INDEX

GENERAL INFORMATION

1. HOW TO READ ELECTRICAL WIRING DIAGRAM..... 3

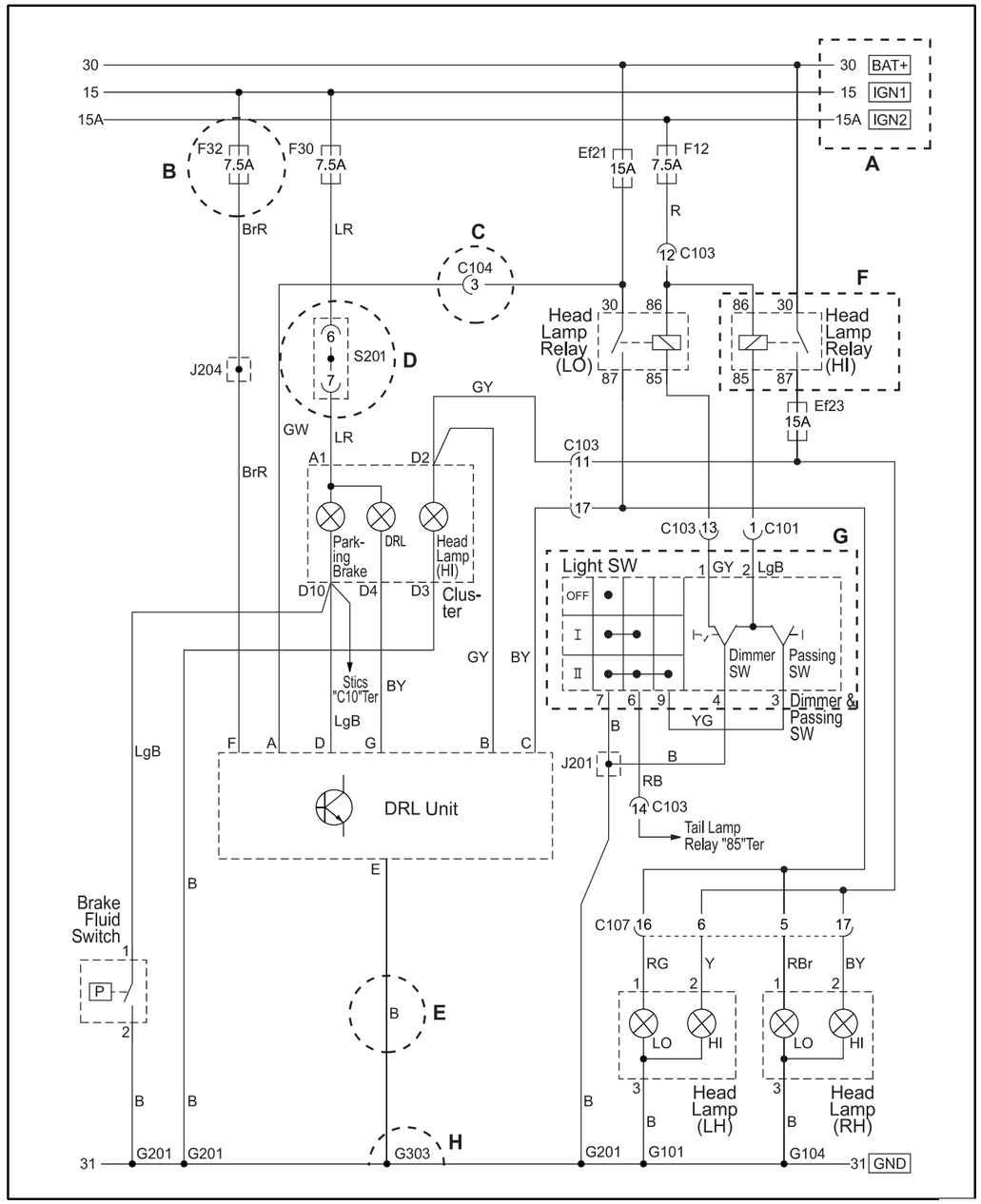
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GENERAL INFORMATION

1. HOW TO READ ELECTRICAL WIRING DIAGRAM

1) HOW TO READ ELECTRICAL WIRING DIAGRAM



2) CONTENTS OF ELECTRICAL WIRING DIAGRAM (CIRCUIT)

Position	Explanation
A	- Upper horizontal lines : Power supply lines - Power supply lines : 30, 15, 15A, 15C, 58
B	- Ef20 or F2 : Fuse Number ·Ef20 : Fuse No #20 in engine room compartment ·F2 : Fuse No #2 in passenger room compartment
C	- Connector (C101 ~ C402) ·Connector No C203 terminal No1 ·Refer to Major Connector Position (Section 2)
D	- S201 : Splice pack (S101 ~ S302) ·Refer to Major Splice Pack Position (Section2)
E	- Wiring Harness Color ·Refer to Wiring Harness Color Abbreviation
F	-Internal circuit of component (Relay) (Component Name and Terminal Number)
G	- Internal circuit of component (Switch) (Component Name, Terminal Number and Connecting Wiring Circuit)
H	- Lower horizontal line : Ground line ·Ground position (G101 ~ G401) ·B : Body Ground ·Refer to Major Ground Position (Section2)

3) CIRCUIT IDENTIFICATION SYMBOL

Identification Symbol	Meaning
C	Connector
D	Diode
Ef	Fuse in engine room fuse & relay box
F	Fuse in passenger room fuse box
G	Ground
S	Splice pack (Junction connector)

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 "ON" and "ACC"
30	Battery Voltage (B+) supply directly regardless of Ignition Switch
31	Ground connected to battery (-)
58	Battery Voltage (B+) supply in Head Lamp Switch 1st and 2nd step (Illumination circuit)

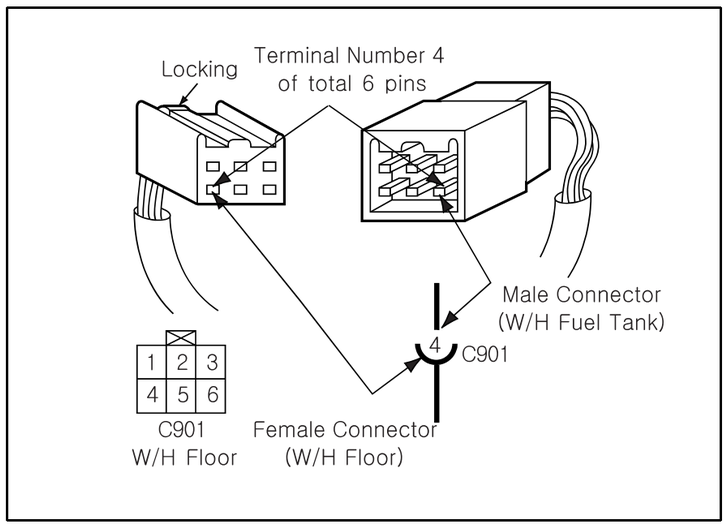
5) WIRING HARNESS COLOR IDENTIFICATION

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
Gr	Orange	B	Black
Lg	Light Green		

6) HOW TO CHECK TERMINAL NUMBER OF CONNECTOR

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

- ex) Terminal Number 4 of C901 connection



Modification basis	
Application basis	
Affected VIN	

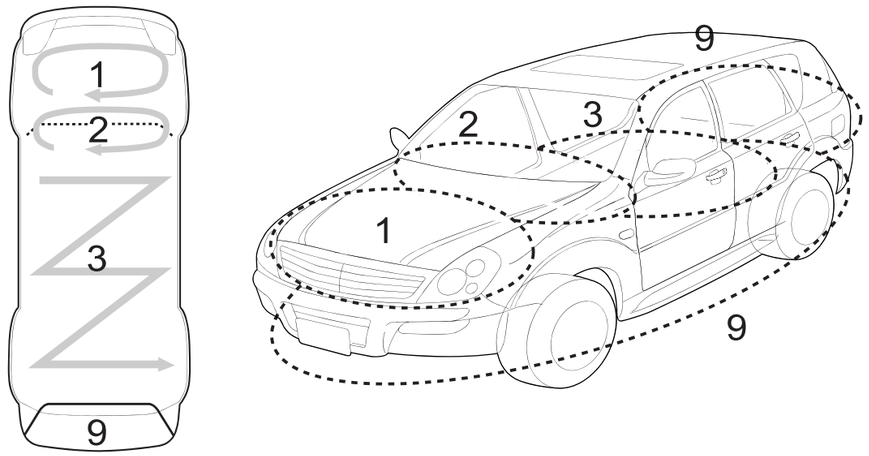
7) PART LOCATION ACCORDING TO PART NUMBER

▶ **Ex.) C 1 0 2**

- C : Symbol character for connector

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 : Part location number



- Part number according to locating section

Part Numbe	Location
□ 1□□	Engine compartment
□ 2□□	Instrument panel
□ 3□□	Passenger compartment, Tailgate
□ 9□□	Underbody

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

- 02 : Part number

8) 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	

9) ABBREVIATIONS

Classification	Abbreviations	Full words
A	A/BAG	Air Bag
	A/CLNR	Air Cleaner
	A/CON (A/C)	Air Conditioner
	A/DUCT	Air Duct
	A/T	Auto Transmission
	ABD	Automatic Brake Differential
	ABS	Anti-lock Braking System
	AC	Alternating Current
	ACC	Accessory
	ACCEL	Accelerator
	ACS	Auto Cruise System
	ACTR (ACT)	Actuator
	ALT	Alternator
	AMP	Ampere
	ANT	Antenna
	ASR	Anti Slip Regulator
	ASSY	Assembly
	ATC	Automatic Temperature Controller
	ATDC	After Top Dead Center
	AUX	Auxiliary
	AVR	Automatic Voltage Regulator
B	BATT	Battery
	B/UP	Back Up
	B/DR	Back Door
	B/WDW	Back Window
	BDC	Bottom Dead Center
	BIW	Body in White
	BTDC	Before Top Dead Center
C	COMP	Compressor
	C/FAN	Condenser Fan
	CONN	Connector
	C/LIGHTER	Cigar Lighter
	CRU	Cruise
	C/PAD	Crash Pad
	CANI	Canister
	CB	Contact Breaker
	CBL	Cable
	CC	Catalystic Converter

Classification	Abbreviations	Full words
C	CD-I	Compact Disk - Interactive
	CLG	Cooling
	CLH	Clutch
	CONT	Control
	CONV	Converter
	CPLG	Coupling
	CRS	Child Restraint System
	CTR	Center
D	DSL	Diesel
	DR	Door
	DN	Down
	D/CTSY	Door Courtesy
	D/SW	Dimmer Switch
	DC	Direct Current
	DEFOG	Defogger
	DIAPH	Diaphragm
	DYN	Dynamo
	DWG	Drawing
	DRV	Driver
	D/P SW	Dual Pressure Switch
E	ENG	Engine
	ECU	Electronic Control Unit
	EGR	Exhaust Gas Recirculation System
	ESC	Engine Spark Control
	ESIMS	Electronic Steering & Inside Mirror Control System
	EXTR	Exterior
F	FRM	Frame
	FWD	Forward
	FL	Front Left
	FR	Front Right
	F/PUMP (F/P)	Fuel Pump
	F/LEVEL'G	Fluid Leveling
	FRT	Front
	F/LINK	Fusible Link
	F/BOX	Fuse Box
	F/DR	Front Door
	F/FLR	Front Floor
	F/SEAT	Front Seat

Modification basis	
Application basis	
Affected VIN	

Classification	Abbreviations	Full words
F	F/TIME	Full Time
	F/C	Fuel Cut
	FLEX	Flecible
	FLR	Floor
	FLTR	Filter
	FM	Frequency Modulation
	FO	Firing Order
G	GND	Ground
	GSL	Gasoline
	GL/BOX (G/BOX)	Glove Box
H	HARN	Harness
	HTG	Heating
	HTR	Heater
	H/LP (H/LAMP)	Head Lamp
	HI/LH (RH)	High Beam/Left Hand (Right Hand)
	HFM	Hot Film Air Flow Meter
	HI	High
I	INTLK	Interlock
	INTR	Interior
	IGN (IGN1, IGN2)	Ignition
	IND	Indicator
	INT	Intermittent
J	JNT	Joint
K	K/DOWN	Kick Down
L	LHD	Left Hand Drive
	LP	Lamp
	LH	Left Hand
	LO	Low
M	MTR	Motor
	M/T	Manual Transmission
N	N/C	Normal Close
	N/O	Normal Open
O	O/PRESS	Oil Pressure
	O/PUMP	Oil Pump
	O/S MIRROR	Out Side Mirror
	OVPR	Over Voltage Protection Relay
P	POS LP	Position Lamp
	PTC	Potentio Temperature Contol

Classification	Abbreviations	Full words
P	PLA	Pneumatic Idle Speed Increase
	P/ANT	Power Antenna
	POS	Position
	P/WDW	Power Window
	PBR	Potentio Balance Resistor
R	REKES	Remote Keyless Entry System
	RHD	Right Hand Drive
	RLY	Relay
	RH	Right hand
	RR	Rear
	RHEO	Rheostat
S	S & E MODE	Standard & Exonomy Mode
	S/M	Speed Meter
	SPK	Speaker
	SW	Switch
	S/LP	Stop Lamp
	S/BELT	Seat Belt
	SIG	Signal
	SLD (SOL)	Solenoid
	S/ROOF	Sun Roof
	STICS	Super Time & Alarm Intergrated Control
T	TCU	Transmission Contol Unit
	TEMP	Temperature
	T/LP	Tail Lamp
	T/SIG	Turn Signal
	TCS	Traction Control System
	TCCU	Transfer Case Control Unit
	T/C	Transfer Case
	T/GATE	Tail Gate
U	U/D	Up/Down
W	W/SHLD	Windshield
	W/WHSHER	Windshield Washer
	W/WPR	Windshield Wiper
	WDW	Window
	WHL	Wheel
	WPR	Wiper
	WIR'G	Wiring
	WSS	Wheel Speed Sensor

Modification basis	
Application basis	
Affected VIN	

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CONNECTOR/GROUND

6810-00/7410-00/8201-00/8210-00/8210-02/8210-03/8210-08/8210-09/8210-10/

POSITION OF CONNECTOR

8201-00 POSITION OF CONNECTORS AND GROUNDS..... 3

CONNECTOR/GROUND

8210-00 W/H ENGINE ROOM..... 13
8210-02 W/H MAIN..... 14
8210-03 W/H FLOOR(LH)..... 16
8210-03 W/H FLOOR(LH)..... 17
8210-06 W/H DOOR (LH/RH)..... 17
8210-08 W/H RR DOOR..... 18
6810-00 W/H AIR-CON..... 18
8210-10 W/H TAIL GATE..... 19
8210-09 W/H ROOF..... 19
7410-00 W/H SEAT..... 20

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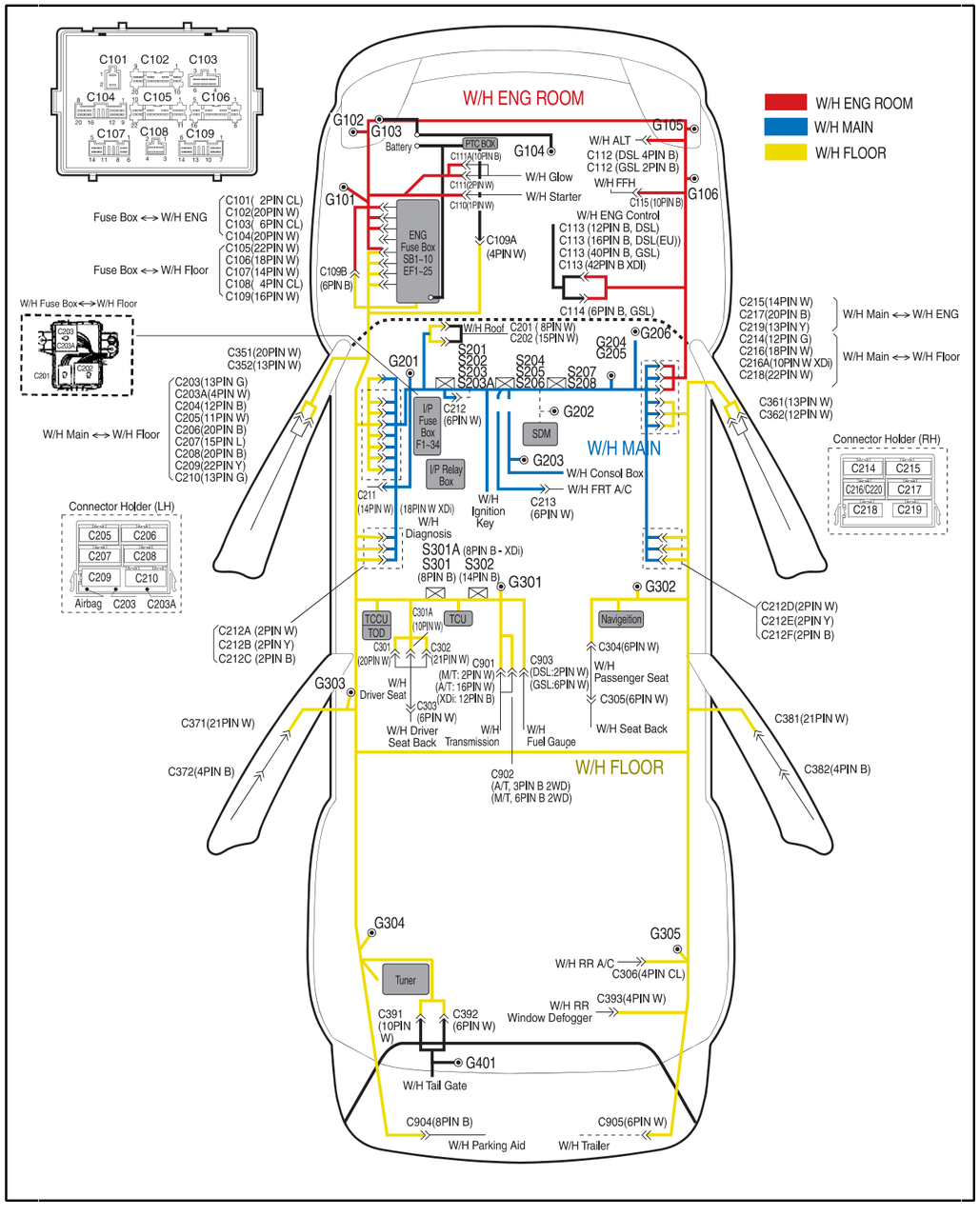
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POSITION OF CONNECTOR

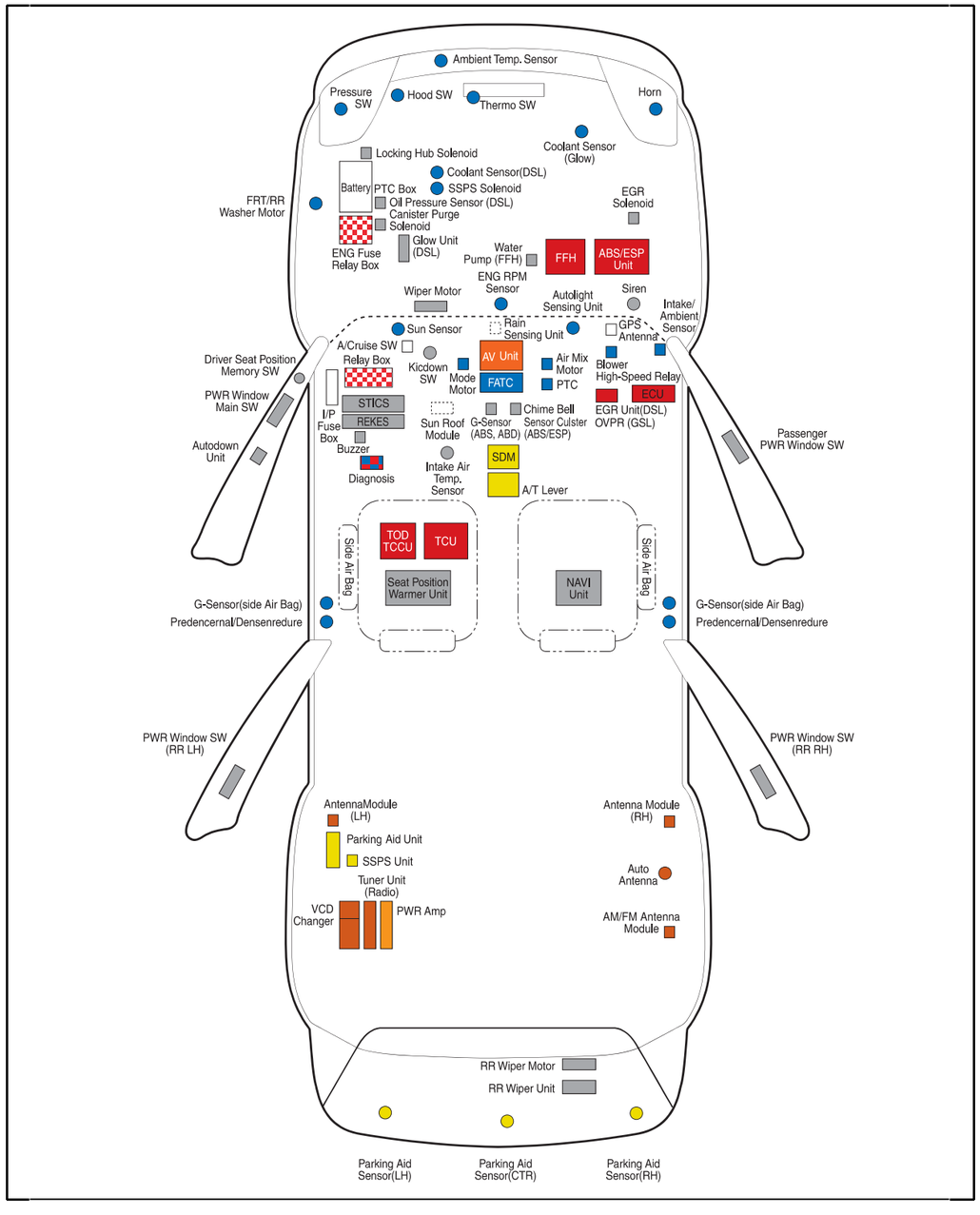
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POSITION OF CONNECTORS AND GROUNDS

1) POSITION OF CONNECTOR, GROUND & SPLICE PACK



2) COMPONENTS LOCATION



Modification basis	
Application basis	
Affected VIN	

3) CONNECTOR, GROUND & SPLICE PACK INFORMATION

▶ CONNECTOR

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C101 (2Pin, Colorless)	Engine Room Fuse Box (A) - Engine	Engine Room Fuse Box	
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C103 (6Pin, Colorless)	Engine Room Fuse Box (C) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C109A (4Pin, White)	Engine - PTC BOX	Engine Room Fuse Box	XDi
C109B (6Pin, Black)	Engine - ABS/ESP Pressure Sensor	Engine Room Fuse Box (RH)	XDi
C110 (1Pin, Gray)	Engine - Starter "ST"	FRT Pre-Heating Unit	
C111 (2Pin, Black)	Engine - Pre-Heating	RR Pre-Heating Unit	DSL
C111A (10Pin, Black)	Engine - W/H EGR	FRT Pre-Heating Unit	CLUSTER
C112 (4Pin, Black)	Engine - Alternator	Under the Coolant Reserve Tank	DSL
C112 (2Pin, Black)	Engine - Alternator	Under the Coolant Reserve Tank	GSL
C113 (12Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	DSL
C113 (40Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	GSL
C113 (16Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	DSL (EU)
C113 (42Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	XDi
C114 (6Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	GSL
C115 (10Pin, Black)	Engine - FFH Control	Under the Coolant Reserve Tank	XDi
C201 (8Pin, White)	Main - Roof	Under the I/P Fuse Box	
C202 (15Pin, White)	Main - Roof	Under the I/P Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C203A (4Pin, White)	Main - Floor (LH)	Under the I/P Fuse Box	XDi
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C211 (14Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	
C211 (18Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	XDi
C212 (6Pin, White)	Main - Air-Bag	Behind the Cluster (Inside Dash PNL)	

Connector Number (Pin Number, Color)	Connecting Wiring	Connector Position	Remark
C212A (2Pin, White)	Floor - W/H Air-Bag	Inside Driver Side Cowl PNL	Side Air-Bag
C212B (2Pin, Yellow)	Floor - W/H Air-Bag	Inside Driver Side Cowl PNL	Side Air-Bag
C212C (2Pin, Black)	Floor - W/H Air-Bag	Inside Driver Side Cowl PNL	Freetensioner
C212D (2Pin, White)	Floor - W/H Air-Bag	Inside Co-Driver Side Cowl PNL	Side Air-Bag
C212E (2Pin, Yellow)	Floor - W/H Air-Bag	Inside Co-Driver Side Cowl PNL	Side Air-Bag
C212F (2Pin, Black)	Floor - W/H Air-Bag	Inside Co-Driver Side Cowl PNL	Freetensioner
C213 (16Pin, White)	Main - Air-Con	Inside Dash PNL	
C213A (13Pin, White)	W/H Air Bag - W/H Blower	Inside Dash PNL	XDi
C213B (2Pin, White)	Main - Kick Down SW	Acceleration Pedal (RH)	AUTO
C214 (12Pin, Black)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C215 (14Pin, White)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	ABS, ABD
C216 (18Pin, White)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C216 (10Pin, White)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C217 (20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C220 (15Pin, Blue)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	XDi
C301 (20Pin, White)	Floor - Driver Seat	Under the Driver Seat	Power Seat
C301A (10Pin, White)	Floor - Driver Seat	Under the Driver Seat	Seat Warmer
C302 (21Pin, White)	Floor - Driver Seat	Under the Driver Seat	Power Seat
C303 (6Pin, White)	Driver Seat - Seat Back	Under the Driver Seat	Power Seat
C304 (6Pin, White)	Floor - Co-Driver Seat	Under the Co-Driver Seat	Power Seat
C305 (4Pin, White)	Co-Driver Seat - Seat Back	Under the Co-Driver Seat	Power Seat
C306 (4Pin, Colorless)	Floor - RR Air Con	Right Side 3rd Seat	A/C
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C352 (13Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C353 (13Pin, White)	Driver Door - Door Extention	Inside Driver Side Cowl PNL	
C361 (13Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C362 (12Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C371 (21Pin, White)	Floor - RR Left Door	Under Left "B" Filler	
C372 (4Pin, Black)	RR LH Door - Door Extention	Inside RR LH Door PNL	
C381 (21Pin, White)	Floor - RR Right Door	Under Right "B" Filler	
C382 (4Pin, Black)	RR RH Door - Door Extention	Inside RR RH Door PNL	
C391 (10Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
C392 (6Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
C392 (10Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
C393 (10Pin, White)	Floor - RR Defogger	Inside the Upper the Tail Gate	

Modification basis	
Application basis	
Affected VIN	

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C901 (16Pin, Black)	Floor - T/M	Left the T/C (Under the Floor)	A/T
C901 (2Pin, Black)	Floor - T/M	Left the T/C (Under the Floor)	M/T
C901 (12Pin, Black)	Floor - T/M	Left the T/C (Under the Floor)	XDi
C902 (6Pin, Black)	Floor - T/M	Under the T/C (Under the Floor)	M/T 2WD
C902 (3Pin, Black)	Floor - T/M	Under the T/C (Under the Floor)	A/T 2WD
C903 (6Pin, Black)	Floor - Fuel Sender	Left the T/C (Under the Floor)	GSL
C903 (2Pin, Black)	Floor - Fuel Sender	Left the T/C (Under the Floor)	DSL
C904 (8Pin, Black)	Floor - Parking Aid	Inside the Left RR Bumper	Parking Aid
C905 (6Pin, White)	Floor - Trailer	Inside the Left RR Bumper	

▶ GROUND

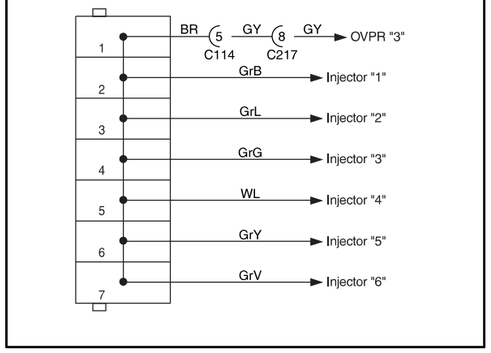
Connector Number	Connecting Wiring Harness	Connector Position	Remark
G101	W/H Engine	Center the Engine Room Fuse Box	
G102	W/H Engine	Center BATT	
G103	W/H Engine	Behind the Left Head Lamp	
G104	W/H Engine	Beside the Engine Mounting Bracket	
G105	W/H Engine	Behine the Right Head Lamp	
G106	W/H Engine	Beside the Engine Coolant Reserve Tank	ABS, ABD
G201	W/H Main	Inside Driver Side Cowl PNL	
G202	W/H Main	Beside the SDM	
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag
G204	W/H Main	Inside Co-Driver Side Cowl PNL	
G205	W/H Main	Inside Co-Driver Side Cowl PNL	GSL
G206	W/H Main	Under Co-Driver Dash PNL	DSL
G301	W/H Floor	Under Driver Seat	ECU GND
G302	W/H Floor	Under Driver Seat	
G303	W/H Floor	Under the Left "B" Filler	
G304	W/H Floor	Behind the Quarter Grass #1	
G305	W/H Floor	Behind the Quarter Grass #1	
G401	W/H Tail Gate	Center the Tail Gate	
G402	W/H Tail Gate	Lift the Tail Gate	
G403	W/H Tail Gate	Right the Tail Gate	

▶ SPLICE PACK

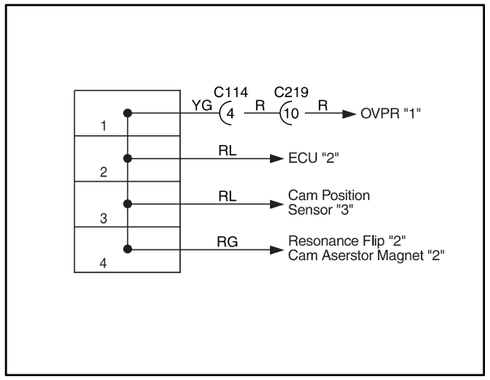
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
S101 (7Pin, -)	OVPR "6" - Injector	Inside the C113, C114	GSL
S102 (4Pin, -)	OVPR "8" - IGN Coil	Inside the Injector "6"	GSL
S103 (4Pin, -)	OVPR "2" - HFM/CPS	Inside the C113, C114	GSL
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S203A (14Pin, Black)	W/H Main	Behind the Left FATC	XDi
S204 (14Pin, Black)	W/H Main	Behind the Left FATC	GND
S205 (14Pin, Black)	W/H Main	Behind the Left FATC	GND
S206 (14Pin, Black)	W/H Main	Behind the Left FATC	
S207 (14Pin, Black)	W/H Main	Behind the Right FATC	Tail Lamp
S208 (14Pin, Black)	W/H Main	Behind the Right FATC	
S301 (8Pin, Black)	W/H Floor	Under Driver Seat	CAN (GSL)
S301A (8Pin, Black)	W/H Floor	Under Driver Seat	XDi
S302 (14Pin, Black)	W/H Floor	Under Driver Seat	

4) SPLICE PACK

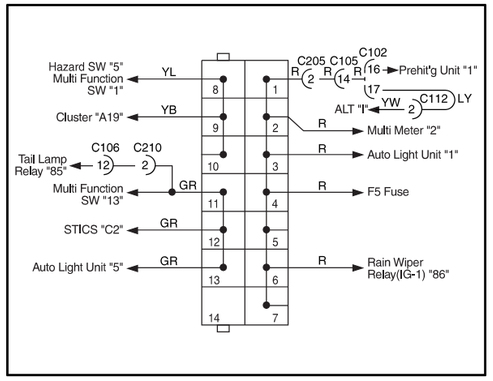
▶ S101



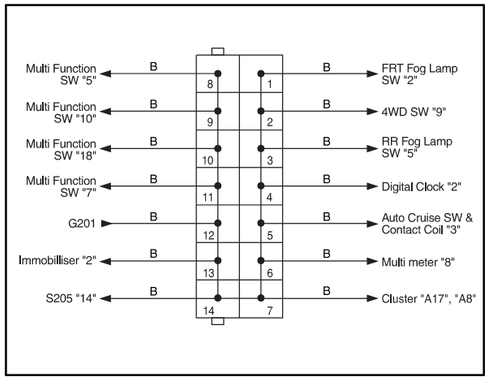
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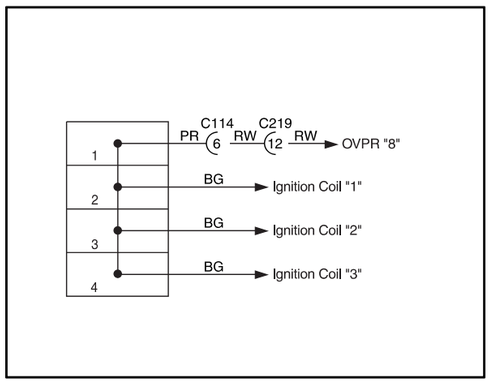
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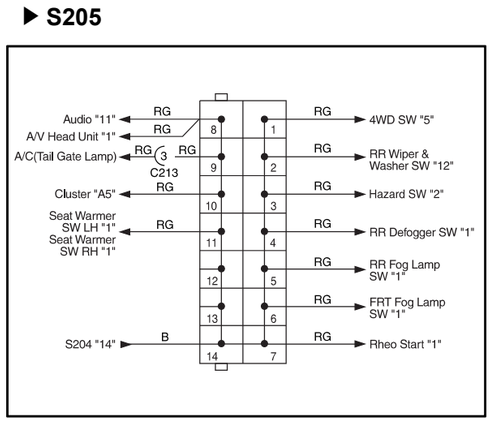
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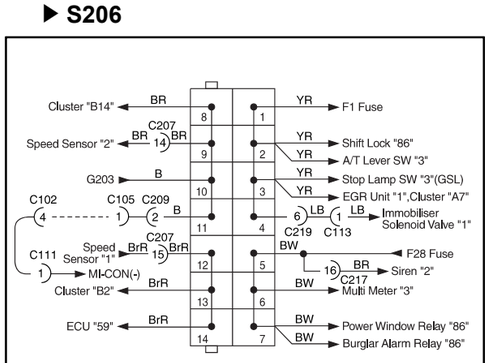
▶ S103



▶ S205

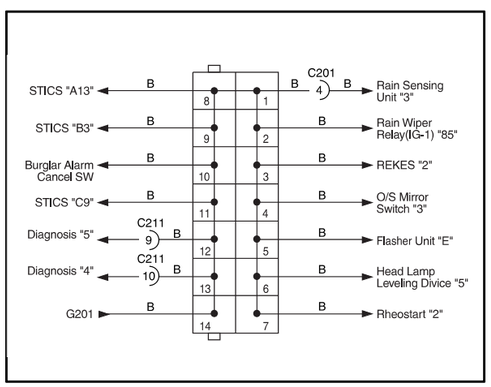


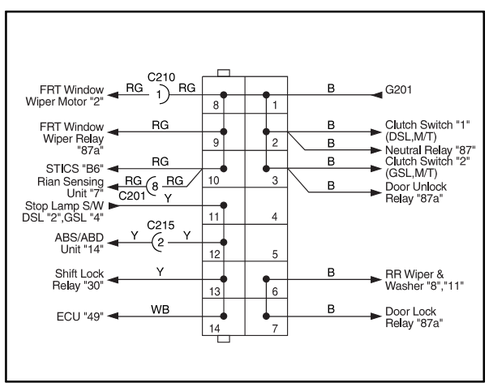
▶ S206



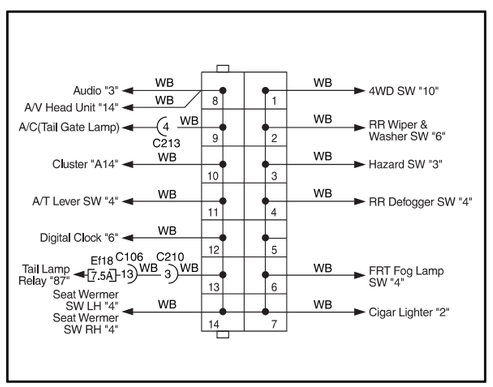
(1) ~ 2002 MODEL

▶ S202 (CAN)

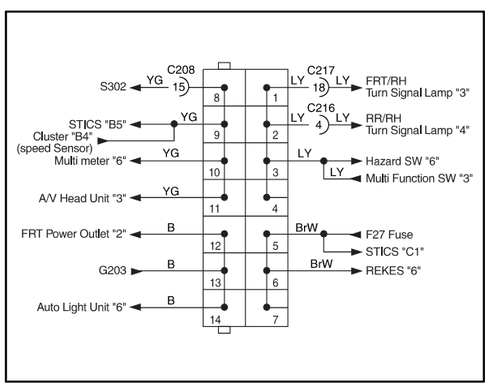




▶ S207



▶ S208

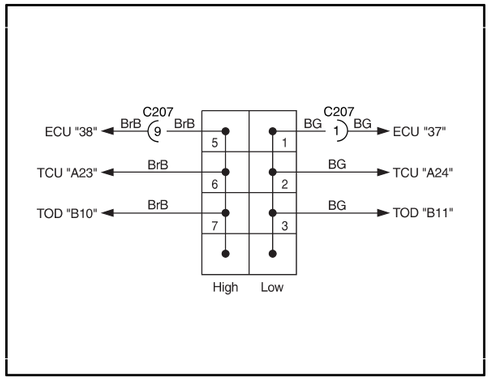


CONNECTOR/GROUND

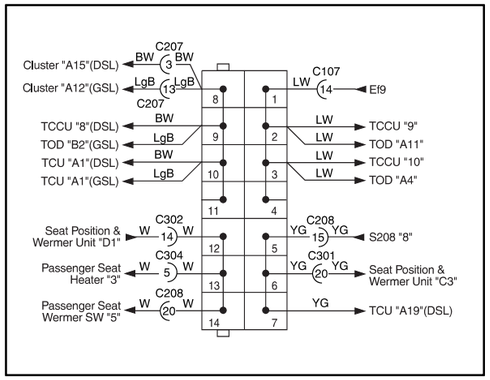
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

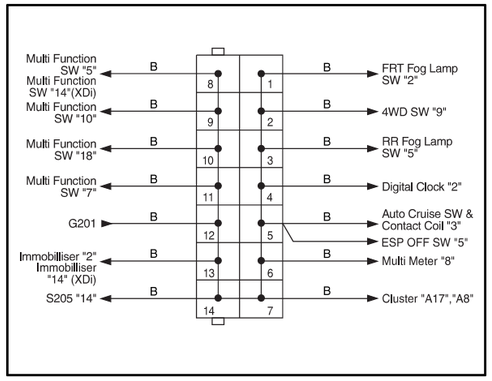
▶ S301



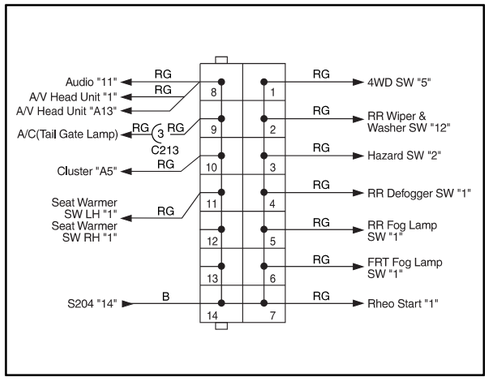
▶ S302



▶ S204



▶ S205

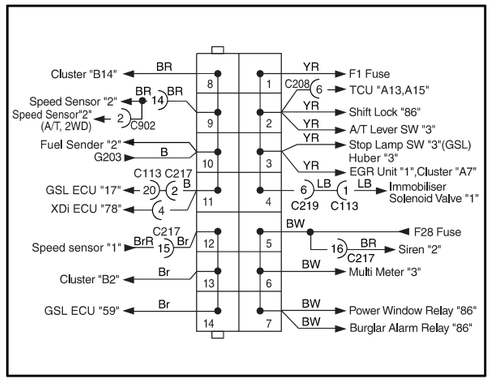


(2) 2003 MODEL ~

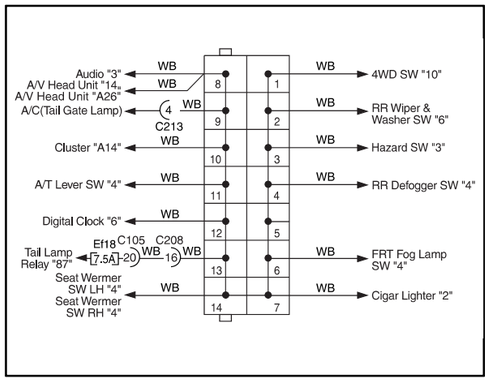
▶ S201

▶ S202

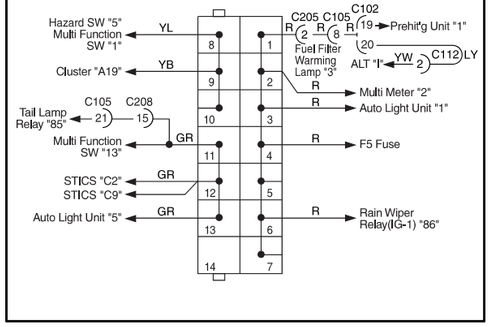
▶ S206



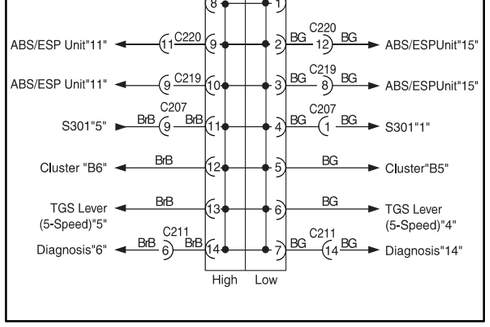
▶ S207



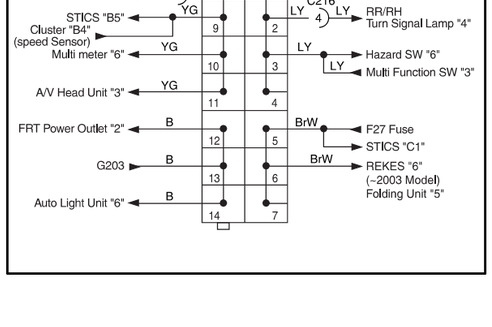
▶ S203



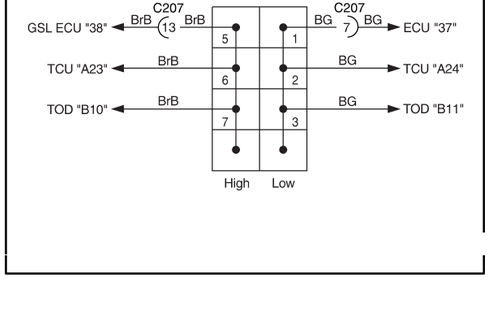
▶ S203A



▶ S208



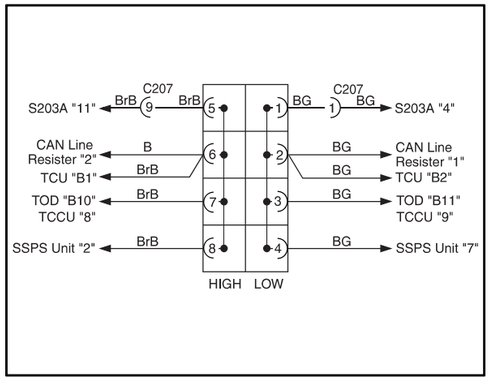
▶ S301



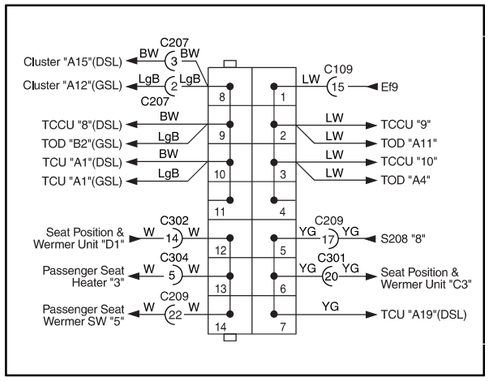
( ): XDi Only

Modification basis	
Application basis	
Affected VIN	

▶ **S301A**



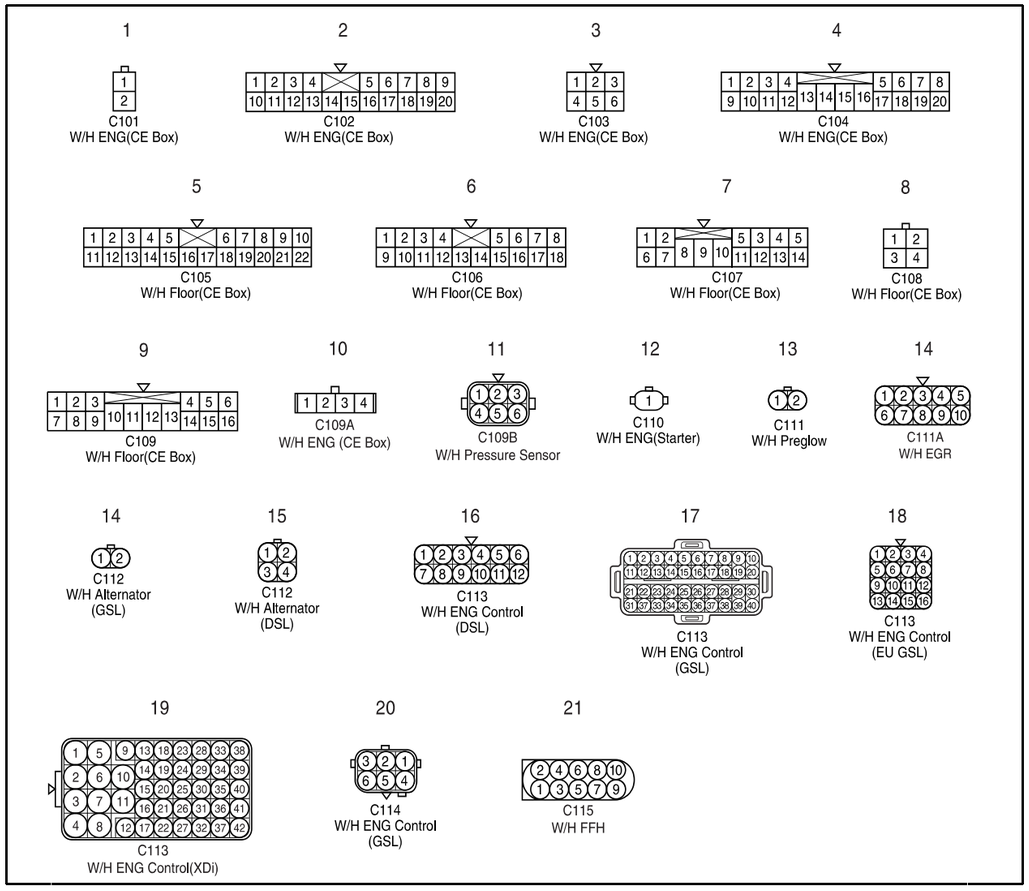
▶ **S302**



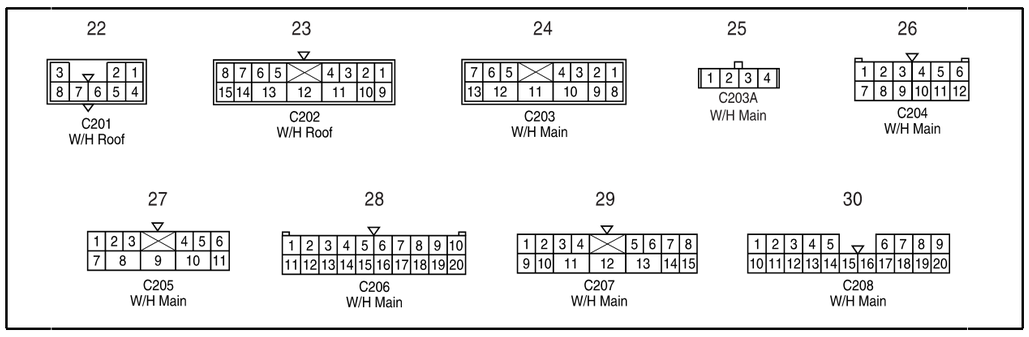
Modification basis	
Application basis	
Affected VIN	

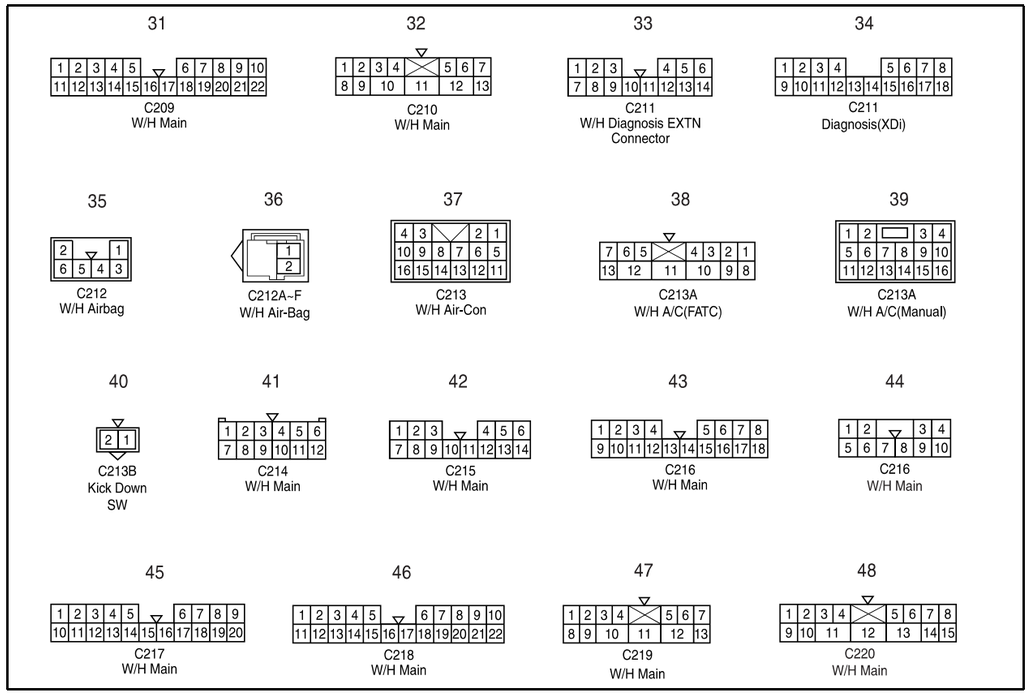
5) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

▶ C101 ~ C115

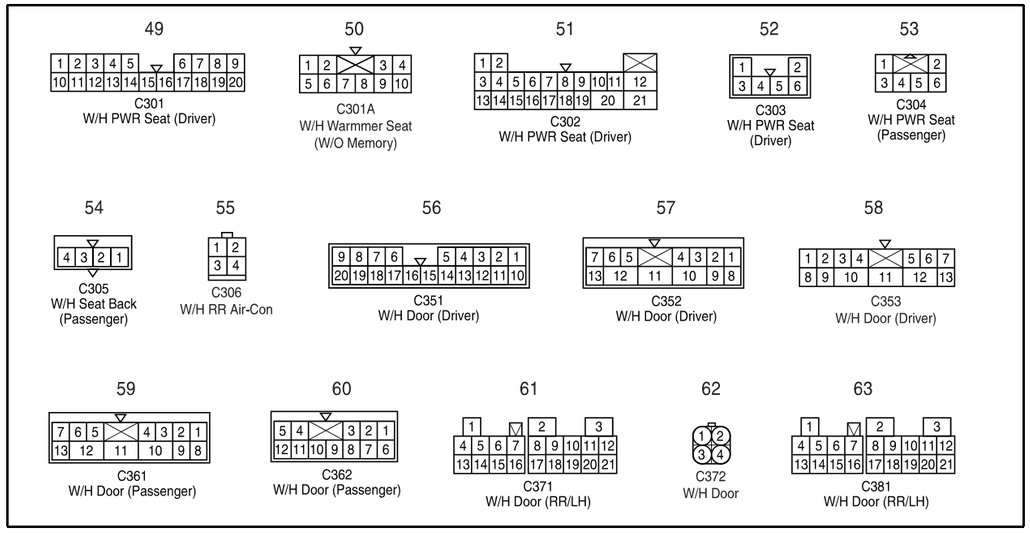


▶ C101 ~ C115





▶ C301 ~ C905



Modification basis	
Application basis	
Affected VIN	

64 C382 W/H Door
65 C391 W/H Floor (Tail Gate)
66 C392 W/H Floor (Tail Gate)
67 C392 W/H Tail Gate
68 C393 W/H Tail Gate
69 C901 W/H Transmission(A/T)
70 C901 W/H Transmission(A/T)
71 C901 W/H Transmission (M/T)
72 C902 W/H Transmission (A/T 2WD)
73 C902 W/H Transmission (M/T 2WD)
74 C903 W/H Fuel Sender (GSL)
75 C903 W/H Fuel Sender (DSL)
76 C904 W/H Parking Aid
77 C905 W/H Trailer

▶ CONTROL UNIT

78 ECU
79 XDi ECU
80 TCU (4-Speed)
81 TCU (5-Speed)
82 TOD
83 TCCU (Old)
84 Cluster
85 STICS
86 ECBM (ABS/ABD)
87 ABS/ESP Unit
88 Diagnosis
89 Transmission (A/T)
90 Audio
91 Multi Meter
92 REKES
93 A/Cruise SW & Contact Coil

94 Huber EGR

▶ SW (SWITCH)

95 Multi Function
96 Seat Belt (Driver)
97 Seat Belt (Passenger)
98 Power Seat SW
99 Seat Warmer
100 Seat Memory (Driver)
101 Stop Lamp (GSL)
102 Stop Lamp (DSL)
103 Power Window (Driver)
104 Power Window (Passenger)
105 Power Window (RR)
106 Power O/S Mirror
107 Temper & Lock SW (Driver,Passenger)
108 Tail Gate
109 Tail Gate Key Clinder
110 Glass Gate
111 RR Grass Wiper/Washer
112 RR Defogger
113 Back Up Lamp (M/T)
114 Inhibitor (A/T)
115 A/T Lever
116 Clutch (M/T)
117 Kickdown
118 4WD SW
119 Key Reminder
120 Fog Lamp
121 Hood
122 Ignition
123 Hazard
124 P/Brake
125 Micro
126 Door
127 A/C Coolant Pressure SW (Duel Pressure SW)
128 A/C Coolant Pressure SW (Trinary SW)
129 A/C Blower SW (RR)

Modification basis	
Application basis	
Affected VIN	

130 Blower SW
131 Thermo SW (DSL)
132 Oil Level
133 Start SW
134 Head Lamp Level'g Derice SW
135 ESP OFF SW
136 Damper & Lock SW

▶ LAMP

137 Glove Box Lamp
138 Sun Visor Lamp
139 Luggage Lamp
140 Room Lamp
141 Door Courtesy (Step) Lamp
142 Position Lamp
143 Map Lamp
144 Head Lamp
145 Tail Lamp & Combi Lamp
146 Turn Signal Lamp
147 Side Repeater (Side Turn Signal Lamp)
148 Stop Lamp
149 Fog Lamp
150 License Lamp

▶ AIR BAG

151 SDM
152 Driver Airbag
153 Passenger Airbag
154 Airbag Contact Coil (Steering Side)
155 Airbag Contact Coil (Column Side)

▶ SENSOR

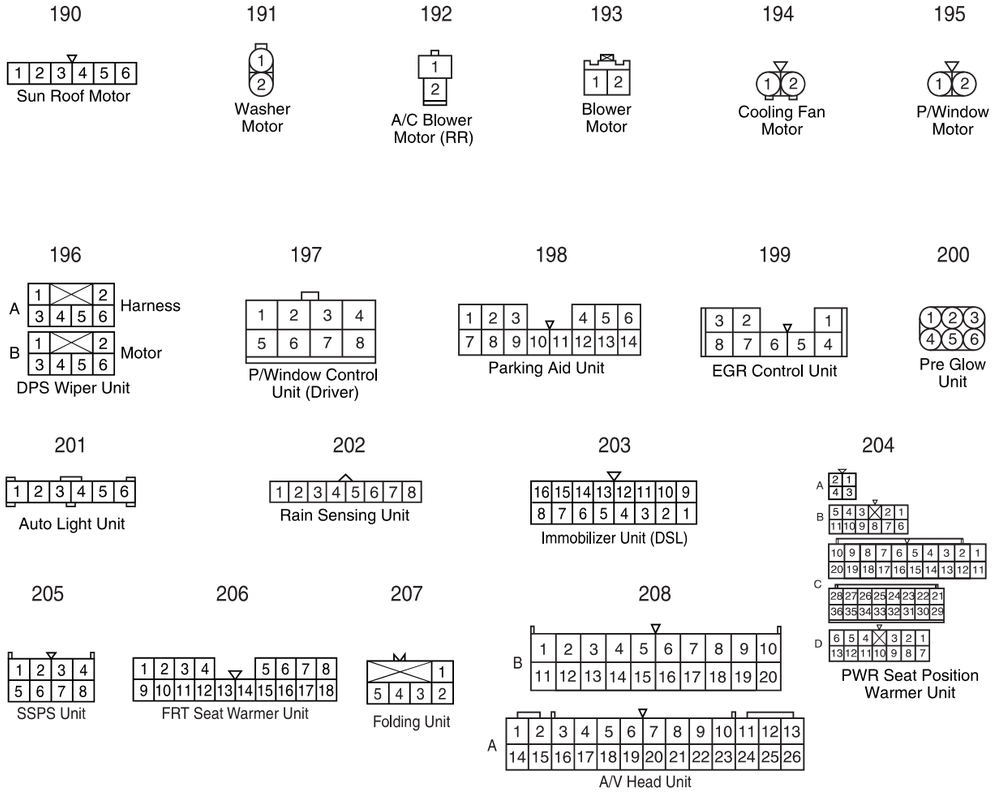
156 Coolant Temp. Sensor
157 Coolant Temp. Sensor
158 Cam Shaft Position Sensor
159 Crank Position Sensor
160 Accelerator Pedal Sensor
161 A/T Lever Position Sensor
162 T/C Speed Sensor
163 Wheel Speed Sensor (FRT)
164 Wheel Speed Sensor (RR)
165 Seat Slide Motor Sensor
166 Vehicle Speed Sensor
167 Acceleration Sensor (ABS, ABD)
168 Acceleration ("G"-Sensor)
169 ENG RPM
170 O2 Sensor (GSL)
171 Trottle Position Sensor (DSL)
172 Air Flow Sensor
173 Ambient Sensor
174 Sun Sensor
175 Knock Sensor
176 Intake Sensor
177 Coolant Sensor
178 Sensor Cluster
179 Steering Wheel Angle Sensor

▶ MOTOR

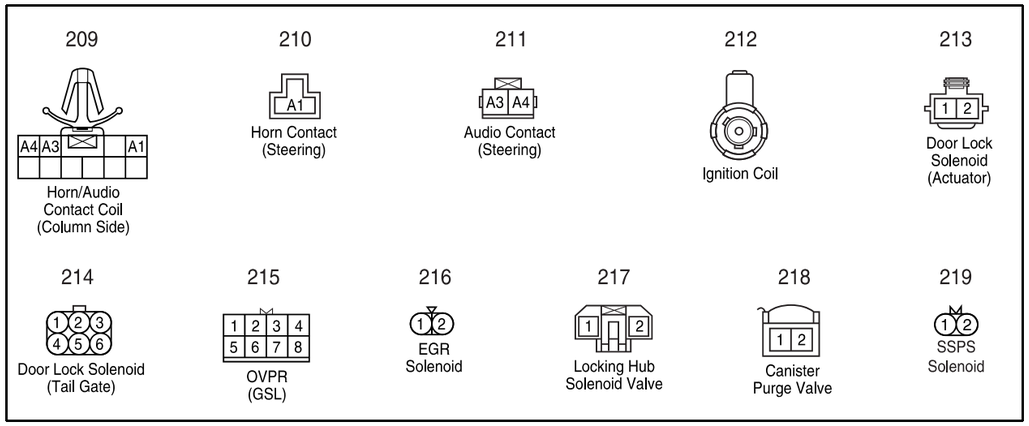
180 O/S Mirror & Heater Sensor
181 O/S Mirror & Heater Sensor (Memory Type)
182 Seat Tilt Motor (FRT)
183 Seat Tilt Motor (RR)
184 Seat Recline Motor
185 Seat Sliding Motor
186 T/C Shift Motor
187 T/C Motor
188 FRT Glass Wiper Motor
189 RR Glass Wiper Motor

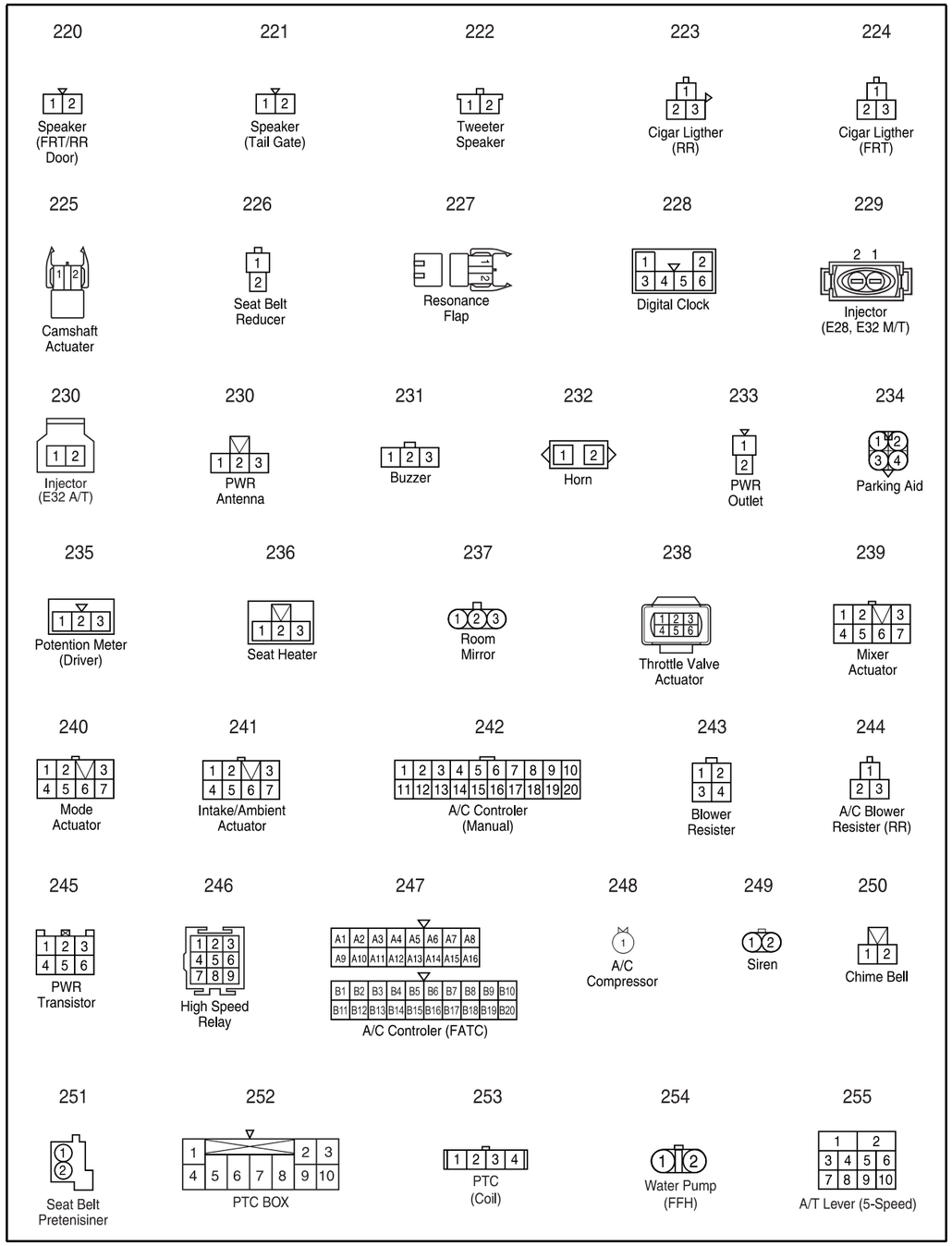
Modification basis	
Application basis	
Affected VIN	

▶ UNIT



▶ COIL/SOLENOID



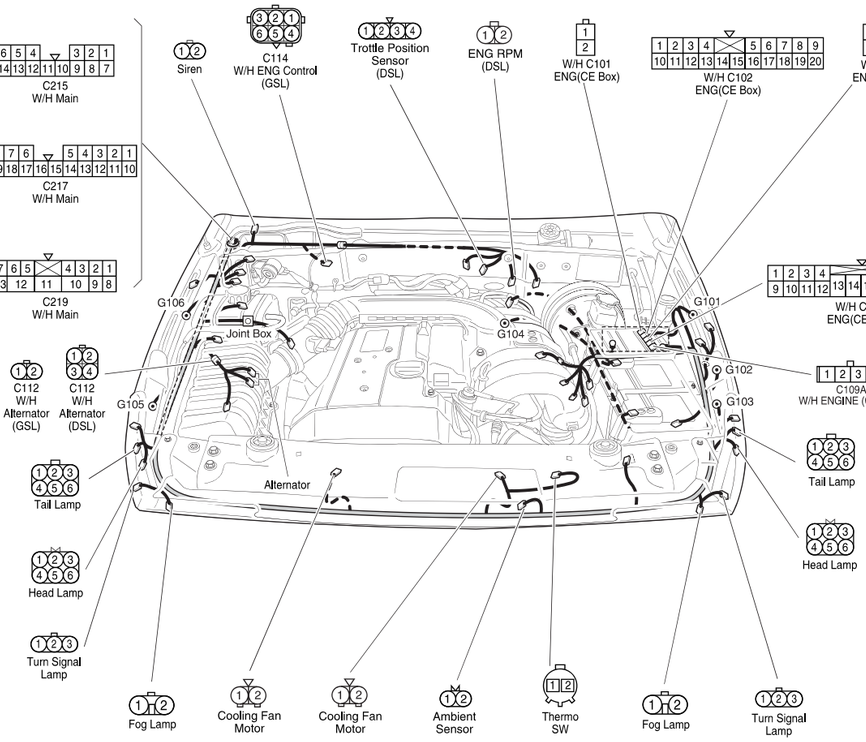


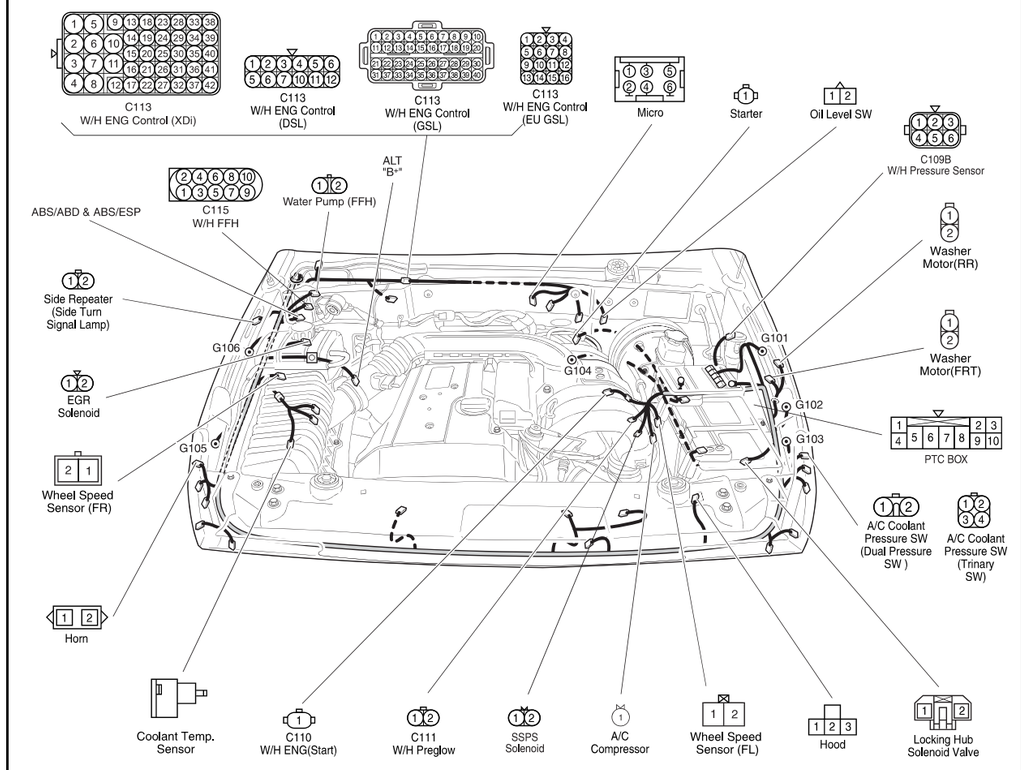
Modification basis	
Application basis	
Affected VIN	

CONNECTOR

S.G.N. 8210-02

W/H ENGINE ROOM

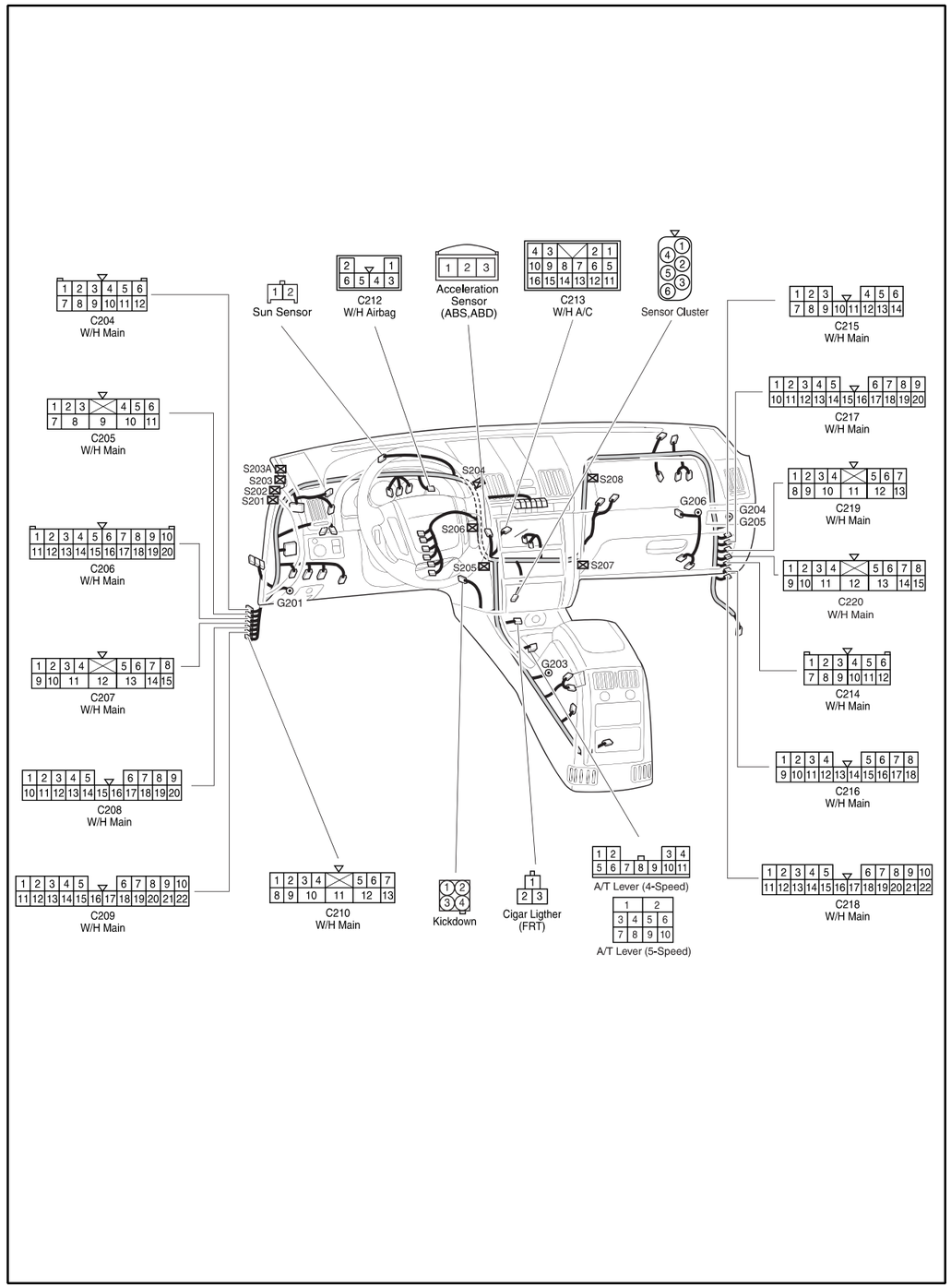


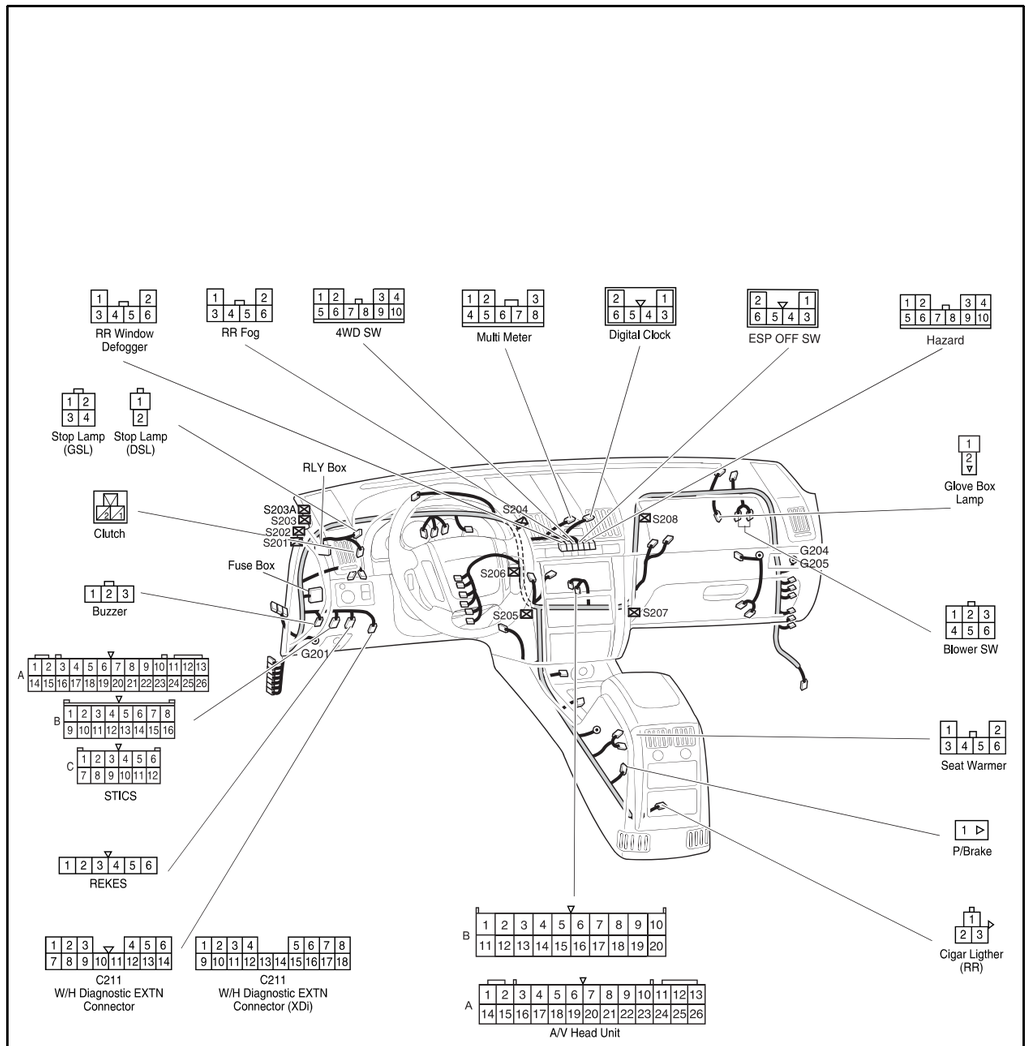


Modification basis	
Application basis	
Affected VIN	

S.G.N. 8210-01

W/H MAIN

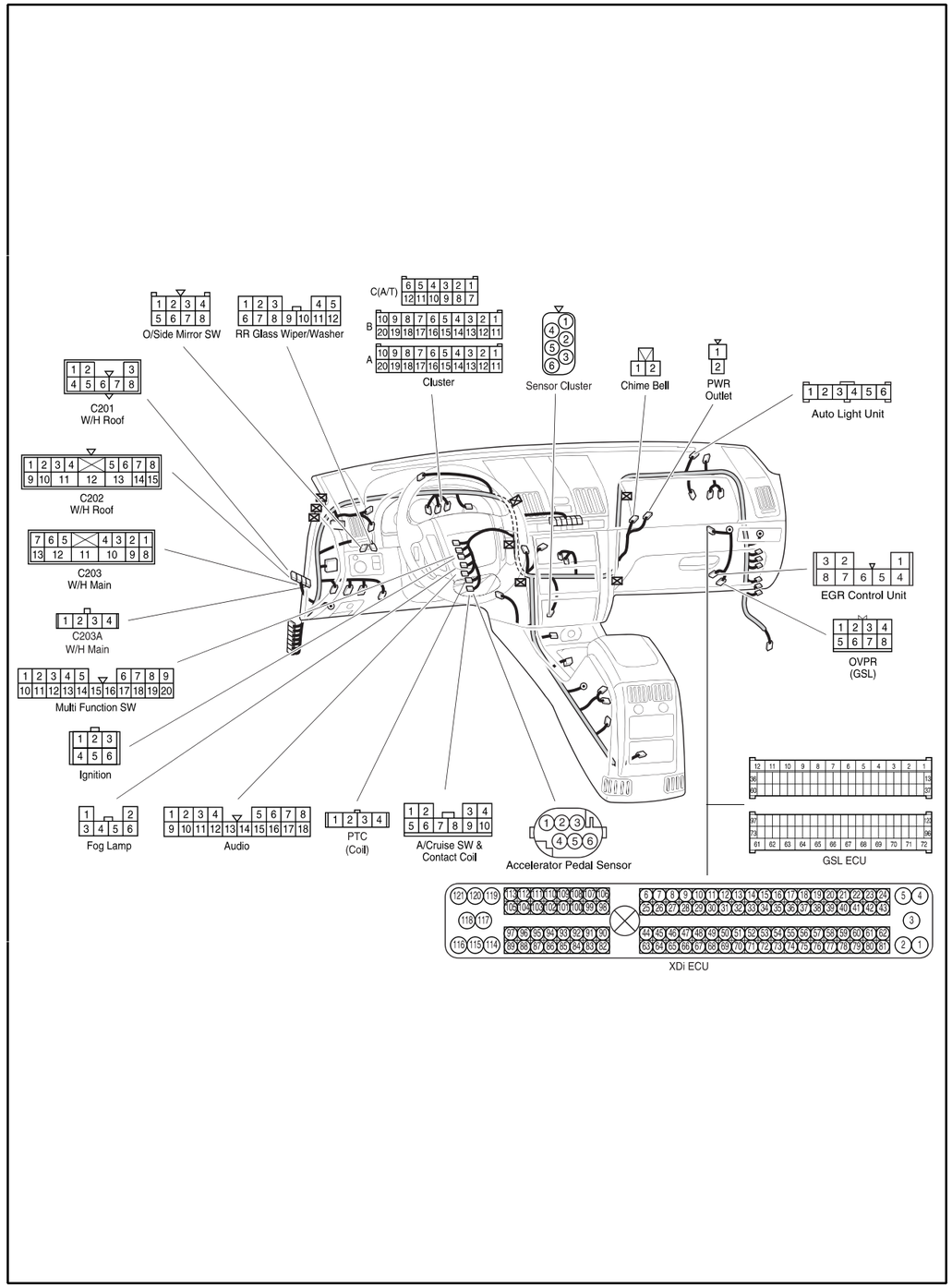




CONNECTOR/GROUND

REXTON 2004.04

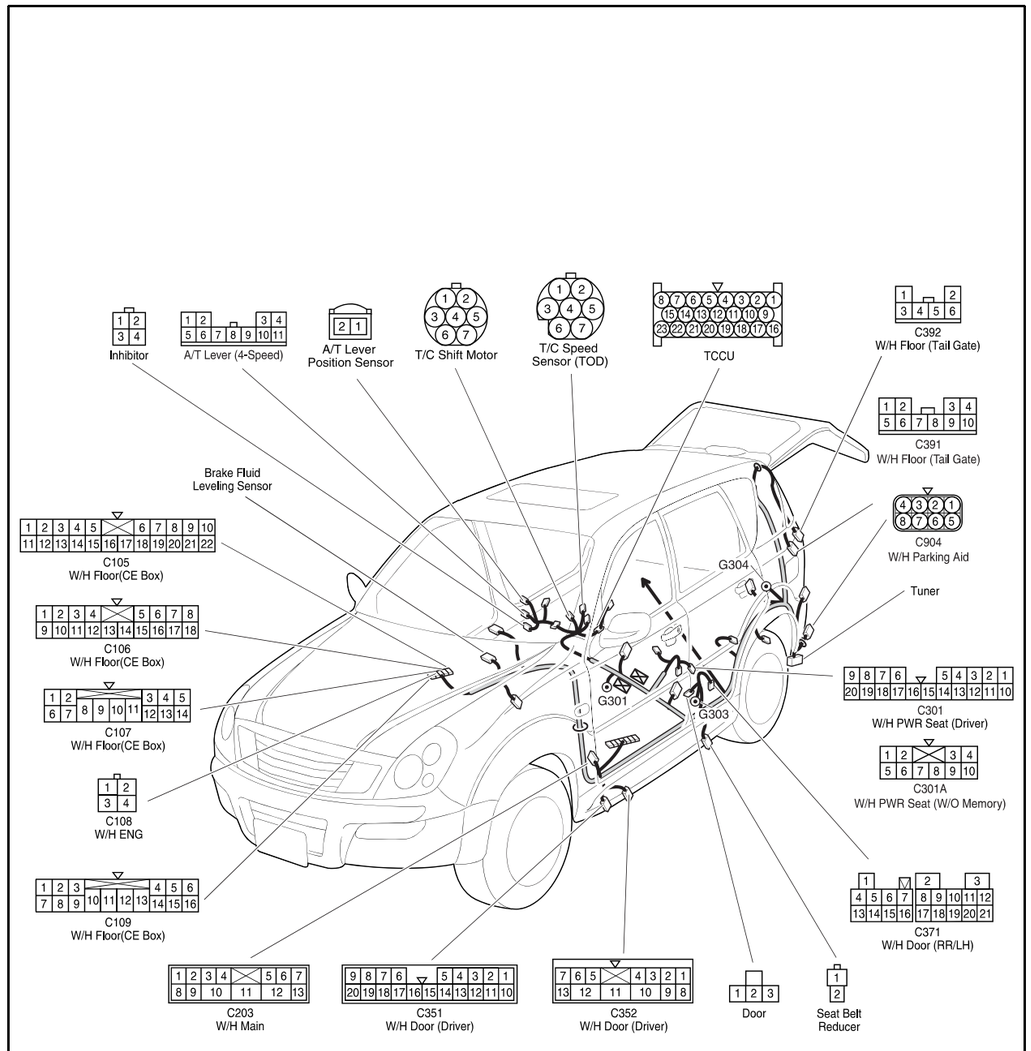
Modification basis	
Application basis	
Affected VIN	

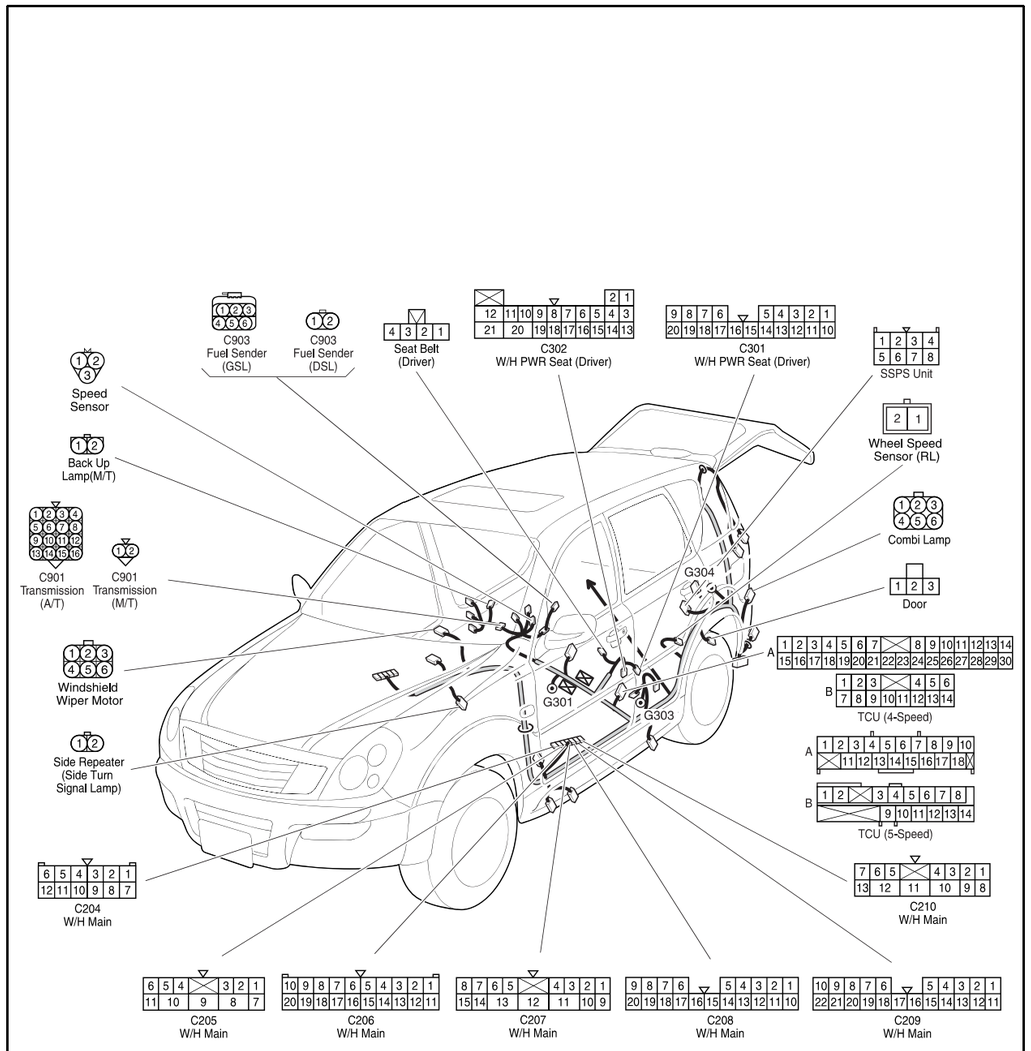


Modification basis	
Application basis	
Affected VIN	

S.G.N. 8210-03

W/H FLOOR (LH)



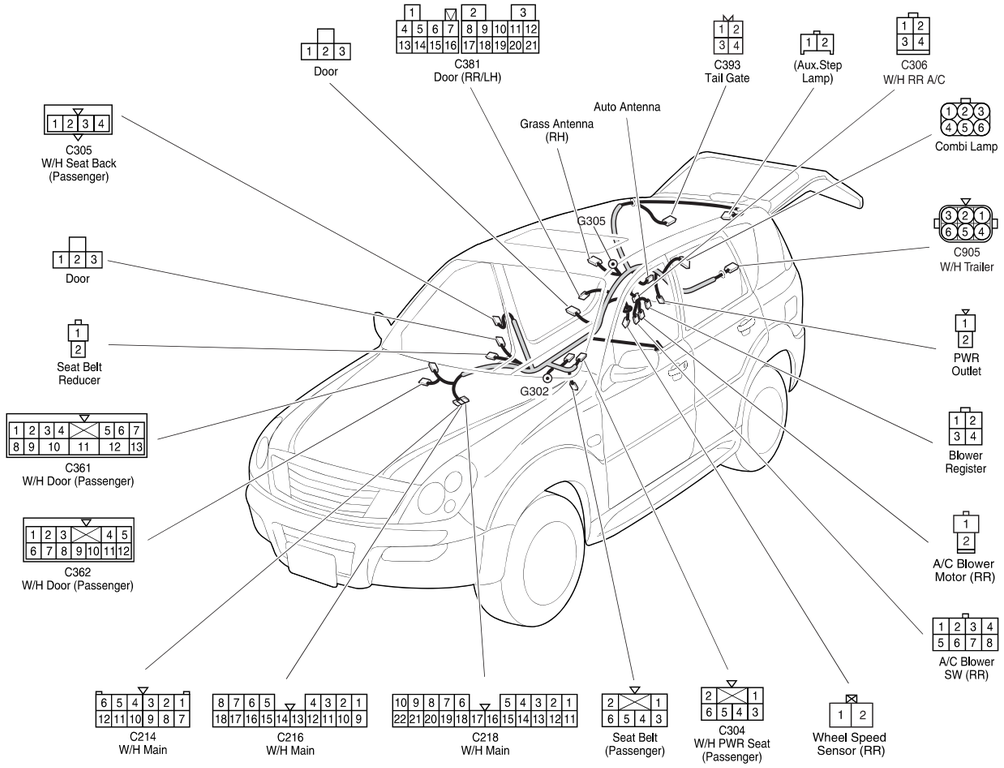


CONNECTOR/GROUND

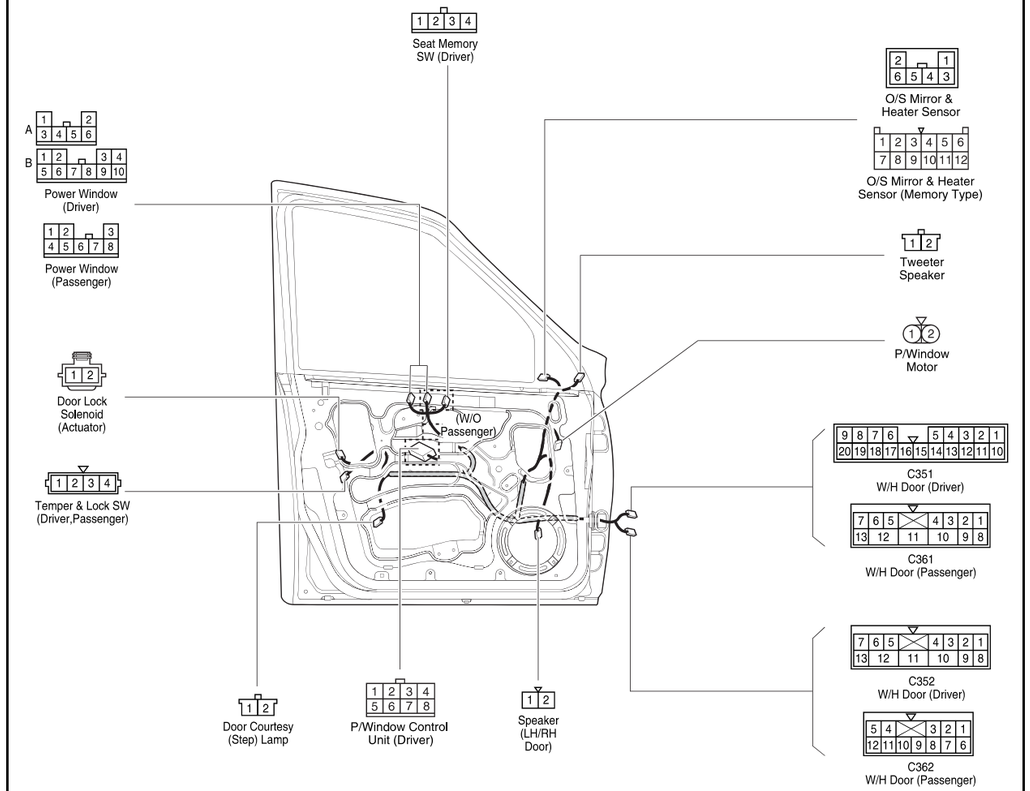
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

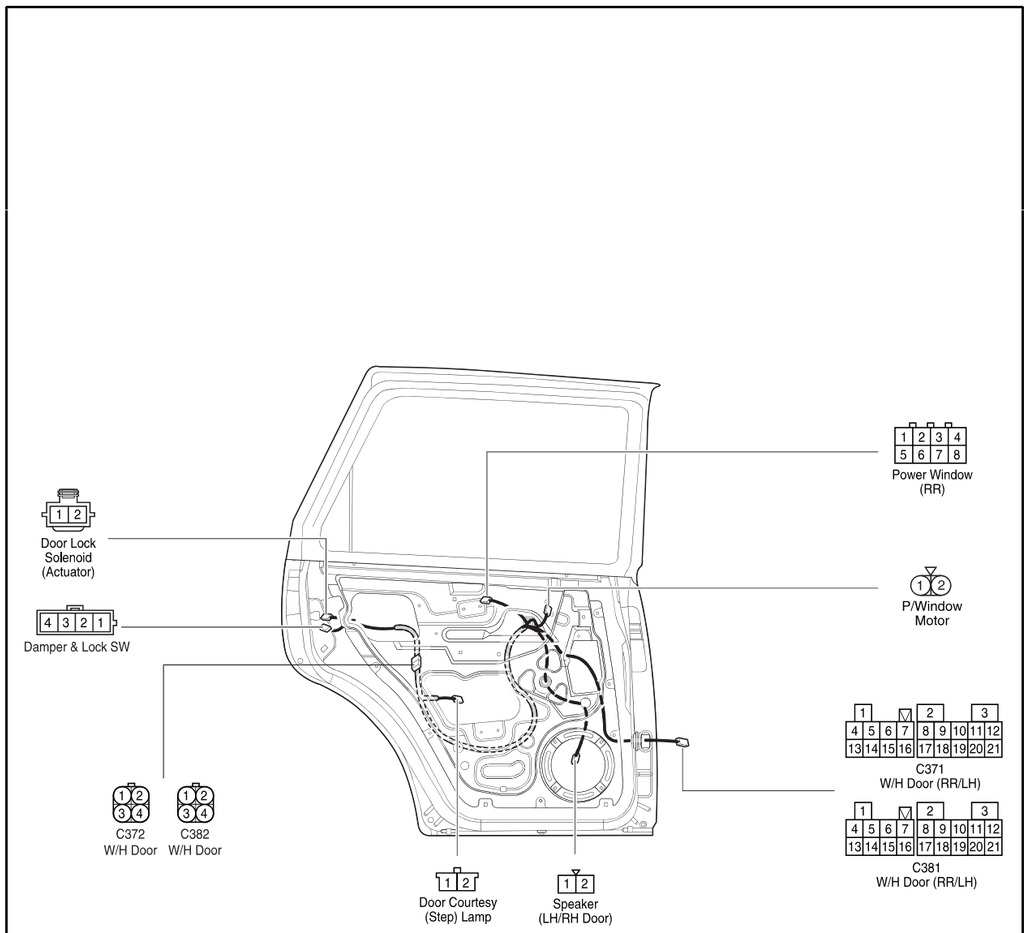
S.G.N. 8210-03 W/H FLOOR (RH)



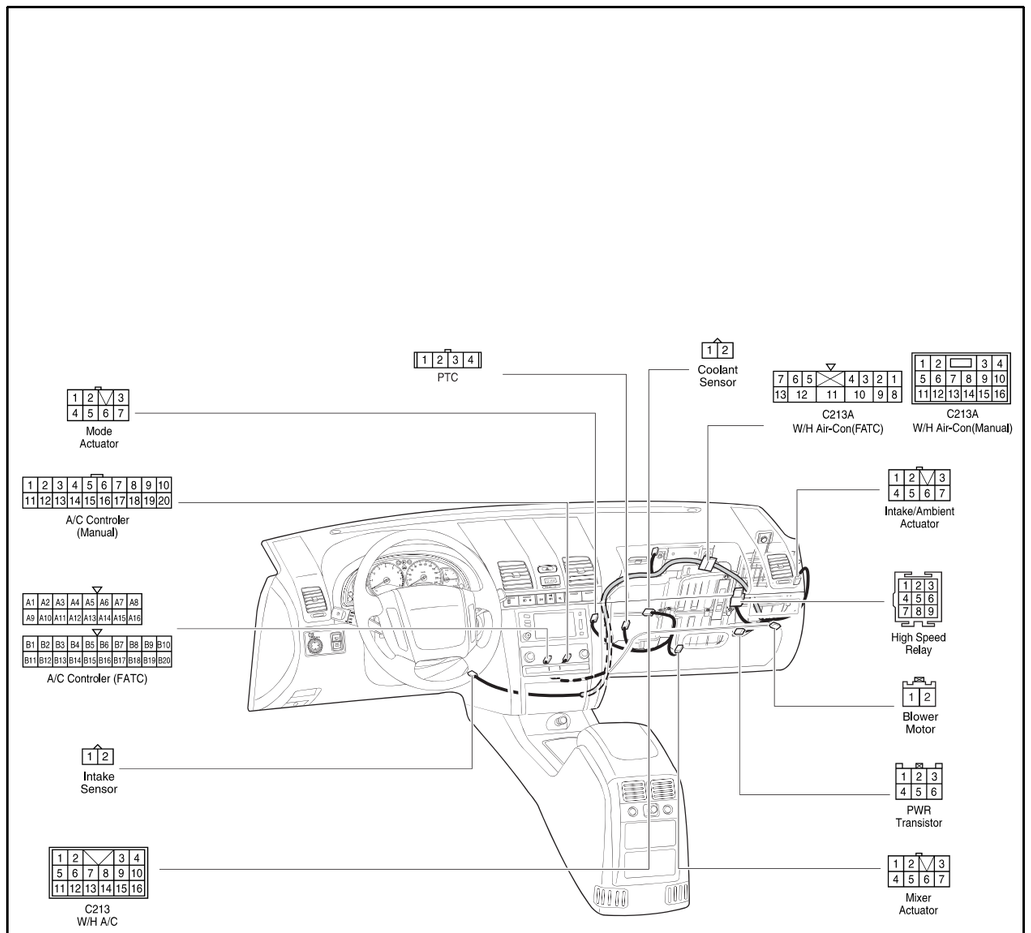
S.G.N. 8210-06 W/H DOOR (LH/RH)



S.G.N. 8210-08 W/H RR DOOR

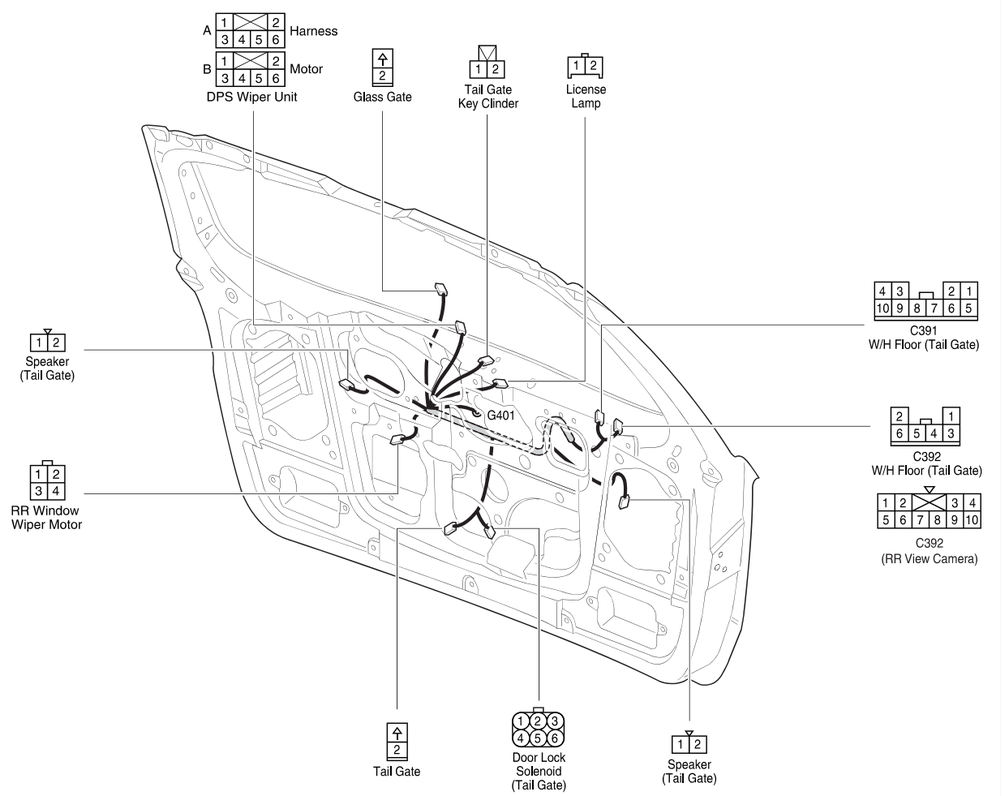


S.G.N. 6810-00 W/H AIR-CON

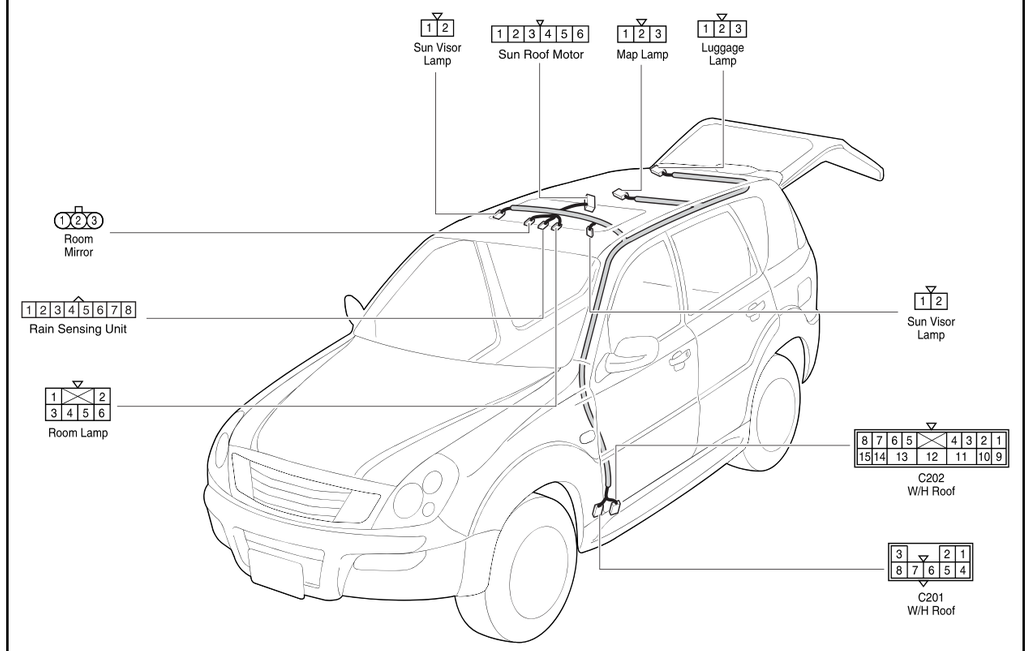


Modification basis	
Application basis	
Affected VIN	

S.G.N. 8210-10 W/H TAIL GATE



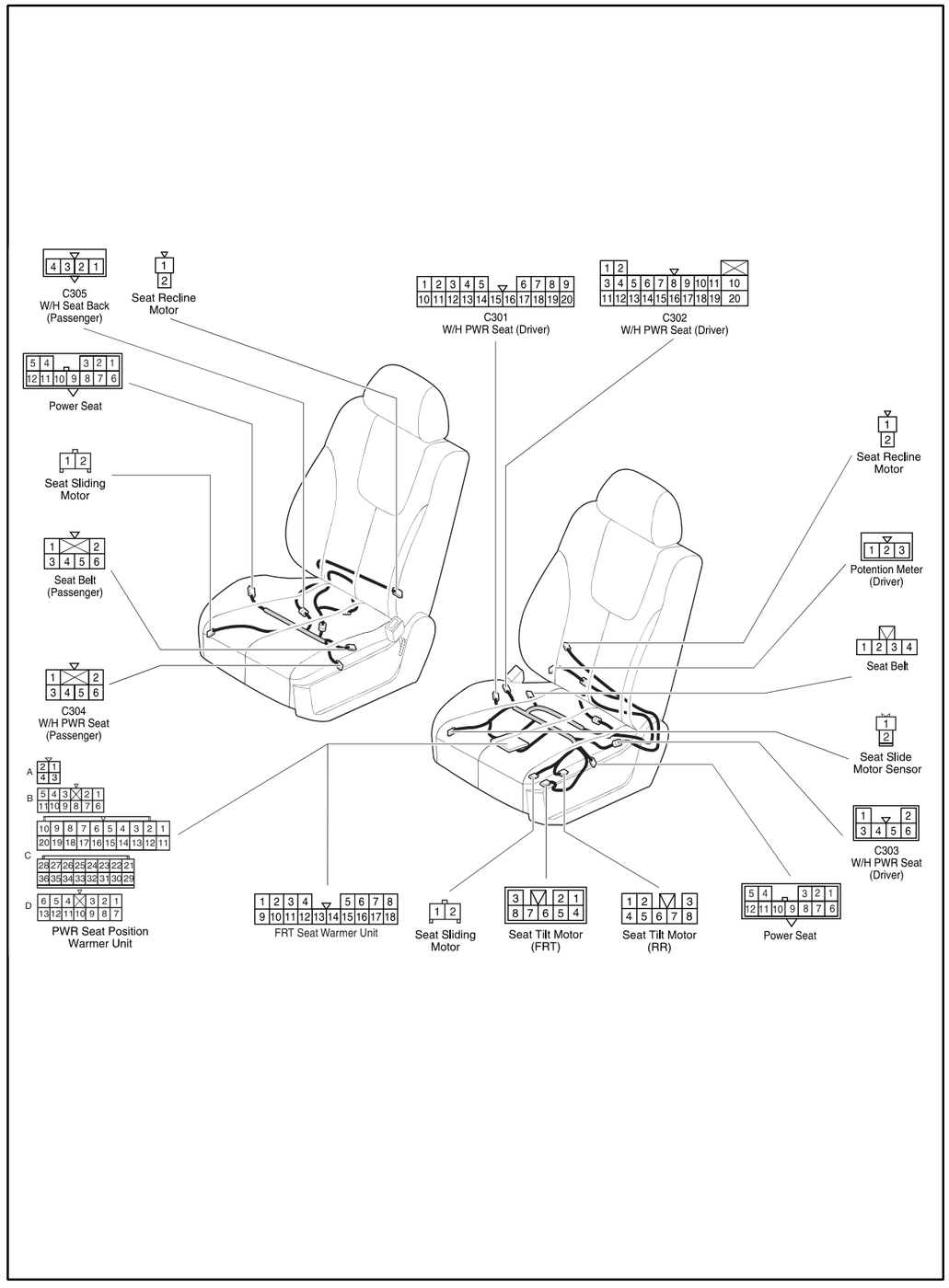
S.G.N. 8210-09 W/H ROOF



Modification basis	
Application basis	
Affected VIN	

S.G.N. 7410-00

W/H SEAT



Modification basis	
Application basis	
Affected VIN	

POWER DISTRIBUTION

8410-02/8410-04/8410-06/

FUSE/RELAY

8410-02 ENGINE ROOM FUSE & RELAY BOX 3
8410-04 I.P FUSE & RELAY BOX..... 7

ELECTRICITY DIVIDE

8210-02 POWER WIRING DIAGRAM (DSL)..... 10
8410-04 POWER WIRING DIAGRAM (GSL)..... 14
8410-06 POWER WIRING DIAGRAM (XDi, 2003 MODEL ~)..... 18

Memo

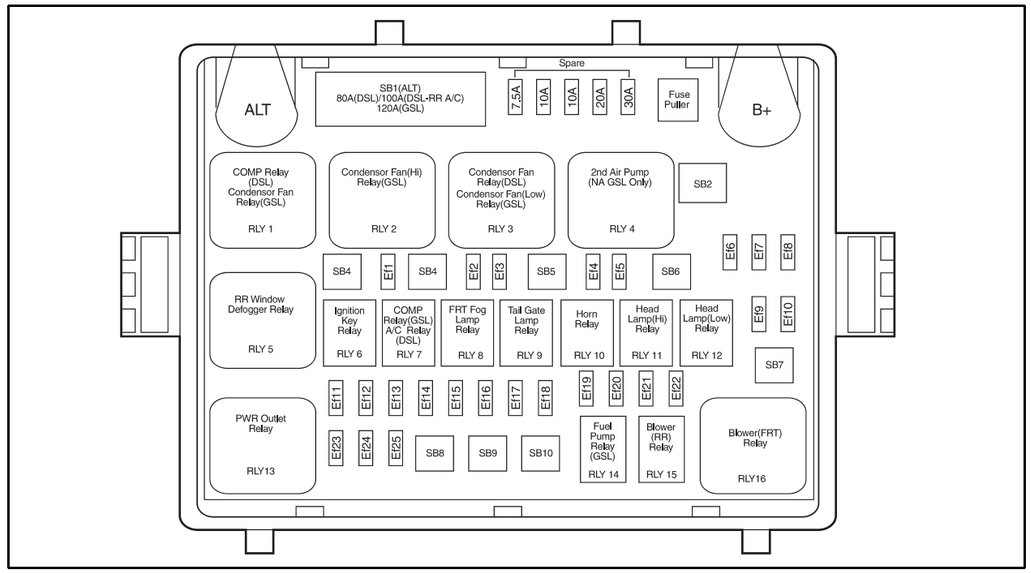
Memo

FUSE & RELAY

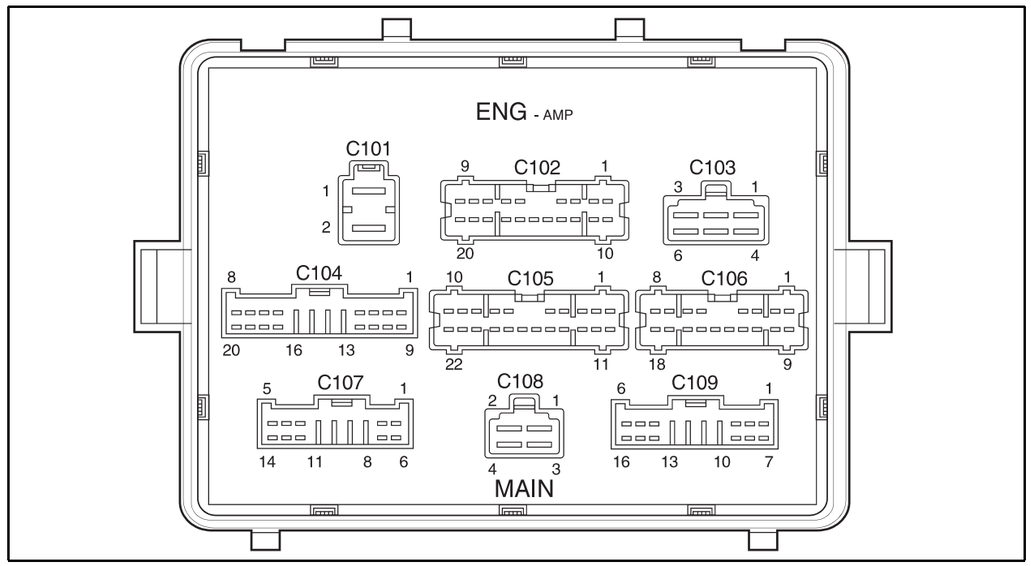
S.G.N. 8410-02 ENGINE ROOM FUSE & RELAY BOX

1) ~ 2002 MODEL

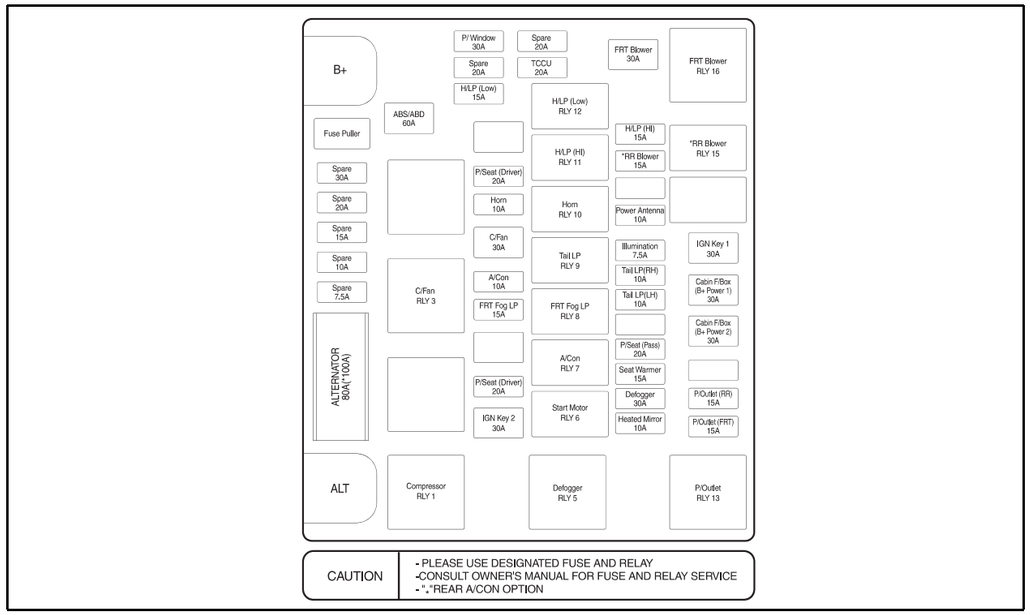
(1) FRONT



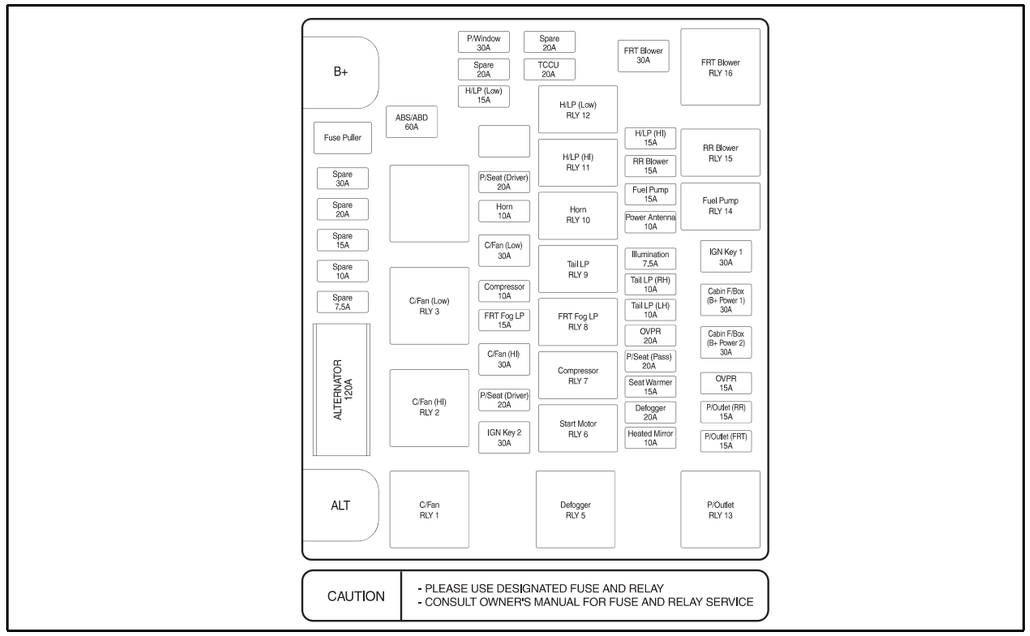
(2) REAR



(3) FRONT (DSL)



(4) FRONT (GSL)



Modification basis	
Application basis	
Affected VIN	

(5) USAGE OF FUSE IN ENGINE ROOM FUSE BOX

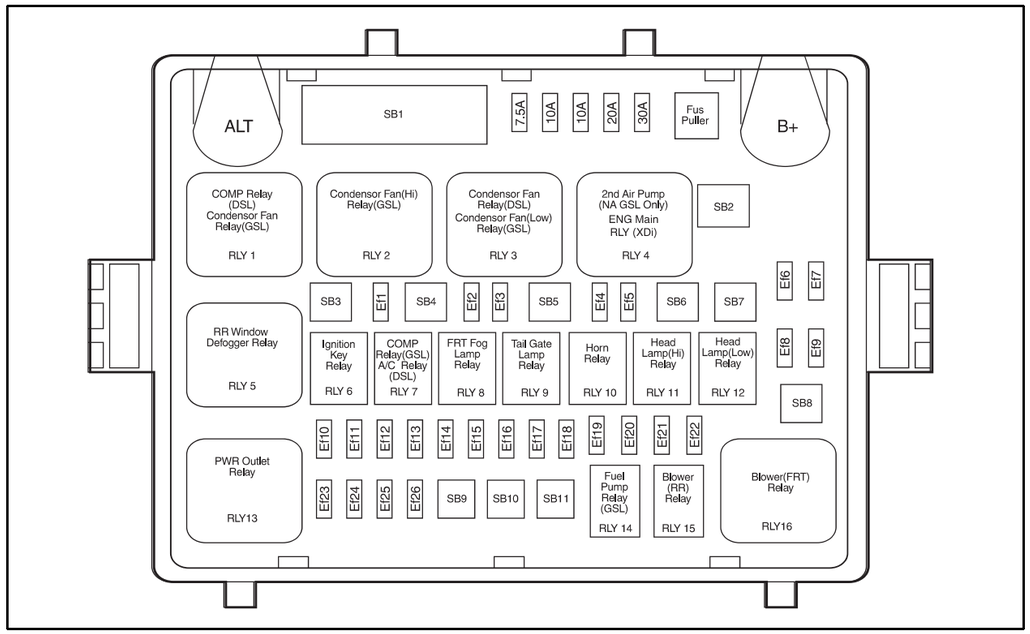
Fuse NO.	Capacity	Usage	Fuse NO.	Capacity	Usage
Ef1	20A	Power Seat (Driver)	Ef19	10A	Power Antenna.
Ef2	15A	FRT Fog Lamp	Ef20	15A	Fuel Pump (GSL)
Ef3	10A	A/C Comp. (GSL)	Ef21	15A	RR Blower
Ef4	10A	Horn	Ef22	15A	Head Lamp (HI)
Ef5	20A	Power Seat (Driver)	Ef23	15A	Power Outlet (FRT)
Ef6	15A	Head Lamp (Low)	Ef24	15A	Power Outlet (RR)
Ef7	20A	Spare	Ef25	15A	OVPR (GSL)
Ef8	30A	Power Window	SB1	80A/100A/120A	Alternator
Ef9	20A	TCCU/TOD (GSL)	SB2	60A	ABS/ABD
Ef10	20A	Spare	SB3	30A	IGN Key "2"
Ef11	10A	Heated Mirror	SB4	30A	C/Fan (HI) - GSL
Ef12	30A	Defogger	SB5	30A	C/Fan (DSL), C/Fan (LOW) - DSL
Ef13	15A	Seat Warmer	SB6	50A	2nd Air Pump
Ef14	20A	Power Seat (Passenger)	SB7	30A	FRT Blower
Ef15	20A	OVPR (GSL)	SB8	30A	Cabin F/Box "B+" - 2
Ef16	10A	Tail Lamp (LH)	SB9	30A	Cabin F/Box "B+" - 1
Ef17	10A	Tail Lamp (RH)	SB10	30A	IGN Key "1"
Ef18	7.5A	Illumination			

(6) CONNECTOR

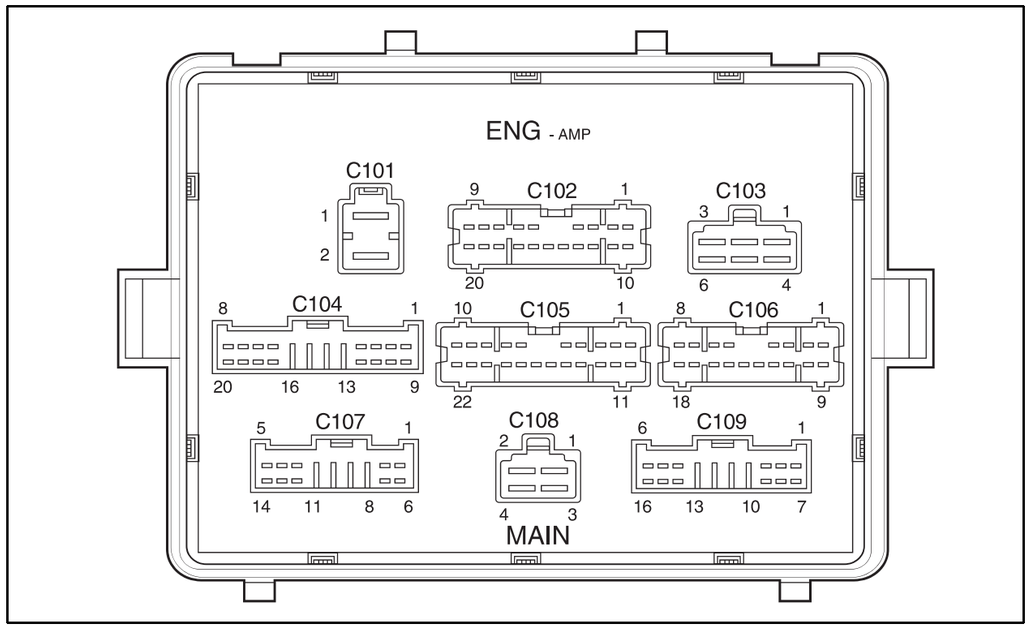
Position	Connector NO.	Pin NO.	Connector Color
A	C101	2	Black
B	C102	20	White
C	C103	6	Colorless
D	C104	20	White
E	C105	22	White
F	C106	18	White
J	C107	14	White
K	C108	4	Colorless
M	C109	16	White

2) 2003 MODEL (W/ XDi) ~

(1) FRONT

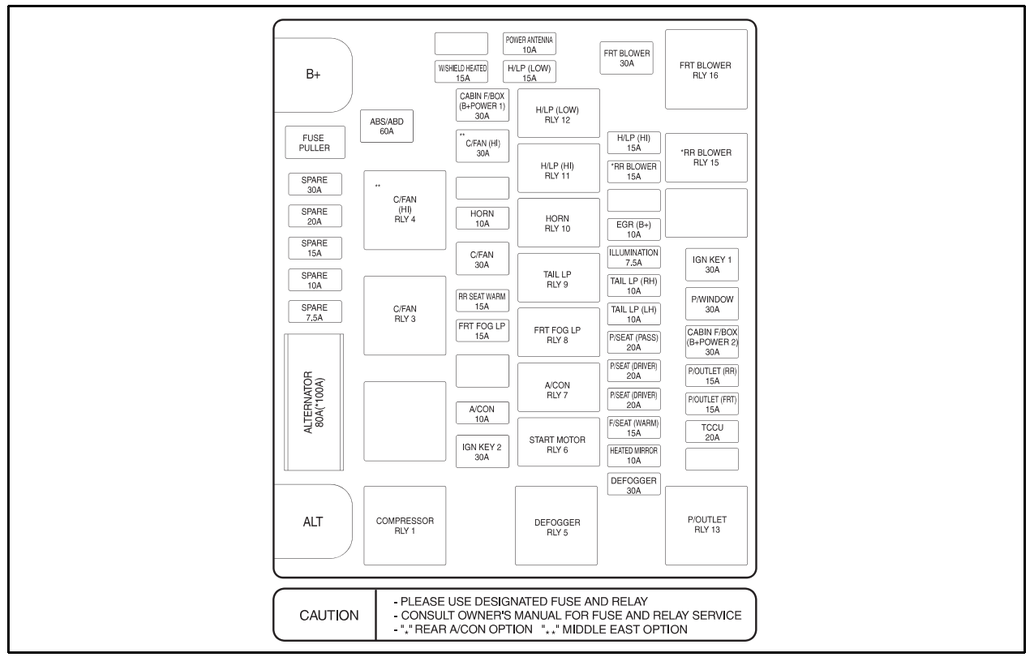


(2) REAR

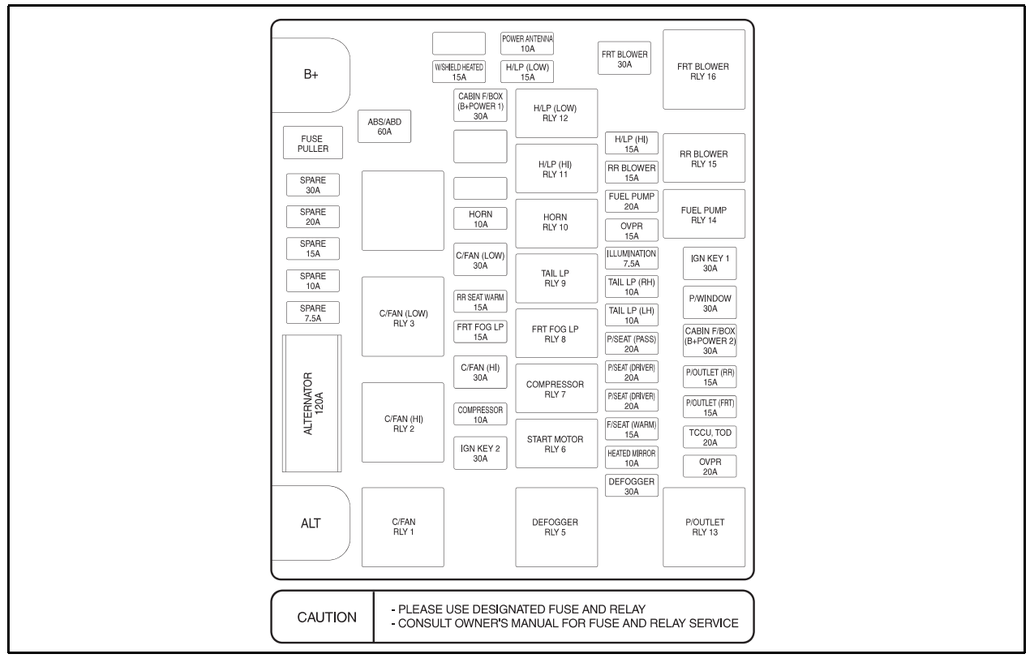


Modification basis	
Application basis	
Affected VIN	

(3) FRONT (DSL)



(4) FRONT (GSL)



(5) USAGE OF FUSE IN ENGINE ROOM FUSE BOX

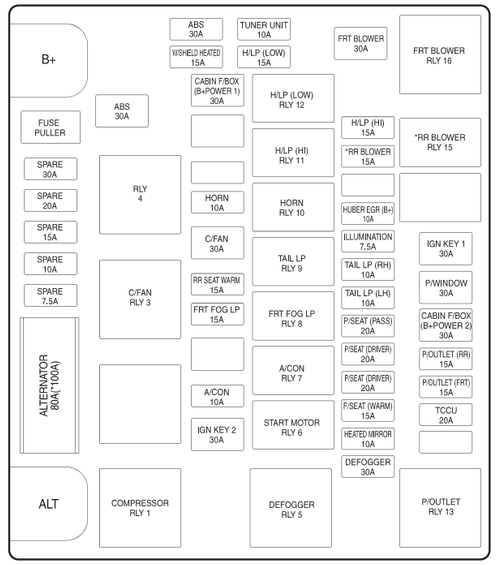
Fuse NO.	Capacity	Usage	Fuse NO.	Capacity	Usage
SB1	80A/100A/120A	Generator	Ef9	10A	PWR Antenna/Tuner Unit
SB2	60A	ABS/ABD	Ef10	30A	RR Glass Defogger
SB3	30A	IGN KEY "2"	Ef11	10A	Mirror Defogger
SB4	30A	Condenser Fan (High)-GSL	Ef12	15A	Seat Warmer
SB5	30A	Condenser Fan (Low)	Ef13	20A	Seat Position Warmer Unit
SB6	50A				(Slide & FRT Lift Motor)
SB7	30A	Fuse Box "BATT-1"	Ef14	20A	Seat Position Warmer Unit
SB8	30A	Blower (FRT)			(Recline & RR Lift Motor)
SB9	30A	Fuse Box "B+"-2	Ef15	20A	Passenger PWR Seat
SB10	30A	PWR Window	Ef16	10A	Tail Lamp (LH)
SB11	30A	IGN KEY "1"	Ef17	10A	Tail Lamp (RH)
Ef1	20A	A/C Compressor (GSL)	Ef18	7.5A	Illumination
Ef2	15A	Fog Lamp (FRT)	Ef19	15A	OVPR (GSL) 7
Ef3	15A	RR Seat Heater Unit	Ef20	20A	Fuel Pump (GSL)
Ef4	10A	Horn	Ef21	15A	RR Blower
Ef5	15A	Spare	Ef22	15A	Head Lamp (High)
Ef6	15A	Window Shield Glass	Ef23	20A	OVPR (GSL) 2
Ef7	30A	Spare	Ef24	20A	TCCU/TOD (GSL)
Ef8	15A	Head Lamp (Low)	Ef25	15A	PWR Outlet (FRT)
			Ef26	15A	PWR Outlet (RR)

(6) CONNECTOR

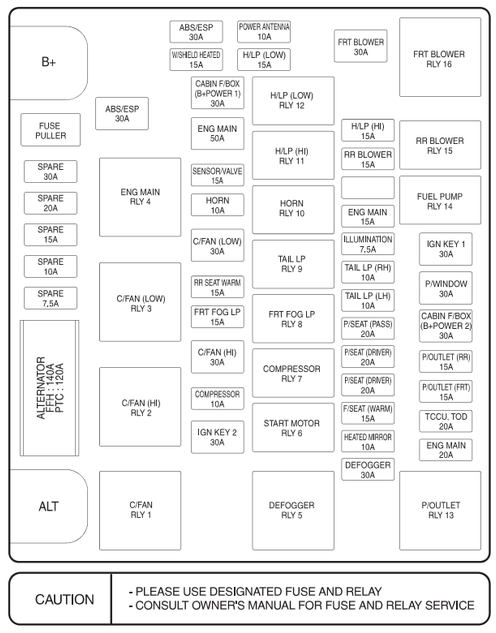
Position	Connector NO	Pin NO	Connector Color
A	C101	2	Black
B	C102	20	White
C	C103	6	Colorless
D	C104	20	White
E	C105	22	White
F	C106	18	White
J	C107	14	White
K	C108	4	Colorless
M	C109	16	White

Modification basis	
Application basis	
Affected VIN	

(7) FRONT (TI)



(8) FRONT (XDi)



(9) USAGE OF FUSE IN ENGINE ROOM FUSE BOX

Fuse NO.	Capacity	Usage	Fuse NO.	Capacity	Usage
SB1	80A/100A/120A	Generator	Ef9	10A	Tuner Unit
SB2	60A	ABS, ABS/ESP	Ef10	30A	RR Glass Defogger
SB3	30A	IGN KEY "2", Start RLY	Ef11	10A	Mirror Defogger
SB4	30A	Condenser Fan (High)	Ef12	15A	Seat Warmer
SB5	30A	Condenser Fan (Low), Condenser Fan	Ef13	20A	Seat Position Warmer Unit (Slide & FRT Lift Motor)
SB6	50A	ENG MAIN RLY			
SB7	30A	Fuse Box "BATT-1"	Ef14	20A	Seat Position Warmer Unit (Recline & RR Lift Motor)
SB8	30A	Blower (FRT)			
SB9	30A	Fuse Box "B+"-2	Ef15	20A	Passenger PWR Seat
SB10	30A	PWR Window	Ef16	10A	Tail Lamp (LH)
SB11	30A	IGN KEY "1"	Ef17	10A	Tail Lamp (RH)
Ef1	20A	A/C Compressor, (XDi) A/C RLY	Ef18	7.5A	Illumination
Ef2	15A	Fog Lamp (FRT)	Ef19	15A	ENG Main RLY(XDi), Huber EGR
Ef3	15A	RR Seat Heater Unit	Ef20	15A	
Ef4	10A	Horn	Ef21	15A	RR Blower
Ef5	15A	EGR, HFM Sensor	Ef22	15A	Head Lamp (High)
Ef6	15A	Window Shield Glass	Ef23	20A	ENG Main RLY(XDi)
Ef7	30A	ABS, ABS/ESP	Ef24	20A	TCCU/TOD
Ef8	15A	Head Lamp (Low)	Ef25	15A	PWR Outlet (FRT)
			Ef26	15A	PWR Outlet (RR)

(10)CONNECTOR

Position	Connector NO	Pin NO	Connector Color
A	C101	2	Black
B	C102	20	White
C	C103	6	Colorless
D	C104	20	White
E	C105	22	White
F	C106	18	White
J	C107	14	White
K	C108	4	Colorless
M	C109	16	White

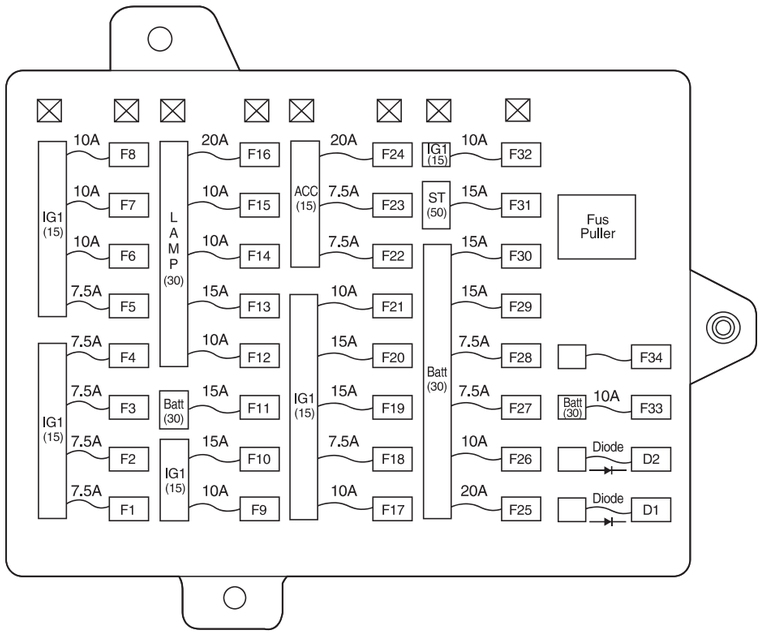
Modification basis	
Application basis	
Affected VIN	

S.G.N. 8410-04

I.P FUSE & RELAY BOX

1) ~ 2002 MODEL

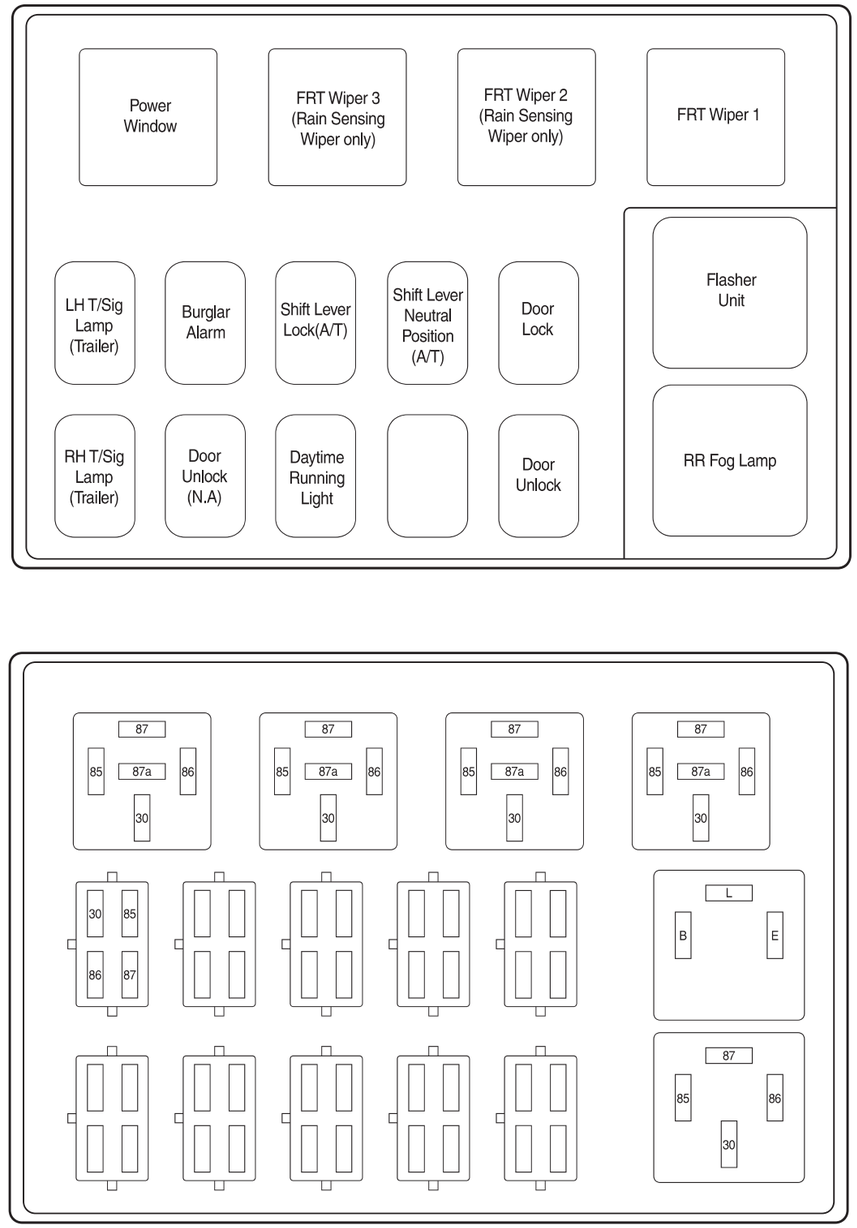
(1) FUSE BOX



(2) POWER SUPPLY

Diode (Air-con)		NO.25	Sun Roof	NO.17	Head Lamp	NO.9	Condensor Fan	NO.1	Shift Lever Shift Lock Immobilizer
		20A		10A		10A		7.5A	
Diode		NO.26	Rear Wiper	NO.18	A/C Outside Rear View Mirror	NO.10	OVPR	NO.2	I/P STICS
		10A		7.5A		15A		7.5A	
NO.33	OVPR	NO.27	Audio STICS I/P	NO.19	Front Wiper Front Washer	NO.11	Rain Sensor	NO.3	Backward Lamp
10A		7.5A		15A		15A		15A	
NO.34		NO.28	Siren Power Window	NO.20	Rear Wiper Rear Washer	NO.12	Trailer	NO.4	TCU TCCU
		7.5A		15A		10A		7.5A	
		NO.29		NO.21	Rear Defogger Blower A/C	NO.13	Hazard Lamp	NO.5	Rear Video Mirror Autolight ENG Glow
		15A		10A		15A		7.5A	
		NO.30	Door Lock	NO.22	Power Outlet Rear View Mirror Clock	NO.14	RR Fog	NO.6	Speed Sensor
		15A		7.5A		10A		10A	
Fuse Puller		NO.31	Ignition	NO.23	Audio	NO.15	Passenger Lamp	NO.7	ABS ABD
		15A		7.5A		10A		10A	
		NO.32	IDI ECU	NO.24	Ciger Lighter	NO.16	Stop Lamp	NO.8	Air Bag
		10A		20A		20A		10A	
		20A	Reserve Fuse	15A	Reserve Fuse	10A	Reserve Fuse	7.5A	Reserve Fuse

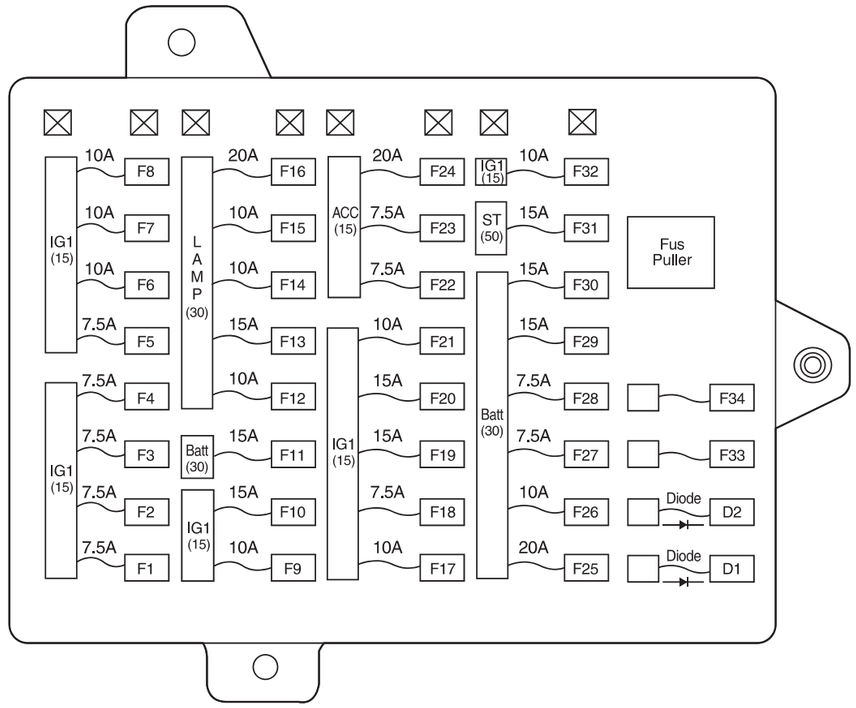
(3) RELAY



Modification basis	
Application basis	
Affected VIN	

2) 2003 MODEL ~

(1) FUSE BOX

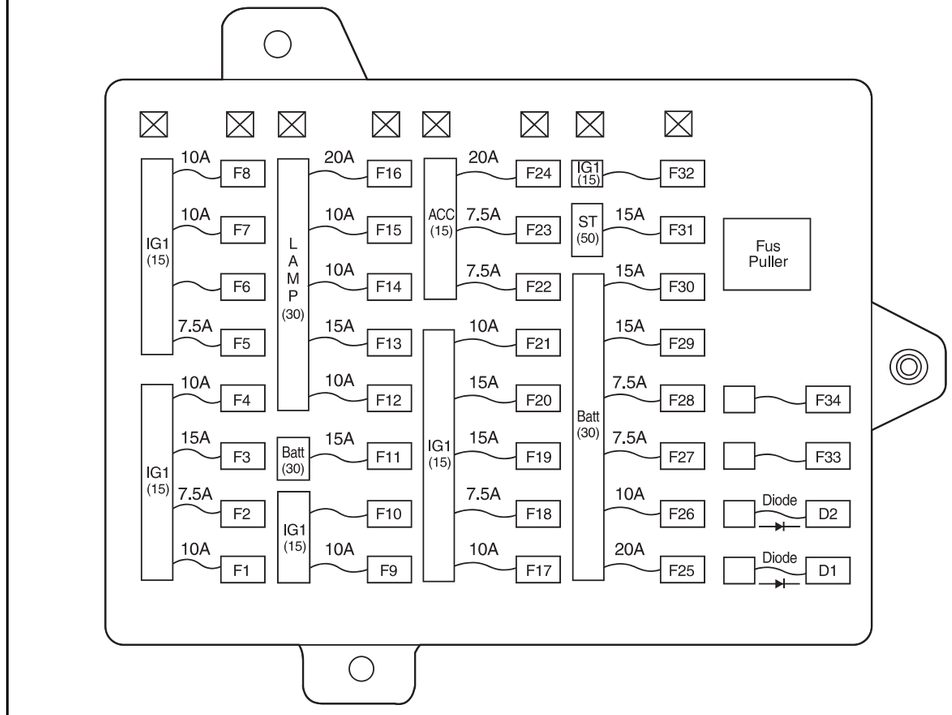


(2) POWER SUPPLY

DIODE	NO.25 20A	SUN ROOF	NO.17 10A	HEAD LAMP	NO.9 10A	C/FAN	NO.1 7.5A	AT SHIFT LEVER LOCK IMMOBILIZER
DIODE	NO.26 10A	RR WIPER	NO.18 7.5A	A/CON O/S MIRROR	NO.10 15A	OVPR	NO.2 7.5A	CLUSTER STICS DRL
NO.33	NO.27 7.5A	AUDIO STICS CLUSTER	NO.19 15A	FRT WIPER FRT WASHER	NO.11 15A	RAIN SENSOR	NO.3 15A	B/UP LAMP T/SIG LAMP
NO.34	NO.28 7.5A	SIREN P/W WINDOW	NO.20 15A	RR WIPER FRT WASHER	NO.12 10A	STOP LAMP (TRAILER)	NO.4 7.5A	TCU TCCU
	NO.29 15A	MULTIVISION	NO.21 10A	DEFOGGER BLOWER A/CON	NO.13 15A	HAZARD LAMP	NO.5 7.5A	I/S MIRROR ENG PREHEAT'G AUTO LIGHT
	NO.30 15A	DOOR LOCK	NO.22 7.5A	POWER OUTLET O/S MIROR CLOCK	NO.14 10A	RR FOG LAMP	NO.6 10A	SPEED SENSOR
FUSE PULLER	NO.31 15A	START MOTOR	NO.23 7.5A	AUDIO	NO.15 10A	INTERIOR LAMP	NO.7 10A	ABS ABD
	NO.32 10A		NO.24 20A	CIGAR LIGHTER	NO.16 20A	STOP LAMP	NO.8 10A	AIR BAG
	20A	RESERVE FUSE	15A	RESERVE FUSE	10A	RESERVE FUSE	7.5A	RESERVE FUSE

3) TI

(1) FUSE BOX



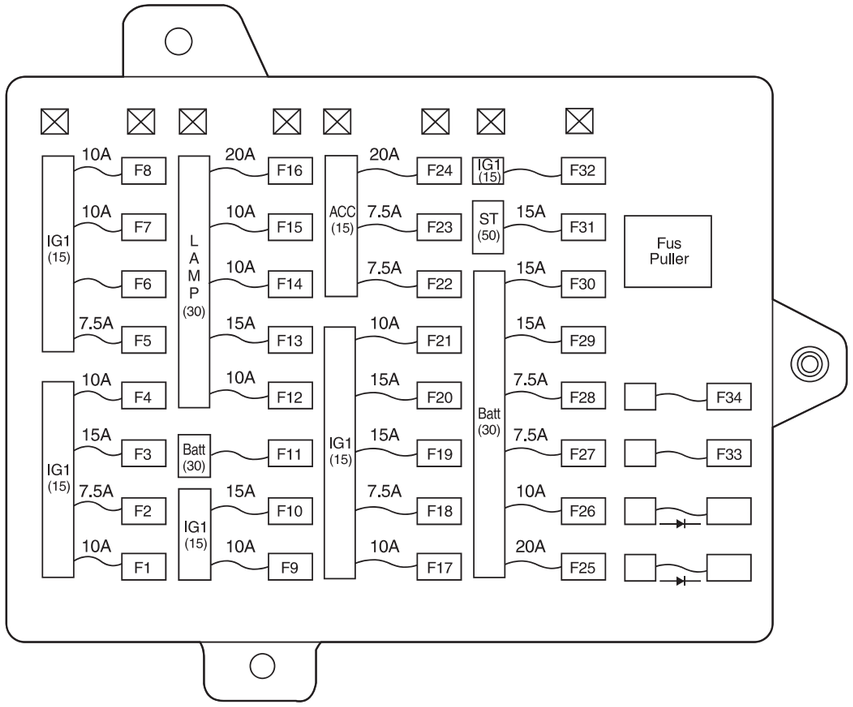
(2) POWER SUPPLY

	NO.25 20A	SUN ROOF	NO.17 10A	HEAD LAMP	NO.9 10A	C/FAN	NO.1 10A	AT SHIFT LEVER LOCK IMMOBILIZER
DIODE (A/C)	NO.26 10A	RR WIPER	NO.18 7.5A	A/CON O/S MIRROR	NO.10		NO.2 7.5A	CLUSTER STICS DRL
NO.33	NO.27 7.5A	FOLDING UNIT STICS CLUSTER	NO.19 15A	FRT WIPER FRT WASHER	NO.11 15A	RAIN SENSOR	NO.3 15A	B/UP LAMP T/SIG LAMP
NO.34	NO.28 7.5A	SIREN P/W WINDOW	NO.20 15A	RR WIPER FRT WASHER	NO.12 7.5A	STOP LAMP (TRAILER)	NO.4 7.5A	TCU TCCU
	NO.29 15A	MULTIVISION	NO.21 10A	DEFOGGER BLOWER A/CON	NO.13 15A	HAZARD LAMP	NO.5 7.5A	I/S MIRROR ENG PREHEAT'G AUTO LIGHT
	NO.30 15A	DOOR LOCK	NO.22 7.5A	POWER OUTLET O/S MIROR CLOCK	NO.14 10A	RR FOG LAMP	NO.6 10A	SPEED SENSOR
FUSE PULLER	NO.31 15A	START MOTOR	NO.23 7.5A	AUDIO	NO.15 10A	INTERIOR LAMP	NO.7 10A	ABS
	NO.32		NO.24 20A	CIGAR LIGHTER	NO.16 20A	STOP LAMP	NO.8 10A	AIR BAG
	20A	RESERVE FUSE	15A	RESERVE FUSE	10A	RESERVE FUSE	7.5A	RESERVE FUSE

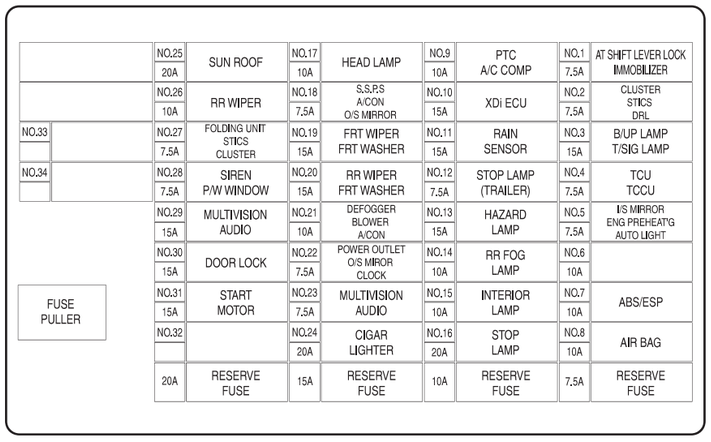
Modification basis	
Application basis	
Affected VIN	

4) XDi

(1) FUSE BOX

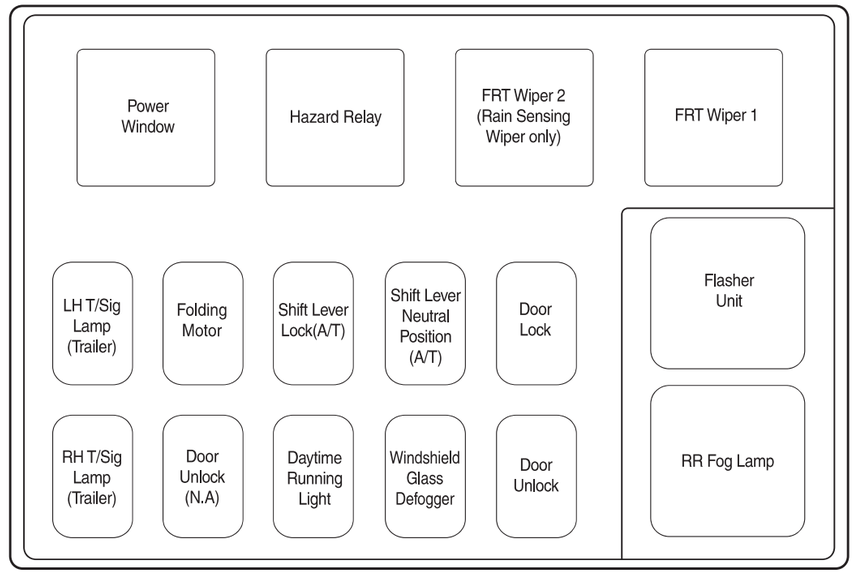


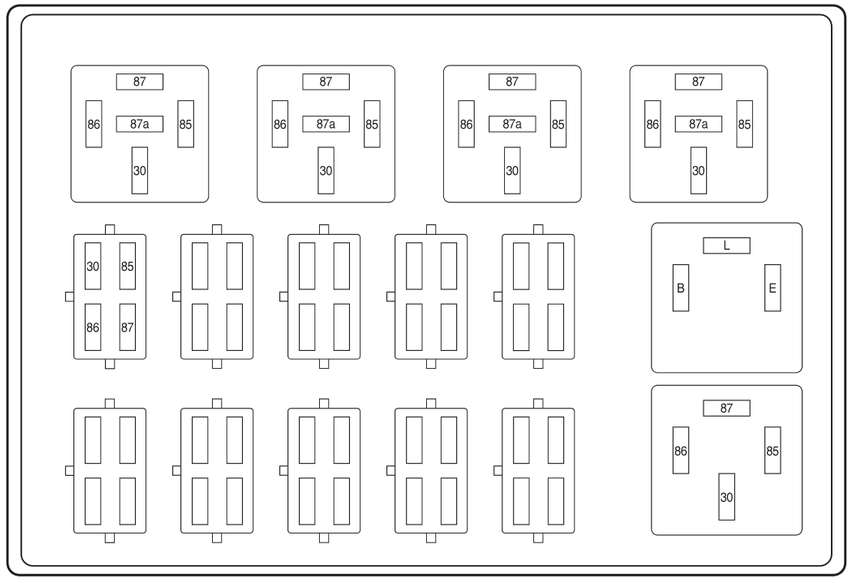
(2) POWER SUPPLY



	NO.25 20A	SUN ROOF	NO.17 10A	HEAD LAMP	NO.9 10A	PTC A/C COMP	NO.1 7.5A	AT SHIFT LEVER LOCK IMMOBILIZER
	NO.26 10A	RR WIPER	NO.18 7.5A	S.S.P.S A/CON O/S MIRROR	NO.10 15A	XDi ECU	NO.2 7.5A	CLUSTER STICS DRL
NO.33	NO.27 7.5A	FOLDING UNIT STICS CLUSTER	NO.19 15A	FRT WIPER FRT WASHER	NO.11 15A	RAIN SENSOR	NO.3 15A	B/UP LAMP T/SIG LAMP
NO.34	NO.28 7.5A	SIREN P/W WINDOW	NO.20 15A	RR WIPER FRT WASHER	NO.12 7.5A	STOP LAMP (TRAILER)	NO.4 7.5A	TCU TCCU
	NO.29 15A	MULTIVISION AUDIO	NO.21 10A	DEFOGGER BLOWER A/CON	NO.13 15A	HAZARD LAMP	NO.5 7.5A	I/S MIRROR ENG PREHEAT'G AUTO LIGHT
	NO.30 15A	DOOR LOCK	NO.22 7.5A	POWER OUTLET O/S MIROR CLOCK	NO.14 10A	RR FOG LAMP	NO.6 10A	
FUSE PULLER	NO.31 15A	START MOTOR	NO.23 7.5A	MULTIVISION AUDIO	NO.15 10A	INTERIOR LAMP	NO.7 10A	ABS/ESP
	NO.32		NO.24 20A	CIGAR LIGHTER	NO.16 20A	STOP LAMP	NO.8 10A	AIR BAG
	20A	RESERVE FUSE	15A	RESERVE FUSE	10A	RESERVE FUSE	7.5A	RESERVE FUSE

(3) RELAY



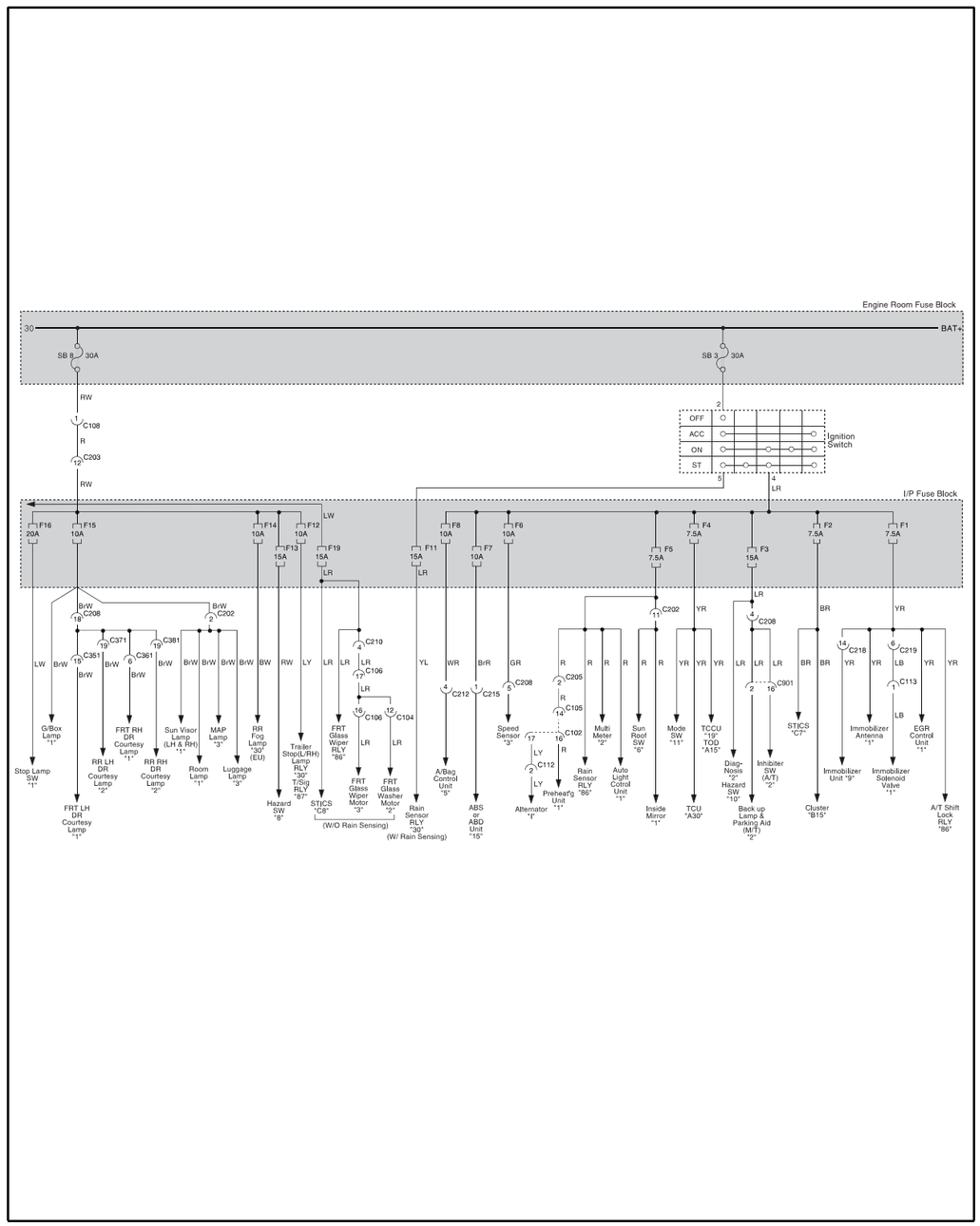


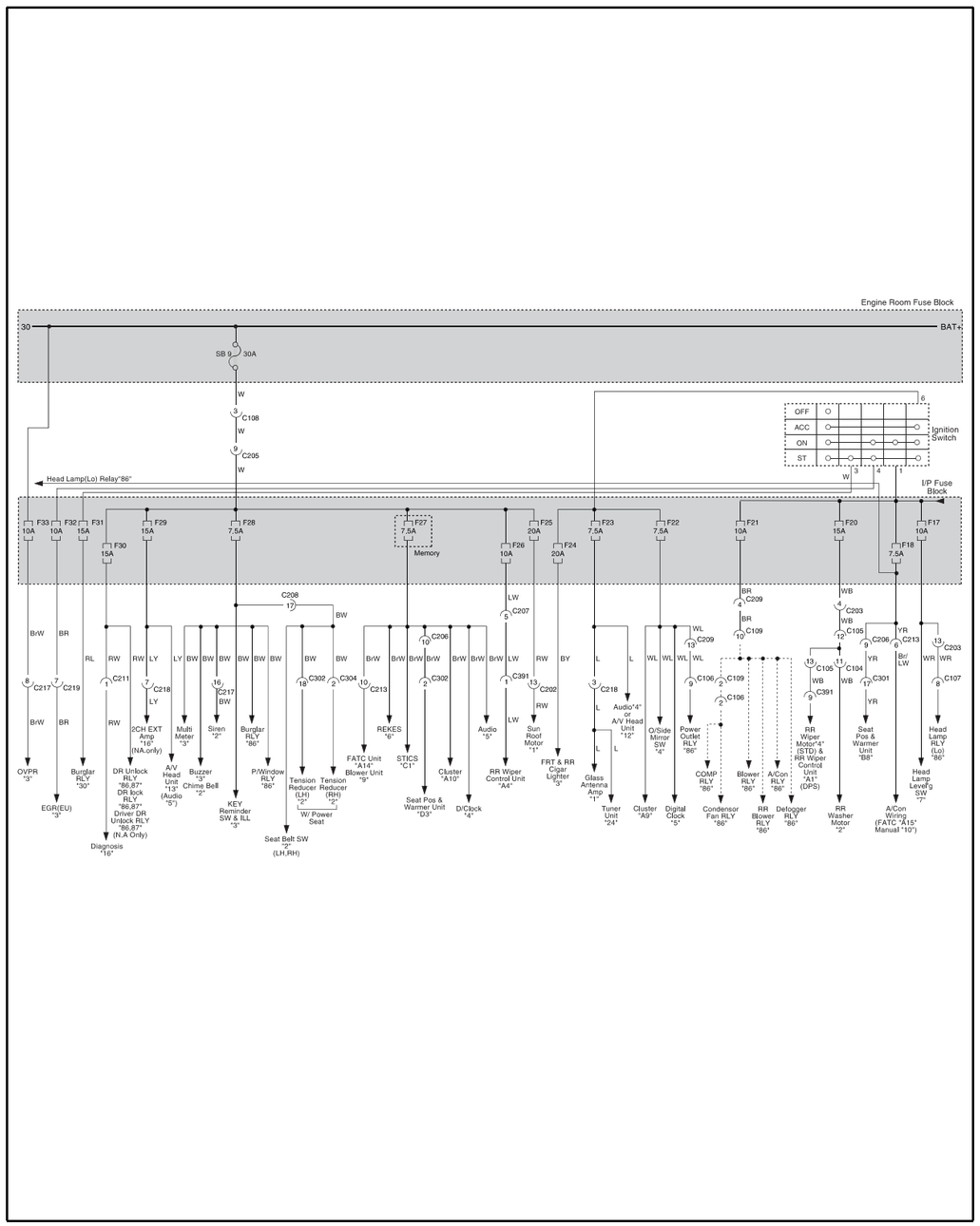
Modification basis	
Application basis	
Affected VIN	

ELECTRICITY DIVIDE

S.G.N 8210-02 POWER WIRING DIAGRAM (DSL)

(1) ~ 2002 MODEL

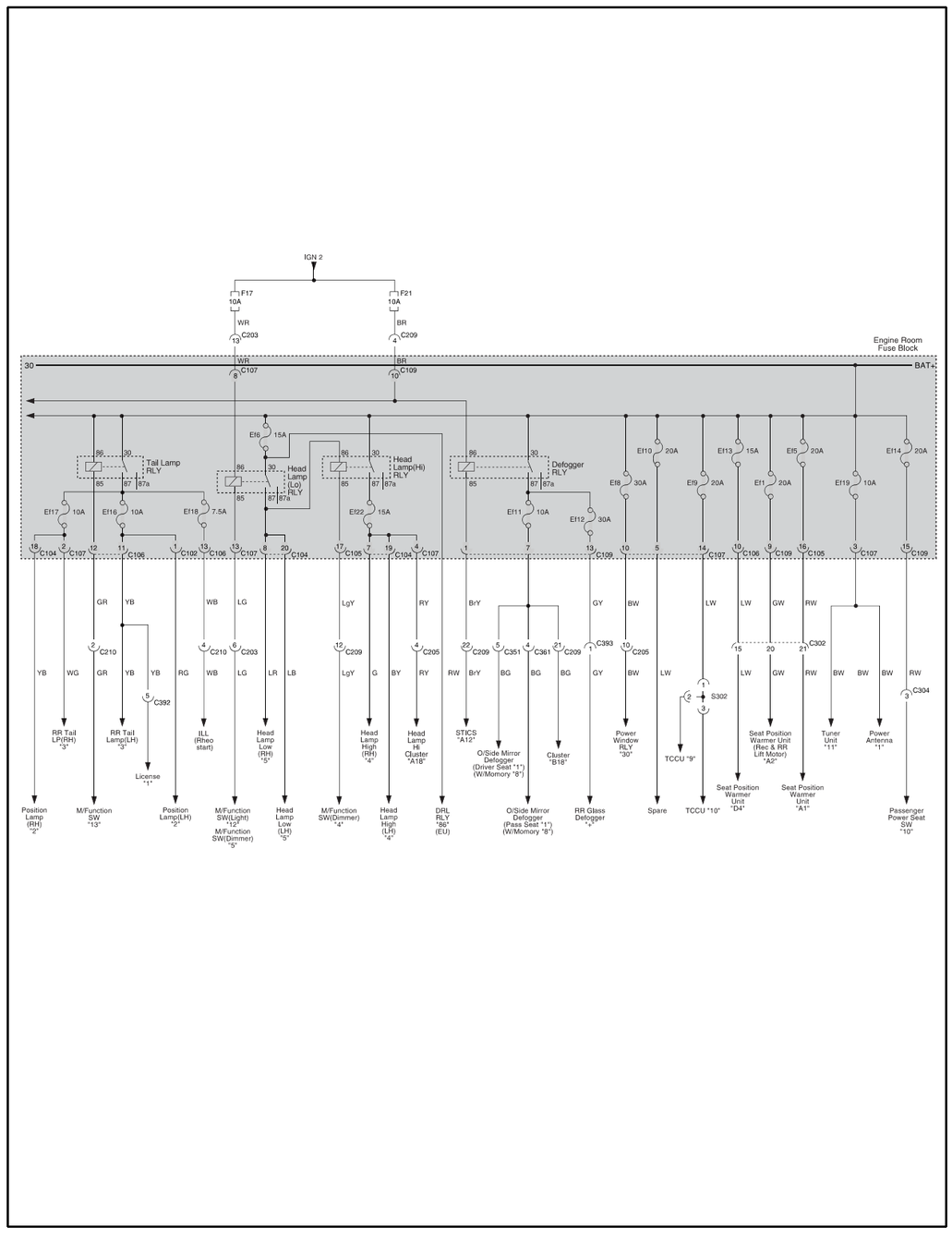


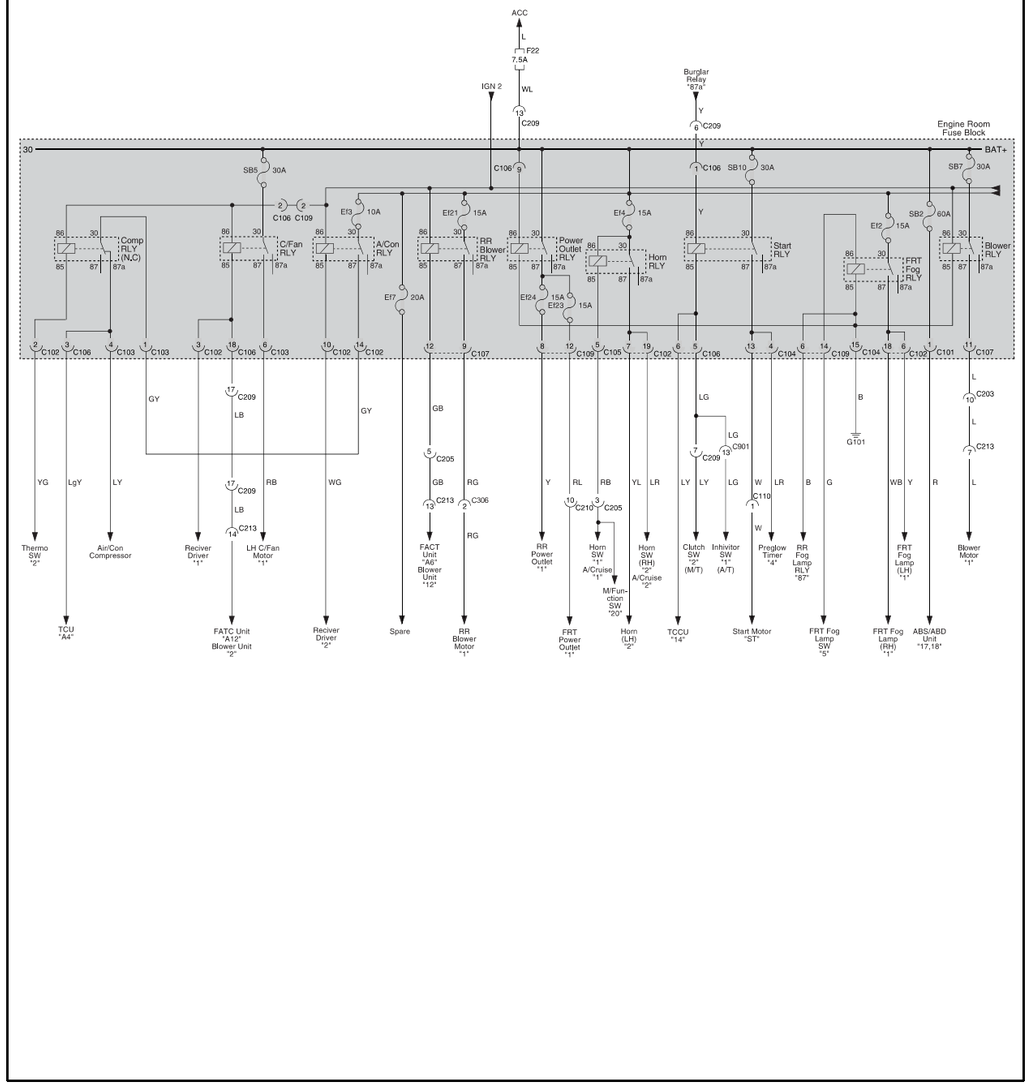


POWER DISTRIBUTION

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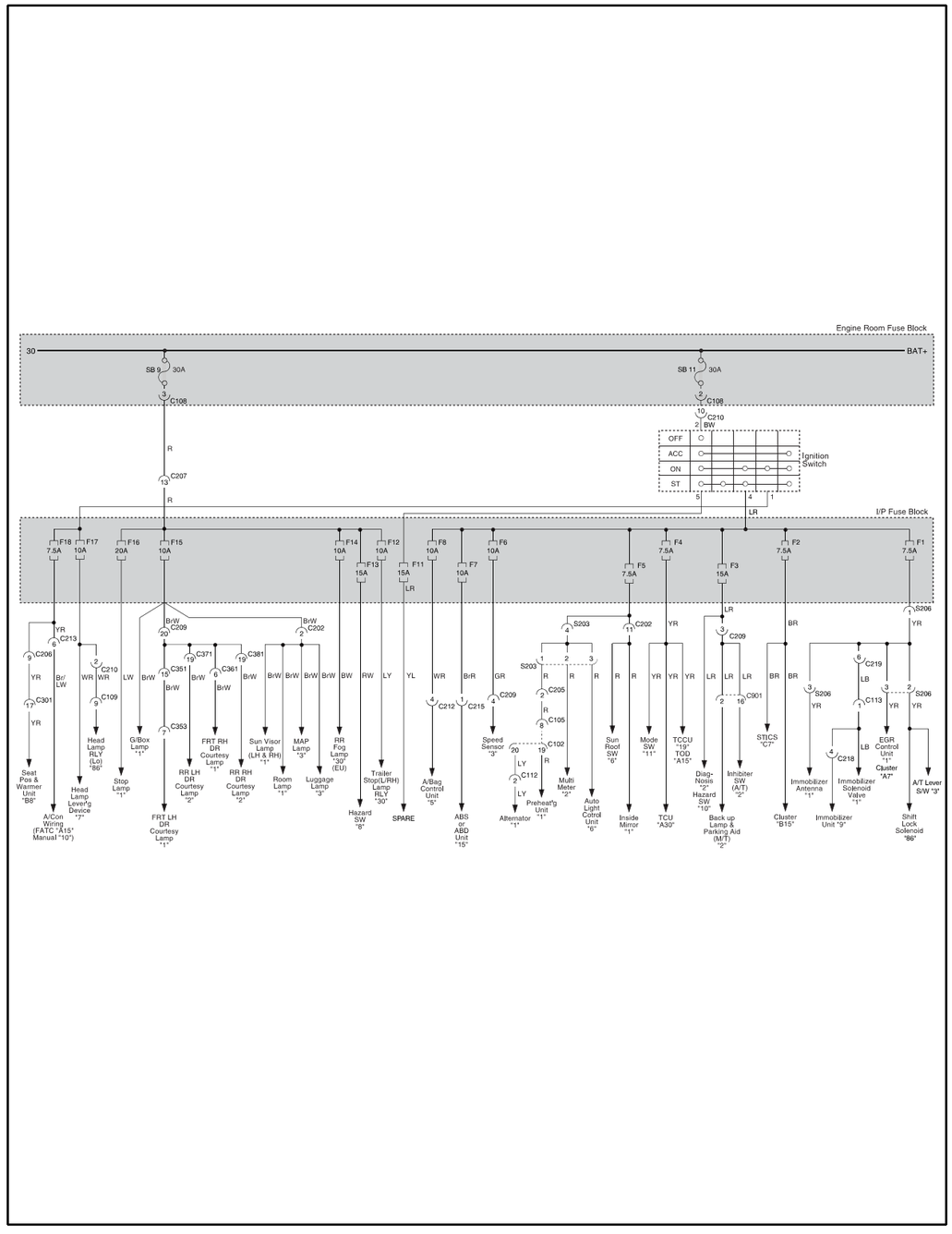
Modification basis	
Application basis	
Affected VIN	

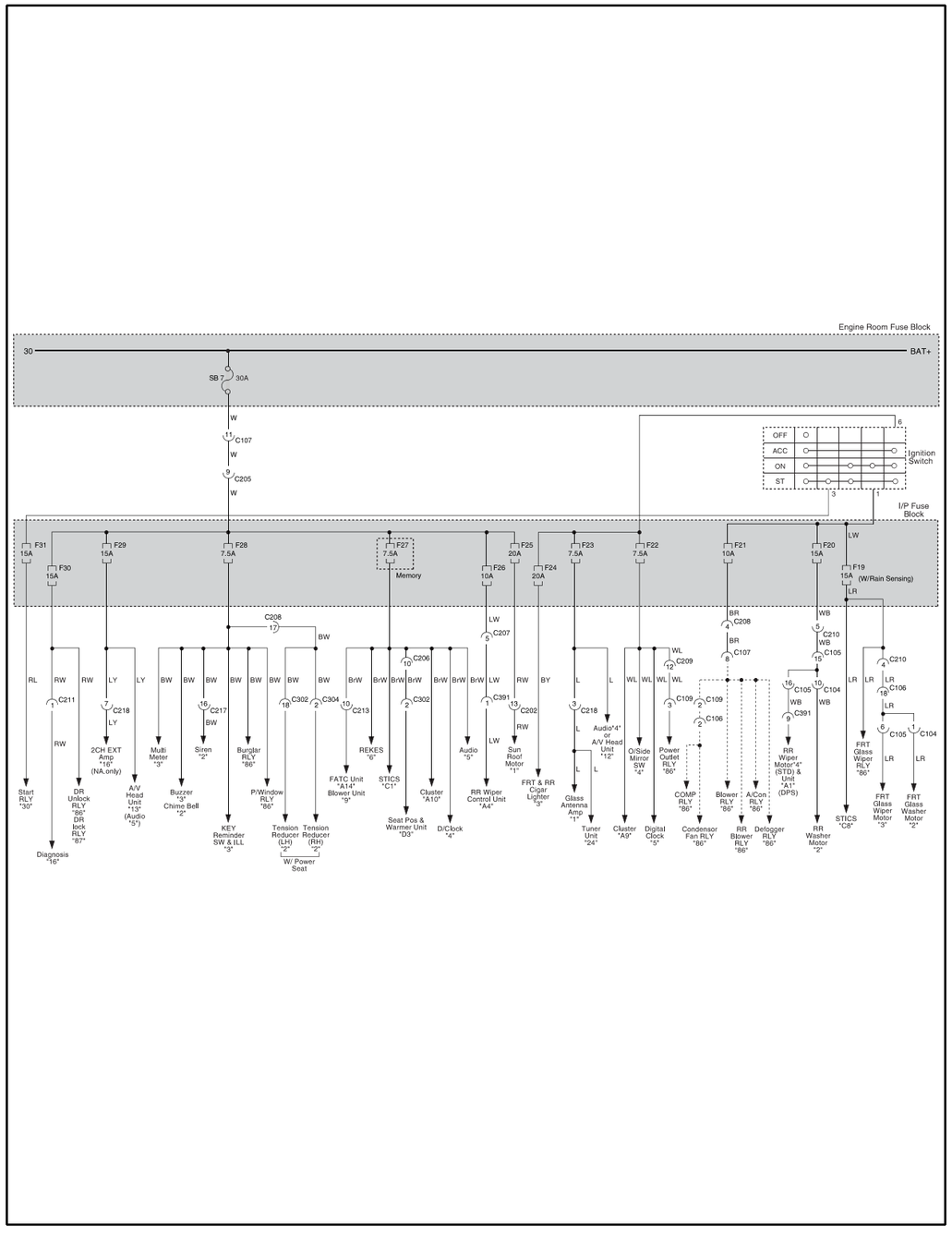




Modification basis	
Application basis	
Affected VIN	

(2) 2003 MODEL

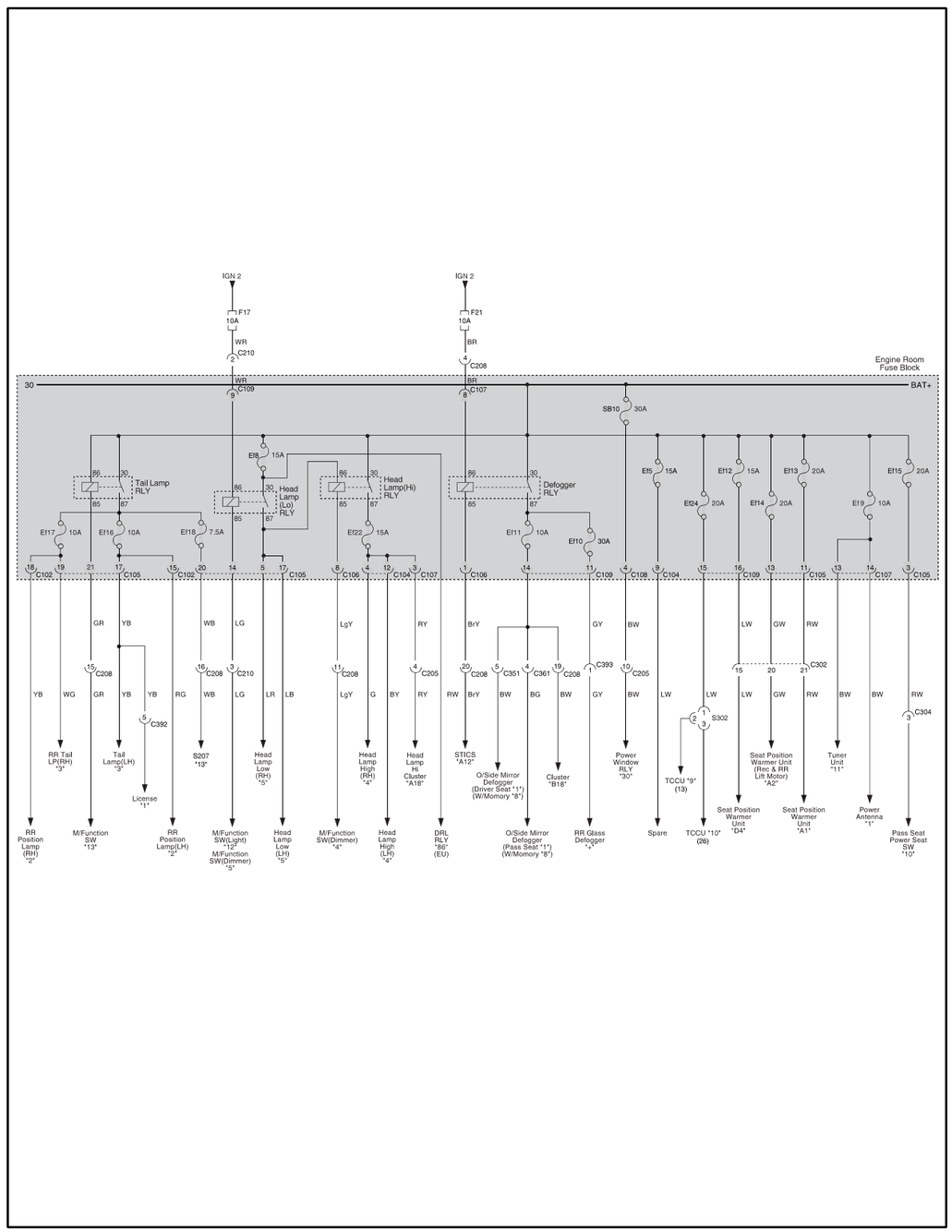


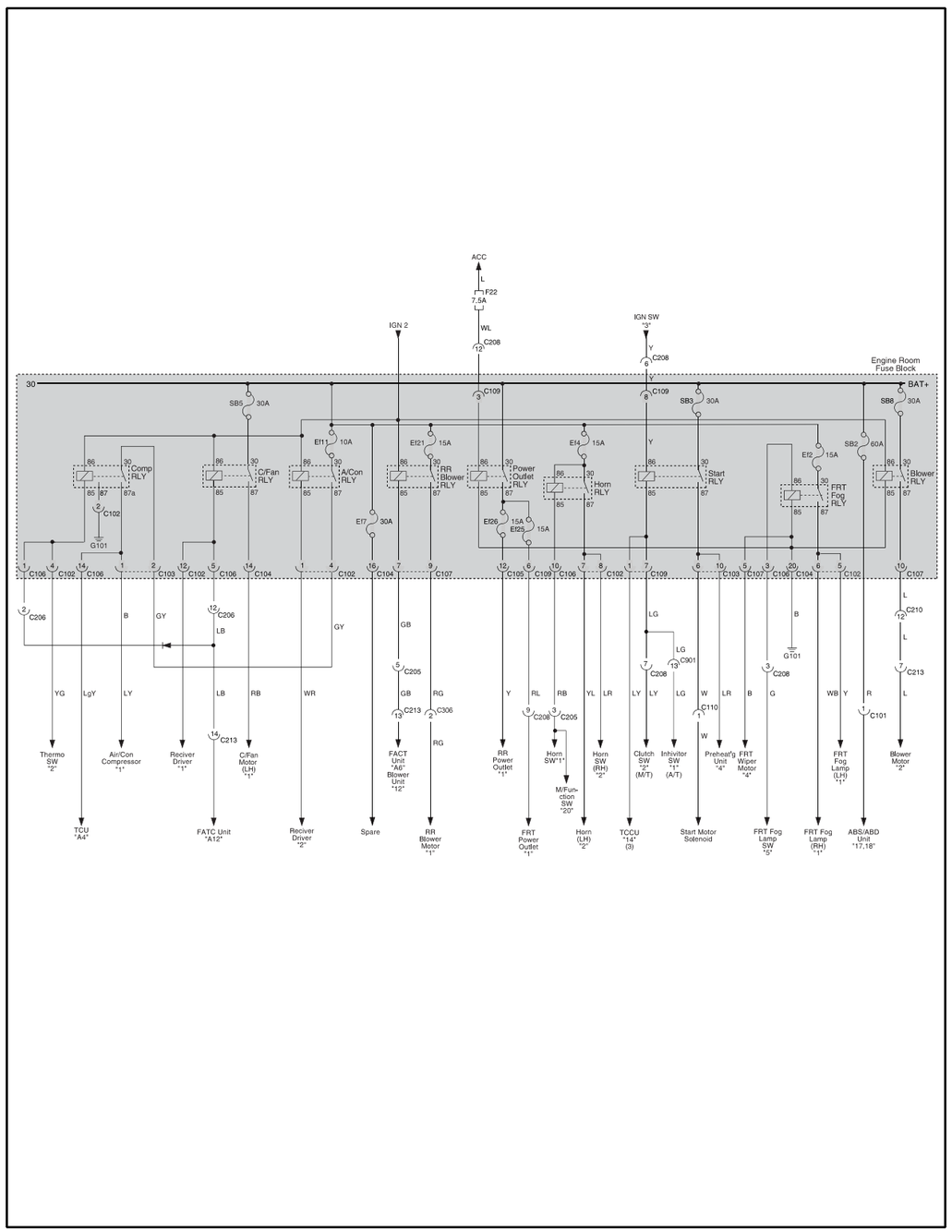


POWER DISTRIBUTION

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	



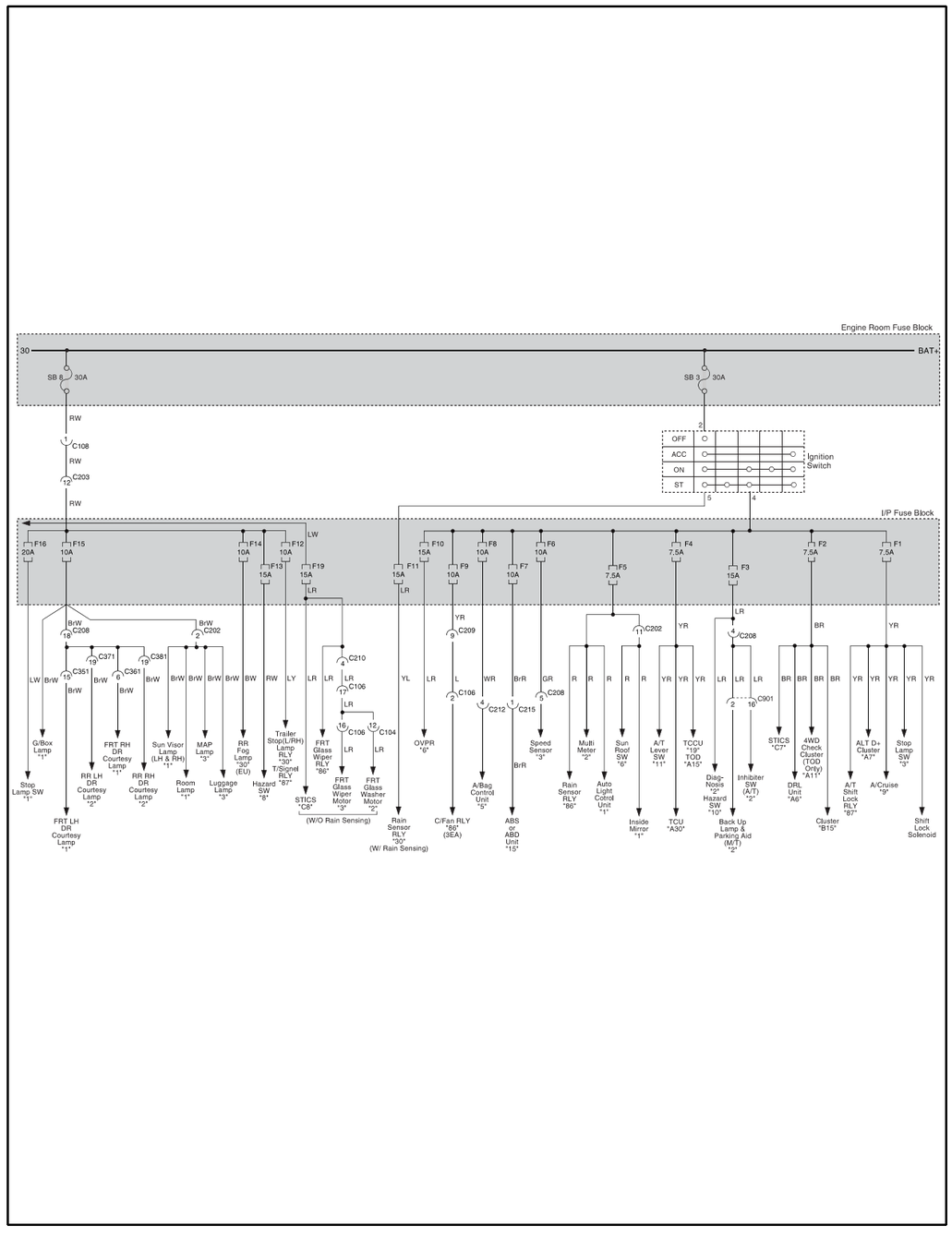


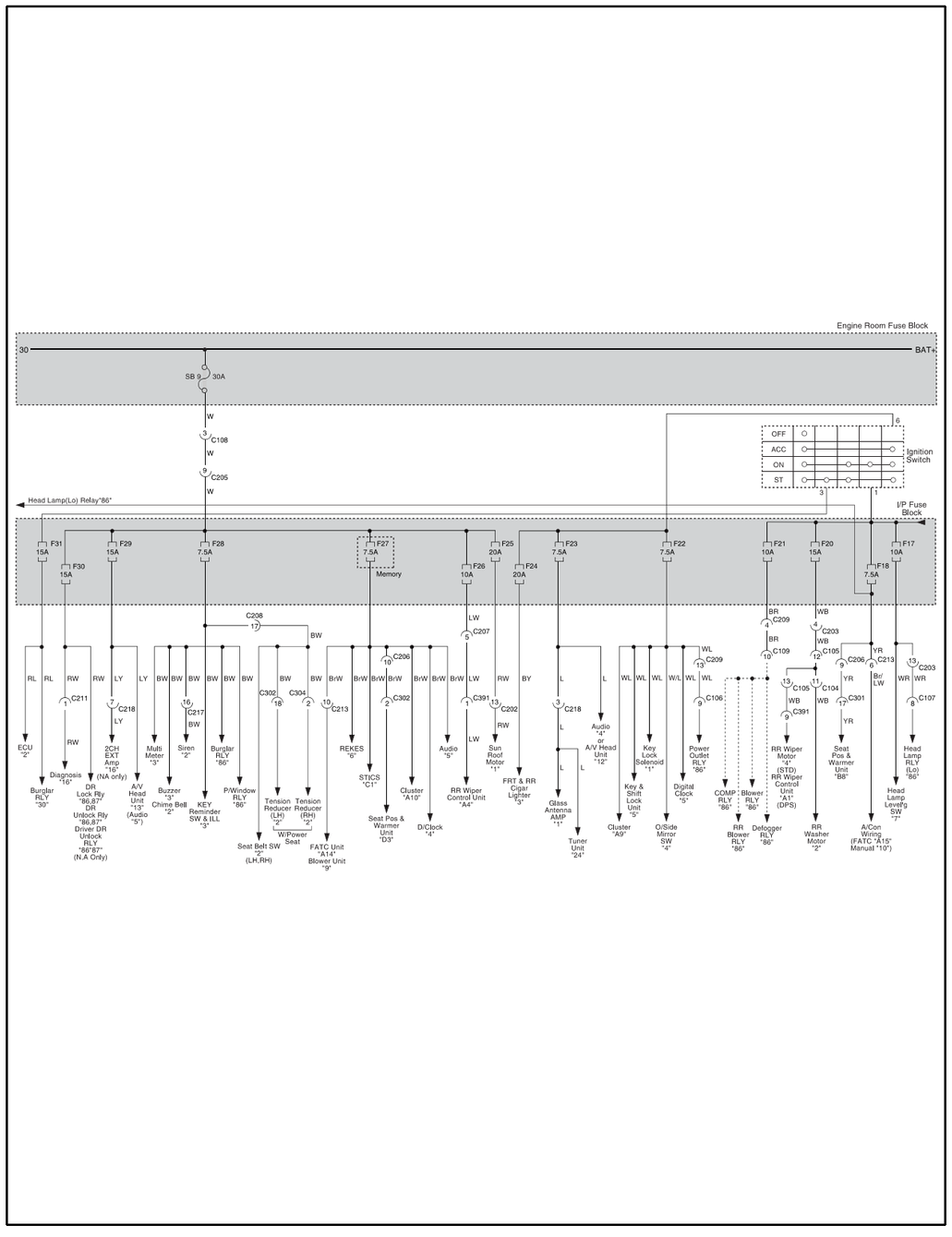
Modification basis	
Application basis	
Affected VIN	

S.G.N. 8410-04

POWER WIRING DIAGRAM (GSL)

(1) ~ 2002 MODEL

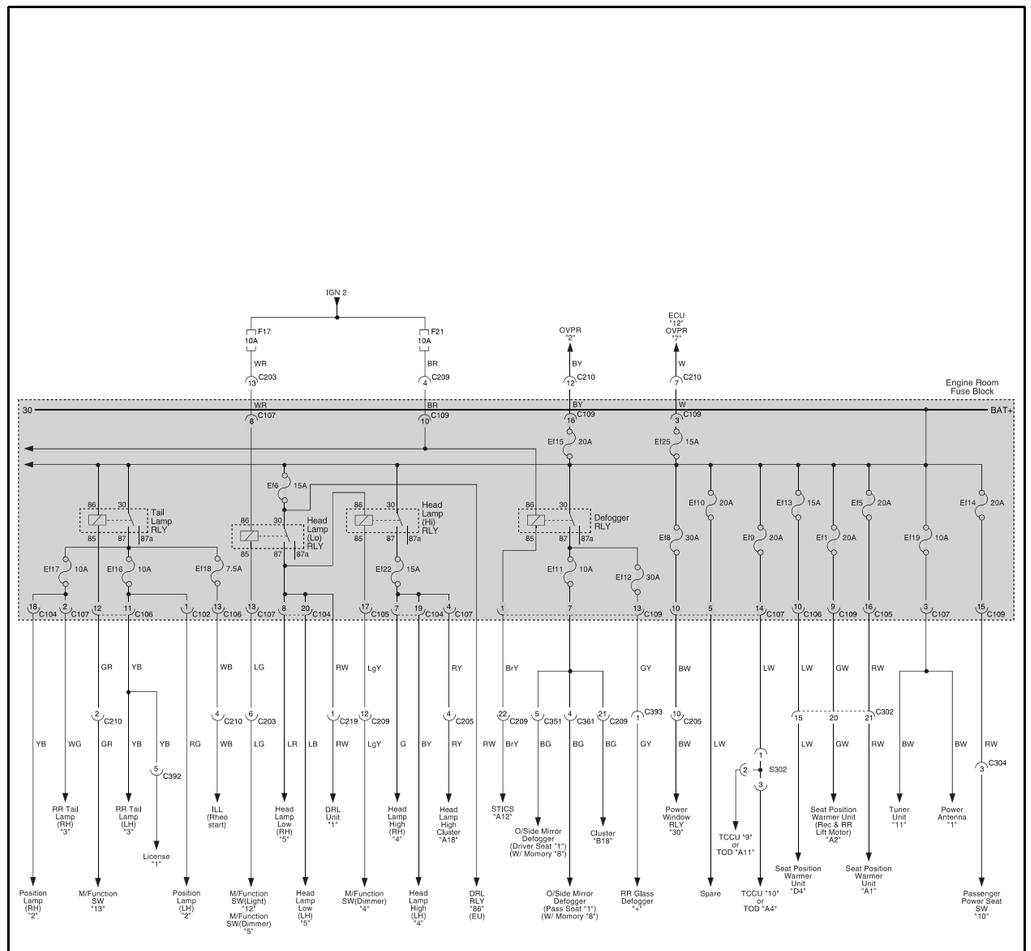


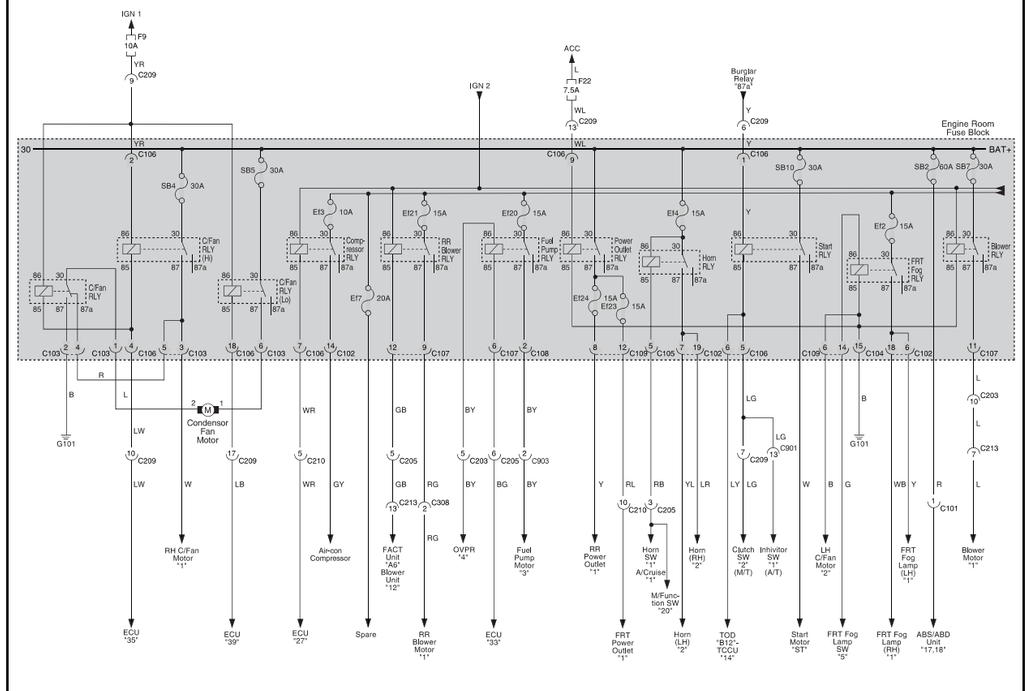


POWER DISTRIBUTION

REXTON 2004.04

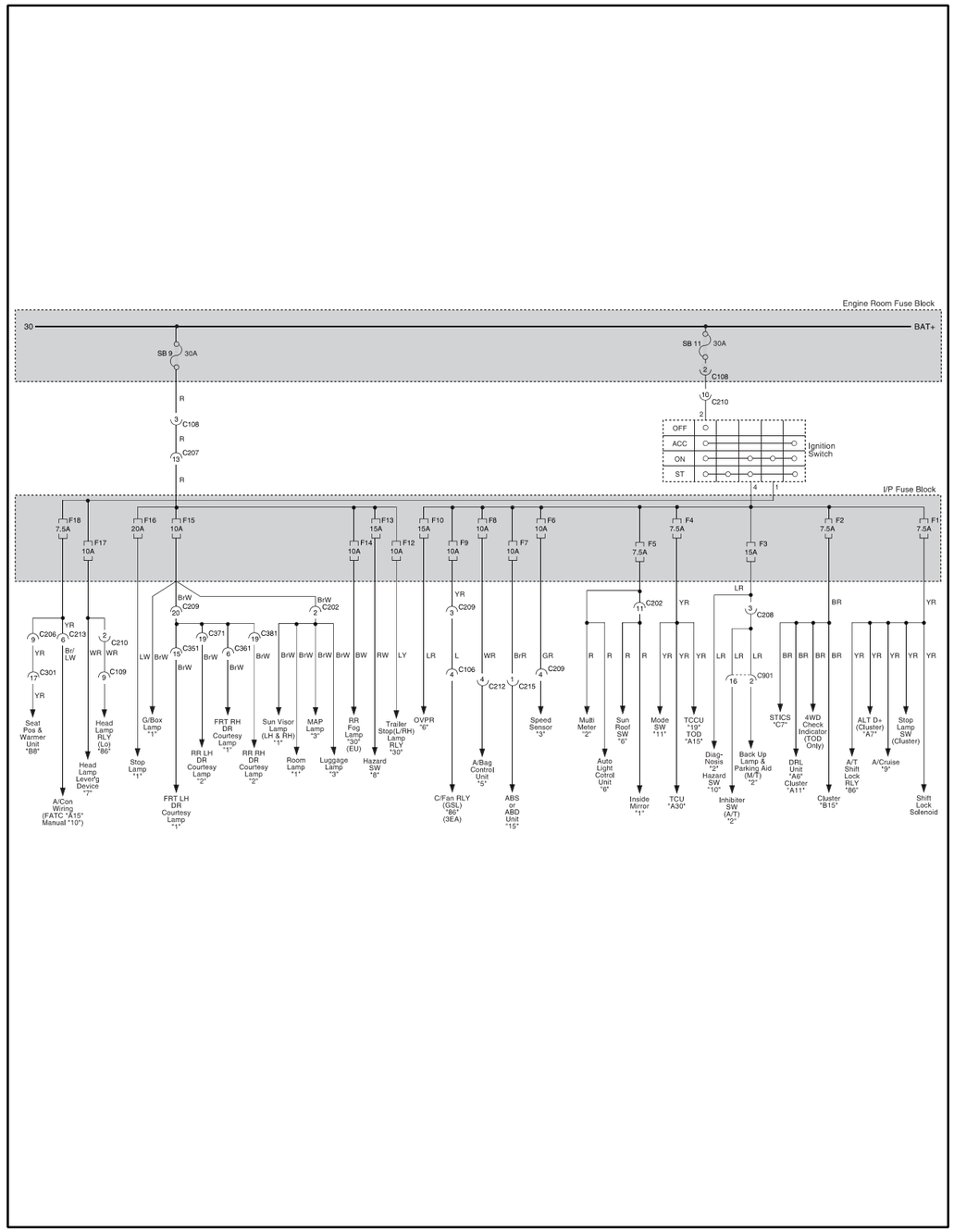
Modification basis	
Application basis	
Affected VIN	

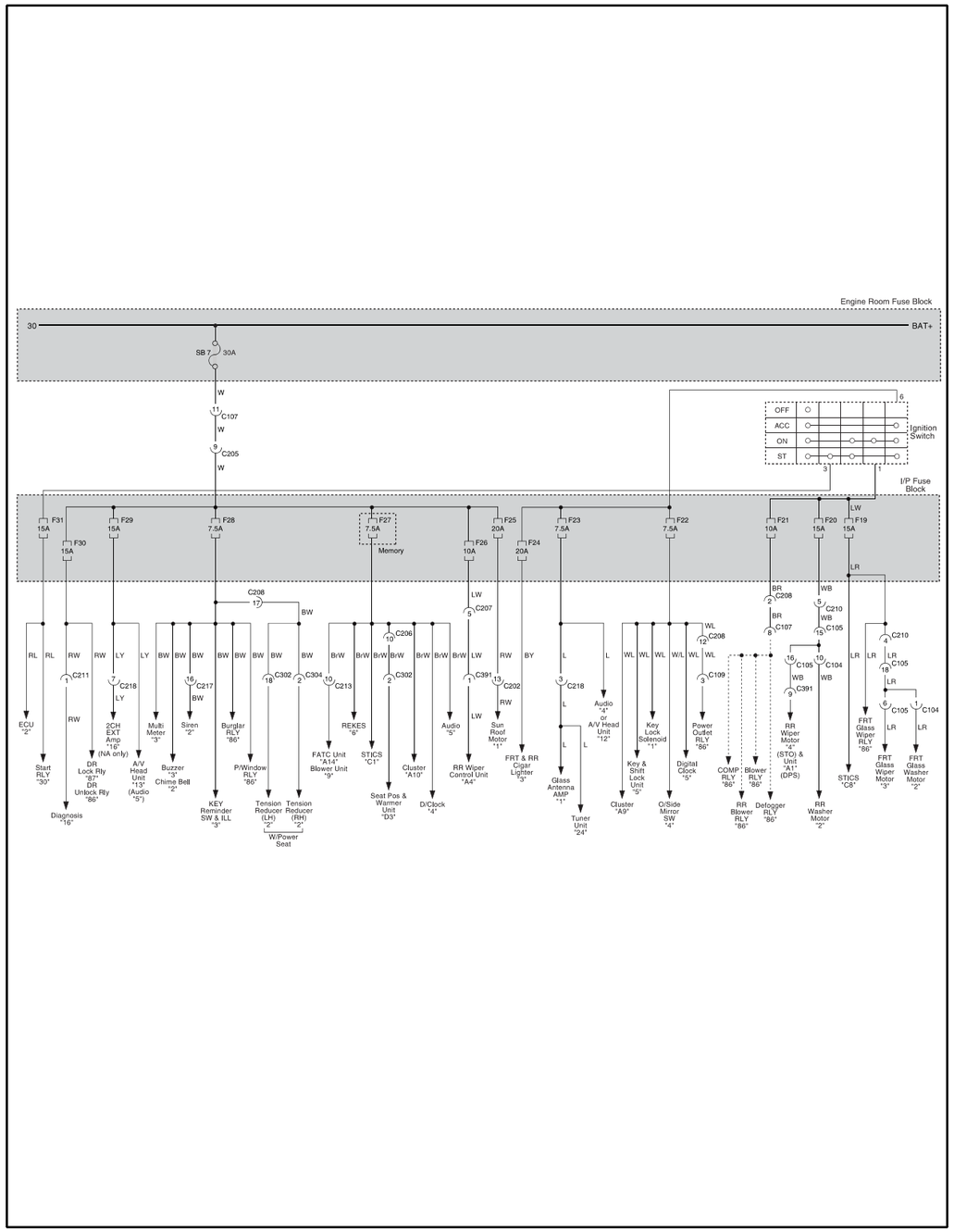




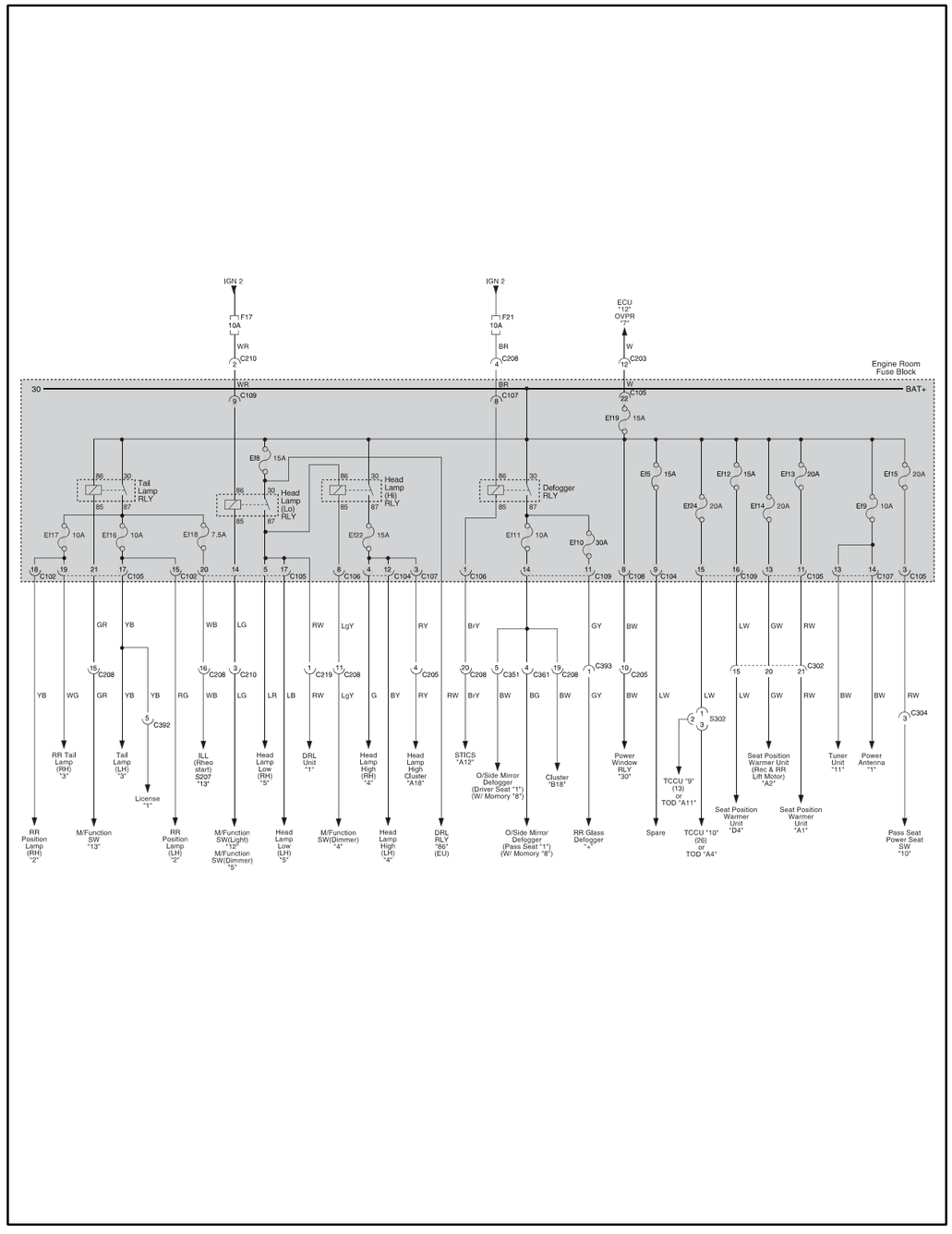
Modification basis	
Application basis	
Affected VIN	

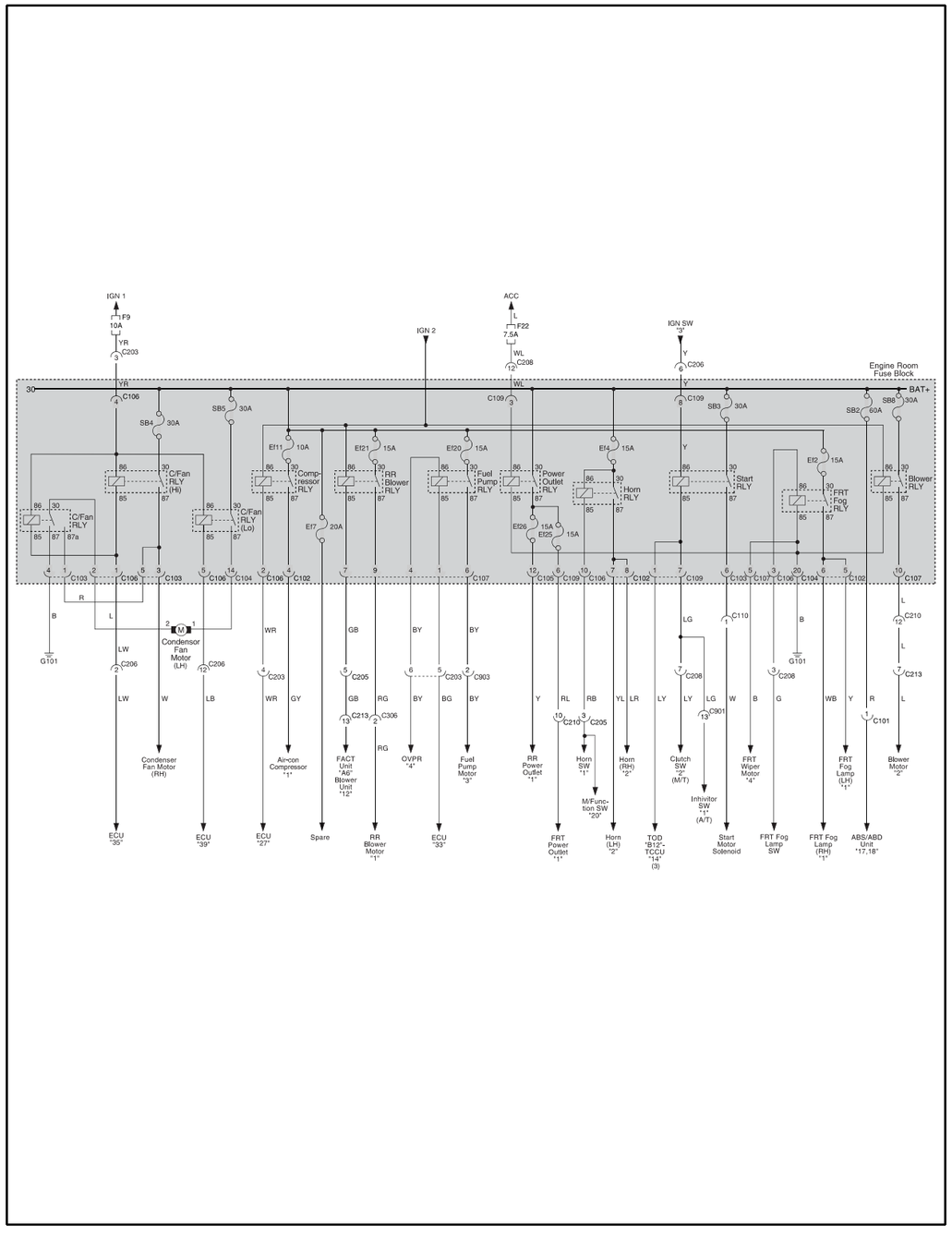
(2) 2003 MODEL





Modification basis	
Application basis	
Affected VIN	





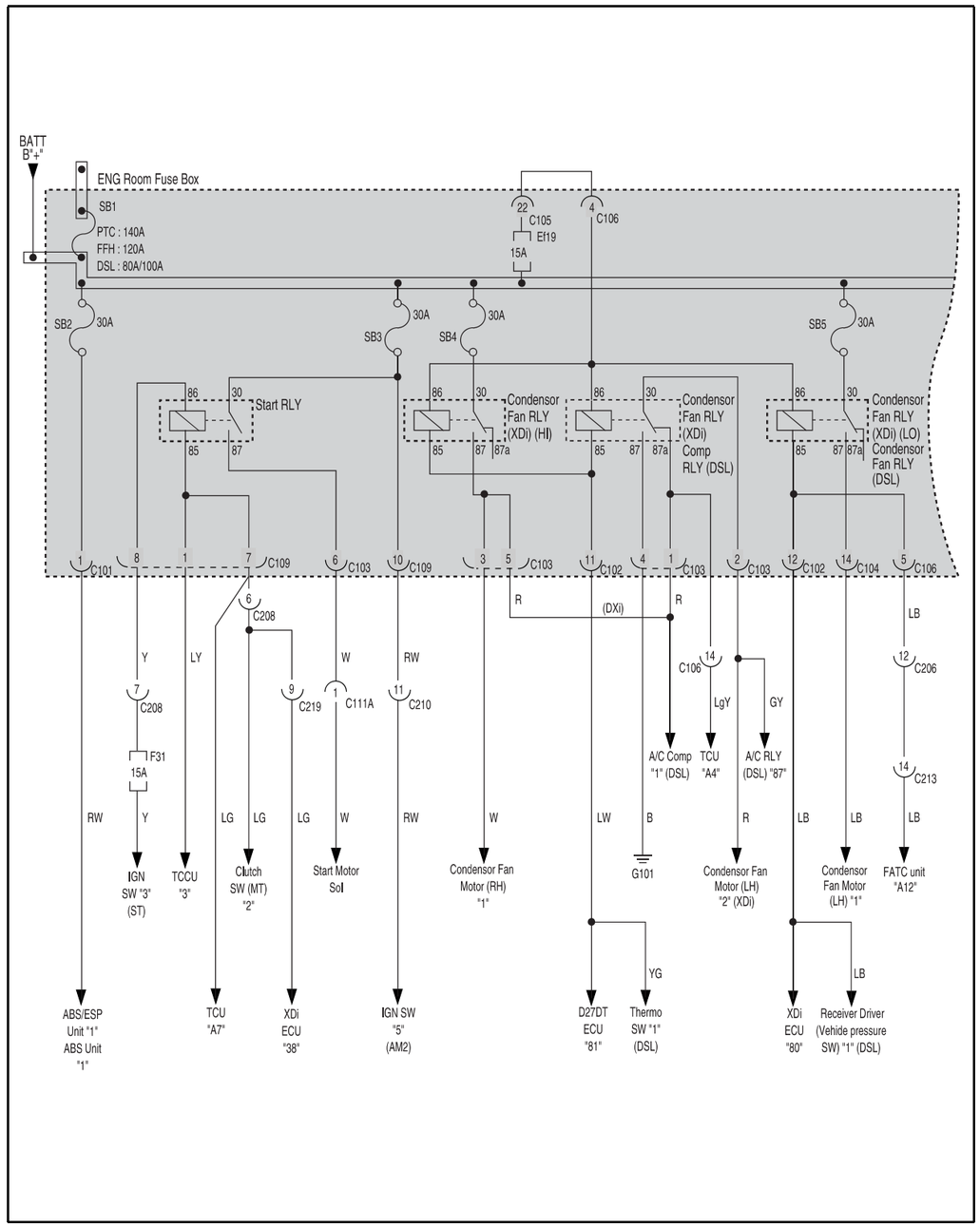
Modification basis	
Application basis	
Affected VIN	

S.G.N. 8410-06

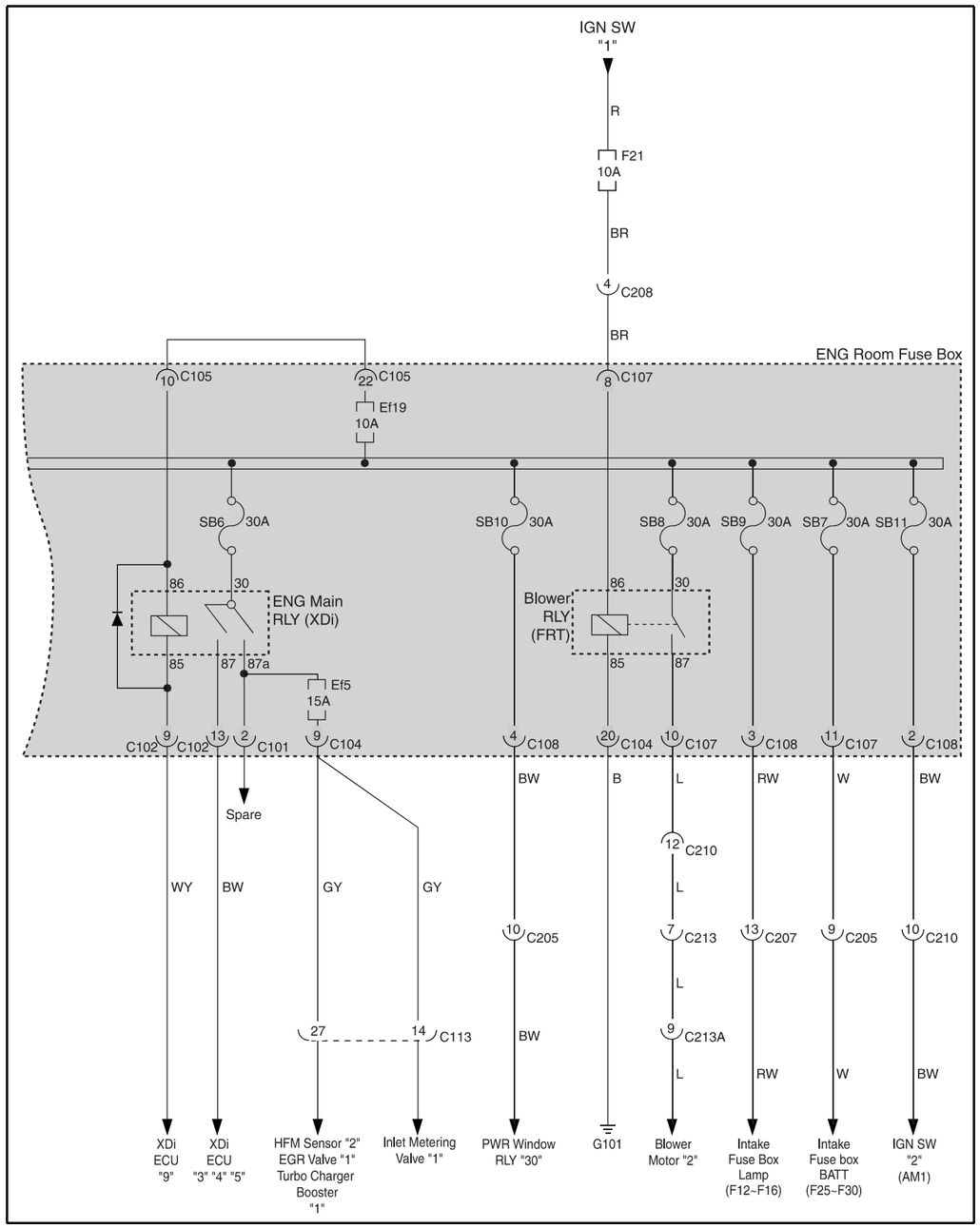
POWER WIRING DIAGRAM(XDi, 2003 MODEL ~

1) ENG ROOM & FUSE BOX

(1) SB1 ~ SB5



(2) SB6 ~ SB11

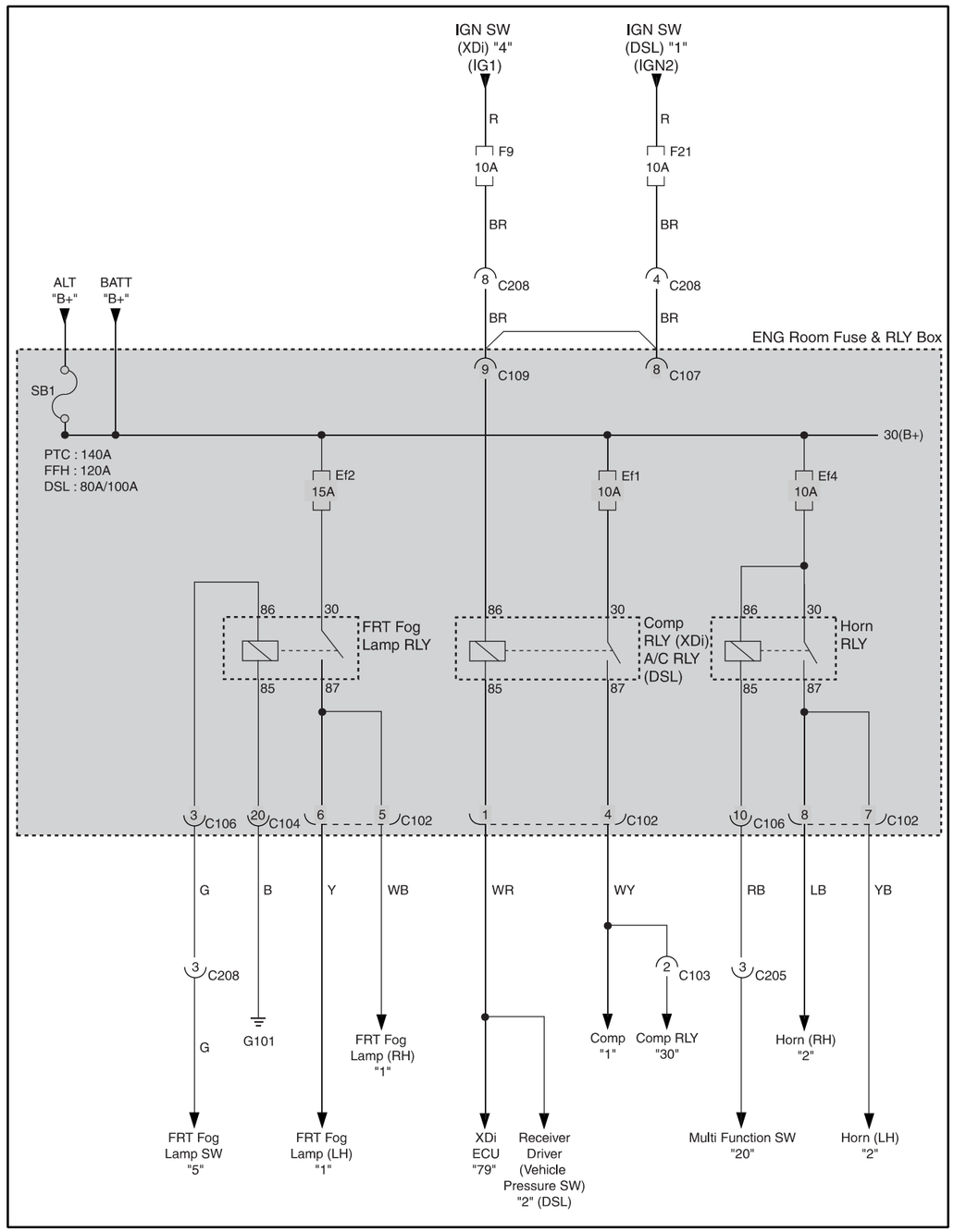


POWER DISTRIBUTION

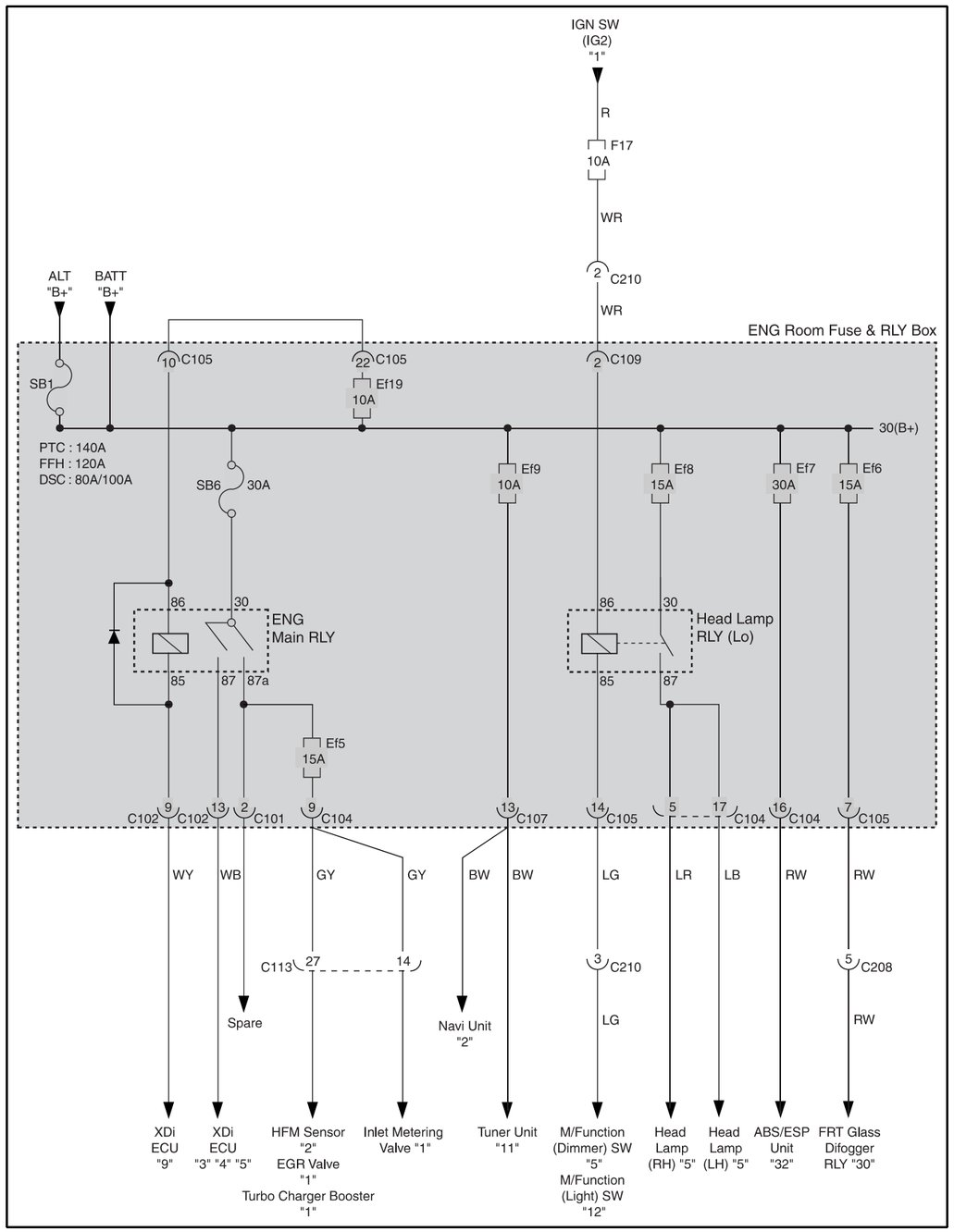
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

(3) Ef1 ~ Ef4

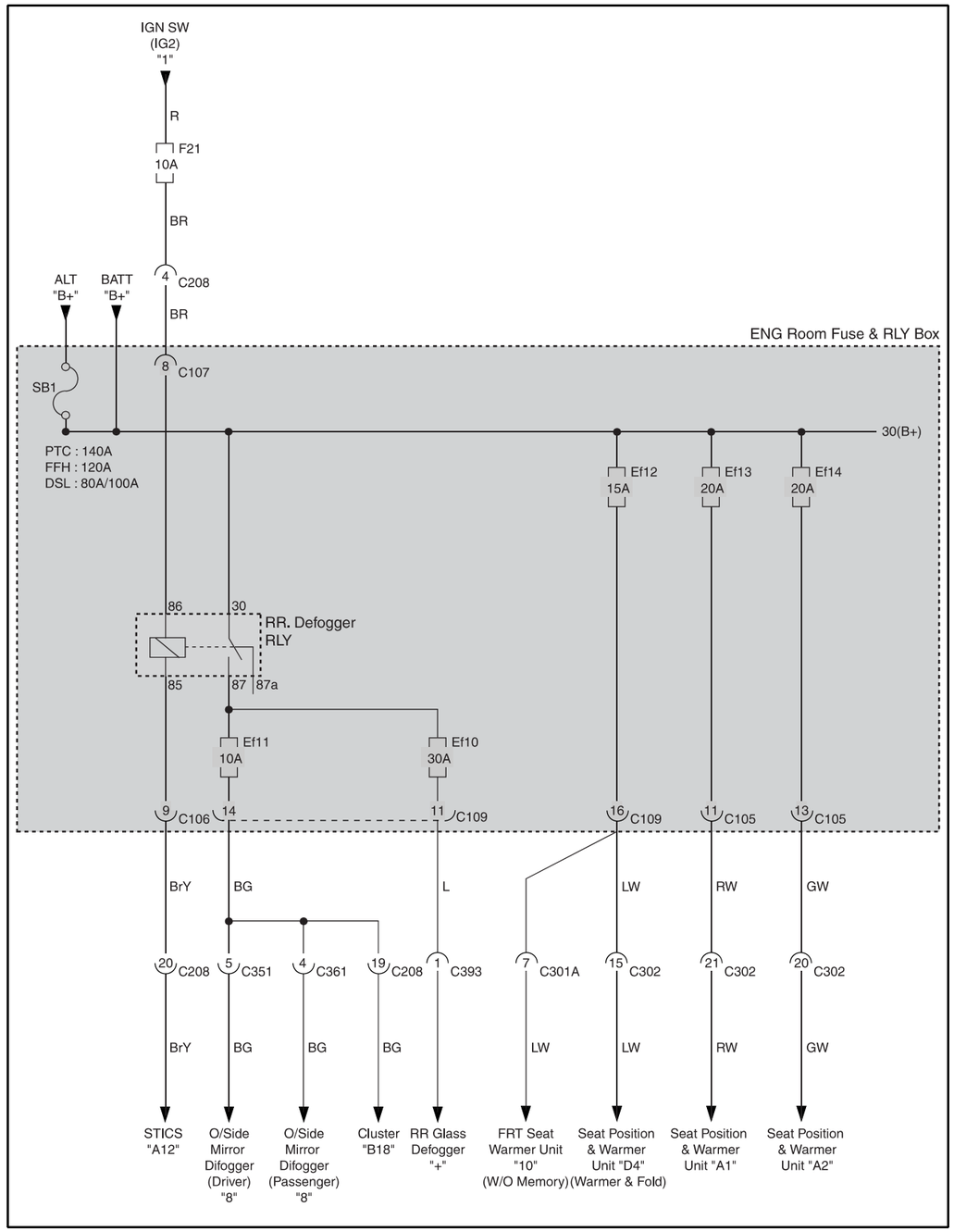


(4) Ef5 ~ Ef9

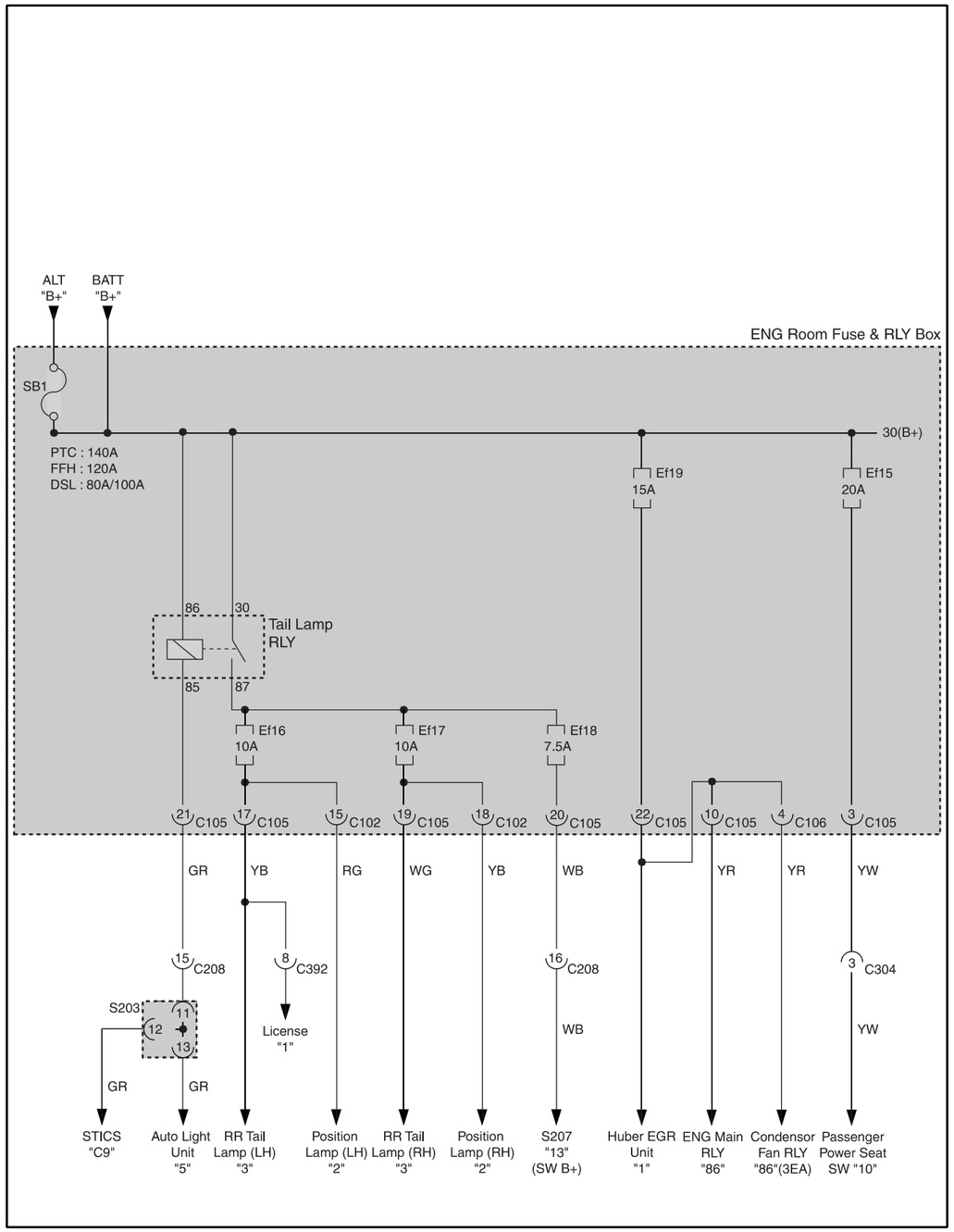


Modification basis	
Application basis	
Affected VIN	

(5) Ef10 ~ Ef14

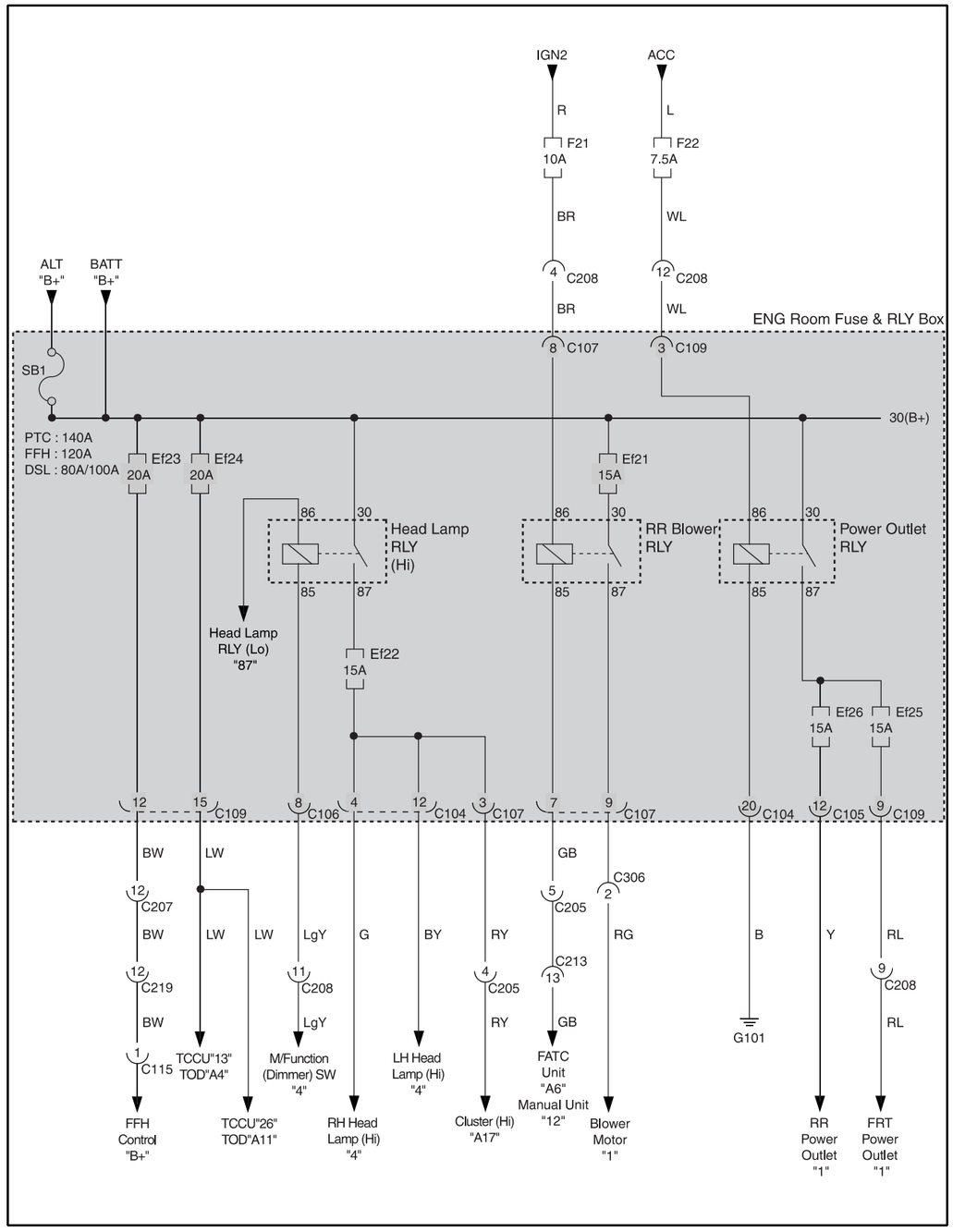


(6) Ef15 ~ Ef20



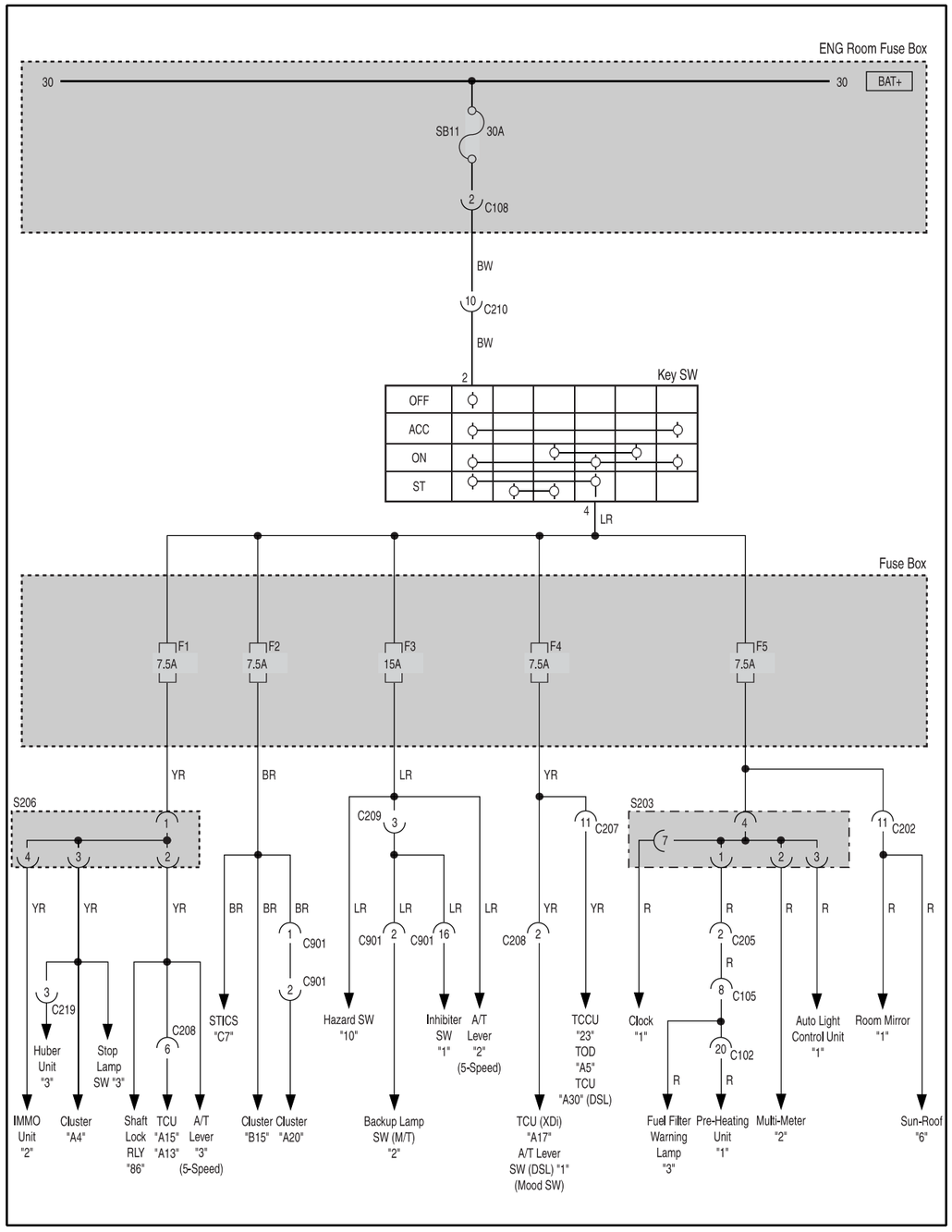
Modification basis	
Application basis	
Affected VIN	

(7) Ef21 ~ Ef26



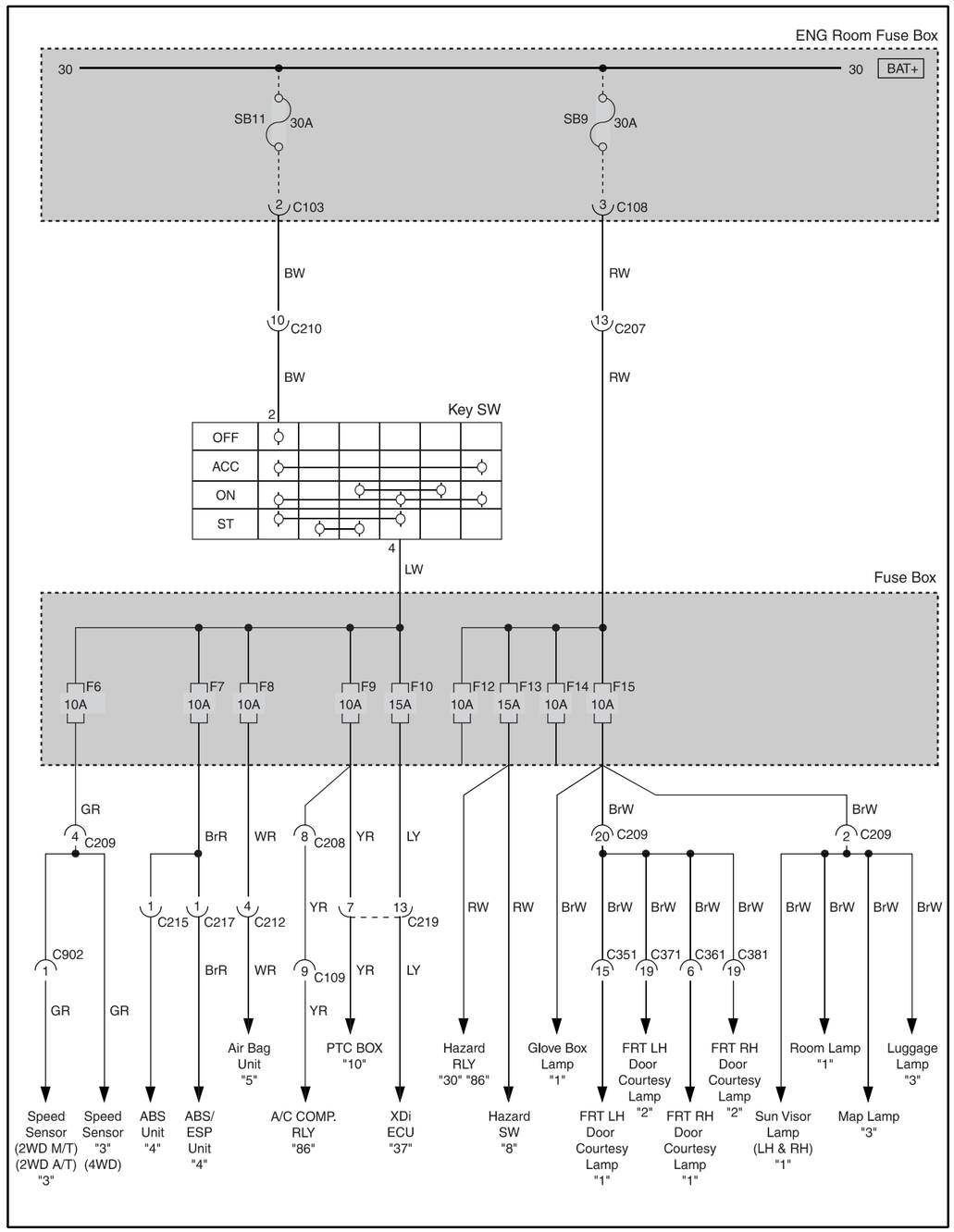
2) FUSE BOX

(1) F1 ~ F5

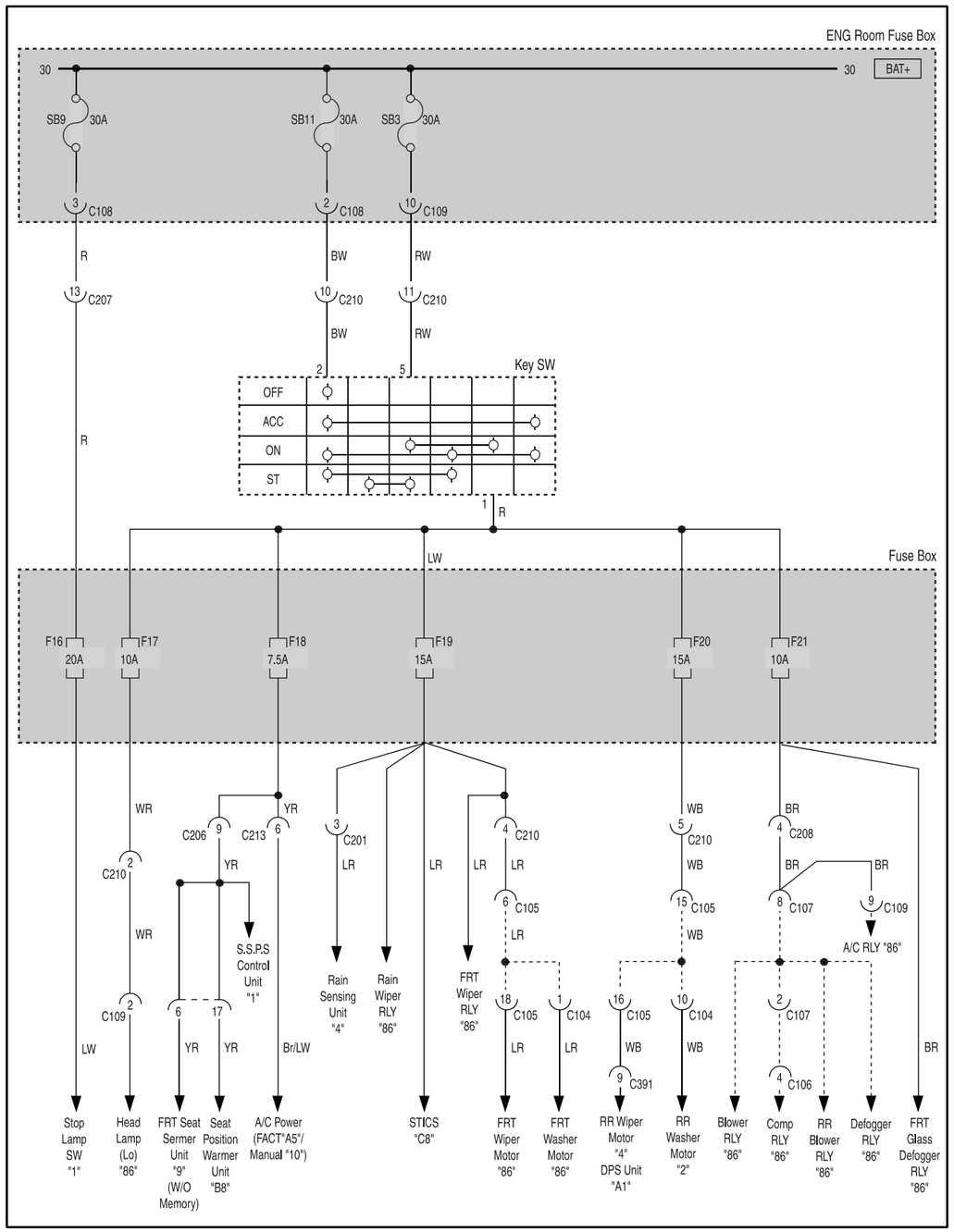


Modification basis	
Application basis	
Affected VIN	

(2) F6 ~ F15

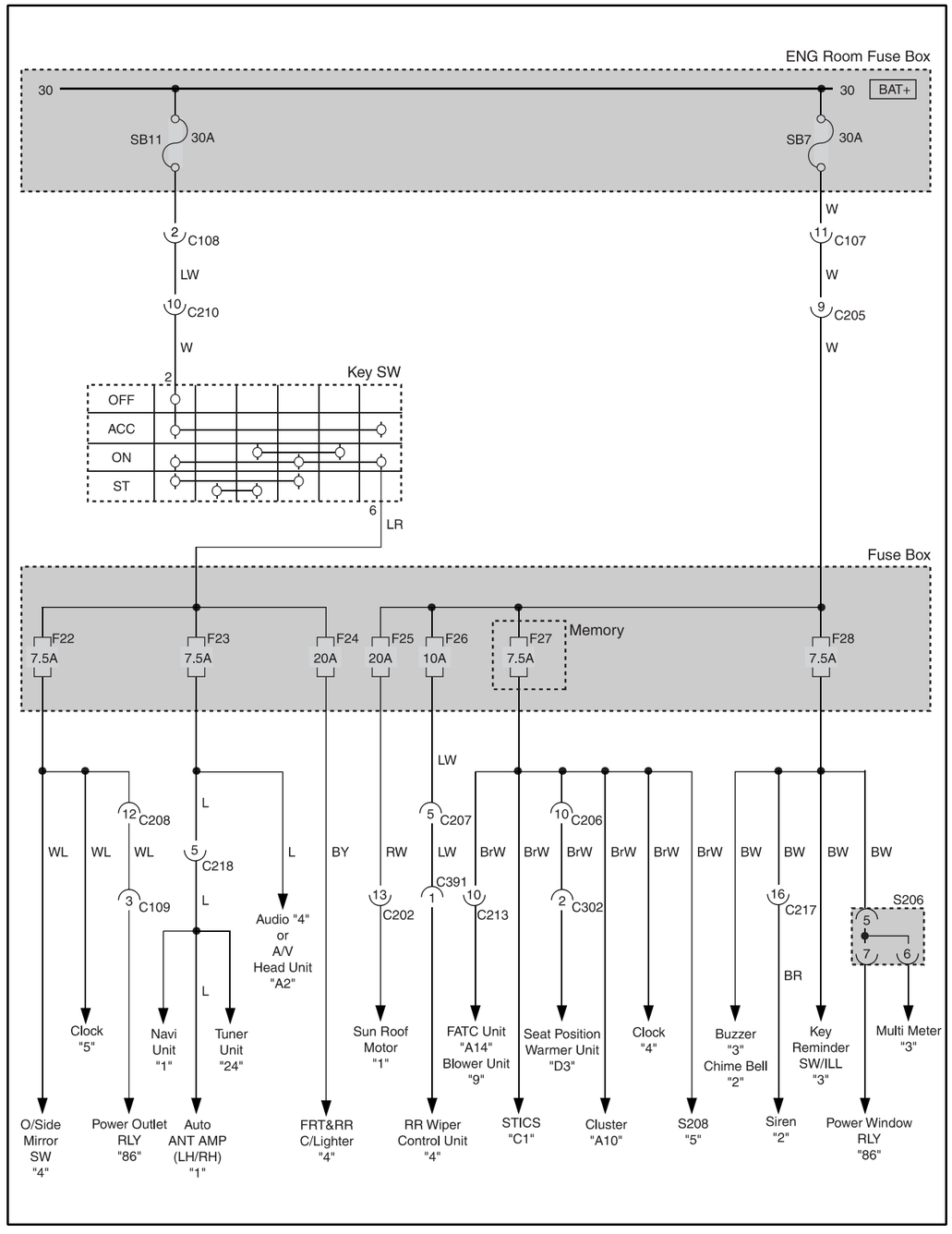


(3) F16 ~ F21

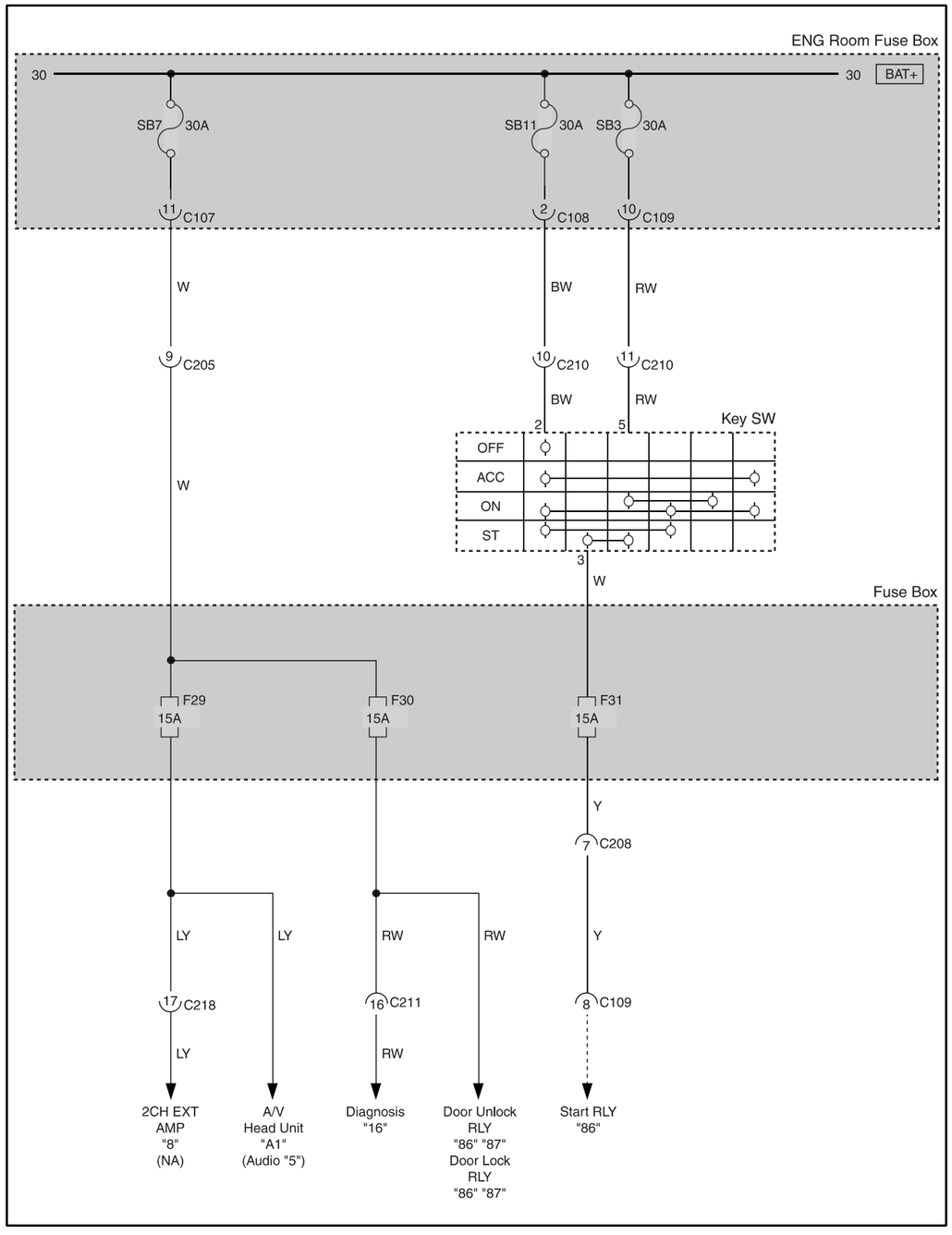


Modification basis	
Application basis	
Affected VIN	

(4) F22 ~ F28



(5) F29 ~ F31



Modification basis	
Application basis	
Affected VIN	

Memo

Memo

1491-01/1792-01/2820-01/3110-01/3232-34/3410-01/4610-00/4620-12/4892-01/6810-15/6810-18/6910-01/7010-06/7340-03/7410-00/7410-04/7410-32/7632-20/7770-03/7770-08/7830-02/8010-01/8211-01/8310-01/8310-10/8310-23/8320-01/8410-30/8511-05/8610-10/8611-09/8710-01/8711-02/8790-01/8810-01/8910-02/8931-01/

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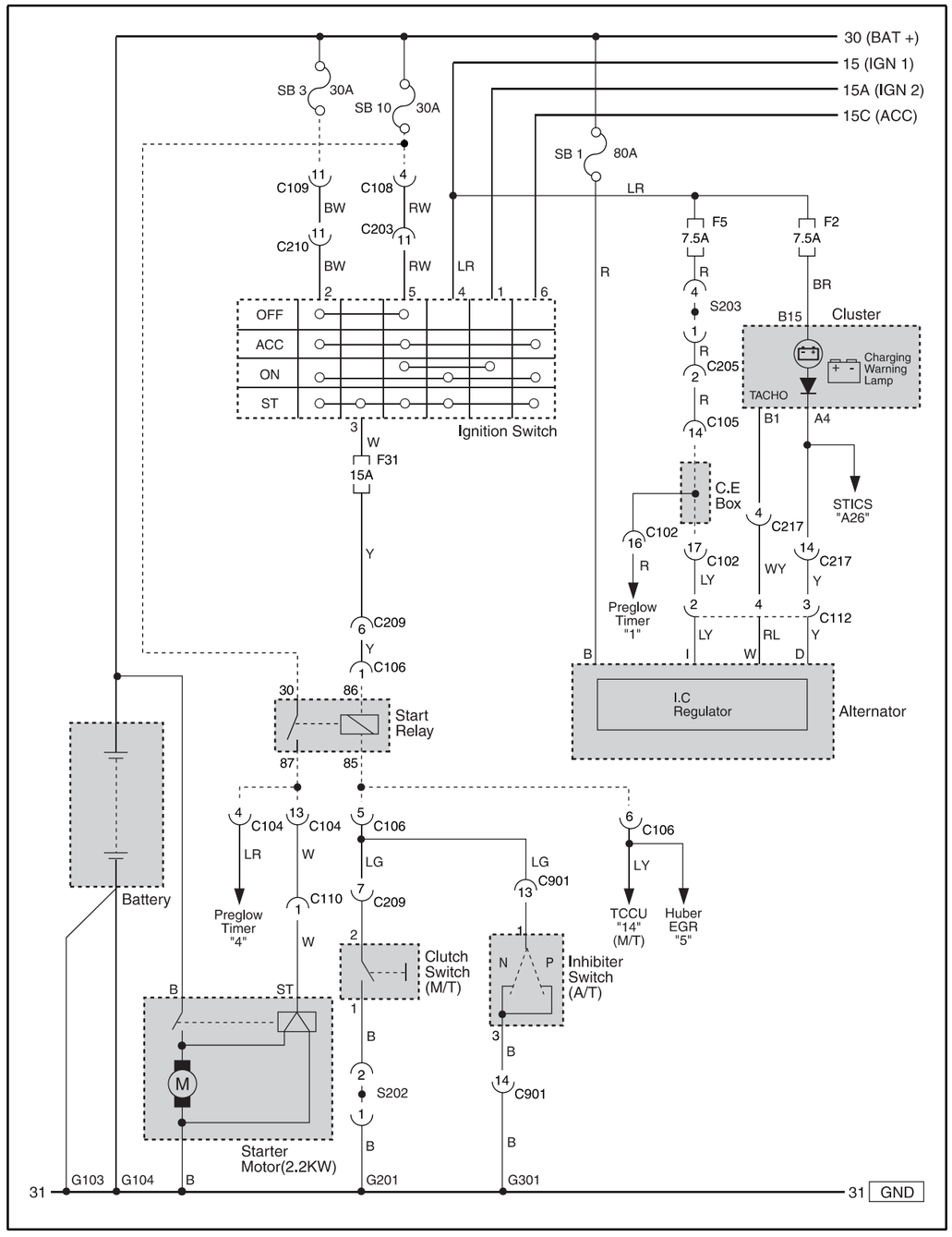
Memo

Memo

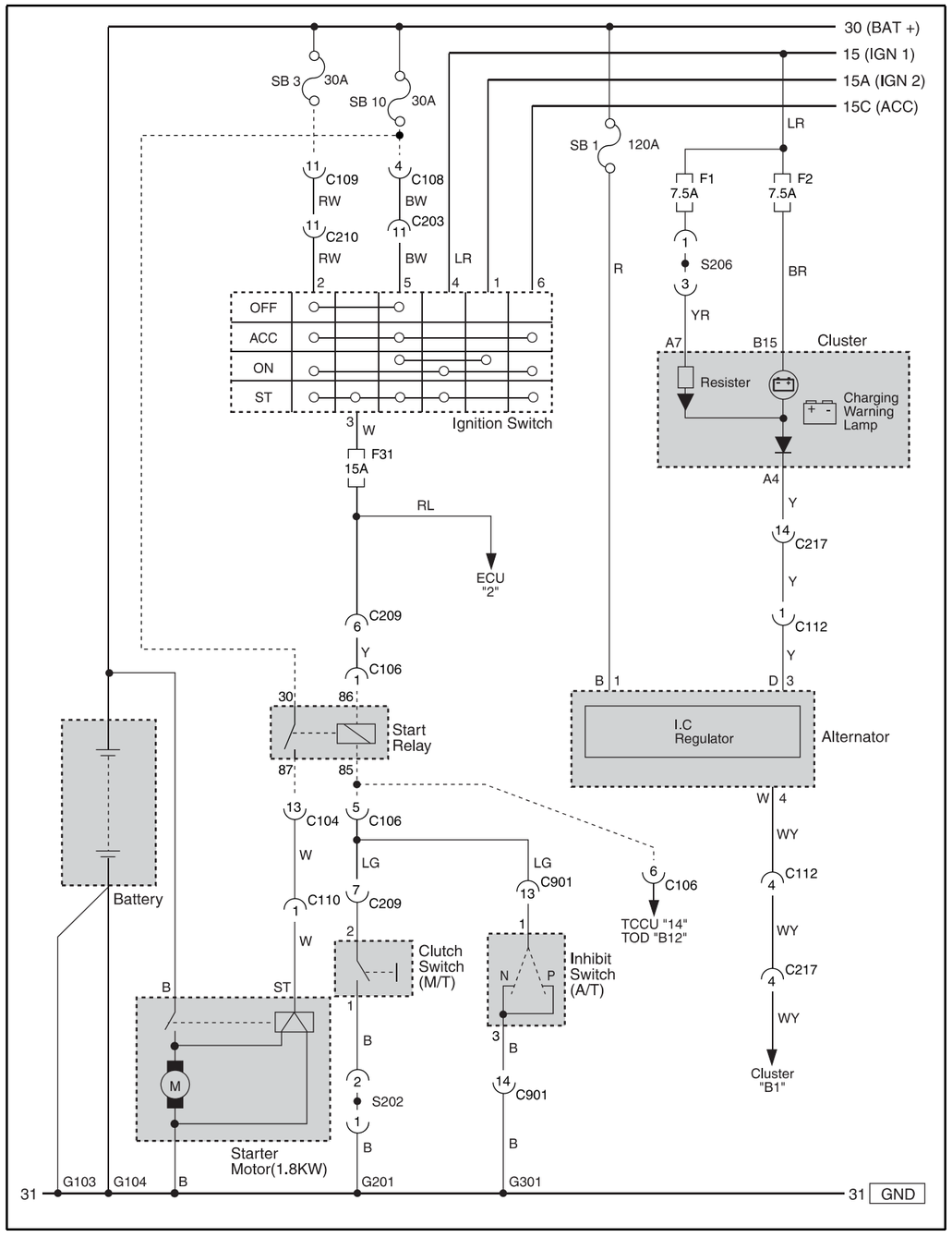
S.G.N. 1461-01

STARTING & CHARGING

1) DIESEL (M/T, A/T) ~ 2002 MODEL

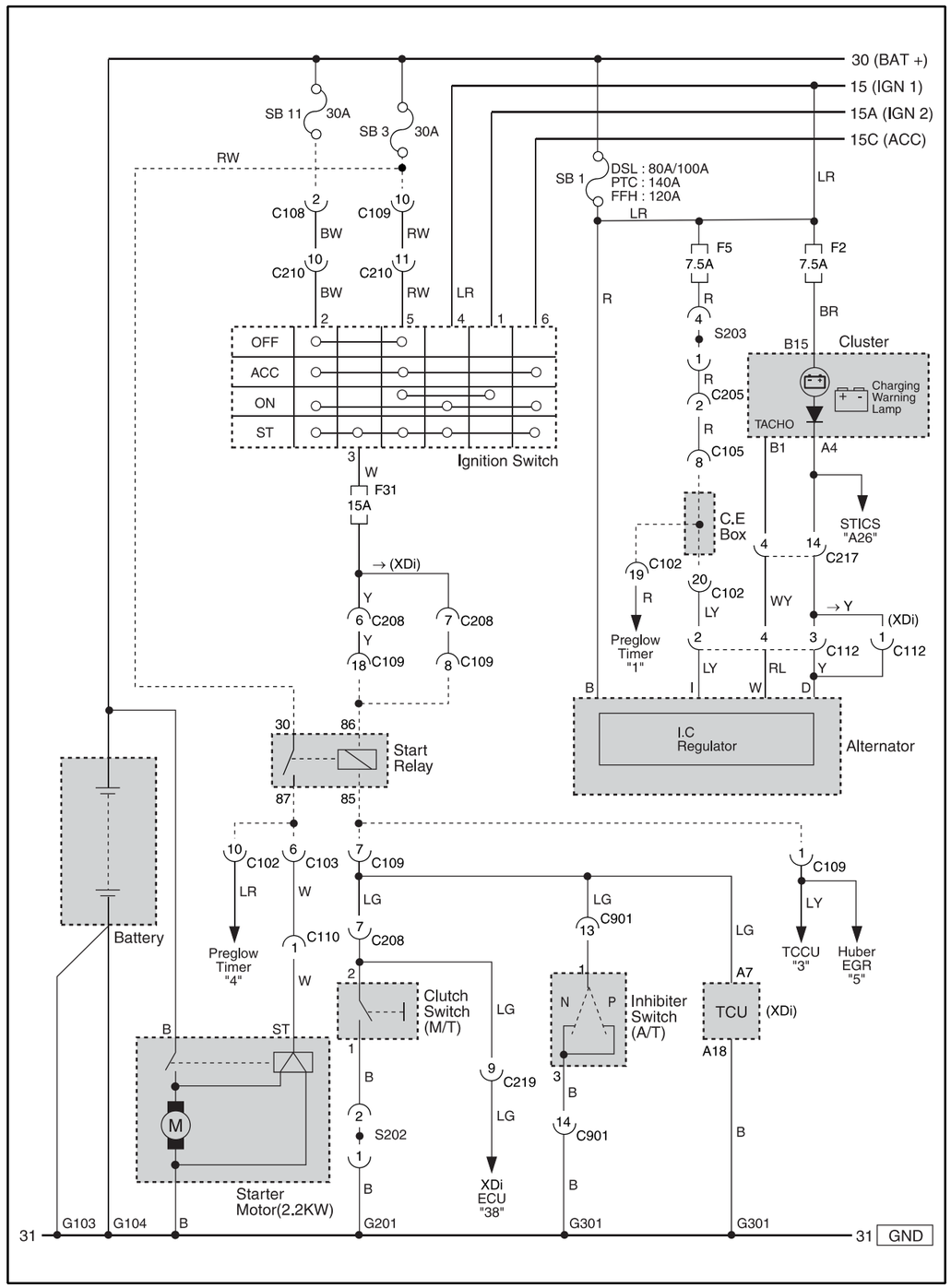


2) GASOLINE (M/T, A/T) ~ 2002 MODEL

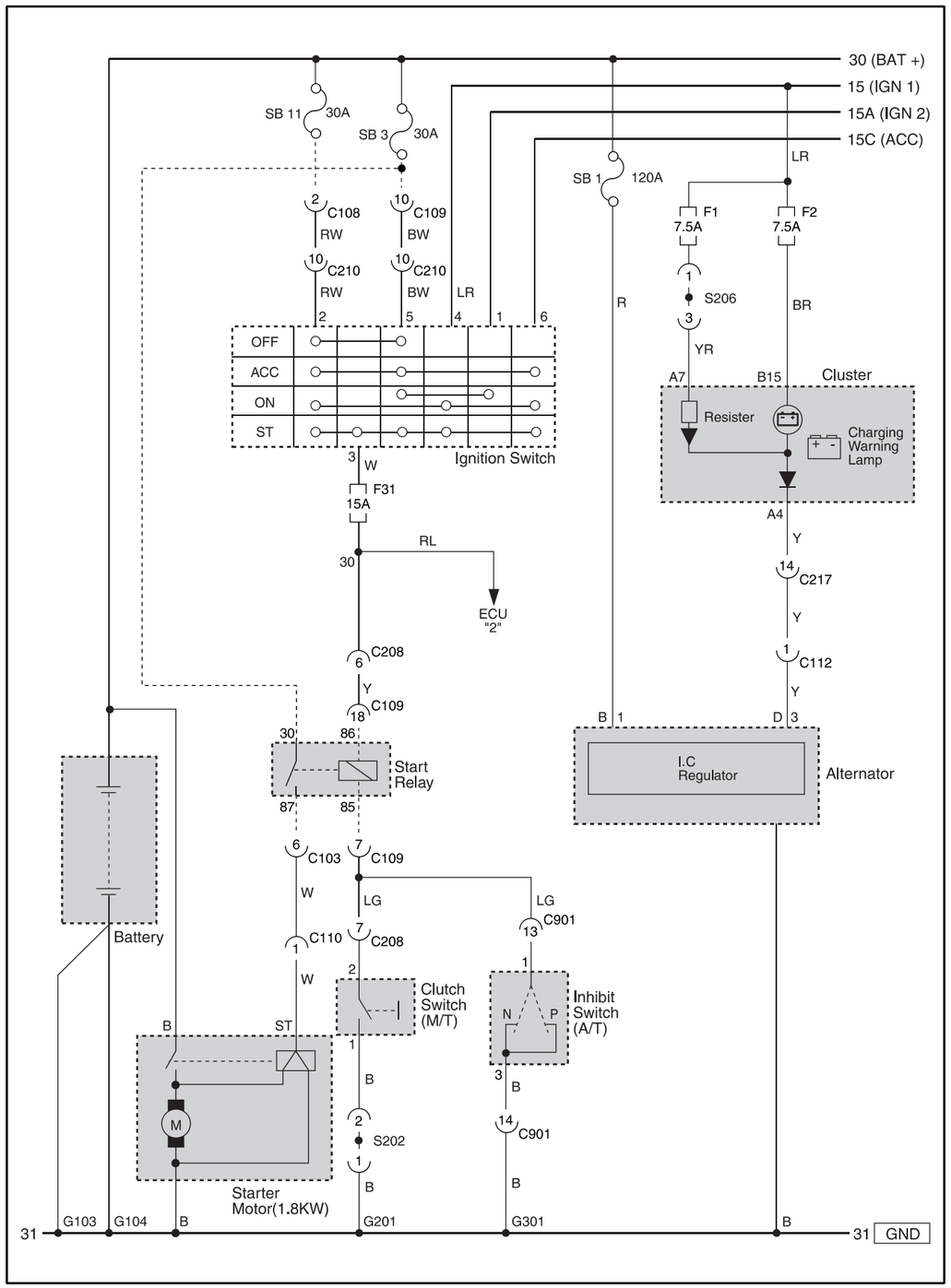


Modification basis	
Application basis	
Affected VIN	

3) DIESEL (M/T, A/T) 2003 MODEL (W/ XDi) ~



4) GASOLINE (M/T, A/T) 2003 MODEL (W/ XDi) ~



CIRCUIT

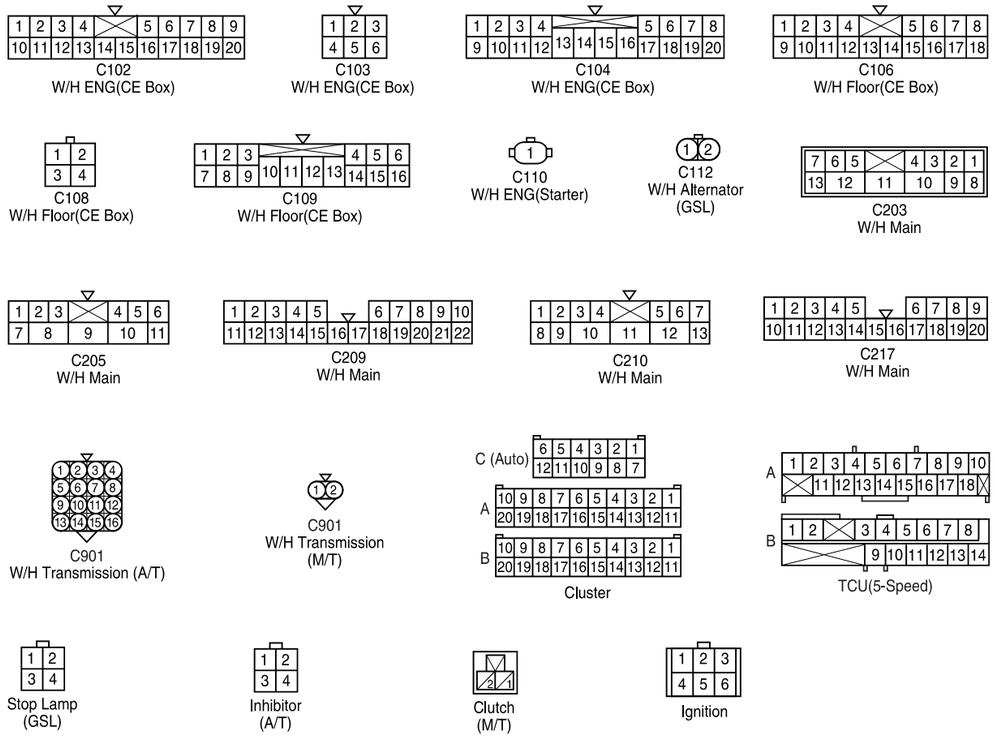
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C103 (6Pin, Colorless)	Engine Room Fuse Box (C) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C110 (1Pin, Gray)	Engine - Starter "ST"	FRT Pre-Heating Unit	
C112 (4Pin, Black)	Engine - Alternator	Under the Coolant Reserve Tank	DSL
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C217 (20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C901 (16Pin, White)	Floor - T/M	Left the T/C (Under the Floor)	A/T
C901 (2Pin, White)	Floor - T/M	Left the T/C (Under the Floor)	M/T
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S206 (14Pin, Black)	W/H Main	Behind the Left the FATC	
G103	W/H Engine	Behind the Left Head Lamp	
G104	W/H Engine	Beside the Engine Mounting Bracket	
G201	W/H Main	Inside Driver Side Cowl PNL	
G301	W/H Floor	Under Driver Seat	ECU GND

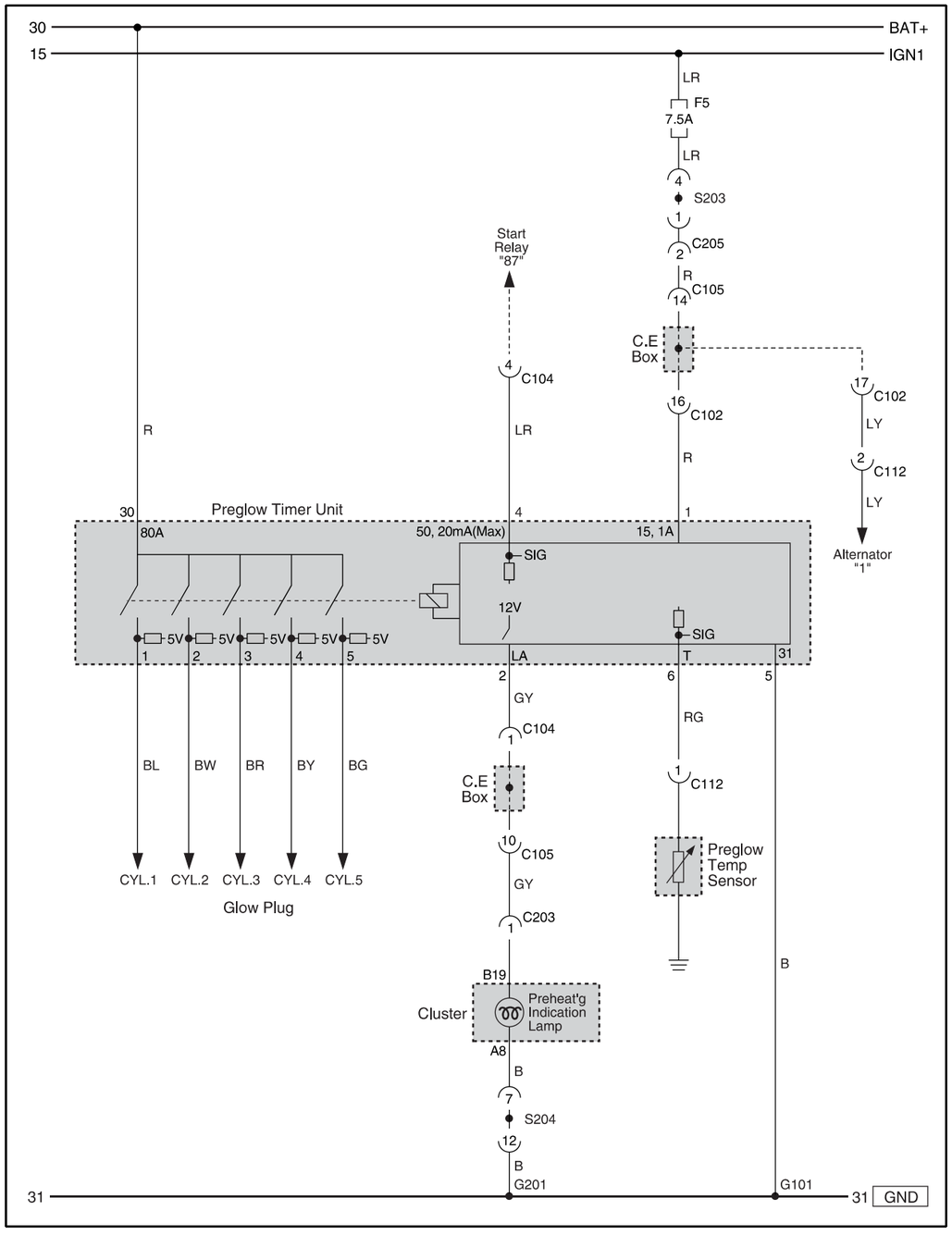
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



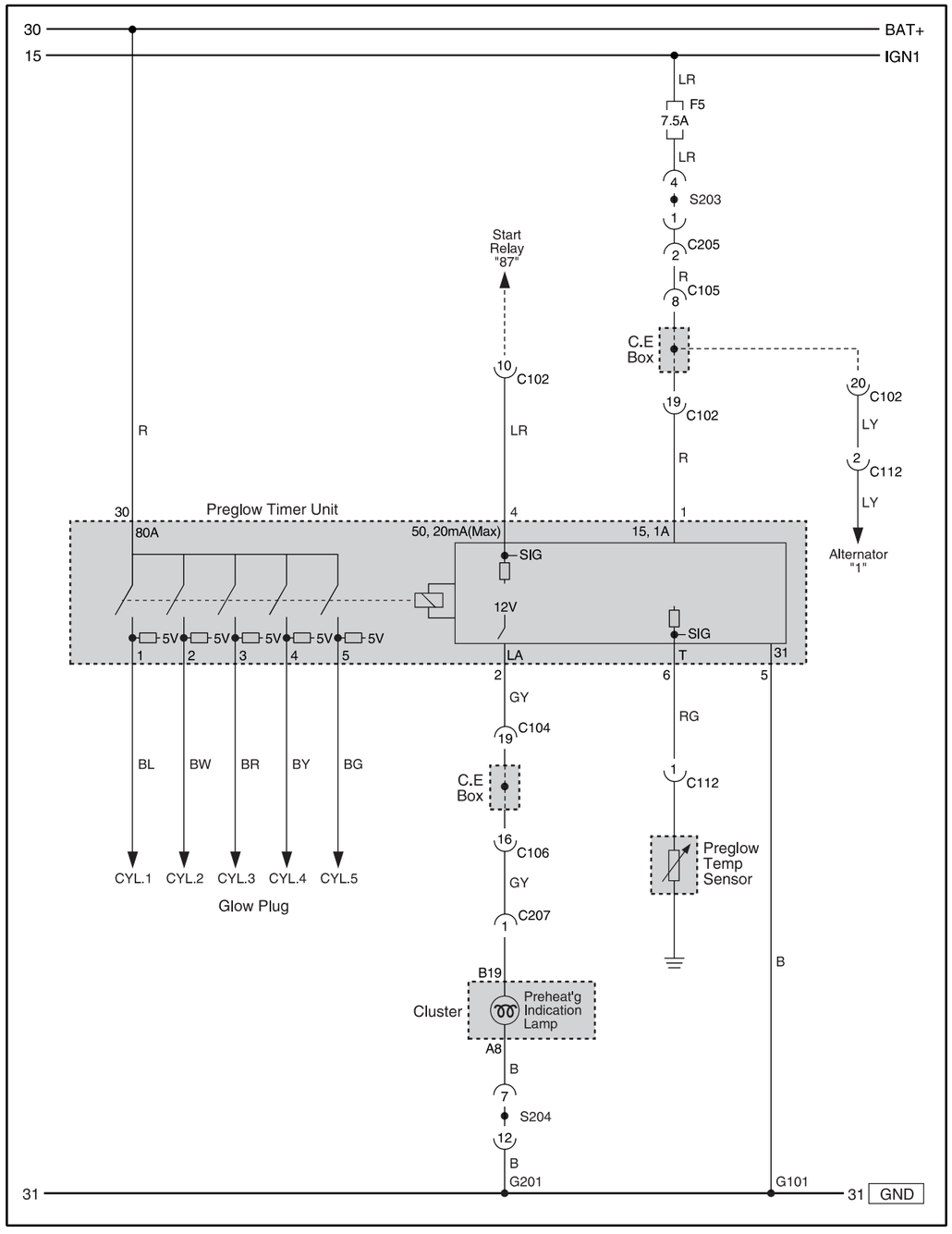
S.G.N. 2820-11

PREHEATING UNIT CIRCUIT

1) ~ 2002 MODEL



2) 2003 MODEL ~

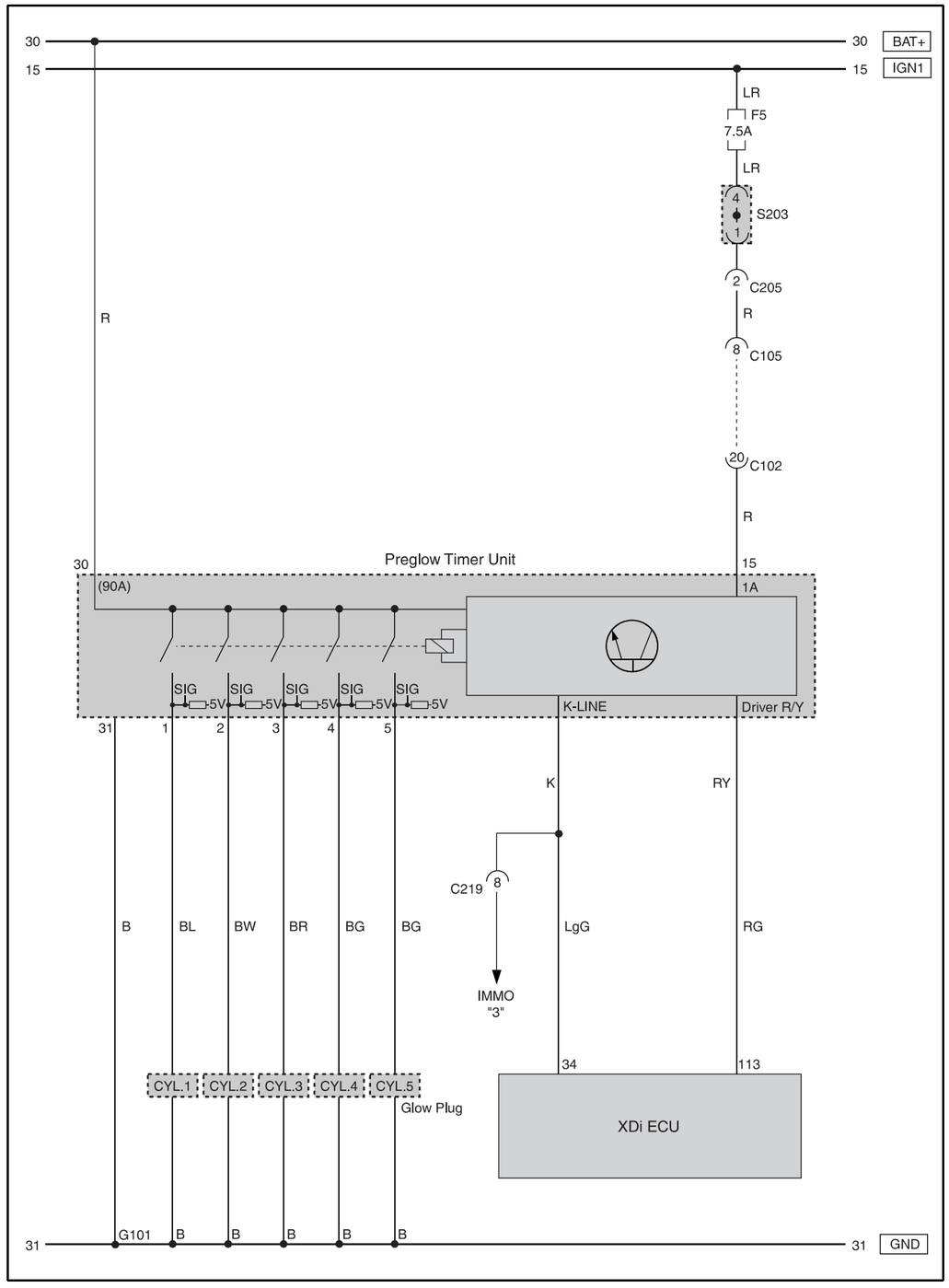


CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

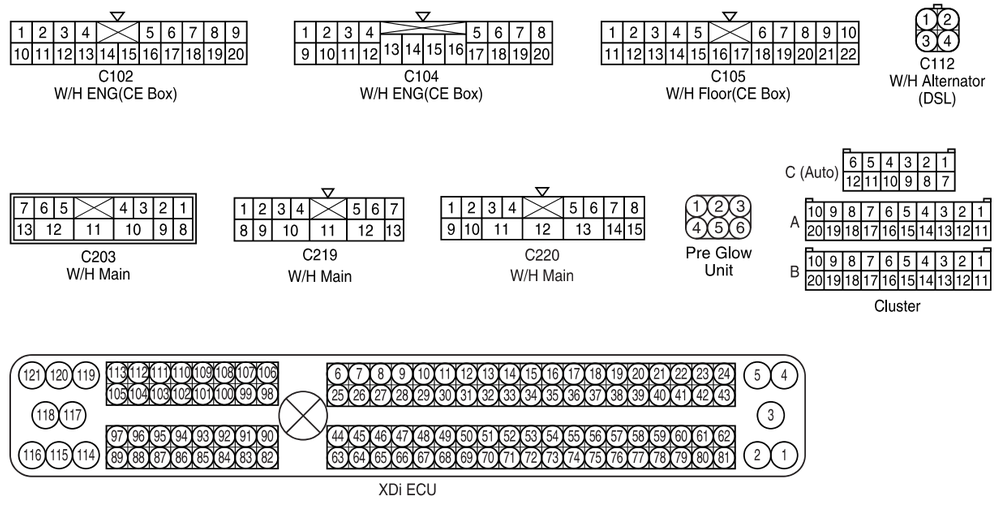
3) XDi



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C112 (4Pin, Black)	Engine - Alternator	Under the Coolant Reserve Tank	DSL
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C220 (15Pin, Blue)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	XDi
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	
G101	W/H Engine	Center the Engine Room Fuse Box	
G102	W/H Engine	Center BATT	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

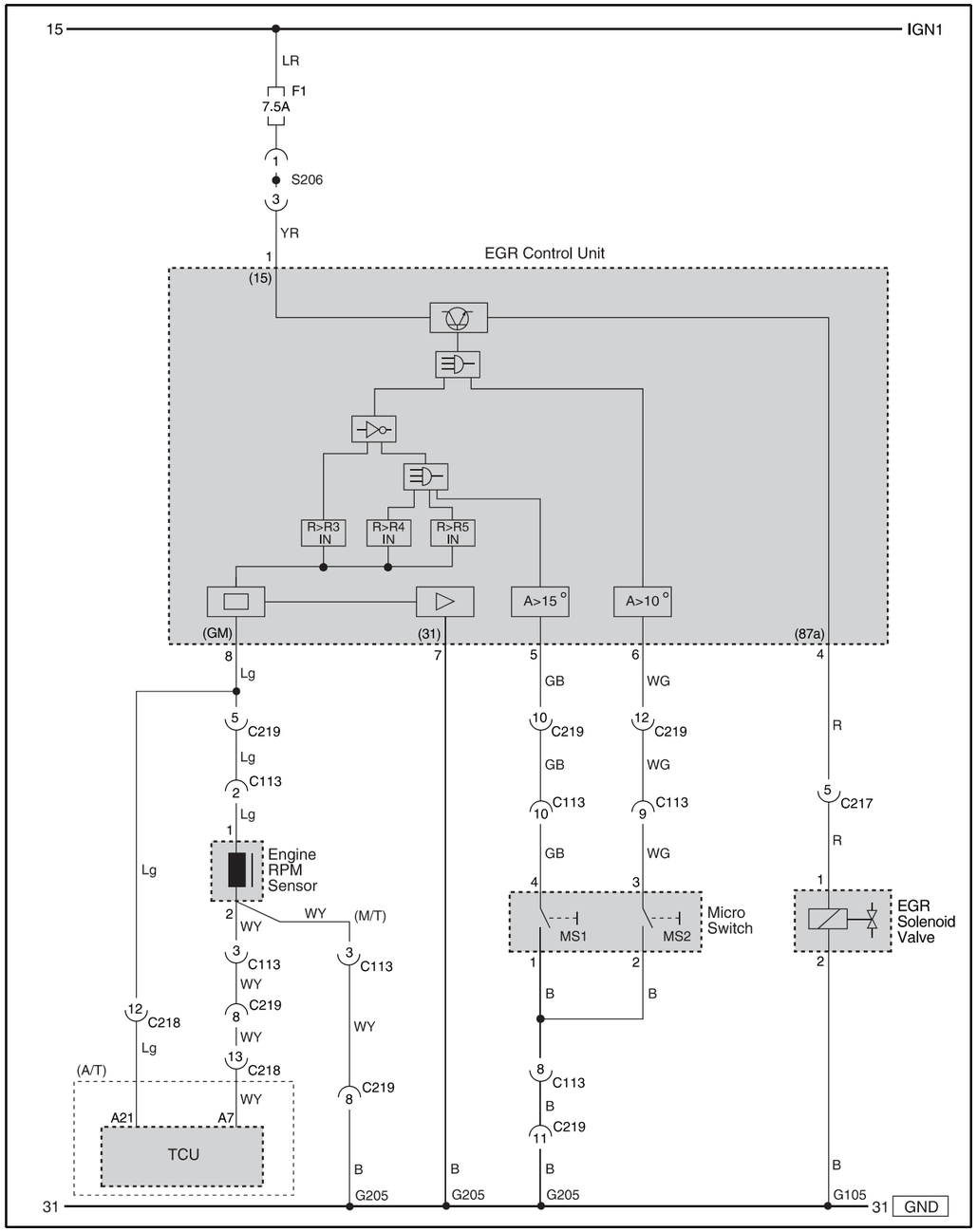


Modification basis	
Application basis	
Affected VIN	

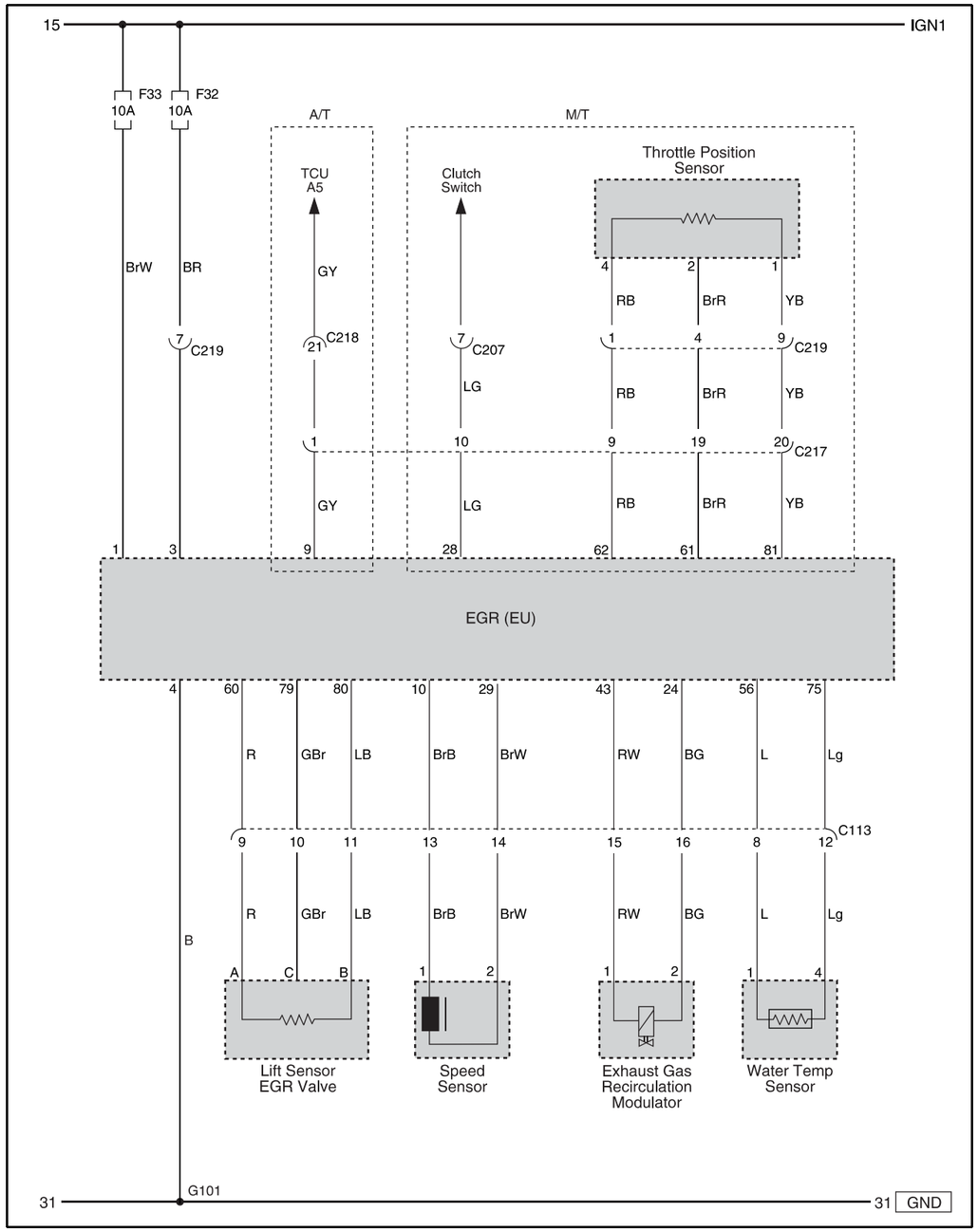
S.G.N. 1792-01

EGR (EXHAUST GAS RECIRCULATION) CONTROL CIRCUIT (DSL)

1) GENERAL ~ 2002 MODEL



2) EURO ~ 2002 MODEL

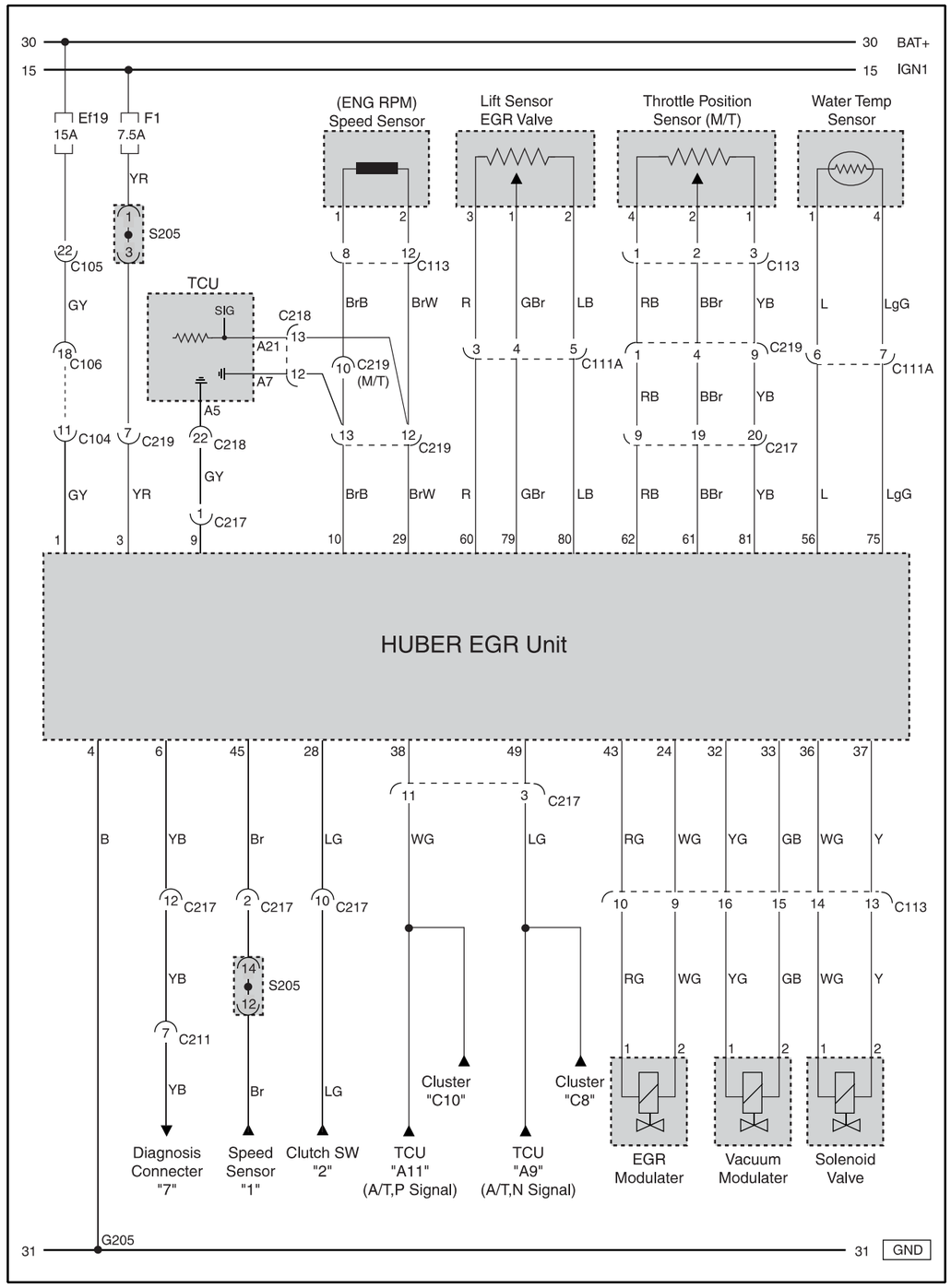


CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

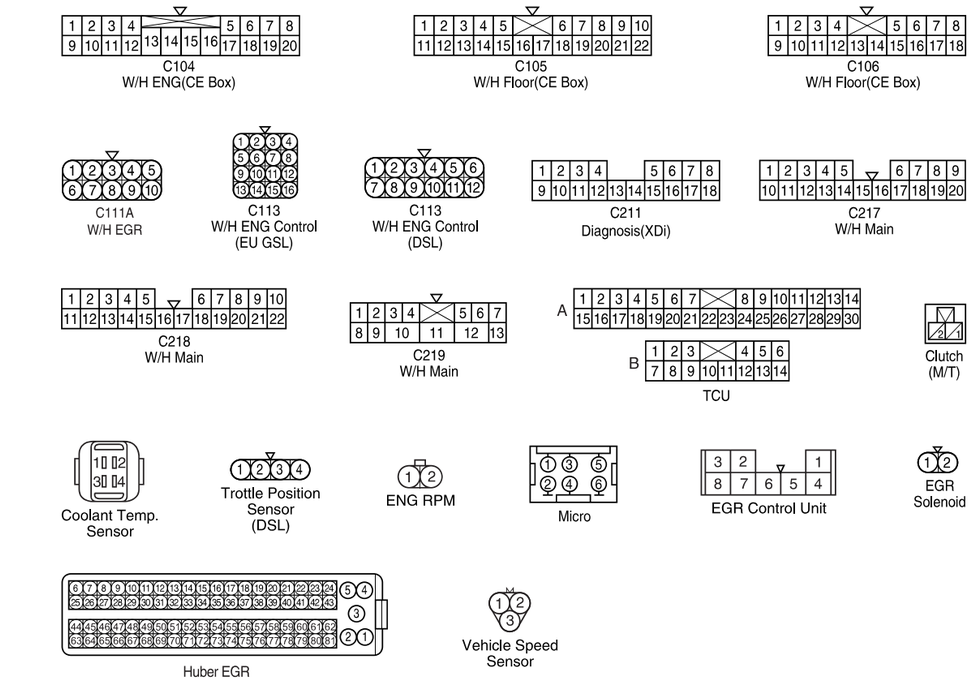
3) HUBER EGR



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C111A (10Pin, Black)	Engine - W/H EGR	FRT Pre-Heating Unit	CLUSTER
C113 (12Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	DSL
C113 (16Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	DSL (EU)
C211 (18Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	XDi
C217(20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
G101	W/H Engine	Center the Engine Room Fuse Box	
G105	W/H Engine	Behine the Right Head Lamp	
G205	W/H Main	Inside Co-Driver Side Cowl PNL	GSL
S205 (14Pin, Black)	W/H Main	Behind the Left FATC	GND

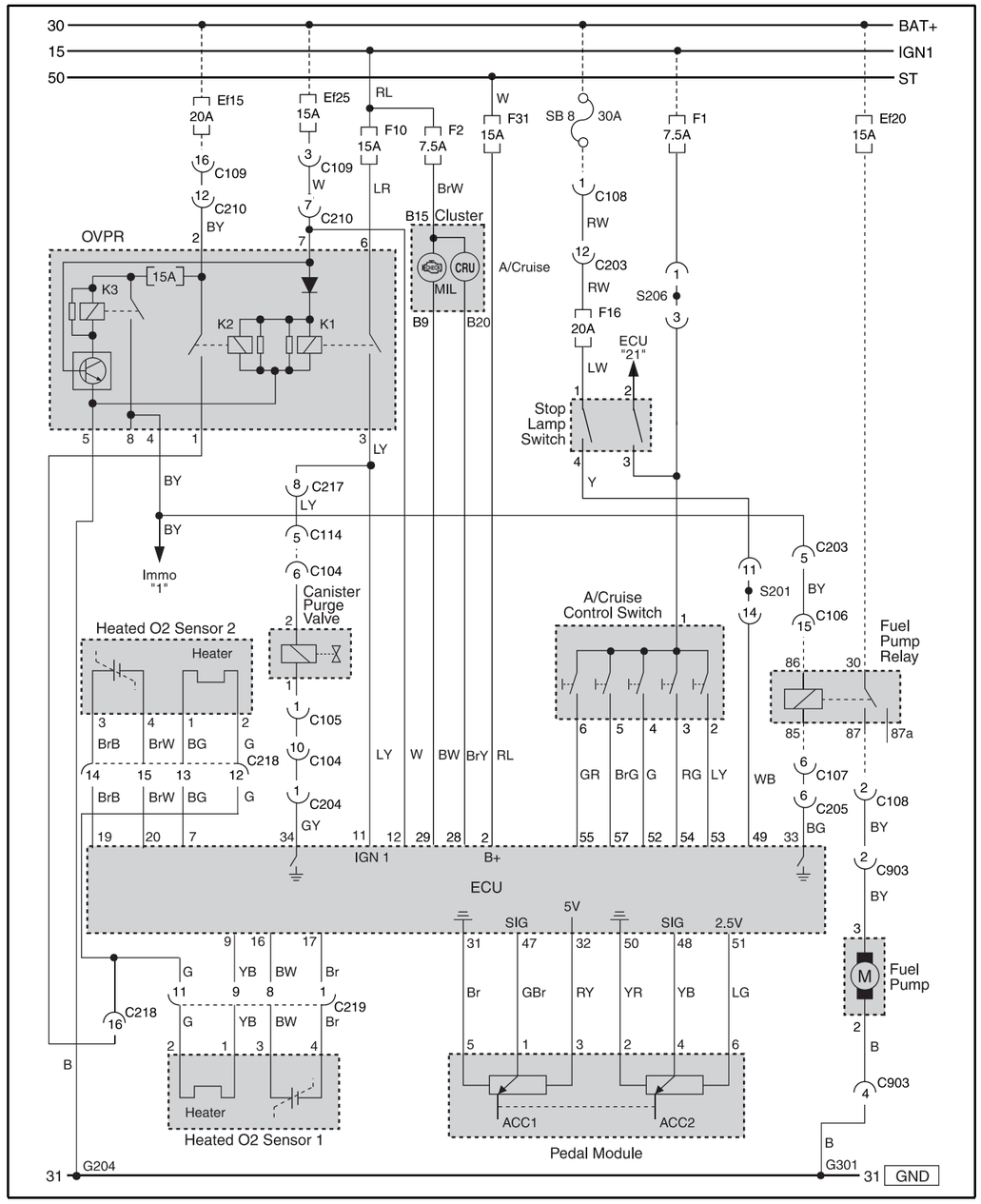
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



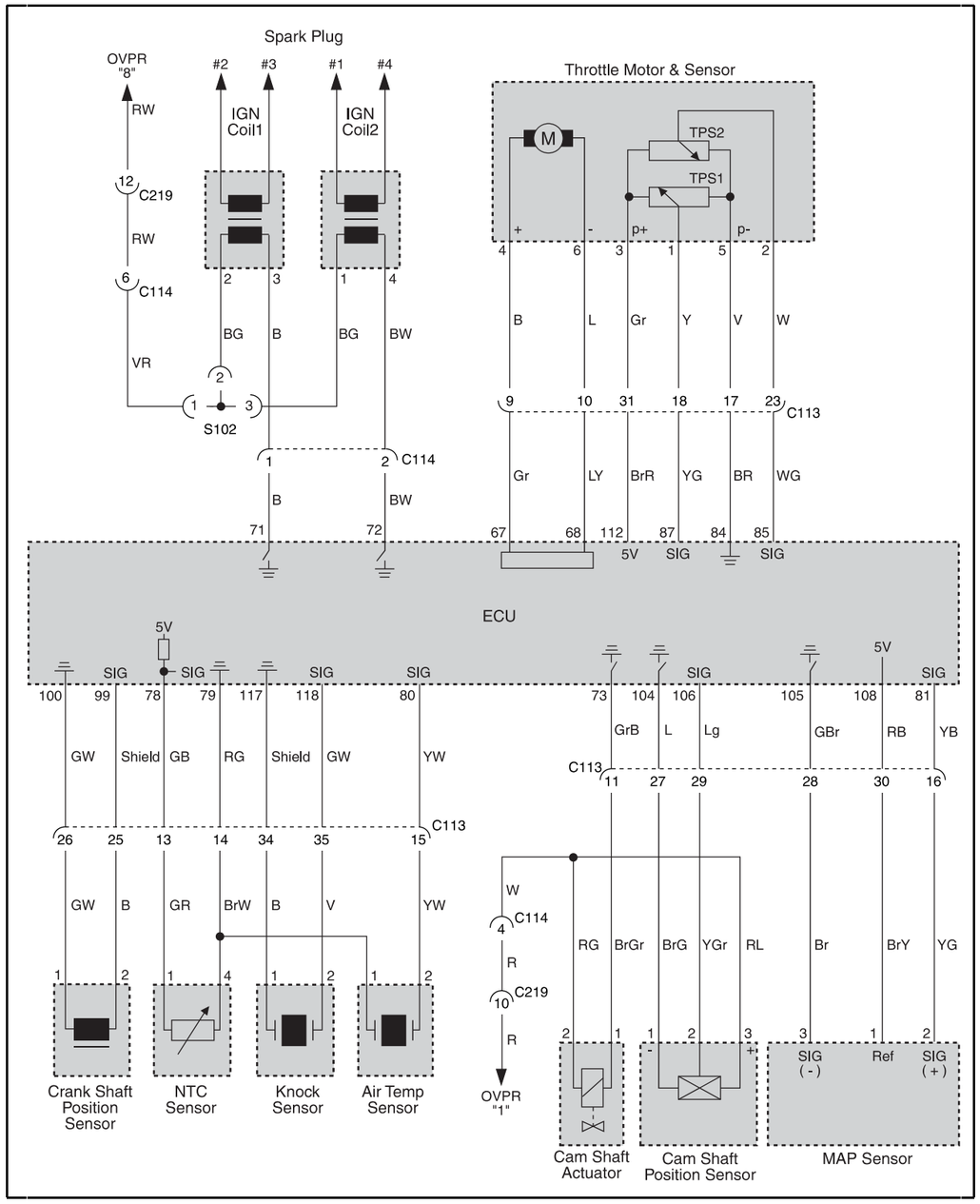
S.G.N. 1491-01

ECU (ELECTRONIC CONTROL UNIT) (E23)

1) OVPR, FUEL PUMP, CANISTER PURGE VALVE, O2 SENSOR, PEDAL MODULE CIRCUIT ~ 2002 MODEL



2) SPARK PLUG, SENSOR (CAM SHAFT POSITION, MAP, NTC, CRANK SHAFT POSITION,THROTTLE MOTOR, AIR TEMP, KNOCK), CAM SHIFT ACTUATOR CIRCUIT ~ 2002 MODEL

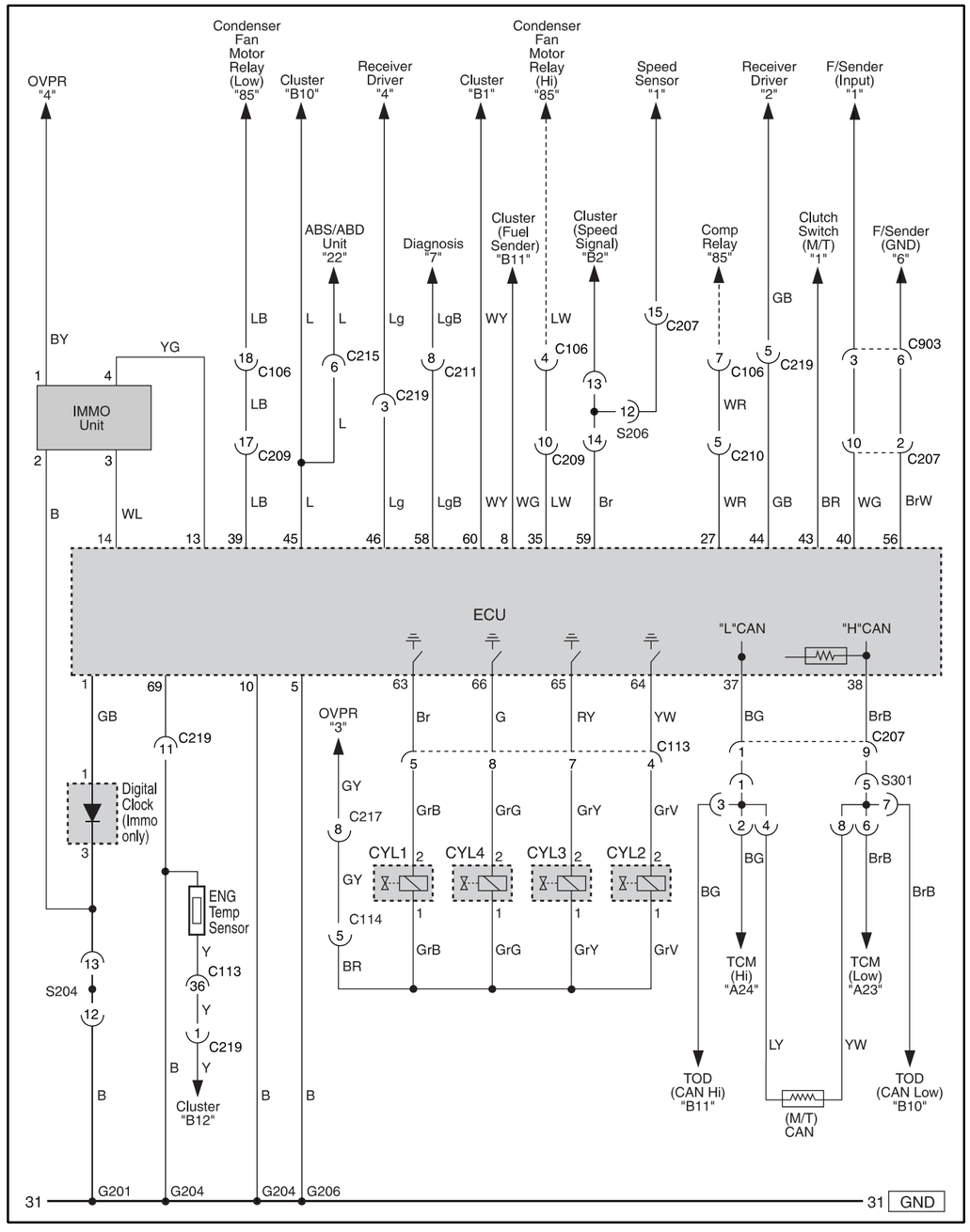


CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

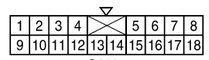
3) DIGITAL CLOCK, ENG TEMP SENSOR, IMMOBILIZER CIRCUIT ~ 2002 MODEL

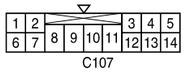


(1) CONNECTOR INFORMATION

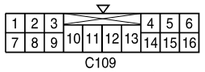
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C113 (40Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	GSL
C114 (6Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	GSL
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
C217 (20Pin, Black)	Floor - T/M	Inside Co-Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C306 (6Pin, Black)	Floor - Fuel Sender	Left the T/C (Under the Floor)	GSL
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S206 (14Pin, Black)	W/H Main	Behind the Left the FATC	
G204	W/H Main	Inside Co-Driver Side Cowl PNL	
G301	W/H Floor	Under Driver Seat	ECU GND

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION


C106
W/H Floor(CE Box)

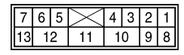

C107
W/H Floor(CE Box)

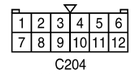

C108
W/H Floor(CE Box)

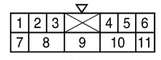

C109
W/H Floor(CE Box)

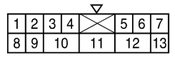

C113
W/H ENG Control
(GSL)

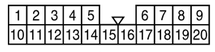

C114
W/H ENG Control
(GSL)

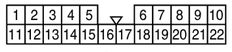

C203
W/H Main

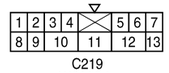

C204
W/H Main


C205
W/H Main

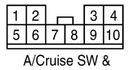

C210
W/H Main


C217
W/H Main


C218
W/H Main


C219
W/H Main


C306
W/H Fuel Sender
(GSL)

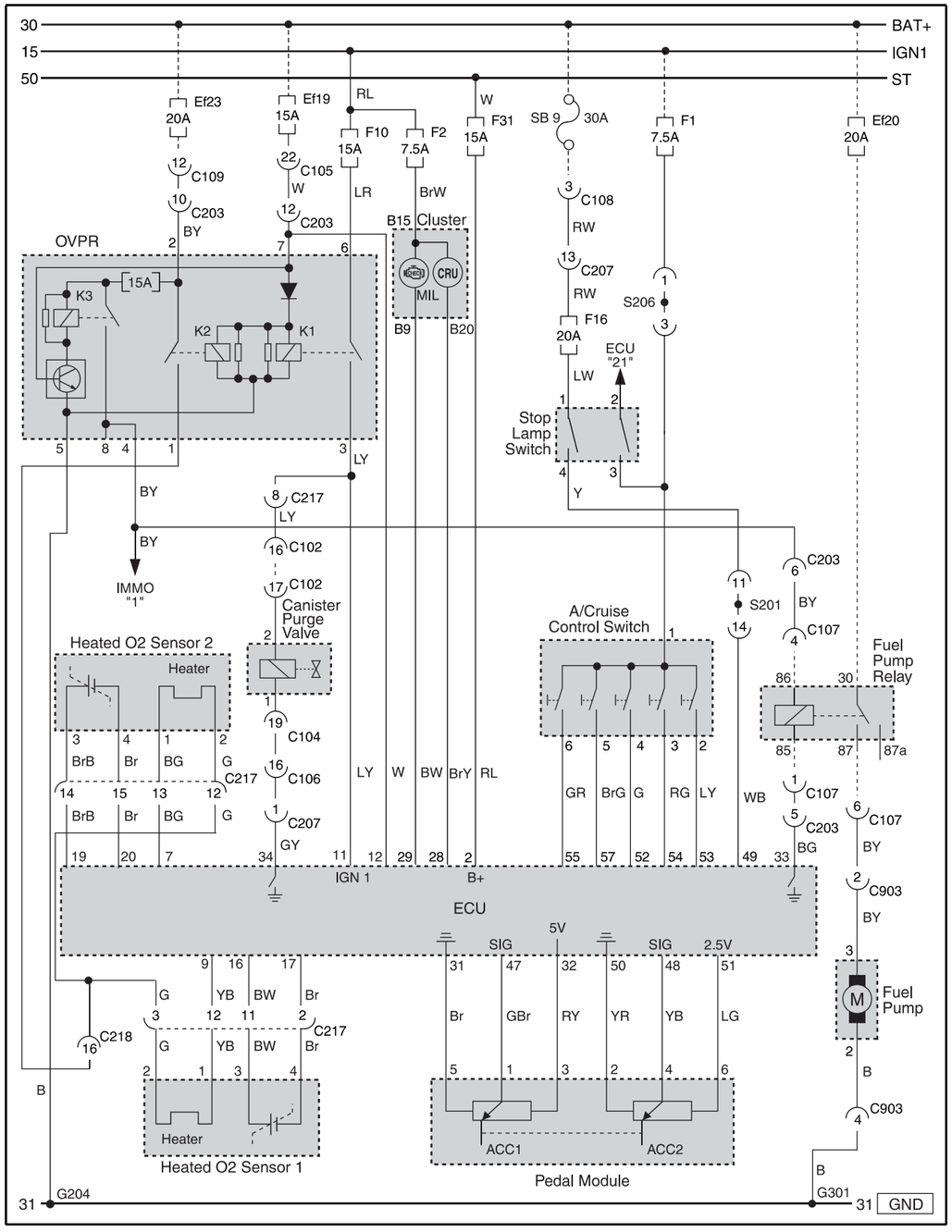

A/Cruise SW &
Contact Coil


Stop Lamp
(GSL)

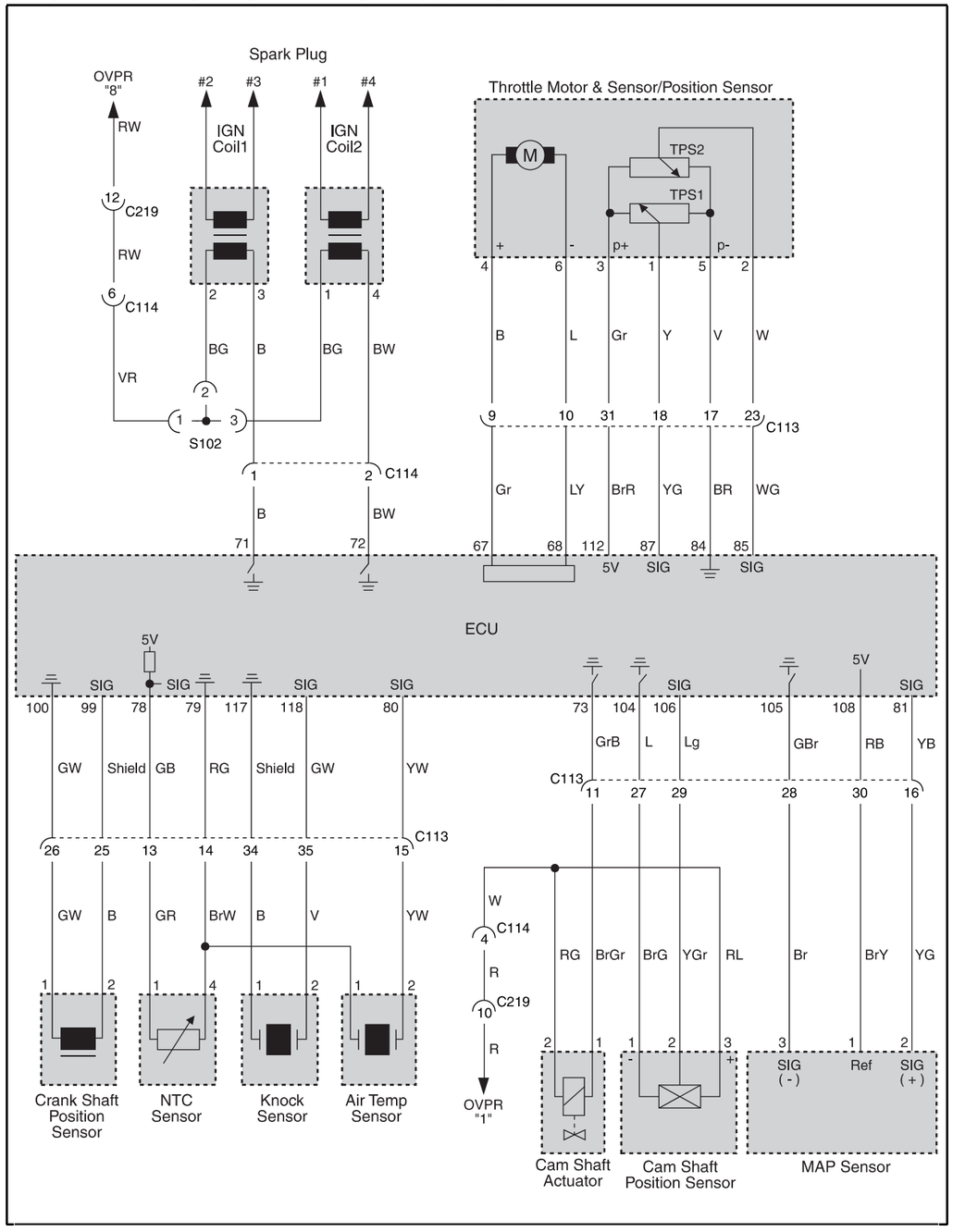

Accelerator Pedal
Sensor

Modification basis	
Application basis	
Affected VIN	

4) OVPR, FUEL PUMP, CANISTER PURGE VALVE, O2 SENSOR, PEDAL MODULE CIRCUIT 2003 MODEL ~



5) SPARK PLUG, SENSOR (CAM SHAFT POSITION, MAP, NTC, CRANK SHAFT POSITION, THROTTLE MOTOR, AIR TEMP, KNOCK), CAM SHIFT ACTUATOR CIRCUIT 2003 MODEL ~



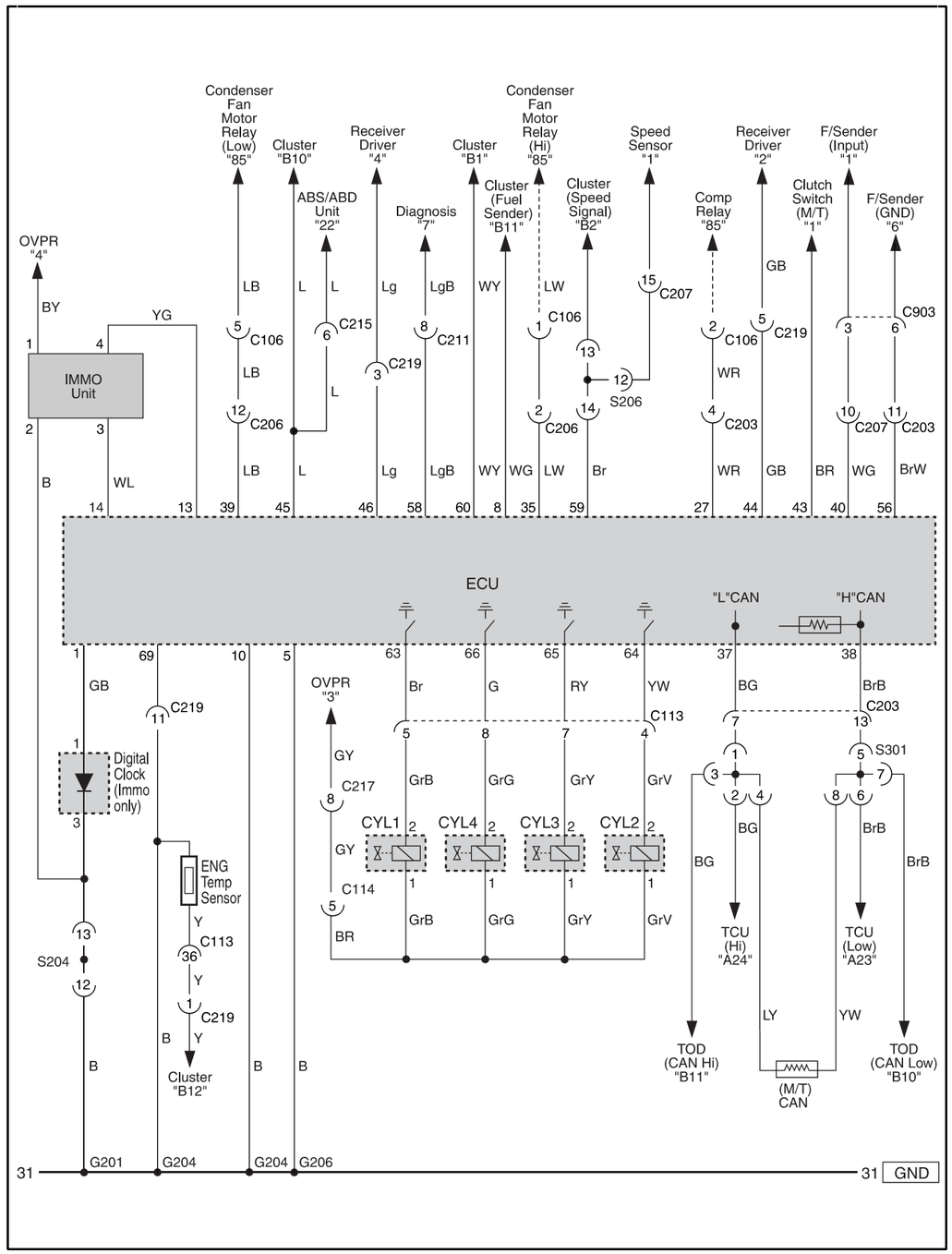
CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

6) DIGITAL CLOCK, ENG TEMP SENSOR, IMMOBILIZER CIRCUIT

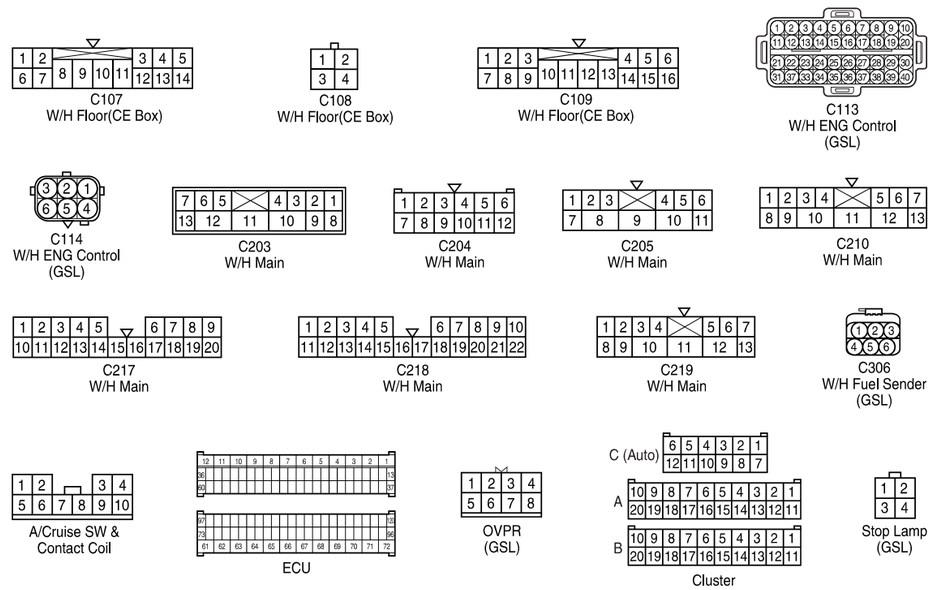
2003 MODEL ~



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
C217 (20Pin, Black)	Floor - T/M	Inside Co-Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C306 (6Pin, Black)	Floor - Fuel Sender	Left the T/C (Under the Floor)	GSL
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S206 (14Pin, Black)	W/H Main	Behind the Left the FATC	
G204	W/H Main	Inside Co-Driver Side Cowl PNL	
G301	W/H Floor	Under Driver Seat	ECU GND

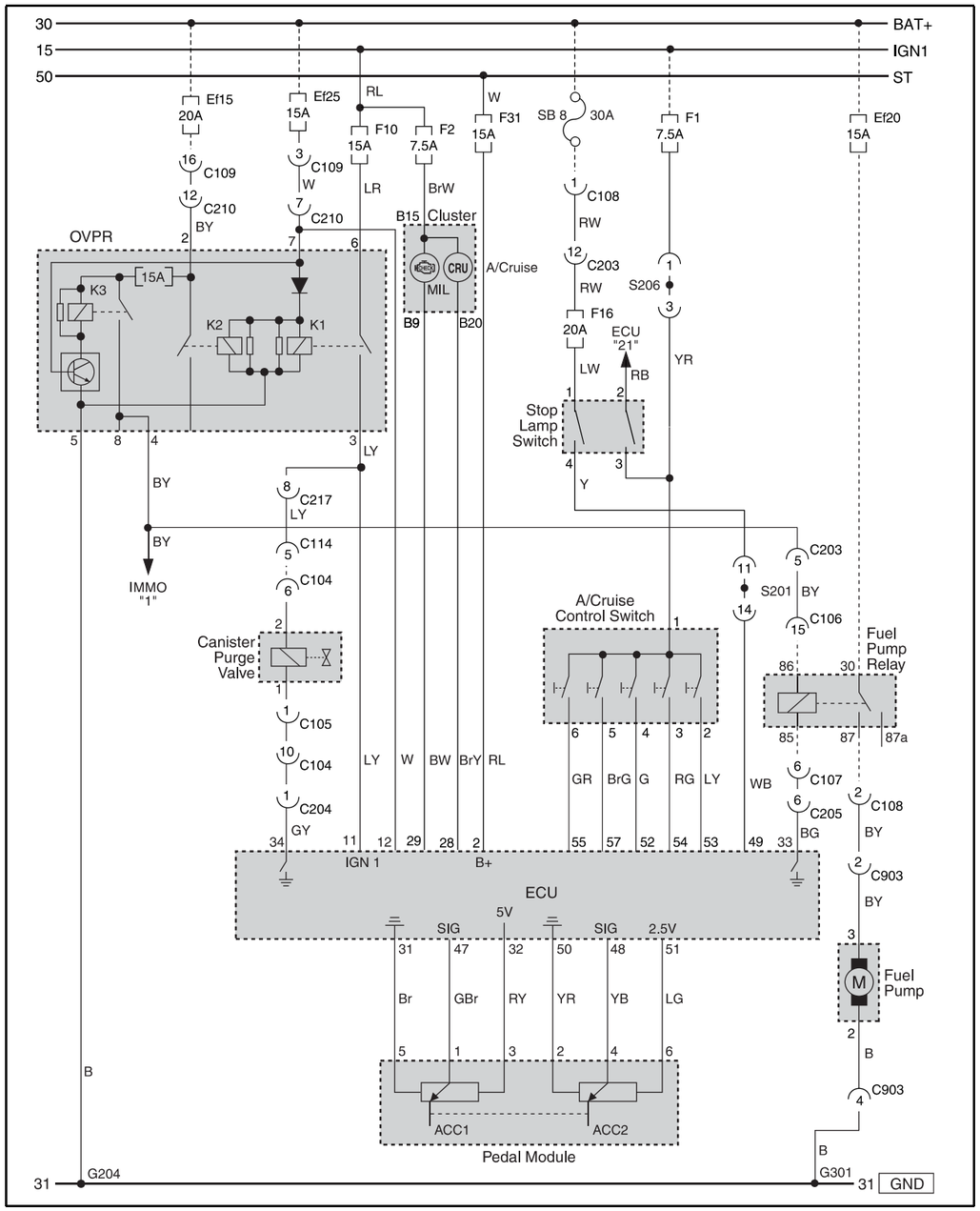
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



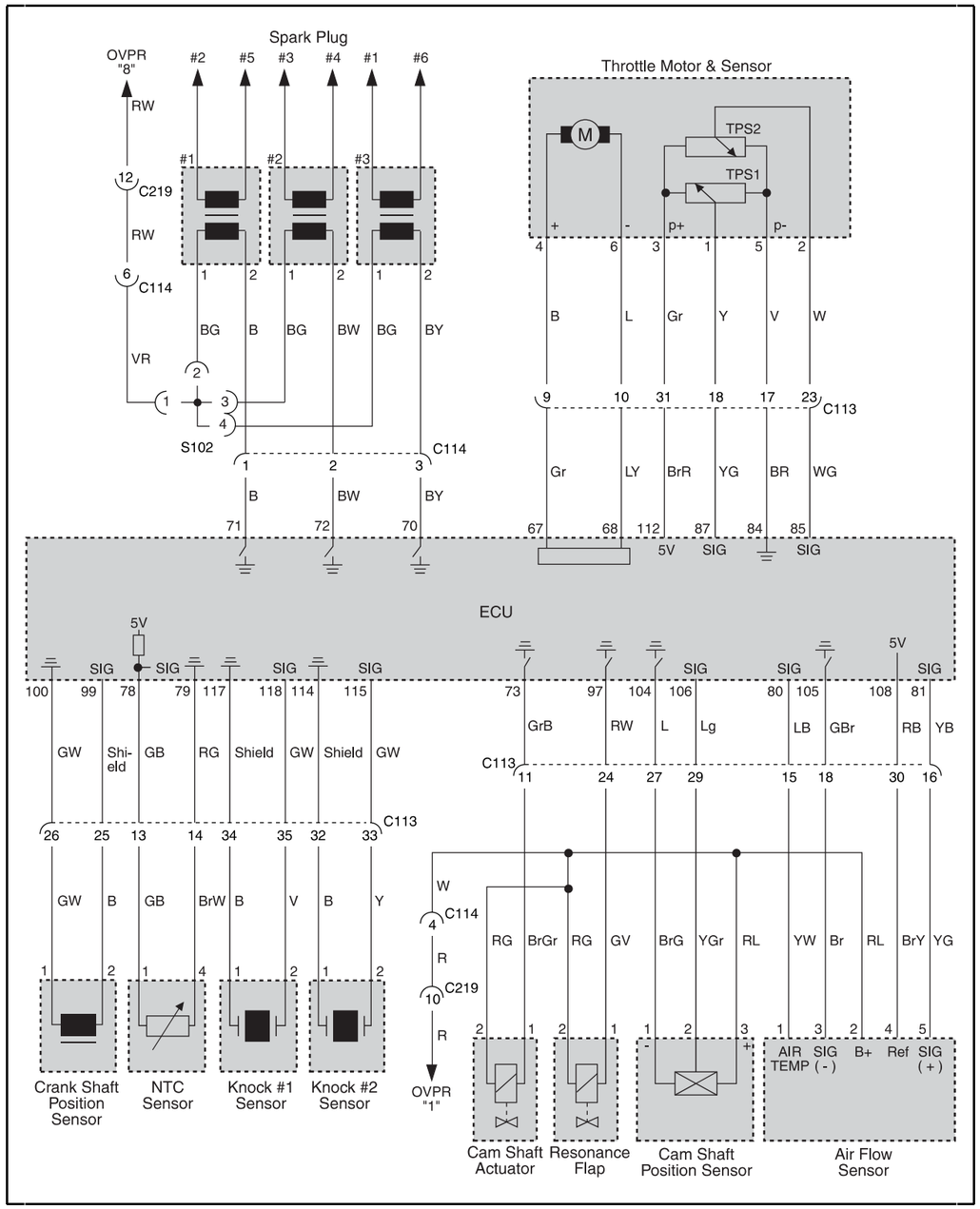
S.G.N. 1491-01

ECU (ELECTRONIC CONTROL UNIT) (E28, E32)

1) OVPR, FUEL PUMP, CANISTER PURGE VALVE, PEDAL MODULE CIRCUIT ~ 2002 MODEL



2) SPARK PLUG, SENSOR (CAM SHAFT POSITION, NTC, CRANK SHAFT POSITION,THROTTLE MOTOR & SENSOR, KNOCK), CAM SHIFT ACTUATOR, RESONANCE FLAPCIRCUIT ~ 2002 MODEL

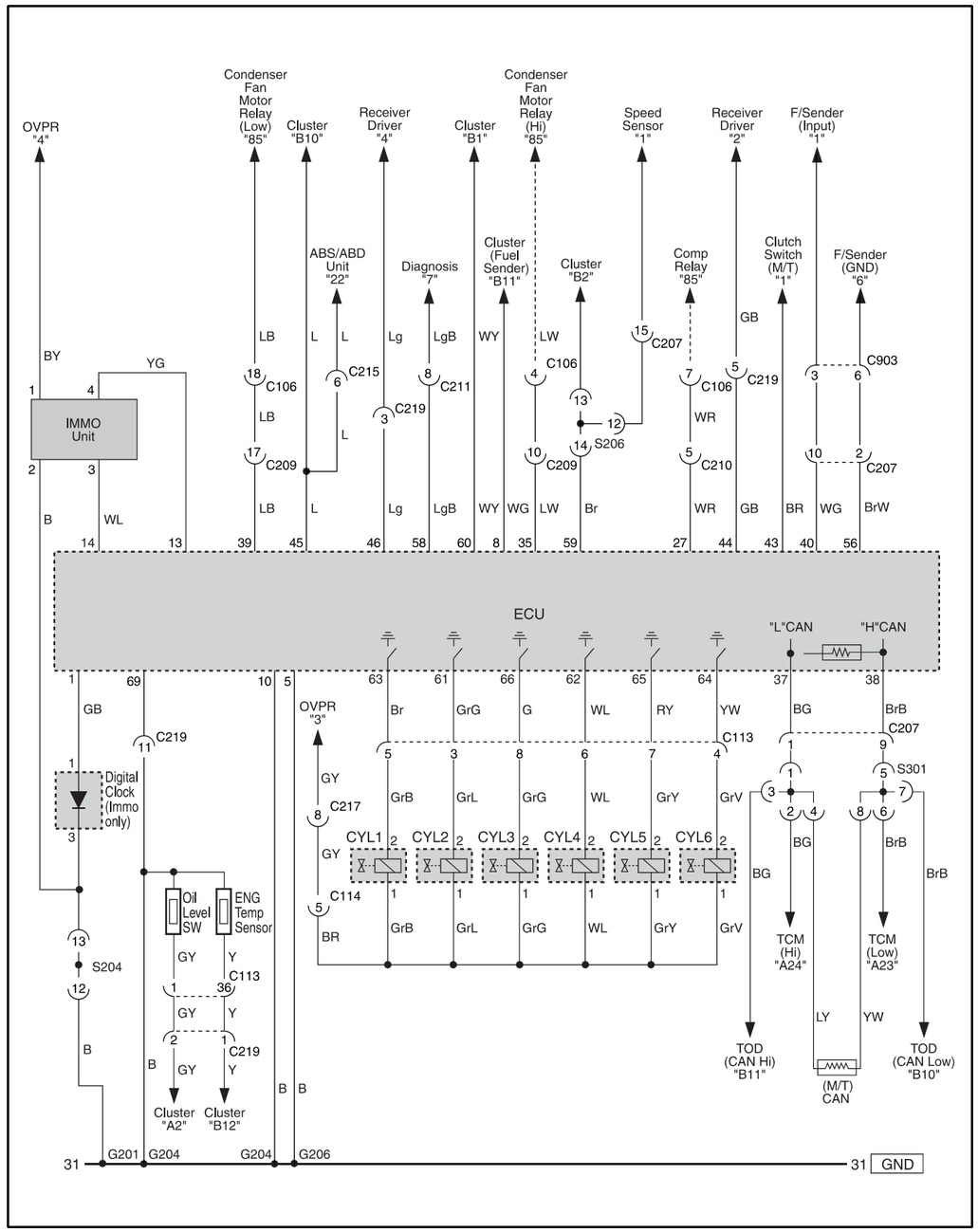


CIRCUIT

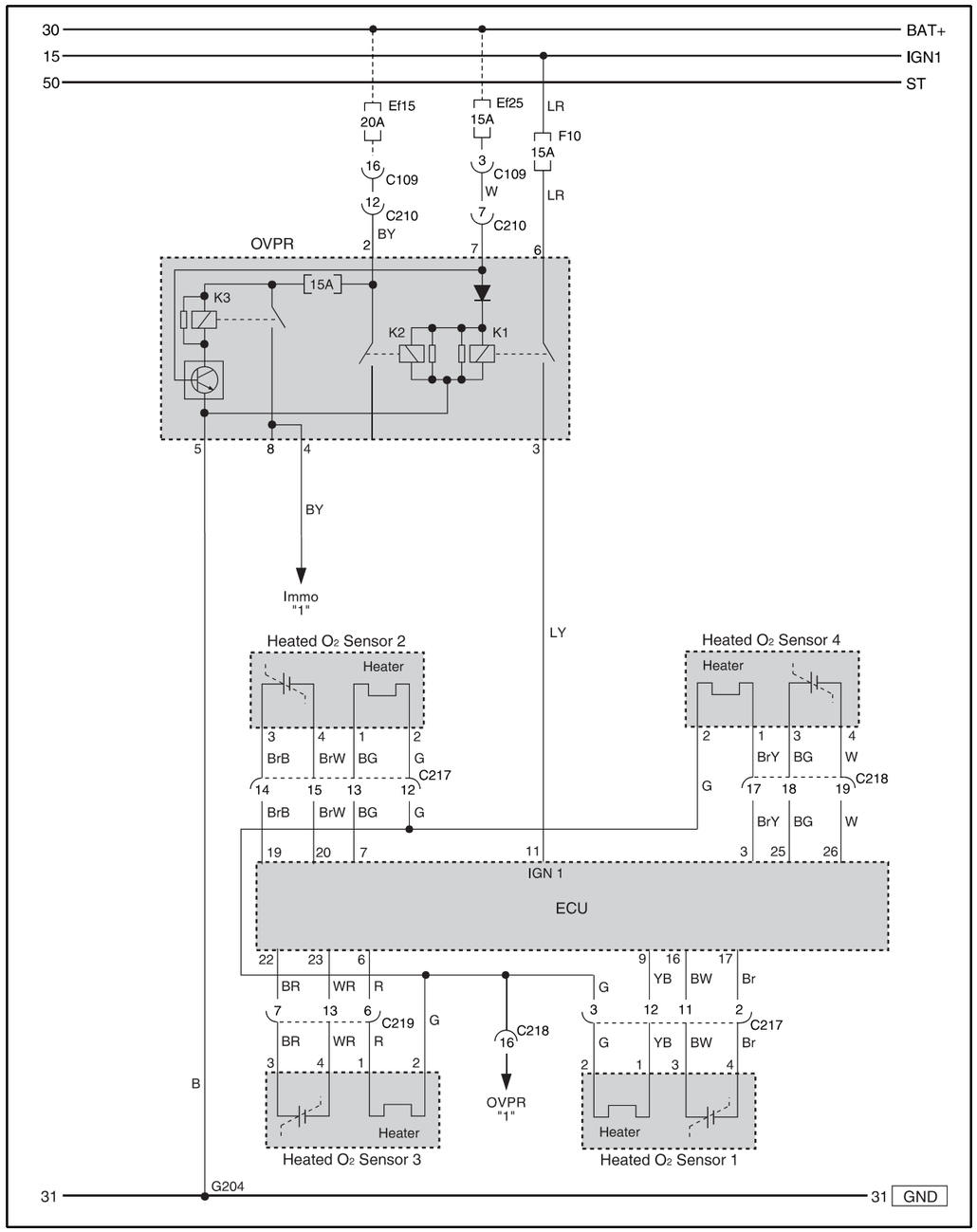
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

3) DIGITAL CLOCK, ENG TEMP SENSOR, IMMOBILIZER CIRCUIT ~ 2002 MODEL



4) O2 SENSOR ~ 2002 MODEL

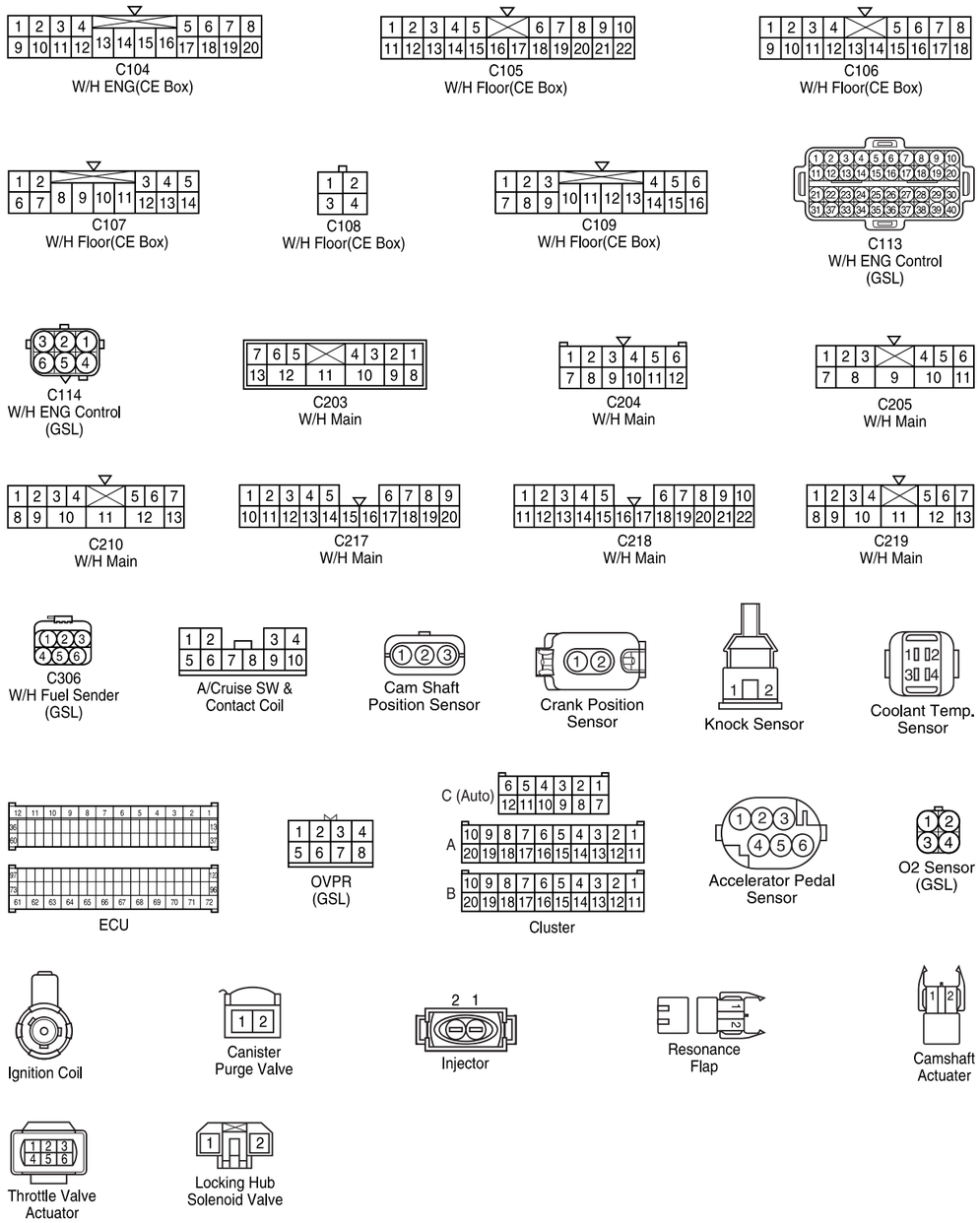


Modification basis	
Application basis	
Affected VIN	

(1) CONNECTOR INFORMATION

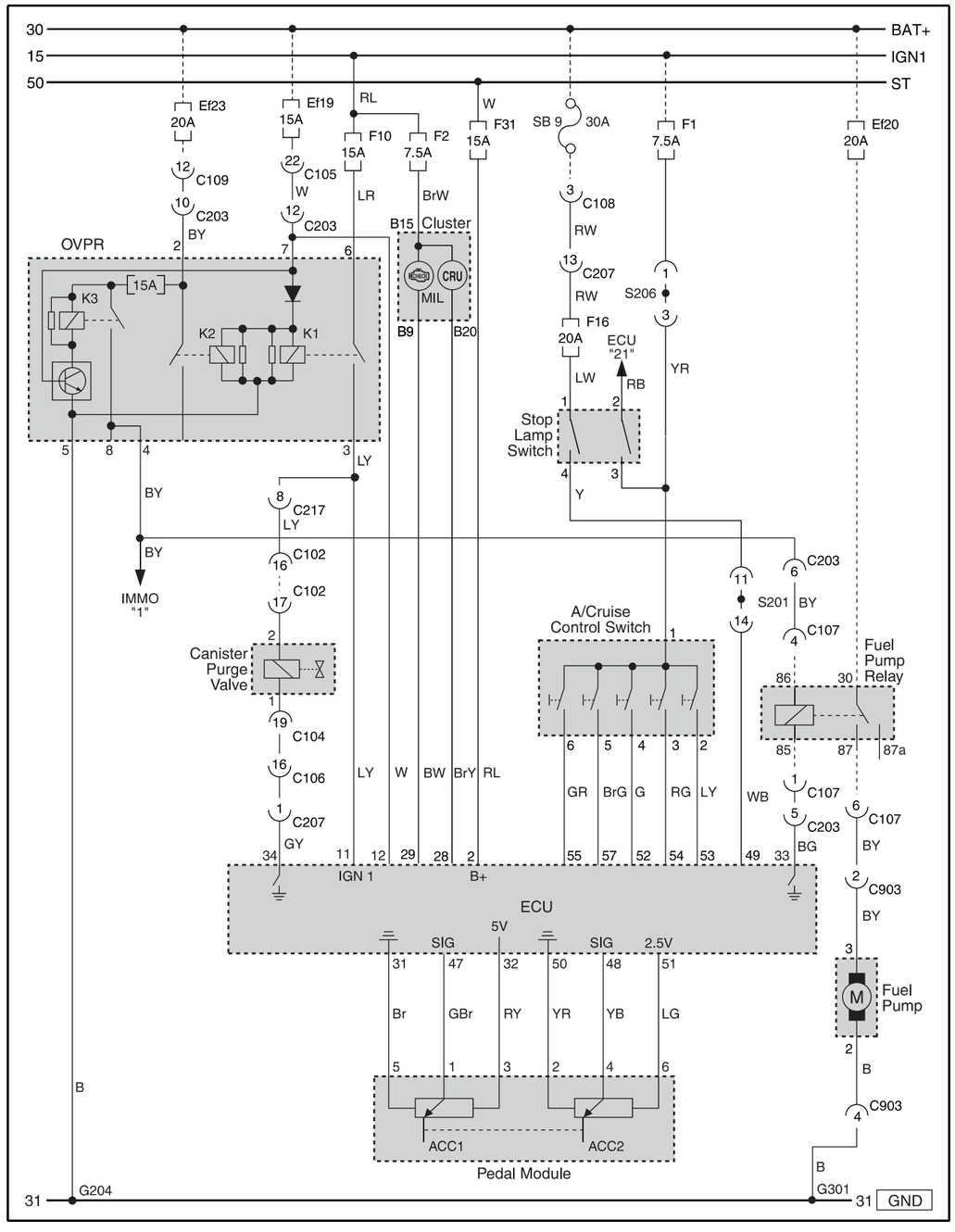
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C113 (40Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	GSL
C114 (6Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	GSL
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
C217 (20Pin, Black)	Floor - T/M	Inside Co-Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C306 (6Pin, Black)	Floor - Fuel Sender	Left the T/C (Under the Floor)	GSL
S101 (7Pin, -)	OVPR "6" - Injector	Inside the C113, C114	GSL
S102 (4Pin, -)	OVPR "8" - IGN Coil	Inside the Injector "6"	GSL
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S206 (14Pin, Black)	W/H Main	Behind the Left the FATC	
G204	W/H Main	Inside Co-Driver Side Cowl PNL	
G301	W/H Floor	Under Driver Seat	ECU GND

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

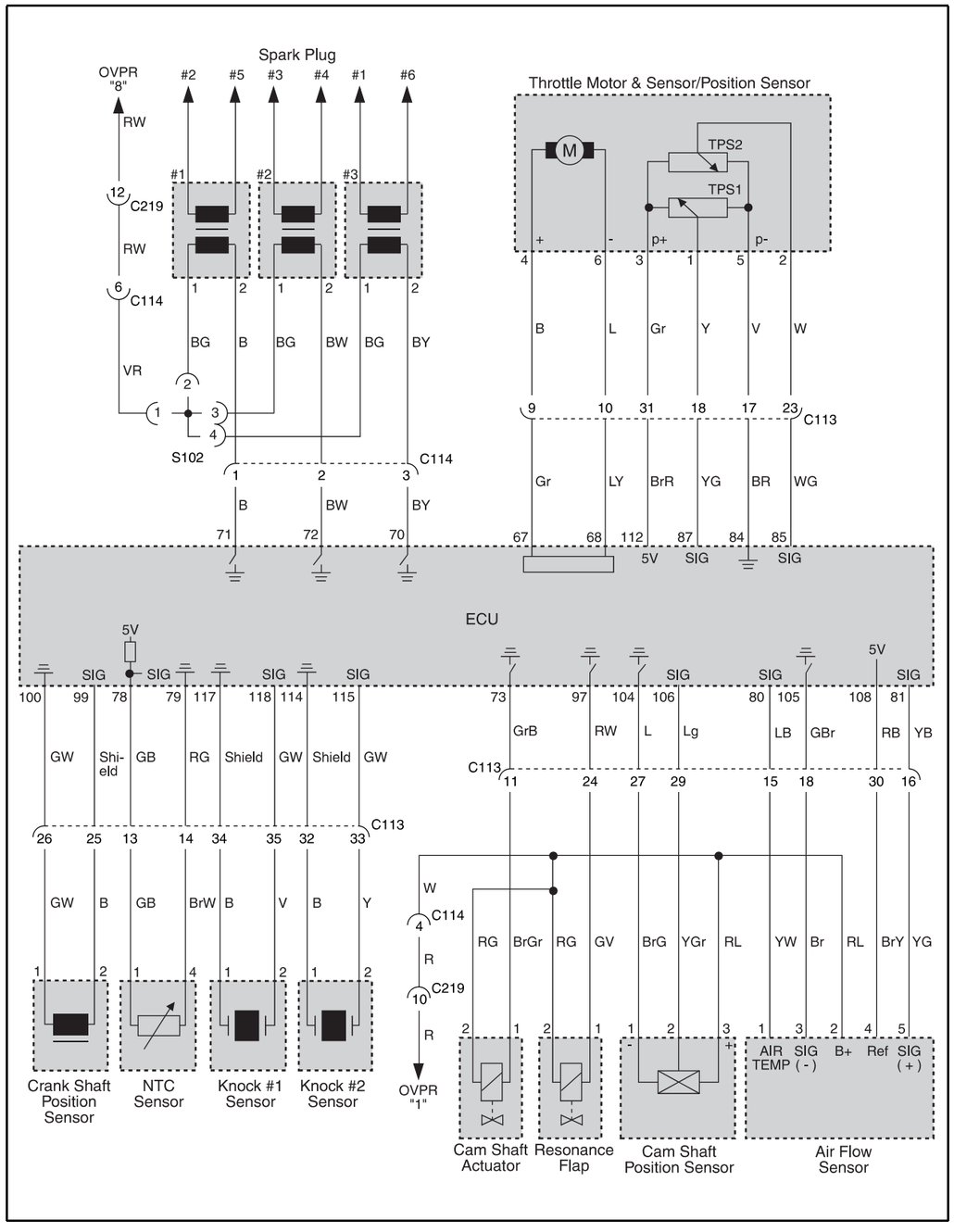


Modification basis	
Application basis	
Affected VIN	

5) OVPR, FUEL PUMP, CANISTER PURGE VALVE, PEDAL MODULE CIRCUIT 2003 MODEL ~

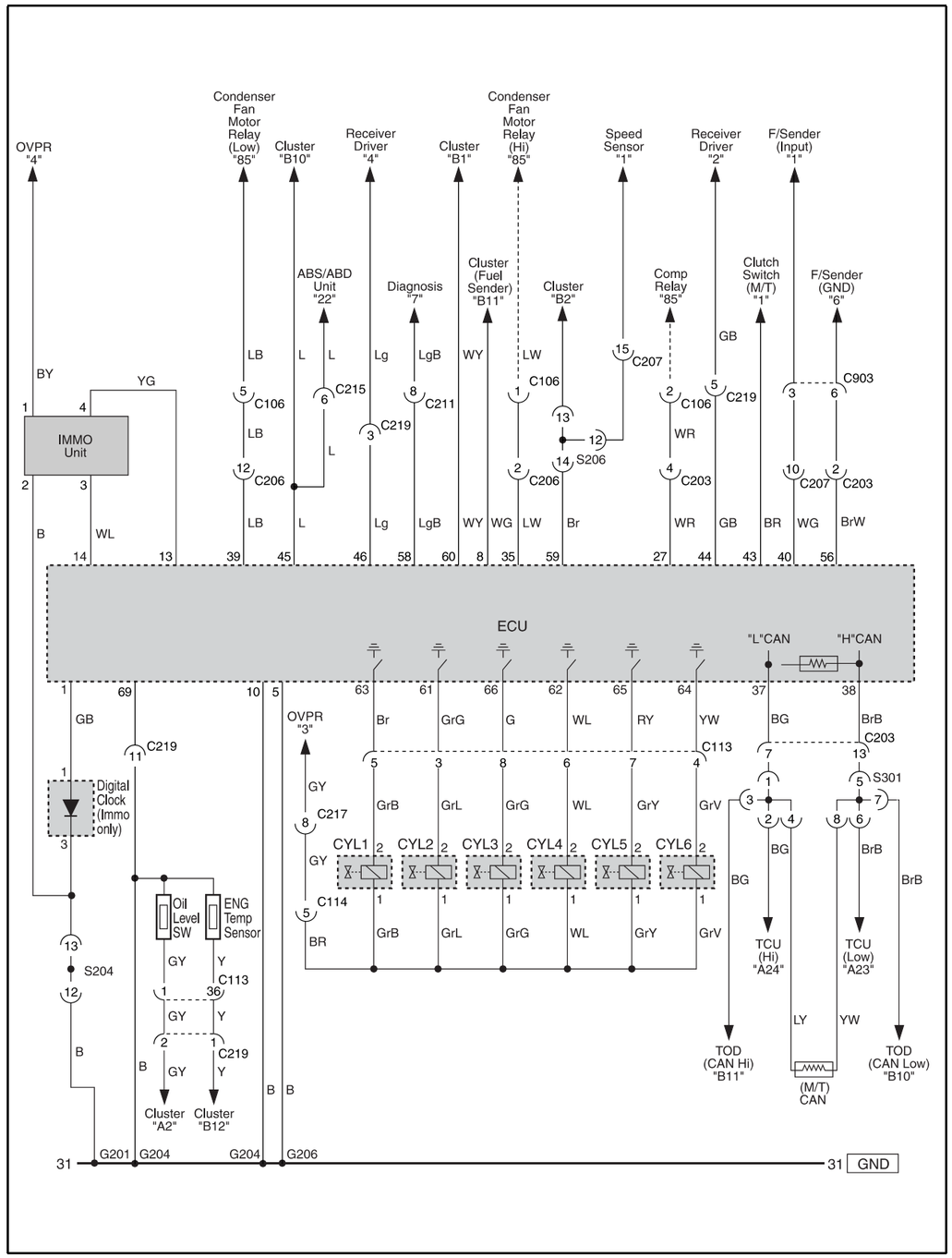


6) SPARK PLUG, SENSOR(CAM SHAFT POSITION, NTC, CRANK SHAFT POSITION,THROTTLE MOTOR & SENSOR, KNOCK), CAM SHIFT ACTUATOR, RESONANCE FLAPCIRCUIT 2003 MODEL ~

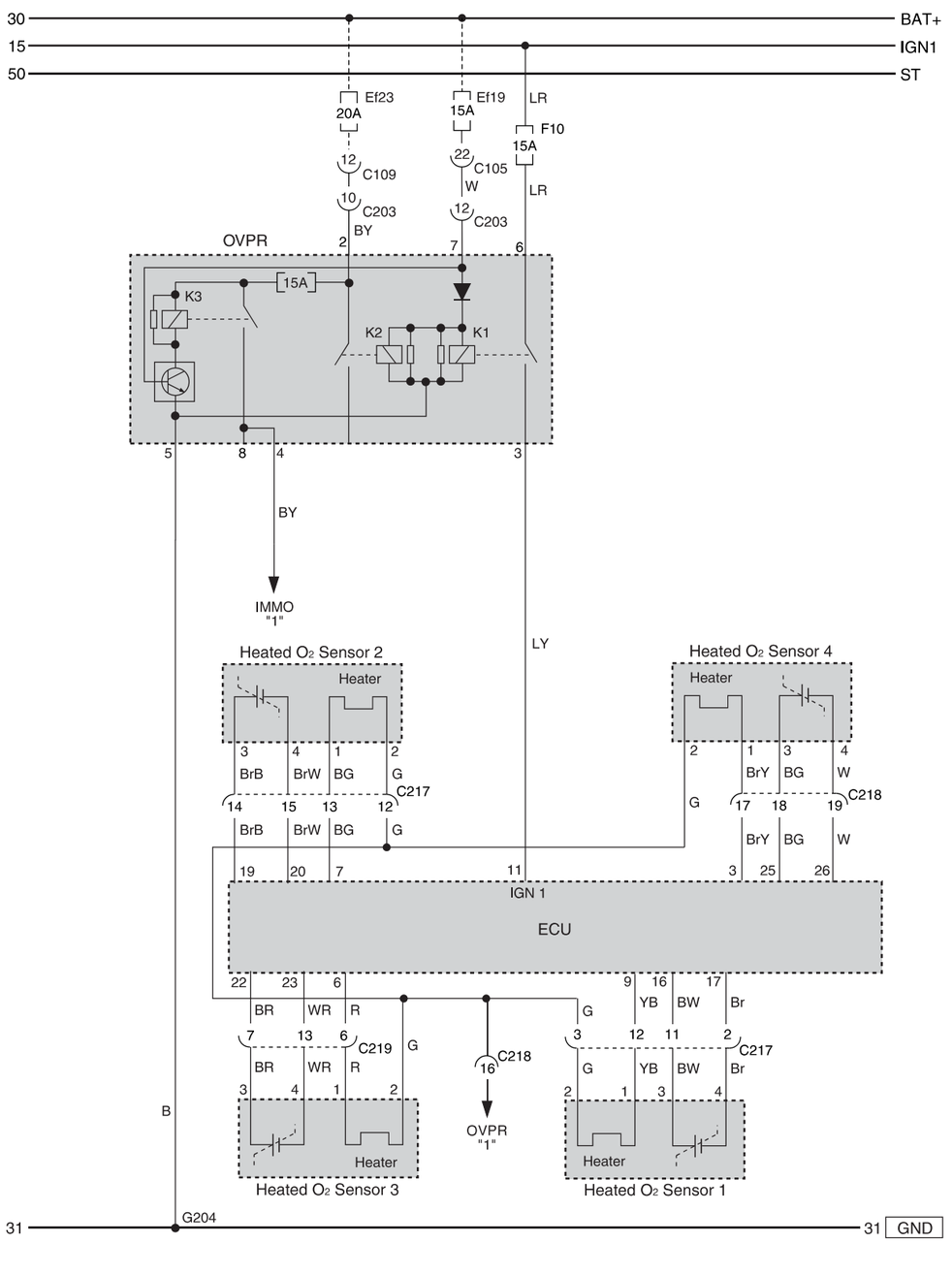


Modification basis	
Application basis	
Affected VIN	

7) DIGITAL CLOCK, ENG TEMP SENSOR, IMMOBILIZER CIRCUIT 2003 MODEL ~



8) O2 SENSOR 2003 MODEL ~



CIRCUIT

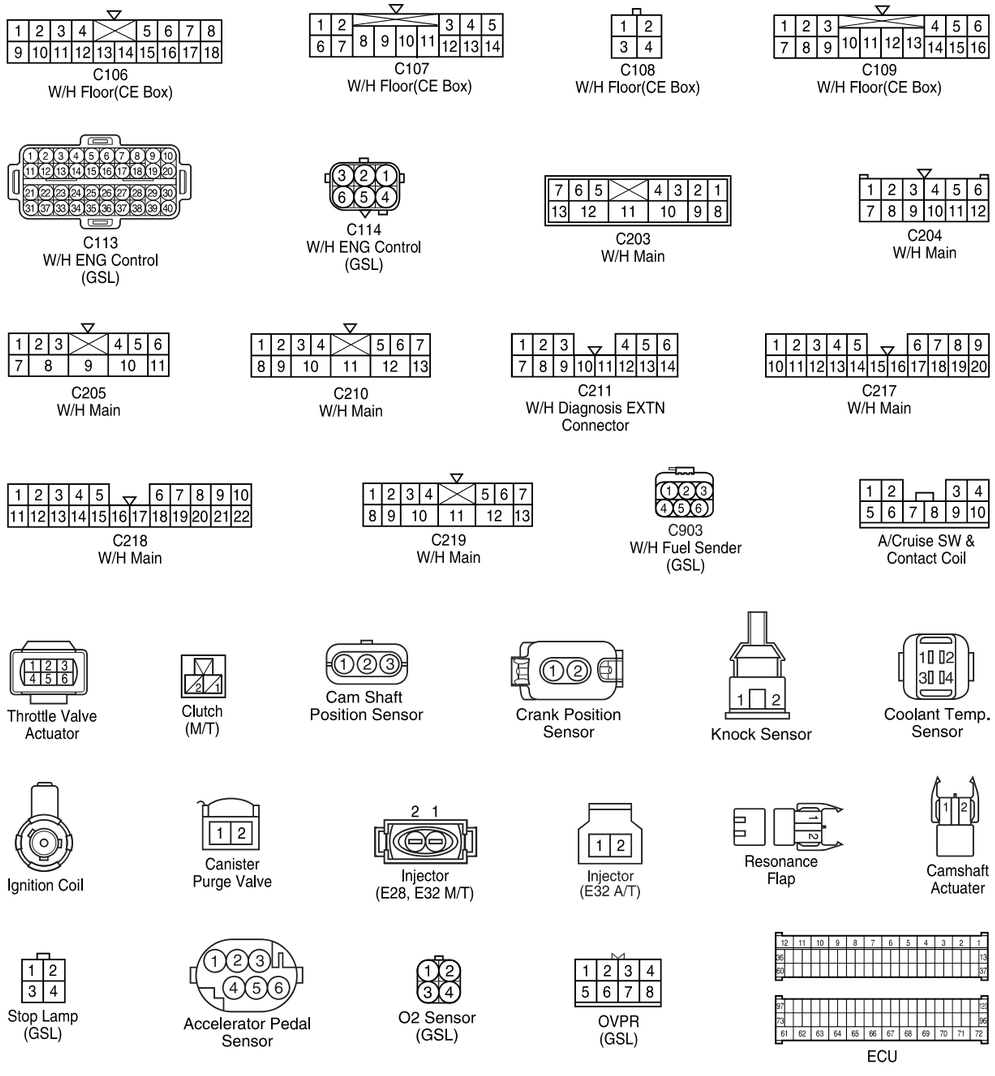
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C113 (40Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	GSL
C114 (6Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	GSL
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
C211 (14Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	
C215 (14Pin, White)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	ABS, ABD
C217 (20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C903 (2Pin, White)	Floor - Fuel Sender	Left the T/C (Under the Floor)	DSL
S102 (4Pin, -)	OVPR "8" - IGN Coil	Inside the Injector "6"	GSL
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S206 (14Pin, Black)	W/H Main	Behind the Left the FATC	
S301 (8Pin, Black)	W/H Floor	Under Driver Seat	CAN (GSL)
G204	W/H Main	Inside Co-Driver Side Cowl PNL	
G301	W/H Floor	Under Driver Seat	ECU GND

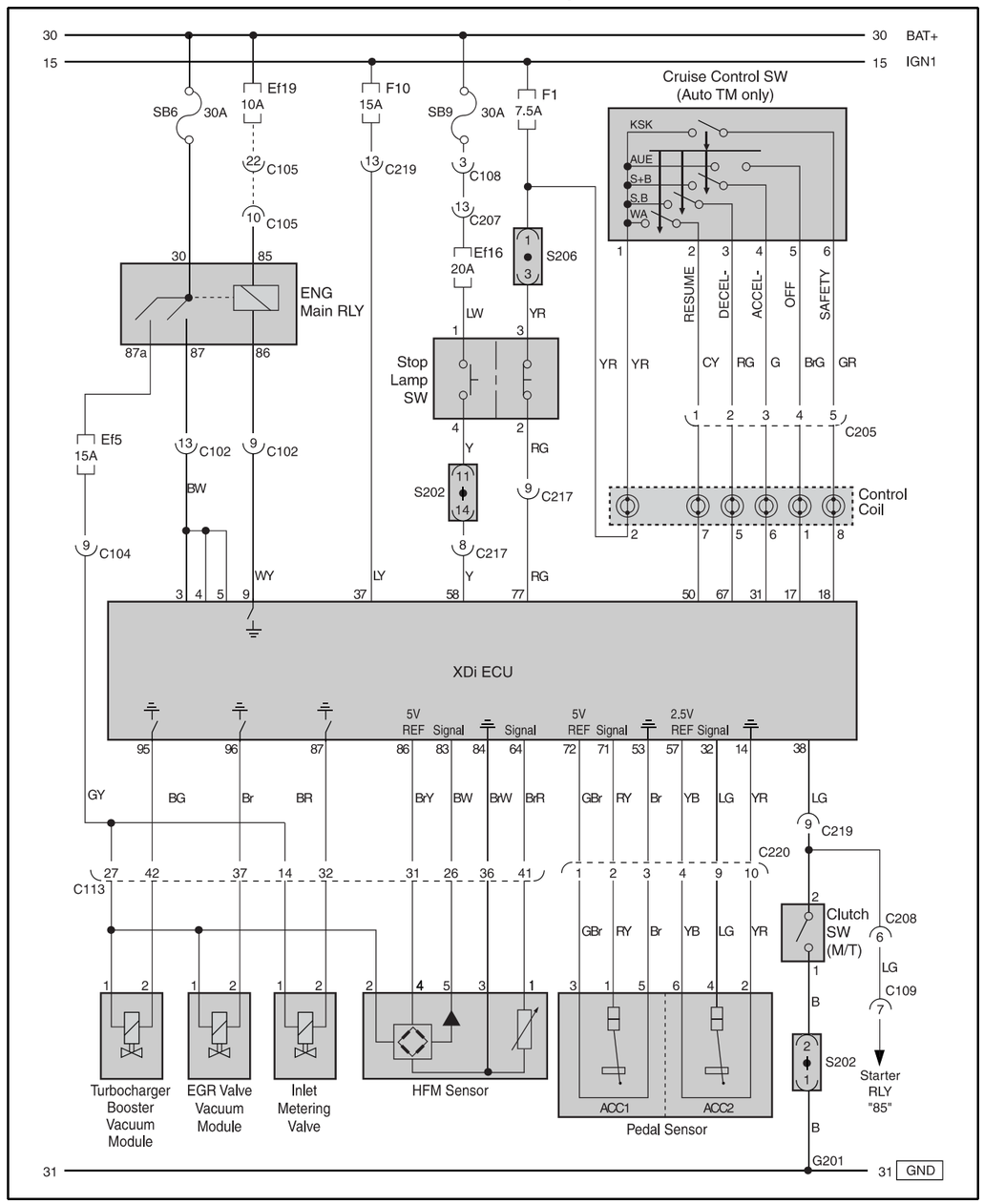
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



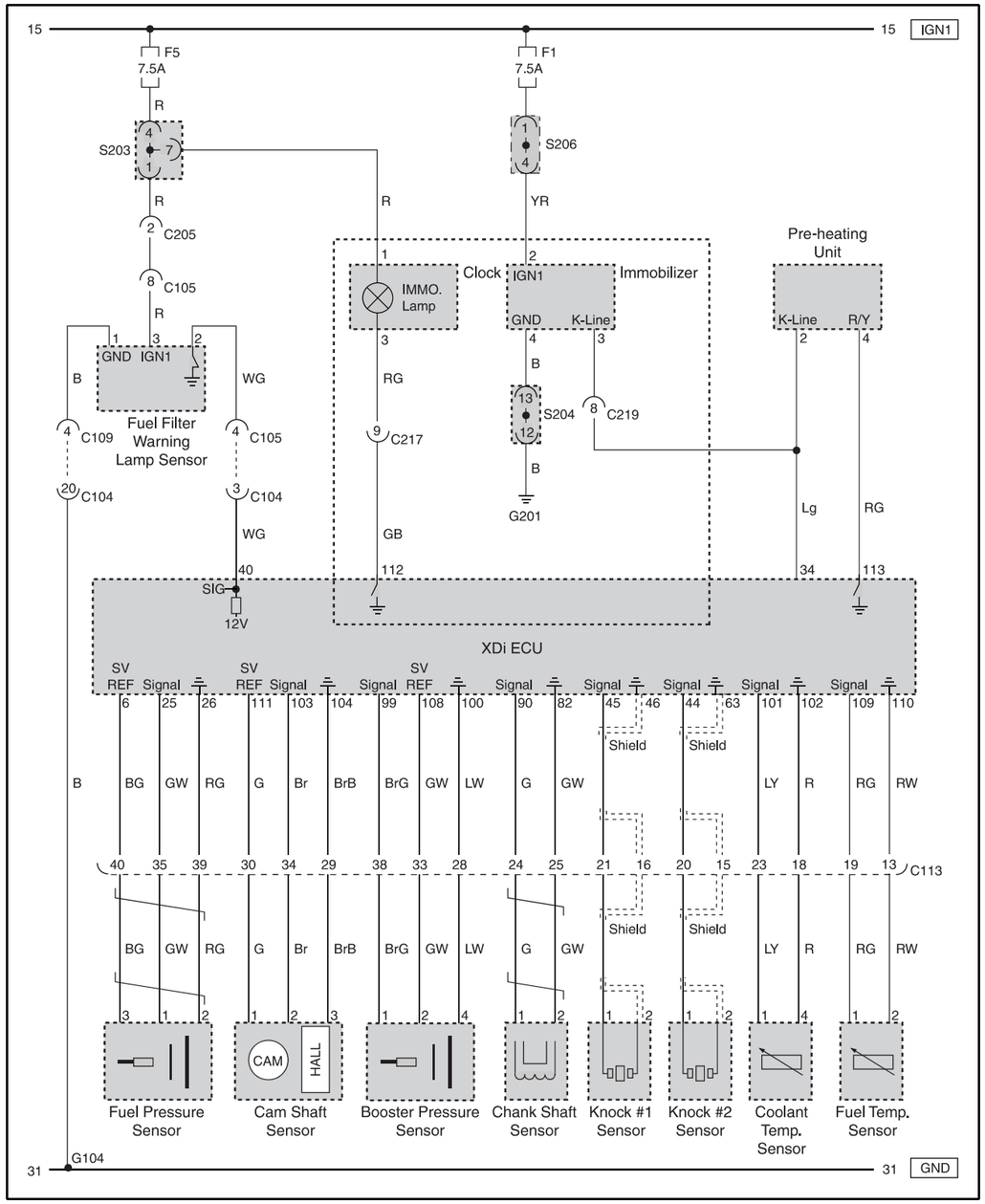
S.G.N. 1491-01

ECU(XDi)

1) ENG MAIN RLY, PEDAL MODULE, HFM SENSOR, VALVE(TURBO CHANGER BOOSTER, EGR VACUUM MODULE, INLETMETERING VALVE)



2) FUEL FILTER WARNING LAMP, IMMOBILIZER, SENSOR(FUEL PRESSURE, CAM SHAFT, BOOSTER PRESSURE, CRANK SHAFT, KNOCK,WATER PUMP, FUEL TEMP)

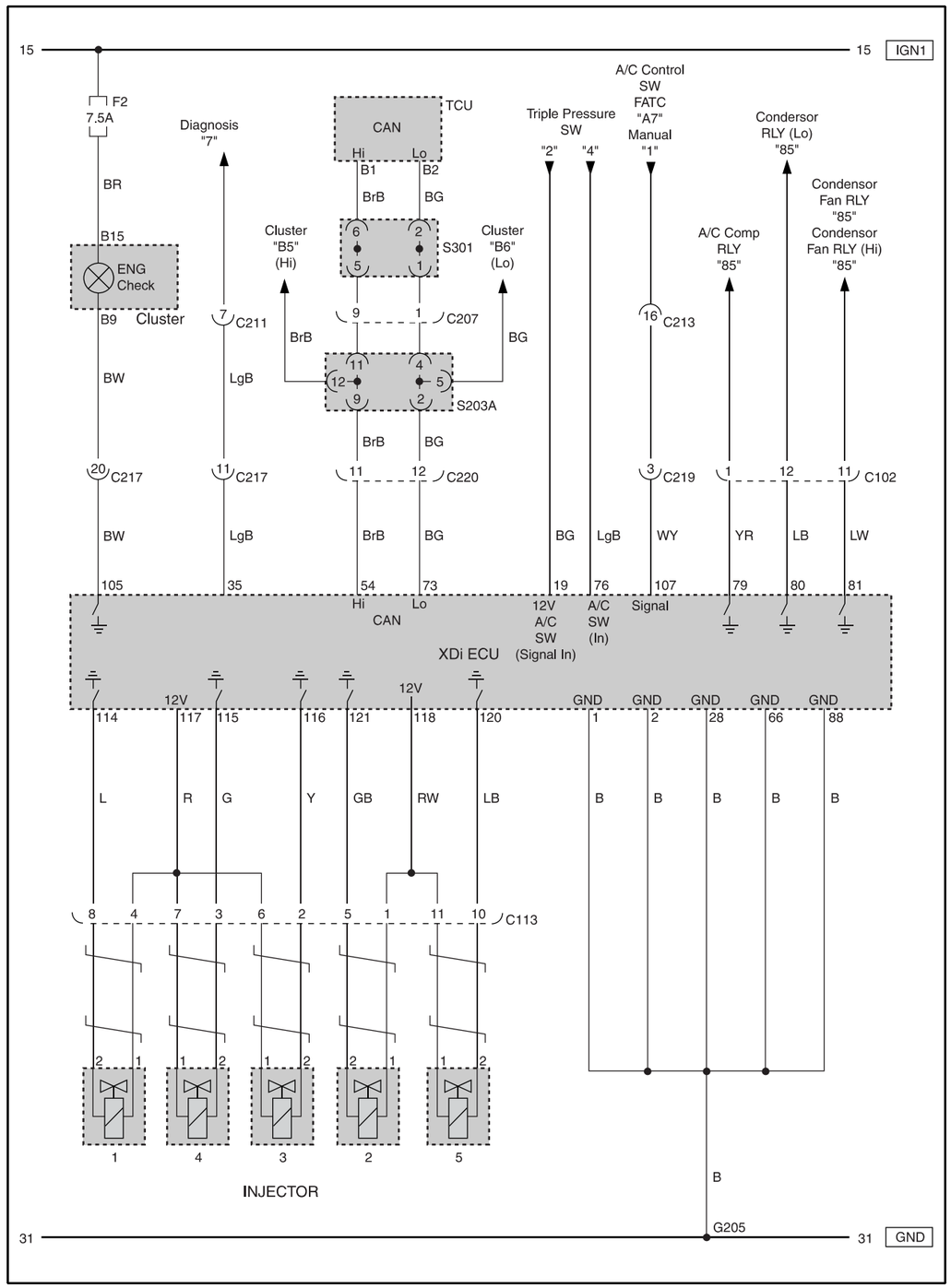


CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

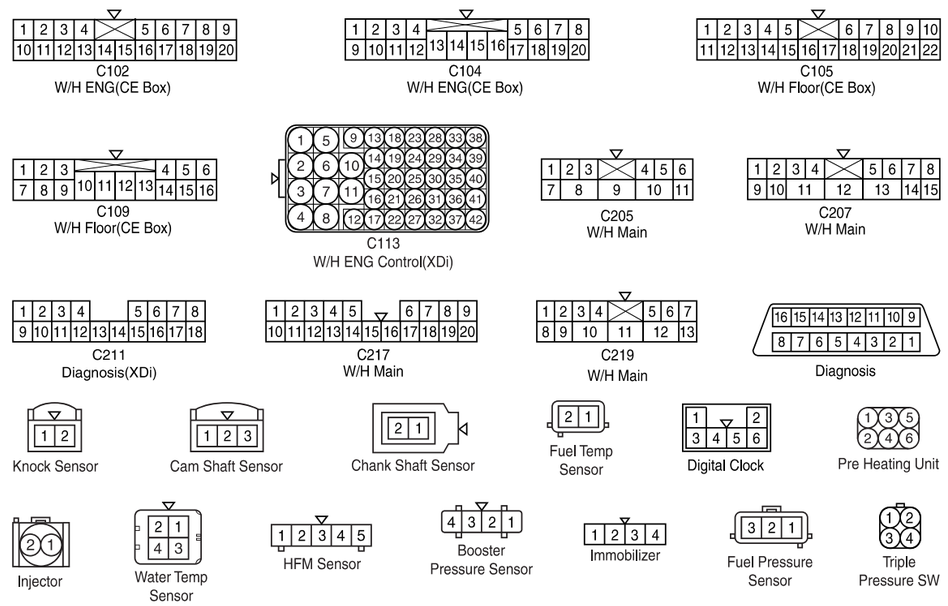
3) INJECTOR, CAN LINE



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C113 (42Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	XDi
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C217 (20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	XDi
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S205 (14Pin, Black)	W/H Main	Behind the Left FATC	GND
G101	W/H Engine	Center the Engine Room Fuse Box	
G201	W/H Main	Inside Driver Side Cowl PNL	
G205	W/H Main	Inside Co-Driver Side Cowl PNL	GSL

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

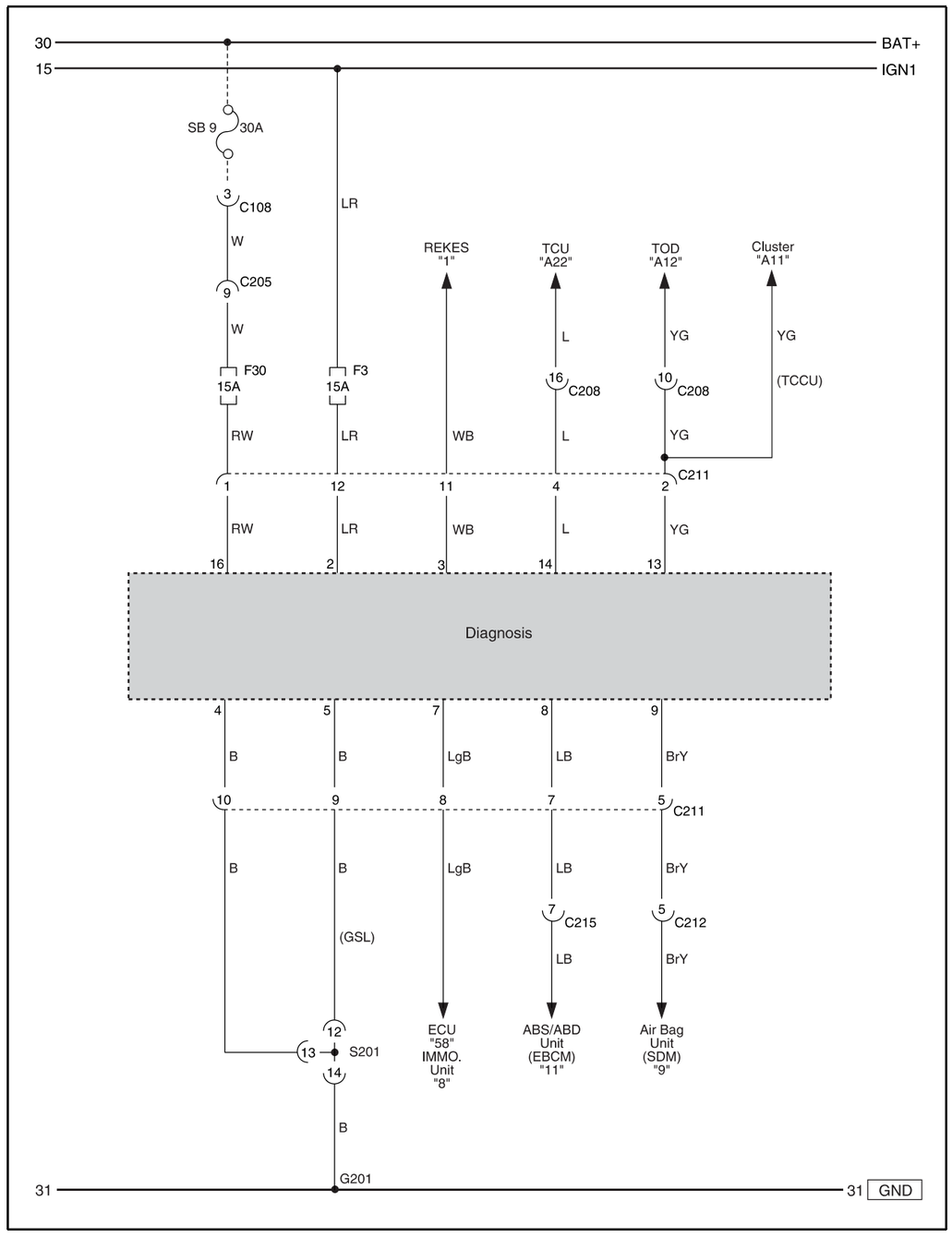


Modification basis	
Application basis	
Affected VIN	

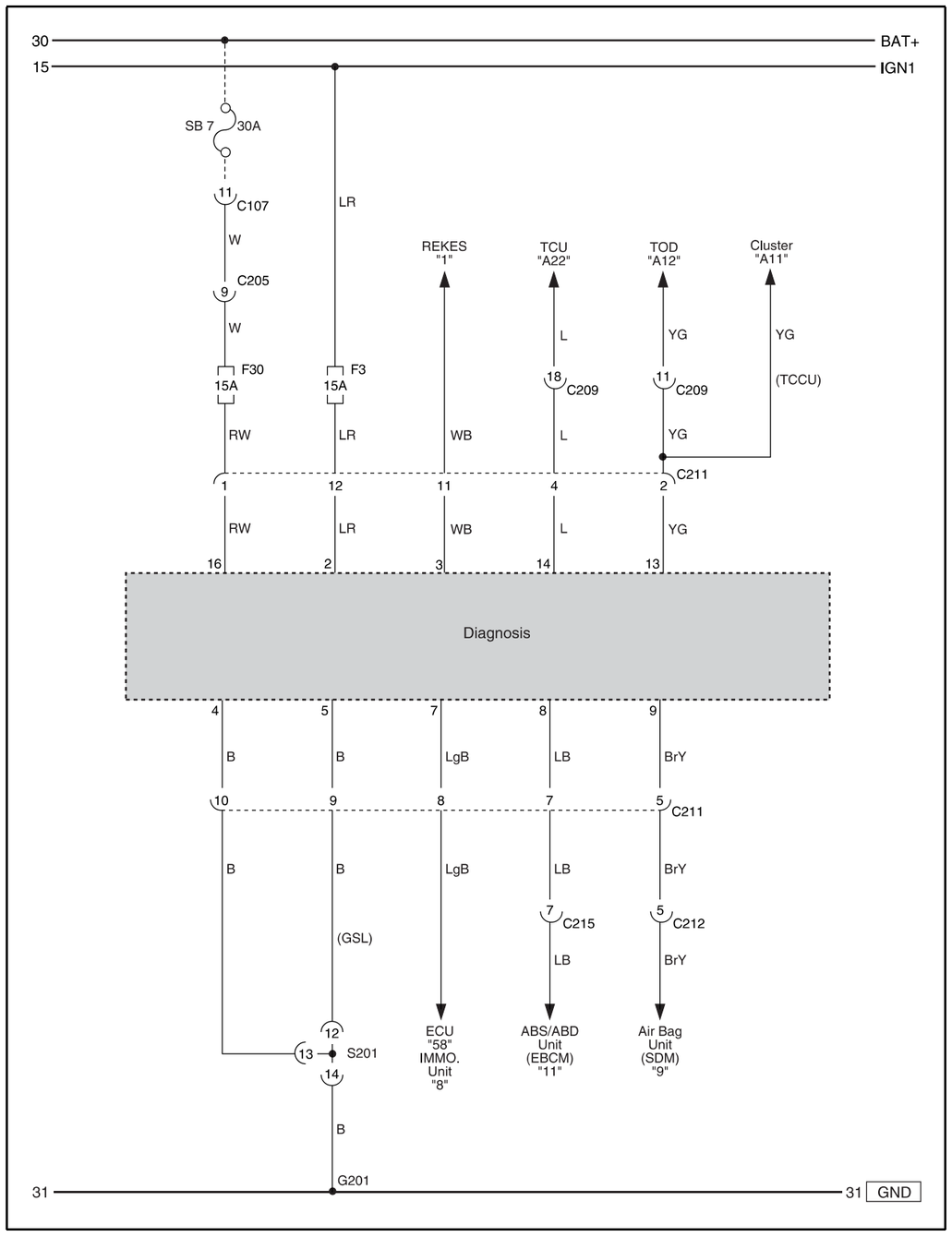
S.G.N. 8211-01

DIAGNOSIS CIRCUIT

1) ~ 2002 MODEL

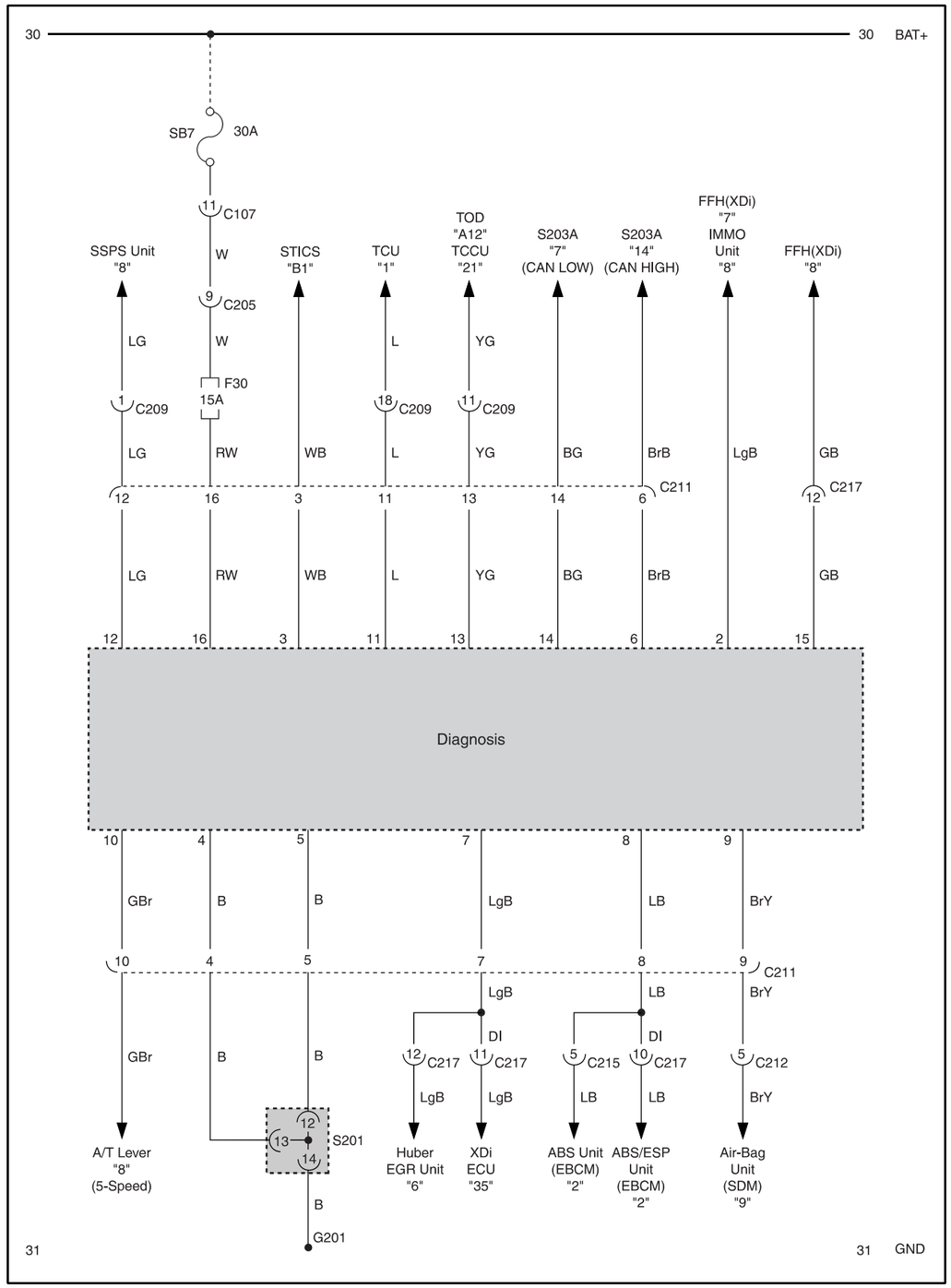


2) 2003~ MODEL



Modification basis	
Application basis	
Affected VIN	

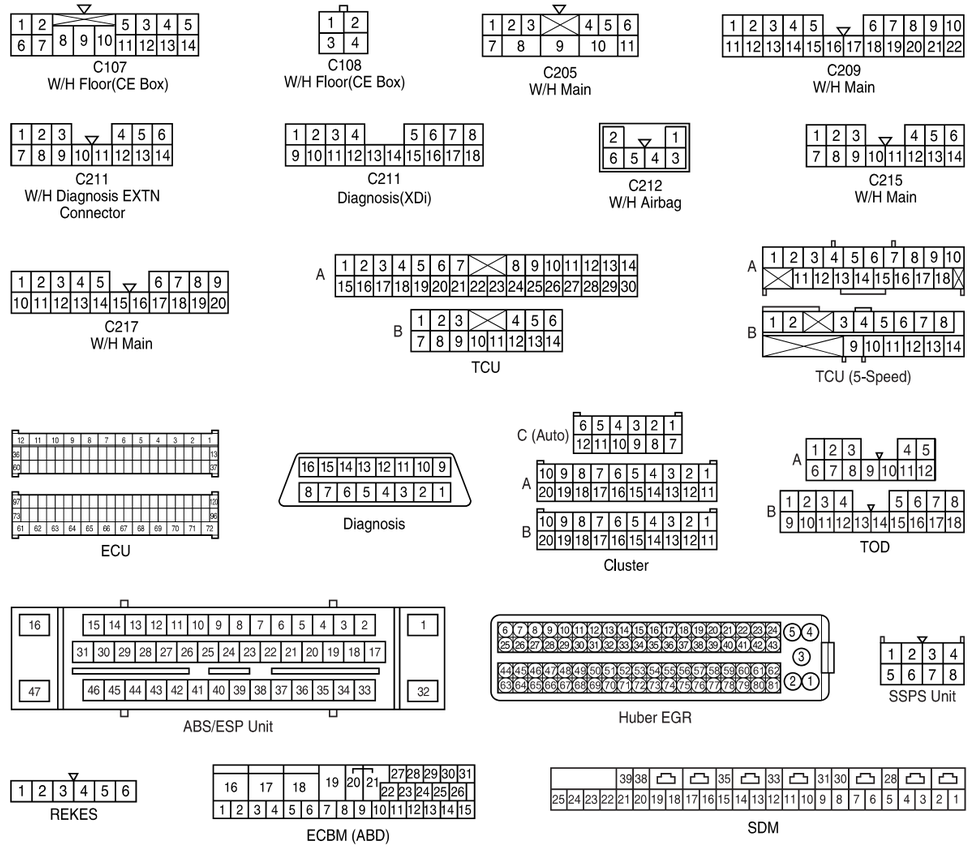
3) XDi



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C211 (18Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	XDi
C212 (6Pin, White)	Main - Air-Bag	Behind the Cluster (Inside Dash PNL)	
C215 (14Pin, White)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	ABS, ABD
C217 (20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
G201	W/H Main	Inside Driver Side Cowl PNL	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

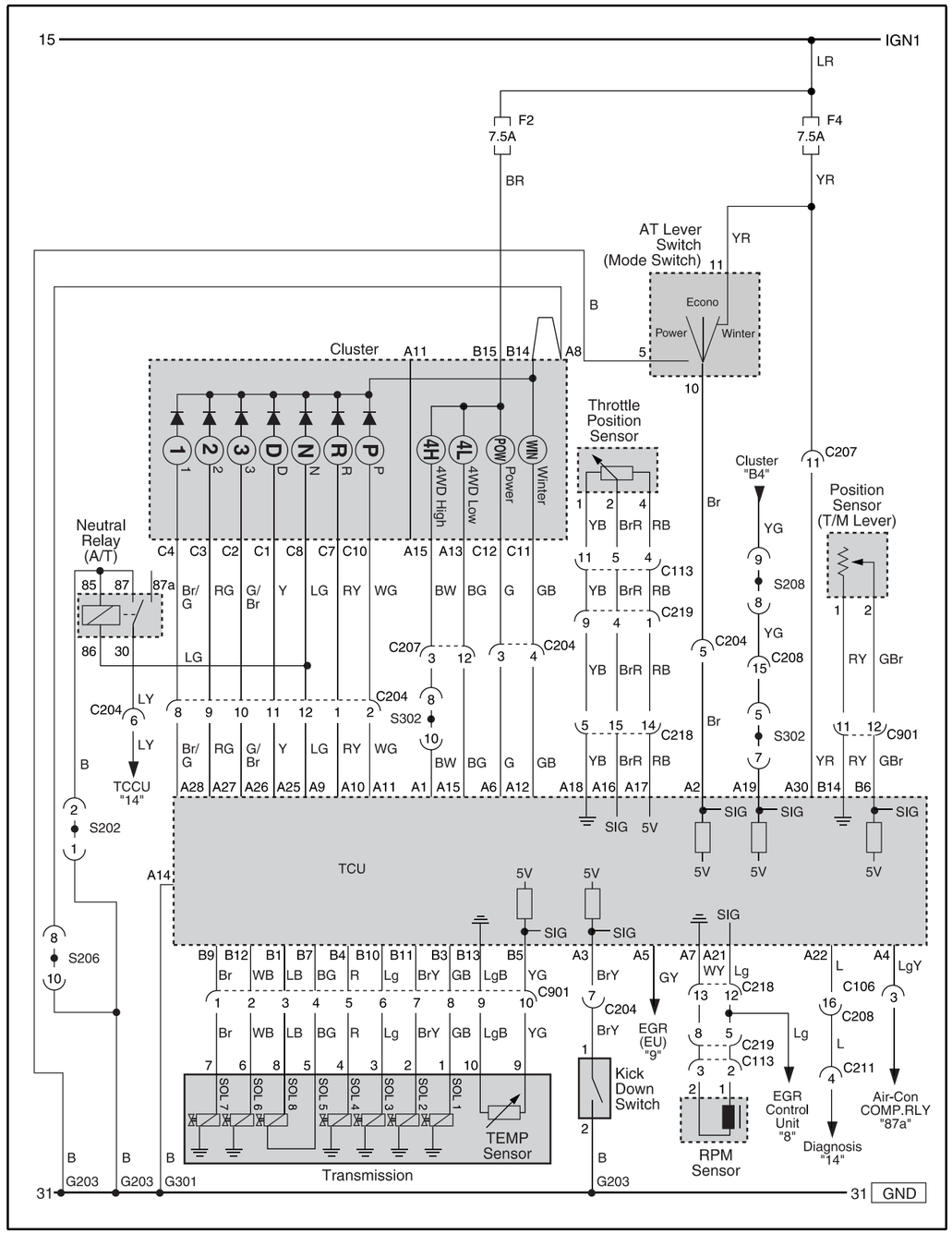


Modification basis	
Application basis	
Affected VIN	

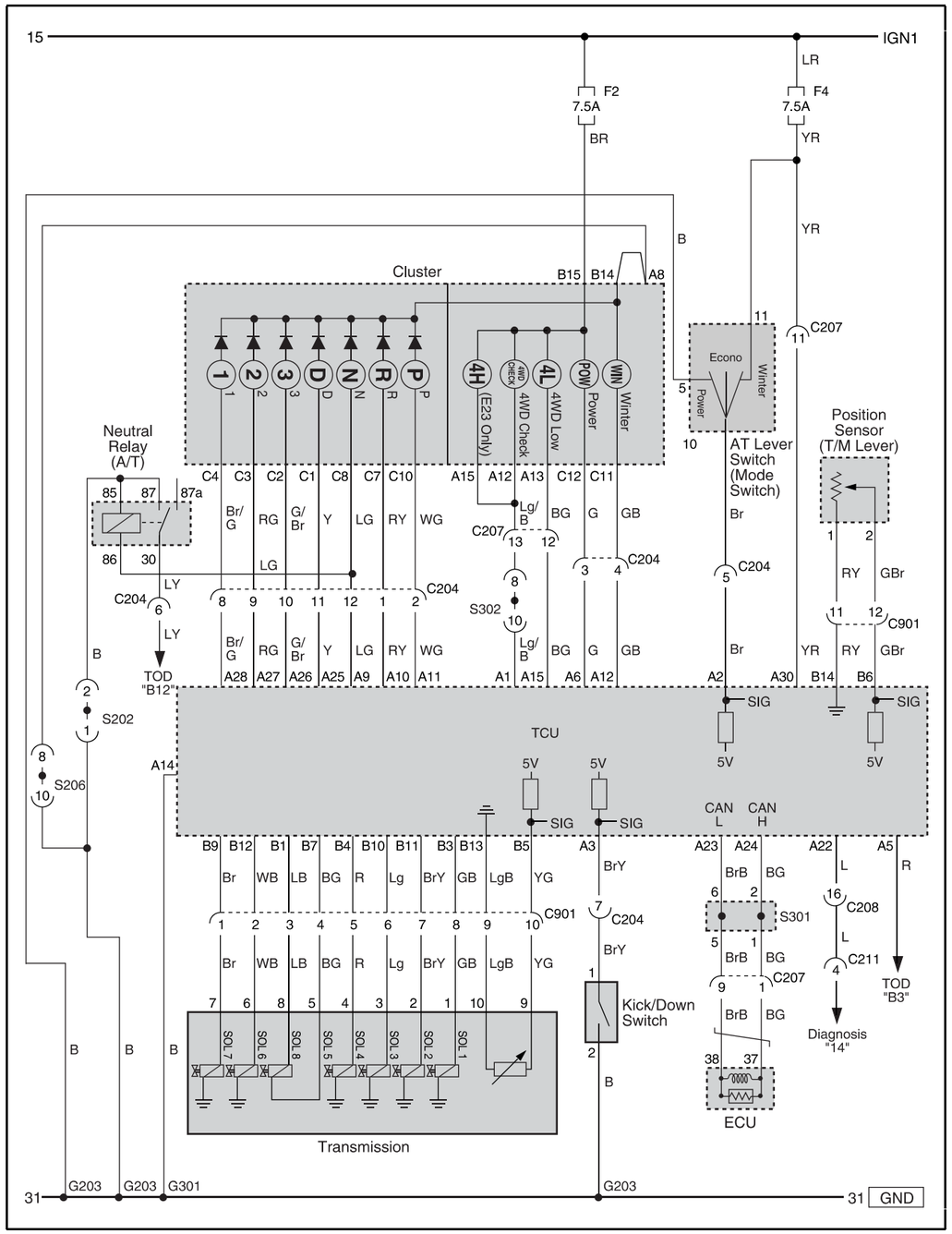
S.G.N. 3110-01

TCU(TRANSMISSION CONTROL UNIT 4-SPEED

1) DSL ~ 2002 MODEL



2) GSL ~ 2002 MODEL

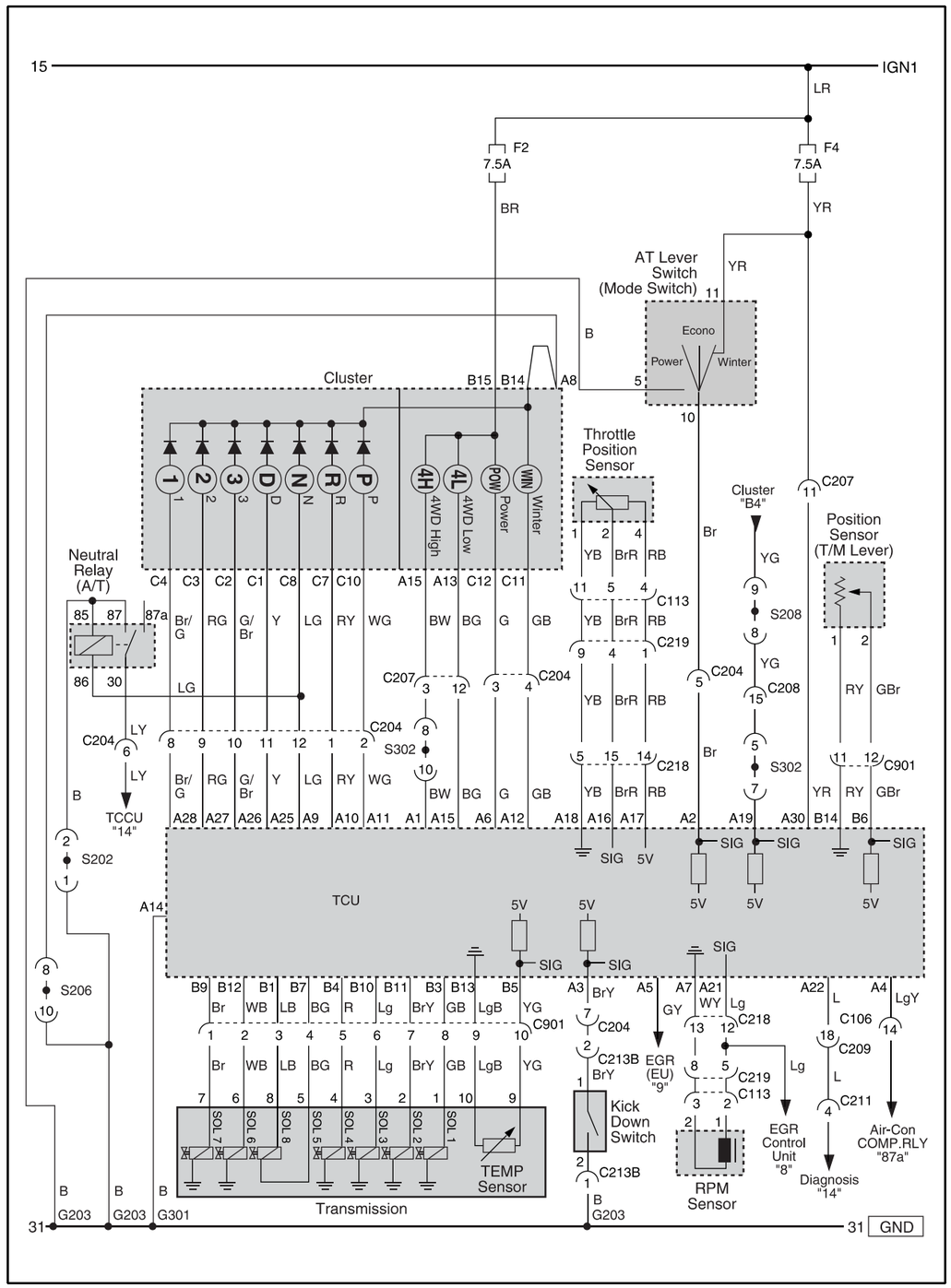


CIRCUIT

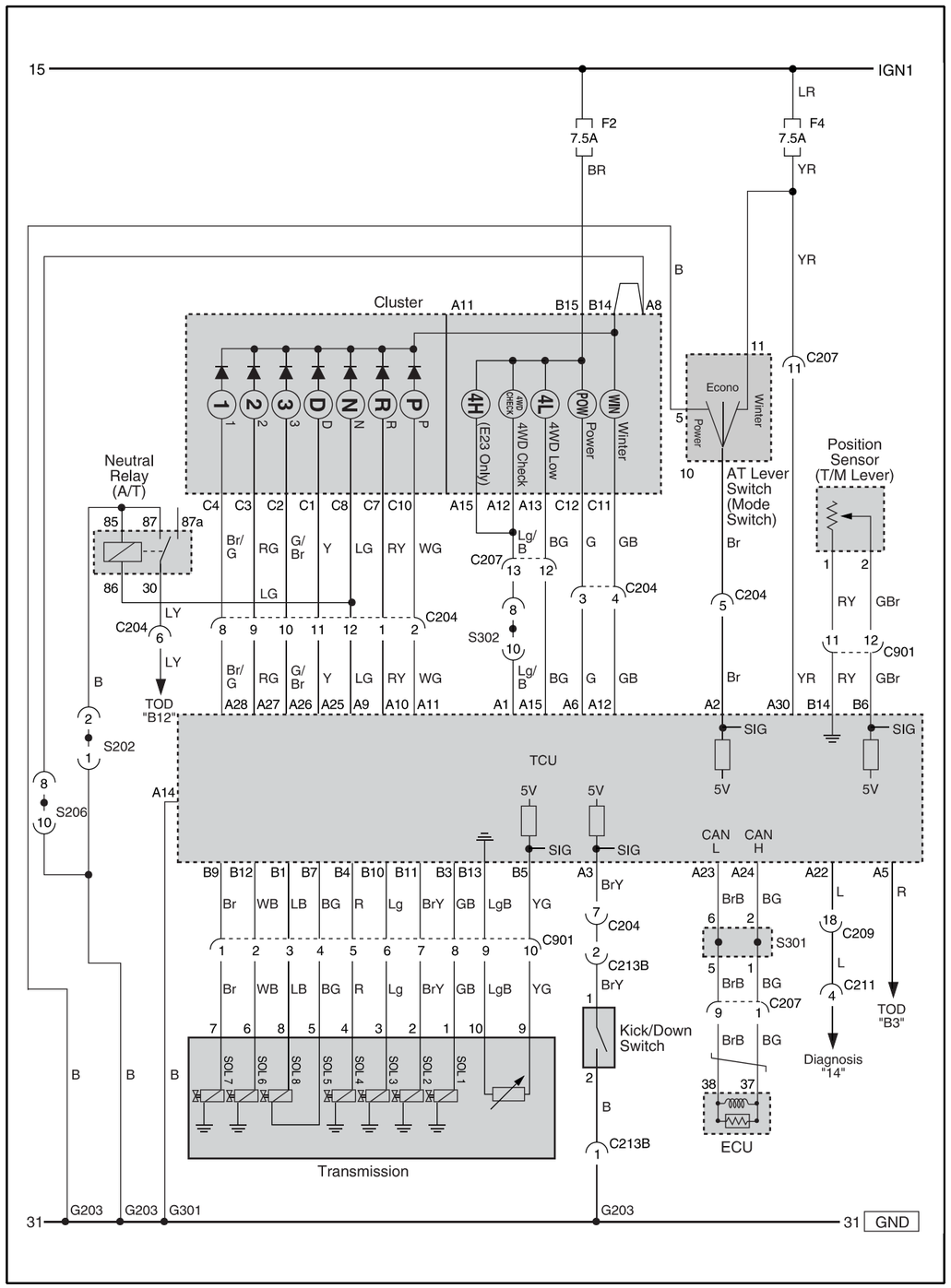
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

3) DSL 2003 MODEL ~



4) GSL 2003 MODEL ~

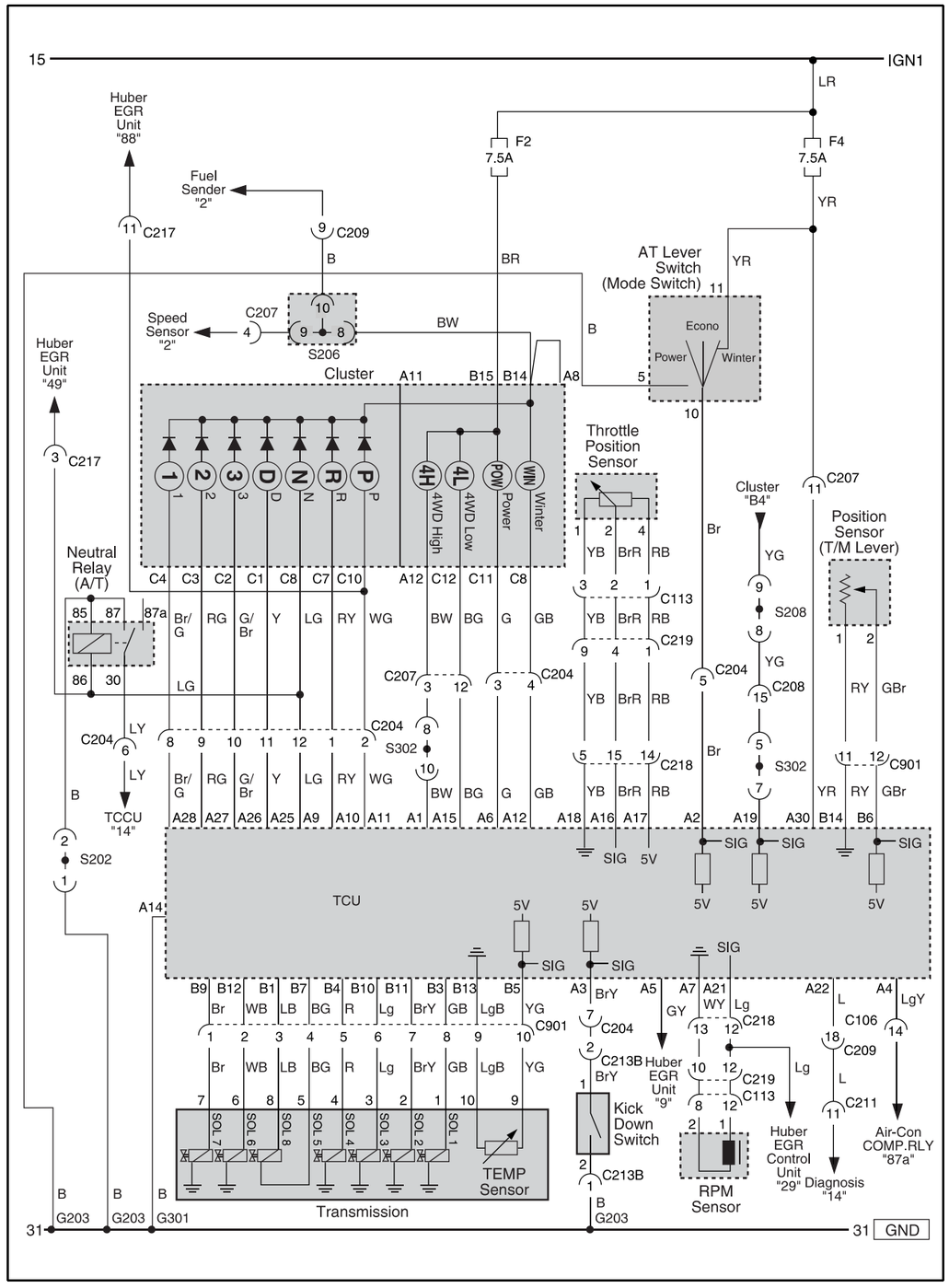


Modification basis	
Application basis	
Affected VIN	

CIRCUIT

REXTON 2004.04

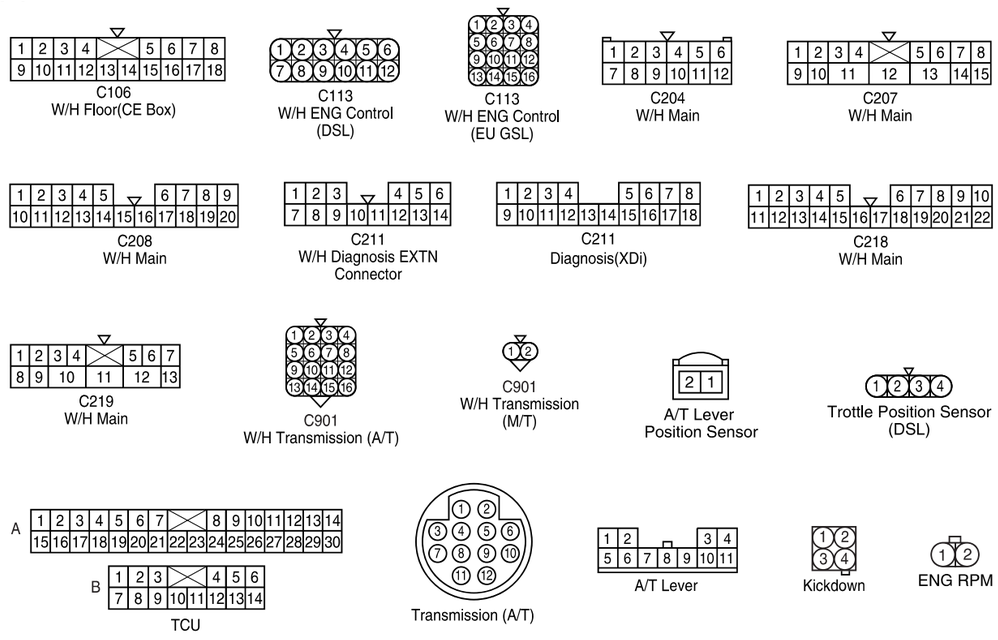
5) 2004 MODEL (DSL)



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C113 (12Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	DSL
C113 (16Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	DSL (EU)
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C211 (14Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C901 (16Pin, White)	Floor - T/M	Left the T/C (Under the Floor)	A/T
C901 (2Pin, White)	Floor - T/M	Left the T/C (Under the Floor)	M/T
S202 (14Pin, Black)	W/H Main	Upper the I/P Realy Box	
S208 (14Pin, Black)	W/H Main	Behind the Right the FATC	
G201	W/H Main	Inside Driver Side Cowl PNL	
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag
G301	W/H Floor	Under Driver Seatz	ECU GND

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

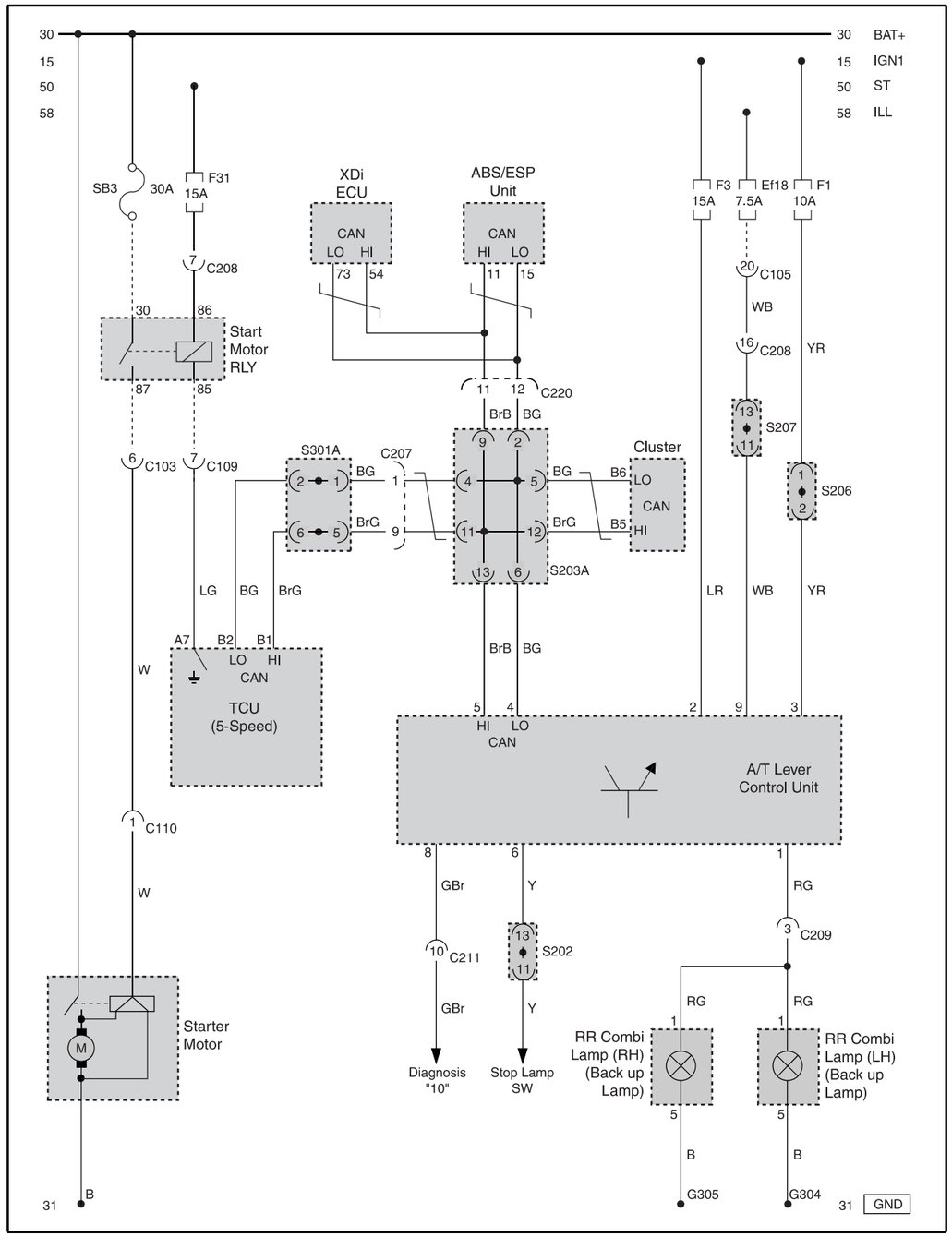


Modification basis	
Application basis	
Affected VIN	

S.G.N. 3110-01

TCU (5-SPEED)

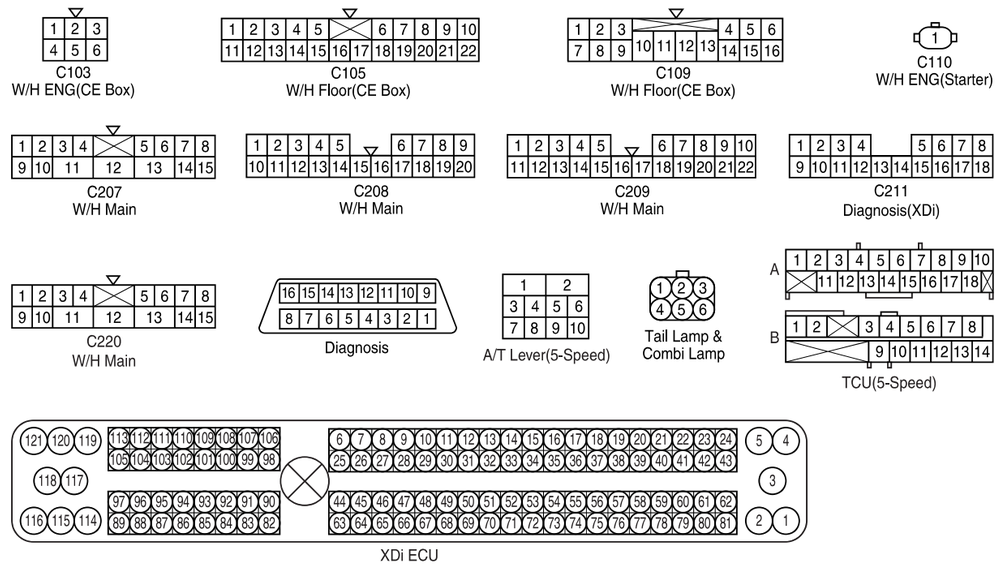
1) START MOTOR, A/T LEVER, CAN LINE



(1) CONNECTOR INFORMATION

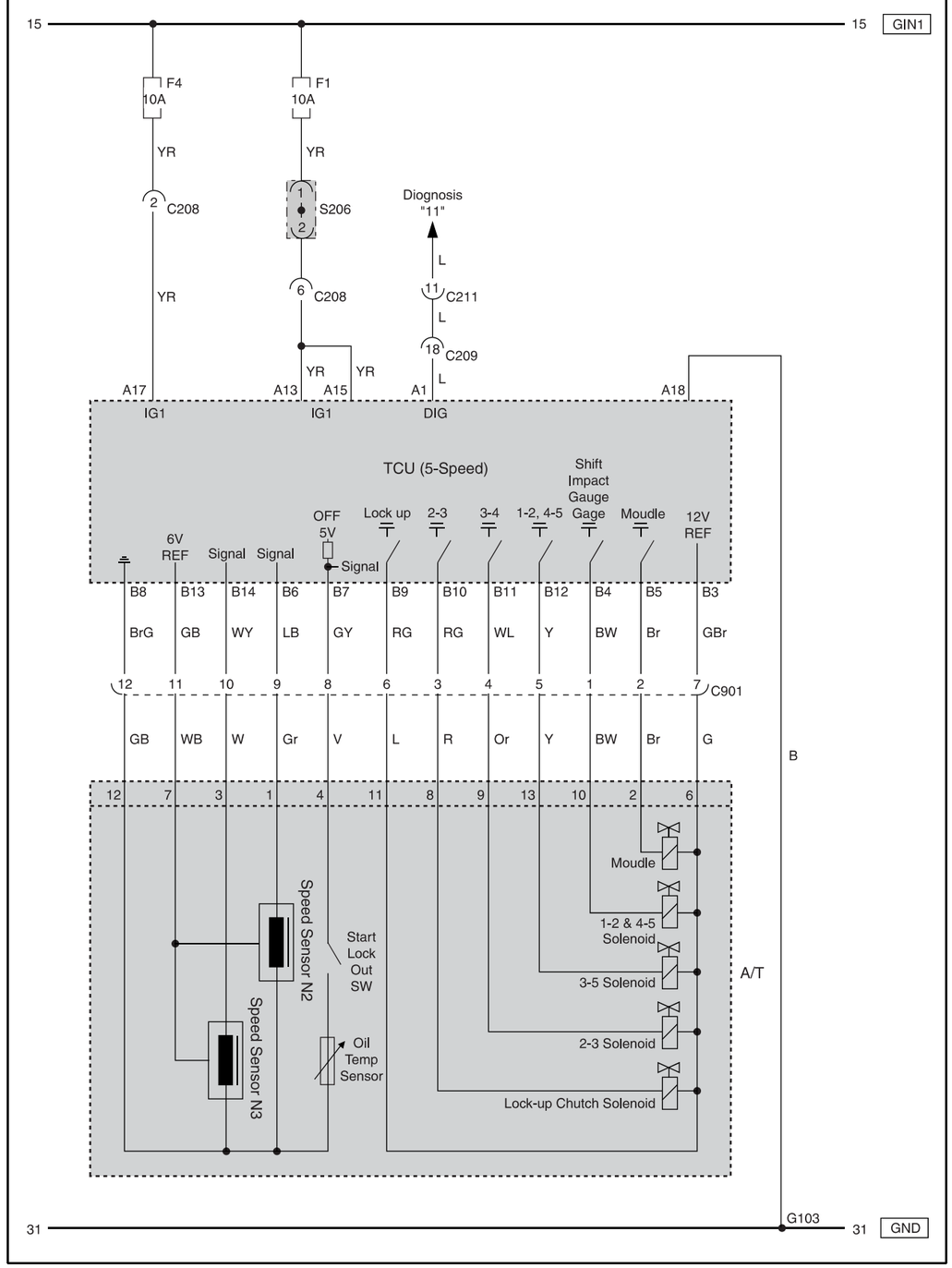
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C103 (6Pin, Colorless)	Engine Room Fuse Box (C) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C110 (1Pin, Gray)	Engine - Starter "ST"	FRT Pre-Heating Unit	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C211 (18Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	XDi
C220 (15Pin, Blue)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	XDi
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	XDi
S203A (14Pin, Black)	W/H Main	Behind the Left FATC	
S206 (14Pin, Black)	W/H Main	Behind the Left FATC	
S207 (14Pin, Black)	W/H Main	Behind the Right FATC	Tail Lamp
S301 (8Pin, Black)	W/H Floor	Under Driver Seat	CAN (GSL)
G304	W/H Floor	Behind the Quarter Grass #1	
G305	W/H Floor	Behind the Quarter Grass #1	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

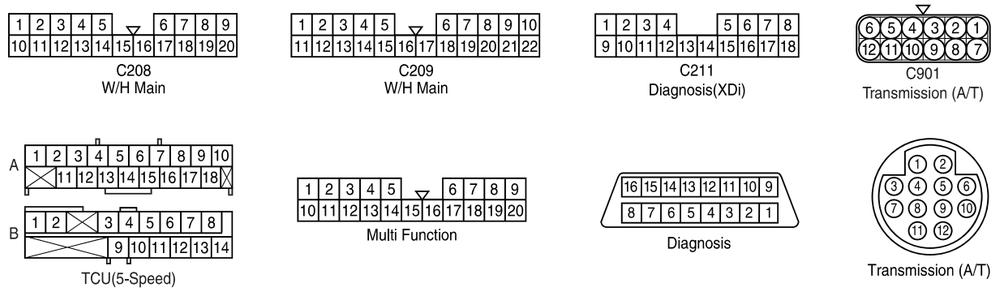
2) SOLENOID OIL TEMP SENSOR, SPEED SENSOR



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C211 (18Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	XDi
C901 (12Pin, White)	Floor - T/M	Left the T/C (Under the Floor)	XDi
S207 (14Pin, Black)	W/H Main	Behind the Right FATC	Tail Lamp
G103	W/H Engine	Behind the Left Head Lamp	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

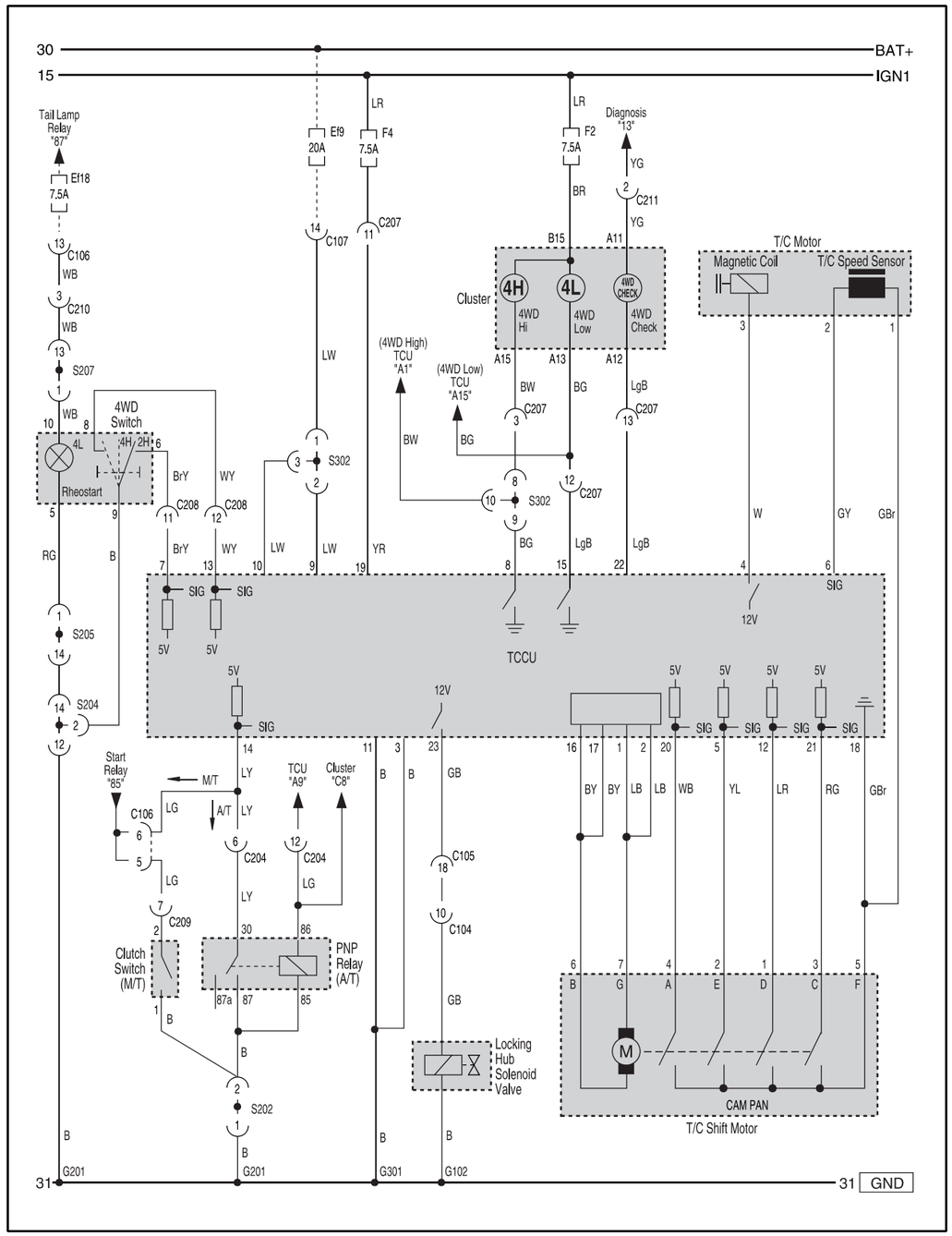


Modification basis	
Application basis	
Affected VIN	

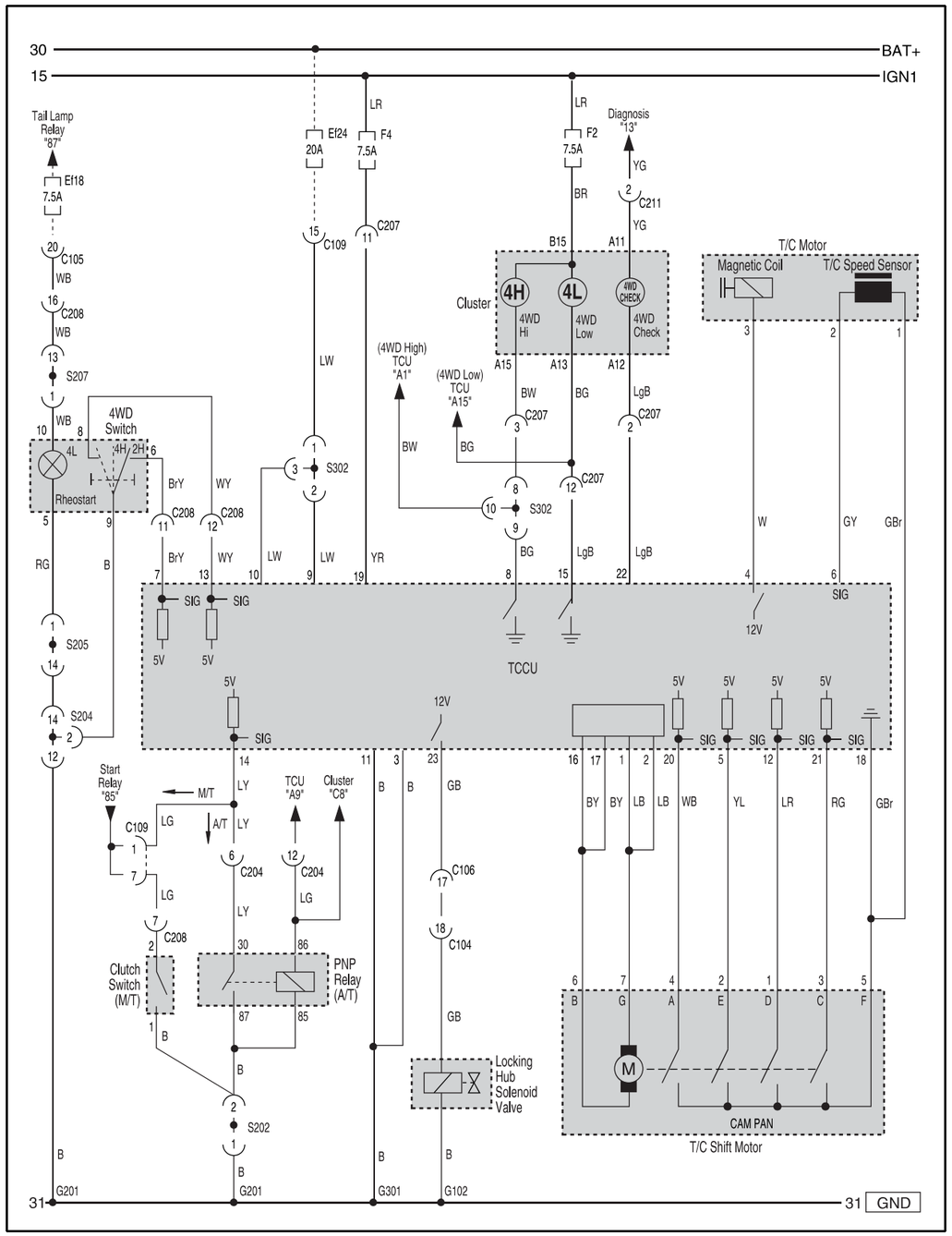
S.G.N. 3410-01

TCCU (TRANSFERCASE CONTROL UNIT)

1) ~ 2002 MODEL

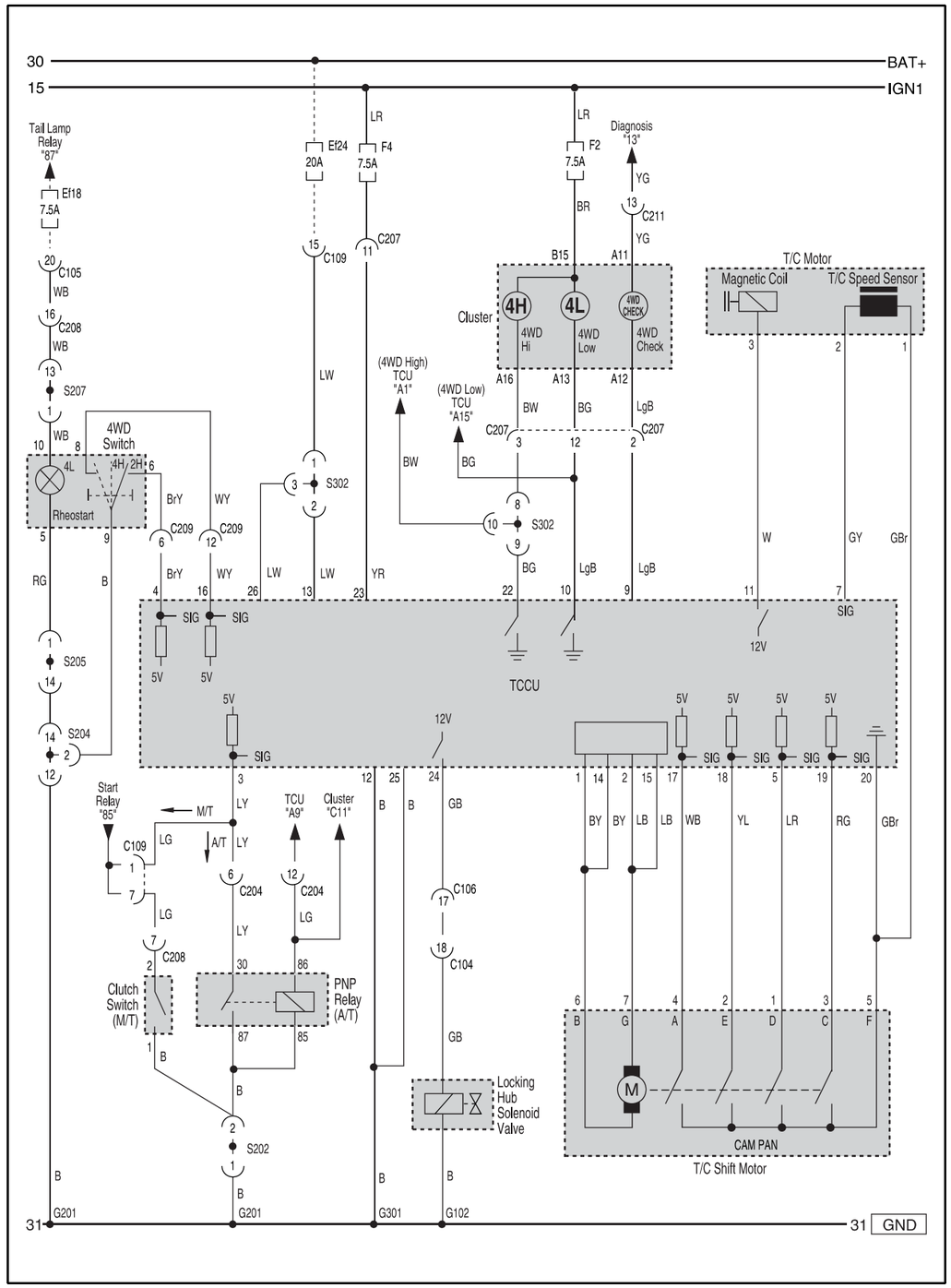


2) 2003 MODEL

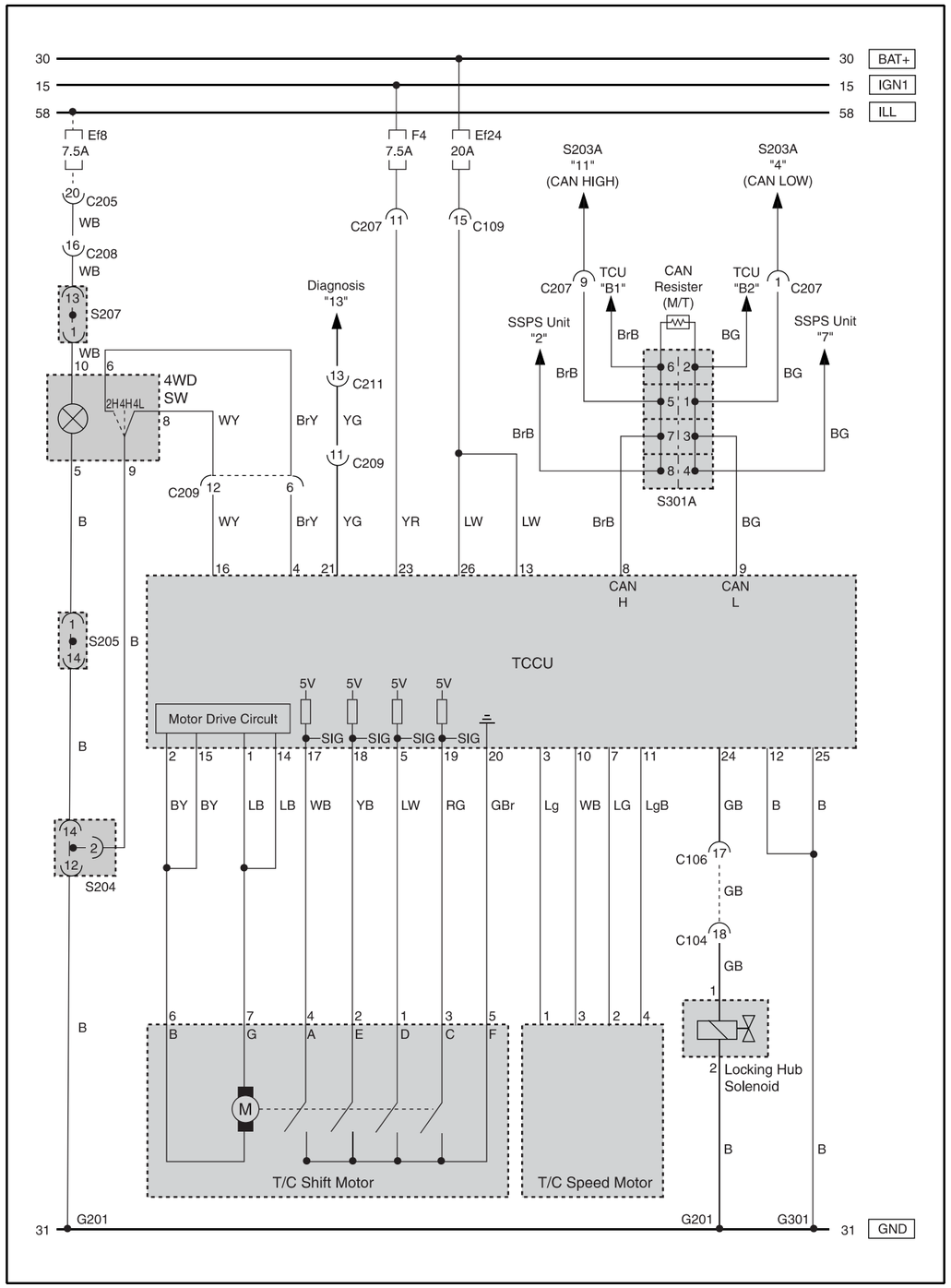


Modification basis	
Application basis	
Affected VIN	

3) 2004 MODEL ~



4) XDi



CIRCUIT

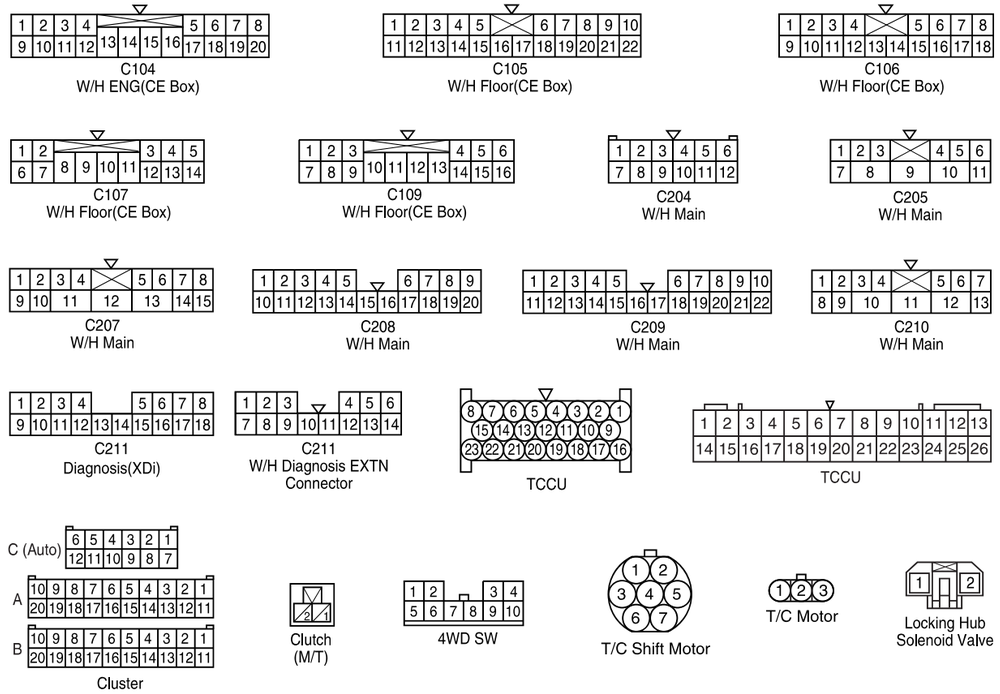
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
C211 (14Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	
C211 (18Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	XDi
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S205 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
G102	W/H Engine	Center BATT	
G201	W/H Main	Inside Driver Side Cowl PNL	
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag
G301	W/H Floor	Under Driver Seat	ECU GND

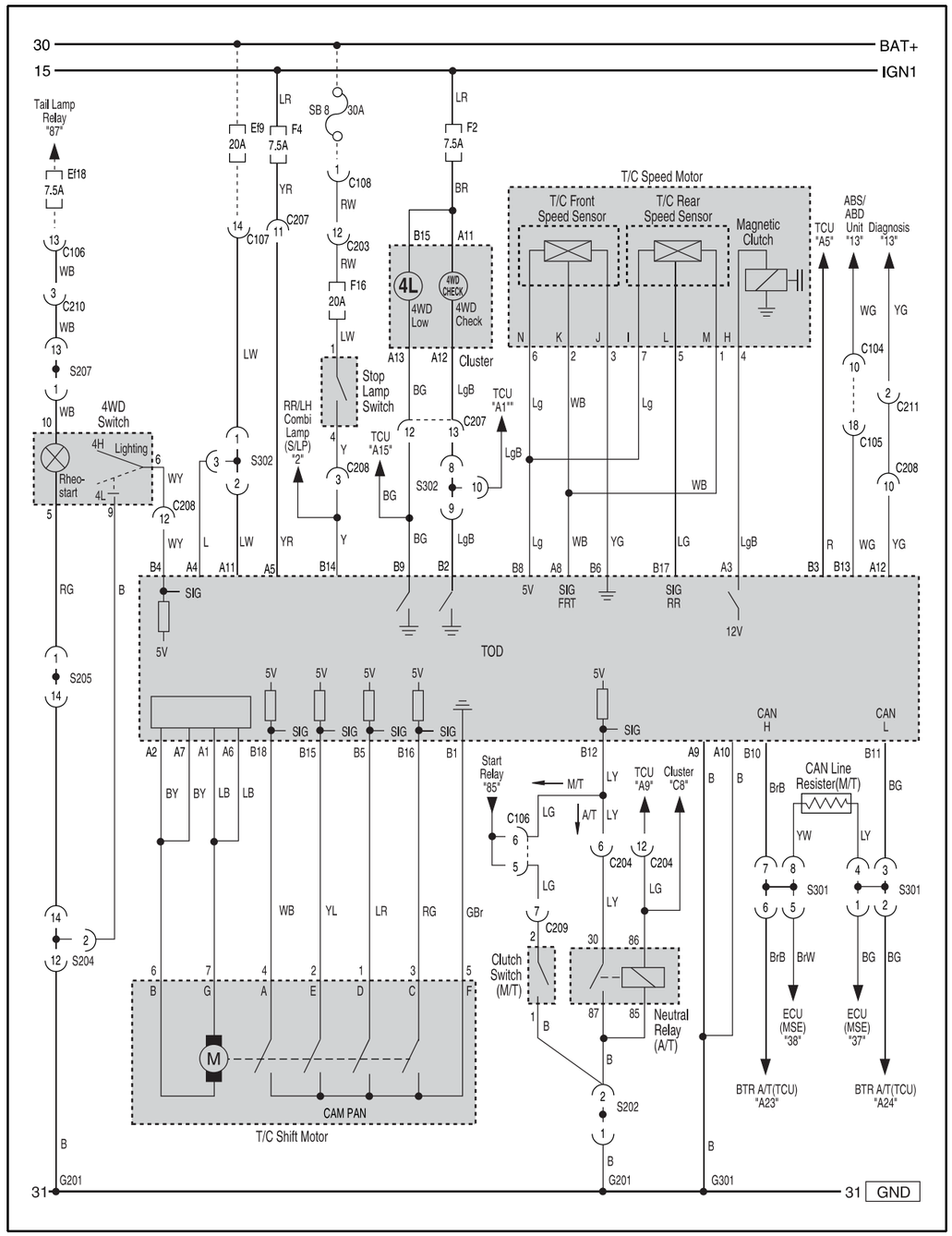
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



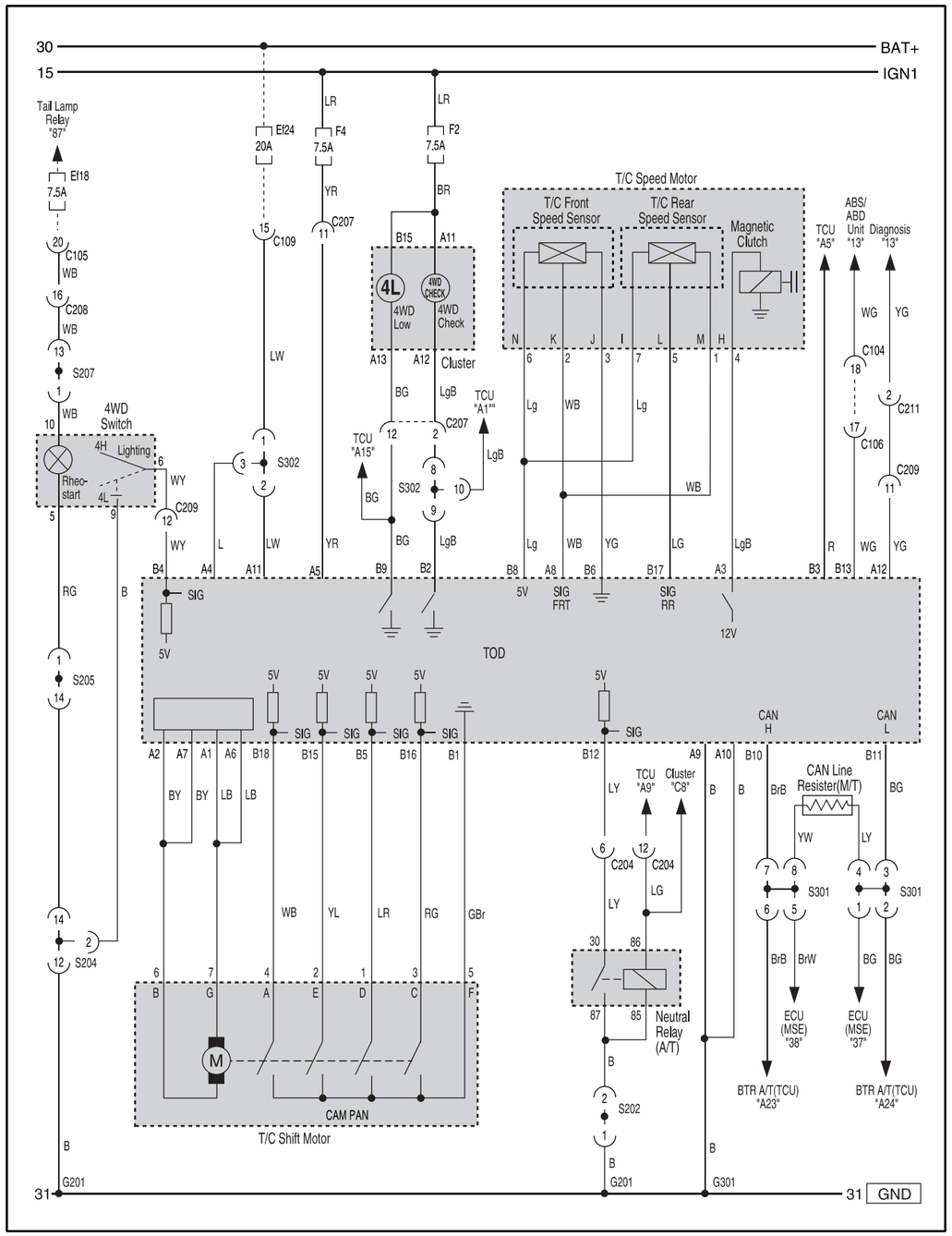
S.G.N. 3232-34

TOD(TORQUE ON DEMAND)

1) ~ 2002 MODEL



2) 2003 MODEL ~

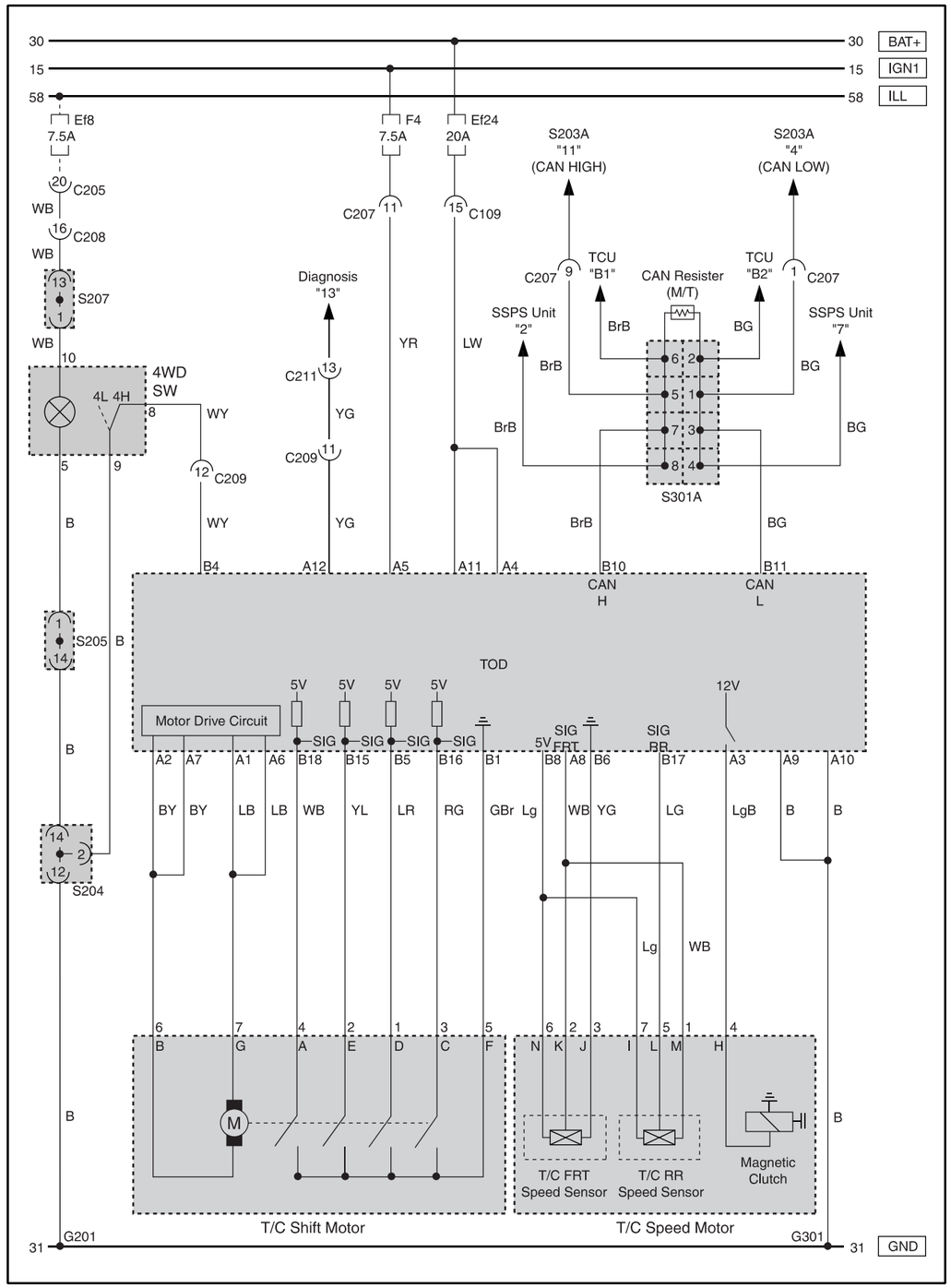


CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

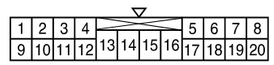
3) XDi

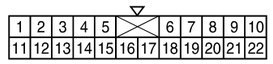


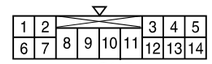
(1) CONNECTOR INFORMATION

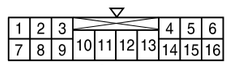
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C211 (14Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	
C211 (18Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	XDi
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S205 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
S301 (8Pin, Black)	W/H Floor	Under Driver Seat	CAN (GSL)
G201	W/H Main	Inside Driver Side Cowl PNL	
G301	W/H Floor	Under Driver Seat	ECU GND

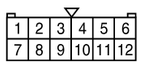
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

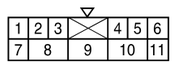

C104
W/H ENG(CE Box)

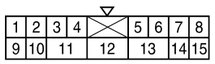

C105
W/H Floor(CE Box)

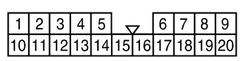

C107
W/H Floor(CE Box)

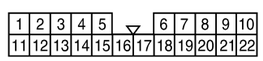

C109
W/H Floor(CE Box)

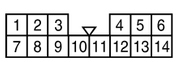

C204
W/H Main

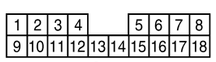

C205
W/H Main

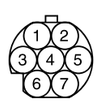

C207
W/H Main

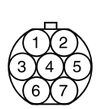

C208
W/H Main

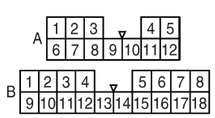

C209
W/H Main

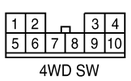

C211
W/H Diagnosis EXTN
Connector


C211
Diagnosis(XDi)


T/C Speed
Sensor


T/C Shift Motor


TOD

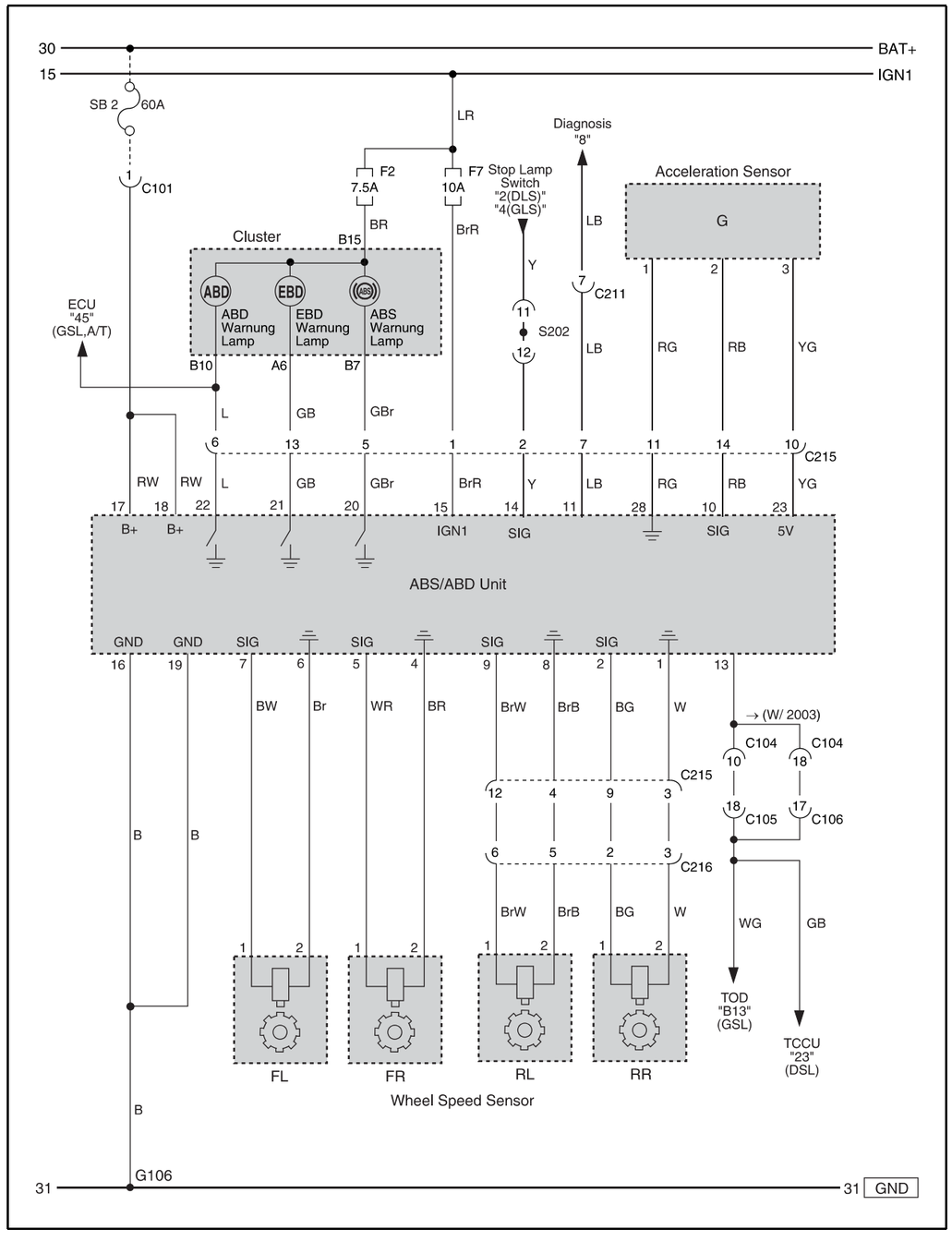

4WD SW

Modification basis	
Application basis	
Affected VIN	

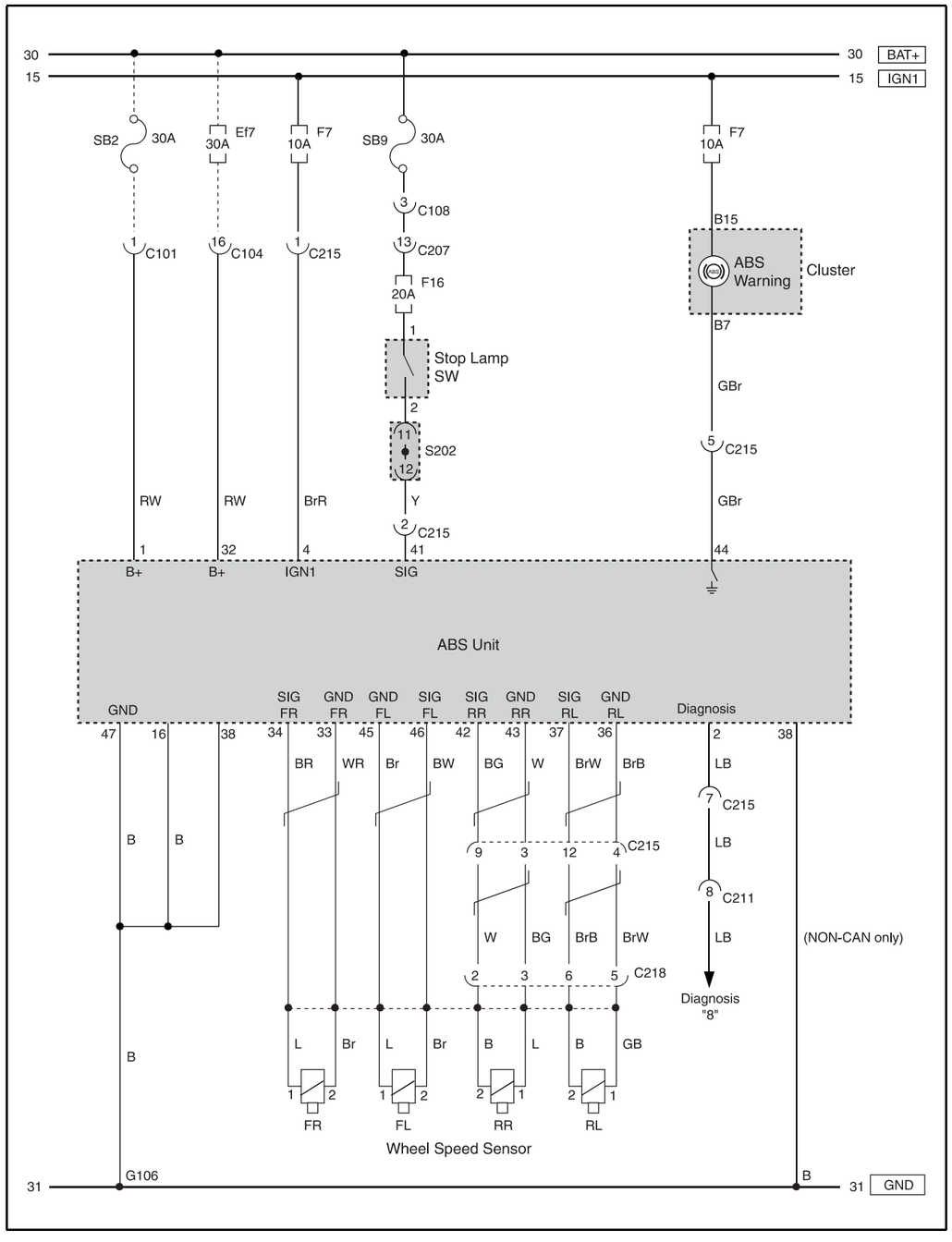
S.G.N. 4892-01

BRAKE SYSTEM

1) ABS & ABS/ABD 5.3 II



2) ABS(TEVES)



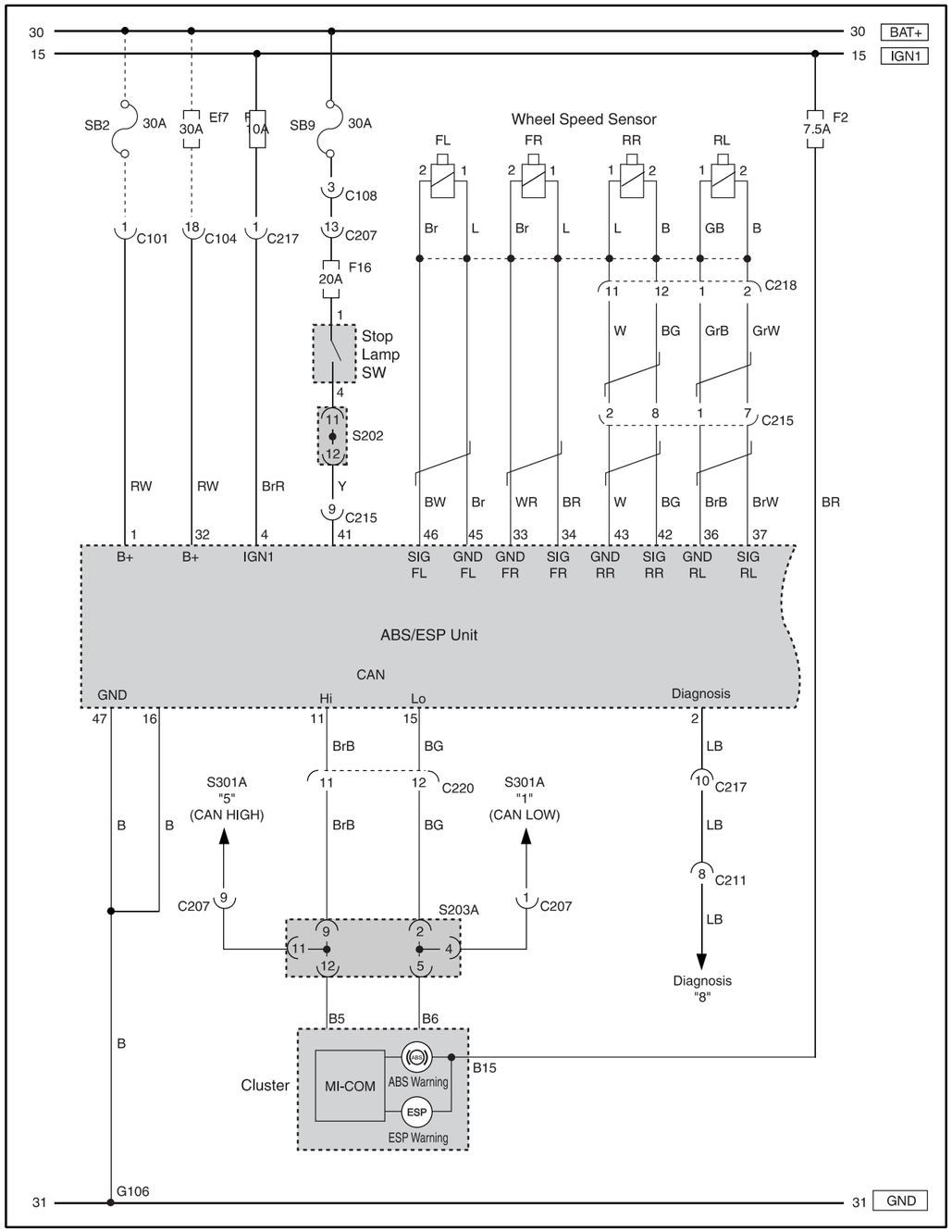
CIRCUIT

REXTON 2004.04

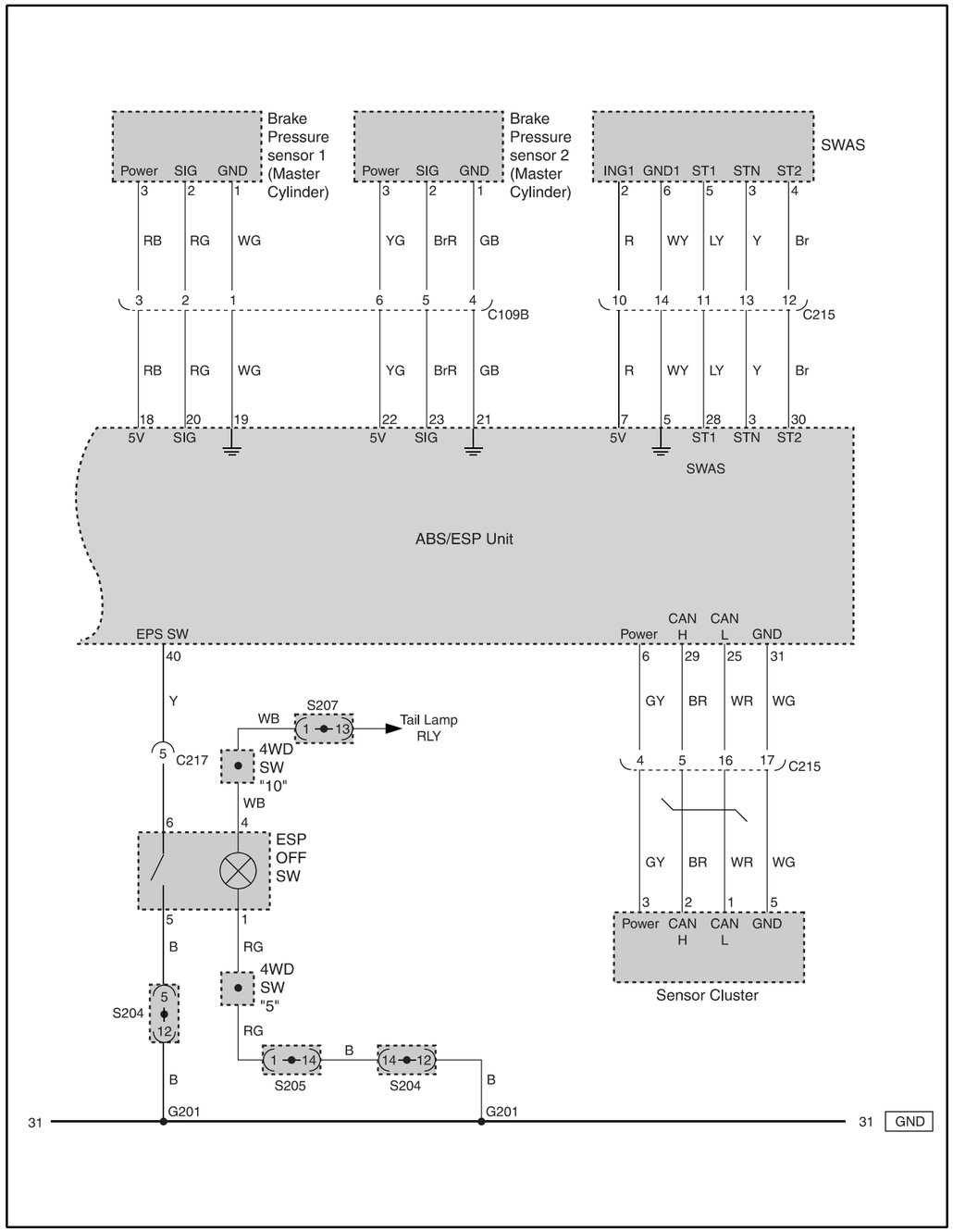
Modification basis	
Application basis	
Affected VIN	

3) ABS/ESP(TEVES)

(1) WHEEL SPEED SENSOR, STOP LAMP SW, DIAGNOSIS, WARNING LAMP



(2) BRAKE PRESSURE SENSOR, SWAS, SENSOR CLUSTER, ESP OFF SW

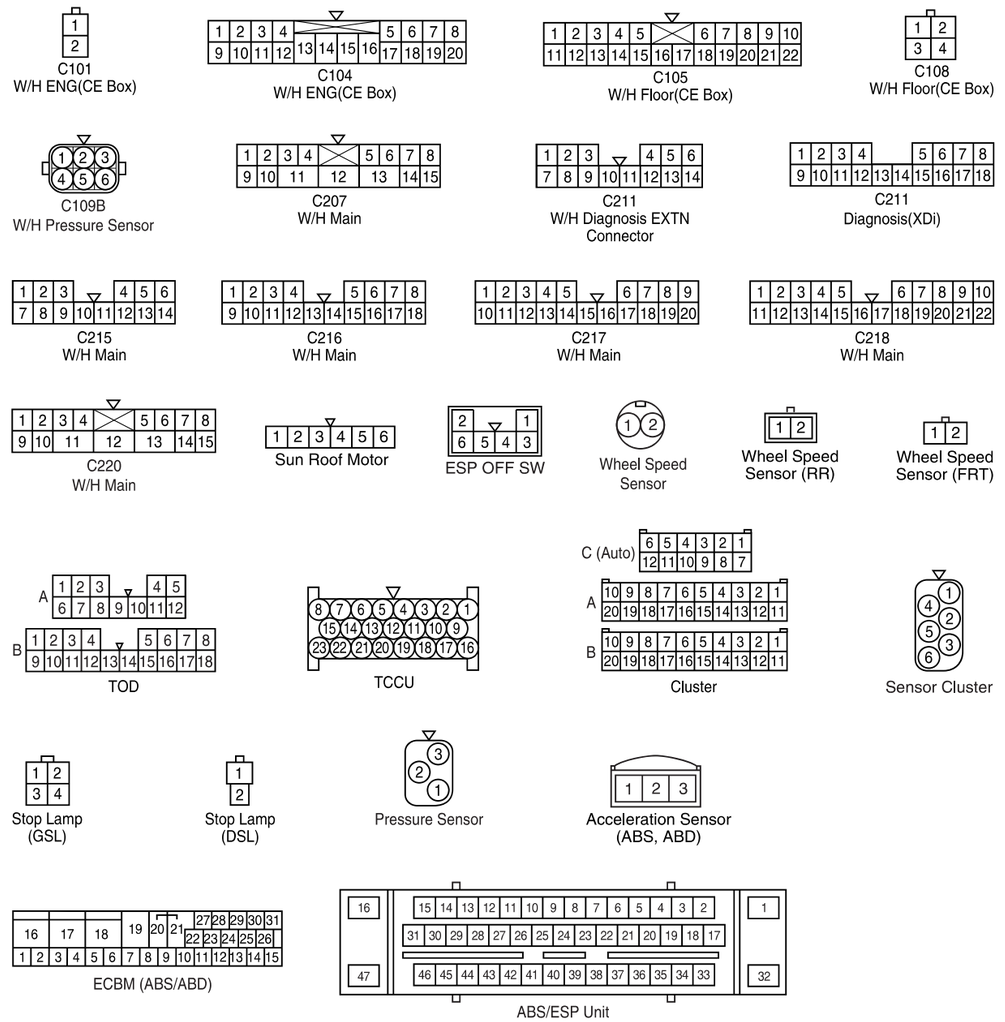


Modification basis	
Application basis	
Affected VIN	

A. CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C101 (2Pin, Colorless)	Engine Room Fuse Box (A) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C109B (6Pin, Black)	Engine - ABS/ESP Pressure Sensor	Engine Room Fuse Box	XDi
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C211 (14Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	
C215 (14Pin, White)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	ABS, ABD
C216 (18Pin, White)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C217 (20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C220 (15Pin, Blue)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	XDi
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left FATC	GND
S205 (14Pin, Black)	W/H Main	Behind the Left FATC	GND
G103	W/H Engine	Behind the Left Head Lamp	
G106	W/H Engine	Beside the Engine Coolant Reserve Tank	ABS, ABD

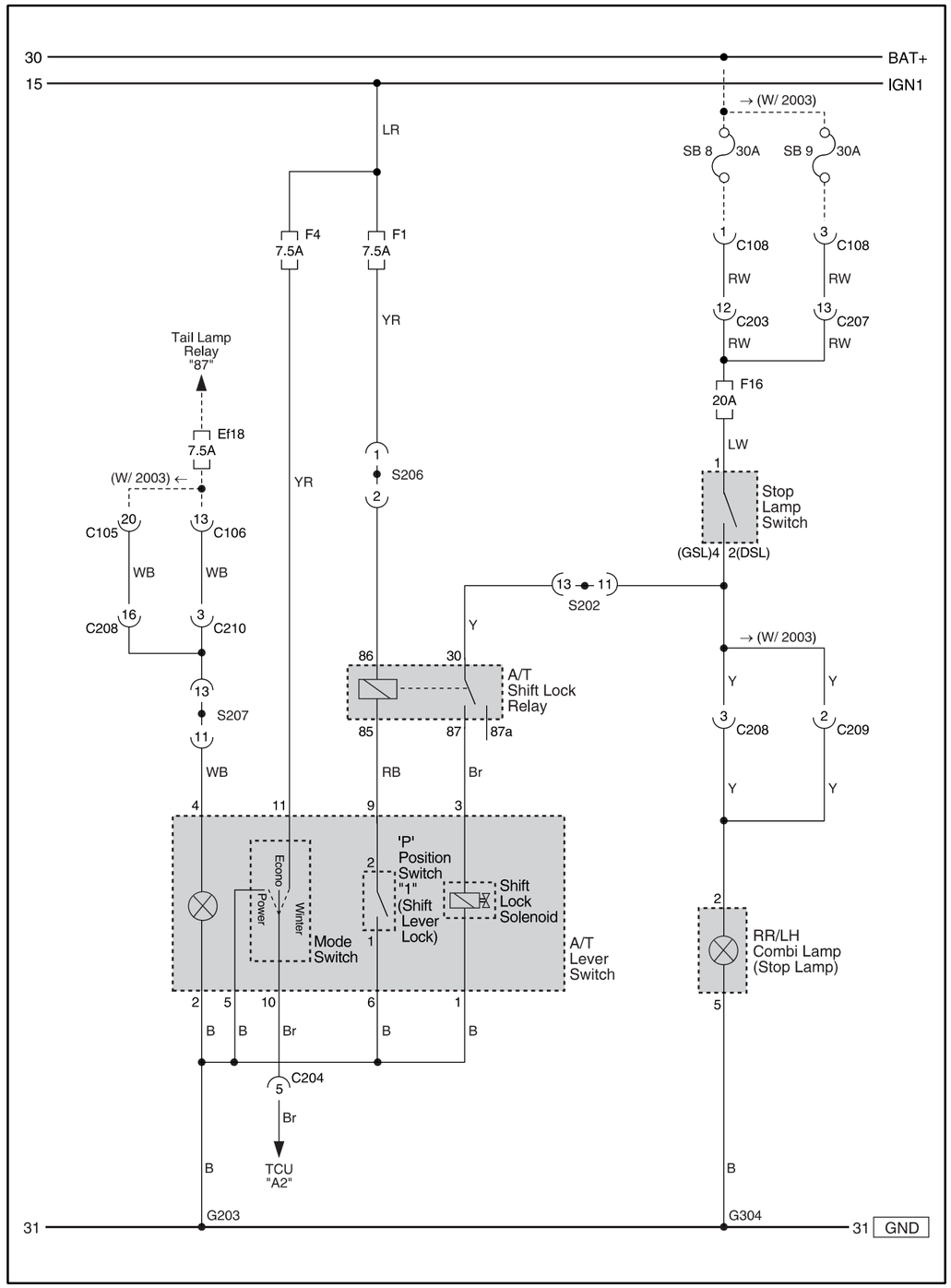
B. CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 3110-01

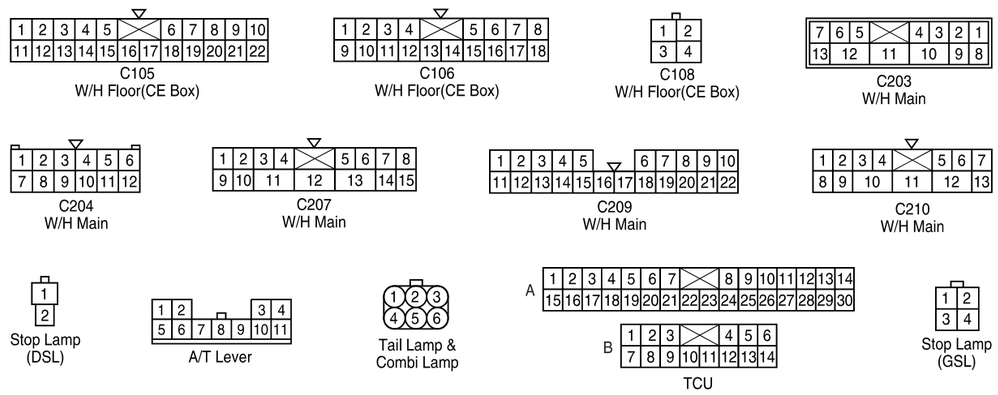
A/T SHIFT LOCK CIRCUIT



(1) CONNECTOR INFORMATION

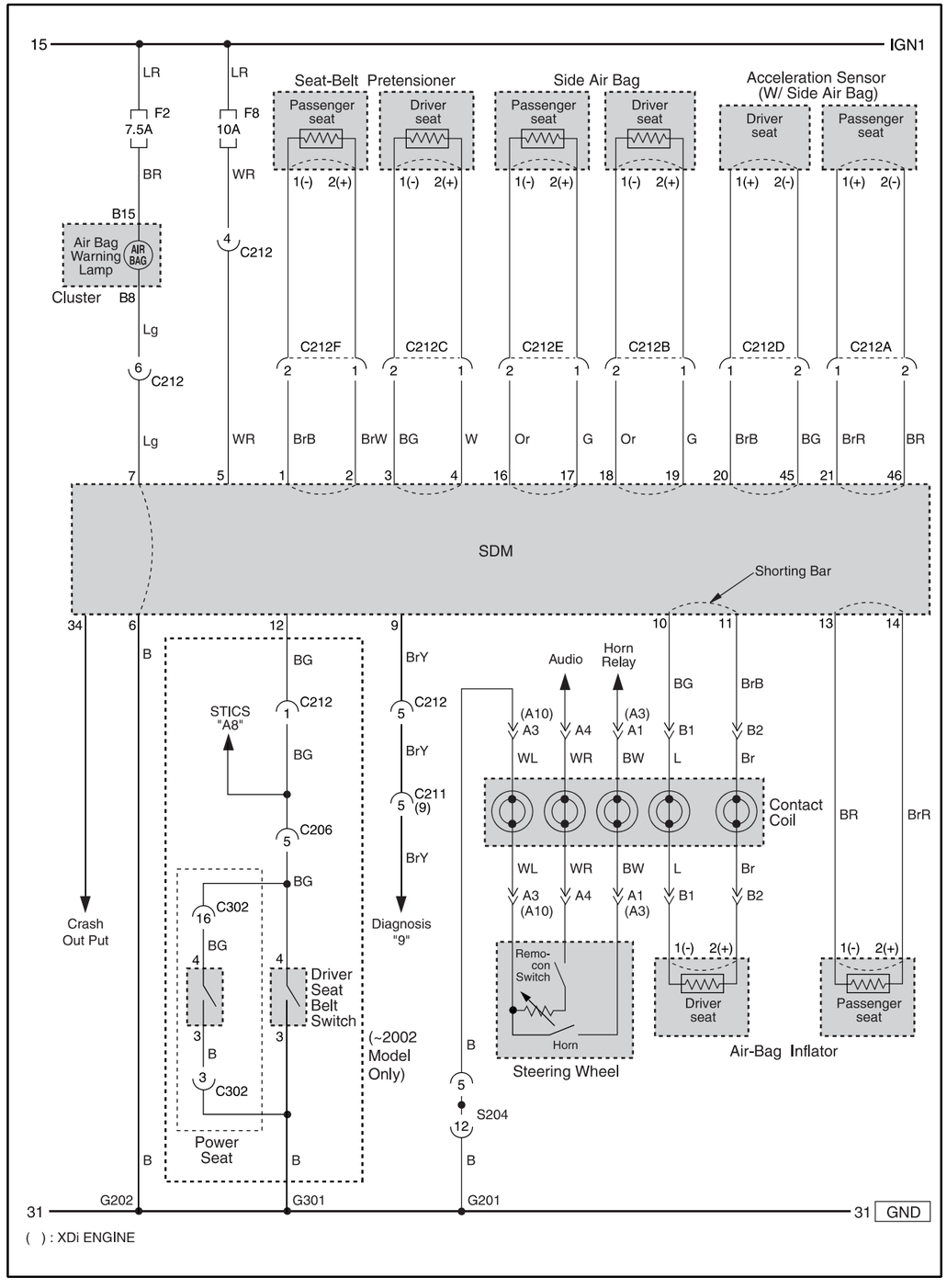
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S206 (14Pin, Black)	W/H Main	Behind the Left the FATC	
G203	W/H Main	Upper the Seat Heating SW	
G304	W/H Floor	Behind the Quarter Grass #1	W/H Air Bag

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



S.G.N. 8810-01

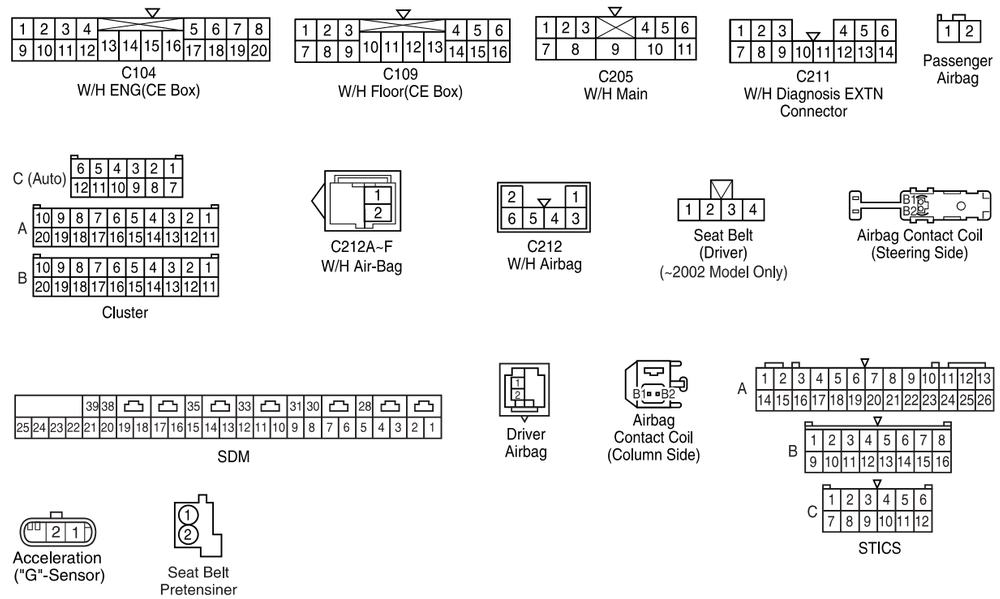
AIR BAG & SIDE AIR-BAG CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C211 (14Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	
C212 (6Pin, White)	Main - Air-Bag	Behind the Cluster (Inside Dash PNL)	
C212A (2Pin, White)	Floor - W/H Air-Bag	Inside Driver Side Cowl PNL	Side Air-Bag
C212B (2Pin, Yellow)	Floor - W/H Air-Bag	Inside Driver Side Cowl PNL	Side Air-Bag
C212C (2Pin, Black)	Floor - W/H Air-Bag	Inside Driver Side Cowl PNL	Freetensioner
C212D (2Pin, White)	Floor - W/H Air-Bag	Inside Co-Driver Side Cowl PNL	Side Air-Bag
C212E (2Pin, Yellow)	Floor - W/H Air-Bag	Inside Co-Driver Side Cowl PNL	Side Air-Bag
C212F (2Pin, Black)	Floor - W/H Air-Bag	Inside Co-Driver Side Cowl PNL	Freetensioner
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
G101	W/H Engine	Center the Engine Room Fuse Box	
G202	W/H Main	Beside the SDM	
G301	W/H Floor	Under Driver Seat	ECU GND

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



CIRCUIT

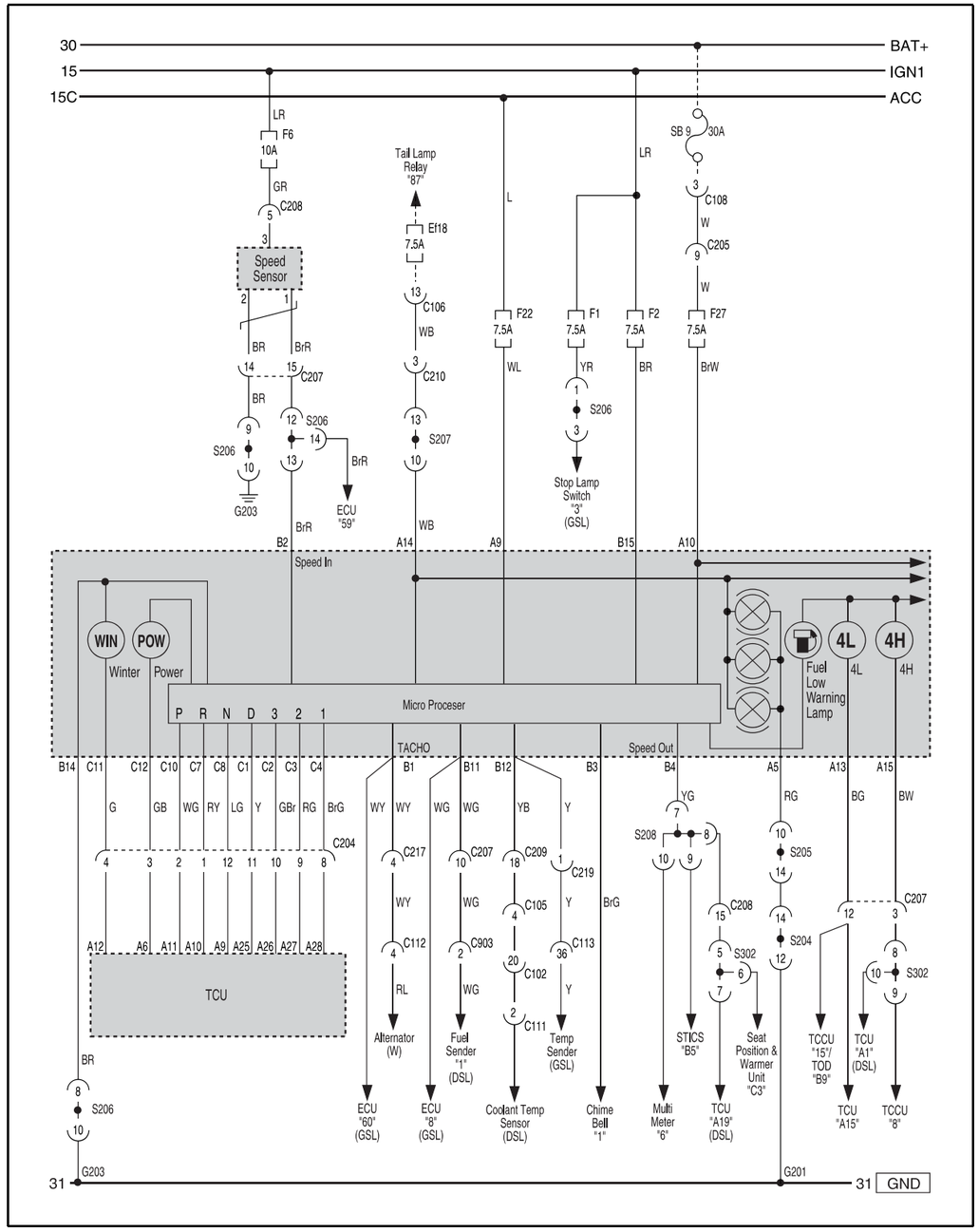
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

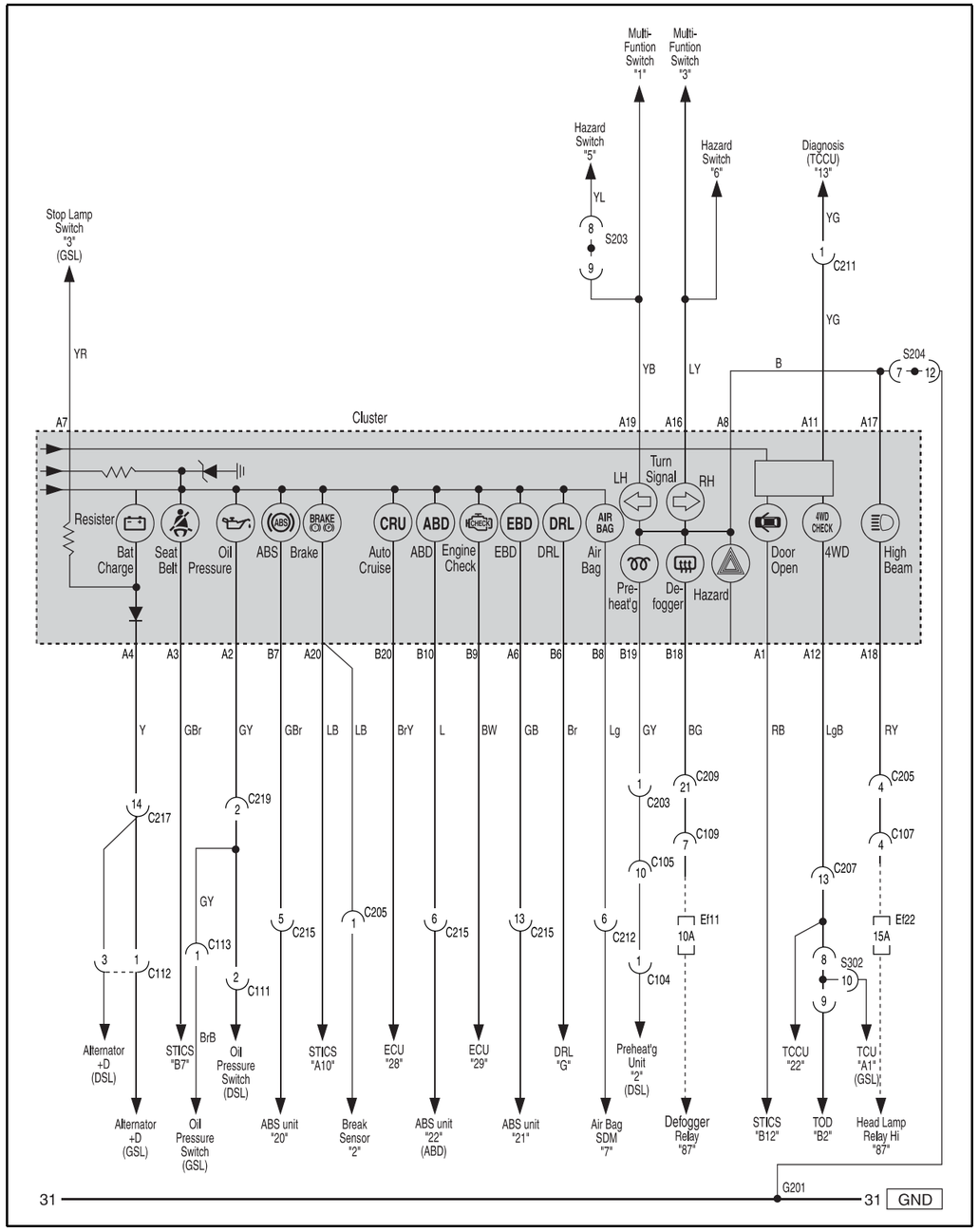
S.G.N. 8010-01

CLUSTER

1) POWER SUPPLY, GROUND, LAMP (FUEL LOW WARNING, 4H, 4L) CIRCUI ~ 2002 MODEL

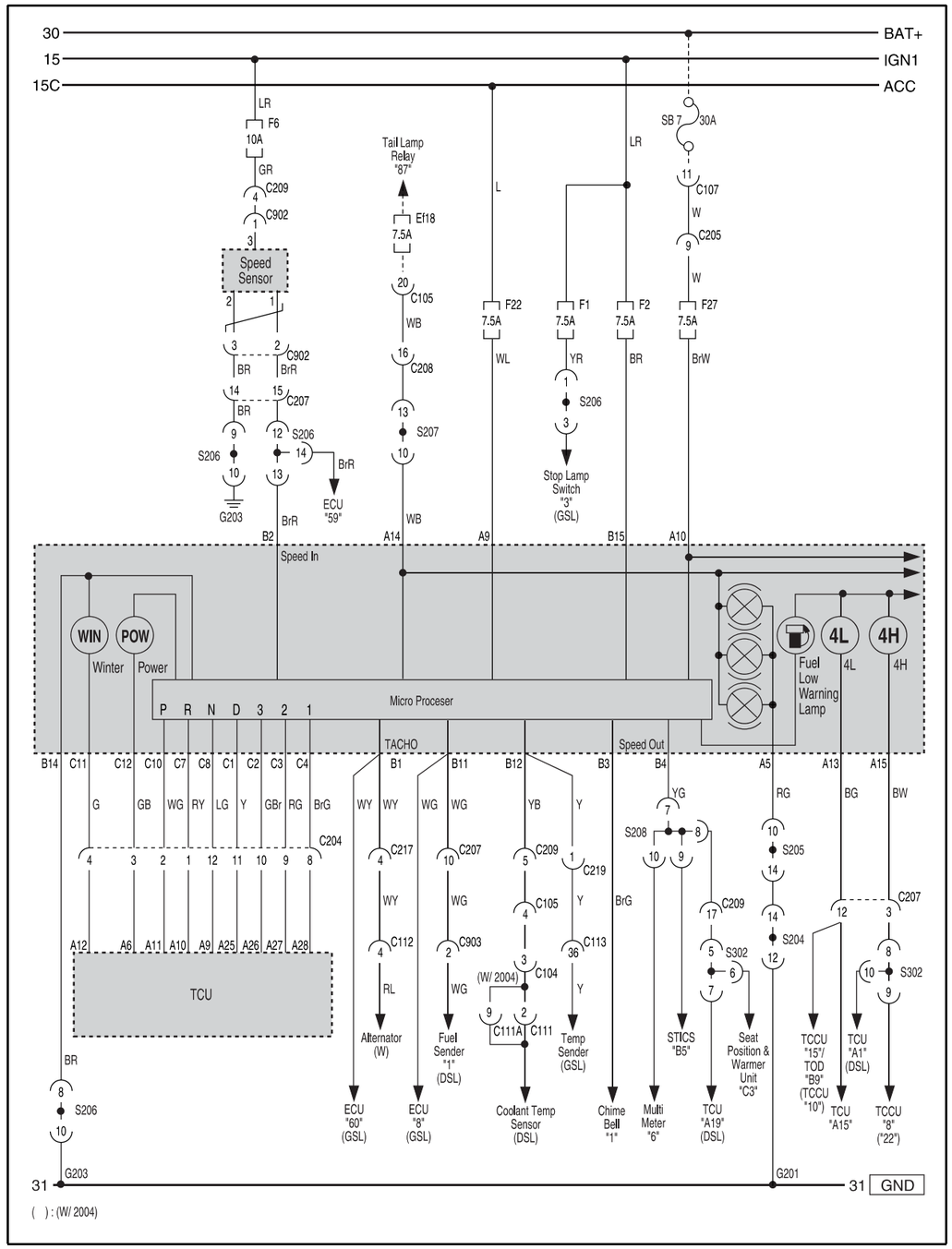


2) WARNING LAMP, DEFOGGER CIRCUIT ~ 2002 MODEL

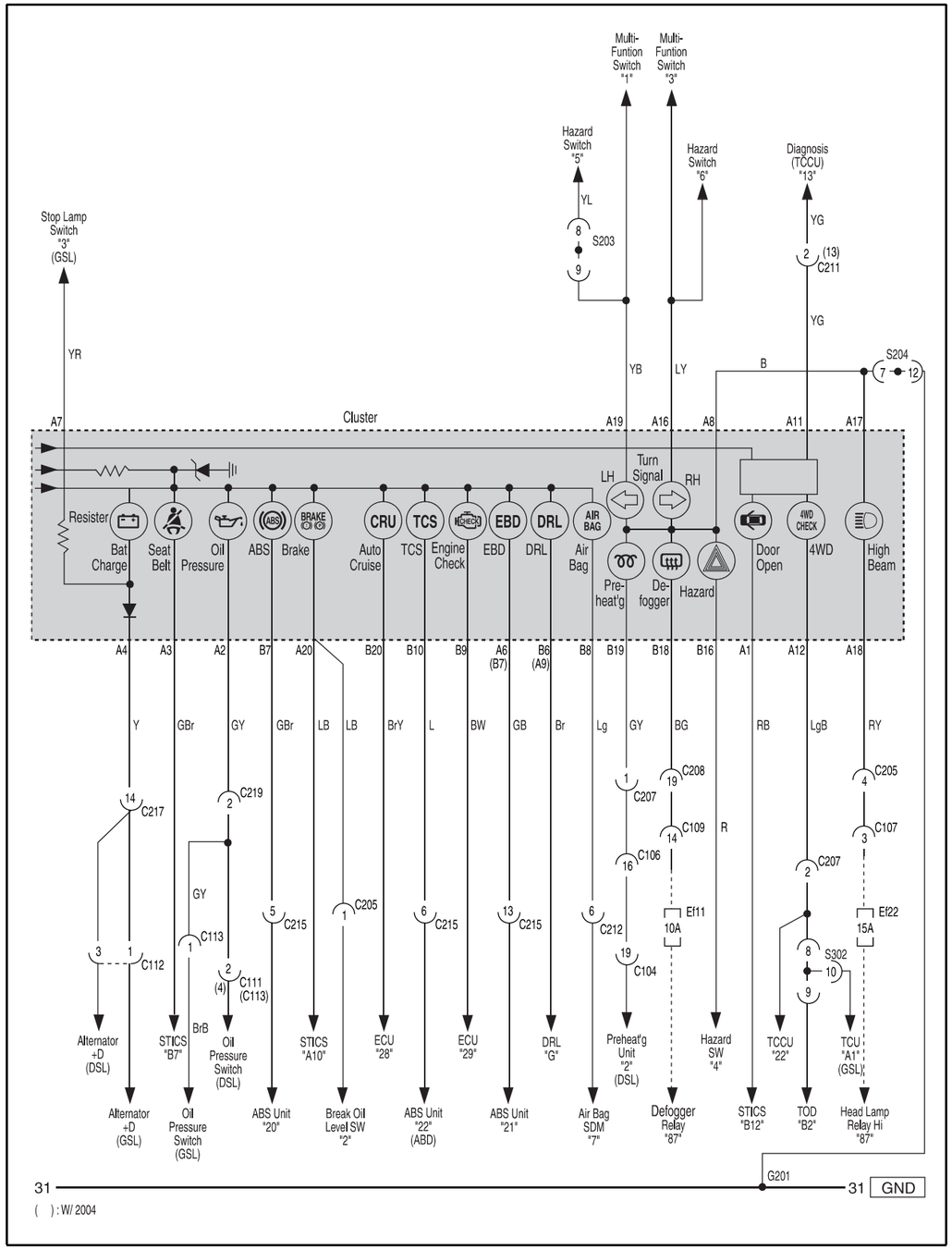


Modification basis	
Application basis	
Affected VIN	

3) POWER SUPPLY, GROUND, LAMP (FUEL LOW WARNING, 4H, 4L) CIRCUIT 2003 MODEL ~



4) WARNING LAMP, DEFOGGER CIRCUIT 2003 MODEL ~



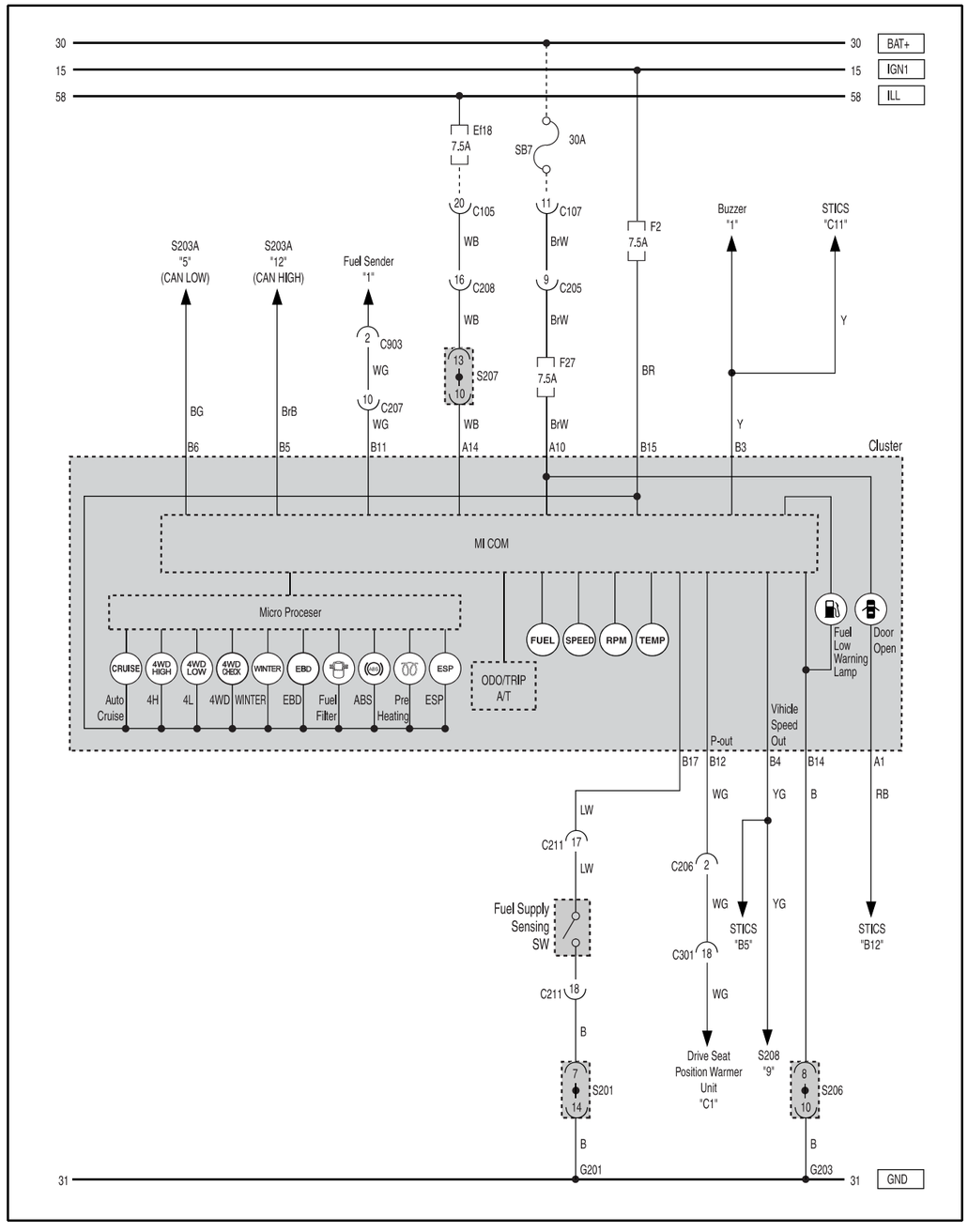
CIRCUIT

REXTON 2004.04

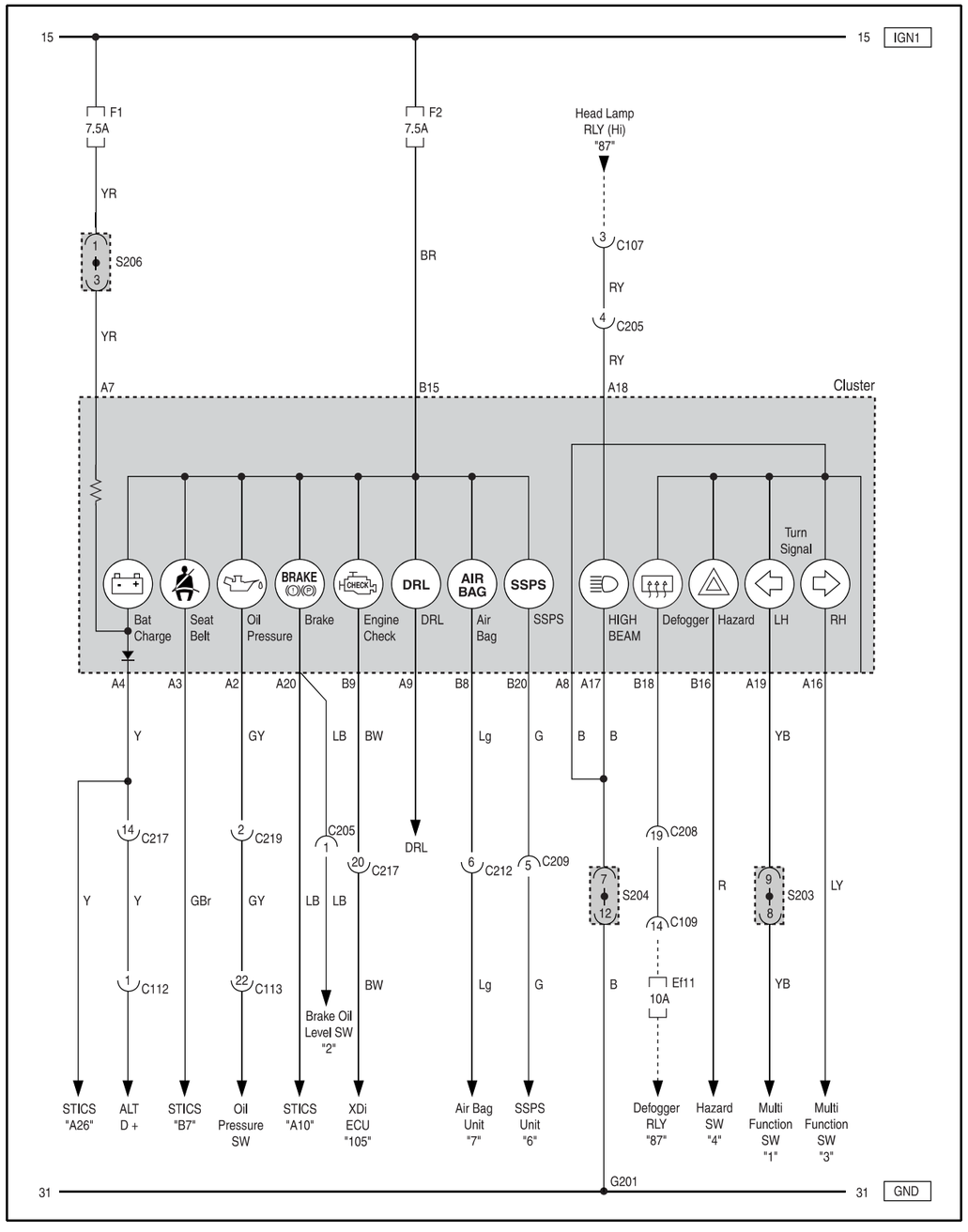
Modification basis	
Application basis	
Affected VIN	

3) XDi

(1) GAUGE(SPEED, RPM, FUEL, TEMP), WARNING(FUEL, DR OPEN, FUEL FILTER, ABS/ESP)



(2) WARNING(BAT CHANGE OIL, BRAKE, EGR CHECK, AIR BAG, SSPS, SEAT BELT), TURNSIGNAL DEFOGGER

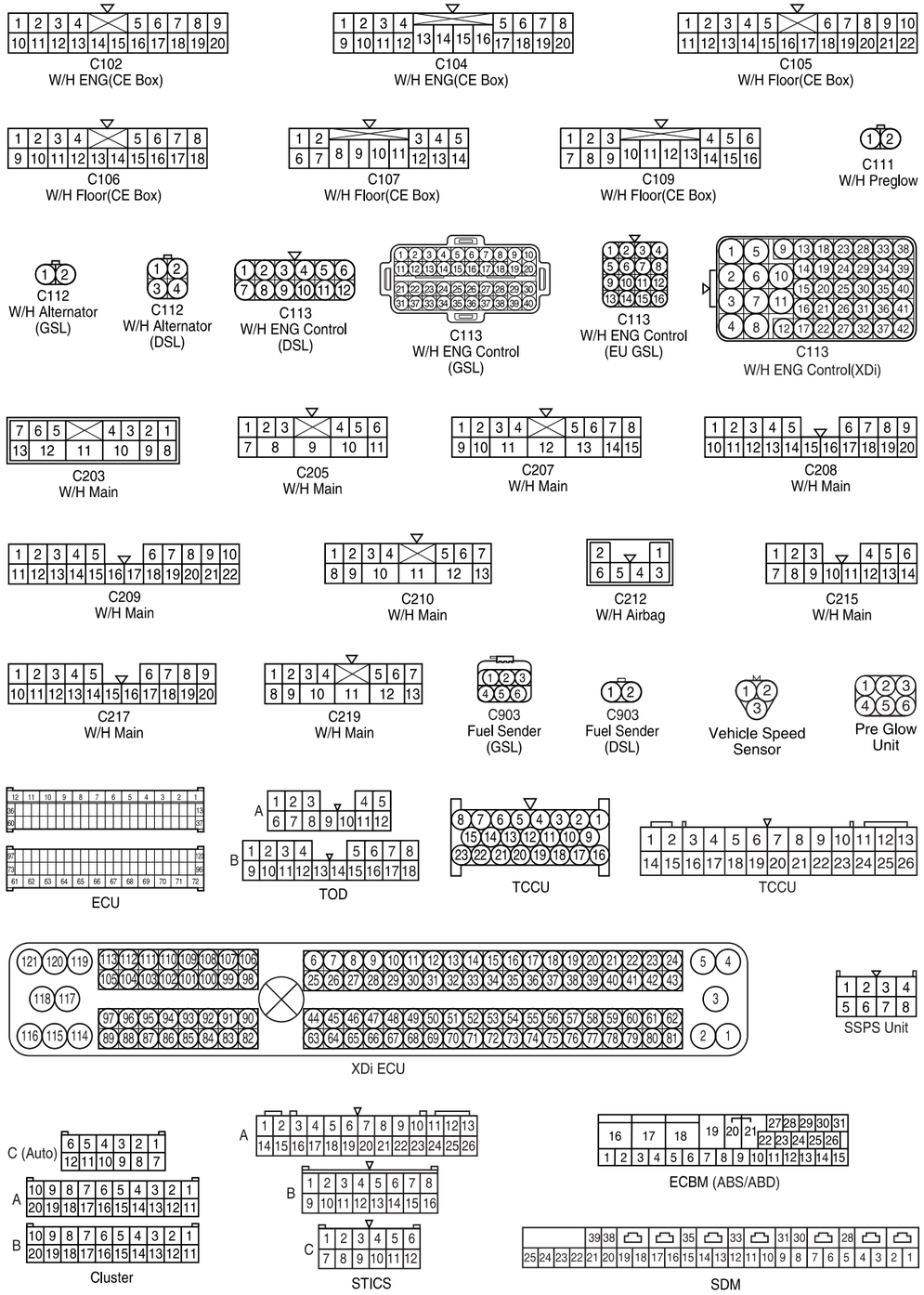


Modification basis	
Application basis	
Affected VIN	

A. CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C111 (2Pin, Black)	Engine - Pre-Heating	RR Pre-Heating Unit	DSL
C112 (4Pin, Black)	Engine - Alternator	Under the Coolant Reserve Tank	DSL
C112 (2Pin, Black)	Engine - Alternator	Under the Coolant Reserve Tank	GSL
C113 (12Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	DSL
C113 (40Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	GSL
C113 (42Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	XDi
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C211 (18Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	XDi
C212 (6Pin, White)	Main - Air-Bag	Behind the Cluster (Inside Dash PNL)	
C215 (14Pin, White)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	ABS, ABD
C217 (20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C903 (6Pin, White)	Floor - Fuel Sender	Left the T/C (Under the Floor)	GSL
C903 (2Pin, White)	Floor - Fuel Sender	Left the T/C (Under the Floor)	DSL
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S205 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S206 (14Pin, Black)	W/H Main	Behind the Left the FATC	
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
S208 (14Pin, Black)	W/H Main	Behind the Right the FATC	
S302 (14Pin, Black)	W/H Floor	Under Driver Seat	
G201	W/H Main	Inside Driver Side Cowl PNL	
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag

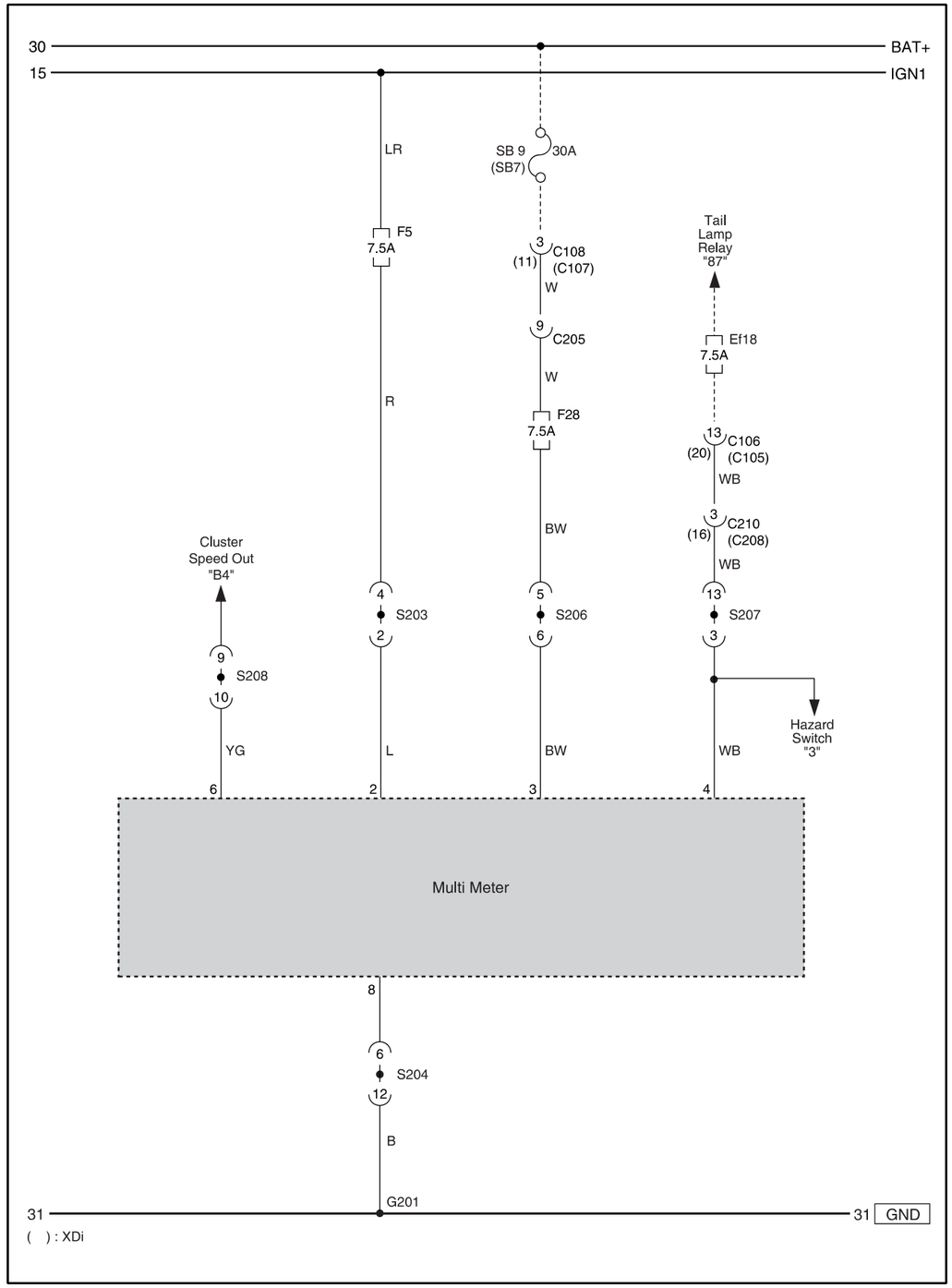
B. CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8010-01

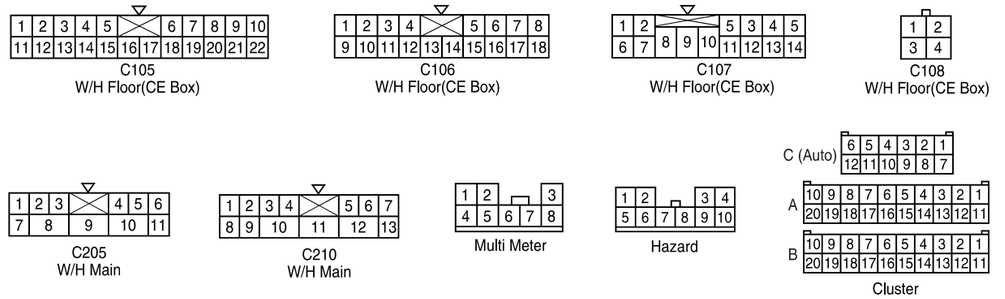
MULTI METER CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S206 (14Pin, Black)	W/H Main	Behind the Left the FATC	
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
S208 (14Pin, Black)	W/H Main	Behind the Right the FATC	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

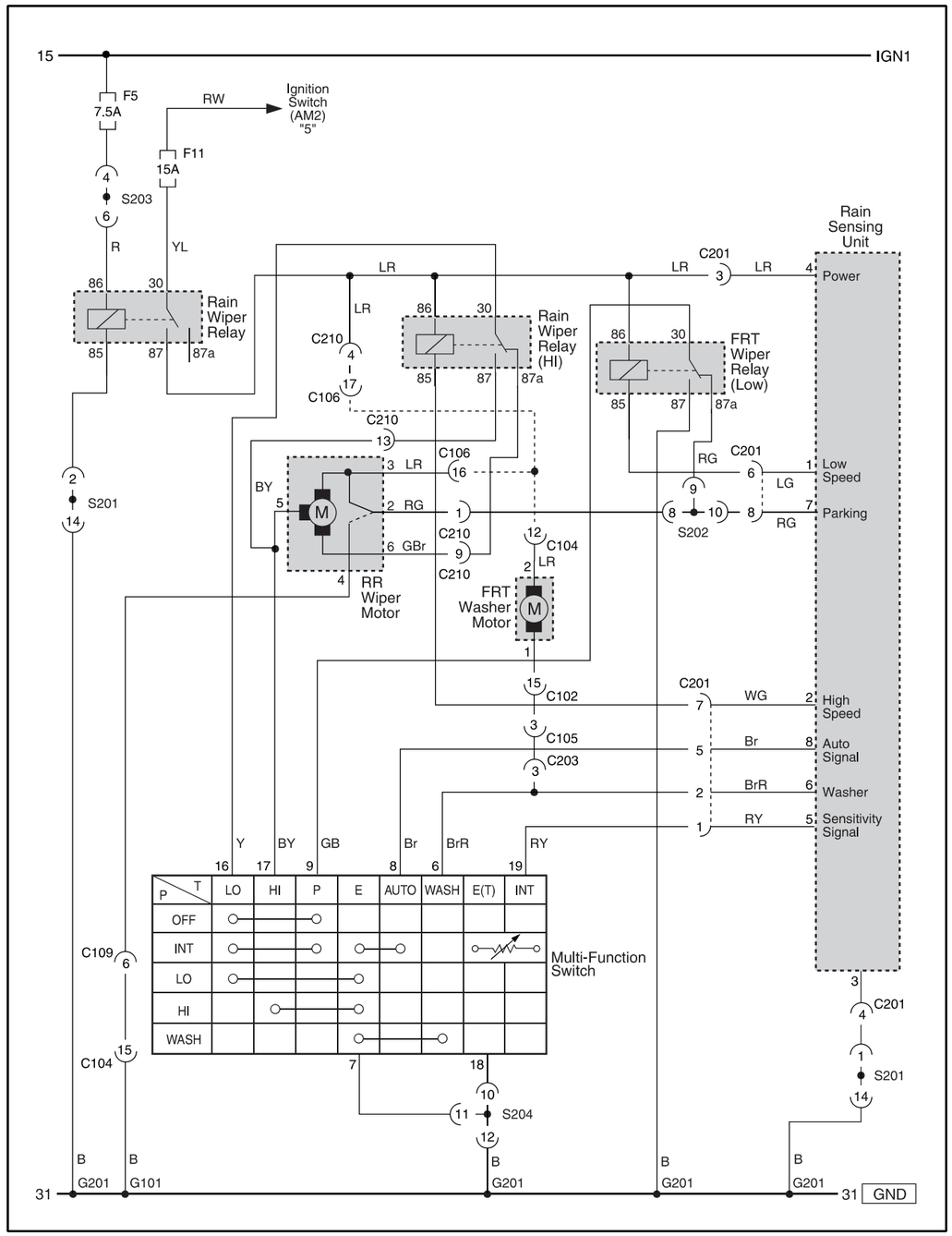


Modification basis	
Application basis	
Affected VIN	

S.G.N. 8611-09

RAIN SENSING WIPER CIRCUIT

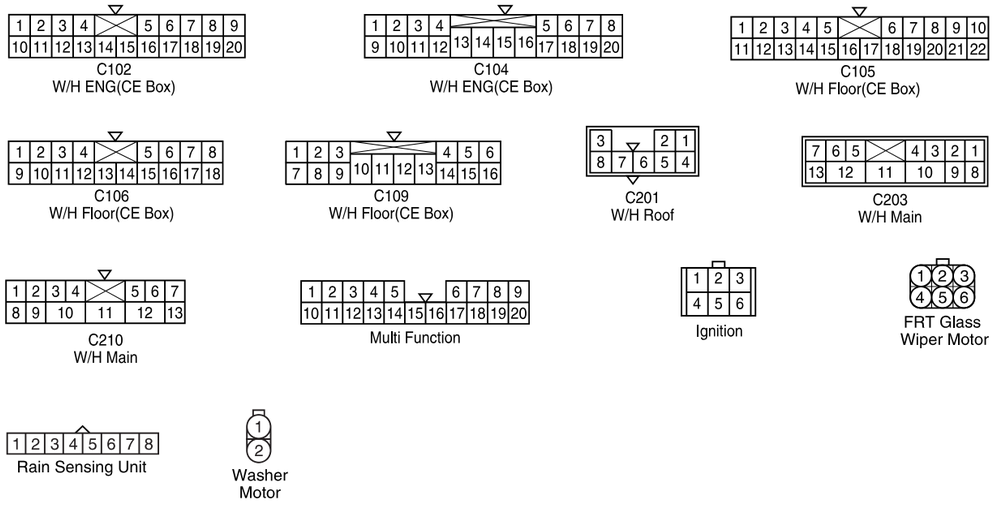
1) ~ 2002 MODEL



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C201 (8Pin, White)	Main - Roof	Under the I/P Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
G101	W/H Engine	Center the Engine Room Fuse Box	
G201	W/H Main	Inside Driver Side Cowl PNL	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

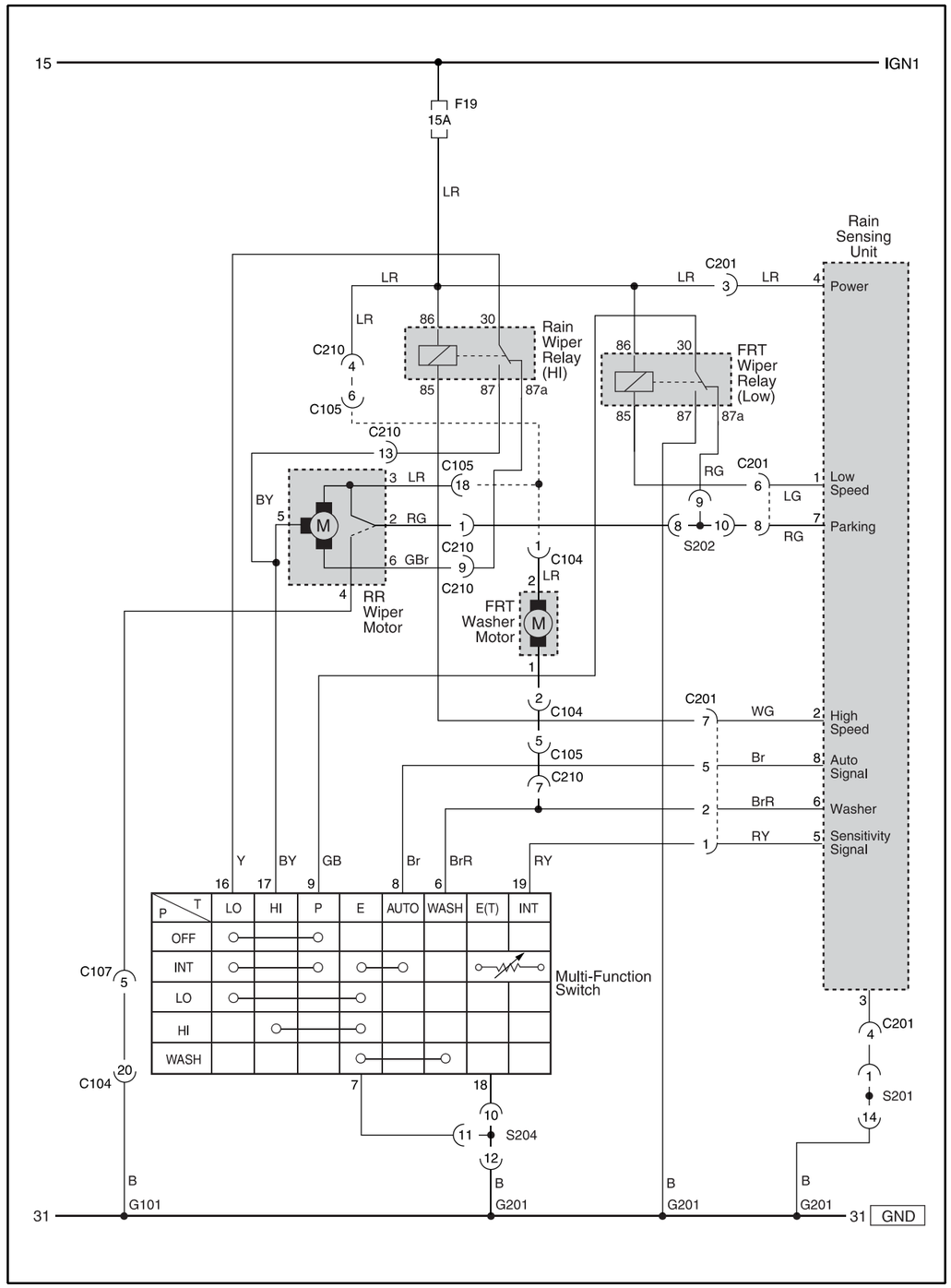


CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

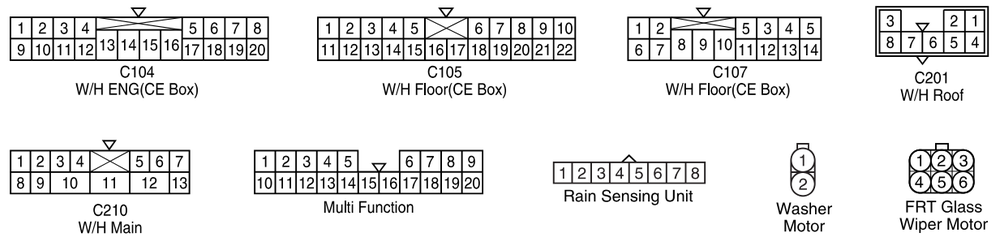
2) XDi, 2003 MODEL ~



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C201 (8Pin, White)	Main - Roof	Under the I/P Fuse Box	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
G101	W/H Engine	Center the Engine Room Fuse Box	
G201	W/H Main	Inside Driver Side Cowl PNL	

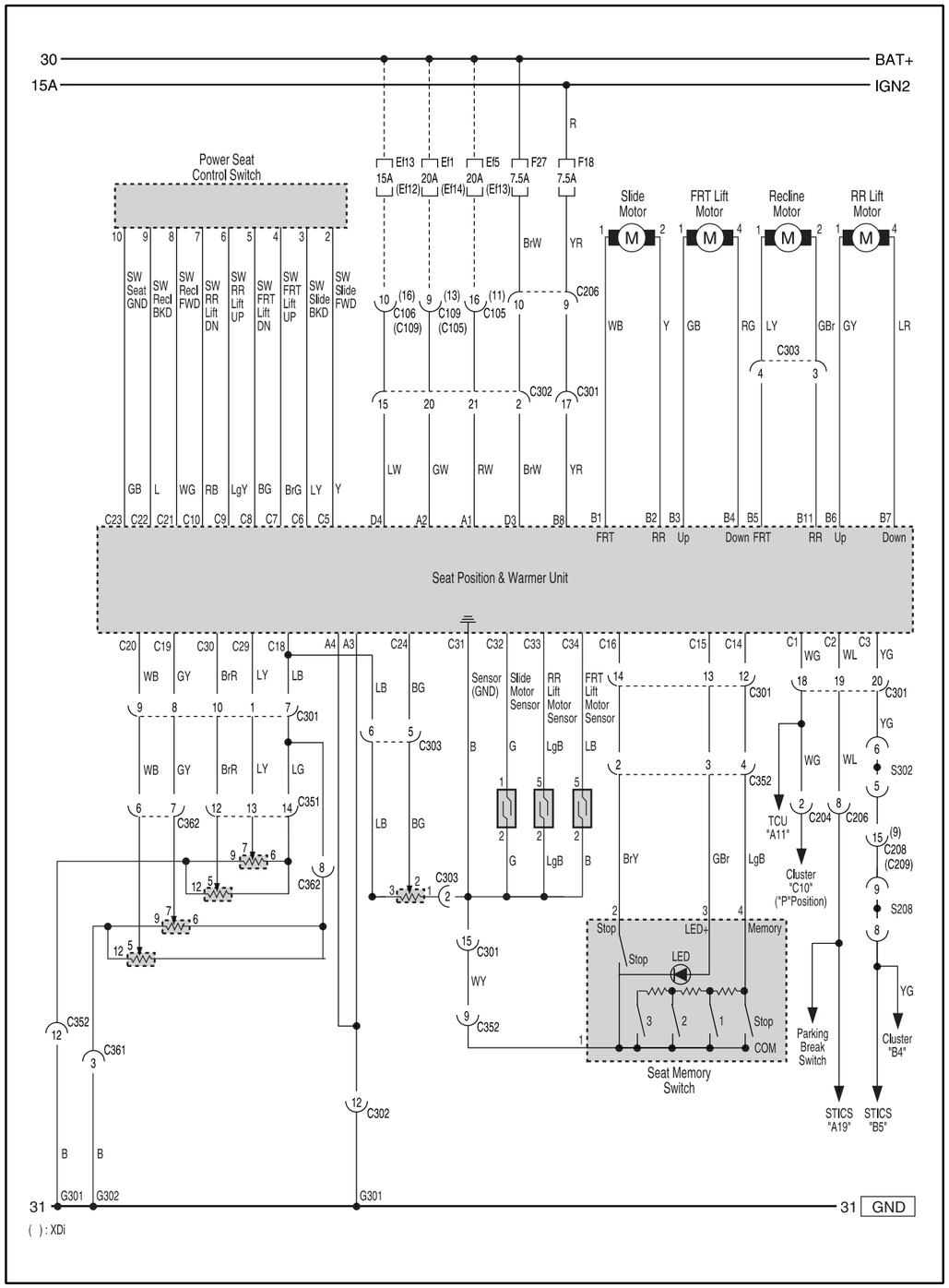
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 7410-04

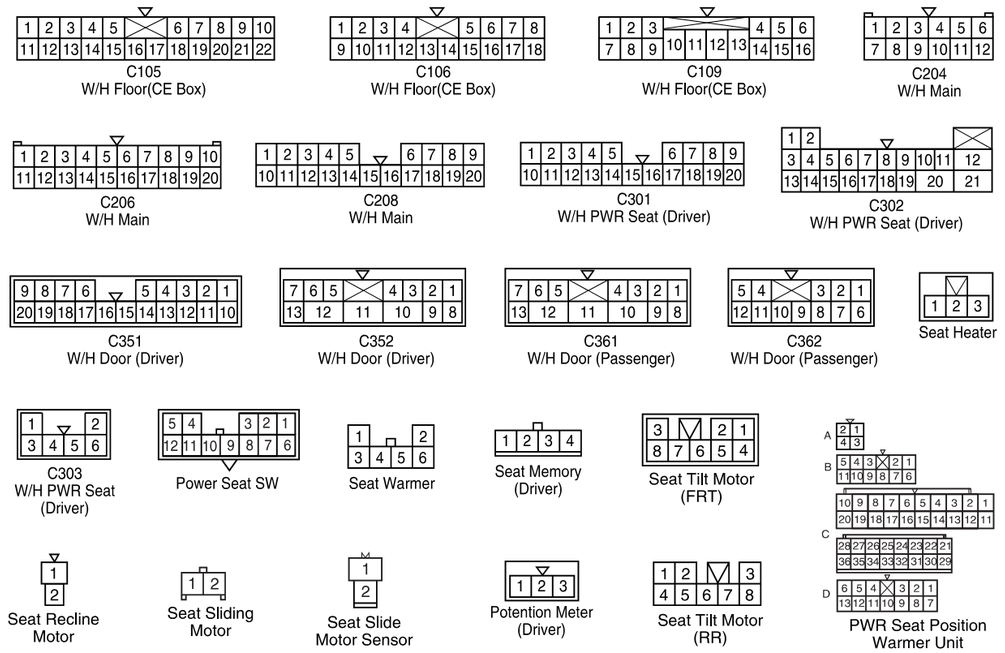
POWER SEAT CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C301 (20Pin, White)	Floor - Driver Seat	Under the Driver Seat	Power Seat
C302 (21Pin, White)	Floor - Driver Seat	Under the Driver Seat	Power Seat
C303 (6Pin, White)	Driver Seat - Seat Back	Under the Driver Seat	Power Seat
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C352 (13Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C361 (13Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C362 (12Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
S208 (14Pin, Black)	W/H Main	Behind the Right the FATC	
S302 (14Pin, Black)	W/H Floor	Under Driver Seat	
G301	W/H Floor	Under Driver Seat	ECU GND
G302	W/H Floor	Under Driver Seat	

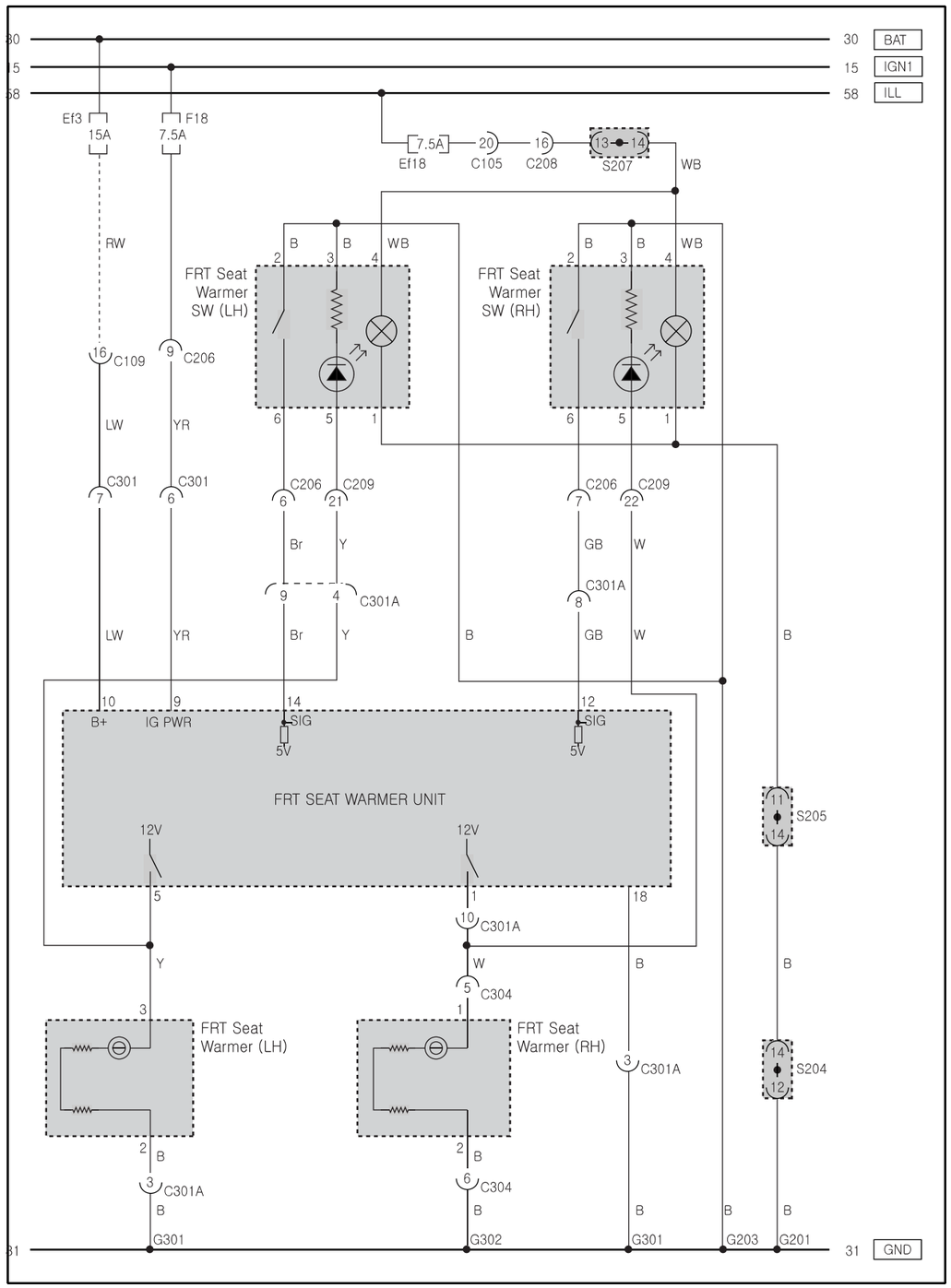
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 7410-32

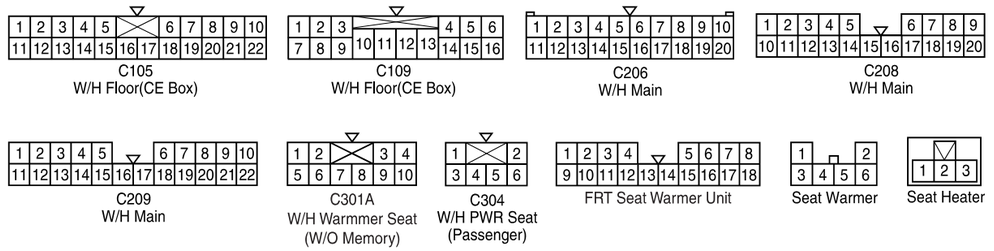
FRT SEAT WARMER(W/O MEMORY)



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C301A (10Pin, White)	Floor - Driver Seat	Under the Driver Seat	Seat Warner
C304 (6Pin, White)	Floor - Co-Driver Seat	Under the Co-Driver Seat	Power Seat
S205 (14Pin, Black)	W/H Main	Behind the Left FATC	GND
S206 (14Pin, Black)	W/H Main	Behind the Left FATC	
S208 (14Pin, Black)	W/H Main	Behind the Right FATC	
G201	W/H Main	Inside Driver Side Cowl PNL	
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag
G301	W/H Floor	Under Driver Seat	ECU GND
G302	W/H Floor	Under Driver Seat	

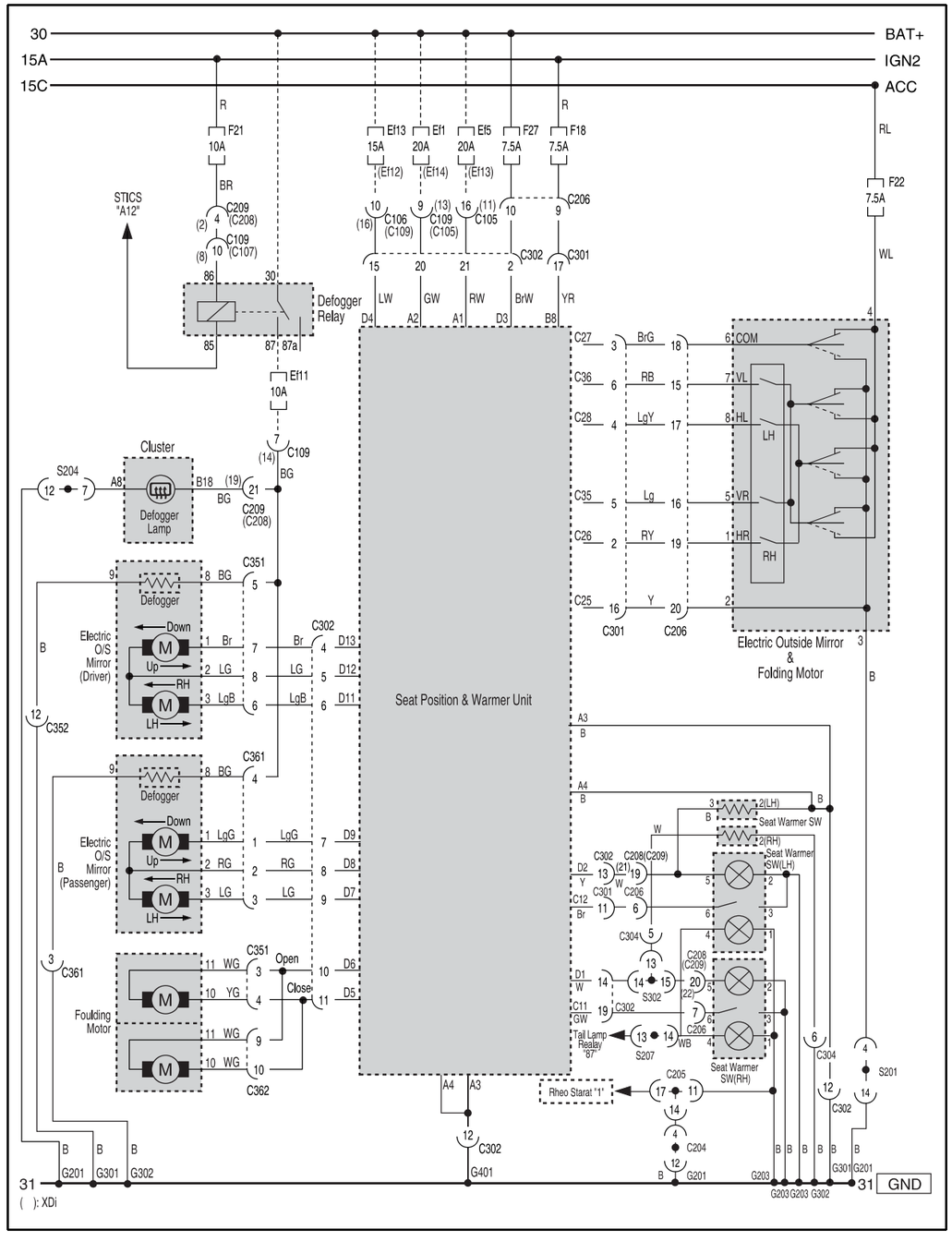
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8410-30

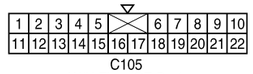
POWER O/SIDE MIRROR, DEFOGGER SEAT WARMER CIRCUIT(W/ MEMORY)

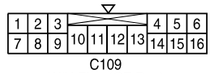


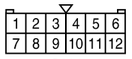
(1) CONNECTOR INFORMATION

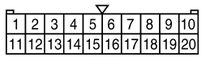
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C301 (20Pin, White)	Floor - Driver Seat	Under the Driver Seat	Power Seat
C302 (21Pin, White)	Floor - Driver Seat	Under the Driver Seat	Power Seat
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C352 (13Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C362 (12Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S302 (14Pin, Black)	W/H Floor	Under Driver Seat	
G201	W/H Main	Inside Driver Side Cowl PNL	
G301	W/H Floor	Under Driver Seat	ECU GND
G401	W/H Floor	Center the Tail Gate	

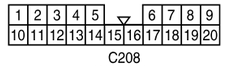
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

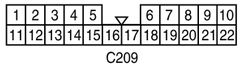

C105
W/H Floor(CE Box)

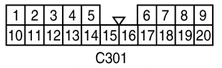

C109
W/H Floor(CE Box)

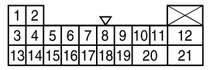

C204
W/H Main

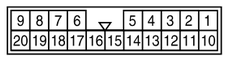

C206
W/H Main

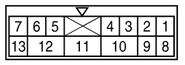

C208
W/H Main

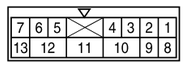

C209
W/H Main

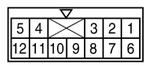

C301
W/H PWR Seat (Driver)


C302
W/H PWR Seat (Driver)

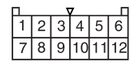

C351
W/H Door (Driver)

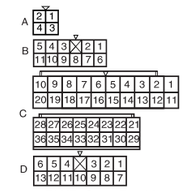

C352
W/H Door (Driver)


C361
W/H Door (Passenger)


C362
W/H Door (Passenger)


Power O/S Mirror


O/S Mirror & Heater Sensor (Memory Type)


PWR Seat Position Warmer Unit

CIRCUIT

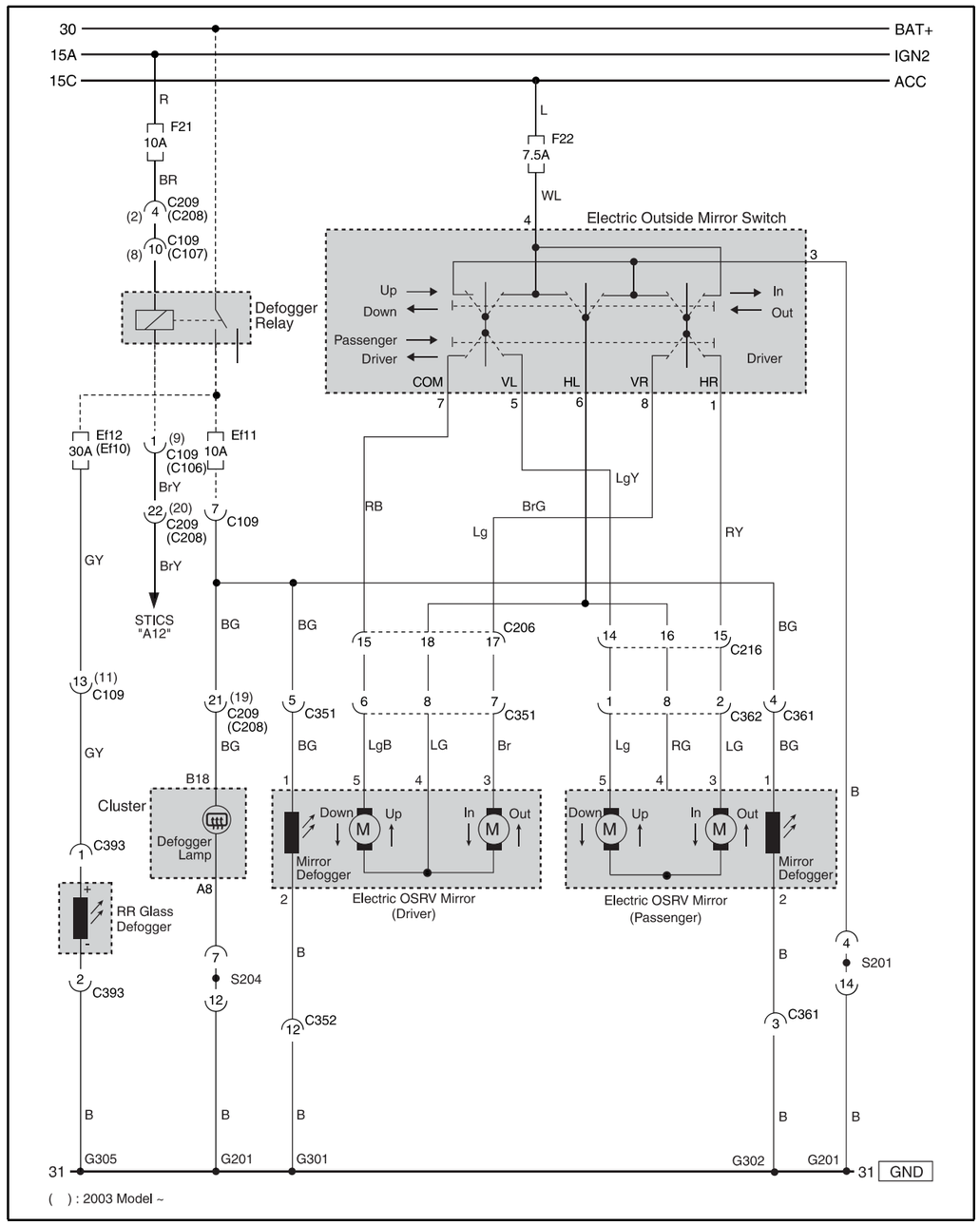
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8410-30

POWER O/SIDE MIRROR, DEFOGGER CIRCUIT (W/O MEMORY)

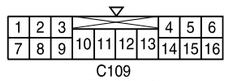
1) ~ 2002 MODEL

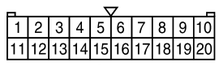


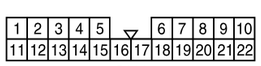
(1) CONNECTOR INFORMATION

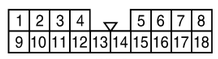
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C216 (18Pin, White)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C352 (13Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C362 (12Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C393 (4Pin, White)	Floor - RR Defogger	Inside the Upper the Tail Gate	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
G201	W/H Main	Inside Driver Side Cowl PNL	
G301	W/H Floor	Under Driver Seat	ECU GND
G302	W/H Floor	Under Driver Seat	
G305	W/H Floor	Behind the Quter Grass #1	

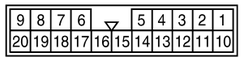
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

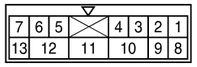

C109
W/H Floor(CE Box)

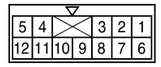

C206
W/H Main


C209
W/H Main

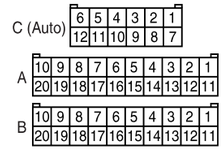

C216
W/H Main


C351
W/H Door (Driver)

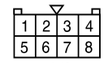

C352
W/H Door (Driver)

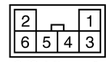

C362
W/H Door (Passenger)


C393
W/H Tail Gate



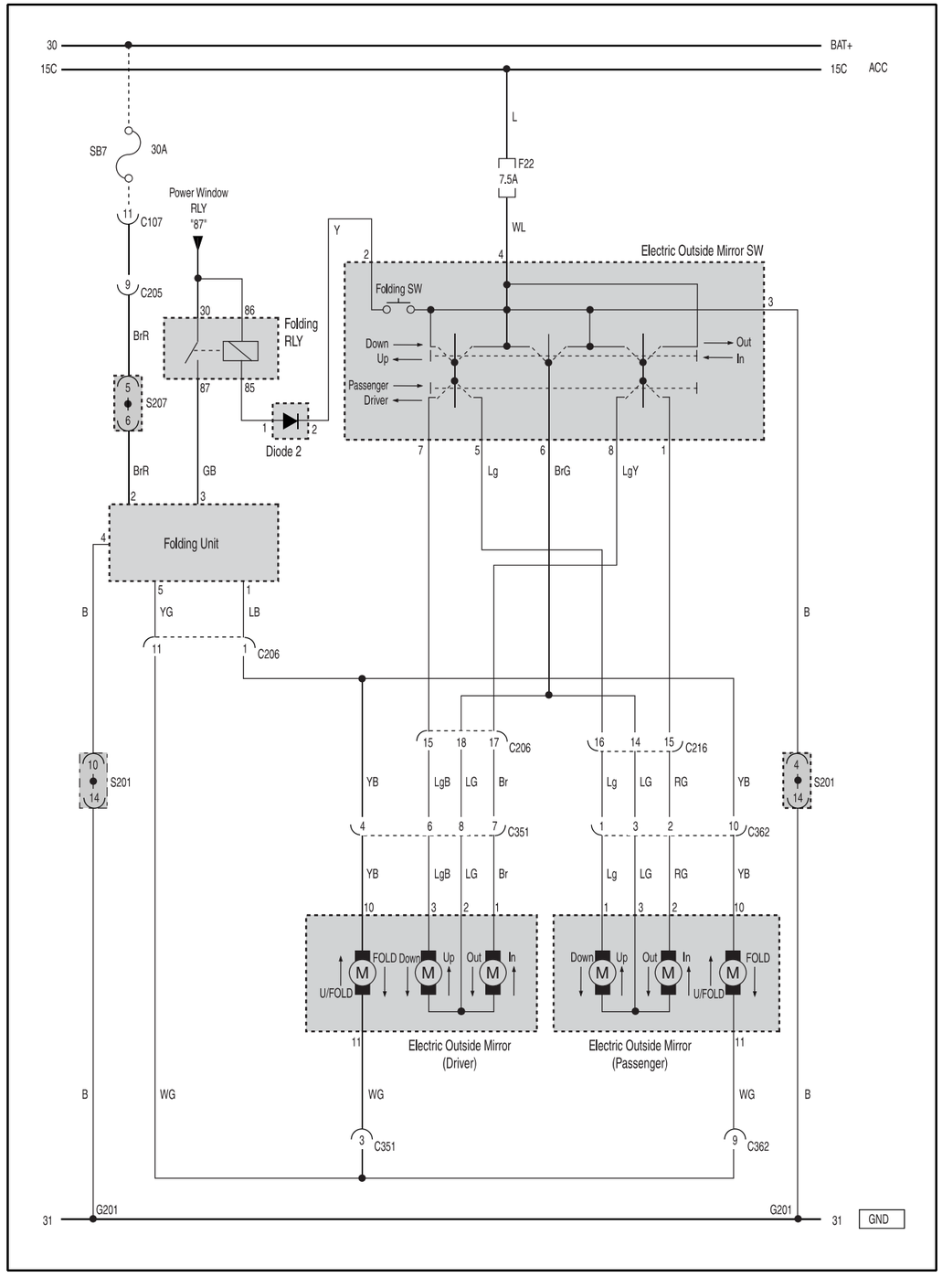
Cluster


Power O/S Mirror


O/S Mirror & Heater Sensor

Modification basis	
Application basis	
Affected VIN	

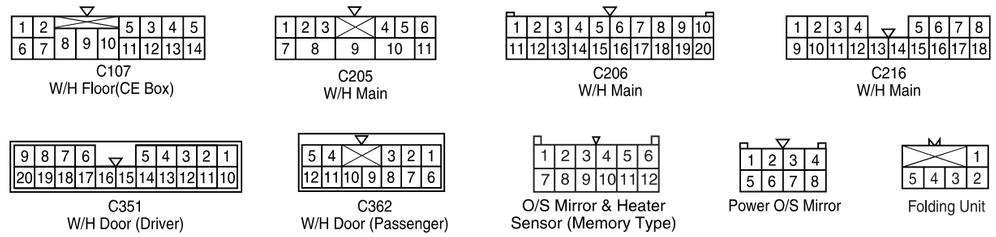
2) XDi



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C216 (18Pin, White)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C362 (12Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S208 (14Pin, Black)	W/H Main	Behind the Right FATC	
G201	W/H Main	Inside Driver Side Cowl PNL	

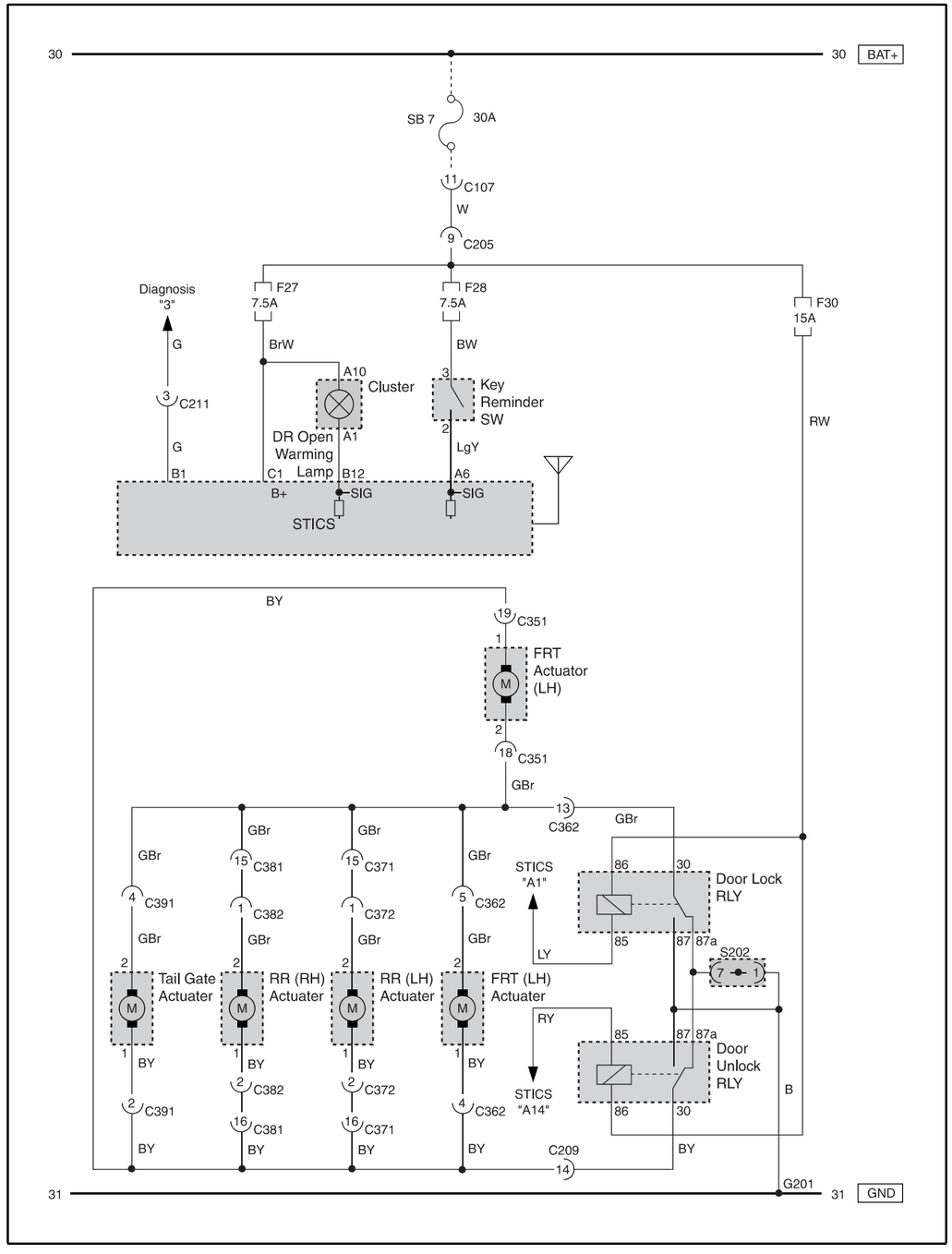
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITIO



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8710-01

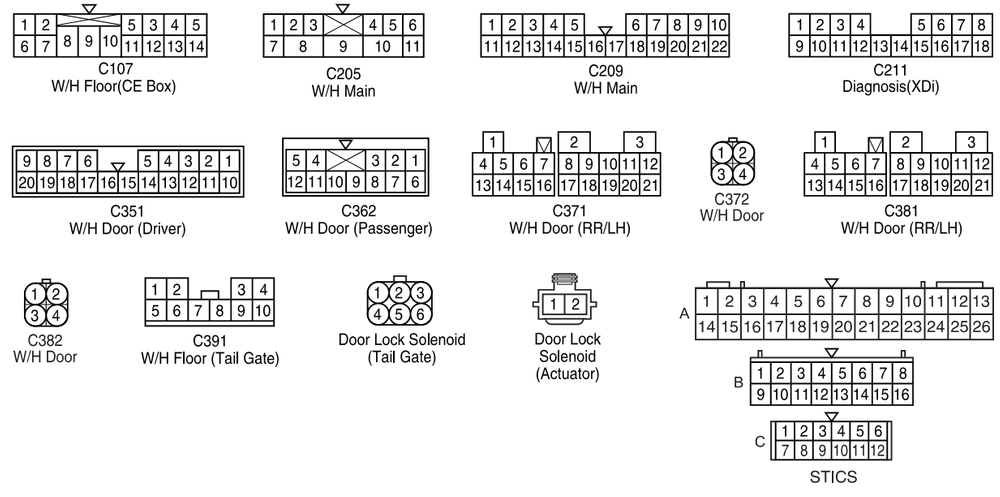
CENTRAL DOOR LOCKING SYSTEM



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C211 (18Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	XDi
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C362 (12Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	
C371 (21Pin, White)	Floor - RR Left Door	Under Left "B" Filler	
C372 (4Pin, Black)	RR LH Door - Door Extention	In Side RR LH Door PNL	
C381 (21Pin, White)	Floor - RR Right Door	Under Right "B" Filler	
C382 (4Pin, Black)	RR RH Door - Door Extention	Inside RR RH Door PNL	
C391 (10Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
G201	W/H Main	Inside Driver Side Cowl PNL	

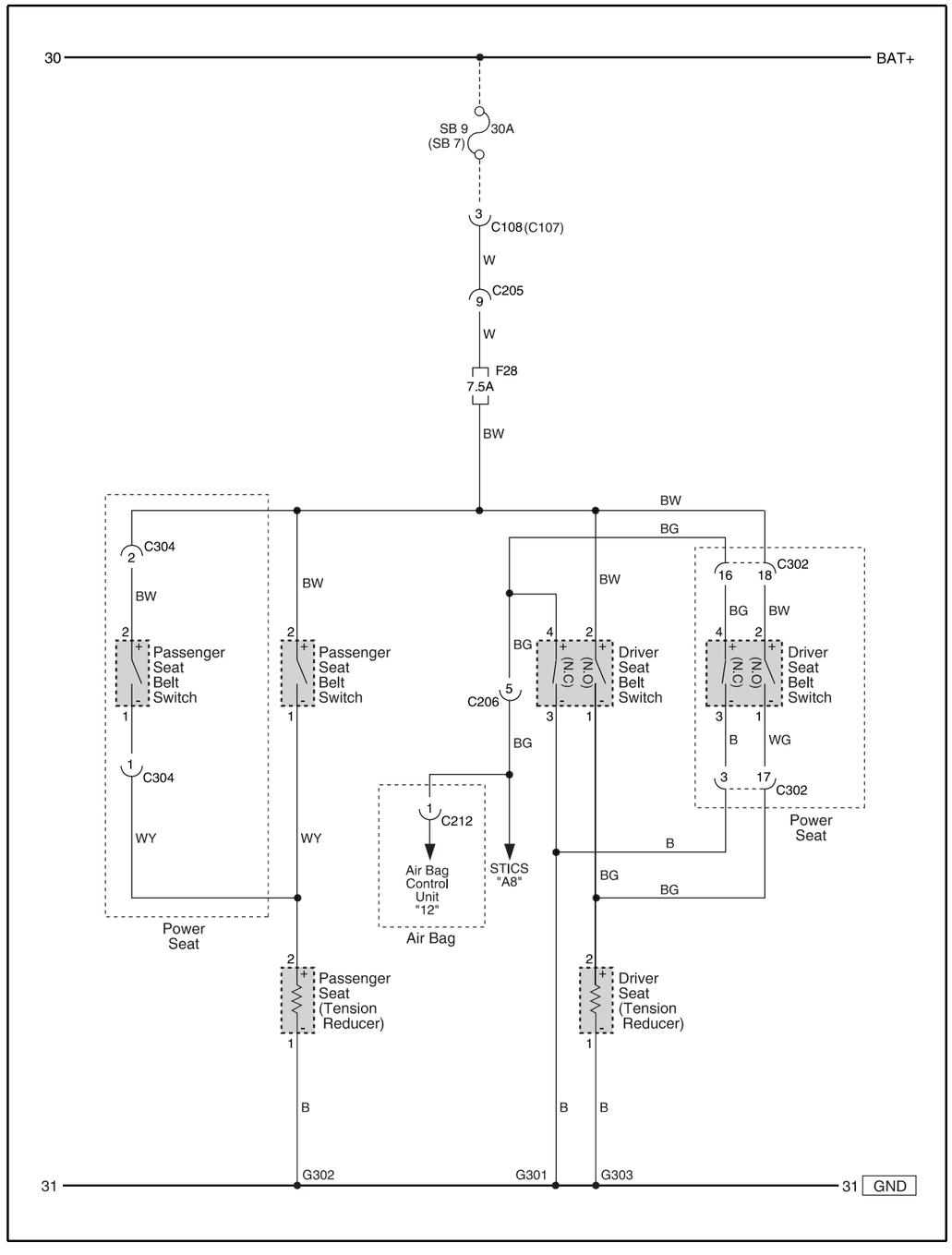
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 7410-00

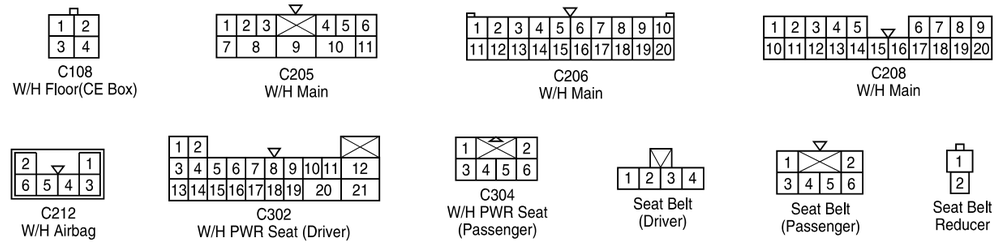
SEAT BELT, TENSION REDUCER CIRCUIT (2002 MODEL ONLY)



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C212 (6Pin, White)	Main - Air-Bag	Behind the Cluster (Inside Dash PNL)	
C302 (21Pin, White)	Floor - Driver Seat	Under the Driver Seat	Power Seat
C304 (6Pin, White)	Floor - Co-Driver Seat	Under the Co-Driver Seat	Power Seat
G301	W/H Floor	Under Driver Seat	ECU GND
G302	W/H Floor	Under Driver Seat	
G303	W/H Floor	Under the Left "B" Filler	

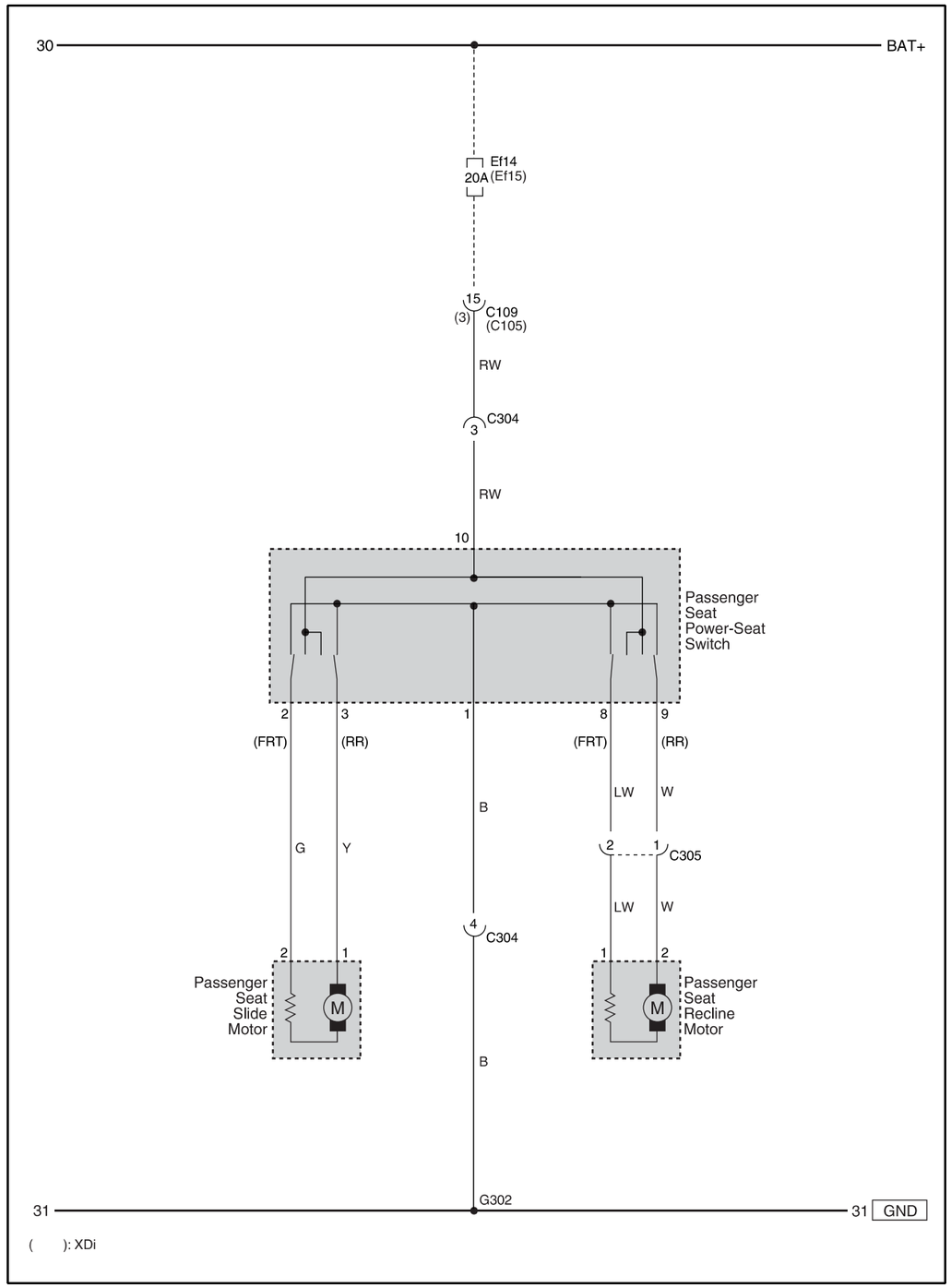
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 7410-04

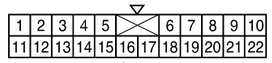
PASSENGER POWER SEAT CIRCUIT



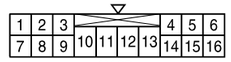
(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C304 (6Pin, White)	Floor - Co-Driver Seat	Under the Co-Driver Seat	Power Seat
C305 (4Pin, White)	Co-Driver Seat - Seat Back	Under the Co-Driver Seat	Power Seat
G302	W/H Floor	Under Driver Seat	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



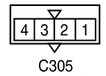
C105
W/H Floor(CE Box)



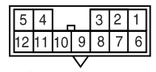
C109
W/H Floor(CE Box)



C304
W/H PWR Seat
(Passenger)



C305
W/H Seat Back
(Passenger)



Power Seat SW



Seat Recline
Motor



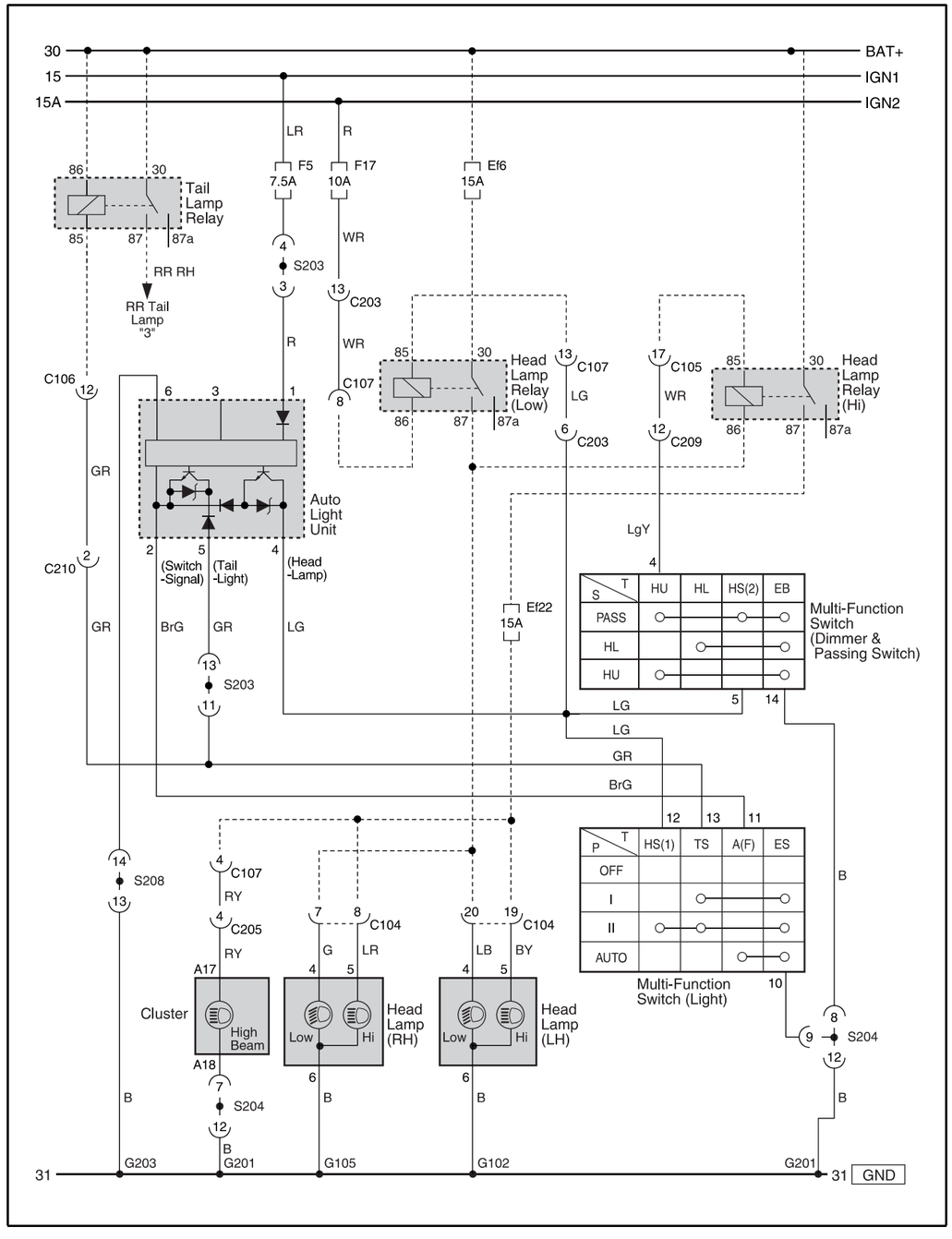
Seat Sliding
Motor

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8310-10

AUTO LIGHT CONTROL CIRCUIT

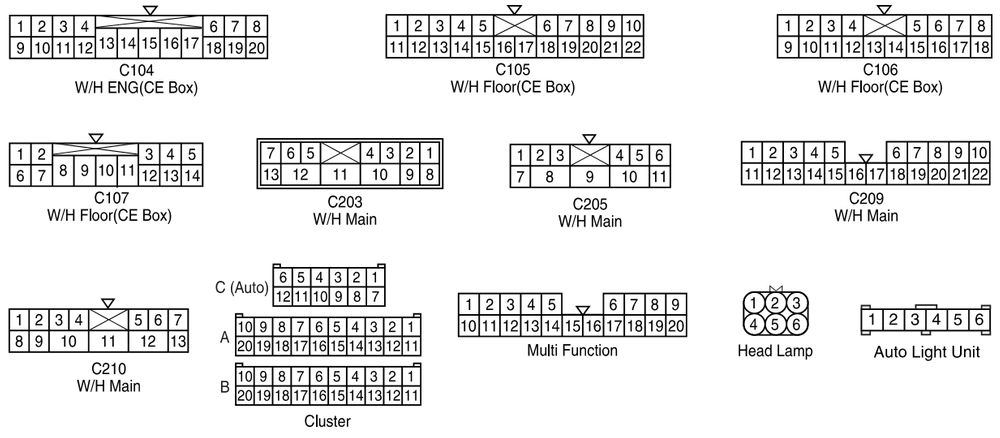
1) ~ 2002 MODEL



(1) CONNECTOR INFORMATION

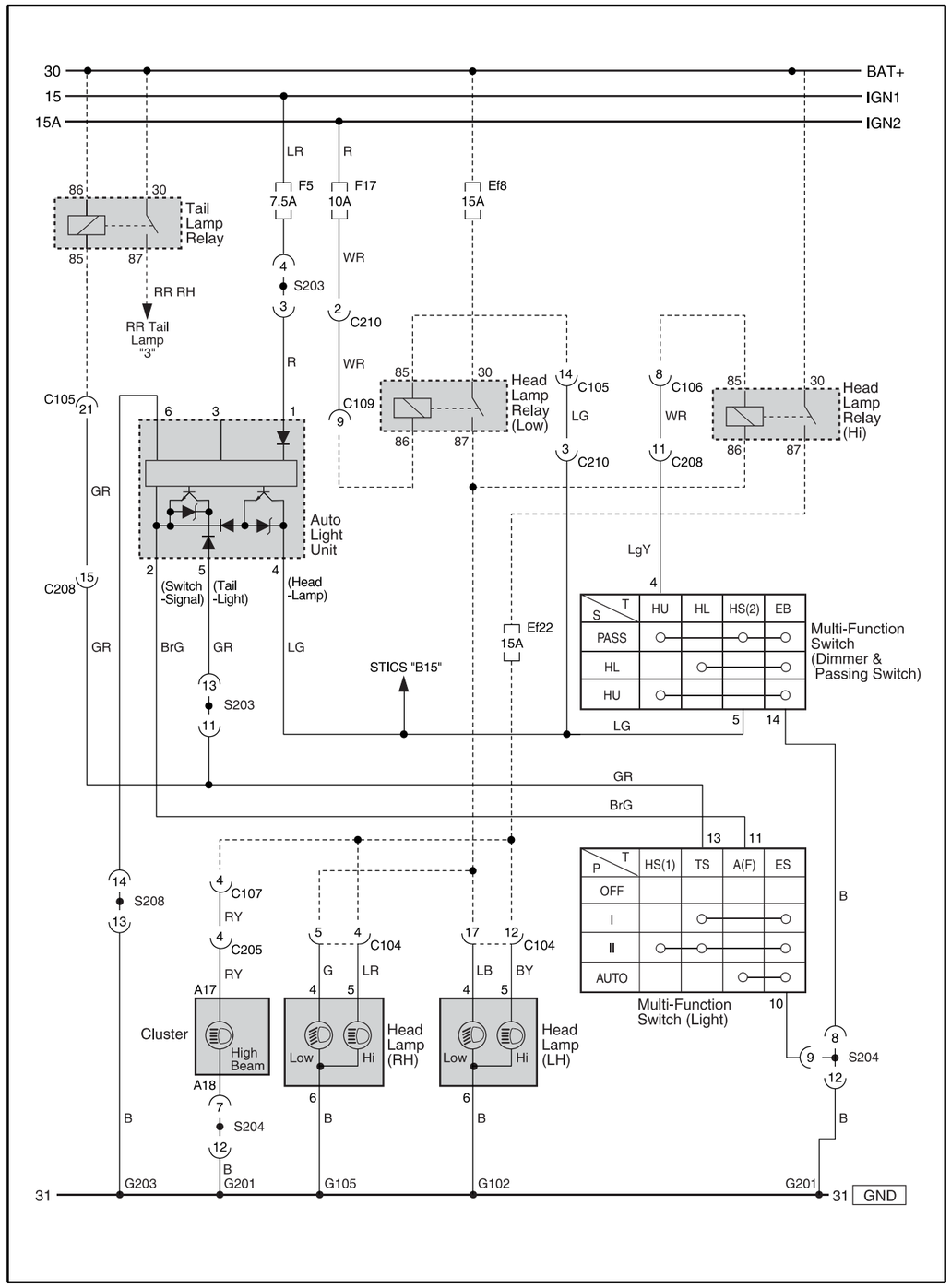
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S208 (14Pin, Black)	W/H Main	Behind the Right the FATC	
G102	W/H Engine	Center BATT	
G105	W/H Engine	Behine the Right Head Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

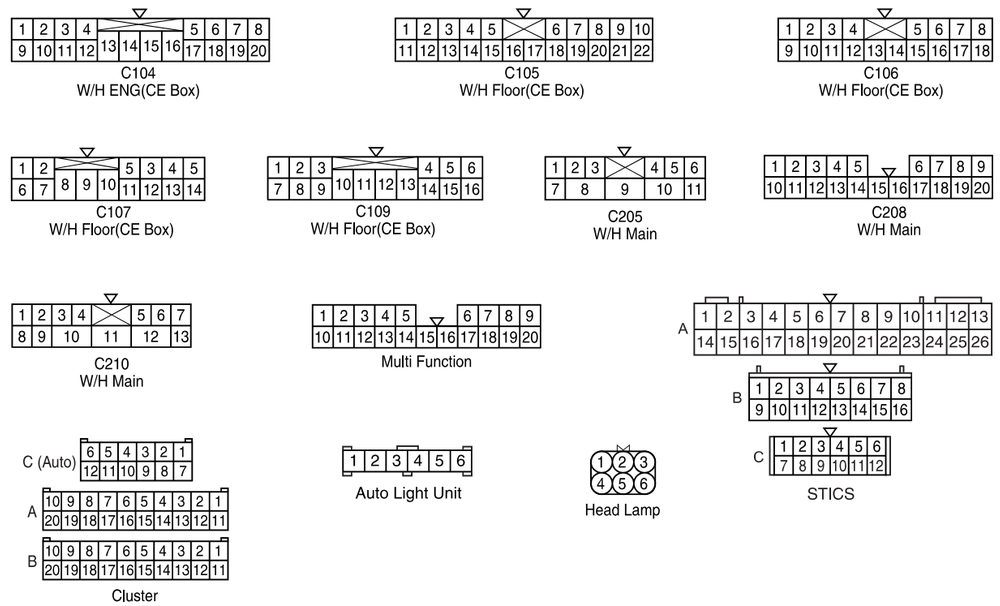
2) XDi



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S208 (14Pin, Black)	W/H Main	Behind the Right the FATC	
G102	W/H Engine	Center BATT	
G103	W/H Engine	Behind the Left Head Lamp	
G105	W/H Engine	Behine the Right Head Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

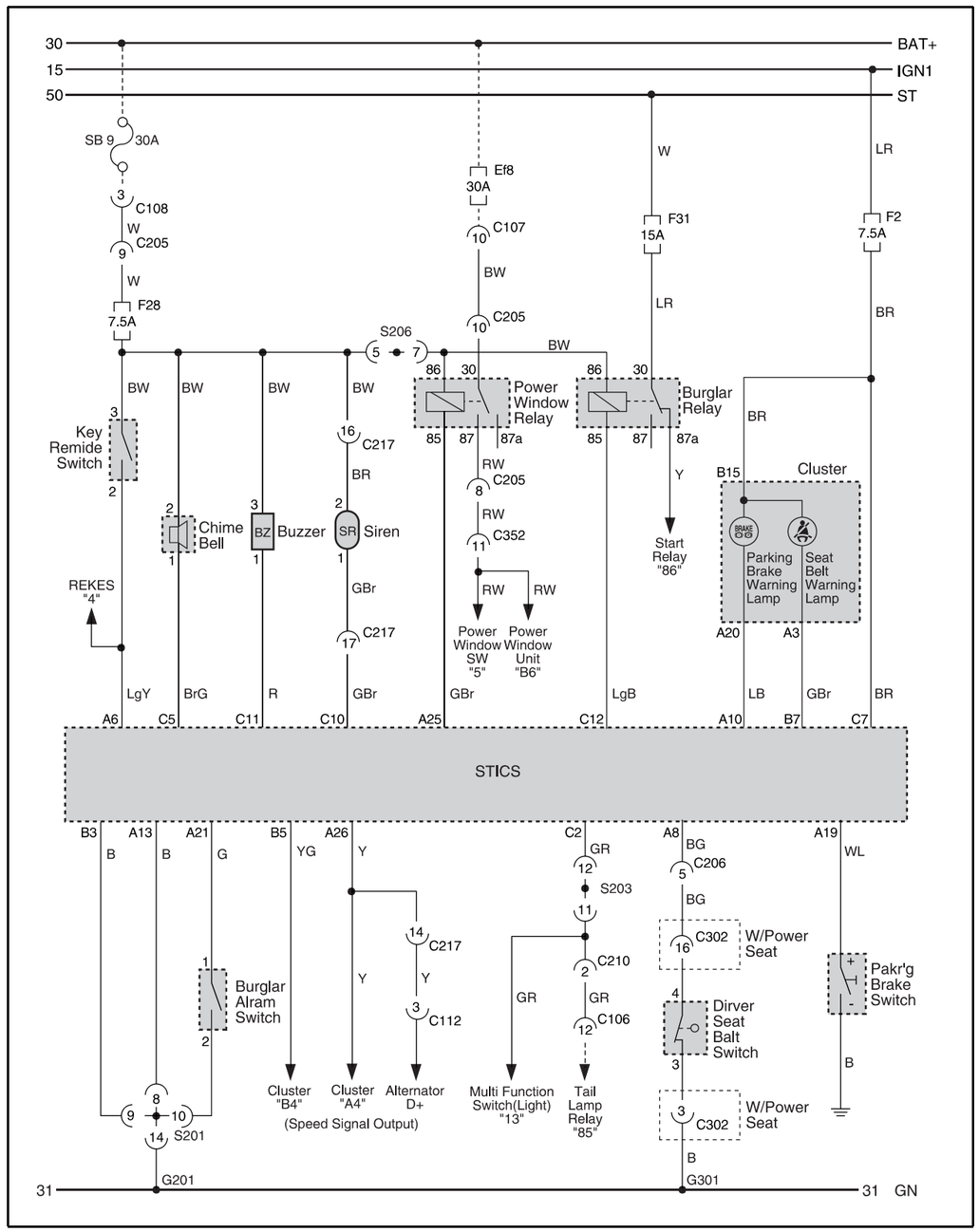


Modification basis	
Application basis	
Affected VIN	

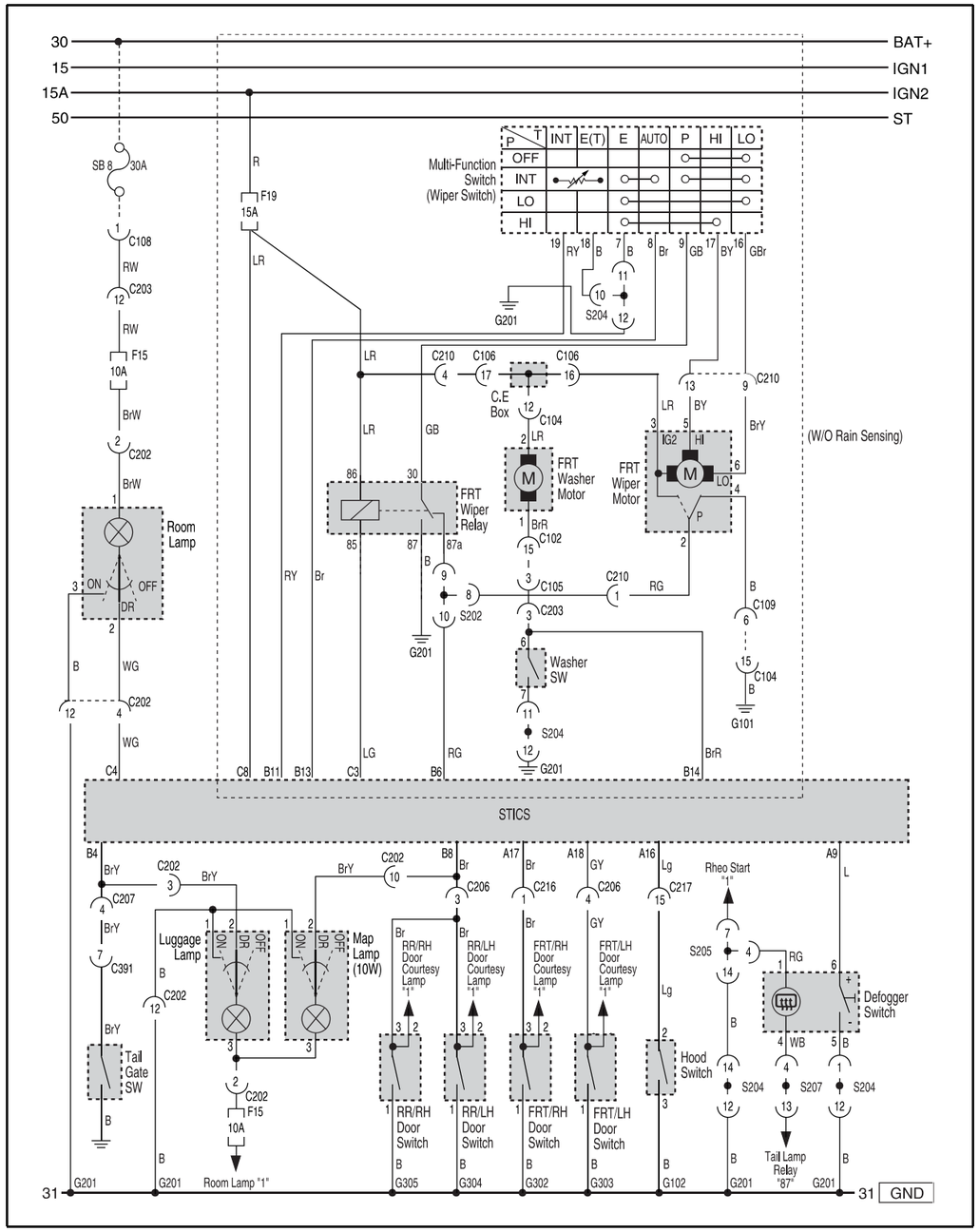
S.G.N. 8711-02

STICS ~ 2002 MODEL

1) POWER SUPPLY, GND, CHIME BELL, BUZZER, WARNING LAMP (PARKING BRAKE, SEATBELT) CIRCUIT



2) FRT WIPER, DR SWITCH, LAMP (ROOM, MAP) CIRCUIT

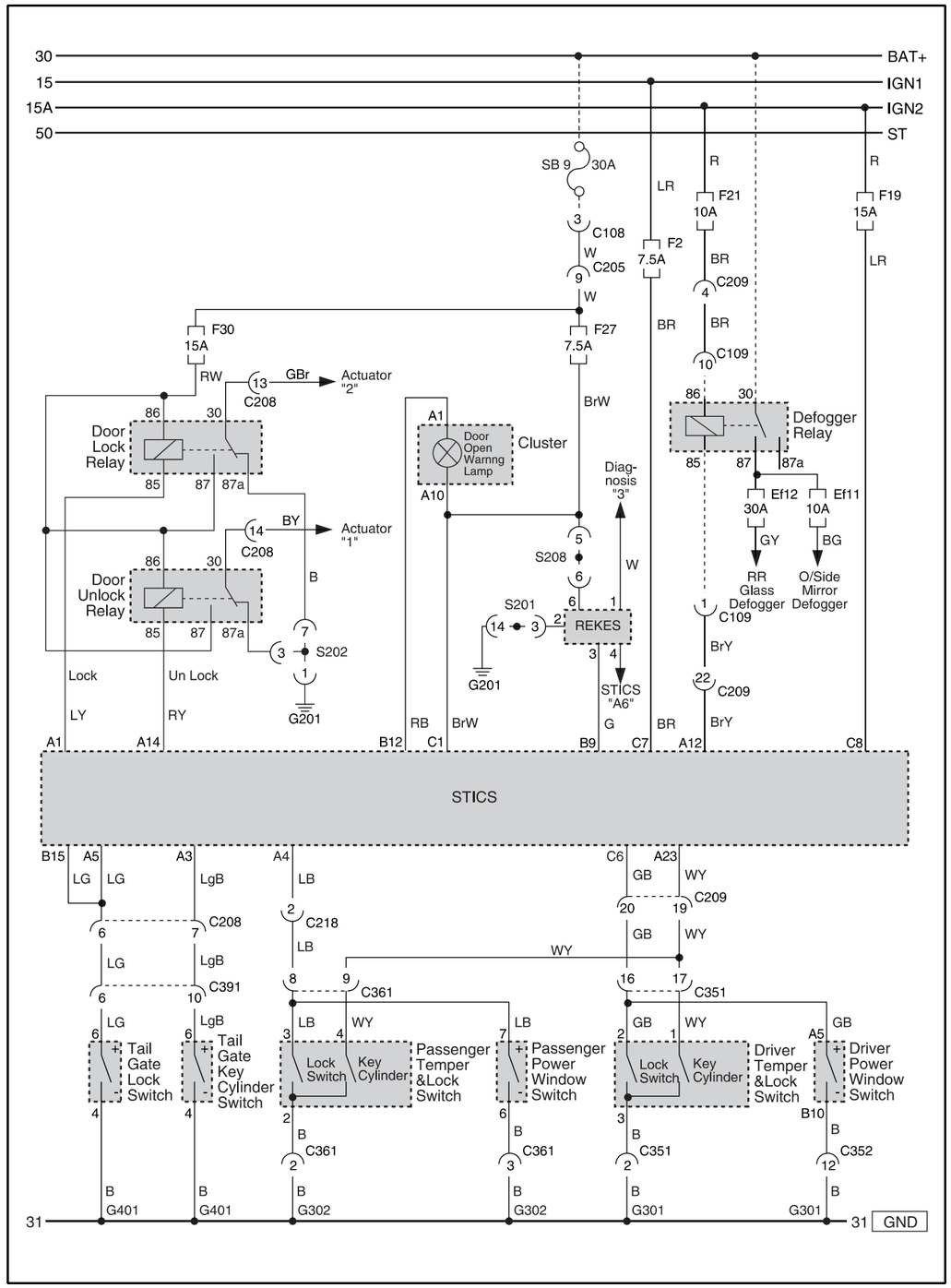


CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

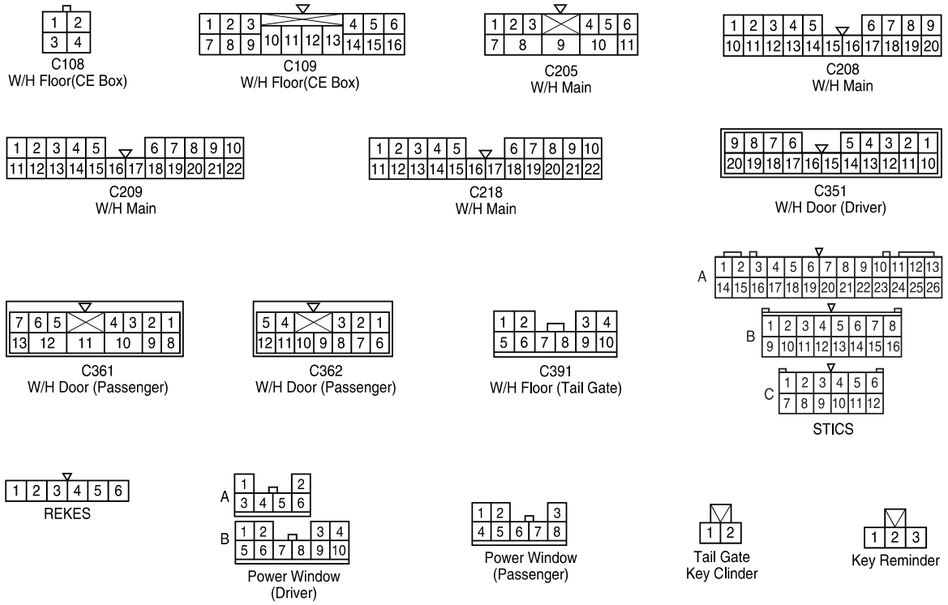
3) DR LOCK, DEFOGGER, POWER WINDOW CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C361 (13Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C362 (12Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C391 (10Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S208 (14Pin, Black)	W/H Main	Behind the Right the FATC	
G201	W/H Main	Center BATT	
G301	W/H Floor	Under Driver Seat	ECU GND
G302	W/H Floor	Under Driver Seat	
G401	W/H Floor	Center the Tail Gate	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

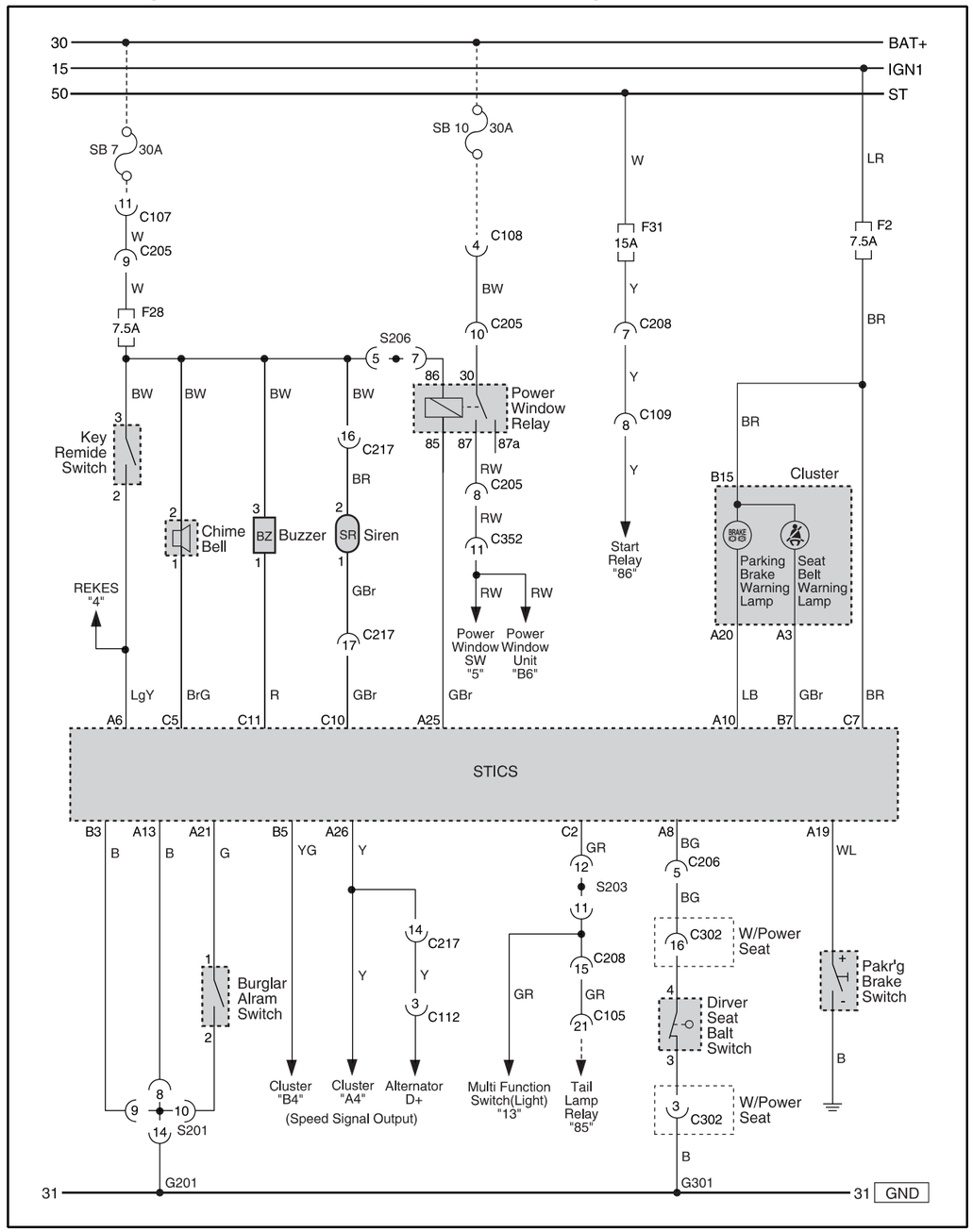


Modification basis	
Application basis	
Affected VIN	

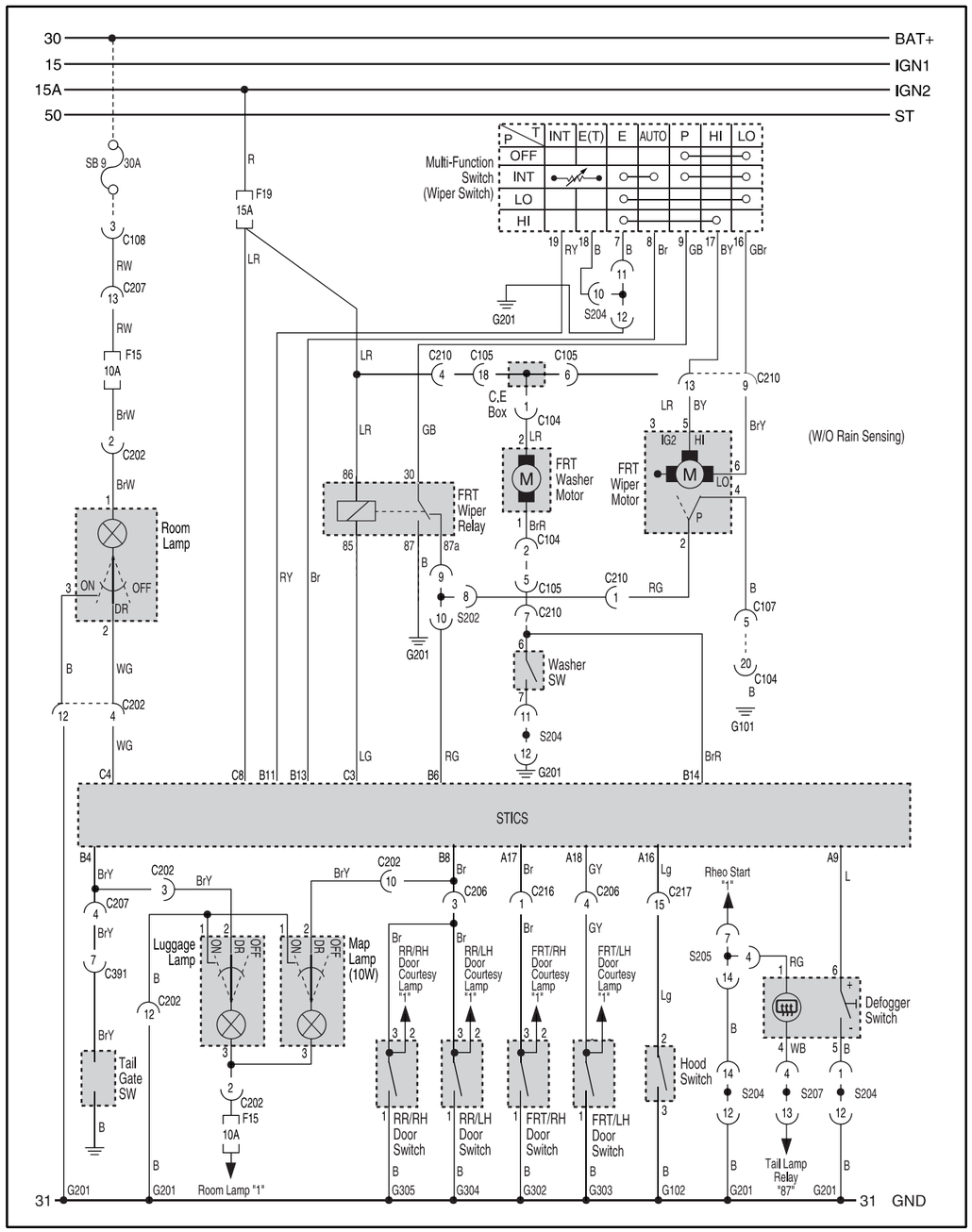
S.G.N. 8711-02

STICS 2003 MODEL

1) POWER SUPPLY, GND, CHIME BELL, BUZZER, WARNING LAMP (PARKING BRAKE, SEATBELT) CIRCUIT



2) FRT WIPER, DR SWITCH, LAMP (ROOM, MAP) CIRCUIT

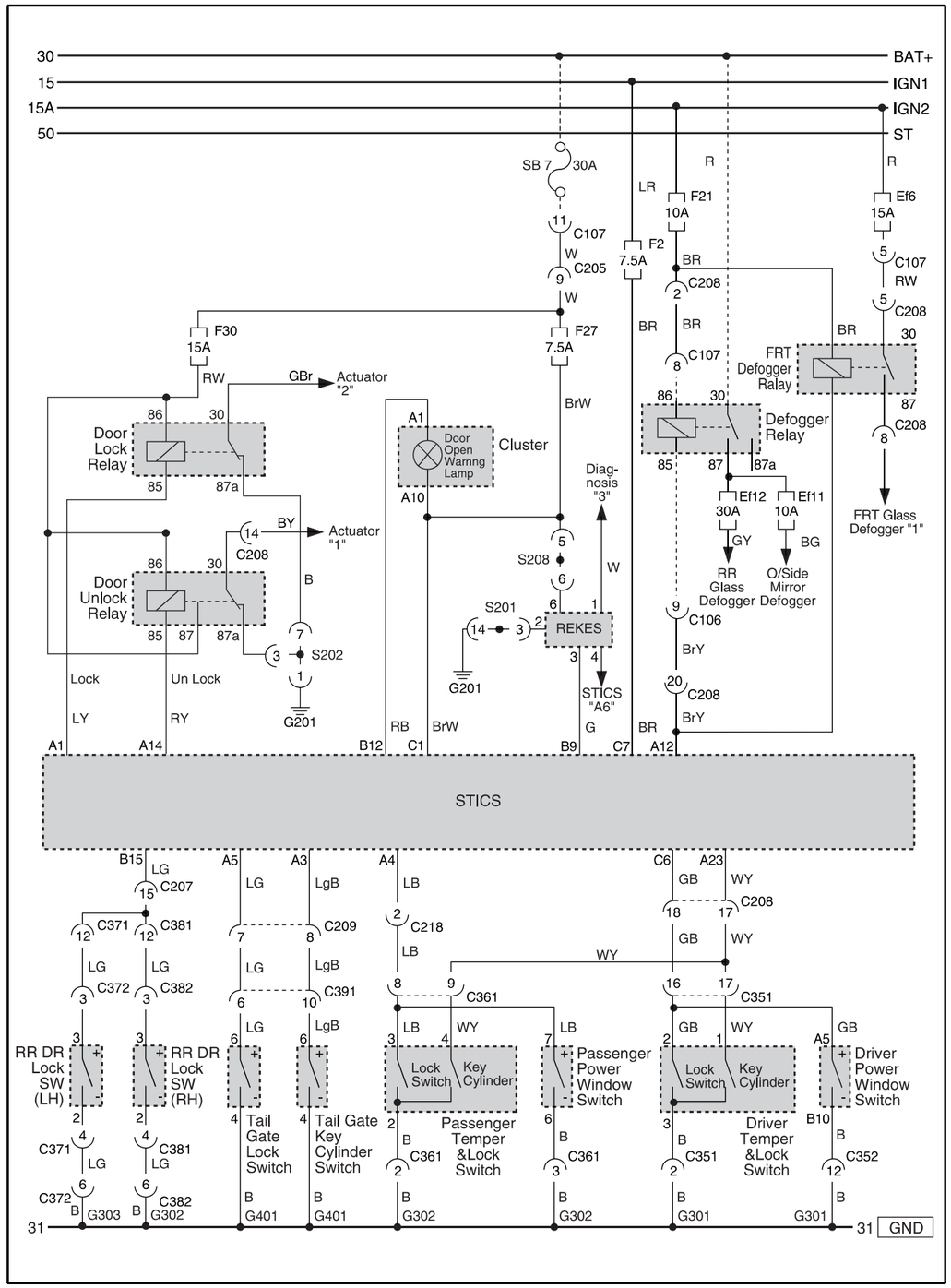


CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

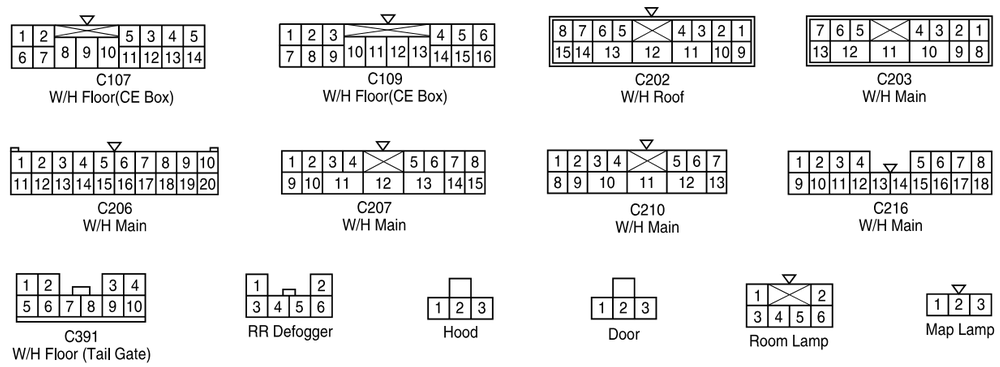
3) DR LOCK, DEFOGGER, POWER WINDOW CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C109 (14Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C202 (15Pin, White)	Main - Roof	Under the I/P Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
C216 (18Pin, White)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C217 (20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C391 (10Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S205 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
G102	W/H Engine	Center BATT	
G201	W/H Main	Inside Driver Side Cowl PNL	
G302	W/H Floor	Under Driver Seat	
G303	W/H Floor	Under the Left “B” Filler	
G304	W/H Floor	Behind the Quarter Grass #1	
G305	W/H Floor	Behind the Quarter Grass #1	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

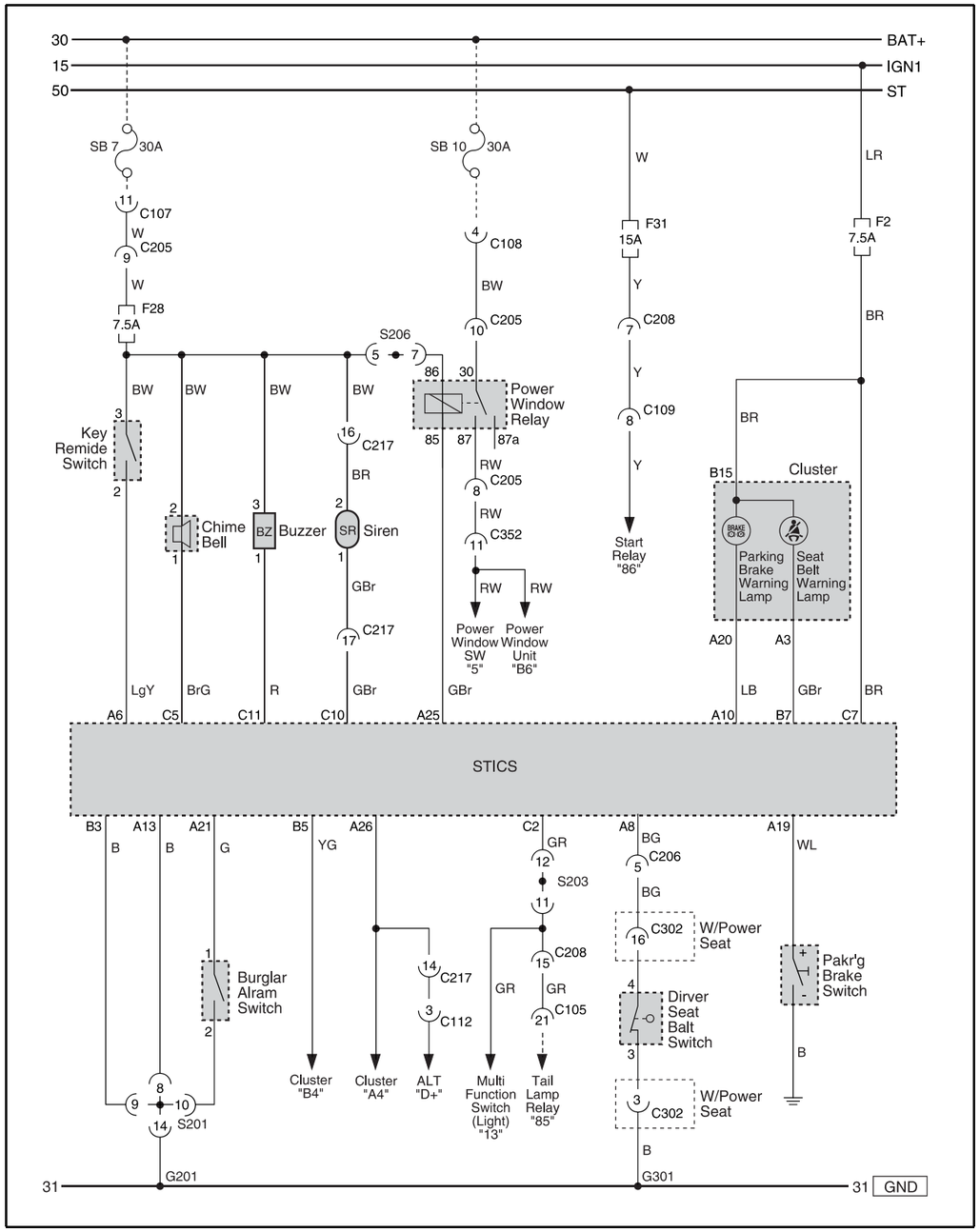


Modification basis	
Application basis	
Affected VIN	

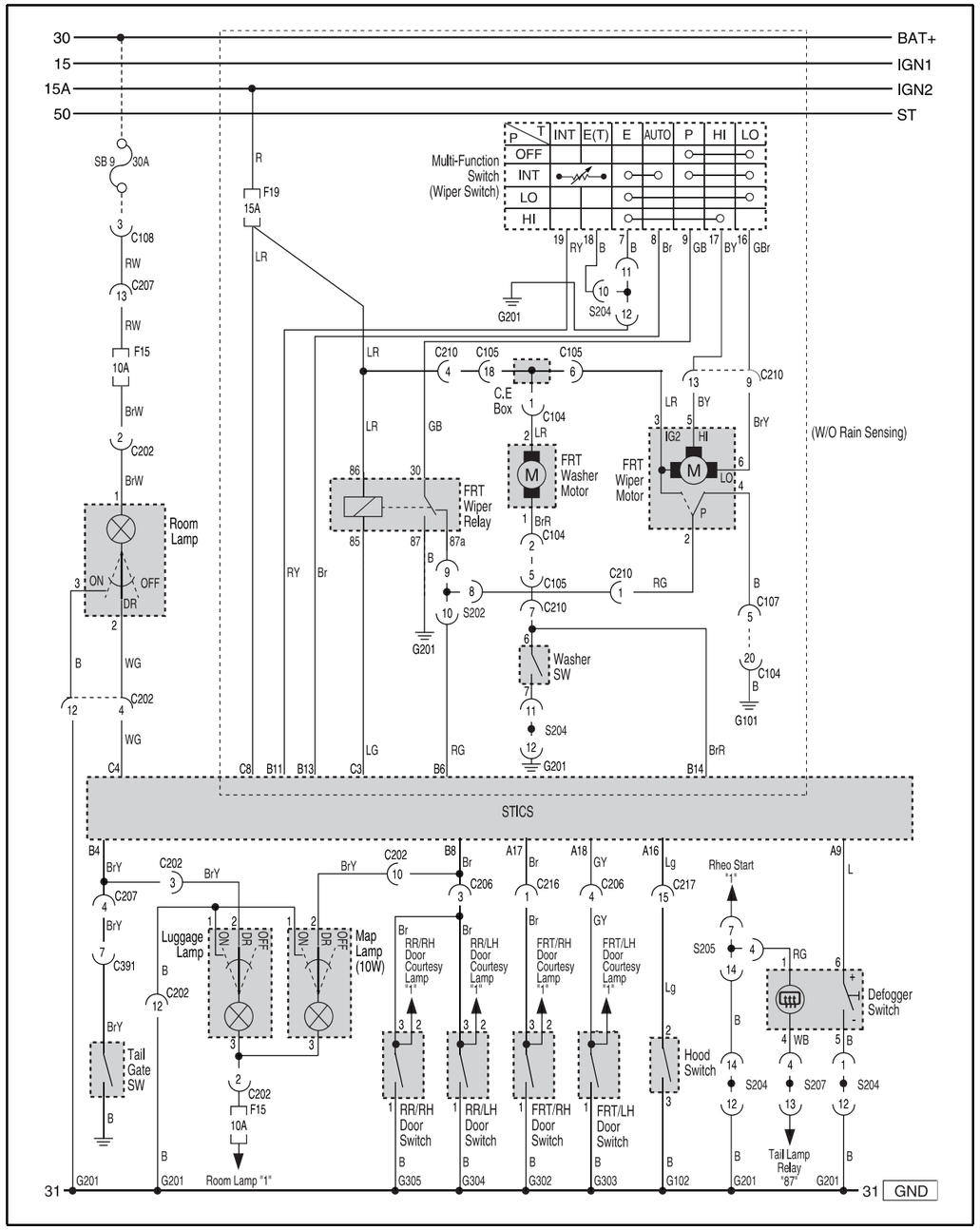
S.G.N. 8711-02

STICS XDi

1) POWER SUPPLY, GND, CHIME BELL, BUZZER, WARNING LAMP (PARKING BRAKE, SEATBELT) CIRCUIT



2) FRT WIPER, DR SWITCH, LAMP (ROOM, MAP) CIRCUIT

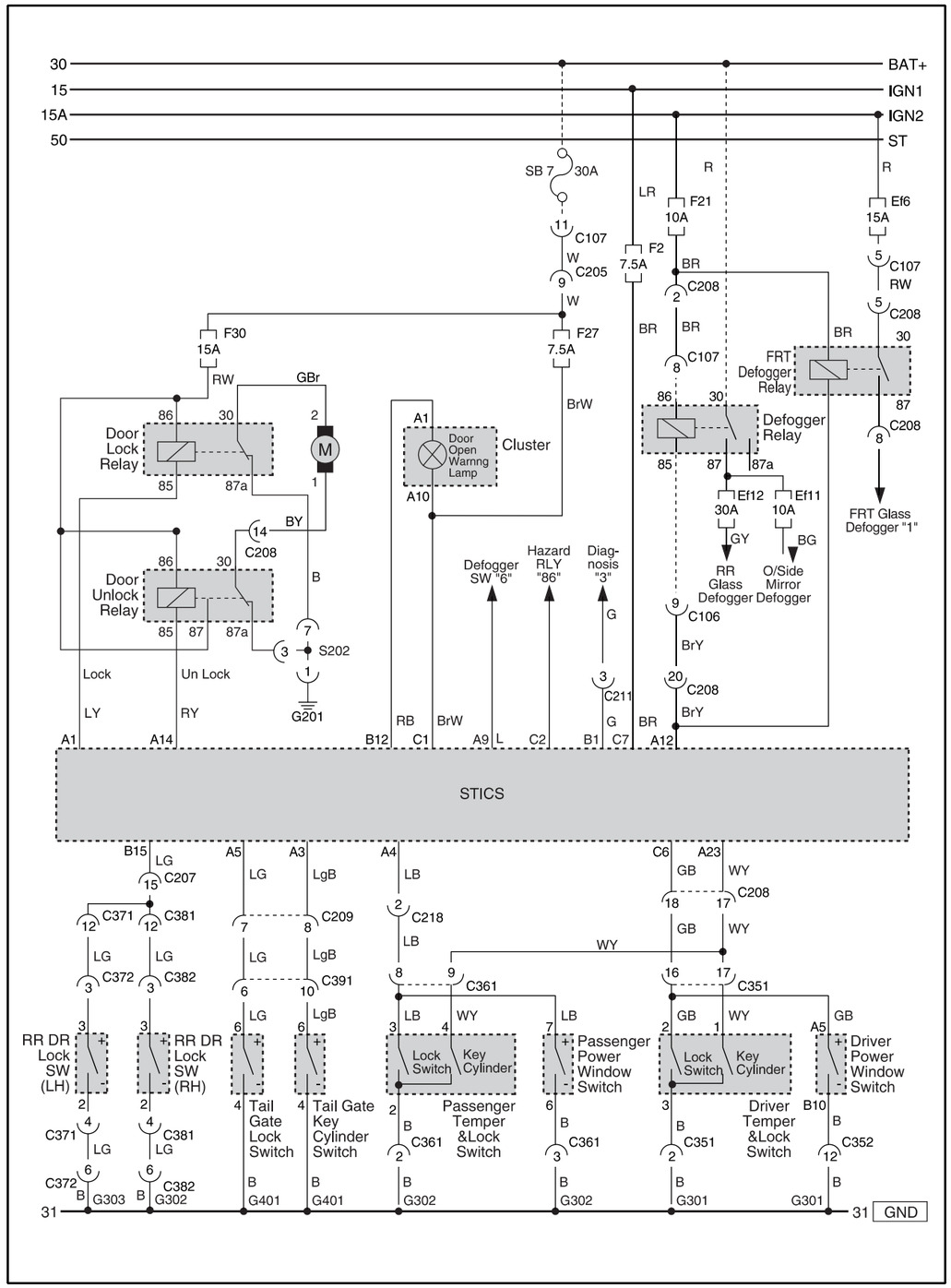


CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

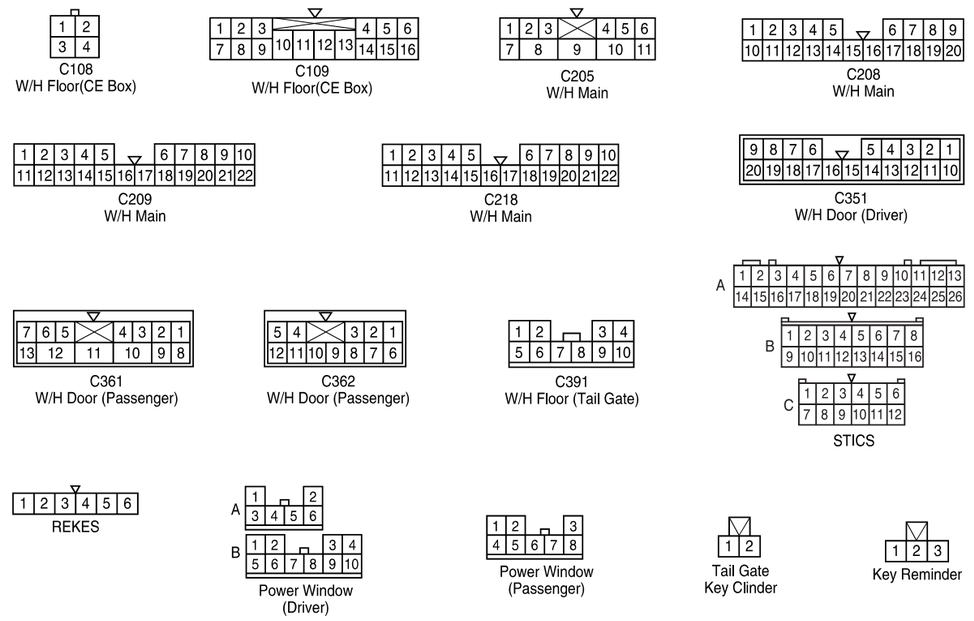
3) DR LOCK, DEFOGGER, POWER WINDOW CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C361 (13Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C362 (12Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C391 (10Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S208 (14Pin, Black)	W/H Main	Behind the Right the FATC	
G201	W/H Main	Center BATT	
G301	W/H Floor	Under Driver Seat	ECU GND
G302	W/H Floor	Under Driver Seat	
G401	W/H Floor	Center the Tail Gate	

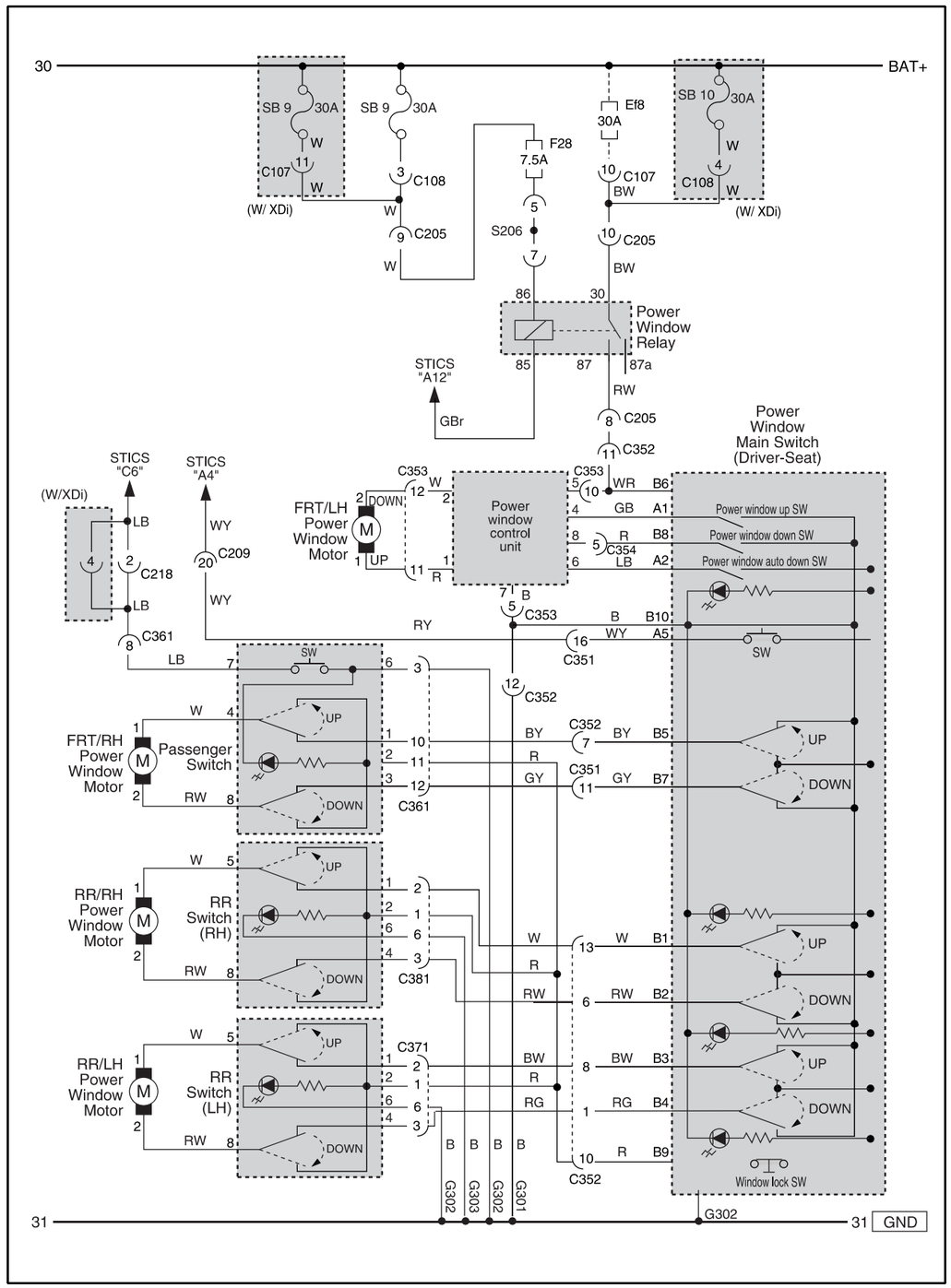
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8511-05

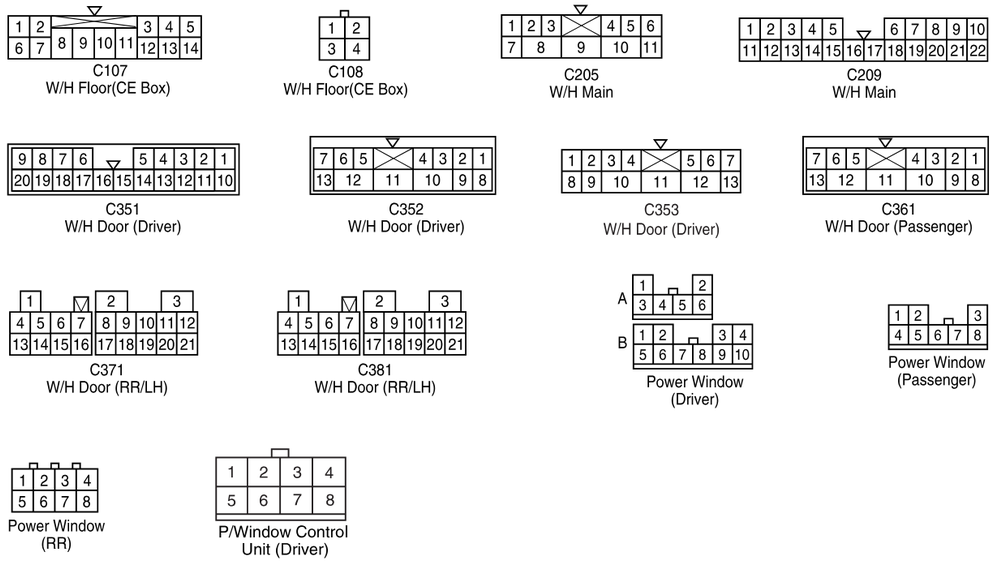
POWER WINDOW CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C352 (13Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C353 (13Pin, White)	Driver Door - Door Extention	Inside Driver Side Cowl PNL	
C361 (13Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C371 (21Pin, White)	Floor - RR Left Door	Under Left "B" Filler	
C381 (21Pin, White)	Floor - RR Right Door	Under Right "B" Filler	
S206 (14Pin, Black)	W/H Main	Behind the Left the FATC	
G301	W/H Floor	Under Driver Seat	ECU GND
G302	W/H Floor	Under Driver Seat	
G303	W/H Floor	Under the Left "B" Filler	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

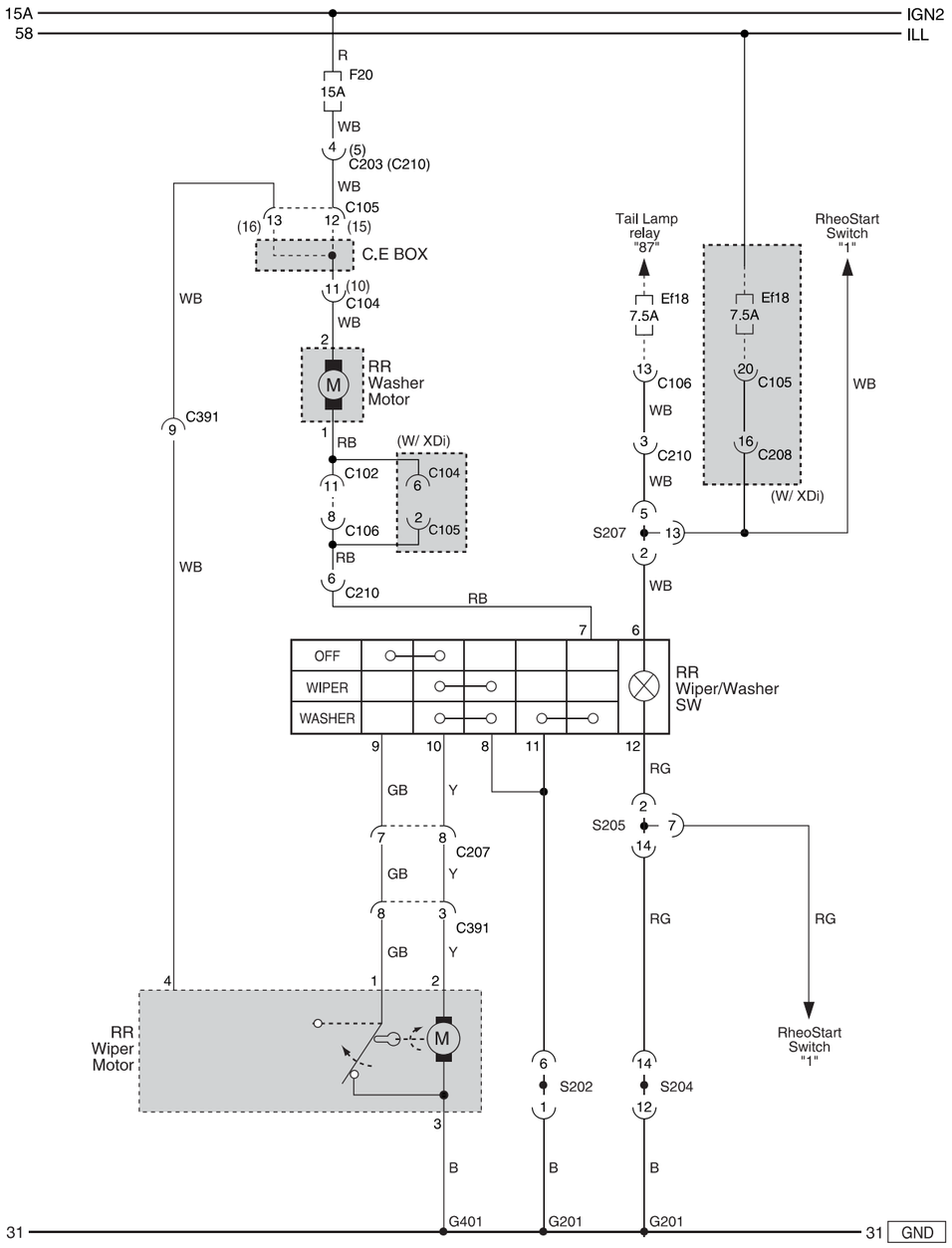


Modification basis	
Application basis	
Affected VIN	

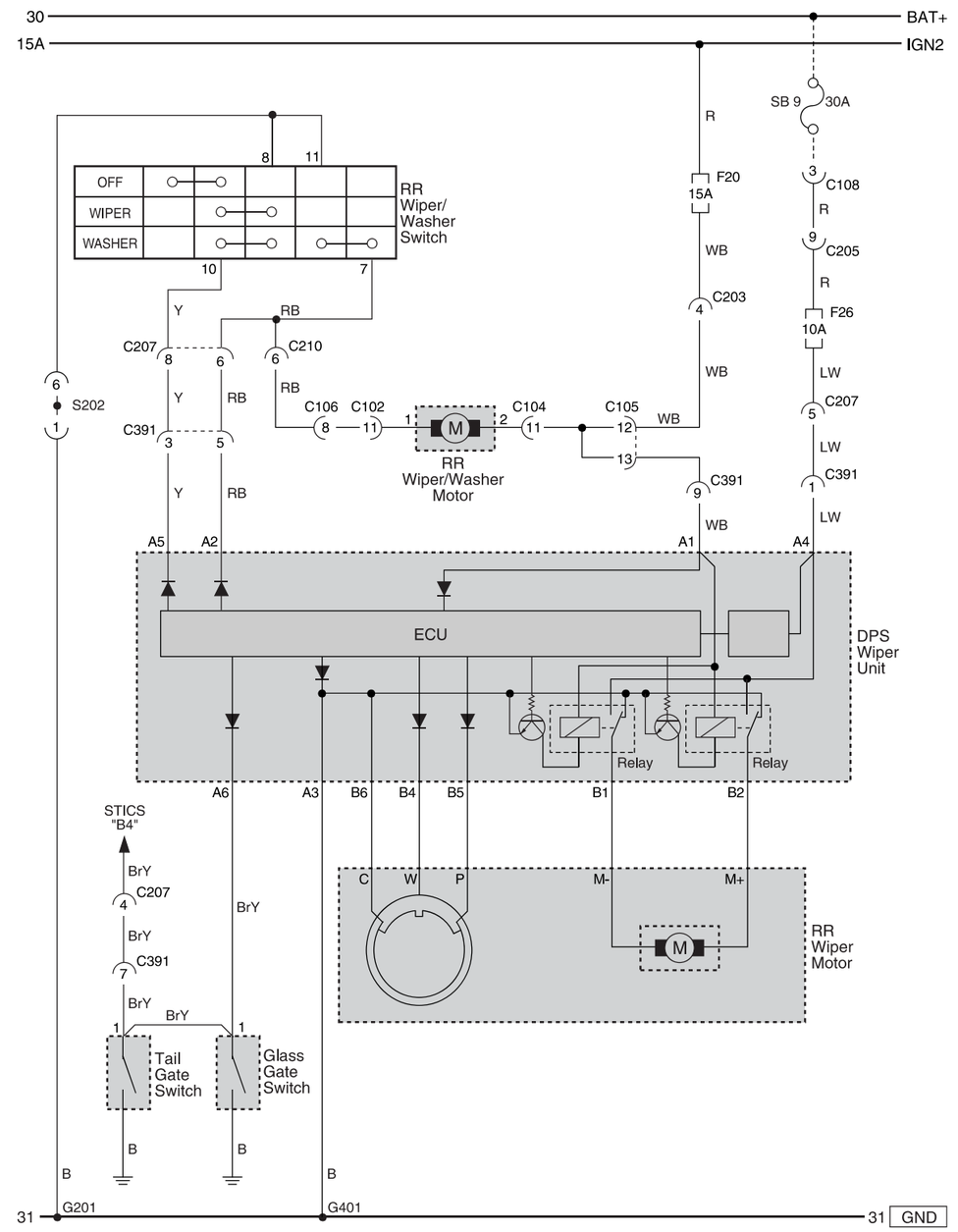
S.G.N. 7830-02

REAR GLASS WIPER & WASHER CIRCUIT

1) REAR GLASS WIPER & WASHER (W/O FLIP UP GLASS)

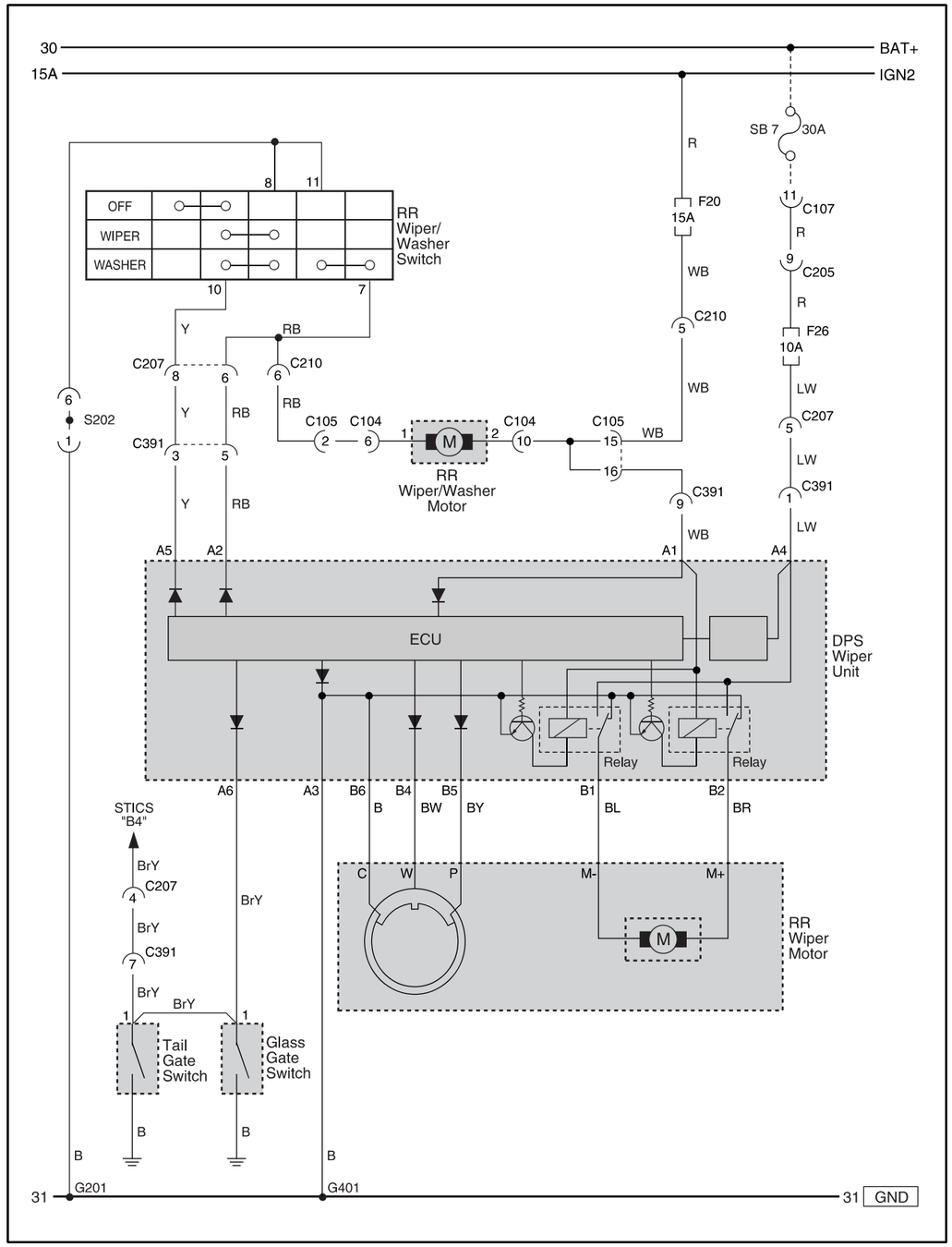


2) REAR GLASS DPS WIPER & WASHER (W/ FLIP UP GLASS)



Modification basis	
Application basis	
Affected VIN	

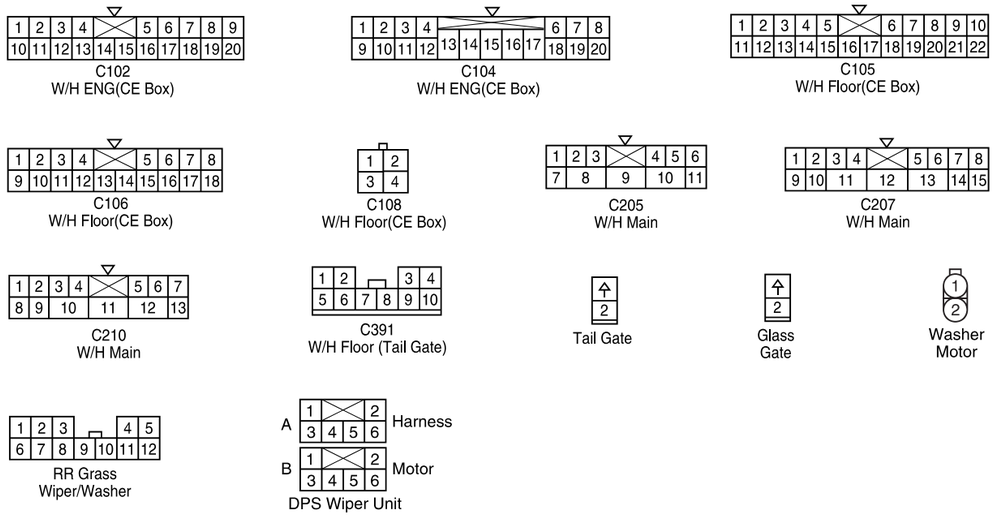
3) REAR GLASS DPS WIPER & WASHER (W/ FLIP UP GLASS) (XDi)



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
C391 (10Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
G201	W/H Main	Inside Driver Side Cowl PNL	
G401	W/H Floor	Center the Tail Gate	

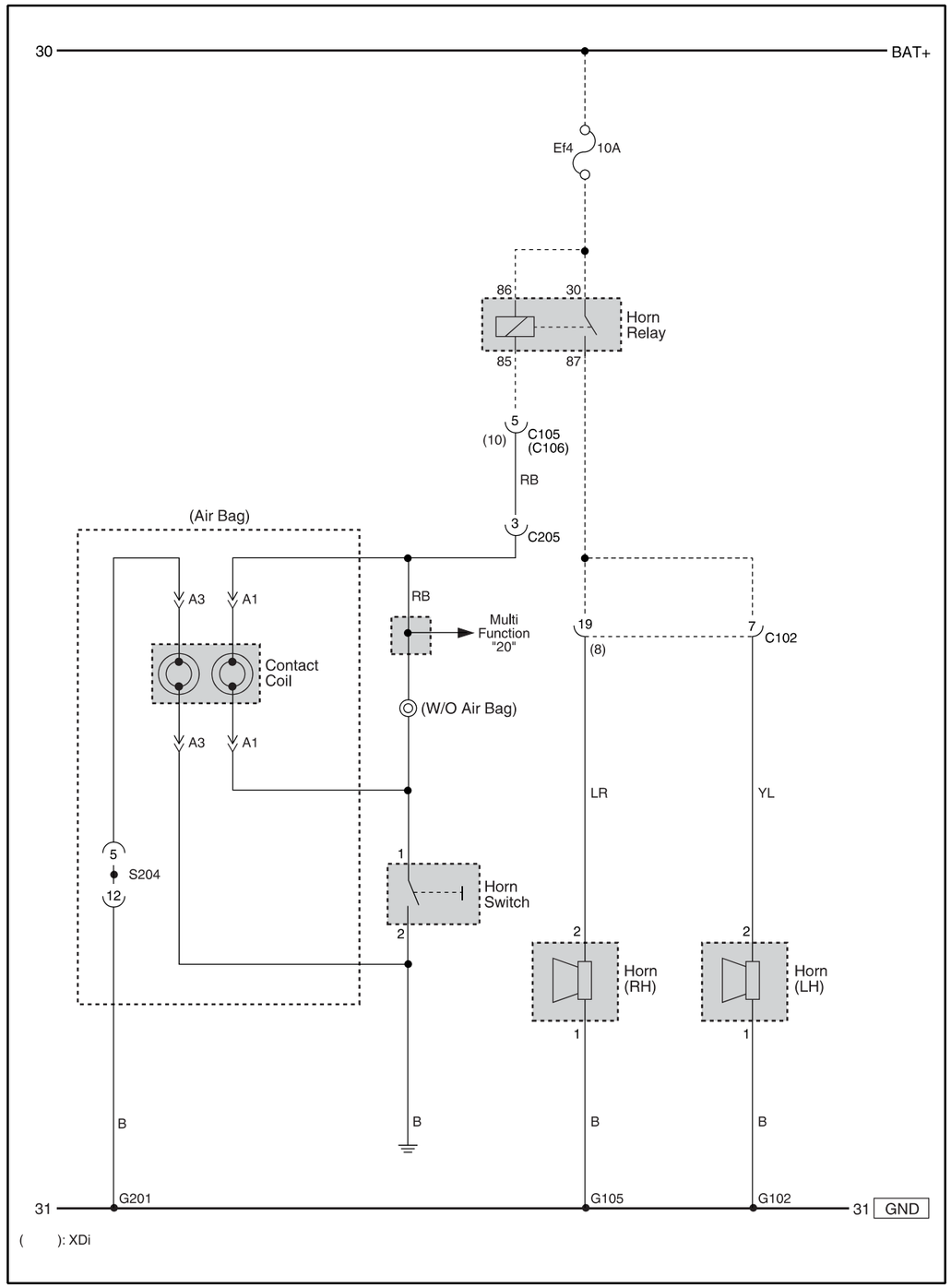
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8610-10

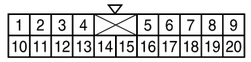
HORN CIRCUIT



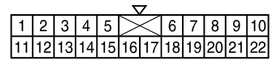
(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
G102	W/H Engine	Center BATT	
G105	W/H Engine	Behind the Right Head Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	

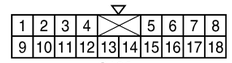
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



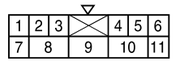
C102
W/H ENG(CE Box)



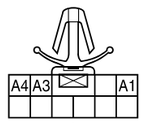
C105
W/H Floor(CE Box)



C106
W/H Floor(CE Box)



C205
W/H Main



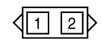
Horn/Audio
Contact Coil
(Colum Side)



Horn Contact
(Steering)



Audio Contact
(Steering)

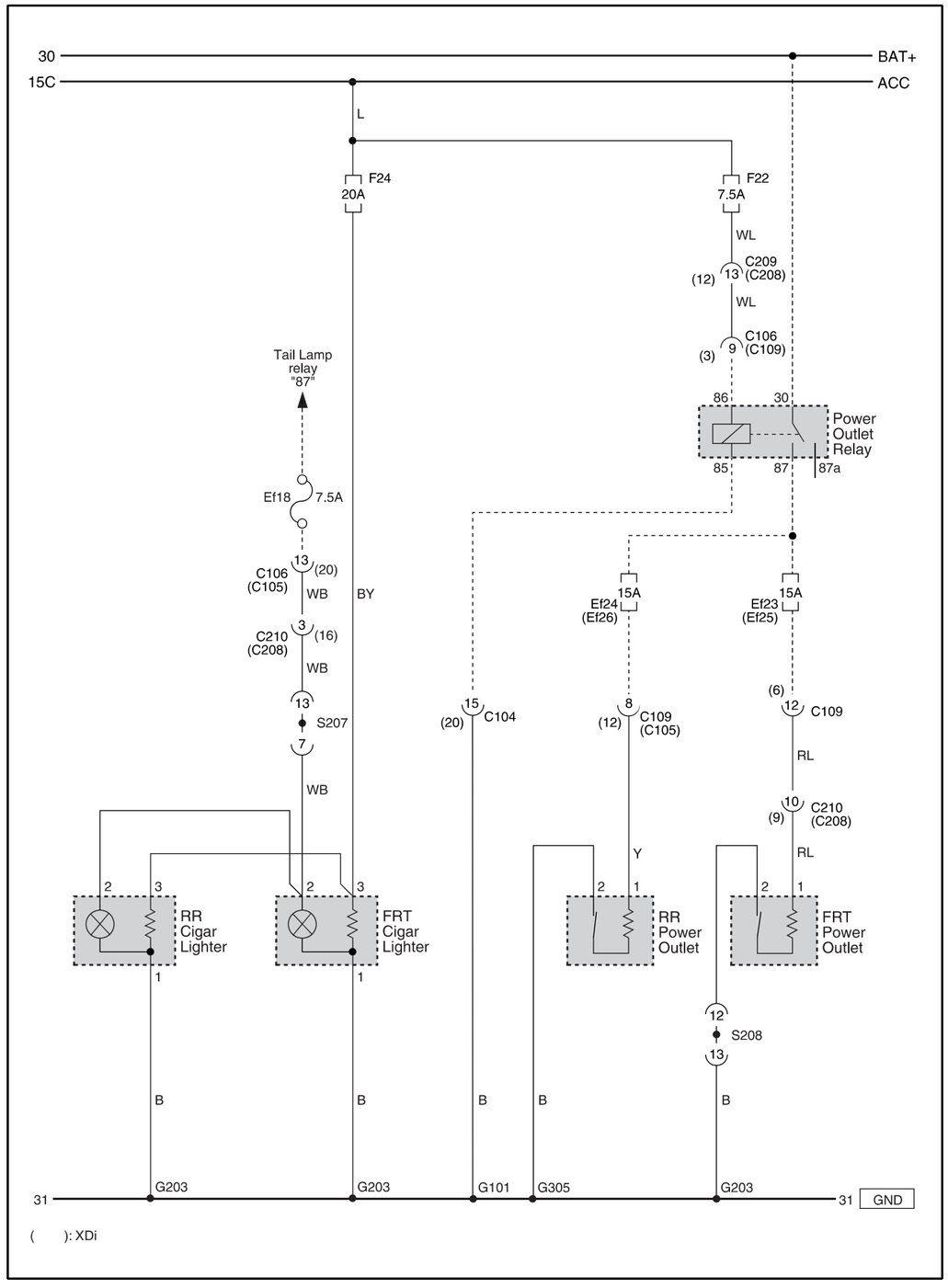


Horn

Modification basis	
Application basis	
Affected VIN	

S.G.N. 7632-20

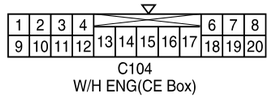
CIGAR LIGHTER CIRCUIT



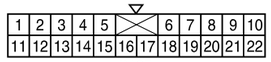
(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
S208 (14Pin, Black)	W/H Main	Behind the Right the FATC	
G101	W/H Engine	Center the Engine Room Fuse Box	
G203	W/H Engine	Under the Seat Heating SW	W/H Air Bag
G305	W/H Floor	Behind the Quarter Grass #1	

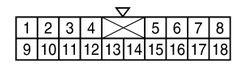
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



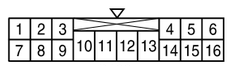
C104
W/H ENG(CE Box)



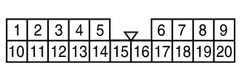
C105
W/H Floor(CE Box)



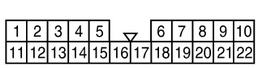
C106
W/H Floor(CE Box)



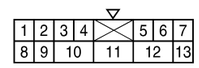
C109
W/H Floor(CE Box)



C208
W/H Main



C209
W/H Main



C210
W/H Main



Cigar Ligther
(FRT)



Cigar Ligther
(RR)

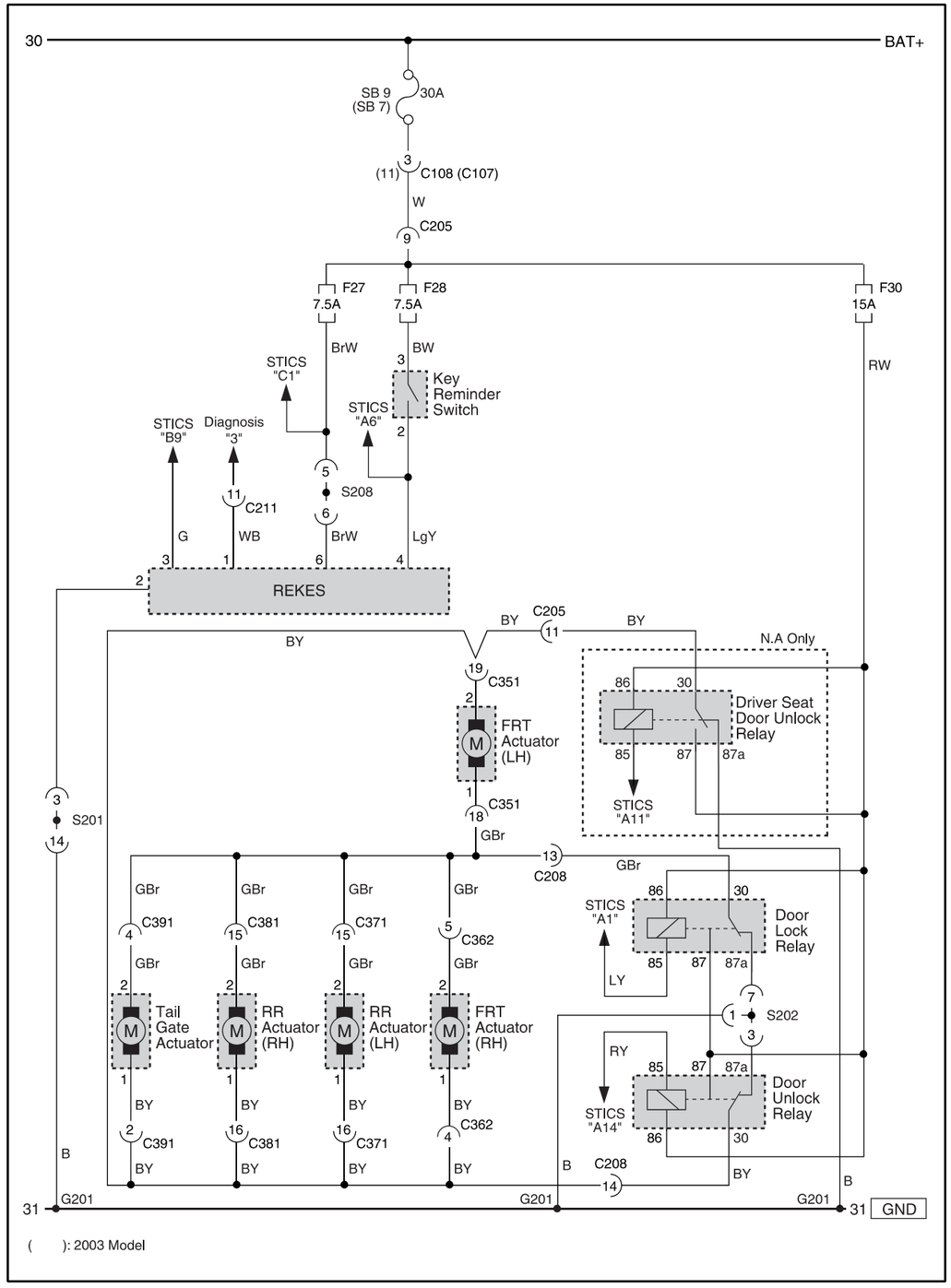


PWR
Outlet

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8711-02

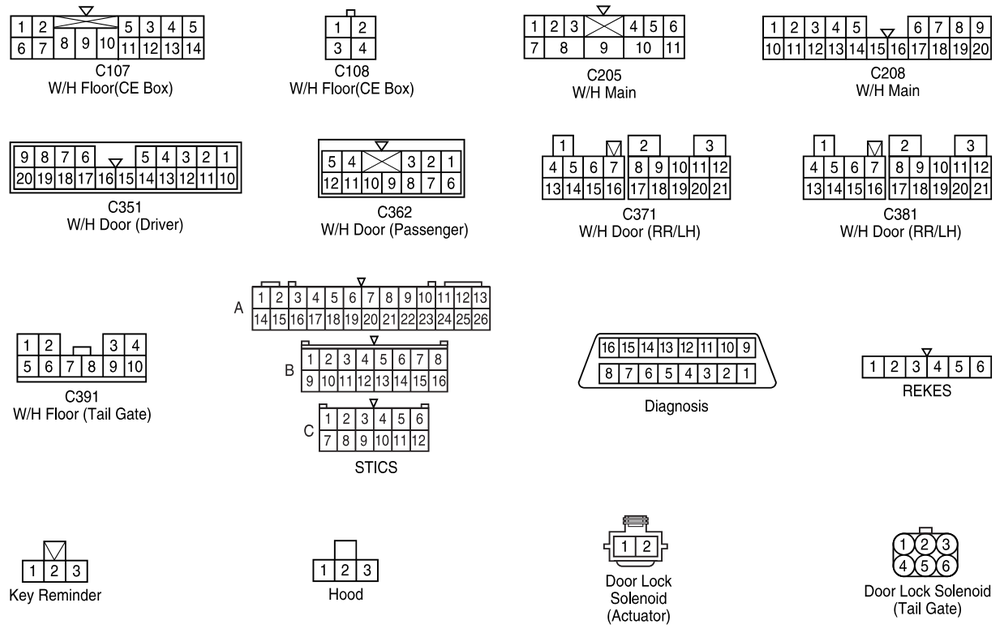
REKES CIRCUIT (~ 2003 MODEL)



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C362 (12Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C371 (21Pin, White)	Floor - RR Left Door	Under Left "B" Filler	
C381 (21Pin, White)	Floor - RR Right Door	Under Right "B" Filler	
C391 (10Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S208 (14Pin, Black)	W/H Main	Behind the Right the FATC	
G201	W/H Main	Inside Driver Side Cowl PNL	

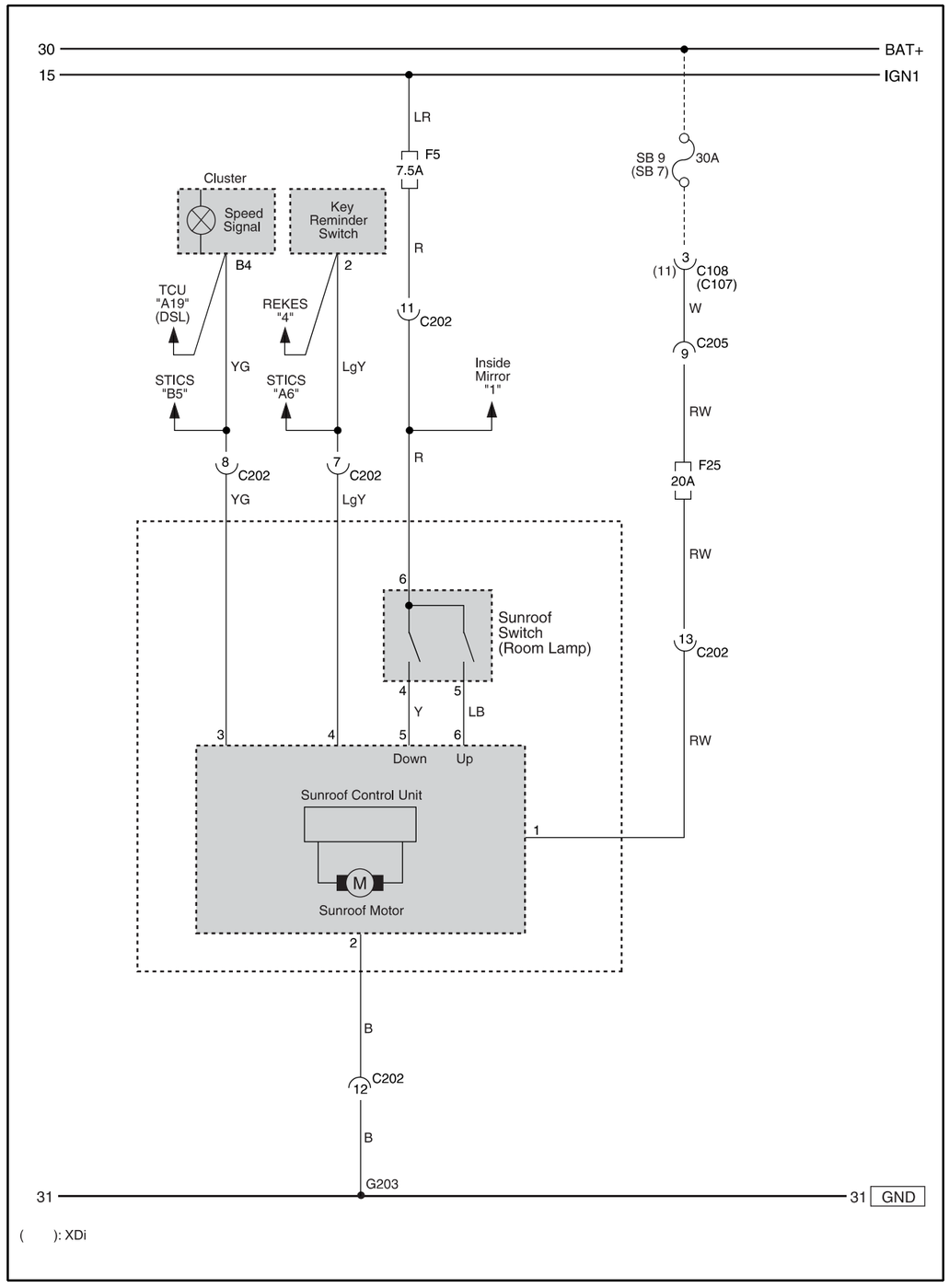
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 7340-03

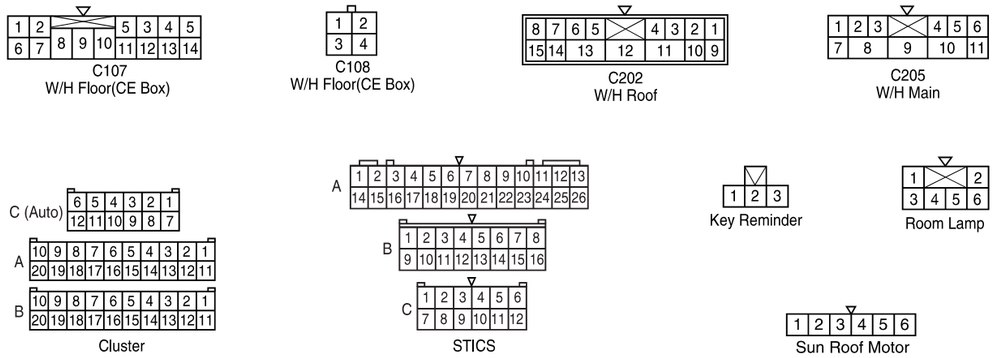
SUN ROOF CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C202 (15Pin, White)	Main - Roof	Under the I/P Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
G201	W/H Main	Inside Driver Side Cowl PNL	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



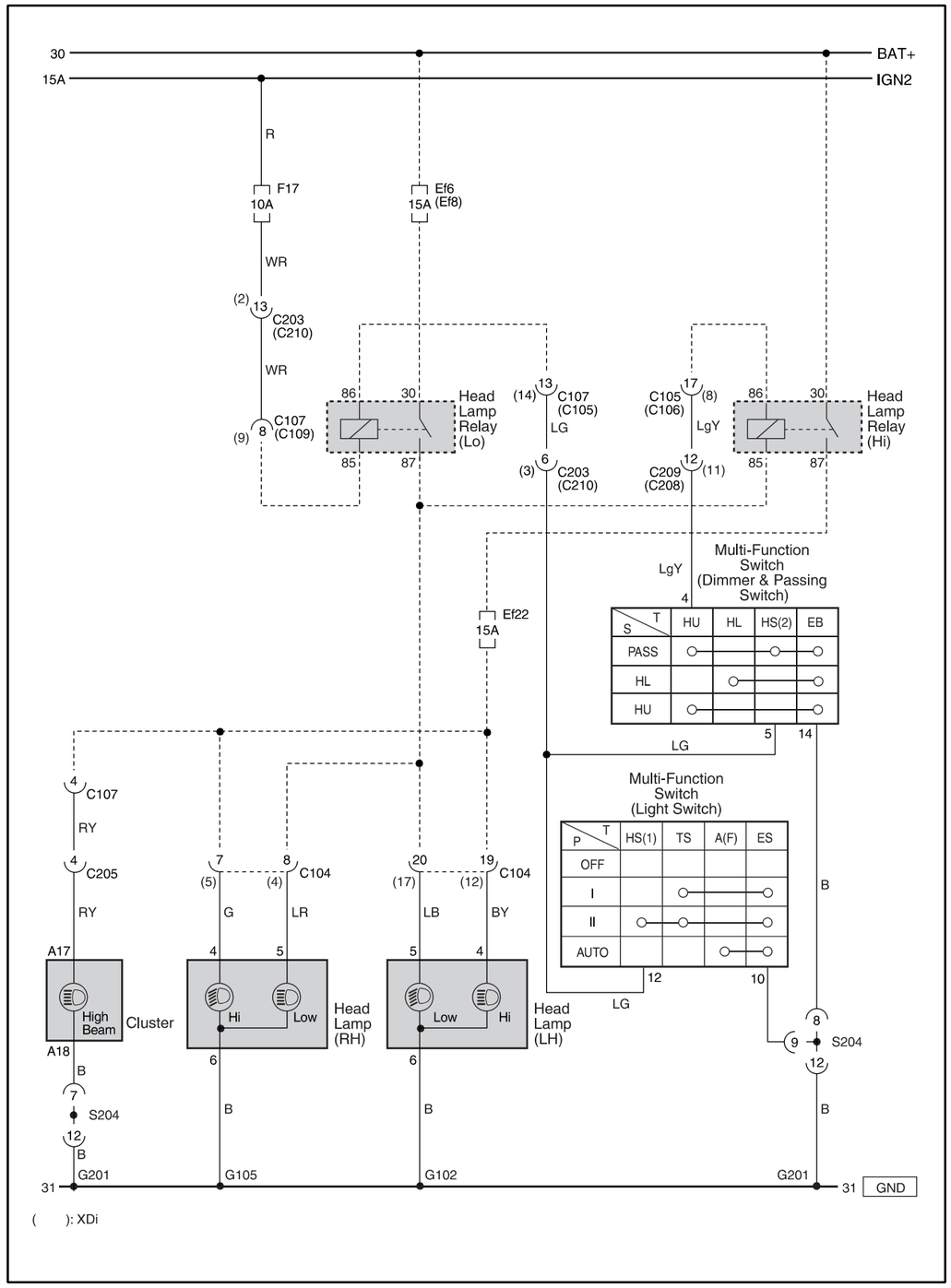
CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8310-01

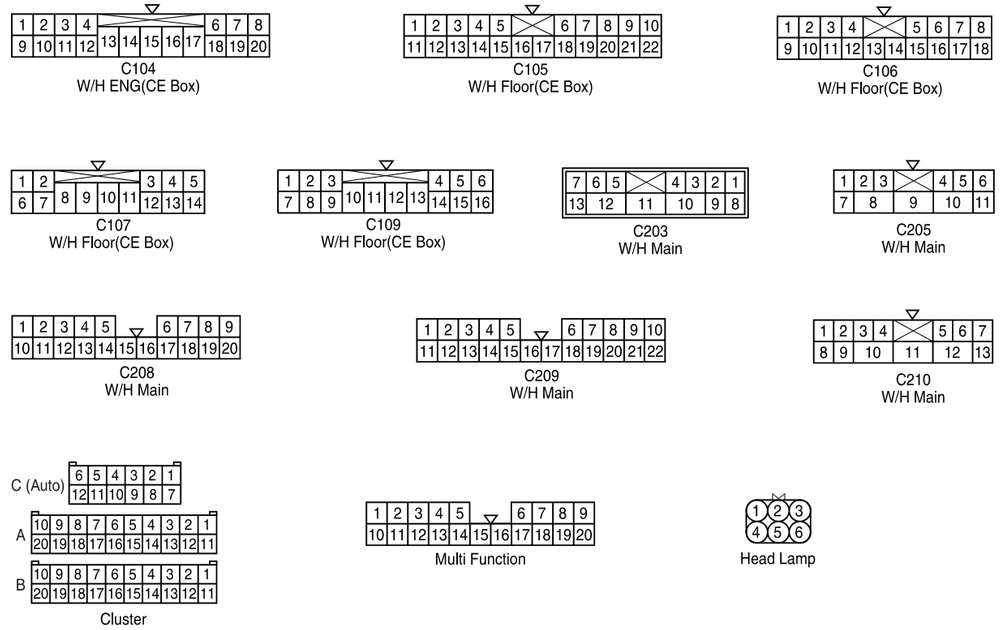
HEAD LAMP CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	GND
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	
G102	W/H Engine	Center BATT	
G105	W/H Engine	Behine the Right Head Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	

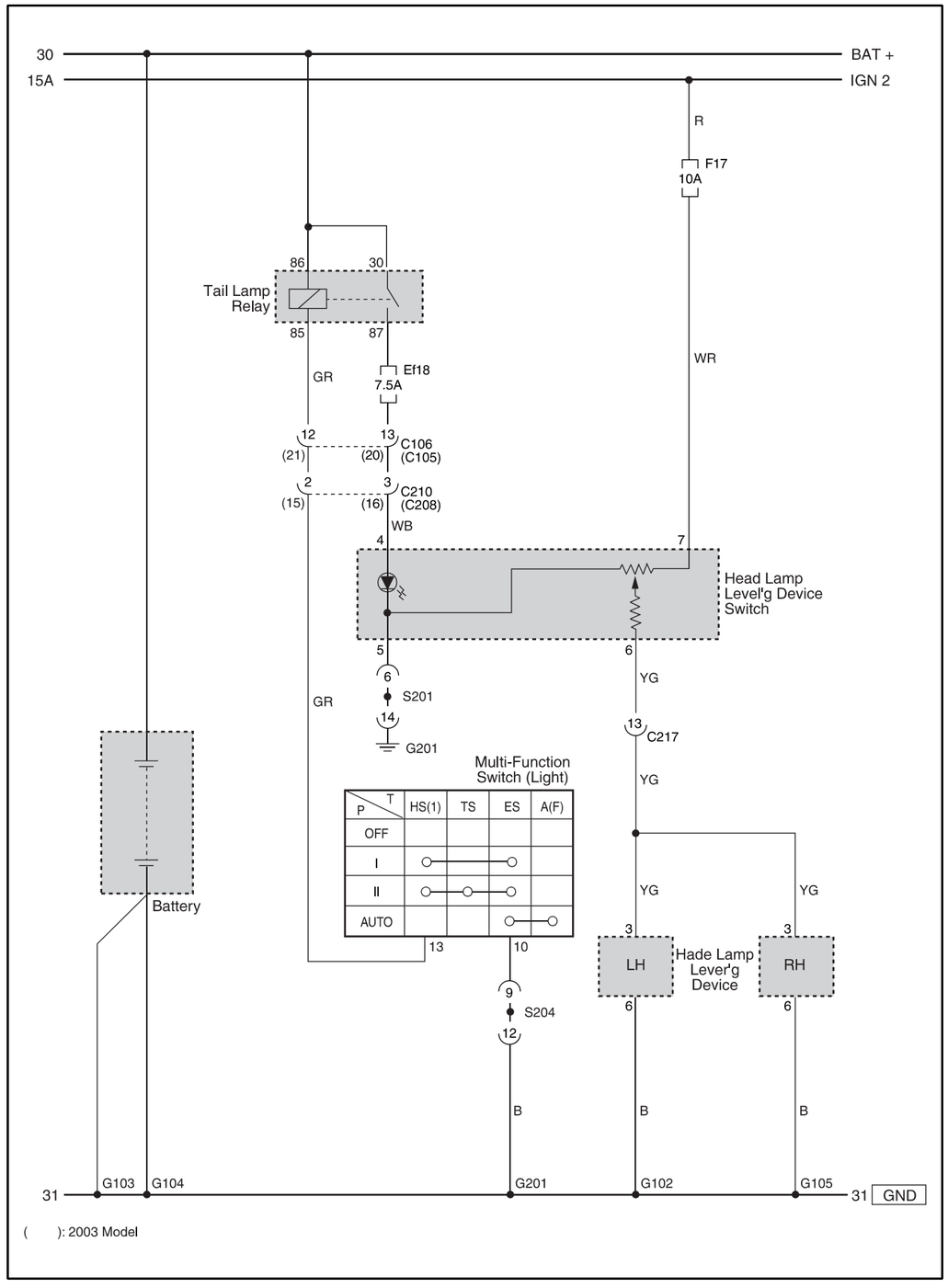
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8310-01

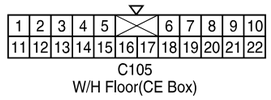
HEAD LAMP LEVELING DEVICE CIRCUIT

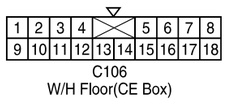


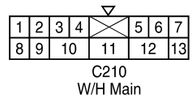
(1) CONNECTOR INFORMATION

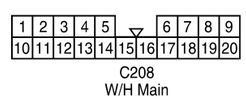
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C217 (20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
G102	W/H Engine	Center BATT	
G105	W/H Engine	Behine the Right Head Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	GND

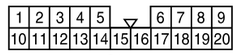
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION


C105
W/H Floor(CE Box)


C106
W/H Floor(CE Box)

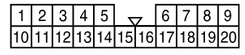

C210
W/H Main


C208
W/H Main


C217
W/H Main


Luggage Lamp


Head Lamp Level'g Device SW


Multi Function

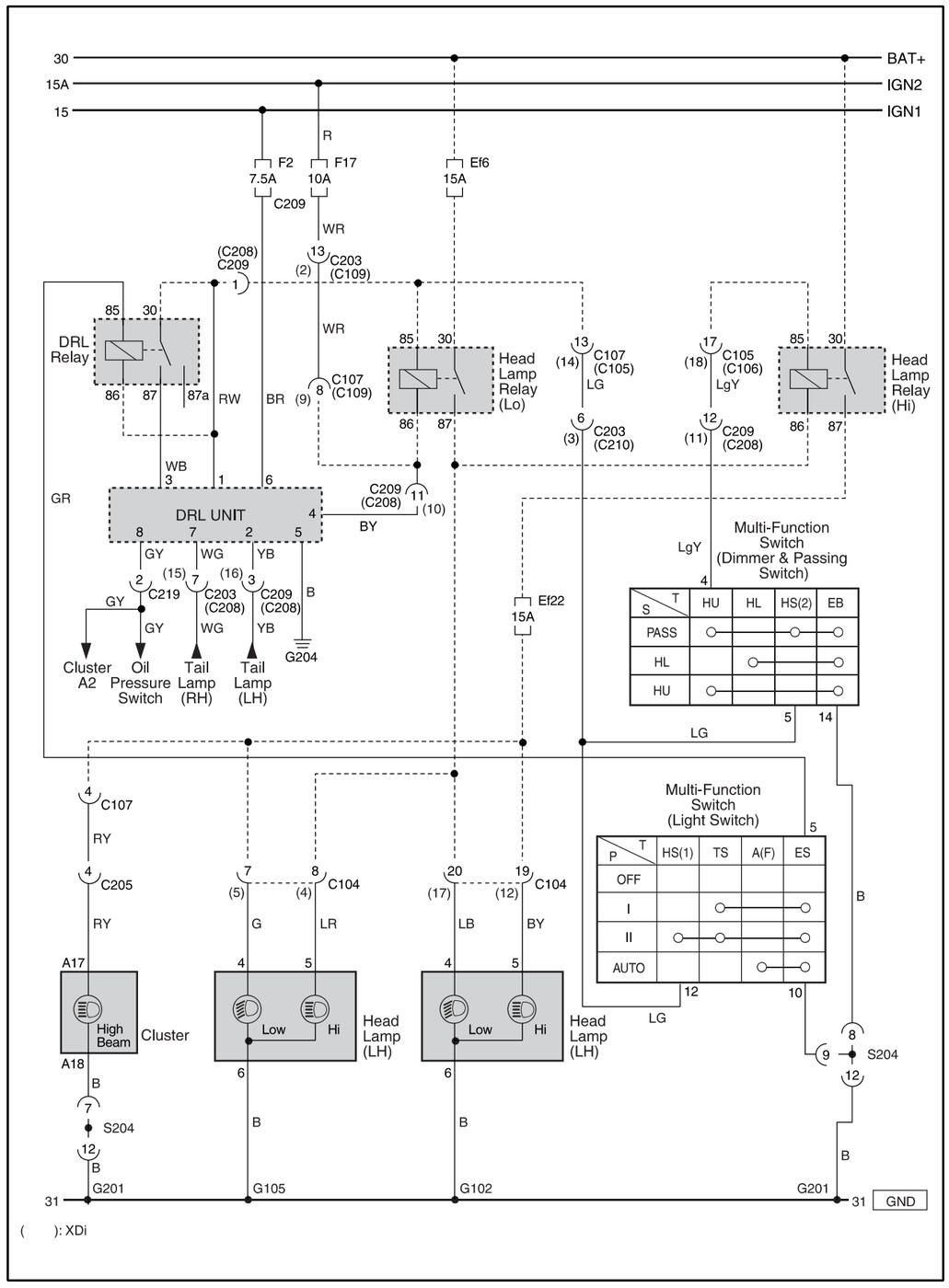
CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8310-01

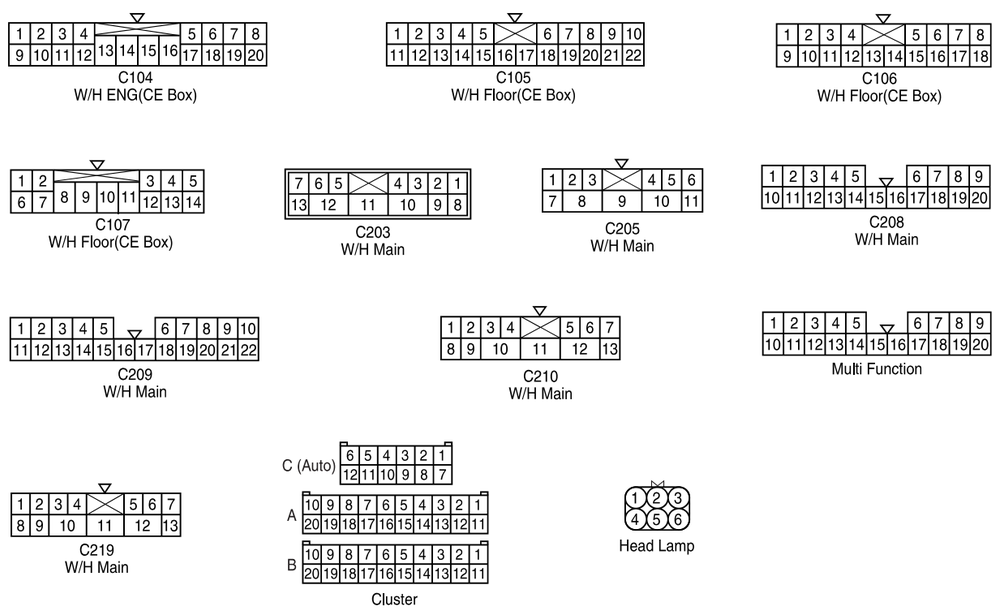
DRL (DAY TIME RUNNING LIGHT) UNIT (EU)



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
G102	W/H Engine	Center BATT	
G105	W/H Engine	Behine the Right Head Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	
G204	W/H Main	Inside Co-Driver Side Cowl PNL	

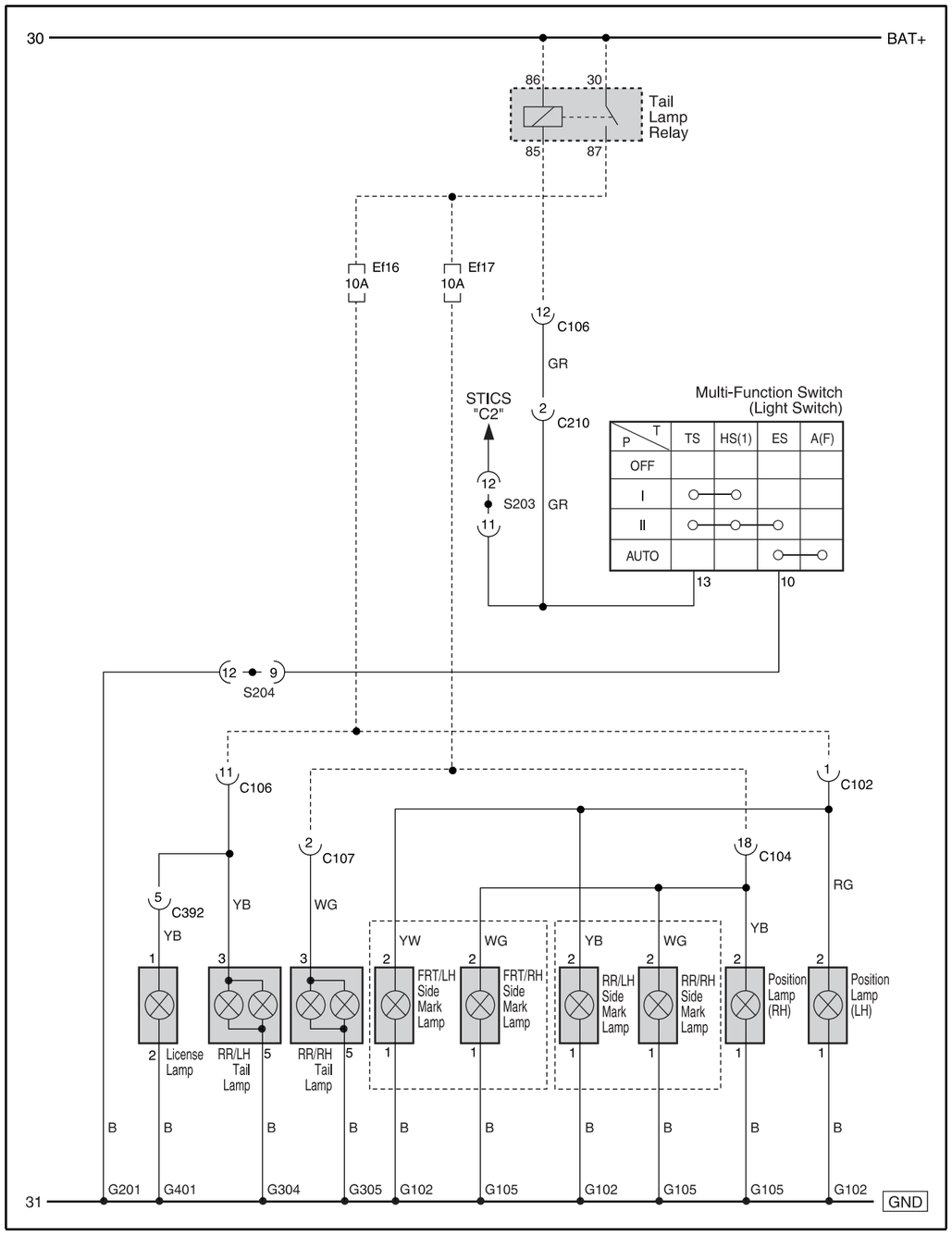
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



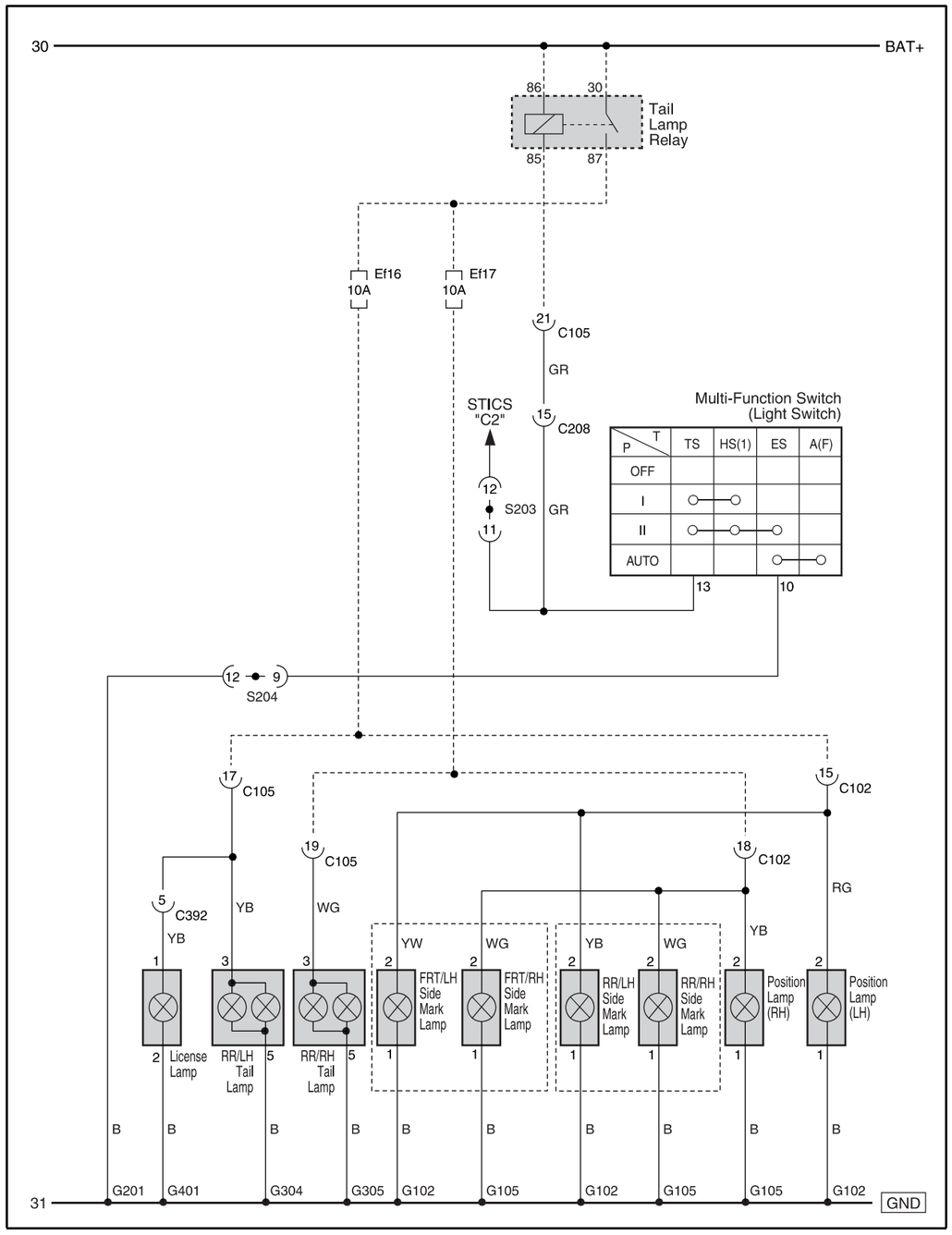
Modification basis	
Application basis	
Affected VIN	

S.G.N. 8320-01 TAIL LAMP CIRCUIT

1) ~ 2002 MODEL



2) 2003 MODEL

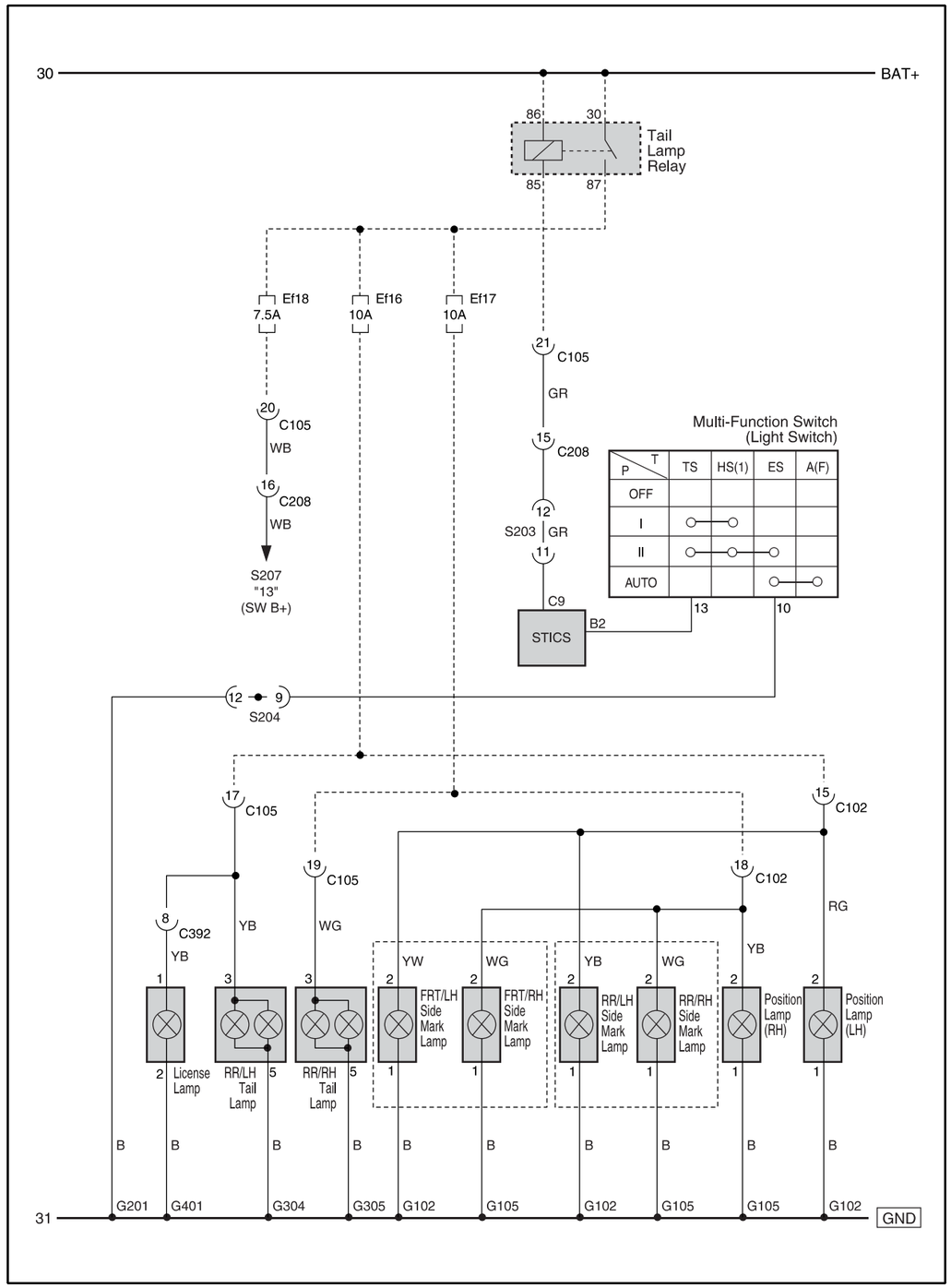


CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

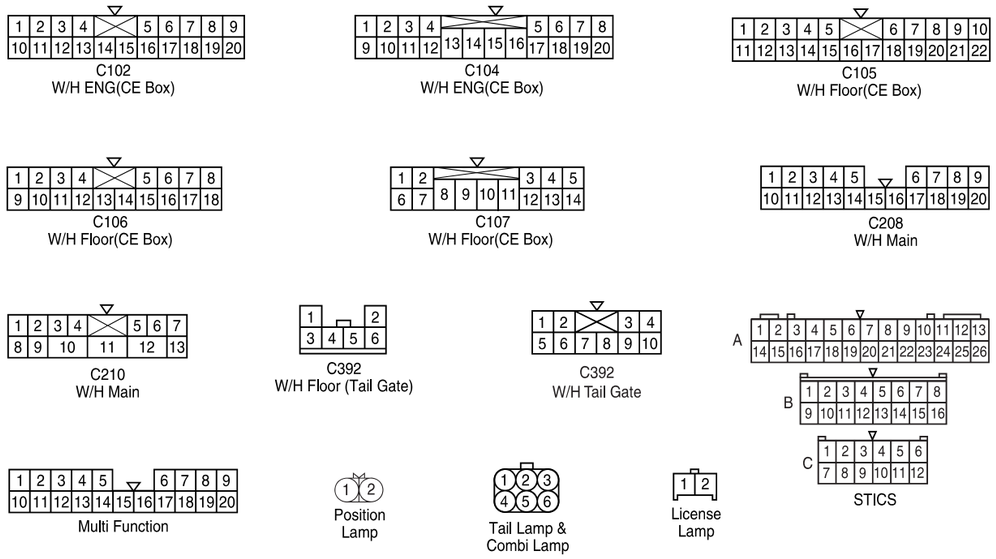
3) XDi



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
C392 (6Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
C392 (10Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
G102	W/H Engine	Center BATT	
G105	W/H Engine	Behine the Right Gead Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	
G304	W/H Floor	Behind the Quarter Grass #1	
G305	W/H Floor	Behind the Quarter Grass #1	
G401	W/H Floor	Center the Tail Gate	

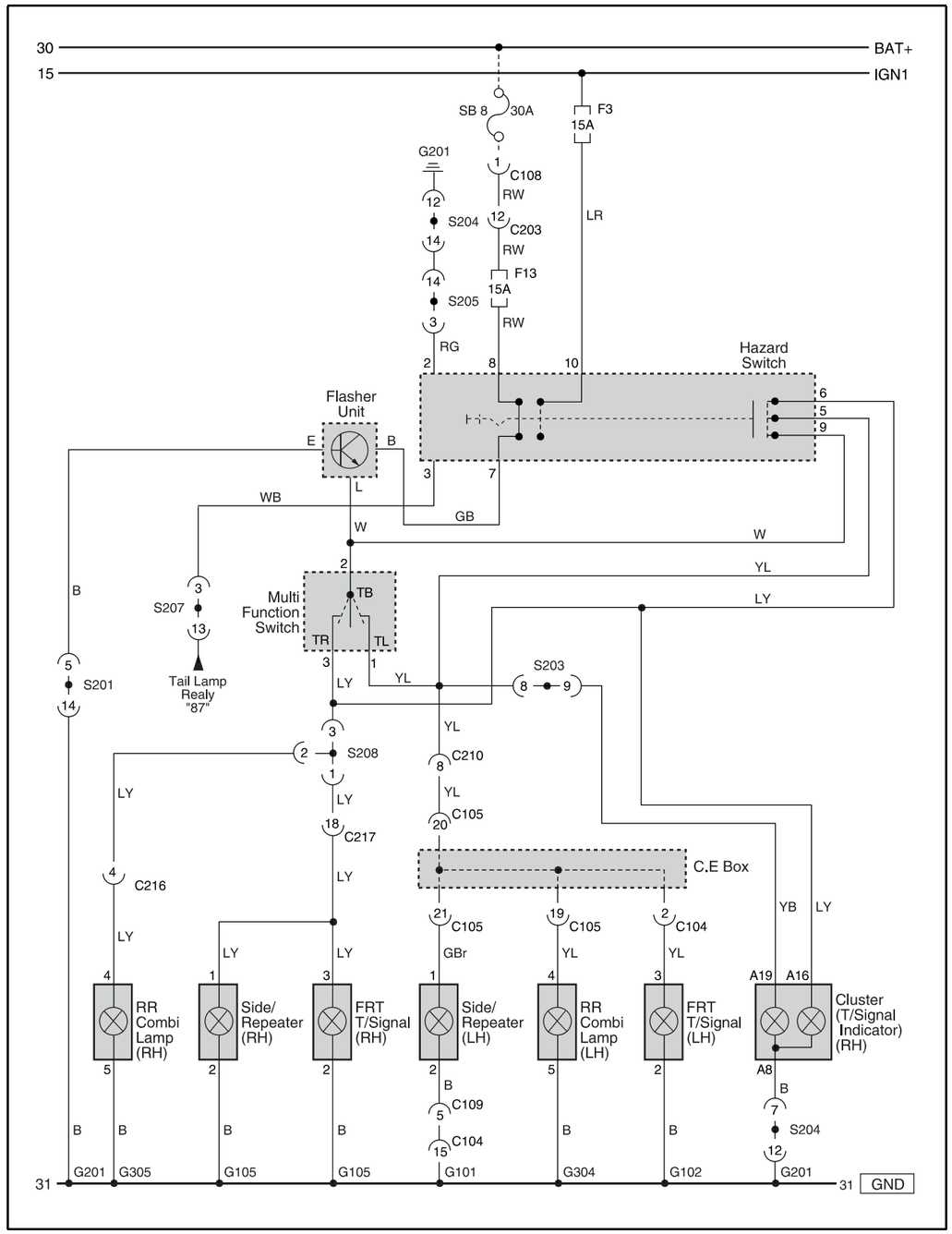
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



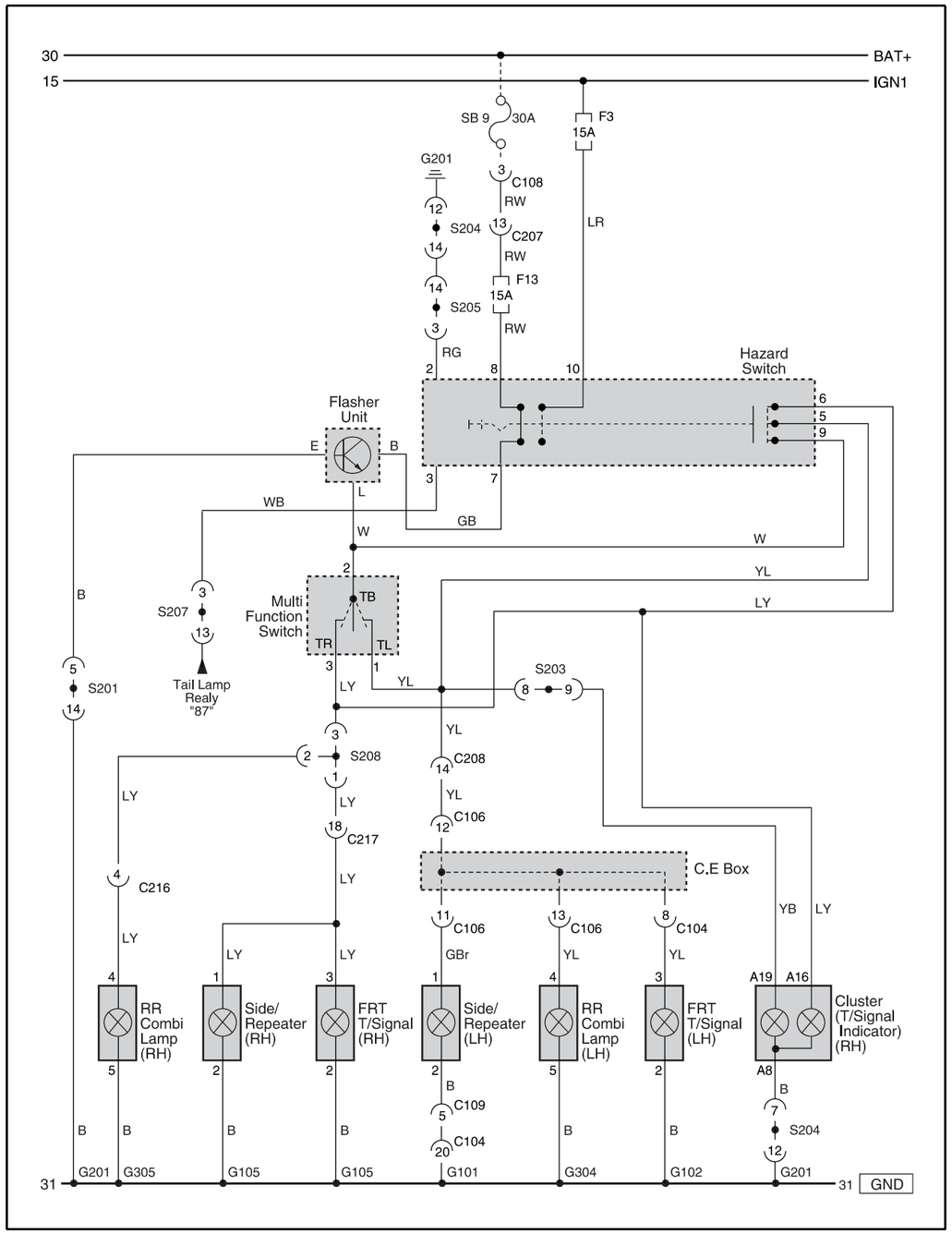
Modification basis	
Application basis	
Affected VIN	

S.G.N. 8310-01 TURN SIGNAL & HAZARD LAMP CIRCUIT

1) ~ 2002 MODEL



2) 2003 MODEL

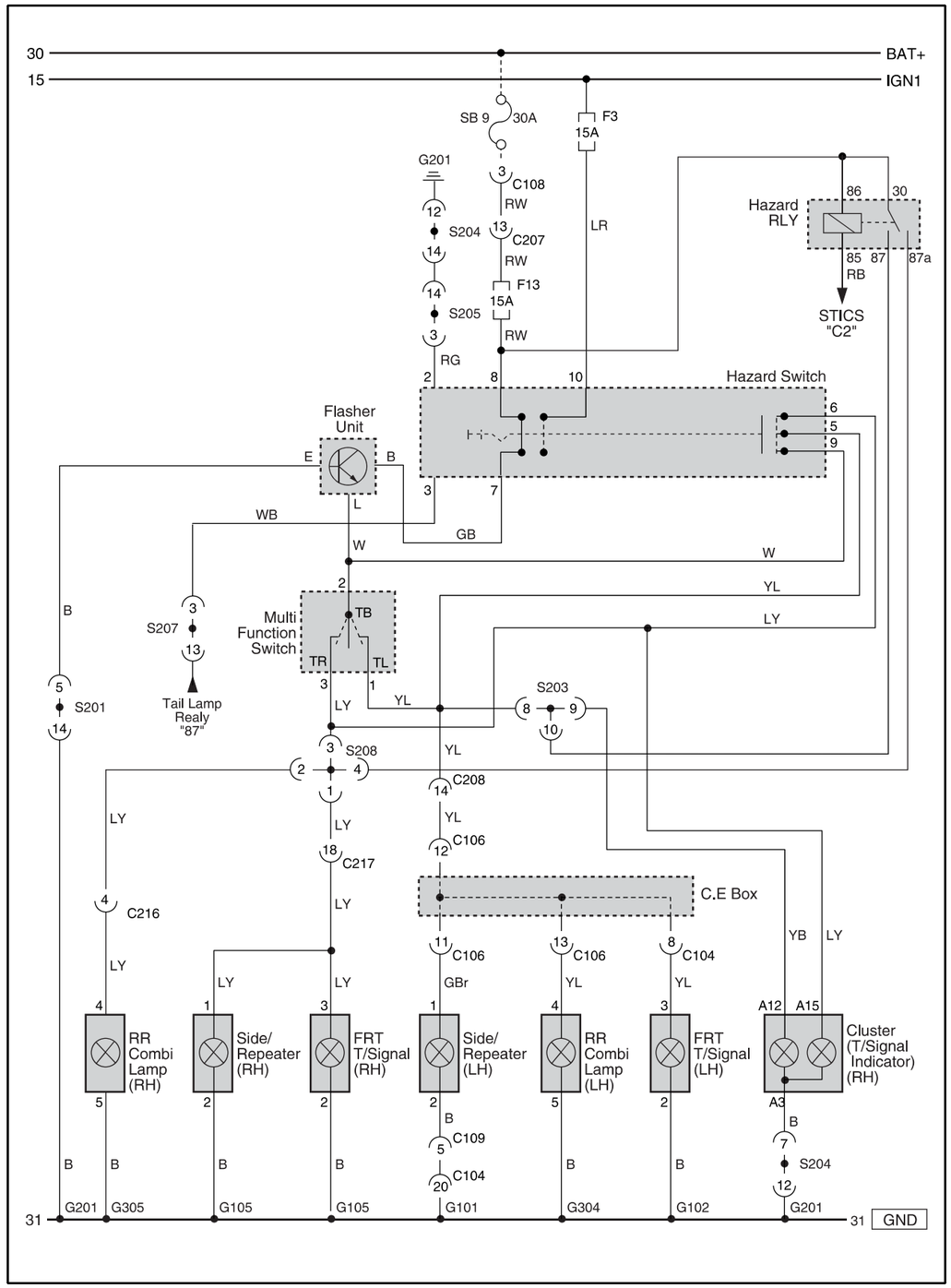


CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

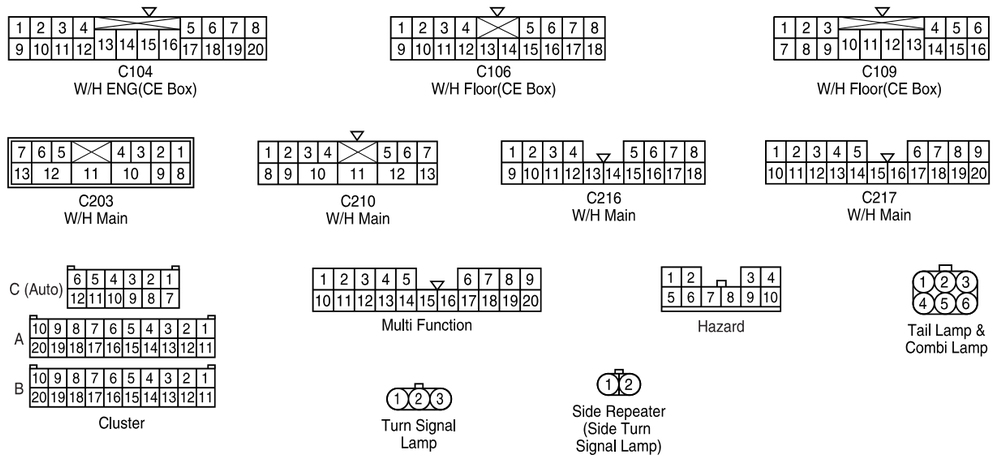
3) XDi



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C216 (18Pin, White)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S205 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
S208 (14Pin, Black)	W/H Main	Behind the Right the FATC	
G101	W/H Engine	Center the Engine Room Fuse Box	
G102	W/H Engine	Center BATT	
G105	W/H Engine	Behine the Right Gead Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	
G304	W/H Floor	Behind the Quarter Grass #1	
G305	W/H Floor	Behind the Quarter Grass #1	

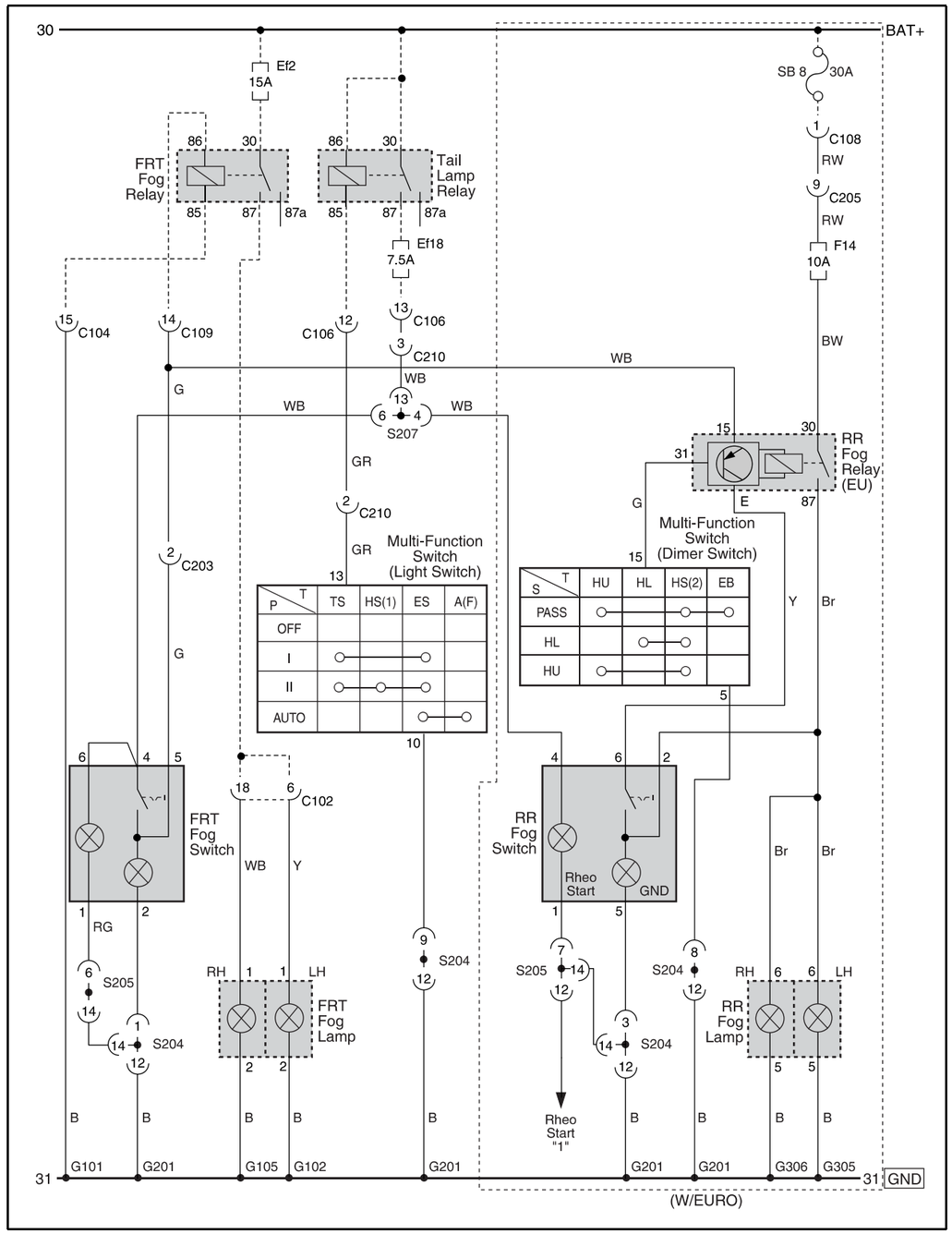
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



S.G.N. 8310-23

FOG LAMP CIRCUIT

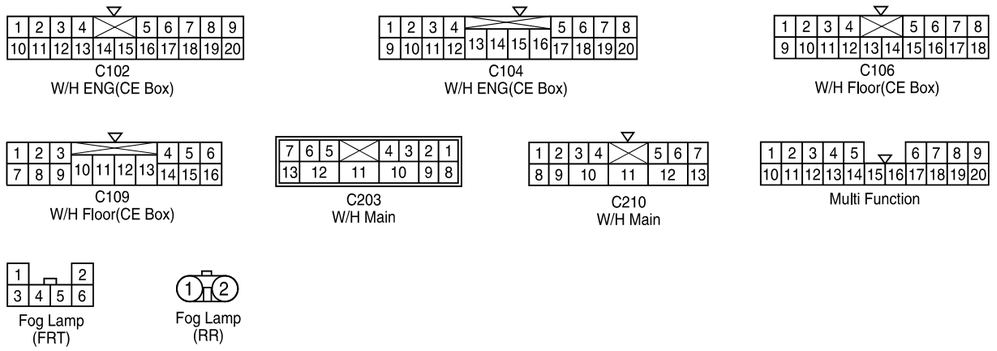
1) ~ 2002 MODEL



(1) CONNECTOR INFORMATION

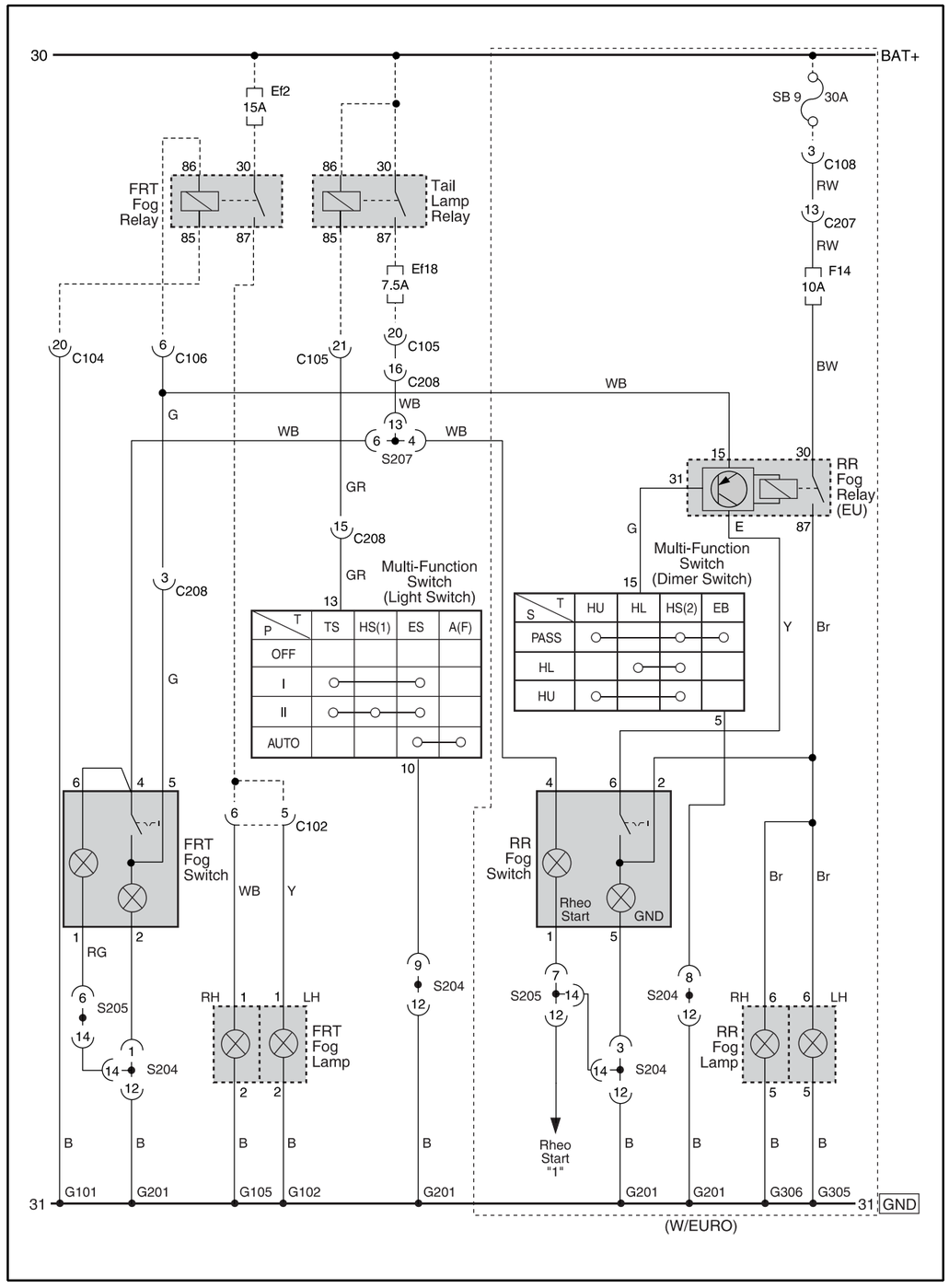
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C109 (14Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
G101	W/H Engine	Center the Engine Room Fuse Box	
G102	W/H Engine	Center BATT	
G105	W/H Engine	Behine the Right Head Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

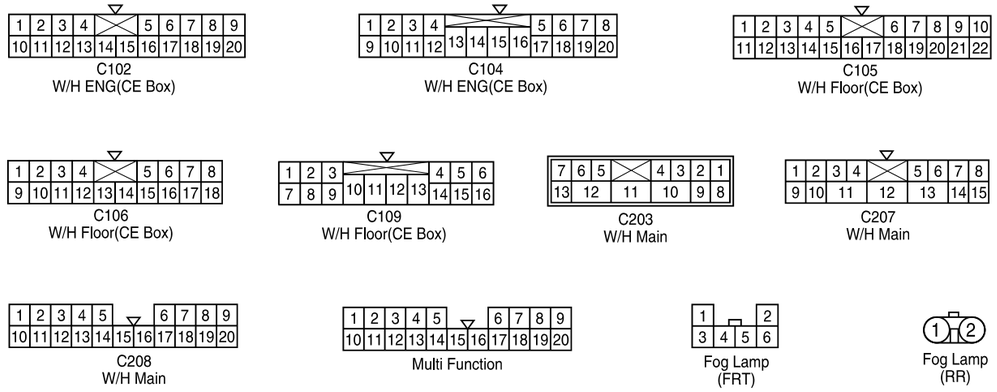
2) XDi



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C109 (14Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C210 (13Pin, Green)	Engine - Main (RH)	Inside Driver Side Cowl PNL	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
G101	W/H Engine	Center the Engine Room Fuse Box	
G102	W/H Engine	Center BATT	
G105	W/H Engine	Behine the Right Head Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	

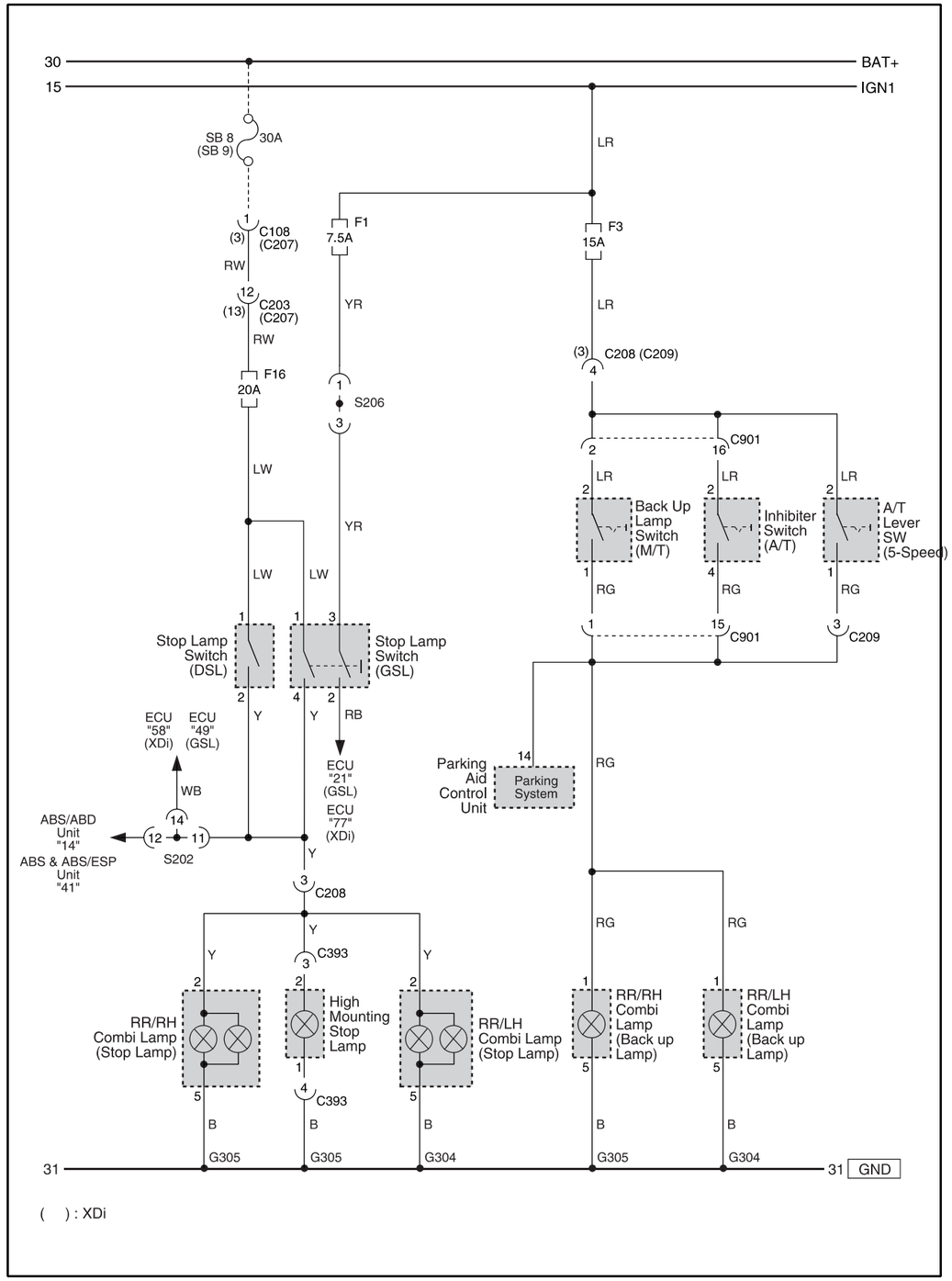
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8320-01

STOP & BACK UP LAMP CIRCUIT

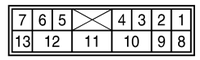


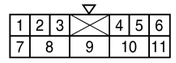
(1) CONNECTOR INFORMATION

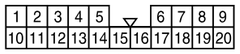
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	EEngine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C901 (2Pin, White)	Floor - T/M	Left the T/C (Under the Floor)	M/T
C901 (12Pin, White)	Floor - T/M	Left the T/C (Under the Floor)	XDi
C393 (4Pin, White)	Floor - RR Defogger	Inside the Upper the Tail Gate	
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S206 (14Pin, Black)	W/H Main	Behind the Left the FATC	
G304	W/H Floor	Behind the Quarter Grass #1	
G305	W/H Floor	Behind the Quarter Grass #1	

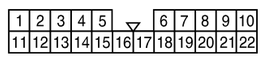
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION


C108
W/H Floor(CE Box)


C203
W/H Main


C205
W/H Main

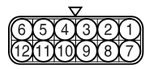

C208
W/H Main

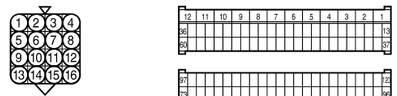

C209
W/H Main


C306
W/H Fuel Sender (GSL)

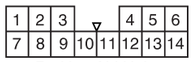

C393
W/H Tail Gate


C901
W/H Transmission (M/T)


C901
W/H Transmission(A/T)


C901
W/H Transmission(A/T)

ECU


Parking Aid Unit


Buzzer

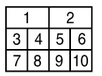

Stop Lamp


Stop Lamp (GSL)


Stop Lamp (DSL)


Back Up Lamp (M/T)


Inhibitor (A/T)


A/T Lever(DC5)


Tail Lamp & Combi Lamp

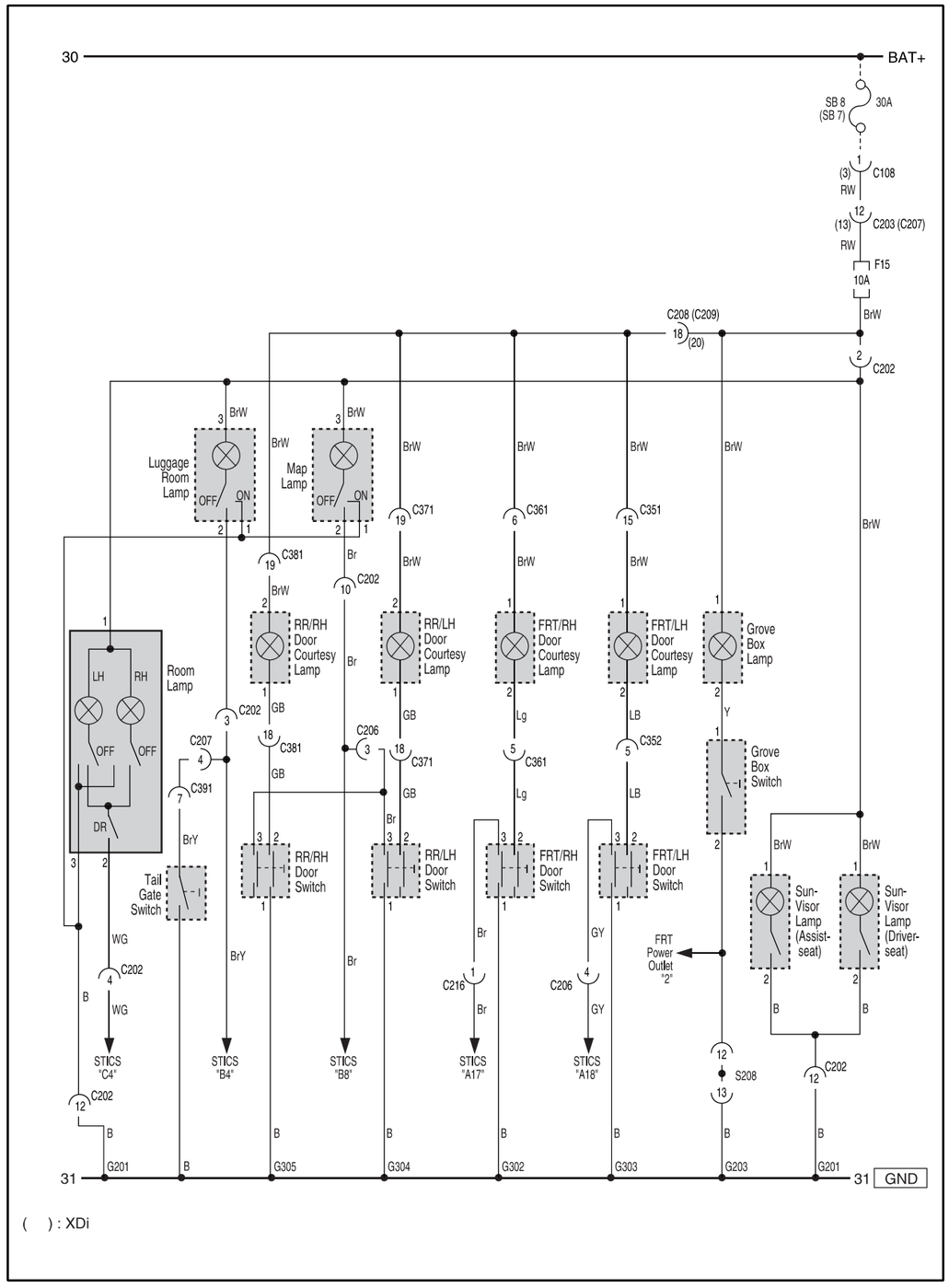
CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

S.G.N. 7770-08

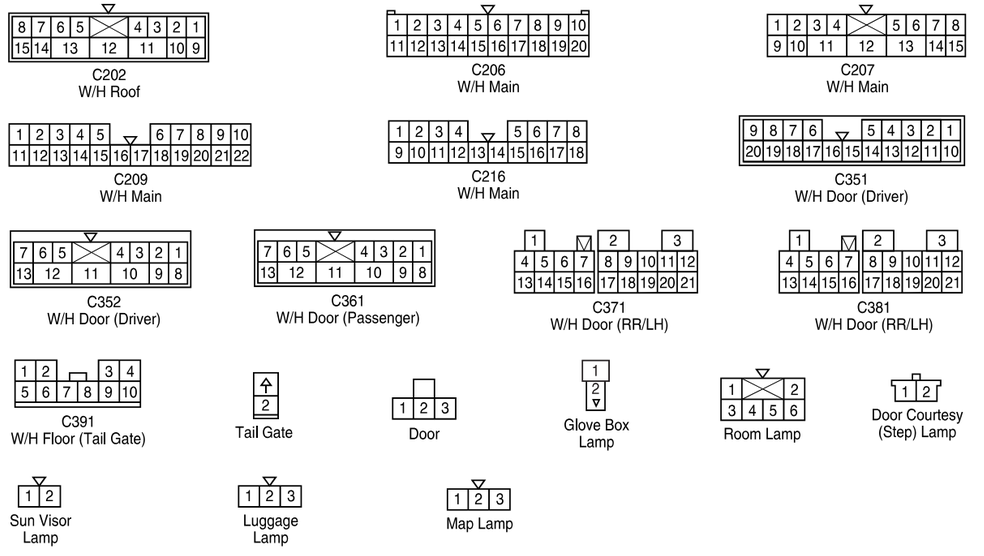
INTERIOR LAMP CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C202 (15Pin, White)	Main - Roof	Under the I/P Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C216 (18Pin, White)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C352 (13Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C361 (13Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C371 (21Pin, White)	Floor - RR Left Door	Under Left "B" Filler	
C381 (21Pin, White)	Floor - RR Right Door	Under Right "B" Filler	
C391 (10Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
G201	W/H Main	Inside Driver Side Cowl PNL	
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag
G302	W/H Floor	Under Driver Seat	
G303	W/H Floor	Under the Left "B" Filler	
G304	W/H Floor	Behind the Quarter Grass #1	
G305	W/H Floor	Behind the Quarter Grass #1	

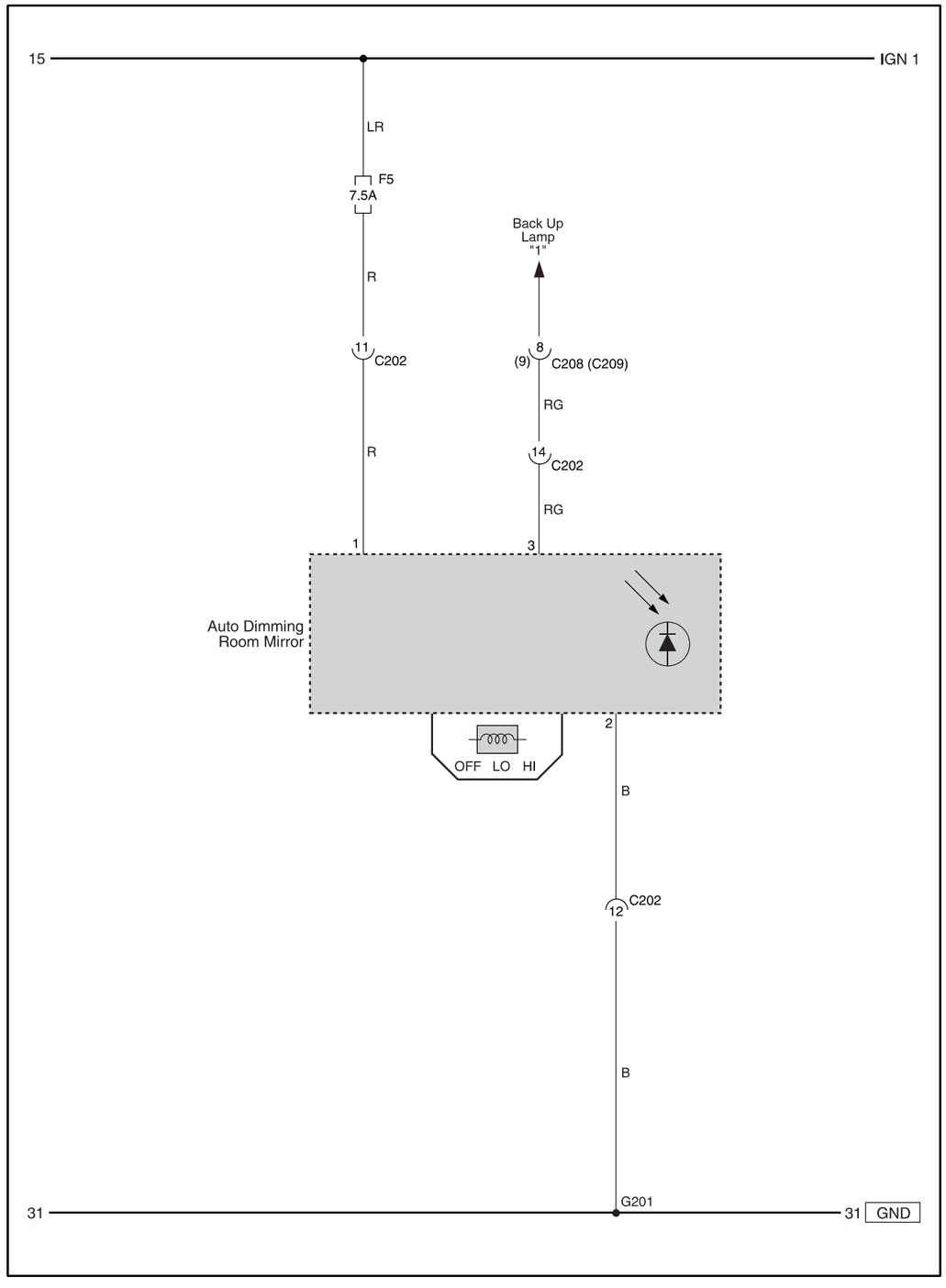
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 7770-03

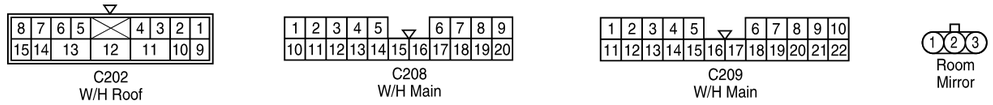
AUTO DIMMING ROOM MIRROR CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C202 (15Pin, White)	Main - Roof	Under the I/P Fuse Box	
C205 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
G201	W/H Main	Inside Driver Side Cowl PNL	

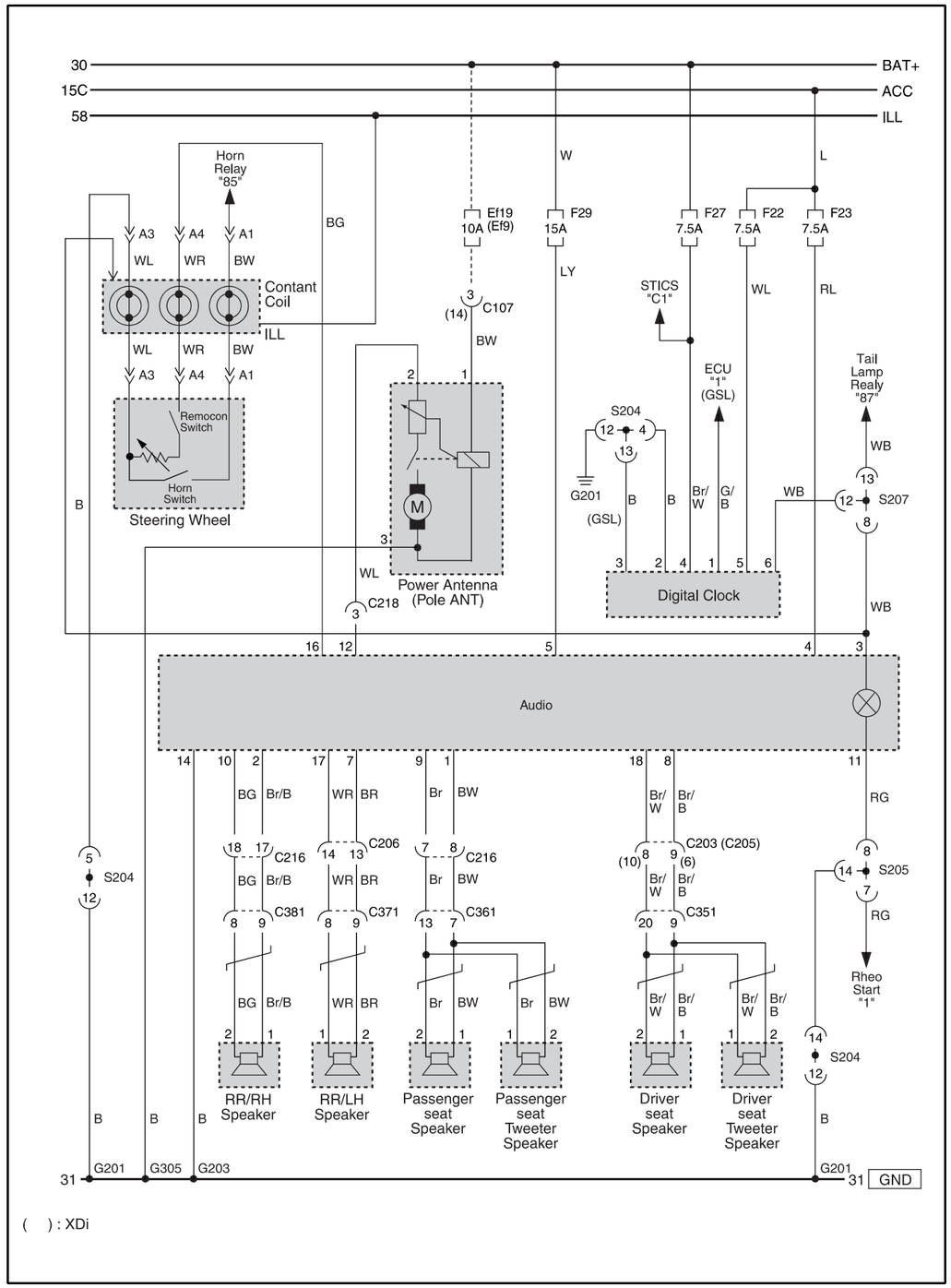
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8910-02

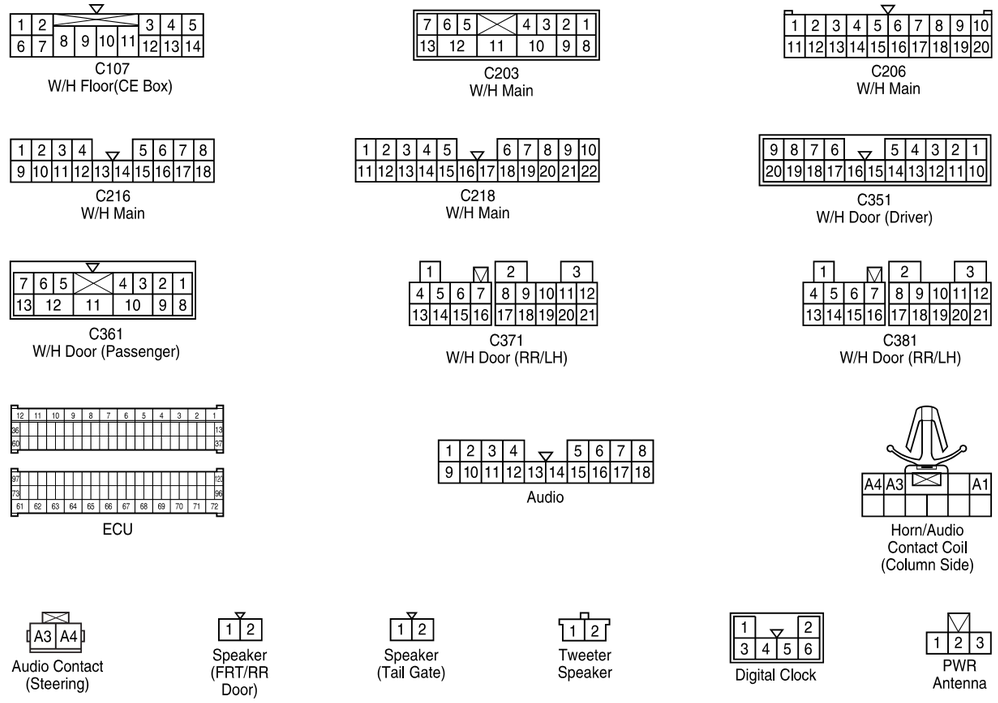
AUDIO, DIGITAL CIOCK CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C216 (18Pin, White)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C361 (13Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C371 (21Pin, White)	Floor - RR Left Door	Under Left “B” Filler	
C381 (21Pin, White)	Floor - RR Right Door	Under Right “B” Filler	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S205 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
G201	W/H Main	Inside Driver Side Cowl PNL	
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag
G305	W/H Floor	Behind the Quarter Grass #1	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

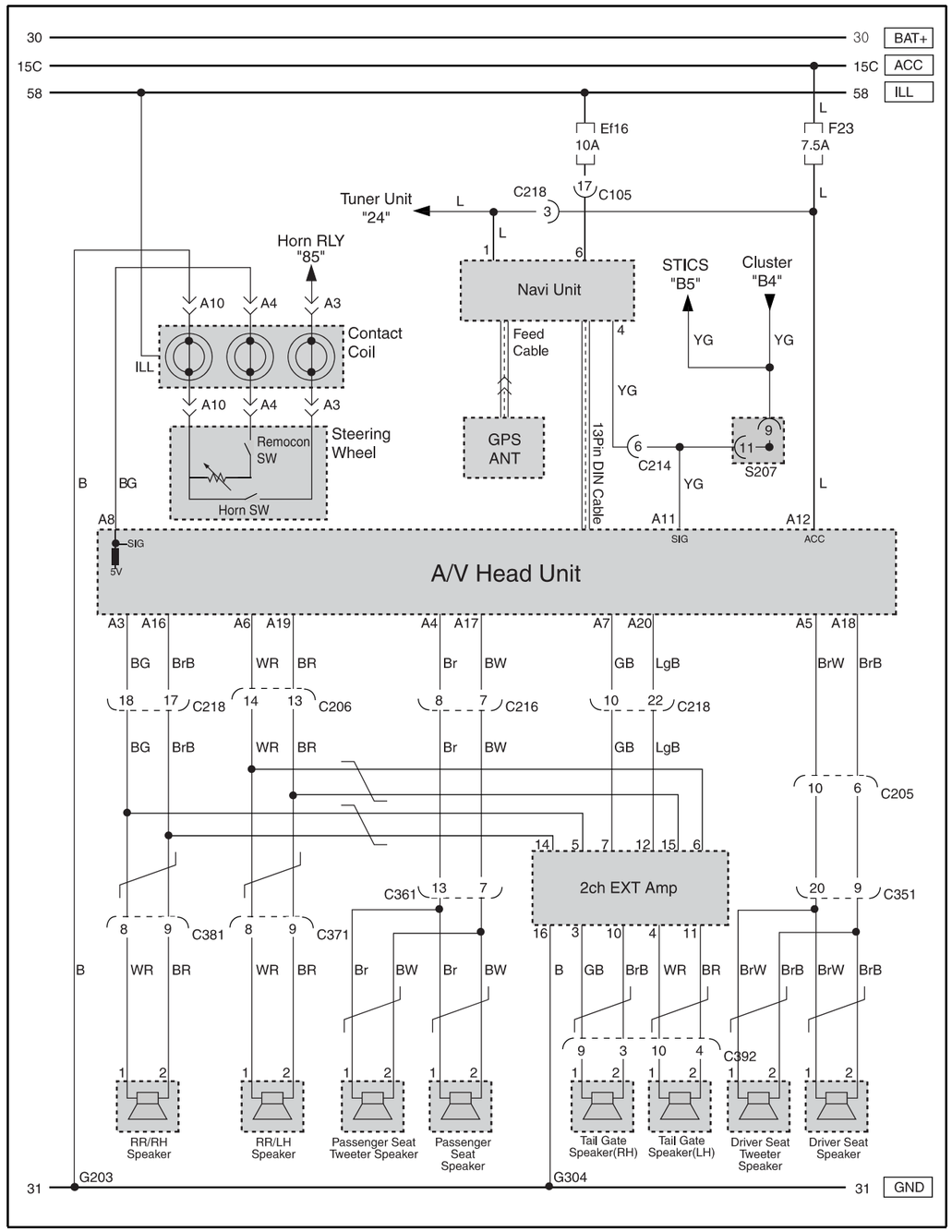


Modification basis	
Application basis	
Affected VIN	

S.G.N. 8931-01

AUDIO(MULTI VISION)

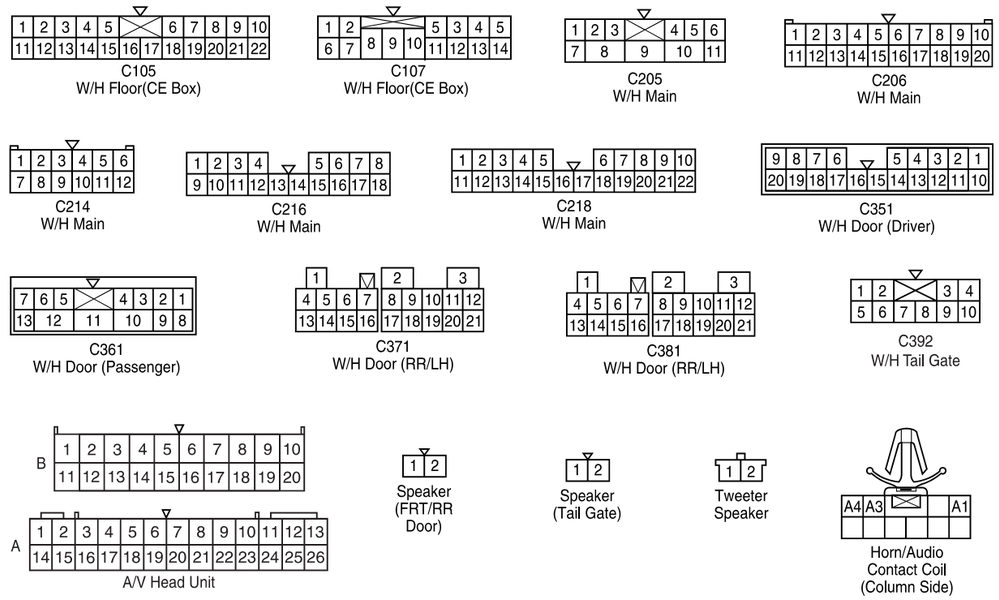
1) HEAD UNIT, 2CH EXT AMP, REMOCON, NAVI UNIT, GPS



(1) CONNECTOR INFORMATION

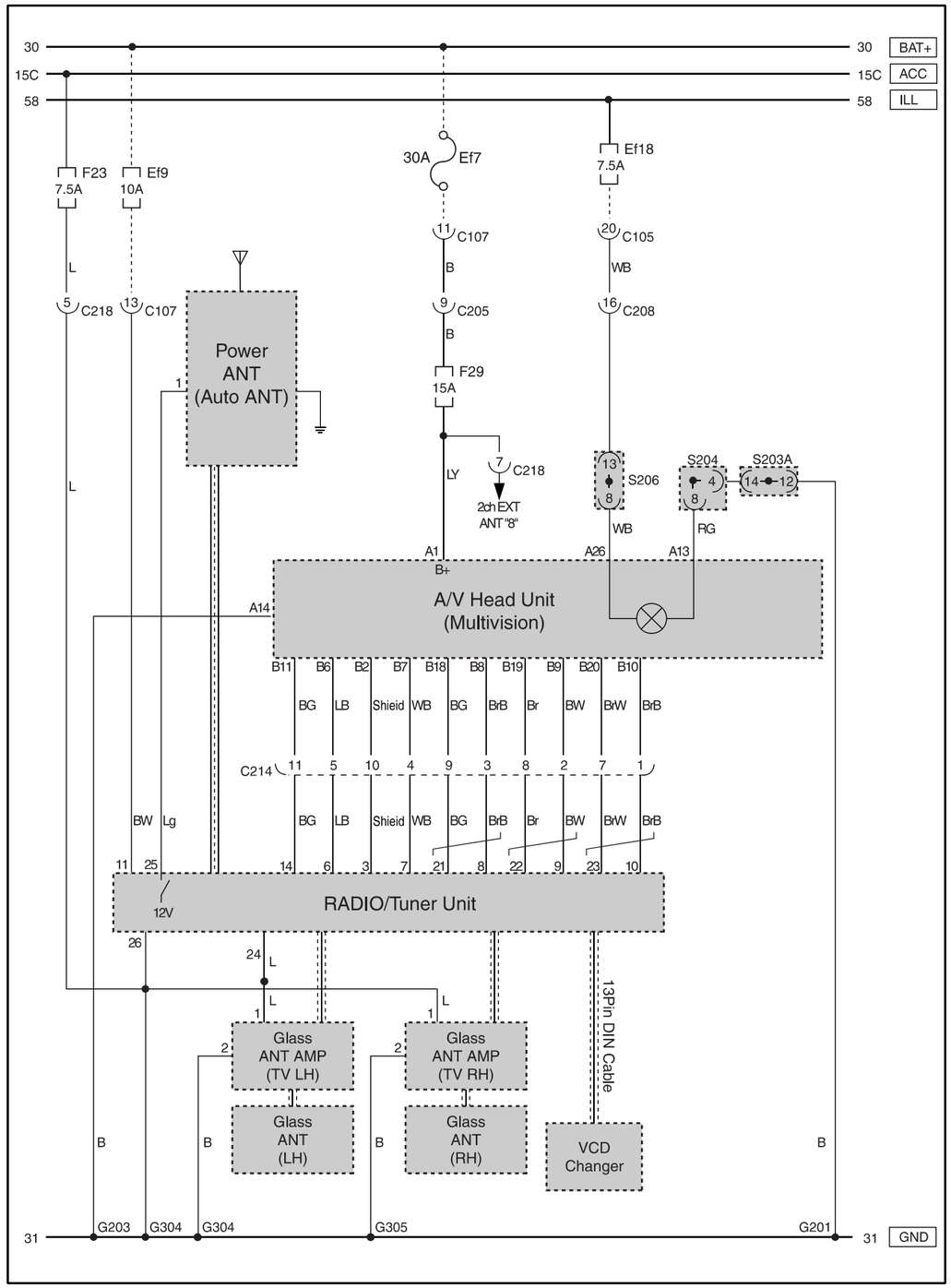
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C214 (12Pin, Black)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C216 (18Pin, White)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C351 (20Pin, White)	Floor - Driver Door	Inside Driver Side Cowl PNL	Behinel Conn Holder
C361 (13Pin, White)	Floor - Co-Driver Door	Inside Co-Driver Side Cowl PNL	Behinel Conn Holder
C371 (21Pin, White)	Floor - RR Left Door	Under Left “B” Filler	
C381 (21Pin, White)	Floor - RR Right Door	Under Right “B” Filler	
C392 (6Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
S207 (14Pin, Black)	W/H Main	Behind the Right FATC	Tail Lamp
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag
G304	W/H Floor	Behind the Quarter Grass #1	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

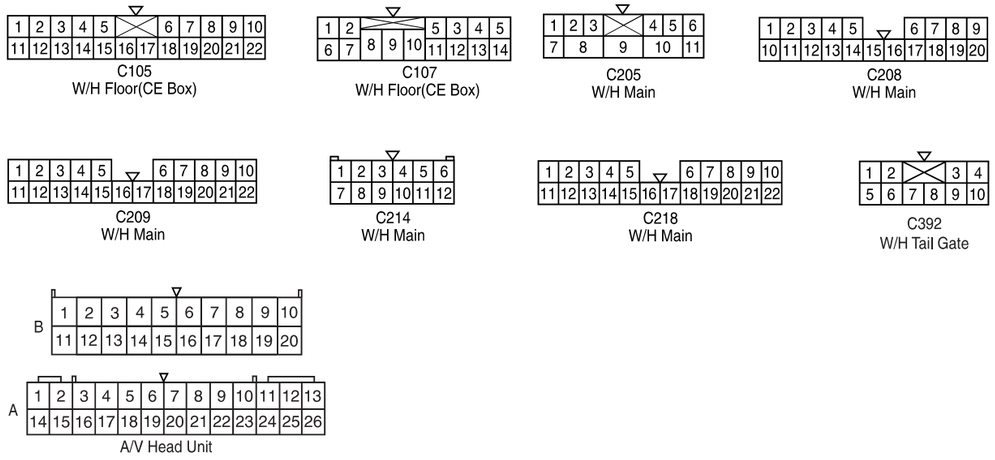
2) HEAD UNIT, TUNER UNIT, VCD CHANGER



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C214 (12Pin, Black)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C392 (10Pin, White)	Floor - Tail Gate	Inside the Left Side Cover the Tail Gate	
S204 (14Pin, Black)	W/H Main	Behind the Left FATC	GND
S205 (14Pin, Black)	W/H Main	Behind the Left FATC	GND
S207 (14Pin, Black)	W/H Main	Behind the Right FATC	Tail Lamp
G201	W/H Main	Inside Driver Side Cowl PNL	
G202	W/H Main	Beside the SDM	
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag
G304	W/H Floor	Behind the Quarter Grass #1	
G305	W/H Floor	Behind the Quarter Grass #1	

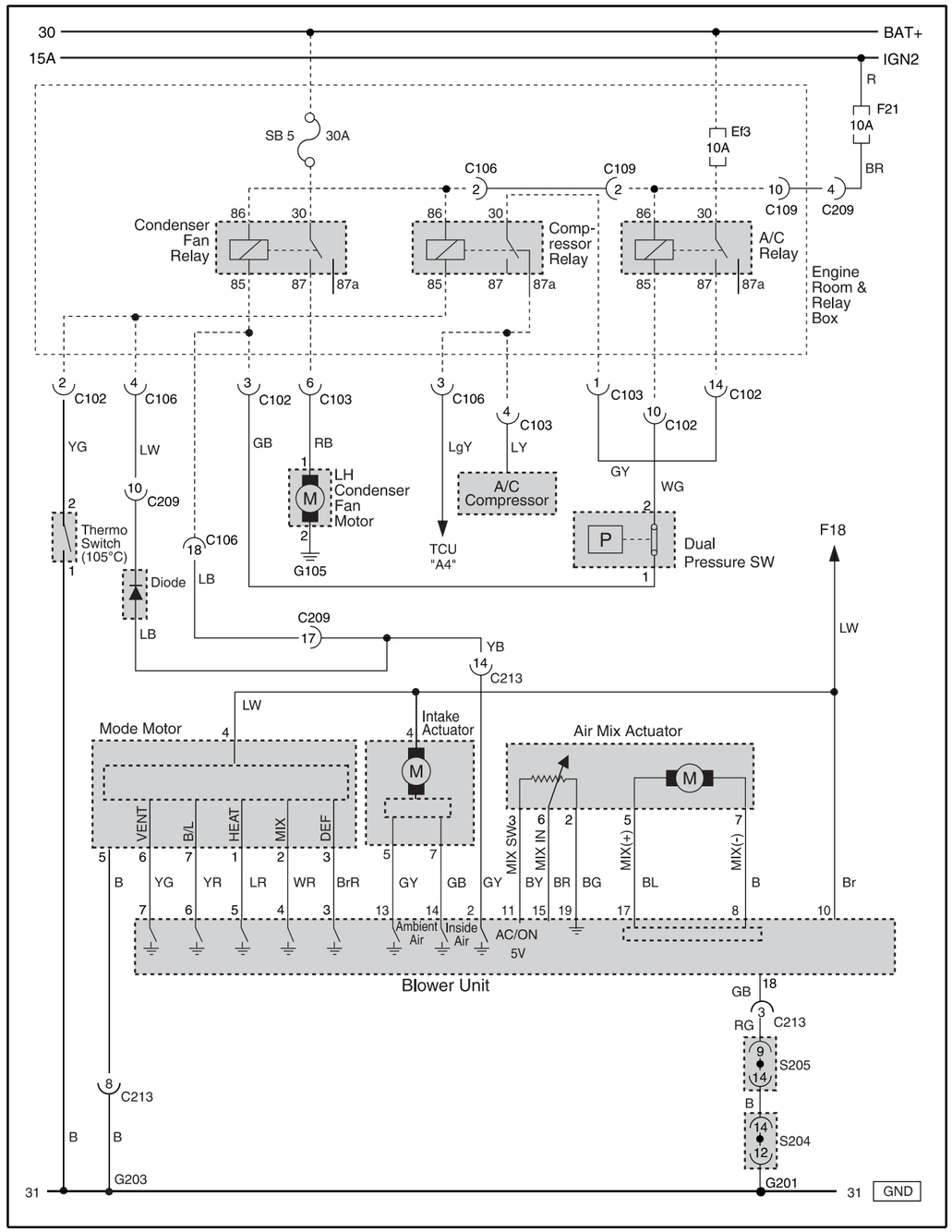
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



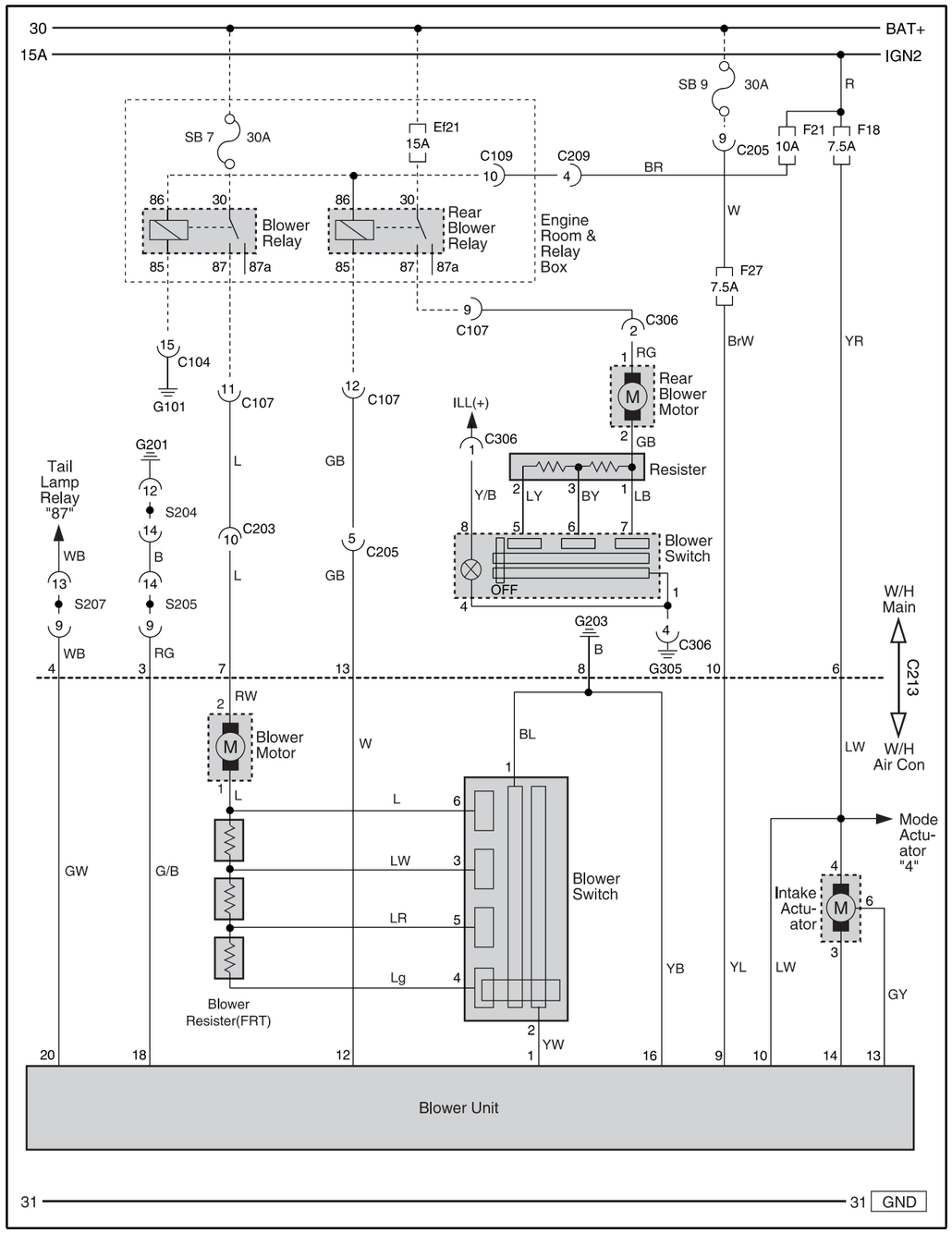
S.G.N. 6810-18

AIR-CON (MANUAL, DSL) ~ 2002 MODEL

1) ACTUATOR (MODE, AIR MIX), BLOWER UNIT CIRCUIT



2) INTAKE MOTOR, BLOWER MOTOR CIRCUIT



CIRCUIT

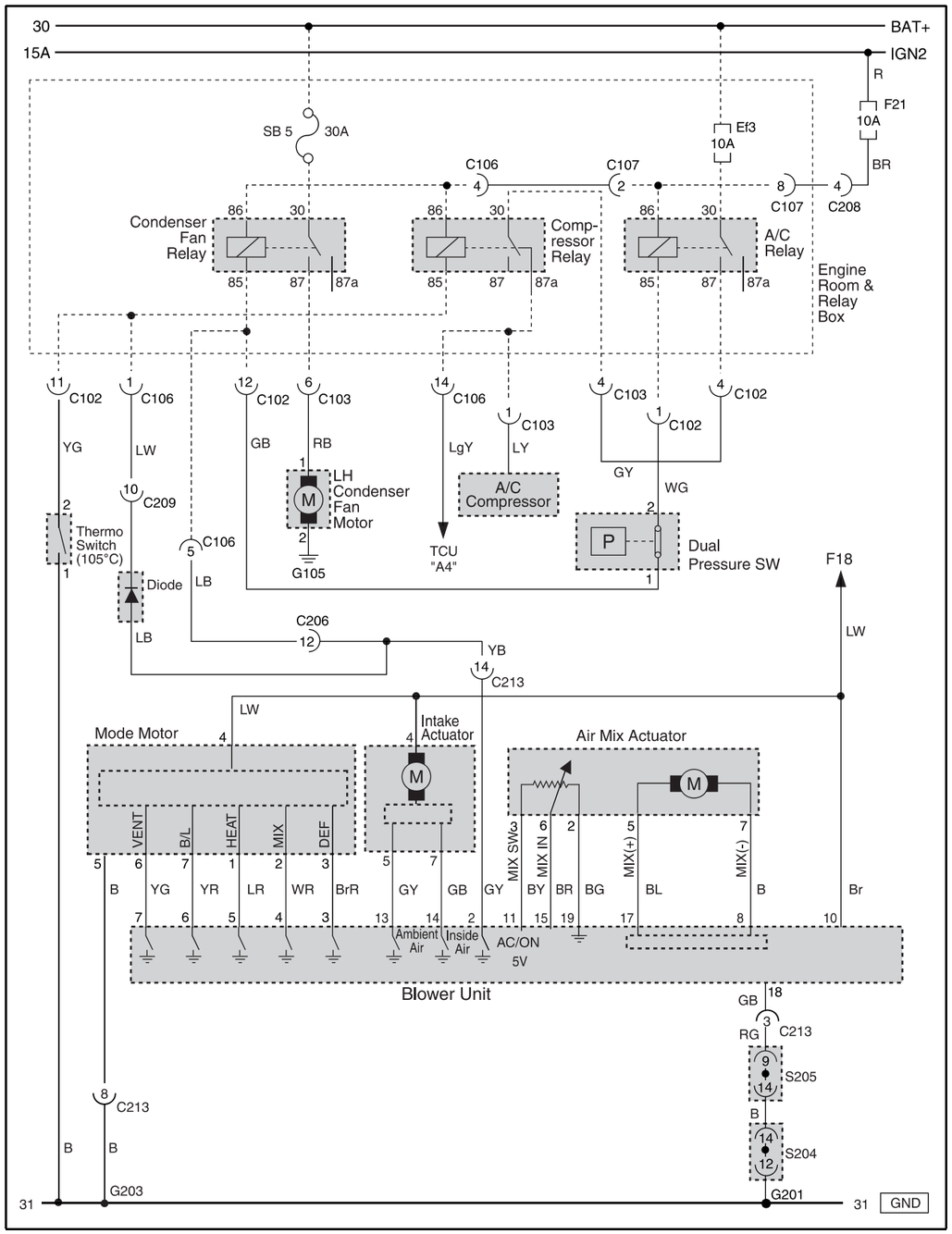
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

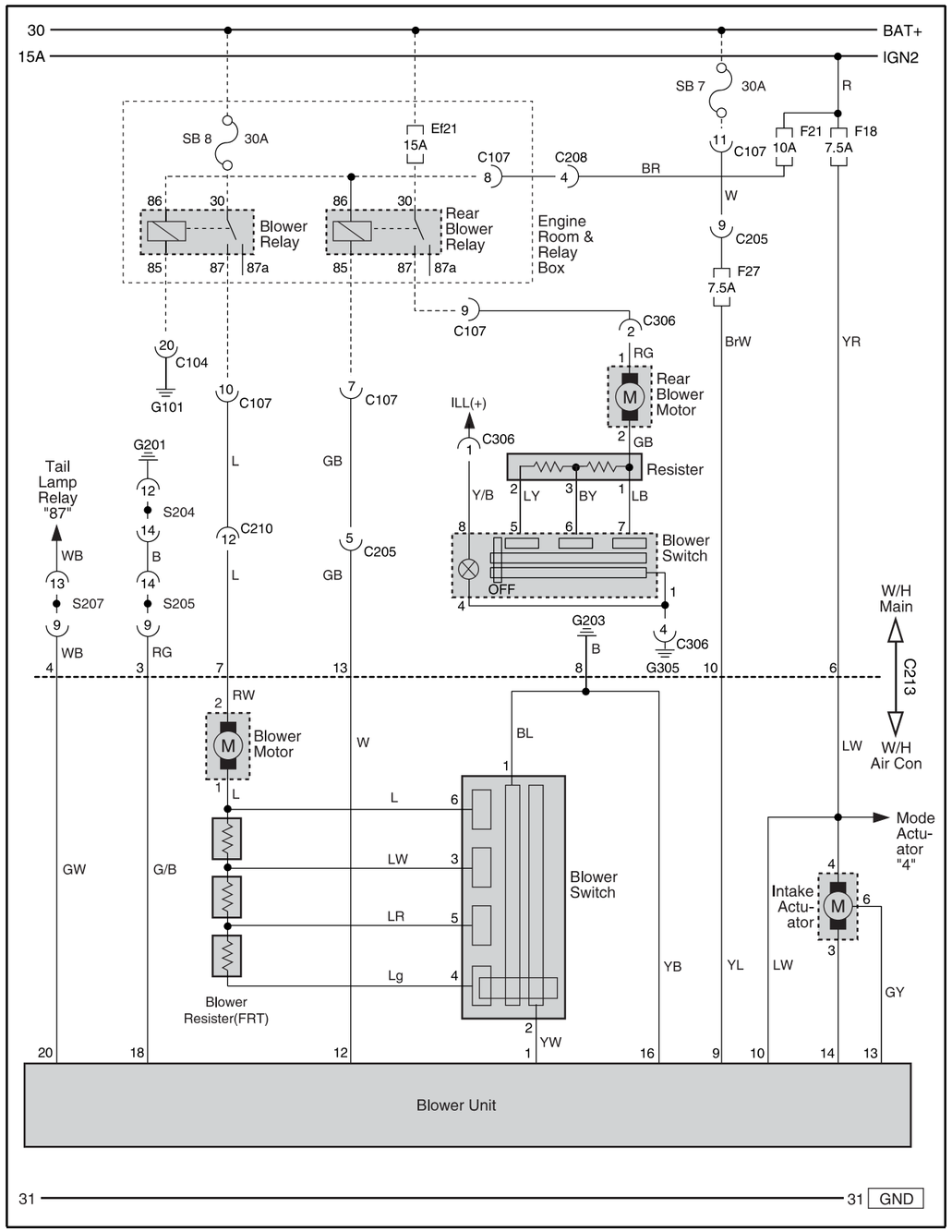
S.G.N. 6810-18

AIR-CON (MANUAL, DSL) 2004 MODEL ~

1) ACTUATOR (MODE, AIR MIX), BLOWER UNIT CIRCUIT



2) INTAKE MOTOR, BLOWER MOTOR CIRCUIT



Modification basis	
Application basis	
Affected VIN	

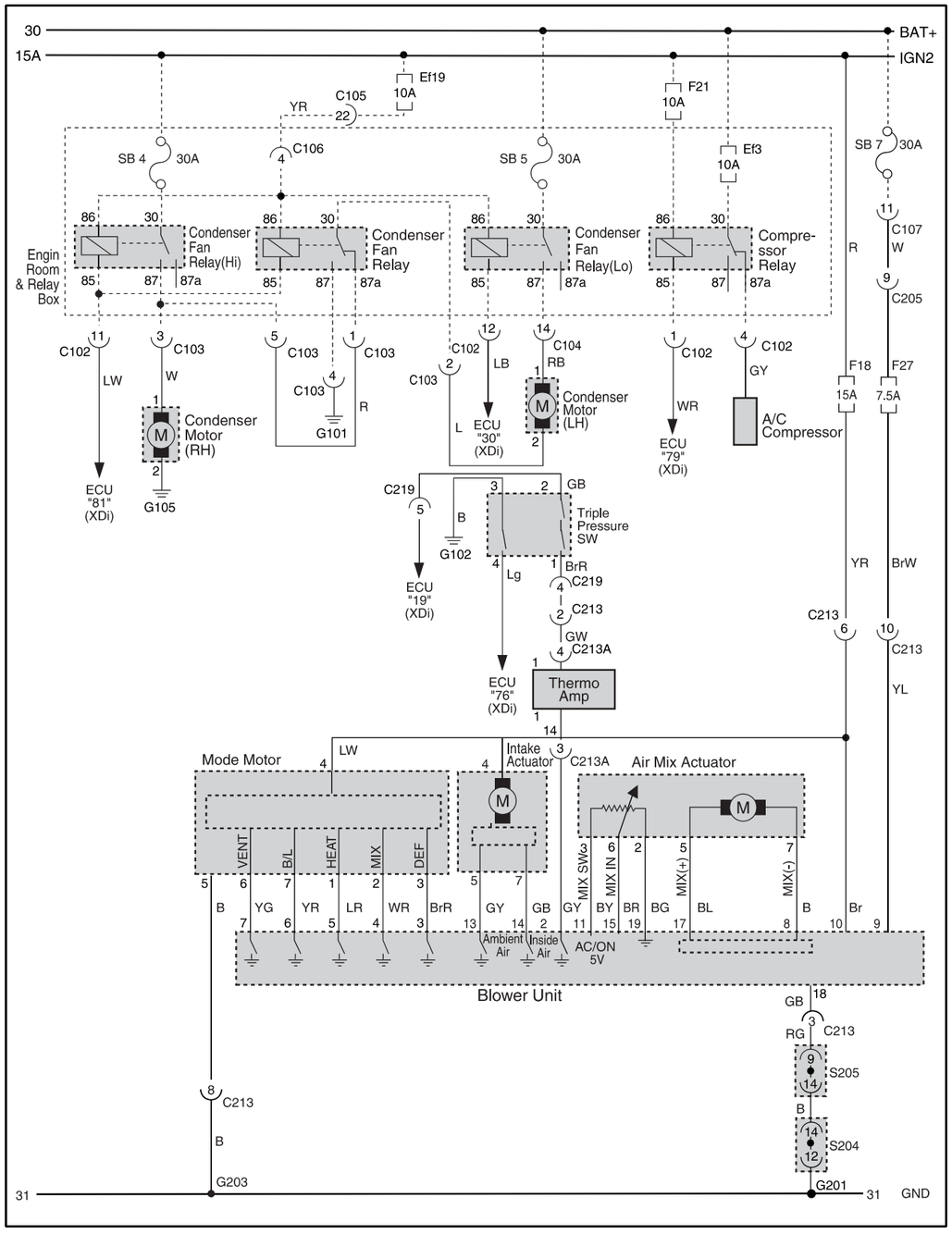
CIRCUIT

REXTON 2004.04

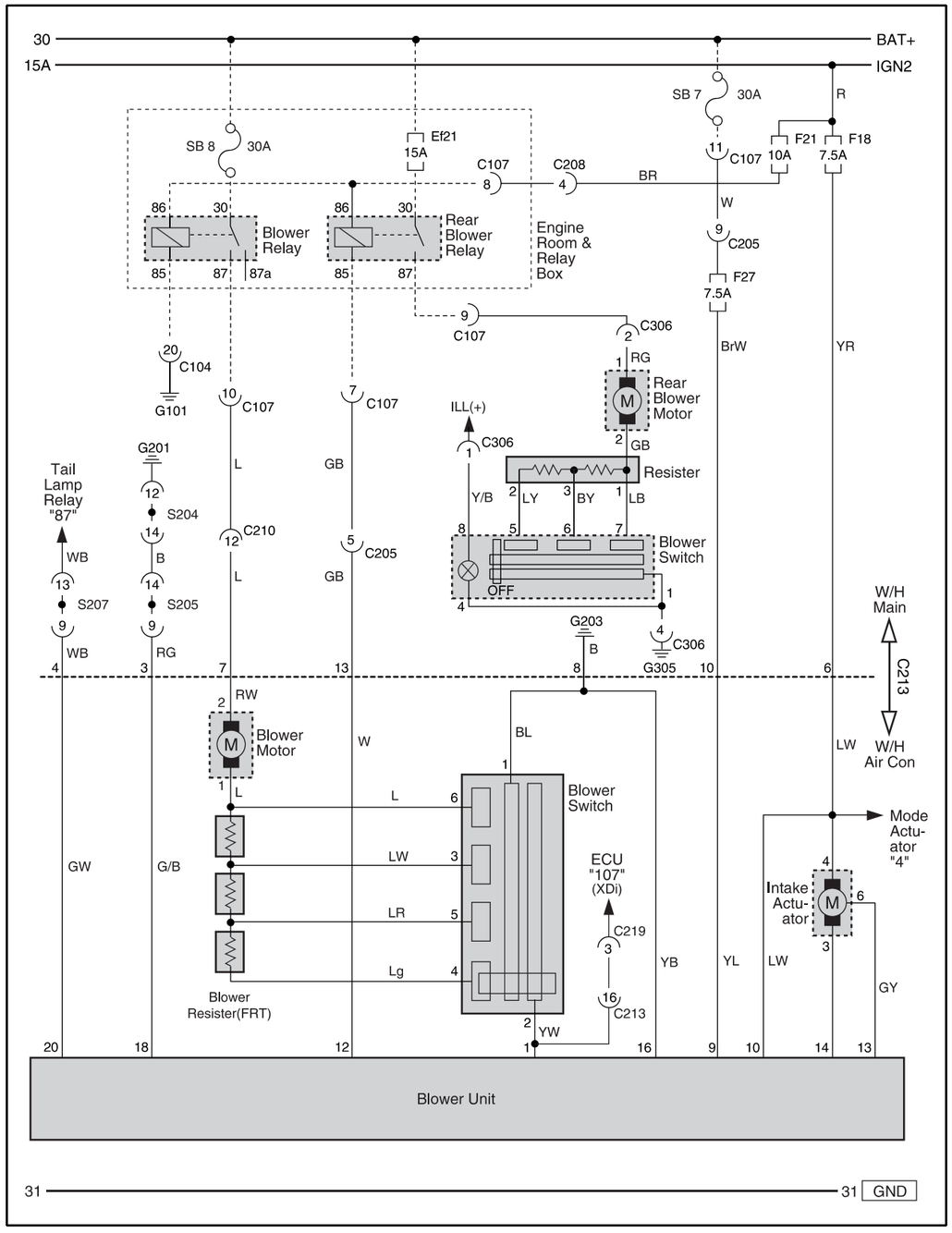
S.G.N. 6810-18

AIR-CON (MANUAL, DSL) XDi

1) ACTUATOR (MODE, AIR MIX), BLOWER UNIT CIRCUIT



2) INTAKE MOTOR, BLOWER MOTOR CIRCUIT



CIRCUIT

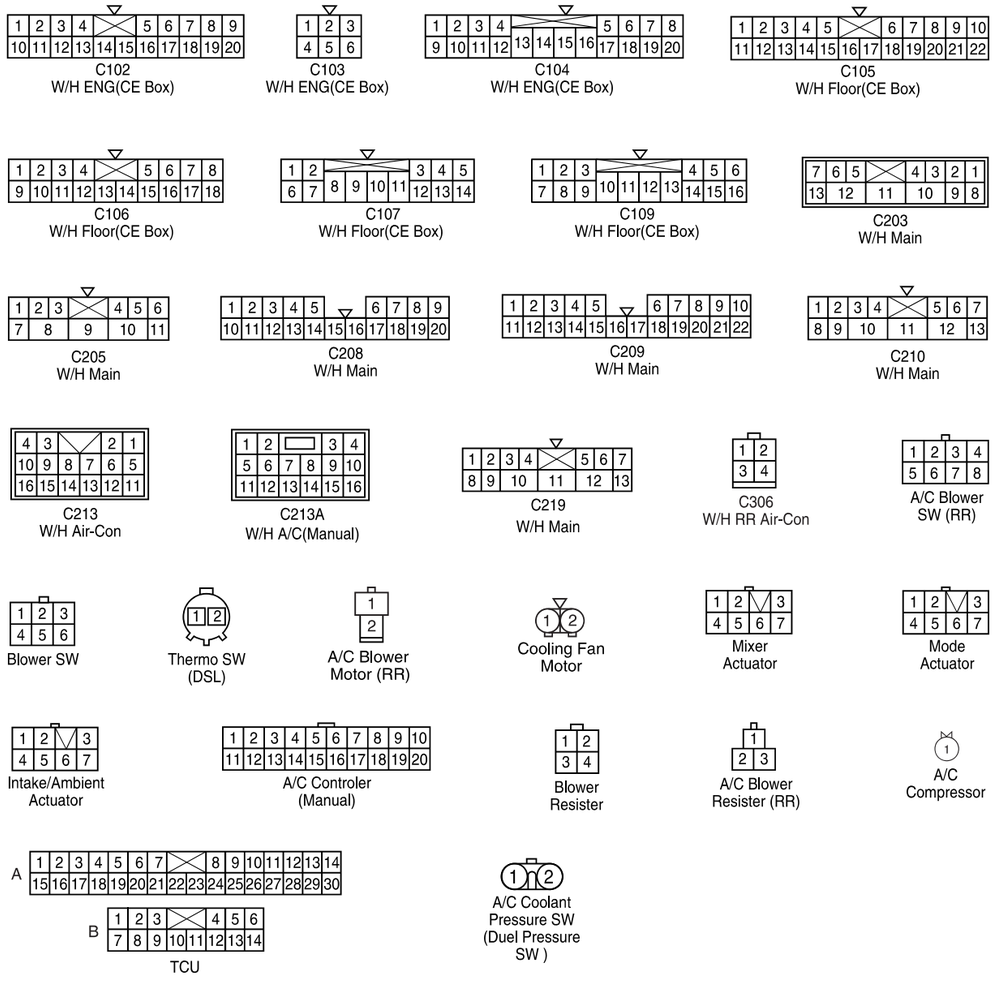
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C103 (6Pin, Colorless)	Engine Room Fuse Box (C) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C213 (16Pin, White)	Main - Air-Con	Inside Dash PNL	
C213A (13Pin, White)	W/H Air Bag - W/H Blower	Inside Dash PNL	XDi
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C306 (4Pin, Colorless)	Floor - RR Air Con	Right Side 3rd Seat	A/C
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S205 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
G101	W/H Engine	Center the Engine Room Fuse Box	
G105	W/H Engine	Behine the Right Head Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag

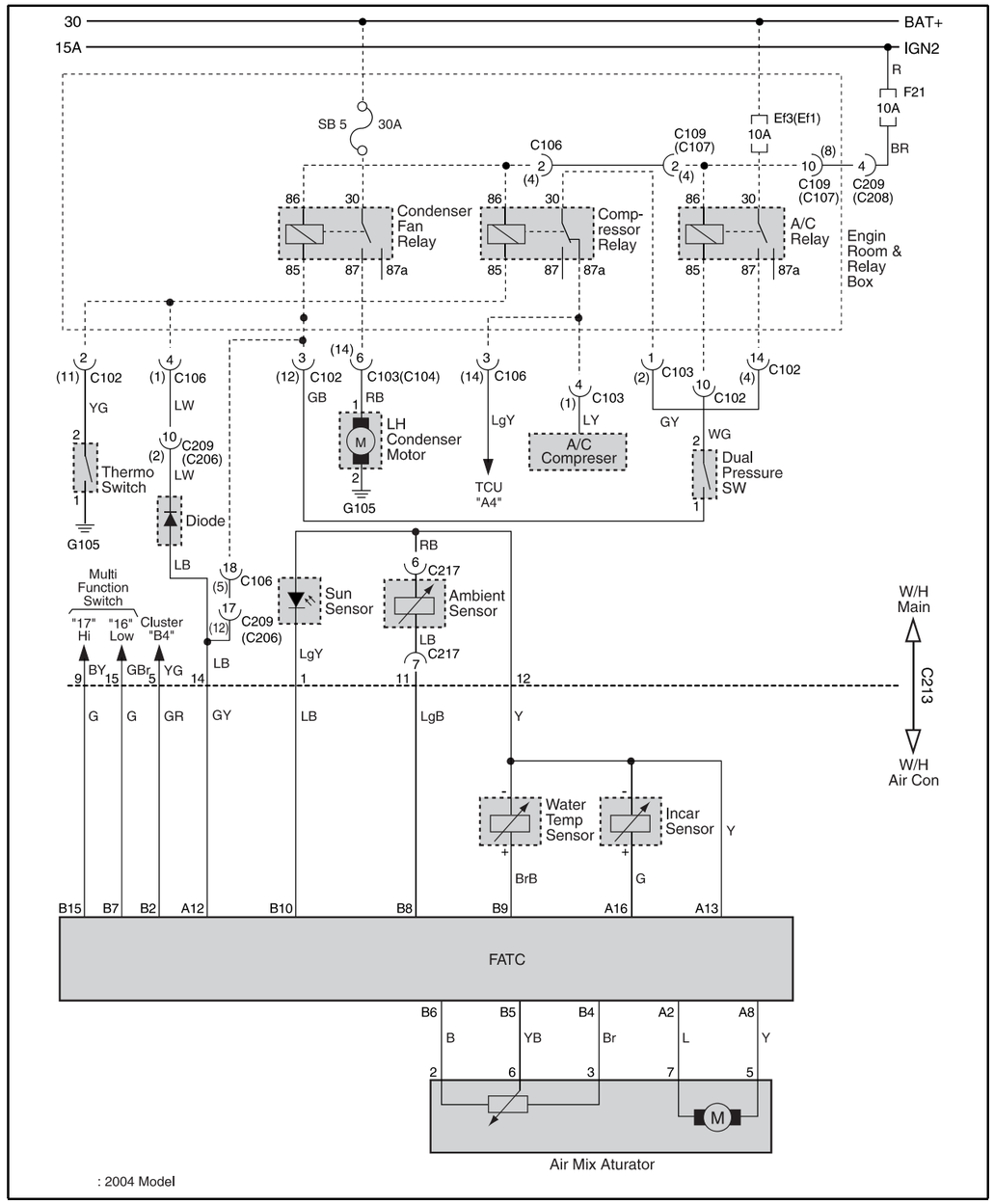
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



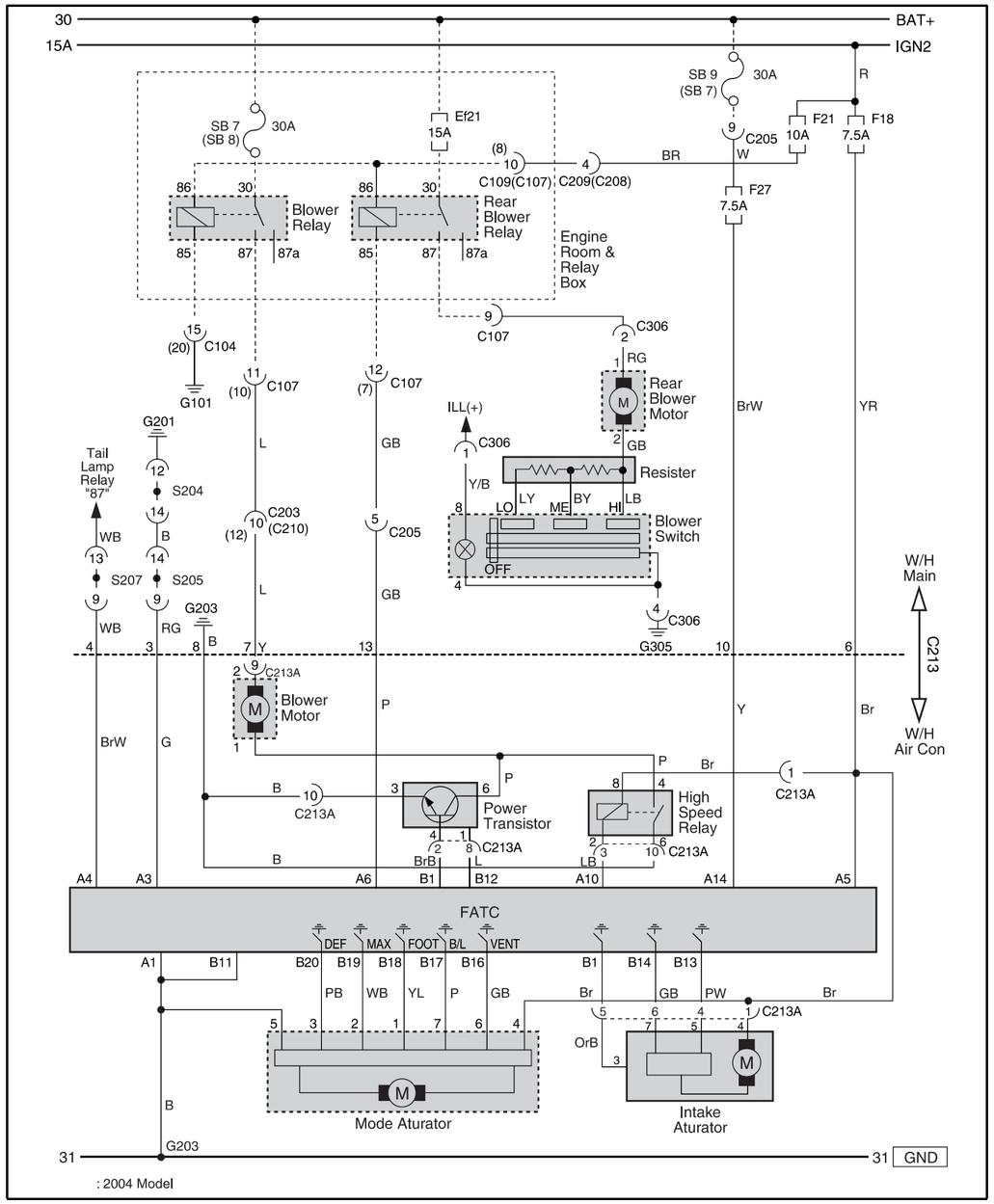
S.G.N. 6810-18

FATC (FULL AUTO TEMPERATURE CONTROL) CIRCUIT DIESEL

1) AIR MIX ACTUCTOR, SENSOR (SUN, AMBIENT, INCAR, WATER TEMP) CIRCUIT



2) ACTURATOR (MODE, INTAKE) CIRCUIT



CIRCUIT

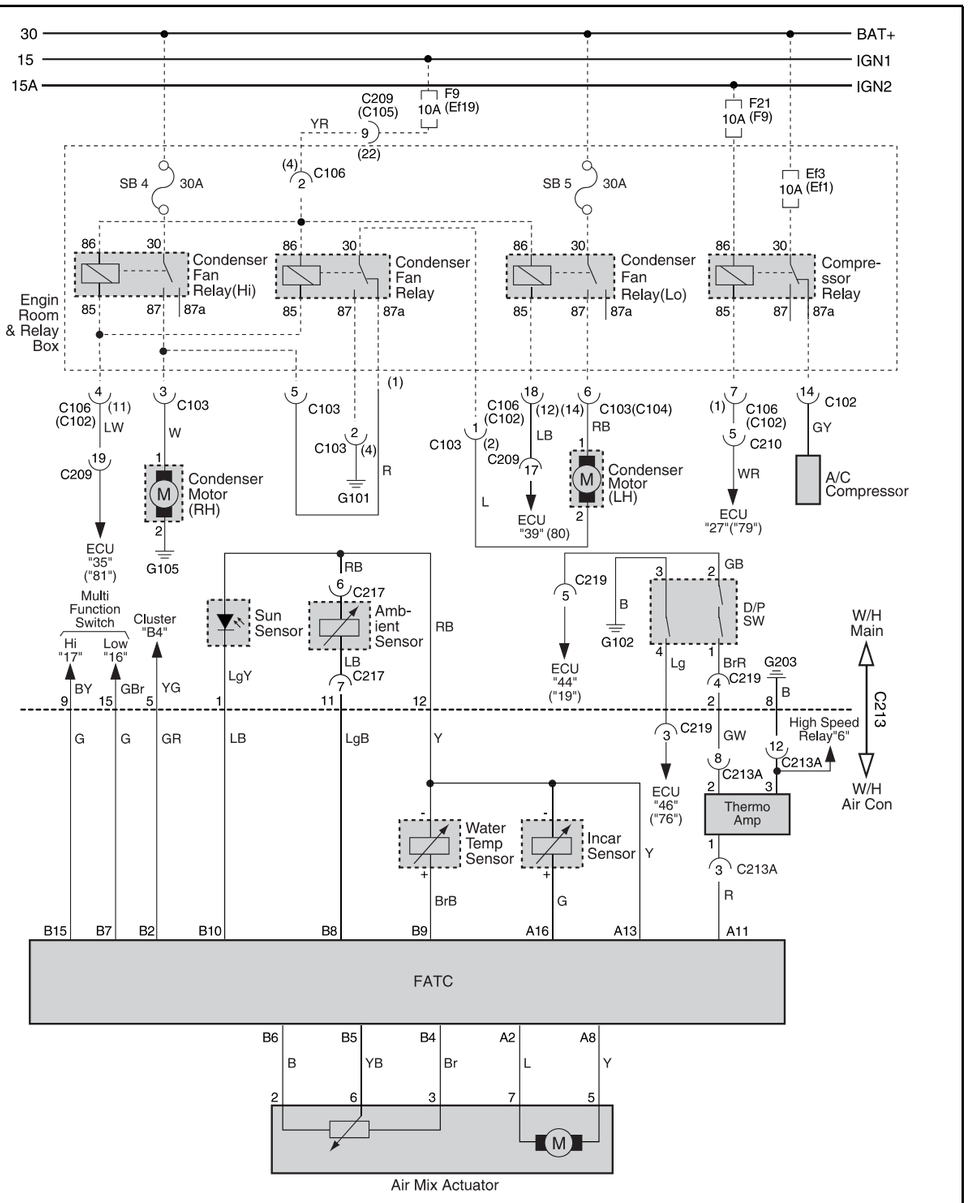
REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

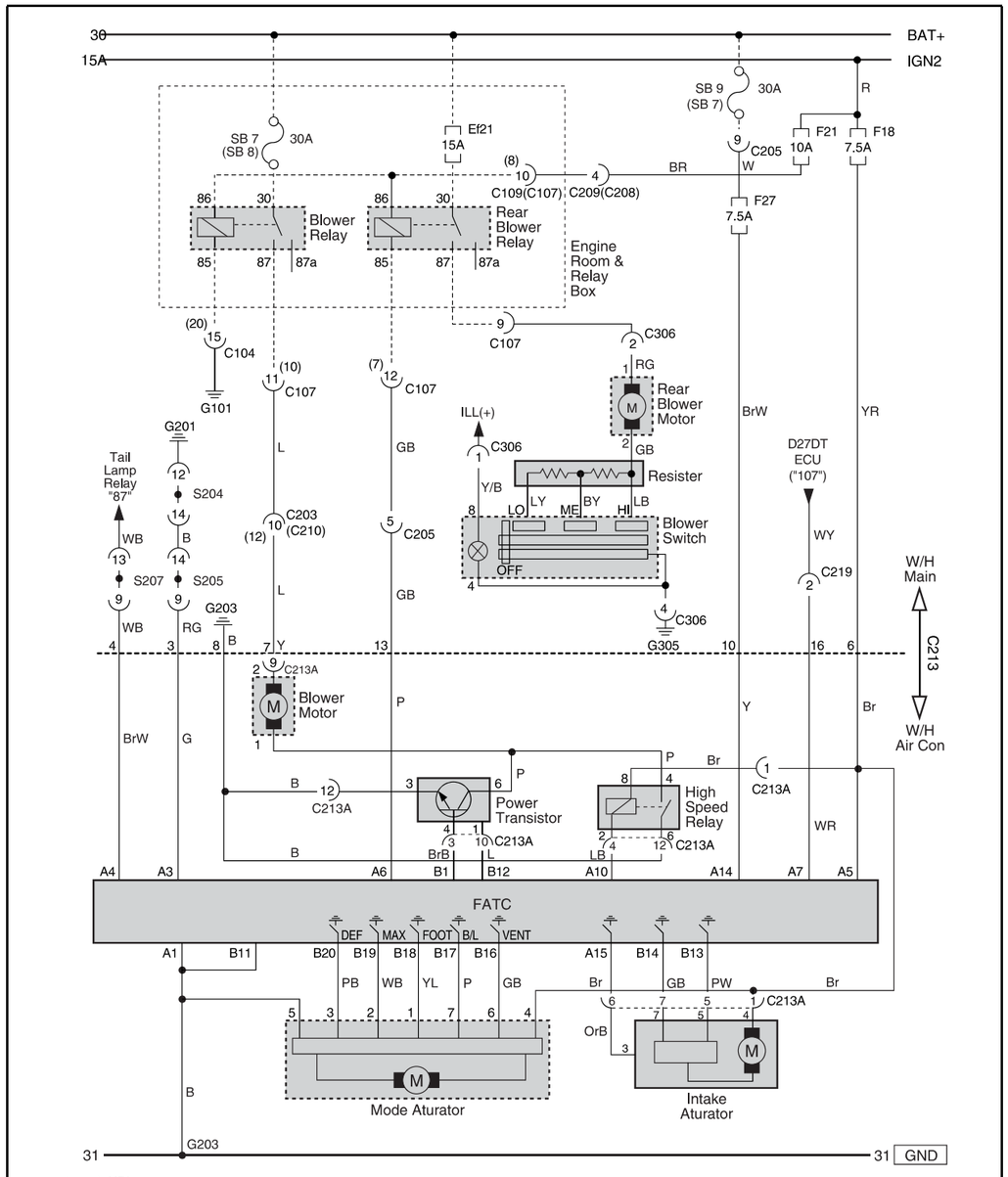
S.G.N. 6810-18

FATC (FULL AUTO TEMPERATURE CONTROL) CIRCUIT GASOLINE & XDi

1) AIR MIX ACTUCTOR, SENSOR (SUN, AMBIENT, INCAR, WATER TEMP) CIRCUIT



2) ACTURATOR (MODE, INTAKE) CIRCUIT

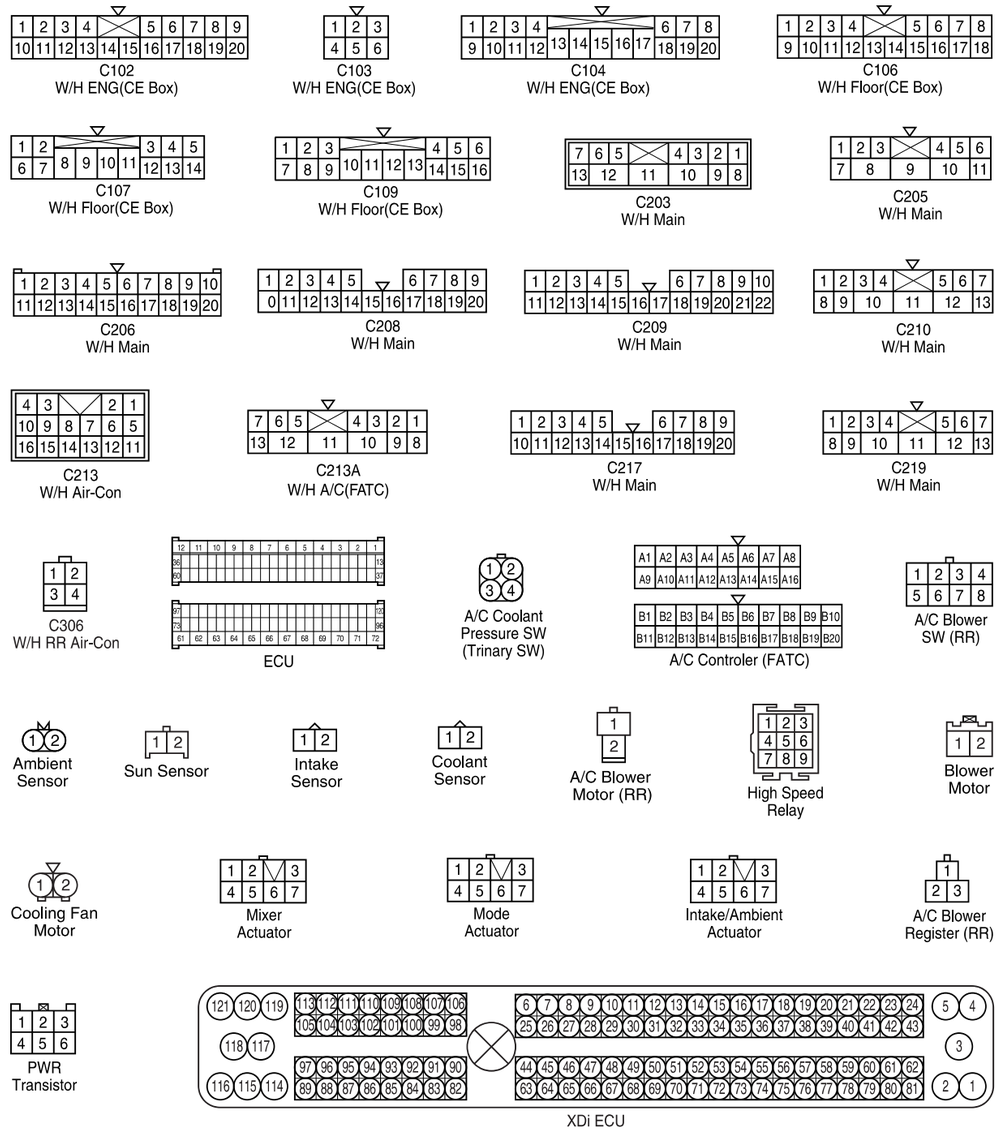


Modification basis	
Application basis	
Affected VIN	

(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	Engine Room Fuse Box (B) - Engine	Engine Room Fuse Box	
C103 (6Pin, Colorless)	Engine Room Fuse Box (C) - Engine	Engine Room Fuse Box	
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C210 (13Pin, Green)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C213 (16Pin, White)	Main - Air-Con	Inside Dash PNL	
C213A (13Pin, White)	W/H Air Bag - W/H Blower	Inside Dash PNL	XDi
C217 (20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C306 (4Pin, Colorless)	Floor - RR Air-Con	Right Side 3rd Seat	A/C
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S205 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S207 (14Pin, Black)	W/H Main	Behind the Right the FATC	Tail Lamp
G101	W/H Engine	Center the Engine Room Fuse Box	
G105	W/H Engine	Behine the Right Head Lamp	
G201	W/H Main	Inside Driver Side Cowl PNL	
G203	W/H Main	Under the Seat Heating SW	W/H Air Bag
G305	W/H Floor	Behind the Quarter Grass #1	

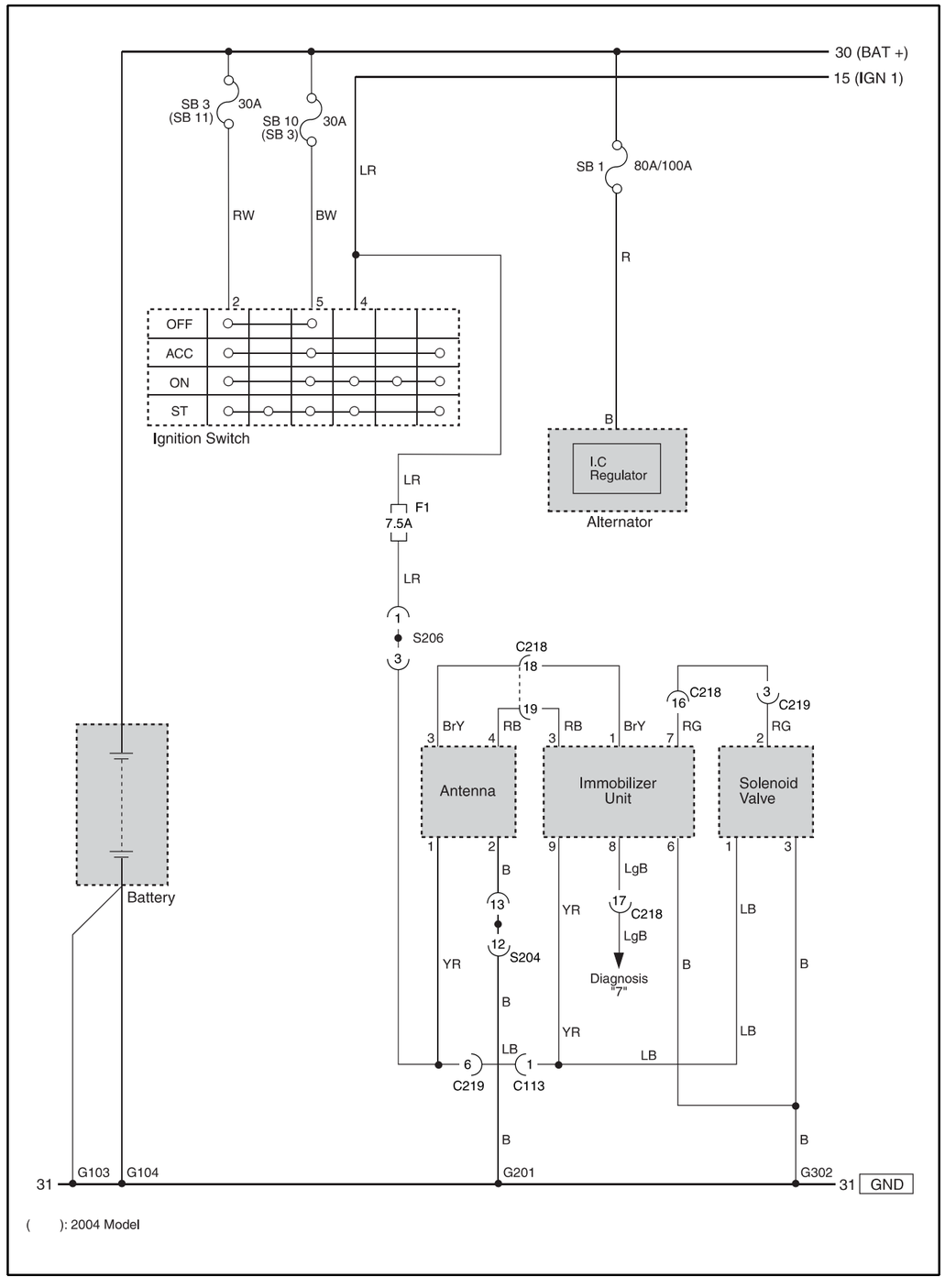
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 7010-06

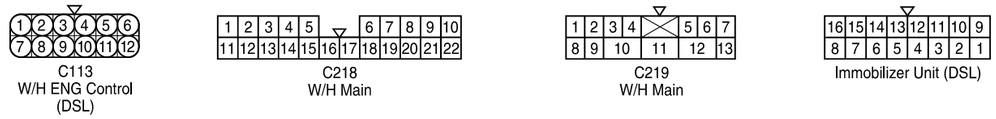
IMMOBILIZER (DSL)



(1) CONNECTOR INFORMATION

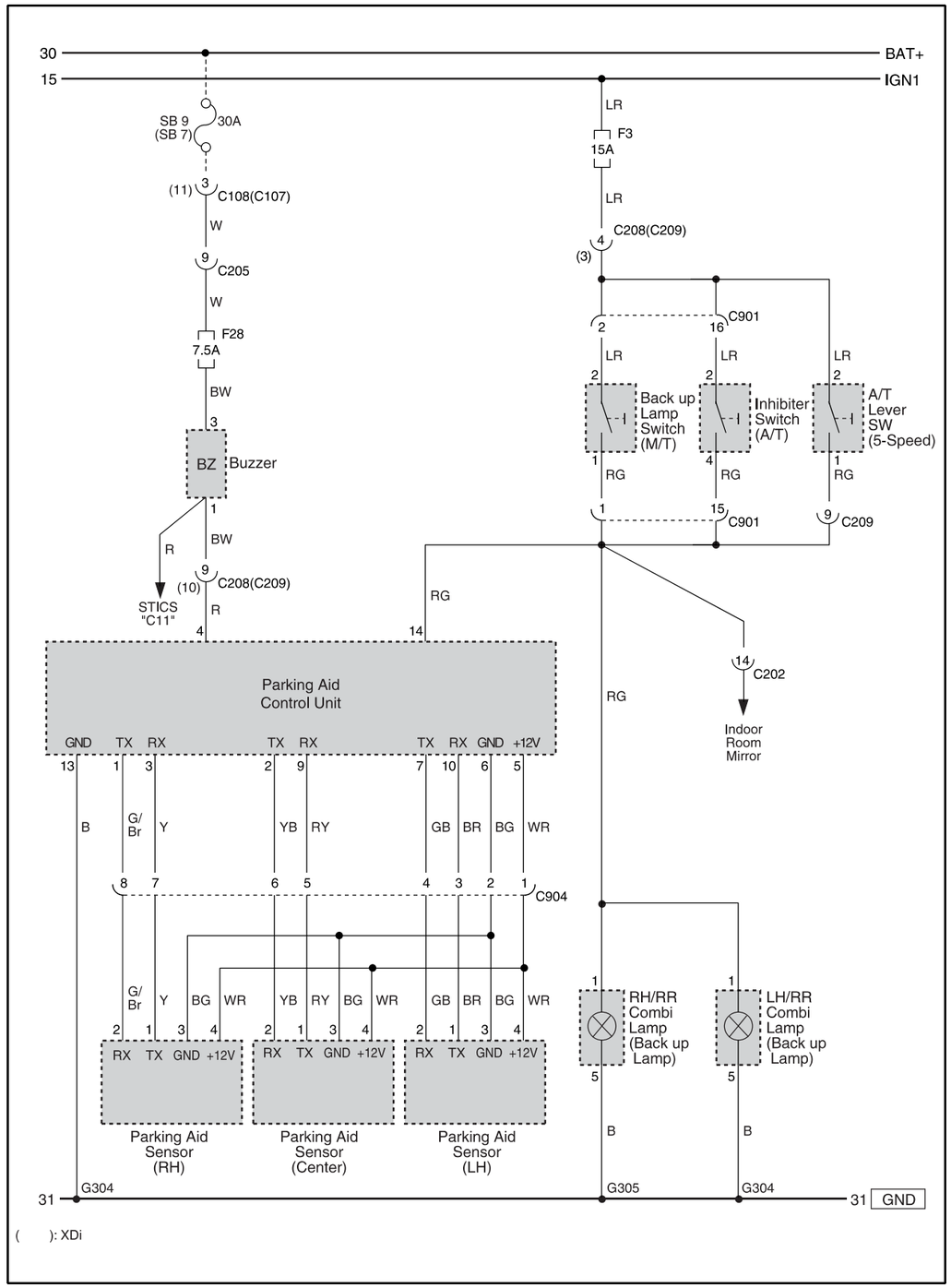
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C113 (12Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	DSL
C218 (22Pin, Yellow)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
S204 (14Pin, Black)	W/H Main	Behind the Left the FATC	GND
S206 (14Pin, Black)	W/H Main	Behind the Left the FATC	
G201	W/H Main	Inside Driver Side Cowl PNL	
G302	W/H Floor	Under Driver Seat	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



S.G.N. 8790-01

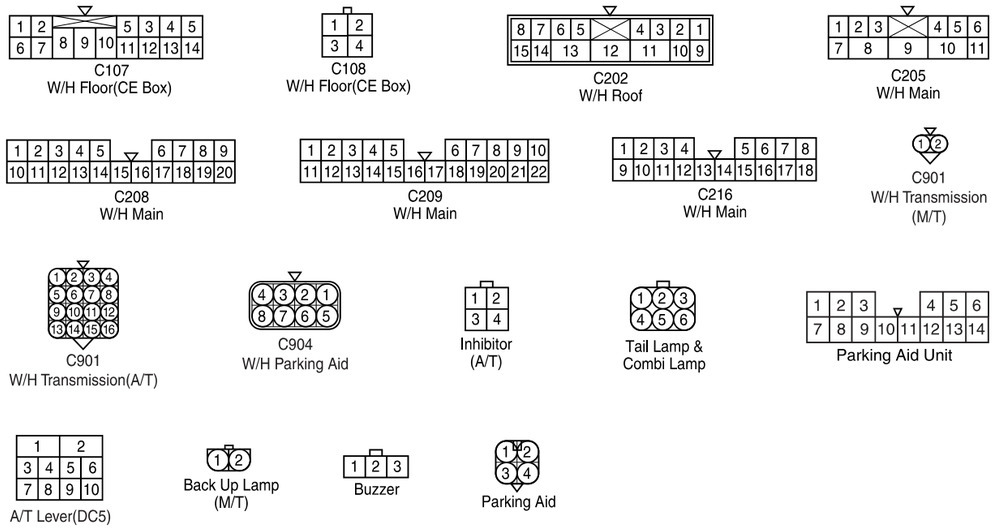
PARKING AID CIRCUIT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	Engine Room Fuse Box (J) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C202 (15Pin, White)	Main - Roof	Under the I/P Fuse Box	
C205 (11Pin, White)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C216 (18Pin, White)	Main - Floor (RH)	Inside Co-Driver Side Cowl PNL	
C901 (16Pin, White)	Floor - T/M	Left the T/C (Under the Floor)	A/T
C901 (2Pin, White)	Floor - T/M	Left the T/C (Under the Floor)	M/T
C904 (8Pin, White)	Floor - Parking Aid	Inside the Left RR Bumper	Parking Aid
G304	W/H Floor	Behind the Quarter Grass #1	
G305	W/H Floor	Behind the Quarter Grass #1	

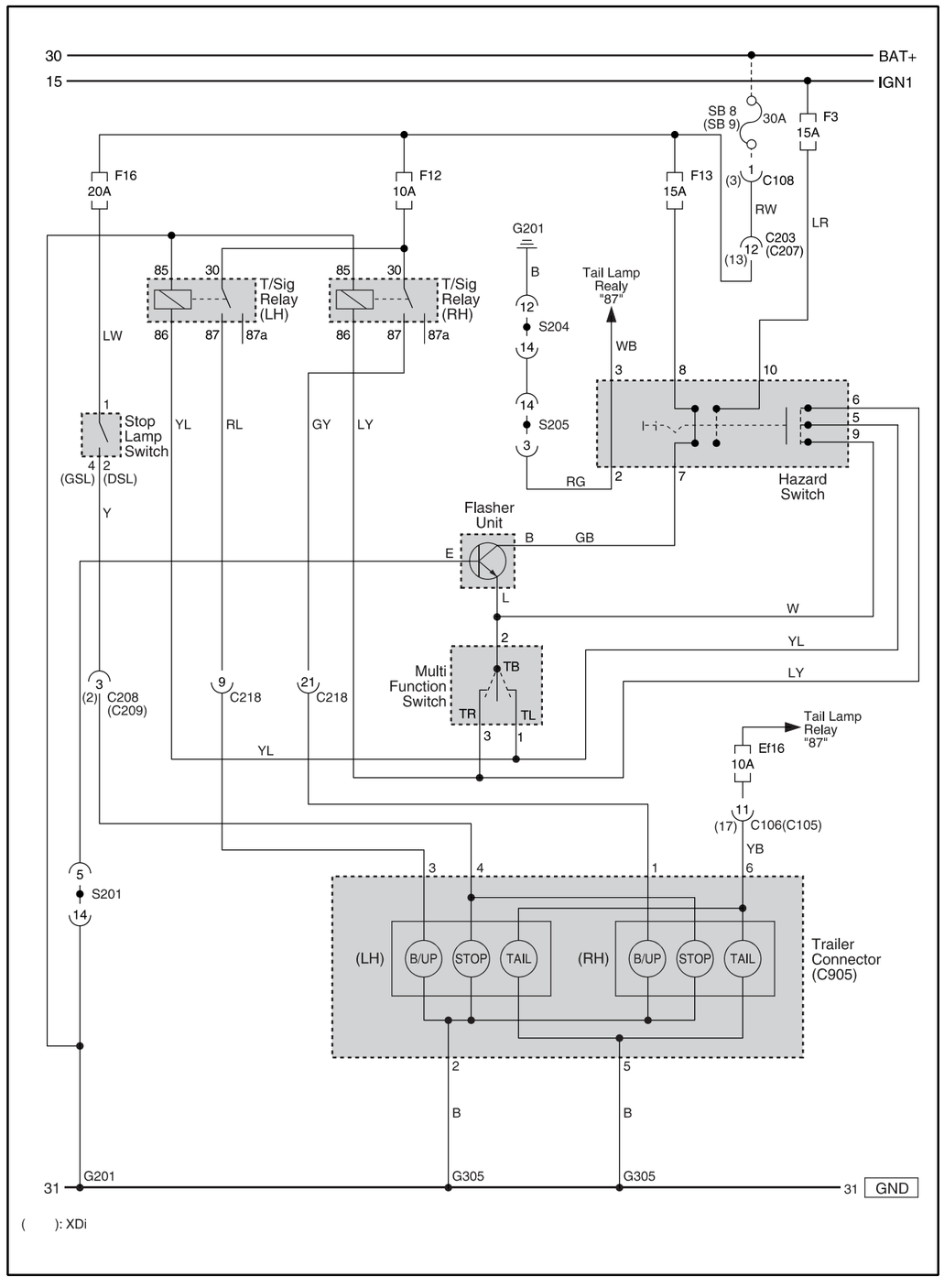
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 4610-00

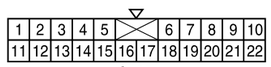
TRAILER CONNECTOR CIRCUIT



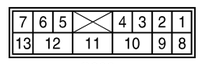
(1) CONNECTOR INFORMATION

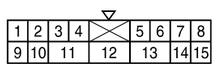
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C105 (22Pin, White)	Engine Room Fuse Box (E) - Engine	Engine Room Fuse Box	
C108 (4Pin, Colorless)	Engine Room Fuse Box (K) - Engine	Engine Room Fuse Box	
C203 (13Pin, Green)	Main - Floor (LH)	Under the I/P Fuse Box	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C208 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C218 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C905 (6Pin, White)	Floor - Trailer	Inside the Left RR Bumper	
G305	W/H Floor	Behind the Quarter Grass #1	

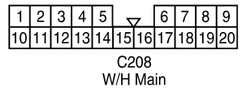
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

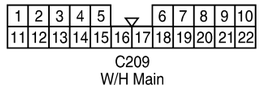

C105
W/H Floor(CE Box)

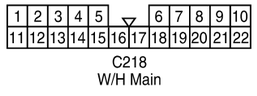

C108
W/H Floor(CE Box)


C203
W/H Main


C207
W/H Main


C208
W/H Main


C209
W/H Main


C218
W/H Main

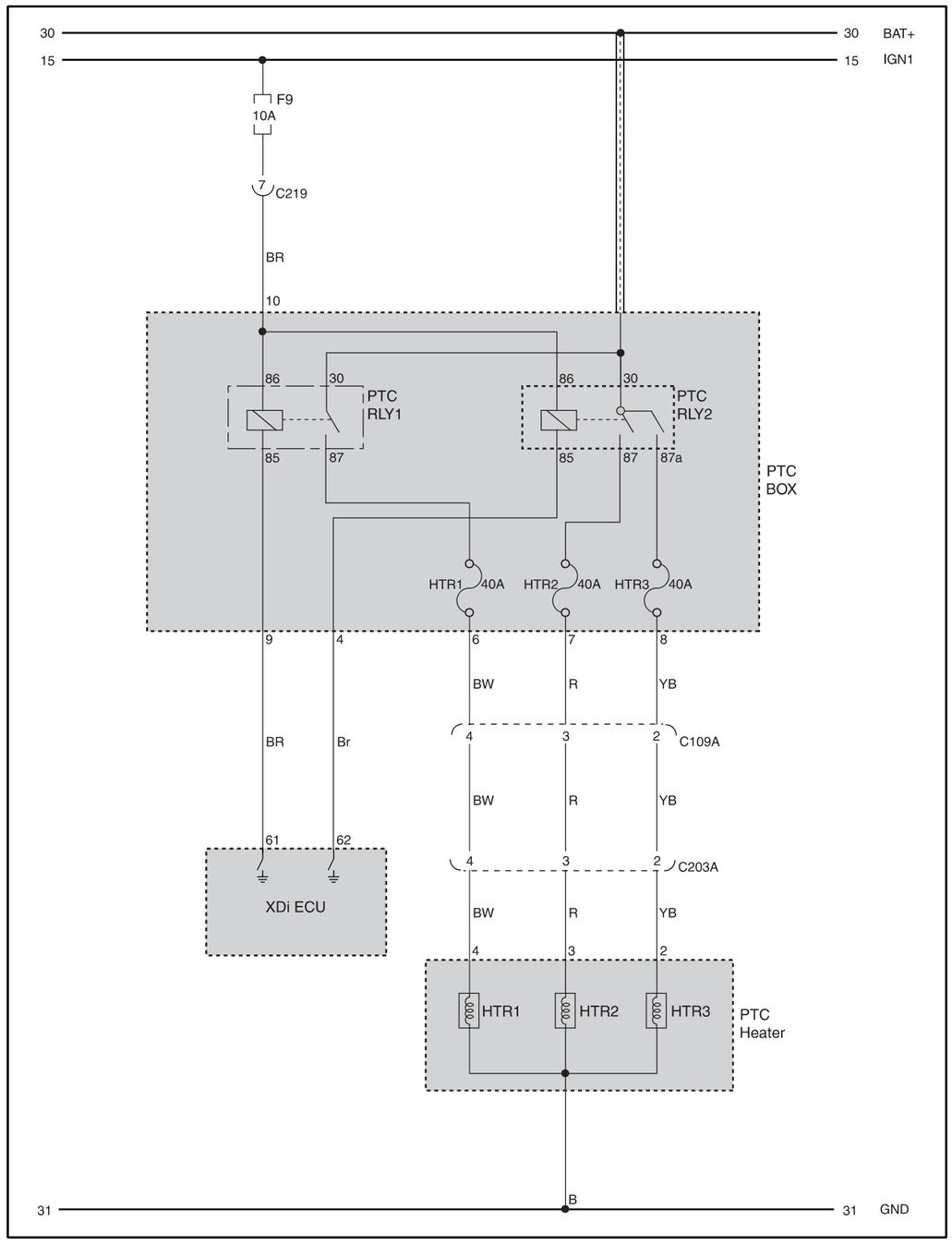

C905
W/H Trailer


Stop Lamp
(GSL)


Stop Lamp
(DSL)

Modification basis	
Application basis	
Affected VIN	

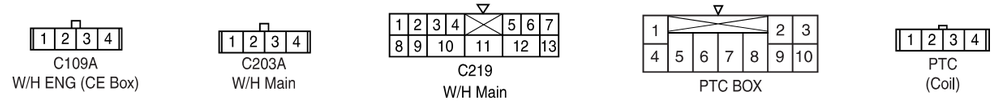
S.G.N. 6810-15 P.T.C HEATER(POSITIVE TEMPERATURE COEFFICIENT)

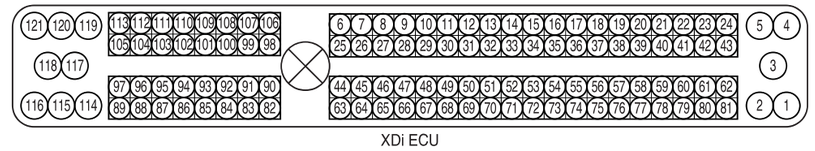


(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C110 (1Pin, Gray)	Engine - Starter "ST"	FRT Pre-Heating Unit	
C204 (12Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	A/T
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION





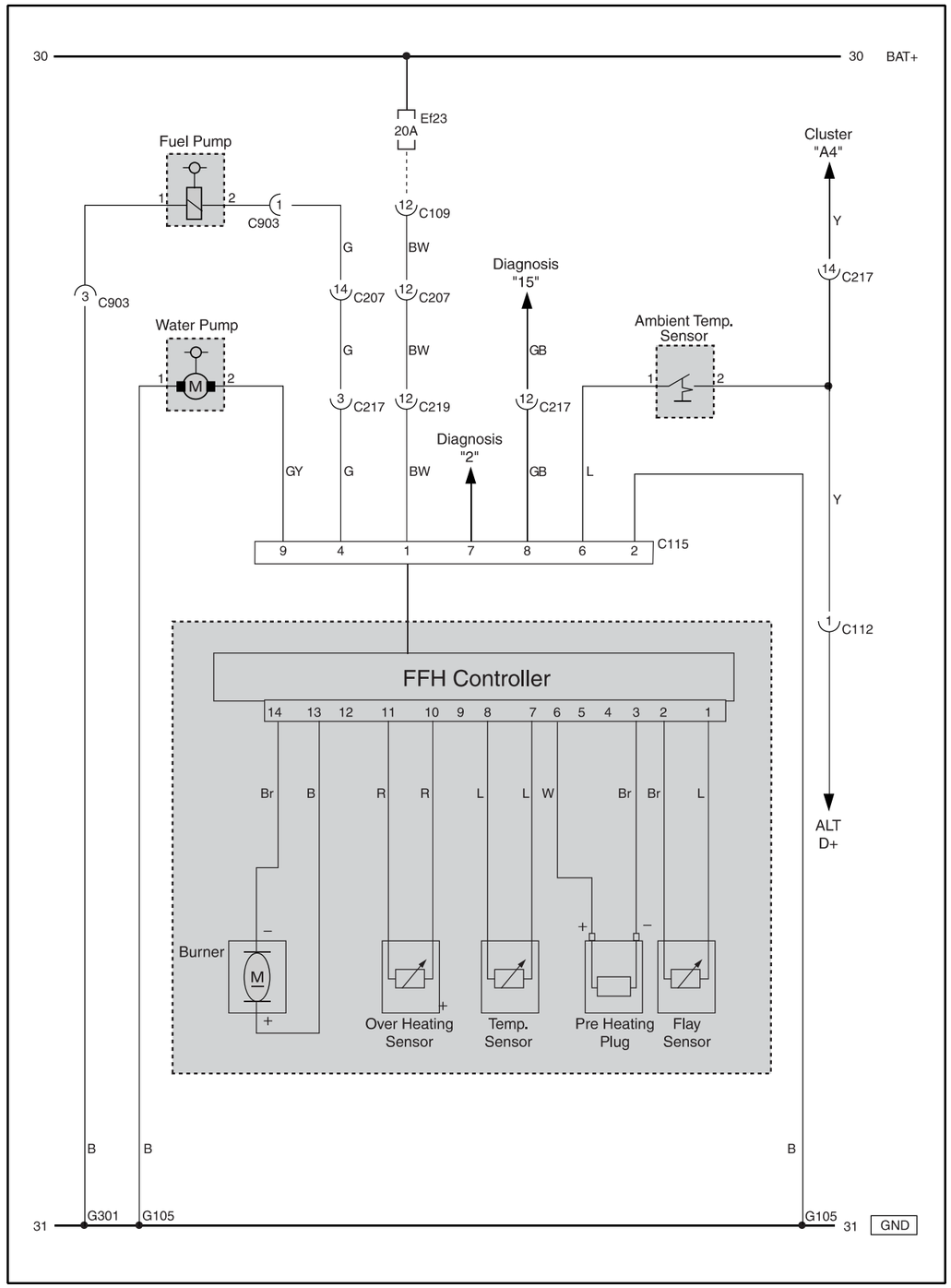
CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

S.G.N. 6910-01

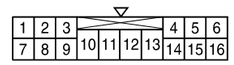
FFH (FUEL FIRED HEATER)



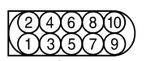
(1) CONNECTOR INFORMATION

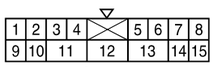
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C109 (16Pin, White)	Engine Room Fuse Box (M) - Engine	Engine Room Fuse Box	
C112 (2Pin, Black)	Engine - Alternator	Under the Coolant Reserve Tank	GSL
C114 (6Pin, Black)	Engine - Engine Control	Right Engine Room Dash PNL	GSL
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C217 (20Pin, Black)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C219 (13Pin, Green)	Engine - Main (RH)	Inside Co-Driver Side Cowl PNL	
C902 (6Pin, White)	Floor - T/M	Under the T/C (Under the Floor)	M/T 2WD
G105	W/H Engine	Behine the Right Head Lamp	
G301	W/H Floor	Under Driver Seat	ECU GND

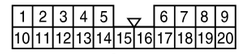
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

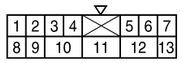

C109
W/H Floor(CE Box)


C112
W/H Alternator
(GSL)


C115
W/H FFH


C207
W/H Main


C217
W/H Main

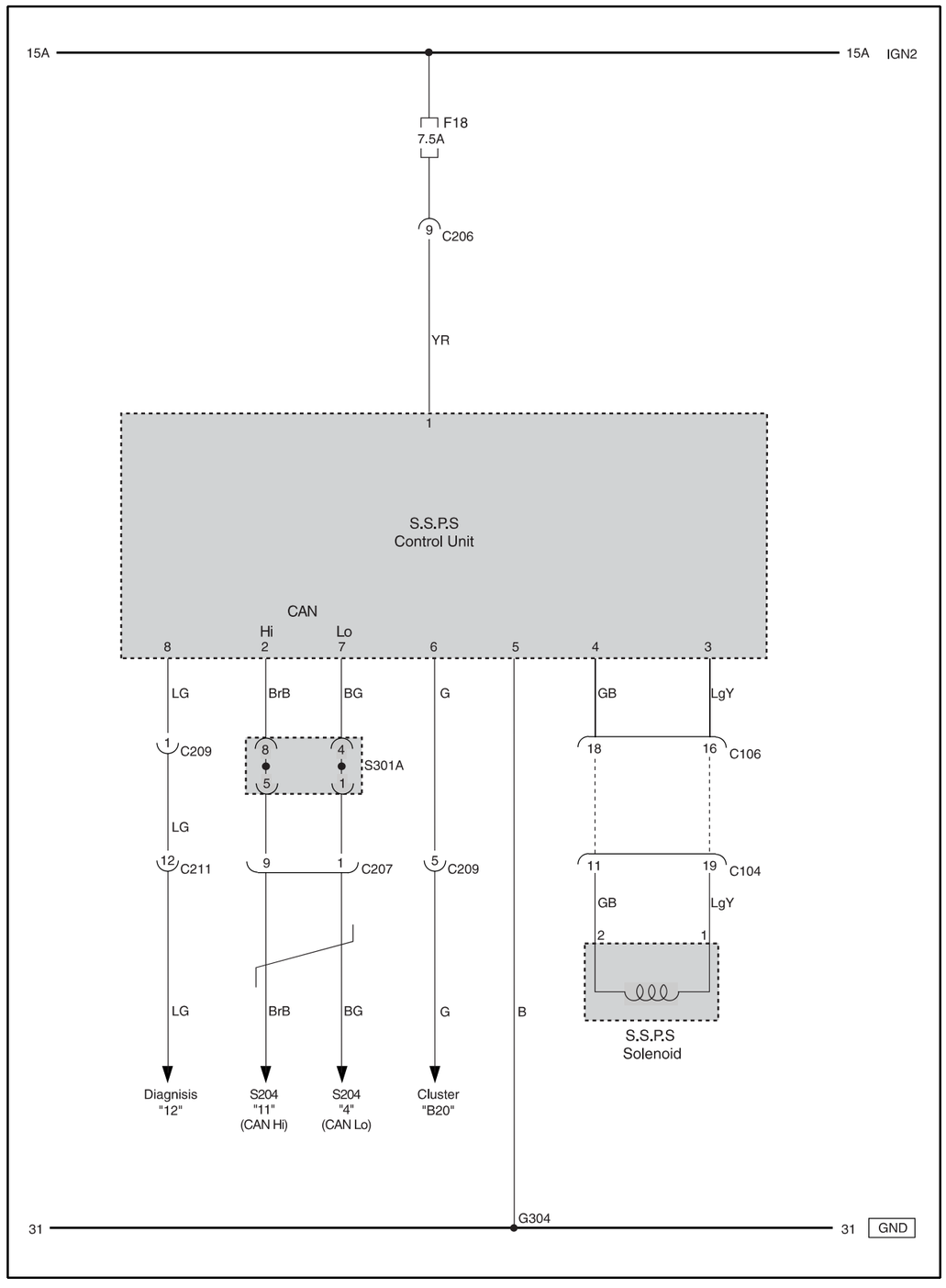

C219
W/H Main


Water Pump
(FFH)

Modification basis	
Application basis	
Affected VIN	

S.G.N. 4620-12

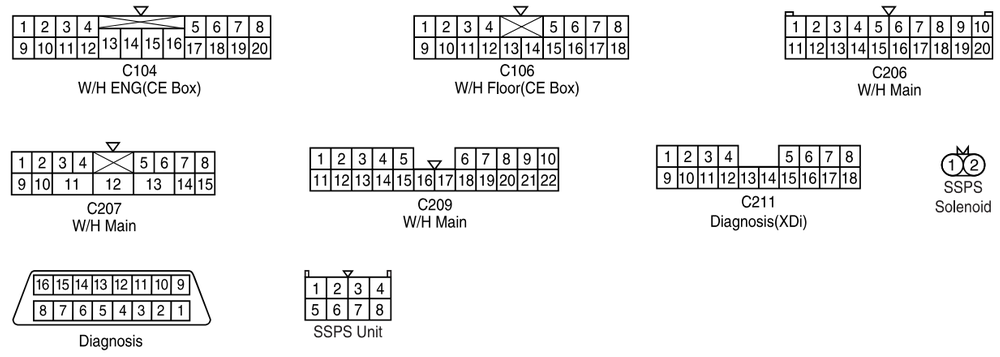
S.S.P.S



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	Engine Room Fuse Box (D) - Engine	Engine Room Fuse Box	
C106 (18Pin, White)	Engine Room Fuse Box (F) - Engine	Engine Room Fuse Box	
C206 (20Pin, Black)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C207 (15Pin, Blue)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C209 (22Pin, Yellow)	Main - Floor (LH)	Inside Driver Side Cowl PNL	
C211 (18Pin, White)	Main - Diagnosis Connector	Upper the Diagnosis	XDi
S301A (8Pin, Black)	W/H Floor	Under Driver Seat	CAN (GSL)
G304	W/H Floor	Behind the Quarter Grass #1	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



CIRCUIT

REXTON 2004.04

Modification basis	
Application basis	
Affected VIN	

INDEX

VEHICLE GENERAL

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2. VEHICLE IDENTIFICATION..... 8
3. GUIDELINES FOR SERVICE WORK SAFETY..... 10
4. LIFTING POINTS..... 17
5. TIGHTENING TORQUE OF STANDARD BOLTS..... 18
6. CLEANNESS..... 19

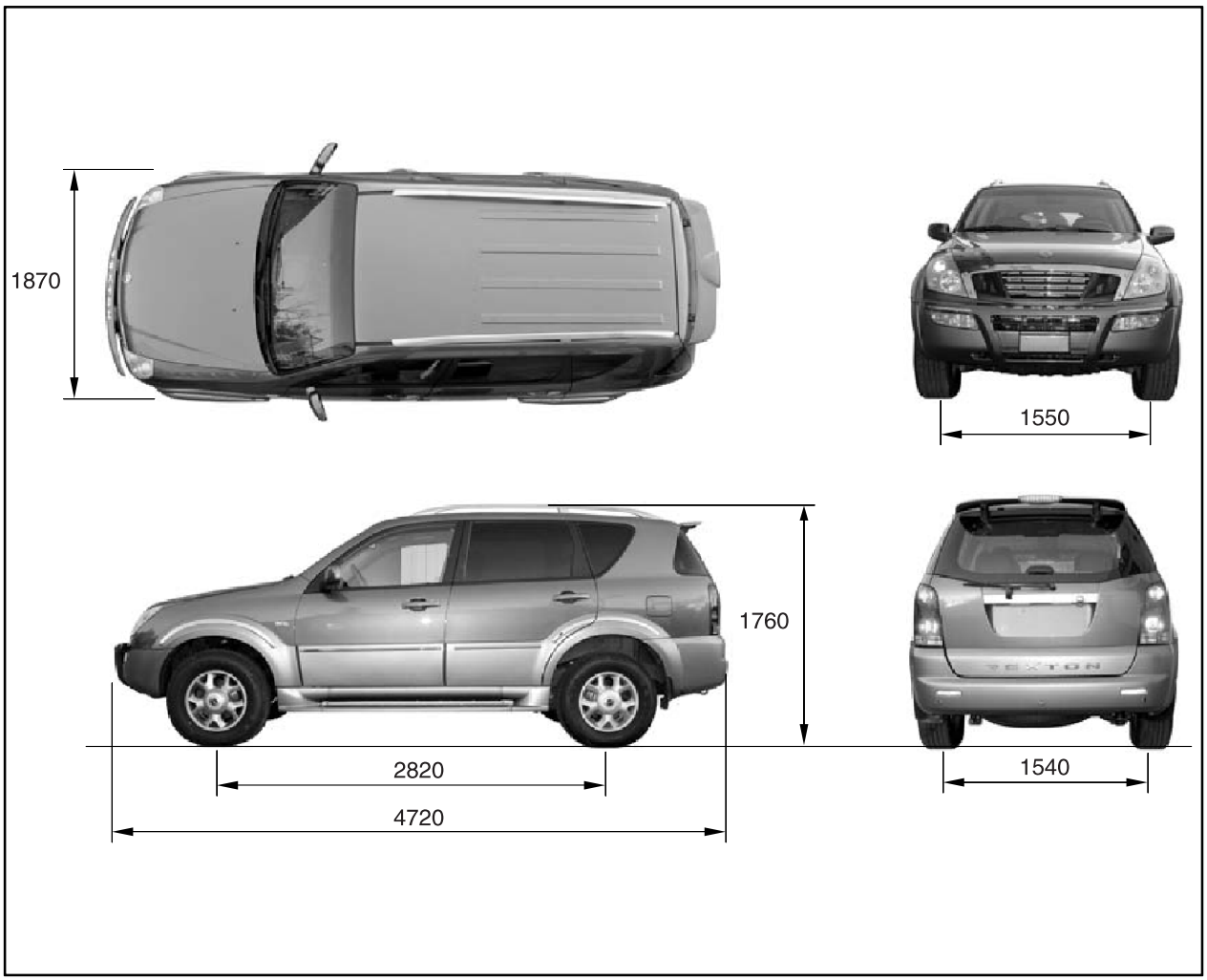
VEHICLE GENERAL

0000-00

GENERAL

1. VEHICLE SPECIFICATIONS

1) Vehicle Dimension



Modification basis	
Application basis	
Affected VIN	

2) Specifications

Systems	Items		Diesel			Remark
General	Overall length (mm)		4,720 (4,785)			( ): optional item
	Overall width (mm)		1,870			
	Overall height (mm)		1,760 (1,830)			
	Gross vehicle weight (kg)		AT: 2450 (2510), MT: 2405 (2465)			
	Curb weight (kg)		AT: 1995 (2055), MT: 1950 (2010)			
	Min. turning radius (m)		5.6			
	Ground clearance (mm)		200			
	Fuel		Diesel			
	Fuel tank capacity		80ℓ			
Engine	Model		D27DT			
	No. of cyl./Compression ratio		5/18:1			
	Total displacement		2,696 cc			
	Camshaft arrangement		DOHC			
	Max. power		170 ps/4,000 rpm			
	Max. torque		34.7 kg•m/1,800 rpm			
	Injection timing		ATDC 4° ± 1°(at idle)			
	Idle speed		760 ± 50 rpm			
	Cooling system		Water-cooled/forced circulation			
	Coolant capacity		Approx. 11.5ℓ			
	Lubrication		Gear pump, forced circulation			
	Max. oil capacity		9.3ℓ			
	Turbo charger and cooling type		Turbo charger, air-cooled			
Manual transmission	Type		Remote control, floor change type			
		1st	IDI Engine 4.007	DI Engine 4.315		
		2nd	2.367	2.475		
		3rd	1.473	1.536		
		4th	1.000	1.000		
		5th	0.872	0.807		
		Rev.	3.700	3.591		
Automatic transmission	Model		Electronic			
	Type		Floor change type			
		1st	2.742	3.595	2.742	
		2nd	1.508	2.186	1.508	
		3rd	1.000	1.405	1.000	
		4th	0.708	1.000	0.708	
		5th	-	0.831	-	
		Rev. 1st	2.429	3.162	2.429	
		Rev. 2nd	-	1.926	-	

Modification basis	
Application basis	
Affected VIN	

▶Specifications (Cont'd)

Systems	Items		Diesel		Remark
Transfercase	Model		Part-time		( ): optional item
	Type		Planetary gear type		
	Gear ratio	High	1.000 : 1		
		Low	2.483 : 1		
Clutch	Type		Hydraulic [A/T: Torque converter]		
	Disc type		Dry single diaphragm type [A/T: 3 elements 1 stage 2 phases]		
Power steering	Type		Rack and pinion		
	Steering angle	Inner	36° 17´		
		Outer	32° 40´		
Front axle	Drive shaft type		Ball joint type		
	Axle housing type		Build-up type		
Rear axle	Drive shaft type		Semi-floating type		
	Axle housing type		Build-up type		
Brake	Master cylinder type		Tandem type		
	Booster type		Vacuum booster		
	Type	Inner	Disc		
		Outer	Drum (Disc)		
	Parking brake		Cable type (internal expansion)		
Suspension	Front		Wishbone + Coil spring		
	Rear		5-link + Coil spring		
Air conditioner	Refrigerant		R134a		
	Compressor type		Vane type		
Electrical	Battery type/Capacity (V-AH)		MF / 12 - 90		
	Starter capacity (V-kW)		Diesel : 12 - 2.2, Gasoline : 12 - 1.8		
	Alternator capacity (V-A)		IDI	12 - 75 (12 - 90)	
			DI	12 - 140 (12 - 115)	
			Gasoline	12 - 115	

3) Maintenance

▶Major Components and Service Interval

* Use only Ssangyong Genuine Parts.

Components		Daily	Weekly	Service Interval	Remarks
Engine oil and oil filter	Gasoline engine	O	-	Initial change: 10,000 km Replace at every 15,000 km	More frequent maintenance is required if the vehicle is operated under severe condition. Severe conditions? - Frequent low-speed operation as in stop-and-go traffic - When most trips are less than 6 km (in winter, less than 16 km) - Driving in sandy, dusty, and salty road - Driving in mountainous areas - Extensive idling or high load operation such as towing a trailer
	DI diesel engine	O	-	Initial change: 5,000 km Replace at every 10,000 km or 12 months	
	IDI diesel engine	O	-		
Coolant		O	-	Replace at every 60,000 km or 3 years	
Brake pipe and hose		-	-	Initial inspection: 1,000 km Inspect at every 20,000 km, replace if necessary	
Brake pad, shoe and disc		-	-	Inspect at every 10,000 km, check or adjust if necessary	
Air cleaner element	Gasoline engine	-	O	Clean at every 15,000 km, Replace at every 60,000 km	If vehicle is operated under dusty or sandy area, frequently clean and inspect the air cleaner system. If necessary, replace the air cleaner element.
	DI diesel engine	-	O	Initial clean: 5,000 km, Clean at every 10,000 km, replace if necessary, Replace at every 30,000 km	
	IDI diesel engine	-	O		
Fuel filter	Gasoline engine	-	-	Replace at every 60,000 km	
	DI diesel engine	-	-	Replace at every 30,000 km (Drain the water from fuel filter at every 10,000 km)	
	IDI diesel engine	-	-	Replace at every 40,000 km	
Auto-matic transmis-sion oil	4-speed	-	-	Inspect at every 30,000 km or 1 year, replace if necessary (replace at every 60,000 km if the vehicle is operated under severe conditions)	More frequent maintenance is required if the vehicle is operated under severe condition. - Driving in unpaved road - Towing a trailer
	5-speed	-	-		
Manual transmission oil		-	-	Inspect at every 10,000 km, Replace at every 60,000 km	
Transfer case oil		-	-	Inspect at every 10,000 km, Replace at every 60,000 km (but, frequently chexk the leaks)	
Axle oil		-	-	Replace at every 30,000 km	
Air conditioner air filter		-	-	Replace at every 10,000 km	More frequent maintenance is required if the vehicle is operated under severe condition. - Driving in sandy, dusty, and unpaved road - Excessive operation of air conditioner or heater
Spark plug (gasoline engine)		-	-	Replace at every 60,000 km	

▶Lubrication Chart

Lubricant		Capacity		Classification	
Engine oil	Diesel	IDI Engine	6.0 ~ 8.0 L	Quality class**	API : CG grade or above, ACEA : B2, B3 or B4 MB sheet : 229.1/3 (preferable)
		DI Engine	6.8 ~ 8.3 L		
				Viscosity	MB sheet No. 224.1
	Gasoline	G23D	5.5 ~ 7.5 L	Quality class**	API : SJ grade or above, ACEA : A2 or A3 MB sheet : 229.1/3 (preferable)
		G32D/G28D	7.0 ~ 9.0 L		
				Viscosity	MB sheet No. 224.1
Engine coolant (Antifreeze and soft water mixed)		IDI Engine	10.5 ~ 11.0 L	MB sheet 325.0	
		DI Engine	11.0 ~ 12.0 L		
		G23D	10.0 ~ 10.5 L	BASF GLYSANTIN G05-11,	
		G32D/G28D	11.3 ~ 11.5 L	HOECHST GENANTIN SUPER 8023/14	
Manual transmission oil		4WD: 3.6 L, 2WD: 3.4 L		ATF DEXRON® II, III, ATF S-2, S-3, S-4, TOTAL FLUID ATX	
Brake/Clutch fluid (Level must be maintained between MAX & MIN level)		Properly		SAE J 1703, DOT 3 or DOT 4	
Power steering fluid		1.1 L		ATF DEXRON® II, III	
Automatic transmission fluid		4-speed: 9.5 L		CASTROL TQ 95	
		5-speed: 8.0 L		SHELL or FUCHS ATF 3353	
Transfer case fluid	IDI Engine	Part time	1.2 ~ 1.4 L	ATF DEXRON® II, III	
	DI Engine	Part time	1.4 ~ 1.5 L		
		Full time(TOD)	1.4 ~ 1.5 L	ATF S-4, TOTAL FLUID ATX	
	Gasoline	Full time(TOD)	1.4 ~ 1.5 L		
Axle fluid	Front	1.4 ~ 1.5 L		SAE 80W/90, API GL-5	
	Rear	2.2 L			
Wheel bearing grease		Properly		SHELL Retinax "A" grade	
Propeller shaft grease - Front/Rear		Properly		ALVANIA EP#2	

※ Please contact Ssangyong Dealer for approved alternative fluid.

※※ In only case not available MB 229.1 or 229.3, API or ACEA oil may be accepted, however it would rather recommend to shorten the change interval around 30%.

IDI: Indirect Injection

DI: Direct Injection

2. VEHICLE IDENTIFICATION

1) Vehicle identification Number



Vehicle identification number (VIN) is is on the right front axle upper frame.

[KPTPOA19S1P 122357]

K.. Nation	(K: Korea)
P .. Maker Identification	(P: Ssangyong Motor Company)
T .. Vehicle Type	(T: Passenger car - 4WD)
P .. Line Models	(P: Rexton)
O . Body Type	(O: 5-door)
A.. Trim Level	(A: Standard, B: Deluxe, C: Super deluxe)
1 .. Restraint System	(0: No seatbelts, 1: 3-point seatbelts, 2: 2-point seatbelt)
9 .. Engine Type	(9: 3199cc, In-line 6 cylinders, Gasoline E32)
	(D: 2874cc, Il-line 5 cylinders, Diesel)
S .. Check Digit	(S: All area except North America)
1 .. Model Year	(1: 2001, 2: 2002, 3: 2003)
P .. Plant Code	(P: Pyungtaek plant)
122357	(Production serial number)

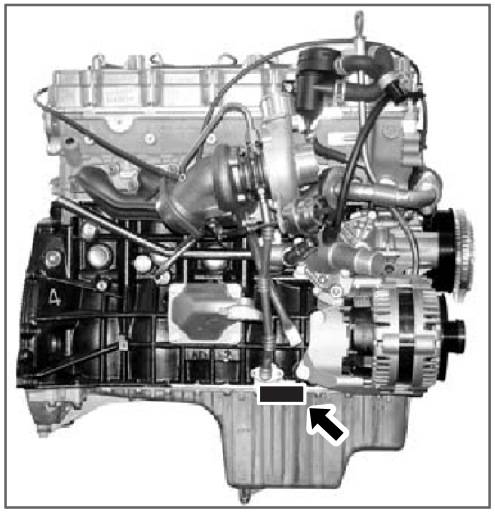
2) Certification Label



The certification label is affixed on the bottom of driver's side B-pillar.

Modification basis	
Application basis	
Affected VIN	

3) Engine Serial Number

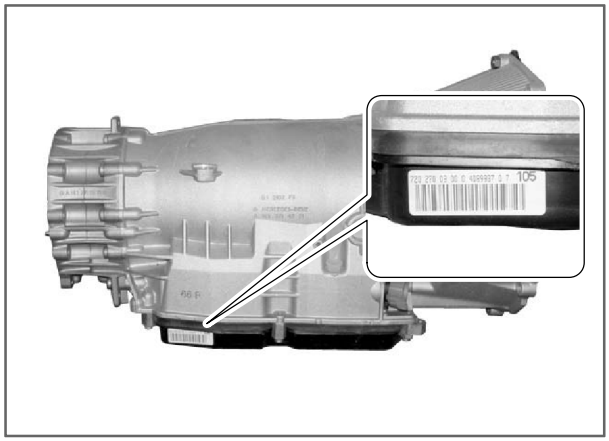


The engine serial number is stamped on the lower area of cylinder block in exhaust manifold side.

4) Manual Transmission Number

The transmission label is affixed on the upper area of clutch housing.

5) Automatic Transmission Number



The transmisson label is affixed on the right area of transmission housing.

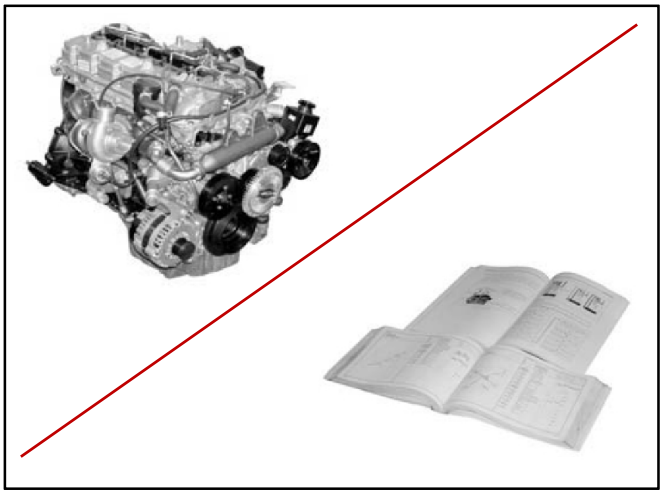
6) Transfer Case Number



The transfer case label is affixed on the transfer case housing.

3. GUIDELINES FOR SERVICE WORK SAFETY

1) General



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.

CAUTION

- While using this manual, there are a lot of Note or Notice having below meaning.
- Note means detailed description of supplementary information on work procedure or skill.
- 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.

Modification basis	
Application basis	
Affected VIN	

2) Cautions on Inspection/Service

CAUTION

During service works, be sure to observe below general items for your safety.

- For service works, be sure to disconnect battery negative (-) terminal if not starting and inspection.
- While inspecting vehicle and replacing various consumable parts, be sure to take caution not to damage vehicle and injure people.
- Engine and transmission may be hot enough to burn you. So inspect related locations when they cooled down enough.
- If engine is running, keep your clothing, tools, hair and hands away from moving parts.
- Even when the ignition key is turned off and positioned to LOCK, electrical fan can be operated while working on near around electrical fan or radiator grille if air conditioner or coolant temperature rises.
- Every oil can cause skin trouble. Immediately wash out with soap if contacted.
- Painted surface of the body can be damaged if spilled over with oil or anti-freeze.
- Never go under vehicle if supported only with jack.
- Never near the battery and fuel related system to flames that can cause fire like cigarette.
- Never disconnect or connect battery terminal or other electrical equipment if ignition key is turned on.
- While connecting the battery terminals, be cautious of polarities (+, ?) not to be confused.
- There are high voltage and currency on the battery and vehicle wires. So there can be fire if shortcircuited.
- Do not park while running the engine in an enclosed area like garage. There can be toxication with CO, so make sufficient ventilation.
- The electrical fan works electrically. So the fan can be operated unexpectedly during working causing injuries if the ignition key is not in LOCK position. Be sure to check whether ignition key is in LOCK position before work.
- Be careful not to touch hot components like catalytic converter, muffler and exhaust pipe when the engine is running or just stopped. They may burn you badly.

3) 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

- 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 D27DT 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.

▶ 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	

▶ 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.

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

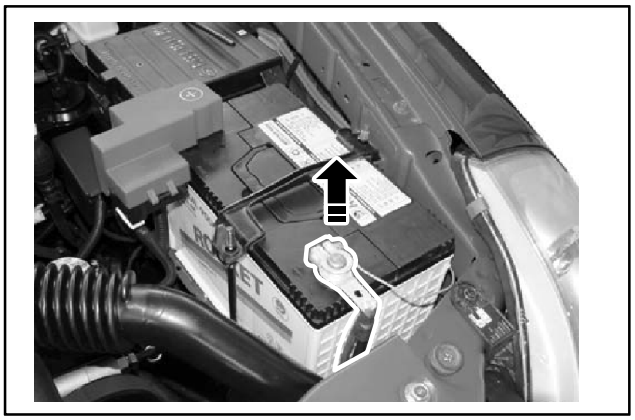
Electrical equipment should be handled more carefully. Currently, the engine is equipped with a lot of electrical equipments so there can be engine performance drops, incomplete combustion and other abnormals due to short and poor contact. Mechanics should well aware of vehicle's electrical equipment.

- 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.

4) During Service Work - Inspection



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 block front and rear wheels. 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.

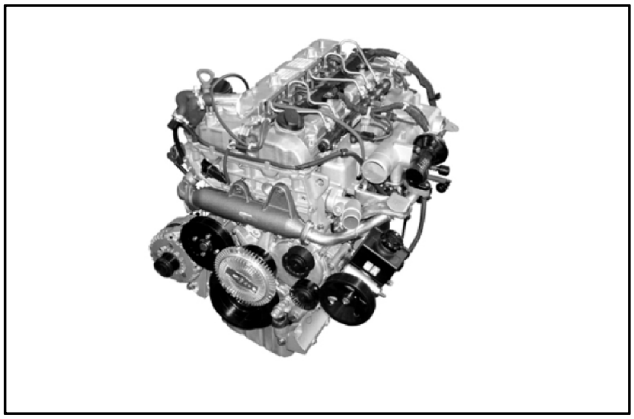


4. If service from interior of the vehicle, use protection cover to prevent damage and contamination of seat and floor.
5. Brake fluid and anti-freeze can damage painted surface of body. So carefully handle them during service work.



6. Use recommended and specified tools to increase efficiency of service work.
7. Use only genuine spare parts.

Modification basis	
Application basis	
Affected VIN	





8. Never reuse cotter pin, gasket, O-ring, oil seal, lock washer and self-locking nut. Replace them with new. If reused, normal functions cannot be maintained.
9. Align the disassembled parts in clean according to disassembling order and group for easy assembling.
10. 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.
11. To inspect and assemble, clean the
12. parts.
    Securely clean the parts that related with
13. oil not to be affected by viscosity of oil.
    Coat oil or grease on the driving and
14. sliding surfaces before installing parts.
    Use sealer or gasket to prevent leakage
15. if necessary.
    Damaged or not, never reuse removed gasket. Replace with new and cautious
16. on installing directions.
    Tighten every bolt and nut with specified
17. torque.
    When service work is completed, check finally whether the work is performed
18. properly or the problem is solved.
    If work on the fuel line between priming pump and injector (including return line), be sure to cover the removed parts with cap and be careful not to expose the connecting passage and removed parts to external foreign materials or dust.
19. (Refer to cleanness.)
    If remove high pressure fuel supply pipe between HP pump and fuel rail and high pressure fuel pipe between fuel rail and each injector, be sure to replace them with new.

5) During Service Work for Electric Devices

CAUTION

Be careful not to modify or alter electrical system and electrical device. Or there can be vehicle fire or serious damage.



1. Be sure to disconnect battery negative (-) terminal during every service work. Before disconnecting battery negative (-) terminal, turn off ignition key.
2. Replace with specified capacity of fuse if there is bad, blown or short circuited fuse. If use electrical wire or steel wire other than fuse, there can be damages on the various electrical systems. If replaced with over-capacity fuse, there can be damages on the related electrical device and fire.
3. Every wire on the vehicle should be fastened securely not to be loosened with fixing clip.
4. If wires go through edges, protect them with tape or other materials not to be damaged.



5. Carefully install the wires not to be damaged during installation/removal of parts due to interference.
6. Be careful not to throw or drop each sensor or relay.
7. Securely connect each connector until hear a "click" sound.

Modification basis	
Application basis	
Affected VIN	

4. LIFTING POINTS

1) Lifting Positions

▶4-post lift

As illustrated, position the vehicle on the 4-post lift securely and block the front and rear of each tire not to move during working.

CAUTION

During lifting, be sure to check whether vehicle is empty

- Board-on lift connection device installed in front of vehicle should be positioned in front of sill locating under the front door.
- Install lift connecting device on the edge of front and rear of board-on lift.

WARNING

- Be sure to use attachment during lifting to prevent the lift from contacting with body floor.
- While lifting the vehicle, widen the lift floor as far as possible to stabilize between vehicle front and rear. When fixing the lift floor, be careful not to contact with brake tube and fuel lines

▶Safety jack and safety stand

If lift up the vehicle with safety jack and stand, should be more careful during works.

WARNING

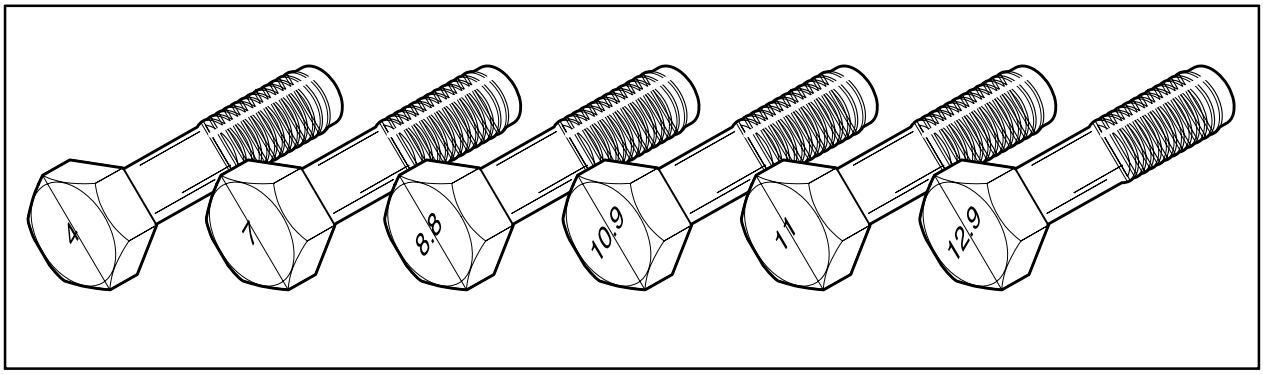
- Never be under the vehicle if supported with only jack. If have to be under the vehicle, be sure to use safety block.
- Use wheel block in front and rear of every wheel.



5. TIGHTENING TORQUE OF STANDARD BOLTS

▶ Tightening Torque By Bolt Specification

Bolt Diameter	Pitch	Tightening Torque (kg·cm)					
		Standard Tightening Torque			Max. Allowable Tightening Torque		
		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.

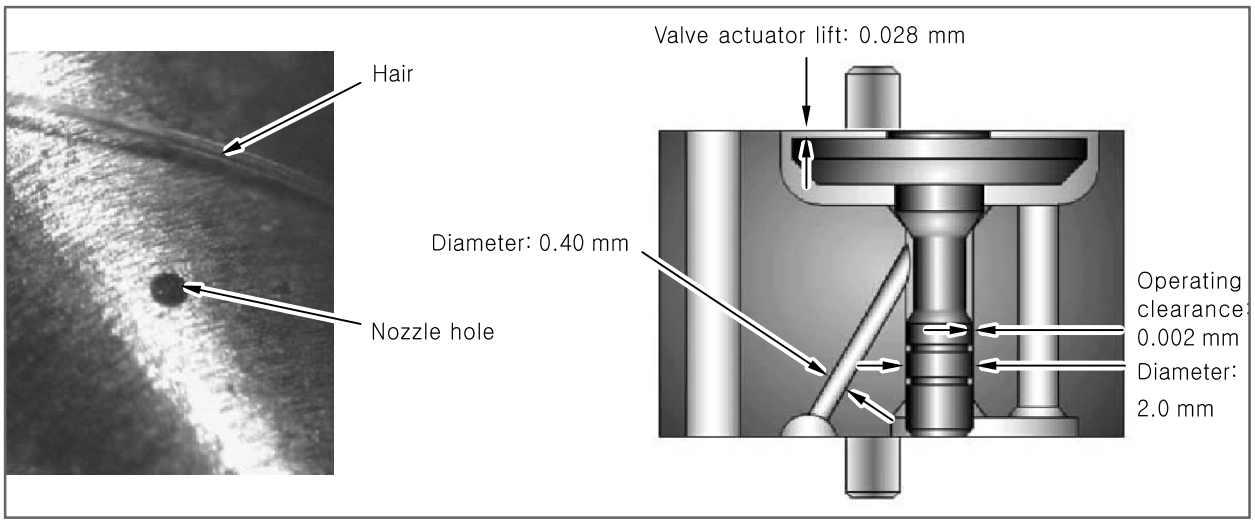
Modification basis	
Application basis	
Affected VIN	

6. CLEANNESS

1) Cleanness of 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 1600 mbar. Some components in injector and HP pump are machined with 100 μm of preciseness. The pressure regulation and injector operation are done by electric source from engine ECU. Accordingly, if the internal valve is stucked 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 right side 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.

2) Job procedures

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.
4. 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-i
(refer to "DIAGNOSIS" section in this manual).

↓

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.

5. 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 "DIAGNOSIS" section 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	Tool kit for transfer line	Sealing caps and torque wrench
		

Modification basis	
Application basis	
Affected VIN	

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

Disconnect the negative battery cable.

↓

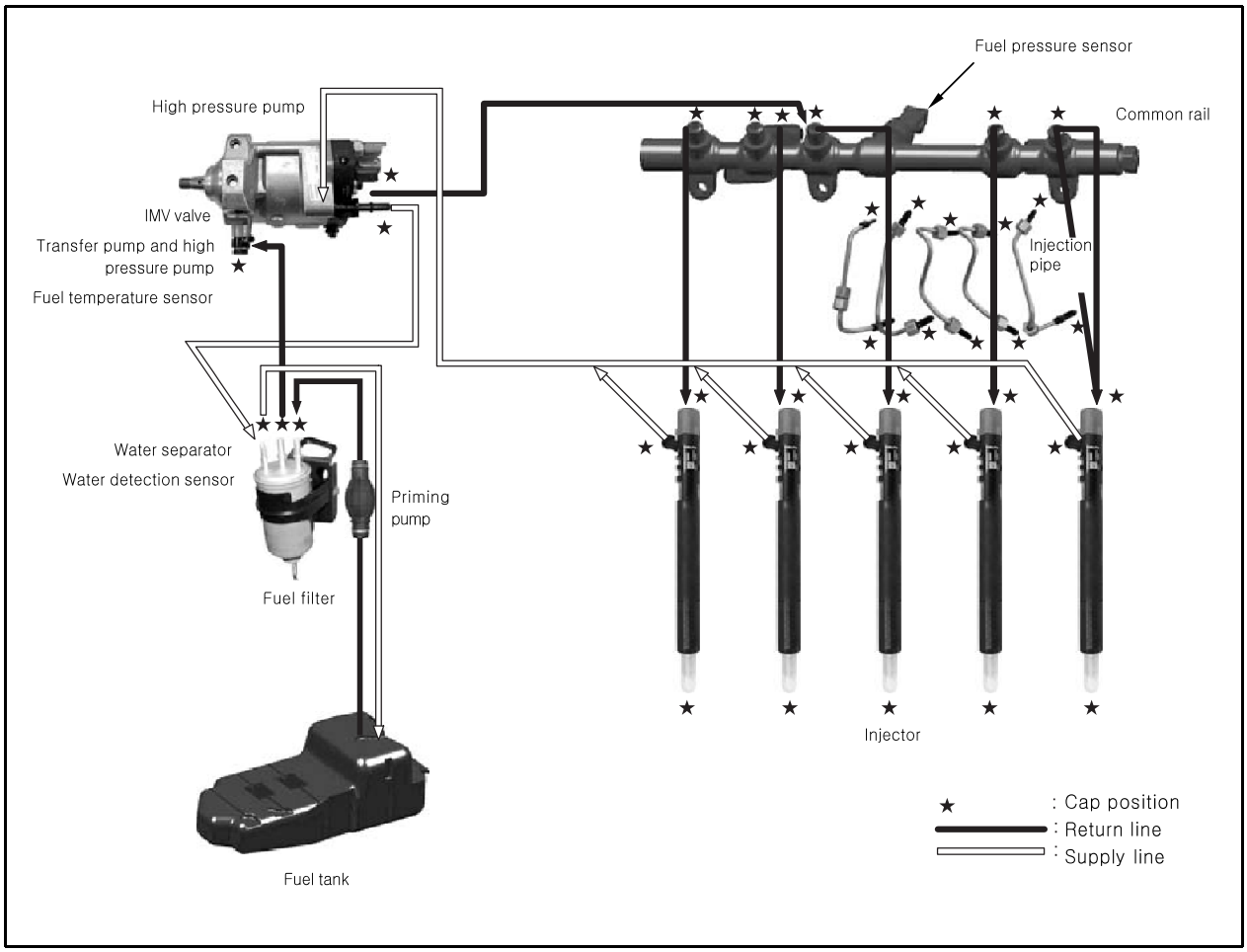
Use special tools and torque wrench to perform the correct works.

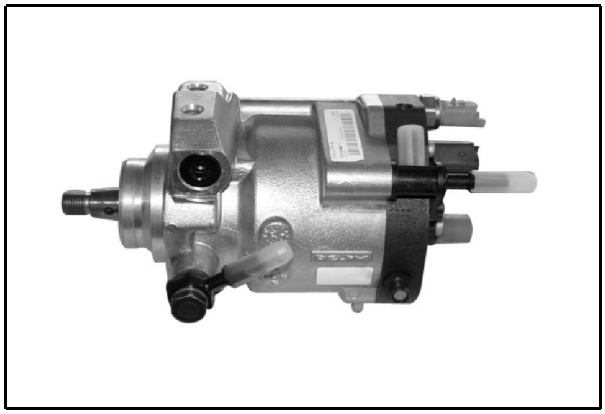
Once disconnected, the fuel pipes between HP pump and fuel rail and between fuel rail and each injector should be replaced with new ones. The pipes should be tightened to specified tightening torques during installation. Over or under torques out of specified range may cause damages and leaks at connections. Once installed, the pipes have been deformed according to the force during installtion, 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.

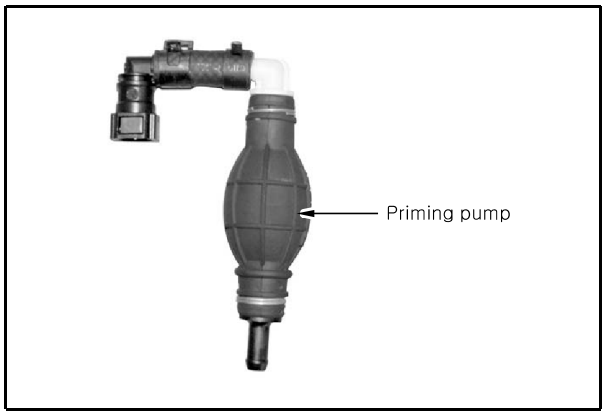
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Plug the disconnected parts with sealing caps, and remove the caps immediately before replacing the components.

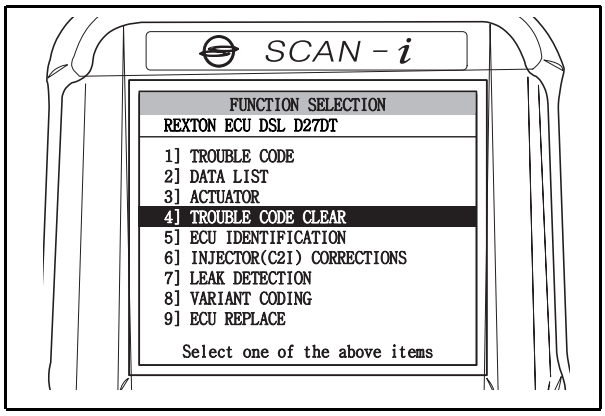




7. Plug the removed components with clean and undamaged sealing caps and store it into the box to keep the conditions when it was installed.
8. Clear the high pressure offset value from scan tool after replacing the high pressure pump.



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



10. Check the installed components again and connect the negative battery cable. Start the engine and check the operating status.
11. With Scan-i, check if there are current faults and erase the history faults.

CAUTION

For details, refer to "DI10 Diagnosis teable".

Modification basis	
Application basis	
Affected VIN	

3) DI Engine and Its Expected Problems and Remedies Can be Caused by Water in Fuel

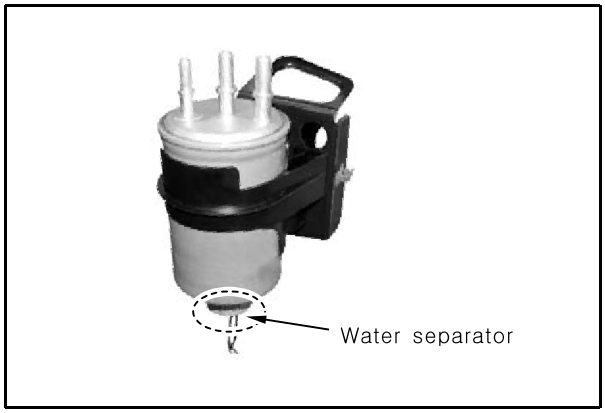
(1) SYSTEM SUPPLEMENT AGAINST PARAFFIN SEPARATION.

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).

(2) 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 due to centrifugal separation effect.

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 light ( ) 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. (See fuel system for details.)

Memo

ENGINE ASSEMBLY

1113-01

GENERAL

1. SPECIFICATIONS

1) Fastener Tightening Specifications

Application		N•m	Lb-Ft	Lb-In
Fuel Feed and Return Line		21 - 25	15 - 18	-
Exhaust Manifold and Pipe		30	22	-
Engine Mounting Nuts		70	52	-
Generator Carrier Bolts		25	18	-
Tensioning Pulley Bolt		40.5 - 49.5	29.9 - 36.5	-
Steering Pump Bolts		22.5 - 27.5	16.6 - 20.3	-
A/C Braket Bolts		22.5 - 27.5	16.6 - 20.3	-
Intake Air Duct Mounting Nuts		9 - 11	-	80 - 97
Spark Plug Cover Bolts		9 - 11	-	80 - 97
Cylinder Head Cover Bolts		9 - 11	-	80 - 97
Magnetic Assembly Bolt		9 - 11	-	80 - 97
Cylinder Head Front Cover Bolts	M8	22.5 - 27.5	16.6 - 20.3	-
	M6	9 - 11	-	80 - 97
Cylinder Head Bolts		55 +90° +90°	41 +90° +90°	- - 80 - 97
Timing Gear Case Cover Bolts		22.5 - 27.5	16.6 - 20.3	-
Crankshaft Sealing Rear Cover Mounting Bolts		9 - 11	-	-
Vibration Damper Center Bolts		200 + 20 +90° + 10°	148 + 15 +90° + 10°	- -
Flywheel Mounting Bolt		40 +90°	30 +90°	- -
Amarture Bolt in Flywheel		45 + 5	33 + 3.7	-
Camshaft Adjuster Flange Bolts		+90° + 10° 35	+90° + 10° 26	- -
Intake Flange Shaft Bolts		18 - 22 60° ± 5°	13 - 16 60° ± 5°	- -
Exhaust Camshaft Sprocket Bolts		18 - 22 60° ± 5°	13 - 16 60° ± 5°	- -
Intake Flange Shaft Bolts		18 - 22	13 - 16	-
Exhaust Camshaft Sprocket Bolts		60° ± 5°	60° ± 5°	-
Camshaft Bearing Cap Bolts		22.5 - 27.5	16.6 - 20.3	-
Chain Tensioner Screw Plug		40	30	-
Chain Tension Assembly		72 - 88	53 - 65	-
Oil Pump Sprocket Bolt		29 - 35	21 - 26	-
Tensioning Device Bolts		26 - 32	19 - 24	-
Water Pump Pulley		22.5 - 27.5	16.6 - 20.3	-
Upper Intake Manifold Bolt		22.5 - 27.5	16.6 - 20.3	-
Lower Intake Mainfold Bolt		22.5 - 27.5	16.6 - 20.3	-
Flange Bolt to Exhaust Mainfold		30	22	-

▶ Fastener Tightening Specifications (Cont'd)

Application	N•m	Lb-Ft	Lb-In
Exhaust Mainfold Nut to Stud Bolt	26 - 34	19 - 25	-
Oil Drain Plug	25	18	-
Oil Filter Cover	25	18	-
Oil Filter Bolt	22.5 - 27.5	16.6 - 20.3	-
Oil Pump Drive Sprocket Bolt	29 - 35	21 - 26	-
Oil Pump Mounting Bolt	22.5 - 27.5	16.6 - 20.3	-
Oil Strainer Bracket Bolt	9 - 11	-	80 - 97
Oil Pressure Relief Valve Screw Plug	50	37	-
Oil Dipstick Guide Tube Bolt	9 - 11	-	80 - 97
Oil Gallery Screw Plug	15	11	-
Shock Absorber Bolts	22.5 - 27.5	16.6 - 20.3	-
Crankshaft Bearing Cap Bolts	55/+90°	41/+90°	-
Torque Converter Mounting Bracket Bolts	42	31	-

FUEL SYSTEM

2211-06

GENERAL

1. FUEL SYSTEM SPECIFICATION

▶ Use Only Unleaded Fuel Rated at 89 Octane or Higher

Fuel quality and additives contained in fuel have a significant effect on power output, drivability, and life of the engine.
Fuel with too low an octane number can cause engine knock.
Caution: Use of fuel with an octane number lower than 89 may damage engine and exhaust system.

CAUTION
- To prevent accidental use of leaded fuel, the nozzles for leaded fuel are larger, and will not fit the fuel filler neck of your vehicle.

▶ Do Not Use Methanol

Fuels containing methanol (wood alcohol) should not be used in vehicle.
This type of fuel can reduce vehicle performance and damage components of the fuel system.

CAUTION
- Use of methanol may damage the fuel system.

▶ Vehicle Fueling from Drums or Storage Containers

For safety reasons (particularly when using noncommercial fueling systems) fuel containers, pumps and hoses must be properly earthed.
Static electricity build up can occur under certain atmospheric and fuel flow conditions if unearthed hoses, particularly plastic, are fitted to the fuel-dispensing pump.
It is therefore recommended that earthed pumps with integrally earthed hoses be used, and that storage containers be properly earthed during all noncommercial fueling operations.

▶ Temperature VS Resistance

°C	°F	ECT sensor	IAT sensor
		ohms ( )	
Temperature vs Resistance Values (Approximate)			
130	266	88	102
120	248	111.6	127
110	230	143	159
100	212	202	202
90	194	261	261
80	176	340	340
70	158	452	452
60	140	609	609
50	122	835	835
40	113	1166	1166
30	86	1662	1662
20	68	2420	2420
10	50	3604	3604
0	32	5499	5499
-10	14	8609	8609
-20	-4	13850	13850
-30	-22	22960	22960
-40	-40	39260	39260

CONFIGURATION AND PROCESS

1. FUEL SYSTEM

The function of the fuel metering system is to deliver the correct amount of fuel to the engine under all operating conditions.

The fuel is delivered to the engine by the individual fuel injectors mounted into the intake manifold near each cylinder.

The main fuel control sensors are the Mass Air Flow (MAF) sensor and the oxygen (O2) sensors.

The MAF sensor monitors the mass flow of the air being drawn into the engine. An electrically heated element is mounted in the intake air stream, where it is cooled by the flow of incoming air. Engine Control Module (ECM) modulates the flow of heating current to maintain the temperature differential between the heated film and the intake air at a constant level. The amount of heating current required to maintain the temperature thus provides an index for the mass air flow. This

concept automatically compensates for variations in air density, as this is one of the factors that determines the amount of warmth that the surrounding air absorbs from the heated element. MAF sensor is located between the air filter and the throttle valve.

Under high fuel demands, the MAF sensor reads a high mass flow condition, such as wide open throttle.

The ECM uses this information to enrich the mixture, thus increasing the fuel injector on-time, to provide the correct amount of fuel. When decelerating, the mass flow decreases. This mass flow change is sensed by the MAF sensor and read by the ECM, which then decreases the fuel injector on-time due to the low fuel demand conditions.

The O2 sensors are located in the exhaust pipe before catalytic converter. The O2 sensors indicate to the ECM the amount of oxygen in the exhaust gas, and the ECM changes the air/fuel ratio to the engine by controlling the fuel injectors. The best air/fuel ratio to minimize exhaust emissions is 14.7 to 1, which allows the catalytic converter to operate most efficiently. Because

of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a "closed loop" system.

The ECM uses voltage inputs from several sensors to determine how much fuel to provide to the engine. The fuel is delivered under one of several conditions, called "modes".

1) Starting Mode

When the ignition is turned ON, the ECM turns the fuel pump relay on for 1 second. The fuel pump then builds fuel pressure. The ECM also checks the Engine Coolant Temperature (ECT) sensor and the Throttle Position (TP) sensor and determines the proper air/fuel ratio for starting the engine. This ranges from1.5 to 1 at -36 °C (-33 °F) coolant temperature to 14.7 to 1 at 94 °C (201 °F) coolant temperature. The ECM controls the amountof fuel delivered in the starting mode by changing how long the fuel injector is turned on and off. This is done by "pulsing" the fuel injectors for very short times.

2) Run Mode

The run mode has two conditions called "open loop" and "closed loop".

3) Open Loop

When the engine is first started and it is above 690 rpm, the system goes into "open loop" operation. In "open loop", the ECM ignores the signal from the HO2S and calculates the air/fuel ratio based on inputs from the ECT sensor and the MAF sensor. The ECM stays in "open loop" until the following conditions are met:

- The O2 has a varying voltage output, showing that it is hot enough to operate properly.
- The ECT sensor is above a specified temperature (22.5 °C).
- A specific amount of time has elapsed after starting the engine.

4) Closed Loop

The specific values for the above conditions vary with different engines and are stored in the Electronically Erasable Programmable Read-Only Memory (EEPROM).
When these conditions are met, the system goes into "closed loop" operation. In "closed loop", the ECM calculates the air/fuel ratio (fuel injector on- time) based on the signals from the O2 sensors. This allows the air/fuel ratio to stay very close to 14.7 to 1.

5) Acceleration Mode

The ECM responds to rapid changes in throttle position and airflow and provides extra fuel.

6) Deceleration Mode

The ECM responds to changes in throttle position and airflow and reduces the amount of fuel. When deceleration is very fast, the ECM can cut off fuel completely for short periods of time.

Modification basis	
Application basis	
Affected VIN	

7) Battery Voltage Correction Mode

When battery voltage is low, the ECM can compensate for a weak spark delivered by the ignition module by using the following methods:

- Increasing the fuel injector pulse width.
- Increasing the idle speed rpm.
- Increasing the ignition dwell time.

8) Fuel Cut-Off Mode

No fuel is delivered by the fuel injectors when the ignition is off. This prevents dieseling or engine runon. Also, the fuel is not delivered if there are no reference pulses received from the CKP sensor. This prevents flooding.

Memo

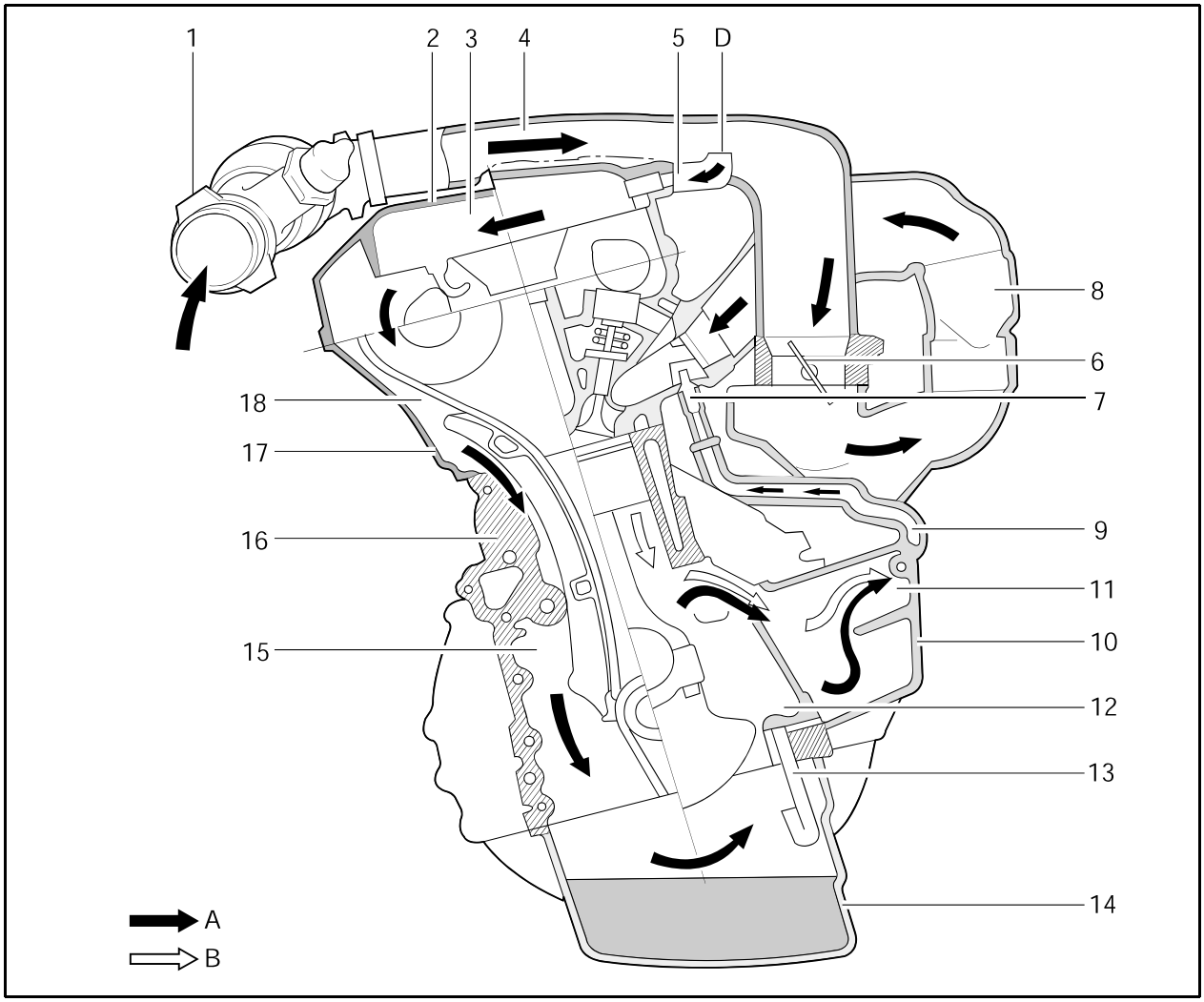
EXHAUST SYSTEM

2411-01

OVERVIEW AND OPERATION PROCESS

1. CRANKCASE VENTILATION SYSTEM

1) Operation at Idling and Mid- Load



1 HFM Sensor
2 Cylinder Head Cover
3 Oil Spearation Chamber (Full-Load or Over Mid- Load)
4 Intake Air Duct (Cross Pipe)
5 Vent Line (Full-Load or Over Mid-Load)
6 Throttle Valve
7 Restrictor, Diameter 1.1mm (Mid-Load at Idling)
8 Intake Manifold
9 Vent Line (Mid-Load at Idling)
10 Air Conditioner Bracket
11 Oil Separation Chamber (Mid-Load at Idling)
12 Crank Chamber
13 Oil Return Pipe
14 Oil Pan
15 Timing Gear Case Cover
16 Crankcase
17 Chain Housing
A Fresh Air
B Blow-By Gas
D Vent Connection

▶ Operation at Idling and Mid- Load

The throttle valve (6) is closed or very partially opened, and the vacuum pressure in intake manifold is high.

The blow-by gas and the fresh air that is additionally supplied through the vent connection (D) in the crank-case in partial load gets supplied to the combustion chamber from the crank chamber (12) through the oil separation chamber (11), airconditioner bracket (10), vent line (9), and restrictor (7) mounted to the cylinder head.

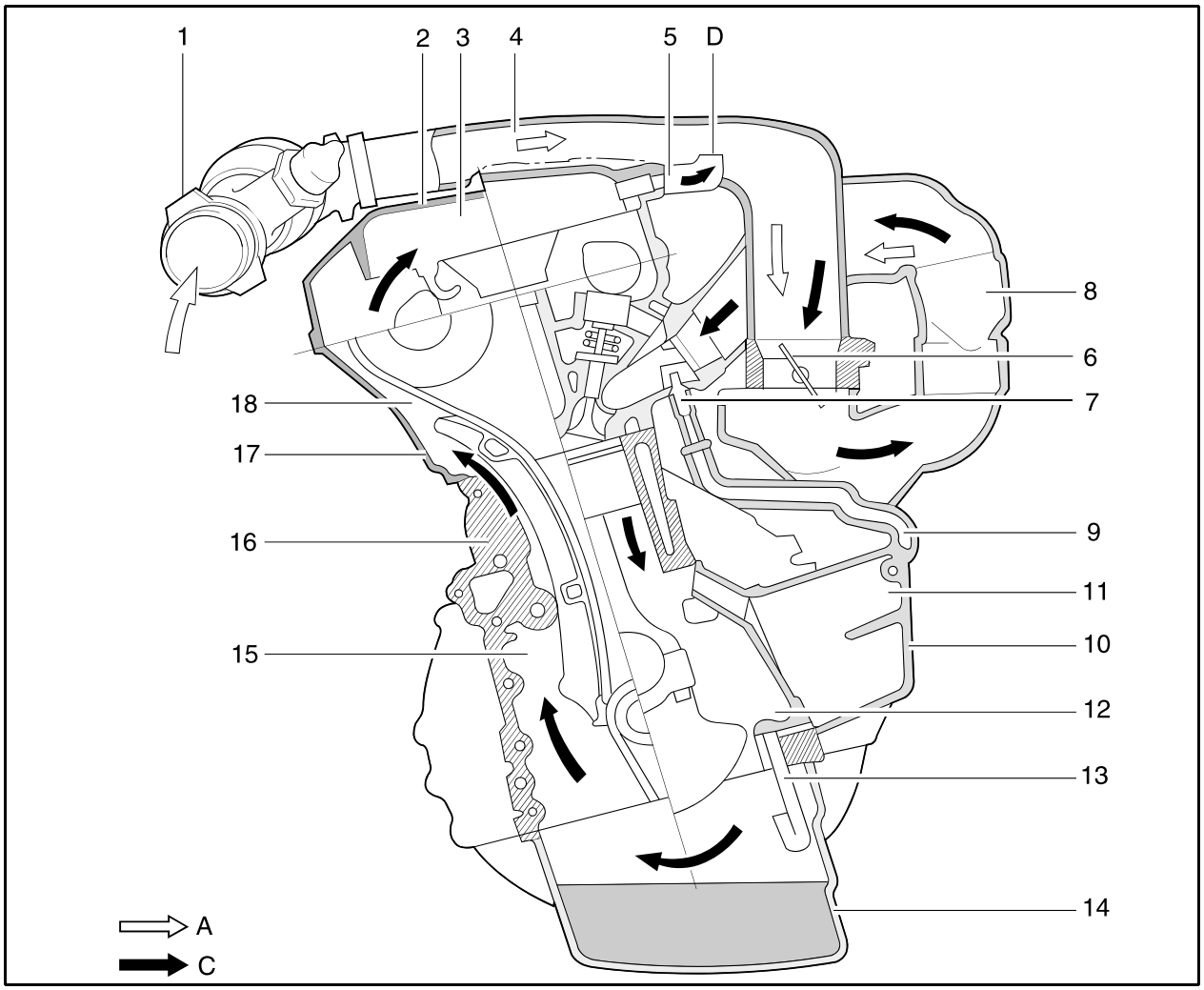
The circulated engine oil returns to the oil pan through the oil return pipe (13) at the bottom of oil separation chamber (11).

The fresh air gets supplied to the crank chamber (12) through the HFM sensor (1), intake air duct (4), vent line (5), oil separation chamber (3), chain housing (17), and the timing gear case cover (15).

The additional supply of the fresh air is needed to prevent from forming the residues of the engine oil.

Modification basis	
Application basis	
Affected VIN	

2) Operation When Full- Load at Partial Load



1 HFM Sensor
2 Cylinder Head Cover
3 Oil Spearation Chamber (Full-Load or Over Mid-Load)
4 Intake Air Duct (Cross Pipe)
5 Vent Line (Full-Load or Over Mid-Load)
6 Throttle Valve
7 Restrictor, Diameter 1.1mm (Mid-Load at Idling)
8 Intake Manifold
9 Vent Line (Mid-Load at Idling)
10 Air Conditioner Bracket
11 Oil Separation Chamber (Mid-Load at Idling)
12 Crank Chamber
13 Oil Return Pipe
14 Oil Pan
15 Timing Gear Case Cover
16 Crankcase
17 Chain Housing
A Fresh Air
C Blow-By Gas
D Vent Connection

▶ **Operation When Full- Load at Partial Load**

The throttle valve (6) is partially opened or fully opened.

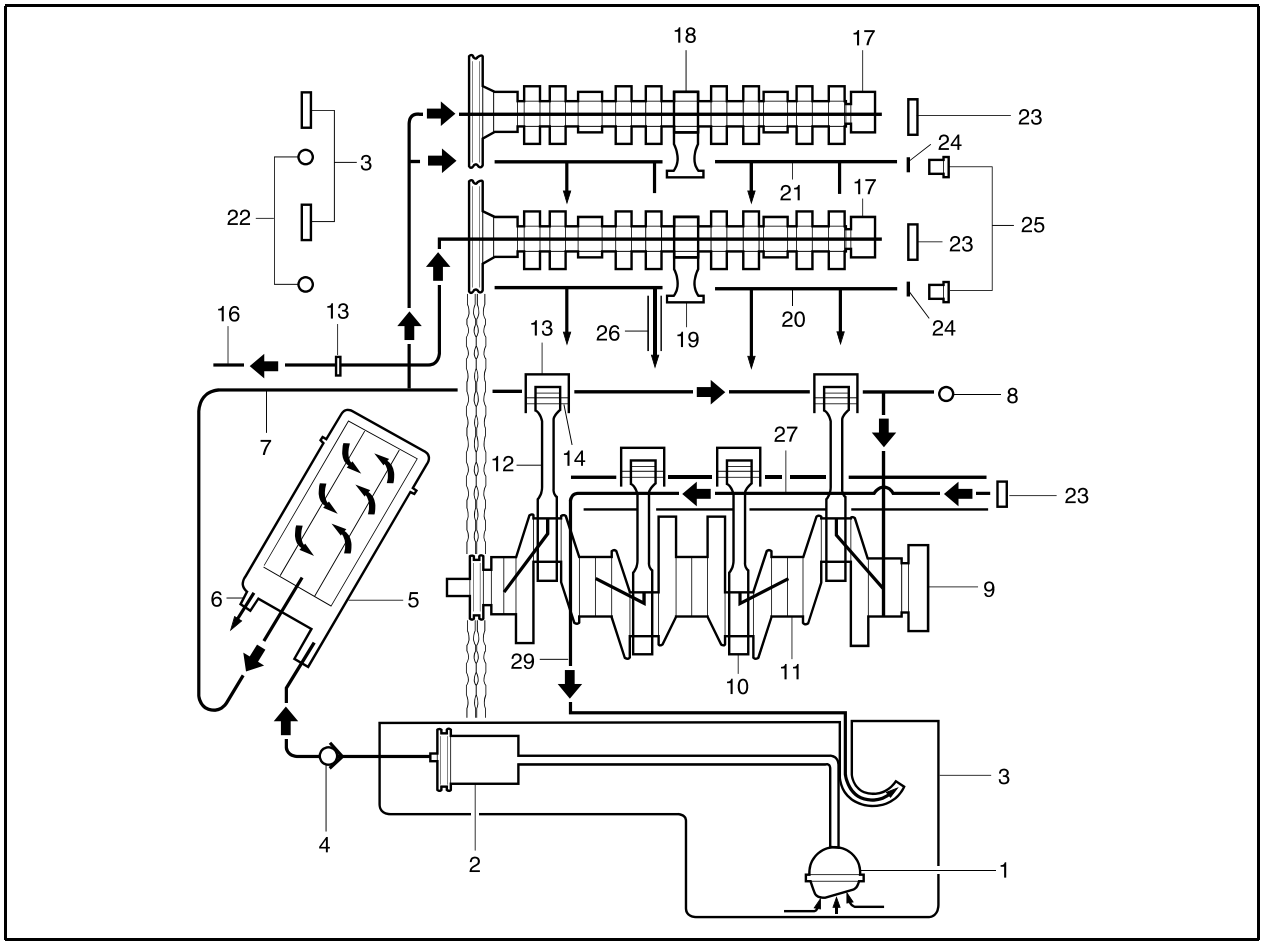
The air flows very rapidly through the vent line (5) s connection (D) and the intake air duct when full load at partial load.

Consequently, most of the low-by gases are supplied to the combustion chamber through the timing gear case cover (15), chain housing (17), oil separation chamber (3), vent line (5), throttle valve (6), and intake manifold (8).

LUBRICATION SYSTEM 1532-24

OVERVIEW AND OPERATION PROCESS

1. OIL CIRCULATION



1 Oil Strainer
2 Oil Pump
3 Oil Pan
4 Oil Non-Return Valve
5 Oil Filter
6 Oil Filter Bypass Valve
7 Main Oil Gallery
8 Closing Ball (ϕ 15 mm)
9 Crankshaft
10 Connecting Rod Bearing
11 Crankshaft Bearing
12 Connecting Rod
13 Piston
14 Oil Spray (Piston Crown Area)
15 Non-Return Valve (Crankcase)
16 Oil Supply (To Chain Tensioner)
17 Camshaft
18 Cam Bearing
19 Valve
20 Oil Gallery (Supply Oil to Intake Tappet)
21 Oil Gallery (Supply Oil to Exhaust Tappet)
22 Ball (ϕ 8 mm)
23 Camshaft Plug
24 Seal
25 Screw Plug
26 Oil Return Gallery (Cylinder Head and Crankcase)
27 Oil Return Gallery (Crankcase)
28 End Cover (ϕ 20 mm)
29 Oil Return Pipe

ENGINE ELECTRICAL 1441-01

OVERVIEW AND OPERATION PROCESS

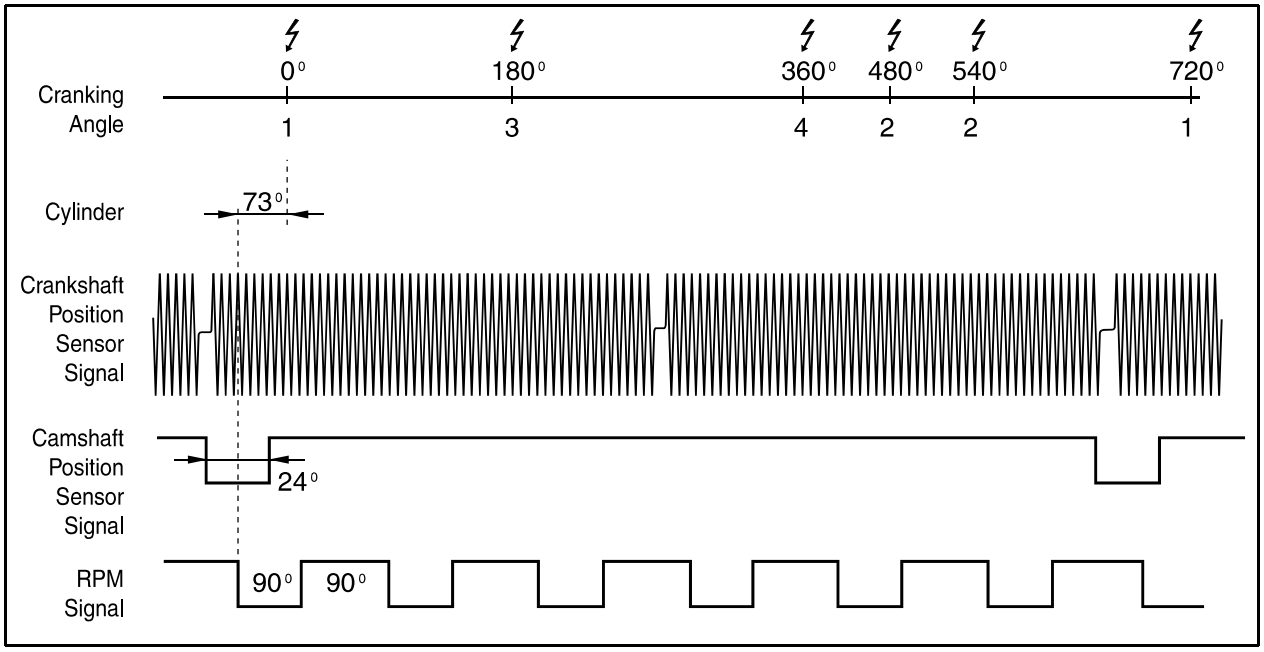
1. IGNITION SYSTEM

This ignition system does not use a conventional distributor and coil. It uses a crankshaft position sensor input to the Engine Control Module (ECM). The ECM then determines Electronic Spark Timing (EST) and triggers the electronic ignition system ignition coil.

This type of distributorless ignition system uses a "waste spark" method of spark distribution. Each cylinder is paired with the cylinder that is opposite it (2-3 or 1-4). The spark occurs simultaneously in the cylinder coming up on the compression stroke and in the cylinder coming up on the exhaust stroke. The cylinder on the exhaust stroke requires very little of the available energy to fire the spark plug. The remaining energy is available to the spark plug in the cylinder on the compression stroke.

These systems use the EST signal from the ECM to control the EST. The ECM uses the following information:

- Engine load (mass air flow sensor).
- Engine temperature.
- Intake air temperature.
- Crankshaft position.
- Engine speed (rpm).



NO DATA

ENGINE CONTROLS 1430-01

GENERAL

1. ENGINE AND ECM PROBLEM CHECK REPORT

1) Vehicle and Customer Information

Date Problem Occurred			
Customer Name		Vehicle Model	
Driver Name		VIN	
Purchase date		Engine Model	
License No.		Mileage	Km miles

2) MIL Information

Condition of MIL	☐ Remains on ☐ Sometimes illuminates ☐ Does not illuminate
DTC inspection (if available)	☐ Normal ☐ Malfunction code(s) (code) ☐ Freeze frame data ( )

3) Problem Description

☐ Engine Does Not Start	☐ No cranking ☐ No initial combustion ☐ No complete combustion
☐ Hard to Start	☐ Slow cranking ☐ Others
☐ Poor Idling	☐ Incorrect first Idle ☐ Abnormal idle rpm ☐ High (rpm) ☐ Low (rpm) ☐ Idling Unstable ☐ Others
☐ Poor Driveability	☐ Hesitation ☐ Back fire ☐ Muffler explosion (after-burning) ☐ Surging ☐ Knocking ☐ Poor performance ☐ Other
☐ Engine Stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C operation ☐ Shifting from N to D or D to N ☐ At full steering ☐ Others
☐ Others	

4) Condition When Problem Occurs

Problem Frequency	☐ Constant ☐ Intermittent (times per day/month) ☐ Once only ☐ Others
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Others
Ambient Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold (approx.____°F/____°C)
Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough Road ☐ Others
Engine Temperature	☐ Cold ☐ Warming Up ☐ Before warming up ☐ After warm-up ☐ Any temp. ☐ Others
Engine Operation	☐ Starting ☐ Just after starting (min.) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other

Modification basis	
Application basis	
Affected VIN	

2. SPECIFICATIONS

1) Engine Data Display Table

Parameter	Unit	Value
Engine Coolant Temp.	°C	greater than 95 °C after warm up
Intake Air Temp.	°C	-40 ~ 130 °C (varies with ambient temp. or engine mode)
Engine RPM	rpm	700 ± 50 (P/N), 600 ± 50 (D)
Regular RPM	rpm	700 ± 50 (P/N), 600 ± 50 (D)
Engine Load	%	18 ~ 25 %
Mass Air Flow Meter	Kg/h	16 ~ 25 Kg/h
Throttle Position Angle	°TA	0 °TA (up to 100 °TA at the wide open throttle)
Spark Advance	°CA	°CA (6 ~ 9 °CA)
Indicated Engine Torque	Nm	Varies with engine condition
Injection Time	ms	3 ~ 5 ms
Battery Voltage	V	13.5 ~ 14.1 V (engine running)
Front Axle Speed	Km/h	0 ~ 265 Km/h
Rear Axle Speed	Km/h	0 ~ 265 Km/h
Accel. Pedal Position 1	V	0.4 ~ 4.8 V
Accel. Pedal Position 2	V	0.2 ~ 2.4 V
Throttle Position 1	V	0.3 ~ 4.6 V
Throttle Position 2	V	0.3 ~ 4.6 V
Fuel Integrator		0.8 ~ 1.2
Oxygen Sensor	mv	100 ~ 900 mv
A/C S/W Condition	1=ON/0=OFF	-
Full Load State	1=ON/0=OFF	-
Shift Gear State (A/T)	1=ON/0=OFF	-
A/C Control State	1=ON/0=OFF	-
Clutch Switch (M/T)	1=ON/0=OFF	-
Cam Actuator State	1=ON/0=OFF	-
Knocking Control	1=ON/0=OFF	-
Protect Mission	1=ON/0=OFF	-
Purge Control Valve	1=ON/0=OFF	-
Lambda Function	1=ON/0=OFF	-
Catalyst Heating	1=ON/0=OFF	-
Overrun Fuel Cut	1=ON/0=OFF	-
Full Fuel Cut	1=ON/0=OFF	-
Brake Switch	1=ON/0=OFF	-
Cruise Control Status	1=ON/0=OFF	-

Condition : Warmed up, idle, P/N or neutral

2) Fastener Tightening Specifications

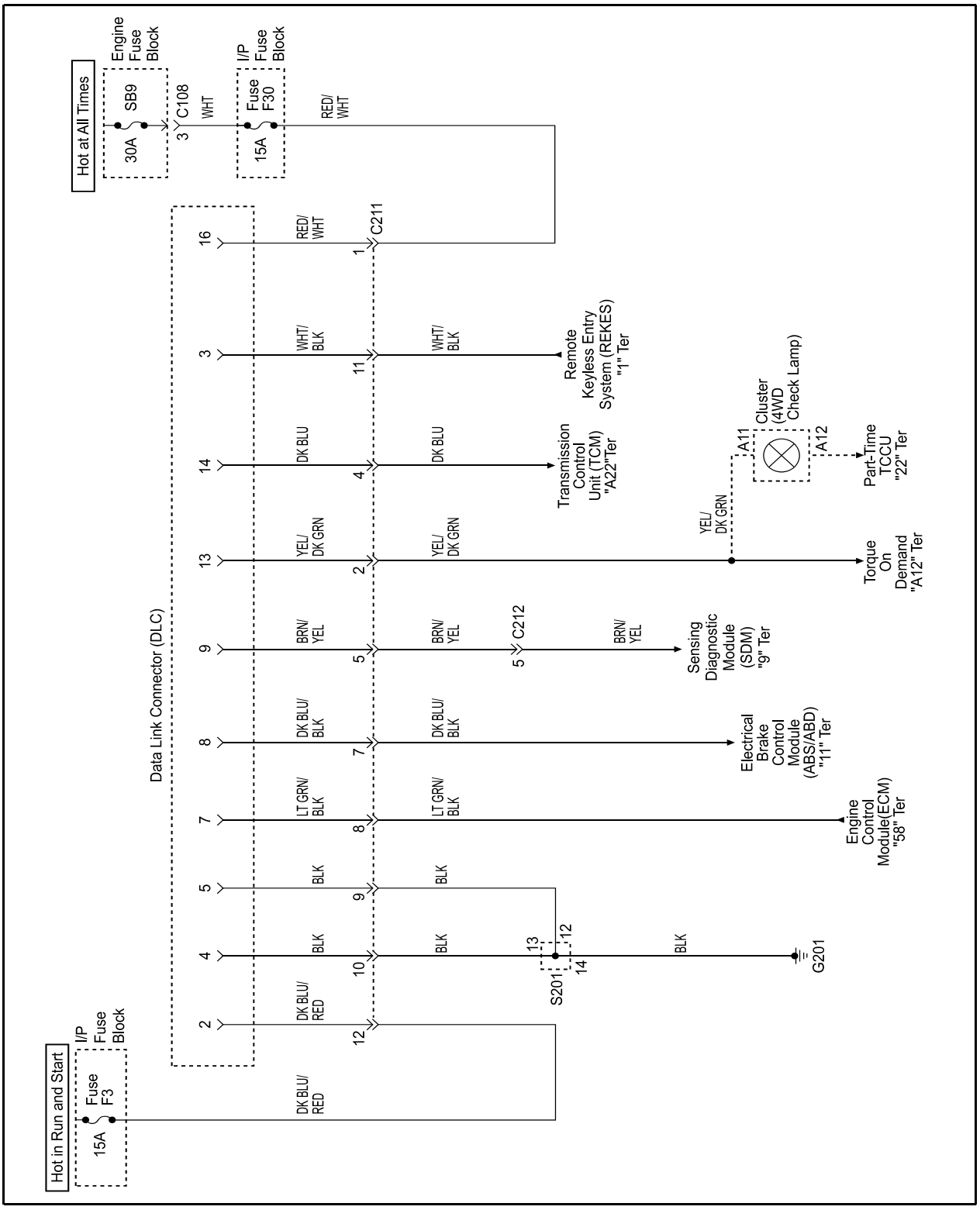
Application	N•m	Lb-Ft	Lb-In
Camshaft Position Sensor Retaining Bolts	10	-	89
Canister Mounting Bolts	6	-	53
Coolant Temperature Sensor	30	22	-
Crankshaft Position Sensor Retaining Bolt	10	-	89
Engine Control Module (ECM) Mounting Bracket Nuts	10	-	89
Fuel Filter Mounting Bracket Bolt	6	-	53
Fuel Filter Lines	28	21	-
Fuel Pressure Test Connector	25	18	-
Fuel Rail Assembly Bolts	25	18	-
Fuel Return And Supply Lines	23	17	-
Fuel Tank Retaining Nuts	38	28	-
Knock Sensor Mounting Bolt	25	18	-
Oxygen Sensor	55	41	-
Pedal Position Censor Mounting Bolts And Nut	6	-	53
Throttle Body Bolts	12	-	106

Modification basis	
Application basis	
Affected VIN	

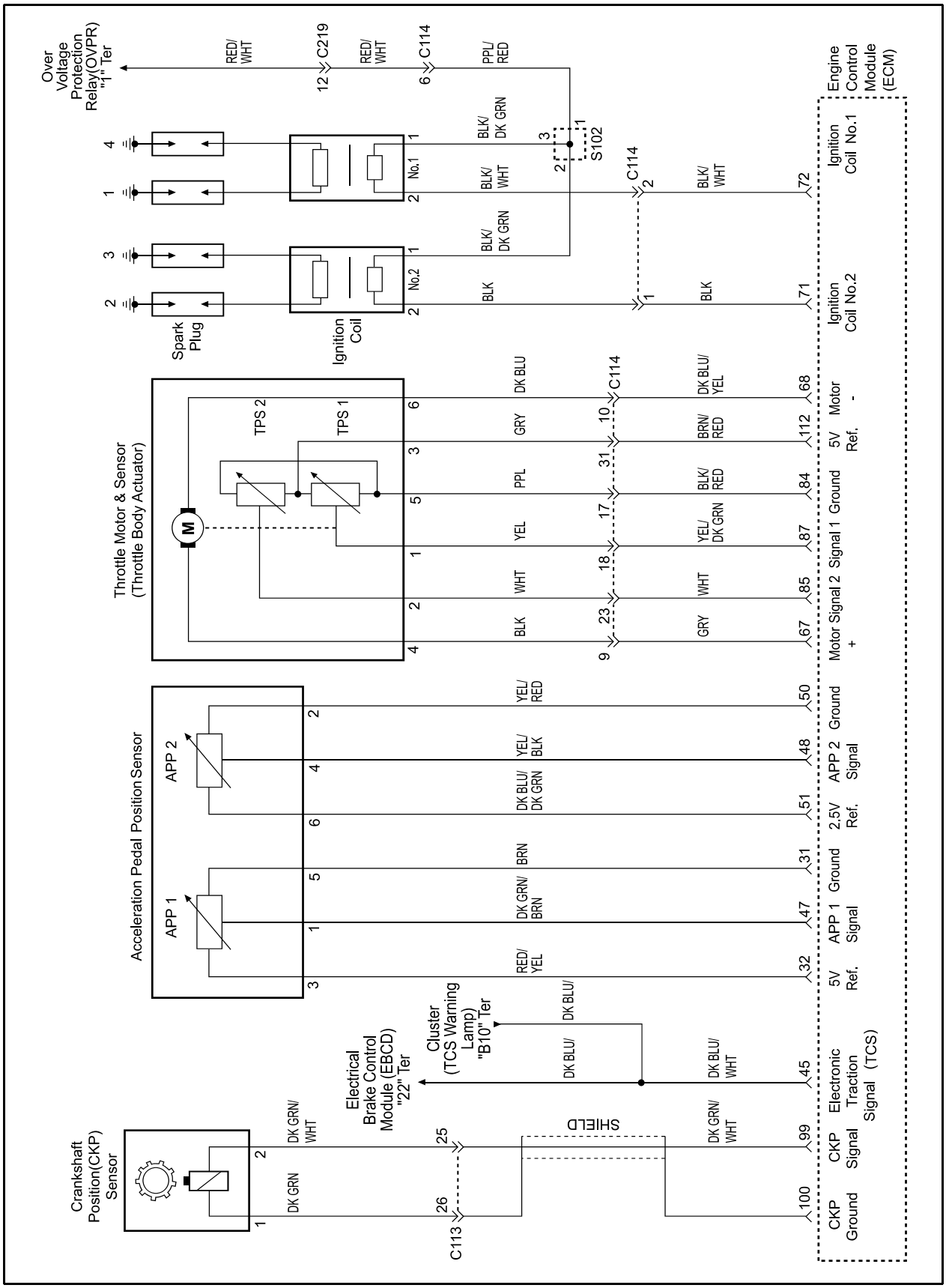
OVERVIEW AND OPERATION PROCESS

1. SCHEMATIC AND ROUTING DIAGRAMS

1) ECM Wiring Diagram (2.3L DOHC - 1 of 7) (MSE 3.53D)

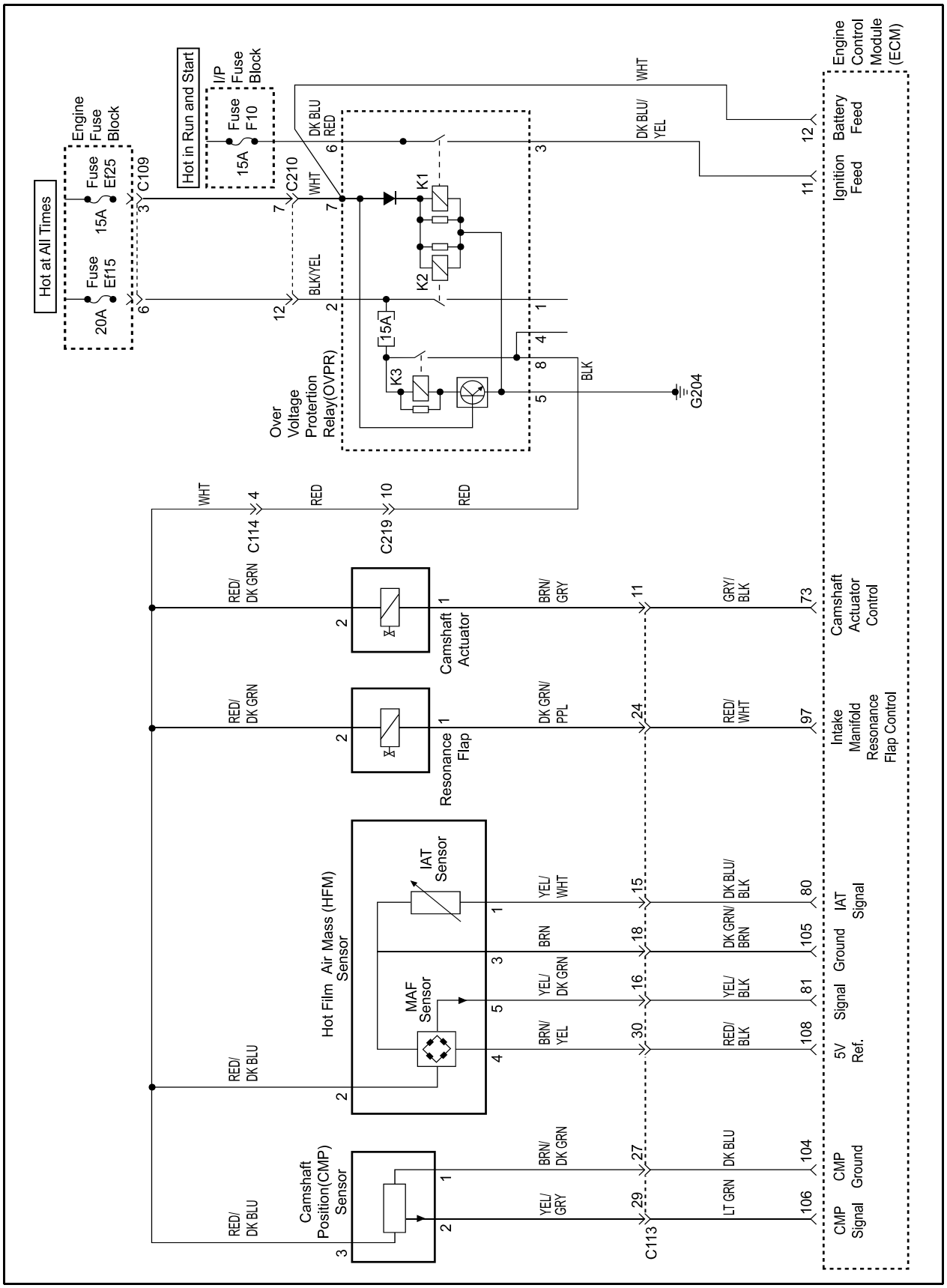


2) ECM Wiring Diagram (2.3L DOHC - 2 of 7) (MSE 3.53D)



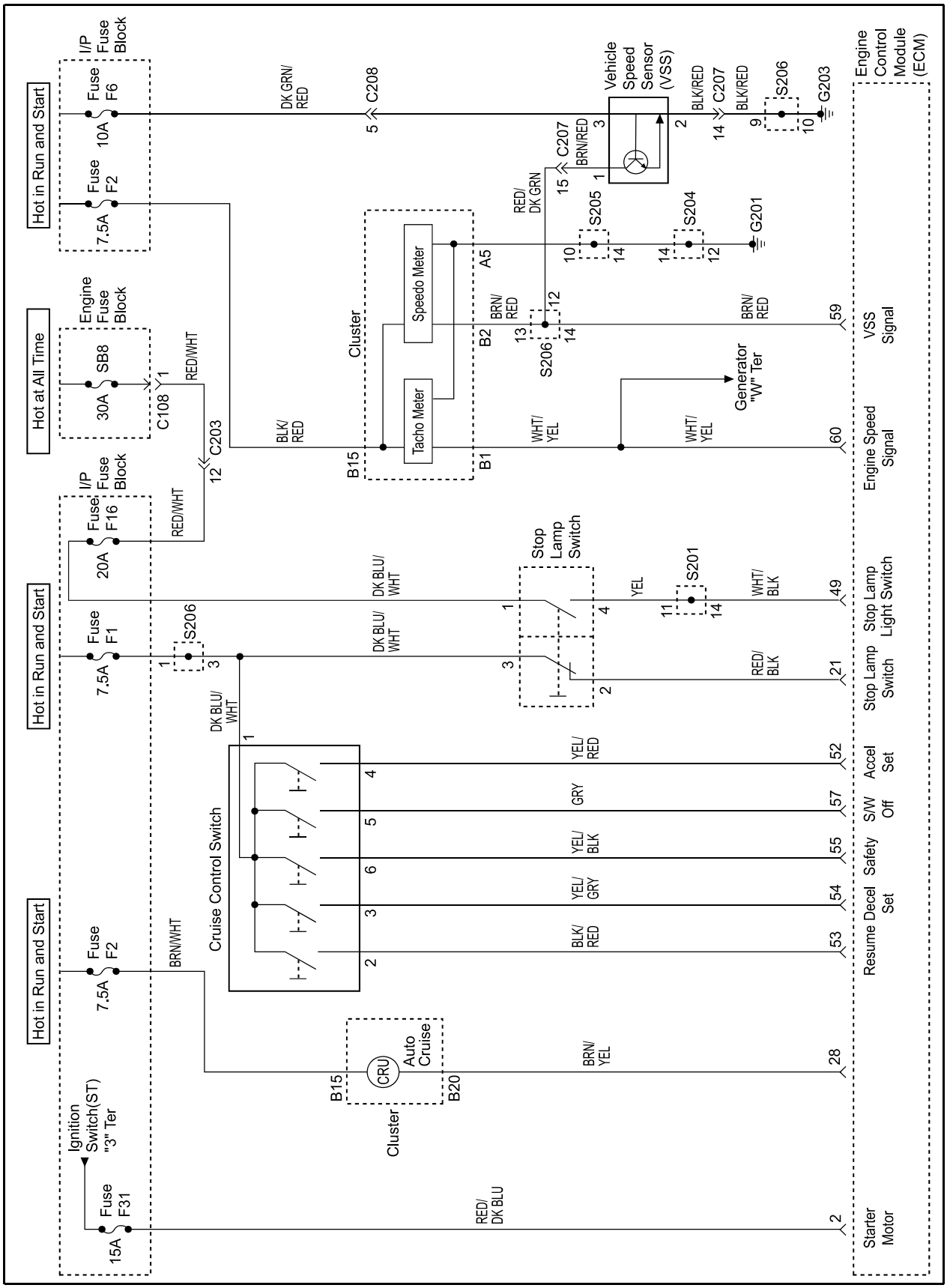
Modification basis	
Application basis	
Affected VIN	

3) ECM Wiring Diagram (2.3L DOHC - 3 of 7) (MSE 3. 53D)



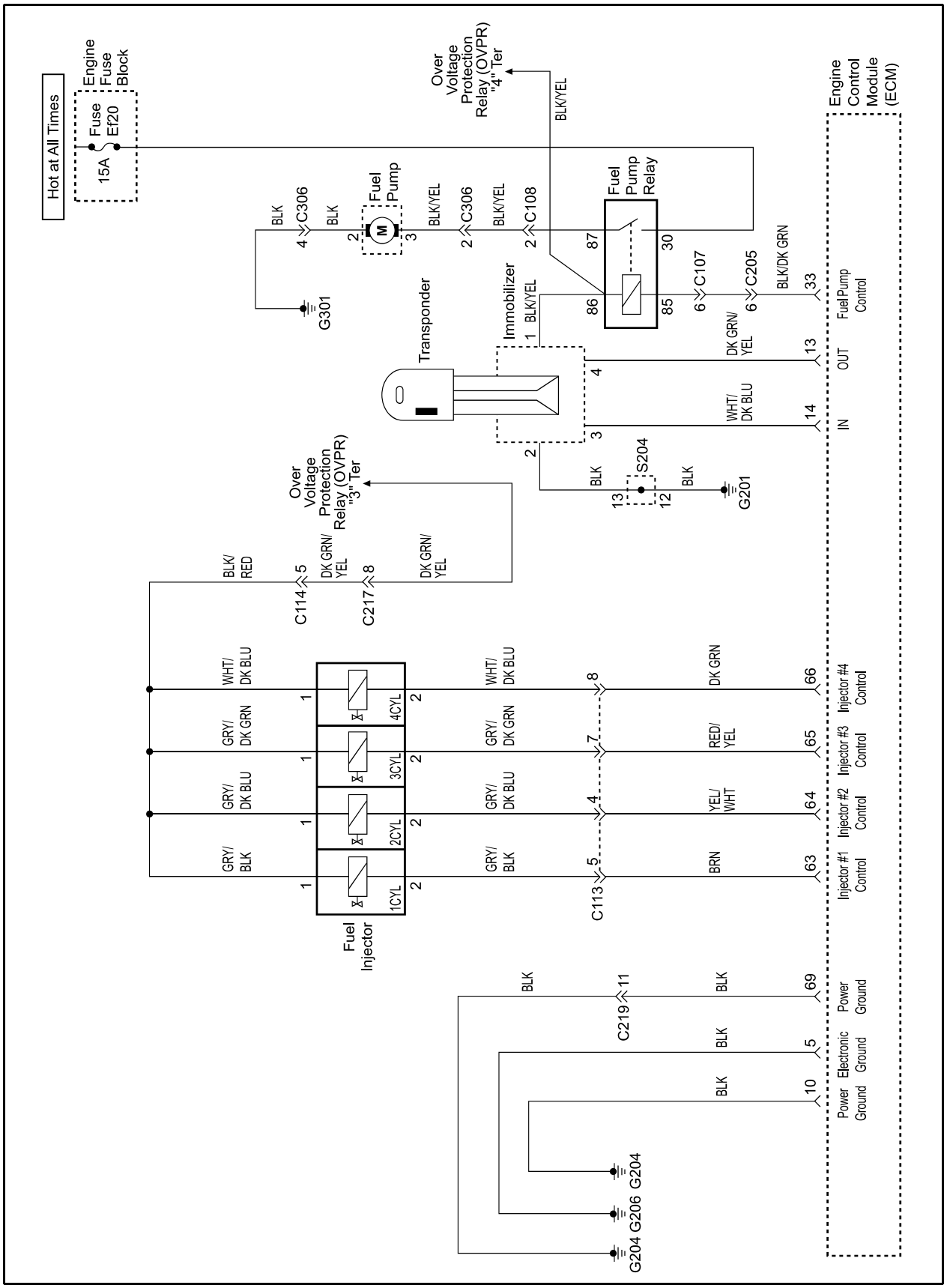
Modification basis	
Application basis	
Affected VIN	

4) ECM Wiring Diagram (2.3L DOHC - 4 of 7) (MSE 3.53D)



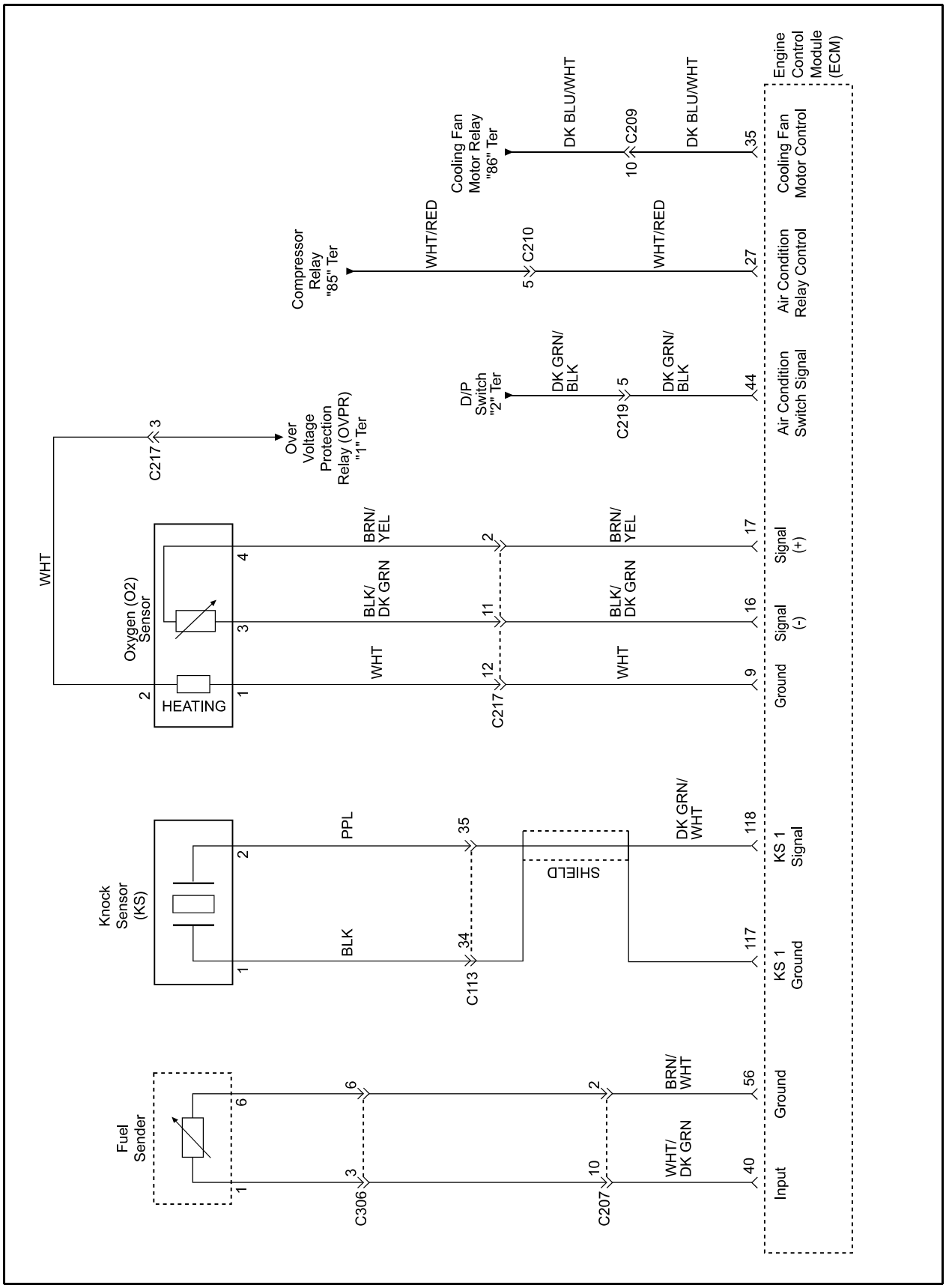
Modification basis	
Application basis	
Affected VIN	

5) ECM Wiring Diagram (2.3L DOHC - 5 of 7) (MSE 3.53D)



Modification basis	
Application basis	
Affected VIN	

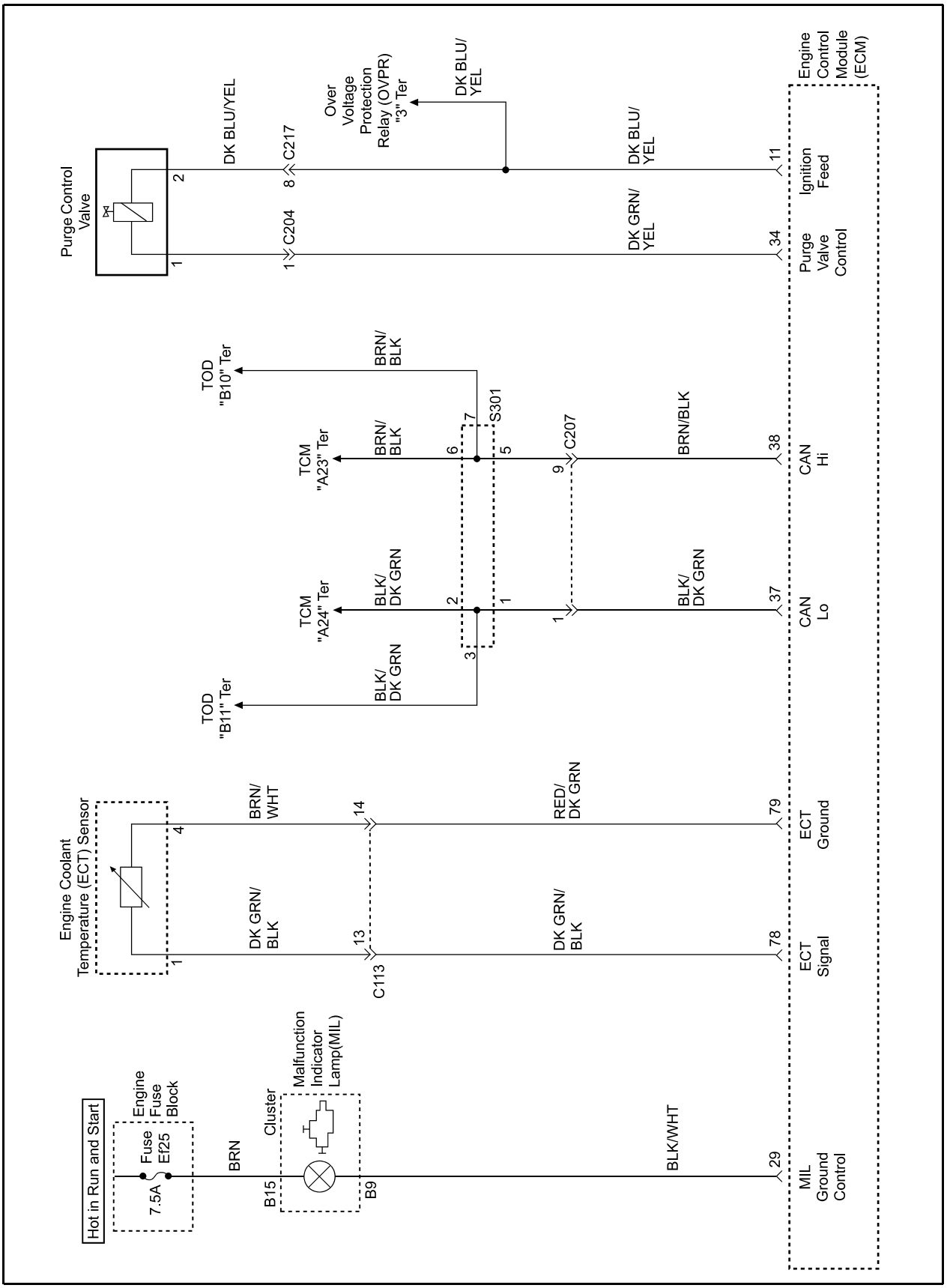
6) ECM Wiring Diagram (2.3L DOHC - 6 of 7) (MSE 3.53D)



undefined

Modification basis	
Application basis	
Affected VIN	

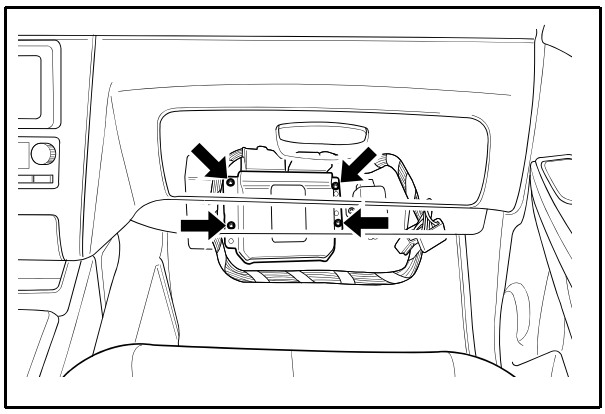
7) ECM Wiring Diagram (2.3L DOHC - 7 of 7) (MSE 3.53D)



Modification basis	
Application basis	
Affected VIN	

S.G.N.
1491-01

ENGINE CONTROL MODULE



1. Disconnect the negative battery cable.
2. Remove the cowl side trim form passenger side. Re-er to Section 9G, Interior trim.
3. Remove the four securing nuts for the Engine Control Module (ECM) from the mounting bracket.

Tightening torque **10 Nm (89 lb-in)**

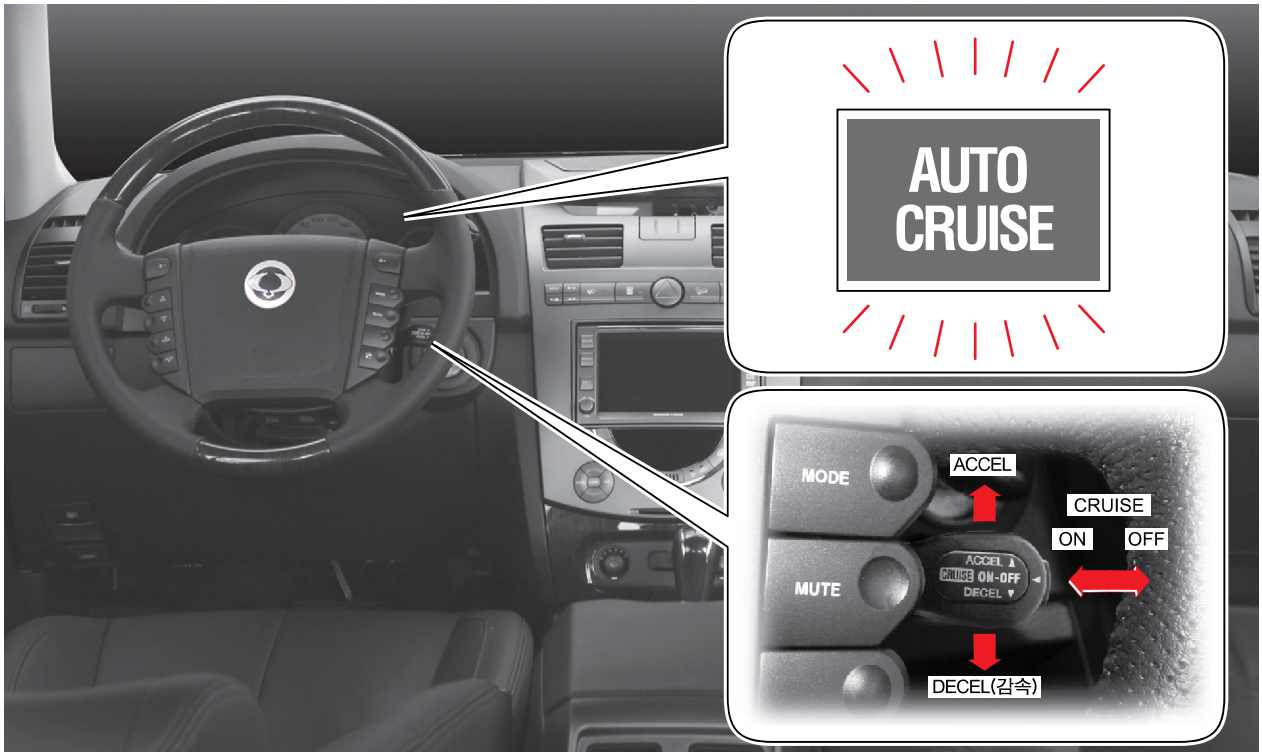
4. Pull out the ECM from the bracket.
5. Disconnect the vehicle side coupling.
6. Installation should follow the removal procedure in the reverse order.

CRUISE CONTROL SYSTEM

8510-23

OVERVIEW AND OPERATION PROCESS

1. CRUISE CONTROL SWITCH



The purpose of the cruise control system is to automatically maintain a vehicle speed set by the driver, without depressing the accelerator pedal. The cruise control switch is located under the right side of the steering wheel, and when this switch is operating "AUTO CRUISE" lamp comes on.

The minimum speed for setting the cruise control system is 36 km/h (22.37 mph). Pay constant attention to the distance between the vehicles and the traffic conditions when using the cruise control system.

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.

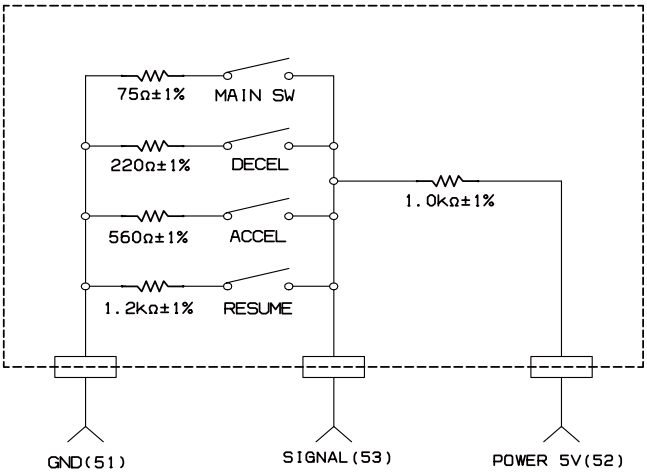
1) When To Use

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

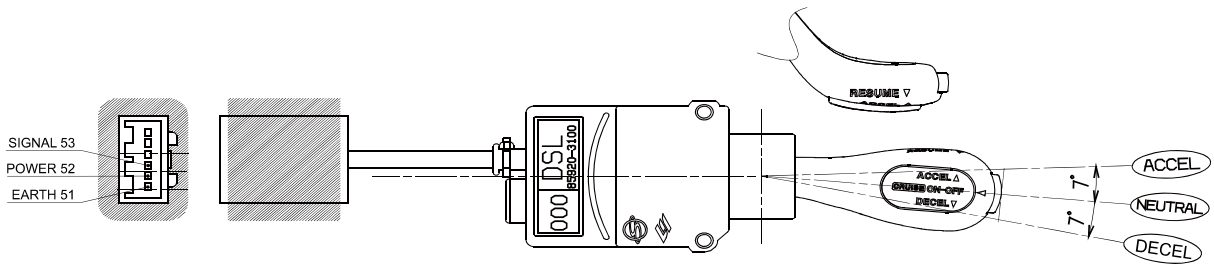
WARNING

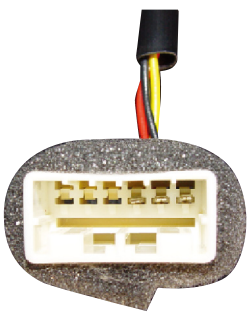
Use the cruise control system only when driving on motorways or highways. Do not use the cruise control system where the road conditions are as follows:
- When there is strong wind or cross wind.
- Heavy traffic.
- Slippery roads or steep decline.

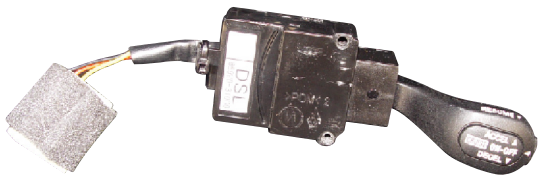
2. CIRCUIT DIAGRAM



1) Configuration







3. HOW TO OPERATE CRUISE CONTROL SWITCH

1) How To Set Speed



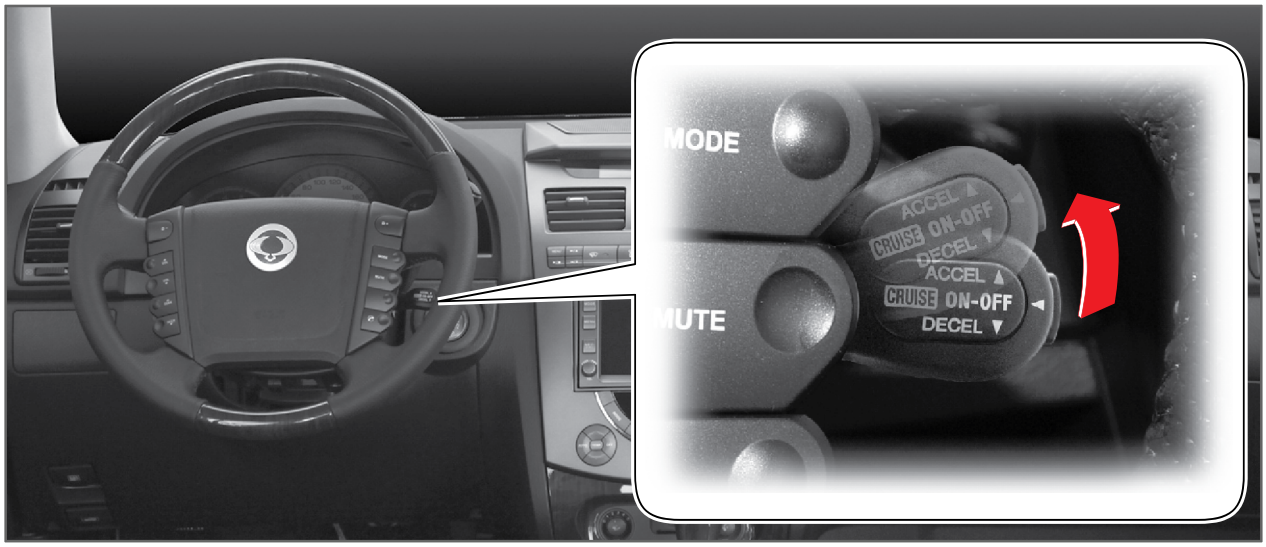
1. To operate the cruise control system, accelerate the vehicle to the speed within the specified range below with depressing the accelerator pedal.
   - Cruise control operating range: between 36 km/h (22.37 mph) and 150 km/h (93.207 mph)
2. When the desired speed is reached, which should be within the above range, push up the cruise control switch lever to ACCEL side (upwards arrow), or push down the switch lever to DECEL side (downwards arrow).
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.

Modification basis	
Application basis	
Affected VIN	

2) Accelerating with the Cruise Control System



(1) While the cruise control system is running

1. To increase the set speed, push up the cruise control switch lever to ACCEL side and hold it until the desired speed is reached without depressing the accelerator pedal.
2. When the desired speed is set, release the switch 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 the vehicle to more than 36 km/h (22.37 mph) using the accelerator pedal. Push up the cruise control switch lever to ACCEL side and hold it.
2. When the desired speed is reached, release the accelerator pedal and the switch 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 cruise control switch lever to ACCEL side for less than 0.5 second per one switching while the cruise control system is running; the speed increases each time by 1.3 km/h (0.81 mph).
2. For example, if you want to increase the speed 13 km/h (81 mph) more than the previous set speed, tap up the switch lever to ACCEL side ten times without using the accelerator pedal.

3) Decelerating with the Cruise Control System



(1) While the cruise control system is running

1. To decrease the set speed, push down the cruise control switch lever to DECEL side and hold it until the desired speed is reached without depressing the brake pedal.
   But the cruise control system cannot maintain the cruise function at less than 34 km/h (21.13 mph).
2. When the desired speed is set, release the switch lever.

(2) When the cruise control system is not running

To decrease the speed with the cruise control system while 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 36 km/h (22.37 mph).
2. When the desired speed is reached, release the switch lever.
3. But the cruise control system cannot maintain the cruise function at less than 34 km/h (21.13 mph).

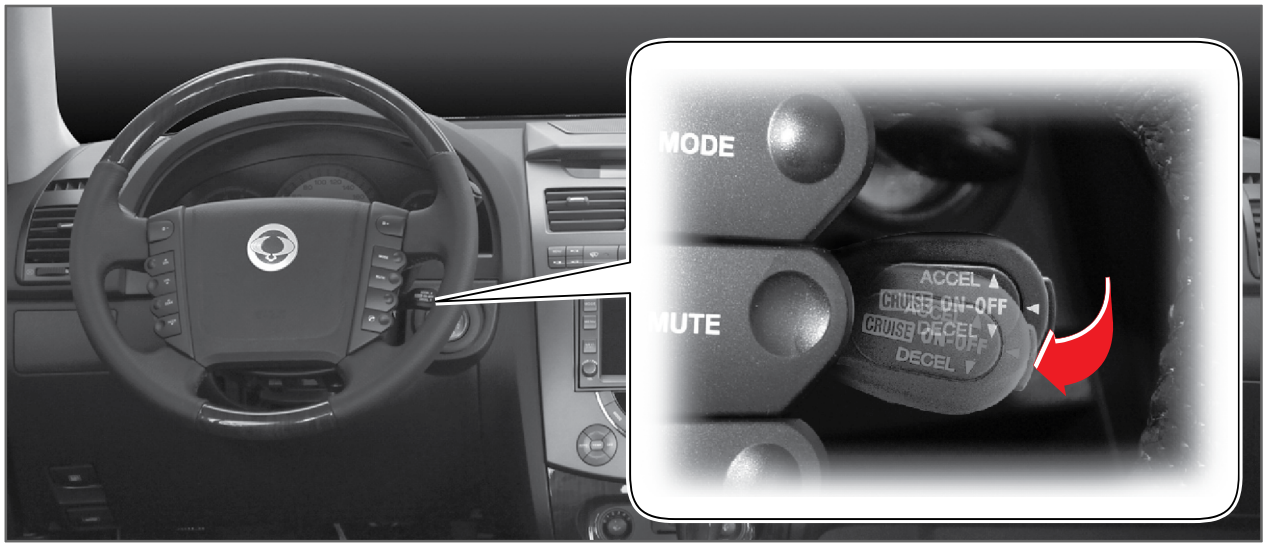
(3) Tap-down while the cruise control system is running

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

1. Push down the cruise control switch lever to DECEL side for less than 0.5 second per one switching while the cruise control system is running; the speed decreases each time by 1.0 km/h (0.62 mph).
2. For example, if you want to decrease the speed 10 km/h (62 mph) lower than the previous set speed, tap down the switch lever to DECEL side ten times without using the brake pedal.

Modification basis	
Application basis	
Affected VIN	

4) Recovery of Set Speed (RESUME)



Even if the cruise control is cancelled, the previous set cruise speed can be recovered by operating the cruise control switch lever like below:
- Pull the switch lever in the arrow direction shown in the illustration.

This RESUME function works only when the vehicle speed is more than 36 km/h (22.37 mph) without using the accelerator or brake pedal.

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.

5) Normal Cancellation of the Cruise Control (OFF ↔ ON)



The cruise control system will be cancelled when the button on the side of the switch is pressed, or when one of the following conditions is met:

1. When the brake pedal is depressed or ESP is activated.
2. When the vehicle speed is less than 34 km/h (21.13 mph).
3. When the parking brake is applied while driving.
4. When the clutch pedal is depressed for shifting (M/T only).

CAUTION

Put the cruise control switch lever in the neutral position when not using the cruise control system.

(1) Abnormal Cancellation of the Cruise Control

1. When the rapid deceleration or acceleration occurs.
2. When the cruise control lever is faulty.
3. When the brake switch is malfunctioning or has an open circuit.

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

- 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.
- Always be prepared to use the brake or accelerator pedal for safe driving while the cruise control system is running.
- 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.
- Ensure that the braking distance is maintained and use the brake pedal if needed.

Modification basis	
Application basis	
Affected VIN	

ENGINE ASSEMBLY

1113-01

GENERAL

1. SPECIFICATIONS

1) Fastener Tightening Specifications

Application		N•m	Lb-Ft	Lb-In
A/C Bracket Bolt		22.5 - 27.5	16.6 - 20.3	-
Armature Bolt in Camshaft Actuator		35	26	-
Belt Tensioning Pulley Nut		40.5 - 49.5	29.9 - 36.5	-
Camshaft Actuator Bolt		9 - 11	-	80 - 97
Camshaft Adjuster Mounting Nut		60 - 70	44 - 52	-
Camshaft Bearing Cap Bolt		22.5 - 27.5	16.6 - 20.3	-
Chain Tensioner Assembly		72 - 88	53 - 65	-
Chain Tensioner Screw Plug		40	30	-
Connecting Rod Bearing Cap Bolt		40 + 5 90° + 10°	30 + 3.7 90° + 10°	-
Cooling Fan Bracket Bolt		22.5 - 27.5	16.6 - 20.3	-
Crankshaft Bearing Cap Bolt		50 - 60 90° + 5°	37 - 44 90° + 5°	-
Crankshaft Sealing Rear Cover Mounting Bolt		9 - 11	-	80 - 97
Cylinder Block Drain Plug		30	22	-
Cylinder Head Bolt		55 + 90 ° + 90 °	41 + 90 ° + 90 °	-
Cylinder Head Cover Bolt		9 - 11	-	80 - 97
Cylinder Head Front Cover Bolt		22.5 - 27.5	16.6 - 20.3	-
Engine Mounting Bracket Nut		70	52	-
Exhaust Camshaft Sprocker Bolt		18 - 22 90° ± 5°	13 - 16 90° ± 5°	-
Exhaust Manifold and Pipe		30	22	-
Flywheel Mounting Bolt		45 + 5 90° + 10°	33 + 3.7 90° + 10°	-
Fuel Feed and Return Hose to Fuel Rail		21 - 25	15 - 18	-
Generator Carrier Bolt		25	18	-
Intake Air Duct Nut		9 - 11	-	80 - 97
Intake Flange Shaft Bolt		18 - 22 90° ± 5°	13 - 16 90° ± 5°	-
Lower Engine Mounting Nut		38	28	-
Oil Dipstick Guide Tube Bolt		9 - 11	-	80 - 97
Oil Drain Plug		22.5 - 27.5	16.6 - 20.3	-
Oil Filter Bolt		22.5 - 27.5	16.6 - 20.3	-
Oil Filter Cover		25	18	-
Oil Gallery Screw Plug in Cylinder Head		15	11	-
Oil Pan Bolt	M10	40	30	-
	M8	22.5 - 27.5	16.6 - 20.3	-
	M6	9 - 11	-	80 -97

▶ Fastener Tightening Specifications (Cont'd)

Application		N•m	Lb-Ft	Lb-In
Oil Pressure Relief Valve Screw Plug		50	37	-
Oil Pump Drive Sprocket Bolt		29 - 35	21 - 26	-
Oil Pump Mounting Bolt		22.5 - 27.5	16.6 - 20.3	-
Oil Pump Sprocket Bolt		29 - 35	21 - 26	-
Spark Plug Cover Bolt		9 - 11	-	80 - 97
Steering Pump Bolt		22.5 - 27.5	16.6 - 20.3	-
Tensioning Device Bolt		26 - 32	19 - 24	-
Timing Gear Case Cover Bolt	M8	22.5 - 27.5	16.6 - 20.3	-
	M6	9 - 11	-	80 - 97
Torque Converter Mounting Bolt		42	31	-
Transmission Mounting Nut		54 - 68	40 - 50	-
Under Cover		28 - 47	21 - 35	-
Upper Engine Mounting Nut		70	52	-
Vibration Damper Center Bolt		180 - 220 90° + 10°	133 - 162 90° + 10°	-
Water Pump Pulley Bolt		22.5 - 27.5	16.6 - 20.3	-

Modification basis	
Application basis	
Affected VIN	

FUEL SYSTEM

2211-06

GENERAL

1. FUEL SYSTEM SPECIFICATION

▶ Use Only Unleaded Fuel Rated at 89 Octane or Higher

Fuel quality and additives contained in fuel have a significant effect on power output, drivability, and life of theengine.

Fuel with too low an octane number can cause engine knock.

CAUTION

- Use of fuel with an octane number lower than 89 may damage engine and exhaust system.

CAUTION

- To prevent accidental use of leaded fuel, the nozzles for leaded fuel are larger, and will not fit the fuel filler neck of your vehicle.

▶ Do Not Use Methanol

Fuels containing methanol (wood alcohol) should not be used in vehicle.

This type of fuel can reduce vehicle performance and damage components of the fuel system.

CAUTION

- Use of methanol may damage the fuel system.

▶ Vehicle Fueling from Drums or Storage Containers

For safety reasons (particularly when using noncommercial fueling systems) fuel containers, pumps and hoses must be properly earthed.

Static electricity build up can occur under certain atmospheric and fuel flow conditions if unearthed hoses, par-ticularly plastic, are fitted to the fuel-dispensing pump.

It is therefore recommended that earthed pumps with integrally earthed hoses be used, and that storage containers be properly earthed during all noncommercial fueling operations.

▶ Temperature VS Resistance

°C	°F	ECT sensor	IAT sensor
		ohms ( )	
Temperature vs Resistance Values (Approximate)			
130	266	88	102
120	248	111.6	127
110	230	143	159
100	212	202	202
90	194	261	261
80	176	340	340
70	158	452	452
60	140	609	609
50	122	835	835
40	113	1166	1166
30	86	1662	1662
20	68	2420	2420
10	50	3604	3604
0	32	5499	5499
-10	14	8609	8609
-20	-4	13850	13850
-30	-22	22960	22960
-40	-40	39260	39260

Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATION PROCESS

1. FUEL SYSTEM

The function of the fuel metering system is to deliver the correct amount of fuel to the engine under all operating conditions.

The fuel is delivered to the engine by the individual fuel injectors mounted into the intake manifold near each cylinder.

The main fuel control sensors are the Mass Air Flow (MAF) sensor and the oxygen (O2) sensors.

The MAF sensor monitors the mass flow of the air being drawn into the engine. An electrically heated element is mounted in the intake air stream, where it is cooled by the flow of incoming air. Engine Control Module (ECM) modulates the flow of heating current to maintain the temperature differential between the heated film and the intake air at a constant level. The amount of heating current required to maintain the temperature thus provides an index for the mass air flow. This concept automatically compensates for variations in air density, as this is one of the factors that determines the amount of warmth that the surrounding air absorbs from the heated element. MAF sensor is located between the air filter and the throttle valve.

Under high fuel demands, the MAF sensor reads a high mass flow condition, such as wide open throttle.

The ECM uses this information to enrich the mixture, thus increasing the fuel injector on?time, to provide the correct amount of fuel. When decelerating, the mass flow decreases. This mass flow change is sensed by the MAF sensor and read by the ECM, which then decreases the fuel injector on?time due to the low fuel demand conditions.

The O2 sensors are located in the exhaust pipe before catalytic converter. The O2 sensors indicate to the ECM the amount of oxygen in the exhaust gas, and the ECM changes the air/fuel ratio to the engine by controlling the fuel injectors. The best air/fuel ratio to minimize exhaust emissions is 14.7 to 1, which allows the catalytic converter to operate most efficiently. Because of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a "closed loop" system.

The ECM uses voltage inputs from several sensors to determine how much fuel to provide to the engine. The fuel is delivered under one of several conditions, called ' 'modes" .

▶ Starting Mode

When the ignition is turned ON, the ECM turns the fuel pump relay on for 1 second. The fuel pump then builds fuel pressure. The ECM also checks the Engine Coolant Temperature (ECT) sensor and the Throttle Position (TP) sensor and determines the proper air/fuel ratio for starting the engine. This ranges from1.5 to 1 at -36 ° C (-33 °F) coolant temperature to 14.7 to 1 at 94 °C (201 °F) coolant temperature. The ECM controlsthe amount of fuel delivered in the starting mode by changing how long the fuel injector is turned on and off. This is done by "pulsing" the fuel injectors for very short times.

▶ Run Mode

The run mode has two conditions called "open loop" and "closed loop".

▶ Open Loop

When the engine is first started and it is above 690 rpm, the system goes into "open loop" operation. In "open loop", the ECM ignores the signal from the O2S and calculates the air/fuel ratio based on inputs from the ECT sensor and the MAF sensor. The ECM stays in "open loop" until the following conditions are met:

- The O2 has a varying voltage output, showing that it is hot enough to operate properly.
- The ECT sensor is above a specified temperature (22.5 °C).
- A specific amount of time has elapsed after starting the engine.

▶ Closed Loop

The specific values for the above conditions vary with different engines and are stored in the Electronically Erasable programmable Read-Only Memory (EEPROM).
When these conditions are met, the system goes into "closed loop" operation. In "closed loop", the ECM calculates the air/fuel ratio (fuel injector on-time) based on the signals from the O2 sensors. This allows the air/fuel ratio to stay very close to 14.7 to 1.

▶ Acceleration Mode

The ECM responds to rapid changes in throttle position and airflow and provides extra fuel.

▶ Deceleration Mode

The ECM responds to changes in throttle position and airflow and reduces the amount of fuel. When deceleration is very fast, the ECM can cut off fuel completely for short periods of time.

▶ Battery Voltage Correction Mode

When battery voltage is low, the ECM can compensate for a weak spark delivered by the ignition module by using the following methods:

- Increasing the fuel injector pulse width.
- Increasing the idle speed rpm.
- Increasing the ignition dwell time.

▶ Fuel Cut-Off Mode

No fuel is delivered by the fuel injectors when the ignition is off. This prevents dieseling or engine runon. Also, the fuel is not delivered if there are no reference pulses received from the CKP sensor. This prevents flooding.

Modification basis	
Application basis	
Affected VIN	

NO DATA

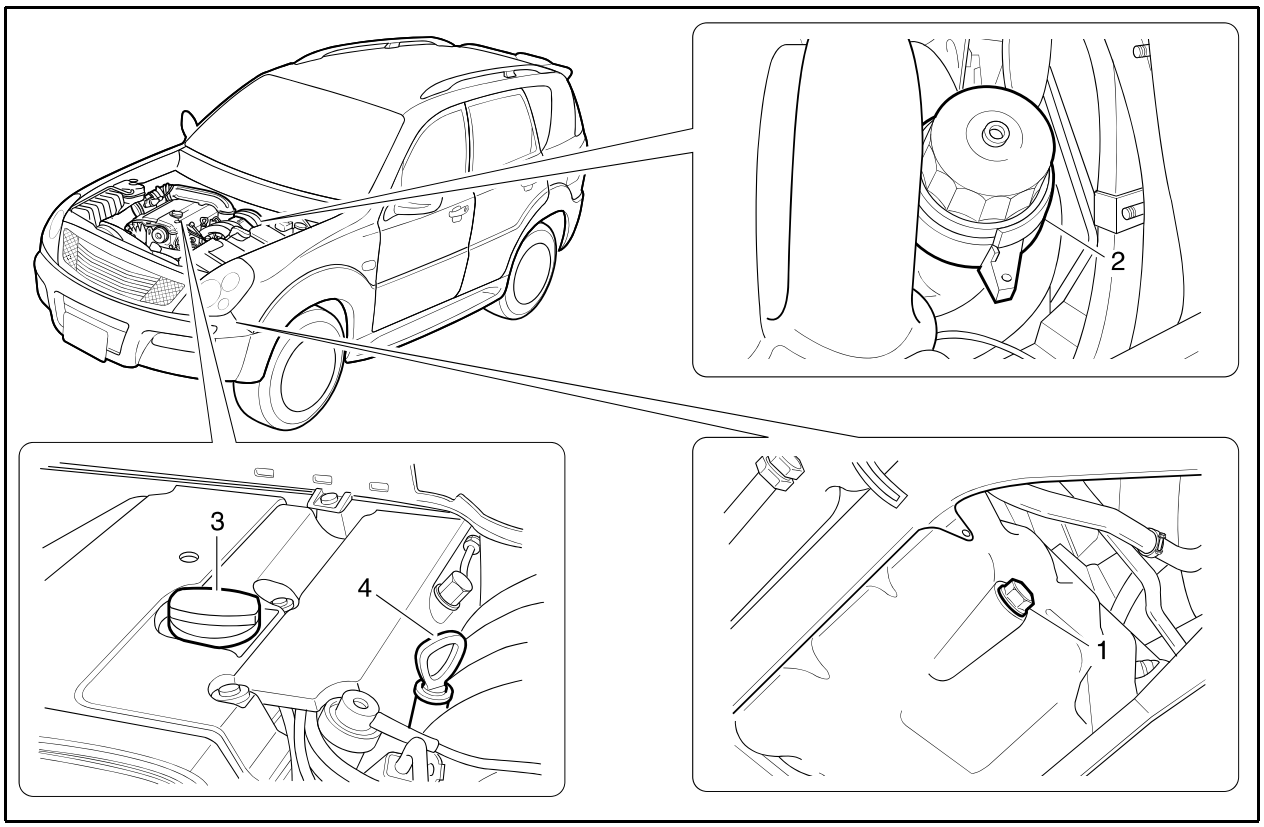
NO DATA

LUBRICATION SYSTEM

1542-07

GENERAL

1. ENGINE OIL SPECIFICATION



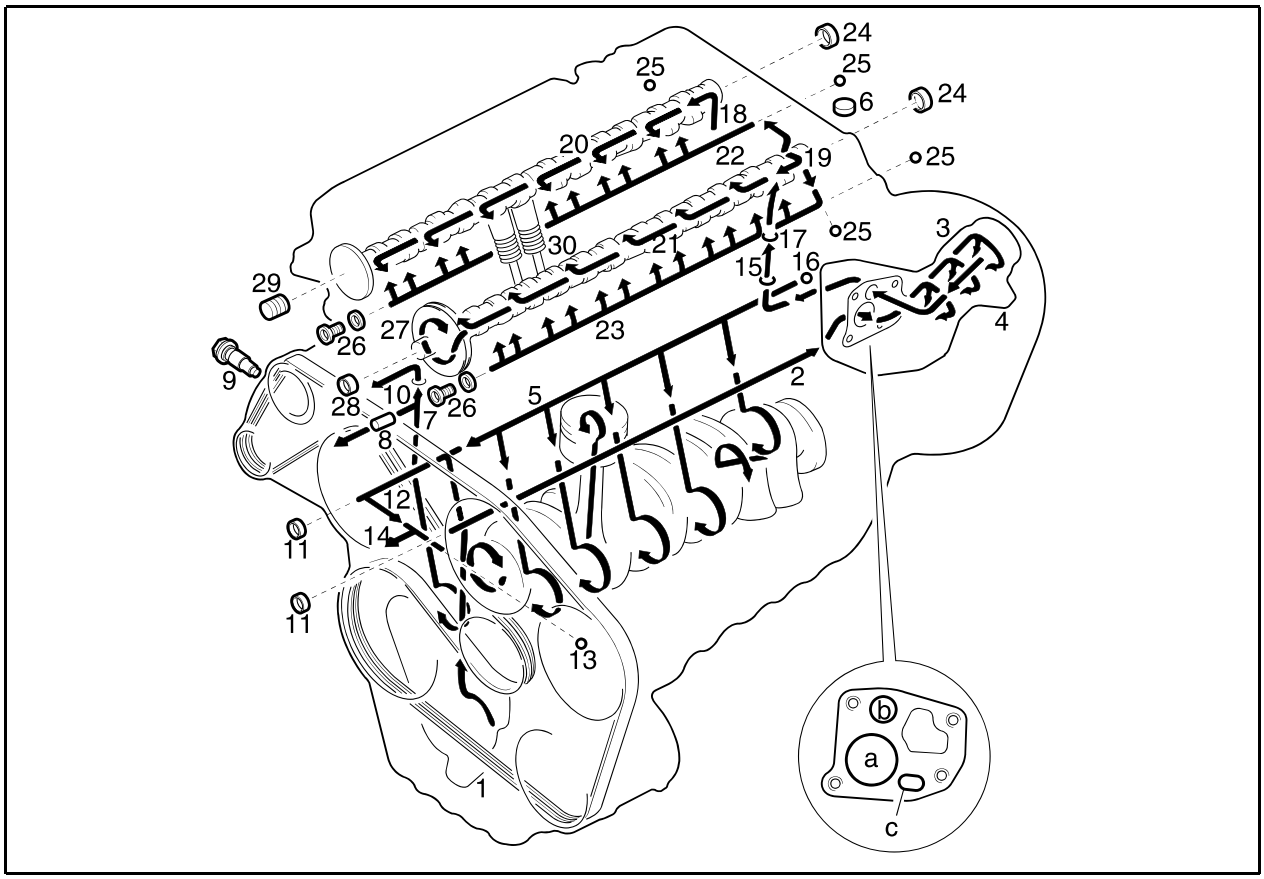
1 Drain Plug ..... 25 Nm (18 lb-ft)
2 Oil Filter
3 Engine Oil Filler Cap
4 Dipstick Gauge

▶ **Specifications**

Application	Descrition
Capacity	Min : 6.7 L, Max : 8.2 L
Quality	• API SH or above grade
	• ACEA : A2 or A3
	• Approved oil by MB Sheet 229.1
Viscosity	• Approved oil by MB Sheet 224.1
Replacemant	• Initial at 1000-1500 km, Replace every 15000 km

OVERVIEW AND OPERATION PROCESS

1. OIL CIRCULATION



1 Oil Pump
2 Oil Gallery (to oil filter)
3 Oil Filter
4 Oil Pressure Switch
5 Main Oil Gallery
6 Cylinder Head Closing Cover
7 Oil Gallery (At Chain Tensioner)
8 Oil Non-return Valve
9 Chain Tensioner
10 Vent (Chain Tensioner)
11 Front Closing Cover (ϕ 17 mm)
12 Oil Gallery (Perpendicular to The Shaft)
13 Ball (ϕ 6 mm)
14 Oil Spray Nozzle (Timing Chain)
15 Oil Gallery (At Cylinder Head)
16 Ball (ϕ 15mm)
17 Oil Restriction Inner (ϕ 4mm)
18 Oil Supply (To Exhaust Camshaft)
19 Oil Supply (To Intake Camshaft)
20 Oil Supply (To Exhaust Camshaft Bearing)
21 Oil Supply (To Intake Camshaft Bearing)
22 Oil Gallery (Oil Supply to Exhaust Valve Tappet)
23 Oil Gallery (Oil Supply to Intake Valve Tappet)
24 Camshaft Closing Cover
25 Ball (ϕ 8 mm)
26 Screw Plug
27 Camshaft Adjuster
28 Front Closing Cover (Intake Camshaft)
29 Front Treaded Bushing (Exhaust Camshaft)
30 Valve tappet
a Oil Gallery (From Oil Pump to Oil Filter)
b Main Oil Gallery
c Oil Return Line (Oil Returns to the Oil Pan when Replacing the Filter Element)

Modification basis	
Application basis	
Affected VIN	

ENGINE ELECTRICAL 1441-01

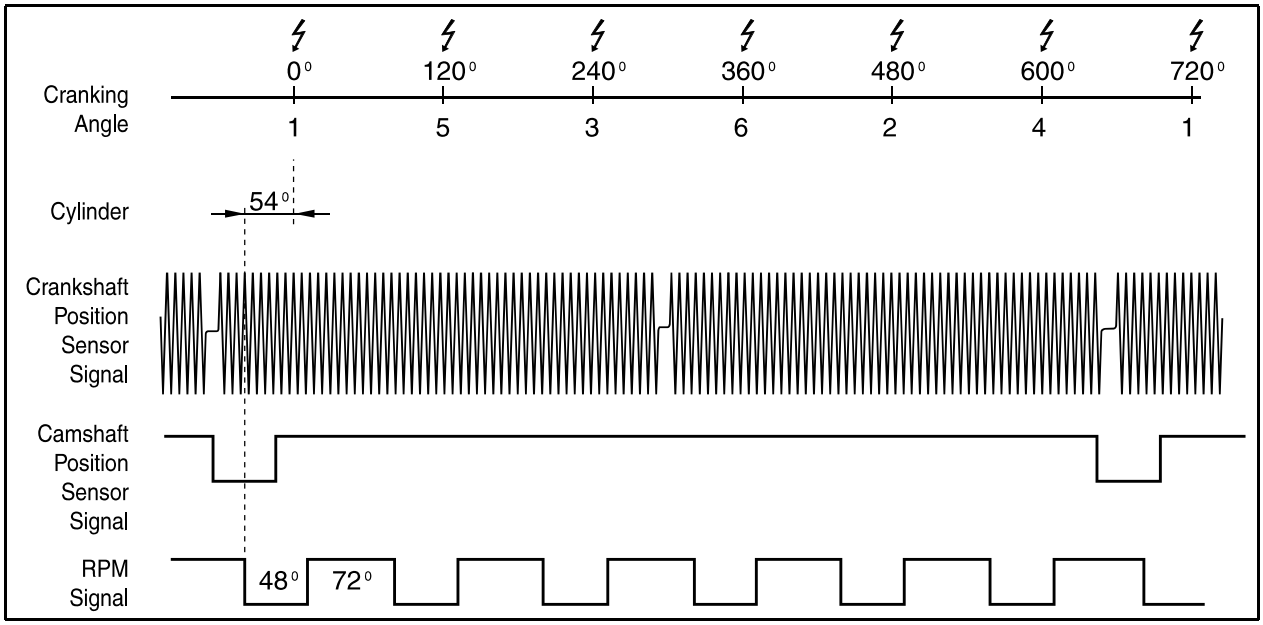
OVERVIEW AND OPERATIONPROCESS

1. IGNITION SYSTEM

This ignition system does not use a conventional distributor and coil. It uses a crankshaft position sensor input to the Engine Control Module (ECM). The ECM then determines Electronic Spark Timing (EST) and triggers the electronic ignition system ignition coil.
This type of distributorless ignition system uses a "waste spark" method of spark distribution. Each cylinder is paired with the cylinder that is opposite it (1-6 or 2-5 or 3-4). The spark occurs simultaneously in the cylinder coming upon the compression stroke and in the cylinder coming up on the exhaust stroke. The cylinder on the exhaust stroke requires very little of the available energy tofire the spark plug. The remaining energy is available to the spark plug in the cylinder on the compression stroke.

These systems use the EST signal from the ECM to control the EST. The ECM uses the following information:

- Engine load (mass air flow sensor).
- Engine temperature.
- Intake air temperature.
- Crankshaft position.
- Engine speed (rpm).



NO DATA

ENGINE CONTROLS

1430-01

GENERAL

1. SPECIFICATIONS

1) Engine Data Display Table

Parameter	Unit	Value
Engine Coolant Temp.	°C	greater than 95 °C after warm up
Intake Air Temp.	°C	-40 ~ 130 °C (varies with ambient temp. or engine mode)
Engine RPM	rpm	700 ± 50 (P/N), 600 ± 50 (D)
Regular RPM	rpm	700 ± 50 (P/N), 600 ± 50 (D)
Engine Load	%	18 ~ 25 %
Mass Air Flow Meter	Kg/h	16 ~ 25 Kg/h
Throttle Position Angle	°TA	0 °TA (up to 100 °TA at t he wi de open throttle)
Spark Advance	°CA	°CA (6 ~ 9 °CA)
Indicated Engine Torque	Nm	Varies with engine condition
Injection Time	ms	3 ~5 ms
Battery Voltage	V	13.5 ~ 14.1 v (engine running)
Front Axle Speed	Km/h	0 ~ 265 Km/h
Rear Axle Speed	Km/h	0 ~ 265 Km/h
Accel. Pedal Position 1	V	0.4 ~ 4.8 V
Accel. Pedal Position 2	V	0.2 ~ 2.4 V
Throttle Position 1	V	0.3 ~ 4.6 V
Throttle Position 2	V	0.3 ~ 4.6 V
Fuel Integrator		0.8 ~ 1.2
Oxygen Sensor	mv	100 ~ 900 mv
A/C S/W Condition	1=ON/0=OFF	-
Full Load State	1=ON/0=OFF	-
Shift Gear State (A/T)	1=ON/0=OFF	-
A/C Control State	1=ON/0=OFF	-
Clutch Switch (M/T)	1=ON/0=OFF	-
Cam Actuator State	1=ON/0=OFF	-
Knocking Control	1=ON/0=OFF	-
Protect Mission	1=ON/0=OFF	-
Purge Control Valve	1=ON/0=OFF	-
Lambda Function	1=ON/0=OFF	-
Catalyst Heating	1=ON/0=OFF	-
Overrun Fuel Cut	1=ON/0=OFF	-
Ful l Fuel Cut	1=ON/0=OFF	-
Brake Switch	1=ON/0=OFF	-
Cruise Control Status	1=ON/0=OFF	-

2) Fastener Tightening Specifications

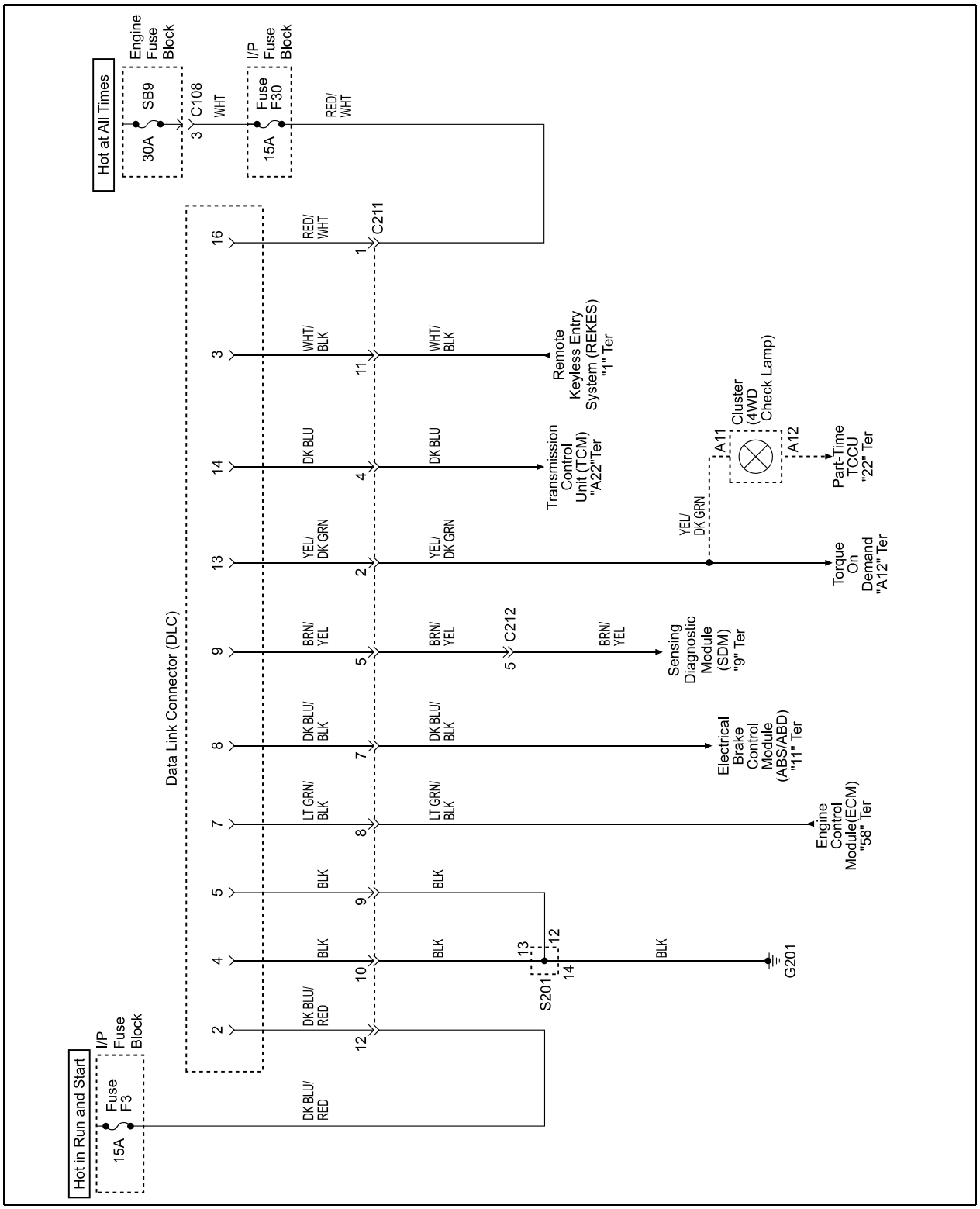
Application	N•m	Lb-Ft	Lb-In
Camshaft Position Sensor Retaining Bolts	10	-	89
Canister Mounting Bolts	6	-	53
Coolant Temperature Sensor	30	22	-
Crankshaft Position Sensor Retaining Bolt	10	-	89
Engine Control Module (ECM) Mounting Bracket Nuts	10	-	89
Fuel Filter Mounting Bracket Bolt	6	-	53
Fuel Filter Lines	28	21	-
Fuel Pressure Test Connector	25	18	-
Fuel Rail Assembly Bolts	25	18	-
Fuel Return And Supply Lines	23	17	-
Fuel Tank Retaining Nuts	38	28	-
Intake Air Duct Mounting Bolts	9	-	80
Knock Sensor Mounting Bolt	25	18	-
Oxygen Sensor	55	41	-
Pedal Position Censor Mounting Bolts And Nut	6	-	53
Throttle Body Bolts	12	-	106

Modification basis	
Application basis	
Affected VIN	

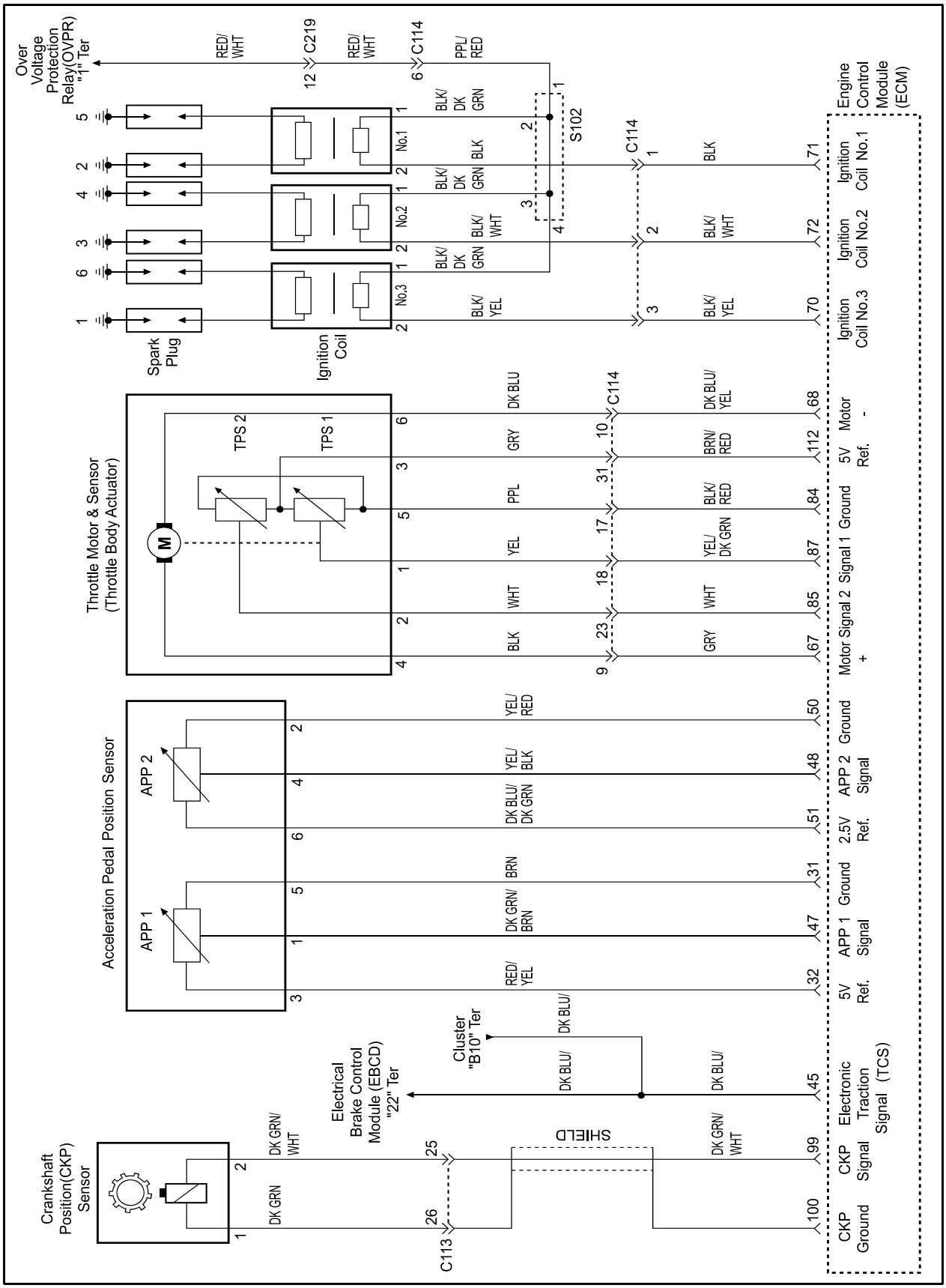
OVERVIEW AND OPERATION PROCESS

1. SCHEMATIC AND ROUTING DIAGRAMS

1) ECM Wiring Diagram (3.2L DOHC - 1 of 7) (MSE 3.63D)

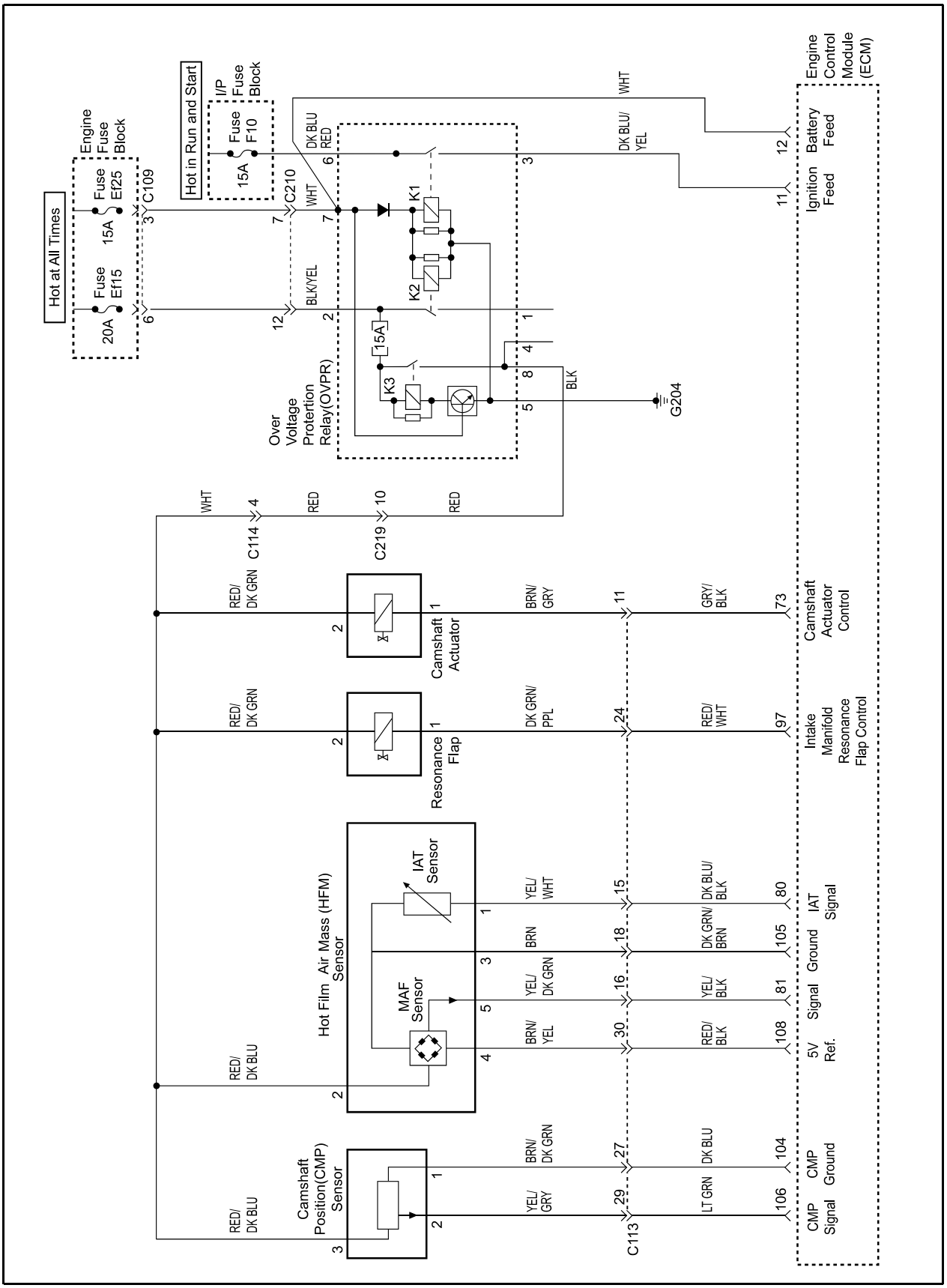


2) ECM Wiring Diagram (3.2L DOHC - 2 of 7) (MSE 3.63D)



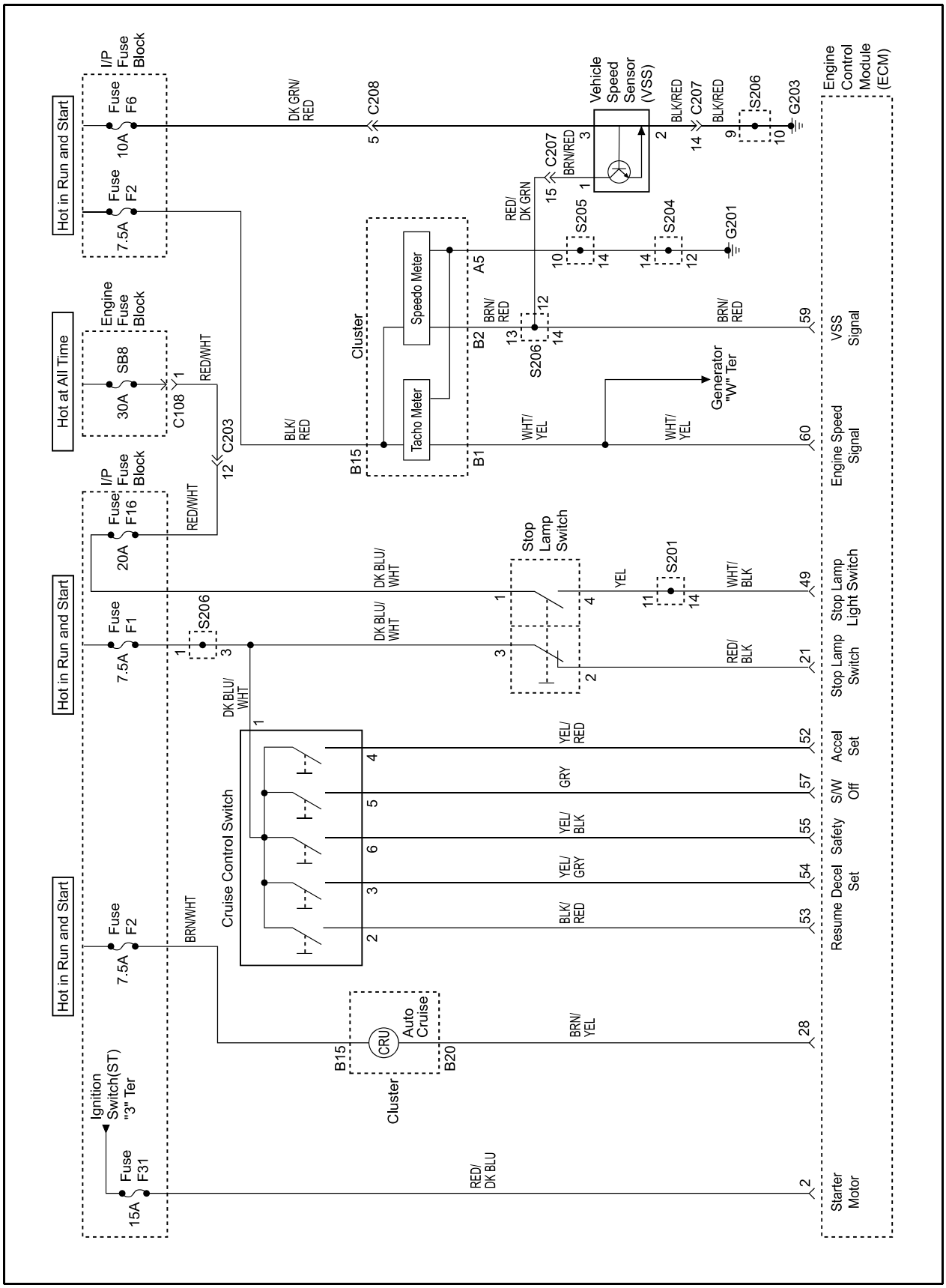
Modification basis	
Application basis	
Affected VIN	

3) ECM Wiring Diagram (3.2L DOHC - 3 of 7) (MSE 3.63D)



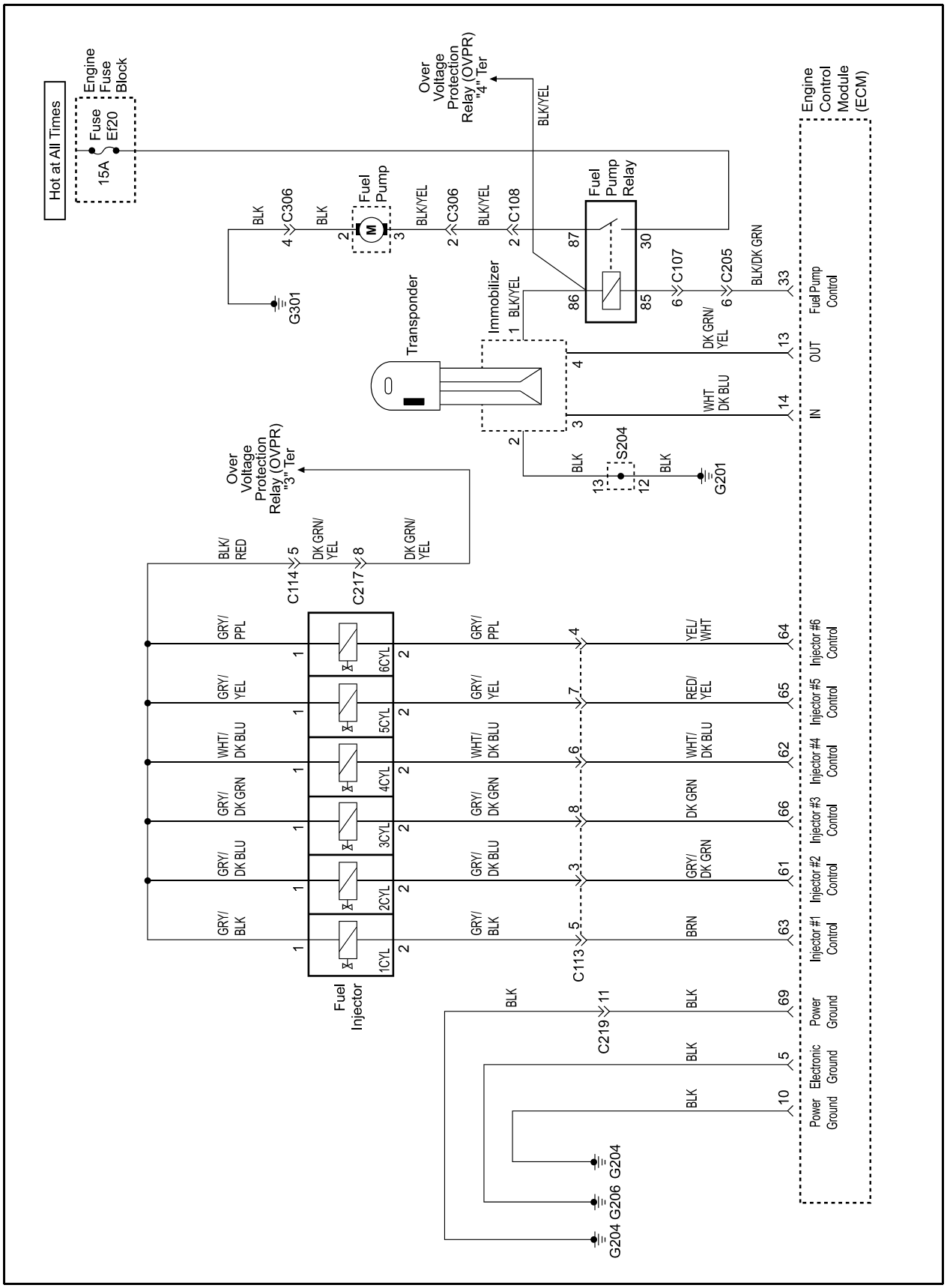
Modification basis	
Application basis	
Affected VIN	

4) ECM Wiring Diagram (3.2L DOHC - 4 of 7) (MSE 3.63D)



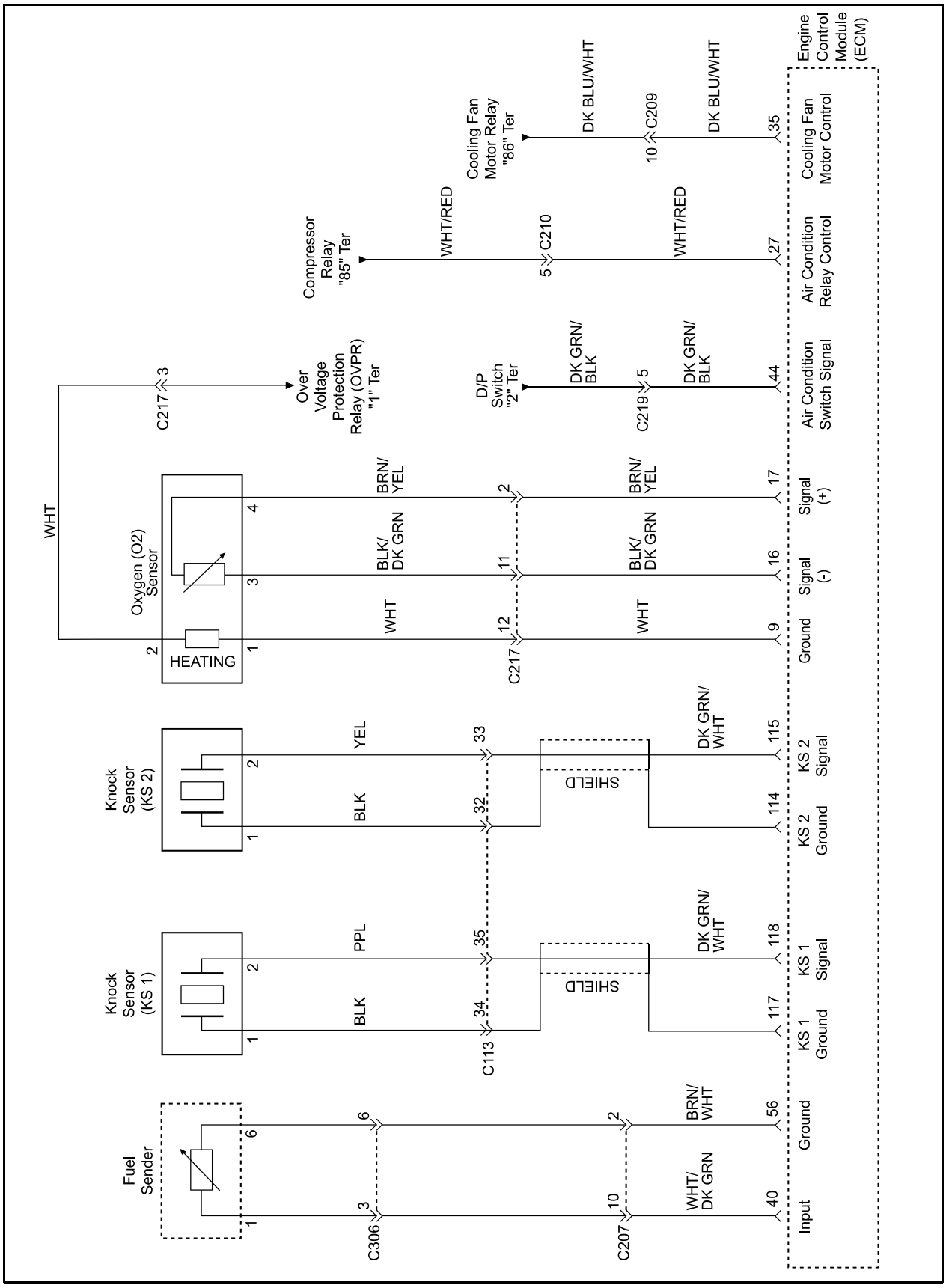
Modification basis	
Application basis	
Affected VIN	

5) ECM Wiring Diagram (3.2L DOHC - 5 of 7) (MSE 3.63D)



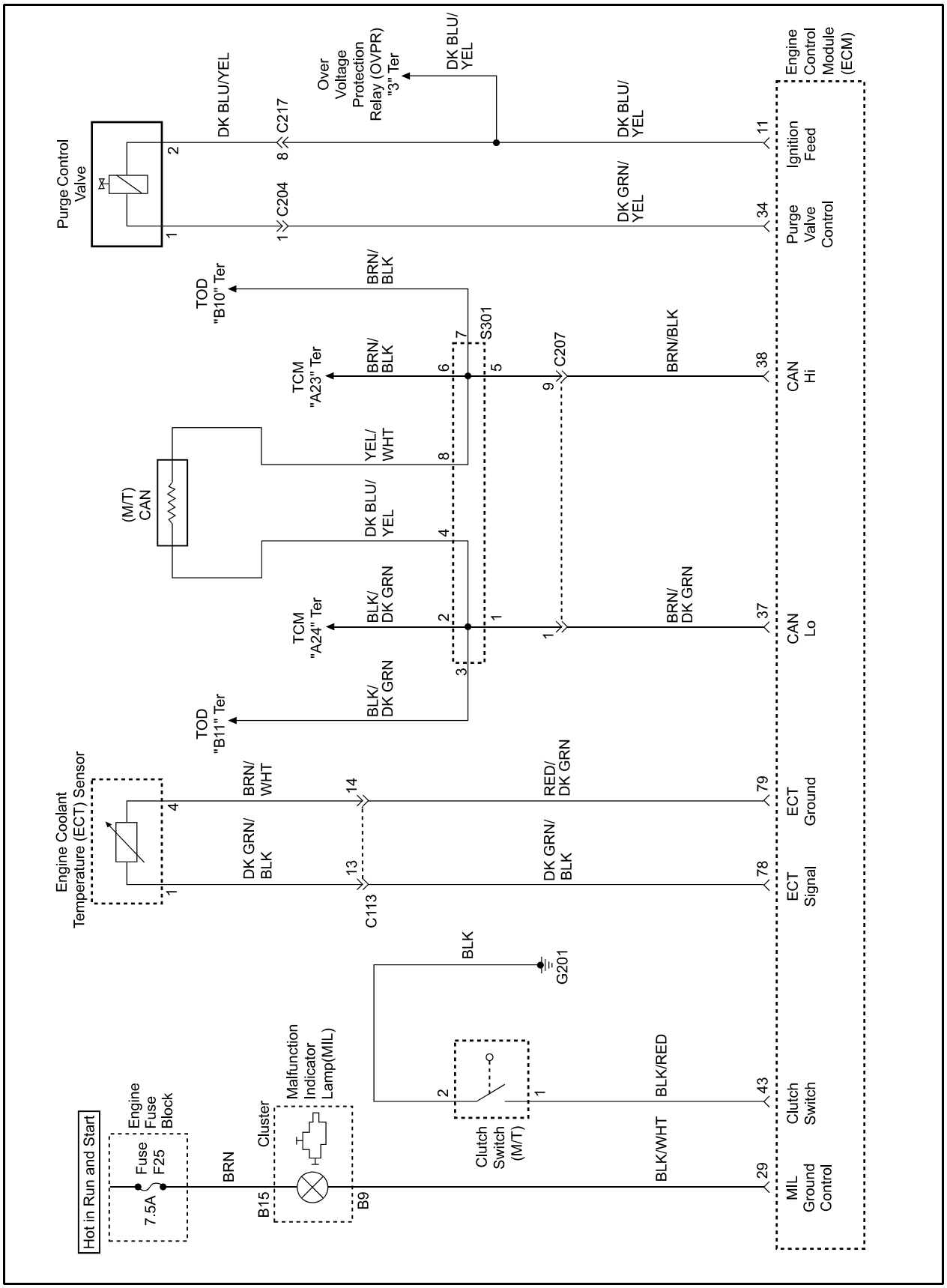
Modification basis	
Application basis	
Affected VIN	

6) ECM Wiring Diagram (3.2L DOHC - 6 of 7) (MSE 3.63D)



Modification basis	
Application basis	
Affected VIN	

7) ECM Wiring Diagram (3.2L DOHC - 7 of 7) (MSE 3.63D)



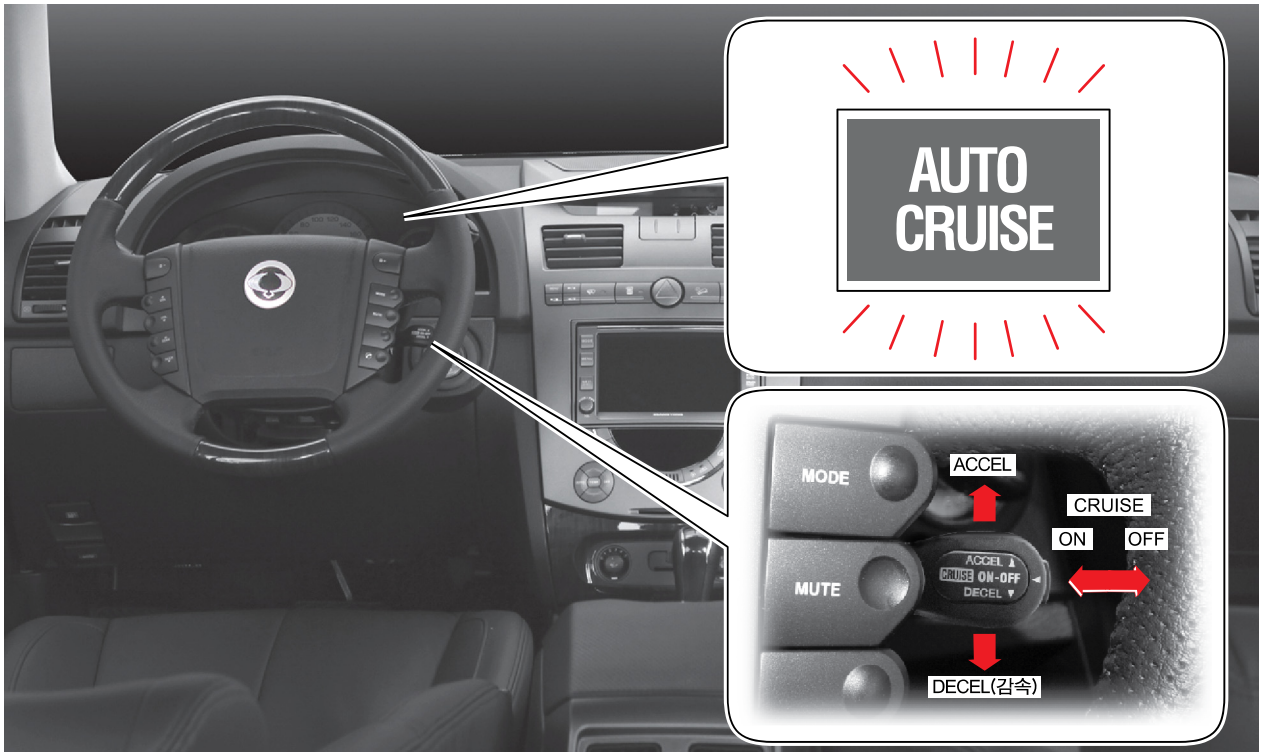
Modification basis	
Application basis	
Affected VIN	

CRUISE CONTROL SYSTEM

8510-23

OVERVIEW AND OPERATION PROCESS

1. CRUISE CONTROL SWITCH



The purpose of the cruise control system is to automatically maintain a vehicle speed set by the driver, without depressing the accelerator pedal. The cruise control switch is located under the right side of the steering wheel, and when this switch is operating "AUTO CRUISE" lamp comes on.

The minimum speed for setting the cruise control system is 36 km/h (22.37 mph). Pay constant attention to the distance between the vehicles and the traffic conditions when using the cruise control system.

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.

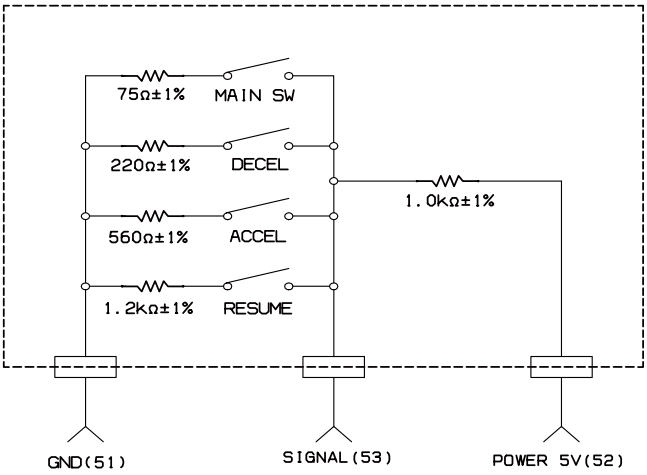
1) When To Use

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

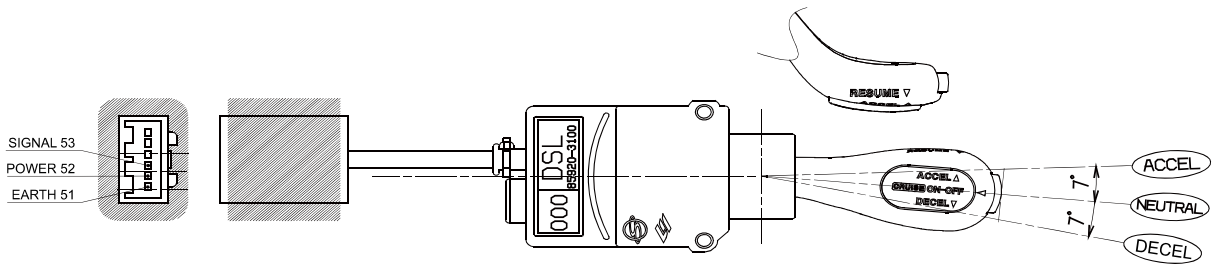
WARNING

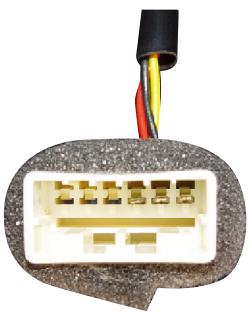
Use the cruise control system only when driving on motorways or highways. Do not use the cruise control system where the road conditions are as follows:
- When there is strong wind or cross wind.
- Heavy traffic.
- Slippery roads or steep decline.

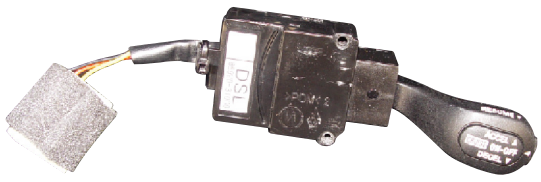
2. CIRCUIT DIAGRAM



1) Configuration







3. HOW TO OPERATE CRUISE CONTROL SWITCH

1) How To Set Speed



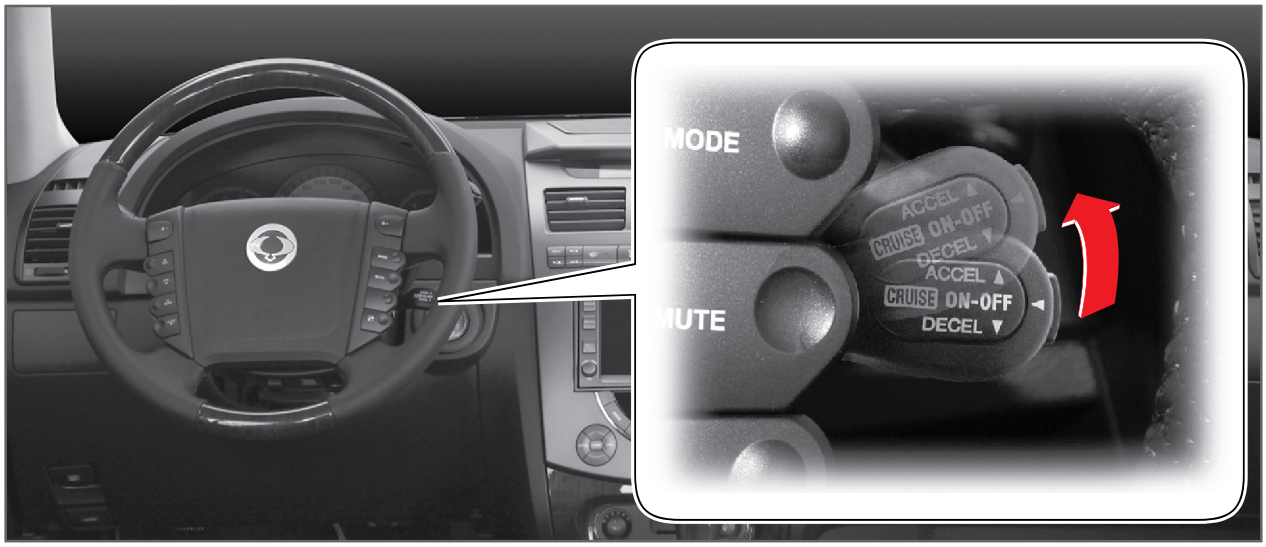
1. To operate the cruise control system, accelerate the vehicle to the speed within the specified range below with depressing the accelerator pedal.
   - Cruise control operating range: between 36 km/h (22.37 mph) and 150 km/h (93.207 mph)
2. When the desired speed is reached, which should be within the above range, push up the cruise control switch lever to ACCEL side (upwards arrow), or push down the switch lever to DECEL side (downwards arrow).
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.

Modification basis	
Application basis	
Affected VIN	

2) Accelerating with the Cruise Control System



(1) While the cruise control system is running

1. To increase the set speed, push up the cruise control switch lever to ACCEL side and hold it until the desired speed is reached without depressing the accelerator pedal.
2. When the desired speed is set, release the switch 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 the vehicle to more than 36 km/h (22.37 mph) using the accelerator pedal. Push up the cruise control switch lever to ACCEL side and hold it.
2. When the desired speed is reached, release the accelerator pedal and the switch 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 cruise control switch lever to ACCEL side for less than 0.5 second per one switching while the cruise control system is running; the speed increases each time by 1.3 km/h (0.81 mph).
2. For example, if you want to increase the speed 13 km/h (81 mph) more than the previous set speed, tap up the switch lever to ACCEL side ten times without using the accelerator pedal.

3) Decelerating with the Cruise Control System



(1) While the cruise control system is running

1. To decrease the set speed, push down the cruise control switch lever to DECEL side and hold it until the desired speed is reached without depressing the brake pedal.
   But the cruise control system cannot maintain the cruise function at less than 34 km/h (21.13 mph).
2. When the desired speed is set, release the switch lever.

(2) When the cruise control system is not running

To decrease the speed with the cruise control system while 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 36 km/h (22.37 mph).
2. When the desired speed is reached, release the switch lever.
3. But the cruise control system cannot maintain the cruise function at less than 34 km/h (21.13 mph).

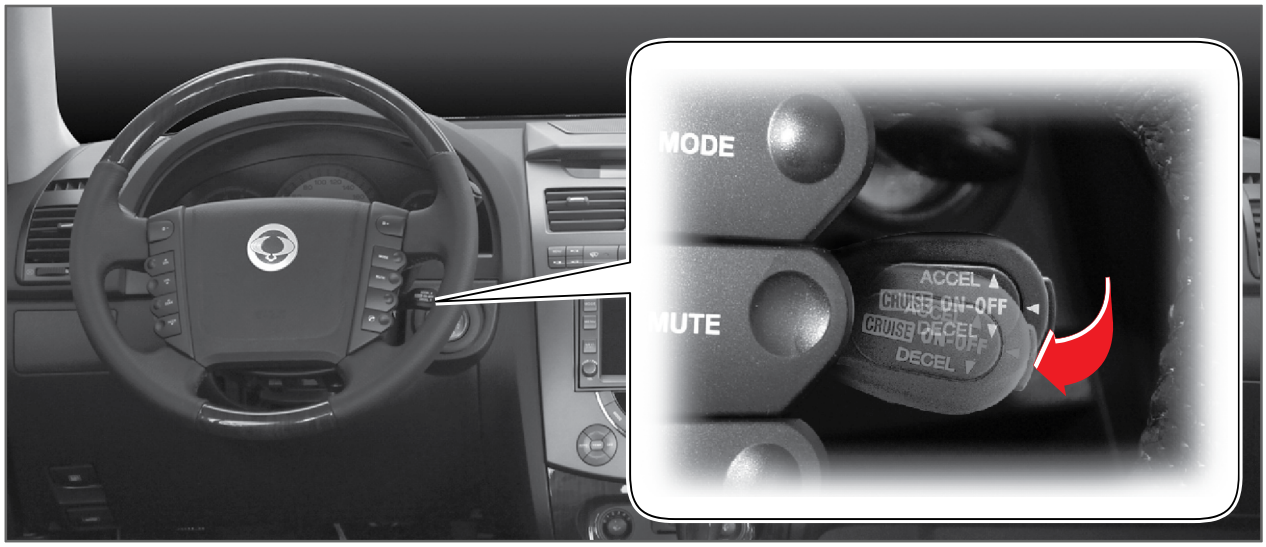
(3) Tap-down while the cruise control system is running

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

1. Push down the cruise control switch lever to DECEL side for less than 0.5 second per one switching while the cruise control system is running; the speed decreases each time by 1.0 km/h (0.62 mph).
2. For example, if you want to decrease the speed 10 km/h (62 mph) lower than the previous set speed, tap down the switch lever to DECEL side ten times without using the brake pedal.

Modification basis	
Application basis	
Affected VIN	

4) Recovery of Set Speed (RESUME)



Even if the cruise control is cancelled, the previous set cruise speed can be recovered by operating the cruise control switch lever like below:
- Pull the switch lever in the arrow direction shown in the illustration.

This RESUME function works only when the vehicle speed is more than 36 km/h (22.37 mph) without using the accelerator or brake pedal.

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.

5) Normal Cancellation of the Cruise Control (OFF ↔ ON)



The cruise control system will be cancelled when the button on the side of the switch is pressed, or when one of the following conditions is met:

1. When the brake pedal is depressed or ESP is activated.
2. When the vehicle speed is less than 34 km/h (21.13 mph).
3. When the parking brake is applied while driving.
4. When the clutch pedal is depressed for shifting (M/T only).

CAUTION

Put the cruise control switch lever in the neutral position when not using the cruise control system.

(1) Abnormal Cancellation of the Cruise Control

1. When the rapid deceleration or acceleration occurs.
2. When the cruise control lever is faulty.
3. When the brake switch is malfunctioning or has an open circuit.

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

- 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.
- Always be prepared to use the brake or accelerator pedal for safe driving while the cruise control system is running.
- 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.
- Ensure that the braking distance is maintained and use the brake pedal if needed.

Modification basis	
Application basis	
Affected VIN	

ENGINE GENERAL

0000-00

GENERAL

1. STRUCTURE..... 3

OVERVIEW AND OPERATION PROCESS

1. ENGINE CONTROLS COMPONENTS.... 6
2. INTAKE SYSTEM COMPONENTS..... 9
3. EXHAUST SYSTEM COMPONENTS..... 11
4. LUBRICATION SYSTEM COMPONENTS..... 13
5. COOLING SYSTEM COMPONENTS..... 15
6. FUEL SYSTEM COMPONENTS..... 17

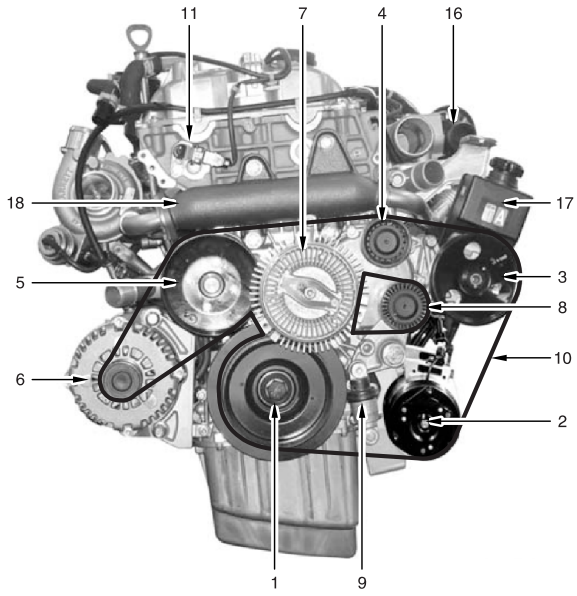
ENGINE GENERAL

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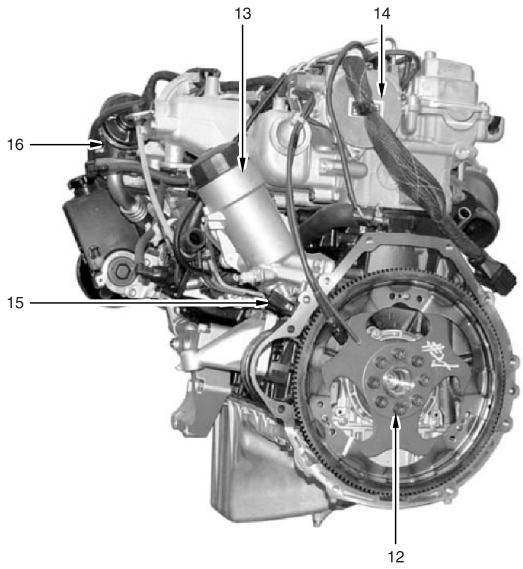
GENERAL

1. STRUCTURE

▶ **Front view**

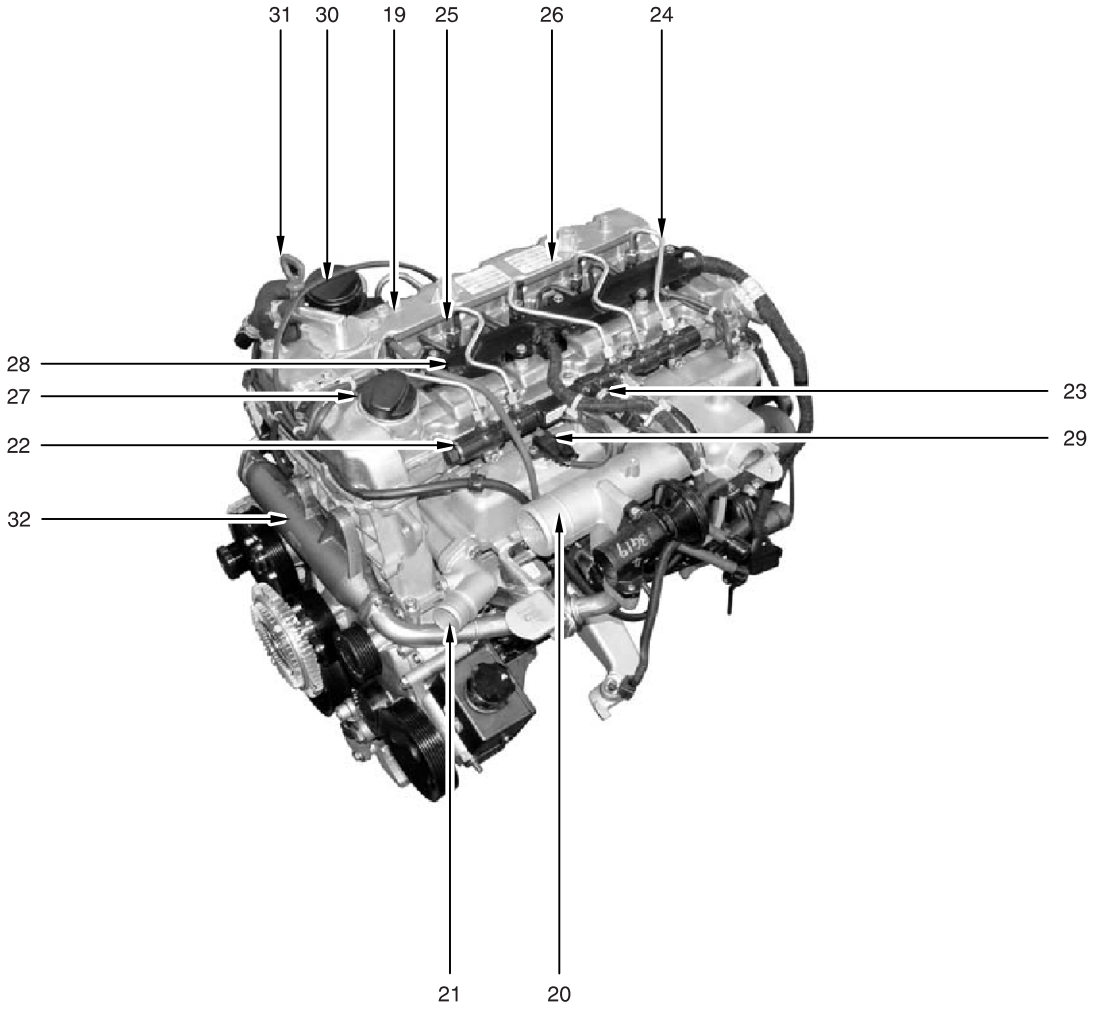


▶ **Rear view**



1. TVD (Torsional Vibration	7. Cooling fan pulley	13.Oil filter
2. Damper)	8. Aut tensioner pulley	14.Vacuum pump
3. Air conditioner compressor	9. Auto tensioner	15.Crank position sensor
4. Power steering pump pulley	10.Poly-groove belt	16.EGR valve
5. Idle pulley	11.Cam position sensor	17.Power steering pump
6. Water pump pulley	12.Drive plate (M/T: DMF)	18.EGR center pipe
Alternator		

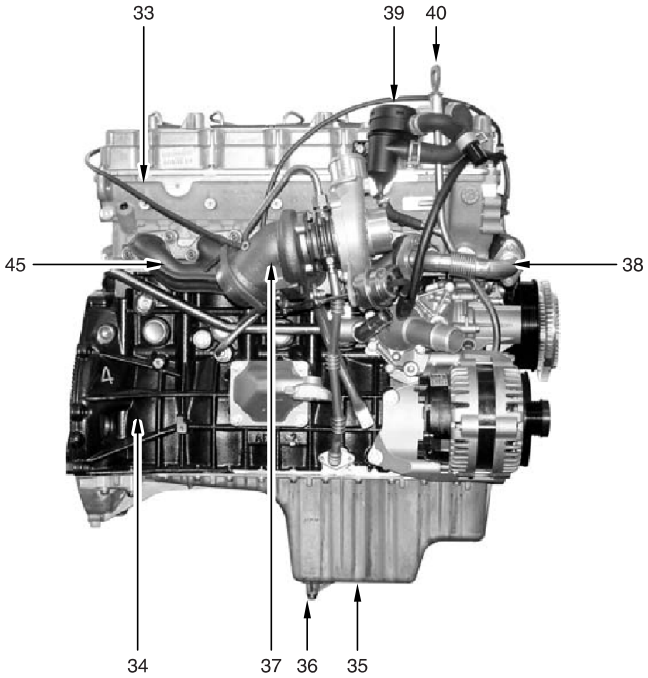
▶ **Top view**



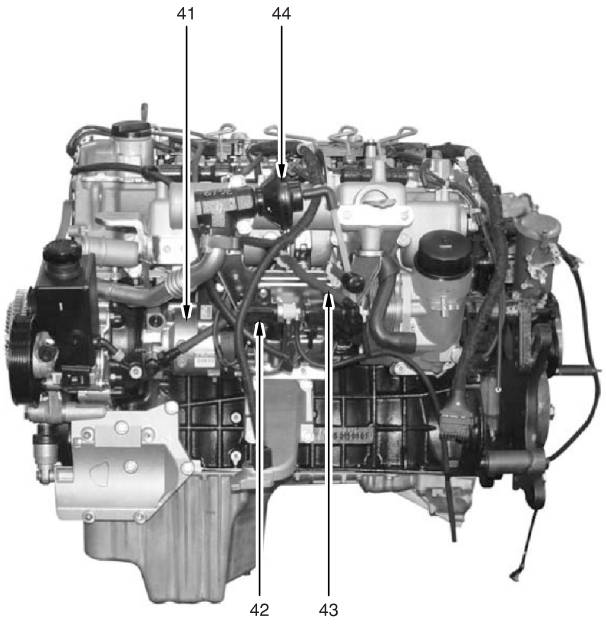
19.Cylinder head cover	24.Fuel pipe	29.Booster pressure sensor
20.Intake manifold	25.Injector	30.Oil separator
21.Water outlet port	26.Fuel return line	31.Oil dipstic
22.Common rail	27.Oil filler cap	32.EGR center pipe
23.Fuel pressure sensor	28.Glow plug	

Modification basis	
Application basis	
Affected VIN	

▶ **Left side view**



▶ **Right side view**

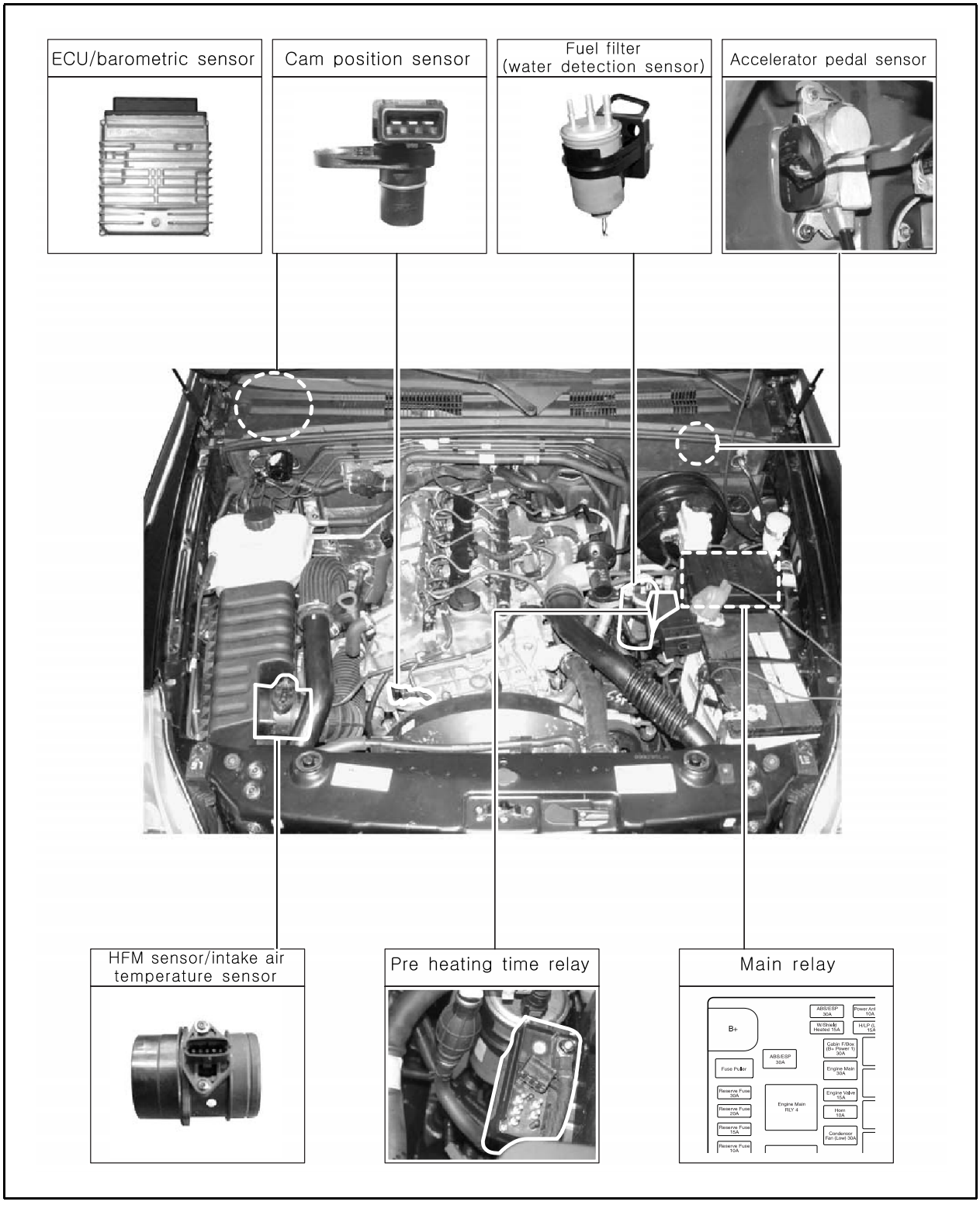


33.Cylinder head	38.EGR - RH (#3) pipe	42.Turbocharger vacuum modulator
34.Cylinder block	39.Oil separator	43.EGR valve vacuum modulator
35.pan	40.Oil dipstic	44.EGR valve
36.Drain plug	41.HP pump	45.Exhaust manifold
37.Turbocharger		

OVERVIEW AND OPERATION PROCESS

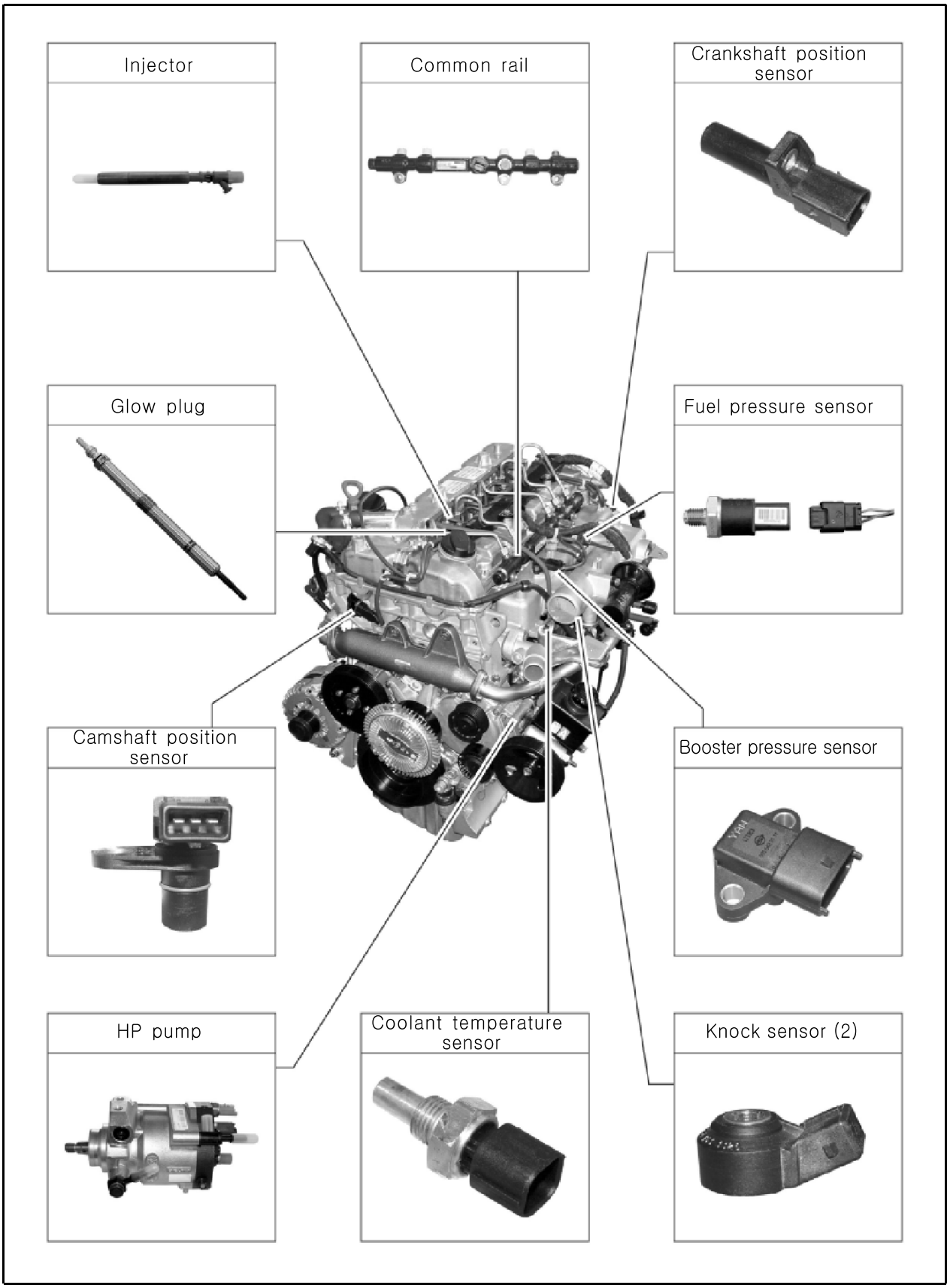
1. ENGINE CONTROLS COMPONENTS

1) ECU Related Components



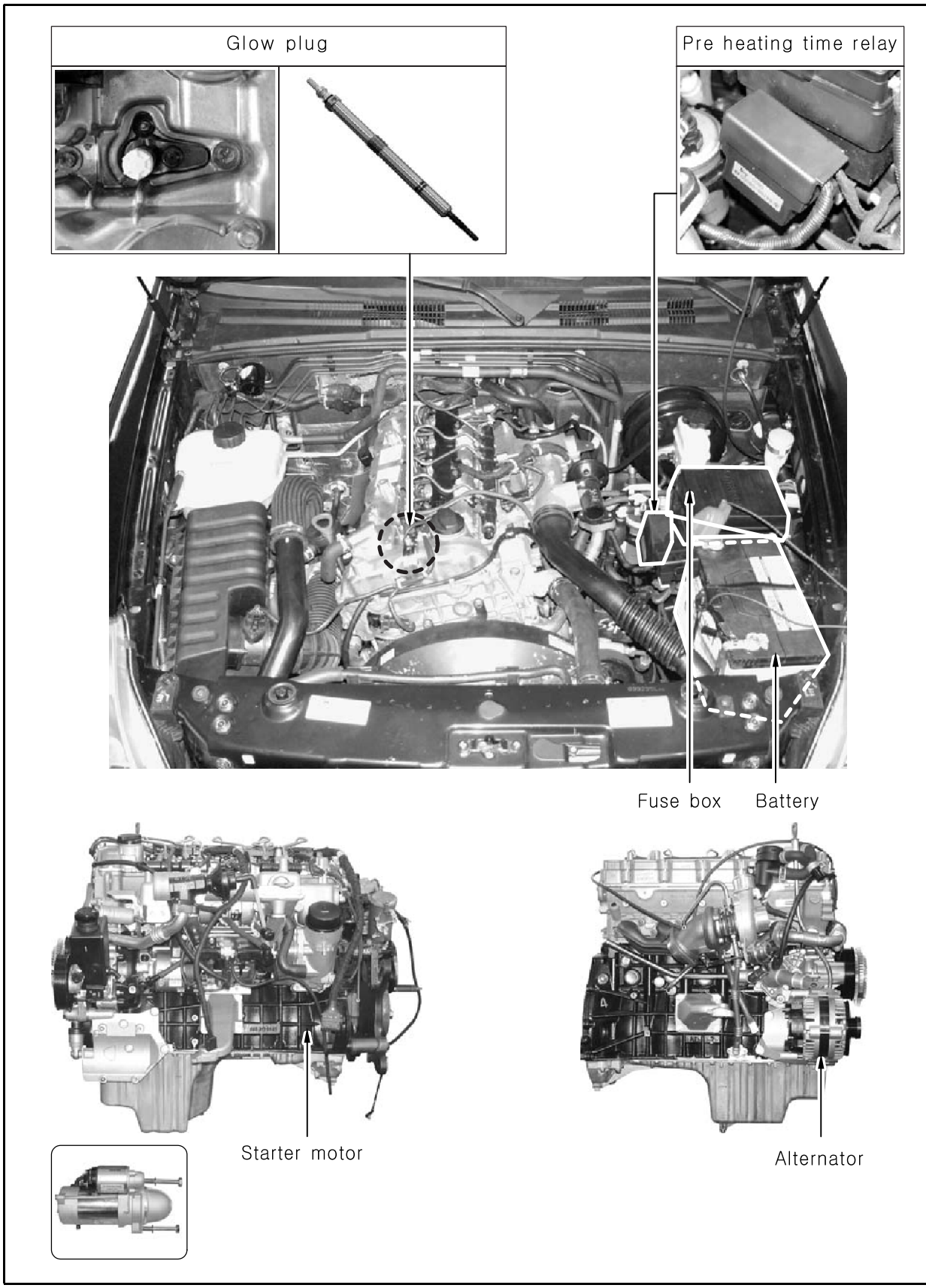
Modification basis	
Application basis	
Affected VIN	

2) Engine And Sensors



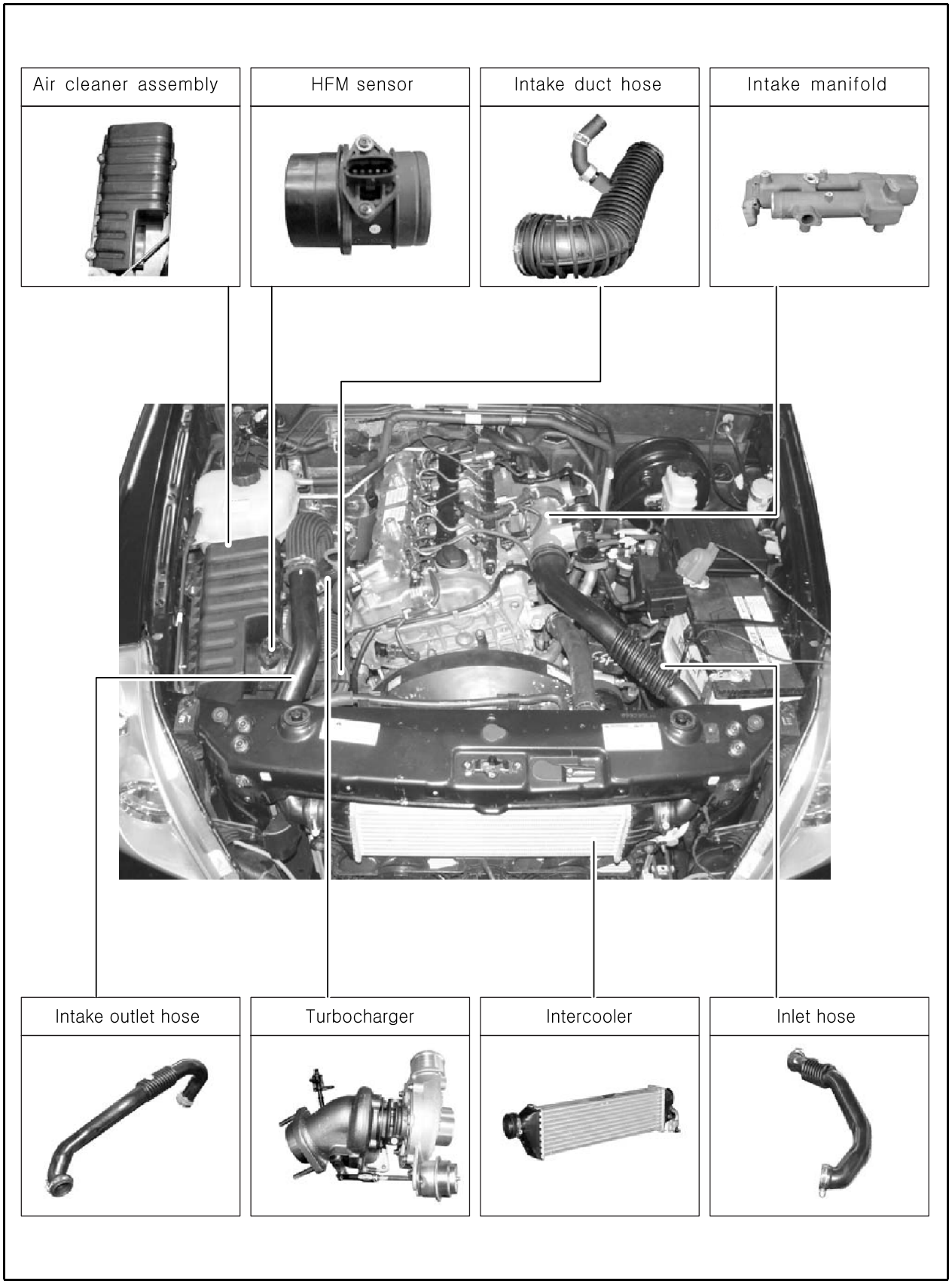
Modification basis	
Application basis	
Affected VIN	

3) Electrical Components And Pre Heating System



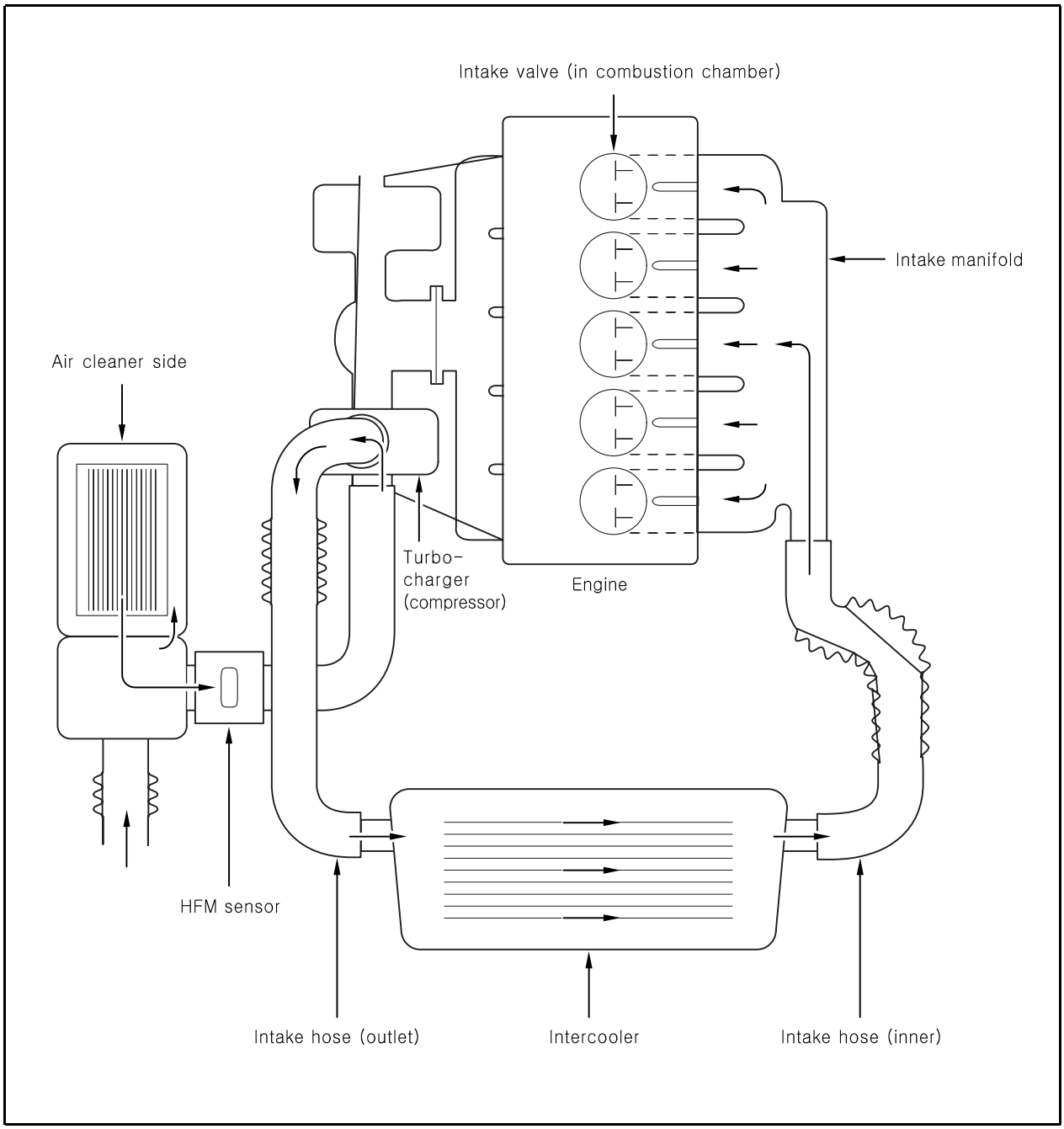
Modification basis	
Application basis	
Affected VIN	

2. INTAKE SYSTEM COMPONENTS



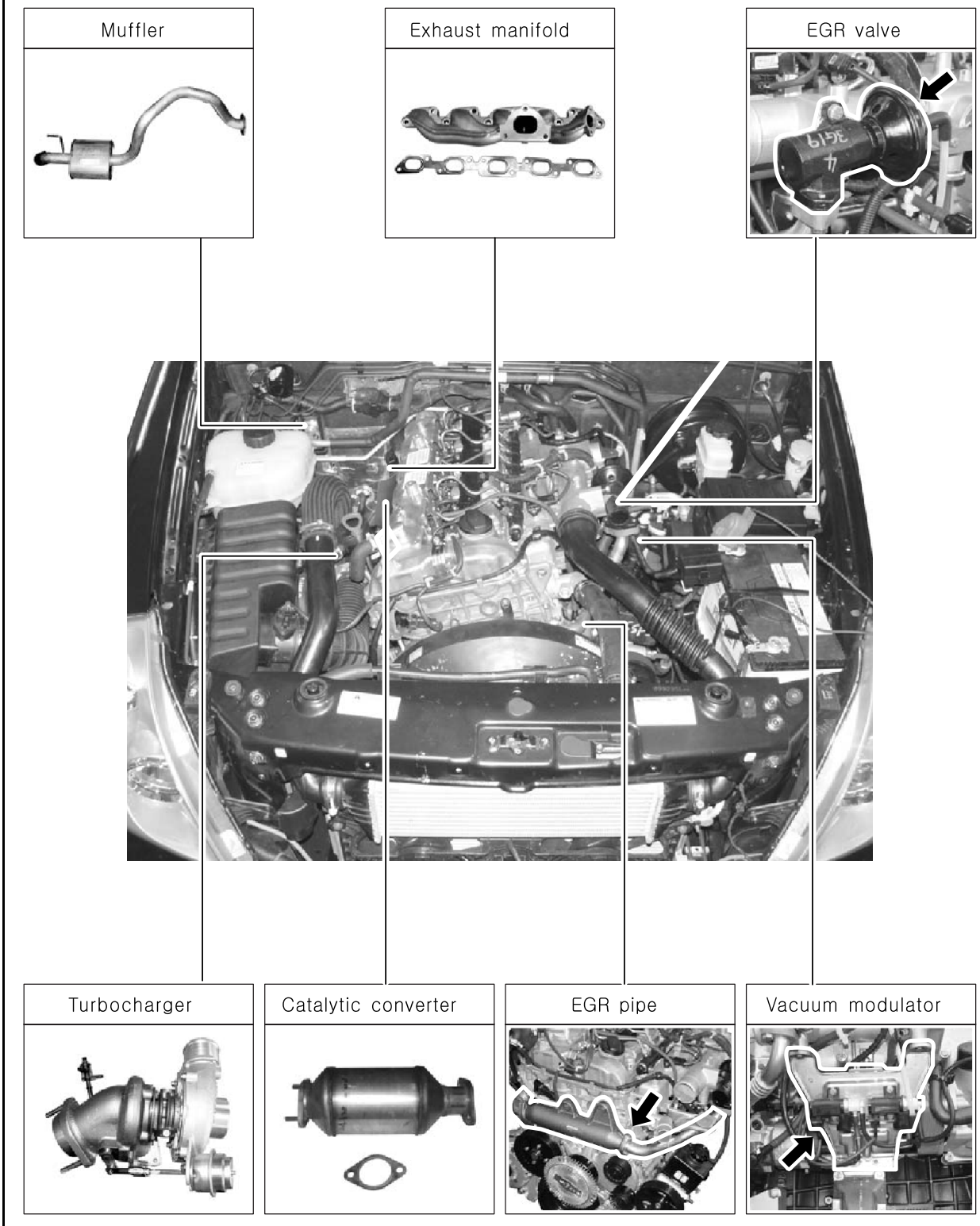
Modification basis	
Application basis	
Affected VIN	

▶ Intake Air Flow Chart



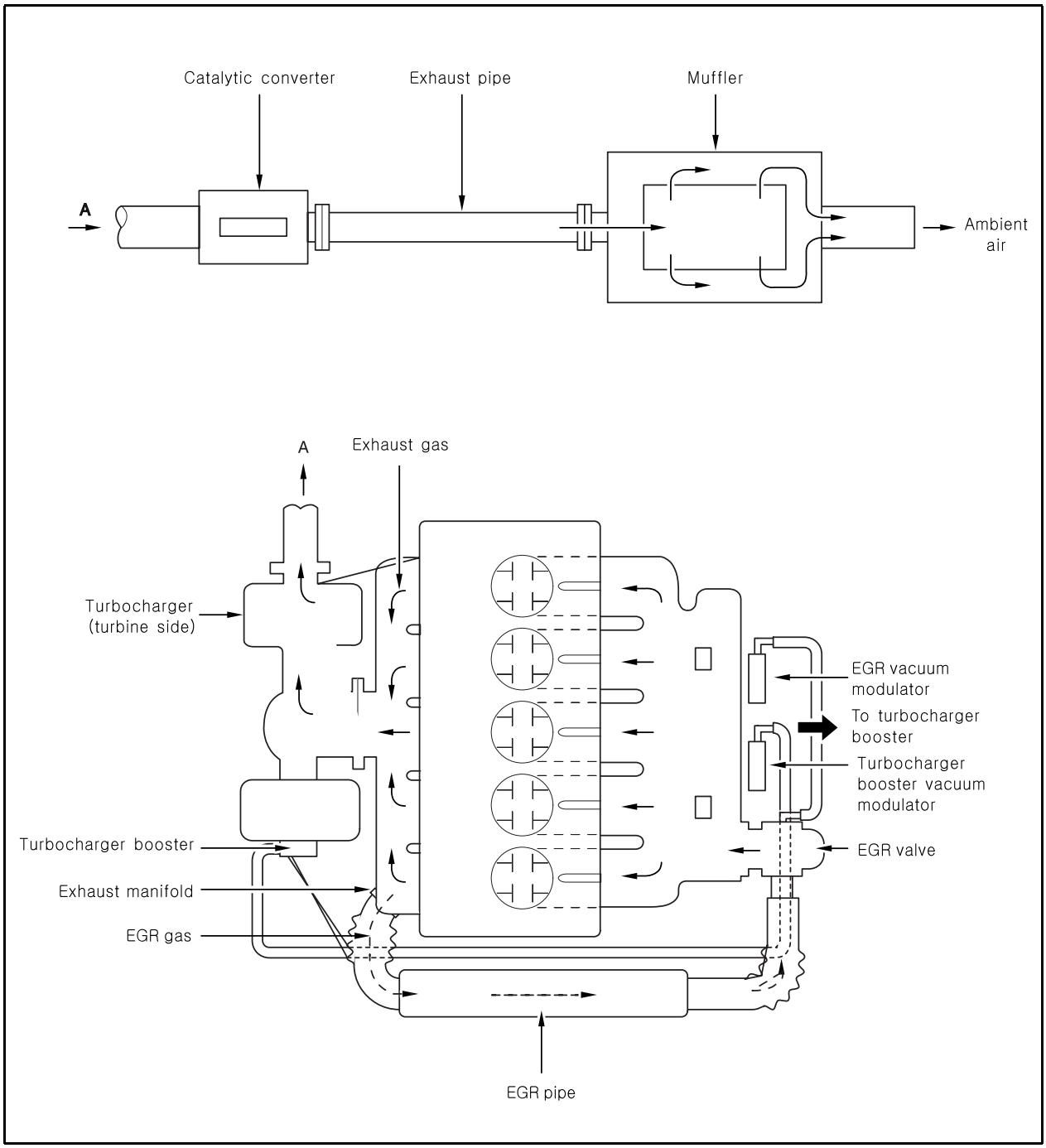
Modification basis	
Application basis	
Affected VIN	

3. EXHAUST SYSTEM COMPONENTS



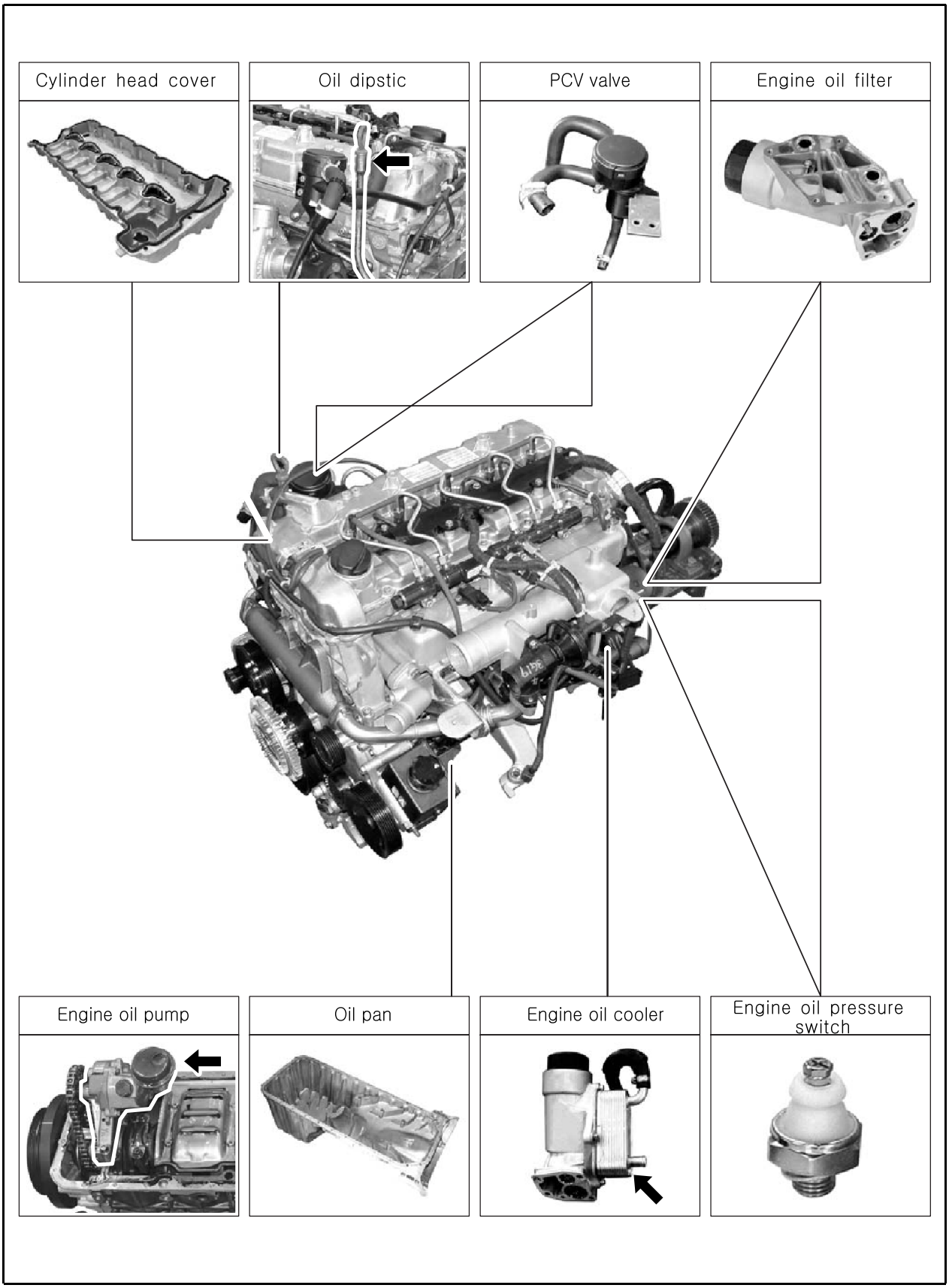
Modification basis	
Application basis	
Affected VIN	

▶ Exhaust Air Flow Chart



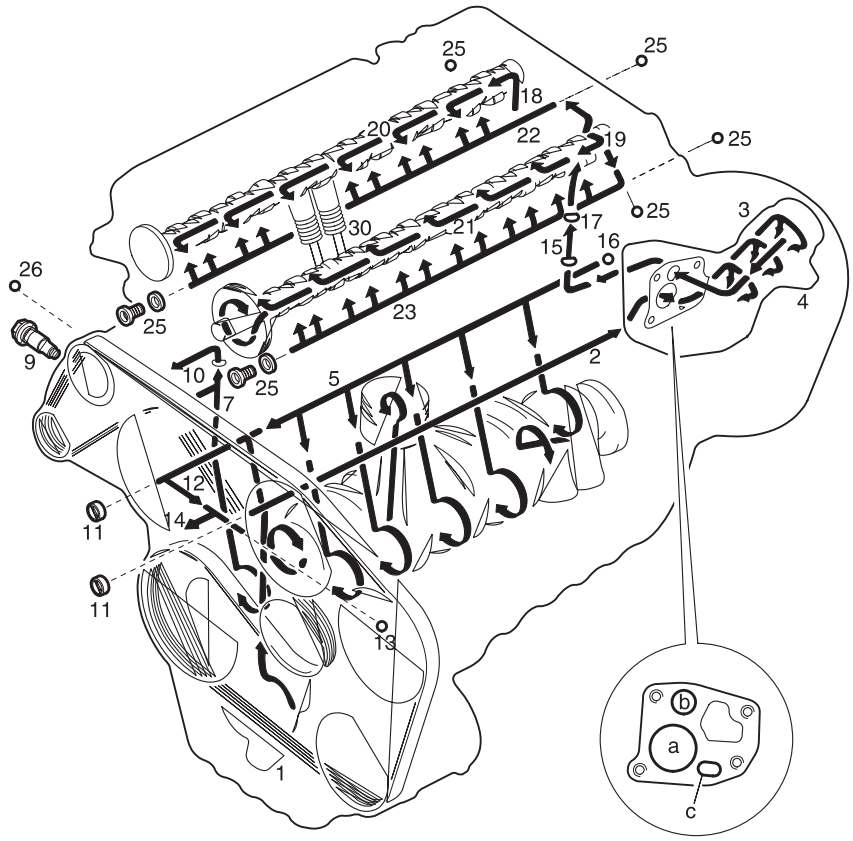
Modification basis	
Application basis	
Affected VIN	

4. LUBRICATION SYSTEM COMPONENTS



Modification basis	
Application basis	
Affected VIN	

▶ Lubrication Flow Chart

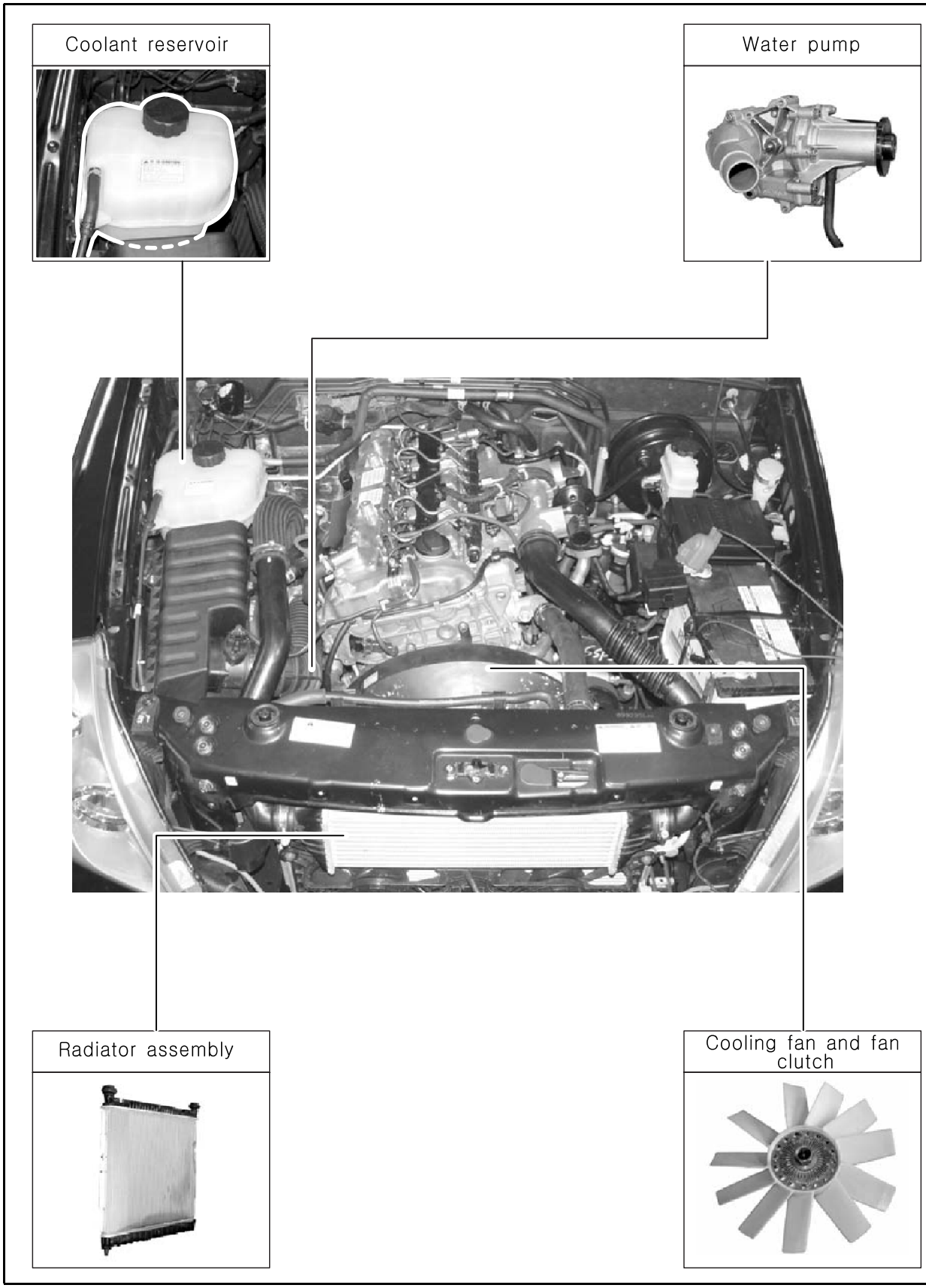


1. Oil pump
2. Oil gallery (to oil filter)
3. Oil filter
4. Oil pressure switch
5. Main oil gallery
7. Oil gallery (chain tensioner side)
9. Chain tensioner
10. Vent (chain tensioner)
11. Front closing cover (ϕ 17 mm)
12. Oil gallery (at a right angle to axial direction)
13. Ball (ϕ 6 mm)
14. Oil spray nozzle (timing chain)
15. Oil gallery (cylinder head side)
16. Ball (ϕ 15 mm)
17. Oil restriction (inner - ϕ 4 mm)
18. Oil supply (to exhaust camshaft)
19. Oil supply (to intake camshaft)
20. Oil supply (to exhaust camshaft bearing)
21. Oil supply (to intake camshaft bearing)
22. Oil gallery (to exhaust valve tappet)
23. Oil gallery (to intake valve tappet)
24. Oil gallery (to chain tensioner)
25. Expansion plug
26. Ball
30. Valve tappet

a. Oil gallery (between oil pump and oil filter)
b. Main oil gallery
c. Oil return line (the oil is returned to oil pan side
when replacing filter element)

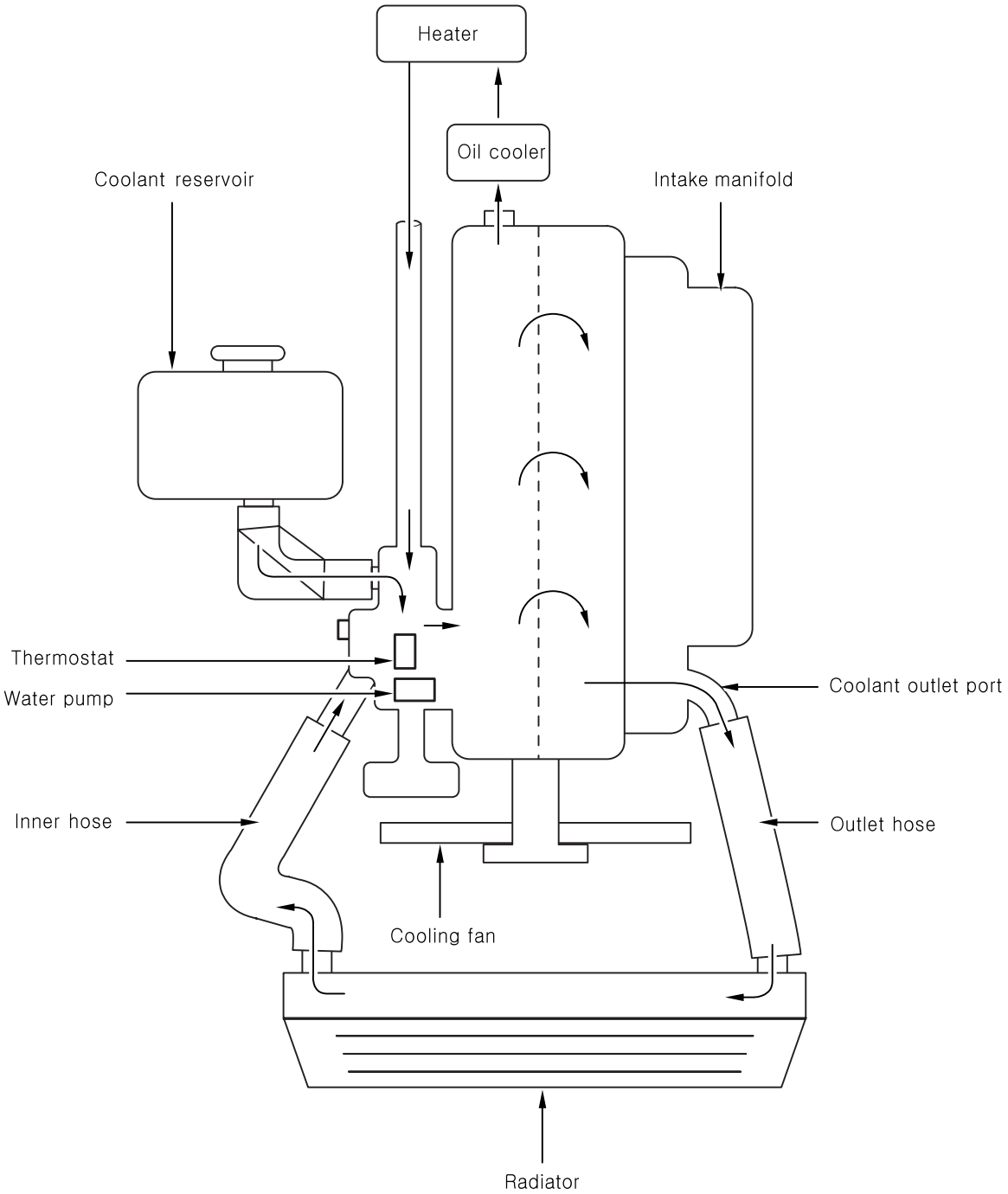
Modification basis	
Application basis	
Affected VIN	

5. COOLING SYSTEM COMPONENTS



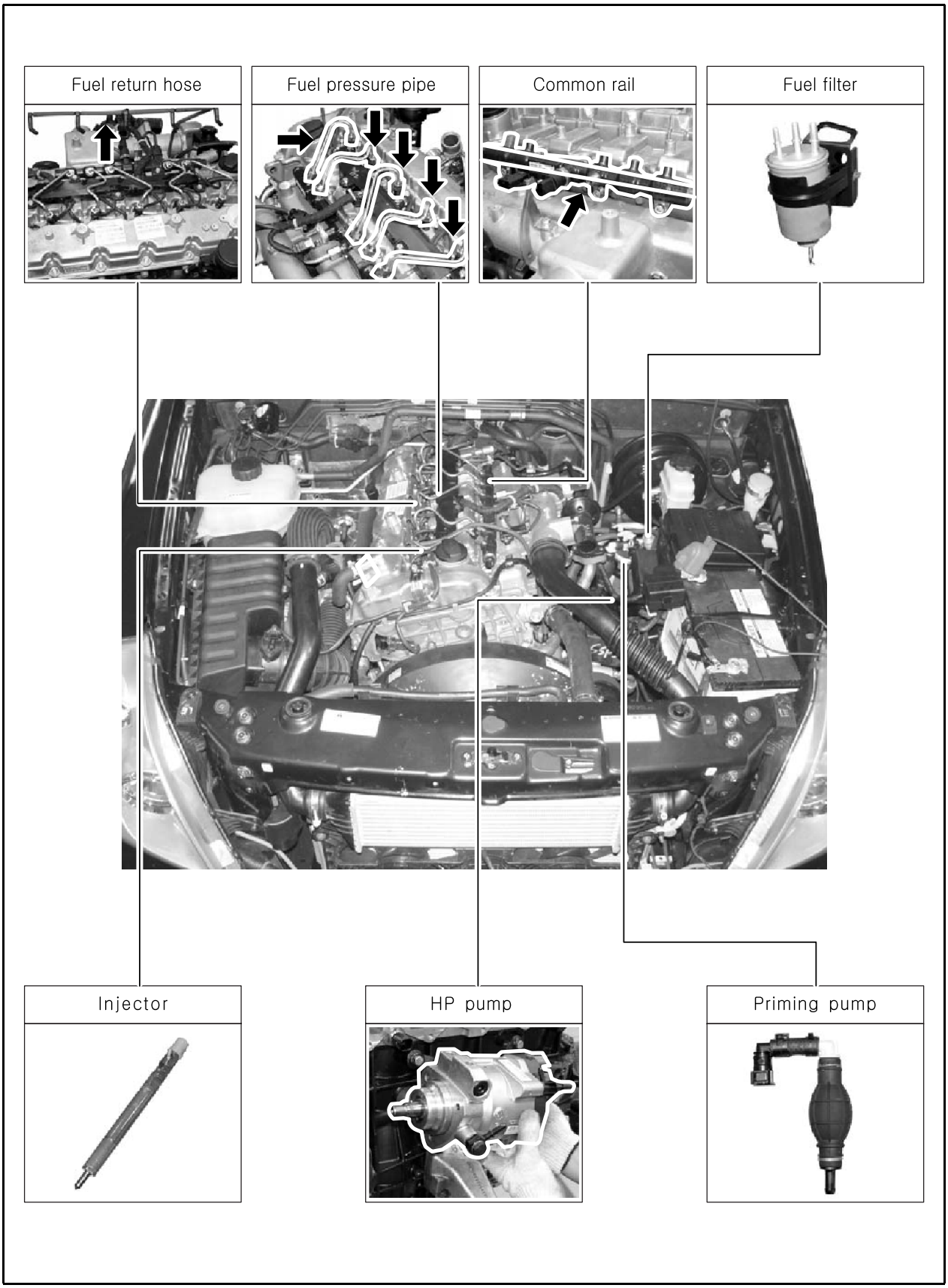
Modification basis	
Application basis	
Affected VIN	

▶ Coolant Flow Chart



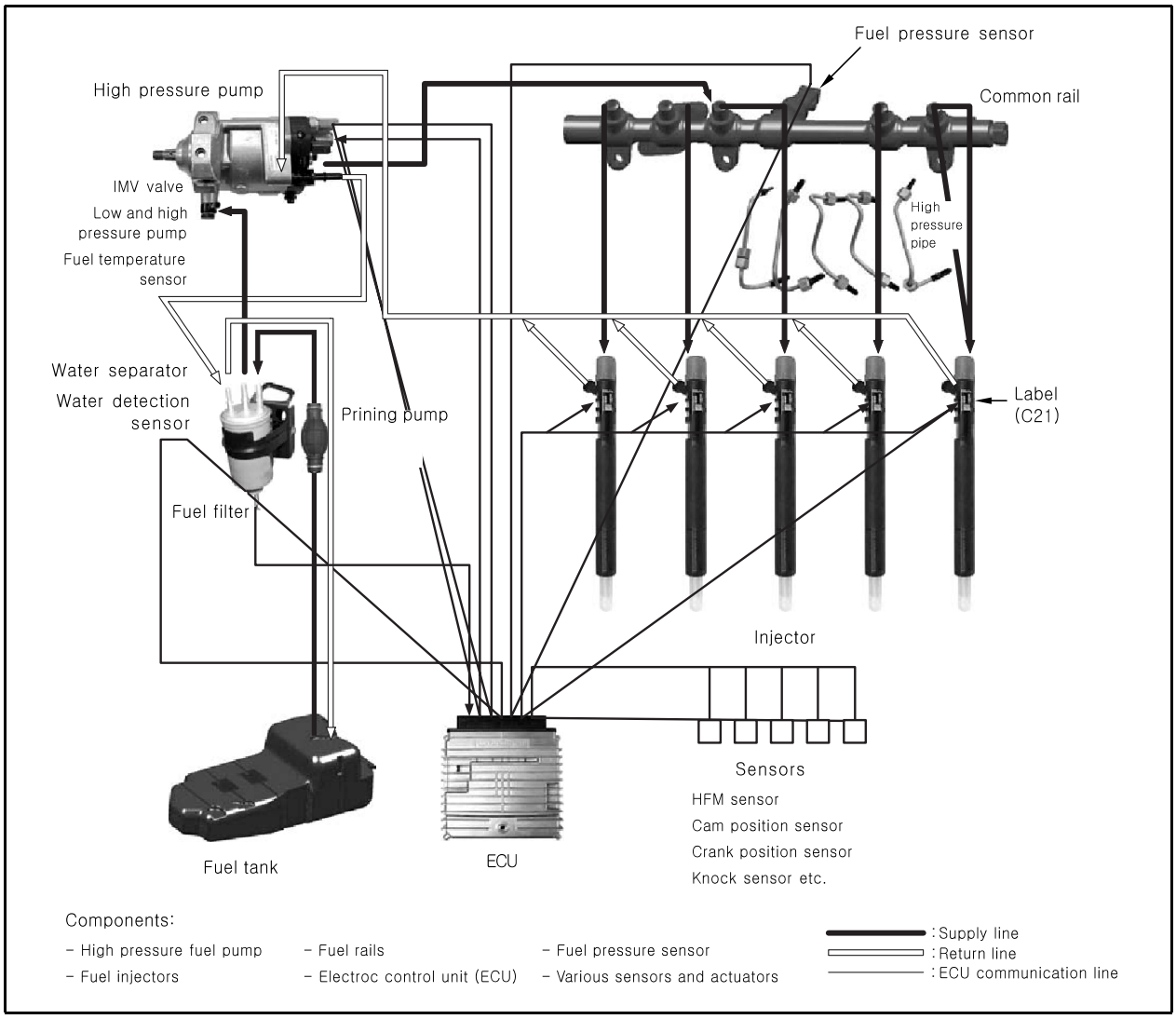
Modification basis	
Application basis	
Affected VIN	

6. FUEL SYSTEM COMPONENTS



Modification basis	
Application basis	
Affected VIN	

▶ Fuel Supply System



According to input signals from various sensors, engine ECU calculates driver's demand (position of the accelerator pedal) and then controls overall operating performance of engine and vehicle on that time.

ECU receives signals from sensors via data line and then performs effective engine air-fuel ratio controls based on those signals.

Engine speed is measured by crankshaft speed (position) sensor and camshaft speed (position) sensor determines injection order and ECU detects driver's pedal position (driver's demand) through electrical signal that is generated by variable resistance changes in accelerator pedal sensor.

Air flow (hot film) sensor detects intake air volume and sends the signals to ECU. Especially, the engine ECU controls the air-fuel ratio by recognizing instant air volume changes from air flow sensor to decrease the emissions (EGR valve control). Furthermore, ECU uses signals from

coolant temperature sensor and air temperature sensor, booster pressure sensor and barometric sensor as compensation signal to respond to injection starting, pilot injection set values, various operations and variables.

Modification basis	
Application basis	
Affected VIN	

ENGINE ASSEMBLY

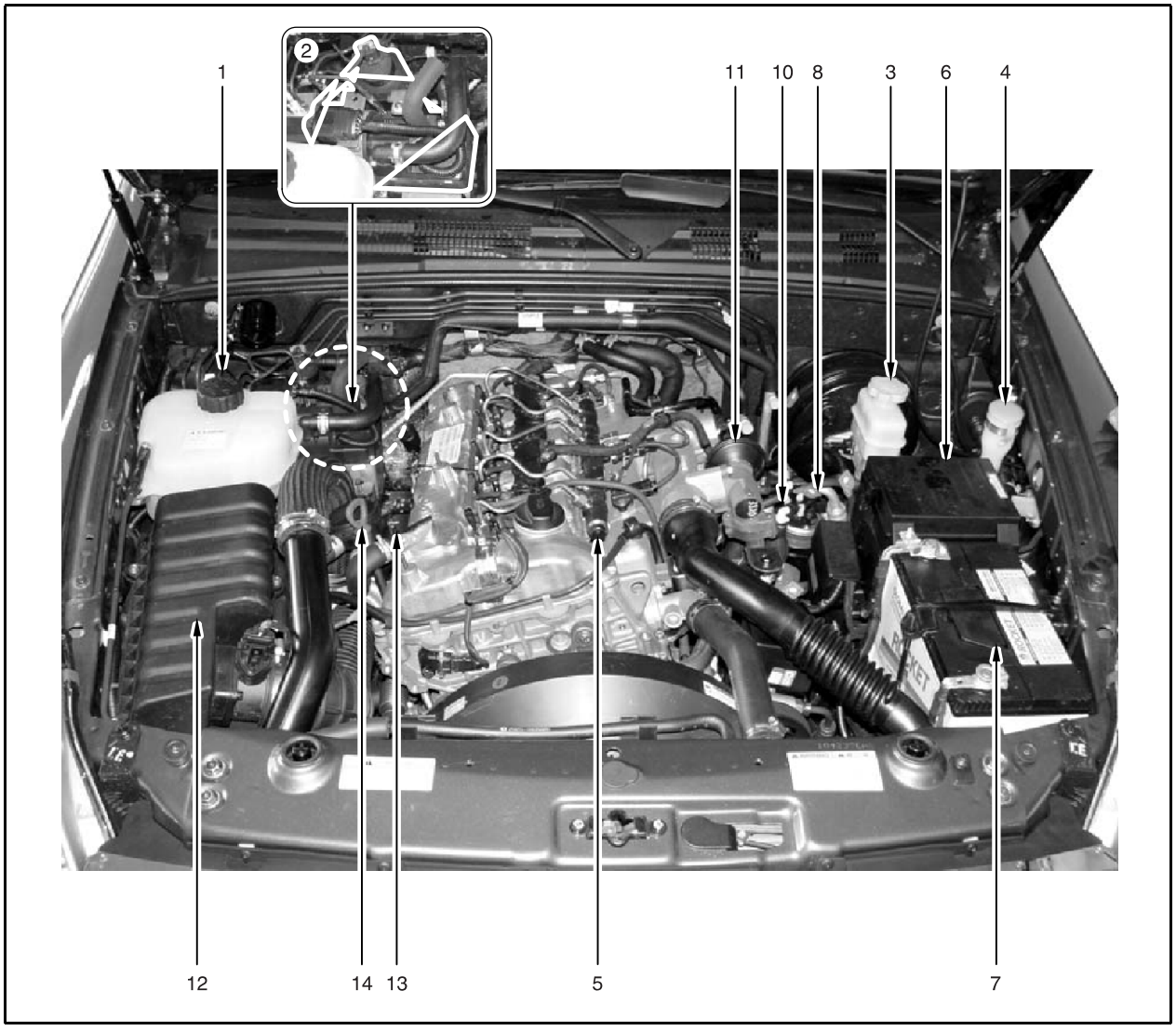
1212-01

GENERAL

1. D27DT ENGINE STRUCTURE

1) Major Components in Engine and Engine Compartment

The advanced electronically controlled D27DT engine that has high pressure fuel system has been introduced to this vehicle. It satisfies the strict emission regulation and provides improved output and maximum torque.

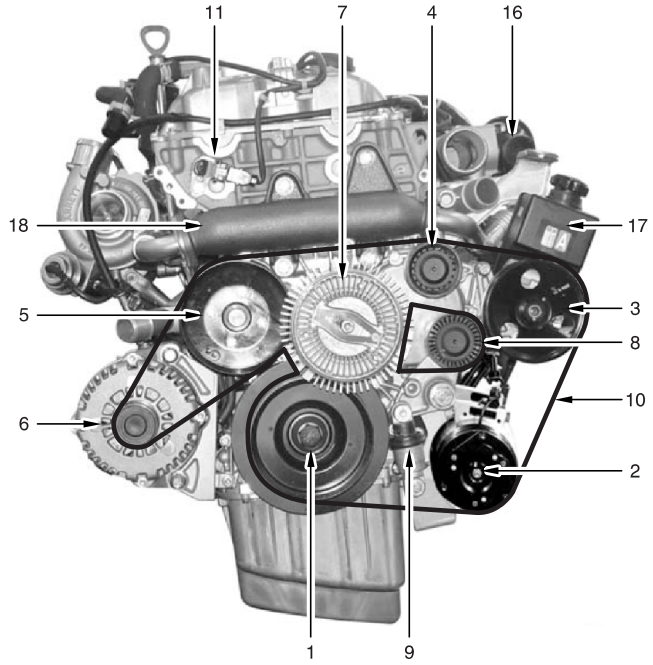


1. Coolant reservoir
2. FFH device
3. Brake fluid reservoir
4. Washer fluid reservoir
5. Common rail
6. Fuse box
7. Battery
8. Fuel filter
9. Power steering pump
10. Priming pump
11. EGR valve
12. Air cleaner assembly
13. Turbo charger
14. Oil dipstick

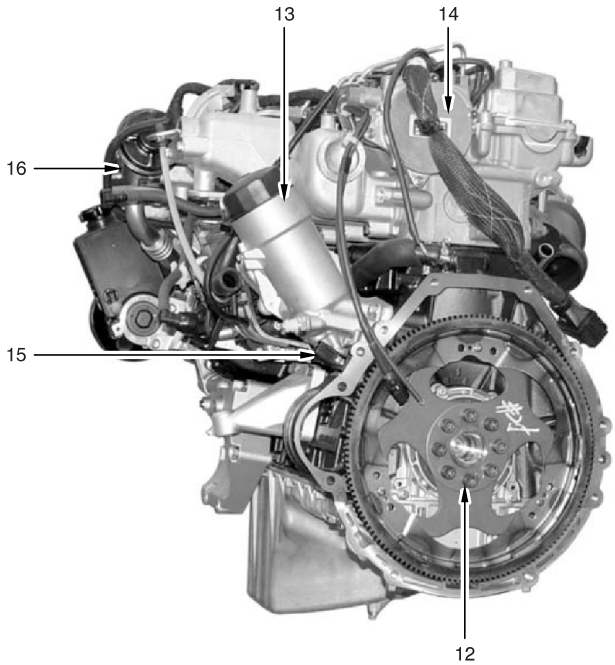
Modification basis	
Application basis	
Affected VIN	

2) Engine Structure

Front View



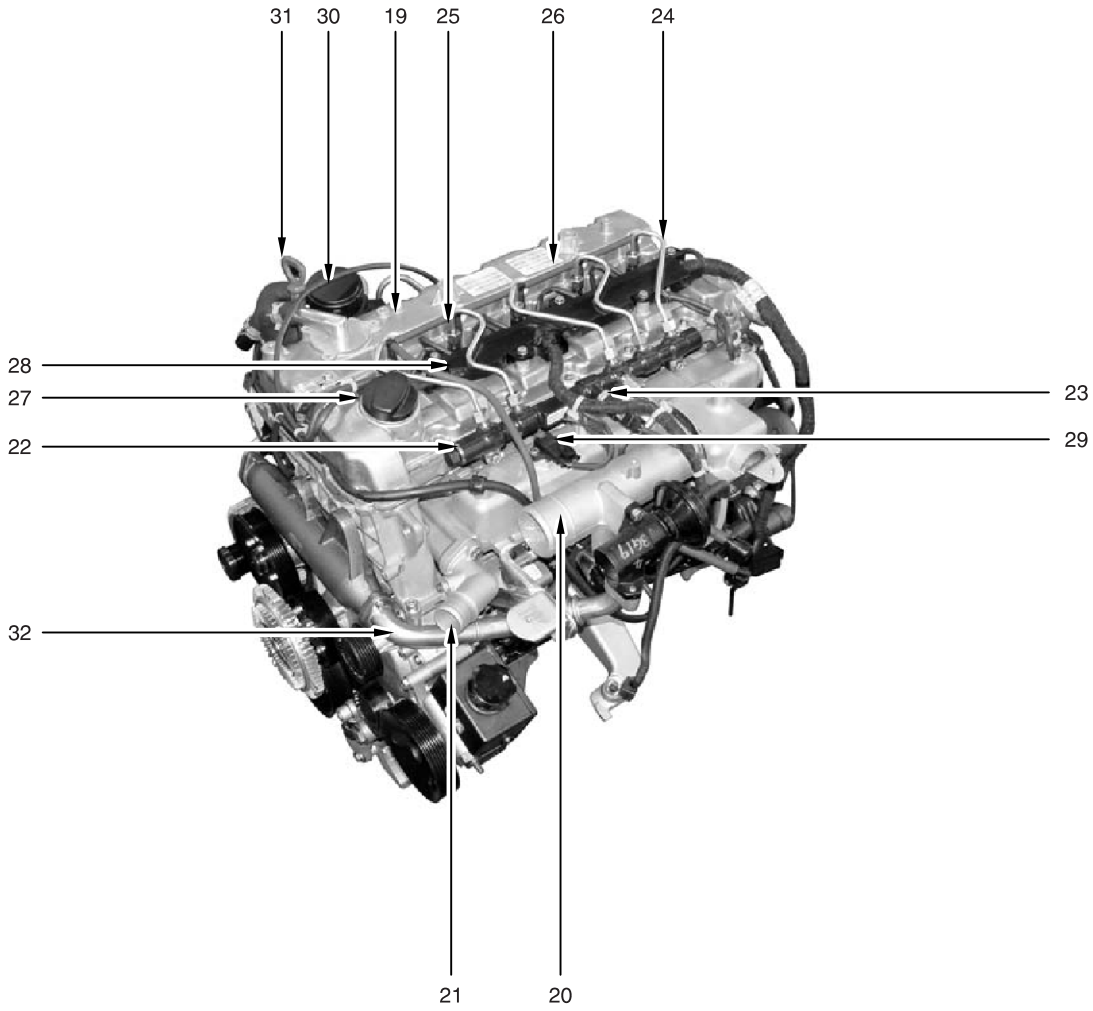
Rear View



1. TVD (Torsional Vibration Damper)
2. Air conditioner compressor
3. Power steering pump pulley
4. Idle pulley
5. Coolant pump pulley
6. Alternator
7. Viscos fan clutch
8. Auto tensioner pulley
9. Auto tensioner
10. Poly-grooved belt
11. Cam position sensor
12. Drive plate (MT: DMF)
13. Oil filter
14. Vacuum pump
15. Crank position sensor
16. EGR valve
17. Power steering pump
18. EGR to center pipe

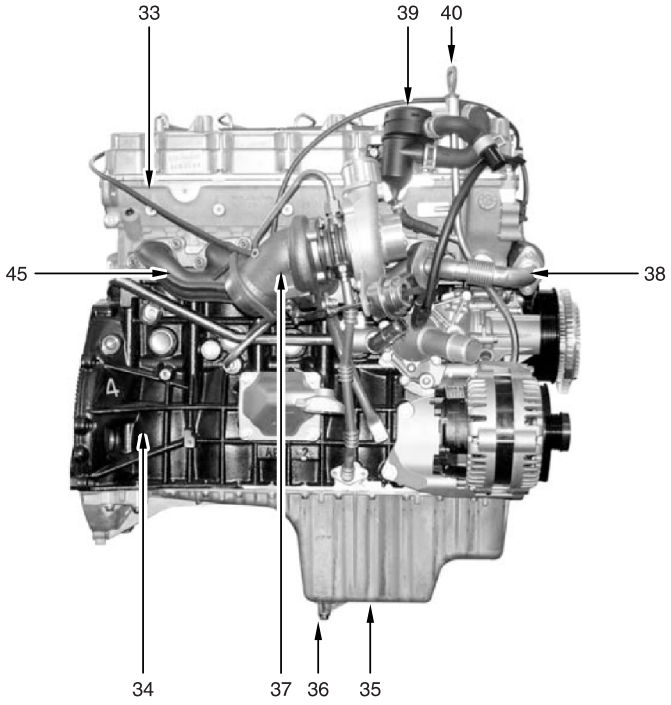
Modification basis	
Application basis	
Affected VIN	

Top View

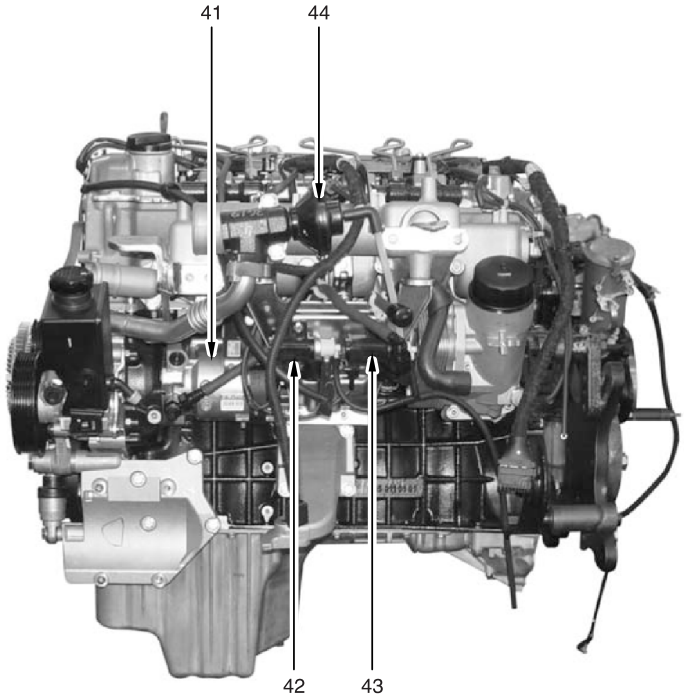


19. Cylinder head cover
20. Intake manifold
21. Water outlet port
22. Common rail
23. Fuel pressure sensor
24. Fuel pipe
25. Injector
26. Fuel return line
27. Oil filler cap
28. Glow plug
29. Booster pressure sensor
30. PCV valve and oil separator
31. Oil dipstick
32. EGR-LH (#1) pipe

Left Side View



Right Side View



33. Cylinder head
34. Cylinder block
35. Oil pan
36. Drain plug
37. Turbo charger
38. EGR-RH (#3) pipe
39. PCV valve and oil separator
40. Oil dipstick
41. High pressure pump
42. Turbo charger booster vacuum modulator
43. EGR valve vacuum modulator
44. EGR valve
45. Exhaust manifold

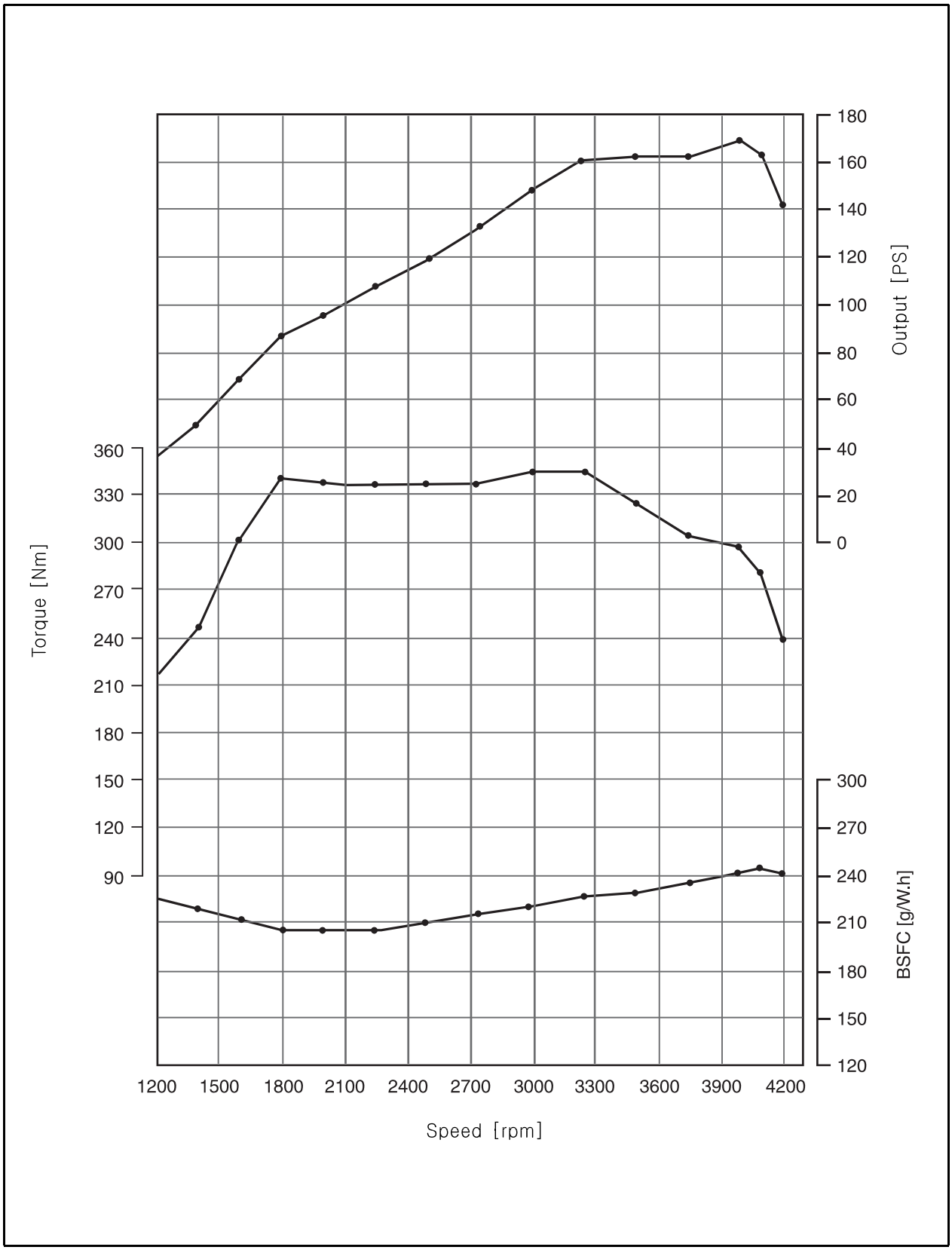
Modification basis	
Application basis	
Affected VIN	

2. SPECIFICATIONS

Description			Specification
Engine	Type/Number of cylinders		D27DT/5-cylinder
Cylinder	Inner diameter (mm)		86.2
	Stroke (mm)		92.4
Displacement (cc)			2696
Compression ratio			18:1
Maximum output (ps/rpm)			170/4,000
Maximum torque (kg·m/rpm)			34.7/1,800
Idle speed	For Manual Transmission		750 ± 50 rpm
	For Automatic Transmission		750 ± 50 rpm
Valve	Intake	Opens (BTDC)	16°
		Closes (ABDC)	33°
	Exhaust	Opens (BBDC)	46°
		Closes (ATDC)	21°
Camshaft	Type		DOHC
Fuel system	Fuel type		Low sulfur diesel
	Fuel pump type		Vane pump in HP pump
	Fuel supply pressure		HP pump inlet port: max. 400 mbar HP pump outlet port (with IMV fully open): over 1,050 bar
	Water separation in fuel filter		at every 10,000 km
	Fuel tank capacity (ℓ)		80
Lubrication system	Oil specification		SAE 10W40, 5W40 (MB Sheet 229.1, 229.3 approved oil)
	Lubrication type		Forced delivery
	Oil filter type		Full flow, filter element type
	Oil capacity (ℓ)		6.8 ~ 8.3
Cooling system	Cooling type		Water cooling type
	Cooling fan operation type		Belt operated typr
	Thermostat: Fully Open: 100°C)	Opening temperature (°C)	85
		Type	WAX pellet type
	Coolant capacity (ℓ)		≒11.5

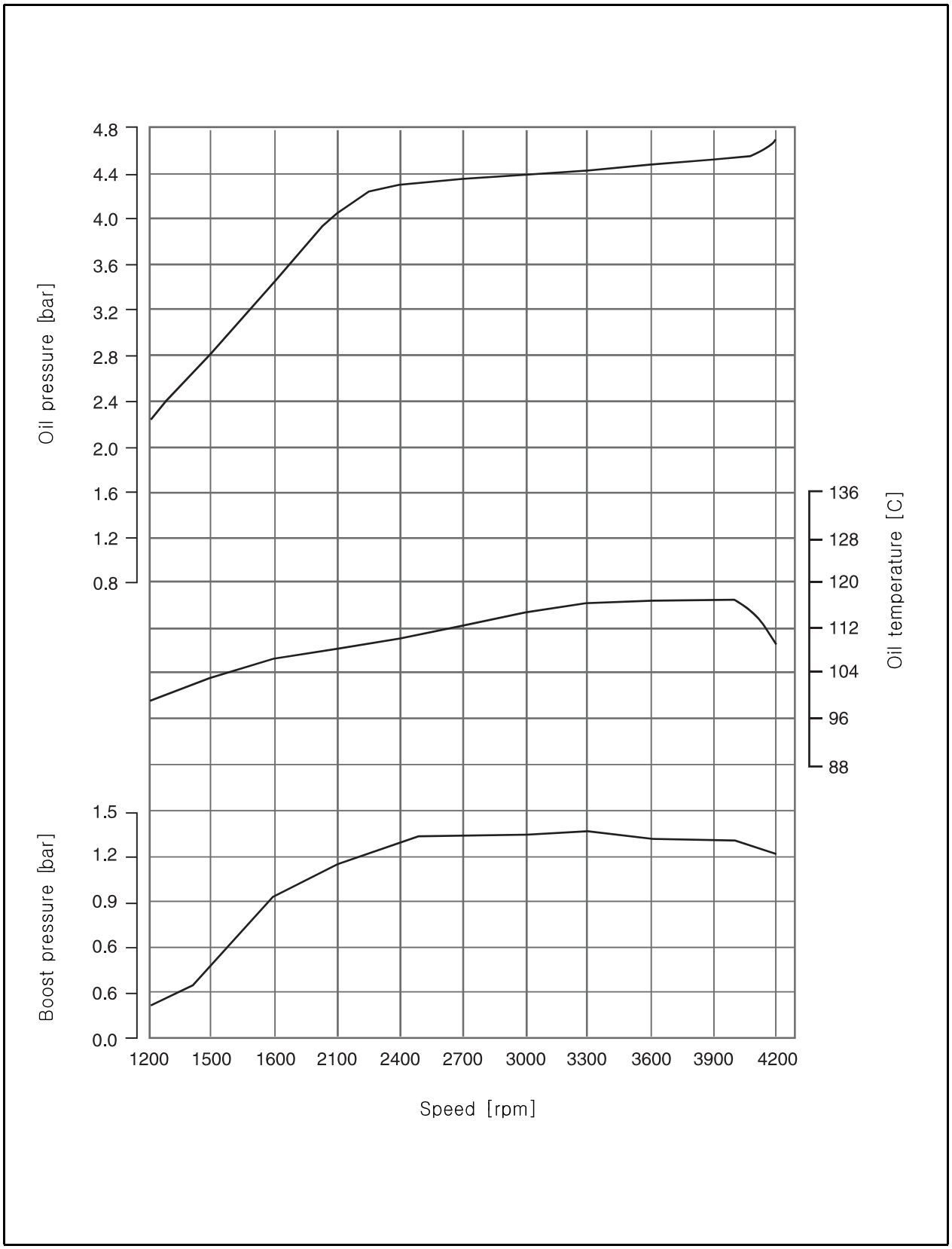
3. ENGINE PERFORMANCE CURVE

▶Output and Torque



Modification basis	
Application basis	
Affected VIN	

▶Oil Temperature/Pressure and Boost Pressure



4. TIGHTENING TORQUE

NO.	Name	Size	Quantity	Tightening Torque
1	Oil nozzle	M6 x 22	5	10 ± 1
2	Main bearing cap	M11 x 62	12	55 ± 5
				90° ± 10°
3	Connecting rod cap	M9 x 52	5	40 ± 5
				90° ± 10°
4	Rear cover	M6 x 20	6	10 ± 1
5	Oil pump	M8 x 35SOC	3	25 ± 2.5
6	Oil baffle plate assembly	M6 x 20	10	10 ± 1
7	T.G.C.C	M6 x 16	1	10 ± 1
		M6 x 40	6	10 ± 1
		M6 x 60	3	10 ± 1
		M6 x 70	2	10 ± 1
		M8 x 80SOC	1	25 ± 2.5
8	Flywheel	M10 x 30	8	45 ± 5
				90° ± 10°
9	Crankshaft hub	M18 x 50	1	325 ± 33
				90° ± 10°
10	Oil pan	M6 x 20	24	10 ± 1
		M6 x 35	3	10 ± 1
		M6 x 38	3	10 ± 1
		M6 x 40	4	25 ± 2.5
11	High pressure pump assembly	M8 x 40	4	25 ± 2.5
12	High pressure pump sprocket assembly	M14 x 1.5-8-1	1	65 ± 5
13	High pressure pump bracket	M7 x 16	3	20 ± 2 x 90° + 10°
14	Cylinder head assembly	M8 x 25	2	25 ± 2.5
		M8 x 50	2	
		M12 x 177	11	Step1: 20 Nm ± 2 Nm Step2: 85 Nm ± 5 Nm
		M12 x 158	1	Step3: 3 x 90° + 10°
15	Camshaft cap	M8 x 60	24	25 ± 2.5
16	Stud bolt	M8	10	15 ± 1.5
17	Camshaft sprocket (Intake)	M11 x 52	1	25 ± 2.5
	Camshaft sprocket (Exhaust)		1	90° ± 10°
18	Chain tensioner	M22	1	65 ± 5
19	Coolant temperature sensor	M14	1	22 ± 2.2

Modification basis	
Application basis	
Affected VIN	

NO.	Name	Size	Quantity	Tightening Torque
20	Auto tensioner	M8 x 45(LOWER)	1	32 ± 3
		M12 x 90	1	82 ± 6
21	Water pump assembly	M6 x 50	7	10 ± 1
22	Water pump pulley	M6 x 12	4	10 ± 1
23	Hot water inlet pipe assembly	M6 x 12	2	10 ± 1
24	Alternator bracket	M8 x 32	4	25 ± 2.5
25	Alternator	M10 x 90	2	46 ± 4.6
26	Air conditioner compressor assembly	M8 x 95	4	46 ± 4.6
27	Air conditioner compressor bracket assembly	M8 x 25	1	25 ± 2.5
		M8 x 60	3	25 ± 2.5
28	Air conditioner compressor sub bracket assembly	M6 x 14	1	10 ± 1.0
		M8 x 16	1	25 ± 2.5
29	Intake manifold	M8 x 45	6	25 ± 2.5
		M8 x 130	6	25 ± 2.5
30	Bracket	M6 x 16	1	10 ± 1.0
31	Knock sensor	M8 x 28	2	20 ± 2.6
32	Camshaft position sensor	M8 x 16	1	12 ± 1.7
33	Booster pressure sensor	M6 x 16	2	10 ± 1.0
34	Exhauster manifold	M8	10	40 ± 4
35	Turbo charger assembly	M8	4	25 ± 2.5
36	Turbo charger adaptor piece		1	32 ± 3.2
37	Nut	M8	1	25 ± 2.5
38	Combination bolt	M8 x 22	1	25 ± 2.5
39	T/C oil supply pipe	M6 x 16 (Cylinder block side)	1	25 ± 2.5
		M16 (T/C side)	1	20 ± 2.0
40	T/C oil return pipe	M6 x 16 (T/C side)	2	10 ± 1.0
		M6 x 16 (Cylinder block side)	2	10 ± 1.0
41	EGR valve assembly	M8 x 22	2	25 ± 2.5
42	EGR-LH pipe bolt	M6 x 16	2	10 ± 1.0
		M8 x 22	2	35 ± 2.0
43	EGR combination bolt	M6 x 16	4	10 ± 1.0
		M8 x 16	4	25 ± 2.5
	EGR-RH pipe nut	M8	2	35 ± 2.0
44	Glow plug cable nut	M5	5	15 ± 3
45	Vacuum pump	M6 x 20	3	10 ± 1.0
46	Cooling fan bracket assembly	M6 x 25	5	10 ± 1.0
		M6 x 65	1	10 ± 1.0
		M6 x 85	3	10 ± 1.0
47	Cylinder head cover	M6 x 35	21	23 ± 2.3

NO.	Name	Size	Quantity	Tightening Torque
48	Vacuum modulator	M6 x 16SOC	4	10 ± 1.0
49	WDT combination bolt	M6 x 16	3	10 ± 1.0
50	Oil dipstick tube	M6 x 16	1	10 ± 1.0
51	Oil filter assembly	M8 x 35SOC	1	25 ± 2.5
		M8 x 50SOC	2	25 ± 2.5
		M8 x 55SOC	1	25 ± 2.5
52	Fuel rail assembly	M8 x 35SOC	3	25 ± 2.5
53	Injector clamp washer	M6 x 60	5	10 ± 1.0 180 + 20°
54	Fuel pipe clip (H-C)	M6 x 19	1	10 ± 1.0
55	Fuel pipe clip (C-I)	M6 x 16	5	10 ± 1.0
56	Crankshaft position sensor	M5 x 17	1	0.8 ± 0.4
57	Crankshaft position sensor	GAP		0.7 ~ 1.5
58	Fuel pressure sensor		1	
59	Wiring	M6 x 16	5	10 ± 1.0
60	Intake manifold bracket	M8 x 16	2	25 ± 2.5
		M8 x 40	2	25 ± 2.5
61	Power steering pump	M8 x 100	2	25 ± 2.5
		NUT	2	25 ± 2.5
62	Piston protrusion		5	0.765 ~ 1.055
63	Clearance between connecting rod and pin boss		5	0.05 ~ 0.31
64	End play of crankshaft	NEW: 0.100 ~ 0.245 mm // USED: 0.300 mm		

Modification basis	
Application basis	
Affected VIN	

ENGINE FUEL SYSTEM

1881-01

GENERAL

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.

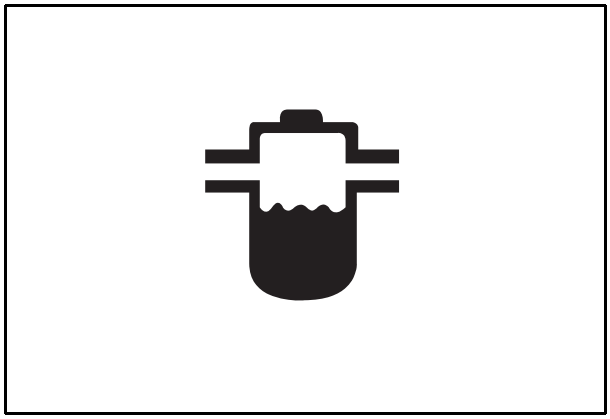
▶ DI Engine

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

▶ 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.

▶ Water Separator Warning Light



When the water level inside water separator in fuel filter exceeds a certain level (approx. 39 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.
For the draining procedures, please refer to "How to drain the water from fuel filter" section.

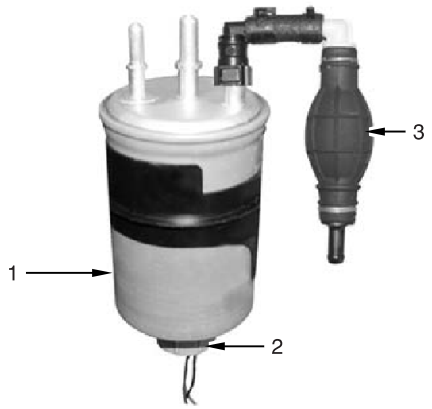
▶ Priming Pump

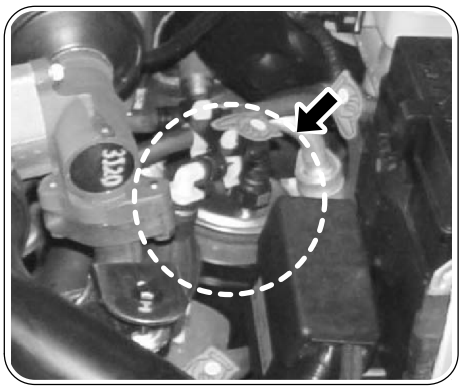
The priming pump installed in fuel pump is the device to fill the fuel into the fuel filter. When the vehicle is under the conditions as below, press the priming pump until it becomes rigid before starting the engine.

▶ Conditions for Using Priming Pump

- After run out of fuel
- After draining the water from fuel separator
- After replacing the fuel filter

▶ Fuel Filter and Water Separator





1. Fuel filter
2. Water drain plug (water separating operation: every 10,000 km)
3. Priming pump

CAUTION

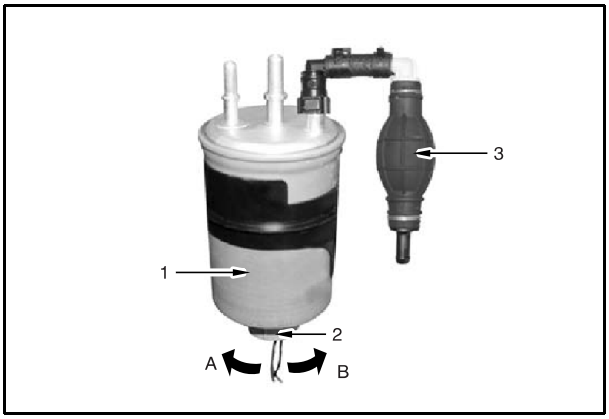
- When replaced the fuel filter or drained the water from fuel filter, press the priming pump until it becomes rigid before starting the engine.
- The water drain from fuel filter should be performed whenever changing the engine oil.

Modification basis	
Application basis	
Affected VIN	

▶ Draining the Water From Fuel Filter

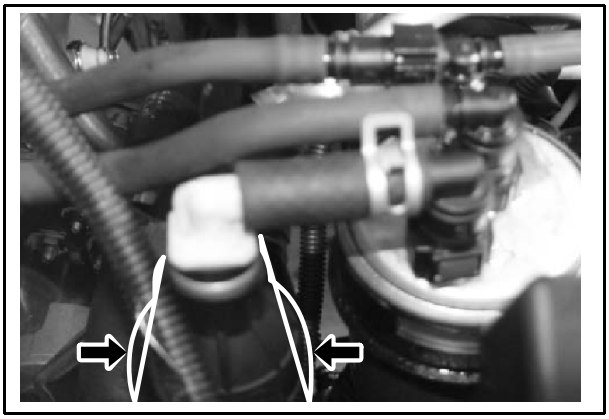


1. Place the water container under the fuel filter.



2. Turn the drain plug (2) to "A" direction to drain the water.
3. Wait until a certain amount of fuel gets out from the port, then turn the drain plug to "B" direction to tighten it.

CAUTION
- Be careful not to be injured by surrounding equipment during the working procedures.



4. Press the priming pump until it becomes
5. rigid.

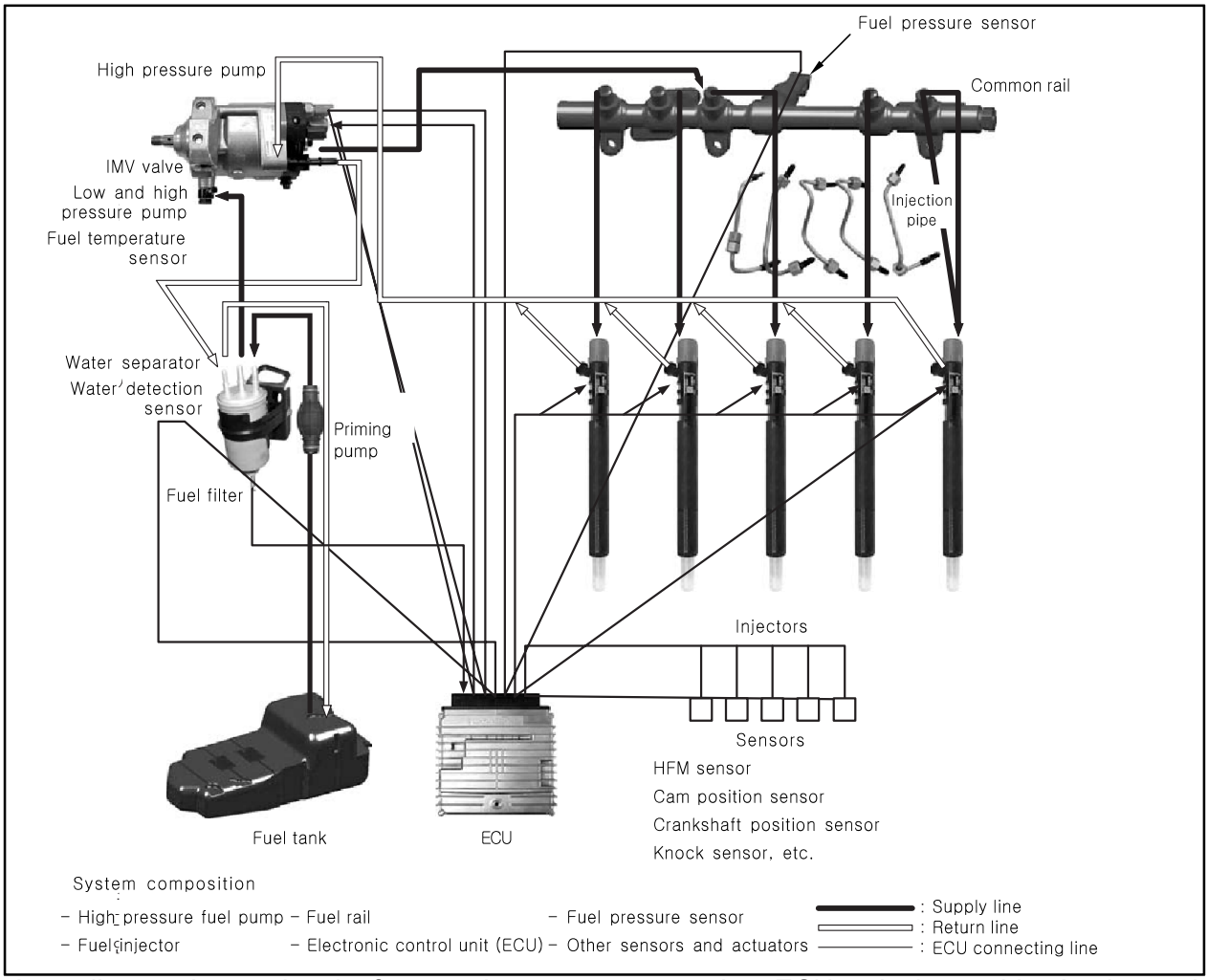
Start the engine and check the conditions

WARNING
- If the priming pump is not properly operated, air may get into the fuel line. It may cause starting problem or fuel system problem. Make sure to perform the job in step 4.

OVERVIEW AND OPERATION PROCESS

1. FUEL INJECTION SYSTEM

1) Electronic Control of Fuel System



According to input signals from various sensors, engine ECU calculates driver's demand (position of the accelerator pedal) and then controls overall operating performance of engine and vehicle on that time.

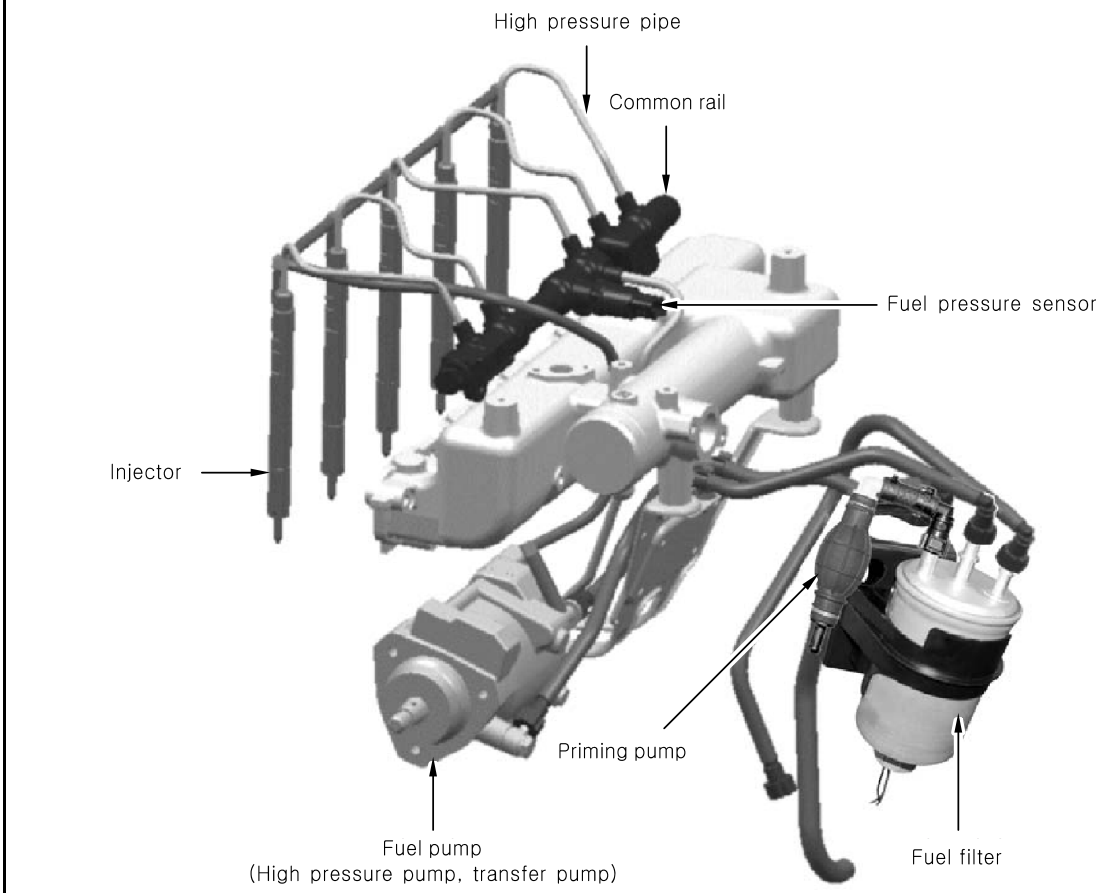
ECU receives signals from sensors via data line and then performs effective engine air-fuel ratio controls based on those signals. Engine speed is measured by crankshaft speed (position) sensor and camshaft speed (position) sensor determines injection order and ECU detects driver's pedal position (driver's demand) through electrical signal that is generated by variable resistance changes in accelerator pedal sensor. Air flow (hot film) sensor detects intake air volume and sends the signals to ECU. Especially, the engine ECU controls the air-fuel ratio by recognizing instant air volume changes from air flow sensor to decrease the emissions (EGR valve control). Furthermore, ECU uses signals from coolant temperature sensor and air temperature sensor, booster pressure sensor and atmospheric pressure sensor as compensation signal to respond to injection starting, pilot injection set values, various operations and variables.

Modification basis	
Application basis	
Affected VIN	

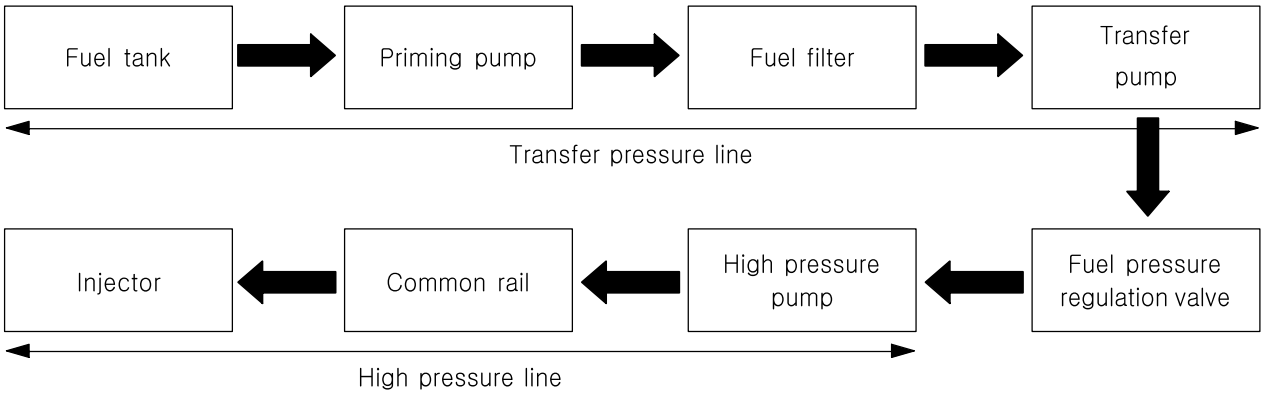
2) Composition of Fuel System

Components in fuel system are designed to generate and distribute high pressure, and they are controlled electronically by engine ECU. Accordingly, fuel system is completely different from injection pump type fuel supply system on the conventional Diesel engine. The fuel injection system in common rail engine is composed of transfer pressure section that transfers fuel in low pressure, high pressure section that transfers fuel in high pressure and ECU control section.

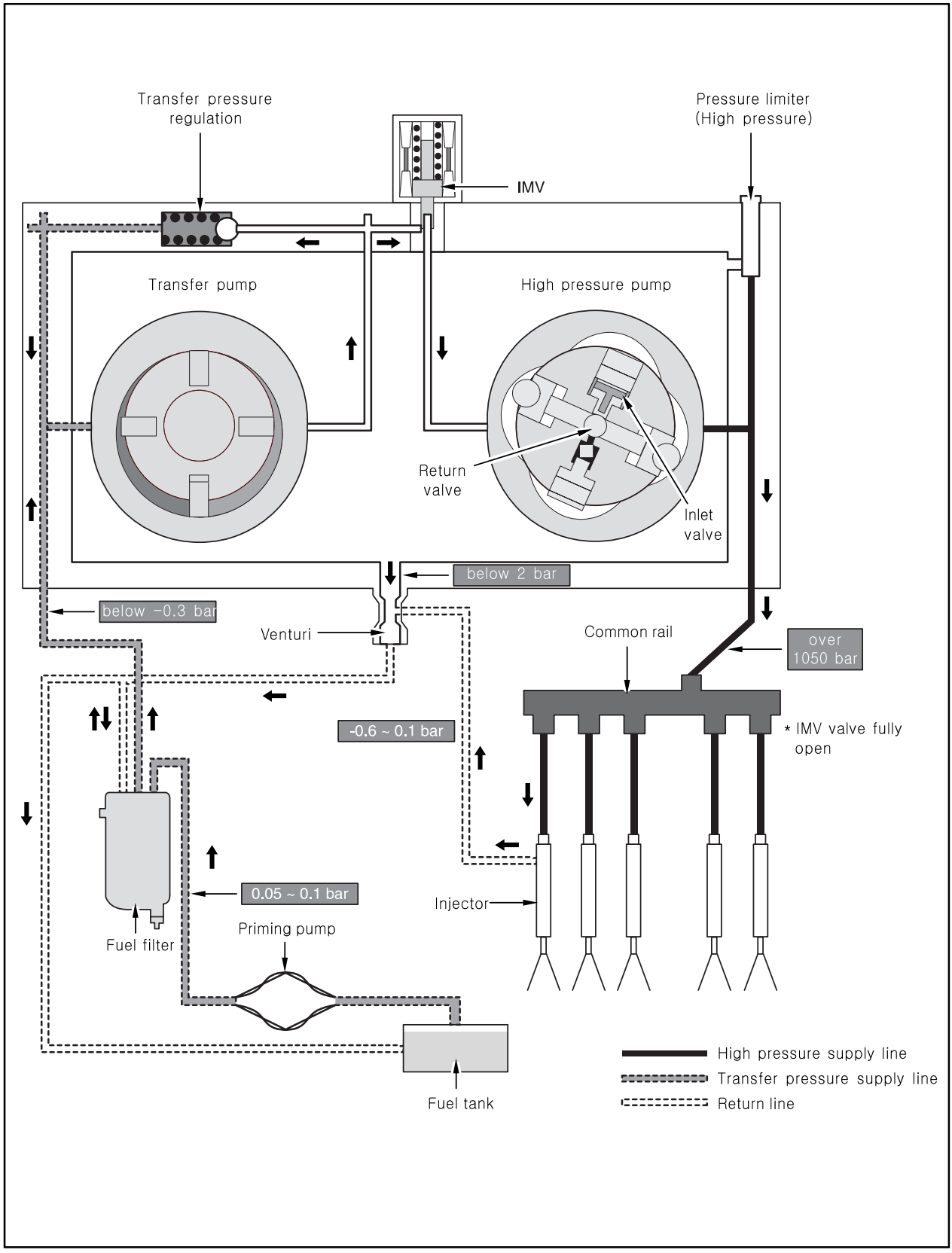
Fuel Line System



▶ **Fuel route**



3) Hydraulic Cycle in Fuel Line (Transfer and High Pressure Line)



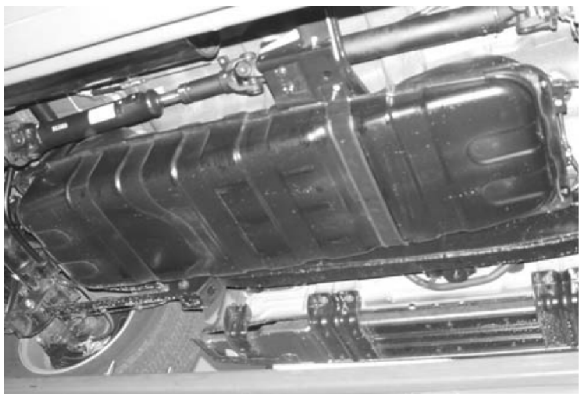
Modification basis	
Application basis	
Affected VIN	

4) Components of Low Pressure Transfer Line

Low pressure stage is to supply sufficient fuel to high pressure section and components are as below.

- Fuel tank (including strainer)
- Hand priming pump
- Fuel filter
- Transfer pump
- Other low pressure fuel hoses

(1) Fuel tank



Fuel tank is made of anti-corrosion material and its allowable pressure is 2 times of operating pressure (more than min. 0.3 bar).
It has protective cap and safety valve to prevent excessive pressure building. Also, to supply fuel smoothly, it has structure to prevent fuel from leaking in shocks, slopes and corners and.

(2) Priming pump



If fuel runs out during driving or air gets into fuel line after fuel filter replacement, it may cause poor engine starting or damage to each component. Therefore, the hand priming pump is installed to bleed air from transfer line.
When the vehicle is under the conditions as below, press the priming pump until it becomes rigid before starting the engine.

- After run out of fuel
- After draining the water from fuel separator
- After replacing the fuel filter

Press the priming pump until it becomes rigid before starting the engine.

(3) Fuel filter



It requires more purified fuel supply than conventional diesel engine. If there are foreign materials in the fuel, fuel system including pump components, delivery valve and injector nozzles may be damaged.
Fuel filter purifies fuel before it reaches to high pressure pump to help proper operations in high pressure pump. And more, it separates water from fuel to prevent water from getting into FIE system (high pressure line).

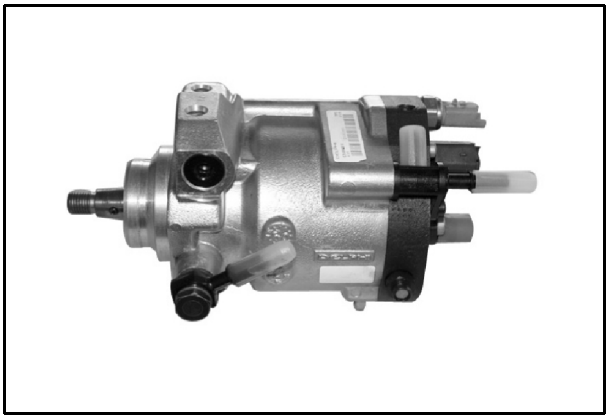
Modification basis	
Application basis	
Affected VIN	

5) Components of High Pressure Transfer Line

In the high pressure section, sufficient fuel pressure that injectors requires will be generated and stored. The components are as below:

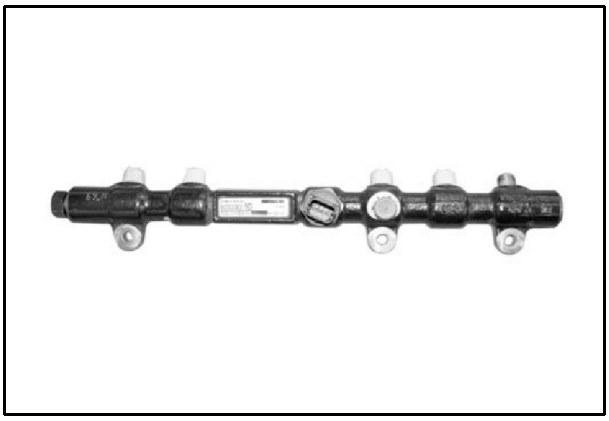
- High pressure pump
- Rail pressure sensor
- Pressure limit valve
- Common rail
- High pressure pipe
- Injector
- Fuel pressure regulating valve (IMV)

(1) High pressure pump



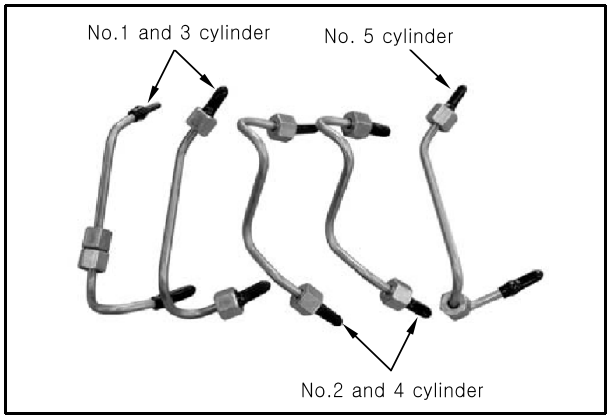
This is plunger pump that generates high pressure and driven by crankshaft with timing chain. The high pressure pump increases system pressure of fuel to approx. 1,600 bar and this compressed fuel is transferred to high pressure accumulator (common rail) in tube through high pressure line.

(2) Common rail



It stores fuel transferred from high pressure pump and also stores actual high pressure of fuel. Even though the injectors inject fuel from the rail, the fuel pressure in the rail is maintained to a specific value. It is because the effect of accumulator is increased by unique elasticity of fuel. Fuel pressure is measured by rail pressure sensor.
And the fuel pressure regulating valve (IMV, Inlet Metering Valve) included in high pressure pump housing keeps pressure to a desired level.

(3) High pressure pipe (fuel pipe)



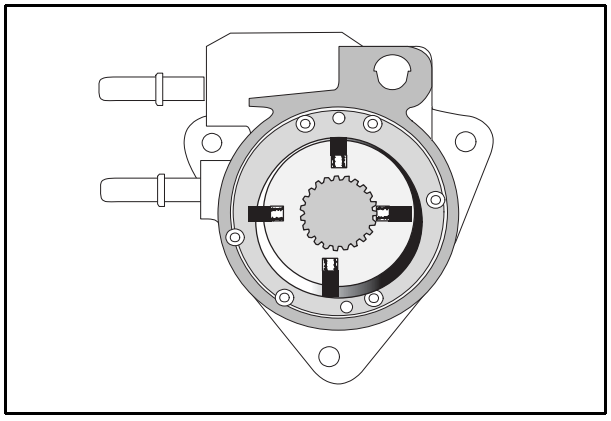
Fuel line transfers high pressure fuel. Accordingly, it is made of steel to endure intermittent high frequency pressure changes that occur under maximum system pressure and injection stops. Injection lines between rail and injectors are all in the same length; it means the lengths between the rail and each injector are the same and the differences in length are compensated by each bending.

(4) Injectors



The fuel injection device is composed of electrical solenoid valve, needle and nozzle and controlled by engine ECU. The injector nozzle opens when solenoid valve is activated to directly inject the fuel into combustion chamber
in engine. When injector nozzle is open, remaining fuel after injection returns to fuel tank through return line.
Pressure limit valve, fuel returned by low pressure and fuel used for high pressure pump lubrication also return to fuel tank through return line.

(5) Transfer pump



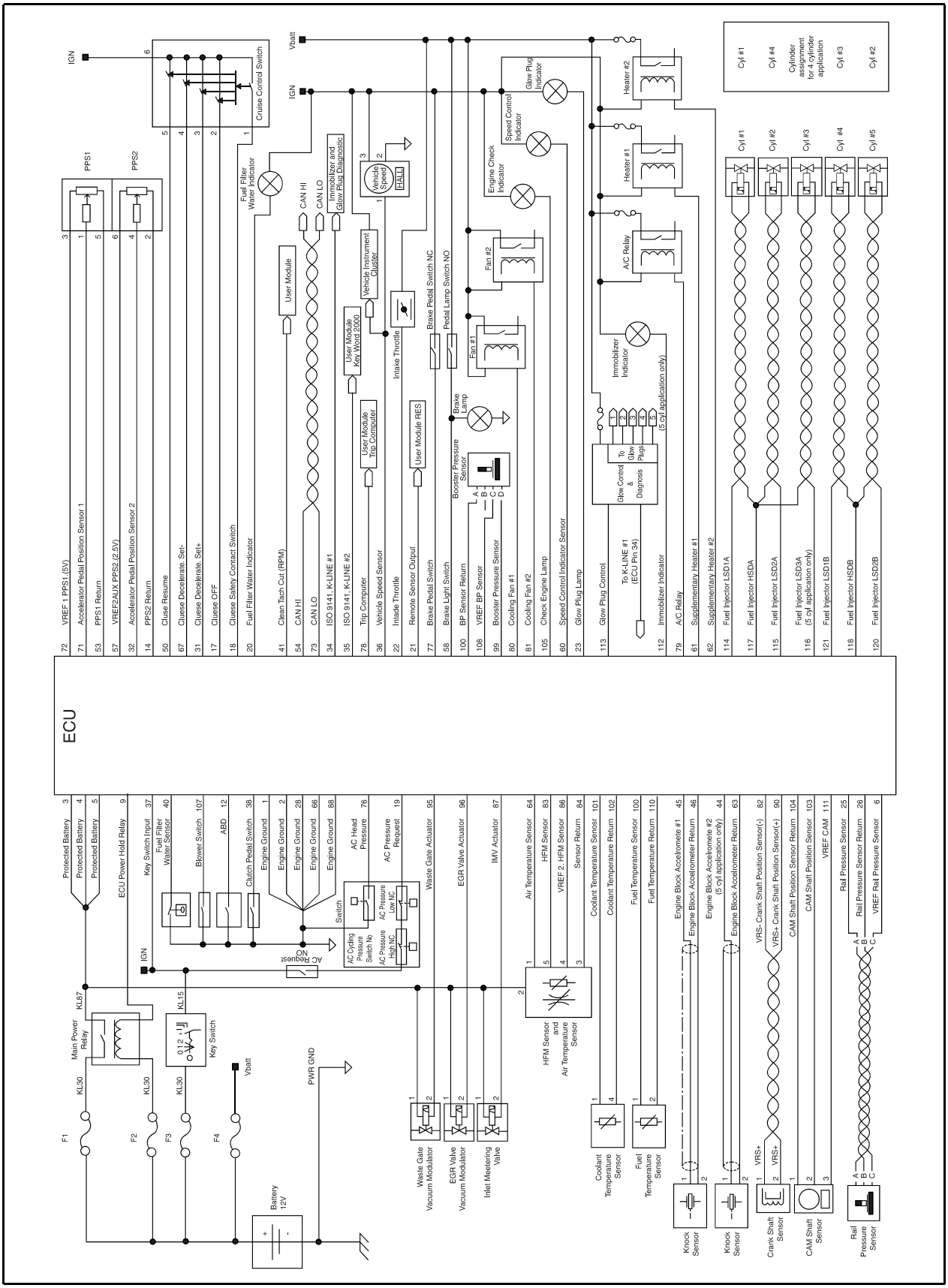
The transfer pump is included in the housing of the high pressure pump. The transfer pump is the volumetric blade type pump. To deliver the continuously required fuel volume, the pump transfers fuel from the fuel tank to high pressure pump.

(6) Fuel filter replacement

- Fuel filter change interval: every 30,000 km
- Water separation interval: every 10,000 km (same with engine oil change interval)
- Never reuse the removed fuel filter

Modification basis	
Application basis	
Affected VIN	

6) Electrical Wiring Diagram



Modification basis	
Application basis	
Affected VIN	

ENGINE INTAKE SYSTEM

2313-01

OVERVIEW AND OPERATION PROCESS

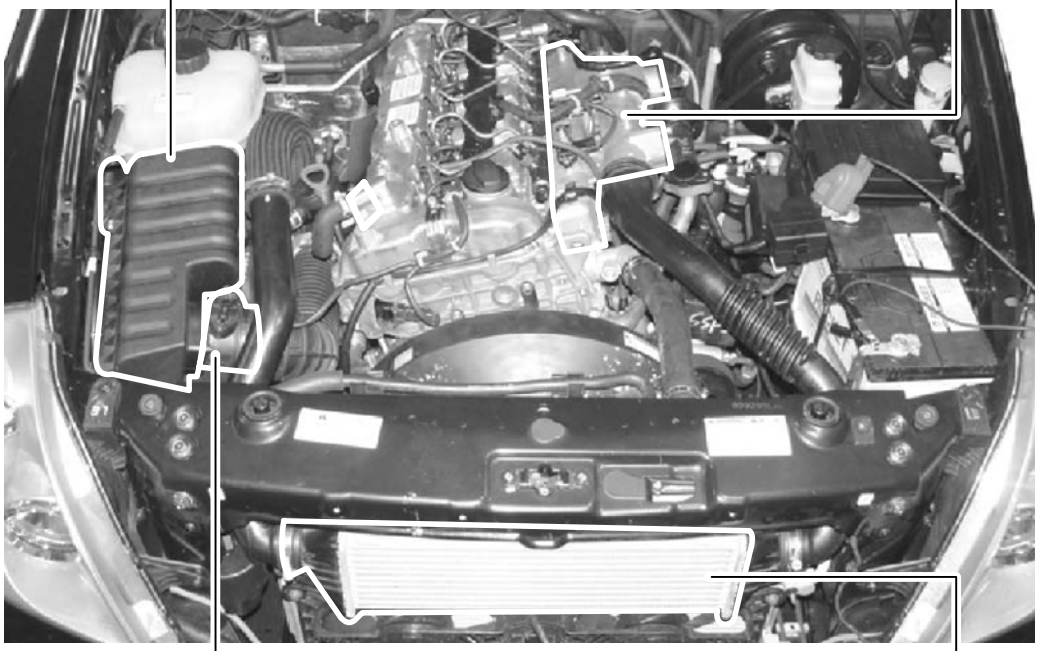
1. COMPONENTS LOCATOR

Air cleaner



Intake manifold





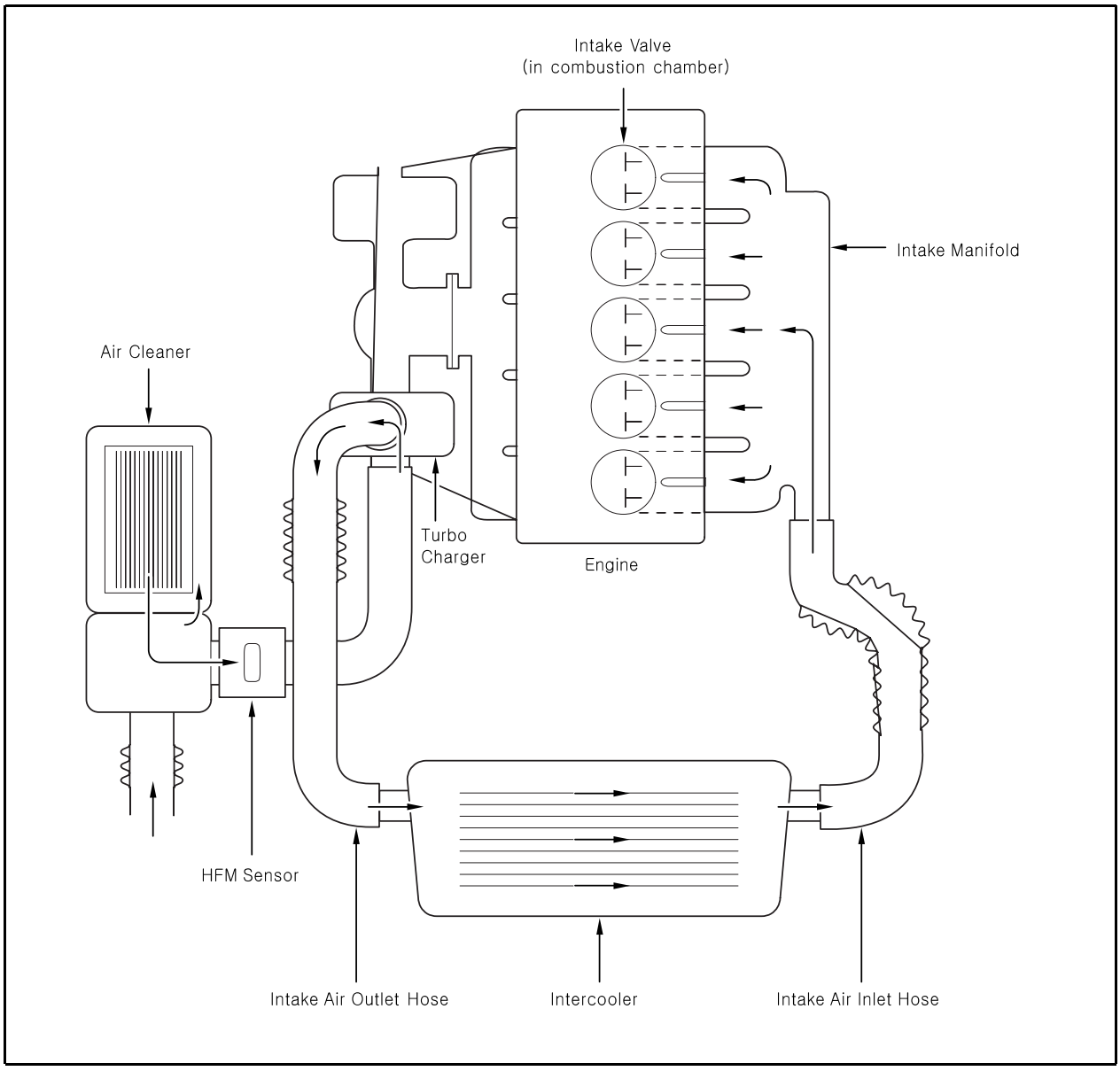
HFM sensor



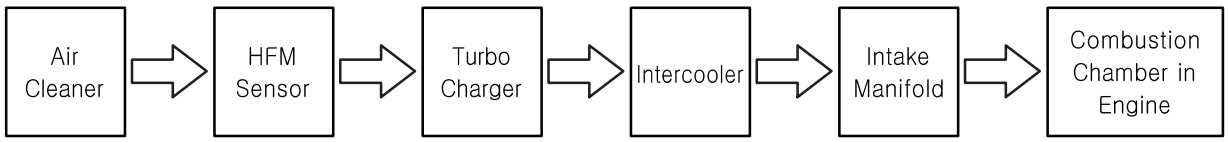
Intercooler



2. AIR FLOWS



▶ Work Flow of Intake System



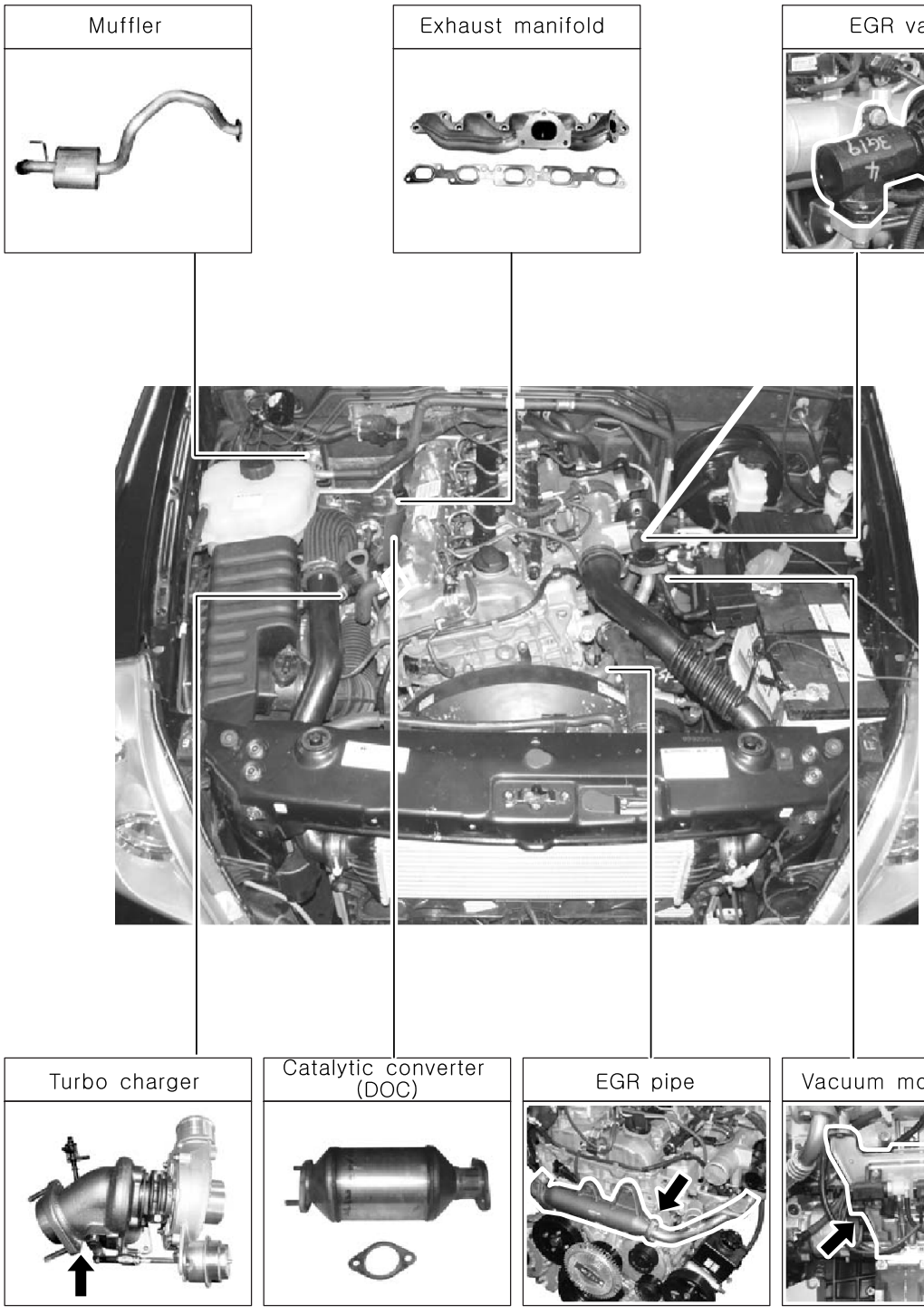
Modification basis	
Application basis	
Affected VIN	

ENGINE EXHAUST SYSTEM

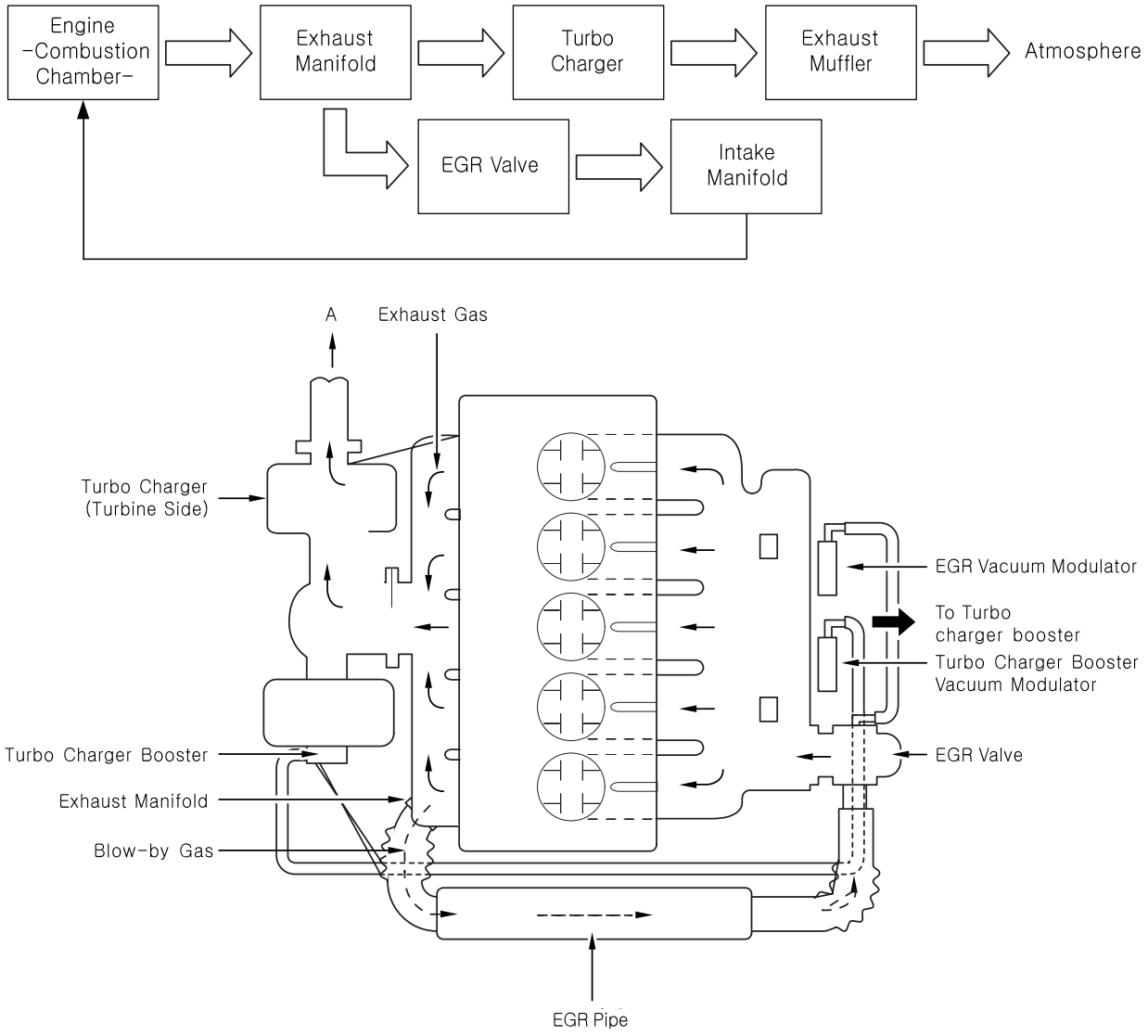
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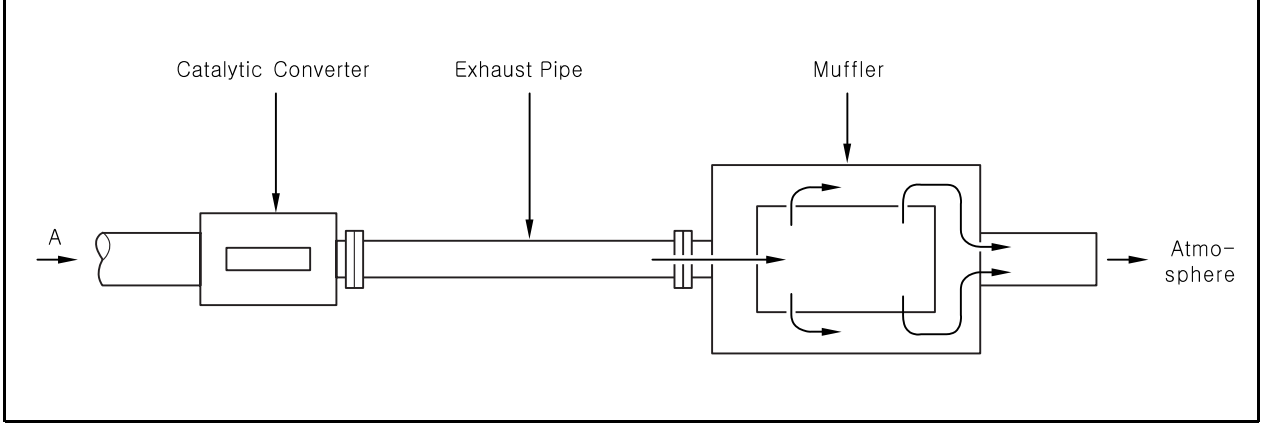
OVERVIEW AND OPERATION PROCESS

1. COMPONENTS LOCATOR



2. EXHAUST GAS FLOWS





Modification basis	
Application basis	
Affected VIN	

ENGINE LUBRICATION SYSTEM

1533-01

GENERAL

1. SPECIFICATIONS

Engine oil	Specification	Approved by MB Sheet 229.1 or 229.3 Viscosity: See MB Sheet 224.1
	Capacity	6.8 ~ 8.3 liter
	Service interval	Initial change: 5,000 km, Change every 10,000 km or 12 months (Frequently check the oil level and add if needed. And, every 5,000 km or 6 months under severe conditions)
Engine oil filter		Same interval with engine oil
Oil relief valve opening pressure		5.8 ± 0.3 bar

※ Severe condition:

- When most trips include extended idling and/or frequent low-speed operation as in stop-and-go traffic.
- When most trips are less than 6 km (Operating when outside temperatures remain below freezing and when most trips are less than 16 km)
- When operating in dusty, sandy and salty areas
- In hilly or moutainous terrain
- When doing frequent trailer towing

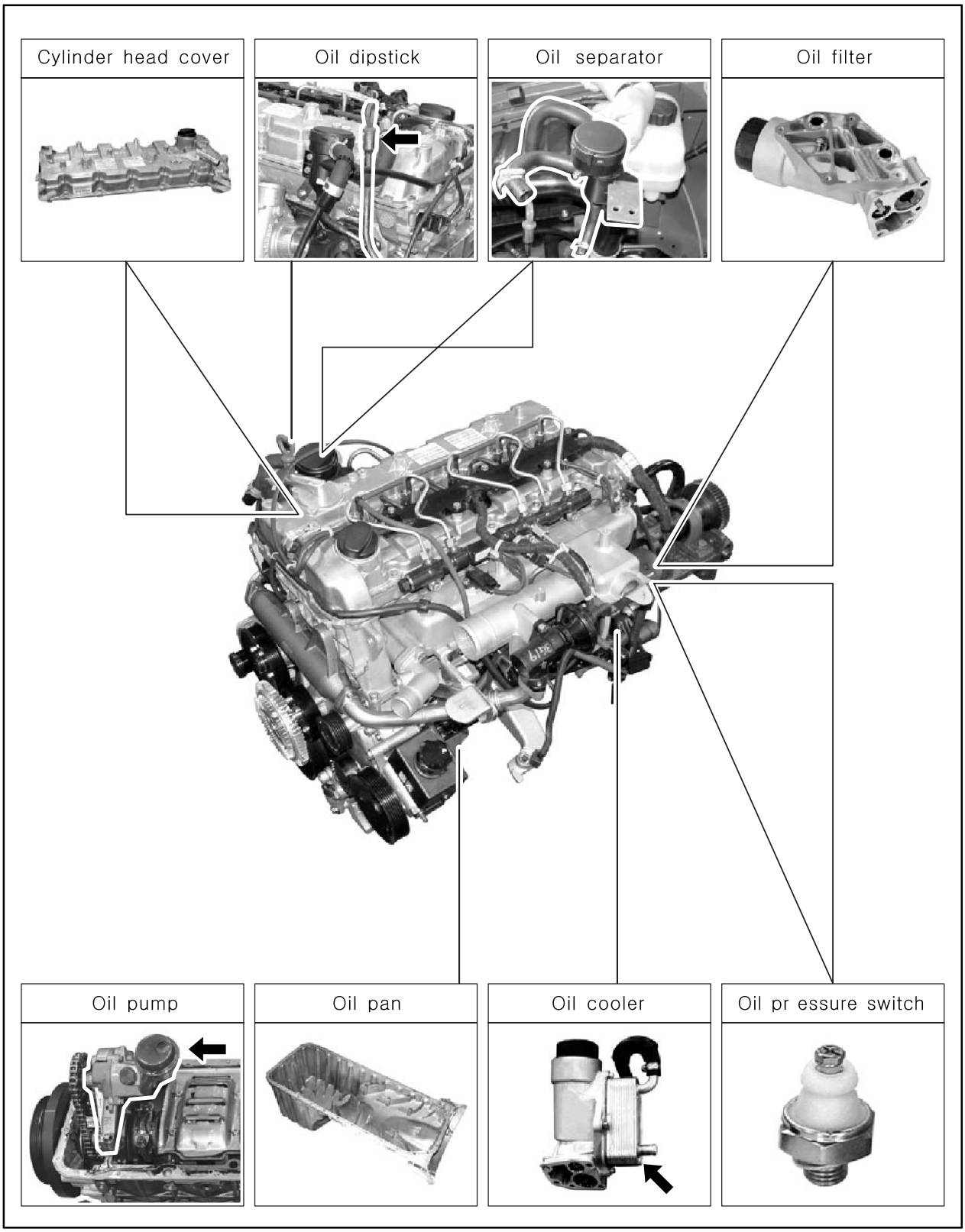


▶Oil Pressure Switch

· Operating temperature: -40 ~ 140‘
· Operating pressure: 0.3 ~ 0.55 bar
· Permissible pressure: 10 bar

OVERVIEW AND OPERATION PROCESS

1. COMPONENTS LOCATOR

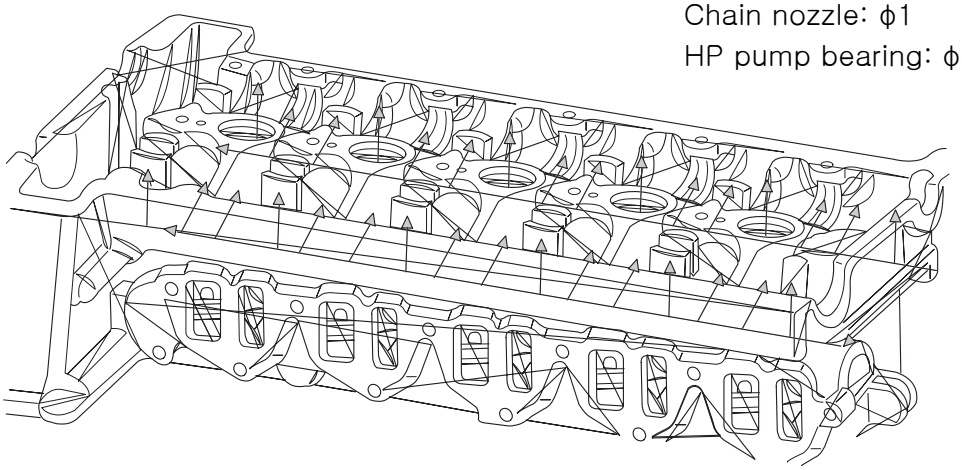


Modification basis	
Application basis	
Affected VIN	

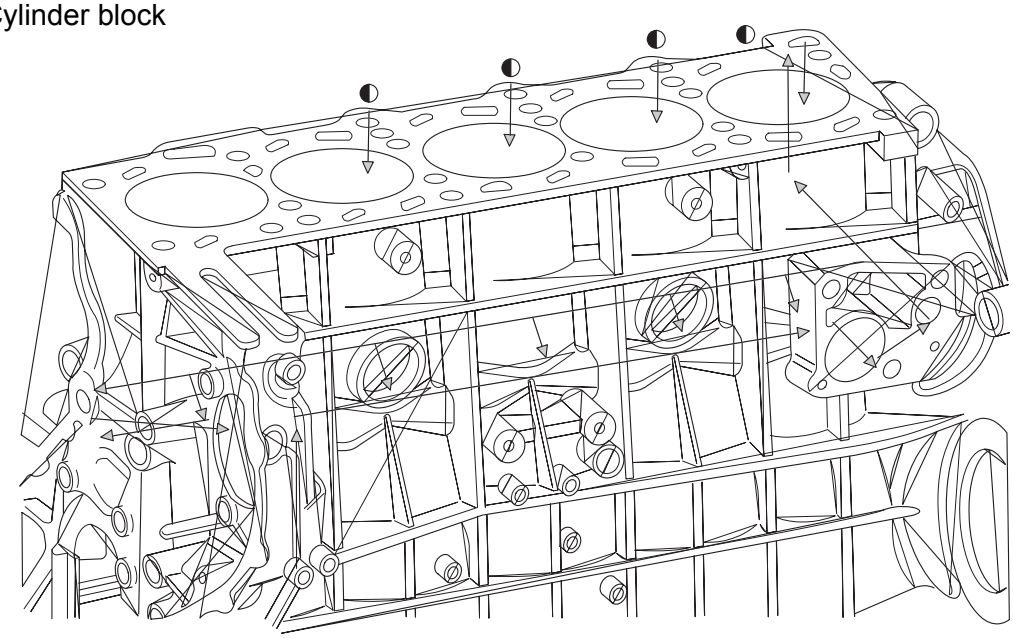
2. LUBRICATION SYSTEM LAYOUT

Main oil gallery: ϕ16
Hole to cylinder head: ϕ9
Main bearing hole: ϕ7
Chain and injection pump: ϕ7
Return hole: ϕ14
Chain nozzle: ϕ1
HP pump bearing: ϕ6

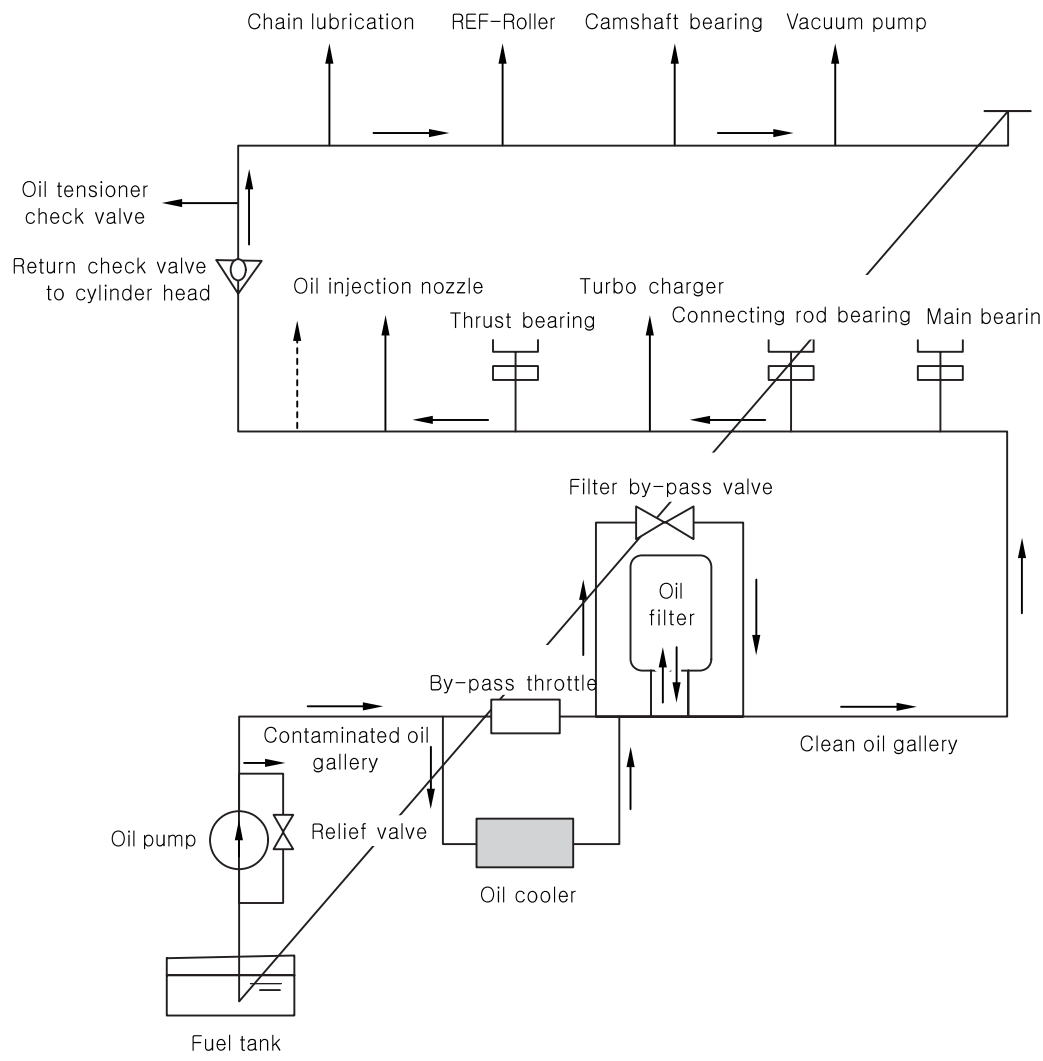
Cylinder head



Cylinder block



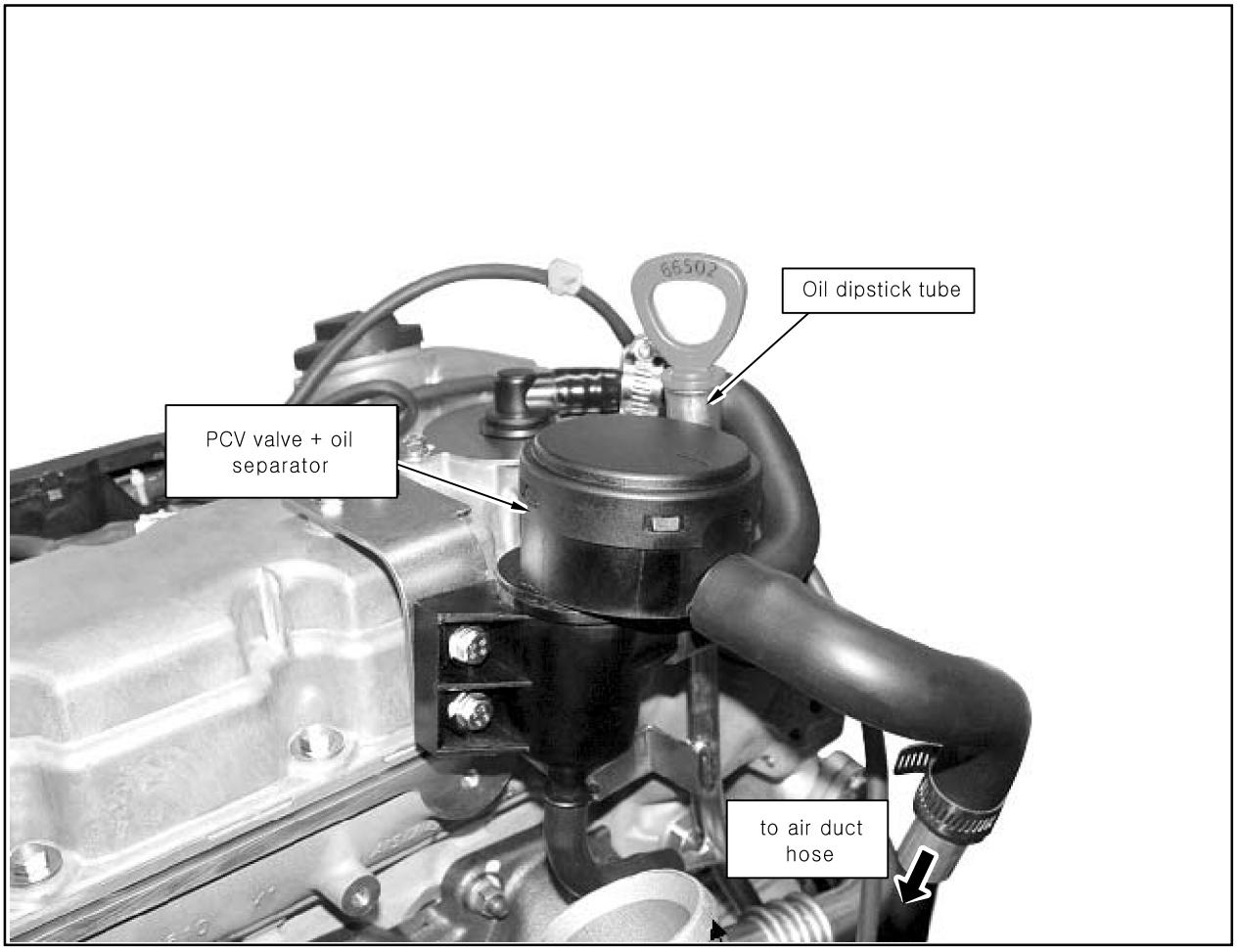
3. LUBRICATION DIAGRAM



※ 1. Opening pressure of by-pass valve in oil filter: 3 ± 0.4 bar
2. To prevent instant oil shortage after stopping the engine, the return check valve is installed in oil supply line of cylinder head.

Modification basis	
Application basis	
Affected VIN	

4. BLOW-BY GAS REDUCTION DEVICE



ENGINE COOLING SYSTEM

1520-11

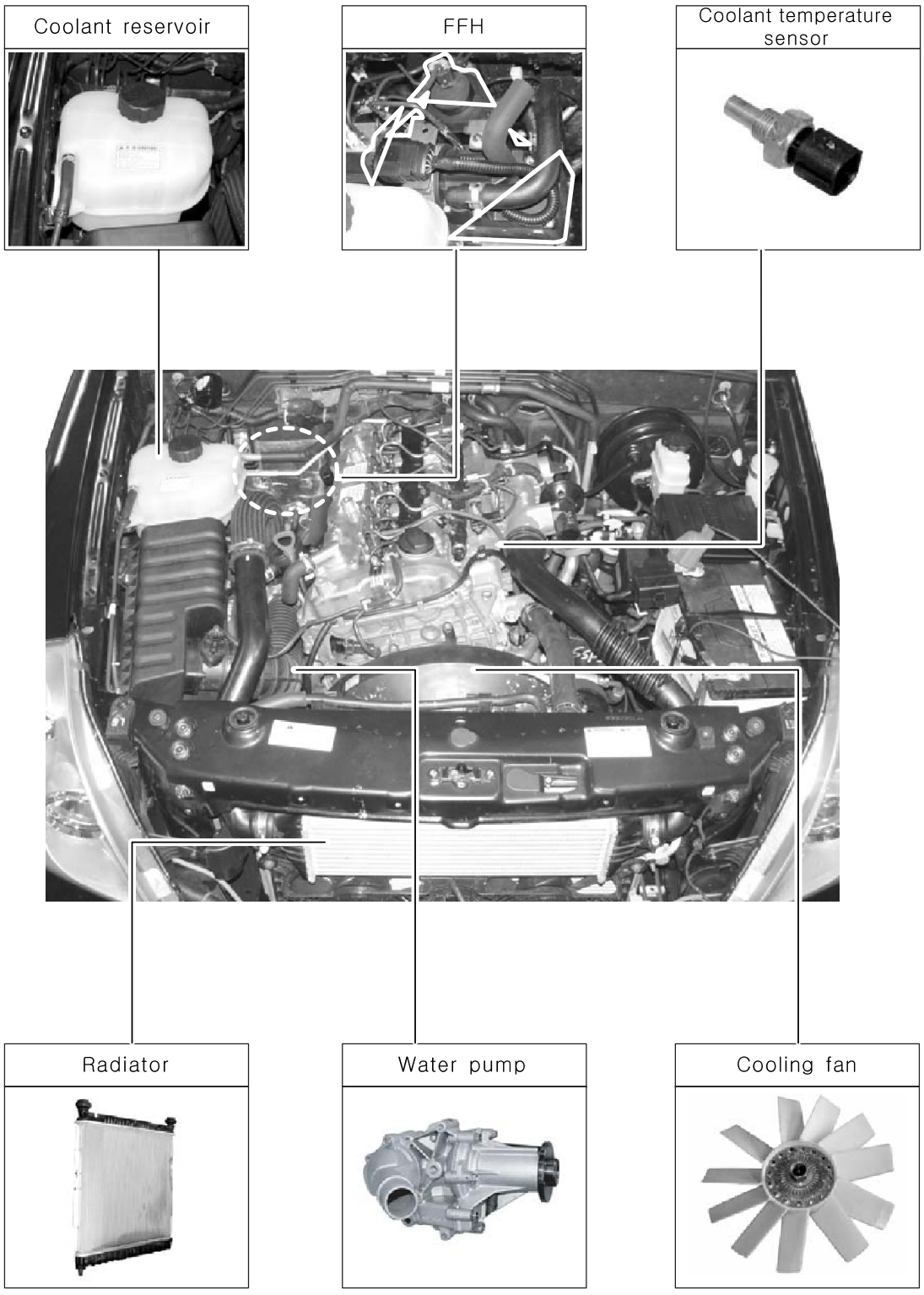
GENERAL

1. SPECIFICATIONS

Description			Unit	Specification
Cooling system	Type		-	Water cooling forced circulation
Coolant	Capacity		ℓ	11.3
Thermostat	Type		-	Wax pellet type
	Initial opening temperature	DI Engine	°C	80 (85)
		IDI Engine	°C	85 (80)
	Fully opening temperature	DI Engine	°C	95 (100)
		IDI Engine	°C	100 (95)
	Fully closing temperature	DI Engine	°C	78 (83)
		IDI Engine	°C	83 (78)
	Stroke	DI Engine	mm	min. 8
		IDI Engine	mm	min. 8
Cooling fan	Type		-	Electric
	Blades			5
	Diameter		mm	320 (2)
	Low speed ON temp		°C	91
	Low speed OFF temp		°C	88
	High speed ON temp		°C	95
	High speed OFF temp		°C	92
	High speed ON temp. (By A/C pressure)		psi	270
Coolant reservoir	pressure valve opening pressure		Kg/cm^2	1.2 ~ 1.5
	Vacuum valve opening pressure		Kg/cm^2	0.1
Water pump	Type		-	Turbo Centrifugal
	Impeller diameter		mm	72.3
	Impeller blades			10
Radiator	Type		-	Down-flow
	Core width		mm	701
	Core height		mm	372
	Core thickness		mm	18
	Minimum radiation capability		Kcal/h	45,000
Coolant temperature sensor	Resistance (at 20°C)		KΩ	3.33 ~ 3.78
	Resistance (at 80°C)		KΩ	0.32 ~ 0.35
Anti-freeze agent	Type		–	ALUTEC-P78
	Mixture ratio (water and anti-freeze)		–	50 : 50

OVERVIEW AND OPEATION PROCESS

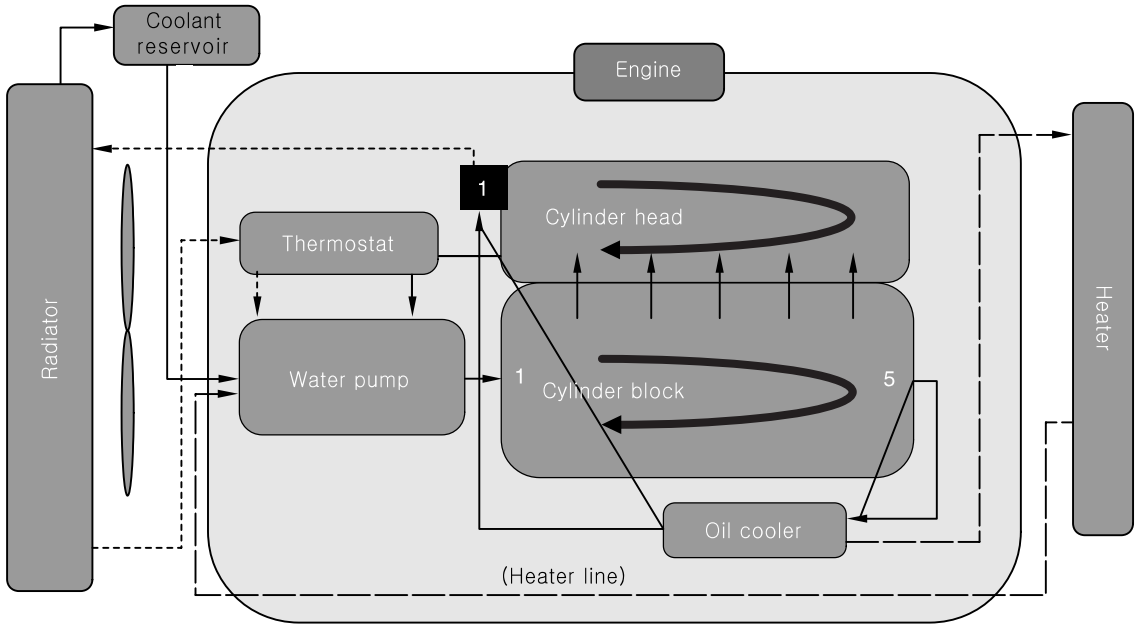
1. COMPONENTS LOCATOR



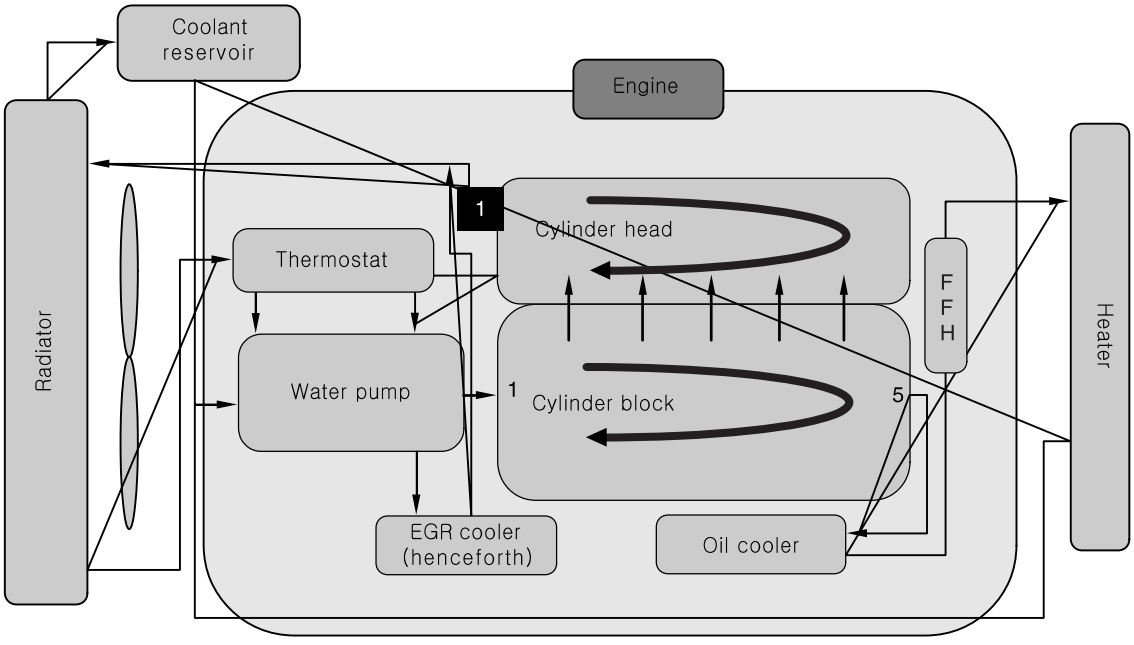
- FFH(Fuel Fired Heater): refer to "FFH System" in this manual.

Modification basis	
Application basis	
Affected VIN	

2. COOLING FLOWS



<PTC Engine Coolant Flows>



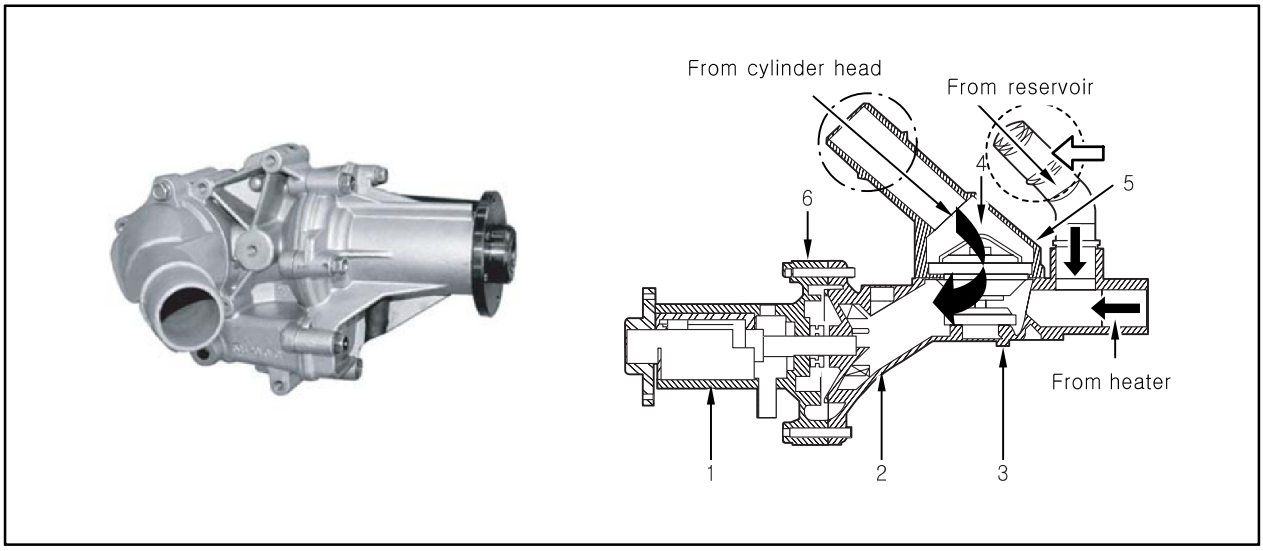
<FFH Engine Coolant Flows>

- Cylinder block side
  Block #5 → Oil cooler → Heater → Heater water pump inlet pipe → Water pump
- Cylinder head side
  Cylinder head → Coolant outlet port (intake #1) → Radiator → Water pump

3. FUNCTION DESCRIPTION



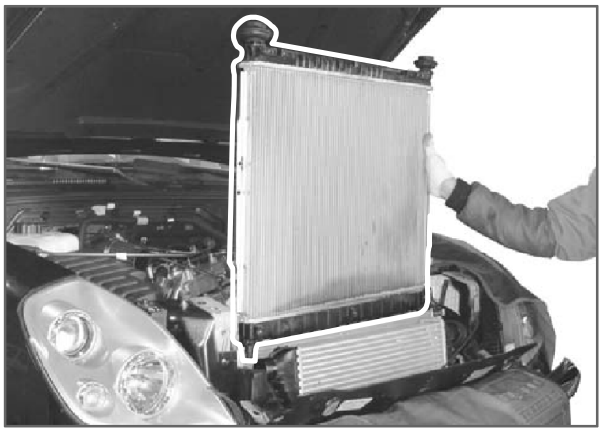
- Cylinder head coolant outlet port is integrated into intake manifold. (in front of cylinder #1)
  : Improved shape and gasket material to prevent coolant from leaking



- In OM 600 engine, coolant inflows through the heater line rear section (cylinder #4 and #5) of cylinder head. However, in D27DT engine, coolant inflows from cylinder block through oil cooler (refer to coolant flows layout in previous page).
  : It prevents cooling efficiency from decreasing due to coolant separation between cylinder #4 and #5.

- In OM 600 engine, the cooling fan is installed with water pump, however, in case of D27DT engine, it is connected to water pump with an additional pulley.

Modification basis	
Application basis	
Affected VIN	



1) Radiator

This vehicle has a lightweight tube-and-fin aluminum radiator.
Be careful not to damage the radiator core when servicing.



2) Water pump

The belt-driven centrifugal water pump consists of an impeller, a drive shaft, and a belt pulley. The impeller is supported by a completely sealed bearing.
The water pump is serviced as an assembly and, therefore, cannot be disassembled.



3) Coolant reservoir

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.

The coolant reservoir is a transparent plastic reservoir, similar to the windshield washer reservoir. The coolant reservoir is connected to the radiator by a hose and to the engine cooling system by another hose. As the vehicle is driven, the engine coolant heats and expands. The portion of the engine coolant displaced by this expansion flows from the radiator and the engine into the coolant reservoir. The air trapped in the radiator and the engine is degassed into the coolant reservoir. When the engine stops, the engine coolant cools and contracts. The displaced engine coolant is then drawn back into the radiator and the engine. This keeps the radiator filled with the coolant to the desired level at all times and increases the cooling efficiency. Maintain the coolant level between the MIN and MAX marks on the coolant reservoir when the system is cold.

ENGINE ELECTRIC SYSTEM

2820-01

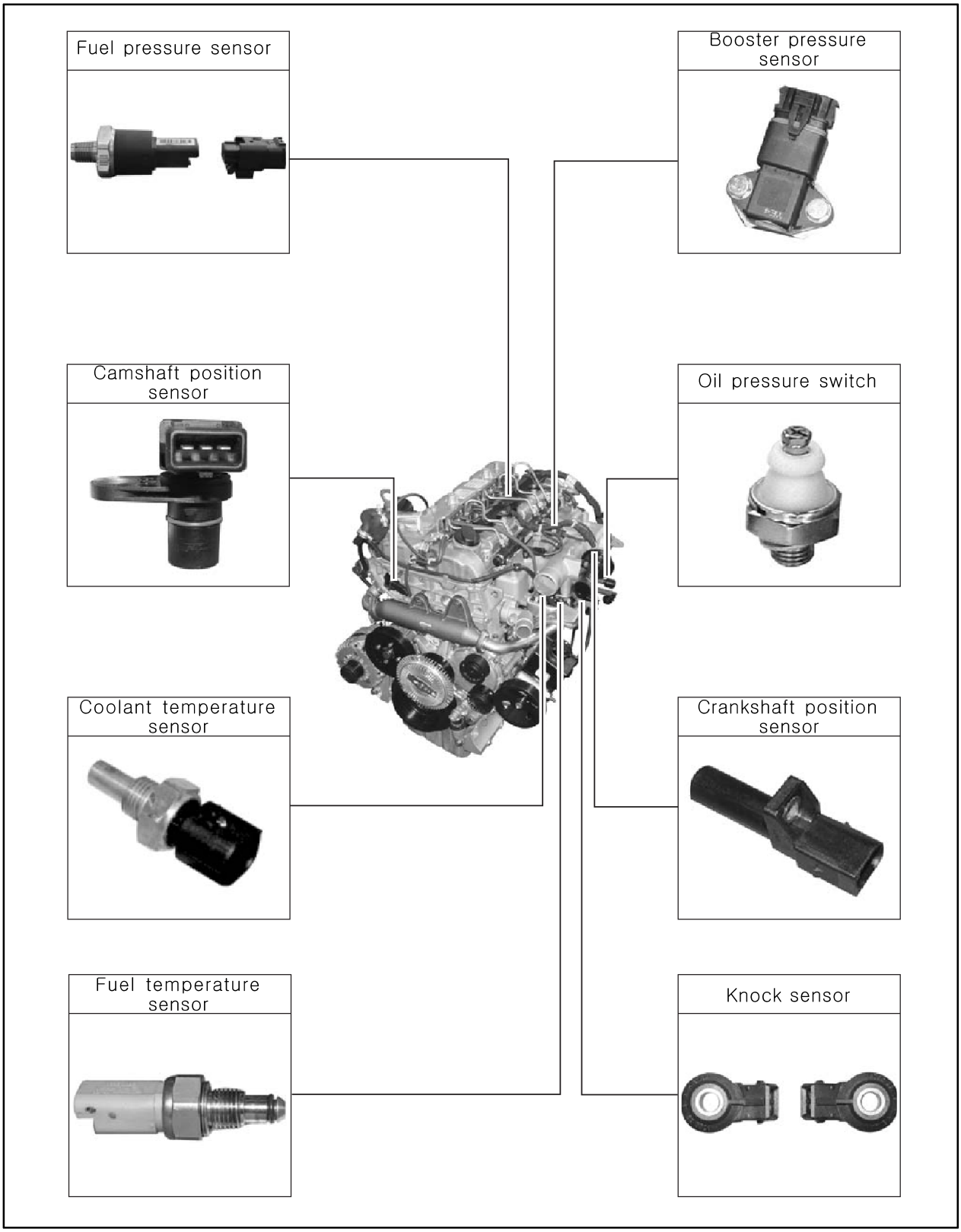
GENERAL

1. SPECIFICATIONS

Description			Unit	Specification
Starter	Type		-	WP220
	Output power		Kw	2.2
	No load test @ 12 volts		A	160
	Drive pinion speed at no load		rpm	4500
	Drive pinion speed at load		rpm/A	1700/430
	Brush length		mm	18
	Armature diameter		mm	55
	Armature run-out		mm	0.1
	Segment groove depth		mm	21.7
Alternator	Type		-	CS128D
	Output voltage / current		V/A	PTC equipped vehicle: 12V-140A FFH equipped vehicle: 12V-115A
	Regulator type		-	←
	Regulating voltage		V	14.6
	Brush	Length	mm	12.5
		Quantity	-	2
		Wear limit	mm	7
Battery	Type		-	M F
	Capacity		AH	12V - 90AH
Glow plug	Reserved capatity		RC	160
	Type		-	Seized type
	Rated voltage		-	11.5
	Circuit connection		-	Parallel
	Preheating time		sec	Max. 60 ~ 90

OVERVIEW AND OPERATION PROCESS

1. SENSORS IN ENGINE COMPARTMENT



Modification basis	
Application basis	
Affected VIN	

2. PREHEATING SYSTEM COMPARTMENT

ECU

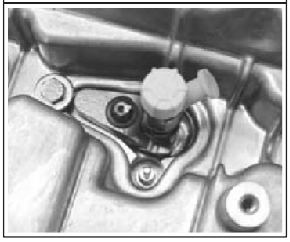


Glow indicator (meter cluster)





Glow plug



Preheating relay



Modification basis	
Application basis	
Affected VIN	

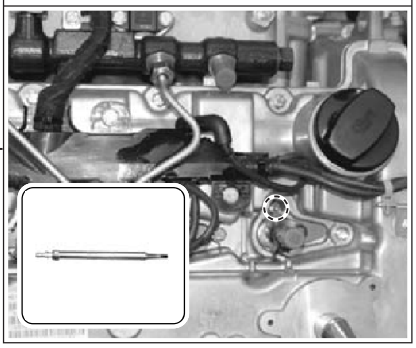
3. ELECTRIC DEVICES IN ENGINE COMPARTMENT

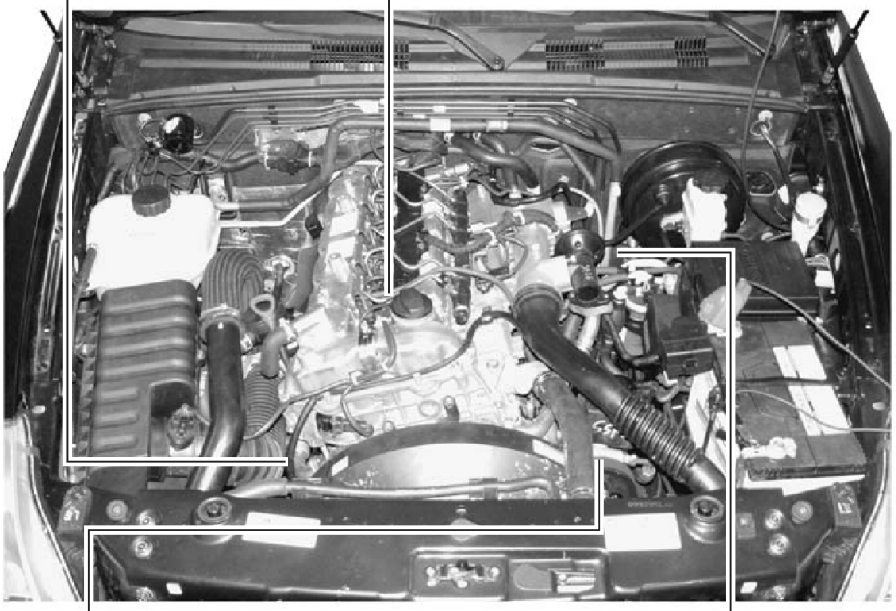
Alternator



* Capacity
PTC equipped vehicle
: 12V - 140A
FFH equipped vehicle
: 12V - 115A

Glow plug





Air conditioner compressor

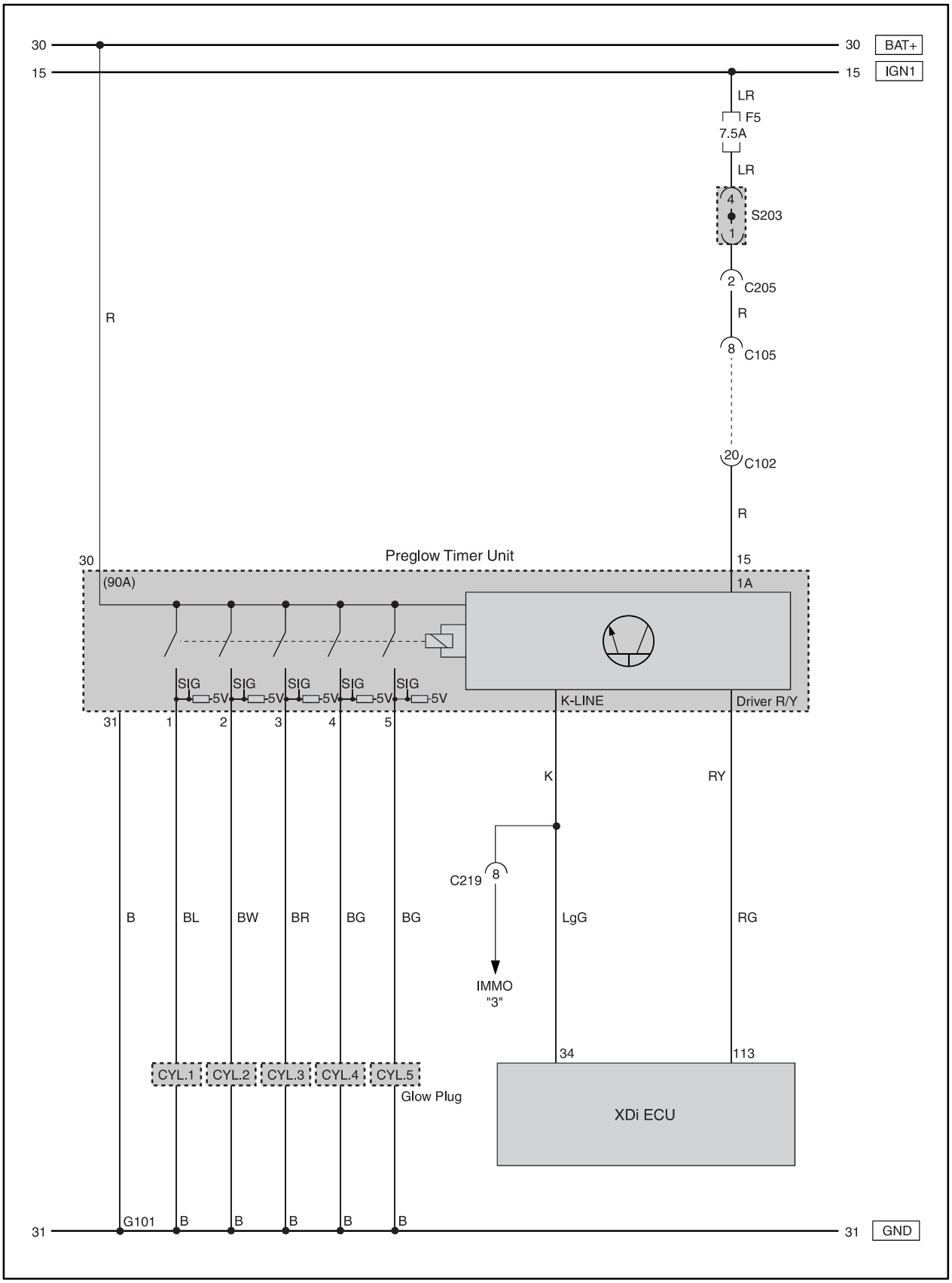


Starter



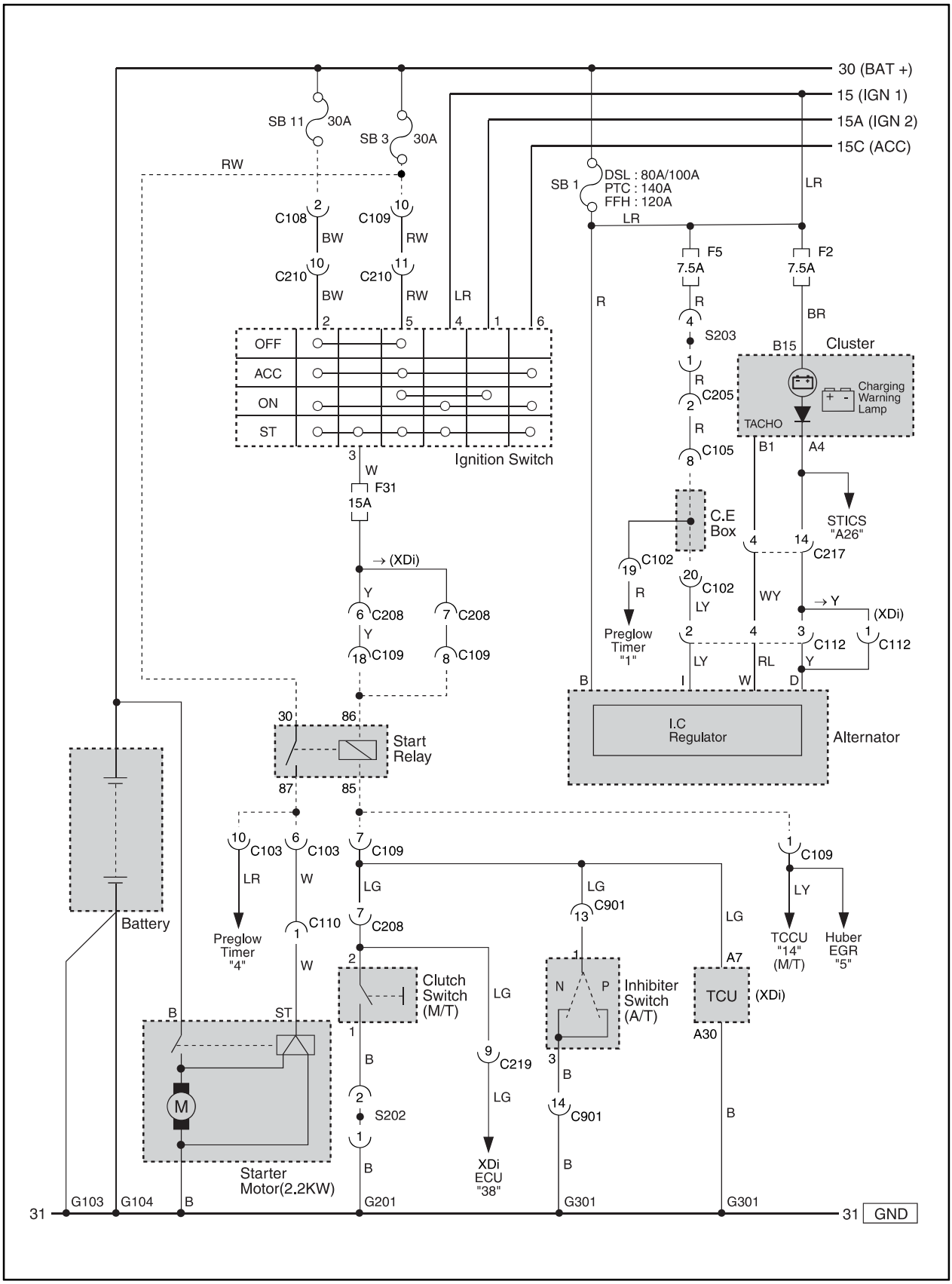
Modification basis	
Application basis	
Affected VIN	

4. CIRCUIT DIAGRAM OF PREHEATING SYSTEM



Modification basis	
Application basis	
Affected VIN	

5. CIRCUIT DIAGRAM OF STARTING AND ALTERNATOR



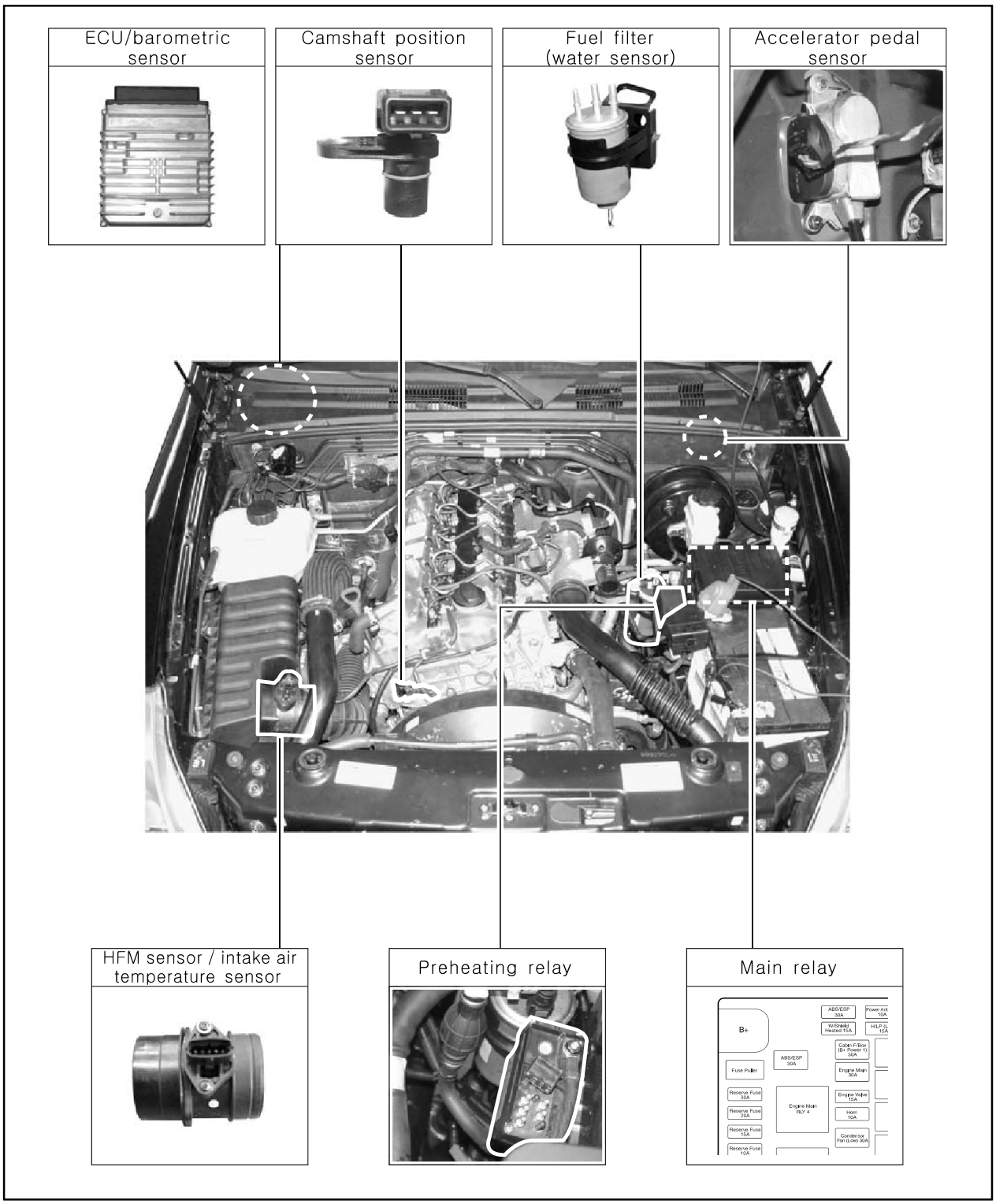
Modification basis	
Application basis	
Affected VIN	

ENGINE CONTROL SYSTEM

1491-01

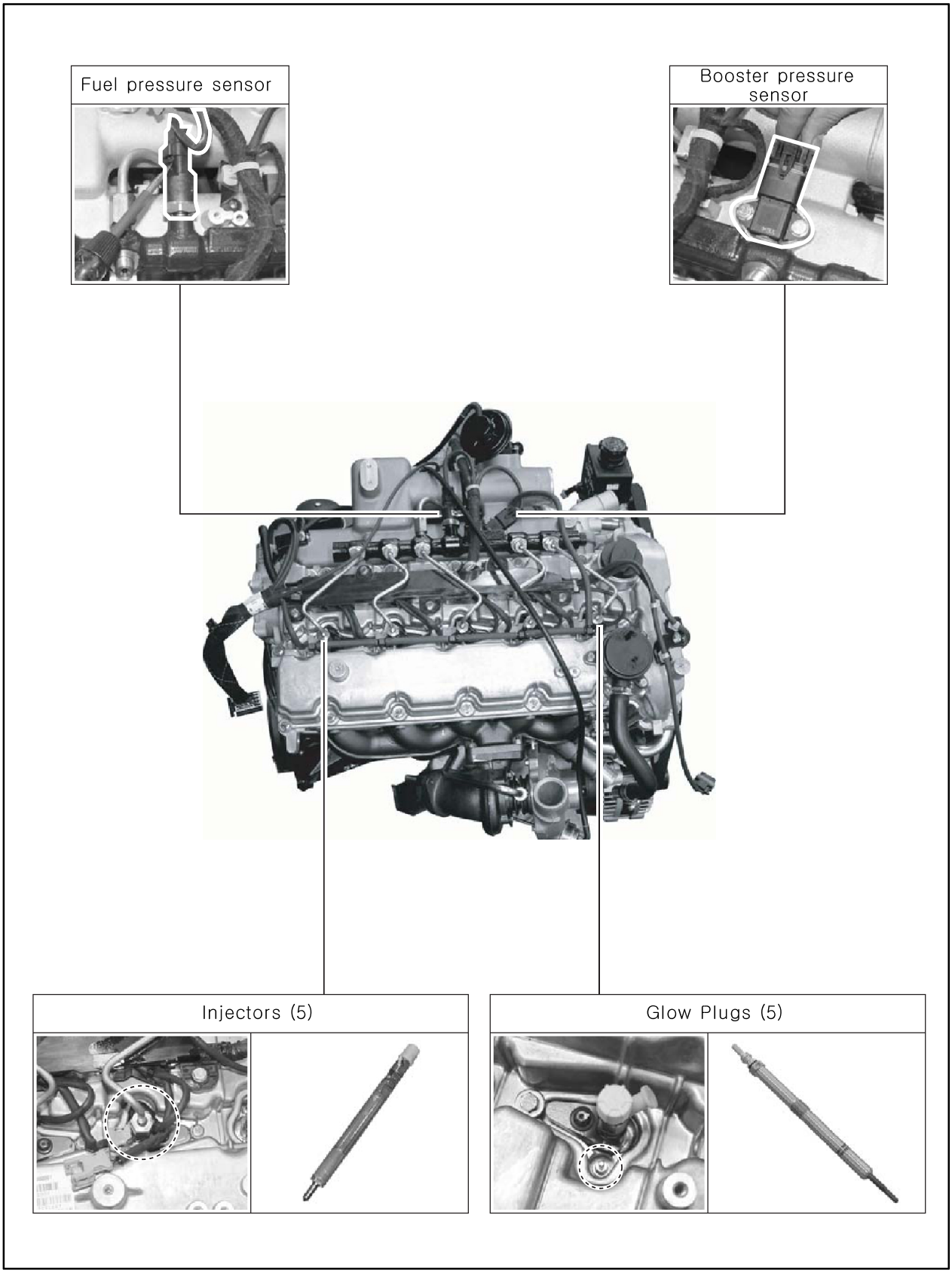
OVERVIEW AND OPERATION PROCESS

1. ENGINE ECU AND OTHER COMPONENTS



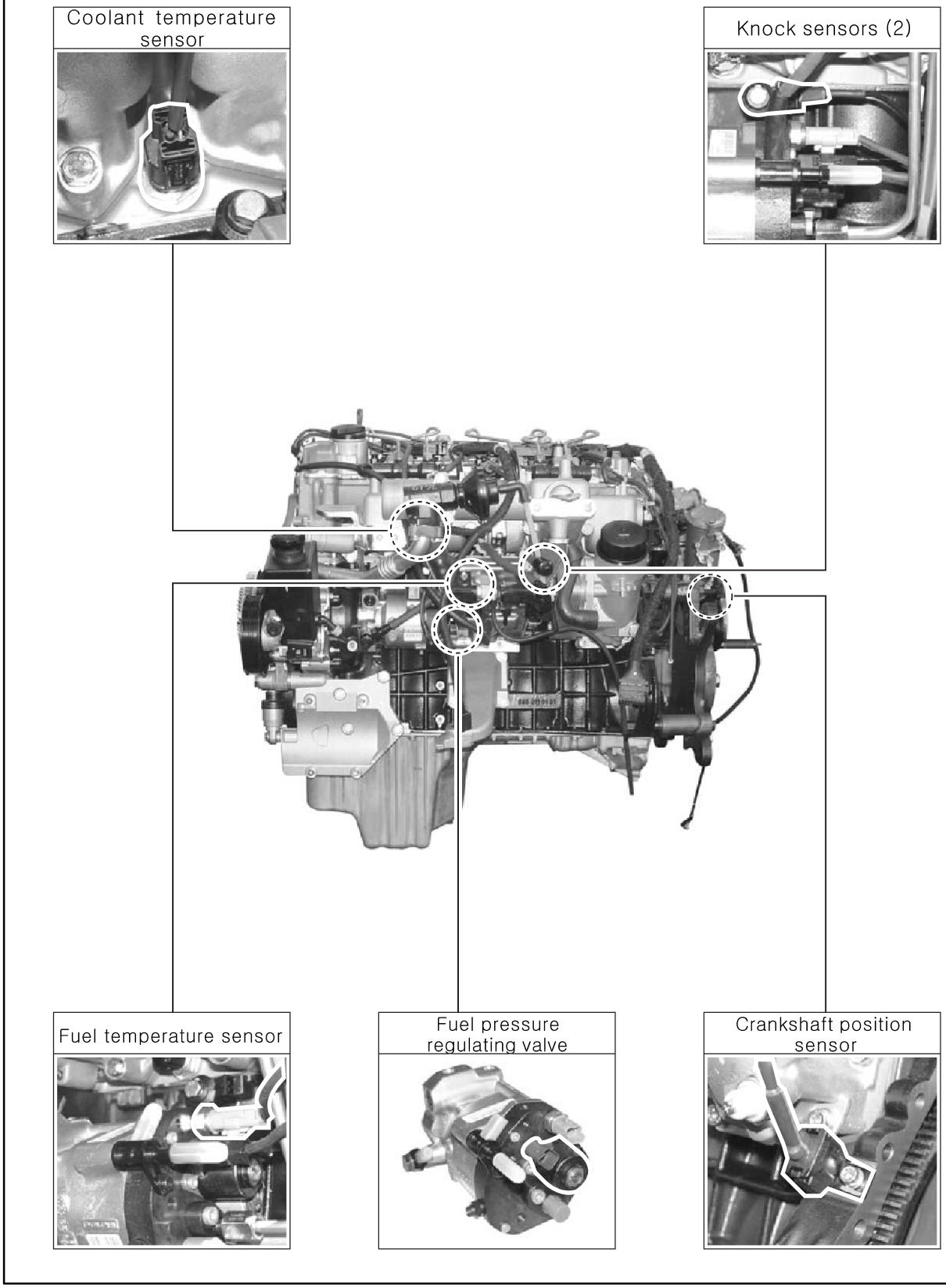
Modification basis	
Application basis	
Affected VIN	

▶ TOP VIEW



Modification basis	
Application basis	
Affected VIN	

▶ SIDE VIEW



Modification basis	
Application basis	
Affected VIN	

2. FUEL PRESSURE CONTROL

1) Fuel Pressure Control Elements

Pressure control consists of 2 principle modules.
- 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. The aim is to adapt the injection pressure to the engine's requirements.

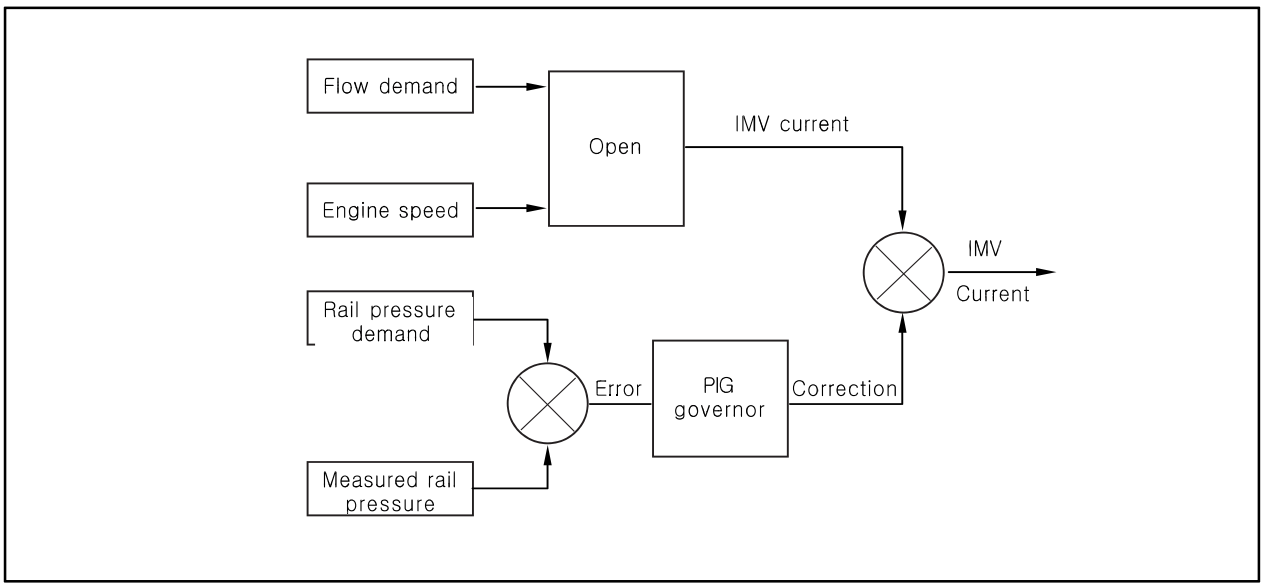
- When engine speed and load are high
  : The degree of turbulence is very great and the fuel can be injected at very high pressure in order to optimize combustion.

- 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.

2) Fuel Pressure Control

Rail pressure is controlled by closed loop regulation of IMV. A mapping system-open loop-determines the current which needs to be sent to the actuator in order to obtain the flow demanded by the ECU. The 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	

3. FUEL INJECSTION CONTROL

1) 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.
  - a reference tooth (CTP)
  - the delay between this tooth and the start of the pulse (Toff)
  - the pulse time (Ton)

▶ 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. This requirement only concerns the starting phase, since once the engine has started the system must re-use the mapping and the corrections described previously.

▶ 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.

During the starting phase, the pilot injection timing is determined as a function of the engine speed and of the coolant temperature.

4. FUEL FLOW 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.
: The driver's demand is compared with the value of the minimum flow determined by the idle speed controller.

- 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.

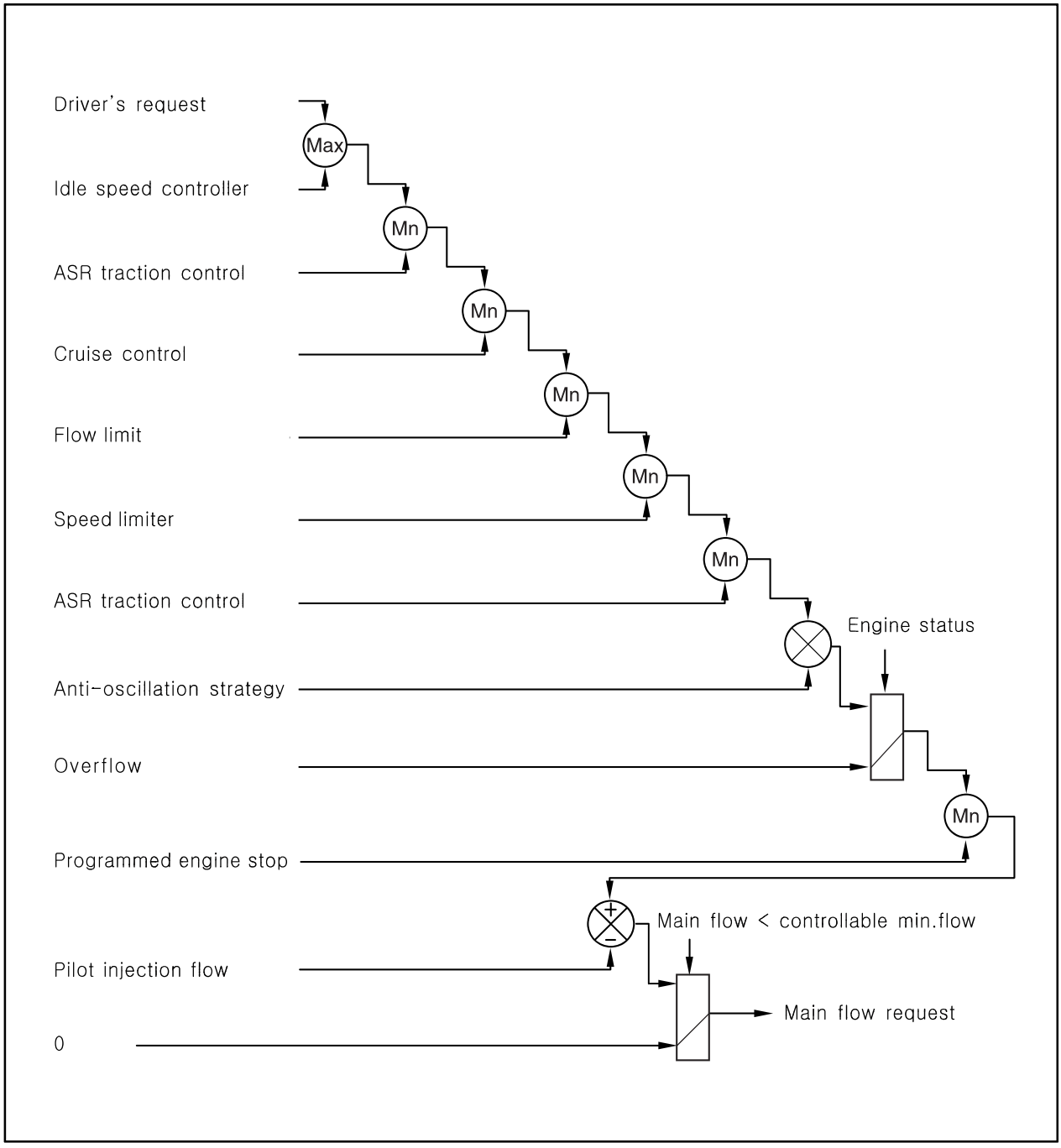
It is therefore the greater of these 2 values which is retained by the system. This value is then compared with the lower flow limit determined by the ASR trajectory control system. As soon as the injected fuel becomes lower than the flow limit determined by the ASR trajectory control system, the antagonistic 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.
This value is then compared with the flow limit determined by the cruise control. As soon as the injected fuel becomes lower than the flow limit determined by the cruise control, the vehicle's speed falls below the value required by the driver.
The system therefore chooses the greater of these 2 values in order to maintain the speed at the required level. This valve is then compared with the flow limit determined by the flow limitation strategy. This strategy allows the flow to be limited as a function of the operating conditions of the engine. The system therefore chooses the smaller of these 2 values in order to protect the engine. This value is then compared with the fuel limit determined by the ASR trajectory control system.
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. The correction is determined before each injection as a function of the instantaneous engine speed.

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.



Modification basis	
Application basis	
Affected VIN	

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.

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, the accelerated idle speed is activated to prevent the engine from stalling when operating in degraded mode.
  - · It is possible to increase or to reduce the required idle speed with the aid of the diagnostic tool.
- 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 these 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.

Modification basis	
Application basis	
Affected VIN	

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.

This correction is used to adapt the pilot flow according to the atmospheric pressure and therefore the altitude. 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.

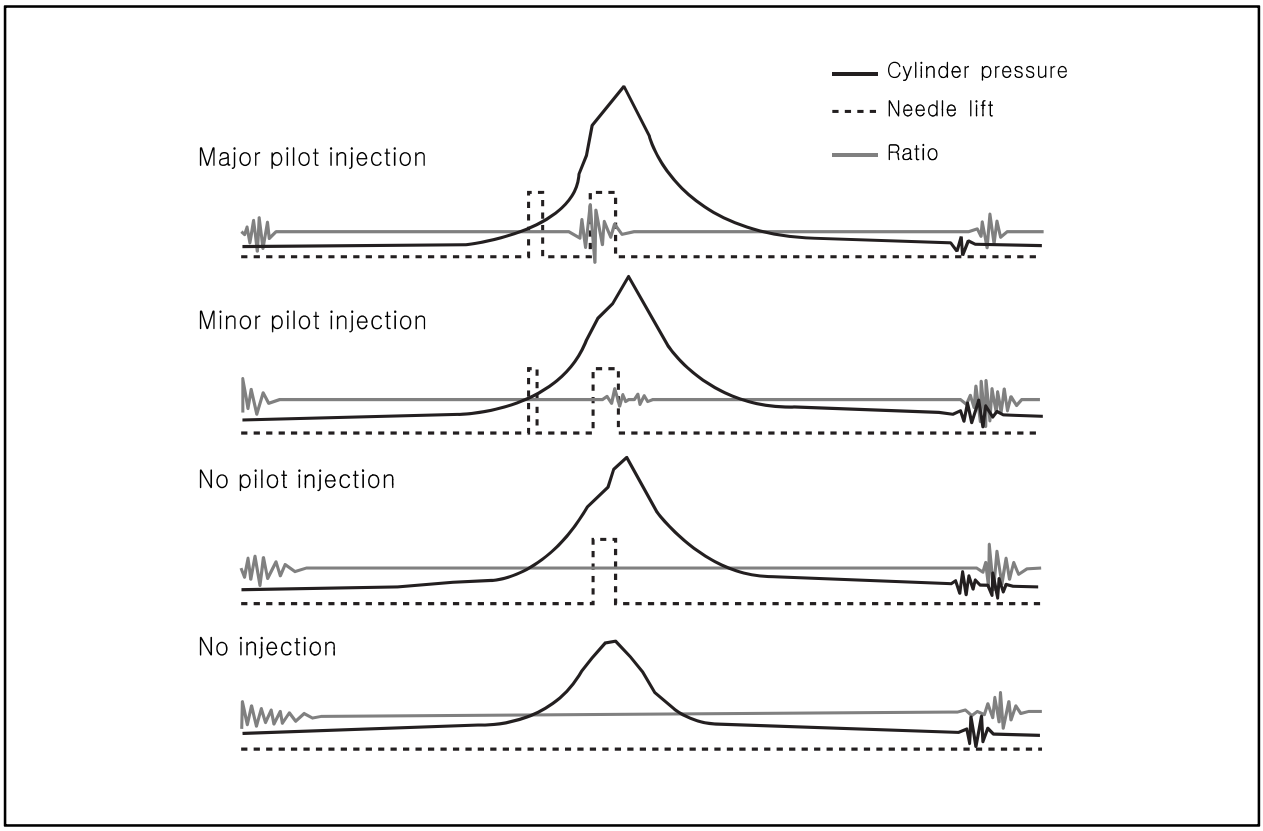
7) Accelerometer Strategy

▶ 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.

- 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.
- 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).



Modification basis	
Application basis	
Affected VIN	

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 C2I. Each resetting then allows the closed loop of the MDP to be updated according to the deviation of the injector.

▶ 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 strong
- Main combustion offset
- Fuel leak in the cylinder

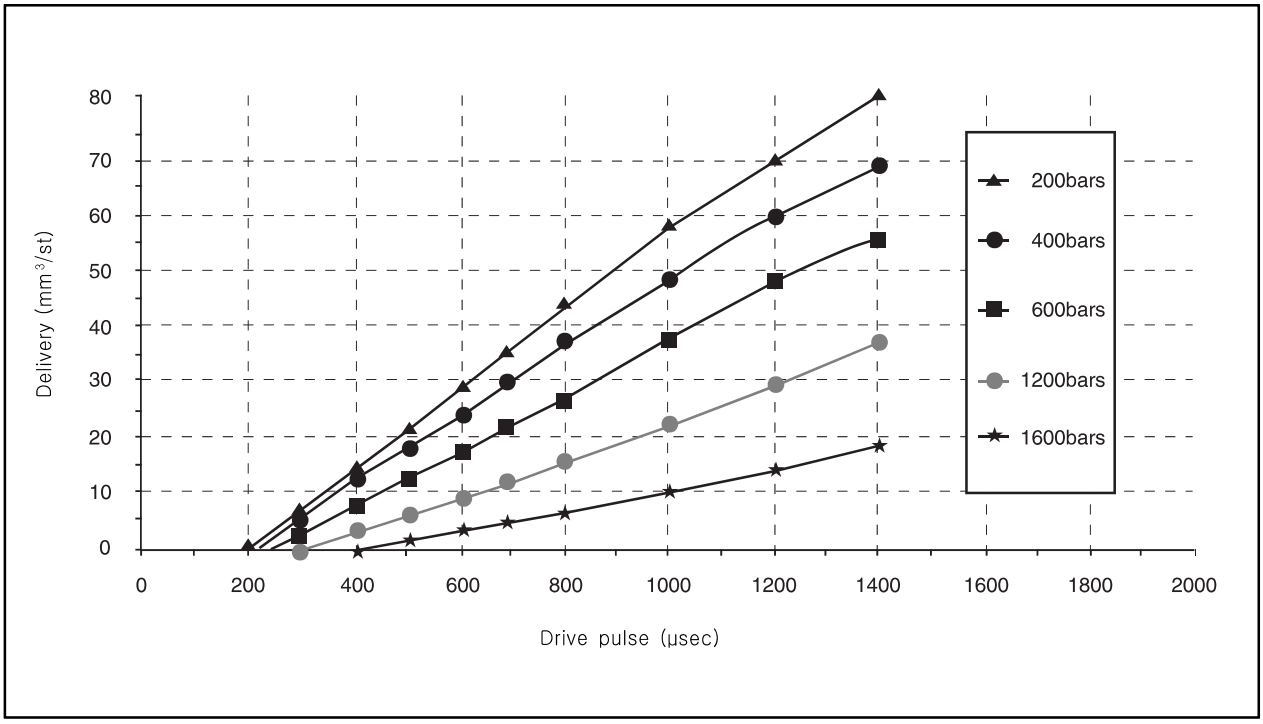
If the ratio becomes too high, the strategy initially restricts the pilot injection flow and retards the main injection. If the ratio remains high despite these interventions, this shows that a real leak is present, a fault is signaled and the engine is shut down.

▶ 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.

5. INDIVIDUAL INJECTOR CALIBRATION (C2I)

Injected fuel is proportional to square root of injection time and rail pressure. It is function between pulse and rail pressure and fuel injection curve is called injector characteristics curve having the following shape.

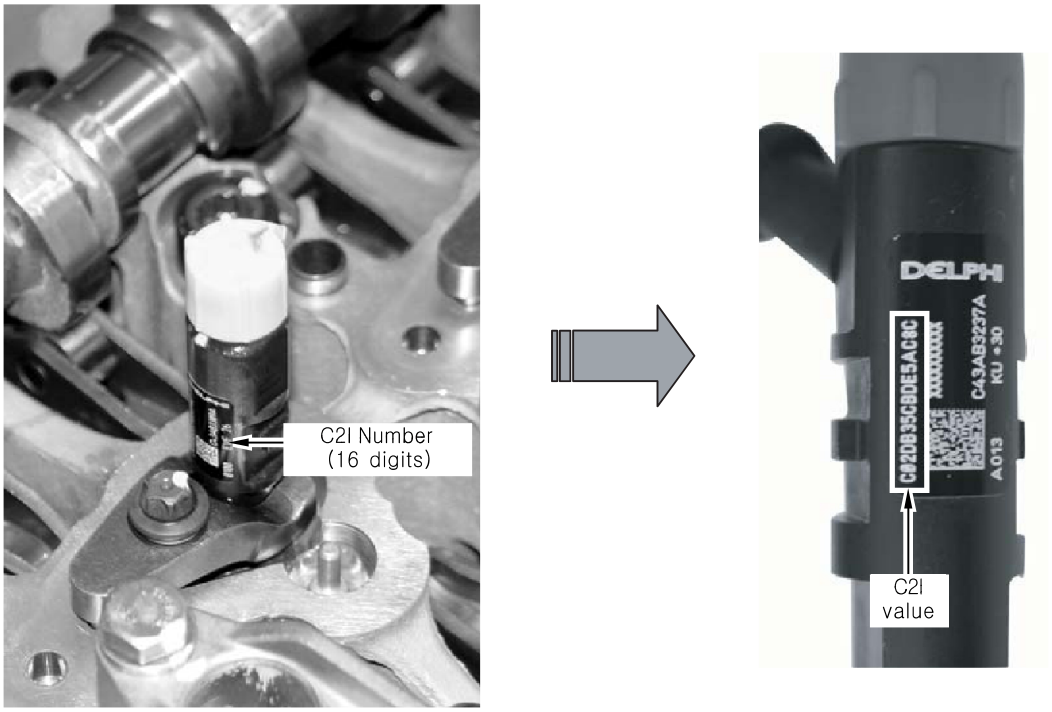


Common rail injectors are very accurate components. They are able to inject fuel delivery between 0.5 to 100 mg/str under pressure varying from 150 to 1600 bar.
This high level of accuracy requires very low machining tolerances (few).
Nevertheless, due to the machining dispersion, the loss of charge through the functional orifices, the friction between moving parts and electromagnetic field level are different from one injector to the other. So, the difference of fuel delivery for the same pressure and the same pulse can reach 5 mg/str from one injector to the other. It is impossible to control efficiently the engine with such a dispersion between the different injectors. It is necessary to add a correction that allows injecting the demanded fuel delivery whatever the initial hydraulic characteristics of the injector is. The method consists in correcting the pulse that is applied to the injector with an offset that depends on the initial hydraulic map of the injector. So, the pulse should be corrected according to characteristics of each injector.

Modification basis	
Application basis	
Affected VIN	

C2I is composed of models on these characteristics of injectors.
C2I consists of 16-digit; composed of numbers from 1 to 9 and alphabets from A to F. ECU remembers C2I, characteristics of each injector, to make the most optimal fuel injection.

- When replacing the injector, C2I code on the top of new injector should be input into ECU because the ECU is remembering the injector's C2I value. If C2I is not input, engine power drops and occurs irregular combustion.
- When ECU is replaced, C2I code of every injector should be input. If not, cannot accelerate the vehicle even when the accelerator pedal is depressed.



* For coding of C2I, refer to "Diagnosis" section

Modification basis	
Application basis	
Affected VIN	

6. MINIMUM DRIVE PULSE (MDP) LEARNING

When the pulse value that the injector starts injection is measured, it is called mininum drive pulse (MDP). Through MDP controls, can correct pilot injections effectively. Pilot injection volume is very small, 1 ~ 2 mm/str, so precise control of the injector can be difficult if it gets old. So there needs MDP learning to control the very small volume precisely through learning according to getting older injectors.

1) Learning conditions

Coolant temperature	> 75°C
Vehicle speed	> 50 Km/h (over 5 seconds)
Intake manifold pressure	> 0.7 bar
Engine speed	> 2,500 rpm
Battery voltage	10 V < MDP < 16 V
Fuel temperature	0 < fuel temperature < 80 °C
Initial MDP learning on each injector	5 seconds

2) Trouble codes

Trouble code	Description	Diagnosis
P1171	Fault MDP learning on injector No. 1	• Check each injector
P1172	Fault MDP learning on injector No. 2	
P1173	Fault MDP learning on injector No. 3	
P1174	Fault MDP learning on injector No. 4	
P1175	Fault MDP learning on injector No. 5	

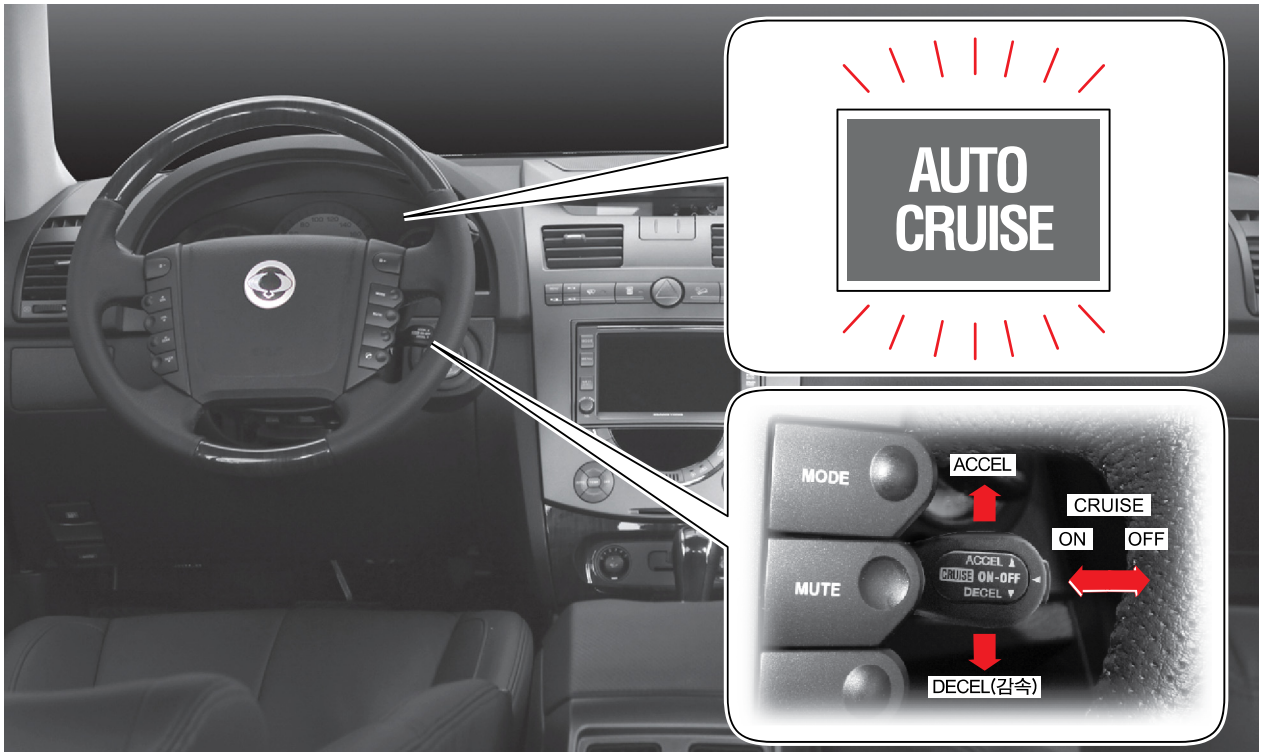
Modification basis	
Application basis	
Affected VIN	

CRUISE CONTROL SYSTEM

8510-23

OVERVIEW AND OPERATION PROCESS

1. CRUISE CONTROL SWITCH



The purpose of the cruise control system is to automatically maintain a vehicle speed set by the driver, without depressing the accelerator pedal. The cruise control switch is located under the right side of the steering wheel, and when this switch is operating "AUTO CRUISE" lamp comes on.

The minimum speed for setting the cruise control system is 36 km/h (22.37 mph). Pay constant attention to the distance between the vehicles and the traffic conditions when using the cruise control system.

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.

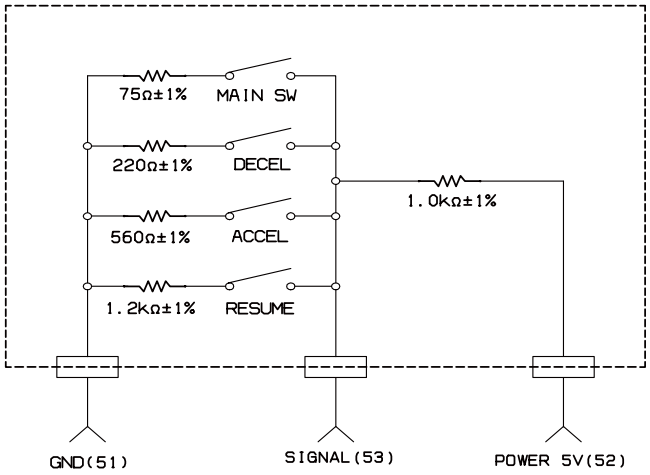
1) When To Use

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

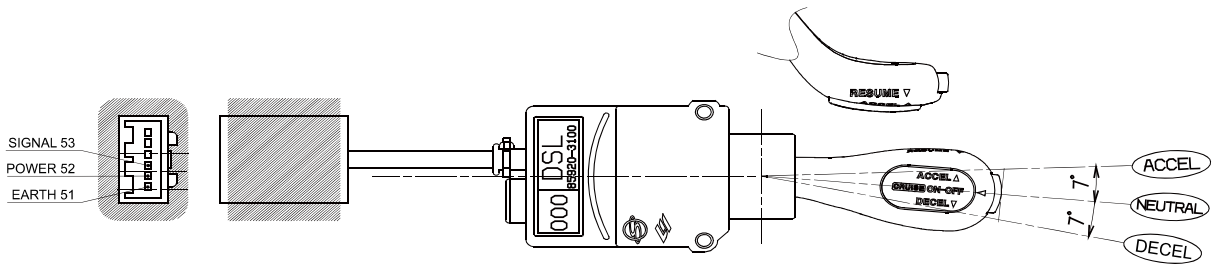
WARNING

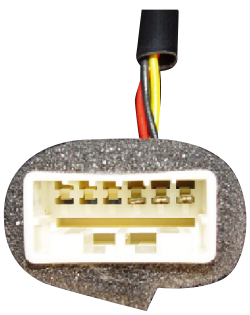
Use the cruise control system only when driving on motorways or highways. Do not use the cruise control system where the road conditions are as follows:
- When there is strong wind or cross wind.
- Heavy traffic.
- Slippery roads or steep decline.

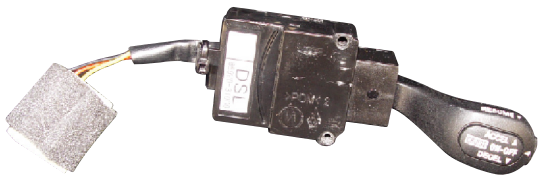
2. CIRCUIT DIAGRAM



1) Configuration







Modification basis	
Application basis	
Affected VIN	

3. HOW TO OPERATE CRUISE CONTROL SWITCH

1) How To Set Speed



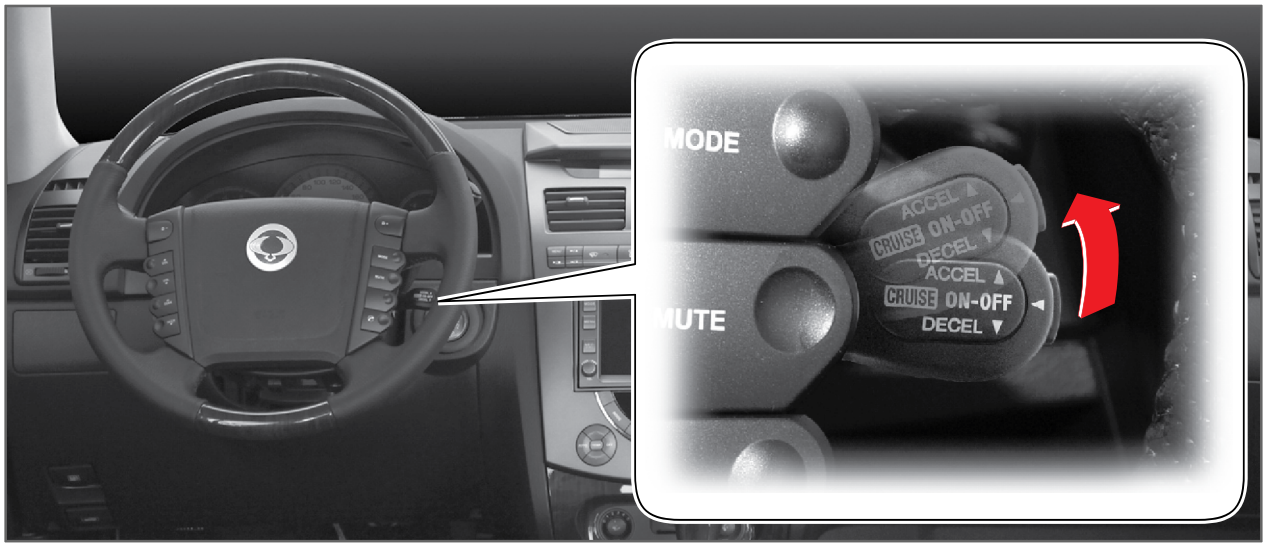
1. To operate the cruise control system, accelerate the vehicle to the speed within the specified range below with depressing the accelerator pedal.
   - Cruise control operating range: between 36 km/h (22.37 mph) and 150 km/h (93.207 mph)
2. When the desired speed is reached, which should be within the above range, push up the cruise control switch lever to ACCEL side (upwards arrow), or push down the switch lever to DECEL side (downwards arrow).
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.

Modification basis	
Application basis	
Affected VIN	

2) Accelerating with the Cruise Control System



(1) While the cruise control system is running

1. To increase the set speed, push up the cruise control switch lever to ACCEL side and hold it until the desired speed is reached without depressing the accelerator pedal.
2. When the desired speed is set, release the switch 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 the vehicle to more than 36 km/h (22.37 mph) using the accelerator pedal. Push up the cruise control switch lever to ACCEL side and hold it.
2. When the desired speed is reached, release the accelerator pedal and the switch 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 cruise control switch lever to ACCEL side for less than 0.5 second per one switching while the cruise control system is running; the speed increases each time by 1.3 km/h (0.81 mph).
2. For example, if you want to increase the speed 13 km/h (81 mph) more than the previous set speed, tap up the switch lever to ACCEL side ten times without using the accelerator pedal.

3) Decelerating with the Cruise Control System



(1) While the cruise control system is running

1. To decrease the set speed, push down the cruise control switch lever to DECEL side and hold it until the desired speed is reached without depressing the brake pedal.
   But the cruise control system cannot maintain the cruise function at less than 34 km/h (21.13 mph).
2. When the desired speed is set, release the switch lever.

(2) When the cruise control system is not running

To decrease the speed with the cruise control system while 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 36 km/h (22.37 mph).
2. When the desired speed is reached, release the switch lever.
3. But the cruise control system cannot maintain the cruise function at less than 34 km/h (21.13 mph).

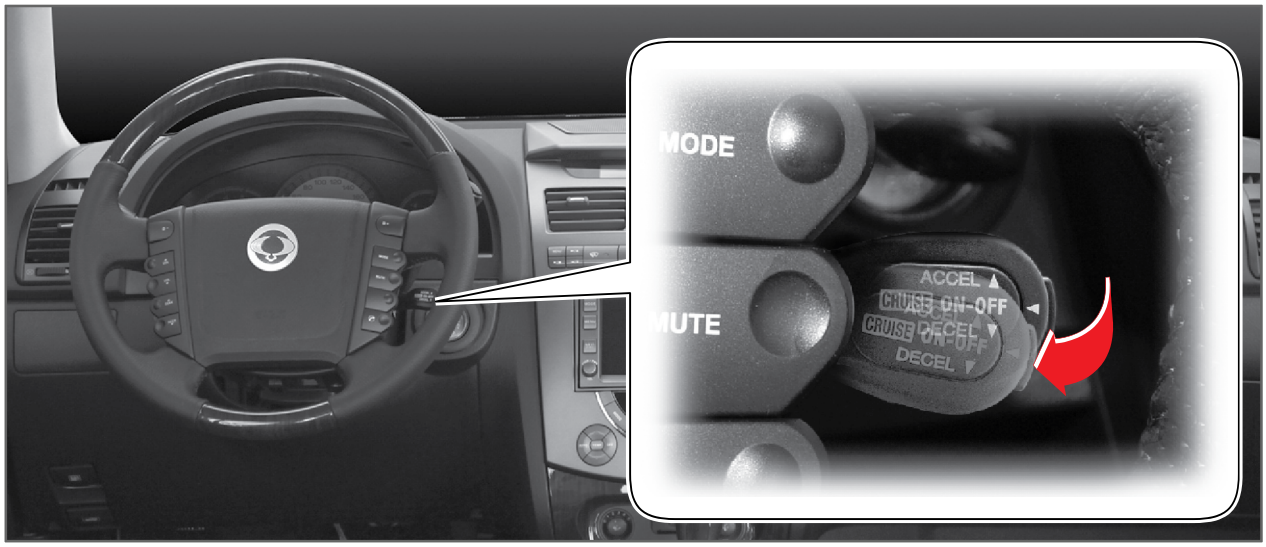
(3) Tap-down while the cruise control system is running

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

1. Push down the cruise control switch lever to DECEL side for less than 0.5 second per one switching while the cruise control system is running; the speed decreases each time by 1.0 km/h (0.62 mph).
2. For example, if you want to decrease the speed 10 km/h (62 mph) lower than the previous set speed, tap down the switch lever to DECEL side ten times without using the brake pedal.

Modification basis	
Application basis	
Affected VIN	

4) Recovery of Set Speed (RESUME)



Even if the cruise control is cancelled, the previous set cruise speed can be recovered by operating the cruise control switch lever like below:
- Pull the switch lever in the arrow direction shown in the illustration.

This RESUME function works only when the vehicle speed is more than 36 km/h (22.37 mph) without using the accelerator or brake pedal.

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.

5) Normal Cancellation of the Cruise Control (OFF ↔ ON)



The cruise control system will be cancelled when the button on the side of the switch is pressed, or when one of the following conditions is met:

1. When the brake pedal is depressed or ESP is activated.
2. When the vehicle speed is less than 34 km/h (21.13 mph).
3. When the parking brake is applied while driving.
4. When the clutch pedal is depressed for shifting (M/T only).

CAUTION

Put the cruise control switch lever in the neutral position when not using the cruise control system.

(1) Abnormal Cancellation of the Cruise Control

1. When the rapid deceleration or acceleration occurs.
2. When the cruise control lever is faulty.
3. When the brake switch is malfunctioning or has an open circuit.

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

- 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.
- Always be prepared to use the brake or accelerator pedal for safe driving while the cruise control system is running.
- 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.
- Ensure that the braking distance is maintained and use the brake pedal if needed.

Modification basis	
Application basis	
Affected VIN	

FUSES AND RELAYS

0000-00

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GENERAL

1. GENERAL INFORMATION..... 3

OVERVIEW AND OPERATION PROCESS

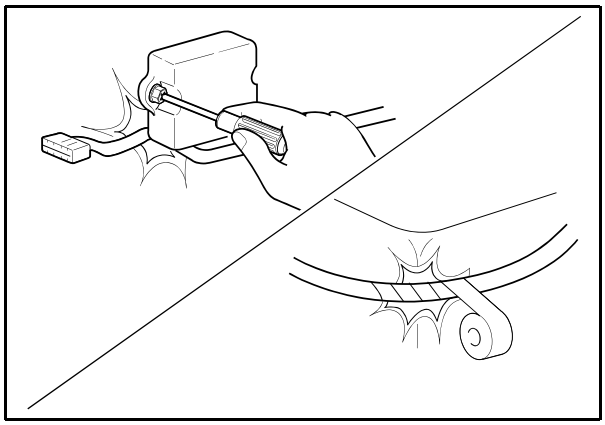
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2. ELECTRIC COMPONENTS LOCATOR.. 12

FUSES & RELAYS

0000-00

GENERAL

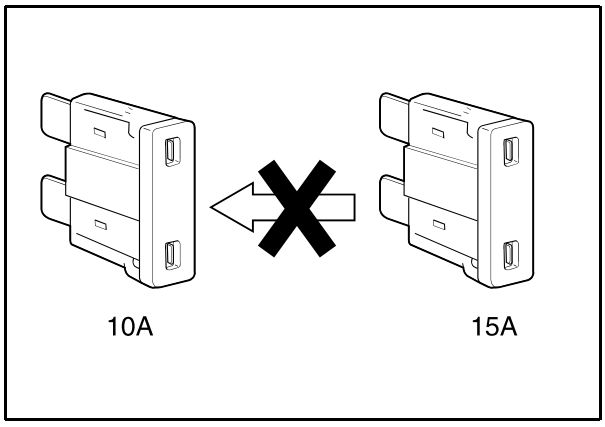
1. GENERAL INFORMATION



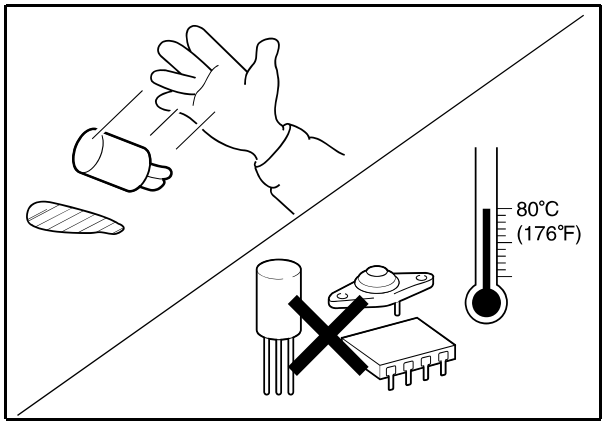
1. Before starting repairs which do not require battery power:
   Turn off ignition switch.
   Disconnect the negative battery cable.

CAUTION
- Turn off all the electrical devices before disconnecting and connecting the negative battery cable. Otherwise, the semiconductor components are subject
- to be damaged.
  The volatile memory in electrical devices may be erased. Store them with safe methods.

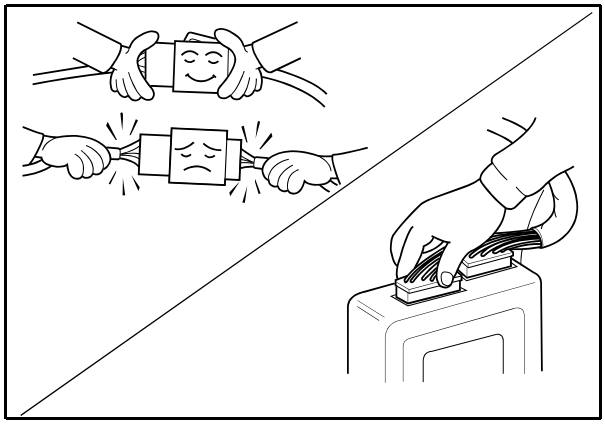
2. The harnesses that can be touched with a sharp edge or corner should be wrapped with insulating tape to prevent damaging.
3. Carefully handle the wiring harnesses not to damage them during servicing the electric components.



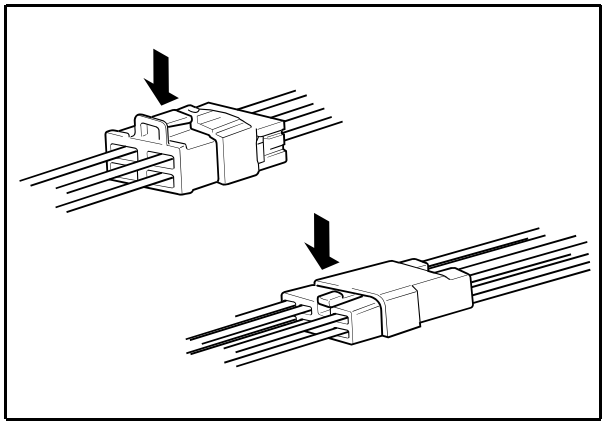
4. If a fuse is blown, be sure to eliminate the cause of problem before installing a new fuse. Use only the fuse of specified rating. Never use a fuse of more than specified rating. It may cause a fire or damage to the electric components.



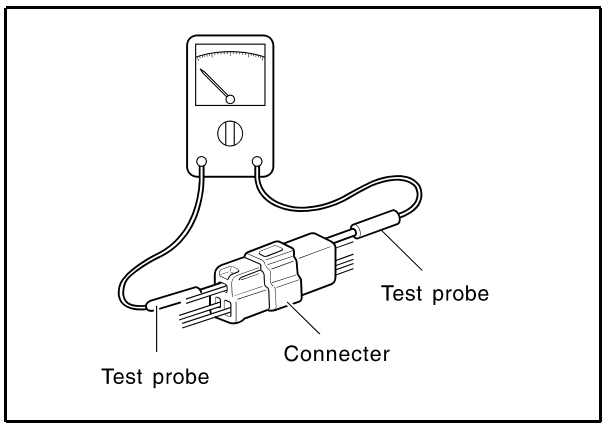
5. Be careful not to drop or jar the sensors and relays.
6. The electric components used in computer and relays are heat sensitive. If the working temperature will be exceeded 80°C, remove the components before starting the service operation.



7. Loosened connection may cause a malfunction. Always firmly engage the connector.
8. When connecting, push the connector until it sounds "click".
9. When disconnecting, always hold the connector body other than the harness.



10. Disconnect the connector while pressing down the locking tab if applicable.



11. When checking the continuity or voltage, the test probes of the circuit tester should be inserted from harness side (rear of connector). In case of sealed connector, insert the test probe through the cavity in wiring rubber cap. Be careful not to damage the wire insulation.
    And, the test probe should be insert until its end contacts to the connecter pin.

CAUTION

- The circuit tester cannot be used for checking the air bag system. Use only the diagnostic tool (Scanner).

Modification basis	
Application basis	
Affected VIN	

▶ INSPECTION OF CABLES AND WIRES

1. Check the connections for looseness and rust.
2. Check the terminals and wires for corrosion due to electrolyte.
3. Check the circuit for open.
4. Check the wire insulation. Check the cover clothing of the wire for damage, crack and deterioration.
5. Check if any electric continuity can be transferred to other metal components such as vehicle body.
6. Check if the continuity exists on the bolt and vehicle body in ground connection.
7. Check the wire arrangement.
8. Securely fasten the wiring harnesses not to contact to a sharp edge and hot elements (exhaust manifold and pipes).
9. Keep the proper clearance between the wire harness and the moving components such as fan pulley and fan belt.
10. In case of the wiring harnesses connected to the vehicle body and vibrating components such as engine, to avoid damage, do not bind the harnesses without marginal length.

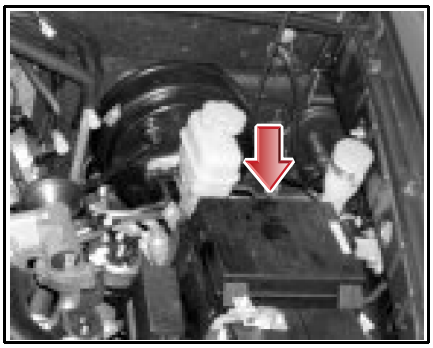
OVERVIEW AND OPERATION PROCESS

1. COMPARTMENT

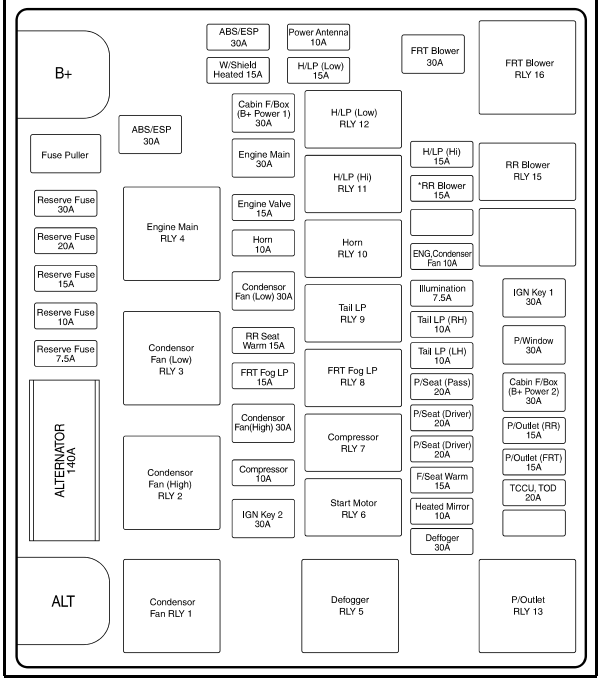
1) DI (D27DT) ENGINE EQUIPPED VEHICLE

▶ Fuse Box In Engine Compartment

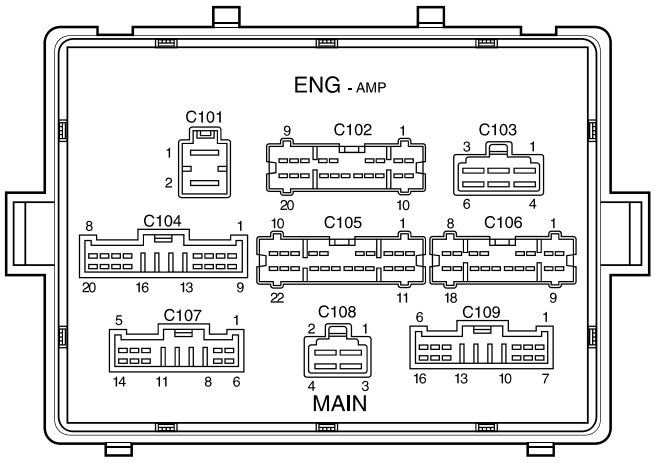
It is installed in the left side of engine compartment.



Name and Capacity



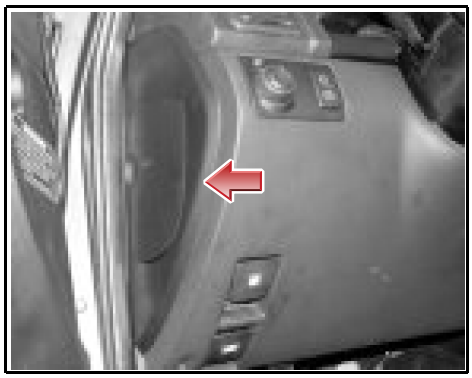
Connector Arrangement



Modification basis	
Application basis	
Affected VIN	

▶ Interior Fuse Box

It is install at left side of the instrument panel.

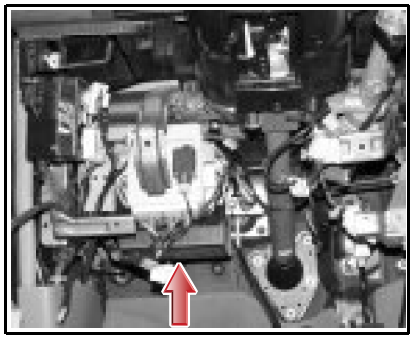


Name and Capacity

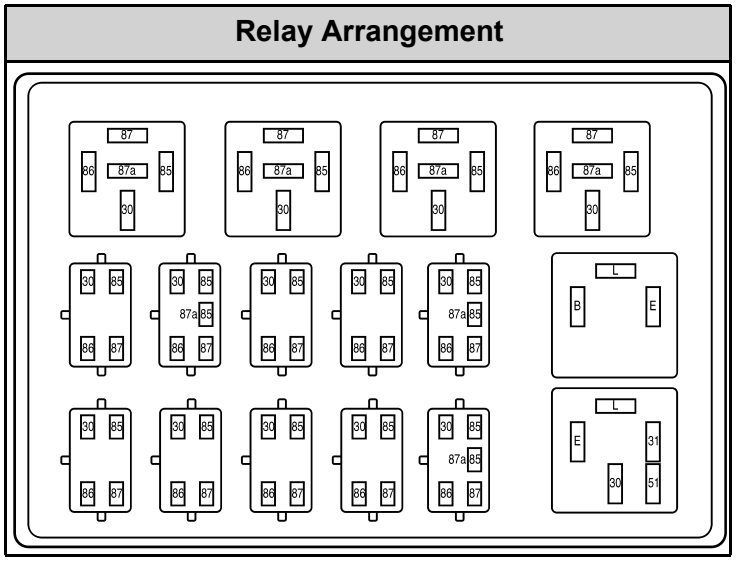
Diode	NO.25 20A	Sun Roof	NO.17 10A	Head Lamp	NO.9 10A	C/Fan	NO.1 7.5A	A/T SHFT Lever Lock Immobilizer
	NO.26 10A	RR Wiper	NO.18 7.5A	A/Con O/S Mirror	NO.10 15A	OVPR	NO.2 7.5A	Cluster STICS
NO.33	NO.27 7.5A	Clock STICS Cluster	NO.19 15A	FRT Wiper FRT Washer	NO.11 15A		NO.3 15A	B/UP Lamp T/SIG Lamp
NO.34	NO.28 7.5A	Siren P/W Window	NO.20 15A	RR Wiper RR Washer	NO.12 10A	Stop Lamp (Trailer)	NO.4 7.5A	TCU TCCU
	NO.29 15A	Audio Multi Vision	NO.21 10A	Defogger Blower A/Con	NO.13 15A	Hazard Lamp	NO.5 7.5A	I/S Mirror ENG Preheat'G Auto Light
	NO.30 15A	Door Lock	NO.22 7.5A	Power Outlet O/S Mirror Clock	NO.14 10A	RR Fog Lamp	NO.6 10A	Speed Sensor
Fuse Puller	NO.31 15A	Start Motor	NO.23 7.5A	Audio Multi Vision Navigation	NO.15 10A	Interior Lamp	NO.7 10A	ABS ESP
	NO.32		NO.24 20A	Cigar Lighter	NO.16 20A	Stop Lamp	NO.8 10A	Air Bag
	20A	Spare Fuse	15A	Spare Fuse	10A	Spare Fuse	7.5A	Spare Fuse

▶ Interior Relay Box

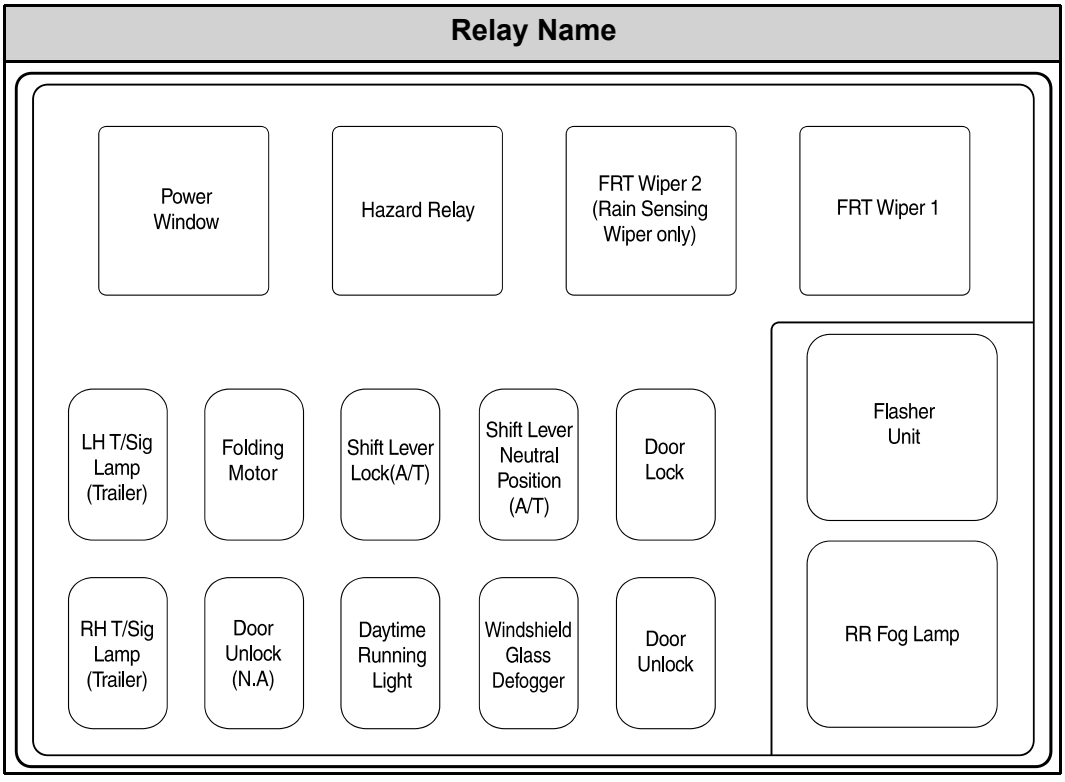
It is installed behind the lower instrument panel.



Relay Arrangement



Relay Name



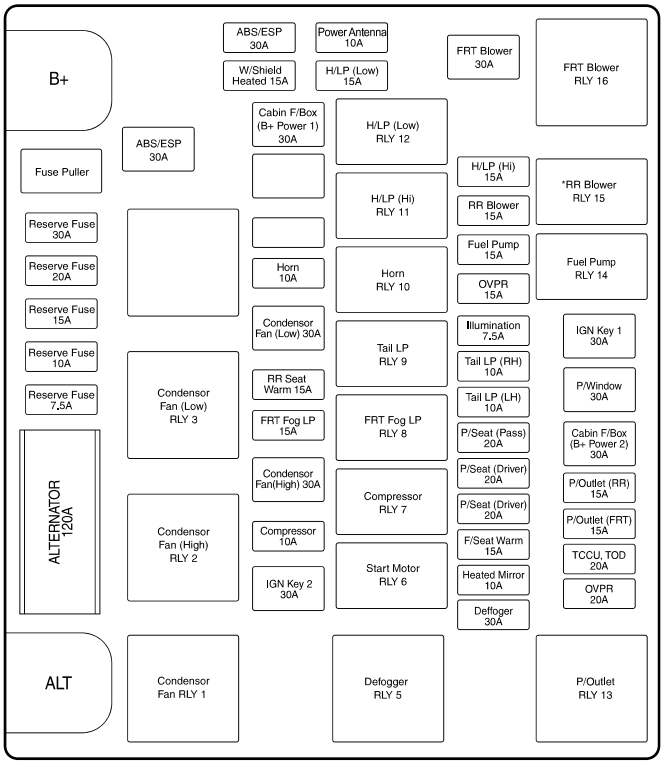
Modification basis	
Application basis	
Affected VIN	

2) GASOLINE ENGINE EQUIPPED VEHICLE

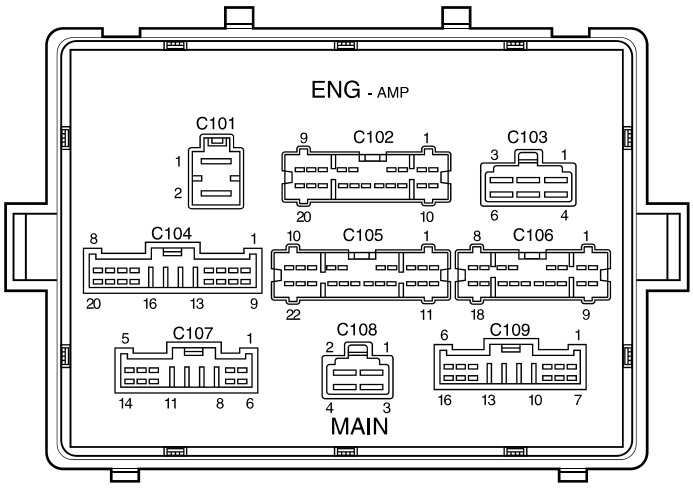
▶Fuse Box In Engine Compartment

It is installed in the left side of engine compartment.

Fuse Name and Capacity



Connector Arrangement



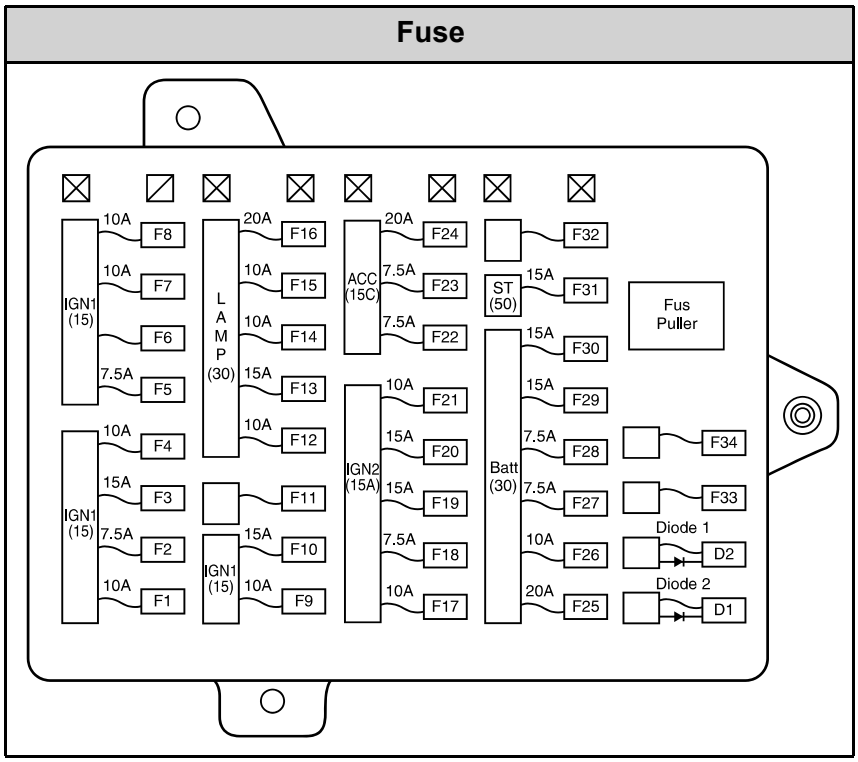
▶Interior Fuse Box

It is install at keft side of the instrument panel.

Name and Capacity

Diode	NO.25 20A	Sun Roof	NO.17 10A	Head Lamp	NO.9 10A	C/Fan	NO.1 7.5A	A/T SHFT Lever Lock Immobilizer
	NO.26 10A	RR Wiper	NO.18 7.5A	A/Con O/S Mirror	NO.10 15A	OVPR	NO.2 7.5A	Cluster STICS
NO.33	NO.27 7.5A	Clock STICS Cluster	NO.19 15A	FRT Wiper FRT Washer	NO.11 15A		NO.3 15A	B/UP Lamp T/SIG Lamp
NO.34	NO.28 7.5A	Siren P/W Window	NO.20 15A	RR Wiper RR Washer	NO.12 10A	Stop Lamp (Trailer)	NO.4 7.5A	TCU TCCU
	NO.29 15A	Audio Multi Vision	NO.21 10A	Defogger Blower A/Con	NO.13 15A	Hazard Lamp	NO.5 7.5A	I/S Mirror ENG Preheat'G Auto Light
	NO.30 15A	Door Lock	NO.22 7.5A	Power Outlet O/S Mirror Clock	NO.14 10A	RR Fog Lamp	NO.6 10A	Speed Sensor
Fuse Puller	NO.31 15A	Start Motor	NO.23 7.5A	Audio Multi Vision Navigation	NO.15 10A	Interior Lamp	NO.7 10A	ABS ESP
	NO.32		NO.24 20A	Cigar Lighter	NO.16 20A	Stop Lamp	NO.8 10A	Air Bag
	20A	Spare Fuse	15A	Spare Fuse	10A	Spare Fuse	7.5A	Spare Fuse

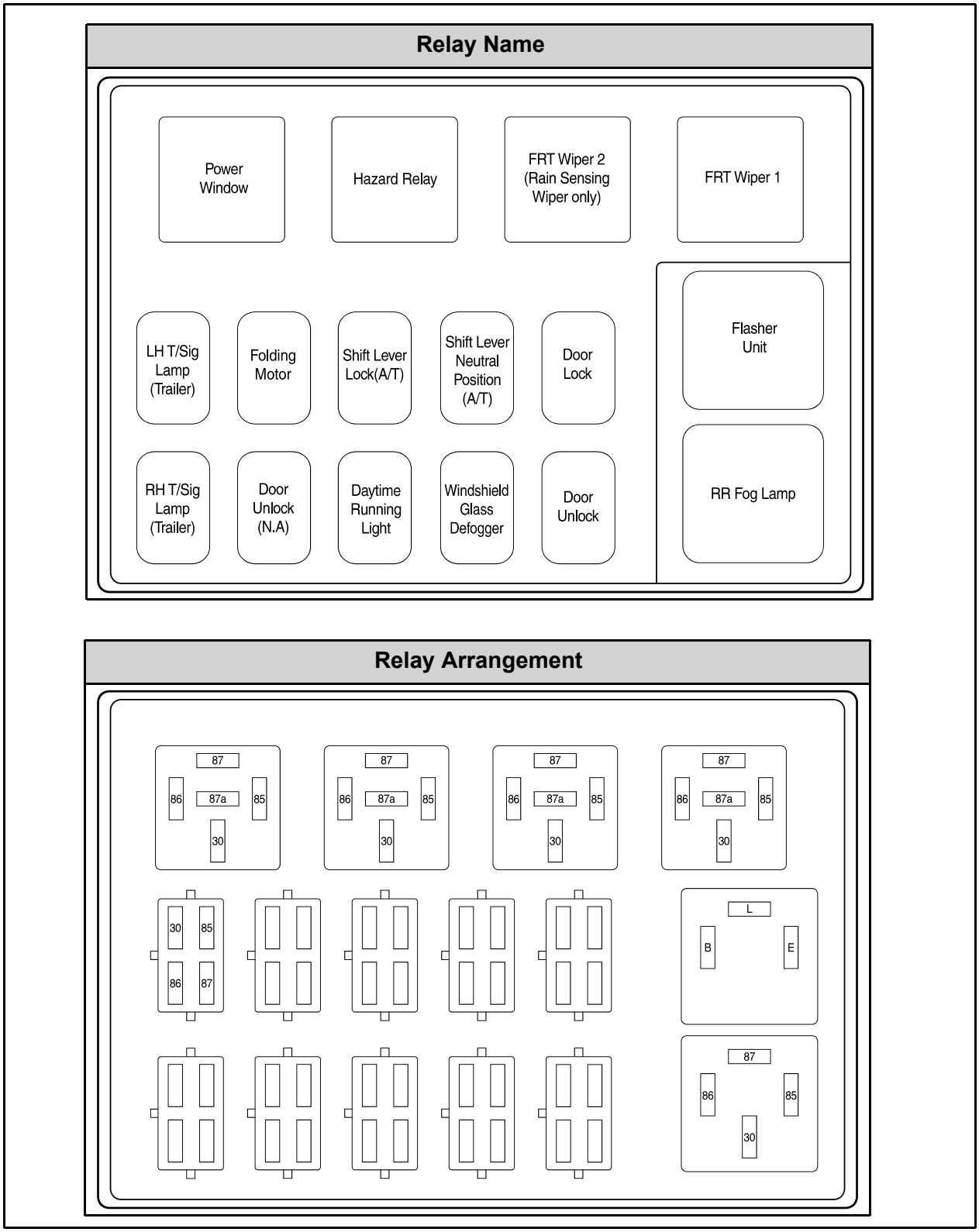
Fuse



Modification basis	
Application basis	
Affected VIN	

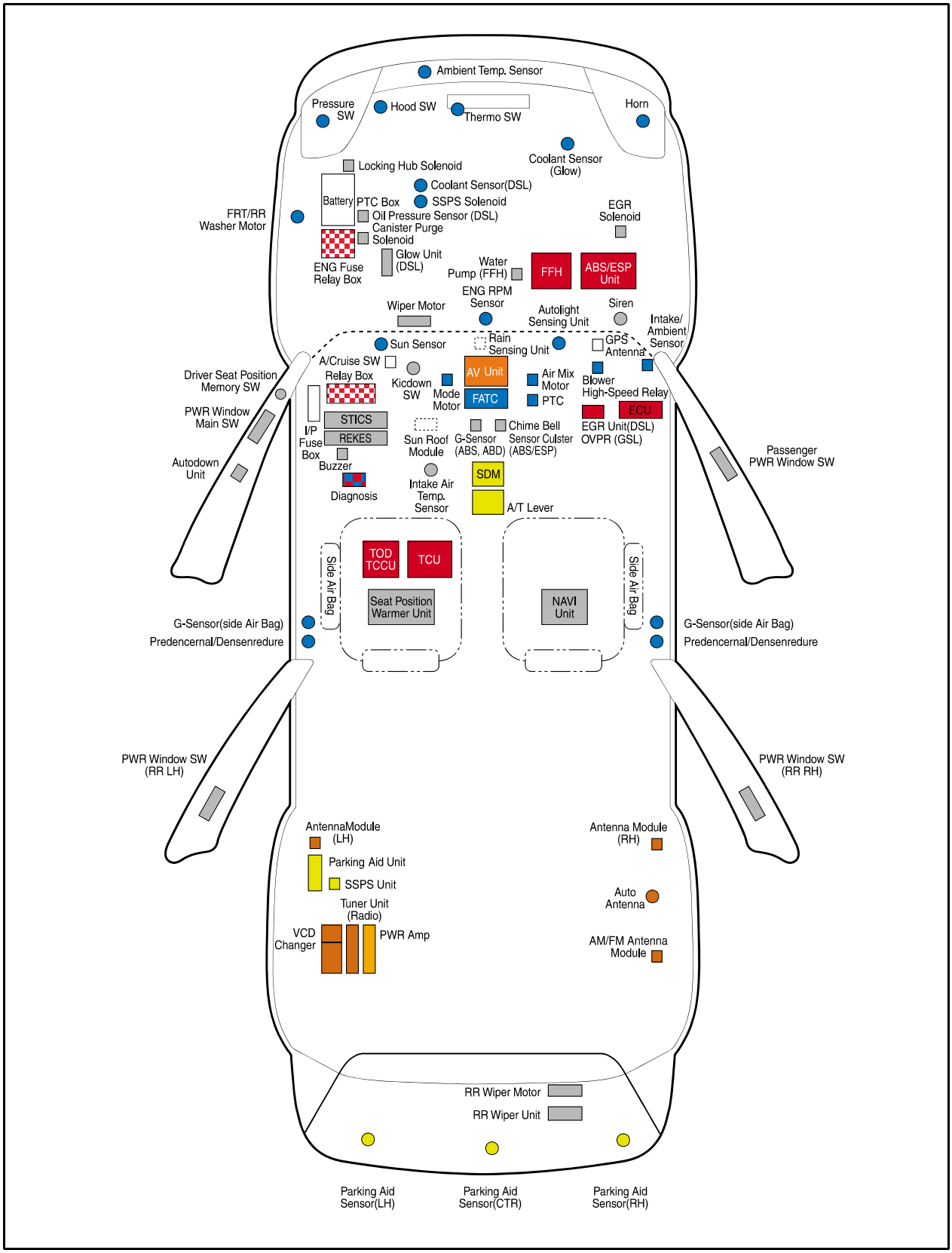
▶Interior Relay Box

It is installed behind the lower instrument panel.



Modification basis	
Application basis	
Affected VIN	

2. ELECTRIC COMPONENTS LOCATOR



FUSES AND RELAYS

undefined

Modification basis	
Application basis	
Affected VIN	

STICS

8710-01

GENERAL

1. SPECIFICATIONS

Description	Specification	Remark
Rated voltage	DC 12 V	
Operating voltage	DC 9 ~ 16 V	
Operating temperature	-30°C ~ +80°C	
Reserved temperature	-40°C ~ +85°C	
Max. operating humidity	95 %	
Resistible voltage	24 V	
Insulating resistance	No heat and fire due to the current leaks	Confined with PCB, waterproof and coating that require the insulation
Parasitic current	below 4.0 mA (MASK type) below 4.5 mA (OTP type)	IGN1 = OFF, IGN2 = OFF, Full output load = OFF, T x 30 seconds (after received the signals), No input changes for 2 seconds
Voltage drop	below 1.5 V	Pin no. 1 and 2, 3, 5, 7, 10, 14, 15, 20
	below 1.8 V	Pin no. 1 and 13, 23, 40, 51, 53
	below 2.0 V	Pin no. 1 and 12, 18, 19

2. RATED LOAD

Description	Rated Load
Wiper relay	DC12 V 250 mA (inducted load)
Power window relay	DC 12 V 200 mA (Inducted load)
Rear defogger relay	DC 12 V 200 mA (Inducted load)
Tail relay	DC 12 V 200 mA (Inducted load)
Hazard warning relay	DC 12 V 200 mA (Inducted load)
Start inhibit relay	DC 12 V 200 mA (Inducted load)
Lock relay	DC 12 V 200 mA (Inducted load)
Unlock relay	DC 12 V 200 mA (Inducted load)
Door unlock relay	DC 12 V 200 mA (Inducted load)
Room lamp	DC 12 V 16 W (Lamp load)
Door ajar warning lamp	DC 2.2 V 20 mW (LED load)
Parking brake warning lamp	DC 2.2 V 20 mW (LED load)
Seatbelt warning lamp	DC 2.2 V 20 mW (LED load)
Hey hole illumination	DC 12 V 1.2 W (Lamp load)
Siren	DC 12 V 250 mA (Inducted load)
Chime bell	DC 12 V 350 mA (Inducted load)
Buzzer	DC 12 V 40 mA (Inducted load)

3. CHATTERING OF INPUT SIGNALS

▶ **Vehicle speed input**

- The vehicle speed calculating time is 1.0 second. The elapsed time of 1.5 seconds after IGN1 switch "ON" is not included.

▶ **150 ms target input**

- Door lock switches, tailgate lock switch

▶ **80 ms target input**

- IGN1 switch, IGN2 switch, door switches, tailgate switch

▶ **40 ms target input**

- Inputs except 10 ms, 80 ms and 150 ms target inputs

▶ **20 ms target input Wiper motor stop, speed sensor**

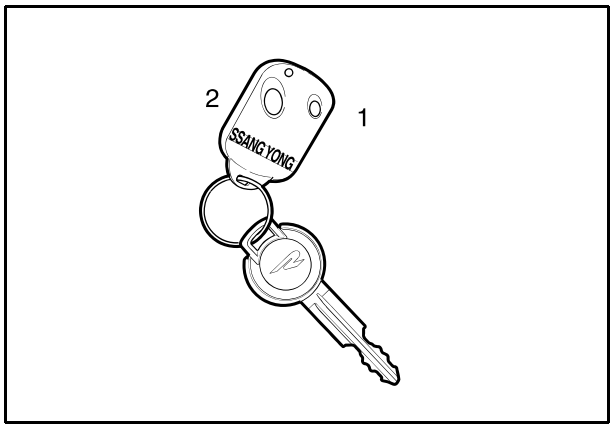
※ The time described for each function doesn't include the time from switch input change to chattering process.

Modification basis	
Application basis	
Affected VIN	

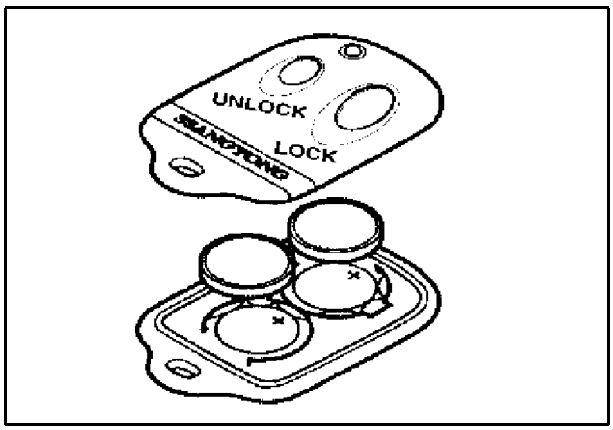
OVERVIEW AND OPERATION PROCESS

1. REMOTE KEYLESS ENTRY SYSTEM (REKES)

1) Function



1. UNLOCK button (1): Unlocks all doors.
2. LOCK button(2): Locks all doors.



▶ **Battery Replacement**

- Use a CR 2025 battery for replacement.

2) Immobilizer System

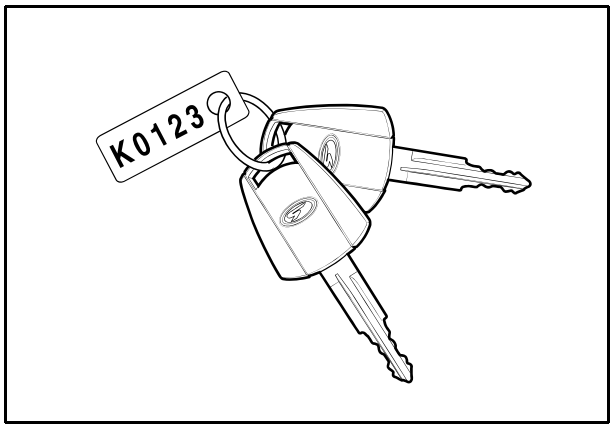
The Immobilizer System provides an additional theft deterrent to the vehicle in which it is installed and prevents it from being started by unauthorized persons.
When the ignition key with integrated transponder is turned to the ON position, ECU (Engine Control Unit) checks the crypto code of key and, if correct, allow the vehicle to start the engine. Only valid ignition keys can be used to start the engine. The immobilizer system isolates fuel injection control system in ECU (electric control unit) when invalid keys are used.

▶ Transponder code

- The 2 keys have respectively coded transponders.

▶ When lost the keys

- When lost the keys, the transponder key have to be erased from the engine control unit.



- The ignition key with immobilizer system has a key illumination lamp. It will help to find the door lock when dark.

CAUTION

- In any cases, the immobilizer system can not be removed from the vehicle.
  If you attempt to remove it and damage the system, starting will be impossible, so never attempt to remove, damage or modify it.
- Do not drop or shock to the transponder in the key, or it could be damaged.

▶ When the transponder has damaged

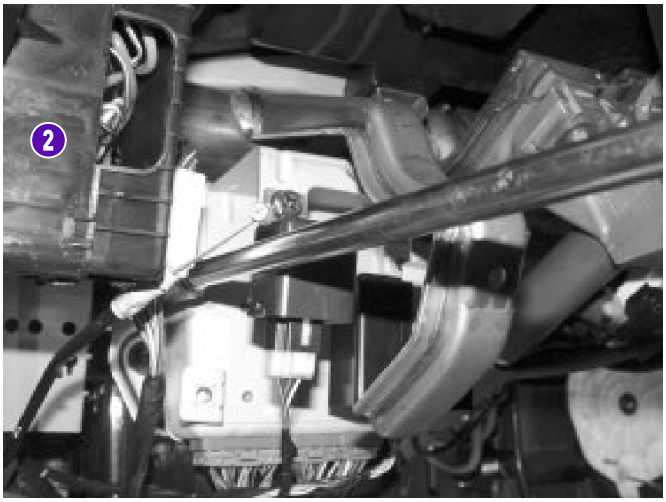
- When the transponder has damaged, replace it with new one and register new code on engine control unit at our authorized service network. Otherwise, the engine cannot be started.

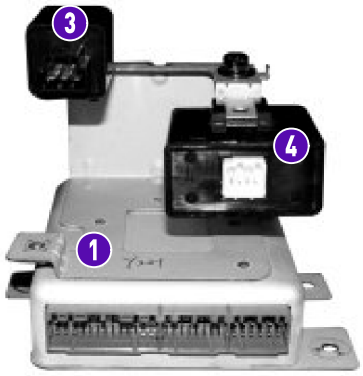
CAUTION

- In any cases, the immobilizer system can not be removed from the vehicle.
  If you attempt to remove it and damage the system, starting will be impossible, so never attempt to remove, damage or modify it.
- Do not drop or shock to the transponder in the key, or it could be damaged.
- If the transponder has damaged, replace the key and register the code to the engine control unit to be started.
- When replacing the engine control unit, replace all transponders at the same time.

Modification basis	
Application basis	
Affected VIN	

2. REKES + STICS (RKSTICS) COMPONENTS LOCATOR





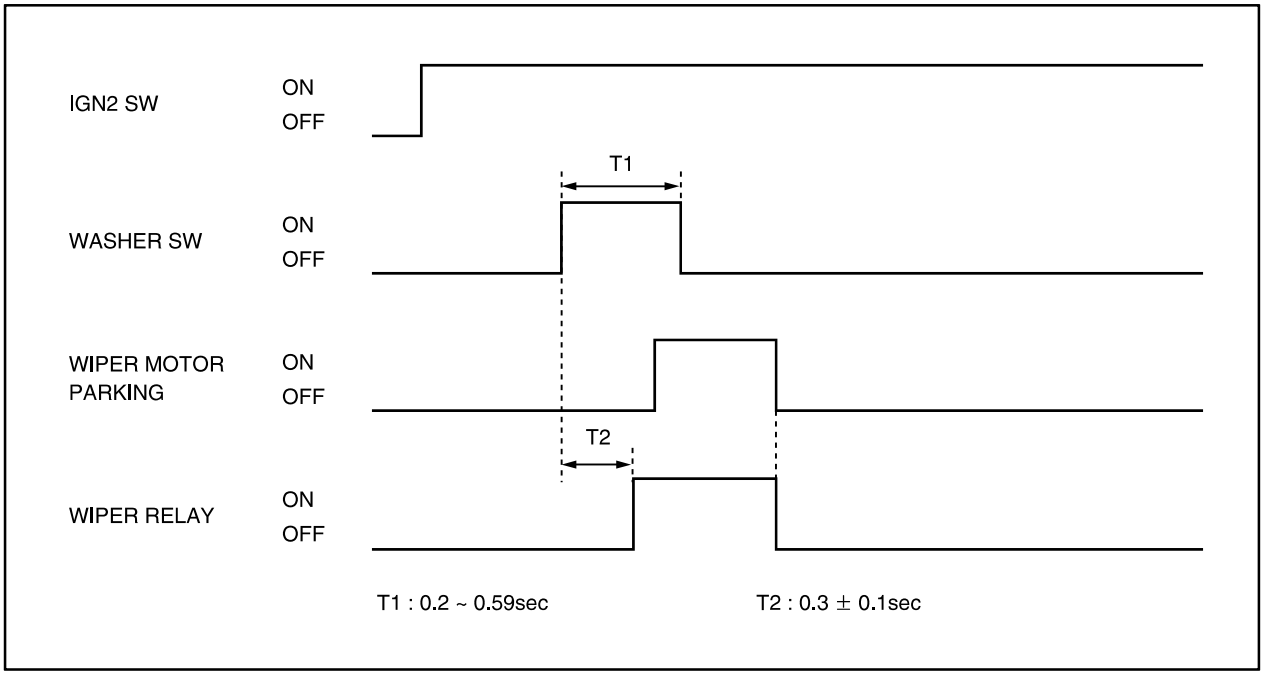
1. RK-STICS
2. Interior fuse box
3. Buzzer
4. Outside mirror folding unit

3. REKES + STICS (RKSTICS) OPERATING PROCESS

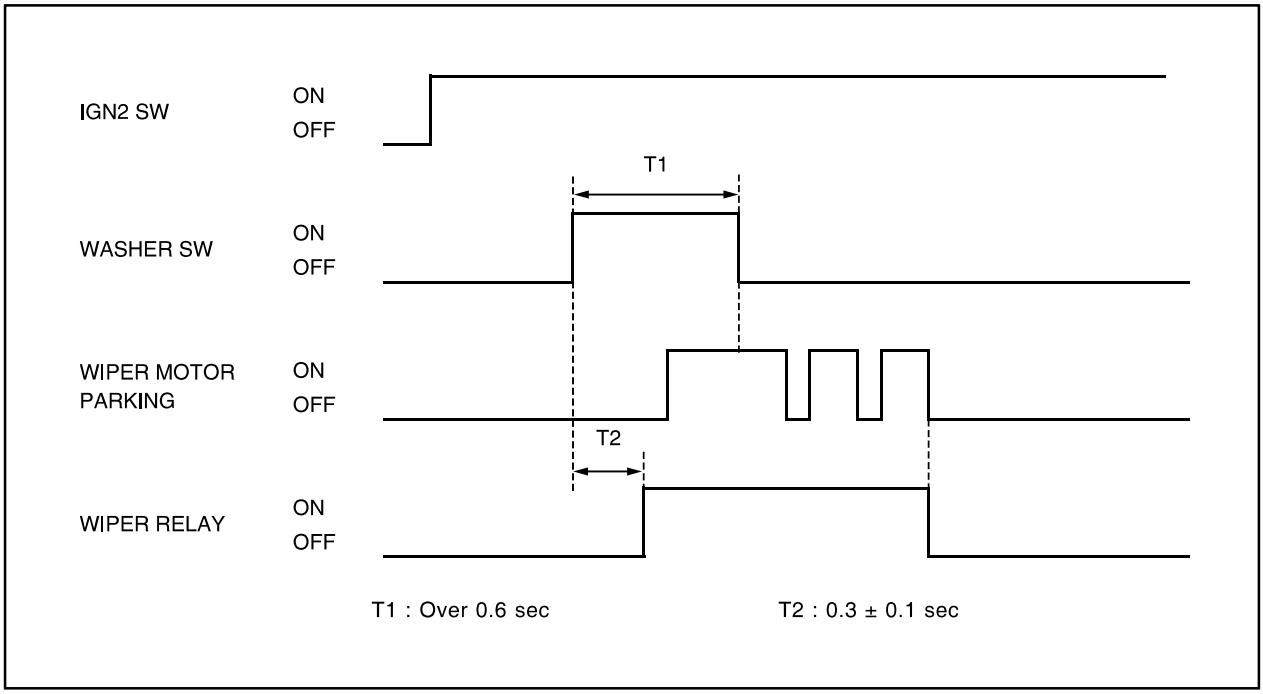
1) Wiper Control

▶Wiper MIST and Washer Coupled Wiper

1. The wiper MIST and washer coupled wiper output is "ON" when turning "ON" the washer switch for 0.2 ~ 0.59 seconds.

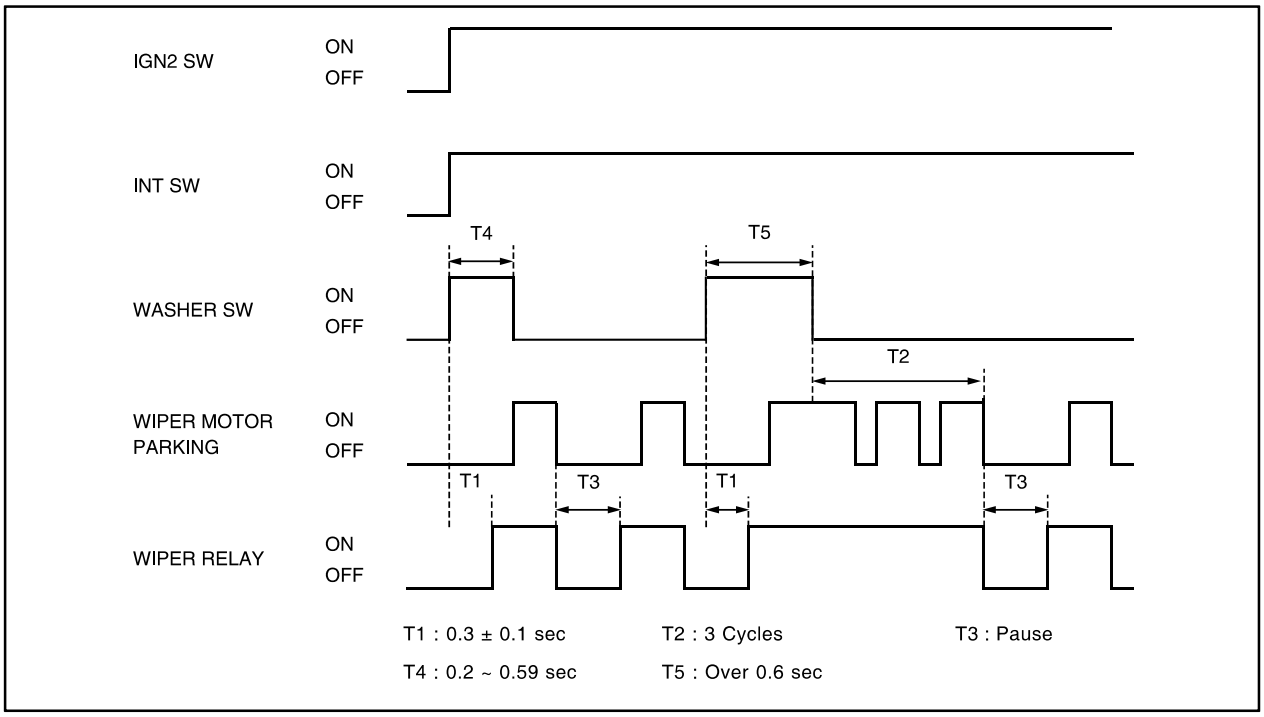


2. The wiper MIST and washer coupled wiper output is "ON" when turning "ON" the washer switch for over 0.6 seconds.



Modification basis	
Application basis	
Affected VIN	

3. If turning "ON" the washer switch for over 0.6 seconds while the intermittent wiper is operating, the wiper relay turns "ON" from T2 after the washer switch is turned "ON" and it is turns "OFF" from 3 cycles after the washer switch is turned "OFF".
4. If turning "ON" the washer switch for 02 ~ 0.59 seconds while the intermittent wiper is operating, the wiper relay turns "OFF" from T2 after the washer switch is turned "ON".



CAUTION

▶ Cautions for wiper control

▷ Wiper MIST and washer coupled wiper

- When turning on the washer switch while the wiper relay is operating.
  · If the wiper relay "ON" request time is shorter than the remained "ON" time, it is disregarded.

▷ Speed sensitive INT (intermittent) wiper

- The wiper relay continues to output for remaining "ON" time even when the INT switch is turned off.
- IGN 2 switch "ON", INT switch "OFF": resume the intermittent time when turning "ON"
- IGN 2 switch "OFF", INT switch "ON": resume the intermittent time when turning "ON"

▷ Controls when the wiper motor parking is defective

- The wiper relay continues to output when the parking terminal is fixed at the ground or IGN while the wiper relay is "ON" (INT switch = ON or Washer switch = ON)

▷ Controls when the wiper motor parking is defective

- The wiper relay continues to output when the parking terminal is fixed at the ground or IGN while the wiper relay is "ON" (INT switch = ON or Washer switch = ON)

▶ Speed Sensitive INT (intermittent) Wiper

▷ Controls the wiper intermittent operation by the values from vehicle speed and volume

- Calculates and converts the intermittent time automatically by using the vehicle speed and INT VOLUME when IGN 2 switch is "ON" and INT switch is "ON".

▷ Vehicle speed calculation

- Uses a faster vehicle speed than previous vehicle speed to calculate the intermittent time.

V = max (Vnew, Vold) Vnew : current vehicle speed value
Vold : previous vehicle speed value
V : vehicle speed for calculation

- If the vehicle speed is over 150 km/h, the value is regarded as 150 km/h.

[Input the vehicle speed]
It is calculated by the numbers of input pulses for one second.

$$1\ [\text{pulses/sec}] = \frac{60\ [\text{Km/h}] \times 60\ [\text{sec}]}{637\ \text{pulses}} \quad 1.41\ [\text{Km/h}]$$

▷ VOLUME calculation

- Calculates the INT VOLUME as 5 grades.

Volume	Resistance	Remark
0 %	below 7.7 k	FAST
25 %	7.8 k ~ 19.5 k	
50 %	19.6 k ~ 31.3 k	
75 %	31.4 k ~ 43.1 k	
100 %	43.2 ~ 55 k	SLOW

- VOLUME value has a hysteresis as below.
  When the VOLUME value goes over the upper grade and goes below the lower grade, the grade is changed.
  EX) When the VOLUME value in 25 % goes over 18 kΩ it will be 50 %, and the VOLUME
- value in 50 % goes below 13 kΩ it will be 25 %.
  When the VOLUME value is over 2.5 V, it is regarded as 2.5 V.

Modification basis	
Application basis	
Affected VIN	

▷ Pause time calculation

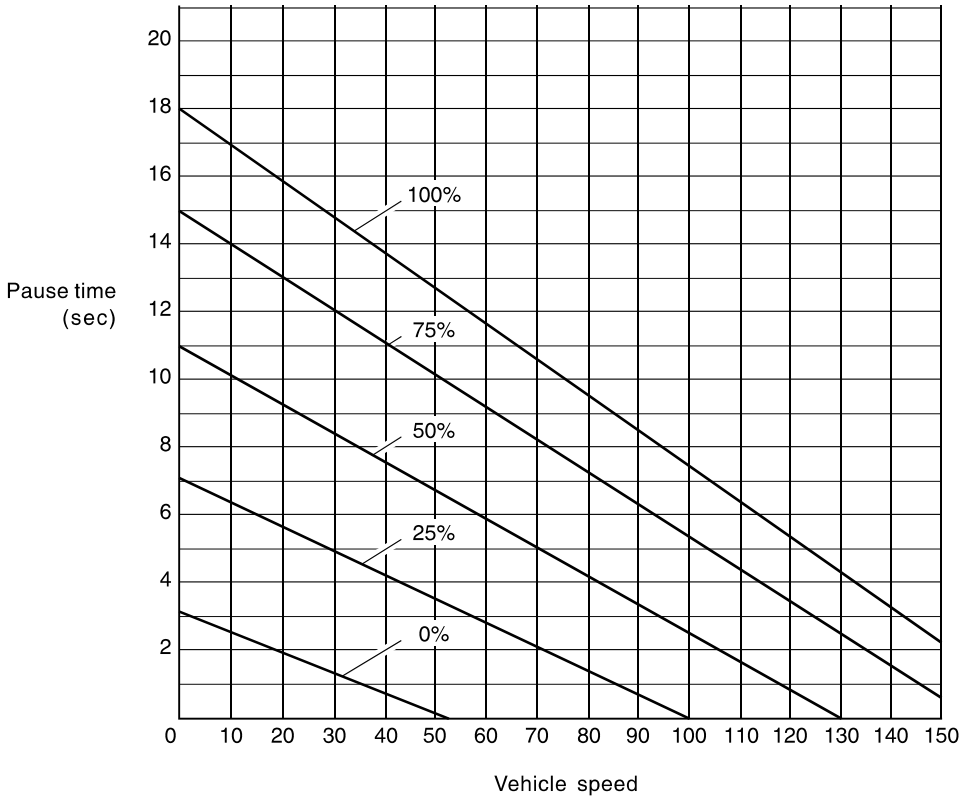
- Pause time: the duration that wipers are stopped at parking position
- Elapsed time: the duration after the wiper motor started to operate from parking position
- The pause time is calculated by the vehicle speed and VOLUME value.

. The changes of pause time is immediately applied.
If the elapsed time is greater than the current intermittent time, the wiper relay turns on immediately.

. If the pause time is below 1.0 second, the wiper operates without pause.
However, in continuous operation, the wiper start to operate intermittently from when the pause time goes over 1.5 seconds.

Pause time table of vehicle speed coupled INT wiper

SPEED / VIR Resistance	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
100%	19.00	17.88	16.76	15.64	14.52	13.40	12.28	11.16	10.04	8.92	7.80	6.68	5.56	4.44	3.32	2.20
75%	15.00	14.02	13.04	12.06	11.08	10.10	9.12	8.14	7.16	6.18	5.20	4.22	3.24	2.26	1.28	0.30
50%	11.00	10.16	9.32	8.48	7.64	6.80	5.96	5.12	4.28	3.44	2.60	1.76	0.92	0.08	0.00	0.00
25%	7.00	6.30	5.60	4.90	4.20	3.50	2.80	2.10	1.40	0.70	0.00	0.00	0.00	0.00	0.00	0.00
0%	3.00	2.44	1.88	1.32	0.76	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

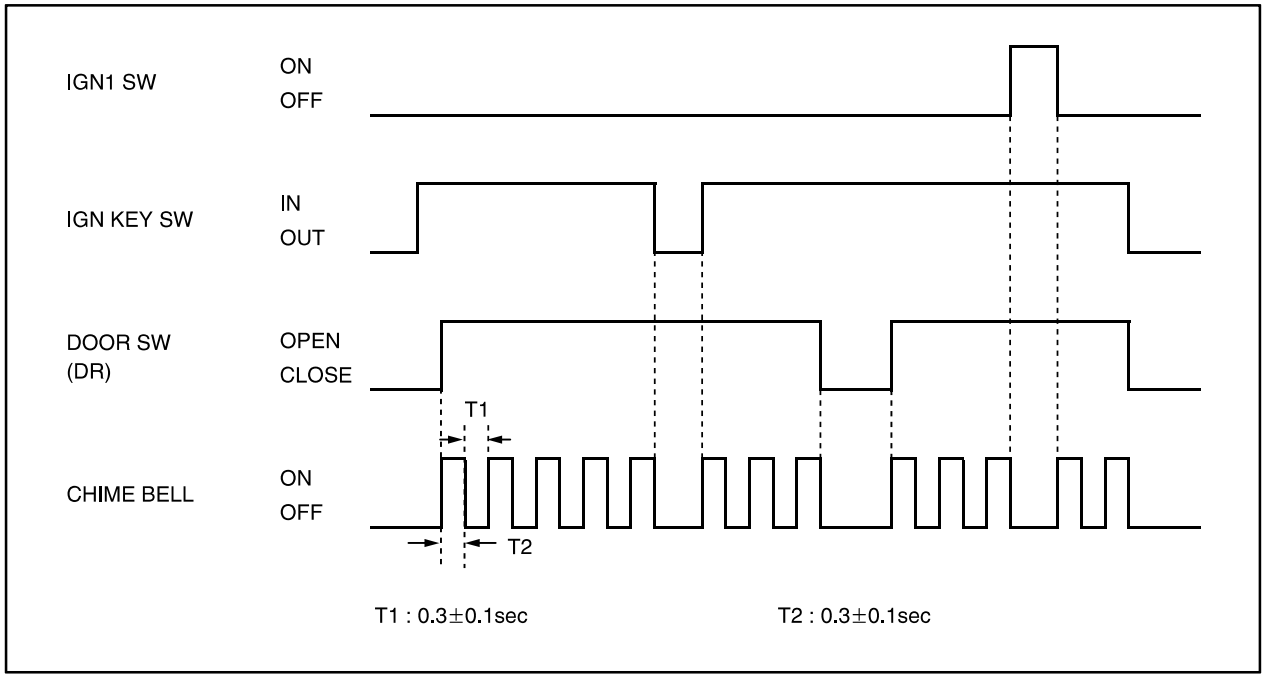


2) Ignition Key Reminder

- The ignition key reminder warning has priority over the "MARKER LAMP LEFT ON WARNING".

▶ Chime Bell Control

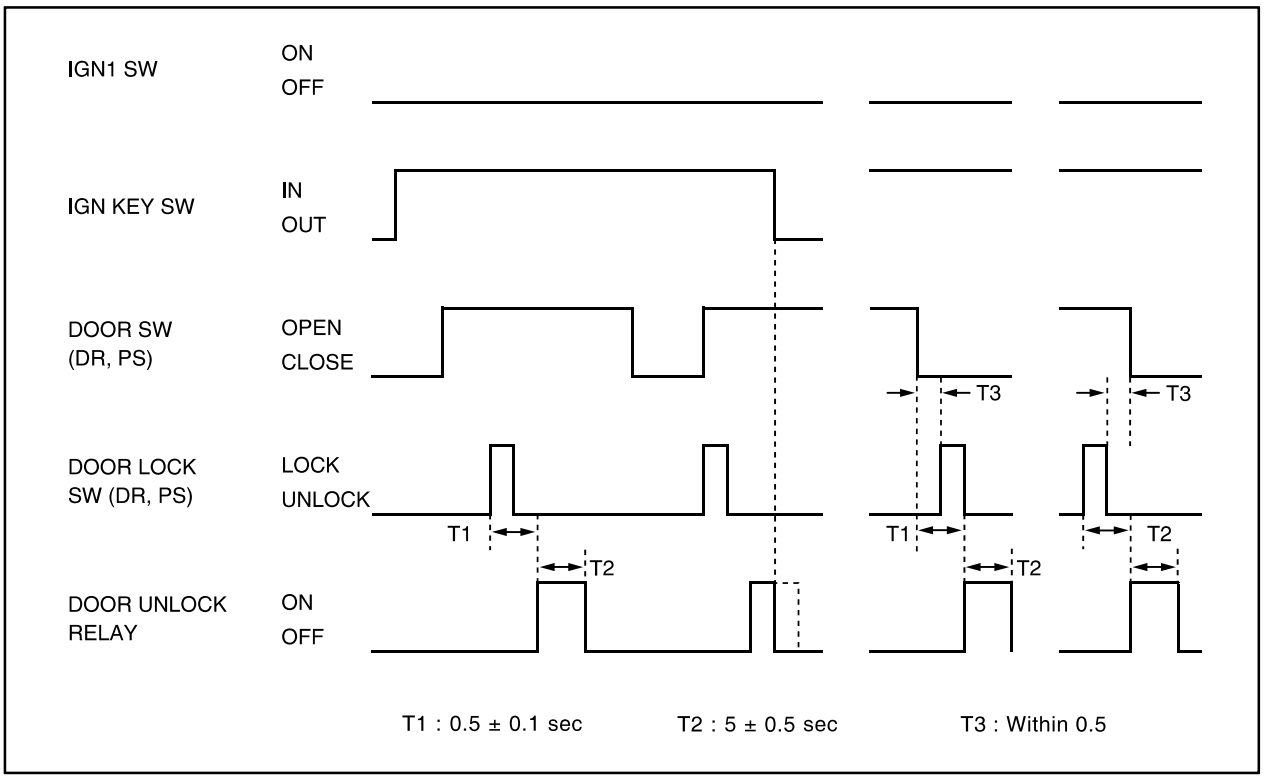
- The chime bell output is "ON" when opening the driver's door while the ignition key is inserted into ignition switch.
- In above conditions, the chime bell output is "OFF" when closing the driver's door or removing the ignition key from ignition switch.
- This function is not available when the IGN 1 switch is "ON".



Modification basis	
Application basis	
Affected VIN	

▶ Door Control

- The door unlock relays output is "ON" when the driver's door lock switch turns "ON" while the ignition key is inserted into ignition switch and the driver's door opens.
- The door unlock relays output is "ON" when the passenger's door lock switch turns "ON" while the ignition key is inserted into ignition switch and the passenger's door opens.
- The door unlock relay output is "ON" when the door lock switch turns "ON" within T3 after closing door while the ignition key is inserted into ignition switch and driver's door opens.
- The door unlock relay output is "ON" when closing the door within T3 after turning "ON" the door lock switch while the ignition key is inserted into ignition switch and driver's door opens.
- The unlock relay output is "ON" when any of unlock conditions are changed within T1.
- The unlock relay output will not be "ON" when removing the ignition switch from the ignition switch from T1 after changing the conditions.
  (The output is "OFF" when removing the ignition key with unlocked for 5 seconds)
  (This function is not available when IGN 1 switch is "ON" and vehicle speed is over 3 km/h)

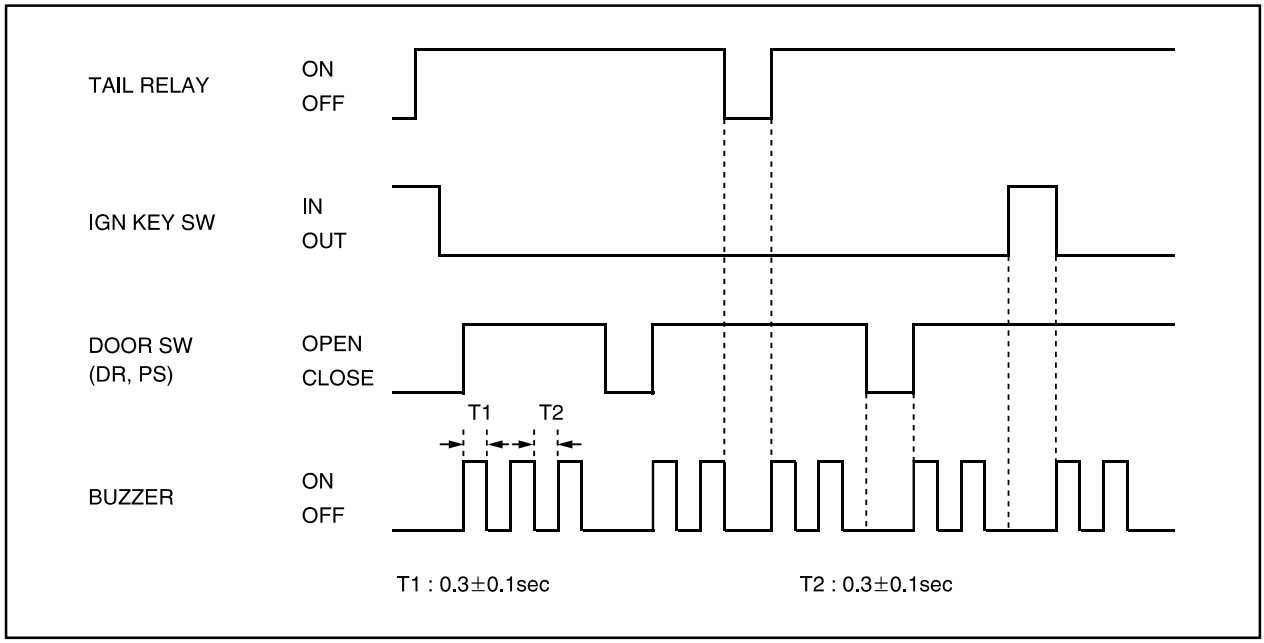


DR : Driver's door
PS : Passenger's door
RR : Rear door

3) Mark Lamp Left On Warning

▶ **Buzzer Control**

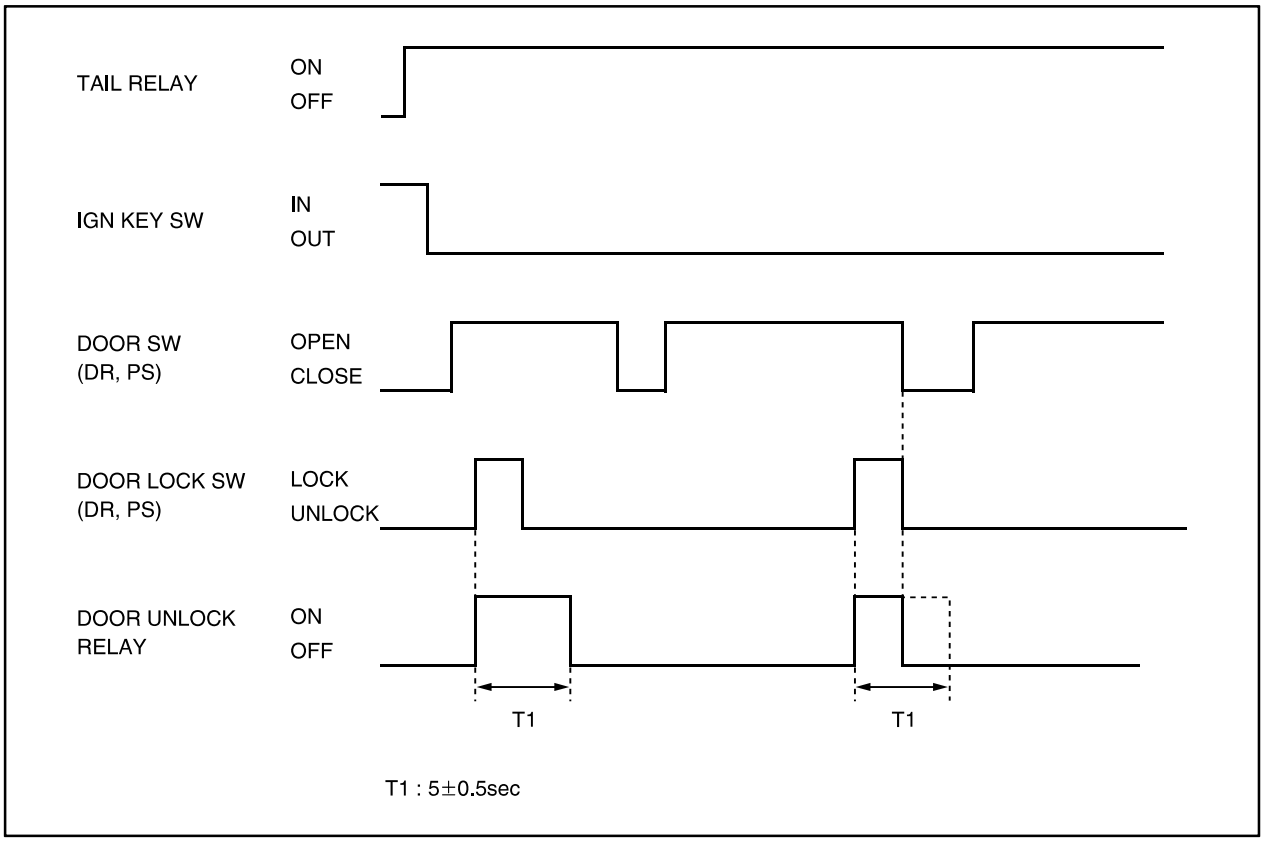
- The buzzer output is "ON" when opening the driver's door or passenger's door while the tail lamp relay turns "ON" and the ignition key is removed.
- The buzzer output is "OFF" when any of above conditions are not met.
- This function is not available when IGN 1 is "ON".
- This function is not available when the tail lamp relay output is "OFF" by the battery saver function.



Modification basis	
Application basis	
Affected VIN	

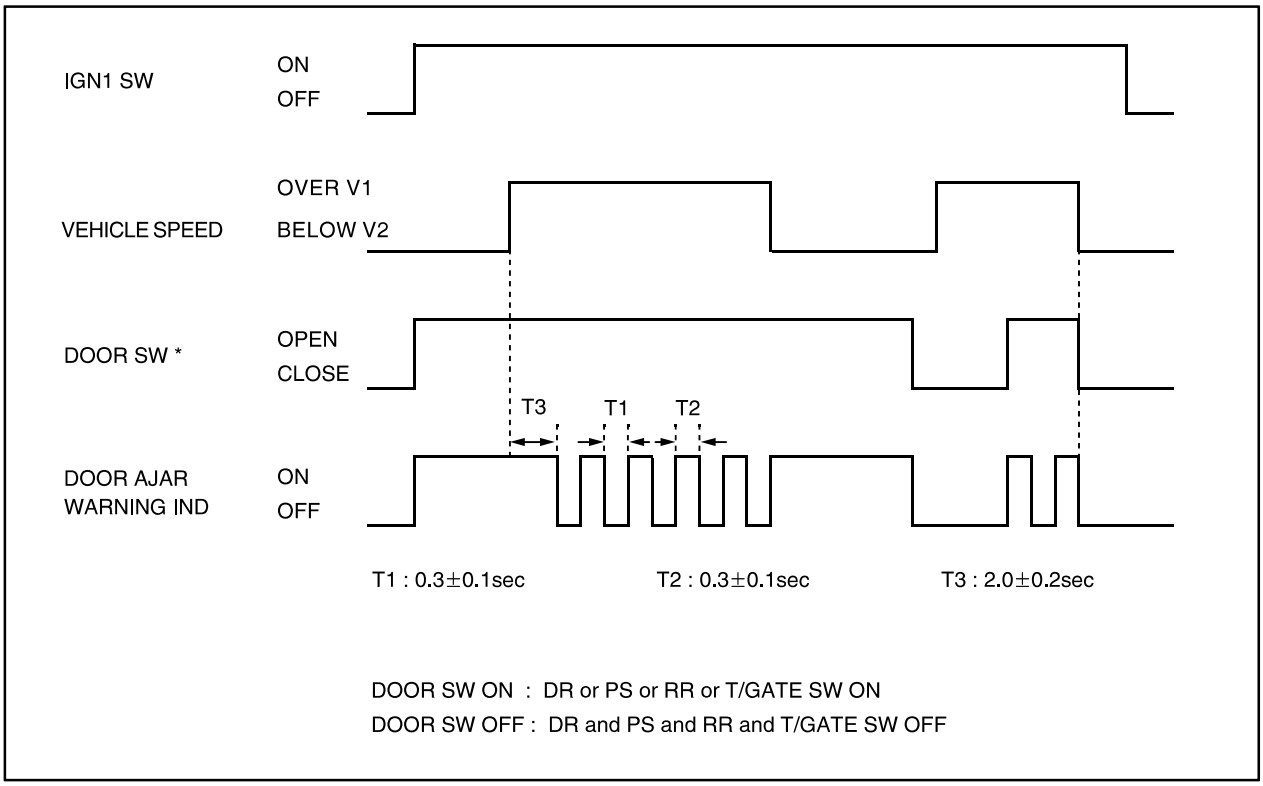
▶ Door Control

- The door unlock relay output is "ON" when opening the driver door or passenger's door and locking the door lock switch while the tail lamp relay output is "ON" and the ignition key is removed.
- The door unlock relay output is "OFF" when closing both doors or turning off the tail lamp switch.
- This function is not available when IGN 1 is "ON".
- This function is not available when the tail lamp automatically turns off.



4) Door Ajar Warning

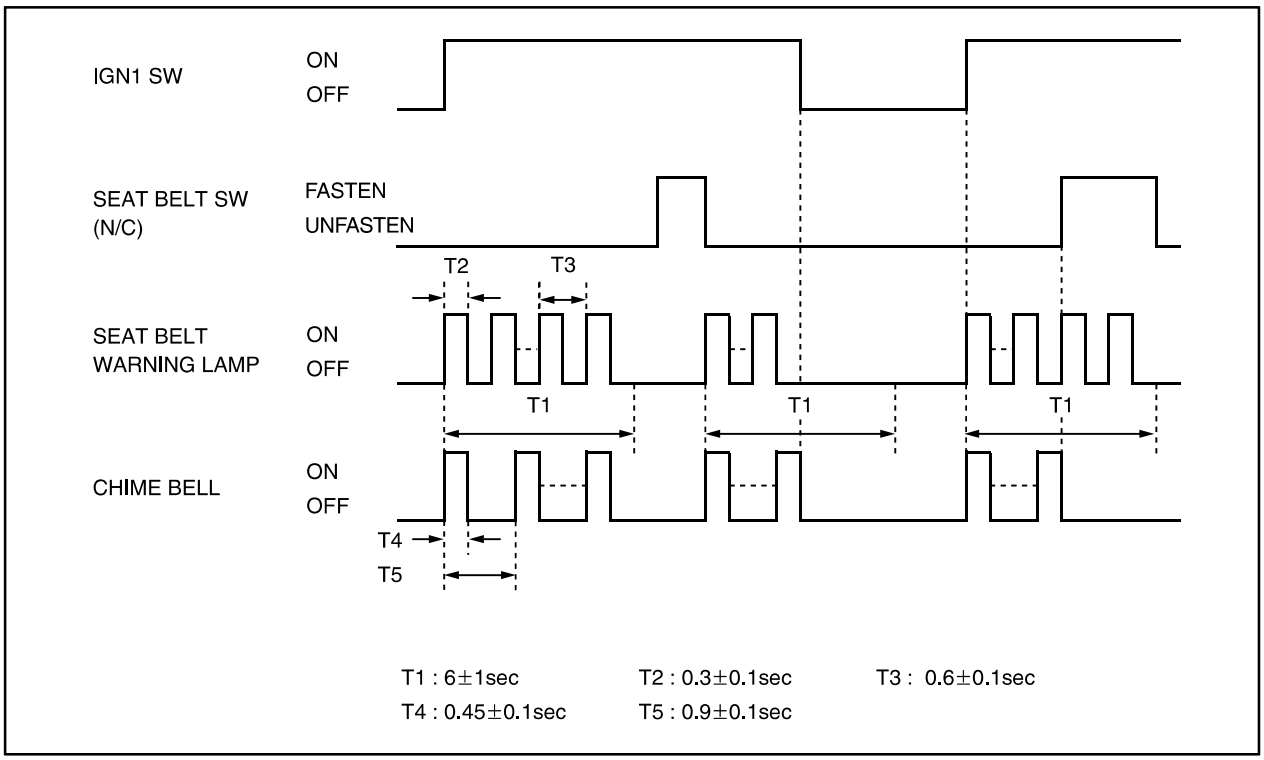
- The warning lamp comes on when opening a door while the vehicle speed is below 3 km/h.
- The warning lamp blinks when opening a door while the vehicle speed is over V1 (10 km/h).
- The warning lamp goes off when closing the door (in step 1 and step 2).
- The warning lamp comes on when the vehicle speed is below V1 (in step 2).
- This function is not available when IGN 1 is "OFF". (However, the vehicle speed can be detected from 1.5 seconds after turning "ON" the IGN 1 switch.)



Modification basis	
Application basis	
Affected VIN	

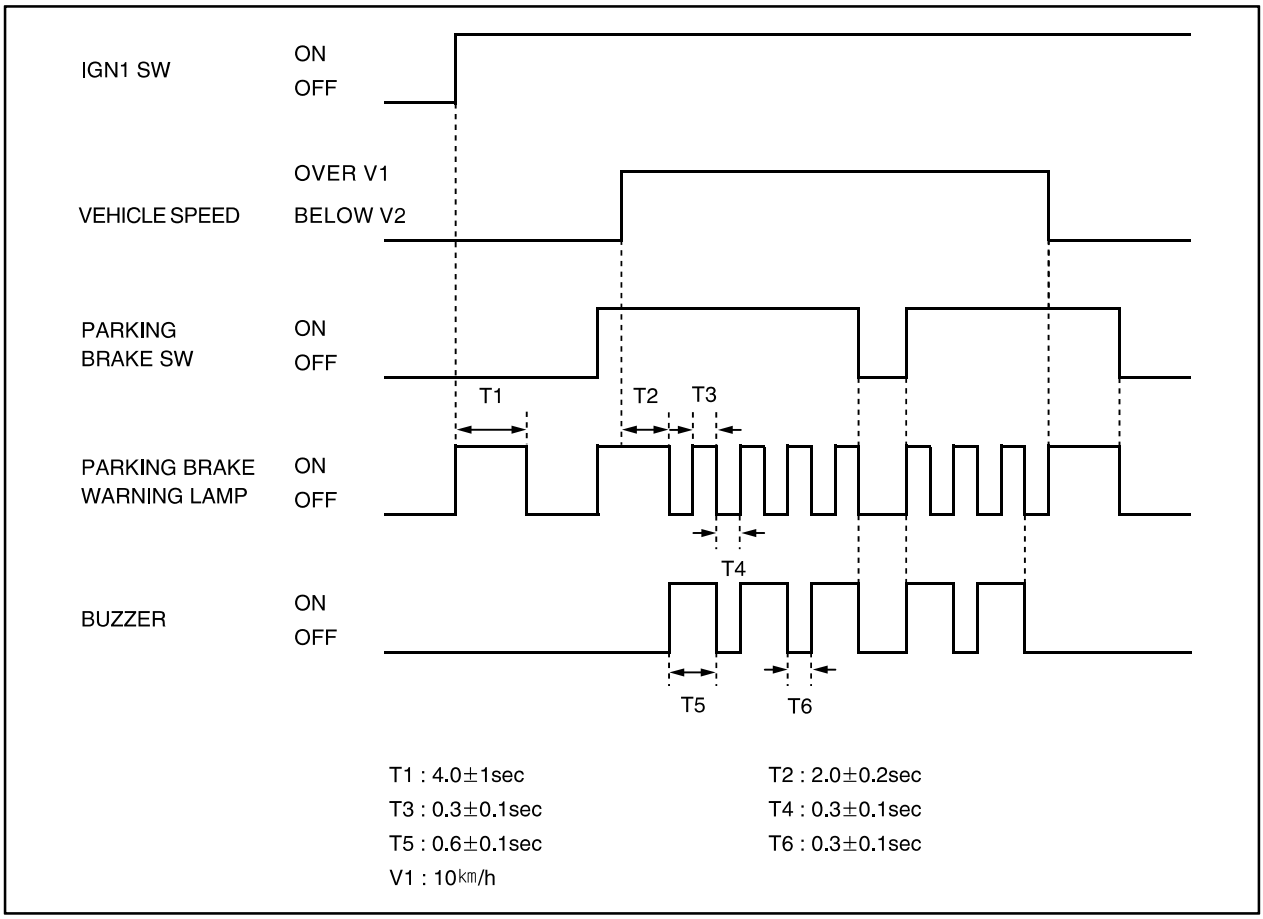
5) Seatbelt Warning Timer

- The seatbelt warning lamp comes on and the chime bell sounds for 6 seconds when turning "ON" the IGN 1 switch.
- The seatbelt warning lamp goes off and the chime bell stops when turning "OFF" the IGN 1 switch during the warning operation.
- The chime bell stops and the seatbelt warning lamp stays on for the specified duration (6 seconds) when fastening the seatbelt during the warning operation.
- The seatbelt warning lamp comes on and the chime bell sounds when unfastening the seatbelt with IGN 1 switch "ON".



6) Parking Brake Warning

- The parking brake warning lamp comes on for approx. 4 seconds when turning "ON" the IGN 1 switch regardless of the vehicle speed and parking brake switch position. After this 4 seconds, the warning lamp comes on, goes off and blinks according to the vehicle speed and parking brake switch position.
- The warning lamp comes on when the parking brake switch output is "ON" while the vehicle speed is below V1.
- The warning lamp blinks and the buzzer sounds when the vehicle speed is over 10 km/h for 2 seconds with the warning lamp "ON" and when turning "ON" the parking brake switch while the vehicle is over 10 km/h (PARKING START WARNING).
- The warning lamp comes on and the buzzer stops when the vehicle speed goes down below V1 in step 3.
- The warning lamp goes off and the buzzer stops when turning "OFF" the parking brake switch with step 3.
- The warning lamp and the buzzer do not work when the IGN 1 switch output is "OFF". (However, the vehicle speed can be detected from 1.5 second after turning "ON" the IGN 1 switch.)

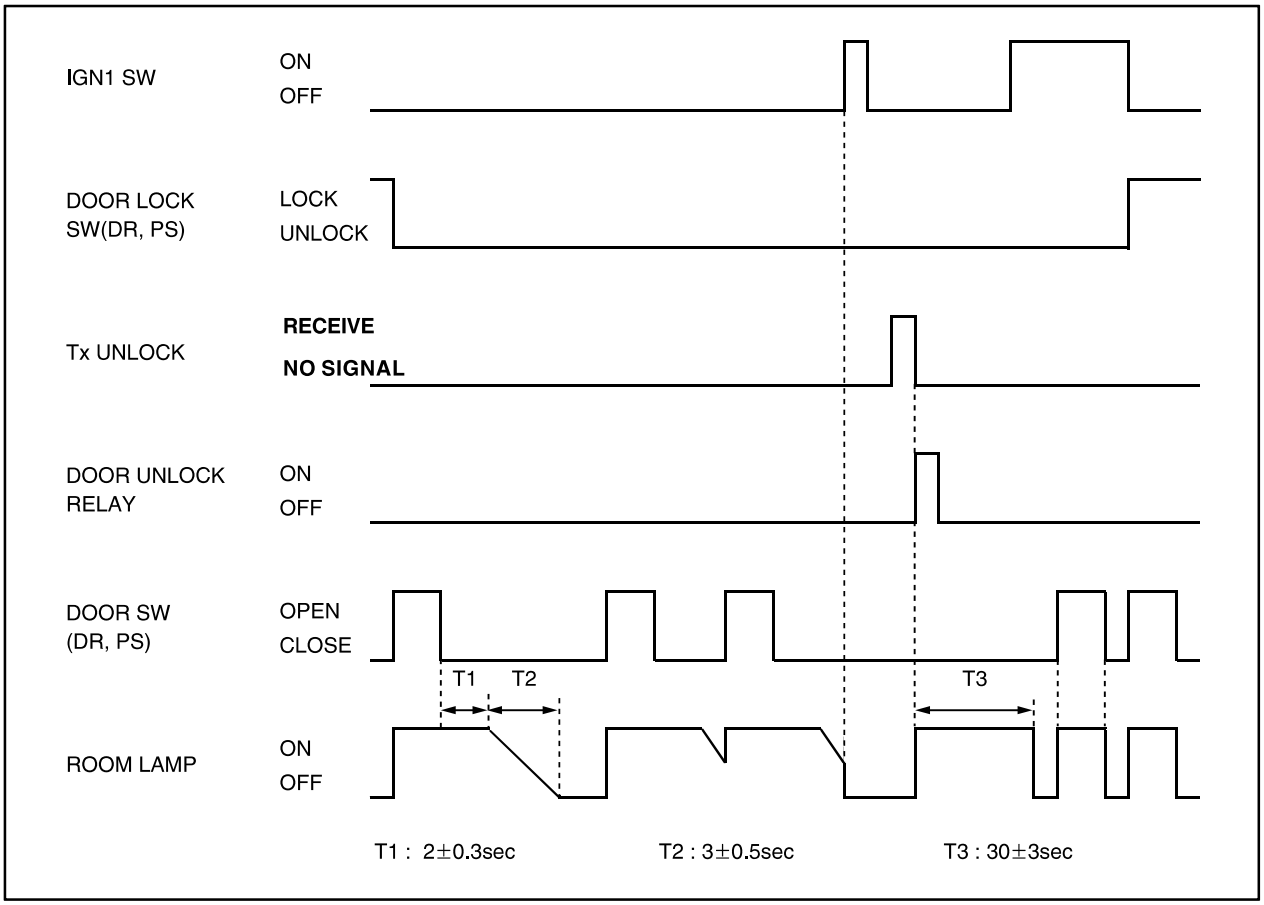


T1 : 4.0±1sec
T2 : 2.0±0.2sec
T3 : 0.3±0.1sec
T4 : 0.3±0.1sec
T5 : 0.6±0.1sec
T6 : 0.3±0.1sec
V1 : 10㎞/h

Modification basis	
Application basis	
Affected VIN	

7) Decayed Room Lamp Timer

- The room lamp comes on when opening the door while the room lamp switch is at coupled operating position, IGN 1 switch output is "OFF" and the driver's and passenger's door switch are at unlock position.
- The room lamp prolongs its operation time for T1 and decays for T2 when closing the door in step 1.
- The decaying operation must have greater than 32 steps per one second.
- The room lamp comes on again when opening the door within T2. And, the room lamp prolongs its operation time for T1 and decays for T2 when closing the door within T2.
- The room lamp output immediately stops when turning "ON" the IGN 1 switch while decaying operation.
- The room lamp comes on for 30 seconds when receiving the unlock signal from remote control key while the door is closed.
- The output prolongs 30 seconds when receiving the unlock signal from remote control key while outputting in step 6.
- The room lamp immediately goes off when opening and then closing the door while the IGN 1 switch output is "ON".
- The room lamp immediately goes off when closing the driver's/passenger's door while the driver's/passenger's door lock switch is at lock position.

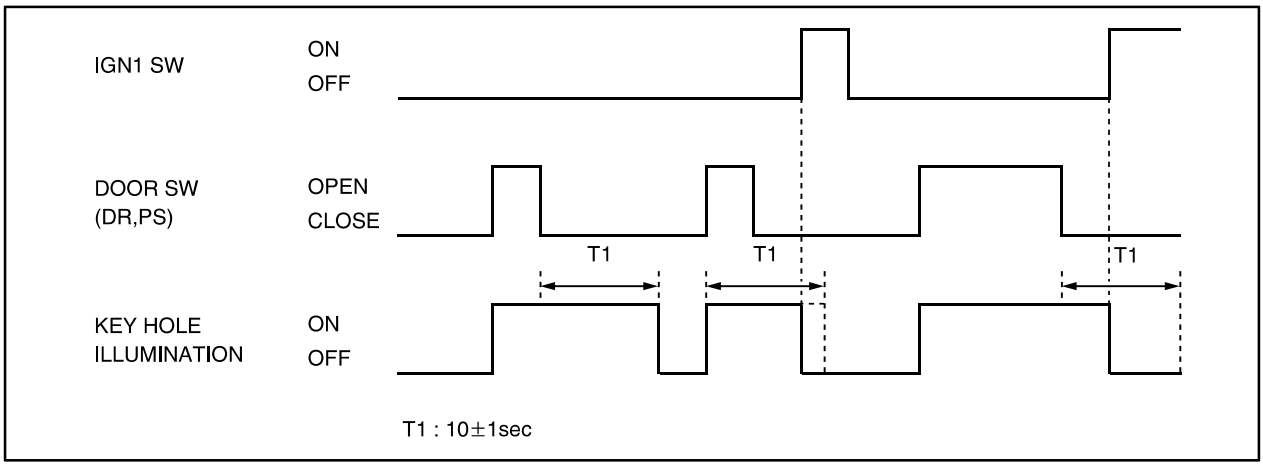


8) Ignition Key Hole Illumination

- The ignition key hole illumination comes on when opening the door while the ignition key is removed.
- The ignition key hole illumination stays on 10 seconds after closing the door in step 1.
- The ignition key hole illumination stops when turning "ON" the IGN 1 switch or when receiving the lock signal from remote control key within 10 seconds.

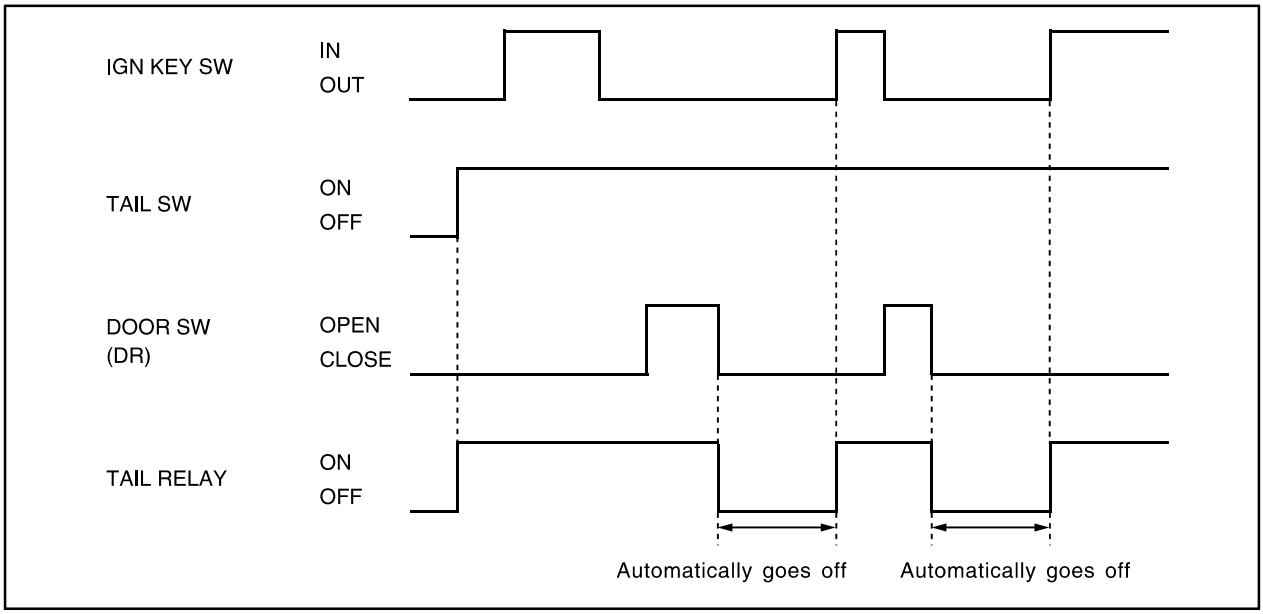
CAUTION

- This function is not available in the immobilizer equipped vehicle.



9) Battery Saver

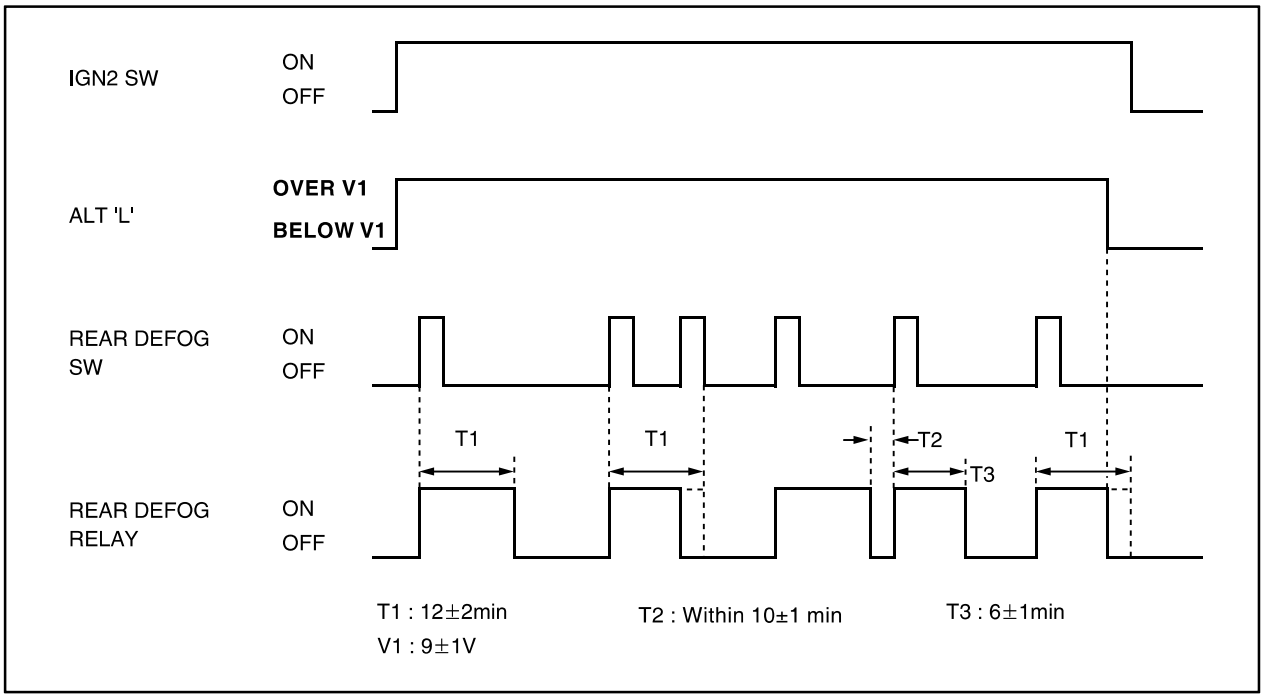
- The tail lamp relay output is "OFF" when removing the ignition key from the ignition switch and opening and then closing the door while the tail lamp is coming on.
- The tail lamp relay output is "OFF" when inserting the ignition key into the ignition switch after completion of step 1.



Modification basis	
Application basis	
Affected VIN	

10) Rear Defogger Timer

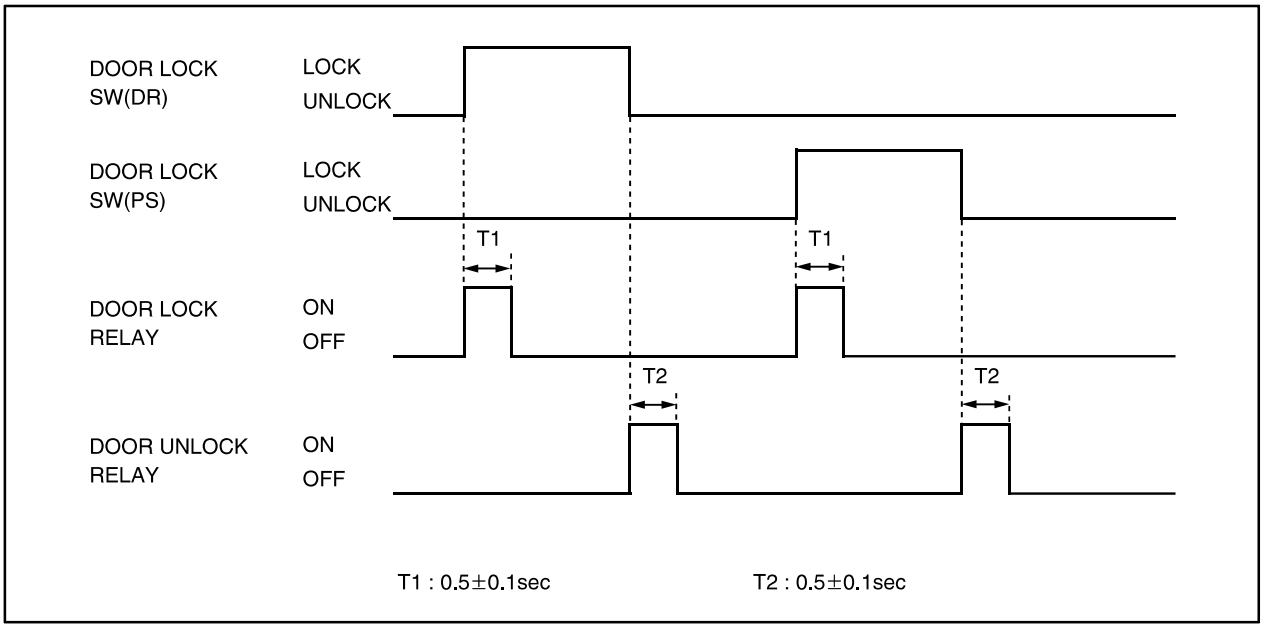
- The rear defogger output is "ON" when turning "ON" the rear defogger switch while the IGN 2 switch is "ON" (with engine running).
- The output is "OFF" when turning "ON" the rear defogger switch again during outputting.
- The output is "ON" only for T3 when turning "ON" the rear defogger switch within T2 after completion of output. This can be done only once.
- The output is "OFF" when the IGN 2 switch is "OFF" or the ALT 'L' terminal is below V1.



11) Door Lock/Unlock Control

▶Door Lock/Unlock by Door Lock Switch

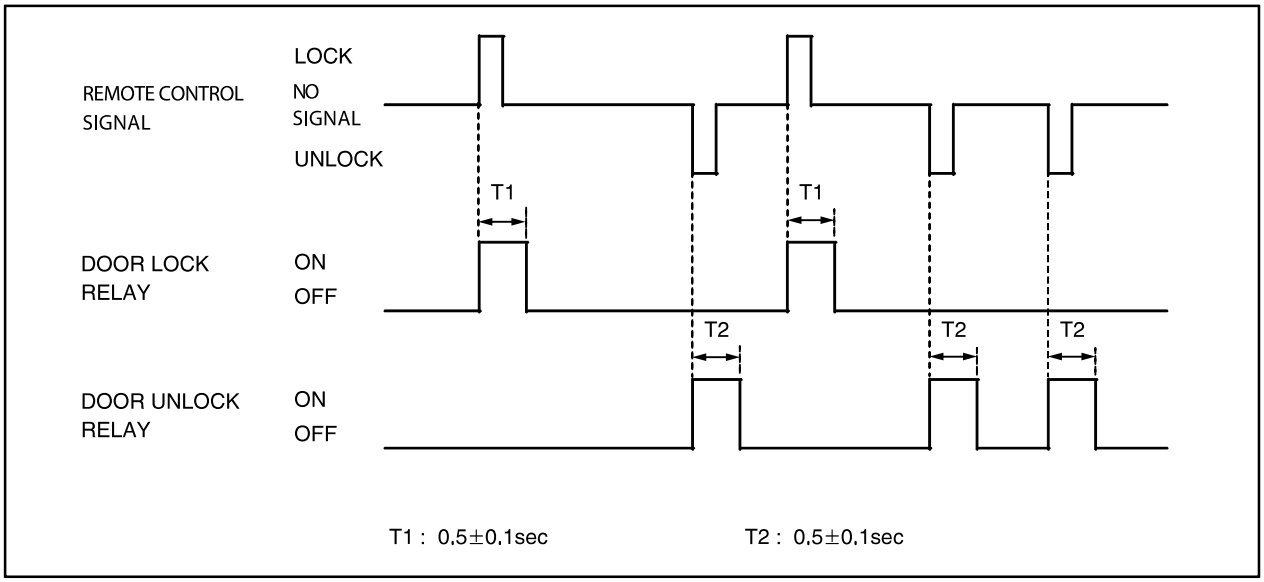
- The door lock output is "LOCK" for T1 when positioning the driver's or passenger's door lock switch to lock position.
- The door lock output is "UNLOCK" for T2 when positioning the driver's or passenger's door lock switch to unlock position.
- The changes of locking position are disregarded when outputting the "LOCK" or "UNLOCK" by other functions.
- The door lock/unlock is not operating regardless of the door lock switch positions when connecting to battery.
- If the LOCK/UNLOCK conditions are generated along with IGN KEY REMINDER conditions, outputs only when the ignition key is removed (after 0.5 seconds).
- In case of operation by the outside door lock control (key operation), outputs same with step 1 and step 2.
- The signal shorter than 0.15 seconds is disregarded.



Modification basis	
Application basis	
Affected VIN	

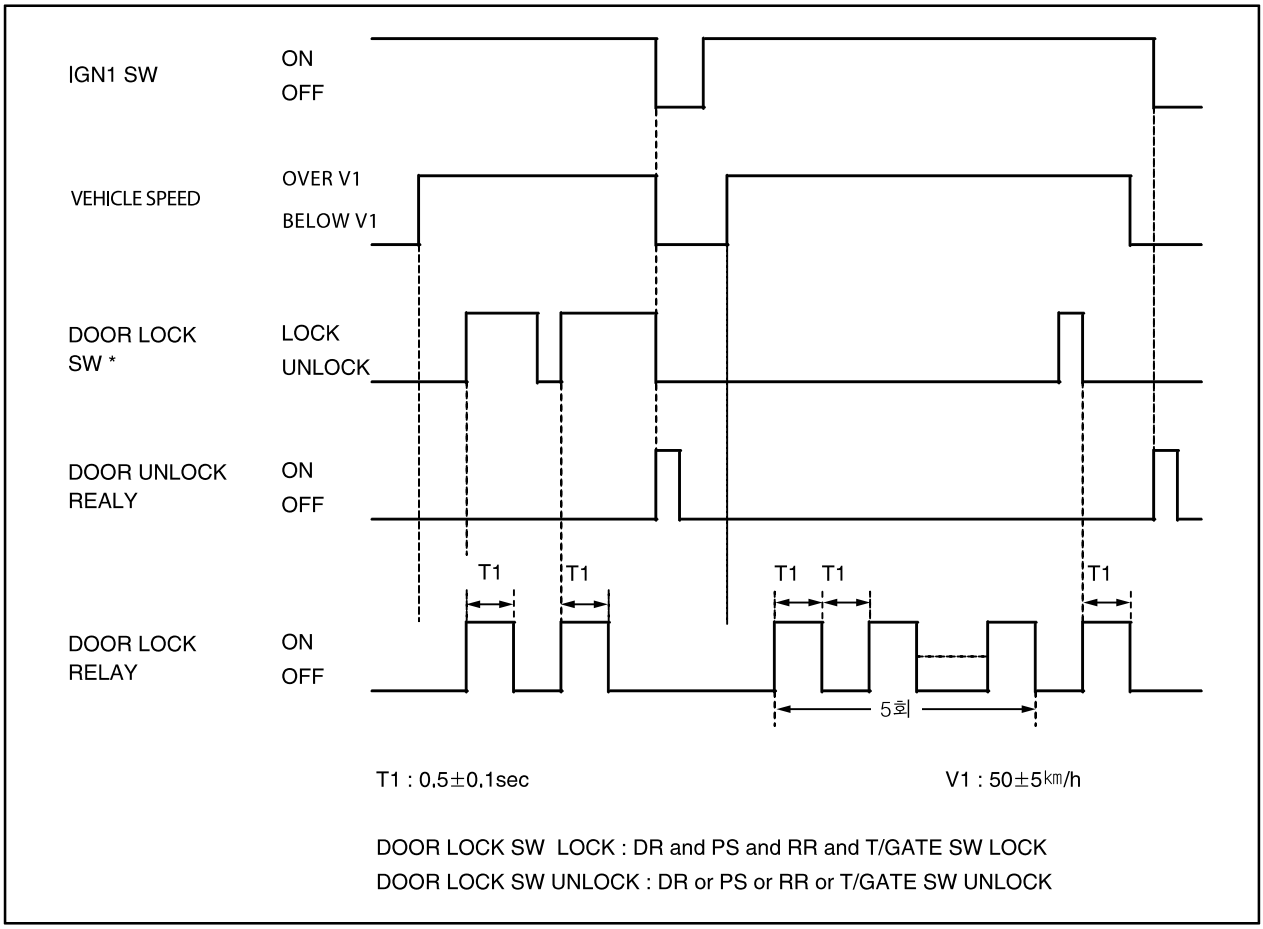
▶Lock/Unlock by REKES (Remote Keyless Entry System)

- The door lock relay output is "ON" for 0.5 seconds when receiving the remote control lock signal.
- The door unlock relay output is "ON" for 0.5 seconds when receiving the remote control unlock signal.



▶ Auto Door Lock

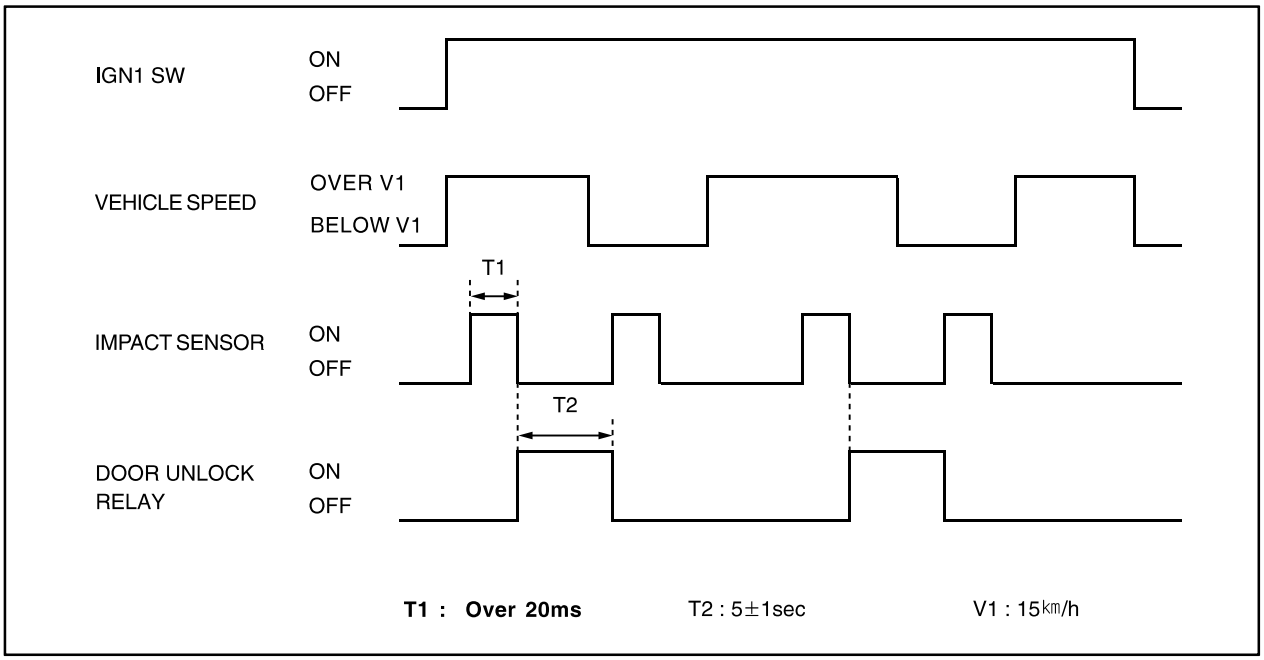
- All door lock relay outputs are "ON" when the vehicle speed keeps over V1 while the IGN 1 switch turns "ON". However, if all doors are locked or failed, the output will not be "ON".
- If any of doors is unlocked after outputting the "AUTO DOOR LOCK", "LOCK" output can be done up to 5 times.
- If any of doors is unlocked after 5 times of "LOCK" outputs, the door is regarded as "FAIL". However, the door that is changed to "UNLOCK" from "LOCK" during the 5 outputs will not be regarded as "FAILED". If the door that was regarded as "FAIL" will be unlocked again, only one "LOCK" output will be done.
- If the door that was "LOCK" is changed to "UNLOCK", only one "LOCK" output will be done.
- Do not try "AUTO DOOR LOCK" operation for the vehicle speed after the completion of auto door unlock operation.
- The "FAIL" is erased when turning "OFF" the IGN 1 switch.
- All doors unlock relay output are "ON" when turning "OFF" the IGN 1 switch after completion of step 1 operation. (However, the vehicle speed input can be detected from 1.5 seconds after turning "ON" the IGN 1 switch.)



Modification basis	
Application basis	
Affected VIN	

▶ Auto Door Unlock (Unlocking When Taking An Impact)

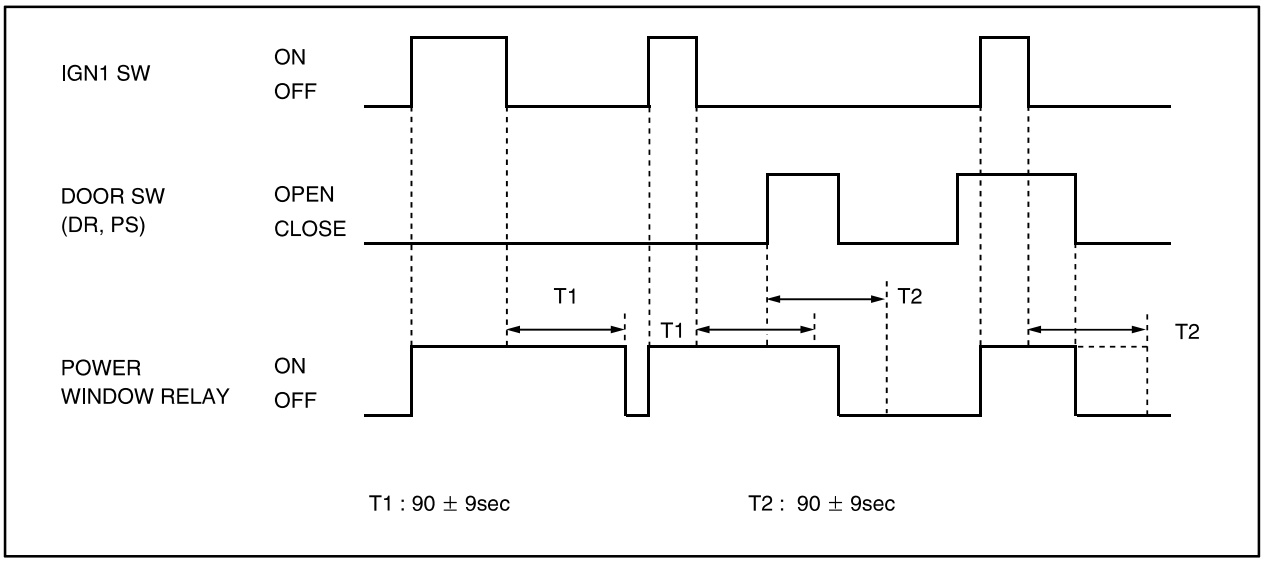
- The auto door unlock relay turns "ON" automatically when taking an impact while the IGN 1 switch turns "ON" and the vehicle speed is over 15 km/h.
- If taking an impact again after manually locking in above "UNLOCK" condition (IGN "ON"), "UNLOCK" can be done regardless of the numbers of operation. (However, the vehicle speed input can be detected from 1.5 seconds after turning "ON" the IGN 1 switch.)



The impact sensor in unit moves to unlock all doors when taking an impact.
However, the "AUTO DOOR UNLOCK" function may not be operated when the door has been damaged or the internal electric components are defective due to the impact.

12) Time Lag Power Window Control

- The power window relay output is "ON" when turning on the IGN 1 switch.
- The power window relay output is "ON" for T1 when turning off the IGN 1 switch.
- The power window relay output is "ON" for T2 when opening the door within T1.
- The power window relay output is "OFF" when closing the door within T2.



Modification basis	
Application basis	
Affected VIN	

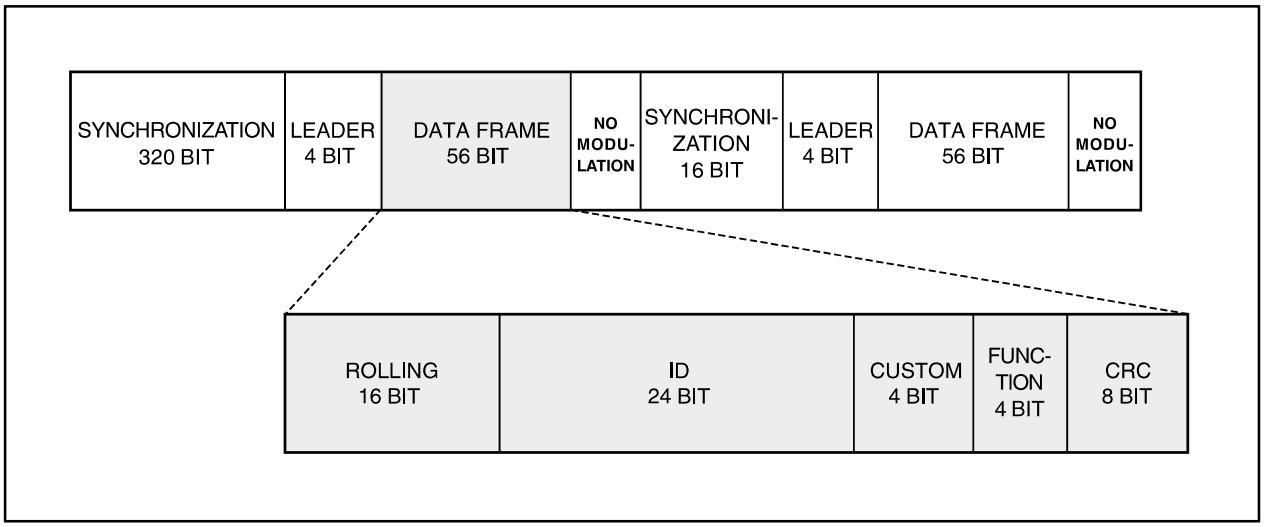
13) Rekes

▶Specifications of Transmitter

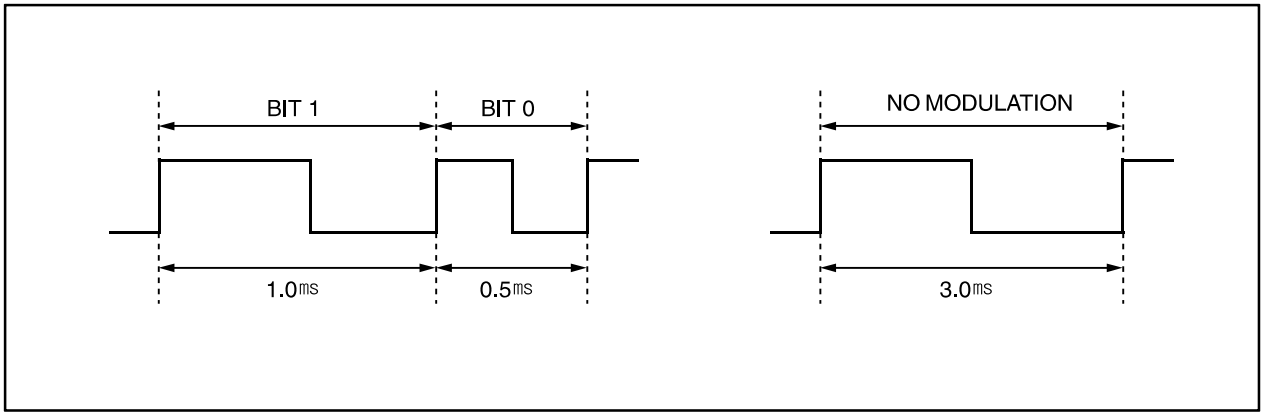
▷ Transmitter signals

- When pressing a switch on the transmitter, sends the data as follows.
- When pressing over two switches at a time, only one signal can be sent according to the below priority.
- Priority: LOCK ⇒ UNLOCK

▷ Data structure



▷ Definition of data



▶Specifications of Receiver

▷ Operating requirements

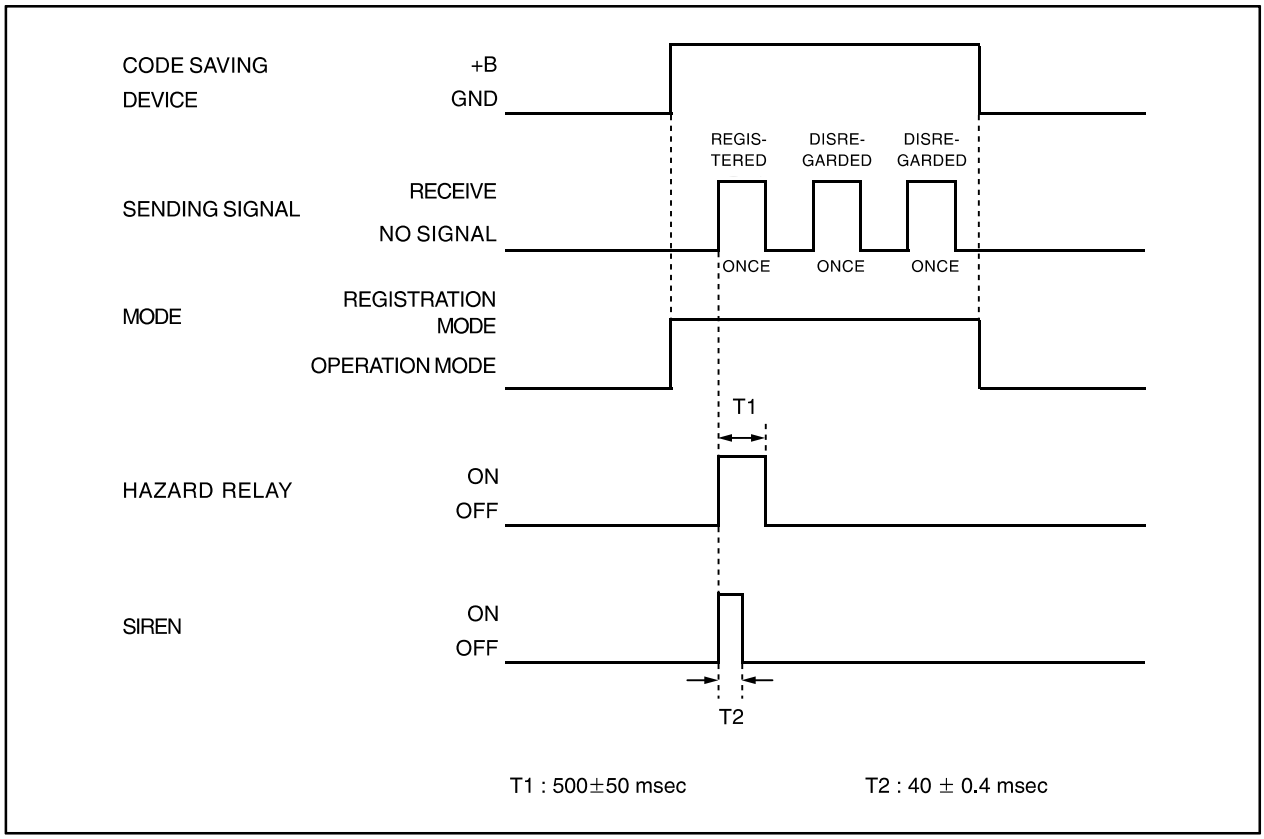
- The ignition key should be removed.

▷ Code registration requirement

- After connecting the B+ to external code save terminal (applying battery voltage)

▷ Registration of receiver code

- Only one receiver code can be registered.
- The received code cannot be output during the registration.
- The hazard relay output is "ON" for T1 and the siren output is "ON" for T2 when registering the code.



▷ Code output requirements

- When the "customer" and "ID" codes are correct and the "rolling" code is within operating range while the ignition switch is removed and the code saving device is turned off, the code can be output after identifying the "function" code.
- The function codes that can be output are "LOCK" and "UNLOCK".

Modification basis	
Application basis	
Affected VIN	

14) Theft Warning

▶ Theft Warning Selection

▷ When the theft warning selection switch is "ON"

- When a warning operating condition occurs, the warning outputs (Hazard relay/Siren) will not be done. However, if the armed mode is started, the hazard relay output is "ON".
- When turning "OFF" the theft warning selection switch from "ON" while the operating condition is present, the warning operation output will not be done.

▷ When the theft warning selection switch is "OFF"

- When a warning operating condition occurs, the warning outputs (Hazard relay/Siren) will be done.
- When turning "ON" the theft warning selection switch from "OFF" during the warning output, the warning operation output can be done by remained time.

▷ Determination for ON/OFF position of theft warning selection switch

- Can be determined only when the theft warning operating is in normal mode (before receiving Tx LOCK signal).
- Disregards the changes of theft warning selection switch in the armed mode or warning operation.

▷ Definition of terms

- Door
  - · OPEN : Door switch (hood, driver's door, passenger's door, rear doors and tailgate) = OPEN
  - · CLOSE : Door switch (hood, driver's door, passenger's door, rear doors and tailgate) = CLOSE
- Door Lock Switch
  - · LOCK : Door lock switch (driver's door, passenger's door, rear doors and tailgate) = LOCK
  - · UNLOCK : Door lock switch (driver's door, passenger's door, rear doors and tailgate) = UNLOCK

▶Description of Theft Warning Function

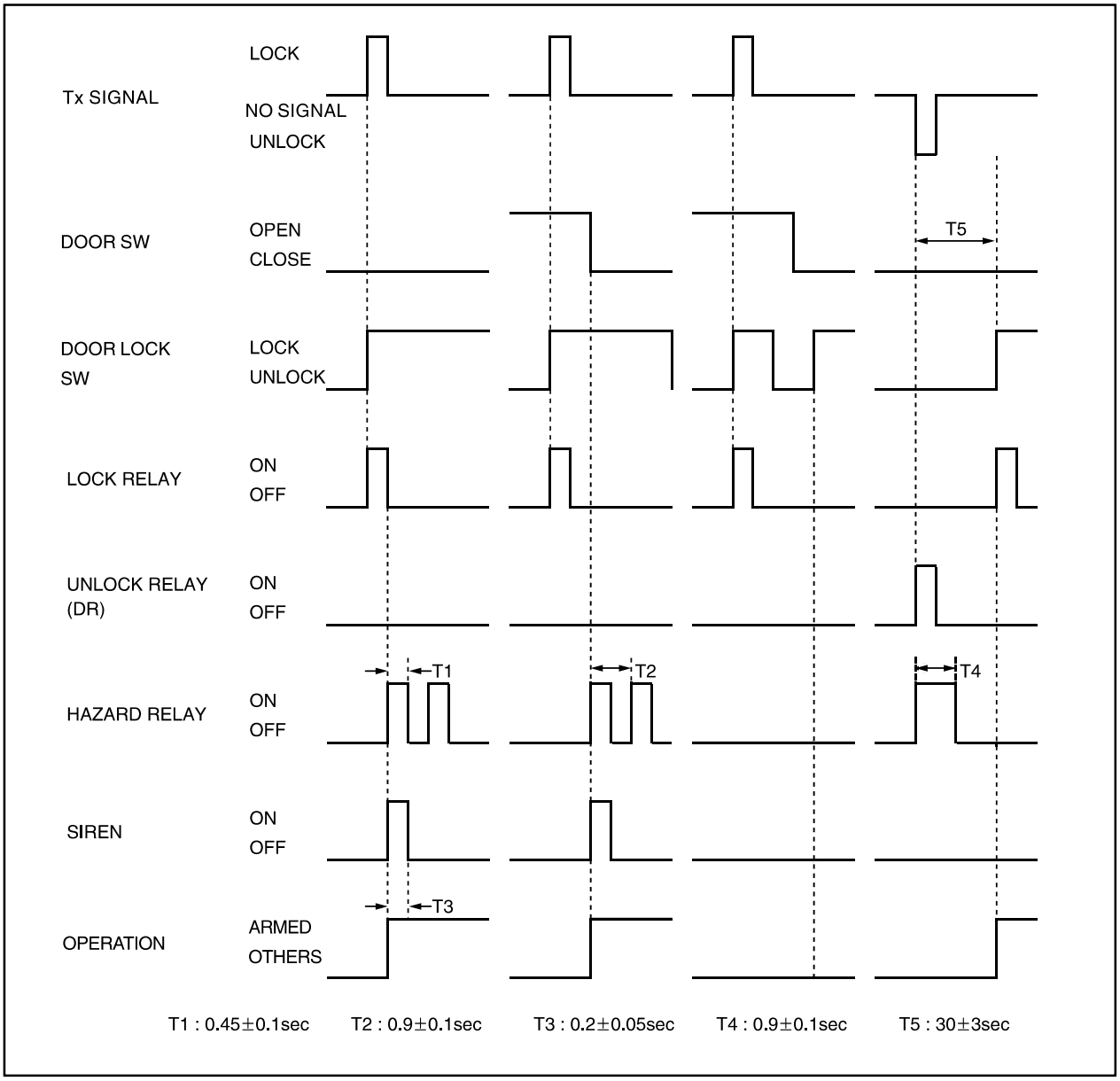
▷ Armed mode activation requirements

- The "LOCK" output is "ON" when receiving the T x LOCK signal while the ignition key is removed and all doors are closed. The armed mode is activated when the door lock switch is locked (siren output: once, hazard relay output: twice)
- The siren and hazard relay outputs are "ON" when receiving T x LOCK signal again in armed mode (maintaining the armed mode).
- When receiving Tx LOCK signal while any of doors are not closed, only the "LOCK" output can be done and then activates the armed ready mode (without siren and hazard relay output). At this moment, if the ignition key is in the ignition switch, the door unlock switch is turned "ON" or the door lock switch is unlocked (after 0.6 seconds), cancels the armed mode and activates the normal mode. However, in these cases, if closing the door and locking the door lock switch, the siren outputs once and the hazard relay outputs twice and then activates armed mode.
- When the door is opened, the door unlock switch is "ON" or the ignition key is not inserted into ignition switch for 30 seconds after receiving T x UNLOCK signal, outputs "LOCK" and then activates armed mode (RELOCK operation).
- The armed mode will not be activated except above conditions.
  ex) The armed mode is not activated when locked by door unlock switch.

▷ Armed mode cancellation requirements

- Unlocking by Tx, turning "ON" the door unlock switch, inserting the ignition key into the ignition switch, turning "ON" the IGN 1 switch, turning "ON" the IGN 2 switch
- Armed mode cancellation requirements for tailgate The armed ready mode for tailgate is activated when turning "ON" the tailgate cylinder switch in the armed mode. At this moment, if opening and then closing the tailgate, the armed mode is activated with one siren output and two hazard relay outputs.

Modification basis	
Application basis	
Affected VIN	



▷ Warning operating requirements

- When opening the door in armed mode
- When unlocking the door lock switch in armed mode
- When closing and then opening the door after completion of warning (27 seconds)

▷ Warning operation

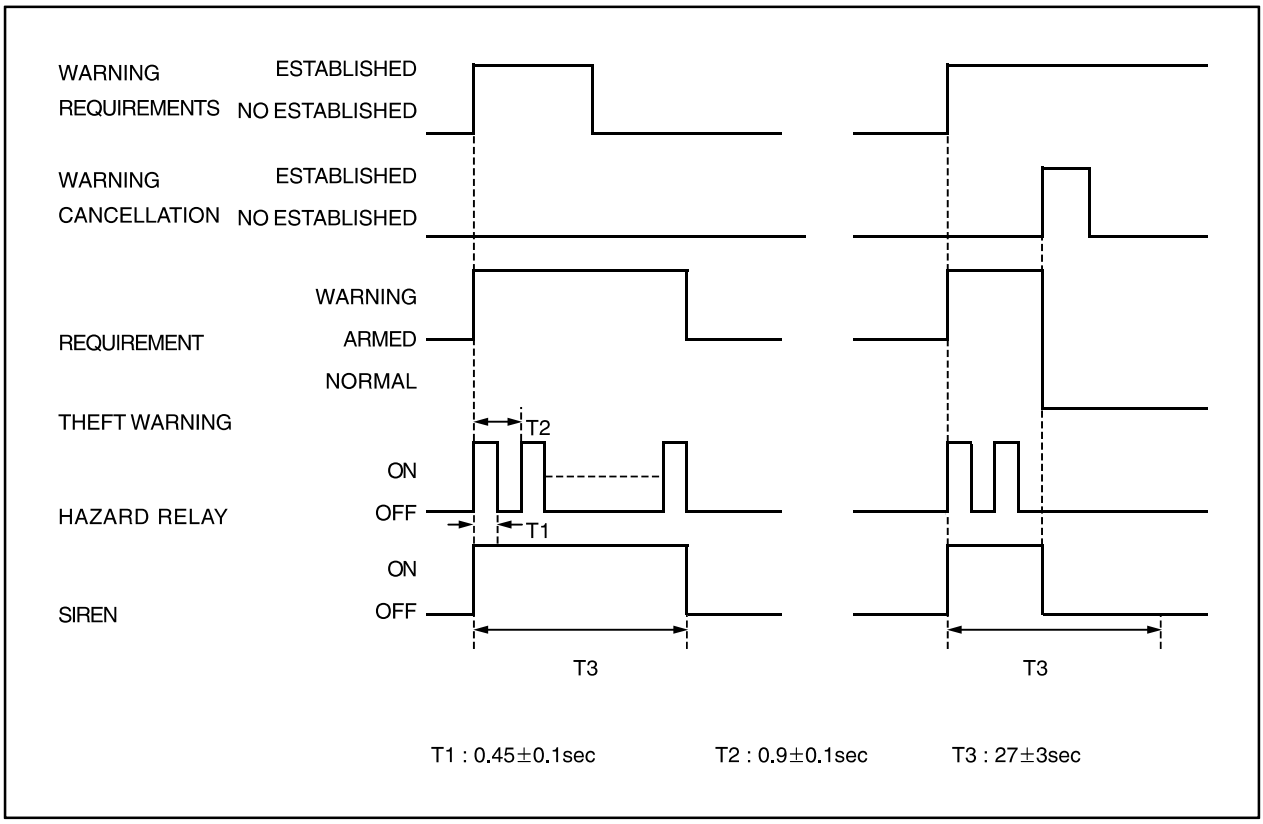
- The siren output is "ON" for T3 and the hazard relay output is "ON" for T3 with the interval of T2.

▷ Warning cancellation requirements

- When locking or unlocking by Tx
- When turning "ON" the door unlock switch

▷ Warning cancellation operation

- The siren and the hazard relay outputs are "OFF".



Modification basis	
Application basis	
Affected VIN	

▷ Operations when removing and installing the battery

Removed \ Installed	Normal	Armed	Warning	Remark
Normal Armed	○			
Armed Ready	○			
Armed		○		
Warning			○	
Warning Completion			○	
RELOCK Ready	○			

▶ System Power Consumption

▷ The "SLEEP" mode is activated to save the system power when:

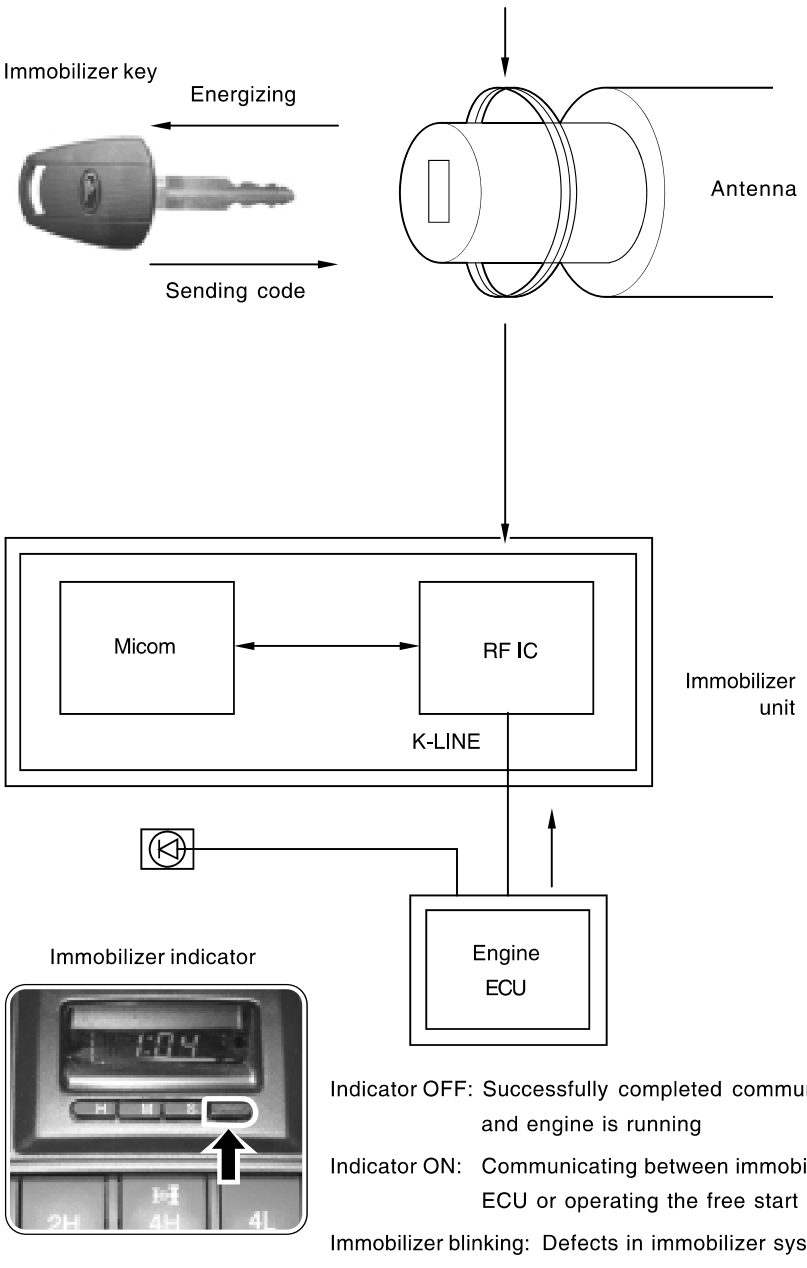
- All doors (driver's door, passenger's door, rear doors, tailgate, hood) are closed
- The IGN 1 switch and the IGN 2 switch are turned "OFF"
- Driver's and passenger's door lock switch and the ignition key switch are not changed for 2 seconds while the door unlock switch and the tailgate cylinder switch are turned "OFF"

▷ The "WAKE UP" mode is activated immediately after any of above requirements is failed (canceling the "SLEEP" mode).

▷ The "WAKE UP" mode is activated immediately after inputting the "KEYLESS" signal (canceling the "SLEEP" mode).

▷ The above output conditions and ready conditions are cancelled after a certain period of waiting when some outputs
(room lamp, key hole illumination, tail lamp, power windows etc.) are "ON" in the conditions in step 1 and all the doors are closed for 30 seconds after unlocking by keyless system. The "SLEEP" mode is activated when the driver's or passenger's door lock switch and the ignition switch is not changed for 2 seconds.

4. IMMOBILIZER (FOR D27DT ENGINE EQUIPPED VEHICLE)



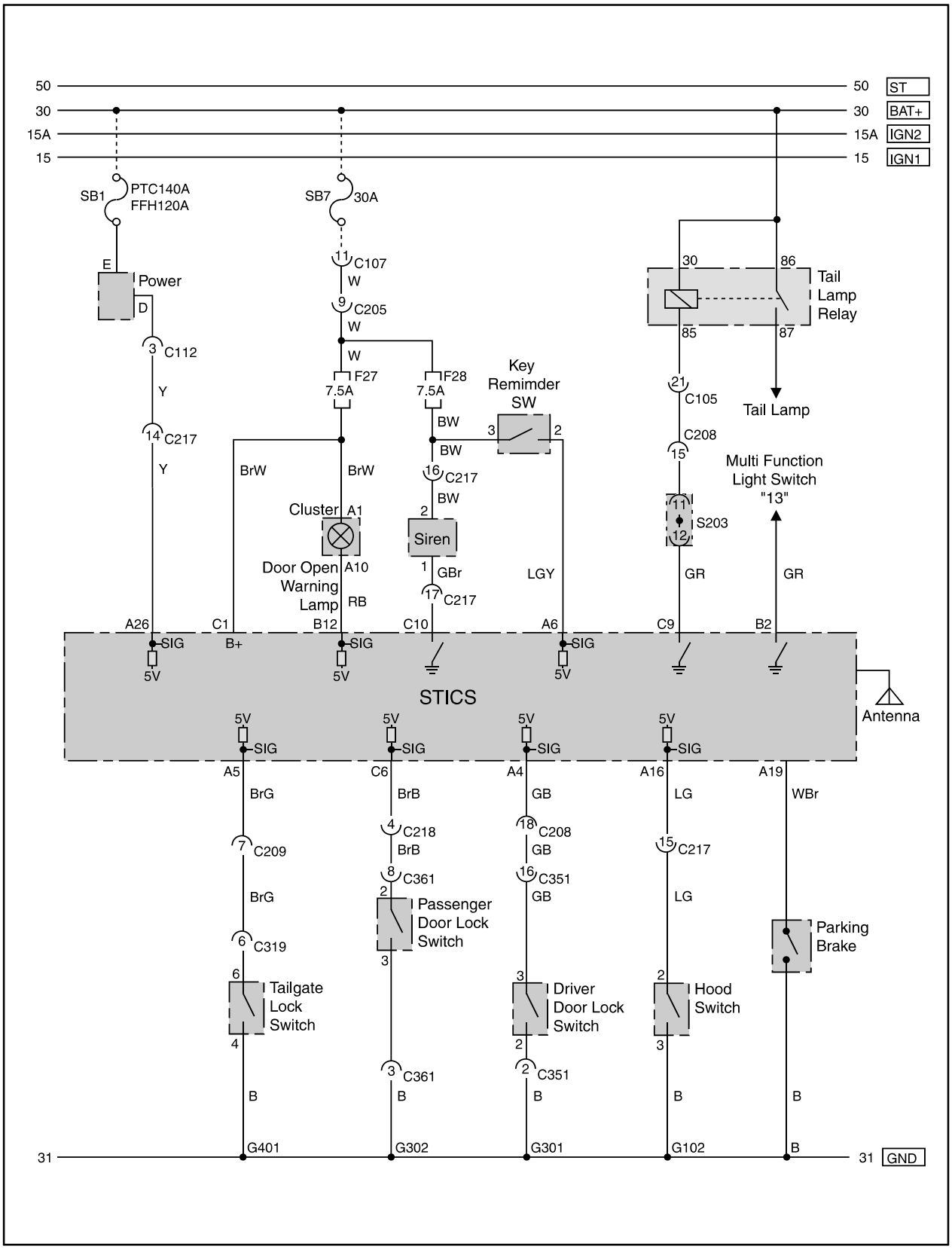
- Total 5 immobilizer key can be coded to ECU with Scan-i. Refer to the coding procedures in Troubleshooting section.

The immobilizer should be coded whenever replacing the immobilizer related components and ECU at the Ssangyong Authorized Service Operation.

Modification basis	
Application basis	
Affected VIN	

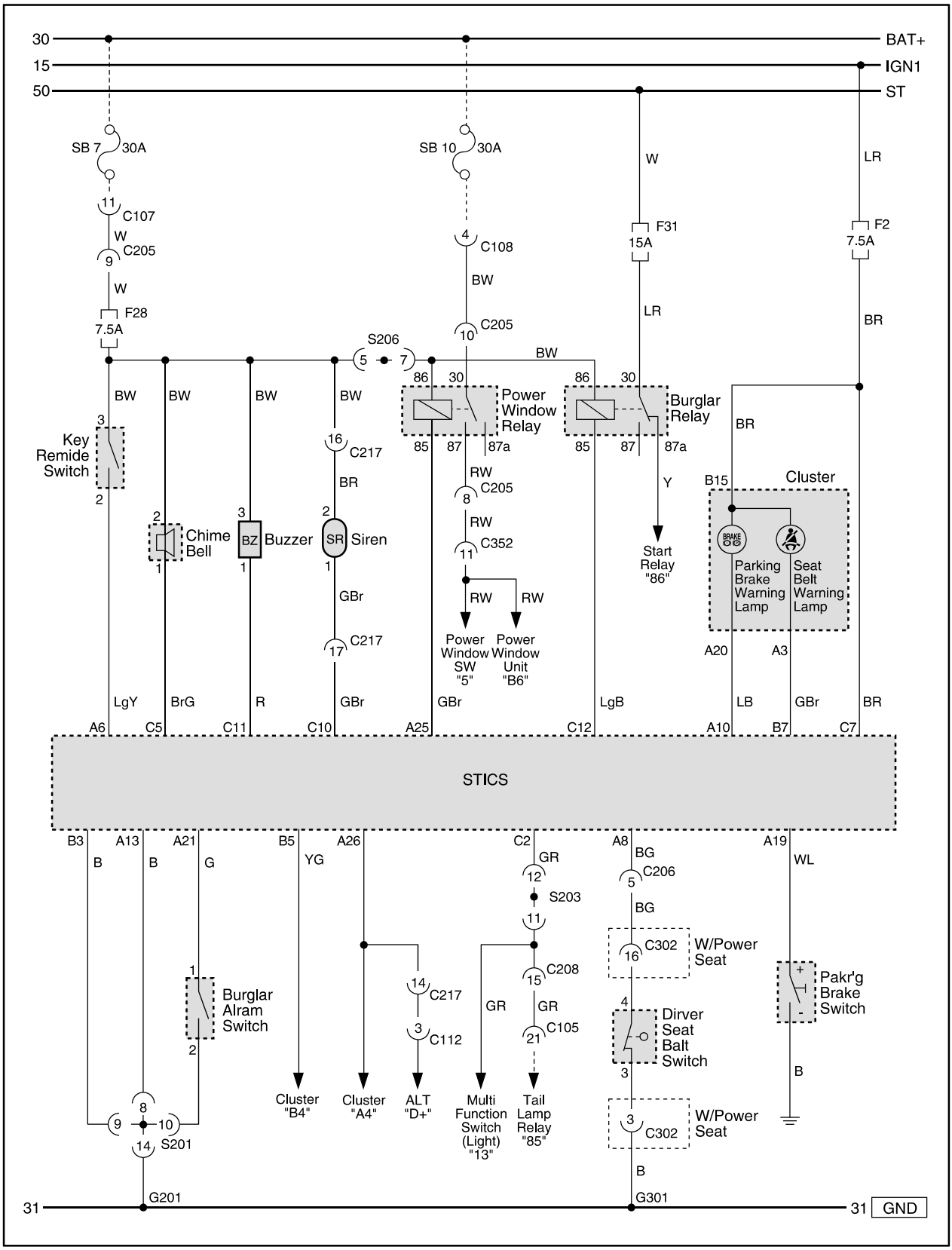
5. RK-STICS CIRCUIT DIAGRAM

▶Tail Lamp and Switch



Modification basis	
Application basis	
Affected VIN	

▶Warning Lamps

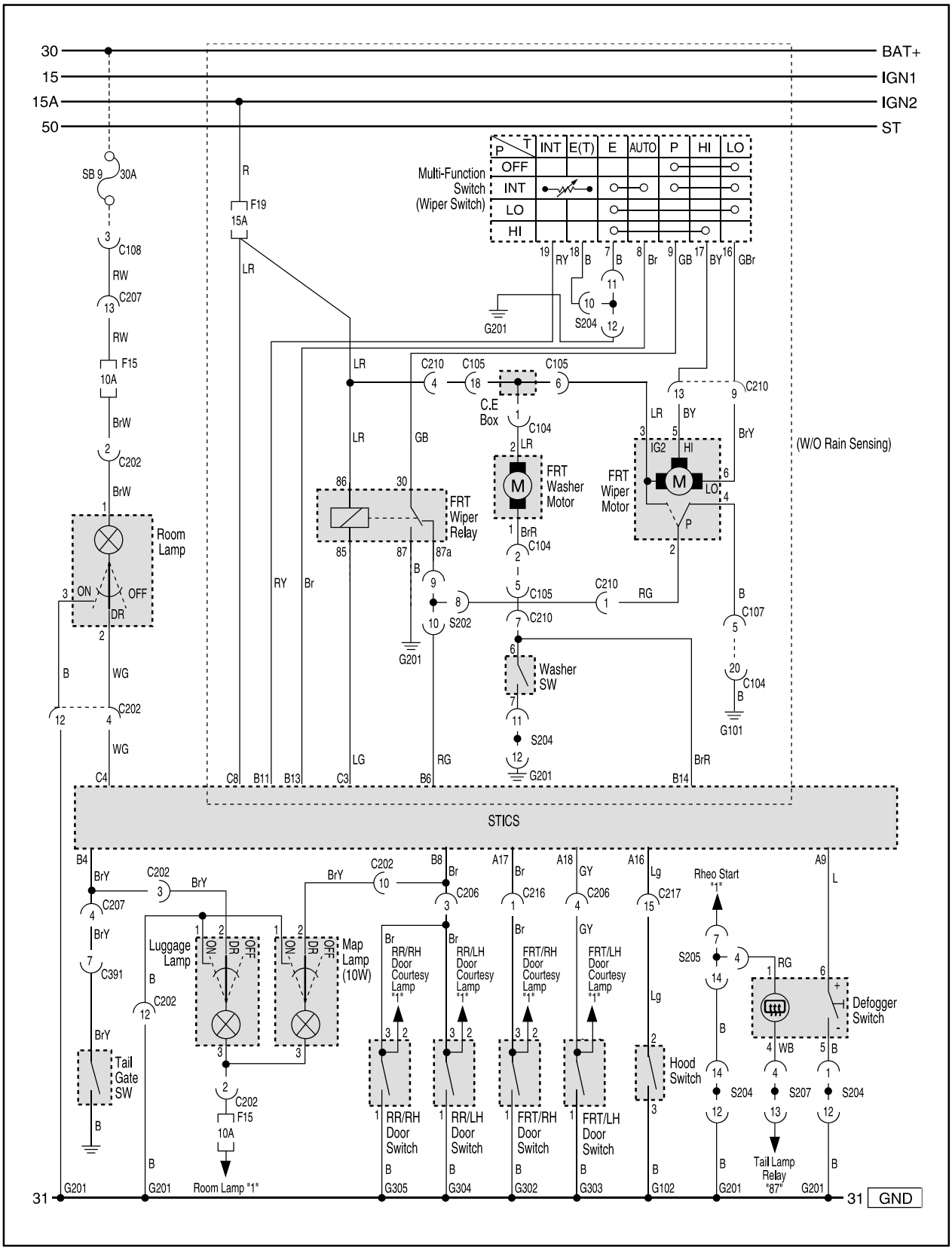


STICS

undefined

Modification basis	
Application basis	
Affected VIN	

▶Wiper, Door Switch, Lamps (Room Lamp, Map Lamp), Door Ajar Warning Lamp

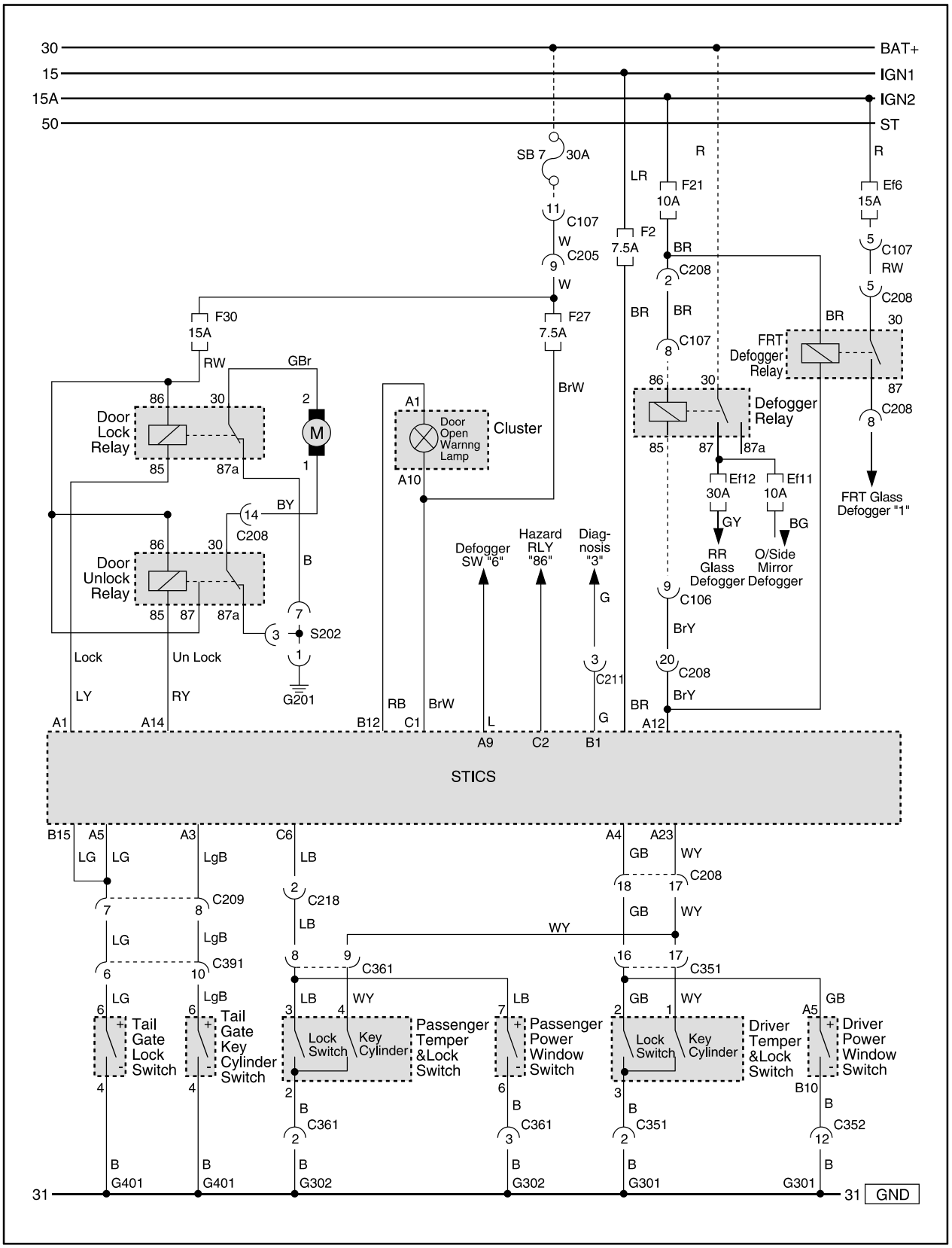


Modification basis	
Application basis	
Affected VIN	

STICS

undefined

▶Door Lock, Heated Wire

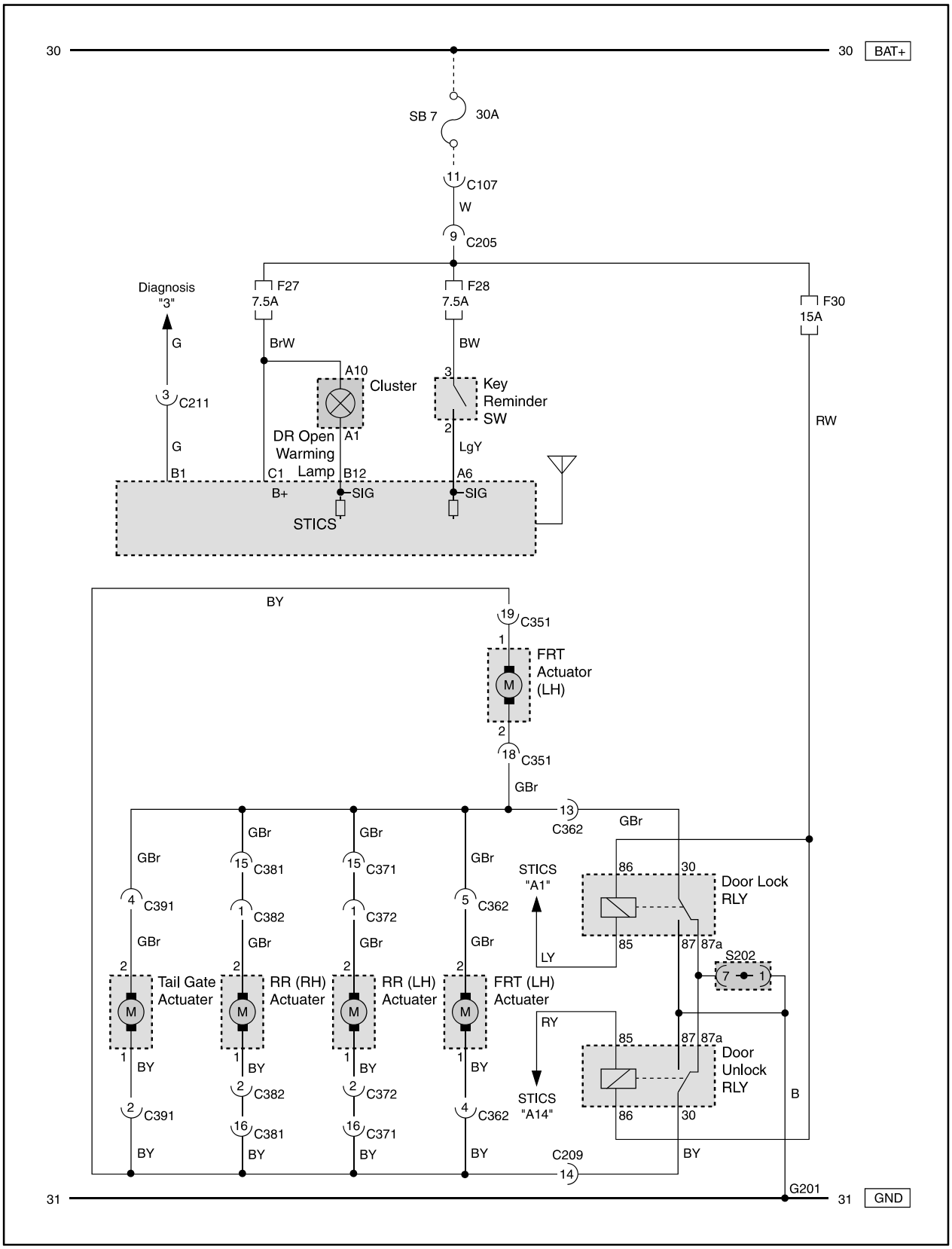


STICS

undefined

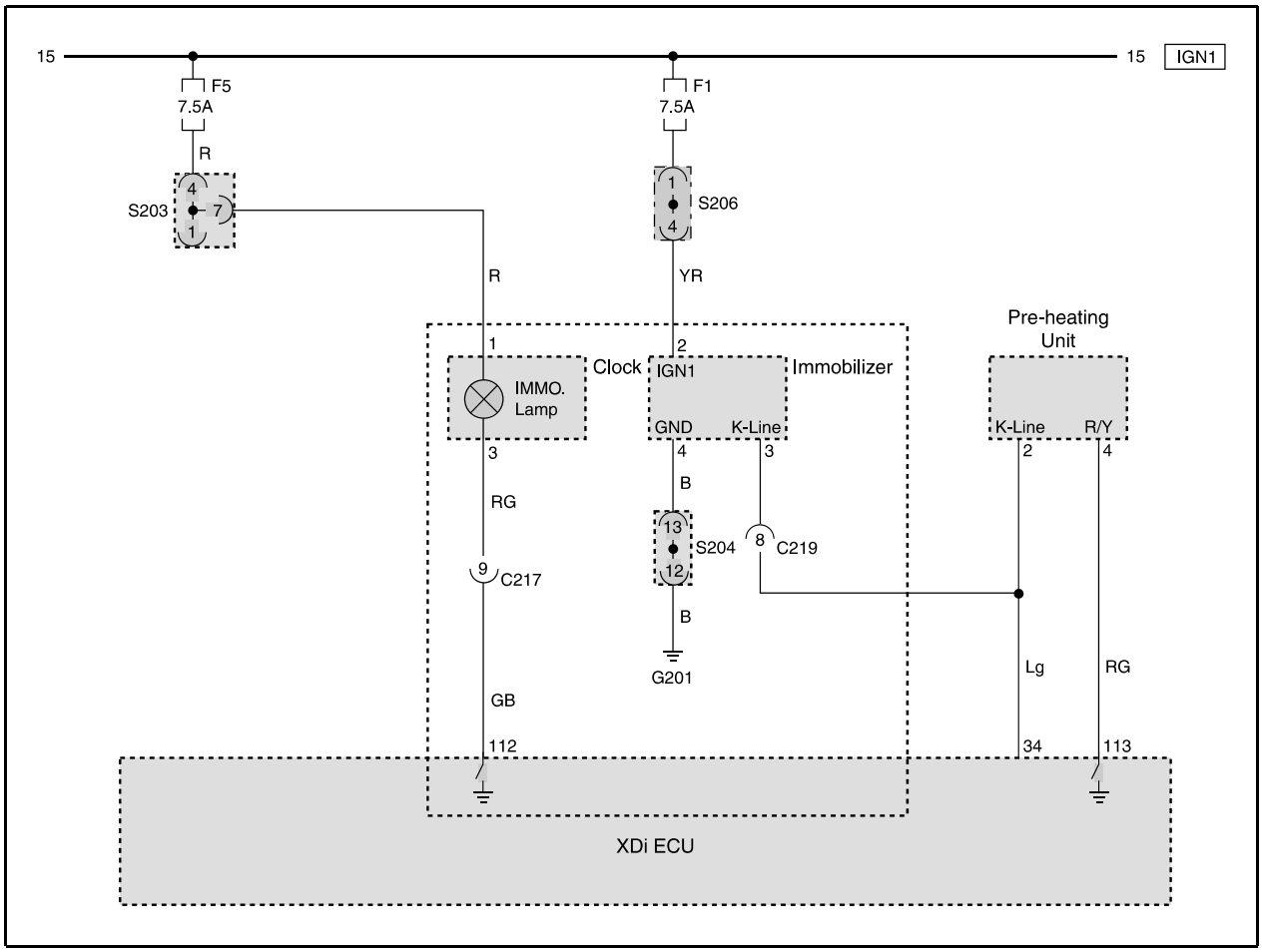
Modification basis	
Application basis	
Affected VIN	

▶Central Door Locking Device



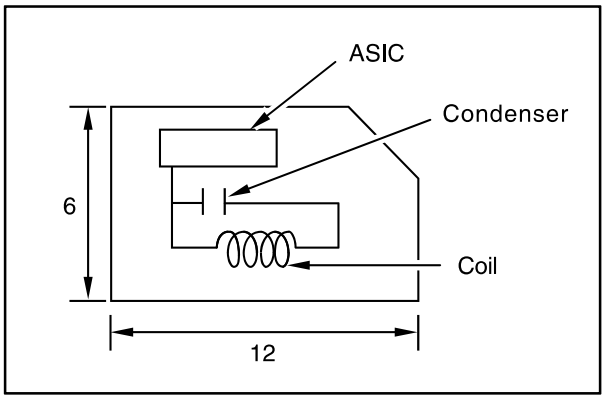
Modification basis	
Application basis	
Affected VIN	

6. IMMOBILIZER CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

▶ COMPONENTS



▷ Transponder

- It receives the "ENERGY" and "CHALLENGE" signals and computes them by the crypto key in ASCI and sends the "RESPONSE" and serial number

▷ Coil Antenna

- Ls (inductance): 1.08 mH
  It provides the "ENERGY" and "CHALLENGE" to the transponder, receives the output signals from the transponder, and delivers them to the immobilizer ECU. It is installed at the top of steering handle lock. It uses the active type to enhance the sensitiveness and stability.

▷ Immobilizer RF IC

- It drives the coil antenna, converts the received signals from the coil antenna to special code, and delivers it to the immobilizer ECU.

▷ Immobilizer Unit

- It analyzes the received signals from the immobilizer RF IC, confirms the authorized transponder, and delivers the result (start or start inhibition) to the engine ECU.

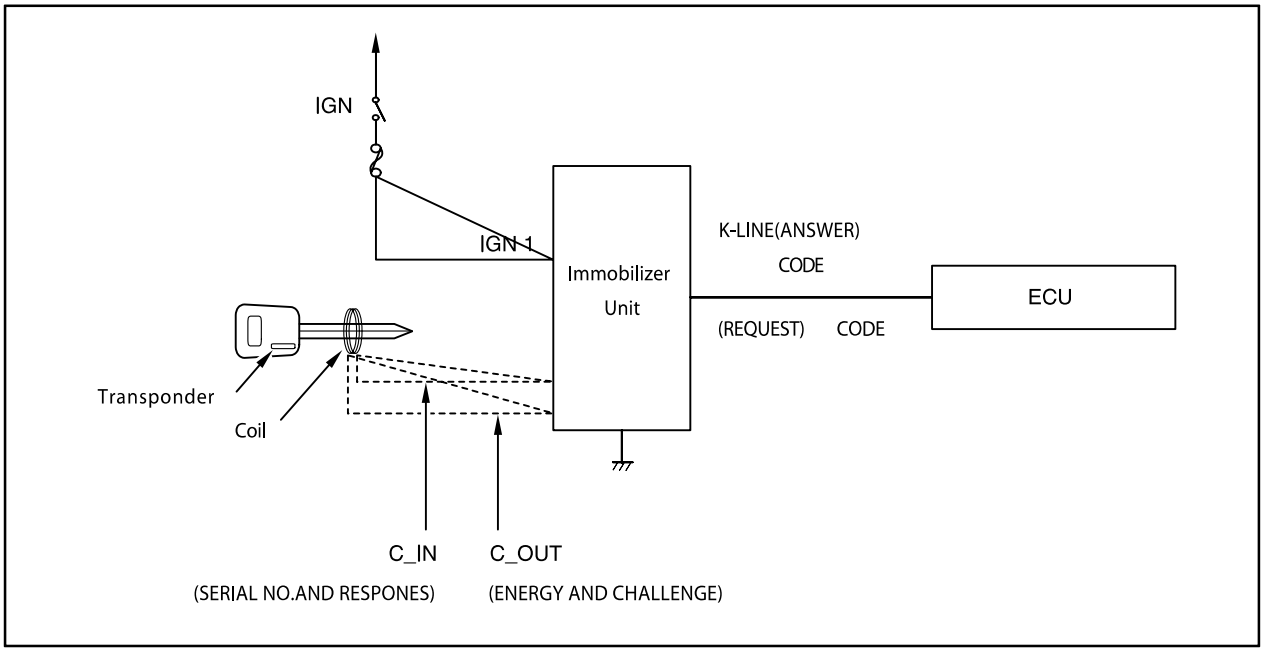
▷ Engine ECU

- It provides the start or start inhibition command by using the transponder related information from the immobilizer ECU when turning on the ignition switch.

▷ Diagnostic Tester

- It diagnoses the immobilizer ECU and the engine ECU.

▶ SCHEMATIC DIAGRAM



Modification basis	
Application basis	
Affected VIN	

CLUSTER

8010-01

OVERVIE AND OPERATION PROCESS

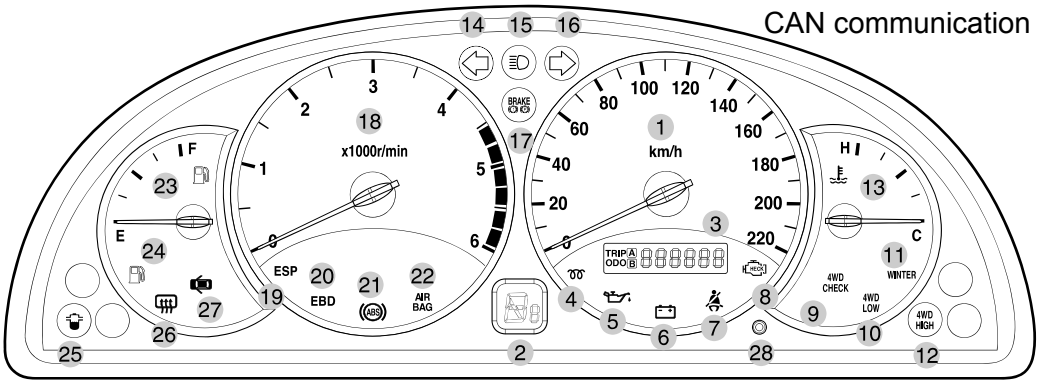
1. APPEARANCE AND CIRCUIT DIAGRAM

Several types of clusters are used according to the vehicle models.

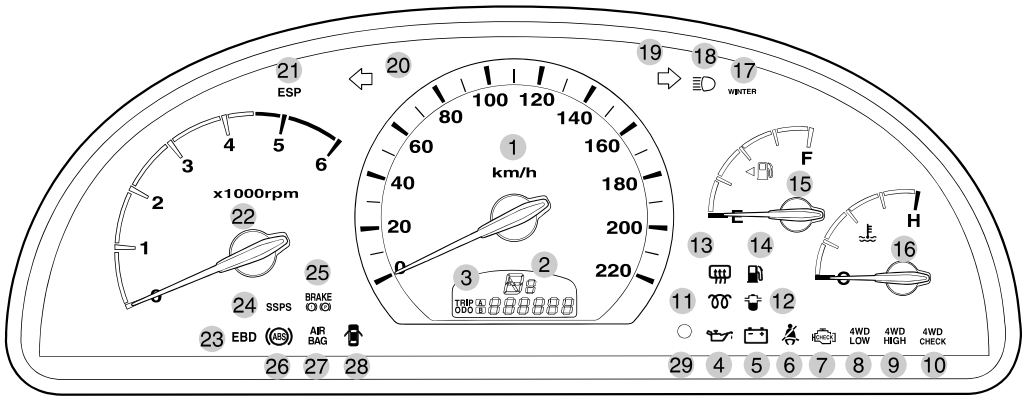
- IDI Engine (D29ST): Conventional cluster that cannot communicate with CAN
- DI Engine (D27DT): Conventional appearance + CAN communication function (internal function)
- New cluster with BLACK-FACE appearance (CAN communication)
  Gasoline Engine (G32D): New cluster with BLACK-FACE appearance (CAN communication)

IDI Engine (D29ST) / DI Engine (D27DT) equipped vehicle

- IDI Engine equipped vehicle: CAN communication (X)
- DI Engine equipped vehicle: CAN communication (O)



DI Engine (D27DT) / Gasoline Engine (G32D) equipped vehicle

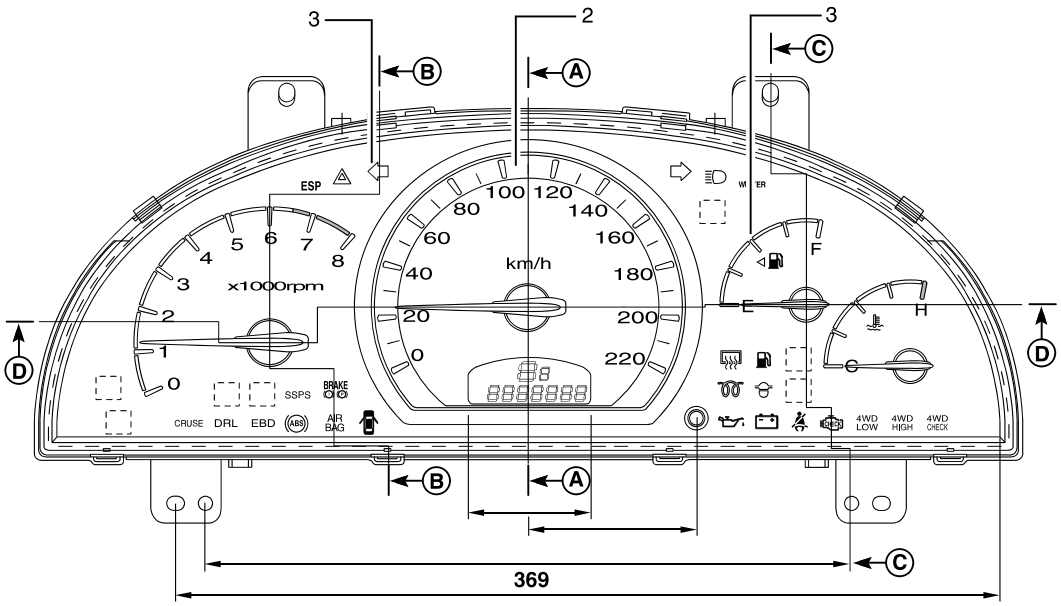


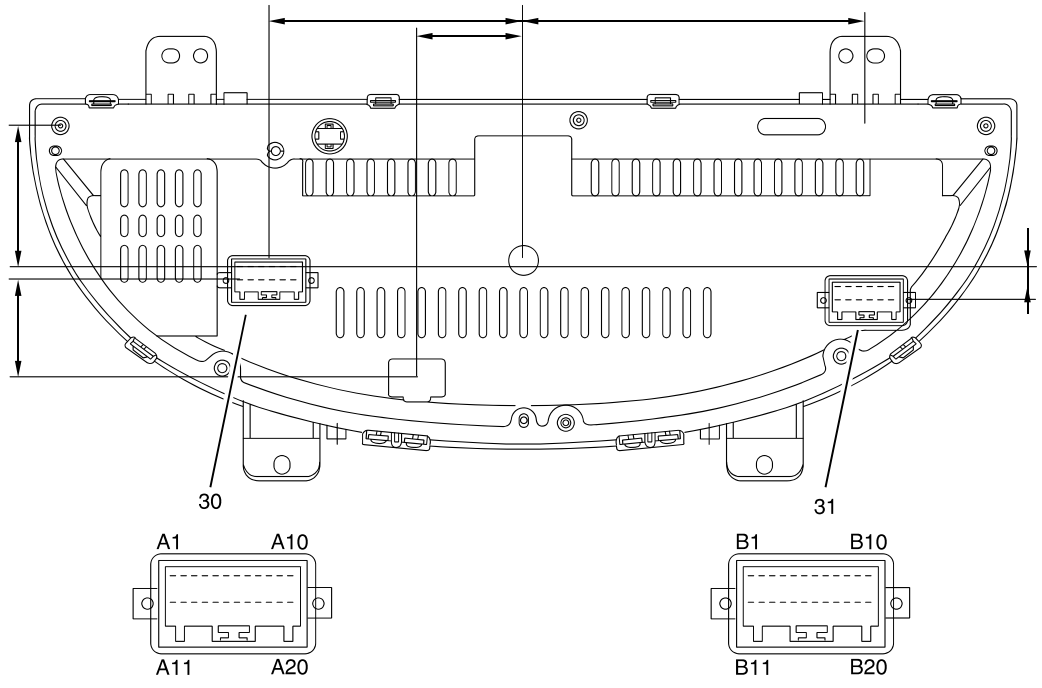
BLACK-FACE Cluster

Modification basis	
Application basis	
Affected VIN	

1) BLACK-FACE TYPE CLUSTER

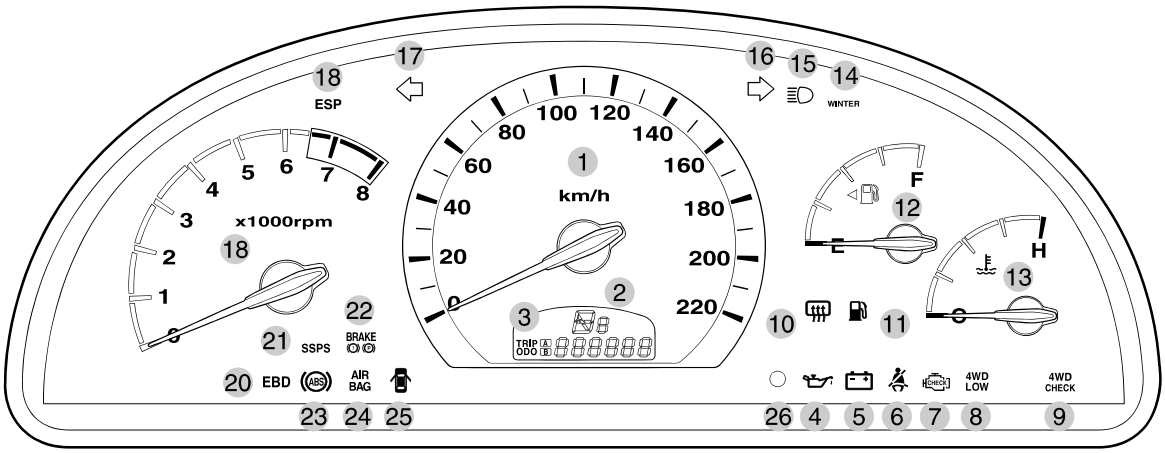
(1) DI/GASOLINE ENGINE EQUIPPED VEHICLE





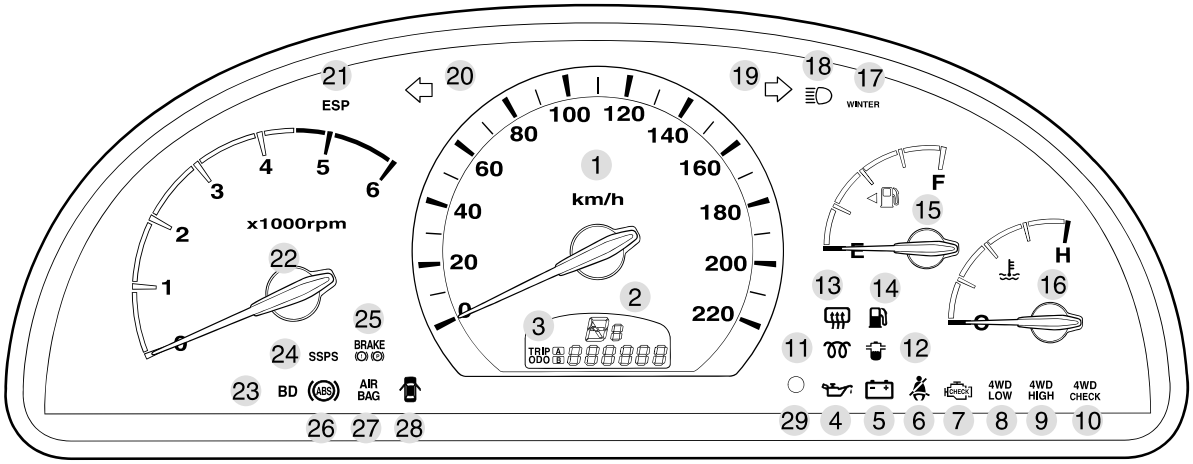
Modification basis	
Application basis	
Affected VIN	

(2) GASOLINE ENGINE EQUIPPED VEHICLE



1. Speedometer
2. Auto shift indicator (A/T)
3. Odometer/Trip odometer
4. Engine oil pressure warning light
5. Battery charge warning light
6. Seatbelt reminder
7. Engine CHECK indicator
8. 4WD LOW indicator
9. 4WD CHECK indicator
10. Defogger indicator
11. Low fuel level warning light
12. Fuel gauge
13. Temperature gauge
14. WINTER mode indicator (A/T)
15. High beam indicator
16. Turn signal indicator (right)
17. Turn signal indicator (left)
18. ESP warning light
19. Tachometer
20. EBD waring light
21. SSPS warning light
22. Brake system warning light
23. ABS warning light
24. Aigbag warning light
25. Door open warning light
26. Trip odo meter reset button/Rheostat button

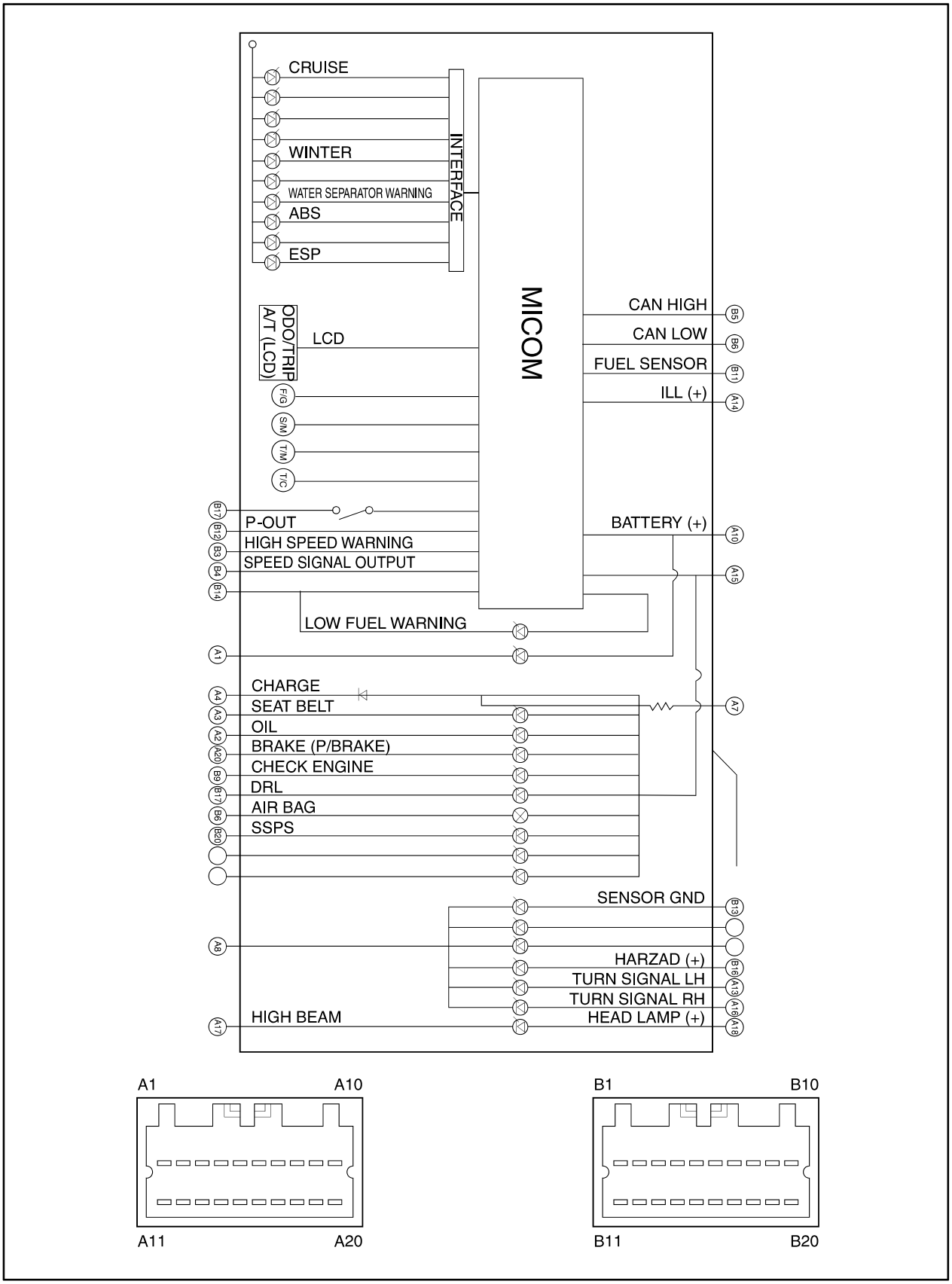
(3) DIRECT INJECTION DIESEL ENGINE EQUIPPED VEHICLE (WITH CAN COMMUNICATION)



1. Speedometer
2. Auto shift indicator (A/T)
3. Odometer/Trip odometer
4. Engine oil pressure warning lightt
5. Battery charge warning light
6. Seatbelt reminder
7. Engine CHECK indicator
8. 4WD LOW indicator
9. 4WD HIGH indicator
10. 4WD CHECK indicator
11. Glow indicator
12. Water separator warning light
13. Defogger indicator
14. Low fuel level warning light
15. Fuel gauge
16. Temperature gauge
17. WINTER mode indicator (A/T)
18. High beam indicator
19. Turn signal indicator (right)
20. Turn signal indicator (left)
21. ESP warning light*
22. Tachometer
23. EBD waring light
24. SSPS warning light
25. Brake system warning light
26. ABS warning light
27. Aigbag warning light
28. Door open warning light
29. Trip odo meter reset button/Rheostat button

Modification basis	
Application basis	
Affected VIN	

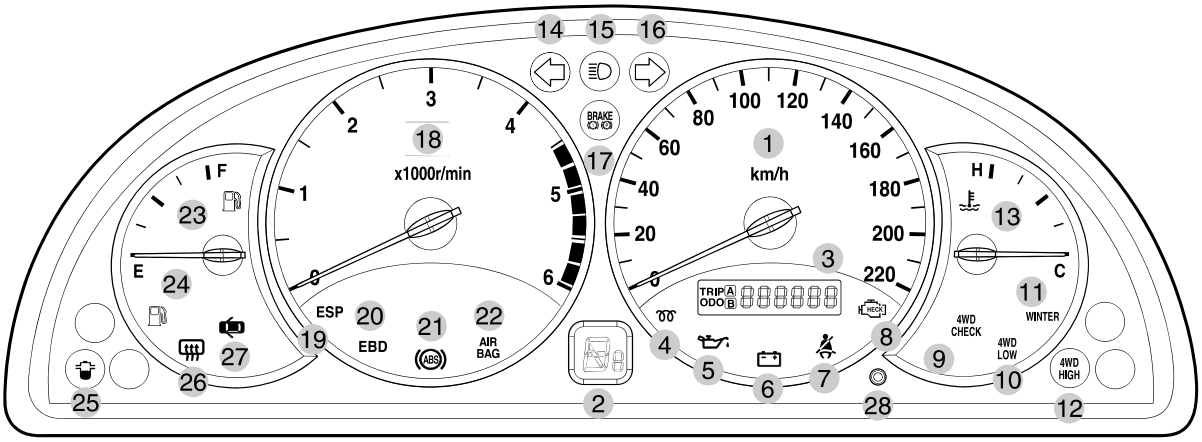
▶ CIRCUIT DIAGRAM AND CONNECTER PIN ARRANGEMENT



Modification basis	
Application basis	
Affected VIN	

2) CLEAR GLASS TYPE CLUSTER

(1) DIRECT INJECTION DIESEL ENGINE EQUIPPED VEHICLE (WITH CAN COMMUNICATION)

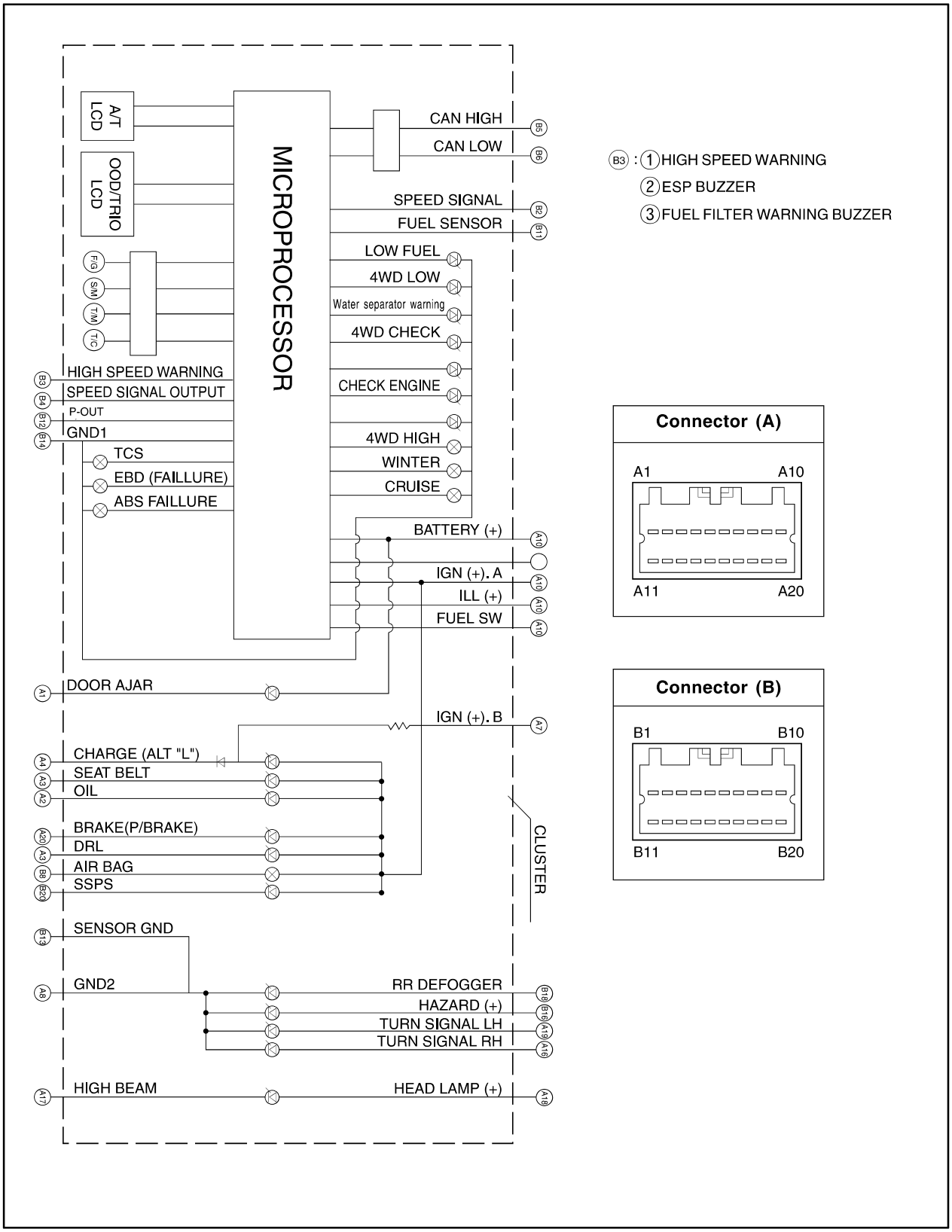


1. Speedometer
2. Auto shift indicator
3. Odometer/Trip odometert
4. Glow indicator
5. Engine oil pressure warning light
6. Battery charge warning light
7. Seatbelt reminder
8. Engine CHECK indicator
9. 4WD CHECK indicator
10. 4WD LOW indicator
11. WINTER mode indicator (A/T)
12. 4WD HIGH indicator
13. Temperature gauge
14. Turn signal indicator (left)
15. High beam indicator
16. Turn signal indicator (right)
17. Brake system warning light
18. Tachometer
19. ESP warning light
20. EBD waring light
21. ABS warning light
22. Aigbag warning light
23. Fuel gauge
24. Low fuel level warning light
25. Water separator warning light
26. Defogger indicator
27. Door open warning light
28. Trip odo meter reset button

Modification basis	
Application basis	
Affected VIN	

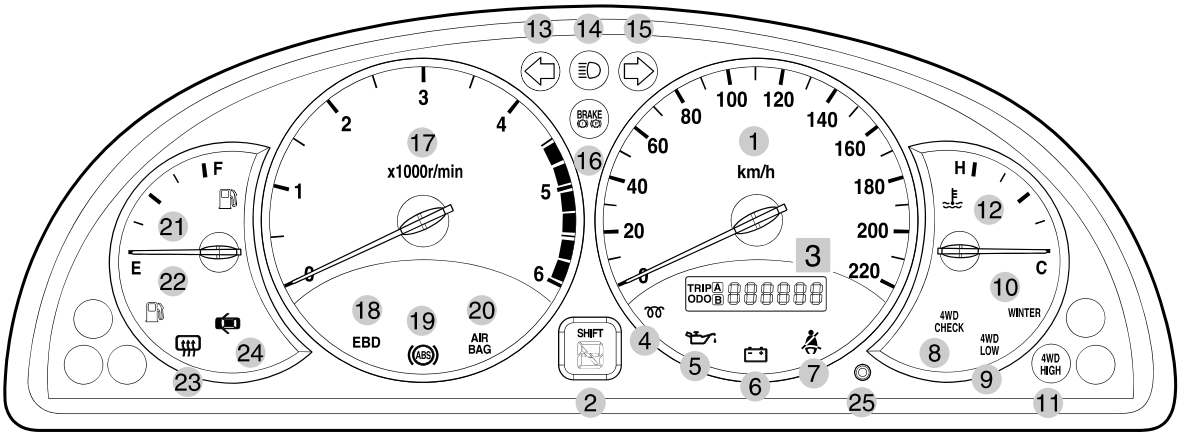
▶ CIRCUIT DIAGRAM AND CONNECTER PIN ARRANGEMENT

(DI Engine Equipped Vehicle)



Modification basis	
Application basis	
Affected VIN	

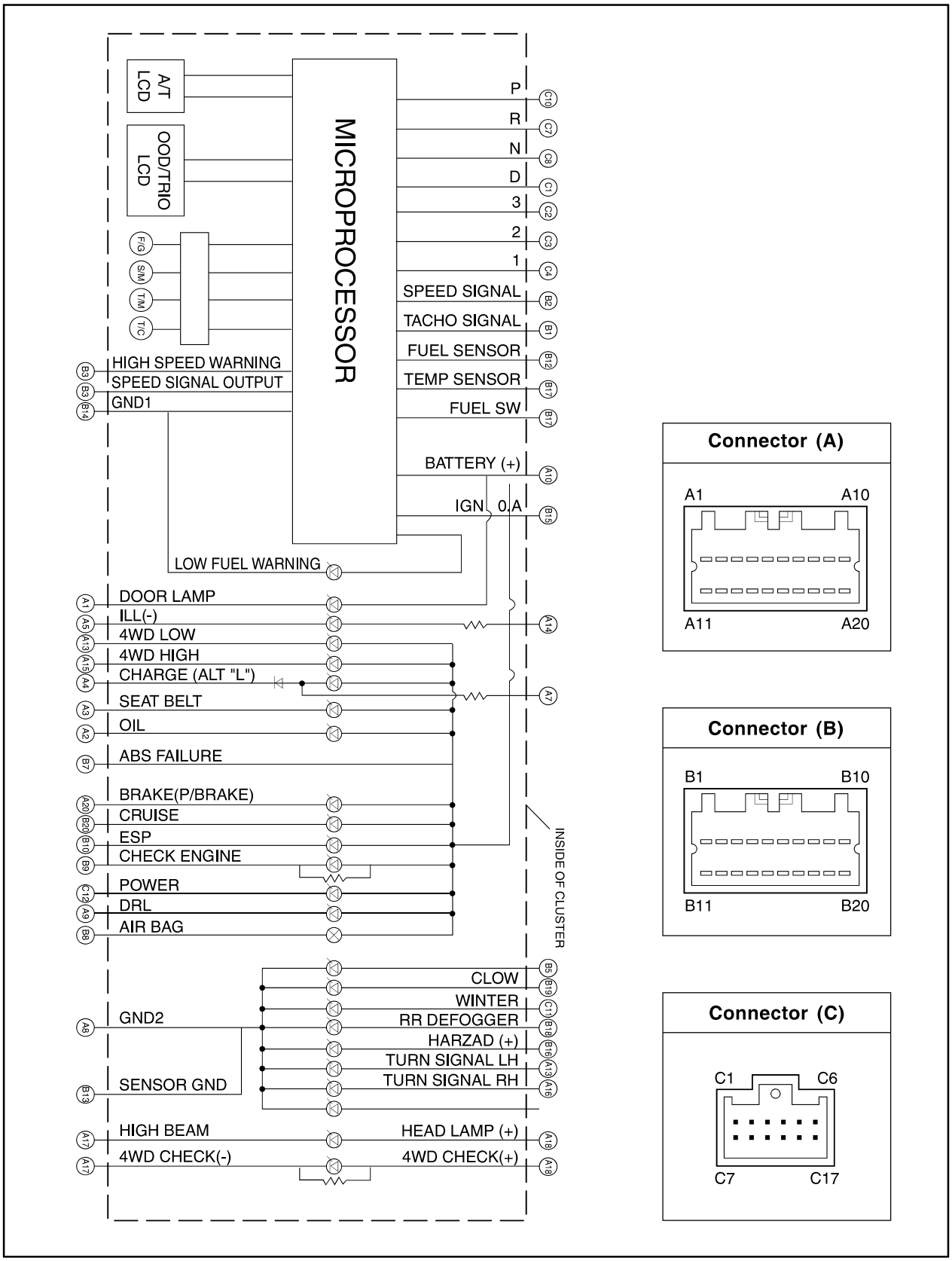
(2) INDIRECT INJECTION DIESEL ENGINE EQUIPPED VEHICLE (WITHOUT CAN COMMUNICATION)



1. Speedometer
2. Auto shift indicator
3. Odometer/Trip odometer
4. Glow indicator
5. Engine oil pressure warning light
6. Battery charge warning light
7. Seatbelt reminder
8. 4WD CHECK indicator
9. 4WD LOW indicator
10. WINTER mode indicator (A/T)
11. 4WD HIGH indicator
12. Temperature gauge
13. Turn signal indicator (left)
14. High beam indicator
15. Turn signal indicator (right)
16. Brake system warning light
17. Tachometer
18. EBD waring light
19. ABS warning light
20. Aigbag warning light
21. Fuel gauge
22. Low fuel level warning light
23. Defogger indicator
24. Door open warning light
25. Trip odo meter reset button

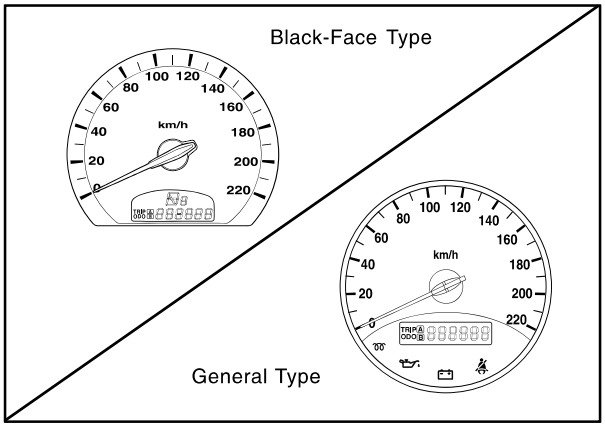
Modification basis	
Application basis	
Affected VIN	

▶IDI Engine Equipped Vehicle (without CAN Communication)



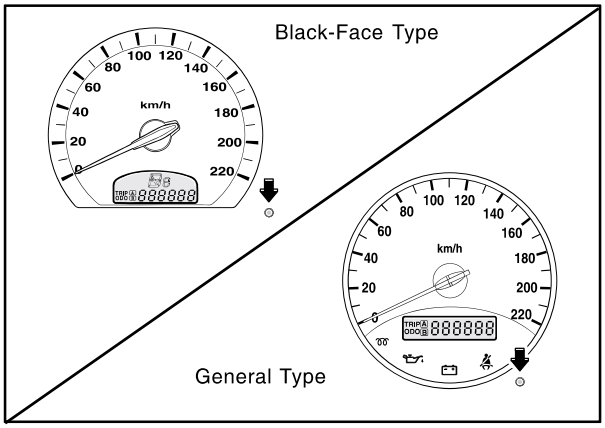
Modification basis	
Application basis	
Affected VIN	

2. METERS/INDICATORS/WARNING LIGHTS



▶Speedometer

The speedometer indicates the vehicle speed in kilometers per hour (km/h) or mile per hour (m/h).

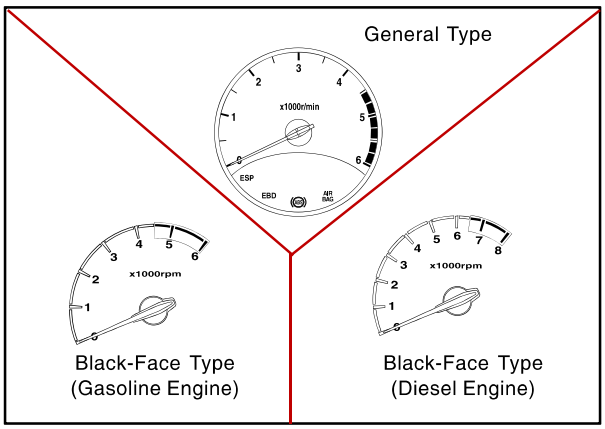


▶Odometer/Trip Odometer

When the reset button located in the right and lower area of odometer is pressed once, the first driving distance (TRIP A) will be indicated and pressed again, the second driving distance (TRIP B) will be indicated.
When the button is pressed once more, total distance (ODO) will be indicated.

CAUTION

- If pressing and holding the reset button for over 3 seconds in TRIP A or TRIP B mode, the trip odometer resets to zero.



▶Tachometer

The tachometer indicates engine speed in revolutions per minute.
Multiply 1,000 to the current number, then it will be the current number of engine revolutions.

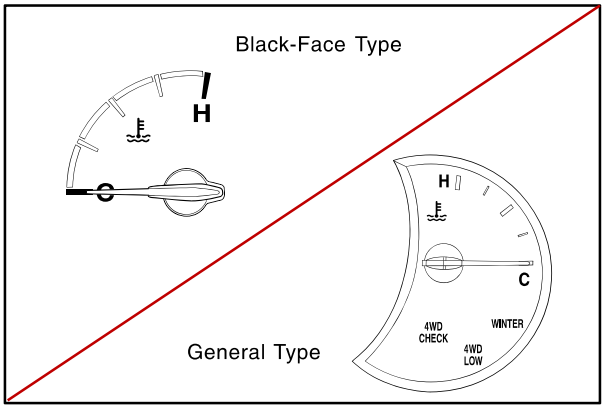
Ideal engine idle speed

1. DI Engine	700 ~ 800 rpm
2. IDI Engine	700 ~ 800 rpm
3. Gasoline Engine	650 ~ 750 rpm

WARNING

- Excessive speed can damage engine.
  Do not let engine reach excessive speed, indicated by pointer being in red zone.

Modification basis	
Application basis	
Affected VIN	



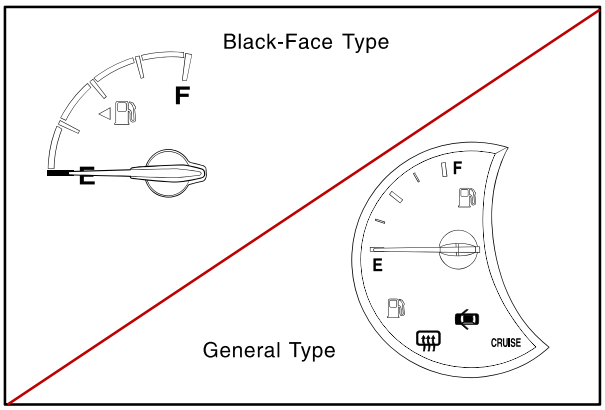
▶Temperature Gauge

The temperature gauge indicates the temperature of engine coolant when the ignition switch is in the "ON" position.

CAUTION

The engine can overheat.

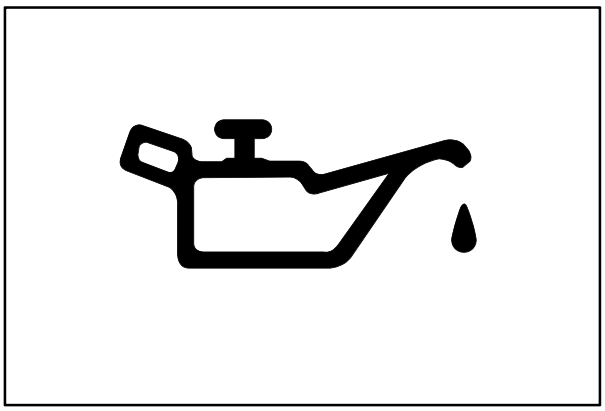
- If the pointer reaches the red zone, stop the vehicle.
- Allow engine to cool.



▶Fuel Gauge

This gauge indicates the level of fuel remaining in the fuel tank. This gauge operates only when the ignition switch is in "ON" position.

- F : Full
- E : Empty



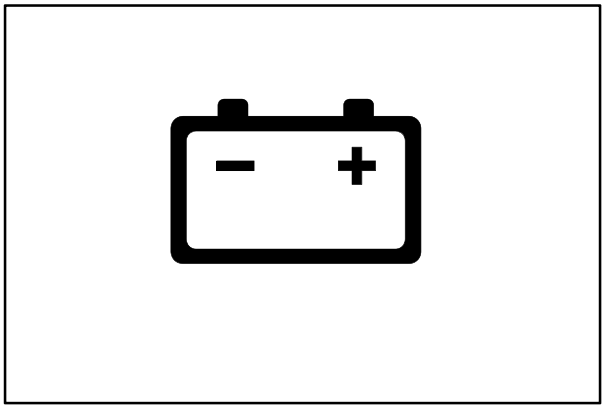
▶Engine Oil Pressure Warning Light

This warning light comes on when the ignition is switched on and should go out after the engine is started.

CAUTION

Severe engine damage could result.

- Do not run the engine with the engine oil pressure warning light illuminated.
- If oil level is normal, have the system checked and repaired immediately by the nearest Ssangyong Dealer or Ssangyong Authorized Service Operation.



▶Battery Charge Warning Light

This warning light indicates that the battery is being discharged. When the ignition is switched on, this warning light comes on and should go out when the engine is started. If the light illuminates while driving,

- Pull off the road and stop the car.
- Check the alternator drive belt for looseness or breakage.
- If the belt is OK, there is a problem somewhere in the charging system. The problem should be located and corrected as soon as possible. Have the system checked and repaired immediately by the nearest Ssangyong Dealer or Ssangyong Authorized Service Operation.



▶Seat Belt Reminder

The seat belt warning light comes on whenever the ignition switch is placed in the "ON" position unless the driver's seat belt is securely fastened. Also the seat belt warning chime will sound for about 6 seconds when the ignition switch is in the "ON" position unless the driver's seat belt is secured fastened.



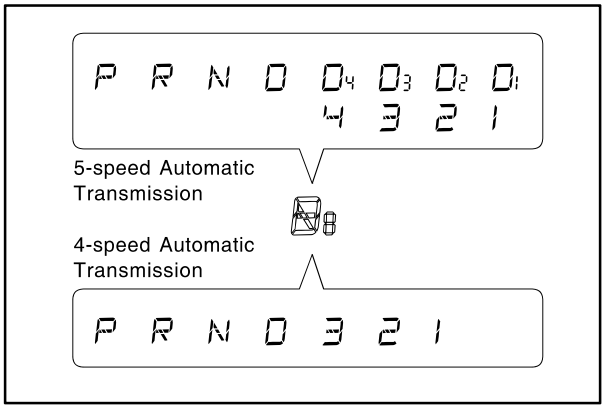
▶Winter Mode Indicator
(for Automatic Transmission)

The indicator will come on when the Winter mode (W) switch near the gear selector lever is selected. Use this mode to drive off smoothly under icy and slippery road.

CAUTION

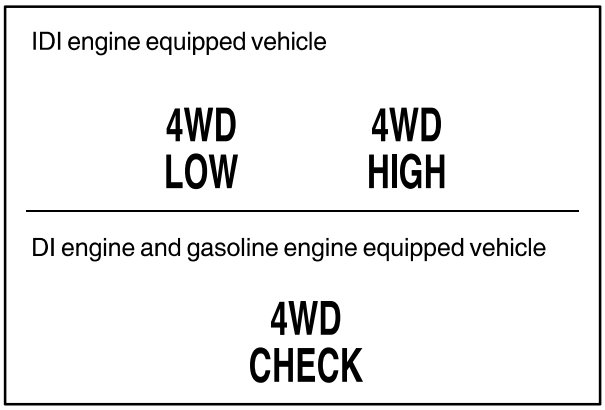
- In winter mode, vehicle starts with 2nd gear so the power could be a little bit reduced.

Modification basis	
Application basis	
Affected VIN	



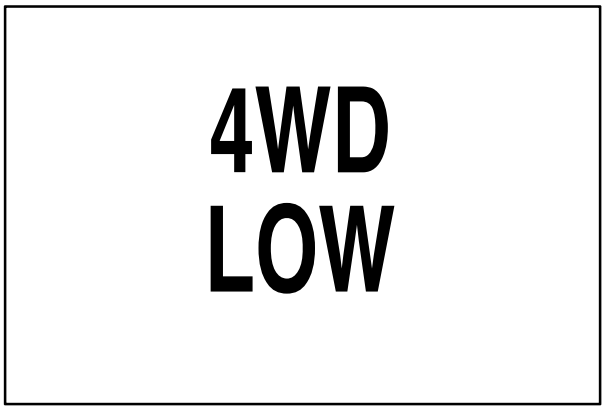
▶Auto Shift Indicator
(for Automatic Transmission)

The indicator comes on when the ignition switch is ON and the indicator shows the automatic transmission selector lever position.



▶4WD Check Warning Light

These indicators come on when the ignition switch is turned to ON and should go out if the system is normal. If the "4WD LOW" and "4WD HIGH" warning light come on or blink (IDI Engine), or "4WD CHECK" warning light stays on, have the 4WD system checked at Ssangyong Dealer or Ssangyong Authorized Service Operation.



▶4WD LOW Indicator

This indicator comes on when the 4WD LOW mode is selected by pushing 4L switch.

To shift "4L" position, completely stop the vehicle and always depress the clutch pedal, for manual transmission, or position the selector lever to "N", for automatic transmission, and select the 4WD switch to "4L".
When the switch is selected and the mode is shifting into 4L, the indicator blinks for a moment.

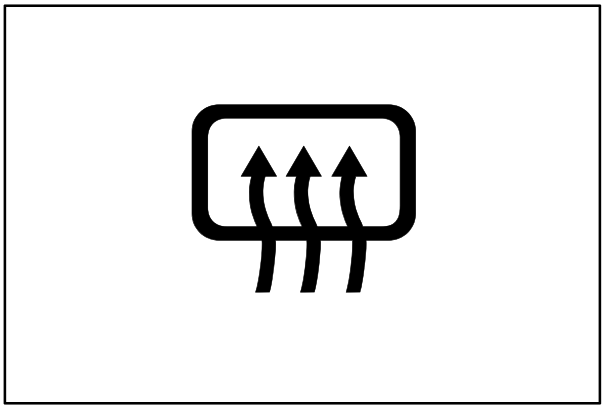


▶4WD HIGH Indicator
(for Part-Time 4WD)

This indicator comes on when the 4WD HIGH mode is selected by pushing 4H switch. Shift the driving mode from 2WD to 4WD HIGH only when the vehicle speed is under 70 km/h.

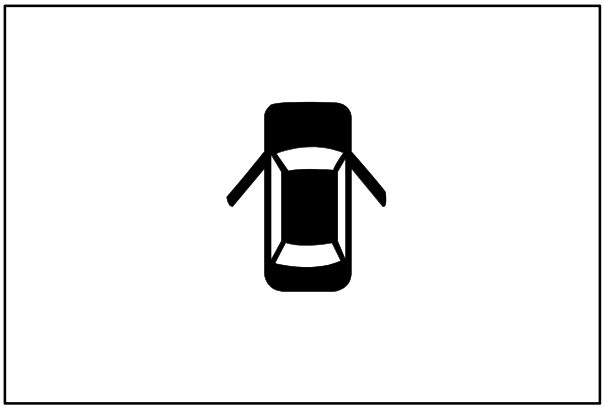
CAUTION

- When shifting the driving mode from 4WD LOW to 4WD HIGH, this indicator will blinks until the shift is completed.
  After completion of shift, the indicator stays on. The indicator comes on without blinking when shifting from 2WD to 4WD HIGH.



▶Defogger Indicator

The indicator comes on when the tailgate glass defogger is switched "ON".
It goes out after specified time.



▶Door Open Warning Light

This light comes on when a door or tailgate is either opened or not closed completely.

WARNING

Driving with door open can cause injury to people inside and outside the vehicle.

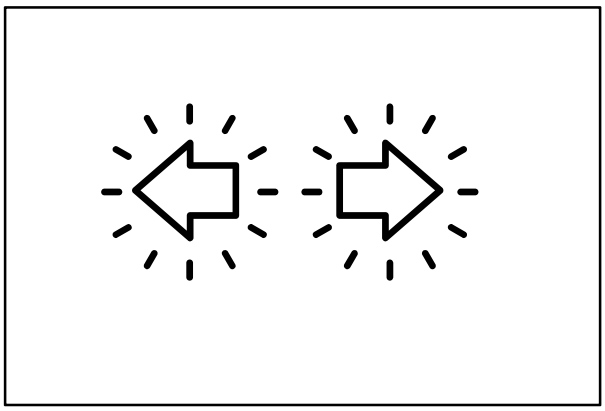
- Before driving off, close all doors.
- Check warning light is off.

Modification basis	
Application basis	
Affected VIN	



▶Air Bag Warning Light

When the ignition is switched on, this warning light illuminates and then should go out, to confirm that the air bag is operational. If it does not come on, or if it does not go out, or if it flashes or illuminates continuously while driving, it means that there is malfunction in the system. The air bag system would therefore not be triggered in the event of an accident. Have the air bag system checked without delay by a Ssangyong Dealer or Ssangyong Authorized Service Operation.

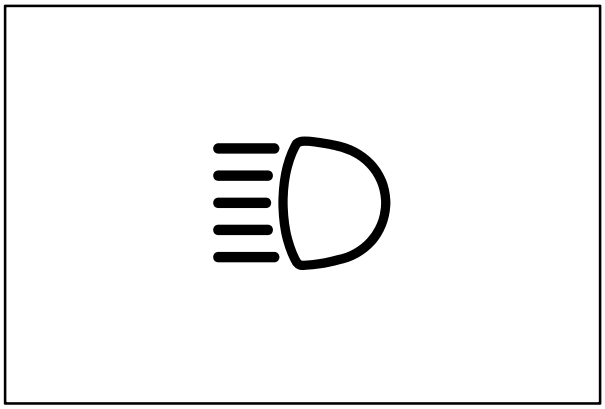


▶Turn Signal/Hazard Flasher Indicator

When the turn signal switch is turned on, this indicator flashes to indicate operation of the external turn signal. Shorter flashes indicate the failure of a turn signal lamp bulb. Both right and left lights flash when the hazard warning switch is turned on.

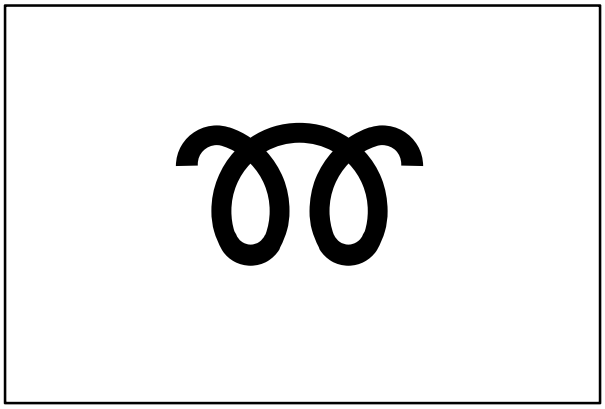
CAUTION

- If a bulb is burned out, replace it immediately to help avoid an accident. If the indicating arrows don't go on at all when a driver signals a turn, check the fuse and for burnt out bulbs.



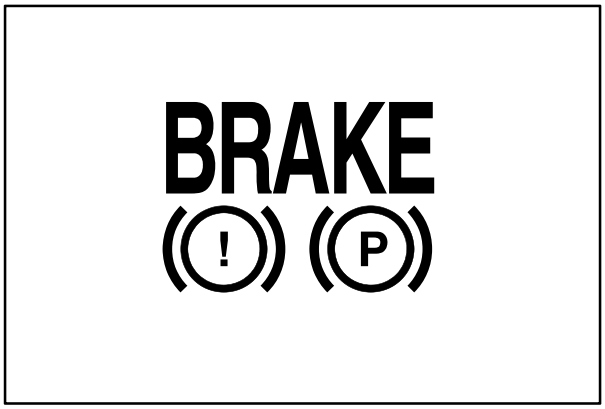
▶High Beam Indicator

This indicator illuminates when the headlight high beam is switched on.



▶Glow Indicator (for Diesel Engine)

This indicator comes on when the ignition switch is turned on and stays on for a short time or may go off right away. The waiting time will vary according to the engine coolant temperature. When the glow plugs are sufficiently heated for cold starting, the light will go out. Then, the engine should be started.



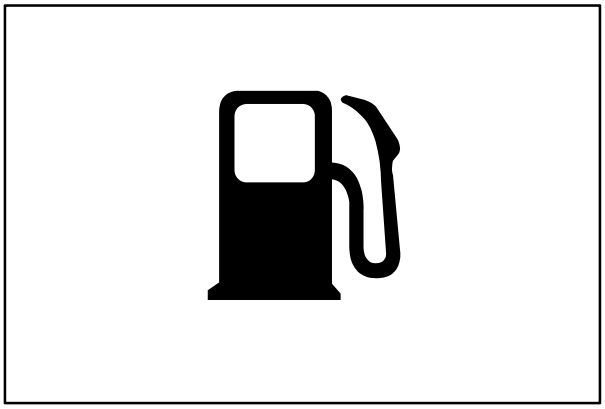
▶Brake System Warning Light

This warning light comes on when the parking brake is applied with the ignition on and goes out when the parking brake is released.

CAUTION

- If the parking brake is applied, this warning light still remains on until the parking brake released. Make sure the parking brake is fully released before driving.
  If this warning light comes on even when the parking brake is completely released, it may indicate that the brake fluid in the reservoir is low.
  Driving the vehicle with the brake fluid warning light on is dangerous.
  Have the brake system checked and repaired immediately by nearest Ssangyong Dealer or Ssangyong Authorized Service Operation.

Modification basis	
Application basis	
Affected VIN	



▶Low Fuel Level Warning Light

This warning light indicates that the fuel will soon be exhausted.
Fill up the fuel tank as soon as possible if this warning light comes on.

CAUTION

- During driving on steep hill or rough roads, this warning light may come on if the remaining fuel is low.



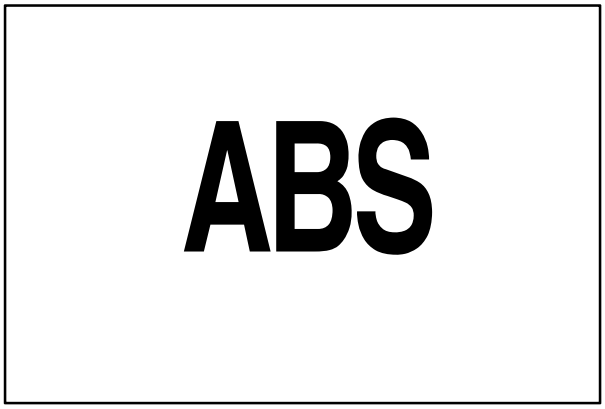
▶EBD Warning Light

When the ignition is switched on, this warning light comes on and should go out after 2 seconds. If the EBD system is abnormal, the warning light comes on and when the relative ABS system is also abnormal, it comes on with ABS warning light.

CAUTION

If this warning light fails to go out or comes on, have the system checked and repaired immediately by the nearest Ssangyong Dealer or Ssangyong Authorized Service Operation.

- EBD (Electronic Brake-force Distribution)
  When the brake pedal is applied, it controls the braking pressure electronically to effectively distribute the braking forces to the front wheels and rear wheels. EBD operates when the speed differences between the most fast front wheel and the rear wheel are over 1 km/h and if ABS is engaged, it does not operate.



▶ABS Warning Light

This warning light illuminates when the ignition is switched on and should go out after about 2 seconds.

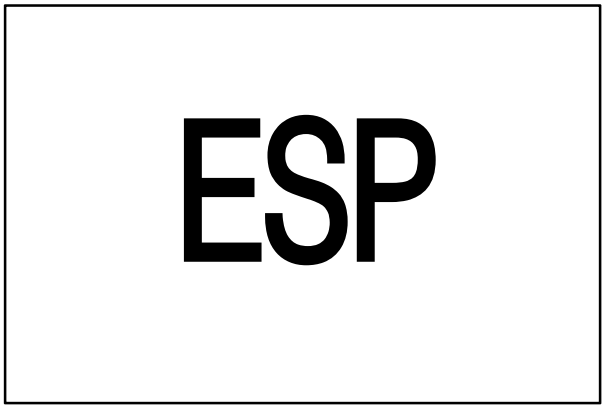
CAUTION

- ABS (Anti-Lock Brake System)
  When a driver brake abruptly or on the slippery road, the vehicle keeps going on ahead but the wheels are locking not to rotate. At this time, the vehicle will not be steered or rotate and could be resulted in accident.
  ABS controls the wheels properly not to be locked and allows steering to increase the vehicle's stability.

CAUTION

- If this light illuminates while driving, a malfunction of ABS is indicated. In this case the brake system performs its regular function but without the anti-locking capability. Have the system checked by Ssangyong Dealer as soon as possible if this condition occurs.
- If the brake system warning light and ABS warning light illuminate at the same time while driving, it may indicate a failure in the base brake system due to the malfunction of ABS.
- Even though the vehicle is equipped with ABS, it may need normal braking distances like conventional brake vehicles or could be longer according to road conditions, so keep the safety distance.
- ABS is auxiliary system for safety. Do not over rely on the system and keep on safety driving.

Modification basis	
Application basis	
Affected VIN	

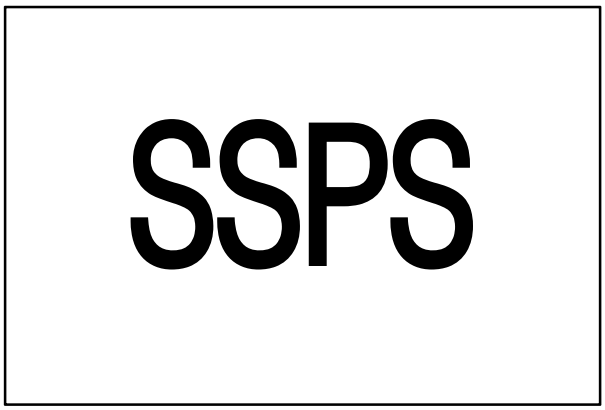


▶ESP Warning Light

If pressing the ESP OFF switch, the ESP function stops and the indicator lamp in instrument panel comes on.
Press this switch again to resume the ESP function. At this time, the indicator lamp goes out. If the ESP function operates while driving, the indicator lamp flickers and the alarm sounds.

CAUTION

- If the ESP warning light comes on, the ESP related system is defective. At this moment, the ABS works in a basic way. However, make sure to check the vehicle at the nearest Ssangyong Dealer or Ssangyong Authorized Service Operation.



▶SSPS Warning Light

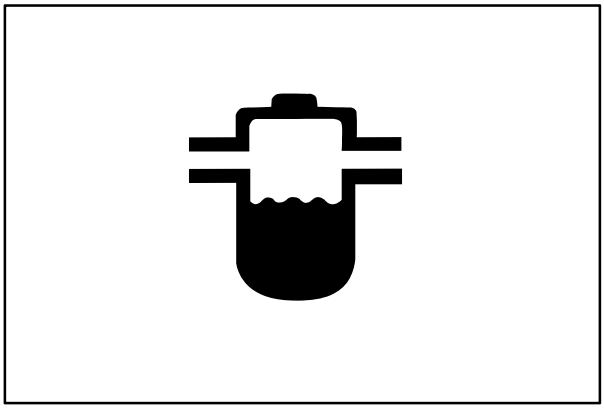
This warning light comes on when the SSPS system is defective. When this warning light comes on, the steerability becomes heavy.

CAUTION

- If this light comes on, have the SSPS system checked by Ssangyong Dealer or Ssangyong Authorized Service Operation.

CAUTION

- SSPS
  In traditional constant power assist steering system, the steerability gets lighter as vehicle speed rises, and this may cause dangerous situation.
  SSPS, by providing appropriate steerability to driver according to the changes of vehicle speed, gives steering stability. In other words, the steering wheel gets lighter by adjusting steerability in stop or low speed and provides steering stability by adjusting steering wheel to become heavier in high speed.



▶Water Separator Warning Light
(Direct Injection Diesel Engine Equipped Vehicle)

When the water level inside water separator in fuel filter exceeds a certain level, this warning light comes on and buzzer sounds. Also, the driving force of the vehicle decreases. If these conditions occur, immediately drain the water from fuel filter. For the draining procedures, please refer to "How to drain the water from fuel filter" on next page.
This warning light goes out when the draining is completed.

CAUTION

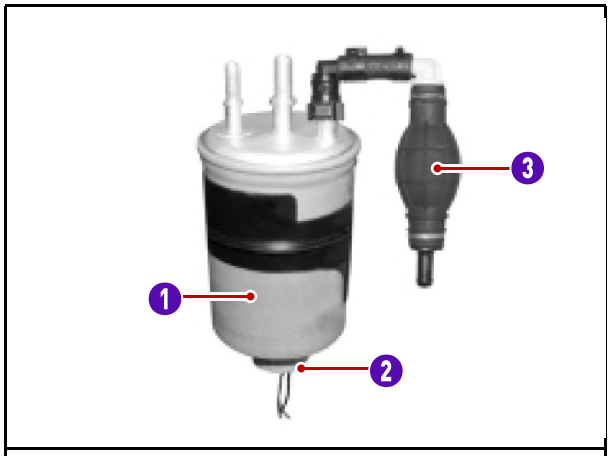
- Drain the water from fuel filter immediately after the warning light comes on. If you cannot do that by yourself, visit nearest Ssangyong Dealer or Ssangyong Authorized Service Operation.
- For the draining procedures, please refer to "How to drain the water from fuel filter" on next page. After draining the water, press the priming pump until it becomes rigid.
- The fuel system in engine may get serious damage if you keep driving while the warning light is coming on. Prompt correction should be necessary.

Modification basis	
Application basis	
Affected VIN	



▶ How to Drain the Water from Fuel Filter (Direct Injection Diesel Engine Equipped Vehicle)

1. Locate the fuel filter in engine compartment.
2. Place the water container under the fuel filter.

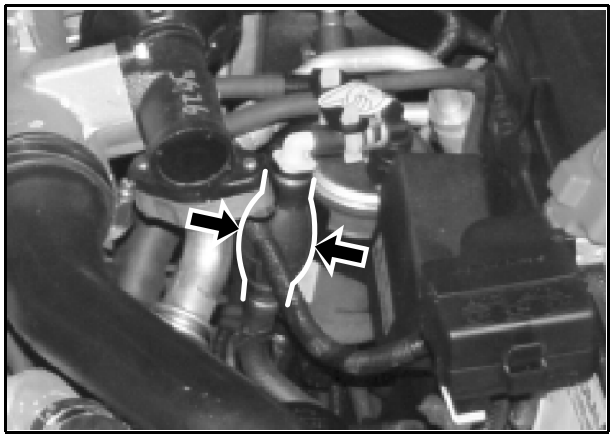


1. Fuel filter
2. Drain plug
3. Priming pump

3. Disconnect the connector under the drain plug.
4. Turn the drain plug to clockwise direction to drain the water.

CAUTION

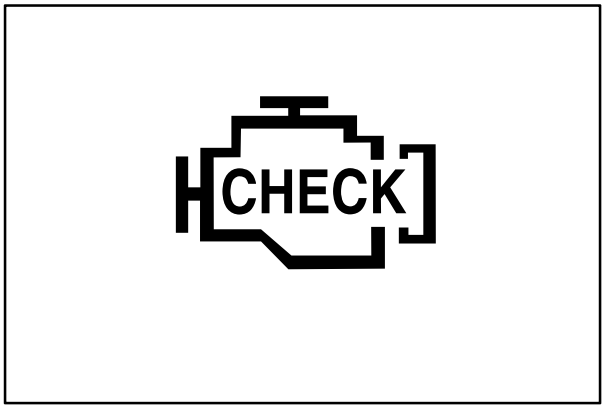
- Be careful not to be injured by surrounding equipment during the working procedures.



5. Wait until a certain amount of fuel gets out from the port, then turn the drain plug to counterclockwise direction to tighten it.
6. Engage the connector under the drain plug and press the priming pump until it becomes rigid.
7. Close the engine hood and start the engine.

CAUTION

- If the priming pump is not properly operated, air may get into the fuel line. It may cause starting problem or fuel system problem. Make sure to perform the job in step 6.



▶Engine CHECK Indicator

This warning light comes on when the ignition switch is turned to ON and goes out if the engine is in normal condition. If the light stays ON, inspect the vehicle by Ssangyong Dealer or Ssangyong Authorized Service Operation.

CAUTION

Do not drive with the engine check indicator lamp on. The indicator lamp signals that the vehicle has a problem that requires attention.

- Driving with the engine check indicator lamp on can damage the emissions control system and can affect the fuel economy and drivability or the vehicle.
- Consult a Ssangyong Dealer or a Ssangyong Authorized Service Operation to repair the problem as soon as possible.



▶Rheostat (Black-Face type)

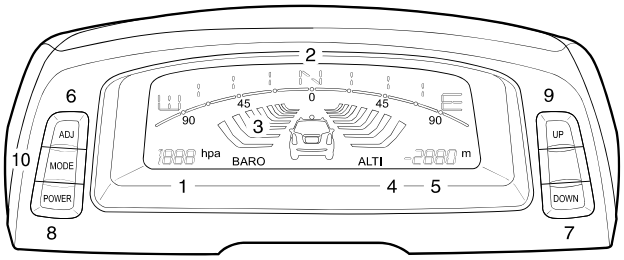
Press and hold the Trip odometer reset button/Rheostat button to adjust the instrument panel illumination. Release the button when the illumination reaches the brightness.

Modification basis	
Application basis	
Affected VIN	

3. MULTI-METER OPERATING PROCESS

1) SYSTEM LAYOUT









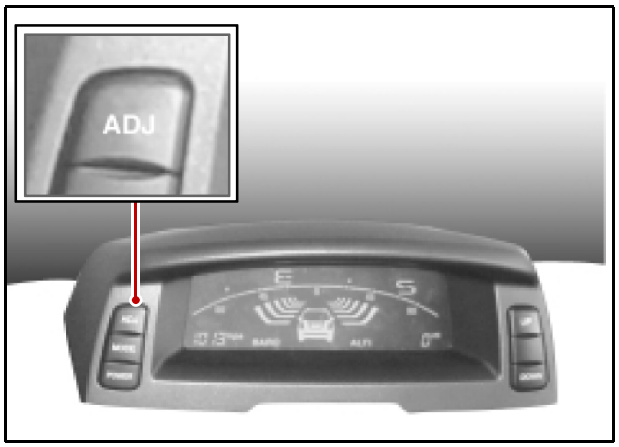
1. Barometer
2. Electronic compass
3. Speed sensing indicator
4. Relative altimeter
5. Altimeter
6. Adjustment switch
7. Down switch
8. Power switch
9. Up switch
10. Mode switch

Modification basis	
Application basis	
Affected VIN	

2) ELECTRONIC COMPASS



1. It indicates 16-direction by intervals of 22.5° according to the vehicle's driving direction.
   - Direction:
     ·E: East
     ·W: West
     ·S: South
     ·N: North
   - When the first equipped to the vehicle or the battery is exchanged, you have to perform calibration by circulating your vehicle. If not, there will be misreading in direction.



▶ Turning Calibration

1. If you press the adjustment switch for 0.5~5 seconds, the current direction flashes.
2. Turn the vehicle over 1 complete circle within 128 seconds slowly, then the calibration will be accomplished.
3. When the calibration is finished, the vehicle's new direction will be indicated.

CAUTION
- If the compass continues to flash, turn again slowly until it goes off.



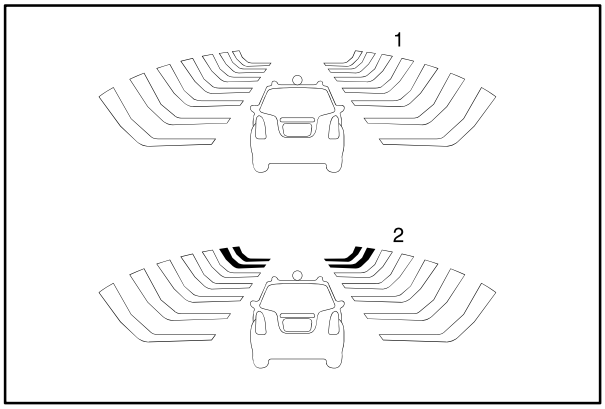
▶ Release Conditions for Turning **Calibration**

- When the adjustment switch is pressed over 0.6 second.
- When the vehicle is not turned within 128 seconds after calibration mode started.

Warning for turning
When the vehicle has been turned out of the specification due to external elements, direction indicator flashes to inform you that there are abnormal signals.

Modification basis	
Application basis	
Affected VIN	

3) SPEED SENSING INDICATOR

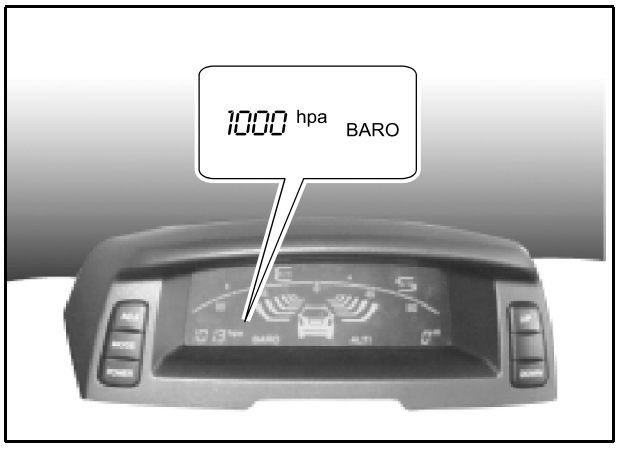


The flashing interval of the road signs changes gradually according to the vehicle speed.

Flashing intervals by speed ranges

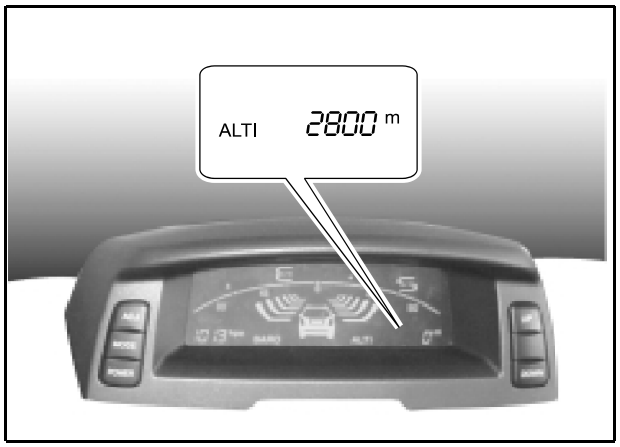
Speed range	Flashing interval
Less than 1.8 km/h	All “ON”
Less than 40 km/h	per 1 second
Less than 60 km/h	per 0.8 second
Less than 80 km/h	per 0.5 second
Less than 100 km/h	per 0.3 second
Over 100 km/h	per 0.2 second

4) BAROMETER



It indicates the current atmospheric pressure up to 600 hpa ~ 1,100 hpa by 1 hpa.

5) ALTIMETER (ABSOLUTE ALTIMETER)



It operates by atmospheric pressure. 0m above the sea level is equivalent to 1013.25 hpa and the altimeter convert the difference between this pressure and atmospheric pressure to altitude and shows by every 20 m. (however, if less than 20 m, it indicates as 0 m)

▶ How to Calibrate the Altitude

SWITCH	SWITCH	SWITCH
UP	ON (less than 0.5 sec.)	Increase by 20 m
	ON (more than 0.5 sec.)	Automatic increase by 20 m (per 0.2 sec.)
DOWN	ON (less than 0.5 sec.)	Decrease by 20 m
	ON (more than 0.5 sec.)	Automatic decrease by 20 m (per 0.2 sec.)

▶ How to Erase the Calibrated Altitude Value

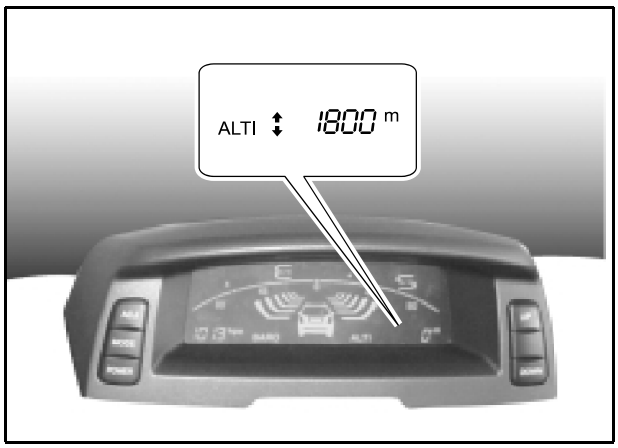
Press the UP and DOWN switches simultaneously for more than 1 second then the calibrated altitude value will be erased and the current altitude will be indicated after showing -0000 for 2 seconds.

▶ Altitude Calibration Ranges

The difference between minimum value and maximum value is 3000m: the calibration is available within the altitude range of -200 ~ +2800 m.

Modification basis	
Application basis	
Affected VIN	

6) RELATIVE ALTIMETER



Use this to see the specific area's altitude; it shows the specific area's relative altitude based on the current altitude of the vehicle.

▶ Mode Setting of the Relative **Altimeter**

1. Press the "MODE" switch over 0.5 second.

- To see the difference of the altitude Set the vehicle's altitude to 0 by pressing "UP" and "DOWN" switches simultaneously over 1 second.

→ read the indicated altitude after arrival.

▶ To See the Destination's Altitude

1. Enter the altitude of the point where you know the altitude from the sea level.
2. The indicated value on the destination is the altitude from the sea level.

CAUTION

- The altimeter operates by using changes of atmospheric pressure.
  So, sometimes, the indicated altitude may different due to changing atmospheric pressure in the same place, however, it is normal, not malfunctions.

▶ Coming Out Order of the Road Signs

- If the vehicle stops, the currently turned off area of the signs will remain as it is.
- If the vehicle drives off again, the next area from the turned off signs will start to flash.

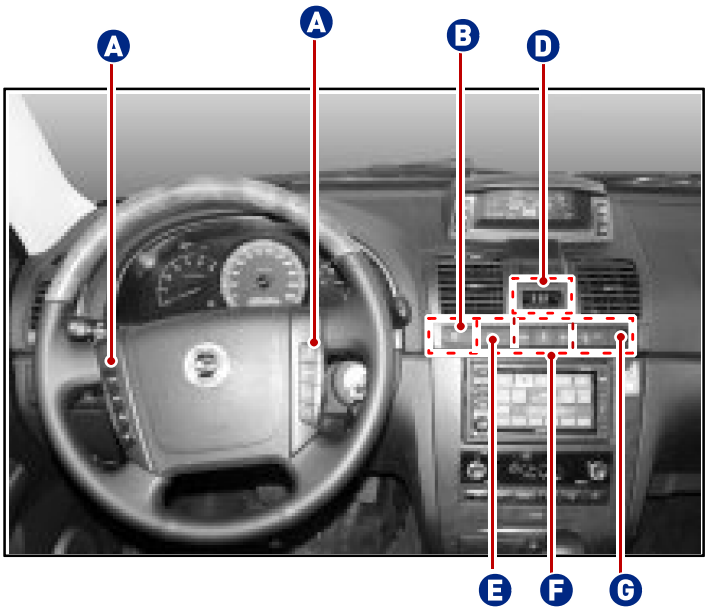
SWITCHES

8510-01

OVERVIEW AND OPERATION PROCESS

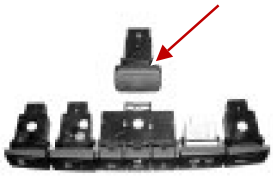
1.COMPONENTS LOCATOR

1) Center Switches



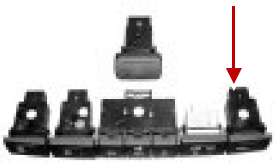
Hazard warning switch

D



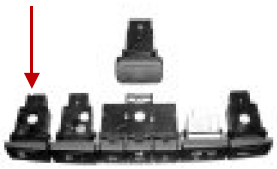
ESP OFF switch

G



Defogger switch

B



Audio remote control switch

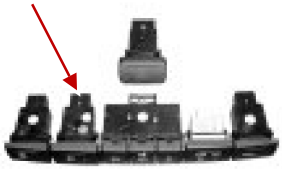
A





Front fog lamp switch

E



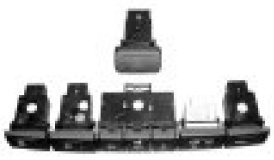
4WD switch (Full-Time)

F



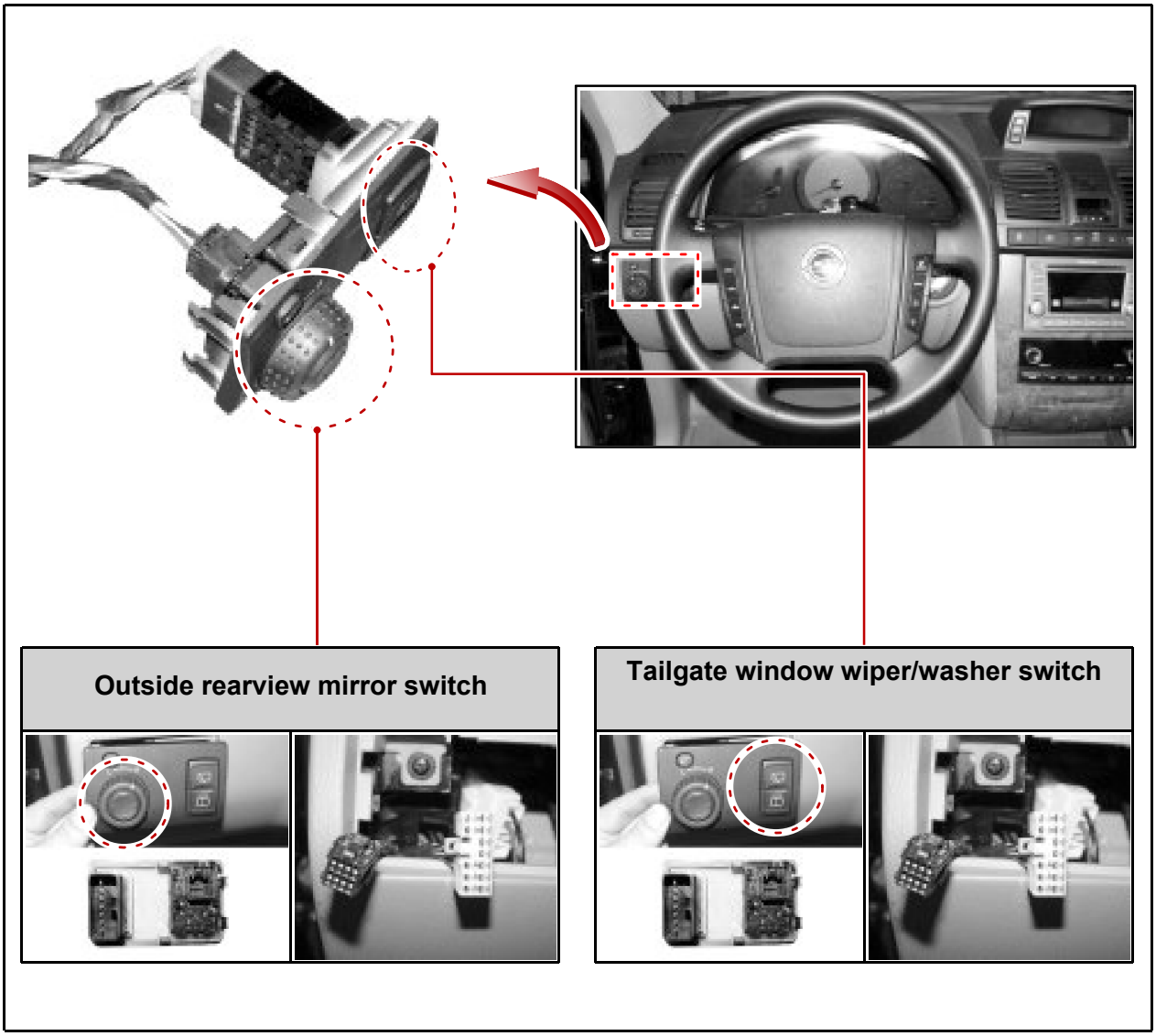
4WD switch (Part-Time)

F



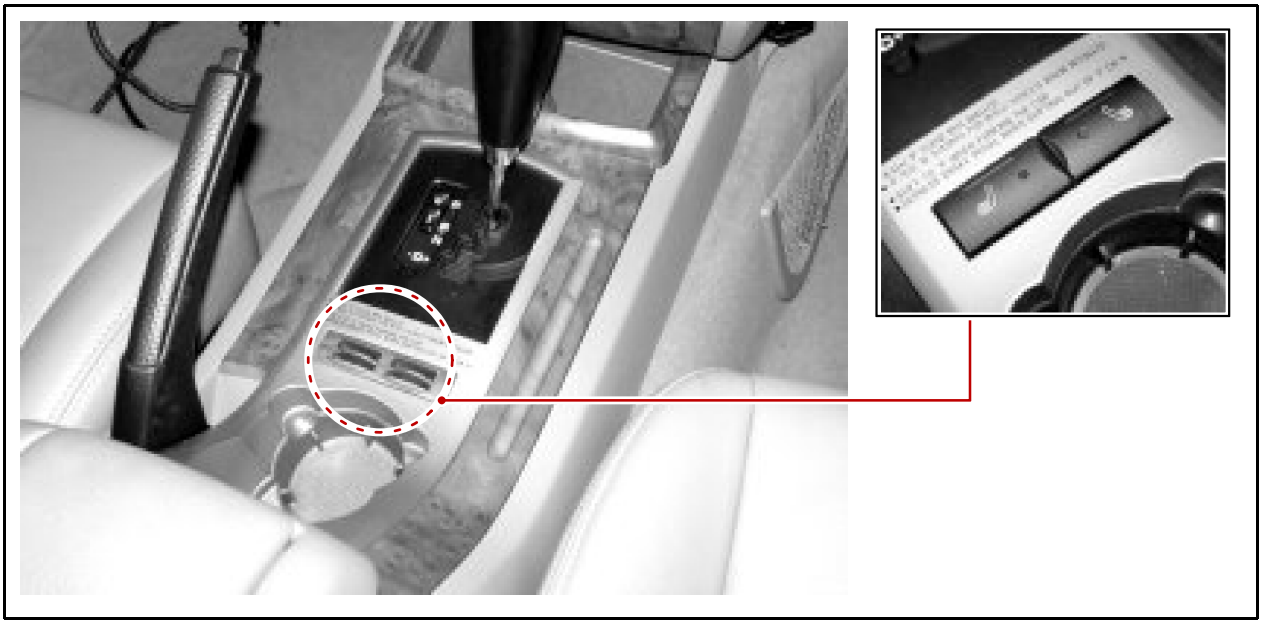
Modification basis	
Application basis	
Affected VIN	

2) Others



Modification basis	
Application basis	
Affected VIN	

3) Seat Warmer Switch



Warm the seat in the cold weather for comfortable driving.
Press the button to warm the seat, and press it again to stop the operation.

CAUTION
- Do not place anything sharp on the seat. This may cause damages to the seat warmer.
- When cleaning the seats, do not use organic solvents such as benzene or thinner. The seat surfaces may get deteriorated.

CAUTION
- Do not operate when the engine is not running.

LAMP

8310-01

GENERAL

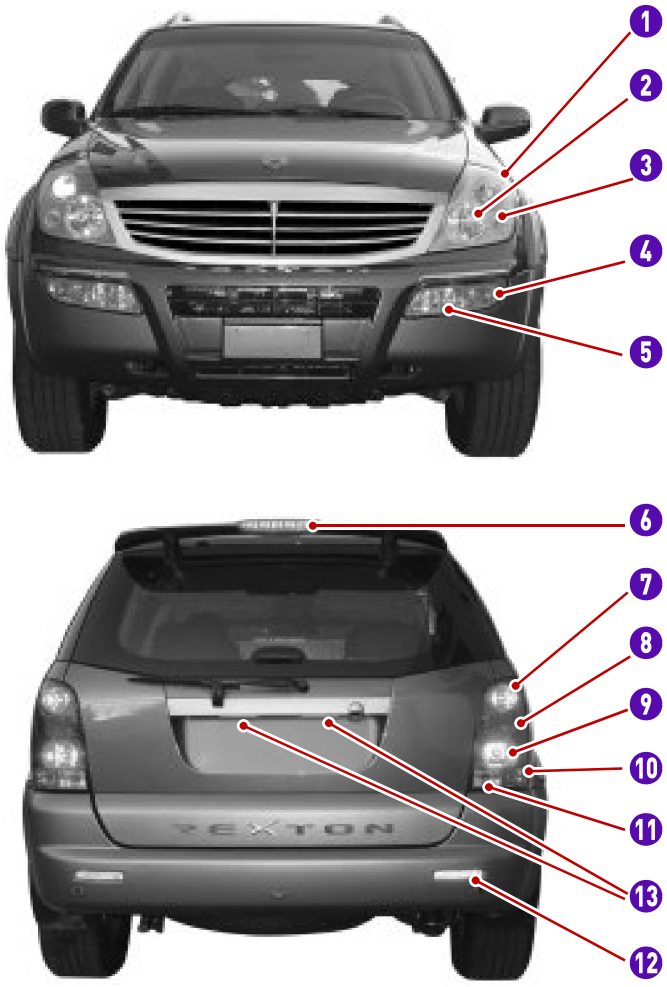
1. SPECIFICATIONS

Description		Specification	Description		Specification
Headlamp	Low beam	55W x 1	Rear combination lamp	Back-up lamp	27W x 1
	High beam	55W x 1	Deflector	Rear	-
	Clearance lamp	5W x 2	License plate lamp	License plate lamp	5W x 2
Front combination lamp	Fog lamp	27W (H27W)	Interior	Glove box	10W x 1
	Turn signal lamp	28/8W		Front room lamp	8W x 2
Rear	High mounted stop lamp	5W x 4		Center room lamp	10W x 2
Rear combination lamp	Tail/Stop	27/8W x 1		Door lamp	5W x 4
	Tail lamp	8W x 1		Vanity mirror lamp	
	Stop lamp	27W x 1	Side turn signal lamp	Turn signal lamp	5W x 1
	Turn signal lamp	27W x 1			

OVERVIEW AND OPERATION PROCESS

1. LOCATIONS

▶ EXTERIOR LAMPS



1. Headlamp - Low beam
2. Headlamp - High beam
3. Clearance lamp
4. Turn signal lamp
5. Fog lamp
6. High mounted stop lamp
7. Tail and stop lamp
8. Tail lamp
9. Stop lamp
10. Turn signal lamp
11. Back-up lamp
12. Rear deflector
13. License plate lamp

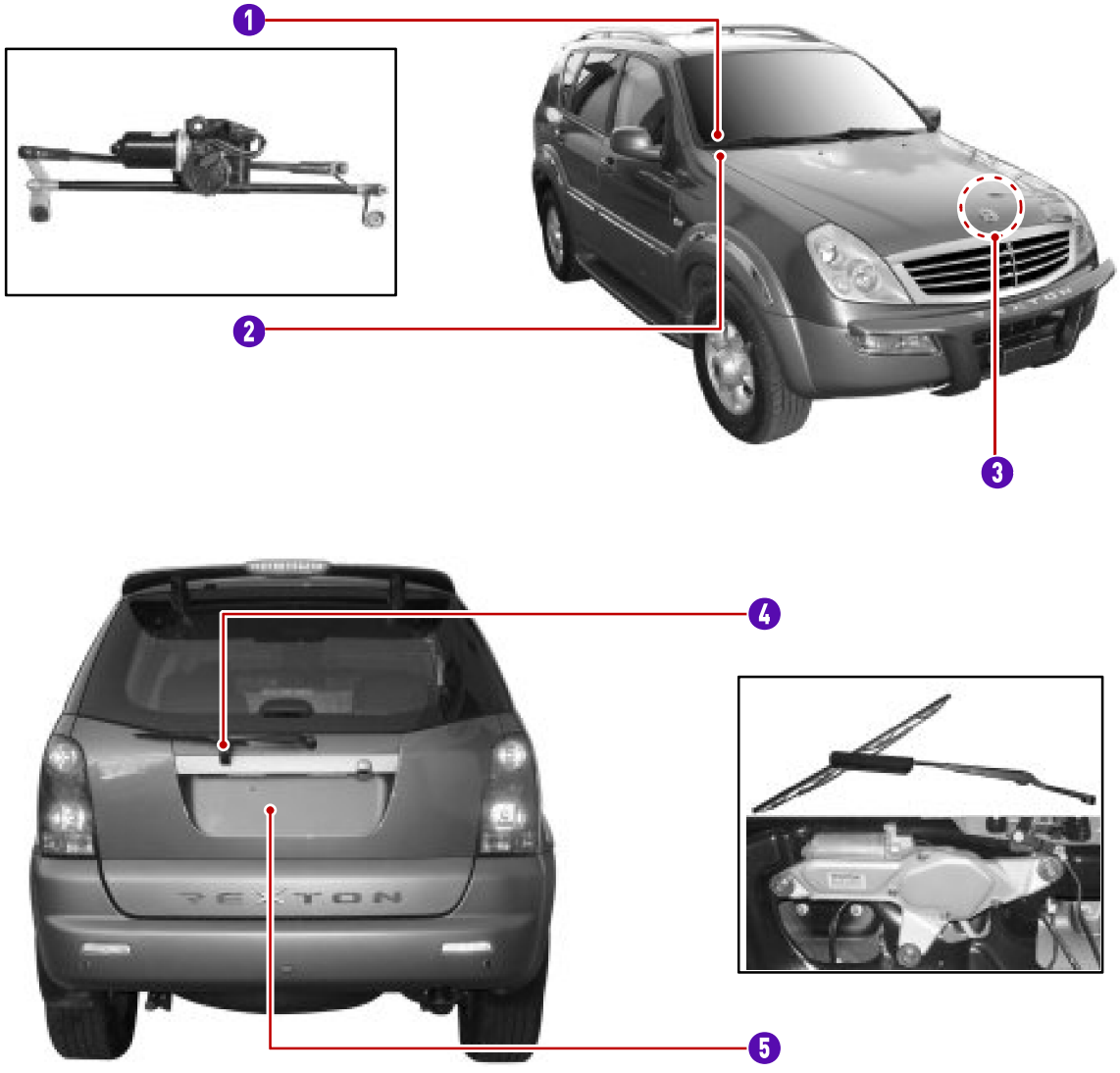
Modification basis	
Application basis	
Affected VIN	

WIPER AND WASHER

7810-01

OVERVIEW AND OPERATION PROCESS

1. COMPONENTS LOCATOR



1. Wiper blade
2. Wiper motor and linkage
3. Washer reservoir assembly
4. Wiper blade
5. Wiper motor

RAIN SENSOR

8610-11

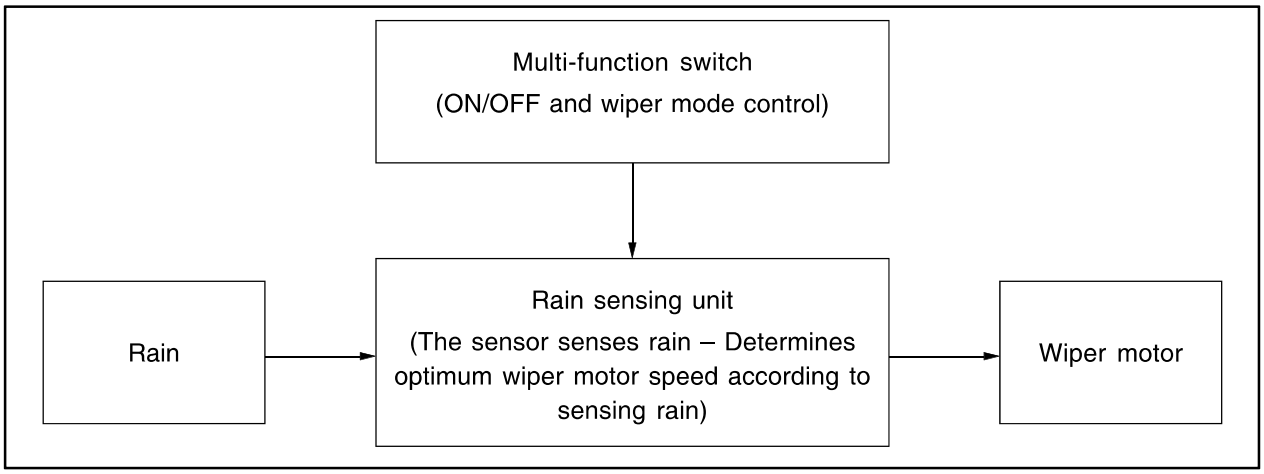
OVERVIEW AND OPERATION PROCESS

1. OPERATION PROCESS

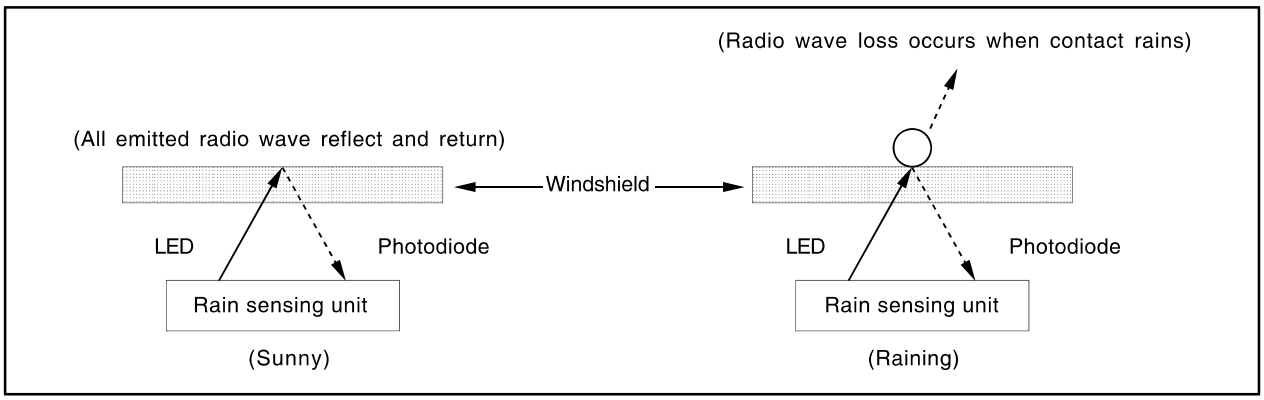
1) Overview

Rain sensor wiper system is a wiper operation system that sets wiper operation time to fast or slow automatically without driver's operation by controlling wiper motor drive when the rain sensing unit on the inner upper central windshield senses rain.

2) System Diagram



3) Principle of Rain Sensor



1. Rain sensing unit detects amount of rains through LED and photodiode.
2. When infrared rays emitted from LED are reflected against rains on the windshield surface, photodiode detects the amount of rains.
3. Rain sensing unit has glass transmitting rate compensation circuit so it can detect rains constantly regardless of transmitting rays.
4. Windshield transmitting rate can be measured at the central point on the glass between LED and photodiode.

2. OPERATION MODE



Rain sensor wiper control system has AUTO mode (on the conventional INT position) in addition to conventional wiper functions of OFF, MIST, LOW and WASHER. When positioned to AUTO, the rain sensor detects rains on the windshield and then controls wiper operation time and wiper operation speed to LOW or HIGH automatically.

Wiper Switch Position	Rain Sensor Operation Mode	System Operation Mode
MIST	MIST	As long as the switch is in MIST position, the wiper motor operates in low speed. The wiper blade returns to park position after wiping and does not affect on the sensor.
OFF	OFF	When wiper is not in park position, the wiper motor continues to operate in low speed until the wiper returns to park position.
AUTO (Sensitivity of AUTO mode can be controlled to stage 1 ~ 5)	AUTO	Automatic delay (INT)/automatic speed control in AUTO (can be controlled by driver) position, the sensitivity against rains on windshield can be controlled by wiper switch.
LOW	MANUAL	Wiper motor operates continuously in low speed of approx. 45 rev./min.
HI	MANUAL	Wiper motor operates continuously in high speed of approx. 60 rev./min.
WASHER (When washer button pressing time is ≥ 0.6)	WASHER	When the washer switch is pressed over 0.6 sec., the wiper operates for 2.5 ~ 3.8 sec.
WASHER (When washer button pressing time is < 0.6)	WASHER	When the washer switch is pressed for 0.2 ~ 0.6 sec., the wiper operates once.

(1) OFF mode

When wiper switch is in OFF position and ignition switch is in ON position, rain sensor operates in OFF mode. On this mode, the wiper motor does not operate. During OFF mode, rain sensor monitors windshield conditions and then sets the wiper switch sensitivity stage.
So the sensor performance can be optimized when turned from OFF mode to AUTO mode.
Control algorism in OFF mode is assumed as set to normal detection.

Modification basis	
Application basis	
Affected VIN	

(2) AUTO mode

When wiper switch is turned to AUTO mode from OFF, wiper operates once immediately to notice the driver wiper system operation. When operated once, the wiper stays on park position to determine whether the wiper parking time is proper for rain volume. However, this operation varies according to driver's set volume. When parking period is completed, rain sensor inputs signal to wiper motor to wipe out rains on windshield.

(3) Automatic intermittent

Under AUTO INT mode, the wiper cleans windshield once and then takes variable parking time on the inner area position.

(4) Automatic low speed

AUTO LO mode operates when rains on windshield exceed critical value of AUTO INT and AUTO LO. This critical value has magnetization characteristics that prevents repeating operation between AUTO INT and AUTO LO while accumulating rain.

(5) Automatic high speed

AUTO HI mode operates when rains on windshield exceed critical value of AUTO LO and AUTO HI. This critical value has magnetization characteristics that prevents repeating operation between AUTO LO and AUTO HI while accumulating rain.

(6) Washer mode

Rain sensor monitors whether the wiper switch has selected washer function. When washer switch on the wiper switch in wiper system is pressed on for over 0.6 sec., wiper operates for 2.5 ~ 3.8 sec. and, if not, operates once only. Under washer mode, wiper motor operates in low speed to clean the windshield.

(7) Manual mode

If the driver operates switch, the wiper motor operates in low or high speed. At this moment, the wiper operation is controlled by direct ground from wiper switch, not by rain sensor controls.

CAUTION

- When rain sensor is defective, wiper operates in low/high speed normally.

3. OPERATIONAL CHARACTERISTICS OF RAIN SENSOR

(1) Power stabilization time

When power is supplied, rain sensor outputs OFF signal until there is effective output within 250 msec. Effective output is available after 2 sec. from the power supply.

(2) Control of wiper speed and frequency

Main function of rain sensor is controlling wiping speed and delay time between wiping operations and maintaining level of rains (degree of rains that covering windshield) that driver has selected. According to set sensitivity and level of rains, rain sensor algorism determines operation mode among AUTO INT, AUTO LO and AUTO HI. When sensitivity is set, wiper operation continues without driver's switch operations.

(3) Shifts between modes

Rain sensor algorism shifts among AUTO INT, AUTO LO and AUTO HI at lower so does not make shocks.

(4) Adjustable sensitivity performance

Sensitivity of rain sensor can be set by increasing/decreasing INT on wiper switch.
Sensitivity can be set from stage 1 to stage 5 according to actual system. Each stage can be identified so that can satisfy every driver's desire on level of rains. Adjustable ranges are from short delay time (1 ~ 5 sec.) to long delay time (over 20 sec.), so that can meet very small amount of rain. However, if rains heavily, wiper operates continuously in high speed regardless of set sensor sensitivity.

(5) Response characteristics of AUTO LO

If rains and the wiper should be operated from 0 to AUTO LO, rain sensor's high speed demand signal output period does not exceed 9 sec.

(6) Response characteristics of AUTO HI

If rains and the wiper should be operated from 0 to AUTO HI, rain sensor's high speed demand signal output period does not exceed 9 sec.

(7) Response characteristics when shifting from AUTO LO to AUTO HI

If rains and wiper operation changes from AUTO LO to AUTO HI, rain sensor's high speed demand signal output period does not exceed 9 sec.

(8) Response characteristics when shifting from AUTO HI to OFF

If rains and wiper operation changes from AUTO HI to 0, the system counts wiping times when it is high and low (12-time) and when it is changing from INT to OFF (7-time) not to exceed 19 times in total.

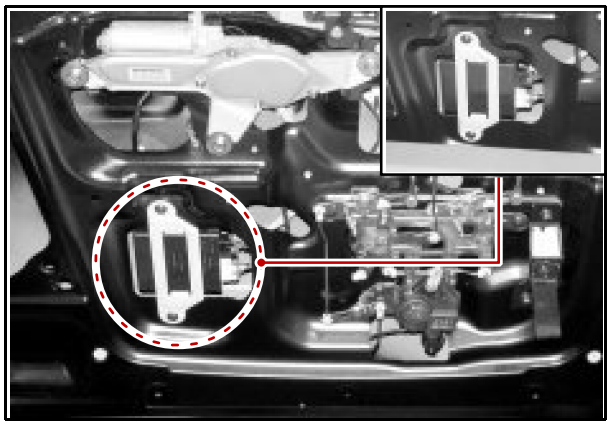
(9) Instant wipe

When wiper system is operated by wiper switch, it wipes windshield once before returning to operation position.

This one-time operation happens every time when wiper switch is operated to increase the sensitivity by changing INT volume from lower state (state 1) to higher stage. However, it does not happen when wiper switch is changed into lower sensitivity. If ignition switch is turned ON when ignition switch is turned off and wiper switch is set to a certain sensitivity, wiper operates once immediately to notice the driver wiper system operation. If rain is too small to operate the wiper system with AUTO mode, rain sensor remains in AUTO INT mode for long time.

4. REAR WIPER CONTROL SYSTEM

1) General



Conventional rear wiper system is controlled when rear wiper relay is operated by operating switch. However, rear wiper system on Rexton is controlled by separate ECU. The reason is that the conventional vehicle has rear wiper brush on the rear glass but the Rexton can open the rear glass so cannot install rear wiper brush on the rear glass. The rear wiper brush is installed on the back panel and the wiper motor is operated in 2 stages.

2) Description on System Operation

▶ Wiping mode

1. Wiper switch is turned on, relay 1 on CONT turns on to rotate the motor clockwise.
2. When "W" and "C" points on the CAM switch are connected during revolution, relay 1 on CONT turns off and then relay 2 turns on to rotate the motor counterclockwise.
3. If "W" and "C" points on the CAM switch are connected during revolution again, relay 2 on CONT turns off and then relay 1 turns on to rotate the motor clockwise. It means by changing motor polarities between 2 and 4 with CAM switch, the wiper operates.

▶ Parking mode operation

1. Parking while operating clockwise: If turns off wiper switch during wiper operation, "W" and "C" points on the CAM switch are connected during revolution, then relay 1 on CONT turns off to stop the motor. After 1 second, relay 1 on CONT turns on to rotate the motor clockwise and then "P" and "C" grounds on the CAM switch are connected to turn off relay 1 on CONT and to stop motor.
2. Parking while operating counterclockwise: If turns off wiper switch during wiper operation, "W" and "C" points on the CAM switch are connected with ground during revolution, then relay 2 on CONT turns off to stop the motor. After 1 second, relay 2 on CONT turns on to rotate the motor counterclockwise and then "P" and "C" grounds on the CAM switch are connected to turn off relay 2 on CONT and to stop motor.

Modification basis	
Application basis	
Affected VIN	

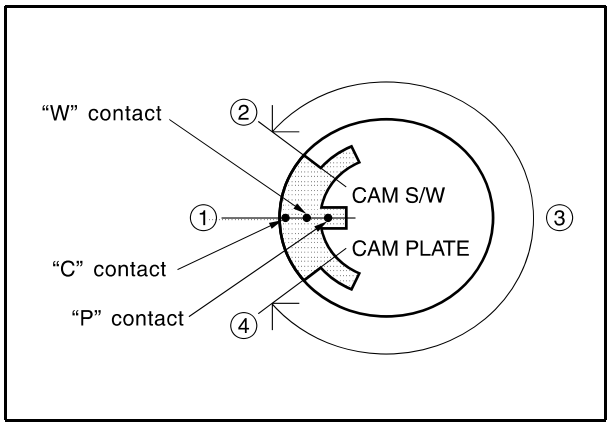
▶ **Washer mode operation**

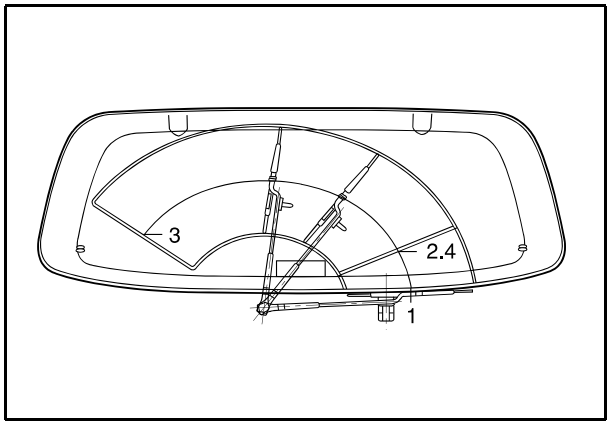
When washer switch is turned on for over 0.5 sec., wiper mode operates 2 times and then performs parking mode operation to stop motor.
However, when washer switch is turned on for less than 0.5 sec., wiper motor does not operate.

▶ **Limit switch ON mode operation**

1. Limit switch ON during wiper operation: If turn on limit switch during wiper operation, returns to parking position immediately to stop the motor.
2. Limit switch ON under parking position: Even when the wiper switch or INT switch is turned on, the motor does not operate.

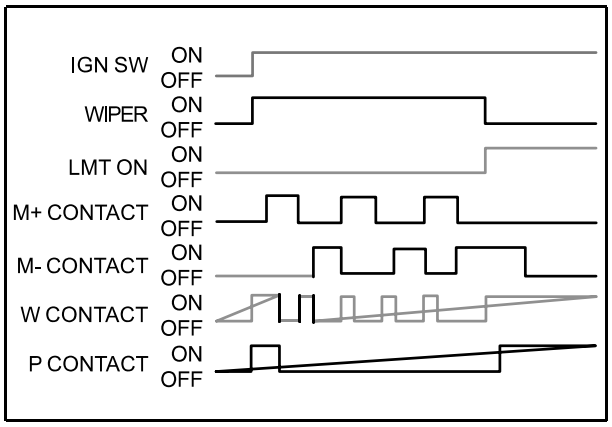
3) System operation description





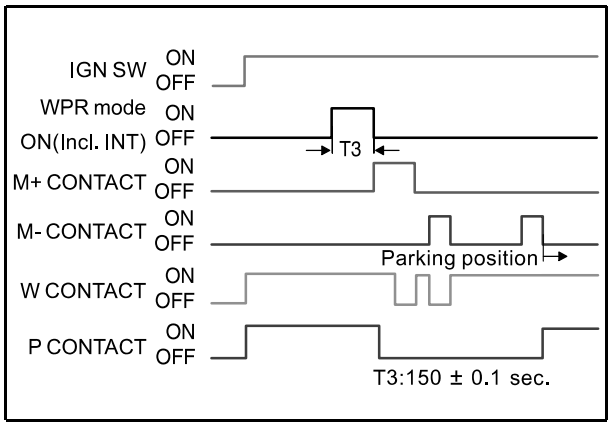
1. If turn on motor operation switch, relay 1 on controller turns on to rotate the motor clockwise (operation order: (1) → (2) → (3) → (4))
2. When "W" and "C" points on the CAM switch are connected during revolution, relay 2 on controller turns off and relay 1 on controller turns on to rotate the motor clockwise. It means by changing motor polarities between wiping ranges with CAM switch, the wiper operates. (operation order: reciprocates (2) → (3) → (4) → (3) → (2))
3. DSP angle means angle between (1) and (2) or (1) and (4).
4. If rotates from (3) to (4) in clockwise, the motor parks in position (1). If rotates from (3) to (2) in counterclockwise, the motor parks in position (1).
   It means when motor is in park position, "W", "C" and "P" points are in a line as shown in below.

1) Washer coupled mode



1. When wiper switch is turned on for over 0.6 sec. under ignition switch on condition, washer coupled wiper output comes on.
2. When washer switch is turned off, wiper mode operation will be performed 2 times and then return to parking position.
3. Wiper motor output works same as the wiper operation mode.

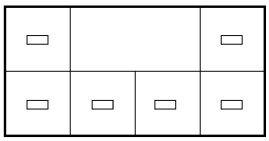
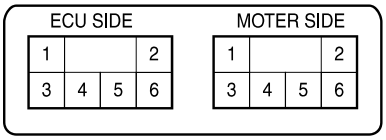
2) Limit switch ON/OFF mode operation



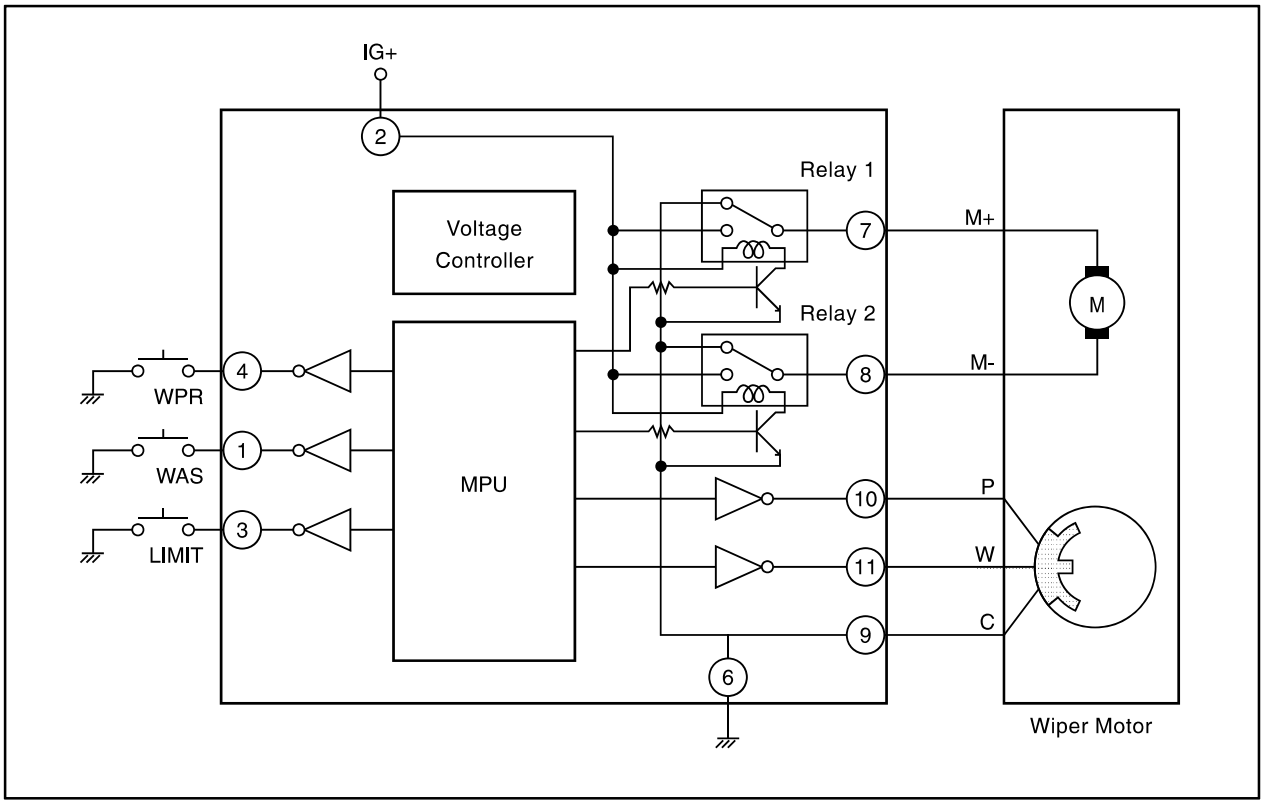
1. If turn on limit switch while wiper motor is operating under ignition switch on condition, returns to parking position without delay to stop the motor.
2. Under limit switch on condition, wiper motor output control will be stopped.
   (It is to control the wiper blade not to be blocked by rear glass when opened.)

Modification basis	
Application basis	
Affected VIN	

4) Specifications

Item			Specification
Motor 	Rated voltage		DC 12 V ± 0.3 V
	Test voltage		DC 13.5 ± 0.3 V
	Operating voltage range		DC 10 ~ 15 V
	Min. operation voltage		Below DC 8 V
	Insulation resistance		Over 500 V mega 1 M
	Lock test	Torque	Over 1.1 Km
		Current	Below 14 A
	Operating temperature range		- 40°C ~ + 80°C
Control 	Rated voltage		DC 12 V
	Operating voltage range		DC 9 ~ 16 V
	Operating temperature range		- 30°C ~ + 80°C
	Storage temperature range		- 40°C ~ + 90°C
	Insulation resistance		Over 1 M
	Voltage drop		Below 0.5 V (Load current between terminals 5-7, 6-8, 5-8 and 6-7 at 5 A)
	Test voltage		14.0 ± 0.5 A
	Allowable load current		Max. 10 A

5) Circuit Diagram



Modification basis	
Application basis	
Affected VIN	

5. AUTO LIGHT SYSTEM

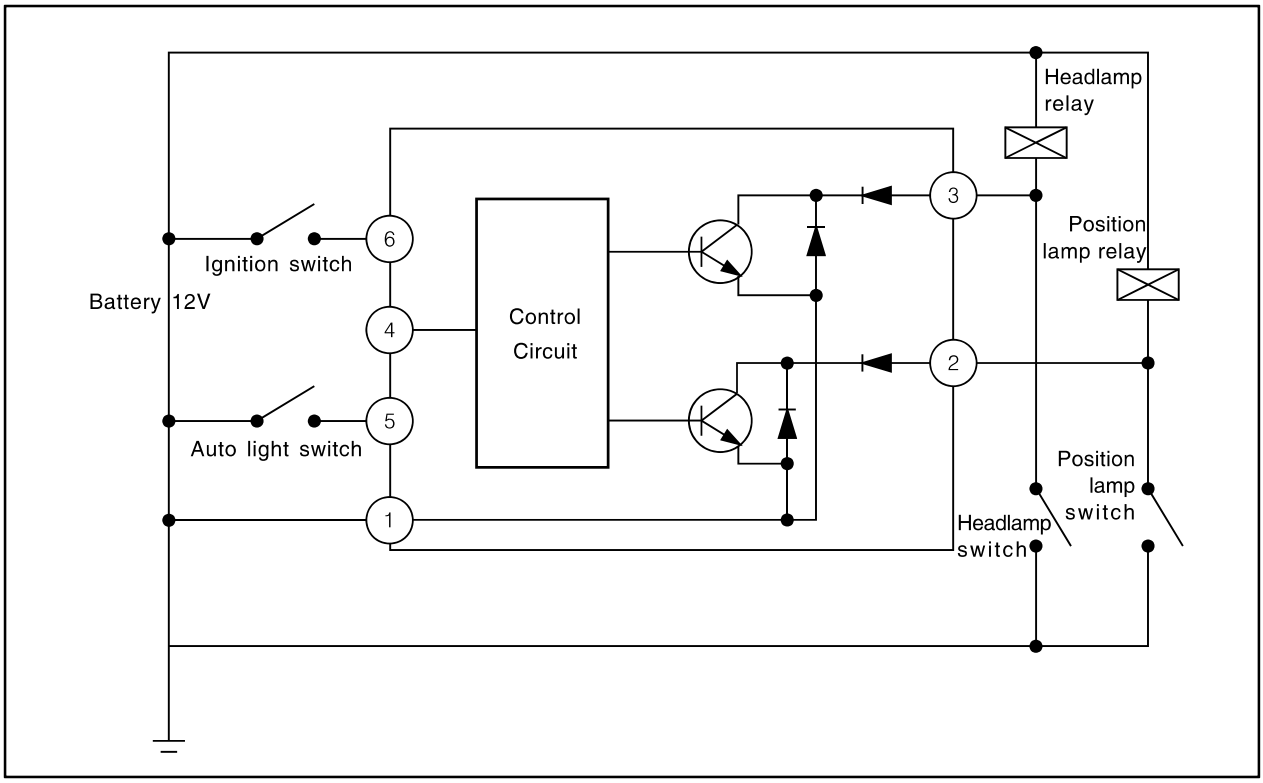
1) Overview

Auto light control is a system that turns on/off position lamps and headlamps automatically.
Auto light sensor unit on the instrument panel upper (passenger) detects surrounding brightness and then turns on or off position lamps and headlamps automatically if light switch is in AUTO mode even when the driver does not operate light switch. If enters tunnel during day driving or gets dark due to fog, rain or snow, it also operates.

2) Specifications

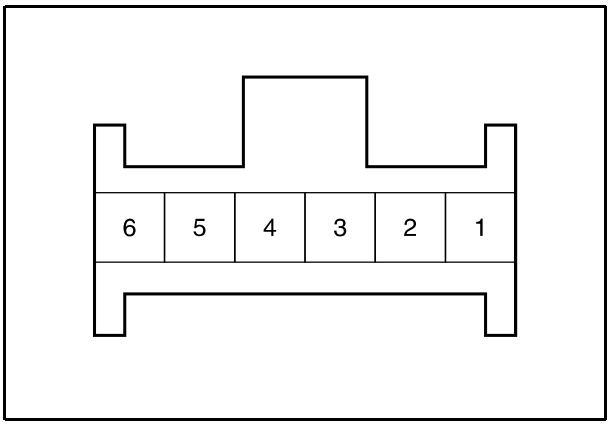
Item	Specifications	
Auto light sensor unit	Operating voltage	9 ~ 16 V
	Load	Max. 200 mA of relay load
	Operating temperature	- 30 ~ + 85°C
	Storage temperature	- 40 ~ + 120°C
	Installation position	Interior IP upper right (Passenger)

3) Input/Output Diagram



Modification basis	
Application basis	
Affected VIN	

4) Auto Light Sensor Unit Terminal



1. System power supply
2. Auto light switch
3. Reserved
4. Headlamp relay
5. Position lamp relay
6. System ground

5) Auto Light Operation and Turning on Condition

▶ **Switch operations by function**

1. Turn on the ignition switch and operate the multi-function switch in the order of OFF → position lamp → headlamp → AUTO → switch.
2. Turn on/off the position lamp, headlamp and switch.
3. Turn on the AUTO switch. At this moment, position lamps and headlamps come on automatically if brightness of light that reflected on the photodiode in the auto light sensor unit is the same as voltage that set by software in CPU.
4. If operate position lamp and headlamp switch manually again, the lamps turn on/off according to switch operations not by brightness of light that detected by sensor.
5. When ignition switch is removed, position lamps and headlamps turn off.

▶ **Turning on conditions**

Lamp / Brightness	Position lamp ON condition	Headlamp ON condition	Operation delay time
For ON	30.5 ± 5 (LUX)	8.9 ± 3 (LUX)	0.5 ± 0.1 sec.
For OFF	60.5 ± 5 (LUX)	17.2 ± 3(LUX)	3 ± 1 sec.

BTRA 4 AUTO TRANSMISSION 3650-01

GENERAL

1. SPECIFICATIONS

1) Model Part Numbers and Applications

SYMC P/NO	Transmission	Engine Version	Torque Converter
36100-05442	0574-000013	E23	179K
36100-05432	0574-000012	E32	150K
36100-05412	0574-000014	662LA	150K

2) Model Specifications

Application	Descriprtion
Torque Converter	
Mean Diameter of Fluid Circuit Description	260 mm (10.2 in.)
Maximum Torque Multiplication	2.0 : 1
Gear Ratios	
First	2.741 : 1
Second	1.508 : 1
Third	1.000 : 1
Fourth	0.708 : 1
Reverse	2.429 : 1
Lubricant	
Type	Castrol TQ95
Capacity	
Dry System	9.0 Liters (approx.)
Service Refill	4.5 Liters (approx.)
Gear Train End Float	0.50 - 0.65 mm (0.020 - 0.026 in.)
Gear Set Pinion End Float	0.10 - 0.50 mm (0.004 - 0.020 in.)

3) Clutch Pack Details

	0574-000012	0574-000013 (14)
C1		
Composition	5	4
Steel	5	6
C2		
Composition	5	4
Steel	4	5
C3		
Composition	4	3
Steel	4	5
C4		
Composition	3	3
Steel	4	4

4) Model Part Numbers and Applications

▶ E23 Gasoline Engine

MODE	THROTTLE OPENING	SHIFT (km/h)									
		1/2	2/3	3/4	4/3	3/2	2/1	UNL3	LCK3	UNL4	LCK4
NORMAL MODE	0 %	10.1	19.3	36.4	20.8	8.9	9.2	50.7	79.1	71.7	79.1
	16 %	10.1	19.3	36.4	20.8	8.9	9.2	50.7	79.1	71.7	79.1
	31 %	13.9	30.9	47.0	28.4	12.4	9.2	50.7	79.1	71.7	79.1
	49 %	22.3	46.1	70.5	41.8	18.9	9.3	50.7	90.3	74.2	90.3
	50 %	22.8	46.4	71.7	42	19.2	9.3	50.7	58.1	75.4	91.5
	58 %	27.2	53.2	89.0	52.7	24.7	10.9	59.4	66.8	81.6	100.2
	64 %	30.9	59.4	94.0	60	28.4	12.1	66.8	74.2	86.6	106.4
	71 %	34.1	66.5	103.3	69.3	32.6	18.6	71.7	76.7	95.8	115.0
	100 % (WOT)	47.4	91.9	147.2	98.9	45.5	34.6	81.6	95.1	134.3	147.2
	Kickdown	47.9	94.0	149.6	139.7	86.9	45.4	90.7	95.5	147.2	149.6
POWER MODE	0 %	11.9	22.8	42.0	20.8	8.9	9.2	73.0	75.4	73.0	75.4
	16 %	11.9	22.8	42.0	20.8	8.9	9.2	73.0	75.4	73.0	75.4
	31 %	22.5	42.0	70.0	33.4	17.3	9.2	73.0	79.1	73.0	79.1
	49 %	27.2	56.9	87.2	42.0	24.7	9.2	73.6	94.0	73.6	94.0
	50 %	30.7	64.3	96.5	49.5	29.7	10.4	76.2	103.9	76.2	103.9
	58 %	35.1	73.2	110.8	60.6	37.8	15.1	81.6	110.8	81.6	110.8
	64 %	37.6	77.4	116.3	68	42.5	18.1	86.6	116.3	87.8	116.3
	71 %	40.1	81.1	121.2	77.7	47.7	20.8	86.6	121.2	97.7	121.2
	100 % (WOT)	47.4	91.9	147.2	115.0	66.7	33.0	86.6	136.0	142.2	147.2
	Kickdown	47.9	94.0	149.6	139.7	86.9	45.4	90.7	95.5	147.2	149.6

Modification basis	
Application basis	
Affected VIN	

▶ E32 Gasoline Engine

MODE	THROTTLE OPENING	SHIFT (km/h)									
		1/2	2/3	3/4	4/3	3/2	2/1	UNL3	LCK3	UNL4	LCK4
NORMAL MODE	0 %	11.7	20.2	39.5	24.6	10.2	10.5	37.4	81.9	73.1	81.9
	15 %	11.7	22.8	39.5	24.6	10.2	10.5	37.4	81.9	73.1	81.9
	25 %	13.3	30.4	67.3	32.2	14.6	10.5	37.4	81.9	73.1	81.9
	32%	16.8	36.6	76.0	38.0	19.7	11.0	39.5	83.4	73.1	83.4
	35 %	18.6	40.1	80.4	40.9	21.9	11.7	40.9	62.9	74.6	86.3
	45 %	24.0	49.7	93.6	52.6	27.8	13.9	46.8	70.2	81.9	93.6
	55 %	31.9	66.1	114.1	70.2	32.2	17.3	54.1	79.0	102.4	114.1
	70 %	42.1	85.4	146.2	90.7	39.5	21.9	64.3	93.6	128.7	146.2
	100 % (WOT)	56.7	110.0	170.4	119.9	46.8	26	93.6	114.1	152.1	170.4
	Kickdown	57.0	110.6	175.5	163.8	104.7	50.3	116.4	119.3	166.7	175.5
POWER MODE	0 %	12.3	24.6	40.9	24.6	10.2	10.5	76.0	81.9	76.0	81.9
	15 %	14.0	27.8	43.9	29.2	10.2	10.5	76.0	81.9	76.0	81.9
	25 %	23.4	43.9	65.8	39.5	17.5	11.0	76.0	81.9	76.0	81.9
	32 %	24.6	49.1	76.6	46.1	24.9	11.6	81.9	90.7	81.9	90.7
	35 %	26.3	52.6	81.9	51.2	27.8	12.0	84.8	96.5	84.8	96.5
	45 %	32.2	65.8	105.3	67.3	37.3	15.4	102.4	117.0	102.4	117.0
	55 %	38.6	76.9	125.8	87.7	51.2	21.4	111.1	125.8	114.1	125.8
	70 %	46.7	90.8	146.2	113.3	66.5	28.7	111.1	146.2	128.7	146.2
	100 % (WOT)	56.7	110.0	170.4	148.4	89.9	42.4	111.1	170.4	152.1	170.4
	Kickdown	57.0	110.6	175.5	163.8	104.7	50.3	116.4	119.3	166.7	175.5

▶ 662LA Diesel Engine

MODE	THROTTLE OPENING	SHIFT (km/h)									
		1/2	2/3	3/4	4/3	3/2	2/1	UNL3	LCK3	UNL4	LCK4
NORMAL MODE	0 %	11.4	20.4	35.4	26.7	9.3	9.5	47.6	76.2	72.1	76.2
	25 %	11.4	20.4	35.4	27.2	9.3	9.5	47.6	76.2	72.1	76.2
	40 %	12.2	25.4	40.8	29.9	13.6	9.5	47.6	76.2	72.1	76.2
	60 %	14.7	36.5	61.8	38.1	21.8	9.5	47.6	76.2	72.1	76.2
	61 %	14.7	36.7	62.0	38.4	22.0	9.5	47.6	50.3	72.1	76.2
	70 %	16.6	40.0	70.7	43.5	25.9	12.2	47.6	51.7	72.1	77.0
	75 %	18.2	43.3	76.2	49.0	28.6	13.6	47.6	54.4	72.1	81.6
	80 %	21.8	51.7	84.4	54.4	31.3	15.0	49.0	57.7	75.1	89.0
	100 % (WOT)	28.6	62.6	104.5	69.4	38.1	19.6	57.1	62.6	92.5	104.5
	Kickdown	34.8	68.0	110.2	100.7	63.9	31.3	61.2	68.0	100.7	110.2
POWER MODE	0 %	11.7	21.8	38.1	26.7	9.3	9.5	61.2	76.2	72.1	76.2
	25 %	11.7	21.8	38.1	31.3	9.3	9.5	61.2	76.2	72.1	76.2
	40 %	14.1	27.5	43.5	32.7	16.3	10.2	61.2	76.2	72.1	76.2
	60 %	21.8	44.6	69.4	47.6	27.2	12.8	61.2	76.2	72.1	76.2
	61 %	28.0	57.1	88.7	54.4	35.4	14.4	61.2	88.7	72.1	88.7
	70 %	29.9	59.9	93.9	61.2	40.8	15.8	61.2	93.9	72.1	93.9
	75 %	31.3	61.8	96.6	65.3	46.3	17.4	61.2	96.6	75.1	96.6
	80 %	32.7	64.8	100.4	70.7	50.3	20.4	61.2	100.4	81.6	100.4
	100 % (WOT)	34.0	67.8	105.3	83.0	54.4	23.1	61.2	105.3	92.5	105.3
	Kickdown	34.8	68.0	110.2	100.7	63.9	31.3	61.2	68.0	100.7	110.2

Modification basis	
Application basis	
Affected VIN	

2. FASTENER TIGHTENING SPECIFICATIONS

Application	Nm	Lb-Ft	Lb-Ft
Adaptor Housing to Case Bolts	30 - 35	22 - 26	-
Cam Plate to Case (Parking Pawl) Screws	16 - 22	12 - 16	-
Centre Support to Case Bolts	20 - 27	15 - 20	-
Detent Spring Screw	20 - 22	15 - 16	-
Extension Housing to Case Bolts	54 - 68	40 - 50	-
Front Propeller Shaft Bolts	70 - 80	52 - 59	-
Inhibitor Switch to Case Bolts	4 - 6	-	35 - 53
Oil Cooler Pipes	40 - 45	29 - 33	-
Oil Pan to Case Bolts	4 - 6	-	35 - 53
On/Off Solenoid Retainer Screws	8 - 12	-	71 - 106
Output Flange Nuts	35	26	-
Pump Cover Plate to Crescent Screw	13 - 16	10 - 12	-
Pump Cover Plate to Pump Cover Screws	13 - 16	10 - 12	-
Pump Cover to Case Bolts	24 - 34	18 - 25	-
Pump to Pump Cover Bolts	24 - 27	18 - 20	-
Rear Propeller Shaft Bolts	70 - 80	52 - 59	-
Rear Servo Cover to Case Bolts	30 - 35	22 - 26	-
TCM Mounting Bolt	10	-	89
Torque Converter Housing to Case Bolts	54 - 68	40 - 50	-
Torque Converter Mounting Bolts	42	31	-
Transfer Case to Transmission Housing Bolts	35 - 60	26 - 44	-
Transmission Filler Plug	30 - 35	22 - 26	-
Upper Valve Body to Lower Valve Body Screws	11 - 16	8 - 12	-
Valve Body To Case Bolts	8 - 13	-	71 - 115
Variable Pressure Solenoid (S5) Retainer Screw	8 - 12	-	71 - 106

OVERVIEW AND OPERATION PROCESS

1. DESCRIPTION AND OPERATION

The BTR Automotive Model 74 Four Speed Automatic Transmission is an electronically controlled overdrive four speed unit with a lock-up torque converter. The lock-up torque converter results in lower engine speeds at cruise and eliminates unnecessary slippage. These features benefit the customer through improved fuel economy and noise reduction.

Of primary significance is the Transmission Control Module (TCM) which is a microprocessor based control system.

	Max. Power (kW)	Configuration
320	160	260 mm Torque Converter-Wide Ratio Gear Set Splined Output for Transfer Case

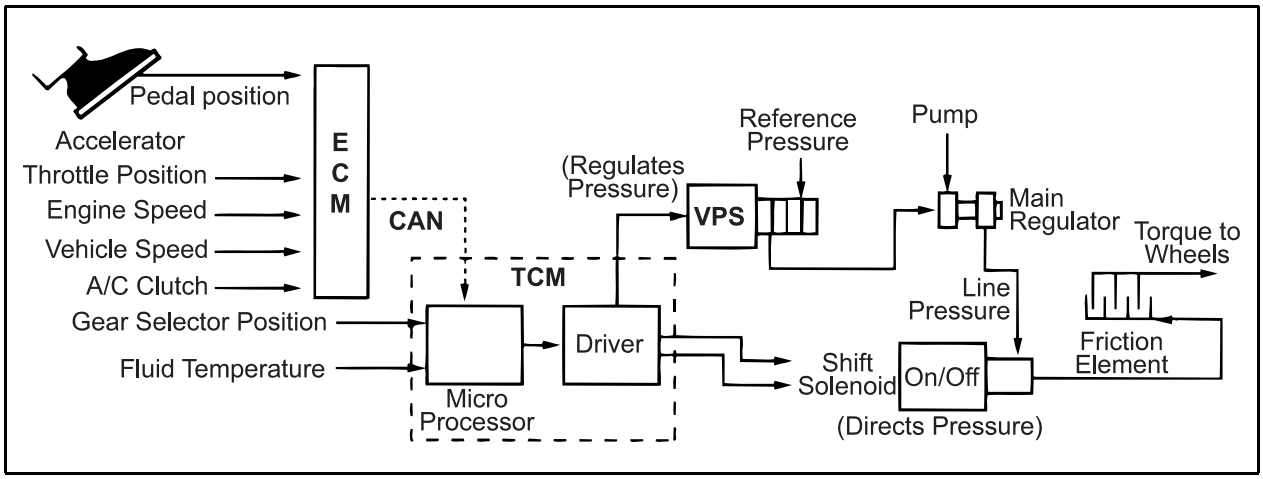
The TCM utilizes throttle position, rate of throttle opening, engine speed, vehicle speed, transmission fluid temperature, gear selector position and mode selector inputs, and in some applications a Kickdown Switch to control all shift feel and shift schedule aspects.

The TCM drives a single proportional solenoid multi-plexed to three regulator valves to control all shift feel aspects.

The output pressure of this solenoid is con-trolled as a function of transmission fluid temperature to maintain consistent shift feel throughout the operating range.

Shift scheduling is highly flexible, and several independent schedules are programmed depending on the ve-hicle.

Typically the NORMAL schedule is used to maximize fuel economy and driveability, and a POWER schedule is used to maximize performance. WINTER schedule is used to facilitate starting in second gear.



Modification basis	
Application basis	
Affected VIN	

2. OPERATORS INTERFACES

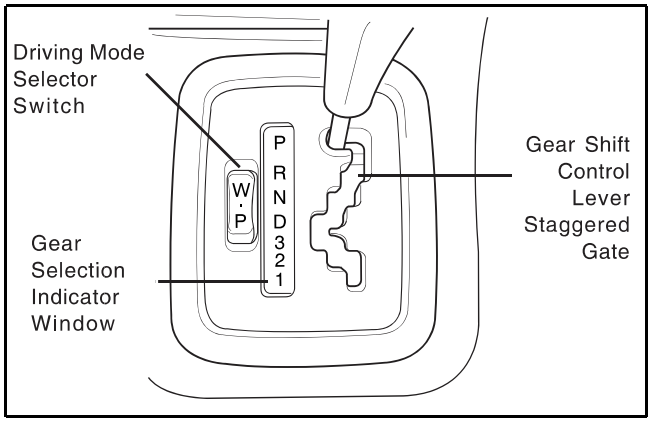
There are three operator interfaces as the following;

- Gear Shift Control Lever
- Driving Mode Selector
- Indicator Light

1) Gear Shift Control Lever

The transmission uses a conventional shift control lever.
The gear shift control lever can be moved from one position to another within the staggered configuration of the shift control lever gate to positively indicate the gear selection.

- P - Park position prevents the vehicle from rolling either forward or backward by locking the transmission output shaft. The inhibitor switch allows the engine to be started. For safety reasons, the parking should be used in addition to the park position. Do not select the Park position until the vehicle comes to a complete stop because it mechanically locks the output shaft.
- R - Reverse allows the vehicle to be operated in a rearward direction. The inhibitor switch enables re-verse lamp operation.
- N - Neutral allows the engine to be started and operated while driving the vehicle. The inhibitor switch allows the engine to be started. There is no power transferred through the transmission in Neutral. But the final drive is not locked by the parking pawl, so thewheels are free to rotate.
- D - Overdrive range is used for all normal driving conditions. 4th gear (overdrive gear) reduces the fuel consumption and the engine noise. Engine braking is applied with reduced throttle.
  First to second (1 → 2), first to third (1 → 3), second to third (2 → 3), second to fourth (2 → 4), third to fourth (3 → 4), fourth to third (4 → 3), fourth to second (4 → 2), third to second (3 → 2), third to first (3 → 1) and second to first (2 → 1) shifts are all available as a function of vehicle speed, throttle position and the time change rate of the throttle position.
  Downshifts are available for safe passing by depressing the accelerator. Lockup clutch may be enabled in 3rd and 4th gears depending on vehicle type.
- 3 - Manual 3 provides three gear ratios (first through third) and prevents the transmission from operating in 4th gear. 3rd gear is used when driving on long hill roads or in heavy city traffic. Downshifts are available by depressing the accelerator.
- 2 - Manual 2 provides two gear ratios (first and second).
  It is used to provide more power when climbing hills or engine braking when driving down a steep hill or starting off on slippery roads.
- 1 - Manual 1 is used to provide the maximum engine braking when driving down the severe gradients.



2) Driving Mode Selector

The driving mode selector consists of a driving mode selector switch and indicator light. The driving mode selector is located on the center console and allows the driver to select the driving mode.

The driving modes available to be selected vary with vehicle types. Typically the driver should have the option to select among NORMAL, POWER and WINTER modes.

When NORMAL mode is selected upshifts will occur to maximize fuel economy. When POWER mode is se-lected, upshifts will occur to give maximum performance and the POWER mode indicator light is switched ON.

When WINTER mode is selected, starting in second gear is facilitated, the WINTER mode indicator light is switched ON and the POWER mode indicator light is switched OFF.

3) Indicator Light

The indicator light is located on the instrument panel.

- Auto shift indicator light comes ON when the ignition switch ON and shows the gear shift control lever position.
- POWER mode indicator light comes ON when the POWER mode is selected and when the kickdown switch is depressed.
- WINTER mode indicator light comes ON when the WINTER mode is selected.

Modification basis	
Application basis	
Affected VIN	

3. CONTROL SYSTEMS

BTRA M74 4WD automatic transmission consists of two control systems. One is the electronic control system that monitors vehicle parameters and adjusts the transmission performance. Another is the hydraulic control system that implements the commands of the electronic control system commands.

4. ELECTRONIC CONTROL SYSTEM

The electronic control system comprises of sensors, a TCM and seven solenoids. The TCM reads the inputs and activates the outputs according to values stored in Read Only Memory (ROM).

The TCM controls the hydraulic control system. This control is via the hydraulic valve body, which contains seven electromagnetic solenoids. Six of the seven solenoids are used to control the line pressure, operate the shift valves and the torque converter lock-up clutch, and to turn ON and OFF the two regulator valves that control the shift feel.

The seventh solenoid is the proportional or Variable Pressure Solenoid (VPS) which works with the two regu-lator valves to control shift feel.

1) Transmission Control Module (TCM)

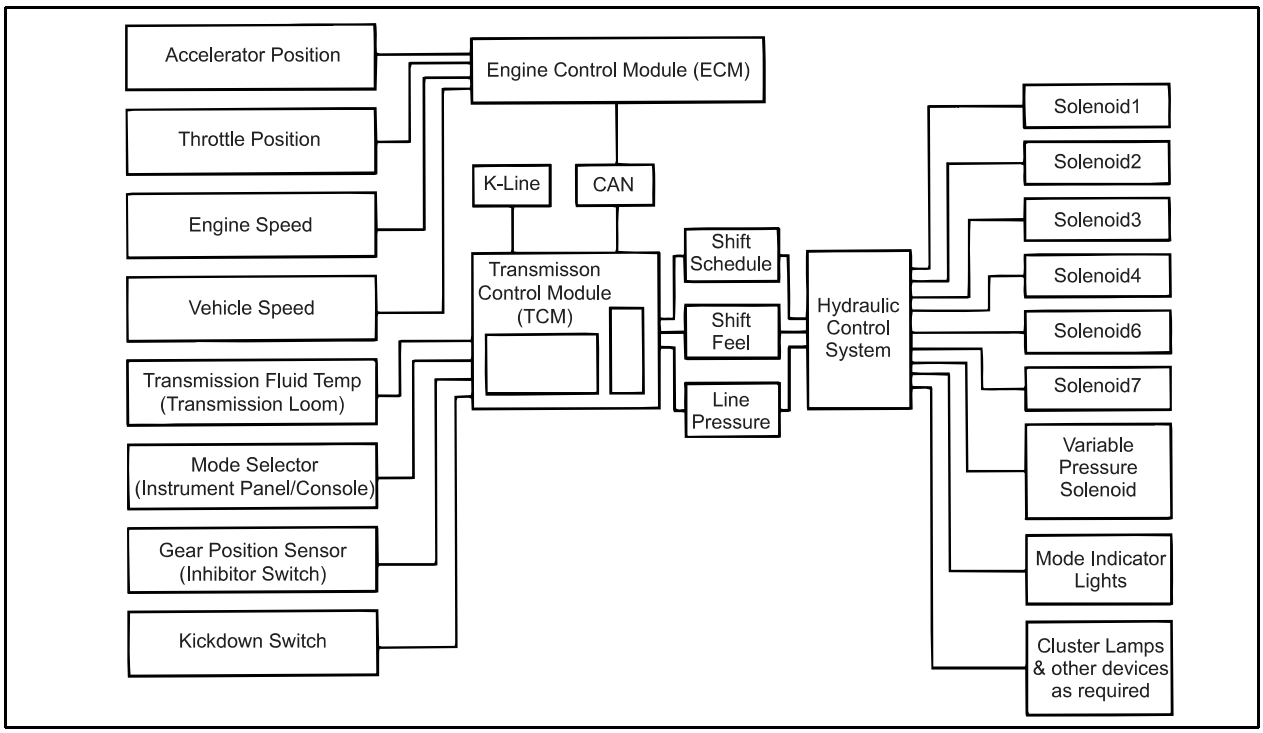
The TCM is an in-vehicle micro-processor based trans-mission management system. It is mounted under the driver's side front seat in the vehicle cabin.

The TCM contains:

- Processing logic circuits which include a central microprocessor controller and a back-up memory system.
- Input circuits.
- Output circuits which control external devices such as the Variable Pressure Solenoid (VPS) driver, On/Off solenoid drivers, a diagnostics output and the driving mode indicator light.

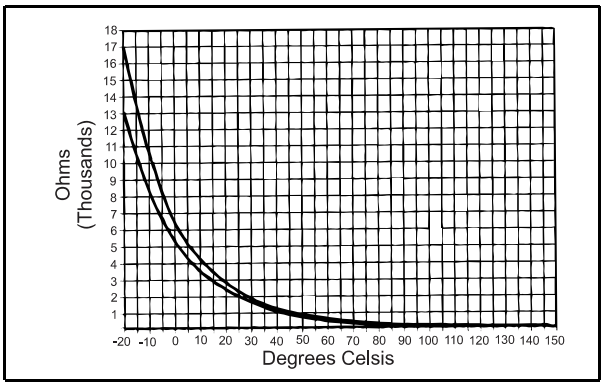
2) Processing logic

Shift schedule and calibration information is stored in an Erasable Programmable Read Only Memory (EPROM).
Throttle input calibration constants and the diagnostics information are stored in Electrically Erasable Programmable Read Only Memory (EEPROM) that retains the memory even when power to the TCM is disconnected.
TCM continuously monitors the input values and uses these, via the shift schedule, to determine the required gear state. At the same time it monitors, via the solenoid outputs, the current gear state, whenever the input conditions change such that the required gear state is different to the current gear state, the TCM initiates a gear shift to bring the two states back into line.
Once the TCM has determined the type of gearshift required the TCM accesses the shift logic, estimates the engine torque output, adjusts the variable pressure solenoid ramp pressure then executes the shift.
The TCM continuously monitors every input and output circuit for short or open circuits and operating range.
When a failure or abnormal operation is detected the TCM records the condition code in the diagnostics memory and implements a Limp Home Mode (LHM).
The actual limp home mode used depends upon the failure detected with the object to maintain maximum driveability without damaging the transmission. In general input failures are handled by providing a default value. Output failures, which are capable of damaging the transmission, result in full limp mode giving only third or fourth gear and reverse. For further details of limp modes and memory retention refer to the Diagnostic Trouble Code Diagnosis Section.
The TCM is designed to operate at ambient temperatures between − 40 and 85°C (− 40 and 185°F). It is also protected against electrical noise and voltage spikes, however all the usual precautions should be observed, for example when arc welding or jump starting.



Modification basis	
Application basis	
Affected VIN	

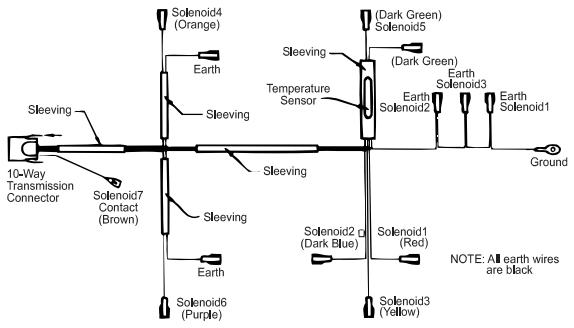
Temperature (°C)	Resistance (Ohms)	
	Minimum	Maximum
-20	13,638	17,287
0	5,177	6,616
20	2,278	2, 723
100	117	196
135 (Overheat Mode Threshold)	75	85



Pin No. Codes and colors in Solenoid Loom

Pin No.	Wire Color	Connects to
1	Red	Solenoid 1
2	Blue	Solenoid 2
3	Yellow	Solenoid 3
4	Orange	Solenoid 4
5	Green	Solenoid 5
6	Violet	Solenoid 6
7	Brown	Solenoid 7
8	Green	Solenoid 5
9	White	Temperature Sensor
10	Red	Temperature Sensor

Temperature Sensor Location in Solenoid Loom



3) TCM inputs

To function correctly, the TCM requires engine speed, vehicle speed, transmission fluid temperature, throttle position, gear position and Kickdown Switch inputs to determine the variable pressure solenoid current ramp and on/off solenoid states.
This ensures the correct gear selection and shift feel for all driving conditions.

The inputs required by the TCM are as follows;

- **Engine Speed**
  The engine speed signal is derived from the Control- ler Area Network (CAN) via Engine Control Module (ECM).
- Vehicle Speed
  The vehicle speed sensor, which is located in the transfer case, sends the output shaft speed signal to the Engine Control Module (ECM). The information is then transferred to
  the TCM via the CAN.
- **Transmission Fluid Temperature**
  The transmission fluid temperature sensor is a thermistor located in the solenoid wiring loom within the valve body of the transmission. This sensor is a typical Negative Temperature Coefficient (NTC) resistor with low temperatures producing a high resistance and high temperatures producing a low resistance.
  If the transmission fluid temperature exceeds 135°C (275°F), the TCM will impose converter lock-up at lower vehicle speeds and in some vehicles flashes the mode indicator light. This results in maximum oil flow through the external oil cooler and eliminates slippage in the torque converter. Both these actions combine to reduce the oil temperature in the transmission.

Modification basis	
Application basis	
Affected VIN	

4) Throttle position sensor

▶ **Gasoline engine:**

The throttle position signal is sent from the ECM to the TCM via the CAN. Refer to Engine Section for further details.

▶ **Diesel engine:**

The throttle position sensor (TPS) is a resistance potentiometer which is installed on the injection pump. It transmits a signal to the TCU proportional to the throttle plate opening.

The potentiometer is connected to the TCU by three wires: 5 volts positive supply, earth and variable wiper voltage.

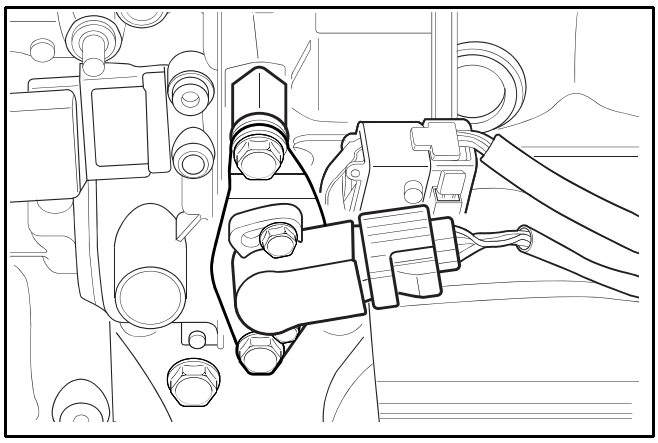
Throttle voltage adjustments are as follows:

- Closed throttle voltage is 0.2 V to 1.0 V.
- Wide open throttle voltage is 3 V to 4.5 V.

These measurements are taken between pins 1 and 3 of the TPS connentor.

Maintaining good shift feel through the transmission life span is dependant on having an accurate measure of the engine throttle position. To achieve this the TCU continu-ously monitors the maximum and minimum throttle potentiometer voltages and, if a change occurs, stores the new voltage values.

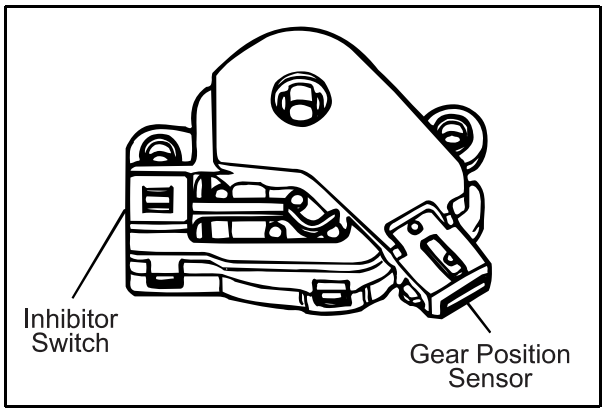
However these limits will be lost and will require relearning should a new TCU be installed, or the throttle calibration data is cleared by the execution of a particular sequence. This last instance depends on the installation, and reference should be made to the Diagnostics Section of this manual. The relearning will happen automatically.



Modification basis	
Application basis	
Affected VIN	

5) Gear position sensor

The gear position sensor is incorporated in the inhibitor switch mounted on the side of the transmission case. The gear position sensor is a multi-function switch providing three functions;



- Inhibit starting of the vehicle when the shift lever is in a position other than Park or Neutral
- Illuminate the reverse lamps when Reverse is se-lected
- Indicate to the TCM which lever position has been selected by way of a varying resistance.

Readings for Resistance / Shift Lever Positions

Shift Lever Position	Resistance (kΩ)
Manual 1	1 ~ 1.4
Manual 2	21.8 ~ 2.2
Manual 3	3 3 ~ 3.4
Drive	4.5 ~ 4.9
Neutral	6.8 ~ 7.2
Reverse	10.8 ~ 11.2
Park	18.6 ~ 19

6) Kickdown switch

The Kickdown Switch is used to signal the TCM that the driver has pressed the acclerator to the floor and requires a kickdown shift. When this switch is used, the POWER light comes ON and the POWER shift pattern is used.

▶ Diagnostic inputs

The diagnostic control input or K-line is used to initiate the outputting of diagnostic data from the TCM to a diagnostic test instrument. This input may also be used to clear the stored fault history data from the TCM's retentive memory.
Connection to the diagnostic input of the TCM is via a connector included in the vehicle's wiring harness or computer interface.

▶ Battery voltage monitoring input

The battery voltage monitoring input is connected to the positive side of the battery. This signal is taken from the main supply to the TCM.
If the battery voltage at the TCM falls below 11.3 V, the transmission will adopt a low voltage mode of operating in which shifts into first gear are inhibited. All other shifts are allowed but may not occur because of the reduced voltage.
This condition normally occurs only when the battery is in poor condition.
If the battery voltage is greater than 16.5 V, the transmission will adopt limp home mode and all solenoids are turned OFF.
When system voltage recovers, the TCM will resume normal operation after a 30 seconds delay period.

▶ TCM outputs

The outputs from the TCM are supplied to the compo-nents described below;

- Solenoids
- Mode Indicator Light

Modification basis	
Application basis	
Affected VIN	

7) Solenoids

The TCM controls seven solenoids. Solenoids 1 to 6 (S1 to S6) are mounted in the valve body, while Solenoid 7 (S7) is mounted in the pump cover.

- Solenoid 1 and 2: S1 and S2 are normally open ON/ OFF solenoids that set the selected gear. These solenoids determine static gear position by operating the shift valves. Note that S1 and S2 solenoids also send signal pressure to allow or prohibit rear band engagement.
- Solenoid 3 and 4: S3 and S4 are normally open ON/ OFF solenoids that combine to control shift quality and sequencing. S3 switches the clutch regulator valve OFF or ON. S4 switches the front band regula-tor valve OFF or ON. S5 also provides the signal pressure for the converter clutch regulator valve.
- Solenoid 5: S5 is a variable pressure solenoid that ramps the pressure during gear changes. This solenoid provides the signal pressure to the clutch and band regulator, thereby controlling the shift pres-sures. S5 also provides the signal pressure for the converter clutch regulator valve.
- Solenoid 6: S6 is a normally open ON/OFF solenoid that sets the high/low level of line pressure. Solenoid OFF gives high pressure.
- Solenoid 7: S7 is a normally open ON/OFF solenoid that controls the application of the converter clutch. Solenoid ON activates the clutch.

▶ Solenoid Logic for Static Gear States

Gear	S1	S2
1st	ON	ON
2nd	OFF	ON
3rd	OFF	OFF
4th	ON	OFF
Reverse	OFF	OFF
Neutral	OFF	OFF
Park	OFF	OFF

▶ Solenoid Operation during Gearshifts

Shift	To Initiate Shift	Typical S5 Current Ramp	To Complete Shift
1-2	S1 OFF S4 ON	750mA to 600mA	S4 OFF
1-3	S1 OFF S2 OFF S3 ON S4 ON	850mA to 750mA	S3 OFF S4 OFF
1-4	S2 OFF S3 ON S4 ON	850mA to 750mA	S3 OFF S4 OFF
2-3	S2 OFF S3 ON S4 ON	700mA to 500mA	S3 OFF S4 OFF
3-4	S1 ON S4 ON	750mA to 600mA	S4 OFF
4-3	S4 ON	750mA to 900mA	S1 OFF S4 OFF
4-2	S3 ON		S1 OFF
		750mA to 950mA	S2 ON
			S3 OFF
4-1	S3 ON		S2 ON
	S4 ON	600mA to 1000mA	S3 OFF
			S4 OFF
3-2	S2 ON		S4 OFF
	S4 ON	600mA to 450mA @ 20 kph.	
		550mA to 400mA @ 60 kph.	
		800mA to 650mA @ 100 kph.	
3-1	S3 ON		S1 ON
	S4 ON		S2 ON
			S3 OFF
2-1		700mA to 950mA	S4 OFF
	S4 ON	800mA to 950mA	S1 ON
			S4 OFF
Conv. Clutch			
ON	S7 ON	700mA to 400mA	S7 OFF
OFF		600mA to 100mA	

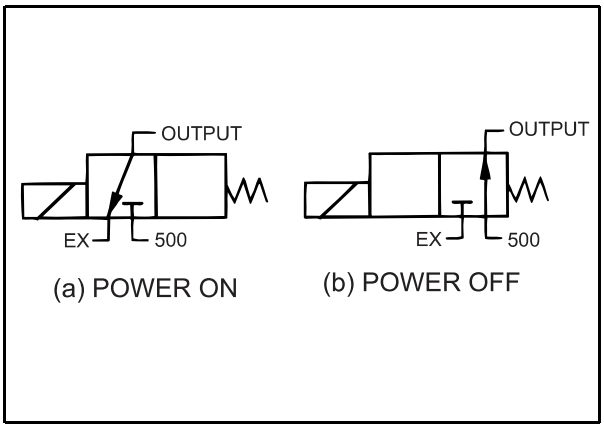
Modification basis	
Application basis	
Affected VIN	

8) Solenoid valve symbols (ON/OFF solenoids)

The solenoid symbol shown adjacent to each solenoid on the hydraulic system schematics indicates the state of the oil flow through the solenoid valve with the power ON or OFF.

▶ Normally open (NO) solenoid

POWER ON: Line 500 port is closed. The output port is open to exhaust at the solenoid valve.
POWER OFF: The exhaust port is closed. The output port is open to line 500.



▶ Variable pressure solenoid multiplexing system

Friction element shifting pressures are controlled by the Variable Pressure Solenoid (VPS).
Line pressure is completely independent of shift pres-sure and is a function of throttle position, gear state and engine speed.
S5 is a proportional or variable pressure solenoid that provides the signal pressure to the clutch and band regulator valves thereby controlling shift pressures.
VPS pressure is multiplexed to the clutch regulator valve, the band regulator valve and the converter clutch regulator valve during automatic gearshifts.
A variable pressure solenoid produces a hydraulic pressure inversely proportional to the current applied.
During a gearshift the TCM applies a progressively increasing or decreasing (ramped) current to the solenoid. Current applied will vary between a minimum oaf 200 mA and a maximum of 1000 mA. Increasing current decreases output (S5) pressure. Decreasing current increases output (S5) pressure. Line 500 pressure, (approximately 440 to 560 kPa), is the reference pressure for the VPS, and the VPS output pressure is always below line 500 pressure.
When the VPS is at standby, that is no gearshift is taking place, the VPS current is set to 200 mA giving maximum output pressure. Under steady state conditions the band and clutch regulator valve solenoids are switched OFF.
This applies full Line 500 pressure to the plunger and because Line 500 pressure is always greater than S5 pressure it squeezes the S5 oil out between the regulator valve and the plunger. The friction elements are then fed oil pressure equal to Line 500 multiplied by the amplification ratio.
When a shift is initiated the required ON/OFF solenoid is switched ON cutting the supply of Line 500 to the plunger.
At the same time the VPS pressure is reduced to the ramp start value and assumes control of the regulator valve by pushing the plunger away from the valve.
The VPS then carries out the required pressure ramp and the timed shift is completed by switching OFF the ON/ OFF solenoid and returning the VPS to the standby pressure.
This system enables either the band or clutch or both to be electrically controlled for each gearshift.

▶ Mode indicator light

Depending on the application, the mode indicator light may be used to indicate the mode that has been se-lected or if an overheat condition exists. The mode indicator light is usually located on the instrument cluster.

Modification basis	
Application basis	
Affected VIN	

5. COMMUNICATION SYSTEMS

1) CAN

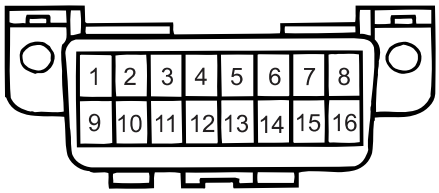
The Controller Area Network (CAN) connects various control modules by using a twisted pair of wires, to share common information. This results in a reduction of sensors and wiring. TCM obtains the actual engine speed and throttle position, vehicle speed and accelerator position etc. from ECM via CAN without any additional sensors.

2) K-Line

The K-line is typically used for obtaining diagnostic information from the TCM. A scan tool with a special interface is connected to the TCM via Data Link Connector (DLC) and all current faults, stored faults, runtime parameters are then available. The stored trouble codes can also be cleared by scan tool.
The K-line can be used for vehicle coding at the manufacturer's plant or in the workshop. This allows for one TCM design to be used over different vehicle mod-els.
The particular code is sent to the microprocessor via the K-line and this results in the software selecting the correct shift and VPS ramp parameters.

3) Data Link Connector (DLC)

The Data Link Connector (DLC) is a multiple cavity connector. The DLC provides the means to access the serial data from the TCM.
The DLC allows the technician to use a scan tool to monitor the various systems and display the Diagnostic Trouble Codes (DTCs).
The DLC connector is located within the driver's compartment, directly below the instrument panel on the driver's side.



DATA LINK
CONNECTOR
(DLC)

6. HYDRAULIC CONTROL SYSTEM

The hydraulic controls are located in the valve body, pump body and main case.

The valve body contains the following;

- Manual valve
- Three shift valves
- Sequence valve
- Solenoid supply pressure regulator valve
- Line pressure control valve
- Clutch apply feed regulator valve
- Band apply feed regulator valve
- Solenoid S1 to S6
- Reverse lockout valve

The pump cover contains the following;

- Primary regulator valve for line pressure
- Converter clutch regulator valve
- Converter clutch control valve
- Solenoid S7

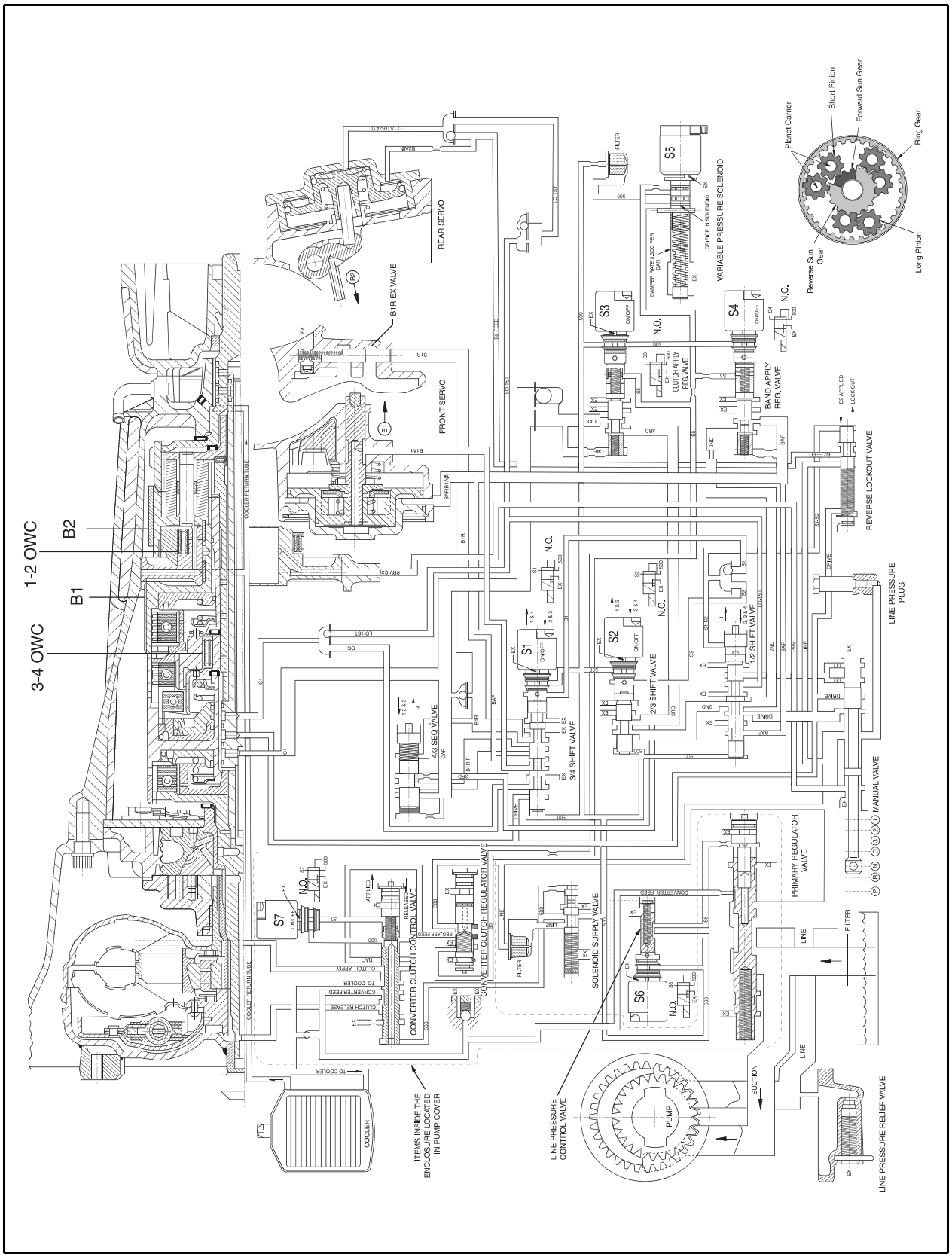
The main case contains the following;

- B1R exhaust valve

All upshifts are accomplished by simultaneously switching on a shift valve(s), switching VPS pressure to the band and/or clutch regulator valve, and then sending the VPS a ramped current. The shift is completed by switching the regulators OFF and at the same time causing the VPS to reach maximum pressure.
All downshifts are accomplished by switching VPS pressure to the band and/or clutch regulator valve and sending a ramped current to the VPS. The shift is completed by simultaneously switching the regulators OFF, switching the shift valves and at the same time causing the VPS to return to stand-by pressure.
The primary regulator valve is located in the pump cover and supplies four line pressures; high and low for forward gears, and high and low for reverse. This pressure has no effect on shift quality and merely provides static clutch capacity during steady state operation. Low pressure can be obtained by activating an ON/OFF solenoid with high line pressure being the default mode.
Torque converter lock-up is initiated by toggling the converter clutch control valve with an ON/OFF solenoid.
The actual apply and release of the clutch is regulated by the VPS via the converter clutch regulator valve.
The solenoid supply pressure regulator valve provides reference pressure for all the solenoids.

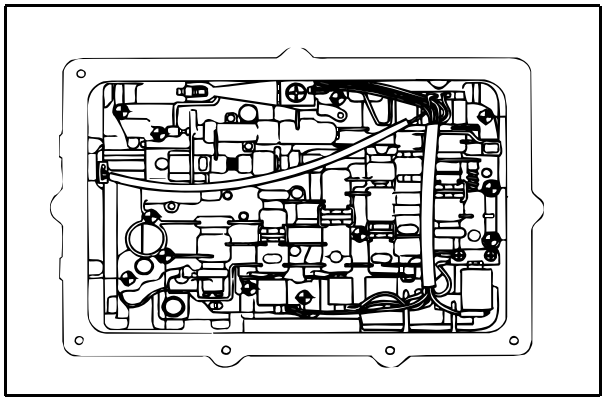
Modification basis	
Application basis	
Affected VIN	

1) HYDRAULIC CONTROL CIRCUIT



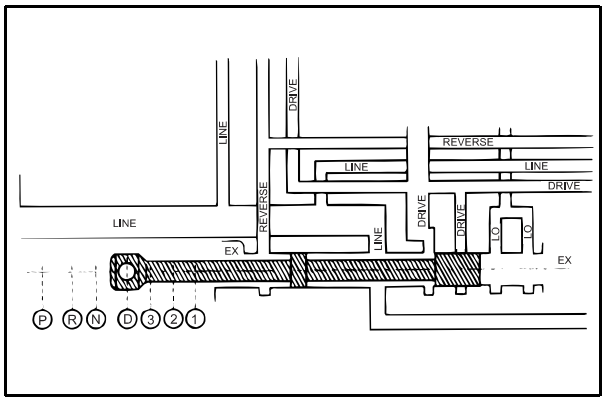
Modification basis	
Application basis	
Affected VIN	

2) Valve Body



▶ Manual valve

The manual valve is connected to the vehicle selector mechanism and controls the flow of oil to the forward and reverse circuits. The manual valve function is identical in all forward gear positions except that in the Manual 1 position an additional supply of oil is directed to the 1-2 shift valve for application of the rear band and the C4 overrun clutch. The manual valve directs the line pressure into the PRND fluid circuits.



▶ 1-2 shift valve

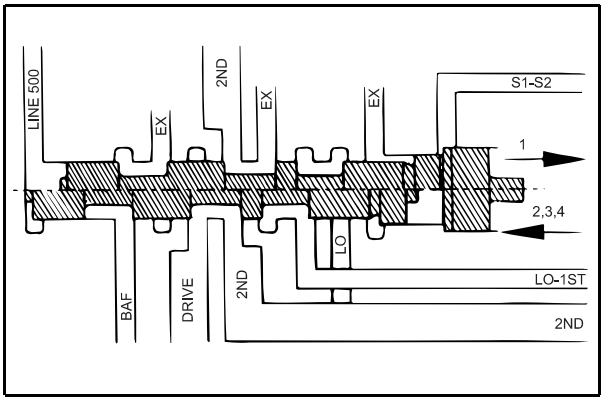
The 1-2 shift valve is a two position valve that must be switched to the 2, 3 and 4 position in order to get any forward gear other than first gear. It is used for all 1-2 and 2-1 gearshifts.

The switching of this valve is achieved by using S1 and/ or S2.

During a 1-2 gearshift drive oil from the manual valve passes through to the second gear circuit. During a 2-1 gearshift the band apply feed oil is allowed to exhaust via the 1-2 shift valve.

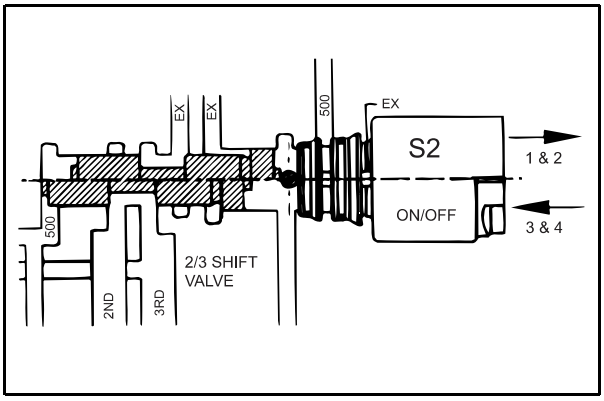
The 1-2 shift valve works in conjunction with the 3-4 shift valve to disengage the C4 clutch in first gear, and engage C4 in second gear. When Manual 1 is selected the C4 clutch and rear band (B2) are engaged.

Modification basis	
Application basis	
Affected VIN	



▶ 2-3 shift valve

The 2-3 shift valve is a two position valve. It is used on all 2-3 and 3-2 gearshifts.
The switching of this valve is achieved by S2 which is located at the end of the valve spool.
In the 1, 2 position, second gear oil from the 1-2 shift valve is prevented from entering the third gear circuit.
When the valve is moved to the 3, 4 position, oil from the second gear circuit is routed to the third gear circuit and the transmission is changed to third gear.



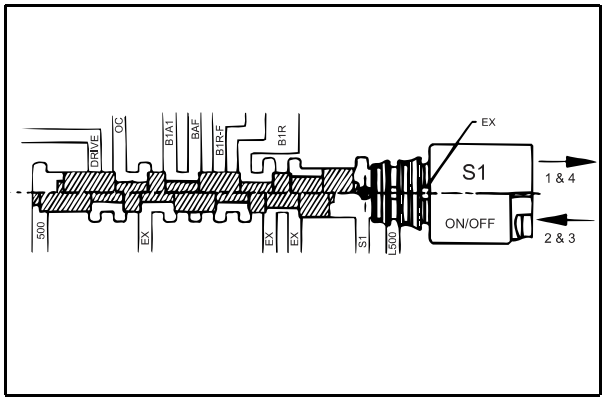
▶ 3-4 shift valve

The 3-4 shift valve is a two position valve. It is used for all 3-4 and 4-3 gearshifts.
The switching of this valve is achieved by S1 which is located at the end of the valve spool.

During a 3-4 gearshift the 3-4 shift valve:

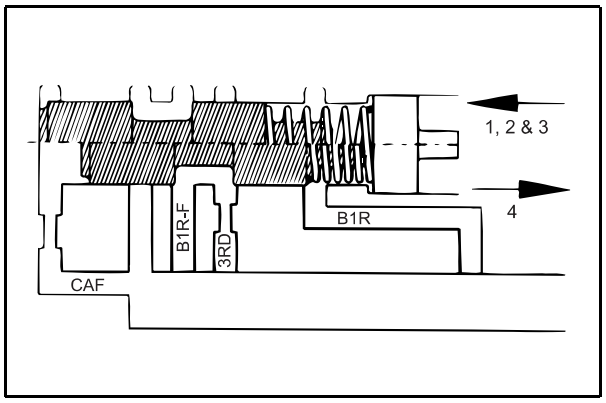
- Exhausts the front band release (B1R) circuit thereby allowing the application of the front band (B1).
- Connects the inner apply area of the front servo (B1AI) to the Band Apply Feed (BAF) circuit thus allowing greater apply forces to the front band.
- Exhausts the Overrun Clutch (OC) circuit which allows the C4 clutch to disengage.

During a 4-3 gearshift, the C4 clutch is engaged and the front band (B1) is released. These actions are se-quenced by the 4-3 sequence valve.
The 3-4 shift valve also switches during 1-2 and 2-1 gearshifts where its function is to apply the overrun clutch (C4) in second gear but to release it in first gear.
Note that the C4 clutch is applied in Manual 1 by virtue of the manual valve and the 1-2 shift valve. Refer to "1-2 Shift Valve" in this section.



▶ 4-3 sequence valve

The 4-3 sequence valve is a two position spring loaded valve. It switches during 3-4 and 4-3 gearshifts although it performs no function during the 3-4 shift.
During the 4-3 shift the 4-3 sequence valve delays the connection of the Clutch Apply Feed (CAF) circuit to the B1R circuit until the B1R circuit has been fully pressurized by using the third gear circuit. This prevents objectionable engine flare on completion of the 4-3 gearshift.



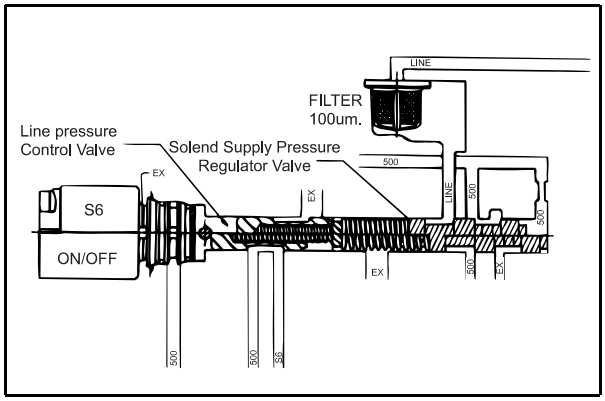
▶ Solenoid supply pressure regulator valve

The solenoid supply pressure regulator valve supplies a constant pressure to all solenoids (S1 to S7). Line pressure is used as the feeding oil to this regulator and the output is termed line 500.

▶ Line pressure control valve

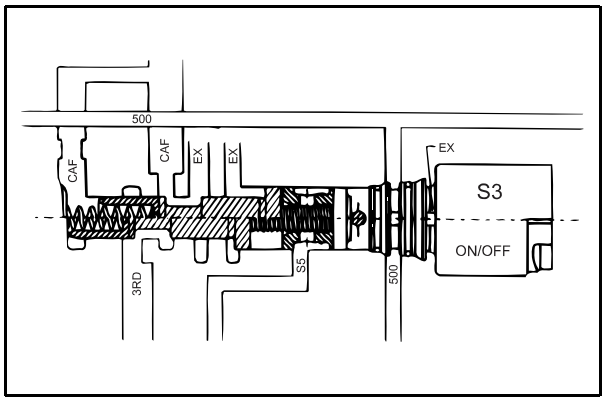
Line pressure is controlled by S6, which acts as the line pressure control valve. When S6 pressure is applied to the end of the Primary Regulator Valve (PRV), it is opposed by spring force and causes LOW line pressure for light throttle application and cruising.
Heavy throttle application causes the normally open S6 to open (switch Off) thus closing line 500 and opening S6 to exhaust. Removal of S6 pressure from the PRV results in HIGH line pressure.

Modification basis	
Application basis	
Affected VIN	



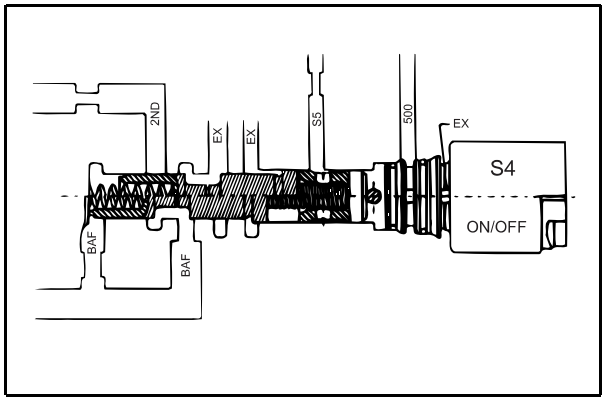
▶ Clutch apply feed regulator valve

The clutch apply feed regulator valve is a fixed ratio (2.25: 1) valve. This valve provides a regulated pressure to the C1 clutch and controls the change rate of the clutch state to give the desired shift quality.
Third gear oil supplied to the valve is regulated to pro-vide an output pressure, Clutch Apply Feed (CAF) pres-sure, of 2.25 times the S5 signal pressure when S3 is ON. When S3 is OFF, the output pressure is 2.25 times the line 500 pressure.



▶ Band apply feed regulator valve

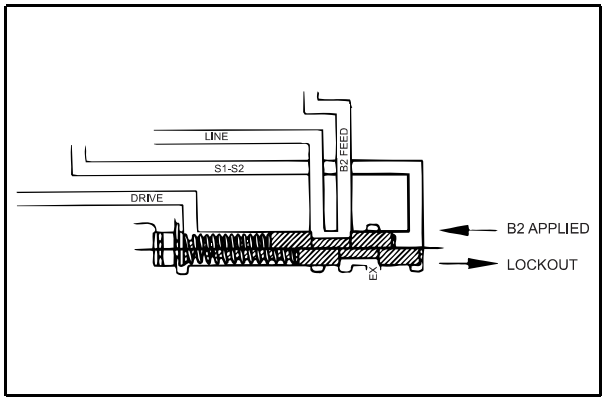
The band apply feed regulator valve is a fixed ratio (1.4:1) valve. It provides a regulated pressure to the front servo, and controls the change rate of the front band (B1) state to give the desired shift quality.
Second gear oil supplied to the valve is regulated to provide an output pressure, Band Apply Feed (BAF) pressure, of 1.4 times the S5 signal pressure when S4 is ON. When S4 is OFF the output pressure is 1.4 times the line 500 pressure.



▶ Reverse lockout valve

The reverse lockout valve is a two position valve con-tained in the upper valve body. This valve uses S1-S2 pressure as a signal pressure and controls the applica-tion of the rear band (B2).

While the manual valve is in D, 3, 2 or 1 positions, drive oil is applied to the spring end of the valve, overriding any signal pressures and holding the valve in the lockout position. This prevents the application of B2 in any of the forward driving gears except M1.



When the manual valve is in P, R or N positions, drive oil is exhausted and the reverse lockout valve may be toggled by S1-S2 pressure.

B2 is applied in P, R, and N if the following conditions are satisfied;

- In P or N, vehicle speed = 3 km/h.
- In R, vehicle speed = 10 km/h.
- Engine speed = 1600 rpm.
- Throttle position = 12 %.

Under these conditions, the TCM switches solenoids S1 and S2 to OFF. The reverse lockout valve toggles under the influence of the S1-S2 pressure, to connect the line pressure to the B2 feed. Oil is fed to both the inner and outer apply areas of the rear servo piston, applying B2. If any of the above conditions are not satisfied, the TCM switches solenoids S1 and S2 to ON.

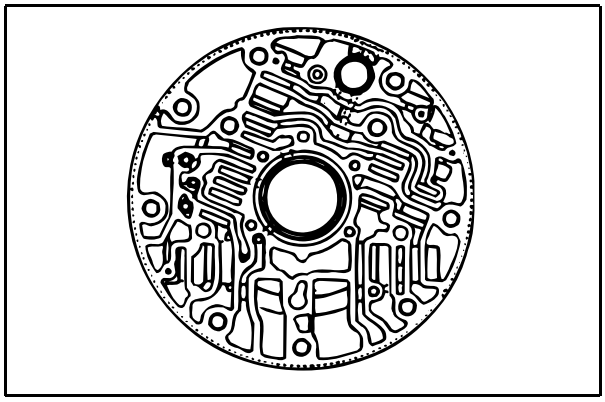
S1- S2 pressure is exhausted and the valve is held in the lockout position by the spring. In this position, engagement of B2 is prohibited.

This feature protects the transmission from abuse by preventing the undesirable application of B2 at high speed, and by providing a reverse lockout function.

Note that if the transmission is in failure mode, the rear band will be applied at all times in P, R and N.

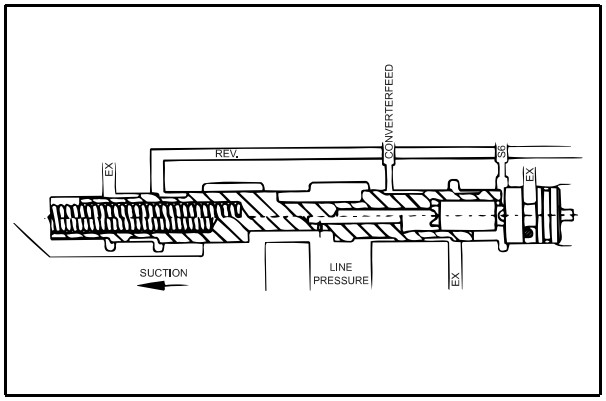
Modification basis	
Application basis	
Affected VIN	

▶ Pump cover



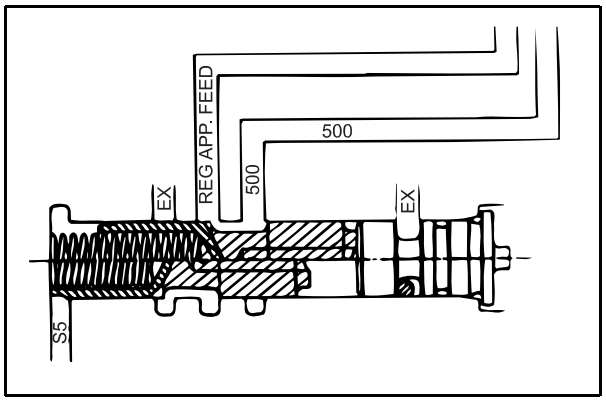
▶ Primary regulator valve

The Primary Regulator Valve (PRV) regulates the trans-mission line pressure (or pump output pressure). This valve gives either high or low line pressure depending on whether S6 is switched OFF or ON. When S6 is switched ON, S6 pressure is applied to the PRV moving it against spring pressure and opening the line pressure circuit to the pump suction port resulting in reduced line pressure.
Low line pressure is used during light throttle applica-tions and cruising. Heavy throttle will cause S6 to switch OFF and thereby cause high line pressure.
This stepped line pressure control has no detrimental effect on shift feel because all shifting pressures are controlled by separate band and clutch regulator valves, and the output of S5.
When reverse gear is selected, both the low and high line pressure values are boosted to guard against slip-page.
This is achieved by applying reverse oil line pressure to the PRV to assist the spring load. The other end of the valve contains ports for line pressure feedback and S6 pressure.
The PRV also regulates the supply of oil to the converter via the converter feed port. The cascade effect of the PRV ensures the first priority of the valve is to maintain line pressure at very low engine speeds. When the engine speed increases and the pump supplies an excess of oil the PRV moves to uncover the converter feed port thereby pressurizing the converter. If there is an excess of oil for the transmission's needs then the PRV moves further to allow oil to return to the suction port.



▶ Converter clutch regulator valve

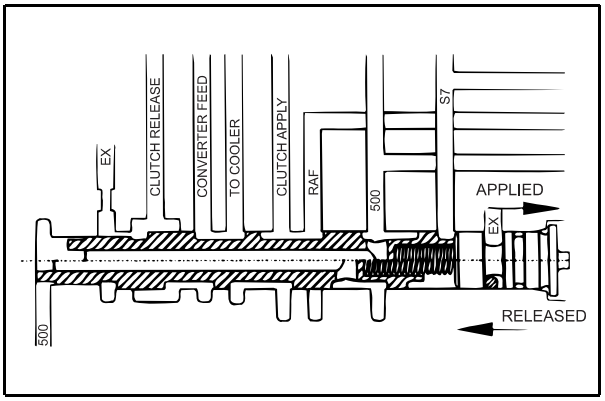
The converter clutch regulator valve regulates the pressure of the oil which applies the converter clutch. Input oil from the line 500 circuit is regulated within the valve, with the output pressure being variable according to the signal pressure from the S5 circuit. Converter clutch apply and release application is smoothed by electronically varying the S5 circuit pressure.



▶ Converter clutch control valve

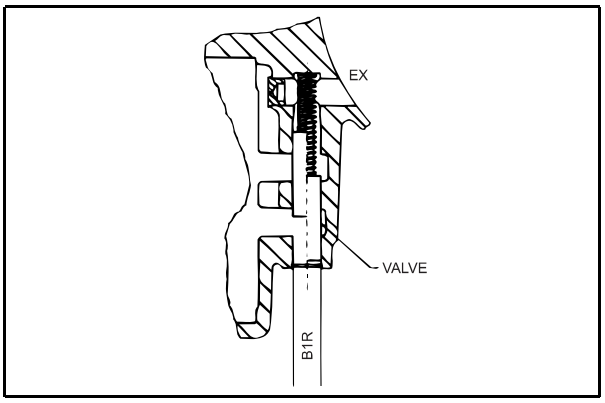
The converter clutch control valve is a two position valve which applies or releases the converter clutch.
The switching of this valve is governed by the signal pressure from S7.
When the valve is in the OFF or released position, converter feed oil from the PRV is directed to the release side of the converter clutch. After flowing through the converter, oil returns to the converter clutch control valve and is then directed to the oil cooler.
When the valve is in the ON or applied position, regu-lated oil from the converter clutch regulator valve is directed to the apply side of the converter clutch. This oil remains within the converter because the converter clutch piston is sealed against the flat friction surface of the converter cover. To provide oil flow to the cooler the converter clutch control valve directs converter feed oil from the PRV directly to the cooler circuit.

Modification basis	
Application basis	
Affected VIN	



▶ B1R exhaust valve

The B1R exhaust valve is a two position spring loaded valve located in the transmission case directly adjacent to the front servo. It permits the servo release oil to be rapidly exhausted into the transmission case during application of the front band (B1). This prevents the need to force the oil back from the front servo through the valve body and through the 3-4 shift valve. The spring positions the valve to prevent oil entering the release area of the servo until the B1R circuit oil pressure reaches approximately 100 kPa.



7. POWER TRAIN SYSTEM

The Power Train System consists of;

- A torque converter with single face lock-up clutch
- Four multi-plate clutch assemblies
- Two brake bands
- Two one-way clutches
- Planetary gear set
- Parking mechanism

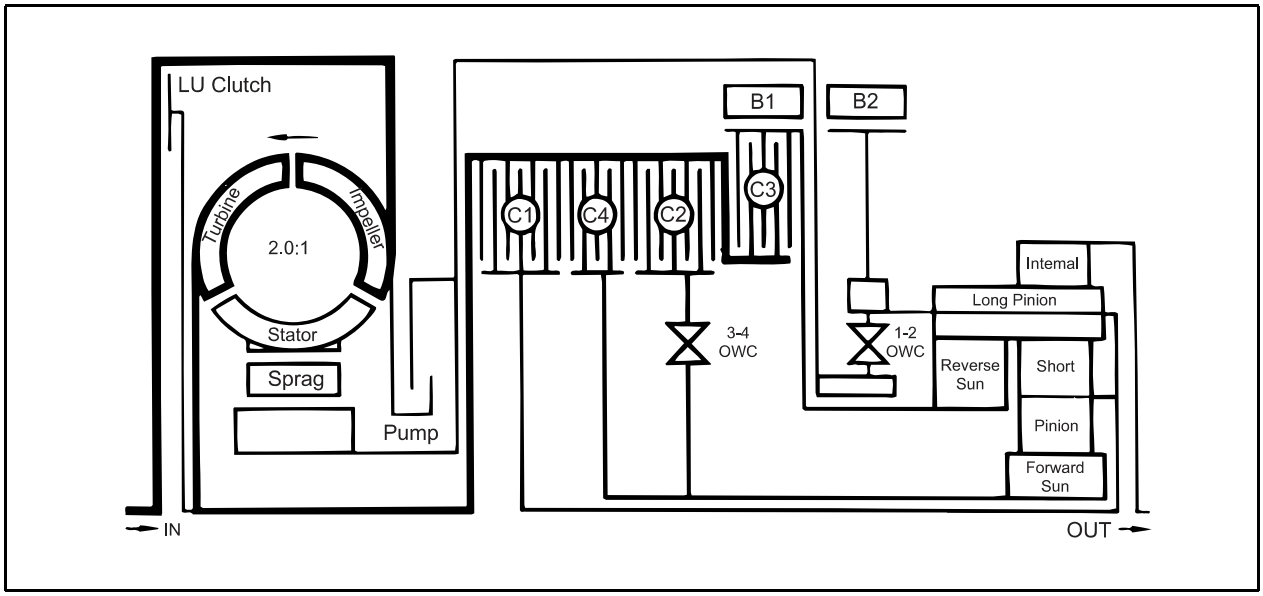
A conventional six pinion Ravigneaux compound planetary gear set is used with overdrive (fourth gear) being obtained by driving the carrier.
The cross-sectional arrangement is very modular in nature.
Four main sub-assemblies are installed within the case to complete the build. These subassemblies are;

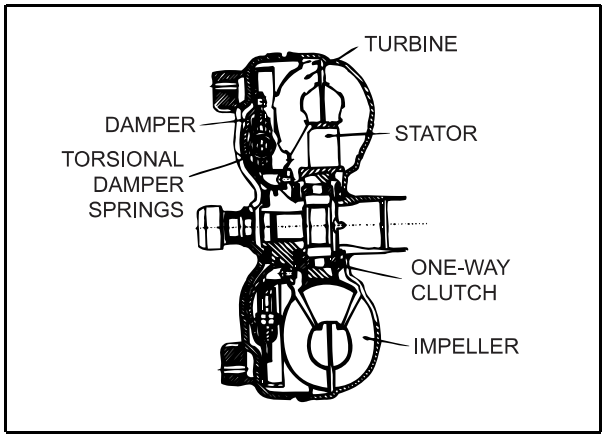
- Gear set-sprag-centre support
- C1 -C2 -C3 -C4 clutch sub-assembly
- Pump assembly
- Valve body assembly

One, or a combination of selective washers are used between the input shaft flange and the number 4 bearing to control the transmission end float. This arrangement allows for extensive subassembly testing and simplistic final assembly during production.
A general description of the operation of the Power Train System is detailed below.
First gear is engaged by applying the C2 clutch and locking the 1-2 One Way Clutch (1-2 OWC). The 1-2 shift is accomplished by applying the B1 band and overrunning the 1-2 OWC. The 2-3 shift is accomplished by applying the C1 clutch and releasing the B1 band. The 3-4 shift is accomplished by re-applying the B1 band and overrunning the 3-4 OWC. Reverse gear is engaged by applying the C3 clutch and the B2 band.
The C4 clutch is applied in the Manual 1, 2 and 3 ranges to provide engine braking. In addition, the C4 clutch is also applied in the Drive range for second and third gears to eliminate objectionable freewheel coasting.
The B2 band is also applied in the Manual 1 range to accomplish the low-overrun shift.
Both the front and rear servos are dual area designs to allow accurate friction element matching without the need for secondary regulator valves. All the friction elements have been designed to provide low shift energies and high static capacities when used with the new low static coefficient transmission fluids. Non-asbestos friction materials are used throughout.

Modification basis	
Application basis	
Affected VIN	

		ELEMENTS ENGAGED								
Gear	**Gear Ratio**	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
First	2.741		X					X	X	
Second	1.508		X			X			X	
Third	1.000	X	X		X	X			X	X *
Fourth	0.708	X	X		X				X	X
Reverse	2.428			X			X			
Manual 1	2.741		X		X		X		X	
* For Certain Vehicle Applications, Refer to the Owner's Manual.										





1) Torque converter

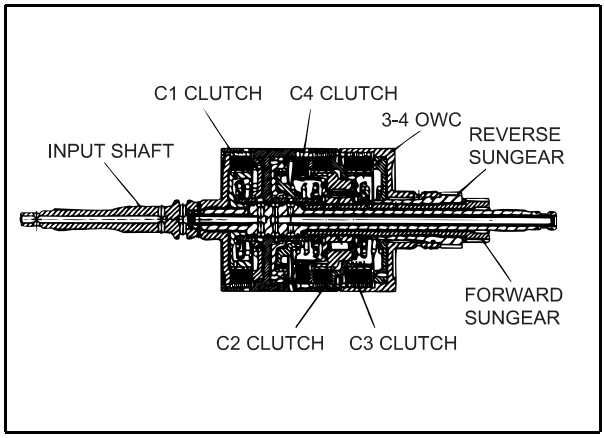
The torque converter consists of a turbine, stator pump, impeller and a lock-up damper and piston assembly. As in conventional torque converters, the impeller is attached to the converter cover, the turbine is splined to the input shaft and the stator is mounted on the pump housing via a one way clutch (sprag).

The addition of the damper and piston assembly en-ables the torque converter to lock-up under favorable conditions.

Lock-up is only permitted to occur in third and fourth gears under specified throttle and vehicle speed conditions.

Lock-up is achieved by applying hydraulic pressure to the damper and piston assembly which couples the turbine to the converter cover, locking-up the converter and eliminating unwanted slippage. Whenever lock-up occurs, improved fuel consumption is achieved. Torsional damper springs are provided in the damper and piston assembly to absorb any engine torque fluctuations during lock-up.

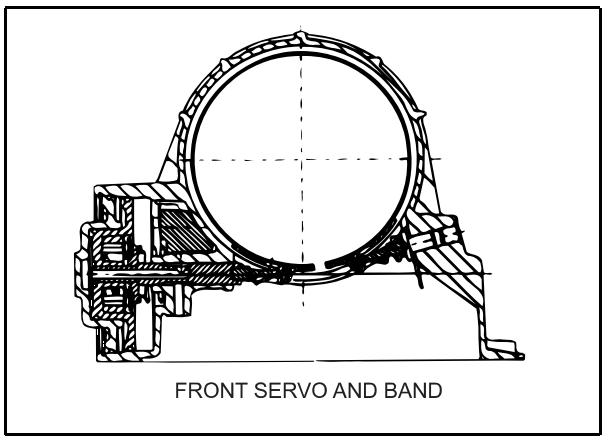
Modification basis	
Application basis	
Affected VIN	



2) Clutch packs

There are four clutch packs. All clutch packs are composed of multiple steel and friction plates.

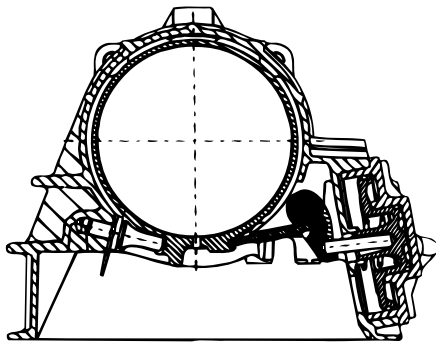
- **C1 CLUTCH:** When applied, this clutch pack allows the input shaft to drive the planet carrier. This occurs in third and fourth gears.
- **C2 CLUTCH:** When applied this clutch pack allows the input shaft to drive the forward sun gear via the 3-4 OWC. This occurs in all forward gears.
- **C3 CLUTCH:** When applied this clutch pack allows the input shaft to drive the reverse sun gear. This only occurs in reverse gear.
- **C4 CLUTCH:** When applied this clutch provides engine braking on overrun. This occurs in Manual 1, 2 and 3 and also Drive 2 and Drive 3 to prevent objectionable free wheel coasting.


FRONT SERVO AND BAND

3) Bands

The transmission utilizes two bands, the B1 band (sometimes known as the 2-4 band), and the B2 band (sometimes known as the low-reverse band).

The B1 band is a flexible band which is engaged by the front servo piston. B1 is activated in second and fourth gear. When activated B1 prevents the reverse sun gear from rotating by holding the C3 clutch assembly stationary. In second gear only the outer area of the apply piston is utilized. In fourth gear both areas are utilized for greater clamping force.



REAR SERVO AND BAND

4) One way clutches

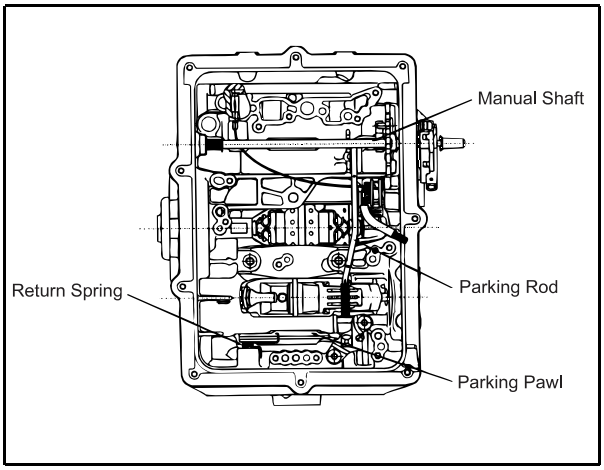
The transmission uses two OWCs, the 1-2 OWC and the 3-4 OWC. (Note that a third OWC is located in the torque converter, also known as a sprag.)

The 1-2 OWC is located between the planetary carrier assembly and the center support. This allows the carrier to rotate around the center support in one direction only. The one way clutch is engaged only in Drive 1.

This 3-4 OWC is located between the C4 and the C2 clutch assemblies. This allows the C2 clutch to drive the forward sun gear in first, second and third gears but unlocks in fourth gear and during overrun.

The B2 band is a solid band which is engaged by the rear servo piston. B2 is activated in Park, Reverse, Neutral and Manual 1. When activated B2 prevents the planet carrier assembly from rotating. In Manual 1 only the inner area of the apply piston is utilized. In Park, Reverse and Neutral, both areas are utilized for greater clamping force.

Modification basis	
Application basis	
Affected VIN	



5) Planetary gear set

The planetary gear set used in the transmission is a conventional six pinion Ravigneaux compound gear set.

6) Parking mechanism

When Park is selected the manual lever extends the park rod rearwards to engage the parking pawl. The pawl will engage the external teeth on the ring gear thus locking the output shaft to the transmission case. When Park is not selected a return spring holds the parking pawl clear of the output shaft, preventing accidental engagement of Park.

8. POWER FLOWS

The power flows for the various transmission selections are listed below;

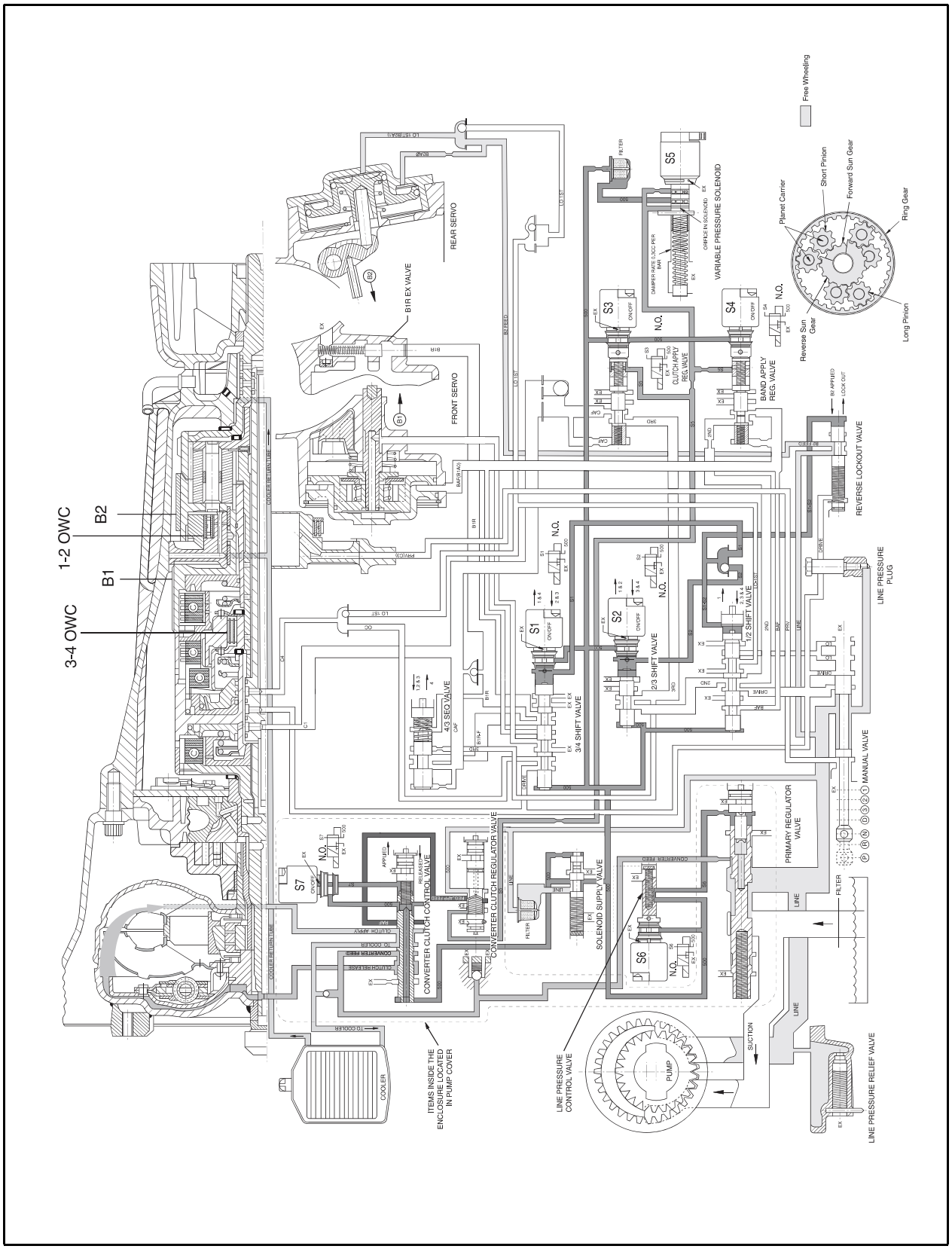
- Power Flow - Neutral and Park
- Power Flow - Reverse
- Power Flow - Manual 1
- Power Flow - Drive 1
- Power Flow - Drive 2
- Power Flow - Drive 3
- Power Flow - Drive 3 Lock Up
- Power Flow - Drive 4 (Overdrive)
- Power Flow - Drive 4 Lock Up

The following table details the engaged elements versus the gear selected for all transmission selections.

	ELEMENTS ENGAGED								
Gear State	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
Park and Neutral	-	-	-	-	-	X	-	-	-
Reverse	-	-	X	-	-	X	-	-	-
Manual 1	-	X	-	X	-	X	-	X	-
Drive 1	-	X	-	-	-	-	X	X	-
Drive 2 and Manual 2	-	X	-	X	X	-	-	X	-
Drive 3 and Manual 3	X	X	-	X	-	-	-	X	-
Drive 3 Lock Up and Manual 3 Lock Up	X	X	-	X	-	-	-	X	X
Drive 4 Overdrive	X	X	-	-	X	-	-	X	-
Drive 4 Lock Up	X	X	-	-	X	-	-	X	X

Modification basis	
Application basis	
Affected VIN	

1) PARK AND NEUTRAL



Modification basis	
Application basis	
Affected VIN	

▶ Power flow - Park and neutral

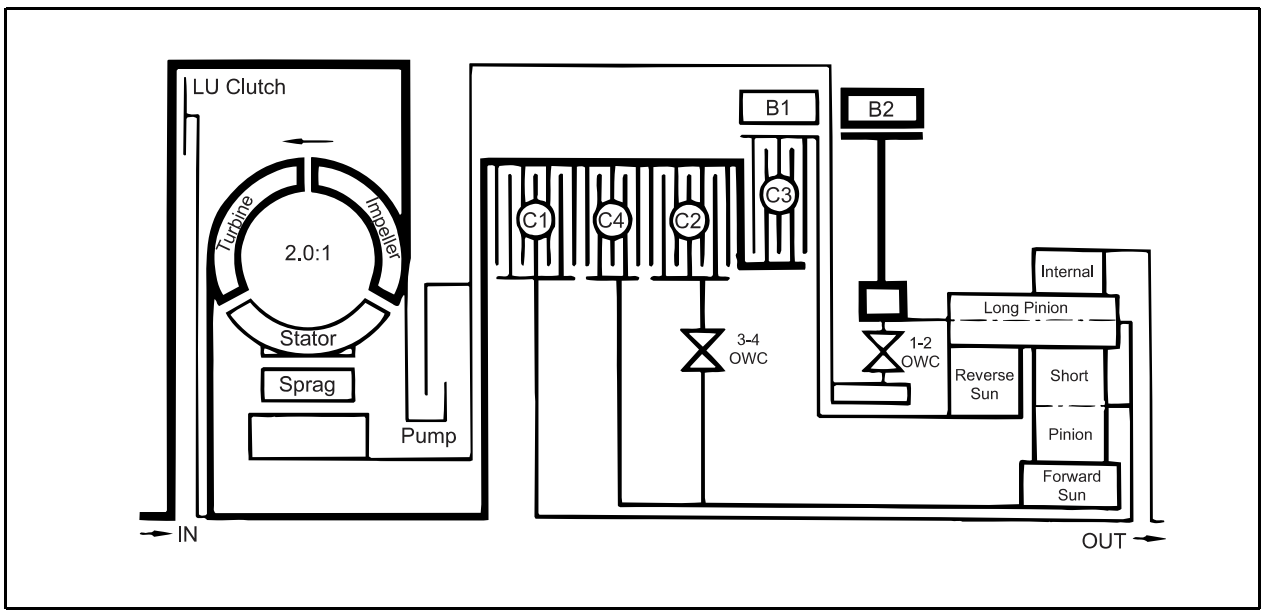
In Park and Neutral, there is no drive to the planetary gear set. The rear band is applied to eliminate 'clunk' on engagement of the reverse gear, and to improve the low range engagement for 4WD applications. No other clutches or bands are applied.
In Park the transmission is mechanically locked by engaging a case mounted pawl with teeth on the output shaft ring gear.

▶ Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows:

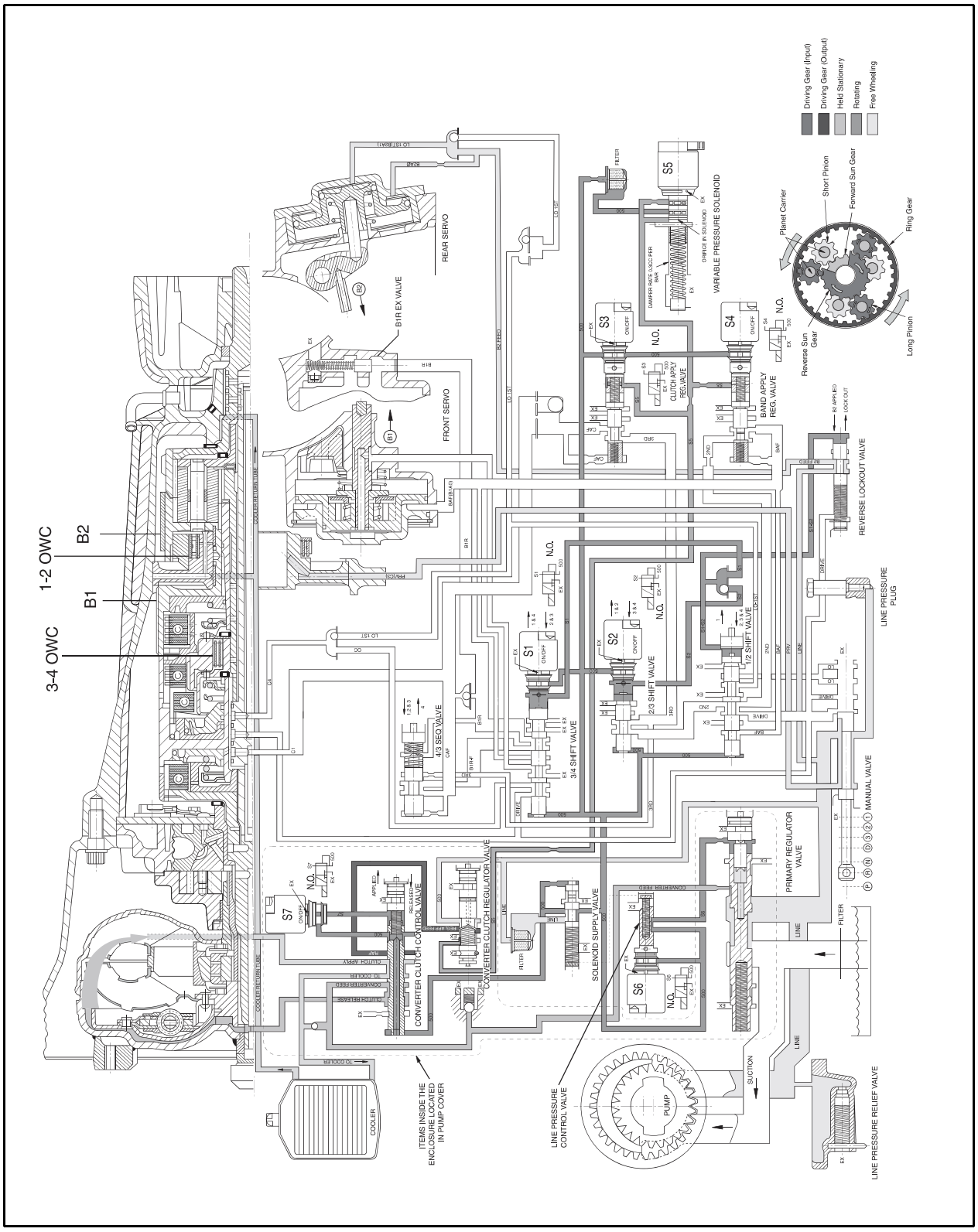
- Solenoids S1 and S2 are switched OFF.
- Line (pump) pressure is applied to the Primary Regulator Valve (PRV) and to the solenoid supply pressure regulator valve.
- The converter, oil cooler, and lubrication circuits are charged from the primary regulator valve.
- The line 500 circuit is charged by the solenoid supply pressure regulator valve.
- The S5 circuit is charged by the variable pressure solenoid (S5).
- Line pressure is prevented from entering the drive circuit by the manual valve.
- The B1 circuit and all clutch circuits are open to exhaust.

	ELEMENTS ENGAGED								
Gear State	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
Park and Neutral	-	-	-	-	-	X	-	-	-



Modification basis	
Application basis	
Affected VIN	

2) REVERSE



Modification basis	
Application basis	
Affected VIN	

▶ Power flow - Reverse

In Reverse, transmission drive is via the input shaft and the forward clutch cylinder to the hub of the C3 clutch.
The elements of the transmission function as follows;

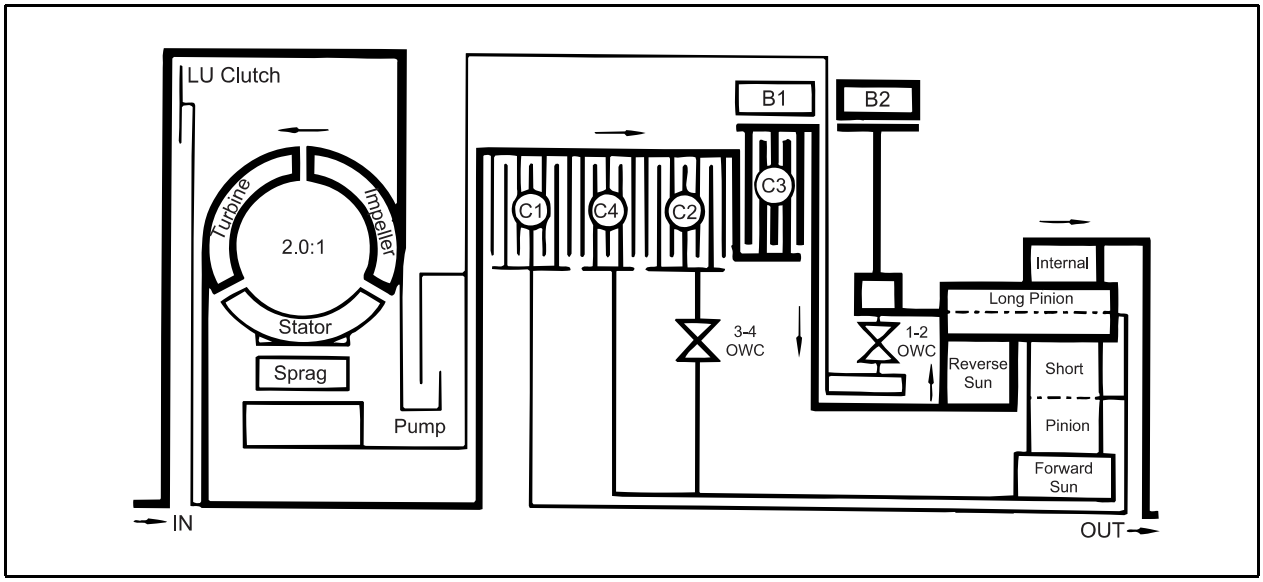
- The C3 clutch is engaged and drives the reverse sun gear in a clock-wise direction.
- The B2 band is engaged and holds the planetary gear carrier stationary causing the long pinion to rotate anticlockwise about its axis on the pinion shaft.
- The long pinion drives the internal ring gear in the same direction.
- The internal ring being splined to the output shaft drives it in an anti-clockwise or reverse direction.

▶ Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows;

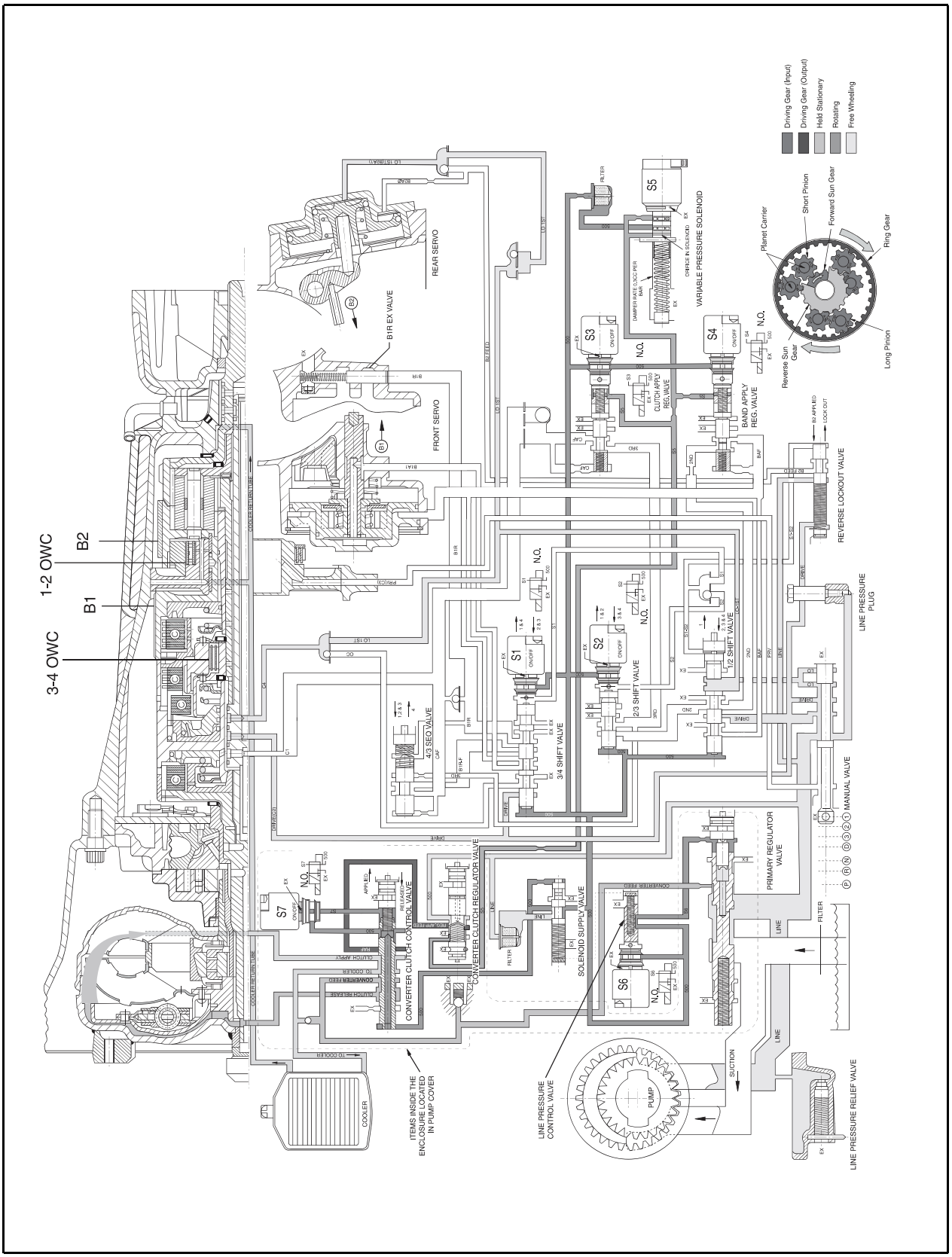
- Solenoids S1 and S2 are switched OFF.
- Line pressure is directed through the reverse lockout valve to both the inner and outer apply areas of the rear servo piston for B2 band application.
- Line pressure feeds the reverse oil circuit via the manual valve.
- Reverse oil is routed from the manual valve to the C3 clutch.
- Reverse oil is also applied to the spring end of the primary regulator valve to assist the spring and to boost the line pressure value.
- All other clutch and band apply circuits are open to exhaust.

	ELEMENTS ENGAGED								
Gear State	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
Reverse	-	-	X	-	-	X	-	-	-



Modification basis	
Application basis	
Affected VIN	

3) MANUAL 1



Modification basis	
Application basis	
Affected VIN	

▶ Power flow - Manual 1

In Manual 1, transmission drive is via the input shaft to the forward clutch cylinder. The elements of the trans-mission function as follows;

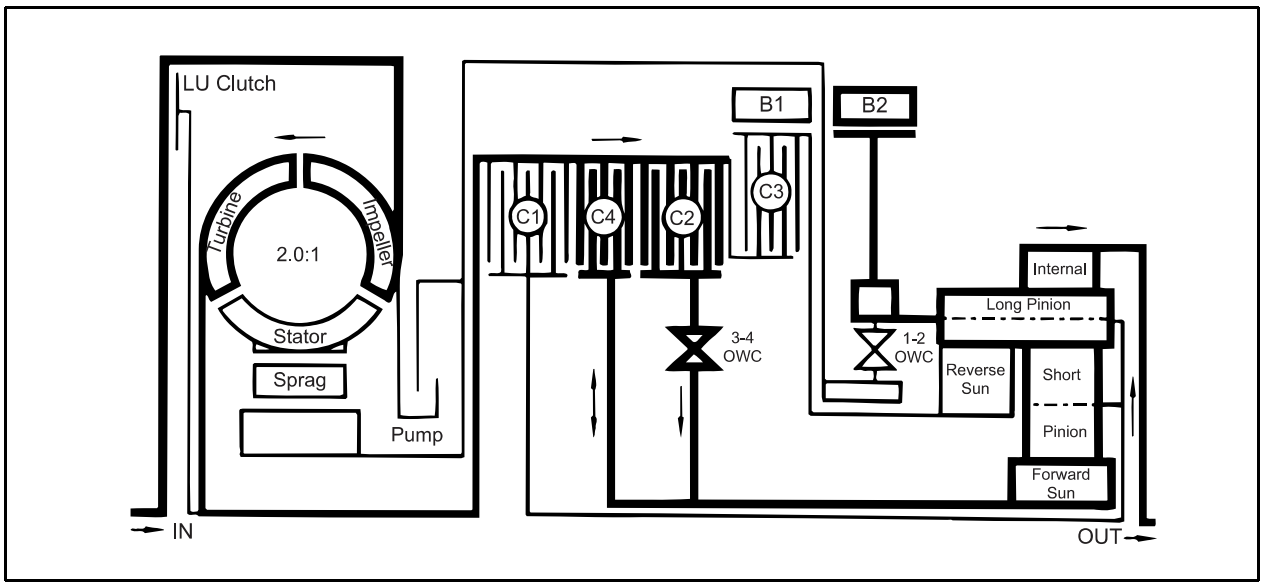
- The C2 clutch is engaged to drive the forward sun gear, via the 3-4 OWC.
- The B2 band is engaged to hold the planetary gear carrier stationary.
- The forward sun gear drives the short pinion anticlockwise.
- The short pinion drives the long pinion clockwise.
- The long pinion rotating about its axis drives the internal ring gear and the output shaft in a clockwise or forward direction.
- The C4 clutch provides engine braking through the 3-4 OWC on overrun.

▶ Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows;

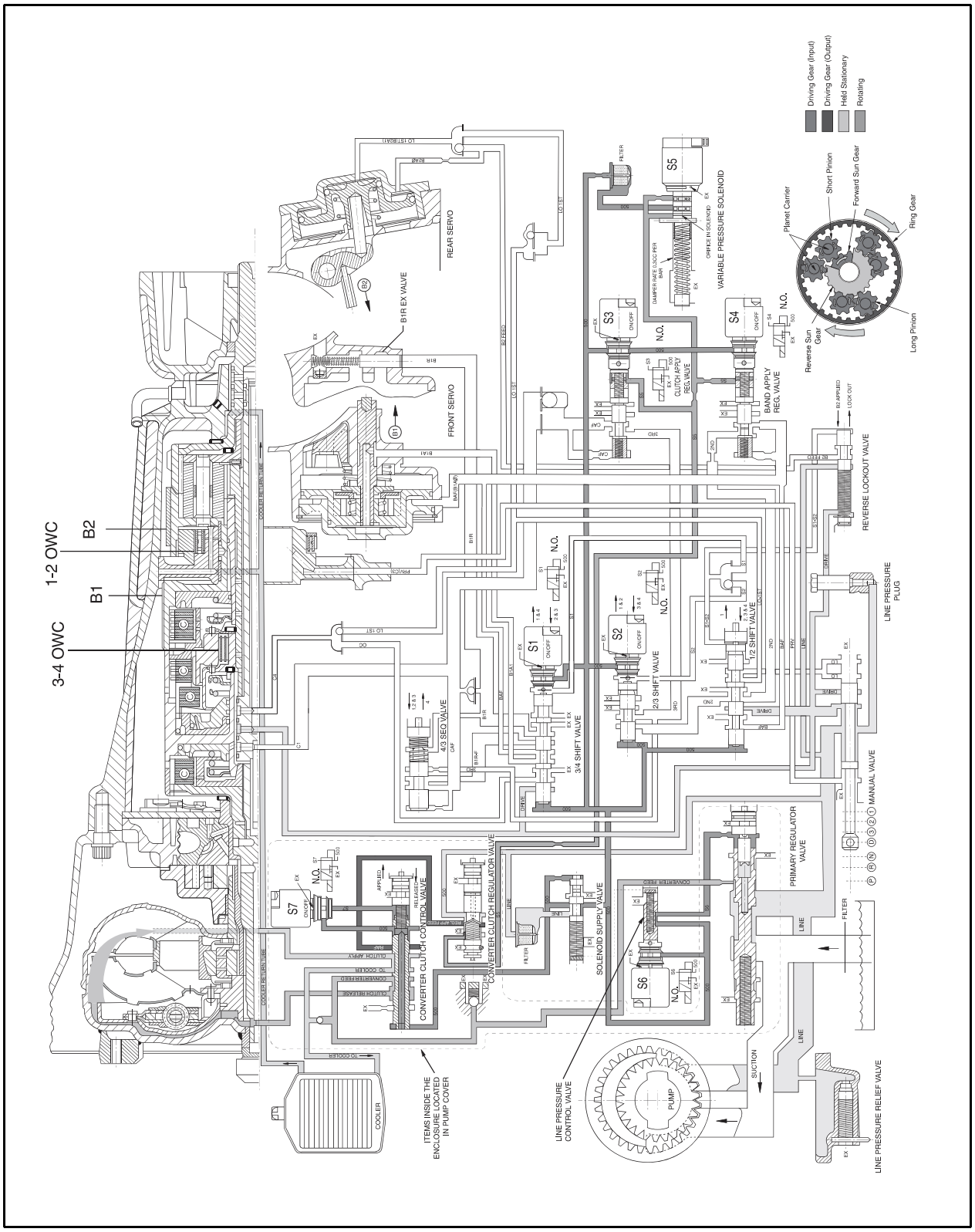
- Solenoids S1 and S2 are switched ON.
- The 1-2, 2-3, and 3-4 shift valves are held in their first gear positions by line 500 pressure.
- Drive (line pressure) oil from the manual valve en-gages the C2 clutch.
- Lo-1st (line pressure) oil is routed through the 1-2 shift valve to the C4 clutch, and to the inner apply area of the rear servo piston for B2 band application.

	ELEMENTS ENGAGED								
Gear State		**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
Manual 1		X	-	X	-	X	-	X	-



Modification basis	
Application basis	
Affected VIN	

4) DRIVE 1



Modification basis	
Application basis	
Affected VIN	

▶ Power flow - Drive 1

In Drive 1, transmission drive is via the input shaft to the forward clutch cylinder. The elements of the transmission function as follows :

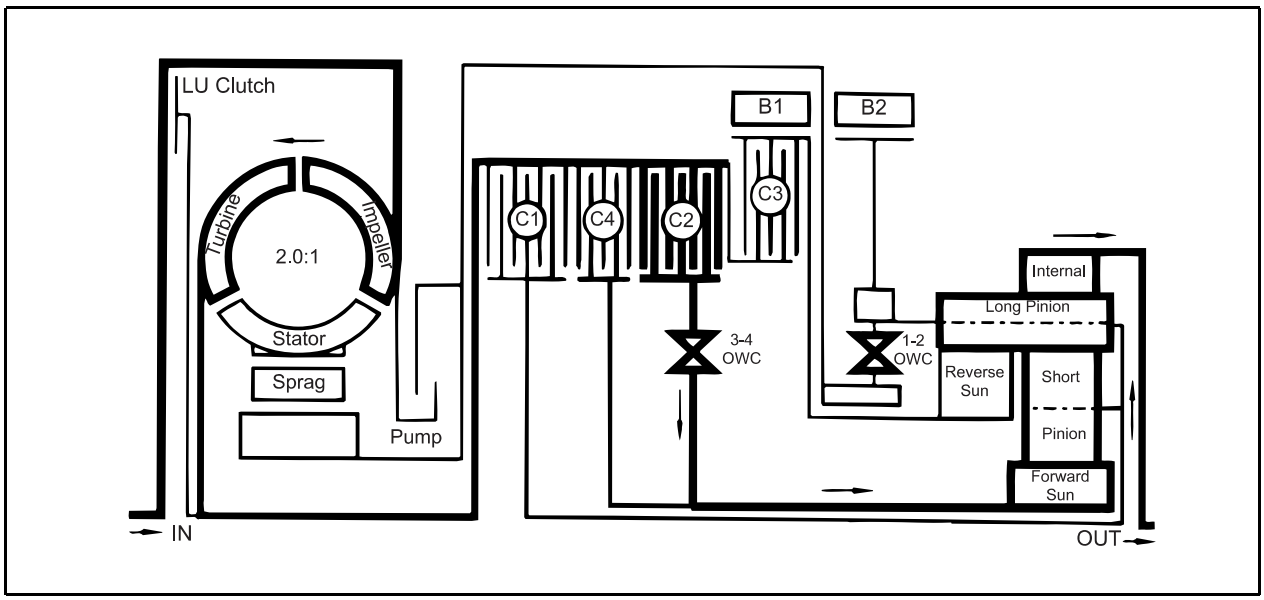
- The C2 clutch is engaged to drive the forward sun gear via the 3-4 OWC.
- The forward sun gear drives the short pinion anticlockwise.
- The short pinion drives the long pinion clockwise.
- The 1-2 OWC prevents the planetary gear carrier from rotating under reaction force and the long pinion rotates on its axis driving the internal ring gear and output shaft in a clockwise or forward direction.
- There is no engine braking on overrun.

▶ Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows:

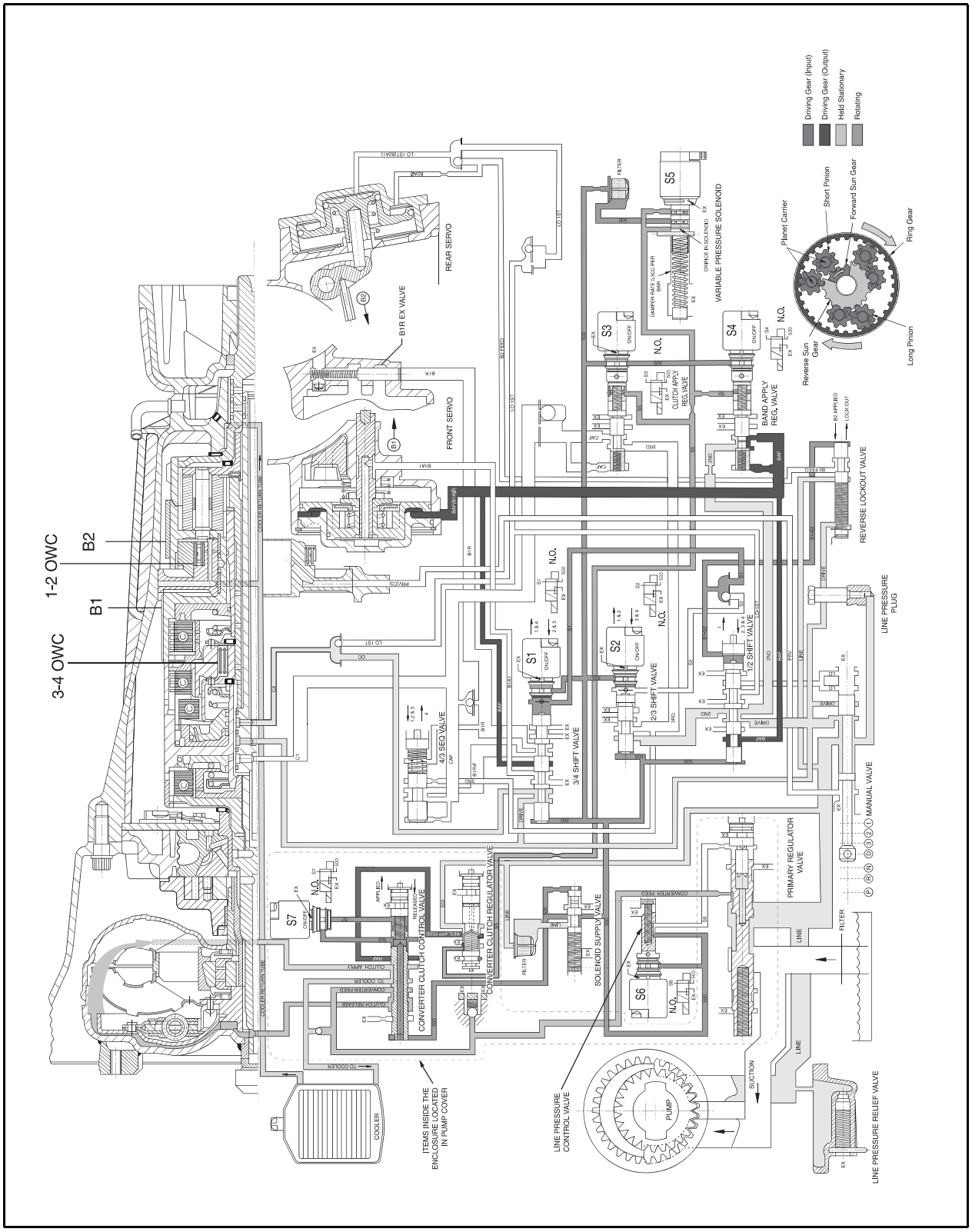
- Solenoids S1 and S2 are switched ON.
- The 1-2, 2-3, and 3-4 shift valves are held in their first gear positions by line 500 pressure.
- Drive (line pressure) oil from the manual valve en-gages the C2 clutch.

	ELEMENTS ENGAGED								
Gear State	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
Drive 1	-	X	-	-	-	-	X	X	-



Modification basis	
Application basis	
Affected VIN	

5) DRIVE 2 AND MANUAL 2



Modification basis	
Application basis	
Affected VIN	

▶ Power flow - Drive 2 and manual 2

In Drive 2 and Manual 2, transmission drive is via the input shaft and forward clutch cylinder. The elements of the transmission function as follows;

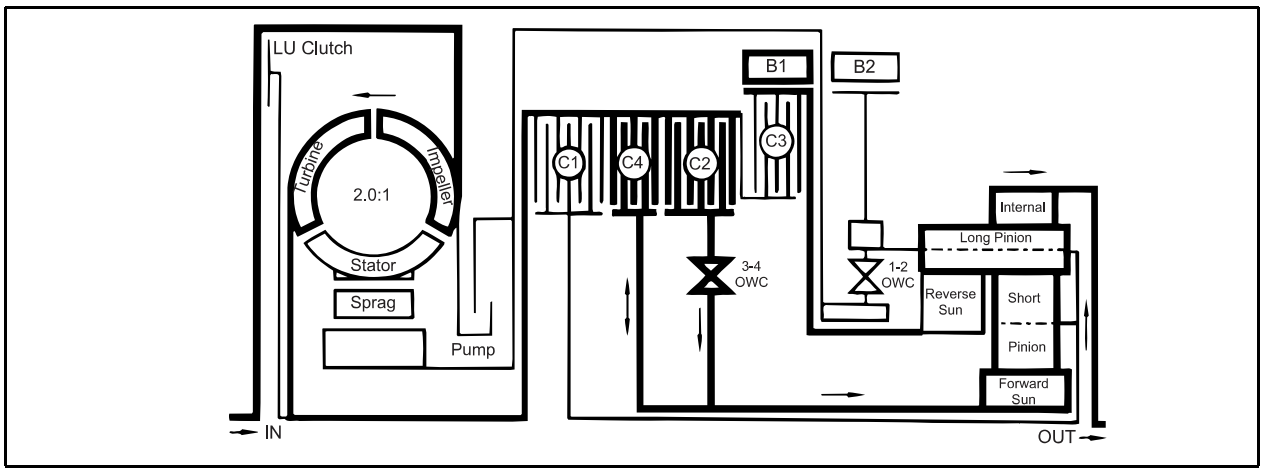
- The C2 clutch is applied to drive the forward sun gear.
- The forward sun gear drives the short pinion anticlockwise.
- The short pinion drives the long pinion clockwise.
- The B1 band is applied holding the reverse sun gear stationary therefore the long pinion walks around the reverse sun gear taking the internal ring gear and output shaft with it in a clockwise or forward direction.
- The C4 clutch is applied to bypass the 3-4 OWC and provide engine braking on overrun.

▶ Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows;

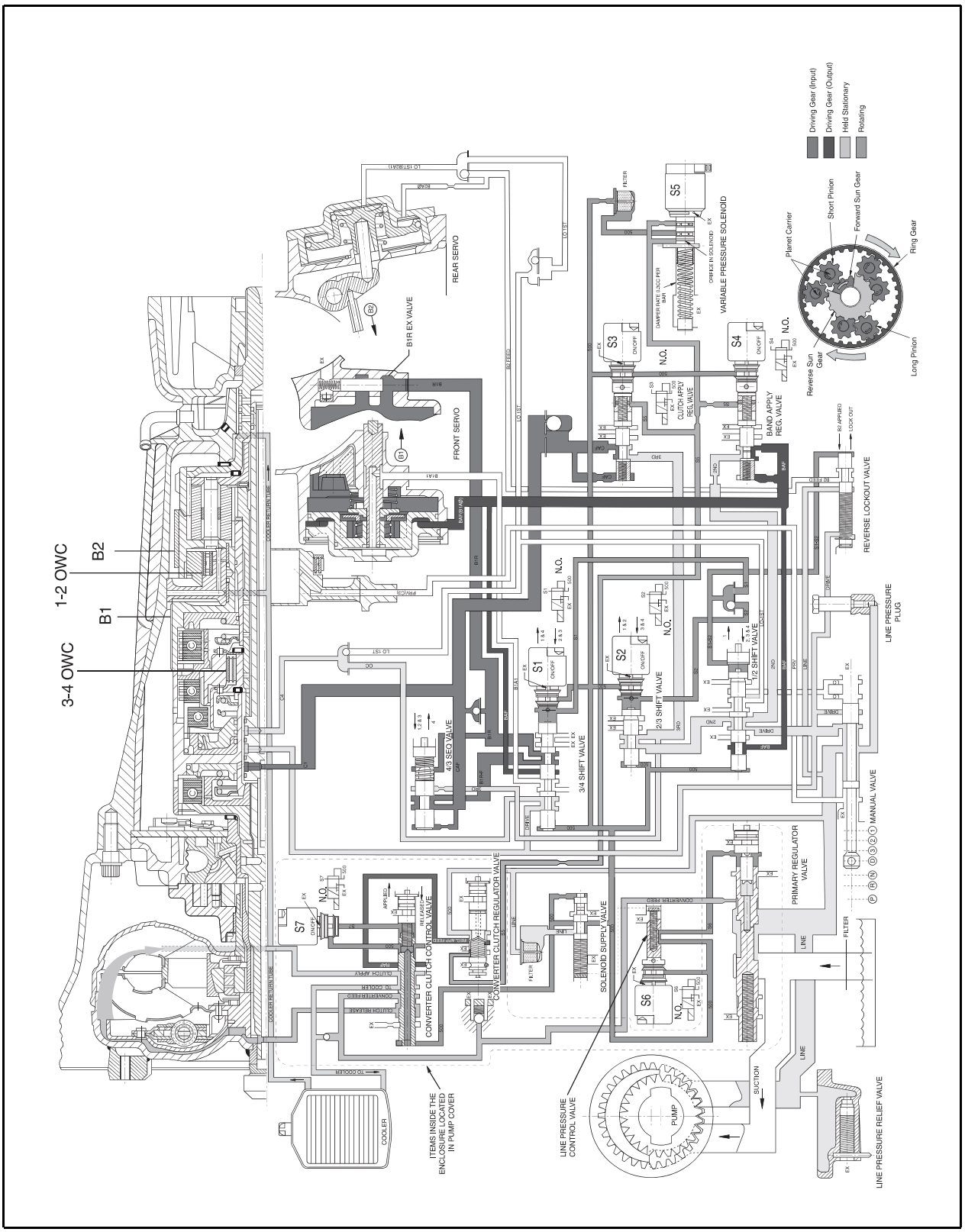
- Solenoid S1 is switched OFF. S2 is switched ON.
- Drive (line pressure) oil from the manual valve en-gages the C2 clutch.
- When S1 switches OFF, S1 oil pressure, which is derived from line 500 pressure, moves the 3-4 shift valve to the left. At the same time S1 oil is directed to the 1-2 shift valve which moves the valve to the second gear position.
- 2nd oil (line pressure) from the 1-2 shift valve is directed to the band apply regulator valve, and to the 2- 3 shift valve.
- The band apply feed regulator valve supplies 2nd oil (regulated to line pressure multiplied by the valve ratio) to the Band Apply Feed (BAF) circuit.
- Band apply feed oil is directed to;
  - The outer apply area of the front servo
  - The 1-2 shift valve to provide an exhaust port when the transmission is shifted to first gear
  - The 3-4 shift valve for use when the transmission is shifted into fourth gear
- Drive (line pressure) is routed through the 3-4 shift valve to apply the C4 clutch.

	ELEMENTS ENGAGED								
Gear State	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
Drive 2 and Manual 2	-	X	-	X	X	-	-	X	-



Modification basis	
Application basis	
Affected VIN	

6) DRIVE 3 AND MANUAL 3



Modification basis	
Application basis	
Affected VIN	

▶ Power flow - Drive 3 and manual 3

In Drive 2 and Manual 2, transmission drive is via the input shaft and forward clutch cylinder. The elements of the transmission function as follows;

· The C2 clutch is engaged to drive the forward sun gear.
· The C1 clutch is engaged to drive the planet carrier.
· The short pinion drives the long pinion clockwise.
· The forward sun gear and the planet carrier are driv-en clockwise at the same speed therefore there is no relative motion between the sun gear and the pinions.
· The ring gear and output shaft are driven in a clockwise or forward direction at input shaft speed.
· The C4 clutch is applied to bypass the 3-4 OWC and provide engine braking on overrun.

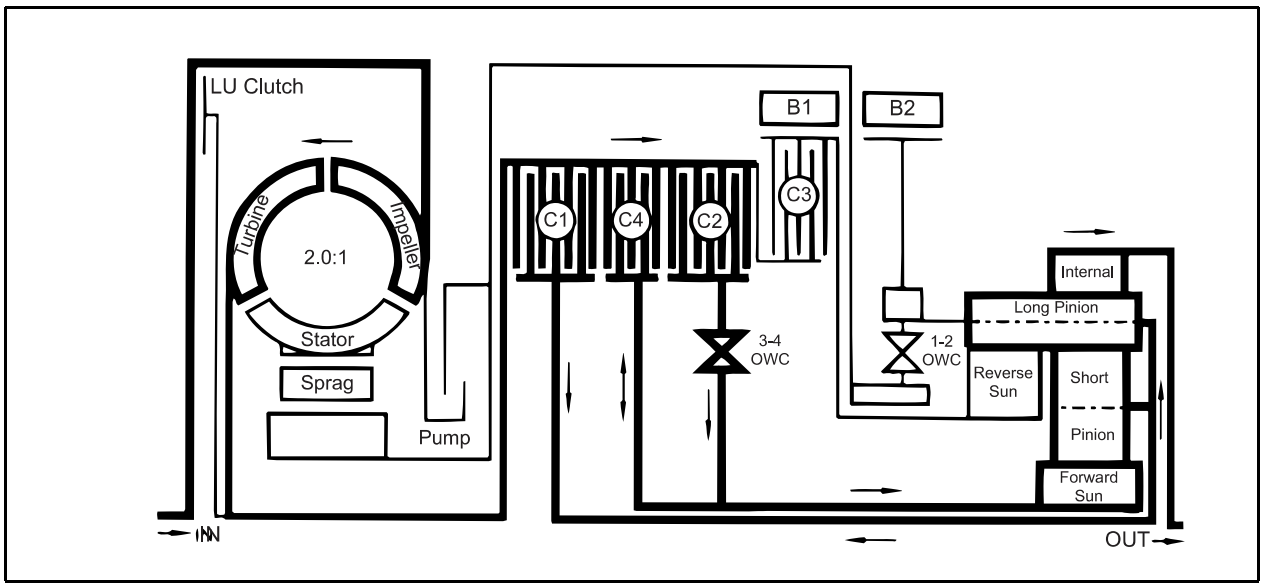
▶ Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows:

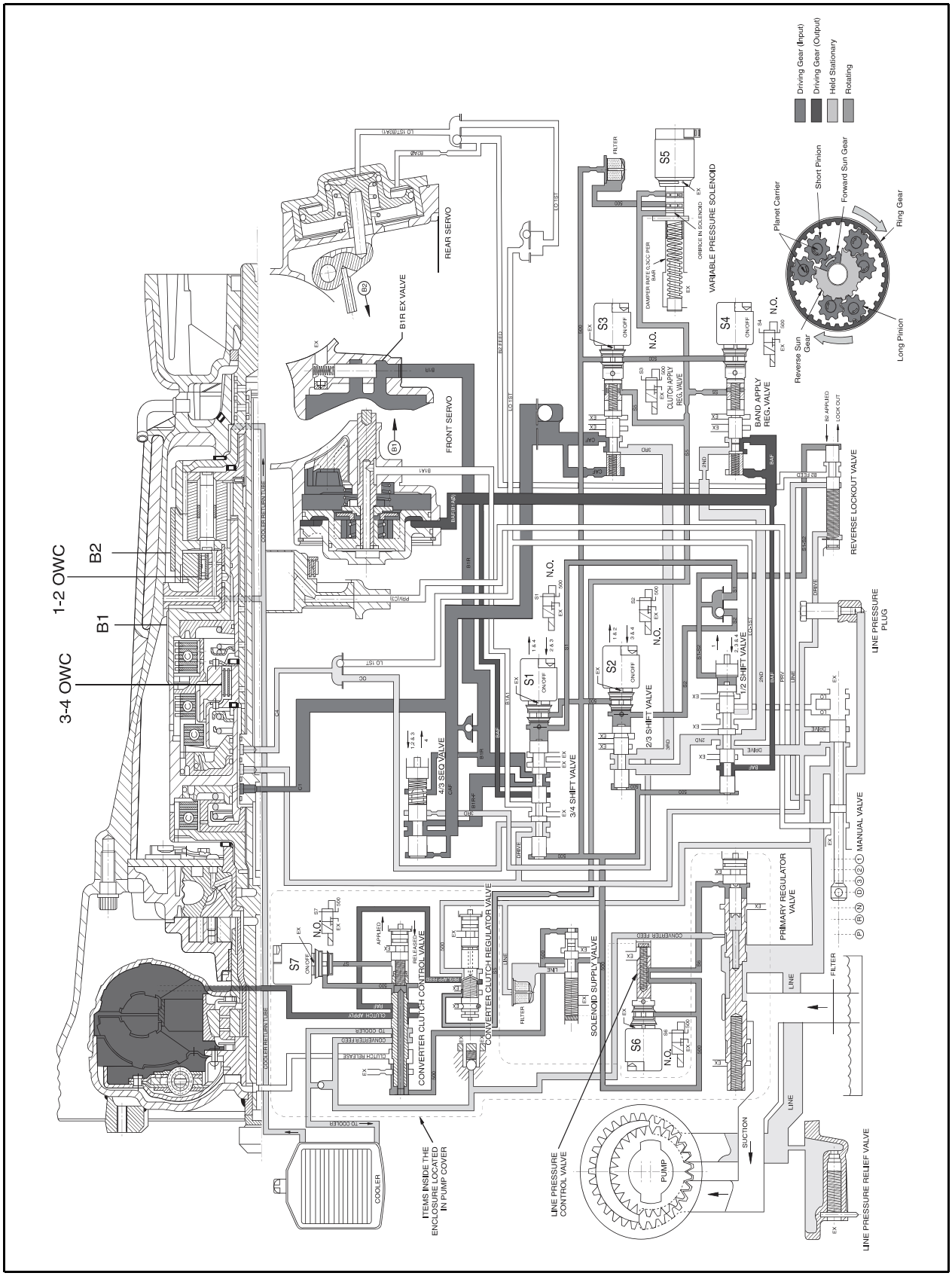
· Solenoid S1 is switched OFF. S2 is switched OFF.
· With S1 and S2 switched OFF, the 2-3 and 3-4 shift valves are held in the third gear position by line 500 pressure.
· The 1-2 shift valve is held in the third gear position by S1-S2 oil pressure.
· 2nd oil (line pressure) from the 1-2 shift valve is directed to the band apply feed regulator valve and to the 2-3 shift valve.
· The band apply feed regulator valve supplies 2nd oil (regulated to line pressure multiplied by the valve ratio) to the Band Apply Feed (BAF) circuit.
· Band apply feed oil is directed to;
  - The outer apply area of the front servo
  - The 1-2 shift valve to provide an exhaust port when the transmission is shifted to first gear
  - The 3-4 shift valve for use when the transmission is shifted into fourth gear
· 2nd oil at the 2-3 shift valve is directed to the 3rd oil circuit.
· 3rd oil from the 2-3 shift valve is directed to the clutch apply regulator valve, and to the 4-3 sequence valve.
· The clutch apply regulator valve supplies oil (regu-lated to line 500 pressure multiplied by the valve ratio) to the Clutch Apply Feed (CAF) circuit.
  The CAF oil is directed to;
  - The C1clutch
  - The 4-3 sequence valve
· At the 4-3 sequence valve the CAF oil becomes Band 1 Release Feed (B1R-F) oil, and is directed through the 3-4 shift valve to the spring end of the 4-3 sequence valve, and to the release side of the front servo piston to hold band 1 OFF.
· Drive (line pressure) is routed through the 3-4 shift valve to apply the C4 clutch.

Modification basis	
Application basis	
Affected VIN	

Gear State	ELEMENTS ENGAGED								
	C1	C2	C3	C4	B1	B2	1-2 OWC	3-4 OWC	LU CLUTCH
Drive 3 and Manual 3	X	X	-	X	-	-	-	X	-



7) DRIVE 3 LOCK UP AND MANUAL 3 LOCK UP



Modification basis	
Application basis	
Affected VIN	

▶ Power flow - Drive 3 lock up and manual 3 lock up

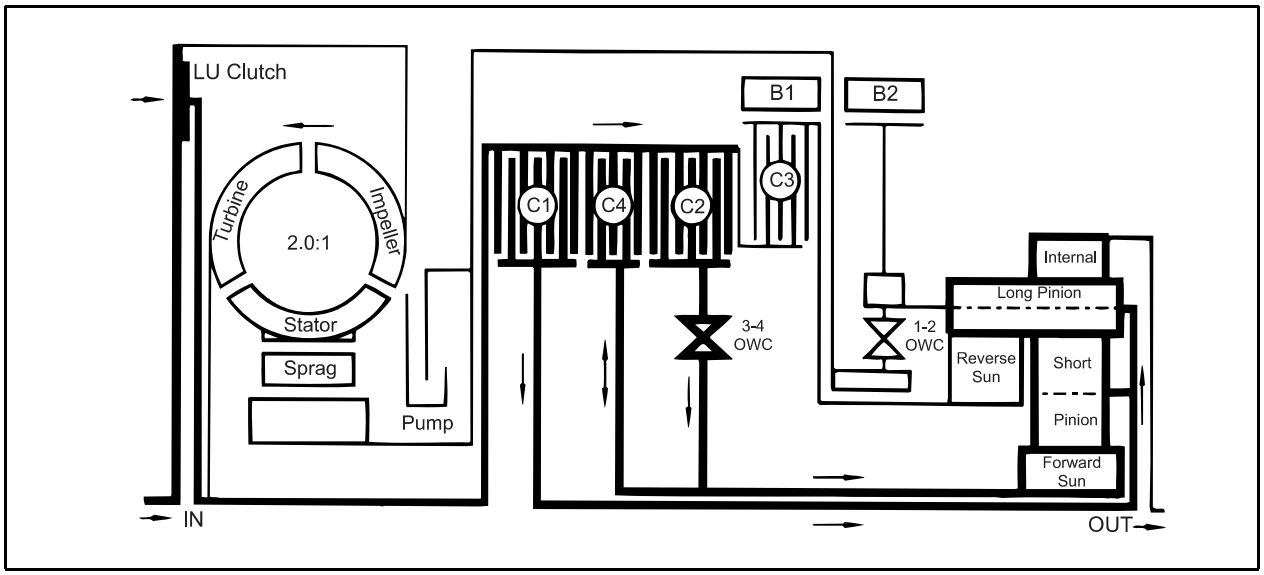
In Drive 3 Lock Up and Manual 3 Lock Up, transmission drive is the same as for Drive 3 but with the application of the converter lock up clutch to provide positive no-slip converter drive.

▶ Control

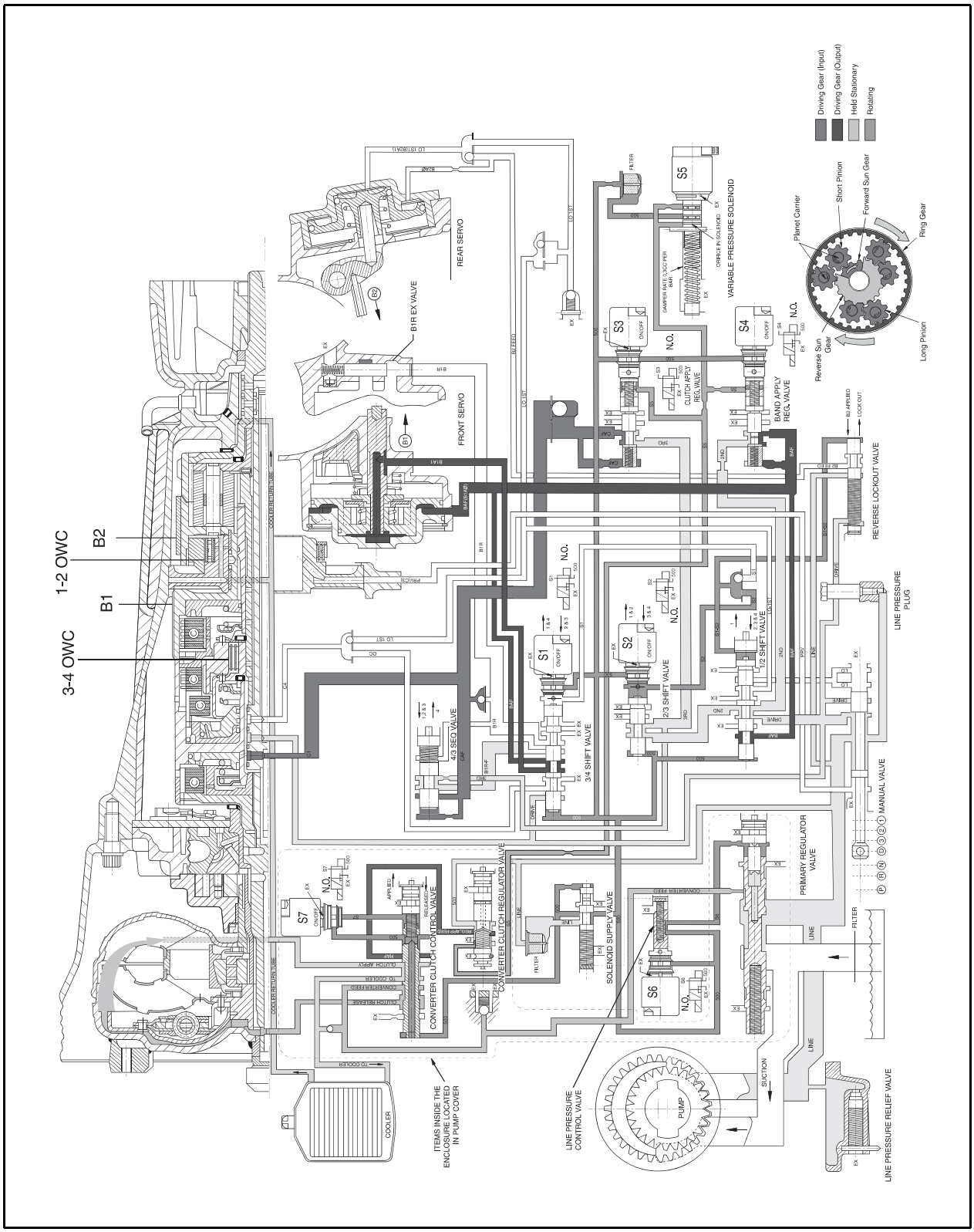
Control for Drive 3 Lock Up and Manual 3 Lock Up is the same as for Drive 3 with the addition of the converter clutch circuit activated by solenoid S7.

- When S7 is switched ON, S7 feed oil to the converter clutch control valve is switched OFF and allowed to exhaust through the S7 solenoid. This allows the valve to move to the clutch engage position.
- Regulated apply feed oil, drive oil at the converter clutch regulator valve, is directed by the converter clutch control valve to the engage side of the converter clutch.
- Converter clutch release oil is exhausted at the converter clutch control valve.
- Converter feed oil is re-routed by the converter clutch control valve directly to the oil cooler and lubrication circuit.

	ELEMENTS ENGAGED								
Gear State	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
Drive 3 Lock Up and Manual 3 Lock Up	X	X	-	X	-	-	-	X	X



8) DRIVE 4 (OVERDRIVE)



Modification basis	
Application basis	
Affected VIN	

▶ Power flow - Drive 4 (Overdrive)

In Drive 4 (Overdrive), transmission drive is via the input shaft to the forward clutch cylinder.
The elements of the transmission function as follows;

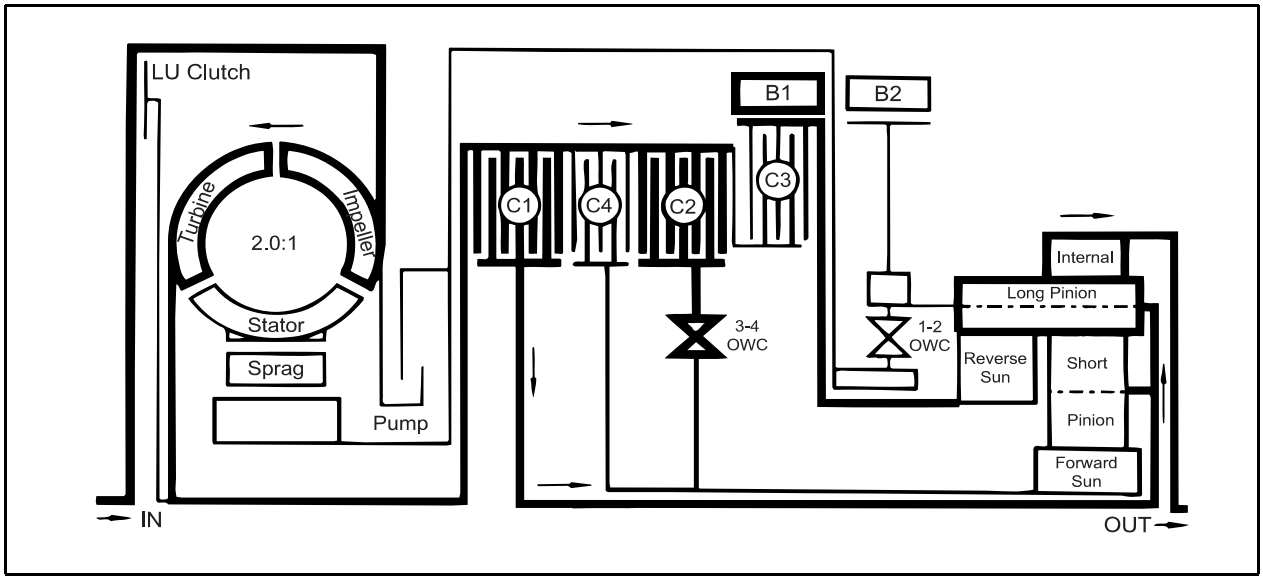
- The C1 clutch is applied to drive the planet carrier clockwise.
- The B1 band is applied to hold the reverse sun gear stationary.
- As the planet carrier tuns, the long pinion walks around the stationary reverse sun gear and rotates around its axis driving the internal ring gear and output shaft in a clockwise or forward direction at a speed faster than the input shaft i.e. in overdrive ratio.
- The forward sun gear is also driven faster than the input shaft and overruns the 3-4 OWC.
- The C2 clutch is engaged to reduce the speed differential across the 3-4 OWC.

▶ Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows;

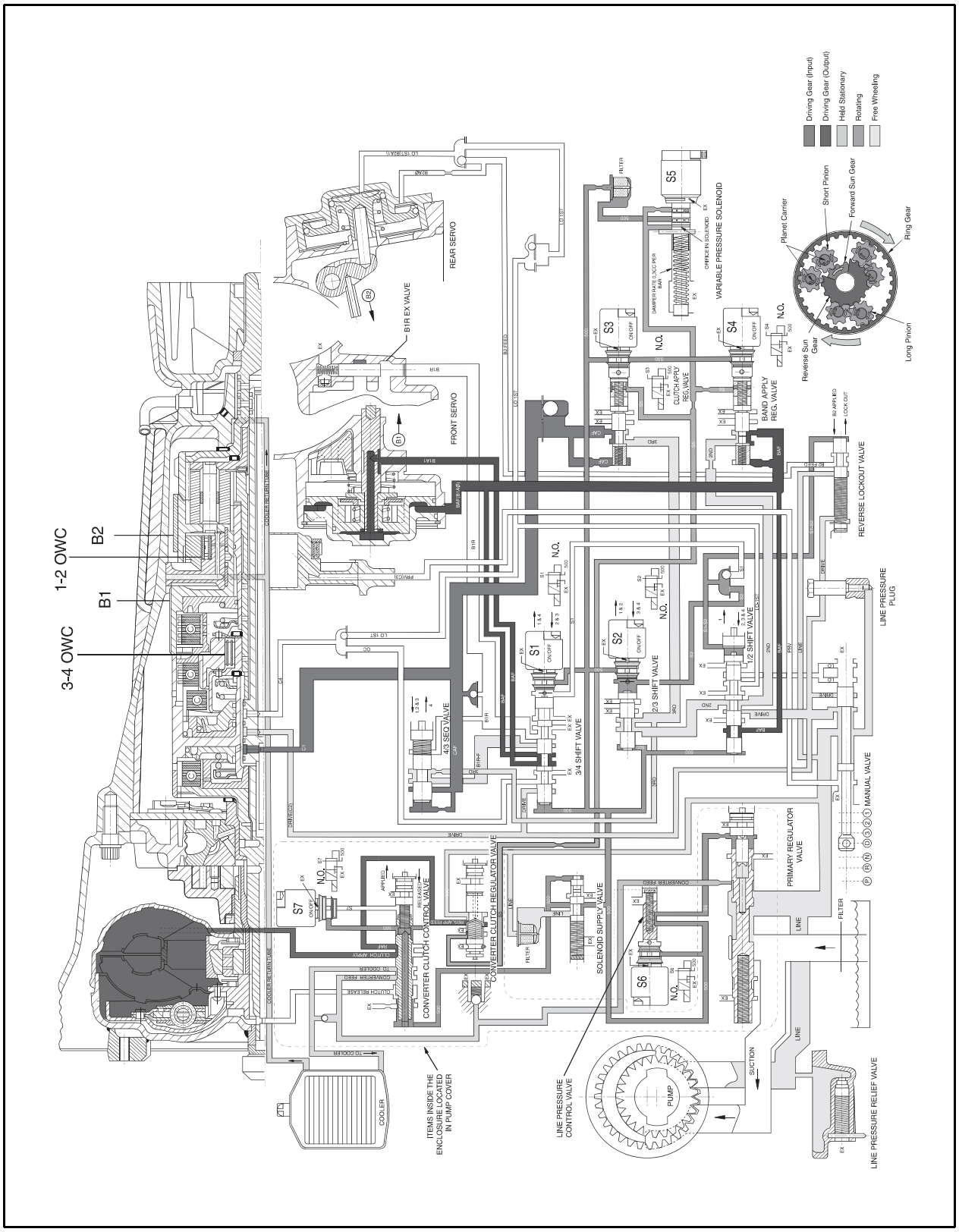
- Solenoid S1 is switched ON. S2 is switched OFF.
- With S1 switched ON, the 3-4 shift valve is held in the fourth gear position by line 500 pressure on the small end of the valve.
- With S2 switched OFF, the 2-3 shift valve is held in the fourth gear position by line 500 pressure on the large end of the valve.
- The 1-2 shift valve is held in the fourth gear position by S2 oil pressure.
- 2nd oil (line pressure) from the 1-2 shift valve is directed to the band apply feed regulator valve, and to the 2-3 shift valve.
- The band apply feed regulator valve supplies 2nd oil (regulated to line pressure multiplied by the valve ratio) to the Band Apply Feed (BAF) circuit.
- Band apply feed oil is directed to;
  - the outer apply area of the front servo
  - the inner apply area of the front servo piston via the 3-4 shift valve
  - the 1-2 shift valve to provide an exhaust port when the transmission is shifted to first gear
- 2nd oil at the 2-3 shift valve is directed to the 3rd oil circuit.
- 3rd oil from the 2-3 shift valve is directed to the clutch apply regulator valve, and to the 4-3 sequence valve.
- The clutch apply regulator valve supplies oil (regu-lated to line 500 pressure multiplied by the valve ratio) to the Clutch Apply Feed (CAF) circuit.
- The CAF oil is directed to;
  - the C1 clutch
  - the 4-3 sequence valve
- Drive oil (line pressure) from the manual valve en-gages the C2 clutch.

Gear State	ELEMENTS ENGAGED								
	C1	C2	C3	C4	B1	B2	1-2 OWC	3-4 OWC	LU CLUTCH
Drive 4 Overdrive	X	X	-	-	X	-	-	-	-



Modification basis	
Application basis	
Affected VIN	

9) DRIVE 4 LOCK UP



Modification basis	
Application basis	
Affected VIN	

▶ Power flow - Drive 4 lock up

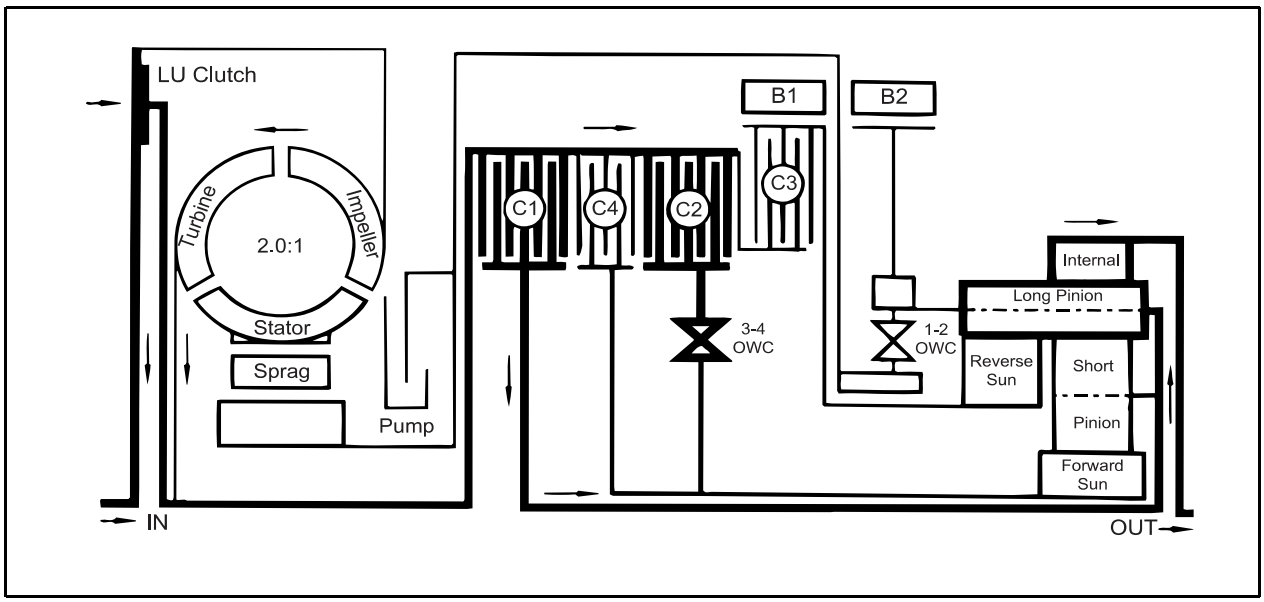
In Drive 4 Lock Up, transmission drive is the same as for Drive 4 but with the application of the converter lock up clutch to provide positive no-slip converter drive.

▶ Control

To maintain this arrangement in the steady state solenoids and valves are activated as follows;

- When S7 is switched ON, S7 feed oil to the converter clutch control valve is switched OFF and allowed to exhaust through the S7 solenoid. This allows the valve to move to the clutch engage position.
- Regulated apply feed oil, drived from drive oil at the converter clutch regulator valve, is directed by the converter clutch control valve to the engage side of the converter clutch.
- Converter clutch release oil is exhausted at the converter clutch control valve.
- Converter feed oil is re-routed by the converter clutch control valve directly to the oil cooler and lubrication circuit.

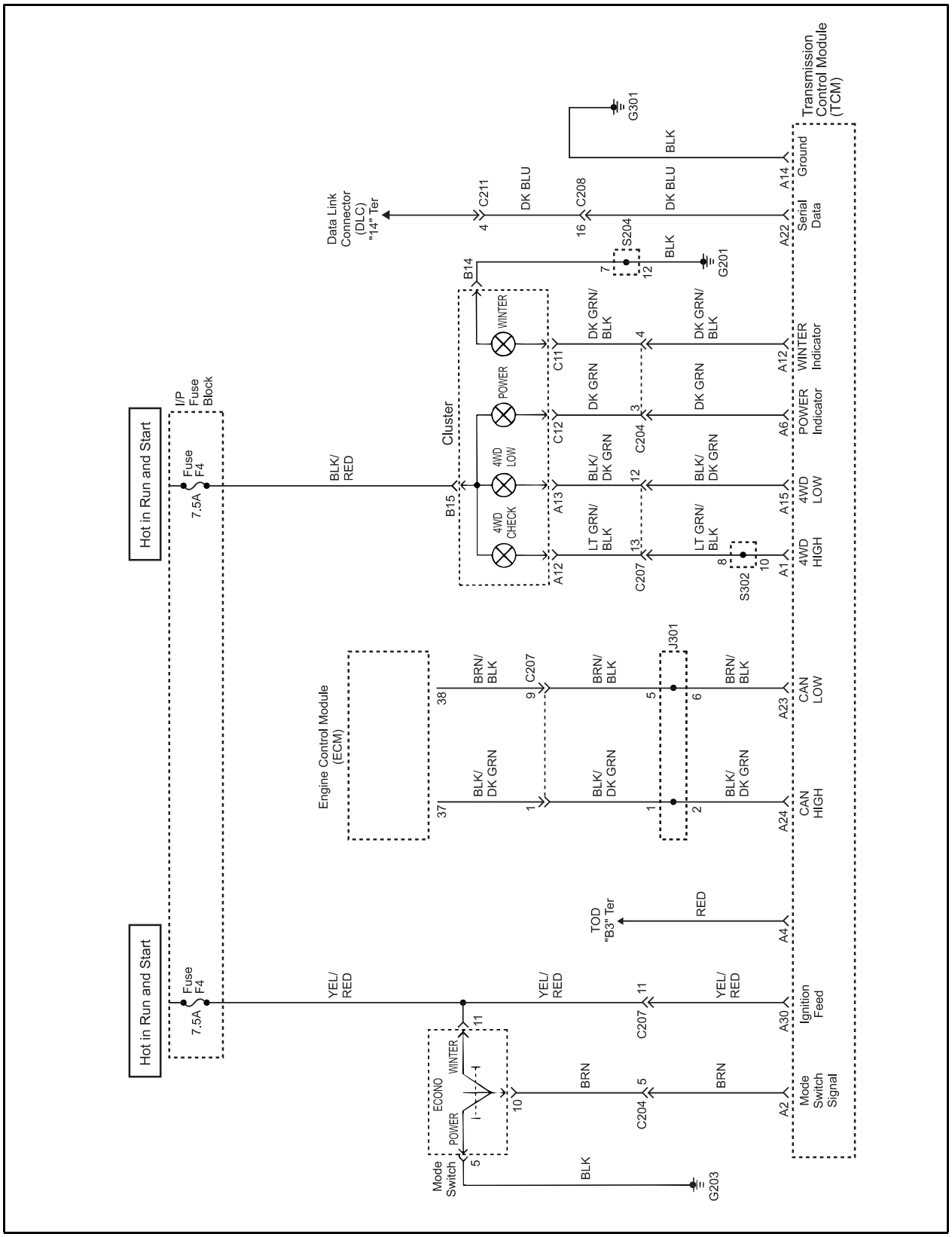
	ELEMENTS ENGAGED								
Gear State	**C1**	**C2**	**C3**	**C4**	**B1**	**B2**	**1-2 OWC**	**3-4 OWC**	**LU CLUTCH**
Drive 4 Lock Up	X	X	-	-	X	-	-	-	-



Modification basis	
Application basis	
Affected VIN	

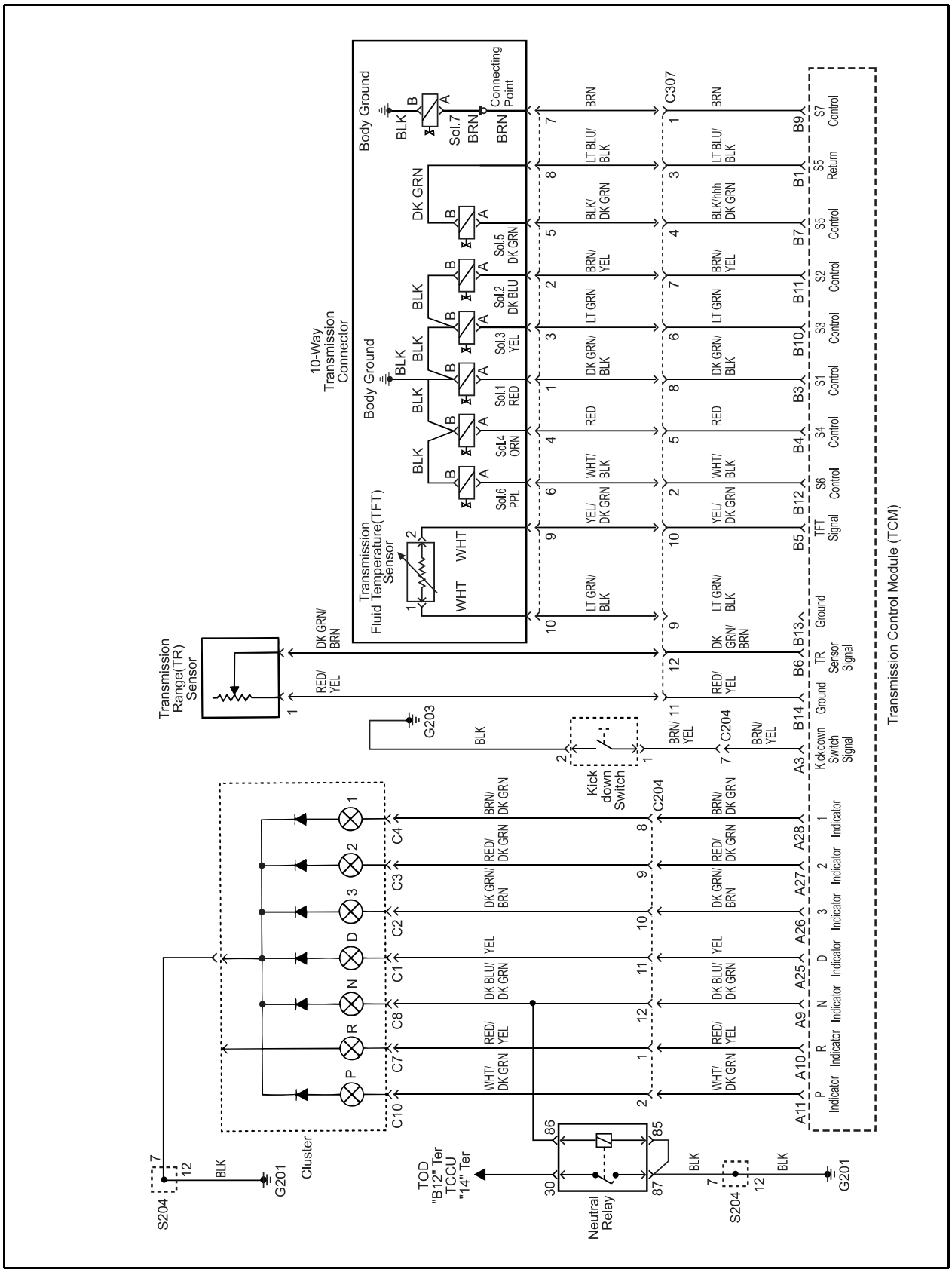
9. SCHEMATIC AND ROUTING DIAGRAMS

▶ TCM WIRING DIAGRAM (gasoline engine-1 OF 2)



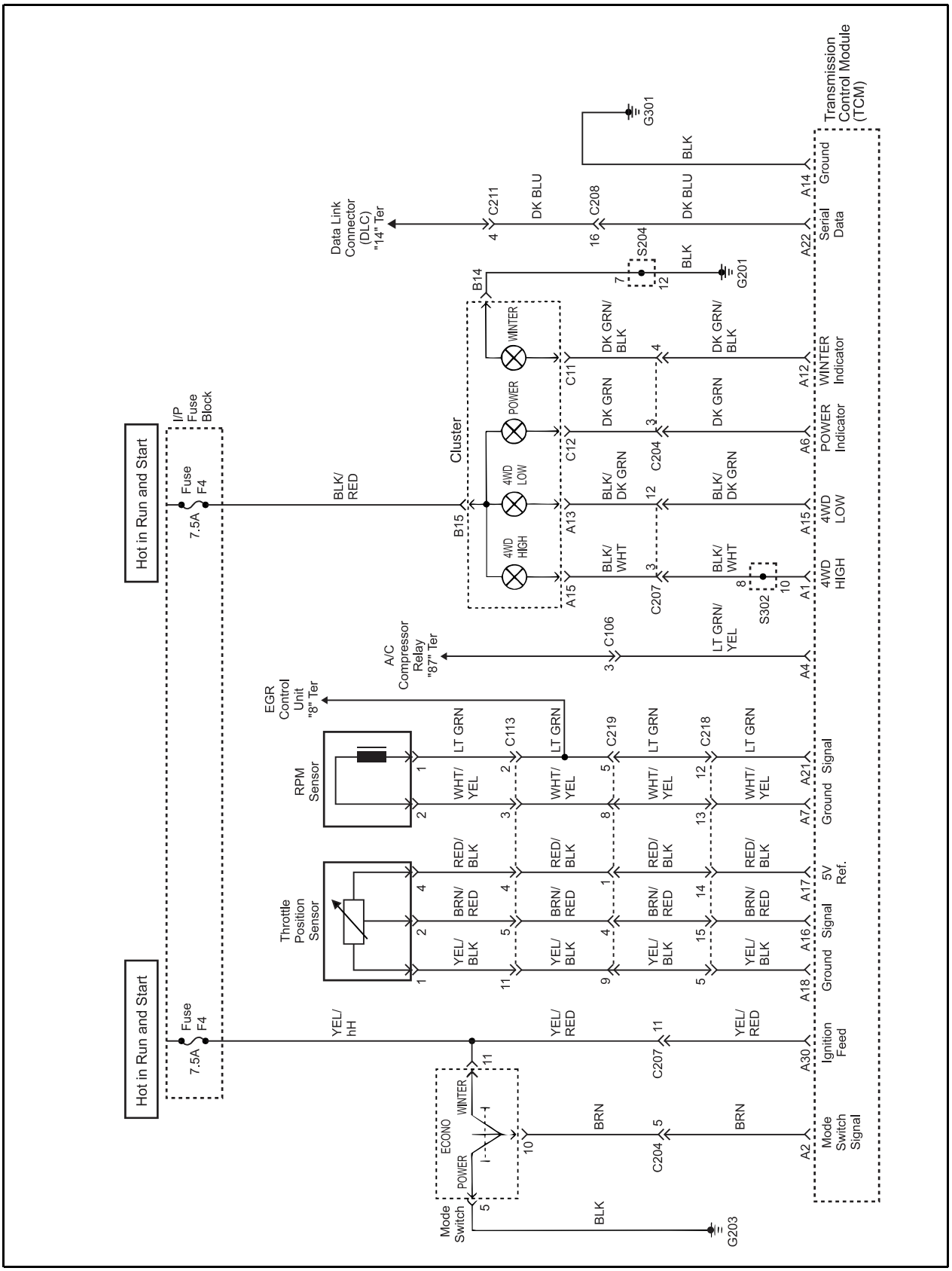
Modification basis	
Application basis	
Affected VIN	

▶ TCM WIRING DIAGRAM (GASOLINE ENGINE-2 OF 2)



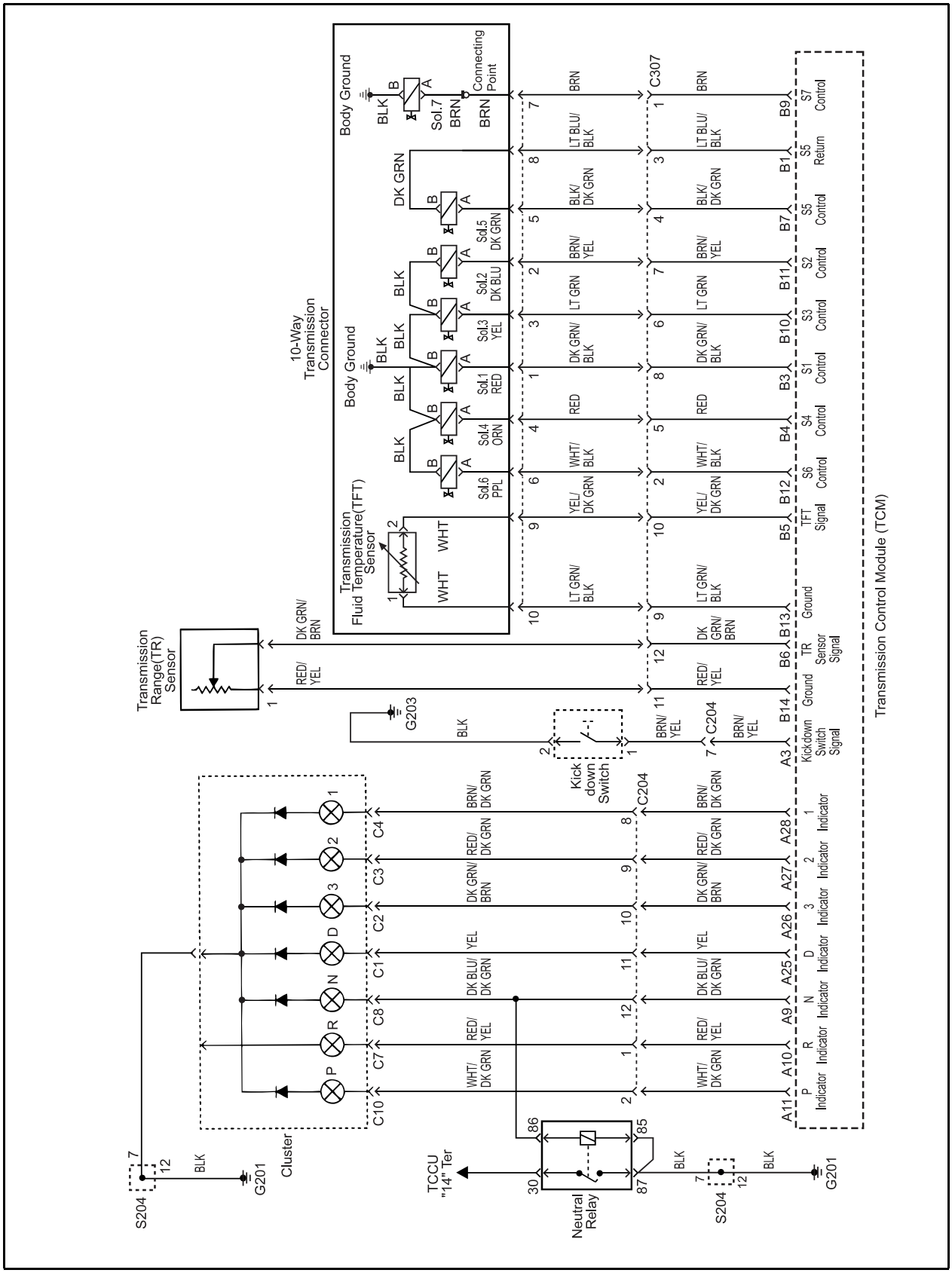
Modification basis	
Application basis	
Affected VIN	

▶ TCM WIRING DIAGRAM (DIESEL ENGINE-1 OF 2)



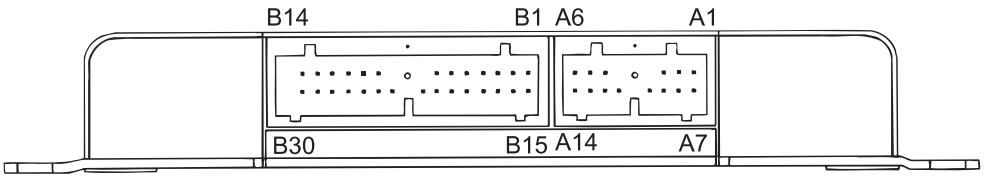
Modification basis	
Application basis	
Affected VIN	

▶ TCM WIRING DIAGRAM (DIESEL ENGINE-2 OF 2)

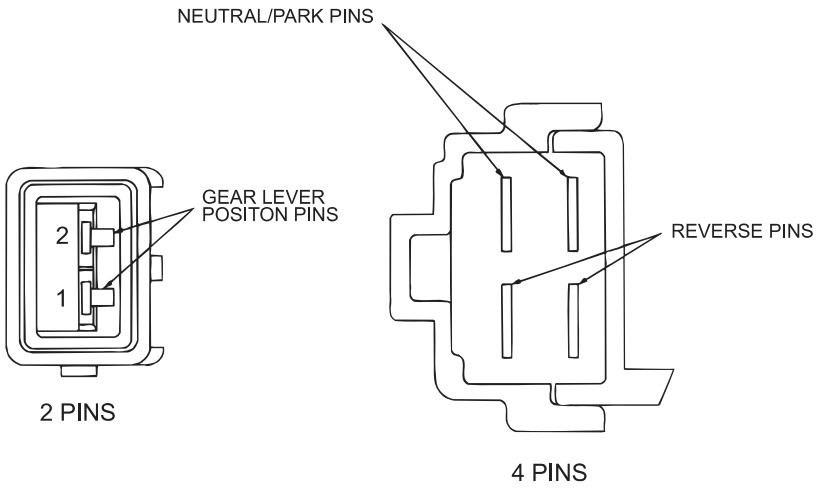


Modification basis	
Application basis	
Affected VIN	

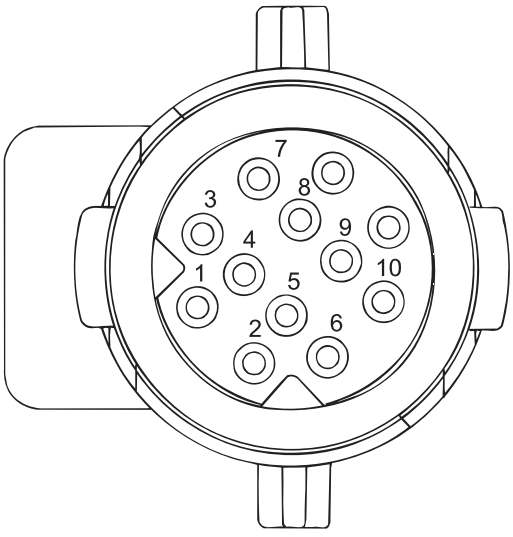
▶ CONNECTOR END VIEW



Transmission Control Module (TCM) Pin Numbers



Inhibitor Switch Pins



10-Way Transmission Connector

DC-5 SPEED AUTOMATIC TRANSMISSION

3650-01

GENERAL

1. SPECIFICATIONS

Item		W5A330 (300)	W5A580 (400)
Input torque		330 Nm	580 Nm
Weight (including ATF)		78 kg	78 kg
Diameter (Torque converter)		270 mm	270 mm
Lockup function		Yes	Yes
Gear ratios	1st	3.951	3.595
	2nd	2.423	2.186
	3rd	1.486	1.405
	4th	1.000	1.000
	5th	0.833	0.831
	Reverse: S mode / W mode	3.147/1.93	3.167/1.926
Driving type		2WD (4WD)	
Fluid specification		Fuchs ATF 3353 or Shell ATF 3353	
Fluid capacity		approx. 8ℓ	
Selector lever position	P.R.N.D	Mechanical	
	D+/D-	Electrical	
Parking lock system		Brake switch (signal) → TGS lever	
Reverse lock system		CAN → TGS lever	
Selected lever indication	P.R.N.D	Lever position	
	4, 3, 2, 1	CAN	
Oil temperature sensor	Resistance: R, D	0.5 ~ 2.5 kΩ	
	Resistance: P, N	20 kΩ	
TCU		EGS 52	
Shift solenoid valve (25°C)	Resistance	3.8 ± 0.2Ω	
	Operating distance	0.2 mm	
	Operating current	1.5 ~ 2 A	
M/P, S/P solenoid valve (23°C)	Resistance	5.0 ± 0.2Ω	
	Operating distance	0.6 mm	
	Operating current	0 ~ 1 A	
Lockup solenoid valve (25°C)	Resistance	2.5 ± 0.2Ω	
	Operating distance	0.2 mm	
	Operating current	1.5 ~ 2.0 A	
	Operating range	3rd to 5th gears	
RPM sensor	Resistance	HALL type	
	Operating voltage	6 V	
Start lockout switch	Switch contact	ON (D position)	
	Switch contact	OFF (P, N position)	

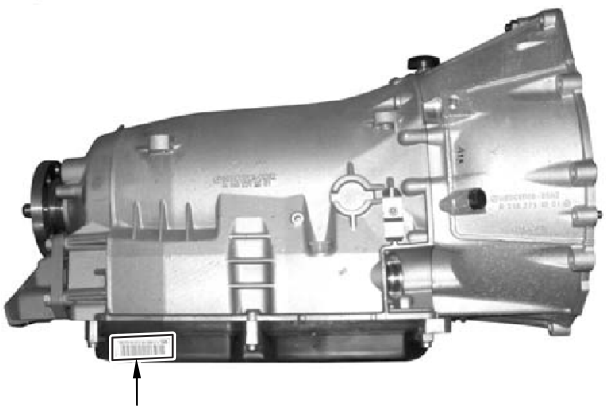
Item		W5A330 (300)	W5A580 (400)
Mode switch		W (Winter)	
		S (Standard)	
One-way clutch		F1, F2	
Planetary gear set	Plain planetary gear: 3 (number of pinion)	3, 4, 3	4, 4, 4
Disc clutch	Disc: C1*, C2, C3*	Single plate type*	
Disc brake	Disc: B1*, B2, B3	Single plate type*	

Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

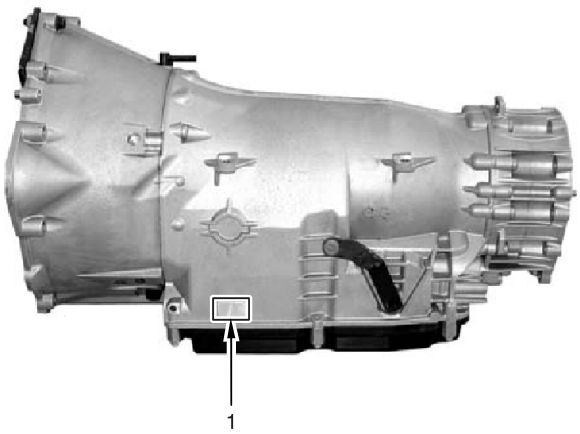
2WD



1
7202700600 — DC Part Number
722 600 0 — DC Variant Number
377900 — Serial Number

3 Automatic Transmission Assembly

4WD



722 600 0
Engine Code Number
Transmission Type
Automatic Transmission for Passenger Car
61: D27DT (4WD)
62: E3.2 Engine (4WD)

▶DC 5-Speed Automatic Transmission

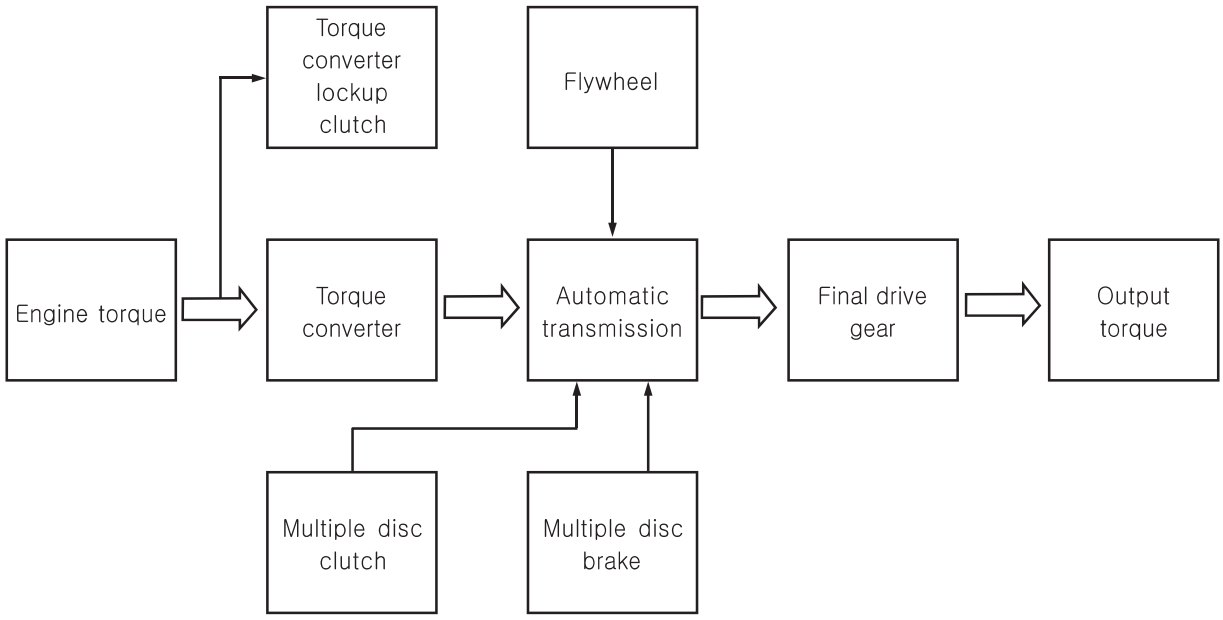
DCAG 5-speed automatic transmission is an electronically controlled 5-speed transmission with a lockup clutch in the torque converter. The ratios for the gears are realized by three planetary gear sets. The 5th gear is designed with a step-up ratio of 0.83 as an overdrive. The selector lever is controlled by electronically and mechanically. The gears are shifted by the corresponding combination of three hydraulically actuated multiple-disc brakes, three hydraulically actuated multiple-disc clutches and two mechanical one-way clutches. This electronically controlled automatic transmission adjusts the operating pressure to provide proper shifting in relation to engine power. This function improves shifting quality significantly. And, the driver can select "S" (Standard) mode or "W" (Winter) mode according to the driving conditions. This automatic transmission provides two gears even during reverse driving. The internal sensors and controls are connected to TCU by cylindrical 13-pin connector.

* DCAG 5-speed automatic transmission offers the following advantages:

1. Improved shifting quality
2. More gears
3. Extended working life and reliability
4. Reduced fuel consumption

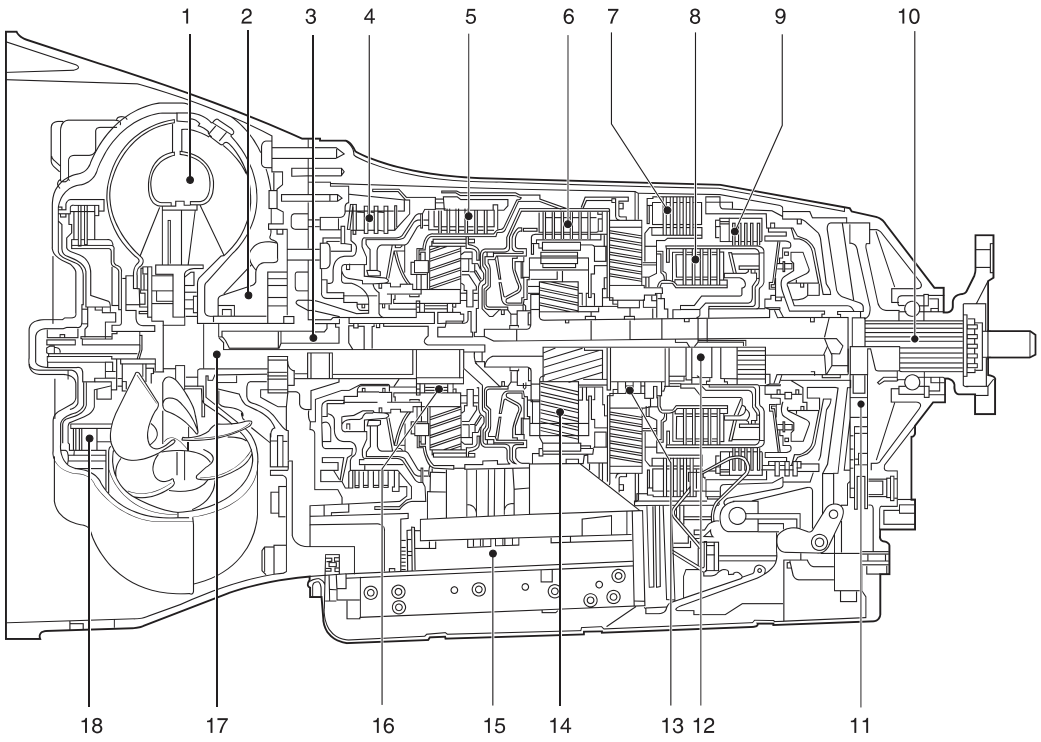
2. CHARACTERISTICS

Characteristic	Function and Description	Effect
Slope recognition (down hill, up hill)	Recognize it according to engine RPM and accelerator pedal position	Delay up shift
Engine torque limitation	During 1st gear driving or reverse driving with full throttle condition	Prevent automatic transmission from overheating
Engine torque decrease	Delay of ignition timing to reduce torque at all shifting moments	Improve shift quality
Engine rpm limitation	Limit engine rpm until the gears are fully engaged when shifting from "P" or "N" to "D"	Prevent shift shock
ESP Operation	When the ESP is controlling the engine torque, shifting is not available and vehicle starts off with 2nd gear.	Cannot use kick-down function and shift at maximum rpm
ABS Operation	Not any effect to brake control	
Fast-off function	Does not up shift when accelerator pedal is abruptly released	To get an engine brake effect during cornering
Altitude recognition	As altitude increases (atmospheric pressure reduces) engine torque decreases. Up shift while additionally depressing the accelerator pedal (adjusting shift diagram)	Improves driving performance and increases torque
Oil temperature	If transmission oil temperature is too low, the shifting point gets delayed in full throttle and kick down	Improves driving performance
Hydraulic pressure is produced in emergency driving mode	When starting the engine with cycling the ignition switch ("OFF" and "ON") due to transmission trouble, the selector lever should be placed in "P" position. If starting the engine with selector lever "N" position, the lever should be moved into "P" position. Because, the hydraulic pressure can be produced in selector lever "P" position.	The hydraulic pressure flows with direct operation mode via "R" and "D" valve to operate "R" and "forward 2nd" gear.
Adaptation	Function to optimize the shifting quality.	To exclude play and wear



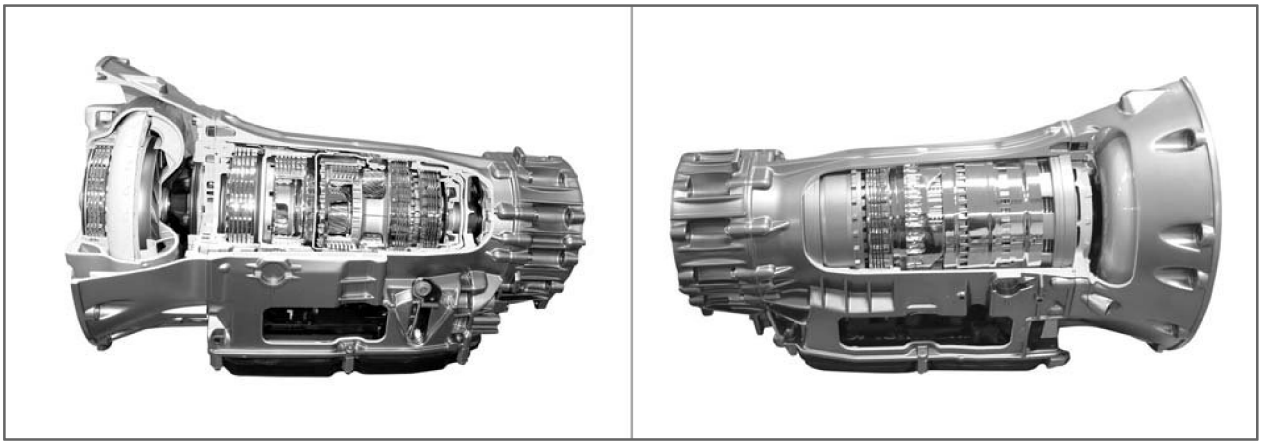
Modification basis	
Application basis	
Affected VIN	

3. STRUCTURE



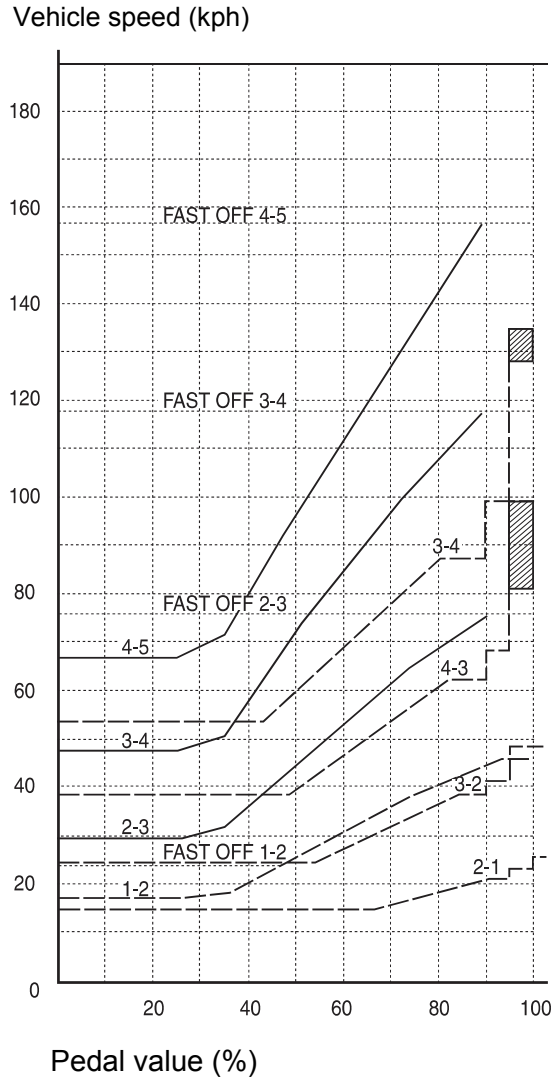
* Basic structure of DC 5-speed automatic transmission

1. Torque converter
2. Oil pump
3. Input shaft
4. Disc brake B1
5. Disc clutch C1
6. Disc clutch C2
7. Disc brake B3
8. Disc clutch C3
9. Disc brake b2
10. Output shaft
11. Parking lock gear
12. Intermediate shaft
13. Freewheel F2
14. Center planetary gear set
15. Electric control unit (valve body)
16. Freewheel F1
17. Stator shaft
18. Converter lockup clutch



4. PERFORMANCE CURVE AND GENERAL CHARACTERISTICS

Standard mode



CAUTION

1. Based on DI Engine + A/T equipped vehicle specifications

   Gear ratio

1st gear: 3.595	Rev. 1st gear: 3.167
2nd gear: 2.185	Rev. 2nd gear: 1.926
3rd gear: 1.405	
4th gear: 1.000	
5th gear: 0.831	
Axle ratio: 3.31	

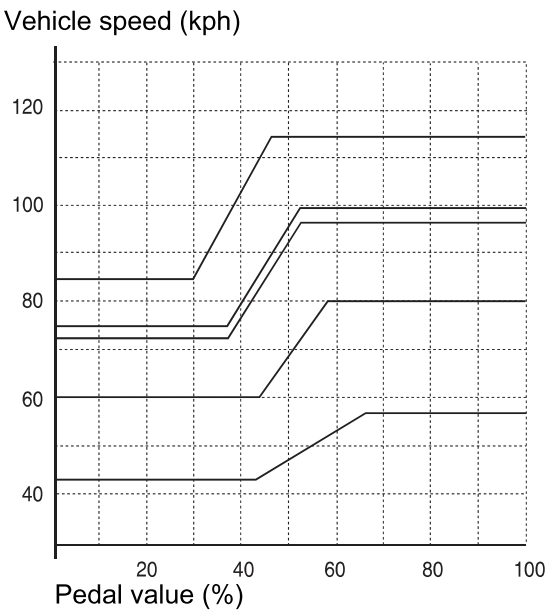
2. WINTER Mode: Standard Mode

3. Allowable shifting point:

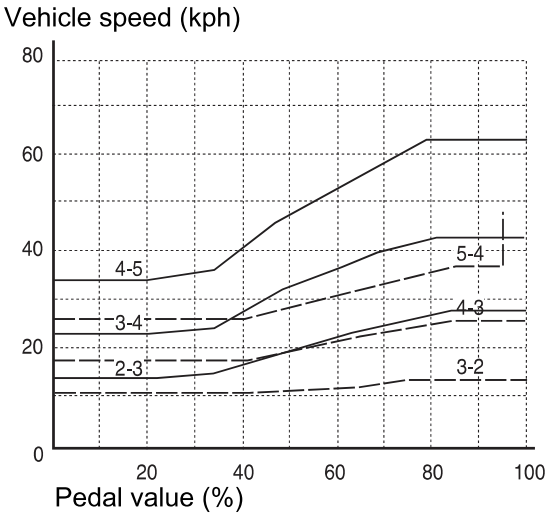
   Upshift
   Downshift
   Lockup (sleeping)
   Unlock (open)
   FAST OFF
   Dynamic shift range

Modification basis	
Application basis	
Affected VIN	

Lockup mode (open/sleeping)



4-LOW mode



CAUTION

4. FAST OFF

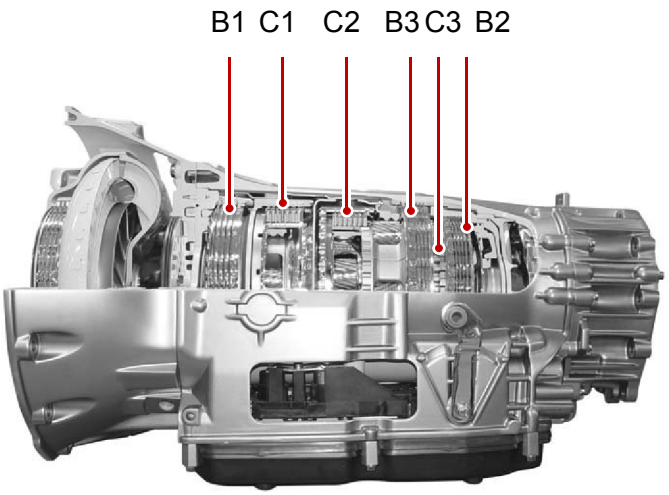
- When abruptly releasing the accelerator pedal, the transmission remains at 4th gear other than 4 → 4 shift (when slowly releasing the accelerator pedal, the transmission is shifted to 5th gear).

5. Dynamic shift range

- When operating the accelerator pedal, the 4 → 3 shift is completed by kick-down signal after completion of 4 → 4 shift.
- When promptly operating the accelerator pedal, the 4 → 3 shift is done in shaded arae.

5. POWER FLOW

▶Sectional View



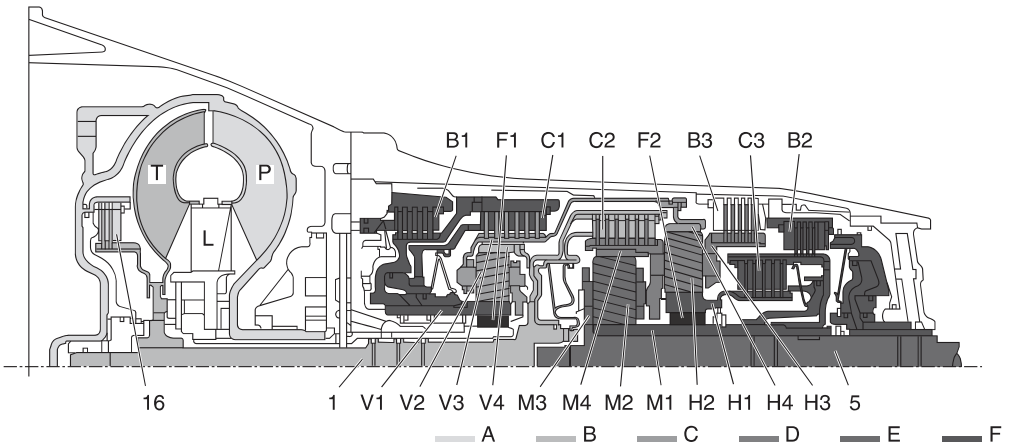
▶Shifting elements

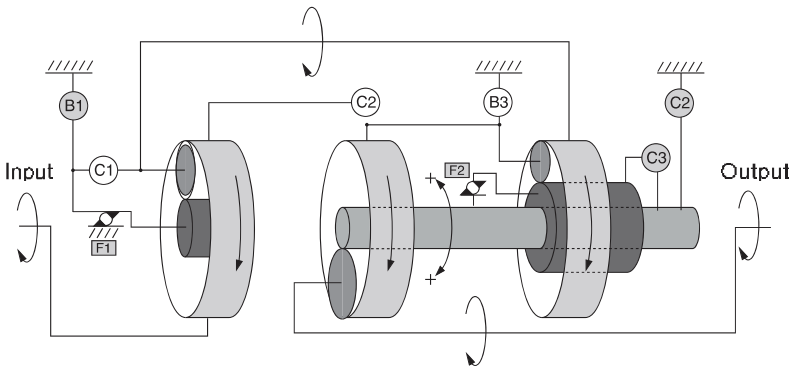
Gear	C1	C2	C3	B1	B2	B3	F1	F2
1			● 3)	● 3)	●		●	●
2	●		● 3)		●			●
3	●	●			●			
4	●	●	●					
5		●	●	● 3)			●	
P/N 1)			●	●				
P/N 2)	●		●					
R 1)			●	● 3)		●	●	
R 2)	●		●			●		

1) Selector program switch: "S" mode
2) Selector program switch: "W" mode
3) Overrun

Modification basis	
Application basis	
Affected VIN	

▶1st Gear (3.932)





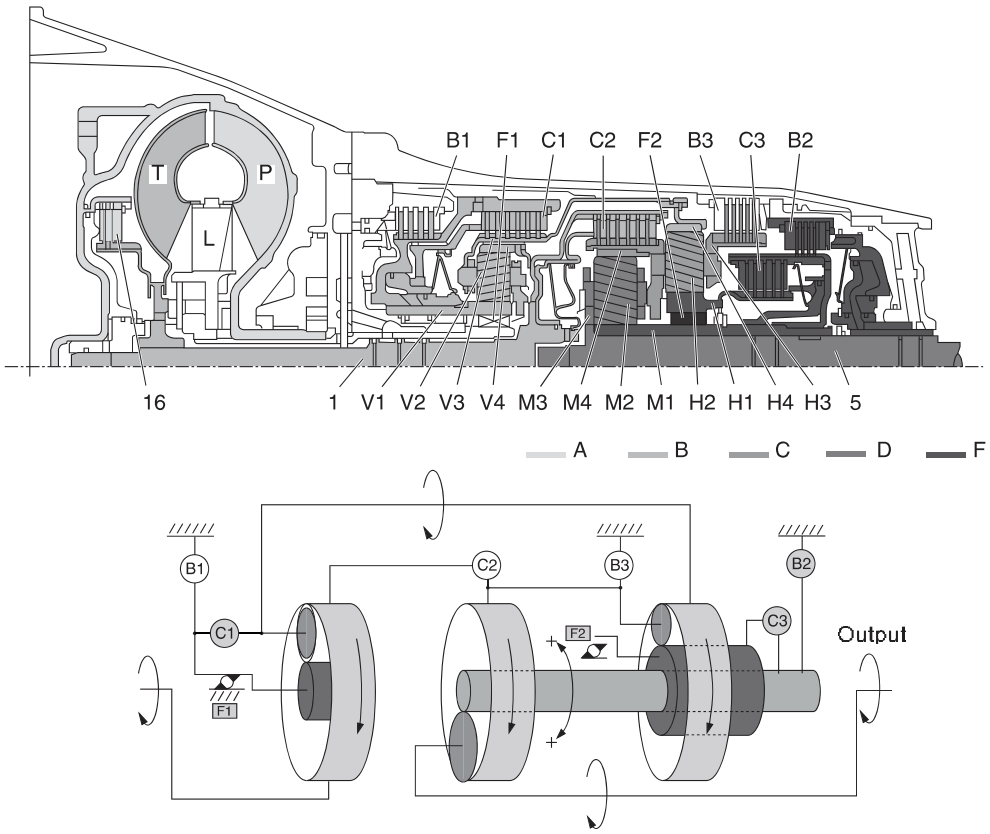
16.Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. 3rd gear ratio
F. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

* Input shaft: Clockwise rotation
* Front sun gear: Locked by F1 and B1, Planetary gear carrier: Rotation with reduced speed
* Rear ring gear: Counterclockwise rotation
* Rear sun gear: Locked by F2 and B2, Planetary gear carrier: Clockwise rotation with reduced speed
* Center ring gear: Clockwise rotation
* Center sun gear: Locked by B2, Rotation with reduced speed
* Output shaft: Clockwise rotation

Gear	C1	C2	C3	B1	B2	B3	F1	F2	Lockup clutch
1			● 3)	● 3)	●		●	●	

3) Overrun

▶2nd Gear (2.408)



16.Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

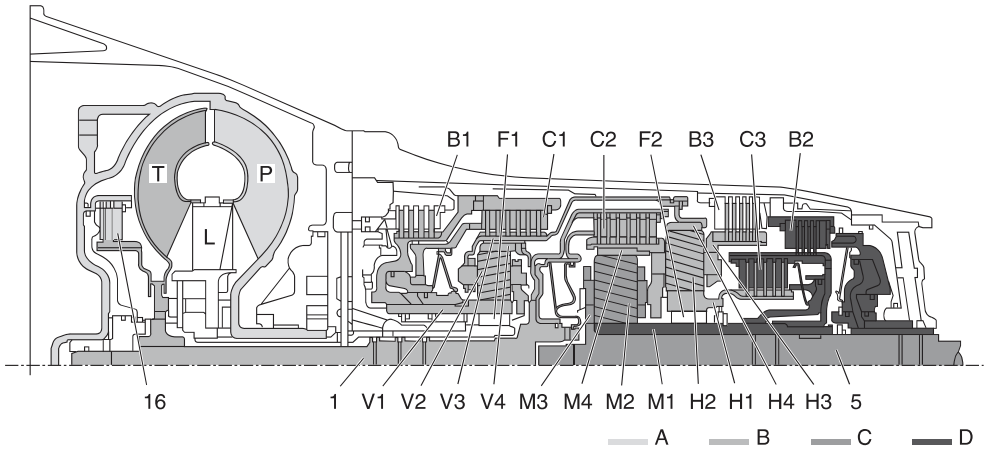
* Input shaft: Clockwise rotation
* Sun gear and planetary gear carrier: Clockwise rotation by C1 activation
* Rear ring gear: Clockwise rotation
* Rear sun gear: Locked by F2 and B2, Planetary gear carrier: Rotation with reduced speed
* Center ring gear: Clockwise rotation
* Sun gear: Locked by B2, Planetary gear carrier: Rotation with reduced speed
* Output shaft: Clockwise rotation

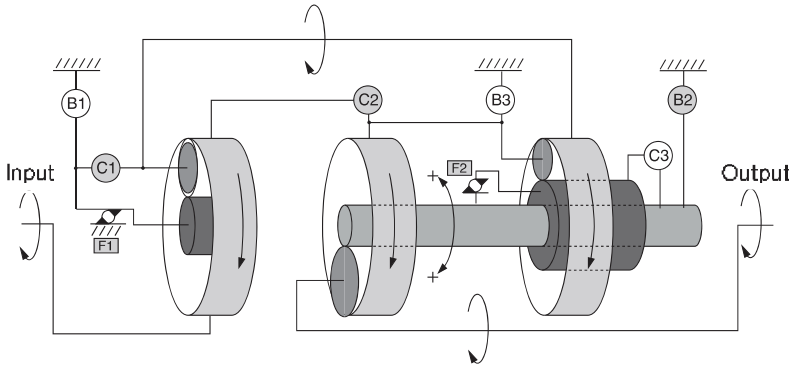
Gear	C1	C2	C3	B1	B2	B3	F1	F2
2	●		● 3)		●			●

3) Overrun

Modification basis	
Application basis	
Affected VIN	

▶3rd Gear (1.486)



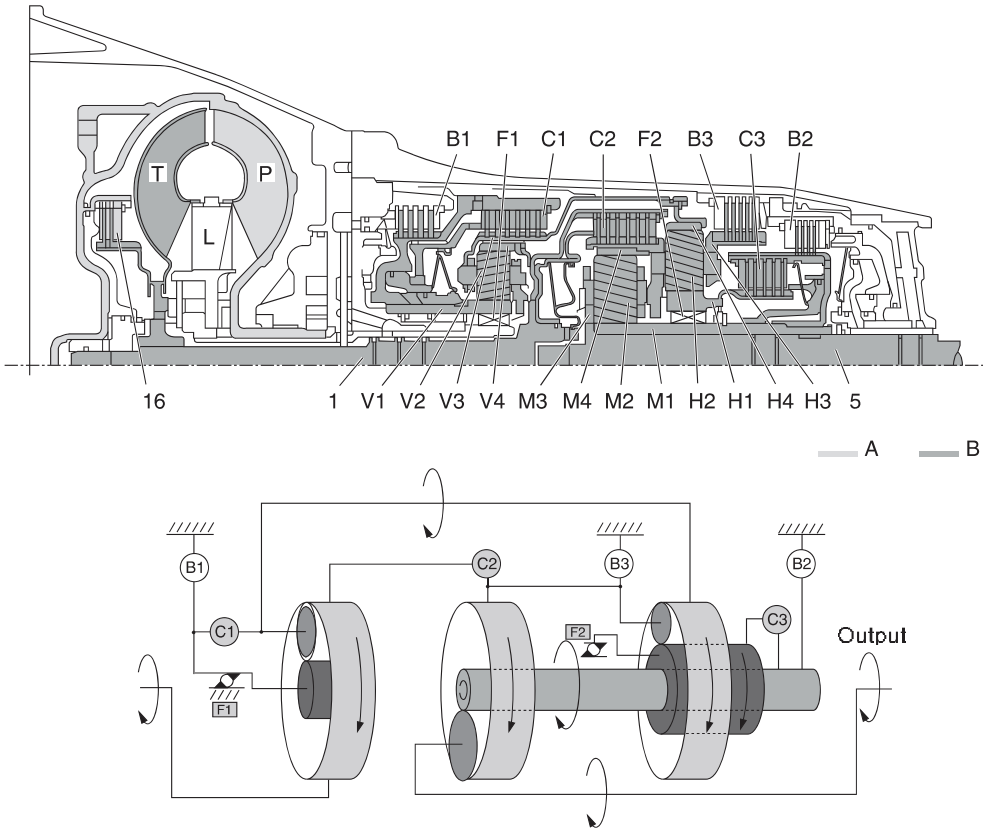


16.Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

* Input shaft: Clockwise rotation
* Front ring gear: Clockwise rotation
* Center ring gear: Clockwise rotation by clutch 2 activation (direct connection)
* Center sun gear: Locked by B2, Planetary gear carrier: Clockwise rotation with reduced speed
* Output shaft: Clockwise rotation

Gear	C1	C2	C3	B1	B2	B3	F1	F2
3	●	●			●			

▶4th Gear (1.000)



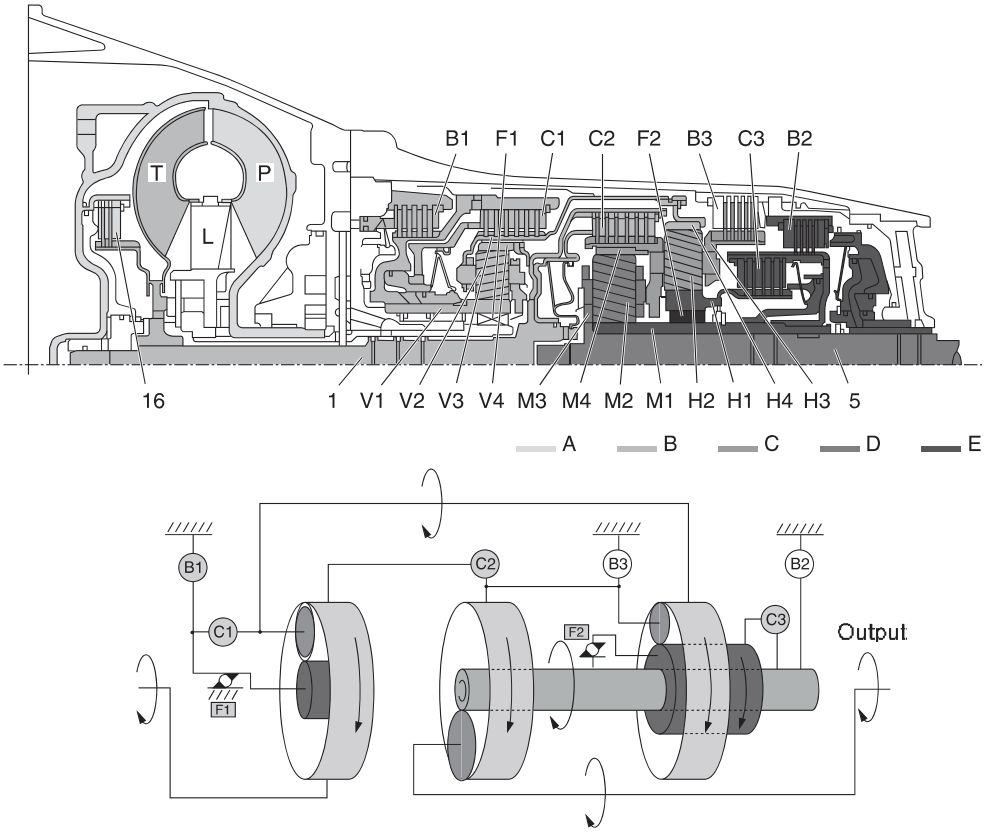
16.Torque converter lockup clutch L. Stator T. Turbine wheel
A. Engine speed M. Center planetary gear set V. Front planetary gear set
B. Planetary gear set P. Impeller

* Input shaft: Clockwise rotation
* Front ring gear: Clockwise rotation
* Center ring gear and rear planetary gear carrier: Clockwise rotation
* Front sun gear and planetary gear carrier: Clockwise rotation (direct connection)
* Rear ring gear: Clockwise rotation
* Rear sun gear: Rotation by ring gear and planetary gear carrier (direct connection)
* Center ring gear: Clockwise rotation by C3 activation
* Planetary gear carrier: Clockwise rotation by center sun gear and ring gear (direct connection)
* Output shaft: Clockwise rotation

Gear	C1	C2	C3	B1	B2	B3	F1	F2
4	●	●	●					

Modification basis	
Application basis	
Affected VIN	

▶5th Gear (0.830)



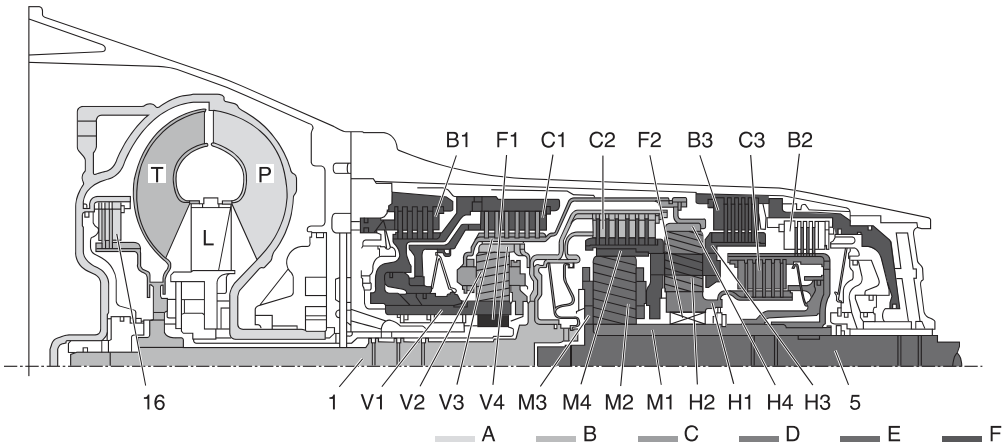
16.Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. 3rd gear ratio
F. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

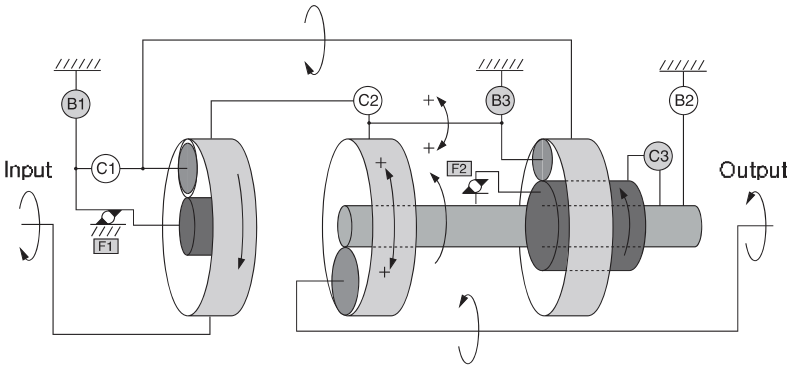
* Input shaft: Clockwise rotation
* Front sun gear: Locked, Planetary gear carrier: Rotation with reduced speed
* Rear planetary gear carrier: Clockwise rotation with reduced speed
* Center ring gear and rear planetary gear carrier: Clockwise rotation by clutch C2 activation
* Rear sun gear: Clockwise rotation because rear planetary gear carrier rotates faster than rear ring gear (increasedspeed)
* Center sun gear: Clockwise rotation with increased speed by C3 activation
* Center planetary gear carrier: Clockwise rotation (increased speed)
* Output shaft: Clockwise rotation (increased speed)

Gear	C1	C2	C3	B1	B2	B3	F1	F2
5		●	●	● 3)			●	

Modification basis	
Application basis	
Affected VIN	

▶Reverse 1st Gear (3.160, "S" Mode)





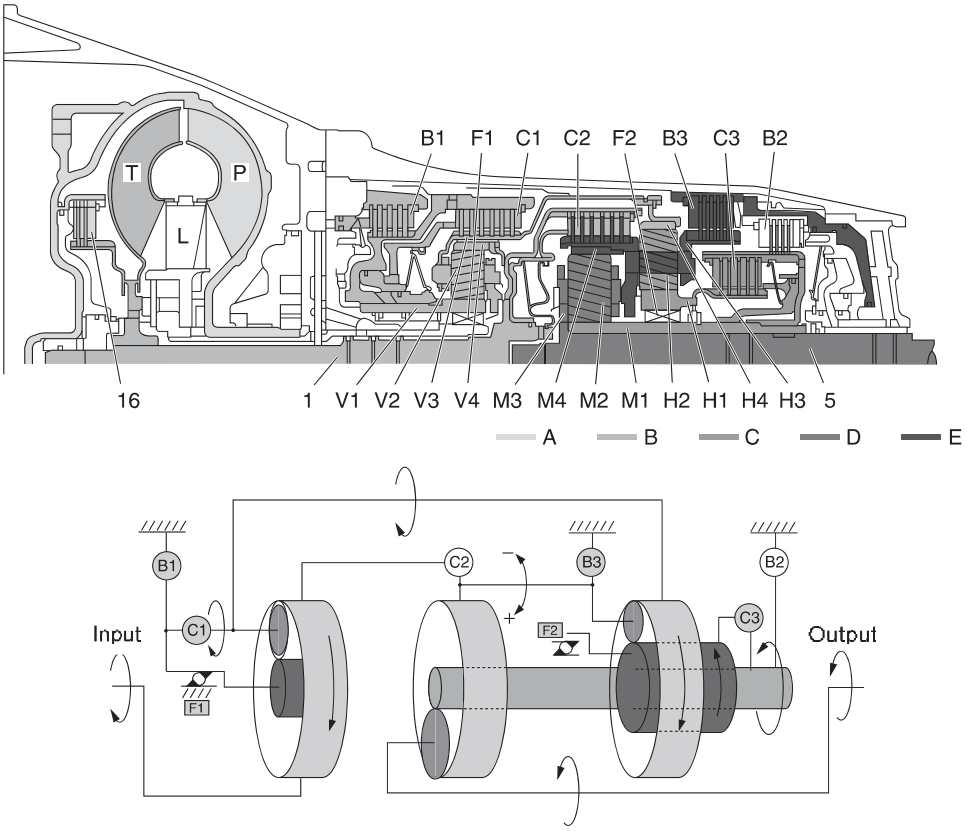
16.Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. Mounting elements
F. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

* Input shaft: Clockwise rotation
* Front ring gear: Clockwise rotation
* Front sun gear: Locked by one-way clutch F1
* Front planetary gear carrier: Clockwise rotation (reduced speed)
* Rear planetary gear ring gear: Clockwise rotation
* Rear planetary gear carrier: Locked by B3
* Rear sun gear and center sun gear: Counterclockwise rotation (increased speed)
* Center ring gear: Locked by B3
* Center planetary gear carrier: Counterclockwise rotation (reduced speed)
* Output shaft: Counterclockwise rotation

Gear	C1	C2	C3	B1	B2	B3	F1	F2
R (S)			●	● 3)		●	●	

Modification basis	
Application basis	
Affected VIN	

▶Reverse 2nd Gear (1.930, "W" Mode)



16.Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

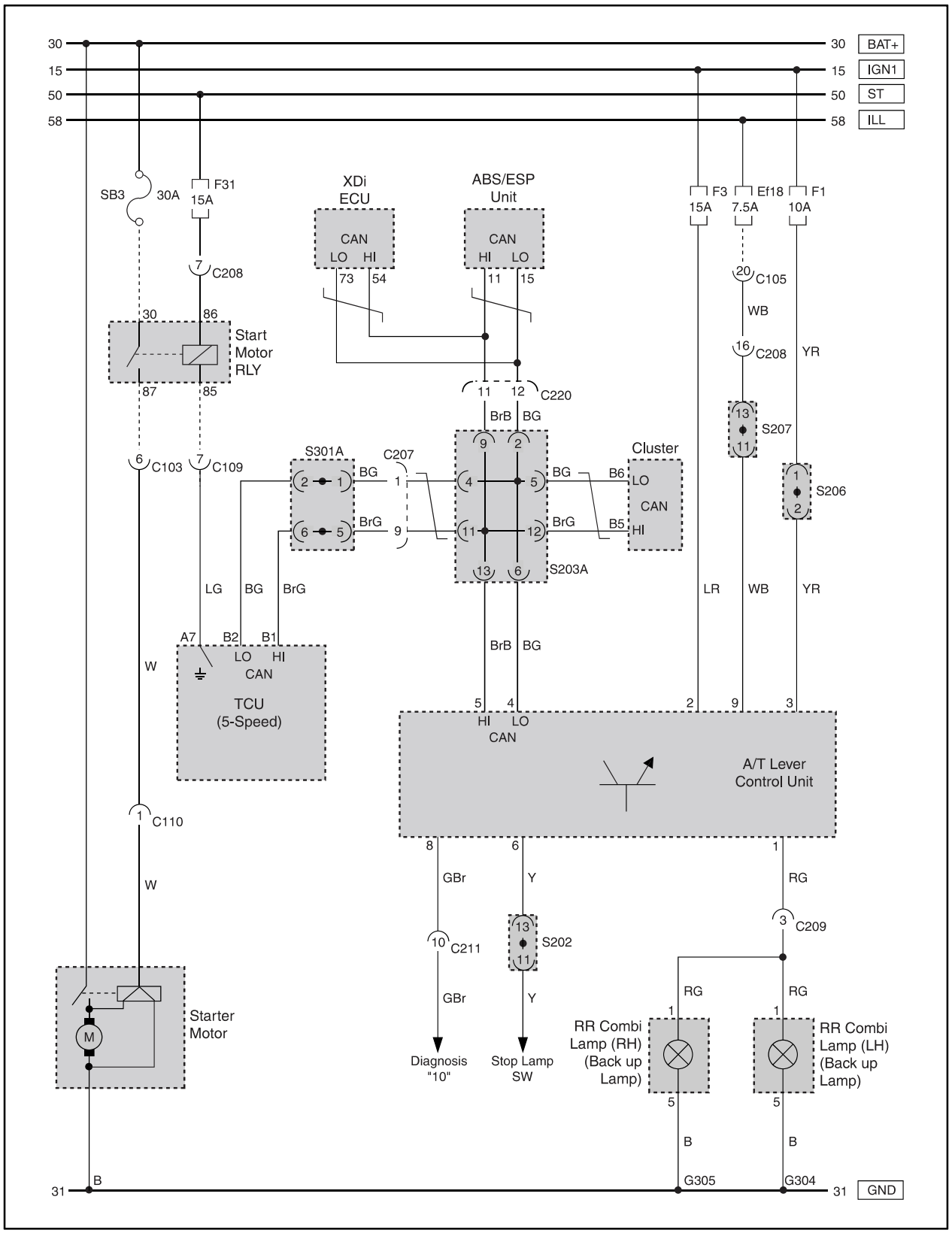
* Input shaft: Clockwise rotation
* Front ring gear: Clockwise rotation
* Front planetary gear carrier: Clockwise rotation by clutch C1 activation (direct connection)
* Rear ring gear: Clockwise rotation
* Rear planetary gear carrier and center ring gear: Locked by brake B3
* Rear sun gear and center sun gear: Counterclockwise rotation (increased speed)
* Center planetary gear carrier: Counterclockwise rotation (reduced speed)
* Output shaft: Counterclockwise rotation

Gear	C1	C2	C3	B1	B2	B3	F1	F2
R (W)	●		●			●		

Modification basis	
Application basis	
Affected VIN	

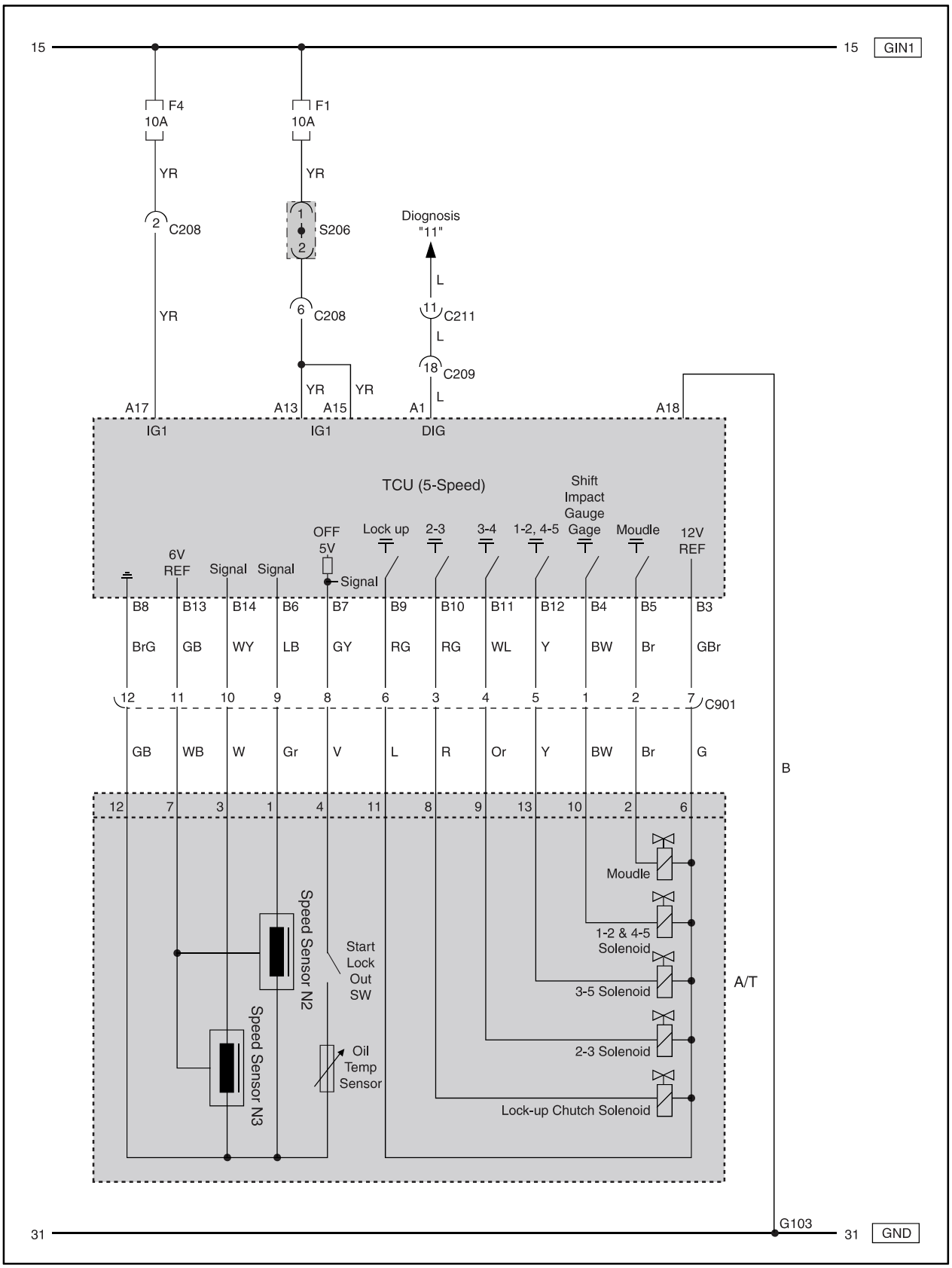
6. CIRCUIT DIAGRAM

1) Starter, Selector Lever, CAN Communication



Modification basis	
Application basis	
Affected VIN	

2) Solenoid, Oil Temperature Sensor, RPM Sensor (N2, N3)



Modification basis	
Application basis	
Affected VIN	

MTMANUAL TRANSMISSION

3170-01

GENERAL

1. SPECIFICATIONS

1) General Specifications

Description		IDI ENGINE	DI ENGINE
Length (mm)		4WD: 625, 2WD: 672	4WD: 628.3, 2WD: 672
Distance between shafts (mm)		81	
Input torque (kg•m)		32 (320 Nm)	34.7 (340 Nm)
Transmission control type		Semi-remote	
Weight (kg) – not including transmission fluid (kg•m)		4WD: 44, 2WD: 45	
Gear ratio/Gear teeth (input gear : main gear)	1st gear	4.007	4.315
	2nd gear	2.365	2.475
	3rd gear	1.473	1.536
	4th gear	1.000	1.000
	5th gear	0.872	0.807
	Reverse gear	3.700	3.591
Transmission fluid	Specification	ATF DEXRON II	
	Capacity (ℓ)	4WD: 3.6, 2WD: 3.4	
	Change interval	Inspect at every 10,000 km, replace at every 60,000 km (add or replace if necessary)	

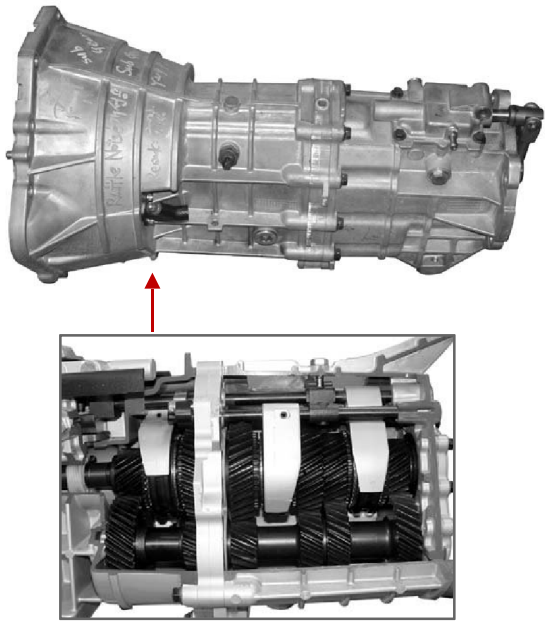
2) Tightening Torque

Description	Tightening Torque	
Oil drain plug	4 ~ 5 kgf•m	39.22 ~ 49.03 Nm
Backup lamp switch	3 ~ 4 kgf•m	29.42 ~ 39.22 Nm
Extension housing bolt	4.2 ~ 5.7 kgf•m	41.18 ~ 55.89 Nm
Selector lever lower cover bolt	1.7 ~ 5 kgf•m	16.67 ~ 49.03 Nm
Extension housing spring plug	3.0 ~ 3.5 kgf•m	29.42 ~ 34.32 Nm
Offset plate countersunk screw	0.4 ~ 0.6 kgf•m	3.92 ~ 5.88 Nm

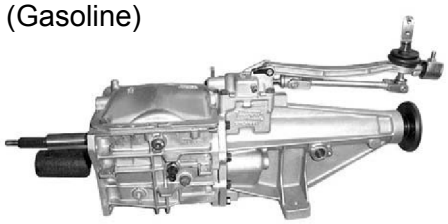
OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

4WD

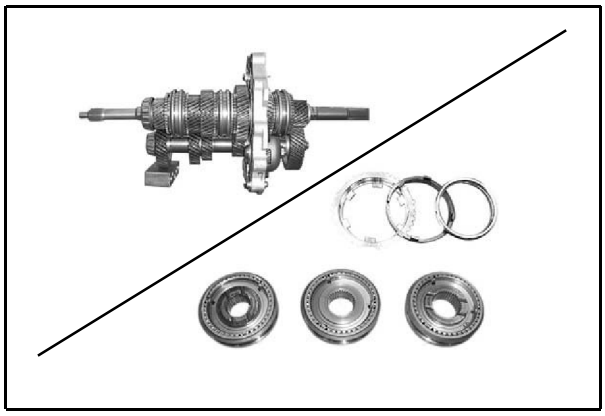


2WD (Gasoline)



1. TSM54/52 transmission is designed to link the gearratio, installation dimensions and shapes with current T5 transmission and BTRA automatic transmission.
   It provides maximum drivability by the optimized engine torque and gear ratio.
2. TSM54/52 transmission uses linkage type shift elements directly connected to the transmission. It prevent the transmission from shifting to the reverse gear from 5th gear when shifting to reverse gear. It also prevents the break and wear.

▶Features



1. All gears use the helical type and high strength materials.

CAUTION
The helical type gear prevents the axial gear missing and provides less noise.

2. The synchronizing devices are installed in 1/2, 3/4, 5/R gears. To prevent the double engagement, the independent interlock devices are installed.

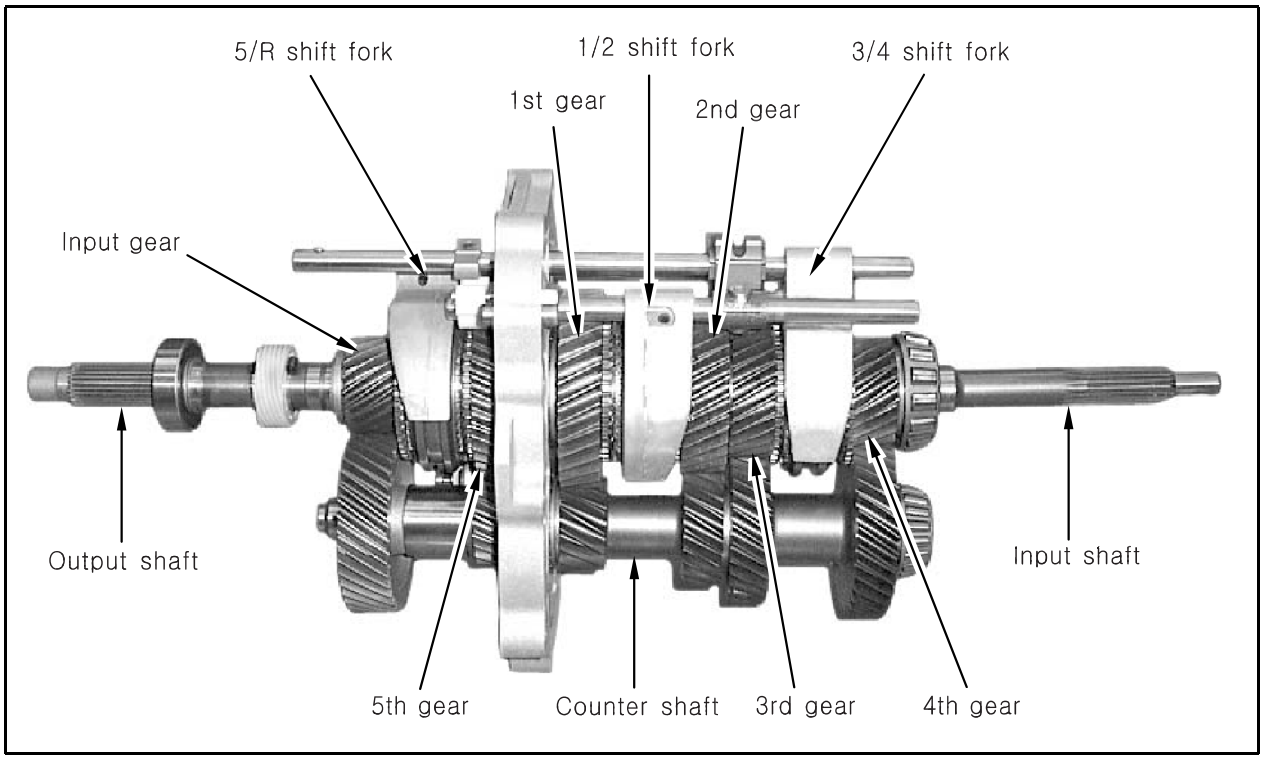
CAUTION
TSM54/52 transmission uses the inertia lock type key to make smooth gear engagement and to provide silent gear engagement.

3. The clutch release system is available to use CSC (Concentric Slave Cylinder) or Fork type according to the vehicle model. New Rexton uses the fork type clutch release system.
4. The semi-remote control type gear shift mechanism is used to prevent incorrect shifting.

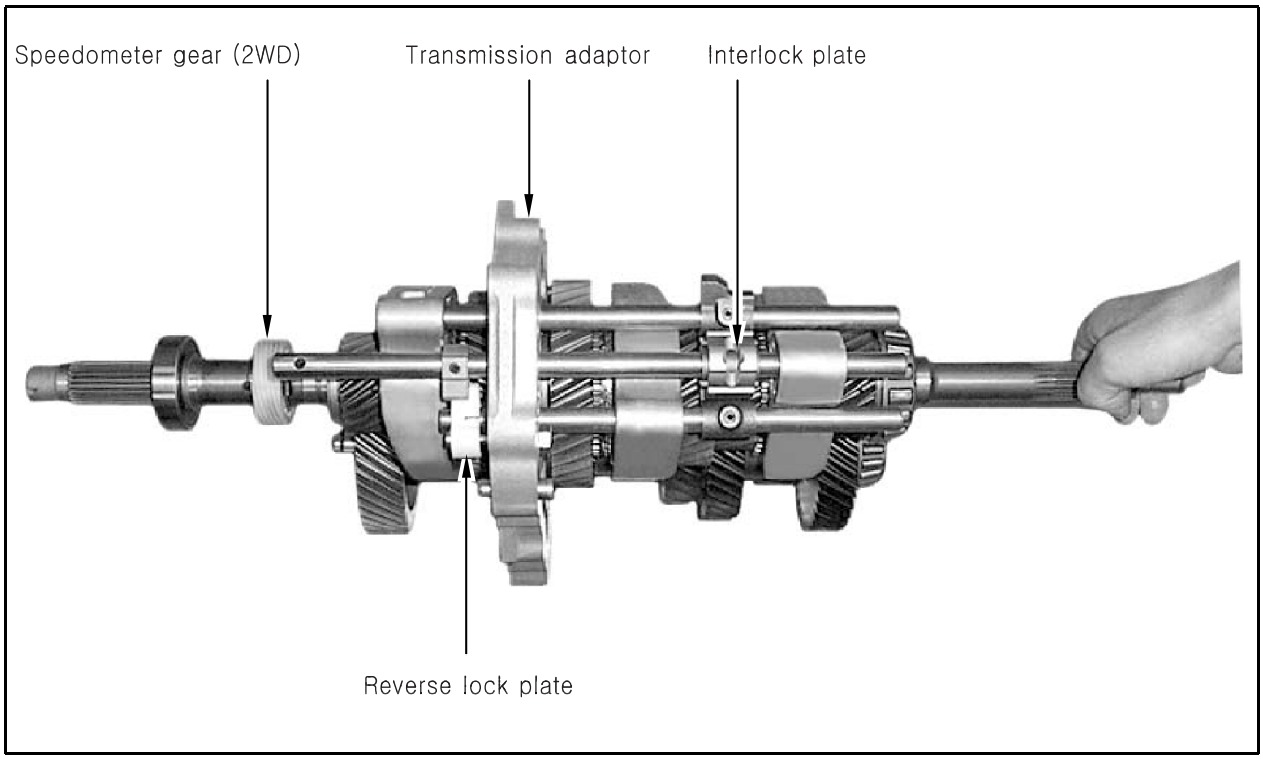
Modification basis	
Application basis	
Affected VIN	

2. SYSTEM COMPONENTS

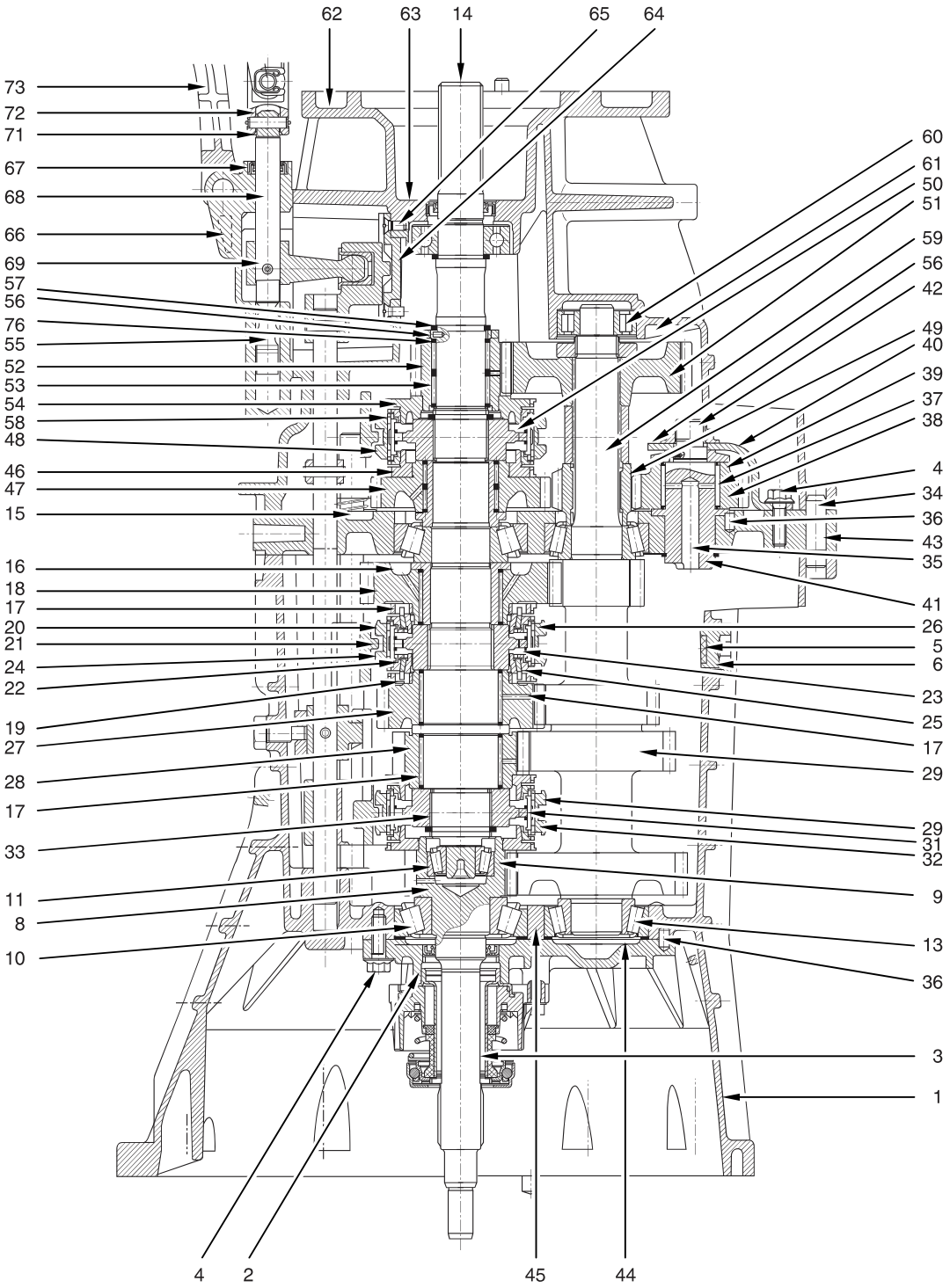
1) Gear Combinations



2) Shift Fork and Rail Combinations



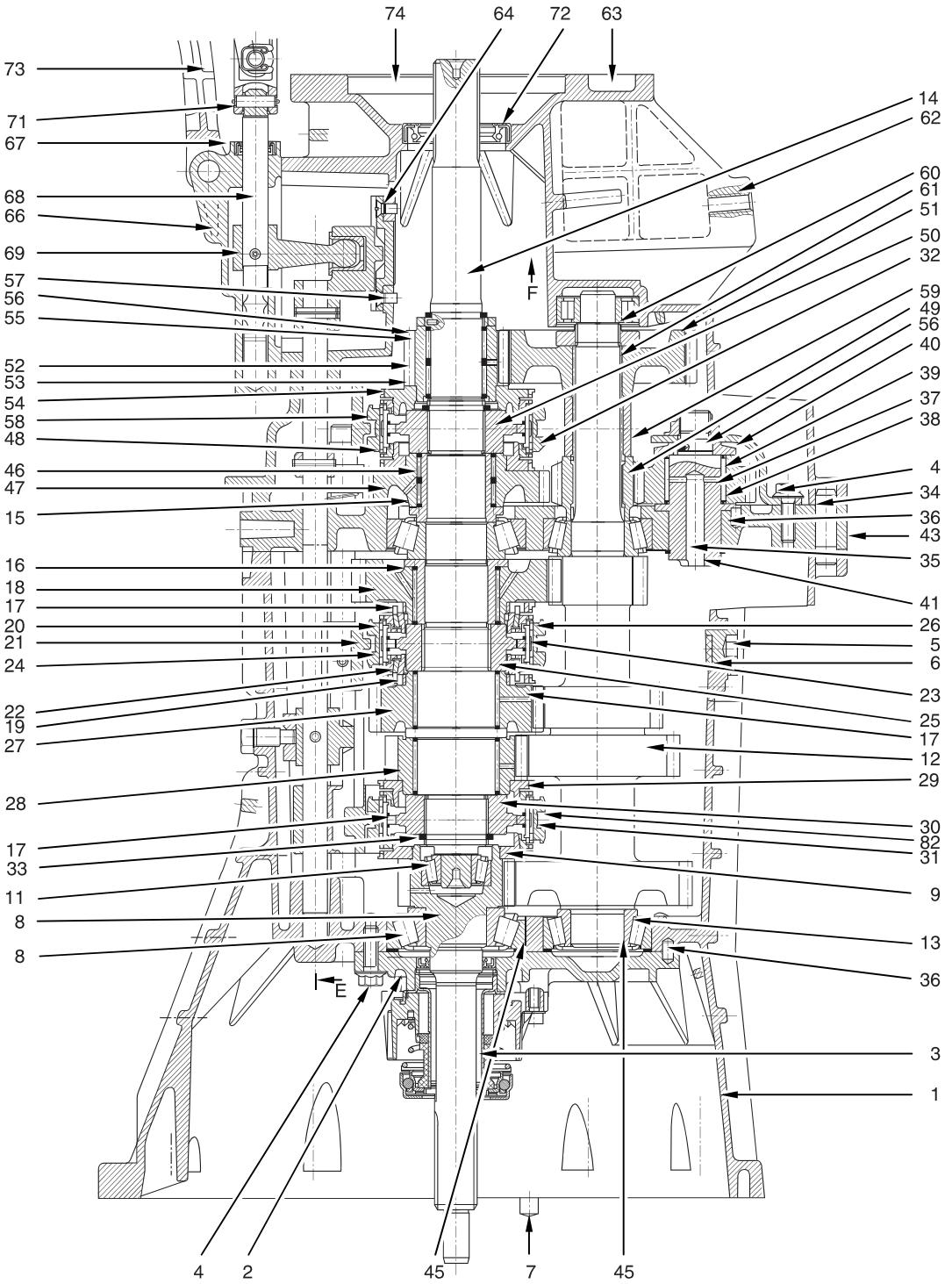
3) Sectional View



Modification basis	
Application basis	
Affected VIN	

1. Transmission front housing
2. Input shaft oil seal
3. Front cover
4. Hexagon flange bolt (17 ~ 26 Nm)
5. Oil drain plug
6. Sealing
7. Pin
8. Input shaft
9. Clutch 4th gear
10. Taper roller bearing (main)
11. Taper roller bearing
12. Counter shaft
13. Taper roller bearing (counter)
14. Output shaft
15. Inner race (reverse)
16. Inner race (1st)
17. Needle bearing
18. 1st gear
19. 1st clutch gear
20. Synchro outer ring
21. Synchro - middle cone
22. Synchro inner ring
23. Synchro spring
24. Synchro key
25. Synchro hub
26. Double synchro sleeve
27. 2nd gear
28. 3rd gear
29. 3rd clutch gear
30. Synchro hub (3 & 4th)
31. Synchro ring (4/5/R)
32. Single synchro sleeve
33. Retainer ring
34. Adaptor dowel pin
35. Reverse idler shaft
36. Dowel pin
37. Needle bearing
38. Reverse idler gear
39. Reverse idler spacer
40. Reverse idler bracket
41. Retainer ring
42. Reverse lock nut
43. Transmission adaptor
44. Input shaft spacer
45. Counter spacer
46. Reverse needle bearing
47. Reverse gear
48. Reverse clutch gear
49. Reverse counter gear
50. Synchro hub
51. Counter 5th gear
52. 5th needle bearing
53. 5th gear
54. 5th clutch gear
55. Thrust washer
56. Spring pin
57. 5th outside retainer ring
58. 5th retainer ring
59. Counter shaft bushing
60. Counter roller bearing assembly
61. Retainer ring
62. Extension housing
63. Output shaft oil seal
64. Offset plate
65. Counter screw
66. Top cover
67. Counter oil seal
68. Shift shaft
69. Shift lever
70. Detent pin
71. Joint pin
72. Retainer ring
73. Semi remote lever assembly

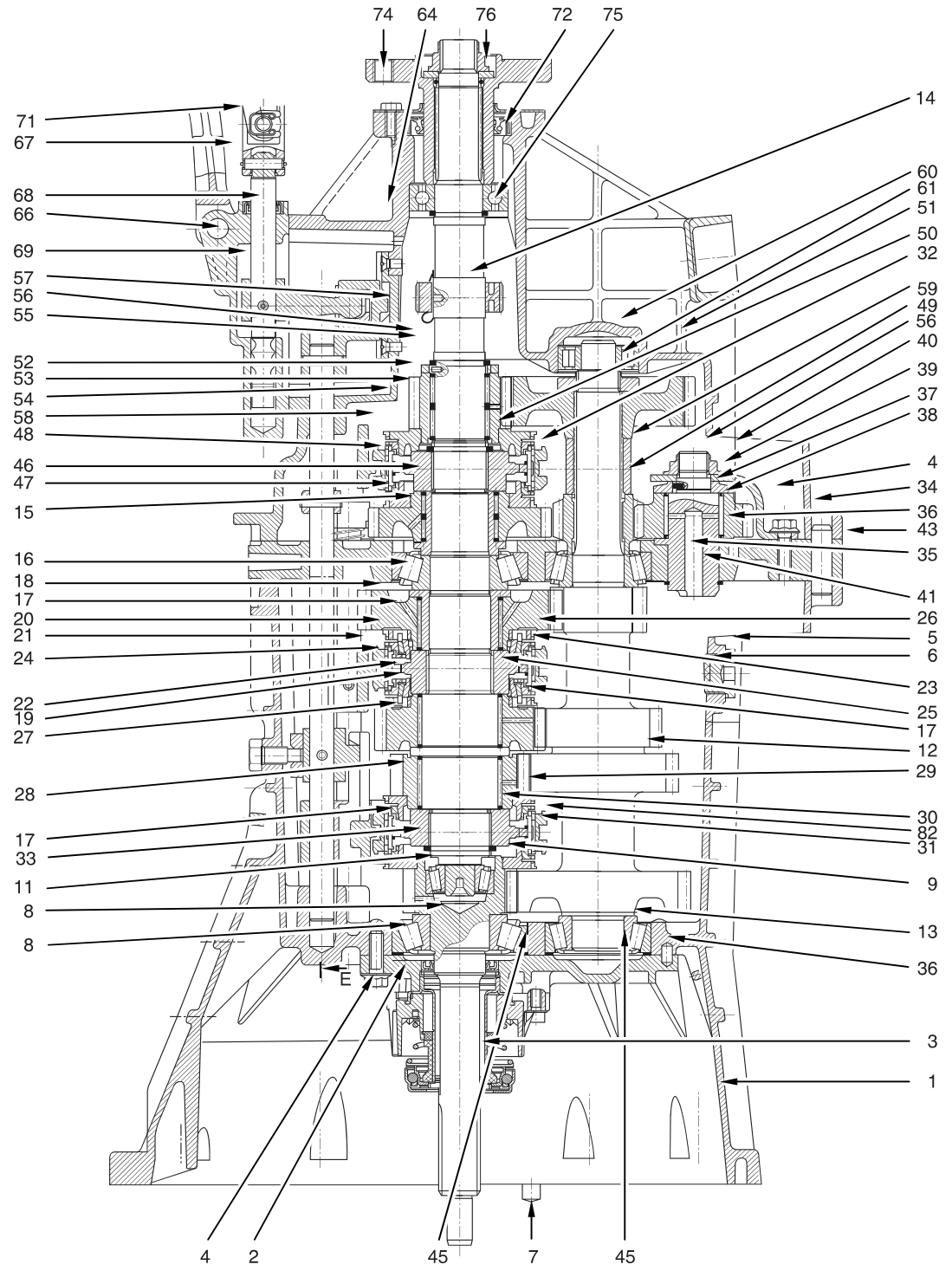
▶IDI Engine equipped vehicle - 4WD



Modification basis	
Application basis	
Affected VIN	

1. Transmission front housing
2. Input shaft oil seal
3. Front cover
4. Hexagon flange bolt (17~26 Nm)
5. Oil drain plug
6. Sealing
7. Pin
8. Input shaft
9. Clutch 4th gear
10. Taper roller bearing (main)
11. Taper roller bearing
12. Counter shaft
13. Taper roller bearing (counter)
14. Output shaft
15. Inner race (reverse)
16. Inner race (1st)
17. Needle bearing
18. 1st gear
19. 1st clutch gear
20. Synchro outer ring
21. Synchro - middle cone
22. Synchro inner ring
23. Synchro spring
24. Synchro key
25. Synchro hub
26. Double synchro sleeve
27. 2nd gear
28. 3rd gear
29. 3rd clutch gear
30. Synchro hub (3 & 4th)
31. Synchro ring (4/5/R)
32. Single synchro sleeve
33. Retainer ring
34. Adaptor dowel pin
35. Reverse idler shaft
36. Dowel pin
37. Bearing
38. Reverse idler gear
39. Reverse idler spacer
40. Reverse idler bracket
41. Retainer ring
42. Reverse lock nut
43. Transmission adaptor
44. Input shaft spacer
45. Counter spacer
46. Reverse needle bearing
47. Reverse gear
48. Reverse clutch gear
49. Reverse counter gear
50. Synchro hub
51. Counter 5th gear
52. 5th needle bearing
53. 5th gear
54. 5th clutch gear
55. Thrust washer
56. Spring pin
57. 5th outside retainer ring
58. 5th retainer ring
59. Counter shaft bushing
60. Counter roller bearing assembly
61. Retainer ring
62. Extension housing
63. Output shaft oil seal
64. Offset plate
65. Counter screw
66. Top cover
67. Counter oil seal
68. Shift shaft
69. Shift lever
70. Detent pin
71. Joint pin
72. Retainer ring
73. Semi remote lever assembly
74. Rear flange

▶IDI Engine equipped vehicle - 2WD

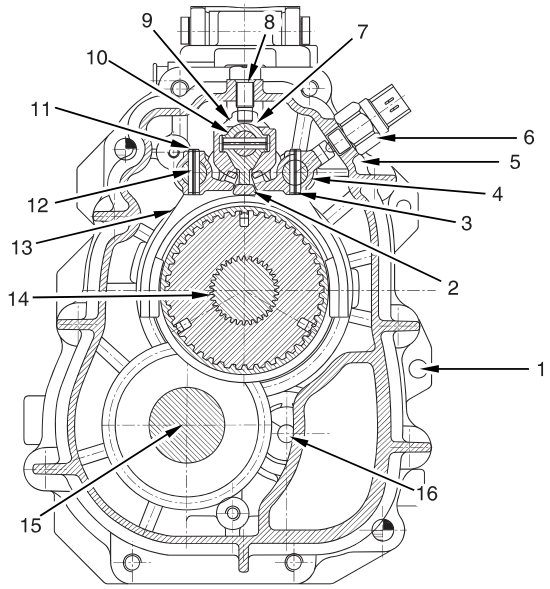


Modification basis	
Application basis	
Affected VIN	

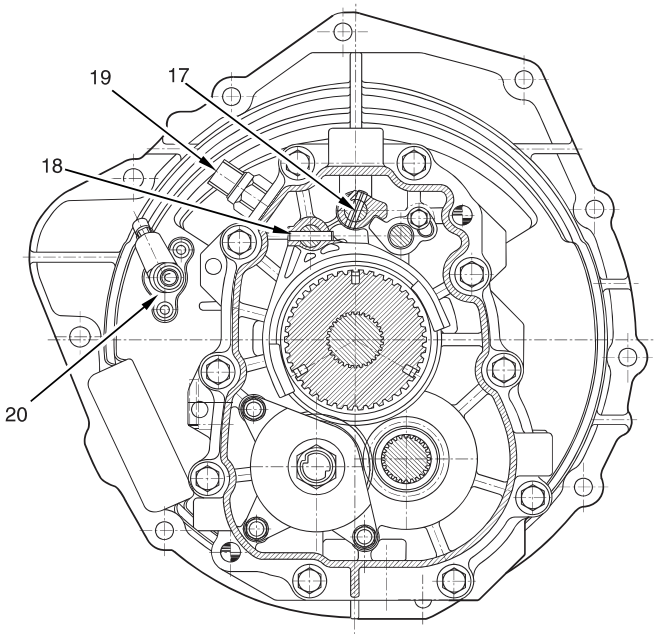
1. Transmission front housing
2. Input shaft oil seal
3. Front cover
4. Hexagon flange bolt (17 ~ 26 Nm)
5. Oil drain plug
6. Sealing
7. Pin
8. Input shaft
9. Clutch 4th gear
10. Taper roller bearing (main)
11. Taper roller bearing
12. Counter shaft
13. Taper roller bearing (counter)
14. Output shaft
15. Inner race (reverse)
16. Inner race (1st)
17. Needle bearing
18. 1st gear
19. 1st clutch gear
20. Synchro outer ring
21. Synchro - middle cone
22. Synchro inner ring
23. Synchro spring
24. Synchro key
25. Synchro hub
26. Double synchro sleeve
27. 2nd gear
28. 3rd gear
29. 3rd clutch gear
30. Synchro hub (3 & 4th)
31. Synchro ring (4/5/R)
32. Single synchro sleeve
33. Retainer ring
34. Adaptor dowel pin
35. Reverse idler shaft
36. Dowel pin
37. Bearing
38. Reverse idler gear
39. Reverse idler spacer
40. Reverse idler bracket
41. Retainer ring
42. Reverse lock nut
43. Transmission adaptor
44. Input shaft spacer
45. Counter spacer
46. Reverse needle bearing
47. Reverse gear
48. Reverse clutch gear
49. Reverse counter gear
50. Synchro hub
51. Counter 5th gear
52. 5th needle bearing
53. 5th gear
54. 5th clutch gear
55. Thrust washer
56. Spring pin
57. 5th outside retainer ring
58. 5th retainer ring
59. Counter shaft bushing
60. Counter roller bearing assembly
61. Retainer ring
62. Extension housing
63. Output shaft oil seal
64. Offset plate
65. Counter screw
66. Top cover
67. Counter oil seal
68. Shift shaft
69. Shift lever
70. Detent pin
71. Joint pin
72. Retainer ring
73. Semi remote lever assembly
74. Rear flange
75. Ball bearing
76. Lock nut

4) Front View and Rear View

Front view



Rear view



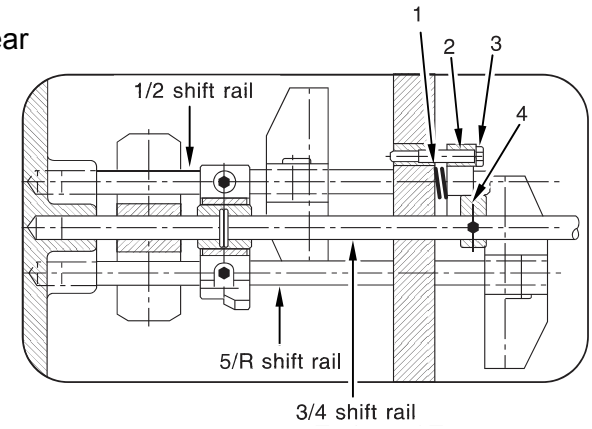
1. Oil filler plug (tightening torque: 40 ~ 50 Nm)
2. Shift rug (3 & 4th)
3. Spring pin (6 x 25)
4. Shift rug (5 & reverse)
5. Shift rail (5 & reverse)
6. Backup lamp switch (tightening torque: 30 ~ 40 Nm)
7. Shift rail (3 & 4th)
8. Interlock bolt (tightening torque: 40 ~ 50 Nm)
9. Shift lever
10. Interlock plate
11. Shift rail (1 & 2nd)
12. Shift rug (1& 2nd)
13. Shift fork (3 & 4th)
14. Input shaft
15. Counter shaft
16. Reverse idler assembly
17. Spring pin (6 x 25)
18. Spring pin (6 x 25)
19. Backup lamp switch
20. Concentric slave cylinder adaptor

(8) Apply Loctite 243
(6) Apply Loctite DRI LOC 200

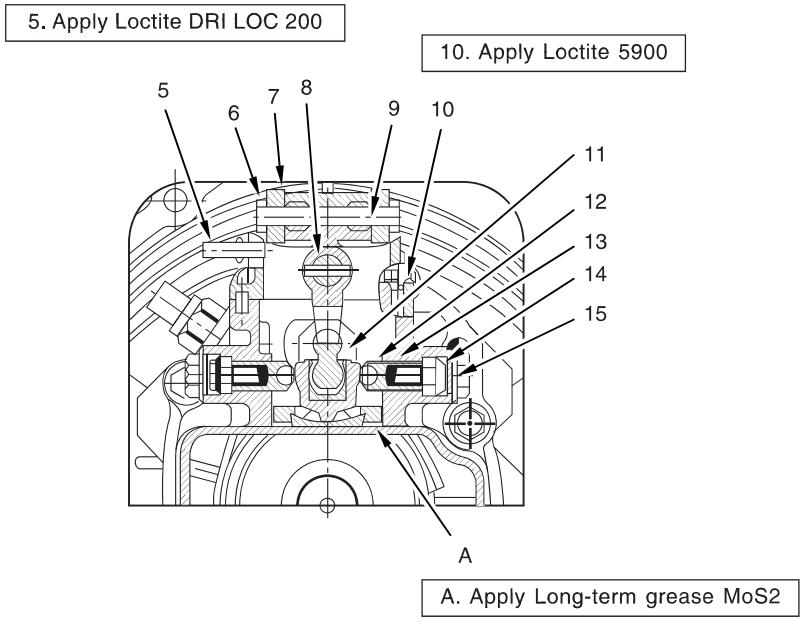
Modification basis	
Application basis	
Affected VIN	

5) Cross Sectional Diagram of Major Components

Shift rail and 5/R gear



Offset lever

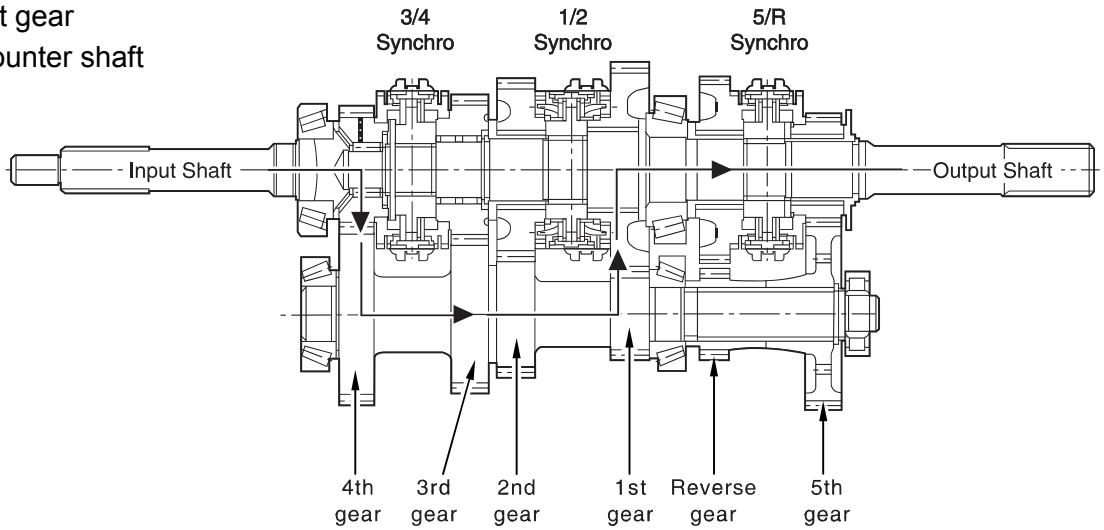


1. Reverse lock spring
2. Reverse lock plate
3. Reverse lock bolt
4. Stopper plate
5. Air vent
   (tightening torque: 30 ~ 40 Nm)
6. Lock washer
7. TGS bushing
8. Outer spring pin
9. TGS pin
10. Lock bolt
    (tightening torque: 17 ~ 26 Nm)
11. Offset lever
12. Offset lever bushing
13. Rolling plunger
14. Return spring
15. Spring plug
    (tightening torque: 30 ~ 35 Nm)

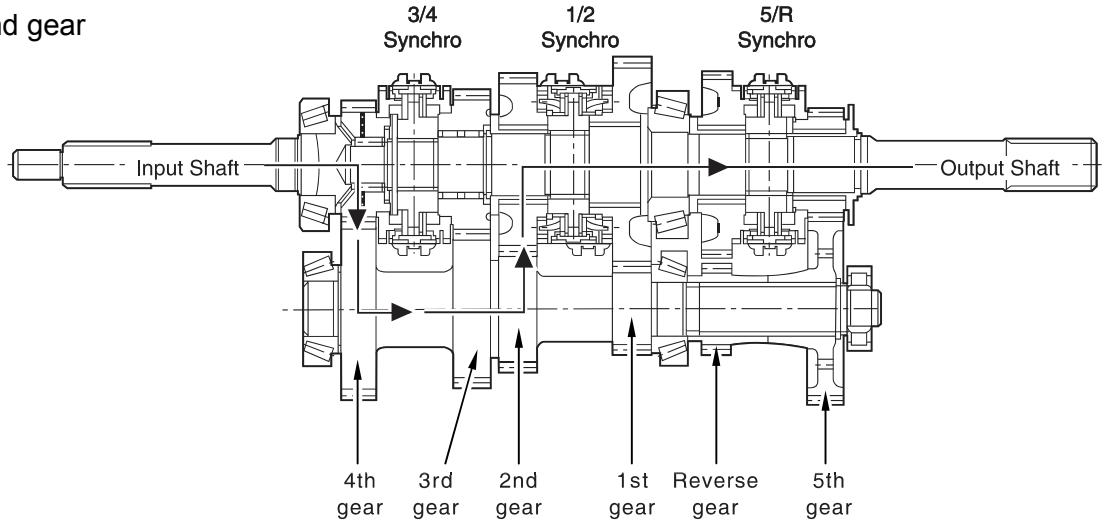
A. Apply Long-term grease MoS2 when installing the offset lever.

6) Power Flows

1st gear
Counter shaft



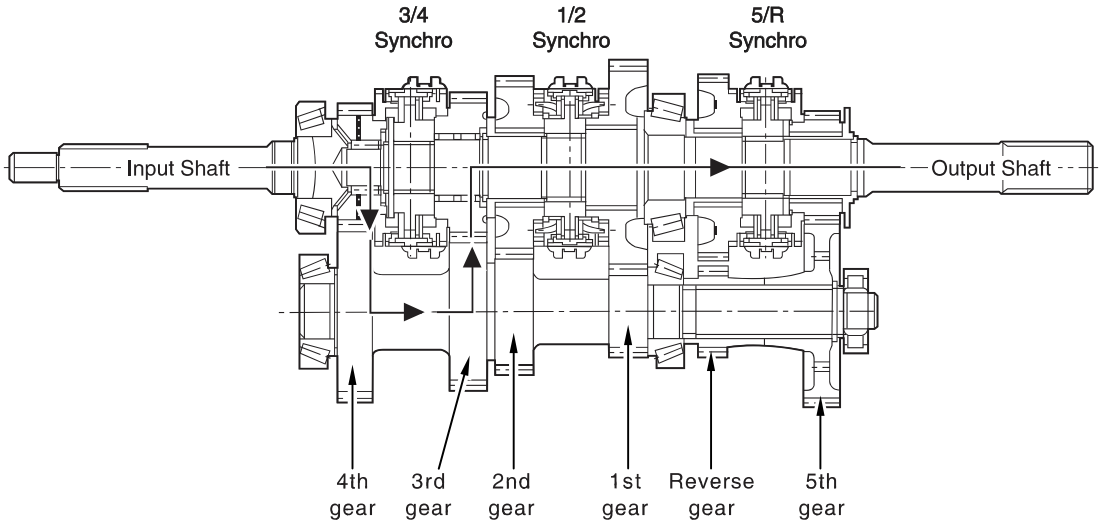
2nd gear



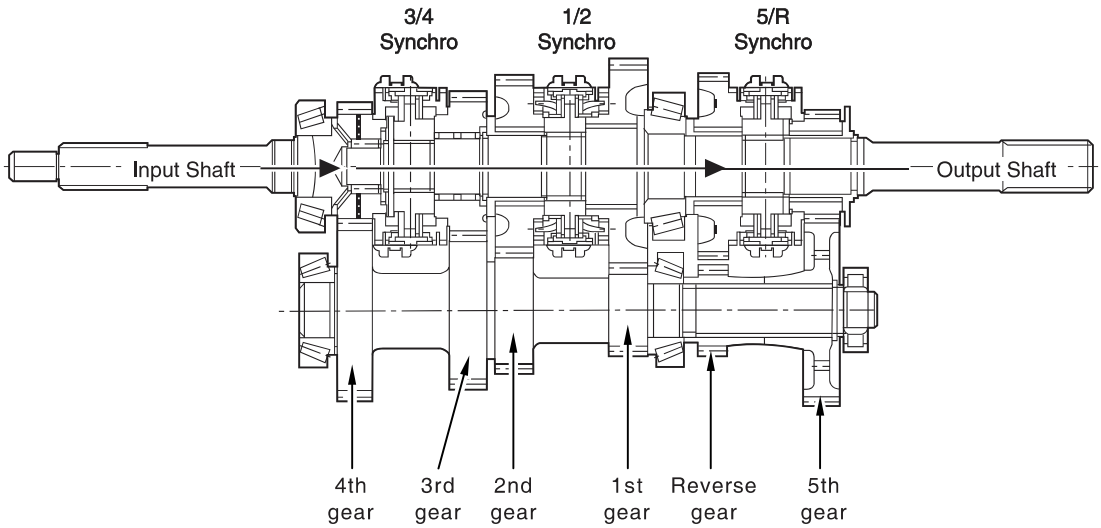
Modification basis	
Application basis	
Affected VIN	

7) Power Flows (Cont'd)

3rd gear

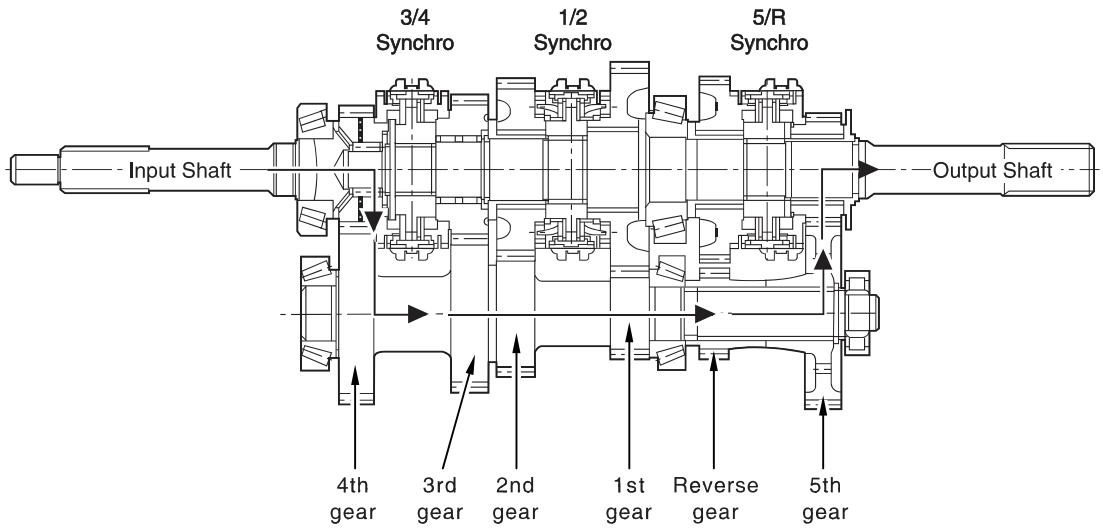


4th gear

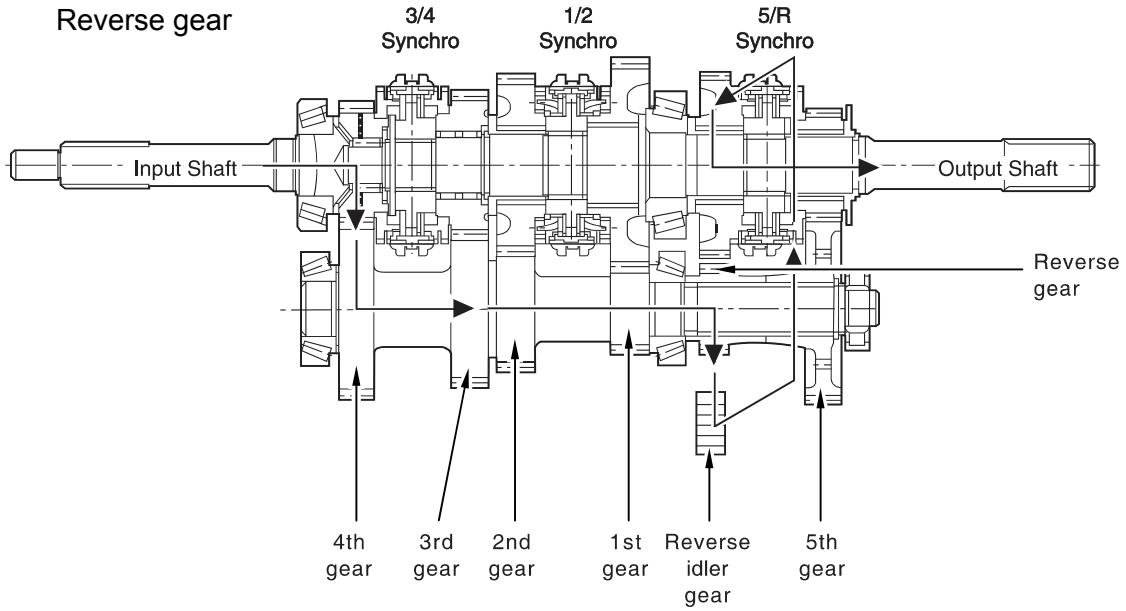


8) Power Flows (Cont'd)

5th gear



Reverse gear

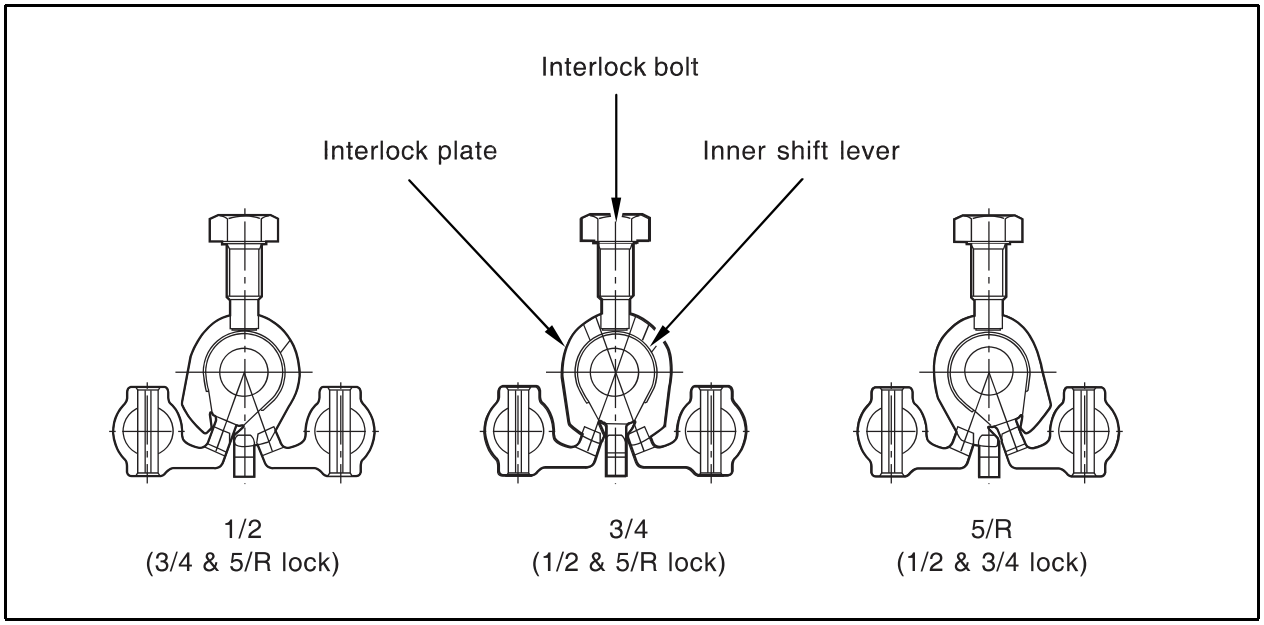


Modification basis	
Application basis	
Affected VIN	

3. SHIFTING MECHANISM

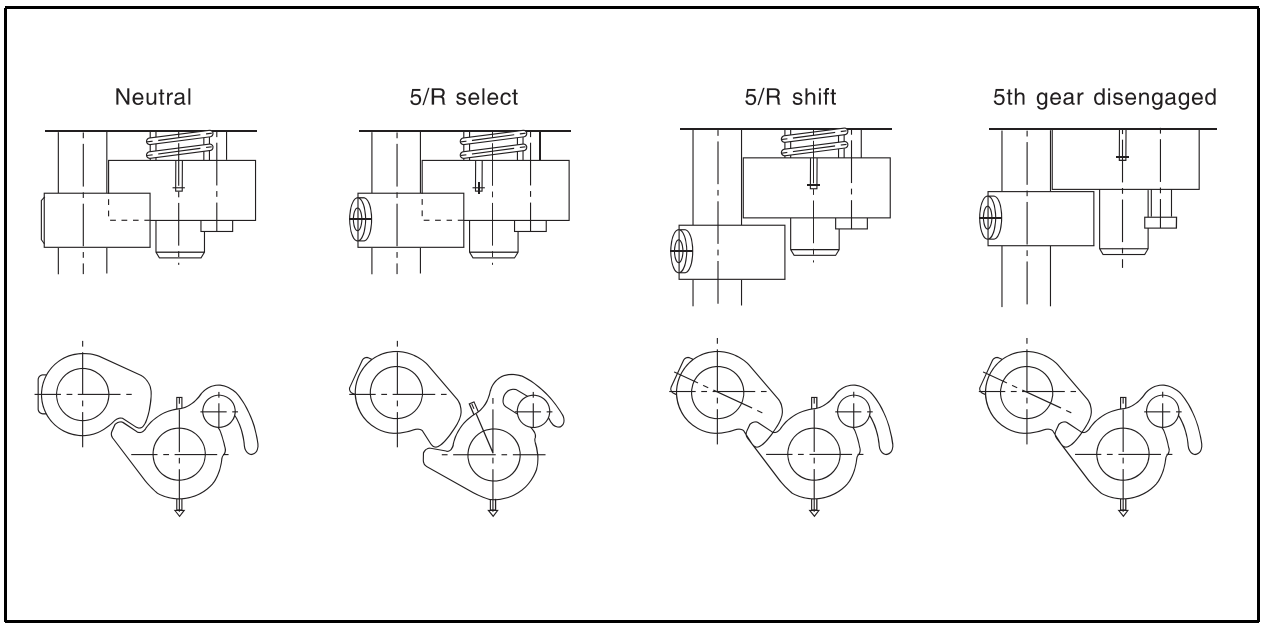
1) Interlock System

Interlock system prevents the gears from meshing over two sets.



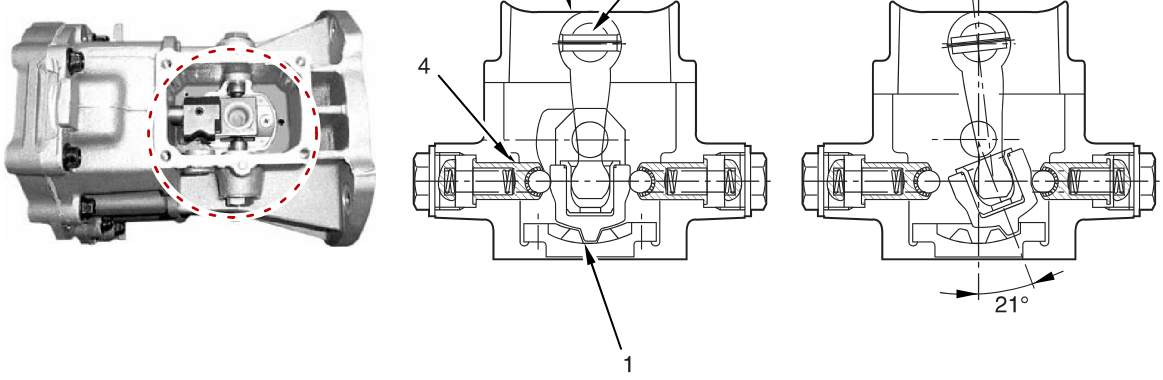
2) Reverse Interlock System

Reverse interlock system prevents the gear from shifting to reverse driving position while driving forward.



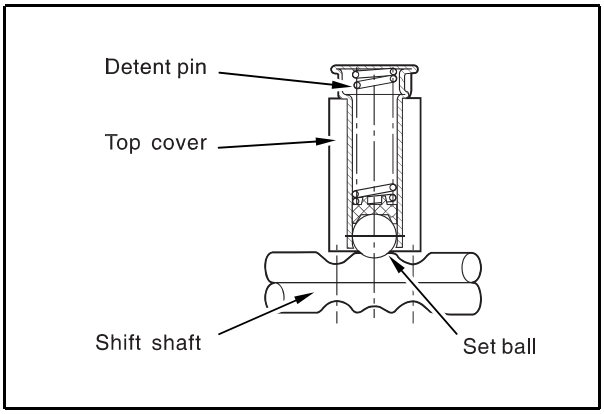
3) Offset Lever and Rolling Plunger

To make the next shift easier, the offset lever applies a reaction force to shift lever toward center position of gear selection gate after a gear has been selected.

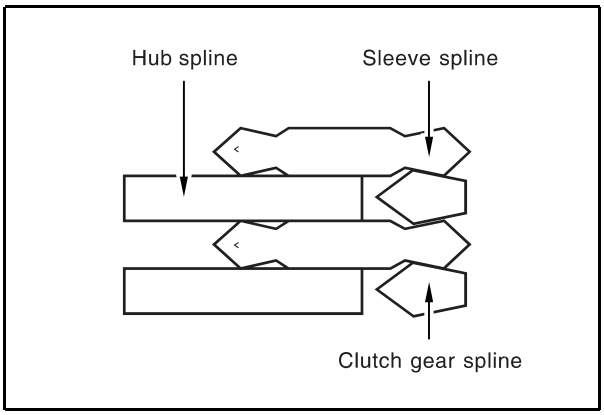


1. Offset lever	3. Shift shaft
2. Shift lever	4. Rolling plunger (rolling plunger return spring and ball)

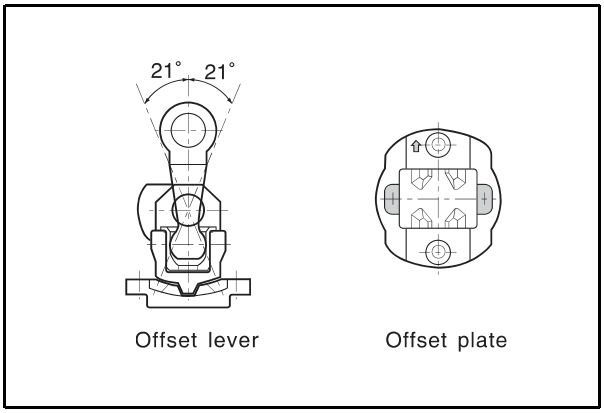
Modification basis	
Application basis	
Affected VIN	



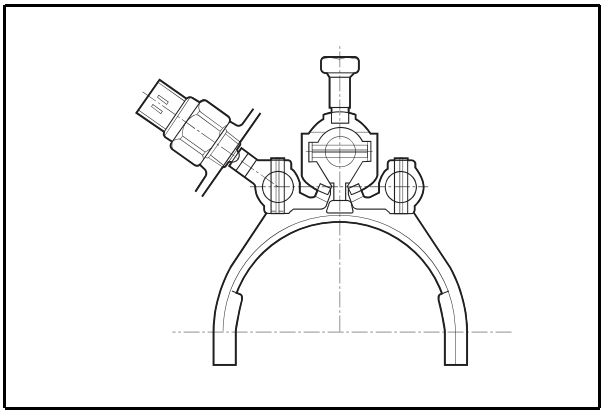
1. Shift check device
   It determines the shift fork position (N or each gear) and gives a detent movement to notice a shift lever seating when operating the shift lever.
   Also, it prevent the selected gear from getting out of its meshed position.



2. Gear pump out locking device
   It prevents the shift lever is beyond the correct shift position while shifting.



3. Guiding a control direction and preventing an over stroke



4) Backup Lamp Switch

It is normal open type switch. Its circuit is formed when the reverse gear is selected.

CAUTION
- Sealant: Loctite DRI LOC 200
- Tightening torque: 3 kg.m ~ 4 kg.m

5) Synchronizer

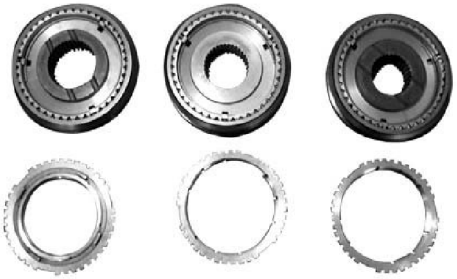
▶Composition

It consists of synchronizer hub, sleeve, ring, key and spring (1/2, 5/R, and 3/4 synchronizer are different from each other).

- 3/4 and 5/R shift: Single cone type
- 1/2 shift: Double cone type - Improving the capacity to bigger engine torque of 1/2 shift (added synchronizer inner cone and middle cone)

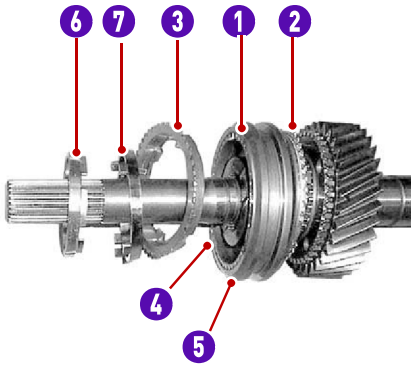
Single cone type





1/2 shift 3/4 shift 5/R shift

Double cone type





1/2 shift 3/4 shift 5/R shift

1.Synchronizer sleeve
2. Synchronizer hub
3. Synchronizer ring
4. Synchronizer key
5. Synchronizer key locking ring
6. Synchronizer inner cone
7. Synchronizer middle cone

CAUTION

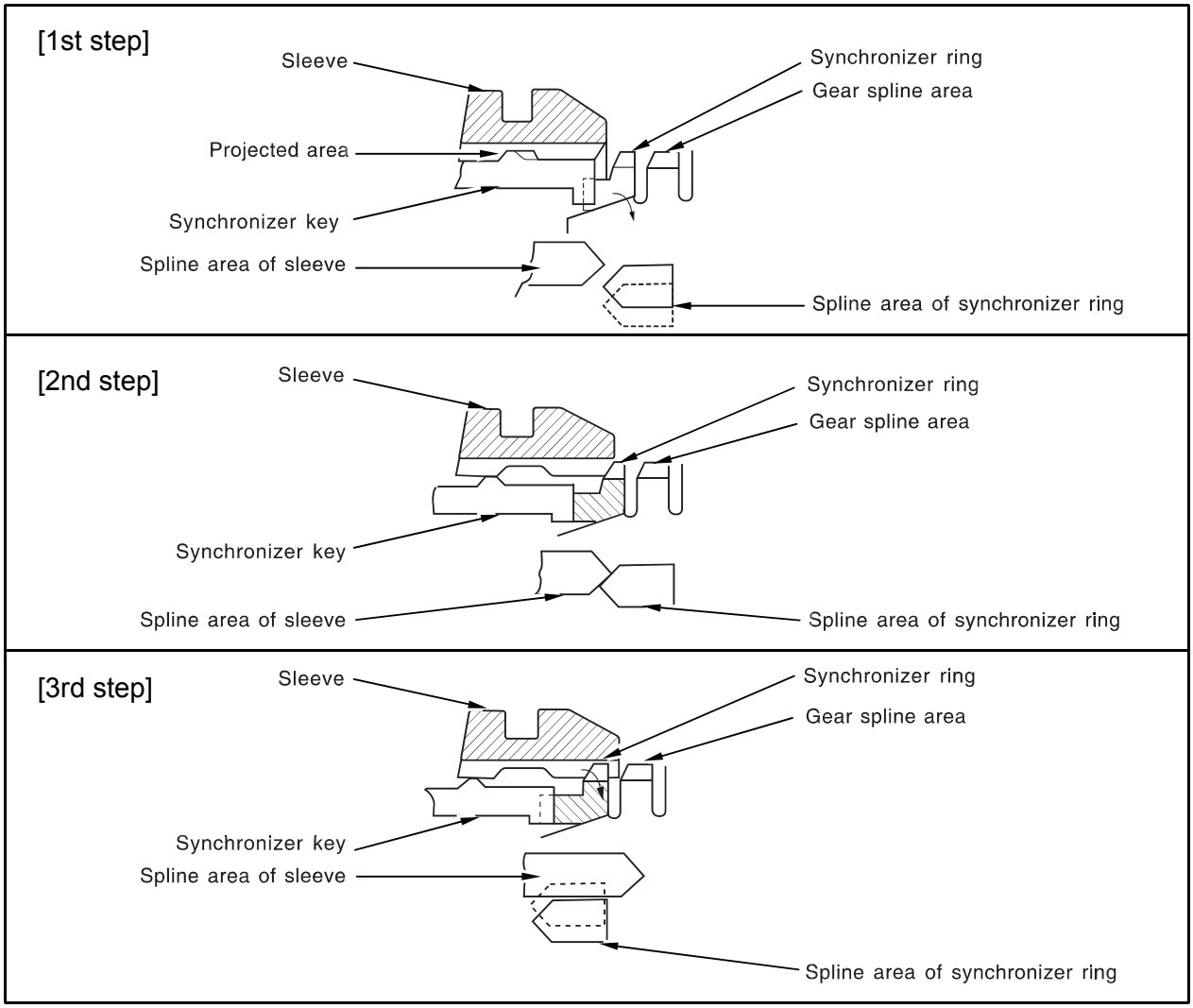
Be careful not to mix up the 1/2 shift synchronizer sleeve with 3/4 or 5/R shift synchronizer sleeve.

The 3/4 synchronizer hub also different from 1/2 and 5/R synchronizer hub (different oil gallery).

Modification basis	
Application basis	
Affected VIN	

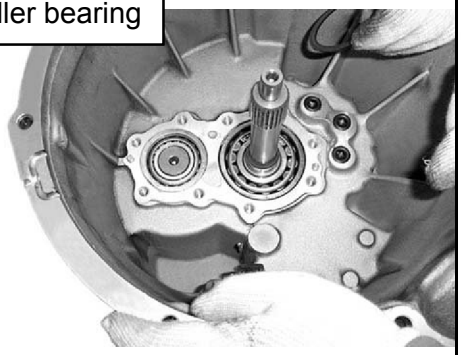
▶Synchronizer element

A cone or sleeve that slides to and fro on the transmission main shaft and makes the gears rotate at the same speed to prevent clash when the gears are about to mesh. Whenever a vehicle is rolling, the transmission main shaft is turning and the clutch gear is spinning. Even though the clutch is disengaged, the clutch gear continues to spin until friction slows it down or stops it. Thus when the driver shifts into another gear he is trying to mesh gears that may be moving at different speeds. By using synchronizers, the possibility of broken or damaged teeth is reduced and shifting effort is lowered.



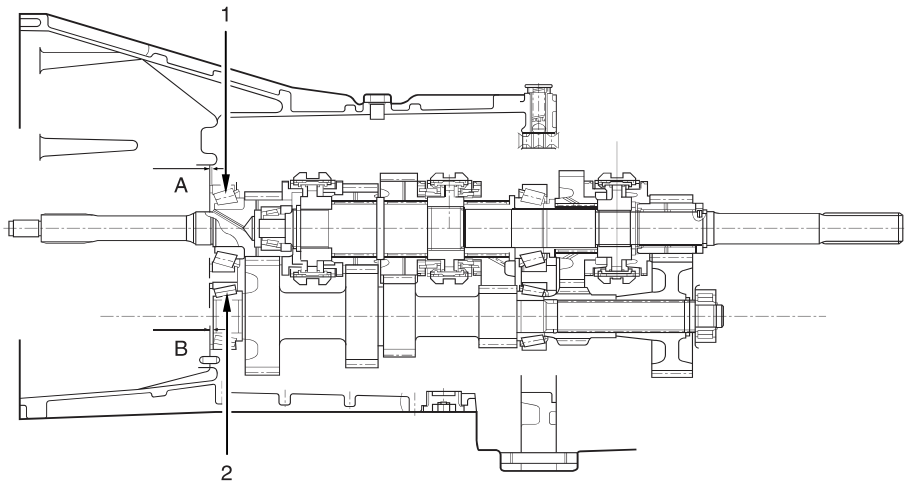
6) Bearing

The needle bearings are introduced to each gear and the taper roller bearings are used for input and counter shaft in transmission housing.

Taper roller bearing	Needle bearing
	

1. Taper roller bearing (input shaft, counter shaft and output shaft)
2. Needle bearings for 1/2 and 3/4 shift
3. Needle bearing for reverse gear (with cut out area)
4. Needle bearing for 5th gear

7) End Play of Taper Roller Bearing



1. Taper roller bearing for input shaft
2. Taper roller bearing for counter shaft

A. End play A: 0.85 ~ 2.28 mm
B. End play B: 1.17 ~ 1.97 mm

CAUTION

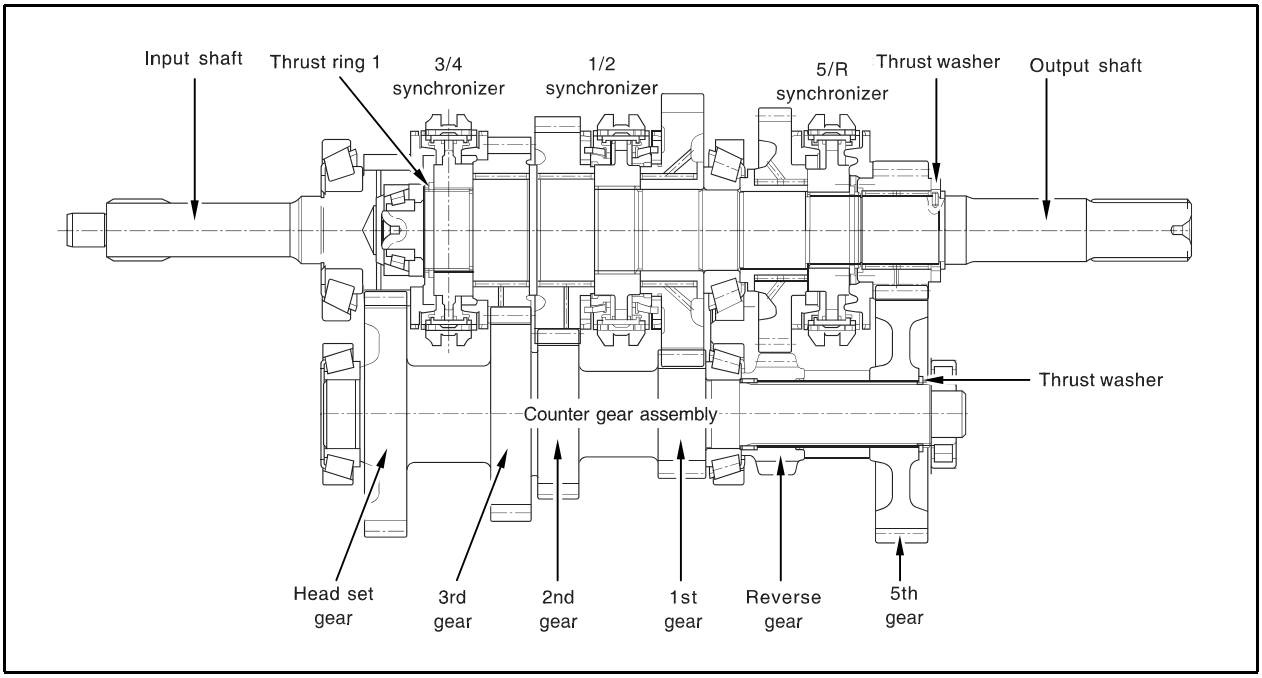
Use the following spacers to adjust the end play (A or B) between input shaft and counter shaft. (Specified range of end play: 0.05 ~ 0.1 mm)

- For input shaft: 0.75 ~ 1.45 mm (15 spacers with increment of 50 μm)
- For output shaft: 0.4 ~ 1.45 mm (10 spacers with increment of 50 μm)

Modification basis	
Application basis	
Affected VIN	

8) Thrust Ring (Washer)

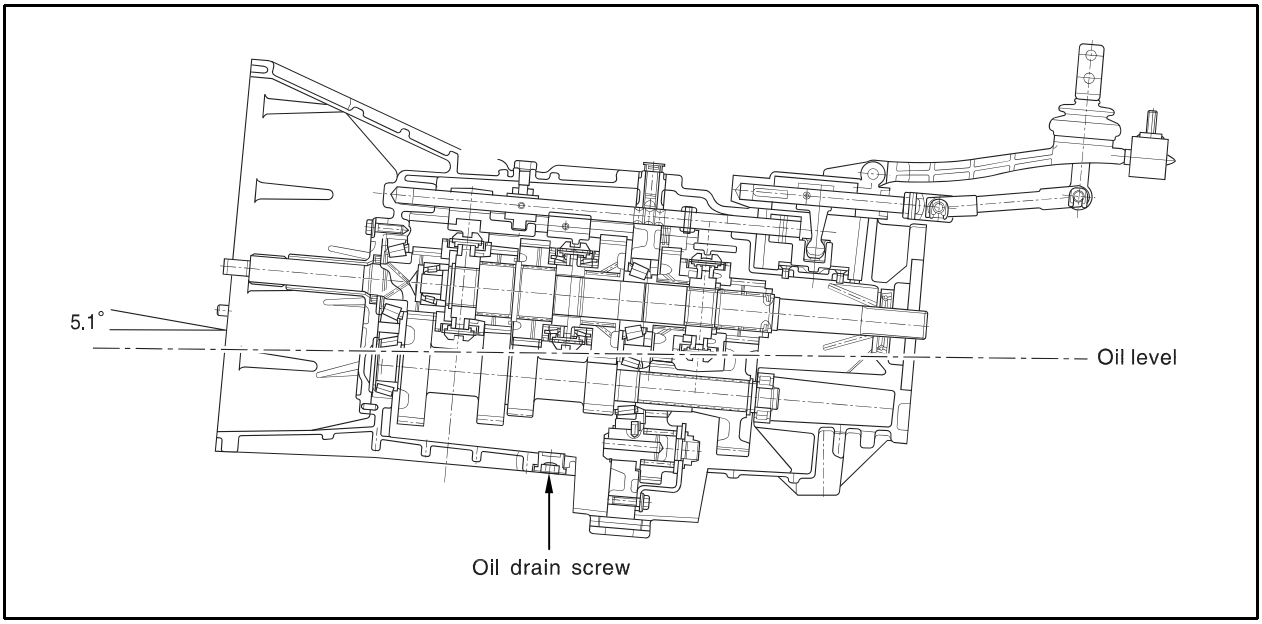
When the driving force from engine is transmitted to the output shaft of transmission, each shaft and gear assembly receives the axial force and this force acts as a resistance to rotating gears.



9) Lubrication

Transmission oil: SAE 75W/90

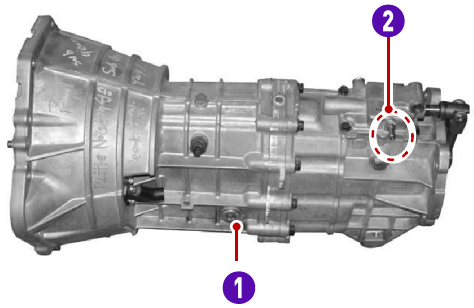
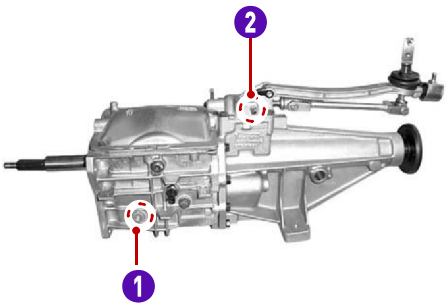
Initial installation for taper roller bearing and needle roller bearing, lubrication for shift rail: MoS2 Grease



CAUTION

Sealant on oil drain screw during installation: Loctite DRI LOC 200

Tightening torque: 40 ~ 50 Nm

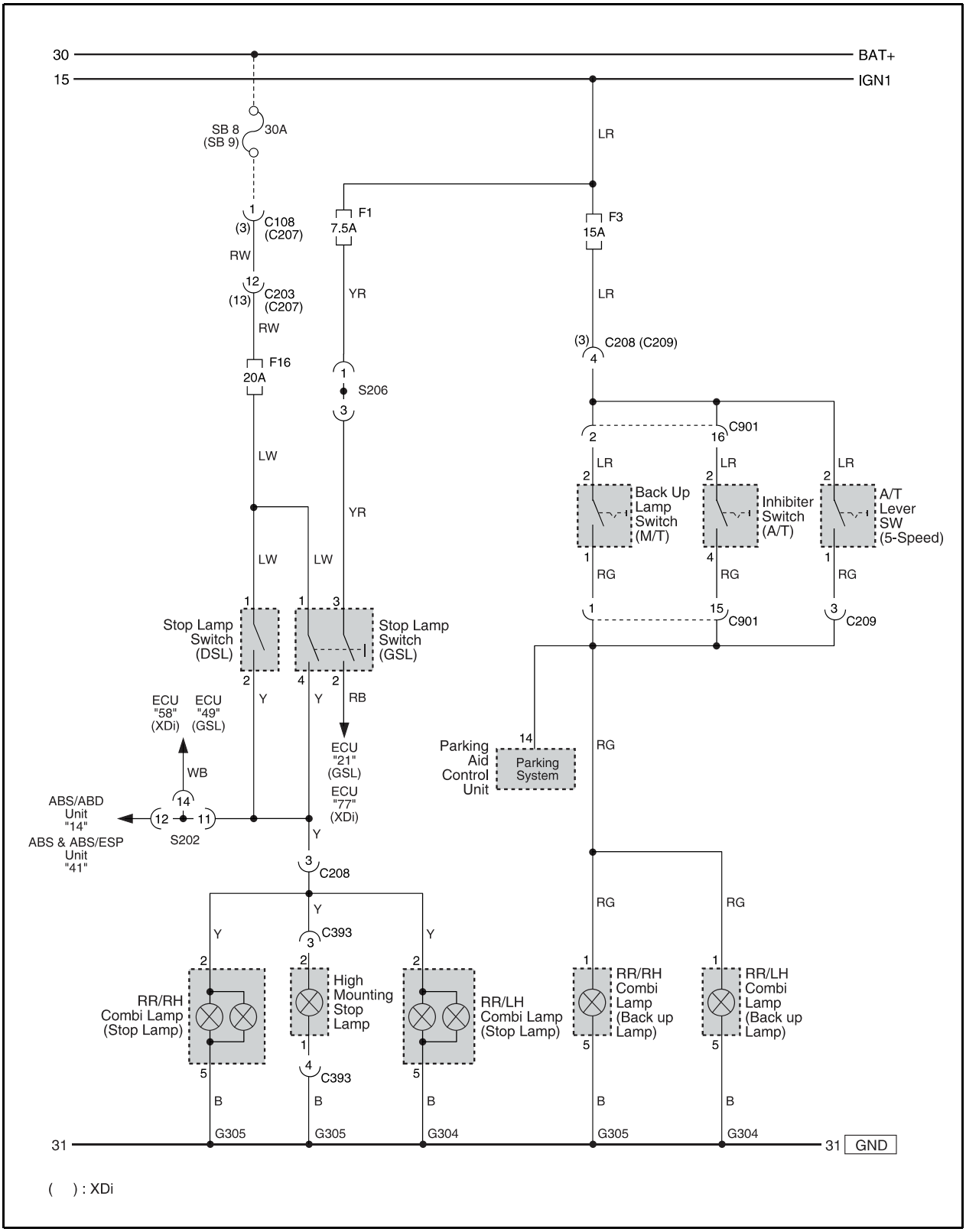
4WD	2WD
	
1. Oil filler plug	2. Air vent

CAUTION

Sealant on oil drain screw during installation: Loctite DRI LOC 200

Tightening torque: 40 ~ 50 Nm

4. CIRCUIT DIAGRAM (BACKUP LAMP)



CLUTCH

0000-00

GENERAL

1. SPECIFICATIONS

Description		Specification
Operating type		Hydraulic
Clutch pedal	Type	Suspended
	Maximum pedal stroke	Diesel engine equipped vehicle: 158 mm
		Gasoline engine equipped vehicle: 150 mm
	Pedal free play	5 ~ 10 mm
Clutch disc	Type	Single dry diaphragm
	Dimension of facing	240 X 155 X 4.0 mm
	Facing size/quantity	263 cm^2/2
	Thickness of disc	Free: 9.35 ~ 9.95 mm When loaded: 8.9 ± 0.2 mm
Clutch cover assembly setting force		9,600 N
Clutch master cylinder	Stroke	28.4 mm
	Inner diameter	ø15.87 mm
Concentric slave cylinder	Stroke	7.0 mm
	Sectional area	630 mm^2
Clutch fluid		DOT 3 or DOT 4

2. TIGHTENING TORQUE

Description	Tightening Torque	
Clutch housing bolt (8 locations)	5.0 ~ 6.0 kgf•m	49 ~ 59 Nm
Clutch cover (pressure plate) bolt	2.1 ~ 2.7 kgf•m	21 ~ 27 Nm
Concentric slave cylinder bolt (3 locations)	1.0 ~ 1.6 kgf•m	10 ~ 16 Nm
Concentric slave cylinder flare nut	2.0 ~ 2.5 kgf•m	20 ~ 25 Nm
Adaptor flare nut	2.0 ~ 2.5 kgf•m	20 ~ 25 Nm
Clutch oil pipe flange nut	1.52 ~ 1.83 kgf•m	15 ~ 18 Nm
Master cylinder bolt	3.05 ~ 4.07 kgf•m	30 ~ 40 Nm
Fulcrum (clutch pedal bushing) bolt/nut	1.63 ~ 2.24 kgf•m	16 ~ 22 Nm
Clutch pedal bracket mounting bolt	0.81 ~ 1.83 kgf•m	8 ~ 18 Nm
Stopper bolt	1.63 ~ 2.24 kgf•m	16 ~ 22 Nm

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

1) 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 steel cover, which is bolted to the flywheel.

2) 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 pressure plate assembly.

3) Operating Elements

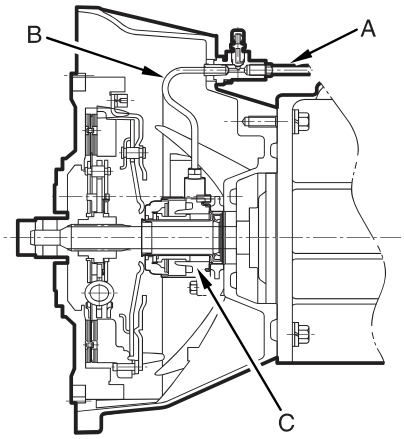
The clutch release system consists of the clutch pedal are clutch release cylinder.
This system directly releases the clutch by using hydraulic pressure while the conventional clutch system releases the clutch by using release lever and release fork.
This system provides higher efficiency than conventional clutch system, and its durability is superior.

Clutch release cylinder pipe (mounted on transmission case)
Concentric slave cylinder pipe (mounted inside of transmission)
Concentric slave cylinder

Modification basis	
Application basis	
Affected VIN	

2. COMPONENTS AND LOCATIONS

B. Concentric slave cylinder pipe



A. Adaptor



D. Clutch assembly



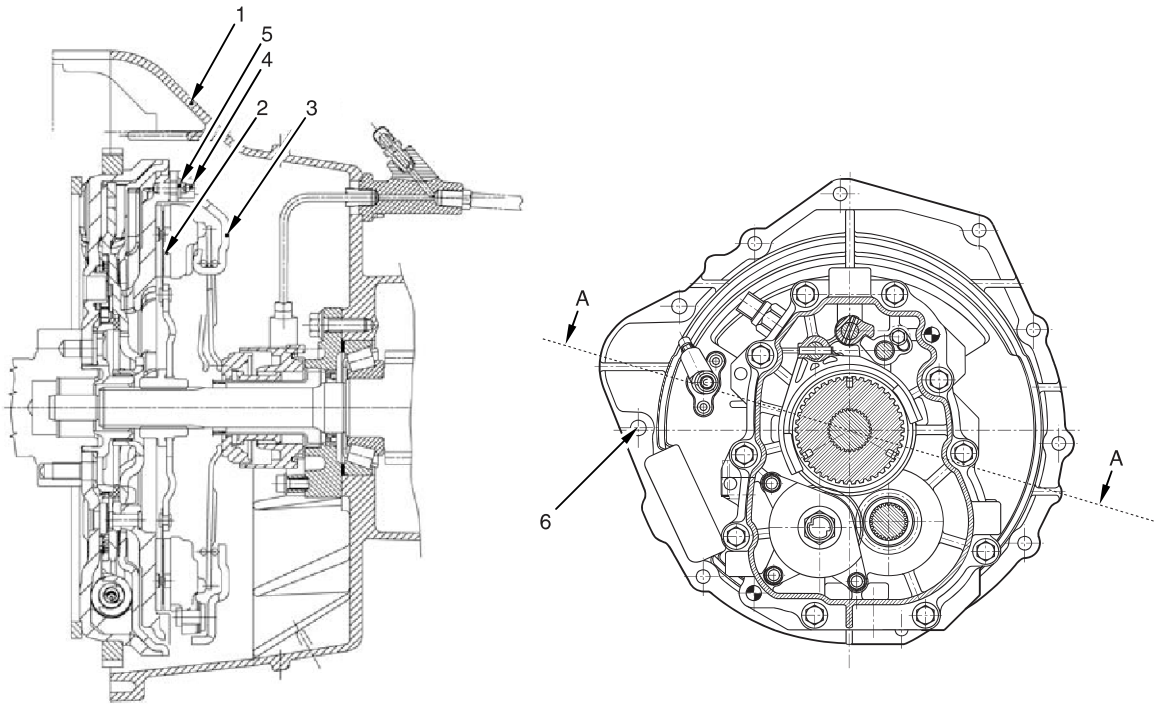


C. Concentric slave cylinder





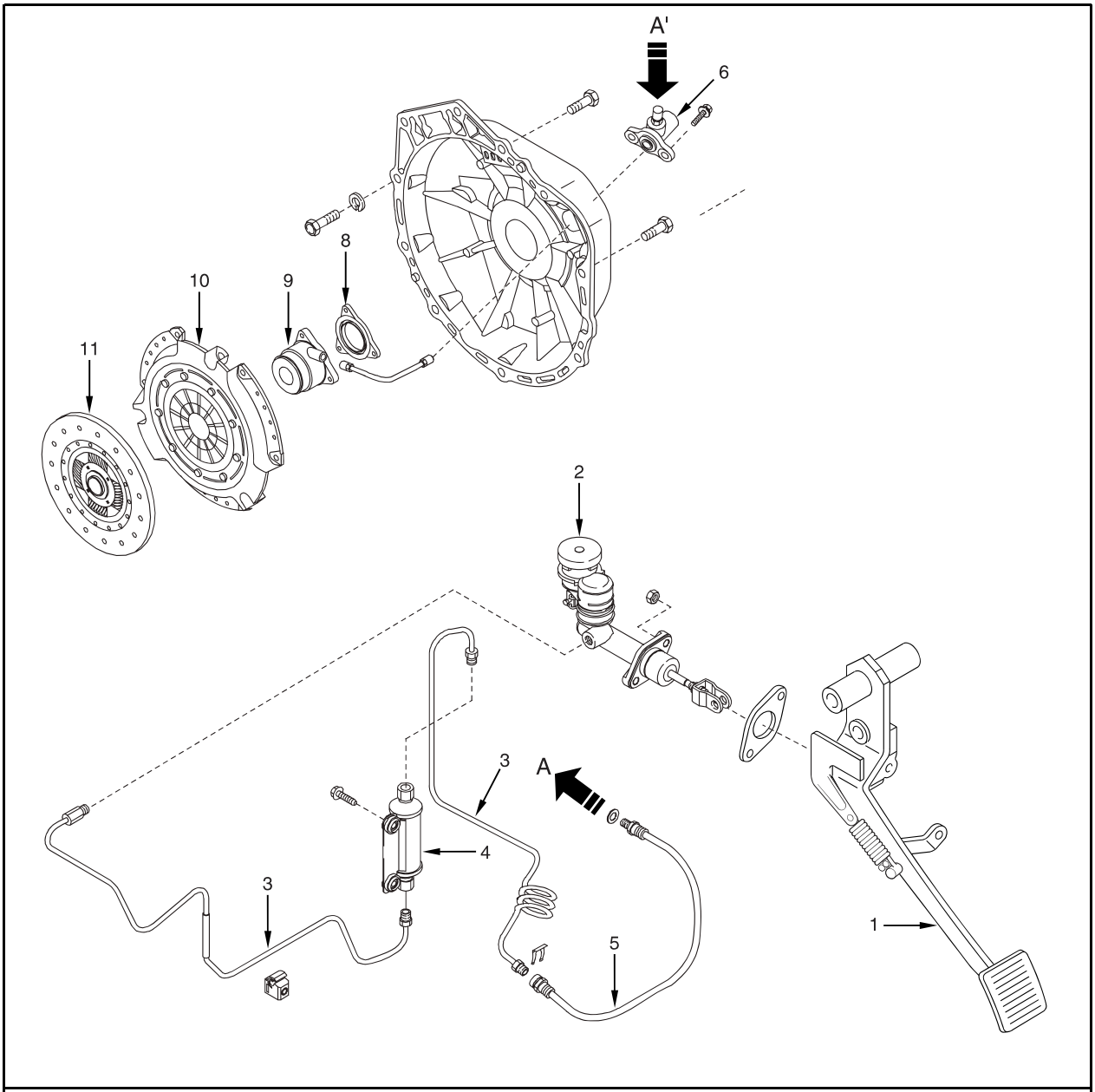
▶CROSS SECTIONAL VIEW OF CLUTCH ASSEMBLY



1. Transmission housing
2. Clutch disc assembly
3. Clutch disc cover assembly
4. Bolt
5. Washer
6. Bolt

Modification basis	
Application basis	
Affected VIN	

▶CLUTCH COMPONENTS



1. Clutch pedal
2. Clutch master cylinder
3. Clutch hydraulic line
4. Clutch fluid chamber
5. Clutch fluid hose
6. Adaptor
7. Clutch housing
8. Concentric slave cylinder cover
9. Concentric slave cylinder
10. Clutch cover
11. Clutch disc

PART TIME TRANSFER CASE

3240-01

GENERAL

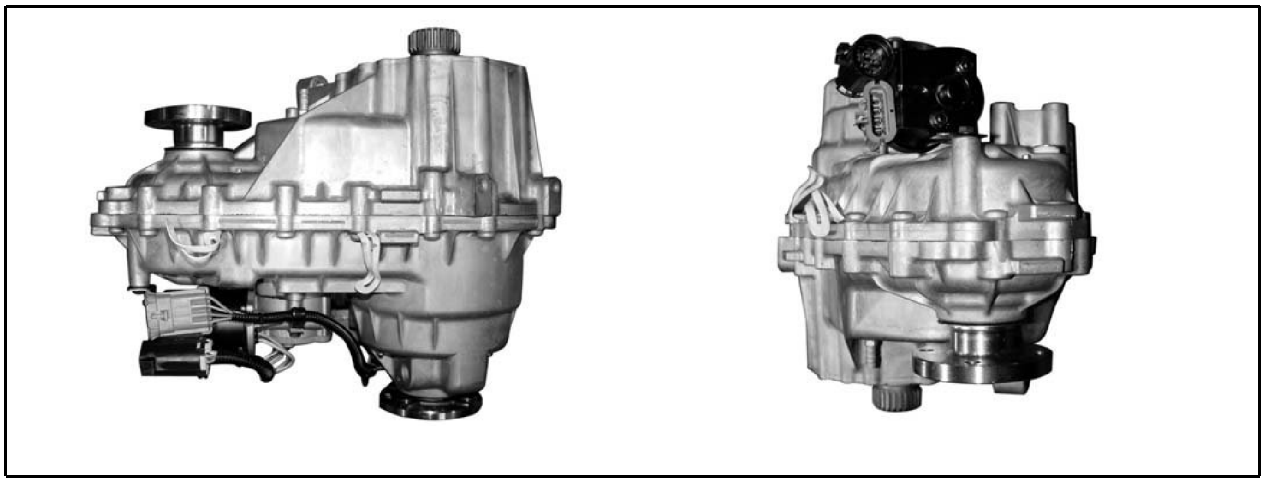
1. SPECIFICATIONS

Description		New Part Time T/C
Total length		343 mm
Mating surface of front flange		40 mm
Weight		33.8 kg (without oil)
Oil capacity		1.4 L
Location		Transfer case
Major elements	Housing	Part time & TOD (common)
	Tightening bolt	11 EA, M8 x 1.25
	Input shaft	A/T: External spline M/T: Internal spline
	Ring gear	Inserted into housing groove
	Sun gear	Separated input shaft and sun gear

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

By using the planetary gear sets, two-gears shift type part time transfer case achieves direct connection when selecting 4WD "HIGH" and 2.48 of reduction gear ratio when selecting 4WD "LOW". The silent chain in transfer case transfers the output power to front wheels.
Simple operation of switches on instrument panel allows to shift to "2H", "4H" and "4L" easily while driving. The warning lamp alarms the driver when the system is defective.

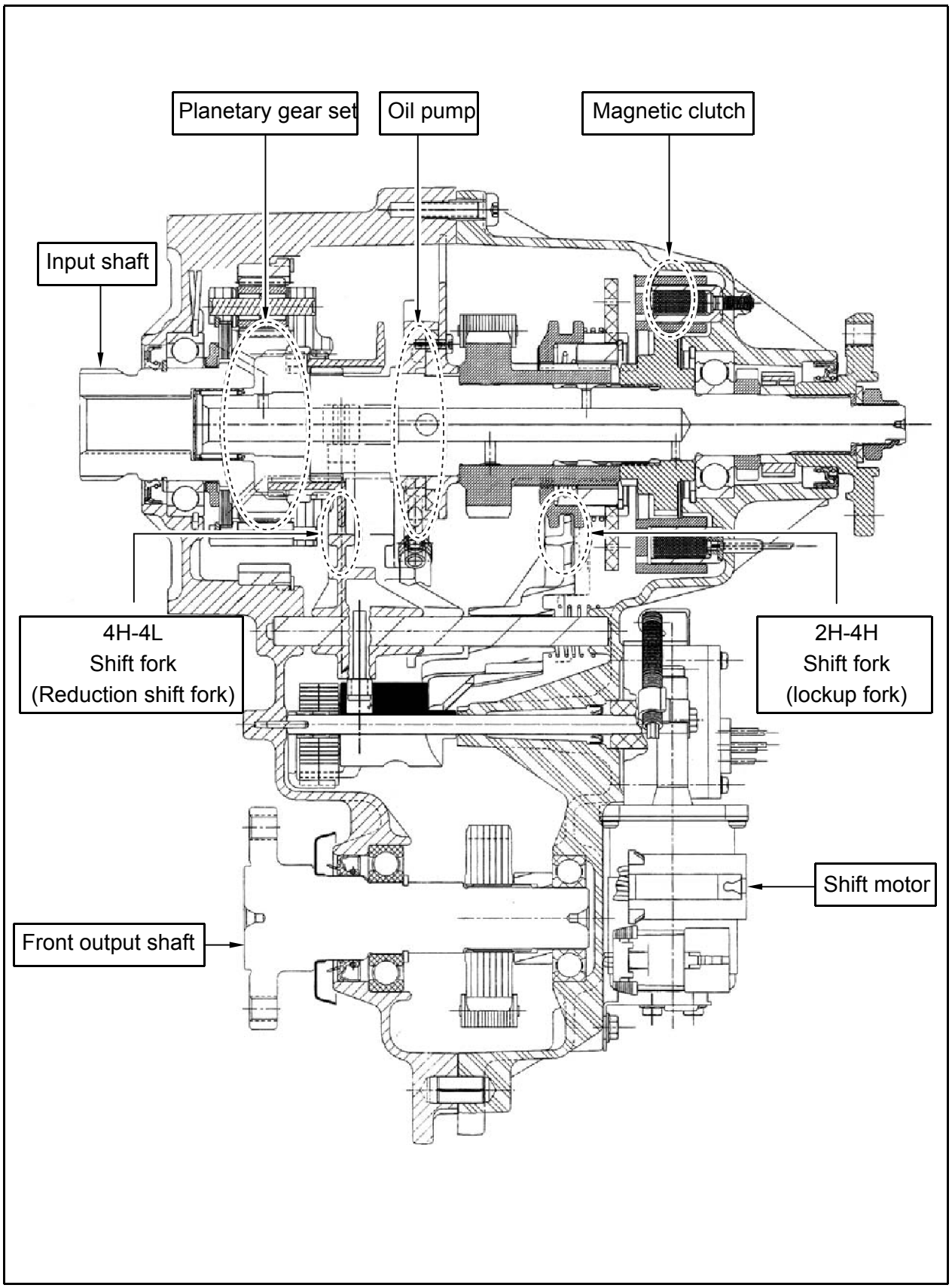


2. OPERATION

Application	Mode Position		Operating Condition
Driving type	2H	2WD Drive (Rear Wheel Drive)	Normal Driving on the normal road and highway, or high speed driving
	4H	4WD Drive (High Speed)	Slippery road such as snow, rainy, sand, mud etc.
	4L	4WD Drive (Low Speed)	Maximum driving force required condition such as towing, rough road. When a vehicle is driven in turning at low speed on the paved road, a vibration and a noise may be occurred by tight corner braking.
When shifting the mode	2H ↔ 4H	2WD Drive ↔ 4WD Drive (High Speed)	It is possible to shift the mode between 2WD and↔ 4WD without clutch operation under the vehicle speed is below 70 km/h.
	2H, 4H ↔ 4L	2WD Drive, 4WD Drive (High Speed) ↔ 4WD Drive (Low Speed)	Manual Transmission • Before shifting the mode, stop the vehicle and fully depress the clutch pedal. Automatic Transmission • Before shifting the mode, stop the vehicle and place the selector lever at [N] position. Note To make the mode shift easier, stop the vehicle, depress the brake pedal, select the mode switch, and move the selector lever with the sequence of [N-P-N].

Modification basis	
Application basis	
Affected VIN	

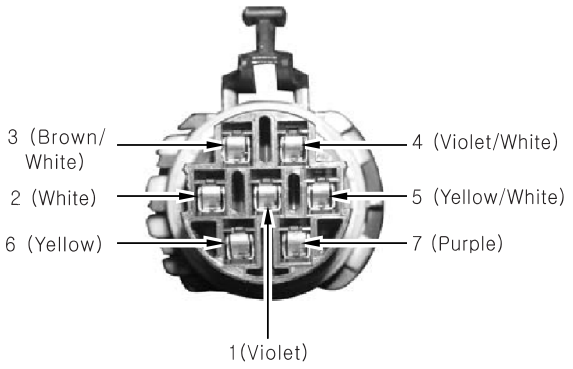
3. SECTIONAL DIAGRAM



▶ Shift Motor

When selecting a position in 4WD switch, the shift control unit exactly changes the motor position to 2H, 4H and 4L by the position encoder in control unit that monitors motor position.

Rear view of Shift Motor connector

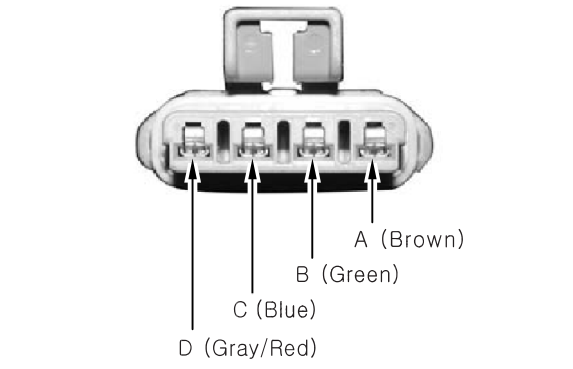


Pin	Function
1	Position A
2	Position B
3	Position C
4	Position D
5	Position ground
6	Control (4L - 4H - 2H)
7	Control (2H - 4H - 4L)

▶ Speed Sensor and Clutch Coil

The rear speed sensor utilizes the hall effect. It generates 0V and 5V of square type digital wave according to the rotation of the wheel with teeth of transfer case rear output shaft. The speed signal from rear propeller shaft is entered into control unit.
When the control unit determines that 4WD HIGH operation is available, electric current flows into the clutch coil. The coil magnetized by this electric current pull in the lockup hub to engage into output spline. Accordingly, the power is transferred to front wheels.

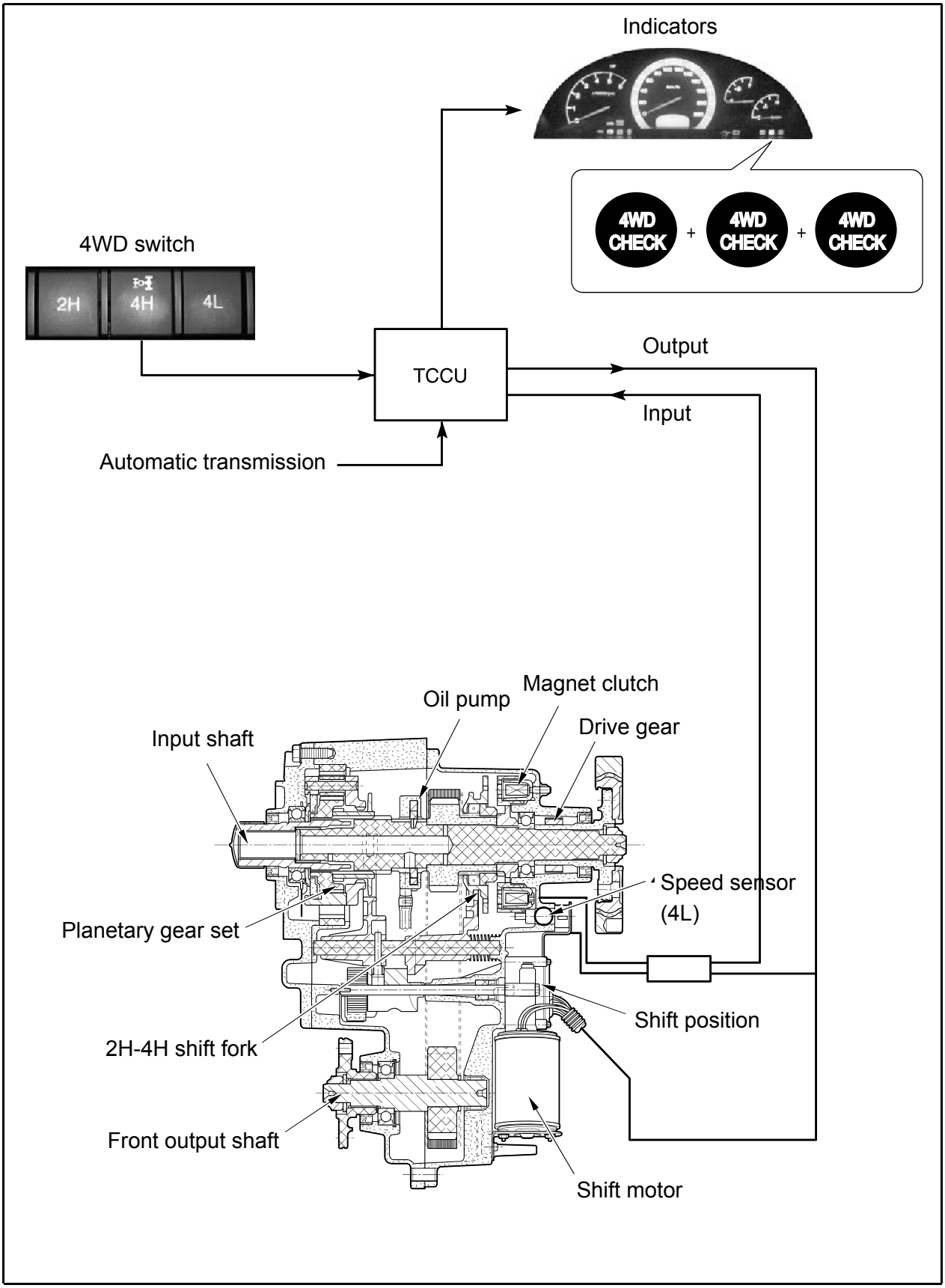
Rear view of Speed Sensor and Clutch Coilconnector



Pin	Function
A	Clutch coil
B	Sensor power (5V)
C	Sensor signal
D	Sensor ground

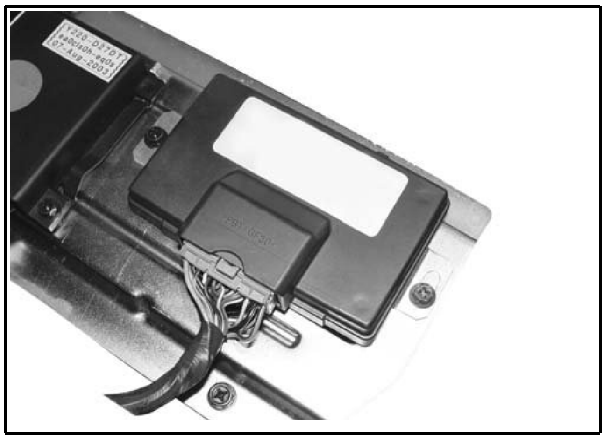
Modification basis	
Application basis	
Affected VIN	

4. SYSTEM LAYOUT



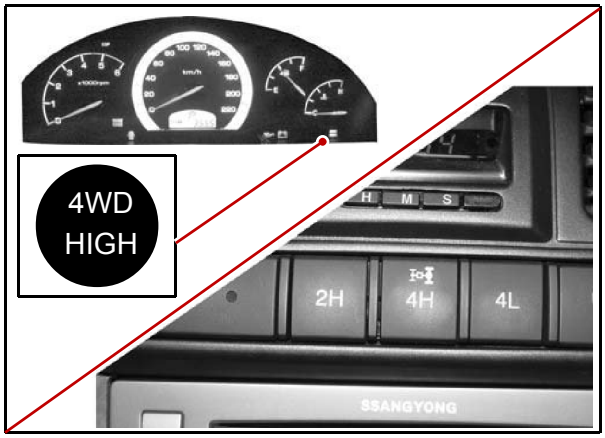
5. SYSTEM OPERATION

1) TRANSFER CASE CONTROL UNIT (TCCU)



▶ 4WD Operation

TCCU is located under the driver's seat and permits the vehicle to shift from two-wheel drive to four-wheel drive (and back shift) according to drivers switch operation during driving (For the shifting between 4WD HIGH and 4WD LOW, stop the vehicle).



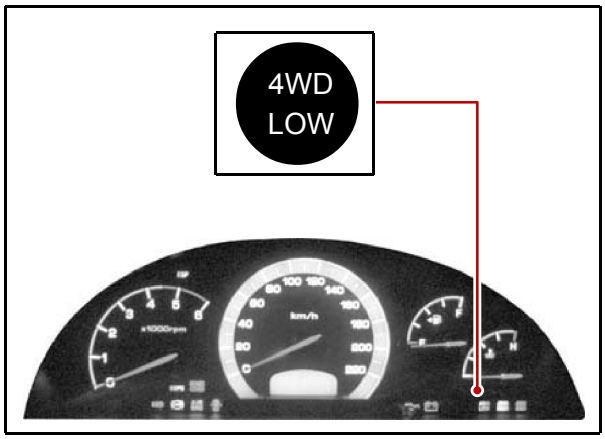
1. 2H → 4H
   - · Change the 4WD switch in instrument panel from 2H to 4H.
   - · This shift is available during driving.
   - · "4WD HIGH" indicator in meter cluster comes on.

When the system is defective

- · 4WD CHECK" warning lamp comes on

2. 4H → 2H
   - · Change the 4WD switch in instrument panel from 4H to 2H.
   - · This shift is available during driving.
   - · "4WD HIGH" indicator in meter cluster goes out.
   - · "4WD CHECK" warning lamp comes on when the system is defective.

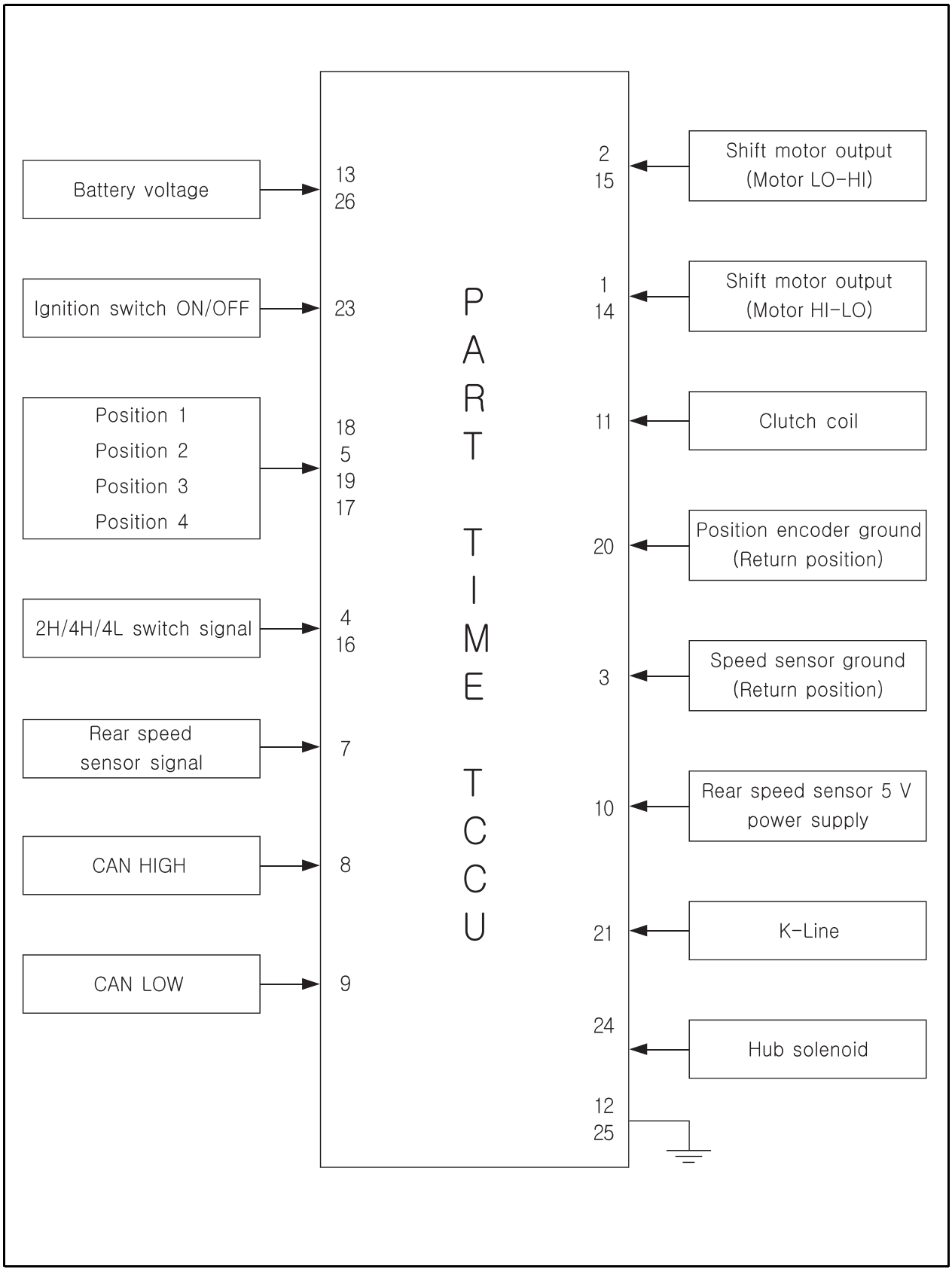
Modification basis	
Application basis	
Affected VIN	



3. 4H → 4H

- This function is only available when the speed signal from speed sensor is about to stop (below 2 km/h).
- This function is only available when clutch pedal is depressed (manual transmission) or selector lever is selected to "N" position (automatic transmission). (TCCU must recognize the clutch pedal signal or "N" signal.)
- Change the 4WD switch in instrument panel from 4H to 4L.
- "4WD LOW" warning lamp in meter cluster flickers during this process, then goes out when the shift is completed.
- "4WD CHECK" warning lamp comes on when the system is defective.

2) Transfer Case Block Diagram



Modification basis	
Application basis	
Affected VIN	

Section	Pin No.	Name	Description
Power supply	12, 25	Ground	Part time TCCU ground
	13, 26	B+	Part time TCCU battery voltage input
Input side	23	Ignition switch	Ignition switch voltage : ON - above 4V, OFF - below 0.9 V
	18	Position 1	Position encoder : recognize shift motor position HIGH - above 4 V, LOW - below 0.9 V
	5	Position 2	Same a above
	19	Position 3	Same a above
	17	Position 4	Same a above
	4, 16	2H, 4H, 4L switch	Mode input by 2H, 4H, 4L selection : HIGH - above 4V, LOW - below 0.9 V
	7	Rear speed sensor	Rear speed sensor (Hall effect) signal input
Both sides	8	CAN HIGH	CAN bus HIGH line
	9	CAN LOW	CAN bus LOW line
	21	K - LINE	Connected to diagnosis connector
Output side	10	Speed sensor voltage	Supply 5V to front and rear speed sensors
	1, 14	Motor HI-LO	Motor output port - Connected to battery when shifting to LO from HI - Connected to ground when shifting to HI from LO or when braking the motor
	2, 15	Motor LO-HI	Motor output port - Connected to battery when shifting to HI from LO - Connected to ground when shifting to LO from HI or when braking the motor
	11	EMC	Supply voltage to clutch coil - Max. current: 9 A
	20	Position ground (return)	Provide ground to position encoder
	3	Speed ground (return)	Provide ground to speed sensor
	24	Hub solenoid	Supply voltage to hub solenoid

3) TCCU System

(1) Position Encoder

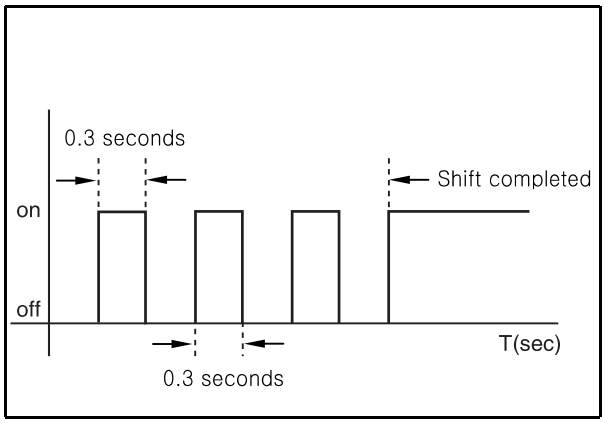
The position encoder is the code that TCCU can determine the shift motor position.

Position Code				Motor Position	Remark
1	2	3	4		
0	0	0	0	Left stop	Input voltage 1 : above 4.5 V (HIGH) 0 : below 0.5 V (LOW)
1	0	1	0	2 H	
0	0	1	0	Zone 1	
0	1	1	0	Zone 2	
0	0	1	0	Zone 3	
0	0	1	1	4 H	
0	0	0	1	Zone 4	
1	0	0	1	Zone 5	
1	0	0	0	Zone 6	
1	1	0	0	4 L	
0	0	0	0	Right stop	
1	1	1	1	Encoder OFF	

(2) Operation

▶TCCU initialization and operation

· TCCU sends relevant data to meter cluster via CAN to diagnose and check the indicators when the ignition switch is turned to ON. At this time, the 4WD indicators (4WD LOW and 4WD HIGH) comes on for 0.6 seconds.
· TCCU starts diagnosis by operating clutch and hub solenoid for 1.5 seconds.
· If the selector switch position and the shift motor position code does not match when the IG power is turned ON, the shift is controlled to move in the direction of the selector switch position.
· The shift operation is controlled to move only toward selector switch position if the selector switch position is not met with shift motor position code when the ignition switch is turned to ON.



▶Function of indicating lamp

during shifting

· As the operation of shift motor starts, the indicator flickers in interval of 0.3 seconds and stops after the shifting operation is completed or cancelled.
- Operation diagram of "4H" indicator when changing the switch to 4H from 4L.
- Operation diagram of "4L" indicator when changing the switch to 4L from 2H/4H.

Modification basis	
Application basis	
Affected VIN	

▶ Shift conditions

Shift operation is only allowed when some conditions are satisfied. These shift conditions should be satisfied for 2 seconds before starting motor. The motor has three seconds of delay at its initial operation to do trouble diagnosis.
Once the motor starts, the shift conditions are no longer checked.

Shift conditions are as follows:

- Normal battery voltage and shift motor for all gears
- 2H and 4H shifts has nothing to do with vehicle speed, "N" position in automatic transmission or clutch signal.
- Shift operation between 2H/4H and 4L is only available when the vehicle speed is below 46 km/h.
- No defective speed sensor

▶ Motor controls

· The shift steps have the sequence of 2H → 4H → 4L and 4L → 4H → 2H. TCCU operates the shift motor until it reads required position code. If it detects the faulty code, the system is operated with the compensation mode.
· Once the shift operation is started, it is completed regardless of ignition power. If there are not operating signals from position sensor, the shifting failure due to timeout occurs. This failure appears when the shifting time between 2H and 4H and between 4H and 4L is delayed over 5 seconds compared to normal shift. Once the shifting time exceeds the specified time, TCCU cannot properly supply the voltage to shift motor and is operated in compensation mode.
· Even though the system recognize a fault before motor starts, it is considered as fault.
· Motor stops operation when it reaches at target range.

▶ Synchronization

Synchronization occurs during shifting from 2WD (2H) to 4WD (4H or 4L). The synchronizer clutch and hub solenoid are controlled during synchronization as follows:

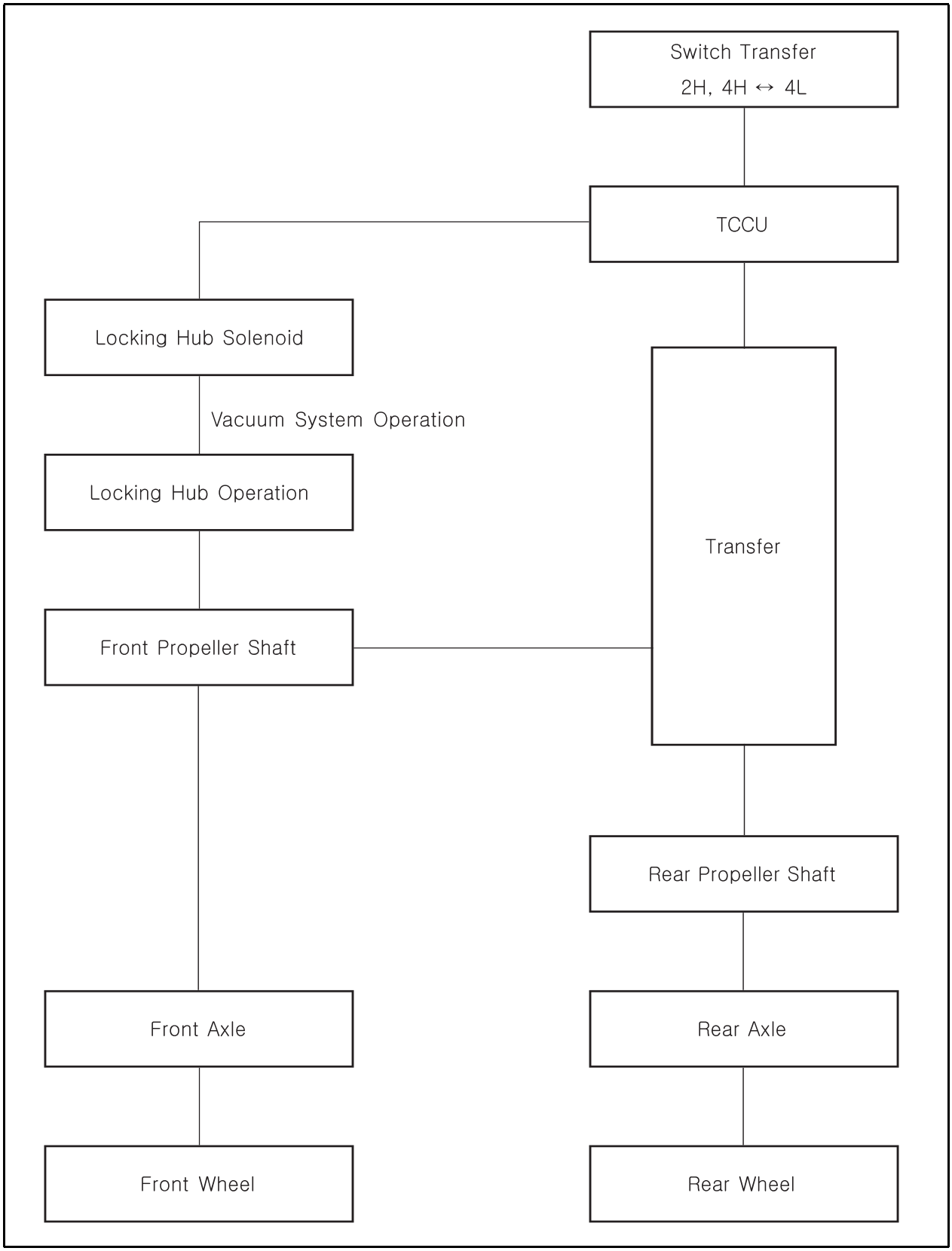
- Clutch coil operates when the selector changes from 2H to 4H/4L.
- Shift motor moves in 4H mode.
- Hub solenoid starts its operation 4 seconds after shifted to 4H.
- Clutch coil stops its operation 5 seconds after the hub solenoid is activated.

▶ Compensation

The motor stops when the encoder related troubles are detected during shift operation. It moves toward LOW-HIGH direction for 5 seconds so that the motor is not left in unidentified position.

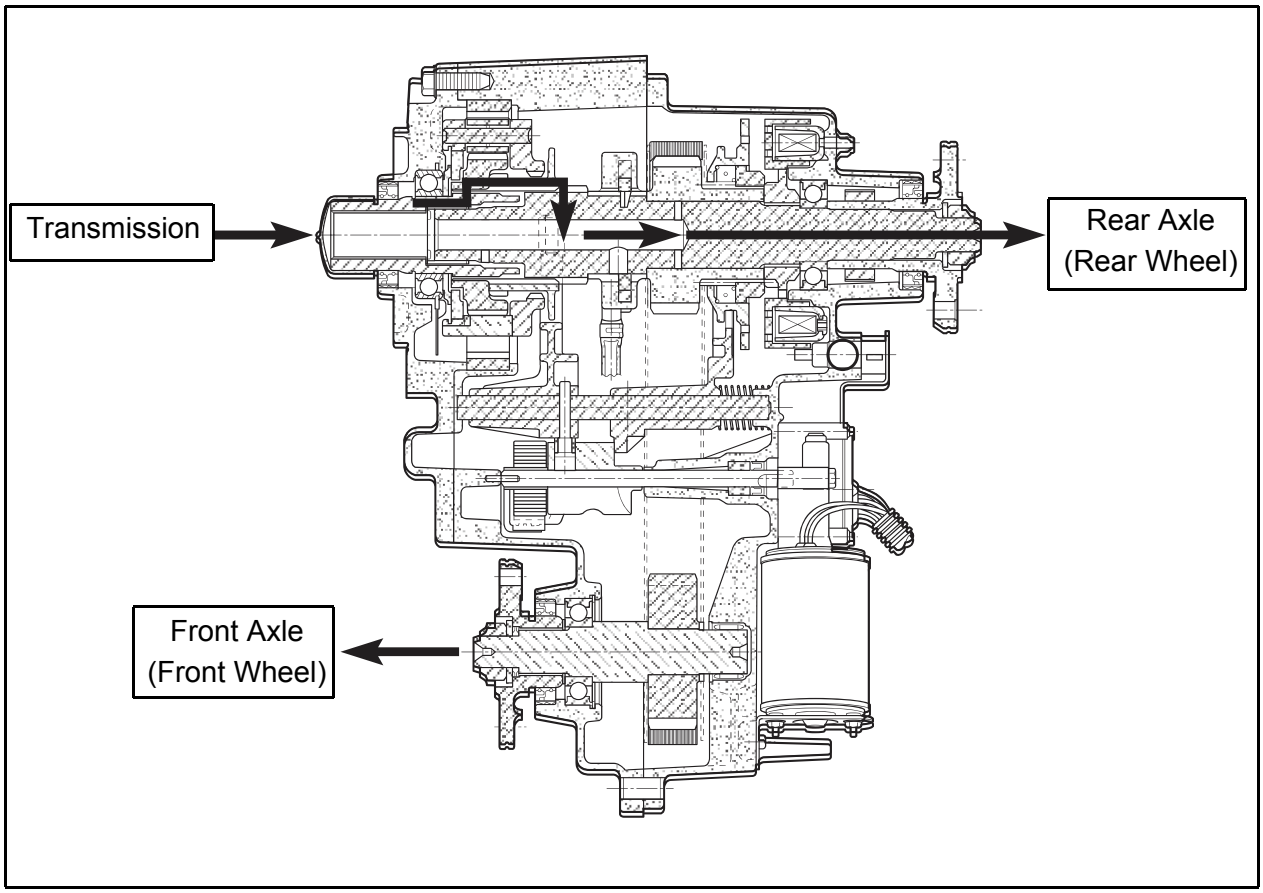
6. POWER FLOW

▶POWER FLOW

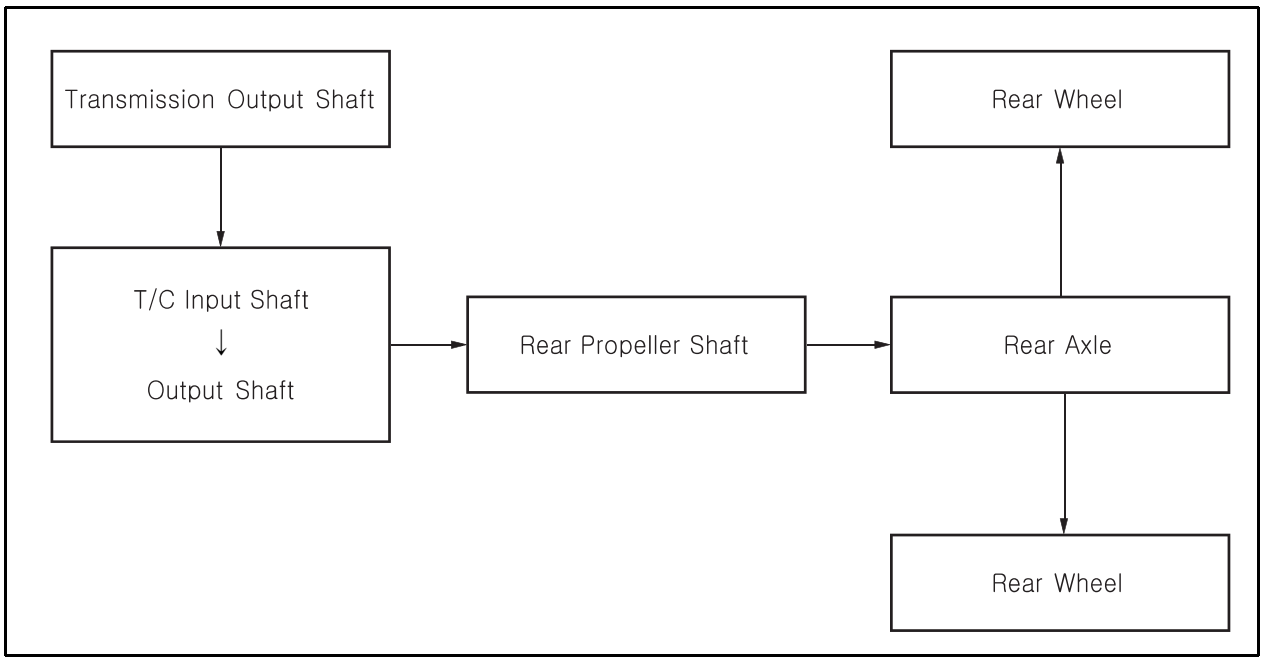


Modification basis	
Application basis	
Affected VIN	

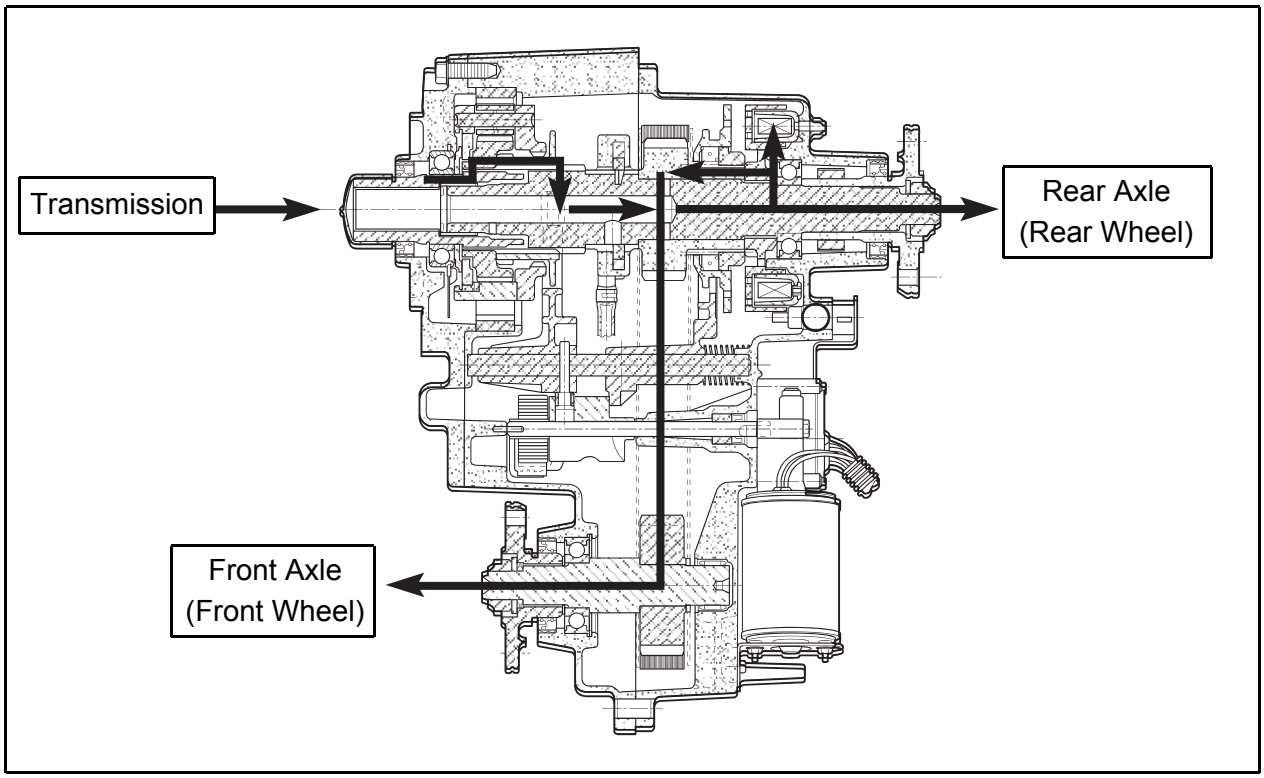
1) 2H MODE (REAR WHEEL DRIVE)



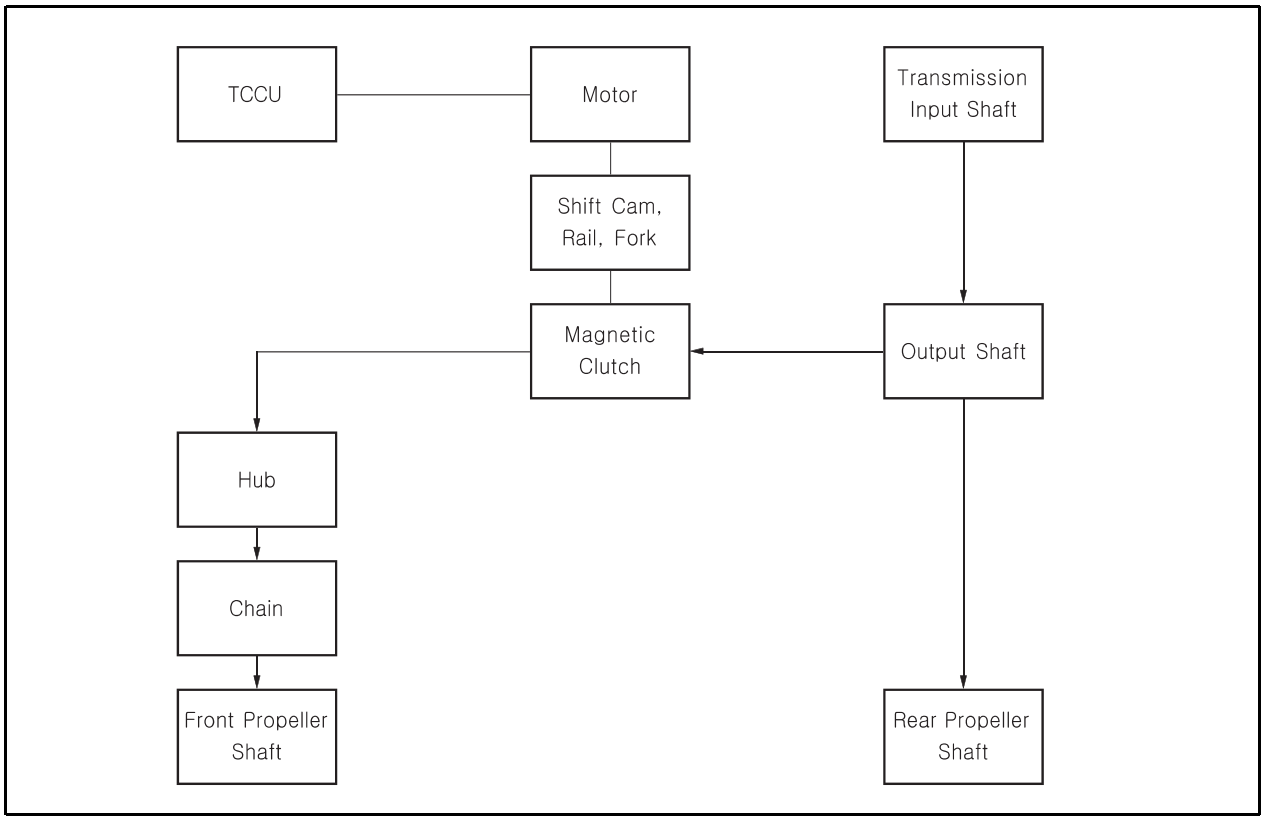
▶ Power Flow



2) 4H MODE (4WD DRIVE - HIGH SPEED)

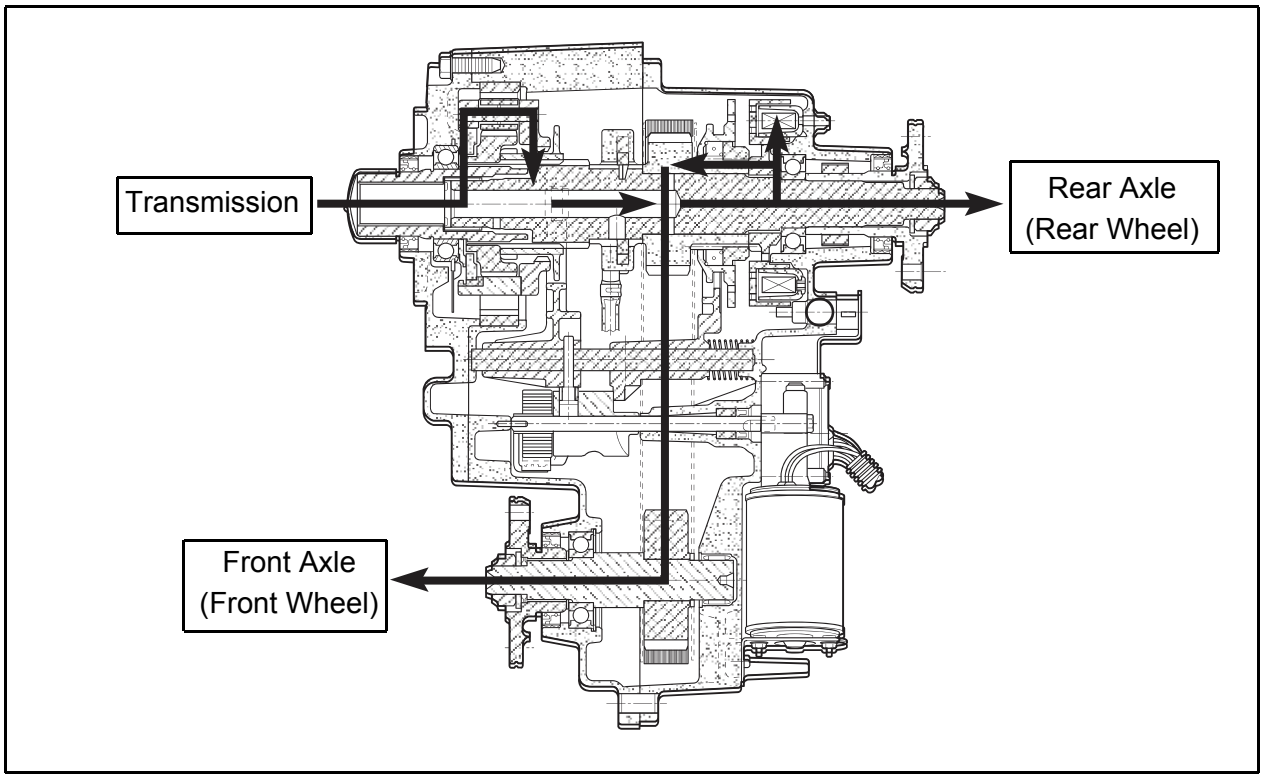


▶ Power Flow

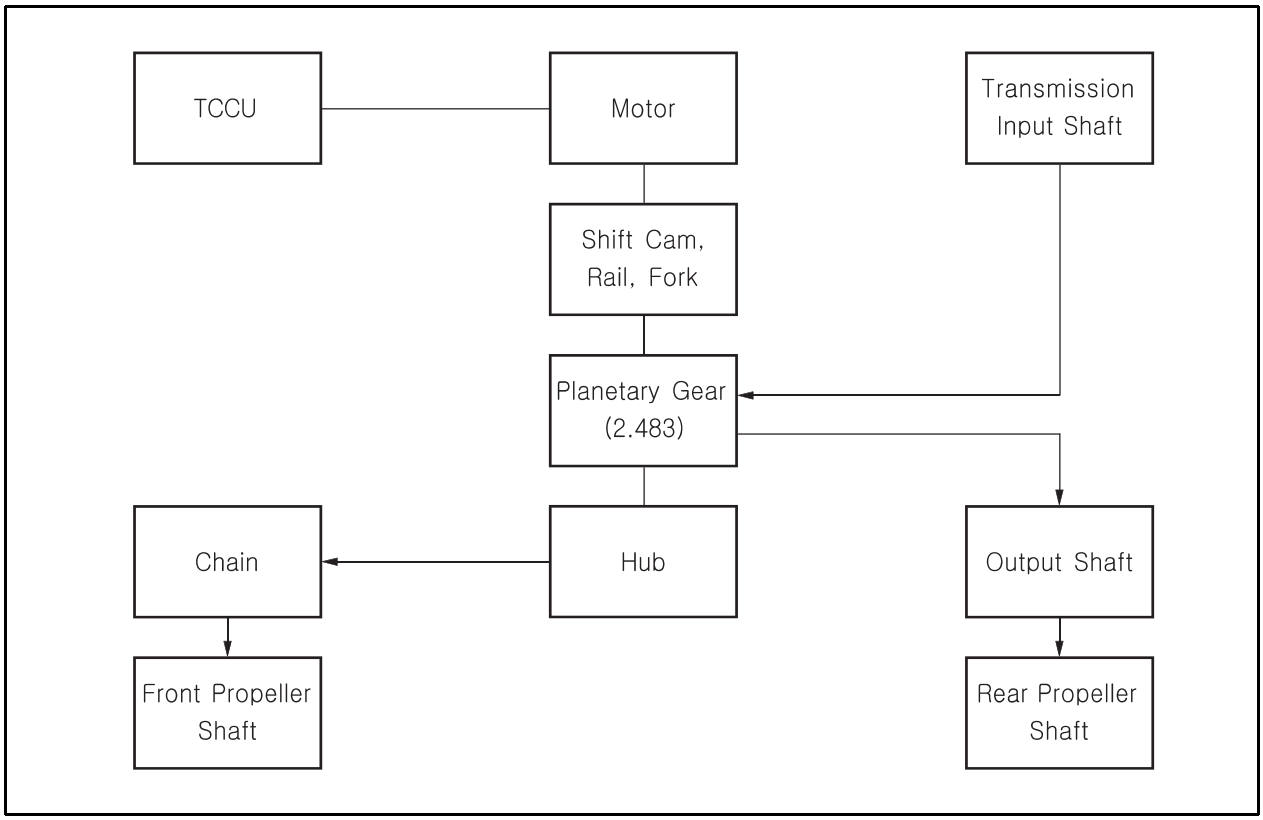


Modification basis	
Application basis	
Affected VIN	

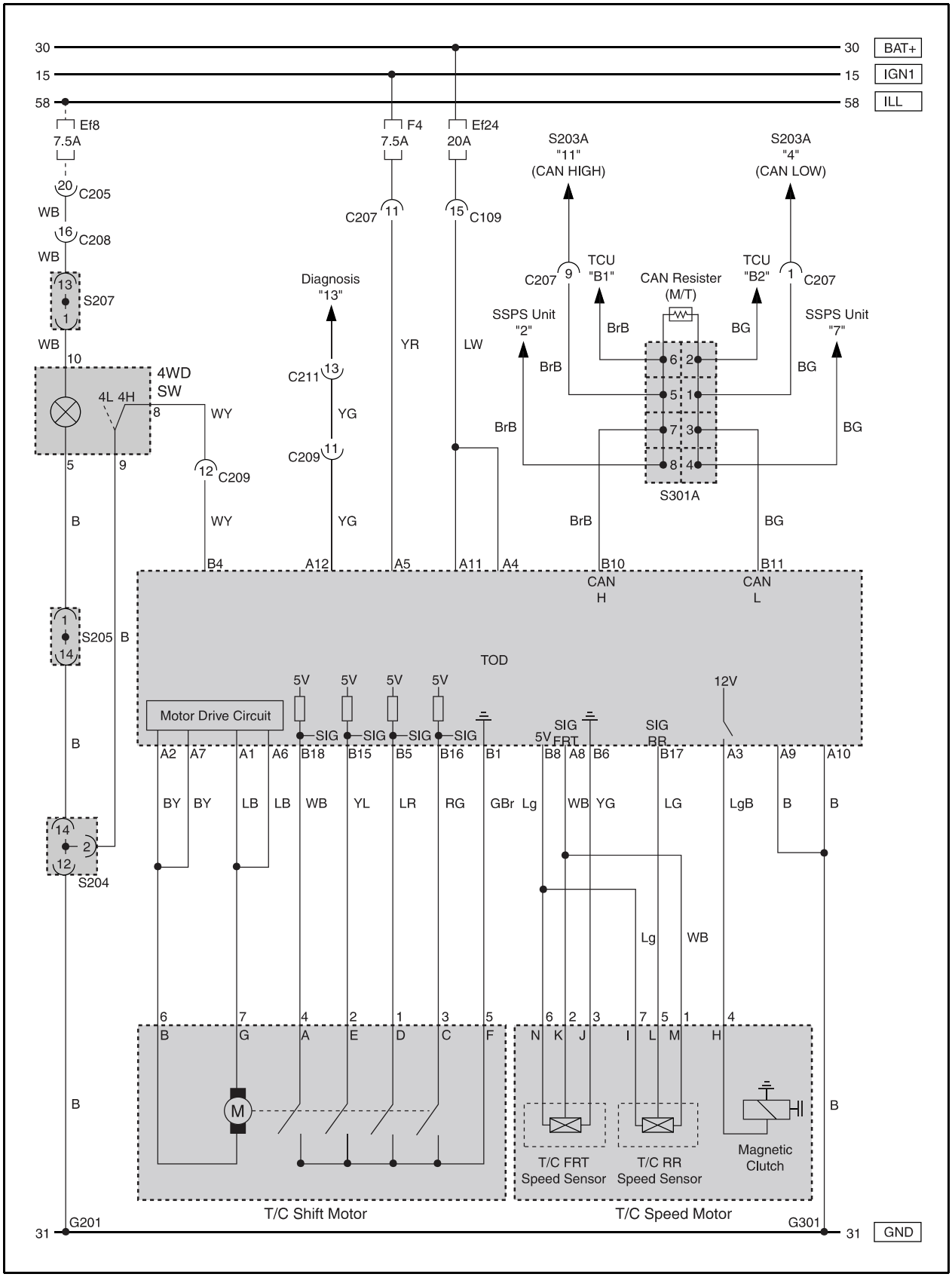
3) 4L MODE (4WD DRIVE - LOW SPEED)



▶ Power Flow



7. CIRCUIT DIAGRAM (DI & 5-SPEED A/T)



Modification basis	
Application basis	
Affected VIN	

TORQUE ON DEMAND(TOD) 3240-01

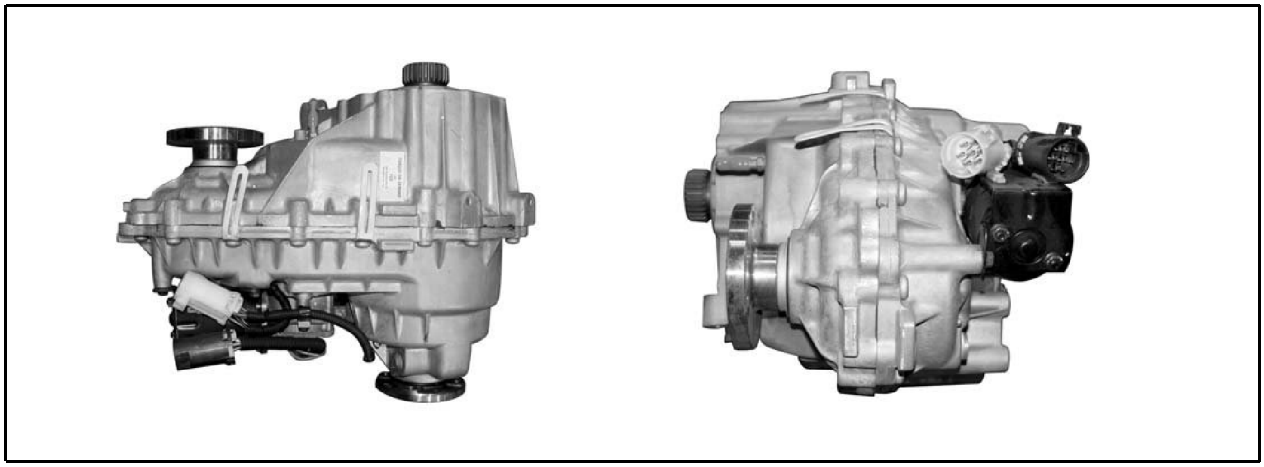
GENERAL

1. SPECIFICATIONS

Description			Specification
TOD	Model		TOD transfer case
	Overall length		343.0 mm
	Weight (including oil)		37.9 kg
	Shifting mode		4H and 4L
	Gear ratio	High	1:1
		Low	2.48:1
	Oil specification	Specification	Ssangyong genuine oil (ATF S-3, S-4 or Dexron II/III)
		Capacity	≒1.4ℓ
		Change interval	Check at every 15,000 km, replace at every 60,000 km
TOD control unit	Maximum torque (front)		Approx. 76 kg•m
	Voltage	Normal operating range	9 ~ 16 V
		CAN communication	6 ~ 16 V
	Current (below maximum operating voltage)	IG switch OFF	2 mA
		IG switch ON	1 A
	Maximum operating current	Motor OFF	7 A
		Motor ON	20 A

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW



TOD system means the full time 4WD system and the registered trade mark of Borg Warner. TOD is an abbreviation of Torque On Demand.

TOD (Torque On Demand) system, which is superior than existing Full Time 4WD, checks the road surface and vehicle conditions via various sensors and, subsequently, according to the situations and conditions, distributes the most optimal driving force to front wheels and rear wheels by activating the electro-magnetic clutch located inside of TOD Transfer Case.

TOD receives the speed signals from speed sensors installed in front axle and rear axle, the TPS signals from engine, and the operating signals from ABS control unit via CAN. Based on these data, TOD control unit controls the electro-magnetic clutch to distribute the 3:97 ~ 44:56 of driving force to front wheels and rear wheels.

The conventional system uses "FR driving" (theoretically, the 100% of driving force is transferred to rear wheels) on normal paved road. When the system detects a slip in the rear wheels, a proper percentage of driving force is transferred to front wheels.

TOD control unit receives the wheel speed signals from the speed sensors in propeller shaft of transfer case and engine output information from the engine control unit. TOD control unit changes the pressure force of the electromagnetic clutch based on the analyzed data.

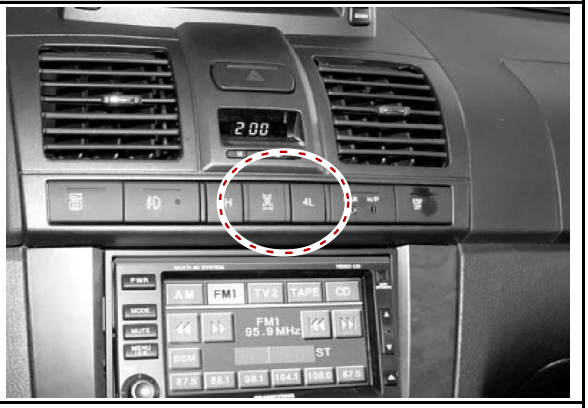
Modification basis	
Application basis	
Affected VIN	

1) Distribution of Driving Force According to Road Surface

1. On normal road surface In vehicle with existing part time transfer case, when a driver turns the steering wheel to park in the 4WD mode, the vehicle may halt sensation of tight corner braking phenomena. However, in vehicle with TOD system, this phenomena does not occur and the driving force is properly and automatically distributed.
2. On paved road with high speed Driving at high speed on roads such as highway mainly uses rear wheels as driving wheel. At this moment, some of torques is also distributed to front wheels so that the vehicle could maintain safe ground grab capacity against side winds and rain. Distribution ratio: 15% for front wheels and 85% for rear wheels.
3. When turning on the road with low friction rate During cornering on roads such as unpaved, snowy, icy and muddy, ground grab capacity is increased by distributing required torque and, at the same time, comfortable steering operation is maintained by controlling the ground grab capacity at high level.
   Distribution ratio: 30 % for front wheels and 70 % for rear wheels.
4. When climbing or starting off on the road with low friction rate In order to secure the maximum ground grab capacity and driving force during climbing or starting off on the roads such as unpaved, snowy and icy road, the system controls the driving force to distribute properly in full 4WD mode. Distribution ratio: 50 % for front wheels and 50 % for rear wheels.

2) Function

Selection Mode



The TOD system has 2 selectable mode, 4H and 4L. 4H is the normal operating mode when drive of which gear ratio is 1:1 and 4L mode distributes power to front and rear wheels 50 : 50 of which gear ratio is 2.48:1.

▶4L Mode

When selecting 4L mode, EMC is locked to apply maximum torque into front and rear propeller shafts. Shift motor rotates also 4L position by rotation of cam thus propeller shaft torque changes from 1:1 to 2.48:1 by planetary gear set.

▶Releasing the 4L Mode

When selecting 4H mode, 4L drive mode is released and 4H mode is resumed.

- "4H" switch: Self-return type
- "4L" switch: Push lock type

3) 4WD Operation Overview

Application	Mode Position		Operation Condition
Driving type	4H	4WD Drive (High Speed)	Normal Driving on the normal road or highway, or high speed driving. Slipped road such as snow, rainy, sand, mud etc.
	4L	4WD Drive (Low Speed)	Max driving force requiring condition such as towing, rough road. Same function as part time transfer case 4L.
Transferring	4H ↔ 4L	4WD Drive High Speed ↔ Low Speed	A vehicle should stop for transfer. Manual Transmission • Transfer starts after the vehicle stops and the clutch is applied Automatic Transmission • Transfer starts after the vehicle stops and the shift lever is shifted [N] position.

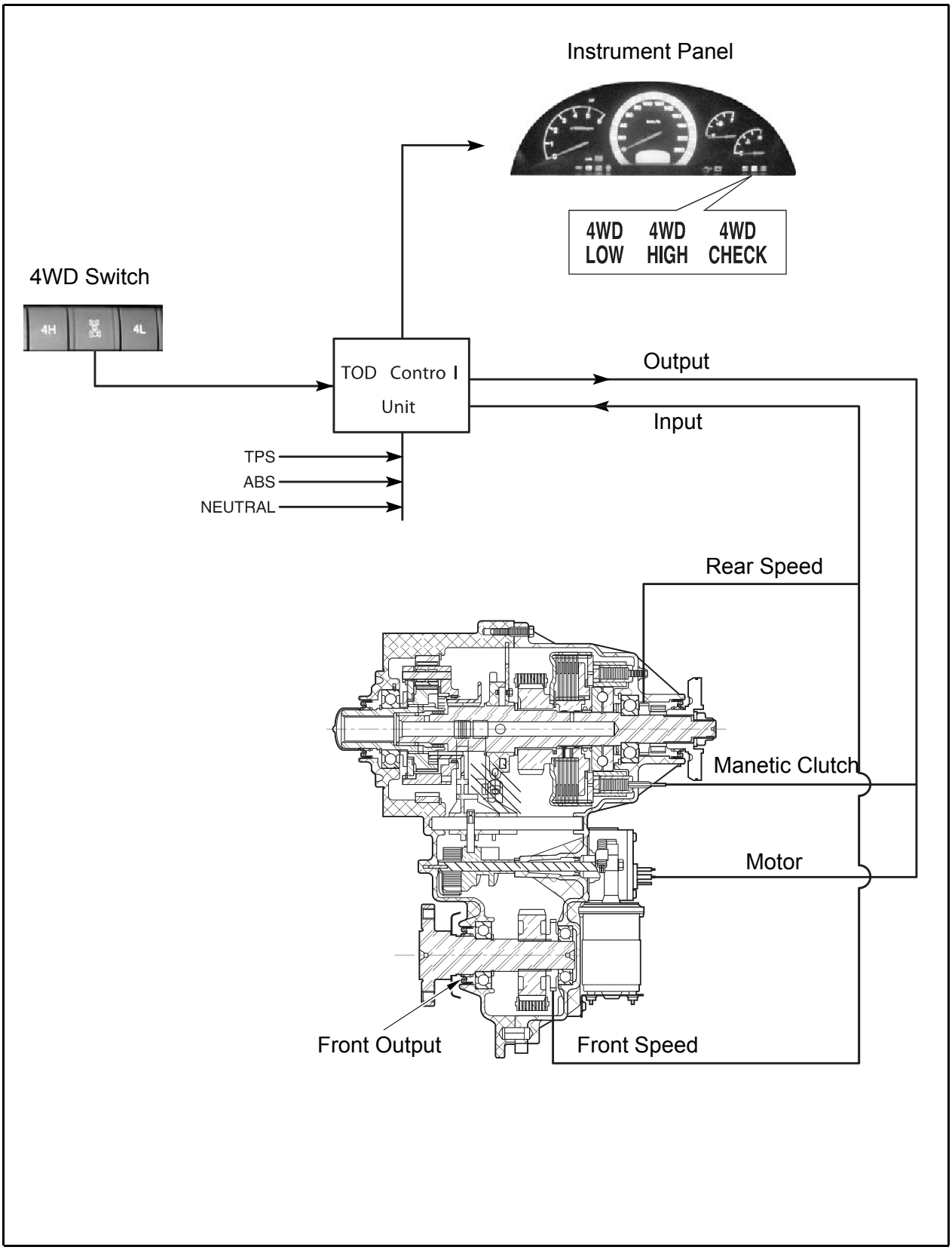
CAUTION

- To make the mode shift easier, stop the vehicle, depress the brake pedal, select the mode switch, and move the selector lever with the sequence of [N-P-N].

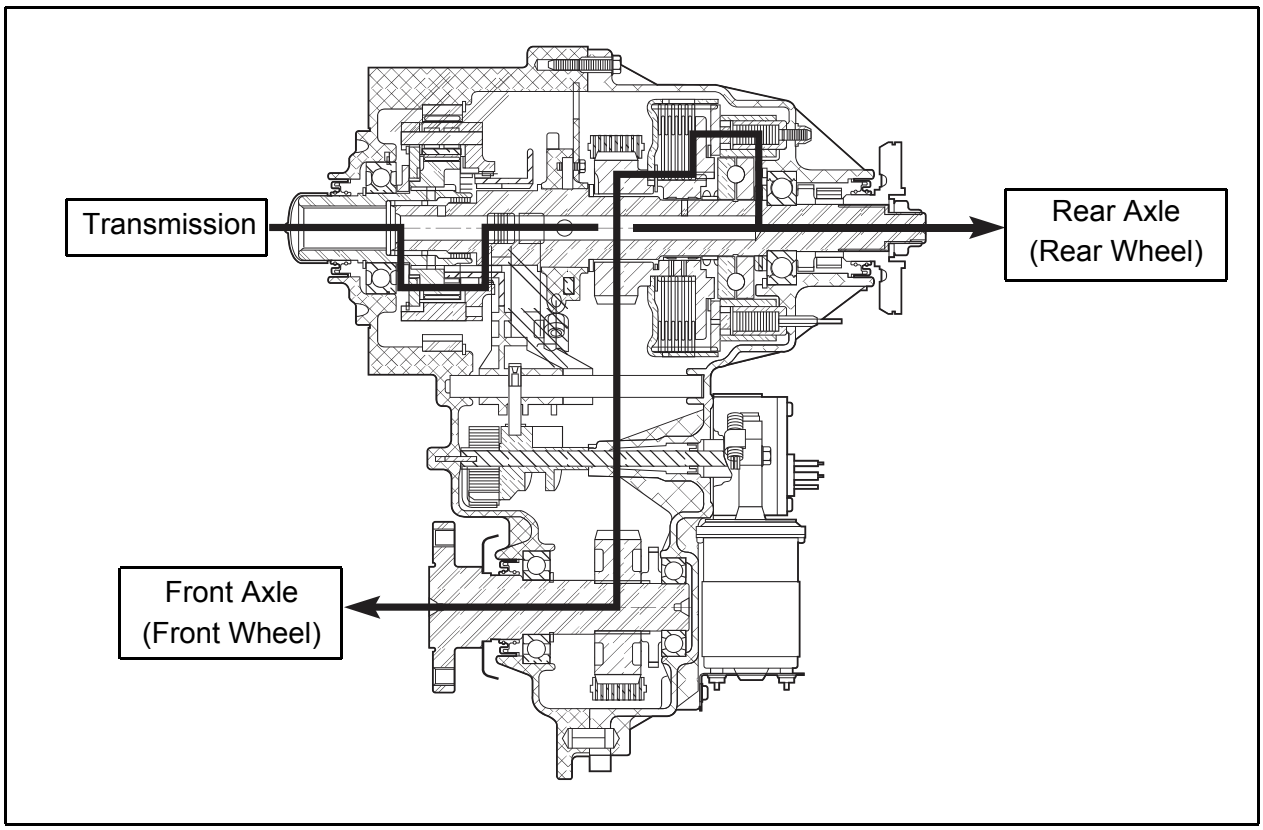
Modification basis	
Application basis	
Affected VIN	

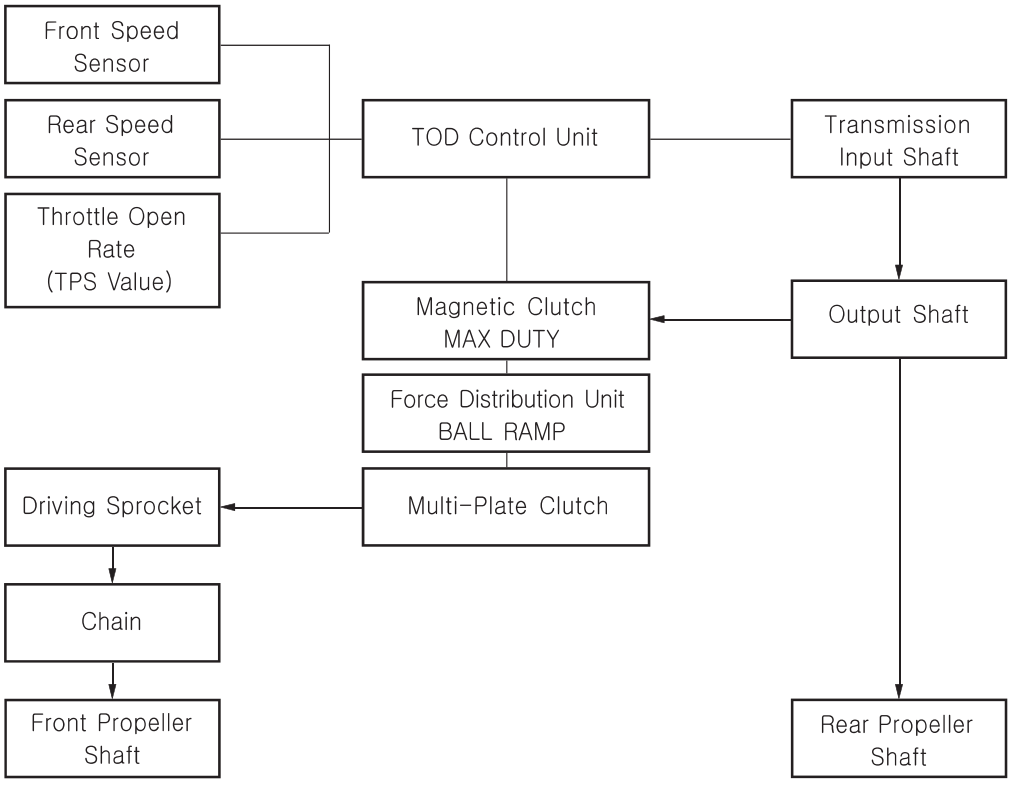
2. POWER FLOW

▶ System Layout



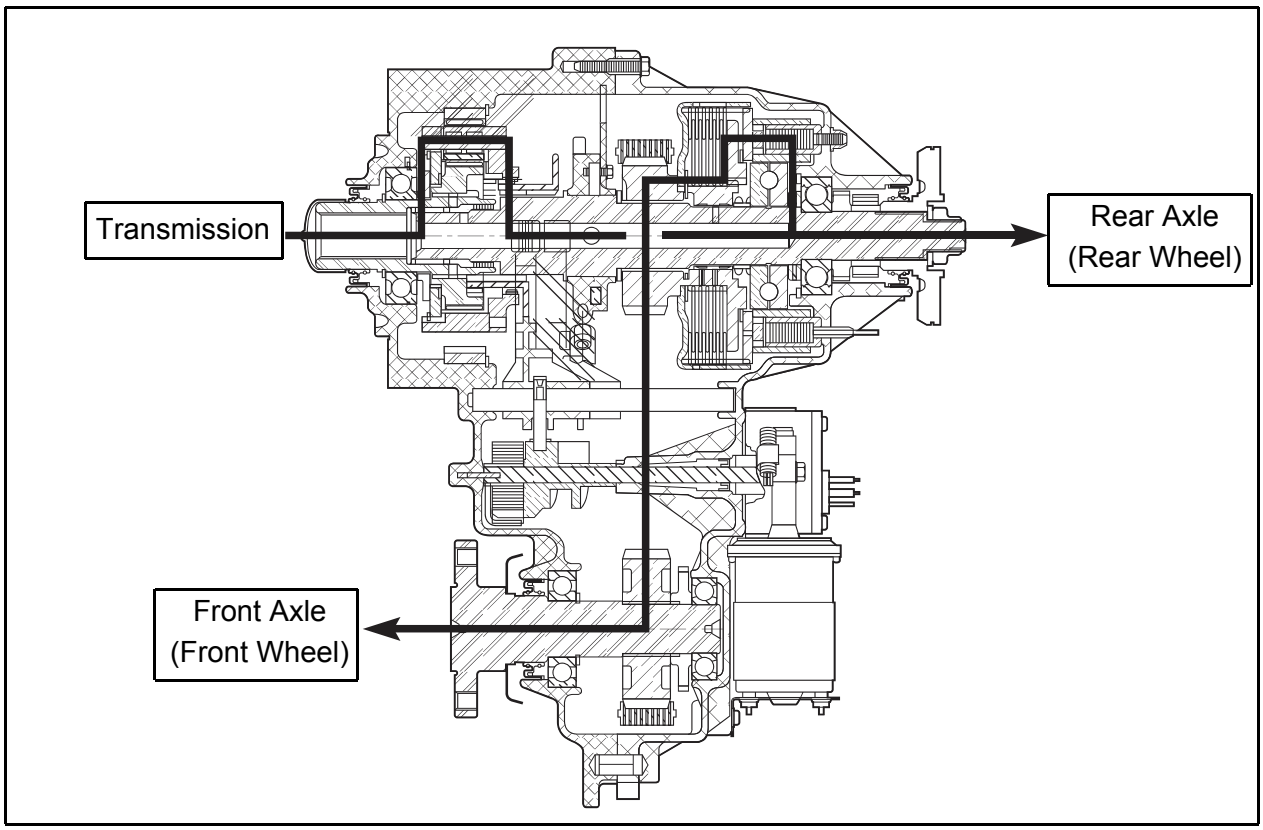
▶ 4H Mode (4WD Drive - High Speed)

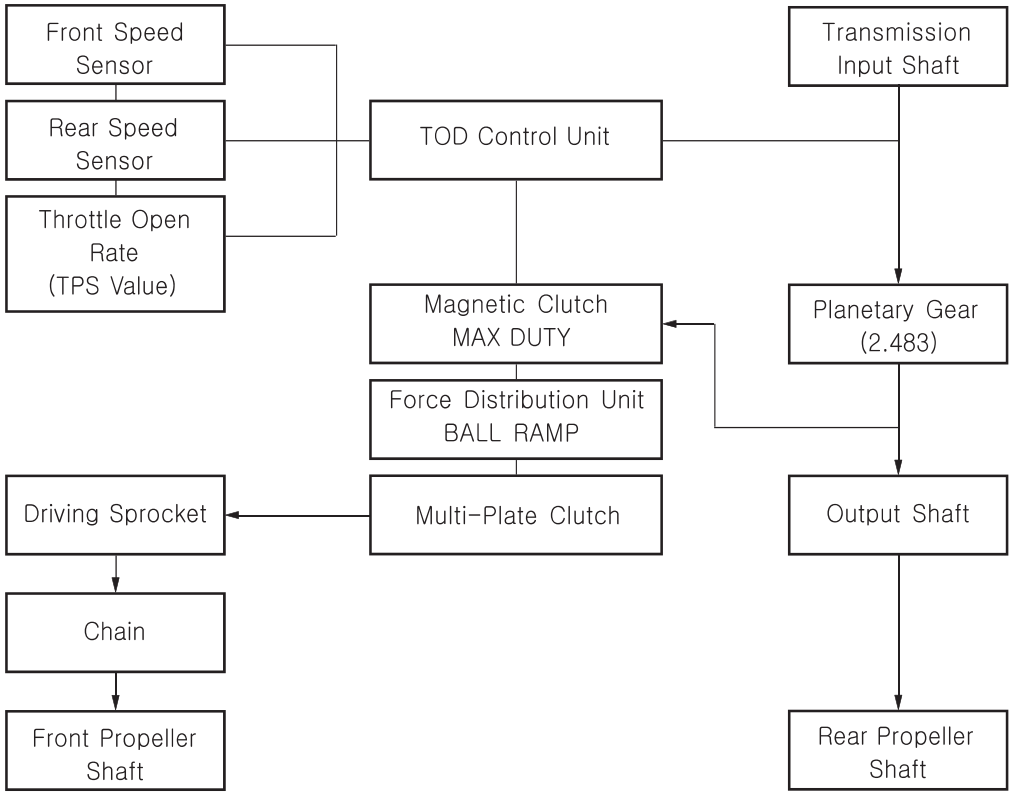




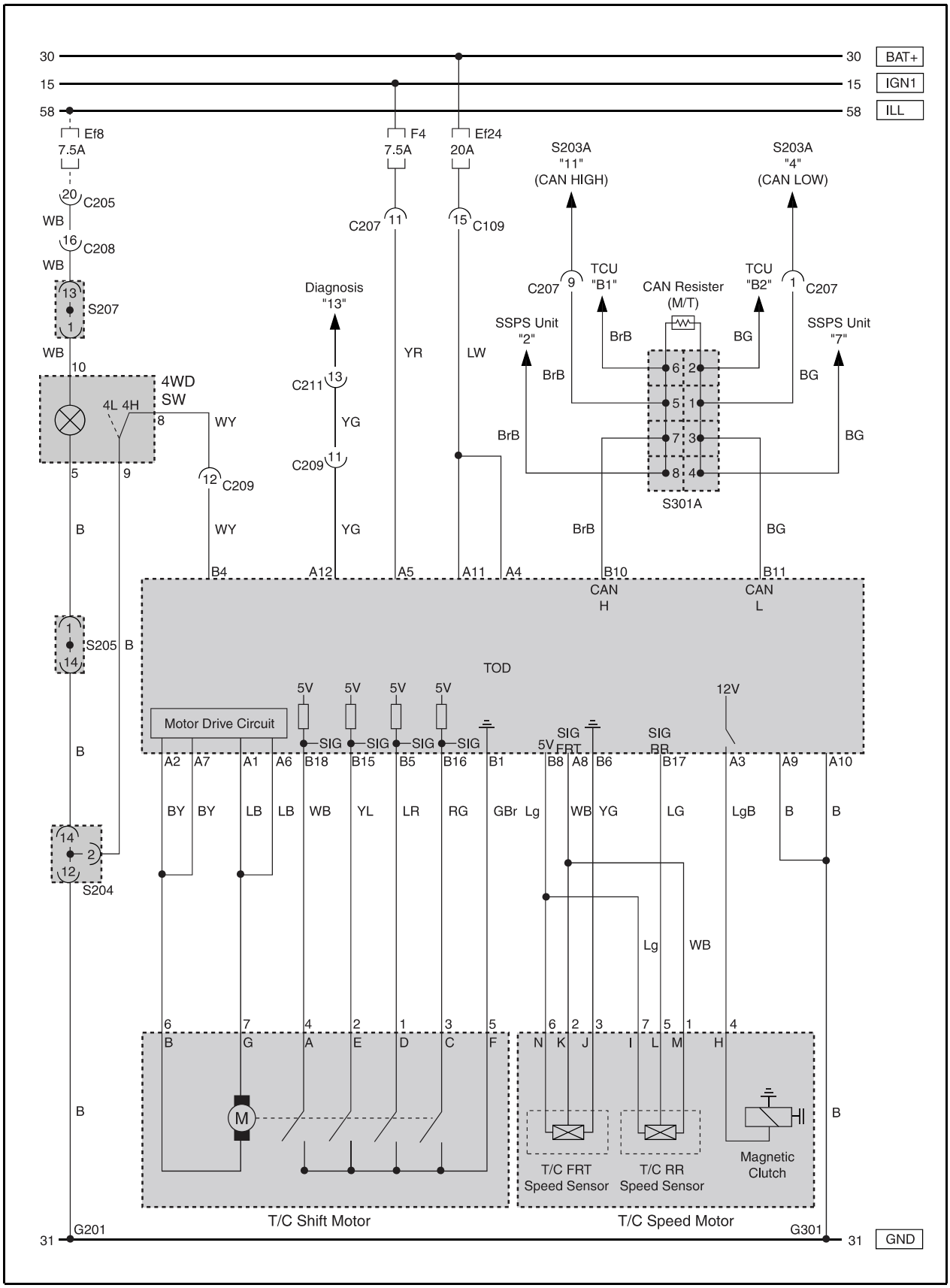
Modification basis	
Application basis	
Affected VIN	

▶ 4L Mode (4WD Drive - Low Speed)





3. CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

AXLE

4120-01

GENERAL

1. SPECIFICATIONS

1) FRONT AXLE

Description	Specification	
Axle shaft type	Semi-floating	
Axle housing type	Build up	
Differential	Type	Conventional type
	Gear type	Hypoid Gear
Final gear reduction ratio	DI engine + M/T	3.73
	DI engine + A/T	3.31
	Gasoline engine + A/T	4.27
Oil	Capacity	1.9ℓ (DI engine: 2.2ℓ)
	Specification	SAE 80W/90 or API GL-5

2) REAR AXLE

Description	Specification	
Axle shaft type	Semi-floating	
Axle housing type	Build up	
Differential	Type	Conventional type
	Gear type	Hypoid Gear
Final gear reduction ratio	DI engine + M/T	3.73
	DI engine + A/T	3.31
	Gasoline engine + A/T	4.27
Oil	Capacity	1.9ℓ (DI engine: 2.2ℓ)
	Specification	SAE 80W/90 or API GL-5

PROPELLER SHAFT

3310-01

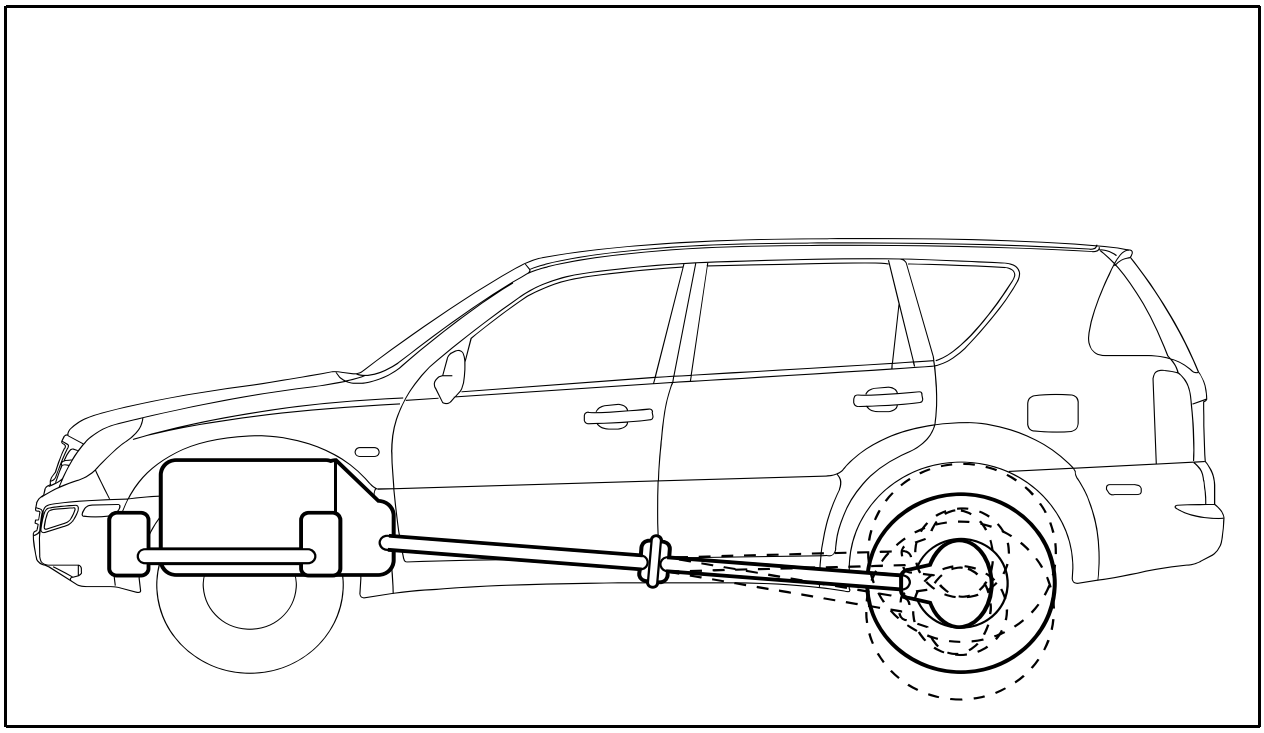
GENERAL

1. SPECIFICATION

Description	Specification		
Structure			Yoke and spider type universal joint
Joint type			Spider (Needle roller bearing)
Number of spiders	Front	Full time T/C	1
		Part time T/C	2
	Rear		3
Outer diameter of spider (mm)			ϕ17.91
Tube run-out (after installation)			below 0.4 mm
Front shaft dimension Length x Inner diameter x Outer diameter (mm)	Diesel + M/T(A/T) + 4408 TC (Part time)		607.1 x ϕ 59.5 x ϕ 63.5 (compressed)
	Gasoline + M/T(A/T) + 4421 TC (TOD)		577.9 x ϕ 44.7 x ϕ 50.8 (center position)
Front shaft dimension Length x Inner diameter x Outer diameter (mm)	Diesel + M/T(A/T) + 4408 TC		(585.2 + 567.5) x ϕ 59.5 x ϕ 63.5 (compressed)
	Gasoline + M/T(A/T) + 4421 TC		(566.1 + 567.5) x ϕ 59.5 x ϕ 63.5 (compressed)
Unbalance	below 30 g·cm @ 4500 rpm (Front shaft + Part time TC, Rear shaft)		
	below 14.5 g·cm @ 5300 rpm (Front shaft + Full time TC)		
Front shaft dimension Length x Inner diameter x Outer diameter (mm)	DI engine + M/T(A/T) + Part time TC		575.7 x ϕ 59.5 x ϕ 63.5 (compressed)
	DI engine + M/T(A/T) + Full time TC		560.8 x ϕ 44.7 x ϕ 50.8 (center position)
Front shaft dimension Length x Inner diameter x Outer diameter (mm)	DI engine + M/T(A/T) + Part time TC		(565.9 + 547.6) x ϕ 59.6 x ϕ 63.5 (compressed)
	DI engine + M/T(A/T) + Full time TC		

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW



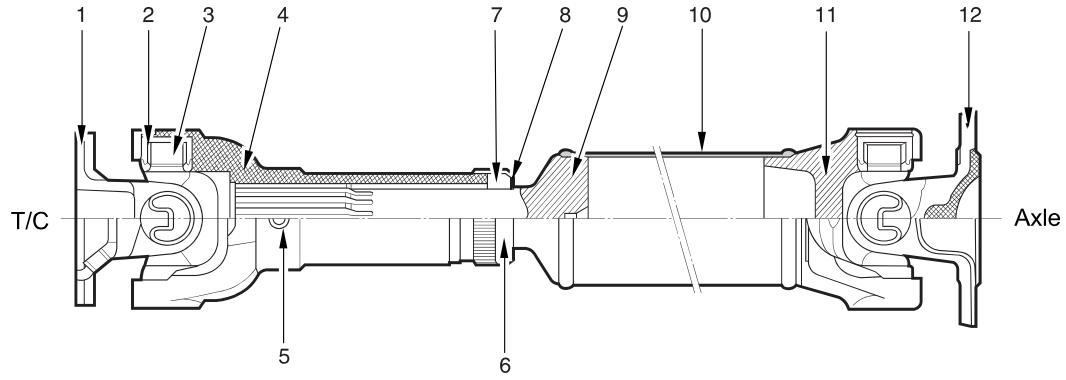
The propeller shaft transfers the power through the transmission and transfer case to the front/rear axle differential carrier (final reduction gear).
It is manufactured by a thin rounded steel pipe to have the strong resisting force against the torsion and bending.
Both ends of propeller shaft are connected to the spider and the center of propeller shaft is connected to the spline to accommodate the changes of the height and length.
The rubber bushing that covers the intermediate bearing keeps the balance of rear propeller shaft and absorbs its vibration.

Modification basis	
Application basis	
Affected VIN	

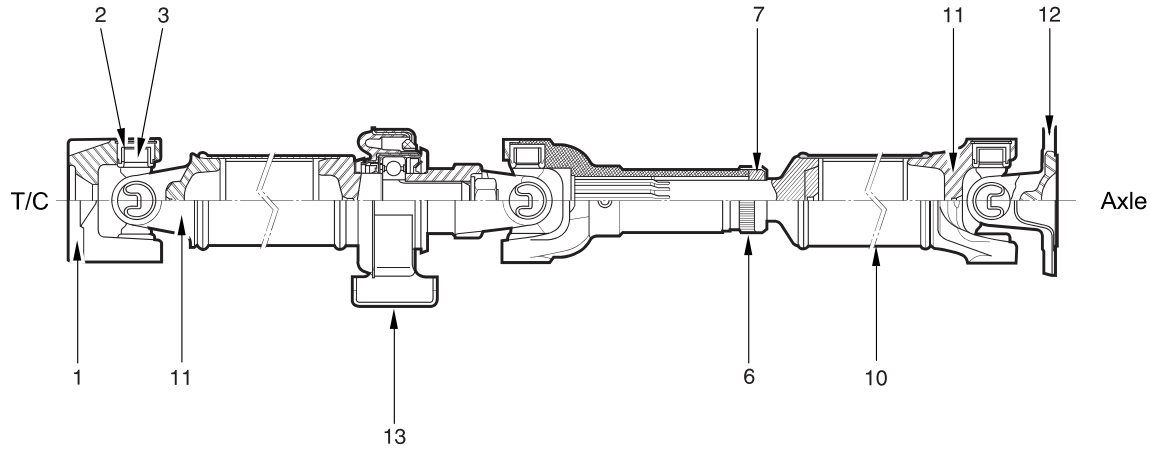
2. COMPONENT LOCATOR

▶ Cross Sectional View

Front Propeller Shaft

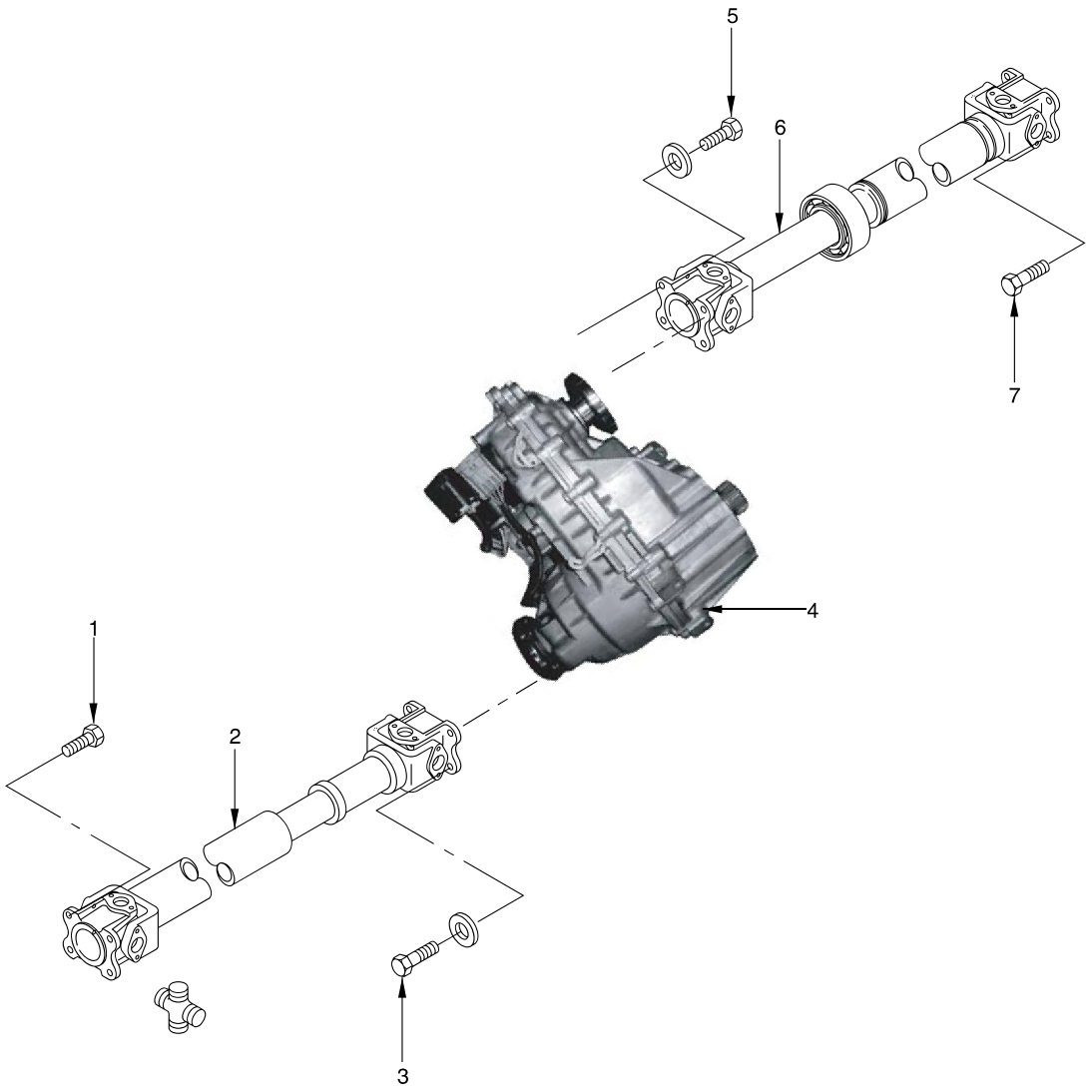


Rear Propeller Shaft



1. Flange yoke
2. Journal bearing cap
3. Spider journal
4. Slip yoke assembly
5. Grease nipple
6. Dust cap
7. Oil seal
8. Split washer
9. Slip tube shaft
10. Tube
11. Tube yoke
12. Flange yoke
13. Center bearing

▶ PROPELLER SHAFT ASSEMBLE



1. Bolt
2. Front propeller shaft
3. Bolt
4. Transfer case
5. Bolt
6. Rear propeller shaft
7. Bolt

Modification basis	
Application basis	
Affected VIN	

STEERING SYSTEM

4620-01

GENERAL

1. SPECIFICATIONS

Description			Specification
Steering wheel	Type		4-spoke type
	Outer diameter (mm)		390
Steering gear box	Type		Rack and pinion
	Gear ratio		∞
	Steering angle	Inner	36° 17'
		Outer	32° 40'
Oil pump	Type		Vane type
	Maximum pressure (kgf/cm²)		85 ~ 92
	Displacement (ℓ /min)		10.5
	Pulley size (mm)		124
Tilt column adjusting angle	Up		4°
	Down		8°
Minimum turning radius	(m)		5.7
Oil	Specification		ATF Dexron II or III
	Capacity (ℓ)		1.1

2. TIGHTENING TORQUE

Description		Kgf•m	Nm
Steering column shaft	Steering column mounting bolt (upper)	2.0 ~ 2.5	20 ~ 25
	Steering column mounting bolt (lower)	1.8 ~ 2.5	18 ~ 25
	Steering wheel and steering column shaft lock nut	4.0 ~ 6.0	40 ~ 60
	Steering column and airbag module connection bolt	0.7 ~ 1.1	7.0 ~ 11
	Steering column and lower shaft connection bolt	2.5 ~ 3.0	25 ~ 30
Power steering gear box	Steering gear box and gear box cross member mounting bolt	10.0 ~ 13.0	100 ~ 130
	Steering gear box and lower shaft connection bolt	2.5 ~ 3.0	25 ~ 30
	Tie rod end and steering lock connection nut	3.5 ~ 4.5	35 ~ 45
	Tie rod end lock nut	6.5 ~ 8.0	65 ~ 80
	Steering gear box and pressure hose connection nut	1.2 ~ 1.8	12 ~ 18
	Steering gear box and return line connection nut	1.2 ~ 1.8	12 ~ 18
Power steering pump	Power pump bracket and timing gear case cover mounting bolt	2.0 ~ 2.3	20 ~ 23
	Power pump and pressure hose connection nut	4.0 ~ 5.0	40 ~ 50
Power steering line	Return line and cilp connection bolt	0.9 ~ 1.4	9.0 ~ 14

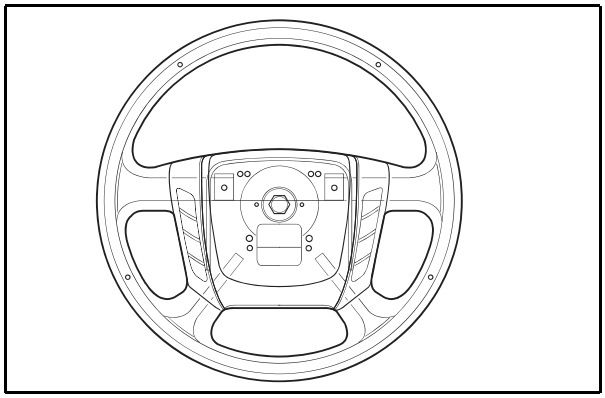
Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

When colliding the steering wheel and column release the impact by the steering wheel and also are designed in order that the steering column shaft may be folded or absorb the impact.
The steering column has the ignition switch and lock cylinder. If removing the ignition key with the ignition switch in "LOCK" position, the lock cylinder locks the steering wheel.

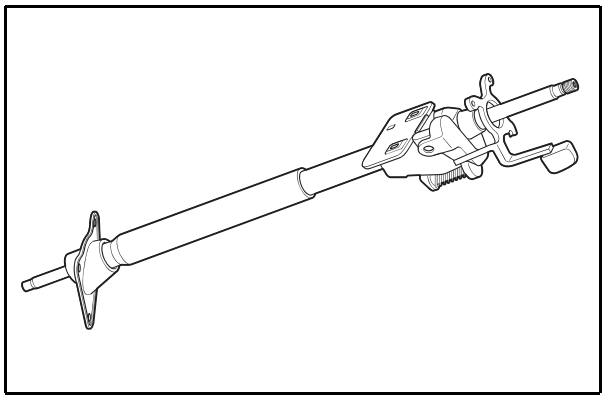
1) Steering Wheel



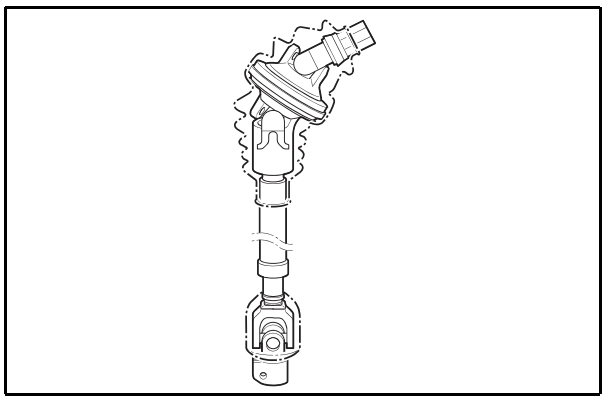
Type	4-spoke type
Outer Diameter	390 mm
Material	Forming PU/leather

The vibration damper absorbs the vibration from vehicle to minimize it.

2) Column and Shaft Assembly



3) Lower Shaft

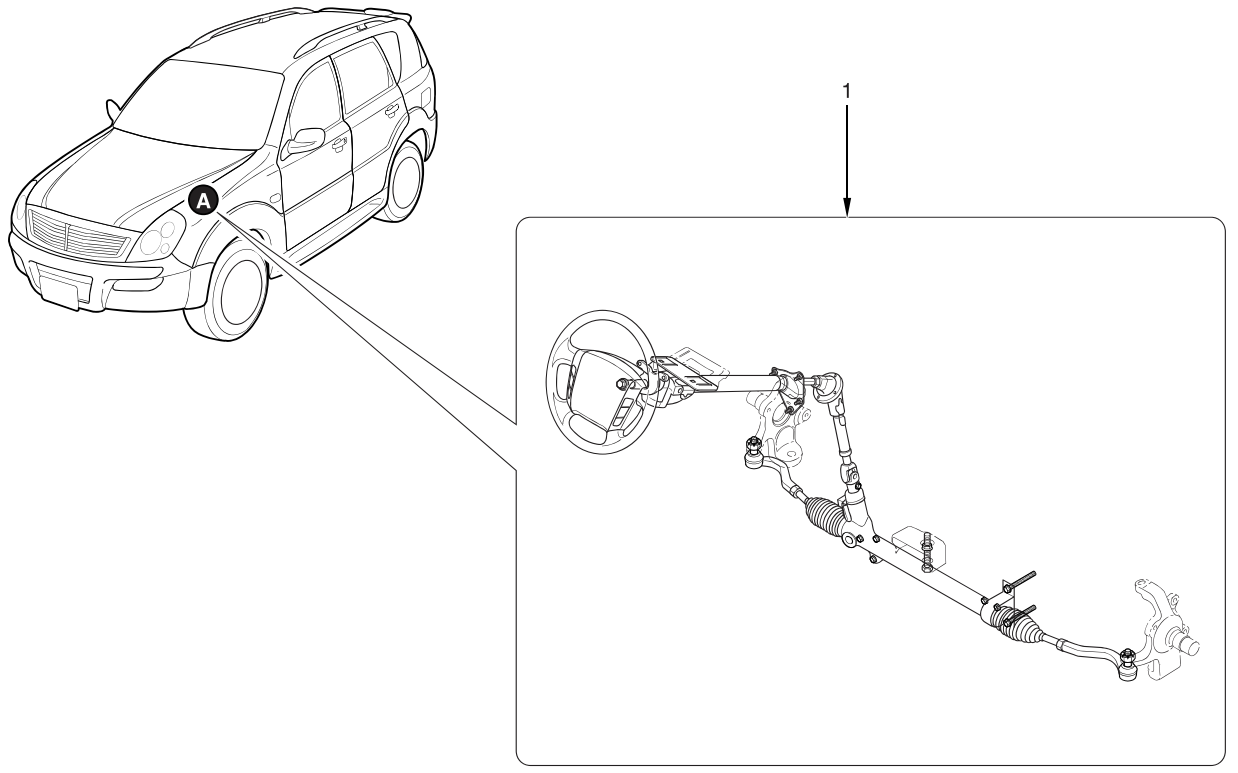


Type	Double cardan constant velocity joint
Angle	62 ~ 68°
Composition	CV joint (top) Hook joint (bottom) Elastic sleeve

This minimizes the torque changes due to angular speed changes.

2. COMPONENT LOCATOR

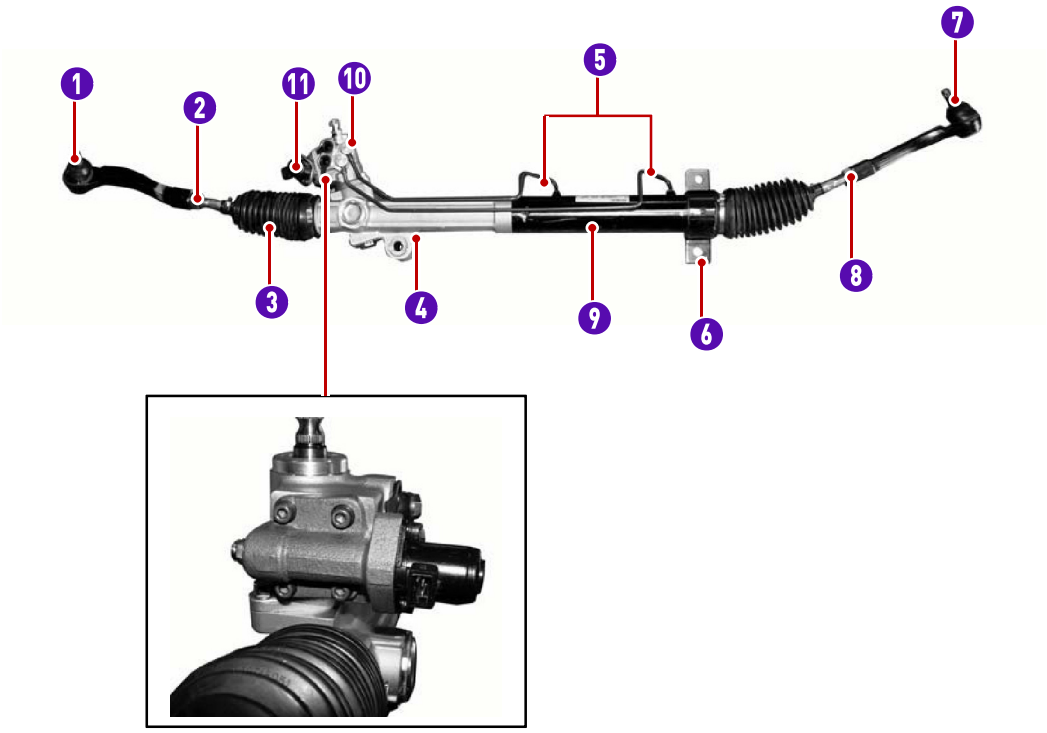
1) System Layout



A. Installation point	1. Steering components

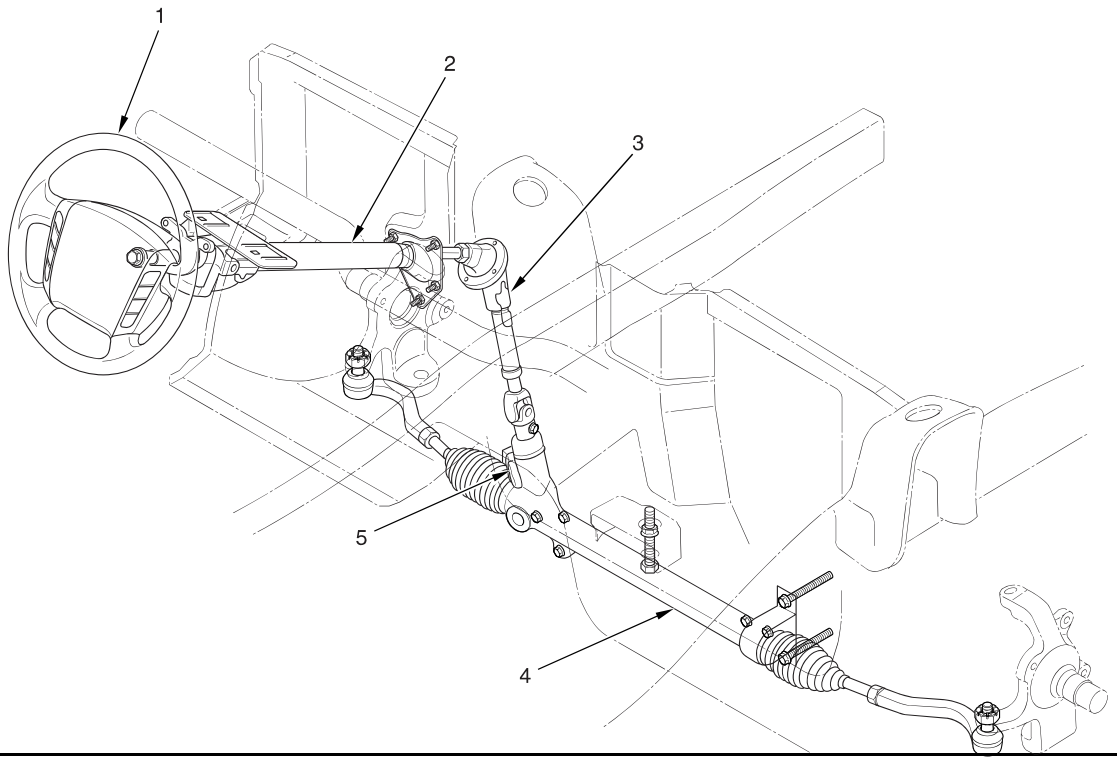
Modification basis	
Application basis	
Affected VIN	

2) Sctional View of Steering Gear Box



1. Tie rod end
2. Tie rod
3. Bellows
4. Rack housing
5. Feed tube
6. Mounting bracket
7. Tie rod end
8. Tie rod
9. Cylinder tube
10. Valve assembly
11. ECPS solenoid valve

3) Steering Column Assembly



1. Steering wheel
2. Column shaft assembly
3. Lower shaft assembly
4. Steering gear assembly
5. ECPS solenoid valve

Modification basis	
Application basis	
Affected VIN	

SUSPENSION

4411-01

GENERAL

1. SPECIFICATIONS

1) FRONT SUSPENSION SPECIFICATIONS

Description		Specification
Suspension type		Double wishbone
Spring type		Coil spring
Shock absorber type		Cylindrical double tube (gas type)
Stabilizer type		Torsion bar
Wheel alignment	Toe-in	2 ± 2 mm
	Camber	0° ± 30° (the difference between both ends is should be below 30°)
	Caster	3° ± 30° (the difference between both ends is should be below 30°)

2) REAR SUSPENSION SPECIFICATIONS

Symptom	Cause	Action
Vehicle rolling	Broken stabilizer bar	Replace
	Faulty shock absorber	Replace
Abnormal noises	Loosening mountings	Re-tighten
	Damaged or worn wheel bearing	Replace
	Damaged shock absorber	Replace
	Damaged tire	Replace
Poor riding	Over inflated tire	Pressure adjust
	Faulty shock absorber	Replace
	Loosened wheel nut	Tighten as specified torque
	Bent or broken coil spring	Replace
	Damaged tire	Replace
	Worn bushing	Replace
Vehicle pulls to right or left	Deformed arm assembly	Replace
	Worn bushing	Replace
	Bent or broken coil spring	Replace
Hard steering	Incorrect front wheel alignment	Repair
	Excessive resistance of lower arm ball joint	Replace
	Insufficient tire pressure	Adjust
	Faulty power steering	Repair or replace
Steering instability	Incorrect front wheel alignment	Repair
	Worn or loosened lower arm bushing	Re-tighten or replace
Vehicle bottoming	Worn or broken coil spring	Replace

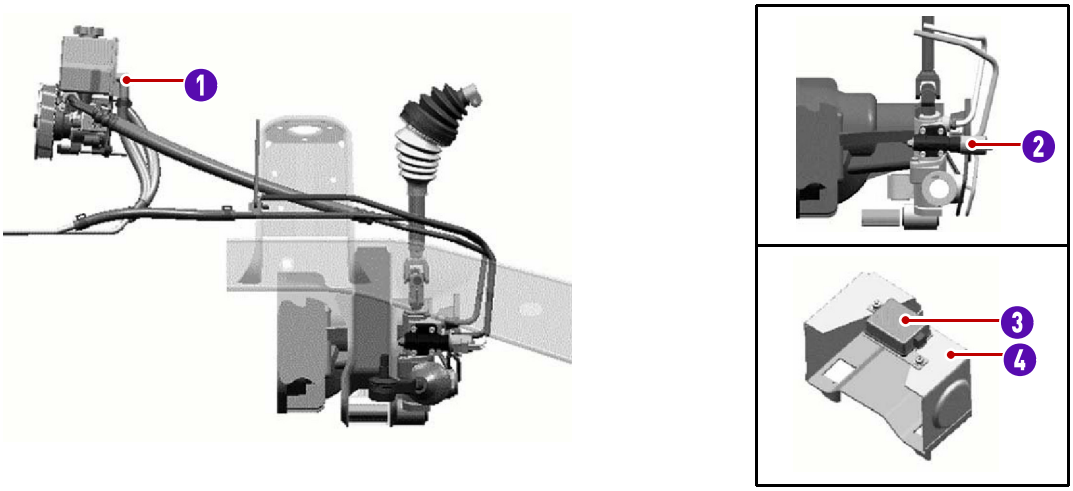
Modification basis	
Application basis	
Affected VIN	

ECPS(ELECTRONIC CONTROL POWER STEERING) 4620-01

GENERAL

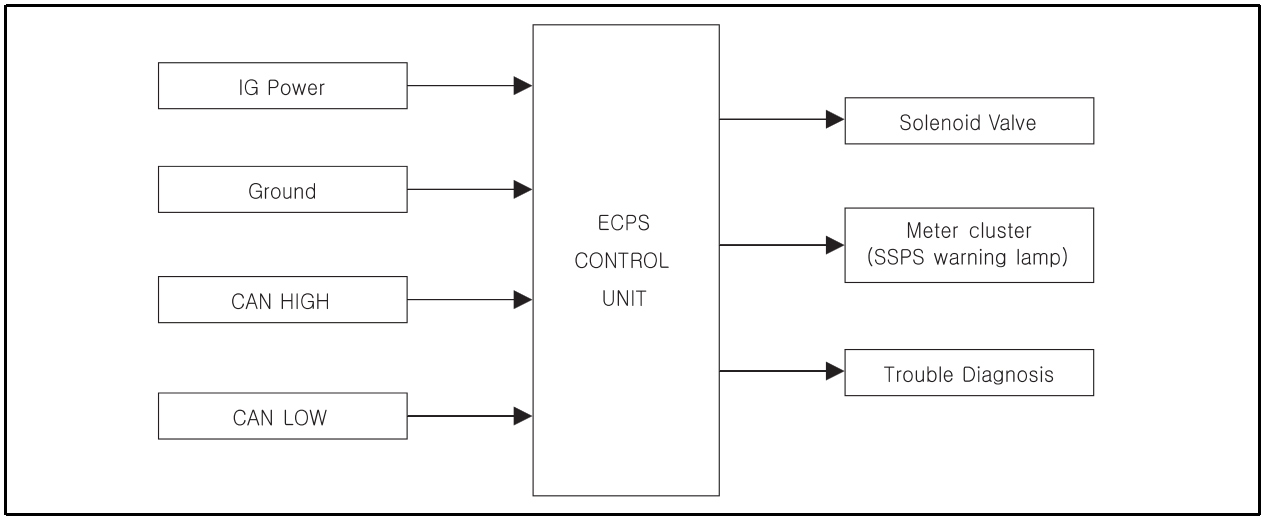
1. OVERVIEW

In traditional constant power assist steering system, the steerability gets lighter as vehicle speed rises, and this may cause dangerous situation. Where as having heavy steerability in high speed driving makes it difficult to manipulate the steering wheel when vehicle is in stop. This steering system solve this problem as the steerability is changed according to the vehicle speed, which is called Speed Sensitive Power Steering (SSPS).
SSPS, by providing appropriate steerability to driver according to the changes of vehicle speed, gives steering stability.
In other words, the steering wheel gets lighter by adjusting steerability in stop or low speed and provides steering stability by adjusting steering wheel to become heavier in high speed.
SSPS system applied in Rexton is ECPS (Electronic Control Power Steering: Hydraulic Pressure Reaction Force Control) type that allows to change the steerability according to the vehicle speed. The power steering control unit adjusts the hydraulic pressure to reaction plunger by controlling the pressure solenoid valve located in gear box to optimize the steerability.



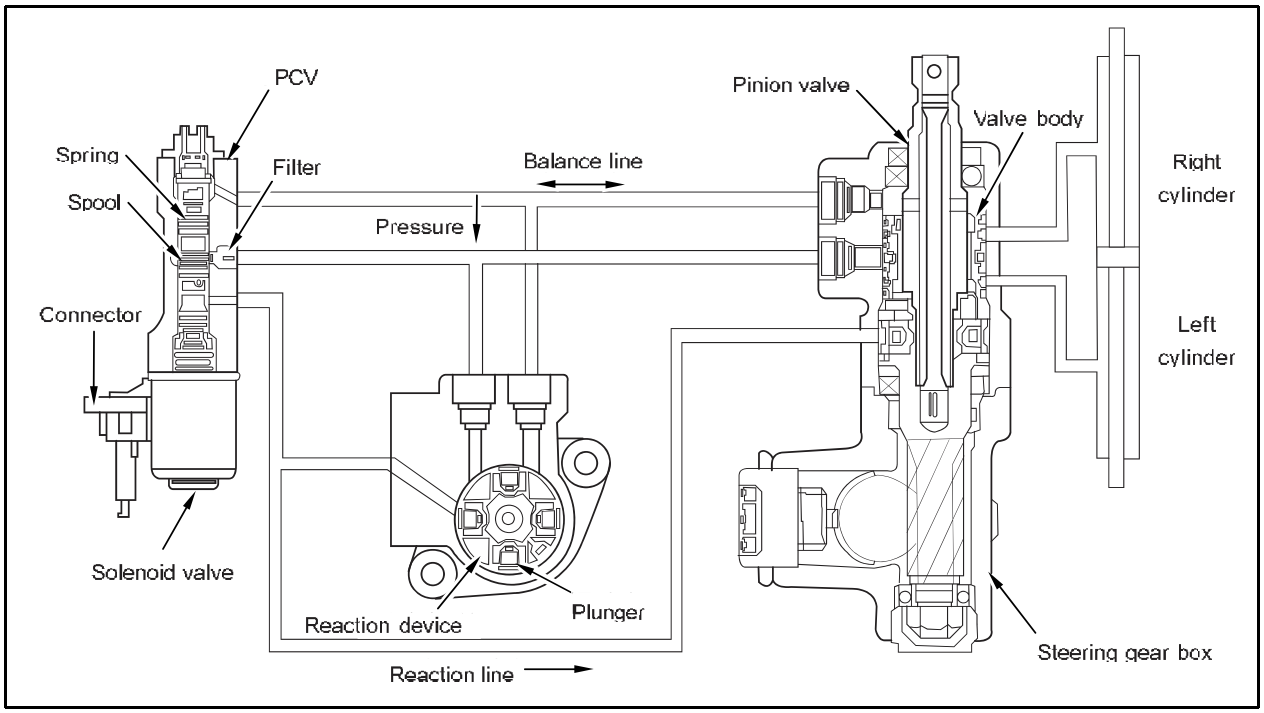
1. Pump
2. Solenoid valve
3. Control unit
4. Jack bracket

2. INPUT/OUTPUT OF ECPS CONTROL UNIT



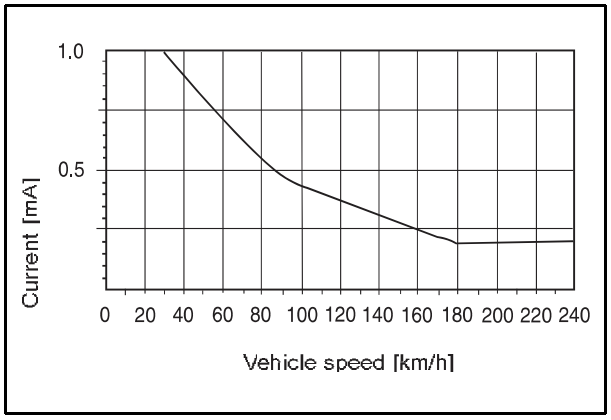
Modification basis	
Application basis	
Affected VIN	

3. ECPS CONFIGURATION



- PCV (Pressure Control Valve)
  This valve controls the hydraulic pressure supplied to reaction device by moving the spool valve according to the changes of solenoid valve.
- Reaction device
  This device increases the steerability effect by binding the input shaft with supplied hydraulic pressure from PCV.
- Solenoid valve
  This valve determines the valve spool position in PCV with the electric current supplied from ECPS control unit.

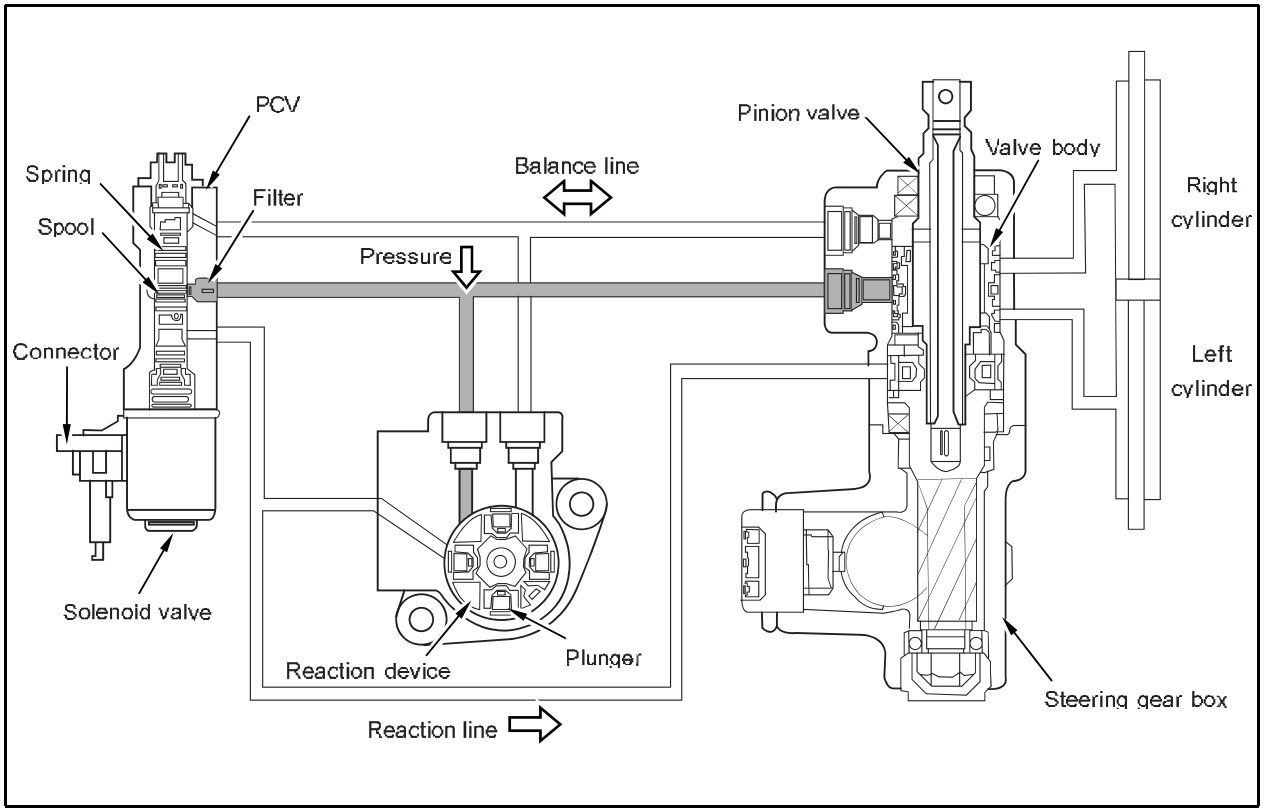
4. SYSTEM CONTROL



ECPS system, according to the vehicle speed, enables to achieve proper steering characteristics by controlling hydraulic pressure to reaction plunger located in input shaft of power steering gear box. In other words, ECPS control unit enhances the parking conveniences by controlling duty type current control. It provides heavy steerability with low current as the vehicle speed increases. And, it provides light steerability with high current as the vehicle speed decreases.

1. **During parking and low speed driving**

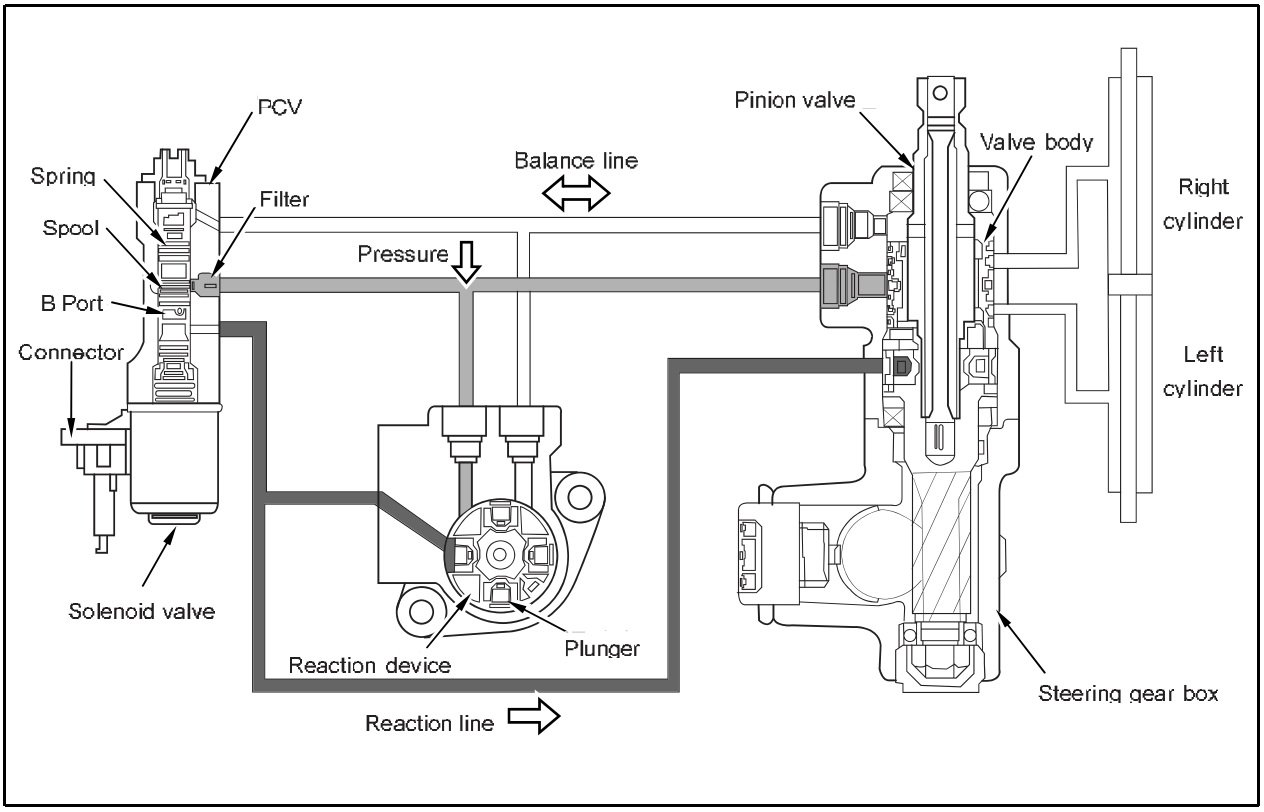
During parking and driving in low speed, the control unit supplies approx. 1 A of electric current to solenoid valve. Then, the spool located in PCV compresses the upper spring and elevates upward and, the working pressure from oil pump (A port) is not able to flow to the reaction plunger (C port). As a result, the pressing force from reaction plunger disappears and the steerability enhances.



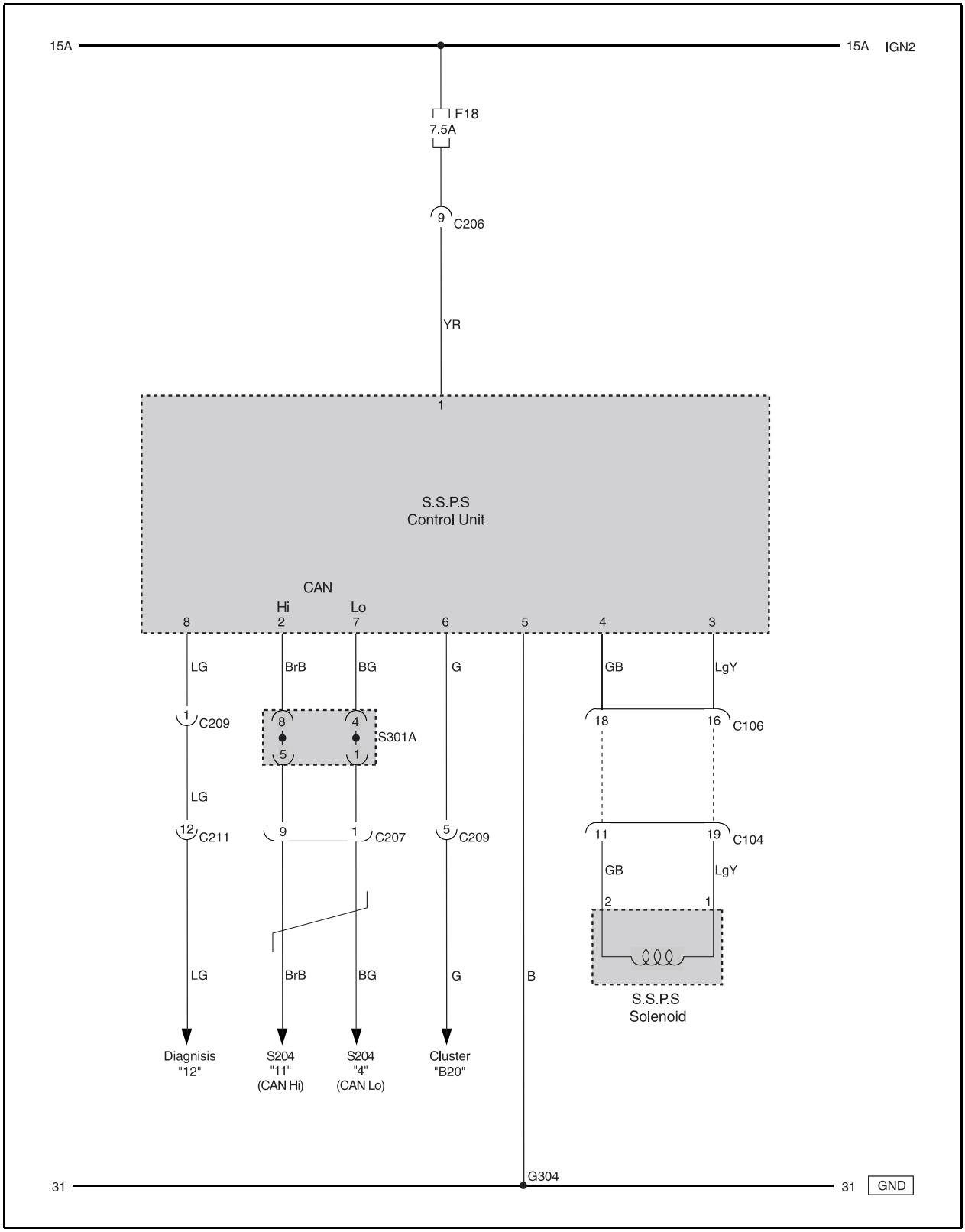
Modification basis	
Application basis	
Affected VIN	

2. **During high speed driving**

During high speed driving, the control unit supplies weak electric current to solenoid valve. Then, the spool located PCV moves from top to bottom, and the working pressure (A port) from oil pump is applied to reaction plunger (C port) through B port. As a result, the pressing force from reaction plunger against input shaft is increased and the steerability becomes heavier.



5. CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

BRAKE SYSTEM

4850-01

OVERVIEW AND OPERATION PROCESS

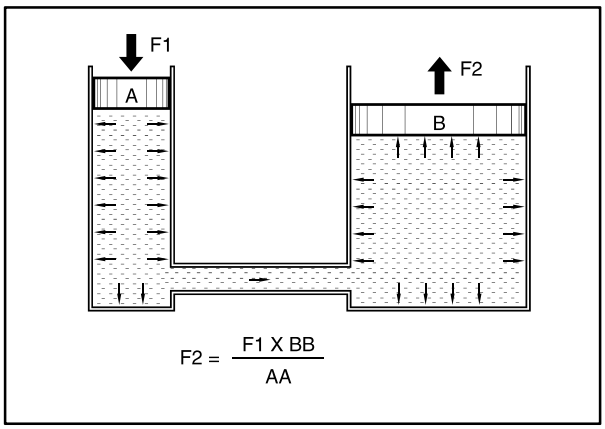
1. BRAKE SYSTEM GENERAL INFORMATION

1) DESCRIPTION AND OPERATION

(1) Brake System

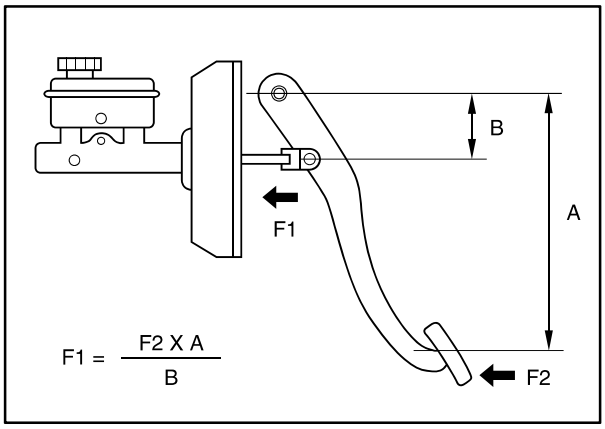
Even though a driver cuts off the power, while driving, the vehicle continues to move due to the law of inertia. Therefore, a braking device is needed to stop the vehicle. The brake system normally uses the frictional discs that converts the kinetic energy to the thermal energy by frictional operation. 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).

(2) Hydraulic Brake



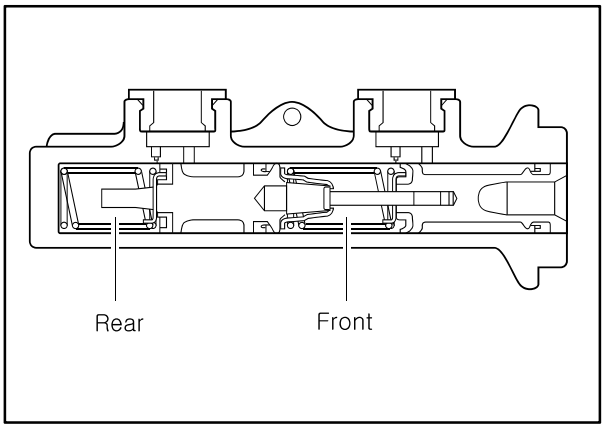
This system uses the leverage effect and Pascal's principle. When depressing the brake pedal, the pedal pressure is increased by booster and is delivered to master cylinder to generate hydraulic pressure. The hydraulic pressure generated by the master cylinder is delivered to the brake caliper through 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.

(3) Brake Pedal



Brake pedal uses the leverage effect to apply bigger force to the brake master cylinder.

(4) Master Cylinder

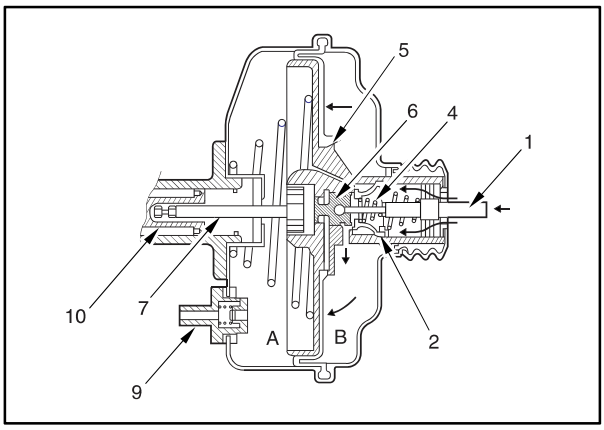


The brake master cylinder is designed to convert the force from the brake master cylinder to the high hydraulic pressure. The brake system uses the tandem type master cylinder with in-line 2 pistons.
The in-line 2 pistons generate the hydraulic pressure. The piston cup on the piston keeps the sealing conditions in cylinder and prevents the oil leaks. The hydraulic pressure generated by the primary piston is delivered to the front wheels, and the hydraulic pressure generated by the secondary piston is delivered to the rear wheels.

(5) Brake Booster

The brake booster is a power assist device for brake system. It relieves the pedal depressing force by using the pressure difference between the vacuum pressure generated by vacuum pump in intake manifold and the atmospheric pressure.

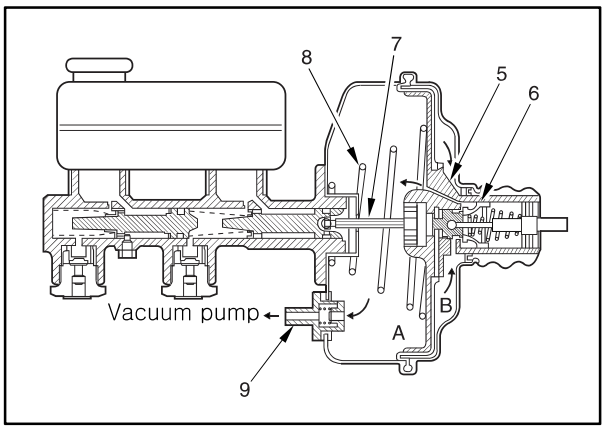
1. Pressure distribution at working



When depressing the brake pedal, the push rod (1) in booster pushes the poppet (2) and valve plunger (3). The poppet (2) pushes the power piston seat (5) resulting in closing the vacuum valve (9). The chamber (A) and (B) in power cylinder are isolated and the valve plunger (3) is separated from the poppet (2). And then the air valve (6) opens and air flows into the chamber (B) through filter.
Then, the power piston (5) pushes the master cylinder push rod (7) to assist the brake operation.

Modification basis	
Application basis	
Affected VIN	

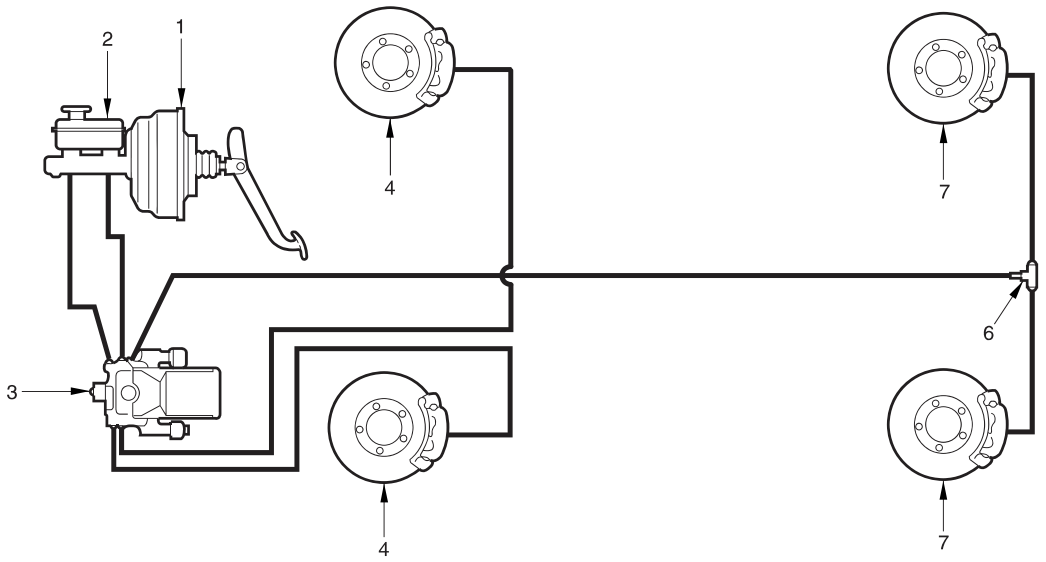
2. Pressure distribution after working



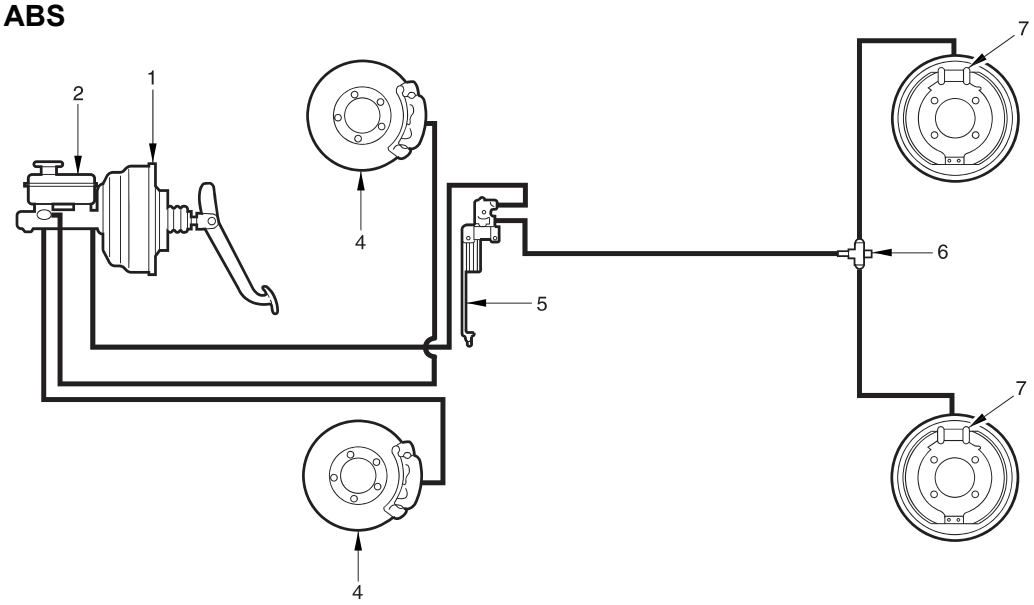
When releasing the brake pedal, the valve plunger (3) returns back to the original position by return spring (4) and the air valve (6) closes. At this time, the vacuum valve (9) opens and the pressure difference between chamber (A) and (B) in power cylinder is eliminated. Accordingly, the power piston (5) returns back to original position by the reaction of master cylinder (10) and the diaphragm return spring (8).

2. BRAKE SYSTEM LAYOUT (HYDRAULIC LINE)

With ABS



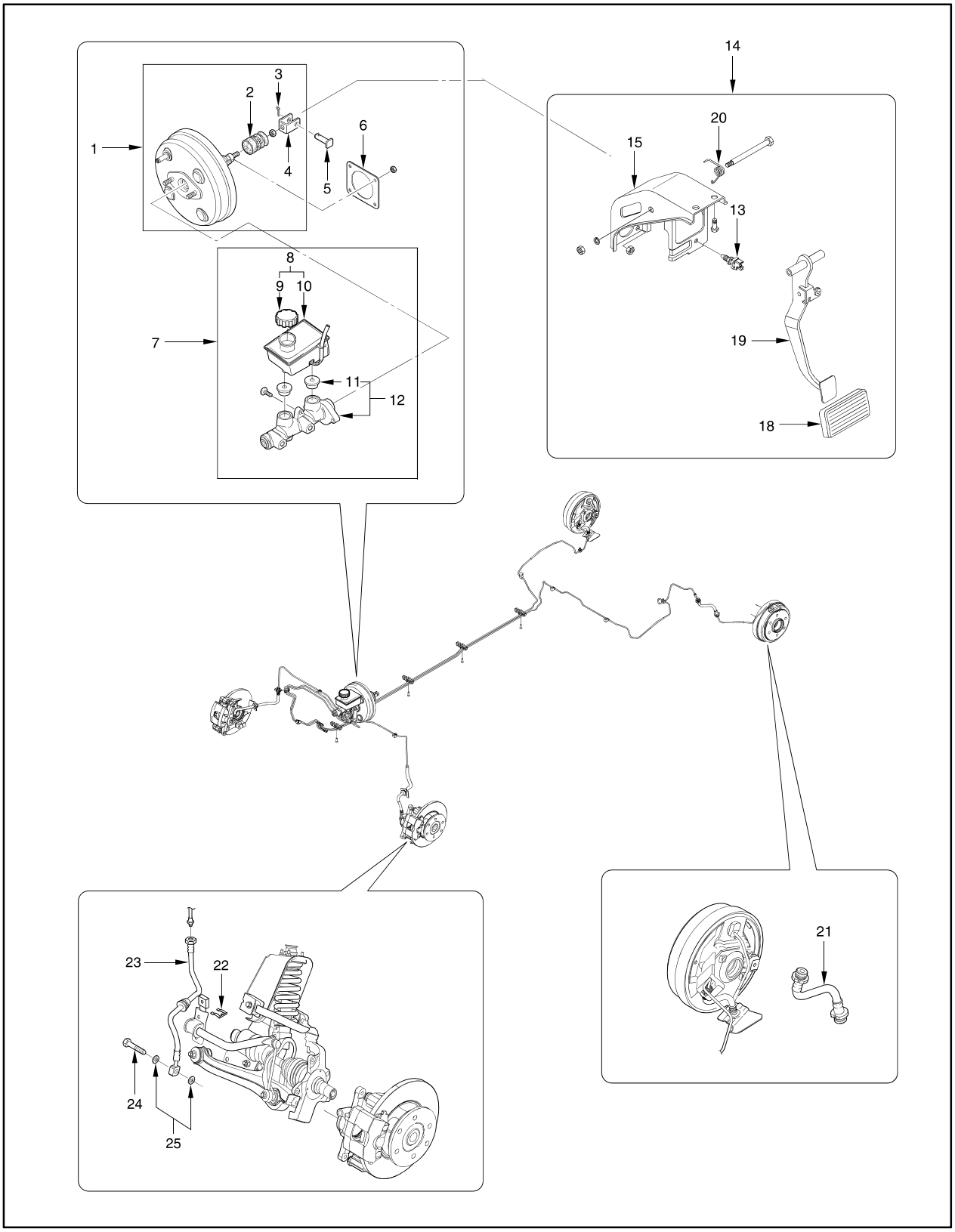
Without ABS



1. Brake booster
2. Brake reservoir and master cylinder
3. ABS control unit
4. Front disc brake and caliper
5. Load conscious reducing valve (LCRV)
6. 3-way connector
7. Rear drum (disc) and wheel cylinder (caliper)

Modification basis	
Application basis	
Affected VIN	

3. BRAKE SYSTEM COMPONENTS LOCATOR



1. Brake booster
2. Brake booster boot
3. Cotter pin
4. Clevis
5. Clevis pin
6. Packing (1)
7. Master cylinder assembly
8. Brake reservoir assembly
9. Brake reservoir cap
10. Brake reservoir
11. Grommet seal
12. Master cylinder
13. Stop lamp switch
14. Pedal assembly
15. Pedal bracket assembly
16. Brake pedal pad
17. Brake pedal
18. Brake pedal spring
19. Rear brake hose
20. Clip
21. Front brake hose
22. Union bolt
23. Plane washer

ANTI-BRAKE SYSTEM

4892-01

GENERAL

1. REPAIR INSTRUCTIONS

1) ON-VEHICLE SERVICE

(1) Service Precautions

NOTE

Brake Fluid may irritate eyes and skin. In case of contact, take the following actions:
- Eye contact - rinse thoroughly with water.
- Skin contact - wash with soap and water.
- Ingestion - consult a physician immediately.

To help avoid personal injury due to poor braking. DO NOT Tap into the vehicle's brake system to operate a trailer brake system.

When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread-locking compound will be called out. The correct torque values must be used when installing fasteners that require them. If the above procedures are not followed, parts or system damage could result.

Use only DOT-3 equivalent hydraulic brake fluid. The use of DOT-5 (silicone) brake fluid is not recommended. Reduced brake performance or durability may result.

Avoid spilling brake fluid on any the vehicle's painted surfaces, wiring, cables or electrical connectors. Brake fluid will damage paint and electrical connections. If any fluid is spilled on the vehicle, flush the area with water to lessen the damage.

(2) Electronic system service precautions

Take care to avoid electronic brake control module (HECU) circuit overloading. In testing for opens or shorts, do not ground or apply voltage to any circuit unless instructed to do so by the diagnostic procedure. Test circuits only with a high-impedance multi-meter. Never remove or apply power to any control module with the ignition switch in the ON position. Always turn the ignition to the OFF position before removing or connecting battery cables, fuses or connectors.

(3) General service precautions

Disconnect the HECU connector before performing any vehicle welding work using an electric arc welder. Do not attempt to disassemble any component designated as nonserviceable. The hydraulic modulator and the HECU cannot be separated from each other. They have no replaceable parts, and there is no replaceable parts, and there is no access to the components they contain.

(4) Bleeding system

Replacement modulators are shipped already filled and bled. In normal procedures requiring removal of the modulator, such as to replace the HECU, air will not enter the modulator, and normal bleeding will be all that is needed. If air enters the hydraulic modulator, or if an unfilled modulator is installed, use the brake bleeding program in the scan tool to bleed the modulator. Manual bleeding of the hydraulic modulator is not possible.

Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATION PROCESS

1. SUMMARY

The aim of the ABS is to mmaintain steerability and driving stability and to take the burden off the driver. If the stopping distance is shorter on some road surfaces (carriageway conditions), this is a gift of physics and not a development aim.
ABS is a device which senses that one or more of the wheels are locking up during braking. It monitors the rotational speeds of the wheels and reduces hydraulic pressure to any wheel it senses locking up. It is controlled by both mechanical and electronic components. When you apply the brakes, the ABS will regulate the flow of brake fluid being delivered to the brake calipers. By the use of electronic computers, the brakes rapidly alternate (at a rate of 30 times per second) from full pressure to full release.

1) DRIVING PHYSICS

To give you a better understanding of the tasks and functions of ABS, we will first look at the physics principles.

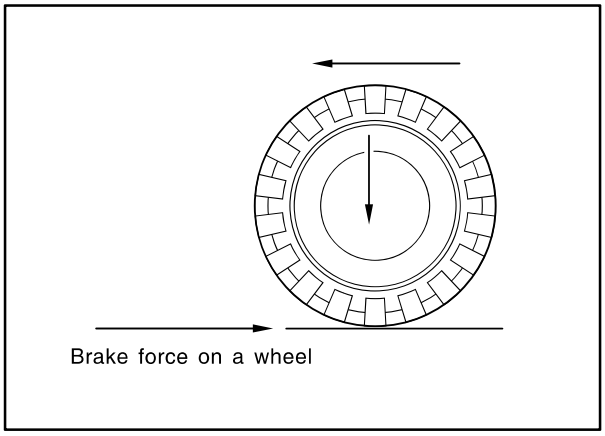
(1) The Stopping Distance

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:

(3) Maximum brake force



FB_{max} = Wheel load F_R x Adhesion coefficient$_{mh}$

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.

(4) 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 unbraked, 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:

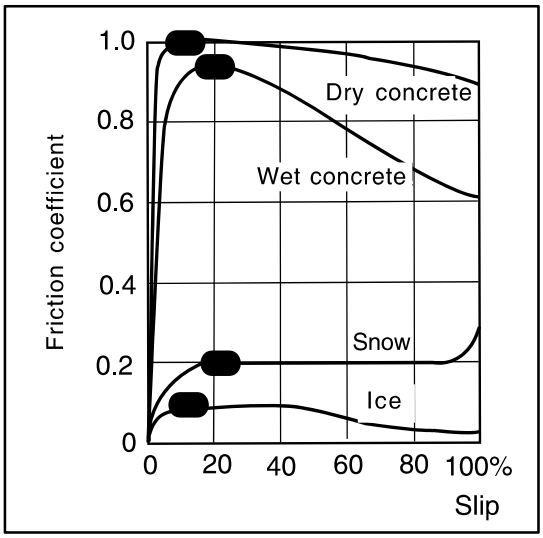
$$S = \frac{V_{veh} - V_w}{V_{veh}} \text{ X } 100\ \%$$

V_{veh} = 100 km/h, V_w = 70 km/h

$$S = \frac{100 - 70}{100} \text{ X } 100\ \%$$

Modification basis	
Application basis	
Affected VIN	

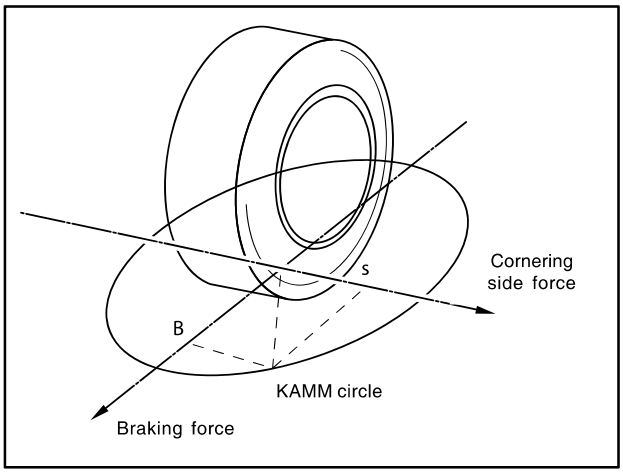
(5) Typical slip curves



For the various carriageway conditions the adhesion 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.

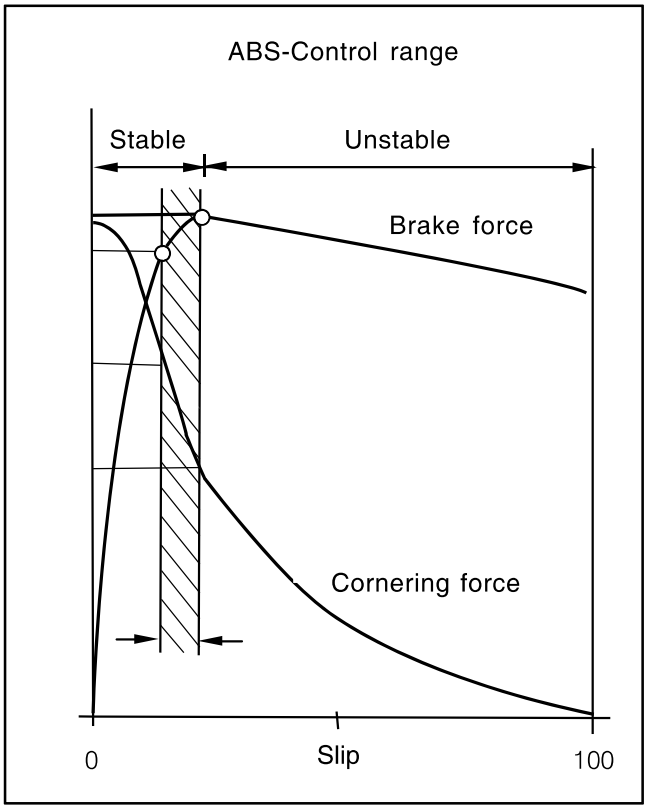
The reason for this is based in physics and not in the Anti-Lock System. However, as mentioned before, ABS is not about the stopping distance, but maneuverability and driving stability, for with ABS you can steer round an obstacle. A device with locking wheels without ABS cannot be steered. So what use then is the shorter stopping distance if the vehicle has already hit the car in front, because you did not have a chance to steer round the obstacle?

(6) 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.

(7) 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.

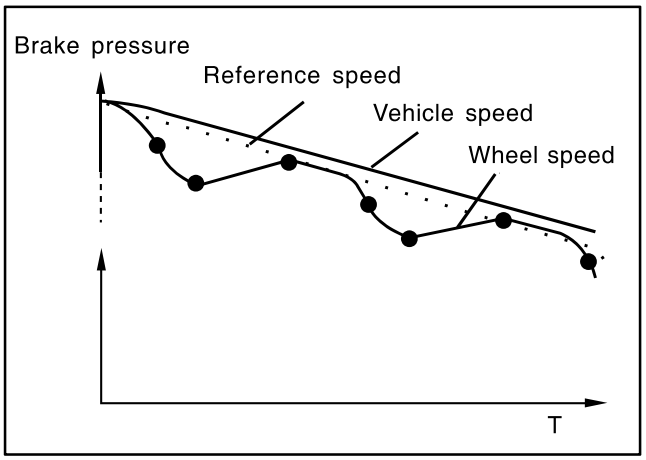
▶ **Cornering force**

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.

(8) Basic ABS Controls



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

Modification basis	
Application basis	
Affected VIN	

(9) 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.

▶ Selector low control

This control is used for regulating the brake pressure for rear axle during ABS operation. This control uses lower adhesion coefficient to prevent the rear wheels from locking.

2. SYSTEM LAYOUT

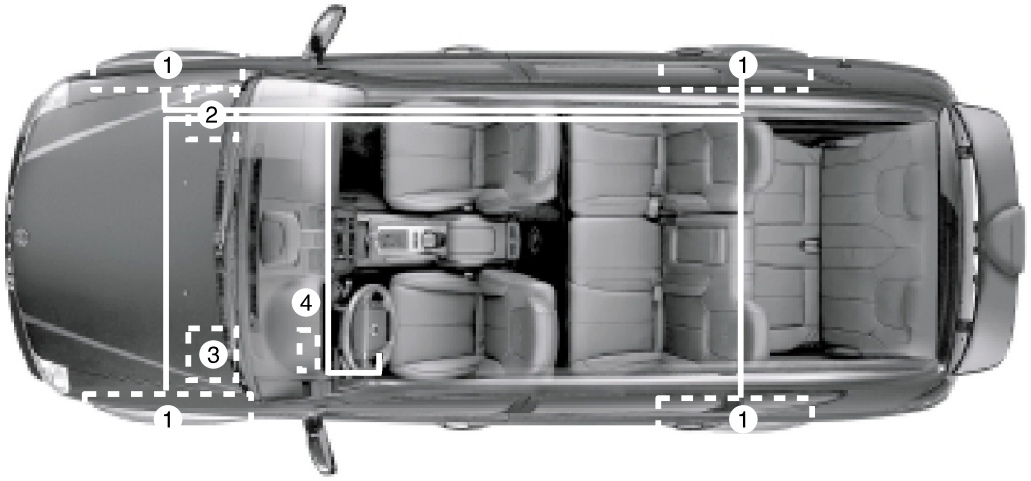
Newly introduced ABS has a different shape of integrated hydraulic modulator and HECU (Hydraulic and Electronic Control Unit) compared to existing ABS. And, the wheel speed sensor uses different method to detect wheel speed. The basic function of the ABS that maintains the vehicle stability by controlling the steerability of the vehicle when braking has not been changed.

1. Wheel speed sensor



2. ABS HECU

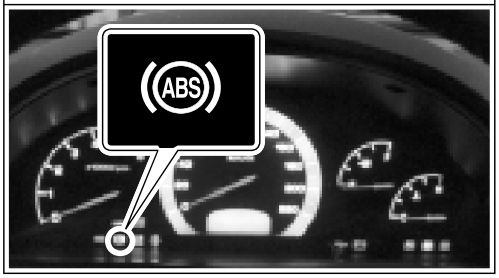




3. Brake master cylinder



4. ABS warning lamp



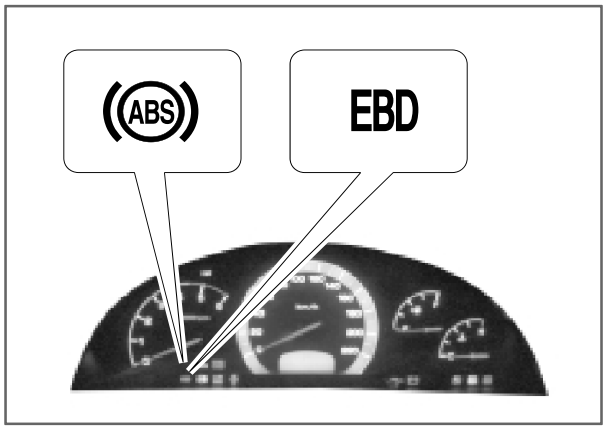
Modification basis	
Application basis	
Affected VIN	

1) SYSTEM FUSE



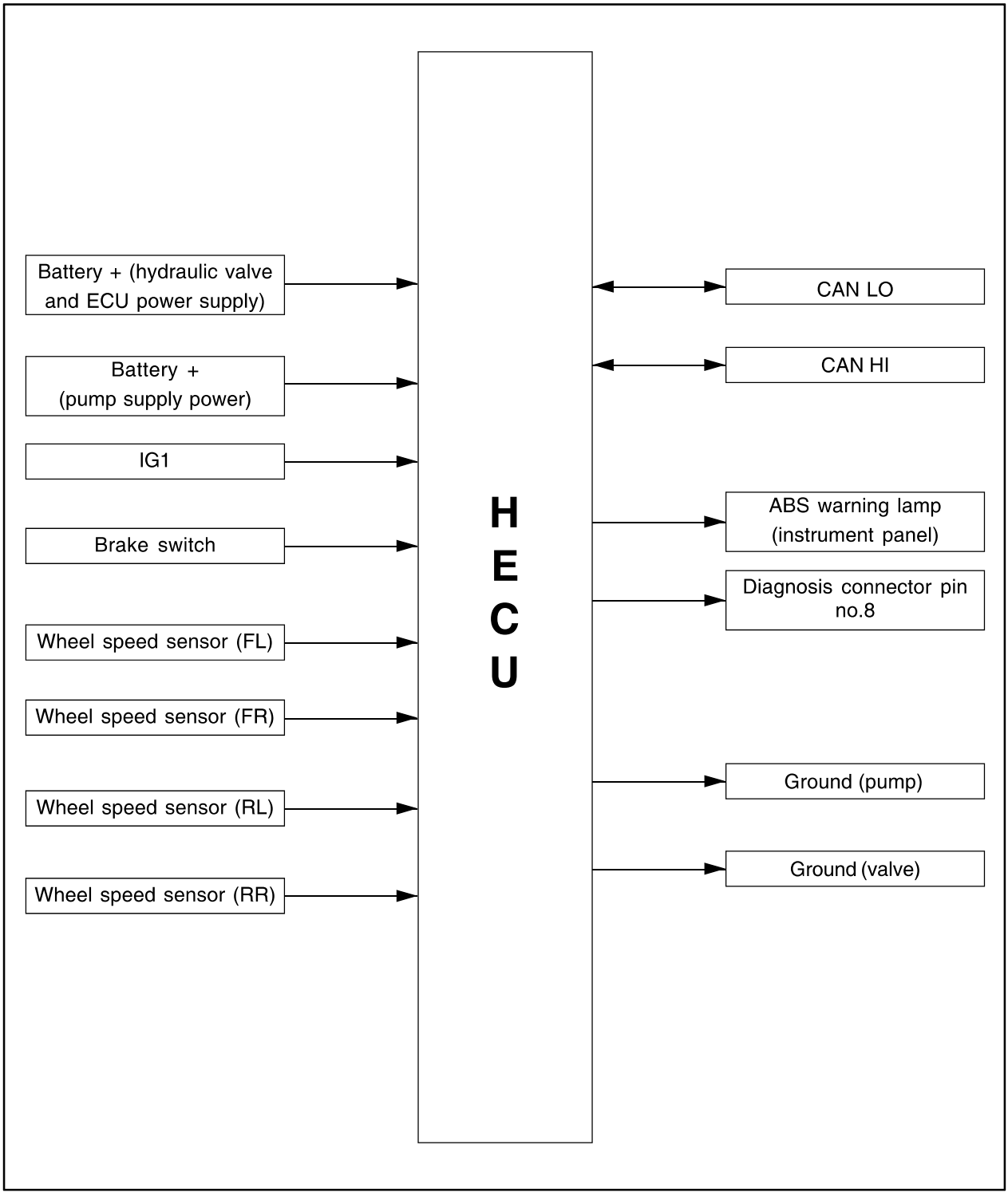
The ABS/TCS system fuse and SB2 is located at the fuse box in engine compartment.

2) INDICATORS



The ABS and TCS indicators are in instrument cluster.

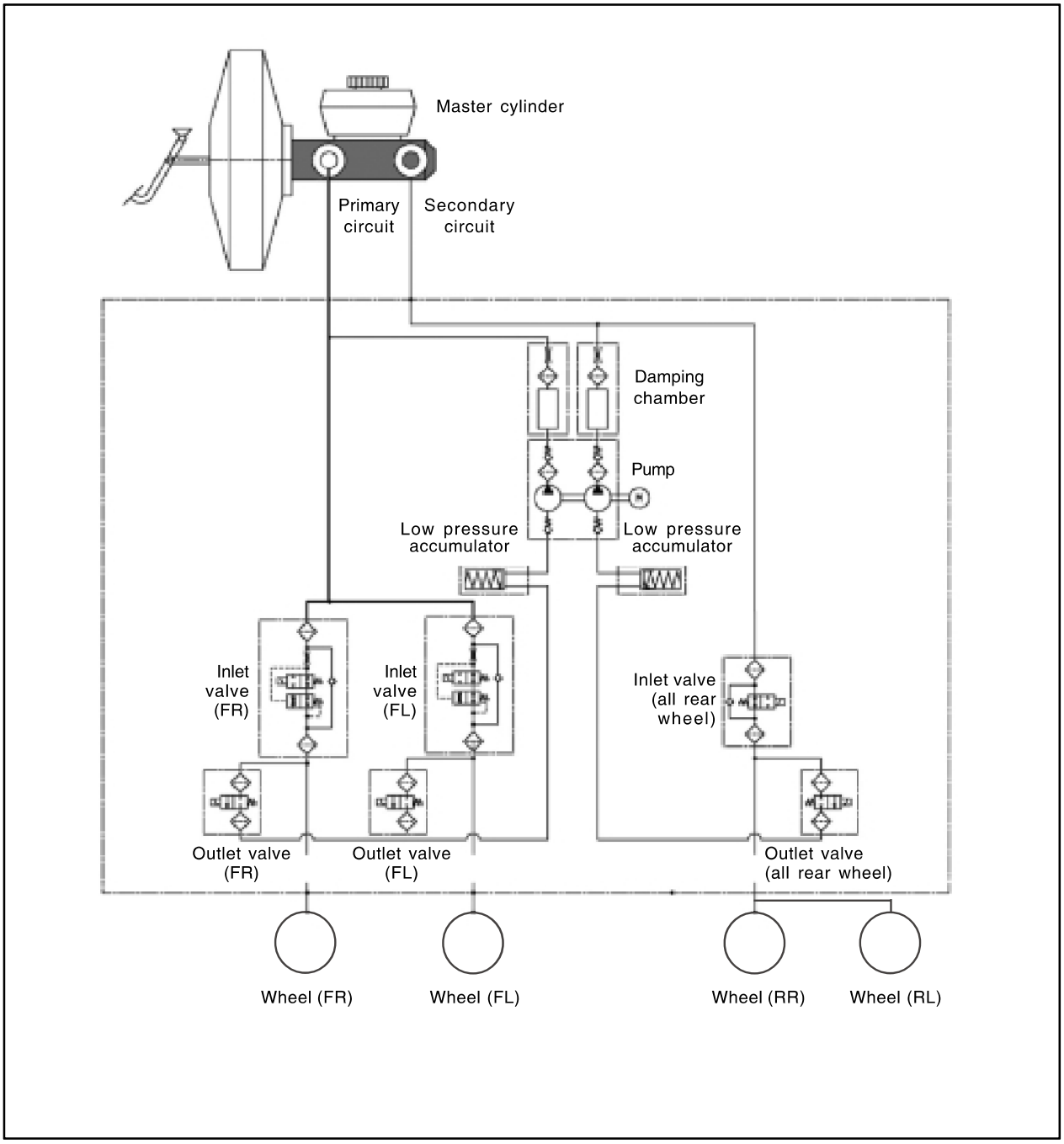
3. INPUT AND OUTPUT DIAGRAM OF ABS UNIT



Modification basis	
Application basis	
Affected VIN	

4. HYDRAULIC CIRCUIT DIAGRAM

1) ABS HYDRAULIC CIRCUIT DIAGRAM

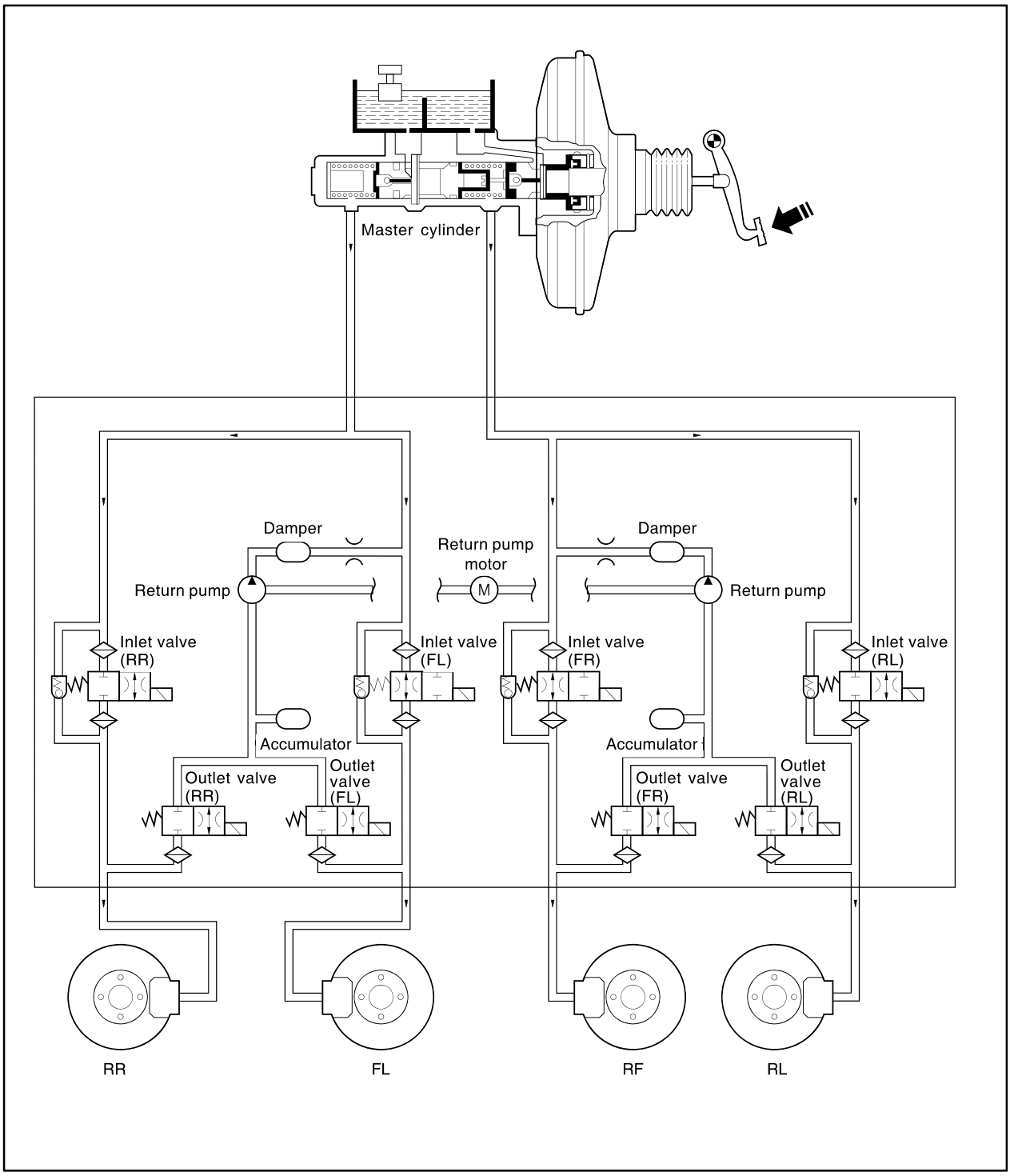


The vehicle equipped only with the ABS controls the wheel's braking force using three 3-channel 4-sensor method. The front wheels that are the primary circuit of the brake system is composed of two wheel speed sensors and two channel valves system with two inlet valves and two outlet valves. The rear wheels that are the secondary circuit of the brake system is composed of two wheel speed sensors, one inlet valve and one outlet valve. This system is similar to the one from the previous model.

2) ABS/EBD HYDRAULIC CIRCUIT DIAGRAM

▶ When the EBD is Operating

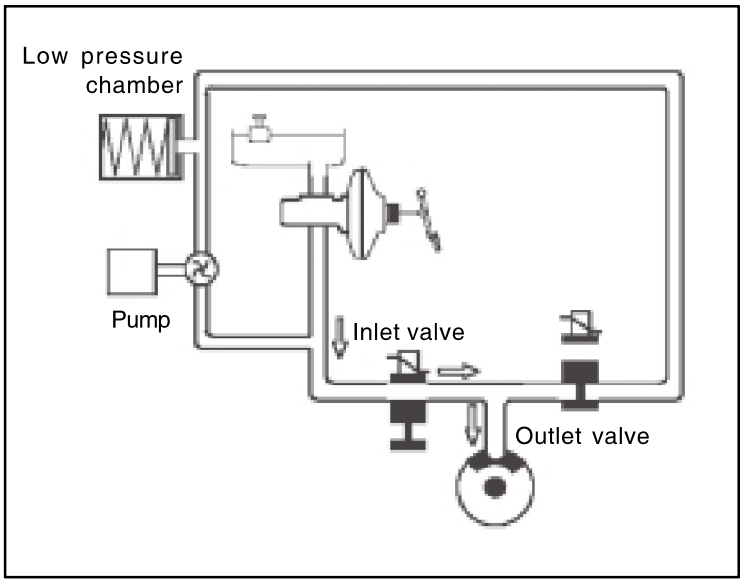
To prevent the rear wheels locking when braking, HECU receives the signals from wheel speed sensors and brake signals to calculate the reduced braking speed, and controls the brake pressure to rear wheels by operating the intake 2-channel valve to provide the optimal braking conditions.



Modification basis	
Application basis	
Affected VIN	

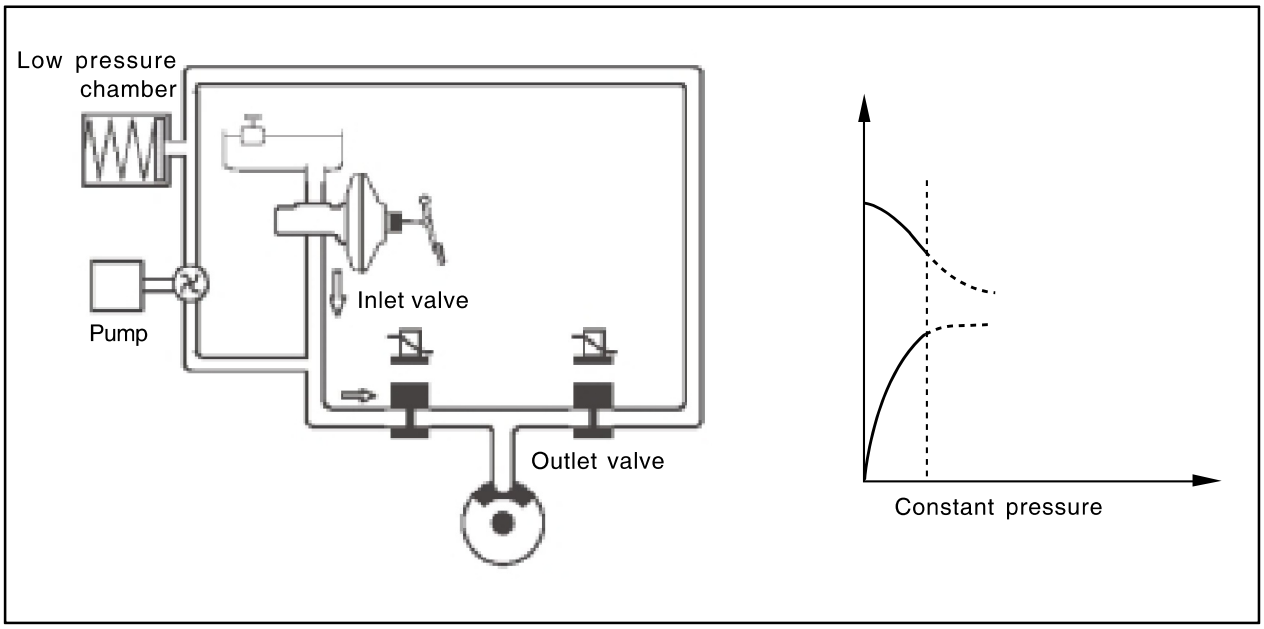
3) ABS HYDRAULIC CIRCUIT PER ABS OPERATION RANGE

▶ Hydraulic Pressure Circuit when ABS is Not Operating



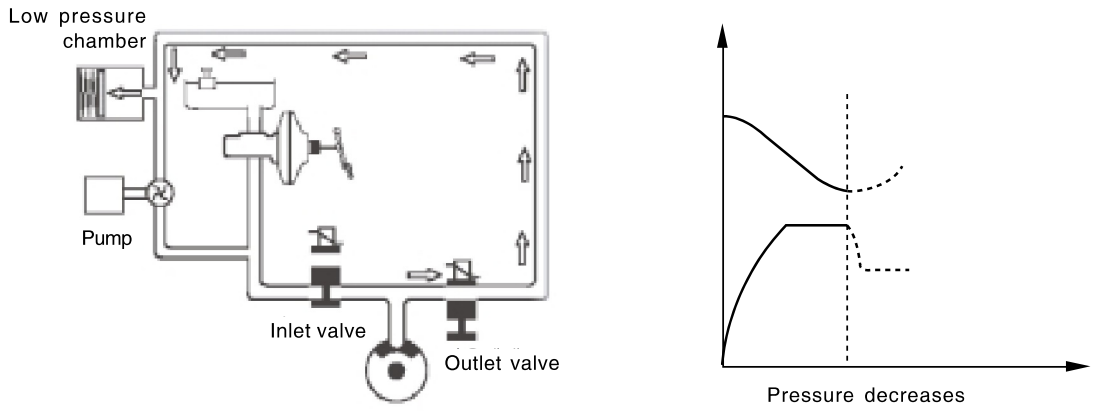
The hydraulic pressure in the master cylinder increases through the vacuum booster and it is delivered to the wheel via the normal open inlet valve. At this moment, the normally-closed outlet valve is closed. The speed of the wheel that hydraulic pressure is delivered reduces gradually .

▶ No Hydraulic Pressure Circuit when ABS is Operating



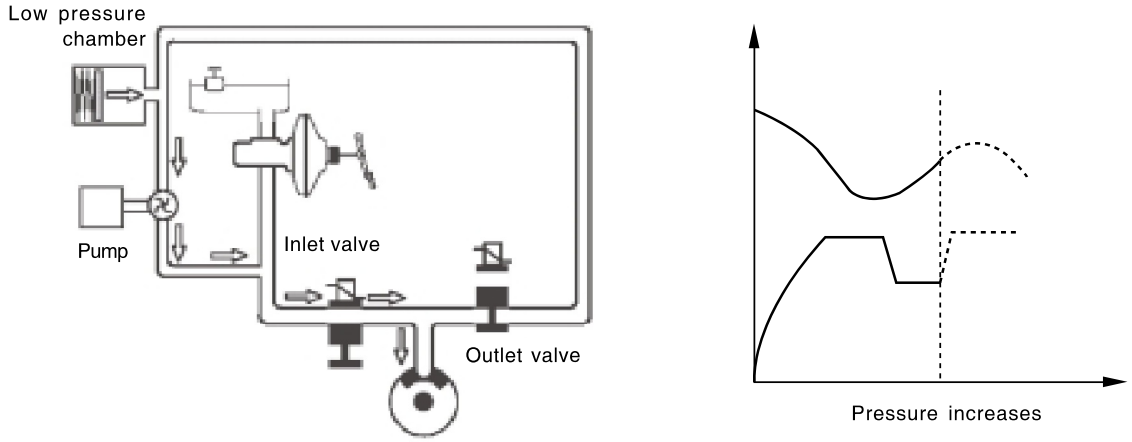
As hydraulic pressure on each wheel increases, the wheel tends to lock. In order to prevent the wheel from locking, the hydraulic valve modulator operates the inlet valve control solenoid to close the inlet valve and stop the hydraulic pressure increases. At this moment, the outlet valve is closed. This procedure helps the wheel to maintain a stable hydraulic pressure.

▶ Pressure Decreases in the Circuit when ABS is Operating



Even when the hydraulic pressure on each circuit is stable, the wheel can be locked as the wheel speed decreases. This is when the ABS ECU detects the wheel speed and the vehicle speed and gives the optimized braking without locking the wheels. In order to prevent from hydraulic pressure increases, the inlet valve is closed and the outlet valve is opened. Also, the oil is sent to the low pressure changer and the wheel speed increases again. The ABS ECU 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

▶ Pressure Increases in the Circuit when ABS is Operating



As the wheel speed increases, the inlet valve opens and the wheel's pressure increases due to the master cylinder pressure. The oil in the low pressure chamber circulates to the wheel by the pump and the wheel speed decreases as the hydraulic pressure at wheel increases. This operation continues repetitively until there are no signs that the ECU is locking the wheels. When the ABS hydraulic pressure control takes place, there may be some vibration and noises at the brake pedal.

Modification basis	
Application basis	
Affected VIN	

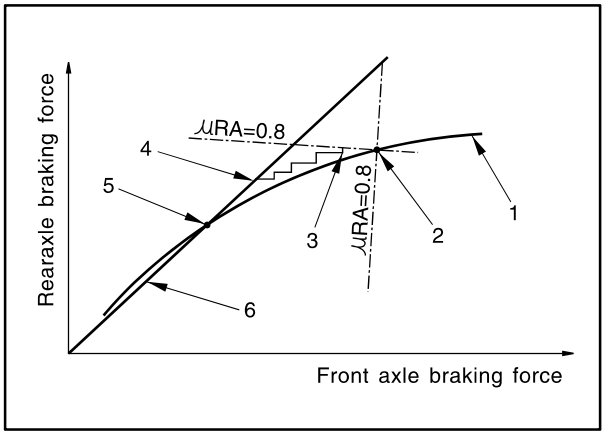
5. EBD (ELECTRONIC BRAKE FORCE DISTRIBUTION) SYSTEM

1) 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 loaden vehicle the efficiency of the EBD system is higher due to the better use of rear axle braking capability.

2) The Benefits of EBD

- 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).
- "Keep alive" function.



▶ Service precautions

Observe the following general precautions during any ABS/ TCS service. Failure to adhere to these precautions may result in ABS/TCS system damage.

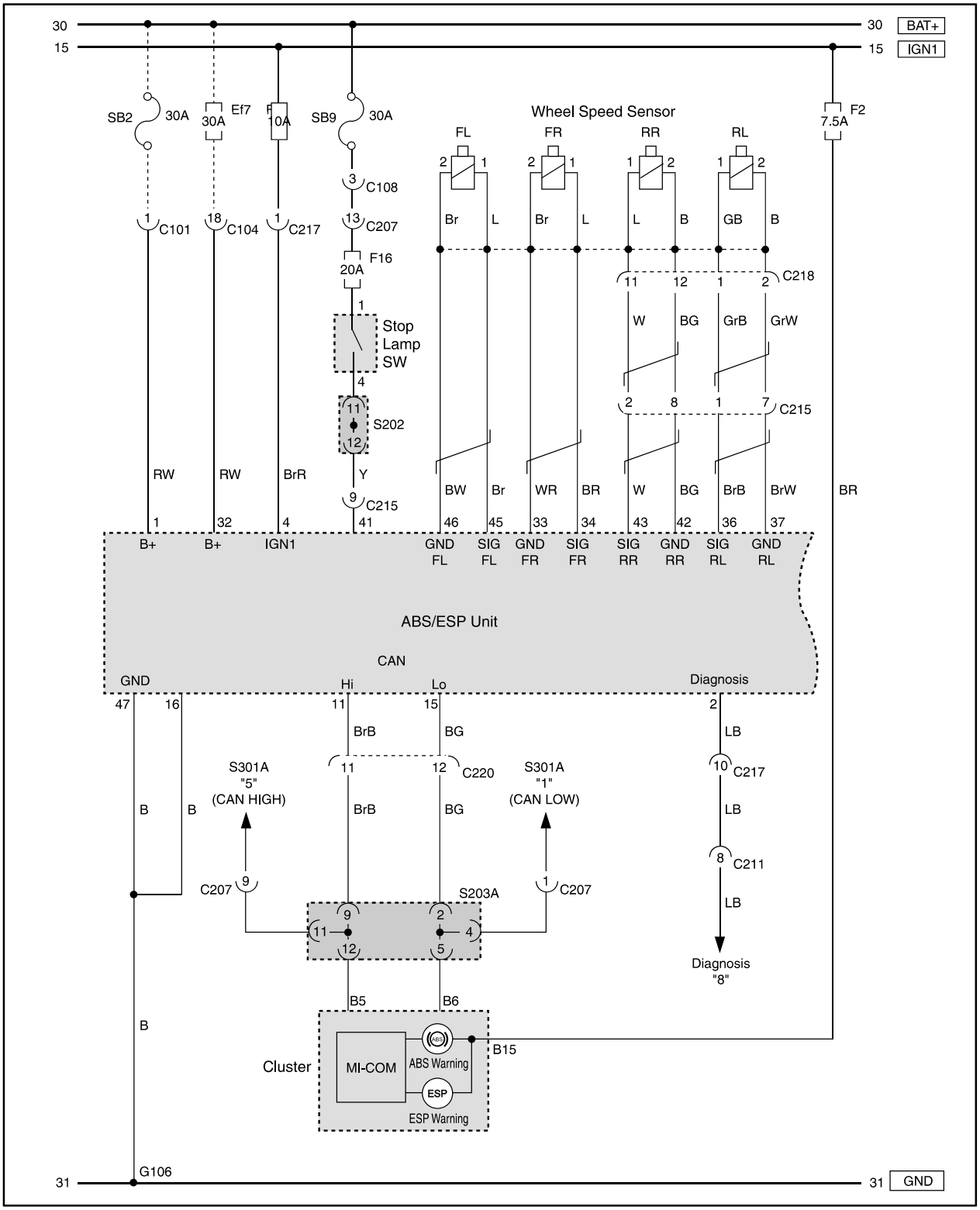
1. Disconnect the EBCM harness connector before performing the electric welding procedures.
2. Carefully note the routing of the ABS/TCS wiring and wring components during removal. The ABS/TCS components are extremely sensitive to EMI (eletromagnetic interference). Proper mounting is critical during component service.
3. Disconnect the EBCM connector with the ignition OFF.
4. Do not hang the suspension components from the wheel speed sensor cables. The cables may be damaged.
5. Do not use petroleum based fluids in the master cylinder. Do not use any containers previously used for petroleum based fluids. Petroleum causes swelling and distortion of the rubber components in the hydraulic brake system, resulting in water entering the system and lowering the fluid boiling point.

Modification basis	
Application basis	
Affected VIN	

6. ELECTRIC CIRCUIT DIAGRAM

1) ABS

▶ Wheel Speed Sensor, Stop Lamp Switch, Diagnostic Connector, Warning Lamp (ABS/ESP)



Modification basis	
Application basis	
Affected VIN	

ESP(Electronic Stability Program) SYSTEM 4892-01

GENERAL

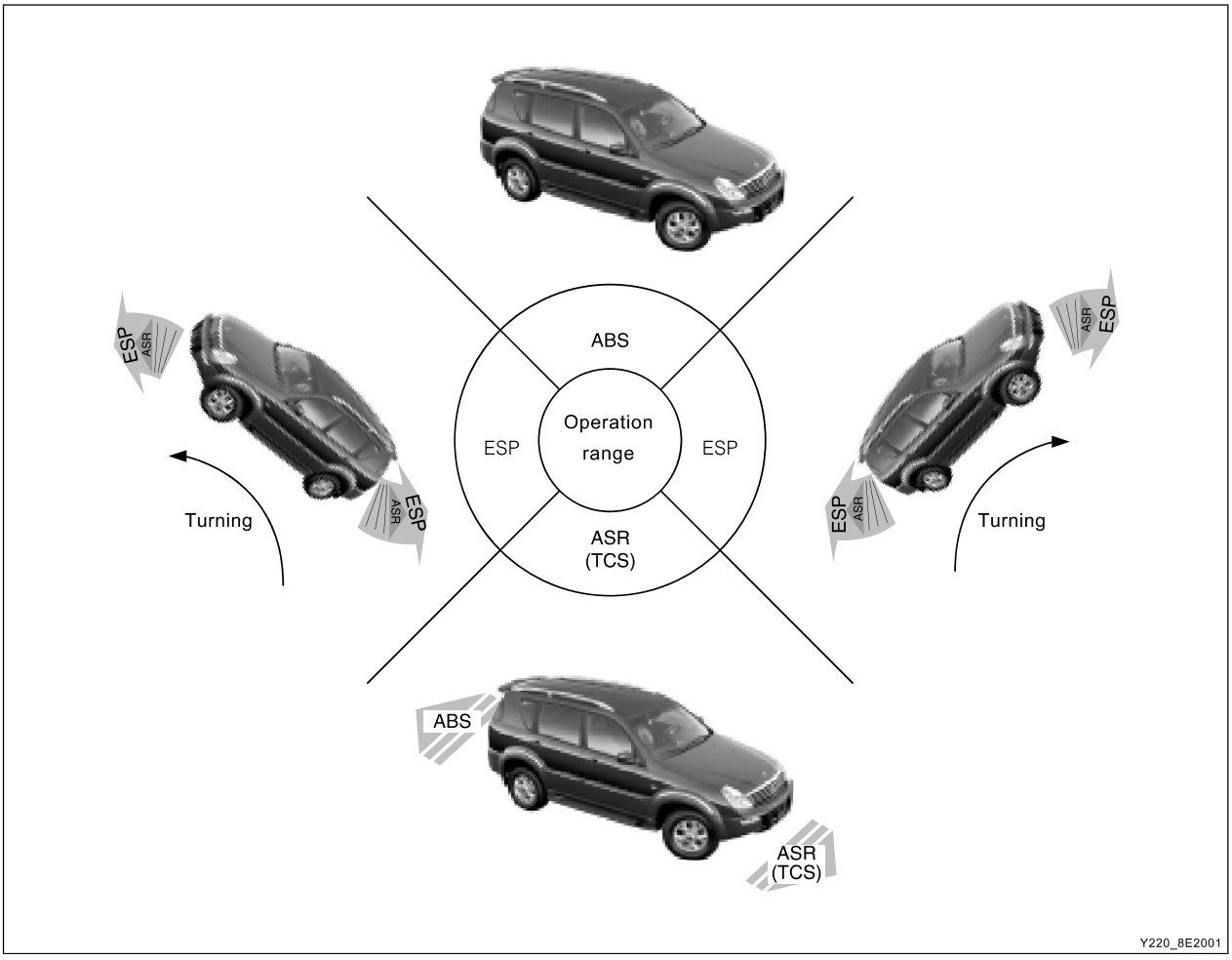
1. SPECIFICATIONSS

Name	Specifications		Reference
	ABS	ESP	
HECU	CPU: MCU60 (32 bit) Clock Frequency: 28 MHz Memory: 128 ~ 256 KB Switched Orifice	CPU: MCU60 (32 bit) Clock Frequency: 33 MHz Memory: 256 ~ 512 KB Switched Orifice	
Wheel speed sensor	Active Type	Active Type	Output: 7 ~ 14 mA
Steering wheel angle sensor	N/A	Maximum angular velocity: 1500°/Sec Working voltage: 9 ~ 12 V	Pulse duty: 50 ± 10 %
Sensor cluster	N/A	2WD: Yaw rate sensor + Lateral sensor 4WD: Yaw rate sensor + Lateral sensor + Longitudinal sensor	Directional (CAN communication)
Longitudinal accel-eration sensor	Integrated into HECU		
Pressure sensor	N/A	Analog Output	

OVERVIEW AND OPERATION PROCESS

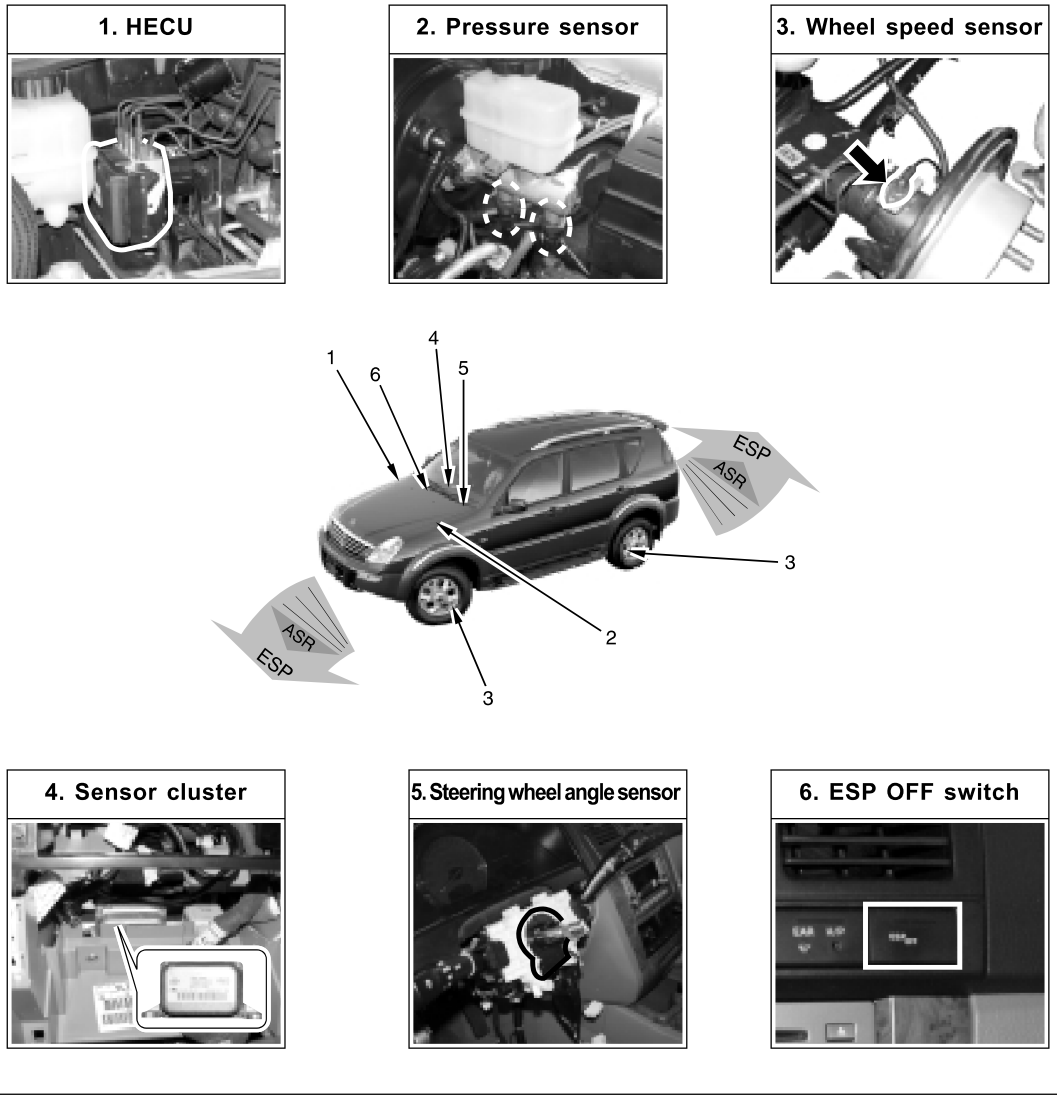
1. SUMMARY

ESP (Electronic Stability Program) recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention with no need for actuating the brake. This system is developed to help the driver avoid the danger of losing the control of the vehicle stability due to under-steering or over-steering 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 spin present at any wheels during over-steering, under-steering or cornering. The ESP ECU controls against over-steering or under-steering during cornering by controlling the vehicle stability using the input values from the sensors and applying the brakes independently to the corresponding wheels. The system also controls during cornering by detecting the moment right before the spin and automatically limiting the engine output (coupled with the ASR system).



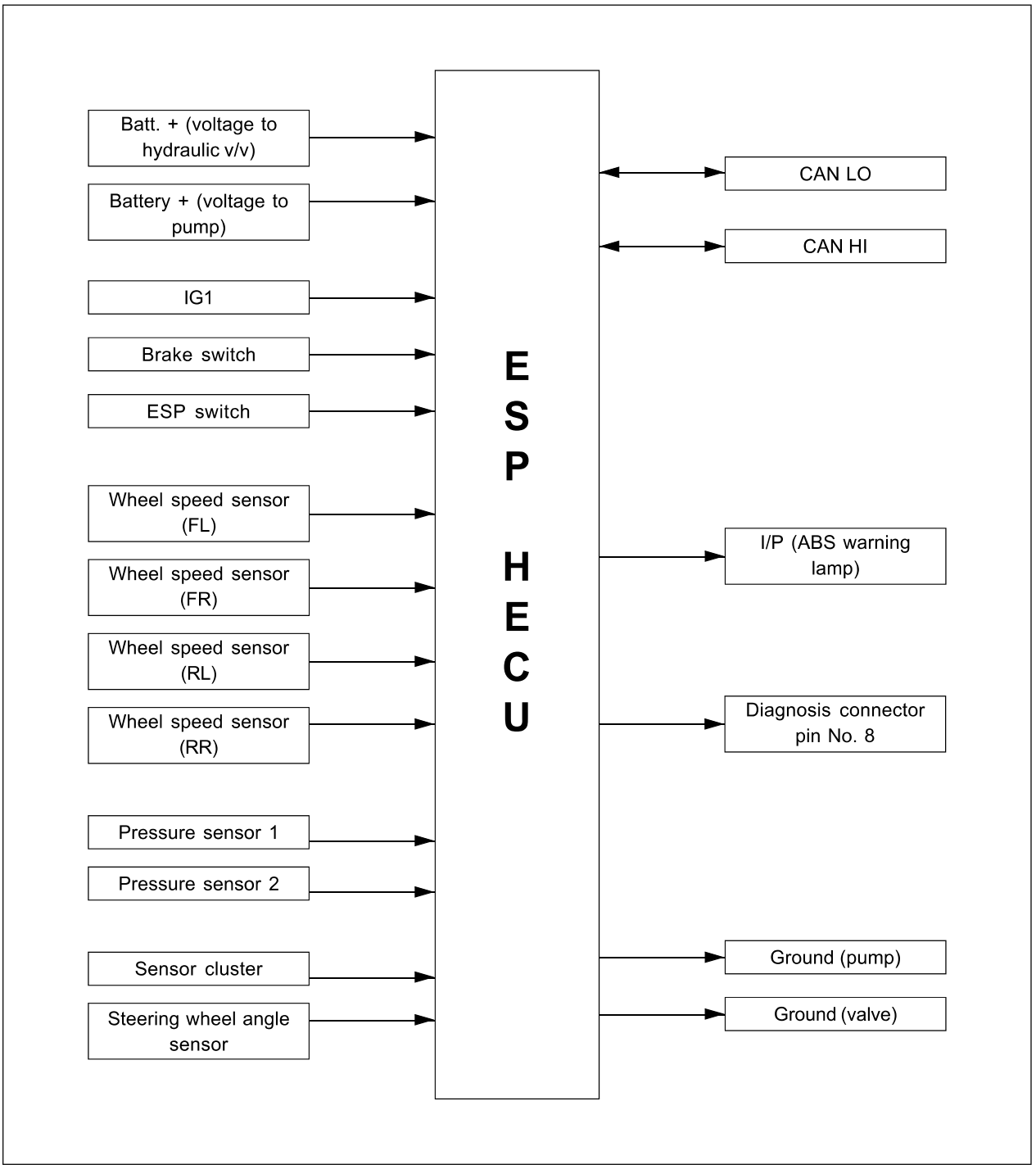
Modification basis	
Application basis	
Affected VIN	

2. COMPONENTS LOCATION



	Name	Location
1	HECU	In front of RH dash panel in engine compartment
2	Pressure sensor	Under master cylinder (two)
3	Wheel speed sensor	Active wheel speed sensor (four)
4	Sensor cluster	Under center audio (directional)
5	Steering wheel angle sensor	Inside multifunction switch
6	ESP OFF switch	In center instrument panel

3. INPUT AND OUTPUT DIAGRAM OF ESP UNIT

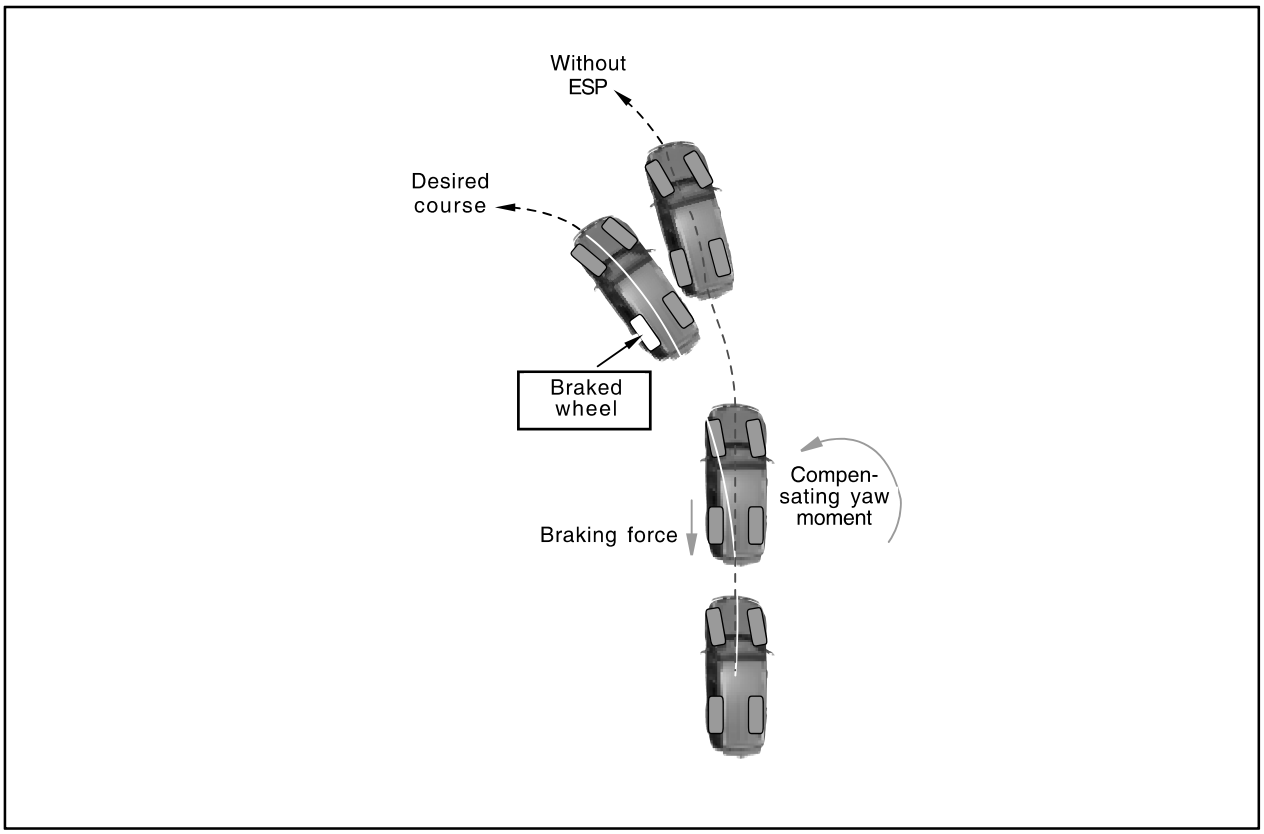


Modification basis	
Application basis	
Affected VIN	

4. ESP CONTROL

The ESP system includes the ABS/EBD and ASR systems allowing the system to be able to operate depending to the vehicle driving conditions. For example, when the brakes are applied during cornering at the speed of 100 km/h, the ABS system will operate at the same time the ASR or ABD systems operate to reduce the power from the slipping wheel. And when yaw rate sensor detects the rate exceeding 4¡Æ/seconds, the ESP system is activated to apply the brake force to the corresponding wheel to compensate the yaw moment with the vehicle stability control function. When various systems operate simultaneously under a certain situation, there may be vehicle control problems due to internal malfunction of a system or simultaneous operations. In order to compensate to this problem, the ESP system sets the priority among systems. The system operates in the order of TCS (ASR or ABD), ESP and ABS. The order may be changed depending on the vehicle driving situations and driving conditions. As the single-track vehicle model used for the calculations is only valid for a vehicle moving forward, ESP intervention never takes place during backup.

1) Understeering



▶Understeering

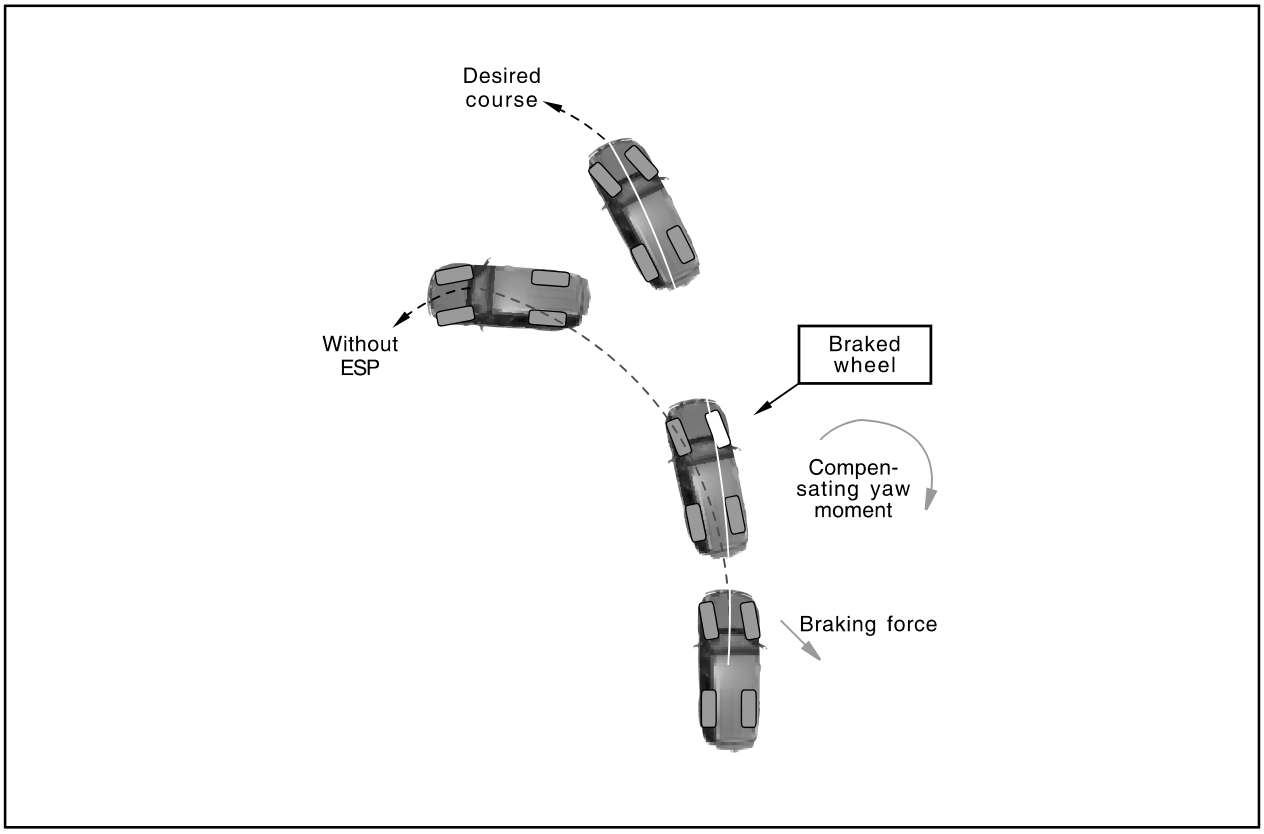
Understeering is when the steering wheel is steered to a certain angle during driving and the front tires slip toward the reverse direction of the desired direction. Generally, vehicles are designed to have under steering. The vehicle can return back to inside of cornering line when the steering wheel is steered toward the inside even when the vehicle front is 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.

▶ESP controls during under steering

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 understeering with the yaw rate sensor and the lateral sensor. Then the ESP system applies the brake at 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 driver intends.

Modification basis	
Application basis	
Affected VIN	

2) Oversteering



▶Oversteering

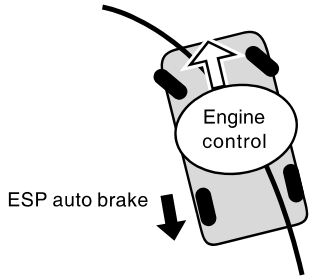
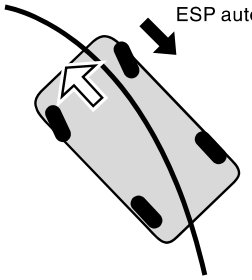
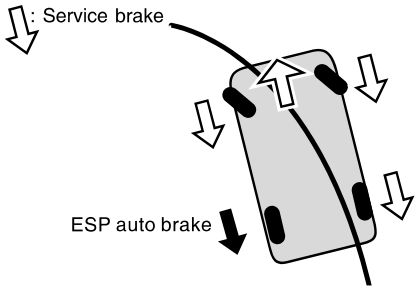
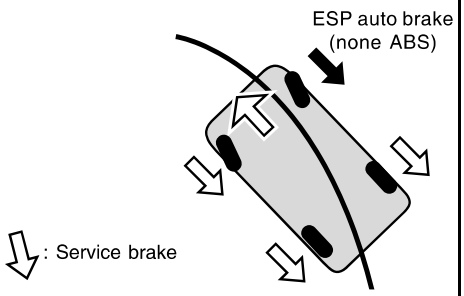
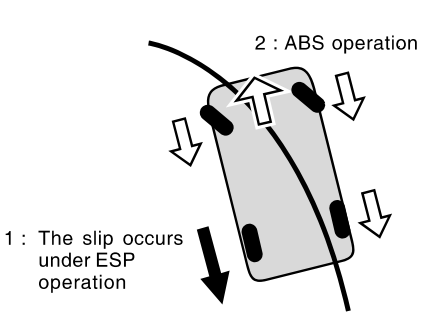
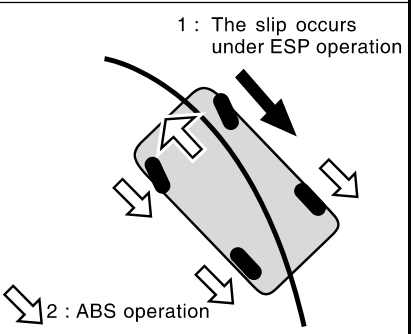
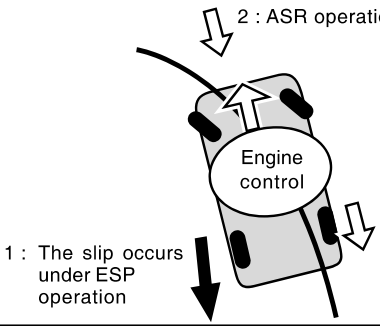
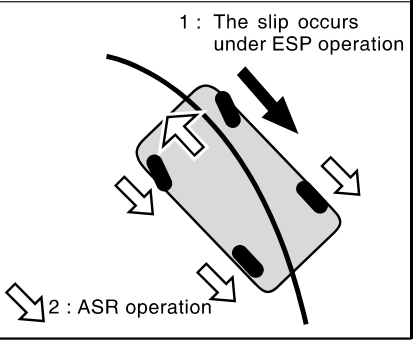
Oversteering is when the steering wheel is steered to a certain angle during driving and the rear tires slip outward losing traction. When compared with under steering vehicles, the controlling of the vehicle is difficult during cornering and the vehicle can spin due to rear wheel moment when the rear tires lose traction and the vehicle speed increases.

▶ESP controls during oversteering

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 oversteering with the yaw rate sensor and the lateral sensor.
Then the ESP system applies the brake at 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 he or she intends.

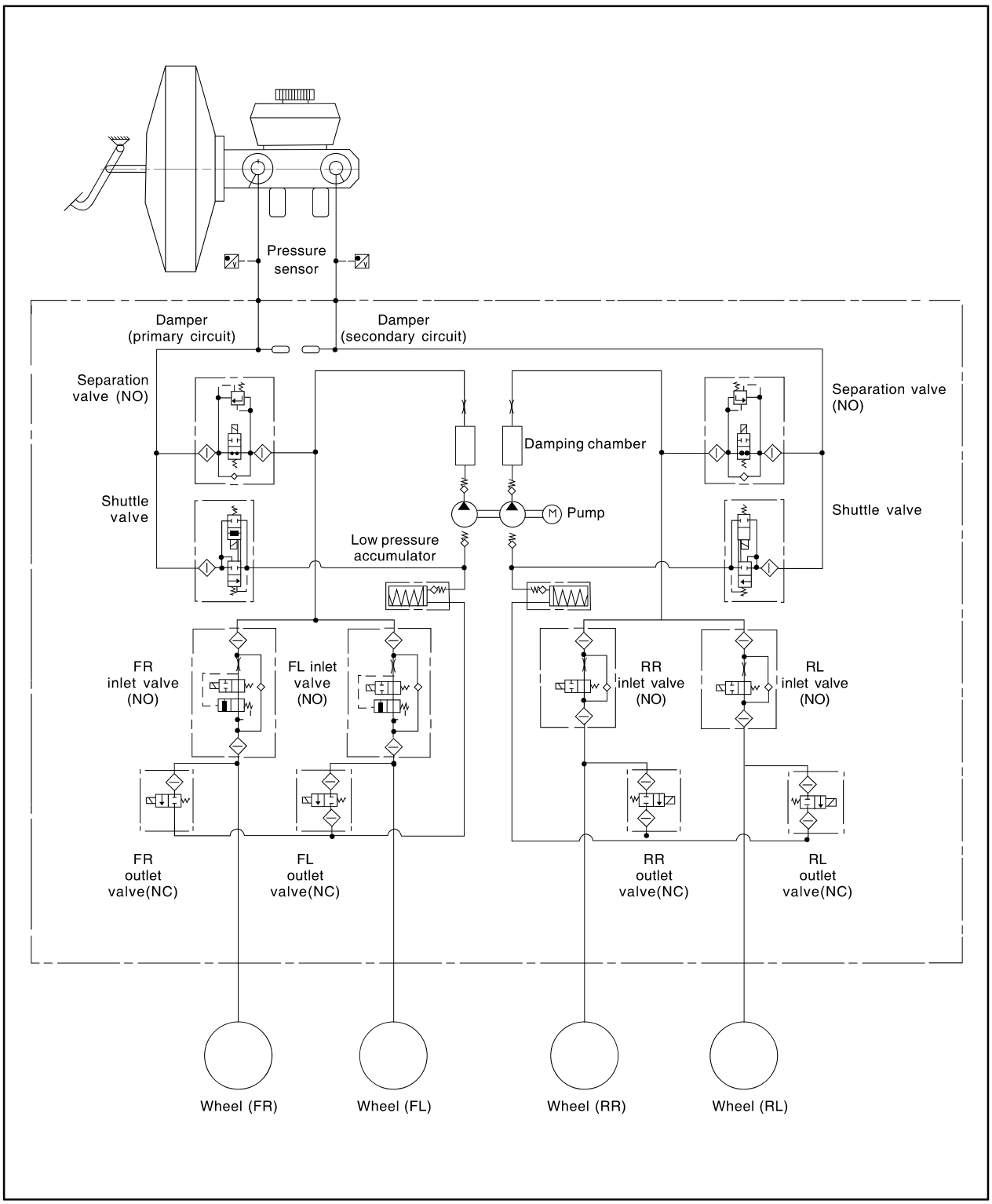
3) Vehicle Control During Cornering

The figure below shows the vehicle controls by ESP system under various situations such as when the brake pedal is pressed (or not pressed) during cornering and when the ABS is operating or when just the conventional brake is operating during braking. It also includes the vehicle conditions when the TCS that is included in the ESP system is operating.

Operations	Understeering Control	Oversteering Control
Only ESP operating No braking by driver		
ESP + Conventional brake (ABS not operating)		
ESP + ABS brake		
ESP + ASR		

Modification basis	
Application basis	
Affected VIN	

5. HYDRAULIC DIAGRAM OF ESP



When equipped with ABS, the braking force at each wheel will be controlled with 3-channel 4-sensor method. And when equipped with ESP, 4 wheels will be controlled independently with 4-channel method. (When controlling ABS system only, it will be operated with 3-channel method.) 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 increase, decrease or unchanged conditions. For details, refer to "Hydraulic circuit by ESP operation range".

▶The warning lamp comes on and warning beep sounds when the ESP is operating

When the ESP operates during vehicle movement, the ESP warning lamp on the instrument panel flickers and beep comes on every 0.1 seconds. The ESP operation shows that the vehicle stability is extremely unstable and it is used to warn the driver. The ESP system is just a supplementary system for the vehicle motion and it cannot control the vehicle when it exceeds the physical limits. Do not solely rely on the system but be advised to drive the vehicle safely.

▶Driving feeling when the ESP is operating

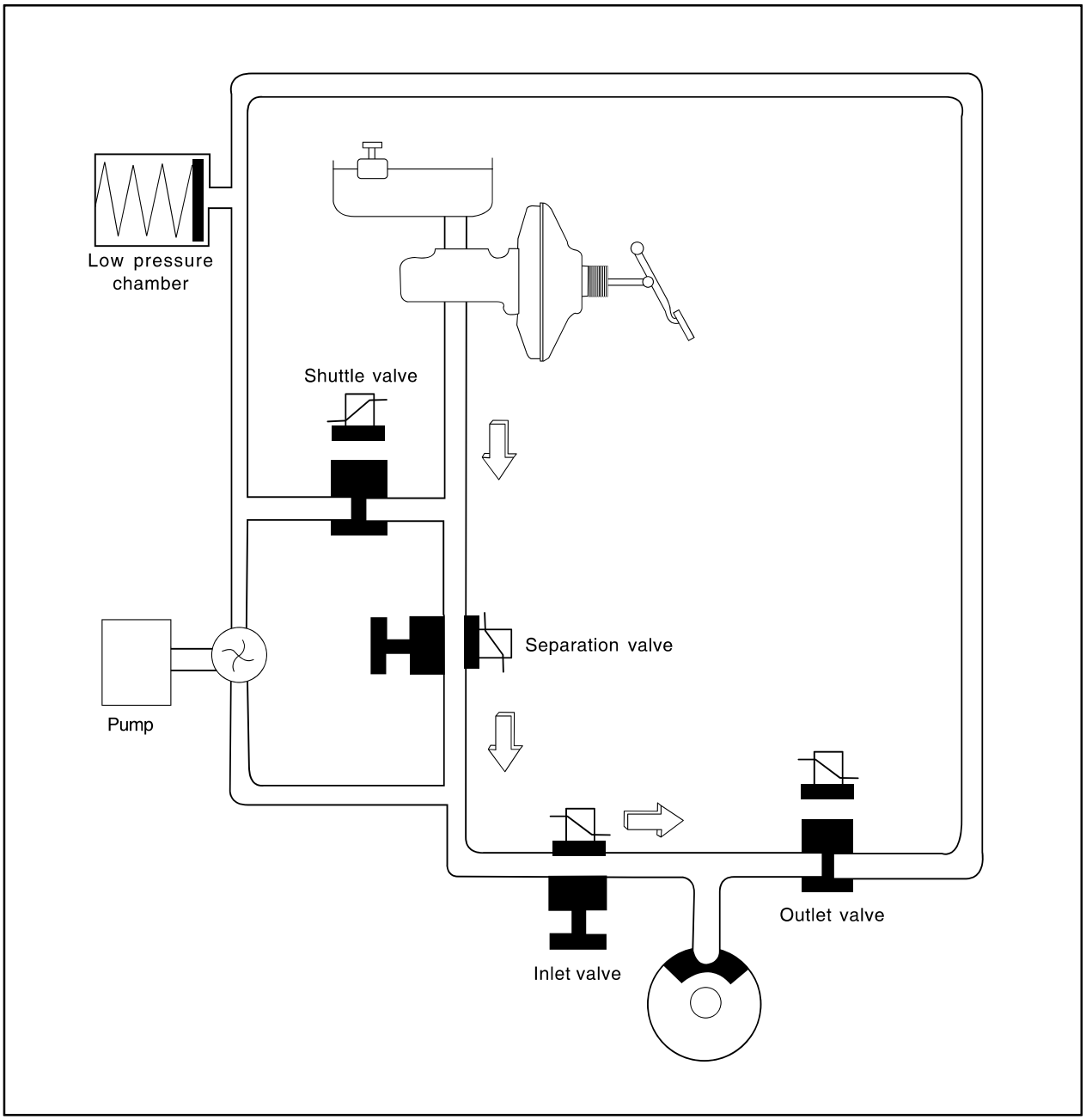
When the ESP system activates, the driving feeling can be different depending on vehicle driving conditions. For example, you will feel differently when the ESP system is activated during when ABS is operating with the brakes applied and when brakes are not applied on a curve. Thus, the ESP system would make the driver feel more abruptly when the brakes are applied during the ESP system activation.

▶Noise and vibration that driver senses when the ESP 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. Extreme cornering will trigger the ESP operation and this will make the driver feel noise and vibration due to sudden brake application. Also, the ESP system controls the engine output. So, the driver may notice the engine output decrease even when the accelerator pedal is being applied.

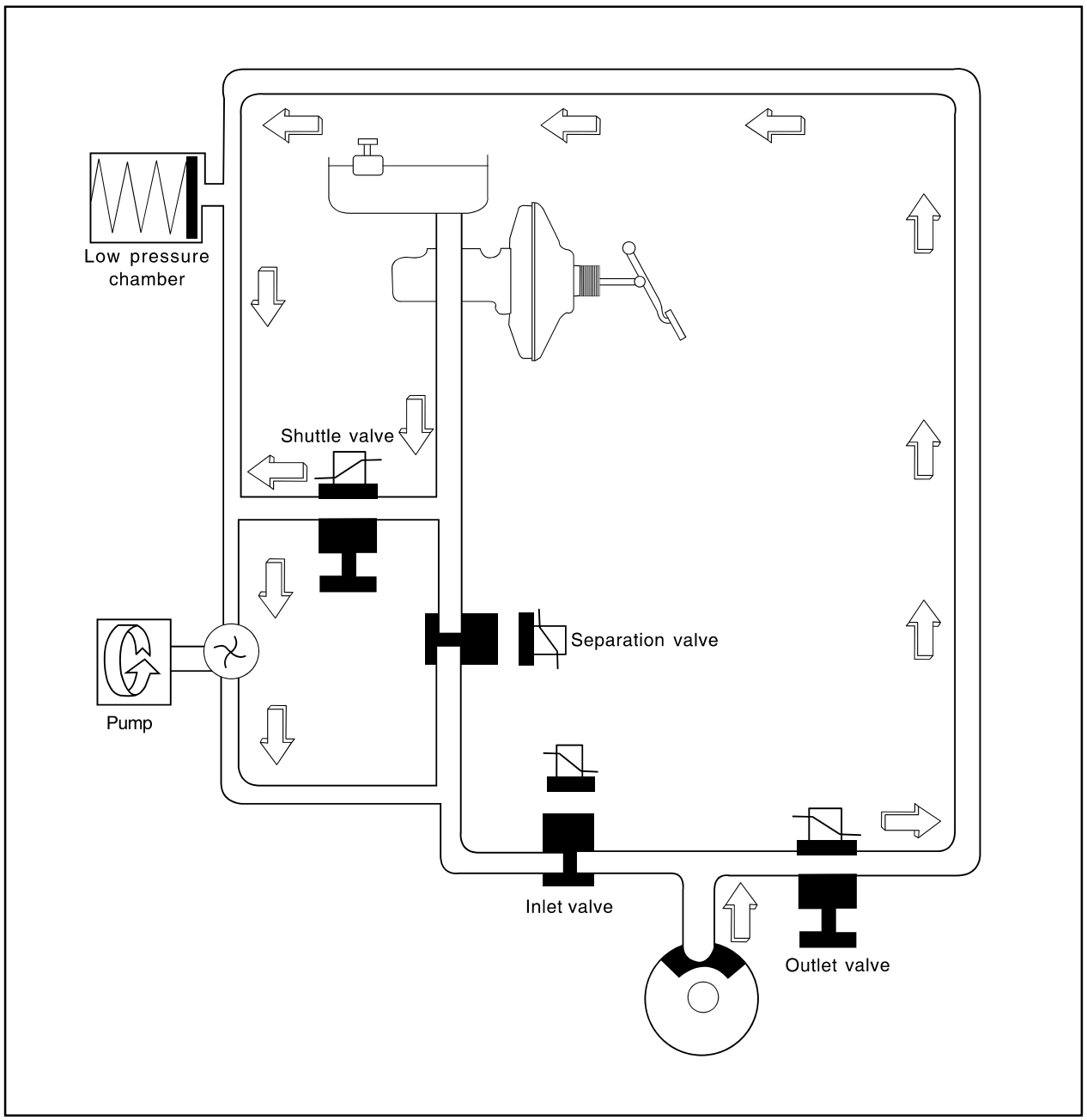
Modification basis	
Application basis	
Affected VIN	

1) ESP HYDRAULIC UNIT IN IDLING AND NORMAL BRAKING POSITION



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.

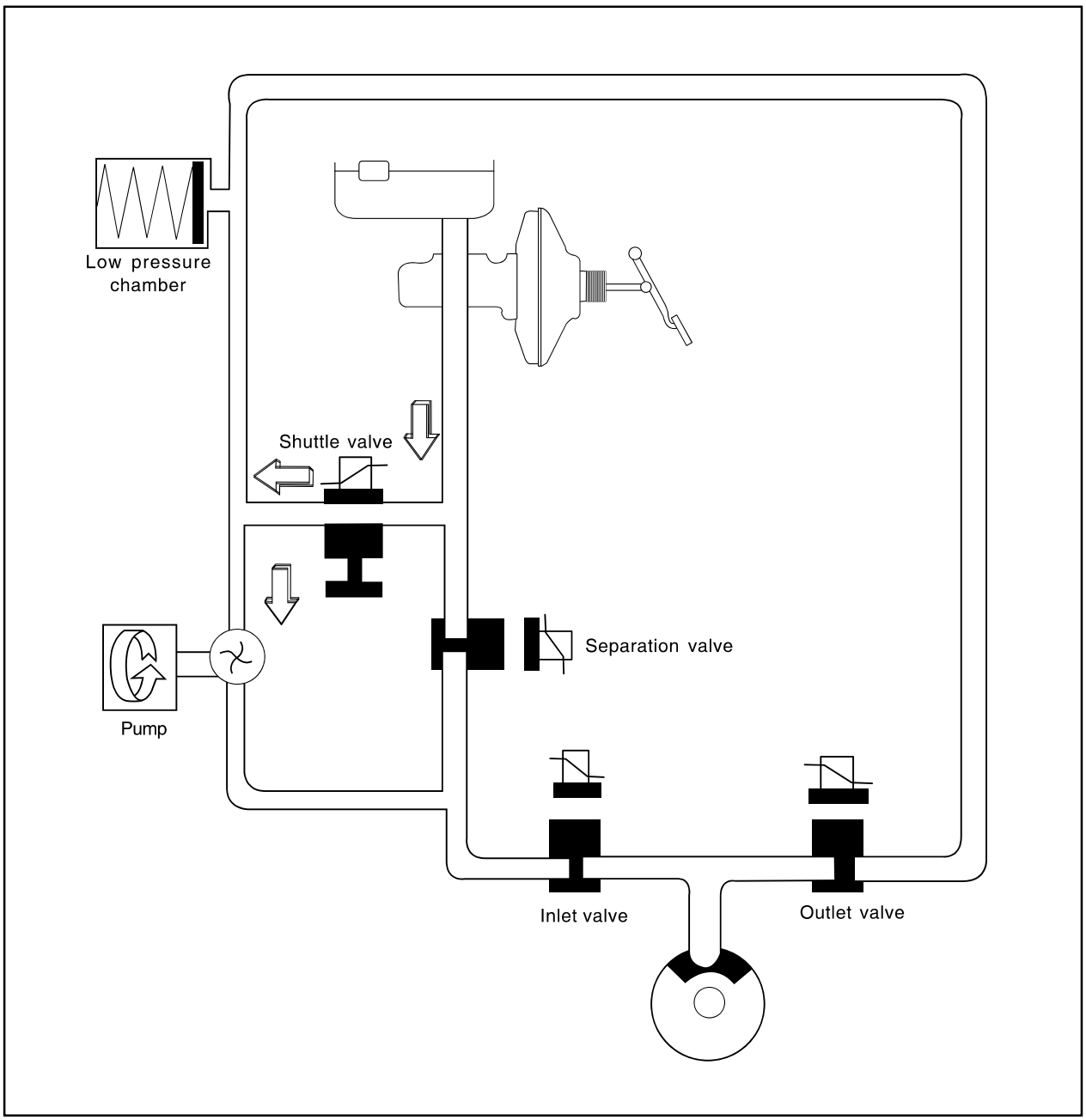
2) When applied ABS (decreased pressure)



The pressure decreases just before the wheel speed drops and the wheels. 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 .

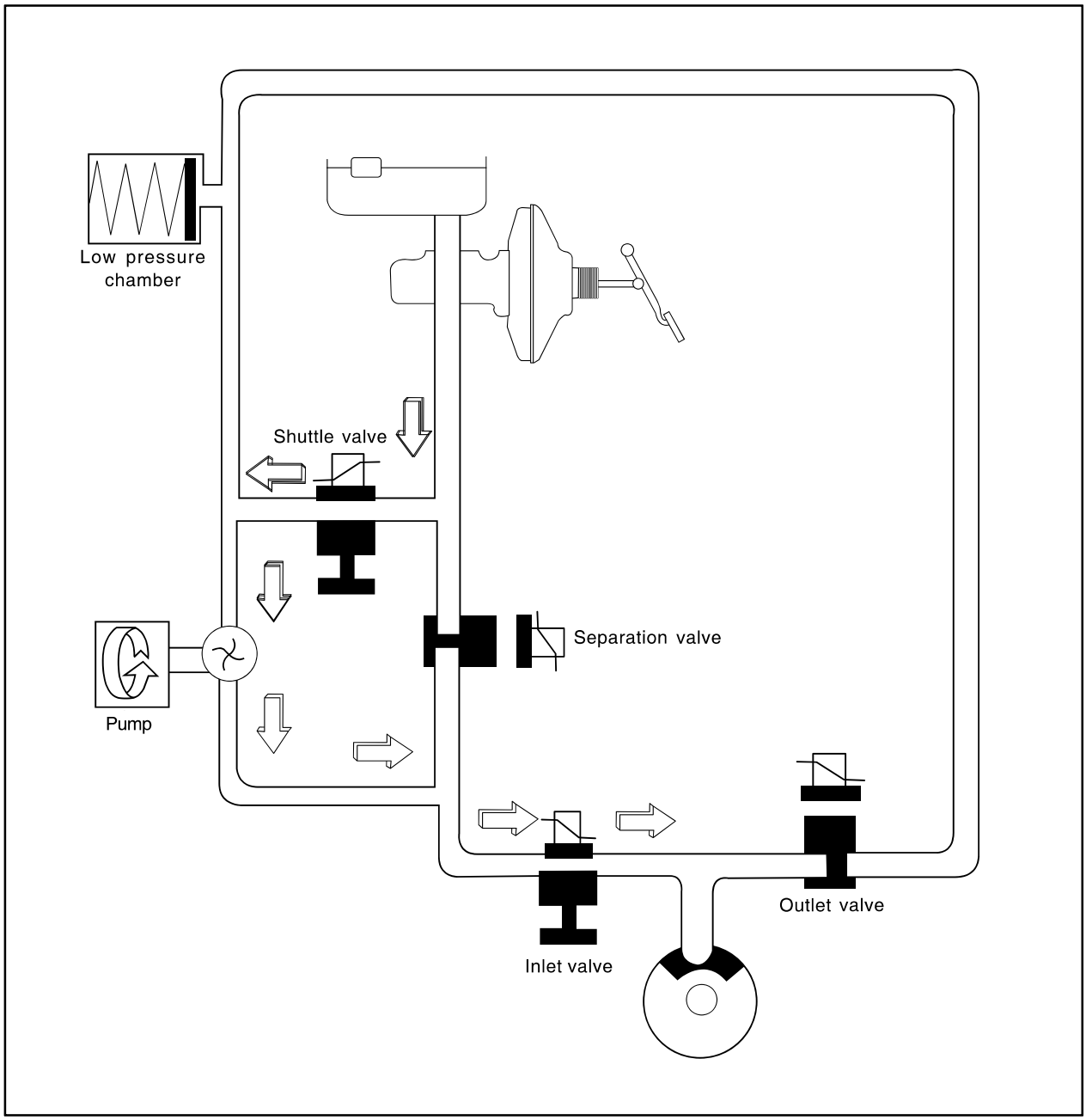
Modification basis	
Application basis	
Affected VIN	

3) When applied ABS (maintained pressure)



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.

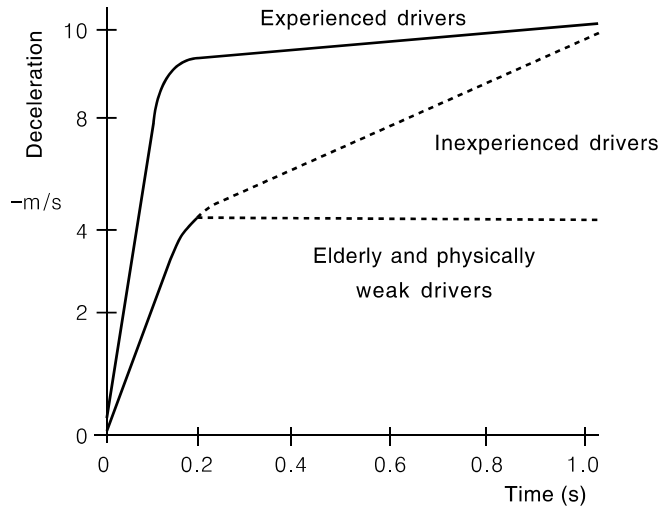
4) When applied ABS (increased pressure)



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	

6. 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.

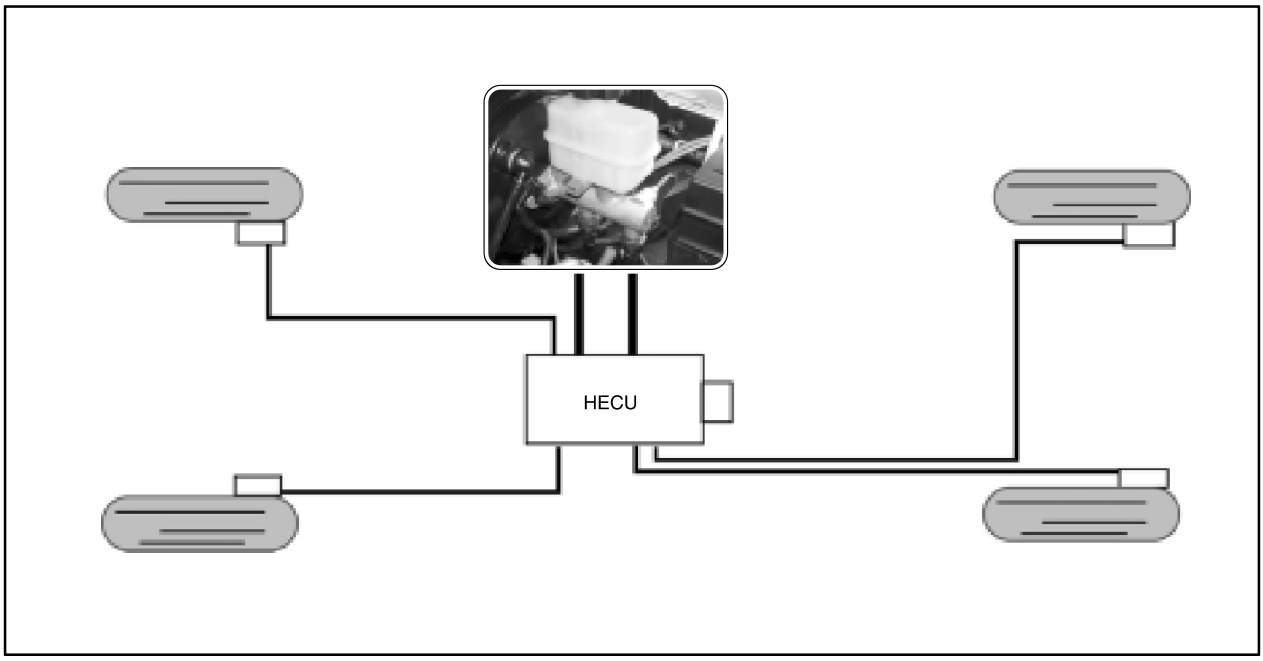
Based on the fact that some drivers depress the brake pedal too soft even under when hard braking is necessary, the HECU system is a safety supplementary system that builds high braking force during initial braking according to pressure value of the brake pressure sensor and the pressure changes of the 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

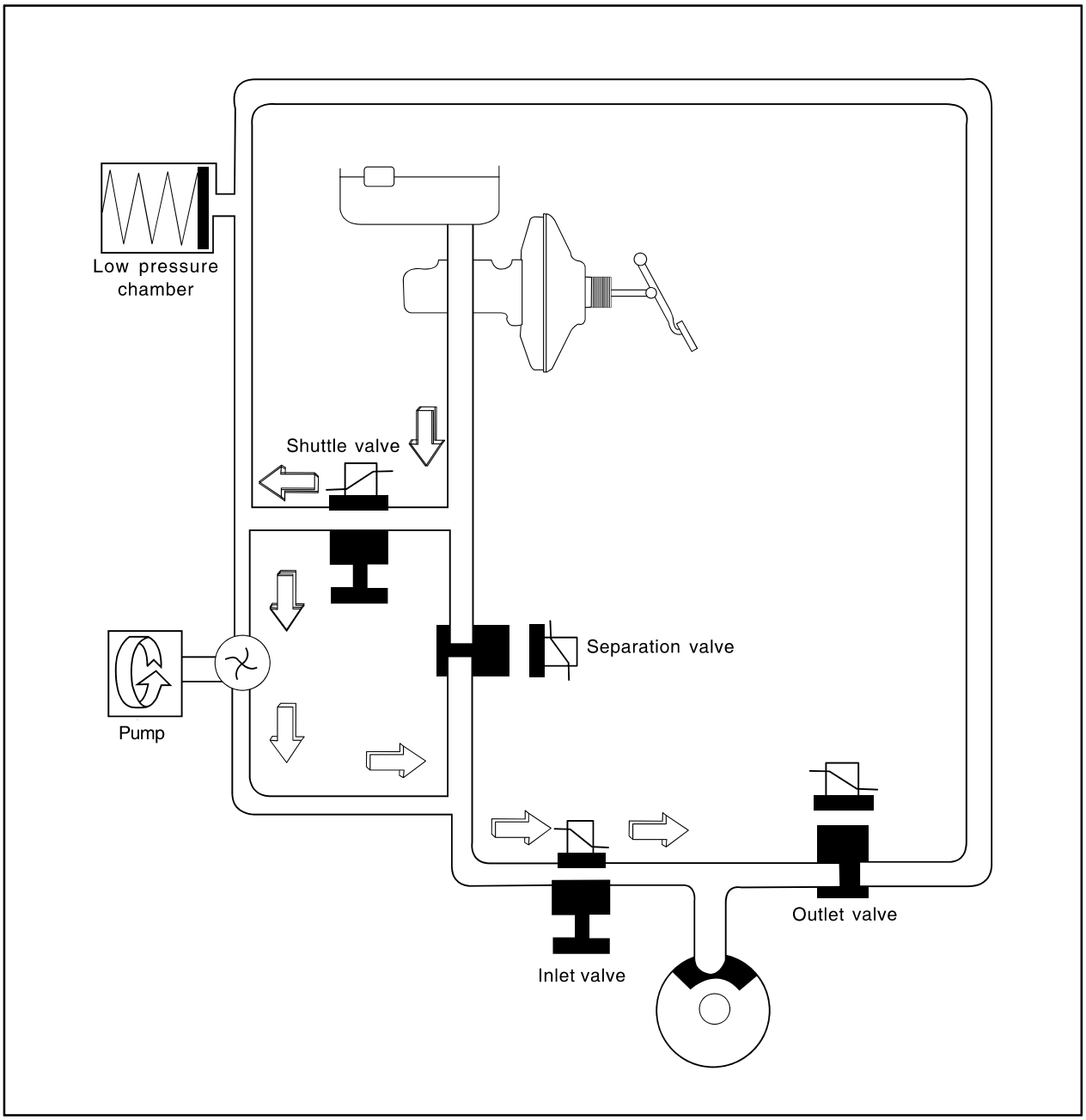
The brake pressure value and the changed value of the pressure sensor are the conditions in which the HBA System operates. There are 2 pressure sensors under the master cylinder. When the ESP ECU system determines that emergency braking is present, the pump operates, the brake fluid in the master cylinder 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.



Modification basis	
Application basis	
Affected VIN	

3) Hydraulic Diagram of HBA

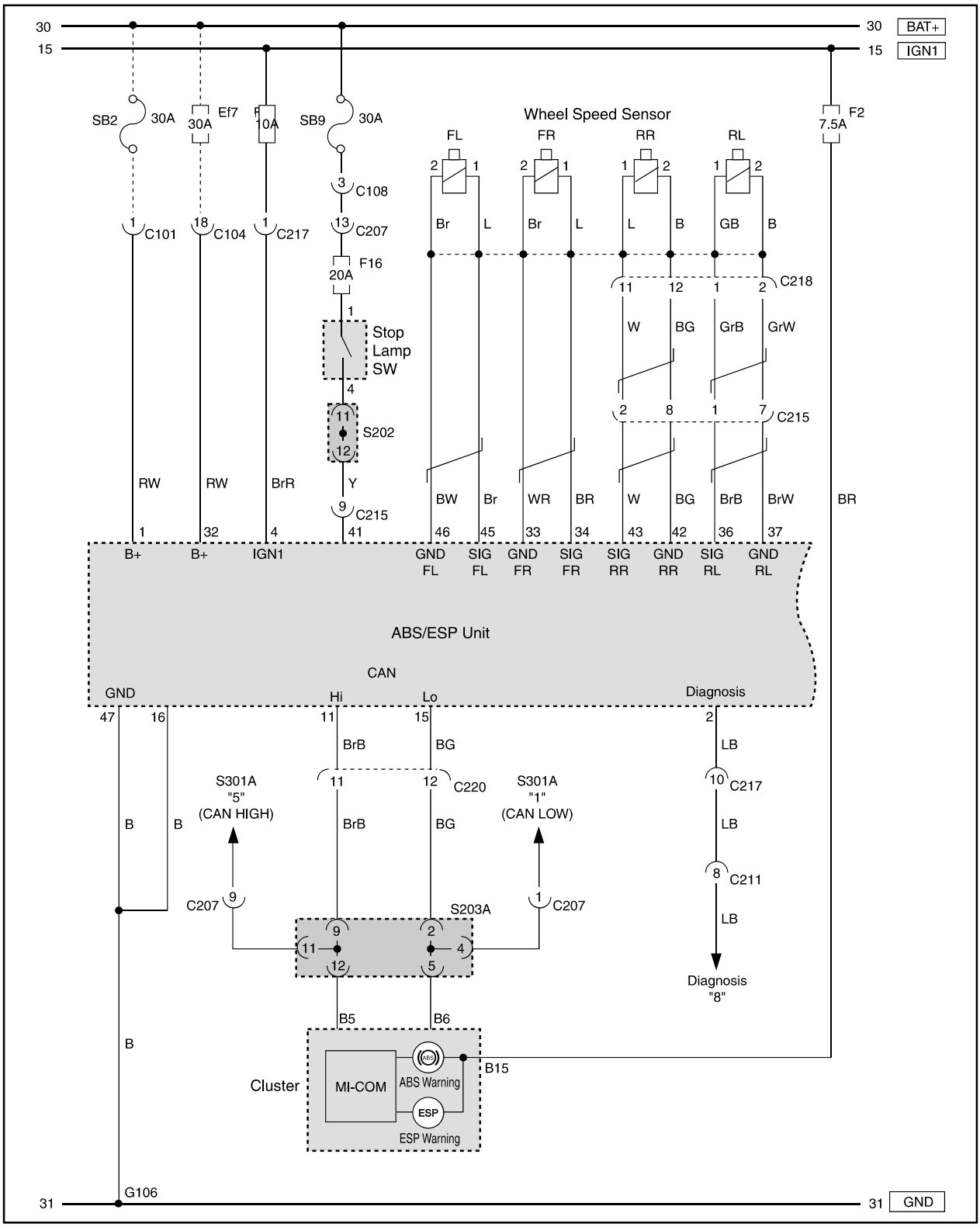


The above figure shows one front and one rear wheel and the same hydraulic circuit forms as in the ESP operation.

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 are will stay closed. When the wheel starts to lock, the HBA function cancels and switches to ABS operation

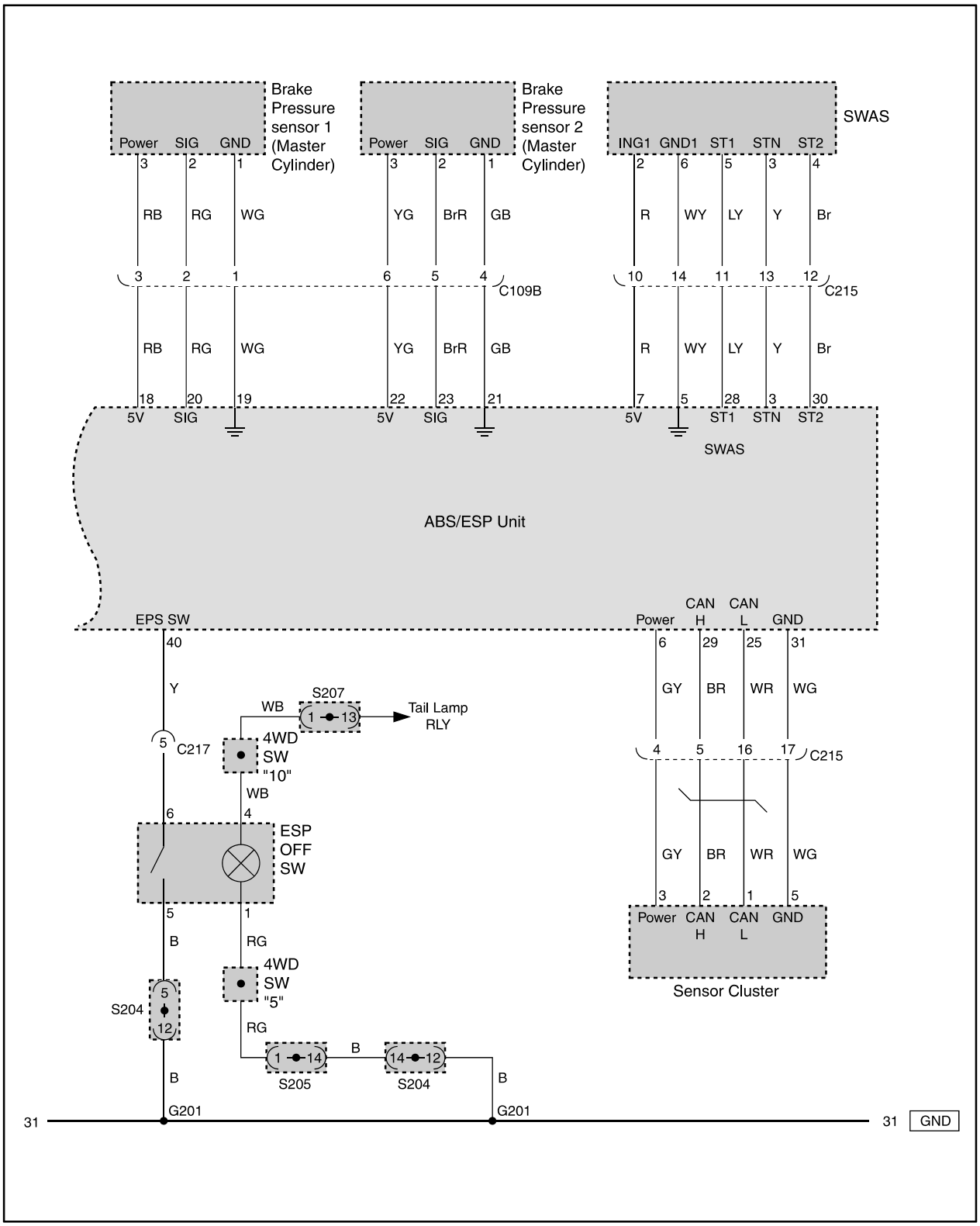
7. ELECTRIC CIRCUIT DIAGRAM

▶ Wheel Speed Sensor, Stop Lamp Switch, Diagnostic Connector, Warning Lamp (ABS/ESP)



Modification basis	
Application basis	
Affected VIN	

▶ Brake Pressure Sensor, Steering Wheel Angle Sensor, Sensor Cluster, ESP OFF Switch



Modification basis	
Application basis	
Affected VIN	

AIR CONDITIONER

6820-11

GENERAL

1. SPECIFICATIONS

Component			Description	
Compressor		Type	Variable Displacement	
		Model	Single	V-5 Compressor
			Dual	KC83
			Gasoline	KC83
		Displacement	Single	9.8 ~ 151 cc/rev
			Dual	175.5 cc/rev
			Gasoline	175.5 cc/rev
		Max. RPM	6,000 ~ 7,500 rpm	
Refrigerant		Type	R-134a	
		Capacity	Single	850 ± 50 g
			Dual	1200 ± 50 g
Oil		Type	Synthetic PAG Oil	
		Capacity	260 cc	
Receiver-drier		Material	Aluminum	
		Capacity	260 cc	
A/C condenser		Max. capacity	11,400 Kcal/h	
Evaporator		Size	263.0 x 228.6 x 88.9 mm	
		Capacity	6,500 Kcal/h	
A/C pressure sensor	High pressure	A/C ON/OFF	305/425 psi	
	Low pressure	A/C ON/OFF	39/30 psi	
A/C cutoff pressure		High pressure	32 Kgf/cm ^{2}	
		Low pressure	4 Kgf/cm ^{2}	

2. REPAIR INSTRUCTIONS

1) Precautions for Working with R-134a

- R-12 refrigerant and R-134a refrigerant are not compatible. These refrigerants must never be mixed, even in the smallest amounts. If the refrigerants are mixed, compressor failure is likely to occur.
- Use only specified lubricant for the R-134a A/C system and R-l34a components. If lubricant other than that specified is used, compressor failure is likely to occur.
- The specified R-134a lubricant rapidly absorbs moisture from the atmosphere.

The following handling precautions must be observed:

1. When removing refrigerant components from a vehicle, immediately cap (seal) the component to minimize the entry of moisture from the atmosphere.
2. When installing refrigerant components to a vehicle, do not remove the caps (unseal) until just before connecting the components. Connect all refrigerant loop components as quickly as possible to minimize the entry of moisture into system.
3. Only use the specified lubricant from a sealed container. Immediately reseal containers of lubricant. Without proper sealing, lubricant will become moisture saturated and should not be used.
4. Avoid breathing A/C refrigerant and lubricant vapor or mist. Exposure may irritate eyes, nose and throat. Use only approved recovery/recycling equipment to discharge R-134a refrigerant. If accidental system discharge occurs, ventilate work area before resuming service. Additional health and safety information may be obtained from refrigerant and lubricant manufacturers.
5. Do not allow lubricant to come in contact with Styrofoam parts. Damage may result.

Modification basis	
Application basis	
Affected VIN	

2) General Refrigerant Precautions

- Do not release refrigerant into the air. Use approved recovery/recycling equipment to capture the refrigerant every time an air conditioning system is discharged.
- Always wear eye and hand protection (goggles and gloves) when working with any refrigerant or air conditioning system.
- Do not store or heat refrigerant containers above 52°C.
- Do not heat a refrigerant container with an open flame: if container warming is required place the bottom of the container in a warm pail of water.
- Do not intentionally drop, puncture, or incinerate refrigerant containers.
- Keep refrigerant away from open flames: poisonous gas will be produced if refrigerant burns.
- Refrigerant will displace oxygen, therefore be certain to work in well ventilated area to prevent suffocation.
- Do not introduce compressed air to any refrigerant container or refrigerant component.

3) Handling O-Ring

1. Even though O-rings may look identical, it is extremely important that only recommended service replacement air conditioning O-rings be used, or excessive leakage of the refrigerant may occur.
2. Always O-ring and installation area should be kept clean. Any foreign material and dust may result in excessive refrigerant leakage.
3. Before installation, verify that both O-ring and fittings have not been nicked or deformed. Deformed or nicked parts must be replaced.
4. Failure to use the proper service replacement parts and procedures may result in excessive refrigerant leakage.

4) Handling Refrigerant

1. Always work in a well-ventilated area.
2. If you have difficulty breathing, seek medical attention immediately. If refrigerant comes in contact with any part of your body, flush the exposed area with water. If a rush or pain develops seek medical attention.

5) Handling of Refrigerant Lines and Fittings

1. Using too low or too high a torque when tightening a fitting can result in loose joints or deformed joint parts.
2. Back up the opposing fitting to prevent the distortion of the connecting lines or the components. Back up both the swaged fitting on the flexible hose connections and the coupling to which it is attached two wrenches to prevent turning the fitting and damaging the ground seat.

6) Maintaining Chemical Stability In the Refrigeration System

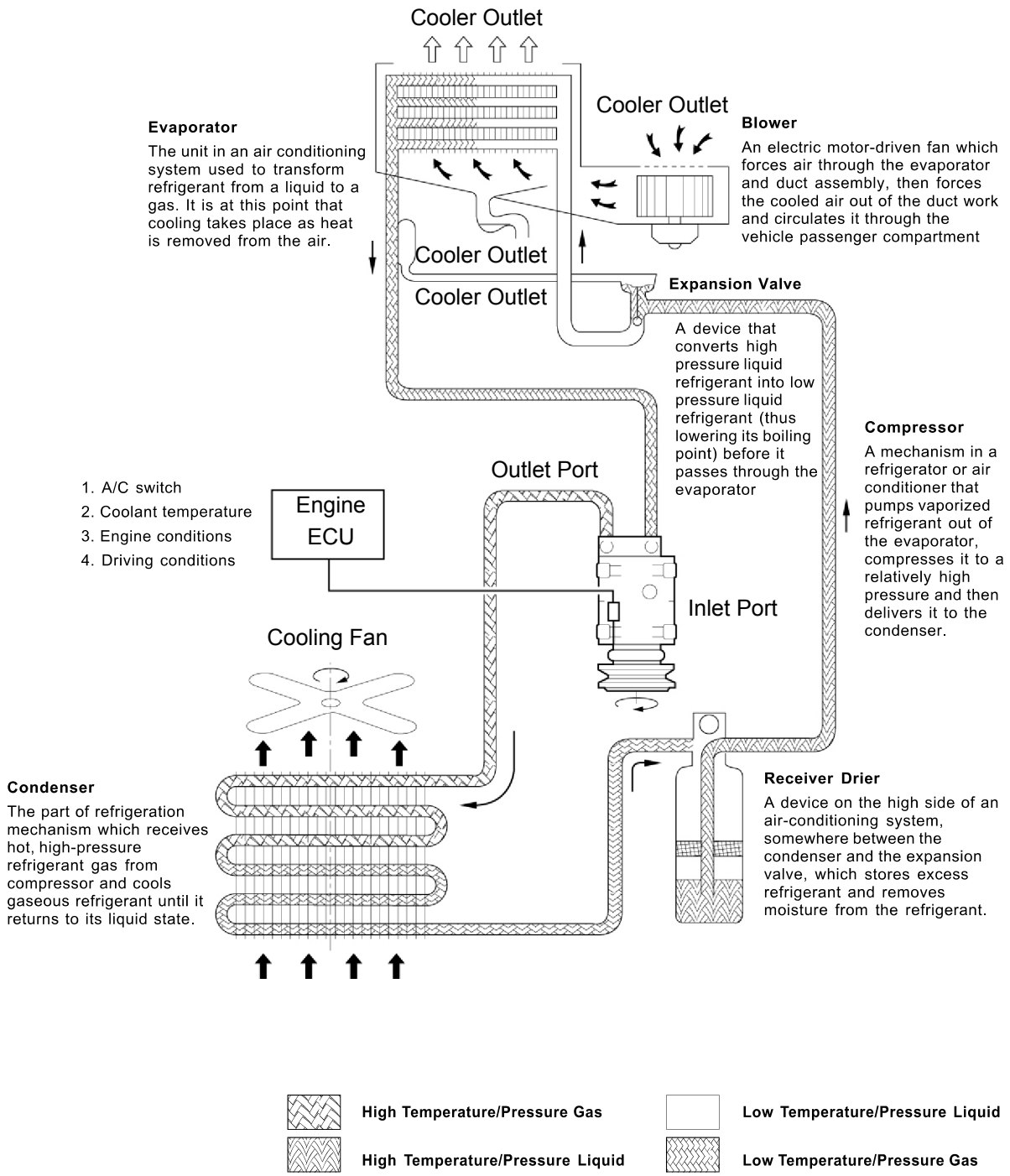
The efficient operation and life of the air conditioning system is dependent upon the chemical stability of the refrigeration system.
When foreign materials, such as dirt, air or moisture, contaminate the refrigeration system, they will change the stability of the refrigeration and the polyalkalene glycol (PAG) compressor oil. They will also affect the pressure-temperature relationship, reduce efficient operation and can possibly cause interior corrosion and abnormal wear of moving parts.
Observe the following practices to ensure chemical stability in the system:

1. Wipe away dirt or oil at and near any connection before opening that connection. This will reduce the chance of dirt entering the system.
2. Cap, plug or tape both sides of a connection as soon as possible after opening the connection. This will prevent the entry of dirt, foreign material and moisture.
3. Keep all tools clean and dry including the manifold gauge set and all replacement parts.
4. Use a clean and dry transfer device and container to add PAG refrigerant oil. This will ensure that the oil remains as moisture-free as possible.
5. When opening an A/C system, have everything needed to perform all operations ready. Do not leave the A/C system open any longer than necessary.
6. Evacuate and recharge any A/C system that has been opened.

Modification basis	
Application basis	
Affected VIN	

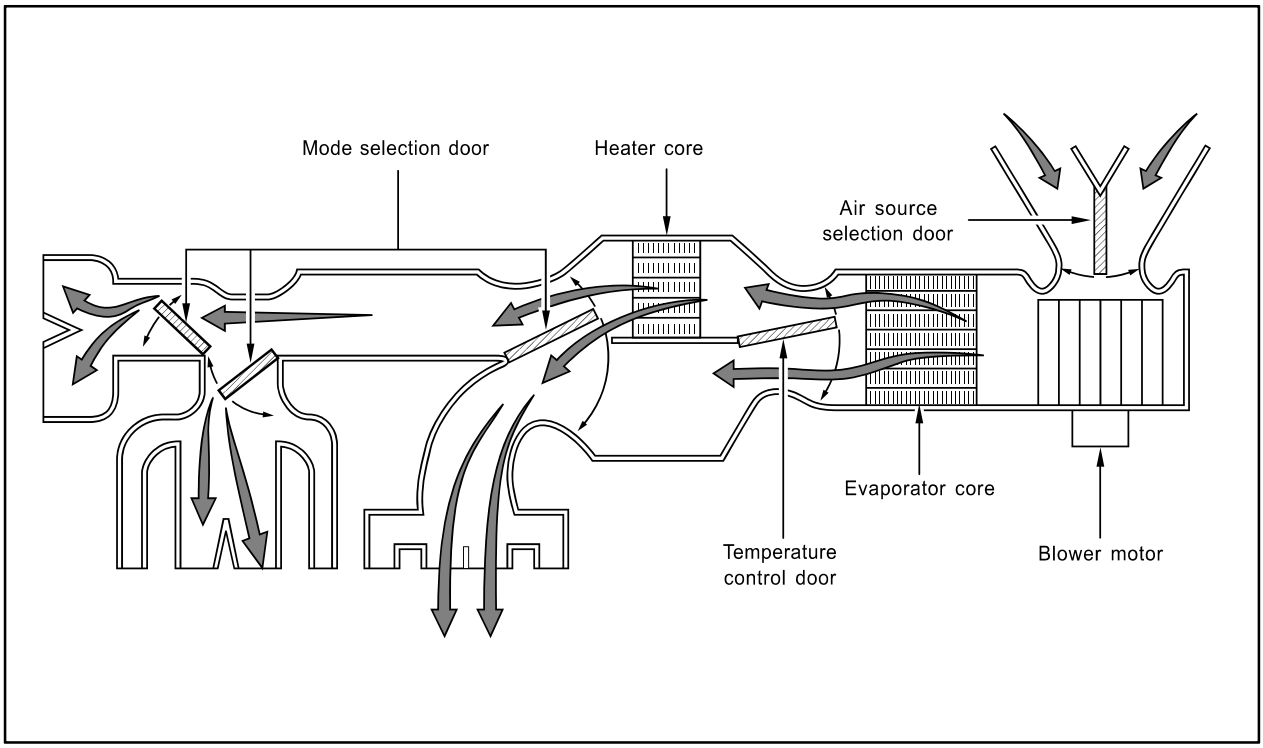
OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

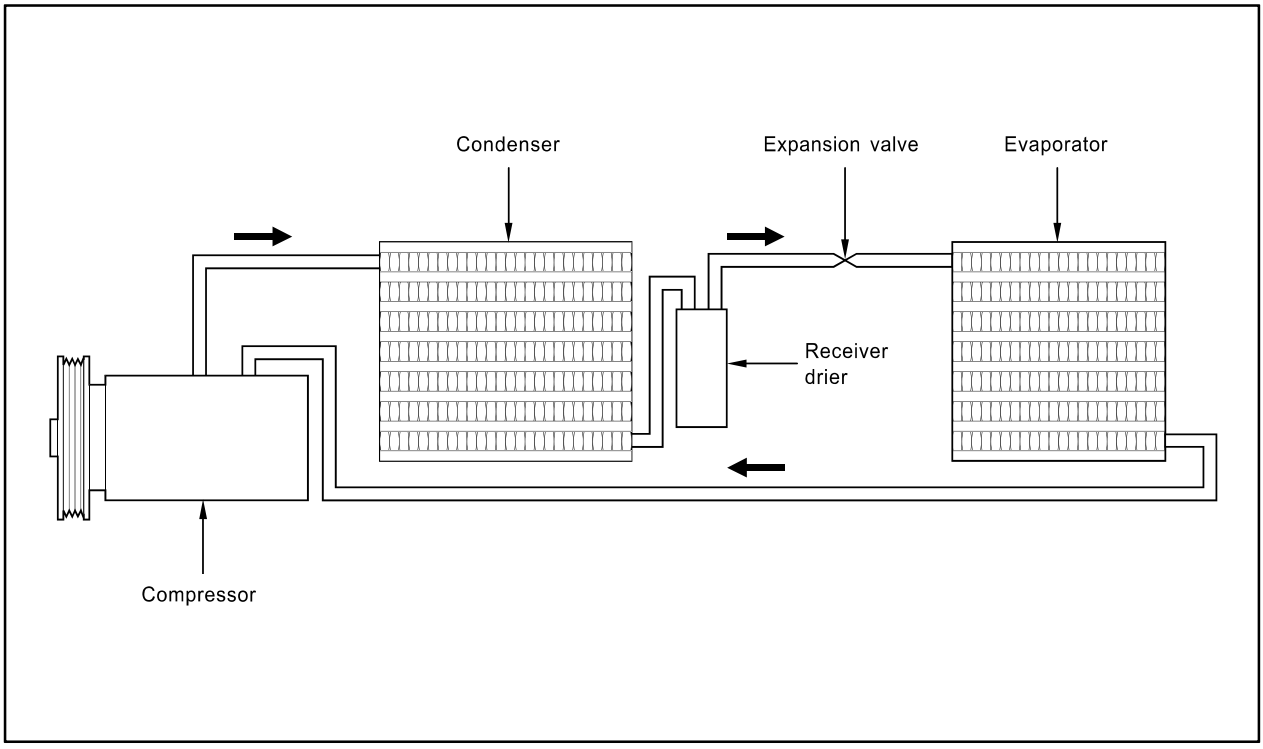


Modification basis	
Application basis	
Affected VIN	

2. AIR FLOWS



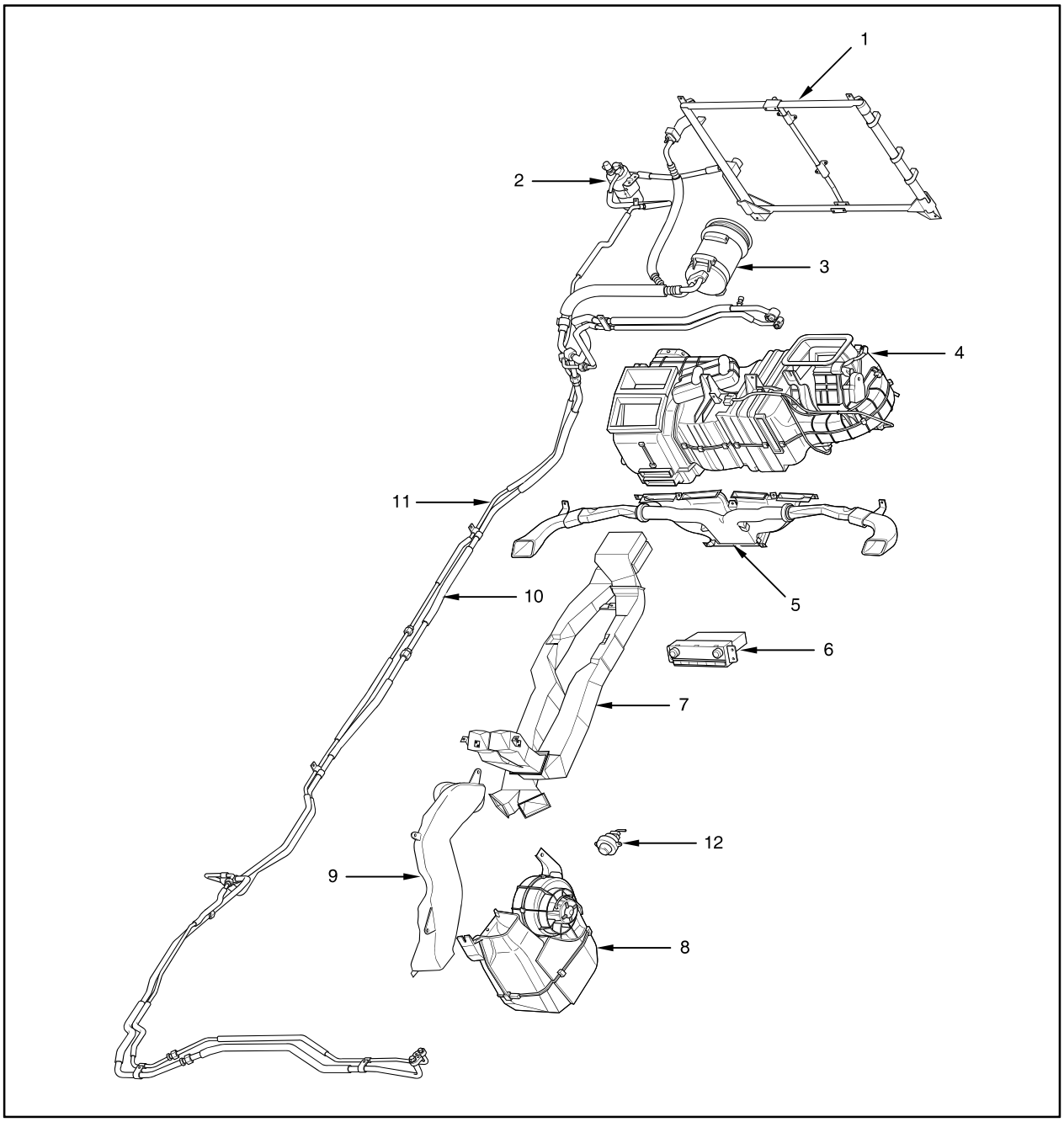
▶Refrigerant Flows



Modification basis	
Application basis	
Affected VIN	

3. SYSTEM LAYOUT

▶Components Locator



1. Condenser
2. Receiver drier
3. Compressor
4. Air conditioner/Heater (Blower) module
5. Defrost nozzle
6. Front air conditioner controller
7. Rear duct
8. Rear cooler assembly
9. Rear cooler duct
10. Suction rear pipe line
11. Liquid rear pipe line
12. Rear cooler controller

4. FUNCTION DESCRIPTION

1) Compressor

All compressor are belt-driven from the engine crankshaft through the compressor clutch pulley. The compressor pulley rotates without driving the compressor shaft until an electromagnetic clutch coil is energized. When voltage is applied to energize the clutch coil, the clutch plate and hub assembly is drawn rearward toward the pulley. The magnetic force locks the clutch plate and pulley together as one unit to drive the compressor shaft. As the compressor shaft driven, it compresses the low pressure refrigerant vapor from evaporator into high pressure, high temperature vapor. The refrigerant oil that is used to lubricate the compressor is carried with the refrigerant.

2) Magnetic Clutch

The magnetic clutch is assembled in front of the compressor and controls to stop or operate the compressor. The center piece is inserted to the compressor crankshaft and rotate the only the pulley when it doesn't operate the compressor. When the A/C switch is turned ON, the current flows into the wrapped coil of the stator and the stator is converted to the powerful electromagnet. Therefore, the compressor can rotate with the pulley together because the stator can pull the center piece tightly.

3) V-5 Compressor-General

Vehicle using the V5 compressor may have differences between installations in the mounting brackets, the drive system, the pulleys, the connections and the system capacities. Basic overhaul procedures are similar between the compressors used on different vehicles. When serving the compressor, keep dirt and foreign material from getting on or into the compressor parts and the system. Clean tools and a clean work area are important for proper service. The compressor connections and outside of the compressor should be cleaned before performance of any on-vehicle repairs and before removal of the compressor. The parts must be kept clean at all times and any parts that are to be reassembled should be cleaned with trichloroethane, naphtha, stoddard solvent, kerosene or equivalent solvents and dried with dry air. Use only lintfree cloths to wipe the parts. The operations described are based on bench overhaul with the compressor removed from the vehicle, except as noted. They have been prepared in the order of accessibility of the components. When a compressor is removed from the vehicle for servicing, the amount of oil remaining the compressor should be drained, measured and recorded. This should then be discarded and new polyalkaline glycol (PAG) refrigerant oil added to the compressor.

Modification basis	
Application basis	
Affected VIN	

CAUTION

The oil drain plug must be removed and the oil drained through the plug opening to insure complete draining of oil from the compressor.

4) V-5 Compressor-Operation

The V5 is a variable displacement compressor that can match the automotive air conditioning demand under all conditions without cycling. The basic compressor mechanism is a variable angle wobble-plate with seven axially oriented cylinders. The center of the control of the compressor displacement is a billows-actuated control valve located in the rear head of the compressor that senses compressor suction pressure. The wobble-plate angle and the compressor displacement are controlled by the crankcase suction pressure differential. When the A/C capacity demand is high, the suction pressure will be above the control point. The valve will maintain a bleed from crankcase to suction. With no crankcase suction pressure differential, the compressor will have maximum displacement.
When the A/C capacity demand is lower and the suction pressure reaches the control point, the valve will bleed discharge gas in the crankcase and close off a passage from the crankcase to suction plenum. The angle of the wobble-plate is controlled by a force balance of seven pistons. A slight elevation of the crankcase suction pressure differential creates total force on the piston resulting in a movement about the wobble-plate pivot pin that reduces the plate angle. The compressor has a unique lubrication system. The crankcase suction bleed is routed through the rotating wobble-plate for lubrication of wobble-plate bearing. The rotation acts as an oil separator that removes some of the oil from the crankcase where it can lubricate the compressor mechanism.

5) Condenser Core

The condenser assembly in front of the radiator consists of coils, which carry the refrigerant and cooling fins that provide the rapid transfer of heat. The air passing through the condenser cools the high-pressure refrigerant vapor and causes it to condense it to condense into a liquid.

6) Receiver-Drier

The sealed receiver-drier assembly is connected between the condenser and evaporator. It acts as a refrigerant storing container, receiving liquid and some vapor and refrigerant oil from the condenser. At the bottom of the receiver-drier is the desiccant, which acts as drying agent for the moisture that may have entered the system. An oil bleed hole is located near the bottom of the receiver-drier outlet pipe to provide an oil return path to the compressor. The receiver drier is serviceable as an assembly.

7) Expansion Valve

The expansion valve can fall in three different positions: open, closed or restricted.
An expansion valve that fails in open position will result in a noisy A/C compressor or no cooling. The cause can be a broken spring, a broken ball or excessive moisture in the A/C system. If the spring or the ball are found to be defective, replace the expansion valve. If excessive moisture is found in the A/C system recycle the refrigerant. A restricted expansion valve will result in low suction pressure and no cooling. This may be caused by debris in the refrigerant system. If debris is believed to be the cause, recycle the refrigerant, replace the expansion valve and replace the receiver-drier.

8) Evaporator

The evaporator is a device which cools and dehumidifies the air before it enters the vehicle. High pressure liquid refrigerant flows through the expansion tube (orifice) and becomes a low pressure gas in the evaporator. The heat in the air passing through the evaporator core is transferred to the cooler surface or the core, which cools the air. As the process of heat transfer from the air the evaporator core surface is taking place, any moisture (humidity) in the air condenses on the outside surface of the evaporator core and is drained off as water.

9) Pressure Relief Valve

The compressor is equipped with a pressure relies valve which is placed in the system as a safety factor. Under certain conditions, the refrigerant on the discharge side may exceed the designed operating pressure at approximately at 3,171 to 4,137 kPa (460 to 600 psi) in an R-134a system. Conditions that might cause this valve to open, such as a defective pressure transducer, an inoperative cooling fan, etc., should be corrected. The refrigerant oil and the refrigerant should be replaced as necessary.

10) Controller

The operation of the A/C system is controlled by the switches and knob on the control head.
This consolemounted controller contains following control knobs.
Temperature control

- Actuates by cable.
- Raise the temperature of the air entering the vehicle by sliding to the right or the red portion of the knob.
- Varies the mix of the fresh air from outside the vehicle with the heated air from inside the vehicle to suit individual performance.

Modification basis	
Application basis	
Affected VIN	

▶Mode control

- Actuates by cable.
- Regulates the air distribution between the windshield, the instrument panel and the floor vents.

▶Blower control

- Turn on to operate the blower motor at four speeds.
- Turn OFF to stop the blower.
- Operates completely independently from both the mode control knob and temperature control knob.
- Changes the fan speed in any mode and at any speed.

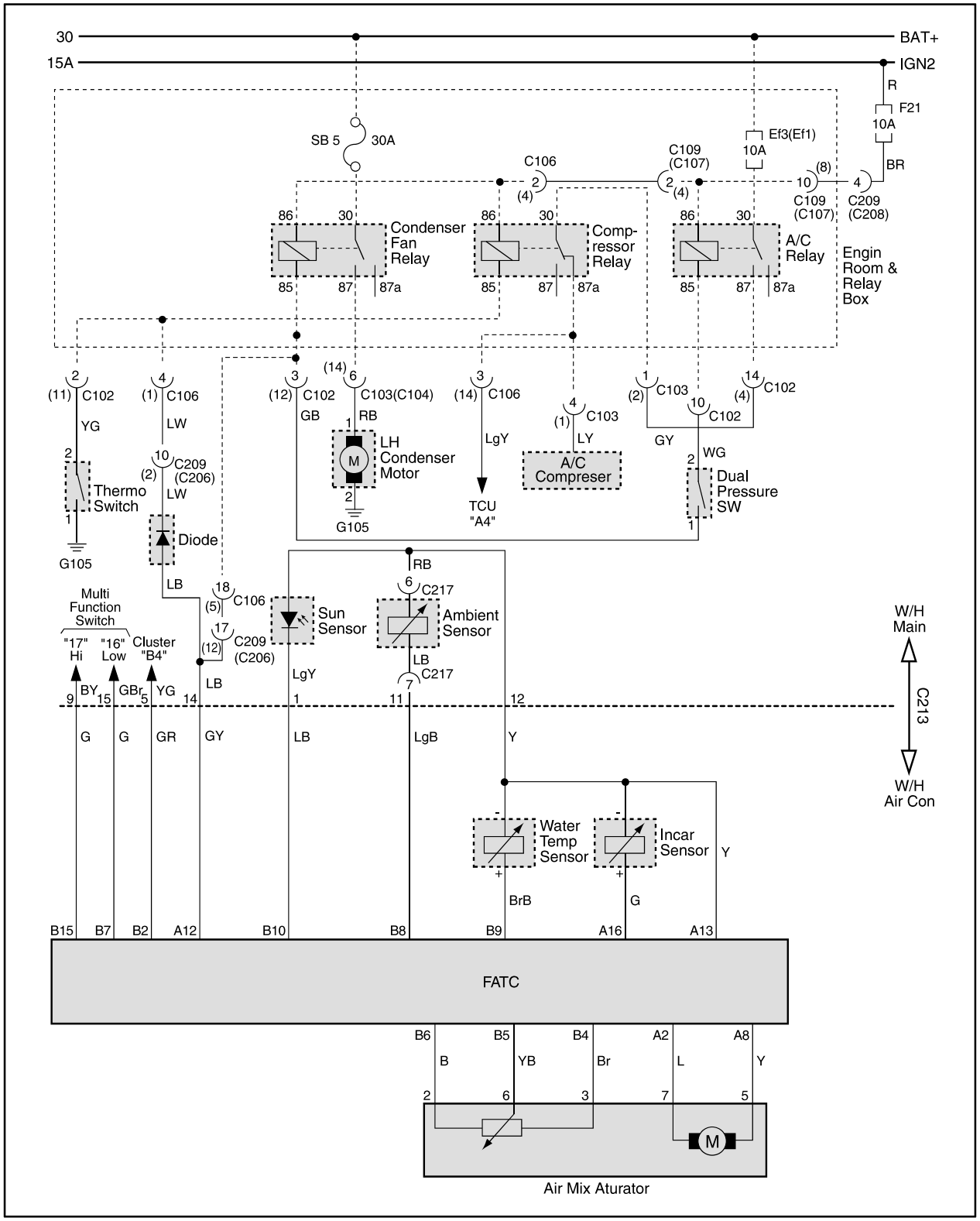
▶A/C System Delay Relay

This relay controls the current to A/C system and instantly delays the A/C operation during starting the engine.

5. CIRCUIT DIAGRAM

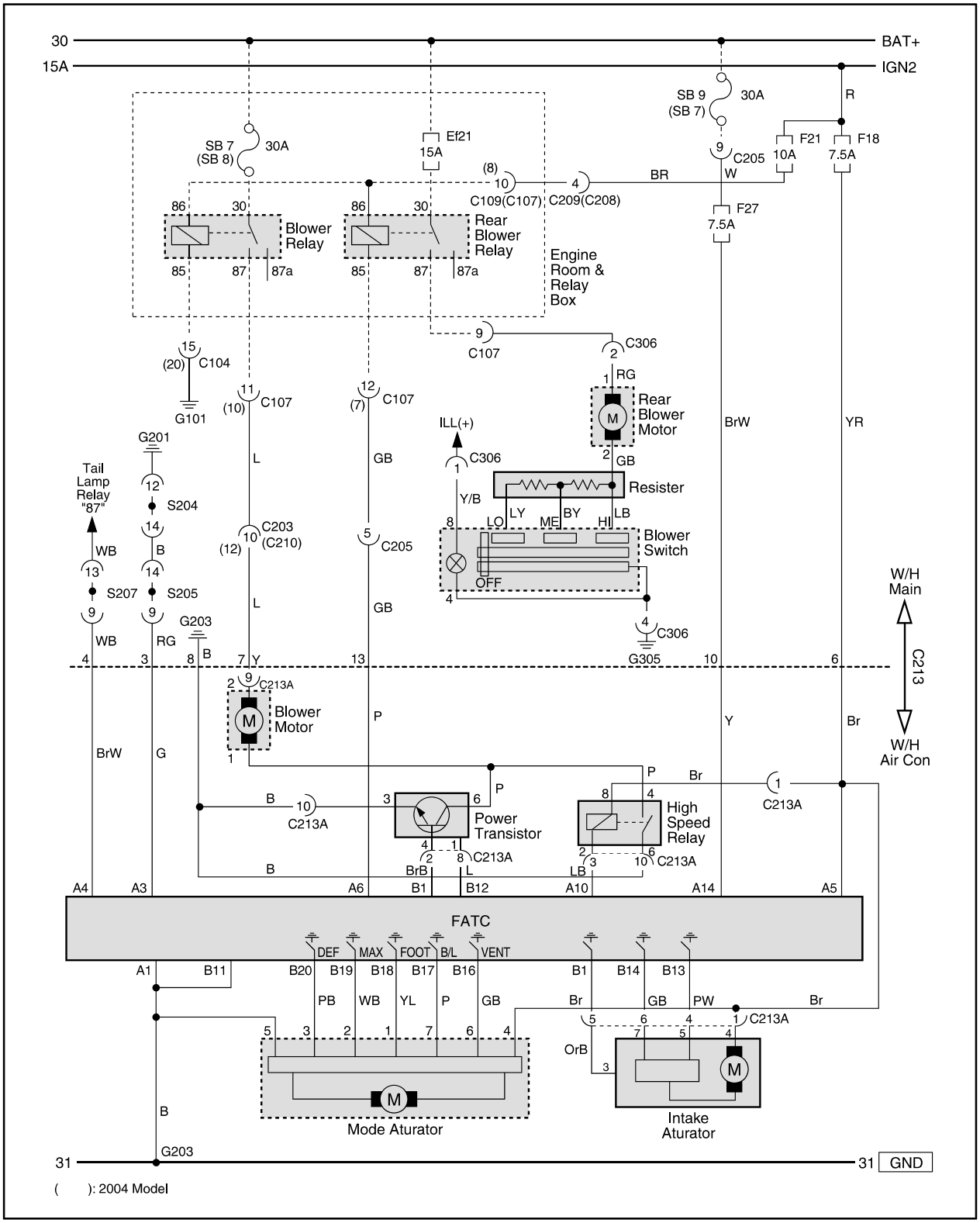
1) Automatic Air Conditioner

▶Air Mix Motor, Sensors (Sun, Ambient, Interior, Coolant Temperature)



Modification basis	
Application basis	
Affected VIN	

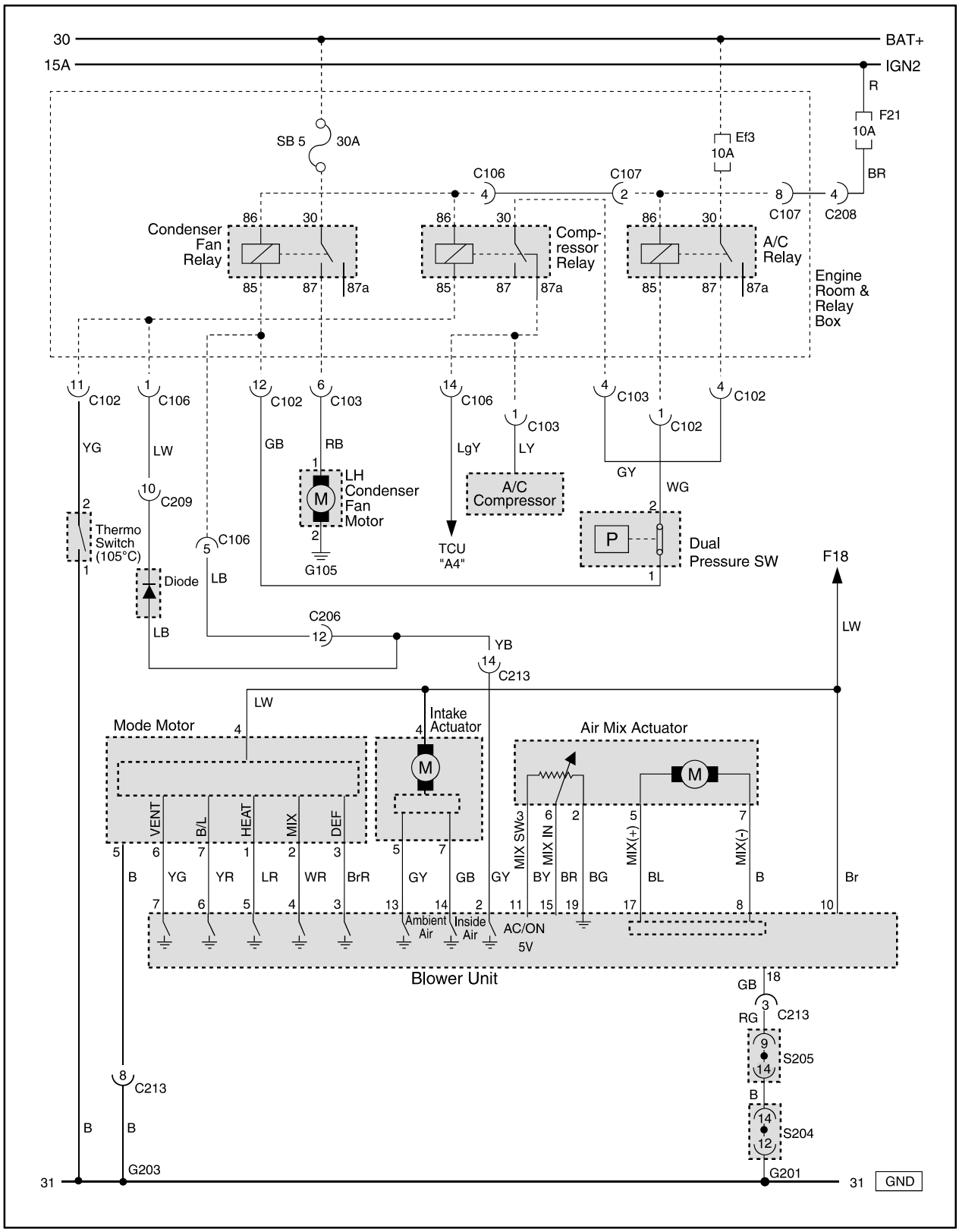
▶Motor (Mode, Interior/Ambient)



Modification basis	
Application basis	
Affected VIN	

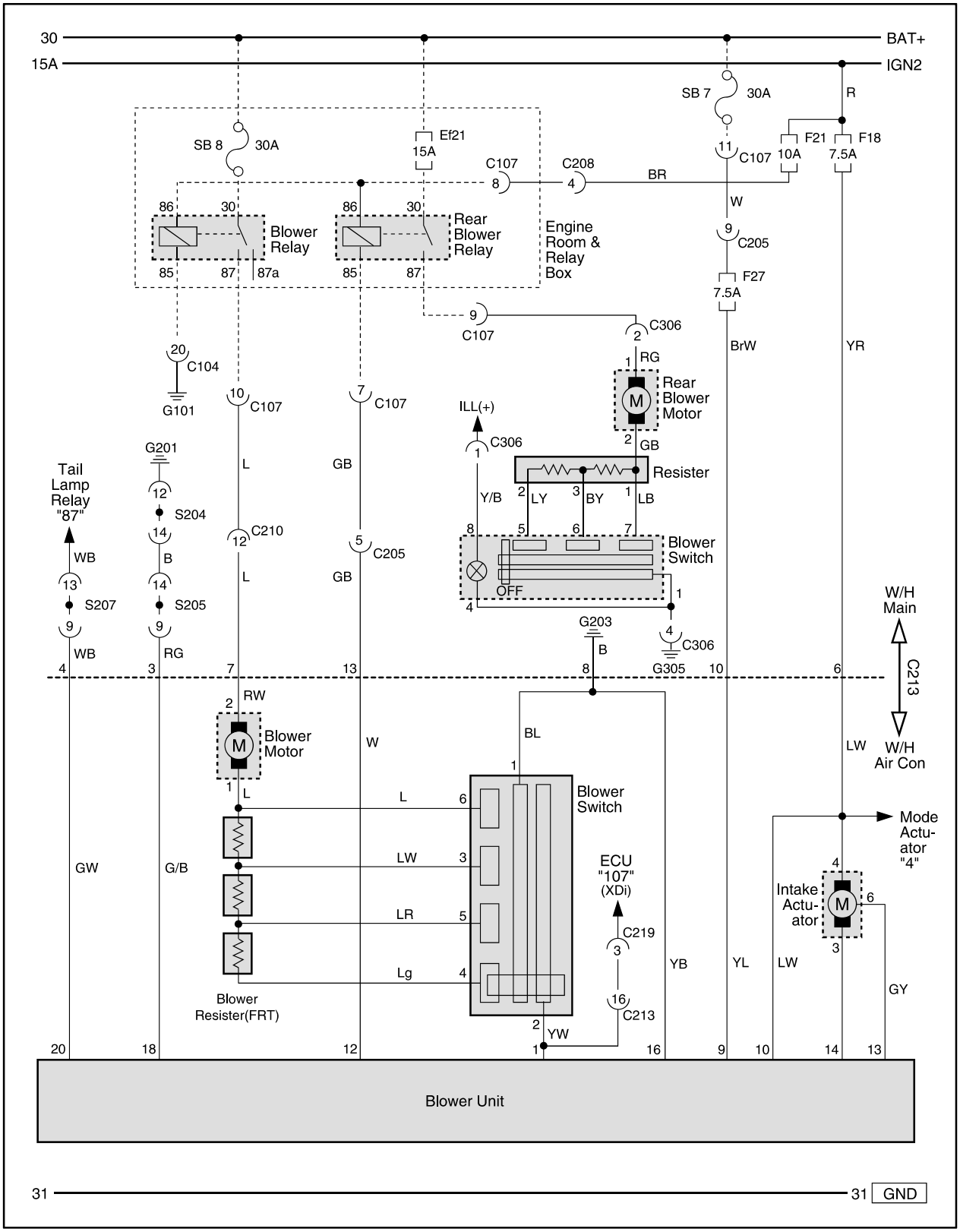
2) Manual Air Conditioner

▶Power, A/C Compressor, Motors (Mode, Interior/Ambient, Air Mix)



Modification basis	
Application basis	
Affected VIN	

▶Blower Motor (Front, Rear)



FULL AUTOMATIC TEMPERATURE CONTROL(FATC) 6810-30

GENERAL

1. SPECIFICATIONS

Description			Specification
Compressor		Type	Variable Displacement
		Model	V-5 Compressor
		Displacement	9.8 ~ 151 cc/rev
		Max. RPM	6,000 ~ 6,500 rpm
Receiver-drier		Material	AL R/DRIER
		Capacity	210 cc
Refrigerant		Type	R-134a
		Capacity	750 ± 20 g
Oil		Type	Synthetic PAG Oil
		Capacity	220 cc
Condenser		Max. capacity	11,400 Kcal/h
A/C pressure sensor	High (gauge pressure)	A/C ON	305 psi
		A/C OFF	425 psi
	Low (gauge pressure)	A/C ON	39 psi
		A/C OFF	30 psi
Blower motor		Max. capacity	7,475 ~ 9,075 Kcal/h
Heater core		Fin pitch	1.52 mm
		Size	200.5 x 168.2 x 25.0 mm
		Capacity	8,250 Kcal/h

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

THE V5 FULL AUTOMATIC TEMPERATURE CONTROL (FATC) SYSTEM The full automatic temperature control (FATC) uses the integrated control panel as the driver's interface to the system.

The FATC receives driver's input signal and various input signal from sensors and controls the actuators to maintain driver's desired room temperature.

Vacuum Fluorescent Display panel provides system operating information for the driver.

With the system in OFF mode, the outside temperature is displayed continuously.

The driver may display the current temperature setting by selecting any mode except OFF or adjusting the temperature control.

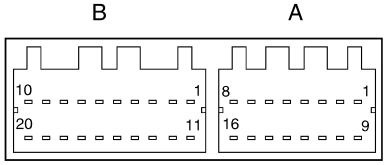
Also, it provides the convenience to the driver by indicating the ambient air temperature.

If it occurs the faulty in the FATC system, the MICOM informs the driver or mechanics of the results of the self-diagnostic check and controls the system by

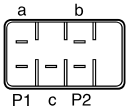
▶ FATC CONTROL



MOLEX 53874-3615

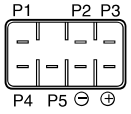


AMD MTR MG 610203



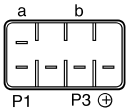
MTR SIDE

MODE MTR MG 610203



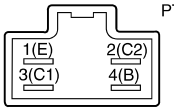
MTR SIDE

INTAKE MTR MG 610203



MTR SIDE

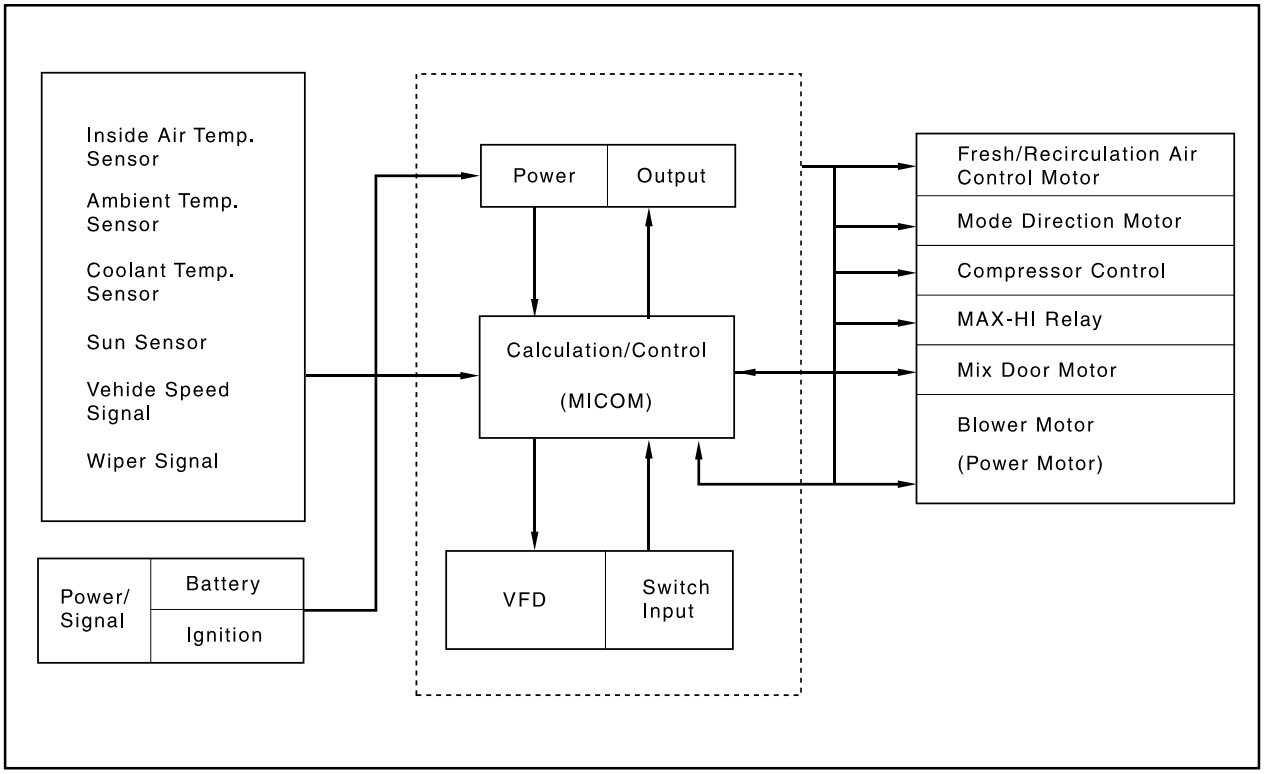
P/TR MDL MG 610269



PTR SIDE

Modification basis	
Application basis	
Affected VIN	

2. FATC INPUT/OUTPUT ROUTING DIAGRAM



3. FATC SYSTEM CHARACTERISTIC

1) Display Performance Enhancement

It allows VFD (Vacuum Fluorescent Display) to develop the effect of the visible.

2) Airflow Control Enhancement

It allows MICOM to control the temperature and perform the control automatically of the heating operation, the cooling operation and the Mild operation. Also, MICOM enable to control the amount of the airflow and the direction of the vent outlet in order to keep the inside air fresh.

3) Self-Diagnostic Circuit Check

The full automatic temperature control (FATC) air conditioning controller contains a self-diagnosis function to aid in finding any problem with the system. If the FATC detects some errors it will blink the temperature display screen for 5 seconds when the ignition switch is ON.
To enter the diagnostic mode, perform the following procedure.

1. Turn the ignition switch ON.
2. Set the temperature control to 26°C (79°F).
3. Within 3 seconds, push the AUTO and the OFF switches simultaneously, more than three times.
4. Check the diagnostic trouble code (DTC) in the temperature indicator screen blinks.
   If there are no diagnostic trouble code (DTC) set, the screen will display 00.
5. When the FATC controller indicates a DTC, proceed to the table for the DTC.
6. Push the OFF switch to return the controller to its normal function.

DTC	Description
0	Normal (No Error)
1	Inside Air Temperature Sensor Error
2	Ambient Air Temperature Sensor Error
3	Coolant Temperature Sensor Error
4	Air Mix Door Error
5	Sun Sensor Error
6	Power Transistor Error
7	High Blower Relay Error

▶ Action taken when the faulty occurred

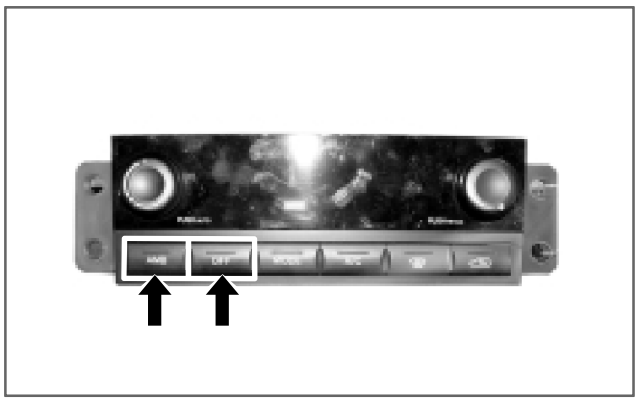
When any faulty is occurred in the automatic temperature control system, it's sign is informed to the driver by flashing the set temperature display for 5 seconds at initial starting.

Modification basis	
Application basis	
Affected VIN	

▶ How to verify faulty code

When the temperature is set to 26°C and then within 3 second, push the AMB switch and the OFF switch simultaneously at three times, the FATC controller temperature display indicates the faulty code after performing the self-diagnosis by MICOM.

▶ Condition for clearing the faulty code



1. When the vehicle restarts
2. When push the OFF switch after indicating the faulty code
3. When pass over 32 seconds after indicating the faulty code

▶ Fault safety function

FATC air conditioner not only performs self-diagnosis but also has safety function against faults. If there is open or short in the sensors or potentiometer of temperature door some specific value will be substitute.

Error	Fault Safety Function
Inside air Sensor Error	25°C will be substituted as temperature of inside of vehicle.
Ambient Temperature Sensor Error	25°C will be substituted as ambient temperature.
Coolant Temperature Sensor Error	Sensor ON. 50°C will be substituted as coolant temperature.
Sun Sensor Error	Zero (0) will be substituted as sun load.

4. SYSTEM BASIC FUNCTION

1) Set Temperature Control

When you set the setting temperature using the temperature control switch, the FATC receives the various input signals from sensors including the information of inside air temperature, ambient temperature, coolant temperature and sun loads etc.. The FATC uses this signals to control automatically the A/C compressor, the mode door, the I/A door, air mix door and blower motor etc.

2) Airflow Control

For setting at Full AUTO, it is possible to control the blower motor operation both manually and automatically in order to adjust the airflow according to the set temperature.

3) Manual Control

When you push the blower switch, you can control the blower motor manually and it increases or decreases each step by moving the switch to HI/LO. (with the ignition ON)

Step	Blower Voltage
1	4.5 V
2	6.0 V
3	7.5 V
4	9.0 V
5	11.0 V
6	Max Hi

- The voltage of the blower motor may increase or decrease (0.5 V) according to power voltage.

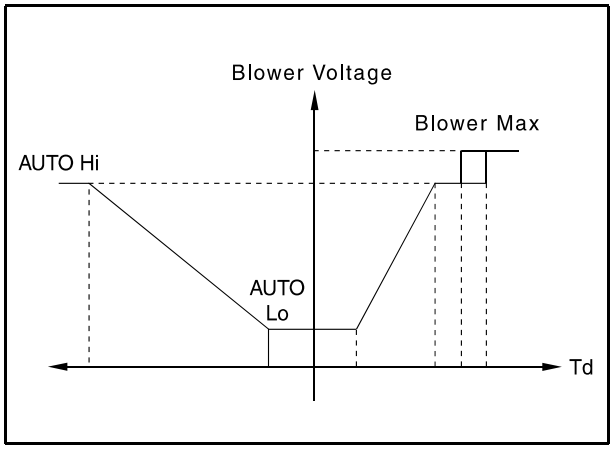
Modification basis	
Application basis	
Affected VIN	

4) Automatic Control

Td value can be determined by the set temperature value and Td value is set to the target voltage of the blower motor simultaneously. The blower motor can shift without step.

CAUTION

- Td (Thermal Demand): Td value is the default for automatic control of the automatic temperature control and allows it to control the set temperature calculating the differences between inside air temperature and ambient temperature.



Blower Step	Blower Motor Voltage
1	4.0 ~ 5.5 V
2	5.5 ~ 7.5 V
3	7.5 ~ 8.5 V
4	8.5 ~ 9.5 V
5	9.5 ~ 10.5 V
6	10.5 ~ 13.5 V

5) Vent Rate Control By Heating Operation

When the temperature of the engine coolant is low or it's difficult to obtain the desired hot air in winter, the system controls to prevent the cold airflow from the outlet due to the cold air give a negative effect to the heating performance.
Therefore vent step is fixed 1st on blower AUTO step until the coolant sensor detects above 20°C and also the blower step increases gradually according to going up the coolant temperature. When the coolant temperature goes up above 40°C, the heating operation stops.

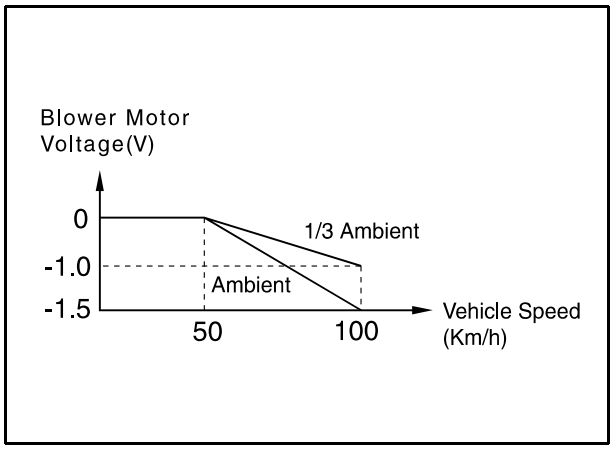
6) Vent Rate Control By Cooling Operation

When the air inside the resonance duct is hot in summer, after the system keeps the low vent rate (1st) operating for 5 seconds and discharges the hot air to the windshield side (Def Mode), the system starts to control normally in order to avoid for the passengers contacting the hot air.

7) Defroster Calibration

On the blower AUTO step, when the passenger sets to Defroster (Def), the system increases the blower voltage by 2 V for some intervals comparing AUTO voltage. But it is excluded the condition when the blower voltage is above 11.0 V. Also, the voltage increasing by defroster calibration is limited up to 10.5 V.

8) Vehicle Speed Calibration



On the Ambient or the 1/3 Ambient and the blower AUTO, the blower decreases the voltage with the vehicle speed 100 Km/h such as 1.5 V for the Ambient, 1.0 V for the 1/3 Ambient.
But it is the exception for the blower max.

9) Ambient Temperature Display

It indicates the ambient temperature as 0.5°C increment in the set temperature digit by ambient temperature sensor.

- When you push the AMB key it indicates the ambient temperature for 5 seconds and return back the set temperature.
- If you push the AMB key again during indicating in 5 seconds, it returns back.
- The ambient temperature sensor is securing in the front of radiator and may be influenced easily to the heat of the engine compartment in parking. Therefore the ambient temperature sensor indicates the ambient temperature accurately on the condition of above 40 km/h running.

10) Delivery Condition

- For the initial installation (the initial current draw), the initial mode follows

Actuator	Mode	Suction Air	A/C	Blower	Mix
Condition	FOOT/ DEF	FRESH	OFF	OFF	Td Basic Control

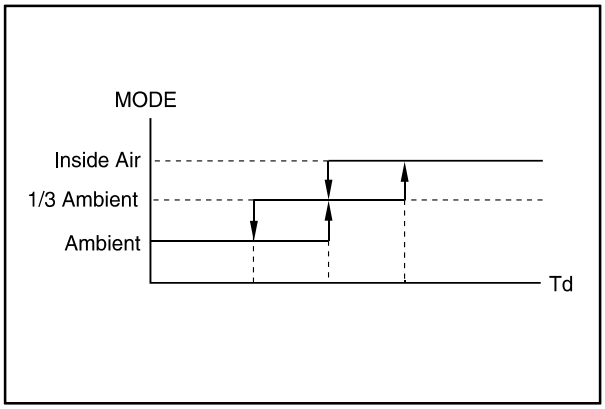
Modification basis	
Application basis	
Affected VIN	

11) Vent Inlet Control

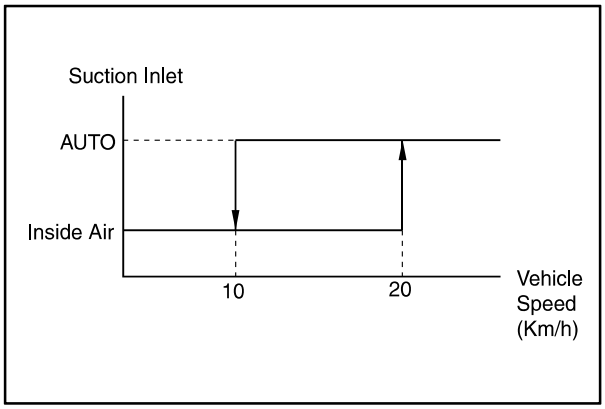
▶ Manual control

When you push the I/A control switch, you can control the I/A door manually and the I/A door changes between the recirculation air and the fresh air flow alternately by the control switch. For changing the fresh air step (FRE) to the recirculation air step (REC), the blower voltage decrease 15 % and for changing the recirculation air step (REC) to the fresh air step (FRE), the blower voltage return back.

▶ AUTO control



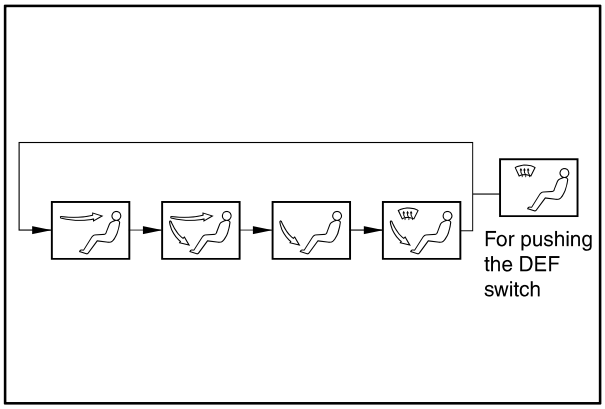
Control by the vehicle speed The system controls the vent inlet according to the vehicle speed in order to prevent the exhaust gas of the preceding vehicle from flowing inside with the vehicle stopping or driving at low speed.
The operation and control condition is following as



1. When the vent inlet mode is AUTO and the A/C "ON".
2. When the vehicle keeps to drive at below 10 km/h for 10 seconds and changes the REC mode at stop.
3. If 10 minutes passes after changing the REC mode, it returns back to the AUTO mode.

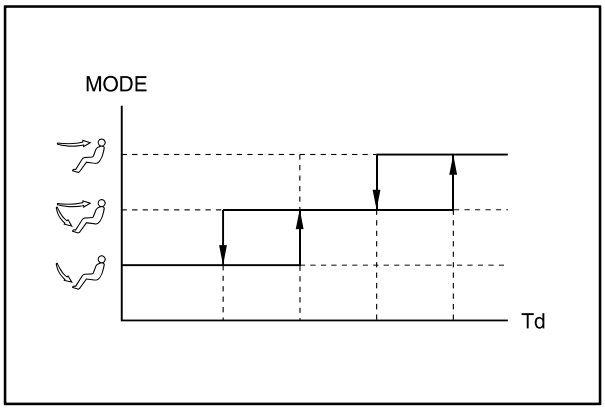
12) Vent outlet Control

▶ Manual control



For pushing the mode switch of AUTO temperature control, you can select four type of the vent outlets.
When you push the Def switch, it keeps to change to the defroster mode regardless of the sequence.

▶ **AUTO Control**



13) A/C Control

▶ **Manual control**

- When you pushed the A/C switch "ON" or the Def switch "ON", A/C starts to operate.

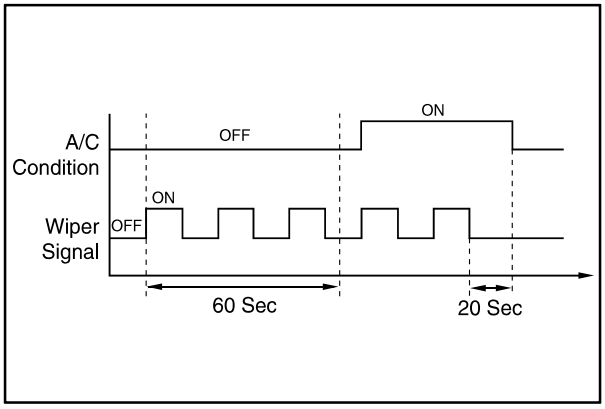
▶ **AUTO control**

- Basic Control: A/C "ON" has the priority for the initial operation.

14) Full Cold/Hot Control

When you sets the set temperature to full cold (LO) or full hot (HI), the system controls the temperature to full cold or full hot regardless of sensor's detection. For LO, it becomes A/C "ON", front vent mode, recirculation air, max blower speed, air mix door close and for HI, A/C "OFF", floor vent mode, ambient mode, air mix door open.

15) Wiper Calibration Control



It is possible to generate the frost on the windshield in the rainy days. At this time, FATC controller allows the mode to change the AUTO defroster mode.

- Operation Condition: When the passenger operates the wiper on AUTO mode, the system controls the wiper on the A/C AUTO mode after sending the wiper signal and controlling the delay for 1 minutes.

16) FATC Controller Illumination Control

When the tail lamp is "ON", FATC Controller illumination lamp turns "ON".

Modification basis	
Application basis	
Affected VIN	

5. SYSTEM COMPONENTS - CONTROL

1) Controller Assembly

The operation of the A/C system is controlled by the switched on the control head. This console-mounted controller consist of control knobs and a vacuum fluorescent display (VFD) indicating the status of the control settings selected.

2) Sensors and Motors

- Inside air sensor, ambient sensor, coolant temperature and sun sensor
- Door mode motor, intake air control door motor, air mix door motor

3) Inside Air Temperature Sensor

Inside air temperature sensor located in left side of full automatic temperature control (FATC) controller, is a sensor that detects the interior air temperature and a thermistor that decreases its resistance when temperature up and increases when temperature down. If there is open or short in the sensors, 25°C (77°F) will be substitute.

▶ **Inspection**

- When the inside air temperature sensor error displays, check the followings

1. Remove the inside air temperature sensor and measure the resistance between the sensor connectors. (approximately 2.2 KW at 25°C) Replace the inside air temperature sensor when the resistance value is excessive low or high.
2. Replace the inside air temperature sensor for outside the specified value and check the followings for within the specified value;
3. Turn the ignition ON.
4. Measure the voltage between A13 and A16 terminal of the AUTO temperature control connector. (approximately 2.2 V at 25°C)
5. Verify the open circuit of the wiring harness when you can not measure the voltage value and replace the AUTO temperature control when it's normal.

4) Ambient Air Temperature Sensor

Ambient air temperature sensor is a thermistor (NTC resistance) that decreases its resistance when temperature up and increases when temperature down and it detects ambient air temperature. If there is open or short in the sensors, 25°C (77°F) will be substitute.
The sensor is located in the left back side of front bumper.

▶ **Inspection**

- When the ambient temperature sensor error displays, check the followings

1. Remove the ambient temperature sensor and then measure the resistance between the sensor connectors.
   (approximately 2.2 KW at 25°C) Replace the ambient temperature sensor when the resistance value is excessive low or high.
2. Replace the ambient temperature sensor for outside the specified value and check the followings for within the specified value;
3. Turn the ignition ON.
4. Measure the voltage between A13 and B8 terminal of the AUTO temperature control connector. (approximately 2.2 V at 25°C)
5. Verify the open circuit of the wiring harness when you can not measure the voltage value and replace the AUTO temperature control when it's normal.

5) Coolant Temperature Sensor

Coolant temperature sensor is a thermistor that decreases its resistance when temperature up and increases when temperature down. It detects coolant temperature to operate the blower speed at low when the coolant temperature is less than 50°C (122°F). If the coolant temperature sensor is open or short, 100°C (212°F) will be substitute.

▶ **Inspection**

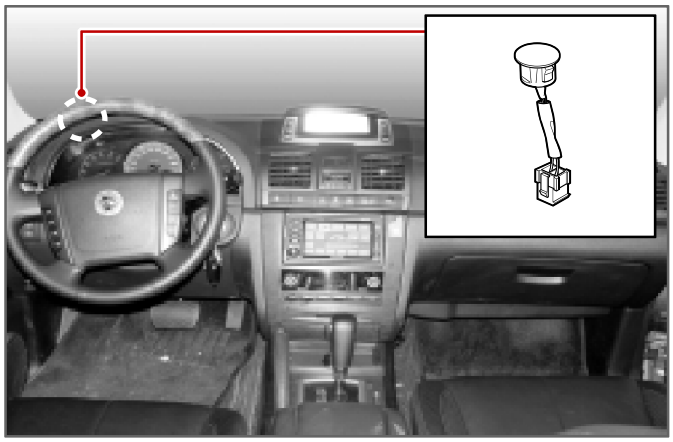
- When the coolant temperature sensor error displays, check the followings

1. Measure the resistance between the sensor connectors. (approximately 2.2 KW at 25°C)
2. Replace the coolant temperature sensor for outside the specified value and check the followings for within the specified value;
3. Turn the ignition ON.
4. Measure the voltage between A13 and B9 terminal of the AUTO temperature control connector. (approximately 2.2 V at 25°C)
5. Verify the open circuit of the wiring harness when you can not measure the voltage value and replace the AUTO temperature control when it's normal.

Modification basis	
Application basis	
Affected VIN	

6) Sun Sensor

Sun sensor is a photo diode that detects lights. Resistance of the diode can be measured as current by using voltmeter according to increasing sun loads. If the sun sensor is error, no sun load will be substitute. Photo diode
It is used to the circuit converting the sun light loads to the electric signals.



▶ Inspection

- When the sun sensor error displays, check the followings

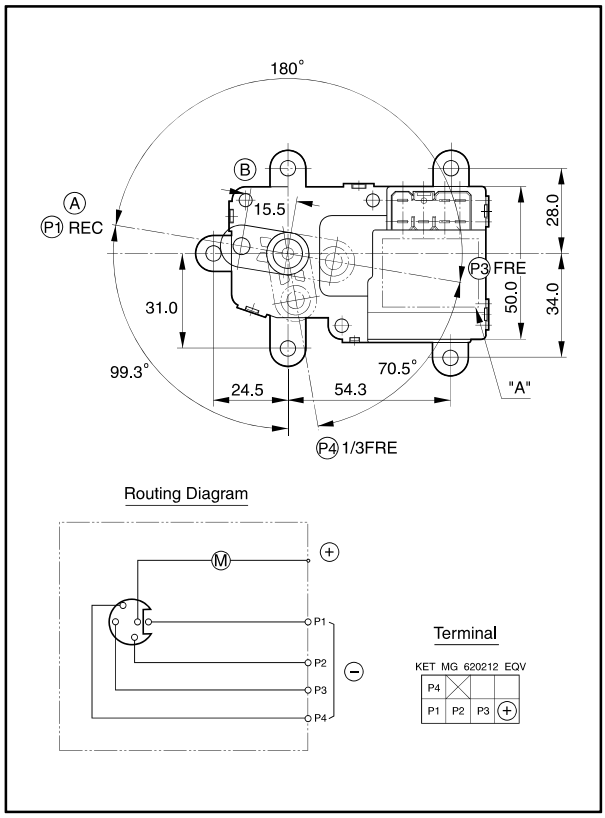
1. Remove the sensor to place it under the sun light and measure the current between the connector terminals.
2. Place the sun sensor under the shadow place and measure the current between the connector terminals. If the value is lower than the value under the sun light, it's normal.
3. Turn the ignition ON.
4. Measure the voltage between A13 and B10 terminal of the AUTO temperature control connector. (Sun light: 2.5 V, Shadow: 4.8 V)
5. Verify the open circuit of the wiring harness when you can not measure the voltage value and replace the AUTO temperature control when it's normal.

7) Intake Control Door Motor

The mode motor set the I/A mode by the control signal of the AUTO temperature control.
When the mode displayed in the AUTO temperature control is different from the actual mode, check the followings

- Turn the ignition ON.
- Measure the voltage between the (+) terminals at each mode and verify that changes from 0 V before the mode selection to 12 V after the mode selection.
- If the value is the specified value, check the open or short circuit.
- If the wiring is normal, replace the AUTO temperature control.
- If the voltage value is outside the specified value, replace the I/A mode motor.
- Check the motor operation connecting the (+) terminal to No.4 of the motor connector and connecting No.5 and No.7 to (-) terminal sequentially using 12 V power.

▶ Inspection



When the vent inlet mode displayed in the AUTO temperature control is different from the actual mode, check the followings

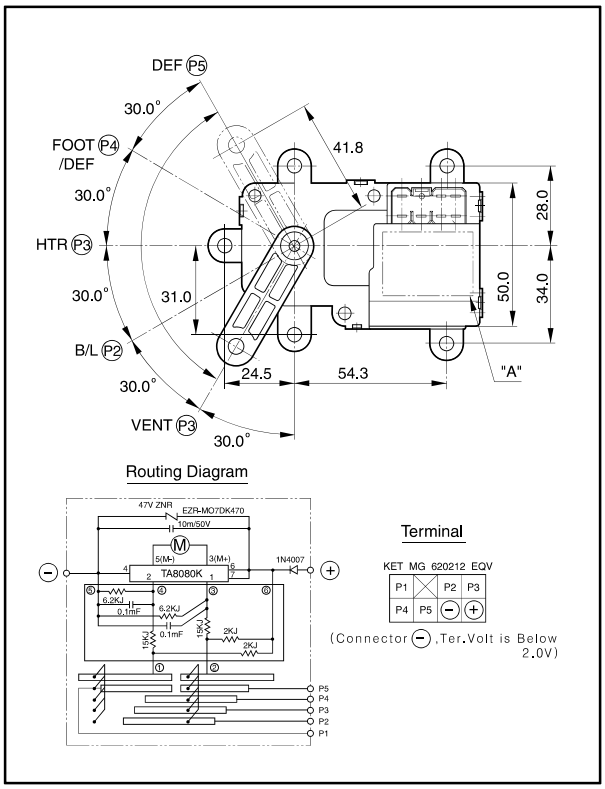
1. Turn the ignition ON.
2. Measure the voltage between positive terminal and negative terminal of the Mtr-Act, AI connector. (Specified value; 12 V)
3. Measure the voltage between P1, P2, P3 and (+) terminal. (If it changes from 0V before the mode selection to 12 V after the mode selection, it's normal)
4. If the value is outside the specified value, check the open or short circuit.
5. If the wiring is normal, replace the AUTO temperature control.
6. If the value is the specified value, replace the Mtr- Act, AI.
7. Check the motor operation connecting the (+) terminal to No.4 of the motor connector and connecting No.5 and No.7 to (-) terminal sequentially using 12 V power.

Modification basis	
Application basis	
Affected VIN	

8) Mode Control Motor

The control motor sets the mode of Vent, Bi-level, Foot, Foot/Def or Def by opening/closing the outlet damper at the outlet of Vent, Foot or Def according to control signal of the AUTO temperature control.

▶ Inspection



When the vent inlet mode displayed in the AUTO temperature control is different from the actual mode, check the followings

1. Turn the ignition ON.
2. Measure the voltage between P1 ~ P5 and (+) terminal. (If it changes from 0V before the mode selection to 12 V after the mode selection, it's normal)
3. If the value is outside the specified value, check the open or short circuit.
4. If the wiring is normal, replace the AUTO temperature control.
5. If the value is the specified value, replace the Mtr- Act, AI.
6. Check the motor operation connecting the (+) (-) terminal to the Mtr-Act mode and each terminal P1 ~ P5 to (-) terminal sequentially using 12 V power.

9) Power Transistor

Power transistor controls the blower airflow and it receives the airflow control signal from the AUTO temperature control in order to for blower motor to shift the speed without step by adding the current to the power transistor basic current.

▶ Inspection

- When the power transistor error displays, check the followings.

1. Turn the ignition ON.
2. Measure the voltage between blower connectors by changing the step from 1st to 6th.
3. The voltage value by each step is the followings; (specified value: 0.5)
4. If the value is outside the specified value, check the open or short circuit.

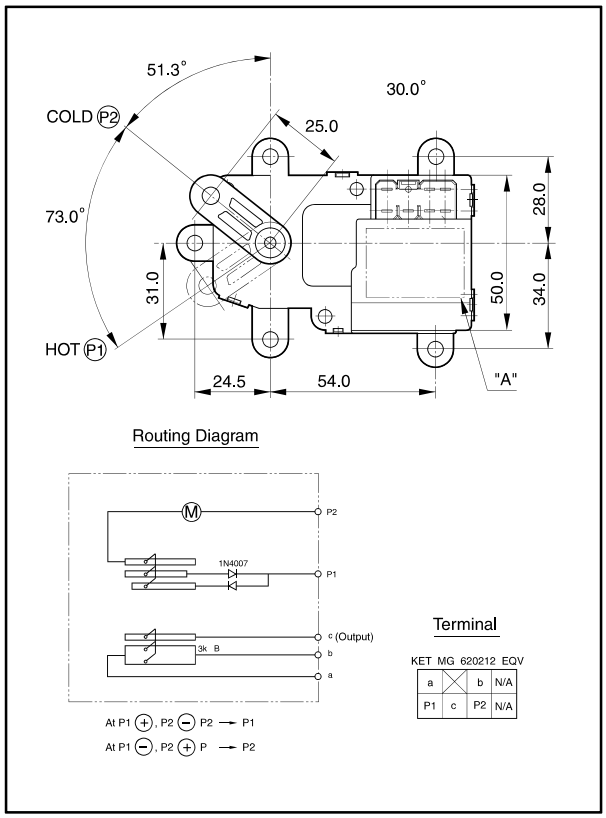
1st	2nd	3rd	4th	5th	6th
4.5 V	6.0 V	7.5 V	9.0 V	11.0 V	Relay Hi

5. When there is no problem in the wiring harness, replace the power transistor.

10) Air Mix Door Motor

The air mix door motor is located on left side of heater module. The air mix door motor controls the exhaust air temperature by the signal of the FATC.

▶ Inspection



When the air mix door motor error displays, check the followings

1. Turn the ignition ON.
2. Measure the voltage within P1, P2 terminals (specified value: 12 V) and a,b (specified value: 5).
3. If the value is outside the specified value, check the open or short circuit.
4. If the wiring is normal, replace the Mtr Act, Temp.
5. If the (+) (-) terminal connects to P1 and P2 of the Mtr-Act, Temp alternately, the output by the each mode is following

AMD	Mode	Bc Resistance
Cool	P1 (-), P2 (+)	Below 300 Ω
Hot	P1 (+), P2 (-)	Above 2.4 KΩ

Modification basis	
Application basis	
Affected VIN	

HEATER AND VENTILATION SYSTEM

6810-18

GENERAL

1. SPECIFICATIONS

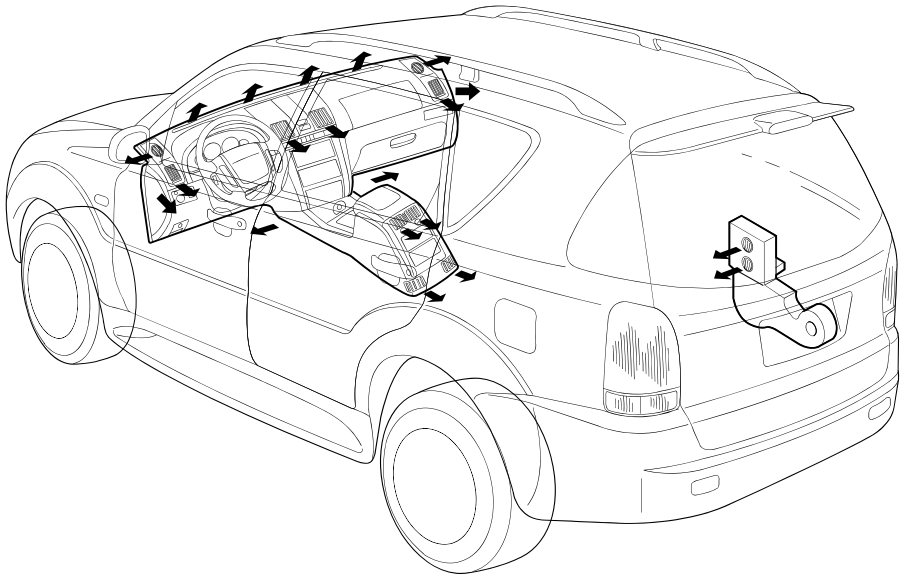
Blower motor	Max. Capacity	7.425 ~ 9.075 kcal/h
Heater core	Fin pitch	1.52 mm
	Size (L X H X W)	194.6 x180 x 35 mm
	Heating capacity	8,250 (Min. 4,700) kcal/h
Blower motor resistance	1st mode	3.25
	2nd mode	1.45
	3rd mode	0.35
	4th mode	
Front A/C and heater unit	Type	Heater + Evaporator and blower (2 pieces)
	Heating capacity	Min. 4600 kcal/h (5.5 m ^{3}/Min)
	Cooling capacity	Min. 4700 kcal/h (7.5 m ^{3}/Min)
	Expansion valve	Block Type
	Input power	Max. 250 W
Rear cooler	Type	Evaporator and blower (only cooler)
	Cooling capacity	Min. 2700 kcal/h (5 m ^{3}/Min)
	Expansion valve	ANGLE Type
	Input power	Max. 180 W

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

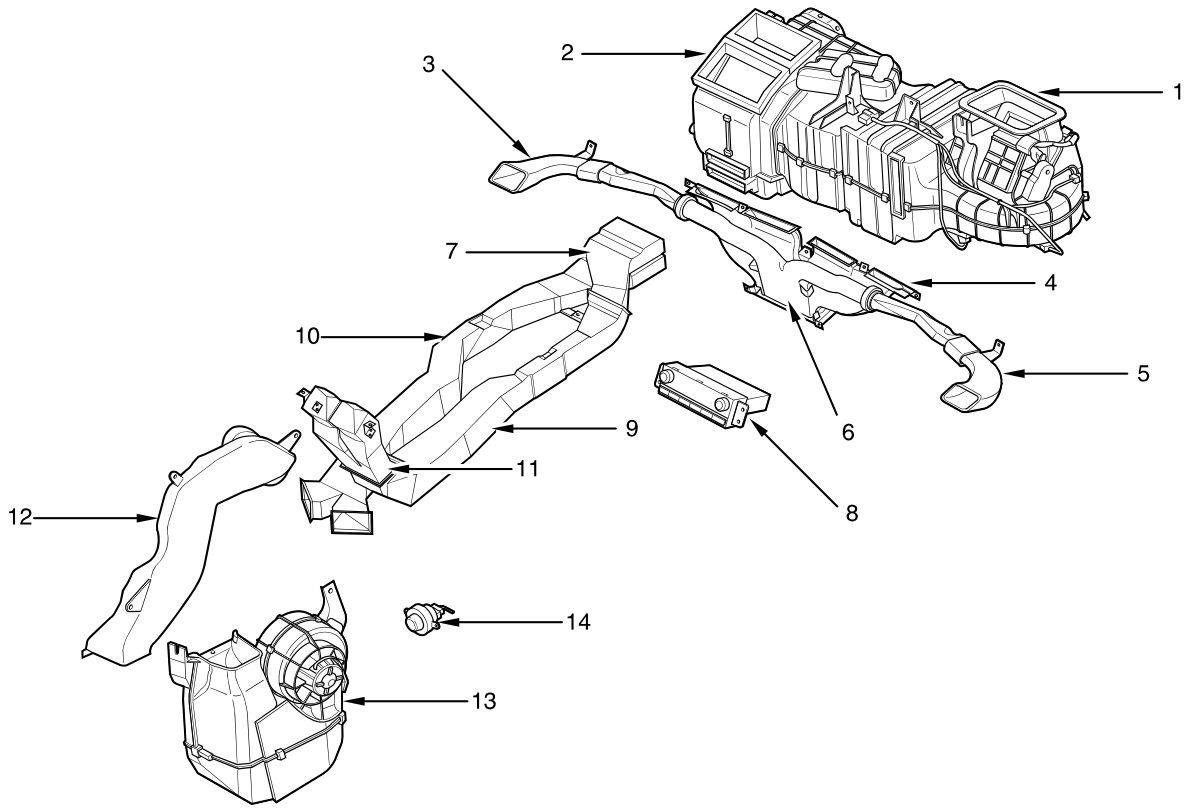
The heater system is designed to provide heating, ventilation, windshield defrosting. The heater and fan assembly regulates the air-flow from the air inlet for further processing and distribution. The heater core transfers the heat from the engine coolant to the inlet air.

The heater system consists of the heater hoses, heater module, blower motor and control system. The control switch assembly installed on the instrument panel regulates the temperature, amount and flow direction of the air.



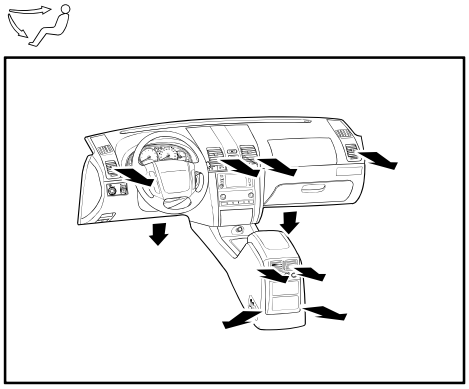
Modification basis	
Application basis	
Affected VIN	

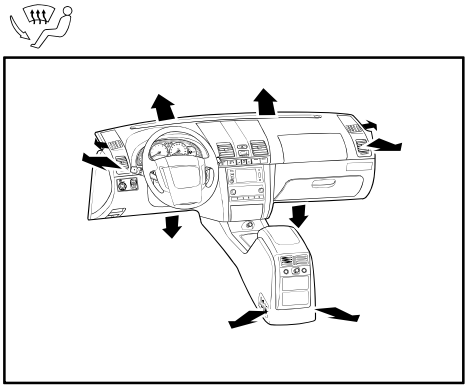
2. COMPONENTS LOCATOR

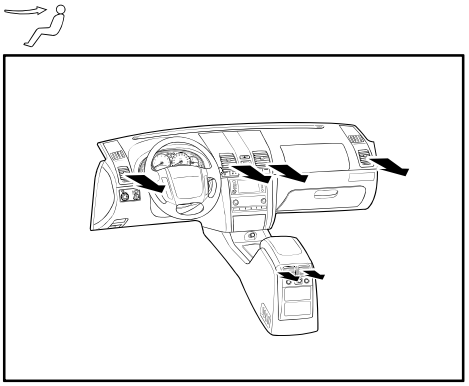


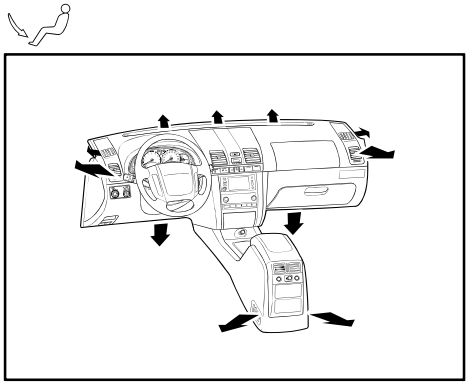
1. Blower and evaporator assembly
2. Heater assembly
3. Side defroster duct (LH)
4. Main defroster nozzle
5. Side defroster duct (RH)
6. Side defroster joint
7. Console front ventilation duct
8. A/C controller
9. Console middle ventilation duct
10. Console foot duct
11. Console rear ventilation duct
12. Rear cooler duct
13. Rear cooler assembly
14. Rear cooler controller

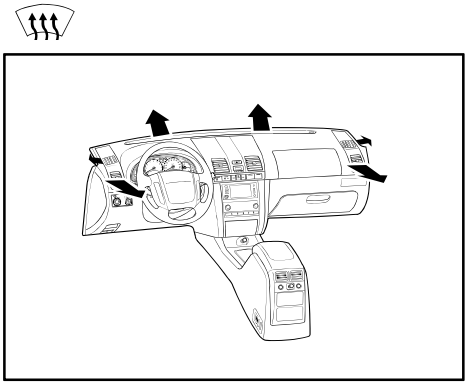
3. AIR FLOWS THROUGH VENTS (MODE SWITCH OPERATIONS)











Modification basis	
Application basis	
Affected VIN	

4. AIR DISTRIBUTION

1) Mode Door Motor

▶ **Location**

Located at the left side of heater case.

▶ **Function**

Controls the air outlet directions: Vent, Bi-level, Foot, Foot/ Def or Def mode.

2) Air Source Door Motor

▶ **Location**

Located at the upper right side of blower housing.

▶ **Function**

Selects the air source by operating the air source door motor: Outside air intake and recirculation mode.

3) Air Mix Door Motor

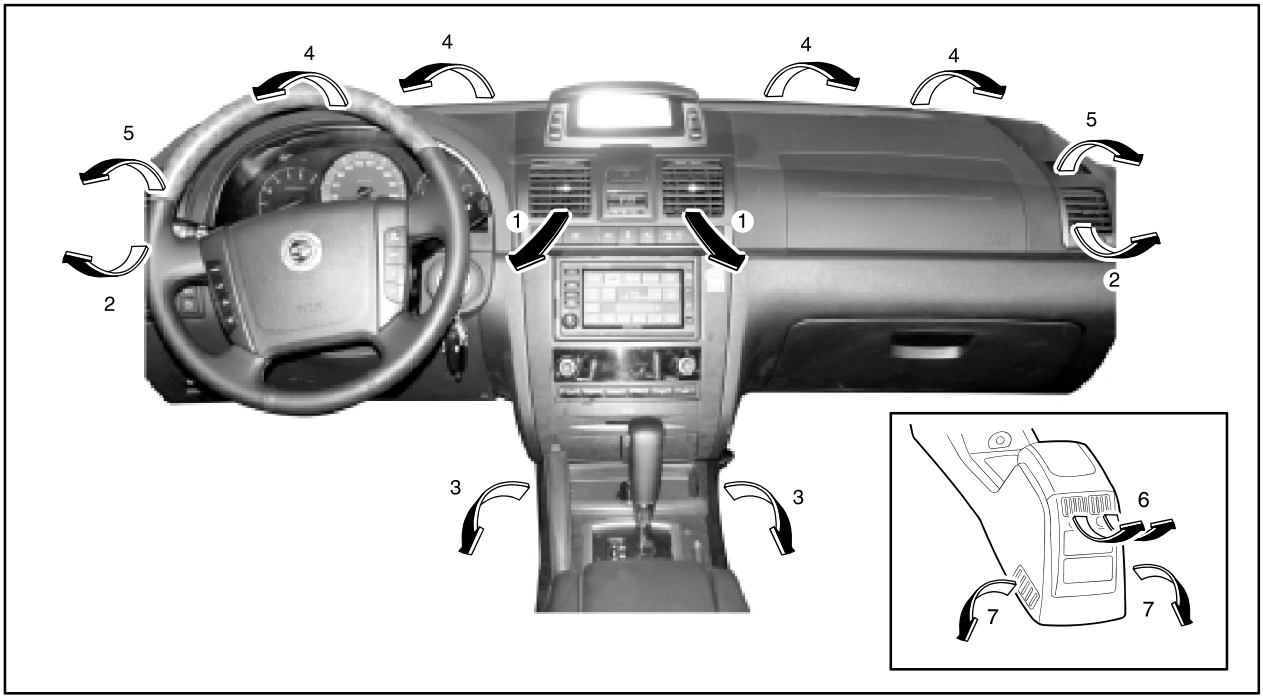
▶ **Location**

Located at the bottom of heater housing.

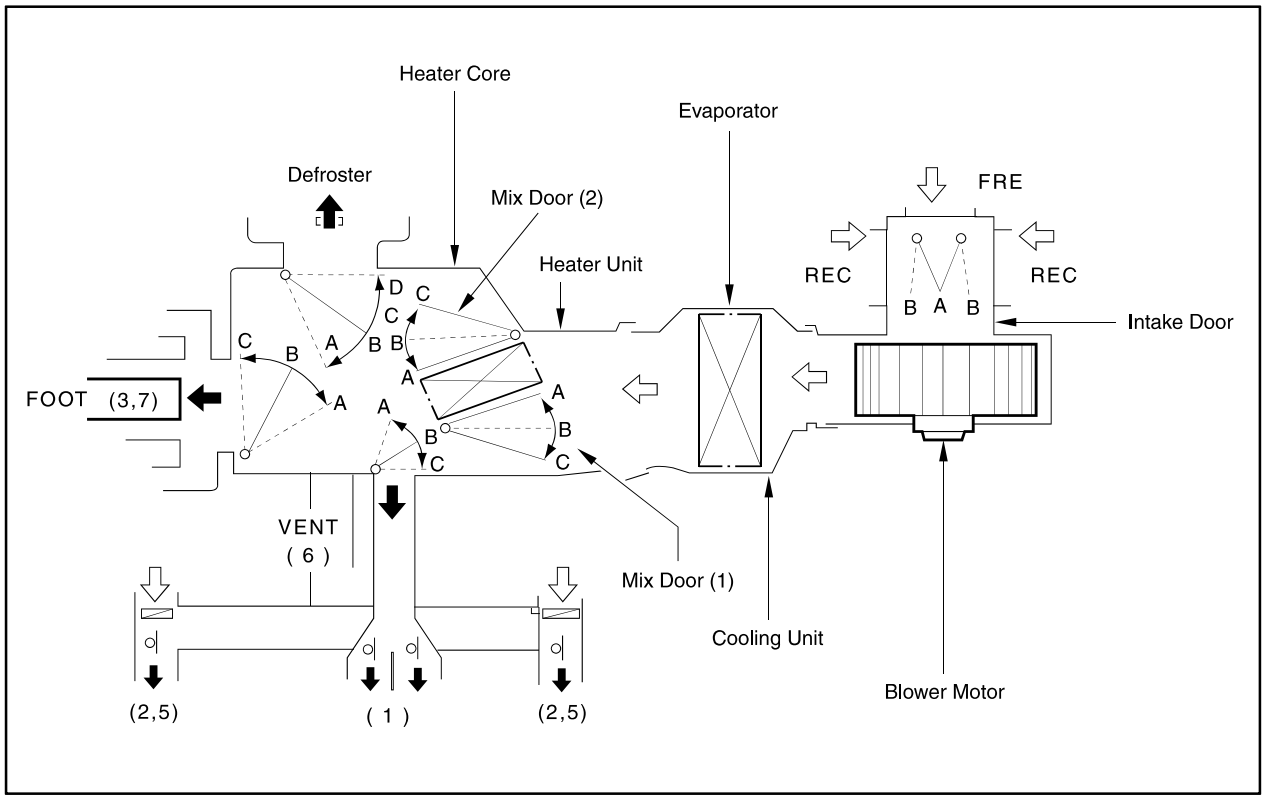
▶ **Function**

Controls the outlet air temperature by opening an closing the damper.

▶Air Flows



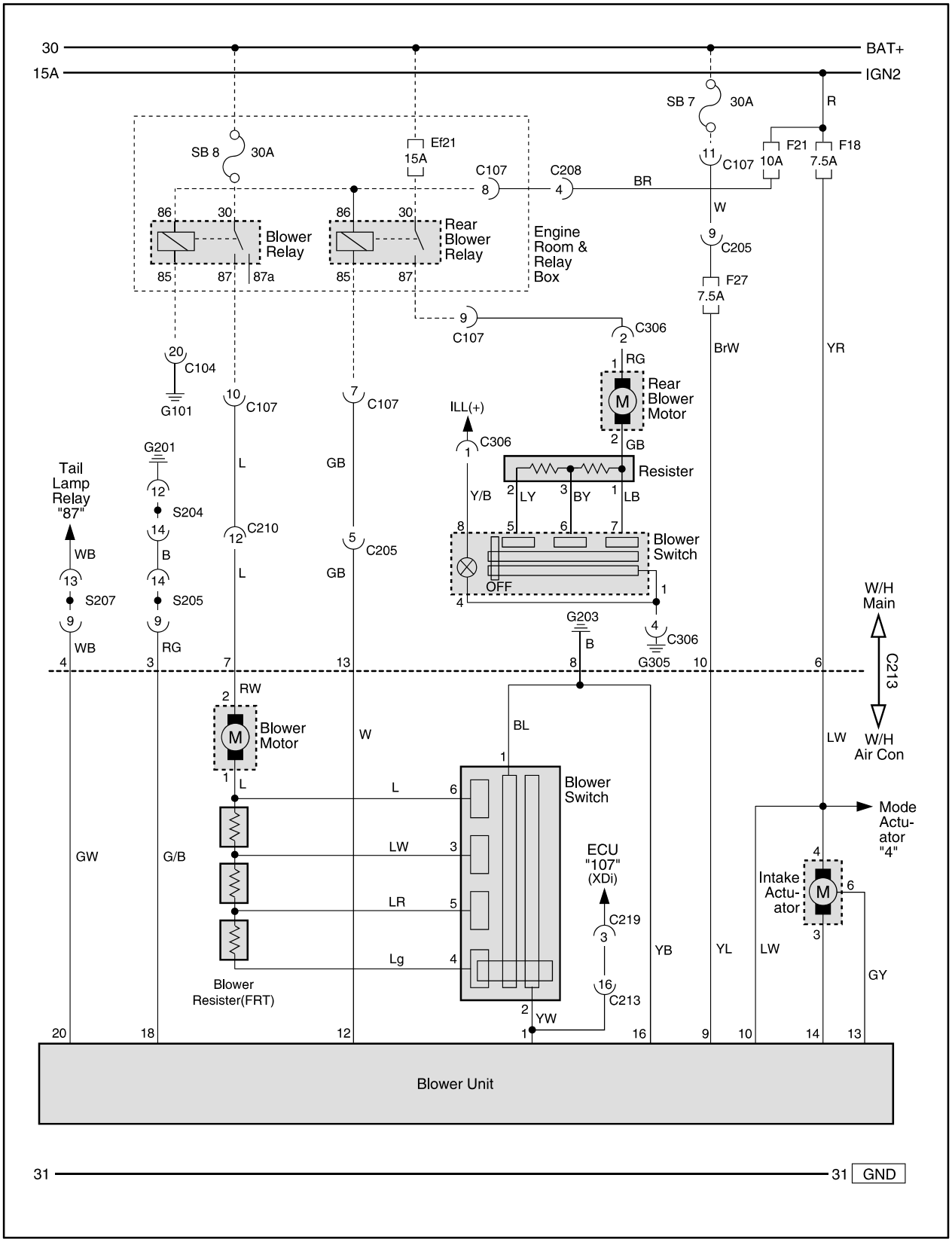
MODE		VENT	BI-LEVEL	FOOT	FOOT/DEF	DEF	Air Source Selection Switch		Temperature Control Switch
							REC	FRE	
Front	CENTER VENT (1)	A	B	-	-	-	-	-	-
	SIDE VENT (2)	A	B	B	B	B	-	-	-
	FOOT (3)	-	C	B	C	-	-	-	-
	DEFROSTER (4)	-	-	D	C	B	-	-	-
	SIDE DEF (5)	-	-	D	D	C	-	-	-
Rear	VENT* (6)	B	C	-	-	-	-	-	-
	FOOT (7)	-	C	B	D	-	-	-	-
INTAKE Door							(A)	(B)	-
AIR MIX Door							-	-	A B C



Modification basis	
Application basis	
Affected VIN	

5. CIRCUIT DIAGRAM

▶Blower Motor



Modification basis	
Application basis	
Affected VIN	

FFH SYSTEM

6910-03

GENERAL

1. SPECIFICATIONS

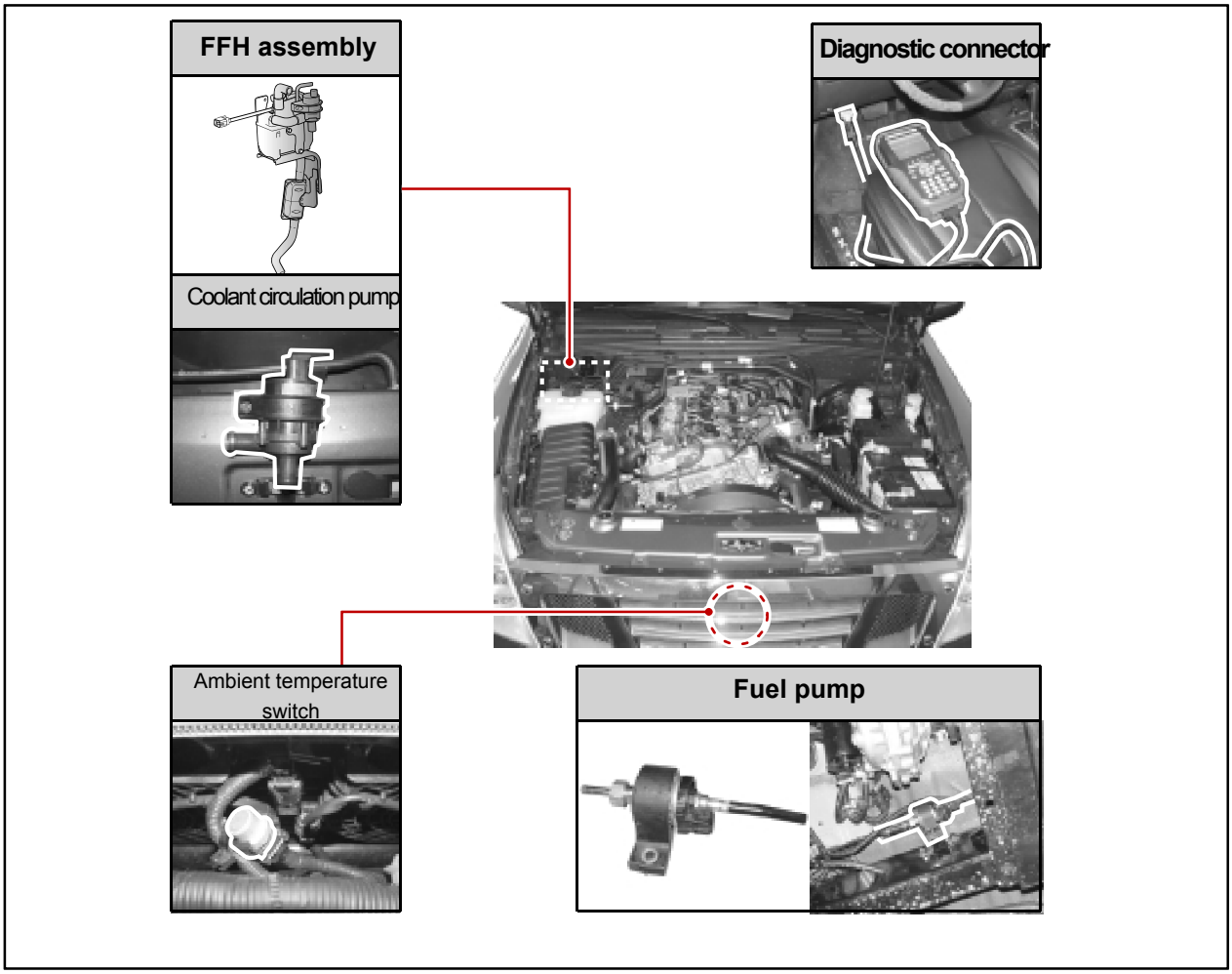
Heater		D 5 S-H	
Heating medium		Coolant	
Control of the heat flow		Large (full load)	Small (small load)
Heat flow		5000 W	2300 W
Fuel consumption per hour		≒ 0.62 ℓ	≒ 0.27 ℓ
Mean electric power consumption	in operation	35 W	11 W
	at start	100 W	
	after-running	12 W	
Rated voltage		12 V	
Operating range • Lower voltage limit: An undervoltage protection device in the controller switches the heaters off at approx. 10 volt.		10 V	
• Upper voltage limit: An overvoltage protection device in the controller switches the heaters off at approx. 15 volt.		15 V	
Tolerable operating pressure		up to 2.5 bar overpressure	
Minimum water flow through the heater		200 L/h	
Fuel		From main fuel tank	
Tolerable ambient temperature	operation	-40 °C ~ 80 °C	
	storage	-40 °C ~ 105 °C (2h for 125 °C)	
Weight (without coolant and mounted parts)		approx. 2.7 kg	

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

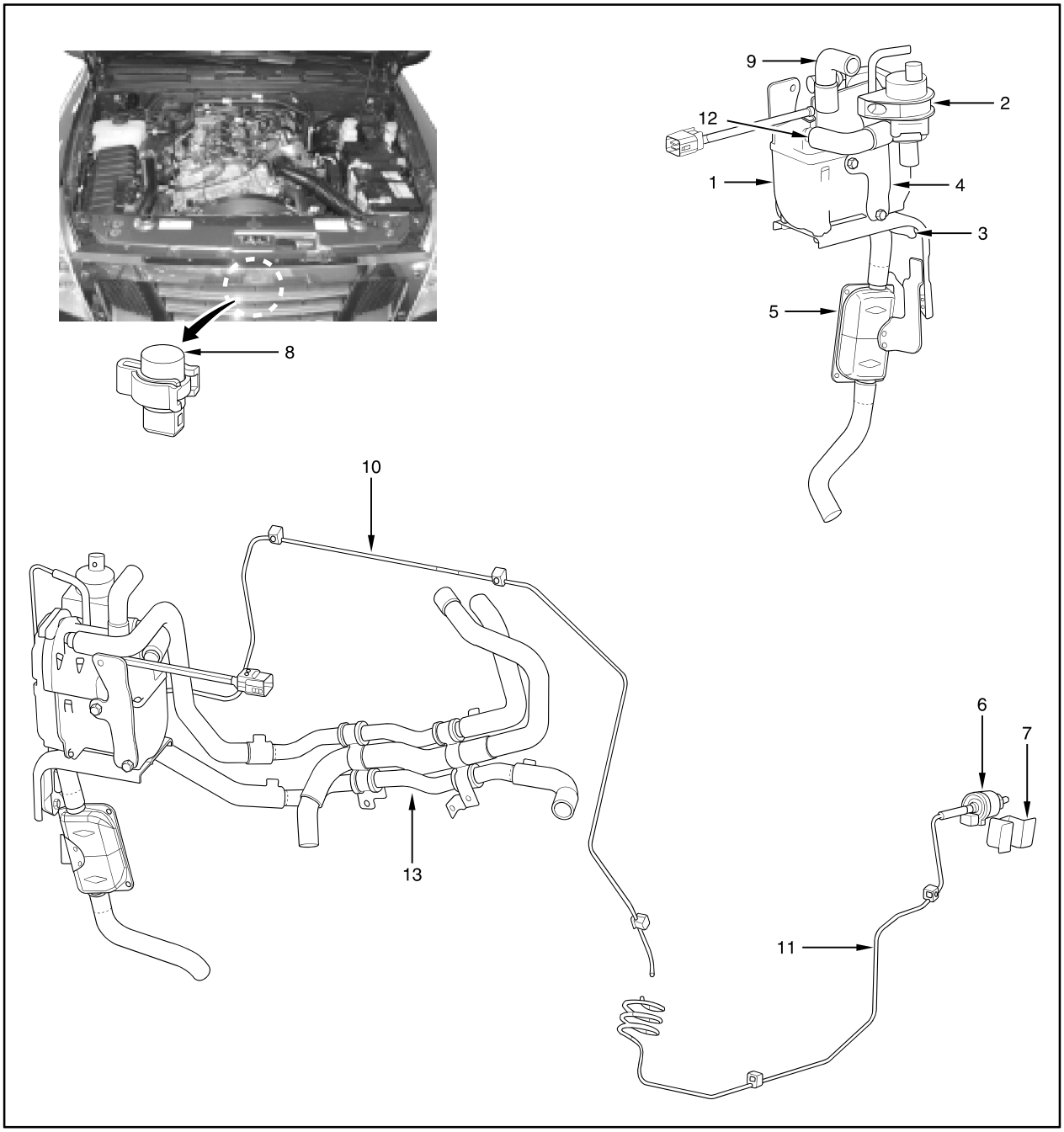
In fuel fired heater system equipped vehicle (D27DT engine equipped), when the ambient temperature and coolant temperature is low, the burner installed in engine cooling system increases the temperature of coolant that flows into heater by firing diesel fuel for a certain period of time. The D27DT engine equipped vehicle has the Positive Temperature Coefficient (PTC) system as a basic equipment. FFH is operated by the coolant temperature and ambient temperature while PTC is operated by the coolant temperature intake air temperature.
FFH system consists of independent fuel lines and fuel pump, coolant circuit and coolant circulation pump, electrical glow plug and exhaust system. It also provides the diagnostic function. FFH system cannot be operated or stopped by driver's intention. The FFH system is automatically operated by the coolant temperature and the ambient temperature.
The FFH system operates up to more 2 minutes to burn the residual fuel inside the system when stopping the engine during its operation. Therefore, a certain period of FFH operation after stopping the engine is not a malfunction.

2. COMPONENTS LOCATOR



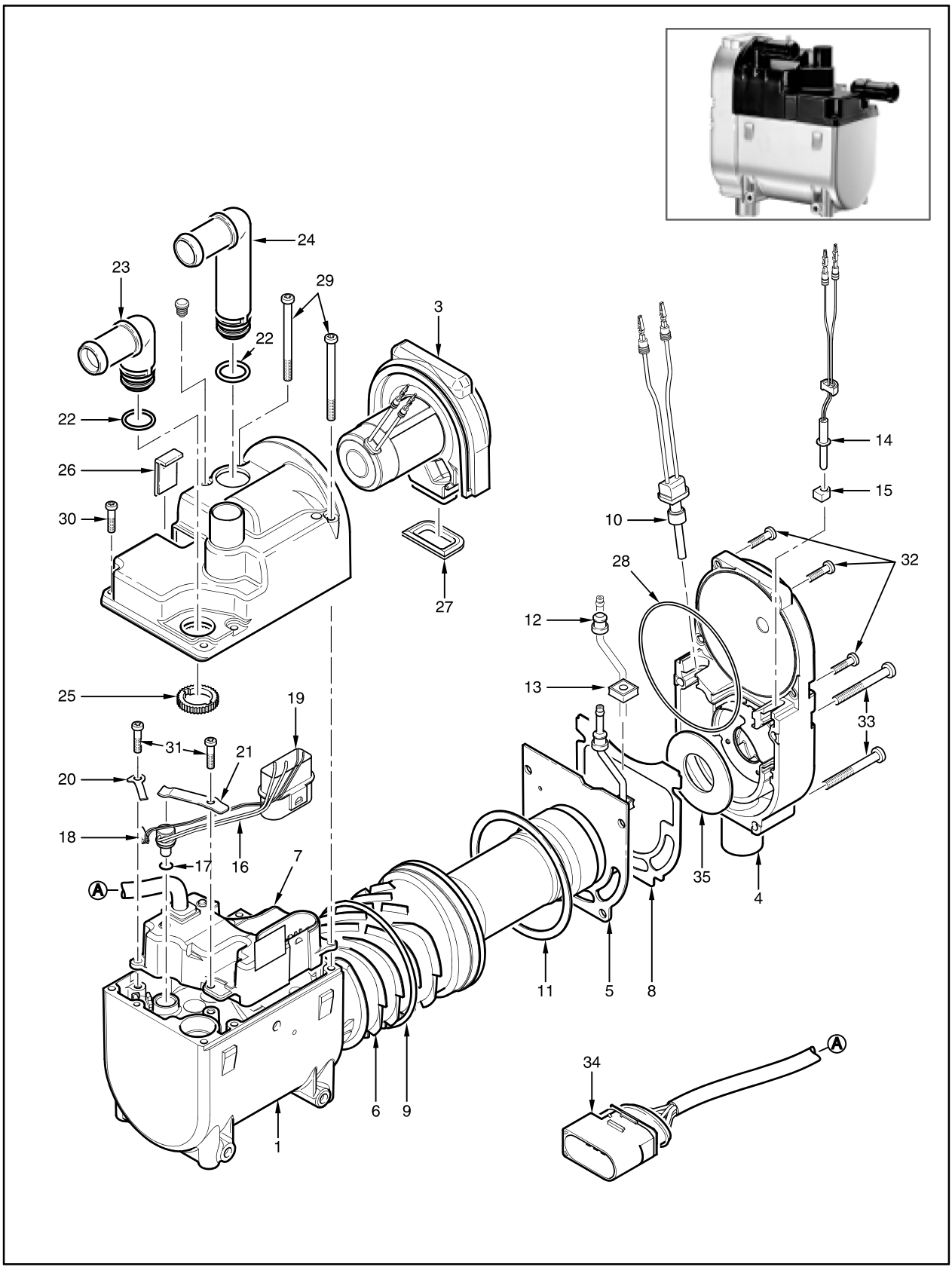
Modification basis	
Application basis	
Affected VIN	

3. SYSTEM LAYOUT



1. FFH assembly
2. Water pump and bracket assembly
3. FFH No.1 bracket assembly
4. FFH No.2 bracket assembly
5. Silencer and pipe assembly
6. Fuel pump assembly
7. Fuel pump bracket assembly
8. Temperature sensor assembly
9. Intake hose
10. Fuel pipe No.1
11. Fuel pipe No.2
12. Pump outlet hose
13. FFH inlet/outlet hose assembly

▶ Exploded View



Modification basis	
Application basis	
Affected VIN	

1. Jacket
2. Jacket cover
3. Combustion air fan
4. Combustion chamber
5. Combustion chamber with flame tube
6. Heat exchanger
7. Controller
8. Seal (between combustion chamber and combustion air fan)
9. O-ring
10. Glow plug with cable
11. Seal (between combustion chamber and heat exchanger)
12. Upper bush for fuel pipe
13. Lower bush for fuel pipe
14. Flame sensor
15. Bush for flame sensor (graphite)
16. Control and overheating sensor with cable
17. O-ring
18. Surface sensor with cable
19. Controller connector - 14-pin connector (waterproof)
20. Pressure spring for surface sensor
21. Pressure spring for control and overheating sensor
22. O-ring
23. Coolant hose (inlet)
24. Coolant hose (outlet)
25. Tooth ring (2x)
26. Cable harness cover
27. Rubber seal
28. O-ring
29. Screw (M4 x 55 TORX/2x)
30. Screw (M4 x 16 TORX/2x)
31. Screw (M4 x 12 TORX/2x)
32. Screw (M4 x 16 TORX/4x)
33. Screw (M4 x 44 TORX/4x)
34. Controller cable harness
35. Insulation washer

4. FFH OPERATING PROCESS

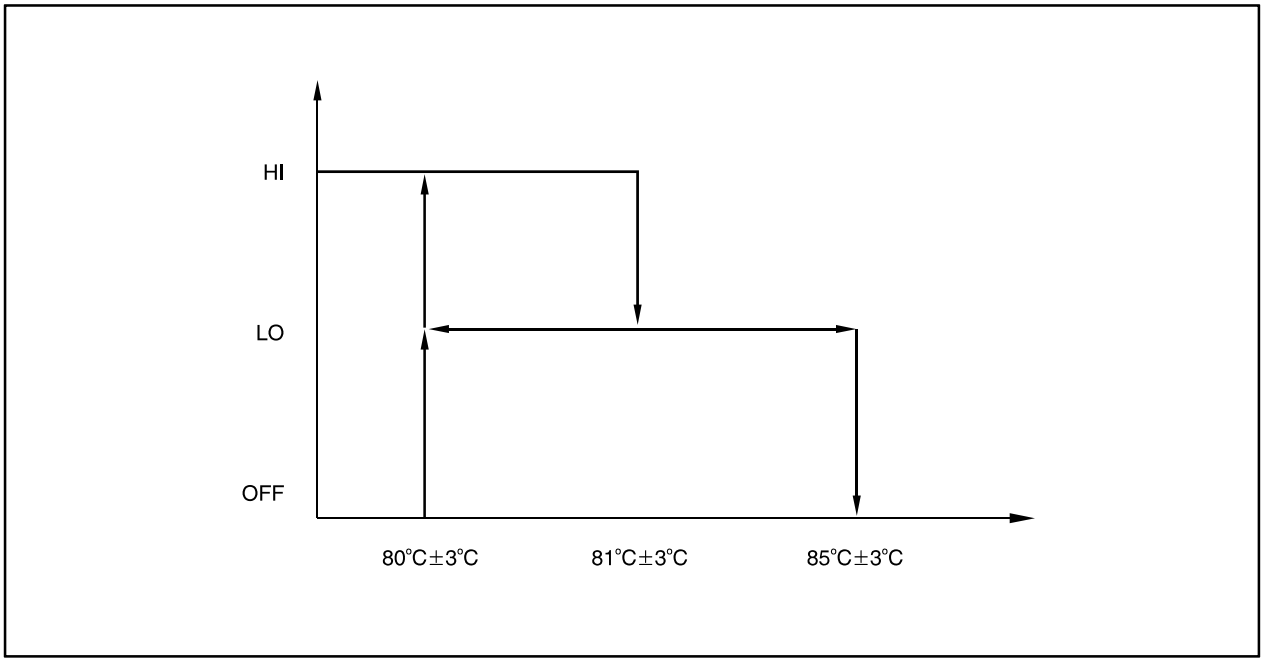
FFH (Fuel Fired Heater) is operated according to the ambient temperature and coolant temperature.

1) Initial and Repeat Operating Conditions of FFH

▶Initial Operating Conditions of FFH:
Ambient temperature: below 5°C
Coolant temperature: below 75°C

▶Repeat Operating Conditions of FFH:
Coolant temperature: below 75°C
When the difference between the ambient temperature at initial operation and current ambient temperature is over 3°C (to reduce the hysteresis with the temperature difference when operating FFH), FFH is operated again. For example, if the initial operating temperature was 4°C, the ambient temperature at repeat operation should be below 1°C and the coolant temperature should be below 75°C.

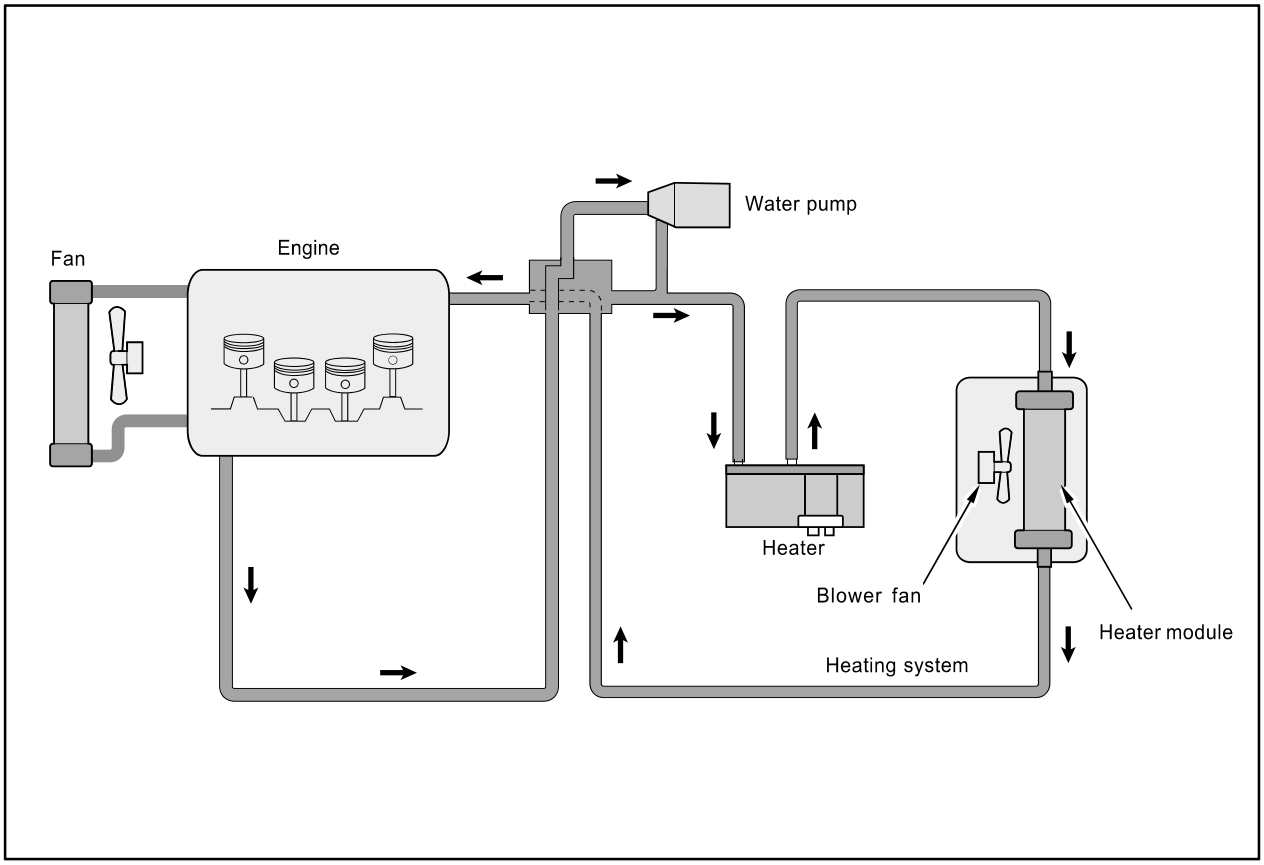
2) FFH Operations According to the Changes of Coolant Temperature



Above graph shows the FFH control process while the FFH is operating. The control element is coolant as shown in the graph. The FFH is operated in HI mode (high output: approx. 5000 W) until the coolant temperature reaches at 80°C and starts to be operated in LO mode (low output: approx. 2300 W) from 81°C. When the coolant temperature reaches at approx. 85°C, FFH stops its operation until the operating conditions will be met again.

Modification basis	
Application basis	
Affected VIN	

3) Coolant Circulating Route



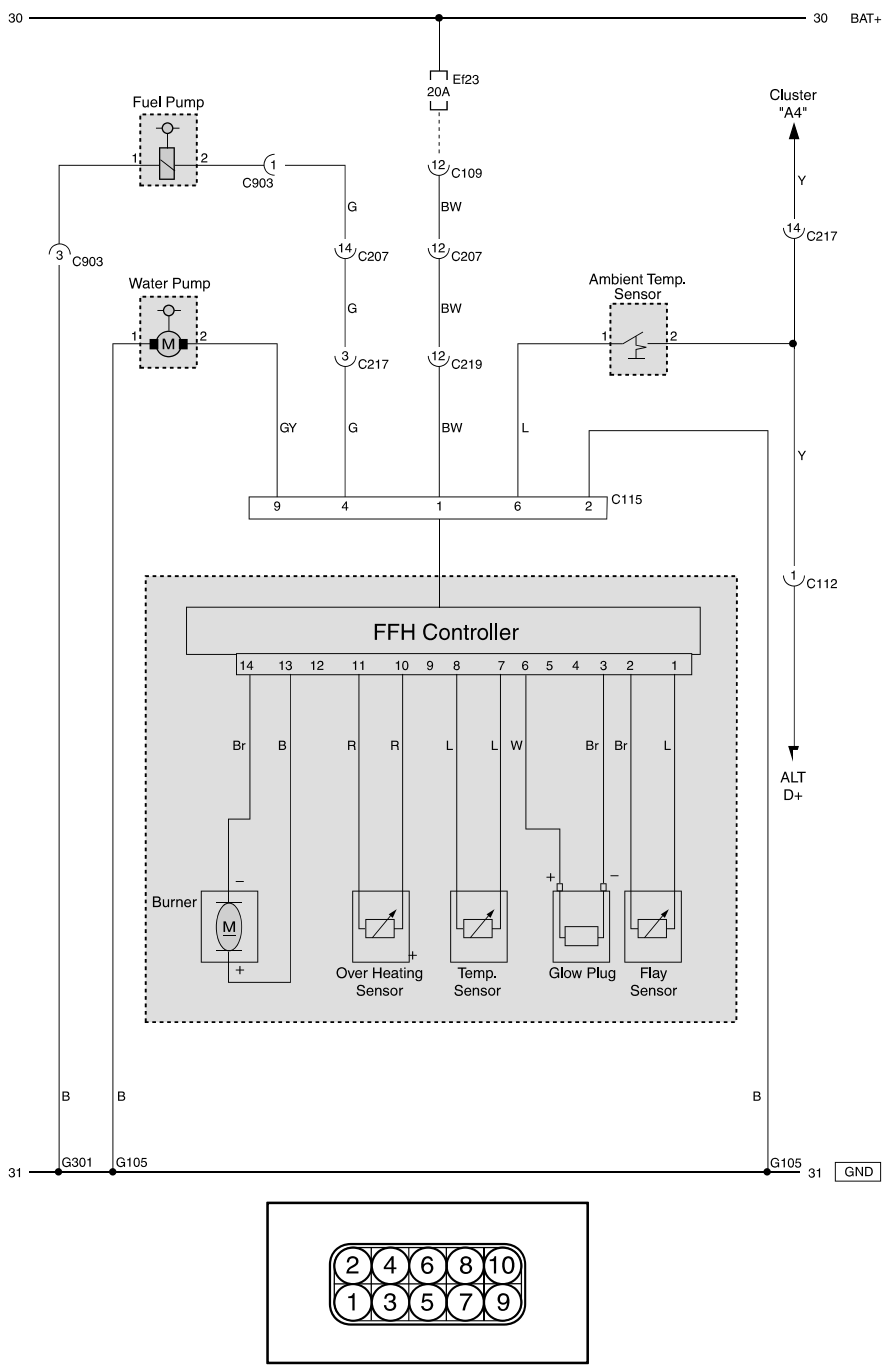
4) Connecting the Coolant Circuit

The heater is connected to the coolant circuit in the coolant feed pipe from the vehicle engine to the heat exchanger.

CAUTION

- Parts conveying coolant must be routed and fastened in such a way that they pose no temperature risk to person or material sensitive to temperature from radiation and direct contact.
- Before working on the coolant circuit, disconnect the negative battery cable and wait until all components have cooled down completely.
- When installing the heater and the water pump, note the direction of flow of the coolant circuit.
- Fill the heater and water hoses with coolant before connecting to the coolant circuit.
- When routing the coolant pipes, observe a sufficient clearance to hot vehicle parts.
- Protect all coolant hoses/coolant pipes from chafing and from extreme temperatures.
- Secure all hose connections with hose clips.

5) Circuit Diagram



The FFH has various sensors in FFH unit, and the FFH unit is connected to the water pump, the fuel circulation pump and the ambient temperature sensor (switch) that provides important signals for the initial and repeat operations. For diagnosis, remove the FFH system connector and install the scan tool. Currently, the K-Line that is connected to the diagnostic connector is not available.

Modification basis	
Application basis	
Affected VIN	

6) Control and Safety Mode

Heater operations and safety mode
* If the fuel pump

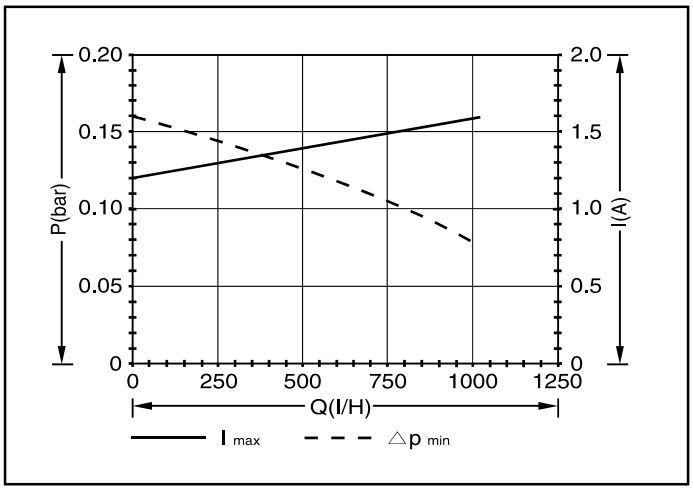
1. If the fuel pump fails to ignite within 90 seconds after fuel pumping starts, the start procedure is repeated as described. If after a further 90 seconds fuel pumping
   the fuel pump still fails to ignite, the heater is switched off in fault mode. The controller is locked after a certain number of failed starts.
2. If the flame does out by itself during operation, firstly a new start is activated. If the fuel pump fails to ignite within 90 seconds after fuel pumping has started again, the heater is switched off.
3. If the heater is overheated (lack of water, poorly vented cooling circuit), the overheating sensor triggers, the fuel supply is interrupted and the heater is switched off.
4. The heater is switched off if the lower or upper voltage limit is reached.
5. The fuel pump does not start when the glow plug is defect or electrical lead to the dosing pump is interrupted.
6. The fan motor speed is monitored continuously. If the fan motor does not start up, the heater is switched off in fault mode after 120 seconds.
7. It is possible to diagnose the system by connecting the diagnostic device to controller. For details, refer to the "Diagnosis Procedures" section.

[Emergency shutdown]
If an emergency shutdown -EMERGENCY OFF- is necessary during operation, proceed as follows;
- Pull the fuse (Ef23: 20A) out.
- Disconnect the heater from the battery.

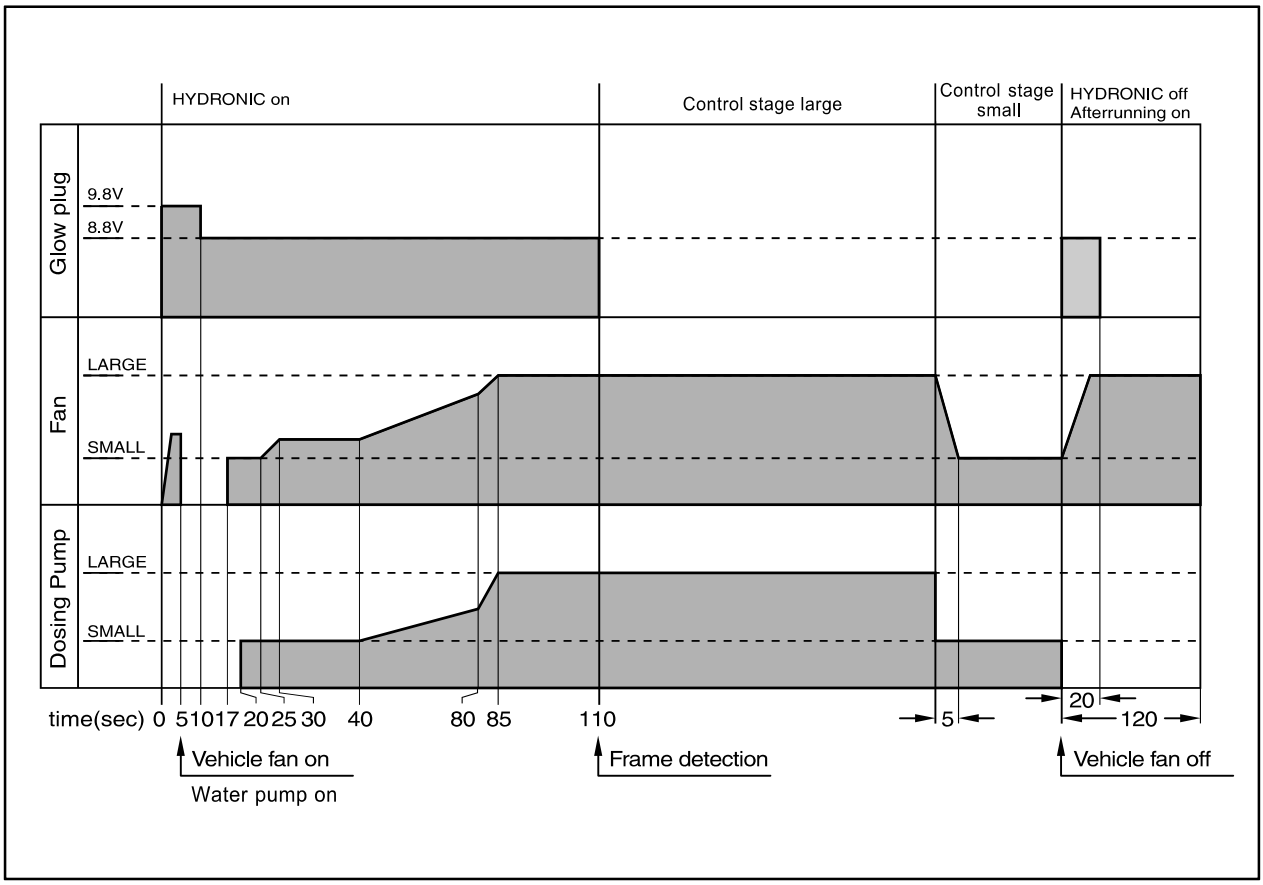
▶Technical Data – Water Pump

Rated voltage	12 V
Operating voltage	9 V ~ 15 V
Power consumption	16 W
Pumping capacity (0.1 bar)	800 l/h
Operating temperature	-40 ℃ ~ 135 ℃
Weight	0.28 kg

7) Characteristic Curve of Water Pump (12 V)

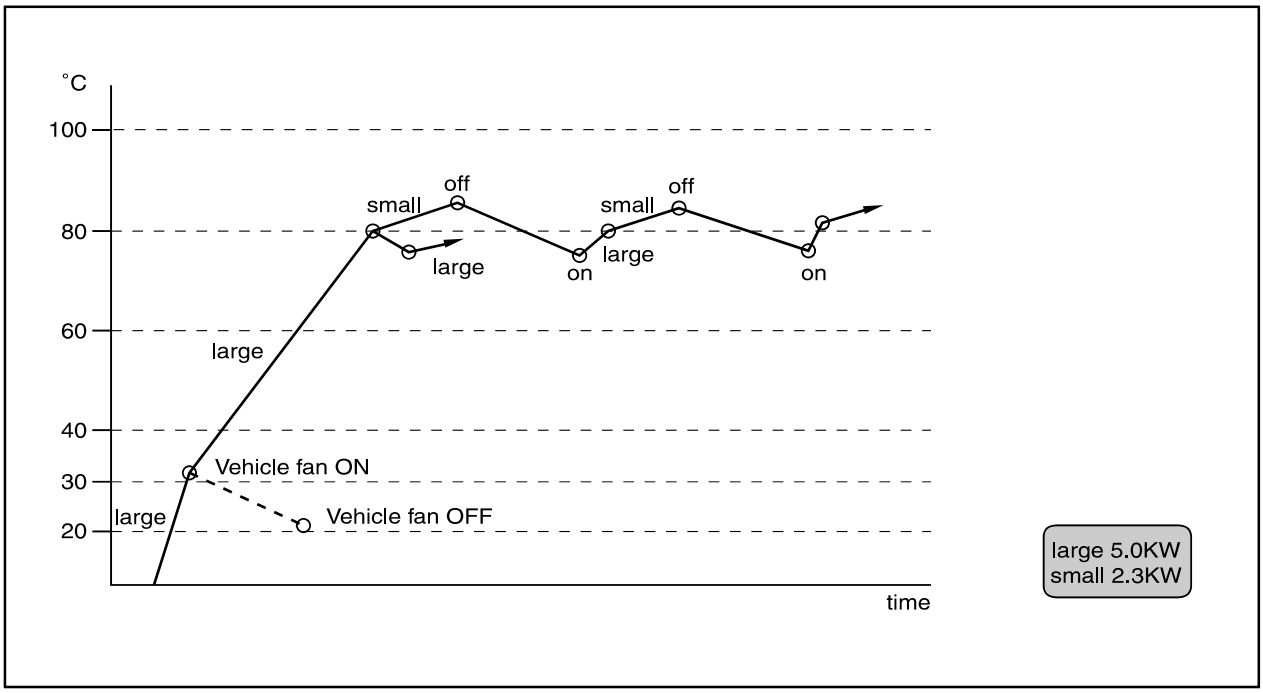


8) Function Diagram



Modification basis	
Application basis	
Affected VIN	

9) Sectional Drawing according to the Temperatures

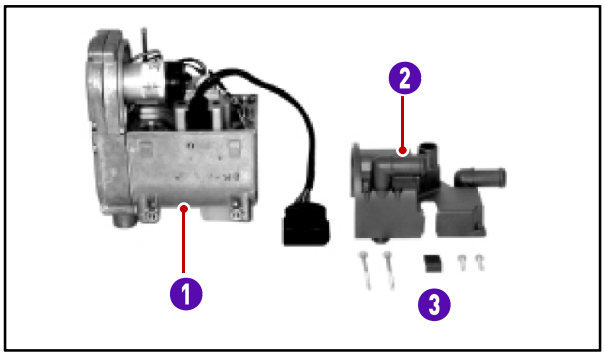


5. COMPONENTS AND COMPOSITIONS

CAUTION

There is no need to disassemble the FFH unit for repair. This section is to show the internal components of the FFH unit.

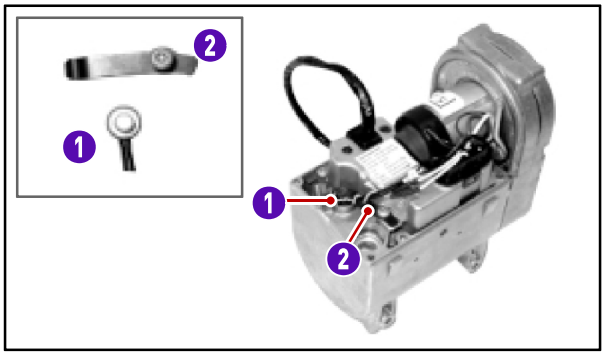
1) Jacket cover



- The O-rings are installed between jacket
- cover and two coolant hoses.
  The coolant hoses should be connected to right side.

1. Jacket
2. Jacket cover
3. Cable harness cover

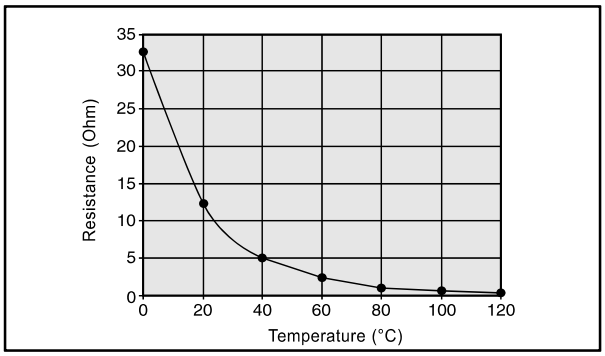
2) Control and overheating Sensor



The Control and overheating sensor and cable harness make up one component.

1. Control and overheating sensor
2. Pressure spring

▶Check control and overheating sensor

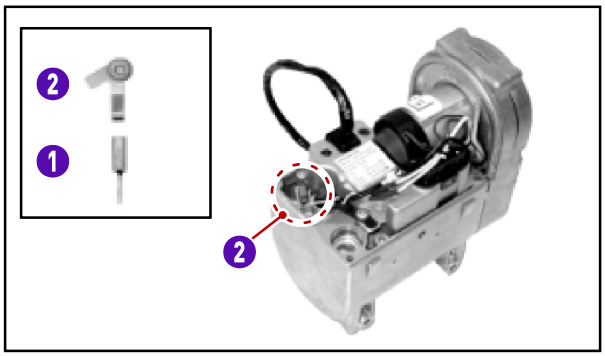


Check the control and overheating sensor with a digital multimeter. If the resistance according to the changes of flame sensor temperature is out of specified values, the flame sensor is defective.

Temperature [℃]	0	10	20	30	40	50	60	70	80	90	100	110	120
Resistance [Ω]	32.54 ±2.2	19.87 ±1.0	12.48 ±0.5	8.06 ±0.4	5.33 ±0.3	3.60 ±0.25	2.48 ±0.17	1.75 ±0.13	1.25 ±0.1	0.91 ±0.08	0.67 ±0.06	0.50 ±0.05	0.38 ±0.04

Modification basis	
Application basis	
Affected VIN	

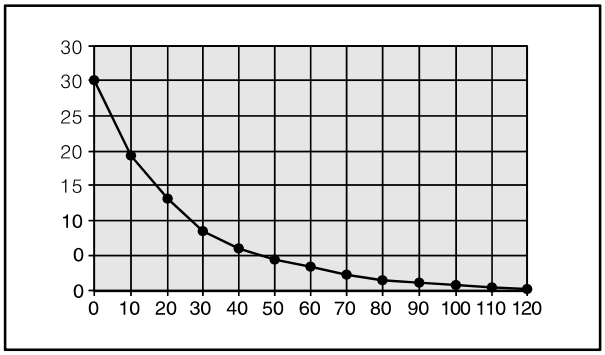
3) Surface sensor



The surface sensor and cable harness make up one component.

1. Surface sensor
2. Pressure spring

▶Check surface sensor

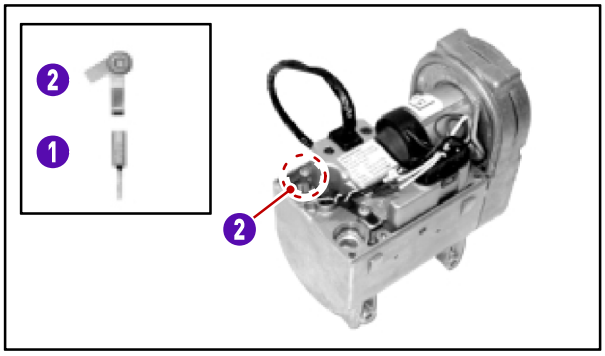


Check the surface sensor with a digital multimeter. If the resistance of flame sensor is out of specified values, the flame sensor is defective.

▶Specifiedl value

Temperature [℃]	0	10	20	30	40	50	60	70	80	90	100	110	120
Resistance [Ω]	30.00 ±0.13	19.53 ±1.6	13.03 ±1.89	8.90 ±2.2	6.20 ±2.4	4.41 ±2.9	3.19 ±3.19	2.34 ±3.6	1.75 ±3.92	1.32 ±4.4	1.02 ±4.78	0.79 ±5.3	0.62 ±5.70

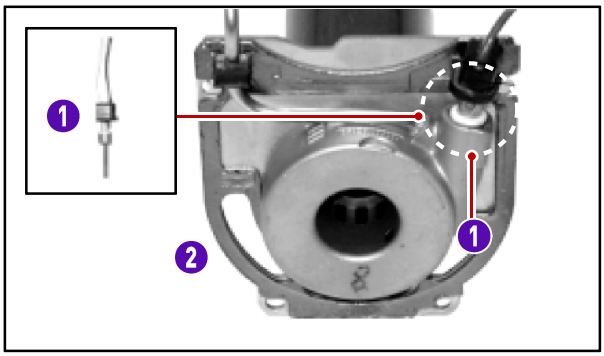
4) Controller



The surface heater and cable harness make up one component.

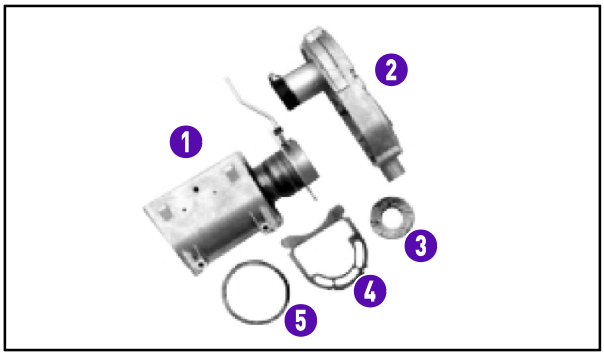
1. Controller
2. Jacket
3. Combustion chamber housing
4. Screw

5) Glow plug



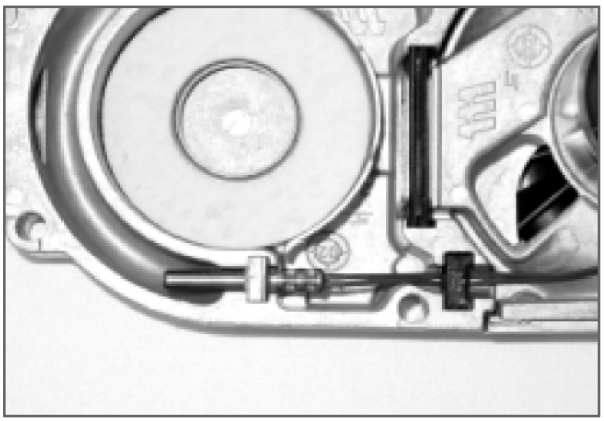
1. Glow plug
2. Combustion chamber with flame pipe

6) Combustion chamber housing



1. Jacket
2. Combustion chamber
3. Combustion chamber housing
4. Insulation washer
5. Seal - combustion chamber / combustion air fan
6. Seal - combustion chamber / heat exchanger

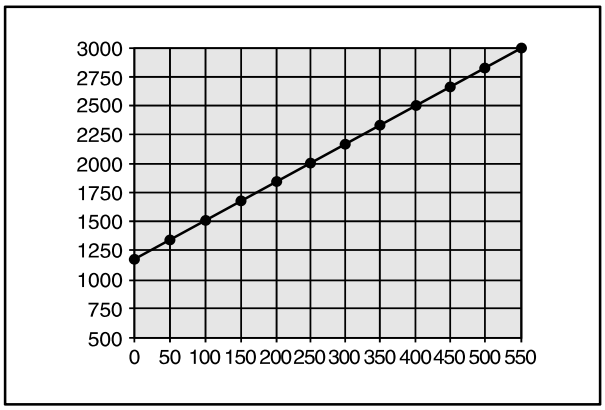
7) Flame sensor



1. Flame sensor
2. Graphite bush
3. Bush

Modification basis	
Application basis	
Affected VIN	

▶Check flame sensor

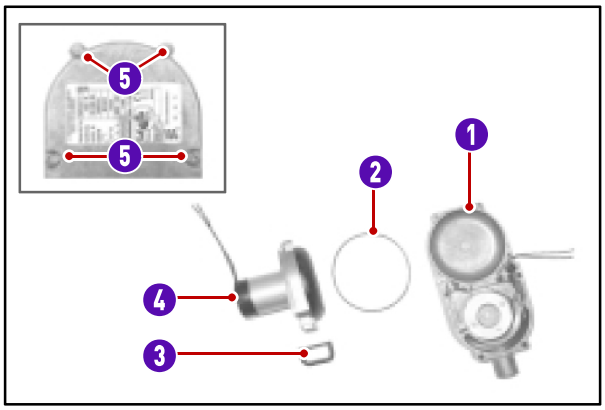


Check the surface sensor with a digital multimeter. If the resistance of flame sensor is out of specified values, the flame sensor is defective.

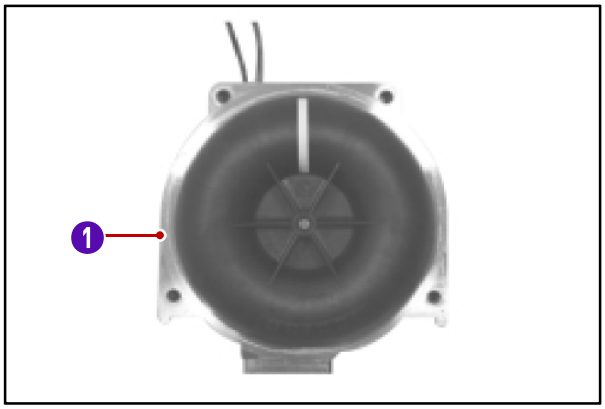
▶Specifiedl value

Temperature [℃]	0	10	20	30	50	80	90	100	130	150	200	250	300	350	400
Resistance [Ω]	1000 ±10	1022 ±10	1062 ±11	1097 ±11	1194 ±12	1309 ±13	1347 ±14	1385 ±15	1498 ±17	1573 ±20	1758 ±24	1941 ±28	2120 ±32	2297 ±36	2470 ±40

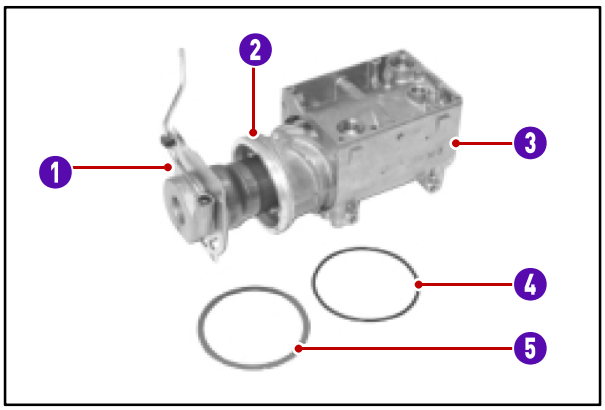
8) Combustion air fan



1. Combustion chamber
2. O-ring
3. Rubber seal
4. Combustion air fan

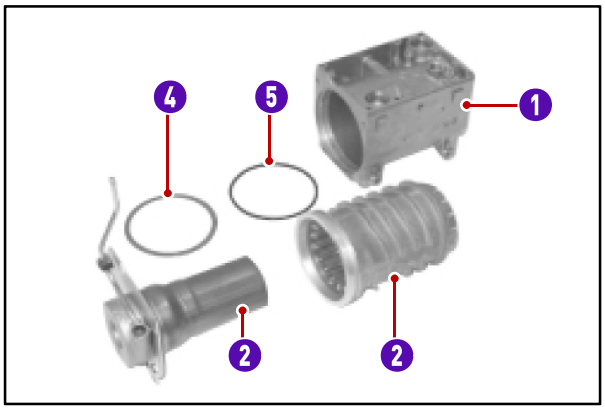


9) Combustion chamber



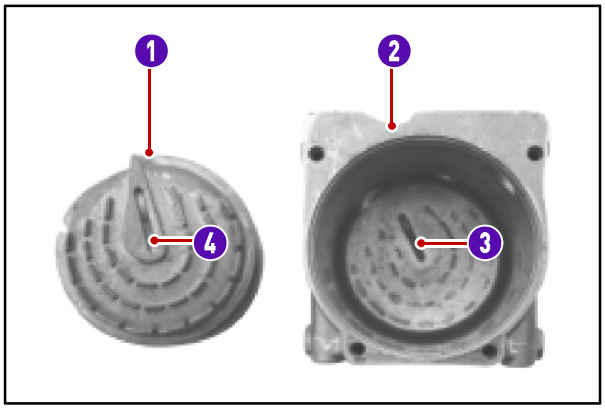
1. Combustion chamber
2. Heat exchanger
3. Jacket
4. O-ring
5. Seal - combustion chamber / heat exchanger

10) Heat exchanger



1. Jacket
2. Heat exchanger
3. Combustion chamber with flame tube
4. Seal - combustion chamber / heat exchanger
5. O-ring (for heat exchanger)

11) Heat exchanger



1. Heat exchanger
2. Jacket
3. Stopper
4. Groove (bottom of heat exchanger)

Modification basis	
Application basis	
Affected VIN	

PTC SYSTEM

6810-21

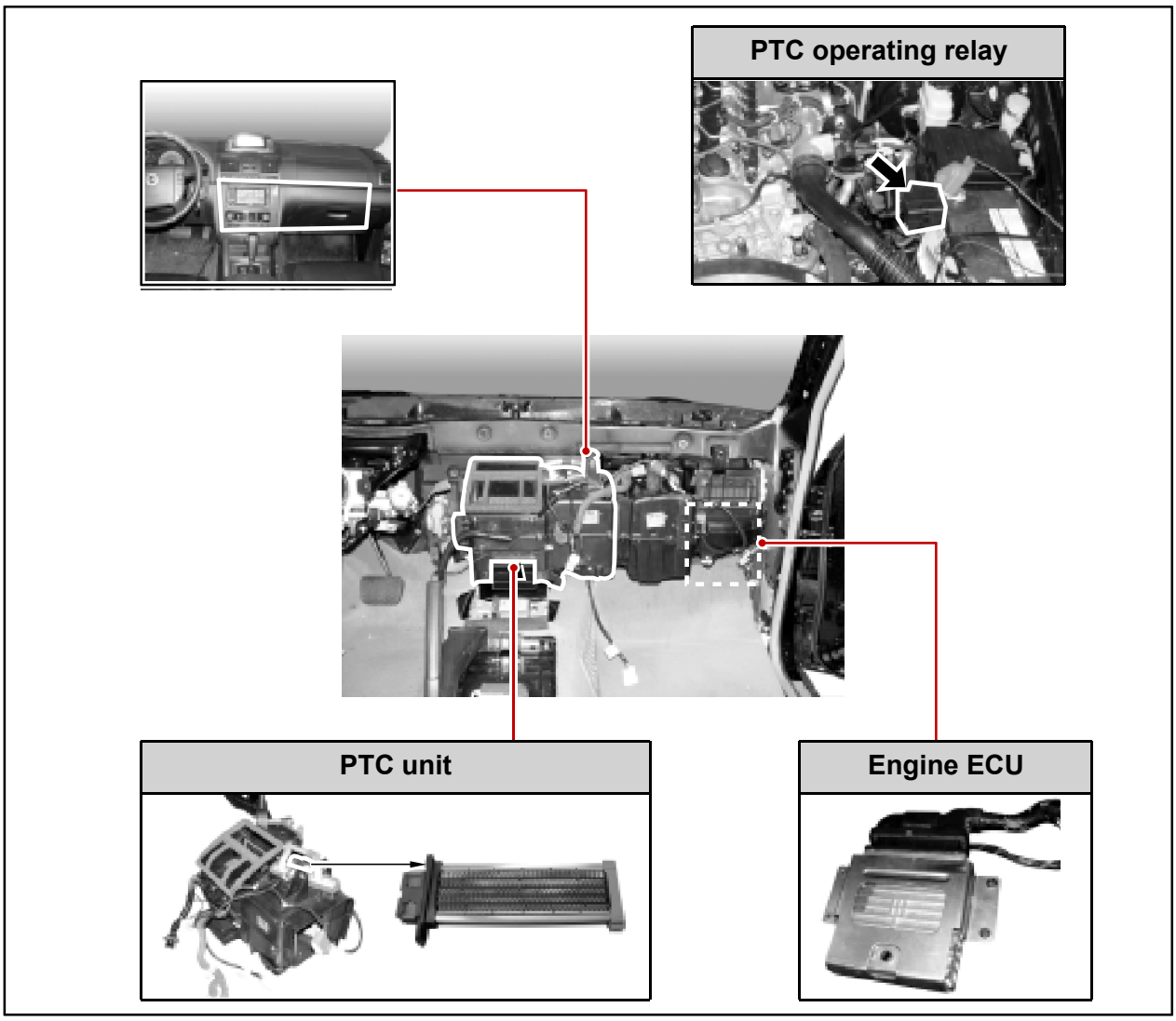
OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

The supplementary electrical heater is installed in D27DT engine equipped vehicle as a basic equipment. The PTC system is operated by the measured temperature values at the coolant temperature sensor and the HFM sensor. This device improves the heating effect by increasing the temperature of flowing air into the passengers room. This system needs higher electric power than conventional system due to it heats the ceramic in PTC with the electricity. And, the alternator capacity has been largely increased (12 V ~ 75 A / 90 A to 12 V ~ 140 A). Non-operational Condition

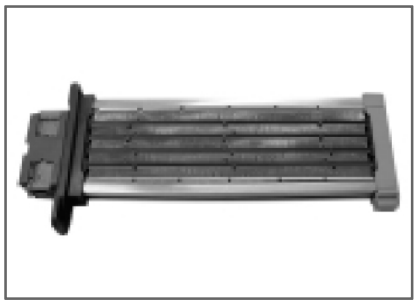
- During engine cranking
- Too low battery voltage (below 11 V)
- During preheating process of glow plugs

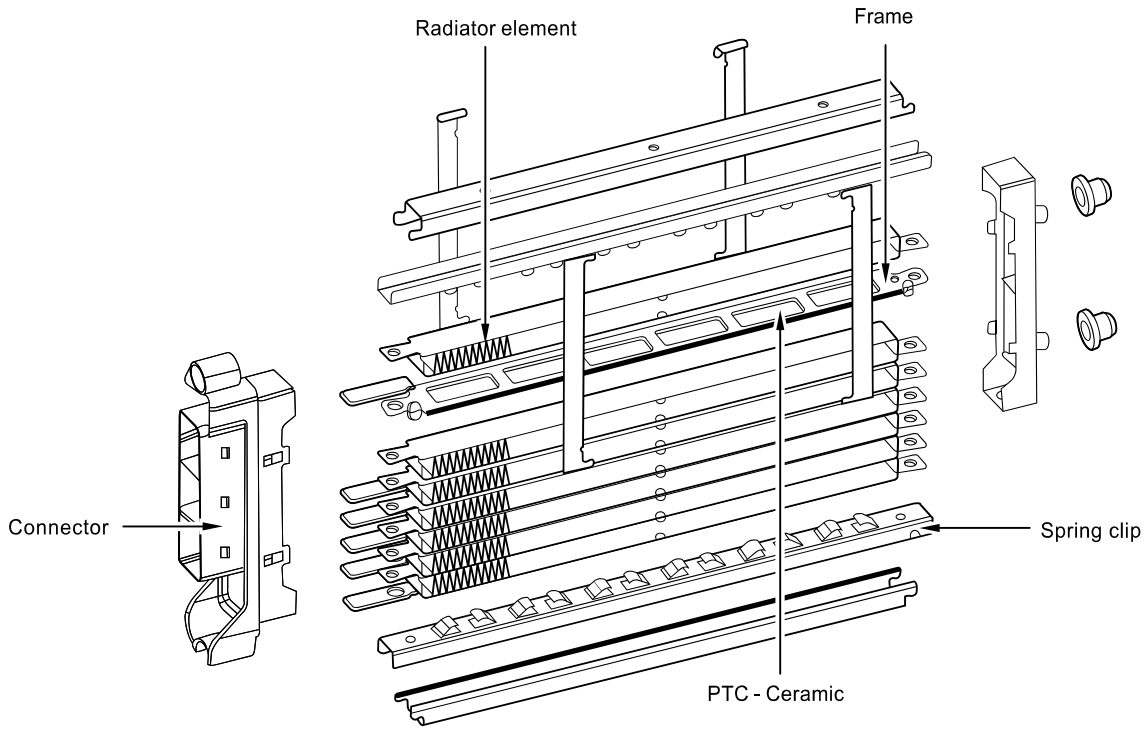
2. COMPONENTS LOCATOR



Modification basis	
Application basis	
Affected VIN	

3. COMPONENTS

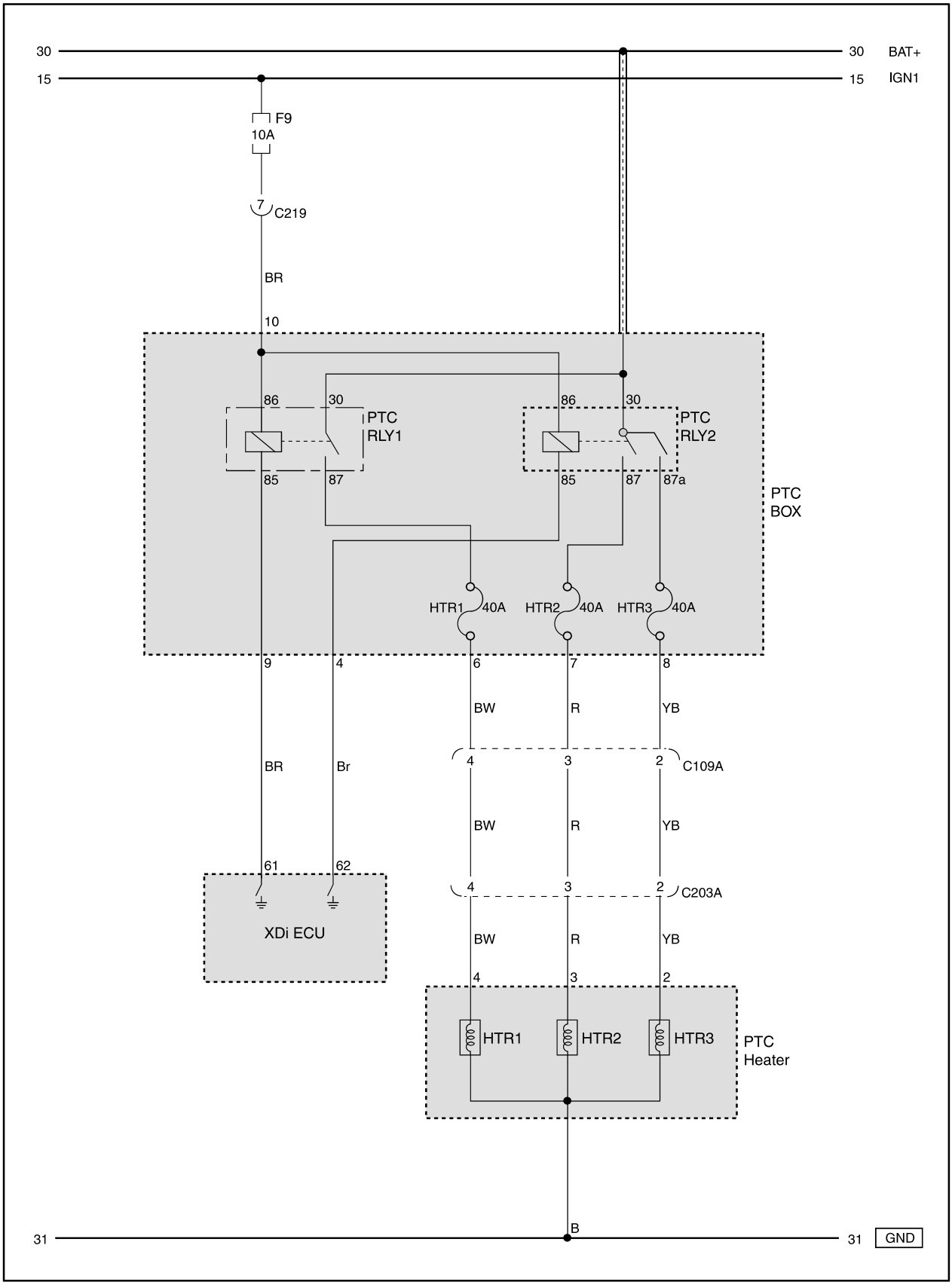




▶ CHARACTERISTICS OF PTC

	P.T.C Heater
Heating type	Air heating type
Heating efficiency	Excellent
Element	Ceramic PTC ($BaTio_3$)
Weight	approx. 500g
Durability	Excellent
Safety	Excellent
Advantages	- Stable output regardless of voltage changes - Block the overcurrent with switch effect of PTC element - High heating capacity in a moment - Excellent durability of heating element against high current

4. CIRCUIT DIAGRAM



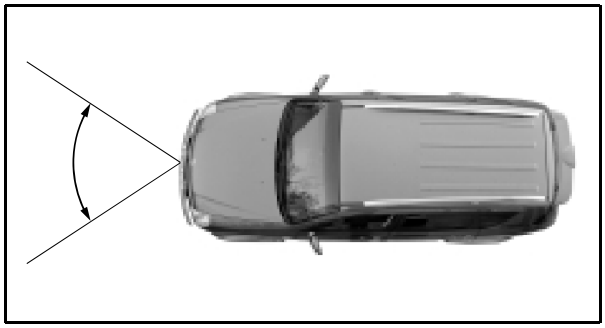
Modification basis	
Application basis	
Affected VIN	

AIR BAG AND SEAT BELT

8810-05

GENERAL

1. CAUTIONS WITH THE AIR BAG



1) Side Airbag Operation

The air bag inflates when:

· Vetical side impact is over 25 km/h of vehicle speed

The air bag does not inflate when:

· Impact speed is very low
· Rear impact

The air bag seldom inflates when:

· Oblique impact (diagonal direction)
· Impact at engine compartment or trunk
· Partial impact at side of the front seat such as telegraph pole
· Vertical impact against a motorcycle
· Rollover

2) Front Airbag Operation (Driver's and Passenger's)

The air bag inflates when:

· Frontal impact against a solid concrete wall at over 25 km/h or near-frontal impact within 30 degrees from the center of the vehicle at both corners

The air bag can inflate when:

· Underbody impact from the road surface; impact against the curb at a very high speed; dropping impact onto the road surface with a large angle

The air bag does not inflate when:

· Rollover, side impact or rear impact

The air bag seldom inflates when:

· Oblique impact, rollover
· Weak impact in which the sensor is unable to detect (under the inflation requirements)
· Impact against narrow objects such as a telegraph pole or a tree
· The vehicle falls into a drainage or a puddle
· The front of the vehicle crashes into high impact point vehicle such as a truck
· Impact on the hood by falling stones
· The air bag warning lamp is on

3) Warnings for Airbag

- Do not diagnose the circuit with a circuit tester. Do not attempt to modify any air bag components including the steering wheel, air bag mounting area, and harness.
- Do not impact any air bag components including the steering wheel, air bag mounting area, and harness by hand or tools. You may get injured by sudden deployment.
- The air bag components will be very hot after deployment. Do not touch them.
- Once the air bag system is triggered, the triggered air bag assembly should be removed from the vehicle and replaced with new one.
- The air bag contains explosive materials, so contact Ssangyong Dealer or Ssangyong Authorized Service Operation when trashing or replacing it.
- Incorrect air bag inspection can be dangerous and cause injuries. The air bag system must be disposed only by Ssangyong Dealer or Ssangyong Authorized Service Operation.
- Replace the steering wheel with only Ssangyong genuine part.
- When the engine starts, the air bag warning lamp comes on for a system check. It goes out after 3 to 7 seconds when the system is normal. If this warning lamp stays ON, then the system may be defective. Have the air bag system checked immediately by Ssangyong Dealer or Ssangyong Authorized Service Operation.
- The seat belt and air the bags are the most effective when you are sitting well back and upright in the seat.
- A child restraint system must not be placed on the front seat. The infant or child can be severely injured by an air bag inflation in case of an accident.
- Do not carry your child on your lap while driving. You cannot resist against the impact pressure in an accident.
  The child could be crushed between you and the parts of the vehicle.
- Do not place any objects on the air bag inflation location. You may get injured by those objects during deployment.
- Do not attach any objects such as a sticker, scent bottle, or phone holder on the steering wheel pad and to the dashboard.
- Do not put the seat cover on the front seatbacks. It may interfere with the side air bag inflation.
- When sitting in the rear seat, do not hold onto the seatback of the front seat. If the side air bag inflates, the occupant may get seriously injured.
- Do not lean on the door. When the side air bag inflates, the occupant may get seriously injured.
- Do not place any objects such as an umbrella or a bag between the side air bag and the door. Do not place the part of your body near the side air bag. You may obstruct the side air bag or get injured by the inflation impact.

Modification basis	
Application basis	
Affected VIN	

- Do not slam the front doors. It may lead to an unintended inflation of the side air bag.
- Do not move your seat too close to the steering wheel or dashboard. If you lower your head, the air bag can hit your head during inflation and can cause severe injury or even death.
- Hold only the outer rim of the steering so that the air bag can inflate without any hinderances.
- Do not place your face or chest near the steering wheel and dashboard. Also, do not allow anyone to place their hands, leg or face on the dashboard. The air bag cannot work properly.
- Do not hold and operate the steering wheel by crossing your arms. You could get seriously injured when the air bag deploys.
- When the air bag inflates, it makes a loud noise and smoke. However, the smoke is a non-toxic nitrogen gas.
- When the air bag is deployed, non-toxic gas will come out. This gas may cause skin, eyes or nose irritation.
  Wash it out with cold and clean water and consult the doctor if irritation continues.
- When any repairs are needed for the steering wheel, or when an accident occured without the air bag deployment, have the air bag system checked by Ssangyong Dealer or Ssangyong Authorized Service Operation.
- The windshield glass may be broken when the passenger's air bag is deployed.
- The air bag deployment can cause abrasion on your hands and face.

4) Airbag Module Discard

▶ Airbag module deployment (inside vehicle)

Deploy the airbag before disposing of them. If a vehicle to be scraped, the airbag may be deployed inside the vehicle.

- Before deploying the airbags, remove all loose objects from the airbag's expansion area.
- Deploy the airbags with the vehicle doors closed and the side windows open.
- Deploy the airbags only in an evacuated area. Service personnel who must be present during the deployment should be at least 10 meters (33 feet) in front of the vehicle.
- Do not connect the voltage source until after having completed all other preparations for the deployment of the airbags.
- Allow a deployed airbag module or pretensioner to cool for at least 30 minutes before handling.
- If the deployment fails, disconnect the voltage source and wait 5 minutes before approaching the vehicle.

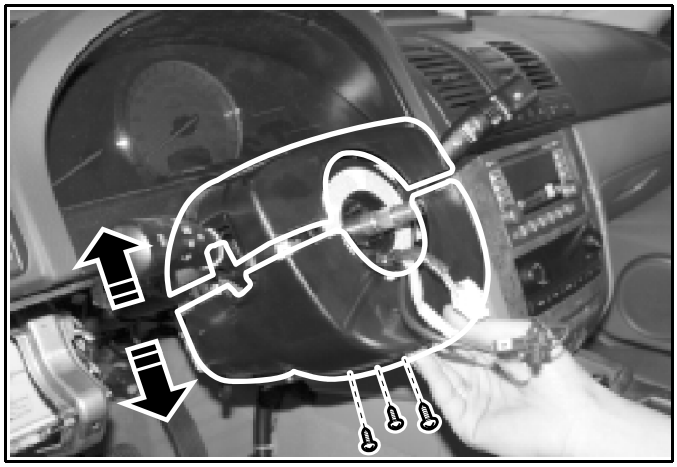
5) Airbag Module Discard (Driver)

1. Disconnect the battery cable and place the vehicle battery at least 10 meters (33 feet) away from the airbag module.

CAUTION

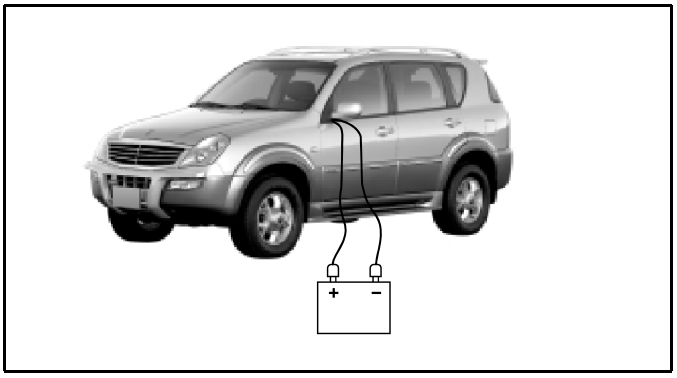
- If the airbags are not disconnected, service cannot begin until one minute has passed after disconnecting power to the SDM. If the airbags are disconnected, service can begin immediately without waiting for one-minute time period to expire. Failure to temporarily disable the SRS during service result in unexpected deployment, personal injury and otherwise unneeded SRS repair.

2. Remove the lower cover of the steering column.



3. Cut two wires between the airbag and the contact coil.
4. Strip 13 mm (0.5 inch) of the insulation from the end of the wires leading to the contact coil.
5. Use two additional wires, each at least 10 meters (33 feet) long, to reach from the deployment battery to the airbag module.
6. Strip 13 mm (0.5 inch) of the insulation from the ends of these two additional wires.
7. Twist the two wires together at one end.
8. Place the twisted ends of the two wires near the deployment battery. Do not connect the wires to the battery at this time.
9. Using the free ends of the 10 meters (33 feet) wires leading to the airbag module, make two splices, one at each wires from the airbag module.
10. Wrap the splices with insulating tape.
11. Now that the free ends of the 10 meters (33 feet) wires are spliced to the airbag module wires and the ends that are twisted together are near the deployment battery, clear the area.
12. Untwist the wires that near the deployment battery.

Modification basis	
Application basis	
Affected VIN	



13.Touch one wire to the positive battery terminal and touch the other wire to the negative battery terminal.
The airbag module will deploy.
14.Refer to "DEPLOYED AIRBAG MODULE DISPOSAL PROCEDURE" in this section.

▶ Airbag module discard (passenger)

The passenger airbag deployment is the same procedure of the driver's. Remove the glove box instead of the contact coil and cut two passenger airbag wires.
Refer to "AIRBAG MODULE DISCARD (DRIVER)" in this section for more information.

▶ Airbag module deployment (outside vehicle)

Deploy airbag modules in following situations:

- If the airbag module is removed in the discarded vehicle.
- If the airbag module is replaced due to any fault.
- If an airbag module is damaged during transfer, storage or servicing.

Observe following precaution if the airbag is deployed:

- Deploy the airbags only in an evacuated area. Service mechanics should be at least 10 meters (33 feet).
- Do not connect the voltage source until after having completed all other preparations for the deployment of the airbags.
- Allow a deployed airbag module or pretensioner to cool for at least 30 minutes before handling.
- If the deployment fails, disconnect the voltage source and wait 5 minutes before approaching the vehicle.

1. Position the airbag module face up, on flat ground outdoors, at least 10 meters (33 feet) from any obstacle or people.
2. Place a vehicle battery at least 10 meters (33 feet) away from the airbag module.
3. Deploy the airbag module using the deployment tool. If you do not have deployment tool, cut the two additional wires to the airbag module and strip 13 mm (0.5 inch) of the insulation from the end of the wires leading to the airbag module.
4. Refer to "DEPLOYED AIRBAG MODULE DISPOSAL PROCEDURE" in this section.

6) Deployed Airbag Module Disposal Procedure

After deployment, a powdery residue may be on the surface of the airbag. The powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by-products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by-product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate also known as baking soda}. Therefore, it is unlikely that sodium hydroxide will be present after deployment. Wear gloves and eye protection during the disposal procedure.

After deployment, the metal surfaces of the airbag module will be hot. In order to avoid the risk of an injury or a fire, do not place the deployed airbag module near any flammable objects, and allow the airbag module to cool for 30 minutes before handling. Deploy an airbag or pretensioner before disposing of it.

This includes those in a whole vehicle being scrapped. If the vehicle is still within the warranty period contact the SsangYong regional service manager for approval or special instructions before deploying an airbag module or pretensioner.

Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

When the ignition is switched ON, the supplemental inflatable restraints (SIR) warning lamp must blink at six times for 6 seconds and then turn off.
There is a fault in the airbag system if the warning lamp does not turn OFF or the warning lamp illuminates while the vehicle is in operation. If the warning lamp indicates there is a fault in the airbag system, assume that the SIR system may not be functional.

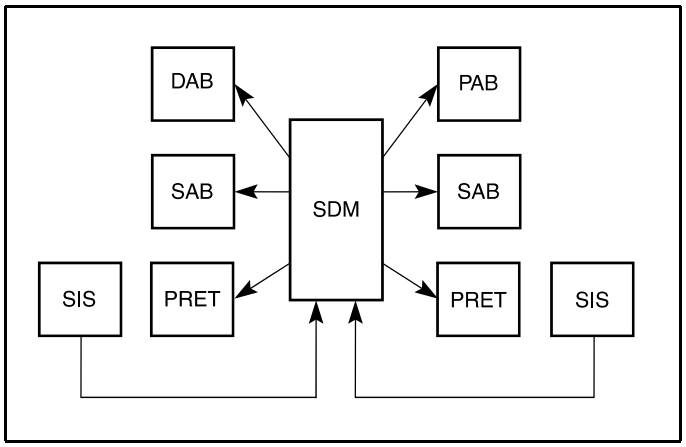
CAUTION

Failure to follow all service procedures in the correct sequence can cause the airbag system to deploy unexpectedly and possibly cause a serious injury.

- Only trained personnel at franchised SsangYong dealers and authorized SsangYong service dealerships may service the airbag system.
- Never attempt to disassemble, repair or reuse the following component;
  - Airbag modules
  - Clock spring
  - Sensing and diagnostic module
  - Wiring harness
- When repairing SIR component, follow the service notice;
  - Inspect any SIR part before it is installed.
  - Use only new parts.
  - Do not install used SIR parts from other vehicles.
  - Do not install any part that has been dropped or that has dents, cracks or other defects.
- Before testing, disconnect the negative battery cable.
  Wait one minute for the SDM capacitor to discharge.
  The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected.
  Unintentional deployment of the airbags can cause injury.

1) SIR System

SIR system consists of 6-Loop (DAB, PAB, 2*SAB, 2*PRET) fully and the block diagram is as shown below.
On this diagram, SDM sends the output signal to DAB, PAB, 2*SAB, 2*PRET and receives the input of side impact from 2*SIS (Side Impact Seasor).



Abbreviation

1	SDM	Sensing and Diagnostic Module
2	DAB	Driver-side Airbag Module
3	PAB	Passenger-side Airbag Module
4	SAB	Side Airbag Module (Driver, Passenger)
5	PRET	Seatbelt Pretensioner (Driver, Passenger)
6	SIS	Side Impact Sensor (Driver, Passenger)

Modification basis	
Application basis	
Affected VIN	

2. FUNCTION DESCRIPTION

1) Back (Cushion)

- The airbag system performance is influenced on the cushion size, shape and position.
- The cushion strength is a important parameter on the impact absorb effect.
- Therefore, the control of the airbag performance depends on cushion size, shape, inflator characteristic and vent hole size for the gas discharge.
- The cushion's material and folding function to control the cushion deployment direction and the performance to protect passenger's face.

2) Module cover/housing

- It is a type of a container that includes the cushion and the inflator.
- The module housing functions to deliver the reaction force between the body structure and the airbag (The airbag reaction is absorbed generally to the steering wheel or instrument panel).
- The module cover must be considered in a viewpoint of protection between exterior, internal units and cushion. Also the module cover should be designed not to cause any personal injury for deployment.

3) Inflator

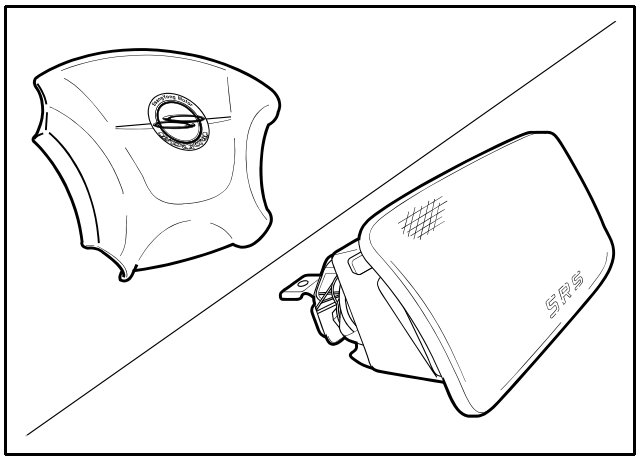
- The inflator is a type of the direct gas generated device.
- The inflator with initial low pressure provides negative restraint effect regarding passengers moving and time.
  On the contrary, the inflator with initial high pressure allows other components of the airbag to make a excessive impact resulting in any personal injury.
  Thus, the inflator output must be optimized according to the characteristic of the vehicle and passenger moving.
- The discharge gas has no toxicity or inflammability and also it is the important parameter to control the high temperature for gas firing.

4) Airbag Module

The driver airbag module is under the center pad of the steering wheel.
The passenger airbag module is installed in the instrument panel at passenger side.
The driver and passenger side airbag is inside each seat.

CAUTION

- Do not disassemble the airbag module because unintentional deployment of the airbags resulting from any damage or interference of the module can cause injury.



Modification basis	
Application basis	
Affected VIN	

5) SDM (Sensing and Diagnostic Module)

1. The airbag system consists of the module section (driver, passenger and side), seat belt section and SDM.
2. The SDM has no user-serviceable parts and monitors the system components continuously. The SDM also records any faults which are discovered.
3. The SDM allows the fault codes to be retrieved with a scan tool and illuminates a warning lamp that alerts the driver to any faults.

The SDM located on floor beneath the floor console assembly. The SDM performs the following functions:

- Impact decision processor function.
  Determine the airbag deployment through the impact signal of the accelerometer sensor and the safety sensor.
- Malfunction detection and recording any faults that are detected.
  Monitor the supplemental restrain system electrical components and set a diagnostic trouble code when malfunction is detected.
- Display airbag fault codes Display airbag fault codes and system status information when connected to a scan tool.
- Self-diagnosis function Illuminate the AIRBAG indicator to alert the driver to any fault.
- Power supply function Provide a reserve power source to deploy the airbags and pretensioners if an accident has disabled the normal power source.

6) Acceleromenter sensor

The accelerometer sensor electronically represents the acceleration or deceleration of the vehicle during a frontal impact.
In this electronic representation, the electrical signal is proportional to the acceleration or deceleration of the vehicle.

7) Safety sensor

The safety sensor is safety device made up of a dualcontact, electro-mechanical switch that:

1. Acts independently of the electronic components.
2. Connects the acceleration sensor in series in order to make up for the weak points in the current electronic sensor.

8) Micro controller

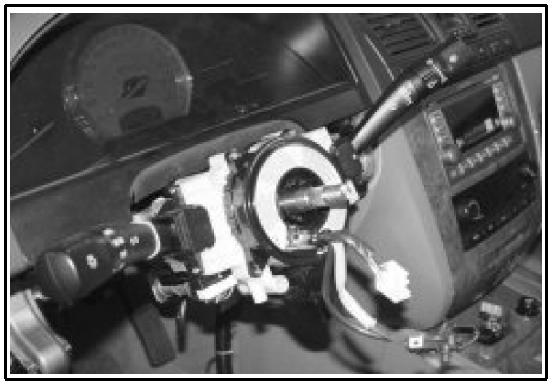
This device receives the impact signal from the sensor for vehicle impact and identifies whether the current condition is necessary for airbag deployment or not. And then the controller sends the specified currents to the airbag ignition circuit as needed.
This device always monitors the airbag system in conduction with the diagnostic circuit. When it is detected any problem, it illuminates the airbag warning indicator to inform driver of the fault and stores the fault information.

9) Contact coil

The contact coil is installed between the steering wheel and the steering column and contains a coil that enables to contact electrically between the airbag wiring harness, the driver airbag module and the horn switch.

CAUTION

- Turning the steering wheel more than three and onequarter turns may damage the clock spring. The contact coil should never be disassembled and must be replaced if the airbag have been deployed.



CAUTION

- Turn the label of the clock spring clockwise to lock and turn the label of the clock spring counterclockwise approximately 2.9 ± 0.2 turns to the neutral positions with the front wheels ahead.
  Align the pointed marks "▶◀".

Modification basis	
Application basis	
Affected VIN	

10) Airbag Warning Lamp

The instrument cluster contains an airbag warning indicator bulb to verify the operation of the AIRBAG indicator and sensing and diagnostic module (SDM).
The SDM performs a turn-on test when the ignition is turned ON. The SDM flashes the AIRBAG indicator seven tomes by supplying an intermittent ground to the indicator lamp circuit. After flashing seven times, the AIRBAG indicator will turn off if no more malfunctions have been detected.



Warning Lamp Status	Fault Contents
Flash at seven times for 7 seconds and then turn off	System OK
Warning lamp stays ON	System fault
	Internal SDM fault
No turn on	Power supply circuit open and fuse open
	Warning lamp circuit open
	SDM fault

11) Wiring Harness Connectors

If the sensing and diagnostic module (SDM) electrical connector is not attached properly, a built in shorting bar will connect the wire from airbag warning lamp with the SDM ground wire. This turns on the AIRBAG indicator.

To prevent deployment during servicing, additional shorting bars are located in following locations:

- Driver airbag module connector
- Passenger airbag module connector
- Driver and passenger side airbag module connector
- SDM wiring harness connector
- Contact coil connector to airbag wiring harness

The shorting bar is only a backup safety device. Always disable the supplemental restraints system (SRS) before beginning any service procedure.

12) Belt Pretensioner

The belt pretensioner enables to retract the driver and the passenger seat belt webbing to reduce any personal impact when accounted a frontal collision.

Modification basis	
Application basis	
Affected VIN	

SEAT

8510-31

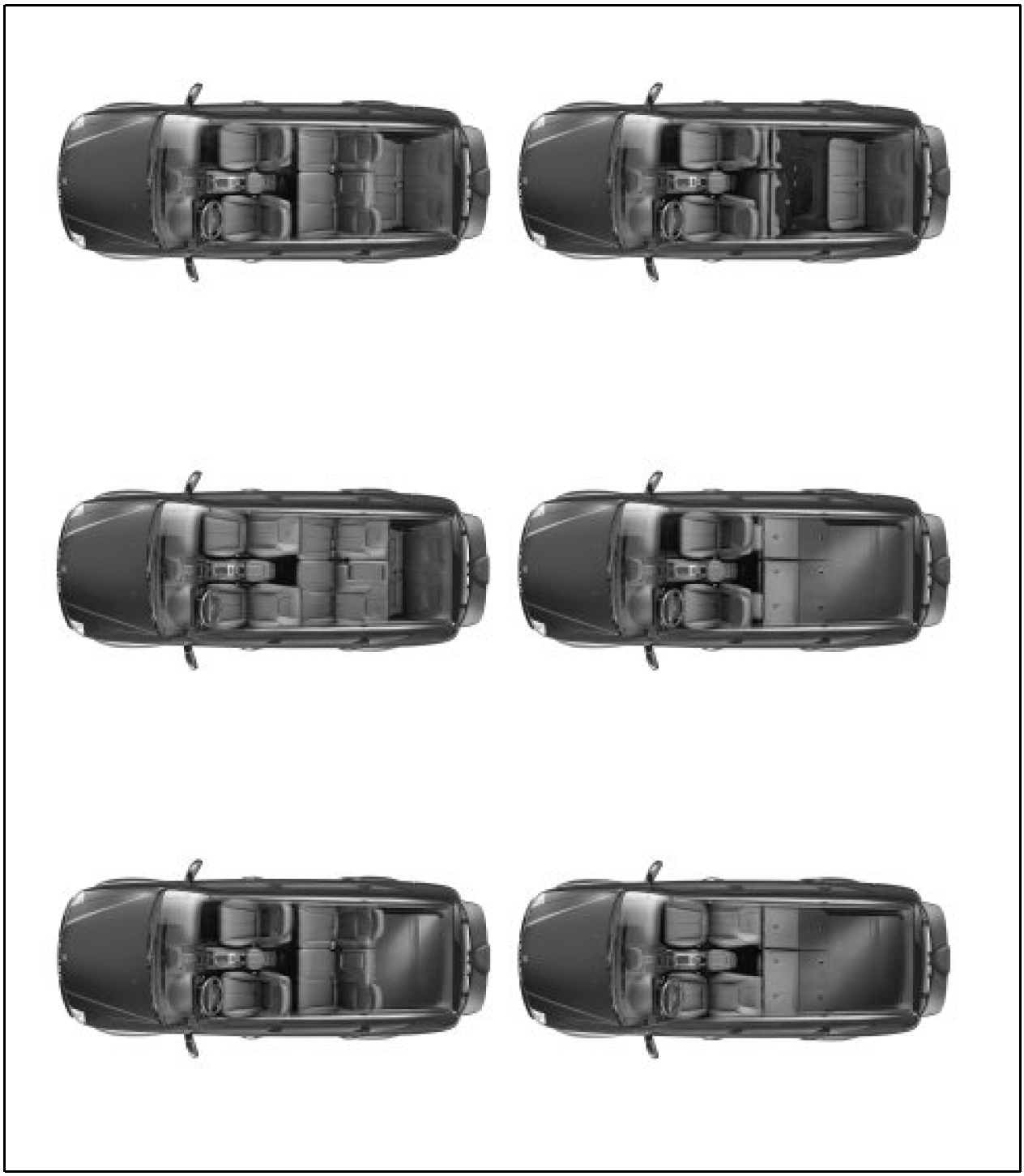
GENERAL

1. SPECIFICATIONS

Component	Description		Specification
Seat Note: Operated regardless of the ignition switch position	Operating voltage		DC 11 ~ 15 V
	Operating temperature range		-30°C ~ 80°C
	Seat moving speed (at 13.5 V)	Slide	20 ± 7 mm/sec
		Tilt	10.6 ± 5 mm/sec
		Height	7 ± 5 mm/sec
	Seat moving distance	Slide	228 ± 3 mm
		Recline	20° ↔ 0 ↔ 48°
		Lift	30 ± 3 mm
	Operating current (at 13.5 V)	Slide	below 7A
		Recline	below 7A
		Tilt and lift	below 8A
	Seat warmer switch	Rated load	DC 12 V / 1A
		Operating temperature range	40 ± 5°C
		Switch operating force	0.3 ~ 0.7 kgf
Outside rearview mirror	Up/Down angle		-8° ~ 8°
	Left/Right angle		-8° ~ 8°
	Folding angle		67° (available 30 seconds delayed operation after ignition "OFF")

OVERVIEW AND OPERATION PROCESS

1. SEAT ARRANGEMNT



Modification basis	
Application basis	
Affected VIN	

NO DATA

NO DATA

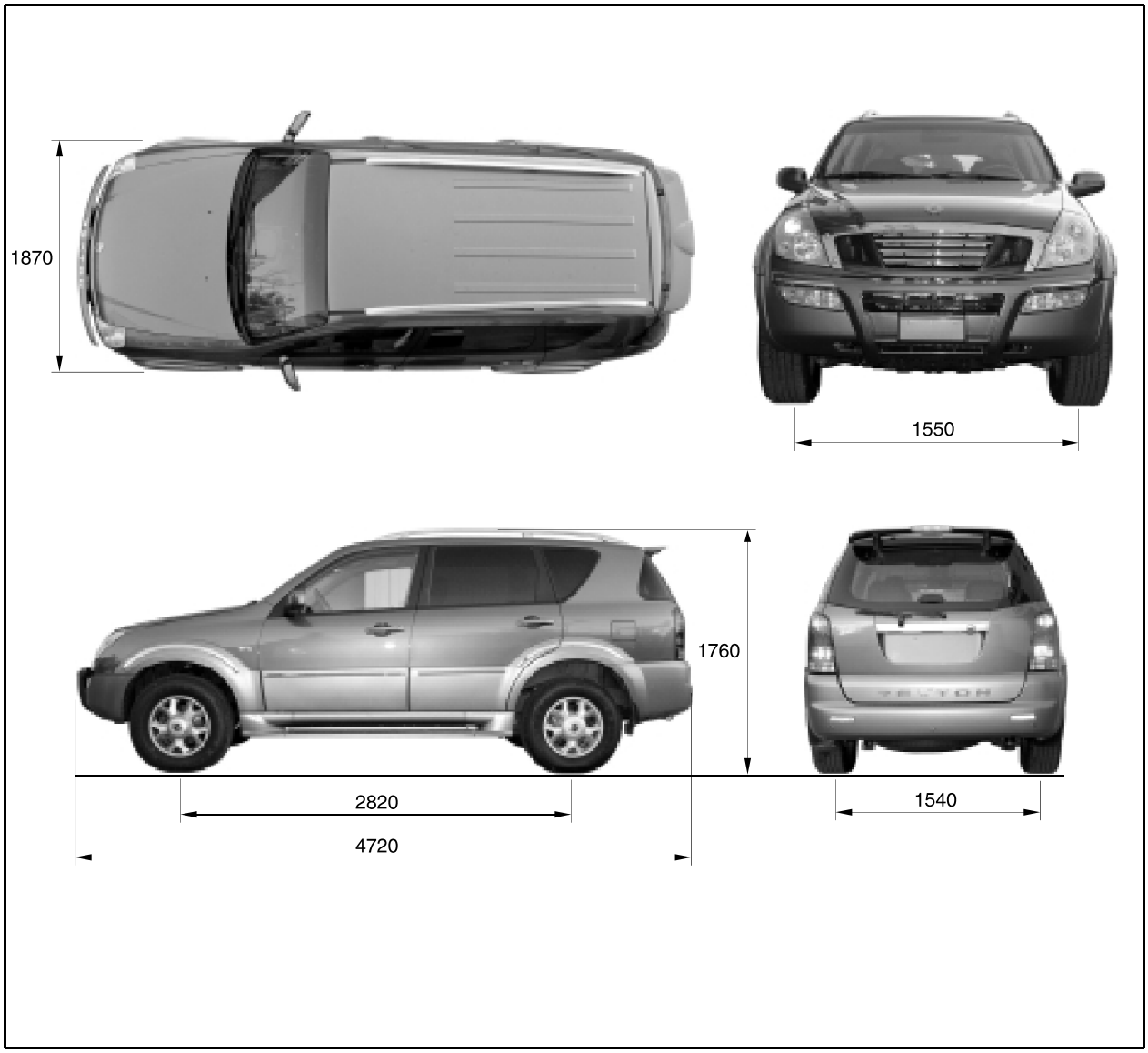
NO DATA

BODY REPAIR

5110-01

GENERAL

1. VEHICLE DIMENSION



2. SPECIFICATIONS

Description			Specification
Hood	Type		Gas lifter type
Front door	Structure		Frame door
	Regulator type		Wire-Drum type
	Locking device		Pin-Fork device
Rear door	Structure		Frame door
	Regulator type		Wire-Drum type
	Locking device		Pin-Fork device
Tailgate	Type		Gas lifter type
Thickness of glasses	Windshield		5 mm
	Front door		4.0 mm
	Rear door		4.0 mm
	Side quarter glass		4.0 mm
	Tailgate	Fixed type	4.0 mm
		Open type	5.0 mm
Requirements of leak tester stand	Nozzle type		Full-zet spray nozzle #1/2 GG-25 or nozzle with 60° angle
	Nozzle height		1,600 mm from ground
	Displacement		14 liter per minute
	Pressure		155 kPa (22.5 psi): at nozzle
	Location of test stand for windshield and A-pillar		From windshield corner center line: - downward: approx. 30° - rearward: approx 45°
	Location of test stand for B-pillar		From rear door center line: - downward: approx. 30° - rearward: approx 45°
	Location of test stand for tailgate and rear deck lid		At 60 mm from rear door corner: - downward: approx. 30° - rearward: approx 45°

Modification basis	
Application basis	
Affected VIN	

INDEX

1. ECU-GASOLINE..... 3

ECU-GASOLINE

0000-00

DIAGNOSIS

1. ECU-GASOLINE

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Variable Valve Timing System	P0010	Cam Actuator - Short circuit to B+	• **Condition** - Variable valve timing system circuit: short circuit to battery • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 73. 3. Check the cam actuator's power circuit for short and open. 4. Check the magnet and hardware. 5. Check the ECU.	o
		Cam Actuator - Short or Open circuit to Ground	• **Condition** - Variable valve timing system circuit: short or open circuit to ground • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 73. 3. Check the cam actuator's power circuit for short and open. 4. Check the magnet and hardware. 5. Check the ECU.	o
	P0011	Cam Actuator - Fixed to Advance Position	• **Condition** - The noise occurred by valve timing (advance/retard) in each range is over than the specified value. • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 73. 3. Check the cam actuator's power circuit for short and open. 4. Check the magnet and hardware. 5. Check the ECU.	o
	P0012	Cam Actuator - Fixed to Retard Position	• **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 73. 3. Check the cam actuator's power circuit for short and open. 4. Check the magnet and hardware. 5. Check the ECU.	o
HFM Sensor	P0101	Faulty HFM Sensor Signal	• **Condition** - Improper air volume is detected. • **Specification** - 20 kg/h - 0.47 V 0 kg/h - 0.99 V 10 kg/h - 1.2226 ~ 1.2398 V 15 kg/h - 1.3552 ~ 1.3778 V 30 kg/h - 1.6783 ~ 1.7146 V 60 kg/h - 2.1619 ~ 2.2057 V 120 kg/h - 2.7215 ~ 2.7762 V 250 kg/h - 3.4388 ~ 3.5037 V 370 kg/h - 3.8796 ~ 3.9511 V 480 kg/h - 4.1945 ~ 4.2683 V 640 kg/h - 4.5667 ~ 4.6469 V • **Actions** 1. Measure the actual air volume using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 92 and 116. 3. Inspect HFM sensor. 4. Check the ECU.	o

Modification basis	
Application basis	
Affected VIN	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
HFM Sensor	P0102	Low HFM Sensor Signal	• **Condition** - The signal is below the minimum engine load (0.02). - Related circuit: open circuit • **Specification** - 20 kg/h - 0.47 V 0 kg/h - 0.99 V 10 kg/h - 1.2226 ~ 1.2398 V 15 kg/h - 1.3552 ~ 1.3778 V 30 kg/h - 1.6783 ~ 1.7146 V 60 kg/h - 2.1619 ~ 2.2057 V 120 kg/h - 2.7215 ~ 2.7762 V 250 kg/h - 3.4388 ~ 3.5037 V 370 kg/h - 3.8796 ~ 3.9511 V 480 kg/h - 4.1945 ~ 4.2683 V 640 kg/h - 4.5667 ~ 4.6469 V • **Actions** 1. Measure the actual air volume using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 92 and 116. 3. Inspect HFM sensor. 4. Check the ECU.	o
	P0103	High HFM Sensor Signal	• **Condition** - The signal is over the maximum engine load (0.02). - Related circuit: short circuit • **Specification** - 20 kg/h - 0.47 V 0 kg/h - 0.99 V 10 kg/h - 1.2226 ~ 1.2398 V 15 kg/h - 1.3552 ~ 1.3778 V 30 kg/h - 1.6783 ~ 1.7146 V 60 kg/h - 2.1619 ~ 2.2057 V 120 kg/h - 2.7215 ~ 2.7762 V 250 kg/h - 3.4388 ~ 3.5037 V 370 kg/h - 3.8796 ~ 3.9511 V 480 kg/h - 4.1945 ~ 4.2683 V 640 kg/h - 4.5667 ~ 4.6469 V • **Actions** 1. Measure the actual air volume using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 92 and 116. 3. Inspect HFM sensor.	o
MAP Sensor (G23 only)	P0105	Defective Intake Manifold Pressure Sensor Signal		

Modification basis	
Application basis	
Affected VIN	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Intake Air Temperature Sensor	P0111	Faulty Intake Air Temperature Sensor Signal	• **Condition** - The temperature change of over 20 °C is occurred more than 5 times. • **Specification** 20°C - 2420 Ω - 2.65 V 30°C - 1662 Ω - 2.18 V 50°C - 853 Ω - 1.40 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 80 and 116. 3. Inspect intake air temperature sensor (ATS-HFM6.0 integrated). 4. Check the ECU.	o
	P0112	Intake Air Temperature Sensor Malfunction - Open circuit	• **Condition** - The sensor value is less than minimum specified value (0.1 V). - Related circuit: open circuit • **Specification** 20°C - 2420 Ω - 2.65 V 30°C - 1662 Ω - 2.18 V 50°C - 853 Ω - 1.40 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 80 and 116. 3. Inspect intake air temperature sensor (ATS-HFM6.0 integrated). 4. Check the ECU.	o
	P0113	Intake Air Temperature Sensor Malfunction - Short circuit	• **Condition** - The sensor value is over the maximum specified value (4.9 V). - Related circuit: short circuit • **Specification** 20°C - 2420 Ω - 2.65 V 30°C - 1662 Ω - 2.18 V 50°C - 853 Ω - 1.40 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 80 and 116. 3. Inspect intake air temperature sensor (ATS-HFM6.0 integrated). 4. Check the ECU.	o
Coolant Temperature Sensor	P0116	Faulty Coolant Temperature Sensor Signal	• **Condition** - The coolant temperature is below 50 °C after engine warmed up. • **Specification** 20°C - 2.50 kΩ - 3.57 V 80°C - 0.32 kΩ - 1.22 V 100°C - 0.18 kΩ - 0.78 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 78 and 79. 3. Check the coolant temperature sensor. 4. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Coolant Temperature Sensor	P0117	Coolant Temperature Sensor Malfunction - Open circuit	• **Condition** - The sensor value is less than minimum specified value (0.11 V). - Related circuit: open circuit • **Specification** 20°C - 2.50 kΩ - 3.57 V 80°C - 0.32 kΩ - 1.22 V 100°C - 0.18 kΩ - 0.78 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 78 and 79. 3. Check the coolant temperature sensor. 4. Check the ECU.	o
	P0118	Coolant Temperature Sensor Malfunction - Short circuit	• **Condition** - The sensor value is over the maximum specified value (4.96 V). - Related circuit: short circuit • **Specification** 20°C - 2.50 kΩ - 3.57 V 80°C - 0.32 kΩ - 1.22 V 100°C - 0.18 kΩ - 0.78 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits of ECU pin No. 78 and 79. 3. Check the coolant temperature sensor. 4. Check the ECU.	o
Throttle Body Control	P0120	No.1 Throttle Position Sensor - Low Voltage	• **Condition** - No.1 throttle position sensor circuit: short or open circuit to ground. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	o

Modification basis	
Application basis	
Affected VIN	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Control	P0120	No.1 Throttle Position Sensor - High Voltage	• **Condition** - No.1 throttle position sensor's main power is grounded. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	o
		No.2 Throttle Position Sensor - Low Voltage	• **Condition** - No.2 throttle position sensor circuit: short or open circuit to ground. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	o
		No.2 Throttle Position Sensor - High Voltage	• **Condition** - No.2 throttle position sensor's main power is grounded. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Control	P0120	Throttle Actuator - Insuffcient Supply Power	• **Condition** - Actuator circuit: short circuit • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
		TPS Valve Inconsistent with HFM Sensor Value	• **Condition** - The potentiometer is defective. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O
		Both Throttle Position Sensors Malfunction	• **Condition** - The potentiometer is defective. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	O

Modification basis	
Application basis	
Affected VIN	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Control	P0120	Inconsistent Signals of No.1 and No.2 Throttle Position Sensors	• **Condition** - The difference in amount of 1/2 is occurred in potentiometer. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	o
		Throttle Actuator Control Malfunction	• **Condition** - The wiring or actuator is defective. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	o
		Intake Air Flow Sensor and Throttle Sensor Malfunction	• **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Accelerator Pedal Sensor	P0120	Accelerator Pedal Sensor Malfunction - Supply Voltage Fault	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	o
		Accelerator Pedal Sensor #1 Malfunction - Low Voltage	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	o
		Accelerator Pedal Sensor #1 Malfunction - High Voltage	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	o
		Accelerator Pedal Sensor #2 Malfunction - Low Voltage	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	o
		Accelerator Pedal Sensor #2 Malfunction - High Voltage	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	o
		Accelerator Pedal Sensor #1 & #2 - Defective Signal	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	o
		Accelerator Pedal Sensor #1 & #2 Malfunction	• **Specification** - SPS 1/2 pull-down resistance: 464 kΩ - Potentiometer 1/2 voltage: 5 / 2.5 V • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 31, 32, 47, 48, 50 and 51. 3. Check the electric throttle controller.	o

Modification basis	
Application basis	
Affected VIN	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Control	P0121	Throttle Position Sensor Actuator's Learning Control Malfunction	• **Condition** - The actuator is not properly adjusted and the conditions are not satisfied. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	o
		Faulty Throttle Body Return Spring	• **Condition** - The return spring of actuator is defective. • **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	o
Coolant Temperature Sensor	P0125	Low coolant temperature while controlling air/fuel ratio	• **Condition** - The coolant temperature is below the specified temperature for controlling air/fuel ratio after engine warmed up. • **Specification** 20°C - 2.50 kΩ - 3.57 V 80°C - 0.32 kΩ - 1.22 V 100°C - 0.18 kΩ - 0.78 V • **Actions** 1. Measure the actual temperature using SCAN-100. 2. Inspect the circuits for ECU pin No. 78 and 79. 3. Check the coolant temperature sensor. 4. Check the ECU.	o
Thermostat	P0128	Thermostat Fully Open	• **Condition** 1. The actual coolant temperature is lower than the coolant temperature calculated by ECU due to the slow preheat. • **Actions** 1. Check the thermostat.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.1 Oxygen Sensor (Installed Before Catalytic Converter)	P0131	No.1 Oxygen Sensor - Below the Minimum Permissible Voltage	• **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds (refer to P0133) • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 9. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	o
	P0132	No.1 Oxygen Sensor - Overvoltage	• **Condition** - No.1 oxygen sensor is defective. Output voltage > 1.05 V The sensing voltage is not in the specified range. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) - Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 16 and 17. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
	P0133	No.1 Oxygen Sensor - Poor Performance	• **Condition** - No.1 oxygen sensor is defective. The response to the sensor signal is delayed. Closed loop interval of air/fuel ratio control > 1500 ms • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) - Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 16 and 17. 3. Inspect the oxygen sensor. 4. Check the ECU.	o

Modification basis	
Application basis	
Affected VIN	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.1 Oxygen Sensor (Installed Before Catalytic Converter)	P0134	No.1 Oxygen Sensor - Malfunction	• **Condition** - No.1 oxygen sensor is defective. The sensor does not operate. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) - Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 16 and 17. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
		No.1 Oxygen Sensor - Lean Indication (When Decelerating)	• **Condition** - No.1 oxygen sensor is defective. There is no "LEAN" signal after shutting off the fuel. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) - Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 16 and 17. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
	P0135	No.1 Oxygen Sensor - Faulty Heating Current, Heater Circuit is Open or Short circuit or Short circuit to Ground	• **Condition** - No.1 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 9. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.1 Oxygen Sensor (Installed Before Catalytic Converter)	P0135	No.1 Oxygen Sensor Heater - Short circuit to B+	• **Condition** - No.1 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 9. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	o
		No.1 Oxygen Sensor Heater - Open or Short circuit to Ground	• **Condition** - No.1 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 9. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	o
No.2 Oxygen Sensor (Installed After Catalytic Converter)	P0137	No.2 Oxygen Sensor - Below the Minimum Permissible Voltage	• **Condition** - No.2 oxygen sensor is defective. The sensor does not operate. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 19 and 20. 3. Inspect the oxygen sensor. 4. Check the ECU.	o

Modification basis	
Application basis	
Affected VIN	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.2 Oxygen Sensor (Installed After Catalytic Converter)	P0138	No.2 Oxygen Sensor - Overvoltage	• **Condition** - No.2 oxygen sensor is defective. The output value is not within the specified range. The sensing voltage is not in the specified range. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 19 and 20. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
	P0140	No.2 Oxygen Sensor - Lean Indication (When Decelerating)	• **Condition** - No.2 oxygen sensor is defective. There is no "LEAN" signal after shutting off the fuel. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 19 and 20. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
	P0141	No.2 Oxygen Sensor Heater - Short circuit to B+	• **Condition** - No.2 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 7. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.2 Oxygen Sensor (Installed After Catalytic Converter)	P0141	No.2 Oxygen Sensor Heater - Open or Short circuit to Ground	• **Condition** - No.2 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 7. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
		No.2 Oxygen Sensor - Poor Heating	• **Condition** - No.2 oxygen sensor is defective. The response to the sensor signal is delayed. • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 7. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	O
No.3 Oxygen Sensor (Installed Before Catalytic Converter)	P0151	No.3 Oxygen Sensor - Below the Minimum Permissible Voltage	• **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	O

Modification basis	
Application basis	
Affected VIN	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.3 Oxygen Sensor (Installed Before Catalytic Converter)	P0152	No.3 Oxygen Sensor - Overvoltage	• **Condition** - No.3 oxygen sensor is defective. The output value is not within the specified range. The sensing voltage is not in the specified range. • **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
	P0153	No.3 Oxygen Sensor - Poor Performance	• **Condition** - No.3 oxygen sensor is defective. The response to the sensor signal is delayed. • **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
	P0154	No.3 Oxygen Sensor - Malfunction	• **Condition** - No.3 oxygen sensor is defective. The sensor does not operate. • **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.3 Oxygen Sensor (Installed Before Catalytic Converter)	P0154	No.3 Oxygen Sensor - Lean Indication (When Decelerating)	• **Condition** - No.3 oxygen sensor is defective. There is no "LEAN" signal after shutting off the fuel. • **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
	P0155	No.3 Oxygen Sensor - Faulty Heating Current	• **Condition** - No.3 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 6. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	o
		No.3 Oxygen Sensor Heater - Short circuit to B+	• **Condition** - No.3 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 6. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	o
		No.3 Oxygen Sensor Heater - Open or Short circuit to Ground	• **Condition** - No.3 oxygen sensor is improperly heated. The heating current is below or over the specified range (below 0.2 A or over 2 A). • **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 6. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	o

Modification basis	
Application basis	
Affected VIN	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.4 Oxygen Sensor (Installed After Catalytic Converter)	P0157	No.4 Oxygen Sensor - Below the Minimum Permissible Voltage	• **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 MΩ (850°C) Between sensor circuit and housing - Operating temperature: 850 °C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 25 and 26. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
	P0158	No.4 Oxygen Sensor - Overvoltage	• **Condition** - No.4 oxygen sensor is defective. The output value is not within the specified range. The sensing voltage is not in the specified range. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 MΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip -Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 25 and 26. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
	P0160	No.4 Oxygen Sensor - Lean Indication (When Decelerating)	• **Condition** - No.4 oxygen sensor is defective. There is no "LEAN" signal after shutting off the fuel. • **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 MΩ (850°C) Between sensor circuit and housing - Operating temperature: 850 °C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 25 and 26. 3. Inspect the oxygen sensor. 4. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.4 Oxygen Sensor (Installed After Catalytic Converter)	P0161	No.4 Oxygen Sensor - Poor Heating	• **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 3. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	o
		No.4 Oxygen Sensor Heater - Short circuit to B+	• **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 3. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	o
		No.4 Oxygen Sensor Heater - Open or Short circuit to Ground	• **Specification** - Operating current: below 1.6 A - Initial current: below 6.0 A for 2 seconds • **Actions** 1. Check the heating condition using SCAN-100. 2. Inspect the circuit and terminal of the ECU pin No. 3. 3. Inspect the heating power supply. 4. Inspect the heating circuit of oxygen sensor. 5. Check the ECU.	o
No.1 Oxygen Sensor (Installed Before Catalytic Converter)	P0171	Short-term Learning Control of Air/Fuel Ratio: Fuel Rich	• **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) - Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 16 and 17. 3. Inspect the oxygen sensor. 4. Check the ECU.	o

Modification basis	
Application basis	
Affected VIN	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Correction	P0171	Air/Fuel Ratio Control Malfunction - Fuel Rich	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	•
		Learning Control Malfunction - Rich at Idling	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	•
		Learning Control Malfunction - Rich under Low Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	•
		Learning Control Malfunction - Rich under High Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	•
	P0172	Air/Fuel Ratio Control Malfunction - Fuel Lean	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	•
		Learning Control Malfunction - Lean at Idling	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	•
		Learning Control Malfunction - Lean under Low Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	•
		Learning Control Malfunction - Lean under High Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	•

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
No.2 Oxygen Sensor (Installed After Catalytic Converter)	P0172	Short-term Learning Control of Air/Fuel Ratio: Fuel Lean	• **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 19 and 20. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
Fuel Correction	P0174	Air/Fuel Ratio Control Malfunction - Fuel Rich	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	o
		Fuel Rich at Idling	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	o
		Fuel Rich under Low Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	o
		Fuel Rich under High Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	o
No.3 Oxygen Sensor (Installed Before Catalytic Converter)	P0174	Short-term Learning Control of Air/Fuel Ratio: Fuel Rich	• **Specification** - Specified voltage: Below 100 ~ 900 mV - Insulating resistance: ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 kΩ (850°C) Between sensor circuit and housing - Operating temperature: 850 °C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 22 and 23. 3. Inspect the oxygen sensor. 4. Check the ECU.	o

Modification basis	
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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Correction	P0175	Air/Fuel Ratio Control Malfunction - Fuel Lean	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	o
		Fuel Lean at Idling	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	o
		Fuel Lean under Low Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	o
		Fuel Lean under High Load	• **Actions** 1. Check the oxygen sensor signal and heating line. 2. Check the purge valve unit and circuit. 3. Check the coolant temperature sensor. 4. Check the ignition coil and spark plug. 5. Check the HFM sensor's intake air temperature.	o
No.4 Oxygen Sensor (Installed After Catalytic Converter)	P0175	Short-term Learning Control of Air/Fuel Ratio: Fuel Lean	• **Specification** - Specified voltage: 100 ~ 900 mV - Insulating resistance : ≥ 10 MΩ (350°C) ≥ 300 kΩ (850°C) Resistance between heater and sensor: ≥ 10 MΩ (850°C) Between sensor circuit and housing - Operating temperature: 850°C Gas temperature at ceramic tip - Internal resistance: ≥ 1 kΩ • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of the ECU pin No. 25 and 26. 3. Inspect the oxygen sensor. 4. Check the ECU.	o
Throttle Body Safety Function	P0221	Deceleration Over Limit (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		Acceleration Over Limit (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Safety Function	P0221	Control Lever Double Action (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		Control Lever Safety Terminal Malfunction (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		Pedal Position Change Fault (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		Throttle Position Change Fault (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		Defective Constant Speed Driving Control Data (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		Faulty Pedal Position Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		Faulty Throttle Position Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		Faulty CAN Communi-cation Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		Faulty Configuration Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		Faulty A/D Converter Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		CPU #1 and #2 - Pedal Position Signal Fault	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o

Modification basis	
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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Throttle Body Safety Function	P0221	CPU #1 and #2 - TP Valve Position Signal Fault	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		CPU #1 and #2 - MSR Signal Fault	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		CPU #1 and #2 - Idle Control	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		AD Converter Overflow Detected (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		ROM Malfunction (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		RAM Malfunction (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
		CPU Recognition Malfunction (CPU2)	• **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the electric throttle controller. 3. Check the ECU.	o
Fuel Pump Relay	P0231	Fuel Pump Relay - Open circuit to Ground	• **Condition** - Fuel pump circuit: short or open circuit to ground • **Specification** - The voltage drop of pin No. 33 and ground: Below 1 V (current = 150 mA) • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 33. 2. Inspect the fuel pump relay. 3. Check the ECU.	o
	P0232	Fuel Pump Relay - Short circuit to B+	• **Condition** - Fuel pump: short circuit to battery • **Specification** - The voltage drop of pin No. 33 and ground: Below 1 V (current = 150 mA) • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 33. 2. Inspect the fuel pump relay. 3. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Injection System	P0261	No.1 Injector - Short or Open circuit to Ground	• **Condition** - No.1 injector is defective. No.1 injector circuit: short circuit to ground • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 63. 2. Inspect the injector. 3. Check the ECU.	o
	P0262	No.1 Injector - Short circuit to B+	• **Condition** - No.1 injector is defective. No.1 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.1 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	o
	P0264	No.2 Injector - Short or Open circuit to Ground	• **Condition** - No.2 injector is defective. No.2 injector circuit: short circuit to ground • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 61. 2. Inspect the injector. 3. Check the ECU.	o
	P0265	No.2 Injector - Short circuit to B+	• **Condition** - No.2 injector is defective. No.2 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.2 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	o

Modification basis	
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Affected VIN	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Injection System	P0267	No.3 Injector - Short or Open circuit to Ground	• **Condition** - No.3 injector is defective. No.3 injector circuit: short circuit to ground • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 66. 2. Inspect the injector. 3. Check the ECU.	o
	P0268	No.3 Injector - Short circuit to B+	• **Condition** - No.3 injector is defective. No.3 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.3 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	o
	P0270	No.4 Injector - Short or Open circuit to Ground	• **Condition** - No.4 injector is defective. No.4 injector circuit: short circuit to ground • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 62. 2. Inspect the injector. 3. Check the ECU.	o
	P0271	No.4 Injector - Short circuit to B+	• **Condition** - No.4 injector is defective. No.4 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.4 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Injection System	P0273	No.5 Injector - Short or Open circuit to Ground	• **Condition** - No.5 injector is defective. No.5 injector circuit: short circuit to ground • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 65. 2. Inspect the injector. 3. Check the ECU.	o
	P0274	No.5 Injector - Short circuit to B+	• **Condition** - No.5 injector is defective. No.5 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.5 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	o
	P0276	No.6 Injector - Short or Open circuit to Ground	• **Condition** - No.6 injector is defective. No.6 injector has a short circuit to ground. • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 64. 2. Inspect the injector. 3. Check the ECU.	o
	P0277	No.6 Injector - Short circuit to B+	• **Condition** - No.6 injector is defective. No.6 injector circuit: short circuit to battery • **Specification** - Electric resistance: 14.5 Ω ± 0.7 Ω at 20°C - Operating pressure: 380 Kpa - Supply voltage: 6 ~ 16 V • **Actions** 1. Check the No.6 injector's power supply and terminal. 2. Inspect the injector. 3. Check the ECU.	o

Modification basis	
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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Poor Ignition (Misfire)	P0300	Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in more than one cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9.Check the ECU.	•
	P0301	No.1 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.1 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	•
	P0302	No.2 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.2 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	•

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Poor Ignition (Misfire)	P0303	No.3 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.3 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	•
	P0304	No.4 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.4 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	•
	P0305	No.5 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.5 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	•

Modification basis	
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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Poor Ignition (Misfire)	P0306	No.6 Cylinder - Poor Ignition	• **Condition** - Misfire is occurred in No.6 cylinder causing excessive exhaust gas and catalyst deterioration. • **Actions** 1. Check the ignition system. 2. Check the fuel injection system. 3. Check the fuel pressure. 4. Check the compression pressure. 5. Check the valve timing and clearance. 6. Check the intake air flow sensor. 7. Check the crank angle sensor and air cap. 8. Check the engine wiring harness. 9. Check the ECU.	•
Knock Sensor	P0325	#1 Knock Sensor Malfunction (1, 2, 3 CYL)	• **Condition** - No.1 knock sensor is defective. The value is not within the specified range when the engine temperature is over 75°C, the engine speed is over 3000 rpm and other units are properly operated (for cylinder No. 1, 2 and 3). • **Specification** - Sensitivity: approx. 26 ± 8 mV/g Resistance > 10 MΩ • **Actions** 1. Inspect the circuits and terminals of the ECU pin No. 117 and 118. 2. Inspect the No.1 knock sensor. 3. Check the ECU.	o
	P0330	#2 Knock Sensor Malfunction (4, 5, 6 CYL)	• **Condition** - No.2 knock sensor is defective. The value is not within the specified range when the engine temperature is over 75°C, the engine speed is over 3000 rpm and other units are properly operated (for cylinder No. 4, 5 and 6). • **Specification** - Sensitivity: approx. 26 ± 8 mV/g Resistance > 10 MΩ • **Actions** 1. Inspect the circuits and terminals of the ECU pin No. 114 and 115. 2. Inspect the No.2 knock sensor. 3. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Crank Position Sensor	P0335	Faulty Crank Position Sensor Signal - No Engine RPM	• **Condition** - The crank angle signals cannot be detected even the cam position is properly detected. • **Specification** - Sensor's internal resistance : 700 ~ 1050 Ω • **Actions** 1. Measure the crankshaft rpm using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 100 and 99. 3. Inspect the crank angle sensor. 4. Inspect air gap between sensor and drive plate. 5. Check the drive plate's teeth. 6. Check the ECU.	o
		Faulty Crank Position Sensor Signal - Faulty Recognition of Gap	• **Condition** - The cam and crank angle signal is improperly recognized or not recognized. • **Specification** - Sensor internal resistance: 700 ~ 1050 Ω • **Actions** 1. Measure the crankshaft rpm using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 100 and 99. 3. Inspect the crank angle sensor. 4. Inspect air gap between sensor and drive plate. 5. Check the drive plate's teeth. 6. Check the ECU.	o
		Crank Position Sensor Adaptation Malfunction - Poor Initialization	• **Condition** - The crank angle sensor is faulty initialized. • **Specification** - Sensor internal resistance: 700 ~ 1050 Ω • **Actions** 1. Measure the crankshaft rpm using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 100 and 99. 3. Inspect the crank angle sensor. 4. Inspect air gap between sensor and drive plate. 5. Check the drive plate's teeth. 6. Check the ECU.	o
	P0336	Crank Position Sensor - Excessive Engine RPM	• **Condition** - The engine rpm is over the proper amount or improper. • **Specification** - Sensor internal resistance: 700 ~ 1050 Ω • **Actions** 1. Measure the crankshaft rpm using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 100 and 99. 3. Inspect the crank angle sensor. 4. Inspect air gap between sensor and drive plate. 5. Check the drive plate's teeth. 6. Check the ECU.	o

Modification basis	
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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Cam Position Sensor	P0340	#1 Cylinder Synchronization Malfunction	• **Condition** - The cam position sensor is defective. The No.1 cylinder is poorly synchronized. • **Specification** - Sensor supply voltage: 4.5 V - 24 V • **Actions** 1. Measure the set voltage of cam position sensor. 2. Inspect the circuits and terminals of ECU pin No. 106 and 104. 3. Inspect the cam position sensor. 4. Check the cam sensor and sprocket for damage. 5. Check the ECU.	o
	P0341	#1 Cylinder Recognition Malfunction	• **Condition** - There is no cam recognition signal. • **Specification** - Sensor supply voltage: 4.5 V - 24 V • **Actions** 1. Measure the set voltage of cam position sensor. 2. Inspect the circuits and terminals of ECU pin No. 106 and 104. 3. Inspect the cam position sensor. 4. Check the cam sensor and sprocket for damage. 5. Check the ECU.	o
Ignition Coil	P0351	#1 Ignition Coil - Faulty Output Voltage	• **Condition** - The ignition unit is defective (for No. 2 and 5 cylinders). Ignition circuit: short circuit to primary and secondary current • **Specification** - Primary resistance: 0.36 Ω Secondary resistance: 5.9 kΩ - Secondary voltage: 38 KV - Ignition output Primary current: 7.0 A Primary voltage: 380 V • **Actions** 1. Inspect the circuits and terminals of the ECU pin No. 70, 71 and 72. 2. Inspect the power supply of ignition coil. 3. Inspect the ignition coil and high-voltage cable. 4. Inspect the spark plug for moisture, crack, wear, improper cap and excessive burnt electrode residue. 5. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Ignition Coil	P0352	#2 Ignition Coil - Faulty Output Voltage	• **Condition** - The ignition unit is defective (for No. 3 and 4 cylinders). Ignition circuit: short circuit to primary and secondary current • **Specification** - Primary resistance: 0.36 Ω Secondary resistance: 5.9 kΩ - Secondary voltage: 38 KV - Ignition output Primary current: 7.0 A Primary voltage: 380 V • **Actions** 1. Inspect the circuits and terminals of the ECU pin No. 70, 71 and 72. 2. Inspect the power supply of ignition coil. 3. Inspect the ignition coil and high-voltage cable. 4. Inspect the spark plug for moisture, crack, wear, improper cap and excessive burnt electrode residue. 5. Check the ECU.	o
	P0353	#3 Ignition Coil - Faulty Output Voltage	• **Condition** - The ignition unit is defective (for No. 1 and 6 cylinders). Ignition circuit: short circuit to primary and secondary current • **Specification** - Primary resistance: 0.36 Ω Secondary resistance: 5.9 kΩ - Secondary voltage: 38 KV - Ignition output Primary current: 7.0 A Primary voltage: 380 V • **Actions** 1. Inspect the circuits and terminals of the ECU pin No. 70, 71 and 72. 2. Inspect the power supply of ignition coil. 3. Inspect the ignition coil and high-voltage cable. 4. Inspect the spark plug for moisture, crack, wear, improper cap and excessive burnt electrode residue. 5. Check the ECU.	o
Secondary Air Supply System	P0411	Defective Secondary Air Pump - Insufficient Air Volume	• **Condition** - The secondary air injection pump relay and air pump valve/ hose are defective. • **Specification** - The voltage drop of pin No. 76 and ground: Below 1 V (current = 1000 mA) • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 76. 2. Inspect the secondary air pump relay. 3. Inspect the arrange ment of secondary air pump's valve and hose. 4. Check the ECU.	o

Modification basis	
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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Secondary Air Supply System	P0413	Secondary Air Pump - Open circuit to Ground	• **Condition** - Secondary air injection pump relay circuit: short or open circuit to ground • **Specification** - The voltage drop of pin No. 76 and ground: Below 1 V (current = 1000 mA) • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 76. 2. Inspect the secondary air pump relay. 3. Check the ECU.	o
	P0414	Secondary Air Pump - Short circuit to B+	• **Condition** - Secondary air injection pump relay circuit: short circuit to battery • **Specification** - The voltage drop of pin No. 76 and ground: Below 1 V (current = 1000 mA) • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 76. 2. Inspect the secondary air pump relay. 3. Check the ECU.	o
Catalytic Monitoring Device	P0420	Faulty Catalyst 1 Purification Rate (1, 2, 3 Cylinder lines)	• **Condition** - The calculated purification rate for bank 1 is below the specified range. (Bank 1 - Cylinder 1/2/3) • **Actions** 1. Inspect the exhaust gas for leaks. 2. Inspect the oxygen sensor and its signal. 3. Inspect the actual effciency of exhaust gas through the exhaust gas test. 4. Inspect the catalyst. 5. Check the ECU.	o
	P0430	Faulty Catalyst 2 Purification Rate (4, 5, 6 Cylinder lines)	• **Condition** - The calculated purification rate for bank 2 is below the specified range. (Bank 2 - Cylinder 4/5/6) • **Actions** 1. Inspect the exhaust gas for leaks. 2. Inspect the oxygen sensor and its signal. 3. Inspect the actual effciency of exhaust gas through the exhaust gas test. 4. Inspect the catalyst. 5. Check the ECU.	o
Evaporated Gas Control System	P0442	Fuel Tank: Oil Leakage	• **Condition** - Minute leak of evaporated gas is occurred (below 1 mm). • **Actions** 1. Inspect the fuel tank and connecting route for the followings: - Fuel tank cap for crack or damage - Vacuum hose for crack, puncture and clogging - Fuel tank for crack, puncture and damage - Canister for crack, puncture and damage - Fuel tank pressure sensor - Canister shut-off valve 2. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Purge Control Solenoid Valve	P0443	Purge Control Solenoid Valve Malfunction - Faulty closing	• **Condition** - The purge control circuit is defective. The purge control is not available. • **Specification** - Duty ratio: 0 ~ 100 % Below 20 % - 7.5 Hz 20 ~ 30 % - 15 Hz 30 ~ 75 % - 30 Hz - Internal resistance ≥ 26 Ω • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 34. 2. Inspect the power of the solenoid valve. 3. Inspect the purge control solenoid valve. 4. Check the ECU.	o
	P0444	Purge Control Solenoid Valve Malfunction - Short or Open circuit to Ground	• **Condition** - Power supply circuit: short or open circuit to ground • **Specification** - Duty ratio: 0 ~ 100 % below 20 % - 7.5 Hz 20 ~ 30 % - 15 Hz 30 ~ 75 % - 30 Hz - Internal resistance ≥ 26 Ω • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 34. 2. Inspect the power of the solenoid valve. 3. Inspect the purge control solenoid valve. 4. Check the ECU.	o
	P0445	Purge Control Solenoid Valve Malfunction - Short circuit to B+	• **Condition** - Power supply circuit: short circuit to battery • **Specification** - Duty ratio: 0 ~ 100 % below 20 % - 7.5 Hz 20 ~ 30 % - 15 Hz 30 ~ 75 % - 30 Hz - Internal resistance ≥ 26 Ω • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 34. 2. Inspect the power of the solenoid valve. 3. Inspect the purge control solenoid valve. 4. Check the ECU.	o

Modification basis	
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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Canister Shut-off Valve	P0447	Canister Shut-off Valve Malfunction - Short or Open circuit to Ground	• **Condition** - Fuel system shut-off valve circuit: short or open circuit to ground • **Specification** - Duty ratio: 0 ~ 100 % below 20 % → 7.5 Hz 20 ~ 30 % → 15 Hz 30 ~ 75 % → 30 Hz - Internal resistance ≥ 26 Ω • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 36. 2. Inspect the power of the solenoid valve. 3. Inspect the purge control solenoid valve. 4. Check the ECU.	o
	P0448	Canister Shut-off Valve: Short circuit to B+	• **Condition** - Fuel system shut-off valve circuit: short circuit to battery • **Specification** - Duty ratio: 0 ~ 100 % below 20 % → 7.5 Hz 20 ~ 30 % → 15 Hz 30 ~ 75 % → 30 Hz - Internal resistance ≥ 26 Ω • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 36. 2. Inspect the power of the solenoid valve. 3. Inspect the purge control solenoid valve. 4. Check the ECU.	o
Fuel tank pressure sensor	P0450	Fuel Tank Pressure Sensor Malfunction	• **Condition** - Improper fuel tank pressure is detected. • **Specification** 37.5 mbar → 4.51 V 30.0 mbar → 3.90 V 20.0 mbar → 3.10 V 10.0 mbar → 2.30 V 0 mbar → 1.50 V 10.0 mbar → 0.60 V 12.5 mbar → 0.49 V • **Actions** 1. Measure the actual fuel tank pressure using SCAN-100. 2. Inspect the circuits of ECU pin No. 18 and 41 and check pin No. 42. 3. Check the fuel tank pressure sensor. 4. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel tank pressure sensor	P0452	Low Fuel Tank Pressure Sensor Signal	• **Condition** - The fuel tank pressure signal is below the minimum fuel tank pressure (0.1V). - Related circuit: open circuit • **Specification** 37.5 mbar → 4.51 V 30.0 mbar → 3.90 V 20.0 mbar → 3.10 V 10.0 mbar → 2.30 V 0 mbar → 1.50 V 10.0 mbar → 0.60 V 12.5 mbar → 0.49 V • **Actions** 1. Measure the actual fuel tank pressure using SCAN-100. 2. Inspect the circuits of ECU pin No. 18 and 41 and check pin No. 42. 3. Check the fuel tank pressure sensor. 4. Check the ECU.	O
	P0453	High Fuel Tank Pressure Sensor Signal	• **Condition** - The fuel tank pressure signal is over the maximum fuel tank pressure (4.9 V). - Related circuit: open circuit • **Specification** 37.5 mbar → 4.51 V 30.0 mbar → 3.90 V 20.0 mbar → 3.10 V 10.0 mbar → 2.30 V 0 mbar → 1.50 V 10.0 mbar → 0.60 V 12.5 mbar → 0.49 V • **Actions** 1. Measure the actual fuel tank pressuring using SCAN-100. 2. Inspect the circuits of ECU pin No. 18 and 41 and check pin No. 42. 3. Check the fuel tank pressure sensor. 4. Check the ECU.	O
Evaporated Gas Control System	P0455	Fuel Tank: Large Oil Leakage	• **Condition** - The evaporated gas in the fuel tank is leaked. Diagnosis for large leaks • **Actions** 1. Inspect the fuel tank and connecting route for the followings: - Fuel tank cap for crack or damage - Vacuum hose for crack, puncture and clogging - Fuel tank for crack, puncture and damage - Canister for crack, puncture and damage - Fuel tank pressure sensor - Canister shut-off valve 2. Check the ECU.	O

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Fuel Level Detection Sensor	P0460	Faulty Fuel Pump Fuel Level Sensor Indication	• **Condition** - The fuel level or the changed amount of fuel after driving for certain distance is improper. • **Specification** 67.29 liters - 38.0 Ω 62.48 liters - 48.2 Ω 58.28 liters - 56.8 Ω 52.23 liters - 67.0 Ω 45.34 liters - 83.3 Ω 37.41 liters - 99.5 Ω 30.10 liters - 122.5 Ω 21.36 liters - 150.0 Ω 6.45 liters - 268.2 Ω • **Actions** 1. Measure the actual fuel level using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 102 and 75. 3. Check the external resistance (200 Ω). 4. Inspect the fuel sender unit. 5. Check the ECU.	o
	P0462	Faulty Fuel Pump Fuel Level Transmission	• **Condition** - The FF (hexadecimal) is inputted to ECU from cluster. • **Specification** 67.29 liters - 38.0 Ω 62.48 liters - 48.2 Ω 58.28 liters - 56.8 Ω 52.23 liters - 67.0 Ω 45.34 liters - 83.3 Ω 37.41 liters - 99.5 Ω 30.10 liters - 122.5 Ω 21.36 liters - 150.0 Ω 6.45 liters - 268.2 Ω • **Actions** 1. Measure the actual fuel level using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 102 and 75. 3. Check the external resistance (200 Ω). 4. Inspect the fuel sender unit. 5. Check the ECU.	o
Cooling fan system (PWM electric fan)	P0480	PWM electric fan - Short circuit to power supply	• **Condition** - The cooling fan's output wiring has a short circuit to power supply. • **Actions** 1. Inspect the circuit and the terminal of No. 39 ECU pin. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Cooling fan system (PWM electric fan)	P0480	PWM electric fan - Open/Short circuit to ground	• **Condition** - The cooling fan's output wiring has a short circuit to power supply. • **Actions** 1. Inspect the circuit and the terminal of No. 39 ECU pin. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	
Condenser Fan Unit	P0481	Condenser Fan (Low) Relay - Short circuit to B+	• **Condition** - Power supply wiring: short circuit • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 35. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	
		Condenser Fan (Low) Relay - Open circuit to Ground	• **Condition** - Short or open circuit to ground • **Actions** 1. Inspect the circuit and terminal of ECU pin No. 35. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	
Cooling fan system (PWM electric fan)	P0483	PWM electric fan - Motor overloaded	• **Condition** - The cooling fan's output wiring has a short circuit to power supply. • **Actions** 1. Inspect the circuit and the terminal of No. 39 ECU pin. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	
	P0484	PWM electric fan - Motor stalled	• **Condition** - The cooling fan's output wiring has a short circuit to power supply. • **Actions** 1. Inspect the circuit and the terminal of No. 39 ECU pin. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	
	P0485	PWM electric fan - Short circuit	• **Condition** - The cooling fan's output wiring has a short circuit to power supply. • **Actions** 1. Inspect the circuit and the terminal of No. 39 ECU pin. 2. Inspect the power supply. 3. Inspect the cooling fan. 4. Check the ECU.	

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Auto Cruise Control	P0500	CAN signal Fault: Auto Cruise Malfunction	• **Condition** - The auto cruise is defective.	o
		Auto Cruise Acceleration Function Fault	• **Condition** - The acceleration signal is faulty.	o
		Auto Cruise Deceleration Function Fault	• **Condition** - The deceleration signal is faulty.	o
	P0501	Defective Vehicle Speed Sensor Signal	• **Condition** - The vehicle speed signal is faulty.	o
		Defective Vehicle Speed Sensor Signal	• **Condition** - The vehicle speed signal is faulty.	o
Battery Voltage	P0562	Low Battery Voltage	• **Condition** - The voltage of ECU is faulty. * Less than minimum 8 Volts in 2000 rpm below * Less than 10 Volts in 2000 rpm above • **Specification** Over 8 V • **Actions** 1. Measure the actual battery voltage using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 12, 11, 10 and 5. 3. Check the power supply relay. 4. Check the battery and the ECU.	o
Auto Cruise Control	P0564	Defective Auto Cruise Control Lever	• **Condition** - The auto cruise lever is defective.	o
CAN Communication	P0600	CAN Communication Malfunction: ASR	• **Condition** - The CAN communication with ASR is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	o
		CAN Communication Malfunction: ABS	• **Condition** - The CAN communication with ABS is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	o
		Defective Immobilizer System	• **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
CAN Communication	P0600	CAN Communication Malfunction: TCU	• **Condition** - The CAN communication with TCU is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	o
		CAN Communication Malfunction: TOD (Not used)	• **Condition** - The CAN communication with TOD is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	o
		CAN Communication Malfunction: Shift Lever	• **Condition** - The CAN communication with TGS lever is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	o
		CAN Communication Malfunction: ABS Speed Sensor (FR)	• **Condition** - The ABS front speed sensor's signal is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	o
		CAN Communication Malfunction: ABS Speed Sensor (RR)	• **Condition** - The ABS rear speed sensor's signal is defective. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	o

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
CAN Communication	P0600	CAN Communication Malfunction: Faulty Initialization	• **Condition** - The communication network data is not initialized. • **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	o
		CAN Communication Malfunction: MSR Transmission Signal	• **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	o
		CAN Communication Malfunction: ASR Transmission Signal	• **Specification** - Transfer rate: 500 K Baud • **Actions** 1. Check the CAN communication line of relevant unit. 2. Inspect the circuits and terminals of ECU pin No. 37 and 38. 3. Check the ECU.	o
Throttle Body Control	P0601	Throttle Position Sensor - Faulty Learning Signal	– **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	o
ECU	P0601	Auto Cruise Shutdown Memory Malfunction	• **Condition** - The ECU's internal circuit is defective. • **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o
		ECU Malfunction (Call Monitor)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
ECU	P0601	Servo Motor's Voltage Output Stopped	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o
		Servo Motor - Short or Open circuit	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o
		ECU Malfunction (CPU not compatible)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o
		ECU Malfunction (Faulty CPU Communication)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o
		ECU Malfunction (Faulty CPU (2) Environment)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o
		ECU Malfunction (CPU (2) Malfunction)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o
		ECU Malfunction (Faulty CPU run-time)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o
		Communication Malfunction (CPU2)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o
	P0602	ECU Not Coded	• **Condition** - The ECU coding is incorrect. • **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o
Incorrect Coding	P0602	Incorrect Transmission Coding	• **Condition** - TCU (Variant) coding is faulty. • **Actions** 1. Check the current coding using SCAN-100. 2. Check ECU and TCU. 3. Check the CAN line.	o
Incorrect Coding	P0603	Incorrect VIN ECU Coding	• **Actions** 1. Check the current coding using SCAN-100. 2. Check ECU and TCU. 3. Check the CAN line.	o
ECU	P0604	ECU Fault (RAM)	• **Condition** - The memory function of ECU RAM is defective. • **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	o

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
ECU	P0605	ECU Fault (EPROM)	• **Condition** - The memory function of ECU is defective. • **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Fault (Faulty NVRAM Checksum)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Fault (Faulty Coding ID Checksum)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Fault (Faulty Coding Checksum)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
		ECU Fault (Faulty Programming Checksum)	• **Actions** 1. Check the ECU connector for contact. 2. Check the ECU.	O
Engine CHECK Warning Lamp	P0650	Engine CHECK Warning Lamp - Short circuit to B+	• **Condition** - Lamp circuit: short circuit to battery • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 29.	O
		Engine CHECK Warning Lamp - Open or Short circuit to Ground	• **Condition** - Lamp circuit: short or open circuit to ground • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 29.	O
Variable Air Intake System	P0661	Variable Air Intake Valve - Open or Short circuit to Ground	• **Condition** - Variable air intake valve circuit: short or open circuit to ground • **Specification** - ON/OFF flip range: approx. 3500 rpm - Operating current: 0.4 - 0.6 A - Solenoid internal resistance: 25 ± 5 Ω (20°C) • **Actions** 1. Check the actual operation condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 97. 3. Check the resonance flap's power supply. 4. Check the resonance flap solenoid and unit for damage. 5. Check the ECU.	O

Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Variable Air Intake System	P0662	Variable Air Intake Valve - Short circuit to B+	• **Condition** - Variable air intake valve circuit: short circuit to battery • **Specification** - ON/OFF flip range: approx. 3500 rpm - Operating current: 0.4 - 0.6 A - Solenoid internal resistance: 25 ± 5 Ω (20°C) • **Actions** 1. Check the actual operating condition using SCAN-100. 2. Inspect the circuit and terminal of ECU pin No. 97. 3. Check the resonance flap's power supply. 4. Check the resonance flap solenoid and unit for damage. 5. Check the ECU.	o
TCU	P0702	TCU Fault	• **Actions** - Check DTC codes for TCU.	o
		Transmission Malfunction: Solenoid Valve Voltage	• **Actions** - Check DTC codes for TCU.	o
Auto Cruise Control	P0703	CAN Communication Fault: Stop Lamp Switch	• **Condition** - The brake switch is defective.	o
TCU	P0705	Transmission Malfunction: Shift Lever	• **Actions** - Check DTC codes for TCU.	o
	P0715	Transmission Malfunction: Vehicle Speed Sensor	• **Actions** - Check DTC codes for TCU.	o
	P0720	Transmission Malfunction: Faulty Speed to Output	• **Actions** - Check DTC codes for TCU.	o
	P0730	Transmission Malfunction: Hydraulic System	• **Actions** - Check DTC codes for TCU.	o
		Transmission Malfunction: Faulty Gear Recognition	• **Actions** - Check DTC codes for TCU.	o
	P0734	A/T Control Malfunction	• **Actions** - Check DTC codes for TCU.	o
	P0740	Transmission Malfunction: TCC Head Control	• **Actions** - Check DTC codes for TCU.	o
	P0743	Transmission Malfunction: Lockup Converter Clutch	• **Actions** - Check DTC codes for TCU.	o
	P0748	Transmission Malfunction: Modulator Pressure	• **Actions** - Check DTC codes for TCU.	o
	P0753	Transmission Malfunction: Solenoid Valve 1-2/4-5	• **Actions** - Check DTC codes for TCU.	o
	P0758	Transmission Malfunction: Solenoid Valve 2-3	• **Actions** - Check DTC codes for TCU.	o
	P0763	Transmission Malfunction: Solenoid Valve 3-4	• **Actions** - Check DTC codes for TCU.	o
	P0778	Transmission Malfunction: Transmission Pressure	• **Actions** - Check DTC codes for TCU.	o
	P0836	Transmission Malfunction: Transfer Case	• **Actions** - Check DTC codes for TCU.	o

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Related Item	DTC	Trouble	Help	Engine CHECK warning lamp
Incorrect Coding	P1570	Immobilizer Not Coded	• **Actions** 1. Check the current coding using SCAN-100. 2. Check ECU and TCU. 3. Check the CAN line.	o
Throttle Body Control	P1590	Safety Fuel Shut-off Time Expired	• **Specification** - Connection between No.1 throttle position sensor and No.2 throttle position sensor No.1 TPS's pull-down resistance: 464 kΩ No.2 TPS's pull-up resistance: 464 kΩ - Potentiometer voltage: 5 V - Potentiometer resistance: 1 kΩ ± 20 % - Permissible current for wiper arms: below 15 μA - Protective resistance for wiper arms: 320 Ω ± 20 % - Motor voltage/max. current : 12 V / below 1.7 A • **Actions** 1. Measure the actual output value using SCAN-100. 2. Inspect the circuits and terminals of ECU pin No. 67, 68, 84, 85, 87 and 112. 3. Inspect the electric throttle controller. 4. Check the ECU.	o
Starter Signal	P1609	Starter Signal Recognition Malfunction	• **Condition** - The starter signal is improperly recognized. • **Specification** - Over 9.6 V (for 1 seconds) • **Actions** 1. Inspect the circuit and terminal of the ECU pin No. 2. 2. Check the ECU.	o

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DIAGNOSIS

1. ECU-DIESEL

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0100	Air Mass Flow (HFM) Malfunction	- The external power supply is faulty. • Check the external power supply. • Check the sensor wiring harness (open, short, poor contact). - Actual air mass flow vs. Output voltages. • -20 Kg/h: 0.47 V • 0 Kg/h: 0.99 V • 10 Kg/h: 1.2226 ~ 1.2398 V • 15 Kg/h: 1.3552 ~ 1.3778 V • 30 Kg/h: 1.6783 ~ 1.7146 V • 60 Kg/h: 2.1619 ~ 2.2057 V • 120 Kg/h: 2.7215 ~ 2.7762 V • 250 Kg/h: 3.4388 ~ 3.5037 V • 370 Kg/h: 3.8796 ~ 3.9511 V • 480 Kg/h: 4.1945 ~ 4.2683 V • 640 Kg/h: 4.5667 ~ 4.6469 V - Replace the ECU if required.						
P0102	Low HFM Sensor Signal (Circuit Open)	- HFM sensing values are lower than minimum sensing values. - Check the resistance in HFM sensor. - Check the ECU wiring harness (open and poor contact). - Actual air mass flow vs. Output voltages. • -20 Kg/h: 0.47 V • 0 Kg/h: 0.99 V • 10 Kg/h: 1.2226 ~ 1.2398 V • 15 Kg/h: 1.3552 ~ 1.3778 V • 30 Kg/h: 1.6783 ~ 1.7146 V • 60 Kg/h: 2.1619 ~ 2.2057 V • 120 Kg/h: 2.7215 ~ 2.7762 V • 250 Kg/h: 3.4388 ~ 3.5037 V • 370 Kg/h: 3.8796 ~ 3.9511 V • 480 Kg/h: 4.1945 ~ 4.2683 V • 640 Kg/h: 4.5667 ~ 4.6469 V - Replace the ECU if required.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0103	High HFM Sensor Signal (Circuit Short)	- HFM sensing values are higher than maximum sensing values. - Check the resistance in HFM sensor. - Check the ECU wiring harness (open and poor contact). - Actual air mass flow vs. Output voltages. • -20 Kg/h: 0.47 V • 0 Kg/h: 0.99 V • 10 Kg/h: 1.2226 ~ 1.2398 V • 15 Kg/h: 1.3552 ~ 1.3778 V • 30 Kg/h: 1.6783 ~ 1.7146 V • 60 Kg/h: 2.1619 ~ 2.2057 V • 120 Kg/h: 2.7215 ~ 2.7762 V • 250 Kg/h: 3.4388 ~ 3.5037 V • 370 Kg/h: 3.8796 ~ 3.9511 V • 480 Kg/h: 4.1945 ~ 4.2683 V • 640 Kg/h: 4.5667 ~ 4.6469 V - Replace the ECU if required.						
P0105	Supply Voltage Fault to Booster Pressure Sensor	- Out of range of supply voltages about boost pressure sensor at Ignition key-On and Engine Stop (Higher than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction		o				o

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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0106	High Booster Pressure Sensor Signal	- Out of signal range about boost pressure sensor at Ignition key-On and Engine Stop (Higher than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages. • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction						o
P0107	Booster Pressure Sensor Open/GND Short	- Out of signal range about boost pressure sensor at Engine running condition (Lower than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction		o				o

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0108	Booster Pressure Sensor Short	- Out of signal range about boost pressure sensor at Engine running condition (Higher than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages • Raw Signal Range: 0.545~2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction		o				o
P0109	Low Booster Pressure Sensor Signal	- Out of signal range about boost pressure sensor at Ignition key-On and Engine Stop (Lower than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages. • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction						o

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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0110	Intake Air Temperature Circuit Malfunction - Source Power Problem	- The intake air temperature sensing value is lower than minimum value or higher than maximum value, or the external power to HFM sensor is faulty. - Check the supply voltage to sensor. • Actual air temperature vs. Voltages • 20°C: 2.65 Ω • 30°C: 2.18 Ω • 50°C: 1.40 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the sensor wiring harness. • Check the source power circuit for short to ground. - Check the sensor resistance. • Actual air temperature vs. Resistance • -40°C: 39.260 Ω • -20°C: 13.850 Ω • 0°C: 5.499 Ω • 20°C: 2.420 Ω • 40°C: 1.166 Ω • 60°C: 0.609 Ω • 80°C: 0.340 Ω • 100°C: 0.202 Ω • 120°C: 0.127 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the ECU wiring harness. - Replace the ECU if required.		o				

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0112	Intake Air Temperature Circuit Malfunction - Open	- The intake air temperature sensing value is lower than maximum value of 150°C: Open - Check the supply voltage to sensor. • Actual air temperature vs. Voltages • 20°C: 2.65 Ω • 30°C: 2.18 Ω • 50°C: 1.40 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the sensor wiring harness. • Check the source power circuit for short to ground. - Check the sensor resistance. • Actual air temperature vs. Resistance • -40°C: 39.260 Ω • -20°C: 13.850 Ω • 0°C: 5.499 Ω • 20°C: 2.420 Ω • 40°C: 1.166 Ω • 60°C: 0.609 Ω • 80°C: 0.340 Ω • 100°C: 0.202 Ω • 120°C: 0.127 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the ECU wiring harness. - Replace the ECU if required.		o				

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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0113	Intake Air Temperature Circuit Malfunction - Short	- The intake air temperature sensing value is lower than maximum value of 150°C: Open - Check the supply voltage to sensor. • Actual air temperature vs. Voltages • 20°C: 2.65 Ω • 30°C: 2.18 Ω • 50°C: 1.40 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the sensor wiring harness. • Check the source power circuit for short to ground. - Check the sensor resistance. • Actual air temperature vs. Resistance • -40°C: 39.260 Ω • -20°C: 13.850 Ω • 0°C: 5.499 Ω • 20°C: 2.420 Ω • 40°C: 1.166 Ω • 60°C: 0.609 Ω • 80°C: 0.340 Ω • 100°C: 0.202 Ω • 120°C: 0.127 Ω • Recovery values when intake air temperature sensor failure: 50°C - Check the ECU wiring harness. - Replace the ECU if required.		o				
P0115	Supply Voltage Fault to Coolant Temperature Sensor	- Check if the supply voltage of approx. 12 V is applied.						
P0117	Coolant Temperature Sensor Malfunction - Open	- Malfunction in recognition of coolant temperature • Less than minimum values (Circuit Open) • External power supply malfunction - If Fuel temperature is invalid, the previous coolant temperature is retained. - Check the supply voltage to sensor. - Actual air temp. vs. Resistance • 20°C: 2449 Ω • 50°C: 826.3 Ω • 80°C: 321.4 Ω • 100°C: 112.9 Ω - Check the wiring harness (open and poor contact). • ECU pin #A01, A02 - Visually check the sensor and replace if required. - Replace the ECU if required.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0118	Coolant Temperature Sensor Malfunction - Short	- Malfunction in recognition of coolant temperature • More than maximum values (Circuit Short) • External power supply malfunction - If Fuel temperature is invalid, the previous coolant temperature is retained. - Check the supply voltage to sensor. - Actual air temp. vs. Resistance • 20°C: 2449 Ω • 50°C: 826.3 Ω • 80°C: 321.4 Ω • 100°C: 112.9 Ω - Check the wiring harness (short and poor contact). • ECU pin #A01, A02 - Visually check the sensor and replace if required. - Replace the ECU if required.						
P0120	Accelerator Pedal Sensor #1 Malfunction - Supply Voltage Fault	- The supply voltage is faulty. - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	o					o
P0122	Accelerator Pedal Sensor #1 Malfunction - Open	- Out of range about potentiometer 1 of pedal sensor: lower than specified values - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	o					o
P0123	Accelerator Pedal Sensor #1 Malfunction - Short	- Out of range about potentiometer 1 of pedal sensor: higher than specified values - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	o					o

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0147	Impossible to Learn Idle MDP	- Causes (Idle range MDP learning) • The MDP is not learned again until driving over 50,000 km after the MDP is learned. - Conditions for MDP learning (Idle) • Leaning twice for each cylinder (attempt every 5 sec.) • Initial MDP learning: coolant temperature > 60°C • Fuel temperature: 0 ~ 80°C • Vehicle speed: Idle. • The tachometer's needle vibrates while learning idle MDP. • Replace ECU after learning.						
P0148	Impossible to Learn Drive MDP	- Causes • It occurs twice for each cylilnder if MDP is not learned again until driving over 50,000 km after the MDP is learned. - Actions • Check knock sensor and wiring. • Check injector specification. • Check C3I/C2I.						
P0171	Insufficient MDP of Injector #1	- MDP learning value is decreased due to aged injector #1.						
P0172	Insufficient MDP of Injector #2	- MDP learning value is decreased due to aged injector #2.						
P0173	Insufficient MDP of Injector #3	- MDP learning value is decreased due to aged injector #3.						
P0174	Insufficient MDP of Injector #4	- MDP learning value is decreased due to aged injector #4.						
P0175	Insufficient MDP of Injector #5	- MDP learning value is decreased due to aged injector #5.						
P0180	Fuel Temperature Sensor - Malfunction	- The power source circuit is faulty for fuel temperature sensor. (Fuel temperature sensor is mounted in high pressure pump) - Actual fuel temp. vs. Resistance • -40°C: 75.780 Ω -20°C: 21.873 Ω • -10°C: 12.462 Ω 0°C: 7.355 Ω • 10°C: 4.481 Ω 20°C: 2.812 Ω • 25°C: 2.252 Ω 30°C: 1.814 Ω • 40°C: 1.199 Ω 50°C: 0.811 Ω • 70°C: 0.394 Ω 90°C: 0.206 Ω • 120°C: 0.087 Ω - Recovery values when fuel temperature sensor failure: 95°C - Check the supply voltage to sensor. - Check the wiring harness for open, short and poor contact. • ECU pin #A09, A10 - Check the ECU wiring and replace the ECU if required.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0182	Fuel Temperature Sensor - Short to Ground	- The sensing values are higher than specified values for fuel temperature sensor. (More than maximum sensing values 140°C - Circuit Short) - Actual fuel temp. vs. Resistance • -40°C: 75.780 Ω -20°C: 21.873 Ω • -10°C: 12.462 Ω 0°C: 7.355 Ω • 10°C: 4.481 Ω 20°C: 2.812 Ω • 25°C: 2.252 Ω 30°C: 1.814 Ω • 40°C: 1.199 Ω 50°C: 0.811 Ω • 70°C: 0.394 Ω 90°C: 0.206 Ω • 120°C: 0.087 Ω - Recovery values when fuel temperature sensor failure: 95°C - Check the supply voltage to sensor. - Check the wiring harness for open, short and poor contact. • ECU pin #A09, A10 - Check the ECU wiring and replace the ECU if required.						
P0183	Fuel Temperature Sensor - Short to B+	- The sensing values are lower than specified values for fuel temperature sensor. (Less than maximum sensing values - 40°C - Circuit Open) - Actual fuel temp. vs. Resistance • -40°C: 75.780 Ω -20°C: 21.873 Ω • -10°C: 12.462 Ω 0°C: 7.355 Ω • 10°C: 4.481 Ω 20°C: 2.812 Ω • 25°C: 2.252 Ω 30°C: 1.814 Ω • 40°C: 1.199 Ω 50°C: 0.811 Ω • 70°C: 0.394 Ω 90°C: 0.206 Ω • 120°C: 0.087 Ω - Recovery values when fuel temperature sensor failure: 95°C - Check the supply voltage to sensor. - Check the wiring harness for open, short and poor contact. - Check the ECU wiring and replace the ECU if required.						

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0190	Supply Voltage Fault to Fuel Rail Pressure Sensor	- The supply voltage to fuel rail pressure sensor is faulty. - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055± 0.125V • Output voltage at atmospheric pressure: 0.5±0.04V - Check the sensor and ECU wiring harness. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	O					O
P0191	Fuel Rail Pressure Sensor Signal Fault	- The rail pressure drop is too high. - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the sensor and ECU wiring harness. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	O					O
P0192	Fuel Rail Pressure Sensor Malfunction - Open	- The fuel rail pressure sensing values are lower than specified values. • Minimum sensing values: - 112 bar (Open) - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the sensor and ECU wiring harness. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	O					O

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0193	Fuel Rail Pressure Sensor Malfunction - Short	- The fuel rail pressure sensing values are higher than specified values. • Maximum sensing values: 1,600 bar (Short) - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055± 0.125V • Output voltage at atmospheric pressure: 0.5±0.04V - Check the sensor and ECU wiring harness. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	O					O
P0201	Injector #1 Circuit Open	- Injector #1 circuit malfunction: Open. • If the injector pin is defective, perform C2I/C3I coding and check again. • If the injector pin is normal, check the ECU wiring harness . - Replace the ECU if required.						O
P0202	Injector #2 Circuit Open	- Injector #2 circuit malfunction: Open. • If the injector pin is defective, perform C2I/C3I coding and check again. • If the injector pin is normal, check the ECU wiring harness. - Replace the ECU if required.						O
P0203	Injector #3 Circuit Open	- Injector #3 circuit malfunction: Open. • If the injector pin is defective, perform C2I/C3I coding and check again. • If the injector pin is normal, check the ECU wiring harness. - Replace the ECU if required.						O
P0204	Injector #4 Circuit Open	- Injector #4 circuit malfunction: Open. • If the injector pin is defective, perform C2I/C3I coding and check again. • If the injector pin is normal, check the ECU wiring harness. - Replace the ECU if required.						O
P0205	Injector #5 Circuit Open	- Injector #5 circuit malfunction: Open. • If the injector pin is defective, perform C2I/C3I coding and check again. • If the injector pin is normal, check the ECU wiring harness. - Replace the ECU if required.						O

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0215	Main Relay Fault - Stuck	- The main relay is stuck ; Shut down. - Resistance of main relay: 92 Ω ± 9 Ω (at 20°C) - Check the main relay wiring harness. - Check the ECU wiring harness. - If the forced operation is not available, replace the ECU. - Check the fuse for main relay						
P0219	Too Small Clearance of Crank Angle Sensor	- Crank angle signal faults or clearance too close. - Check the sensor wiring harness (open, short, poor contact). - Check the resistance of crank angle sensor: 1090 Ω ± 15 %. - Measure the air gap: 0.3 ~ 1.3 mm • 1.3 mm of air gap: outputs 1.0 V at 40 rpm • 0.3 mm of air gap: outputs 150 V at 7000 rpm - Check the teeth condition. • Drive plate (A/T), DMF (M/T) - Replace the ECU if required.						o
P0220	Accelerator Pedal Sensor #2 Malfunction - Supply Voltage Fault	- The supply voltage is faulty. - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	o					o
P0222	Accelerator Pedal Sensor #2 Malfunction - Open	- Out of range about potentiometer 2 of pedal sensor: lower than specified values - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	o					o
P0223	Accelerator Pedal Sensor #2 Malfunction - Short	- Out of range about potentiometer 2 of pedal sensor: higher than specified values - Check the supply voltage to sensor. - Check the wiring harness. • Check the circuit for open and short. - Check the accelerator pedal. - Check the ECU wiring harness. - Replace the ECU if required.	o					o

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0243	VGT Turbocharger Actuator Circuit Short	- Causes • There is electric problem in the vacuum modulator drive module of turbocharger. - Check pin for the followings (Vacuum Modulator): • Power (Main Relay) • GND - Actions • Check the unit's resistance (15.4 +/- 0.7 Ω) and wiring. • Check the input voltage (12V). • Visually check the unit and replace if necessary.						
P0245	Turbo Charger Actuator Circuit Fault - Short	- The waste gate driver circuit is short to ground or open - Check the actuator wiring harness. - Check the solenoid valve. - Check the ECU wiring harness. - Replace the ECU if required.	O					O
P0246	Turbo Charger Actuator Circuit Fault - Short to B+	- The turbo charger actuator power source circuit is short. - Check the actuator wiring harness. - Check the solenoid valve. - Check the ECU wiring harness for short and poor contact. - Replace the ECU if required.	O					O
P0251	IMV Driver Circuit Malfunction - Short	- IMV driver circuit malfunction: Short - Check the IMV wiring harness. - Check the ECU wiring harness. - Check the IMV resistance. • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.			O		O	O
P0253	IMV Driver Circuit Malfunction - Short to Ground	- IMV driver circuit malfunction: Short to ground - Check the IMV wiring harness. - Check the ECU wiring harness. - Check the IMV resistance. • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.			O		O	O
P0255	IMV Driver Circuit Malfunction - Open	- IMV driver circuit malfunction: Open - Check the IMV wiring harness. - Check the ECU wiring harness. - Check the IMV resistance. • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.			O		O	O

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0263	Injector #1 Balancing Fault	- Injector #1 cylinder balancing faults (Injector stuck closed). - Check the injector circuit for open. - Check the glow plug. - Check the inlet tube for clogging. - Check the EGR. - Replace the ECU if required (perform C2I/C3I coding after replacement).						
P0266	Injector #2 Balancing Fault	- Injector #2 cylinder balancing faults (Injector stuck closed). - Check the injector circuit for open. - Check the glow plug. - Check the inlet tube for clogging. - Check the EGR. - Replace the ECU if required (perform C2I/C3I coding after replacement).						
P0269	Injector #3 Balancing Fault	- Injector #3 cylinder balancing faults (Injector stuck closed). - Check the injector circuit for open. - Check the glow plug. - Check the inlet tube for clogging. - Check the EGR. - Replace the ECU if required (perform C2I/C3I coding after replacement).						
P0272	Injector #4 Balancing Fault	- Injector #4 cylinder balancing faults (Injector stuck closed). - Check the injector circuit for open. - Check the glow plug. - Check the inlet tube for clogging. - Check the EGR. - Replace the ECU if required (perform C2I/C3I coding after replacement).						
P0275	Injector #5 Balancing Fault	- Injector #5 cylinder balancing faults (Injector stuck closed). - Check the injector circuit for open. - Check the glow plug. - Check the inlet tube for clogging. - Check the EGR. - Replace the ECU if required (perform C2I/C3I coding after replacement).						
P0325	Accelerometer #1 (Knock Sensor) Malfunction	- The signal / noise ratio is too low about accelerometer # 1. - Check the accelerometer wiring harness and tightening torque. • Tightening torque: 20 ± 5 Nm - Check the ECU wiring harness for open and short. - If the trouble still exists even after replacing the accelerometer, replace the ECU.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0325	Accelerometer #1 (Knock Sensor) Malfunction	- The signal / noise ratio is too low about accelerometer # 1. - Check the accelerometer wiring harness and tightening torque. • Tightening torque: 20 ± 5 Nm - Check the ECU wiring harness for open and short. - If the trouble still exists even after replacing the accelerometer, replace the ECU.						
P0335	No Crank Signals	- Refer to P0372.						O
P0336	Too Large Clearance of Crank Angle Sensor	- Air gap of crank angle sensor is abnormal. - Check the sensor wiring harness (open, short, poor contact). - Check the resistance of crank angle sensor: 1090 Ω ± 15 %. - Measure the air gap: 0.3 ~ 1.3 mm • 1.3 mm of air gap: outputs 1.0 V at 40 rpm • 0.3 mm of air gap: outputs 150 V at 7000 rpm - Check the teeth condition. • Drive plate (A/T), DMF (M/T) - Replace the ECU if required.						O
P0341	Cam Position Sensor Malfunction (Poor Synchronization)	- Not synchronized with Crank angle signal. - Check the source voltage of cam position sensor (specified value: 4.5 ~ 12 V). - Check the sensor wiring harness (open, short, poor contact). - Check the cam position sensor. - Measure the air gap: 0.2 ~ 1.8 mm - Replace the ECU if required.						O
P0344	Cam Position Sensor Malfunction	- No cam recognition signal (missing events). - Check the source voltage of cam position sensor (specified value: 4.5 ~ 12 V). - Check the sensor wiring harness (open, short, poor contact). - Check the cam position sensor. - Measure the air gap: 0.2 ~ 1.8 mm - Replace the ECU if required.						O

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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0372	Crank Angle Sensor Malfunction	- Even though cam position recognition is normal, no crank angle signal recognition (missing tooth). - Check the sensor wiring harness (open, short, poor contact). - Check the resistance of crank angle sensor: 1090 Ω ± 15 %. - Measure the air gap: 0.3 ~ 1.3 mm • 1.3 mm of air gap: outputs 1.0 V at 40 rpm • 0.3 mm of air gap: outputs 150 V at 7000 rpm - Check the teeth condition. • Drive plate (A/T), DMF (M/T) - Replace the ECU if required.						o
P0400	EGR Control Valve Fault	- When the EGR emission is more than specified value. • The EGR controller circuit is open or short to ground. • The EGR controller is short to battery. - Check the EGR actuator wiring harness. - Check the supply voltage to EGR solenoid valve. - Check if the EGR valve is stuck. - Check the resistance of EGR valve: 15.4 Ω. - Check the ECU wiring harness.						
P0401	EGR Control Valve Fault (Low)	- When the EGR emission is more than specified value. • The EGR controller circuit is open or short to ground. • The EGR controller is short to battery. - Check the EGR actuator wiring harness. - Check the supply voltage to EGR solenoid valve. - Check if the EGR valve is stuck. - Check the resistance of EGR valve: 15.4 Ω. - Check the ECU wiring harness.						
P0402	EGR Valve Stuck in Open Position	- Causes • The E-EGR valve is stuck with it open. - Check pin (refer to the page 1407) - Actions • Check E-EGR valve and sensor wiring. • Visually check the unit and replace if necessary. • Replace the ECU if required. • Refer to DTCs (P0407 and P0408).						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0405	High EGR Open Position Deviation	- Causes • The difference between E-EGR position demand (MAP) value and E-EGR position feedback signal value is over 15% (the sensor output indicates E-EGR is open over 15% in the close status). - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.						o
P0406	High EGR Close Position Deviation	- Causes • The difference between E-EGR position demand (MAP) value and E-EGR position feedback signal value is over 15% (the sensor output indicates EEGR is closed over 15% in the open status). - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.		o				
P0407	Low EGR Position Signal	- Diagnosis of E-EGR signal for the followings: • Sensor signal is high or low. • Total resistance value: 4Ω +/-40% • Sensor output range: 1.2 ~ 4.0 V • Total sensor resistance: 4 kΩ ± 40% • Total motor resistance: 8.0Ω ± 0.5Ω - Check pin for the followings: • Check sensor reference voltage (5V) - ECU Pin #A33 • Sensor signal - ECU Pin #A82 • Sensor GND - ECU Pin #A09 - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.						

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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0408	High EGR Position Signal	- Diagnosis of E-EGR signal for the followings: • Sensor signal is high or low. • Total resistance value: 4Ω +/-40% • Sensor output range: 1.2 ~ 4.0 V • Total sensor resistance: 4 kΩ ± 40% • Total motor resistance: 8.0Ω ± 0.5Ω - Check pin for the followings: • Check sensor reference voltage (5V) • Sensor signal - ECU pin #A82 • Sensor GND - ECU pin #A09 - Actions • Measure the resistance of E-EGR valve sensor. • Check the sensor and actuator wiring harness. • Check the unit.						
P0430	Front and Rear Exhaust Gas Temperature Sensors - Excessive Temperature Value Difference	- The value difference between the front exhaust gas temperature sensor on the exhaust manifold and the rear exhaust gas temperature sensor on the CDPF is out of the specified range. - Measure the resistance of the exhaust gas temperature sensors by temperature and the supplied voltage. - Check the ECU terminal No. A06 and A30 for connecting the front exhaust gas temperature sensor as well as the sensor terminal No. 1 and 2. - Check the ECU terminal No. A23 and A42 for connecting the rear exhaust gas temperature sensor as well as the sensor terminal No. 1 and 2.						o

CDPF temperature (°C)	Resistance (Ω)
-40	169.18
-20	184.64
0	200.0
25	219.07
50	237.99
100	275.4
150	312.2
200	348.5
250	384.1
300	419.2
350	453.7
400	487.6
450	520.9
500	553.6
600	617.3
700	678.7
800	737.7
830	754.9
850	766.3

<table>
<tr><th>DTC</th><th>Trouble</th><th>Help</th><th>Torque Reduction (max.50%)</th><th>Torque Reduction (max.20%)</th><th>Delayed Engine Stop</th><th>Immediately Engine Stop</th><th>Limp Home Mode</th><th>Engine Check Warning Lamp</th></tr>
<tr><td>P0431</td><td>DOC malfunction</td><td>- The measured DOC temperature is below the limit for recycling (below 0.5 times).
- Cause: Old/worn DOC
- The recycling mode cannot be activated.
- Check and clear the DTC using SCAN-100.
- Replace the CDPF.</td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
<tr><td>P0432</td><td>CDPF - Excessive Soot Accumulated</td><td>- The pressure is over 23 Kpa for over 960 seconds due to the resistance by soot.
- If P0432 is generated without error in pressure sensor, the torque is reduced.
- Remove CDPF and clean it by blowing it from the opposite side of discharged side. Then, install it again and check it for soot.</td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
<tr><td>P0436</td><td>Rear exhaust gas temperature sensor - faulty signal</td><td>- The signal value from the rear exhaust gas temperature sensor is over the specified range.
- See P0437 and P0438 for more information and inspection.</td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
<tr><td>P0437</td><td>Rear exhaust gas temperature sensor - low signal</td><td>- The signal value from the rear exhaust gas temperature sensor is below the specified range.
- Check the ECU terminal No. A23 and A42 for connecting the rear exhaust gas temperature sensor as well as the sensor terminal No. 1 and 2.
<table>
<tr><th>CDPF temperature (°C)</th><th>Resistance (Ω)</th></tr>
<tr><td>-40</td><td>169.18</td></tr>
<tr><td>-20</td><td>184.64</td></tr>
<tr><td>0</td><td>200.0</td></tr>
<tr><td>25</td><td>219.07</td></tr>
<tr><td>50</td><td>237.99</td></tr>
<tr><td>100</td><td>275.4</td></tr>
<tr><td>150</td><td>312.2</td></tr>
<tr><td>200</td><td>348.5</td></tr>
<tr><td>250</td><td>384.1</td></tr>
<tr><td>300</td><td>419.2</td></tr>
<tr><td>350</td><td>453.7</td></tr>
<tr><td>400</td><td>487.6</td></tr>
<tr><td>450</td><td>520.9</td></tr>
<tr><td>500</td><td>553.6</td></tr>
<tr><td>600</td><td>617.3</td></tr>
<tr><td>700</td><td>678.7</td></tr>
<tr><td>800</td><td>737.7</td></tr>
<tr><td>830</td><td>754.9</td></tr>
<tr><td>850</td><td>766.3</td></tr>
</table>
</td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
</table>

Modification basis	
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<table>
<tr><th>DTC</th><th>Trouble</th><th>Help</th><th>Torque Reduction (max.50%)</th><th>Torque Reduction (max.20%)</th><th>Delayed Engine Stop</th><th>Immediately Engine Stop</th><th>Limp Home Mode</th><th>Engine Check Warning Lamp</th></tr>
<tr><td>P0438</td><td>Rear exhaust gas temperature sensor - high signal</td><td>- The signal value from the rear exhaust gas temperature sensor is over the specified range.
- Check the ECU terminal No. A23 and A42 for connecting the rear exhaust gas temperature sensor as well as the sensor terminal No. 1 and 2.
<table><tr><th>CDPF temperature (°C)</th><th>Resistance (Ω)</th></tr><tr><td>-40</td><td>169.18</td></tr><tr><td>-20</td><td>184.64</td></tr><tr><td>0</td><td>200.0</td></tr><tr><td>25</td><td>219.07</td></tr><tr><td>50</td><td>237.99</td></tr><tr><td>100</td><td>275.4</td></tr><tr><td>150</td><td>312.2</td></tr><tr><td>200</td><td>348.5</td></tr><tr><td>250</td><td>384.1</td></tr><tr><td>300</td><td>419.2</td></tr><tr><td>350</td><td>453.7</td></tr><tr><td>400</td><td>487.6</td></tr><tr><td>450</td><td>520.9</td></tr><tr><td>500</td><td>553.6</td></tr><tr><td>600</td><td>617.3</td></tr><tr><td>700</td><td>678.7</td></tr><tr><td>800</td><td>737.7</td></tr><tr><td>830</td><td>754.9</td></tr><tr><td>850</td><td>766.3</td></tr></table></td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
<tr><td>P043A</td><td>Rear exhaust gas temperature sensor - faulty voltage supply</td><td>- The supplied voltage of the rear exhaust gas temperature sensor is out of the specified range.
- Check the ECU terminal No. A42 for connecting the rear exhaust gas temperature sensor as well as the sensor terminal No. 1.</td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
<tr><td>P0470</td><td>Differential Pressure Sensor - Max./Min. Output</td><td>- Specification for output value of pressure sensor : 0.5 ~4.5V
- The output value of sensor is over 4.5 V or below 0.5 V.
- Check the pressure sensor wiring for open or short circuit.</td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
<tr><td>P0471</td><td>Differential Pressure Sensor - Abnormal Differential Pressure</td><td>- The actual (measured) pressure difference (actual pressure) is different from the calculated pressure difference (pressure difference between front and rear side of CDPF).
(Possible cause : malfunctioning pressure sensor, leakage in pressure tube, parts removed)</td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
<tr><td>P0480</td><td>PWM Electric Fan Malfunction (Open circuit)
(Only for D27DTP (POWER UP) model)</td><td>- The communication line between PWM electric fan and ECU is open.
- The PWM electric fan's own malfunction cannot be identified.</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0481	PWM Electric Fan Malfunction(Short to B+) (Only for D27DTP (POWER UP) model)	- The communication line between PWM electric fan and ECU has a short to battery. - The PWM electric fan's own malfunction cannot be identified.						
P0482	PWM Electric Fan Malfunction (Short to GND) (Only for D27DTP (POWER UP) model)	- The communication line between PWM electric fan and ECU has a short to ground. - The PWM electric fan's own malfunction cannot be identified.						
P0483	Fan PWM motor out have short to GND	- Motor out have short to GND						
P0484	Fan PWM Stall motor	- Stall motor						
P0485	Fan PWM motor have over load	- Motor have over load						
P0487	Faulty Maximum Throttle Closing Value	- Causes • The throttle is not fully closed when learning the full open value after stopping the engine. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						
P0488	Throttle Valve - Seized	- The vacuum modulator of throttle valve has an open circuit. - The throttle valve is seized (mechanically). - Check condition for seizing: * No error in HFM and EGR * Engine running						o
P0488	Faulty Maximum Throttle Opening Value	- Causes • The throttle is not fully open when learning the full open value after initial ignition on. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.						

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0530	Air Conditioner Refrigerant Sensor Supply Power Fault	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal ..... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm^2 (0.75V) ~ 32 kgf/cm^2 (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm^2 4.5V ..... 32.0 kgf/cm^2 - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.						
P0532	Air Conditioner Refrigerant Pressure Signal Circuit Short	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal ..... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm^2 (0.75V) ~ 32 kgf/cm^2 (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm^2 4.5V ..... 32.0 kgf/cm^2 - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0533	Excessive Air Conditioner Refrigerant Pressure	- Causes • There is electric problem in the air conditioner's pressure sensor. - Check the sensor's specifications and ECU pin. • Power: 5V ..... ECU Pin #B29 • Sensor signal ..... ECU Pin #B41 • Sensor GND ..... ECU Pin #B36 • Actual range: 2.0 kgf/cm^2 (0.75V) ~ 32 kgf/cm^2 (4.5V) • Resistance: 51KΩ (signal terminal and ground) • Output signal 0.5V ..... 0.0 kgf/cm^2 4.5V ..... 32.0 kgf/cm^2 - Actions • Check the sensor's resistance and wiring. • Visually check the unit and replace if necessary.						
P0560	Battery Voltage Malfunction	- Malfunction in recognition of system source voltage (A/D converter faults). • Less than minimum 8 Volts in 2000 rpm below • Less than 10 Volts in 2000 rpm above. - Check the battery wiring harness (open, short, poor contact). - Check the battery main relay and fuse. - Check the body ground. - Measure the resistance between body ground and ECU ground. • Repair the ECU ground if the resistance is high. - Replace the ECU if required.	O					O
P0562	Low Battery Voltage	- Malfunction in recognition of system source voltage (Lower than threshold). • Less than minimum 8 Volts in 2000 rpm below • Less than 10 Volts in 2000 rpm above. - Check the battery wiring harness (open, short, poor contact). - Check the battery main relay and fuse. - Check the body ground. - Measure the resistance between body ground and ECU ground. • Repair the ECU ground if the resistance is high. - Replace the ECU if required.	O					O

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0563	High Battery Voltage	- Malfunction in recognition of system source voltage (Higher than threshold). • More than minimum 16 Volts in 2000 rpm below - Check the battery wiring harness (open, short, poor contact). - Check the alternator. - Check the body ground. - Measure the resistance between body ground and ECU ground. • Repair the ECU ground if the resistance is high. - Replace the ECU if required.	O					O
P0571	Brake Pedal Switch Fault	- The brake pedal switch or light switch is faulty. • Brake pedal switch: Normal Close (NC) • Light switch: Normal Open (NO) • When operating the brake switch, one signal (NO) is sent to auto cruise and the other (NC) is sent to brake lamp. - Check the brake and light switch wiring harness. - Check the supply voltage to brake and light switch (12 V). - Check the brake and light switch for contact. - Check the ECU wiring harness (short, poor contact). - Replace the ECU if required.						
P0602	Faulty Vehicle Speed Sensor Coding	- The vehicle signal is inputted via CAN communication without ESP or TCCU. - The CAN communication between units is malfunctioning.						
P0606	ECU Watchdog Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.						O

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0608	Faulty ABS/ESP Coding	- The ABS/ESP variant coding is faulty. - The CAN communication is malfunctioning.						
P0611	No Data for C3I	- C3I • There is no C3I data in ECU or the checksum is faulty.						O
P0612	Internal Error in C3I Data	- C3I • The error is occurred while sending C3I data in ECU to RAM.						
P0613	Faulty TCU Coding	- The TCU variant coding is faulty. - The CAN communication between units is malfunctioning.						
P0614	TCCU Coding Failt	- Occurred if TCCU variant coding is faulty. - Occurred when there is CAN communication error between units.						
P0618	Multi calibration not performed	- Perform multi calibration again.						
P0619	Multi calibration performing error	- Perform multi calibration again.						
P062D (former P1611)	Injector Bank #1 Malfunction - Low Voltage 4-cylinder engine : 1nd and 4rd cylinders 5-cylinder engine : 1nd, 4rd and 3rdcylinders	- Malfunction of injector (#1, #4, #3) circuit (Low): Short to Ground or to Battery. - Operating voltage: 6 ~ 18 V - Check the injector bank #1: Open and poor contact - Check if the trouble recurs with the injectors removed and the ignition key “OFF”. • If recurred, check the injector and ECU wiring harness. - Check if the trouble recurs while installing the injectors one by one with the ignition key “ON”. • If recurred, replace the injector (perform C2I/C3I coding after replacement). • Check the other injectors with same manner. - Check the ECU wiring harness. - Replace the ECU if required.						O
P062E (former P1618)	Injector Bank #2 Malfunction - Low Voltage 4-cylinder engine : 2nd and 3rd cylinders 5-cylinder engine : 2nd and 5rd cylinders	- Malfunction of injector (#2, #5) circuit (Low): Short to Ground or to Battery. - Operating voltage: 6 ~ 18 V - Check the injector bank #2: Open and poor contact - Check if the trouble recurs with the injectors removed and the ignition key “OFF”. • If recurred, check the injector and ECU wiring harness. - Check if the trouble recurs while installing the injectors one by one with the ignition key “ON”. • If recurred, replace the injector (perform C2I/C3I coding after replacement). • Check the other injectors with same manner. - Check the ECU wiring harness. - Replace the ECU if required.						O

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P062F	Multi calibration memory error	- Perform multi calibration again.						
P0630	Variant Coding is not done	- Variant coding is not done						O
P0631	Variant Coding writing error	- Variant coding writing error						O
P0633	Immobilizer Fault (refer to immobilizer section)	- Key memory is not available (permissible - 5). - Perform the immobilizer coding again. - Check the ECU wiring harness. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.						
P0641	ECU Supply Voltage 1 Fault (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.						
P0642	ECU Supply Voltage 1 Fault - Low (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.						
P0643	ECU Supply Voltage 1 Fault - High (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.						
P0649	Diag Lamp Drive Open Circuit	Open circuit						
P0650	Diag Lamp Drive Short to BATT	Short to batt						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0651	ECU Supply Voltage 2 Fault (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.			o		o	o
P0652	ECU Supply Voltage 2 Fault - Low (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.			o		o	o
P0653	ECU Supply Voltage 2 Fault - High (5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 5 V - Check the supply voltage to each sensor • Supply voltage (5 V): accelerator pedal sensor 1, HFM sensor, rail pressure sensor, booster pressure sensor, cam sensor - Check the wiring harnesses. - Replace the ECU if required.			o		o	o
P066A	Internal malfunction in #1 glow plug controller	- Cylinder #1 (Glow Plug #1) - Details: refer to P2673.						
P066B	Internal short in #1 glow plug controller	- Cylinder #1 (Glow Plug #1) - Details: refer to P2673.						
P066C	Internal malfunction in #2 glow plug controller	- Cylinder #2 (Glow Plug #2) - Details: refer to P2673.						
P066D	Internal short in #2 glow plug controller	- Cylinder #2 (Glow Plug #2) - Details: refer to P2673.						
P066E	Internal malfunction in #3 glow plug controller	- Cylinder #3 (Glow Plug #3) - Details: refer to P2673.						
P066F	Internal short in #3 glow plug controller	- Cylinder #3 (Glow Plug #3) - Details: refer to P2673.						
P0670	Defective power supply of glow plug controller	- Details: refer to P2673.						

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0671	#3 Glow Plug Fault - Open	- The glow plug circuit is open. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P0671	#3 Glow Plug - Open Circuit (applied for D27DT engine, Not applied for AQGS model)	D27DT: Preheat control relay - The glow plug has an open circuit. - Check the communication line between ECU and glow plug. - Check the glow plug wiring. - Check the resistance of glow plug. - Check the relay of glow plug. - Check the ECU wiring harness. - Replace the ECU if required. D27DTP: AQGS unit - NGK glow module (AQGS: Advanced Quick Glowing System) - Its condition is sent to ECU through CAN after detected by AQGS. - The AQGS has an electrical problem. - Diagnosis criteria of AQGS • Plug short circuit: voltage > 6V, current = 0A • Plug short circuit (GND): voltage = 0V • Plug short circuit (batt.): voltage = battery voltage • FET malfunction, FET short circuit (GND): voltage = 0V, current = 0A • Input voltage fault: 6V < input voltage < 16V • Communication fault: Abnormal data for over 1 second - Actions • Check the glow plug for malfunction (measuring its resistance). • Check the connector and wiring. • Visually check the glow plug. • Replace the glow plug if required. • Check the CAN line. • Check the IG1 power. • Check the battery power.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0672	#4 Glow Plug Fault - Open	- The glow plug circuit is open. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P0672	#4 Glow Plug - Open Circuit (applied for D27DT engine, Not applied for AQGS model)	D27DT: Preheat control relay - The glow plug has an open circuit. - Check the communication line between ECU and glow plug. - Check the glow plug wiring. - Check the resistance of glow plug. - Check the relay of glow plug. - Check the ECU wiring harness. - Replace the ECU if required. D27DTP: AQGS unit - NGK glow module (AQGS: Advanced Quick Glowing System) - Its condition is sent to ECU through CAN after detected by AQGS. - The AQGS has an electrical problem. - Diagnosis criteria of AQGS • Plug short circuit: voltage > 6V, current = 0A • Plug short circuit (GND): voltage = 0V • Plug short circuit (batt.): voltage = battery voltage • FET malfunction, FET short circuit (GND): voltage = 0V, current = 0A • Input voltage fault: 6V < input voltage < 16V • Communication fault: Abnormal data for over 1 second - Actions • Check the glow plug for malfunction (measuring its resistance). • Check the connector and wiring. • Visually check the glow plug. • Replace the glow plug if required. • Check the CAN line. • Check the IG1 power. • Check the battery power.						

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0673	#5 Glow Plug Fault - Open	- The glow plug circuit is open. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P0673	#5 Glow Plug - Open Circuit (applied for D27DT engine, Not applied for AQGS model)	D27DT: Preheat control relay - The glow plug has an open circuit. - Check the communication line between ECU and glow plug. - Check the glow plug wiring. - Check the resistance of glow plug. - Check the relay of glow plug. - Check the ECU wiring harness. - Replace the ECU if required. D27DTP: AQGS unit - NGK glow module (AQGS: Advanced Quick Glowing System) - Its condition is sent to ECU through CAN after detected by AQGS. - The AQGS has an electrical problem. - Diagnosis criteria of AQGS • Plug short circuit: voltage > 6V, current = 0A • Plug short circuit (GND): voltage = 0V • Plug short circuit (batt.): voltage = battery voltage • FET malfunction, FET short circuit (GND): voltage = 0V, current = 0A • Input voltage fault: 6V < input voltage < 16V • Communication fault: Abnormal data for over 1 second - Actions • Check the glow plug for malfunction (measuring its resistance). • Check the connector and wiring. • Visually check the glow plug. • Replace the glow plug if required. • Check the CAN line. • Check the IG1 power. • Check the battery power.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0674	#1 Glow Plug Fault - Open	- The glow plug circuit is open. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P0674	#1 Glow Plug - Open Circuit	D27DT: Preheat control relay - The glow plug has an open circuit. - Check the communication line between ECU and glow plug. - Check the glow plug wiring. - Check the resistance of glow plug. - Check the relay of glow plug. - Check the ECU wiring harness. - Replace the ECU if required. D27DTP: AQGS unit - NGK glow module (AQGS: Advanced Quick Glowing System) - Its condition is sent to ECU through CAN after detected by AQGS. - The AQGS has an electrical problem. - Diagnosis criteria of AQGS • Plug short circuit: voltage > 6V, current = 0A • Plug short circuit (GND): voltage = 0V • Plug short circuit (batt.): voltage = battery voltage • FET malfunction, FET short circuit (GND): voltage = 0V, current = 0A • Input voltage fault: 6V < input voltage < 16V • Communication fault: Abnormal data for over 1 second - Actions • Check the glow plug for malfunction (measuring its resistance). • Check the connector and wiring. • Visually check the glow plug. • Replace the glow plug if required. • Check the CAN line. • Check the IG1 power. • Check the battery power.						

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0675	#2 Glow Plug Fault - Open	- The glow plug circuit is open. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P0675	#2 Glow Plug - Open Circuit (applied for D27DT engine, Not applied for AQGS model)	D27DT: Preheat control relay - The glow plug has an open circuit. - Check the communication line between ECU and glow plug. - Check the glow plug wiring. - Check the resistance of glow plug. - Check the relay of glow plug. - Check the ECU wiring harness. - Replace the ECU if required. D27DTP: AQGS unit - NGK glow module (AQGS: Advanced Quick Glowing System) - Its condition is sent to ECU through CAN after detected by AQGS. - The AQGS has an electrical problem. - Diagnosis criteria of AQGS • Plug short circuit: voltage > 6V, current = 0A • Plug short circuit (GND): voltage = 0V • Plug short circuit (batt.): voltage = battery voltage • FET malfunction, FET short circuit (GND): voltage = 0V, current = 0A • Input voltage fault: 6V < input voltage < 16V • Communication fault: Abnormal data for over 1 second - Actions • Check the glow plug for malfunction (measuring its resistance). • Check the connector and wiring. • Visually check the glow plug. • Replace the glow plug if required. • Check the CAN line. • Check the IG1 power. • Check the battery power.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P067A	Internal malfunction in #4 glow plug controller	- Cylinder #4 (Glow Plug #4) - Details: refer to P2673.						
P067B	Internal short in #4 glow plug controller	- Cylinder #4 (Glow Plug #4) - Details: refer to P2673.						
P067C	Internal malfunction in #5 glow plug controller	- Cylinder #5 (Glow Plug #5) - Details: refer to P2673.						
P067D	Internal short in #5 glow plug controller	- Cylinder #5 (Glow Plug #5) - Details: refer to P2673.						
P0683	Defective CAN communiction of glow plug controller	- GCU's CAN signal is intermittently defective.						
P0685	Main Relay Malfunction	- The the main relay is unexpectedly high/low state (ECU is supplied after 3 seconds). - Relay resistance: 92 ± 9 Ω (at 20°C) - Check the relay wiring harness (open, short and poor contact). - If the forced operation is not available, replace the ECU.						
P0697	ECU Supply Voltage Fault (2.5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 2.5 V - Check the supply voltage to each sensor • Supply voltage (2.55 V): accelerator pedal sensor 2 - Check the wiring harnesses. - Replace the ECU if required.						
P0698	ECU Supply Voltage Fault - Low (2.5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 2.5 V - Check the supply voltage to each sensor • Supply voltage (2.5 V): accelerator pedal sensor 2 - Check the wiring harnesses. - Replace the ECU if required.						
P0699	ECU Supply Voltage Fault - High (2.5 V)	- Malfunction reference supply voltage from ECU • Supply voltage: 2.5 V - Check the supply voltage to each sensor • Supply voltage (2.55 V): accelerator pedal sensor 2 - Check the wiring harnesses. - Replace the ECU if required.						
P0700	TCU Signal Fault	- The communication between ECU and TCU is faulty. - Check the communication line between ECU and TCU. - Replace the ECU if required.						

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P0704	Clutch switch malfunction	- The clutch switch is faulty (Manual Transmission Only). - Check the switch wiring harness. - Check the switch supply voltage and operations. - Replace the ECU if required.						
P0805	Neutral Signal Input Malfunction (Only for D27DT M/T model)	- The neutral signal of M/T is sent to CAN cluster which is then sent to ECU via CAN communication. - The ECU cannot detect whether signal is missing due to the malfunction in neutral signal and wiring or due to the line malfunction. - Check the wiring related to neutral switch.						
P1102	HFM Sensor - High Characteristic Value (Only for D27DT model)	- The characteristic value of HFM sensor is over the specified value (not wiring malfunction).						
P1103	HFM Sensor - Low Characteristic Value (Only for D27DT model)	- The characteristic value of HFM sensor is below the specified value (not wiring malfunction).						
P1105	Barometric Sensor Circuit Short	- Out of range about barometric sensor (over voltage). - Actual barometric pressure vs. Output voltages. • 15 Kpa: 0 V 35 Kpa: 1.0 V • 55 Kpa: 2.0 V 80 Kpa: 3.0 V • 100 Kpa: 4.0 V 110 Kpa: 4.5 V - Replace the ECU.						o
P1106	Booster Pressure Sensor Malfunction	- Out of range of supply voltages about boost pressure sensor at Ignition key-On and Engine Stop (Higher than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages. • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction		o				

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1107	Barometric Sensor Circuit Short/GND Short	- Out of range about barometric sensor (short to ground). - Actual barometric pressure vs. Output voltages. • 15 Kpa: 0 V 35 Kpa: 1.0 V • 55 Kpa: 2.0 V 80 Kpa: 3.0 V • 100 Kpa: 4.0 V 110 Kpa: 4.5 V - Replace the ECU.						
P1108	Barometric Sensor Circuit Short	- Out of range about barometric sensor (short to B+). - Actual barometric pressure vs. Output voltages. • 15 Kpa: 0 V 35 Kpa: 1.0 V • 55 Kpa: 2.0 V 80 Kpa: 3.0 V • 100 Kpa: 4.0 V 110 Kpa: 4.5 V - Replace the ECU.						
P1109	Booster Pressure Sensor Initial Check Fault	- Implausible signal values or range about boost pressure sensor at Engine running condition (Higher than specified values). - Check the supply voltage to sensor. - Actual boost pressure vs. Output voltages • Raw Signal Range: 0.545 ~ 2.490 bar • 0.4 bar: 0.6120 V • 1.4 bar: 2.6520 V • 2.4 bar: 4.6920 V - Check the sensor wiring harness (open, poor contact). - Visually check sensor and replace if required. - Replace the ECU if required. - Check whether existing or not about turbo boosting control malfunction (P1235) simultaneously. - If there is turbo boost control fault, Should be checked followings also; • Leakage before turbo system • Vacuum pump malfunction • Waste gate' solenoid valve • Turbo charger system defect or malfunction itself • Air inlet restriction • Exhaust system restriction						

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P110A	High HFM OBD diagnosis signal	- Air mass flow value from HFM is higher than air mass temperature and other control values. - Check the ECU wiring harness (open and poor contact). - Actual air mass flow vs. output voltages • -20 kg/h: 0.47 V • 0 kg/h: 0.99 V • 10 kg/h: 1.2226 ~ 1.2398 V • 15 kg/h: 1.3552 ~ 1.3778 V • 30 kg/h: 1.6783 ~ 1.7146 V • 60 kg/h: 2.1619 ~ 2.2057 V • 120 kg/h: 2.7215 ~ 2.7762 V • 250 kg/h: 3.4388 ~ 3.5037 V • 370 kg/h: 3.8796 ~ 3.9511 V • 480 kg/h: 4.1945 ~ 4.2683 V • 640 kg/h: 4.5667 ~ 4.6469 V - Replace the ECU if required.						o
P110B	Low HFM OBD diagnosis signal	- Air mass flow value from HFM is lower than air mass temperature and other control values. - Check the air cleaner condition and intake air leakage. - Check the ECU wiring harness (open and poor contact). - Actual air mass flow vs. output voltages • -20 kg/h: 0.47 V • 0 kg/h: 0.99 V • 10 kg/h: 1.2226 ~ 1.2398 V • 15 kg/h: 1.3552 ~ 1.3778 V • 30 kg/h: 1.6783 ~ 1.7146 V • 60 kg/h: 2.1619 ~ 2.2057 V • 120 kg/h: 2.7215 ~ 2.7762 V • 250 kg/h: 3.4388 ~ 3.5037 V • 370 kg/h: 3.8796 ~ 3.9511 V • 480 kg/h: 4.1945 ~ 4.2683 V • 640 kg/h: 4.5667 ~ 4.6469 V - Replace the ECU if required.						o

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1115	Coolant Temperature Sensor Malfunction	- Implausible values of coolant temperature (If the temperature is below the limits values after warm up). - If Fuel temperature is invalid, the previous coolant temperature is retained. - Check the supply voltage to sensor. - Actual air temp. vs. Resistance • 20°C: 2449 Ω • 50°C: 826.3 Ω • 80°C: 321.4 Ω • 100°C: 112.9 Ω - Check the wiring harness (open, short and poor contact). - Visually check the sensor and replace if required. - Check the thermostat, water pump radiator related coolant route (thermostat stuck). - Replace the ECU if required.						
P1120	Accelerator Pedal Sensor #1 Malfunction	- The potentiometer 1 is not plausible with potentiometer 2. - Check the supply voltage to sensor. - Check the wiring harness. - Check the accelerator pedal module. - Check the ECU wiring harness. - Replace the ECU if required.	o					o
P1121	Accelerator Pedal Sensor #2 Malfunction	- The potentiometer 1 is not plausible with potentiometer 2. - Check the supply voltage to sensor. - Check the wiring harness. - Check the accelerator pedal module. - Check the ECU wiring harness. - Replace the ECU if required.	o					o
P1122	Accelerator Pedal Sensor Malfunction (Limp Home Mode)	- When triggering limp home mode. - Check the supply voltage to sensor. - Check the wiring harness. - Check the accelerator pedal module. - Check the ECU wiring harness. - Replace the ECU if required.					o	o
P1123	Accelerator Pedal Sensor Malfunction (Torque Mode)	- When triggering reduced torque mode. - Check the supply voltage to sensor. - Check the wiring harness. - Check the accelerator pedal module. - Check the ECU wiring harness. - Replace the ECU if required	o					o

Modification basis	
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Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1124	Accelerator Pedal Sensor Malfunction - Stuck	- The accelerator pedal sensor is stuck. - Check the brake switch wiring harness and operations. - Check the accelerator pedal operations. - Check the accelerator pedal module. - Check the ECU wiring harness. - Replace the ECU if required.					o	o
P1148	Accelerometer (Knock Sensor) Learning Fault	- Check if the MDP is successful. - Check the accelerometer (knock sensor) sensor and wiring harness. - Replace the ECU if required.		o				
P1149	Too High Water Level in Fuel Filter	- Drain the water from fuel filter.		o				
P1149	Excessive water in fuel filter	- Drain water from the fuel filter.		o	Fuel warning lamp: OFF Water separator warning lamp ON			
P1170	Torque Trim Fault - High	- Refer to P0372.						
P1171	#1 Injector MDP Malfunction	- The #1 injector MDP is faulty. - Replace the injector and perform C2I/C3I coding again.						
P1172	#2 Injector MDP Malfunction	- The #2 injector MDP is faulty. - Replace the injector and perform C2I/C3I coding again.						
P1173	#3 Injector MDP Malfunction	- The #3 injector MDP is faulty. - Replace the injector and perform C2I/C3I coding again.						
P1174	#4 Injector MDP Malfunction	- The #4 injector MDP is faulty. - Replace the injector and perform C2I/C3I coding again.						
P1175	#5 Injector MDP Malfunction	- The #5 injector MDP is faulty. - Replace the injector and perform C2I/C3I coding again.						
P1190	Fuel Rail Pressure Sensor Initial Signal Fault	- The rail pressure sensor initial values are higher or lower than specified values with the ignition “ON”. • Maximum sensing values: 90 bar (Short) • Minimum sensing values: - 90 bar (Open) - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the sensor and ECU wiring harness. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	o					o

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1191	Pressure Build Up - Too Slow	- The pressure build up during cranking is too slow. - Check the IMV wiring harness. - Check the ECU wiring harness. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel lines. • Check the fuel level in fuel tank. • Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.						o
P1192	Fuel Rail Pressure Sensor Initial Signal Fault - Low	- The rail pressure sensor initial values are lower than specified values with the ignition “ON”. • Minimum sensing values: - 90 bar (Open) - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the sensor and ECU wiring harness. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	o					o

Modification basis	
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Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1193	Fuel Rail Pressure Sensor Initial Signal Fault - High	- The rail pressure sensor initial values are higher than specified values with the ignition "ON". • Maximum sensing values: 90 bar (Short) - Check the supply voltage to sensor. • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the sensor and ECU wiring harness. • Check the fuel rails and high pressure pipes for leaks. - Check the fuel rail pressure sensor. - Replace the ECU if required.	o					o
P1201	Injector #1 Circuit Short	- Injector #1 circuit malfunction: Short. • If the trouble recurs with the injector removed, replace the injector. Perform C2I/C3I coding and check again. • If the trouble does not recur, check the wiring harness between the injector and ECU. - Replace the ECU if required.						
P1202	Injector #2 Circuit Short	- Injector #2 circuit malfunction: Short. • If the trouble recurs with the injector removed, replace the injector. Perform C2I/C3I coding and check again. • If the trouble does not recur, check the wiring harness between the injector and ECU. - Replace the ECU if required.						
P1203	Injector #3 Circuit Short	- Injector #3 circuit malfunction: Short. • If the trouble recurs with the injector removed, replace the injector. Perform C2I/C3I coding and check again. • If the trouble does not recur, check the wiring harness between the injector and ECU. - Replace the ECU if required.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1204	Injector #4 Circuit Short	- Injector #4 circuit malfunction: Short. • If the trouble recurs with the injector removed, replace the injector. Perform C2I/C3I coding and check again. • If the trouble does not recur, check the wiring harness between the injector and ECU. - Replace the ECU if required.						
P1205	Injector #5 Circuit Short	- Injector #5 circuit malfunction: Short. • If the trouble recurs with the injector removed, replace the injector. Perform C2I/C3I coding and check again. • If the trouble does not recur, check the wiring harness between the injector and ECU. - Replace the ECU if required.						
P1234	VGT Operation Fault (High)	- The boost pressure control is faulty. - Check the air intake system. - Check the supply voltage to sensor. - Check the wiring harness and the ECU wiring harness. - Replace the ECU if required.	o					
P1235	VGT Operation Fault	- The boost pressure control is faulty. - Check the air intake system. - Check the supply voltage to sensor. - Check the wiring harness and the ECU wiring harness. - Replace the ECU if required.	o					o
P1252	Too High IMV Pressure	- The rail pressure is excessively high. - Check the IMV wiring harness. - Check the ECU wiring harness. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.						

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1253	Minimum Rail Pressure Control Malfunction (IMV Fault)	- Rail pressure faults: Too low - Check the IMV wiring harness. - Check the ECU wiring harness. - Check the high pressure fuel lines, fuel rails and high pressure pipes for leaks. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel pressure lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.						O
P1254	Maximum Rail Pressure Control Malfunction (IMV Fault)	- Rail pressure faults: Too high - Check the IMV wiring harness. - Check the ECU wiring harness. - Check the high pressure fuel lines, fuel rails and high pressure pipes for leaks. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel pressure lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.						O

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1256	Too Small Transfer Pressure Fuel in Rail Pressure System	- Rail pressure fault: IMV current trim too high, drift. - Check the IMV wiring harness. - Check the ECU wiring harness. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel pressure lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.						o
P1257	Too Large Transfer Pressure Fuel in Rail Pressure System	- Rail pressure fault: IMV current trim too high, drift. - Check the IMV wiring harness. - Check the ECU wiring harness. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel pressure lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.						o

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1258	Too Small High Pressure Fuel in Rail Pressure System	- Rail pressure fault: IMV current trim too high, drift. - Check the IMV wiring harness. - Check the ECU wiring harness. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.						o
P1259	Too Large High Pressure Fuel in Rail Pressure System	- Rail pressure fault: IMV current trim too high, drift. - Check the IMV wiring harness. - Check the ECU wiring harness. - Check the rail pressure sensor. • Supply voltage: 5 ± 0.1 V • Output voltage at 1600 bar: 4.055 ± 0.125 V • Output voltage at atmospheric pressure: 0.5 ± 0.04 V - Check the transfer pressure fuel lines. • Check the fuel level in fuel tank. Check the fuel system for air influx. • Check the fuel filter specification. - Check the high pressure fuel system. • Check the fuel rails and high pressure pipes for leaks. - Check the IMV resistance: 5.44 Ω • When out of specified value: replace high pressure pump and IMV - Replace the ECU if required.						o

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1260	Too high IMV Driving Current	- Abnormal rail pressure, IMV CURRENT TRIM TOO HIGH, DRIFT - Check the IMV wiring harnesses. - Check the ECU wiring harnesses. • Check ECU's pin A76 for open and short. - Check the Rail pressure sensor. • Supply voltage: 5 ± 0.1V • Output voltage at 1600 bar: 4.055 ± 0.125V • Output voltage at atmospheric pressure: 0.5 ± 0.04V - Check low-pressure fuel system. • Check fuel in fuel reservoir and air penetration. • Check fuel filter's specification. - Check high-pressure fuel system. • Check fuel rail and high-pressure pipe for leaks. - Check IMV's resistance (5.44 Ω). • If the resistance is out of specification, replace the high-pressure pump and IMV.						O
P1286	Low Resistance for Injector #1 wiring harness	- Out of range about wiring harness resistance for Injector #1. • Low: Less than 0.150 Ω (injector circuit open) - Check the injector #1 wiring harness and electric isolation. - Check the injector #1 wiring harness for open circuit. • If the pin in injector #1 is defective, replace injector #1 and perform C2I/C3I coding, then check again. • If the pin in injector #1 is not defective, check the ECU wiring harness. - Replace the ECU if required.						
P1287	High Resistance for Injector #1 wiring harness	- Out of range about wiring harness resistance for Injector #1. • High: More than 0.573 Ω (injector circuit short) - Check the injector #1 wiring harness and electric isolation. - Check the injector #1 wiring harness for short circuit. • If the trouble still exists after removing the injector connector, replace injector #1 and perform C2I/C3I coding, then check again. • If the trouble is fixed after removing the injector connector, check the wiring harness between ECU and injector. - Replace the ECU if required.						

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1288	Low Resistance for Injector #2 wiring harness	- Out of range about wiring harness resistance for Injector #2. • Low: Less than 0.150 Ω (injector circuit open) - Check the injector #2 wiring harness and electric isolation. - Check the injector #2 wiring harness for open circuit. • If the pin in injector #2 is defective, replace injector #2 and perform C2I/C3I coding, then check again. • If the pin in injector #2 is not defective, check the ECU wiring harness. - Replace the ECU if required.						
P1289	High Resistance for Injector #2 wiring harness	- Out of range about wiring harness resistance for Injector #2. • High: More than 0.573 Ω (injector circuit short) - Check the injector #2 wiring harness and electric isolation. - Check the injector #2 wiring harness for short circuit. • If the trouble still exists after removing the injector connector, replace injector #2 and perform C2I/C3I coding, then check again. • If the trouble is fixed after removing the injector connector, check the wiring harness between ECU and injector. - Replace the ECU if required.						
P1290	Low Resistance for Injector #3 wiring harness	- Out of range about wiring harness resistance for Injector #3. • Low: Less than 0.150 Ω (injector circuit open) - Check the injector #3 wiring harness and electric isolation. - Check the injector #3 wiring harness for open circuit. • If the pin in injector #3 is defective, replace injector #3 and perform C2I/C3I coding, then check again. • If the pin in injector #3 is not defective, check the ECU wiring harness. - Replace the ECU if required.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1291	High Resistance for Injector #3 wiring harness	- Out of range about wiring harness resistance for Injector #3. • High: More than 0.573 Ω (injector circuit short) - Check the injector #3 wiring harness and electric isolation. - Check the injector #3 wiring harness for short circuit. • If the trouble still exists after removing the injector connector, replace injector #3 and perform C2I/C3I coding, then check again. • If the trouble is fixed after removing the injector connector, check the wiring harness between ECU and injector. - Replace the ECU if required.						
P1292	Low Resistance for Injector #4 wiring harness	- Out of range about wiring harness resistance for Injector #4. • Low: Less than 0.150 Ω (injector circuit open) - Check the injector #4 wiring harness and electric isolation. - Check the injector #4 wiring harness for open circuit. • If the pin in injector #4 is defective, replace injector #4 and perform C2I/C3I coding, then check again. • If the pin in injector #4 is not defective, check the ECU wiring harness. - Replace the ECU if required.						
P1293	High Resistance for Injector #4 wiring harness	- Out of range about wiring harness resistance for Injector #4. • High: More than 0.573 Ω (injector circuit short) - Check the injector #4 wiring harness and electric isolation. - Check the injector #4 wiring harness for short circuit. • If the trouble still exists after removing the injector connector, replace injector #4 and perform C2I/C3I coding, then check again. • If the trouble is fixed after removing the injector connector, check the wiring harness between ECU and injector. - Replace the ECU if required.						

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1294	Low Resistance for Injector #5 wiring harness	- Out of range about wiring harness resistance for Injector #5. • Low: Less than 0.150 Ω (injector circuit open) - Check the injector #5 wiring harness and electric isolation. - Check the injector #5 wiring harness for open circuit. • If the pin in injector #5 is defective, replace injector #5 and perform C2I/C3I coding, then check again. • If the pin in injector #5 is not defective, check the ECU wiring harness. - Replace the ECU if required.						
P1295	High Resistance for Injector #5 wiring harness	- Out of range about wiring harness resistance for Injector #5. • High: More than 0.573 Ω (injector circuit short) - Check the injector #5 wiring harness and electric isolation. - Check the injector #5 wiring harness for short circuit. • If the trouble still exists after removing the injector connector, replace injector #5 and perform C2I/C3I coding, then check again. • If the trouble is fixed after removing the injector connector, check the wiring harness between ECU and injector. - Replace the ECU if required.						
P1405	EGR Solenoid Valve Malfunction - Short to ground	- Out of range about EGR gas: High. • EGR controller circuit: Open or short to ground - Check the EGR actuator wiring harness. - Check the supply voltage to EGR solenoid valve. - Check the EGR solenoid valve. - Check the EGR valve for stick. - Check the resistance of EGR actuator: 15.4 Ω. - Check the ECU wiring harness for open and short.		o				
P1406	EGR Solenoid Valve Malfunction - Short to +Batt	- Out of range about EGR gas: Low. • EGR controller circuit: Short to battery - Check the EGR actuator wiring harness. - Check the supply voltage to EGR solenoid valve. - Check the EGR solenoid valve. - Check the EGR valve for stick. - Check the resistance of EGR actuator: 15.4 Ω - Check the ECU wiring harness for open and short.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1407	Faulty EGR Close Position	- Causes • The EGR position is not closed when EGR is not operated within 50 seconds with the engine idling. - Check pin for the followings: • EEGR #1: Valve power (Main relay) • EEGR #2: Sensor (Reference voltage) ..... ECU #A33 • EEGR #4: Sensor (Ground) ..... ECU #A09 • EEGR #5: Valve drive (PWM) ..... ECU #A48 • EEGR #6: Sensor (Signal) ..... ECU #A82 - Actions • Check EEGR valve and sensor wiring. • Visually check the unit and replace if necessary. • Refer to DTCs (P0407 and P0408).						o
P1407	Throttle Valve Vacuum Modulator - Open/Short	- The vacuum modulator of throttle valve has an electrical problem. - The electric circuit has an open circuit. - The electric circuit has a short circuit to ground. - The electric circuit has a short circuit to battery.						
P1408	Poor EGR valve closing position (learn value not agreed)	- See P1407.						
P1409	EGR Valve Circuit Short	- Check pin for the followings: • The EEGR valve wiring is open. • EEGR Pin #1: Power(Main Relay) • EEGR Pin #5: ECU Pin #A48 - Actions • Check EEGR valve wiring. • Visually check the unit and replace if necessary. • Refer to DTCs (P0407 and P0408).						
P1430	CDPF - Soot Accumulated Over the Limit	- The recycling mode cannot be activated. - The pressure is over 23 Kpa for over 960 seconds due to the resistance by soot. - When the engine CHECK warning lamp flashes, drive the vehicle at over 50 km/h for 20 minutes so that the soot in CDPF is combusted.						Flashing

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1432	Torque Reduction Mode	- Operating condition : When the amount of soot is over the specified range (P1430 error stored) and the recycling mode cannot be operated (related error occurred), the torque reduction mode is activated so that the driver let the system inspected as soon as possible. - In operation: torque reduction, engine CHECK warning lamp ON						o
P1480	Condenser Fan #1 Circuit Malfunction - Open	- Condenser fan #1: Open - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. - If the forced operation is not available after replacing the relay, replace the ECU.						
P1481	Condenser Fan #1 Circuit Malfunction - Short	- Condenser fan #1: Short - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. - If the forced operation is not available after replacing the relay, replace the ECU.						
P1482	Condenser Fan #1 Circuit Malfunction - Short to Ground	- Condenser fan #1: Short to ground. - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. - If the forced operation is not available after replacing the relay, replace the ECU.						
P1500	Vehicle Speed Fault	- The vehicle speed signal through CAN communication is faulty. - Check the CAN communication line for open and short. - Check the ABS/ESP and TCU communication lines. - Check the ECU wiring harness. - Replace the ECU if required.						
P1501	Faulty Variant Coding (Vehicle Speed)	- If the vehicle sensor coding is set to YES (for vehicle with ABS), the vehicle speed input is faulty when the vehicle speed is below 15 km/h with the engine running at 1,600 rpm. - If the vehicle sensor coding is set to NO (for vehicle with CAN and ABS/ESP), the corresponding DTC is not shown. - Check the vehicle speed sensor coding.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1503	Faulty Vehicle Speed Sensor Input	- If the vehicle sensor coding is set to YES (for vehicle with ABS), the amount of pulses of the speed pulse ring for vehicle speed detection is more than the specified value. - Specified pulse: 52 pulses/rev. - Check the vehicle speed sensor coding.						
P1526	Condenser Fan #2 Circuit Malfunction - Open	- Condenser fan #2: Open - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. - If the forced operation is not available after replacing the relay, replace the ECU.						
P1527	Condenser Fan #2 Circuit Malfunction - Short	- Condenser fan #2: Short - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. - If the forced operation is not available after replacing the relay, replace the ECU.						
P1528	Condenser Fan #2 Circuit Malfunction - Short to Ground	- Condenser fan #2: Short to ground - Check the relay and relay wiring harness. - Check the ECU wiring harness for open and short. - If the forced operation is not available after replacing the relay, replace the ECU.						
P1530	#1 Heater Operating Circuit - Open	- #1 heater circuit malfunction: Open. - Check the wiring harness for open. - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.						
P1531	#1 Heater Operating Circuit - Short	- #1 heater circuit malfunction: Short. - Check the wiring harness for short. - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.						

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1532	#1 Heater operating circuit - Short to Ground	- #1 heater circuit malfunction: Short to ground. - Check the wiring harness for short. - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.						
P1534	#2 Heater Operating Circuit - Open	- #2 heater circuit malfunction: Open. - Check the wiring harness for open. - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.						
P1535	#2 Heater Operating Circuit - Short	- #2 heater circuit malfunction: Short. - Check the wiring harness for short. - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.						
P1536	#2 Heater Operating Circuit - Short to Ground	- #2 heater circuit malfunction: Short to ground. - Check the wiring harness for short. - Check the heater relay operations. - If the forced operation is not available, replace the ECU. - Check the ECU wiring and replace the ECU if required.						
P1540	Air Conditioner Operating Circuit Fault - Open	- Check the air conditioner sensors and wiring harnesses. - Check the ECU wiring harness. - Check the ECU if required.						
P1541	Air Conditioner Operating Circuit Fault - Short	- Check the air conditioner sensors and wiring harnesses. - Check the ECU wiring harness. - Check the ECU if required.						
P1542	Air Conditioner Operating Circuit Fault - Short to Ground	- Check the air conditioner sensors and wiring harnesses. - Check the ECU wiring harness. - Check the ECU if required.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1564	Auto Cruise Switch Fault (power)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%						
P1565	Auto Cruise Switch Malfunction (Acceleration)	- The auto cruise accelerator switch or related wiring is malfunctioning.						
P1566	Auto Cruise Switch Malfunction (OFF)	- The auto cruise OFF switch or related wiring is malfunctioning.						
P1567	Auto Cruise Switch Malfunction (Return)	- The auto cruise switch or related wiring is malfunctioning.						
P1568	Auto Cruise Switch Fault (when accelerating)	- Auto cruise switch fault (accelerating)						
P1568	Auto Cruise Switch Malfunction (Deceleration)	- The auto cruise decelerator switch or related wiring is malfunctioning.						
P1569	Auto Cruise Switch Fault (when decelerating)	- Auto cruise switch fault (decelerating)						
P1569	Auto Cruise Switch Malfunction (Safety)	- The auto cruise safety switch or related wiring is malfunctioning.						
P1570	Auto Cruise Switch Fault (Signal)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%						

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1571	Brake Lamp Signal Fault	- The brake pedal switch is faulty. • Brake pedal switch: Normal Close (NC) • Light switch: Normal Open (NO) • When operating the brake pedal switch, one signal (NO) is sent to auto cruise and the other (NC) is sent to brake lamp. - Check the brake pedal switch wiring harness. - Check the supply voltage to brake pedal switch (12 V). - Check the brake pedal switch for contact. - Check the ECU wiring harness (open, short, poor contact). - Replace the ECU if required.						
P1572	Brake Lamp Signal Fault	- The brake pedal switch or light switch is faulty. • Brake pedal switch: Normal Close (NC) • Light switch: Normal Open (NO) • When operating the brake pedal switch, one signal (NO) is sent to auto cruise and the other (NC) is sent to brake lamp. - Check the brake pedal and light switch wiring harness. - Check the supply voltage to brake pedal and light switch (12 V). - Check the brake pedal and light switch for contact. - Check the ECU wiring harness (open, short, poor contact). - Replace the ECU if required.						
P1573	Auto Cruise Switch Fault (short)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1578	Auto Cruise Switch Fault (Circuit Short)	- Applied to vehicle with auto cruise, occurred due to coding error for vehicle without auto cruise - Auto cruise switch SPEC • Reference voltage: 5V (ECU Pin #B11) • Switch signal: ECU Pin #B15 • Switch GND: ECU Pin #B16 • Switch signal voltage level * Resistance when accelerating: 220Ω ± 1% * Resistance when decelerating: 560Ω ± 1% * Resumed resistance: 1200Ω ± 1% * Resistance with switch OFF: 75Ω ± 1%						
P1600	ECU Shut Down Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.						o
P1601	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.						o
P1602	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.						o
P1603	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.						
P1604	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.						
P1605	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.						
P1606	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					o	o

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1607	ECU Injector Cut Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.						O
P1608	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.						O
P1614	ECU C2I/C3I/MDP Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O	O
P1615	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O	O
P1616	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O	O
P1620	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O	O
P1621	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O	O
P1622	ECU Fault	- The ECU is defective. - Check the chassis ground wiring harness. - Check the ECU. - Replace the ECU if required.					O	O

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P162D (former P1612)	Injector Bank #1 Malfunction - High Voltage 4-cylinder engine : 1nd and 4rd cylinders 5-cylinder engine : 1nd, 4rd and 3rd cylinders	- Malfunction of injector (#1, #4, #3) circuit (High): Short to Ground or to Battery. - Operating voltage: 6 ~ 18 V - Check the injector bank #1: Short and poor contact - Check if the trouble recurs with the injectors removed and the ignition key "OFF". • If recurred, check the injector and ECU wiring harness. - Check if the trouble recurs while installing the injectors one by one with the ignition key "ON". • If recurred, replace the injector (perform C2I/C3I coding after replacement). • Check the other injectors with same manner. - Check the ECU wiring harness. - Replace the ECU if required.						o
P162E (former P1619)	Injector Bank #2 Malfunction - High Voltage 4-cylinder engine : 2nd and 3rd cylinders 5-cylinder engine : 2nd and 5rd cylinders	- Malfunction of injector (#2, #5) circuit (High): Short to Ground or to Battery. - Operating voltage: 6 ~ 18 V - Check the injector bank #2: Short and poor contact - Check if the trouble recurs with the injectors removed and the ignition key "OFF". • If recurred, check the injector and ECU wiring harness. - Check if the trouble recurs while installing the injectors one by one with the ignition key "ON". • If recurred, replace the injector (perform C2I/C3I coding after replacement). • Check the other injectors with same manner. - Check the ECU wiring harness. - Replace the ECU if required.						o

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1630	Wrong response from Immobilizer (refer to immobilizer section)	- The invalid key is inserted or no communication between transponder and immobilizer (no response from transponder). - Perform the immobilizer coding again. - Check the ECU wiring harness. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.						
P1631	Immobilizer Fault (refer to immobilizer section)	- The immobilizer is not operating. - Perform the immobilizer coding again. - Check the ECU wiring harness. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.						
P1632	Immobilizer Fault (refer to immobilizer section)	- No response from immobilizer. - Perform the immobilizer coding again. - Check the ECU wiring harness. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.						
P1633	Immobilizer Fault (refer to immobilizer section)	- No key coding. - Perform the immobilizer coding again. - Check the ECU wiring harness. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1634	Immobilizer Fault (refer to immobilizer section)	- No response from immobilizer. - Perform the immobilizer coding again. - Check the ECU wiring harness. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna. - Replace the ECU if required.						
P1635	No response from Immobilizer (refer to immobilizer section)	- No response from immobilizer. - Perform the immobilizer coding again. - Check the ECU wiring harness. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna. - Replace the ECU if required.						
P1636	Immobilizer Fault (refer to immobilizer section)	- Severe trouble is not defined. - Perform the immobilizer coding again. - Check the ECU wiring harness. - Check the immobilizer unit for open and short or check the supply voltage. - Check the immobilizer antenna and transponder for damage. - Replace the ECU if required.						
P1650	AMF OBD Short to GND	- Short to GND						
P1657	Engine Mount Control Malfunction (Open)	- The wiring for engine mount level control is malfunctioning. - Standard level: - Operating condition:						
P1658	Engine Mount Control Malfunction (Short to B+)	- The wiring for engine mount level control is short to battery. - ECU pin No. 23, relay control - Engine speed : Over 1,200 rpm (30 km/h for vehicle speed)						
P1659	Engine Mount Control Malfunction (Short to GND)	- The wiring for engine mount level control is short to ground. - ECU pin No. 23, relay control - Engine speed : Over 1,200 rpm (30 km/h for vehicle speed)						

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1671	#3 Glow Plug Fault - Short	- The glow plug circuit is short. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P1671	#3 Glow Plug - Short Circuit (Applied for D27DT engine, Not applied for AQGS model)	D27DT: Preheat control relay - The glow plug has an short circuit. - Check the communication line between ECU and glow plug. - Check the glow plug wiring. - Check the resistance of glow plug. - Check the relay of glow plug. - Check the ECU wiring harness. - Replace the ECU if required. D27DTP: AQGS unit - NGK glow module (AQGS: Advanced Quick Glowing System) - Its condition is sent to ECU through CAN after detected by AQGS. - The AQGS has an electrical problem. - Diagnosis criteria of AQGS • Plug short circuit: voltage > 6V, current = 0A • Plug short circuit (GND): voltage = 0V • Plug short circuit (batt.): voltage = battery voltage • FET malfunction, FET short circuit (GND): voltage = 0V, current = 0A • Input voltage fault: 6V < input voltage < 16V • Communication fault: Abnormal data for over 1 second - Actions • Check the glow plug for malfunction (measuring its resistance). • Check the connector and wiring. • Visually check the glow plug. • Replace the glow plug if required. • Check the CAN line. • Check the IG1 power. • Check the battery power.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1672	#4 Glow Plug Fault - Short	- The glow plug circuit is short. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P1672	#4 Glow Plug - Short Circuit (Applied for D27DT engine, Not applied for AQGS model)	D27DT: Preheat control relay - The glow plug has an short circuit. - Check the communication line between ECU and glow plug. - Check the glow plug wiring. - Check the resistance of glow plug. - Check the relay of glow plug. - Check the ECU wiring harness. - Replace the ECU if required. D27DTP: AQGS unit - NGK glow module (AQGS: Advanced Quick Glowing System) - Its condition is sent to ECU through CAN after detected by AQGS. - The AQGS has an electrical problem. - Diagnosis criteria of AQGS • Plug short circuit: voltage > 6V, current = 0A • Plug short circuit (GND): voltage = 0V • Plug short circuit (batt.): voltage = battery voltage • FET malfunction, FET short circuit (GND): voltage = 0V, current = 0A • Input voltage fault: 6V < input voltage < 16V • Communication fault: Abnormal data for over 1 second - Actions • Check the glow plug for malfunction (measuring its resistance). • Check the connector and wiring. • Visually check the glow plug. • Replace the glow plug if required. • Check the CAN line. • Check the IG1 power. • Check the battery power.						

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1673	#5 Glow Plug Fault - Short	- The glow plug circuit is short. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1Ω - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P1673	#5 Glow Plug - Short Circuit (Applied for D27DT engine, Not applied for AQGS model)	D27DT: Preheat control relay - The glow plug has an short circuit. - Check the communication line between ECU and glow plug. - Check the glow plug wiring. - Check the resistance of glow plug. - Check the relay of glow plug. - Check the ECU wiring harness. - Replace the ECU if required. D27DTP: AQGS unit - NGK glow module (AQGS: Advanced Quick Glowing System) - Its condition is sent to ECU through CAN after detected by AQGS. - The AQGS has an electrical problem. - Diagnosis criteria of AQGS • Plug short circuit: voltage > 6V, current = 0A • Plug short circuit (GND): voltage = 0V • Plug short circuit (batt.): voltage = battery voltage • FET malfunction, FET short circuit (GND): voltage = 0V, current = 0A • Input voltage fault: 6V < input voltage < 16V • Communication fault: Abnormal data for over 1 second - Actions • Check the glow plug for malfunction (measuring its resistance). • Check the connector and wiring. • Visually check the glow plug. • Replace the glow plug if required. • Check the CAN line. • Check the IG1 power. • Check the battery power.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1674	#1 Glow Plug Fault - Short	- The glow plug circuit is short. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω. - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P1674	#1 Glow Plug - Short Circuit (Applied for D27DT engine, Not applied for AQGS model)	D27DT: Preheat control relay - The glow plug has an short circuit. - Check the communication line between ECU and glow plug. - Check the glow plug wiring. - Check the resistance of glow plug. - Check the relay of glow plug. - Check the ECU wiring harness. - Replace the ECU if required. D27DTP: AQGS unit - NGK glow module (AQGS: Advanced Quick Glowing System) - Its condition is sent to ECU through CAN after detected by AQGS. - The AQGS has an electrical problem. - Diagnosis criteria of AQGS –Plug short circuit: voltage > 6V, current = 0A –Plug short circuit (GND): voltage = 0V –Plug short circuit (batt.): voltage = battery voltage –FET malfunction, FET short circuit (GND): voltage = 0V, current = 0A –Input voltage fault: 6V < input voltage < 16V –Communication fault: Abnormal data for over 1 second - Actions –Check the glow plug for malfunction (measuring its resistance). –Check the connector and wiring. –Visually check the glow plug. –Replace the glow plug if required. –Check the CAN line. –Check the IG1 power. –Check the battery power.						

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1675	#2 Glow Plug Fault - Short	- The glow plug circuit is short. - Check the communication line between ECU and each glow plug. - Check each glow plug wiring harness. - Check the resistance of each glow plug: below 1 Ω - Check each glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P1675	#2 Glow Plug - Short Circuit (Applied for D27DT engine, Not applied for AQGS model)	D27DT: Preheat control relay - The glow plug has an short circuit. - Check the communication line between ECU and glow plug. - Check the glow plug wiring. - Check the resistance of glow plug. - Check the relay of glow plug. - Check the ECU wiring harness. - Replace the ECU if required. D27DTP: AQGS unit - NGK glow module (AQGS: Advanced Quick Glowing System) - Its condition is sent to ECU through CAN after detected by AQGS. - The AQGS has an electrical problem. - Diagnosis criteria of AQGS –Plug short circuit: voltage > 6V, current = 0A –Plug short circuit (GND): voltage = 0V –Plug short circuit (batt.): voltage = battery voltage –FET malfunction, FET short circuit (GND): voltage = 0V, current = 0A –Input voltage fault: 6V < input voltage < 16V –Communication fault: Abnormal data for over 1 second - Actions –Check the glow plug for malfunction (measuring its resistance). –Check the connector and wiring. –Visually check the glow plug. –Replace the glow plug if required. –Check the CAN line. –Check the IG1 power. –Check the battery power.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P1676	Glow Plug Communication Fault	- The communication between ECU and glow plug is faulty. - Check the communication line between ECU and glow plug. - Check the glow plug wiring harness. - Check the resistance of glow plug: below 1 Ω. - Check the glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P1677	Glow Plug Controller Fault	- The communication between ECU and glow plug is faulty. - Check the communication line between ECU and glow plug. - Check the glow plug wiring harness. - Check the resistance of glow plug: below 1Ω. - Check the glow plug relay. - Check the ECU wiring harness. - Replace the ECU if required.						
P1678	Glow Plug Malfunction - Open	- Glow plug circuit malfunction: Open. - Check the glow plug wiring harness for open. - Check the glow plug relay operations. - Check the glow plug power supply. - Check the ECU wiring and replace the ECU if required.						
P1679	Glow Plug Malfunction - Short	- Glow plug circuit malfunction: Short. - Check the glow plug wiring harness for open. - Check the glow plug relay operations. - Check the glow plug power supply. - Check the ECU wiring and replace the ECU if required.						
P1680	Glow Plug Malfunction - Short to Ground	- Glow plug circuit malfunction: Short to ground. - Check the glow plug wiring harness for open. - Check the glow plug relay operations. - Check the glow plug power supply. - Check the ECU wiring and replace the ECU if required.						

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<table>
<tr><th>DTC</th><th>Trouble</th><th>Help</th><th>Torque Reduc-tion (max.50%)</th><th>Torque Reduc-tion (max.20%)</th><th>Delayed Engine Stop</th><th>Immedi-ately Engine Stop</th><th>Limp Home Mode</th><th>Engine Check Warning Lamp</th></tr>
<tr><td>P1683</td><td>Defective CAN communiction of glow plug controller</td><td>- No GCU CAN signal
- Details: refer to P2673.</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>P2031</td><td>Front exhaust gas temperature sensor - faulty voltage supply</td><td>- The supplied voltage of the front exhaust gas temperature sensor is out of the specified range.
- Check the ECU terminal No. A30 for connecting the front exhaust gas temperature sensor as well as the sensor terminal No. 1.</td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
<tr><td>P2032</td><td>Front exhaust gas temperature sensor - low signal</td><td>- The signal value from the front exhaust gas temperature sensor is below the specified range.
- Check the ECU terminal No. A06 and A30 for connecting the front exhaust gas temperature sensor as well as the sensor terminal No. 1 and 2.
<table>
<tr><th>CDPF temperature (°C)</th><th>Resistance (Ω)</th></tr>
<tr><td>-40</td><td>169.18</td></tr>
<tr><td>-20</td><td>184.64</td></tr>
<tr><td>0</td><td>200.0</td></tr>
<tr><td>25</td><td>219.07</td></tr>
<tr><td>50</td><td>237.99</td></tr>
<tr><td>100</td><td>275.4</td></tr>
<tr><td>150</td><td>312.2</td></tr>
<tr><td>200</td><td>348.5</td></tr>
<tr><td>250</td><td>384.1</td></tr>
<tr><td>300</td><td>419.2</td></tr>
<tr><td>350</td><td>453.7</td></tr>
<tr><td>400</td><td>487.6</td></tr>
<tr><td>450</td><td>520.9</td></tr>
<tr><td>500</td><td>553.6</td></tr>
<tr><td>600</td><td>617.3</td></tr>
<tr><td>700</td><td>678.7</td></tr>
<tr><td>800</td><td>737.7</td></tr>
<tr><td>830</td><td>754.9</td></tr>
<tr><td></td><td>766.3</td></tr>
</table></td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
</table>

<table>
<tr><th>DTC</th><th>Trouble</th><th>Help</th><th>Torque Reduc-tion (max.50%)</th><th>Torque Reduc-tion (max.20%)</th><th>Delayed Engine Stop</th><th>Immedi-ately Engine Stop</th><th>Limp Home Mode</th><th>Engine Check Warning Lamp</th></tr>
<tr><td>P2033</td><td>Front exhaust gas temperature sensor - high signal</td><td>- The signal value from the front exhaust gas temperature sensor is over the specified range.
- Check the ECU terminal No. A06 and A30 for connecting the front exhaust gas temperature sensor as well as the sensor terminal No. 1 and 2.
<table>
<tr><th>CDPF temperature (°C)</th><th>Resistance (Ω)</th></tr>
<tr><td>-40</td><td>169.18</td></tr>
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</table></td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
<tr><td>P2080</td><td>Front exhaust gas temperature sensor - faulty signal</td><td>- The signal value from the front exhaust gas temperature sensor is over the specified range.
- See P2032 and P2033 for more information and inspection.</td><td></td><td></td><td></td><td></td><td></td><td>O</td></tr>
</table>

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<tr><td>P2081</td><td>Front exhaust gas temperature sensor - Abnormal response</td><td>- The value difference between the front exhaust gas temperature sensor on the exhaust manifold and the rear exhaust gas temperature sensor on the CDPF is out of the specified range.
- Measure the resistance of the exhaust gas temperature sensors by temperature and the supplied voltage.
- Check the ECU terminal No. A06 and A30 for connecting the front exhaust gas temperature sensor as well as the sensor terminal No. 1 and 2.
- Check the ECU terminal No. A23 and A42 for connecting the rear exhaust gas temperature sensor as well as the sensor terminal No. 1 and 2.
<table>
<tr><th>CDPF temperature (°C)</th><th>Resistance (Ω)</th></tr>
<tr><td>-40</td><td>169.18</td></tr>
<tr><td>-20</td><td>184.64</td></tr>
<tr><td>0</td><td>200.0</td></tr>
<tr><td>25</td><td>219.07</td></tr>
<tr><td>50</td><td>237.99</td></tr>
<tr><td>100</td><td>275.4</td></tr>
<tr><td>150</td><td>312.2</td></tr>
<tr><td>200</td><td>348.5</td></tr>
<tr><td>250</td><td>384.1</td></tr>
<tr><td>300</td><td>419.2</td></tr>
<tr><td>350</td><td>453.7</td></tr>
<tr><td>400</td><td>487.6</td></tr>
<tr><td>450</td><td>520.9</td></tr>
<tr><td>500</td><td>553.6</td></tr>
<tr><td>600</td><td>617.3</td></tr>
<tr><td>700</td><td>678.7</td></tr>
<tr><td>800</td><td>737.7</td></tr>
<tr><td>830</td><td>754.9</td></tr>
<tr><td>850</td><td>766.3</td></tr>
</table></td><td></td><td></td><td></td><td></td><td></td><td>o</td></tr>
<tr><td>P2100</td><td>Throttle Drive Circuit Short</td><td>- Perform the diagnosis when the ignition is turned on.
- Defective intake throttle drive circuit (ECU pin #A75, A77)
- Check pin (refer to P213C).
- Sensor specification: Refer to P213C.
- Actions
• Check the throttle valve and sensor wiring harnesses.
• Visually check the unit and replace if necessary.</td><td></td><td>o</td><td></td><td></td><td></td><td></td></tr>
</table>

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P2101	Throttle Drive Ground Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.		O				
P2102	Throttle Drive Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.		O				
P2103	Throttle Drive Battery Short	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.		O				
P2104	Throttle Drive Overheat	- Perform the diagnosis when the ignition is turned on. - Defective intake throttle drive circuit (ECU pin #A75, A77) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.		O				

Modification basis	
Application basis	
Affected VIN	

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P213B	Abnormal Throttle Control	- Causes • The difference between throttle position demand (MAP) and throttle position feedback signal is out of +5% or -13%. - Defective throttle control (P213B) - Defective throttle signal (P213C, P213D) - Defective throttle drive (P2103, P2101, P2102, P2104, P2100) - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.		o				
P213C	Low Throttle Signal	- Causes • The throttle valve position sensor signal is stuck low. - Check pin for the followings: • Throttle valve #1: sensor (Power) ..... ECU #A20 • Throttle valve #2: sensor (Signal) ..... ECU #A22 • Throttle valve #3: sensor (GND) ..... ECU #A81 • Throttle valve #4: valve (Positive) ..... ECU #A75 • Throttle valve #5: valve (Positive) ..... ECU #A77 - Sensor & Motor SPEC • Motor * Power: 12 V * Max. current : 6.8A (Normal: 3.6 ~ 0.2) * Motor resistance: 4.3Ω • Sensor * Power: 5 V - Actions • Check the throttle valve and sensor wiring harnesses. (The signal output of throttle valve is below than 0.24 V.) • Visually check the unit and replace if necessary.		o				
P213D	High Throttle Signal	- Causes • The throttle valve position sensor signal is stuck high. - Check pin (refer to P213C). - Sensor specification: Refer to P213C. - Actions • Check the throttle valve and sensor wiring harnesses. • Visually check the unit and replace if necessary.		o				

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P213E	Abnormal power to throttle position sensor * Torque reduced by 30 % for K2006 engine	See P213C.		o				
P213F	Throttle position sensor malfunction * Torque reduced by 30 % for K2006 engine	See P213C.		o				
P2428	Exhaust gas temperature sensor (T3) - high value (over 830°C for over 10 sec.)	- If the value of the exhaust gas temperature sensor on CDPF is over 830°C for over 10 seconds, the corresponding DTC is generated to protect the CDPF system. - Check the front exhaust gas temperature sensor.		- Perform the forced regeneration with SCAN-100. - Replace the T3 sensor. - Check the muffler (in case of power drop).				o
P2429	Exhaust gas temperature sensor (T3) (over 850°C for over 2 sec.)	- If the value of the exhaust gas temperature sensor on CDPF is over 850°C for 2 seconds, the corresponding DTC is generated to protect the CDPF system. - Check the front exhaust gas temperature sensor.		- Perform the forced regeneration with SCAN-100. - Replace the T3 sensor. - Check the muffler (in case of power drop).				o
P242F	Change Interval for CDPF Filter - Warning	- The vehicle is driven for approx. 500,000 km (CDPF change interval).						o
P2452	Differential pressure sensor - faulty voltage supply	- The power supplied to the differential pressure sensor is abnormal. - Check the ECU wiring harness (open circuit and poor contact). • Check the output voltage at ECU pin No. A05. • Check the supplied power between the ECU pin No. A05 and sensor terminal No. 3.						o
P2453	Differential pressure sensor - input signal fault (front and rear input ports installed reversely)	- The hose for the differential pressure sensor and the pipe for CDPF are reversely connected.						o
P2454	Differential pressure sensor - low output value	- The ECU detects that the pressure difference between the front and rear input ports of differential pressure sensor is lower than the ECU mapping value.		- Check the differential pressure sensor connector.				o
P2455	Differential pressure sensor - high output value	- The ECU detects that the pressure difference between the front and rear input ports of differential pressure sensor is higher than the ECU mapping value.		- Check the differential pressure sensor connector.				o

Modification basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P2456	Differential pressure sensor - input signal fault (clogging)	- Damaged or clogged differential pressure sensor input port and hoses - The differential pressure sensor assembly is integrated with the hose and pipe and is connected to the CDPF connecting pipe. Therefore, check if these hoses and pipes are clogged or damaged.						
P2458	CDPF - Pressure Leakage	- There is pressure leakage at front or rear side of CDPF. - The pressure is dropped below -15 Kpa for over 10 seconds due to soot.						O
P2459	Regeneration mode - overtime	- When CDPF regeneration process is performed due to the pressure difference between the front and rear of the differential pressure sensor, the post injection period is increased if the temperature value from the rear exhaust gas temperature sensor is low. On the other hand, if the the temperature value from the rear exhaust gas temperature sensor is high, the post injection period is shortened. If the exhaust gas temperature is low due to slow driving, etc. during CDPF regeneration, the regeneration process cannot be completed (if the initial 5 regeneration processes took over 1200 seconds at vehicle speed below 100 km). - If this occurs repeatedly and the exhaust gas is not regenerated, an excessive amount of soot may be accumulated. - If a DTC related to this problem is generated, clear it and drive the vehicle at 50-60 km/h for approx. 15-20 minutes to complete the regeneration process. - If the same DTC is still present, check the rear exhaust gas temperature sensor electrically.			- Check the differential pressure sensor. - Replace the DPF.			O

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P2671	#3 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						
P2672	#4 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						

Modification basis	
Application basis	
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DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P2673	#5 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						
P2674	#1 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						

DTC	Trouble	Help	Torque Reduction (max.50%)	Torque Reduction (max.20%)	Delayed Engine Stop	Immediately Engine Stop	Limp Home Mode	Engine Check Warning Lamp
P2675	#2 Glow Plug Short (Battery)	- NGK glow module (AQGS: Advanced Quick Glowing System) - It is detected by AQGS which then sends the message to ECU through CAN. - The electrical problem is occurred in AQGS. - Diagnosis criteria in AQGS • Plug short: voltage > 6V, current = 0A • Plug short (GND): voltage = 0V • Plug short (battery): voltage = Battery voltage • FET defective, FET short (GND): voltage = 0V, current = 0A • Abnormal input voltage: 6V < input voltage < 16V • Abnormal communication: Communication error for over 1 sec., abnormal data - Actions • Check glow plug for defect (measure the resistance of unit). • Check the connector and wiring harnesses. • Visually check the unit. • Replace the unit if necessary. • Check the CAN line. • Check the IG1 voltage. • Check the battery voltage.						
P3040	ECU Internal Malfunction	- The internal sector of ECU is malfunctioning.						
P3041	ECU Internal Malfunction	- The internal sector of ECU is malfunctioning.						

Modification basis	
Application basis	
Affected VIN	

BRAKE

0000-00

DIAGNOSIS

1. BRAKE..... 3

BRAKE

0000-00

DIAGNOSIS

1. BRAKE

Fault code	Defects	Application			Service hint
		ABS	ABD	ASR	
01	No defects	0	0	0	-
02	ECU	0	0	0	Internal fault of ECU. Replace the ECU.
03	Front/left speed sensor (defective wiring)	0	0	0	1. Check resistance between wiring harness and wheel speed sensor : 1.280KW - 1.920KW. 2. Check for wire ground and B+ OPEN. 3. If there is no defect on above, replace sensor.
04	Front/right speed sensor (defective wiring)	0	0	0	1. Check resistance between wiring harness and wheel speed sensor : 1.280KW - 1.920KW. 2. Check for wire ground and B+ OPEN. 3. If there is no defect on above, replace sensor.
05	Rear/left speed sensor (defective wiring)	0	0	0	1. Check resistance between wiring harness and wheel speed sensor : 1.280KW - 1.920KW. 2. Check for wire ground and B+ OPEN. 3. If there is no defect on above, replace sensor.
06	Rear/right speed sensor (defective wiring)	0	0	0	1. Check resistance between wiring harness and wheel speed sensor : 1.280KW - 1.920KW. 2. Check for wire ground and B+ OPEN. 3. If there is no defect on above, replace sensor.
07	Front/left speed sensor (defective wiring)	0	0	0	1. Check that connector pin arrangement on the relevant wire is correct. 2. Check for wire ground and B+ open. 3. Check air gap between wheel rotor and wheel speed sensor : 0.377 - 1.229 mm. 4. Check proper contact of wheel speed sensor connector and ECU connector. 5. Check sensor output voltage while shaking wiring harness by turning wheel 1/2 to 1 revolution per second (Voltage should be over 70mV when checked by multimeter and over 120mV/P-P when checked by oscilloscope). 6. If there is no defect on above, replace sensor.
08	Front/right speed sensor (abnormal signal)	0	0	0	1. Check that connector pin arrangement on the relevant wire is correct. 2. Check for wire ground and B+ open. 3. Check air gap between wheel rotor and wheel speed sensor : 0.377 - 1.229 mm. 4. Check proper contact of wheel speed sensor connector and ECU connector. 5. Check sensor output voltage while shaking wiring harness by turning wheel 1/2 to 1 revolution per second (Voltage should be over 70mV when checked by multimeter and over 120mV/P-P when checked by oscilloscope). 6. If there is no defect on above, replace sensor.
09	Rear/left speed sensor (abnormal signal)	0	0	0	1. Check that connector pin arrangement on the relevant wire is correct. 2. Check for wire ground and B+ open. 3. Check air gap between wheel rotor and wheel speed sensor : 0.369 - 1.213 mm. 4. Check proper contact of wheel speed sensor connector and ECU connector. 5. Check sensor output voltage while shaking wiring harness by turning wheel 1/2 to 1 revolution per second (Voltage should be over 70mV when checked by multimeter and over 120mV/P-P when checked by oscilloscope). 6. If there is no defect on above, replace sensor.

Fault code	Defects	Application			Service hint
		ABS	ABD	ASR	
10	Rear/right speed sensor (abnormal signal)	0	0	0	1. Check that connector pin arrangement on the relevant wire is correct. 2. Check for wire ground and B+ open. 3. Check air gap between wheel rotor and wheel speed sensor : 0.369 - 1.213mm 4. Check proper contact of wheel speed sensor connector and ECU connector. 5. Check sensor output voltage while shaking wiring harness by turning wheel 1/2 to 1 revolution per second (Voltage should be over 70mV when checked by multimeter and over 120mV/P-P when checked by oscilloscope). 6. If there is no defect on above, replace sensor.
11	Wheel rotor teeth	0	0	0	1. This code will appear if a wheel rotor teeth of four wheels is defective. 2. Check the teeth number of wheel rotor and condition.
13	Front/left inlet valve	0	0	0	1. If this code appear together with the items related with valve relay failure, check the items related with valve failure first and repair defective causes. 2. Check each valve using a over-riding function of tester on sole noid valve diagnosis function. 3. Replace hydraulic modulator.
14	Front/left outlet valve	0	0	0	↑
15	Front/right inlet valve	0	0	0	↑
16	Front/right outlet valve	0	0	0	↑
17	Rear/left inlet valve	-	0	0	↑
18	Rear/left outlet valve	-	0	0	↑
19	Rear/right inlet valve	-	0	0	↑
20	Rear/right outlet valve	-	0	0	↑
17	Rear axle inlet valve	0	-	-	↑
18	Rear axle outlet valve	0	-	-	↑
21	Switching valve	-	0	0	1. If this code appear together with the items related with valve relay failure, check the items related with valve failure first and repair defective causes. 2. Check each valve using a over-riding function of tester on sole noid valve diagnosis function. 3. Check contact of ECU and hydraulic modulator connectors and terminals. 4. Check terminals for open or short (When connector is removed). 5. Replace hydraulic modulator if there is no defect on above.

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Fault code	Defects	Application			Service hint
		ABS	ABD	ASR	
22	Shut-off valve	-	0	0	1. If this code appear together with the items related with valve relay failure, check the items related with valve failure first and repair defective causes. 2. Check each valve using a over-riding function of tester on solenoid valve diagnosis function. 3. Check contact of ECU and hydraulic modulator connectors and terminals. 4. Check terminals for open or short (When connector is removed). 5. Replace hydraulic modulator if there is no defect on above.
24	Motor relay/ return pump	0	0	0	1. Check using a over-riding function of tester on pump motor diagnosis function 2. Check resistance between pump motor ground terminal and battery negative terminal : less than 15mW. 3. Check body ground point. 4. Check relay coil internal resistance:40-80W. 5. Replace hydraulic modulator if there is no defect on above.
27	Stop lamp switch	0	0	0	1. Check using stop lamp switch diagnosis function from sensor value output function of tester. 2. Check contact of stop lamp switch terminals on ECU connector. 3. Check other wires for open and short (more than 80% of ECU supply voltage). 4. Check stop lamp switch function and replace if defective (when switch knob (plunger) is pressed by 3mm, resistance between each switch end will be infinite and if not pressed, it will be less than 200mW). 5. Voltage on No.11 when brake pedal is depressed : 11-14V Voltage on No.4 when brake pedal is released : 11-14V
28	Battery voltage low	0	0	0	1. Check battery voltage. 2. Check resistance between relevant voltage terminal of connector and each battery terminal (positive & negative). 3. Check that normal voltage is applied on each pin on connector when ignition switch is turned 'ON' or 'OFF'. 4. Check 10A and 60A fuses for ABS. 5. Replace hydraulic modulator if there is no defect on above.
30	CAN signal (TCU)	-	-	0	1. Check related CAN line for open, short. 2. Check poor contact of related CAN connector. 3. ECU is defective, replace ECU .
31	EMS (Engine)	-	-	0	1. Check related CAN line for open, short. 2. Check poor contact of related CAN connector. 3. ECU is defective, replace ECU . 4. Check EMS using special tool of self-diagnosing.
33	CAN communication	-	-	0	1. Check related CAN line for open, short. 2. Check poor contact of related CAN connector. 3. ECU is defective, replace ECU .
34	Brake over heating	0	0	0	

<table>
<tr><th>Function</th><th>Defective Components</th><th>Trouble Code</th><th>Descriptions</th><th colspan="2">System</th></tr>
<tr><td rowspan="4">Sensor Monitoring</td><td>Front LH
Wheel speed sensor</td><td>C1011 (5011)
C1012 (5012)</td><td>Wheel speed sensor front left-electrical
Wheel speed sensor front left-other</td><td>ABS</td><td>ESP</td></tr>
<tr><td colspan="3">1. C1011 (5011)
<u>Cause</u>
- Defective front LH wheel speed sensor
- Short or poor contact wire to sensor
<u>Action</u>
- Check the wheel speed sensor connector
- Check HECU connector
- Check the harness connection
2. C1012 (5012)
<u>Cause</u>
- Defective front LH wheel speed sensor
- No signals from wheel speed sensor and tooth wheel
- Too large air gap between wheel speed sensor and tooth wheel
- Different number of teeth in tooth wheel
<u>Action</u>
- Check the wheel speed sensor connector
- Check HECU connector
- Check air gap and tooth wheel mounting (Specified air gap: 0.335 ~ 0.945 mm)
- Check the number of teeth (48) in tooth wheel</td><td>O</td><td>O</td></tr>
<tr><td>Front RH
Wheel speed sensor</td><td>C1021 (5021)
C1022 (5022)</td><td>Wheel speed sensor front right-electrical
Wheel speed sensor front right-other</td><td></td><td></td></tr>
<tr><td colspan="3">1.C1021 (5021)
<u>Cause</u>
- Defective front RH wheel speed sensor
- Short or poor contact wire to sensor
<u>Action</u>
- Check the wheel speed sensor connector
- Check HECU connector
- Check the harness connection
2.C1022 (5022)
<u>Cause</u>
- Defective front RH wheel speed sensor
- No signals from wheel speed sensor and tooth wheel
- Too large air gap between wheel speed sensor and tooth wheel
- Different number of teeth in tooth wheel
<u>Action</u>
- Check the wheel speed sensor connector and HECU connector
- Check air gap and tooth wheel mounting (Specified air gap: 0.335 ~ 0.945 mm)
- Check the number of teeth (48) in tooth wheel</td><td>O</td><td>O</td></tr>
</table>

Modification basis	
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<table>
<tr><th>Function</th><th>Defective Components</th><th>Trouble Code</th><th>Descriptions</th><th colspan="2">System</th></tr>
<tr><td rowspan="4">Sensor Monitoring</td><td>Rear RH
Wheel speed sensor</td><td>C1031 (5031)
C1032 (5032)</td><td>Wheel speed sensor rear left-electrical
Wheel speed sensor rear left-other</td><td>ABS</td><td>ESP</td></tr>
<tr><td colspan="3">1. C1031 (5031)
<u>Cause</u>
- Defective rear RH wheel speed sensor
- Short or poor contact wire to sensor
<u>Action</u>
- Check the wheel speed sensor connector
- Check the HECU connector
- Check the harness connection

2. C1032 (5032)
<u>Cause</u>
- Defective rear RH wheel speed sensor
- No signals from wheel speed sensor and tooth wheel
- Too large air gap between wheel speed sensor and tooth wheel
- Different number of teeth in tooth wheel
<u>Action</u>
- Check the wheel speed sensor connector
- Check the HECU connector
- Check air gap and tooth wheel mounting (Specified air gap: 0.309 ~ 0.958 mm)
- Check the number of teeth (48) in tooth wheel</td><td>O</td><td>O</td></tr>
<tr><td>Rear LH
Wheel speed sensor</td><td>C1041 (5041)
C1042 (5042)</td><td>Wheel speed sensor rear left-electrical
Wheel speed sensor rear left-other</td><td></td><td></td></tr>
<tr><td colspan="3">1. C1041 (5041)
<u>Cause</u>
- Defective rear LH wheel speed sensor
- Short or poor contact wire to sensor
<u>Action</u>
- Check the wheel speed sensor connector
- Check the HECU connector
- Check the harness connection

2. C1042 (5042)
<u>Cause</u>
- Defective rear LH wheel speed sensor
- No signals from wheel speed sensor and tooth wheel
- Too large air gap between wheel speed sensor and tooth wheel
- Different number of teeth in tooth wheel
<u>Action</u>
- Check the wheel speed sensor connector and HECU connector
- Check air gap and tooth wheel mounting (Specified air gap: 0.309 ~ 0.958 mm)
- Check the number of teeth (48) in tooth wheel</td><td>O</td><td>O</td></tr>
</table>

<table>
<tr><th>Function</th><th>Defective Components</th><th>Trouble Code</th><th>Descriptions</th><th colspan="2">System</th></tr>
<tr><td rowspan="6">Sensor Monitoring</td><td>Pressure sensor</td><td>C1051 (5051)</td><td>Defective input sensor</td><td>ABS</td><td>ESP</td></tr>
<tr><td colspan="3"><u>Cause</u>
- Abnormal signals from pressure sensor
- Defective pressure sensor or harness
<u>Action</u>
- Check the pressure sensor connector</td><td>X</td><td>O</td></tr>
<tr><td>Steering wheel angle sensor</td><td>C1061 (5061)</td><td>Defective steering wheel angle sensor</td><td></td><td></td></tr>
<tr><td colspan="3"><u>Cause</u>
- Internally defective steering wheel angle sensor
- Abnormal signals from steering wheel angle sensor
- Short circuit between supplying voltage output and ground
- Abnormal signal voltage from steering wheel angle sensor
- Poor installation of steering wheel angle sensor and abnormal signal
<u>Action</u>
- Check the supplying voltage: (Specified voltage: 9 ~ 16 V)
- Check the output voltage: Check voltage between ESP unit terminals with ignition ON
• ST1 voltage check: between ESP unit terminal No. 5 and ground (Specified voltage: 1.3 ~ 4.1V)
• ST2 voltage check: between ESP unit terminal No. 2 and ground (Specified voltage: 1.3 ~ 4.1V)
• STN voltage check: between ESP unit terminal No.12 and ground (Specified voltage: 1.3 ~ 4.1V)</td><td>X</td><td>O</td></tr>
<tr><td>Sensor cluster</td><td>C1073 (5073)
C1074 (5074)</td><td>Sensor cluster -electrical
Sensor cluster-internal</td><td></td><td></td></tr>
<tr><td colspan="3">1. C1073 (5073)
<u>Cause</u>
- Operating voltage exceeds specified range (Hi: 18.0 ± 1.0 V / Lo: 6.5 ± 0.5 V)
- Poor contact or installation of harness
<u>Action</u>
- Check the sensor cluster connector
- Replace the sensor cluster
2. C1074 (5074)
<u>Cause</u>
- Internally defective HECU
- Abnormal A/D converter voltage: 5.0 ± 3 %
- Abnormal supplying voltage (4.580 ~ 4.960 V) to sensor cluster
→ Short circuit between supplying voltage output of sensor cluster and ground
- Poor ground of sensor cluster (0.0 ~ 0.5 V)
→ Short to ground on sensor cluster
- Abnormal signals from lateral acceleration sensor
- Abnormal signals from yawing sensor
- Poor installation of sensor
- Defective sensor cluster
- Defective or short circuit of CAN communication line
<u>Action</u>
- Replace the sensor</td><td>X</td><td>O</td></tr>
</table>

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Function	Defective Components	Trouble Code	Descriptions	System	
Battery Voltage Monitoring	**Battery**	C1101 (5101) C1102 (5102)	Battery under voltage Battery over voltage	**ABS**	**ESP**
	1. C1101 (5101) **Cause** - Low voltage out of specified range (9.7 ± 0.3 V) **Action** - Check the supplying voltage **2. C1102 (5102)** **Cause** - Over voltage out of specified range (18.0 ± 1.0 V) **Action** - Check the supplying voltage			O	O
Brake Monitoring	**Brake disc**	C1111 (5111)	Disk temperature is high		
	Cause - Overheated brake disk due to braking force: over 500°C **Action** - Stop driving for a period of time after turning off the ESP			X	O
	Brake lamp switch **ESP OFF switch**	C1201 (5201) C1202 (5202)	Defective brake lamp switch Defective ESP OFF switch		
	1. C1201 (5201) **Cause** - Mechanical defective in brake switch - Defective brake switch harness **Action** - Check the harness and connector **2. C1202 (5202)** **Cause** - Mechanical defective in ESP OFF switch - Defective ESP OFF switch harness (short to ground) **Action** - Check the harness and connector for ESP OFF switch			X	O
Valve Monitoring	**Valve, valve relay**	C1301 (5301)	Defective valve, valve relay in HECU		
	Cause - Abnormal supplying voltage to valve solenoid - Internally defective HECU **Action** - Replace the HECU - Check the battery voltage - Check the HECU connector			O	O

Function	Defective Components	Trouble Code	Descriptions	System	
Pump Monitoring	**Motor pump**	C1302 (5302)	Defective motor pump	**ABS**	**ESP**
	Cause - Too low (below 6.0 V) or no supplying voltage to pump motor - Over 0.93 V from pump motor voltage - Poor contact in pump motor connector - Poor ground **Action** - Check the supplying voltage - Check the HECU connector - Replace the HECU			**O**	**O**
HECU and Sensor Monitoring	**HECU**	C1401 (5401)	HECU hardware		
	Cause - Internally defective HECU - Defective A/D converter, internal voltage regulator, and controller - Defective sensor and short to supplying voltage line - Abnormal temperature sensor signal **Action** - Replace the HECU			**O**	**O**
	Sensor initialization	C1501 (5501)	Abnormal sensor initialization		
	Cause - Abnormal signals from sensors - Abnormal sensor data **Action** - Check the sensors - Initialize the sensors			**O**	**O**
	Vehicle coding	C1170 (5170)	Variant coding error, or misinstallation HECU		
	Cause - Discrepancy between HECU coding and vehicle coding - Defective CAN communication line - Misinstallation HECU **Action** - Check the HECU coding and vehicle coding - Perform vehicle coding - Replace the exact HECU - Check engine ECU variant coding			**(O)**	**O**

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Function	Defective Components	Trouble Code	Descriptions	System	
	CAN communication	C1601 (5601)	CAN communication error	**ABS**	**ESP**
	Cause - Short or open to CAN communication line - Poor connection of CAN communication line **Action** - Check the CAN communication line - Check the HECU connector			**(O)**	**O**
	CAN communication	C1602 (5602) C1603 (5603) C1604 (5604) C1605 (5605)	Communication error between engine ECU and HECU Communication error between TCU and HECU Communication error between TCCU (4WD) and HECU Communication error between cluster (Meter) and HECU		
	1. C1602 (5602) **Cause** - Short to CAN communication line - Overload to CAN communication Action **Action** - Check the engine ECU - Check the CAN communication line - Check the engine ECU connector **2. C1603 (5603)** **Cause** - Short to CAN communication line - Overload to CAN communication Action **Action** - Check the TCU - Check the CAN communication line - Check the TCU connector **3. C1604 (5604)** **Cause** - Short to CAN communication line - Overload to CAN communication Action **Action** - Check the TCCU - Check the CAN communication line - Check the TCCU connector **4. C1605 (5605)** **Cause** - Short to CAN communication line - Overload to CAN communication Action **Action** - Check the cluster (meter) - Check the CAN communication line - Check the cluster (meter) connector			**X**	**O**

Function	Defective Components	Trouble Code	Descriptions	System	
CAN Communication Monitoring	**CAN signal error EMS**	C1612 (5612)	Signal from engine ECU is abnormal	**ABS**	**ESP**
	Cause - Engine ECU is defective - Signal from engine ECU error **Action** - Check engine ECU - Check ECU S/W version			**X**	**O**

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Possible Cause		Action	
Ignition "ON" Check warning lamp on I/P	Does the warning lamp blink at seven times for 7 seconds and then turn off?	Yes	System OK
		No	Connect the scan tool to diagnostic connector (ALDL). Select the fault code display menu and clear code menu.
	Does the fault code display on the scan tool display?	Yes	Perform "Diagnostic System Check".
		No	Check any fuse open. Replace fuse.
	Is there any open in fuse?	Yes	Disconnect wiring connector.
		No	Check any wiring short between fuse and wiring connector.
	Is there any short in fuse?	Yes	Repair wiring.
		No	Disconnect SDM wiring connector. Check wiring short between connector terminal and SDM connector terminal.
	Is there any short in wiring?	Yes	Replace airbag wiring.
		No	Check any open between ALDL connector No.4, No. 5 terminal and ground.
	Is there any open in wiring?	Yes	Repair wiring
		No	Ignition "ON" Measure voltage at the cigar lighter socket.
	Does the voltage indicate 11 ~ 14 V?	Yes	Check any open or short between ALDL connector terminal and wiring connector terminal.
		No	Repair the wiring of the cigar lighter socket.
	Is there any open or short in wiring?	Yes	Repair wiring
		No	Check any open or short between SDM connector terminal and wiring connector terminal.
	Is there any open or short in wiring?	Yes	Replace the airbag wiring.
		No	Replace the SDM.

Code	Fault Contents	Check
01h	Driver airbag circuit, resistance too high	Check the connection of the driver airbag connector. Check the wiring condition of the driver airbag. (including clock spring) Check the bending of the airbag terminal.
02h	Driver airbag circuit, resistance too low	Check the connection of the driver airbag connector. Check the wiring condition of the driver airbag. (including clock spring) Check the bending of the airbag terminal.
03h	Driver airbag circuit, short to ground	Check the connection of the driver airbag connector. Check the wiring condition of the driver airbag. (including clock spring) Check the bending of the airbag terminal.
04h	Driver airbag circuit, short to battery voltage	Check the connection of the driver airbag connector. Check the wiring condition of the driver airbag. (including clock spring) Check the bending of the airbag terminal.
05h	Passenger airbag circuit, resistance too high	Check the connection of the passenger airbag connector. Check the wiring condition of the passenger airbag. Check the bending of the airbag terminal.
06h	Passenger airbag circuit, resistance too low	Check the connection of the passenger airbag connector. Check the wiring condition of the passenger airbag. Check the bending of the airbag terminal.
07h	Passenger airbag circuit, short to ground	Check the connection of the passenger airbag connector. Check the wiring condition of the passenger airbag. Check the bending of the airbag terminal.
08h	Passenger airbag circuit, short to battery voltage	Check the connection of the passenger airbag connector. Check the wiring condition of the passenger airbag. Check the bending of the airbag terminal.
09h	Driver pretensioner circuit, resistance too high	Check the connection of the driver pretensioner connector. Check the wiring condition of the driver pretensioner. Check the bending of the airbag terminal.
0Ah	Driver pretensioner circuit, resistance too low	Check the connection of the driver pretensioner connector. Check the wiring condition of the driver pretensioner. Check the bending of the airbag terminal.
0Bh	Driver pretensioner circuit, short to ground	Check the connection of the driver pretensioner connector. Check the wiring condition of the driver pretensioner. Check the bending of the airbag terminal.
0Ch	Driver pretensioner circuit, short to battery voltage	Check the connection of the driver pretensioner connector. Check the wiring condition of the driver pretensioner. Check the bending of the airbag terminal.

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Code	Fault Contents	Check
0Dh	Passenger pretensioner circuit, resistance too high	Check the connection of the passenger pretensioner connector. Check the wiring condition of the passenger pretensioner. Check the bending of the airbag terminal.
0Eh	Passenger pretensioner circuit, resistance too low	Check the connection of the passenger pretensioner connector. Check the wiring condition of the passenger pretensioner. Check the bending of the airbag terminal.
0Fh	Passenger pretensioner circuit, short to ground	Check the connection of the passenger pretensioner connector. Check the wiring condition of the passenger pretensioner. Check the bending of the airbag terminal.
10h	Passenger pretensioner circuit, short to battery voltage	Check the connection of the passenger pretensioner connector. Check the wiring condition of the passenger pretensioner. Check the bending of the airbag terminal.
34h	Driver side airbag circuit, resistance too high	Check the connection of the driver side airbag connector. Check the wiring condition of the driver side airbag. Check the bending of the airbag terminal.
35h	Driver side airbag circuit, resistance too low	Check the connection of the driver side airbag connector. Check the wiring condition of the driver side airbag. Check the bending of the airbag terminal.
36h	Driver side airbag circuit, short to ground	Check the connection of the driver side airbag connector. Check the wiring condition of the driver side airbag. Check the bending of the airbag terminal.
37h	Driver side airbag circuit, short to battery voltage	Check the connection of the driver side airbag connector. Check the wiring condition of the driver side airbag. Check the bending of the airbag terminal.
38h	Passenger side airbag circuit, resistance too high	Check the connection of the passenger side airbag connector. Check the wiring condition of the passenger side airbag. Check the bending of the airbag terminal.
39h	Passenger side airbag circuit, resistance too low	Check the connection of the passenger side airbag connector. Check the wiring condition of the passenger side airbag. Check the bending of the airbag terminal.
3Ah	Passenger side airbag circuit, short to ground	Check the connection of the passenger side airbag connector. Check the wiring condition of the passenger side airbag. Check the bending of the airbag terminal.
3Bh	Passenger side airbag circuit, short to battery voltage	Check the connection of the passenger side airbag connector. Check the wiring condition of the passenger side airbag. Check the bending of the airbag terminal.
50h	Driver side airbag sensor, open/short to battery voltage	Check the connection of the driver side airbag sensor connector. Check the wiring condition of the driver side airbag sensor. Check the bending of the airbag terminal.
51h	Passenger side airbag circuit, short to ground	Check the connection of the driver side airbag sensor connector. Check the wiring condition of the driver side airbag sensor. Check the bending of the airbag terminal.

Code	Fault Contents	Check
52h	Communication malfunction of the driver side airbag	Check the connection of the driver side airbag sensor connector. Check the wiring condition of the driver side airbag sensor. Check the bending of the airbag terminal.
53h	Internal fault of the driver side airbag sensor	Check the connection of the driver side airbag sensor connector. Check the wiring condition of the driver side airbag sensor. Check the bending of the airbag terminal.
54h	Passenger side airbag sensor, open/short to battery voltage	Check the connection of the passenger side airbag sensor connector. Check the wiring condition of the passenger side airbag sensor. Check the bending of the airbag terminal.
55h	Passenger side airbag sensor, short to ground	Check the connection of the passenger side airbag sensor connector. Check the wiring condition of the passenger side airbag sensor. Check the bending of the airbag terminal.
56h	Communication malfunction of the passenger side airbag	Check the connection of the passenger side airbag sensor connector. Check the wiring condition of the passenger side airbag sensor. Check the bending of the airbag terminal.
57h	Internal fault of the passenger side airbag sensor	Check the connection of the passenger side airbag sensor connector. Check the wiring condition of the passenger side airbag sensor. Check the bending of the airbag terminal.
17h	Battery voltage too high	Check generator output voltage. Check the battery voltage. Check the bending of the airbag terminal.
18h	Battery voltage too low	Check generator output voltage. Check the battery voltage. Check the bending of the airbag terminal.
1Eh	SDM internal fault (Initialization fault)	Replace the SDM.
1Fh	SDM internal fault	Replace the SDM.

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Trouble Code	Defections	Action
1101	High battery voltage	• Check alternator output voltage. • Check battery condition (over 21.4 V for 16 seconds). • Check air bag unit terminals for damage.
1102	Low battery voltage	• Check alternator output voltage. • Check battery condition (below 7.2 V for 16 seconds, resumes when the voltage is normal level for 9.6 seconds) • Check air bag unit terminals for damage.
1103	Low communication voltage for curtain air bag sensor	• Check curtain air bag sensor connector. • Check curtain air bag sensor wiring. • Check air bag unit terminals for damage. • Check if curtain air bag sensor is short to battery voltage or ground. • Check if curtain air bag sensor is defective. • Check battery condition (below 10.6 V for 16 seconds, resumes when the voltage is normal level for 9.6 seconds).
1346	Driver's air bag circuit resistance is too high	• Check driver air bag connector. • Check driver air bag wiring (including clock spring). • Check air bag unit terminals for damage. • Resistance of squib: over 6.1 Ω
1347	Driver's air bag circuit resistance is too low	• Check driver air bag connector. • Check driver air bag connector (including clock spring). • Check air bag unit terminals for damage. • Resistance of squib: below 1.1 Ω
1348	Driver's air bag circuit is short to ground	• Check driver air bag connector. • Check driver air bag wiring (including clock spring). • Check air bag unit terminals for damage. • Resistance of Firing Loop: below 2 kΩ
1349	Drivers air bag circuit is short to battery voltage	• Check driver air bag connector. • Check driver air bag wiring (including clock spring). • Check the air bag unit terminals for damage. • Resistance of Firing Loop: below 2 kΩ
1352	Passengers air bag circuit resistance is too low	• Check passenger air bag connector. • Check passenger air bag wiring. • Check the air bag unit terminals for damage. • Resistance of squib: below 0.8 Ω
1353	Passengers air bag circuit resistance is too high	• Check passenger air bag connector. • Check passenger air bag wiring. • Check air bag unit terminals for damage. • Resistance of squib: over 4.0 Ω
1354	Passengers air bag circuit is short to ground	• Check passenger air bag connector. • Check passenger air bag wiring. • Check the air bag unit terminals for damage. • Resistance of Firing Loop: below 2 kΩ

Trouble Code	Defections	Action
1355	Passenger's air bag circuit is short to battery voltage	• Check passenger air bag connector. • Check passenger air bag wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 2 kΩ
1361	Driver's pretensioner circuit resistance is too high	• Check driver pretensioner connector. • Check driver pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: over 4.2 Ω
1362	Driver's pretensioner circuit resistance is too low	• Check driver pretensioner connector. • Check driver pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 0.8 Ω
1363	Driver's pretensioner circuit is short to ground	• Check driver pretensioner connector. • Check driver pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 2 kΩ
1364	Driver's pretensioner circuit is short to battery voltage	• Check driver pretensioner connector. • Check driver pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 2 kΩ
1367	Passenger's pretensioner circuit resistance is too high	• Check passenger pretensioner connector. • Check passenger pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: over 4.2 W
1368	Passenger's pretensioner circuit resistance is too low	• Check passenger pretensioner connector. • Check passenger pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 0.8 Ω
1369	Passenger's pretensioner circuit is short to ground	• Check passenger pretensioner connector. • Check passenger pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 2 kΩ
1370	Passenger's pretensioner circuit is short to battery voltage	• Check passenger pretensioner connector. • Check passenger pretensioner wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 2 kΩ
1378	Driver's curtain air bag circuit resistance is too high	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check the air bag unit terminals for damage. • Resistance of squib: over 4.3 Ω
1379	Driver's curtain air bag circuit resistance is too low	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check the air bag unit terminals for damage. • Resistance of squib: below 0.6 Ω

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Trouble Code	Defections	Action
1380	Driver's curtain air bag is short to ground	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 2 kΩ
1381	Driver's curtain air bag is short to battery voltage	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 2 kΩ
1382	Passenger's curtain air bag circuit resistance is too high	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance of squib: over 4.3 Ω
1383	Passenger's curtain air bag circuit resistance is too low	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance of squib: below 0.6 Ω
1384	Passenger's curtain air bag is short to ground	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 2 kΩ
1385	Passenger's curtain air bag is short to battery voltage	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 2 kΩ
1395	Air bag connector problem	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage.
1400	Driver's curtain air bag sensor problem	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage.
1401	Driver's curtain air bag sensor circuit is short to ground	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check the air bag unit terminals for damage. • Resistance: below 250 Ω
1402	Driver's curtain air bag sensor circuit is short to battery voltage	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 25 Ω
1409	Communication error in driver's curtain air bag	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage. • If the voltage drops below 10.6 V during normal system operation, the trouble code is generated. This trouble code is linked with B1 400, B1 401, B1 402, B1 414.

Trouble Code	Defections	Action
1414	Wrong driver's curtain air bag sensor	• Check driver curtain air bag connector. • Check driver curtain air bag wiring. • Check air bag unit terminals for damage.
1403	Passenger's curtain air bag sensor	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage.
1404	Passenger's curtain air bag sensor circuit is short to ground	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 250 Ω
1405	Passenger's curtain air bag sensor circuit is short to battery voltage	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage. • Resistance: below 25 Ω
1410	Communication error in passenger's curtain air bag	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check the air bag unit terminals for damage. • If the voltage drops below 10.6 V during normal system operation, the trouble code is generated. This trouble code is linked with B1 403, B1 404, B1 405, B1 415.
1415	Wrong driver's curtain air bag sensor	• Check passenger curtain air bag connector. • Check passenger curtain air bag wiring. • Check air bag unit terminals for damage.
1620	SDM internal fault	• Replace SDM.
1650	Frontal impact record	• Replace SDM.
1651	Driver's curtain air bag impact record	• Replace SDM.
1652	Passenger's curtain air bag impact record	• Replace SDM.
1657	Belt pretensioner operation record	• Replace SDM.
2500	Warning lamp error	• Check wiring to warning lamp. • Check warning lamp bulb. • Check SDM unit terminal.

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1. CCCS

Code	Malfunction	Help
0 X 01	Driver door lock knob does not lock	- Check the driver side door actuator - Check the sensor values • Driver side door open switch (STICS sensor value: No. 5) • Door lock switch (STICS sensor value: No. 21) • Driver door lock switch (STICS sensor value: No. 37) • Door lock switches other than the driver side door (STICS sensor value: No. 38) • Door lock (DICS-Main: No. 30) • Key lock (DICS-Main: No. 32) - Check the driver side door wires and connectors
0 X 02	Passenger door lock knob does not lock	- Check the passenger side door actuator - Check the sensor values • Passenger side door open switch (STICS sensor value: No. 6) • Door lock switch (STICS sensor value: No. 21) • Door lock switches other than the driver side door (STICS sensor value: No. 38) • Door lock (DICS-Sub: No. 3) • Key lock (DICS-Sub: No. 5) - Check the passenger side door wires and connectors
0 X 03	Rear door lock knob does not lock	- When one of the two rear seat door knobs is defective - Check the rear seat door actuator - Check the sensor values • Rear door knob switch (STICS sensor value: No. 7) • Rear right door open switch (STICS sensor value: No. 8) • Door lock switch (STICS sensor value: No. 21) • Rear door open switch (STICS sensor value: No. 23) • Door lock switches other than the driver side door (STICS sensor value: No. 38) • Door lock switch (DICS-Main sensor value: No. 32) • Key lock (DICS-Main sensor value: No. 32) • Door lock (DICS-Sub sensor value: No. 3) • Key lock (DICS-Sub sensor value: No. 5) - Check the rear door wires and connectors
0 X 04	Defective tail lamp auto off function (Battery save function)	- Check the tail lamp relay connector - Check the sensor values • Tail lamp switch (STICS sensor value: No. 3) • Tail lamp signal input status (STICS sensor value: No. 20) • Tail lamp relay (STICS sensor value: No. 47) - Check the tail lamp wires and connectors - The defective code of signals coming from ABS/ESP which senses the vehicle speed incorrectly due to the exterior noises - Current vehicle speed (STICS sensor value: No. 58)
0 X 05	Incorrect indication of the vehicle speed (Detects as over 300 km/h)	- Check the speed sensor connector - Check the other units (ABS) that use speed signal - Does not receive the vehicle speed signal from STICS when the ignition switch is turned off

Code	Malfunction	Help
0 X 06	Vehicle speed indicates over 0 km/h when the ignition switch is turned off	- Current vehicle speed (STICS sensor value: No. 58) - Check the speed sensor connector - Check the other units (ABS) that use speed signal
0 X 07	Tail lamp turns OFF without any signals when the tail lamp switch is turned on	- Check the tail lamp relay connector - Check the sensor values • Tail lamp switch (STICS sensor value: No. 3) • Tail lamp signal input status (STICS sensor value: No. 20) • Tail lamp relay (STICS sensor value: No. 47)
0 X 08	IGN 2 SW is detected as OFF when IGN 1 SW is ON	- Check the tail lamp wires and connectors - Check the sensor values • Key reminder switch (STICS sensor value: No. 13) • Ignition 1 switch (STICS sensor value: No. 17) • Ignition 2 switch (STICS sensor value: No. 18) • Ignition 1 switch (DICS-Main sensor value: No. 60) • Ignition 2 switch (DICS-Main sensor value: No. 59) • Key reminder (DICS-Main sensor value: No. 62)
0 X 09	Driver side door lock knob does not unlock	- Check the driver side door actuator - Check the sensor values • Door open switch (STICS sensor value: No. 5) • Door unlock switch (STICS sensor value: No. 22) • All door unlock switches (STICS sensor value: No. 39) • Key unlock (Main-DICS: No. 31) - Check the driver side door wires and connectors
0 X 0A	Passenger side door lock knob does not unlock	- Check the passenger side door actuator - Check the sensor values • Passenger side door open switch (STICS sensor value: No. 6) • Door unlock switch (STICS sensor value: No.22) • All door unlock switches (STICS sensor value: No. 39) • Key unlock (DICS-Main: No. 31) • Key unlock (Main-DICS: No. 04) - Check the driver side door wires and connectors
0 X 0B	Rear door lock knob does not unlock	- When one of the two rear seat door knobs is defective - Check the rear seat door actuator - Check the sensor values • Rear door knob switch (STICS sensor value: No. 7) • Rear right door open switch (STICS sensor value: No. 8) • Door unlock switch (STICS sensor value: No. 22) • Rear door open switch (STICS sensor value: No. 23) • All door unlock switches (STICS sensor value: No. 39) • Key unlock (DICS-Main sensor value: No. 31) • Key unlock (DICS-Sub sensor value: No. 4) - Check the rear seat door wires and connectors

No.	Input/ Output	Sensor value item	Information				Help
1	Input	Reverse lever detection	Not detected	GND	Detected	12 V	1. Sensor signal detects when the reverse gear signal in A/T equipped vehicle 2. Ground level when not operating 3. Battery level when operating 4. This signal is used when outside rearview mirror in DICS Main/Sub is linked with 5°C. It is linked only when the outside rearview mirror selection switch in DICS Main is not in center position.
2	Input	Driver side seatbelt switch	Unfasten	GND	Fastened	12 V	1. Switch signal checks the driver side seatbelt has been fastened 2. Ground level when unfastened 3. Battery level when fastened
3	Input	Tail lamp switch	OFF	12 V	ON	GND	1. Switch that turns ON or OFF tail lamp switch 2. Battery level when tail lamp switch is OFF 3. Ground level when tail lamp switch is ON
4	Input	Trunk lid open switch	Close	GND	Open	12 V	1. When equipped with PTL, no input data is transmitted from trunk lid open switch to STICS 2. Battery level when open 3. Ground level when close
5	Input	Front left door open switch	Close	12 V	Open	GND	1. Ground level when door is open 2. Battery level when door is close
6	Input	Front right door open switch	Close	12 V	Open	GND	1. Ground level when door is open 2. Battery level when door is close
7	Input	Rear door knob switch	Open	GND	Close	12 V	1. Operating conditions • When the central door lock and unlock function is in operation • When the doors are locked by the driver's door lock knob • When receiving signal from DICS via CAN communication in auto door lock/unlock operation at vehicle speed of 50 km/h. 2. Ground level when rear door knob is open 3. Battery level when rear door knob is close
8	Input	Rear right door open switch	Close	12 V	Open	GND	1. Ground level when door is open 2. Battery level when door is close
9	Input	Parking brake switch	Not operating	12 V	Operating	GND	1. Switch detects the parking brake engagement 2. Ground level when parking brake is engaged 3. Battery level when not operating
10	Input	Auto windshield wiper switch	OFF	12 V	ON	GND	1. Auto windshields wiper switch. No inputs to STICS when the vehicle is equipped with the rain sensor 2. Ground level when ON 3. Battery level when OFF
11	Input	Hood open switch	Close	12 V	Open	GND	1. Hood open detection switch 2. Ground level when open 3. Battery level when close

No.	Input/ Output	Sensor value item	Information				Help
12	Input	Trunk unlock switch	Not operating	GND	Operating	12 V	1. Switch detects the trunk lid unlock from the glove compartment • With the power trunk: Communication between PTL and CAN • Without the power trunk: Controlled by STICS 2. OFF: GND 3. ON: 12 V
13	Input	Key reminder switch	Not detected	GND	Detected	12 V	1. Key reminder detection switch 2. Battery level when operating 3. Ground level when not operating
14	Input	KEY ACC switch	Not detected	GND	Detected	12 V	1. Key accessory detection switch 2. Battery level when operating 3. Ground level when not operating
15	Input	Alternator switch	Not detected	GND	Detected	12 V	1. Alternator charging detection switch 2. Battery level when operating 3. Ground level when not operating
16	Input	P/N switch	Not detected	GND	Detected	12 V	1. Parking (P) or neutral (N) position of A/T detection switch 2. Battery level when operating 3. Ground level when not operating
17	Input	IGN1 switch	Not detected	GND	Detected	12 V	1. Ignition 1 detection switch 2. Battery level when operating 3. Ground level when not operating
18	Input	IGN2 switch	Not detected	GND	Detected	12 V	1. Ignition 2 detection switch 2. Battery level when operating 3. Ground level when not operating
19	Input	Windshield Wiper position switch	Not detected	12 V	Detected	GND	1. Windshield wiper position switch detects the wiper position when the operation stops. With the rain sensor equipped vehicle, no inputs are transmitted to STICS 2. Ground level when in the original position (operating) 3. Battery level when not operating 4. Cannot detect when equipped with the rain sensor
20	Input	Tail lamp operation signal	No input	12 V	Input	GND	1. Tail lamp operation signal (monitoring) is the function that detects the auto light operation of the tail lamp 2. With signal input 3. Without signal input
21	Input	Central door lock switch	Not detected	12 V	Detected	GND	1. Locking door knob switch (Can be detected when the lock switch is in operation) 2. Battery level during door unlock 3. Ground level during door lock
22	Input	Central door unlock switch	Not detected	12 V	Detected	GND	1. Unlocking door knob switch (Can be detected when the unlock switch is in operation) 2. Battery level during door lock 3. Ground level during door unlock

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No.	Input/ Output	Sensor value item	Information				Help
23	Input	Rear left door open switch	Close	12 V	Open	GND	1. Rear left door open switch 2. Ground level when door is open 3. Battery level when door is close
24	Input	Heating grid switch	Not detected	12 V	Detected	GND	1. Heating grid operation switch (Blink once when the switch is operated) 2. Battery level when not operating (OFF) 3. Ground level when operating (ON)
25	-	-	-	-	-	-	-
26	Input	Washer switch	OFF	GND	ON	12 V	1. Windshield washer operating switch When equipped with the rain sensor,no inputs are transmitted to STICS 2. Battery level when operating (ON) 3. Ground level when not operating (OFF)
27	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-
31	-	-	-	-	-	-	-
32		Armed mode operation	Operating	GND	Not operating	12 V	1. Informs on armed mode 2. Electrical signals cannot be found 3. Battery level when operating 4. Ground level when not operating
33	Output	Rear left P/WDW UP relay	Not operating	12 V	Operating	GND	1. Relay for raising the rear left power window (The value changes when it operates within DICS-Main) 2. Ground level when operating 3. Battery level when not operating
34	Output	Rear left P/WDW DN relay	Not operating	12 V	Operating	GND	1. Relay for lowering the rear left power window (The value changes when it operates within DICS-Main) 2. Ground level when operating 3. Battery level when not operating
35	Output	Rear right P/WDW UP relay	Not operating	12 V	Operating	GND	1. Relay for raising the rear right power window (The value changes when it operates within DICS-Main) 2. Ground level when operating 3. Battery level when not operating
36	Output	Rear right P/WDW DN relay	Not operating	12 V	Operating	GND	1. Relay for lowering the rear right power window (The value changes when it operates within DICS-Main) 2. Ground level when operating 3. Battery level when not operating
37	Output	Driver side door lock relay	Not operating	12 V	Operating	GND	1. Driver side door knob lock relay (Locks all doors) The value appears only when the relay is connected 2. Ground level when operating 3. Battery level when not operating

No.	Input/ Output	Sensor value item	Information				Help
38	Output	All door lock other than driver side	Not operating	12 V	Operating	GND	1. All door knob lock relays other than the driver side The value appears only when the relay is connected 2. Ground level when operating 3. Battery level during normal
39	Output	Driver side door unlock relay	Not operating	12 V	Operating	GND	1. All door knob unlock relays (Cannot operate with driver side lock knob) The value appears only when the relay is connected 2. Ground level when operating 3. Battery level when not operating
40	Output	Windshield wiper relay	Not operating	GND	Operating	12 V	1. Windshield wiper operation switch When equipped with the rain sensor, no inputs are transmitted to STICS 2. Battery level when operating 3. Ground level when not operating
41	Output	Siren operation	Not operating	12 V	Operating	GND	1. Siren operation signal 2. Ground level when operating 3. Battery level when not operating
42	Output	Parking brake headlamp	Not operating	12 V	Operating	GND	1. Parking brake headlamp 2. Ground level when operating 3. Battery level when not operating
43	Output	Buzzer operation	Not operating	12 V	Operating	GND	1. Buzzer operation 2. Ground level when operating 3. Battery level when not operating
44	Output	Door open headlamp	Not operating	12 V	Operating	GND	1. Door open and driving warning 2. Ground level when operating 3. Battery level when not operating
45	Output	Heating grid relay	Not operating	12 V	Operating	GND	1. Heating grid operation relay drive output 2. Ground level when operating 3. Battery level when not operating
46	Output	Hazard warning relay	Operating	GND	Not operating	12 V	1. Heating grid operation relay drive output (Operates when in armed mode) 2. Ground level when operating 3. Battery level when not operating
47	Output	Tail lamp relay	Not operating	12 V	Operating	GND	1. Tail lamp relay drive output (Blink once when operating the tail lamp switch) 2. Ground level when operating 3. Battery level when not operating
48	-	-	-	-	-	-	-
49	Output	Front left foot lamp	Not operating		Operating		1.Driver side foot lamp (Operating value delays as per dimming time) 2. Pulse signal between the battery and ground when operating. → Refer to operation signal STICS specifications

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No.	Input/ Output	Sensor value item	Information				Help
50	Output	Front right foot lamp	Not operating		Operating		1. Passenger side foot lamp (Operating value delays as per dimming time) 2. Pulse signal between the battery and ground when operating. → Refer to operation signal STICS specifications
51	Output	Rear foot lamp	Not operating		Operating		1. Rear door foot lamp (Operating value delays as per dimming time) 2. Pulse signal between the battery and ground when operating. → Refer to operation signal STICS specifications
52	Output	Room lamp	Not operating		Operating		1. Room lamp (Operating value delays as per dimming time) 2. Pulse signal between the battery and ground when operating. → Refer to operation signal STICS specifications
53	Output	Rheostat lamp	Not operating		Operating		1. Brightness changes according to the rheostat volume when the tail lamp is turned on 2. Pulse signal between the battery and ground when operating. Pulse width may change by 20% ~ 100% (based on GND). → Refer to operation signal STICS specifications
54	Output	Fixed rate dimming control	Not operating		Operating		1. Fixed rate dimming light (Operating value changes periodically) 2. Pulse signal between the battery and ground when operating. Pulse width maintains 50% of the duty rate. → Refer to operation signal STICS specifications
55	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-
57	-	-	-	-	-	-	-
58	Output	Current vehicle speed	A km/h				
59	Output	Dimming control	A%				Controls the dimming by 20 ~ 100%
60	Output	Windshield wiper operating resistance stages	A kohn				1. Windshield wiper volume value: 0 ~ 10 kΩ → Value between 0 ~ Vcc For the rain sensor equipped vehicle, no inputs are transmitted to STICS
61	Output	Intermittent time	A · 10 ms				1. The unit time of the windshield wiper intermittent intervals For the rain sensor equipped vehicle, no inputs are transmitted to STICS

Code	Malfunction	Help
0 X 21	Power window limiter switch open	- The inputs have more than 30 edge hall pulses under the limiter switch off recognized as the upper position condition during the power window up or down outputs - Check the limiter switch - Check the sensor values • Power window anti-trap (DICS-Main: No. 50) • Power window limiter switch (DICS-Main: No. 56)
0 X 22	Defective power window motor hall sensor	- When the power window motor is under load, the auto-stop orders the power window to disengage auto-up function regardless ON or OFF inputs (no pulse signals) - No inputs of hall pulse exceeding 700 milliseconds during the power window motor down outputs under the limiter switch OFF (the upper position of the window) conditions or no inputs of pulse exceeding 100 milliseconds during the up outputs under the limit switch ON (the lowest position of the window) conditions. - Replace the power window motor
0 X 23	Inactive key door lock actuator	- Check the driver side door actuator - Check the sensor value • Key lock (DICS-Main: No. 32)
0 X 24	Inactive key door unlock actuator	- Check the driver side door actuator • Check the method of the actuator operation - Check the sensor value • Key unlock (DICS-Main: No. 31)
0 X 25	Memory switch input during no mirror UP or DN input	- When the outside rearview mirror has no UP or DOWN sensor values, DICS-Main recognizes and disables the vehicle memory function. However, when the memory input has detected, it means the sensor is open-circuited or has different mirror has been installed. - Check the outside rearview mirror UP or DOWN sensor wires - Measure sensor values and check the accordance position • Internal DOWN switch of the outside rearview mirror (DICS-Main: No. 21) • Internal UP switch of the outside rearview mirror (DICSMain:No. 22) • Internal DOWN motor of the outside rearview mirror (DICS-Main: No. 37) • Internal UP motor of the outside rearview mirror (DICSMain:No. 38) • Internal sensor of the outside rearview mirror (DICS-Main: No. 49) • Internal operation of the outside rearview mirror (DICSMain:No. 53)
0 X 26	Memory switch input during no mirror LT or RT input	- When the outside rearview mirror has no LEFT or RIGHT sensor values, DICS-Main recognizes and disables the vehicle memory function. However, when the memory input has detected, it means the sensor is open-circuited or has different mirror has been installed. - Check the outside rearview mirror LEFT or RIGHT sensor wires. - Measure the sensor values and check the relevant position • Internal RIGHT switch of the outside rearview mirror (DICS-Main: No. 19) • Internal LEFT switch of the outside rearview mirror (DICSMain: No. 20) • Internal RIGHT motor of the outside rearview mirror (DICSMain: No. 35) • nternal LEFT motor of the outside rearview mirror (DICSMain: No. 36) • Internal sensor of the outside rearview mirror (DICS-Main: No. 49) • Internal operation of the outside rearview mirror (DICSMain: No. 53)
0 X 27	Defective auto-stop	- The window does not lower to the certain range when autostop is detected during the driver side window auto-up operation. - Check the power window motor wires - Measure the sensor values and check the relevant position • Power window anti-trap (DICS-Main: No. 50) • Replace the power window motor

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No.	Input/ Output	Sensor value item	Information				Help
1	Input	Rear left P/WDW UP S/W	Not operating		Operating		1. Switch the input signal to raise the rear left window 2. Internal input 3. Input signal transmits to STICS through CAN
2	Input	Front right P/WDW DN S/W	Not operating		Operating		1. Switch the input signal to lower the passenger's window 2. Internal input 3. Input signal transmits to DICS-Sub through CAN
3	Input	Front right P/WDW AUTO DN S/W	Not detected		Detected		1. Switch the input signal to lower the passenger's window automatically 2. Internal input 3. Input signal transmits to DICS-Sub through CAN
4	Input	Front right P/WDW UP S/W	Not operating		Operating		1. Switch the input signal to raise the passenger's window 2. Internal input 3. Input signal transmits to DICS-Sub through CAN
5	Input	Front left P/WDW DN S/W	Not operating		Operating		1. Switch the input signal to lower the driver side window 2. Internal input 3. DICS-Main has direct drive circuit
6	Input	Front left P/WDW AUTO DN S/W	Not detected		Detected		1. Switch the input signal to lower the driver side window automatically 2. Internal input 3. MICOM drives based on the signal
7	Input	Front left P/WDW UP S/W	Not operating		Operating		1. Switch input signal to raise the driver side window 2. Internal input 3. DICS-Main has direct drive circuit
8	Input	Front left P/WDW AUTO UP S/W	Not operating		Operating		1. Switch input signal to raise the driver side window automatically (operates only when the engine is running) 2. Internal input 3. MICOM drives based on the signal 4. When the obstruction is found (detects as hall pulse signal), the auto-stop engages the window to be lowered by 150 mm from its position
9	Input	Detecting driver's P/WDW detention	Not detected		Detected		1. Input signal of the motor protection is engaged by cutting the motor output when detects the increasing in currency when the motor is stopped at the lowest position of the driver side's window 2. Internal input
10	Input	Detecting 3 km/h of vehicle speed	Not detected		Detected		1. Input signal coming from STICS 2. Outside rearview mirrors will not fold when the signal comes on while outside rearview mirror is folding.

No.	Input/ Output	Sensor value item	Information				Help
11	Input	The driver side window status (limit switch)	Closed		Open		1. A signal that informs when the driver side window is opened. 2. When the window is at upper position, it is OFF (close) and when it's not in upper position by lowering, it is ON (open). 3. VCC 5 V level when window is opened: Operating 4. Ground level when window is closed: Not operating
12	Input	Easy access switch	Not operating		Operating		1. The steering column and electrical seat moves automatically during riding ON or OFF when this signal is ON. 2. Internal input 3. Input signal transmits to ESIMS and MSDOS through CAN
13	Input	P/WDW lock switch	Not operating		Operating		1. Only the driver side window is operational when this signal is ON. 2. Internal input 3. Input signal transmits to STICS and DICS Sub through CAN
14	Input	Rear right P/WDW DN S/W	Not operating		Operating		1. Switch input signal to lower the rear right window 2. Internal input 3. Input signal transmits to STICS through CAN
15	Input	Rear right P/WDW UP S/W	Not operating		Operating		1. Switch input signal to raise the rear right window 2. Internal input 3. Input signal transmits to STICS through CAN
16	Input	Rear left P/WDW DN S/W	Not operating		Operating		1. Switch input signal to lower the rear left window 2. Internal input 3. Input signal transmits to STICS through CAN
17	Input	Passenger side outside rearview mirror selection switch	Not detected		Detected		1. Signal that operates the driver side mirror, passenger side mirror and inside rearview mirror has selected the passenger side outside rearview mirror 2. Internal input 3. The signal transmits to DICS SUB and ESIMS through CAN
18	Input	Driver side outside rearview mirror selection switch	Not detected		Detected		1. Signal that operates the driver side mirror, passenger side mirror and inside rearview mirror has selected the passenger side outside rearview mirror 2. Internal input 3. When both left and right mirror selection signals are OFF, the signal selects inside rearview mirror and then ESIMS controls the inside rearview mirror 4. The signal transmits to DICS SUB and ESIMS through CAN

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No.	Input/ Output	Sensor value item	Information				Help
19	Input	Driver side outside rearview mirror right-turn switch	Not operating		Operating		1. Switch input to raise the mirror toward right 2. Internal input 3. This signal transmits to DICS SUB and ESIMS through CAN
20	Input	Driver side outside rearview mirror left-turn switch	Not operating		Operating		1. Switch input to move the mirror toward left 2. Internal input 3. This signal transmits to DICS SUB and ESIMS through CAN
21	Input	Driver side outside rearview mirror down switch	Not operating		Operating		1. Switch input to lower the mirror 2. Internal input 3. This signal transmits to DICS SUB through CAN
22	Input	Driver side outside rearview mirror up switch	Not operating		Operating		1. Switch input to raise the mirror upward 2. Internal input 3. This signal transmits to DICS SUB through CAN
23	Input	Driver side outside rearview mirror unfolding switch	Not operating		Operating		1. Switch input to unfold the mirror 2. Internal input 3. This signal transmits to DICS SUB through CAN
24	Input	Driver side outside rearview mirror folding switch	Not operating		Operating		1. Switch input to fold the mirror 2. Internal input 3. This signal transmits to DICS SUB through CAN
25	Input	Memory switch 3	Not detected		Detected		1. Signal that selects No. 3 memory position 2. When the memory switch is pressed for more than 2 seconds under P/N signal ON condition, MSDOS receives memorized position of the mirror through CAN and then moves the mirror to memorized position. 3. When the memory position switch is pressed after memory set switch input under the P/N signal ON condition, the current position value of the mirror (sensor value) transmits to MSDOS 4. Analog input when operating (about 3.8V) 5. VCC 5V when not operating
26	Input	Memory switch 2	Not detected		Detected		1. Signal that selects number 2 memory position 2. Analog input when operating (about 2.4V) 3. VCC 5V level when not operating
27	Input	Memory switch 1	Not detected		Detected		1. Signal that selects number 1 memory position 2. Analog input when operating (about 1.3V) 3. VCC 5 V level when not operating
28	Input	Memory stop switch	Not detected		Detected		1. Switch signal to stop the memory return 2. Ground level when operating 3. VCC 5 V level when not operating
29	Input	Memory SET switch	Not detected		Detected		1. Switch input to store the positions of the memory related mechanisms. When one of the memory switch among 3 is pressed after this signal, position value of the outside rearview mirrors will be transmitted to MSDOS through CAN 2. Analog input when operating (about 0V) 3. VCC 5 V level when not operating

No.	Input/ Output	Sensor value item	Information				Help
31	Input	Driver side door key unlock	Not operating		Operating		1. ON when the driver side door key fob is unlocked 2. Ground level when operating 3. VCC 5 V level when not operating
32	Input	Driver side door key lock	Not operating		Operating		1. ON when the driver side door key fob is locked 2. Ground level when operating 3. VCC 5 V level when not operating
33	Output	Driver side outside rearview mirror unfolding motor	Not operating		Operating		1. Unfolding operation of the driver side outside rearview mirror mottor 2. Battery level when operating 3. Ground level when not operating
34	Output	Driver side outside rearview mirror folding motor	Not operating		Operating		1. Folding operation of the driver side outside rearview mirror motor 2. Battery level when operating 3. Ground level when not operating
35	Output	Driver side outside rearview mirror right-turn motor	Not operating		Operating		Operates the driver side outside rearview mirror motor toward right
36	Output	Driver side outside rearview mirror left-turn motor	Not operating		Operating		Operates the driver side outside rearview mirror motor toward left
37	Output	Driver side outside rearview mirror down motor	Not operating		Operating		Operates the driver side outside rearview mirror motor down
38	Output	Driver side outside rearview mirror up motor	Not operating		Operating		Operates the driver side outside rearview mirror motor up
39	Output	Driver side P/WDW DN MTR	Not operating		Operating		1. Driver side power window motor down 2. Battery level when operating 3. Ground level when not operating
40	Output	Driver side P/WDW UP MTR	Not operating		Operating		1. Driver side power window motor up 2. Battery level when operating 3. Ground level when not operating
41	-	-	-	-	-	-	-
42	-	-	-	-	-	-	-
43	Output	Memory LED	Not operating		Operating		1. Indicates when the LED lamp blinks during the memory set or when the return operation is ON 2. 2 V level when operating 3. Ground level when not operating
44	Output	Output power (5V)	Not operating		Operating		1. 5 V of power supplies each of the power window switch, outside rearview mirror sensor and power window motor hall sensor 2. 5 V level when operating 3. Ground level when not operating
45	Output	Driver side outside rearview mirror operating power	Not operating		Operating		1. Supplying power for the mirror LED lamp 2. 5 V level when operating 3. Ground level when not operating
46	Output	Easy access LED	Not operating		Operating		1. LED lamp turns on when easy access switch is pressed and turns off when pressed again.

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No.	Input/ Output	Sensor value item	Information				Help
47	Output	Driver side P/WDW S/W LED					1. LED lamp for power window switch illumination
48	Output	Driver side P/WDW LOCK S/W LED					1. LED lamp turns on when the window lock button is pressed and turns off when pressed again.
49	Status	Yes or No of the driver side outside rearview mirror sensor					1. ON when the driver side outside rearview mirror has no sensor detected or sensor is open-circuited
50	Status	Anti-trap operation status					1. Anti-trap activates when the obstruction is found during auto-up operation of the driver side power window with ignition ON.
51	Status	Side rearview mirror time lag					1. Indicates the outside rearview mirror can be controlled for a certain period of time after ignition key has been removed.
52	Status	Power window time lag					1. Indicates the power window can be controlled for a certain period of time after ignition key has been removed.
53	Status	Possibility of the side rearview mirror operation					1. Indicates the mirror can be controlled when ignition key is in ACC or IGN 1 or when mirror is in time lag
54	Status	Possibility of the power window operation					1. Indicates the power windows can be controlled when ignition key is in IGN 1 or when power windows is in time lag
55	Status	Hall sensor malfunction					1. When the signal coming from a hall sensor in the power window is abnormal
56	Status	Limit switch malfunction					1. When the signal coming from a limit switch in the power window regulator is abnormal
57	Input (CAN)	Armed mode operation state					1. Receives the signal from STICS when the vehicle enters the armed mode by REKES by locking the door. REKES linked power window and outside rearview mirror operation is possible only under the armed status.
58	Input (CAN)	Key ACC power					1. Ignition key ACC status receives from STICS
59	Input (CAN))	IGN 2 power					1. Ignition key IGN 2 status receives from STICS
60	Input	IGN 1 power					1. Ignition key IGN 1 status receives from STICS or DICS receives directly
61	Input (CAN)	Alternator operation status					1. Status of the engine under starting receives from STICS
62	Input (CAN)	Key reminder switch					1. Receives from STICS and indicates when the ignition key is inserted
63	Input (CAN)	Input status of the P/N signals					1. Receives from STICS and indicates the P/N status of transmission
64	Input (CAN)	Input status of the reverse signal					1. Receives from STICS and indicates the reverse status of transmission
65	Input	Lateral sensor value of the driver side outside rearview mirror (HI)	Sensor value (increase or decrease by 1)				1. Vertical sensor upper value of the outside rearview mirror 2. Sensor value when turned right: Increase 3. Sensor value when turned left: Decrease

No.	Input/ Output	Sensor value item	Information	Help
66	Input	Lateral sensor value of the driver side outside rearview mirror (LOW)	Sensor value [value changes within 8 bit (1~255)]	1. Vertical sensor upper value of the outside rearview mirror 2. Sensor value when turned right: Increase 3. Sensor value when turned left: Decrease * HI value increases or decreases by 1 if exceeded 8 bit (1~255)
67	Input	Vertical sensor value of the driver side outside rearview mirror (HI)	Sensor value (increase or decrease by 1)	1. Lateral sensor upper value of the outside rearview mirror 2. Sensor value when moved up: Increase 3. Sensor value when moved down: Decrease
68	Input	Vertical sensor value of the driver side outside rearview mirror (LOW)	Sensor value [value changes within 8 bit (1~255)]	1. Lateral sensor upper value of the outside rearview mirror 2. Sensor value when moved up: Increase 3. Sensor value when moved down: Decrease * HI value increases or decreases by 1 when exceeds 8 bit (1~255)
69	Input	Software version		Indicates current software version

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Code	Malfunction	Help
0 X 07	Operates when power window is locked	- When the power window is locked, the window can be operated from the passenger side. (Passenger switch input during the control by DICS-Main while power window is locking) - Defective CAN communication
0 X 08	Door lock key actuator does not operate	- Check the passenger side door actuator • Check the method of actuator operation status - Check the sensor value • Key lock (DICS-Sub: No. 5)
0 X 09	Door unlock key actuator does not operate	- Check the passenger side door actuator • Checking the method of actuator operation status - Check the sensor value • Key unlock (DICS-Sub: No. 4)
0 X 0A	No mirror UP or DN inputs correspondence to the memory switch inputs	- When the outside rearview mirror has no UP or DOWN sensor values, DICS-Main recognizes and disables the vehicle memory function. However, when the memory input has detected, it means the sensor is open-circuited or has different mirror has been installed. - Check the outside rearview mirror UP or DOWN sensor wires - Measure the sensor values and check the relevant position • Internal DOWN motor of the outside rearview mirror (DICS-Sub: No. 13) • Internal UP motor of the outside rearview mirror (DICSSub: No. 14) • Internal sensor of the outside rearview mirror (DICS-Sub: No. 44)
0 X 0B	No mirror LEFT or RIGHT inputs correspondence to the memory switch inputs	- When the outside rearview mirror has no LEFT or RIGHT sensor values, DICS-Main recognizes and disables the vehicle memory function. However, when the memory input has detected, it means the sensor is open-circuited or has different mirror has been installed. - Check the outside rearview mirror LEFT or RIGHT sensor wires - Measure the sensor values and check the relevant position • Internal RIGHT motor of the outside rearview mirror (DICSSub: No. 11) • Internal LEFT motor of the outside rearview mirror (DICSSub: No. 12) • Internal sensor of the outside rearview mirror (DICS-Sub: No. 17)

No.	Input/ Output	Sensor value item	Information				Help
1	Input	Detecting passenger side P/WDW detention	Not operating		Operating		1. Input signal for the motor protection is transmitted. The motor output detects increasing current when the motor is stopped at the lowest position of the passenger side window. 2. Internal input
2	-	-	-	-	-	-	-
3	Input	Passenger side door lock knob	Not operating		Operating		1. Status of the door lock actuator monitors ring switch on(passenger side) door trim 2. Ground level when the lock is detected 3. VCC 5V level when the unlock is detected
4	Input	Passenger side door key unlock	Not operating		Operating		1. ON when the passenger side door key fob is unlocked 2. Ground level when operating (unlock) 3. VCC 5V level when not operating (lock)
5	Input	Passenger side door key lock	Not operating		Operating		1. ON when the passenger side door key fob is locked 2. Ground level when operating 3. VCC 5V level when not operating
6	Input	Front left P/WDW DN S/W	Not detected		Detected		1. Switch input signal to lower the passenger side window 2. DICS SUB drives directly with the circuit
7	Input	Front right P/WDW auto DN S/W	Not detected		Detected		1. Switch input signal to lower the passenger side window automatically 2. MICOM drives directly according to the above signal
8	Input	Front right P/WDW UP S/W	Not detected		Detected		1. Switch input signal to raise the passenger side window 2. DICS SUB drives directly with the circuit
9	Output	Passenger side outside rearview mirror unfolding MTR	Not detected		Detected		1. Motor operates the passenger side's outside rearview mirror to unfold
10	Output	Passenger side outside rearview mirror folding MTR	Close		Open		1. Motor operates the passenger side's outside rearview mirror to fold
11	Output	Passenger side outside rearview mirror left-turn MTR	Not operating		Operating		1. Motor operates the passenger side's outside rearview mirror towards right
12	Output	Passenger side outside rearview mirror right-turn MTR	Not operating		Operating		1. Motor operates the passenger side's outside rearview mirror towards left
13	Output	Passenger side outside rearview mirror down MTR	Not operating		Operating		1. Motor operates the passenger side's outside rearview mirror down
14	Output	Passenger side outside rearview mirror up MTR	Not operating		Operating		1. Motor operates the passenger side's outside rearview mirror up
15	Output	Passenger side P/WDW down MTR	Not operating		Operating		1. Passenger side's power window motor down 2. Battery level when operating 3. Ground level when not operating

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No.	Input/ Output	Sensor value item	Information				Help
16	Output	Passenger side P/ WDW up MTR	Not operating		Operating		1. Passenger side's power window motor up 2. Battery level when operating 3. Ground level when not operating
17	State	Yes or No of the passenger side outside rearview mirror sensor	Yes		No		1. ON when the passenger side's outside rearview mirror has no sensor or sensor is open-circuited
18	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-
20	Output	Output power (5V) VDD	Not operating		Operating		1. 5 V is supplied to the power window switch and outside rearview mirror sensor 2. 5 V of level when operating 3. Ground level when not operating
21	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-
23	Output	Passenger side P/ WDW SW LED Lamp	Not operating		Operating		1. LED lamp for the power window switch illumination (Value changes when the window is locked)
24	-	-	-	-	-	-	-
25	Input	Lateral sensor value of the driver side outside rearview mirror (HI)	Sensor value (increase or decrease by 1)				1. Lateral sensor upper value of the outside rearview mirror Sensor value when moves up: Increase Sensor value when moves down: Decrease
26	Input	Lateral sensor value of the driver side outside rearview mirror (LOW)	Sensor value [value changes within 8 bit (1~255)]				1. Lateral sensor lowers value of the outside rearview mirror Sensor value when moves up: Increase Sensor value when moves down: Decrease
27	Input	Vertical sensor value of the driver side outside rearview mirror (HI)	Sensor value (increase or decrease by 1)				1. Vertical sensor raises value of the outside rearview mirror Sensor value when turns right: Increase Sensor value when turns left: Decrease
28	Input	Vertical sensor value of the driver side outside rearview mirror (LOW)	Sensor value [value changes within 8 bit (1~255)]				1. Vertical sensor raises value of the outside rearview mirror Sensor value when turns right: Increase Sensor value when turns left: Decrease
29	Input	Software version					Indicates the current software version

Code	Malfunction	Help
0 X 61	Defective driver side seat sliding	• MSDOS continuously monitors the sensor values when the driver operates the seat sliding switch or when the memory return is in action. When the seat sliding operation is engaged but the sensor value remains unchanged, the seat motor sensor may be malfunction. • Measure the sensor values and check the relevant position Driver side seat slides-backward (MSDOS sensor value: No. 7) Driver side seat slides-forward (MSDOS sensor value: No. 8) Driver side seat backward slide motor (MSDOS sensor value: No. 15) Driver side seat forward slide motor (MSDOS sensor value: No. 16)
0 X 62	Defective driver side seat tilting	• MSDOS continuously monitors the sensor values when the driver operates the seat tilting or the memory return is in motion. When the seat tilting operation is engaged but the sensor value remains unchanged, the seat motor sensor may be malfunction. • Measure the sensor values and check the relevant position Driver side seat tilt-down (MSDOS sensor value: No. 5) Driver side seat tilt-up (MSDOS sensor value: No. 6) Driver side seat tilt-down motor (MSDOS sensor value: No. 13) Driver side seat tilt-up motor (MSDOS sensor value: No. 14)
0 X 63	Defective driver side seat height adjustment	• MSDOS continuously monitors the sensor values when the driver operates the seat height adjustment or the memory return is in motion. When the seat height adjustment operation is engaged but the sensor value remains unchanged, the seat motor sensor may be malfunction. • Measure the sensor values and check the relevant position Driver side seat height-lowers (MSDOS sensor value: No. 3) Driver side seat height-raises (MSDOS sensor value: No. 4) Driver side seat height-lowering motor (MSDOS sensor value: No. 11) Driver side seat height-raising motor (MSDOS sensor value: No. 12)

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Code	Malfunction	Help
0 X 64	Defective driver side seatback angle adjustment	• MSDOS continuously monitors the sensor values when the driver operates the seat reclining or the memory return is in motion. When the seat recline operation is engaged but the sensor value remains unchanged, the seat motor sensor may be malfunction. • Measure the sensor values and check the relevant position Driver side seatback angle-declination (MSDOS sensor value: No. 1) Driver side seatback angle-inclination (MSDOS sensor value: No. 2) Driver side seatback angle-declination motor (MSDOS sensor value: No. 10) Driver side seatback angle-inclination motor (MSDOS sensor value: No. 11)
0 X 65	No position data input from DICSMain	• When MSDOS sends memory setting order, all DICS_MAIN, DICS-SUB and ESIMS send the position data to MSDOS. If no position data has received from DICS_MAIN, then it will be recognized as an error. • Input data from a respective unit when resetting the memory switch • Check CAN communication between DICS_MAIN and MSDOS
0 X 66	No position data input from DICSSub	• When MSDOS sends memory setting order, all DICS_MAIN, DICS-SUB and ESIMS send the position data to MSDOS. If no position data has received from DICS_MAIN, then it will be recognized as an error. • Input data from a respective unit when resetting the memory switch • Check CAN communication between DICS_SUB and MSDOS
0 X 67	No position data input from ESIMS	• When MSDOS sends memory setting order, all DICS_MAIN, DICS-SUB and ESIMS send the position data to MSDOS. If no position data has received from DICS_MAIN, then it will be recognized as an error. • Input data from a respective unit when resetting the memory switch • Check CAN communication between ESIMS and MSDOS
0 X 68	No return data input from DICS-Main	• During the memory return, DICS_MAIN, DICS-SUB and ESIMS send the memory return operation signals continuously through CAN communication. MSDOS recognizes malfunction and then determines as an error when no data has been received from DICS_MAIN during the memory return. • Input data from a respective unit when operating the memory switch • Check CAN communication between DICS_MAIN and MSDOS • During the memory return, DICS_MAIN, DICS-SUB and ESIMS send the memory return operation signals continuously through CAN communication. MSDOS recognizes malfunction and then determines as an error when no data has been received from DICS_MAIN during the memory return.
0 X 69	No return data input from DICS-Sub	• Input data from a respective unit when operating the memory switch • Check CAN communication between DICS_SUB and MSDOS • During the memory return, DICS_MAIN, DICS-SUB and ESIMS send the memory return operation signals continuously through CAN communication. MSDOS recognizes malfunction and then determines as an error when no data has been received from ESIMS during the memory return.
0 X 70	No return data input from ESIMS	• Input data from a respective unit when operating the memory switch • Check CAN communication between ESIMS and MSDOS

No.	Input/ Output	Sensor value item	Information				Help
1	Input	Driver side seatback reverse switch	Not operating	Vcc	Operating	GND	• A driver operates the seat recliner (seatback angle adjustment) switch backward • Ground level when operating • Vcc level when not operating
2	Input	Driver side seatback forward switch	Not operating	Vcc	Operating	GND	• A driver operates the seat recliner (seatback angle adjustment) switch forward • Ground level when operating • Vcc level when not operating
3	Input	Driver side seat height down switch	Not operating	Vcc	Operating	GND	• A driver operates the seat height (rear part of the seat bottom) adjustment switch downward • Ground level when operating • Vcc level when not operating
4	Input	Driver side seat height up switch	Not operating	Vcc	Operating	GND	• A driver operates the seat height (rear part of the seat bottom) adjustment switch upward • Ground level when operating • Vcc level when not operating
5	Input	Driver side seat tilt-down switch	Not operating	Vcc	Operating	GND	• A driver operates the seat tilting (front part of the seat bottom) switch downward • Ground level when operating • Vcc level when not operating
6	Input	Driver side seat tilt-up switch	Not operating	Vcc	Operating	GND	• A driver operates the seat tilting (front part of the seat bottom) switch upward • Ground level when operating • Vcc level when not operating
7	Input	Driver side seat slide-backward switch	Not operating	Vcc	Operating	GND	• A driver operates the seat slide switch backward • Ground level when operating • Vcc level when not operating
8	Input	Driver side seat slide-forward switch	Not operating	Vcc	Operating	GND	• A driver operates the seat slide switch forward • Ground level when operating • Vcc level when not operating
9	Input	Driver side seatback declining MTR	Not operating	GND	Operating	12 V	• When the recliner (seatback) is moving backward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.

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No.	Input/ Output	Sensor value item	Information				Help
10	Output	Driver side seatback inclining MTR	Not operating	GND	Operating	12 V	• When the recliner (seatback) is moving forward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
11	Output	Driver side seat height down MTR	Not operating	GND	Operating	12 V	• When the seat height adjustment (rear part of the seat bottom) is moving downward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
12	Output	Driver side seat height up MTR	Not operating	GND	Operating	12 V	• When the seat height adjustment (rear part of the seat bottom) is moving upward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
13	Output	Driver side seat tilt-down MTR	Not operating	GND	Operating	12 V	• When the seat tilts (front part of the seat bottom) downward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.

No.	Input/ Output	Sensor value item	Information				Help
14	Output	Driver side seat tilt-up MTR	Not operating	GND	Operating	12 V	• When the seat tilts (front part of the seat bottom)upward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
15	Output	Driver side seat slide-backward MTR	Not operating	GND	Operating	12 V	• When the seat (forward/backward movement of seat) slides backward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
16	Output	Driver side seat slide-forward MTR	Not operating	GND	Operating	12 V	• When the seat (forward/backward movement of seat) slides forward • Battery level when operating • Ground level when not operating However, when the recliner motor is operated by the driver side switch operation, this information does not appear on the ECU. It is because the switch drives the motor directly. For more information, go to "Easy access and memory switch operation" where ECU internal software drives the motor directly.
17	Output	Driver side seat slide sensor value	Sensor value				• Sensor value when seat slides (forward or backward movement of the seat) is moving • Sensor value when moving forward: Increase • Sensor value when moving backward: Decrease
18	Input	Driver side seat tilting sensor value	Sensor value				• Sensor value when seat tilting (front part of the seat bottom) is moving • Sensor value when moving upward: Increase • Sensor value when moving downward: Decrease
19	Input	Driver side seat height sensor value	Sensor value				• Sensor value when seat height (rear part of the seat bottom) is moving • Sensor value when moving upward: Increase • Sensor value when moving downward: Decrease
20	Input	Driver side seatback sensor value	Sensor value				• Sensor value when seat recliner (seatback) is moving • Sensor value when moving forward: Increase • Sensor value when moving backward: Decrease

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Code	Malfunction	Help
0 X 81	Defective steering column tilt	- ESIMS continuously monitors the sensor values when the driver operates the steering column or the steering column is in motion. When the teering wheel column operation is engaged but the sensor value remains unchanged, the motor or the sensor may be malfunction. - Measure the sensor values and check the relevant position • Steering column tilt-up (ESIMS sensor value: No. 1) • Steering column tilt-down (ESIMS sensor value: No. 2) • Steering column tilt-up motor (ESIMS sensor value: No. 13) • Steering column tilt-down motor (ESIMS sensor value: No. 14)
0 X 82	Defective steering column telescope	- ESIMS continuously monitors the sensor values when the driver operates the steering column or the steering column is in motion. When the steering wheel column operation is engaged but the sensor value remains unchanged, the motor or the sensor may be malfunction. - Measure the sensor values and check the relevant position • Steering column tilt-up (ESIMS sensor value: No. 3) • Steering column tilt-down (ESIMS sensor value: No. 4) • Steering column tilt-up motor (ESIMS sensor value: No. 15) • Steering column tilt-down motor (ESIMS sensor value: No. 16)
0 X 83	Defective inside rearview mirror left or right movement	- ESIMS continuously monitors the sensor values when the driver adjusts the inside rearview mirror horizontally or the inside rearview mirror is in motion. When the inside rearview mirror horizontal operation is engaged but the sensor value remains unchanged, the motor or the sensor may be malfunction. - Measure the sensor values and check the relevant position • Inside rearview mirror moves right (ESIMS sensor value: No. 5) • Inside rearview mirror moves left (ESIMS sensor value: No. 6) • Inside rearview mirror left movement motor (ESIMS sensor value: No. 11) • Inside rearview mirror right movement motor (ESIMS sensor value: No. 12)
0 X 84	Defective inside rearview mirror up or down functions	- ESIMS continuously monitors the sensor values when the driver adjusts the inside rearview mirror vertically or the inside rearview mirror is in motion. When the inside rearview mirror vertical operation is engaged but the sensor value remains unchanged, the motor or the sensor may be malfunction. - Measure the sensor values and check the relevant position • Inside rearview mirror moves down (ESIMS sensor value: No. 7) • Inside rearview mirror moves up (ESIMS sensor value: No. 8) • Inside rearview mirror down movement motor (ESIMS sensor value: No. 10) • Inside rearview mirror up movement motor (ESIMS sensor value: No. 9)

No.	Input/ Output	Sensor value item	Information				Help
1	Input	Steering wheel tilt-up switch	Not operating	Vcc	Operating	GND	1. A driver operates the tilt switch at the steering column upward 2. Ground level when operating 3. Vcc level when not operating
2	Input	Steering wheel tilt-down switch	Not operating	Vcc	Operating	GND	1. A driver operates the tilt switch at the steering column downward 2. Ground level when operating 3. Vcc level when not operating
3	Input	Steering wheel telescope up switch	Not operating	Vcc	Detected	GND	1. A driver operates the telescopic switch on the steering column toward extract 2. Ground level when operating 3. Vcc level when not operating
4	Input	Steering wheel telescope down switch	Not operating	Vcc	Operating	GND	1. A driver operates the telescopic switch on the steering column toward retract 2. Ground level when operating 3. Vcc level when not operating
5	Input	Inside rearview mirror right moving switch	Not operating	Vcc	Operating	GND	1. A driver presses the right side of the mirror operation switch when the mirror selector switch is in the neutral position (center) (at this moment, the mirror can be adjusted) 2. Ground level when operating 3. Vcc level when not operating 4. When this switch is detected, the mirror moves right (*Note: The mirror operates when the ignition switch is in ACC or other position) 5. Receives CAN data from DICS-Main
6	Input	Inside rearview mirror left moving switch	Not operating	Vcc	Detected	GND	1. A driver presses the left part of the mirror operation switch when the mirror selector switch is in center position (at this moment, the mirror can be adjusted) 2. Ground level when operating 3. Vcc level when not operating 4. When this switch is detected, the mirror moves left (*Note: The mirror operates when the ignition switch is in ACC or other position) 5. Receives CAN data from DICS-Main
7	Input	Inside rearview mirror down moving switch	Not operating	Vcc	Operating	GND	1. A driver presses the lower part of the mirror operation switch when the mirror selector switch is in center position (at this moment, the mirror can be adjusted) 2. Ground level when operating 3. Vcc level when not operating 4. When this switch is detected, the mirror tilts down (*Note: The mirror operates if ignition switch is in ACC or more) 5. Receives CAN data from DICS-Main
8	Input	Inside rearview mirror up moving switch	Not operating	Vcc	Operating	GND	1. A driver presses the upper part of the mirror operation switch when the mirror selector switch is in center position (at this moment, the mirror can be adjusted) 2. Ground level when operating 3. Vcc level when not operating 4. When this switch is detected, the mirror tilts up (*Note: The mirror operates if ignition switch is in ACC or more) 5. Receives CAN data from DICS-Main

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No.	Input/ Output	Sensor value item	Information				Help
9	Output	Inside rearview mirror up motor	Not operating	GND	Operating	12 V	1. When the mirror (motor for vertical movement) is moving upward 2. Battery level when operating 3. Ground level when not operating
10	Output	Inside rearview mirror down motor	Not operating	GND	Operating	12 V	1. When the mirror (motor for vertical movement) is moving downward 2. Battery level when operating 3. Ground level when not operating
11	Output	Inside rearview mirror left moving motor	Not operating	GND	Operating	12 V	1. When the mirror (motor for vertical movement) is moving downward 2. Battery level when operating 3. Ground level when not operating
12	Output	Inside rearview mirror right moving motor	Not operating	GND	Operating	12 V	1. When the mirror (motor for horizontal movement) is moving right side 2. Battery level when operating 3. Ground level when not operating
13	Output	Steering wheel tilt-up motor	Not operating	GND	Operating	12 V	1. When the tilt motor on the steering column is moving upward 2. Battery level when operating 3. Ground level when not operating
14	Output	Steering wheel tilt-down motor	Not operating	GND	Operating	12 V	1. When the tilt motor on the steering column is moving downward 2. Battery level when operating 3. Ground level when not operating
15	Output	Steering wheel telescope up MTR	Not operating	GND	Operating	12 V	1. When the telescopic motor on the steering column is moving towards the driver 2. Battery level when operating 3. Ground level when not operating
16	Output	Steering wheel telescope down MTR	Not operating	GND	Operating	12 V	1. When the telescopic motor on the steering column is moving away from the driver 2. Battery level when operating 3. Ground level when not operating
17	Input	Steering wheel column tilting sensor	Sensor value				1. Sensor value when the tilt motor on the steering column is moving up/down 2. Sensor value when moving up: Decrease 3. Sensor value when moving down: Increase
18	Input	Steering wheel column telescope sensor	Sensor value				1. Sensor value when the telescopic motor on the steering column is moving up/down 2. Sensor value when moving long extraction : Decrease 3. Sensor value when moving short retraction : Increase
19	Input	Inside rearview mirror left and right movement sensor	Sensor value				1. Sensor value when the longitudinal motor in the mirror moves left or right 2. Sensor value when moving toward right: Increase 3. Sensor value when moving toward left: Decrease
20	Input	Inside rearview mirror up and down movement sensor	Sensor value				1. Sensor value when the vertical motor in the mirror moves up or down 2. Sensor value when moving upward: Increase 3. Sensor value when moving downward: Decrease

Memo

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DIAGNOSIS

1. SELF DIAGNOSIS

1) Starting Self Diagnosis

Turn the ignition switch to ON position and press OFF switch for more than 5 seconds within 10 seconds.

Check LED segments on the vacuum fluorescent display (VFD).



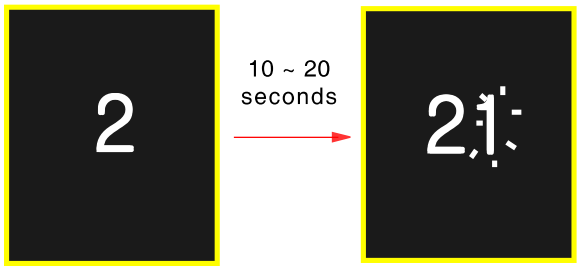
Press OFF switch more than 5 seconds.

2) Set in Trouble Diagnosis Step 2

In this step, check the air mix door and sensors for defect.

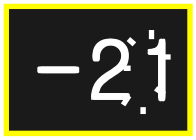
Once the system starts diagnosis step 2, the digit "2" is displayed, implying step 2, on the display window and the trouble diagnosis for sensors is executed. If no failure exists, "20" is displayed. If any failure exists, the appropriate trouble code is displayed as below.





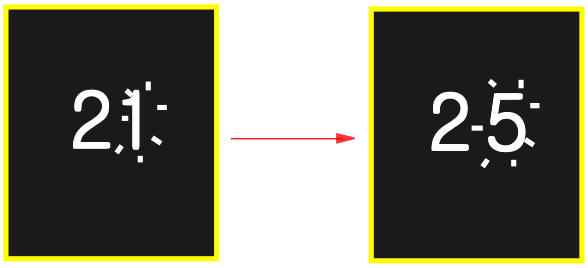
CAUTION

- The symbol "-" in front of step number "2" means a short circuit of the blinking sensor.



Short-circuit in the ambient air temperature sensor

When two sensors are defective



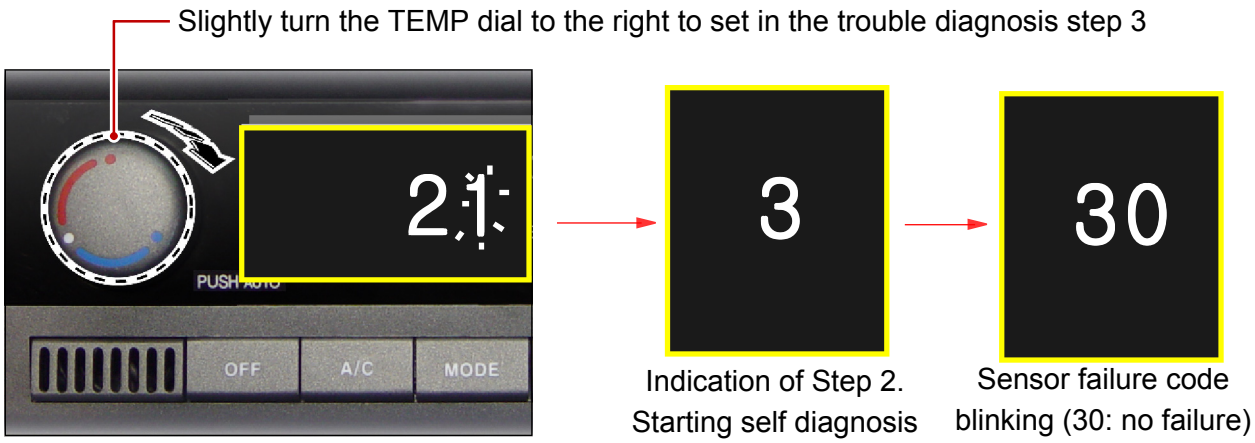
Trouble Code

Code	Malfunction	Remark	Code	Malfunction	Remark
0	VDF segments are OK		5	Defective sun sensor	
1	Defective ambient temperature sensor		6	Check Air mix door	
2	Defective interior temperature sensor		7	Defective humidity sensor	
3	Defective duct temperature sensor		8	-	
4	Defective intake sensor		9	-	

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3) Set in Trouble Diagnosis Step 3

In this step, check the position and conditions of recirculation air door and mode door.
Slightly turn the TEMP switch until "3" is displayed on the display window.
If no failure exists, "30" is displayed. If any failure exists, the appropriate trouble code is displayed.

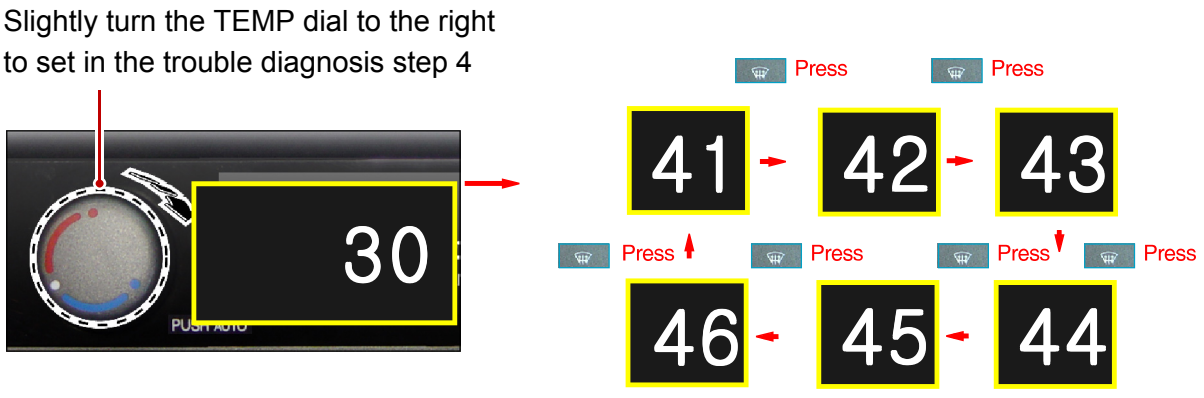


Trouble Code

Code	Malfunction	Remark	Code	Malfunction	Remark
1	Defective VENT		6	DEF	
2	Defective B/L		7	FRE	
3	-		8	20% FRE	
4	FOOT		9	REC	
5	D/F		0	All door OK	

4) Set in Trouble Diagnosis Step 4

In this step, check the position of actuator door, check the fan speed, and check the compressor operation.
Slightly turn the TEMP switch in step 3 until "41" is displayed on the display window. When pressing DEF switch , mode changes as shown below in turns to check each function.

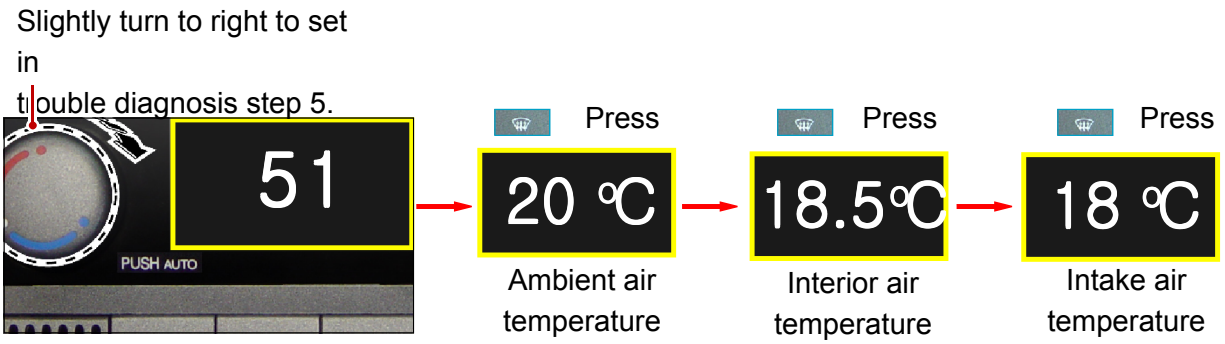


Function Check

Displayed Number	41	42	43	44	45	46
Mode door	VENT	B/L	B/L	FOOT	D/F	DEF
Interior/Ambient door	REC	REC	20%FRE	FRE	FRE	FRE
Air mix door	F/COOL	F/COOL	F/HOT	F/HOT	F/HOT	F/HOT
Blower	4.5 V	10.5 V	8.5 V	8.5 V	8.5 V	MAX
Compressor	ON	ON	OFF	OFF	ON	ON

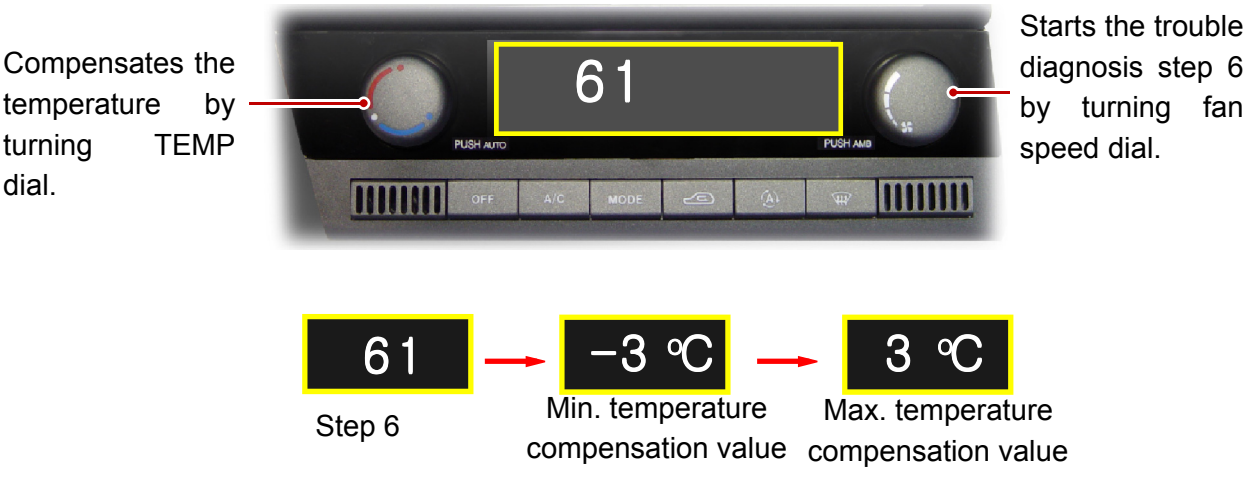
5) Set in Trouble Diagnosis Step 5

In this step, check the conditions of temperature related sensors.
Slightly turn the TEMP switch in step 4 until "51" is displayed on the display window. When pressing DEF switch , displayed temperature changes as shown below in turns.



6) Set in Trouble Diagnosis Step 6

In this step, the temperature can be compensated within the range of −3°C to 3°C in the control process according to the temperature to air conditioner controller. The step 6 initiates when slightly rotating the fan speed switch (other than TEMP switch) in step 5.



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DIAGNOSIS

1. FFH

Trouble Code	Trouble Description	Remedies
0	No faults	-
10	Shutdown for overvoltage	Measure battery voltage (must be < 15.9V). Check alternator and overvoltage.
11	Shutdown for undervoltage	Measure battery voltage (must be > 10.2V under load). Check alternator, wiring and undervoltage.
12	Overheating (abnormal reference value)	Temperature at overheating sensor > 125°C: check cooling system. Check temperature sensor and overheating sensor, replace if necessary.
14	Overheating (difference evaluation-1)	Difference in temperature values between surface sensor and control overheating sensor is too large. (Prerequisite for this trouble code display is that the heater is in operation and the water temperature at the overheating sensor has reached min. 80°C): check cooling system. Check temperature sensor and overheating sensor, replace if necessary
15	Overheating (abnormal heater operation)	Heater does not operate (The controller is locked.) Delete trouble code to release controller lock: check cooling system. Check temperature sensor and overheating sensor, replace if necessary
16	Overheating (difference evaluation-2)	If the surface sensor has a far higher temperature value than the control overheating sensor, then the system proceeds with a fault shutdown.
17	Overheating (defective hardware-2)	Temperature at control overheating sensor > 130°C: check cooling system. Check temperature sensor and overheating sensor, replace if necessary.
20	Open glow plug circuit	Check plug cable for damage, replace if necessary
21	Overload or short circuit of glow plug	Check plug cable for damage, replace if necessary
22	Short circuit of glow plug	Check plug cable for damage, replace if necessary
23	-	-
24	-	-
25	Short circuit of communication line	Check the communication line.
30	Abnormal speed of combustion fan motor	Defective fan wheel or combustion air fan motor (frozen, contaminated, stiff, damaged cable)
31	Defective combustion fan motor	Check cable harness for damage, replace if necessary.
32	Overload or short circuit of combustion fan motor	Defective fan wheel or combustion air fan motor (contaminated, stiff) Check cable harness for damage, replace if necessary.
34	Abnormal output of combustion fan motor	Check the ground and short of combustion air fan motor circuit, replace if necessary.
36	-	-
38	-	-
39	-	-
41	Abnormal water pump operation	Check connector.
42	Overload or short circuit of water pump	Check connector.

Trouble Code	Trouble Description	Remedies
43	Abnormal output of water pump	-
47	Overload or short circuit of fuel pump	Check cable harness for damage, replace if necessary.
48	Abnormal fuel pump operation	Check cable harness for damage, replace if necessary. Check plug-in connection, replace if necessary.
49	Short circuit of fuel pump (B+)	Check cable harness for open to battery voltage, replace if necessary.
50	Improper operation	The controller is locked due to excessive starting problem.
51	Delayed heating time	During start (no flame formed yet), the flame sensor reports temperature value too high for too long, check exhaust gas, combustion air and flame sensor.
52	Time exceeded for cold blowing	Check exhaust gas and combustion air. Check fuel quantity and fuel supply. Clean or replace filter in fuel pump.
53	Flame aborted from “large” stage	Fault (no more starting attempt allowed). Check exhaust gas and combustion air system. Check fuel quantity and fuel supply. Check flame sensor - see trouble code 64 and 65.
54	Flame aborted from “small” stage	Fault (no more starting attempt allowed). Check exhaust gas and combustion air system. Check fuel quantity and fuel supply. Check flame sensor - see trouble code 64 and 65.
60	Abnormal overheating sensor operation	Check cable harness for damage, check plug-in connection, replace if necessary. Check sensor resistance value, replace if necessary.
61	Short circuit or ground of overheating sensor	Check cable harness, replace if necessary. Check sensor resistance value, replace if necessary.
64	Abnormal flame sensor operation	Check cable harness for damage, check plug-in connection, replace if necessary. Check sensor resistance value, replace if necessary.
65	Short circuit of flame sensor	Check cable harness, replace if necessary. Check sensor resistance value, replace if necessary.
71	Defective surface sensor	Check cable harness for damage, check plug-in connection, replace if necessary. Check sensor resistance value, replace if necessary.
72	Short circuit of surface sensor	Check cable harness, replace if necessary. Check sensor resistance value, replace if necessary.
74	Defective overheating prevention device	-
87	-	-
88	-	-
89	-	-
90	Watchdog reset	Replace controller.
91	Abnormal reset function	If too many resets occurs, replace controller
92	ROM error	Replace controller.
93	RAM error	Replace controller.
94	Defective transistor	Replace controller.

Trouble Code	Trouble Description	Remedies
95	Software error	Check cable harness for open to battery voltage, replace if necessary. Replace controller.
96	Abnormal process operation	Replace controller.
97	Wrong processor cycle	Replace controller.
98	Defective main relay	Replace controller.
99	EEPROM error	Replace controller.

Causes		Remedies
Low coolant level	• Leakage in radiator • Leakage in coolant auxiliary tank • Leakage in heater core	• Change radiator. • Change coolant auxiliary tank • Change heater core.
	• Leakage in joint junction of coolant hose • Leakage in defective coolant hose	• Check hose or replace clamp. • Change hose.
	• Leakage in water pump gasket • Leakage in water pump sealing	• Change gasket. • Change water pump.
	• Leakage in water inlet cap • Leakage in thermostat housing	• Change water inlet cap gasket. • Change thermostat sealing.
	• Insufficient tightening torque of cylinder head bolt • Damaged cylinder head gasket	• Tighten bolt to specified torque. • Change cylinder head gasket.
Abnormally high coolant temperature	• The coolant leakage (Check the coolant level) • Excessive anti-freezer • Poor coolant hose condition	• Add coolant • Check density of coolant (Anti-freezer). • Check bent of hose, replace if necessary.
	• Defective thermostat • Defective water pump • Defective radiator • Defective coolant auxiliary tank or tank cap	• Change thermostat • Change water pump. • Change radiator. • Change coolant auxiliary tank or tank cap.
	• Crack in cylinder head or in cylinder block • Clogged water flow in cylinder head or block	• Change cylinder head or cylinder block. • Clean coolant flow line.
	• Clogged water flow in radiator core	• Clean radiator core.
	• Defective cooling fan	• Change or check cooling fan.
	• Defective temp. sensor, wiring, and lamp cluster	• Change sensor or check relevant wiring.
Abnormally low coolant temperature	• Defective thermostat	• Change thermostat.
	• Defective cooling fan	• Change or check cooling fan.
	• Defective temp. sensor, wiring, and lamp cluster	• Change sensor or check relevant wiring.

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P/TRUNK

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1. P/TRUNK

<table>
<tr><th>Function</th><th>System component</th><th>DTC</th><th>Description</th></tr>
<tr><td rowspan="10">Power Trunk Monitoring</td><td>Power striker</td><td>0</td><td>Faulty power striker</td></tr>
<tr><td colspan="3"><u>Causes</u>
- The related wiring is damaged.
- The connector is poorly connected or damaged.
- The micro switch is malfunctioning.
- The power striker'motor is malfunctioning.
<u>Actions</u>
- Check the related wiring and connector for proper connection.
- Replace the power striker.</td></tr>
<tr><td>Power latch</td><td>1</td><td>Faulty power latch</td></tr>
<tr><td colspan="3"><u>Causes</u>
- The related wiring is damaged.
- The connector is poorly connected or damaged.
- The micro switch is malfunctioning.
- The power latch motor is malfunctioning.
<u>Actions</u>
- Check the related wiring and connector for proper connection.
- Replace the power latch.</td></tr>
<tr><td>DC-Gear motor</td><td>2</td><td>Faulty DC-gear motor</td></tr>
<tr><td colspan="3"><u>Causes</u>
- The related wiring is damaged.
- The connector is poorly connected or damaged.
- The hall sensor is malfunctioning.
- The DC-gear motor is malfunctioning.
<u>Actions</u>
- Check the related wiring and connector for proper connection.
- Replace the DC-gear motor.</td></tr>
<tr><td>Power trunk lid</td><td>3</td><td>Faulty power trunk lid</td></tr>
<tr><td colspan="3"><u>Causes</u>
- The related wiring is damaged.
- The connector is poorly connected or damaged.
- The PTL ECU is malfunctioning.
<u>Actions</u>
- Check the related wiring for proper connection.
- Replace the PTL ECU.</td></tr>
</table>

<table>
<tr><th>Function</th><th>System component</th><th>DTC</th><th>Description</th></tr>
<tr><td rowspan="10">Power Trunk Monitoring</td><td>Battery</td><td>4</td><td>Low battery voltage</td></tr>
<tr><td colspan="3"><u>Causes</u>
- The related wiring is damaged.
- The connector is poorly connected or damaged.
- The battery is defective.
<u>Actions</u>
- Check the related wiring for proper connection.
- Check the battery and replace it if necessary.</td></tr>
<tr><td>CAN communication</td><td>5</td><td>Faulty CAN communication</td></tr>
<tr><td colspan="3"><u>Causes</u>
- The related wiring is damaged.
- The connector is poorly connected or damaged.
- The CAN communication is malfunctioning.
- The PTL ECU is malfunctioning.
<u>Actions</u>
- Check the related wiring for proper connection.
- Replace the PTL ECU.</td></tr>
<tr><td>Power trunk</td><td>6</td><td>Faulty usage</td></tr>
<tr><td colspan="3"><u>Cause</u>
- If the DC-gear motor is operated 7 times within 2 minutes, it is considered as misusage and overheated DC-gear motor.
<u>Action</u>
- The system resumes its operation in 90 seconds.</td></tr>
<tr><td>PTL ECU</td><td>7</td><td>Faulty temperature detection of unit</td></tr>
<tr><td colspan="3"><u>Causes</u>
- The related wiring is damaged.
- The connector is poorly connected or damaged.
- The internal temperature sensor in the PTL ECU is malfunctioning.
- The PTL ECU is malfunctioning.
<u>Actions</u>
- Check the related wiring for proper connection.
- Replace the PTL ECU.</td></tr>
<tr><td>PTL ECU</td><td>8</td><td>Faulty temperature detection of unit</td></tr>
<tr><td colspan="3"><u>Causes</u>
- The related wiring is damaged.
- The connector is poorly connected or damaged.
- The power trunk lamp is malfunctioning.
- The PTL ECU is malfunctioning.
<u>Actions</u>
- Check the related wiring for proper connection.
- Replace the power trunk lamp.
- Replace the PTL ECU.</td></tr>
</table>

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RAIN SENSOR

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1. TROUBLE SHOOTING..... 3

RAIN SENSOR

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DIAGNOSIS

1. TROUBLE SHOOTING

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 in the ICM box.

Symptom 2. It rains but the system does not work in the "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 ensitivity 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 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.

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STICS

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DIAGNOSIS

1. STICS

Fault Code	Malfunction	Descriptions
01	Dr Door Lock Knob	Driver's door lock knob is not operated when locking/unlocking doors.
02	Ps Door Lock Knob	Passenger's door lock knob is not operated when locking/unlocking doors.
03	Rr Door Lock Knob	Rear door lock knob is not operated when locking/unlocking doors.
04	T/Gate Lock Knob	Tailgate lock knob is not operated when locking/unlocking doors.
05	Door Lock Output	All door lock knob are not moved to lock position even when the door lock relay is activated.
06	Door Unlock Output	All door lock knob are not moved to unlock position even when the door unlock relay is activated.
07	C/DR Lock Output	Doors are locked by central door lock switch while the engine is running.
08	DR Lock Output	Doors are locked by driver's door lock switch while the engine is running.
09	PS Lock Output	Doors are locked by passenger's door lock switch while the engine is running.
10	Auto Door Lock Output	Door lock knob is not moved to lock position when the system outputs auto door lock signal while the ignition switch is in ON position and the vehicle speed is over 50 km/h.
11	Auto Door Unlock Output	Door lock knob is not moved to unlock position after receiving the output from collision sensor.
12	Wiper Output	The WIPER P-POS signal is not detected when the wiper relay is activated.
13	SPEED SIGNAL	The vehicle speed over 3 km/h is detected at the speed signal area while the ignition switch is in ON position and the alternator signal is "D" LOW.
14	INT WIPER Volume	The circuit is open (over 4.5 V) when changing the INT volume in the speed sensitive INT wiper (saved as history error).
15	SPEED SENSOR	The vehicle speed over 200 km/h is detected (saved as history error).
16	A/BAG COLLISION SENSOR INPUT	A signal is sent to the collision sensor input area while the ignition switch is in OFF position (saved as history error unconditionally).
17	A/BAG COLLISION SENSOR OUTPUT	The RKSTICS outputs UNLOCK signal after receiving collision sensor input while the ignition switch is in ON position (saved as history error).
18	A/BAG COLLISION MONITOR	The STICS outputs the Door Unlock signal due to the collision sensor and the feedback value is in proper range (saved as history error).
19	Door Ajar Warning IND	The door warning indicator blinks when the vehicle speed is over 10 km/h (saved as history error).
20	PARKING BRAKE IND	The parking brake indicator blinks when the vehicle speed is over 10 km/h (saved as history error).
21	Auto Washer Out	The auto washer output is not sent to the front washer (saved as history error).
22	WASHER RELAY	The front washer switch receives the input signal for more than 10 seconds (saved as history error).

Fault Code	Malfunction	Descriptions
23	REMOCON VOLTAGE CHECK	The voltage from remote control key is saved as history error.
24	SBR S/BELT SW (Only EU)	When the seat belt switch circuit is OPEN (HIGH) in KEY OUT & ARMED MODE, the system recognizes it as FAIL and saves it as History error (Normal Close (GND)).
25	SBR SENSOR (Only EU)	When the sensor value is recognized in KEY OUT & ARMED MODE, the system saves it as History error.
26	SBR CONNECTION (Only EU)	When the seat belt switch circuit maintains OPEN (HIGH) in KEY OUT & ARMED MODE while the vehicle speed is over 50 km/h, the system saves it as History error.

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DIAGNOSIS

1. TC

Symptoms	Check	Action
Electric shift problems	• Faulty or damaged TCCU, speed sensor, motor, clutch or internal wirings	• Overhaul and check, replace if necessary
	• Damaged or worn shift cam, hub, fork and rail shift	• Overhaul and check for wear and damage.
	• Binding shift fork, hub collar or gear	• Check sliding parts, replace if necessary.
Cannot drive front wheel when shifting to 4H, 4L	• Broken drive chain	• Check internal parts and replace drive chain.
Noise in 4WD operation	• Improper or low oil	• Drain and replace with specified oil.
	• Loosened bolts or mounted parts	• Retighten as specified.
	• Noisy T/C bearing	• Disassemble bearings and parts and check for wear or damage. Replace if necessary.
	• Gear abnormal noise	• Check for wear and damage including speedometer gear. Replace if necessary.
Noise in 4H or 4L	• Worn or damaged sprockets or drive chain	• Disassemble and check for wear and damage. Replace if necessary.
	• Incorrect tire pressure	• Adjust tire pressure.
Transfer case oil leakage	• Cracked transfer case	• Replace the case.
	• Leakage from other parts	• Clean case and parts and check for leakage.
	• Breather clogging	• Remove breather hose and clean. Replace if necessary.
	• Improper or too much oil	• Use specified oil and adjust oil level.
	• Loosened sealing bolts	• Retighten.
	• Improperly applied sealant	• Use specified sealant and retighten.
	• Worn or damaged oil seal	• Replace oil seal.

Code	Description	Action
P1806	Detective CAN commuication	• Check communication line. • Replace TCCU if necessary.
P1805	Defective mode switch	• When the mode switch is defective • Check TCCU pin No.4 and 16. • Mode change - 2H (Pin No. 4: Ground) - 4H (No contact: Open) - 4L (Pin No.16: Ground)
P1821	Open or short to ground in magnetic clutch coil circuit	• Voltage at TCCU pin No.11: 11 ~ 15 V • EMC resistance: 2.5 Ω • Check the relevant connectors for contact. • Replace TCCU if necessary.
P1822	Open or short to ground in hub control circuit	• When the hub control circuit is open or short to ground over 0.2 second • Replace TCCU if necessary.
P1841	Open to ground in shift motor circuit	• When TCCU detects the motor failure for 1 second • Check the relevant harnesses for contact. • Replace TCCU if necessary.
P1842	Short to ground in shift motor output circuit	• When TCCU detects the motor failure for 1 second • Check the relevant harnesses for contact. • Replace TCCU if necessary.
P1843	Defective position sensor in motor	• 2H-4H: after 1.5 seconds • 4H-4L: after 3 seconds • Check the relevant harnesses for contact. • Replace TCCU if necessary.
P1844	Stuck in 4L mode	• When no shifting operation from 4L to 4H, even though the shift conditions are satisfied and no error. • Replace TCCU if necessary.

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Code	Description	Action
P1850	Defective position encoder	• When the position encoder is defective • Check the relevant harnesses. • Check the relevant connectors for contact. • Check the shift motor.
P1851	Short to ground for position encoder 1	• Short to ground for position encoder 1 in shift motor • Check the relevant harnesses for short. - TCCU pin No.18 • Check the relevant connectors for contact. • Check the shift motor.
P1852	Short to ground for position encoder 2	• Short to ground for position encoder 2 in shift motor • Check the relevant harnesses for short. - TCCU pin No.5 • Check the relevant connectors for contact. • Check the shift motor.
P1853	Short to ground for position encoder 3	• Short to ground for position encoder 2 in shift motor • Check the relevant harnesses for short. - TCCU pin No.19 • Check the relevant connectors for contact. • Check the shift motor.
P1854	Short to ground for position encoder 4	• Short to ground for position encoder 4 in shift motor • Check the relevant harnesses for short. - TCCU pin No.17 • Check the relevant connectors for contact. • Check the shift motor.
P1815	Abnormal CAN neutral signal	• No neutral signal from automatic transmission over 1 second through CAN. • Check CAN communication line. • Check TCU.

Symptoms		Cause	Action
Noise	Noise in all ranges	- Low oil level	- Check major components (bearing surface) for excessive wear
			- Replenish oil
		- Improper oil	- Drain oil and replenish the specified oil
		- Worn or broken chain	- Replace chain or sprocket
	Growling	- Broken bearing	- Replace transfer case housing
		- Low oil level	- Check major components (bearing surface) for excessive wear
			- Replenish oil
	Noise when cornering	- Worn pinion gear teeth	- Replace differential carrier assembly
	Low frequency noise and vibration	- Missing shaft support snap ring	- Visually check the relevant parts for wear and replace if necessary
	Howling	- Abnormal friction in drive system	- Disassemble drive system, check rotating parts for wear and replace the worn parts.
Clunking	Clunking (when starting and stopping)	- Excessive backlash in T/C (over 3°)	- Check backlash and replace if necessary
		- Improper mounting	- Excessive backlash in drive system
			- Check drive system
		- Excessive backlash in other parts	- Excessive backlash in drive system
			- Check drive system
Undrivable	Cannot deliver forward/reverse driving force	- Worn or broken chain	- Replace chain or sprocket
		- Broken sprocket	- Replace chain or sprocket
		- Broken differential carrier	- Replace differential carrier assembly
		- Broken shaft	- Replace shaft
Binding	Dragging in front wheels or rear wheels	- Differential carrier stuck	- Replace differential carrier
Leakage	Leakage at transmission connection	- Damaged oil seal in T/C	- Replace oil seal
		- Clogged breather	- Check breather for clogging
			- Replace connecting hose
	Leakage at front and rear shafts	- Foreign material in oil seal	- Remove any foreign material, check oil seal for damage and replace oil seal
		- Broken oil seal	- Replace oil seal
		- Clogged breather	- Check breather for clogging
			- Replace connecting hose
	Leakage at case or cover body	- Cracked case or cover	- Replace transfer case
		- Air bubbles inside	
	Leakage at drain plug	- Bubbles no mounting bolt	- Replace drain plug
		- Uneven or missing plug coating	
	Leakage at filler plug	- Bubbles no mounting bolt	- Replace filler plug
		- Uneven or missing plug coating	
	Leakage at body connection	- Improperly applied sealant	- Disassembe T/C, apply sealant and reassemble it
		- Loose bolt around the leaking area	- Tighten to the specified torque

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DIAGNOSIS

1. TCU

DTC Code	Defective	Cause and Action
P0742	Torque converter clutch engaged	Cause: - Torque conver clutch is engaged when solenoid valve (S7) is not operated. - The rpm of engine and output shaft is not consistent with the characteristic under the condition with torque converter not engaged. • Allowable slip rpm of torque converter < 50 rpm Symptom: - Torque converter clutch is locked. Action: - Check solenoid valve (S7) wiring for short to B+. - Replace solenoicd valve (S7) if necessary. - Check T/M connector TCU connector for their proper connection. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.
P0710	Defective T/M oil temperature sensor	Cause: - Oil temperature of T/M exceeds the specified value. • Oil temperature sensor voltage > 4.88 V • Oil temperature sensor voltage < 0.21 V Symptom: - Oil temperature is fixed to 120°C - Shifting impression is poor. Action: - Check T/M oil temperature sensor for short or open circuit. - Check T/M connector and TCU connector for proper connection. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 3 seconds.
P0790	Defective W/N/P mode switch	Cause: - The W/N/P mode switch's connection is intermittently disconnected (the input of the mode switch changes rapidly). Symptom: - The switch is fixed to normal mode. Action: - Check W/N/P mode switch input circuit for short or open circuit. - Check W/N/P mode switch wiring. - Replace W/N/P mode switch if necessary. - Returns to the normal operation if the failure does not occur within 3 seconds.

DTC Code	Defective	Cause and Action
P0742	Torque converter clutch engaged	Cause: - Torque conver clutch is engaged when solenoid valve (S7) is not operated. - The rpm of engine and output shaft is not consistent with the characteristic under the condition with torque converter not engaged. • Allowable slip rpm of torque converter < 50 rpm Symptom: - Torque converter clutch is locked. Action: - Check solenoid valve (S7) wiring for short to B+. - Replace solenoicd valve (S7) if necessary. - Check T/M connector TCU connector for their proper connection. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.
P0710	Defective T/M oil temperature sensor	Cause: - Oil temperature of T/M exceeds the specified value. • Oil temperature sensor voltage > 4.88 V • Oil temperature sensor voltage < 0.21 V Symptom: - Oil temperature is fixed to 120°C - Shifting impression is poor. Action: - Check T/M oil temperature sensor for short or open circuit. - Check T/M connector and TCU connector for proper connection. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 3 seconds.
P0790	Defective W/N/P mode switch	Cause: - The W/N/P mode switch's connection is intermittently disconnected (the input of the mode switch changes rapidly). Symptom: - The switch is fixed to normal mode. Action: - Check W/N/P mode switch input circuit for short or open circuit. - Check W/N/P mode switch wiring. - Replace W/N/P mode switch if necessary. - Returns to the normal operation if the failure does not occur within 3 seconds.

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DTC Code	Defective	Cause and Action
P1703	Abnormal engine rpm (CAN)	Cause: - The engine rpm signal (CAN) is out of specified value or there is no engine rpm signal. • Engine rpm < 0 rpm • Engine rpm > 7000 rpm Symptom: - The engine rpm corresponding to the max. engine torque is applyed to the shifting condition. Action: - Check ECU and TCU connectors for poor contact. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 3 seconds.
P1704	Abnormal output shaft rpm (CAN)	Cause: - The output shaft signal (CAN) is out of specified value or there is no output shaft signal. • Output shaft rpm < 0 rpm • Output shaft rpm > 9000 rpm - The actual vehicle speed is 0 while other signals indicate that vehicle is moving. Symptom: - Cannot shift down by limiting the engine rpm to prevent the engine from overrunning. Action: - Check ECU and TCU connectors for poor contact. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 3 seconds and the rpm is over 0.
P1708	Low TCU supply voltage	Cause: - The TCU supply voltage is low or there is no measured voltage value. Symptom: - Cannot shift to 1st gear position. - Cannot shift to other gear positions due to the low supply voltage. - No. 6 solenoid valve (S6) stops from its operation. Action: - Check TCU terminal for poor contact, bending or deformation. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.
P1709	High TCU supply voltage	Cause: - The TCU supply voltage is high. • TCU supply voltage > 16.5 V Symptom: - All solenoid valves stop from their operation when high battery voltage is detected. - Enters into the emergency mode. Action: - Check TCU terminal for short to B+ or short to ground. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.

DTC Code	Defective	Cause and Action
P1713	Defective accelerator pedal signal (CAN)	Cause: - The accelerator pedal signal (CAN) is out of the specified value. • Accelerator pedal signal < 0 % • Accelerator pedal signal > 100 % Symptom: - Cannot shift to 4th gear position. - Torque converter clucth stops from its operation. - The interior default value is applied for shift determination (if the accelerator pedal signal is defective, ECU selects the default value and sends it and error message to TCU via CAN line). - The accelerator pedal signal is not used for P, R, N B2. Action: - Check ECU and TCU connectors for poor contact and their terminals for bend or deformation. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.
P1714	Defective vehicle coding	Cause: - The vehicle coding stored in EEPROM is defective (self-test when IGN ON). Symptom: - Determines the vehicle coding value via CAN communication or selects 0 for the coding value. - Shifting impression is poor. Action: - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1715	Abnormal VPS offset	Cause: - VPS (Variable pressure solenoid valve) is used for controlling clutch and band pressure while shifting. - The VPS offset stored in EEPROM is incorrect (self-test when IGN ON). • VPS offset > 120 mA Symptom: - Shifting impression is poor. Action: - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1717	Defective RAM	Cause: - RAM operates abnormally. (self-test when IGN ON) Symptom: - No output signal. - Enters into the emergency mode. Action: - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1718	Defective ROM	Cause: - The program memory is defective (self-test when IGN ON). - The calculated checksum value is not consistent with the stored checksum value. Symptom: - No output signal. - Enters into the emergency mode. Action: - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

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DTC Code	Defective	Cause and Action
P1719	Abnormal CAN communication	Cause: - Cannot use information necessary for TCU via CAN communication. Symptom: - The default value is used for all CAN signals. - Enters into the emergency mode. Action: - Check ECU and TCU connectors wiring for poor contact. - Check ECU and TCU connectors' terminals for bend or deformation. - Replace TCU if necessary. - Returns to the normal operation if the failure does not occur within 30 seconds.
P1720	Defective EEPROM	Cause: - EEPROM memory is defective. - The calculated checksum value is not consistent with the stored checksum value or the error occurs in EEPROM communication. (self-test when IGN ON) Symptom: - Determines the vehicle coding value via CAN communication or selects 0 for the coding value. - Shifting impression is poor. Action: - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1722	Incorrect vehicle model	Cause: - Cannot detect the vehicle coding through EEPROM or CAN communication. Symptom: - Selects 0 for the coding value. - Enters into the emergency mode. Action: - Check TCU connector and terminals for poor contact. - DTC disappears after turning ignition from OFF to ON.
P1733	No. 1 solenoid valve open	Cause: - The No. 1 solenoid valve operates with the No. 2 solenoid valve to control the oil flow for the 1-2 shift valve. - The No.1 solenoid valve internal circuit or solenoid valve wiring is open. - The solenoid valve connection is short to B+. Symptom: - The No. 1 solenoid valve is OFF. - Enters into the emergency mode. Action: - Check No. 1 solenoid valve wiring and connector (especially its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.1 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

DTC Code	Defective	Cause and Action
P1734	No. 2 solenoid valve open	Cause: - The No. 2 solenoid valve operates with the No. 1 solenoid valve to control the oil flow for the 2-3 shift valve. - The No. 2 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The No. 2 solenoid valve is OFF. - Enters into the emergency mode. Action: - Check No. 2 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.2 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1735	No. 3 solenoid valve open	Cause: - The No. 3 solenoid valve operates with the No. 4 solenoid valve to shift smoothly and control the shifting order. - The No. 3 solenoid valve turns the clutch regulator valve ON and OFF. - The No. 3 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The No. 3 solenoid valve is OFF. - Shifting impression is poor. Action: - Check No. 3 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.3 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

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DTC Code	Defective	Cause and Action
P1736	No. 4 solenoid valve open	Cause: - The No. 4 solenoid valve operates with the No. 3 solenoid valve to shift smoothly and control the shifting order. - The No. 4 solenoid valve turns the clutch regulator valve ON and OFF. - The No. 4 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The No. 4 solenoid valve is OFF or ON. - Shifting impression is poor. Action: - Check No. 4 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.4 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1737	No. 5 solenoid valve open	Cause: - The No. 5 solenoid valve is a variable solenoid valve to change the pressure for shifting. - The No. 5 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The No. 4 solenoid valve is always OFF. - Shifting impression is poor. Action: - Check No. 5 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 3.6 ~ 5.5Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.5 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1738	No. 6 solenoid valve open	Cause: - The No. 6 solenoid valve is used to set the hydraulic line pressure to HIGH/LOW level. - The No. 6 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The hydraulic line pressure is high. (No. 6 solenoid valve stops its operation) - Cannot to shift to 1st gear position. Action: - Check No. 6 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 6 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

DTC Code	Defective	Cause and Action
P1739	No. 7 solenoid valve open	Cause: - The No. 7 solenoid valve controls the operation of the torque converter clutch. - The No. 7 solenoid valve circuit is open. - The solenoid valve connection is short to B+. Symptom: - The No. 7 solenoid valve stops its operation (OFF). - The torque converter clutch cannot be locked. Action: - Check No. 7 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 7 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1741	No. 1 solenoid valve short	Cause: - The No. 1 solenoid valve operates with the No. 2 solenoid valve to control the oil flow for the 1-2 shift valve. - The No. 1 solenoid valve circuit is short to ground. Symptom: - The No. 1 solenoid valve is OFF. - Enters into the emergency mode. Action: - Check No. 1 solenoid valve wiring and connector (especially its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.1 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1742	No. 2 solenoid valve short	Cause: - The No. 2 solenoid valve operates with the No. 1 solenoid valve to control the oil flow for the 2-3 shift valve. - The No. 2 solenoid valve circuit is short to ground. Symptom: - The No. 2 solenoid valve is OFF. - Enters into the emergency mode. Action: - Check No. 2 solenoid valve wiring and connector (especially its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 2 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

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DTC Code	Defective	Cause and Action
P1743	No. 3 solenoid valve short	Cause: - The No. 3 solenoid valve operates with the No. 4 solenoid valve to shift smoothly and control the shifting order. - The No. 3 solenoid valve turns the clutch regulator valve ON and OFF. - The No. 3 solenoid valve circuit is short to ground. Symptom: - The No. 3 solenoid valve is OFF. - Shifting impression is poor. Action: - Check No. 3 solenoid valve wiring and connector (especially its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 3 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1744	No. 4 solenoid valve short	Cause: - The No. 4 solenoid valve operates with the No. 3 solenoid valve to shift smoothly and control the shifting order. - The No. 4 solenoid valve turns the clutch regulator valve ON and OFF. - The No. 4 solenoid valve circuit is short to ground. Symptom: - The No. 4 solenoid valve is OFF. - Shifting impression is poor. Action: - Check No. 4 solenoid valve wiring and connector (especially its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 4 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1745	No. 5 solenoid valve short	Cause: - The No. 5 solenoid valve is a variable solenoid valve to change the pressure for shifting. - The No. 5 solenoid valve circuit is short to ground. Symptom: - The No. 4 solenoid valve is always OFF. - Shifting impression is poor. Action: - Check No. 5 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 3.6 ~ 5.5Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No.5 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

DTC Code	Defective	Cause and Action
P1746	No. 6 solenoid valve short	Cause: - The No. 6 solenoid valve is used to set the hydraulic line pressure to HIGH/LOW level. - The No. 6 solenoid valve circuit is short to ground. Symptom: - The hydraulic line pressure is high. (No. 6 solenoid valve stops its operation) - Cannot to shift to 1st gear position. Action: - Check No. 6 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value : 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 6 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.
P1747	No. 7 solenoid valve short	Cause: - The No. 7 solenoid valve controls the operation of the torque converter clutch. - The No. 7 solenoid valve circuit is short to ground. Symptom: - The No. 7 solenoid valve stops its operation (OFF). - The torque converter clutch cannot be locked. Action: - Check No. 7 solenoid valve wiring and connector (especially, its ground condition). - Specified resistance value: 22 ~ 30Ω - Check TCU connector for proper connection and its terminal for bend or deformation. - Replace No. 7 solenoid valve if necessary. - Replace TCU if necessary. - DTC disappears after turning ignition from OFF to ON.

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Trouble Code	Defectives	Action
P2000	Faulty TCU internal watchdog test	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2001	Faulty TCU internal watchdog function	• Self-diagnosis. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2002	Faulty TCU external watchdog test	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2003	Faulty TCU external watchdog function	• Self-diagnosis. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2004	Faulty TCU Clock	• Self-diagnosis. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2005	Faulty TCU RAM	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2006	Faulty TCU RAM CAN-Controller 1	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2007	Faulty TCU RAM CAN-Controller 2	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2008	Faulty TCU ROM	• Self-diagnosis with IGN ON. • When the TCU internal checksum is different from scanner checksum. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P200A	Faulty TCU EEPROM	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P200B	Faulty TCU CPU (internal)	• Self-diagnosis. • Check harness contact.
P200C	Faulty TCU program control	• Self-diagnosis. • Check harness contact.
P2010	No TCU variant coding	• Self-diagnosis with IGN ON. • When the TCU coding is not exist. • Check again after TCU coding.

Trouble Code	Defectives	Action
P2011	Faulty TCU variant coding	• Self-diagnosis with IGN ON. • When the TCU coding is faulty. • Check again after TCU coding.
P2012	Faulty TCU checksum	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2013	Faulty TCU (internally)	• Self-diagnosis with IGN ON. • Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2100	Defective 1-2, 4-5 shift solenoid valve	• When 1-2 or 4-5 shift solenoid valve is defective. • Measure the resistance of 1-2 or 4-5 shift solenoid valve (turn the IGN OFF, then and disconnect TCU connector). - TCU connector terminals: B12 (14), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2101	1-2, 4-5 shift solenoid valve - short	• When 1-2 or 4-5 shift solenoid valve is defective. • Measure the resistance of 1-2 or 4-5 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B12 (14), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2102	Defective 2-3 shift solenoid valve	• When 2-3 shift solenoid valve is defective. • Measure the resistance of 2-3 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B12 (14), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2103	2-3 shift solenoid valve - short	• When 2-3 shift solenoid valve is defective. • Measure the resistance of 2-3 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B12 (14), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered mechanical emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.

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Trouble Code	Defectives	Action
P2104	Defective 3-4 shift solenoid valve	• When 3-4 shift solenoid valve is defective. • Measure the resistance of 3-4 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B11 (15), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered mechanical emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2105	3-4 shift solenoid valve - short	• When 3-4 shift solenoid valve is defective. • Measure the resistance of 3-4 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B11 (15), B3 (38) - Specified value: 3.8 ± 0.2 Ω • Triggered mechanical emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2106	Defective lockup clutch solenoid valve	• Measure the resistance of lockup clutch solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B9 (17), B3 (38) - Specified value: 2.5 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2107	Defective modulator pressure solenoid valve	• Measure the resistance of modulator pressure solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B5 (36), B3 (38) - Specified value: 5.0 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2108	Defective shift pressure solenoid valve	• Measure the resistance of shift pressure solenoid valve (turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals: B4 (37), B3 (38) - Specified value: 5.0 ± 0.2 Ω • Triggered emergency mode when the defective is detected. - Electrical error: Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.

Trouble Code	Defectives	Action
P2200	Faulty speed sensor N2 signal	• When the speed sensor N2 detects 0 rpm of front sun gear speed. • Check the related harness for open, short and contact. - TCU connector terminal B14: rectangular wave signal B8: signal ground B13: 6V
P2203	Faulty speed sensor N3 signal	• When the speed sensor N3 detects 0 rpm of planetary gear carrier speed. • Check the related harness for open, short and contact. - TCU connector terminal B6: rectangular wave signal B8: signal ground B13: 6V
P220A	Abnormal speed sensor output signal (N2, N3)	• When the rpm difference between speed sensor N2 and N3 is over 150 rpm. • Check the related harness for open, short and contact.
P2220	T/M Oil temperature sensor - short	• Turn the IGN OFF, then disconnect TCU connector. • Selector lever position: R or D • T/M Measure the resistance of oil temperature sensor. • TCU connector terminals B7, B8 • Check the related harness for open, short and contact.
P2221	Abnormal T/M oil temperature sensor signal	• Turn the IGN OFF, then disconnect TCU connector. • Selector lever position: R or D • Measure the resistance of T/M oil temperature sensor. • TCU connector terminals: B7, B8 • Check the related harness for open, short and contact.
P2222	Abnormal T/M oil temperature sensor signal	• Turn the IGN OFF, then disconnect TCU connector. • Selector lever position : R or D • Measure the resistance of T/M oil temperature sensor. • TCU connector terminals: B7, B8 • Check the related harness for open, short and contact.
P2300	Faulty CAN communication	• Turn the IGN OFF, then disconnect TCU connector. • Check the communication line for open, short and contact. • Measure the resistance of CAN line: B1, B2 • Specified value : approx. 120 W
P2301	Faulty CAN communication	• Turn the IGN OFF, then disconnect TCU connector. • Check the communication line for open, short and contact. • Measure the resistance of CAN line: B1, B2 • Specified value : approx. 120 W
P2310	CAN: Faulty brake system communication	• Check CAN communication line H and L. • Check ABS/ESP unit. • Check the related harness for open, short and contact.

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Trouble Code	Defectives	Action
P2311	CAN: Faulty ECU communication	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2312	CAN: Faulty ECU communication	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2313	CAN: Faulty selector lever control communication	• Check CAN communication line H and L. • Check selector lever. • Check the related harness for open, short and contact.
P2315	CAN: Faulty instrument panel communication	• Check CAN communication line H and L. • Check instrument cluster. • Check the related harness for open, short and contact.
P2317	CAN: Faulty communication between TCCU/TOD and CAN (For 4WD only)	• Check CAN communication line H and L. • Check TCCU/TOD unit. • Check the related harness for open, short and contact.
P2330	CAN: Faulty brake system signal	• Check CAN communication line H and L. • Check ABS/ESP unit. • Check the related harness for open, short and contact.
P2331	CAN: Faulty ECU message	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2332	CAN: Faulty ECU message	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2333	CAN: Faulty selector lever signal	• Check CAN communication line H and L. • Check selector lever. Check selector lever. • Check the related harness for open, short and contact.
P2335	CAN: Faulty instrument cluster signal	• Check CAN communication line H and L. • Check instrument cluster. • Check the related harness for open, short and contact.
P2337	CAN: Faulty TCCU/TOD (For 4WD only)	• Check CAN communication line H and L. • Check TCCU/TOD unit. • Check the related harness for open, short and contact.
P2400	CAN: Faulty rear RH wheel speed sensor signal	• Check CAN communication line H and L. • Check ABS/ESP unit. - Check wheel speed sensor connector. - Check the air gap between tooth wheel and wheel speed sensor. (Air gap: 0.309 ~ 0.958 mm) - Check the numbers of tooth wheel: 48 • Check the related harness for open, short and contact.

Trouble Code	Defectives	Action
P2401	CAN: Faulty rear LH wheel speed sensor signal	• Check CAN communication line H and L. • Check ABS/ESP unit. - Check wheel speed sensor connector. - Check the air gap between tooth wheel and wheel speed sensor. (Air gap: 0.309 ~ 0.958 mm) - Check the numbers of tooth wheel: 48 • Check the related harness for open, short and contact.
P2402	CAN: Faulty front RH wheel speed sensor signal	• Check CAN communication line H and L. • Check ABS/ESP unit. - Check wheel speed sensor connector. - Check the air gap between tooth wheel and wheel speed sensor. (Air gap: 0.335 ~ 0.945 mm) - Check the numbers of tooth wheel: 48
P2403	CAN: Faulty front LH wheel speed sensor signal	• Check CAN communication line H and L. • Check ABS/ESP unit. - Check wheel speed sensor connector. - Check the air gap between tooth wheel and wheel speed sensor. (Air gap: 0.335 ~ 0.945 mm) - Check the numbers of tooth wheel: 48
P2404	CAN: No brake signal	• Check CAN communication line H and L. • Check ABS/ESP unit. • Check the related harness for open, short and contact.
P2405	CAN: No accelerator pedal signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2406	CAN: No engine torque signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2407	CAN: No ESP signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2408	CAN: No minimum engine torque signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2409	CAN: No maximum engine torque signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P240A	CAN: No engine rpm signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.

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Trouble Code	Defectives	Action
P240B	CAN: No engine coolant temperature signal	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P240C	CAN: No selector lever position signal	• Check CAN communication line H and L. • Check selector lever. • Check the related harness for open, short and contact.
P240D	CAN: No transfer case position signal (For 4WD only)	• Check CAN communication line H and L. • Check TCCU/TOD unit. • Check the related harness for open, short and contact.
P2500	Invalid transmission gear ratio	• Cycle the IGN switch from OFF to ON. Check A/T system again after a certain period of driving. • If the trouble still exists, replace A/T assembly. • To protect transmission, any shift is not available.
P2501	Excessive engine rpm	• Check CAN communication line H and L. • Check engine ECU. • Check the related harness for open, short and contact.
P2503	Faulty recognition of currently selected gear	• Check selector lever. • Check the related harness for open, short and contact.
P220B	Excessive N2, N3 rpm	• Check speed sensor N2 and N3.
P2510	Torque converter lockup clutch stuck	• Check the hydraulic lines for leaks (valve No.22 in valve body). • Check the resistance of lockup clutch solenoid valve (Turn the IGN OFF, then disconnect TCU connector). - TCU connector terminals B9 (17), B3 (18) - Specified value : 2.5 ± 0.2 W • Triggered emergency mode when the defective is detected. - Fixed at 2nd gear in “D” range. • Check the related harness for open, short and contact.
P2511	Faulty torque converter lockup heat control	• Check the hydraulic lines for leaks.
P2520	Faulty recognition of torque reduction	• Check ECU.
P2502	Poor gear mesh, transmission slip	• Check the hydraulic lines for leaks. • Check oil filter.
P2600	Too low TCU supply voltage	• Check TCU supply voltage.
P2601	Too high TCU supply voltage	• Check TCU supply voltage.
P2602	Abnormal solenoid valve supply voltage	• Check solenoid supply voltage.
P2603	Abnormal speed sensor supply voltage	• Check speed sensor supply voltage. - TCU connector terminals B13 (13) : 6V

Memo

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DIAGNOSIS

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DTC	Malfunction	Help tips
P1000-1	Defective program memory	Cause: The calculated checksum value is not consistent with the stored checksum value. Symptom: - Solenoid valve is inoperative. - Backup lamp is OFF. - CAN bus is OFF. - All shift lever position indicators are OFF. Action: - Reset the unit by cyling the ignition switch (OFF → ON) several times.
P1000-2	Defective data memory	Cause: The malfunction is occurred during the RAM memory test with the ignition ON. Symptom: - Solenoid valve is inoperative. - Backup lamp: OFF - CAN bus: OFF - All shift lever position indicators: OFF Action: - If the malfunction stays after turning the ignition switch from OFF to ON, replace the TGS lever.
P1000-3	Faulty MCU reset	Cause: The malfunction is occurred during the microprocessor test with the ignition ON. Symptom: - Solenoid valve is inoperative. - Backup lamp is OFF. - CAN bus is OFF. - All shift lever position indicators are OFF. Action: - Reset the unit by cyling the ignition switch (OFF → ON) several times.
P1000-4	Faulty MCU data process	
P1000-5	Faulty MCU watchdog function	
P1000-6	Too long MCU data throughput time	
P1750-2	Low battery voltage	Cause: The battery voltage is low. (Specified value: less than 8.0 ± 0.3 V for 50 ms) Symptom: - All shift lever position indicators are OFF. Action: - The operation is automatically resumed if the battery voltage is over 8.7 ± 0.3 V for 50 ms. - Check the shift lever connector and power line for contact.
P1817-1	Faulty backup lamp operating current	Cause: The operating current is over 14 ~ 36 A for 50 ms when the backup lamp is in ON condition. Symptom: - Backup lamp is OFF. - Current shift lever indicator is flashing. - Indicator “R” is flashing in “R” position. Action: - Check the input and output wirings of backup lamp for open and short.
P1832-1	Faulty solenoid operating current	Cause: The solenoid valve operating current is over 3 ~ 5 A when the solenoid is operating. Symptom: - Solenoid valve is OFF. - Current shift lever indicator is flashing. Action: - The operation is automatically resumed since the interior temperature is normally within the solenoid operating temperature range. If the problem stays, check the power to the shift lever.

DTC	Malfunction	Help tips
P1833-2	Open solenoid valve circuit	Cause: The solenoid valve circuit is open or short to battery for 50 ms when the solenoid valve is OFF. Symptom: - Solenoid valve is OFF. - Current shift lever indicator is flashing. Action: - Check the power terminal to the shift lever.
P1856-1	Short shift lever position signal (to B+)	Cause: The shift lever position sensor or the power supply is malfunctioning. Symptom: - All shift lever position indicators are flashing.. - The incorrect lever position signal is transmitted through the CAN line. Action: - The operation is automatically resumed if the fault is not detected for 100 ms. - Check the power supply terminal to the shift lever.
P1856-2	Open or short shift lever position signal (to GND)	Cause: The shift lever position sensor is open or short to ground. Symptom: - All shift lever position indicators: flashing. - The incorrect lever position signal is transmitted through the CAN line. Action: - The operation is automatically resumed if the fault is not detected for 100 ms. - Check the power supply terminal to the shift lever.
P1856-3	Abnormal shift lever position signal	Cause: The shift lever position sensor signal is incorrect. Symptom: - All shift lever position indicators are flashing. - The incorrect lever position signal is transmitted through the CAN line. Action: - The operation is automatically resumed if the fault is not detected for 100 ms. - Check the power supply terminal to the shift lever.
P1856-4	Incorrect shift lever position sensor coding	Cause: The calibration value of shift lever position sensor is not stored or not consistent with the stored value. Symptom: - All shift lever position indicators are flashing. - The incorrect lever position signal is transmitted through the CAN line. Action: - Reset the unit by cyling the ignition switch (OFF → ON) several times. - Check the shift lever and replace it if necessary.
P1860-2	Faulty vehicle speed signal	Cause: The vehicle speed is detected as 300 km/h. Symptom: - The gear is shifted as for the vehicle speed is 0 km/h. - Current shift lever position indicator is flashing. Action: - The operation is automatically resumed if the fault is not detected. * For the shift lever, the vehicle speed data is needed to the solenoid valve operation for R/P lock and N lock function.
P1875-3	Faulty CAN bus OFF signal	Cause: The CAN bus OFF condition of the CAN controller is detected for 3 times in the unit. Symptom: - Cannot send the CAN message. - Current shift lever position indicator is flashing. Action: - Check the CAN communication line for open or short. - Check the shift lever and replace it if necessary. * CAN Bus OFF: The status that the CAN communication is totally interrupted if there is an error in the sent/received data through the CAN communication in the unit.

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DTC	Malfunction	Help tips
P1876-1	Abnormal CAN communication (vehicle speed)	Cause: There is no vehicle speed signal via CAN communication for 500 ms. Symptom: - The gear is shifted as for the vehicle speed is 0 km/h. - Current shift lever position indicator is flashing. Action: - Check the CAN communication line.
P1910-1	High battery voltage	Cause: The battery voltage is too high. (Specified value: Over 16.3 ± 0.3 V for 50 ms) Symptom: - All shift lever position indicators: OFF Action: - The operation is automatically resumed if the battery voltage is over 16.3 ± 0.3 V for 50 ms. - Check the shift lever power supply line.
P1912-1	Open/Short shift lever tip switch signal (to B+)	Cause: The shift lever tip switch signal is open or short to B+. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. Action: - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the shift lever tip switch.
P1912-2	Short shift lever tip switch signal s(to GND)	Cause: The shift lever tip switch signal is open or short to ground. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M”, the malfunction is overridden. Action: - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the shift lever tip switch.
P1912-3	Abnormal shift lever tip switch signal	Cause: The shift lever tip switch signal is faulty. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. Action: - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the shift lever tip switch.
P1912-4	Open/Short steering wheel tip switch signal (to B+)	Cause: The steering wheel tip switch signal is open or short to B+. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the steering wheel's tip switch.
P1912-5	Open/Short steering wheel tip switch signal (to GND)	Cause: The steering wheel tip switch signal is open or short to ground. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. Action: - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the steering wheel tip switch.

DTC	Malfunction	Help tips
P1912-6	Abnormal steering wheel tip switch signal	Cause: The steering wheel tip switch signal is faulty. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. Action: - The operation is automatically resumed if the fault is not detected for 50 ms. - Check the steering wheel tip switch.
P1912-7	Defective tip switch	Cause: The manual mode switch operates for 50 ms when the shift lever is P, R or N positions. Symptom: - Indicator “M” flashes if the shift lever is in D. - The mode is recognized as the manual mode even if the shift lever is in “D” position. Action: - The operation is automatically resumed if the fault is not detected for 50 ms and the shift lever is in P, R or N positions.
P1927-8	Faulty TCU shift	Check the TCU if there is errors related to the A/T shift.
P1928-4	Defective TCU CAN communication	Cause: The up/down shift command in not delivered to the TCU (faulty tip switch). - There is no CAN signal for 500 ms. Symptom: - Indicator “M” is flashing due to malfunction when the shift lever is in the manual mode position. - If the shift lever is not in “M” position, the malfunction is overridden. Action: - Check the CAN communication line.

Modification basis	
Application basis	
Affected VIN	