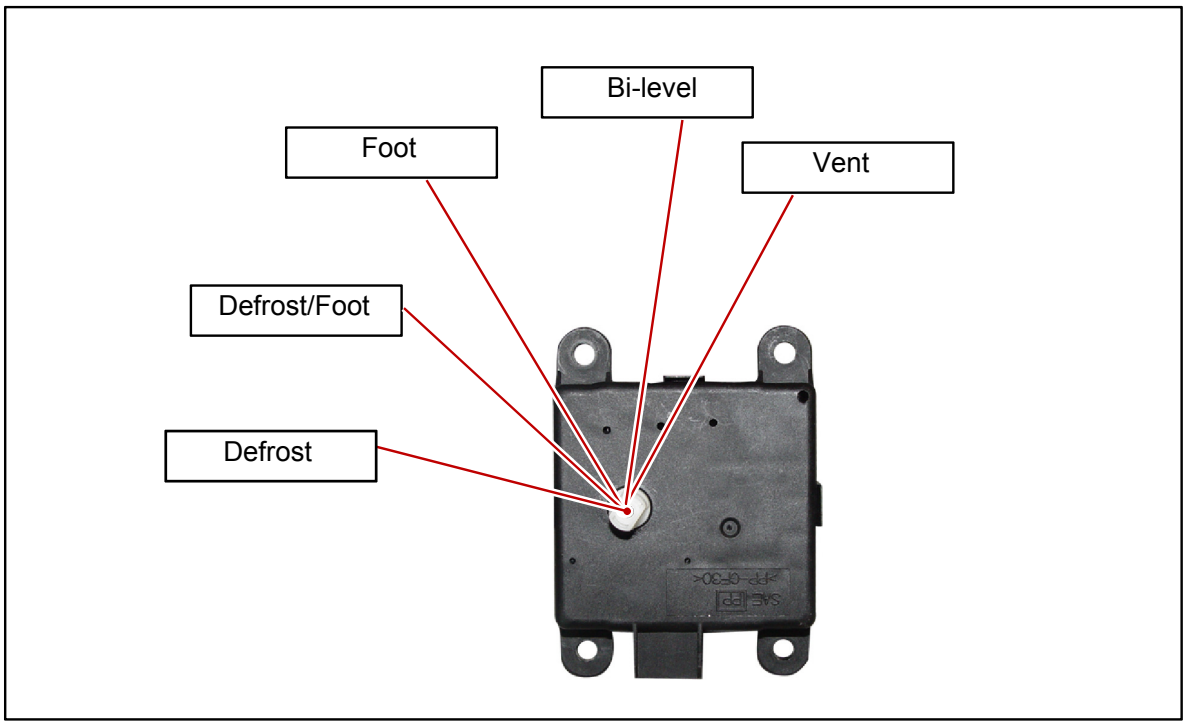
Mode actuator assembly

a. Turn the ignition ON. Then, check the operation position of the actuator each time the mode is changed.
b. If the operating position is not correct, check the wiring for open circuit.
c. If the wiring is intact, replace the mode actuator assembly.

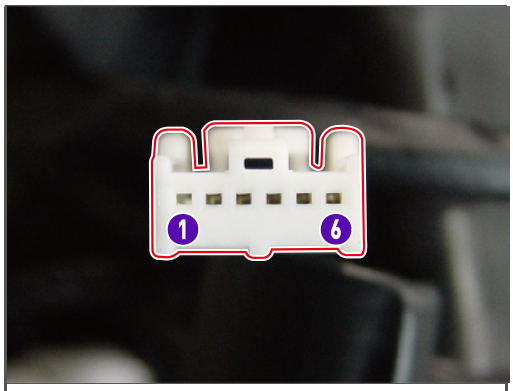
Modification basis	
Application basis	
Affected VIN	

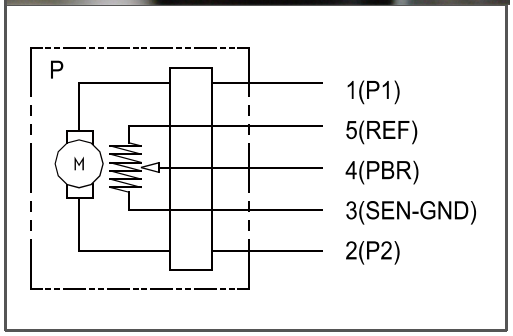
Downloaded from www.Manualslib.com manuals search engine

▶ Mode door actuator operation position



▶ Mode door actuator connector

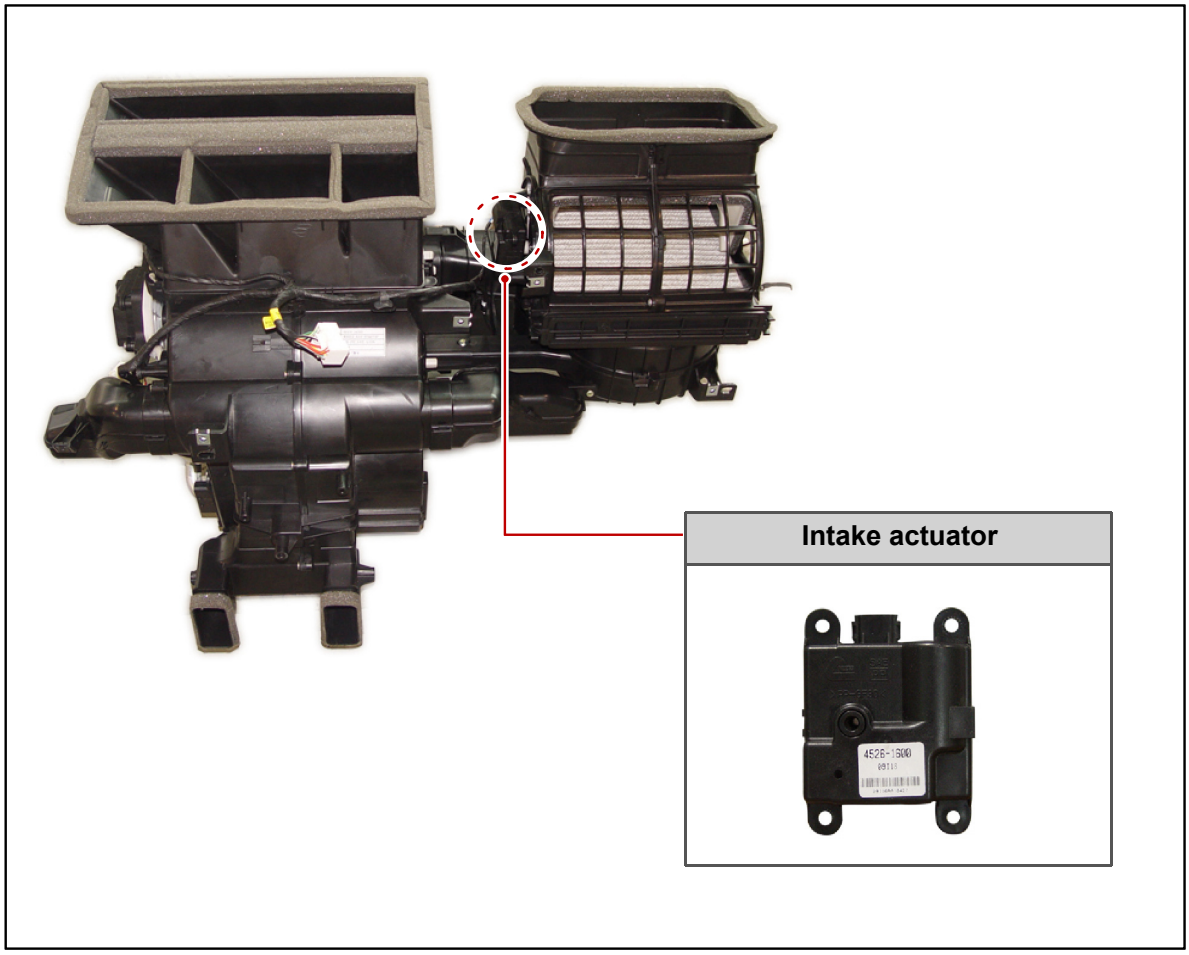




Pin No.	Function
1	-
2	REF
3	PBR
4	Sensor ground
5	P2
6	P1

Downloaded from www.Manualslib.com manuals search engine

(2) Intake Actuator Assembly



▶ Function

Intake actuator assembly

Controls the air source door (intake) by the FATC command.

▶ Maintenance

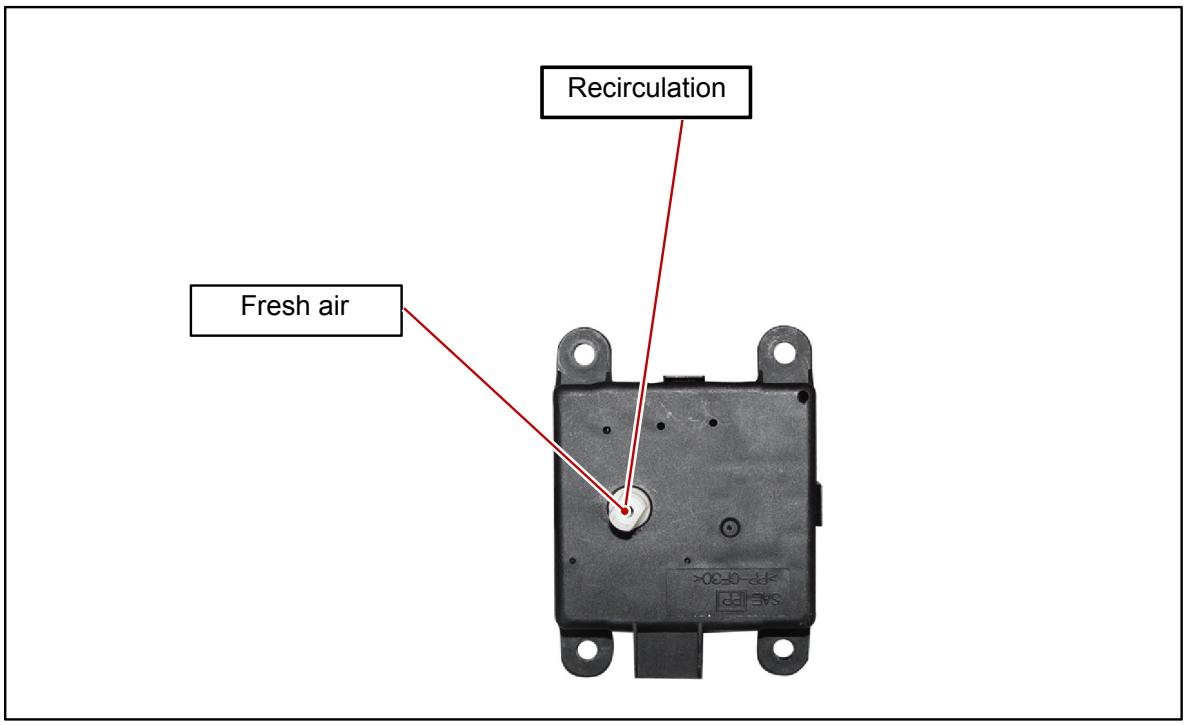
Intake actuator assembly

a. Turn the ignition ON. Then, check the operation position of the actuator each time the air flow mode is changed.
b. If the operating position is not correct, check the wiring for open circuit.
c. If the wiring is intact, replace the intake actuator assembly.

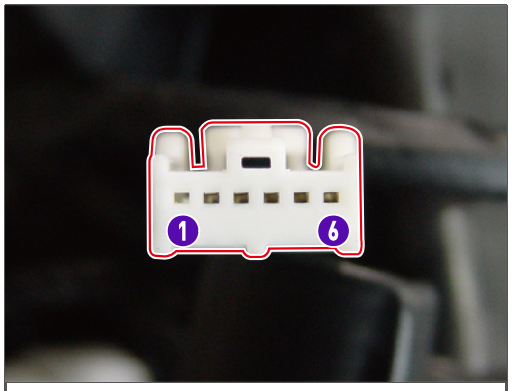
Modification basis	
Application basis	
Affected VIN	

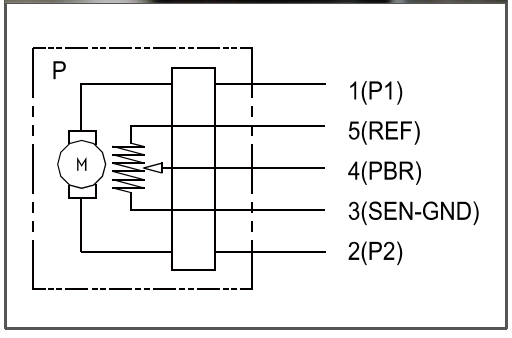
Downloaded from www.Manualslib.com manuals search engine

▶ Intake actuator operation position



▶ Intake actuator connector

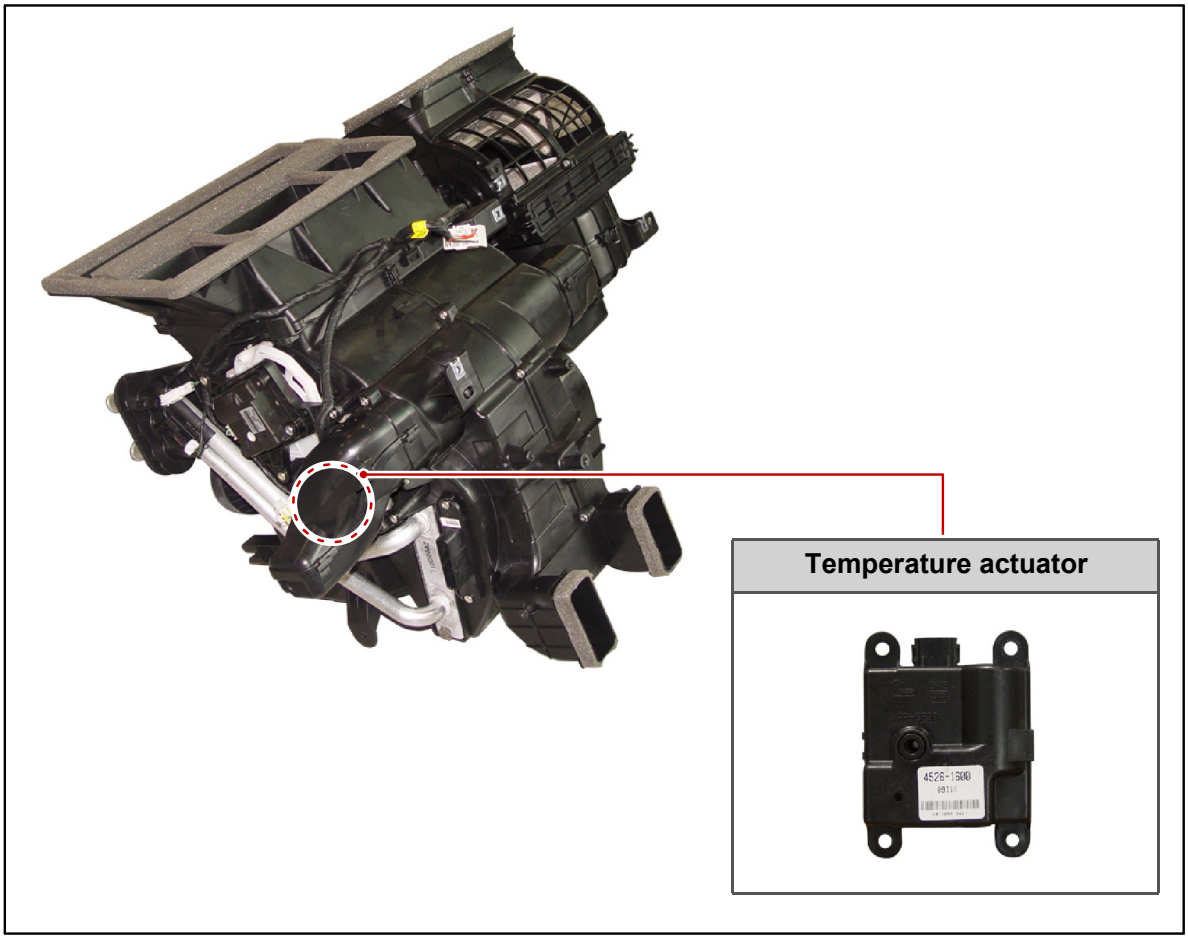




Pin No.	Function
1	-
2	REF
3	PBR
4	Sensor ground
5	P2
6	P1

Downloaded from www.Manualslib.com manuals search engine

(3) Temperature Actuator Assembly



▶ Function

Temperature actuator assembly

Adjusts the temperature of the indoor air by controlling the temperature actuator assembly position according to the FATC command.

▶ Maintenance

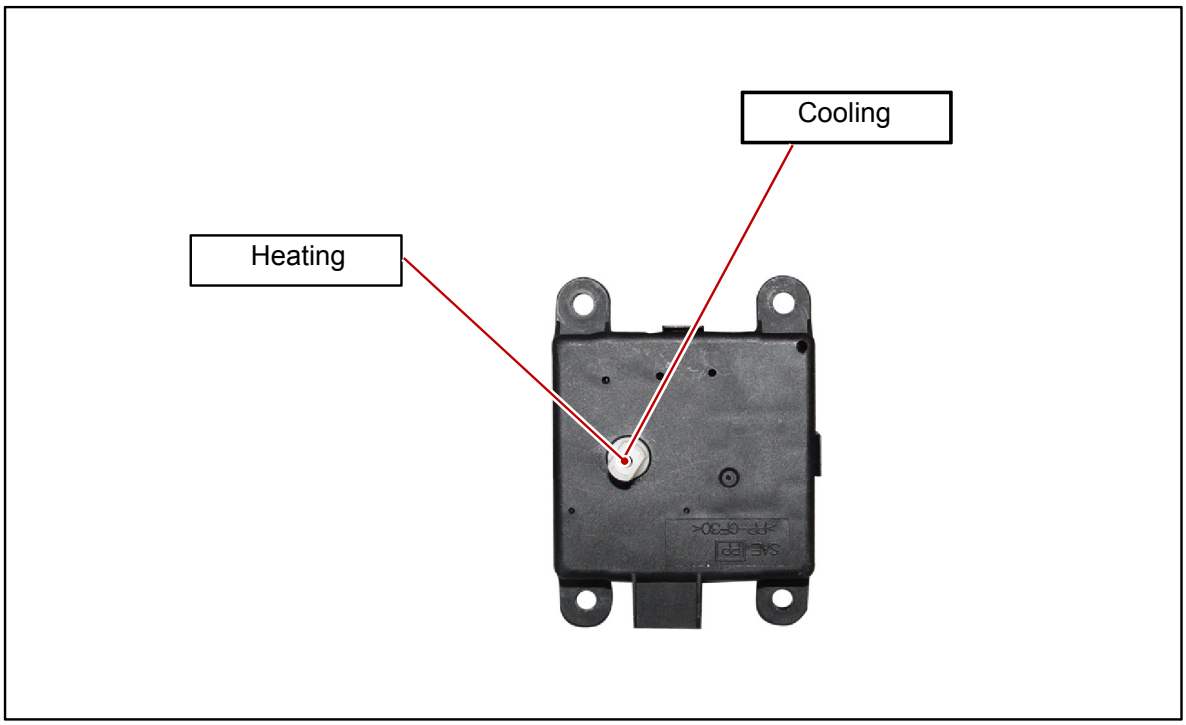
Temperature actuator assembly

a. Turn the ignition ON. Then, check the operation position of the actuator each time the air flow mode is changed.
b. If the operating position is not correct, check the wiring for open circuit.
c. If the wiring is intact, replace the temperature actuator assembly.

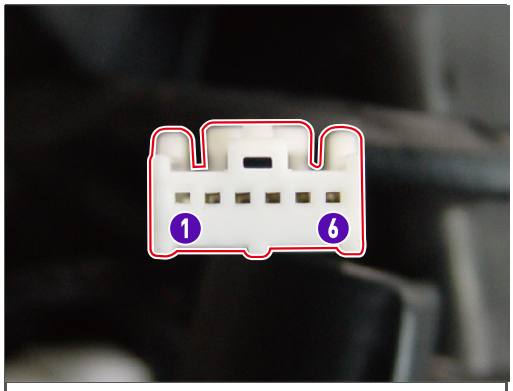
Modification basis	
Application basis	
Affected VIN	

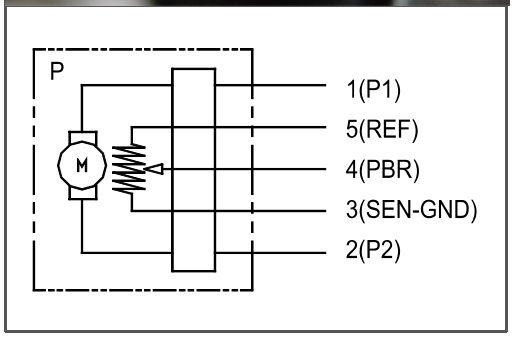
Downloaded from www.Manualslib.com manuals search engine

▶ Temperature actuator operation position



▶ Temperature actuator connector

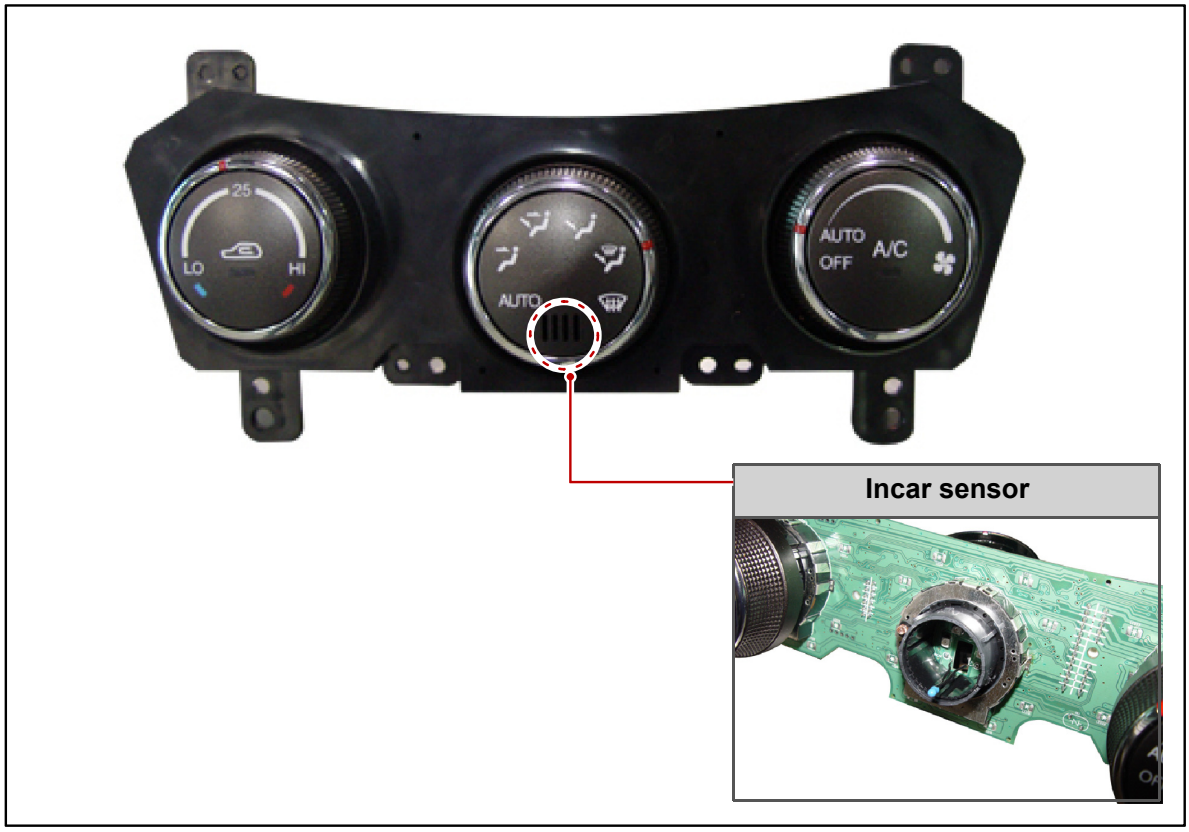




Pin No.	Function
1	-
2	REF
3	PBR
4	Sensor ground
5	P2
6	P1

Downloaded from www.Manualslib.com manuals search engine

(4) Incar Sensor



▶ **Mounting location**

Located to the air intake on the front side of the FATC.

▶ **Function**

This sensor is a negative temperature coefficient (NTC) thermistor and detects the temperature of the interior air coming from senor hole. And the sensor sends the voltage value according to the resistance change to the FATC.

▶ **Maintenance**

If there is any fault in the incar sensor, check as described below:

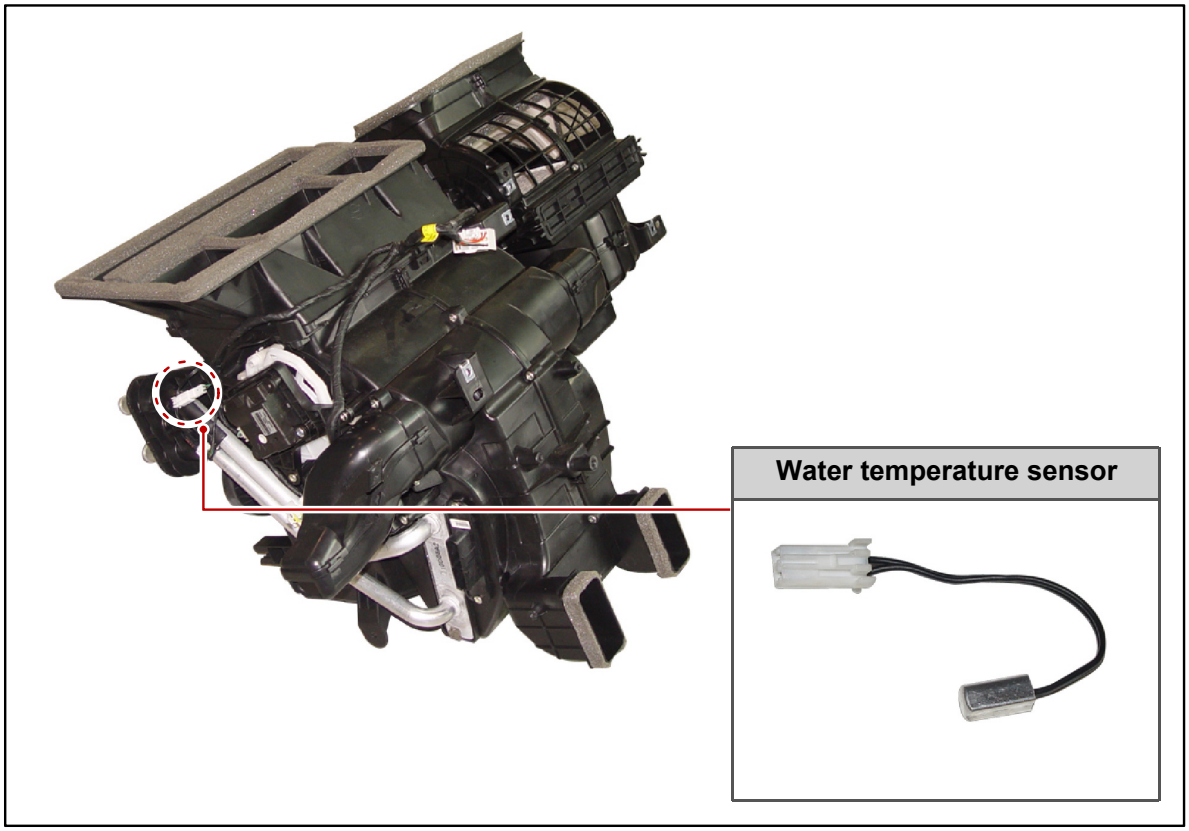
a. Remove the incar sensor and measure the resistance between the two terminals on the connector.
(Specified value: 2.186 kΩ ± 3% at 25℃)
If the measured resistance is extremely high or low, replace the incar sensor.

b. If the measured value is out of the specified range, replace the incar sensor. If the measured value is within the specified range, check as described below:
- Turn the ignition switch to ON position and measure the voltage between the pin no. 25 and 18 of the FATC connector. (Specified value: approx. 1.7 V at 25℃)
- If the voltage value cannot be measured, check the wiring for open circuit. If the measured value is within the specified range, replace the FATC.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(5) Water Temperature Sensor



▶ **Mounting location**

Located to the heater inlet pipe.

▶ **Function**

This sensor is a negative temperature coefficient (NTC) thermistor and detects the coolant temperature to send the voltage value according to the resistance change to the FATC.

▶ **Maintenance**

If there is any fault in the water temperature sensor, check as described below:

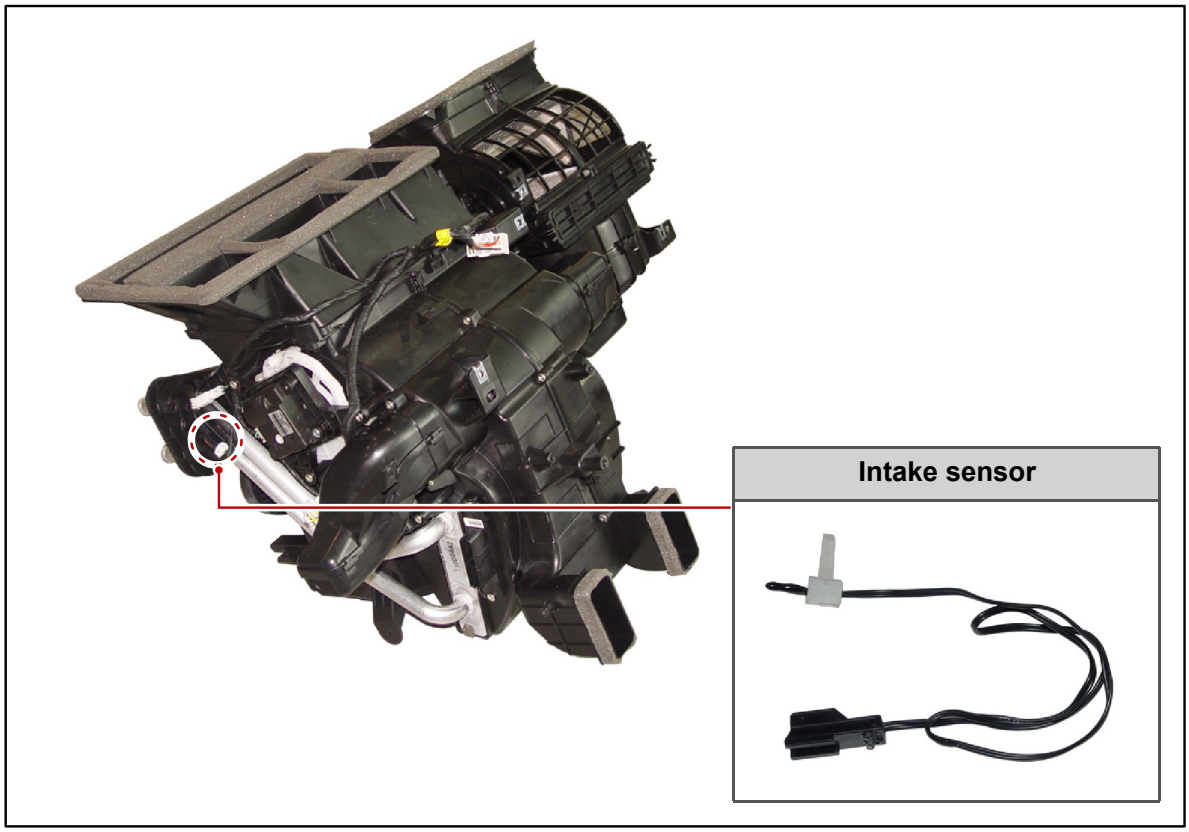
a. Remove the water temperature sensor and measure the resistance between the two terminals on the connector.
(Specified value: 2.186 kΩ ± 3% at 25℃)
If the measured resistance is extremely high or low, replace the water temperature sensor.

b. If the measured value is out of the specified range, replace the water temperature sensor.
If the measured value is within the specified range, check as described below:

- Turn the ignition switch to ON position and measure the voltage between the pin no. 15 and 11 of the FATC connector. (Specified value: approx. 1.1 V at 25℃)
- If the voltage value cannot be measured, check the wiring for open circuit. If the measured value is within the specified range, replace the FATC.

Downloaded from www.Manualslib.com manuals search engine

(6) Intake Sensor



▶ **Mounting location**

Located to the side of the evaporator inside the A/C.

▶ **Function**

This sensor is a negative temperature coefficient (NTC) thermistor and detects the evaporator temperature to send the voltage value according to the resistance change to the FATC.

▶ **Maintenance**

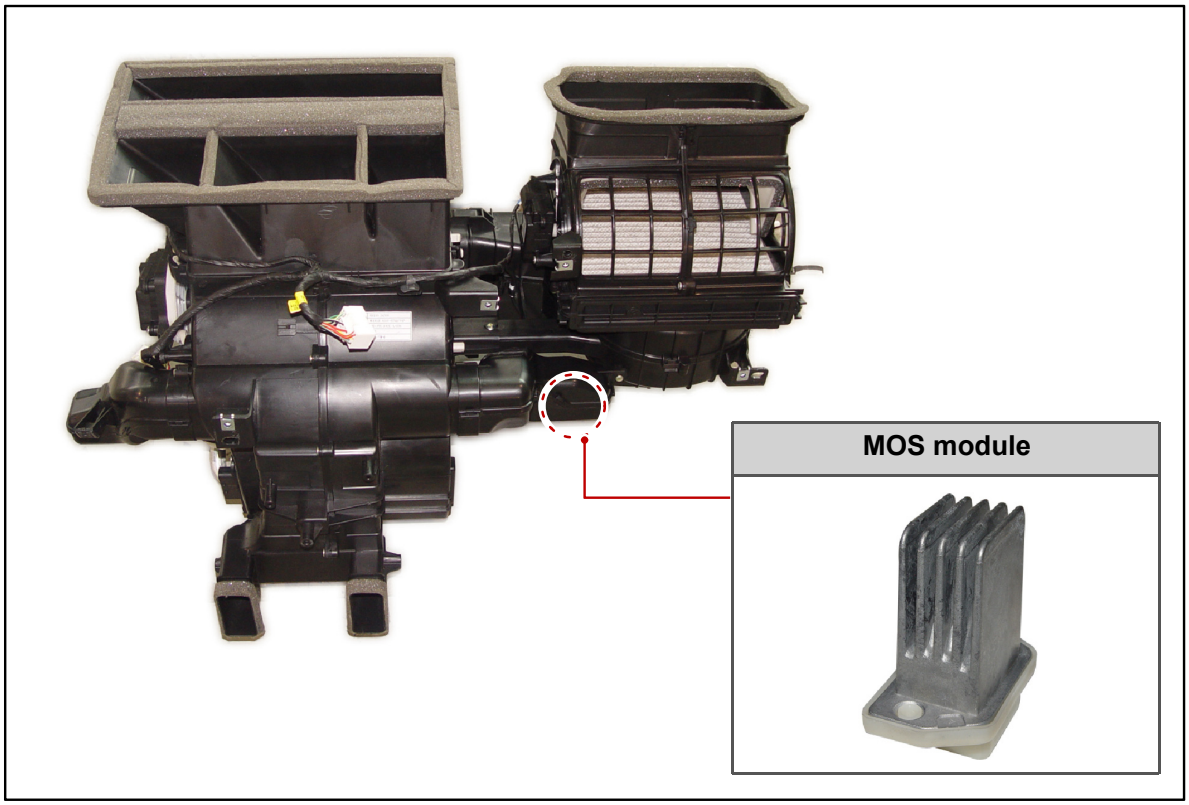
If there is any fault in the intake sensor, check as described below:

a. Remove the intake sensor and measure the resistance between the two terminals on the connector.
(Specified value: 8 kΩ ± 1% at 1℃)
If the measured resistance is extremely high or low, replace the intake sensor.

b. If the measured value is out of the specified range, replace the intake sensor. If the measured value is within the specified range, check as described below:
- Turn the ignition switch to ON position and measure the voltage between the pin no. 21 and 18 of the FATC connector. (Specified value: approx. 5.1 V at 1℃)
- If the voltage value cannot be measured, check the wiring for open circuit. If the measured value is within the specified range, replace the FATC.

Downloaded from www.Manualslib.com manuals search engine

(7) MOS Module



The MOS module controls the fan speed. It receives the fan speed control signal from the A/C control unit to control the rotation speed of the blower motor by adjusting the current applied to the base of the power transistor.

▶ Maintenance

If there is any fault in the MOS module (Fault code 6), check as described below:

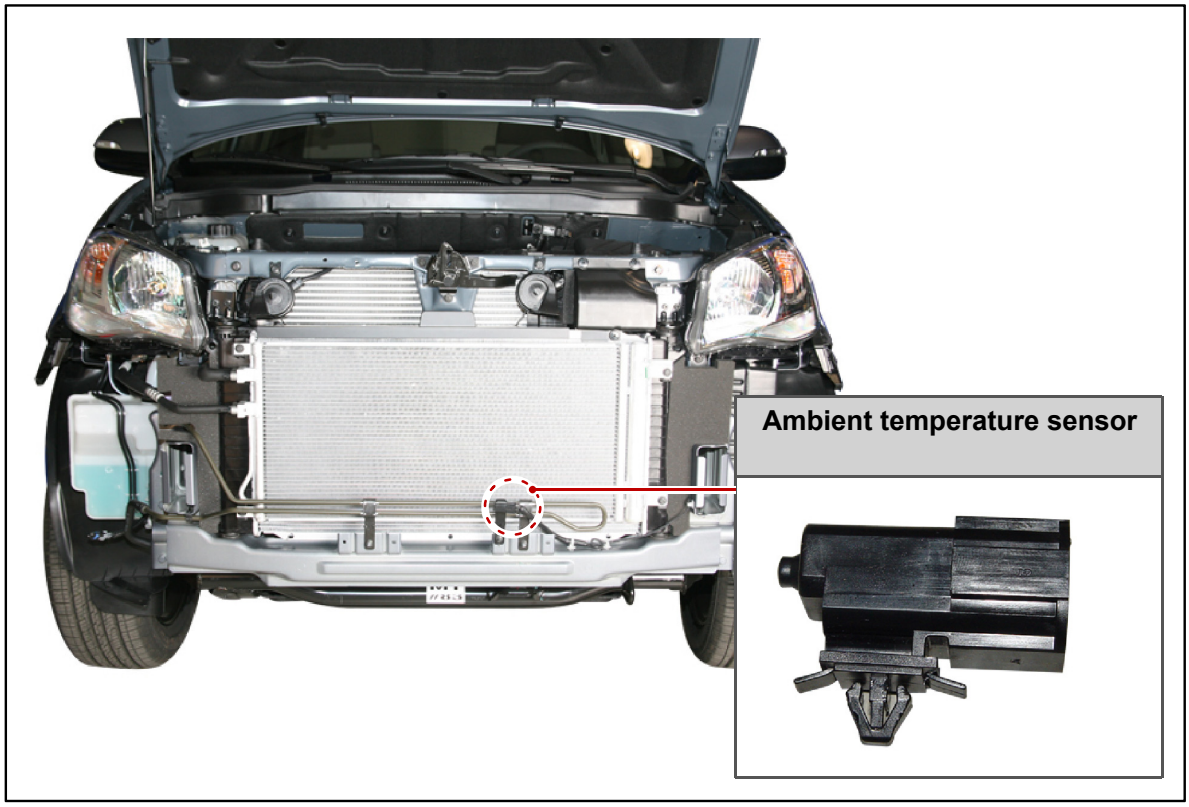
- Turn the ignition switch to ON position.
- Measure the voltage between the two terminals of the blower motor while changing the fan speed from the lowest level to the highest level.
- The specified voltage value in each stage:

Item		1	2	3	4	5	6	7
Voltage	FATC	4 V	5 V	6.5 V	8.5 V	10.5 V	11 V to Battery voltage	-
	Manual	4 V	5 V	6 V	7.5 V	9 V	10.5 V	11 V to Battery voltage

- If the measured value is out of the specified range, check the wiring for open circuit. If the wiring is intact, replace the resistor.

Downloaded from www.Manualslib.com manuals search engine

(8) Ambient Temperature Sensor



▶ **Mounting location**

Located to the upper center side of the front bumper.

▶ **Function**

This sensor is a negative temperature coefficient (NTC) thermistor and detects the ambient temperature to send the voltage value according to the resistance change to the FATC.

▶ **Maintenance**

If there is any fault in the ambient temperature sensor, check as described below:

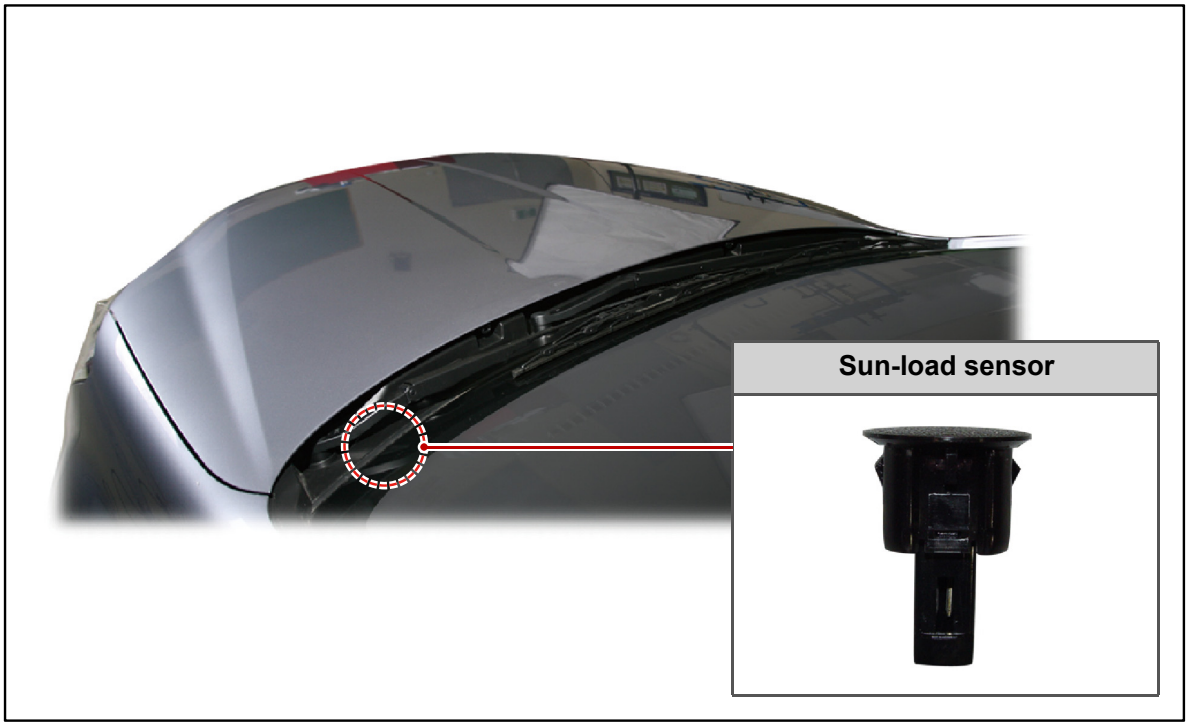
a. Remove the ambient temperature sensor and measure the resistance between the two terminals on the sensor connector.
(Specified value: 2.186 kΩ ± 3% at 25℃)
If the measured resistance is extremely high or low, replace the ambient temperature sensor.

b. If the measured value is out of the specified range, replace the ambient temperature sensor. If the measured value is within the specified range, check as described below:
- Turn the ignition switch to ON position and measure the voltage between the pin no. 31 and 18 of the FATC connector. (Specified value: approx. 1.7 V at 25℃)
- If the voltage value cannot be measured, check the wiring for open circuit. If the measured value is within the specified range, replace the FATC.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

(9) Sun-load Sensor



▶ **Mounting location**
Located on the left side of the instrument panel.

▶ **Function**
Detects the sun-load enters to the interior through the windshield with a photo diode.
Then it converts the sun-load to current value and sends to the FATC.

* **Photo diode**
It uses the characteristic that the current is changed according to the amount of light on the photosensitive surface.

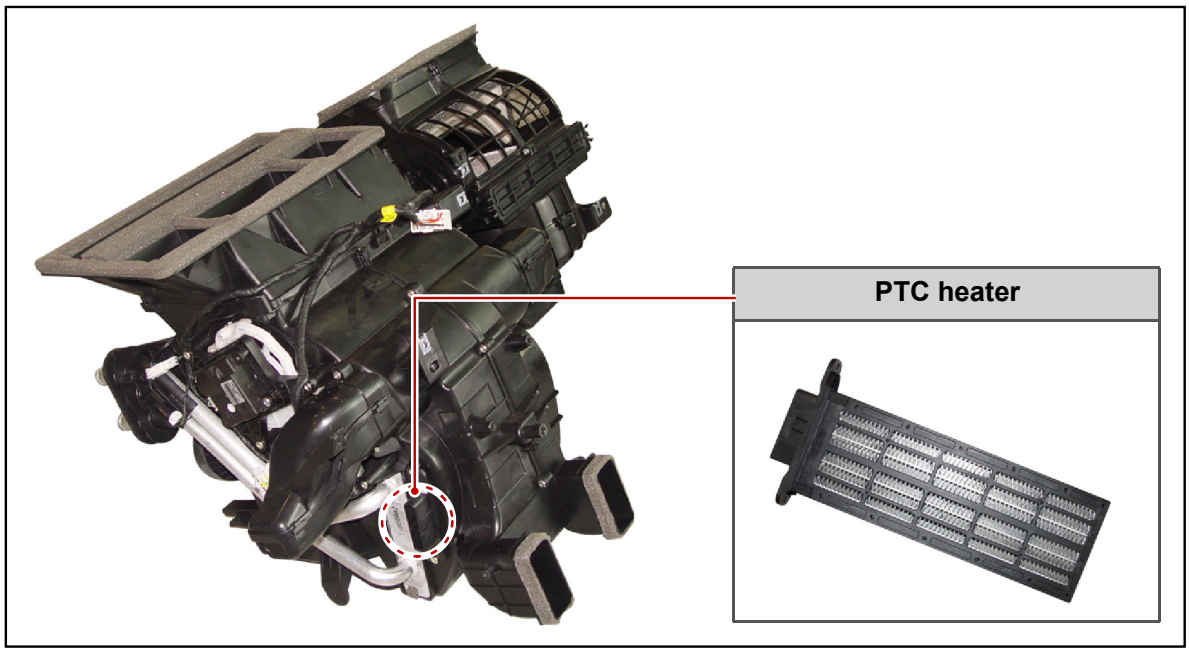
▶ **Maintenance**
If there is any fault in the sun-load sensor, check as described below:

a. Remove the sun-load sensor and measure the current between the two terminals in direct sunlight.
b. Measure the current again under shade. It is in normal if the measured value is less than the measured value in direct sunlight.

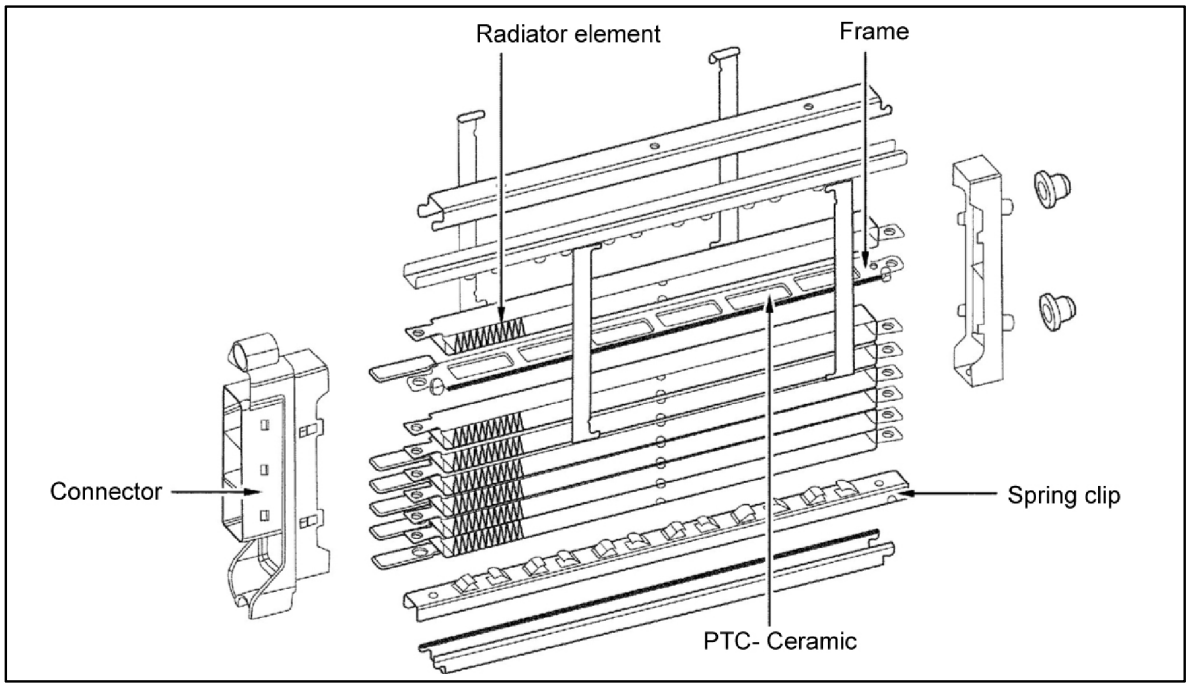
- Turn the ignition switch to ON position and measure the voltage between the pin no. 32 and 18 of the FATC connector.
  (Specified value: approx. 1.7 V in direct sunlight, approx. 3.1 V under shade)
- If the voltage value cannot be measured, check the wiring for open circuit. If the measured value is within the specified range, replace the FATC.

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 6810-15 PTC HEATER ASSEMBLY



This device is mounted to the heater air outlet and increases the temperature of the air to the passenger room.
Because the PTC system is heated by electrical power, the electric load and alternator capacity is greater than the conventional one. For example the alternator capacity of the vehicle with PTC is 140 A while the vehicle with FFH is only 115 A. The PTC does not operate when a) the engine is cranking, b) the battery voltage is below 11 V, c) the glow plug is preheated.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ PTC Operating (ON) Condition

Component	PTC heater
Heating type	Air heating type
Heating efficiency	Excellent
Element	Ceramic PTC (BaTio2)
Weight	Excellent
Durability	Approx. 500 g
Safety	Excellent
Advantages	1. Stable output regardless of voltage changes 2. Blocks the over current with switch effect of PTC element 3. Excellent durability of heating element against high current

▶ PTC Operating (ON) Condition

1. **1st step (Initial PTC operating condition)**

- When the coolant temperature is less than 15℃
- When the coolant temperature is 15℃ or higher, the conditions for the 2nd step described below must be satisfied.

2. 2nd step (Coolant temperature: 15℃)

- When the coolant temperature is 65℃ or less and the intake air temperature is −10℃ or less
- When the coolant temperature is between 65℃ and 60℃ and the intake air temperature is between −10℃ and 0℃
- When the coolant temperature is 60℃ or less and the intake air temperature is between 0℃ and 5℃

▶ PTC "OFF" Condition

- A/C blower switch OFF
- Ambient temperature sensor malfunction (short or open circuit in the wiring)
- When the engine is cranking
- When the battery voltage is 11 V or less
- the glow plug is preheated (Glow indicator ON)

Downloaded from www.Manualslib.com manuals search engine

GENERAL INFORMATION

1. SPECIFICATION

Operating voltage	9 to 16 V
Voltage for system diagnosis and SDM self diagnosis	9 to 16 V
Ignition voltage for side air bag and pretensioner	9 to 16 V
Communication voltage for front impact sensor	9 to 16 V
Communication voltage for side impact sensor	9 to 16 V
Operating temperature	−40℃ to 85℃
Storage temperature	−40℃ to 90℃
Ignition temperature	−30℃ to 85℃
Over voltage protection	24 V

2. MAJOR REPLACEMENT PARTS AFTER AIR BAG DEPLOYMENT

1) In Case of Front Air Bag Deployment

Air bag unit and its wiring (including connector), seat belt pretensioner and its wiring (including connector), whole front air bags, instrument panel, front impact sensor and other damaged components

2) In Case of Curtain Air Bag Deployment

Deployed curtain air bag, air bag unit and its wiring (including connector), impact G sensor assembly for curtain air bag, damaged trim, seat and roof headlining

Downloaded from www.Manualslib.com manuals search engine

3. OPERATION

1) Front Air Bag System

▶ **The air bag deploys when:**

- A front collision occurs, which occupants cannot be protected by seat belt.

▶ **The air bag can deploy when:**

- Underbody impact from the road surface, impact against the curb at a very high speed, or dropping impact onto the road surface with a large angle occurs.

▶ **The air bag does not deploy when:**

- The vehicle rolls over or tips over sideward, or a side/rear collision occurs.
  A minor collision occurs, which occupants can be protected by seat belts.

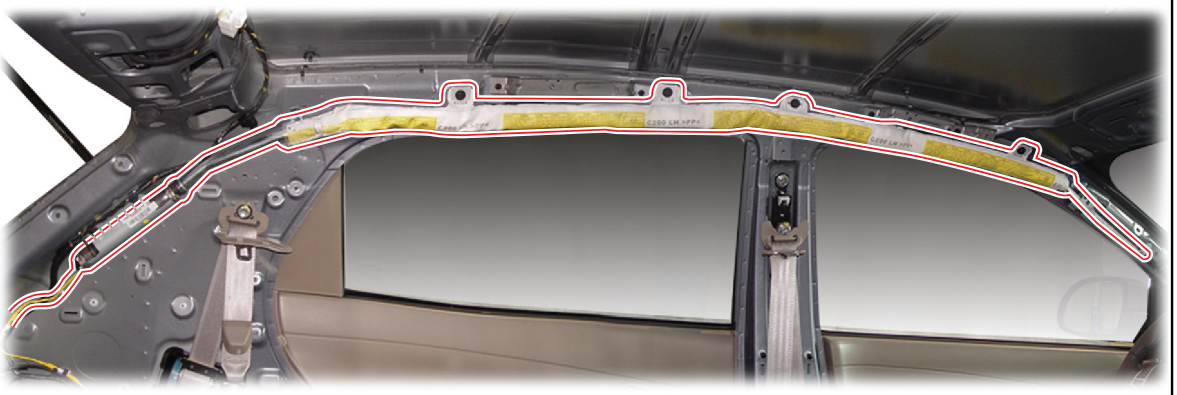
▶ **The air bag seldom deploys when:**

- A collision to diagonal direction (not a front collision) occurs or the vehicle tips over.
- A weak collision, which the sensor cannot detect, occurs (under the activation requirements).
- A collision against narrow objects such as a telegraph pole or a tree occurs.
- The vehicle falls into a drainage or a puddle.
- The front of the vehicle crashes into high impact point vehicle such as a truck.
- The hood is hit by falling stones.
- The air bag warning lamp is on.
- When a oblique collision occurs, only the side air bags will be deployed, and driver/passenger's air bags will not be deployed.

Downloaded from www.Manualslib.com manuals search engine

2) Side Air Bag System

▶ Curtain air bag



The curtain air bags, which are part of the side air bag system, are installed in both roof side rails.

▶ Side air bag

Driver seat	Passenger seat

The side air bags are installed in the outer sides of the driver's and passenger's seats to minimize occupants' side injuries in case of a side impact.

CAUTION

Side airbags and curtain air bags operate independently from the front airbag system.

Downloaded from www.Manualslib.com manuals search engine

▶ **The air bag deploys when:**

- A severe oblique collision occurs corresponding to vehicle specifications for degree, angle, speed, and position of the impact.

▶ **The air bag can deploy when:**

- The vehicle rolls over or tips over sideward by severe impact.
- The vehicle is stationary or a front collision occurs with low speed.
- A rear collision occurs.
- A minor collision occurs, which occupants can be protected by seat belts.

▶ **The air bag does not inflate when:**

- The vehicle is stationary or a front collision occurs with low speed.
- A rear collision occurs.
- A minor collision occurs, which occupants can be protected with seat belts.

▶ **The air bag seldom inflates when:**

- A collision with oblique impact to the front seat direction or a front collision to the diagonal direction occurs.
- A front/rear collision occurs.
- The vehicle rolls over or tips over sideward with minor impact.
- The air bag warning lamp is on.

3) General Warnings For Air Bag

- Do not diagnose the circuit with a circuit tester or attempt to modify any air bag components including the steering wheel, air bag mounting area and harness.
- Incorrect inspection could cause a problem with an air bag and seat belt pretensioner, and they cannot protect occupants properly. Inspection and repair service should be done only by a qualified technician.
- An infant or a child should not be seated on the front seat alone or on an adult's lap. An infant or a child could be severely injured by air bag deployed.
- A child restraint system should be placed on the rear seat which has the 3-point type seat belt.
- Never install a child restraint system on the front seat. Impact by the air bag inflation might cause severe injury or even death.
- When an occupant fastens the seat belt with unstable or inclined posture, the air bag cannot protect the occupant properly. Moreover, the occupant may be injured by the air bag.
- Do not incline toward the steering wheel while driving. If you hit the air bag before it is fully inflated, brain or neck injury, or even death can occur.
- Be careful not to strike the steering wheel, air bag mounting area, any air bag related component (including wiring) and seat belt pretensioner. You might get severely injured by sudden deployment of the air bag.

Downloaded from www.Manualslib.com manuals search engine

- The air bag contains explosive materials, so handle it carefully when disposing or replacing it.
- The air bag components will be very hot immediately after deployment. Do not touch them until they cool down.
- Once the air bag system is triggered, the triggered air bag assembly should be removed from the vehicle and replaced with a new one Once triggered air bag/seat belt pretensioner related components cannot be reused, so they should be removed from the vehicle and the whole system should be replaced with a new one.
- Do not place any object or sticker on the air bag mounting area for correct and safe activation of the air bag.
- Never incline toward the door or put your hands out of the window since it is very dangerous when the side air bag inflates.
- Do not bang the door. Otherwise, an air bag might operate erroneously.
- Hold the outer rim of the steering so that the air bag can inflate without any hindrance.
- Do not incline toward the steering wheel or hold the steering wheel with your hands crossed. It will cause a problem with the air bag activation or severe injury when the air bag inflates.
- Never put your hands or feet on the dash board. You can severely injured when the air bag inflates.
- It is normal that a loud noise, dust and smoke occur when the air bag and seat belt pretensioner operate.
- The gas come out of air bag/seat belt pretensioner activation is non-toxic nitrogen gas.
- However, if this gas occurs irritation to your skin, eyes, nose, and so on, wash it out with clean water. Seek medical help if symptoms develop.
- The windshield or windows can be broken due to impact from front or side air bag inflation.
- When any repairs are needed to the air bag mounting area or its surrounding area, or when an accident has occurred without the air bag deployment, have the air bag system/seat belt pretensioner checked for safety.
- The air bag is a unit to save an occupant's life from sudden accident and it inflates at a very fast speed by gas with high temperature, which might cause injury, such as an abrasion, bruise and burn depending on the accident conditions.
- Normal inflation of the air bag could make a loud noise and smoke (non-toxic gas).
- A minor collision, which occupants can be protected only by seat belts, will not activate the air bag system. It is because that air bag inflation at a minor collision could cause more injury such as an abrasion, bruise and burn.
- Check the air bag system even though there is no fault in the air bag system when 10 years have passed after air bag installation.

Downloaded from www.Manualslib.com manuals search engine

4. CAUTIONS FOR AIR BAG OPERATION

When turning on the ignition switch, the air bag warning lamp comes on for about 6 seconds and goes off.
It should be determined as a faulty air bag system if the air bag warning lamp does not come on or go off while the vehicle is operating normally.

CAUTION

1. When there is any deployed air bag (including curtain air bag and seat belt pretensioner), the air bag unit should be replaced. Any DTC (Diagnostic Trouble Code) for the air bag unit should not be cleared since the unit has data for the status when the air bag was deployed.
2. Note that the used components related to the air bag, especially the air bag unit, should be packaged in an air tight container to prevent any damage.
3. Please do not connect a tester to any air bag connector or single item to measure the supplied power or resistance. The detonator may explode due to a sudden extra power supplied by the tester.
4. Disconnect the negative battery cable before installing or removing the part related to the air bag.

Downloaded from www.Manualslib.com manuals search engine

Memo

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. SYSTEM CONFIGURATION

A Driver air bag module

B Passenger air bag module

C BCM

D SDM unit

E Seat belt pretensioner

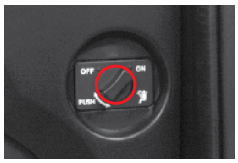
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

F Height adjuster

G ont impact sensor assembly

Air bag warning lamp (instrument cluster)



I Inflatable curtain air bag module

J Side air bag sensor assembly

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. OPERATING CONDITIONS

When the ignition switch is turned to ON, SDM starts to diagnoses the air bag system during the ignition process. If the system is OK, SDM is armed for a specific impact on the vehicle.

1) Deploying Conditions for Front Air Bag

Impact area	Front side
Driver's air bag	Deploy
Passenger's air bag	Deploy
Seat belt pretensioner-driver side	Deploy
Seat belt pretensioner-passenger side	Deploy

2) Deploying Conditions for Side Air Bag

Impact area	Left side	Right side
Seat belt pretensioner-driver side	Deploy	Deploy
Seat belt pretensioner-passenger side	Deploy	Deploy
Side air bag module-driver side	Deploy	Not deploy
Side air bag module-passenger side	Not deploy	Deploy
Inflatable curtain air bag module-driver side	Deploy	Not deploy
Inflatable curtain air bag module-passenger side	Not deploy	Deploy

Downloaded from www.Manualslib.com manuals search engine

3. OPERATION

1) Deployment (Firing Loop)

According to the collision deceleration rate that each collision G sensor reads, the air bag unit sends out about 2 to 4 or higher Amp current. This current generates some heat, which fires the detonator in the inflator. This table shows the basic inner resistance of the air bag related module and the basic instant current necessary for a firing.

Airbag module	Driver/ passenger air bag	Side air bag	Curtain air bag	Seat belt pretensioner
Resistance at -30 to +85°C	2.0 ± 0.3 Ω	2.0 ± 0.3 Ω	2.0 ± 0.3 Ω	2.15 ± 0.35 Ω
Non-firing current at +85°C	0.4 A for 10 sec.	0.4 A for 10 sec.	0.4 A for 10 sec.	0.2 A for 10 sec.
All-firing current at -35°C	1.2 A for 2 ms	1.2 A for 2 ms	1.2 A for 2 ms	0.8 A for 2 ms
Periodic test current	50 mA constantly	50 mA constantly	50 mA constantly	50 mA constantly
Insulating resistance	1 MΩ at DC 500 V for 2 sec.	1 MΩ at DC 500 V for 2 sec.	1 MΩ at DC 500 V for 2 sec.	100 KΩ at DC 500 V

CAUTION

- Please do not connect a tester to any air bag connector or single item to measure the supplied power or resistance. The detonator may explode due to a sudden extra power supplied by the tester.
- Before removing or installing any air bag related components, disconnect the negative battery cable.

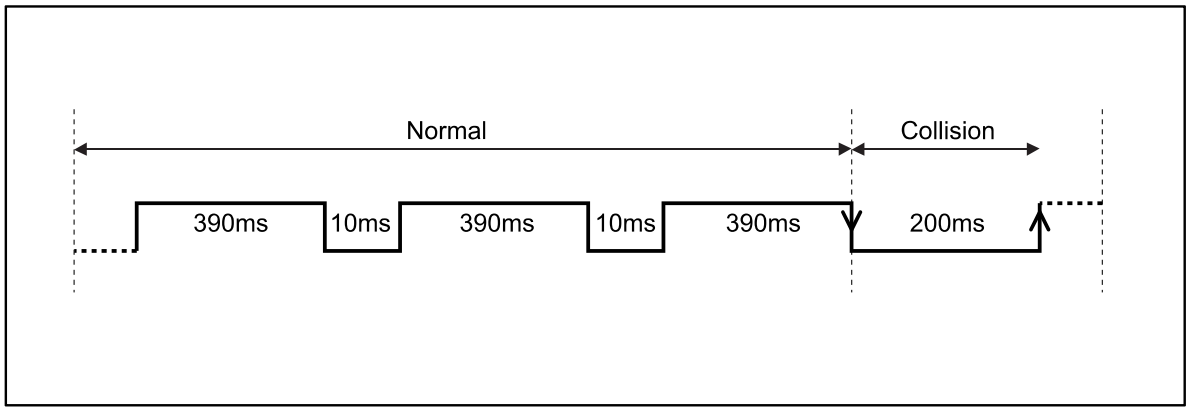
▶ Resistance of air bag wiring harness

Items	Driver side (or LH)	Passenger side (or RH)
Front air bag	0.0366 Ω	0.0530 Ω
Belt pretensioner	0.1477 Ω	0.1563 Ω
Side air bag	0.1074 Ω	0.1149 Ω
Curtain air bag	0.2210 Ω	0.2327 Ω

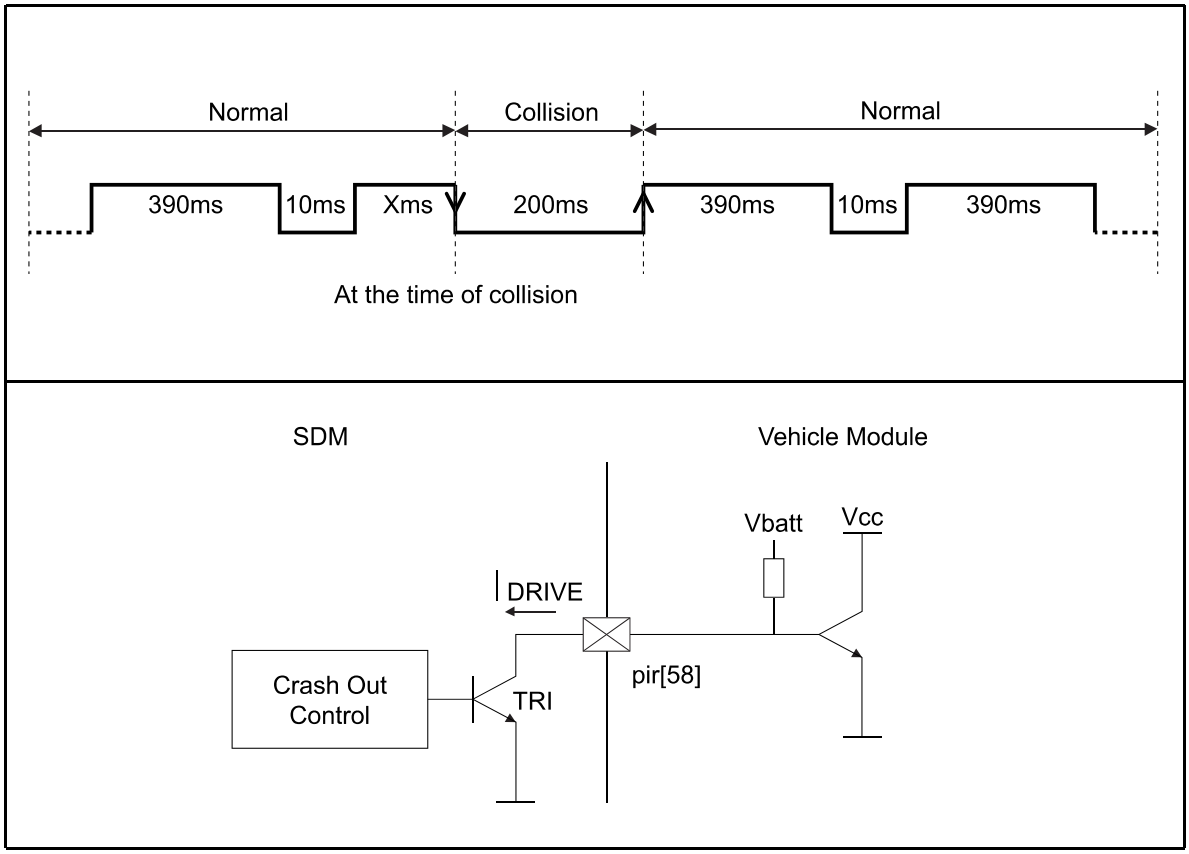
Downloaded from www.Manualslib.com manuals search engine

2) Air Bag Deployment Signal Output (Crash Out)

When any air bag deploys, crash out is performed. If other deployment is occurred while a deployment signal is output, another crash out is delayed until the current 200 ms crash out is completed. (The tolerance at the time of signaling is ±5%)



The signal repeats increasing for 390 ms and decreasing for 10 ms before crash. At the time of crash, the switch is closed and the signal is kept low condition for 200 ms.
At the time of crash, the crash out signal is changed to the low condition for 200 ms immediately to indicate the crash moment.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

▶ Collision signal interface

The open collector driver raises or lowers the voltage of the pin No. 58 by switching on and off the drive transistor. The vehicle module can be operated normally only when the rule of the open collector interface is followed and can be maintained in a pull -up state. The followings are the specifications of the electrical interface.

Items	Minimum	Average	Maximum	Remark
Driving current (current value when the transistor is turned on)	12.31 mA	19.6 mA	30 mA	Depending on the battery voltage
Leakage current (current value when the transistor is turned off)	147.6 μA		376 μA	No crash signal
Load resistance	590 ohms			Above than this value

NOTE

The load resistance of the SDM should be 590 ohms or higher. It may not be possible to operate the collision occurrence circuit normally if the resistance value does not reach this specified value.

Downloaded from www.Manualslib.com manuals search engine

3) CAN Communication Interface (FIS and SIS)

The CAN communication interface uses PWM for the supply current and the current loop and communicates with the SDM to transmit information. The serial communication and power for the satellite are supplied through the communication line.

Stage	FIS	SIS
Initial stage	Tracking/Check (Self test)	Same as FIS
Normal operation	Checks the FIS condition and sends the result as "OK' or 'NOK", and also sends the "severe level" of the crash.	Same as FIS
Voltage	The FIS hardware reset performed under 5 V, communication voltage low	Same as FIS
Fault	The fault is found in the current ignition cycle but the fault is deactivated in the next ignition cycle.	Multiple faults can be found and deactivated in the same ignition cycle.

The FIS moves to the initial stage if 'leakage to GND' is occurred in normal operating stage to shut down the power and prevent abnormal operation.

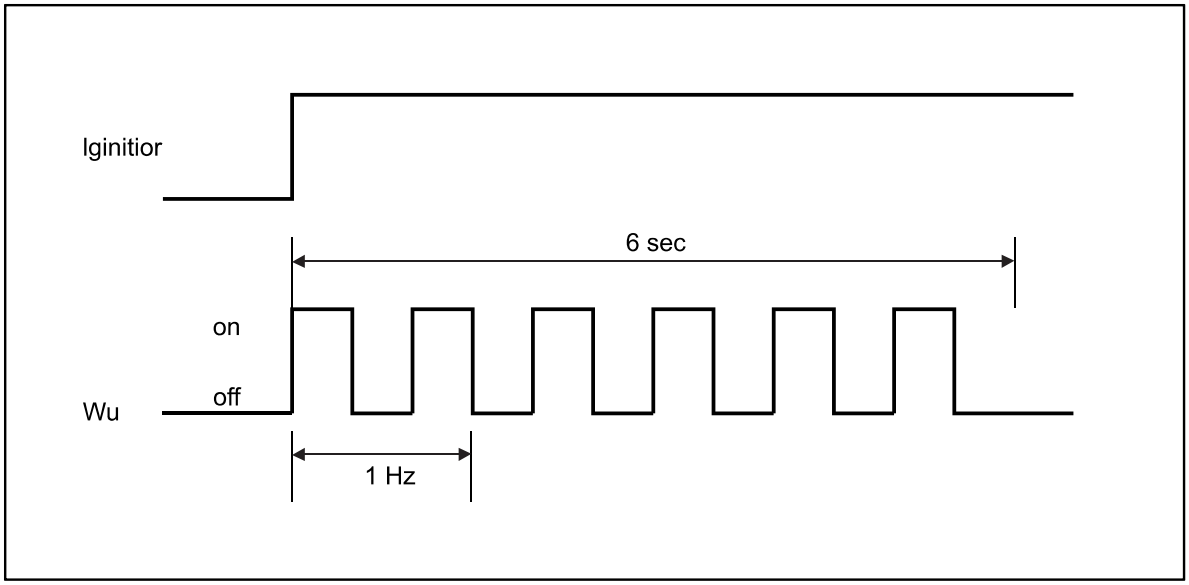
※ FIS: Front Impact Sensor
SIS: Side Air bag Sensor

Downloaded from www.Manualslib.com manuals search engine

4. AIR BAG WARNING LAMP OPERATIONAL CONDITION

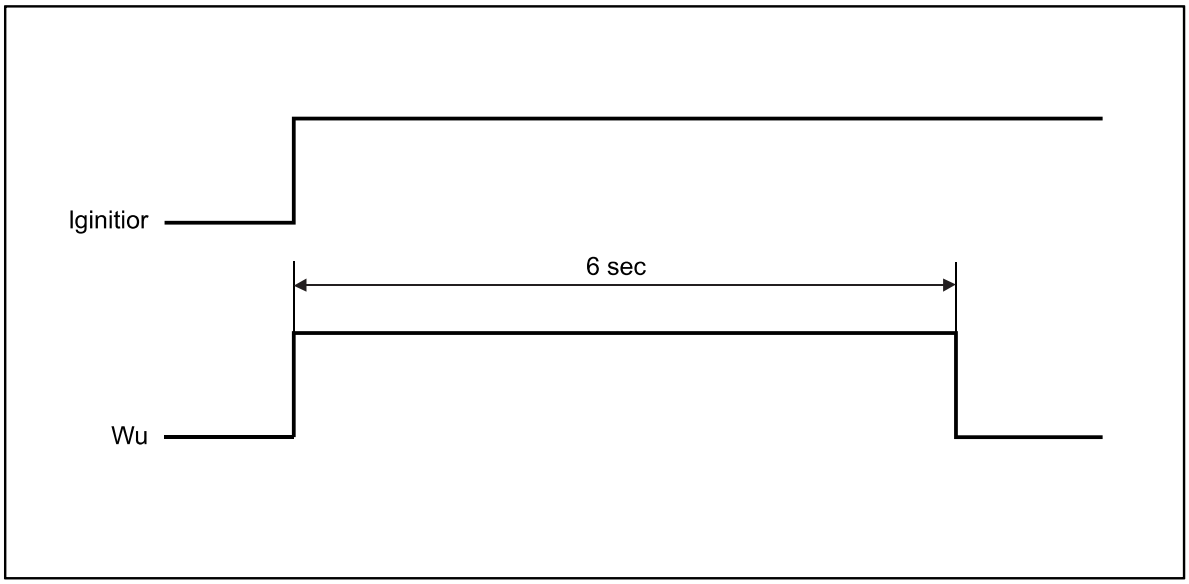
▶ When there are no active and past faults

The air bag warning lamp is operated as shown below if there is no fault occurred in the previous ignition cycle and the SDM is running without any active fault right after starting in the ignition cycle.



▶ When there is no active fault and past faults occurred within 10 times

The warning lamp is operated as shown below every time the vehicle is started if the SDM is running without any active fault in the entire time and past faults in the previous ignition cycle occurred within 10 times.
"Battery voltage too low" is not counted as a past fault.

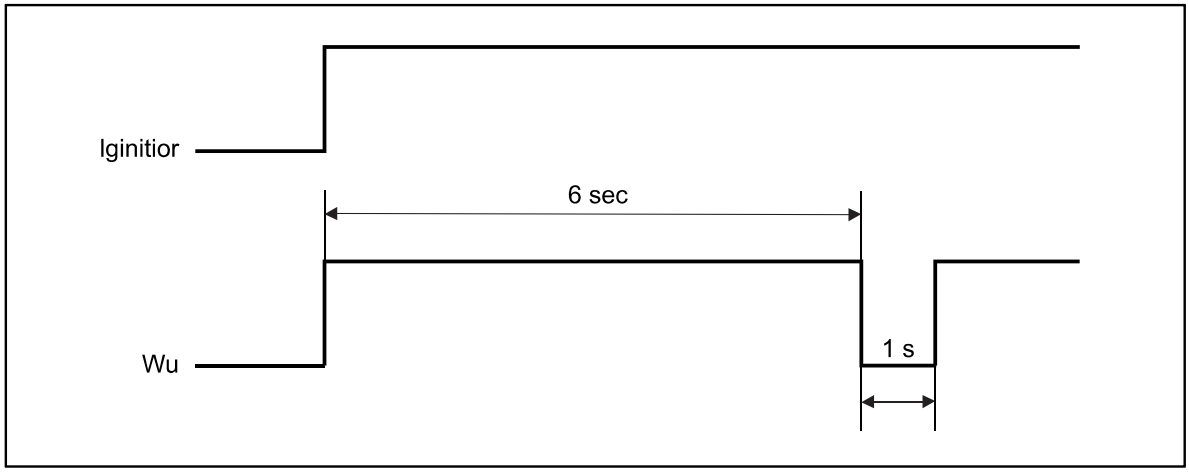


Downloaded from www.Manualslib.com manuals search engine

▶ When there is an active fault or past faults occurred 10 times or more

If active fault or past faults which occurred 10 times or more in the last ignition cycle, the SDM operates the warning lamp as shown below. If below conditions are met, the SDM is operated in the same way.

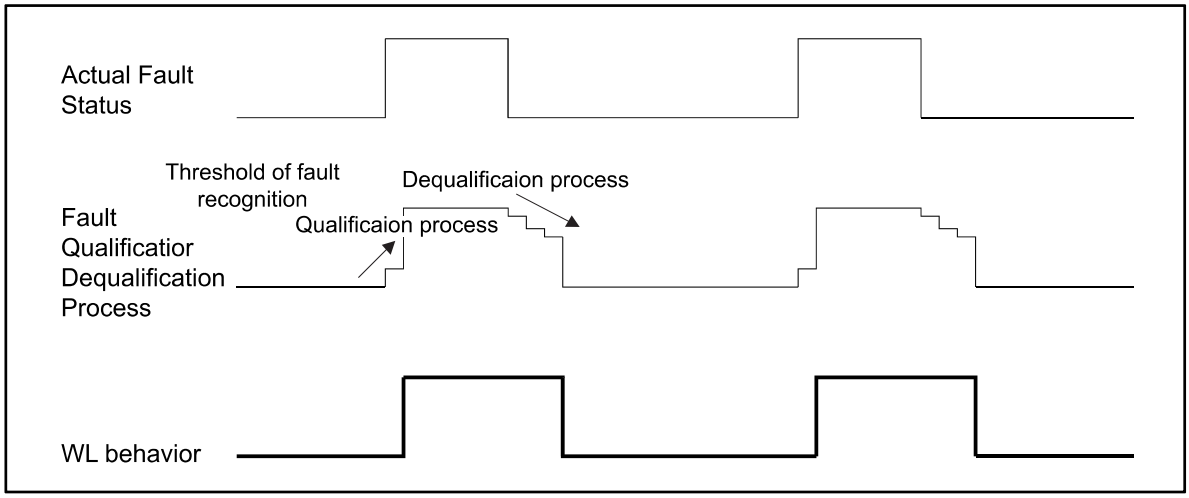
- Active fault
- When the past faults occurred 10 times or more (except 'battery voltage too low')
- Internal fault
- Impact record
- Pretensioner fired only



If the connector is not connected properly or SDM battery voltage is out of the specified range internally (battery voltage for warning lamp), the warning lamp is kept ON.

▶ Warning lamp condition change during operation

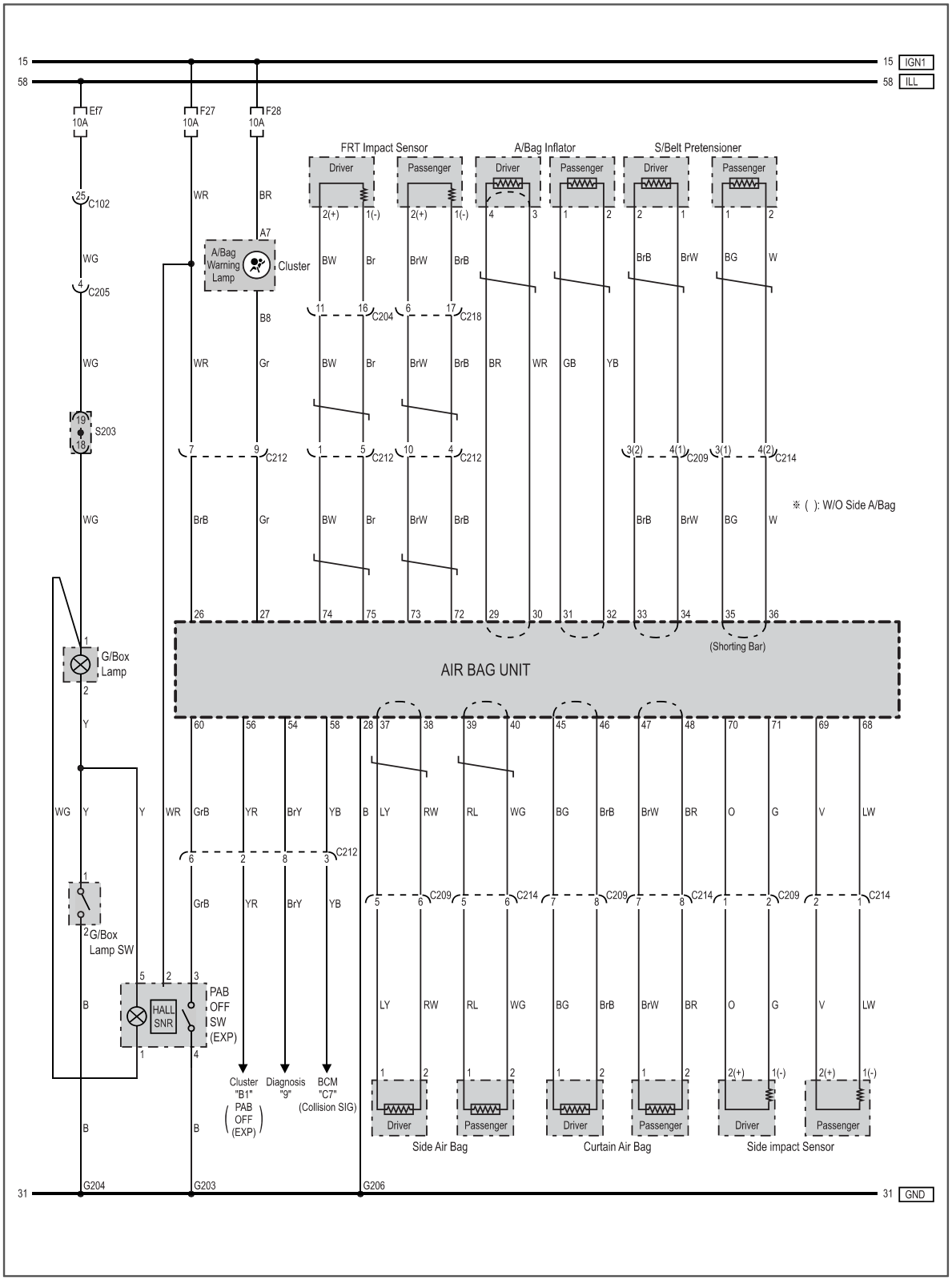
The warning lamp comes on or off according to the actual fault condition during SDM operation. If there is any active fault or active fault becomes past fault, the warning lamp is illuminated, and if the fault is deactivated, the warning lamp is turned off.



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4. CIRCUIT DIAGRAM

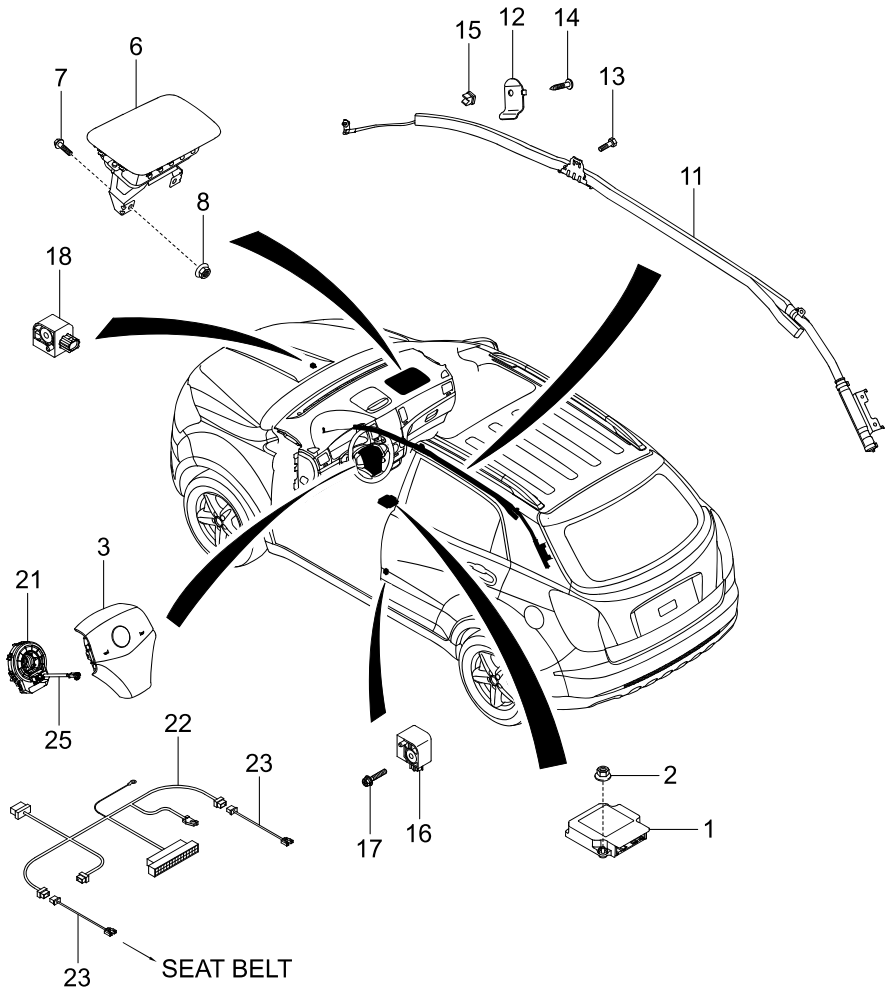


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

COMPONENT

S.G.N. 8810-00 AIR BAG SYSTEM



1. Unit assy - SDM
2. Nut
3. Air bag module - Driver
6. Air bag module - Passenger
7. Screw
8. Nut
11. Air bag module - INF curtain
12. Brkt - Icab FRT
13. Bolt
14. T/screw - Truss_M4x0x12
15. Grommet screw_M4
16. Sensor assy - Side air bag
17. Screw
18. Sensor assy - FRT impact
22. Wiring assy - Air bag
23. Wiring assy - Air bag EXTN

Modification basis	
Application basis	
Affected VIN	

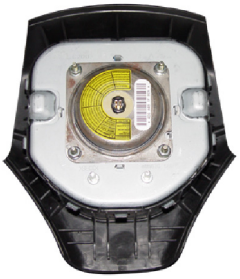
Downloaded from www.Manualslib.com manuals search engine

S.G.N. 8810-03

DRIVER AIR BAG MODULE

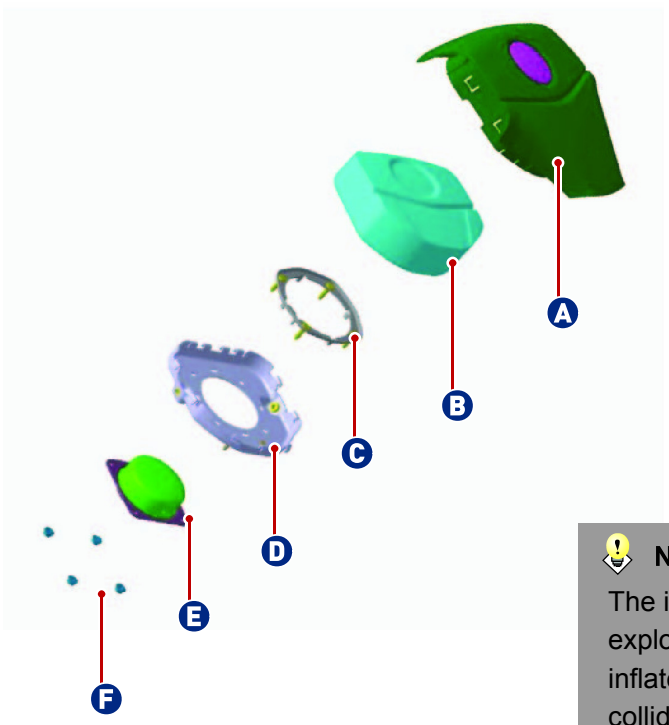
The driver's air bag is installed inside the steering wheel. If the acceleration sensor (inside the air bag unit) is activated by the deceleration from vehicle collision, the detonation is fired by the electrical signal of the air bag unit. Then, the detonation sets off explosives and nitrogen gas is generated. At this point, the air bag very quickly deploys and the gas is emitted from the relieving hole to absorb impact upon the driver.

1) Location

Front side of DAB module	Rear side of DAB module
	

Downloaded from www.Manualslib.com manuals search engine

2) Components

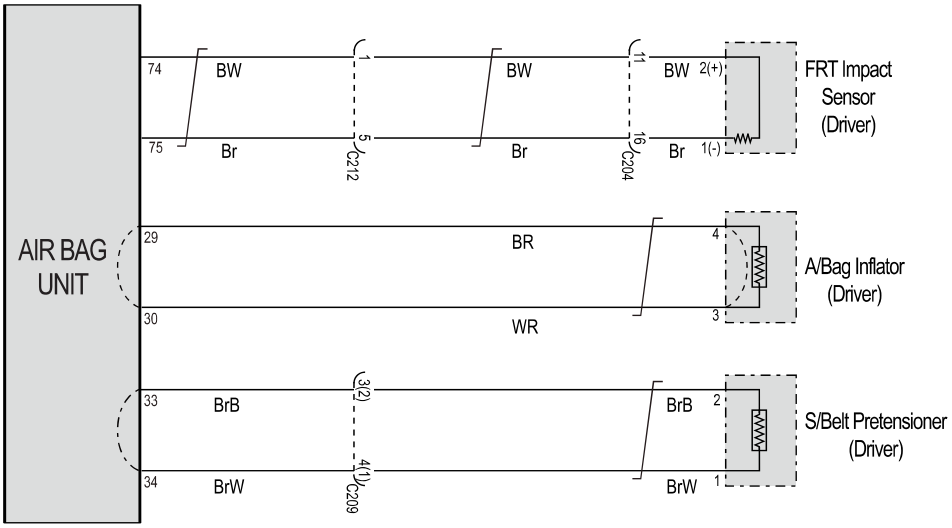


- Ⓐ Air bag cover
- Ⓑ Air bag cushion (approx. 50 liters)
- Ⓒ Retainer ring
- Ⓓ Air bag housing
- Ⓔ Inflator (approx. 195 kP)
- Ⓕ Nut

NOTE

The inflator consists of the detonator, explosives, and the gas generator. It inflates the air bag when the vehicle collides.

3) Inflator Circuit



Modification basis	
Application basis	
Affected VIN	

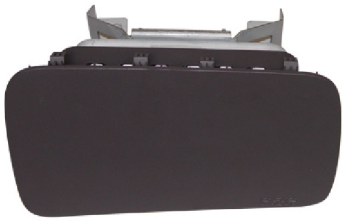
Downloaded from www.Manualslib.com manuals search engine

S.G.N. 8810-06

PASSENGER AIR BAG MODULE

The passenger's air bag is installed inside the instrument panel above the glove box. Its operation process is the same as the driver's one. The driver's air bag, the passenger's air bag, and the seat belt pretensioners on both seats are made to operate together. When the collision G sensor inside the air bag unit sends a collision signal, the air bag unit instantaneously applies a high current to the driver's and passenger's air bags and the seat belt pretensioners on both seats, fires the detonator in the inflator, and inflates the air bag cushions (curtain air bags independently operate in case of the side collisions).

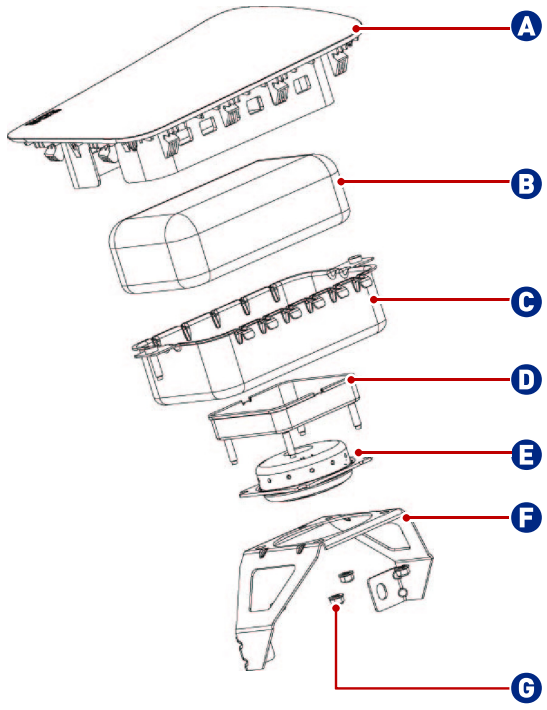
1) Location

Front side of PAB module	Rear side of PAB module
	

Modification basis	
Application basis	
Affected VIN	

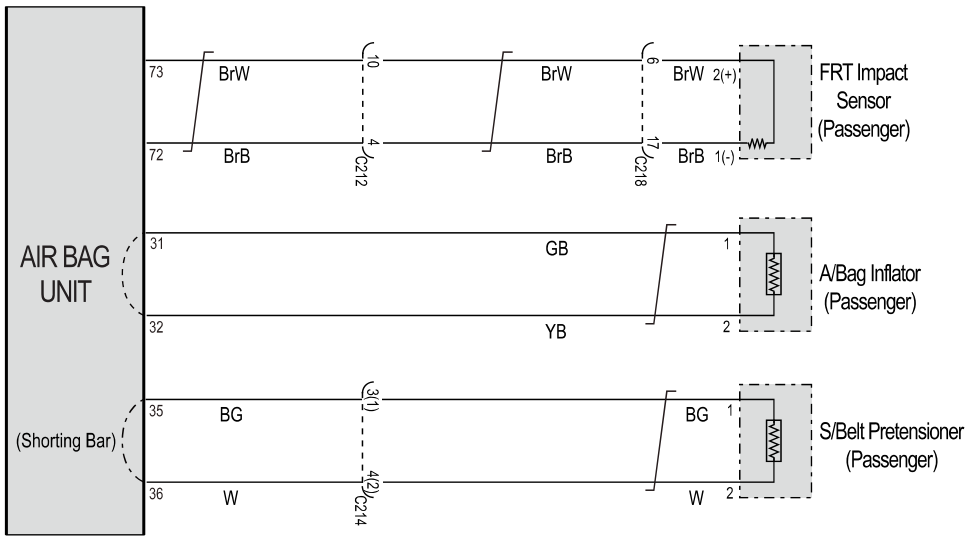
Downloaded from www.Manualslib.com manuals search engine

2) Components



- A Air bag cover
- B Air bag cushion (approx. 50 liters)
- C Air bag housing
- D Retainer
- E Inflator (approx. 330 kP)
- F Cowl bracket
- G Nut

3) Inflator Circuit



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 8810-11

INFLATABLE CURTAIN AIR BAG MODULE

The curtain air bags are installed on both sides of the roof side rails and inside the headlinings. Each curtain air bag is also composed of the air bag cushion and the inflator that has the detonator, explosives, and the gas generator.

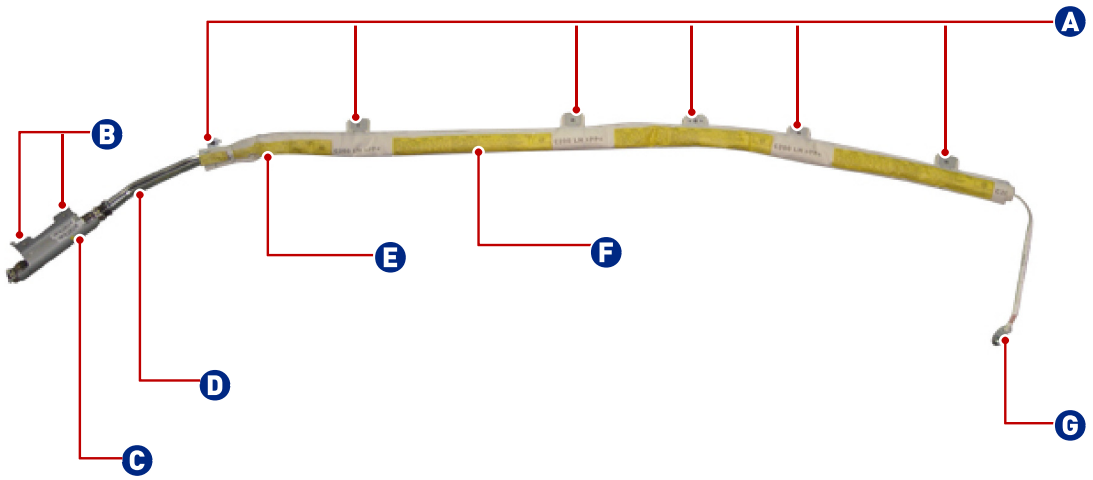
1) Location

Installed

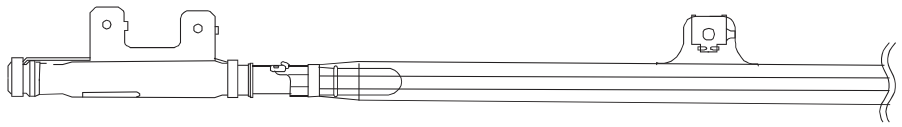
Deployed

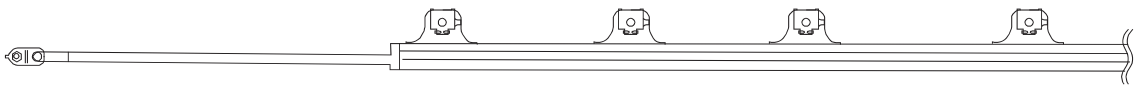
Downloaded from www.Manualslib.com manuals search engine

2) Components



- A Curtain air bag mountings (6 points)
- B Inflator mountings
- C Inflator
- D Gas guide
- E Air bag cushion
- F Cover - curtain air bag
- G Bolt



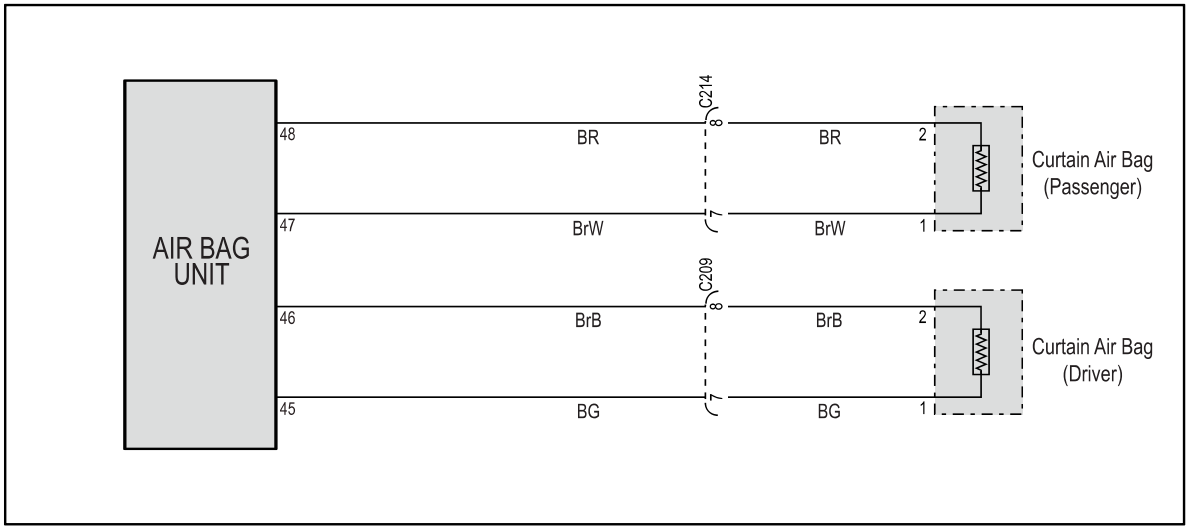


Tightening torque 8 to 10 Nm

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Inflator Circuit



Downloaded from www.Manualslib.com manuals search engine

S.G.N. 8810-16 SAB (SIDE AIR BAG)

The side air bags are installed in the outer sides of the driver, passenger and rear seats to minimize the side impact applied to the occupant. The Side air bags and curtain air bags are operated independently from the front air bag system.

1) Mounting Location

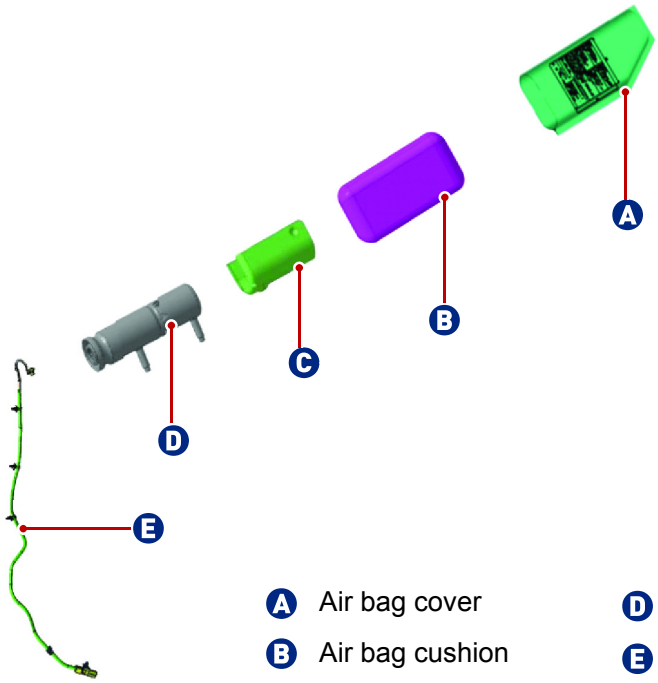
Driver side	Passenger side

Deployed

Modification basis	
Application basis	
Affected VIN	

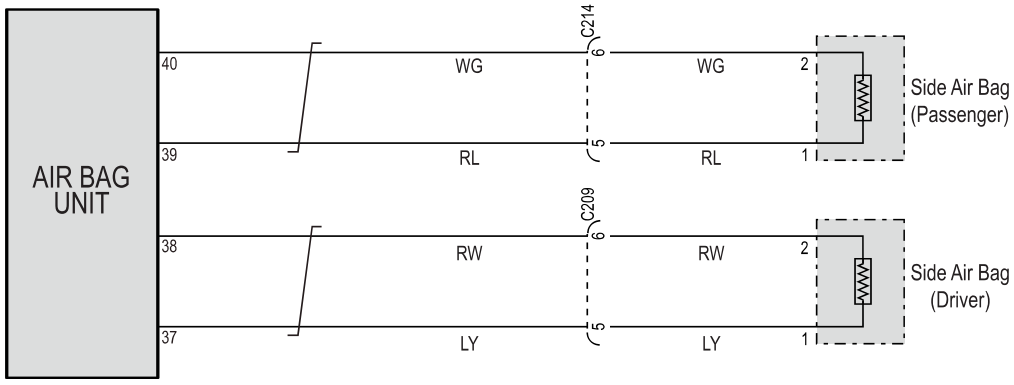
Downloaded from www.Manualslib.com manuals search engine

2) Components



A Air bag cover
B Air bag cushion
C Deflector
D Inflator
E Wiring harness

3) Inflator Circuit



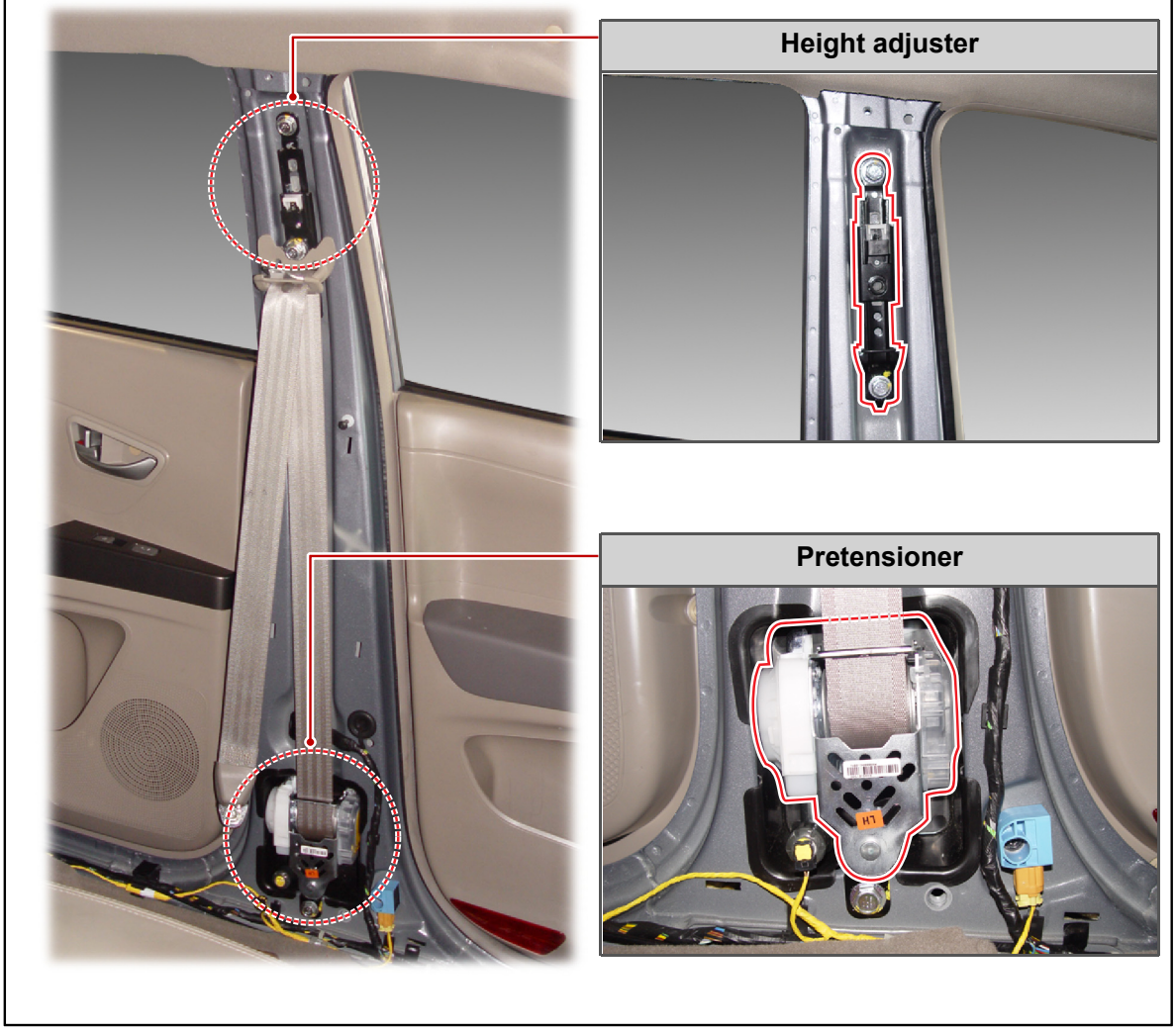
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 7430-00 SEAT BELT PRETENSIONER

The belt pretensioner retracts the seat belt to tighten or take up slack in the wearer's belt.
When a collision occurs or when brakes are applied, a seat belt with a pretensioner detects the stopping action and tightens the belt before the wearer is propelled forward.
This holds the occupant more securely in the seat.

1) Location



NOTE

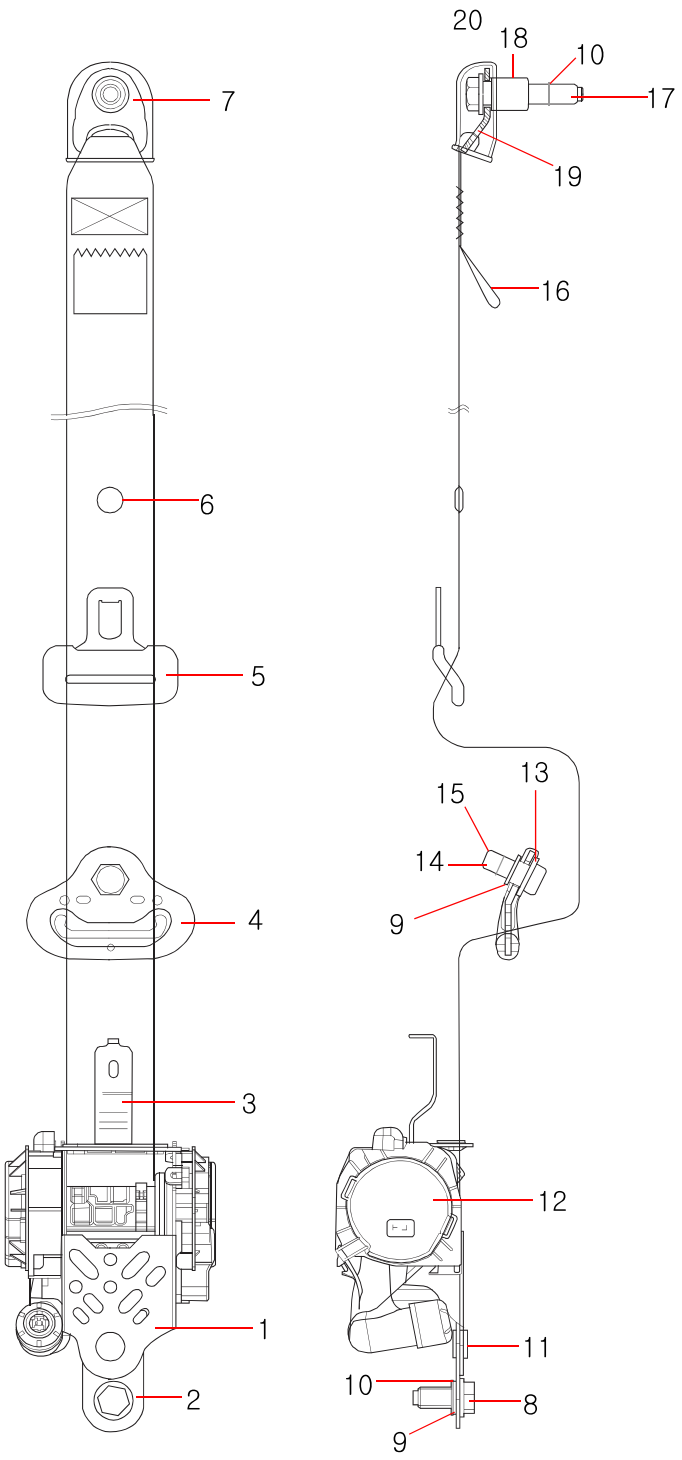
▶ **Height adjuster**

It is to improve comfort and optimize restrictive performance in case of a collision by adjusting the belt position to the occupant's shoulder.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

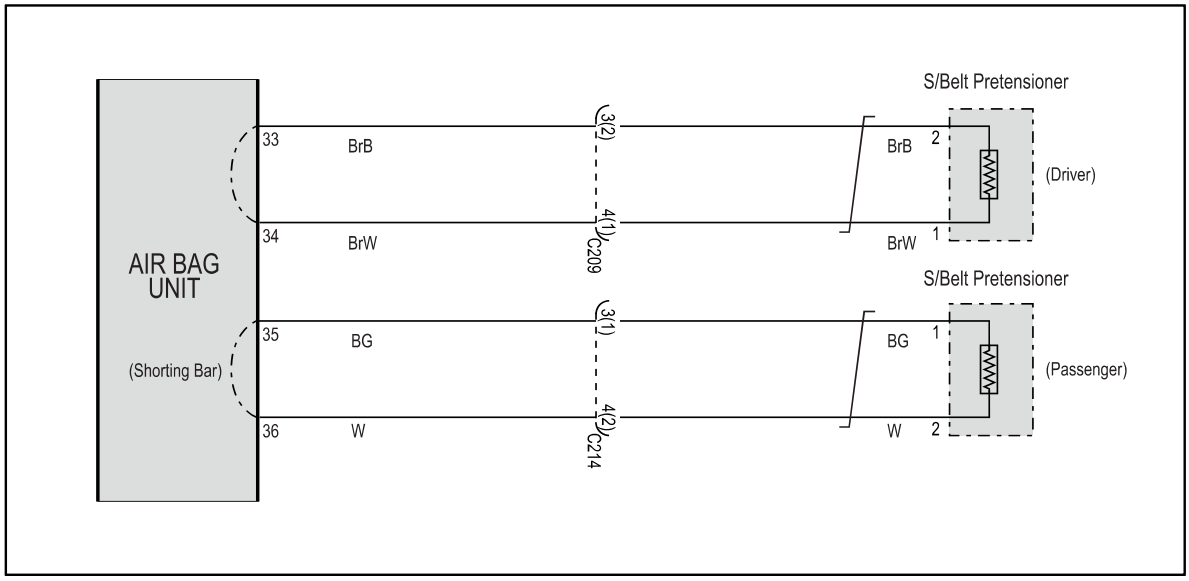
2) Components



1. Pretensioner reel assembly
2. Reel bracket
3. Upper stay for ring
4. D-ring
5. Bending tongue
6. Tongue stopper
7. Mini-anchor
8. D-bolt
9. Washer
10. Fiber washer
11. Rivet
12. D label
13. Plastic washer
14. Steel washer
15. D-bolt
16. Label
17. D-bolt
18. Spacer
19. Bush
20. Mini-anchor cover

Downloaded from www.Manualslib.com manuals search engine

3) Inflator Circuit



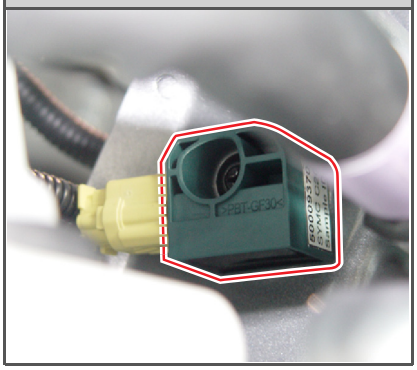
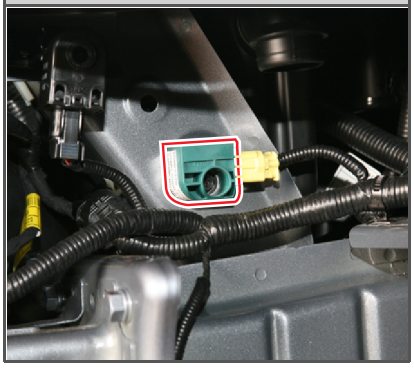
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
8810-18 FRONT IMPACT SENSOR ASSEMBLY

The front air bag system is activated mainly by the signal from the front impact sensor assembly. The SDM unit assembly compares this signal with its longitudinal/lateral G sensor values to inflate the front air bag.

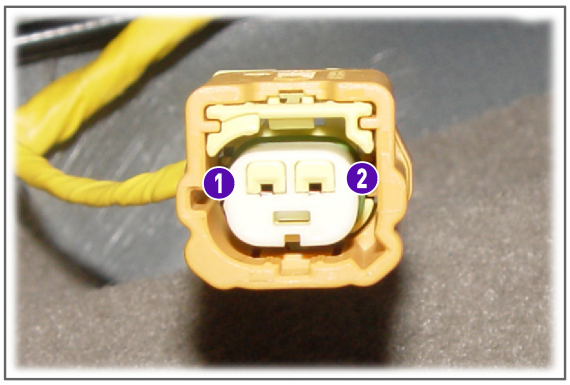
1) Mounting Location

Front impact sensor assembly (RH)	Front impact sensor assembly (LH)
	

Modification basis	
Application basis	
Affected VIN	

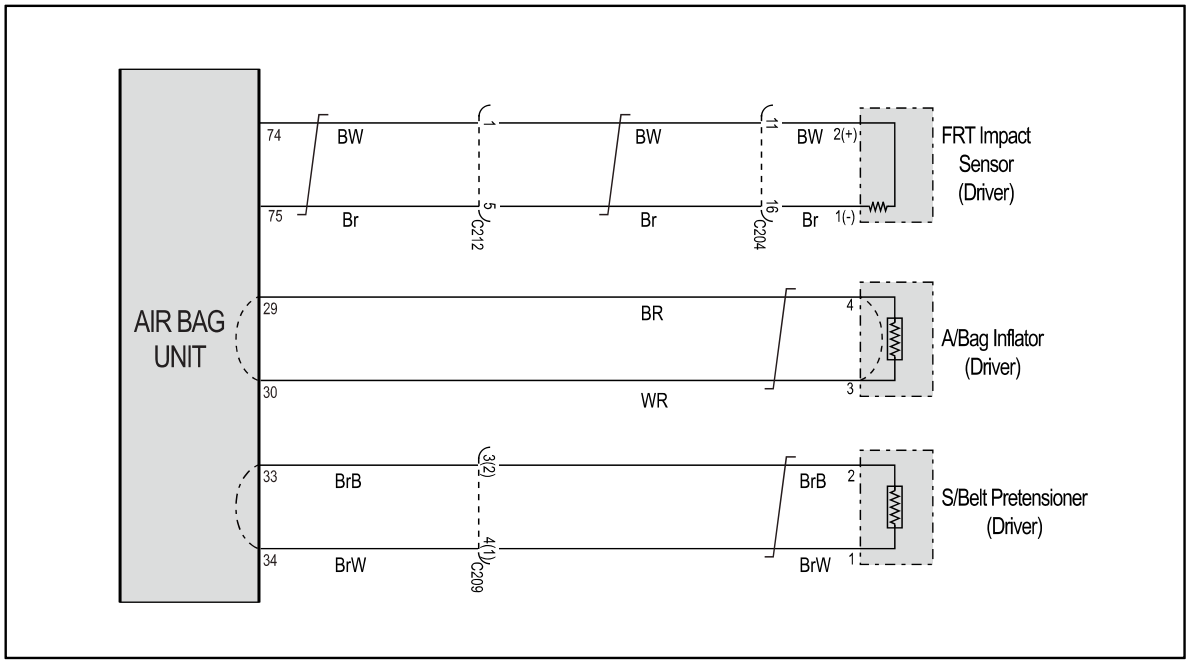
Downloaded from www.Manualslib.com manuals search engine

2) Front Impact Sensor Connector



Pin No.	Function
1	Signal
2	Ground

3) Front Impact Sensor Circuit



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 8810-16

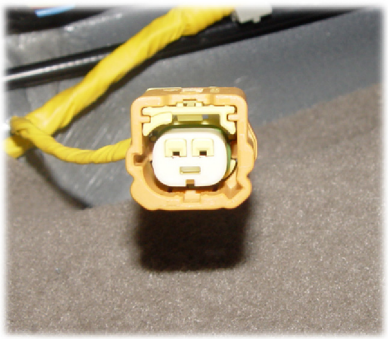
SIDE AIR BAG SENSOR ASSEMBLY

The side air bag sensor assembly receives an ignition signal from the SDM unit assembly independently from the front air bag system. The ignition signals of the side air bag system are supplied from the 2 side air bag sensors installed to the side center of the vehicle body.

1) Location

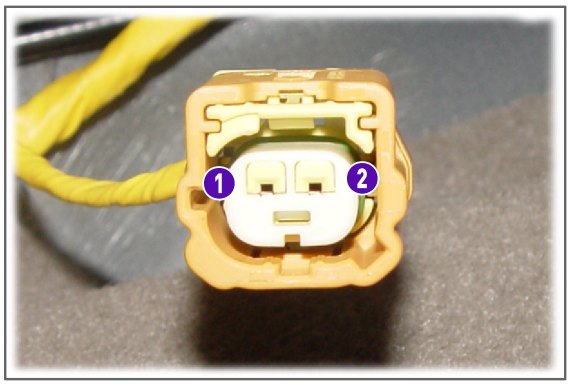
<Left>

<Right>

Side air bag sensor assembly	Side air bag sensor connector
	

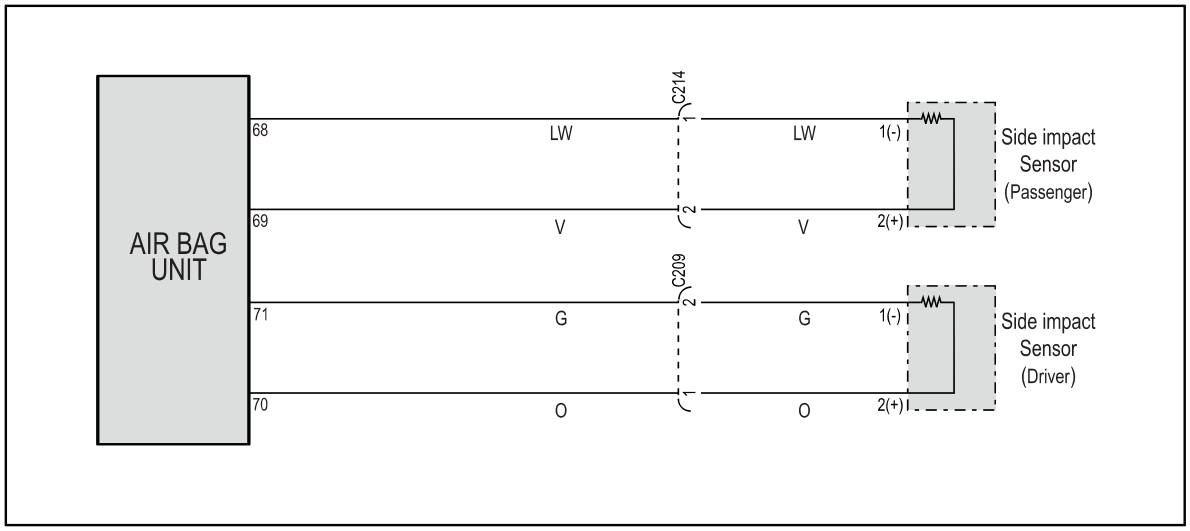
Downloaded from www.Manualslib.com manuals search engine

2) Side Air Bag Sensor Connector



Pin No.	Function
1	Signal
2	Ground

3) Side Air Bag Sensor Circuit



Modification basis	
Application basis	
Affected VIN	

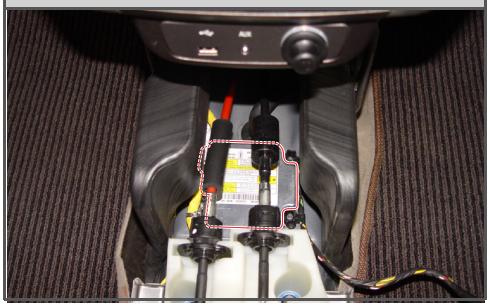
Downloaded from www.Manualslib.com manuals search engine

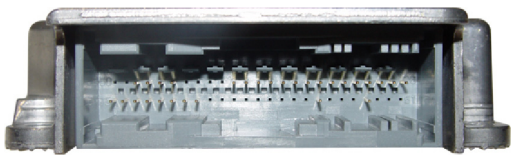
S.G.N.
8810-01 SDM UNIT ASSEMBLY

1) Location

The SDM unit assembly is mounted under the front of the front console.

Location



SDM unit assembly	Connector
	

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Major Functions

- Detects crash
- Activates the front air bag, side air bag, curtain air bag and belt pretensioners
- Monitors the safety system
- Indicates system readiness and faults to the driver by means of a fault warning lamp
- Facilitates servicing capability via a serial diagnostic communication interfaces
- Diagnoses the system including internal system monitoring and ambient sensor monitoring
- Automatic activation
- Records crash data
- Reserves electric energy for deploying the air bag in the event of frontal crash with power cut off

3) Components

- Longitudinal and orthogonal acceleration sensors
- Two inflator circuits with energy reserve function for driver and passenger front air bags
- Two inflator circuits without energy reserve function for front belt pretensioner
- Two inflator circuits without energy reserve function for front side air bag
- Two inflator circuits without energy reserve function for curtain air bag
- Warning lamp indicating system fault
- One service communication interface (KWP2000)
- Two SIS (Side Impact Sensor) interfaces
- Two FIS (Front Impact Sensor) interfaces
- Crash output interface

4) Function

▶ DC/DC converter

The DC/DC converter (Combined ASIC) of the power supply has step up and step down converters, and supplies the firing voltage for the two firing circuits and the internal operating voltage of the SDM. If the internal operating voltage falls below a defined threshold, a reset is executed.

▶ Watchdog

The watchdog checks the micro controller (µC) periodically. If there is any fault in the micro controller, it will be reset and firing loop will be locked. Then, the warning lamp will come on.

Downloaded from www.Manualslib.com manuals search engine

▶ Orthogonal acceleration sensor

The integrated electrical acceleration sensor provides an electrical signal of the vehicle's acceleration along the orthogonal axis and longitudinal axis. The electrical signals are proportional to the acceleration. Those signals are evaluated by the micro controller via the A/D converter. The firing threshold is adjustable by parameter setting for the corresponding algorithm. If the adjusted value exceeds the threshold value, the SDM will drive the high side and low side transistors of the corresponding firing loops.

▶ Arming/Safety circuit

The trigger switch which controls power is implemented as an arming/safety sensor in the SDM. It is only used in the front air bag firing loops and it puts the front air bag firing circuits to the armed status under the air bag deployment conditions and maintains the air bag firing circuits unarmed under the normal driving conditions. All components in the safety circuit can be tested, so a high level of reliability can be achieved. The trigger sensor is continuously monitored to prevent the belt pretensioner loop from activating with the operating conditions not satisfied. It is allowed to be activated only when a loop closing is detected.

▶ Firing loop phase - Front air bag

Each firing loop consists of a high side and low side switch. The current is limited by the ASIC to 2 to 4 A. Both stages of the front air bags are fired by the energy reserve capacitors.

▶ Firing loop - Side air bag

The firing loop consists of a high side and low side switch. The current is limited by the ASIC to 2 to 4 A. The side air bag is fired by the battery power supply.

▶ Firing loop - Belt pretensioner

The firing loop consists of a high side and low side switch. The current is limited by the ASIC to 2 to 4 A. The belt pretensioner is fired by the battery power supply.

▶ Energy reserve and autonomous operating time

The SDM has an energy reserve function that ensures the internal operation of the central unit and buffering firing circuits for a minimum of 150 ms after loss of battery power. The SDM cannot detect a crash or deploy the air bag for up to 5 sec after cutting off the battery voltage from the SDM . Full energy reserve capability is available for 10 sec after the minimum specified operating voltage has been applied to the SDM power line. The SDM checks for charging and discharging conditions by measuring the energy reserve capacitor. If there is any problem in the energy reserve capacitor, it sets a diagnostic trouble code associated with an energy reserve function.

Downloaded from www.Manualslib.com manuals search engine

SEAT 7410-00

GENERAL INFORMATION

1. SPECIFICATION

Description			Front seat (driver's)	Front seat (passenger's)	Rear seat
Type		Manual	Manual 6 steps	Manual 4 steps	4:6 split
		Auto	Electric 6 steps	-	-
Height adjuster		Manual	± 25 mm (pumping type)	-	-
		Auto	± 25 mm	-	-
Sliding			240 mm (190+50 mm)	240 mm (190+50 mm)	-
Reclining			66° (20+46°)	66° (20+46°)	17.5° (7+10.5°)
Lumbar support			2 steps (standard)	-	-
Seat warmer (cushion & seatback)			ON (high, low) OFF	ON (high, low) OFF	ON / OFF
Headrest	Conventional	Up/Down	90 mm (15 mm x 6)	90 mm (15 mm x 6)	45 mm (15 mm x 3)
		Sliding	24 mm (8 mm x 3)	24 mm (8 mm x 3)	-
	Electronic active type		Optional (tilting, 15°)	Optional (tilting, 15°)	-
Seat belt			3-point, ELR, PT, L/L	3-point, ELR, PT, L/L	LH/RH: 3-point, ELR Center: 2-point
Grocery hook			One	One	-
Seatback pocket			Net type	Net type	-

Downloaded from www.Manualslib.com manuals search engine

2. WARNINGS FOR POWER SEAT

▷ Do not adjust the driver's seat when the vehicle is moving. Control of the vehicle can be lost.
▷ Make sure that your seat is completely locked after adjusting.
▷ Pay attention to the passenger in rear seat when adjusting the seat.
▷ Excessive operation of power seat may cause a problem for other electric devices. Stop operating the power seat immediately after getting the desired seat position.
▷ Do not use two or more seat adjustment buttons simultaneously. It can damage the motor.
▷ Be sure to operate the electric seat button one by one.
▷ Do not operate the seat heater for a long time when the passenger is an infant, child, old or handicapped person, person with sensitive skin, person under the influence of alcohol, or excessively fatigued person. They might receive minor burns.
▷ Do not put anything on the seat that insulates heat, such as a blanket, cushion or seat cover.
If the temperature continues to rise, turn the switch off and have the system checked by a
▷ Ssangyong Dealer or Ssangyong Authorized Service Center.
In the case of the driver's seat, an excessive usage of the heated seat might make you sleepy and could negatively affect your safety.
▷ Do not place anything sharp on the seat. This may cause damage to the seat heater.
▷ Power seats will be operated even when the ignition switch is turned to the "OFF" position. However, to prevent battery discharge, operate your seats when the engine is
▷ running.
Do not use two or more seat adjustment buttons simultaneously. It can damage the motor.
▷ Be sure to operate the electric seat button one by one.
When cleaning leather seats, never use oil-based solvents such as benzene, alcohol,
▷ gasoline, or thinner. Or they will cause discoloration and dull the surface of the seats.
Do not forcibly operate any power adjustment switch if the seat comes in contact with other object and cannot be adjusted anymore.
If the power seats are not operational, the seats should be checked and fixed before any driving.

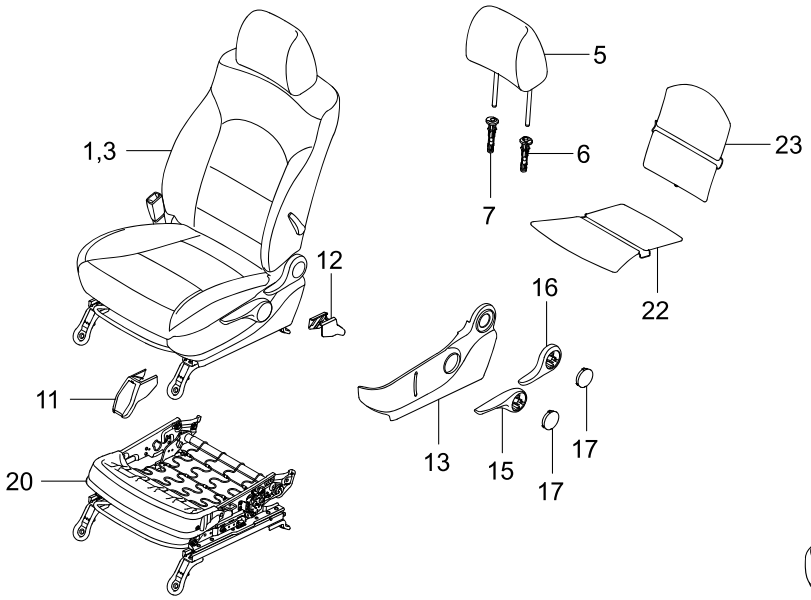
Modification basis	
Application basis	
Affected VIN	

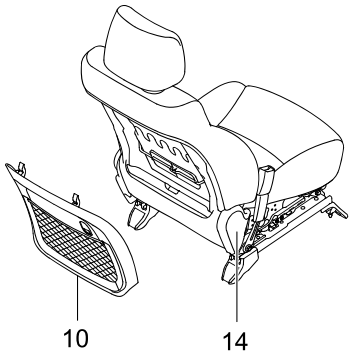
Downloaded from www.Manualslib.com manuals search engine

COMPONENT

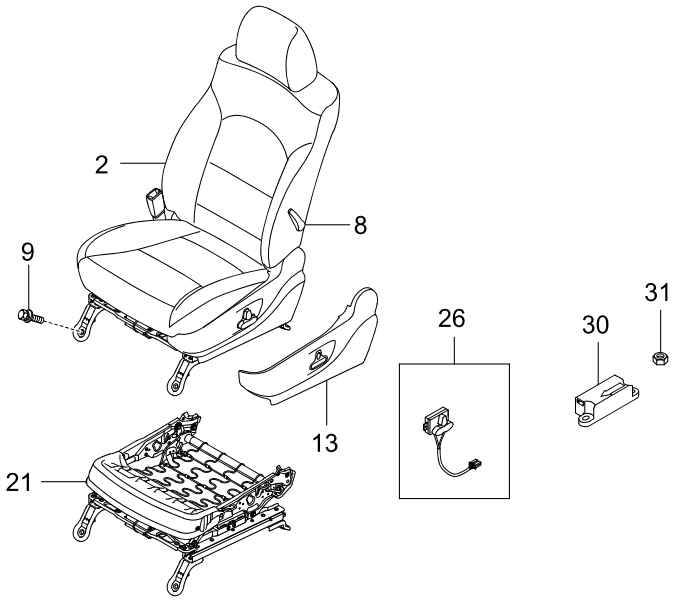
S.G.N. 7410-00 FRONT SEAT

MANUAL SEAT





POWER SEAT



Downloaded from www.Manualslib.com manuals search engine

1. Seat assy - FRT
2. Seat assy - FRT
3. Seat assy - FRT
5. Seat assy - FRT
6. H/rest assy - FRT
7. Sleeve - H/rest
8. Sleeve - H/rest
9. Lever assy - Lumbar SUPT
10. Bolt
11. Back board assy -FRT seat
12. Cover - Seat MTG FRT
13. Cover - Seat MTG RR
    Cover - Shield OTR
14. Cover - Shield INR
15. Lever - Height adjuster
16. Lever - Recliner
17. Cap - Lever
20. Frame assy - FRT seat cushion
21. Frame assy - FRT seat cushion
22. Warmer assy - Seat cush
23. Warmer assy - Seat back
25. Sensor - Seat belt reminder
26. Switch assy - Power seat
30. Sensor - Head rest
31. Nut

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1) Driver Seat

(1) Operation

Power seat	Manual seat

A. Sliding

Sliding switch (power seat)	Sliding lever (manual seat)

Downloaded from www.Manualslib.com manuals search engine

B. Height adjusting

Height adjust switch (power seat)	Height adjust lever (manual seat)

C. Reclining (seatback)

Reclining switch (power seat)	Reclining lever (manual seat)

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

D. Lumbar support

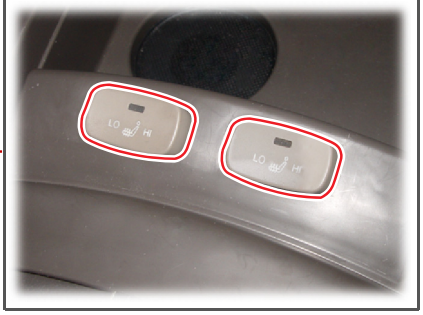
Lumbar support switch (power seat)	Lumbar support lever (manual seat)

Power seat: Turn the lever forward to increase the amount of lumbar support. To decrease it, turn the lever backward.

Downloaded from www.Manualslib.com manuals search engine

(2) Seat warmer & accessories

Seat warmer switch



Seat heated wire

Seatback pocket & grocery hook

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Passenger seat

(1) Operation

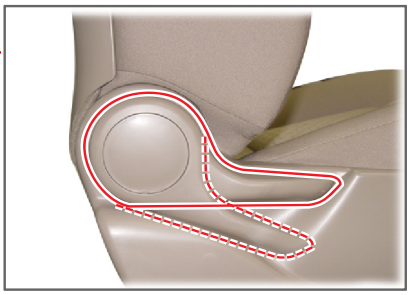
Passenger seat

Sliding

To move the seat forward or backward, pull and hold the seat slide lever up and move the seat as desired.

Reclining

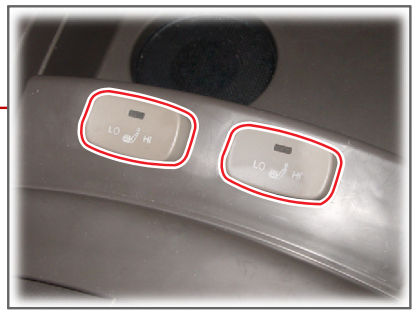
To change the seatback angle, lean forward slightly and raise the lever.



(2) Seat warmer & accessories

Passenger seat

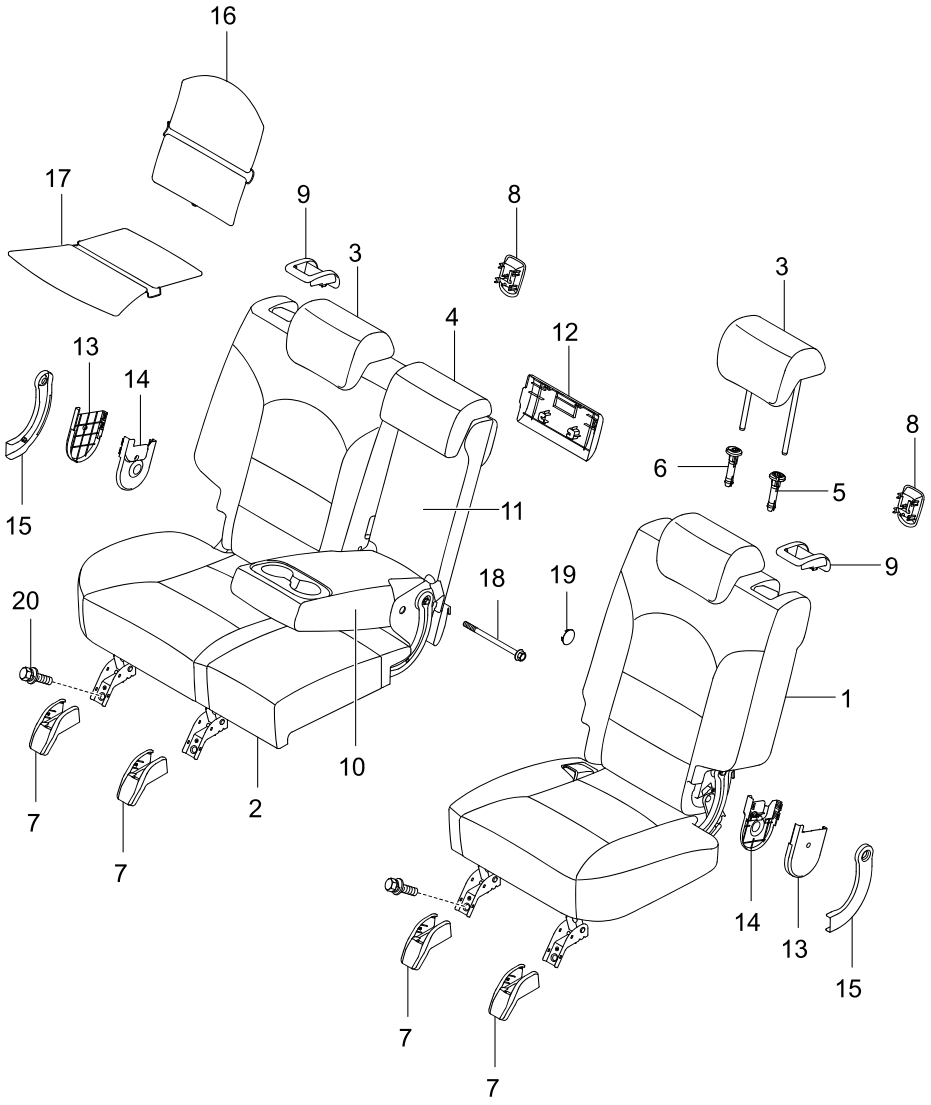
Seat warmer switch



Seatback pocket & grocery hook

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7510-00 REAR SEAT



1. Seat assy - RR 1st
2. Seat assy - RR 1st
3. H/rest assy - Rr 1st otr
4. H/rest assy - RR 1st ctr
5. Sleeve - H/rest
6. Sleeve - H/rest
7. Cover - RR seat mtg
8. Tether anchor - Cover
9. Housing - Folding lever
10. Arm rest assy - RR 1st back
11. Cover - Arm rest-FRT
12. Cover - Arm rest-RR
13. Cover assy - Recliner otr
14. Cover - Recliner - inr
15. Cover - Linkage
16. Warmer assy - RR 1st back
17. Warmer assy - RR 1st cushion
18. Bolt
19. Cap
20. Bolt

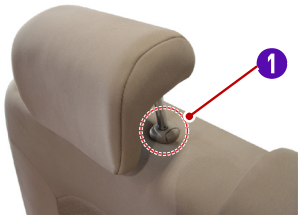
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1) Operation

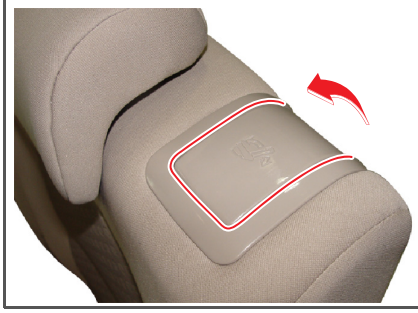
(1) Adjustment

Headrest adjustment



To raise the head restraint, pull it up without pressing the release button. To lower the head restraint, press the release button (1) on top of seatback and push the head restraint down.

Seatback adjustment

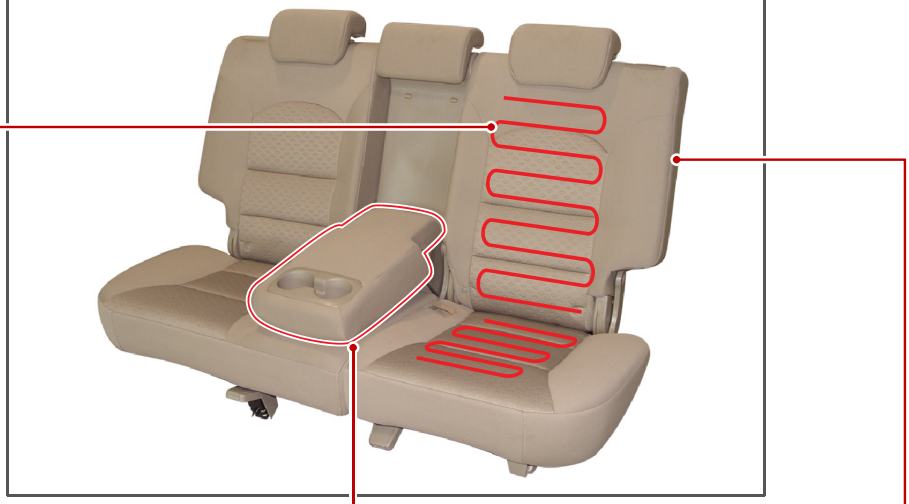


To change the seatback angle, lean forward slightly and raise the lever. Then, lean back to the desired angle and release the lever.

Downloaded from www.Manualslib.com manuals search engine

(2) Seat warmer & accessories

Heated wire



Rear armrest

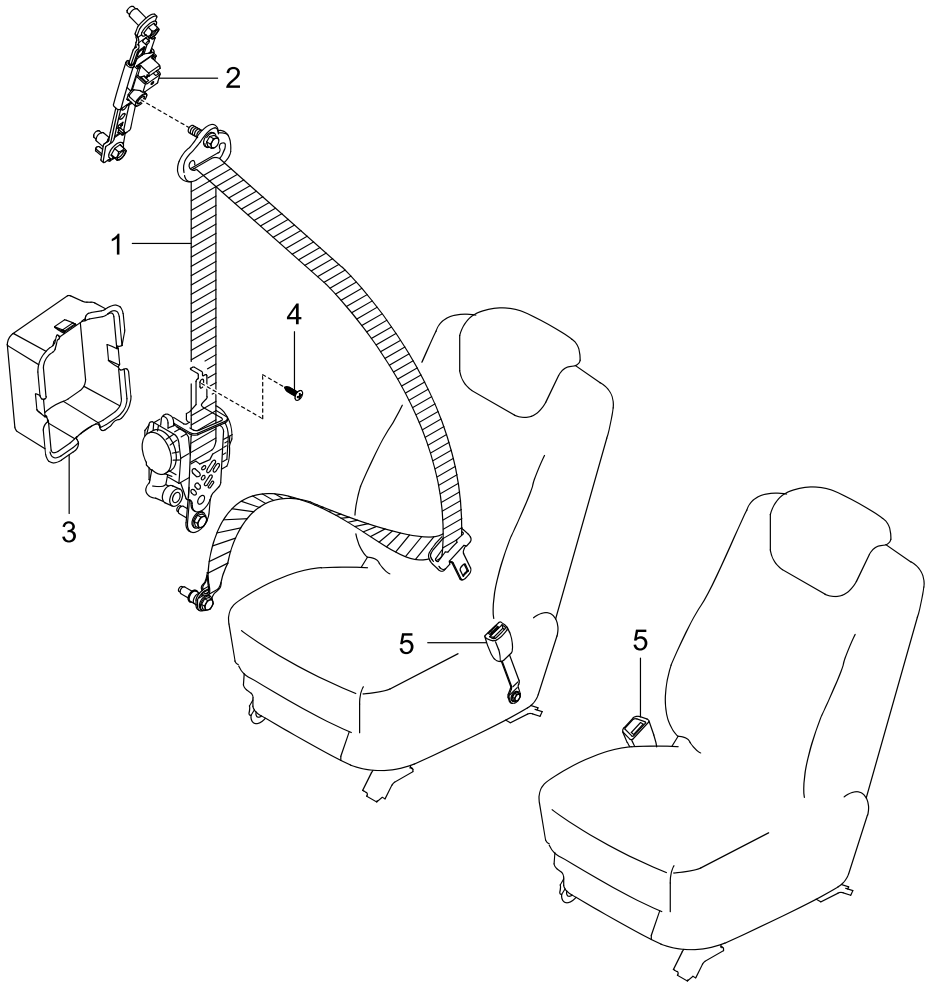
Heated wire

Seatback folding

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7430-00 FRONT SEAT BELT

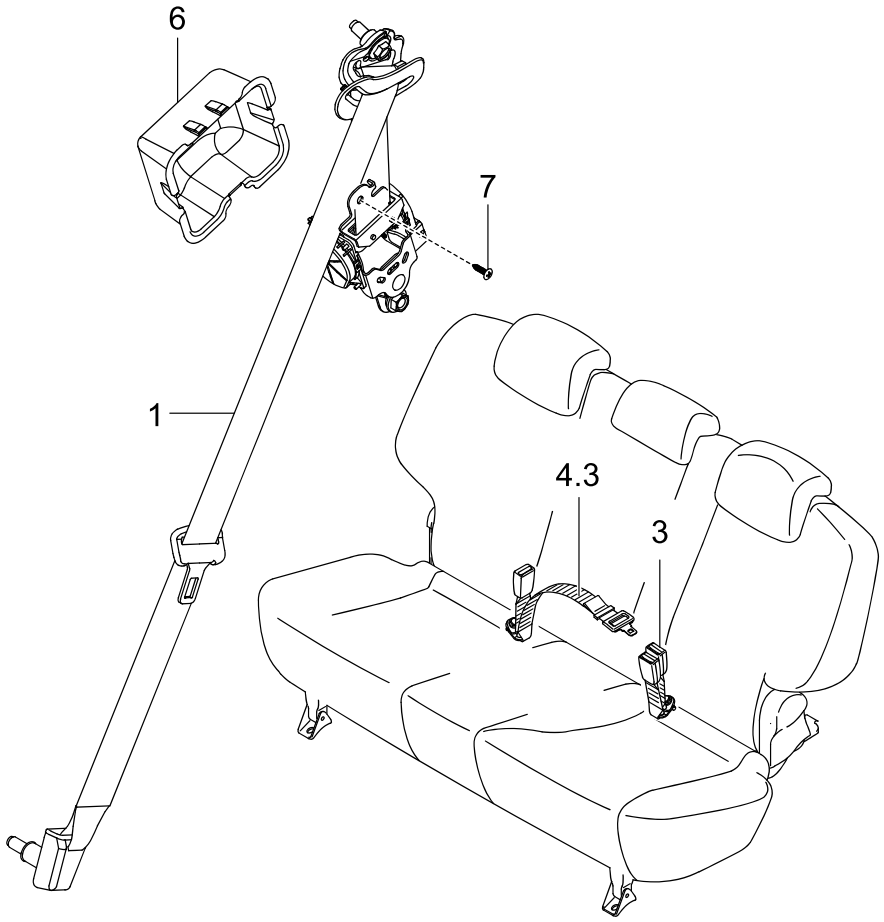


1. Seat belt assy - FRT
2. Height adj assy - FRT s/belt
3. Dust cover - FRT seat belt
4. Screw
5. Buckle assy - FRT

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7530-00 REAR SEAT BELT



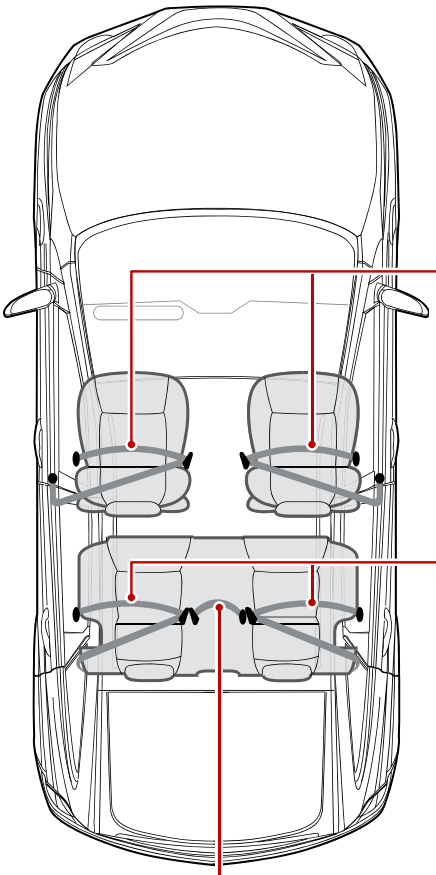
1. Seat belt assy - RR 1st
3. Double buckle assy - RR 1st
4. Tongue & buckle assy - RR 1st
6. Dust cover - RR 1st seat belt
7. Screw

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1) Seat Belt Layout

The three-point seat belt is mounted on the driver seat, passenger seat, both rear seats. The seat belt on the front side (driver seat, passenger seat) includes pretensioner function which rewinds the seat belt immediately to protect occupant's face and chest when a strong frontal collision occurs.



3-point seat belts (front seats)

2 & 3-point seat belt (only for rear-center) - optional

3-point seat belts (for both sides or all rear seats)

Modification basis	
Application basis	
Affected VIN	

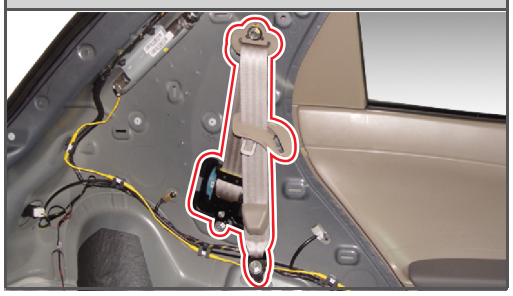
Downloaded from www.Manualslib.com manuals search engine

2) Mounting Location

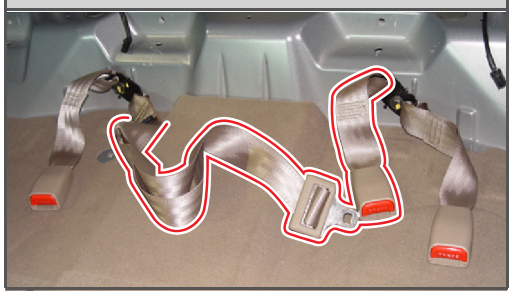
Driver side: 3-point

Front passenger side: 3-point

Rear (3-point)



Rear center (2-point) - optional

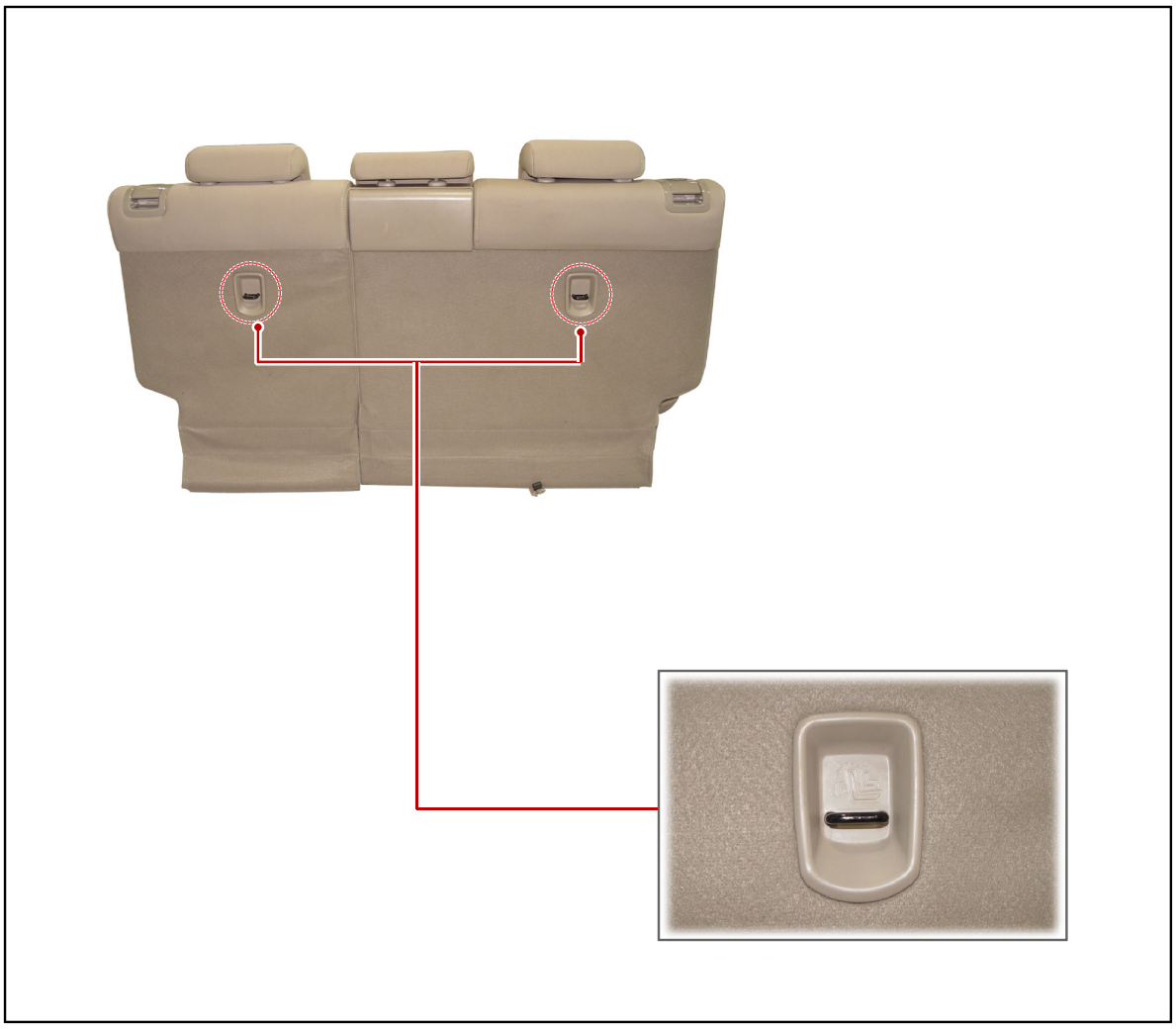


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 7510-08

CHILD RESTRAINT SYSTEM (ISO FIX)



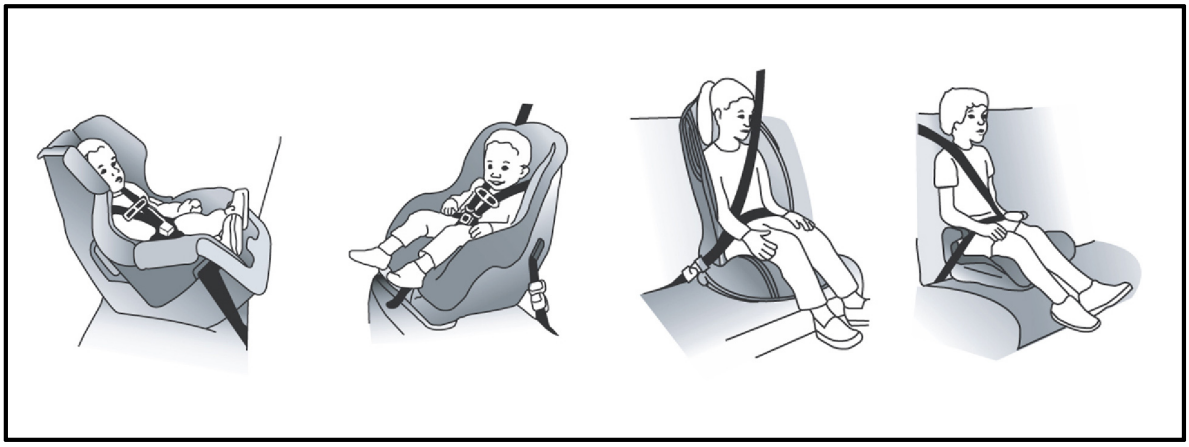
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1) Child Restraint System Type

There are 2 types in the child restraint system.
- Fixing using seat belt
- Fixing using ISOFIX (for the vehicle with ISOFIX system)

2) Child Restraint System Fixing Type



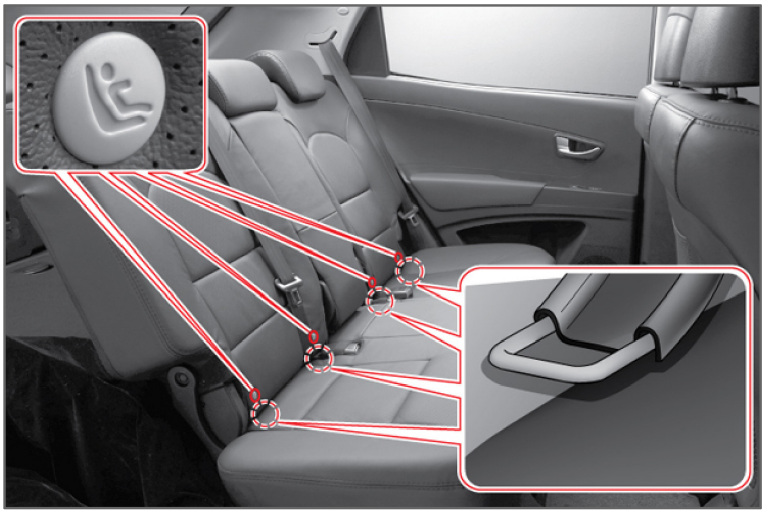
Item	Weight	Age	Fixing method	Rear left/right seat	Driver seat/rear center seat
Reversed seat	<10kg	6 to 9 months	Seat belt	U/SU	X
	<13kg	12 to 15 months	Seat belt	U/SU	X
Forward seat	9 to 18kg	9 to 48 months	Seatbelt/ ISOFIX	U/UF/SU	X
Booster seat	15 to 25 kg	4 to 6 years	Seat belt	U	X
Booster cushion	22 to 36 kg	6 to 11 years	Seat belt	U	X

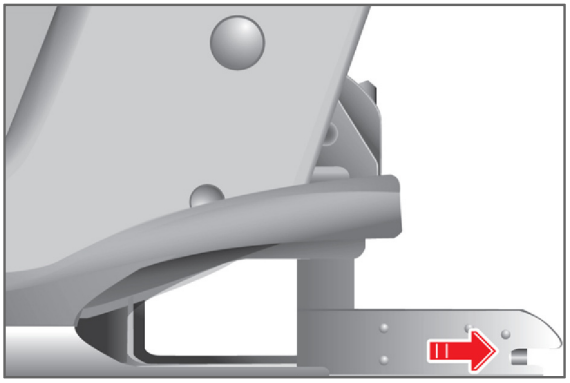
- U: General child restraint system which should be fixed with the seat belt approved by official institute.
- UF/ SU: General child restraint system which should be fixed with the ISOFIX approved by official/semiofficial institute.
- X: Seat which is not allowed to use child restraint system.

Downloaded from www.Manualslib.com manuals search engine

3) ISO FIX

▶ **Fixing lower latch**





- There are marks (A), which indicate that the ISOFIX for child restraint system can be fixed, at the bottom of the rear seatback as shown in the figure.
- Connect the ISOFIX child restraint system (C) to the two latches (B) located at the bottom of the rear seat.
- If using ISOFIX child restraint system, the seat belt is not needed.
- The lower anchor is not installed to the rear seat center.
- The approved ISOFIX child restraint system can be mounted to the vehicle with ISOFIX system (lower latch 2 EA, and rear seatback anchor 1 EA).

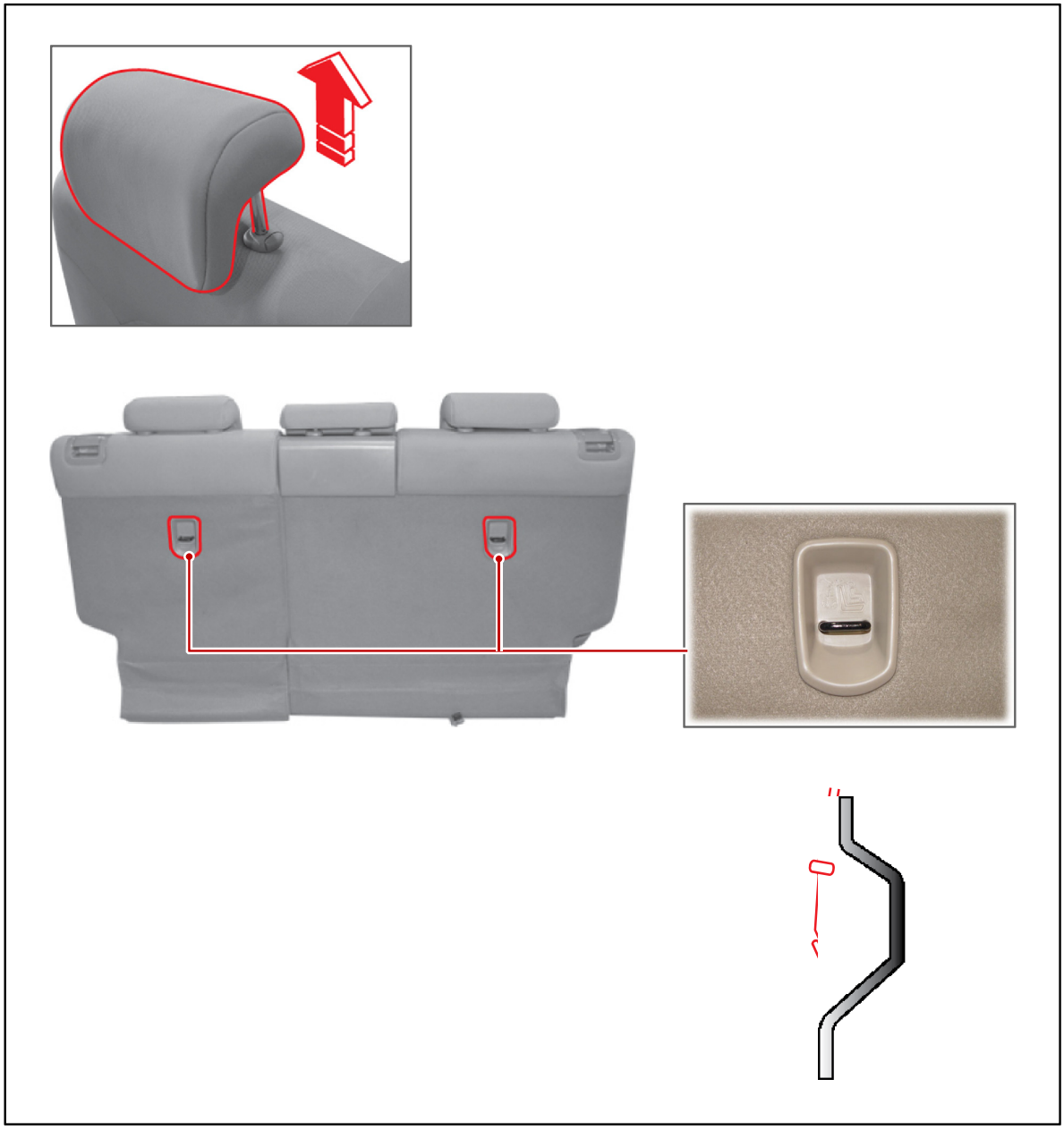
WARNING

- When installing ISOFIX child restraint system, all the seat belts in the rear seat should be inserted to the buckle.
- The mounting latches and anchors for the ISOFIX are only for the child restraint system, so DO NOT fit any restraint system other than ISOFIX specification, seat belt or other device to these latches or anchors.

Downloaded from www.Manualslib.com manuals search engine

▶ Mounting rear seatback anchor

- There are anchors (for hook mounting) for fixing child restraint system, on the back side of the rear seatback as shown in the figure.



- Pass the belt of the child restraint over the seatback of the rear seat.
- Connect the hook of the child restraint system belt to the anchor firmly, and securely tighten the child restraint to the seat.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

SUNROOF SYSTEM 7340-00

GENERAL INFORMATION

1. SPECIFICATION

Operating voltage	9 to 16 V
Operating current (open & close)	Max. 6 A
At no load	Approx. 3 A
Dark current	Max. 1 mA
Roof motor operating speed (at opening and closing)	1.4 ± 0.5 sec/100 mm
Motor overload stop conditions	Current for 25 A or higher and torque (load) for 7.5 A or higher
2-step opening amount	1st step sliding open: 370 ± 5 mm
	2nd step sliding open: 450 ± 5 mm
Vertical/horizontal tolerance for sunroof glass panel	± 2 mm

2. CAUTIONS WHEN WORKING

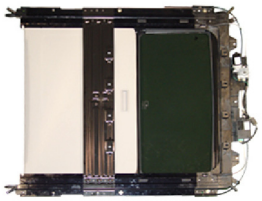
1. Wear clean work clothes and gloves.
2. Replace and wash the gloves frequently.
3. Any unauthorized modification or operational test is not allowed since the sunroof motor and control unit are preset at the factory.
4. You can use basic tools, e.g. a 25T/10T star screwdriver, flat-bladed and cross-tip screwdrivers. Do not use any similar tool.
5. Take care not to drop the sunroof assembly when removing it and do not keep it right up.

Downloaded from www.Manualslib.com manuals search engine

OVERVIEW AND OPERATING PROCESS

1. SYSTEM LAYOUT

OPEN	TILT

Sunroof switch	Sunroof assembly	Sunroof motor & control unit
1	2 	3

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. OPERATING PROCESS

1) Sunroof Switch

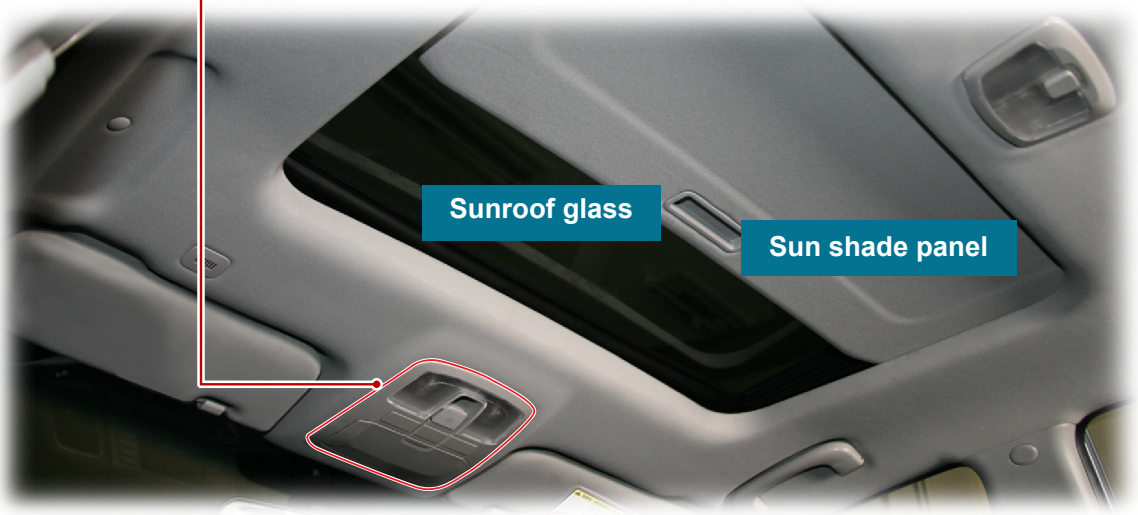
▶ Sunroof switch

The sunroof switch is installed to the overhead console and tilts, closes, opens the sunroof.

▷ **TILT**
Opens the rear section of the sunroof only.

▷ **CLOSE**
Closes the sunroof.

▷ **OPEN**
Opens the sunroof.



▶ Sunroof glass

The sunroof glass can be open in two steps and can also be tilted by the switch operation.

▶ Sun shade panel

The sunroof can be closed or open manually to block sunlight when the sunroof function is not in use.

Downloaded from www.Manualslib.com manuals search engine

2) Sliding Operation

Open: 2-step open

- Push up the switch

- **Push up the switch briefly: 2-step auto sliding open**
  When pushing up the sunroof switch briefly, the sunroof is automatically opened by two third of its travel (first step). When pushing up and holding the sunroof switch again, the sunroof is completely opened (second step).
- **Push up and hold the switch: manual sliding open**
  The sunroof is opened as long as pushing up the switch.

Close

- Pull down the switch

- **Pull down the switch briefly: auto sliding close**
  When pulling down the sunroof switch briefly, the sunroof is automatically closed completely. To stop the sunroof, pull or push the switch at desired position while moving.
- **Pull down and hold the switch: manual sliding close**
  The sunroof is closed as long as pulling down the switch.

Downloaded from www.Manualslib.com manuals search engine

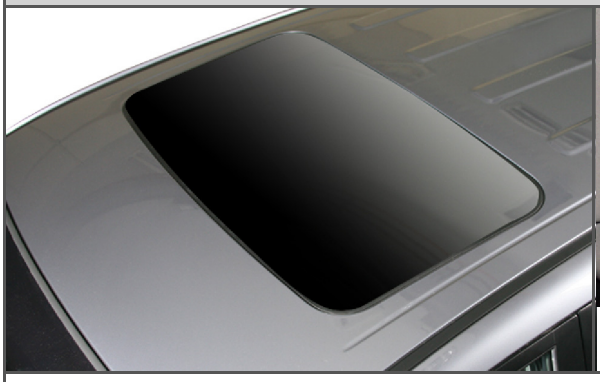
3) Tilting Operation (Up/Down)

Tilt Up

- Pull down the switch

- The rear side of the sunroof is tilted up when pulling down the sunroof switch with the sunroof closed.

Tilt Down



- Push up the switch

- The rear side of the sunroof is tilted down when pushing up the sunroof switch with the sunroof tilted up.

CAUTION

When leaving the vehicle, make sure the sunroof is completely closed. The sunroof may look closed but it might be tilted up.

Downloaded from www.Manualslib.com manuals search engine

4) Safety (Anti-Pinch) Function

To prevent any body parts from being trapped by the sliding sunroof, an Anti-Pinch Function automatically opens the sunroof when an object is trapped.

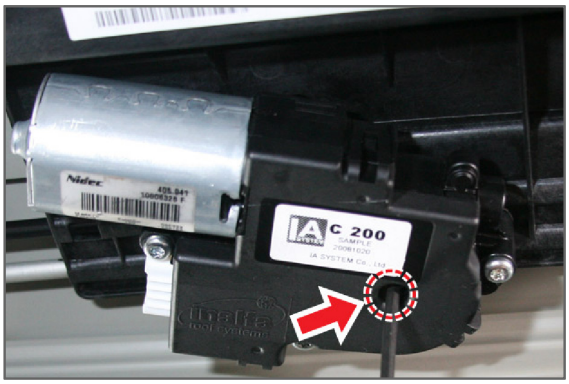
CAUTION

The anti-Pinch function is deactivated just before the sunroof closes.
The sunroof safety function is just a safety supplementary system which cannot replace driver's care and caution. Moreover, it may not be able to operate due to the electric components or other conditions.

▶ **Wind buffeting**

- When driving the vehicle with the window or sunroof open at a certain position, you may feel some pressure upon your ears or hear some noises similar to those from a helicopter. This happens because of an influx in air through the window or sunroof and its resonance effect. If this happens, adjust by opening the window or sunroof.

5) Emergency Operation



If the sunroof is stopped midway due to a discharged battery or power failure, you can adjust the location of the sunroof glass by using the service hole in motor.

Downloaded from www.Manualslib.com manuals search engine

6) Warning Buzzer

If the driver's door is opened after the ignition key is removed with the sunroof opened, the buzzer will sound to alert you that the sunroof is opened. The buzzer will automatically turn off when the door is closed.

7) Cautions When Using Sunroof

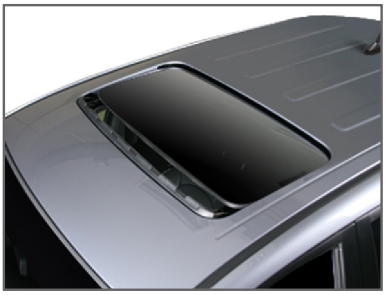
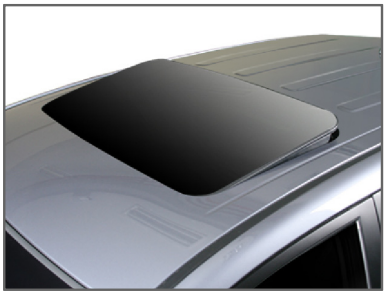
CAUTION

- Even though the sunroof can be operated when the ignition key is in the ON position (the engine is not running), operating the sunroof repeatedly with the engine turned off will run down the battery. Operate the sunroof while the engine is running.
- When a desired sunroof operation is completed, release the switch. If you keep pressing the switch, it could cause a malfunction. Especially in the winter, never operate the sunroof if moving areas are iced. Wait until the areas are deiced.
- When leaving the vehicle unattended, be sure to completely close the sunroof. Otherwise, there is a great risk of vehicle theft. Or, the interior of the vehicle will be wet when it rains or snows.
- When the sunroof is slid to its complete open position, the wind buffet phenomenon can increase. If this happens, adjust by opening the sunroof or only open two thirds of the sunroof by using only the first step of the opening system.
- When operating the sunroof, be aware of safety conditions before operation. Parts of the body can be trapped.
- Clean up the circumference of sunroof regularly. Otherwise, operating the sunroof may cause a noise due to foreign material and dirt.

Downloaded from www.Manualslib.com manuals search engine

3. SUNROOF OPEN WARNING

If the sunroof is stopped midway due to a discharged battery or power failure, you need to re-calibrate the starting point of the sunroof. In addition, the following cases need the re-calibration.

- The sunroof does not completely close or open by operating the switch once.
- The sunroof slides back to close. But the operation does not stop even after a complete close and tilts up the sunroof.
- The opening gap remarkably decreases for the sliding open or tilt up.
- Operation of the sunroof switch does not do anything or work properly.
- The operating process is not same as before due to discharged or disconnected battery.

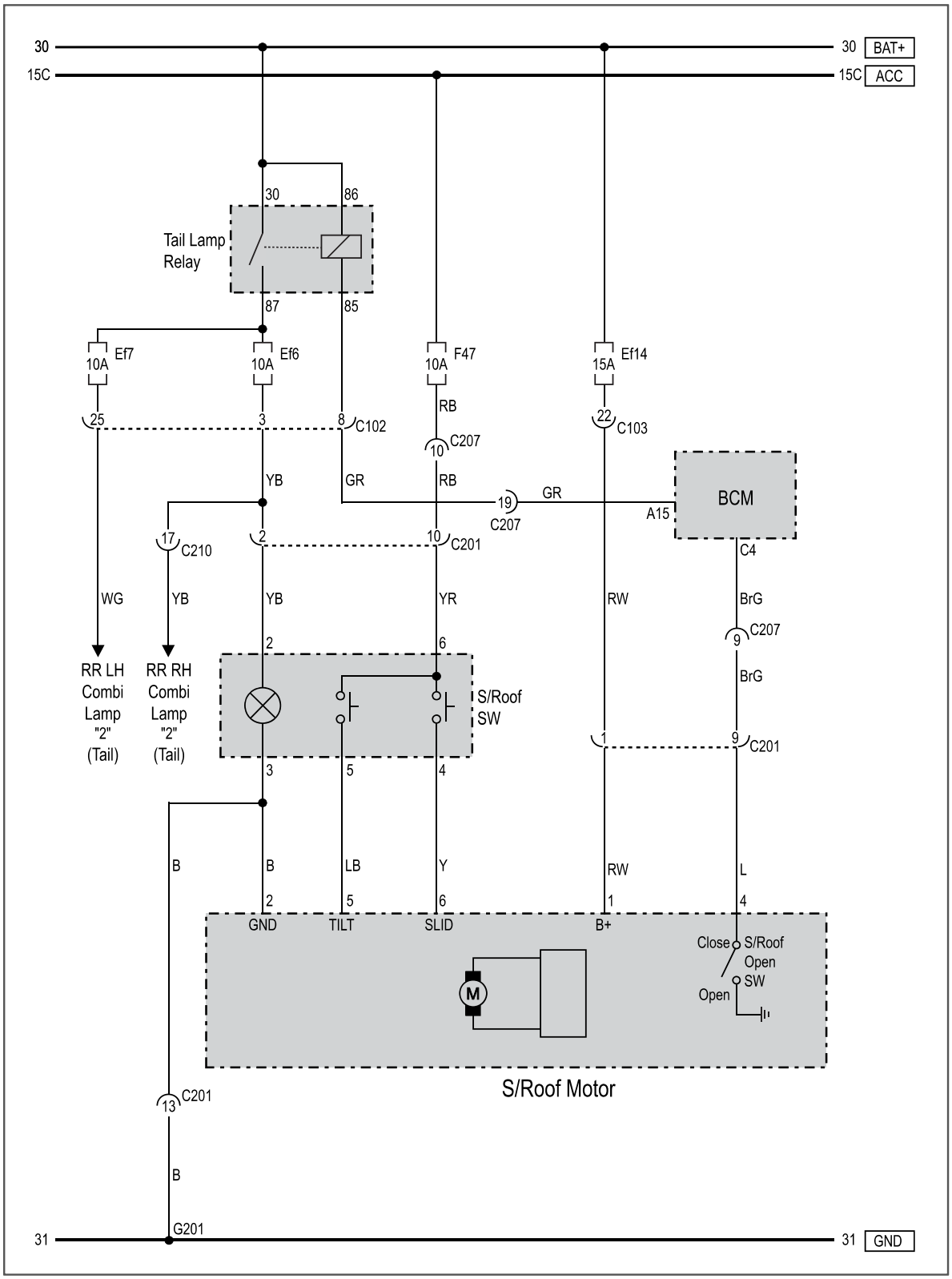
NOTE

When the switch is pushed up for more than 5 seconds with the sunroof is completely open, the sunroof cannot completely be either closed or opened by operating the switch once. The sunroof will move only when the switch is being pushed up or pulled down. When this happens, re-calibrate the starting point of the sunroof to reactivate the one touch function.

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4. CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

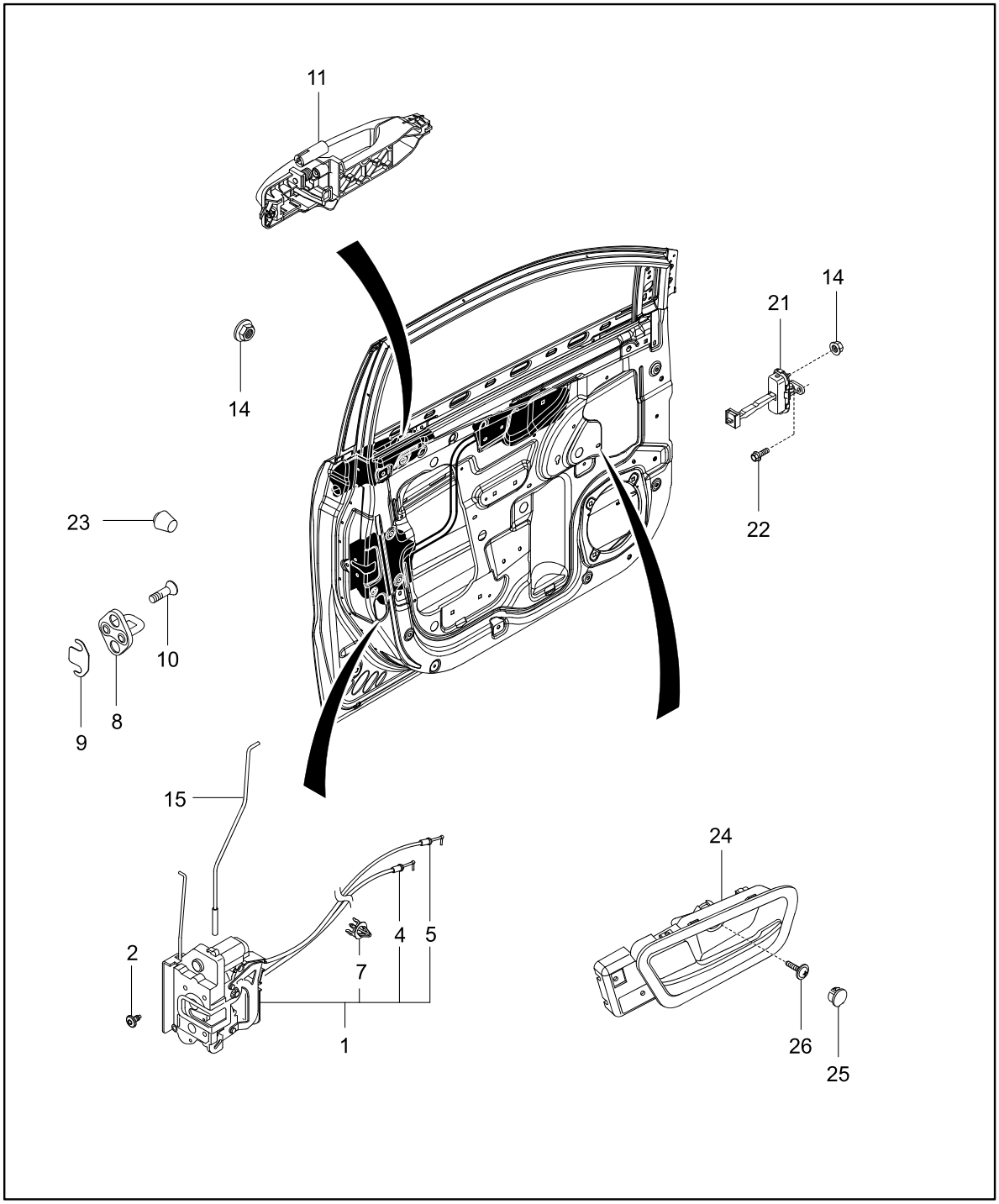
Downloaded from www.Manualslib.com manuals search engine

BODY INTERIOR

5110-01

COMPONENT

S.G.N. 7110-00 **FRONT DOOR OPENING SYSTEM**



Modification basis	
Application basis	
Affected VIN	

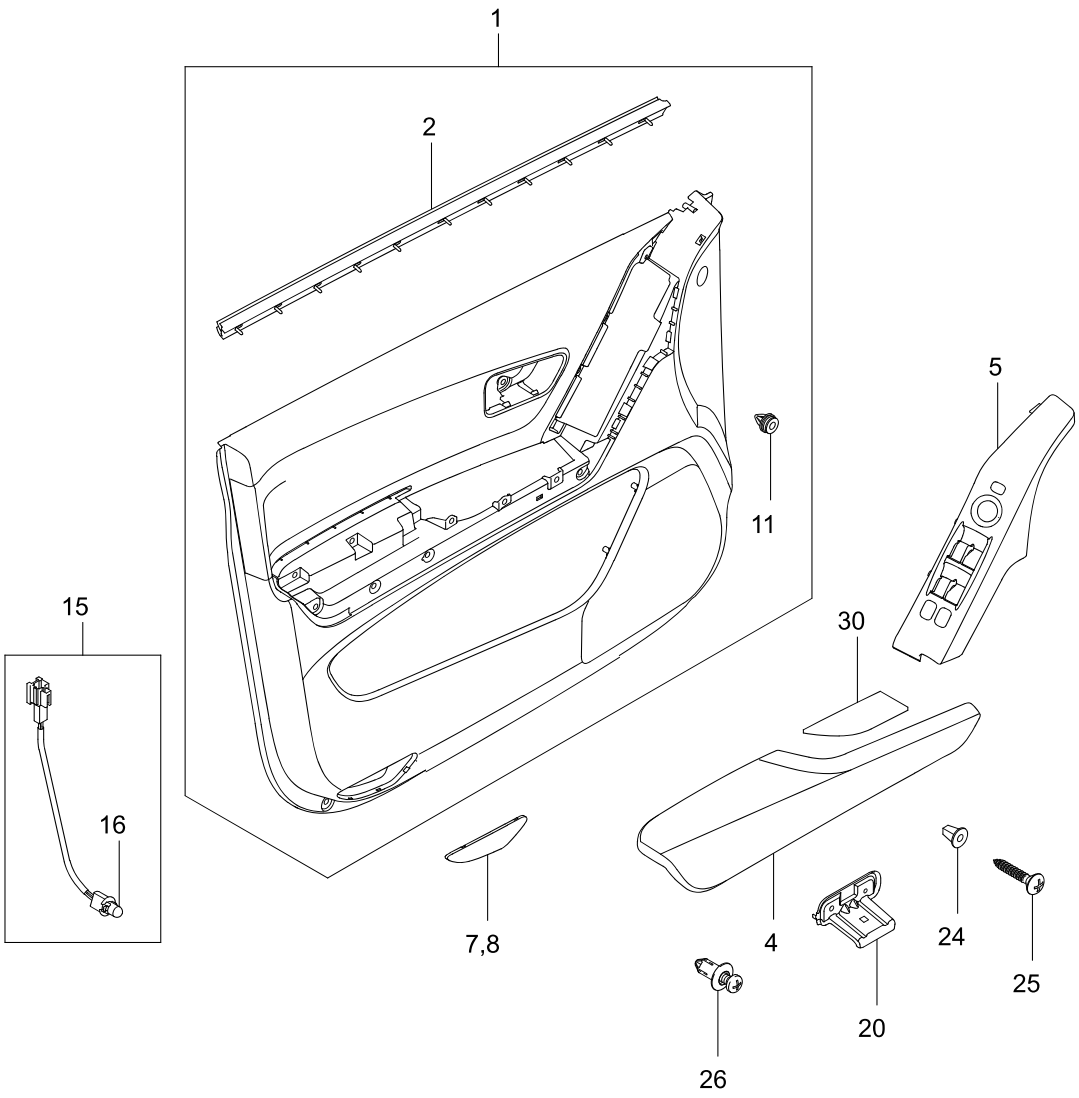
Downloaded from www.Manualslib.com manuals search engine

1. Latch & cable assy - FRT DR
2. Bolt - DR latch MTG
4. Cable assy - FRT DR I/S HDL
5. Cable assy - F/DR s/lock knob
7. Holder - cable
8. Striker assy - DR
9. Shim - DR striker
10. Screw - DR striker MTG
11. Handle assy - FRT DR O/S
14. Nut
15. Rod - FRT DR O/S HDL
21. Checker assy - FRT DR
22. Bolt
23. Bumper - DR overslam
24. Handle assy - FRT DR I/S
25. Cap - DR I/S HDL
26. Screw

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7115-00 FRONT DOOR TRIM

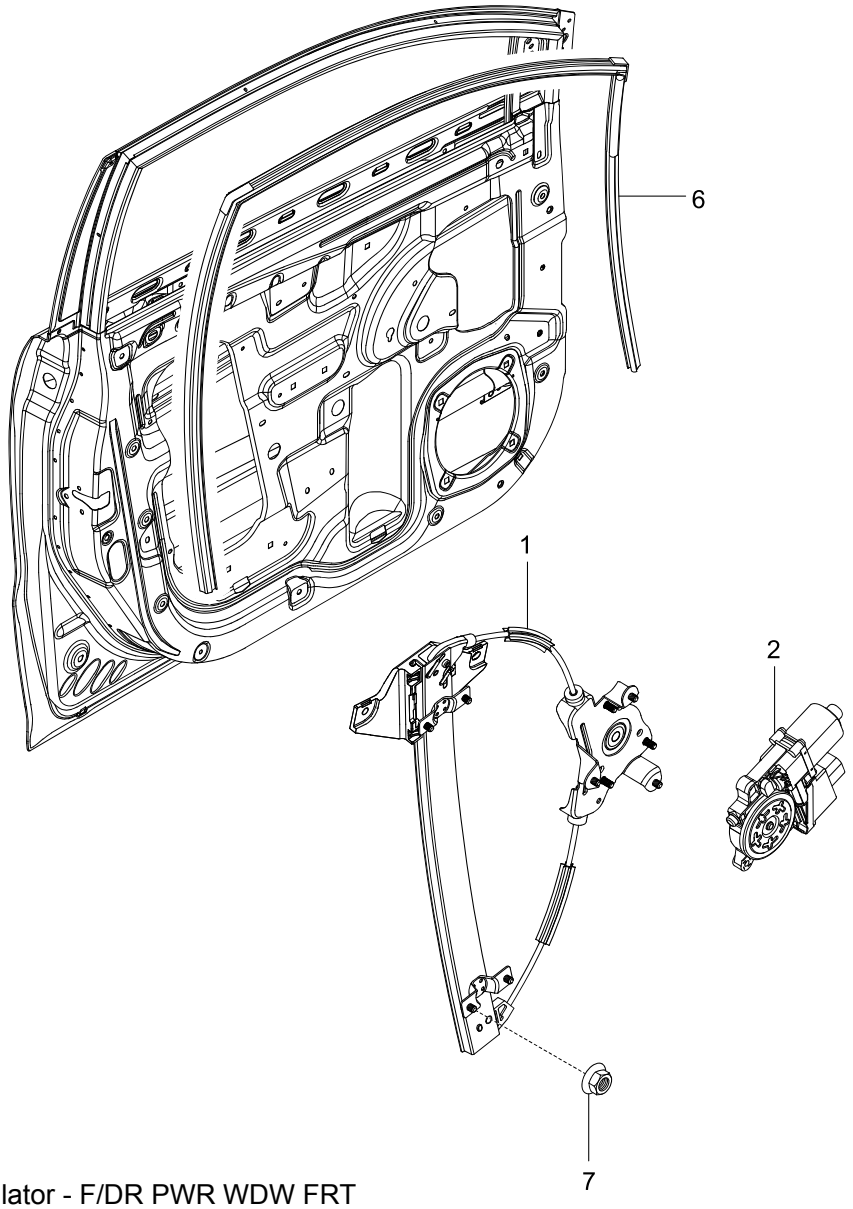


1. FTrim assy - FRT DR
2. W/strip - FRT DR trim
4. Pnl assy - A/rest FRT DR trim
5. Bezel - FRT DR
7. Reflector - DR courtesy FRT
8. Lens - DR courtesy FRT
11. Clip
15. Lamp assy - DR courtesy
16. Bulb
17. Foam block - FRT DR trim
20. BRKT assy - F/DR pull HDL MTG
24. Grommet
25. Screw
26. Screw - Rivet
30. Pull handle - Cover FRT

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7120-00 FRONT WINDOW LIFTER

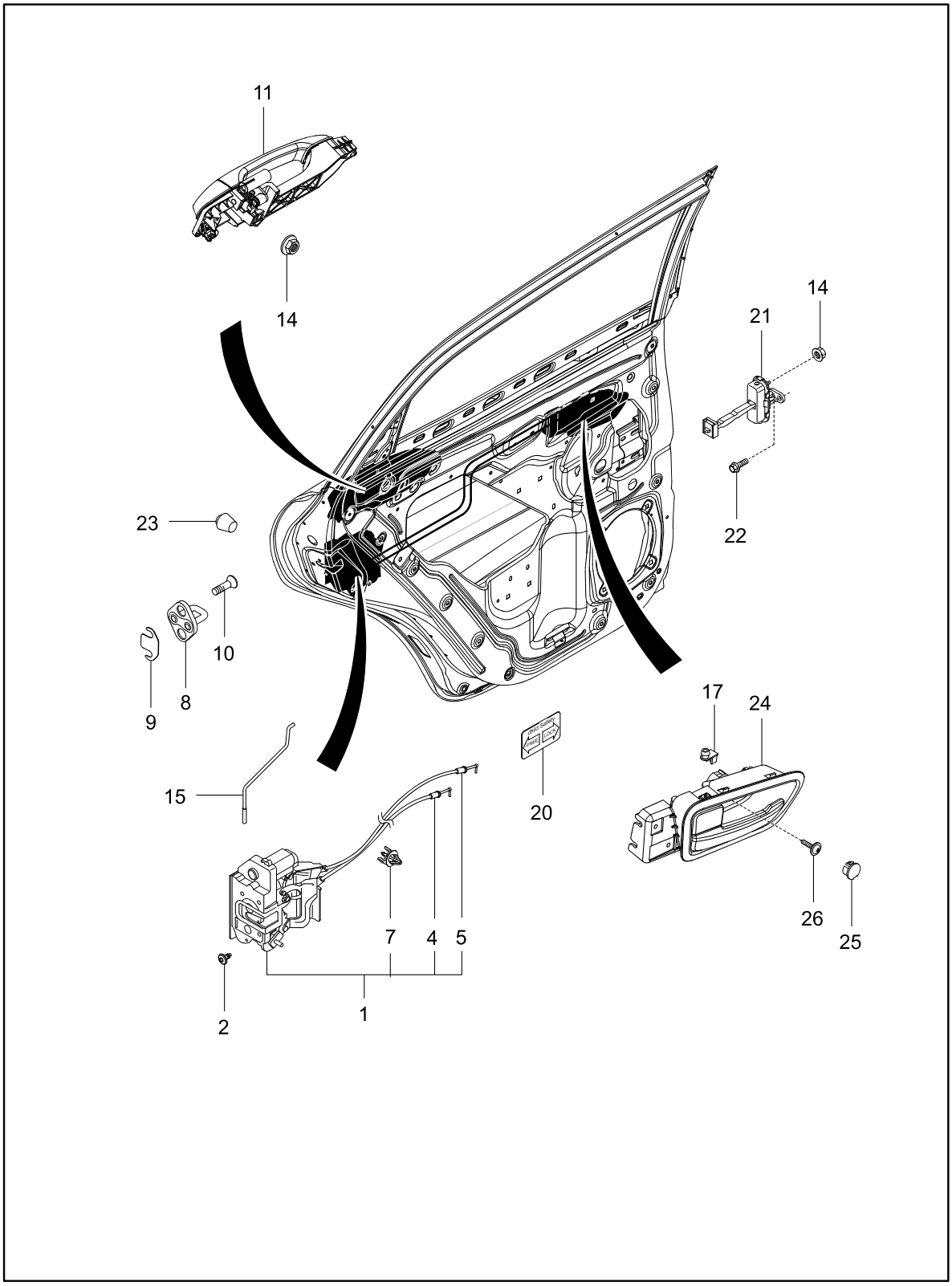


1. Regulator - F/DR PWR WDW FRT
2. Motor assy - Power window FRT
6. Glass run - FRT DR window
7. Nut

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7210-00 REAR DOOR OPENING SYSTEM



Modification basis	
Application basis	
Affected VIN	

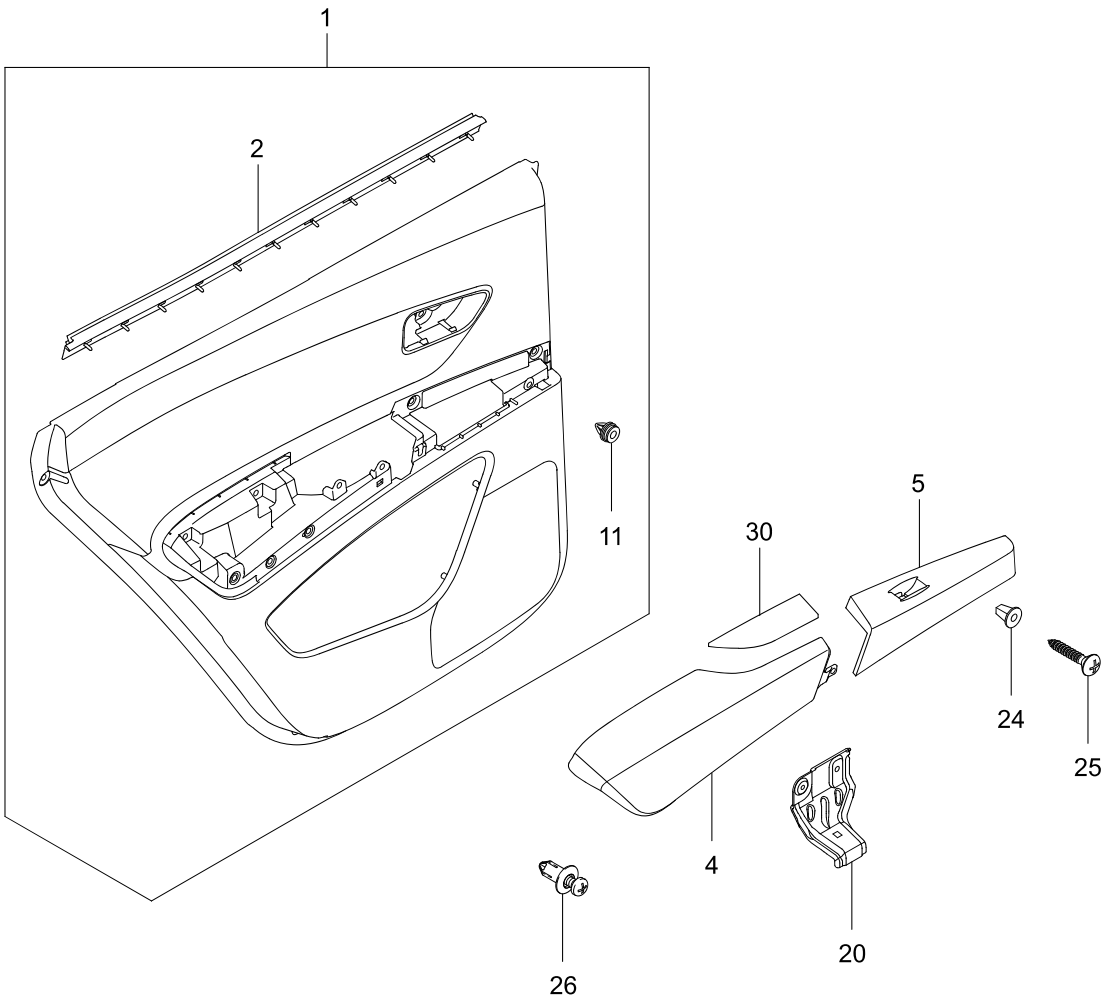
Downloaded from www.Manualslib.com manuals search engine

1. Latch & cable assy - RR DR RR
2. Bolt - DR LATCH MTG
4. Cable assy - RR DR I/S HDL RR
5. Cable assy - R/DR S/lock knob
7. Holder - Cable
8. Striker assy - DR
9. Shim - DR striker
10. Screw - DR striker MTG
11. Handle assy - RR DR O/S
14. Nut
15. Rod - RR DR O/S HDL
20. Label - DR child safety
21. Checker assy - RR DR
22. Bolt - Flange
23. Bumper -DR overslam
24. Handle assy - RR DR I/S
25. Cap - DR I/S HDL
26. Screw

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7215-00 REAR DOOR TRIM

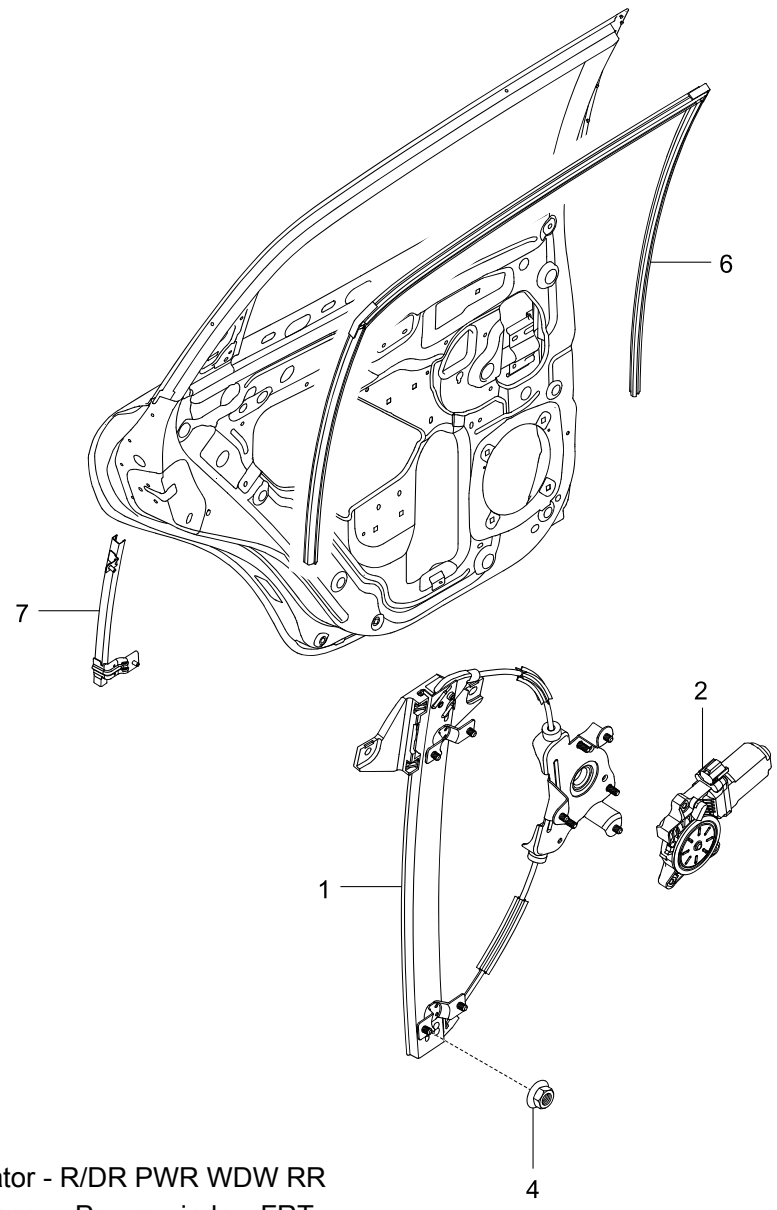


1. Trim assy - RR DR
2. W/strip - RR DR trim
4. PNL assy - A/rest RR DR trim
5. Bezel - RR DR
11. Clip
20. BRKT assy - R/DR pull HDL MTG
24. Grommet
25. Screw
26. Screw - Rivet
30. Pull handle - Cover RR

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7220-00 REAR WINDOW LIFTER

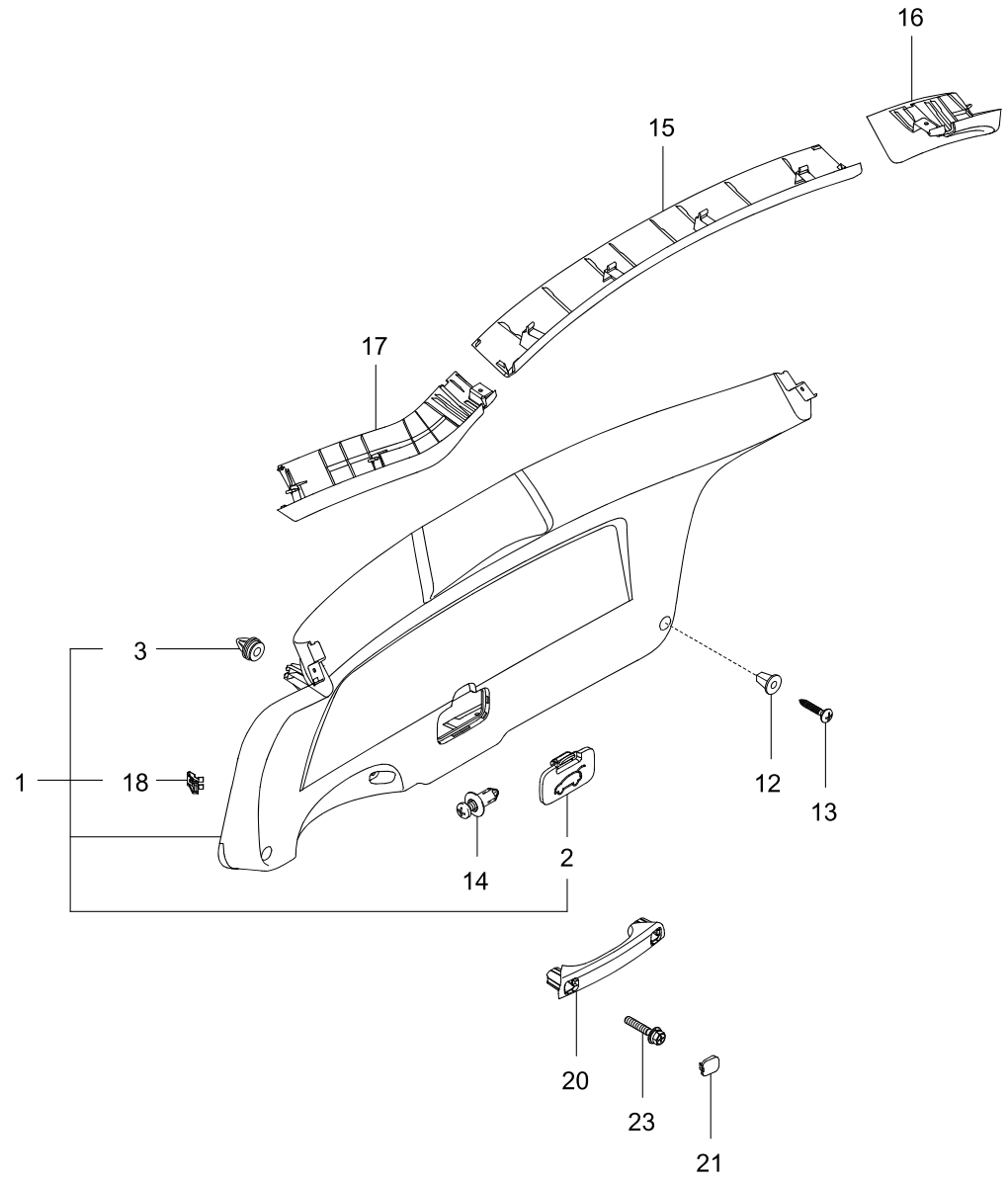


1. Regulator - R/DR PWR WDW RR
2. Motor assy - Power window FRT
4. Nut
6. Glass run - RR DR window
7. Rail assy - RR DR glass guide

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7321-00 TAILGATE TRIM

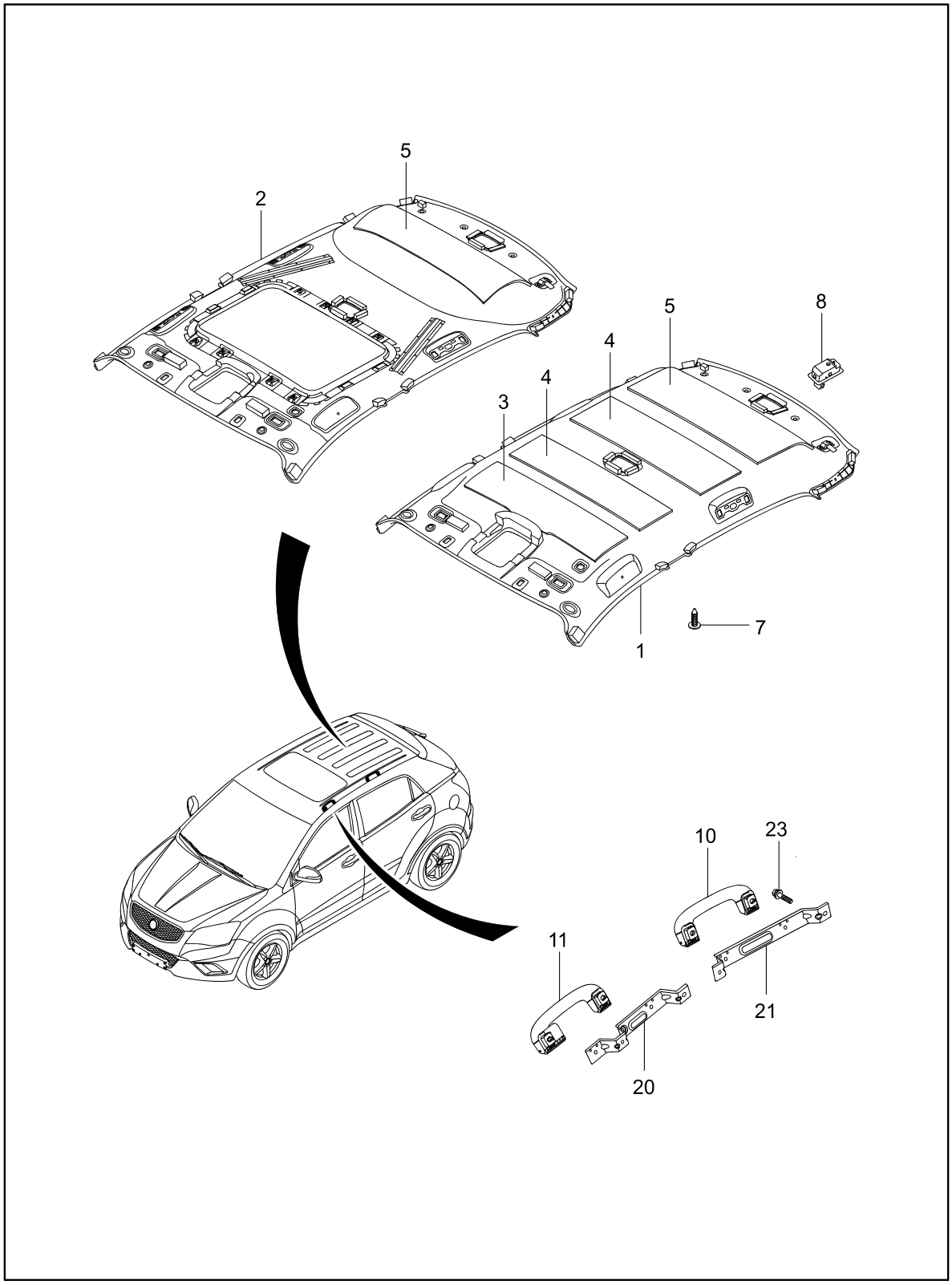


1. Trim assy - T/gate LWR
2. Cover - Latch
3. Clip
12.Grommet
13.Screw
14.Screw - Rivet
15.Trim assy - T/gate UPR
16.Trim assy - T/gate side
17.Trim assy - T/gate side
18.Clip - Trim MTG
20.Grip - T/gate LWR
21.Cap - T/gate HDL
23.Screw

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7330-00 HEAD LINING



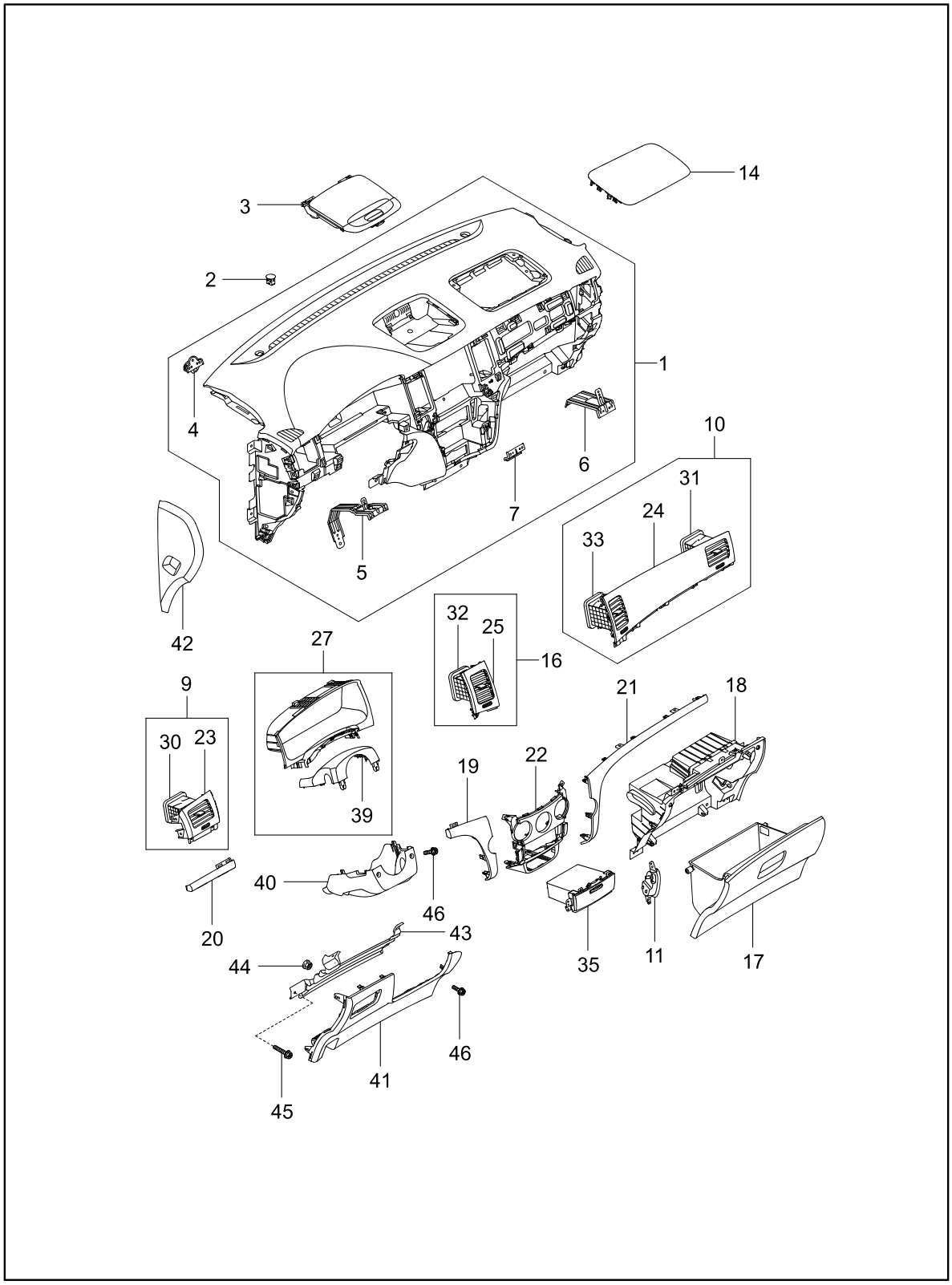
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1. Head lining assy
2. Head lining assy
3. Insulation - Roof no2
4. Insulation - ROOF no3
5. Insulation - Roof no4
7. Fastener - Tree type
8. Coat hook assy
10. Grip assy - FRT
11. Grip assy - RR
20. BRKT assy - Grip MTG FRT
21. BRKT assy - Grip MTG RR
23. Screw

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7610-00 INSTRUMENT PANEL



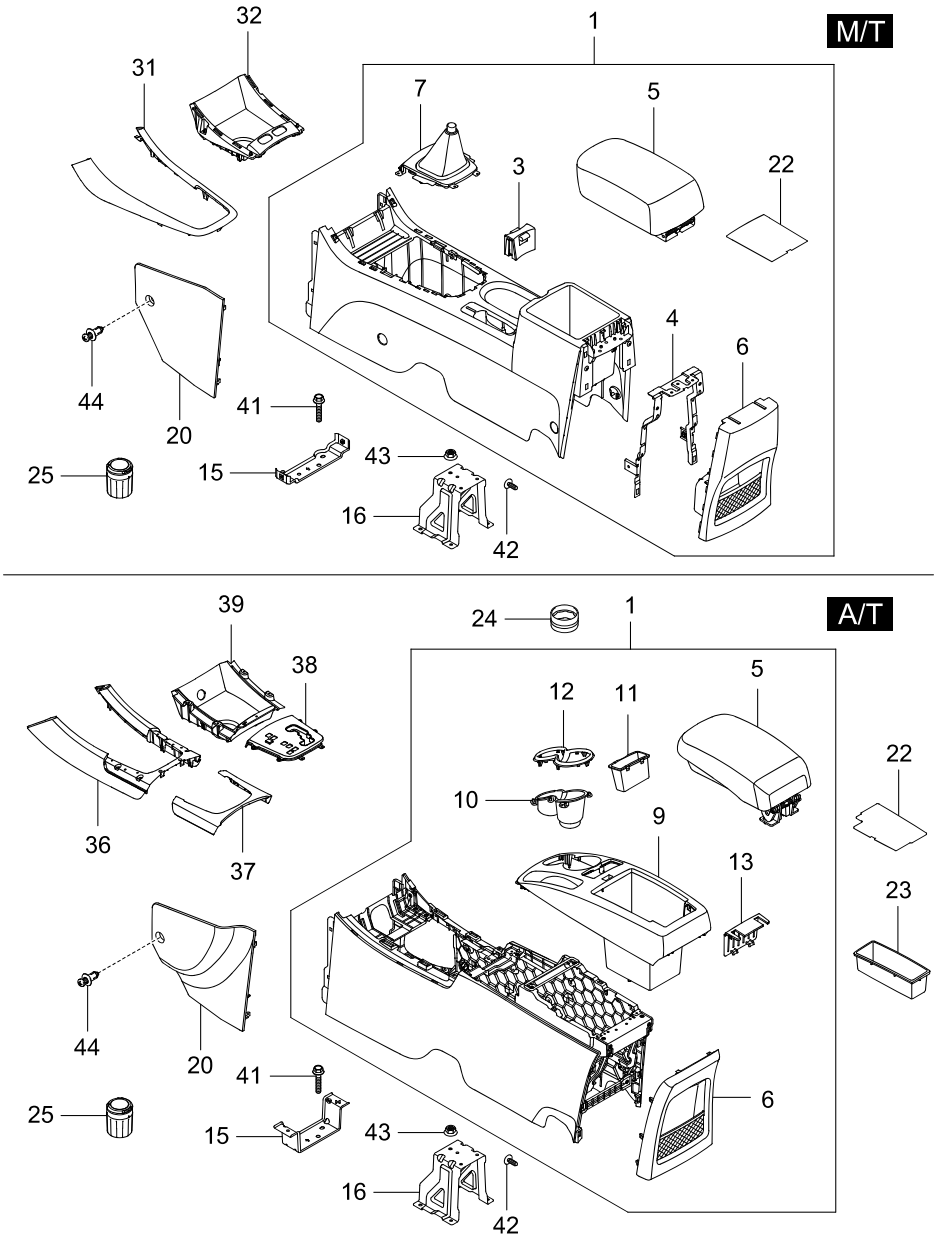
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1. Pad assy - Crash
2. Blanking cover - Auto light
3. Tray assy - Crash pad UPR
4. Guide - Crash pad
5. BRKT assy - Crash pad reinf
6. BRKT - Crash pad reinf
7. BRKT - Audio & video
9. PNL assy - Side fascia
10. PNL assy - Side fascia
11. Hook assy - Grocery
14. Blanking cover - Pass A/bag
15. Reinf - Pass A/bag BLKG CVR
16. PNL assy - CTR fascia
17. Box assy - Glove
18. Housing assy - Glove box
19. Molding assy - CTR fascia
20. Molding assy - Side fascia
21. Molding assy - Side fascia
22. PNL - CTR fascia LWR
23. PNL - Side fascia
24. PNL - Side fascia
25. PNL - CTR fascia
27. PNL assy - Cluster fascia
30. Louver assy - Side A/vent
31. Louver assy - Side A/vent
32. Louver assy - CTR A/vent
33. Louver assy - CTR A/vent
35. Tray assy - CTR fascia LWR
39. PNL - Shroud UPR
40. PNL assy - Shroud LWR
41. PNL assy - LWR main
42. Cover assy - Crash pad side
43. BRKT - Knee bolster
44. Nut
45. Screw
46. Screw

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7630-00 FRONT CONSOLE



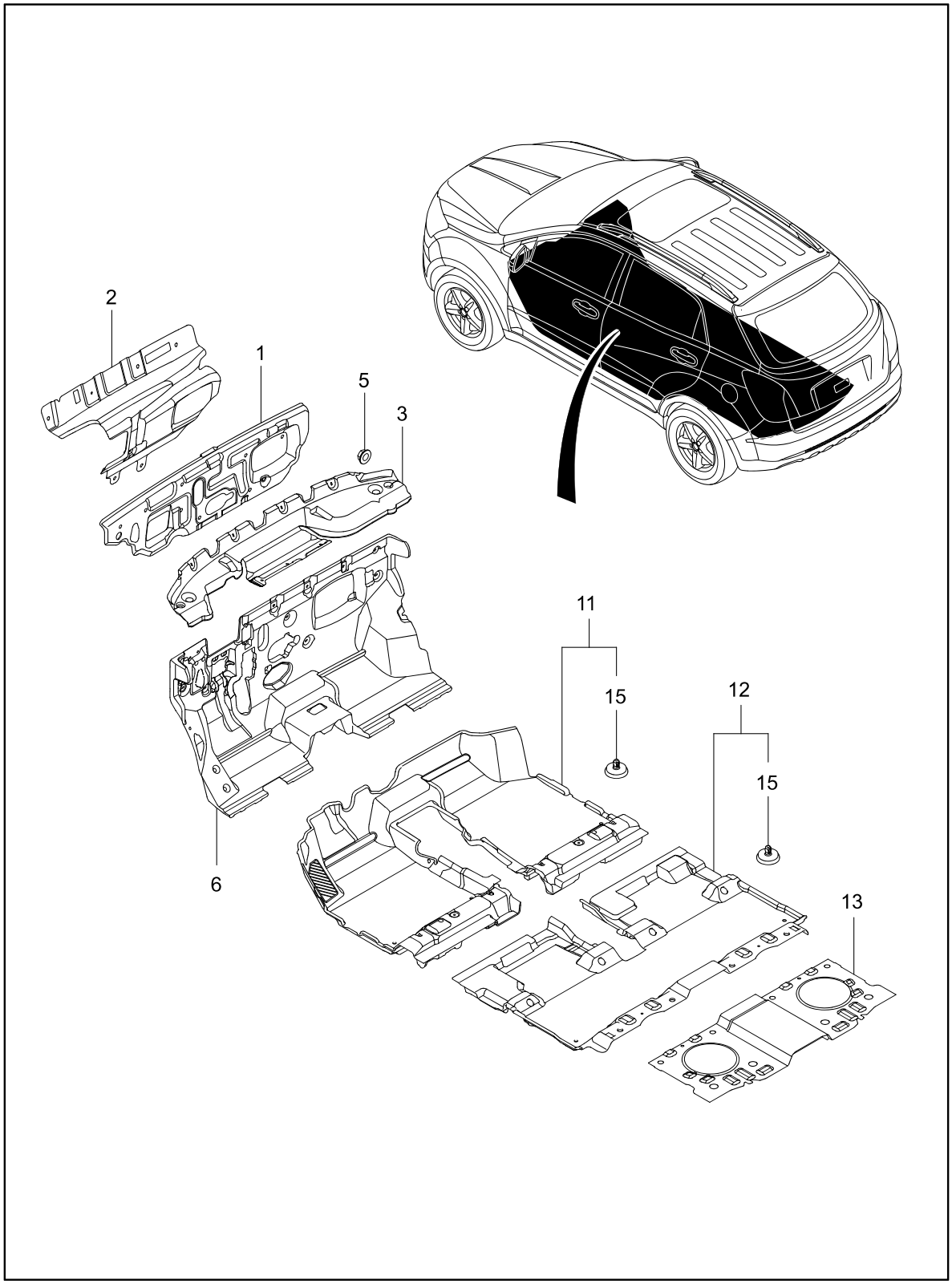
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1. Console assy
3. Cup holder assy - CTR
4. BRKT assy - Console main RR UPR
5. Arm rest assy
6. Fascia assy - Console RR
7. Cover assy - Boots
9. Fascia assy - Console main UPR
10. Housing assy - Cup holder
11. Tray - Main UPR
12. Bezel - Cup holder UPR
13. Cover - ARm rest hinge
15. BRKT assy - Console main CTR
16. BRKT assy - Console main RR LWR
20. Cover assy - FRT end console
22. Mat - Console main tray
24. Guide - Cup
25. Ash tray
31. Fascia - Console UPR
32. Cover - Console FRT
36. Fascia assy - Console FRT
37. Fascia - Console UPR
38. Cover assy - TGS A/T
39. Tray assy - Console FRT
41. Screw
42. Screw
43. Nut
44. Screw-Rivet

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7710-00 FLOOR CARPET



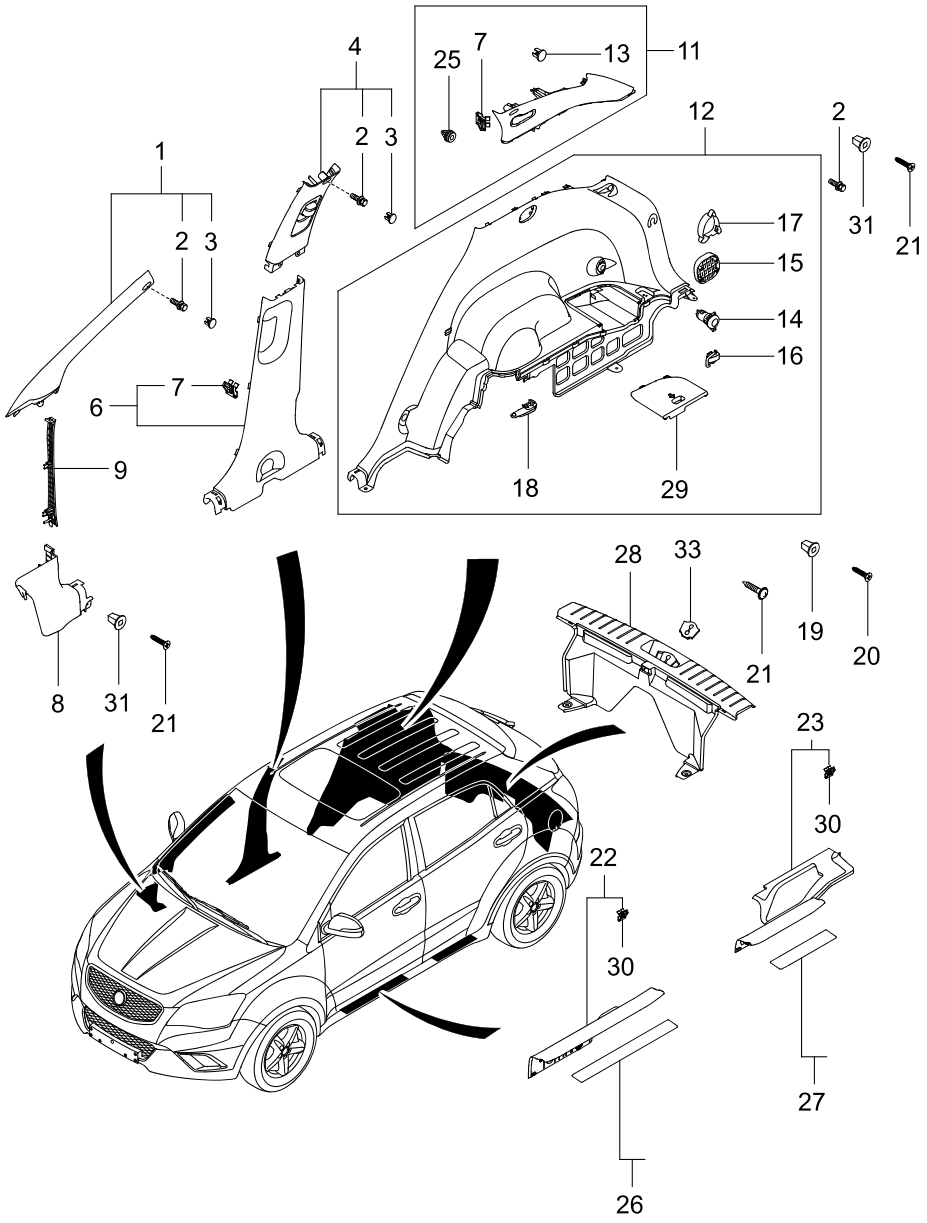
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1. Insulator - Engine room
2. Insulator -Partition
3. Insulator - Dash UPR
5. Nut
6. Insulator - Dash INR
11. Mat assy - Floor FRT
12. Mat assy - Floor CTR
13. Mat - Floor RR
15. Hook - Car MAT

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7730-00 PILLAR TRIM



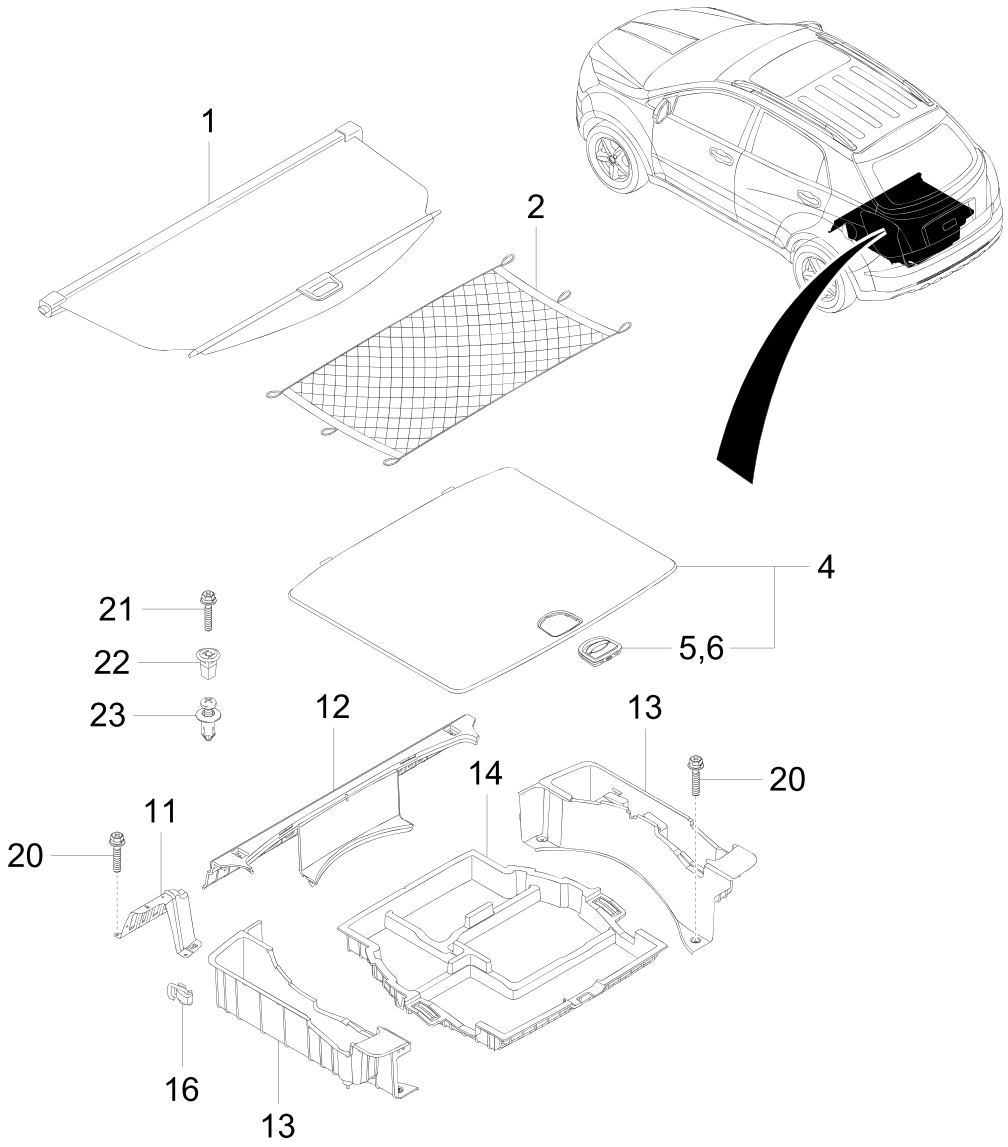
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1. Trim assy - A pillar
2. Bolt
3. Cap - A pillar
4. Trim assy - B pillar UPR
6. Trim assy - B pillar LWR
7. Clip - Trim MTG
8. Trim assy - Cowl side
9. Trim assy - Cowl side UPR
11. Trim assy - QTR UPR
12. Trim assy - QTR LWR
13. Cap - QTR UPR
14. Socket assy - Power
15. Cap - Luggage cover MTG
16. Hook assy - Luggage
17. Cover - Luggage hook
18. Guide - Seat belt
19. Grommet - Screw
20. Screw
21. Screw
22. Trim assy - DR scuff FRT
23. Trim assy - DR scuff RR
25. Clip
26. Trim - Dr scuff FRT OTR
27. Trim - DR scuff RR OTR
28. Trim assy - RR transverse
29. Cover - Luggage
30. Clip
31. Grommet - Screw
32. Screw - Rivet
33. Blanking cover - RR transverse

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 7752-00 LUGGAGE PARTS

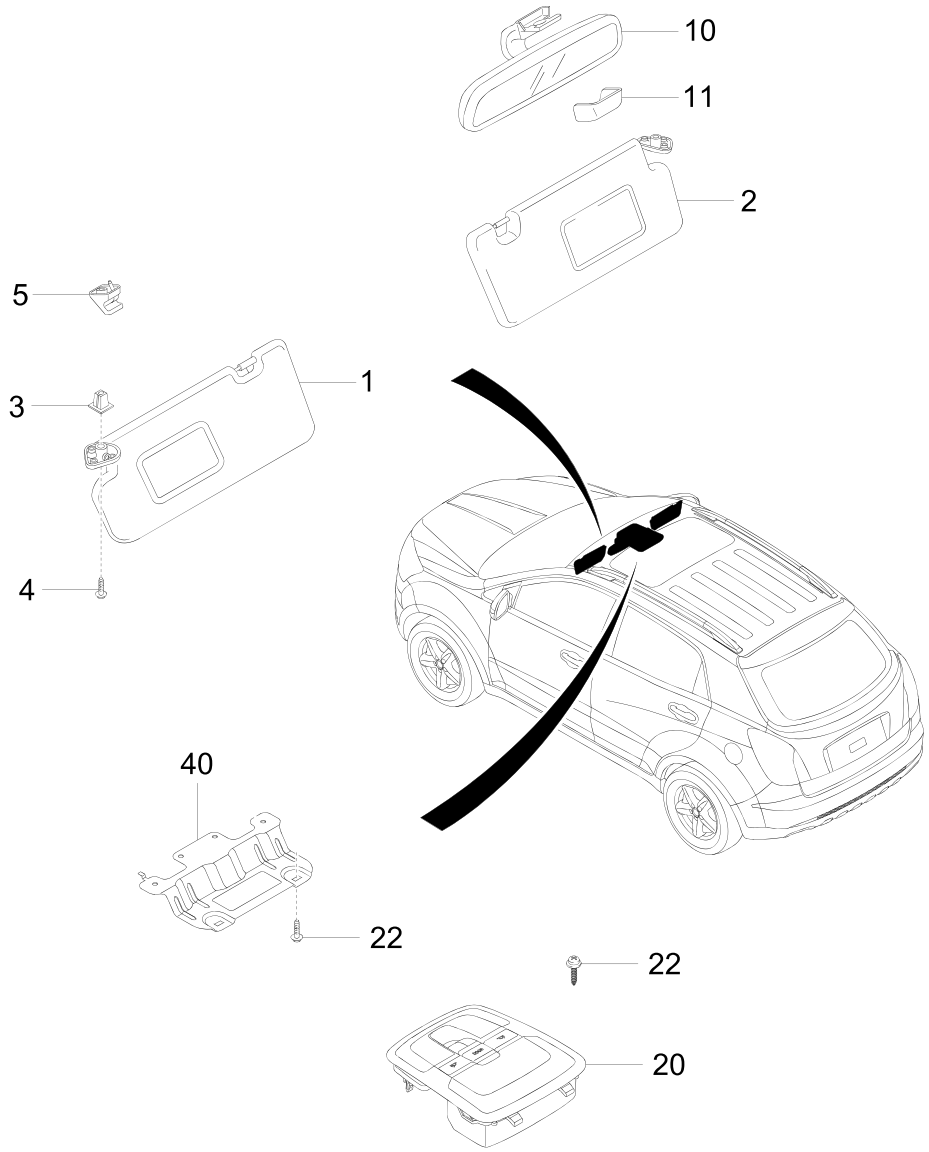


1. Cover assy - Luggage room
2. Net - Luggage
4. Lid assy - Luggage
5. Handle assy - Latch UPR
6. Housing - Latch LWR
11.BRKT assy - Trim MTG
12.Trim assy - Luggage FRT
13.Tray - Luggage
14.Tray - Luggage CTR
16.Hook assy - Luggage
20.Screw
21.Screw
22.Grommet - Screw
23.Screw - Rivet

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7770-00 SUN SHADE AND INSIDE MIRROR

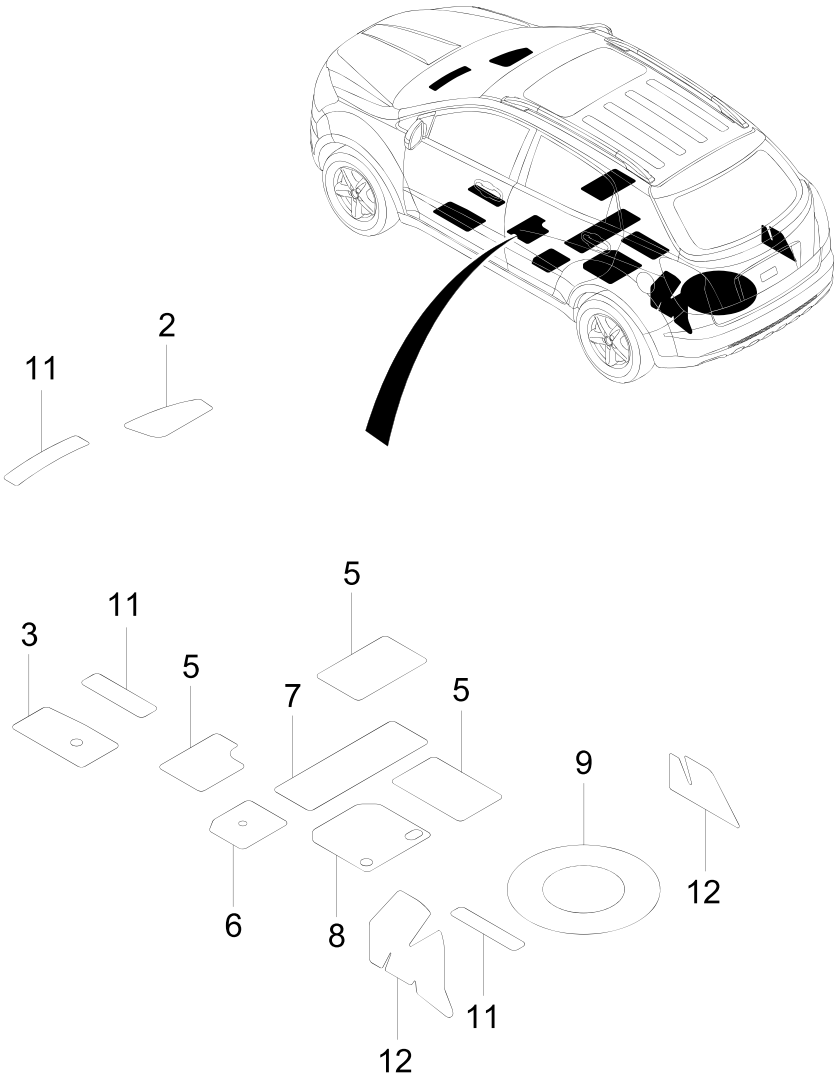


1. Sunvisor assy
2. Sunvisor assy
3. Grommet
4. Screw
5. Retainer assy - Sunvisor
10. Mirror assy - I/S RR view
11. Cover - I/S mirror
20. Console assy - Over head
21. Switch assy - Sunroof
22. Screw
40. BRKT - Over head console MTG

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7792-00 ANTI-VIBRATION PAD



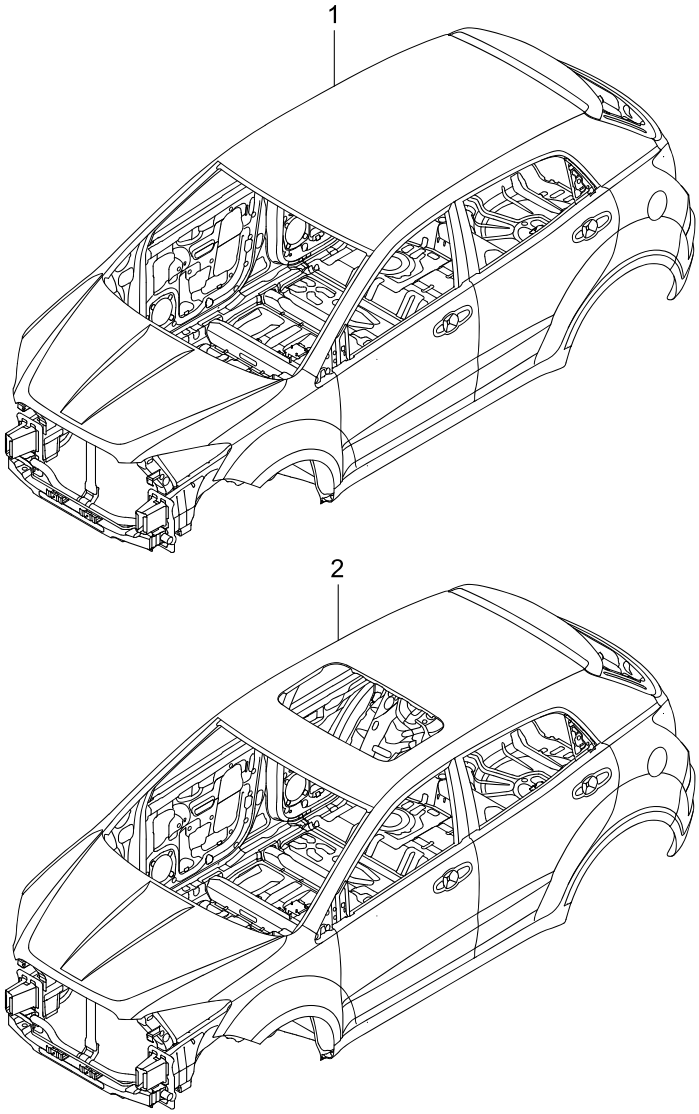
2. Anti pad - Cowl UPR
3. Anti pad - FRT floor FRT
5. Anti pad - FRT floor CTR
6. Anti pad - FRT floor RR
7. Anti pad - FRT floor RR CTR
8. Anti pad - RR floor FRT
9. Anti pad - Spare tire
11. Anti pad - RR floor RR OTR
12. Anti pad - RR wheel house INR

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

COMPONENT

S.G.N. 5110-00 WHITE BODY

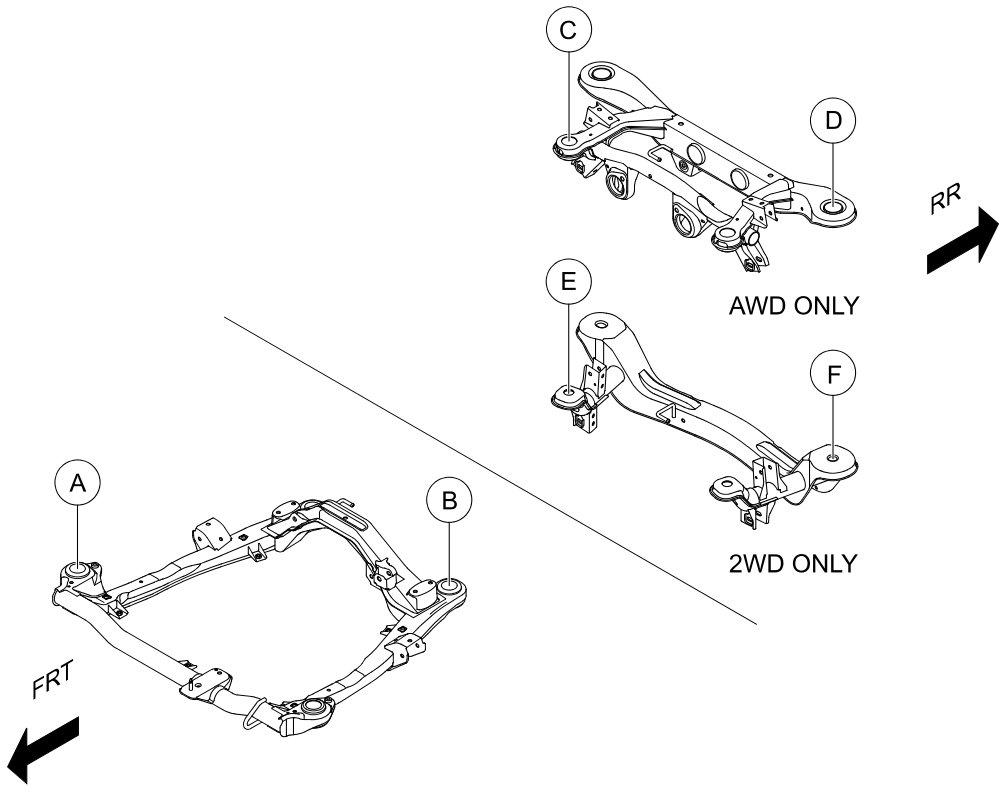


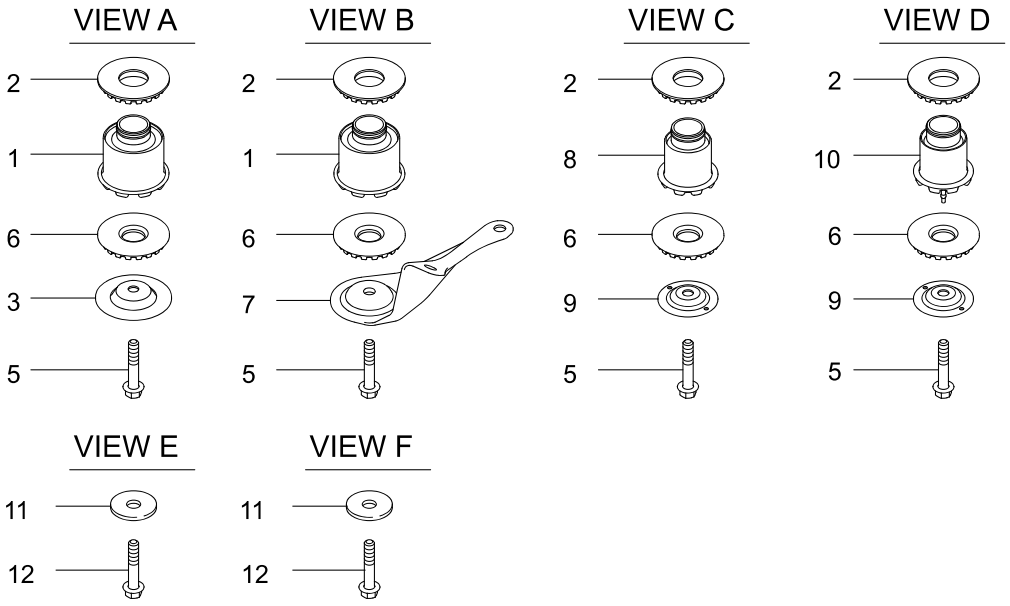
1. WHITE BODY
2. White body (with sunroof)

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
5120-00 BODY MOUNTING





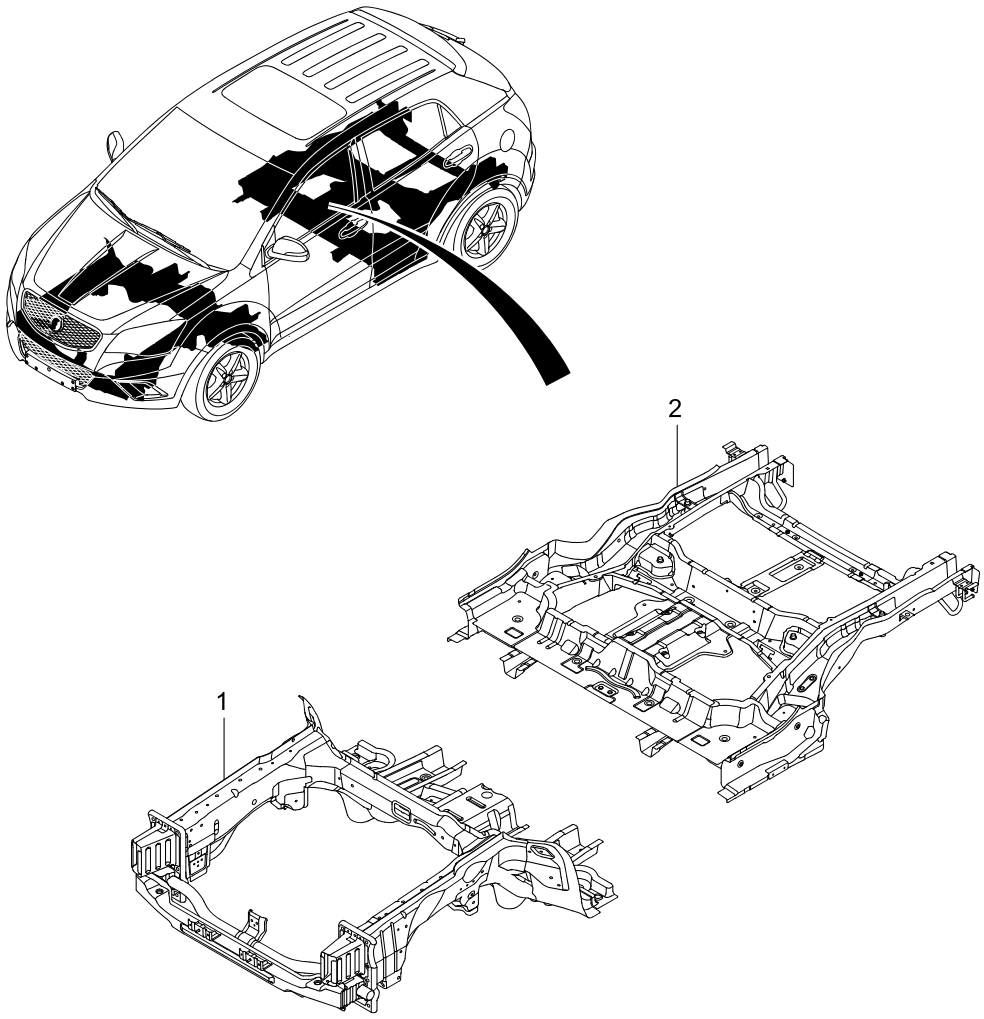
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

1. Bush - FRT subframe MTG
2. Stopper - Subframe MTG FRT UPR
3. Stopper - FRT subframe FRT LWR
5. Bolt - Body MTG
6. Stopper - Subframe MTG RR UPR
7. Stay - FRT subframe
8. Bush - RR subframe MTG FRT
9. Stopper - RR subframe MTG LWR
10. Bush - RR subframe MTG RR
12. Bolt

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 5125-00 BODY FRAME

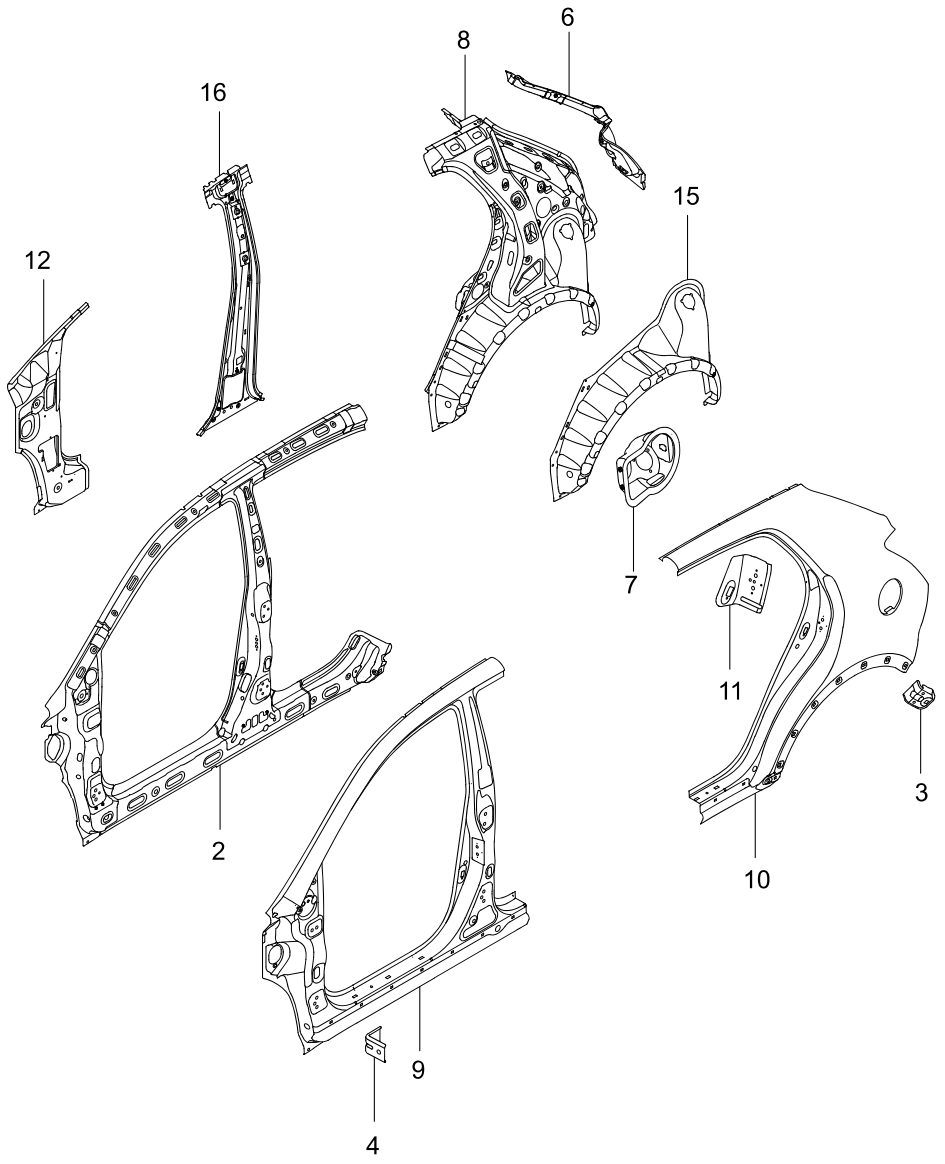


1. Member assy - FRT H frame
2. Member assy - RR H frame

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
5210-00 SIDE AND REAR BODY

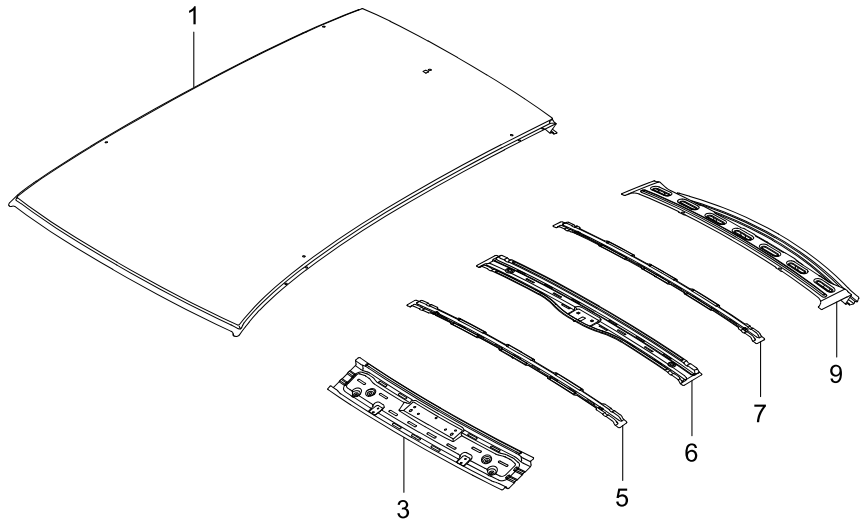


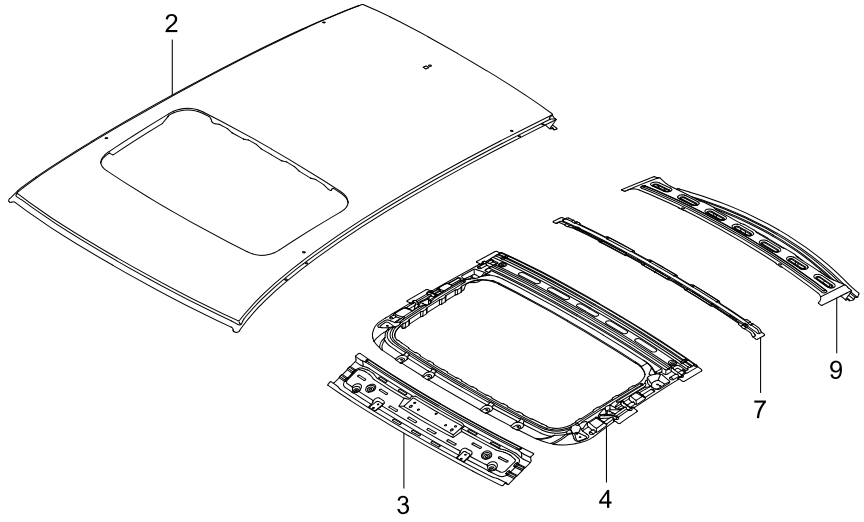
2. Reinf assy - Side OTR
3. Brkt - RR bumper MTG LWR
4. Brkt assy - Fender MTG LWR
6. Pillar compl - D OTR
7. Housing assy - Fuel filler
8. PNL compl - Q/INR & W/HSE
9. PNL - side OTR FRT
10. PNL - Side OTR RR
11. Reinf assy - RR DR striker
12. PNL assy - Cowl side INR
15. PNL - Wheel house RR OTR
16. Pillar assy - B INR

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 5510-00 ROOF PANEL



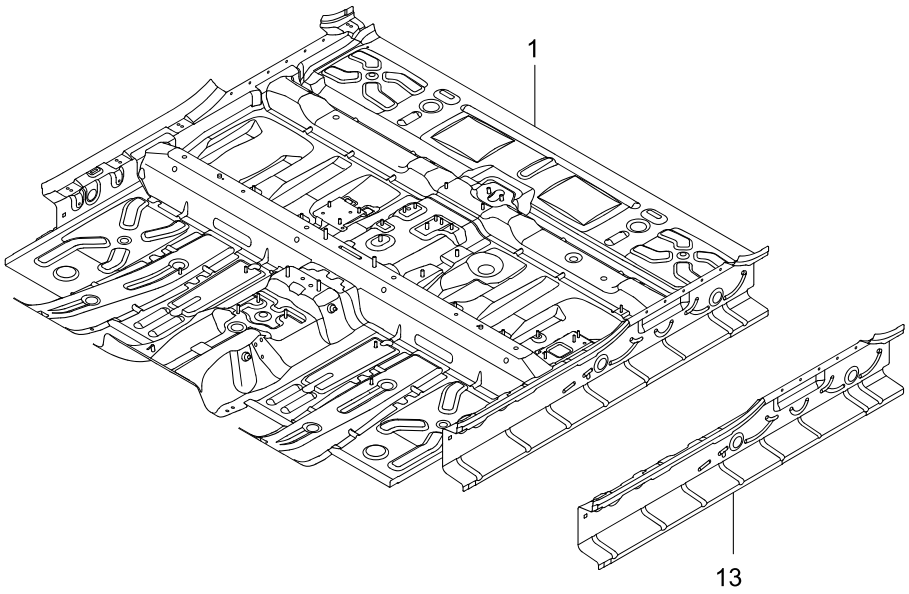


1. PNL - Roof
2. Pnl - Roof
3. Rail assy - Roof FRT
4. Reinf assy - Sunroof
5. Rail - Roof No1 CTR
6. Rail - Roof No2 CTR
7. Rail - Roof No3 CTR
9. Rail assy - Roof RR

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
5610-00 FRONT FLOOR PANEL

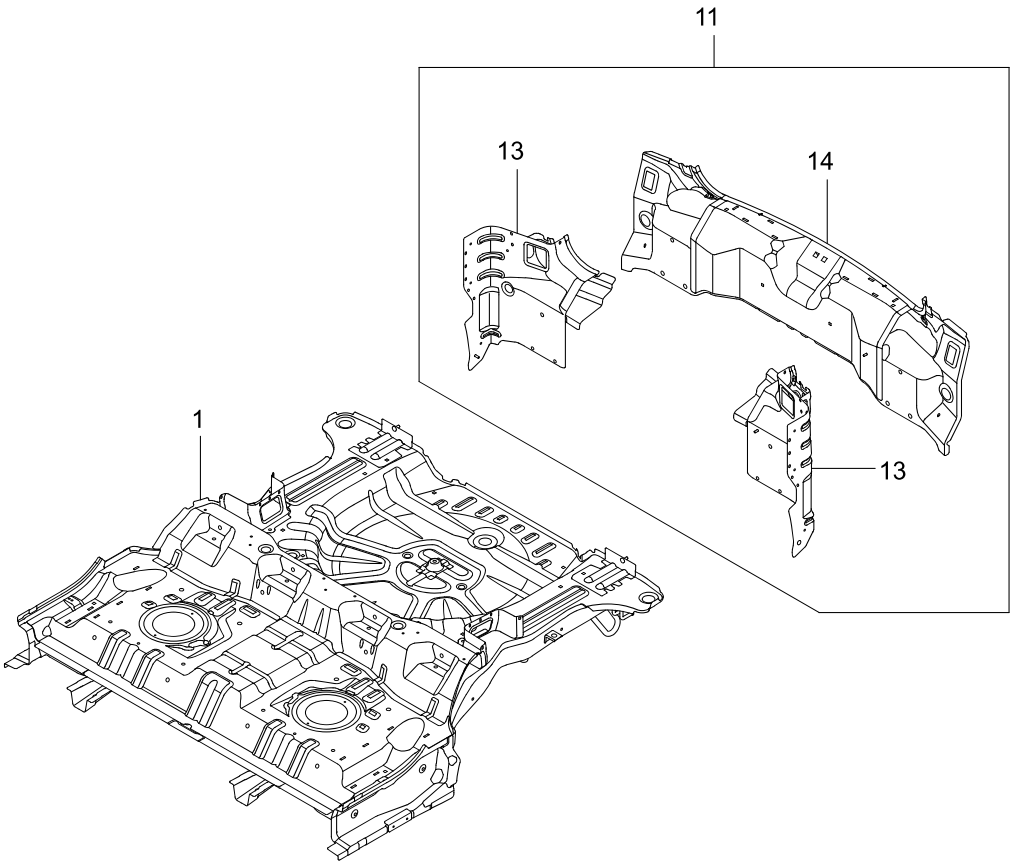


1. PNL compl - FRT floor
13.PNL - Side sill INR

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
5620-00 REAR FLOOR PANEL

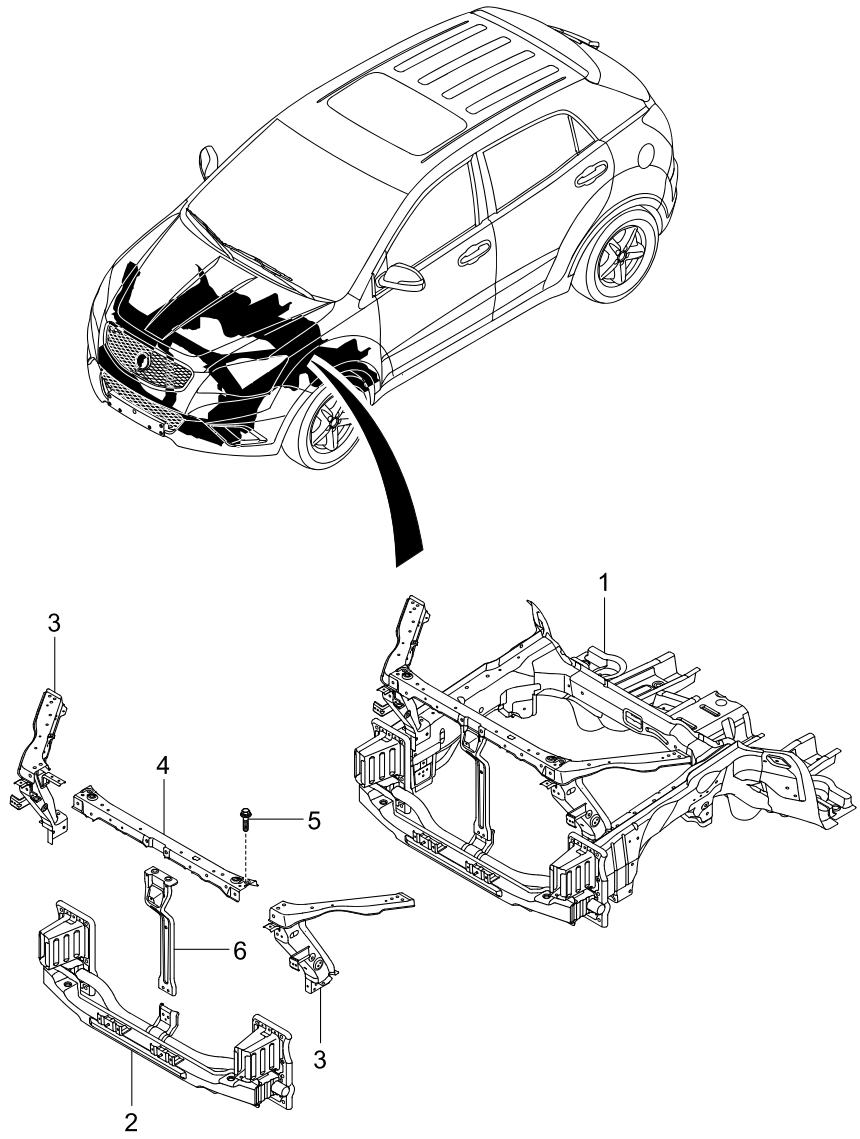


1. PNL compl - RR floor
11.Member assy - RR end
13.Reinf - RR floor corner
14.PNL assy - Back OTR

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
5710-00 FRONT END PANEL

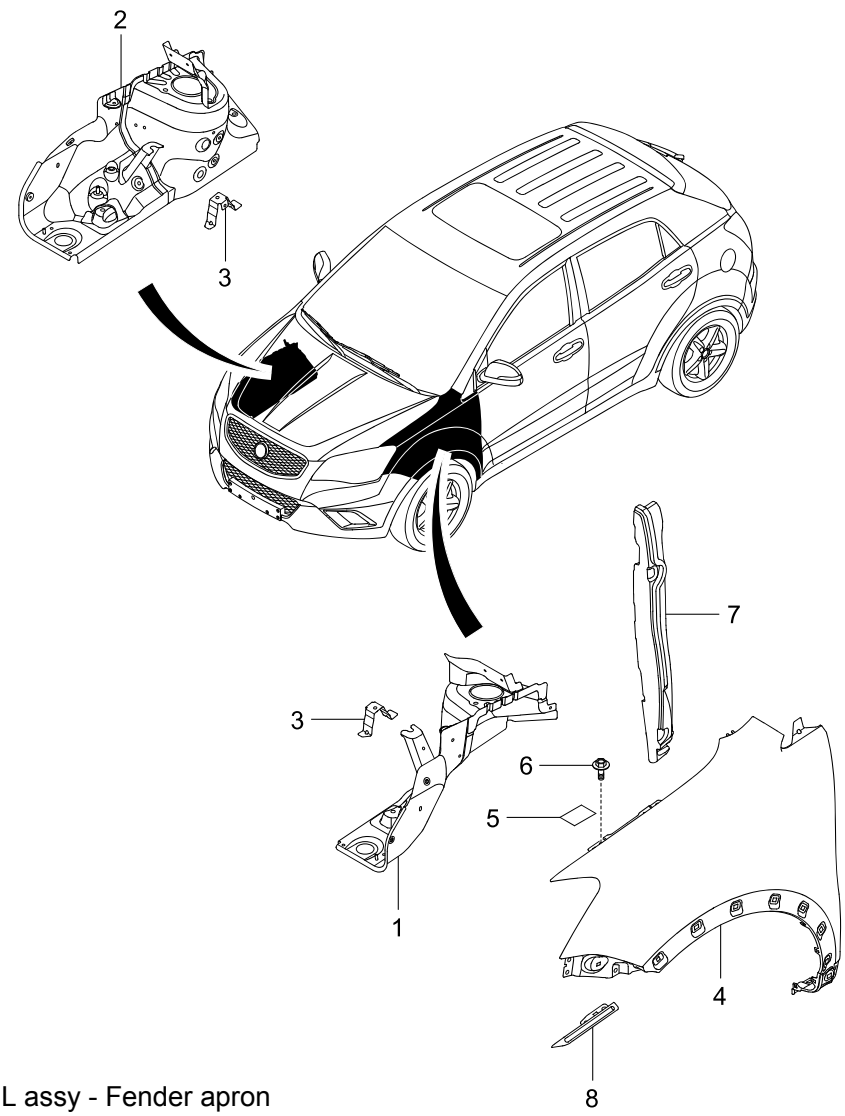


1. PNL compl - Engine room
2. Beam assy - FRT end LWR
3. Member assy - Head lamp
4. Member - FRT end UPR
5. Bolt
6. Member assy - FRT end CTR

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
5720-00 FENDER AND APRON PANEL

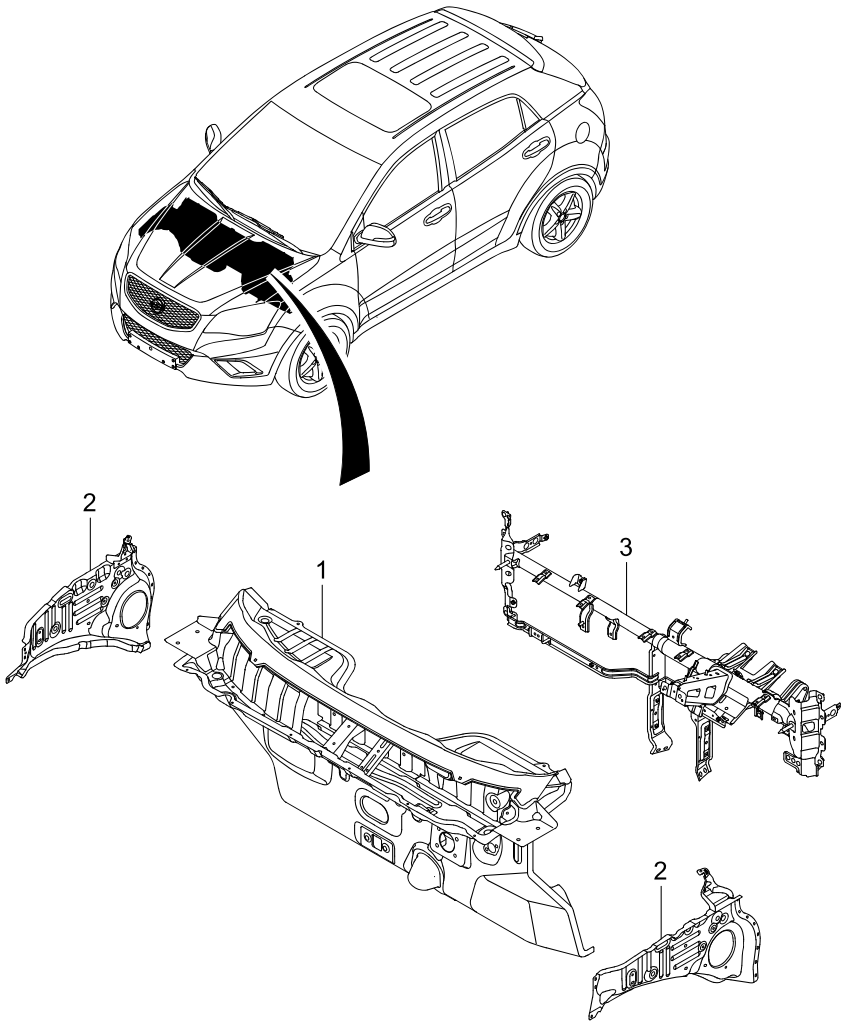


1. PNL assy - Fender apron
2. PNL assy - Fender apron
3. Brkt - Fender MTG FRT
4. PNL - Fender
5. Pad - Fender MTG sealing
6. Bolt
7. Seal - Fender
8. Reinf - Fender

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
5730-00 DASH PANEL AND COWL

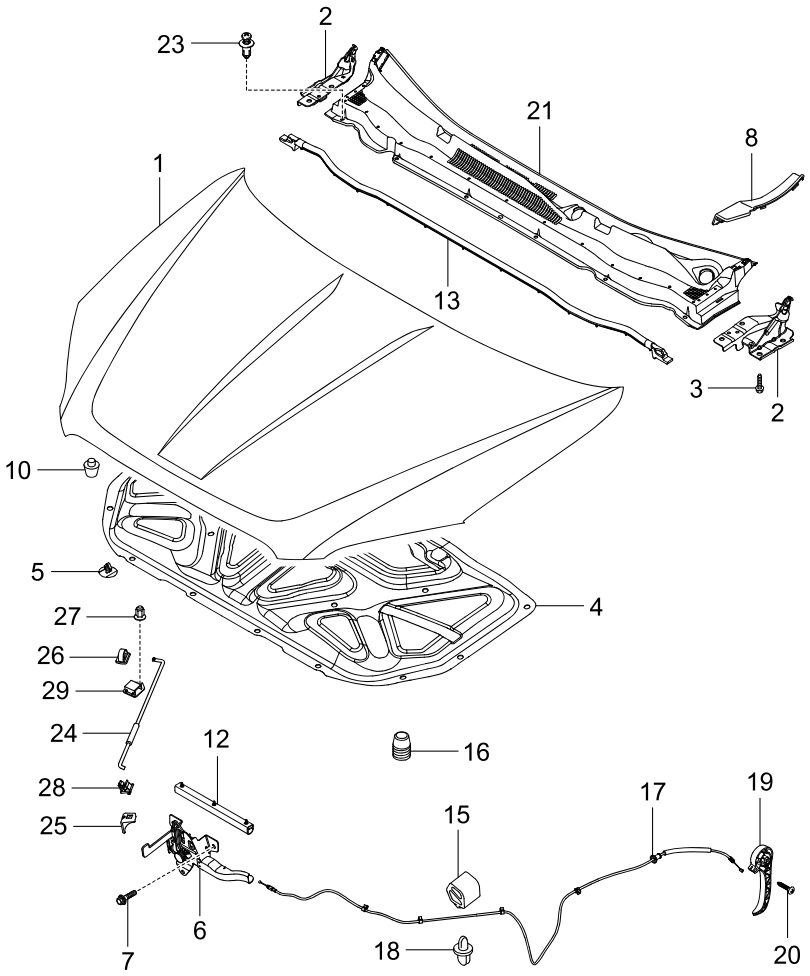


1. PNL compl - Dash & cowl
2. Member compl - Cowl side UPR
3. Cross member assy

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
6110-00 HOOD PANEL

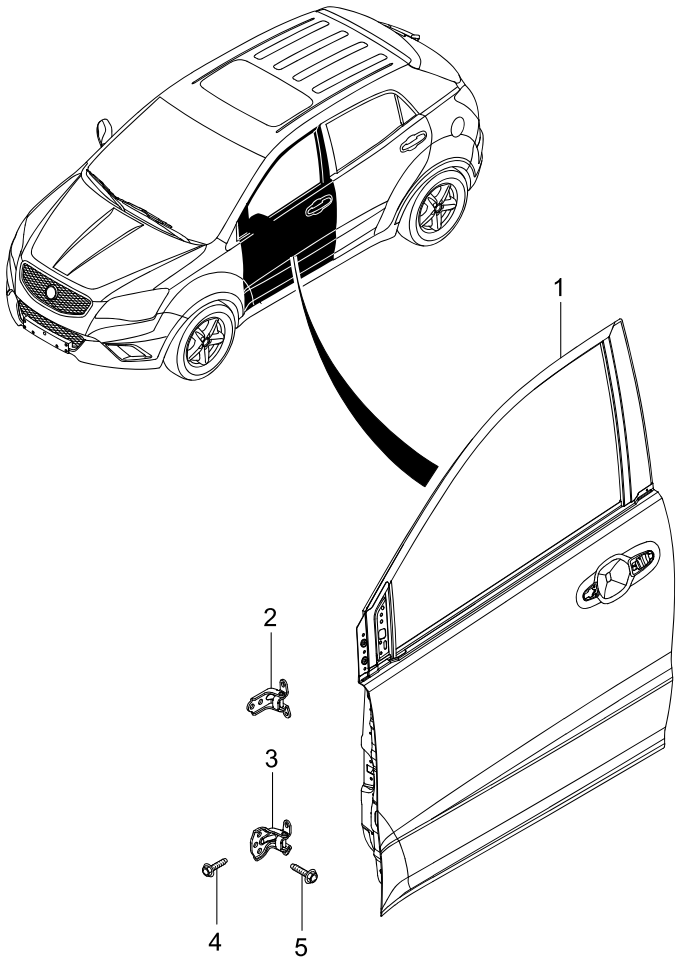


1. Pnl assy - Hood
2. Hinge assy - Hood
3. Bolt
4. Insulator - Hood
5. Fastener - Hood insulation pad
6. Latch assy - Hood
7. Bolt
8. Extension - Cowl grille
10. Bumper - Hood over slam
12. Seal assy - Hood FRT sub
13. Seal assy - Hood RR
16. Bumper - Trunk lid over slam
17. Cable assy - Hood latch release
18. Clip - F/filr DR REL CBL
19. Handle - Hood latch release
20. Screw
21. Grille assy - Cowl
23. Screw - Rivet
24. Rod assy - Hood stay
25. BRKT - Hood stay rod MTG
26. Retainer - Hood stay rod
27. Nut
28. Clip - Hood stay rod
29. Holder - Hood stay rod

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
6210-00 FRONT DOOR PANEL

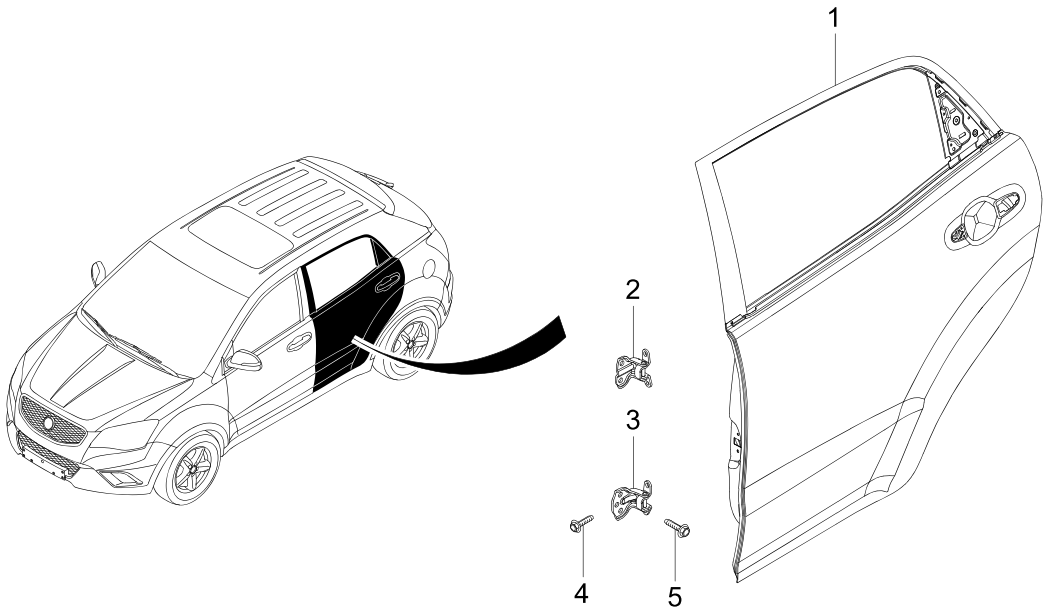


1. PNL assy - FRT DR
2. Hinge assy - FRT DR UPR
3. Hinge assy - FRT DR LWR
4. Bolt
5. Bolt

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
6310-00 REAR DOOR PANEL

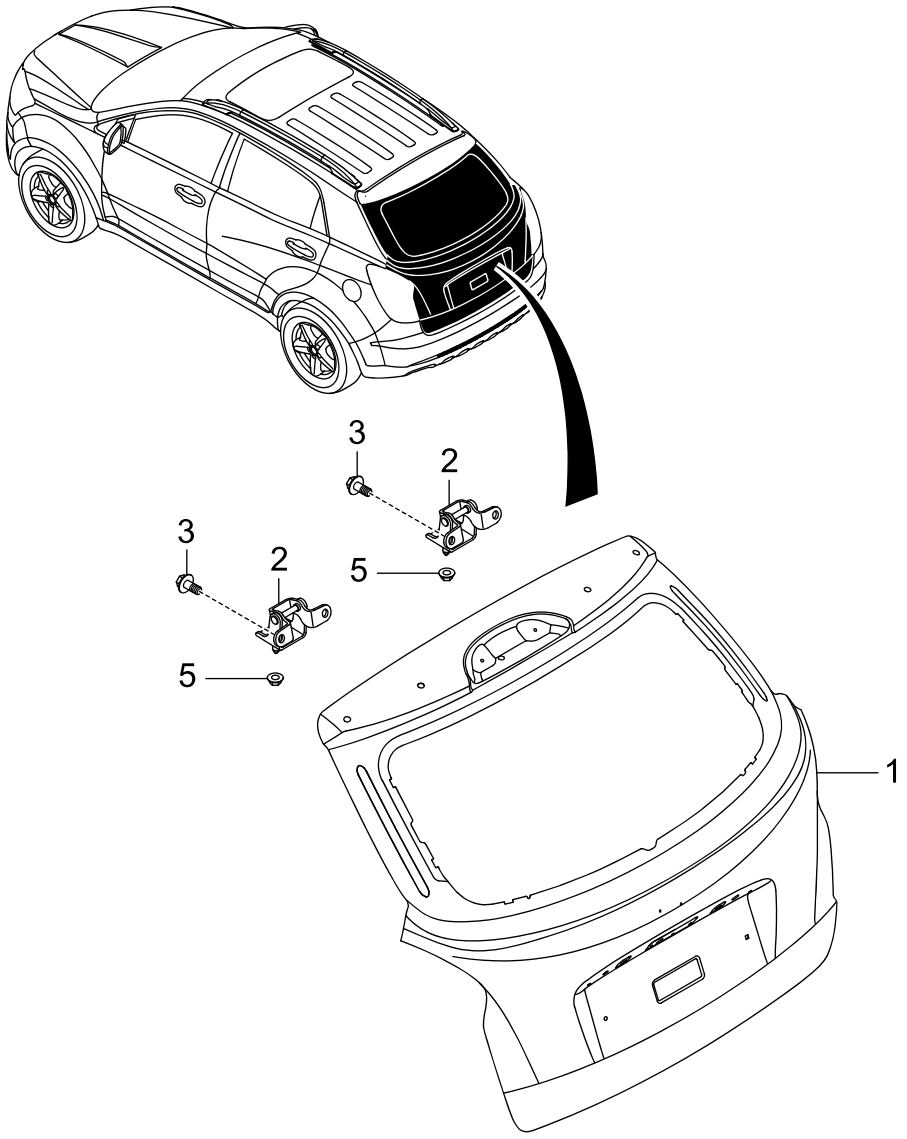


1. PNL assy - RR DR
2. Hinge assy - RR DR UPR
3. Hinge assy - FRT DR LWR
4. Bolt
5. Bolt

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
6410-00 TAILGATE PANEL

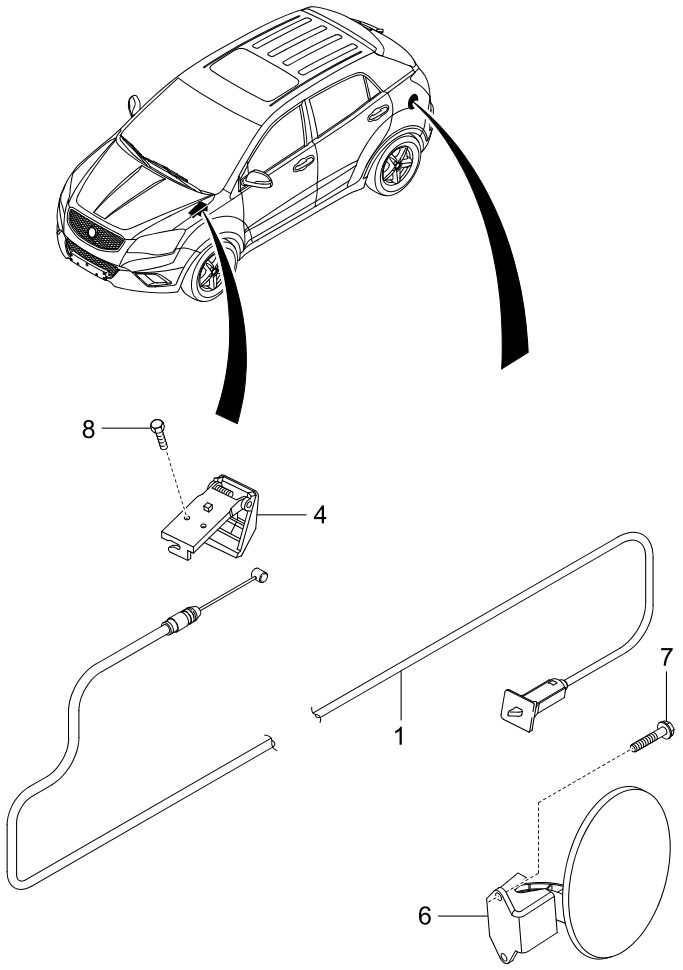


1. PNL assy - Tailgate
2. Hinge assy - Tailgate
3. Bolt
5. Nut

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7090-00 FUEL FILLER DOOR LOCK



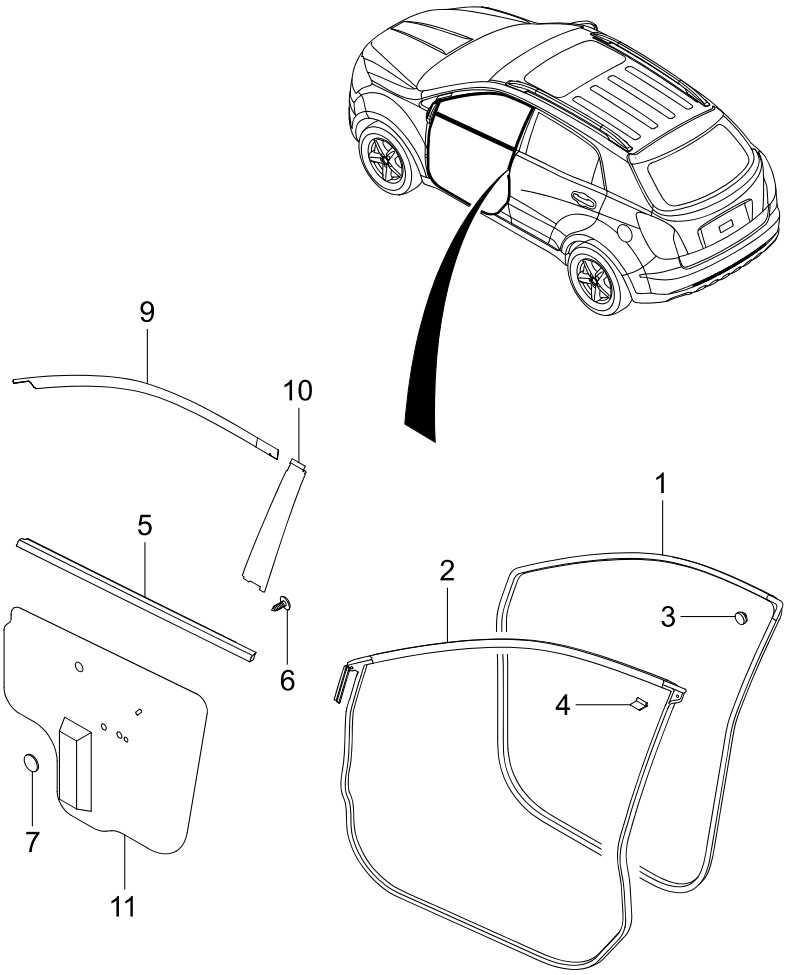
1. Cable assy - F/filr DR REL
4. Handle assy - F/filr DR REL
6. DR assy - Fuel filler
7. Bolt
8. Screw

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 7121-00

FRONT WEATHERSTRIP

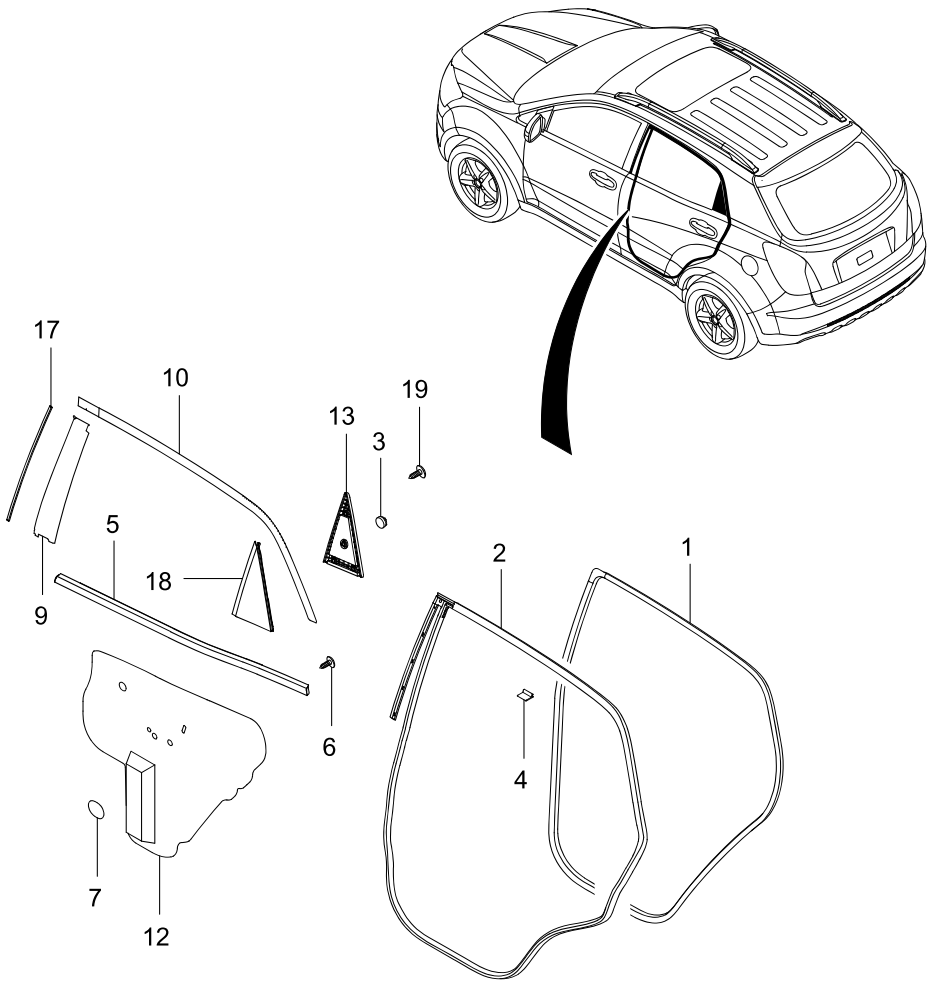


1. W/strip - FRT DR body side
2. W/strip assy - FRT DR opening
3. Cap - W/strip
4. Clip - W/strip
5. W/strip assy - F/DR belt O/S
6. Screw
7. Tape - DR tooling hole sealing
9. Tape - FRT DR frame A
10. Tape - FRT DR frame B
11. Vinyl seal - FRT DR trim

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7221-00 REAR WEATHERSTRIP

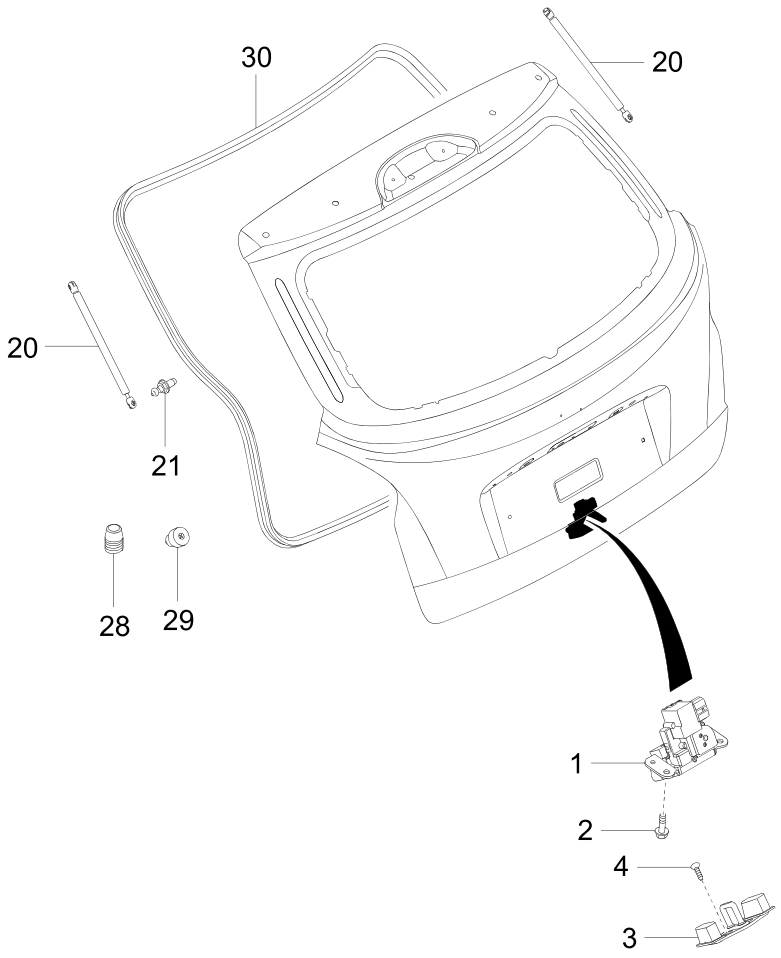


1. W/strip - RR DR body side
2. W/strip assy - RR DR DR side
3. Cap - W/strip
4. Clip - W/strip
5. W/strip assy - RR DR belt O/S
6. Screw
7. Tape - DR tooling hole sealing
9. Tape - RR DR frame B
10. Tape - RR DR frame A
12. Vinyl seal - RR DR trim
13. Cover assy - RR DR trim UPR
17. Cover - RR DR DR side strip
18. Molding assy - RR DR delta
19. Screw

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7310-00 TAILGATE OPENING SYSTEM

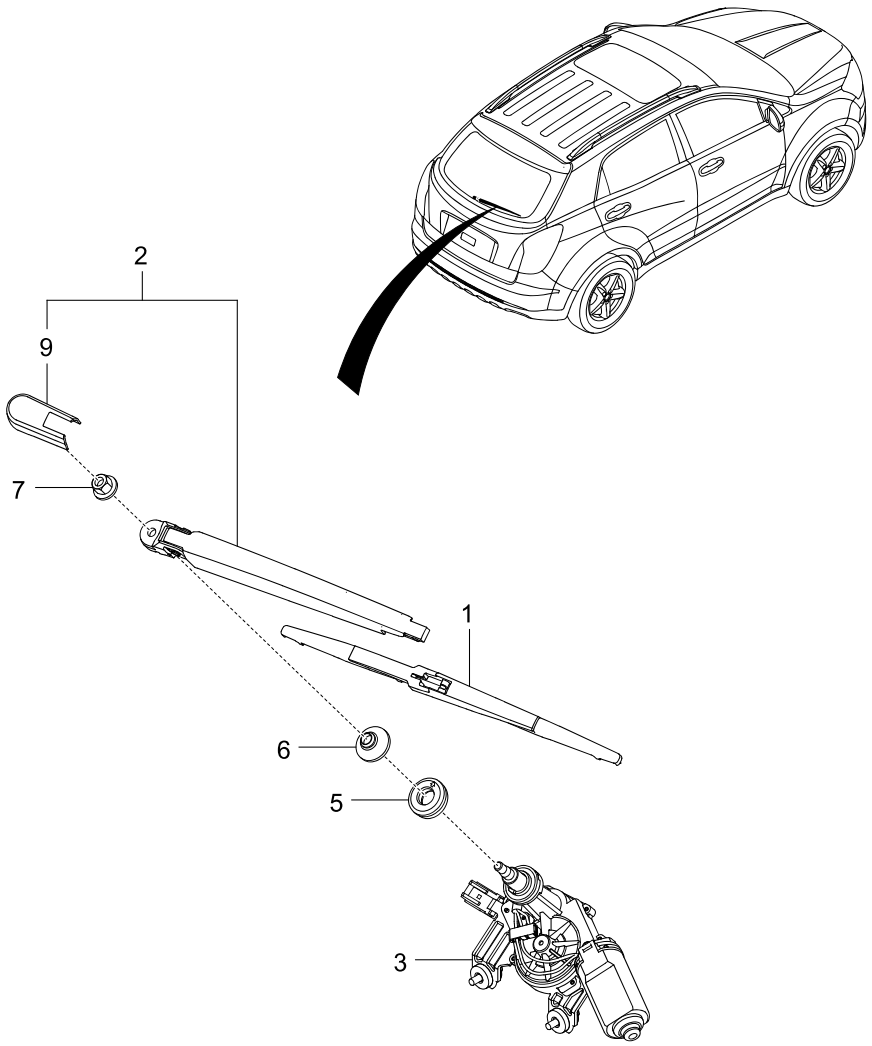


1. Latch assy - T/gate
2. Bolt
3. Striker assy - T/gate
4. Screw - DR striker MTG
20. Lifter assy - T/gate
21. Ball stud
28. Bumper - Trunk lid over slam
29. Bumper assy - T/gate O/slam CTR
30. W/strip - T/gate opening

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N. 7830-00 BACK WINDOW WIPER

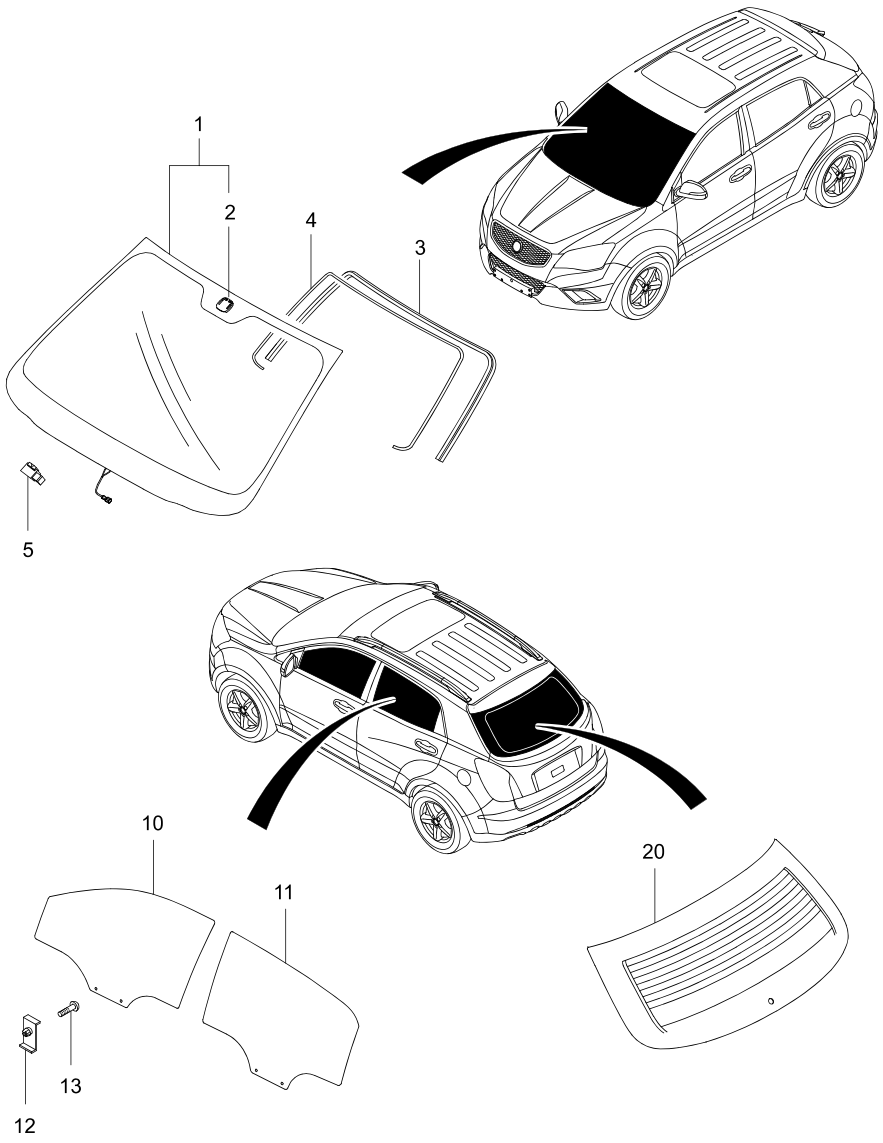


1. Blade assy - RR wiper
2. Arm assy - T/gate wiper
3. Motor assy - RR wiper
5. Spacer assy - T/gate wiper
6. Splash ring - T/gate wiper
7. Nut
9. Cap - Wiper arm

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7840-00 GLASS

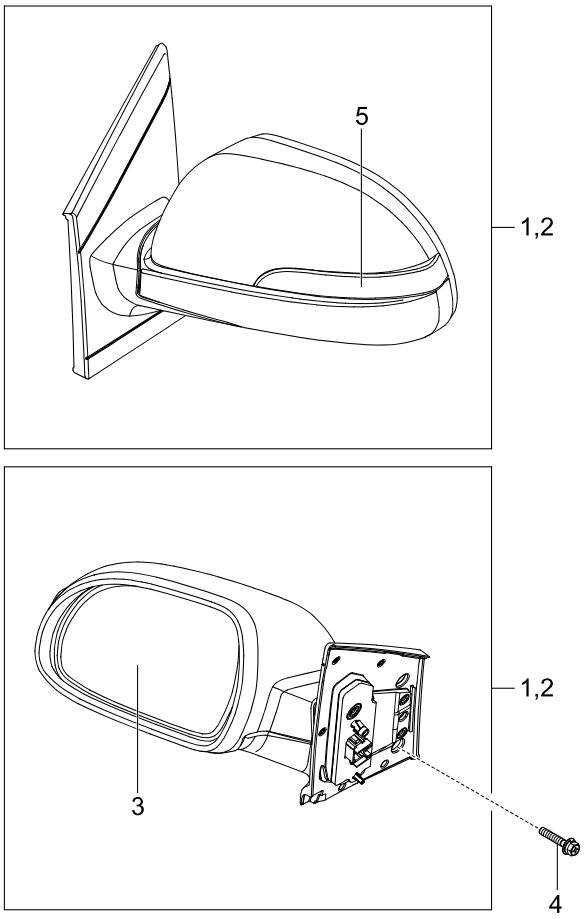


1. Glass assy - Windshield
2. Plate - I/S RR view mirror base
3. Molding assy - Windshield
4. Dam - Windshield
5. Spacer assy - Windshield glass
10. Glass - FRT DR drop
12. Grommet - DR glass MTG
13. Bolt - DR glass MTG
20. Glass assy - T/gate

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7850-00 OUTSIDE REAR VIEW MIRROR

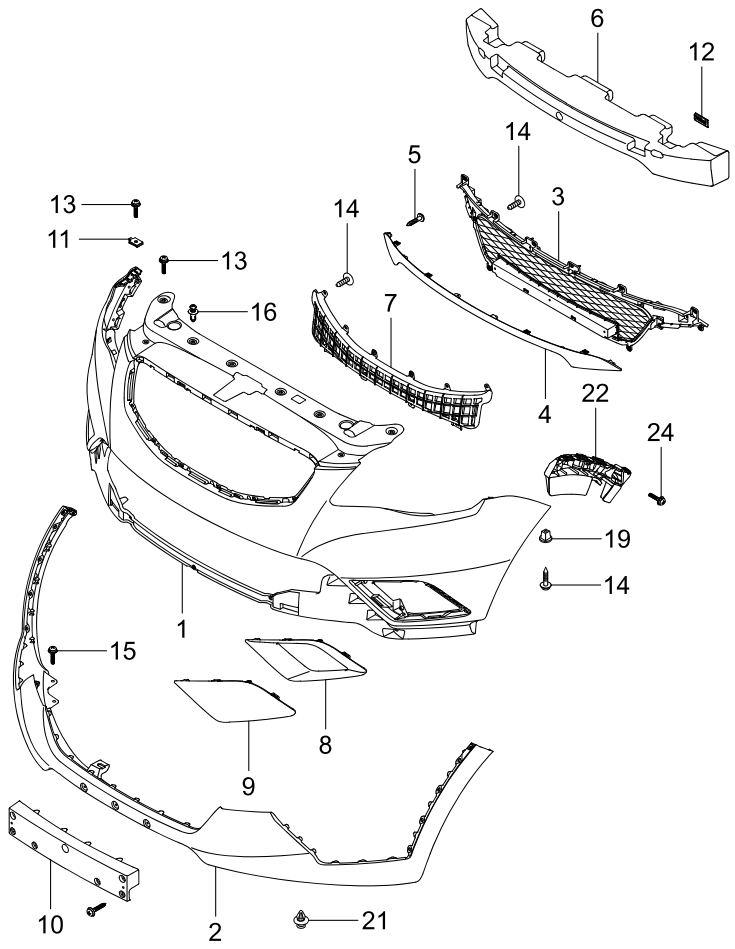


1. Mirror assy - O/S
2. Mirror assy - O/S
3. Glass holder assy - O/S mirr
4. Screw
5. Lamp assy - Turn signal
10. Cover - O/S mirror FRT
11. Rivet - Plastic

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7870-00 FRONT BUMPER

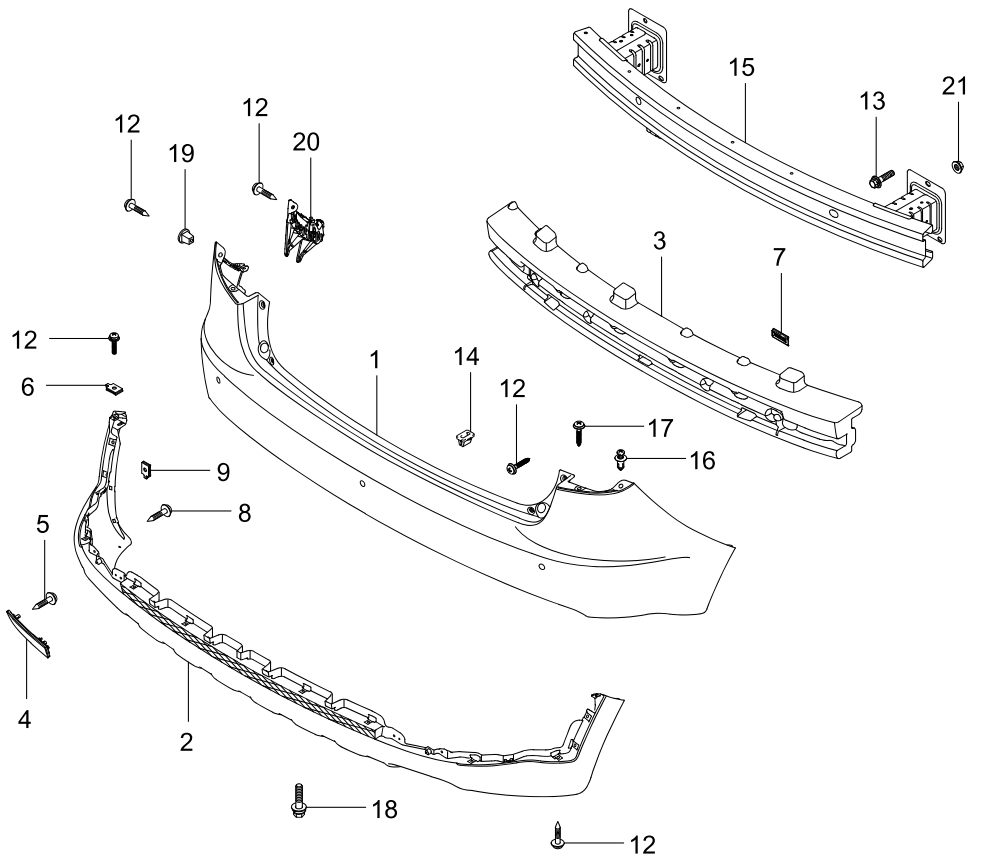


1. Fascia - FRT bumper UPR
2. Fascia - FRT bumper LWR
3. Grille - Intake
4. Molding - Intake
5. Screw
6. Absorber - Energy FRT bumper
7. Reinf - FRT bumper CTR
8. Cover - Fog lamp FRT
9. Blanking cover - Fog lamp FRT
10. Garnish - License plate
11. Spring - Nut
12. Clip - Lock
13. Screw
14. Screw
15. Screw
16. Scrivet
19. Grommet - Screw
21. Screw rivet - RR fascia MTG
22. Brkt assy - Side FRT bumper
24. Bolt

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7880-00 REAR BUMPER

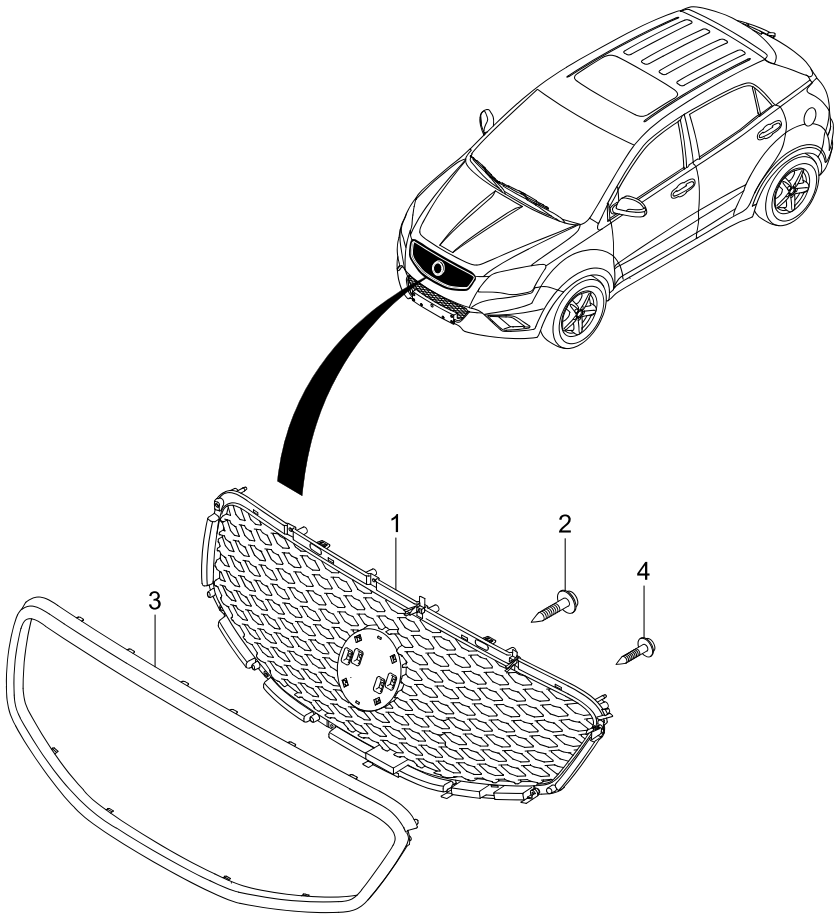


1. Fascia - RR bumper UPR
2. Fascia - RR bumper RR LWR
3. Absorber - Energy RR bumper
4. Lamp assy - Reflex reflector
5. Screw
6. Nut
7. Clip
8. Screw
9. Spring - Nut
12. Screw
13. Bolt
14. Grommet - Screw
15. Beam assy - Impact RR bumper
16. Scrivet
17. Screw
18. Bolt
19. Grommet - Screw
20. BRKT assy - Side RR bumper
21. Nut

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7910-00 RADIATOR GRILLE

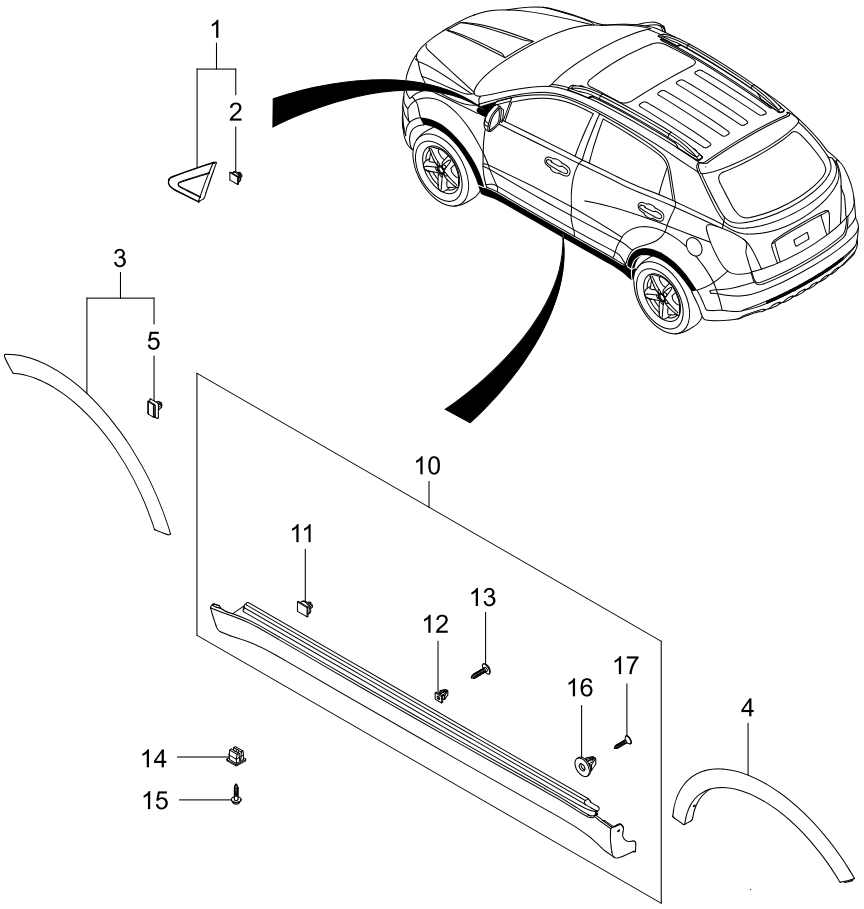


1. Grille - Radiator
2. Screw
3. Molding - Radiator grille
4. Screw

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7930-00 SIDE BODY MOLDING

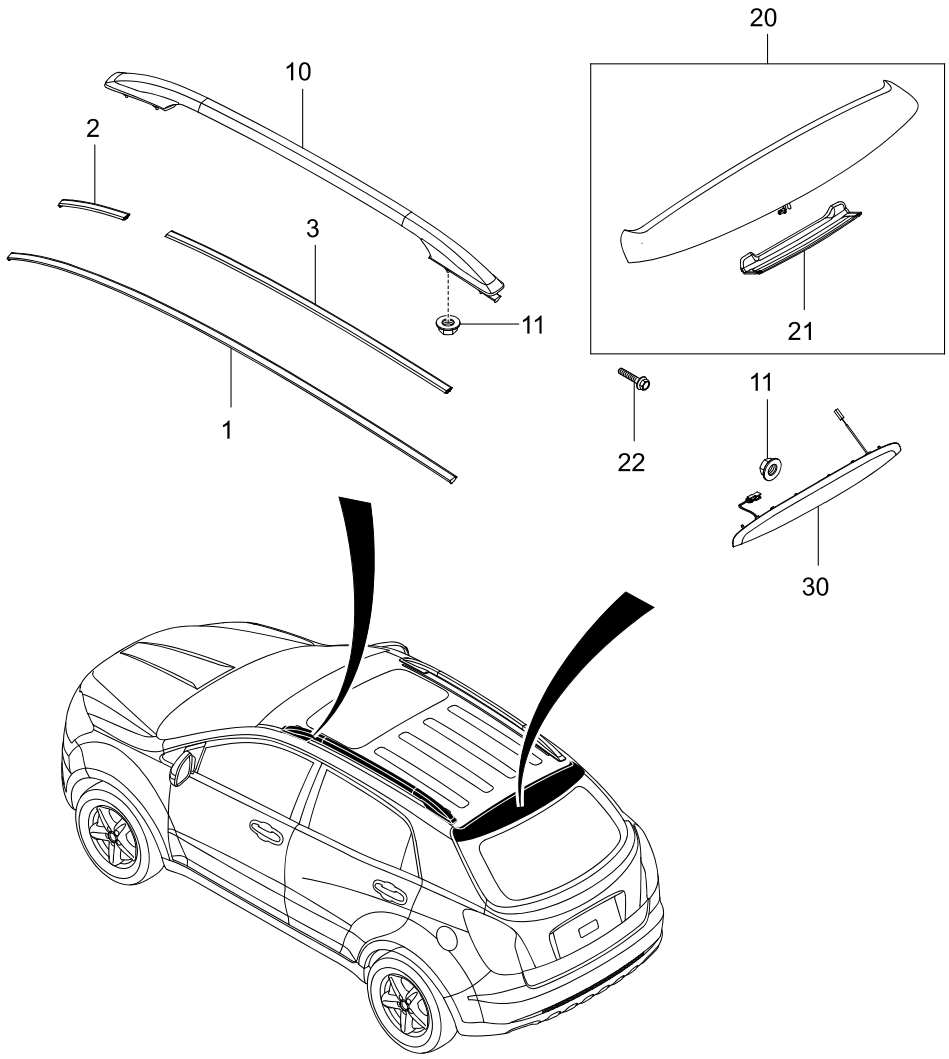


1. Cover assy - Quadrant
2. Clip - Side sill molding MTG
3. Garnish assy - FRT wheel arch
4. Garnish assy - RR wheel arch
5. Clip - DR molding MTG
10. Garnish assy - Side sill
11. Clip - Side sill molding MTG
12. Clip - Side sill molding MTG LWR
13. Screw
14. Grommet
15. Screw
16. Clip - DR garnish MTG
17. Screw

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7940-00 ROOF AND REAR BODY MOLDING

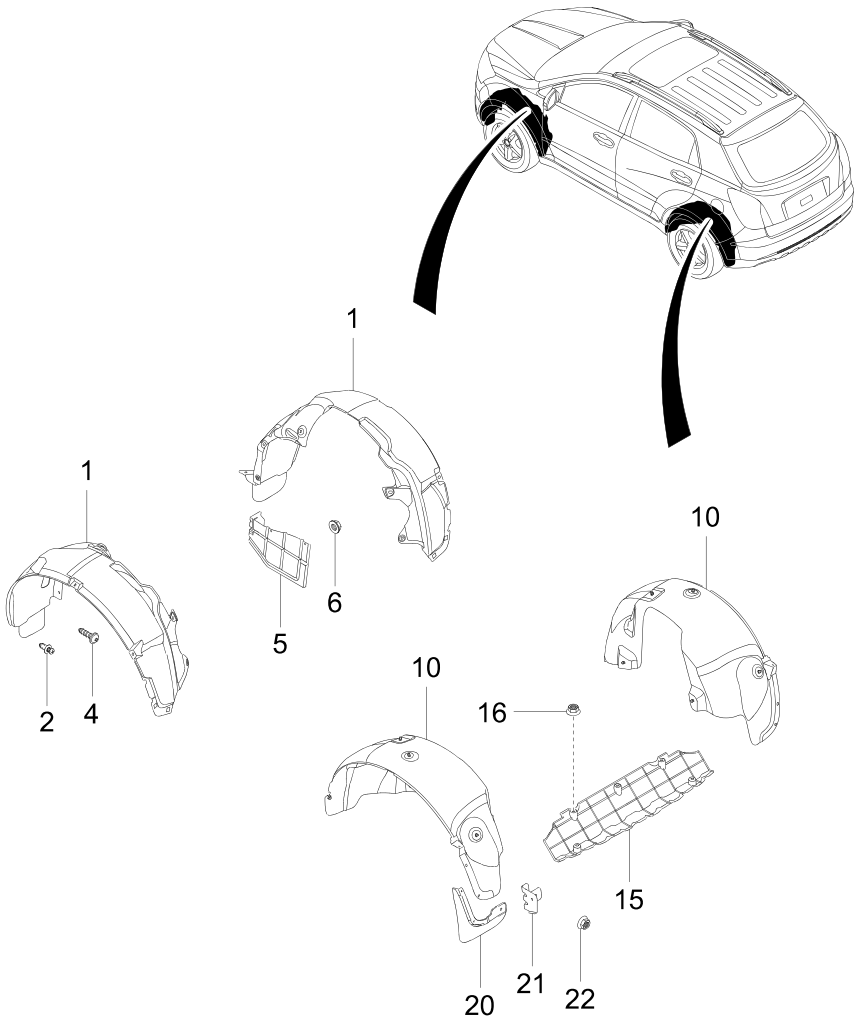


1. Molding assy - Roof
2. Molding assy - Roof No1
3. Molding assy - Roof No2
10. Rail assy - Fashion
11. Nut
20. Spoiler assy
21. Cover - LWR
22. Screw
30. Garnish assy - Tailgate

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

S.G.N.
7970-00 WHEEL HOUSE COVER



1. Cover assy - FRT wheel house
2. Screw
4. Screw
5. Cover - Crankshaft pulley
6. Cap nut
10. Cover - RR wheel house
15. Under cover - RR
16. Nut
20. Mud guard - RR
21. BRKT - RR mud guard MTG
22. Nut

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

BODY REPAIR

GENERAL INFORMATION

1. MAJOR DIMENSION..... 3
2. LIFTING POINTS..... 4
3. SEALING APPLICATION POINTS..... 6
4. DEADENER APPLICATION POINTS..... 11
5. UNDER COATING..... 12
6. MAJOR WELDING POINTS..... 13
7. MAJOR BODY DIMENSIONS..... 23
8. GAP CHART..... 31

Downloaded from www.Manualslib.com manuals search engine

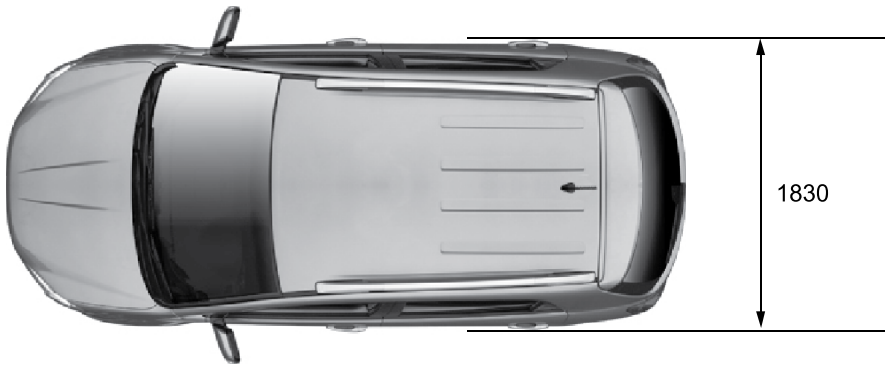
Downloaded from www.Manualslib.com manuals search engine

BODY REPAIR 5110-01

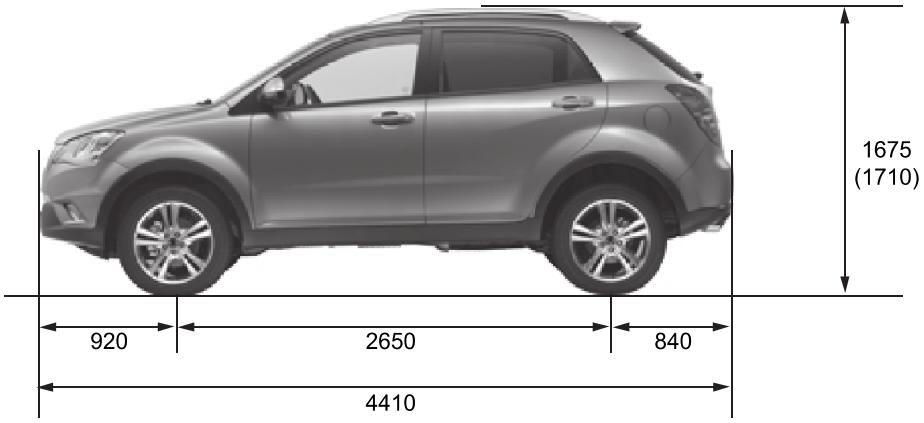
GENERAL INFORMATION

1. MAJOR DIMENSION

Top View



Side View



Front view

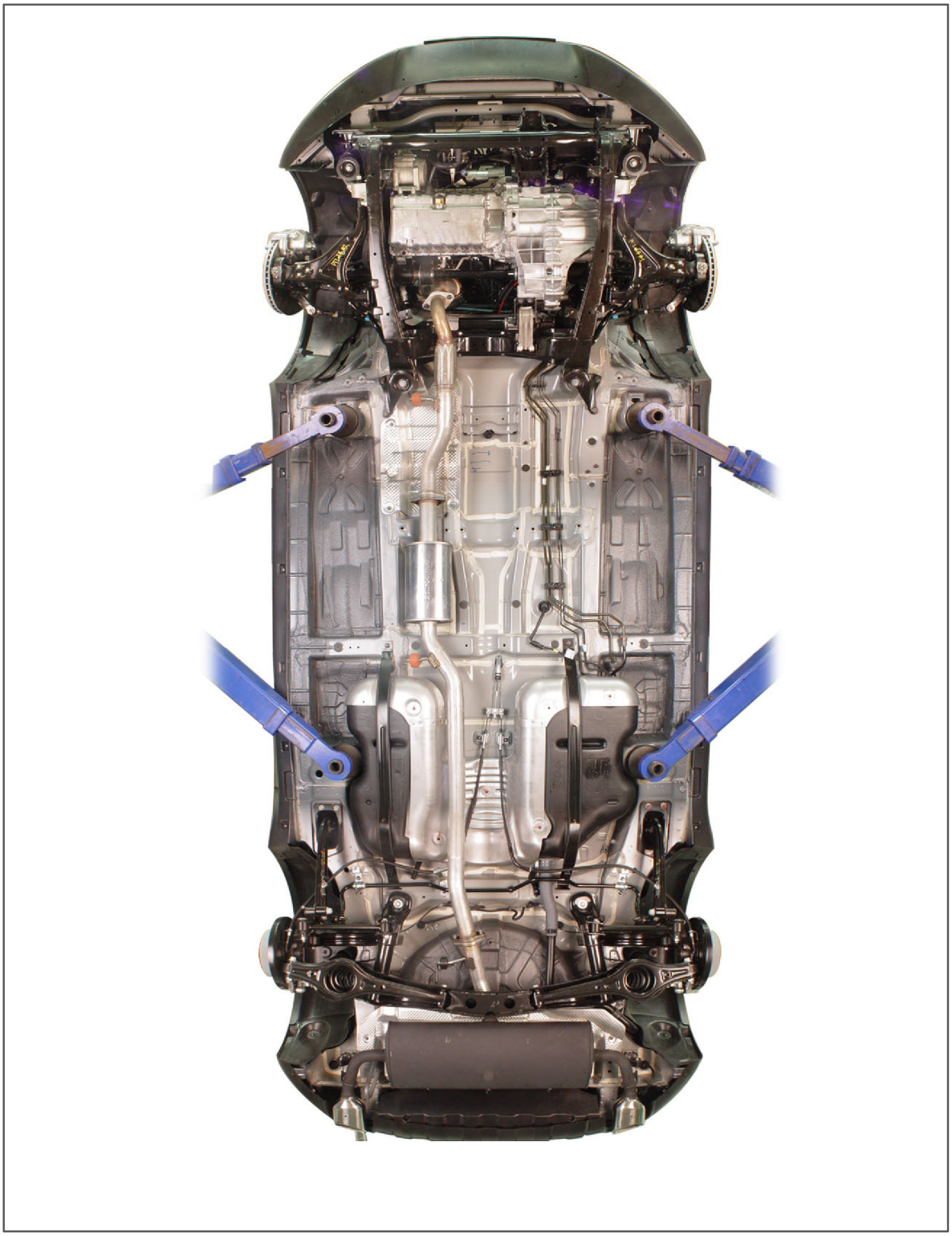
Rear view

Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2. LIFTING POINTS

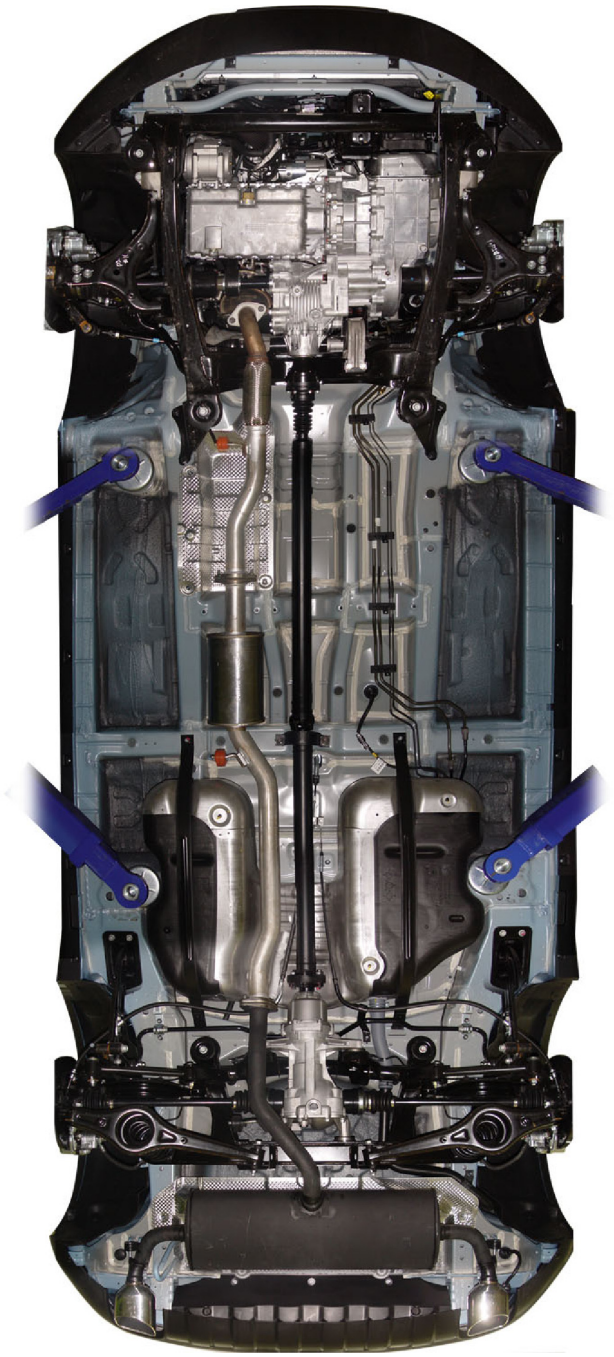
1) 2WD



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

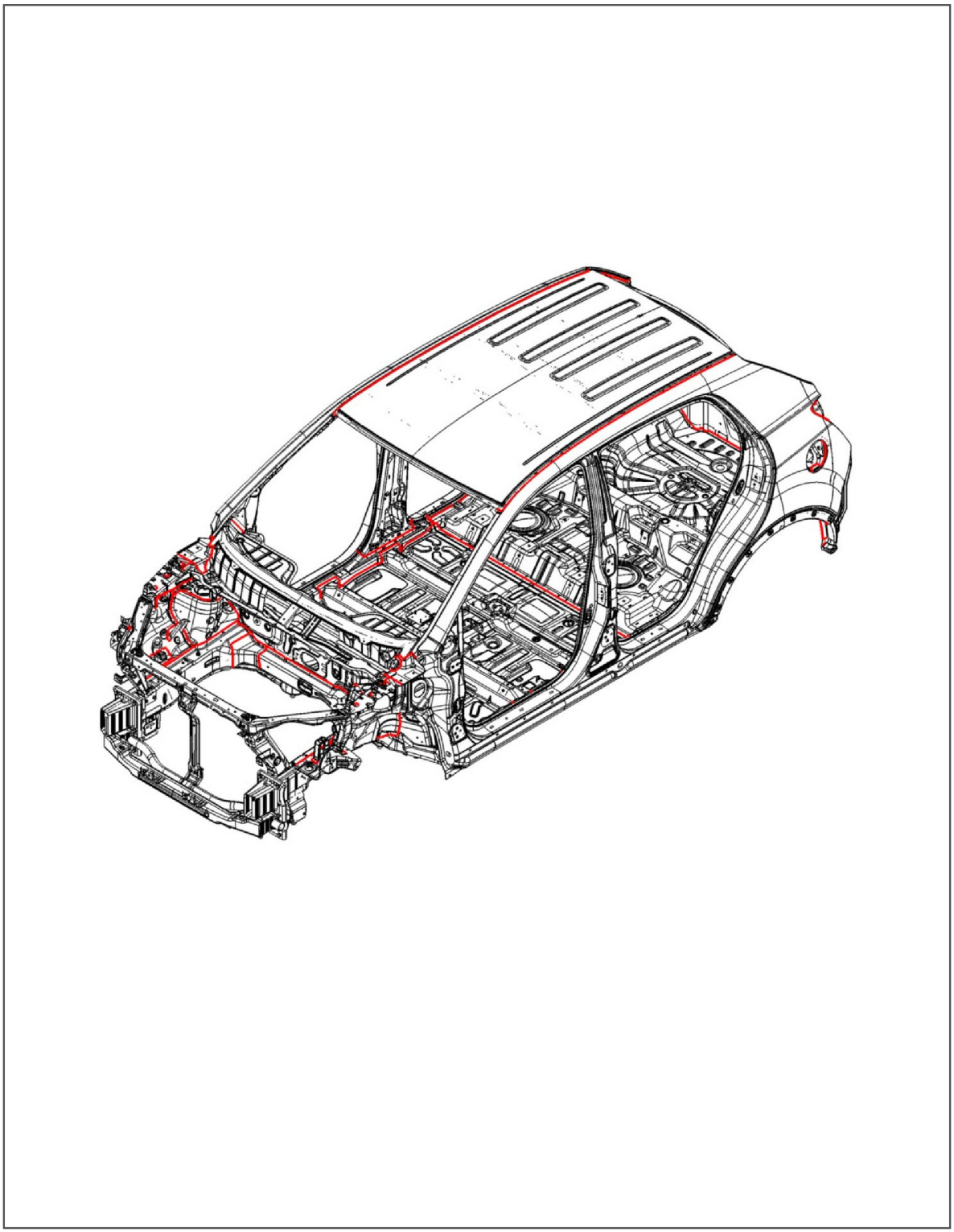
2) 4WD



Downloaded from www.Manualslib.com manuals search engine

3. SEALING APPLICATION POINTS

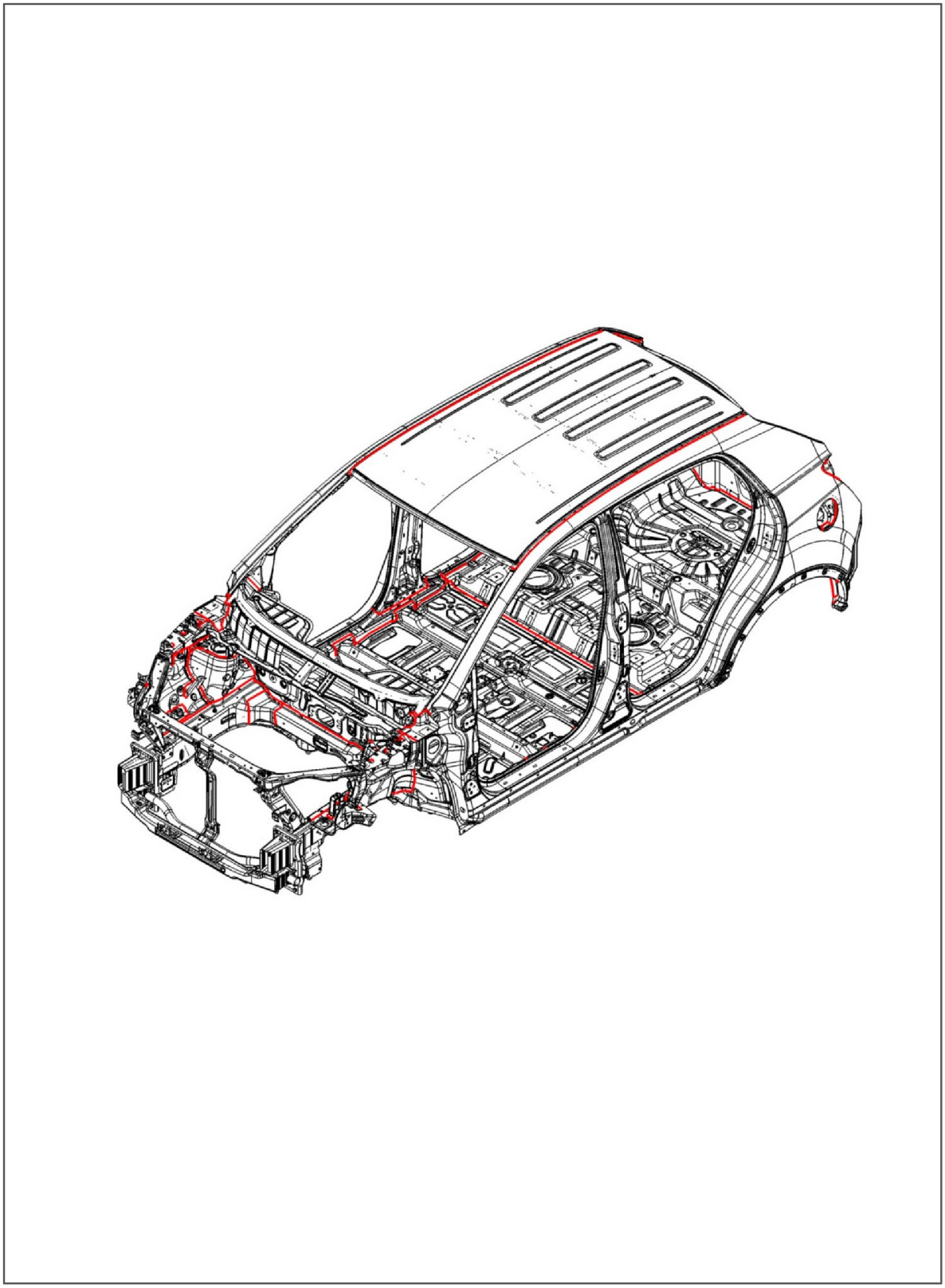
1) Dash panel, engine tunnel, floor, etc.



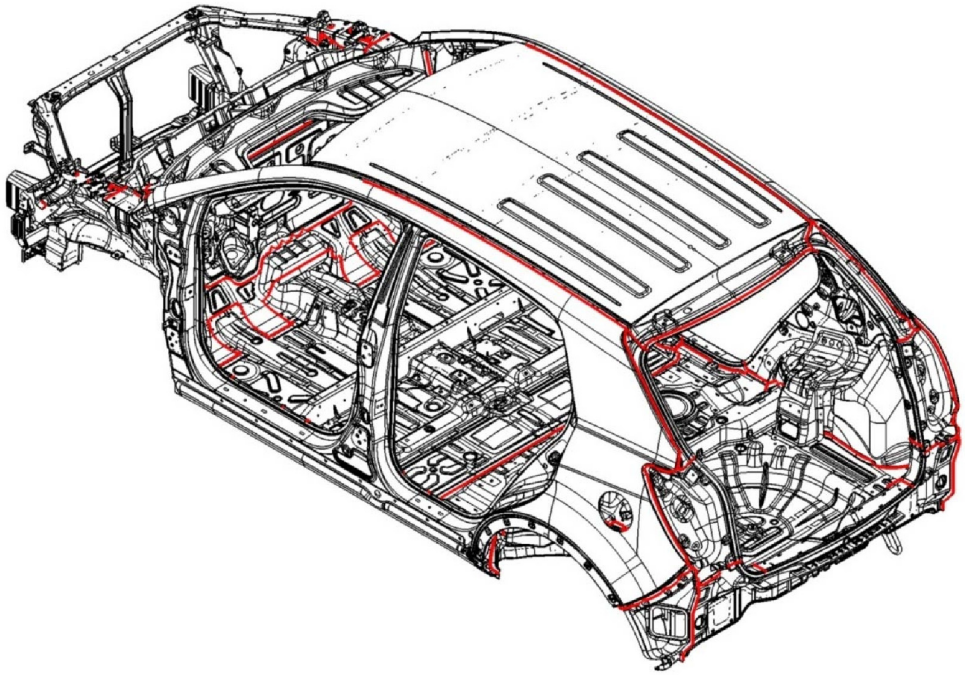
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) White Body



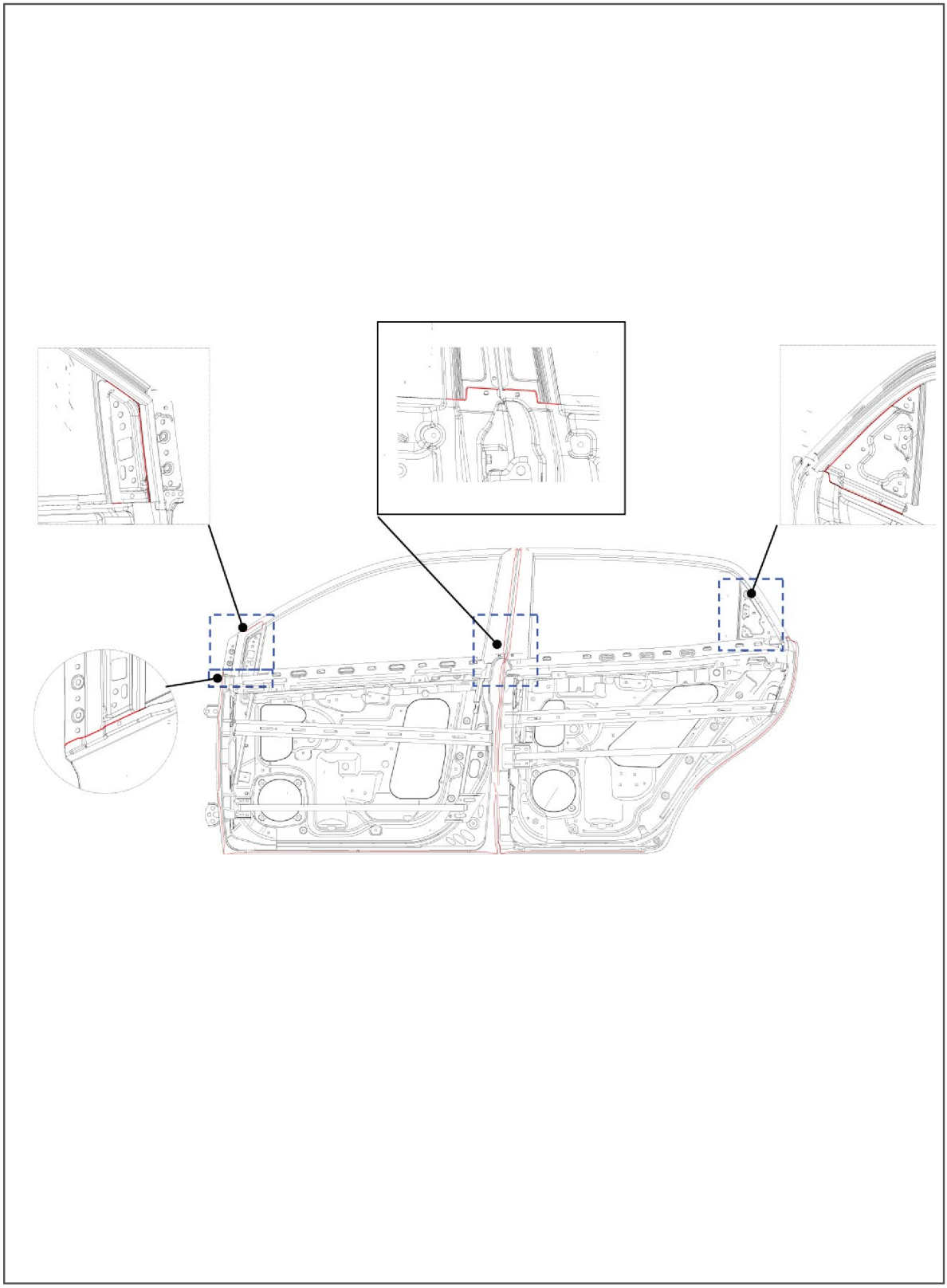
Downloaded from www.Manualslib.com manuals search engine



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

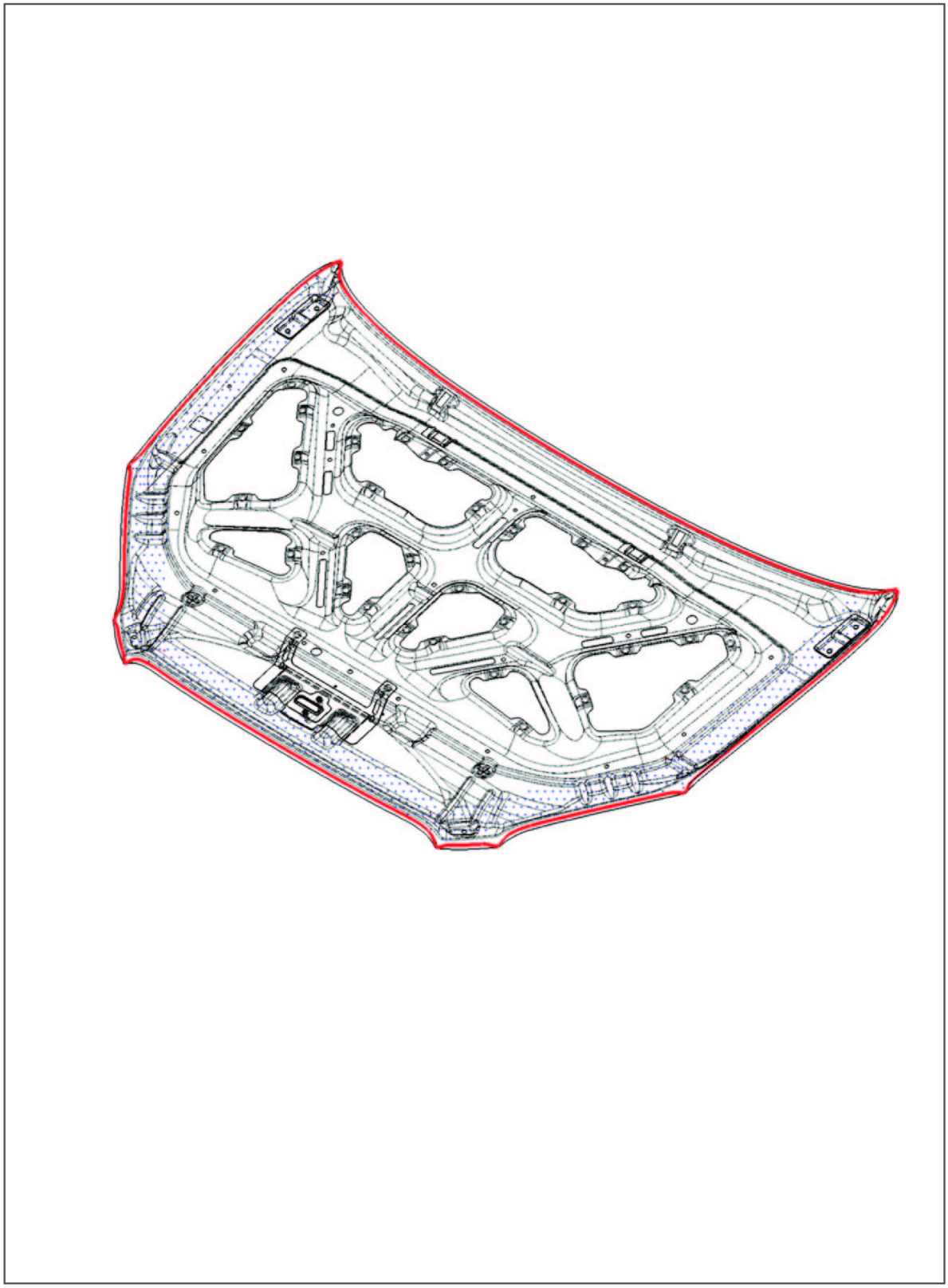
3) Front And Rear Door Panel



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

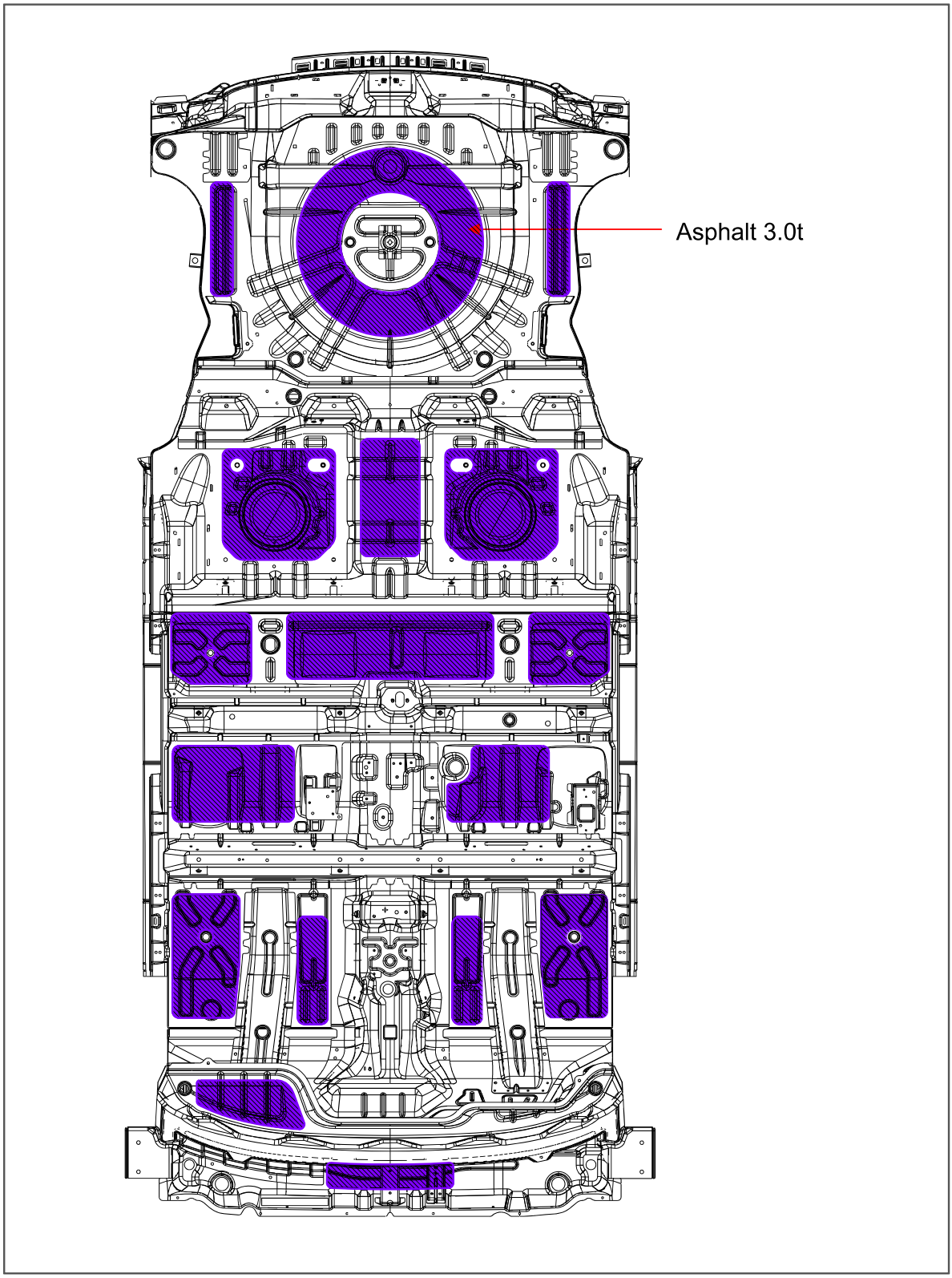
4) Engine Hood Panel



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4. DEADENER APPLICATION POINTS



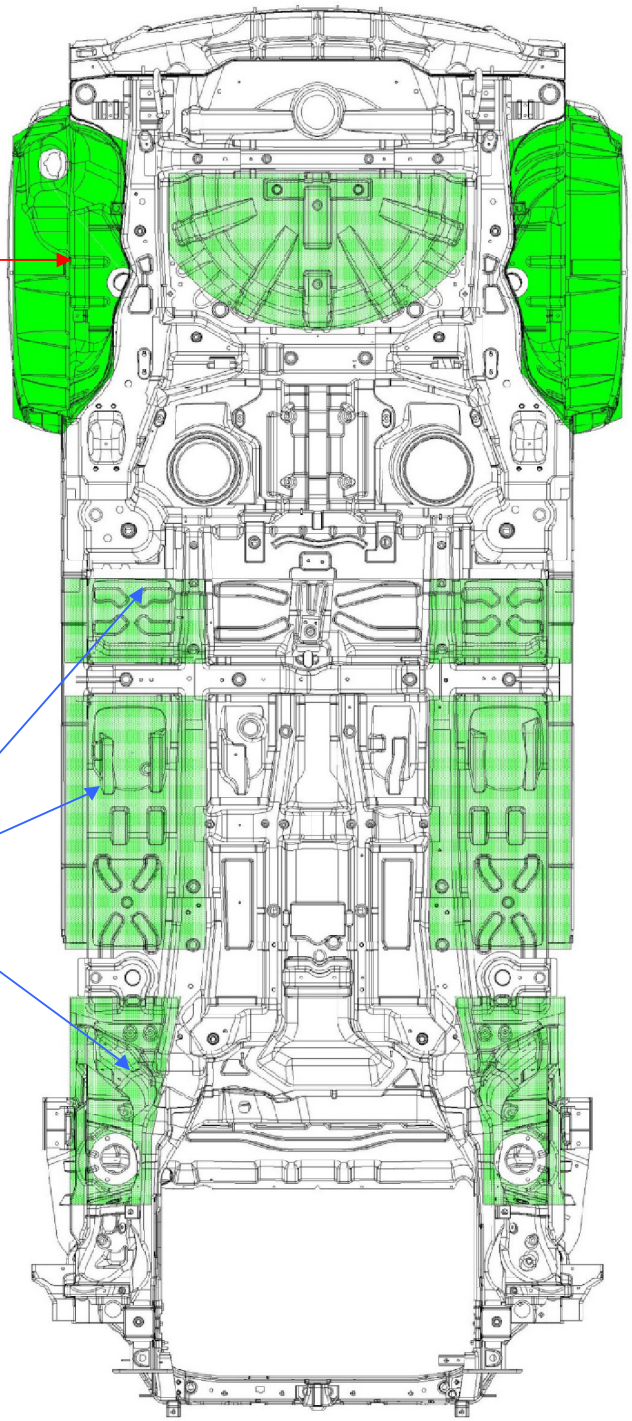
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

5. UNDER COATING

Thickness
: 500 $^{+100}_{-50}$ ㎛

Thickness
: 200 $^{+100}_{-50}$ ㎛

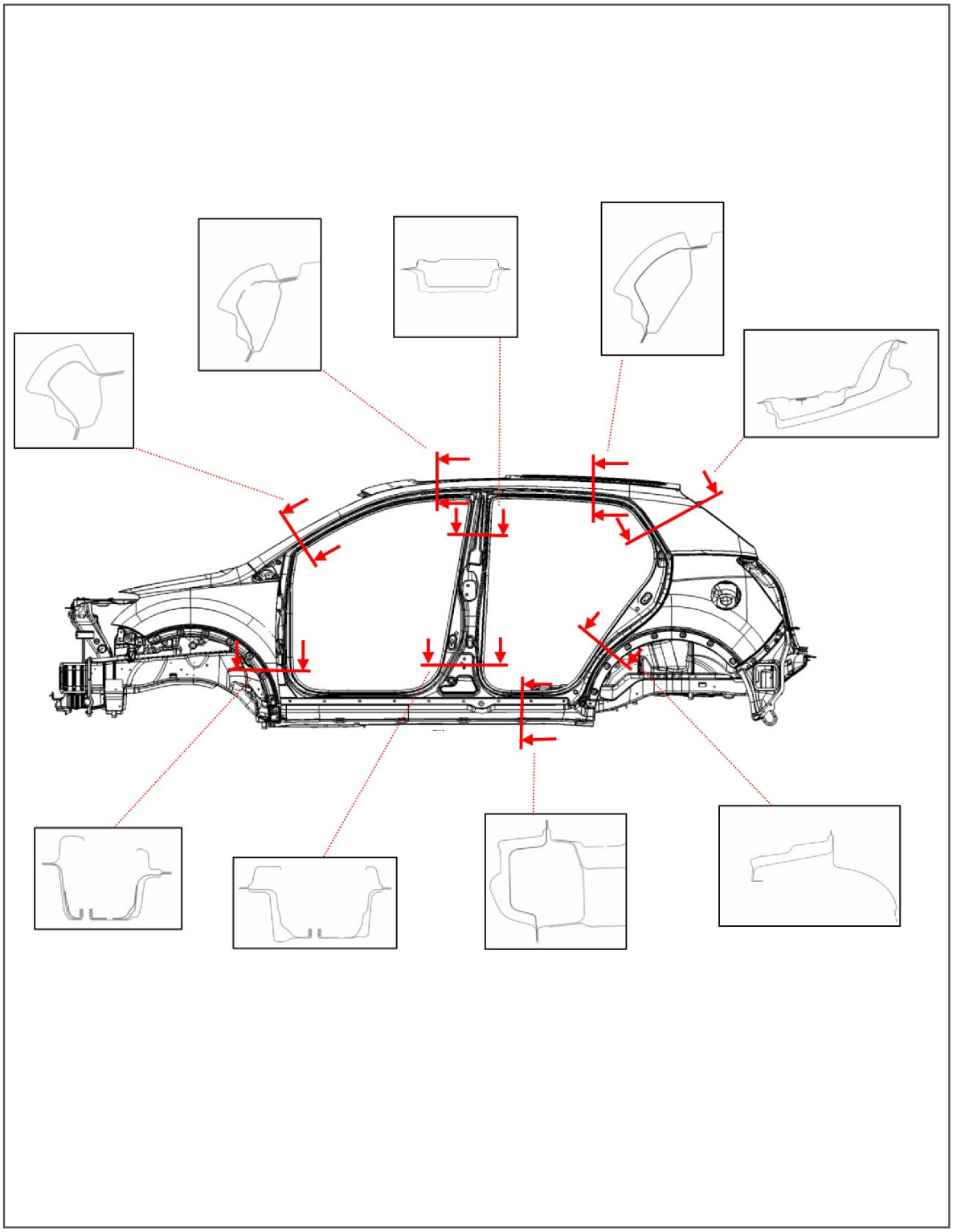


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

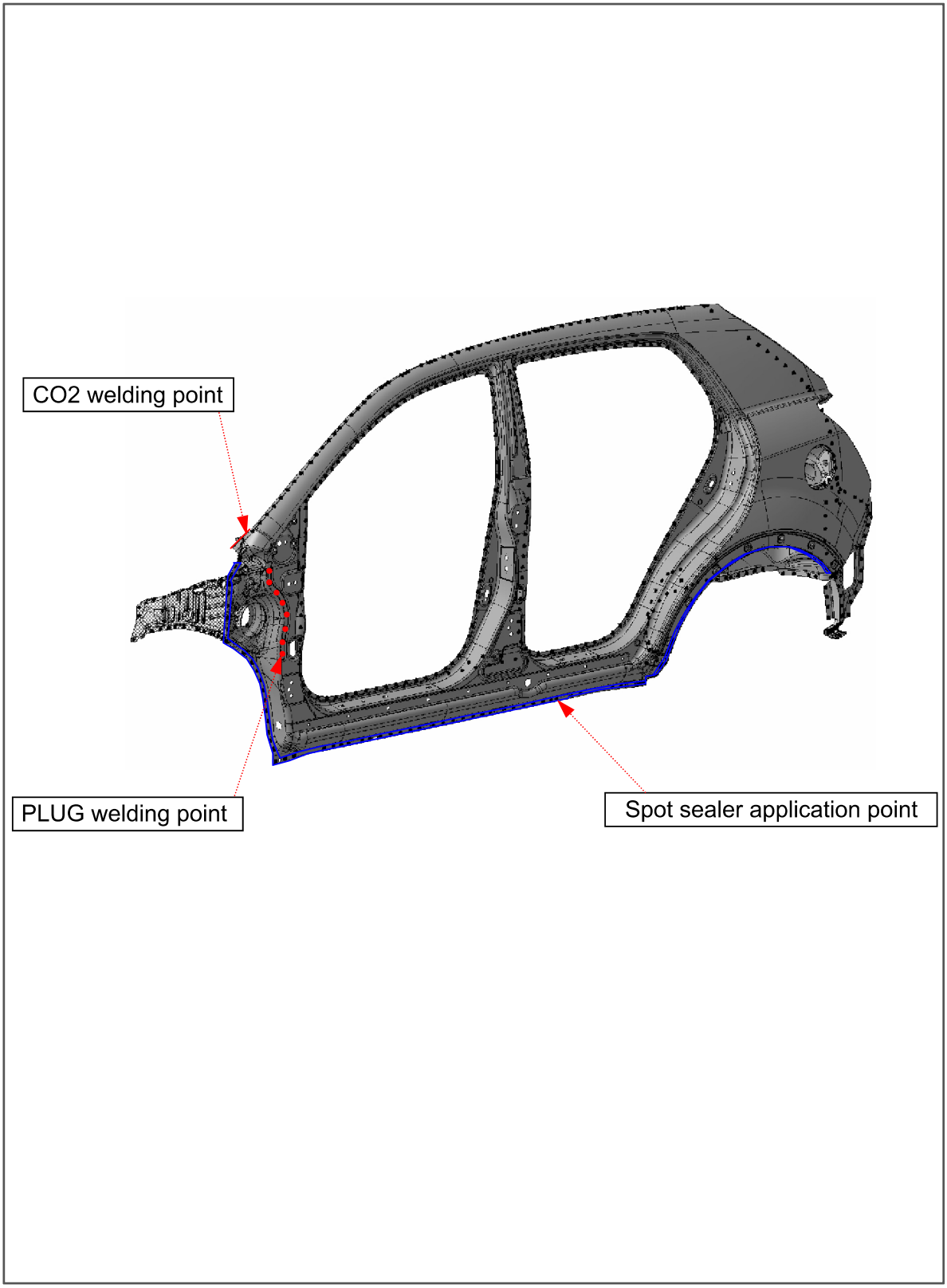
6. MAJOR WELDING POINTS

1) Cross Sectional View of Major Panels



Downloaded from www.Manualslib.com manuals search engine

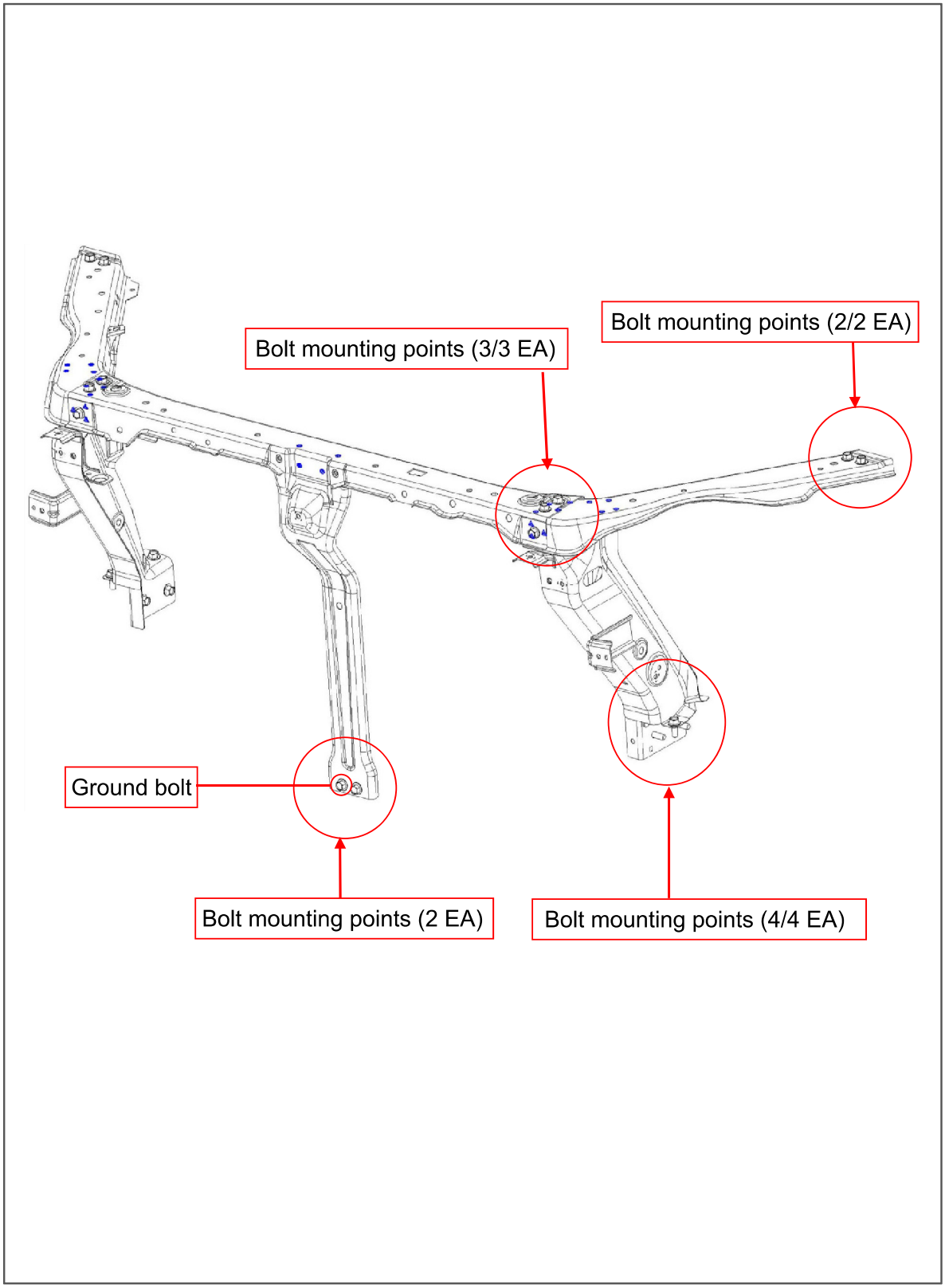
2) Side Panel



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

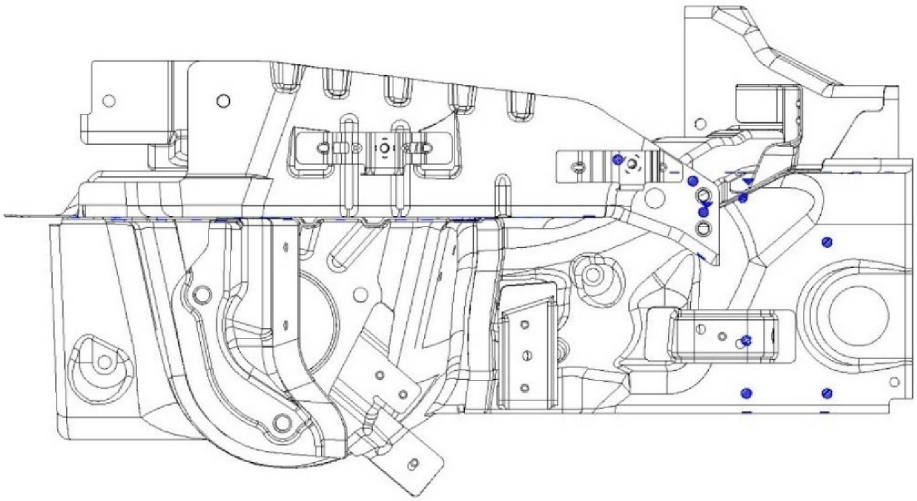
3) Front Panel

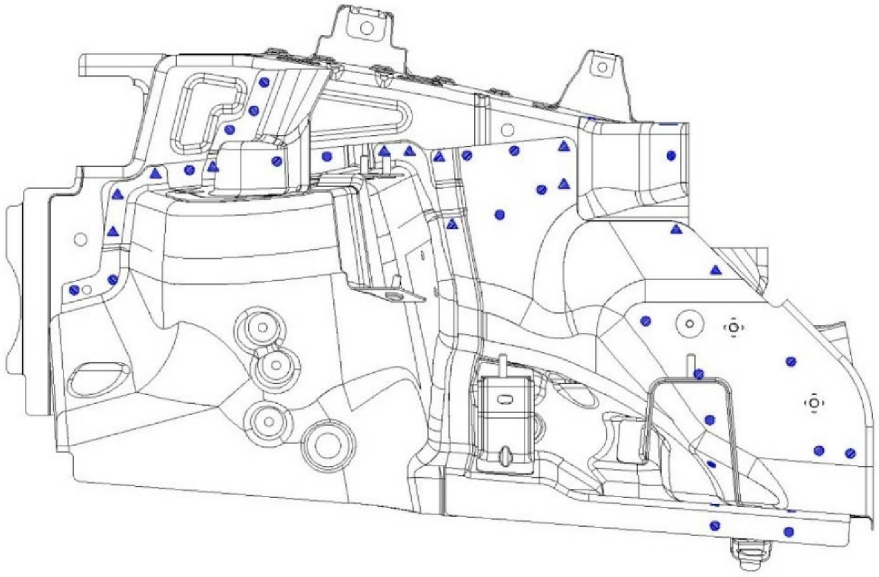


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

4) Apron Panel

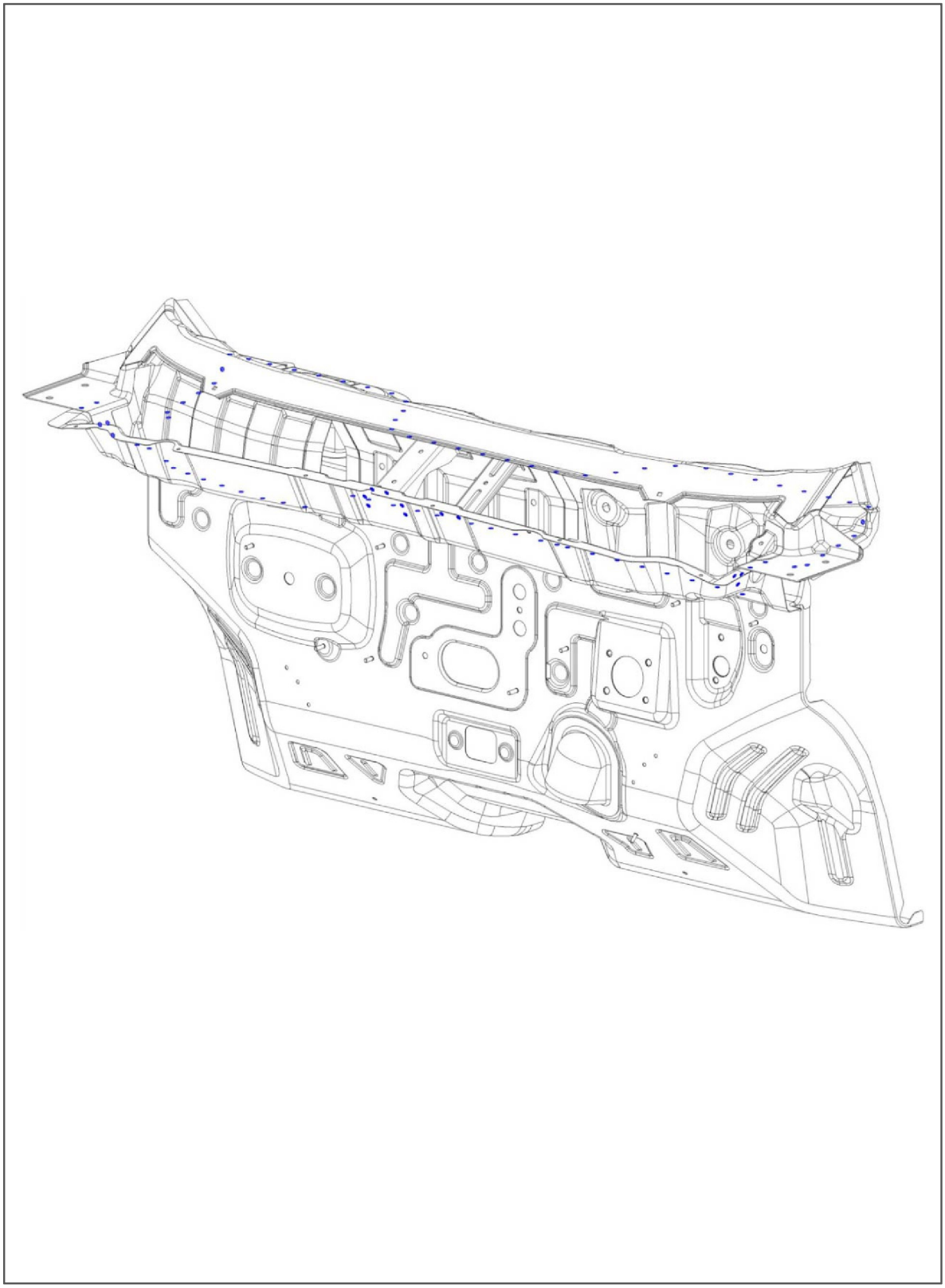




Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

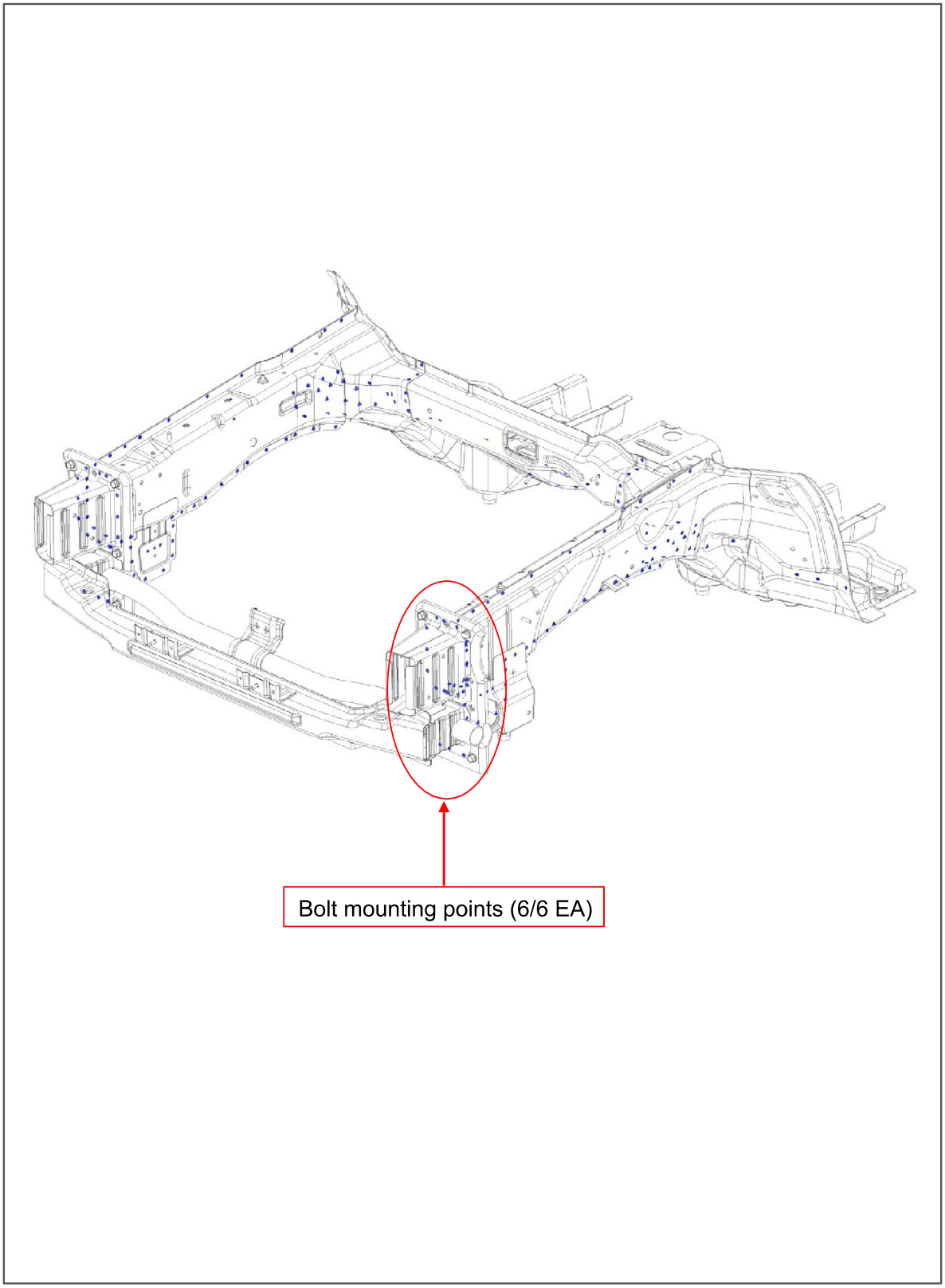
5) Dash & Cowl Panels



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

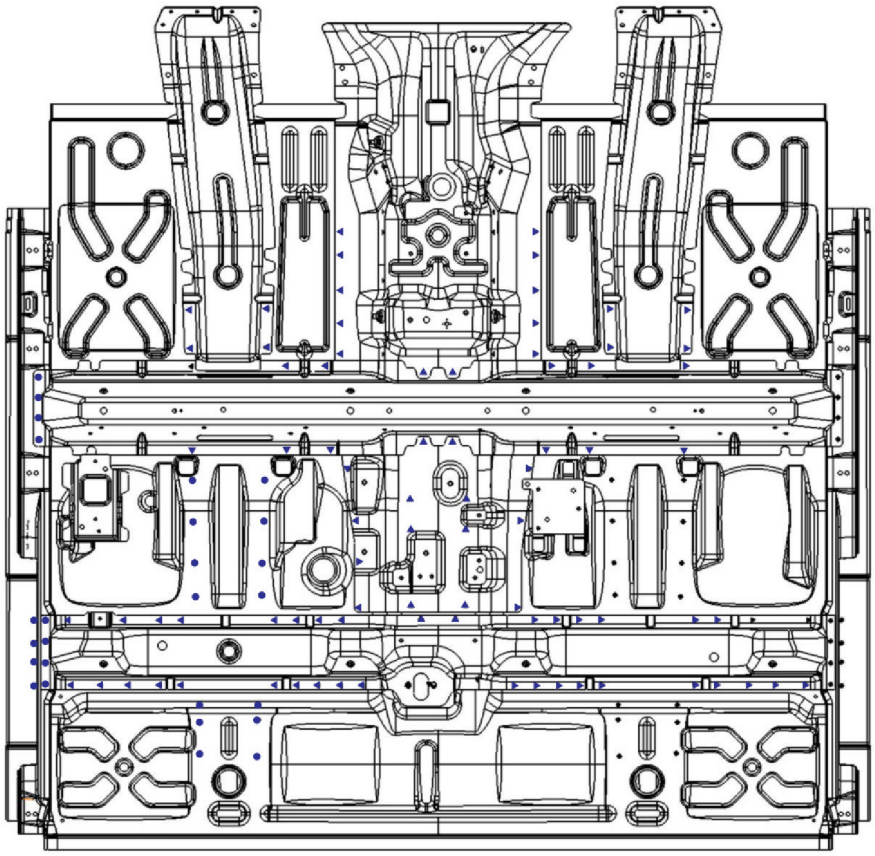
6) Front H-Frame Panel



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

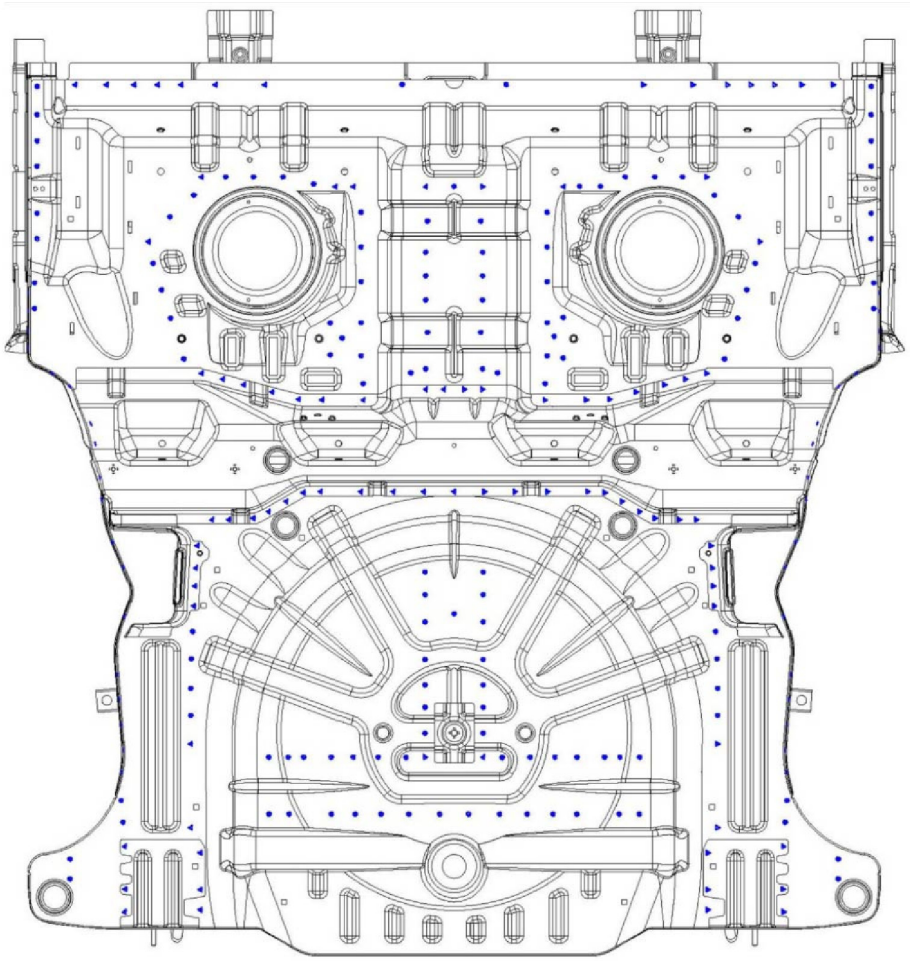
7) Front Floor Panel



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

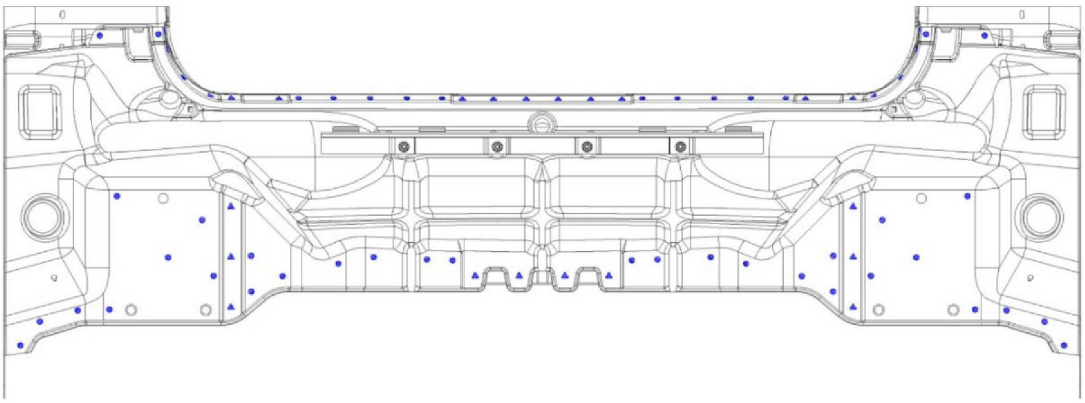
8) Rear Floor Panel



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

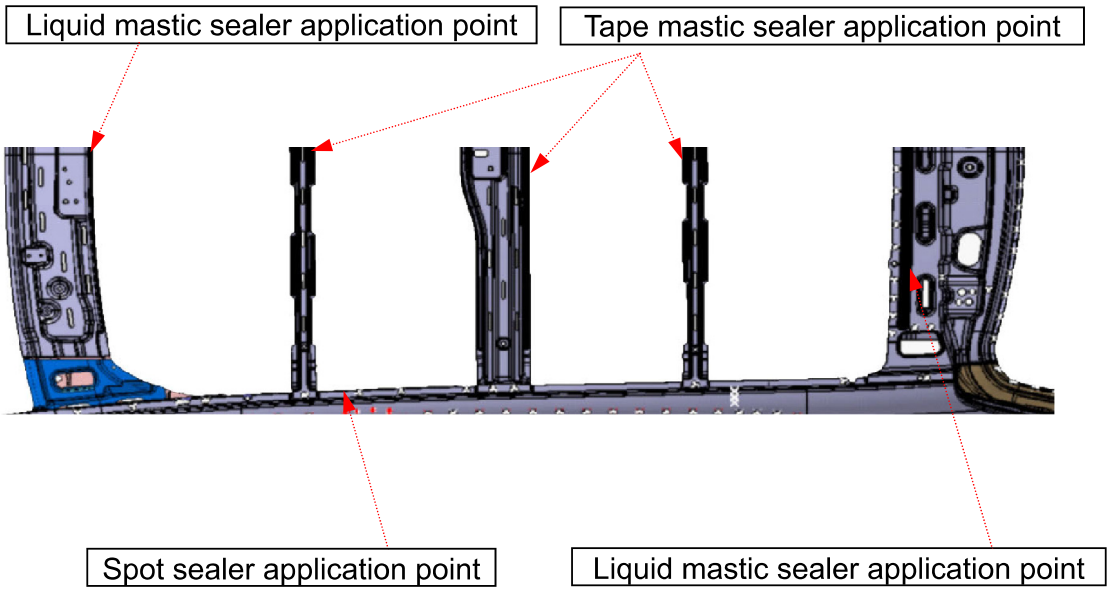
9) Rear End Panel



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

10) Roof Panel



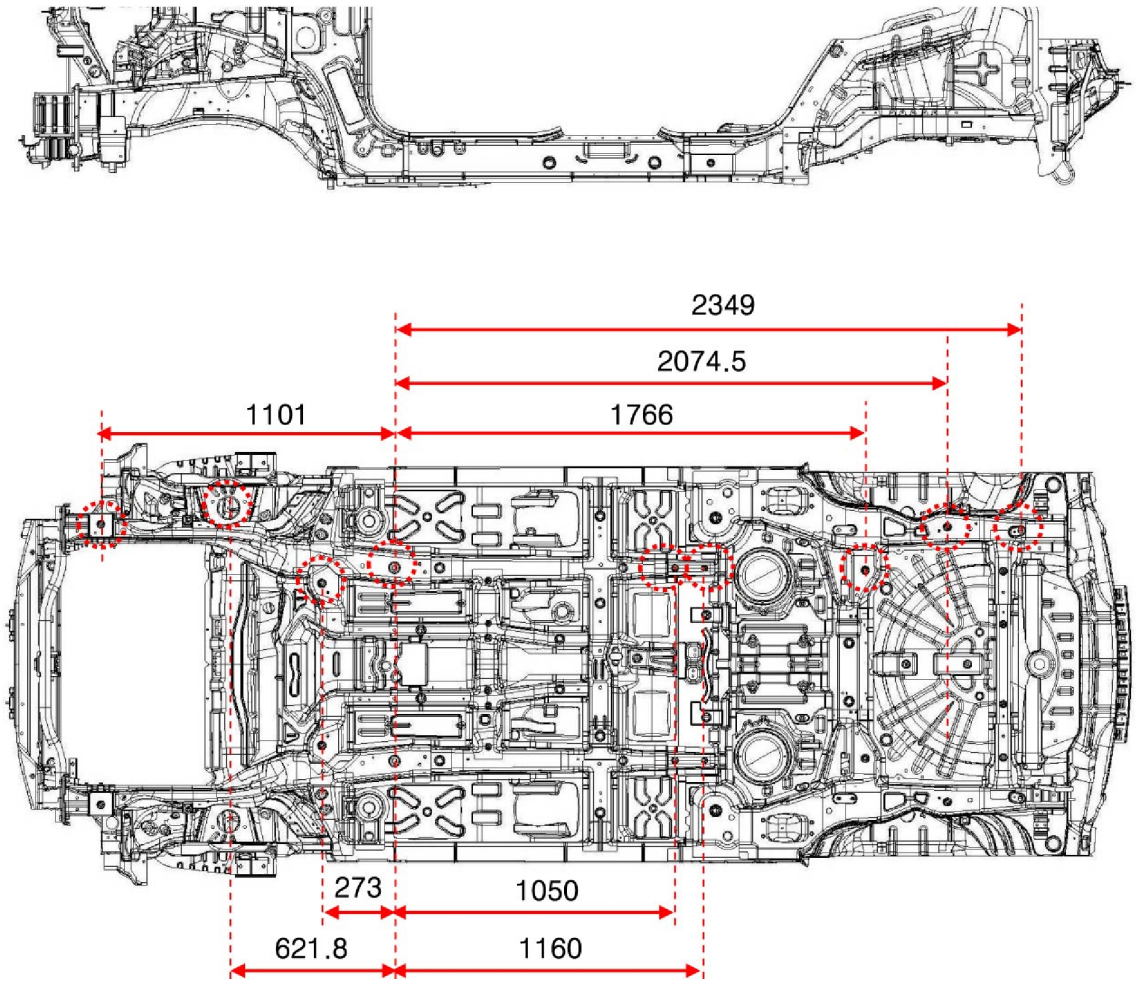
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

7. MAJOR BODY DIMENSIONS

1) Under Body

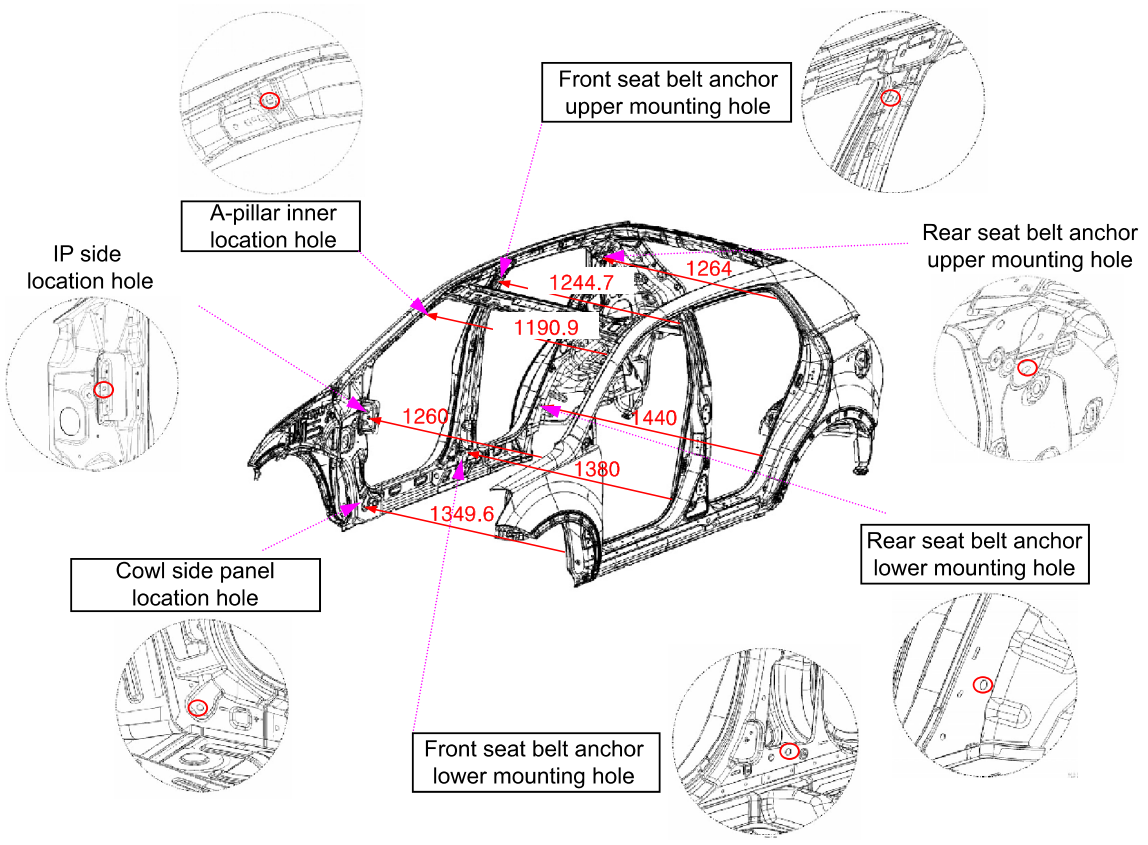
Unit: mm



Downloaded from www.Manualslib.com manuals search engine

2) Vehicle Structure

Unit: mm

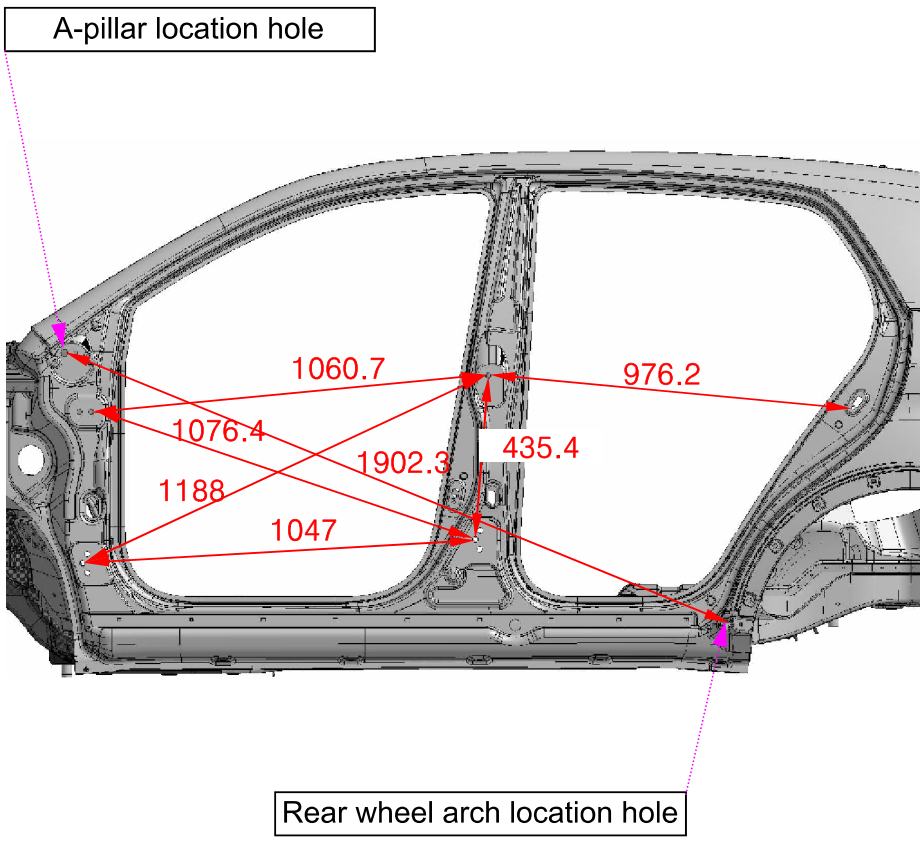


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Side Structure

Unit: mm

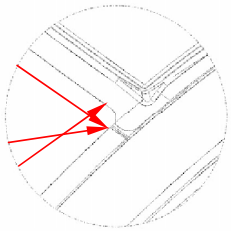


Modification basis	
Application basis	
Affected VIN	

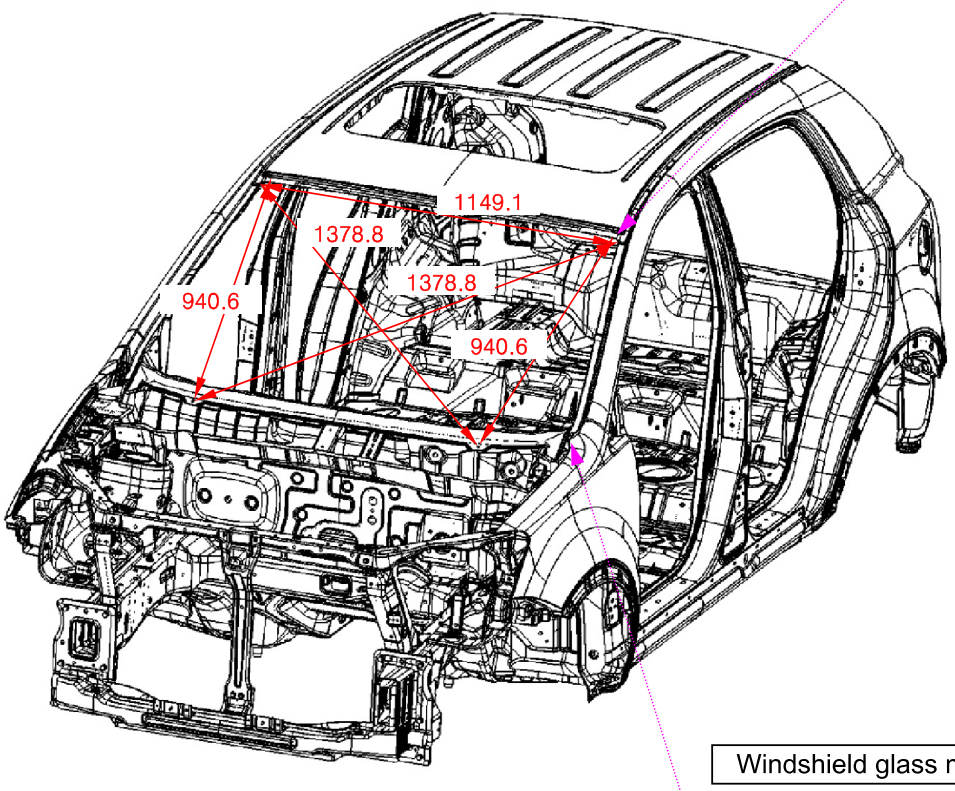
Downloaded from www.Manualslib.com manuals search engine

4) Windshield Glass Area

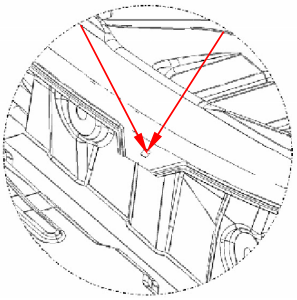
Unit: mm



Roof panel, side outer panel edge



Windshield glass mounting

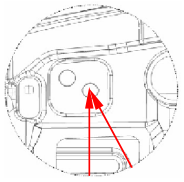


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

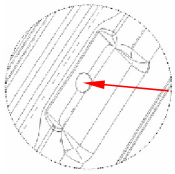
5) Tail Gate Area

Unit: mm

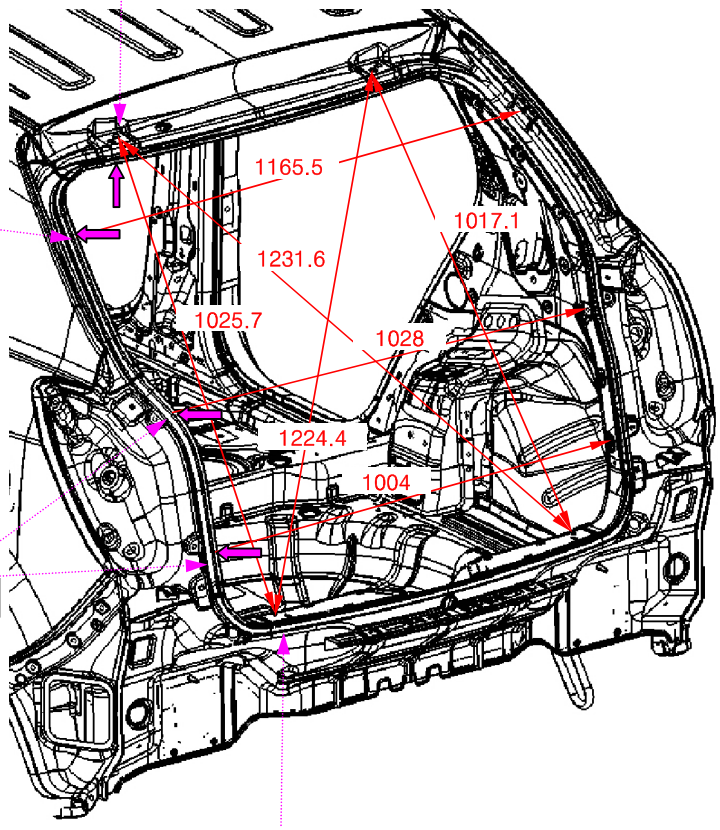


View from inside

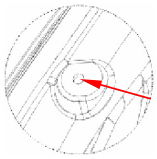
Tailgate hinge mounting
(left-right asymmetry)



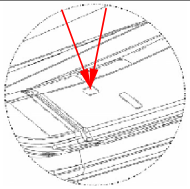
Tailgate gas lift
mounting



Quarter lower trim mounting



Tailgate trim mounting hole

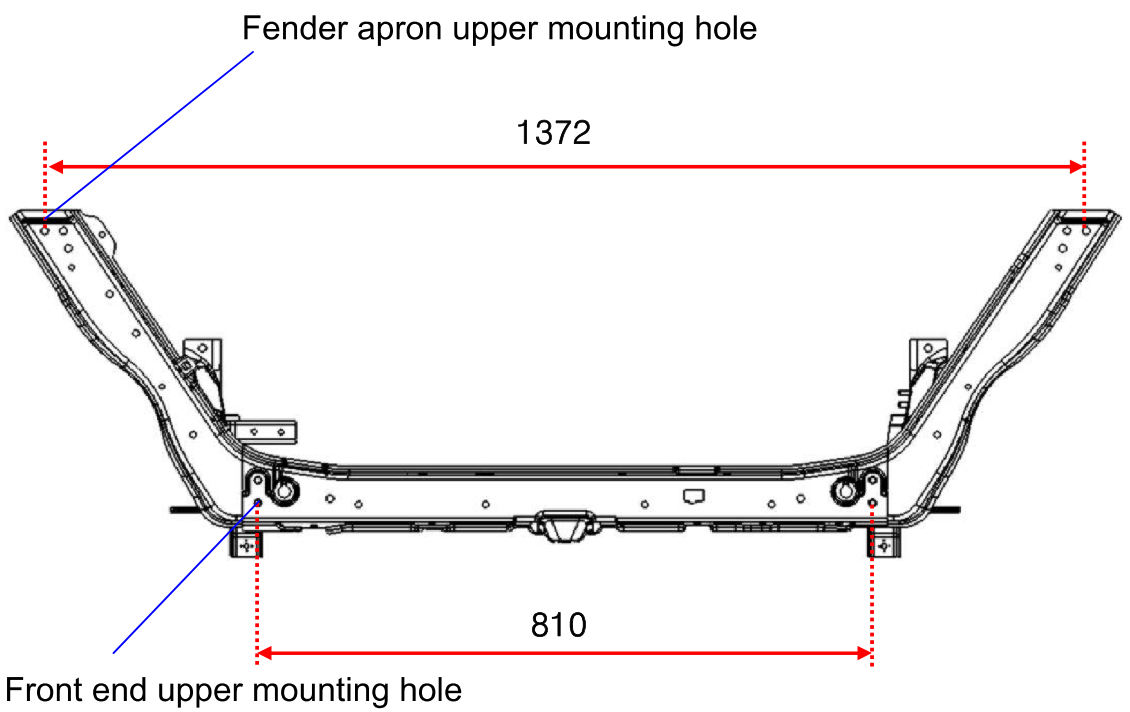


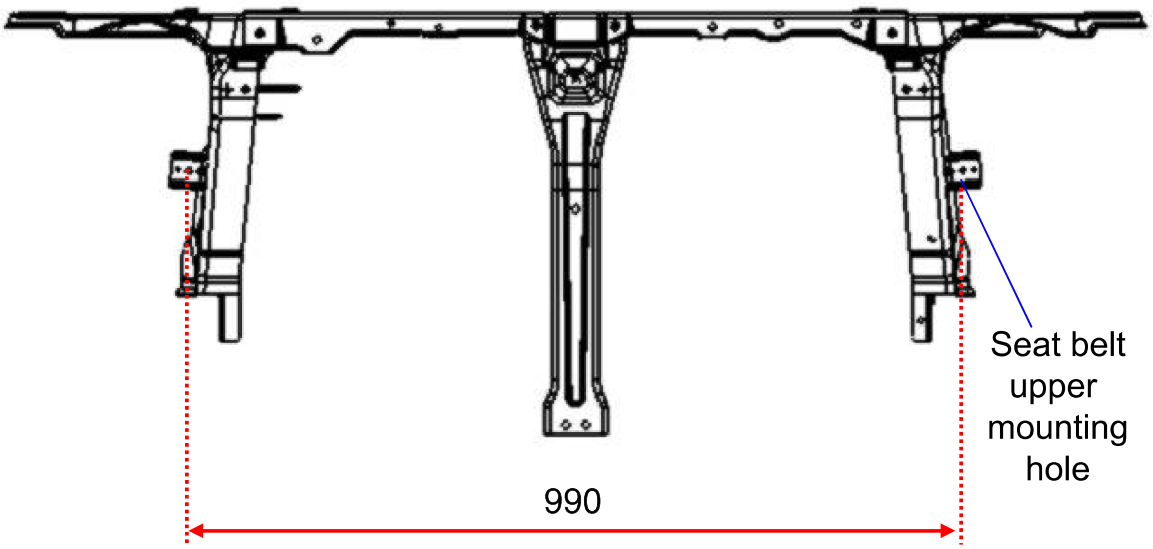
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

6) Front End

Unit: mm



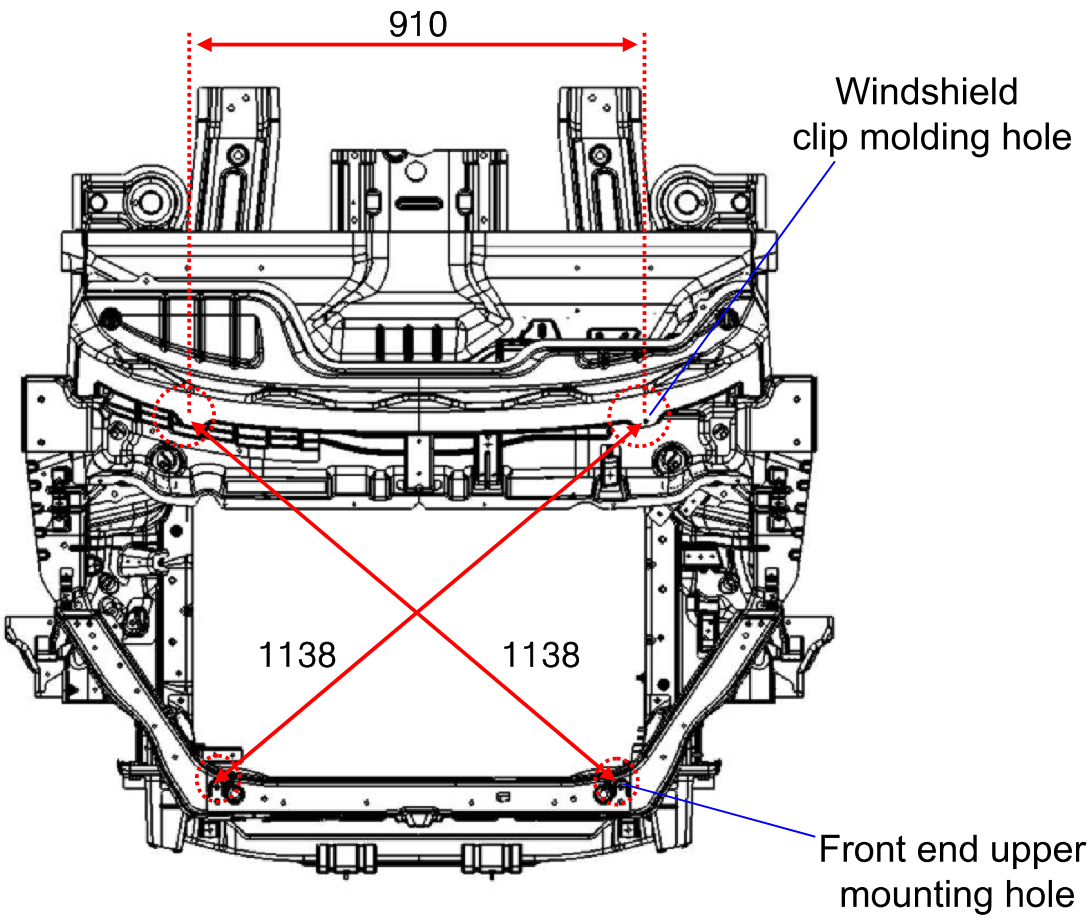


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

7) Engine Compartment

Unit: mm

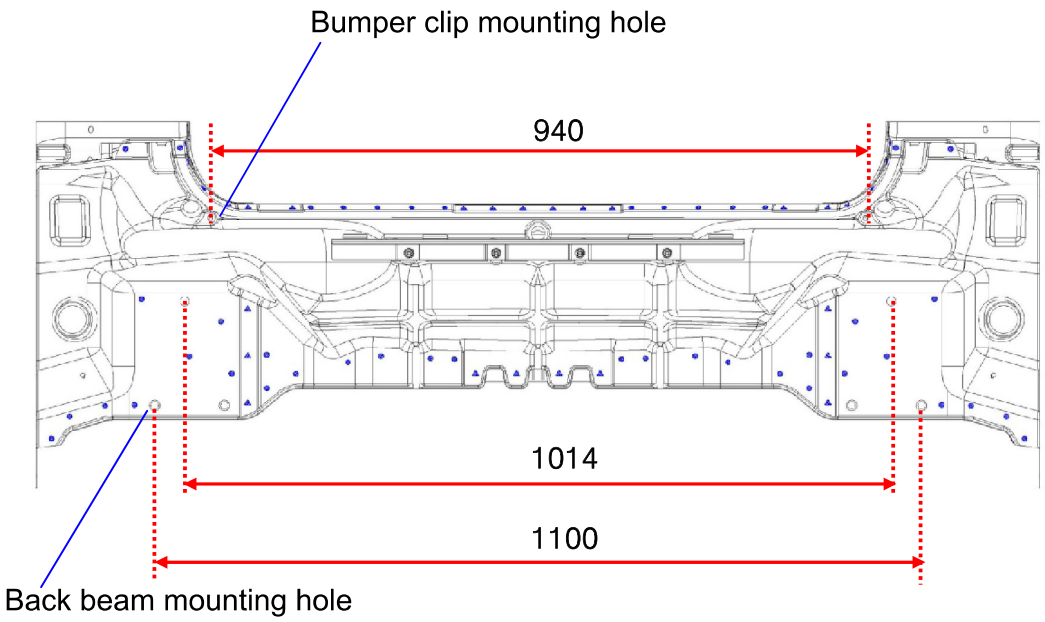


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8) Back Panel

Unit: mm



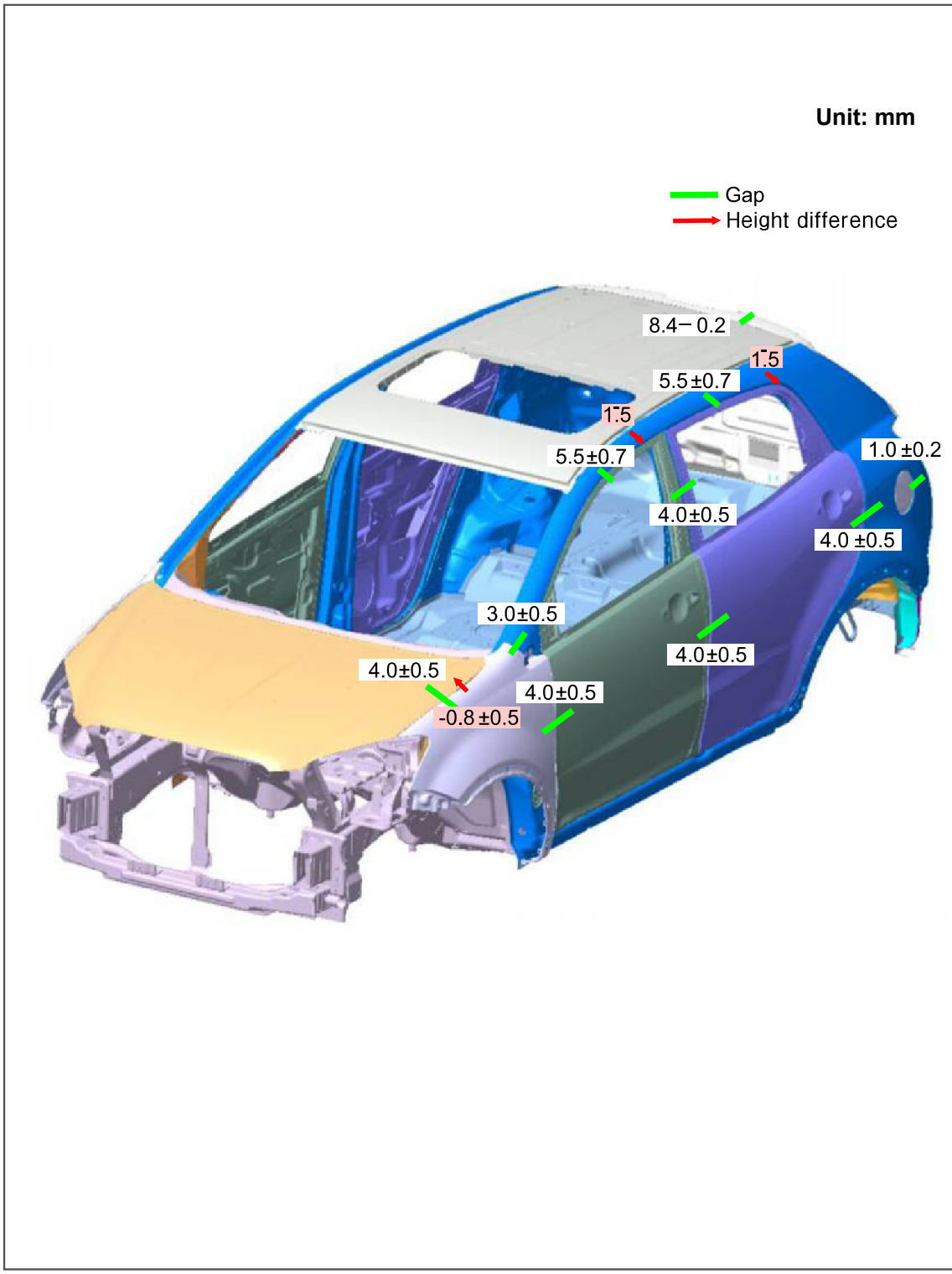
Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

8. GAP CHART

1) Side Body

Unit: mm

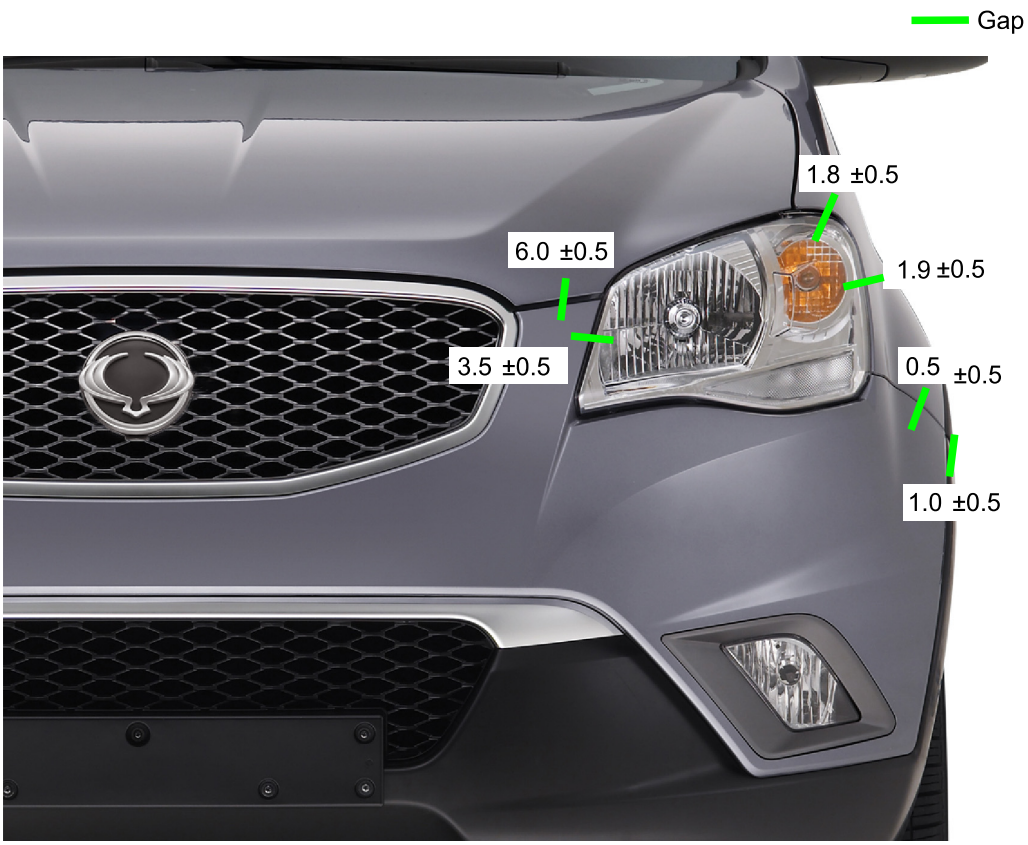


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

2) Front

Unit: mm

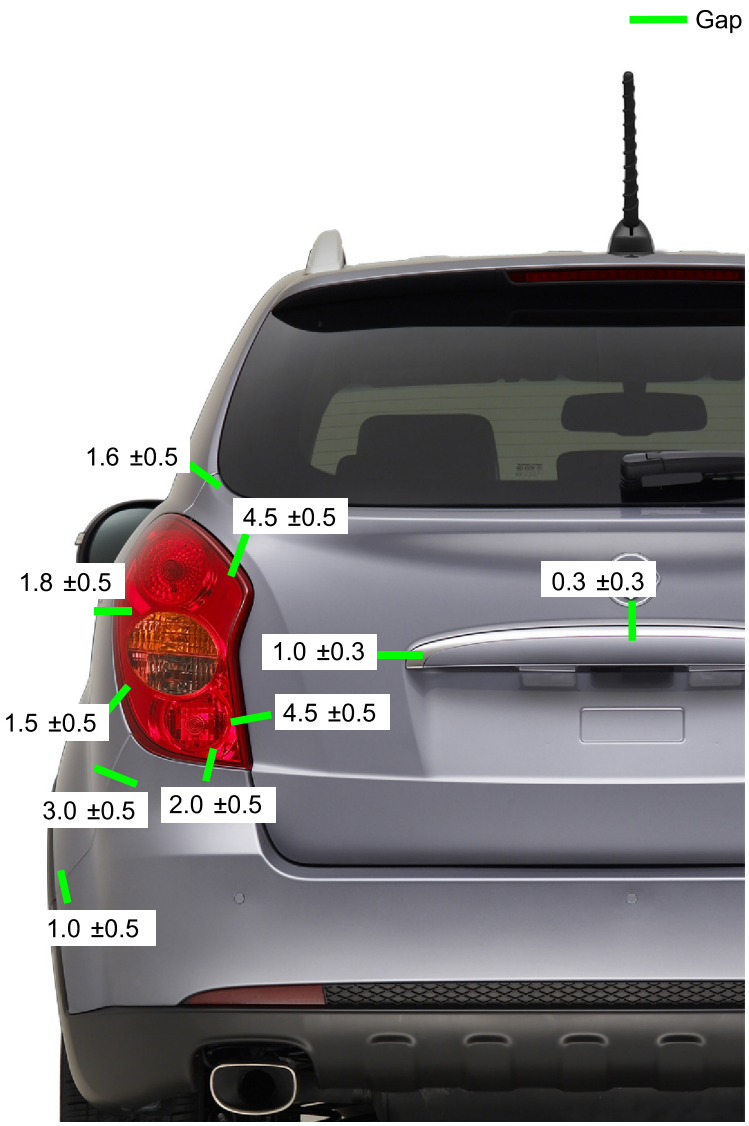


Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

3) Rear

Unit: mm



Modification basis	
Application basis	
Affected VIN	

Downloaded from www.Manualslib.com manuals search engine

Memo

Downloaded from www.Manualslib.com manuals search engine