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VEHICLE GENERAL

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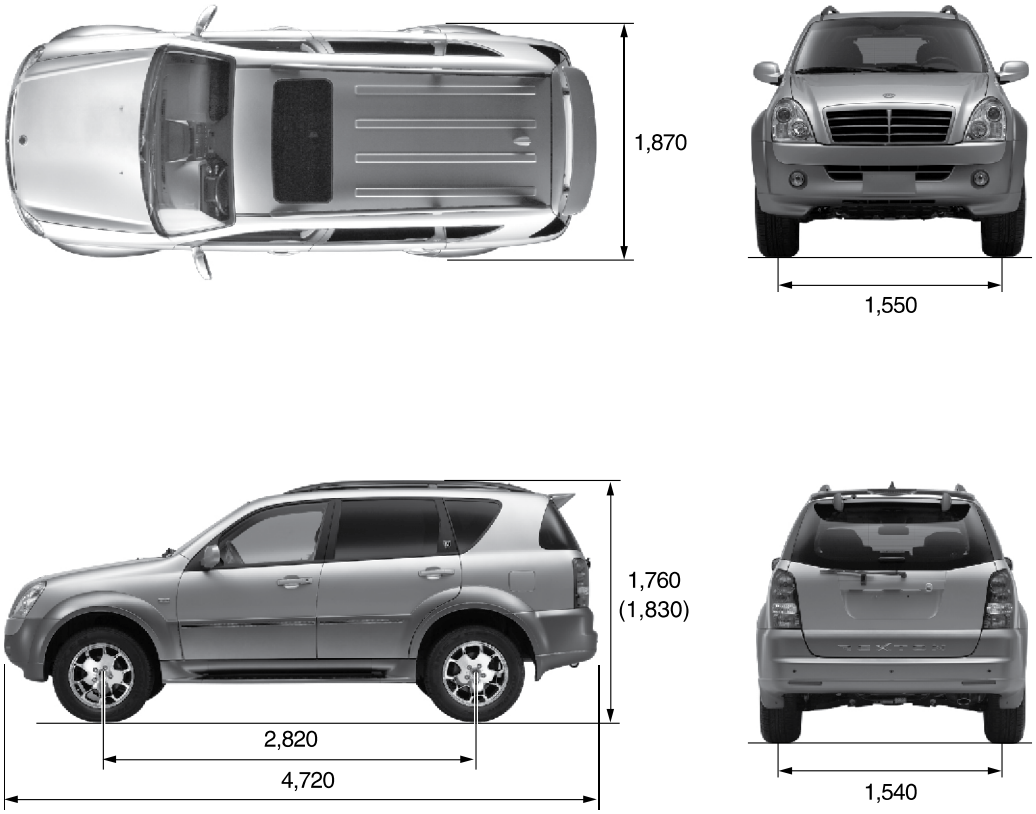
GENERAL

1. DIMENSIONS



* ( ) : Optional

2. SPECIFICATIONS

* ( ): Optional, [ ]: 2WD, D27DTP: Diesel 2.7 Power-Up, D27DT: Diesel 2.7, G32D: Gasoline

Descriptions			D27DTP	D27DT	G32D
General	Overall length (mm)		4,720	←	←
	Overall width (mm)		1,870	←	←
	Overall height (mm)		1,760 (1,830)	←	←
	Gross vehicle weight (kg)		2,760	←	←
	Curb vehicle weight (kg)	A/T	2,099	2,101	2,088
		M/T	–	2,088	–
	Fuel		Diesel	←	Gasoline
	Fuel tank capacity (ℓ)		78	←	←
	Minimum Turning Radius		5.7m	←	←
Engine	Numbers of cylinders/ Compression ratio		5 / 17.5:1	5 / 18:1	6 / 10:1
	Total displacement (cc)		2,696	←	3,199
	Camshaft arrangement		DOHC	←	←
	Max. power	A/T	186 PS / 4,000 rpm	165 PS / 4,000 rpm	220 ps / 6,100 rpm
		M/T	–	165 PS / 4,000 rpm	–
	Max. torque	A/T	395 Nm / 1,600~3,000 rpm	340 Nm / 2,400 rpm	312 Nm / 4,600 rpm
		M/T	–	340 Nm / 2,400 rpm	–
	Idle speed		750 ± 50 rpm	←	700 ± 50 rpm
	Cooling system		Water- cooled / forced circulation	←	←
	Coolant capacity (ℓ)		11.5	←	11.3 ~ 11.5
	Lubrication type		Gear pump, forced circulation	←	←
	Max. oil capacity (ℓ) (when shipping)		9.2	←	9.8
	Turbocharger and cooling type		Turbocharger, air-cooled	←	–
Manual Transmission	Operating type		–	Semi- Remote control, floor change type	–
	Gear ratio	1st	–	4.315	–
		2nd	–	2.475	–
		3rd	–	1.536	–
		4th	–	1.000	–
		5th	–	0.807	–
		Reverse	–	3.919	–
Automatic Transmission	Model		Electronic, 5-speed	←	←
	Operating type		Floor change type	←	←
	Gear ratio	1st	3.595	←	3.951
		2nd	2.186	←	2.423
		3rd	1.405	←	1.486
		4th	1.000	←	1.000
		5th	0.831	←	0.833
		Reverse 1st	3.167	←	3.147
		Reverse 2nd	1.926	←	1.930

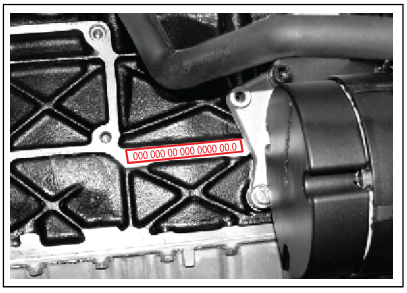
Modification basis	
Application basis	
Affected VIN	

▶Specifications (Cont'd)

Descriptions			D27DTP	D27DT	G32D
Transfer Case	Model		AWD	Part-time (TOD)	Part-time (AWD)
	Type		Planetary gear type	←	←
	Gear ratio	High (4H)	–	1.000 : 1	←
		Low (4L)	–	2.483 : 1	←
Clutch (M/T)	Operating type		–	Hydraulic type	–
	Disc type		–	Dry single diaphragm type	–
Power Steering	Type		Rack and pinion	←	←
	Steering angle	Inner	36.17°	←	←
		Outer	32.4°	←	←
Front Axle	Drive shaft type		Ball joint type	←	←
	Axle housing type		IOP type	Build-up type	Build-up type (IOP type)
Rear Axle	Drive shaft type		Semi-floating type (Ball joint type)	Semi-floating type	Semi-floating type (ball joint type)
	Axle housing type		Build-up type (IRS type)	Build-up type	Build-up type (IRS type)
Brake	Master cylinder type		Tandem type	←	←
	Booster type		Vacuum assisted booster type	←	←
	Brake typ	Front wheels	Disc type	←	←
		Rear wheels	Disc type	←	←
	Parking brake		Cable type (Automatic parking brake)	←	←
Suspension	Front suspension		Wishbone + coil spring	←	←
	Rear suspension		5-link + coil spring (Multi-link + Coil spring) (EAS)	5-link + coil spring	5-link + coil spring (Multi-link + Coil spring) (EAS)
Air Conditioner	Refrigerant (capacity)		R - 134a / 720 ± 30g (R - 134a / 1120 ± 30g)	←	←
Electrical	Battery type / Capacity (V-AH)		MF / 12 - 90	←	←
	Starter capacity (V-kW)		12 - 2.2	←	12 - 1.8
	Alternator capacity (V-A)		12 - 140 (12 - 115)	←	12 - 115

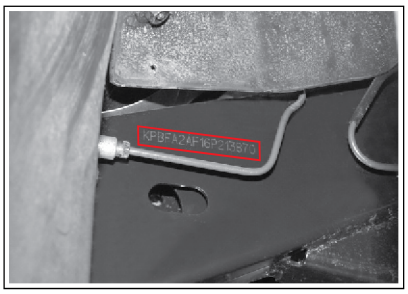
3. VEHICLE IDENTIFICATION

1. Engine Number

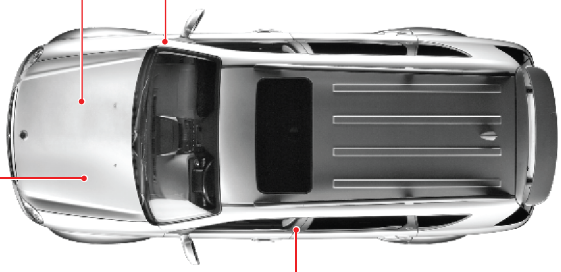


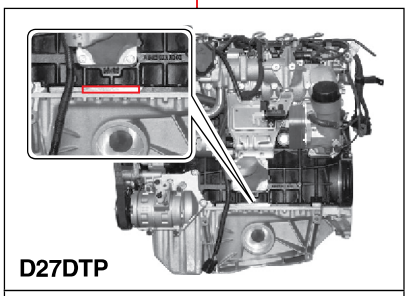
Gasoline Engine: The engine number is stamped on the lower area of cylinder block in exhaust manifold side.

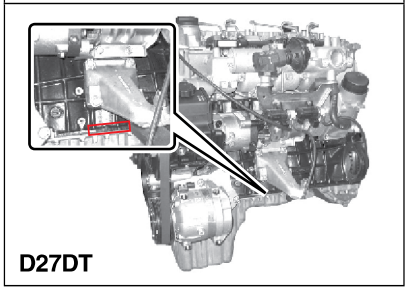
2. Chassis Number



The chassis number is stamped on the frame behind the front right tire.

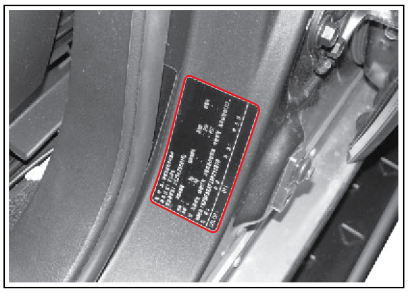






Diesel Engine (D27DTP, D27DT): The engine number is stamped on the lower area of cylinder block behind the Intake manifold.

3. Certification Label



The certification label is located on the driver's door sill.

Modification basis	
Application basis	
Affected VIN	

4. MAINTENANCE

1) Diesel Engine

* Use only approved Ssangyong genuine parts.

Maintenance service and record retention are the owner's responsibility. You should retain evidence that proper maintenance has been performed on your vehicle in accordance with the scheduled maintenance service chart.

* EU Countries: Only countries that belong to EU. (It does not apply to all countries in EU.)

MAINTENANCE INTERVAL / MAINTENANCE ITEM			Kilometers (miles) or time in months, whichever comes first							
		x1,000 km	15	30	45	60	75	90	105	120
		x1,000 miles	10	20	30	40	50	60	70	80
		Months	12	24	36	48	60	72	84	96
ENGINE CONTROL SYSTEM										
Drive belt			I	I	I	I	I	I	I	I
* Engine oil & filter (1)* (3)* (4)*		EU	Initial check: 5,000 km, and replenish if necessary, change every 15,000 km or 12 months							
		General	Initial change: 5,000 km, change every 10,000 km or 12 months							
Cooling system hose & connections			I	I	I	I	I	I	I	I
Engine coolant (3)* (4)*			Change every 60,000 km or 3 years. And, inspect and replenish if necessary.							
* Fuel filter	Direct Injection (Diesel Engine)	EU	I	R*	I	R*	I	R*	I	R*
		General	Replace every 25,000 km (Draining water from fuel filter: whenever replacing the engine oil)							
Additional Water Separator (if equipped)			Replace every 150,000 km or 5 years (Drain the water whenever replacing the engine oil)							
Fuel line & connections			I	I	I	I	I	I	I	I
Air cleaner (2)*		EU	Initial clean: 5,000 km, clean every 15,000 km, replace every 30,000 km (But, shorten the service interval under severe conditions)							
		General	Initial clean: 5,000 km, clean every 10,000 km, replace every 30,000 km (But, shorten the service interval under severe conditions)							
Injection timing (See NOTE1)			I	I	I	I	I	I	I	I

NOTE 1:

Adjust as required; - When excessive smoke is visible (black or white)

- Poor performance/economy

Chart Symbols:

I - Inspect these items and their related parts. If necessary, correct, clean, replenish, adjust or replace.

R - Replace or change.

(1)* If vehicle is operated under severe condition:

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

Shorten the service interval. Inspect the engine oil at any time, occasionally, if necessary refill the engine oil.

(2)* If vehicle is operated under severe condition, driving in dusty condition or sandy condition, pollutant area or off-road driving, frequently inspect the air cleaner, if necessary, change the air cleaner.

(3)* More frequent maintenance is required if under dusty driving condition.

(4)* Refer to " Recommended fluids, coolant and lubricants".

* Water separator: When replace the engine oil, also drain the water from the fuel filter.

* EU Countries: Only countries that belong to EU. (It does not apply to all countries in EU.)

MAINTENANCE INTERVAL / MAINTENANCE ITEM		Kilometers (miles) or time in months, whichever comes first							
	x1,000 km	15	30	45	60	75	90	105	120
	x1,000 miles	10	20	30	40	50	60	70	80
	Months	12	24	36	48	60	72	84	96

CHASSIS AND BODY

Exhaust pipes & mountings				I	I	I	I	I	I	I	I
Brake / Clutch fluid (3)*				Change every: 2 years (inspect frequently)							
Parking brake / Brake pads (Front & Rear) (4)*			EU	Periodic check: every 15,000 km, adjust or replace if necessary.							
			General	Periodic check: every 10,000 km, adjust or replace if necessary.							
Brake line & connections (including booster)				Inspect every 15,000 km or 1 years, adjust or replace if necessary							
Manual transmission oil (5)*				I	I	I	R	I	I	I	R
Clutch & brake pedal free play				I	I	I	I	I	I	I	I
Front & Rear differential fluid (3)*	Front	Non IOP		Inspect frequently, change every 30,000 km							
		IOP	EU	Periodic check: every 15,000 km, adjust or replace if necessary.							
			General	Periodic check: every 10,000 km, adjust or replace if necessary.							
	Rear	Rigid		Inspect frequently, change every 30,000 km							
		IRS	EU	Periodic check: every 15,000 km, adjust or replace if necessary.							
			General	Periodic check: every 10,000 km, adjust or replace if necessary.							
Transfer case fluid (3)*				Inspect every 15,000 km, change every 60,000 km (Frequnt check of oil leak)							
Automatic transmission fluid (6)*				Inspect every 30,000 km or 12 month (But change every 60,000 km under severe condition)							

Chart Symbols:

I - Inspect these items and their related parts. If necessary, correct, clean, replenish, adjust or replace.

R - Replace or change.

(3)* Refer to "Recommended fluids and lubricants".

(4)* More frequent maintenance is required if the vehicle is operated under any of the following conditions:

- In heavy city traffic where the outside temperature regularly reaches 32°C (90°F) or higher, or
- In hilly or moutainous terrain, or
- When doing frequent trailer towing, or
- Uses such as found in taxi, police or delivery service.

(5)* Inspect manual transmission fluid every 15,000 km (Inspect the leak of fluid at any time,occasionally), then change every 60,000 km

(6)* Change automatic transmission fluid and every 60,000 km if the vehicle is mainly driven under severe conditions: Towing a trailer or off-road driving (Inspect the leak of fluid at any time, occasionlly)

Modification basis	
Application basis	
Affected VIN	

* Use only approved Ssangyong genuine parts.

MAINTENANCE INTERVAL / MAINTENANCE ITEM		Kilometers (miles) or time in months, whichever comes first							
	x1,000 km	15	30	45	60	75	90	105	120
	x1,000 miles	10	20	30	40	50	60	70	80
	Months	12	24	36	48	60	72	84	96

CHASSIS AND BODY

Chassis & underbody bolts & nuts tight / Secure (6)*		Check frequntly and adjust or replace if necessary							
Tire condition & inflation pressure		Check frequntly and adjust or replace if necessary							
Wheel alignment (7)*		Inspect when abnormal condition is noted							
Steering wheel & linkage		I	I	I	I	I	I	I	I
Power steering fluid & lines (3)*		I	I	I	I	I	I	I	I
Drive shaft boots (8)*		I	I	I	I	I	I	I	I
Seat belts, buckles & anchors		I	I	I	I	I	I	I	I
Lubricate locks, hinges & bonnet latch		Check frequntly and adjust or replace if necessary							
Wheel bearing grease		I	I	I	I	I	I	I	I
Propeller shaft grease - Front / Rear (9)*	EU	I	I	I	I	I	I	I	I
	General	Inspect every 10,000 km							
Air conditioner filter		Change every 10,000 km (But, shorten the service interval under severe conditions)							

Chart Symbols:

I - Inspect these items and their related parts. If necessary, correct, clean, replenish, adjust or replace.

R - Replace or change.

(3)* Refer to "Recommended fluids and lubricants".

(6)* After completion of off-road operation, the underbody of the vehicle should be throughly inspected. Examine threaded fasteners for looseness.

(7)* If necessary, rotate and balance wheels.

(8)* After completion of off-road operation, the drive shaft boots should be inspected.

(9)* Inspect propeller shaft grease every 5,000 km or 3 months if the vehicle is mainly driven under severe condition.

- In off-road or dusty road, or
- In heavy city traffic where the outside temperature regularly reaches 32°C (90°F) or higher, or
- In hilly or moutainous terrain.

Severe Conditions in Air Conditioner Filter

- Pollutant area or off-road driving, extended air conditioner or heater operation

2) Gasoline Engine

* Use only approved Ssangyong genuine parts.

Maintenance service and record retention are the owner's responsibility. You should retain evidence that proper maintenance has been performed on your vehicle in accordance with the scheduled maintenance service chart.

* EU Countries: Only countries that belong to EU. (It does not apply to all countries in EU.)

MAINTENANCE INTERVAL / MAINTENANCE ITEM	Kilometers (miles) or time in months, whichever comes first							
x1,000 km	15	30	45	60	75	90	105	120
x1,000 miles	10	20	30	40	50	60	70	80
Months	12	24	36	48	60	72	84	96
ENGINE CONTROL SYSTEM								
Drive belt	I	I	I	I	I	I	I	I
Engine oil & engine oil filter (1)* (3)* (Initial change: 10,000 km)	R**	R	R	R	R	R	R	R
Cooling system hose & connections	I	I	I	I	I	I	I	I
Engine coolant (3)*	Change every 60,000 km or 3 years. And, inspect replenish if necessary.							
Fuel filter (2)*	Replace every 100,000 km (if using poor quality of fuel, replace every 30,000 km)							
Fuel line & connections	I	I	I	I	I	I	I	I
Air cleaner (2)*	I	I	I	R	I	I	I	R
Ignition timing	I	I	I	I	I	I	I	I
Spark plugs	-	-	-	R	-	-	-	R
Charcoal canister & vapor lines	-	-	I	-	-	I	-	-

Chart Symbols:

I - Inspect these items and their related parts. If necessary, correct, clean, replenish, adjust or replace.

R - Replace or change.

** - In order to secure engine long life and effective break-in, first oil (factory filled) would be recommended to drain with in 10,000 km.

(1)* If vehicle is operated under severe condition: short distance driving, extensive idling or driving in dusty condition, shorten the service interval.

(2)* If vehicle is operated under severe condition, pollutant area or off-road driving, driving in dusty condition or sandy condition, frequently inspect the air cleaner, if necessary, change the air cleaner.

(3)* Refer to "Recommended fluids and lubricants".

* EU Countries: Only countries that belong to EU. (It does not apply to all countries in EU.)

MAINTENANCE ITEM \ MAINTENANCE INTERVAL		Kilometers (miles) or time in months, whichever comes first							
	x1,000 km	15	30	45	60	75	90	105	120
	x1,000 miles	10	20	30	40	50	60	70	80
	Months	12	24	36	48	60	72	84	96

CHASSIS AND BODY

Exhaust pipes & mountings				I	I	I	I	I	I	I	I
Brake / Clutch fluid (3)*				Change every: 2 years (inspect frequently)							
Parking brake /			EU	Periodic check: every 15,000 km, adjust or replace if necessary.							
Brake pads (Front & Rear) (4)*			General	Periodic check: every 10,000 km, adjust or replace if necessary.							
Brake line & connections (including booster)				Inspect every 15,000 km or 1 years, adjust or replace if necessary							
Manual transmission oil (5)*				I	I	I	R	I	I	I	R
Clutch & brake pedal free play				I	I	I	I	I	I	I	I
Front & Rear differential fluid (3)*	Front	Non IOP		Inspect frequently, change every 30,000 km							
		IOP	EU	Periodic check: every 15,000 km, adjust or replace if necessary.							
			General	Periodic check: every 10,000 km, adjust or replace if necessary.							
	Rear	Rigid		Inspect frequently, change every 30,000 km							
		IRS	EU	Periodic check: every 15,000 km, adjust or replace if necessary.							
			General	Periodic check: every 10,000 km, adjust or replace if necessary.							
Transfer case fluid (3)*				Inspect every 15,000 km, change every 60,000 km (Frequnt check of oil leak)							
Automatic transmission fluid (6)*				Inspect every 30,000 km or 12 month (But change every 60,000 km under severe condition)							

Chart Symbols:

I - Inspect these items and their related parts. If necessary, correct, clean, replenish, adjust or replace.

R - Replace or change.

(3)* Refer to "Recommended fluids and lubricants".

(4)* More frequent maintenance is required if the vehicle is operated under any of the following conditions:

- In heavy city traffic where the outside temperature regularly reaches 32°C (90°F) or higher, or
- In hilly or moutainous terrain, or
- When doing frequent trailer towing, or
- Uses such as found in taxi, police or delivery service.

(5)* Inspect manual transmission fluid every 15,000 km (Inspect the leak of fluid at any time,occasionally), then change every 60,000 km

(6)* Change automatic transmission fluid and every 60,000 km if the vehicle is mainly driven under severe conditions: Towing a trailer or off-road driving (Inspect the leak of fluid at any time, occasionlly)

* EU Countries: Only countries that belong to EU. (It does not apply to all countries in EU.)

MAINTENANCE ITEM \ MAINTENANCE INTERVAL		Kilometers (miles) or time in months, whichever comes first							
	x1,000 km	15	30	45	60	75	90	105	120
	x1,000 miles	10	20	30	40	50	60	70	80
	Months	12	24	36	48	60	72	84	96

CHASSIS AND BODY

Chassis & underbody bolts & nuts tight / Secure (6)*		Check frequntly and adjust or replace if necessary							
Tire condition & inflation pressure		Check frequntly and adjust or replace if necessary							
Wheel alignment (7)*		Inspect when abnormal condition is noted							
Steering wheel & linkage		I	I	I	I	I	I	I	I
Power steering fluid & lines (3)*		I	I	I	I	I	I	I	I
Drive shaft boots		I	I	I	I	I	I	I	I
Seat belts, buckles & anchors		I	I	I	I	I	I	I	I
Lubricate locks, hinges & bonnet latch		Check frequntly and adjust or replace if necessary							
Wheel bearing grease		I	I	I	I	I	I	I	I
Propeller shaft grease - Front / Rear (8)*	EU	I	I	I	I	I	I	I	I
	General	Inspect every 10,000 km							
Air conditioner filter		Change every 10,000 km (But, shorten the service interval under severe conditions)							

Chart Symbols:

I - Inspect these items and their related parts. If necessary, correct, clean, replenish, adjust or replace.

R - Replace or change.

(3)* Refer to "Recommended fluids and lubricants".

(6)* After completion of off-road operation, the underbody of the vehicle should be throughly inspected. Examine threaded fasteners for looseness.

(7)* If necessary, rotate and balance wheels.

(8)* Inspect propeller shaft grease every 5,000 km or 3 months if the vehicle is mainly driven under severe condition.

- In off-road or dusty road, or
- In heavy city traffic where the outside temperature regularly reaches 32°C (90°F) or higher, or
- In hilly or moutainous terrain.

Severe Conditions in Air Conditioner Filter

- Pollutant area or off-road driving, extended air conditioner or heater operation

Modification basis	
Application basis	
Affected VIN	

5. RECOMMENDED FLUIDS AND LUBRICANTS

Descriptions			Capacity	Specifications
Engine Oil		D27DTP	≒ 8.5 ℓ	Quality class: Ssangyong genuine engine oil (Approved by MB Sheet 229.1 or 229.3) Viscosity: MB sheet No. 224.1
		D27DT	≒ 8.5 ℓ	
		G32D	≒ 9.0 ℓ	
Engine Coolant		D27DTP	≒ 11.5 ℓ	Ssangyong genuine coolant HOECHST GENANTIN SUPER 8023/14
		D27DT	≒ 11.5 ℓ	
		G32D	11.3 ~ 11.5 ℓ	
Automatic Transmission Fluid			≒ 8.0 ℓ	Ssangyong genuine oil (Shell ATF 3353 or Fuchs ATF 3353)
Manual Transmission Fluid		2WD	≒ 3.4 ℓ	Ssangyong genuine oil (ATF DEXRON II)
		4WD	≒ 3.6 ℓ	
Transfer Case Fluid		AWD	≒ 1.1 ℓ	Ssangyong genuine oil (ATF DEXRON III)
		TOD	≒ 1.4 ℓ	
		Part Time	≒ 1.4 ℓ	
Axle Oil	Front	Non IOP	≒ 1.4 ℓ ~ 1.5 ℓ	Ssangyong genuine oil (API GL-5 & SAE 80W/90)
		IOP	≒ 0.78 ℓ	Ssangyong genuine oil (Shell synthetic fuel efficient GL 75W/90)
	Rear	Rigid	≒ 2.0 ~ 2.2 ℓ	Ssangyong genuine oil (API GL-5 & SAE 80W/90)
		IRS	≒ 1.5 ℓ	Ssangyong genuine oil (Shell synthetic fuel efficient GL 75W/90)
Brake / Clutch Fluid			As required	Ssangyong genuine oil (DOT4)
Power Steering Fluid			≒ 1.0 ℓ	Ssangyong genuine oil (ATF DEXRON II or III)

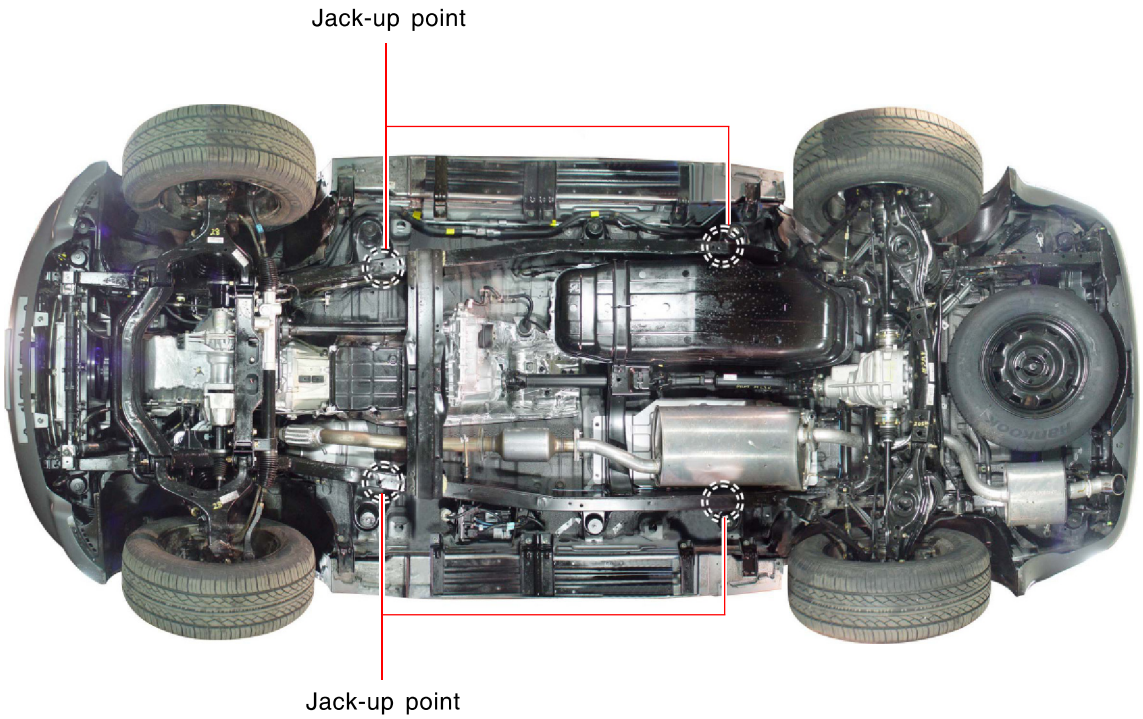
WARNING

- Use only Ssangyong recommended fluids and lubricants.
- Keep the specified levels when adding or replacing the fluids.
- Do not mix any different types or brands of oils or fluids. This may cause damages.

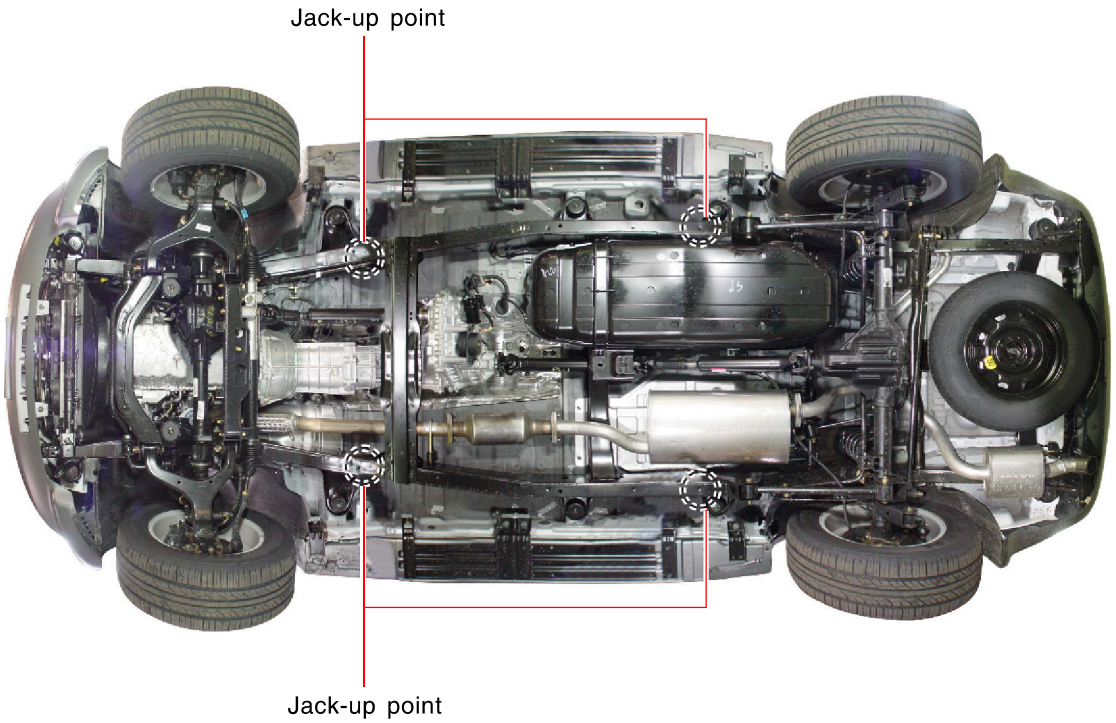
D27DTP: Diesel 2.7 Power-Up
D27DT: Diesel 2.7
G32D: Gasoline

6. JACK-UP POINTS (DOTTED CIRCLES)

IRS type



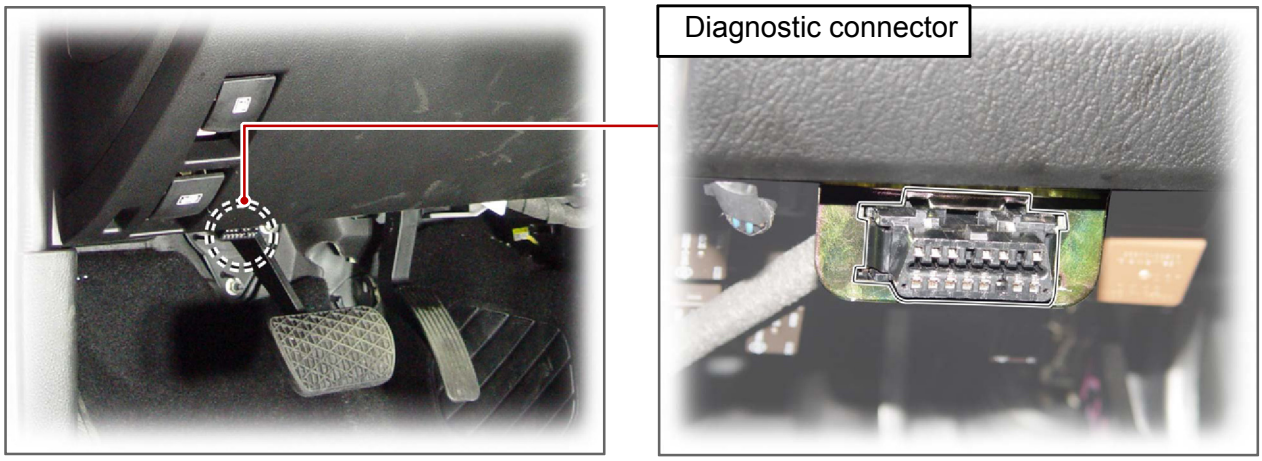
5-link type



Modification basis	
Application basis	
Affected VIN	

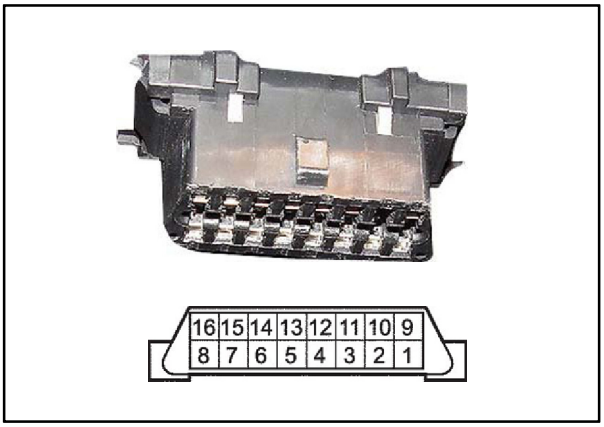
7. PIN ARRANGEMENT OF DIAGNOSTIC CONNECTOR

It is installed under the instrument panel and consists of 16 pins.
The REKES key coding should be performed with SCAN-TOOLS.



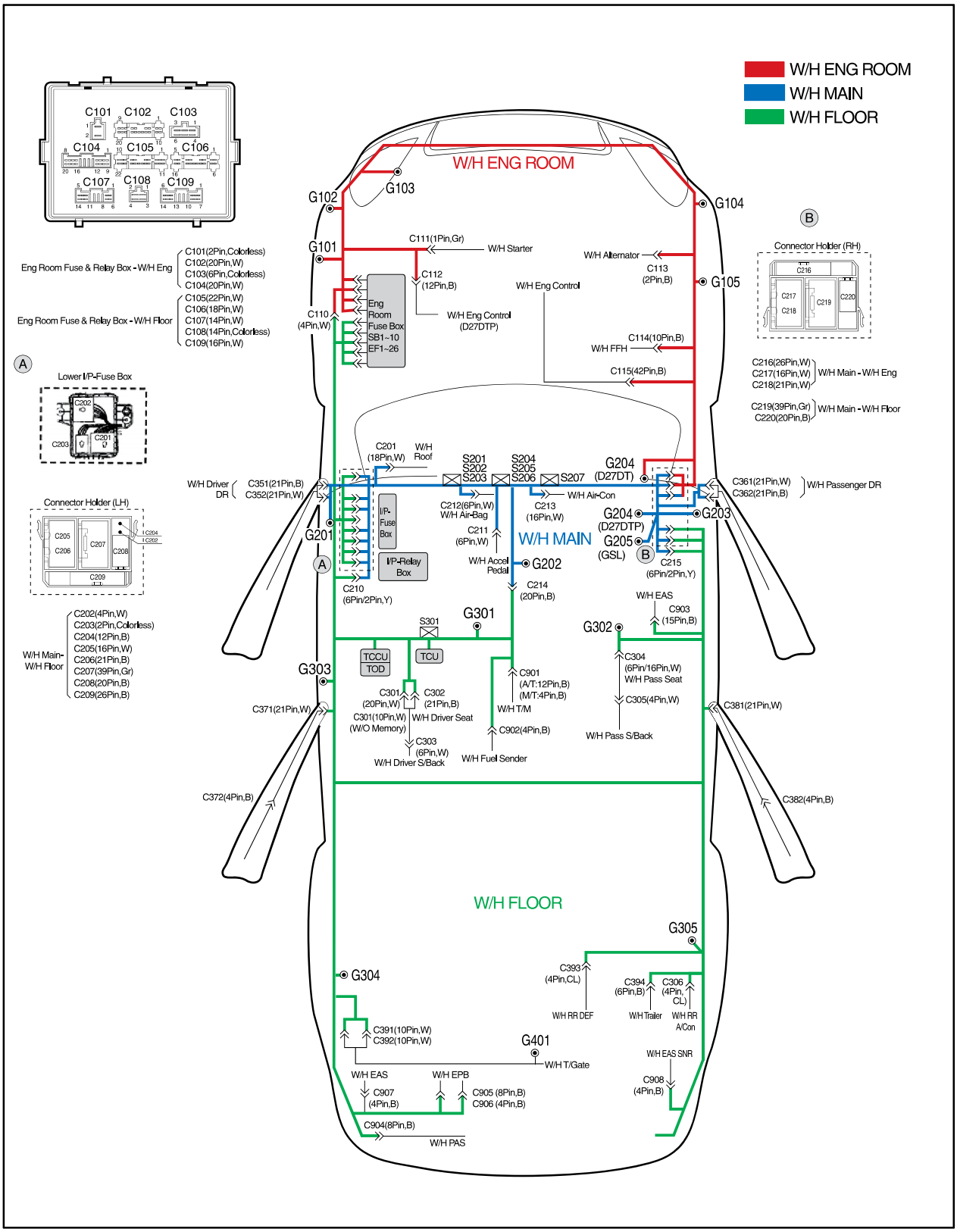
Functions of Terminal

Pin no. 1	FFH diagnosis
Pin no. 2	FFH forced driving
Pin no. 3	-
Pin no. 4	Ground
Pin no. 5	Signal ground
Pin no. 6	CAN - HIGH
Pin no. 7	Engine ECU
Pin no. 8	ABS / ESP
Pin no. 9	Air bag
Pin no. 10	-
Pin no. 11	TCU
Pin no. 12	ECPS
Pin no. 13	TCCU/TOD
Pin no. 14	CAN - LOW
Pin no. 15	REKES coding / RK-STICS
Pin no. 16	Battery +



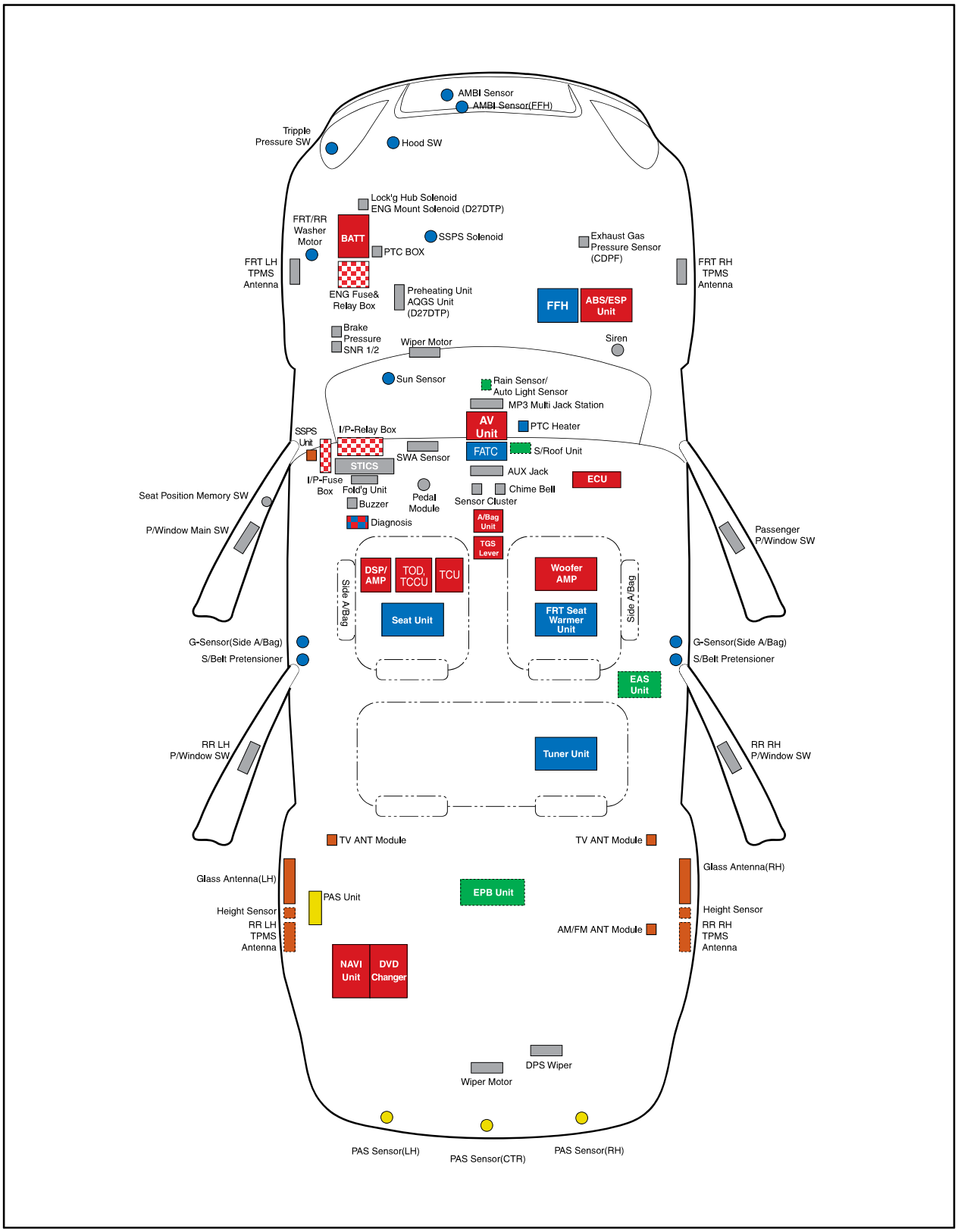
8. ELECTRIC COMPONENTS AND LAYOUT

1) Wiring Harness Arrangement



Modification basis	
Application basis	
Affected VIN	

2) Components Locator

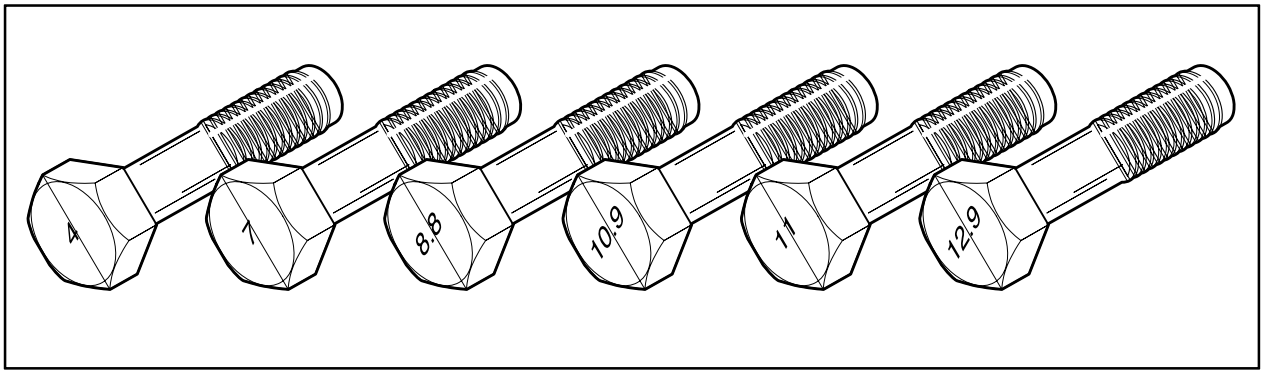


Modification basis	
Application basis	
Affected VIN	

9. 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	

ENGINE ASSEMBLY

1113-01

GENERAL

1. DESCRIPTION AND OPERATION

1) Cleanliness and Care

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the ten-thousanths of an inch.
When any internal engine parts are serviced, care and cleanliness are important.
A liberal coating of enigne oil should be applied to friction areas during assembly, to protect and lubricate the surfaces on initial operation. Proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure.
This is considered standard shop practice even if not specifically stated.
Whenever valve train components are removed for service, they should be kept in order. They should be installed in the same locations, and with the same mating surfaces, as when they were removed.
Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.

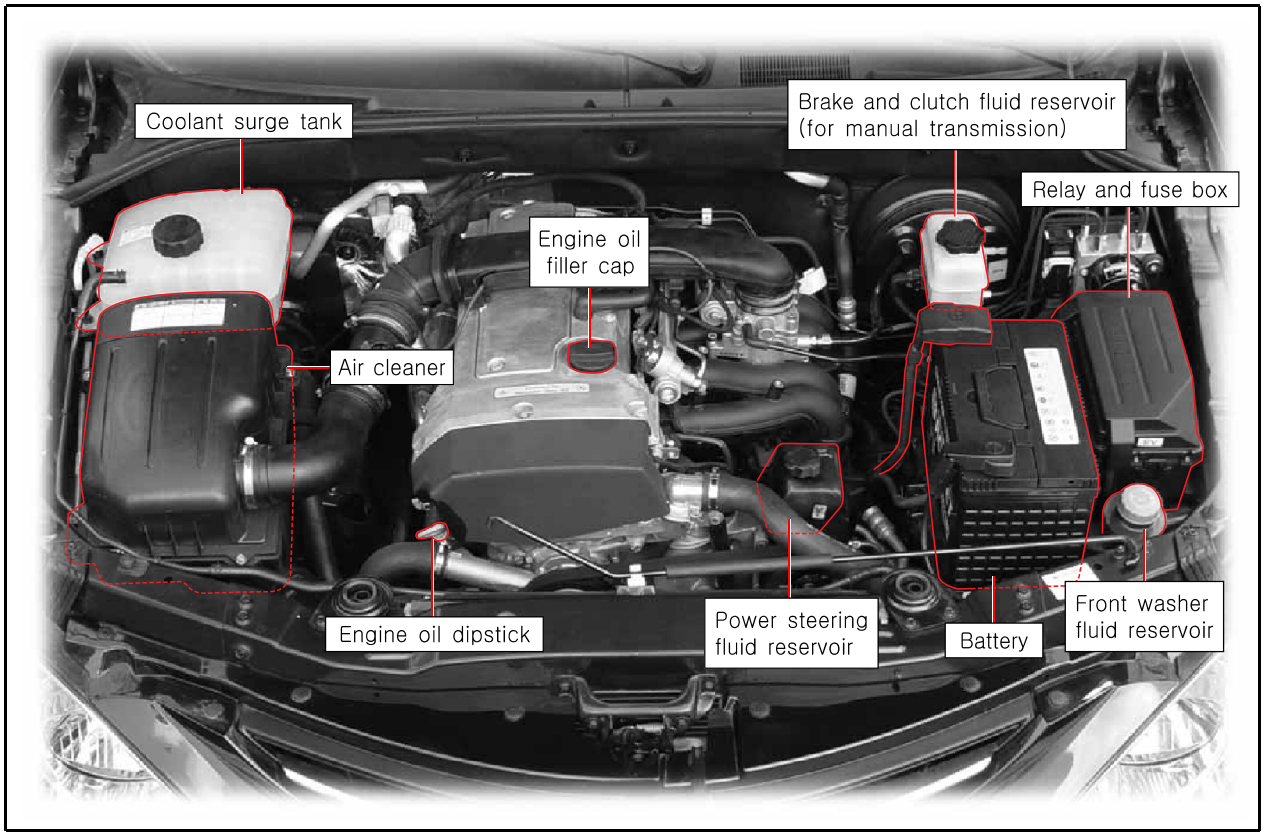
2) On-engine Service

CAUTION

- Disconnect the negative battery cable before removing or installing any electrical unit, or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

CAUTION

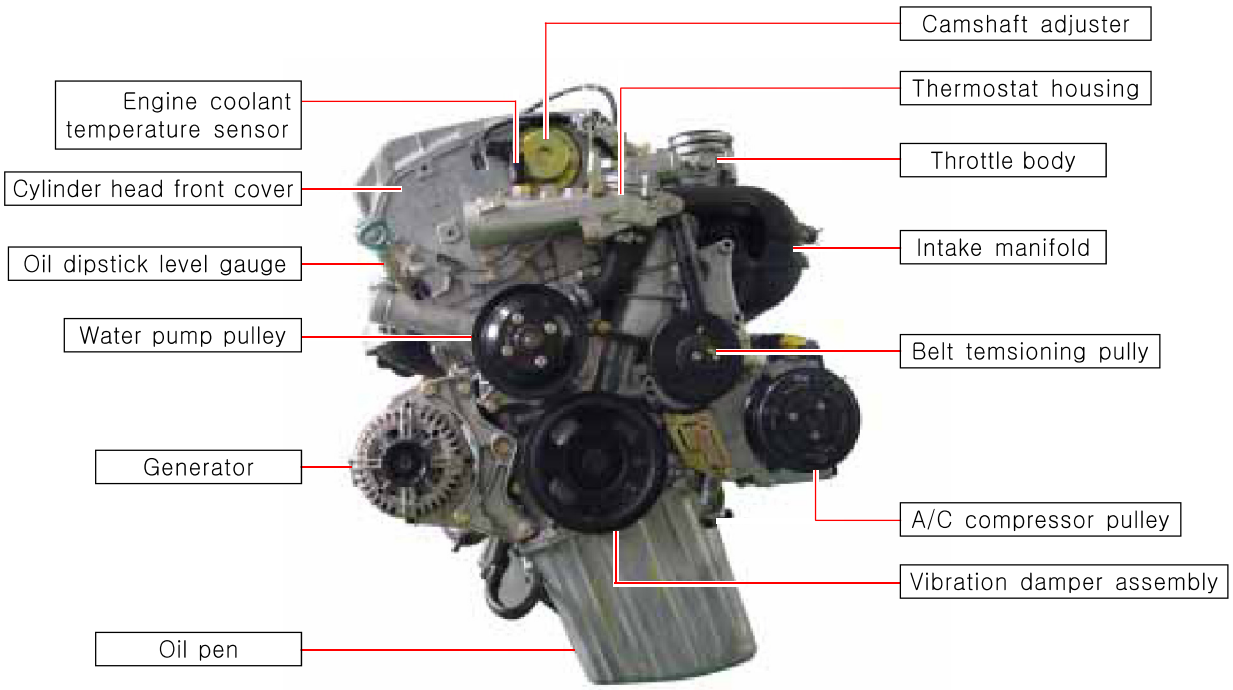
- Any time the air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material, which could follow the intake passage into the cylinder and cause extensive damage when the engine is started.



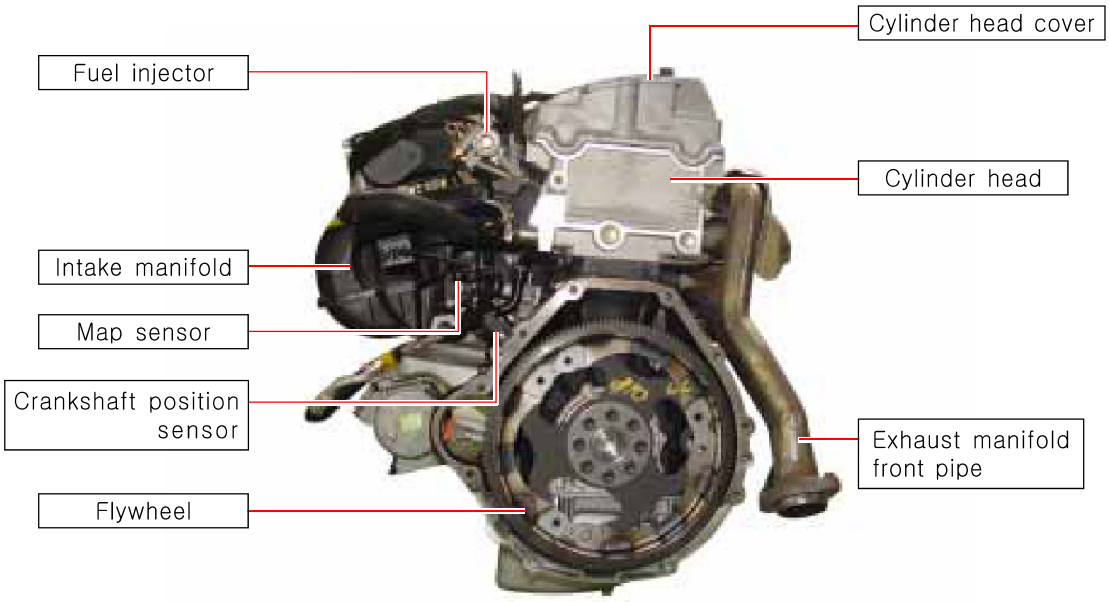
Modification basis	
Application basis	
Affected VIN	

2. G23D ENGINE ASSEMBLY

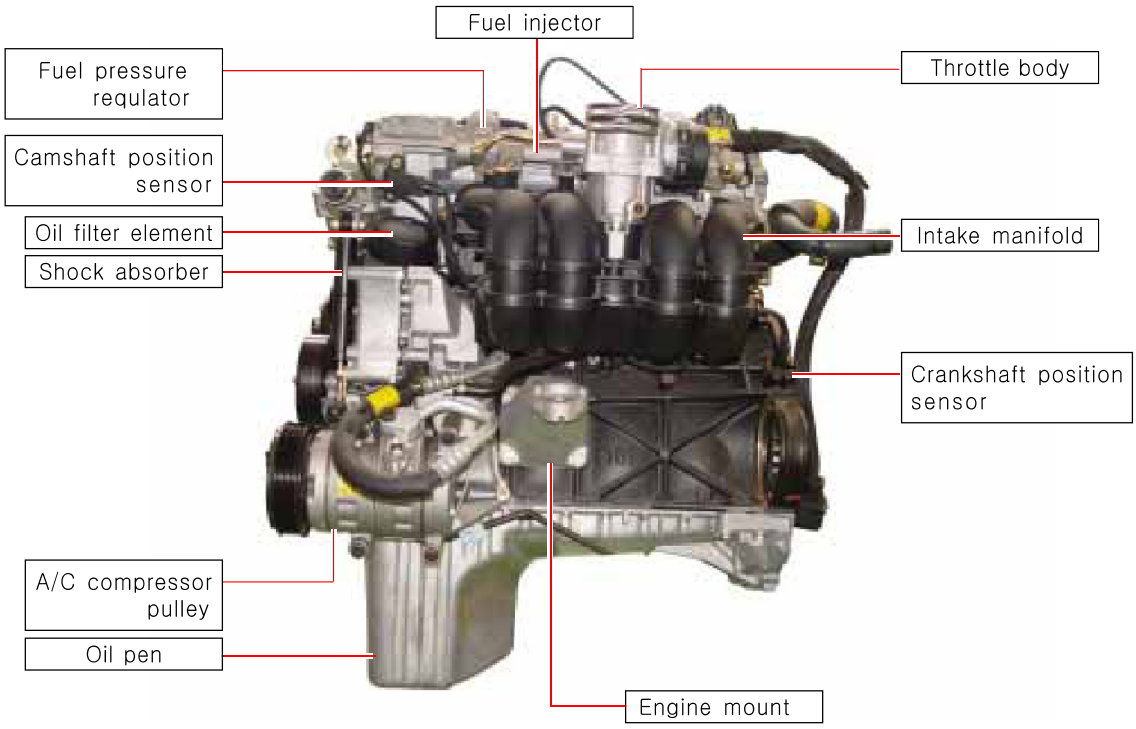
Front View



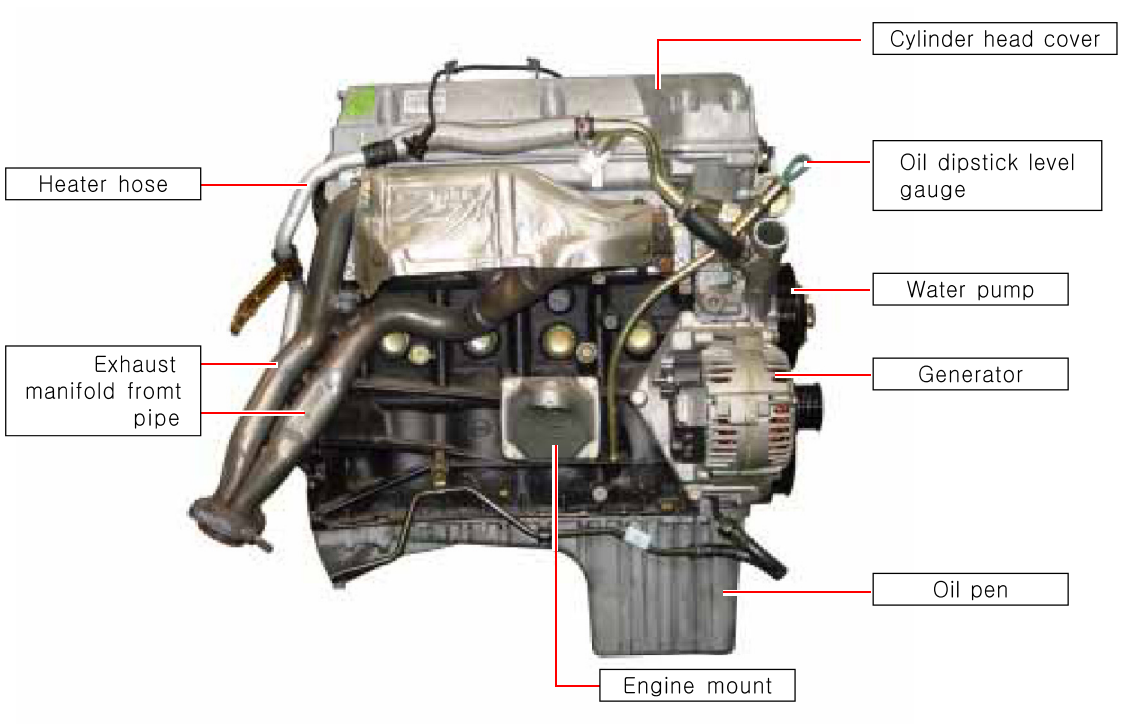
Rear View



LH Side View



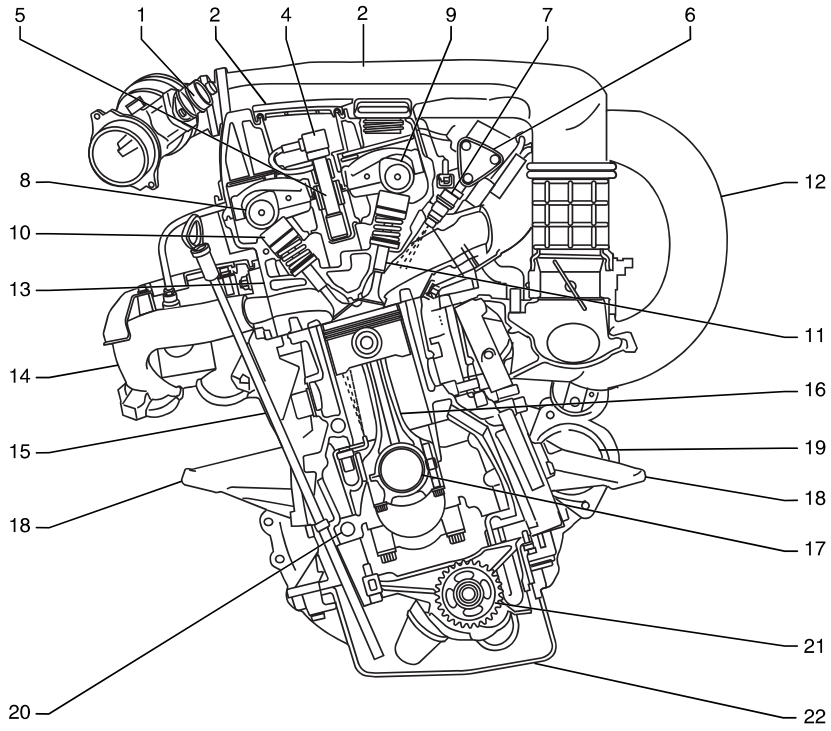
RH Side View



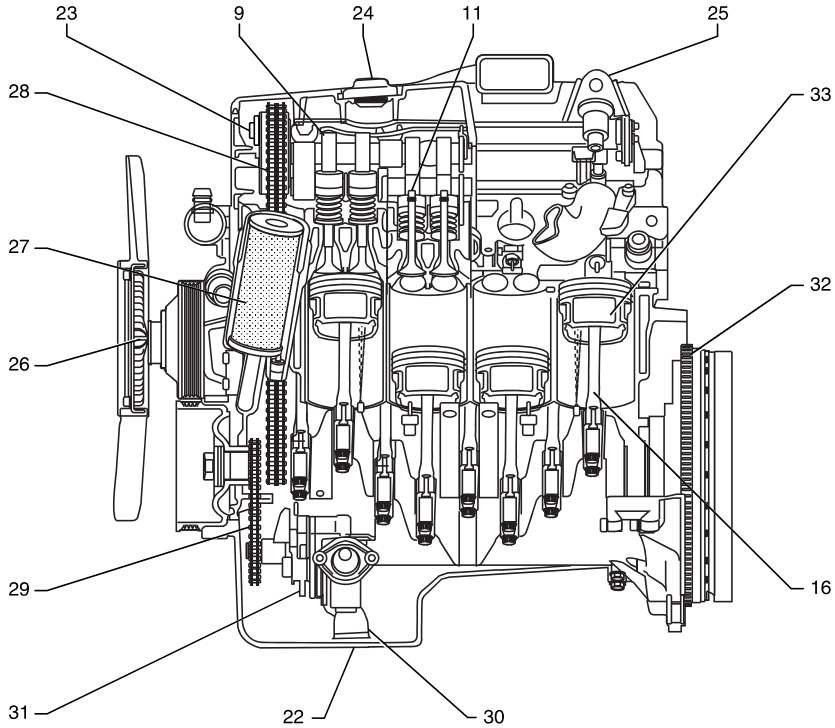
Modification basis	
Application basis	
Affected VIN	

3. G23D ENGINE STRUCTURE

Front View



Side View



▶ **Front View**

NO.	FUNCTION	NO.	FUNCTION
1	HFM Sensor	12	Intake Manifold
2	Intake Air Duct	13	Cylinder Head
3	Cylinder Head Cover	14	Exhaust Manifold
4	Ignition Coi	15	Dipstick Guide Tube and Gauge
5	Spark Plug Connector	16	Connecting Rod
6	Fuel Distributor	17	Crankshaft
7	Injector	18	Engine Mounting Bracket
8	Exhaust Camshaft	19	Starter
9	Intake Camshaft	20	Crankcase
10	Valve Tappet	21	Oil Pump Sprocket
11	Intake Valve	22	Oil Pan

▶ **Side View**

NO.	FUNCTION	NO.	FUNCTION
23	Camshaft Adjuster	29	Oil Pump Drive Chain
24	Oil Filler Cap	30	Oil Strainer
25	Engine Hanger Bracket	31	Oil Pump
26	Cooling Fan and Viscous Clutch	32	Ring Gear and Flywheel of Drive Plate
27	Oil Filter	33	Piston
28	Timing Chain		

Modification basis	
Application basis	
Affected VIN	

4. DIAGNOSTIC INFORMATION AND PROCEDURE

1) Oil Leak Diagnosis

Most fluid oil leaks are easily located and repaired by visually finding the leak and replacing or repairing the necessary parts. On some occasions a fluid leak may be difficult to locate or repair. The following procedures may help you in locating and repairing most leaks.

▶ Finding the Leak

- Identify the fluid. Determine whether it is engine oil, automatic transmission fluid, power steering fluid, etc.
- Identify where the fluid is leaking from.
  · After running the vehicle at normal operating temperature, park the vehicle over a large sheet of paper.
  · Wait a few minutes.
  · You should be able to find the approximate location of the leak by the drippings on the paper.
- Visually check around the suspected component.
  Check around all the gasket mating surfaces for leaks. A mirror is useful for finding leaks in areas that are hard to reach.
- If the leak still cannot be found, it may be necessary to clean the suspected area with a degreaser, steam or spray solvent.
  · Clean the area well.
  · Dry the area.
  · Operate the vehicle for several miles at normal operating temperature and varying speeds.
  · After operating the vehicle, visually check the suspected component.
  · If you still cannot locate the leak, try using the powder or black light and dye method.

▶ Powder Method

- Clean the suspected area.
- Apply an aerosol-type powder (such as foot powder) to the suspected area.
- Operate the vehicle under normal operating conditoins.
- Visually inspect the suspected component. You should be able to trace the leak path over the white powder surface to the source.

▶ Black Light and Dye Method

A dye and light kit is available for finding leaks, Refer to the manufacturer's directions when using the kit.

- Pour the specified amount of dye into the engine oil fill tube.
- Operate the vehicle normal operating conditions as directed in the kit.
- Direct the light toward the suspected area. The dyed fluid will appear as a yellow path leading to the source.

▶ Repairing the Leak

Once the origin of the leak has been pinpointed and traced back to its source, the cause of the leak must be determined in order for it to be repaired properly.

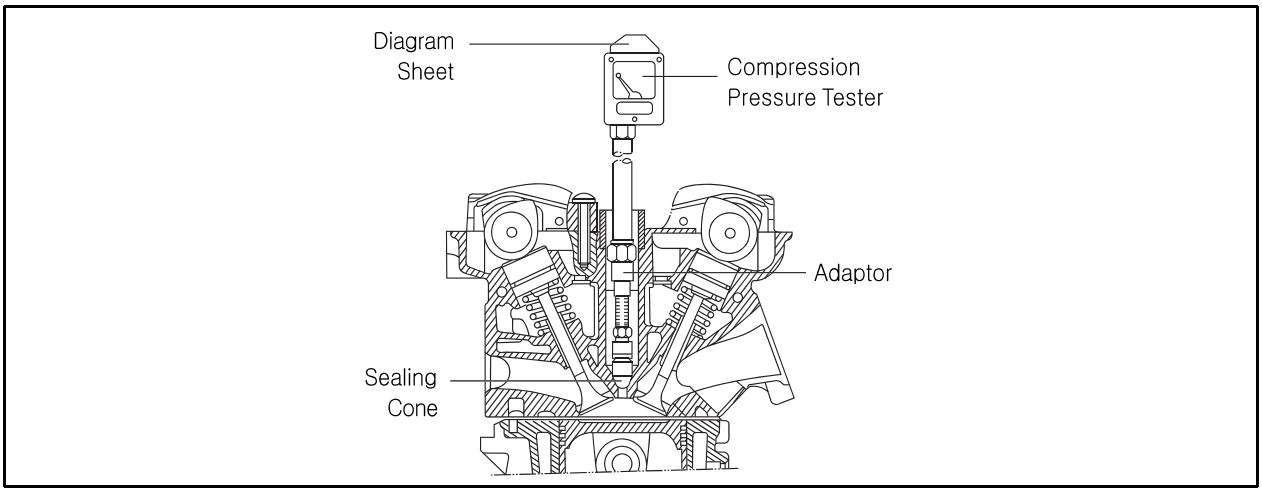
If a gasket is replaced, but the sealing flange is bent, the new gasket will not repair the leak. The bent flange must be repaired also. Before attempting to repair a leak, check for the following conditions and correct them as they may cause a leak.

▶ Gaskets

- The fluid level/pressure is too high.
- The crankcase ventilation system is malfunctioning.
- The seal bore is damaged (scratched, burred or nicked).
- The seal is damaged or worn.
- Improper installation is evident.
- There are cracks in the components.
- The shaft surface is scratched, nicked or damaged.
- A loose or worn bearing is causing excess seal wear.

Modification basis	
Application basis	
Affected VIN	

2) Compression Pressure Test



▶ Standard Service Data

Application	G23D Engine
Compression Ratio	10.4 : 1
Normal Engine Temperature	←
Normal Compression Pressure	Min. 11 bar, Max. 15 bar
Permissible Pressure Difference Between Individual C ylinders	←

CAUTION

- A9912 0012B (001 589 76 21 00) Compression Pressure Tester

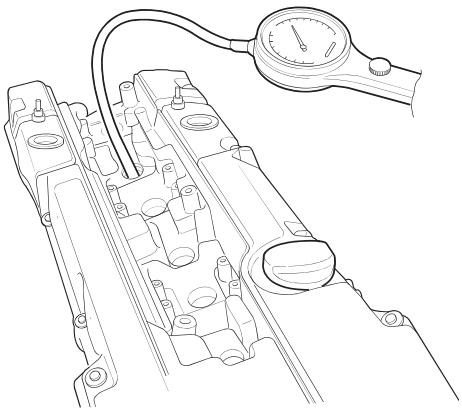
▶ Measuring Procedure

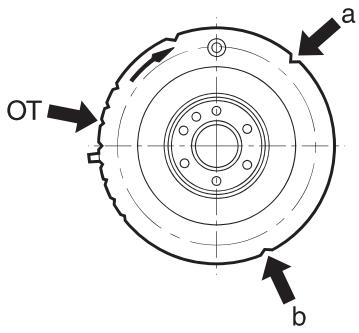
- Warm the engine up to normal operating temperature.
- Remove the spark plugs using the spark plug wrench.
- Place the diagram sheet to compression pressure tester A9912 0012B (001 589 76 21 00).
- Connect the adaptor to compression pressure tester A9912 0012B (001 589 76 21 00) and install it into the spark plug hole.
- Crank the engine approx. eight revolutions by using the start motor.
- Compare the measurements of compression pressure tester A9912 0012B (001 589 76 21 00) with the specifications.
- Measure the compression pressure of the other cylinders in the same way.
- If measured value is not within the specifications, perform the cylinder pressure leakage test.

CAUTION

- Discharge the combustion residues in the cylinders before testing the compression pressure.
- Apply the parking brake before cranking the engine.

3) Cylinder Pressure LeakageTest





▶ **Permissible Pressure Leakage**

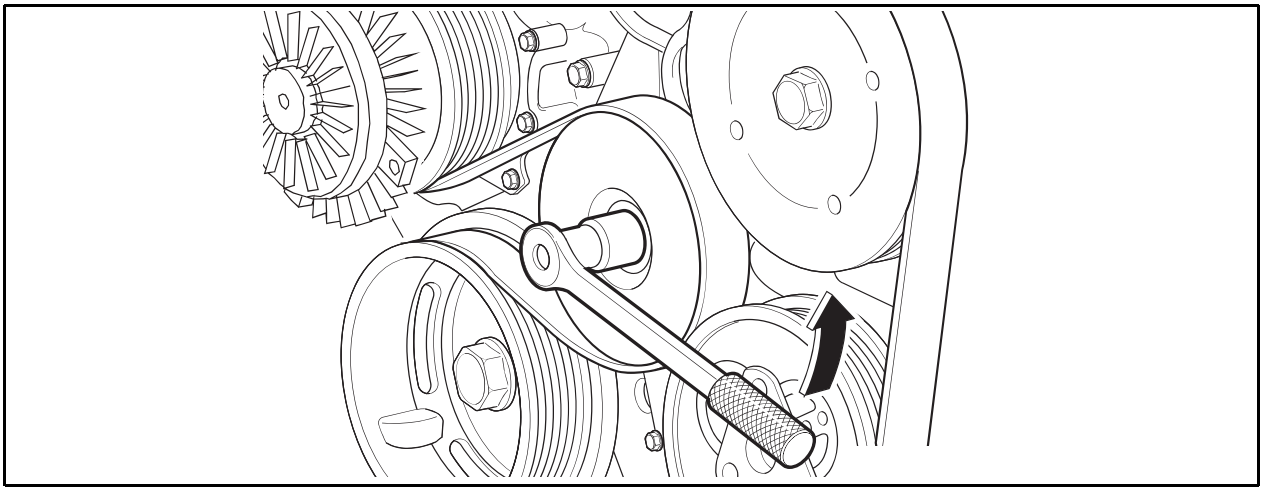
At Whole Engine	Max. 25 %
At Valve and Cylinder Head Gasket	Max. 10 %
At Piston and Piston Ring	Max. 20 %

▶ **Cylinder Number**

OT (TDC)	1, 4
UT (BDC 180 °)	2, 3

▶ **Cylinder Number**

Cylinder Pressure Leakage Tester	Bosch, EFAW210A Sun, CLT 228



▶ **Leakage Test**

- Warm the engine up to normal operating temperature.
- Disconnect the negative battery cable.
- Remove the spark plugs.
- Check the coolant level by opening the coolant reservoir cap and replenish if
- insufficient.
- Open the engine oil filler cap.
- Connect the tester to air pressure line and adjust the scale of tester.
- Install the connecting hose to spark plug hole.
- Position the piston of No.1 cylinder at TDC by rotating the crankshaft.
  Connect the connecting hose to tester and measure the leakage volume after blowing up 5 bar of compressed air.

CAUTION

- Measure the leakage volume in the completely opening condition of throttle valve by pulling the acceleration cable.

- Perform the pressure test according to the firing order.

CAUTION

- Firing Order: 1 - 3 - 4 - 2

- Compare the leakage pressure with the specifications.

5. GENERAL DIAGNOSIS

Condition		Probable Cause	Correction
Hard starting (With normal cranking)	Malfunction of immobilizer system	• Faulty immoblilzer system	• Check (Antenna, Immobilizer transponder) • Replace (Antenna, Immobilizer transponder)
	Malfunction of ignition system	• Faulty fuse	• Replace the fuse.
		• Faulty spark plug.	• Clean, adjust the plug gap or replace.
		• Electric leakage at the high tension cable.	• Replace the cable.
		• Poor connection of the high tension cable or lead wires.	• Replace the cable or wires.
		• Faulty ignition coil.	• Replace the ignition coil.
	Malfunction of fuel system	• Empty of fuel in the fuel tank.	• Feed the fuel.
		• Dirty or clogged fuel filter.	• Replace the filter.
		• Clogged fuel pipe.	• Clean the fuel pipe.
		• Malfunction of the fuel pump.	• Replace the fuel pump.
		• Malfunction of the fuel injector.	• Replace the injector.
		• The foreign material in the fuel tank.	• Clean the fuel tank.
	Decline of compression pressure	• Poor tightening spark plug.	• Tighten to the specified torque. Compression
		• Cracked cylinder head gasket.	• Replace the gasket.
		• Inadequate the valve clearance.	• Adjust the clearance.
		• Leakage of the valve clearance.	• Repair the valve.
		• Interference of the valve stem.	• Replace the valve or the valve guide.
		• Low elasticity or damage of the valve spring.	• Replace the valve spring.
		• Abnormal interference of pistons and cylinders.	• Replace the piston ring.
		• Excessive wear of pistons, rings, or cylinders.	• Replace the ring or the piston and boring or replace the cylinder.
	Others	• Broken timing belt.	• Replace the belt.
		• Loosening, damage or leakage of the vacuum hose.	• Connect the hose correctly or replace it.
		• Leakage of intake system.	• Replace intake system.
Lack of engine power	Decline of compression pressure	• Refer to above in this page.	• Refer to above in this page.
	Malfunction of ignition system	• Faulty spark plug.	• Adjust or replace the spark plug.
		• Electric leakage or poor connection of the high tension cable.	• Connect the cable correctly or replace it.

Modification basis	
Application basis	
Affected VIN	

▶ General Diagnosis (Cont'd)

Condition		Probable Cause	Correction
Lack of engine power	Malfunction of fuel system	• Clogged fuel pipe.	• Clean the pipe.
		• Clogged or contaminated fuel filter.	• Replace the filter.
	Others	• Clogged exhaust system.	• Check and repair the system.
		• Clogged or contaminated air cleaner element.	• Clean or replace the air cleaner element.
		• Leak of the intake manifold gasket.	• Replace the gasket.
		• Dragging brakes.	• Repair or replace the brakes.
Rough engine idling	Decline of compression pressure	• Refer to "Page 1A-7".	• Refer to "Page 1A-7".
	Malfunction of fuel system	• Clogged fuel pipe.	• Clean the pipe.
		• Clogged or contaminated fuel filter.	• Replace the filter.
		• Malfunction of the fuel pressure regulator.	• Replace the regulator.
	Malfunction of ignition system	• Malfunction of the spark plug.	• Adjust or replace the spark plug.
		• Electric leakage or poor connection of the high tension cable.	• Connect the cable correctly or replace it.
		• Malfunction of the ignition coil.	• Replace the ignition coil.
	Others	• Clogged or contaminated air cleaner element.	• Clean or replace the air cleaner element.
		• Leak of the intake manifold gasket.	• Replace the gasket.
		• Poor connection or damage or leakage of the vacuum hose.	• Connect the hose correctly or replace it.
Engine hesitate (Upon pressing accelerating pedal, the engine makes delayed response This situation is remarkable when cruising or starting.)	Decline of compression pressure	• Refer to "Page 1A-7".	• Refer to "Page 1A-7".
	Malfunction of ignition system	• Poor spark plug or Poor adjustment of the plug gap.	• Replace the plug or adjust the gap.
		• Electric leakage or poor connection of the high tension cable.	• Connect the cable correctly or replace it.
	Others	• Malfunction of the air cleaner system.	• Clean or replace the air cleaner system.
		• Leak of the intake manifold gasket.	• Replace the gasket.

▶ General Diagnosis (Cont'd)

Condition		Probable Cause	Correction
Engine surging (Engine power makes fluctuation in a fixed speed and speed changes without operating the accelerating pedal.)	Decline of compression pressure	• Refer to "Page 1A-7".	• Refer to "Page 1A-7".
	Malfunction of fuel system	• Clogged fuel pipe.	• Clean the pipe.
		• Clogged or contaminated fuel filter.	• Replace the filter.
		• Malfunction of the fuel pressure regulator.	• Replace the fuel pressure regulator.
	Malfunction of ignition system	• Malfunction of the spark plug.	• Adjust or replace the spark plug.
		• Electric leakage or poor connection of the high tension cable.	• Connect the cable correctly or replace it.
		• Poor ignition timing.	• Adjust the ignition timing.
	Others	• Leak of the intake manifold gasket.	• Clean or replace the gasket.
		• Leakage of the vacuum hose.	• Connect the hose correctly or replace it.
Excessive detonation (According to the opening range of Malfunction of metallic is made with abnormal explosion)	Overtheated engine	• Refer to "Overheat" in this page.	• Refer to "Overheat" in this page.
	Malfunction of fuel system	• Abnormal spark plug.	• Replace the spark plug.
		• Electric leakage or poor connection of the high tension cable.	• Connect the cable correctly or replace it.
	Malfunction of ignition system	• Clogged or contaminated fuel filter and fuel pipe.	• Clean or replace the fuel filter and the fuel pipe.
	Others	• Leak of the intake manifold gasket.	• Replace the gasket.
		• Excessive carbon deposit due to abnormal combustion.	• Remove the carbon.
Overheat	Malfunction of cooling system	• Lack of coolant.	• Refill coolant.
		• Malfunction of the thermostat.	• Replace the thermostat.
		• Malfunction of the cooling fan.	• Check or replace the cooling fan.
		• Poor water pump performance.	• Replace the pump.
		• Clogged or leaky radiator.	• Clean, repair or replace the radiator.
	Malfunction of lubrication system	• Poor engine oil.	• Replace engine oil with the specified one.
		• Blocking oil filter or strainer.	• Clean or repair the oil filter or the strainer.
		• Lack of engine oil.	• Refill oil.
		• Poor oil pump performance.	• Replace or repair the pump.
	Other	• Leakage of oil	• Repair.
		• Damaged cylinder head gasket.	• Replace the gasket.

Modification basis	
Application basis	
Affected VIN	

▶ General Diagnosis (Cont'd)

Condition		Probable Cause	Correction
Poor fuel consumption	Decline of compression pressure	• Refer to "Page 1A-7".	• Refer to "Page 1A-7".
	Malfunction of fuel system	• Leakage of the fuel tank or the fuel pipe.	• Repair or replace the fuel tank or the fuel pipe
	Malfunction of ignition system	• Abnormal spark plug (Excessive carbon deposit, inadequate gap, burnt electrode).	• Replace the plug.
		• Electric leakage or poor connec-tion of the high tension cable.	• Connect the cable normally or replace it.
	Malfunction of cooling system	• Malfunction of the thermostat.	• Repair the thermostat.
	Others	• Improperly installed valve.	• Repair or replace the valve.
		• Low pressure of tires.	• Adjust the pressure of tires.
Excessive consumption of engine oil	Leakage of engine oil	• Loosened oil drain plug.	• Tighten the plug.
		• Loosened oil pan bolt.	• Tighten the bolt. Engine Oil
		• Loosened oil filter.	• Tighten the filter.
		• Loosened oil pressure switch.	• Tighten the switch.
		• Leakage of camshaft front oil seal.	• Replace the seal.
		• Leakage of crankshaft front oil seal.	• Replace the seal.
		• Leakage at the cylinder head cover gasket.	• Replace the gasket.
		• Damage of the cylinder head gasket.	• Replace the gasket.
	Oil mixing in combustion chamber	• Stuck piston ring.	• Remove carbon and replace the ring.
		• Worn piston or cylinder.	• Replace the piston or the cylinder.
		• Worn piston ring or ring groove.	• Replace the piston or ring.
		• Inadequate position of the piston ring cutting part.	• Adjust the position.
		• Abrasion or damage of the valve system.	• Replace the valve system.
Low oil pressure	Malfunction of lubrication system	• Inadequate oil viscosity.	• Replace with the specified one.
		• Loosening of the oil pressure switch.	• Tighten the switch.
		• Lack of engine oil.	• Refill oil.
		• Blocking oil strainer.	• Clean the strainer.
		• Lowered function of the oil pump.	• Replace the pump.
		• Abrasion or damage of the oil pump relief valve.	• Replace the valve.

▶ General Diagnosis (Cont'd)

Condition		Probable Cause	Correction
Engine noise	Valve noise	• Inadequate valve clearance	• Adjust the valve clearance.
		• Abrasion of valve stem or guide.	• Replace the valve stem or the guide.
		• Weak valve spring.	• Replace the spring.
	Piston, ring, cylinder noise	• Abrasion of the piston, the ring or the cylinder.	• Boring the cylinder or replace the piston, the ring or the cylinder.
	Connecting rod noise	• Abrasion of the connecting rod bearing.	• Replace the bearing.
		• Loosened the connecting rod nut.	• Tighten to the specified torque
	Crankshaft noise	• Abrasion of the crankshaft bearing.	• Replace the bearing.
		• Abrasion of the crankshaft journal.	• Grind or replace the crankshaft journal.
		• Loosened bearing cap bolt.	• Tighten to the specified torque.
		• Excessive clearance of the crankshaft thrust bearing.	• Adjust or replace.

6. SPECIFICATIONS

1) Engine Specifications

Application			G23D Engine	Remarks
Engine Model			M161.970	
Displacement			2295 cc	
Cylinder (Bore x Stroke)			90.9 x 88.4 mm	
Fuel Injection / Ignition System			MSE 3.53D	
Compression Ratio			10.4 : 1	
Number of Cylinders			4	
Camshaft Valve Arrangement			DOHC	
Camshaft Drive Type			Chain-Driven	
Max. Output			149 ps / 5500 rpm	
Max. Torque			22.4 kg•m / 4000 rpm	
Firing Order			1 - 3 - 4 - 2	
Ignition Type			Distributor less double ignition	
Ignition Timing			BTDC 6° ± 2°	
Valve Timing	Intake	Open/Close	ATDC 13.15° / ABDC 13.57°	
	Exhaust	Open/Close	BBDC 16.58° / BTDC 17.05°	
Valve Clearance Adjustment			←	
Idle Speed			750 ± 50 rpm	
Fuel Injection Pressure			3.2 - 4.2 kg/cm²	
Oil Capacity			7.5 ℓ	
Lubrication Type			Forced by gear pump	
Oil Filter Type			Full flow with paper filter	
Fuel			Unleaded gasoline	

MSE : Engine Control Module

3.53D : 4 Cylinder Version

2) Fastener Tightening Specifications

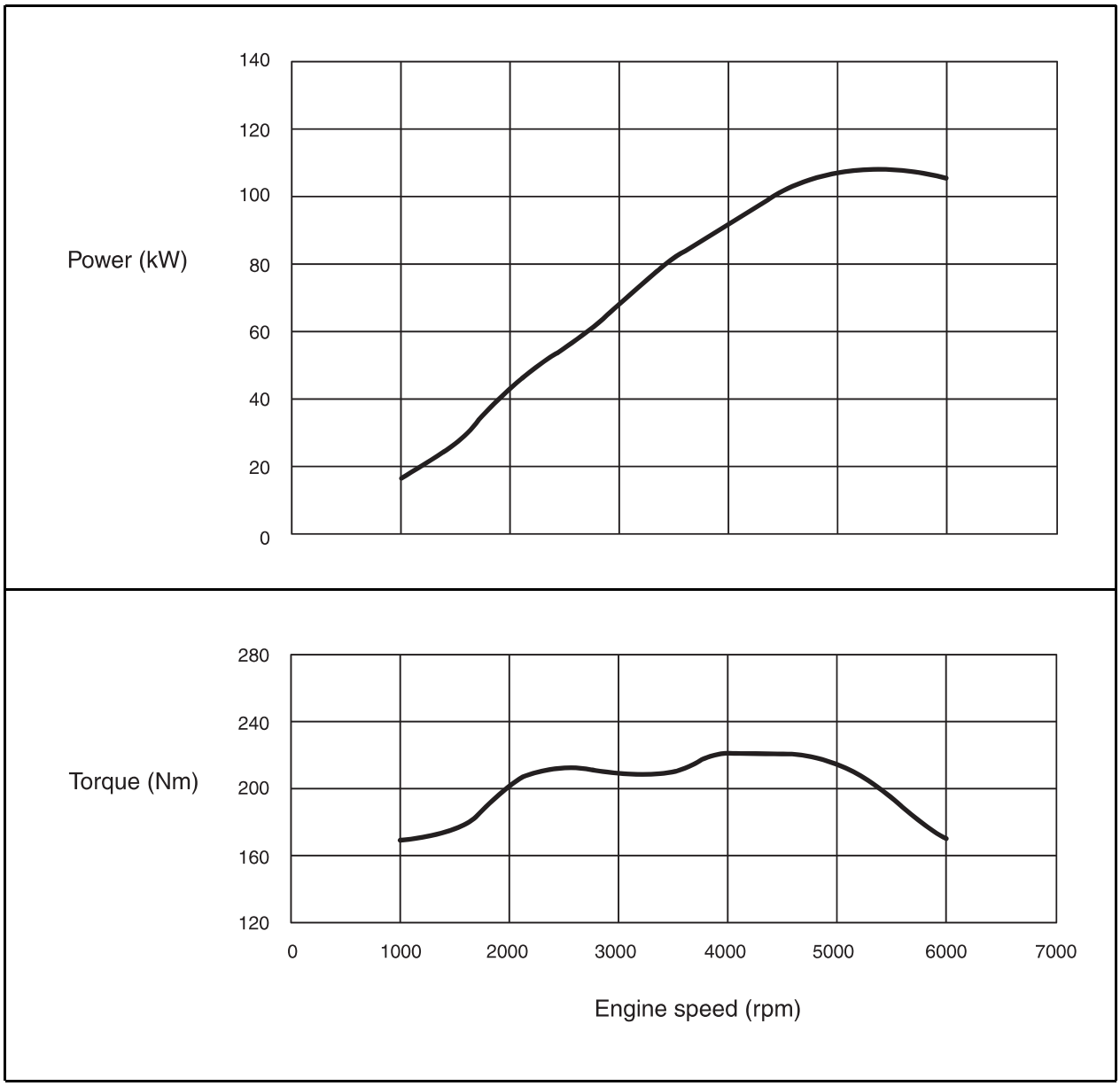
Application		N•m	Lb-Ft	Lb-In
Fuel Feed and Return Line		21 ~ 25	15 ~ 18	-
Exhaust Manifold and Pipe		30	22	-
Engine Mounting Nuts		70	52	-
Generator Carrier Bolts		25	18	-
Tensioning Pulley Bolt		40.5 ~ 49.5	29.9 ~ 36.5	-
Steering Pump Bolts		22.5 ~ 27.5	16.6 ~ 20.3	-
A/C Braket Bolts		22.5 ~ 27.5	16.6 ~ 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	-

Modification basis	
Application basis	
Affected VIN	

▶ 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	-

2) Performance Curve



Modification basis	
Application basis	
Affected VIN	

Memo

ENGINE INTAKE SYSTEM

0000-00

GENERAL

1. SPECIFICATIONS

(1) Fastener Tightening Specifications

Application	N•m	Lb-Ft	Lb-In
DOC to Muffler Nut	28 - 47	21 - 35	-
Exhaust Manifold to Front Exhaust Pipe Nut	15 - 28	11 - 21	-
Front Exhaust Pipe to DOC Nut	28 - 47	21 - 35	-
Front Exhaust Pipe to Muffler Nut	28 - 47	21 - 35	-
Intake Air Duct Mounting Bolt	22.5 - 27.5	16.6 - 20.3	-
Intake Manifold Mounting Bolt	22.5 - 27.5	16.6 - 20.3	-
Muffler to Tail Exhaust Pipe Nut	28 - 47	21 - 35	-
Resonance Flap Mounting Bolt	9 - 11	-	80 - 97

ENGINE EXHAUST SYSTEM

2420-01

GENERAL

1. SPECIFICATION

(1) Fastener Tightening Specifications

Application	N•m	Lb-Ft	Lb-In
DOC to Muffler Nut	28 - 47	21 - 35	-
Exhaust Manifold to Front Exhaust Pipe Nut	15 - 28	11 - 21	-
Front Exhaust Pipe to DOC Nut	28 - 47	21 - 35	-
Front Exhaust Pipe to Muffler Nut	28 - 47	21 - 35	-
Intake Air Duct Mounting Bolt	22.5 - 27.5	16.6 - 20.3	-
Intake Manifold Mounting Bolt	22.5 - 27.5	16.6 - 20.3	-
Muffler to Tail Exhaust Pipe Nut	28 - 47	21 - 35	-
Resonance Flap Mounting Bolt	9 - 11	-	80 - 97

OVERVIEW AND OPERATION PROCESS

1. DESCRIPTION AND OPERATION

1) Exhaust System

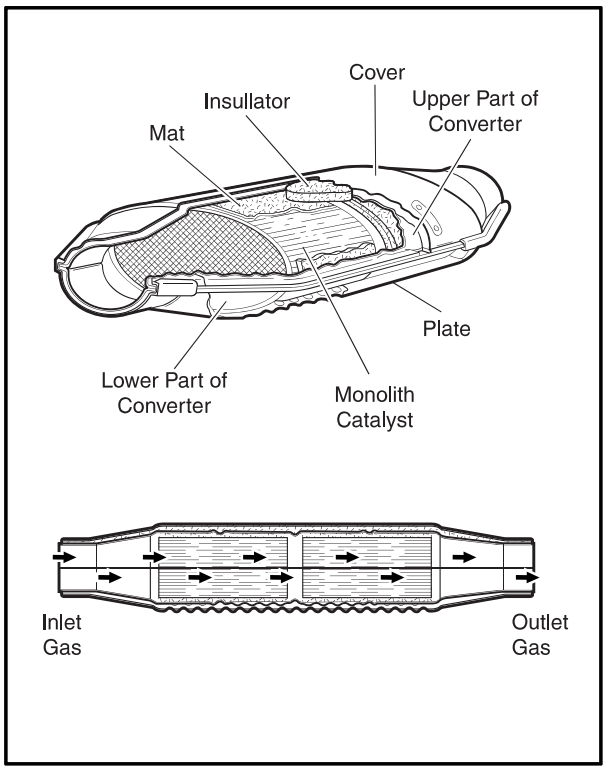
CAUTION

When you are inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to avoid possible
overheating of the floor panel and possible damage to the passenger compartment insulation and trim materials.
Check the complete exhaust system and the nearby body areas and trunk lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections, or other deterioration which could permit exhaust fumes to seep into the trunk may be an indication of a problem in one of these areas. Any defects should be corrected immediately.

2) Catalytic Converter (Gasoline Engine)

1. When jacking or lifting the vehicle from the body side rails, be certain that the lift pads do not contact the catalytic converter, as this could damage the catalytic converter.
2. Use of anything other than unleaded fuel will damage the catalyst in the catalytic converter.

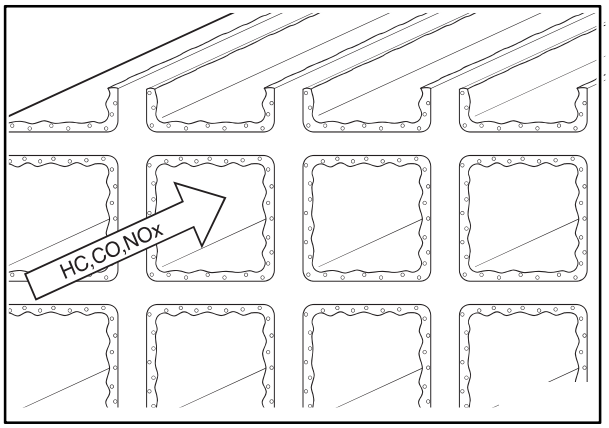
▶ **Catalytic Converter Structure**



The Catalytic converter of monolith type consists of 2 walled metal bodies which is made of Cordierite. The principal element of converter consists of the materials like Alumina or oxidized Serume in order to apply to Ceramic Monolith. Washer coat operates first, and catalytic metal elements (Pt, Pd, Rh) operates to washer coat next.
Monolith type is lighter than other types, easy to manufacture and quickly approaches to proper temperature. Washer coat is used to make a contact surface with exhaust gas bigger by adhering closely to small holes
of inner layer. If a lead compound or phosphorus adheres to the surface and the temperature rises, its surface is decreased. The total area of general monolith converter is about 45, 000~500,000ft3. (10 times of a football field) Generally Alumina (AL2 O3) is used as a raw materialand its 7 phases of gamma, delta, theta have big areas and high stability for the temperature, and nowadays gamma Alumina is used usually.

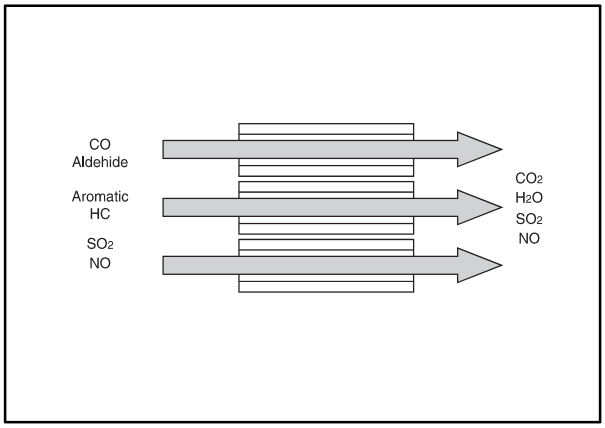
Modification basis	
Application basis	
Affected VIN	

▶ Catalytic Converter and Temperature

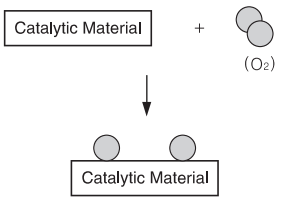
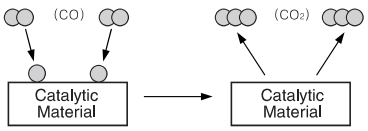
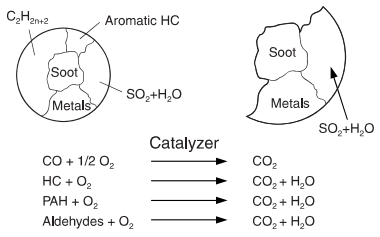


Catalytic converter has the normal function of purification at a range of the temperature. Because it has a weak point of decreasing of the purification rate in the condition of continuous high temperature, it should keep the temperature range of 400 to 500°C for normal condition. HC purification rate becomes better according to the increase of temperature in the normal range of temperature. CO purification rate becomes the best near the temperature of 450°C, and NOx does so near the temperature of 400 to 500°C.

▶ Purification of Catalytic Converter



- Adhesion of soluble organic fraction (SOF) below 180°C
- Purification of soluble organic fraction (SOF) over 180°C
  Chemical reaction formula
  SOF(HC)+O2 → CO2+H2O
  2CO+O2 → 2CO2
  2C2H6+7O2 → 4CO2+6H20
- By catalytic action of two primary catalytic converter, oxidation occurs in order to decrease HC and CO.

Oxygen adheres to catalytic material : below 180°C	Catalytic material supplies each CO and HC with O2 for their oxidation : above 180°C	Catalytic material conversion process by DOC
		

Modification basis	
Application basis	
Affected VIN	

▶ Method for Reduction of NOx

NOx is generated a great deal in case that combustion temperature and excess air factor are high. EGR valve can decrease NOx (30 to 35% decrease) by making temperature of combustion chamber fall by means of exhaust gas re-circulation.

- EGR valve is installed on the diesel engine of Musso, Korando, Istana and Rexton. And micro switch is installed together to control EGR valve.
- The setting method of micro switch is identical with the existing one.

Modification basis	
Application basis	
Affected VIN	

ENGINE COOLING SYSTEM

2110-01

GENERAL

1. GENERAL SPECIFICATIONS

Application		Unit	Gasoline Engine
Cooling System	Type	-	Water Cooling Forced Circulation
Coolant	Capacity	L	11.3
Thermostat	Type	-	Wax Pellet Type
	Initial Opening Temp.	°C (°F)	82 (180)
	Fully Opening Temp.	°C (°F)	95 (203)
	Fully Closing Temp.	°C (°F)	80 (176)
	Stroke	mm	7
Cooling Fan	Type	-	PWM
	Blades	-	5
	Diameter	mm	320
	Low Speed ON Temp.	°C (°F)	95 (203)
	Low Speed OFF Temp.	°C (°F)	90 (194)
	High Speed ON Temp.	°C (°F)	105 (221)
	High Speed OFF Temp.	°C (°F)	100 (212)
	High Speed ON Temp. (By A/C Pressure)	kPa (psi)	269.8 (1860)
Coolaant Reservoir	Pressure Valve Opening Pressure	kPa (psi)	118 - 147 (17.1 - 21.3)
	Vacuum Valve Opening Pressure	kPa (psi)	9.8 (1.4)
Water Pump	Type	-	Turbo Centrifugal
	Impeller Diameter	mm	65
	Impeller Blades	-	8
Radiator	Type	-	Cross-flow
	Core Width	mm	701
	Core Height	mm	372
	Core Thickness	mm	18
Coolant Temperature Gauge	Minimum Radiation Capability	Kcal/h	45,000
	Resistance (at 50 °C (122°F))	Ω	185.2
	Resistance (at 80 °C (176°F))	Ω	47.4
	Resistance (at 105 °C (221°F))	Ω	28.2
Engine Coolant Temperature Sensor	Resistance (at 20 °C (68°F))	K Ω	3.33 - 37.8
	Resistance (at 80 °C (176°F))	K Ω	0.32 - 0.35
Anti-Freeze Agent	Type	-	ALUTEC-P78
	Mixture of Water and Good Quality Ethylene Glycol-Base Anti-Freeze	-	50 : 50

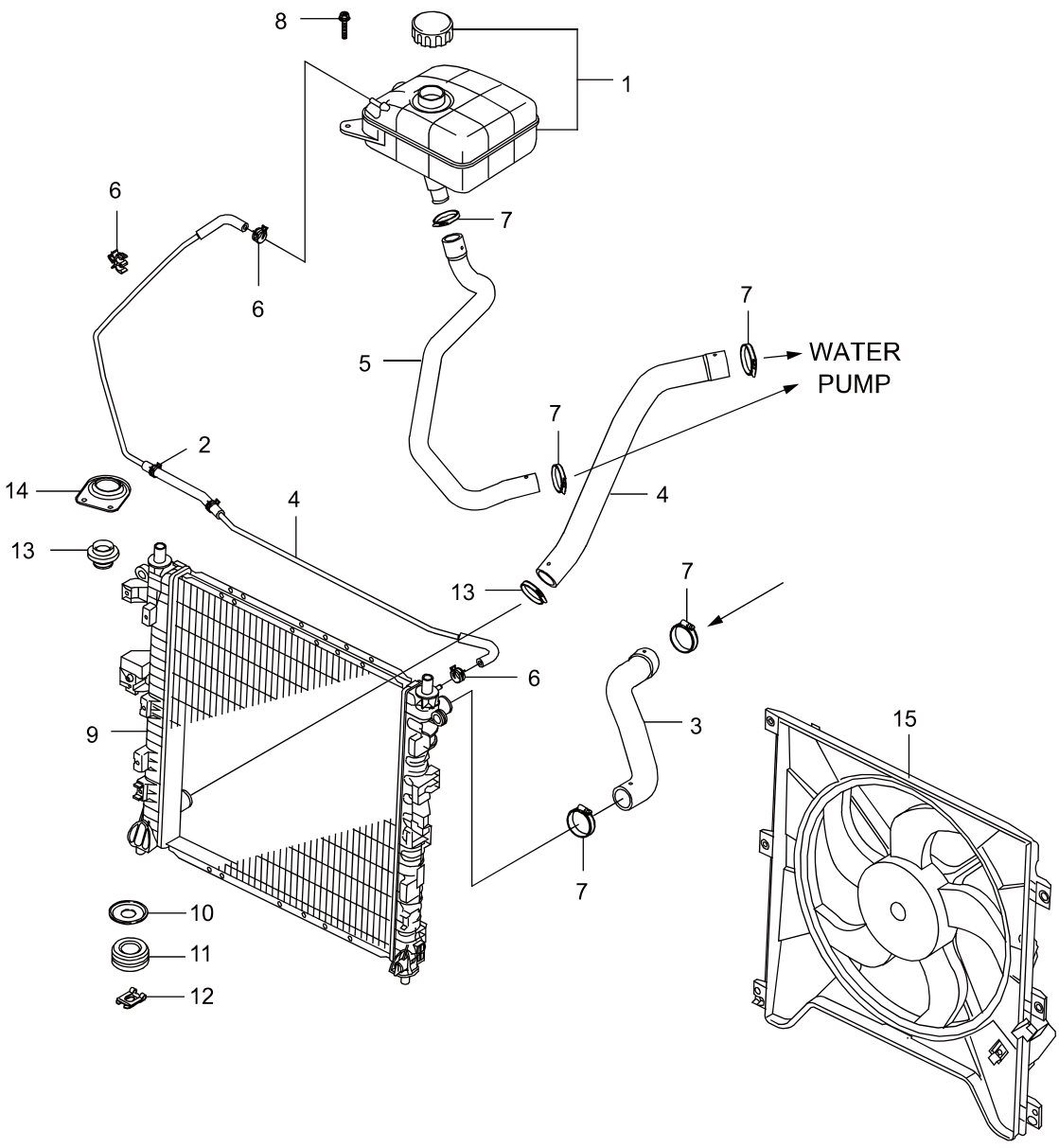
2. FASTENER TIGHTENING SPECIFICATIONS

Application		Nm	Lb-Ft	Lb-In
Automatic Transmission Oil Cooler Pipe		20	15	-
Automatic Transmission Oil Cooler Pipe Mounting Bolt		3 - 7	-	27 - 62
Coolant Drain Plug		30	22	-
Cooling Fan Bolt		9 - 11	-	80 - 97
Cooling Fan Shroud Bolt		3 - 7	-	27 - 62
Oil Cooler Pipe Line Bolt		9 - 11	-	80 - 97
Radiator Mounting Bracket Bolt		3 - 7	-	27 - 62
Tensioning Device Shock Absorber Bolt		22.5 - 27.5	16.6 - 20.3	-
Thermostat Cover Bolt		9 - 11	-	80 - 97
Thermostat Housing Bolt	M6	9 - 11	-	80 - 97
	M8	22.5 - 27.5	16.6 - 20.3	-
Viscous Clutch Mounting Bolt		40.5 - 49.5	29.8 - 36.5	-
Water Pump Housing Bolt	M6	9 - 11	-	80 - 97
	M8	22.5 - 27.5	16.6 - 20.3	-
Water Pump Pulley Bolt		9 - 11	-	80 - 97

Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATION PROCESS

1. COMPONENT LOCATOR



1. Reserver Tank
2. Deaeration Tube
3. Inlet Hose
4. Outlet Hose
5. 3 way Hose
6. Clamp
7. Clamp
8. Bolt (M6, 2 piece)
9. Radiator
10. Lower Radiator Insulator
11. Plate
12. Clip
13. Upper Radiator Insulator
14. Bracket
15. PWM Electric Fan

2. DESCRIPTION AND OPERATION

1) General Description

The cooling system maintains the engine temperature at an efficient level during all engine operating conditions.
When the engine is cold, the cooling system cools the engine slowly or not at all. This slow cooling of the engine allows the engine to warm up quickly.
The cooling system includes a radiator and recovery subsystem, cooling fans, a thermostat and housing, a water pump, and a water pump drive belt. The timing belt drives the water pump.
All components must function properly for the cooling system to operation. The water pump draws the coolant from the radiator. The coolant then circulates through water jackets in the engine block, the intake manifold, and the cylinder head. When the coolant reaches the operating
temperature of the thermostat, the thermostat opens. The coolant then goes back to the radiator where it cools.
This system directs some coolant through the hoses to the heat core. This provides for heating and defrosting.
The coolant reservoir is connected to the radiator to recover the coolant displaced by expansion from the high temperatures. The coolant reservoir maintains the correct coolant level.
The cooling system for this vehicle has no radiator cap or filler neck. The coolant is added to the cooling system through the coolant reservoir.

2) Radiator

This vehicle has a lightweight tube-and-fin aluminum radiator. Plastic tanks are mounted on the upper and the lower sides of the radiator core.
On vehicles equipped with automatic transaxles, the transaxle fluid cooler lines run through the radiator tank.
A radiator drain plug is on this radiator.
To drain the cooling system, open the drain plug.

3) Coolant Reservoir

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.

Modification basis	
Application basis	
Affected VIN	

4) 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.

5) Thermostat

A wax pellet-type thermostat controls the flow of the engine coolant through the engine cooling system. The thermostat is mounted in the thermostat housing to the front of the cylinder head.
The thermostat stops the flow of the engine coolant from the engine to the radiator to provide faster warm-up, and to regulate the coolant temperature. The thermostat remains closed while the engine coolant is cold, preventing circulation of the engine coolant through the radiator. At this point, the engine coolant is allowed to circulate only throughout the heater core to warm it quickly and evenly.
As the engine warms, the thermostat opens. This allows the engine coolant to flow through the radiator wherethe heat is dissipated. This opening and closing of the thermostat permits enough engine coolant to enter the radiator to keep the engine within proper engine temperature operating limits.
The wax pellet in the thermostat is hermetically sealed in a metal case. The wax element of the thermostat expands when it is heated and contracts when it is cooled.
As the vehicle is driven and the engine warms, the engine coolant temperature increases. When the engine coolant reaches a specified temperature, the wax pellet element in the thermostat expands and exerts pressure against the metal case, forcing the valve open. This allows the engine coolant to flow through the engine cooling system and cool the engine.
As the wax pellet cools, the contraction allows a spring to close the valve.
The thermostat begins to open at 82 °C (180 °F) and is fully open at 95 °C (203 °F). The thermostat closes at 80 °C (176 °F).

6) Electric Cooling Fan

CAUTION

- Keep hands, tools, and clothing away from the engine cooling fans to help prevent personal injury.
  This fan is electric and can turn on even when the engine is not running.

CAUTION

- If a fan blade is bent or damaged in any way, no attempt should be made to repair or reuse the damaged part. A bent or damaged fan assembly should always be replaced with a new one to prevent possible injury.

The cooling fans are mounted behind the radiator in the engine compartment. The electric cooling fans increase the flow of air across the radiator fins and across the condenser on air conditioned (A/C)-equipped vehicles.
This helps to speed cooling when the vehicle is at idle or moving at low speeds.
All models have two fans. The main fan is 320 mm (12. 6 inches) in diameter with seven blades to aid the airflow through the radiator and the condenser. An electric motor attached to the radiator support drives the fan.
The auxiliary fan is 320 mm (12.6 inches) in diameter.

▶ **A/C Off or Non-AC Model**

- The cooling fans are actuated by the engine control module (ECM) using a low-speed cooling fan relay, a high-speed cooling fan relay and a cooling fan motor relay.
- The ECM will turn the cooling fans on at low speed when the coolant temperature reaches 95 °C (203 °F) and at high speed when the coolant temperature reaches 105 °C (221 °F).
- The ECM will change the cooling fans from high peed to low speed at 100 °C (212 °F) and will turn the cooling fans off at 90 °C (194 °F).

▶ **A/C On**

- The ECM will turn the cooling fans on at low speed when the A/C system is on. The ECM will change to high speed when the high side A/C pressure reaches 1860 kPa (269.8 psi).
- The cooling fans will return to low speed when the high side A/C pressure reaches 1378 kPa (199.8 psi).

7) Engine Coolant Temperature Sensor

The Engine Coolant Temperature (ECT) sensor uses a temperature to control the signal voltage to the Engine Control Module (ECM).

8) Coolant Temperature Gauge

The coolant temperature gauge controls the instrument panel temperature indicator. The coolant temperature gauge is located with ECT sensor.

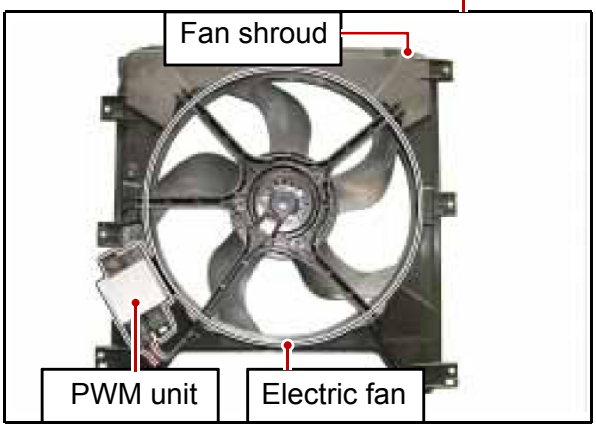
Modification basis	
Application basis	
Affected VIN	

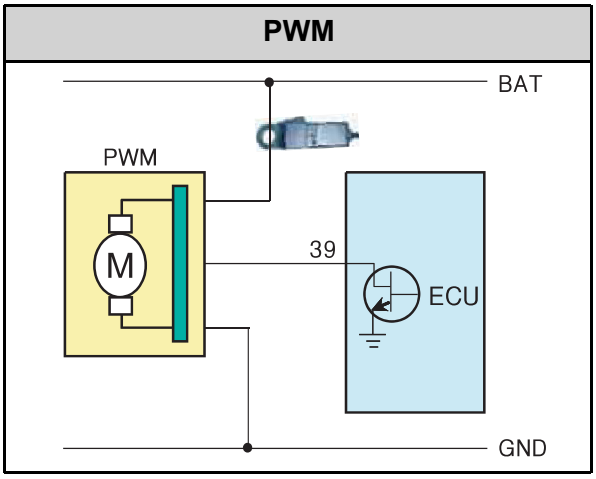
3. PWM (PULSE WIDTH MODULATION) ELECTRIC FAN OPERATION

1) Function

The PWM (Pulse Width Modulation) high capacity electric fan is installed instead of electric condenser fan to enhance the durability and controllability and reduce noise.

2) Mounting Location





3) PWM Electric Fan

(1) Advantages and Disadvantages of the PWM Electric Fan

▶ **Advantages**

- Enhanced A/C performance: at low speed, at idling, driving in city
- Reduction of vibration/noise: fan activated by PWM only when necessary
- Reduction of engine consuming power (V/Fan driving force) by 4 Hp - Cost saving

▶ **Disadvantage**

- Poor engine cooling perfomance at low and high rpm

4) PWM (Pulse Width Modulation) Unit

It controls the time of the output voltage to control the fan motor speed independently.

▶ **Internal functions**

- Motor power shutting-off function when overcurrent is applied
- Adverse voltage prevention function
- Detection function for the motor lock
- Temperature detecting function: The electric fan operates at FULL speed to cool down the PWM unit when the interior
  temperature of PWM unit is over 120~150°C.
- Communication function when failing: The fail signal is transmitted to the ECU when the PWM unit is malfunctioning.
- Soft start function: The motor speed is gradually increased when the motor is initially operated.

Modification basis	
Application basis	
Affected VIN	

5) Shutting-off Condition of the A/C Compressor

▶ **Coolant temperature**

- When coolant temperature is below 20°C or over 115°C, engine speed is below 650 rpm or over 4500 rpm for 4 seconds after engine starting, abrupt acceleration and A/C refrigerant pressure sensor detecting the followings
- A/C compressor is turned off when the refrigerant pressure is below 2.0 kg/cm2 and then is turned on when the refrigerant pressure is over 2.4 kg/cm2.
- A/C compressor is turned off when the refrigerant pressure is over 30 kg/cm2 and then is turned on when the refrigerant pressure is below 21.4 kg/cm2.

ENGINE ELECTRIC DEVICES

0000-00

GENERAL

1. DIAGNOSTIC INFORMATION AND PROCEDURE

1) Ignition System

Condition	Probable Cause	Correction
No Crank	• Low battery voltage.	• Charging the battery or Replace the battery.
	• Battery cable is loose, corroded, or damaged.	• Repair or Replace the battery cable.
	• Faulty starter motor or starter motor circuit is open.	• Repair or Replace the starter motor/starter motor circuit.
	• Faulty ignition switch.	• Replace the ignition switch.
	• Ground short.	• Repair the ground short.
Crank OK, But Too Slow	• Low battery voltage.	• Charging the battery or Replace the battery.
	• Battery. • Battery cables are loose, corroded, or damaged.	• Repair or Replace the battery cable.
	• Faulty starter motor.	• Repair or Replace the starter motor.
Starter Motor Does Not Stop	• Faulty starter motor.	• Repair or Replace the starter motor.
	• Faulty ignition switch.	• Replace the ignition switch.
Starter Motor Running, But Not Cranking	• Broken the clutch pinion gear or faulty starter motor.	• Replace the starter motor.
	• Broken the flywheel ring gear.	• Replace the flywheel.
	• Connected circuit is open.	• Repair the open circuit.
Battery Discharge	• Loosen the generator drive belt.	• Adjust the belt tension or Replace the belt.
	• The circuit is open or a short.	• Repair the open or a short circuit.
	• Battery run down.	• Replace the battery.
	• Open ground circuit.	• Repair the open ground circuit.
Charging Indicator Lamp Does Not Work When the Ignition Switch ON (Engine Does Not Work)	• Charging indicator lamp is blown or fuse is blown.	• Repair or Replace the charging indicator lamp/fuse.
	• Faulty ignition switch.	• Replace the ignition switch.
	• Generator ground circuit is open or a short.	• Repair the circuit.
Charging Indicator Lamp Does Not Put Out Lights After Starting the Engine	• Battery cable is corroded or damaged.	• Repair or Replace the battery cable.
	• Loosen the generator drive belt.	• Adjust the belt tension or Replace the belt.
	• Faulty wiring harness.	• Repair the wiring harness.
Battery Over Charging	• Generator Voltage Regulator Faulty	• Replace Generator
	• Voltage detecfing wiring faulty	• Repair Wiring

2) Ignition System (Cont'd)

Condition	Probable Cause	Correction
Hard Engine Starting	• Ignition coil faulty	• Replace ignition coil
	• Distributor (including optical sensor) faulty	• Replace distribator (or sensor)
	• Spark plug malfuntion	• Replace spark plug or adjust clearance
	• Ignition timing faulty (spark plug light is normal)	• Resetting valve timing
Unstable Engine Idling	• Spark plug malfunction	• Replace spark plug or adjust clearance
	• Ignition coil faulty	• Replace ignition coil
	• Ignition timing faulty	• Resetting valve timing
Enging Acceralation Malfunction	• Ignition timing faulty	• Resetting valve timing

Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATION PROCESS

1. DESCRIPTION AND OPERATION

1) Battey

The sealed battery is standard on all cars. There are no vent plugs in the cover.
The battery is completely sealed, except for two small vent holes in the sides.
These vent holes allow the small amount of gas produced in the battery to escape.
The battery has the following advantages over conventional batteries:

- No water addition for the life of the battery.
- Overcharge protection. If too much voltage is applied to the battery, it will not accept as much current as a conventional battery.
  In a conventional battery, the excess voltage will still try to charge the battery, leading to gassing, which causes liquid loss.
- Not as liable to self-discharge as a conventional battery. This is particularly important when a battery is left standing for long periods of time.
- More power available in a lighter, smaller case.

The battery has three major functions in the electrical system.
First, the battery provides a source of energy for cranking the engine.
Second, the battery acts as a voltage stabilizer for the electrical system. Finally, the battery can, for a limited time, provide energy when the electrical demand exceeds the output of the generator.

2) Ratings

▶ A battery has two ratings: (1) a reserve capacity rating designated at 27 °C (80 °F), which is the time a fully charged battery will provide 25 amperes of current flow at or above 10.5 volts (2) a cold cranking amp rating determined under testing at -18 °C (0 °F), which indicates the cranking load capacity.

(1)Reserve Capacity

The reserve capacity (RC) is the maximum length of time it is possible to travel at night with the minimum electrical load and no generator output. Expressed in minutes, the RC rating is the time required for a fully charged battery, at a temperature of 27 °C (80 °F) and being discharged at a current of 25 amperes, to reach a terminal voltage of 10.5 volts.

(2) Cold Cranking Amperage

The cold cranking amperage test is expressed at a battery temperature of -18 °C (0 °F).
The current rating is the minimum amperage, which must be maintained by the battery for 30 seconds at the specified temperature, while meeting a minimum voltage requirement of 7.2 volts.
This rating is a measure of cold cranking capacity.
The battery is not designed to last indefinitely. However, with proper care, the battery will provide many years of service. If the battery tests well, but fails to perform satisfactorily in service for no apparent reason, the following factors may point to the cause of the trouble:

- Vehicle accessories are left on overnight.
- Slow average driving speeds are used for short periods.
- The vehicle's electrical load is more than the generator output, particularly with the addition of aftermarket equipment.
- Defects in the charging system, such as electrical shorts, a slipping generator belt, a faulty generator, or a faulty voltage regulator.
- Battery abuse, including failure to keep the battery cable terminals clean and tight or a loose battery hold-down clamp.
- Mechanical problems in the electrical system, such as shorted or pinched wires.

3) Charging Time Required

The time required to charge a battery will vary depending upon the following factors:

▶ Size of Battery - A Completely discharged large heavy-duty battery required more than twice the recharging time as a completely discharged small passenger car battery.

▶ Temperature - A longer time will be needed to charge any battery at -18 °C (0 °F) than at 27 °C (80 °F).
When a fast charger is connected to a cold battery, the current accepted by the battery will be very low at first.
The battery will accept a higher current rate as the battery warms.

▶ Charger Capacity - A charger which can supply only 5 amperes will require a much longer charging period than a charger that can supply 30 amperes or more.

▶ State-of-Charge - A completely discharged battery requires more than twice as much charge as a onehalf charged battery.
Because the electrolyte is nearly pure water and a poor conductor in a completely discharged battery, the current accepted by the battery is very low at first. Later, as the charging current causes the electrolyte acid content to increase, the charging current will likewise increase.

Modification basis	
Application basis	
Affected VIN	

4) Charging a Completely Discharged Battery (Off the Vehicle)

Unless this procedure is properly followed, a perfectly good battery may be needlessly replaced.
The following procedure should be used to recharge a completely discharged battery:

1. Measure the voltage at the battery terminals with an accurate voltmeter.
   If the reading is below 10 volts, the charge current will be very low, and it could take some time before the battery accepts the current in excess of a few milliamperes.
   Refer to "Charging Time Required" in this section, which focuses on the factors affecting both the charging time required. Such low current may not be detectable on ammeters available in the field.
2. Set the battery charger on the high setting.

CAUTION
Some chargers feature polarity protection circuitry, which prevents charger unless the charger leads are correctly connected to the battery terminals.
A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly, making it appear that the battery will not accept charging current.
Therefore, follow the specific charger manufacturer's instruction for by passing or overriding the circuitry so that the charger will turn on and charge a low-voltage battery.

3. Continue to charge the battery until the charge current is measurable. Battery chargers vary in the amount of voltage and current provided. The time required for the battery to accept a measurable charger current at various voltages may be as follows:

Voltage	Hours
16.0 or more	Up to 4 hours
14.0 - 15.9	Up to 8 hours
13.9 or less	Up to 16 hours

- If the charge current is not measurable at the end of the above charging times, the battery should be replaced.
- If the charge current is measurable during the charging time, the battery is good, and charging should be completed in the normal manner.

CAUTION
- It is important to remember that a completely discharged battery must be recharged for a sufficient number of ampere hours (AH) to restore the battery to a usable state.

- If the charge current is still not measurable after using the charging time calculated by the above method, the battery should be replaced.

5) Jump Starting Procedure

1. Position the vehicle with the charged battery so that the jumper cables will reach from the charged battery to the battery that requires charging.
2. Turn off the ignition, all the lights, and all the electrical loads in both vehicles.
3. Leave the hazard flasher on if jump starting where there may be other traffic and any other lights needed for the work area.
4. Apply the parking brake firmly in both vehicles.

CAUTION

· In order to avoid damaging the vehicle make sure the cables are not on or near pulleys, fans, or other parts that will move when the engine starts.

5. Shift an automatic transmission to PARK.

CAUTION

· In order to avoid injury, do not use cables that have loose or missing insulation.

6. Clamp one end of the first jumper cable to the positive terminal on the booster battery. Make sure it does not touch any other metal parts.
7. Clamp the other end of the same cable to the positive terminal on the discharged battery. Never connect the other end to the negative terminal of the discharged battery.

CAUTION

Do not attach the cable directly to the neg-ative terminal of the discharged battery. Doing so could cause sparks and possible battery explosion.

8. Clamp one end of the second cable to the negative terminal of the booster battery.
9. Make the final connection to a solid engine ground, such as the engine lift bracket at least 450 millimeters (18 inches) from the discharged battery.
10. Start the engine of the vehicle with the good battery. Run the engine at a moderate speed for several minutes.
11. Then start the engine of the vehicle with the discharged battery.
12. Remove the jumper cables by reversing the above sequence exactly, removing the negative cable from the vehicle with the discharged battery first. While removing each clamp, take care that it does not touch any other metal while the other end remains attached.

Modification basis	
Application basis	
Affected VIN	

6) Alternator

Alternators are equipped with internal regulators.
Unlike three-wire generators, the alternator may be used with only two connections: battery positive and an "D+" terminal to the charge indicator lamp.
As with other charging systems, the charge indicator lamp lights when the ignition switch is turned to RUN, and goes out when the engine is running.
If the charge idicator is on with the engine running, a charging system defect is indicated. This indicator light will glow at full brilliance for several kinds of defects as well as when the system voltage is too high or too low.
The regulator voltage setting varies with temperature and limits the system voltage by controlling rotor field current.
Achieve correct average field current for proper system voltage control by varying the on-off time. At high speeds, the on-time may be 10 percent and the off-time 90 percent.
At low speeds, with high electrical loads, the on-time may be 90 percent and the off-time 10 percent.

7) Charging System

Generators use a new type of regulator that incorporates a diode trio.
A Delta stator, a rectifier bridge, and a rotor with slip rings and brushes are electrically similar to earlier generators.
A conventional pulley and fan are used.
There is no test hole.

8) Starter

Wound field starter motors have pole pieces, arranged around the armature, which are energized by wound field coils.
Enclosed shift lever cranking motors have the shift lever mechanism and the solenoid plunger enclosed in the drive housing, protecting them from exposure to dirt, icy conditions, and splashes.
In the basic circuit, solenoid windings are energized when the switch is closed.
The resulting plunger and shift lever movement causes the pinion to engage the engine flywheel ring gear.
The solenoid main contacts close. Cranking then takes place.
When the engine starts, pinion overrun protects the armature from excessive speed until the switch is opened, at which time the return spring causes the pinion to disengage.
To prevent excessive overrun, the switch should be released immediately after the engine starts.

9) Starting System

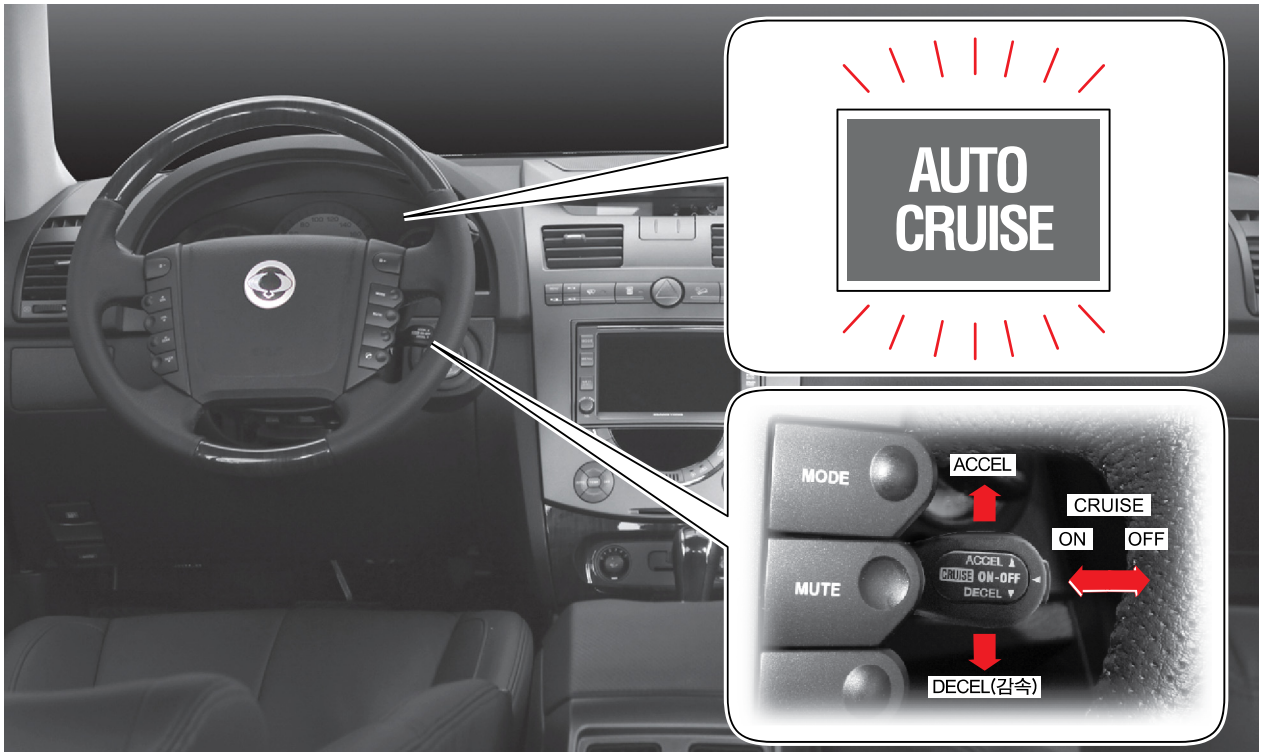
The engine electrical system includes the battery, the ignition, the starter, the generator, and all the related wiring.
Diagnostic tables will aid in troubleshooting system faults. When a fault is traced to a particular component, refer to that component section of the service manual.
The starting system circuit consists of the battery, the starter motor, the ignition switch, and all the related electrical wiring.
All of these components are connected electrically.

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.

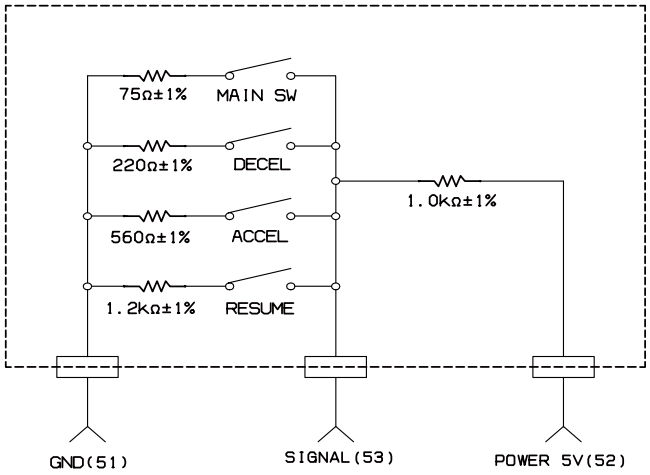
1) When To Use

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.

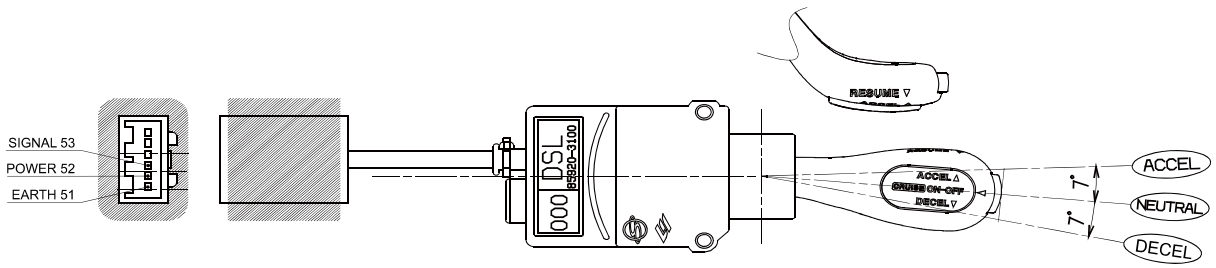
WARNING

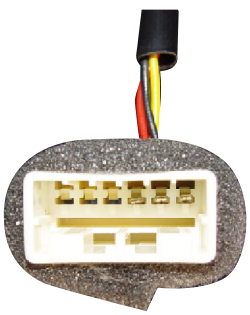
Use the cruise control system only when driving on motorways or highways. Do not use the cruise control system where the road conditions are as follows:
- When there is strong wind or cross wind.
- Heavy traffic.
- Slippery roads or steep decline.

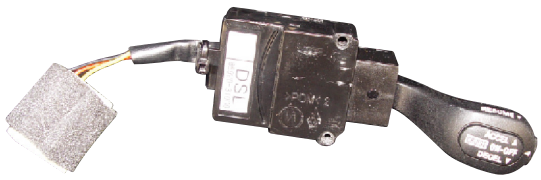
2. CIRCUIT DIAGRAM



1) Configuration







3. HOW TO OPERATE CRUISE CONTROL SWITCH

1) How To Set Speed

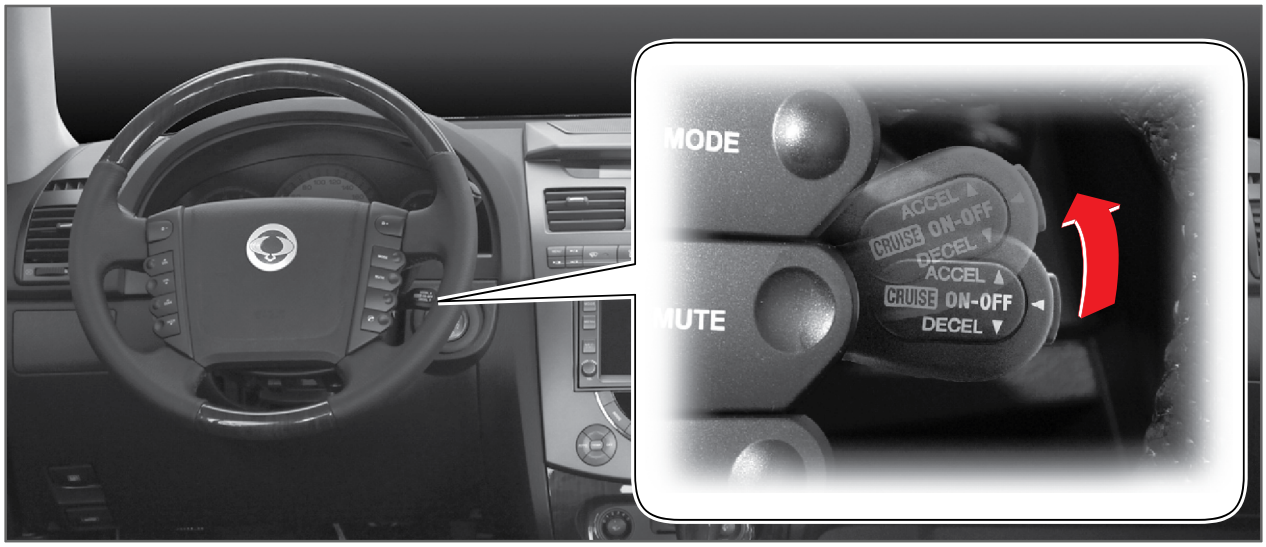
1. To operate the cruise control system, accelerate the vehicle to the speed within the specified range below with depressing the accelerator pedal.
   - Cruise control operating range: between 36 km/h (22.37 mph) and 150 km/h (93.207 mph)
2. When the desired speed is reached, which should be within 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).

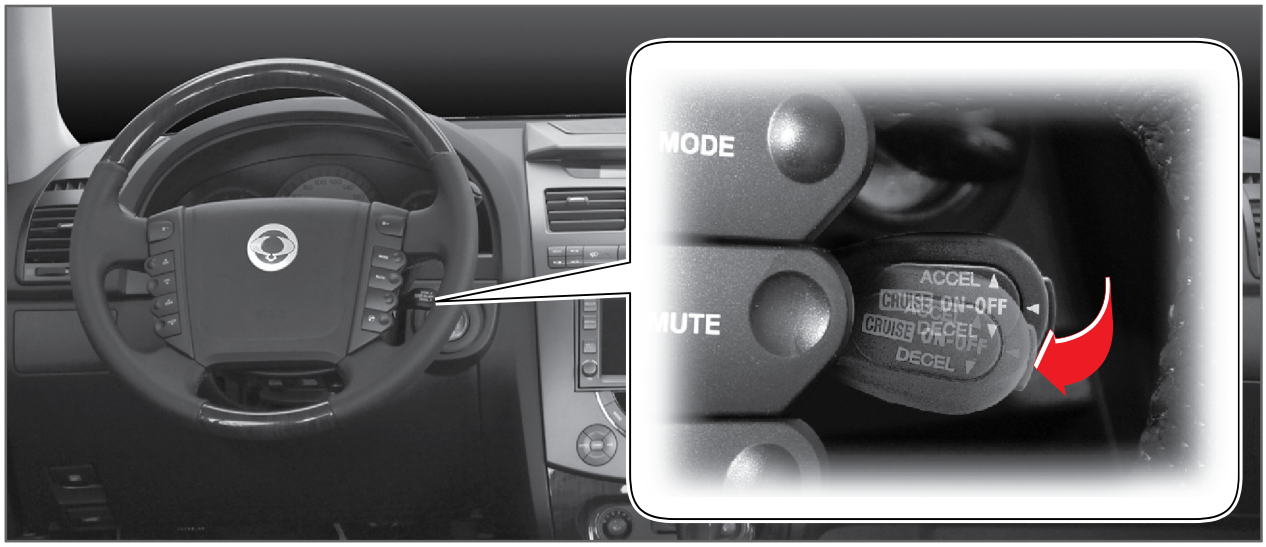
(3) Tap-down while the cruise control system is running

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 INFORMATION

0000-00

GENERAL

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Memo

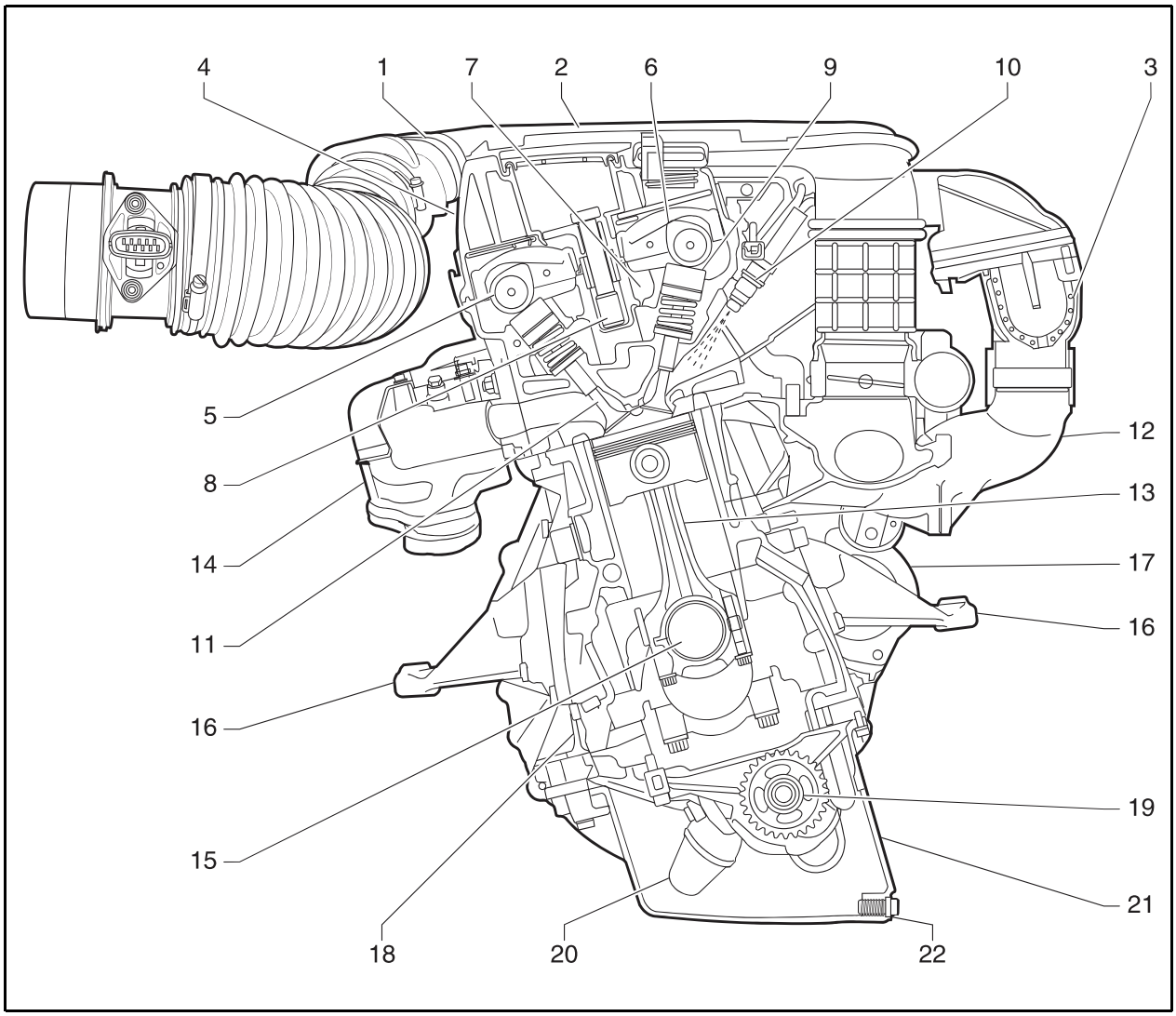
ENGINE GENERAL

0000-00

GENERAL

1. COMPONENT LOCATOR

1) Front View

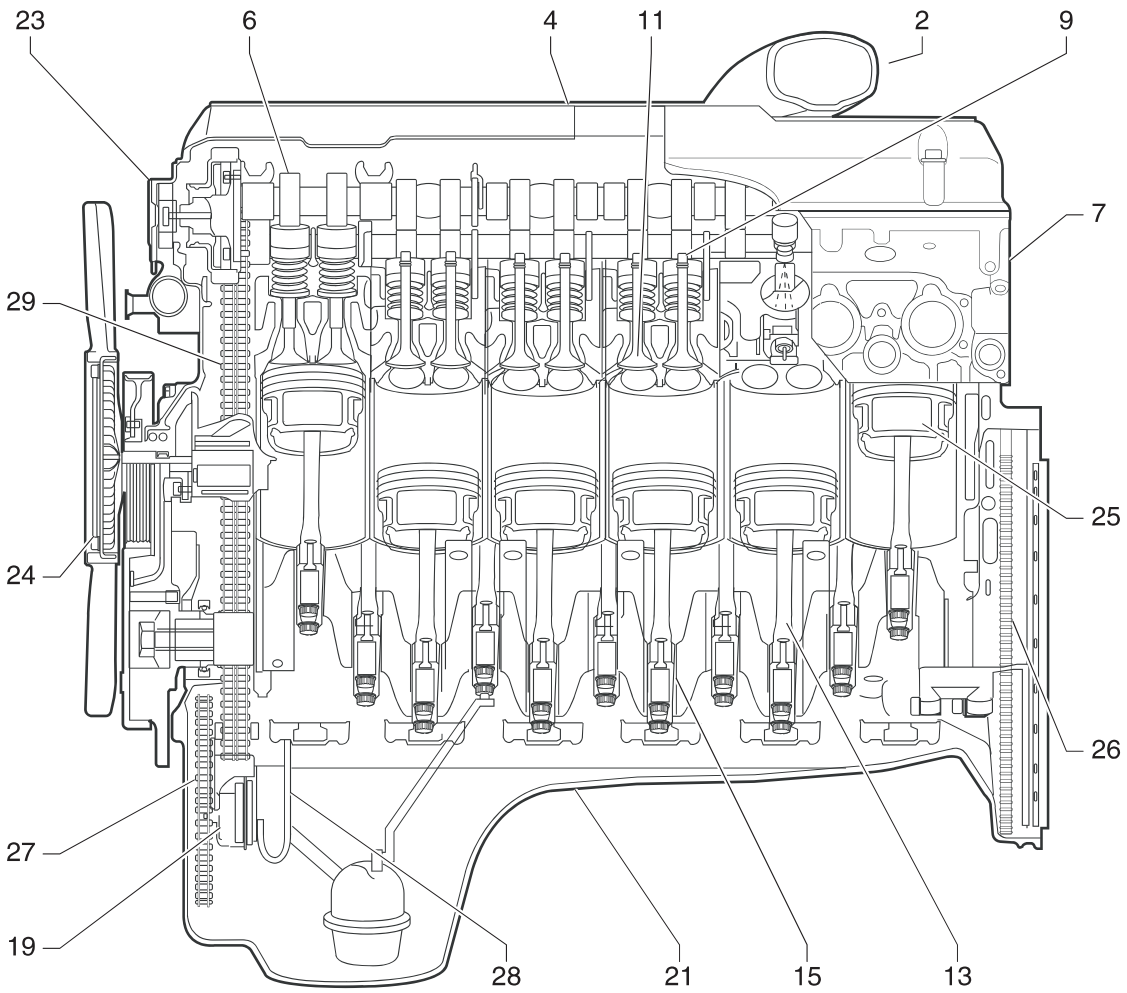


Modification basis	
Application basis	
Affected VIN	

▶ **Front View**

NO.	FUNCTION	NO.	FUNCTION
1	HFM sensor	12	Intake manifold
2	Intake air duct	13	Connecting rod
3	Resonance flap	14	Exhaust manifold
4	Cylinder head cover	15	Crankshaft
5	Exhaust camshaft	16	Engine mounting
6	Intake camshaft	17	Starter
7	Cylinder head	18	Crankcase
8	Spark plug connector	19	Oil pump sprocket
9	Valve tappet	20	Oil strainer
10	Injector	21	Oil pan
11	Exhaust valve	22	Drain plug

2) SIDE VIEW



NO.	FUNCTION	NO.	FUNCTION
23	Camshaft adjuster	27	Oil pump drive chain
24	Cooling fan and viscous clutch	28	Oil return pipe
25	Piston	29	Timing chain
26	Flywheel of drive plate		

Modification basis	
Application basis	
Affected VIN	

2. DESCRIPTION AND OPERATION

1) Cleanliness And Care

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the ten-thousanths of an inch. When any internal engine parts are serviced, care and cleanliness are important. A liberal coating of enigne oil should be applied to friction areas during assembly, to protect and lubricate the surfaces on initial operation.

Proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

Whenever valve train components are removed for service, they should be kept in order.

They should be installed in the same locations, and with the same mating surfaces, as when they were removed. Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.

2) On-Engine Service

CAUTION

- Disconnect the negative battery cable before removing or installing any electrical unit, or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted. Notice Any time the air cleaner is removed, the intake opening

CAUTION

- Any time the air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material, which could follow the intake passage into the cylinder and cause extensive damage when the engine is started.g

Memo

ENGINE ASSEMBLY

1113-01

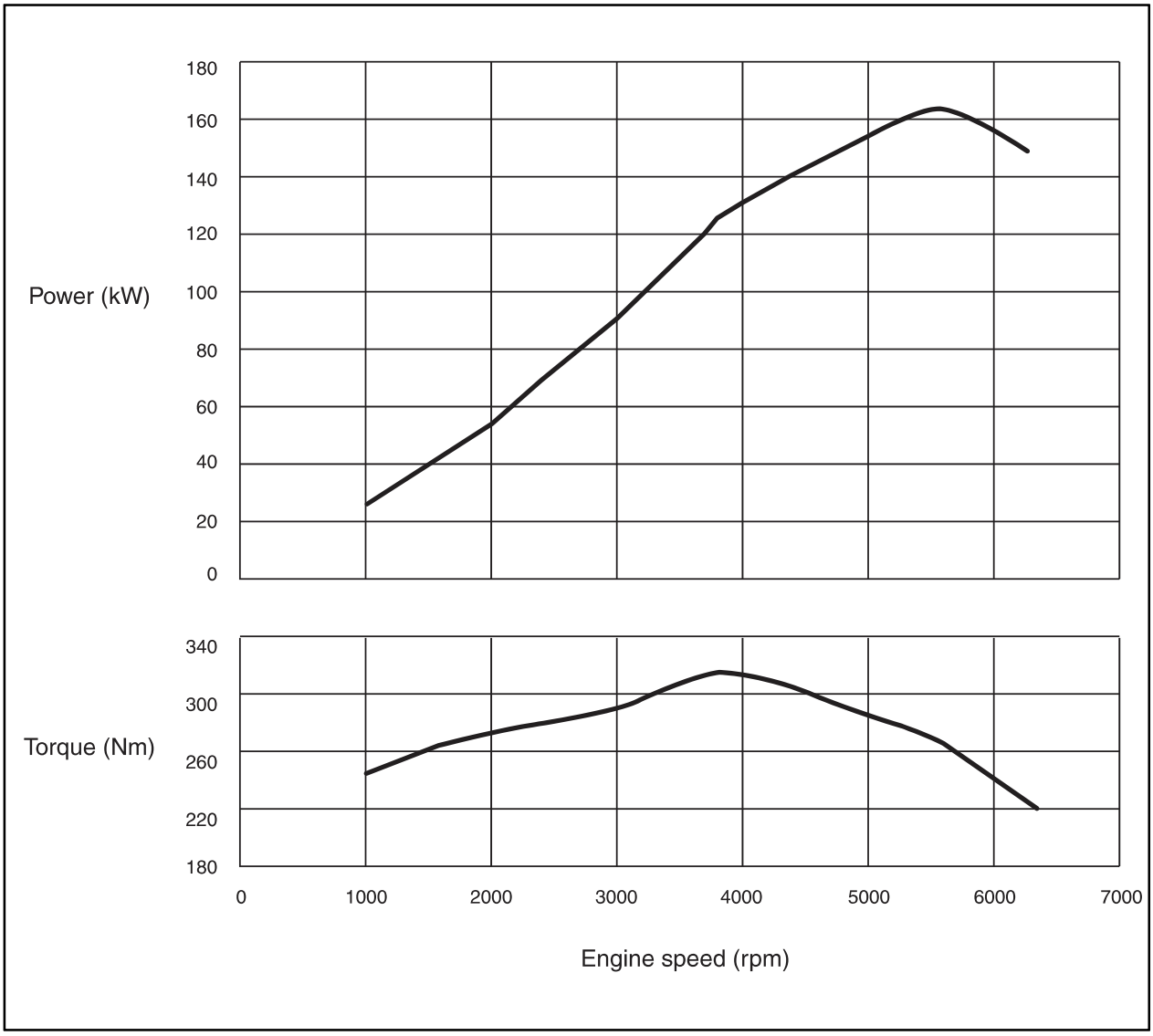
GENERAL

1. SPECIFICATIONS

1) ENGINE SPECIFICATIONS

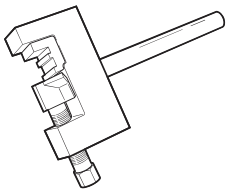
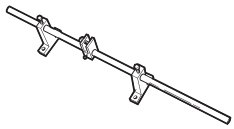
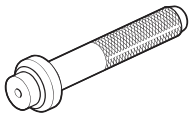
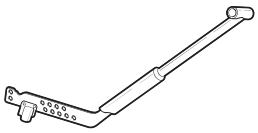
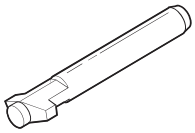
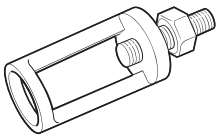
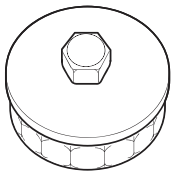
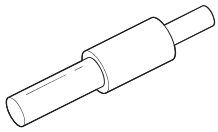
Application			M162 Engine
Engine model			M162.990
Displacement		(CC)	3199
Cylinder (Bore x Stroke)		(mm)	89.9 x 84.0
Fuel injection / Ignition system			MSE 3.63D
Compression ratio			10 : 1
Number of cylinders			6
Camshaft valve arrangement			DOHC
Camshaft drive type			Chain-Driven
Max. output		(ps/rpm)	220 / 6000
Max. torque		(kg•m/rpm)	31.6 / 3900
Firing order			1 - 5 - 3 - 6 - 2 - 4
Ignition type			Distributorless double ignition
Ignition timing			BTDC 8°
Va lve timing	Intake	Open/Close	AT DC 11° / ABDC 34°
Valve clearance adjustment			Automatic control
Idle speed		(rpm)	700 ± 50
Fuel injection pressure		(kg/cm^2)	3 ~ 4
Oil capacity		(liter)	9
Lubrication type			Forced by gear pump
Oil filter type			Full flow with paper filter
Fuel			Unleaded gasoline

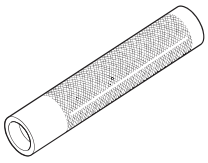
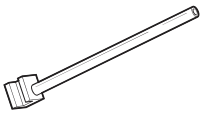
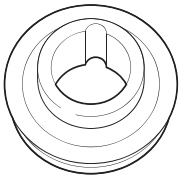
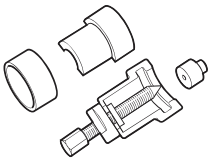
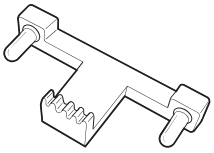
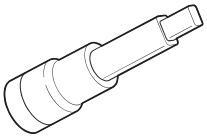
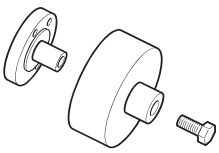
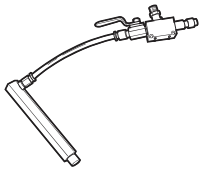
2) PERFORMANCE CURVE



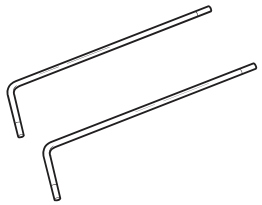
Modification basis	
Application basis	
Affected VIN	

2. SPECIAL TOOLS AND EQUIPMENT

Name and Part Number	Name and Part Number
000 589 58 43 00 Chain Assembly 	A9917 0101B (111 589 01 59 00) Supporting Bar 
W991 1 0010B (102 589 00 15 00) Drift 	A9917 0111B (111 589 18 61 00) Lever Pusher 
A991 1 0050B (102 589 12 15 00) Drift 	A9917 0121B (111 589 25 63 00) Thrust Piece 
A9910 0050A (103 589 02 09 00) Oil Filter Remover 	A9913 0061B (116 589 01 34 00) Threaded Pin 

Name and Part Number	Name and Part Number
A9917 0171B (119 589 00 43 00) Drift 	A9910 0150A (603 589 00 40 00) Fan Clutch Holder 
A991 1 0060B (601 589 03 14 00) Crankshaft Front Seal Installer 	W9910 0150A (615 589 01 33 00) Crankshaft Sprocket Puller 
A9910 0150B (602 589 00 40 00) Engine Lock 	A9912 0080B (617 589 00 10 00) Allen Wrench Socket 
W991 1 0020B (601 589 03 43 00) Crankshaft Rear Seal Installer 	A991 1 0012B (DW1 10-090) Connecting Hose 

Modification basis	
Application basis	
Affected VIN	

Name and Part Number
A9917 0012B (DW110-120)Holding Pin 

3. FASTENER TIGHTENING SPECIFICATIONS

Application	Nm	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	-

Modification basis	
Application basis	
Affected VIN	

1) Fastener Tightening Specifications (Cont'd)

Application		Nm	Lb-Ft	Lb-In
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
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	-

ENGINE FUEL SYSTEM 2211-22

OVERVEIW AND OPERATION PROCESS

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 sys-tem.

▶ 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

℃	℉	ECT Sensor	IAT Sensor
		ohms (Ω)	
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

NO DATA

ENGINE EXHAUST SYSTEM 2420-01

GENERAL

1. OVERVIEW OF EXHAUST SYSTEM

CAUTION

- When you are inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to avoid possible overheating of the floor panel and possible damage to the passenger compartment insulation and trim materials.
  Check the complete exhaust system and the nearby body areas and trunk lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections, or other deterioration which could permit exhaust fumes to seep into the trunk may be an indication of a problem in one of these areas. Any defects should be corrected immediately.

2. OVERVIEW OF MUFFLER

Aside from the exhaust manifold connection, the exhaust system uses a flange and seal joint design rather than a slip joint coupling design with clamp and U-bolts.
If hole, open seams, or any deterioration is discovered upon inspection of the front muffler and pipe assembly, the complete assembly should be replace, the complete assembly should be replaced.
The same procedure is applicable to the rear muffler assembly. Heat shields for the front and rear muffler assembly and catalytic converter protect the vehicle and the environment from the high temperatures that the exhaust system develops.

3. OVERVIEW OF CATALYTIC CONVERTER

CAUTION

- When jacking or lifting the vehicle from the body side rails, be certain that the lift pads do not contact the catalytic converter, as this could damage the catalytic converter.

CAUTION

- Use of anything other than unleaded fuel will damage the catalyst in the catalytic converter.
  · The catalytic converter are emission-control devices added to the exhaust system to reduce pollutants from the exhaust pipes.
  · The oxidation catalyst is coated with a catalytic material containing platinum and palladium, which reduces levels of hydrocarbon (HC) and carbon monoxide (CO) from the exhaust gas. The three-way catalyst has coatings which contain platinum and rhodium, which additionally lower the levels of oxides of nitrogen (NOx).

4. FASTENER TIGHTENING SPECIFICATIONS

Application	Nm	Lb-Ft	Lb-In
Exhaust manifold to front exhaust pipe nut	15 ~ 28	11 ~ 21	-
Front exhaust pipe to muffler nut	28 ~ 47	21 ~ 35	-
Intake air duct mounting bolt	22.5 ~ 27.5	16.6 ~ 20.3	-
Intake manifold mounting bolt	22.5 ~ 27.5	16.6 ~ 20.3	-
Muffler to tail exhaust pipe nut	28 ~ 47	21 ~ 35	-
Resonance flap mounting bolt	9 ~ 11	-	80 ~ 97

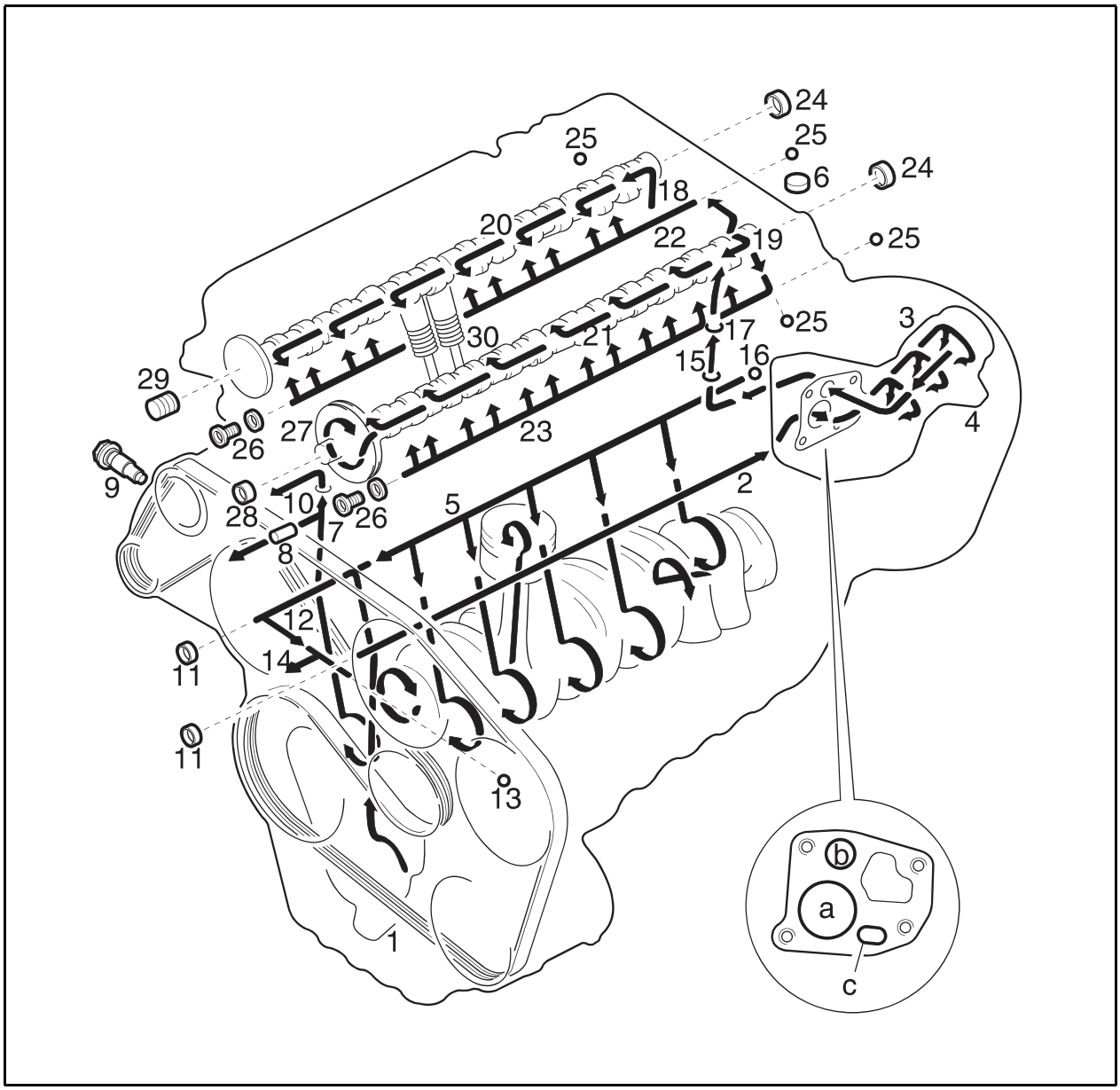
Modification basis	
Application basis	
Affected VIN	

ENGINE LUBRICATION SYSTEM

9210-01

OVERVIEW AND OPERATION PROCESS

1. OIL CIRCULATION



▶ OIL CIRCULATION

NO.	FUNCTION	NO.	FUNCTION
1	Oil pump	18	Oil supply (to exhaust camshaft)
2	Oil gallery (to oil filter)	19	Oil supply (to intake camshaft)
3	Oil filter	20	Oil supply (to exhaust camshaft bearing)
4	Oil pressure switch	21	Oil supply (to intake camshaft bearing)
5	Main oil gallery	22	Oil gallery (oil supply to exhaust valve tappet)
6	Cylinder head closing cover	23	Oil gallery (oil supply to intake valve tappet)
7	Oil gallery (at chain tensioner)	24	Camshaft closing cover
8	Oil non-return valve	25	Ball (ϕ 8 mm)
9	Chain tensioner	26	Screw plug
10	Vent (chain tensioner)	27	Camshaft adjuster
11	Front closing cover (ϕ 17 mm)	28	Front closing cover (intake camshaft)
12	Oil gallery (perpendicular to the shaft)	29	Front treaded bushing (exhaust camshaft)
13	Ball (ϕ 6 mm)	30	Valve tappet
14	Oil spray nozzle (timing chain)	a	Oil gallery (from oil pump to oil filter)
15	Oil gallery (at cylinder head)	b	Main oil gallery
16	Ball (ϕ 15mm)	c	Oil return line (oil returns to the oil pan when replacing the filter element)
17	Oil restriction inner (ϕ 4mm)		

Modification basis	
Application basis	
Affected VIN	

ENGINE COOLING SYSTEM

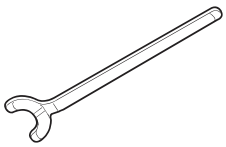
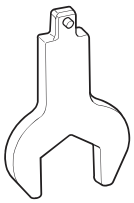
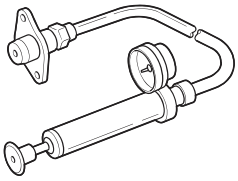
2110-01

GENERAL

1. GENERAL SPECIFICATIONS

Application		Unit	Gasoline Engine
Cooling system	Type	-	Water cooling forced circulation
Coolant	Capacity	L	11.3
Thermostat	Type	-	Wax pellet type
	Initial opening temp.	°C (°F)	82 (180)
	Fully opening temp.	°C (°F)	95 (203)
	Fully closing temp.	°C (°F)	80 (176)
	Stroke	mm	7
Cooling fan	Type	-	Electric cooling
	Blades	-	5
	Diameter	mm	320
	Low speed ON temp.	°C (°F)	95 (203)
	Low speed OFF temp.	°C (°F)	90 (194)
	High speed ON temp.	°C (°F)	105 (221)
	High speed OFF temp.	°C (°F)	100 (212)
	High speed ON temp. (By A/C pressure)	kPa (psi)	269.8 (1860)
Coolant reservoir	Pressure valve opening pressure	kPa (psi)	118 ~ 147 (17.1 ~ 21.3)
	Vacuum valve opening pressure	kPa (psi)	9.8 (1.4)
Water pump	Type	-	Turbo centrifugal
	Impeller diameter	mm	65
	Impeller blades	-	8
Radiator	Type	-	Cross-flow
	Core width	mm	701
	Core height	mm	372
	Core thickness	mm	18
	Minimum radiation capability	Kcal/h	45,000
Coolant temperature gauge	Resistance (at 50°C (122°F))	Ω	185.2
	Resistance (at 80°C (176°F))	Ω	47.4
	Resistance (at 105°C (221°F))	Ω	28.2
Engine coolant temperature sensor	Resistance (at 20°C (68°F))	K Ω	3.33 ~ 37.8
	Resistance (at 80°C (176°F))	K Ω	0.32 ~ 0.35
Anti-freeze agent	Type	-	ALUTEC-P78
	Mixture of water and good quality ethylene glycol-base anti-freeze	-	50 : 50

2. SPECIAL TOOLS AND EQUIPMENT

Name and Part Number	Name and Part Number
A9910 0060A (111 589 00 40 00) Holder 	A9910 0070A (111 589 02 01 00) Open End Wrench 
A9921 0012A (124 589 15 21 00) Leakage Te ster 	A9910 0150A (603 589 00 40 00) Fan Clutch Holder

Modification basis	
Application basis	
Affected VIN	

3. FASTENER TIGHTENING SPECIFICATIONS

Application	Nm	Lb-Ft	Lb-In
Automatic transmission oil cooler pipe	20	15	-
Automatic transmission oil cooler pipe mounting bolt	3 ~ 7	-	27 ~ 62
Coolant drain plug	30	22	-
Cooling fan bolt	9 ~ 11	-	80 ~ 97
Cooling fan shroud bolt	3 ~ 7	-	27 ~ 62
Engine hanger bracket and coolant outlet port bolt	22.5 ~ 27.5	16.6 ~ 20.3	-
Radiator mounting bracket bolt	3 ~ 7	-	27 ~ 62
Thermostat cover bracket bolt	9 ~ 11	-	80 ~ 97
Viscous clutch mounting bolt	40.5 ~ 49.5	29.8 ~ 36.5	-
Water pump mounting bolt	22.5 ~ 27.5	16.6 ~ 20.3	-

OVERVIEW AND OPERATION PROCESS

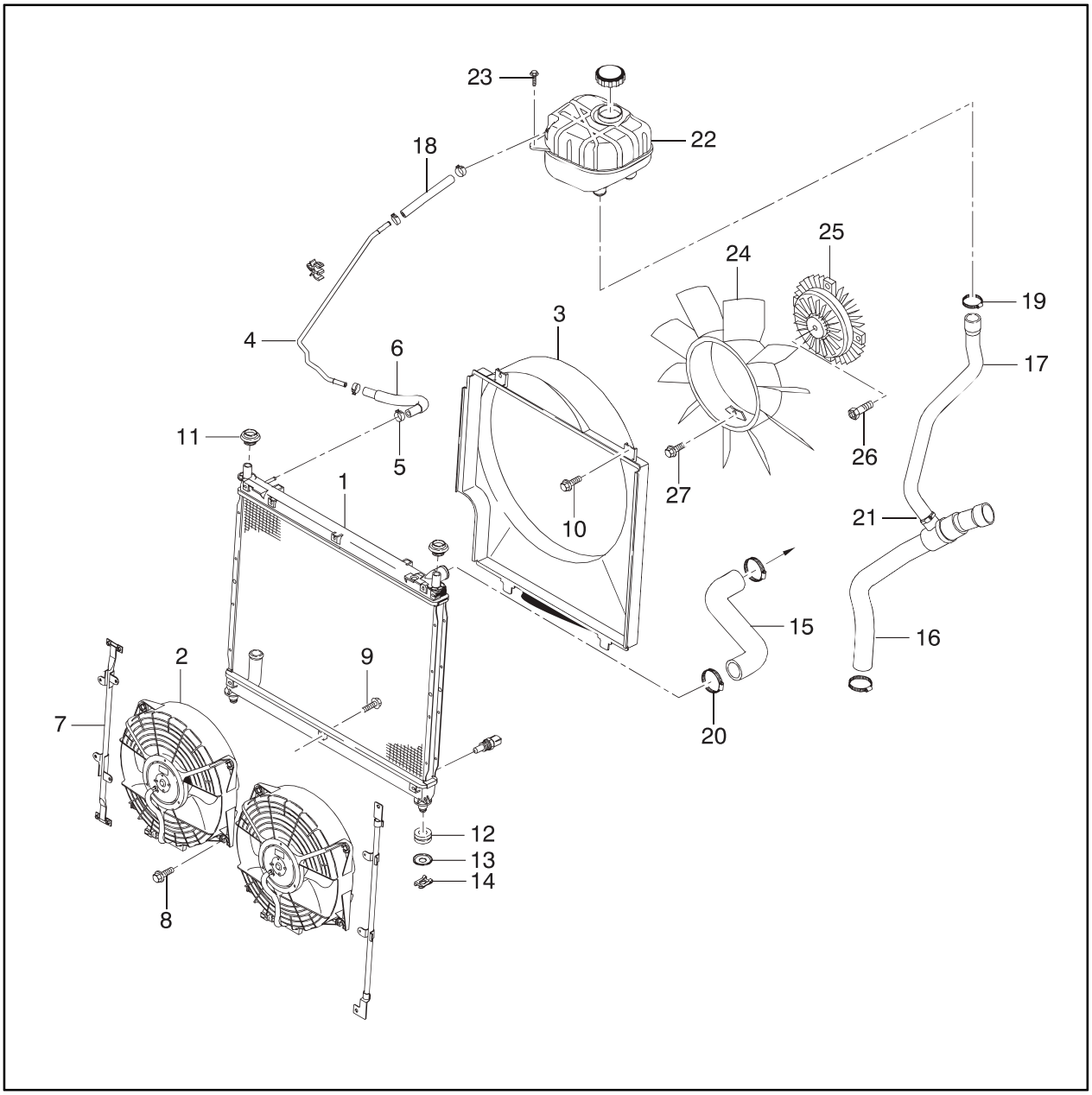
1. GENERAL DESCRIPTION

The cooling system maintains the engine temperature at an efficient level during all engine operating conditions. When the engine is cold, the cooling system cools the engine slowly or not at all. This slow cooling of the engine allows the engine to warm up quickly. The cooling system includes a radiator and recovery subsystem, cooling fans, a thermostat and housing, a water pump, and a water pump drive belt. The timing belt drives the water pump. All components must function properly for the cooling system to operation. The water pump draws the coolant from the radiator.

The coolant then circulates through water jackets in the engine block, the intake manifold, and the cylinder head. When the coolant reaches the operating temperature of the thermostat, the thermostat opens. The coolant then goes back to the radiator where it cools. This system directs some coolant through the hoses to the heat core. This provides for heating and defrosting. The coolant reservoir is connected to the radiator to recover the coolant displaced by expansion from the high temperatures. The coolant reservoir maintains the correct coolant level. The cooling system for this vehicle has no radiator cap or filler neck. The coolant is added to the cooling system through the coolant reservoir.

Modification basis	
Application basis	
Affected VIN	

2. COMPONENT LOCATOR



1. Radiator
2. Electric fan
3. Shroud
4. Deaeration tube
5. Clamp
6. Deaeration hose (radiator)
7. Electric fan mounting bracket
8. Bolt (M6, 8 pieces)
9. Bolt (M6, 4 pieces)
10. Bolt (M6, 4 pieces)
11. Upper radiator insulator
12. Lower radiator insulator
13. Plate
14. Clip
15. Inlet hose
16. Outlet hose
17. 3 way hose
18. Deaeration hose (reserver tank)
19. Clamp
20. Clamp
21. Make up hose holder
22. Reserver tank
23. Bolt (M6, 2 piece)
24. Cooling fan
25. Viscous clutch
26. Bolt (M6, 1 piece)
27. Bolt (M6, 3 piece)

Modification basis	
Application basis	
Affected VIN	

ENGINE ELECTRIC DEVICES

1452-01

GENERAL

1. GENERAL SPECIFICATIONS

Application			Unit	Gasoline Engine
Starter	Type		-	PG170S
	Output power		Kw	1.8
	No load test @ 12 volts		A	98
	Drive pinion speed at no load		rpm	2,600
	Drive pinion speed at load		rpm/A	1,087/380
	Brush length		mm	16.1
	Armature diameter		mm	54.1
	Armature run-out		mm	0.08
	Segment groove depth		mm	19.6
Alternator	Type		-	SG135
	Output voltage / current		V/A	14/115
	Regulator type		-	HYBRID
	Regulating voltage		V	14.7
	Brush	Length	mm	18.5
		Quantity	-	2
		Abrasion limit	mm	13.5
Battery	Type		-	MF
	Capacity		AH	75
	Reserve capacity		RC	130
Ignition coil	Type		-	DIS
	Primary coil resistance		W	0.3 ~ 0.9
	Secondary coil resistance		KW	6 ~ 8.5
Spark plug	Type		-	WR8DC
	Clearance		-	0.8 ~ 0.9
High tension cable	Resistance		KW/m	1.9

2. FASTENER TIGHTENING SPECIFICATIONS

Application	Nm	Lb-Ft	Lb-In
Batter cable nut	12 ~ 18	9 ~ 13	-
Battery cable nut on starter	12 ~ 15	9 ~ 11	-
Batter mounting bracket nut	12 ~ 18	9 ~ 13	-
Engine electric wire nut on starter	6 ~ 7	-	53 ~ 62
Alternator combination bolt	42 ~ 50	31 ~ 37	-
Alternator terminal b+ nut	14 ~ 18	10 ~ 13	-
Alternator terminal d+ nut	4 ~ 5	-	35 ~ 44
Ignition cable cover bolt	9 ~ 11	-	80 ~ 97
Ignition coil bolt	9 ~ 11	-	80 ~ 97
Spark plug	25 ~ 30	15 ~ 22	-
Starter mounting bolt	35 ~ 48	26 ~ 35	-

Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATION PROCESS

1. CHARGING SYSTEM OPERATION

Alternators use a new type of regulator that incorpo-rates a diode trio. A Delta stator, a rectifier bridge, and a rotor with slip rings and brushes are electrically similar to earlier alternators.
A conventional pulley and fan are used. There is no test hole.

1) CHARGING TIME REQUIRED

The time required to charge a battery will vary depending upon the following factors:

▶ Size of Battery
- A Completely discharged large heavy-duty battery required more than twice the recharging time as a completely discharged small passenger car battery.

▶ Temperature
- A longer time will be needed to charge any battery at −18°C (0°F) than at 27°C (80°F). When a fast charger is connected to a cold battery, the current accepted by the battery will be very low at first. The battery will accept a higher current rate as the battery warms.

▶ Charger Capacity
- A charger which can supply only 5 amperes will require a much longer charging period than a charger that can supply 30 amperes or more.

▶ State-of-Charge
- A completely discharged battery requires more than twice as much charge as a onehalf charged battery. Because the electrolyte is nearly pure water and a poor conductor in a completely discharged battery, the current accepted by the battery is very low at first. Later, as the charging current causes the electrolyte acid content to increase, the charging current will likewise increase.

2. STARTING SYSTEM OPERATION

The engine electrical system includes the battery, the ignition, the starter, the alternator, and all the related wiring. Diagnostic tables will aid in troubleshooting system faults. When a fault is traced to a particular component, refer to that component section of the service manual. The starting system circuit consists of the battery, the starter motor, the ignition switch, and all the related electrical wiring. All of these components are connected electrically.

3. IGNITION SYSTEM OPERATION

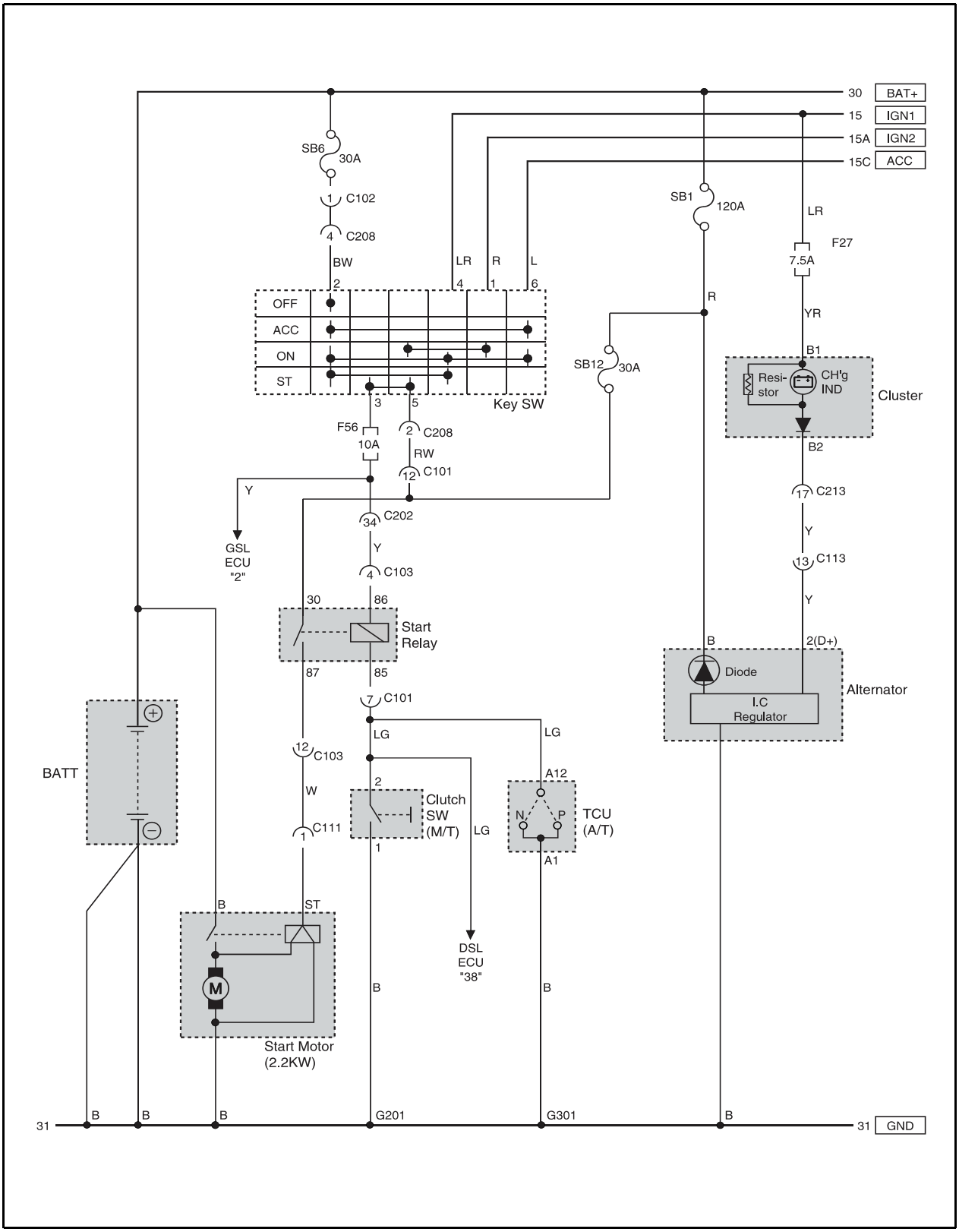
This ignition system does not use a conventional distributor and coil. It uses a crankshaft position sensor input to the Engine Control Module (ECM).
The ECM then determines Electronic Spark Timing (EST) and triggers the electronic ignition system ignition coil.
This type of distributorless ignition system uses a "waste spark" method of spark distribution. Each cylinder is paired with the cylinder that is opposite it (2.3L DOHC: 2 - 3 or 1 - 4, 3.2L DOHC: 1 - 6 or 2 - 5 or 3 - 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, manifold air pressure sensor).
Engine coolant temperature.
Intake air temperature.
Crankshaft position.
Engine speed (rpm).

1) Electronic Ignition System Ignition Coil

The Electronic Ignition (EI) system ignition coil is located on the cylinder head cover.
The double ended coils re ceive the signal for the ECM which controls the spark advance.
Each EI system ignition coil provides the high voltage to two spark plugs simultaneously;
3.2L DOHC
T1/1: cylinder 2 and 5
T1/2: cylinder 3 and 4
T1/3: cylinder 1 and 6
The EI system ignition coil is not serviceable and must be replaced as an assembly.

Modification basis	
Application basis	
Affected VIN	

4. STARTING AND CHARGING SYSTEM (GASOLINE ENGINE) CIRCUIT



Modification basis	
Application basis	
Affected VIN	

ENGINE CONTROL SYSTEM

1522-16

GENERAL

1. ENGINE DATA DISPLAY TABLE

Parameter	Unit	Value
Engine coolant temp.	℃	greater than 95℃ after warm up
Intake air temp.	℃	-40 ~ 130℃ (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 ~ 14.1V (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

1) TEMPERATURE VS RESISTANCE

℃	°F	ECT Sensor	IAT Sensor
		ohms (Ω)	
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

2. FASTENER TIGHTENING SPECIFICATIONS

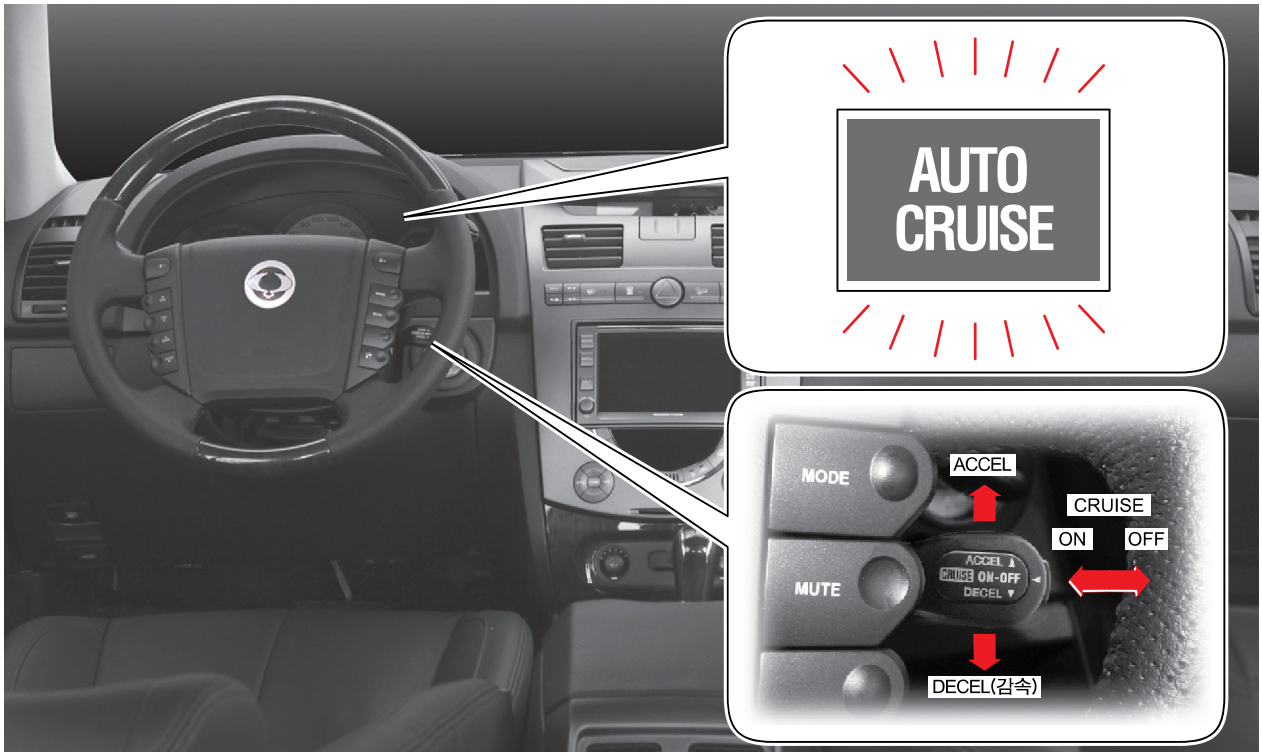
Application	Nm	Lb-Ft	Lb-In
Camshaft position sensor retaining bolts	10	-	89
Canister mounting bolts	6	-	53
Coolant temperature sensor	30	22	-
Crankshaft position sensor retaining bolt	10	-	89
Engine Control Module (ECM) mounting bracket nuts	10	-	89
Fuel filter mounting bracket bolt	6	-	53
Fuel filter 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	

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.

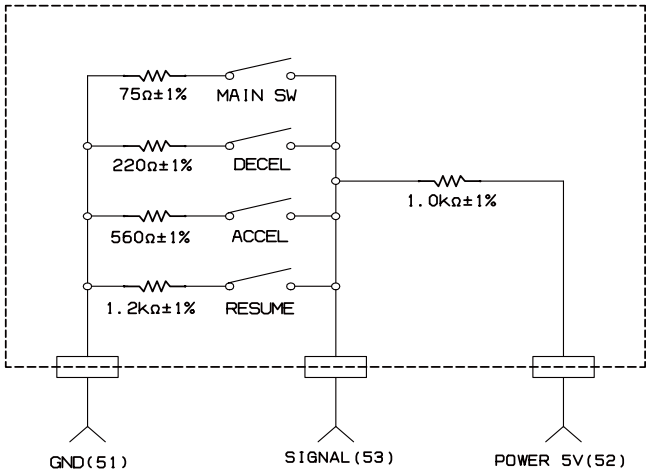
1) When To Use

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.

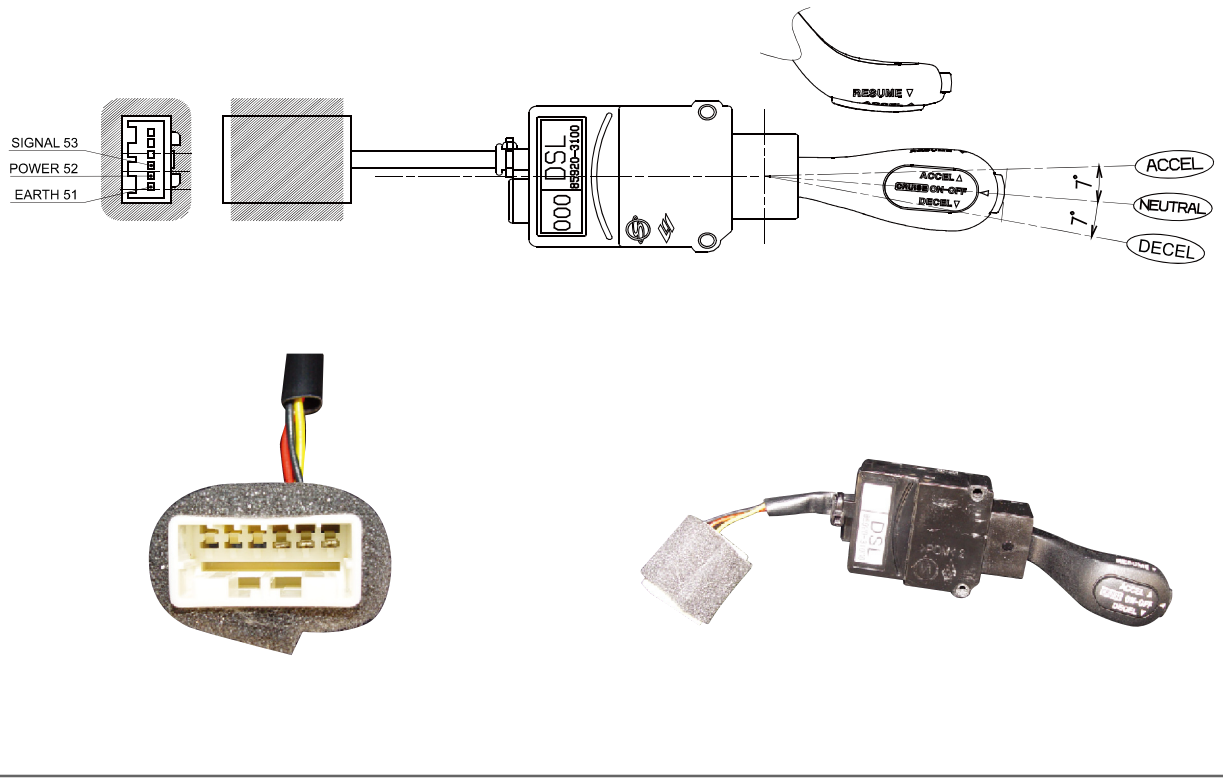
WARNING

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

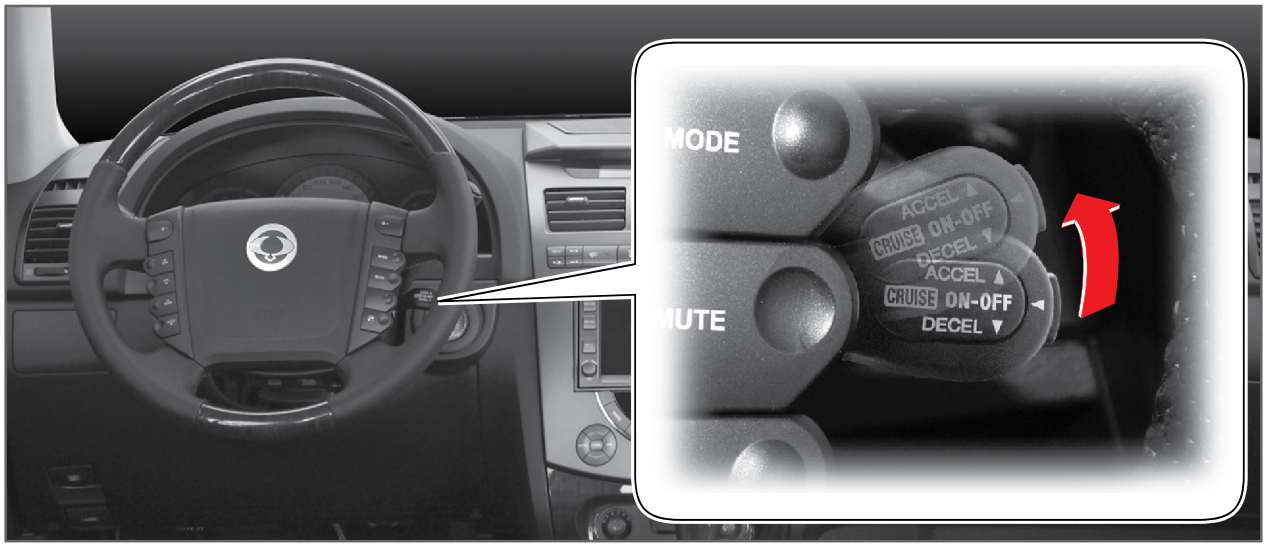
1. To operate the cruise control system, accelerate the vehicle to the speed within the specified range below with depressing the accelerator pedal.
   - Cruise control operating range: between 36 km/h (22.37 mph) and 150 km/h (93.207 mph)
2. When the desired speed is reached, which should be within 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).

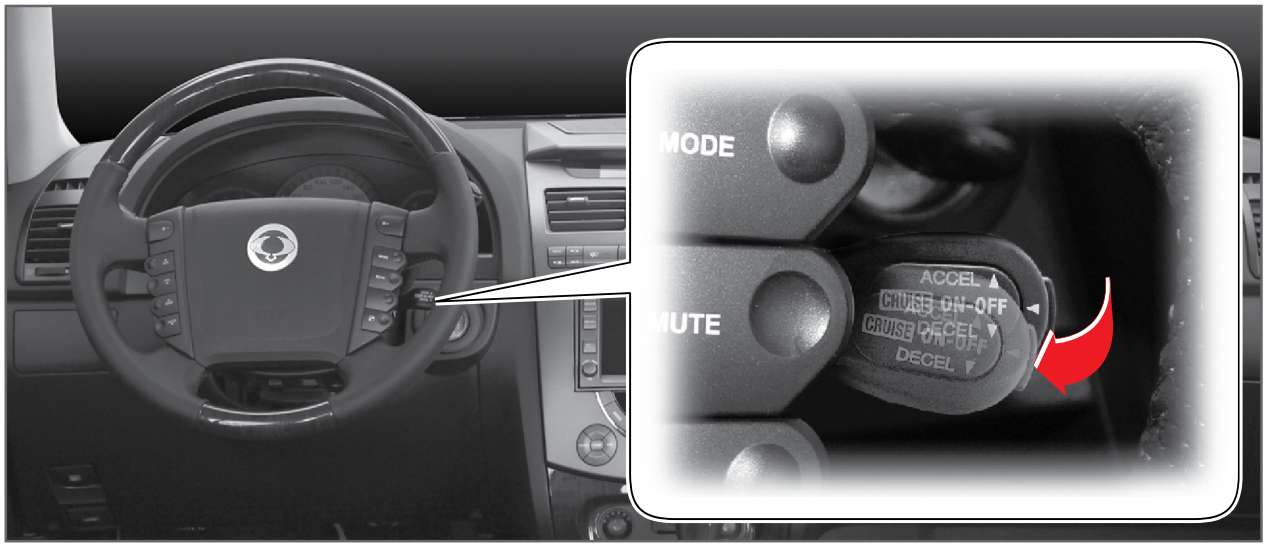
(3) Tap-down while the cruise control system is running

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

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3. TIGHTENING TORQUE..... 9
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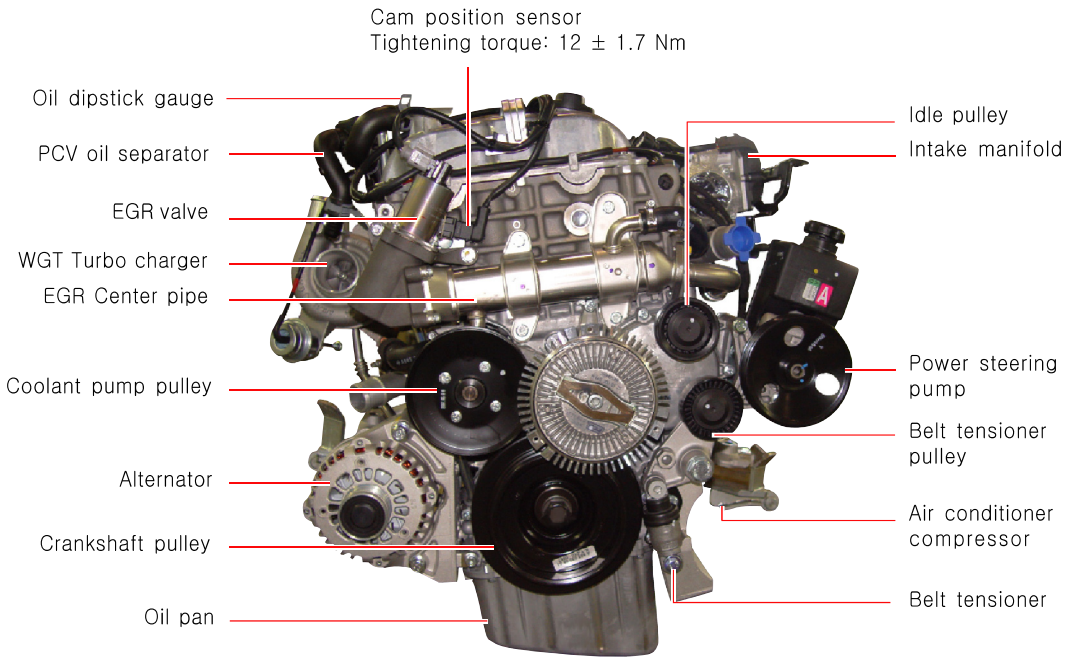
ENGINE GENERAL

0000-00

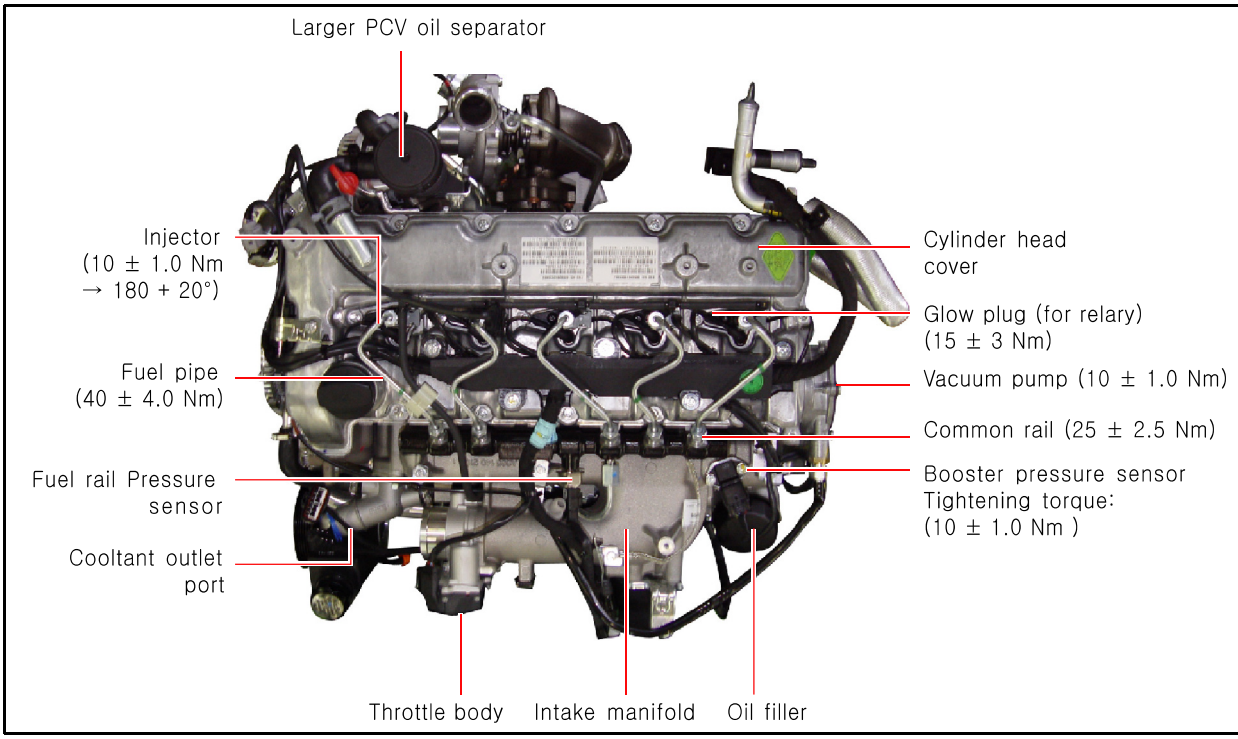
GENERAL

1. STRUCTURE AND COMPARISON

▶D27DT (EU IV) Engine - Front View

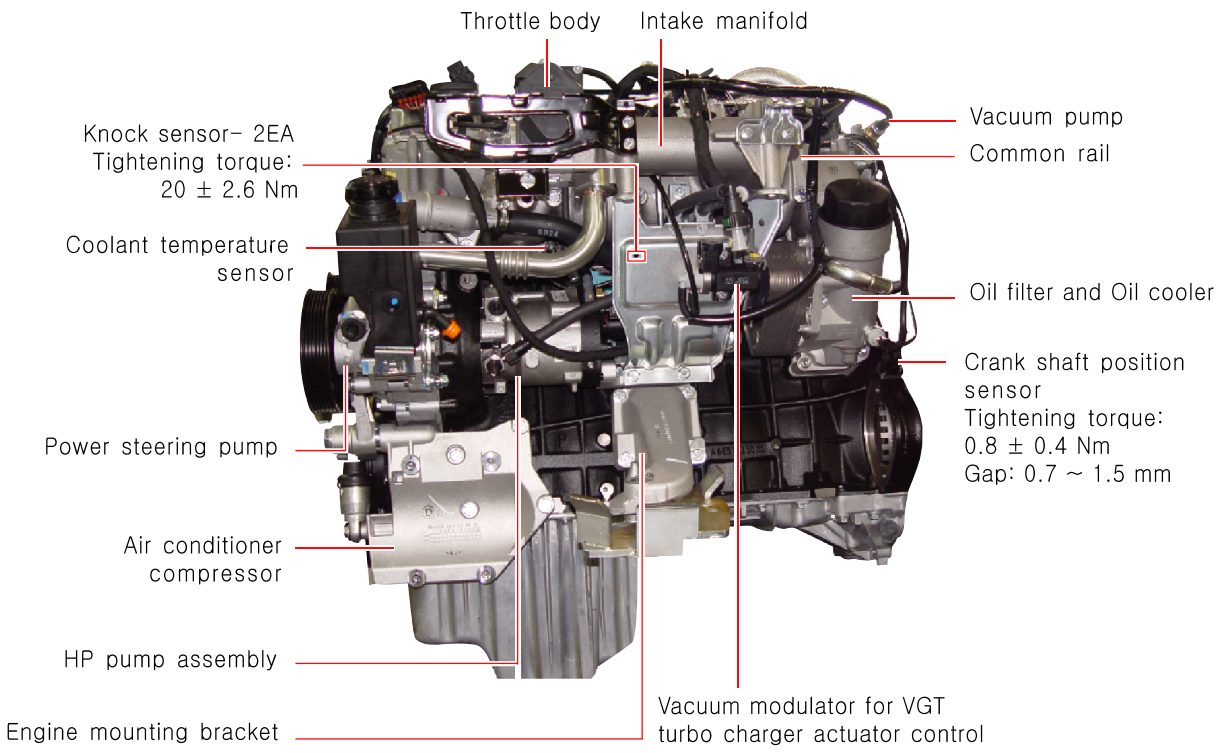


▶D27DT (EU IV) Engine - Top View

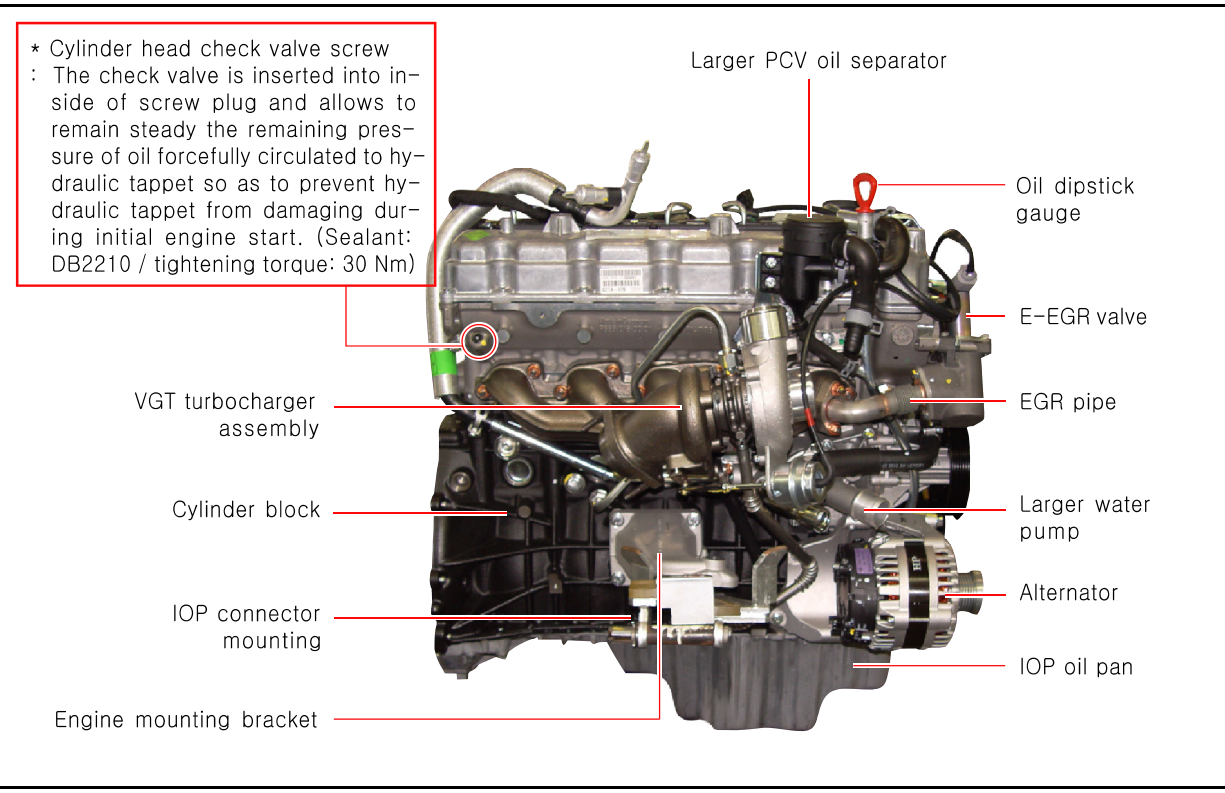


Modification basis	
Application basis	
Affected VIN	

▶D27DT (EU IV) Engine - Side View

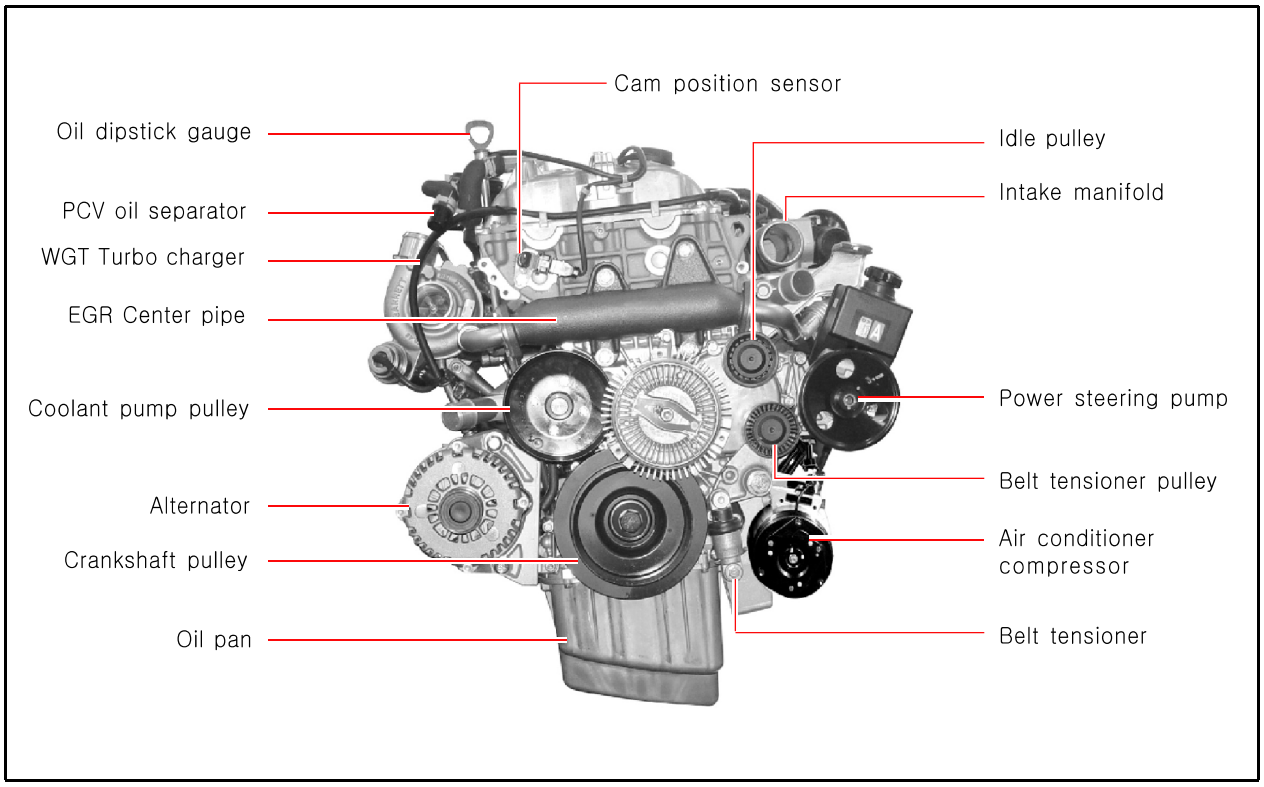


▶D27DT (EU IV) Engine - Left Side View

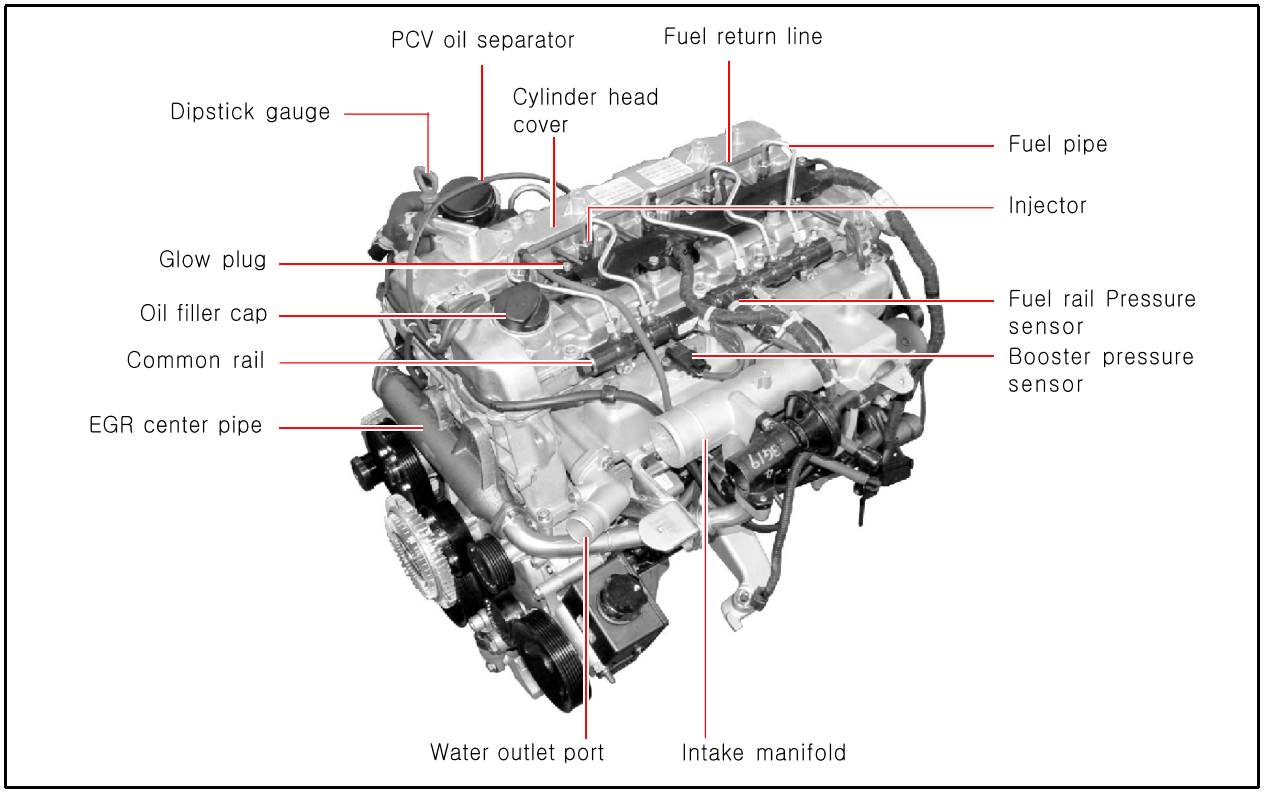


Modification basis	
Application basis	
Affected VIN	

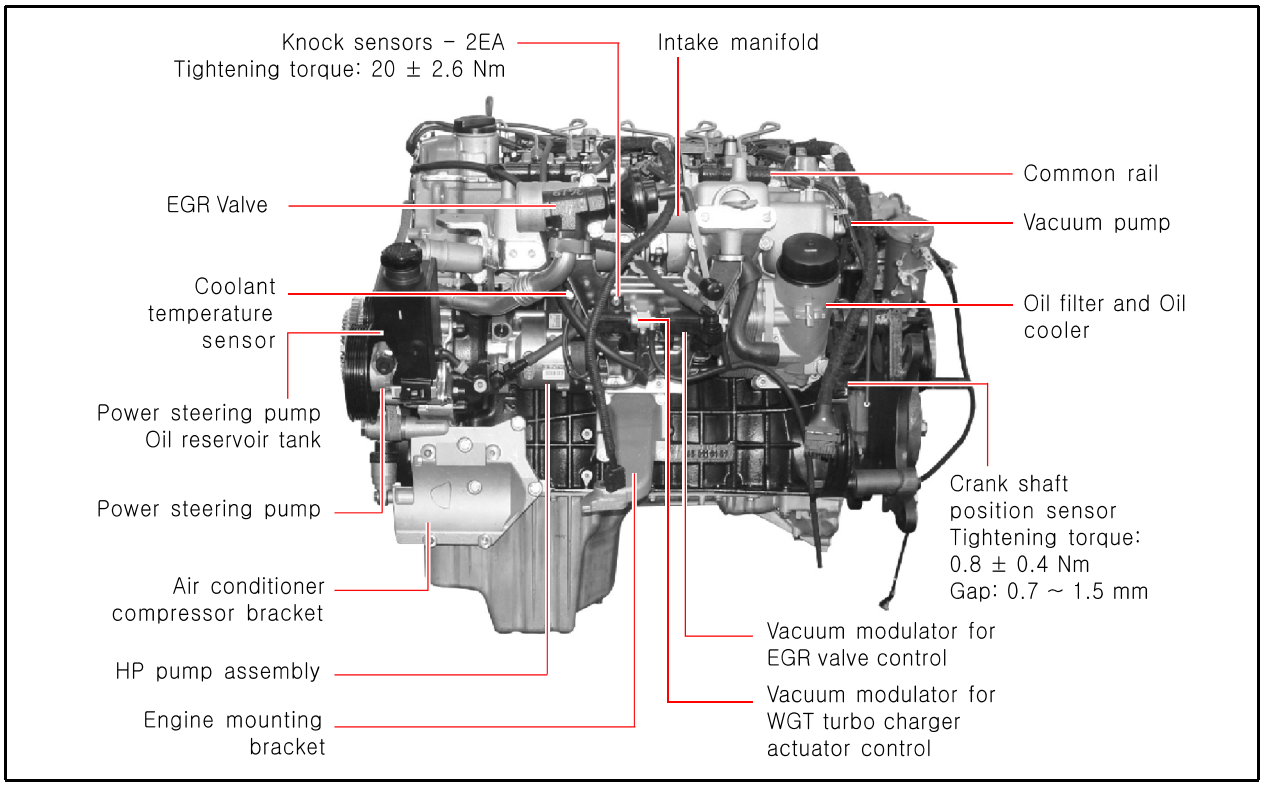
▶D27DT Engine (General) - Front View



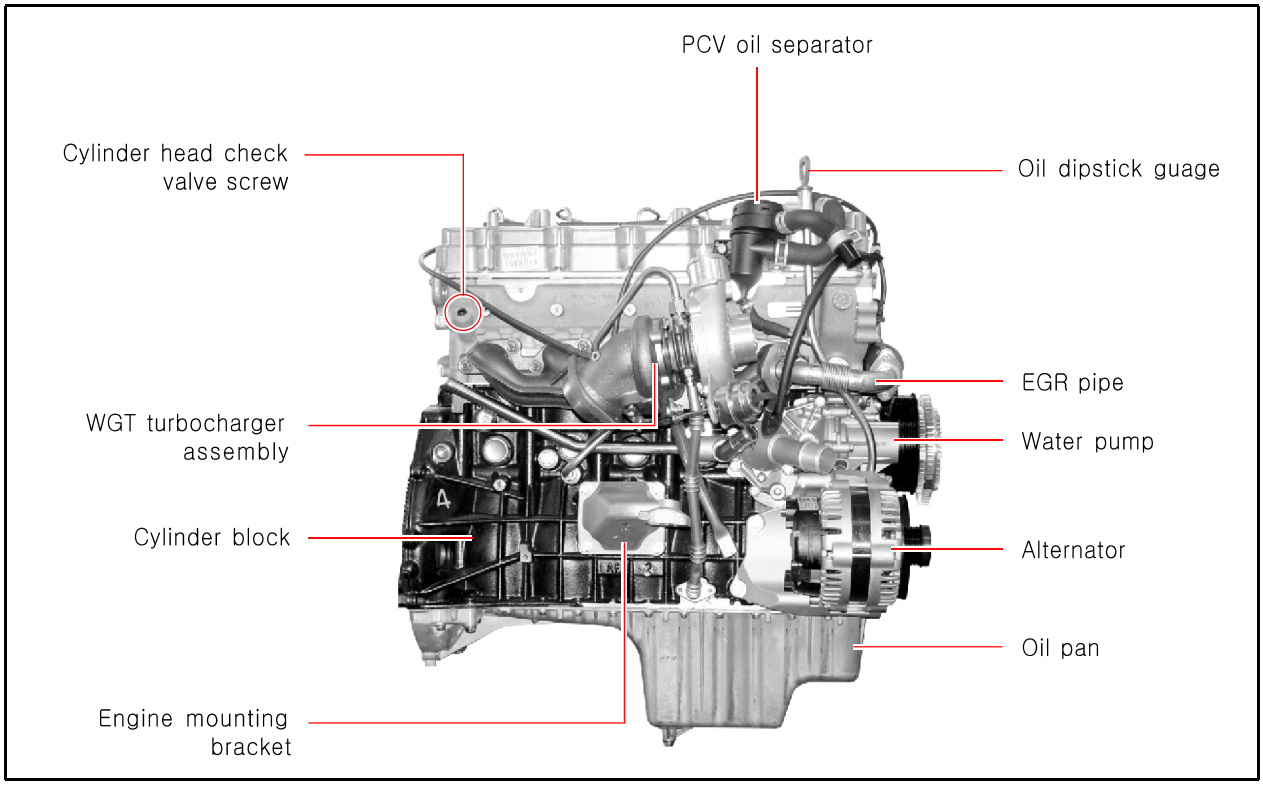
▶D27DT Engine (General) - Top View



▶D27DT Engine (General) - Side View



▶D27DT Engine (General) - Left Side View



Modification basis	
Application basis	
Affected VIN	

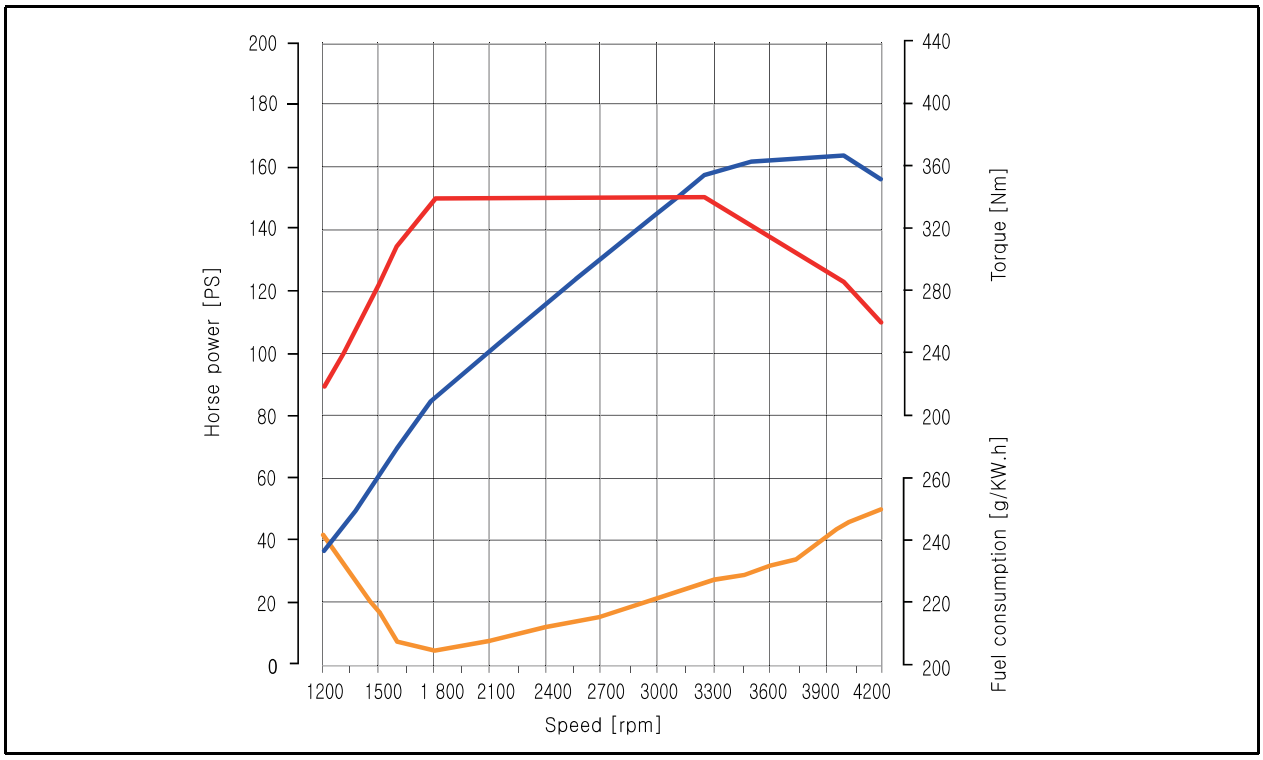
2. ENGINE SPECIFICATIONS AND PERFORMANCE CURVE

1) Specifications

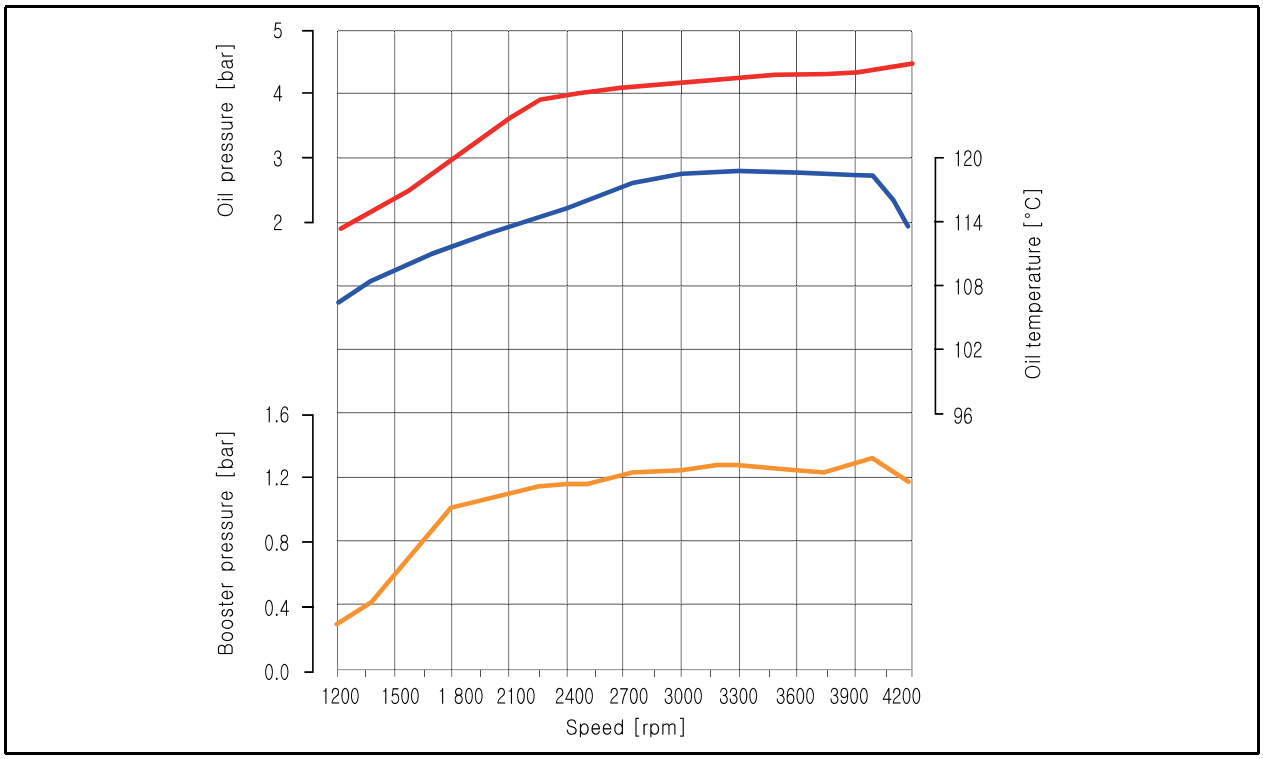
Descriptions			D27DTP (POWER UP) + CDPF Engine * ( ) : CDPF	D27DT (EU IV) Engine	D27DT Engine
Engine	Type/Number of cylinders		D27DT/5-cylinder	←	←
Cylinder	Inner diameter (mm)		86.2	←	←
	Stroke (mm)		92.4	←	←
Displacement (cc)			2696	←	←
Compression ratio			17.5:1	←	←
Maximum output (ps/rpm)		For Automatic Transmission	186 (180) / 4,000	165 / 4,000	←
		For Manual Transmission	-	165 / 4,000	←
Maximum torque (kg ·m/rpm)		For Automatic Transmission	41 / 1,600 ~ 3,000	35.7 / 1,800 ~ 3,250	←
		For Manual Transmission	-	34.7 / 1,800 ~ 3,250	←
Idle speed	For Manual Transmission		-	750 ± 20 rpm	760 ± 50 rpm
	For Automatic Transmission		750 ± 20 rpm	←	←
Valve	Intake	Opens (btdc)	9°	←	←
		Closes (abdc)	26°	←	←
	Exhaust	Opens (bbdc)	38°	←	←
		Closes (atdc)	16°	←	←
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	-0.4 ~ 0 mbar	Max. 400 mbar	←
		HP pump outlet port (with IMV fully open)	Below 1,600 bar	Above 1,050 bar	←
	Water separation in fuel filter		Every 10,000 km	←	←
	Fuel tank capacity (ℓ)		78	←	←
Lubrication system	Oil specification		SAE 10W40, 5W40 (MB Sheet 229.1, 229.3 approved oil)	←	←
	Lubrication type		Gear pump Forced circulation	←	←
	Oil filter type		Full flow type, filter element type	←	←
	Oil capacity (ℓ)		≒ 8.5	←	←
Cooling system	Cooling type		Water cooling type/ Forced circulation	←	←
	Cooling fan operation type		Belt operated type	←	←
	Thermostat (* Note: Fully opened at 100°C)	Opening temperature	85 °C	←	←
		Type	WAX Pellet Type	←	←
	Coolant capacity (ℓ)		≒ 11.0 ~ 11.5	←	←

2) D27DT Engine Performance Curve

(1) Output and Torque



(2) Oil Temperature/Pressure and Boost Pressure



Modification basis	
Application basis	
Affected VIN	

3. TIGHTENING TORQUE

This table shows the tightening torques for removal/mounting and disassembly/reassemly of the engine.

Name	Size	Quantity	Tightening Torque (Nm)		
			D20DT	D27DT	D27DTP
Main bearing cap	M11 x 67	10	55 ± 5 120° ± 10°	←	←
Connecting rod cap	M9 x 51	8	40 ± 5 90° ± 10°	←	←
Rear cover	M6 x 20	6	10 ± 1	←	←
Oil pump	M8 x 35SOC	3	25 ± 2.5	←	←
T.G.C.C	M6 x 40	6	10 ± 1	←	←
	M6 x 60	3	10 ± 1	←	←
	M6 x 70	2	10 ± 1	←	←
Flywheel	M10 x 22	8	45 ± 5 90° ± 10°	←	←
Crankshaft hub	M20 x 85	1	200 180° ± 10°	←	←
Oil pan	M6 x 20	24	10 ± 1	←	←
	M6 x 35	3	10 ± 1	←	←
	M6 x 85	3	10 ± 1	←	←
	M8 x 40	4	25 ± 2.5	←	←
High pressure pump mounting bolt	M8 x 55	3	25 ± 2.5	←	←
High pressure pump main nut (Intermediate shaft)	M14 x 1.5	1	65 ± 5	←	←
Cylinder head	M8 x 25	2	25 ± 2.5	←	←
	M8 x 50	2			
	M10 x 158	1	85 ± 5 270° ± 10°	←	←
	M10 x 177	9			
Camshaft sprocket (Intake)	M11 x 40	1	25 ± 2.5 90° ± 10°	←	←
Camshaft sprocket (Exhaust)					
Chain tensioner	M24	1	65 ± 5	←	←
Auto tensioner	M12 x 90(UP)	1	82 ± 6	←	←
	M8 x 45(LOW)	1	32 ± 3	←	←
Water pump	M6 x 50	7	10 ± 1	←	←
Water pump pulley	M6 x 10	4	10 ± 1	←	←
Hot water inner pipe	M6 x 12	2	10 ± 1	←	←
Alternator brackrt	M8 x 80	1	25 ± 2.5	←	←
	M8 x 34	2	25 ± 2.5	←	←
	M8 x 30	2	25 ± 2.5	←	←
Alternator	M10 x 90	1	46 ± 4.6	←	←
	M10 x 116	1	46 ± 4.6	←	←

Name	Size	Quantity	Tightening Torque (Nm)		
			D20DT	D27DT	D27DTP
Air conditioner compressor bracket	M8 x 25	1	25 ± 2.5	←	←
	M8 x 60	3	25 ± 2.5	←	←
Air conditioner compressor sub bracket	M6 x 16	1	10 ± 1.0	←	←
	M8 x 20	1	25 ± 2.5	←	←
Intake manifold	M8 x 50	5	25 ± 2.5	←	←
	M8 x 133	5	25 ± 2.5	←	←
Acoustic cover bracket	M6 x 16	2	25 ± 2.5	←	←
	M8 x 105	1	25 ± 2.5	←	←
Knock sensor	M8 x 28	1	20 ± 2.6	←	←
Camshaft position sensor	M8 x 14	1	12 ± 1.7	←	←
Booster pressure sensor	M6 x 20	2	10 ± 1.0	←	←
Exhauster manifold stud bolt	M8 x 46	10	15 ± 1.5	←	←
	M8 x 35	2	15 ± 1.5	←	←
Exhaust manifold nut	M8	10	40 ± 4.0	←	←
Turbo charger assembly	M8	3	25 ± 2.5	←	←
Turbo charger hollow bolt	M10 x 1.0	1	18 ± 1.8	←	15 ± 1.0
Turbo charger oil supply pipe	M16 (BLOCK side)	1	25 ± 2.5	←	←
Turbo charger support bar (nut)	M8	1	23 ± 2.3	←	←
Turbo charger support bar (bolt)	M8 x 20	1	25 ± 2.5	←	←
Turbo charger return pipe	M6 x 16 (T/C side)	2	10 ± 1.0	←	←
	M6 x 16 (BLOCK side)	2	10 ± 1.0	←	←
EGR Valve	M6 x 16	4	10 ± 1.0	←	-
EGR pipe (RH) nut	M8	2	35 ± 3.5	←	-
EGR pipe (RH) bolt	M6 x 16	2	10 ± 1.0	←	-
EGR cooler bolt	M8 x 16	4	25 ± 1.0	←	-
EGR valve & EGR cooler	M6 x 20	3	25 ± 2.5	←	-
	M6 x 20	2	25 ± 2.5	←	-
Glow plug	M5	5	15 ± 3.0	←	←
Vacuum pump	M6 x 20	3	10 ± 1.0	←	←
Cooling pan bracket	M6 x 25	5	10 ± 1.0	←	←
	M6 x 55	1	10 ± 1.0	←	←
	M6 x 85	3	10 ± 1.0	←	←
Cylinder head cover	M6 x 35	21	10 ± 1.0	←	←
Vacuum modulator	M6 x 16	4	10 ± 1.0	←	←
Oil dipstick gage	M6 x 16	1	10 ± 1.0	←	←
Oil filter	M8 x 35	1	25 ± 2.5	←	←
	M8 x 55	2	25 ± 2.5	←	←
	M8 x 125	1	25 ± 2.5	←	←

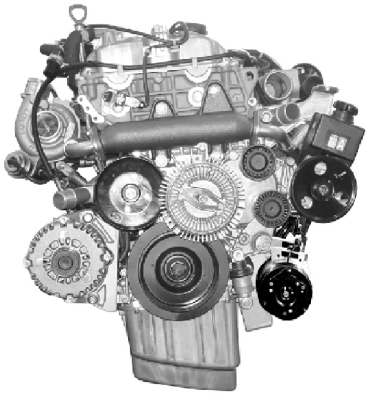
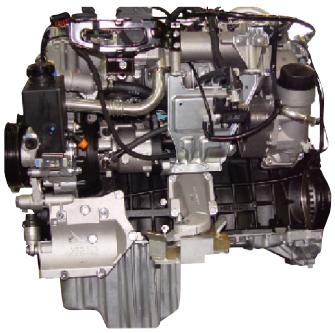
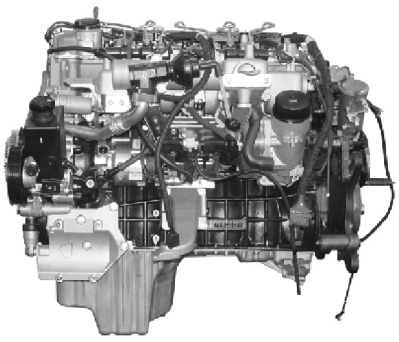
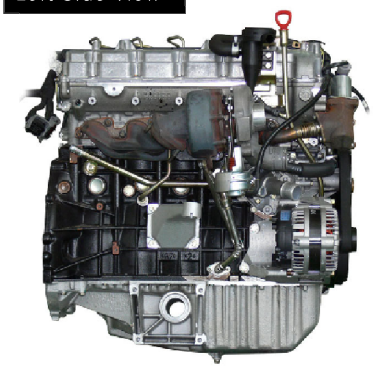
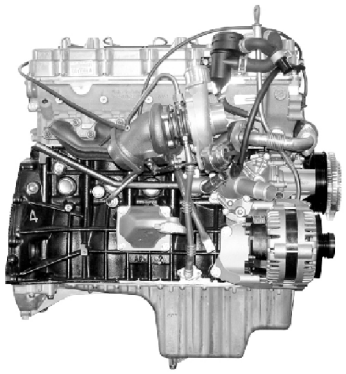
Modification basis	
Application basis	
Affected VIN	

Name	Size	Quantity	Tightening Torque (Nm)		
			D20DT	D27DT	D27DTP
Fuel rail	M8 x 35	2	25 ± 2.5	←	←
Injector	M6 x 60	4	10 ± 1.0 180° ± 20°	←	←
Fuel pipe nut (H -> C)	M14	2	40 ± 4.0	←	←
Fuel pipe nut (C -> I)	M14	8	40 ± 4.0	←	←
Crank position sensor	M6 x 14	1	0.8 ± 0.4	←	←
	Gap	-	0.7 ± 1.5 mm	←	←
Power steering pump	M8 x 100	2	25 ± 2.5	←	←
Head screw plug	-	1	25 ± 2.5	←	←
Camshaft cap bolt	M8 x 60	20	25 ± 2.5	←	←
Piston topping	-	-	0.765 mm ~ 1.055 mm		
Connecting rod end play	-	-	0.500 mm ~ 1.500 mm		
Camshaft end play	-	-	0.100 mm ~ 0.350 mm		
Crank shaft end play	-	-	0.100 mm ~ 0.254 mm		
E-EGR valve assembly	M8 x 60	1	-	25 ± 2.5 (EU IV)	←
	M8 x 35	1	-	25 ± 2.5 (EU IV)	←
	M6 x 20	3	-	10 ± 1.0 (EU IV)	←
E-EGR cooler	M8 x 16	4	-	25 ± 2.5 (EU IV)	←
EGR pipe combination bolt	M6 x 16	6	-	10 ± 1.0 (EU IV)	←
Throttle body	M6 x 45	3	-	10 ± 1.0 (EU IV)	←

4. MAJOR CHANGES IN D27DTP (POWER UP) ENGINE (COMPARED TO D27DT)

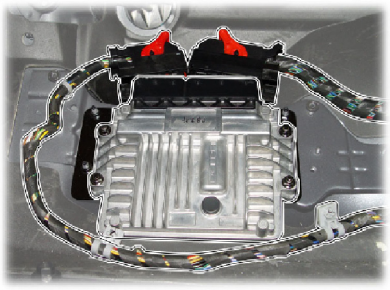
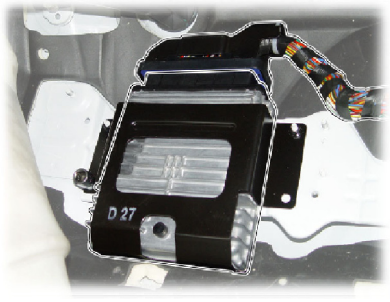
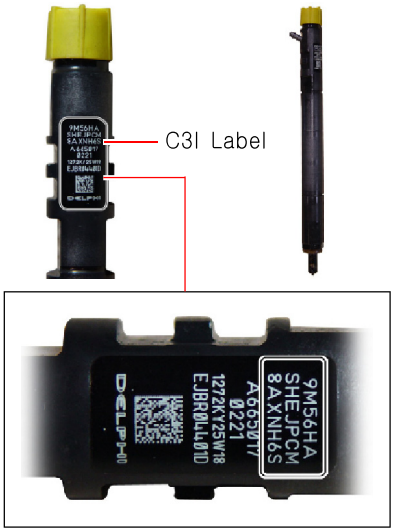
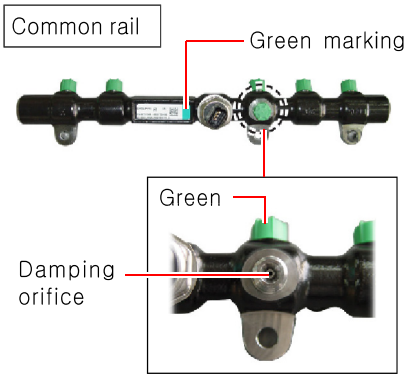
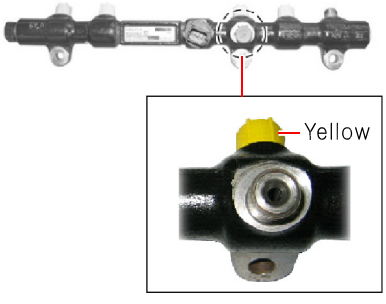
The shape and size of D27DTP (POWER UP) are slightly different from those of D27DT engine but the basic configuration of two systems is almost same.

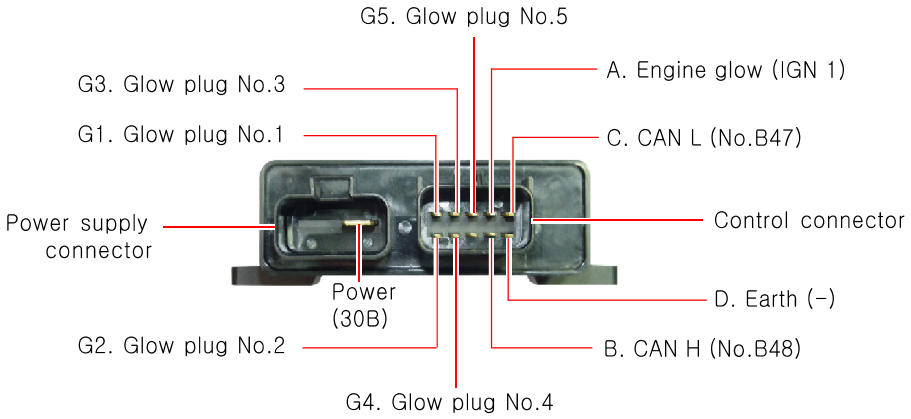
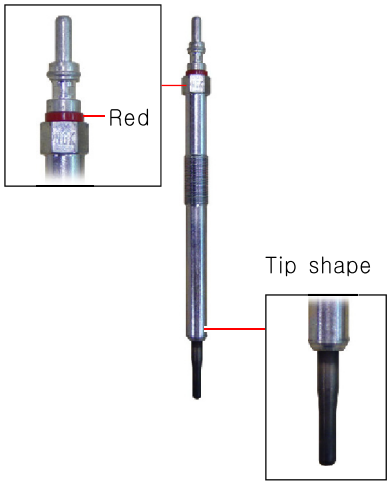
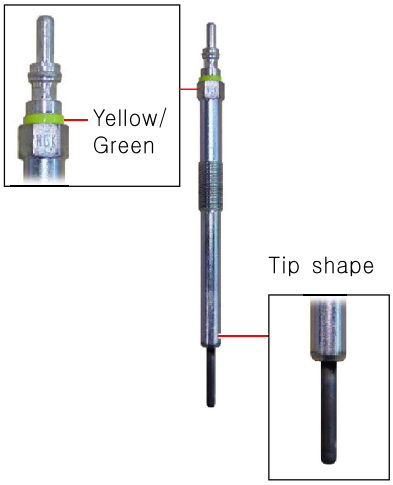
1) Engine Assembly

D27DTP (POWER UP) + CDPF Engine	D27DT (EU IV) Engine	D27DT Engine (General)
Front Side View		
Right Side View		
Left Side View 		

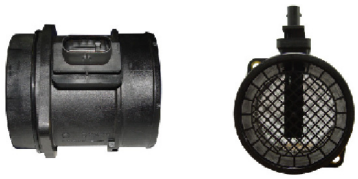
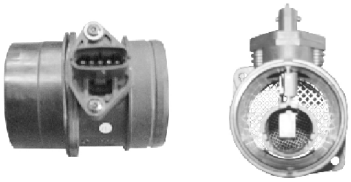
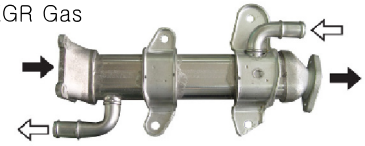
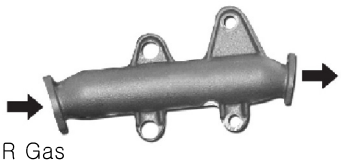
Modification basis	
Application basis	
Affected VIN	

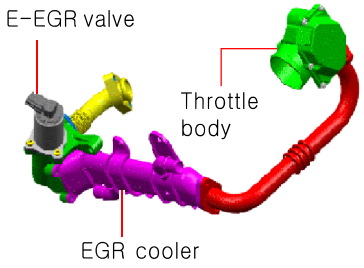
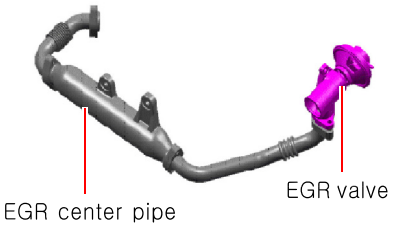
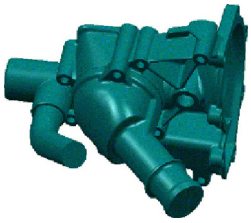
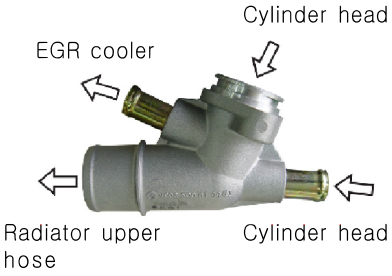
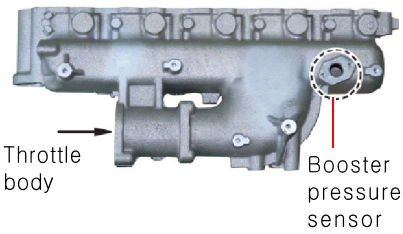
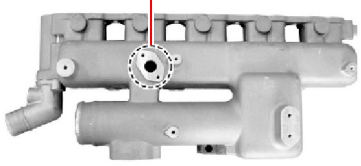
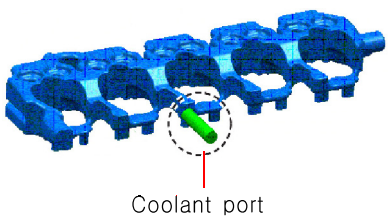
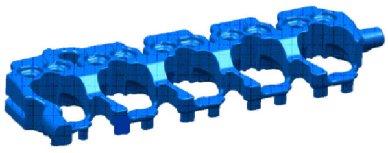
2) Major Changes and Summary

D27DTP (POWER UP) + CDPF Engine D27DT (EU IV) Engine	D27DT Engine (General)	Remarks
ECU D27DTP Engine ECU - Ver. 3.2 	D27DT Engine ECU - Ver. 3.1 	ECU version of D27DTP (POWER UP) & D27DT (EU IV) engine: Changed to 3.2 from 3.1. Number of connectors of D27DTP (POWER UP) & D27DT (EU IV) engine: Changed to 2 from 1. 1.E-EGR valve and related system 2.Throttle body and related system 3.AQGS and related system
Injector 		* Injection nozzle (holes) - D27DT (General) (5) - D27DTP & D27DT (EU IV) (7) * Injector label - D27DT (General) (16 digits: C2I value) - D27DTP & D27DT (EU IV) (20 digits: C3I value)
Common rail 		* D27DTP: Added damping orifice. (Orifice is added to fuel inlet/ outlet ports in order to dampen the pulsation in fuel flow caused by multi-injections.)

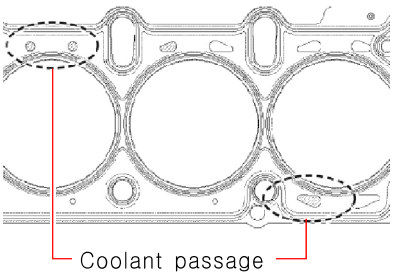
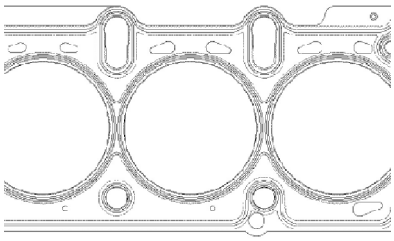
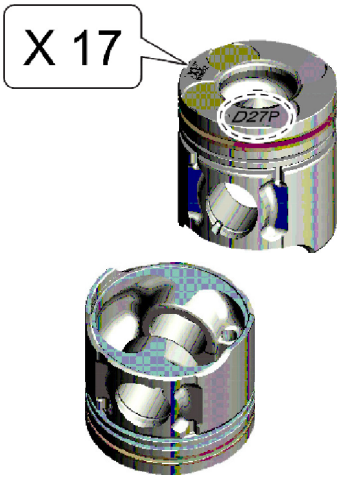
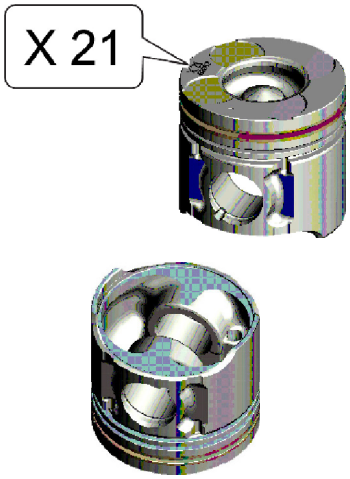
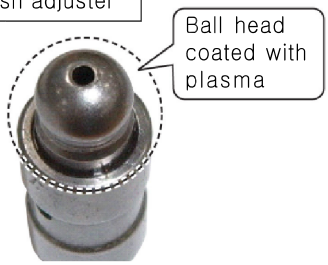
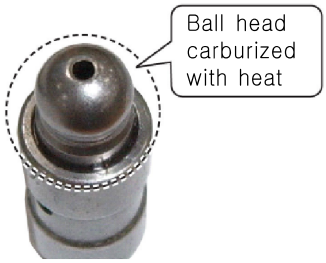
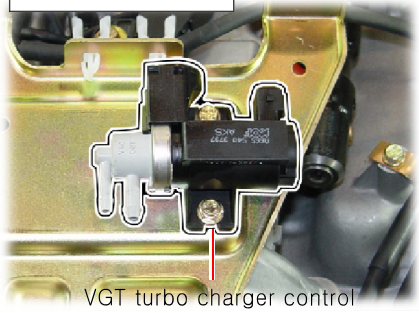
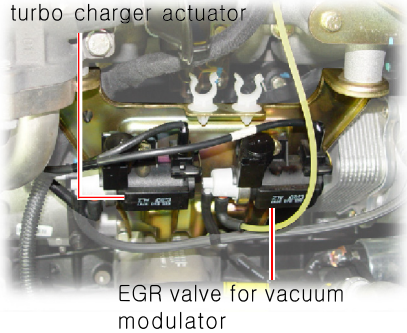
D27DTP (POWER UP) + CDPF Engine D27DT (EU IV) Engine	D27DT Engine (General)	Remarks
Fuel pipe 		* Surface coating color - D27DT: Yellow - D27DTP & D27DT (EU IV): Chrome * Diameter increased - D27DT: ID (2.4 mm), OD (6.0 mm) - D27DTP & D27DT (EU IV): ID (3 mm), OD (6.35 mm)
AQGS unit pin function 		
Glow plug 		* Insulator color - D27DT: Yellow (NGK) or green (BERU) - D27DTP & D27DT (EU IV): Red * Tip diameter and shape changed - D27DT: ϕ 3.5 / 4.0 mm - D27DTP & D27DT (EU IV): ϕ 4.4 mm

Modification basis	
Application basis	
Affected VIN	

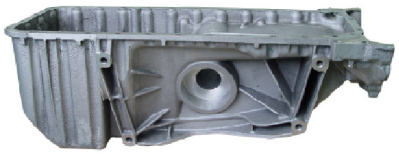
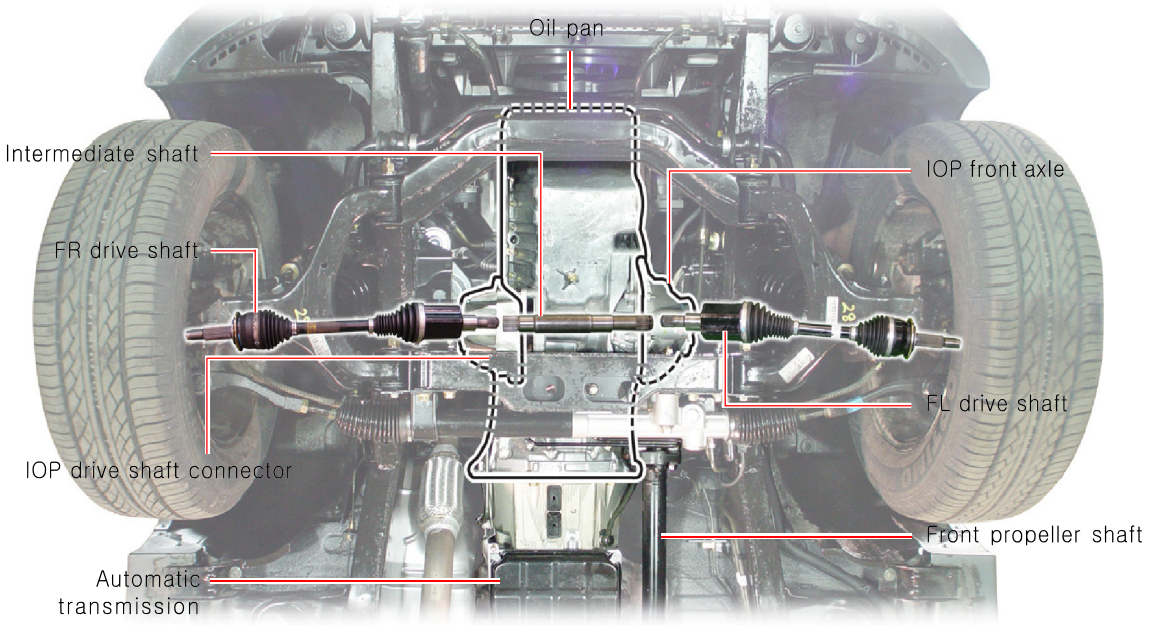
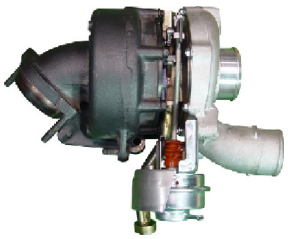
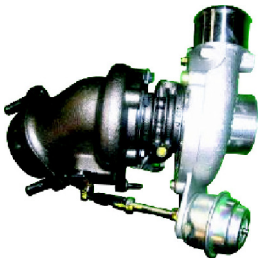
D27DTP (POWER UP) + CDPF Engine D27DT (EU IV) Engine	D27DT Engine (General)	Remarks
HFM 6.0 	HFM 5.0 	* Version up – D27DT (General): HFM5-CI (Analog signal) – D27DTP & D27DT (EU IV): HFM6-ID (Digital signal added)
Electric controlled E-EGR valve 	Vacuum modulator controlled EGR valve 	* E-EGR valve: ECU controls the EGR valve directly without any media. It provide more precise EGR control by transmitting the electric signal of EGR valve operating position.
Throttle body 	N/A	* Throttle body is for future regulation requiring emission reductions. Currently, it is used to prevent the engine from turning off with fluttering noise at the moment the air to intake manifold is blocked by closed flap when the engine is switched off.
EGR cooler EGR Gas  Coolant	EGR center pipe  EGR Gas	* To enhance EGR function, coolant EGR cooler is adopted to reduce the temperature of exhaust gas into the intake manifold.

D27DTP (POWER UP) + CDPF Engine D27DT (EU IV) Engine	D27DT Engine (General)	Remarks
E-EGR system layout  	EGR system layout  	* Reason of changes – To satisfy the emission regulation, E-EGR valve and EGR cooler are adopted. And the layout also has a great difference from D27DT.
Water pump 		* For D27DTP engine: Additional connecting port for EGR cooler hose
Coolant outlet port  		* For D27DTP (POWER UP) engine: Additional port for coolant of EGR cooler
Intake manifold  	Booster pressure sensor 	* The appearance of intake manifold is changed to the round type due to the throttle body. Also, the mounting location of booster pressure sensor is changed.
Cylinder head  		* The cooling port is added to improve cooling performance for D27DTP (POWER UP) & D27DT (EU IV) engine.

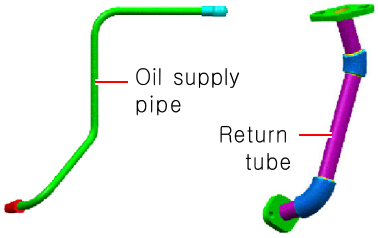
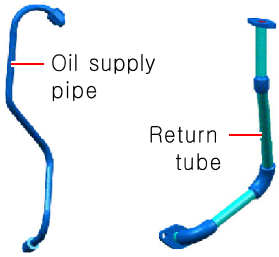
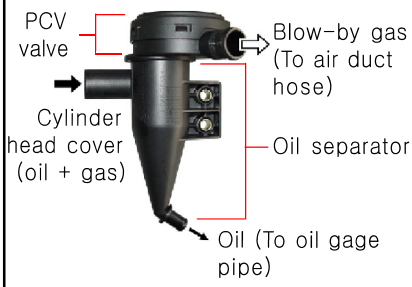
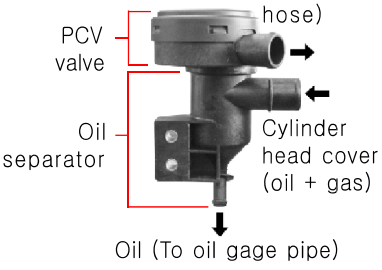
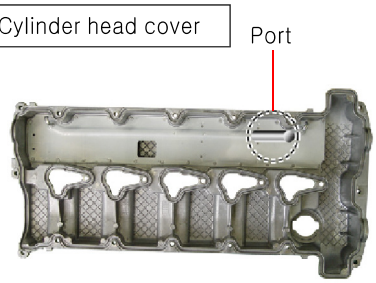
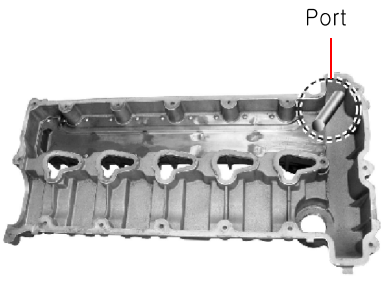
Modification basis	
Application basis	
Affected VIN	

D27DTP (POWER UP) + CDPF Engine D27DT (EU IV) Engine	D27DT Engine (General)	Remarks
Cylinder head gasket  		* The appearance of gasket is changed and the coolant passages are added to improve cooling performance for D27DTP (POWER UP) & D27DT (EU IV) engine.
Piston  	 	* Changed compression ratio - D27DT (General) (18:1) - D27DTP & D27DT (EU IV) (17.5:1) (The appearance of bowl is changed and the color mark is added due to the new compression ratio.) * The appearance fo bowl is changed and the color mark is added due to the new com-pression ratio (18 → 17.5). * The piston pin bending side and the appearance of piston pin hole taper is changed for reinforcement.
Lash adjuster  	 	* The ball head is coated with plasma to prevent the lash adjuster from wearing.
Vacuum modulator  	Vacuum modulator for controlling turbo charger actuator  	* D27DTP (POWER UP) & D27DT (EU IV) engine uses electric ally controlled E-EGR valve. Thus, the vacuum modulator for controlling EGR valve has been deleted.

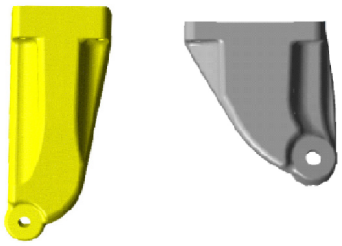
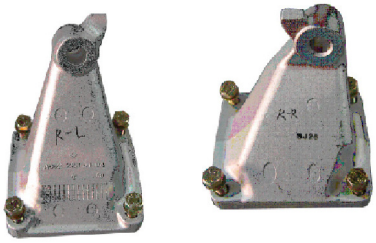
Modification basis	
Application basis	
Affected VIN	

D27DTP (POWER UP) + CDPF Engine	D27DT Engine (General) D27DT (EU IV) Engine	Remarks
IOP oil pan 	Oil pan	* The vehicle with D27DTP (POWER UP) engine is equipped with IOP axle. Refer to the figure below.
Glow system- AQGS unit	Glow system - Glow control relay	* D27DTP (POWER UP) engine adopts AQGS (Advanced Quick Glow System), which controls the quick preheating of glow plugs and CAN communication with engine ECU.
		
VGT turbocharger 	WGT turbocharger 	* D27DTP (POWER UP) engine is equipped with the enhanced VGT turbocharger.

Modification basis	
Application basis	
Affected VIN	

D27DTP (POWER UP) + CDPF Engine	D27DT Engine (General) D27DT (EU IV) Engine	Remarks
1.Support bar of Turbocharger		* Support bar is changed due to VGT turbocharger mounting.
2.Oil supply pipe and return tube of Turbocharger 		* The shape of oil supply pipe and return tube is changed due to VGT turbocharger mounting.
PCV oil separator 		* Increase of Oil separator capacity (approx. 10%) - D27DT & D27DT (EU IV): 120ℓ/min - D27DTP: 160ℓ/min
Cylinder head cover 		* The direction of blow-by outlet port is changed due to the introduction of larger oil separator.

Modification basis	
Application basis	
Affected VIN	

D27DTP (POWER UP) + CDPF Engine	D27DT Engine (General) D27DT (EU IV) Engine	Remarks
Switchable engine mounting 	Engine mounting 	* The switchable engine mounting system (SEM) controls the engine in soft mode or hard mode by dividing the speed to the low speed range and mid-high speed range according to the vehicle speed and the engine rpm. This is only available in D27DTP (POWER UP) engine.
Engine bracket LH RH 	LH RH 	* The bracket is changed due to the mounting location of D27DTP (POWER UP) engine and the switchable engine mounting.

Modification basis	
Application basis	
Affected VIN	

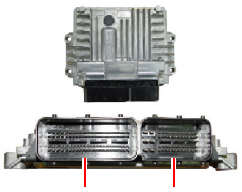
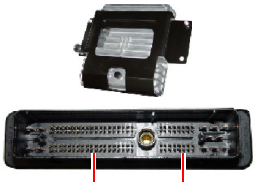
Memo

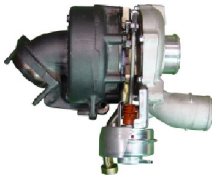
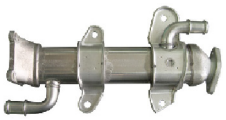
OVERVIEW AND OPERATION PROCESS

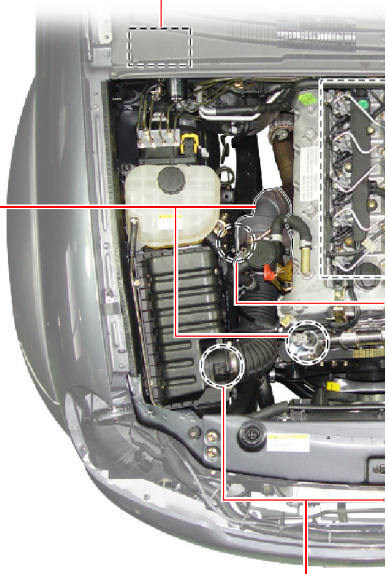
1. ENGINE COMPARTMENT

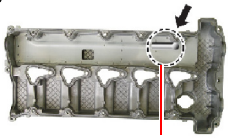
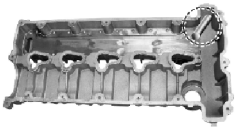
The major changes due to the newly adopted engine compared to D27DT engine are as follows:

Intake System	
D27DTP & D27DT (EU IV)	D27DT
HFM sensor (Ver. 6.0)	Throttle body

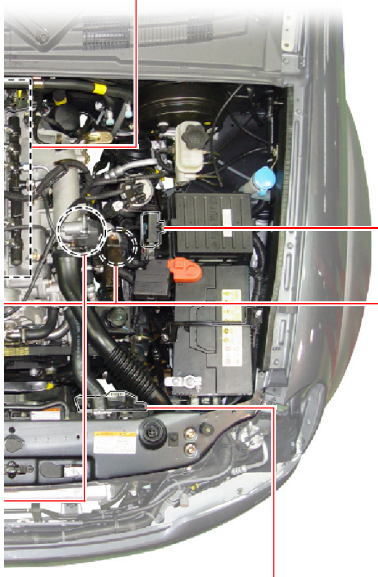
Engine Control (Engine ECU-3.2)	
D27DTP & D27DT (EU IV)	D27DT
 Connector A Connector B	 Connector A Connector B

Exhaust System		
VGT turbo charger 	E-EGR valve	EGR cooler 



Lubrication System		
D27DTP Cylinder head cover  Modification in blow-by gas outlet port	Larger PCV oil separator	OP oil pan * Axle integral type
D27DT (EU IV) & D27DT 		

Modification basis	
Application basis	
Affected VIN	



Fuel System

D27DTP & D27DT (EU IV)

Injector

D27DTP & D27DT (EU IV)

Fuel pipe

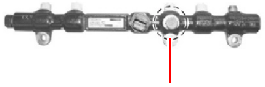
D27DTP & D27DT (EU IV)

Common rail

D27DT

D27DT

D27DT



Preheat System

AQGS unit

D27DTP & D27DT (EU IV)

Glow plug

D27DT

Switchable Engine M ounting (SEM)

D27DTP

LH

RH

D27DT (EU IV) & D27DT

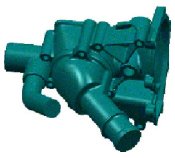
Cooling System

D27DTP & D27DT (EU IV)

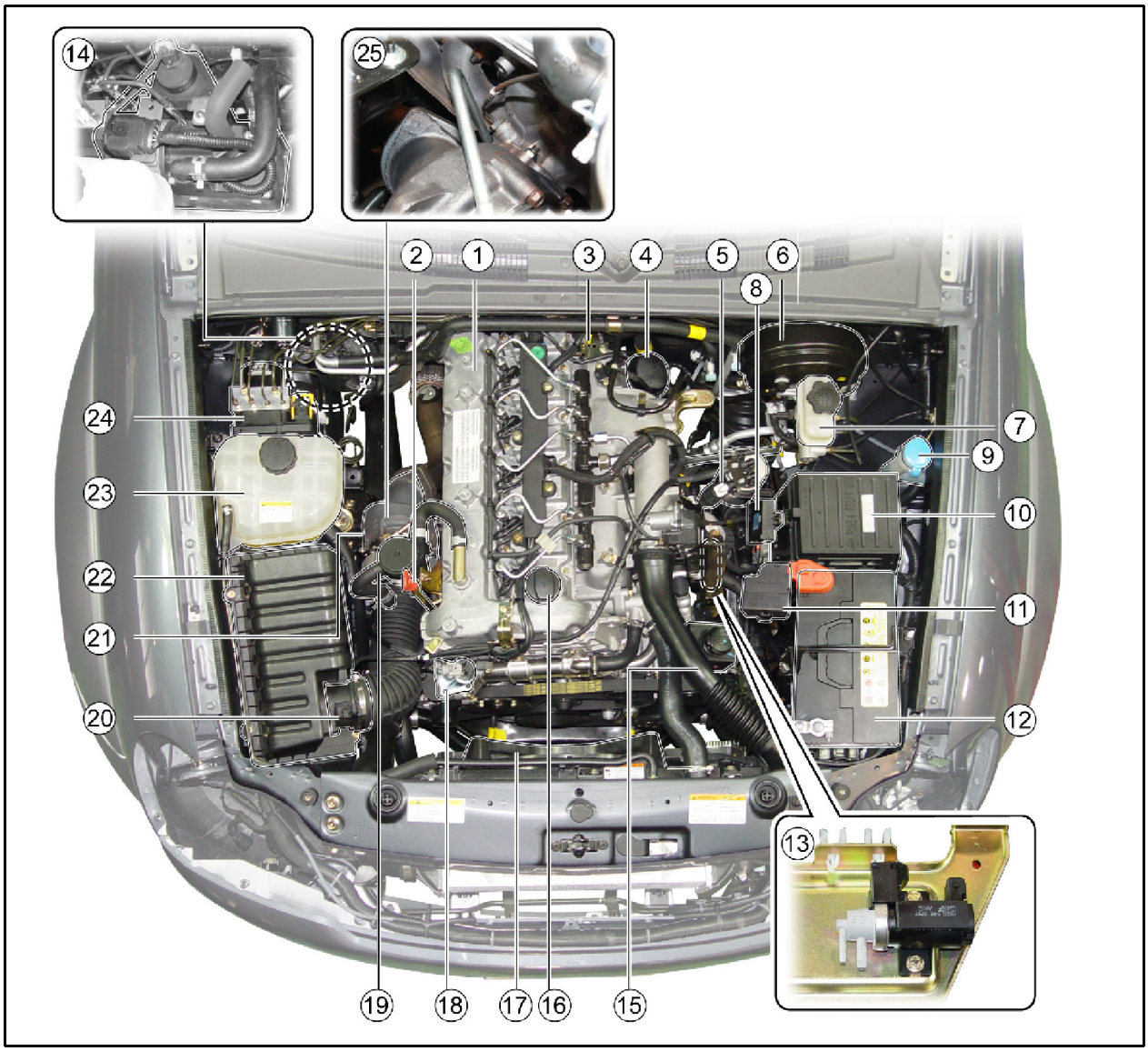
Large water pump

* EGR cooler port included

D27DT



▶Engine Compartment Layout



1. Engine assembly
2. Engine oil dipstick
3. Vacuum pump
4. Oil filter and cooler
5. Fuel filter and priming pump
6. Brake booster
7. Brake oil tank
8. AQGS unit
9. Washer fluid filler cap
10. Engine compartment fuse box
11. PTC relay box
12. Battery
13. Vacuum modulator (for VGT turbo charger)
14. FFH Assembly (Only for vehicle with FFH)
15. Power steering oil tank
16. Engine oil filler cap
17. Fan shroud
18. E-EGR Valve
19. High-capacity PCV oil separator
20. HFM sensor (6.0)
21. VGT turbo charger
22. Air cleaner housing
23. 2Coolant surge tank
24. ABS/ESP HECU (Including TPMS function: optional)
25. Exhaust gas FRT Temp. sensor (T3)

Modification basis	
Application basis	
Affected VIN	

▶Major Sensors and Components

Injector

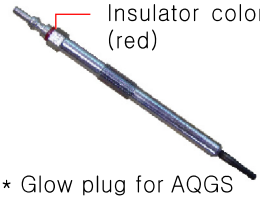
D27DTP & D27DT (EU IV)

* 2 additional injection holes (currectly 7 holes)

D27DT

Glow Plug

D27DTP & D27DT (EU IV)



* Glow plug for AQGS (quick preheat)

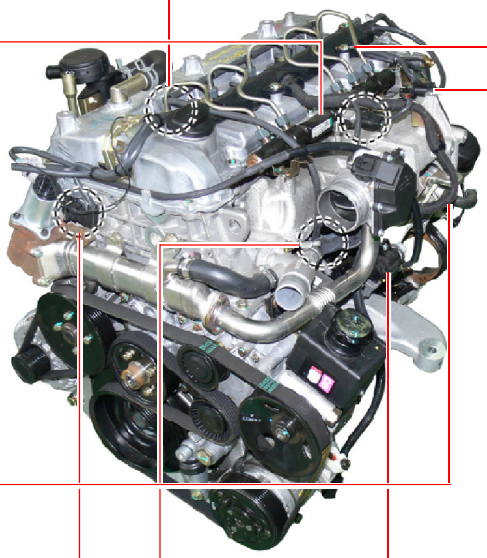
D27DT

Common Rail

D27DTP & D27DT (EU IV)

* Orifice for preventing fuel pulsation

D27DT



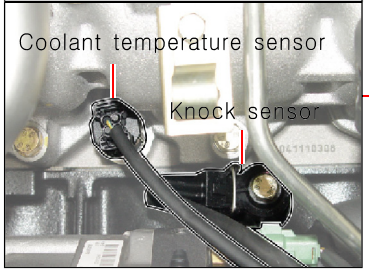
Fuel Pressure Sensor (Common Rail)

Booster Pressure Sensor

Crankshaft Position Sensor

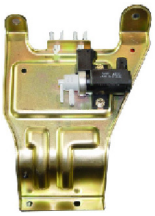
Camshaft Position Sensor

Knock Sensor (2EA) & Coolant Temperature Sensor



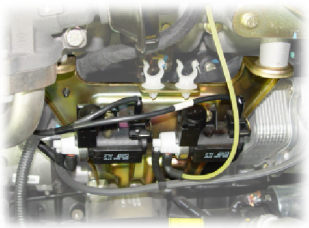
Vacuum Modulator for VGT Turbo Charger

D27DTP & D27DT (EU IV)



* Vacuum modulator for EGR valve deleted

D27DT

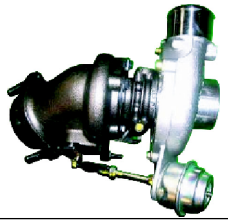


D27DTP

VGT Turbo Charger

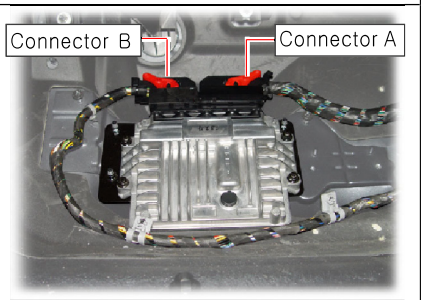
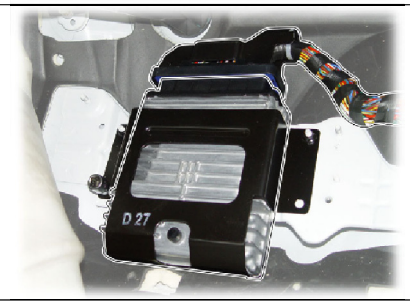
D27DT (EU IV) & D27DT

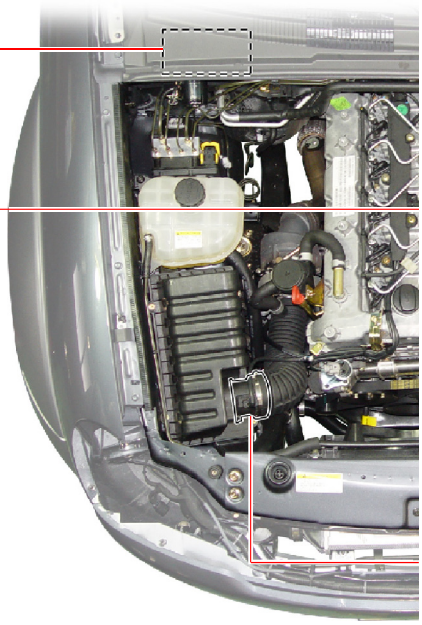
WGT Turbo Charger

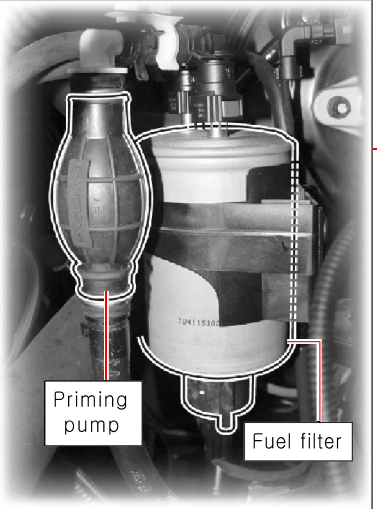


2. SYSTEMS IN ENGINE COMPARTMENT

1) Engine Accessories Related to ECU

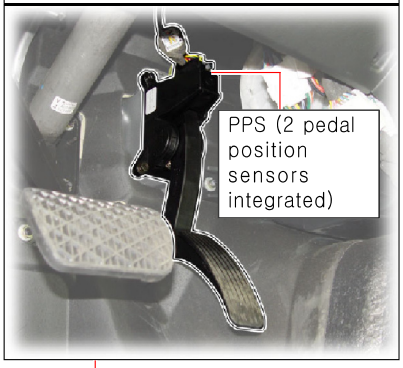
Engine ECU – Ver. 3.2	Engine ECU Mounting Location
D27DTP & D27DT (EU IV)	
D27DT	



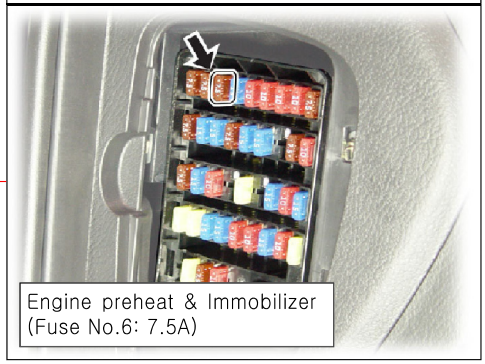
Fuel Filter (Water Detecting) Seneor
 Draining water from fuel filter: every 10,000 km

Modification basis	
Application basis	
Affected VIN	

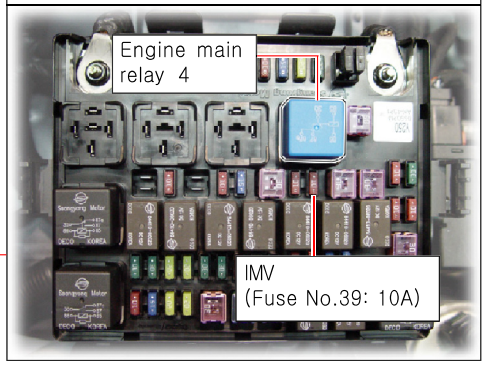
Accelerator Pedal Module

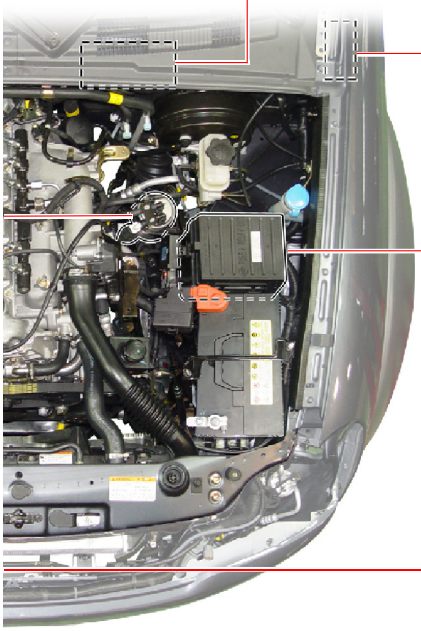


Interior Fuse Box (Driver's Side)



Engine Compartment Fuse Box





HFM Sensor (Ver. 6.0)

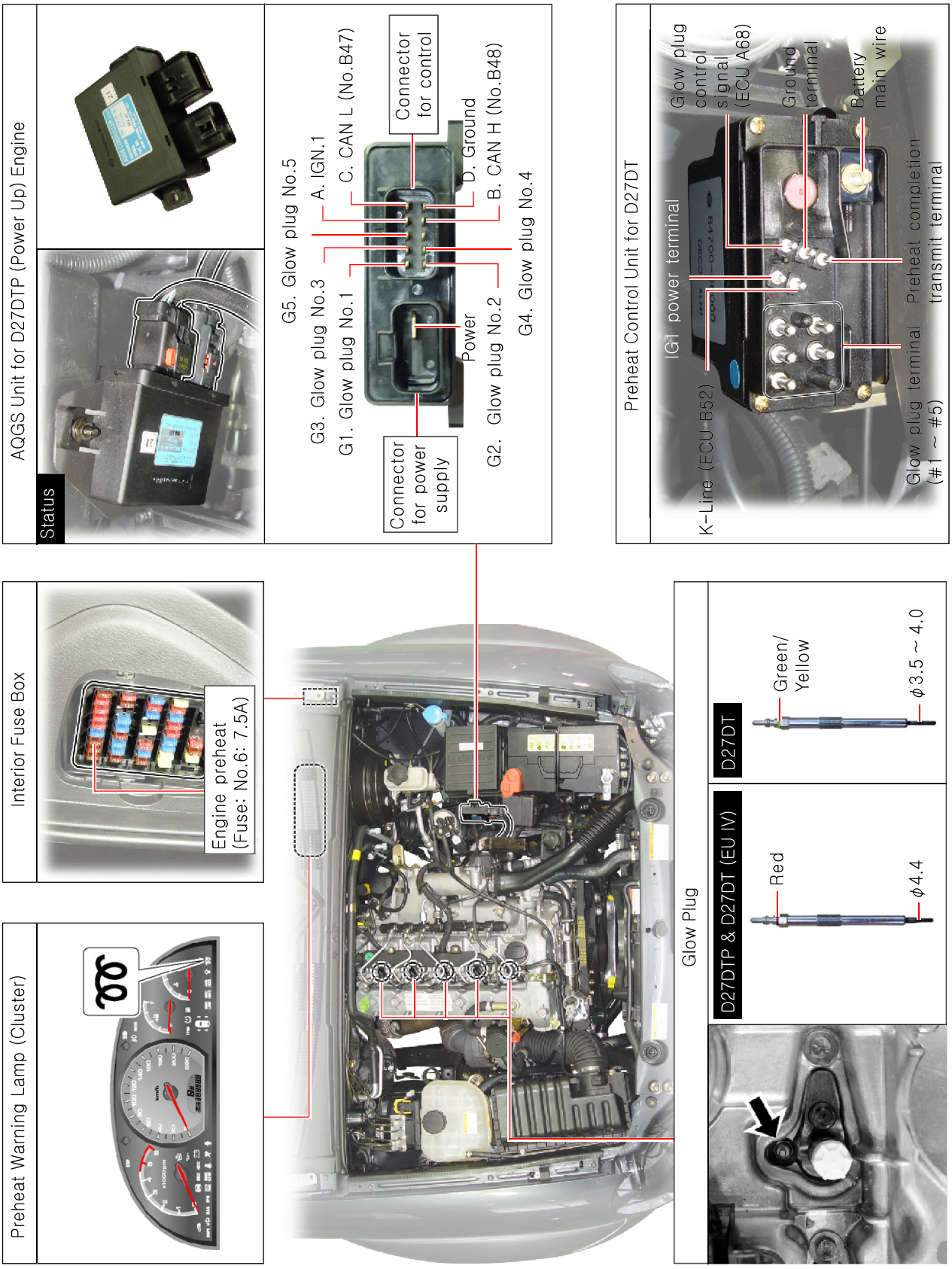
D27DTP & D27DT (EU IV)

Additional function: The digital signal about intake air volume is transfered to control the engine precisely.

D27DT

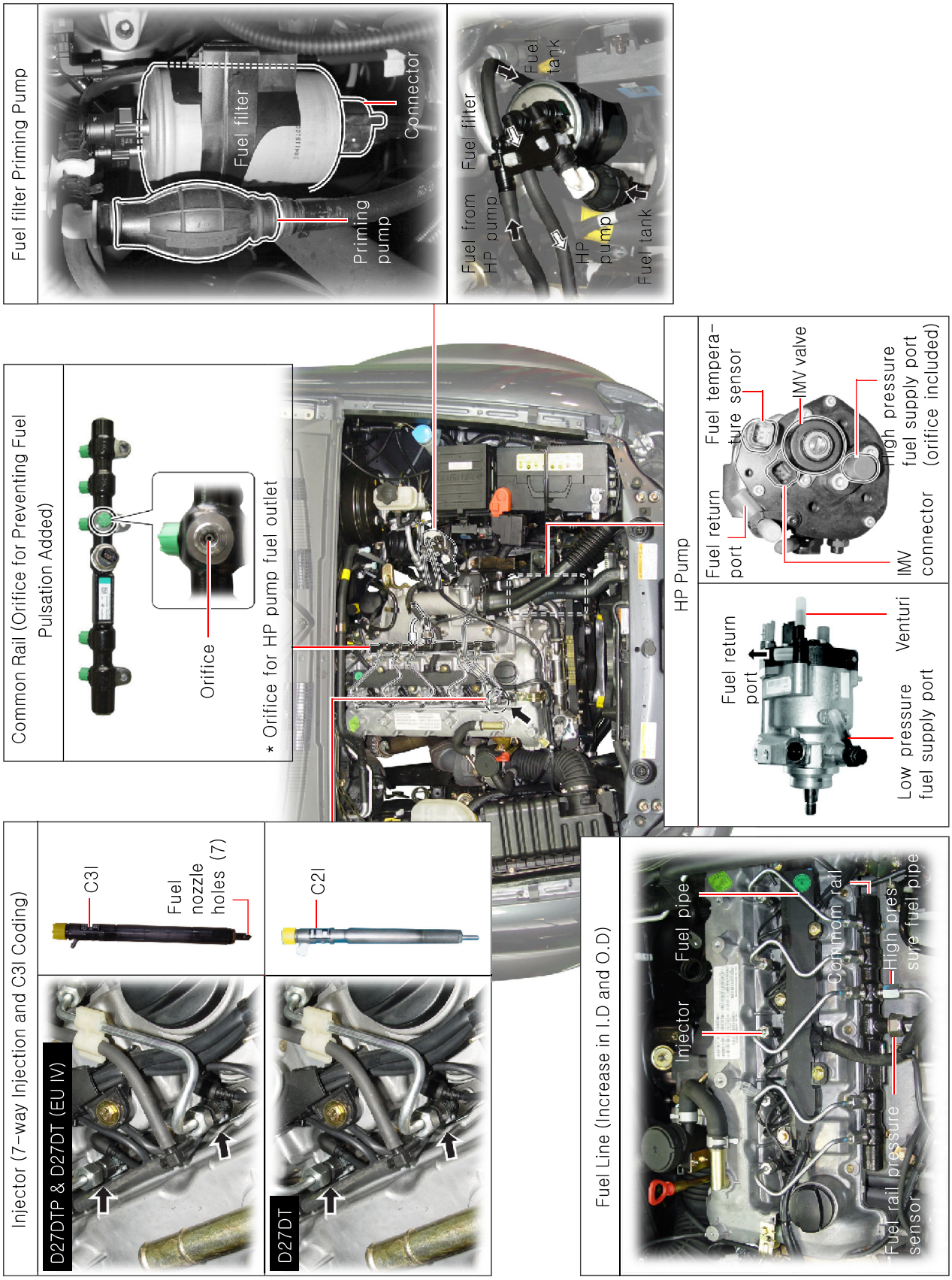
Modification basis	
Application basis	
Affected VIN	

2) Preheat System



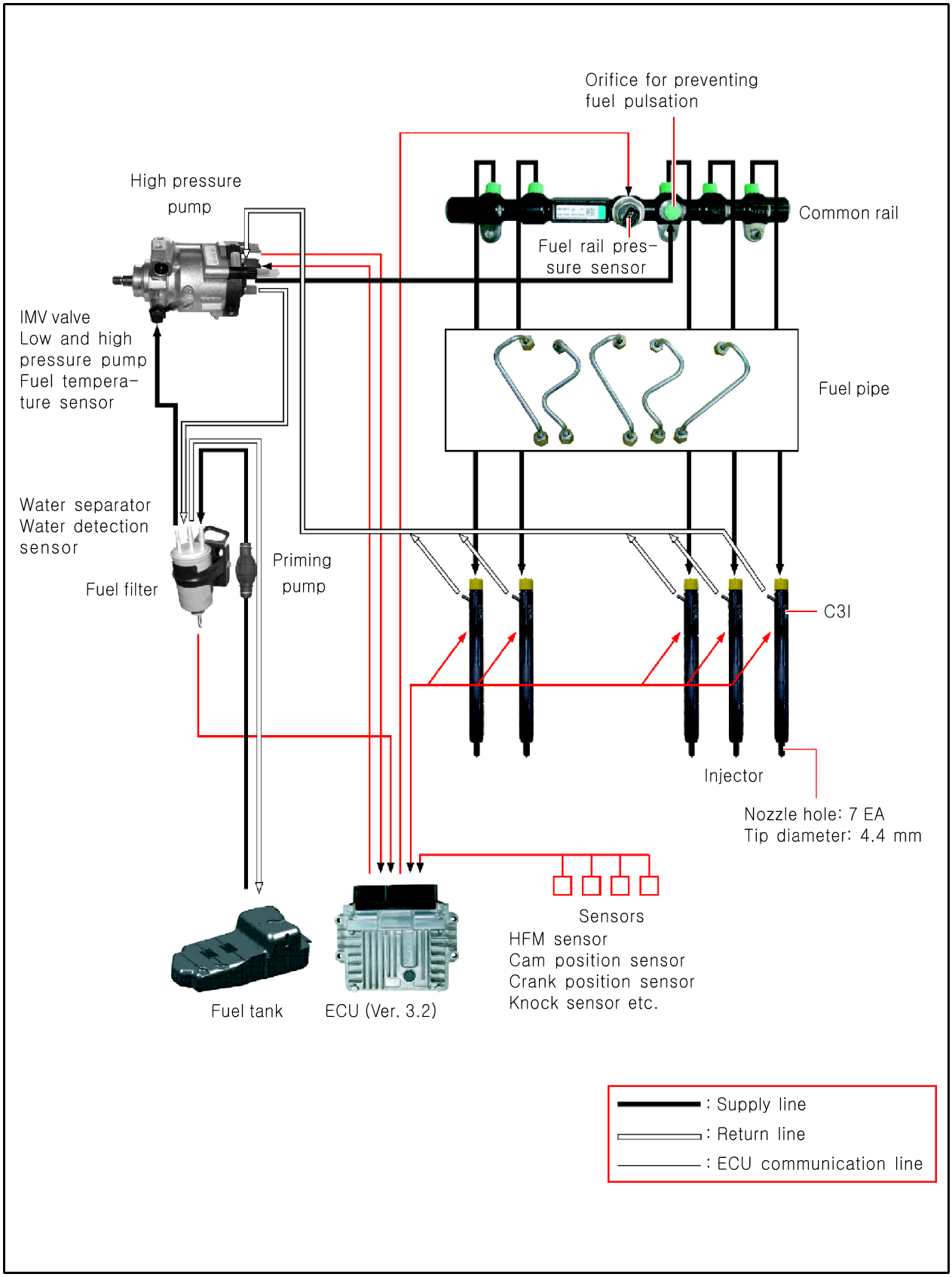
Modification basis	
Application basis	
Affected VIN	

3) Fuel System



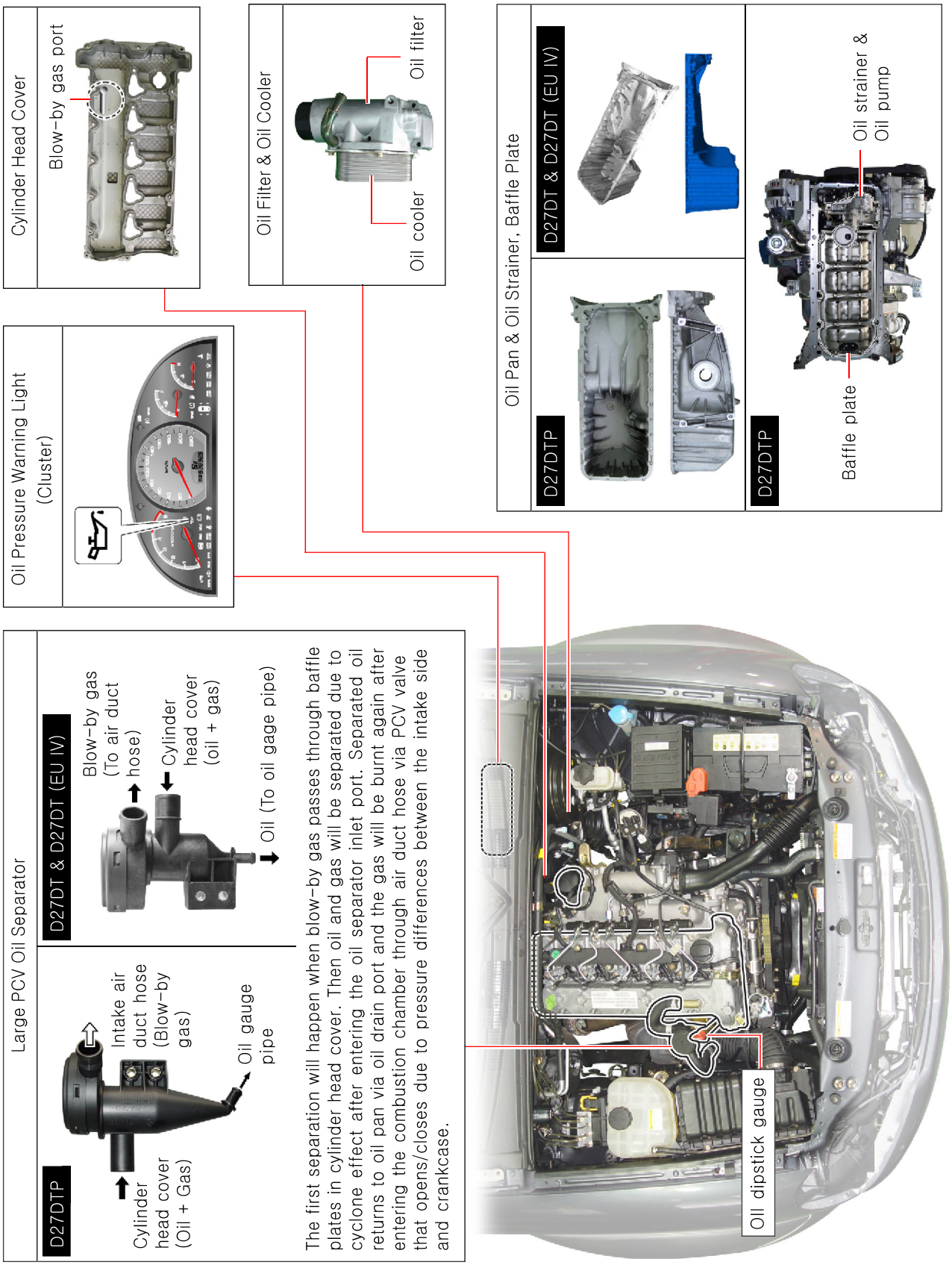
Modification basis	
Application basis	
Affected VIN	

▶Fuel Supply System



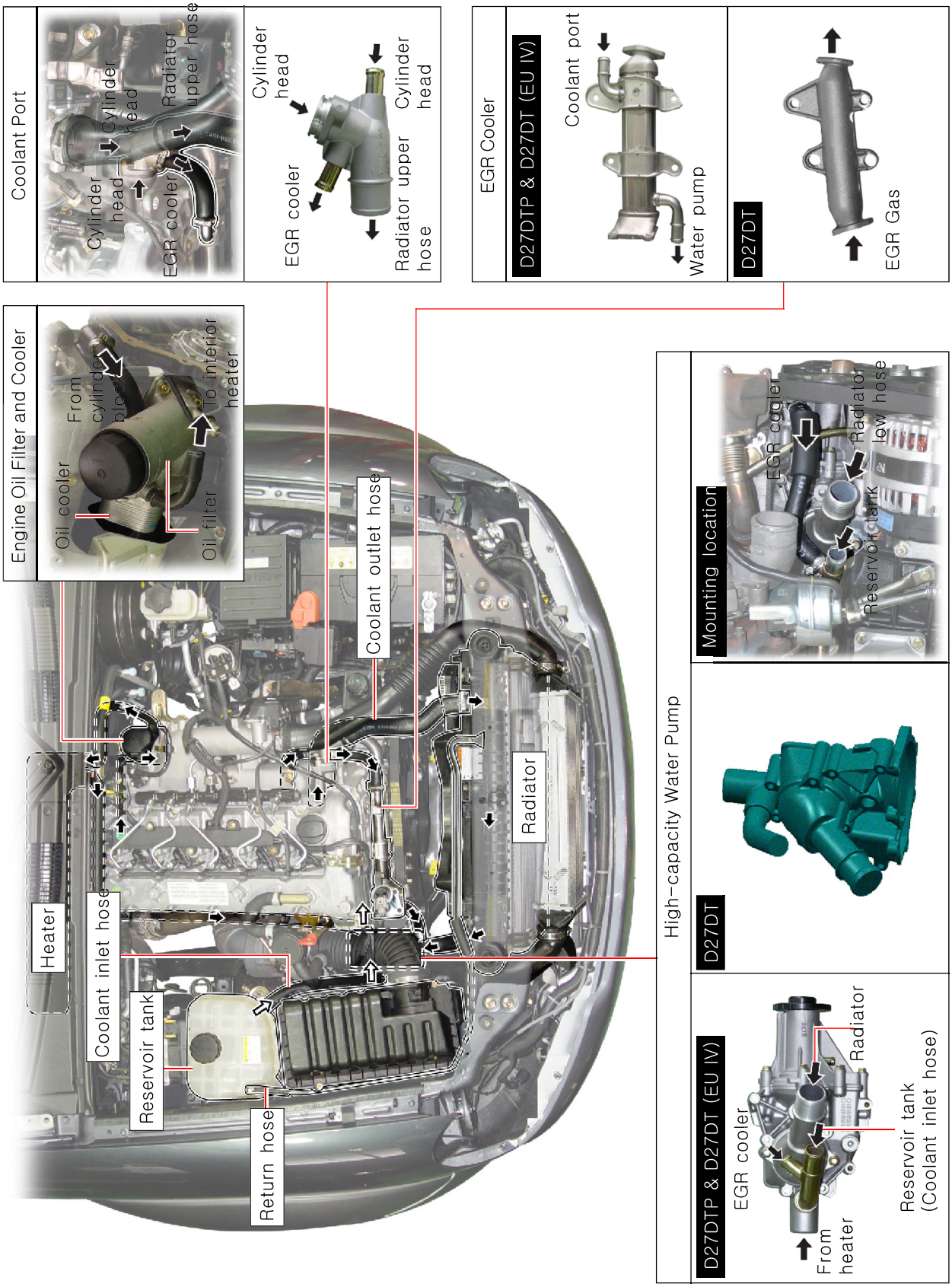
Modification basis	
Application basis	
Affected VIN	

4) Lubrication System



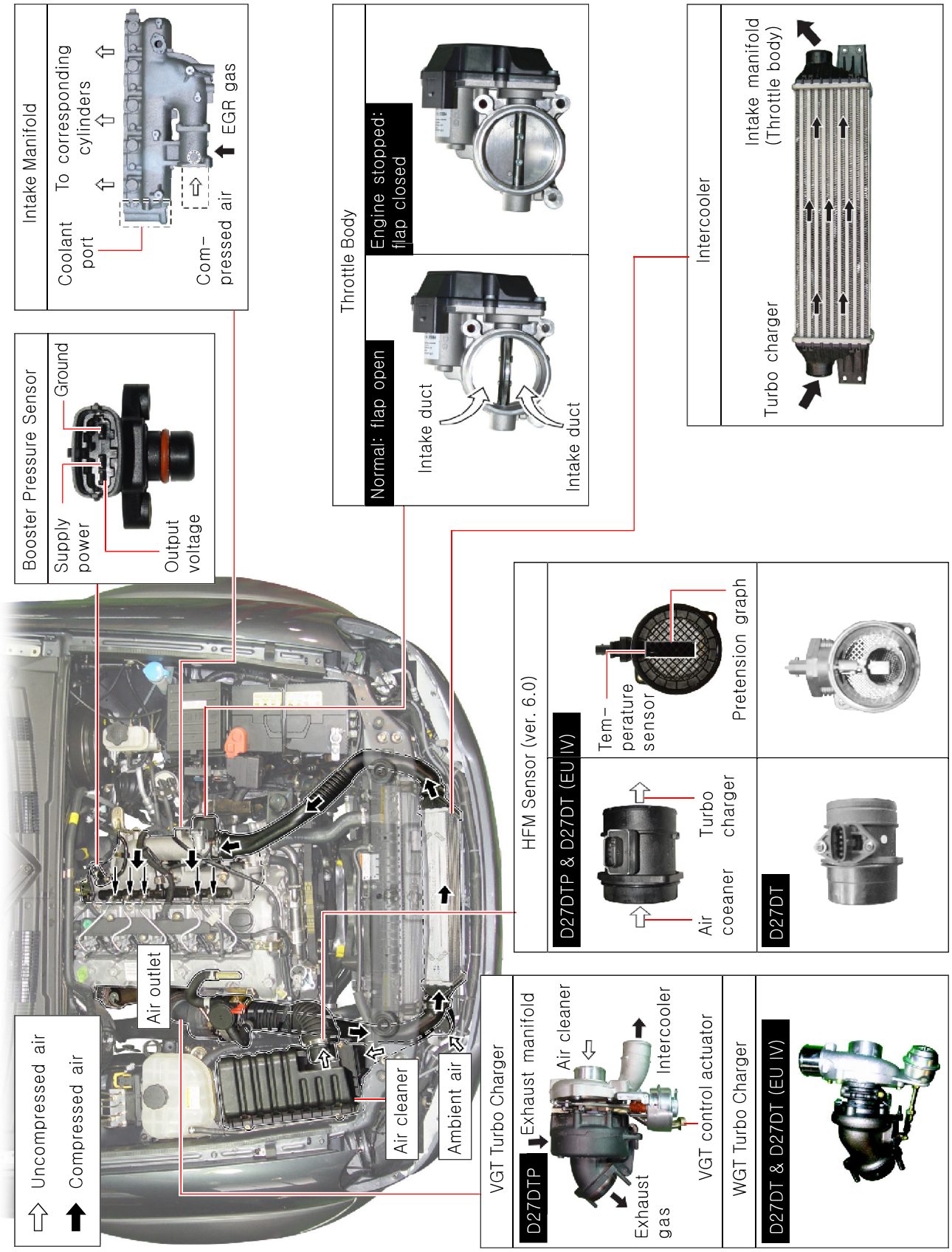
Modification basis	
Application basis	
Affected VIN	

5) Cooling System



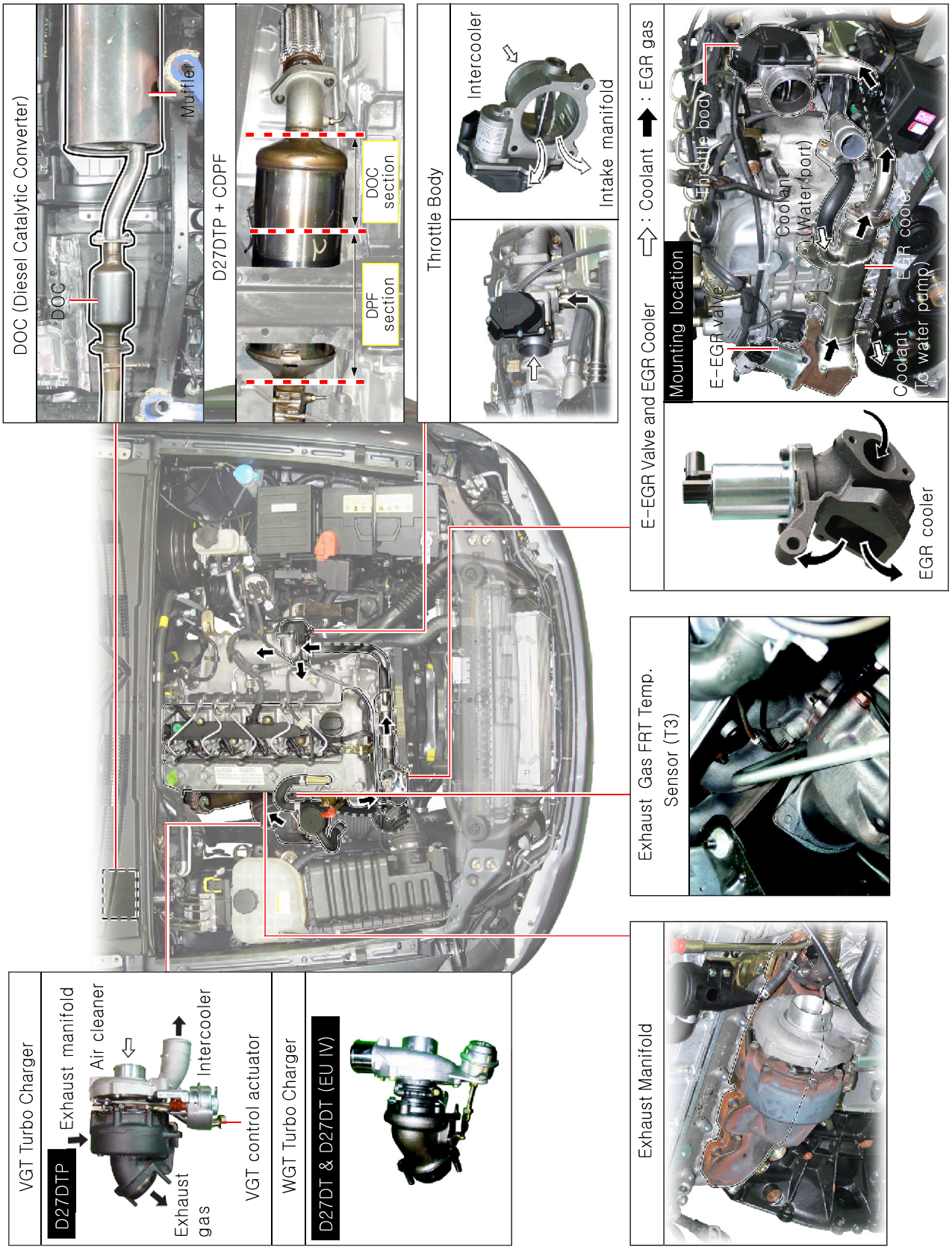
Modification basis	
Application basis	
Affected VIN	

6) Intake System



Modification basis	
Application basis	
Affected VIN	

7) Exhaust System



Modification basis	
Application basis	
Affected VIN	

ENGINE FUEL SYSTEM

1881-09

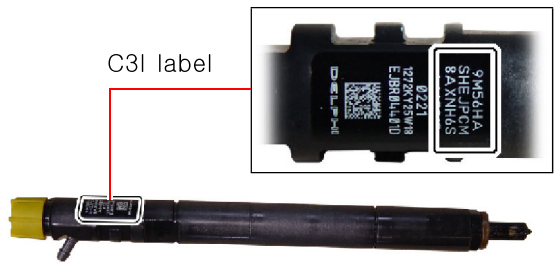
OVERVIEW AND OPERATION PROCESS

1. MAJOR CHANGES IN FUEL SYSTEM OF D27DTP (POWER UP) ENGINE

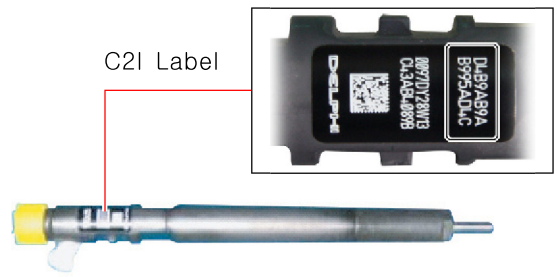
There are some changes in the parts related to the fuel system due to the newly adopted D27DTP (POWER UP) engine. The major changes are as follows. Refer to the next pages for further details.

1) Injector

D27DTP & D27DT (EU IV)



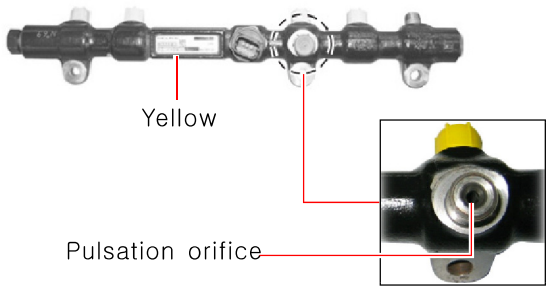
D27DT



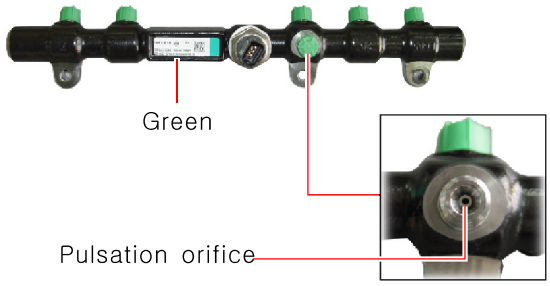
- Two nozzle holes are added (currently 7) to the tip of the injector to increase the amount of fuel injection and to improve injection efficiency according to the increased engine power.
- The existing C2I coding (16 digits) is changed to C3I coding (20 digits) to monitor fuel injection and follow the target value.
- For the D27DT engine, the injector MDP (minumum current for the solenoid in the injector to lift the nozzle) is leaned only when the engine is running. However, for the D27DTP engine, it is learned when the vehicle is in motion and the engine is at idle speed.

2) Common Rail

D27DTP & D27DT (EU IV)



D27DT



· The orifice is added to the connection to the fuel pipe of the HP pump to prevent the fuel pulsation by the fuel supply and fuel cut according to the increase of injected fuel volume. (It is also installed on the connection of the high pressure fuel supply line of the HP pump.)

Modification basis	
Application basis	
Affected VIN	

3) Fuel Rail - Chrome Color

D27DTP & D27DT (EU IV)

* Fuel pipe (Common rail → Injector)

* Fuel high pressure pipe (HP pump → Common rail)

D27DT

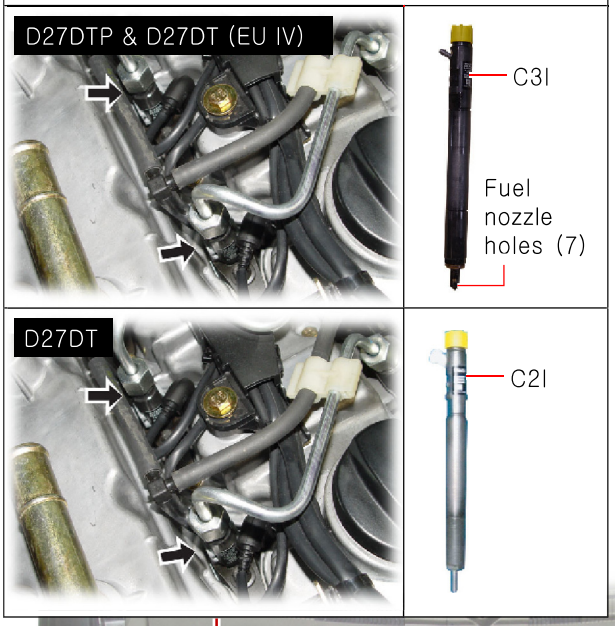
* Fuel pipe (Common rail → Injector)

* Fuel high pressure pipe (HP pump → Common rail)

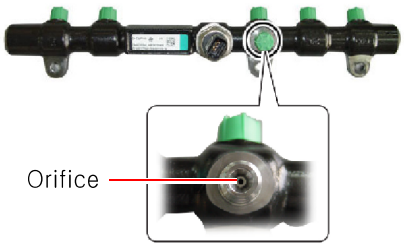
· The I.D and O.D of the fuel rail between HP pump and common rail are increased according to the increased amount of fuel injection.
Also, the engine ECU, HFM sensor and EGR system are changed to control the fuel injection volume and engine more precisely.

2. COMPONENTS OF FUEL SYSTEM

Injector (7-way Injection and C3I Coding)

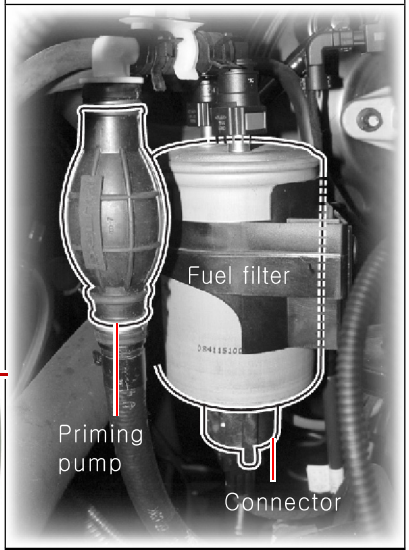


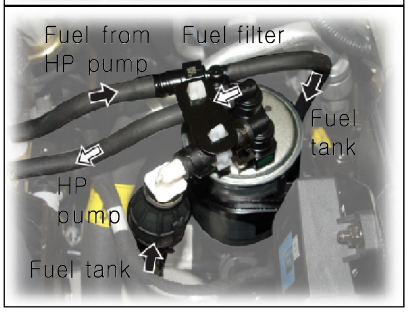
Common Rail (Orifice for Preventing Fuel Pulsation Added)

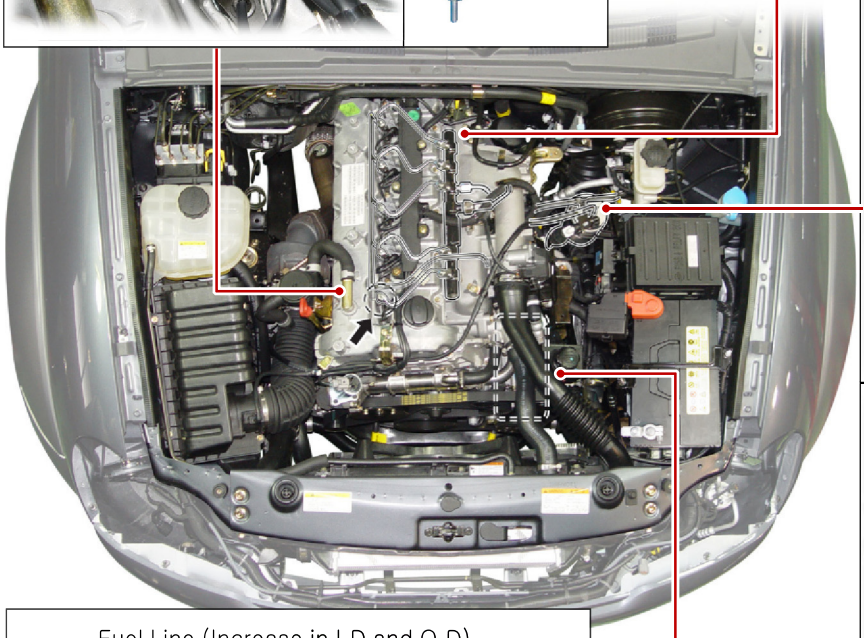


* Orifice for HP pump fuel outlet

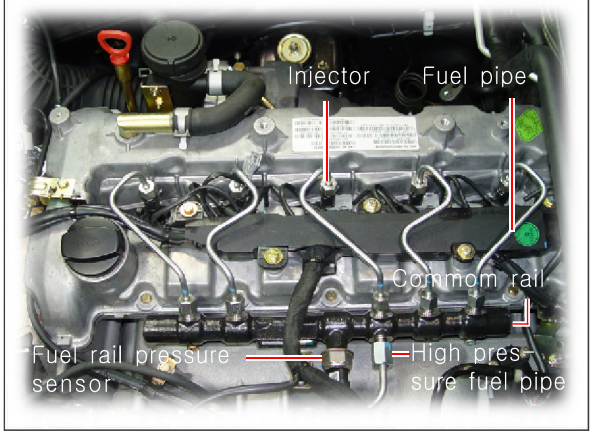
Fuel filter Priming Pump



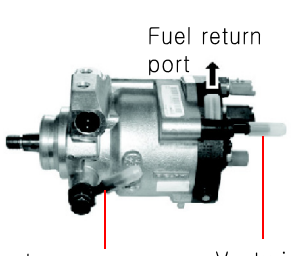


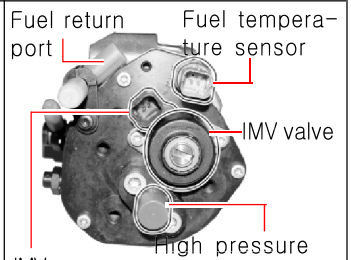


Fuel Line (Increase in I.D and O.D)



HP Pump

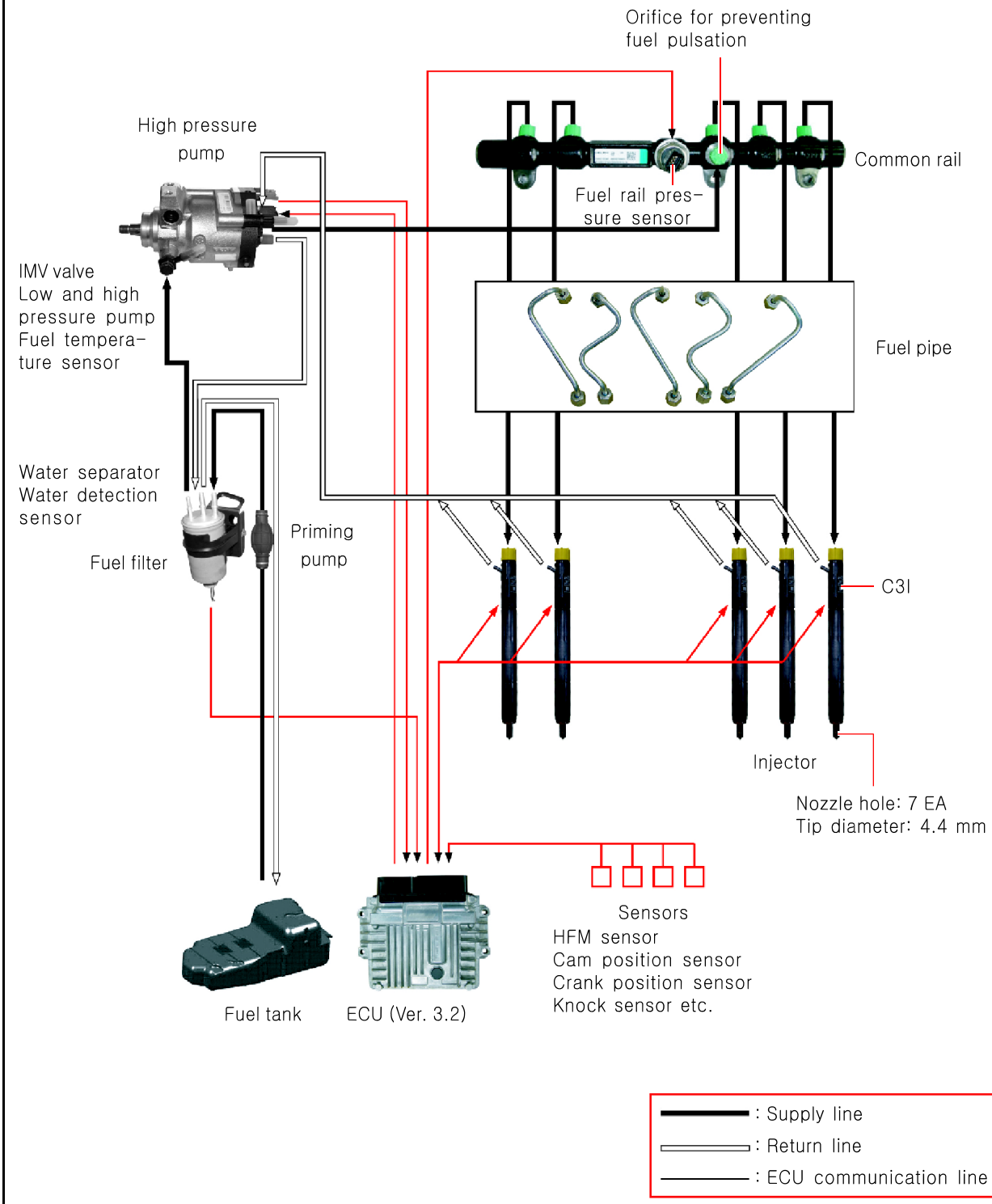




Modification basis	
Application basis	
Affected VIN	

▶Fuel Flow of D27DTP (Power Up) Engine

Fuel Supply System



Modification basis	
Application basis	
Affected VIN	

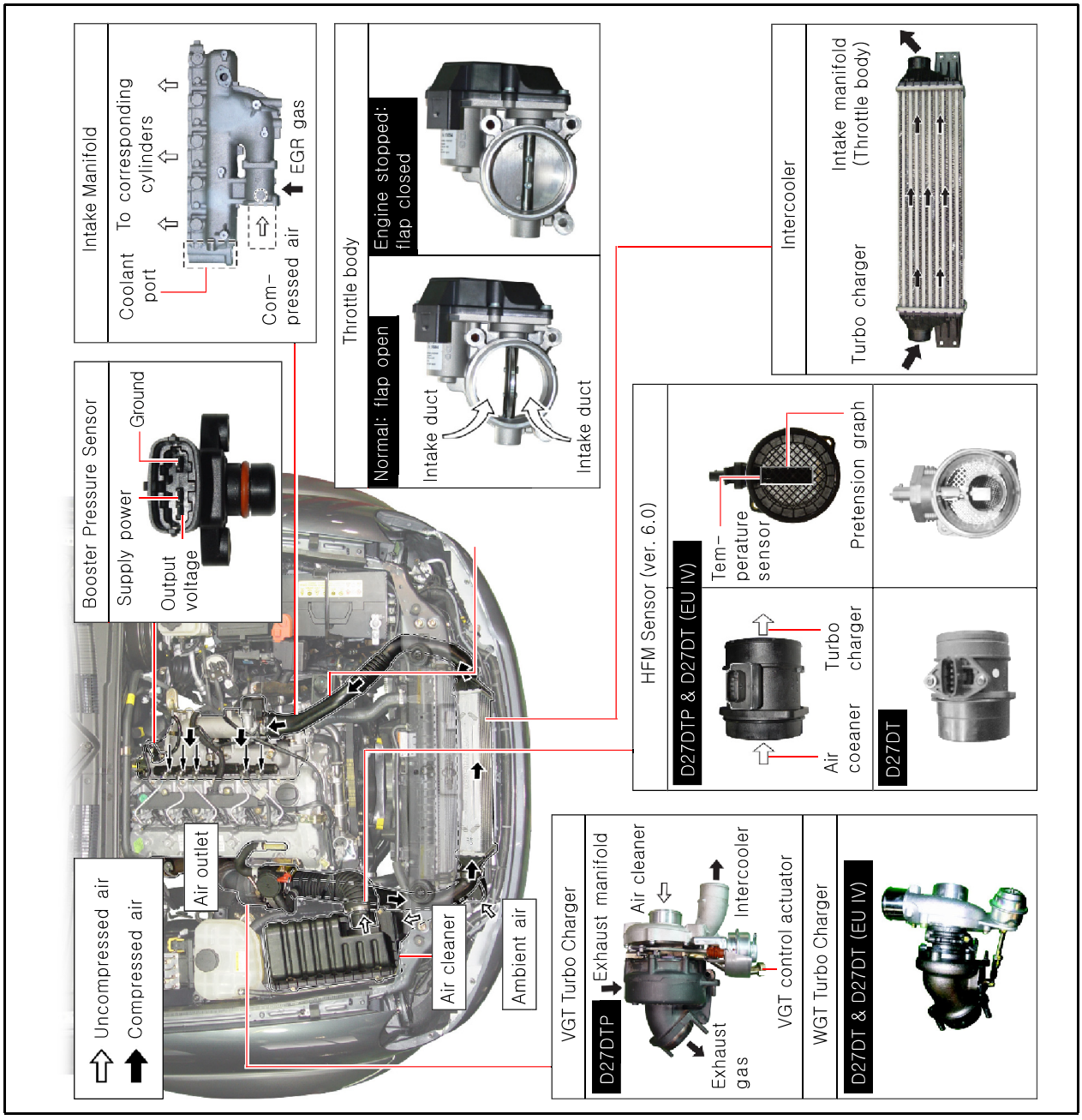
ENGINE INTAKE SYSTEM

2321-01

OVERVIEW AND OPERATION PROCESS

1. INTAKE SYSTEM LAYOUT

The intake system for the D27DTP (POWER UP) engine is equipped with the throttle body that has a flap to block the air coming to the engine when the engine is switched off. Therefore, the structure of the intake manifold has been changed.
Also, the improved HFM sensor (from HFM5.0 to HFM6.0) has been installed to control the intake air precisely so that the NOx in the exhaust gas can be decreased.



Modification basis	
Application basis	
Affected VIN	

ENGINE EXHAUST SYSTEM

1792-01

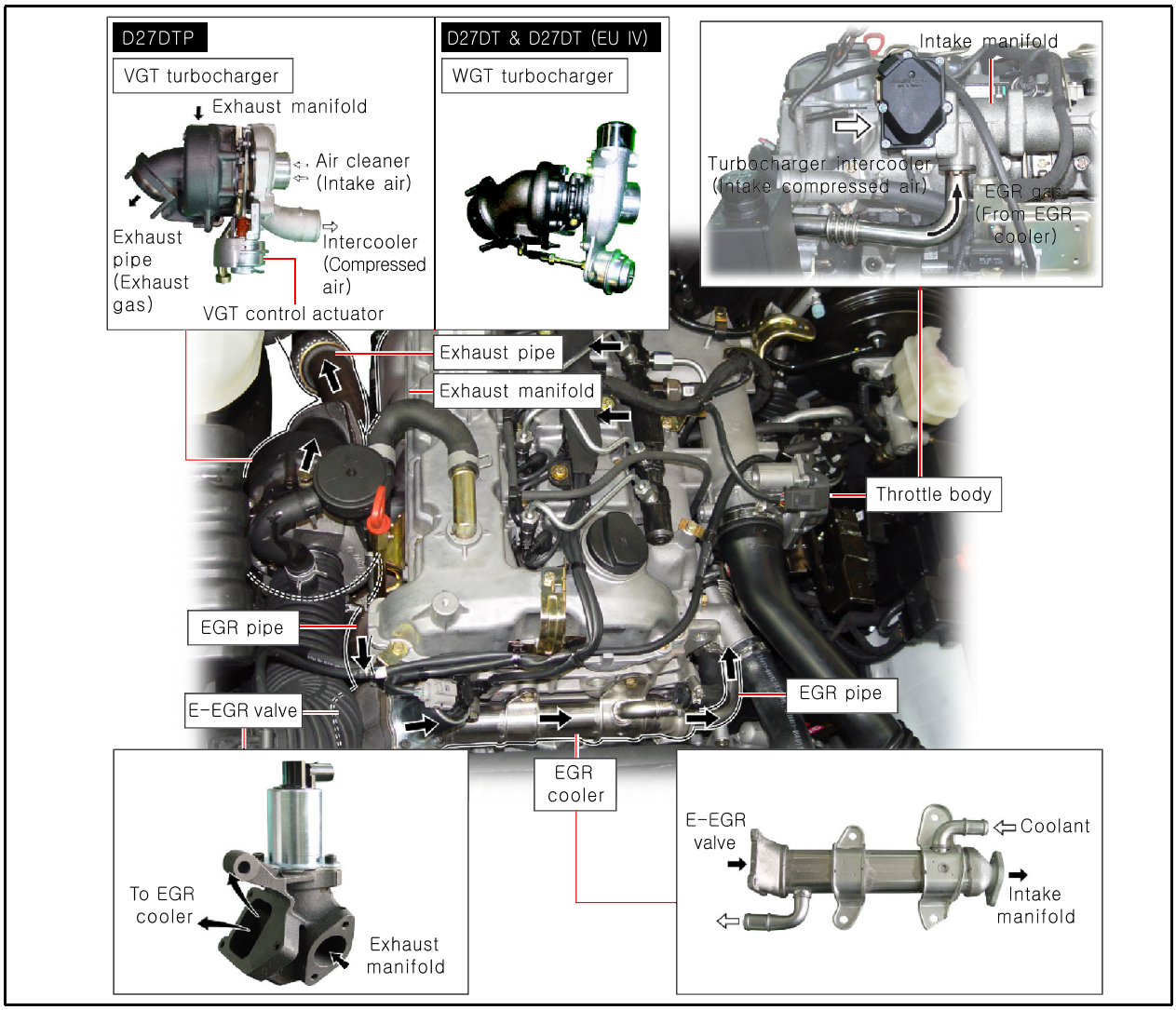
OVERVIE AND OPERATION PROCESS

1. COMPONENTS

The components of the exhaust system for the D27DTP (POWER UP) engine have been changed as follows:

1. E-EGR valve: Controlling the EGR valve electrically and sends the valve location signal to ECU (vacuum modulator control has been deleted)
2. EGR cooler: Decreasing EGR gas (NOx) efficiently by cooling the EGR gas and let it flow to the intake pipe
3. VGT turbocharger: Increase in capacity and performance compared to D27DTP & D20DT engine

The EGR system has been changed to control NOx more efficiently and the VGT turbo charger has been changed to increase the engine power. For more details, refer to the next description. The exhaust system for D27DTP (POWER UP) engine is as follows:



Modification basis	
Application basis	
Affected VIN	

CDPF(Catalytic Disel Particulate Filter) 1725-12

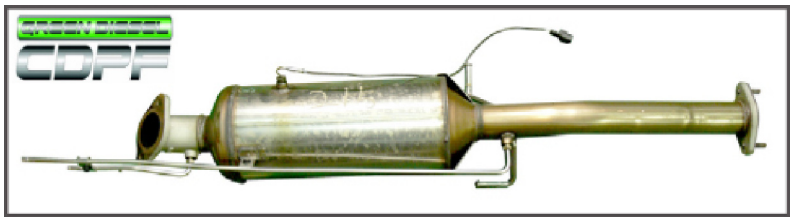
GENERAL

1. Specifications for engine with CDPF

Descriptions			D27DTP (POWER UP) + CDPF Engine * ( ) : CDPF
Engine	Type/Number of cylinders		D27DT/5-cylinder
Cylinder	Inner diameter (mm)		86.2
	Stroke (mm)		92.4
Displacement (cc)			2696
Compression ratio			17.5:1
Maximum output (ps/rpm)		For Automatic	186 (180) / 4,000
		Transmission	-
Maximum torque (kg ·m/rpm)		For Manual	41 /1,600 ~ 3,000
		Transmission	-
Idle speed	For Manual Transmission		-
	For Automatic Transmission		750 ± 20 rpm
Valve	Intake	Opens (btdc)	9°
		Closes (abdc)	26°
	Exhaust	Opens (bbdc)	38°
		Closes (atdc)	16°
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	-0.4 ~ 0 mbar
		HP pump outlet port (with IMV fully open)	Below 1,600 bar
	Water separation in fuel filter		Every 10,000 km
	Fuel tank capacity (ℓ)		78
Lubrication system	Oil specification		SAE 10W40, 5W40 (MB Sheet 229.1, 229.3 approved oil)
	Lubrication type		Gear pump Forced circulation
	Oil filter type		Full flow type, filter element type
	Oil capacity (ℓ)		≒ 8.5
Cooling system	Cooling type		Water cooling type/Forced circulation
	Cooling fan operation type		Belt operated type
	Thermostat (* Note: Fully opened at 100°C)	Opening temperature	85 °C
		Type	WAX Pellet Type
	Coolant capacity (ℓ)		≒ 11.0 ~ 11.5

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW



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

▶ COMPARISON OF THROTTLE BODY FUNCTIONS BASED ON EXHAUST EMISSION REGULATION

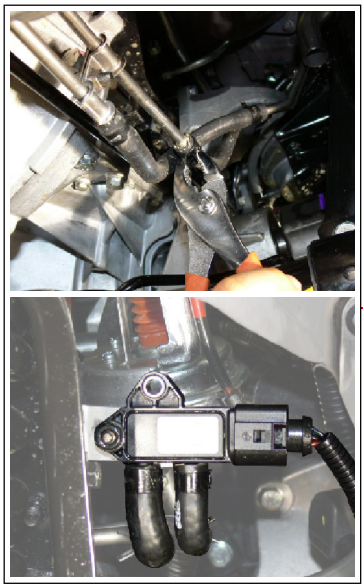
Regulated parts are carbon monoxide (CO), nitrogen oxide (NOx), particular matter (PM) and soot in the exhaust emission, and the particulars of the regulations are prescribed in the following table.

Engine	Control method	Function
D27DTP + CDPF	ECU's electric signal (Duty and On/Off control) + Throttle flap control during CDPF operation	ON/OFF control - prevents the engine from turning off with vibration and noise by closing the throttle body flap to block the intake air when the engine is stopped Duty control - controls the valve inside the throttle body to burn more EGR gas in the EGR valve operating range. CDPF control - added a function that increases the exhaust gas temperature by closing the throttle valve flap to minimize the intake air amount by the fuel injection amount during the CDPF regeneration range with the low engine load range.
D27DT engine	ECU's electric signal (Duty and On/Off control)	ON/OFF control - prevents the engine from turning off with vibration and noise by closing the throttle body flap to block the intake air when the engine is stopped Duty control - controls the valve inside the throttle body to burn more EGR gas in the EGR valve operating range.

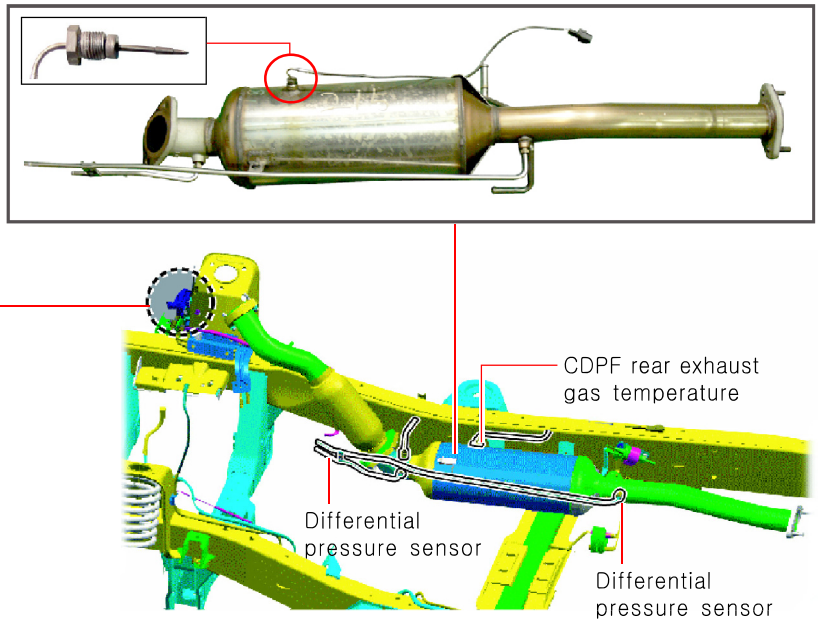
Modification basis	
Application basis	
Affected VIN	

2. COMPONENTS

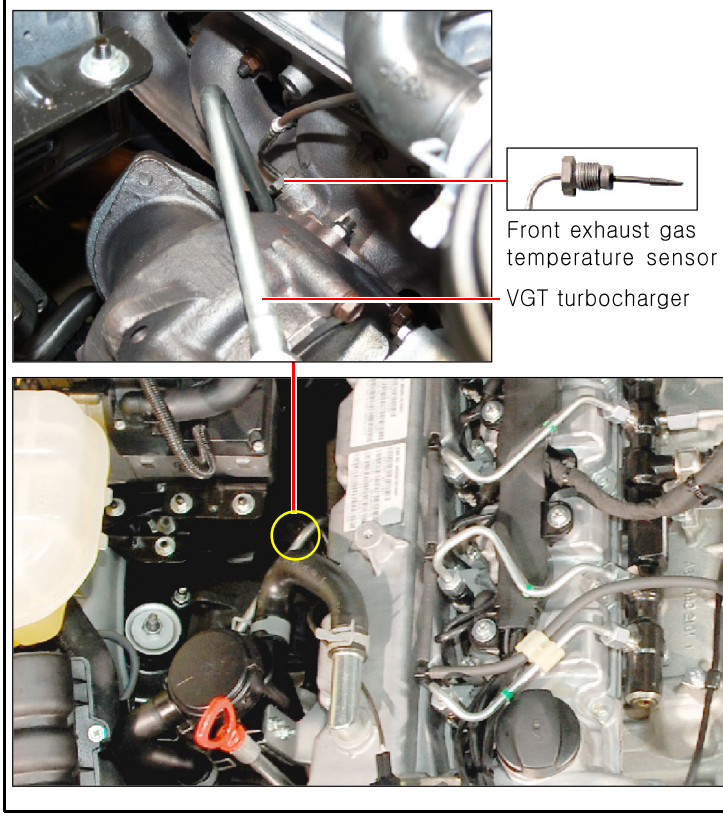
Differential Pressure Sensor



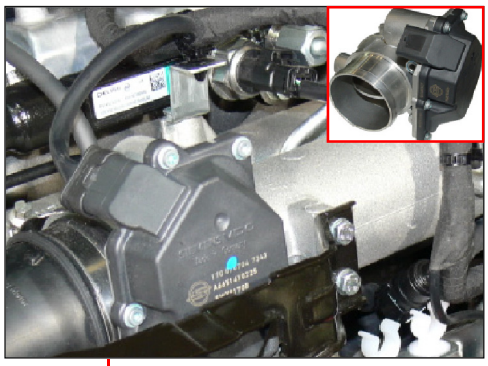
CDPF Assembly and Rear Exhaust Gas Temperatiure Sensor



Front Exhaust Gas Temperature Sensor



Throttle Body



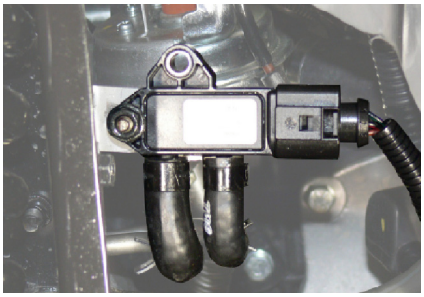
Modification basis	
Application basis	
Affected VIN	

3. MAJOR CHANGES

The CDPF system is only installed to the D27DT engine, and the major changes comparing to the previous D27DT engine is as follows:

CDPF (Catalyst & Diesel Particulate Filter) and Sensors

Differential Pressure Sensor (ΔP sensor)

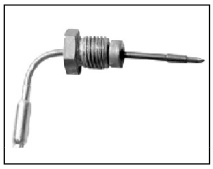


As the soot is filtered in the CDPF, the pressure between the front side and the rear side of the filter is different from each other. If the amount of soot is over 32 g, the soot is burnt in the CDPF. The combustion is determined depending on the pressure difference, temperature of exhaust gas and EGR ratio. According to these, the soot filtered by post injection of injector is burnt at 600°C.

Installation Condition

Installed in the inside frame of the front RH wheelhouse (on the right side of the coil spring)

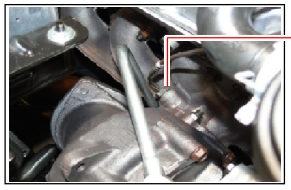
CDPF exhaust gas temperature sensor



The two temperature sensors inside the CDPF are installed in exhaust manifold (front exhaust gas temperature sensor) and in DOC (rear exhaust gas temperature sensor), and performs the following functions.

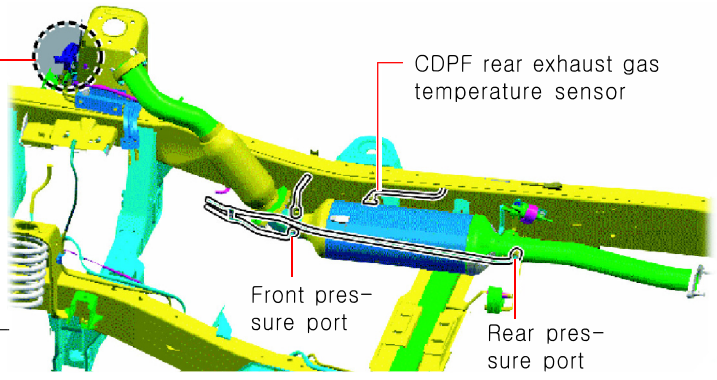
- Front Exhaust Gas Temperature Sensor:
Measures the exhaust gas temperature of the exhaust manifold. As it isinstalled in front of the VGT turbocharger, it also monitors the exhaust gas temperature coming to the turbocharger. If the temperature of the exhaust gas flowing to the turbocharger is higher than the regulation, the engine lowers the exhaust gas temperature.

- Rear Exhaust Gas Temperature Sensor:
Measures the increased exhaust gas temperature after the oxidation process of DOC. If the temperature is below 600°C, the post injection amount is increased to increase the temperature.



CDPF front exhaust gas temperature sensor

Front exhaust gas temperature sensor is installed in the exhaust manifold to measure the exhaust gas temperature before it passes through VGT turbocharger and CDPF.



* The ECU receives signals from the front and rear temperature sensors and differential pressure sensor.

Engine ECU

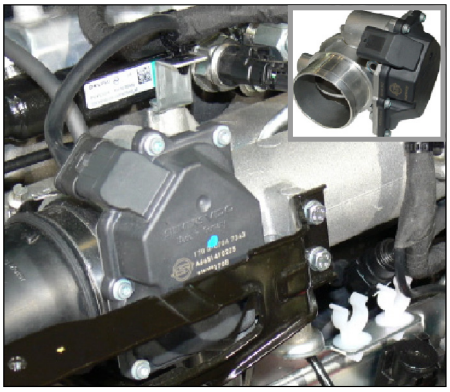
The engine ECU has been revised since terminals have been added for front/rear temperature sensors.
Its version is 3.2, but it is not compatible with ECU without CDPF.

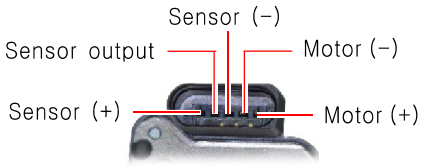
Fuel Common Rail and Fuel Rail (Between Common Rail and Injector)

The I.D and O.D of fuel rail has changed from 2.4 mm/6.0 mm to 3.0 mm/6.35 mm. Also, the damping orifice is installed to prevent the fuel pulsation occured by fuel pressure.

Modification basis	
Application basis	
Affected VIN	

Throttle body



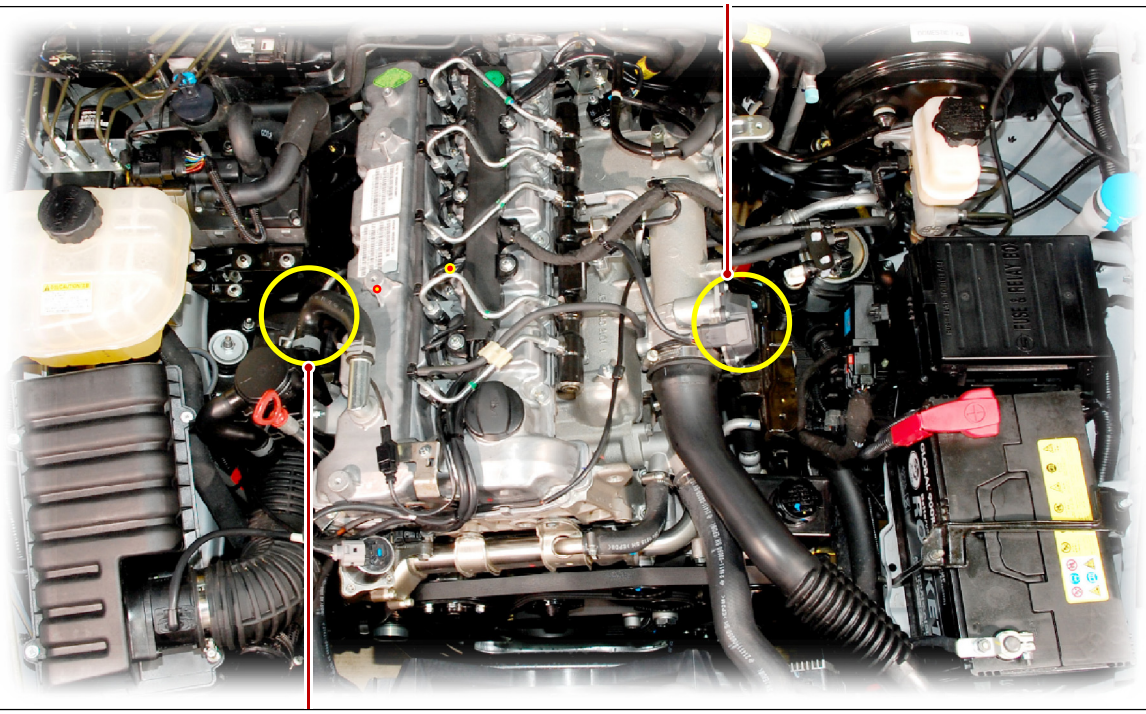


CDPF system controls the amount of intake air by controlling the electronic throttle body. The electronic throttle body has the following main functions.

CDPF control -added a function that increases the exhaust gas temperature by closing the throttle valve flap to minimize the intake air amount by the fuel injection amount during the CDPF regeneration range with the low engine load range.

ON/OFF control - prevents the engine from turning off with vibration and noise by closing the throttle body flap to block the intake air when the engine is stopped.

Duty control - controls the valve inside the throttle body to burn more EGR gas in the EGR valve operating range.

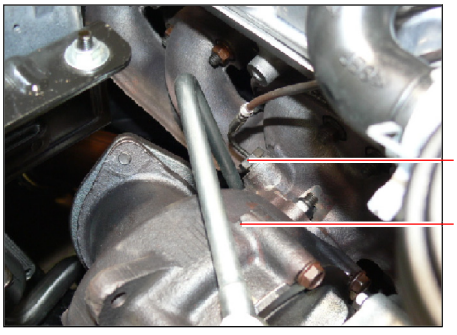


VGT Turbocharger and Front Exhaust Gas Temperature Sensor

Turbocharger may become weaker if high temperature exhaust gas passes through the turbocharger for DPF regeneration process.

The front exhaust gas temperature sensor monitors the temperature of the exhaust gas that flows into the turbocharger.

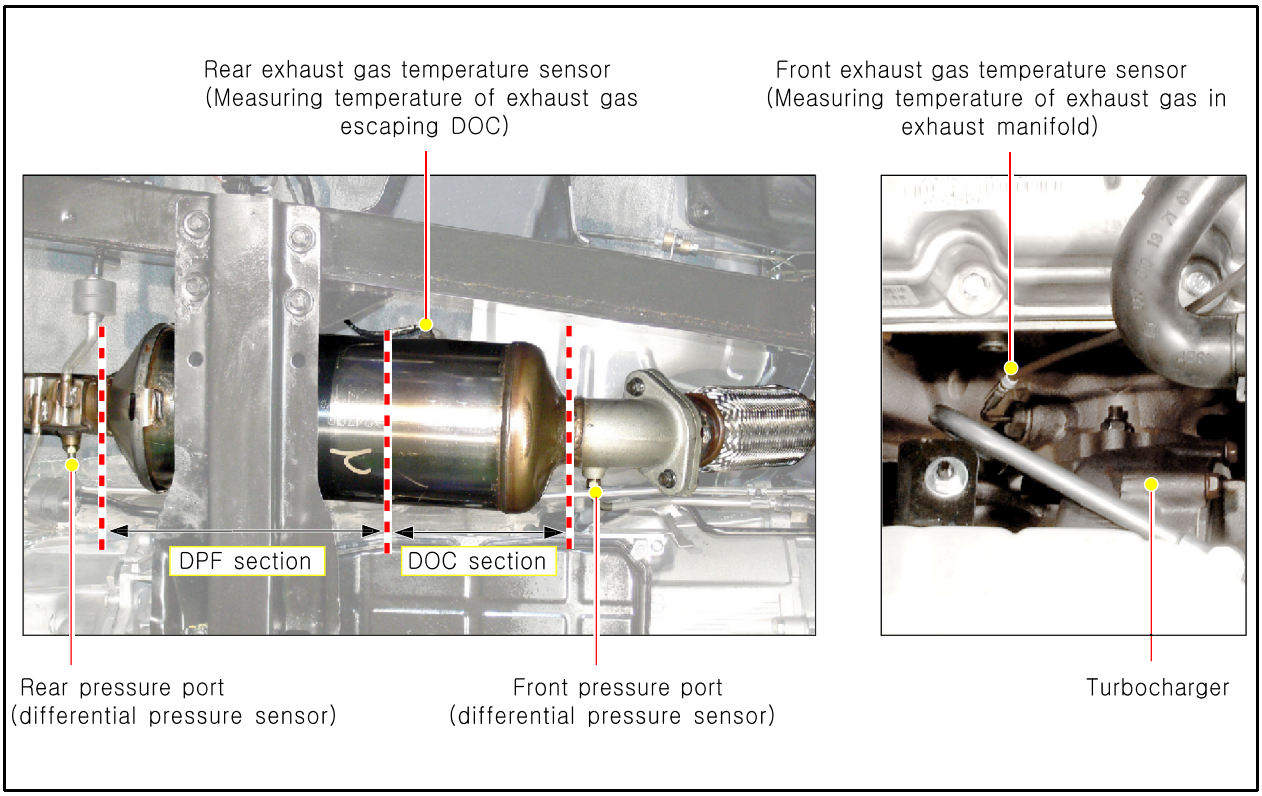
If the temperature of the exhaust gas that passes through the exhaust manifold is higher than the specification, the ECU decreases the fuel injection amount and increases the EGR gas intake amount to decrease the exhaust gas temperature.



4. OPERATION PROCESS

1) Combustion Temperature and Procedures

As the soot is filtered in the CDPF, it is burnt and removed, and the CDPF is returned to the initial state to collect the soot. Therefore, the burning procedures in the CDPF can be called as recycling.
The CDPF assembly is integrated with DOC (at front side) and DPF (at rear side).
The DPF burns the soot with high-temperature exhaust gas (over 600°C). The rear exhaust gas temperature sensor monitors the temperature of DPF section. If this temperature is below the regeneration temperature, the ECU increases the post injection period to increase the fuel injection amount, and consequently to increase the exhaust gas temperature.



CAUTION

Normally, when the vehicle is driven for 600 ~ 1,200 km, the enough amount of soot to be burnt is filtered and accumulated in the CDPF. The ECU increase the amount of post injection to increase the tempeature of exhaust gas up to 600°C so that the soot is burnt. The soot is burnt for 15 ~ 20 minutes.

Modification basis	
Application basis	
Affected VIN	

2) Sytem Composition for Soot Combustion

When the engine is running in low load range, the temperature of exhaust gas is decreased as the amount of fuel supplied is decreased. To burnt the soot filtered in the CDPF, the control system should be installed to check the operating range and increase the temperature of exhaust gas by controlling the amount of fuel supplied and and intake air.
Two temperature sensors and one differential pressure sensor monitor the CDPF's operating range. According to theses sensors' information, the throttle flap decreases the intake air entered to the throttle body. Also, the fuel injection pattern is added to increase the temperature of exhaust gas for soot combustion.
There are two fuel injection patterns (pilot injection and main injection). As the CDPF is installed, the post injection pattern is added.

3) Post Injection and Air Mass Control

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

4) Throttle Body for Different Engines

The throttle body is not installed in the D27DT engine (general), but is installed in the following engines:

1) D27DT (EU IV) engine
2) D27DTP (POWER UP) engine
3) D27DTP (POWER UP) engine + CDPF

Both engines are equipeed with the throttle body, but its appearance and the related control system are differ.

Engine	Control Method	Function
D27DTP + CDPF	ECU's electric signal (Duty and On/Off control) + Throttle flap control during CDPF operation	CDPF control - added a function that increases the exhaust gas temperature by closing the throttle valve flap to minimize the intake air amount by the fuel injection amount during the CDPF regeneration range with the low engine load range. ON/OFF control - prevents the engine from turning off with vibration and noise by closing the throttle body flap to block the intake air when the engine is stopped. EGR gas amount control - Close the valve to decrease the intake air amount and lets more EGR gas flows to burn more EGR gas at EGR valve operating range.
D27DT (EU IV) engine	ECU's electric signal (Duty and On/Off control)	ON/OFF control - prevents the engine from turning off with vibration and noise by closing the throttle body flap to block the intake air when the engine is stopped. EGR gas amount control - Close the valve to decrease the intake air amount and lets more EGR gas flows to burn more EGR gas at EGR valve operating range.
D27DT engine	No throttle body installed	

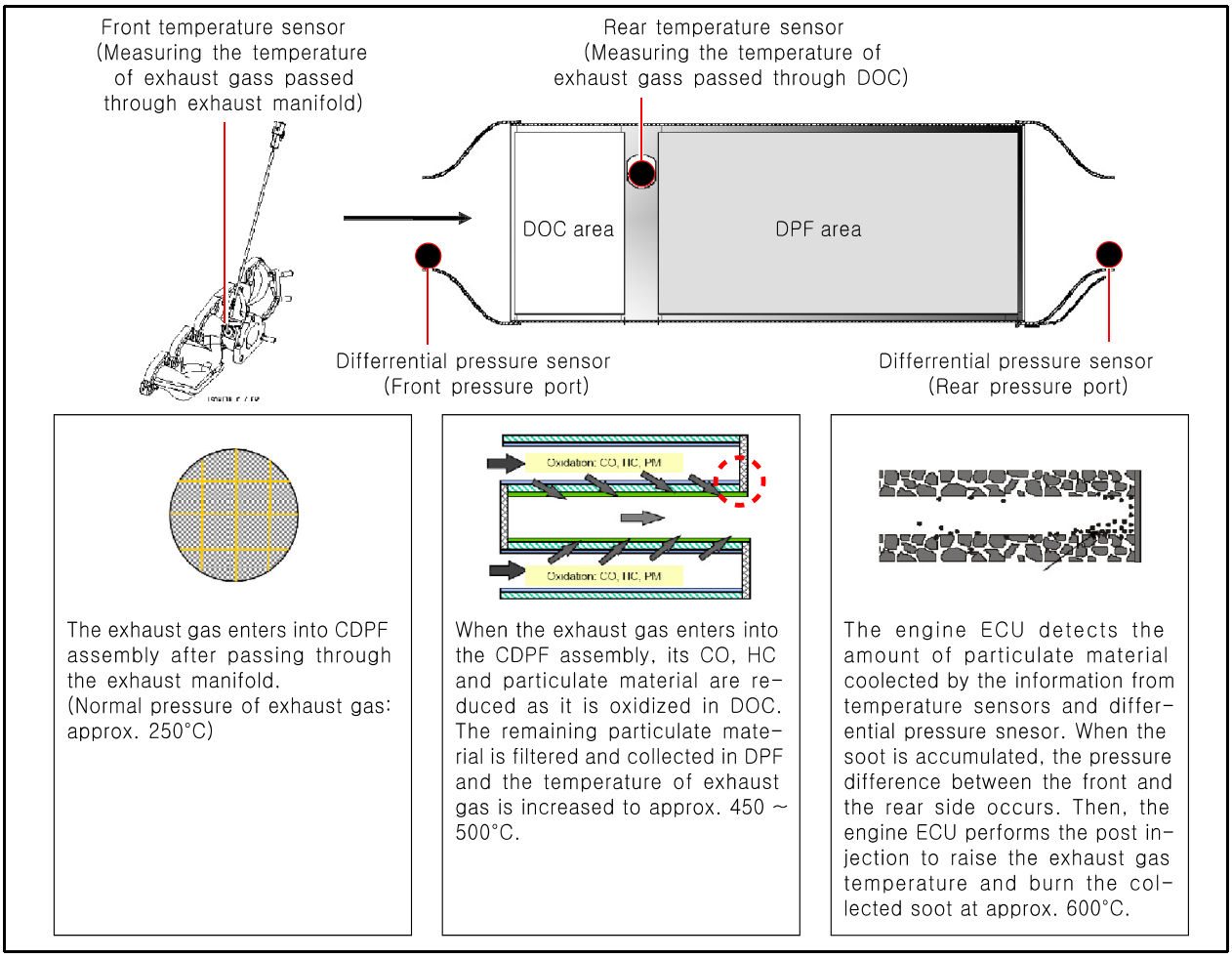
Modification basis	
Application basis	
Affected VIN	

5) Operating Procedures of CDPF

The most efficient and practical technology for now is adopted to the diesel particulate filter (DPF).
This system collects the soot from the diesel engine to the filter and burns the soot so that over than 95% of soot can be removed from the exhaust gas. However, the durability and the cost of additional system remain as problems.
Firstly, the exhaust gas is passed through the DOC and its temperature is increased as it is oxidized. The ECU detects the temperature change with two temperature sensors. The CO, HC and partial particulate material are removed from the exhaust gas (this procedures are the sames as the ones for the conventional DOC and no sensor is required).
After the exhaust gas is passed through the DOC and oxidized, most of the harmful material is removed from the exhaust gas. However, to meet the environmental regulations in the future, the soot is filtered and burnt again in DPF to decrease the particulate material further.

CAUTION

The filtered soot is burned whenever the vehicle is driven for 600 ~ 1200 km. The driving distance can be differed depending on the vehicle's driving conditions. The soot is burnt for 15 ~ 20 minutes.



6) CDPF Over Load (Notice of Beginning CPF Regeneration Mode - P1430)

1. The CDPF system enters the regeneration mode when the mileage is around 600 ~ 1,200 km, depending on the driving condition and driving habits. At this moment, the ECU performs the CDPF regeneration process; however, the driver may not notice anything because there is no engine warning or other signals indicating such process.
   The control logic in the regeneration process is to increase the exhaust gas temperature by increasing the fuel injection during post injection process and controlling the intake air amount(throttle body), and no significant change can be noticed in the vehicle condition.
2. The engine CHECK lamp flashes but there is no decrease in engine torque.
3. The engine CHECK lamp flashes to inform the driver when there is an over load due to soot accumulation because the regeneration temperature cannot be reached due to low speed, even though CDPF regeneration is in process.
4. The CDPF regeneration process must be completed by driving for 15-20 minutes at a speed higher than 80 km/h to solve this problem.
5. The engine CHECK lamp flashes when CDPF is over loaded; therefore, 4) above must be performed in this case.

7) CDPF's Excessive Soot Accumulation (P0432)

1. When the vehicle is driven at a low speed (5-10 km/h) for a long time or long distance, the soot over accumulates inside the CDPF and the combustion temperature cannot be reached even by performing the soot combustion process. In this case, this DTC is generated.
2. This is more serious situation than the CDPF over load condition. Therefore, the engine power is decreased to protect the system and the engine CHECK lamp is turned on.
3. Blow the soot between the engine and the exhaust system several times and clear the DTC to solve this problem. If the same DTC is generated again, check the system according to the DTC description related to the differential pressure sensor.
   * This DTC is actually generated mostly due to the related system malfunction, such as differential pressure sensor malfunction.

Modification basis	
Application basis	
Affected VIN	

NO DATA

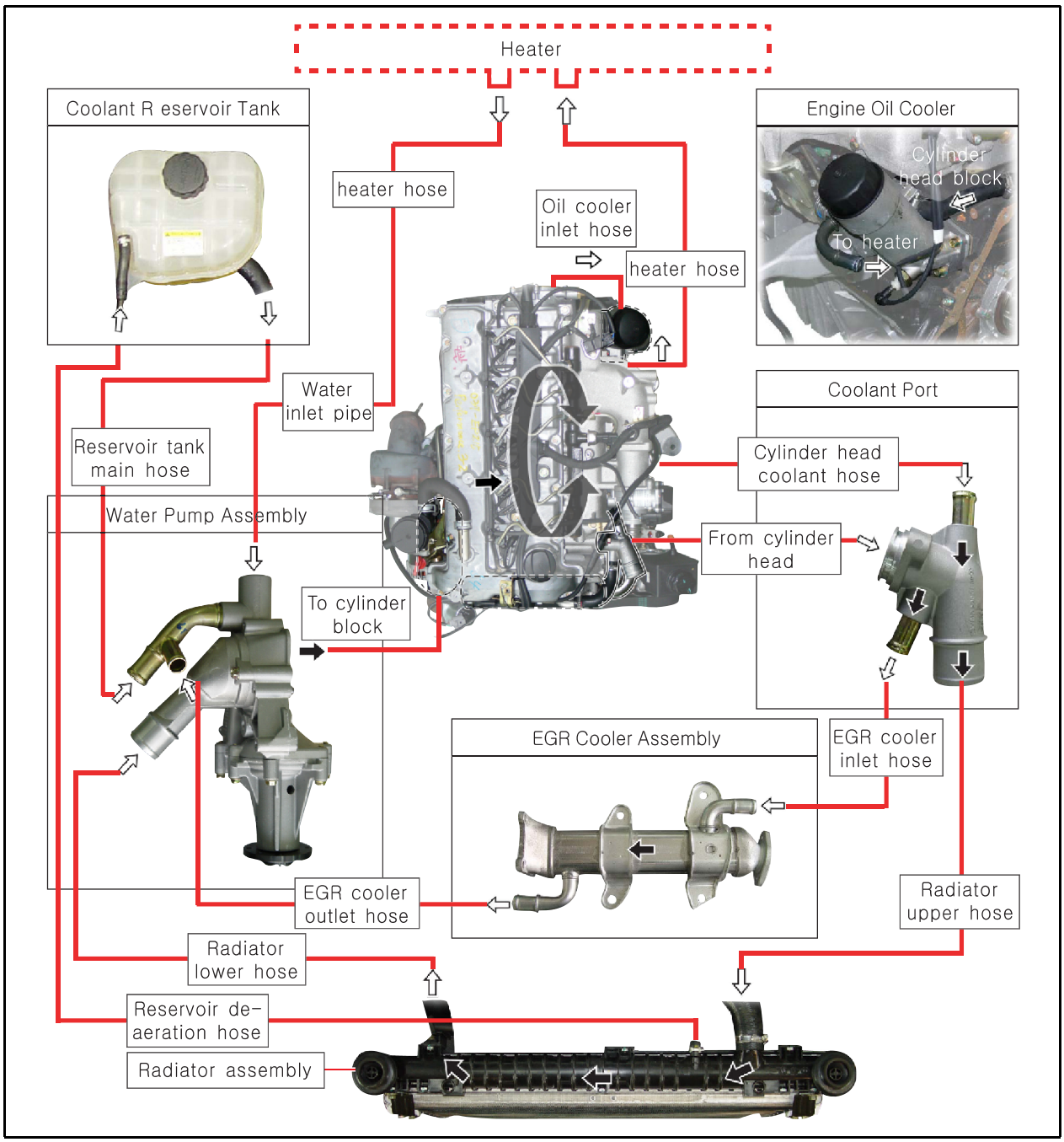
ENGINE COOLING SYSTEM 1520-01

OVERVIEW AND OPERATION PROCESS

1. COMPARISON IN COOLING SYSTEM FOR EACH ENGINE

For the D27DTP (POWER UP) engine, the cooling system is equipped with E-EGR cooler and the water pump which its capacity is improved according to the additional coolant line in the cylinder block. For the D27DT engine, the cooling system uses the fan clutch.

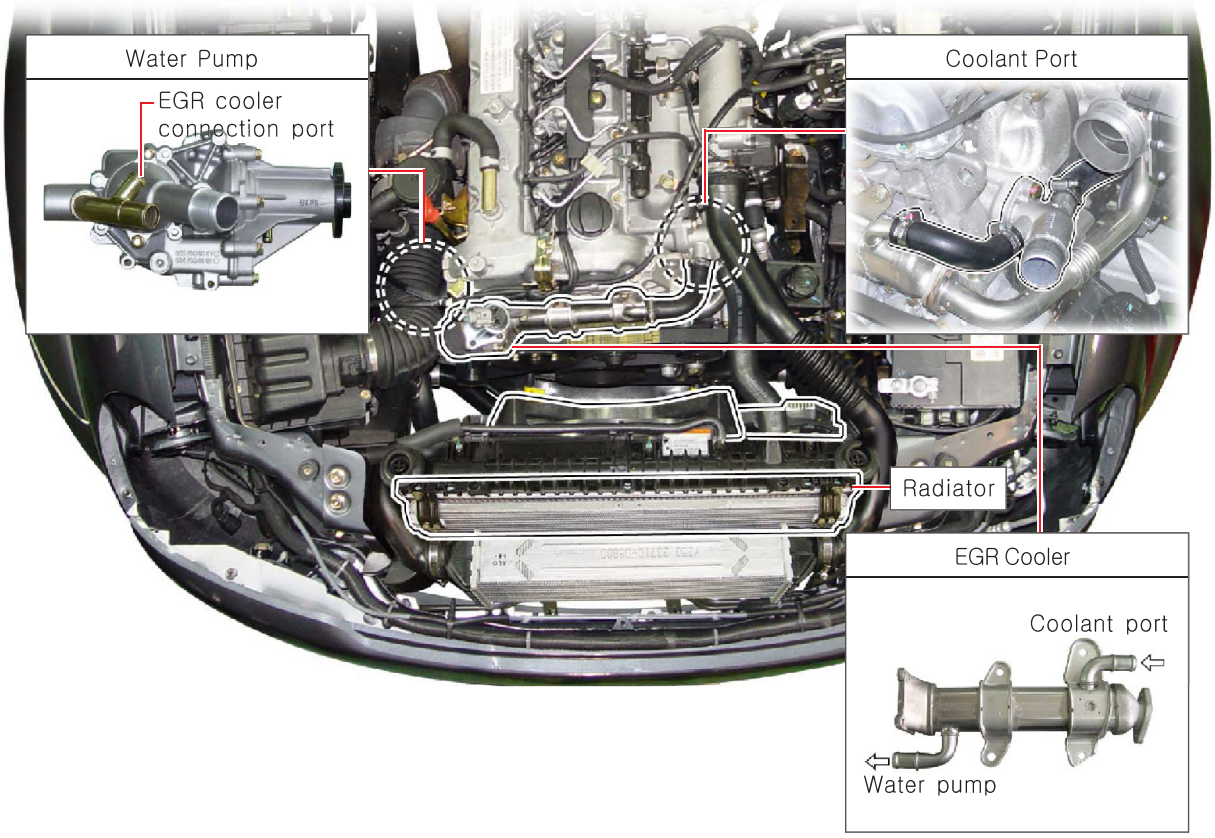
▶Cooling System for D27DTP (POWER UP) Engine



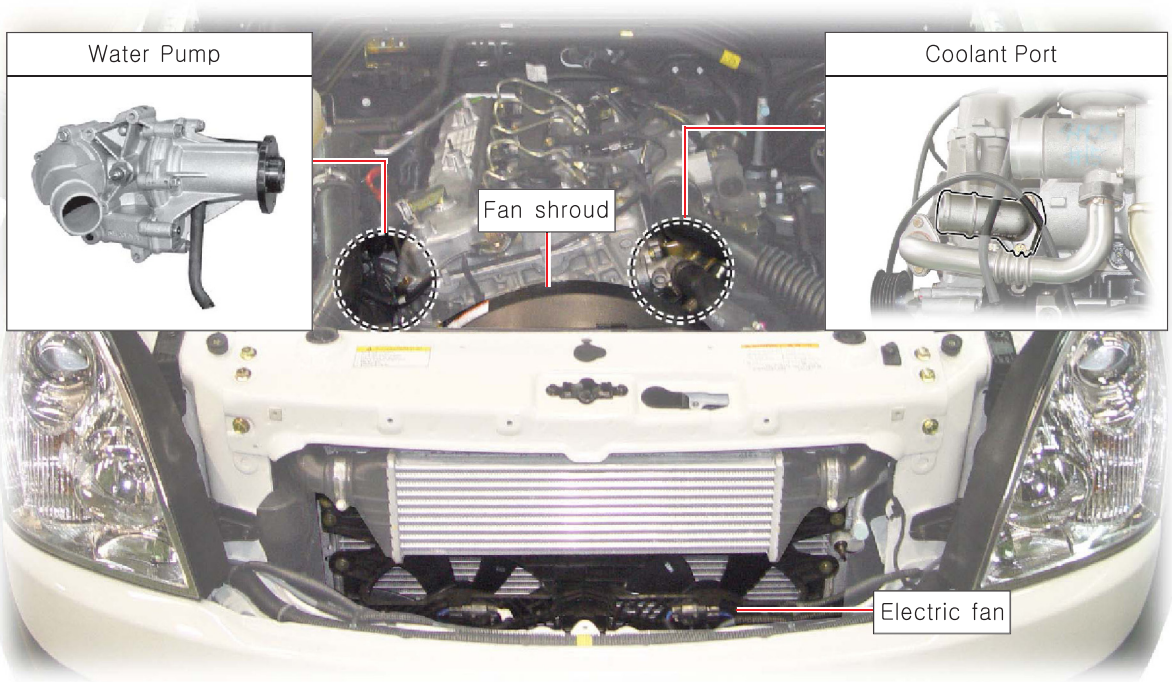
Modification basis	
Application basis	
Affected VIN	

▶Comparison

D27DTP (POWER UP) & D27DT (EU IV) Engine



D27DT Engine



Modification basis	
Application basis	
Affected VIN	

NO DATA

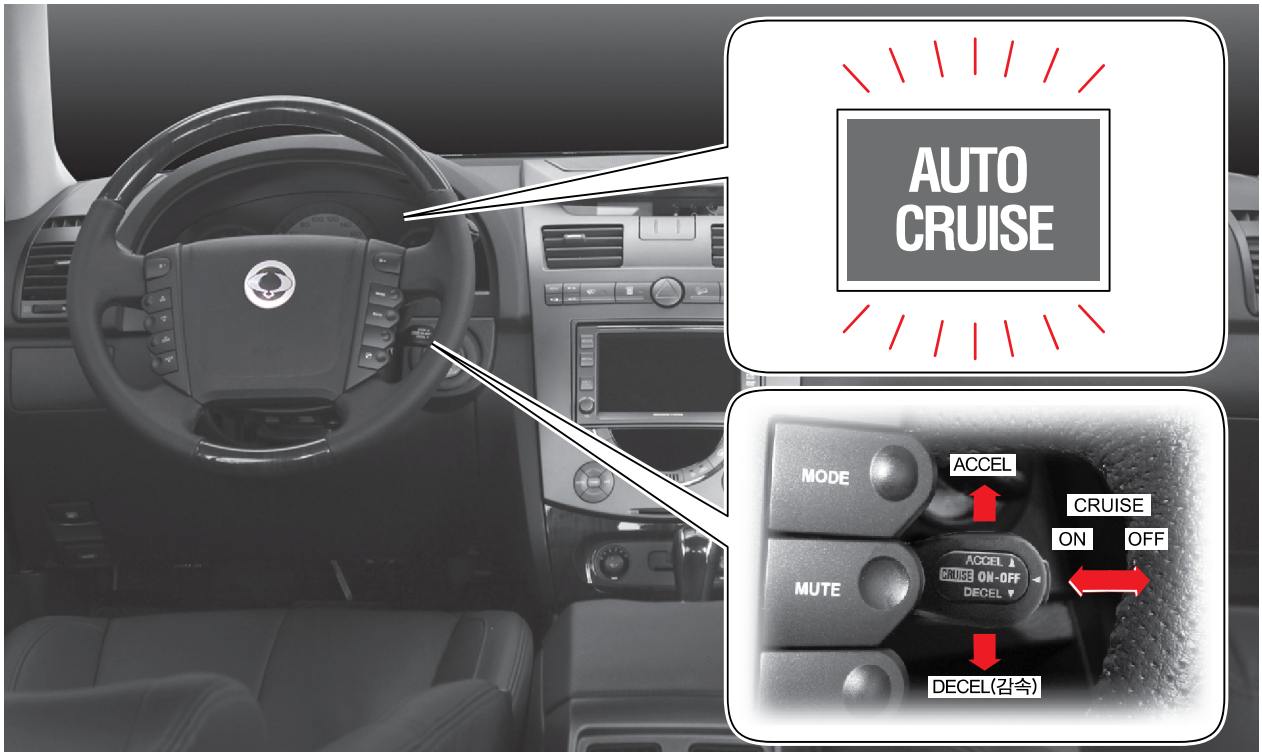
NO DATA

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.

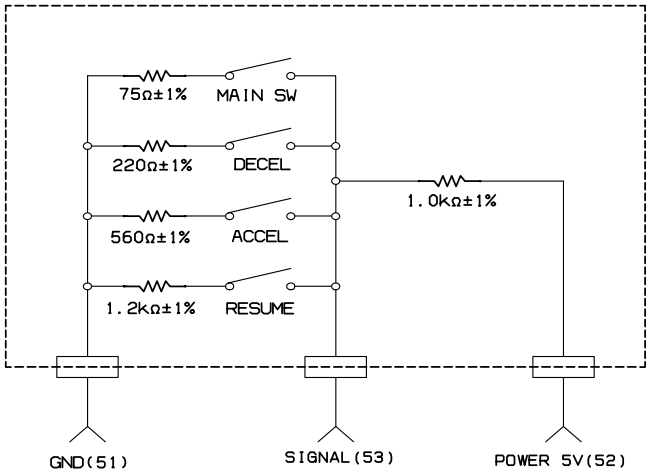
1) When To Use

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.

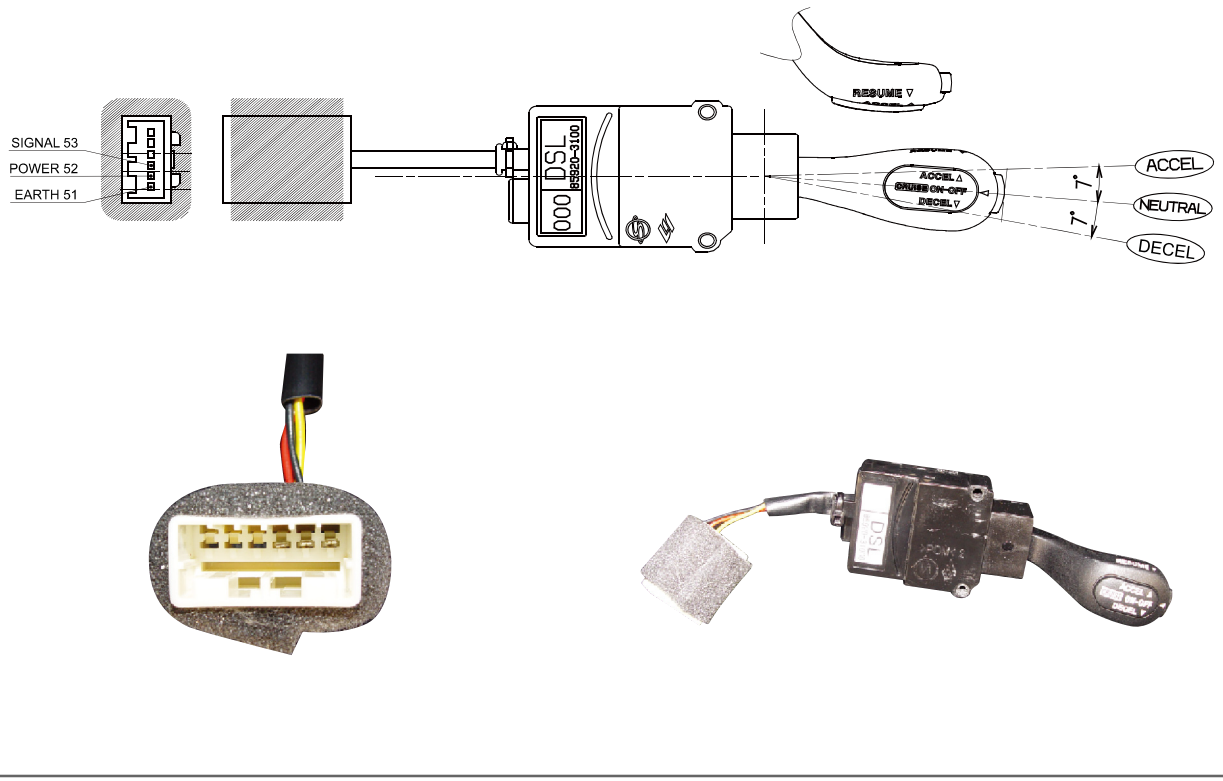
WARNING

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

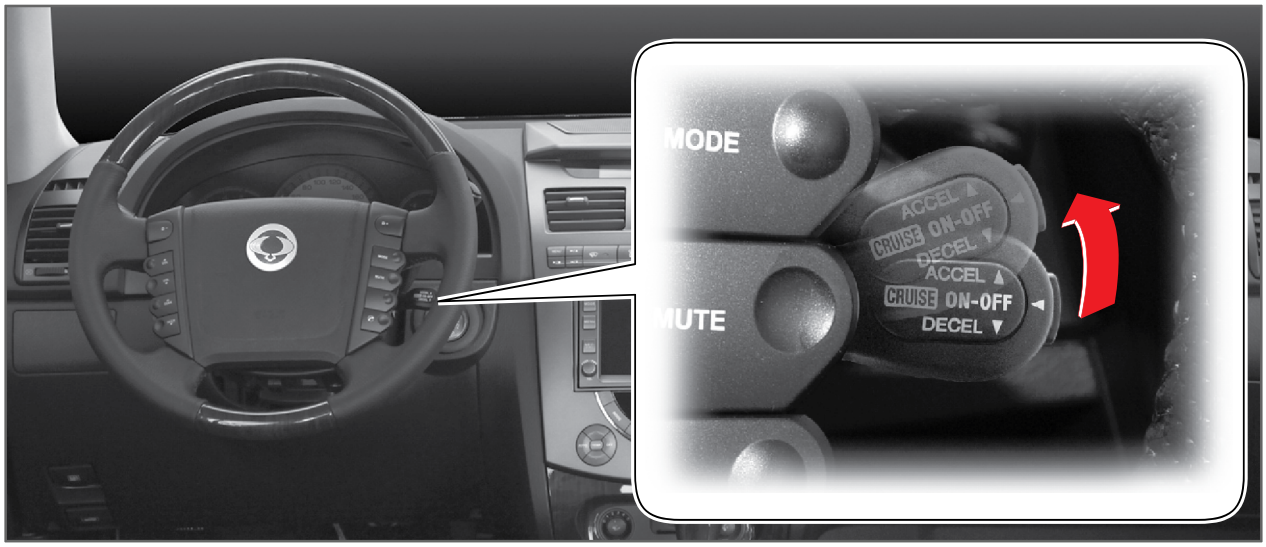
1. To operate the cruise control system, accelerate the vehicle to the speed within the specified range below with depressing the accelerator pedal.
   - Cruise control operating range: between 36 km/h (22.37 mph) and 150 km/h (93.207 mph)
2. When the desired speed is reached, which should be within 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).

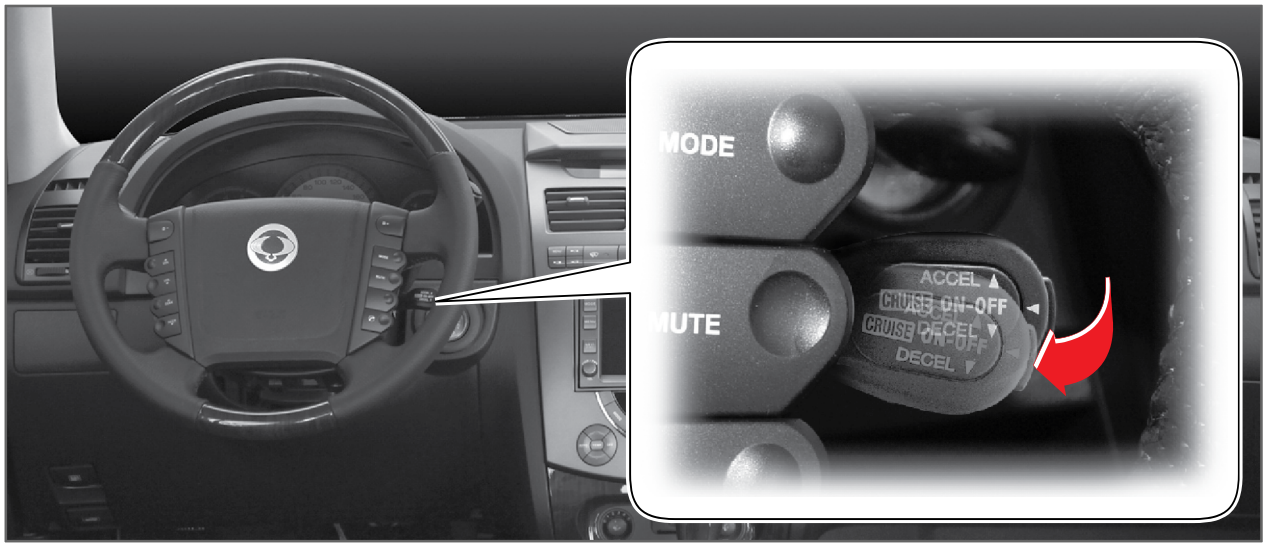
(3) Tap-down while the cruise control system is running

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	

NO DATA

RKSTICS

8710-08

GENERAL

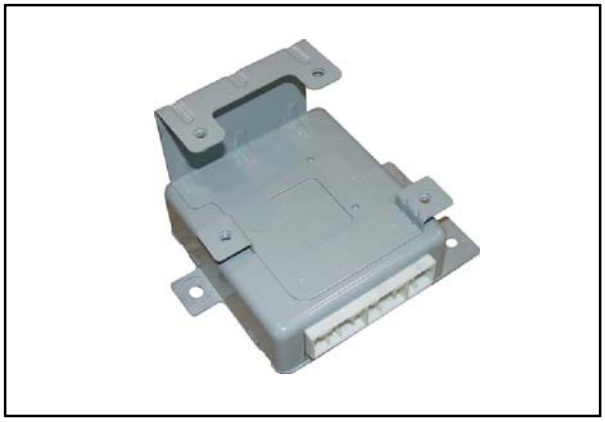
1. SPECIFICATIONS

1) Electrical Performance

Item	Requirement	Remark
Rated voltage	DC 12.0V	
Operating voltage	DC 9.0V ~ 16.0V	Should operate normally within this range. (9.5 V ~ 16.0 V only for auto hazard lamp function)
Operating temperature	-30°C ~ +80°C	Should operate normally within this range.
Reserved temperature	-40°C ~ +85°C	
Max. operating humidity	95%	
Resistible voltage	24V	
Insulating resistance	No heat and fire due to the current leaks	Confined with PCB, waterproof and coating that requires the insulation.
Dark current	below 7.0 mA	When initiating the sleep mode after removing ignition key and locking the doors
Voltage drop	below 1.0V	Pin no. 72 and 2, 7, 8, 9, 10, 11, 19, 24, 27, 28, 29, 30, 31, 32, 33, 36, 56, 57, 58, 59, 60, 61, 70, 71
	below 1.5V	Pin no. 72 and 3, 6, 17, 18, 20, 21, 37, 39, 41, 42, 43, 44, 45, 62, 64, 65, 66, 67, 68, 69

2) Characteristics of Radio Wave

1. Transmitting frequency: 447.800 ± 0.0125 MHz
2. Channel width: below 12.5 KHz
3. Frequency bandwidth: below 8.5 KHz
   Modulation method: FSK (Frequency Shift Keying)
4. Receiving distance: Approx. 10 ~ 15 m (In
5. case there are not obstacles around the system)



3) Rated Load

NO.	Description	Rated Load
1	Chime bell / Buzzer	DC 12V 350 mA / DC 12V 40 mA (Inductive load)
2	Front room lamp	DC 12V 16W (Lamp load)
3	Key hole illumination	DC 12V 1.2W (Lamp load)
4	Seat belt warning lamp	DC 12V 1.2W (Lamp load)
5	Seat belt warning lamp	DC 12V 1.2W (Lamp load)
6	Parking brake warning lamp	DC 12V 1.2W (Lamp load)
7	Door ajar warning lamp	DC 12V 1.2W (Lamp load)
8	Door lock relay	DC 12V 200 mA (Inductive load)
9	Door unlock relay	DC 12V 200 mA (Inductive load)
10	Siren	DC 12V 260 mA (Inductive load)
11	Tail lamp relay	DC 12V 200 mA (Inductive load)
12	Hazard warning relay	DC 12V 200 mA (Inductive load)
13	Power window relay	DC 12V 200 mA (Inductive load)
14	Rear defogger relay	DC 12V 200 mA (Inductive load)
15	Wiper LOW relay	DC 12V 250 mA (Inductive load)
16	Wiper HIGH relay	DC 12V 250 mA (Inductive load)
17	Front washer motor	DC 12V 1.5A
18	Rear washer motor relay	DC 12V 500 mA (Inductive load)
19	Headlamp relay	DC 12V 750 mA (Inductive load)
20	Front defogger relay	DC 12V 200 mA (Inductive load)
21	SPWM easy access button illumination	DC 12V 1.2 W (Lamp load)

4) Input Signals

NO.	Input Signal Name	Logic Status
1	IGN1	ON = BAT (IGN "ON" or "START")
2	IGN2	ON = BAT (IGN "ON")
3	ALT_D	ON = BAT (engine running)
4	Key reminder switch	IN = BAT (Key in)
5	Driver's door switch	OPEN = GND, CLOSE = OPEN
6	Passenger's door switch	OPEN = GND, CLOSE = OPEN
7	Rear door switch	- OPEN (one of rear seat) = GND - CLOSE (all rear seats) = OPEN
8	Tailgate switch	OPEN = GND, CLOSE = OPEN
9	Hood switch	OPEN = GND, CLOSE = OPEN
10	Driver's door lock/unlock switch	LOCK = OPEN, UNLOCK = GND
11	Passenger's door lock/unlock switch	LOCK = OPEN, UNLOCK = GND
12	Rear door lock/unlock switch	- UNLOCK (one of rear seat) = GND - LOCK (all rear seats) = OPEN
13	Tailgate lock/unlock switch	LOCK = OPEN, UNLOCK = GND
14	Rear defogger switch	ON = GND, OFF = OPEN
15	Seat belt switch	Unfastened = GND, Fastened = OPEN
16	Hazard warning flasher selection switch	ON = GND, OFF = OPEN
17	Parking brake switch	ON = GND, OFF = OPEN
18	Air bag collision sensor	ON = 200 ms Low signal, OFF = OPEN
19	Wiper motor (parking) switch	STOP = BAT VOLTAGE, ROTATING = GND
20	Washer switch	ON = BAT, OFF = OPEN
21	Auto switch	ON = BAT, OFF = OPEN
22	Auto washer switch	ON = BAT, OFF = OPEN
23	Auto resistance	0W ~ 51KW (for intermittent wiper)
24	Speed sensor	ON = GND (PWM), OFF = OPEN
25	IDR (Coding)	ON = BAT, OFF = OPEN
26	Front defogger switch	ON = GND, OFF = OPEN
27	Auto hazard switch	ON = GND, OFF = OPEN
28	Central door lock switch	ON = GND, OFF = OPEN
29	SPWM easy access button switch	ON = GND, OFF = OPEN
30	Multifunction auto light switch	ON = GND, OFF = OPEN
31	Indicator lamp switch	ON = BAT/GND, OFF = OPEN (Approx. 5.1V ~ 9.2V)
32	SPWM (Seat Position with Memory)	ON = GND (PWM), OFF = OPEN
33	Rain sensor	ON = GND (DATA), OFF = BAT
34	Diagnosis (SCAN-100)	ON = GND (DATA), OFF = BAT (KWP2000)
35	Immobilizer	ON = GND (DATA), OFF = BAT (KWP2000)
37	Driver/Passenger's door key cylinder switch	ON = GND, OFF = OPEN

5) Chattering of Input Signals

1. Vehicle speed input:
   The vehicle speed is the average value of 4 pulse among 6 pulse inputs regardless of the input for 1.0 second after IGI 1 ON. The time indicated in each function does not include the vehicle speed calculating time.

2. 20 ms target input:
   Wiper motor A/S (parking) terminal

3. 100 ms target input switch
   All switches except wiper motor A/S (parking) terminal

6) Time Tolerance

1. If not indicated, time tolerance will be ± 10%.
   However, if less than 500 ms, time tolerance will be ± 100 ms.

2. The time indicated in each function does not include chattering processing time from switch input changing point.

Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

The RKSTICS (REKES + STICS (Super Time & Integrated Control System)) communicates with the transmitter (remote controller) and other electronic systems to transmit and receive the data.
The STICS also includes a diagnosis function that can inspect the error for related devices.

2. MAJOR CHANGES

Integration of Auto Light Sensor and Rain Sensor
The auto light sensor integrated rain sensor communicates with STICS.

Auto Washer Coupled Wiper
When pressing the auto washer switch, the washer fluid is sprayed on the windshield and the wiper sweeps off 4 times, and then the washer fluid is sprayed and the wiper sweeps off 3 times again.

Communication with SPWM
The communication with SPWM is added due to the introduction of easy access function to SPWM.

3. FUNCTIONS

▶ Wiper and Washer Operations

Front wiper operation

MIST

When pulling up the lever, the wiper operates once and the wiper lever returns to the "OFF" position.

OFF

Stop the operation.

AUTO

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

LO

Continuous wipe, slow operation.

HI

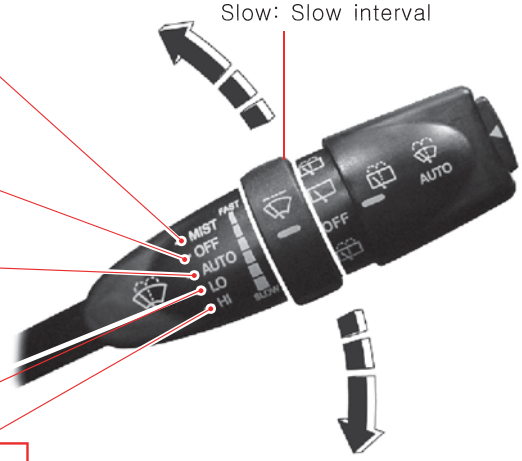
Continuous wipe, fast operation

Front Automatic Wiping Speed Control Switch

The interval of wiper swings can be adjusted by twisting the control knob upward or downward when the windshield wiper switch is the AUTO position.

Fast: Fast interval

Slow: Slow interval



Front Auto Washer and Wiper Switch

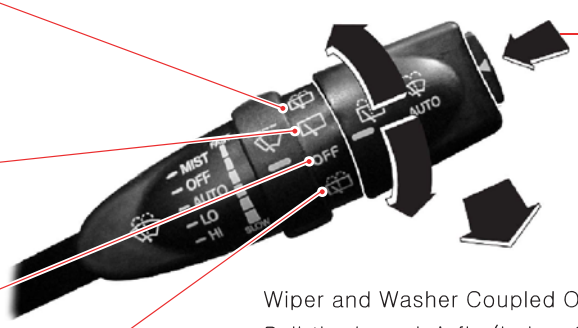
When pressing the auto washer switch with the wiper switch "OFF", the washer fluid is sprayed on the windshield and the wiper sweeps off 4 times, after then the washer fluid is sprayed and the wiper sweeps off 3 times again.

Rear Washer and Wiper

The rear washer and the wiper operate only while holding the switch. When releasing the switch, it returns to the rear wiper operate position.

Rear Wiper Operation

Rear Wiper Stops



Wiper and Washer Coupled Operation

Pull the lever briefly (below 0.6 seconds): One wiping cycle

Pull and hold the lever for more than 0.6 seconds: Three wiping cycles with washer spray

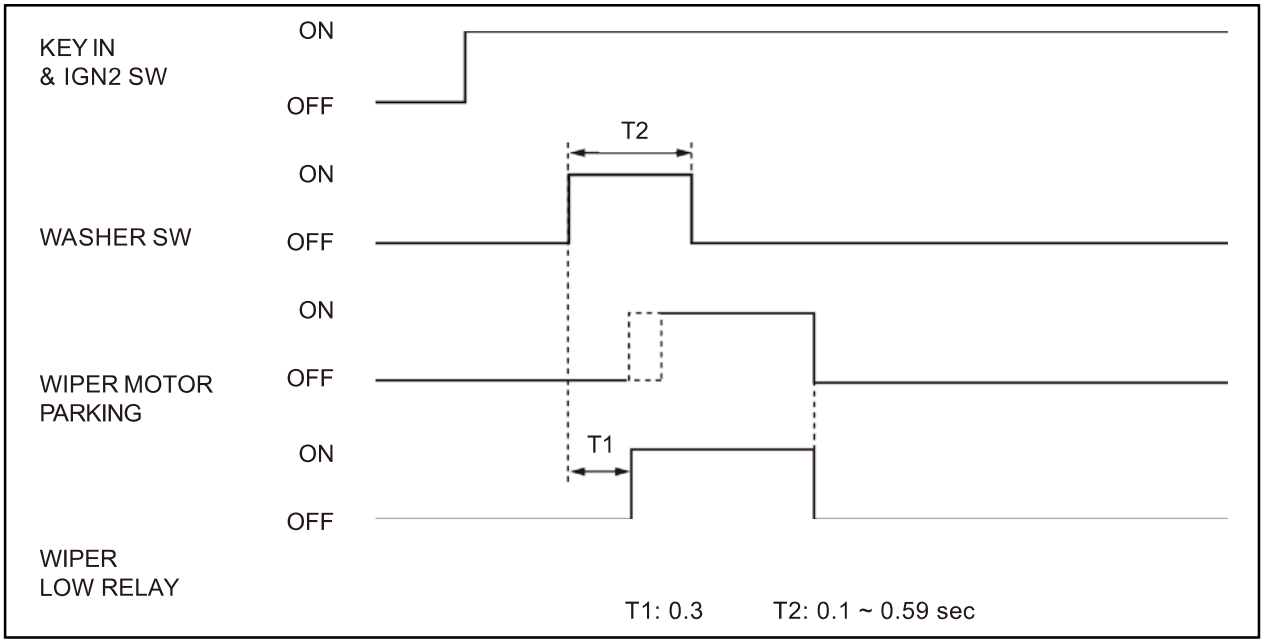
Rear Washer and Wiper

The rear washer and the wiper operate only while holding the switch. When releasing the switch, it returns to "OFF" position.

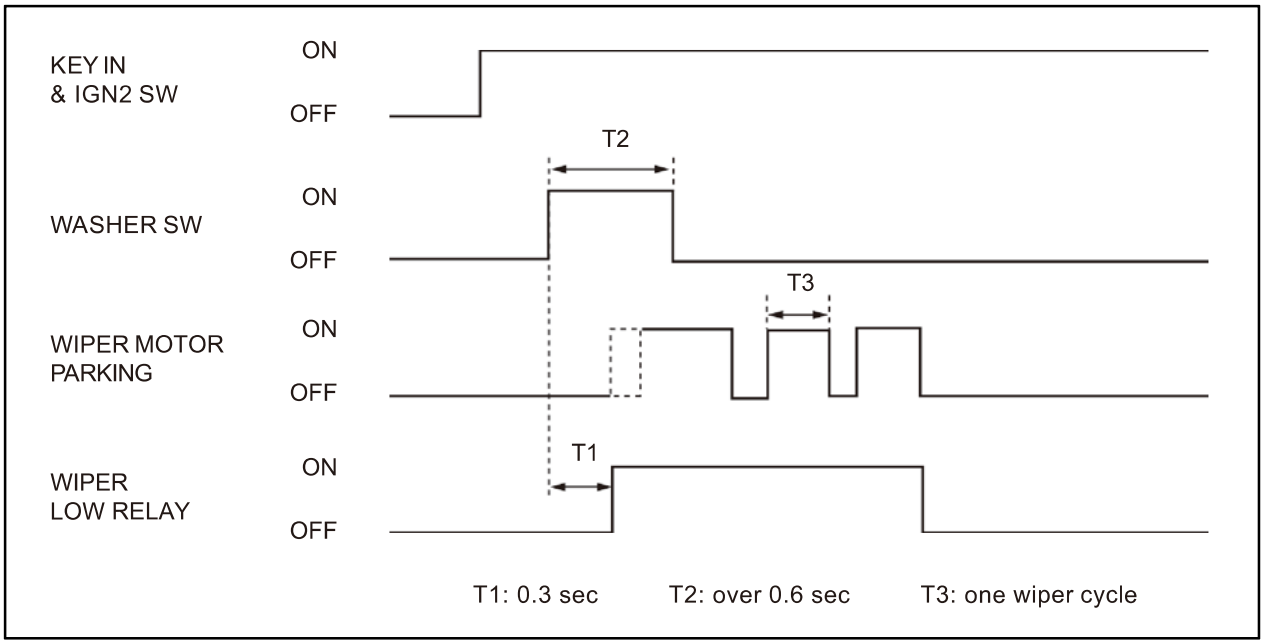
Modification basis	
Application basis	
Affected VIN	

▶ Wiper MIST and Front Washer Coupled Wiper

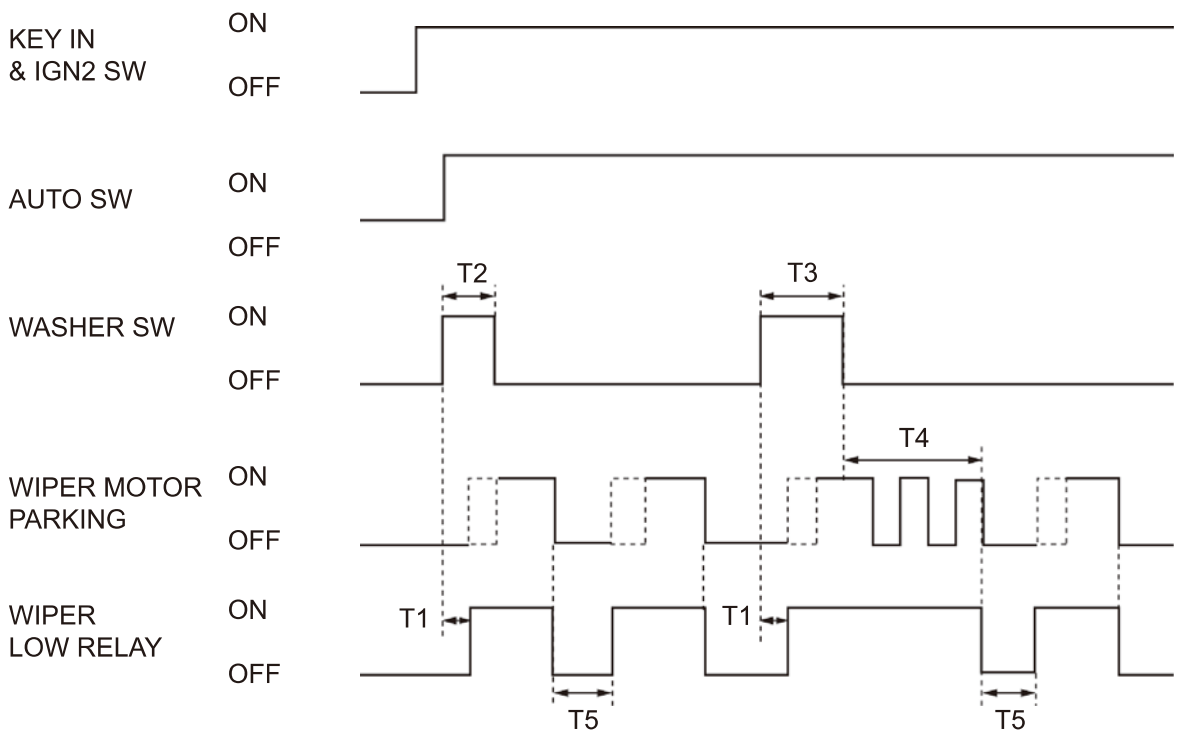
1. The wiper relay is turned on at 0.3 seconds after from the time when the washer switch is turned on for 0.1 to 0. 59 seconds (T2) with the ignition switch "ON", . If the wiper parking terminal gets off, the wiper relay is turned off.



2. The wiper relay is turned on at 0.3 seconds (T1) after from the time when the washer switch is turned on for more than 0.6 seconds (T2) with the ignition switch "ON". The wiper relay gets on 3 times immediately after turning off the washer switch.



3. When the washer switch is turned on for more than 0.6 seconds during the wiper operation by AUTO switch, the wiper operates three times. When it is turned on for a certain period of time (0.1 to 0.59 seconds), the wiper operates once.

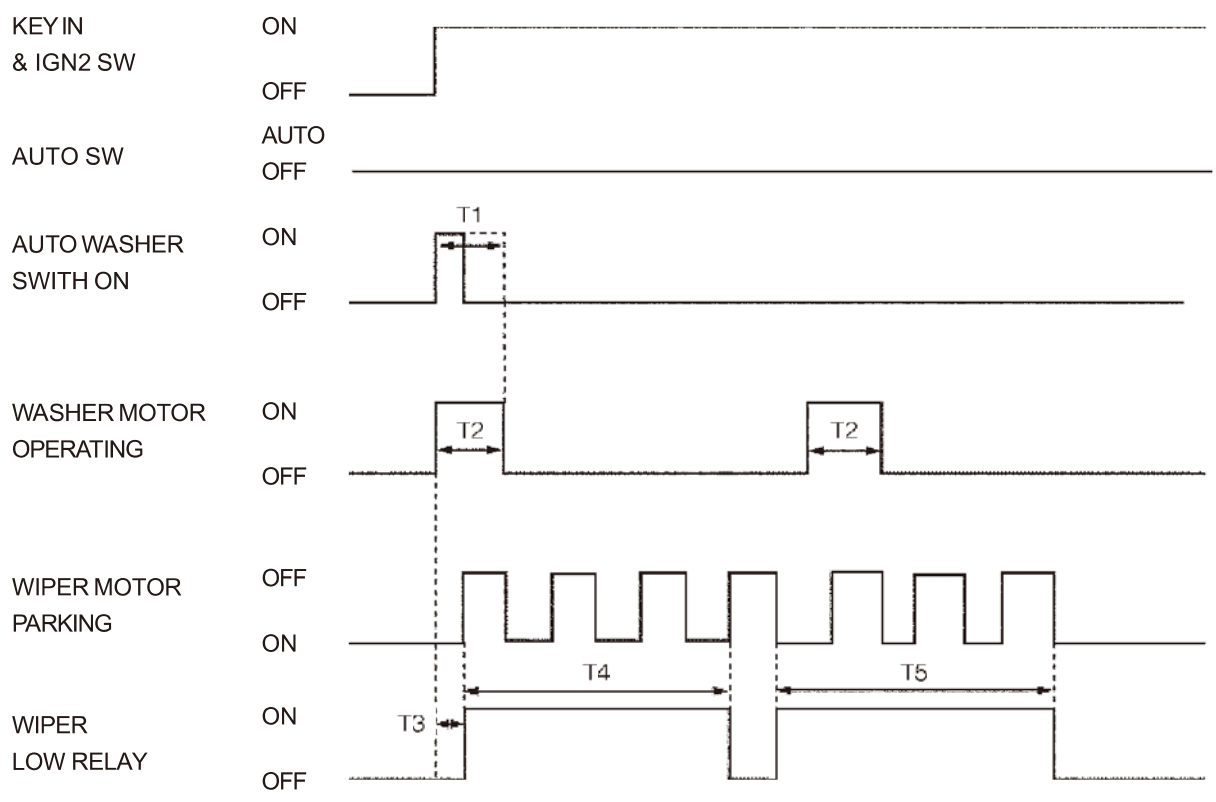


T1: within 0.3 sec T2: 0.1 ~ 0.59 sec T3: over 0.6 sec
T4: 3 cycles T5: pause

Modification basis	
Application basis	
Affected VIN	

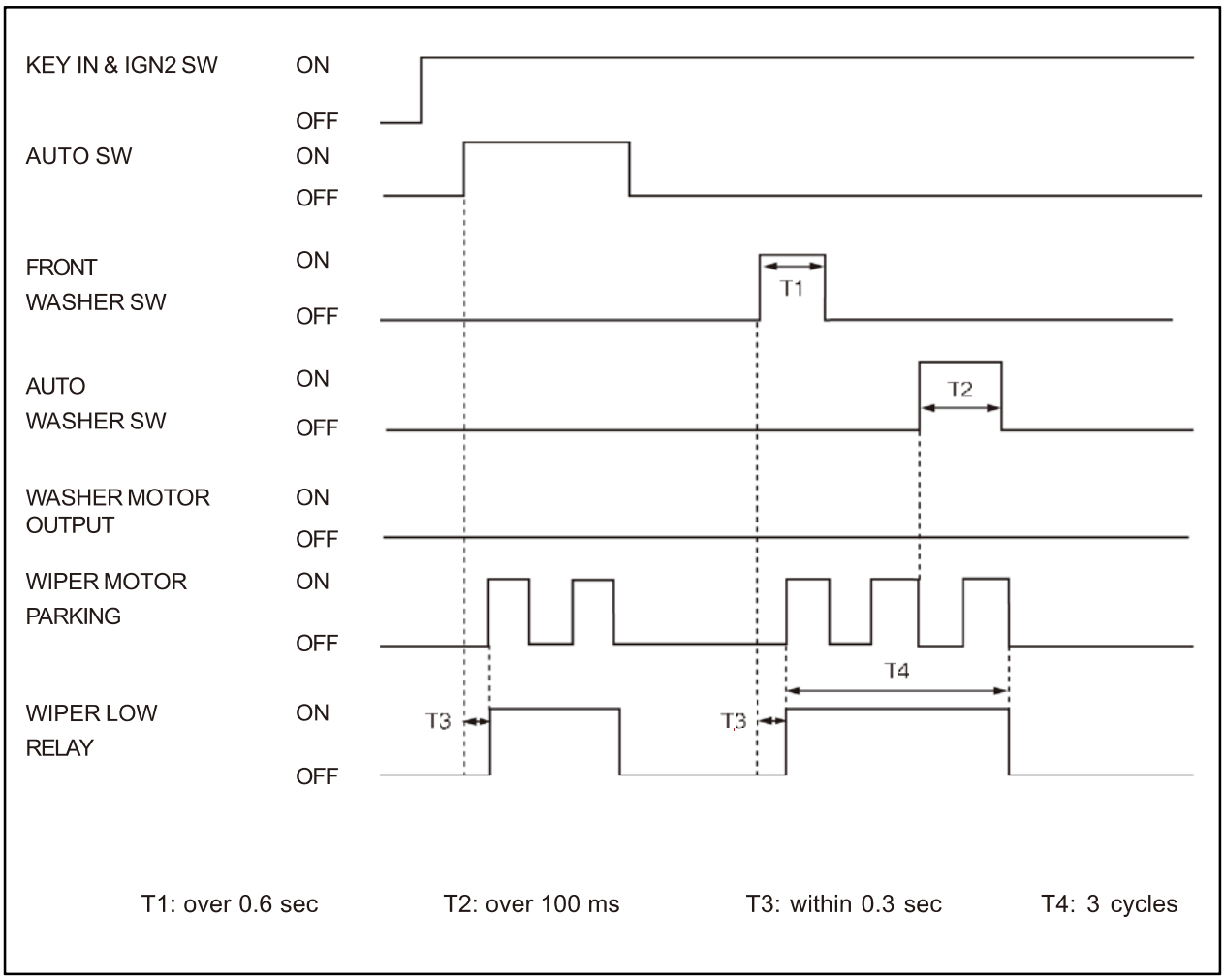
▶ Auto Washer and Wiper Switch

1. When the auto washer switch is turned on with the ignition switch "ON" and the AUTO switch "OFF", the washer motor output gets ON for 1 second. If the system recognizes the output signal, the wiper relay output gets ON during 4 cycles and the washer motor output gets ON for 1 second. Then, the wiper relay output gets OFF after 3 cycles.



T1: Over 100 ms T2: 1.0 ± 0.1 sec T3: within 0.3 sec
T4: 4 cycles T5: 3 cycles

2. The auto washer switch output is overridden during the washer coupled wiper operation.
3. The auto washer switch input is overridden during the auto washer coupled wiper operation.
4. The auto washer switch input is overridden during the rain sensor coupled wiper or vehicle speed sensitive AUTO wiper operation.
5. When the AUTO switch input is received during the auto washer operation, the auto washer operation stops and the auto INT operation is activated.

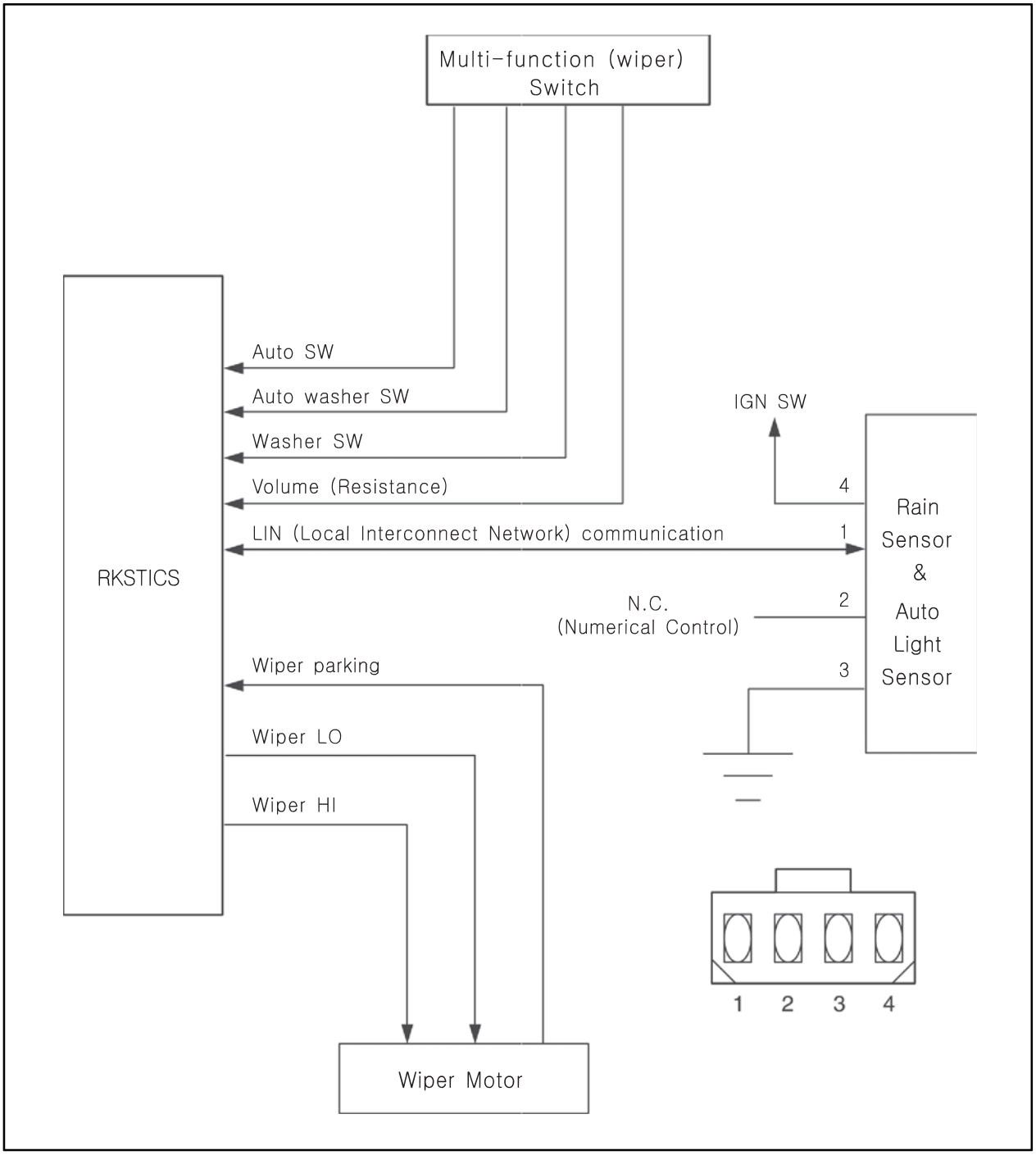


Modification basis	
Application basis	
Affected VIN	

▶ Rain Sensor Coupled Wiper and Auto Light Control

If equipped with RKSTICS rain sensor, it has following operation system.

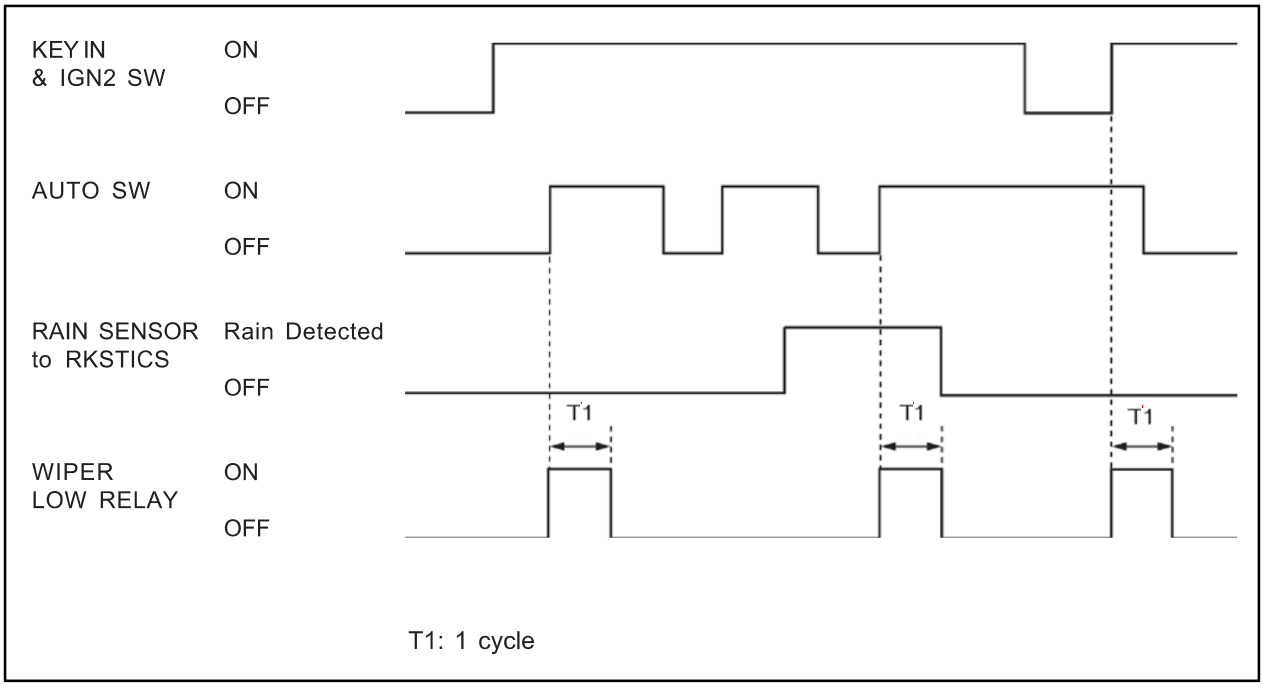
System layout



Modification basis	
Application basis	
Affected VIN	

▶ Auto Switch Position Reminder (Power-Up Reminder Wiper)

1. When turning off and on the IGN2 switch with the auto switch on, the system drives the wiper motor through LOW relay one cycle regardless of communication with rain sensor.
2. The wiper relay (LOW) is turned on and the wiper motor runs one cycle when changing the auto switch from "OFF" to "ON" position regardless of communication with rain sensor(while the ignition key is in the "ON" position).
   When the auto switch is turned to the "ON" position again from the "OFF" position, the system drives the wiper motor through LOW relay one cycle only when the rain sensor detects the "Rain Detected" signal.

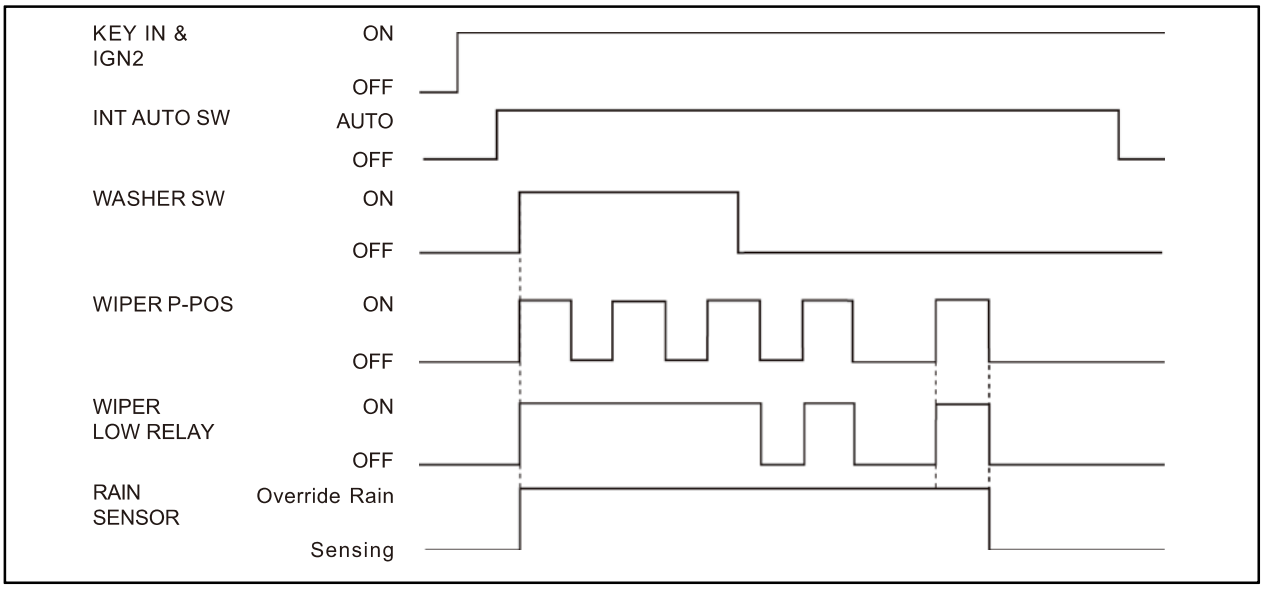


Modification basis	
Application basis	
Affected VIN	

Rain sensing unit (auto light integrated type)	Multifunction wiper switch: AUTO and sensitivity control
A sensor that emits infrared rays through LED and then detects the amount of rain drops by receiving reflected rays against sensing section (rain sensor mounting section on the windshield) with photodiode (auto light sensor integrated type)	AUTO: Wiper operates automatically by rain sensor FAST ↔ SLOW: Auto delay/Auto speed control. A position that can control sensitivity against rains in the windshield and transmits wiping demand signal accordingly

▶ Washer Coupled Wiper in Rain Sensing Mode

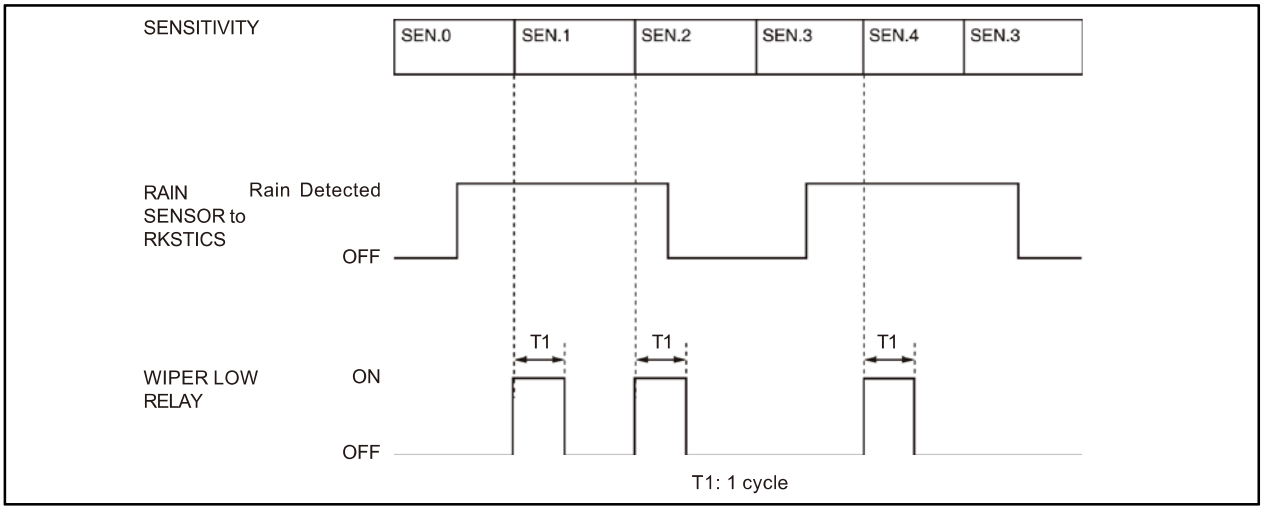
1. The washer coupled wiper is operated when receiving the washer switch input with the ignition switch "ON" and the AUTO switch "ON" in the rain sensing mode. At this moment, the communication with the rain sensor is overridden. However, the washer switch input is overridden during the continuous operation.
2. The operation data is sent to the rain sensor even during the washer coupled wiper's operation.



▶ Rain Sensing Sensitivity Control

1. The wiper LOW relay is turned on and the wiper motor runs one cycle when the volume sensitivity is increased (while the ignition key is in the "ON" position, the AUTO switch is in the "ON" position, and the wiper motor is in "Parked" position). However, the wiper motor can be operated only when the rain sensor detects the "Rain Detected" signal.

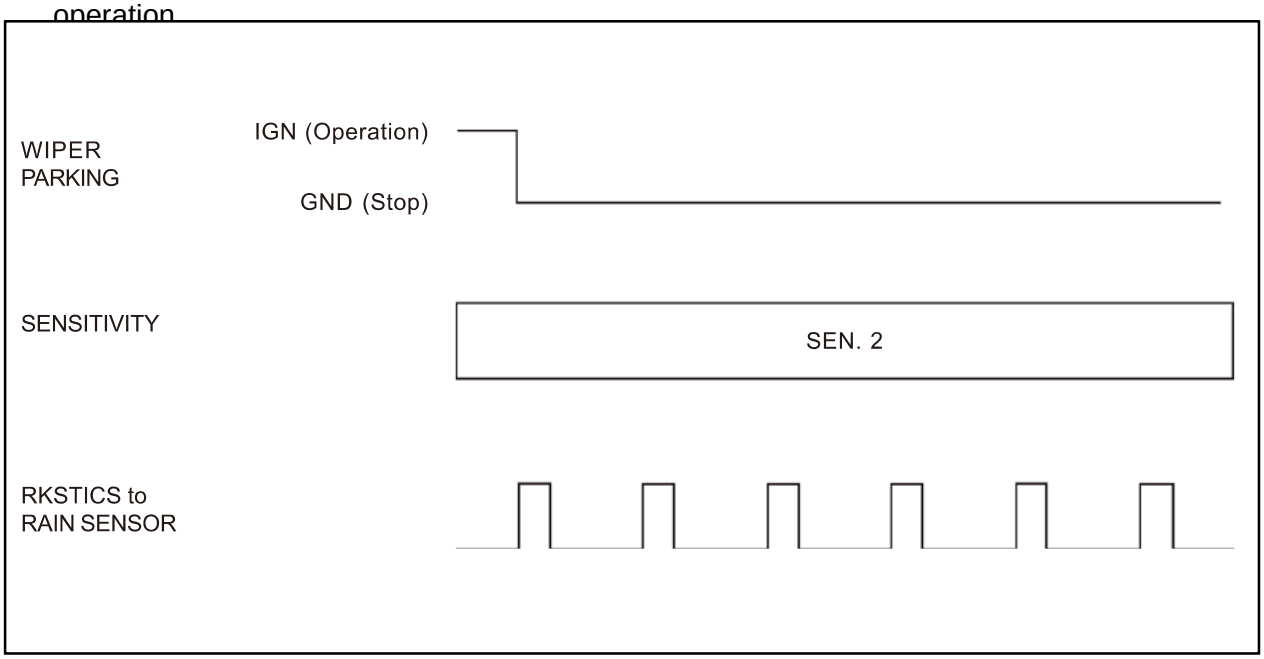
* If the volume sensitivity is changed more than 2 stages within 2 seconds, the wiper motor runs only one cycle.



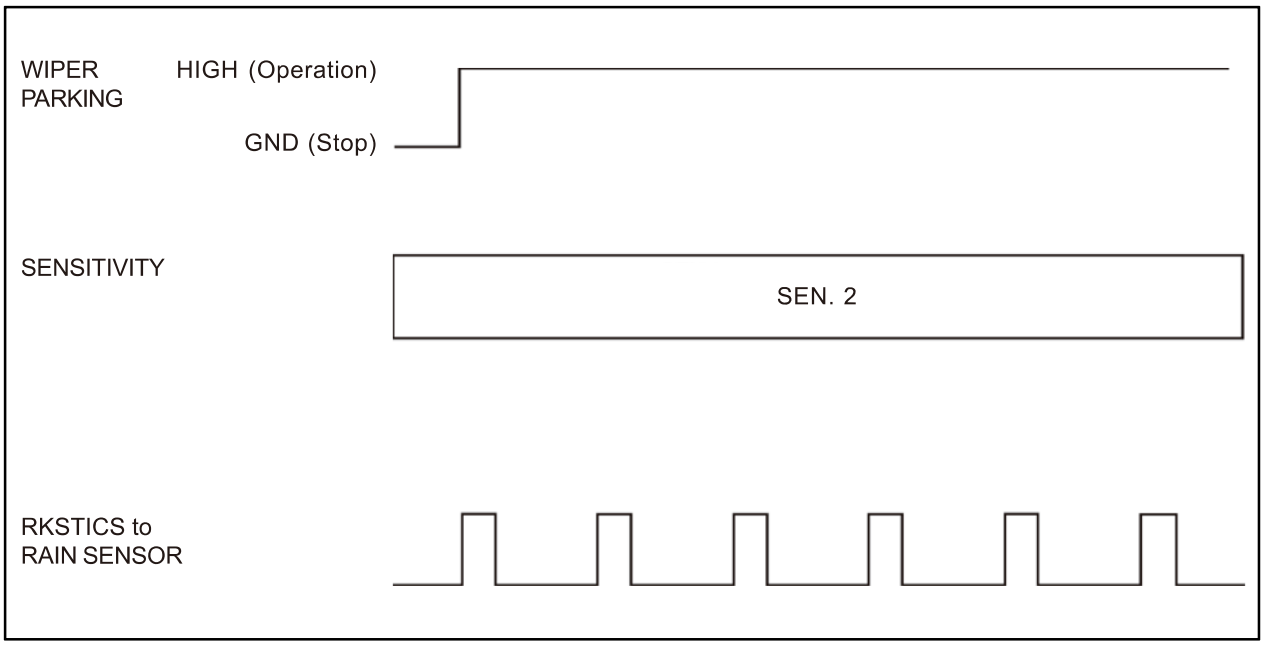
Modification basis	
Application basis	
Affected VIN	

▶ When the Wiper Parking Signal is Abnormal

1. The wiper system continuously outputs the wiper parking signal when the wiper parking terminal is grounded (while the ignition key is in "ON" position and the AUTO switch is in "ON" position). * The wiper motor runs only when the rain sensor requires the wiper operation.

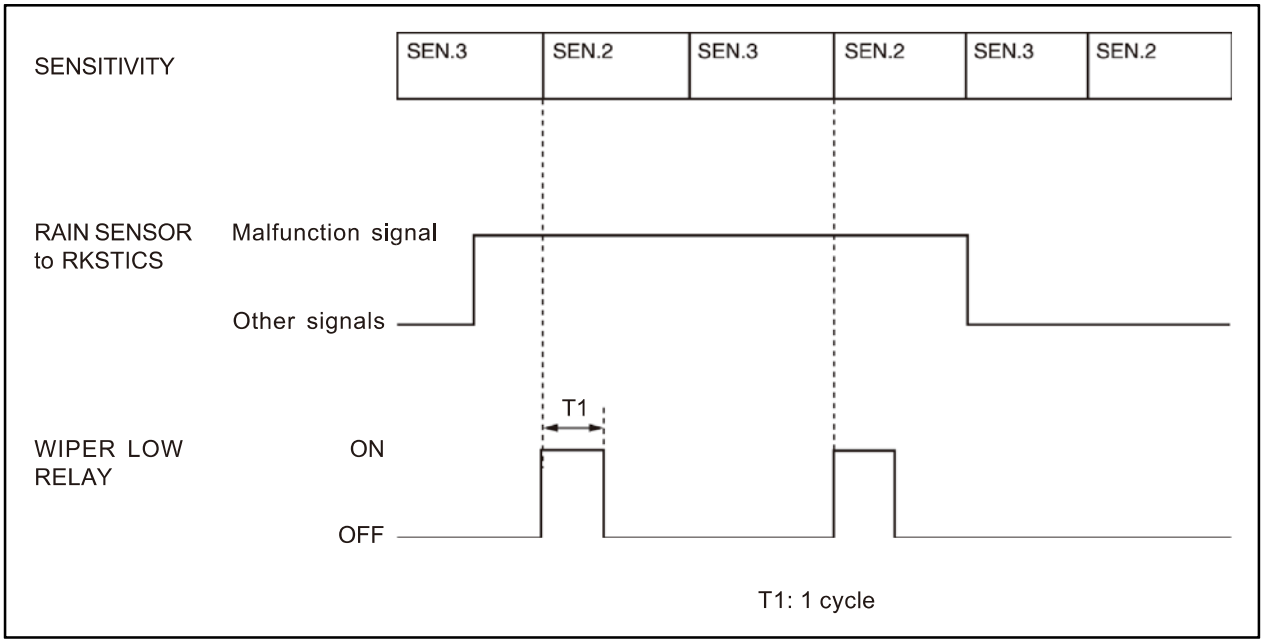


2. When the parking terminal is fixed to HIGH with the ignition key and the AUTO switch in "ON" position, the wiper system outputs the wiper operating signal for 2 seconds, then continuously outputs the wiper parking signal.
   * The wiper motor runs only when the rain sensor requires the wiper operation.

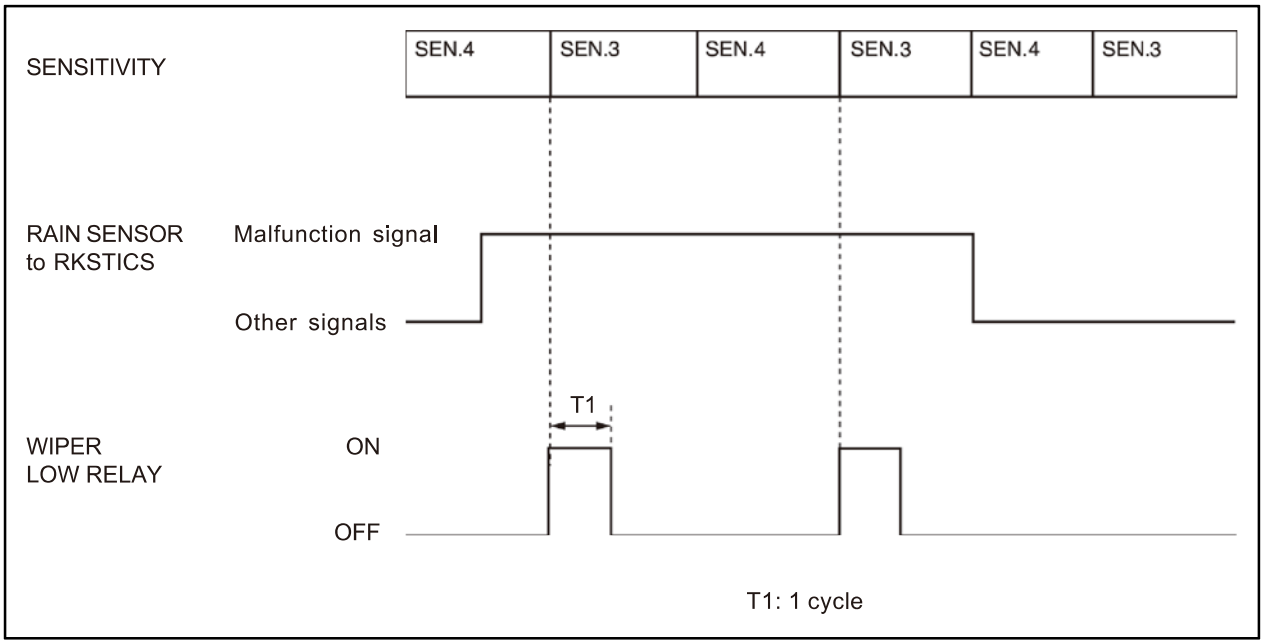


▶ Defective Rain Sensor

1. The wiper relay (LOW) is turned on and the wiper motor runs one cycle when the volume sensitivity is changed to 2 from 3 during receiving the malfunction signal from the rain sensor (while the ignition key is in "ON" position and the AUTO switch is in "ON" position).



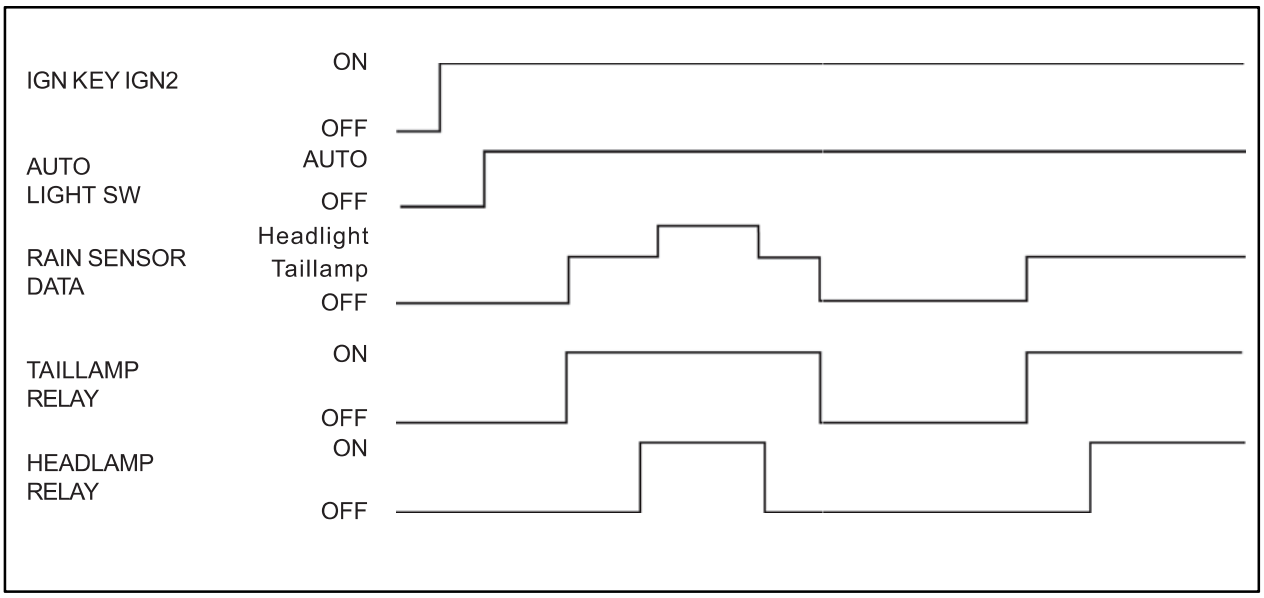
2. The wiper relay (LOW) is turned on and the wiper motor runs one cycle when the volume sensitivity is changed to 3 from 4 during receiving the malfunction signal from the rain sensor (while the ignition key is in "ON" position and the AUTO switch is in "ON" position).



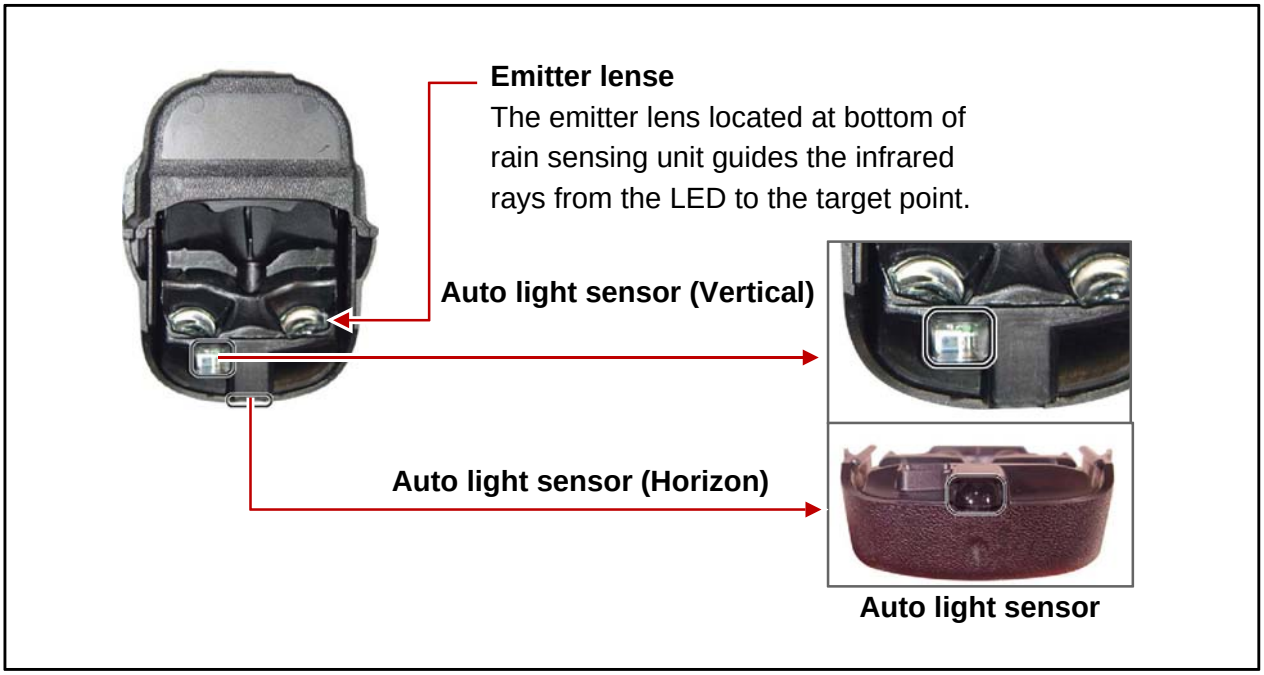
Modification basis	
Application basis	
Affected VIN	

▶ Auto Light Control

1. The tail lamps and headlamps can be controlled by the communication with the rain sensor only when the auto light switch is in "AUTO" position with the ignition switch "ON".



2. Rain detected headlamp: If it rains heavy which requires the highest AUTO speed, the headlamps are turned on automatically (while the light switch is in "AUTO" position and the wiper switch is in "AUTO" position).
3. Night detected wiping: When the auto light control turns on the headlamps and the rain sensor detects the rain, the wiper sensitivity is automatically increased by one level. (i.e. the AUTO wiper switch is at the 3rd level, but the wiper operates at the 4th level.)



▶ **Speed Sensitive AUTO Wiper**

For RKSTICS without the rain sensor, perform the following operation:

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

- Calculates and converts the Intermittent interval automatically by using the AUTO VOLUME when the ignition switch is in the "ON" position and the AUTO switch is in the
- "ON" position.
  The wipers are operated in vehicle speed sensitive mode when turning the AUTO switch to the "ON" position with the engine running or starting the engine with the AUTO switch
- positioned to "ON".
  Intermittent interval (at 0 km/h): 3 ± 0.5 ~ 19 ± 2 seconds

2. Vehicle speed calculation

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

$$1\ [\text{PULSE/SEC}] = \frac{60\ [\text{km/h}] \times 60\ [\text{sec}]}{637 \times 4\ \text{PULSE}} \quad 1.41\ [\text{km/h}]$$

3. VOLUME calculation

- The pause time of the vehicle speed sensitive AUTO wiper is calculated by the AUTO volume (input voltage). Each level has the hysteresis.

4. 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 the VOLUME.

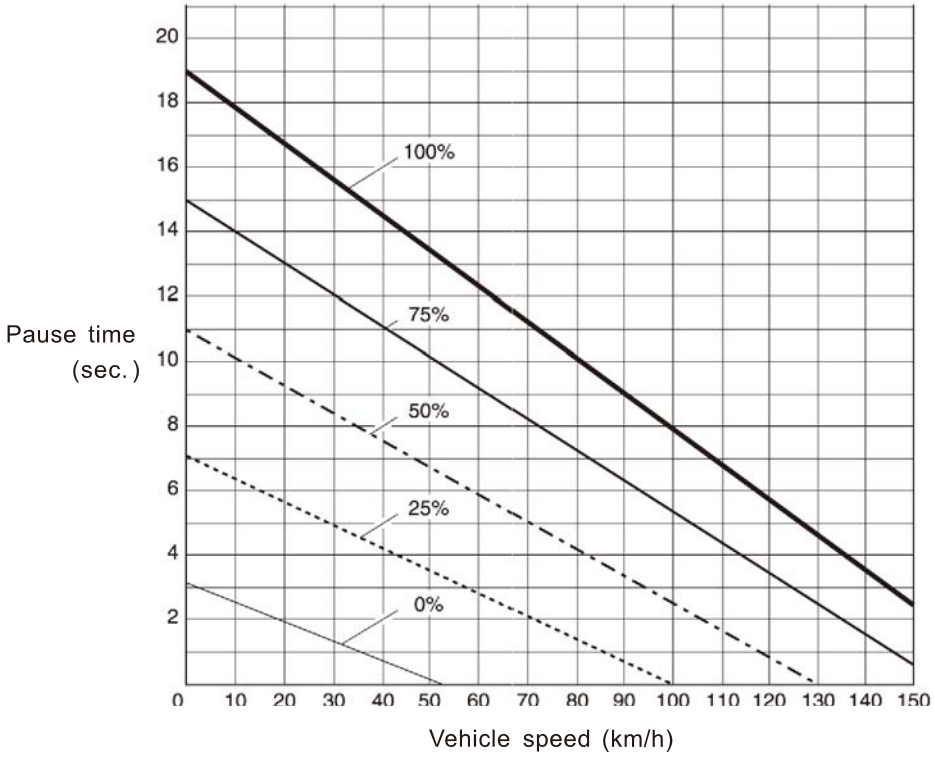
· If the pause time is below 1.0 second, the wipers operate without pause.
· If the pause time is over 1.5 seconds, the wipers operate intermittently.

Modification basis	
Application basis	
Affected VIN	

Pause time of vehicle speed sensitive INT wiper AUTO

Vehicle Speed / Resistance	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
100%	19.00	17.90	16.80	15.70	14.60	13.50	12.40	11.30	10.20	9.10	8.00	6.90	5.80	4.70	3.60	2.50
75%	15.00	14.03	13.06	12.09	11.13	10.16	9.19	8.22	7.26	6.29	5.32	4.35	3.39	2.42	1.45	0.45
50%	11.0	10.16	9.33	8.49	7.66	6.82	5.99	5.15	4.32	3.48	2.65	1.81	0.98	0.14	0.00	0.00
25%	7.00	6.29	5.59	4.89	4.19	3.48	2.78	2.08	1.38	0.67	0.02	0.00	0.00	0.00	0.00	0.00
0%	3.0	2.43	1.86	1.29	0.72	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pause time



CAUTION

- Speed sensitive AUTO wiper

1) The wiper relay continues to output for remaining "ON" time even when the AUTO switch is turned off.
2) IGN 2 switch "ON", AUTO switch "OFF": Resume the intermittent time when turning "ON"
3) IGN 2 switch "OFF", AUTO switch "ON": Resume the intermittent time when turning "ON"

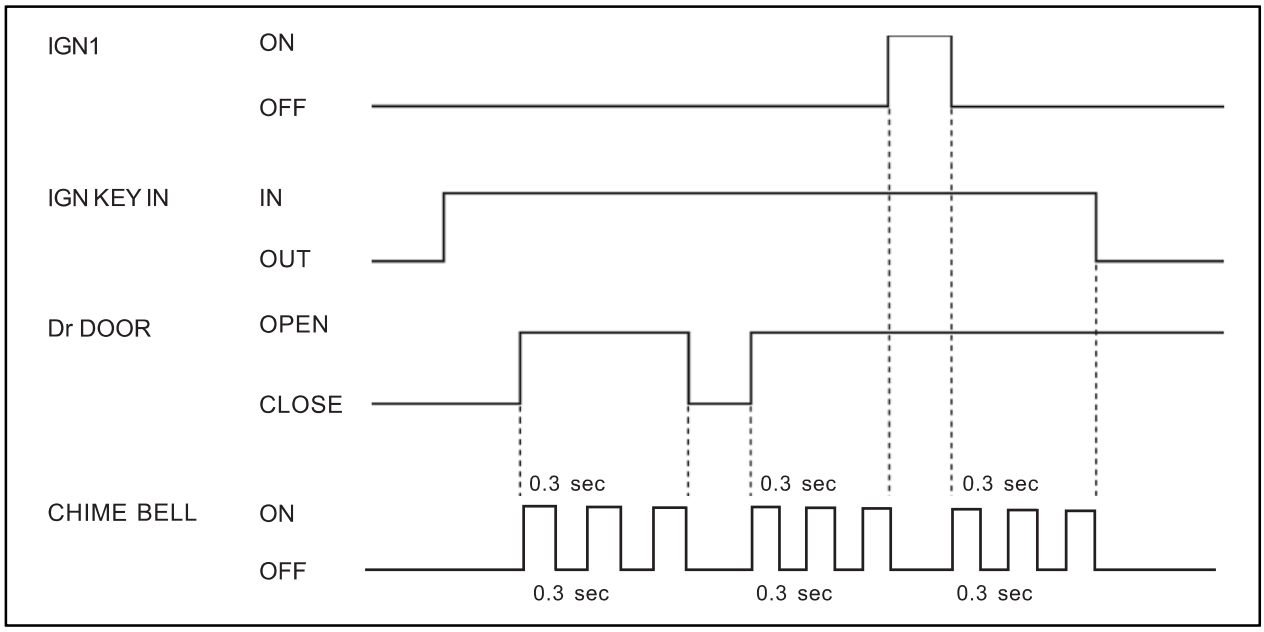
- Controls when the wiper motor parking is defective

1) The wiper relay continues to output when the parking terminal is fixed at the ground or IGN while the wiper relay is "ON" (AUTO switch = ON or Washer switch = ON) (The output stops immediately after turning off the switch) (The output stops immediately after turning OFF the switch.)

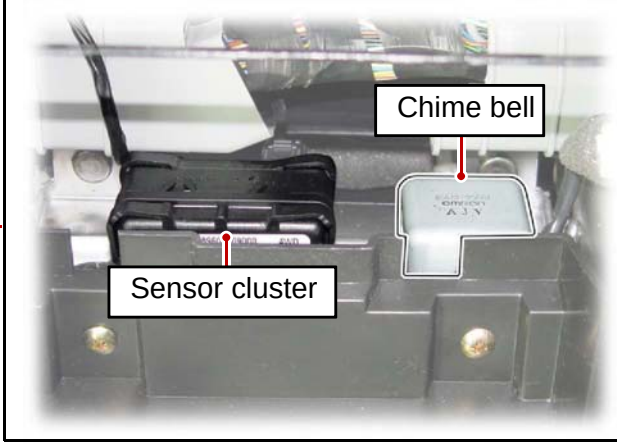
▶ Ignition Key Reminder Warning

(The ignition key reminder warning has priority over the "TAILLAMP ON WARNING".)

1. The chime bell sounds continuously with the interval of 0.3 seconds when opening the driver's door while the ignition key is in ignition switch.
2. When removing the ignition key or closing the driver's door during chime buzzer operation, the buzzer stops.
3. This function is not available when the ignition switch is in "ON" position.



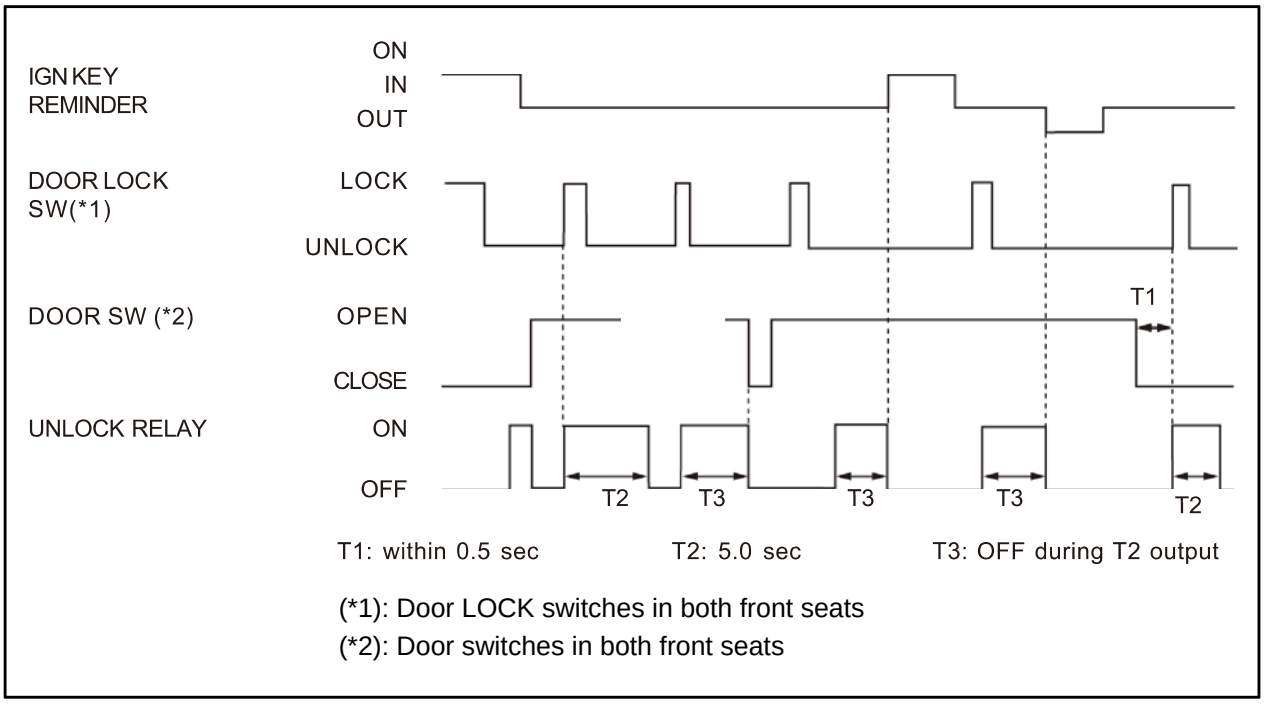
Chime bell location: bottom of audio unit (right to the sensor cluster)



Modification basis	
Application basis	
Affected VIN	

▶ Ignition Key Reminder

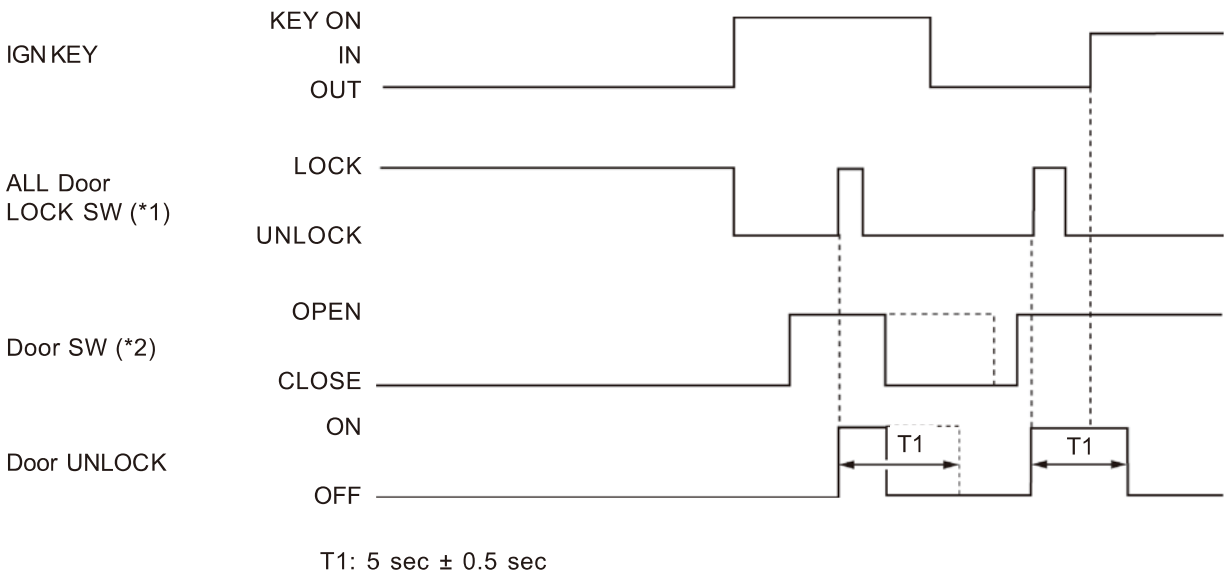
1. The system outputs "UNLOCK" signal for 5 seconds after the driver's door is opened and the door lock switch is changed to "LOCK" (while the ignition key is in ignition switch).
2. The system outputs "UNLOCK" signal for 5 seconds (T2) when the door lock switch is changed to "LOCK" from "UNLOCK" and the driver's door is closed within 0.5 seconds (while the ignition key is in the ignition switch).
3. If the "UNLOCK" conditions are met, the system outputs "UNLOCK" signal unconditionally. However, if the ignition key is removed after the door lock switch is changed from "UNLOCK" to "LOCK", the system does not output "UNLOCK" signal.



(*1): Door LOCK switches in both front seats
(*2): Door switches in both front seats

▶ All Door Lock Prevention Function when a Door is Open

1. All doors, except the tailgate and hood, output "UNLOCK" signal for 5 seconds when the "LOCK" signal is inputted (while the ignition key is removed and one of any doors is open).
2. When the door is closed during the UNLOCK output, the UNLOCK output stops immediately.
3. When the ignition key is inserted during the UNLOCK output, the output continues for approx. 5 seconds.
4. If the ignition switch is in the "ON" position or the ignition switch is removed, the above steps are performed. If the key is in the key cylinder, the ignition key reminder function is activated.
5. This function does not work if the vehicle speed is over 10 km/h.

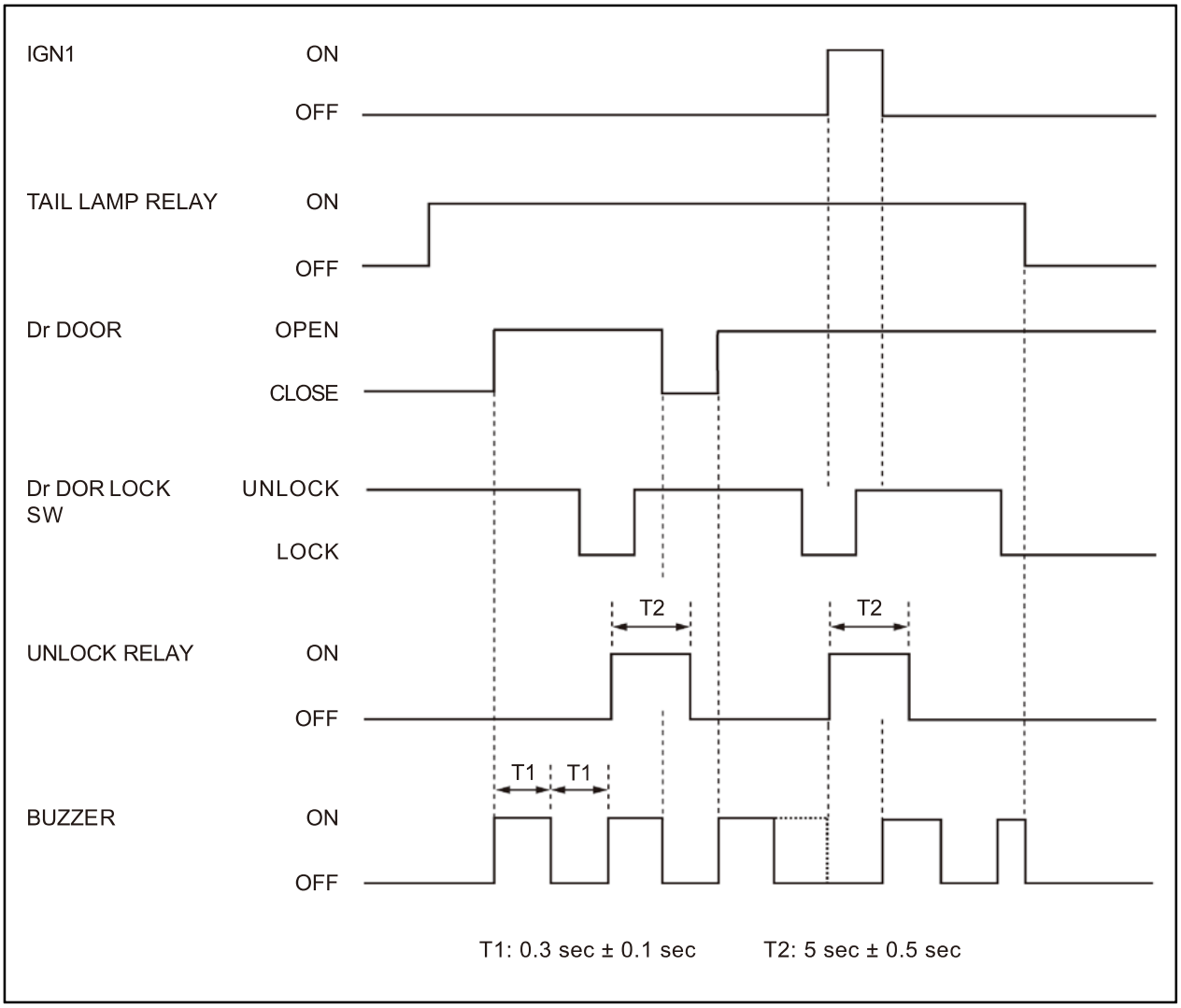


(*1) LOCK switches in all doors including tailgate (*2) Door switches in all doors excluding tailgate

Modification basis	
Application basis	
Affected VIN	

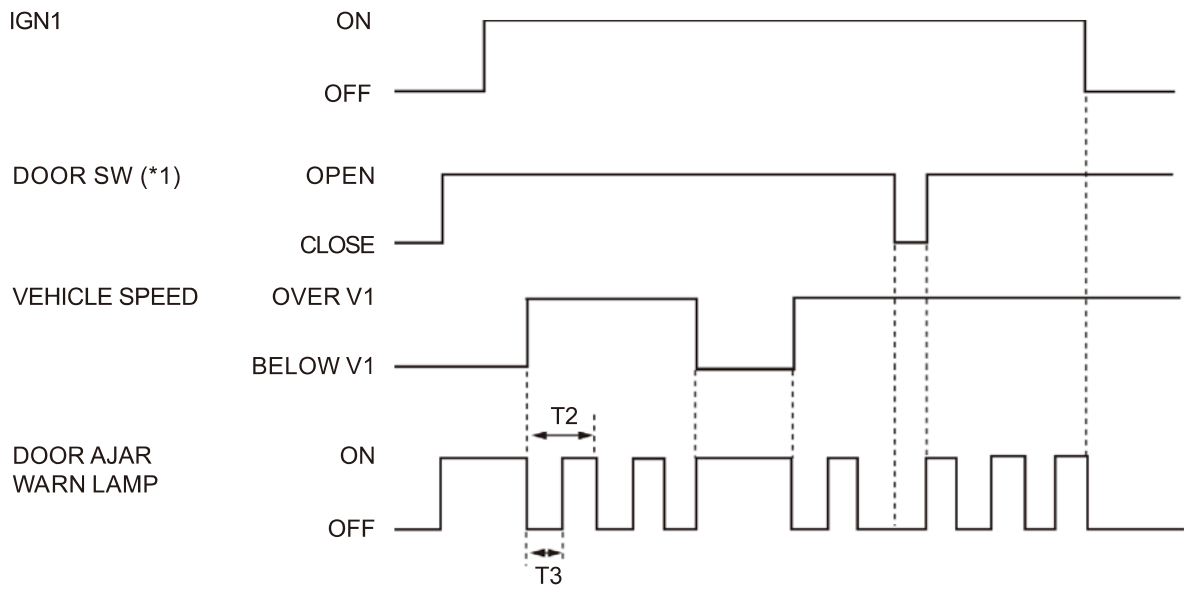
▶ Tail Lamp Left On Warning

1. The buzzer sounds with the interval of 0.3 second when opening the driver's door while the tail lamp is turned on and the ignition key is removed.
2. The buzzer output stops when turning off the tail lamp and closing the driver's door.
3. The system outputs "UNLOCK" signal for 5 seconds when the driver's and passenger's door lock switch is locked (while the tail lamp is turned on and the driver's door is open).
4. This function is not available when the ignition key is in the "ON" position.



▶ Door Ajar Warning

1. The warning light in instrument panel comes on when opening any of doors including tailgate while the vehicle speed is below 10 km/h.
2. The warning light goes off when closing the door under step 1.
3. The warning light blinks when the vehicle speed is over 10 km/h while the warning light is turned on.
4. The warning light blinks when a door is open while the vehicle speed is over 10 km/h.
5. The warning light goes off when closing the door under step 3.
6. The warning light comes on when the vehicle speed goes below 10 km/h under step 3.



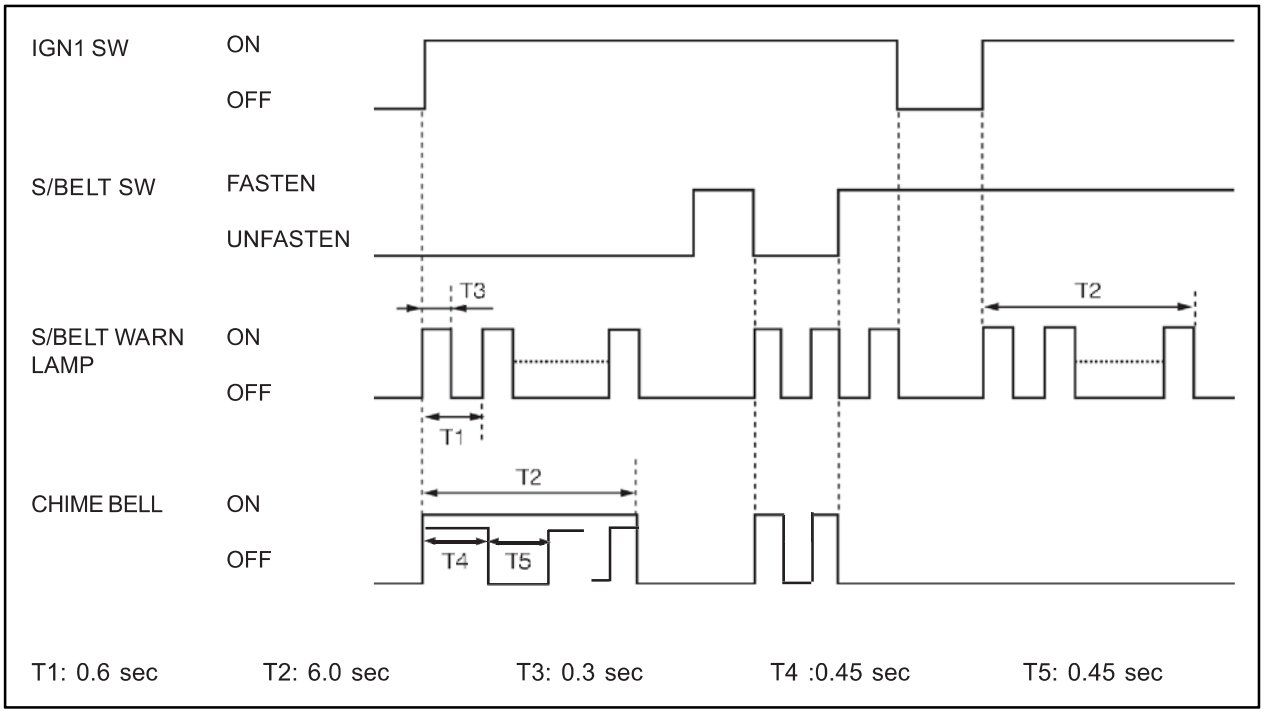
T2: 0.6 sec T3: 0.3 sec V1 = 10 Km/h

(*1) DOOR OPEN: Open any doors including tailgate
CLOSE: Close the opened door

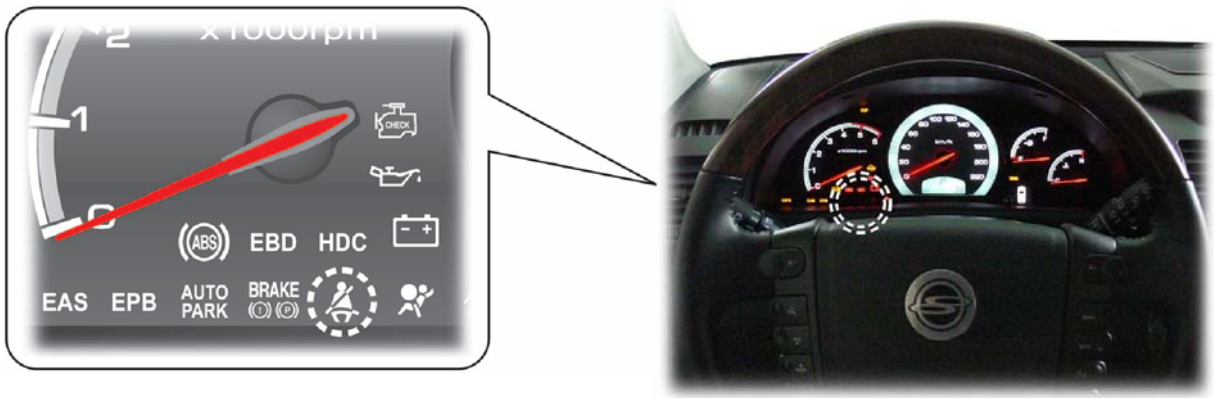
Modification basis	
Application basis	
Affected VIN	

▶ Seat Belt Warning

1. The seat belt warning light comes on and the chime bell sounds for 6 seconds when turning the ignition key to "ON" from "OFF".
   If the seat belt is fastened before turning the ignition key to the the "ON" position, the warning light in the instrument panel blinks, however, the chime bell does not sound.
2. The seat belt warning light goes off and the chime bell stops when turning the ignition switch to the "OFF" position.
3. The chime bell stops and the seat belt warning light stays on for the specified period of time when fastening the seat belt during the warning operation.
4. The seat belt warning light comes on and the chime bell sounds for 6 seconds again when unfastening the seat belt during fastening operation while the ignition key is "ON" position.



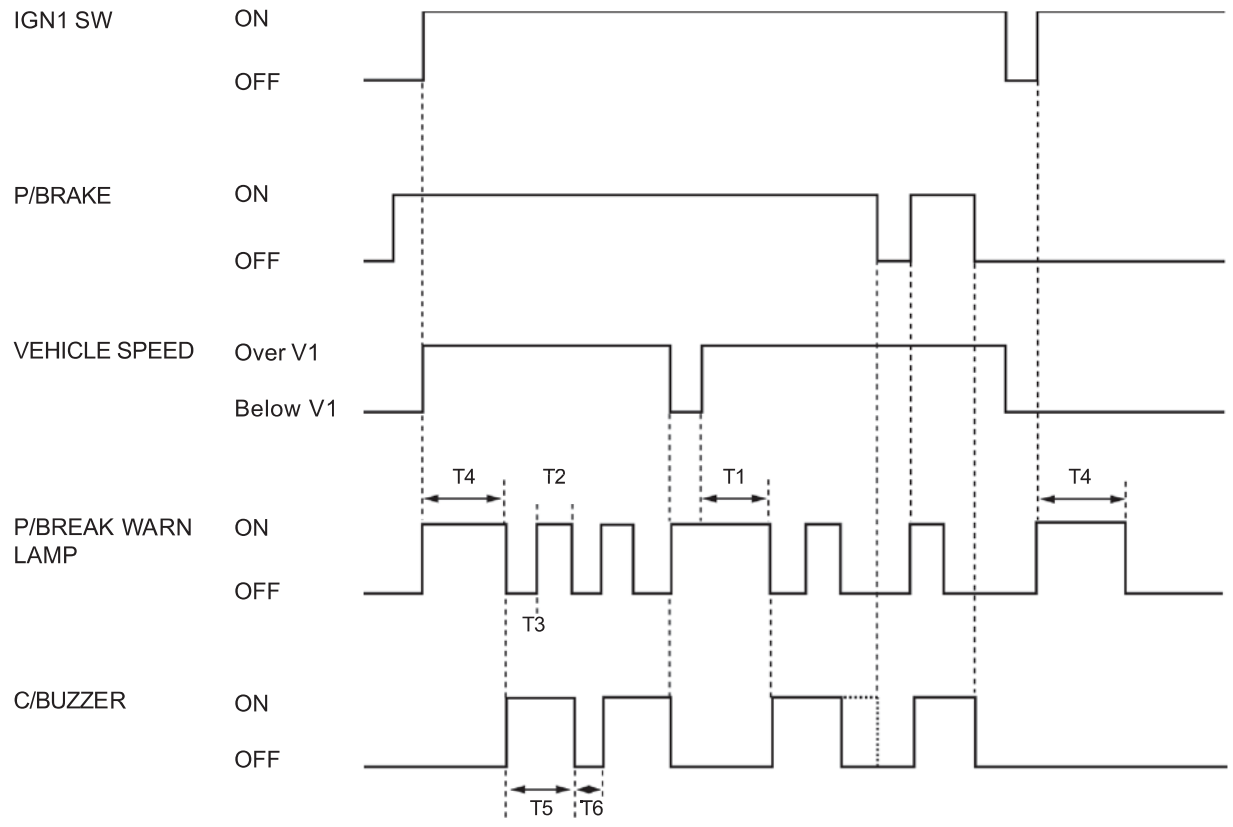
Seat Belt Warning Light



The seat belt warning light comes on and the chime buzzer sounds for 6 seconds when turning the ignition key to "ON" from "OFF". After fastening the seat belt, the chime bell stops.

▶ Parking Brake Warning

1. The parking brake warning light comes on for approx. 4 seconds when turning the ignition key from the "OFF" to the "ON" position regardless of the vehicle speed and the parking brake switch position. After this 4 seconds, the warning lamp comes on, goes off or blinks according to the vehicle speed and the parking brake switch position.
2. The warning light comes on when the parking brake switch is turned on while the vehicle speed is below 10 km/h.
3. The warning light goes off when turning off the parking brake switch under step 2.
4. The warning light blinks and the chime bell sounds for 0.6 seconds and stops for 0.3 seconds when the vehicle speed is over 10 km/h for more than 2 seconds while the parking brake switch is turned on.
5. The warning light goes off and the chime buzzer stops when turning off the parking brake switch under step 4.
6. The warning light comes on and the chime buzzer stops when the vehicle speed goes down below 10 km/h under step 4.
7. This function is not available when the ignition key is turned to the "OFF" position.



T1: 2.0 sec ± 0.5 sec T2: 0.6 sec T3: 0.3 sec T4: 4.0 sec V1: 10 Km/h
T5: 0.6 sec ± 0.1 sec T6: 0.3 sec ± 0.1 sec

Modification basis	
Application basis	
Affected VIN	

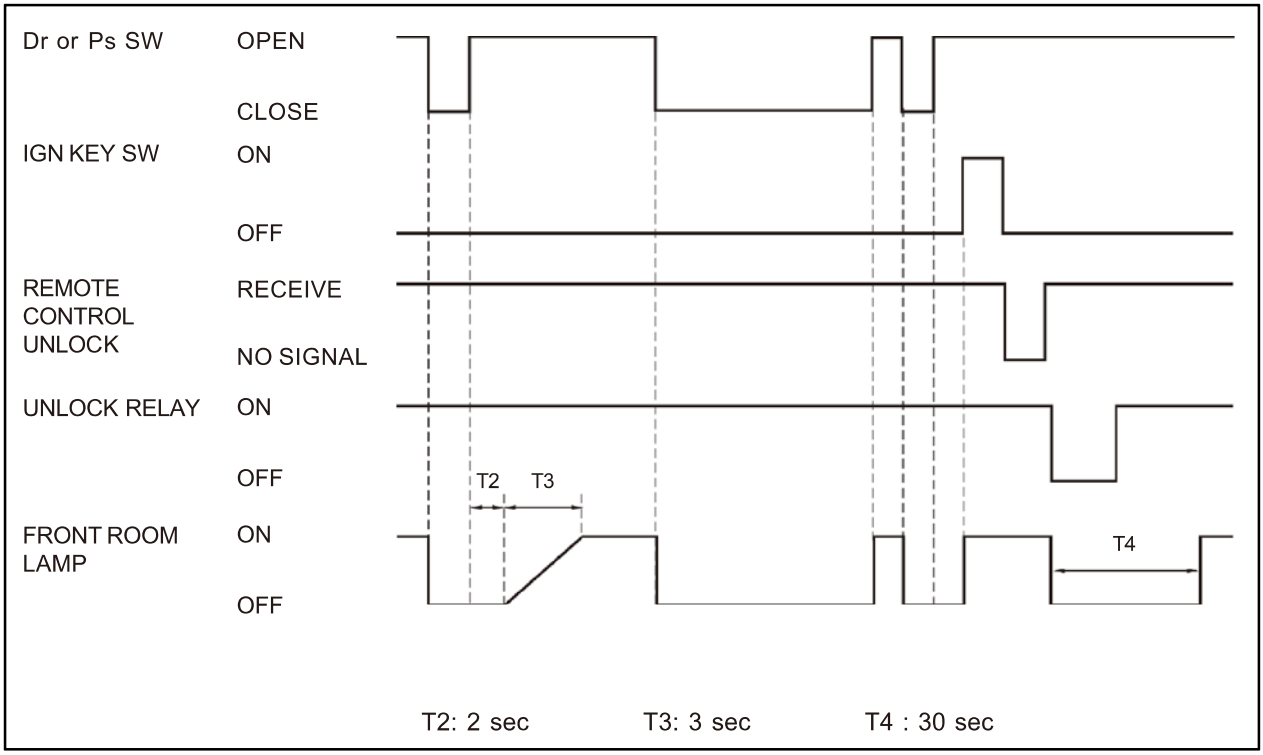
Vehicle with Hand Operated Type Parking Brake

Vehicle with EPB (Operates in EPB module with separate control logic)

▶ Front/Center Room Lamp Control

The overhead console lamp (front room lamp) comes on when opening the door(driver's/passenger's) while the door coupled front rooom lamp switch is at the coupled operating position and the key reminder switch is "OFF".

1. When the door (Driver's/Passenger's) is opened, the front room lamp comes on.
2. The room lamp stays on for 2 seconds and then dims out through 3 seconds when closing the opened door.
3. The dimming operation must have greater than 32 steps per one second.
4. The room lamp output should stop immediately after turning on the ignition key during the dimming operation.
5. The front room lamp comes on for 30 seconds when receiving the unlock signal from the remote control key while the doors are closed.
6. The front room lamp and the center room lamp output period is extended by 30 seconds when receiving the unlock signal from the remote control key again during output. (The lamp stays on when unlocked by the remote control key.)
7. When a door is opened during its extended period, the lamp stays on. If closed, operates as in step 2.
8. The room lamp output stops immediately after receiving the lock signal from driver's/passenger's door lock switches while the driver's and passenger's doors are closed or entering into the anti-theft mode by pushing LOCK button on the remote control key.
9. The front room lamp comes on when opening the driver's door or passenger's door and goes off when closing the opened door while the ignition key is in ON position.

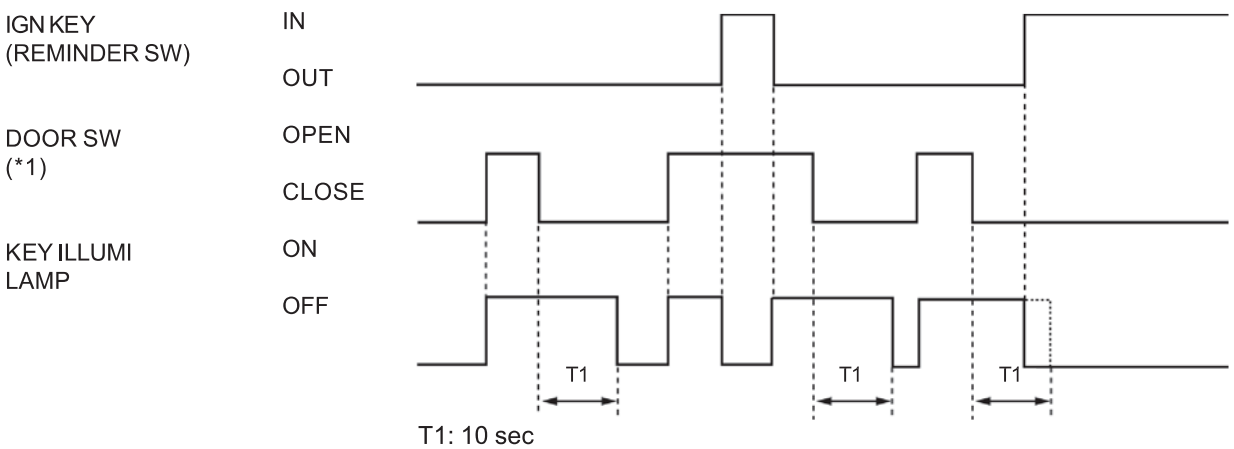


Modification basis	
Application basis	
Affected VIN	

Front Room Lamp	Center Room Lamp
Front room lamp (driver's or passenger's) is turned on and off when pressing the switch (1 or 2). However, it comes on when a door is opened and goes off when the door is closed. The front room lamp comes on when opening any of front doors with the front door coupled switch (3) pressed in.	If the switch is at the door coupled position, the center room lamp comes on when a rear door is opened. The lamp always comes on while the switch is at the other position.

▶ Ignition Key Hole Illumination

1. The ignition key hole illumination comes on when opening the driver's door or passenger's door when the ignition key is removed.
2. The ignition key hole illumination stays on for 10 seconds when closing the door after step
3. 1.
4. The output stops when the ignition key is turned to "ON" position.
   The output stops when receiving the lock signal from the remote control key (under anti-theft mode)

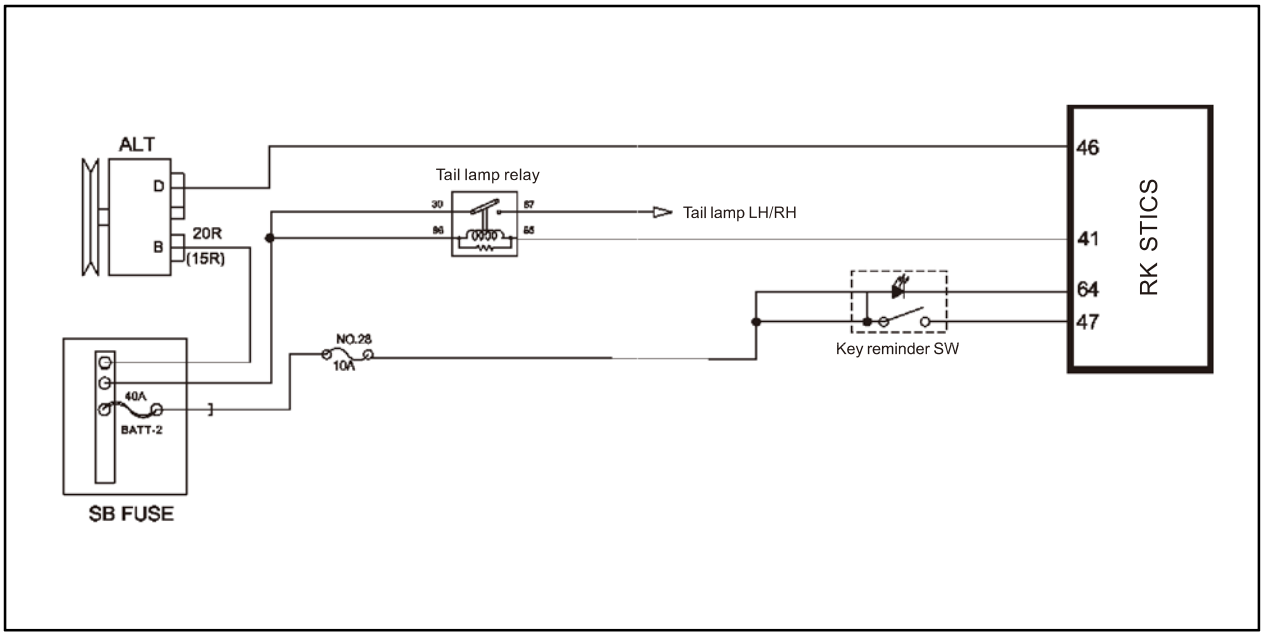


T1: 10 sec

(*1) OPEN : Driver's or Passenger's door = OPEN, CLOSE : Driver's and Passenger's = CLOSE

Opening Driver's or Passenger's Door

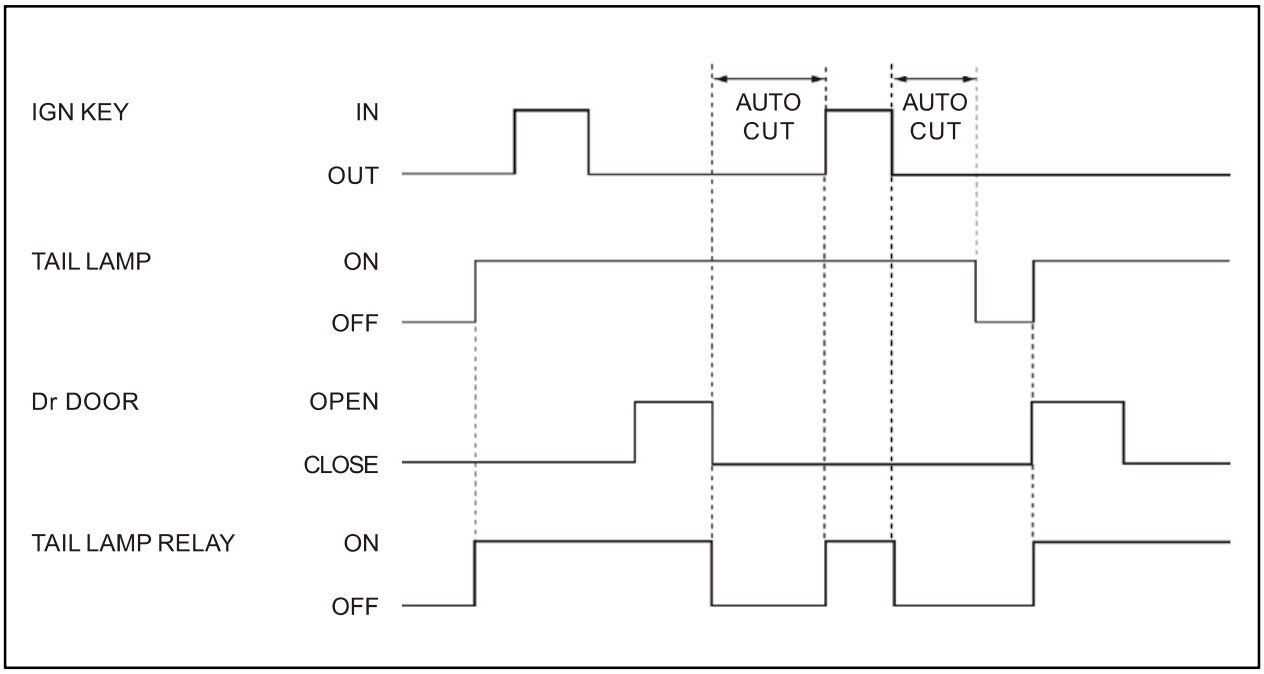
▶ Wiring Circuit of STICS (Related to Tail Lamp Auto Cut (Battery Saver))



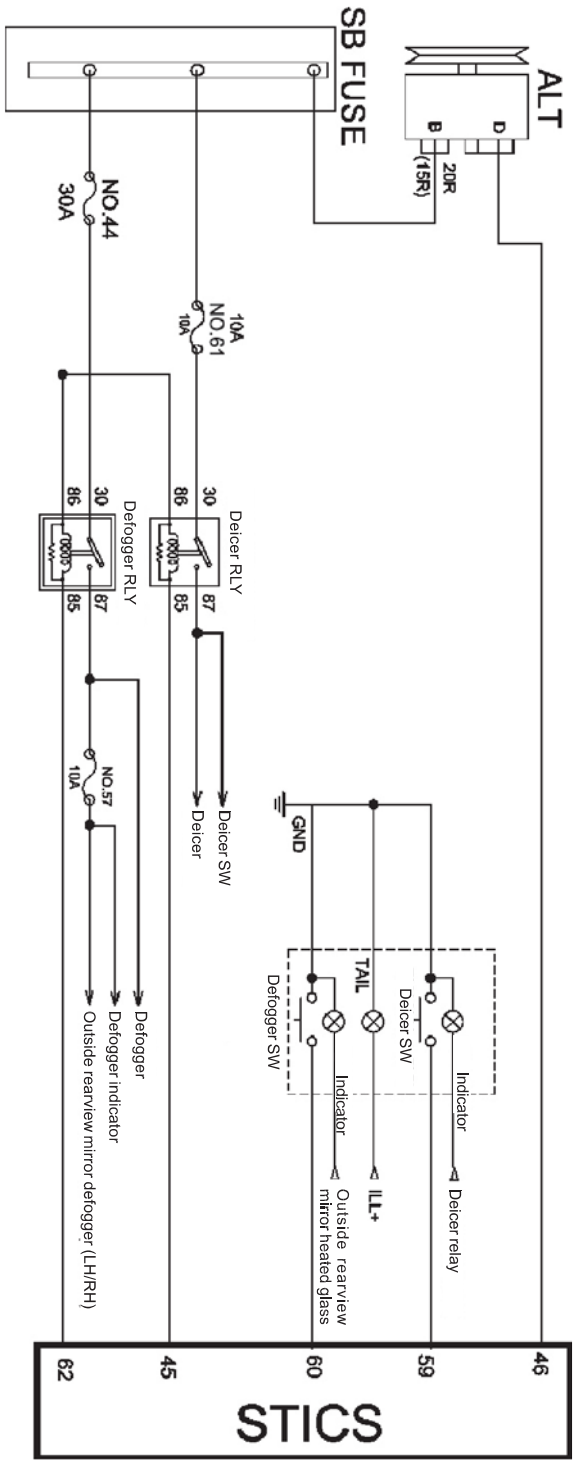
Modification basis	
Application basis	
Affected VIN	

▶ Tail Lamp Auto Cut (Battery Saver)

1. The tail lamp is turned on or off according to the operations of the tail lamp switch.
2. The tail lamp relay is turned off (auto cut) when opening and closing the driver's door after removing the ignition key without turning off the tail lamp.
3. The tail lamp relay is turned on when inserting the ignition key into the ignition switch.
4. The tail lamp relay is not turned off automatically (auto cut) when opening and closing the driver's door while the ignition is removed and the tail lamp is turned on.

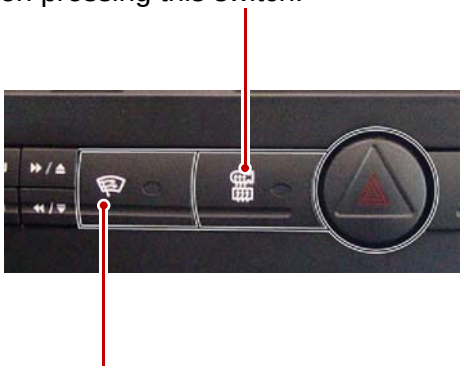


▶ Circuit Diagram of STICS (Related to Front/Rear Defogger Timer)



The defogger system defrosts or demists the window glass with the heated wire integrated in glass.
When operating the defogger switch, STICS controls the operating time only in IGN2 position.

Rear defogger switch
(Tailgate window and outside rearview mirror heated glass switch) The tailgate window and outside rearview mirror heated glass is turned on for 12 minutes when pressing this switch.

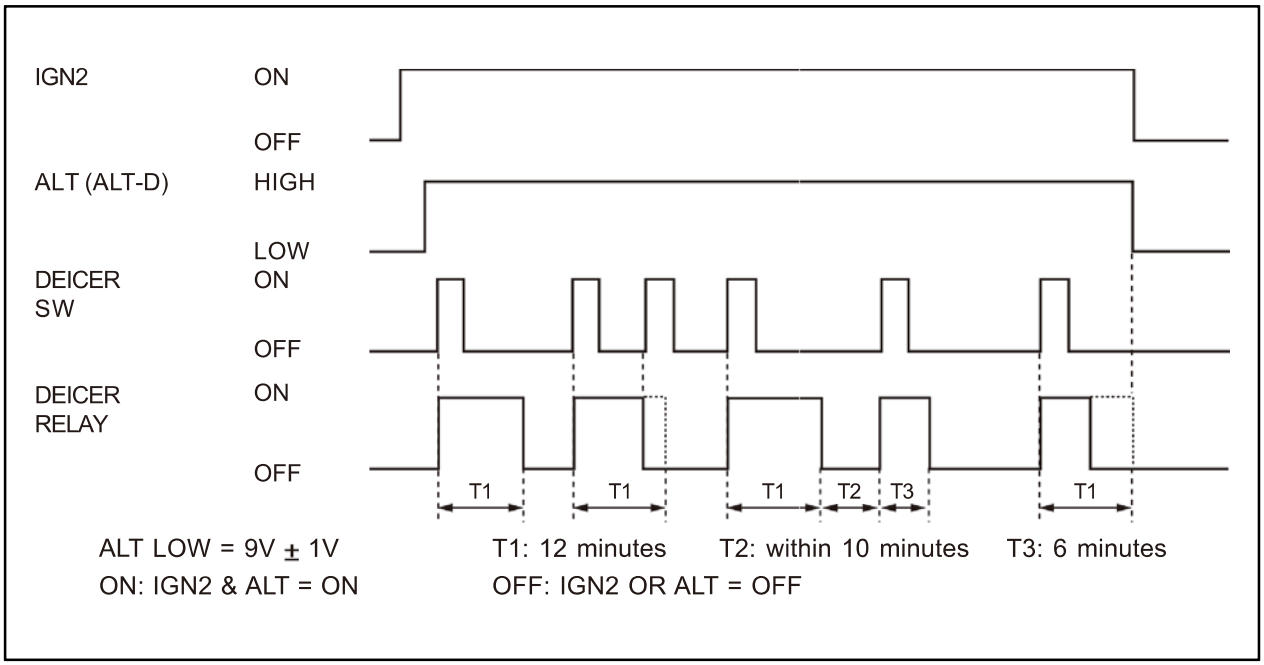


Windshield heated glass switch
The windshield heated glass is turned on for 12 minutes when pressing this switch.

Modification basis	
Application basis	
Affected VIN	

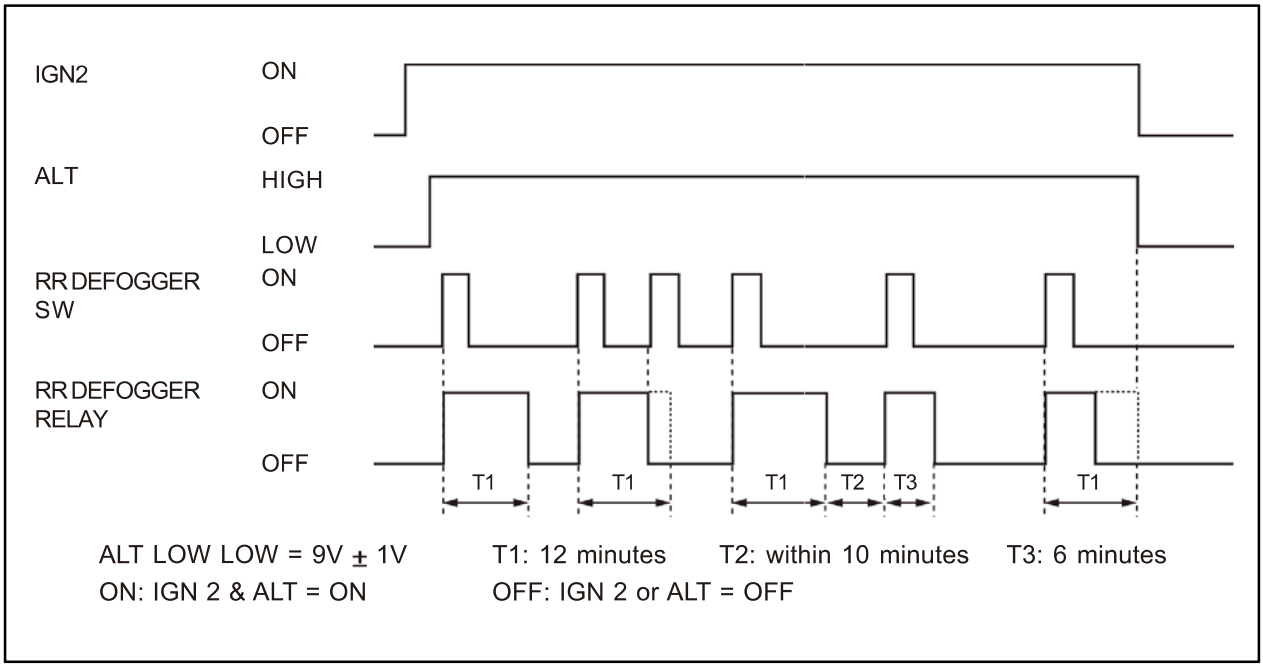
▶ Windshield heated glass (deicer) switch

1. The front defogger output is "ON" when turning "ON" the front defogger (heated glass) switch while the ignition switch is "ON" (with engine running).
2. The output stops when turning on the front defogger (heated glass) switch again during its operation.
3. The output is "ON" only for 6 minutes when turning "ON" the front defogger (heated glass) switch within 10 minutes after completion of output for 12 minutes. This can be done only once.
4. The output is "OFF" when the ignition switch is "OFF".



▶ Rear Defogger Timer

1. The rear defogger output is "ON" when turning "ON" the rear defogger switch while the IGN 2 switch is "ON" (with engine running).
2. The output is "OFF" when turning "ON" the rear defogger switch again during output.
3. The output is "ON" only for 6 minutes when turning "ON" the rear defogger switch within 10 minutes after completion of output for 12 minutes. This can be done only once.
4. The output is "OFF" when the IGN 2 switch is "OFF".

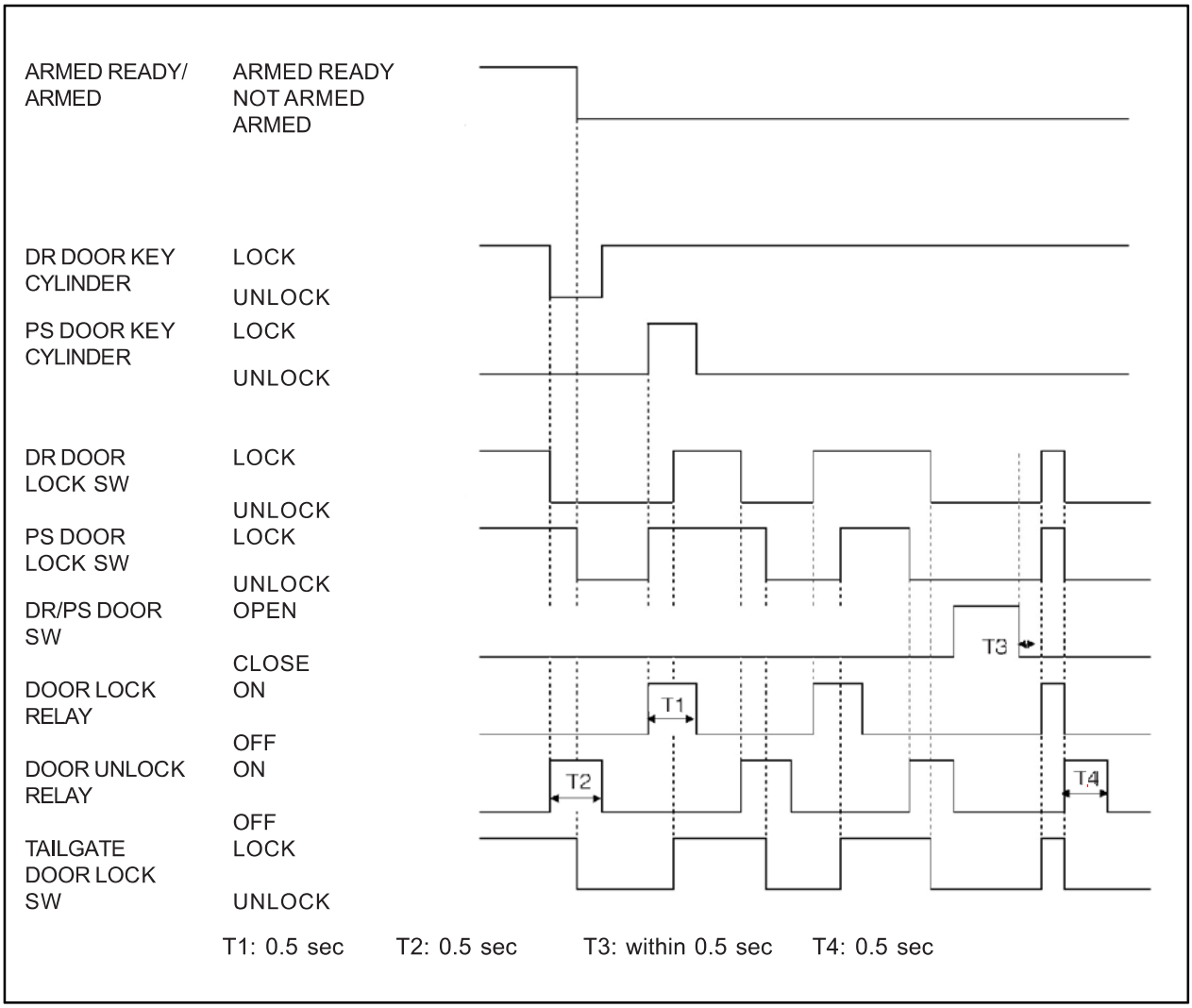


ALT LOW LOW = 9V ± 1V T1: 12 minutes T2: within 10 minutes T3: 6 minutes
ON: IGN 2 & ALT = ON OFF: IGN 2 or ALT = OFF

Modification basis	
Application basis	
Affected VIN	

▶ Door Lock/Unlock Control by Door Lock Switch

1. The door lock system outputs "LOCK" signal for 0.5 seconds when positioning the driver's or passenger's door lock switch to the lock position.
2. The door lock system outputs "UNLOCK" signal for 0.5 seconds when positioning the driver's or passenger's door lock switch to the unlock position.
3. The door lock system outputs "LOCK" signal for 0.5 seconds when switching from LOCK to UNLOCK by the driver's or passenger's door key cylinder.
4. The door lock system outputs "UNLOCK" signal for 0.5 seconds when switching from UNLOCK to LOCK by the driver's or passenger's door key cylinder.
5. The alarm will not be activated when switched to UNLOCK by driver's or passenger's door key cylinder switch in theft deterrent mode.
6. It does not occur abnormal operation when reconnecting the battery after disconnecting the battery cable.
7. All door lock signals are "UNLOCK" for 0.5 seconds just for once when receiving the "LOCK" signal within 0.5 seconds after closing the driver's or passenger's door while the ignition key is removed.

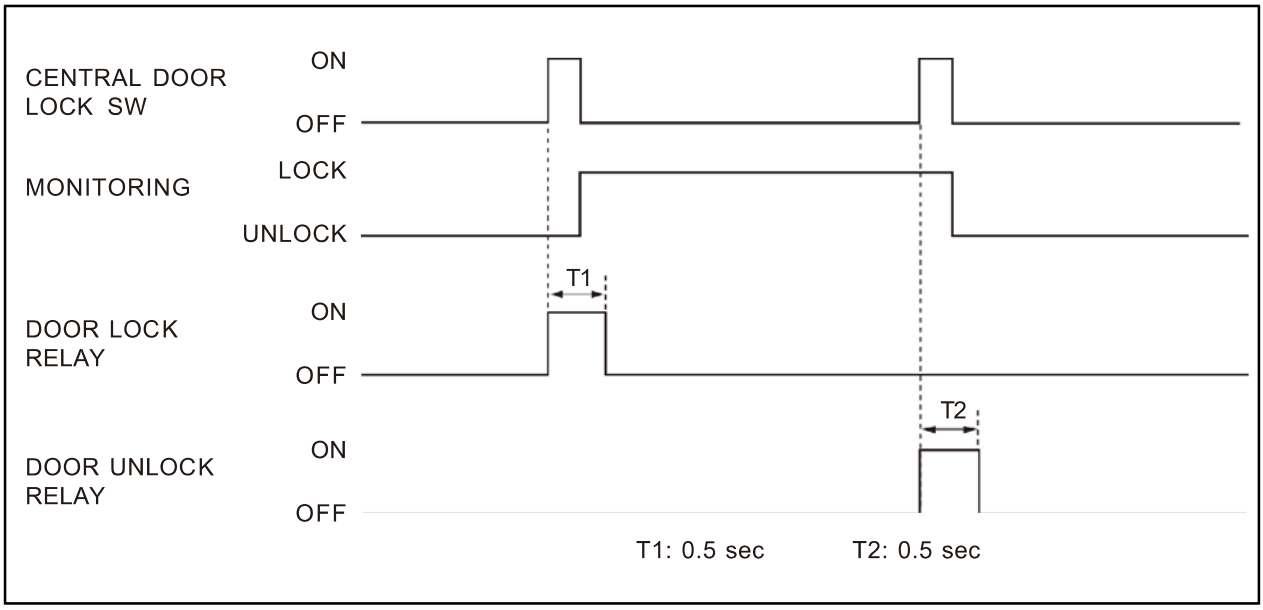


Driver's door lock/unlock switch

Passenger's door lock/unlock switch

▶ Door Lock/Unlock by Central Door Lock Switch

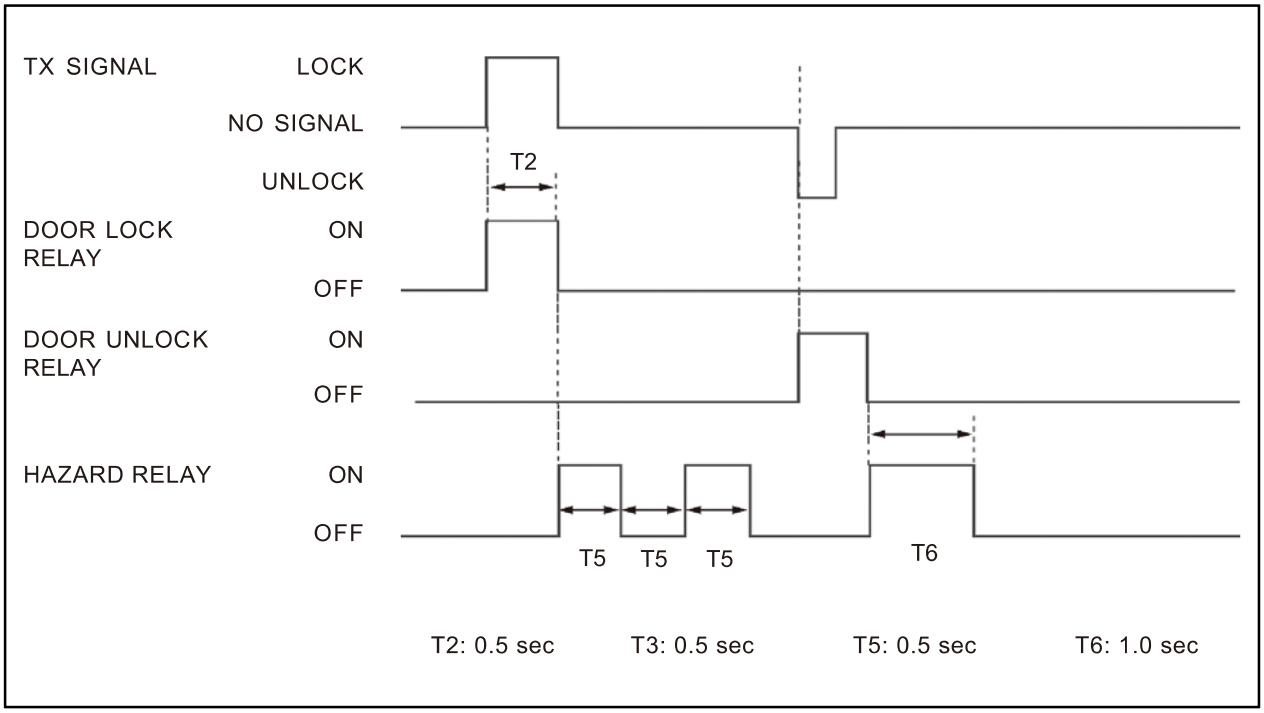
1. The door lock system outputs "LOCK/UNLOCK" signal for 0.5 seconds when operating the central door lock switch. (However, if the door lock switch (front doors) is at LOCK position, the system outputs UNLOCK signal, and vice versa.)
2. The "LOCK" or "UNLOCK" inputs from the central door lock switch in anti-theft mode are ignored.



Modification basis	
Application basis	
Affected VIN	

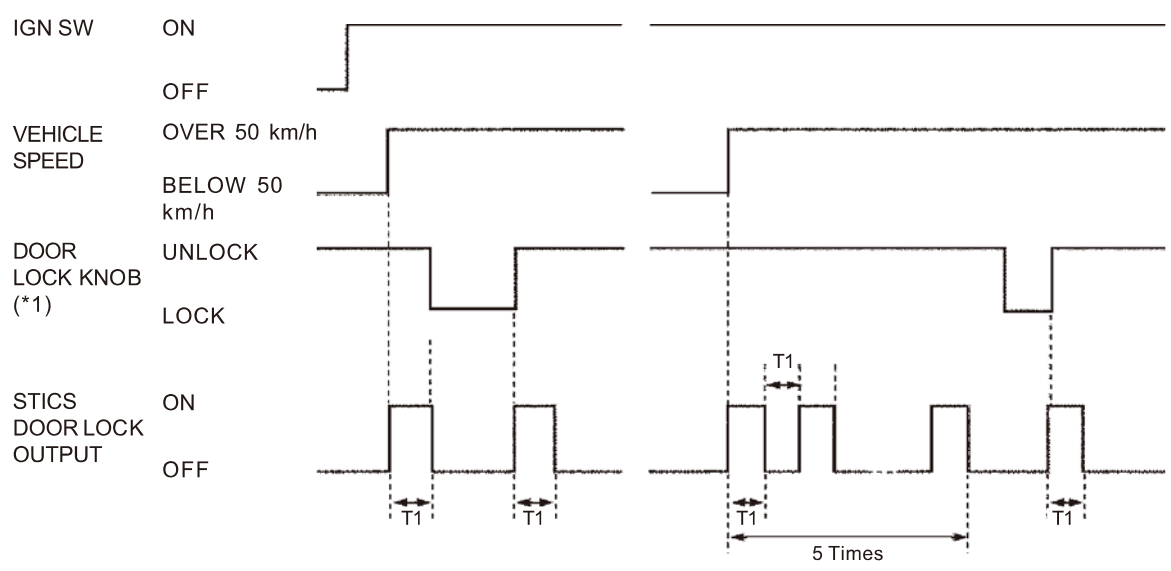
▶ Door LOCK/UNLOCK by Remote Control Key

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



▶ Auto Door Lock

1. The door lock system outputs "LOCK" when the vehicle speed maintains over 50 km/h. However, it doesn't output "LOCK" when all doors are locked or failed.
2. If any of doors is unlocked after outputting "LOCK" in step 1, outputs "LOCK" up to 5 times (except step 1) at the interval of one second.
3. If any of doors is unlocked after 5 times of "LOCK" outputs, the door is regarded as "FAIL".
4. If the door that was regarded as fail changes (UNLOCK to LOCK) to unlock, only one "LOCK" output will be done.
5. If any door is regarded as FAIL, the auto door lock function does not work (if it is occurred when the vehicle speed is over 50 km/h, the auto door lock output does not occur even if the vehicle speed falls below 50 km/h and accelerates again to over 50 km/h.). Nonetheless, the central door lock function works properly.
6. When the system receives "UNLOCK" signal from a door switch, it outputs "LOCK" signals 5 times. If additional "LOCK" signal from another door switch is detected during the period, the system outputs five "LOCK" signals
   5 times for the door system outputs five "LOCK" signals 5 times for the door.
7. The door lock system outputs "UNLOCK" automatically if the "LOCK" output conditions are established by this function or the key is cycled (IGN1=OFF) (even when there is no "LOCK" output while the vehicle speed maintains over 50 km/h under lock condition).
   (If the LOCK condition is established with the ignition switch ON, the system outputs UNLOCK signal unconditionally when turning the ignition switch to OFF position.)
   However, when the ignition key is turned to "OFF" position, the lock output conditions will be cancelled.
8. The "FAIL" condition of the door will be erased when the ignition key is turned to "OFF" position.



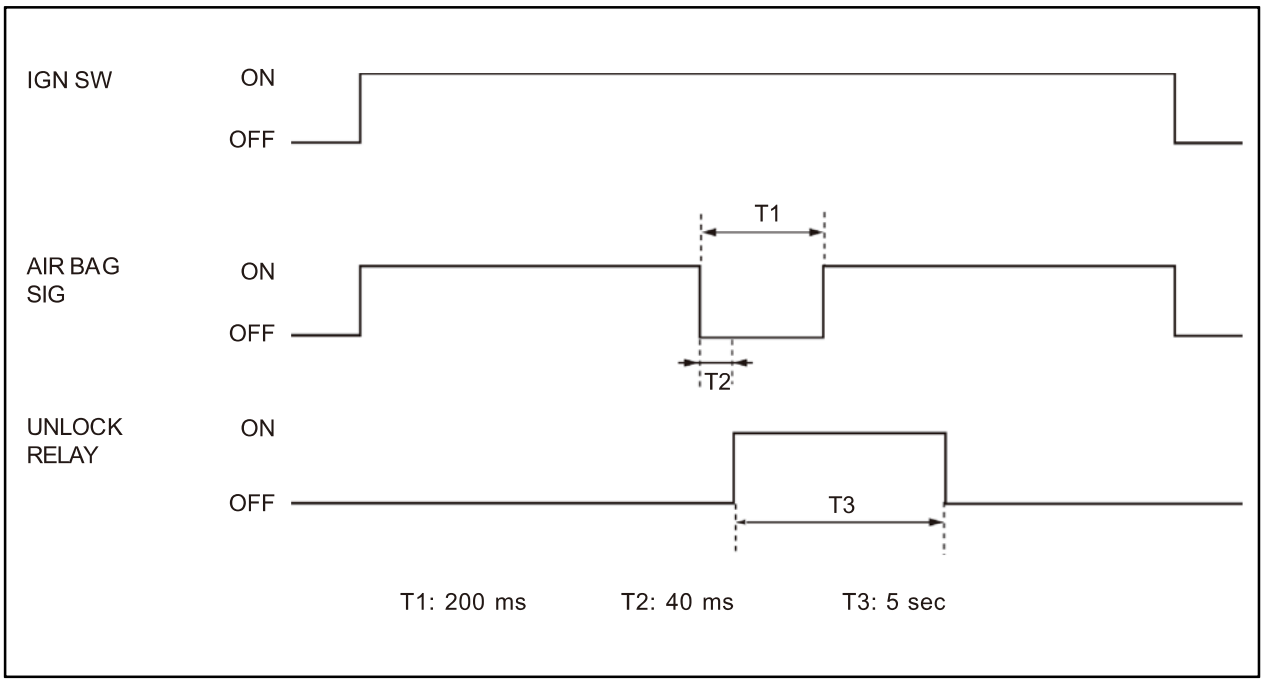
T1: 0.5 sec

(*1) LOCK: All door lock switches (including tailgate) = LOCK
UNLOCK: Any of all door lock switches = UNLOCK

Modification basis	
Application basis	
Affected VIN	

▶ Auto Door Unlock (Crash Unlock)

1. The air bag collision signal input cannot be accepted within 7 seconds after turning the ignition key to "ON" position.
2. After this period, the door lock system outputs "UNLOCK" for all doors for 5 seconds from 40ms after receiving the air bag collision signal.
3. Even though the key is turned to "OFF" position during the output of "UNLOCK", the output continues on for remaining period.
4. The function is erased when turning "OFF" the IGN switch.

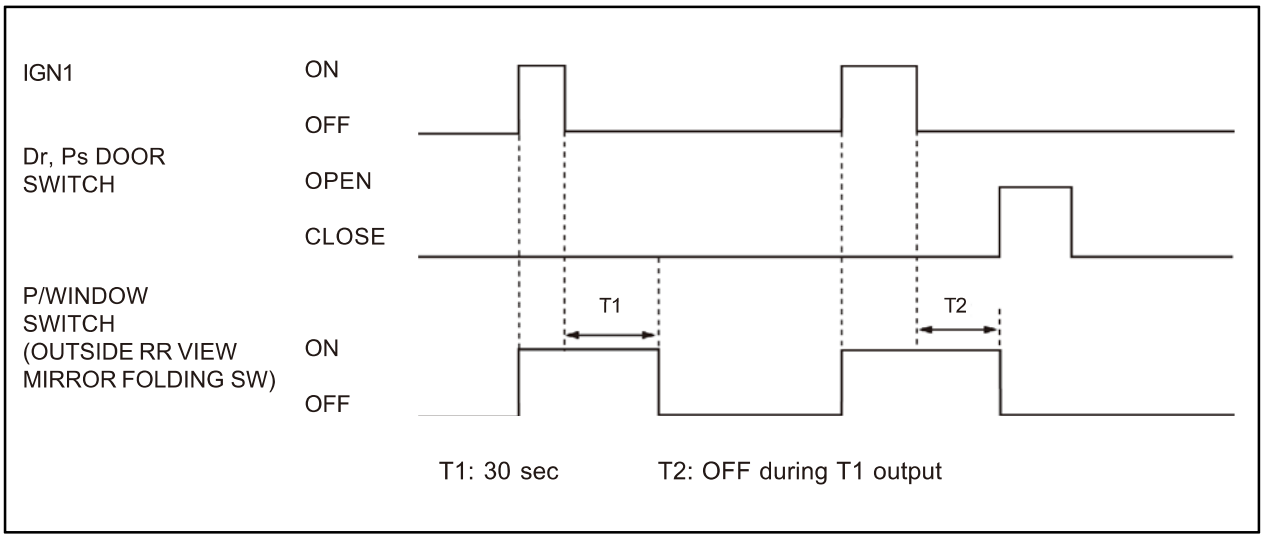


CAUTION

- The "Unlock" control by air bag signal prevails over any "LOCK" or "UNLOCK" control by other functions.
- The "LOCK/UNLOCK" request by other functions will be ignored after/during the output of "UNLOCK" by the air bag.
  However, the door lock is controlled by other functions when the ignition switch is "OFF".
- "LOCK" (or "UNLOCK") output is ignored if "LOCK" (or "UNLOCK") output is required while performing the output of "LOCK" (or "UNLOCK").
- If the door lock system outputs "LOCK" and "UNLOCK" simultaneously, only the "LOCK" output can be activated.

▶ Time Lag Power Window Control

1. The power window relay output is "ON" when turning on the ignition switch.
2. The power window relay output is "ON" for 30 seconds when turning off the ignition switch. The power window relay output is "OFF" when opening the driver's door or the passenger's door.
3. The power window relay is turned "OFF" when receiving the remote control key lock signal (armed mode) during its extended operation period of 30 seconds.



▶ Definition of Terms

1. DOOR OPEN and DOOR CLOSE
   DOOR OPEN: Any of all door switches (including hood and tailgate) is in "OPEN" position.
   DOOR CLOSE: All door switches (including hood and tailgate) are in "CLOSE" position.

CAUTION
The door lock/unlock operation does not affect the engine hood.

2. DOOR LOCK: Indicates that all door lock switches (including tailgate) are in LOCK positions.
   DOOR UNLOCK: Indicates that any of all door lock switches (including tailgate) is in UNLOCK position.

Modification basis	
Application basis	
Affected VIN	

▶ Power Sleep Mode

1. Entering Condition

1) When all the doors including the hood are closed.
2) When the ignition key is in "OFF" position.
3) When there is no key in the driver's/passenger's door key cylinder.
4) The system enters into the sleep mode for saving power if there is any change for 6 seconds while the driver's/passenger's/rear doors and tailgate are locked with the above three conditions met.

2. The sleep mode is deactivated immediately if any of them is out of the specified conditions (wake-up mode).

Also, the sleep mode is deactivated when receiving the UNLOCK signal from the remote control key.

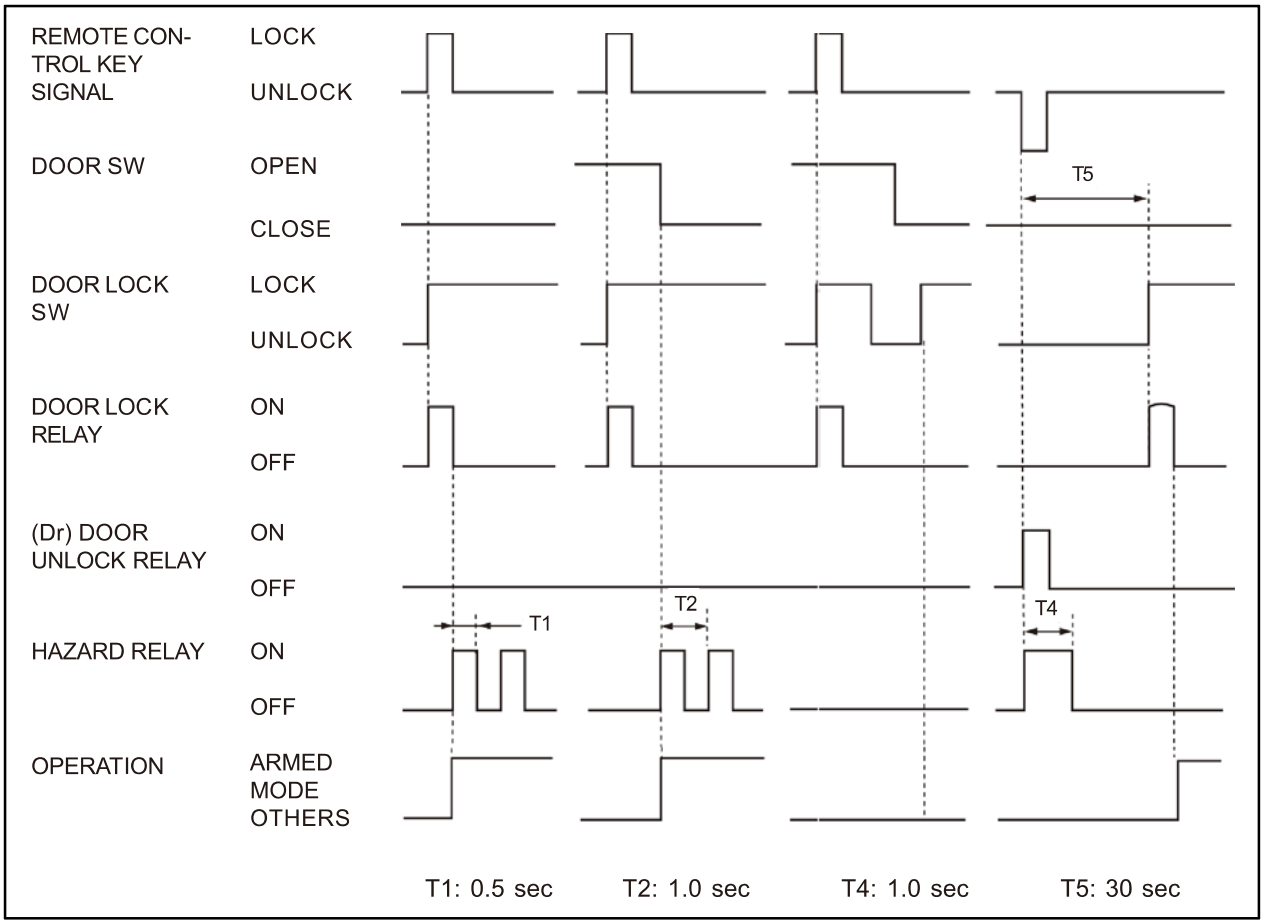
3. During the sleep mode, the sleep mode is deactivated for 30 seconds when room lamp, key hole illumination, tail lamp or power window is operated or after the system receives the UNLOCK signal from the remote control key.

However, if the lamps and power window mentioned above are "OFF" and the conditions in item (1) are met, the system enters into the sleep mode again.

▶ Description of Burglar Alarm Function

1. Armed mode activation requirements

1) The "LOCK" output is "ON" when receiving the "LOCK" signal from transmitter while the ignition key is removed and all doors are closed. The armed mode is activated when the door lock switch is locked (hazard relay output: twice).
2) The theft deterrent horn and hazard relay outputs are "ON" when receiving the "LOCK" signal from the remote control key again in armed mode (hazard relay output: twice).
3) When receiving "LOCK" signal from the remote control key while any of doors is not closed, only the "LOCK" output can be done and then activates the armed ready mode (without hazard warning flasher). 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, it cancels the armed mode and activates the normal mode. However, when closing and locking the opened door, the hazard warning lamps flash twice.
4) When the door is not opened or the ignition key is not inserted into ignition switch for 30 seconds after receiving "UNLOCK" signal, it outputs "LOCK" and then activates armed mode (RELOCK operation). Also, at this moment, the system outputs the hazard warning flasher twice.
5) The armed mode will not be activated except above conditions.
Ex) The armed mode will not be activated when the door is locked by the ignition key.



Modification basis	
Application basis	
Affected VIN	

2. Armed mode cancellation requirements

1) Unlocking by remote control key
2) Door unlocking by the driver's and passenger's key cylinder switch
3) The armed mode is cancelled when turning the ignition key "ON". The siren is deactivated in 27 seconds.

3. Warning operation requirements

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

4. Warning operation

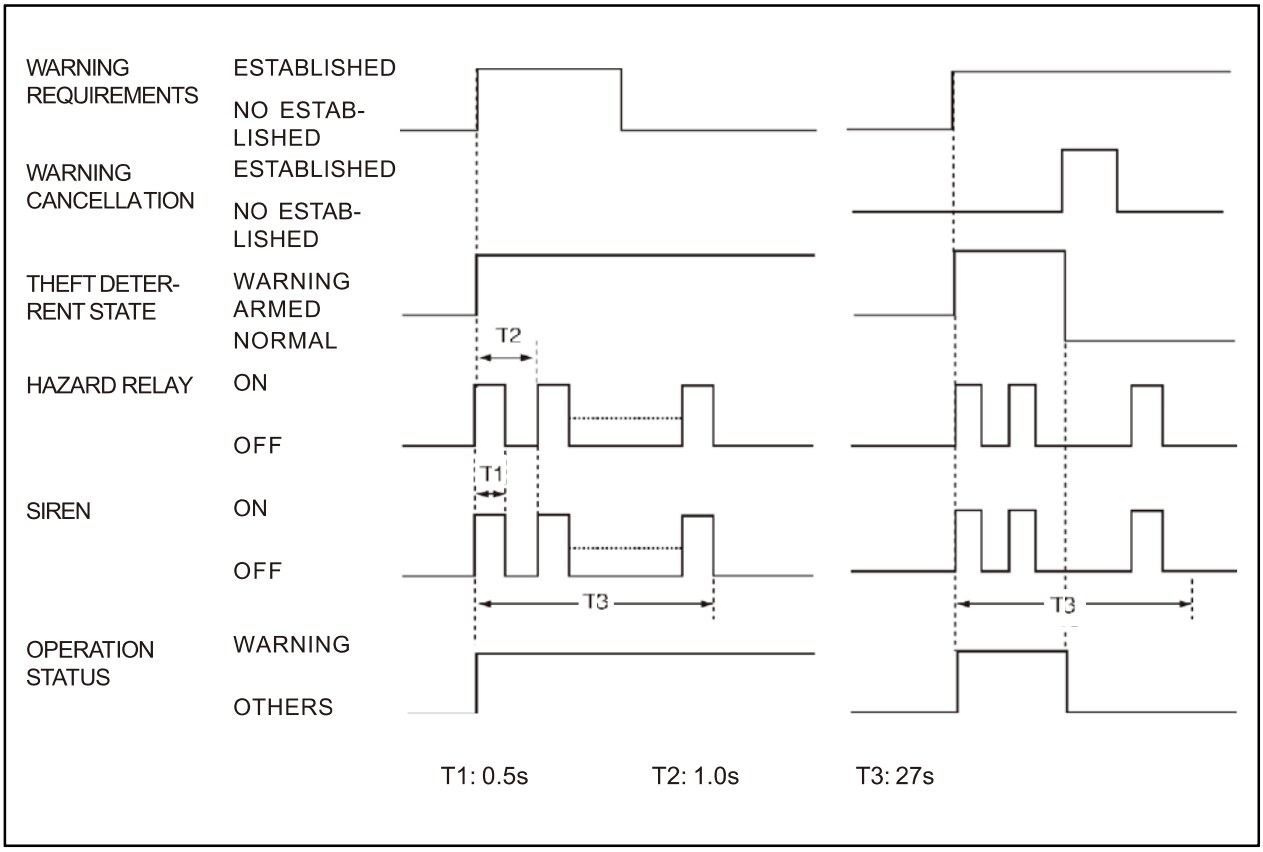
1) The siren and hazard warning flasher output is "ON" for 27 seconds with the interval of 1 second.

5. Warning cancellation requirements

1) Cancels warning by using any signal from the remote control key (LOCK, UNLOCK, PANIC) during warning operation.
2) Cancels warning after 27 seconds (remaining period) while the ignition key is turned to "ON" position.
3) If the ignition switch is turned to ON position when the warning is activated in armed mode, the warning is canceled immediately and the warning buzzer stops after 27 seconds (remaining time).
4) When unlocking the doors by the driver's/passenger's door key cylinder in armed mode, the armed mode is cancelled.

6. Operation when warning is cancelled

1) The siren and hazard warning flasher outputs are "OFF".



7. Operations when removing and installing the battery

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

If the system is in armed mode while installing a battery, the siren sounds and the emergency warning lamp blinks.
(Same operations with warning in armed mode).

CAUTION

- RELOCK Operation: It the door is not opened or the ignition key is not inserted into the key cylinder within 30 seconds after unlocking the door with remote control key, the system outputs "LOCK" signal and activates the armed mode.

Modification basis	
Application basis	
Affected VIN	

▶ Specifications of Remote Control Key

When any of switches on remote control key is pressed, the integrated CPU in remote control key sends the coded control message to the CPU in receiver to control the vehicle.

Switch Functions on Remote Control Key

Door Lock Button

Lock (briefly press)

- If you press this button briefly, all doors and the tailgate are locked and the theft deterrent mode is activated.
- When the theft deterrent mode is activated, the hazard warning flashers blink twice.

Door Unlock/Panic Button

1. Unlock (briefly press)

- If you press this button briefly, all doors and the tail gate are unlocked and the theft deterrent mode is deactivated.
- When the deterrent mode is deactivated, hazard warning flashers blink once.

Panic Button
(operative only when the ignition key is inserted)

2. Panic function (press and hold)

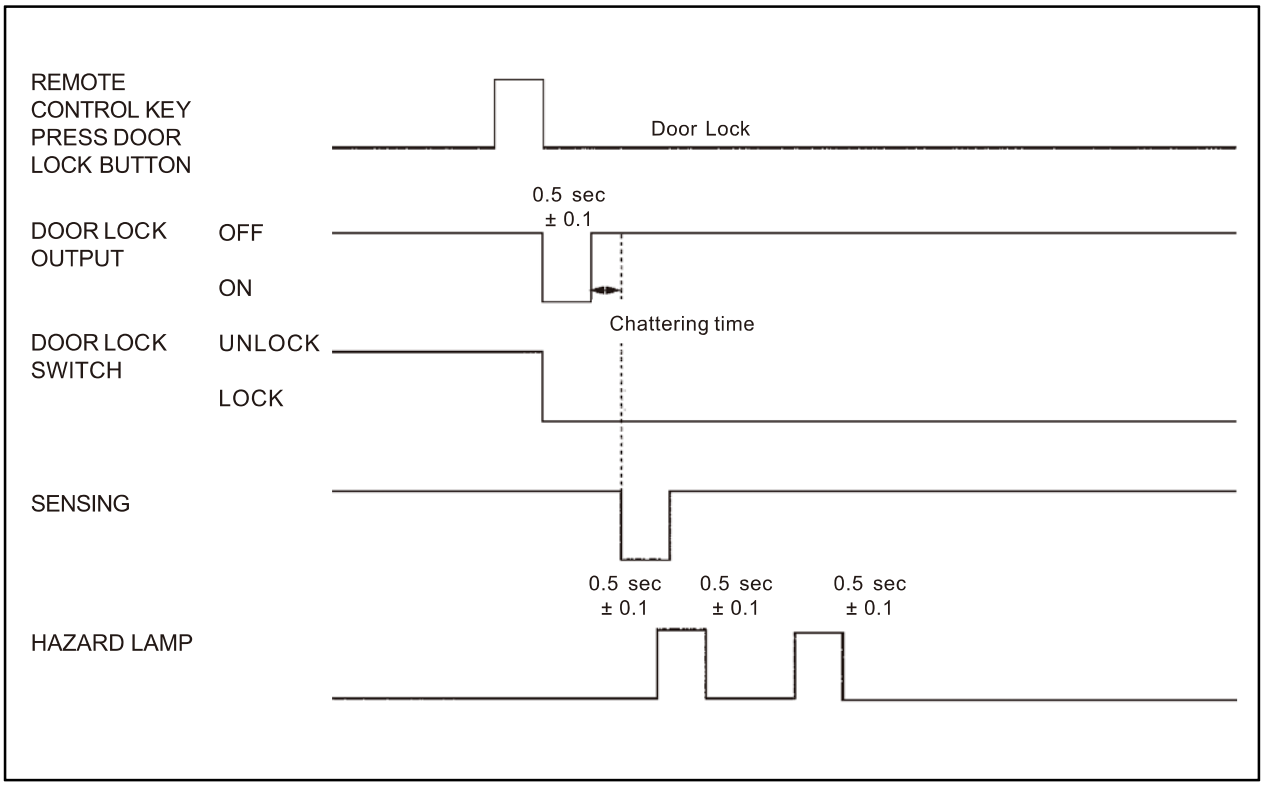
- If you are in your vehicle and feel threatened while the ignition key is inserted into the key switch, you may activate the alarm to call attention. If you press this button, the warning siren will sound for approx. 27 seconds.
- The panic function will stop when any of the buttons on the remote control key is pressed.

CAUTION

The coding signal is transmitted only if pressing the door unlock button long (approx. 2 seconds) when coding the remote control key.

▶ Remote Door Lock

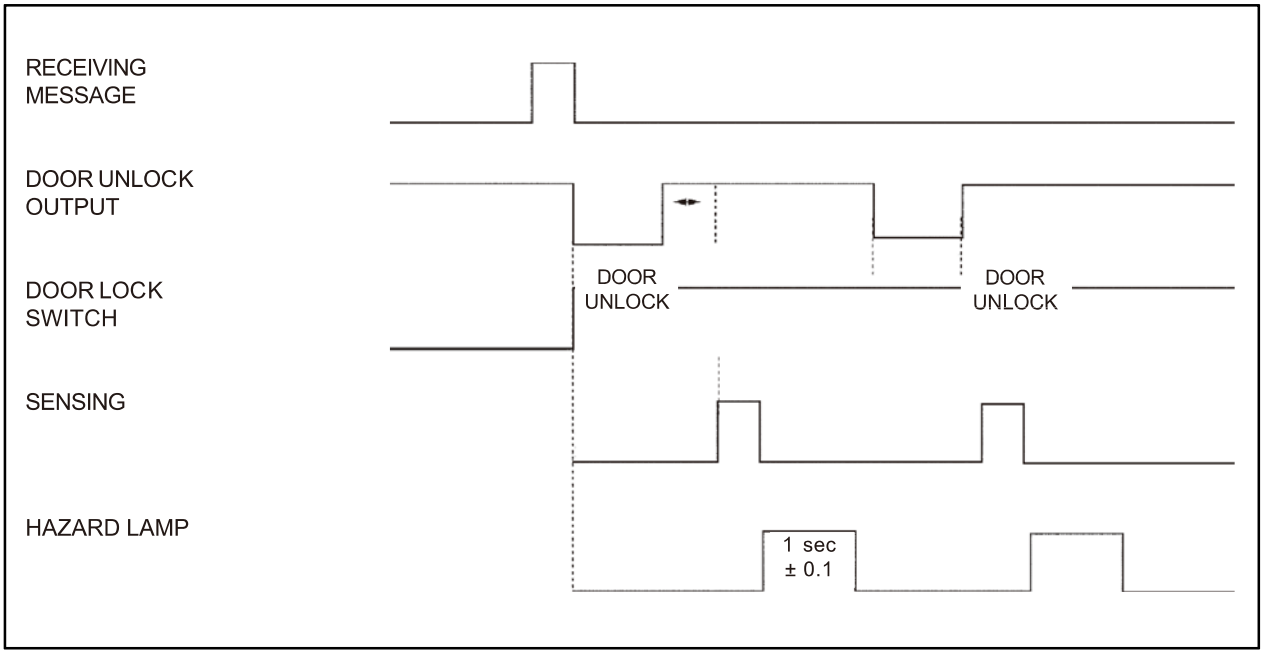
1. All doors are locked when briefly pressing the door LOCK switch on remote control key (less than 0.5 seconds).
2. The system outputs LOCK signal immediately after receiving the door lock message from the remote control key. The system activates the theft deterrent mode when all doors are locked while they are fully closed (the hazard warning lamps blink twice.).



Modification basis	
Application basis	
Affected VIN	

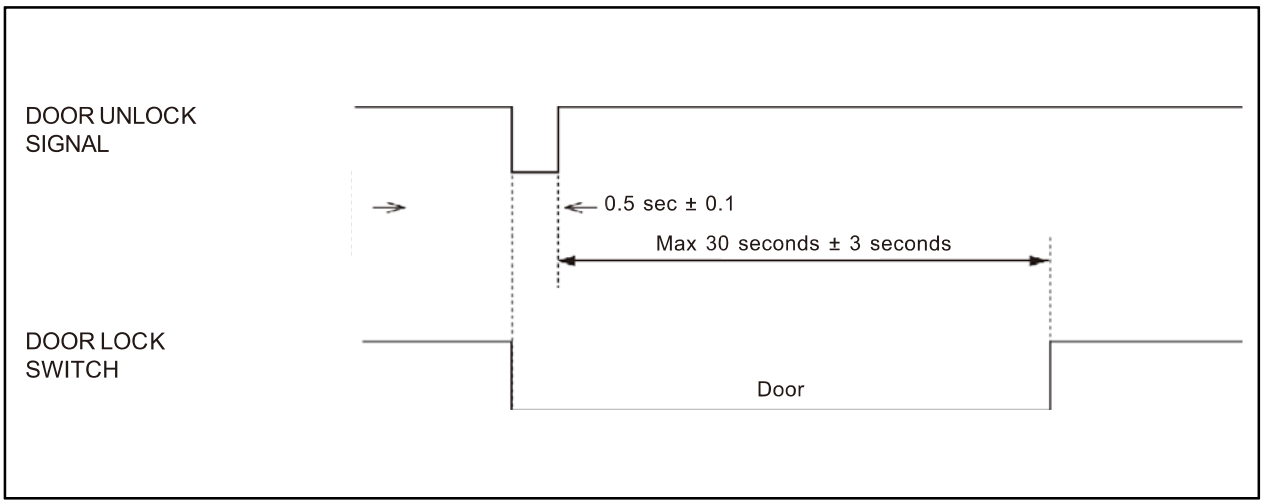
▶ Door Unlock

1. The door unlock operates when pressing the door unlock switch on the remote control key for less than 0.5 seconds.
2. The door unlock relay is "ON" for 0.5 seconds when receiving the door unlock message from the remote control key.
3. The hazard warning lamps blink once only when all the doors unlocked.

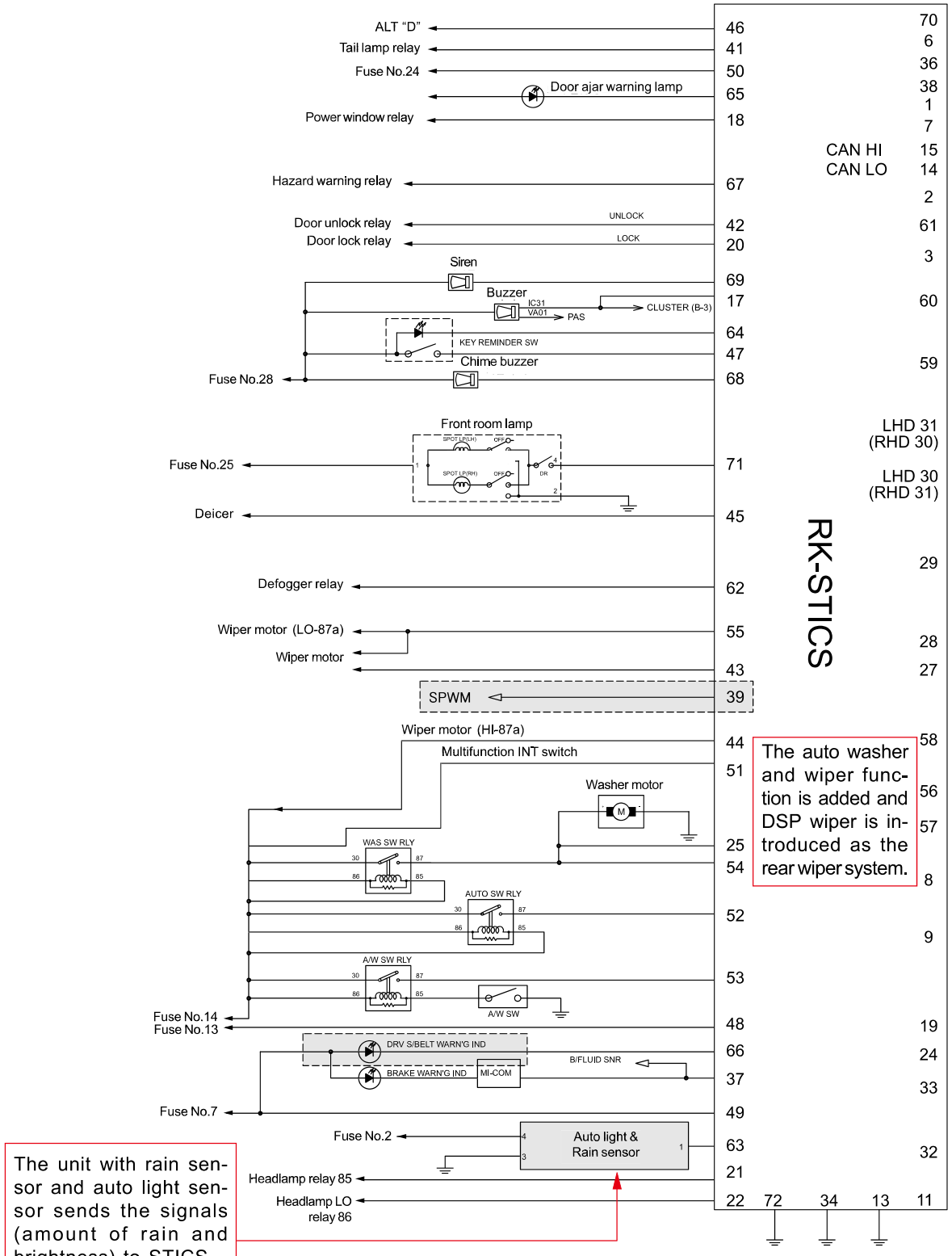


▶ Auto Door Lock in 30 Seconds after Pressing Door Unlock Button

1. If no door is opened for 30 seconds after inputting remote door unlock, the doors are automatically locked and the armed mode of anti-theft system is activated again.

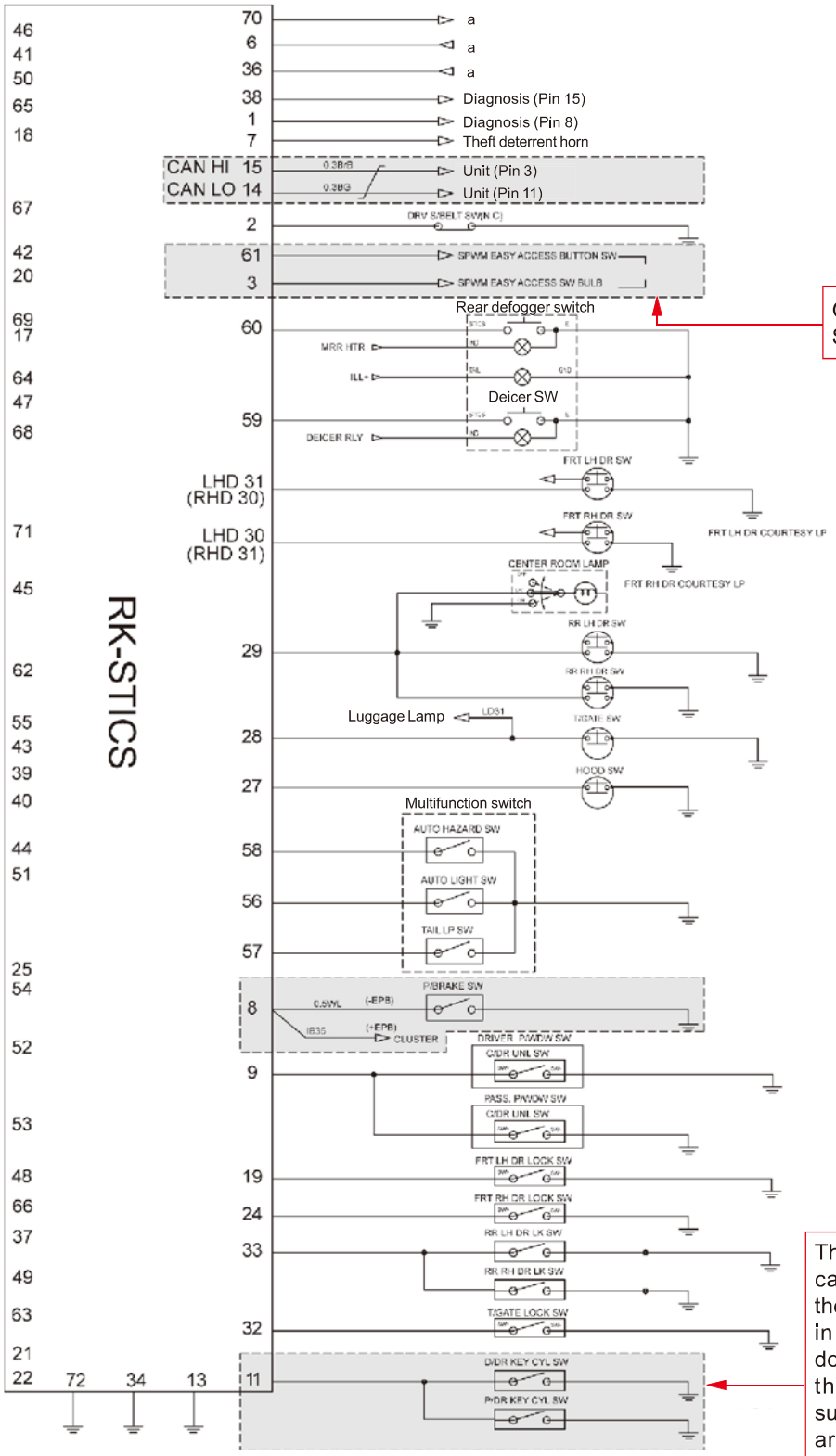


4. CIRCUIT DIAGRAM OF STICS



Modification basis	
Application basis	
Affected VIN	

▶ Output Signals (except STICS)



Only for the model with SPWM unit.

The theft deterrent mode is cancelled when unlocking the doors by the ignition key in driver's or passenger's door key cylinder. However, the mode cannot be resumed even when the doors are locked by the ignition key.

Modification basis	
Application basis	
Affected VIN	

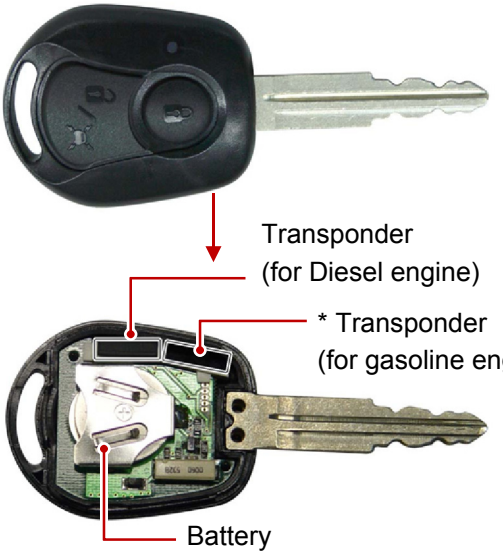
IMMOBILIZER SYSTEM 8710-08

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

▶ **What is the immobilizer system?**

The immobilizer system prevents the vehicle theft by allowing only the authorized key to start the engine. The transponder inside the key communicates with the immobilizer installed in the key box, and the system permits the engine to start after confirming the encrypted coding from the engine ECU. Refer to the information that follows for specific functions and their descriptions.



Modification basis	
Application basis	
Affected VIN	

2. BASIC FUNCTIONS OF IMMOBILIZER KEY (REKES FUNCTION)

The information below is the function that applies to the REKES key and immobilizer key.

Door Lock Button

Lock (briefly press)

- If you press this button briefly, all doors and the tailgate are locked and the theft deterrent mode is activated.
- When the theft deterrent mode is activated, the hazard warning flashers blink twice.

Door Unlock/Panic Button

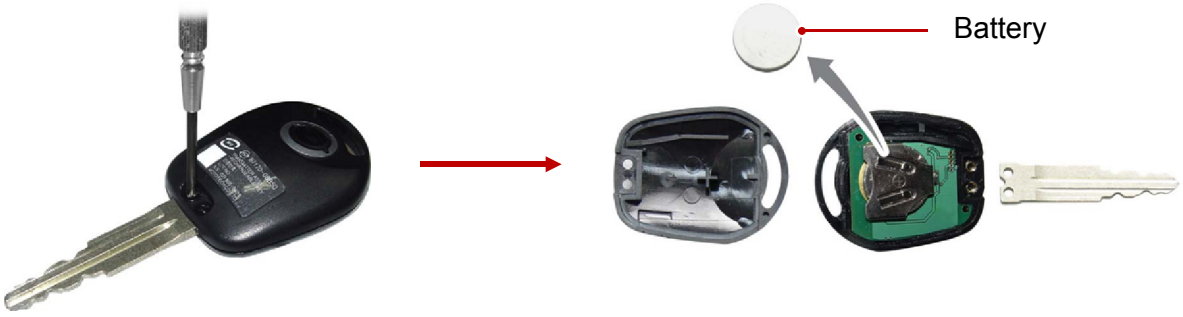
1. Unlock (briefly press)
   - If you press this button briefly, all doors and the tail gate are unlocked and the theft deterrent mode is deactivated.
   - When the deterrent mode is deactivated, hazard warning flashers blink once.

2. Panic function (press and hold)
   - If you are in your vehicle and feel threatened while the ignition key is inserted into the key switch, you may activate the alarm to call attention. If you press this button, the warning siren will sound for approx. 27 seconds.
   - The panic function will stop when any of the buttons on the remote control key is pressed.

Panic Button
(operative only when the ignition key is inserted)

Battery Replacement

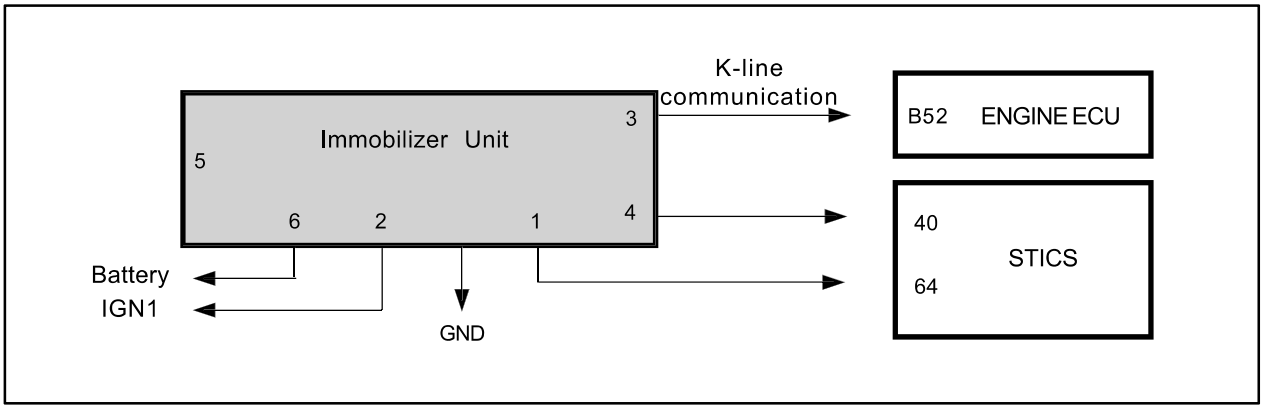
Specification	CR 2032
Quantity	one

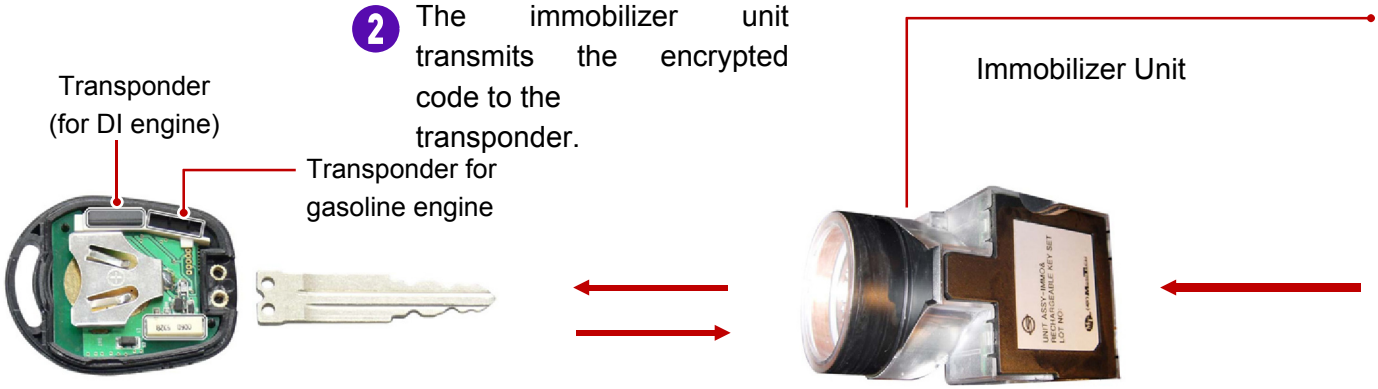


3. OTHER FUNCTIONS IN SYSTEM

▶ Immobilizer Function

The immobilizer system prevents the vehicle theft by allowing only the authorized key to start the engine. The transponder inside the key communicates with the immobilizer installed in the key box, and the system permits the engine to start after confirming the encrypted coding from the engine ECU.





2 The immobilizer unit transmits the encrypted code to the transponder.

3 The transponder sends an encrypted signal to the unit as a response.

4 The transmitted code is changed to an encrypted signal in the unit.

5 The system compares the signal from transponder and the encrypted signal in immobilizer unit.

CAUTION

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

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

Modification basis	
Application basis	
Affected VIN	

▶ Immobilizer and Warning Lamp

This indicator comes on when the ignition key is communicating with the engine control unit (during engine starting) and goes out after starting the engine.

- Lamp ON: in communication
- Blinking twice for one second: immobilizer system failure
- Blinking once for two seconds: immobilizer unit is not coded

CAUTION

- The immobilizer indicator does not come on if the communication time between immobilizer key and ECU is too short.

1 When turning the ignition key to ON position, the ECU transmits the challenge message to the immobilizer unit. (to verify whether the key is valid)

ENGINE CONTROL UNIT (ECU)

6 Only when the two signals are identical, it recognizes the key as the authorized one and transmits the positive message to the ECU.

7 The ECU enable the engine to be started.

CAUTION

- Do not drop or shock to the transponder in the key as it may be damaged.
- With a damaged transponder, the engine cannot be started.
- When you erase the code or register an extra key, let the owner attend on the site. In any case, 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.
- The remote engine starter cannot be installed on the vehicle equipped with the immobilizer system.

CLUSTER

8010-01

GENERAL

1. INDICATOR COLORS AND LED SPECIFICATIONS

Items	Color	LED specification	Items	Color	LED specification
Turn signal lamp (LH/RH)	Green	3.3V 20 mA	4WD HIGH indicator	Green	3.3V 20 mA
Seat belt	Red	2.0V 20 mA	4WD LOW indicator	Amber	2.0V 20 mA
Battery charge warning light	Red	2.0V 20 mA	Winter mode indicator	Green	3.3V 20 mA
Low fuel level warning light	Amber	2.0V 20 mA	Engine CHECK warning light	Amber	2.0V 20 mA
High beam indicator	Blue	3.8V 20 mA	EBD warning light	Red	2.0V 20 mA
Oil pressure warning light	Red	2.0V 20 mA	Front fog light indicator	Green	3.3V 20 mA
Parking brake warning light	Red	2.0V 20 mA	Parking brake warning light (when setting the auto park function)	Green	3.3V 20 mA
Door open warning light	Red	2.0V 20 mA	Immobilizer	Amber	2.0V 20 mA
ABS warning light	Amber	2.0V 20 mA	Coolant temperature warning light	Red	2.0V 20 mA
Pre-glow indicator	Amber	2.0V 20 mA	Water separator warning light	Red	2.0V 20 mA
Air bag warning light	Red	2.0V 20 mA	EPB warning light	Amber	2.0V 20 mA
Auto cruise	Green	3.3V 20 mA	EPB warning light	Amber	3.3V 20 mA
4WD CHECK warning light	Red	2.0V 20 mA	SSPS warning light	Amber	2.0V 20 mA
Global warning	Amber	2.0V 20 mA	EAS warning light	Amber	2.0V 20 mA
TPMS (text)	Amber	2.0V 20 mA	Auto park indicator	Green	3.3V 20 mA
HDC warning light	Red	2.0V 20 mA	HDC indicator	Green	3.3V 20 mA
EAS level change indicator	Green	3.3V 20 mA	Hazard warning light (Exp)	Red	2.0V 20 mA

2. SIGNALS AND LIGHT-ON RELATIONS FOR THE CAN COMMUNICATION OF THE INSTRUMENT PANEL

No	Items	Signal Name	ID	Byte	Bit	Signal bit	Signal function	Cycle time	Remarks
1	ABS	ABS_KL	200	1	2	1BIT	ABS malfunction warning light	21ms	BIT2 ACTIVE : Symbol ON CAN BUS DR EPB UNIT OPEN → Continuously ON
2	EBD	EBD_KL		1	6	1BIT	EBD malfunction warning light	21ms	BIT6 ACTIVE: Symbol ON
3	ESP	ESP_KL		1	3	1BIT	ESP warning light	21ms	BIT3 ACTIVE: Symbol ON
		ESP_INFO_BUZZ			4	1BIT	ESP buzzer	21ms	BIT4 ACTIVE: Buzzer output
		ESP_INFO_BL			5	1BIT	ESP warning light flashing	21ms	BIT5 ACTIVE: Symbol flashing
4	CRUISE	TM_EIN	210	6	5	1BIT	Cruise control operation	20ms	BIT5 ACTIVE: Symbol ON
5	WINTER	FPC	418	2	0	8BIT	Winter indicator	20ms	Data of ID418_2BYTE's map is 57: Symbol ON Driving program: indicates "W"
6	CAN VARIANT	VC_TPMS	609	4	0	1BIT	Vehicle code - TEMP	100ms	"0": Without "1": With
		VC_EPB		5	1	1BIT	Vehicle code - EPB	100ms	"0": Without "1": With
		VC_EAS		5	2	3BIT	Vehicle code - EAS	100ms	"0": Without "2": EAS at 2 corner
9	Cluster	E/L SW	409	1	1	1BIT	Easy loading	100ms	NORMAL MODE: 0 (HEX) EASY LOADING MODE: 1 (HEX)
		MG_P		1	5	3BIT	Gear position (M/T)	100ms	"N" POSITION: 1 (HEX) EXCEPT "N", "R": 2 (HEX) "R" POSITION: 3 (HEX)
		I/G_S		1	4	1BIT	Ignition status	100ms	IGNITION OFF: SINGNAL NOT SENDING IGNITION ON: "1"
		TANK_FS_COMBI	408	1	0	8BIT	Fuel tank level	100ms	RESOLUTION: 1L RANGE: 0 ~ 100L
		KMIB		7	0	16BIT	Odometer display	100ms	RESOLUTION: 2Km RANGE: 0 ~ 99998Km
		EPB_MO	409	1	0	1BIT	EPB mode status	100ms	NORMAL MODE: 0 CITY MODE: 1

Modification basis	
Application basis	
Affected VIN	

No	Items	Signal name	ID	Byte	Bit	Signal bit	Signal function	Cycle time	Remarks
9	Cluster	OM_HIGH	409	2	4	4BIT	Trip A/B display	100ms	RANGE 0 ~ 1.5 MILION Km RESOLUTION: 0.1 MILION Km
		SPEED_ COMBI		3	0	10BIT	Speedometer	100ms	RANGE: 0 ~ 1023 Km/h RESOLUTION: 2 Km/h
		DOOR_ OPEN		1	2	1BIT	Door open status	100ms	OPEN "1" CLOSE "0"
		TRUNK_ OPEN		1	3	1BIT	Tailgate open status	100ms	ALWAYS 0 IN CASE OF 2 CORNAL EAS SYSTEM
11	Fuel filter	WKS_KL	308	1	1	1BIT	Fuel fileter water separator	20ms	Bit_1 ACTIVE : Symbol ON
12	Glow	VGL_KL	308	4	3	1BIT	Glow indicator (with glow relay)	20ms	Bit_3 ACTIVE: glow indicator ON (if glow control relay is "0")
		GLOW_ IND		5	6	2BIT	Glow indicator (with AQGS)	20ms	0: Glow indicator 1: Indicator ON 2: Indicator flashing 3: No signal
13	4WD HIGH	4H_L	428	1	4	1BIT	4H indicator	20ms	Bit_4 ACTIVE: Symbol ON
	4WD LOW	4L_L		1	5	1BIT	4L indicator	20ms	Bit_5 ACTIVE: Symbol ON
	4WD CHECK	DIAG_L		1	6	1BIT	4WD CHECK warning light	20ms	Bit_6 ACTIVE: Symbol ON
14	TEMP warning	T_MOT	608	1	0	8BIT	Coolant temperature warning light	100ms	Temp data is 0 (hex): symbol flashing (500ms ON/OFF)
15	HDC	HDC_WL	330	5	0	2BIT	HDC warning light (red)	21ms	Bit 1 ACTIVE: Symbol flashing Bit 2 ACTIVE: Symbol flashing Only HDC warning light flashes if HDC warning light and operation indicator are active at the same time.
		HDC_FL	330	5	2	2BIT	HDC warning light (green)	21ms	Bit 1 ACTIVE: Symbol ON Bit 2 ACTIVE: Symbol flashing Function symbol flashing & Wwarning symbol flashing → Warning symbol and function symbol comes on alternatively
16	MS	IMMO_ LIGHT	320	5	6	1BIT	Immobilizer indicator	20ms	ID 320 5BYTE MAP zoom 00 (hex): OFF 01 (hex): ON

OVERVIEW AND OPERATION PROCESS

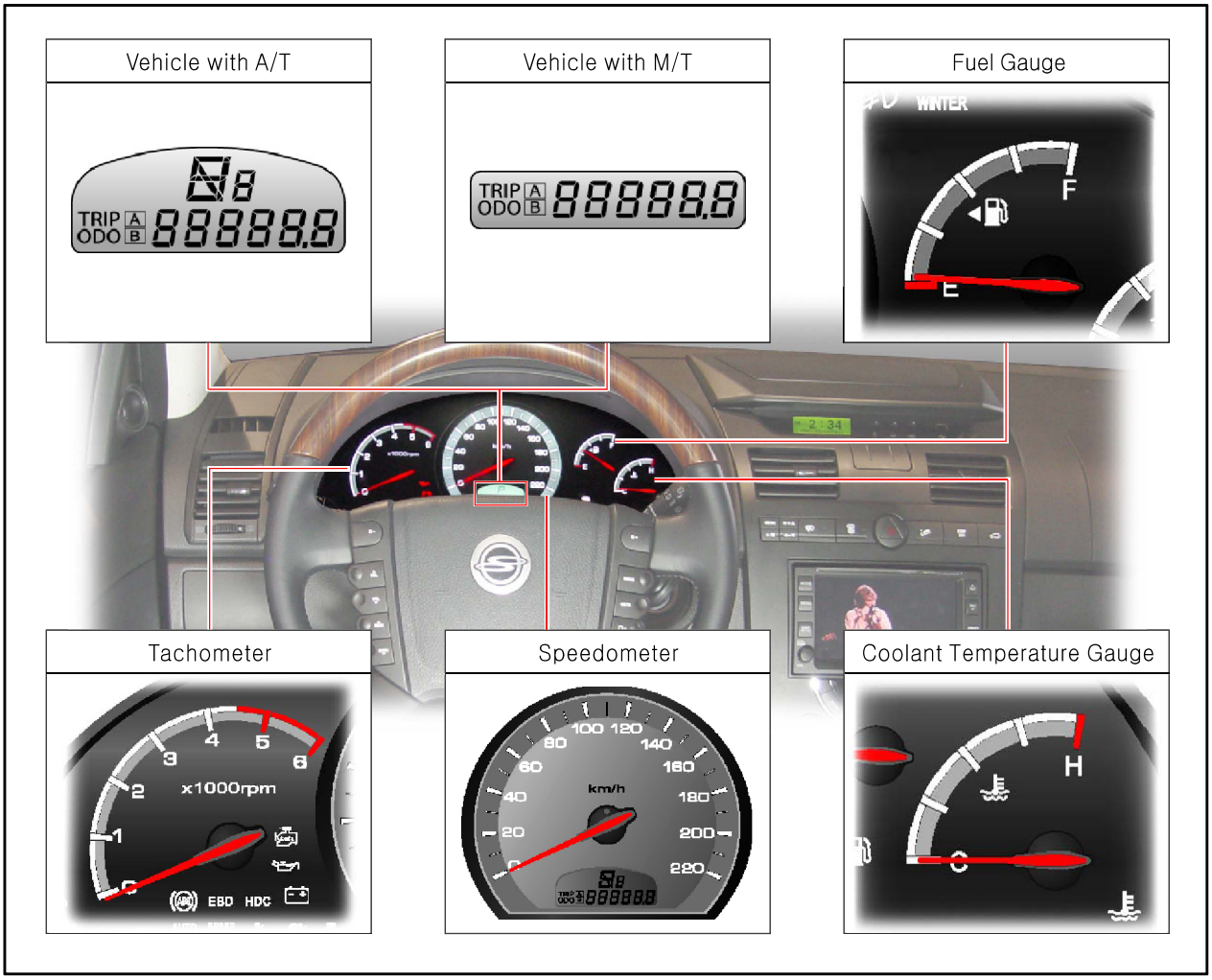
1. OVERVIEW

The instrument cluster uses the CAN communication.
The HDC warning lights (green & red) are added since the HDC function has been introduced into ESP system.

Green	Turn signal, 4WD HIGH, WINTER, Parking Brake, HDC, Front fog light
Blue	High beam
Red	Seat belt, Battery charge, 4WD CHECK, Oil pressure, Door ajar, EBD, Brake, Airbag, Water separator, HDC, Coolant temperature
Amber	Engine CHECK, ABS, Global warning, TPMS, Fuel, Pre-glow, ESP, 4WD LOW, SSPS, Immobilizer

Modification basis	
Application basis	
Affected VIN	

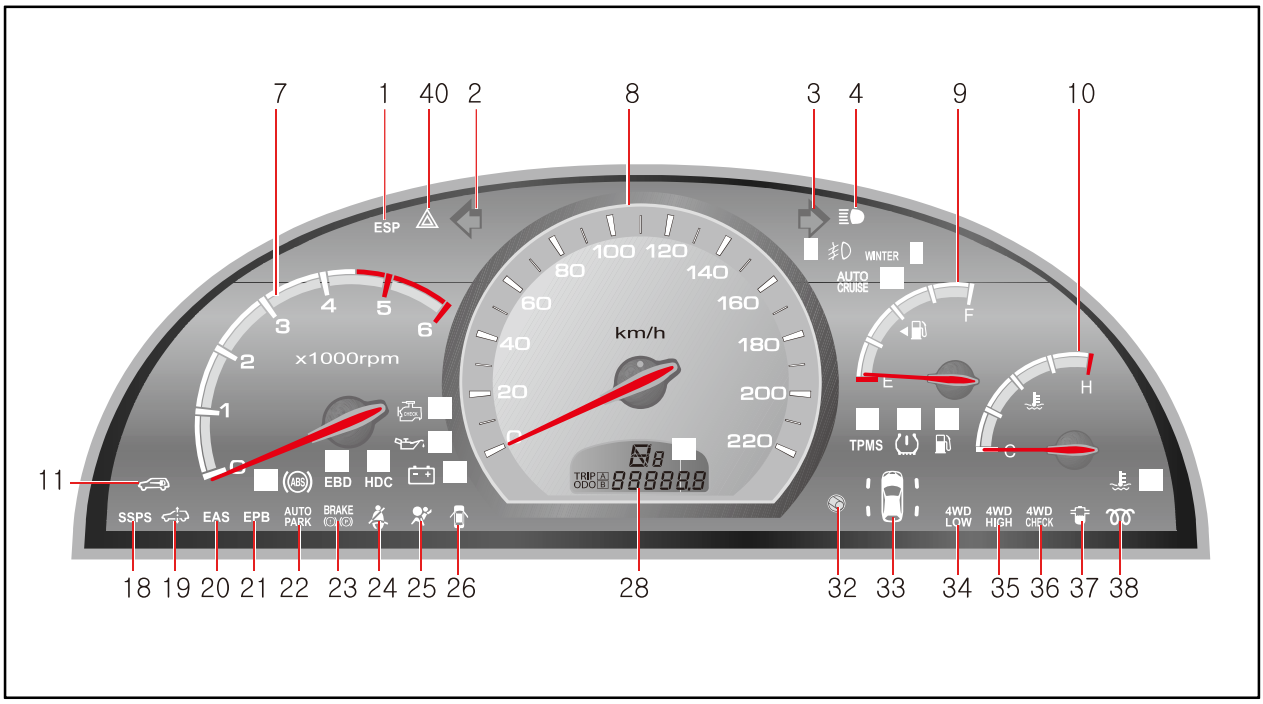
2. LOCATION AND CONFIGURATION



Modification basis	
Application basis	
Affected VIN	

3. DESCRIPTIONS OF INDICATOR DISPLAY

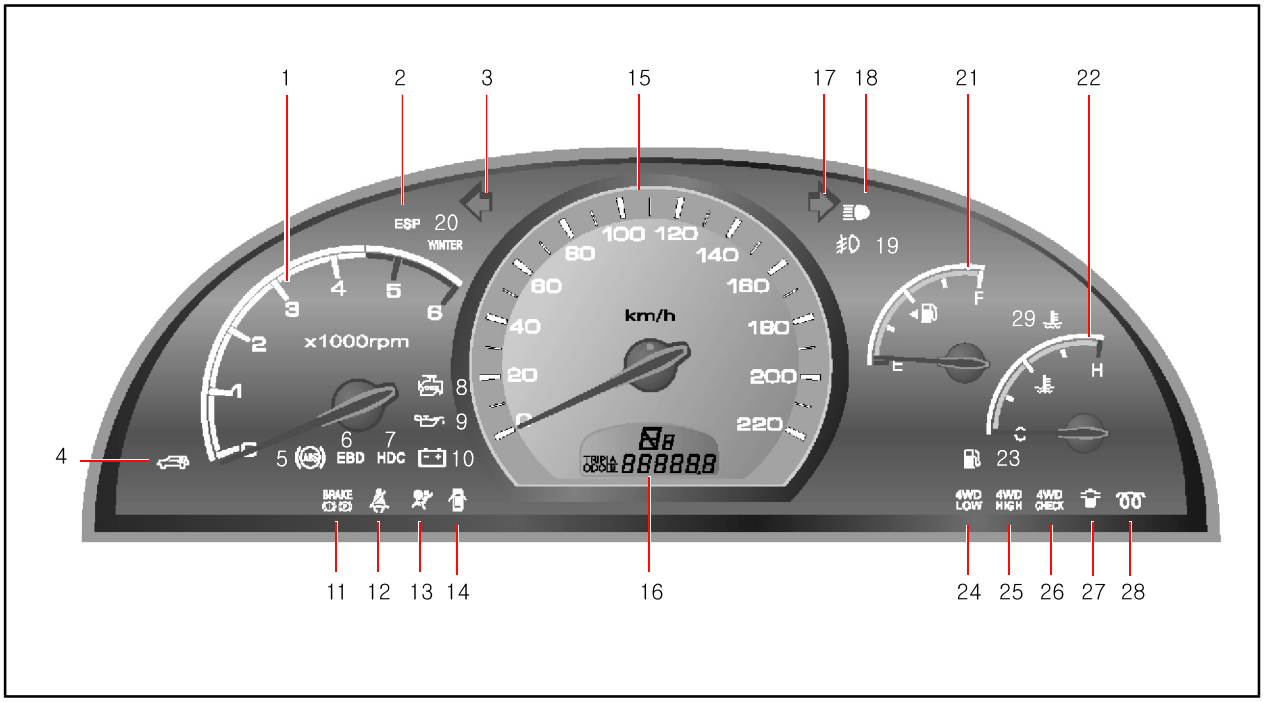
1) Deluxe Version



1. ESP warning light
2. Left turn signal indicator
3. Right turn signal indicator
4. High beam indicator
5. Front fog light indicator
6. Winter mode indicator
7. Tachometer
8. Speedometer
9. Fuel gauge
10. Engine coolant temperature gauge
11. Immobilizer indicator
12. ABS warning light
13. EBD warning light
14. HDC indicator
15. Engine check warning light
16. Engine oil pressure warning light
17. Battery charge warning light
18. SSPS warning light
19. EAS level change indicator
20. EAS warning light
21. EPB warning light
22. Automatic parking brake setting indicator
23. Brake warning light
24. Seat belt reminder (driver's seat)
25. Air bag warning light
26. Door ajar warning light
27. Auto shift indicator
28. Odometer/ Trip odometer
29. TPMS warning light
30. Global warning
31. Low fuel level warning light
32. Trip switch
33. Tire inflation pressure indicator
34. 4WD LOW indicator
35. 4WD HIGH indicator
36. 4WD CHECK warning light
37. Water separator warning light
38. Glow indicator
39. Engine overheat warning light
40. Hazard indicator
41. Auto cruise indicator

Modification basis	
Application basis	
Affected VIN	

2) Standard Version



1. RPM gauge
2. ESP warning light
3. Left turn signal indicator
4. Immobilizer indicator
5. ABS warning light
6. EBD warning light
7. HDC warning light
8. Engine CHECK warning light
9. Engine oil pressure warning light
10. Charge warning light
11. Brake warning light
12. Seat belt reminder
13. Air bag warning light
14. Door open warning light
15. Speedometer
16. Gear display/Odometer
17. Right turn signal indicator
18. High beam indicator
19. Front fog lamp indicator
20. Winter mode indicator
21. Fuel level gauge
22. Coolant temperature gauge
23. Low fuel level warning light
24. 4WD LOW indicator (TOD/Part time)
25. 4WD HIGH indicator (Part time)
26. 4WD CHECK warning light (TOD/Part time)
27. Water separator warning light
28. Glow indicator
29. Over temperature warning light

4. CONFIGURATION

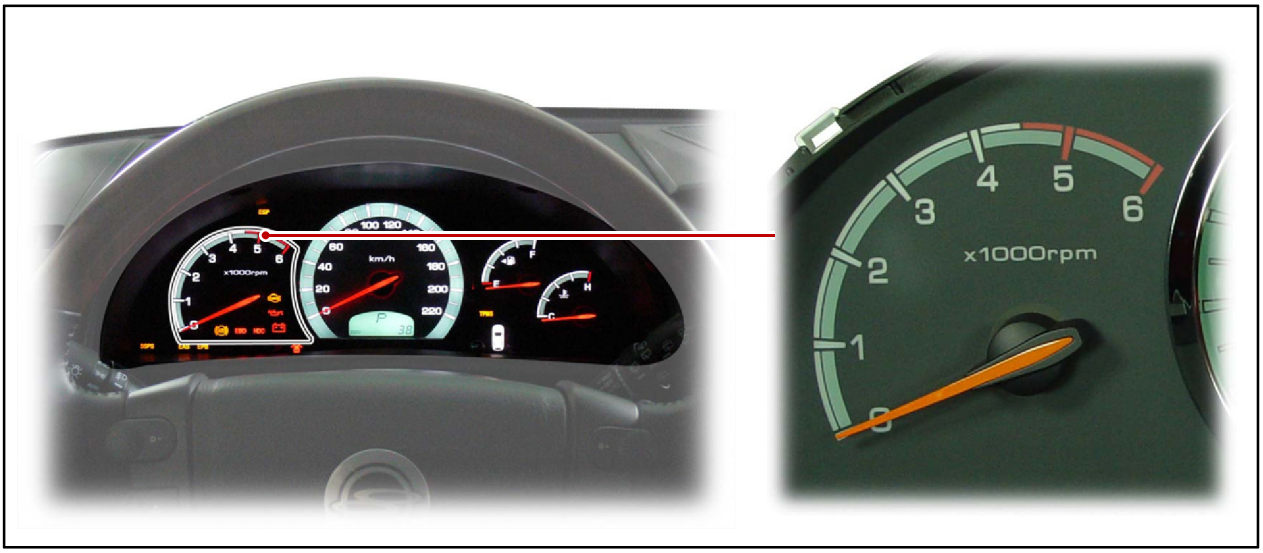
▶ **Deluxe Version**

▶ **Standard Version**

Modification basis	
Application basis	
Affected VIN	

5. WARNING LIGHTS AND INDICATORS

1) Engine 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.
Under the normal engine operating temperature, the proper idling speed is 750 ± 50 rpm for D27DT engine. The red zone (danger rpm range) starts from 4,500 rpm.

1. Connect the tachometer for tune-up test and start the engine.
2. Eliminate the hysteresis by tapping the tachometer.
3. Compare the values on the tester and tachometer and replace the tachometer if the tolerance is excessive.

Description	Specification (VIN=13 ± 0.1V, Temperature: 25°C)						
Engine speed (rpm)	750	1000	2000	3000	4000	5000	6000
Tolerance (rpm)	-	+100	+100	+100	+100	+100	-
	-	-100	-100	-100	-100	-100	

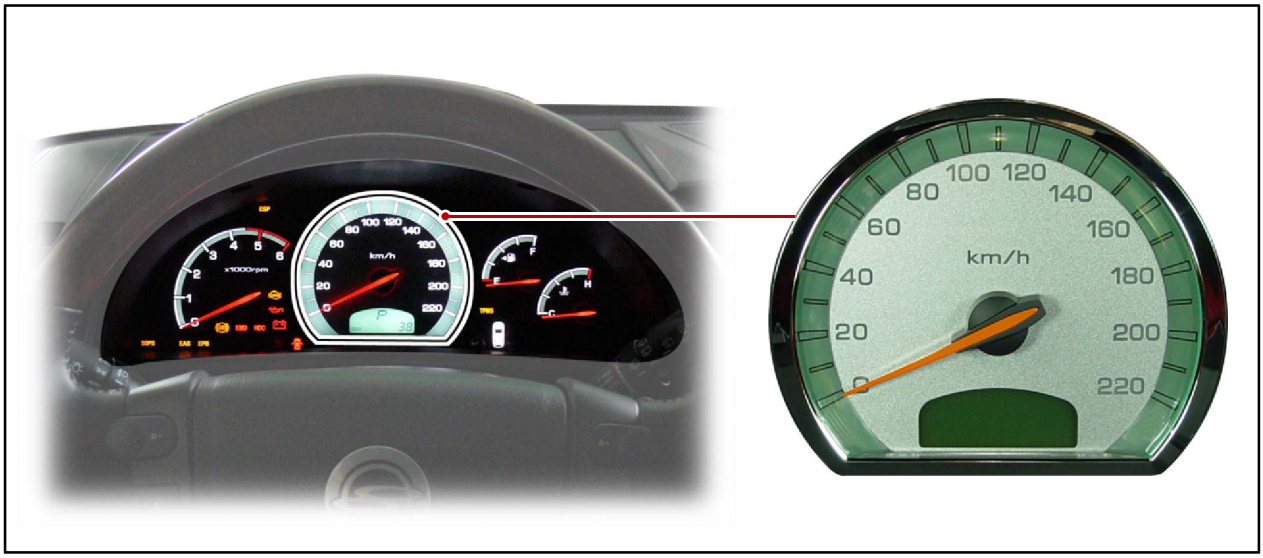
CAUTION

- For vehicle equipped with gasoline engine, the indicator shows up to 7,000 rpm and 8,000 rpm. The tolerance at 7,000 rpm is ±100.

Checking

If the tachometer pointer vibrates, stands at a certain range or sounds abnormal noise, there could be defectives in tachometer. If there is a difference between actual engine speed (rpm) and reading from tachometer, connect a scanner and then compare the value on tachometer with the reading from scanner.

2) Speedometer Gauge



The speedometer indicates the vehicle speed by calculating the signals from the rear wheel speed sensors through ABS or ESP unit (speed signal cycle: 21 ms).
If the speedometer gauge vibrates, stops at a certain range or makes an abnormal noise, there could be defectives in speedometer. However, these symptoms also could be occured when the tire has uneven wear, different tire inflation pressures or different tire specifications.

Perform the speedometer test regarding the tolerance as described. However, it is not similar simple work in field due to lack of measuring conditions such as test equipment and preciseness.

1. Check the allowable tolerance of the speedometer and operations of the trip odometer by using a tester.
2. Check if the speedometer gauge is shaking and the abnormal noise sounds.
3. Eliminate the hysteresis by tapping the speedometer.

Description	(VIN = 13 ± 0.1V, Temperature: 25°C)								
Standard speed (Km/h)	20	40	(60)	80	100	120	140	(160)	(180)
Tolerance (Km/h)	+4	+4	+7	+9	+10.5	+12.5	+14.5	+16	+18
	0	0	+2.5	+3.5	+4	+6	+7.5	+8.5	+10

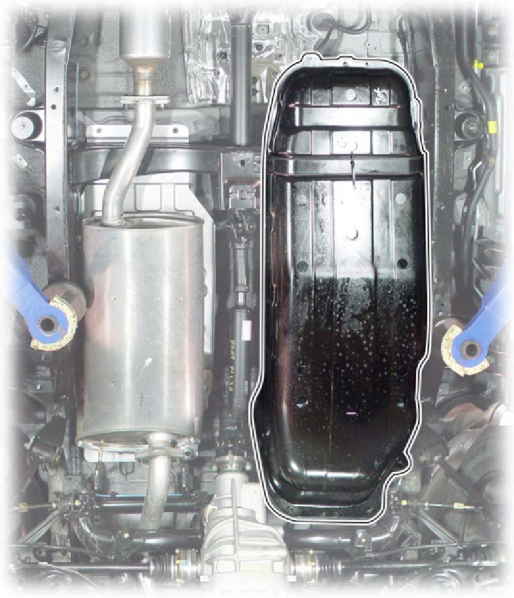
CAUTION

- The allowable tolerance increases when the tires are worn or the tire pressure is out of specified range.
- If an incorrect tire is installed on the vehicle, the speedometer may indicate the wrong values and the units based on the vehicle speed may not work properly.
  - Vehicle speed = CAN INPUT DATA x CAN constant
  (CAN Constant = 2 x π x tire radius (dynamic load) x 60 min x 0.5 rpm)

Modification basis	
Application basis	
Affected VIN	

3) Fuel Level Gauge

Fuel tank: 78 liters



Service hole for removing fuel sender (under the rear left seat)

The fuel level gauge displays the resistance value of the float on the fuel sender in the fuel tank through a pointer.
Note that this vehicle doesn't have a service hole for checking the fuel sender connector in the fuel tank. The fuel sender and its connector can be checked and replaced only when the fuel tank is removed. The power supply and resistance value should be measured at the connector in front of the fuel sender (refer to wiring diagram).
When the power supply and output resistance are normal, the float operation by fuel level may be defective; if so, replace the fuel sender.

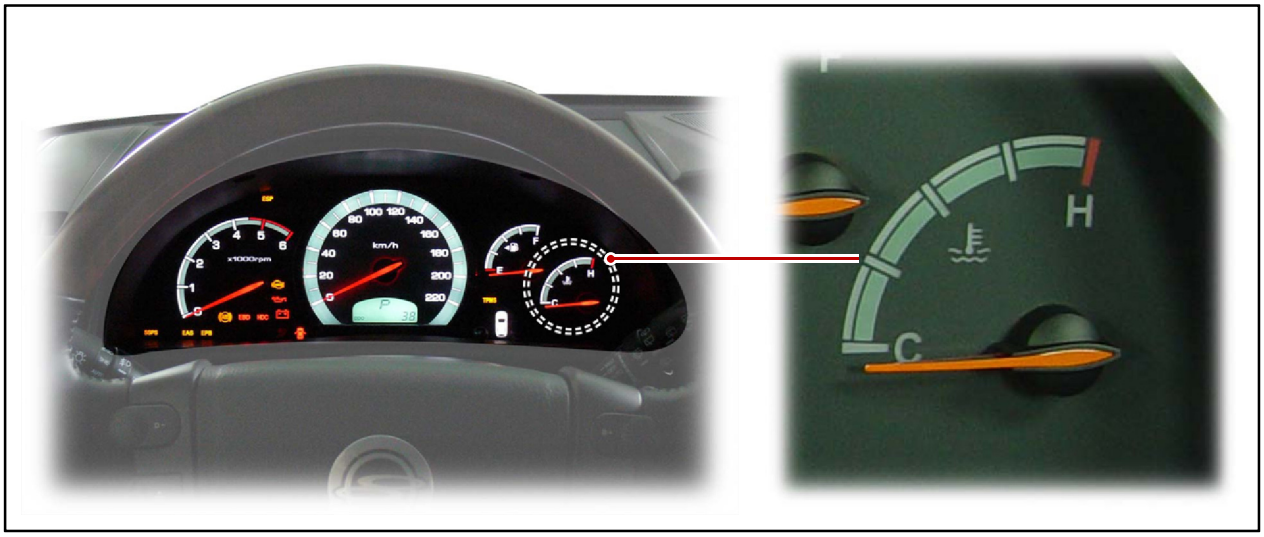
▶ Tolerance and resistance value by indicating angle

	Specification (VIN= 13.5 ± 0.1 V, temperature: 25°C)									
Scale	Full	Full (Gauge)	7/8	3/4	5/8	1/2	1/4	Fuel warning lamp ON	Empty (Gauge)	Empty (center)
Indicating angle (°)	54	50	37.5	25	12.5	0	-25	-47	-50	-54
Tolerance (°)	+2, -2	+2, -2	-	-	-	± 5	-	± 2	+2, -2	+2, -2
Fuel sender resistance (Ω)	38	43	55.8	67	82.5	99.5	150	DSL: 266 GSL: 260	276.3	283
Fuel level in tank	78 liters	76 liters	67 liters	58 liters	49 liters	41 liters	25 liters	DSL: 9.0 GSL: 9.5 liters	5 liters	-

This table shows the tolerance and resistance value changes by fuel level in normal conditions. Therefore, the differences that can be occurred by the road conditions and fuel fluctuations are ignored.

Modification basis	
Application basis	
Affected VIN	

4) Coolant Temperature Gauge



Using a needle, it displays the coolant temperature obtained from the engine coolant temperature sensor. The PTC resistance value of the coolant temperature sensor is transmitted to the engine ECU and then to the cluster as CAN signal. The angle of guage that can be varied by coolant temperature is as shown below.

		Tolerance and resistance value by indicating angle		
Indicating angle (°)	-50	0 (center)		+50
Tolerance	+0°C -5°C	+0°C -5°C	+0°C -5°C	+5°C +0°C
Coolant temperature	Less than 40°C	70 ~ 110°C (diesel)	80 ~ 110°C (gasoline)	Over 125°C

Measurement of coolant temperature sensor resistance

Measure the resistance between the terminal and the ground with an ohmmeter and replace if the resistance is out of specified range.

Resistance value by coolant temperature: 20°C - 2449Ω ± 5 %
50°C - 826Ω ± 5 %
80°C - 321Ω ± 5 %
100°C - 12Ω ± 5 %

- When the resistance value by coolant temperature is within the specified range, check thermostat, water pump, radiator related coolant circuit for normal operation. Also, check the wiring harnesses and connectors for proper connection (D27DT engine ECU: NO.101, 102 / D27DTP (power up) engine ECU: A56, A57).
- The time when the engine coolant temperature reaches the normal temperature (gauge indicating angle: 0°) depends on the ambient temperature and the vehicle's load. Therefore, the coolant temperature gauge should be used only for reading its movement.

6. WARNING & INDICATOR PANEL

Immobilizer Indicator

This indicator comes on when the ignition key is communicating with the engine control unit (during engine starting) for approx. 0.5 seconds.

SSPS warning light

This warning light comes on if there is malfunction in the SSPS (Speed Sensing Power Steering) which changes the sterring force according to the vehicle speed.

Green	Turn signal, 4WD HIGH, WINTER, Parking Brake, HDC, Front fog light
Blue	High beam
Red	Seat belt, Battery charge, 4WD CHECK, Oil pressure, Door ajar, EBD, Brake, Airbag, Water separator, HDC, Coolant temperature
Amber	Engine CHECK, ABS, Global warning, TPMS, Fuel, Pre-glow, ESP, 4WD LOW, SSPS, IMMO

ESP Warning Light

This warning light comes on when pressing the " ESP OFF" switch or the ESP system is defective. If the ESP function operates while driving, this warning light flickers and the alarm sounds.

ABS Warning Light

This warning light comes on when the ignition switch is turned to ON and should go out if the system is normal. The vehicle equipped with ABS performs self-diagnosis on the system when the engine is started and drives off. During the diagnosis, brake pedal vibration and noise may be apparent when the driving motors discharges the hydraulic pressure from the internal hydraulic device. This means the ABS is properly functioning.

EBD Warning Light

This warning light comes on when the ignition switch is turned to ON and should go out if the system is normal. If the EBD system is abnormal, EBD warning light comes on.

HDC Warning Light

Green light on: HDC is ready for use (by pressing the HDC switch).
Green light blinking: HDC is being applied.
Red light on: the HDC system is overheated or malfunctioning.
When HDC is applied, the green HDC indicator blinks. When the red HDC indicator is on, the HDC system is overheated or malfunctioning.

When the red HDC indicator is on, the HDC function does not work.

Battery Charge Warning Light

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

Engine Check Warning Light

If the light stays on or comes on while driving, some of engine control components including sensors and devices are defective.
When this warning light comes on, the vehicle operates in safety mode to maintain minimum driving conditions and to prevent the system from being damaged. In this mode, the engine driving force may be decreased or the engine may stall.

Engine Oil Pressure Warning Light

This warning light comes on when the ignition is switched on and should go out when the engine is started. If the light comes on while driving, it indicates that the oil pressure is dangerously low.

Modification basis	
Application basis	
Affected VIN	

High Beam Indicator

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

Fog Lamp Indicator

When the tail or head lights are on, the fog lights come on if the fog light switch is turned to the "ON" position. Then, the fog light indicator comes on the instrument panel.

Winter Mode Indicator

WINTER

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

Seat Belt Reminder

The seat belt warning light comes on and the seat belt warning chime sound for 6 seconds when the ignition switch is turned to "ON" position unless the driver's seat belt is securely fastened. This reminding operation stops when the driver fastens the seat belt even during its operation period.

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.

Over Temp. Warning Light

When the engine coolant temperate is abnormally hot (over 120ºC), the engine overheat warning light blinks and a warning buzzer sounds. (check the coolant system)

Water Separator Warning Light

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 and water separator.

Glow Indicator

This indicator comes on when the ignition switch is turned on and stays on for a short time or may go off right away. When the glow plugs are sufficiently heated for cold starting, the light will go out. In the vehicle equipped with direct injection type engine, this indicator may come on very shortly or may not come on.

Door Open Warning Light

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

Low Fuel Level Warning Light

This warning light indicates that the fuel will soon be exhausted. The time it takes to turn on, however, varies according to the vehicle operating conditions or gradient of the road.

4WD Indicator

4WD LOW indicator

4WD LOW

It is applied only to the vehicle with part-time 4WD and TOD. When shifting the driving mode to "4WD LOW", this indicator blinks until the shifting operation is completed. After completion of mode change to 4WD LOW, the indicator goes off.

4WD HIGH indicator

4WD HIGH

When shifting the driving mode from "4L" to "4H", this indicator blinks until the shifting operation is completed. After completion of the mode change to 4H, the indicator comes on.

4WD CHECK Warning Light

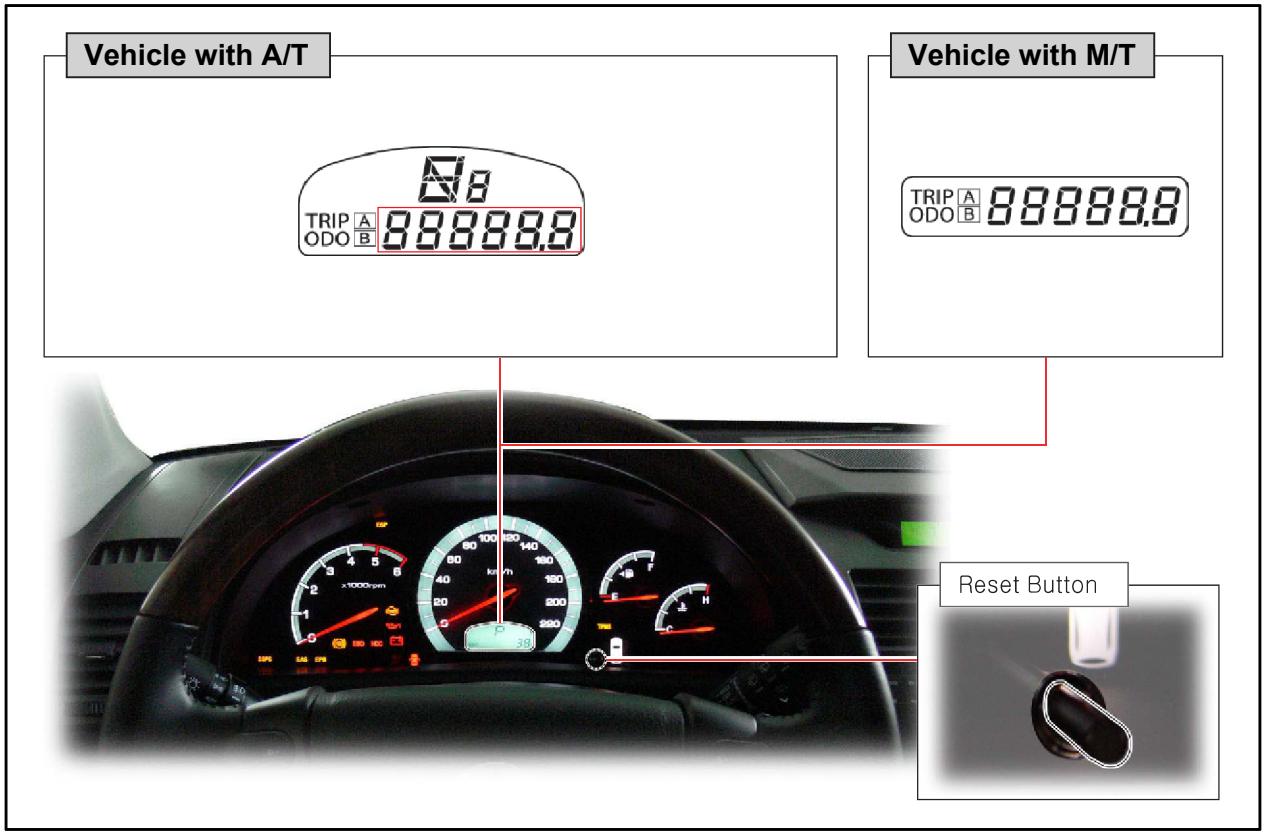
4WD CHECK

If "4WD CHECK" warning light stays on continuously, it may indicate that there is something wrong in the transfer case system.

The vehicle with AWD (All Wheel Drive) doesn't have indicators, warning light, and switch related to 4WD system.

7. INSTRUMENT CLUSTER OPERATION PROCESS

1) TRIP Odometer (TRIP A, TRIP B) and Odometer



▶ **Press "RESET button" to go the each mode.**

Mode changes

0 (Zero) setting when pressing and holding the RESET button in TRIP A/B mode

ODO for less than 1 second (briefly press) → TRIP A for less than 1 second (briefly press) → TRIP B for less than 1 second (briefly press) → ILL MODE for less than 1 second (briefly press)

for less than 1 second (briefly press) | for less than 1 second (briefly press) | for less than 1 second (briefly press)

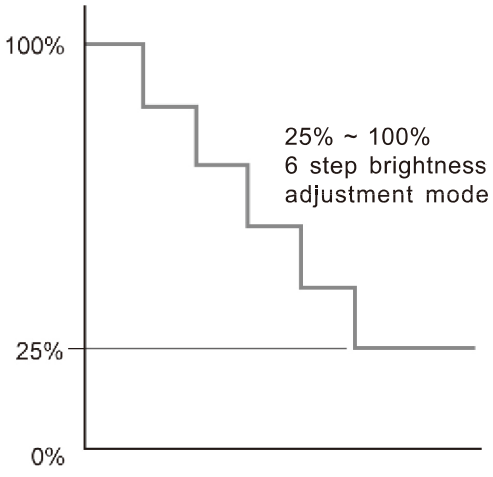
ODO	TRIP A	TRIP B
Display Range: 0~999999 km	Display Range: 0.0~999.9 km	Display Range: 0.0~999.9 km
Minimum unit: 1 km	Minimum unit: 0.1 km	Minimum unit: 0.1 km

Modification basis	
Application basis	
Affected VIN	

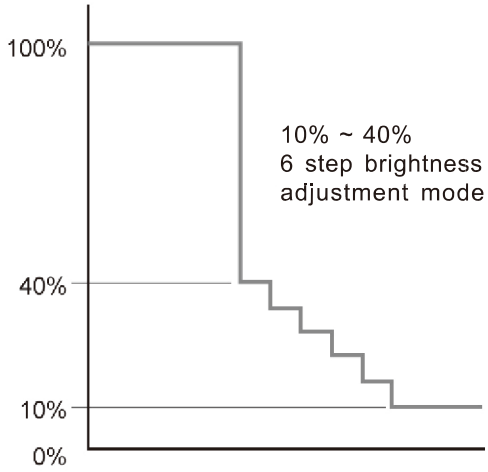
2) Cluster Brightness Adjustment Mode (Rheostat)

For the black face type cluster, the brightness can be adjusted in 6 steps each in day time mode and night time mode.
The tail lamp ON condition is used to determine whether it should be the day time mode or the night time mode.

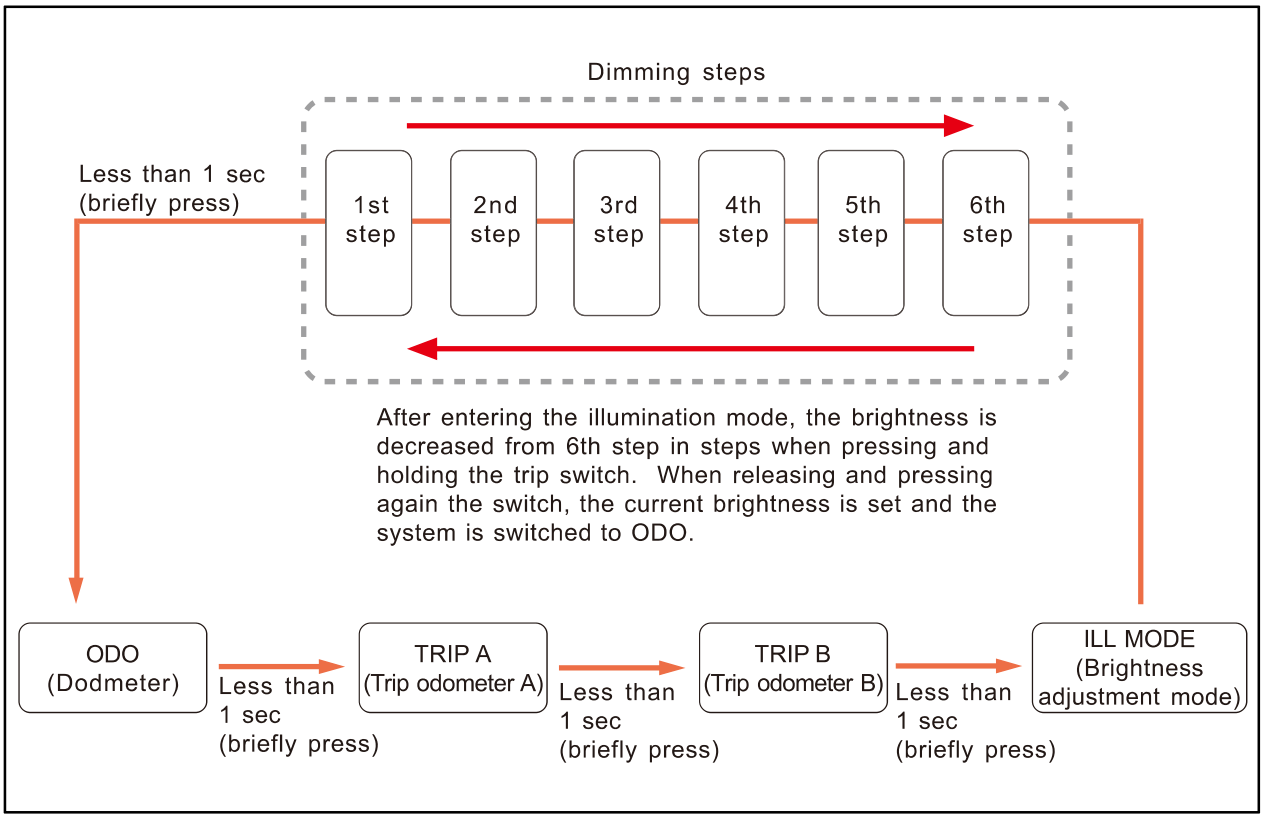
Day Time (tail lamp OFF)



Night Time (tail lamp ON)



The brightness can be adjusted using TRIP switch as follows:



3) Operation of HDC Indicator Controller

Pressed

This table describes the coming-on and blinking mode of HDC indicator according to the HDC switch operation (ON/OFF). The HDC indicator on the instrument panel has two modes; green (function lamp) and red (warning lamp). The HDC switch is a push & self return type switch ? when you press it once, it starts to operate and when you press it again, it stops the operation. For its functions and operation logic, refer to "ABS/ESP" in Chassis section.

CAUTION

Basically, the brake system's basic functions can work even when there are problems with the HDC system. As given in the table above, the HDC warning lamp comes on when:

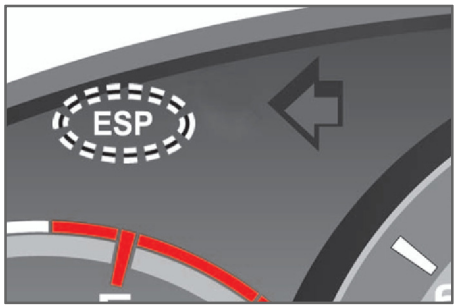
- Initial ignition ON
- HDC system error occurs
- Brake system overheat

<table>
<tr><td colspan="3" rowspan="3">HDC Operation Mode</td><td colspan="2">HDC indicator</td><td>HDC warning lamp</td></tr>
<tr><td colspan="2">Green</td><td>Red</td></tr>
<tr><td colspan="2">HDC</td><td>HDC</td></tr>
<tr><td colspan="3">Initial ignition ON (From hence, this signifies operation mode after the engine starts. Even when HDC switch is ON, if the ignition is OFF, HDC operation stops automatically.)</td><td colspan="2">OFF</td><td>ON</td></tr>
<tr><td rowspan="2">Not available</td><td colspan="2">HDC switch OFF</td><td colspan="2">OFF</td><td>OFF</td></tr>
<tr><td colspan="2">HDC system error</td><td colspan="2">OFF</td><td>ON</td></tr>
<tr><td rowspan="2">Stand-by</td><td colspan="2">HDC switch ON</td><td colspan="2">ON</td><td>OFF</td></tr>
<tr><td colspan="5">The HDC switch is turned ON, but HDC system is in stand-by mode because the operating requirements are not met.</td></tr>
<tr><td rowspan="2">In operation</td><td colspan="2">HDC system is operating.</td><td colspan="2">Blinking (0.5 seconds of interval)</td><td>OFF</td></tr>
<tr><td colspan="5">The HDC switch is turned ON, and the operating requirements are met. HDC is operating with operating sound.</td></tr>
<tr><td rowspan="3">System overheat</td><td rowspan="2">High brake system temperature (over 350°C)</td><td>HDC stand-by mode</td><td colspan="2">OFF</td><td>Blinking</td></tr>
<tr><td>HDC is operating</td><td colspan="3">Alternate blinking of green and red lamp (0.5 seconds of interval)</td></tr>
<tr><td colspan="2">Too high brake system temperature (over 450°C)</td><td colspan="2">OFF</td><td>ON</td></tr>
<tr><td colspan="5">There is no specific temperature sensor in the system, but a programmed logic inside the HECU predicts the temperature based on the operating numbers and conditions of HDC (HDC cannot be operated).</td></tr>
</table>

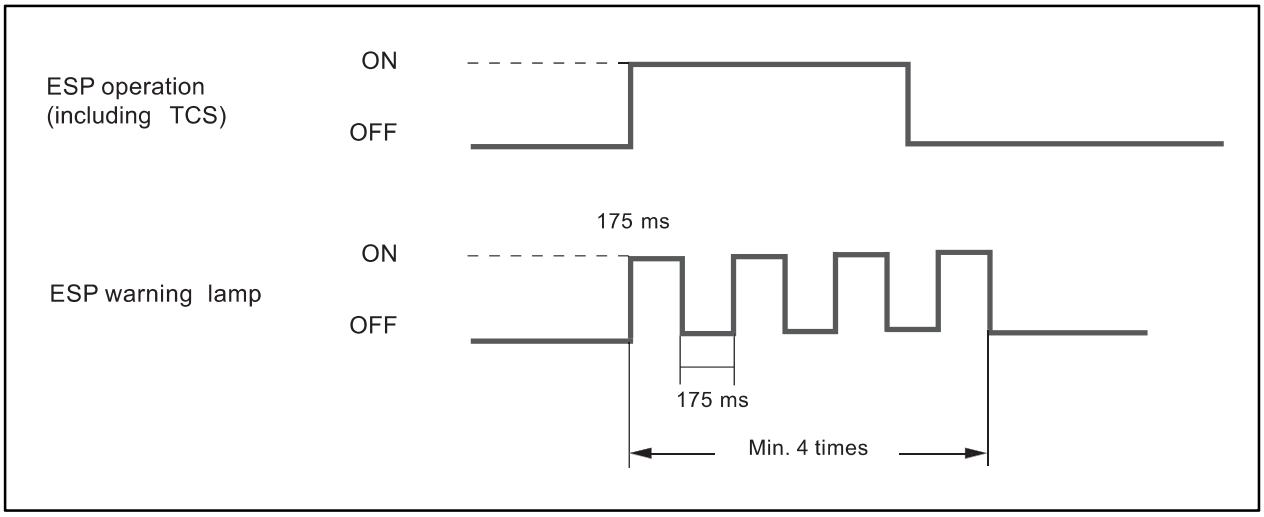
Modification basis	
Application basis	
Affected VIN	

4) ESP Warning Lamp

(1) ESP Warning Lamp Blinking in Control

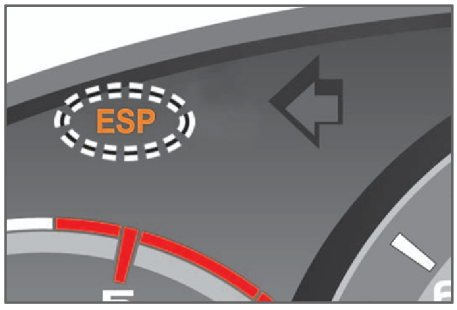


ESP warning lamp blinks when ESP control is activated. If the activation reaches a certain limitation, a beep sounds to warn the driver. The ESP warning lamp goes off when ESP function is deactivated.
Even when the ESP is operated for a very short period of time, the ESP warning lamp blinks minimum of 4 times every 500 milliseconds.



(2) ESP System Cancellation Using the ESP OFF Switch

Pressed

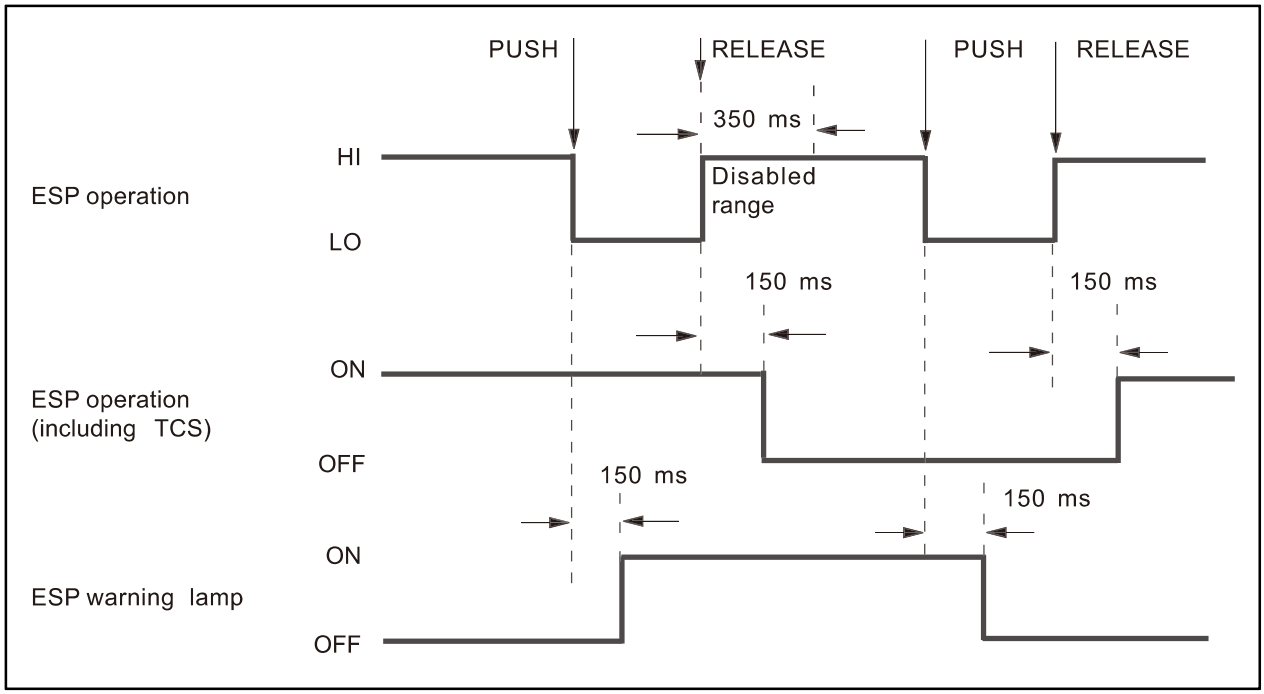


When the ESP switch is pressed (for over approximately 150 ms), the ESP system will be cancelled and the vehicle will be driven regardless of the output values from the corresponding sensors. Then, the ESP warning lamp on the instrument panel comes on. The detailed operation procedures are as follows:
1. The ESP warning lamp comes on when the ESP OFF switch is pressed for over 150 ms. 2. The switch returns to normal position when the OFF switch is released.
3. The ESP system will be cancelled after approximately 150 ms. Based on the above procedures, we can see that the ESP system will be cancelled after a certain period (approx. 150 ms) from releasing the switch to the original position. The ESP system does not get canceled immediately when the ESP warning lamp is turned on by pressing
the ESP OFF switch. When you turn the ESP system off by pressing the ESP switch for over 150 ms, the TCS system is turned off. And the basic ABS system will operate.

(3) Resuming the ESP System by Using the ESPOFF Switch

The ESP system will be resumed and the ESP warning lamp at the instrument panel goes off when the ESPOFF switch at the center switch panel is pushed (for over approximately 150 ms) while the ESP system is not operating.
The detailed operation procedures are as follows.

1. The ESP warning lamp comes on when the ESPOFF switch is pushed for over 150 ms.
2. The switch returns to normal position when the OFF switch is released.
3. The ESP system will be resumed after approx. 150 ms.



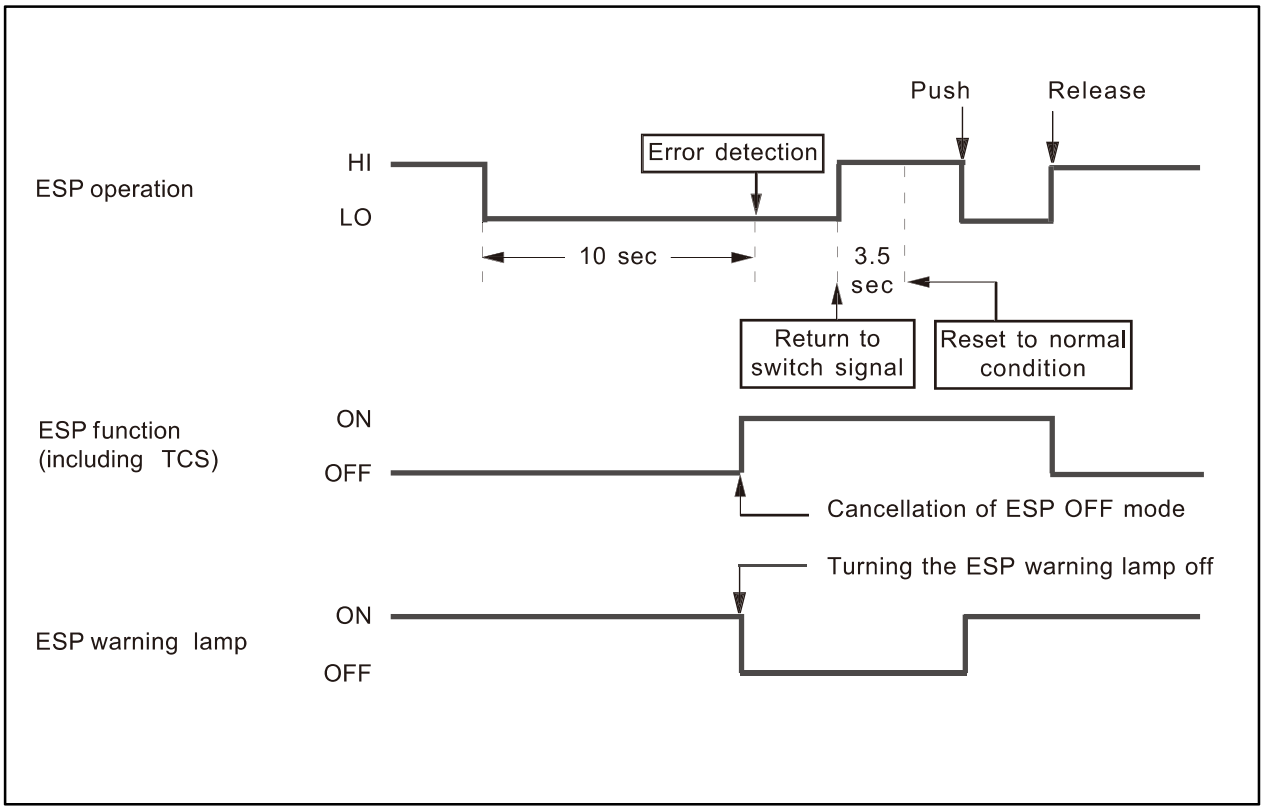
CAUTION

- When turning the ignition switch off while the ESP system is activated, the ESP system will be resumed when ignition switch is turned on again.
- When the vehicle is controlled by ESP system during driving, the ESPOFF switch does not operate.
- The ESPOFF switch operates when it is pushed for over 150 ms. When it is pushed for less than 150 ms, the ESP OFF mode and the ESP warning lamp will not be changed.
- When the ESPOFF switch is pushed within 350 ms of being turned off, the ESP warning lamp and ESP system will not be turned on.

Modification basis	
Application basis	
Affected VIN	

(4) ESPOFF Switch Monitoring

When the ESP unit recognizes that the ESPOFF switch is pushed for over 10 seconds, the ESP unit determines it as a ESPOFF switch malfunction. When the ESPOFF switch is pushed, the ESP system is resumed after 10 seconds.
However, the ESP warning lamp comes on when the ESPOFF switch is pushed (for over 150 ms) and then goes out when the ESP system is resumed. When the ESPOFF switch returns to normal position, the ESP unit resets the ESPOFF switch for approx. 3.5 seconds.



(5) ESP Warning Lamp Operation Depending on System Conditions

The table shows ESP warning lamp operations when the ESP system is defective or ESP (including TCS function) is working.

	Warning Lamp		Controls			
	ABS W/L	ESP W/L	ABS	ASR	ABD	Vehicle yaw control
Initial start (for 1.8 sec)	ON	ON	NO	NO	NO	NO
Normal mode	OFF	BLINKS WHEN ESP OPERATION	OK	OK	OK	OK
ESP fault	OFF	ON	OK	NO	NO	NO
ABS fault	ON	ON	NO	NO	NO	NO
System fault	ON	ON	NO	NO	NO	NO
Low batt. voltage	ON	ON	NO	NO	NO	NO
High battery voltage	ON	ON	NO	NO	NO	NO
High brake pad temp.	OFF	ON	OK	NO	NO	NO
ESP-OFF mode	OFF	ON	OK	NO	NO	OK Note 1)
Entering diag. mode	ON	ON	NO	NO	NO	NO

CAUTION

- When the driver presses the brake pedal during the ESP OFF mode, the yaw control is performed to compensate the vehicle stability (posture) during ESP operation.
- Be careful not to damage other parts when removing the instrument cluster.

Modification basis	
Application basis	
Affected VIN	

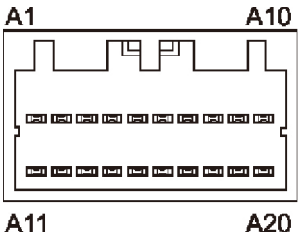
8. CIRCUIT DIAGRAM

1) Connector Pin Arrangement (for Deluxe version)

These connectors are viewed from the cluster body. The arrangement of the pin in the main connector is the same as the one of the sub connector. The common specifications for CAN communication are:

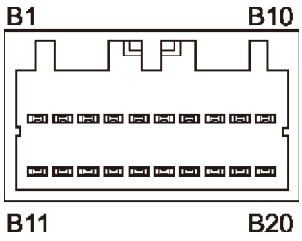
- Protocol: Standard format CAN 2.0B (2.0A included)
- Communication speed: 500 Kbps ± 0.2%
- End resistance: 120W ± 5%
- Configuration of frame standard format: data frame, remote frame, error frame and overload frame

Connector A - 20 pins



1. Door open
2. Oil pressure
3. Seat belt
4. Charge
5. Light (-)
6. -
7. IGN (+) - Alternator
8. Signal ground
9. -
10. Battery (+)
11. Parking brake signal (output)
12. Auto parking switch
13. Easy loading switch
14. Light (+)
15. -
16. Turn signal lamp (RH)
17. High beam (-)
18. Headlamp (+)
19. Turn signal lamp (LH)
20. Parking brake signal (input)

Connector B - 20 pins

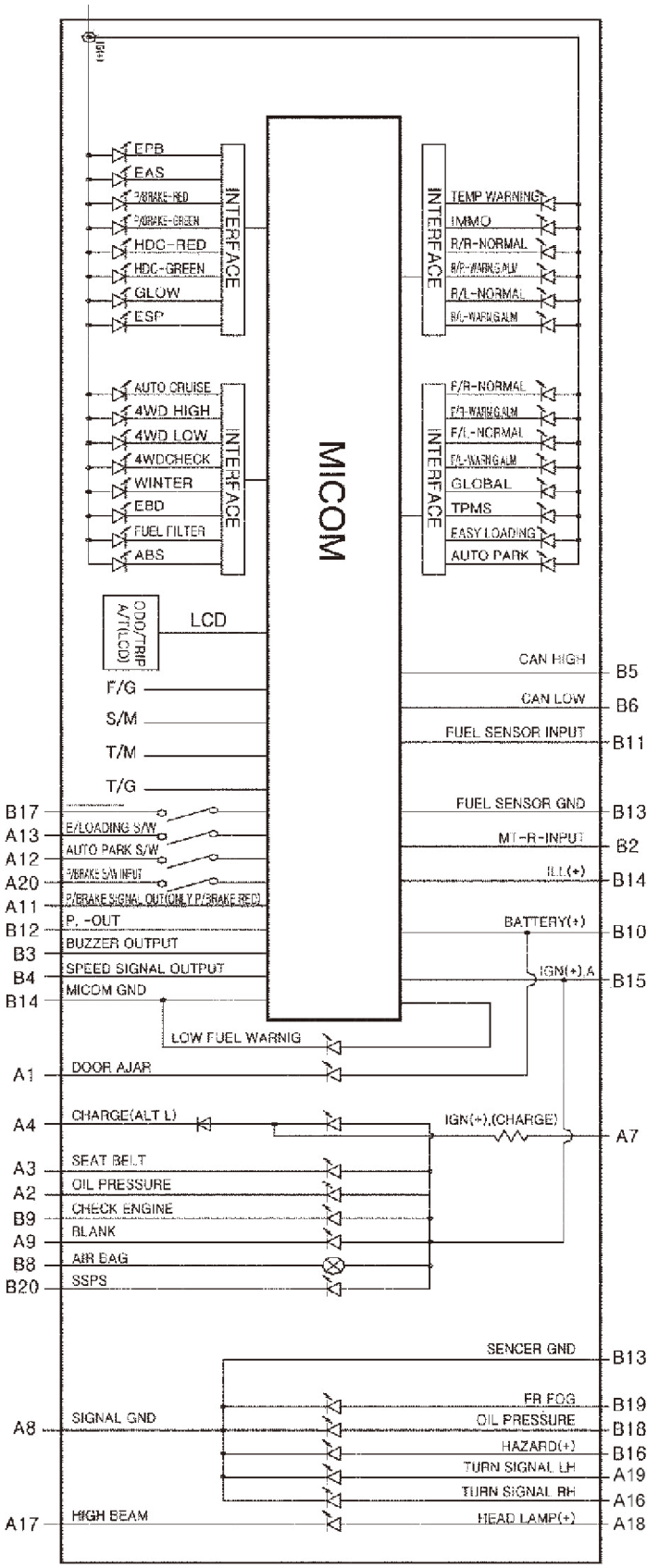


1. Neutral switch input (M/T)
2. Reverse switch input (M/T)
3. ESP/Water separator/Coolant temperature warning, EPB, Over speed warning
4. Speed signal output
5. CAN_ HIGH
6. CAN_LOW
7. -
8. Air bag
9. Engine CHECK lamp
10. -
11. Fuel sender input
12. Park position output
13. Fuel sender ground
14. MICOM ground
15. IGN (+)
16. -
17. -
18. -
19. Front fog lamp
20. SSPS

2) Circuit Diagram (Deluxe version)

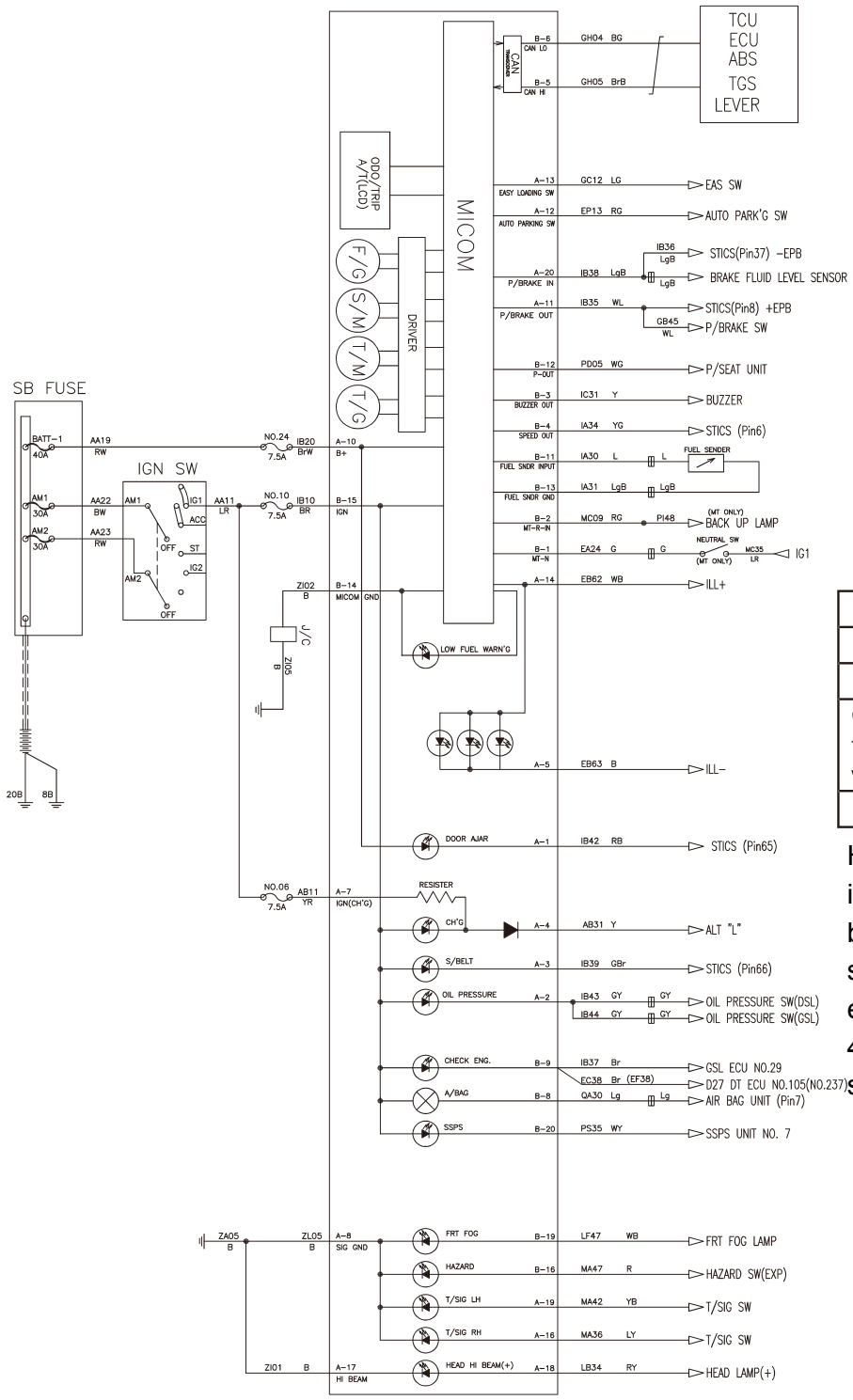
▶ Internal Electric Circuit

This circuit diagram shows the parts controlled through the MICOM and the parts controlled by the switches.



Modification basis	
Application basis	
Affected VIN	

▶ External electric circuit



Items	Interval	Priority
EPB	100ms	1
ESP	100ms	2
Coolant temperature warning	500ms	3
Fuel filter	500ms	4

However, if the fuel filter is filled with water, the buzzer sounds for 6 seconds when the engine speed is over 400 rpm during engine starting.

Modification basis	
Application basis	
Affected VIN	

SPWM(Seat Position With Memory) UNIT

7410-32

GENERAL

1. SPECIFICATIONS

1) Driver's Power Seat

Input s	Specifications		
Position sensor	Type		Reed switch type
	ON:OFF ratio		50 ± 20 %
	Contact current		Max. 0.5 A
	Chattering		Max. 0.2 msec
	Stroke	Sliding	228 mm ± 3 mm
		Reclining	23° (front) ↔ 0° ↔ 48° (rear)
		Raising (FRT/RR)	30 ± 3mm
	Total number of pulses	Sliding	1,200 Pulses
		Raising (FRT/RR)	46.93 Pulses
	Operation speed	Sliding	17.9 mm / Sec
		Reclining	3.50° / Sec
		Raising (FRT/RR)	7.0 mm / Sec
	Resolution	Sliding	0.188 / Pulse
		Raising (FRT/RR)	0.64 / Pulse
	Variable resistance		REC
SPWM memory switch	Type		Selt-return type
	Contact current		Min. 10 mA
	Chattering		Max. 10 msec
Manual switch	Type		Self-return type (Active low)
	Contact current		Max. 7A
	Chattering		Max. 10 msec

2) Actuator

Actuato r	Specifications		
For sliding/ reclining/raising front and rear (DC motor)	Rated voltage		DC 12V
	Operation current	Sliding	Max 2A (No-load)
		Reclining (REC)	Max 3.6A (AT 1.5 Nm)
			Max 8.0A (AT 12 Nm)
		Raising (FRT/RR)	Max 3A
	Limited current	Sliding	Max 16A
		Reclining	Max 13A
		Raising	Max 11A

3) Outside Rearview Mirror

▶ Manual Mode (Normal): 12V

Inputs	Specifications	
Mirror drive motor	Rated voltage	DC 12V
	Operation current	Max. 0.2A
	Limited current	Max. 1.5A
	Operation speed	2.5° ± 0.5° / sec (at 12V)
Folding motor	Rated voltage	DC 12V
	Operation current	Max. 3A
	Limited current	Max. 3.4A
	Turn over torque (by hand)	Manual folding: Min 50 kgf·cm
		Electric folding: Max 100 kgf·cm

▶ Position Sensor and Folding Switch

Inputs	Specifications	
Position sensor	Type	Variable resistance
	Rated voltage	DC 5V
	Output tolerance	± 0.1 V (± 2% from max. output)
	Supply current	Max 20 mA, 0.25W
	Operation range	Vertically and horizontally: ± 8°
Folding switch	Type	Self-return type (Active high)
	Contact current	Min. 10 mA
	Chattering	Max. 10 msec
Manual switch	Type	Self-return type (Active low)
	Contact current	Max. 7A
	Chattering	Max. 10 msec

▶ Motor

Inputs / Controls	H	C	V
UP	GND	12V	GND
DOWN	12V	GND	12V
OFF	GND	GND	GND
RIGHT	GND	12V	12V
LEFT	12V	GND	GND

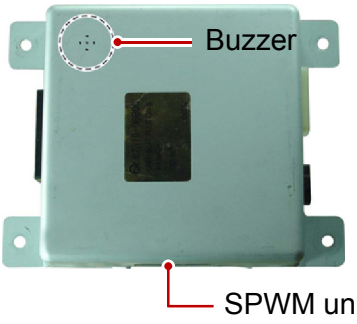
▶ **Motor Output (normal mode: ground)**

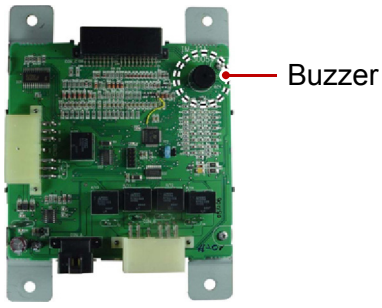
Inputs / Controls	H	C	V
UP	GND	GND	12V
DOWN	12V	12V	GND
RIGHT (IN)	GND	12V	12V
LEFT	12V	GND	GND

4) Buzzer

Output	Specifications	
Buzzer	Rated volatage	DC 12V
	Rated current	Max. 30 mA
	Acoustic pressure	Min. 92 dB
	Base frequency	2200 ± 150 Hz

1. Output time: 2Hz, DUTY 20% (ON: 0.1 sec., OFF: 0.4 sec.)
2. Buzzer output conditions
   - When the memory operation is permitted (memory switch ON): once
   - After completing the memory recall (position switch ON): twice
   - When starting to recall the memory (position switch ON): once
   - When pressing the position switch button twice consecutively: three times
   - When detecting a sensor error while recalling (position switch ON): three times
   - No buzzer output for the easy access memory/recall operations
   - No buzzer output for the outside mirror position recall by the auto down operation when reversing





SEAT WARMER

8511-17

OVERVIEW AND OPERATION PROCES

1. LOCATION

The variable seat warmer system controls the temperature in 5 levels.

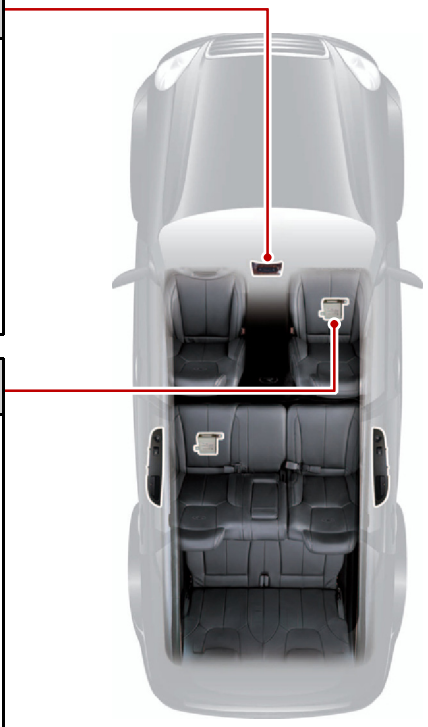
Seat Warmer Switch

It is located on the lower side of the center switch panel.

Seat Warmer Unit

It is installed under the passenger's seat (for vehicle equipped with SPWM unit).

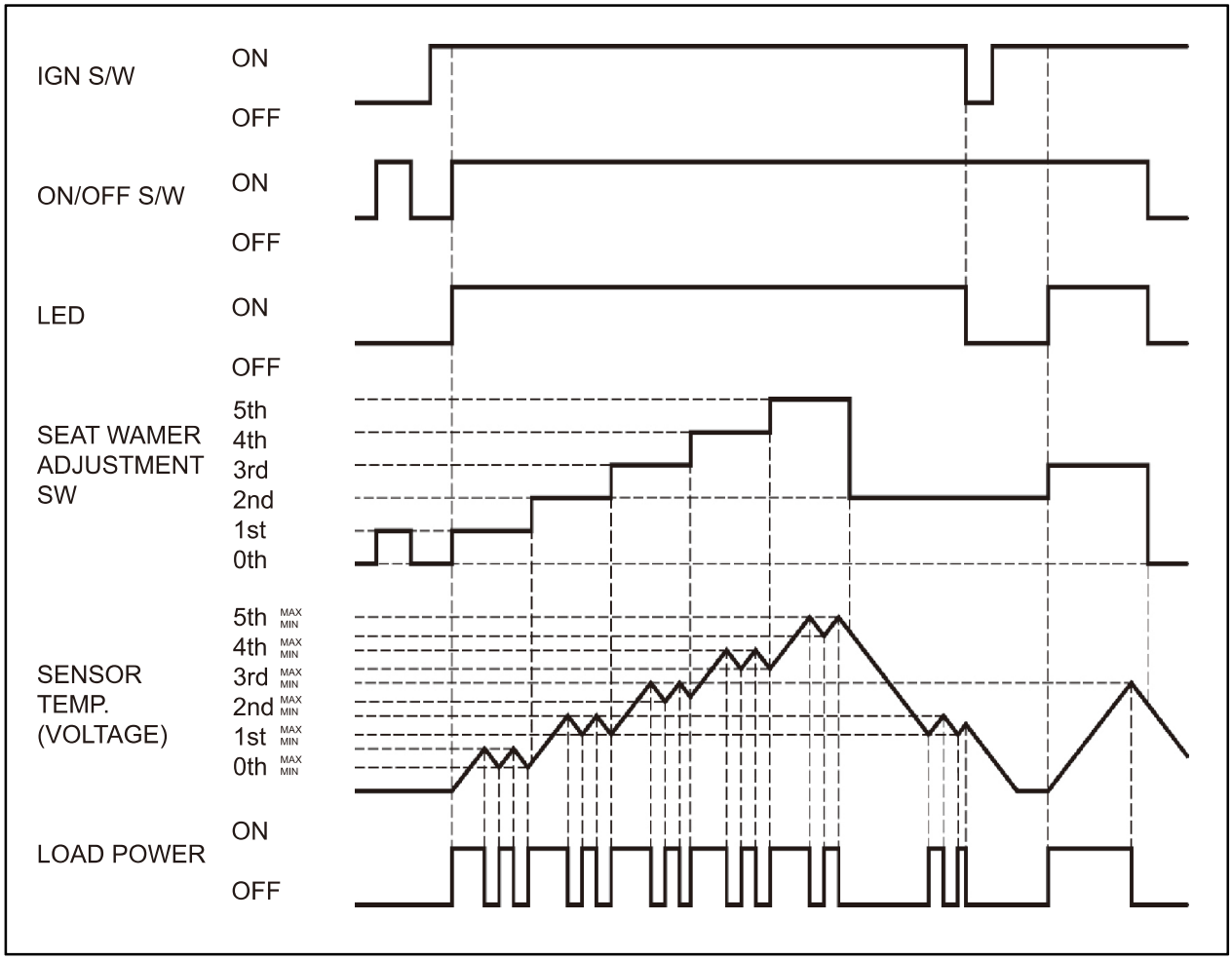
* It is installed under the driver's seat (for vehicle without SPWM unit).



2. OPERATING CHARACTERISTICS

The variable seat warmer system operates when the ignition is ON. The unit heats the seat in each level according to the resistance based on each switch operation.

1) Operation Characteristics



2) Temperature and sensor output value in each switch level

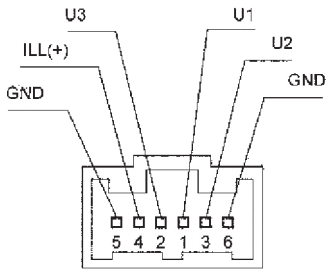
	Seat warmer temp. (°C)		Sensor output resistance (W)		Sensor output value (V)	
	MIN	MAX	MIN	MAX	MIN	MAX
0th	-	-	-	-	-	-
1st	39	41	5419	4982	2.01	1.91
2nd	46	48	4050	3734	1.76	1.66
3rd	54	56	2938	2717	1.53	1.44
4th	61	63	2240	2077	1.32	1.24
5th	69	71	1661	1544	1.14	1.07

Modification basis	
Application basis	
Affected VIN	

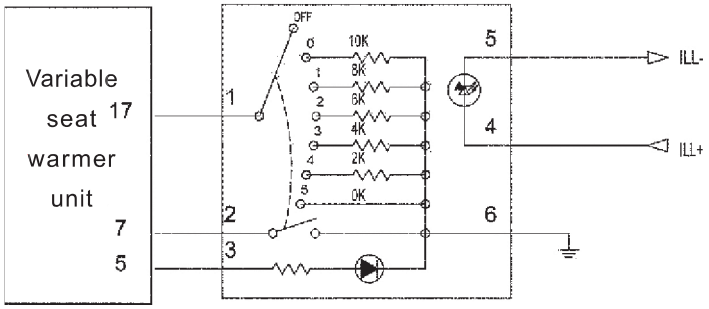
3. FUNCTION AND DESCRIPTION

Seat wamer switch

The seat wamer switch is the rotary type variable switch. The seat cushion and the seatback is heated by operating the switch and the temperature of the seat can be adjusted in five levels.



Seat warmer switch



STEP	1	6	2	3	4	5
	U1	GND	U3	U2	ILL(+)	GND
0	—	○				
1						
2						
3						
4						
5						

SEAT CONTROL UNIT

ILL(+)

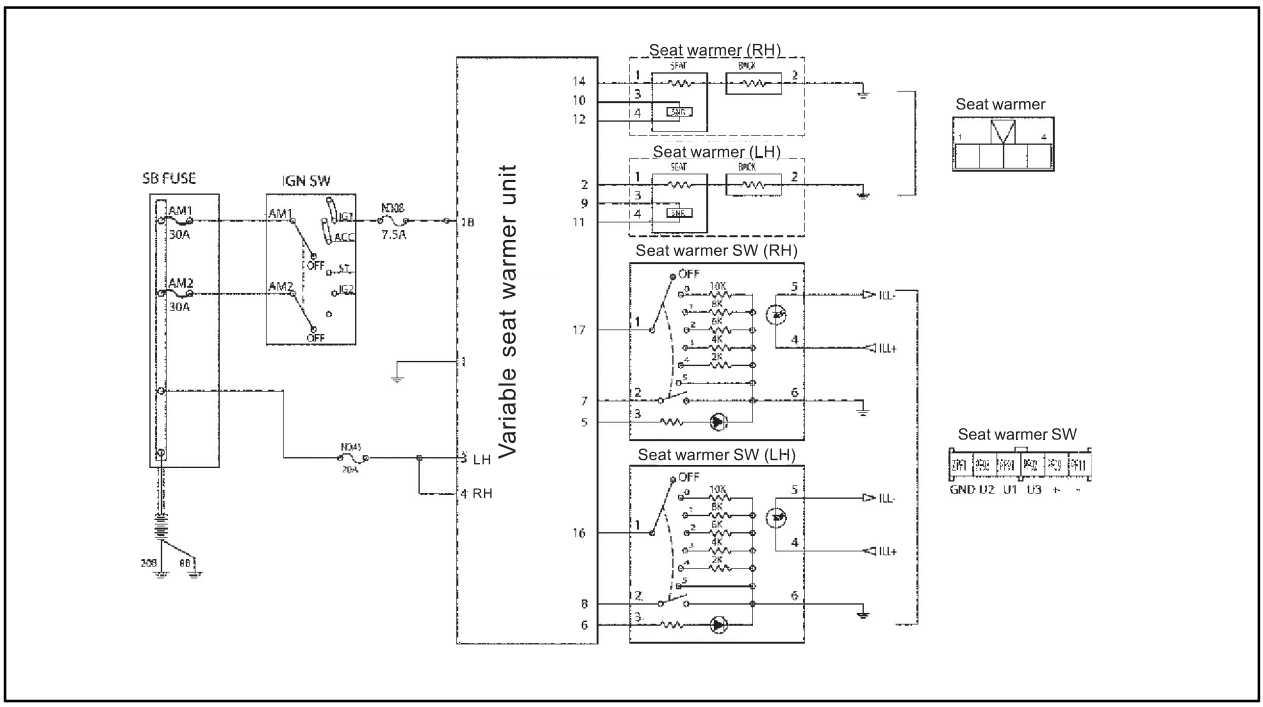
* Resistance tolerance for each switch position: ± 5%

CAUTION

The temperature of the seat surface should be rised to over 20°C within 3 minutes while sitting on the seat (driver's height: 175 ± 5 cm, driver's weight: 75 ± 5 kg) when operating the seat warmer switch.

4. CIRCUIT DIAGRAM

The variable seat warmer unit is supplied the ignition power and the battery power without its own relay.



Modification basis	
Application basis	
Affected VIN	

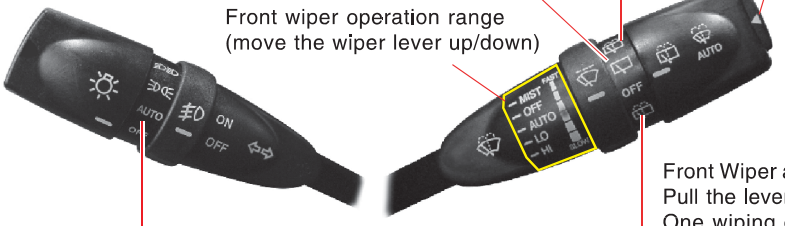
SWITCH

8511-29

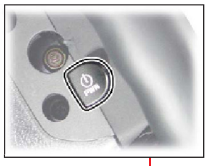
OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

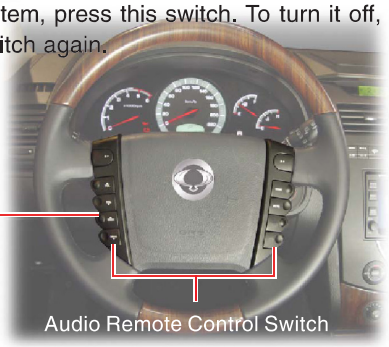
Additional Functions of Multifunction Switch



Power ON/OFF Switch

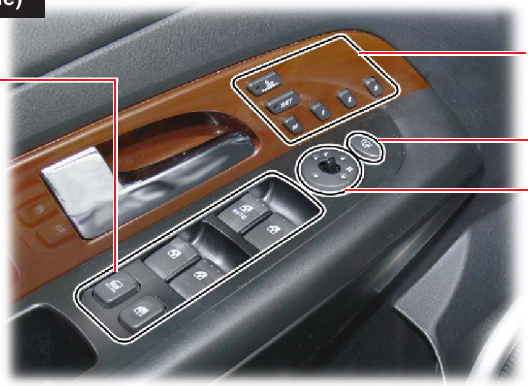


The Power ON/OFF switch of audio system is located at left side of the steering wheel. To turn on the audio system, press this switch. To turn it off, press this switch again.



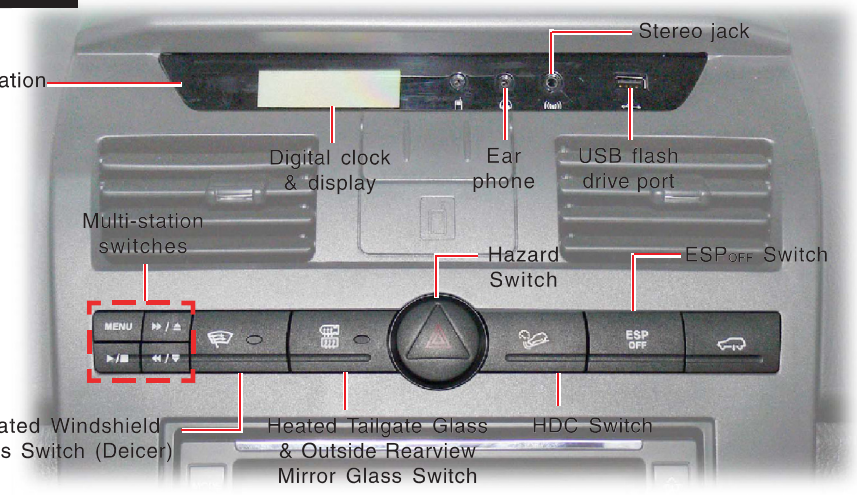
Door Switches (Driver side)

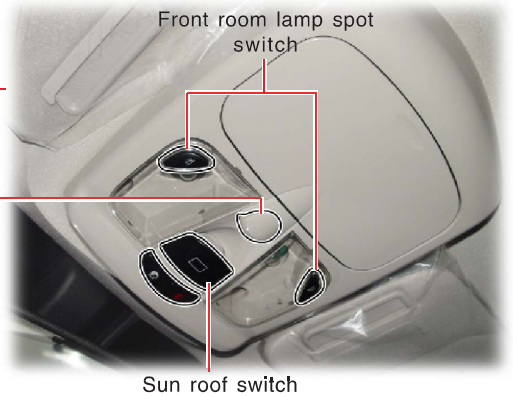
Driver's Power Window Switch
Driver can controls all door windows (Open/Close/Lock/Unlock) and doors (Lock/Unlock) with this switch unit.



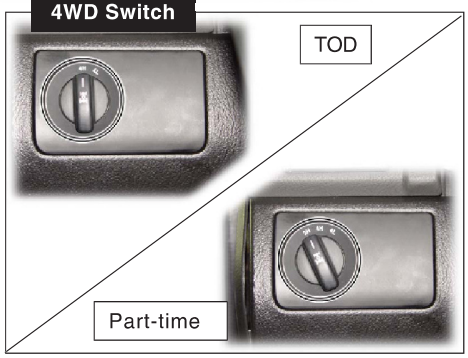
Modification basis	
Application basis	
Affected VIN	

Center Switch Panel



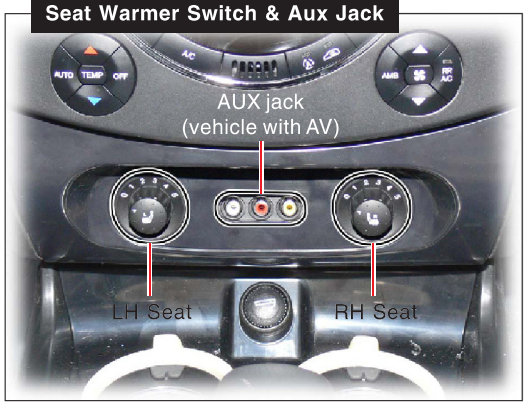


4WD Switch



* No switches for vehicle with AWD and 2WD

Seat Warmer Switch & Aux Jack



Modification basis	
Application basis	
Affected VIN	

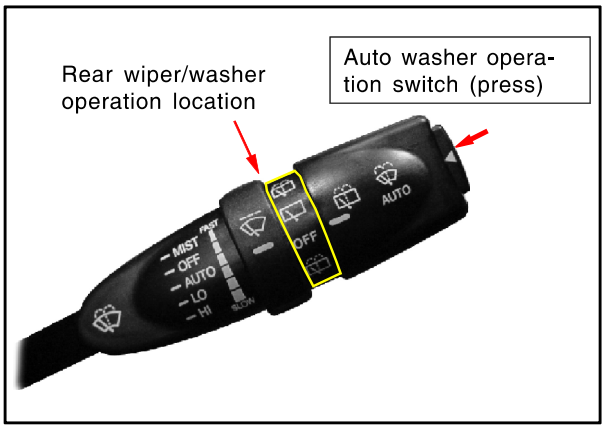
WIPER AND WASHER

7810-01

OVERVIEW AND OPERATION PROCESS

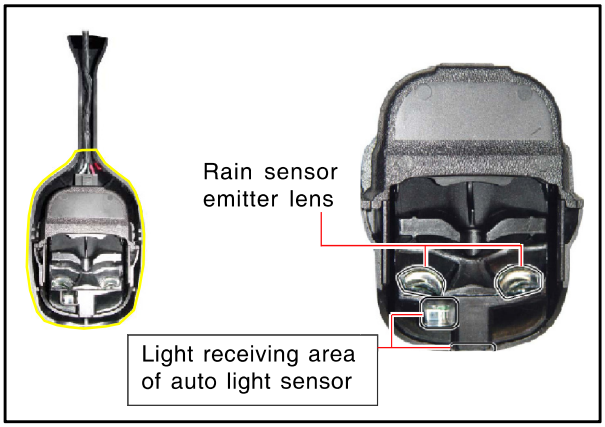
1. OVERVIEW

The wiper and washer system are controlled by STICS according to driver's wiper switch operation. And the detection of rain drops by rain sensor is transmitted to STICS as the signal for wiper system control. The characteristics of the wiper and washer system including basic functions of manual wiper are as follows.



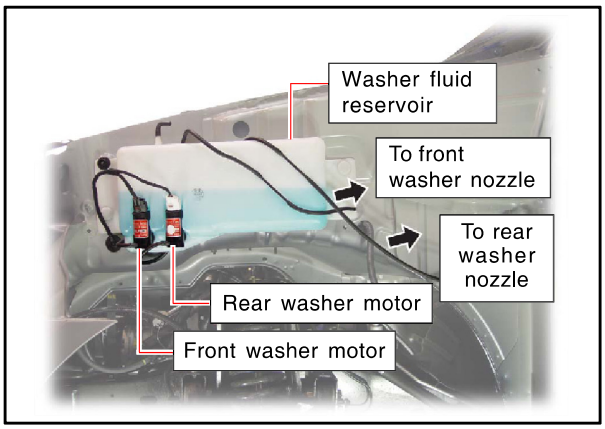
1. Wiper function coupled auto washer

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



2. Integrated auto light sensor in rain sensor unit

The rain sensor unit is installed on a proper location to detect the rain drops and the illumination intensity. When the wiper is in operation in LO mode by the rain sensor, the headlamps come on if the light switch is in AUTO to secure the visibility in rain. To control the system, the sensed values of rain sensor and auto light sensor are sent to pin no. 63 in STICS unit.

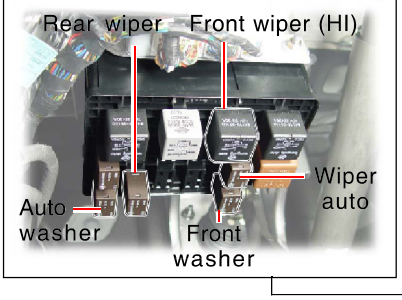


3. Rear washer fluid supply system

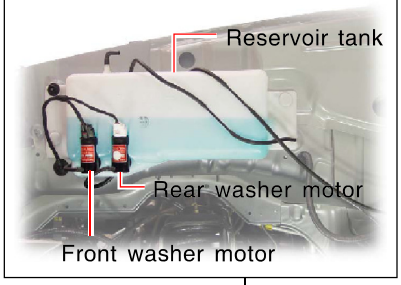
There is no separation of washer fluid reservoir for the rear washer system in this vehicle. The rear washer system uses the front washer fluid reservoir.

2. SYSTEM LAYOUT

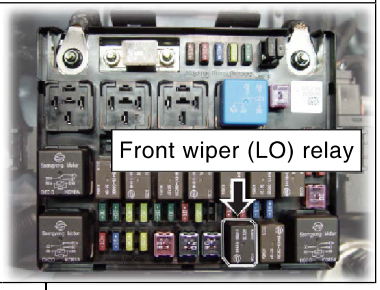
Interior Fuse and Relay Box



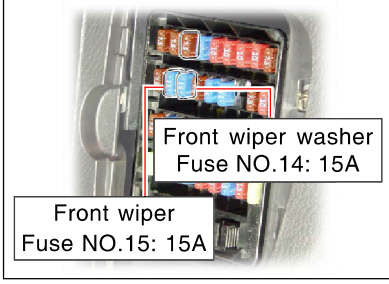
Reservoir Tank



Engine Compartment Fuse and Relay Box



Interior Fuse Box



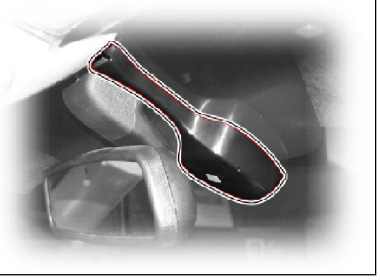
RK STICS

Wiper Switch

Rear Nozzle

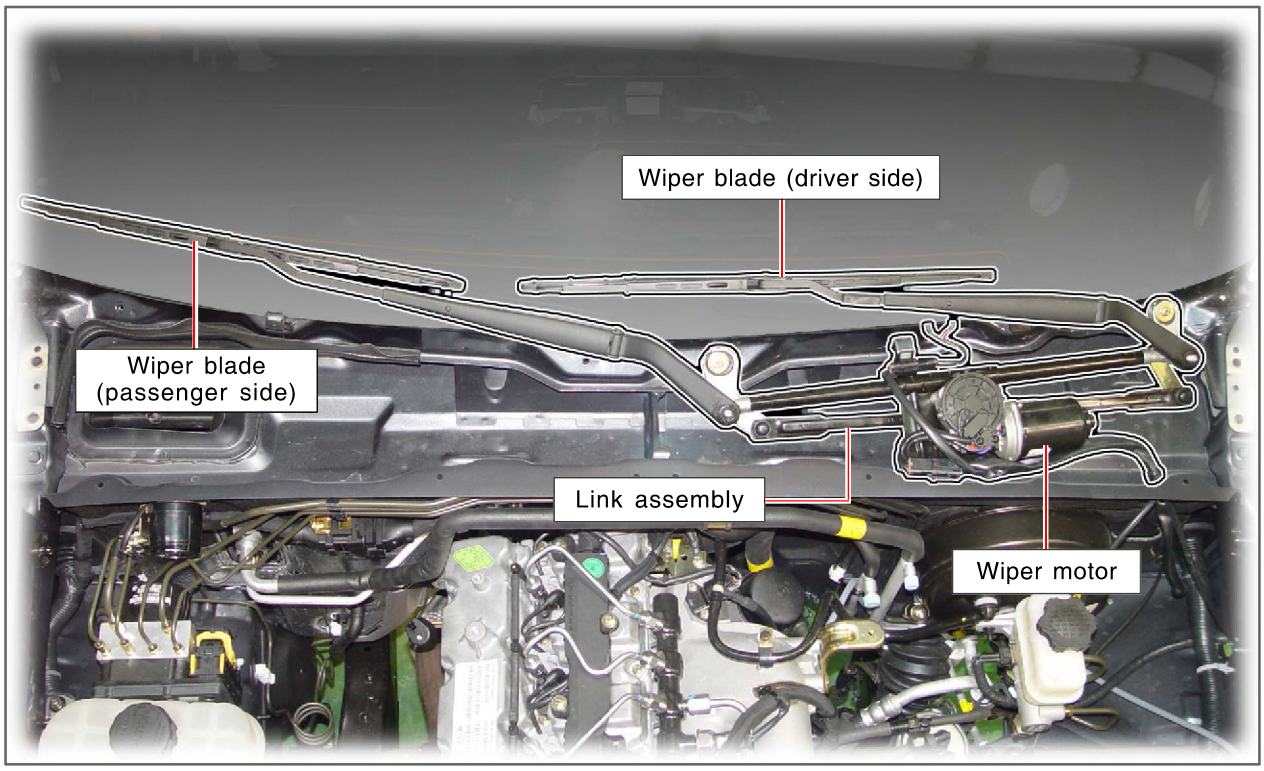
DPS Rear Wiper

Auto Light & Rain Sensor



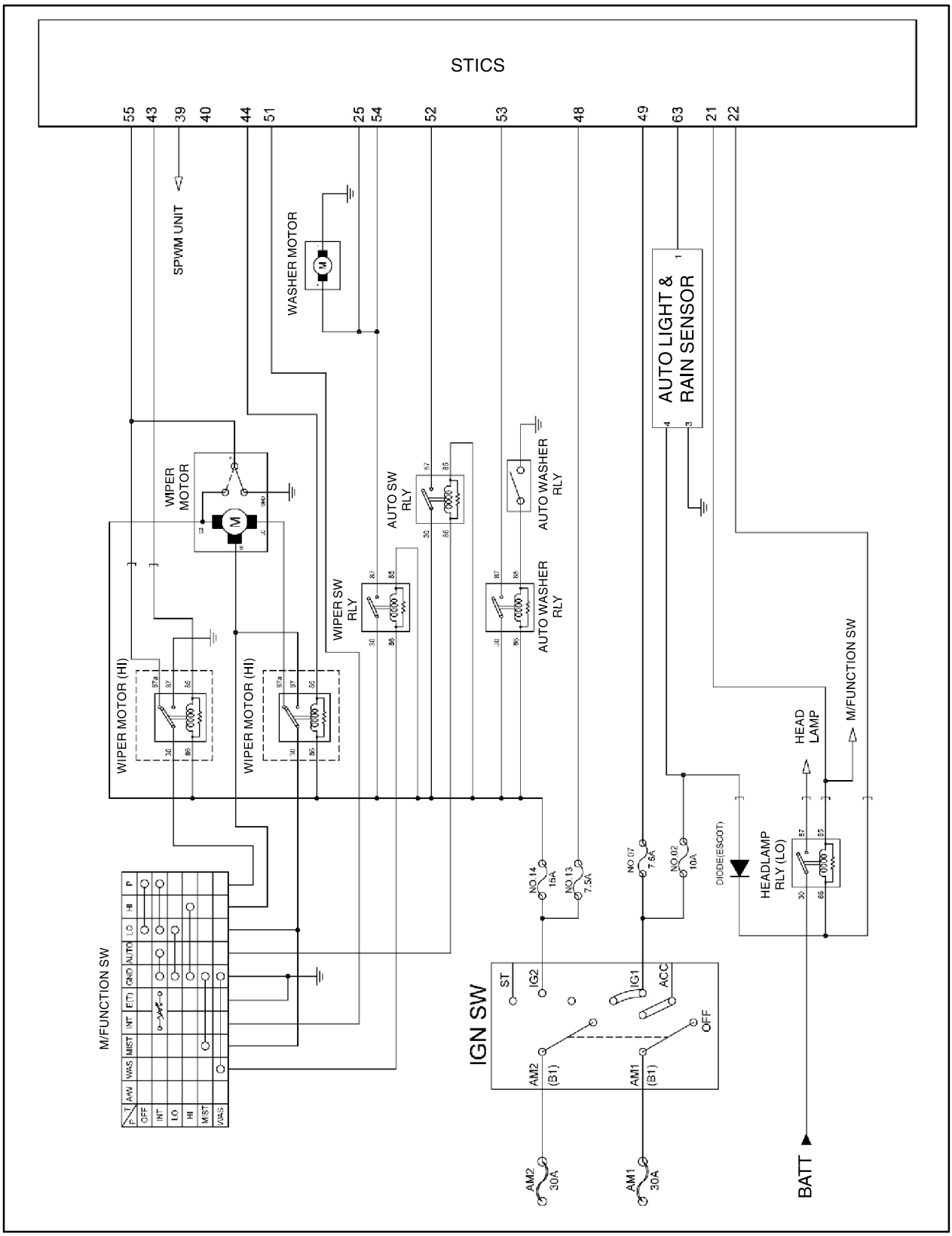
Modification basis	
Application basis	
Affected VIN	

▶ Layout of Front Wiper



3. CIRCUIT DIAGRAM

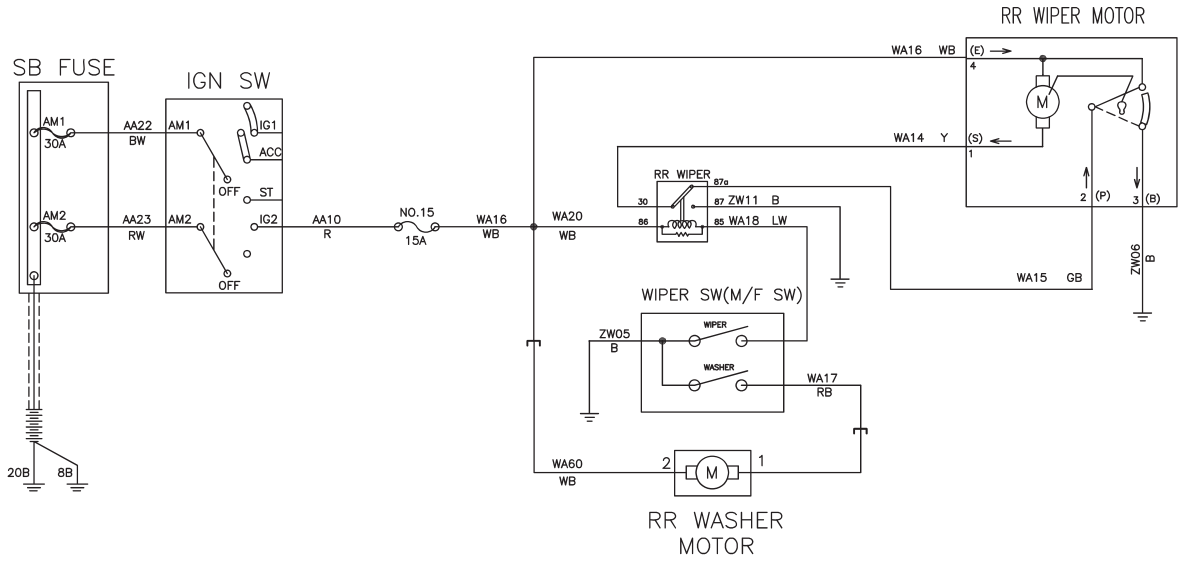
1) Front Wiper and Washer



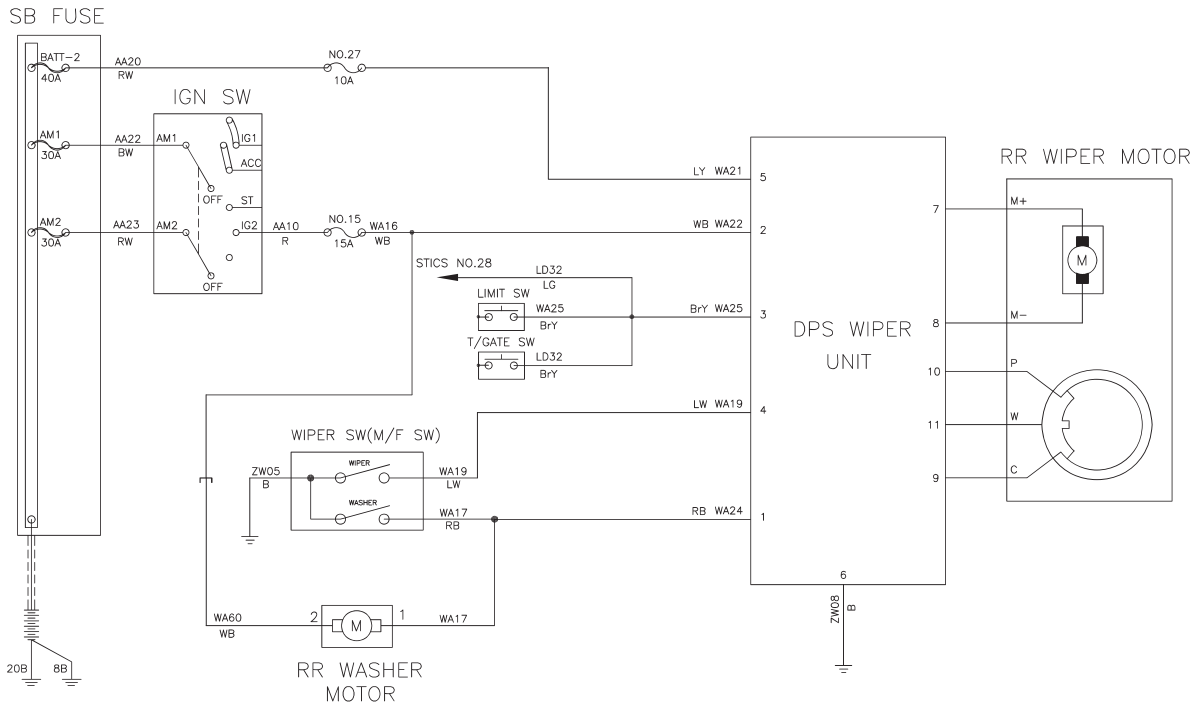
Modification basis	
Application basis	
Affected VIN	

2) Rear Wiper and Washer

(DPS)



(STD)



Modification basis	
Application basis	
Affected VIN	

RAIN SENSOR

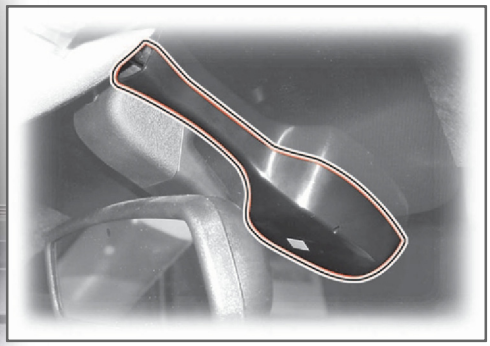
8611-09

OVERVIE

1. SYSTEM LAYOUT AND OVERVIEW

The rain sensing wiper unit in this vehicle doesn't control the wiper directly. The rain sensing unit detects the amount of rain drops and sends the operating signal to STICS, and STICS drives the wiper directly.

Rain Sensor Unit
(Auto Light Sensor Integrated Type)



A sensor that emits infrared rays through LED and then detects the amount of rain drops by receiving reflected rays against sensing section (rain sensor mounting section on the windshield) with photodiode. The auto light sensor is Integrated into the rain sensor.

Multifunction Wiper Switch:
AUTO and Sensitivity Control

AUTO: Wiper operates automatically by rain sensor
FAST <-------> SLOW: Auto delay/Auto speed control. A position that controls sensitivity against rains on the windshield and transmits wiping demand signal accordingly.

1) Internal Components

Emitter lens
The LED which is located at bottom emits the infrared rays and the lens guides the infrared rays to target point.

Auto light sensor (Vertical)

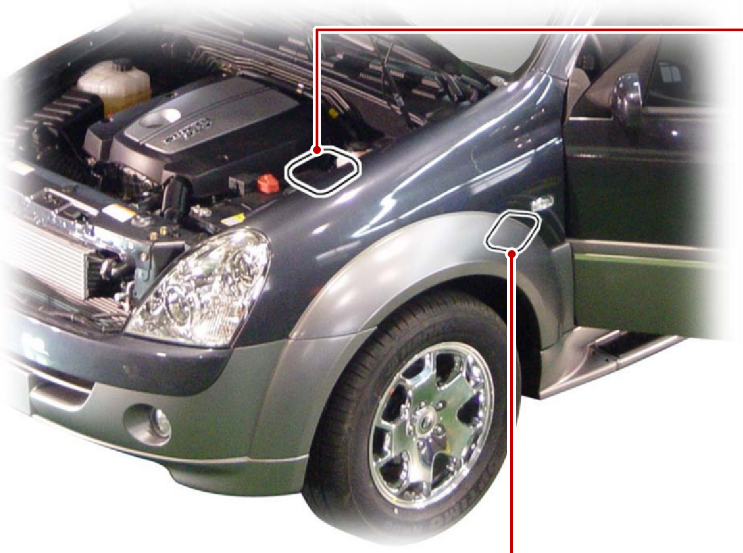
Auto light sensor (Horizon)

Enlarged auto light sensor section

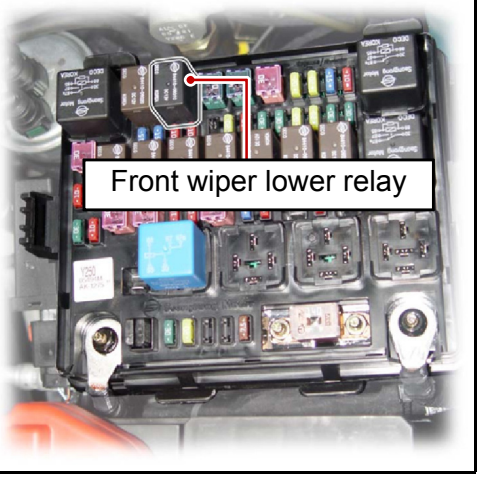
Modification basis	
Application basis	
Affected VIN	

2) Related Components

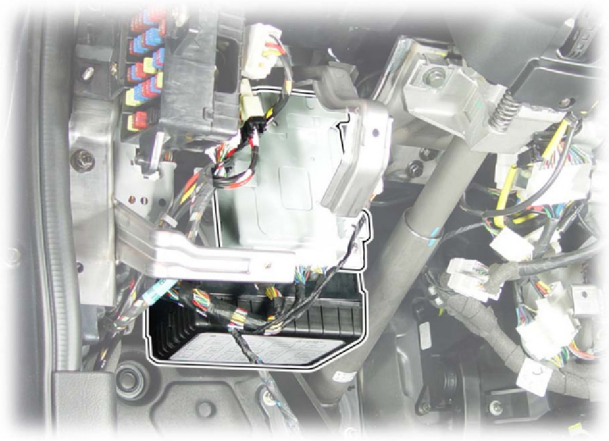
The rain sensing unit detects the amount of rain drops and sends the operating signal to STICS, and STICS drives the wiper directly. At this moment, STICS determines the wiper operation mode (washer, MIST, AUTO), then sends the information to the rain sensor.



Engine Compartment Fuse and Relay Box



IP Lower Relay Box



3) Auto Light Sensor and Rain Sensor Coupled Control

1. Rain detected headlamp:
   If it rains heavy which requires the intermediate INT speed, the headlamps are turned on automatically.

2. Night detected wiping:
   When the auto light control turns on the headlamps and the rain sensor detects the rain, the wiper sensitivity is automatically increased by one level.
   (For example, the AUTO wiper switch is at the 3rd level, but the wiper operates at the 4th level.)

2. OPERATION MODE OF RAIN SENSING WIPER SYSTEM

Driver Switch Positions		Operation Mode
MIST (transmits the manual operation mode signal to sensor)		As long as the switch is in MIST position, the wiper motor operates in low speed. The wiper blade returns to parking position if the switch returns to the original position. The rain sensor ignores inputs during parking signal periods.
OFF (transmits the manual operation mode signal to sensor)		The wiper motor rotates in low speed until it returns to parking position. When the system is in manual mode, the sensitivity of sensor will be set to 2 (AUTO 2) internally. By doing so, immediate wiping with proper intervals is possible when a driver sets the system from OFF to AUTO.
AUTO 1 (low sensitivity)	SLOW ▲	Auto delay/auto speed control. Low sensitivity against rains on windshield. When the switch is in AUTO position, the sensor transmits the wiping request signal to STICS.
AUTO 2 (low/med sensitivity)		Auto delay/auto speed control. Low/medium sensitivity against rains on windshield.
AUTO 3 (medium sensitivity)		Auto delay/auto speed control. Medium sensitivity against rains on windshield.
AUTO 4 (med/hi sensitivity)		Auto delay/auto speed control. Medium/high sensitivity against rains on windshield.
AUTO 5 (high sensitivity)	▼ FAST	Auto delay/auto speed control. High sensitivity against rains on windshield.
LOW SPEED (transmits the manual operation mode signal to sensor)		The wiper motor rotates continuously in low speed of approx. 45 rev./minute (in the normal battery voltage). The rain sensor operations are same as in MIST.
HI SPEED (transmits the manual operation mode signal to sensor)		The wiper motor rotates continuously in high speed of approx. 70 rev./minute at (in the normal battery voltage). The rain sensor operations are same as in MIST.

1. Rain detected head light:

If it rains heavy which requires the highest INT speed, the headlamps are turned on automatically.

2. Night detected wiping:

When the auto light control turns on the headlamps and the rain sensor detects the rain, the wiper sensitivity is automatically increased by one level. (i.e. the AUTO wiper switch is at the 3rd level, but the wiper operates at the 4th level.)

3. FUNCTIONS AND CHECKS OF RAIN SENSOR

The followings are the detailed description of the functions and operations of the rain sensing wiper control.

1) Front Windshield Glass and Coupler Attachment

Check the outer windshield surface of sensing area for wear, damage and scratch. The sensor is able to compensate the wear up to a specific level. Check the coupler attached surface of windshield for porosity. If the porosity exists, the sensor cannot function properly.

CAUTION

- If the installed wiper brushes are out of specification (size and length), the rain sensing area cannot be fully wiped.
- In this case, the rain sensor's sensitivity could be decreased and the wipers are not properly operated.

2) Recognition of AUTO Mode

1. When the engine is started with the multifunction wiper switch in "AUTO" position, the wiper operates one cycle to remind a driver that the wiper switch is in "AUTO" position.
2. When the wiper switch is turned to "AUTO" from "OFF", the wiper operates one cycle. It always operates one cycle for the initial operation, however, the wiper does not operate afterwards to prevent the wiper blade wear if not raining when turning the wiper switch to "AUTO" from "OFF". However, the wiper operates up to 5 minutes after rain stops.
3. If this function does not occur, check No. 2 terminal on the rain sensor. If any defective cannot be found, check the wiper relay (LOW) for defective.

CAUTION

- As described, the STICS recognizes if the wiper switch is in "AUTO" position. If there is no problem, go to diagnosis mode in STICS and check the terminal that receives signal from wiper and communication lines between rain sensor unit and STICS.

3) Instant Wipe Function

When the variable resistance knob on the multifunction wiper switch is turned by each 1 stage from low sensitivity (S mark) to high sensitivity (F mark), the wiper operates one cycle.

CAUTION

- When the variable resistance knob is rotated by 4 stage from 0 stage without stoping, the wiper operates one cycle. The wiper operates one cycle when changing the wiping stage (0 → 1, 1 → 2, 2 → 3).

4) Washer Coupled Wiper Function

Check the washer coupled wiper operation by pressing the washer switch.

5) Irregular Operations (Abrupt Operations)

- Check the sensor for coming off.
- Check the rain sensor cover's installation status.
- Check that the customer is familiar to how to control the wiper sensitivity.
  Check that the customer can select the sensitivity by selecting the variable resistance value (stage 1 to stage 5), that is, the wiper sensitivity control value. And, also check whether the sensitivity is selected to the highest value of FAST (stage 5).
- Check the wiper blade for wear.
  If the wiper blade cannot wipe the glass uniformly and clearly, the irregular operations could be occurred. And, the wiper blade should be replaced with new one with same specifications.

6) Self Diagnosis

▶ Poor Sensing

Position the wiper switch to "AUTO" position and rotate the variable resistance knob from "FAST" toward "SLOW" by one step. At this moment, check if the wiper operates one cycle.
The wiper operates when the windshield glass is excessively worn or scratched, the windshield glass is not cleared wiped due to using worn wiper blade or different wiper blade, or the rain sensor is not improperly installed.

▶ Poor Sensor

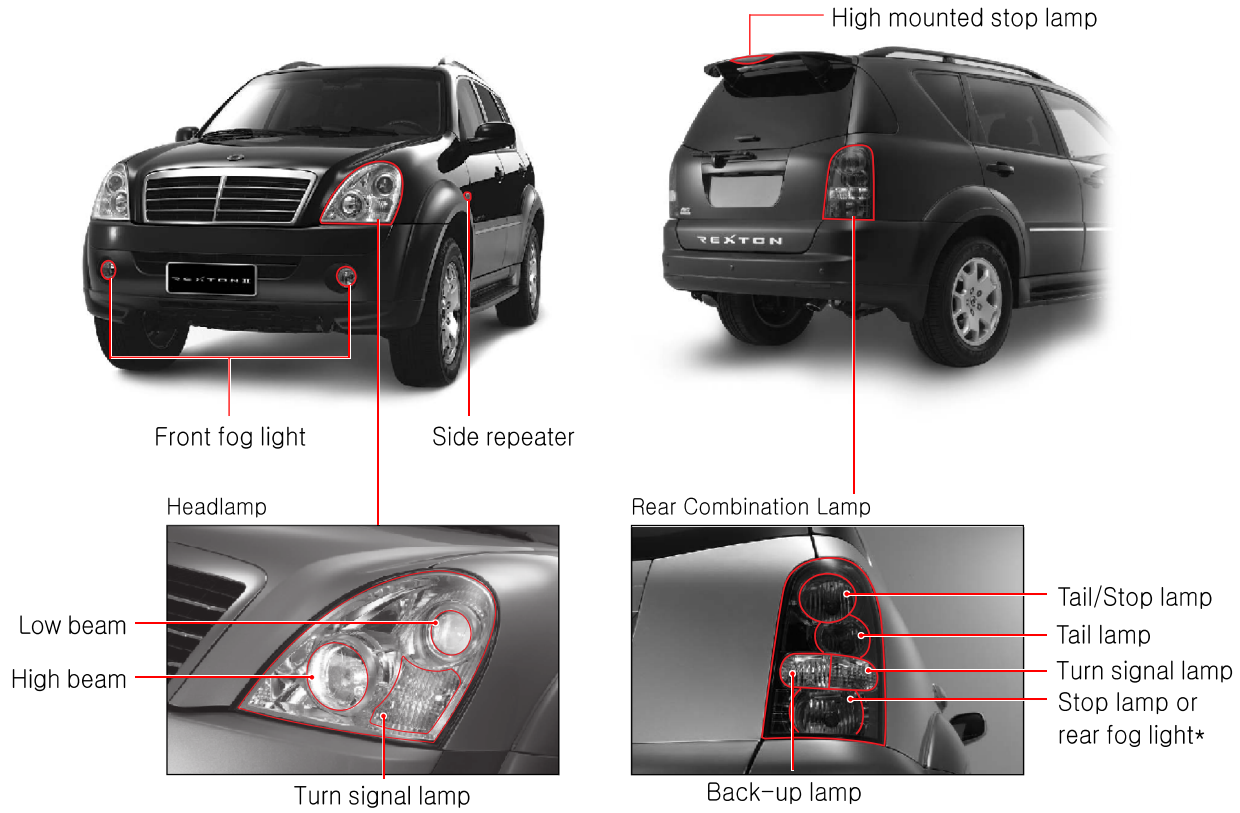
Rotate the variable resistance knob toward "SLOW" by 1 more step. At this moment, check if the wiper operates one cycle.
If the wiper operates, this is caused when the sensor is defective or the sensor has the communication problem with STICS.

LAMP

8310-01

GENERAL

1. BULB SPECIFICATIONS



Description			Amount	Specification (EU)	Specification (General)
Exterior lamp	Headlamp	High beam	2	55W	←
		Low beam	2	55W	←
		Turn signal lamp	2	PY21W	28W
		Position lamp	2	W5W	8W
	Front fog light		2	H27W/2	←
	Side repeater		2	W5W	5W
	Rear combination lamp	Stop (tail) lamp	6 (EU: 4)	P21/5W	27W(8W)
		Turn signal lamp	2	PY21W	27W
		Back-up lamp	2	W16W	←
		Rear fog light	2	P21W	-
	License plate lamp		2	W5W	5W
	High mounted stop lamp		-	LED type	
	Front room lamp		2	10W	←
Interior lamp	Glove box lamp		1	10W	←
	Center room lamp		1	10W	←
	Luggage lamp		1	10W	←
	Door courtesy lamp		4	5W	←

Modification basis	
Application basis	
Affected VIN	

MULTI JACK STATION

8611-41

GENERAL

1. HARDWARE SPECIFICATIONS

Items		Specifications	Remarks
Audio	Number of channels	Stereo (L/R Channel)	
	Frequency	20 ~ 20 KHz	
	Line output	Vrms = 2V	
	CMRR (Common Mode Rejection Ratio)	85 dB	
Supported file	File type	MP3, WMA, OGG	
	Bit Rate	MP3: 8 Kbps ~ 320 Kbps WMA: 64 Kbps ~ 192 Kbps OGG: Q1 ~ Q10	
	Sampling Rate	MPEG 1: 32 KHz, 44.1 KHz, 48 KHz	
		MPEG 2: 16 KHz, 22.05 KHz, 24 KHz	
Power supply	Rated voltage	DC 12.0V	
	Operating power	DC 6V ~ 16V / Standby less than 1 mA	
	Operating current	170 mA (if supplied with 12V)	
General specifica-tions	Operating temperature	-20°C ~ 70°C	Should operate normally within this range.
	Reserved temperature	-40°C ~ +85°C	
	Max. operating humidity	95%	
	Max. internal voltage	24V	
	Insulating resistance	No heat and fire due to the current leaks.	Specified with the parts which needs insulation such as PCB, waterproof, coating, etc.
	Dark current	Less than 1 mA	AT DC 13V
	Max. permissible current	Max. 500 mA	
	Memory	USB flash drive (supports standrad mass storage class)	
	USB interface	USB 1.1 HOST (12 Mbps)	
	USB Supply	DC 5V, 500 mA	
	Supported language	Korean, Chinese and English	
	Supported file system	FAT 16/32	
LCD	Graphic LCD	160 X 48 BIT FSTN TYPE	
	Text color	BLACK	
	LCD size	66 X 26.5 mm	Actual display range: 60 X 16 mm
	DOT pitch	0.35 X 0.33 mm	

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

The multi jack station is an integrated unit of digital clock and various audio play devices. It also includes the stereo jack which can be connected to an external audio device and the MP3 USB jack which can be connected to the USB flash drive for playing music through the speakers on vehicle.

2. COMPONENTS

For the vehicle with the AV system, the device change and the file search in folders can be done by using AV monitor. For the vehicle without monitor, such operations can be done by using the multi jack station buttons.

Electronic device holder
(Cellular phone, MP3 player, etc.)

Stereo jack

MP3 USB port

Buttons in the model without AV system

MENU
File search, time adjustment and various mode change/adjustment

NEXT TRACK (FF)
Plays the next track, fast forward, Up (+)

PLAY/STOP
Play, stop, time setting mode change

PREVIOUS TRACK (REW)
Plays the previous track, fast rewind, Down (-)

Clock and multi jack station buttons
Digital clock adjustment, accessories menu setting and file search for vehicle without AV system

MP3 Player Connected to Stereo Jack

Select AUX

Displays connector status

USB Flash Drive

Select USB in MODE

Displays folders/files in USB flash drive

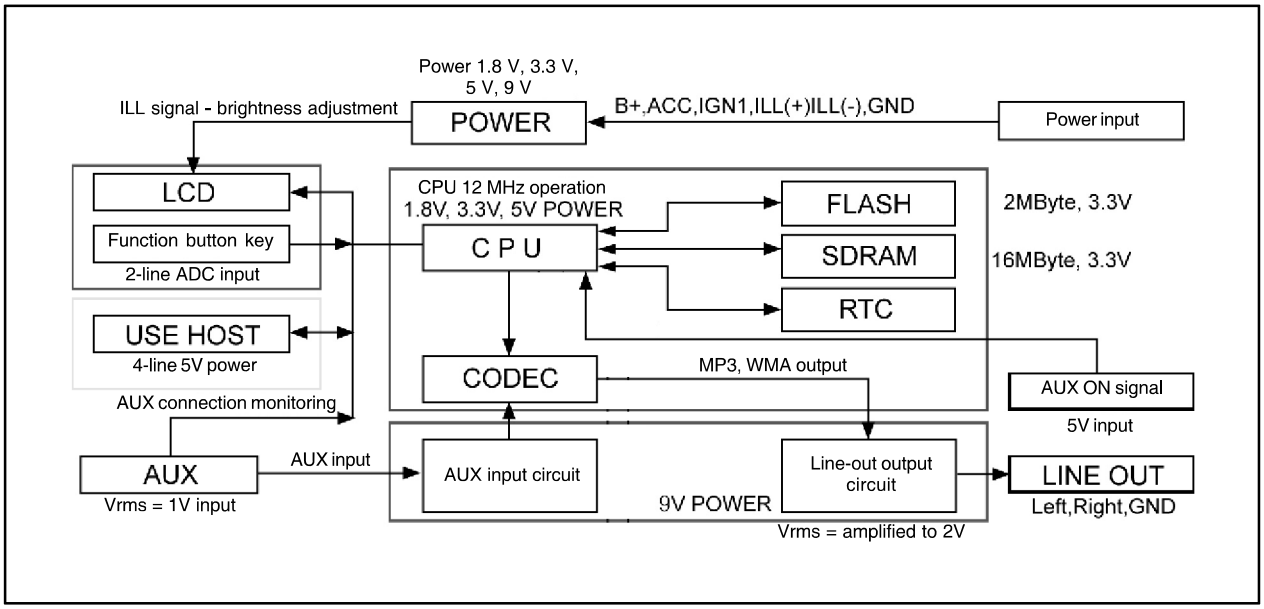
Modification basis	
Application basis	
Affected VIN	

3. ELECTRICAL PERFORMANCE AND CONFIGURATION

1) Electrical Performance

Items	Requirement	Remarks
Rated voltage	DC 12.0V	
Operating voltage	DC 6V ~ 16V	Should operate normally within this range.
Operating temperature	-30°C ~ +80°C	Should operate normally within this range.
Reserved temperature	-40°C ~ +90°C	
Max. operating humidity	95%	
Max. internal voltage	24V	
Insulating resistance	No heat and fire due to the current leaks.	Specified with the parts which needs insulation such as PCB, waterproof, coating, etc.
Dark current		AT DC 13V
Max. permissible current	Less than 5mA	AT DC 13V, current for illumination excluded
Number of audio channels	MAX 70 mA	
Audio frequency	STEREO (LH, RH, GND)	
Audio line output	20 Hz ~ 20 kHz	
CMR (Common Mode Rejection Ratio)	Vpp 4V 85dB	
Graphic LCD	160 X 48 BIT FSTN TYPE	
Text color	Black	
LCD size	66 X 26.5 mm	Actual display range: 60 X 16 mm
DOT pitch	0.35 X 0.33 mm	
Time tolerance	± 2s/day	

2) Configuration



4. DEFINITION OF INPUT/OUTPUT SIGNALS

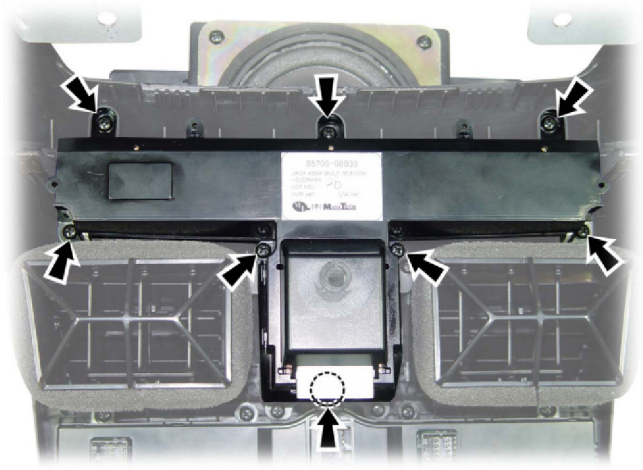
NO.	Input/Output signal	Logics	Remakrs
1	B+	ON = 12V, OFF = OPEN	
2	ACC	ON = BATT, OFF = OPEN	
3	IGN1	ON = BATT, OFF = OPEN	
4	ILLUMINATION +	ON = BATT, OFF = OPEN	
5	ILLUMINATION -	ON = GND, OFF = GND	
6	PLAY KEY	ON = 0.1V, OFF = OPEN	
7	MODE KEY	ON = 1.4V, OFF = OPEN	
8	UP KEY	ON = 2.3V, OFF = OPEN	
9	DOWN KEY	ON = 2.7V, OFF = OPEN	
10	TX	ANALOG INPUT	
11	RX	ANALOG OUTPUT	
12	E/P TEST	Earphone in = 0V, Earphone out = OPEN	
13	HOOK	ON = 0V, OFF = OPEN	
14	SERIAL TX	Communication sending line with hands-free unit (0 V ~ 5 V)	
15	SERIAL RX	Communication receiving line with hands-free unit (0 V ~ 5 V)	
16	ENABLE IN	JACK STATION ENABLE = 0V	
17	LEFT SOUND	JACK STATION DISABLE = 12V	
18	RIGHT SOUND	AUDIO OUTPUT: -4V ~ +4V	
19	5V(USB)	AUDIO OUTPUT: -4V ~ +4V	
20	D+	DC 5V, USB OUTPUT at max. 500 mA	
21	D-	USB SIGNAL LINE: 0V ~ 3.3V	

▶ Time Tolerance

1. For the time in which the tolerance is not specified, the tolerance is ±10%.
   For the time within 500 ms, the tolerance is ±100 ms.
2. The time specfied in each function does not include the lapse from the switch input to the chattering process time.

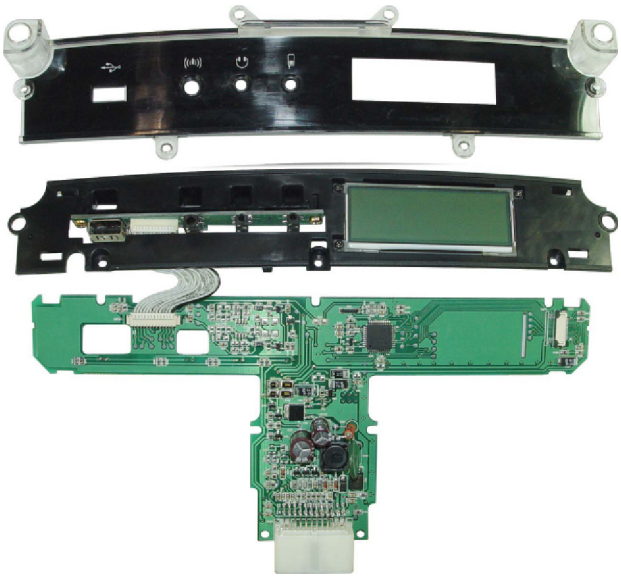
5. APPEARANCE

▶ **Internal Appearance when Installed**



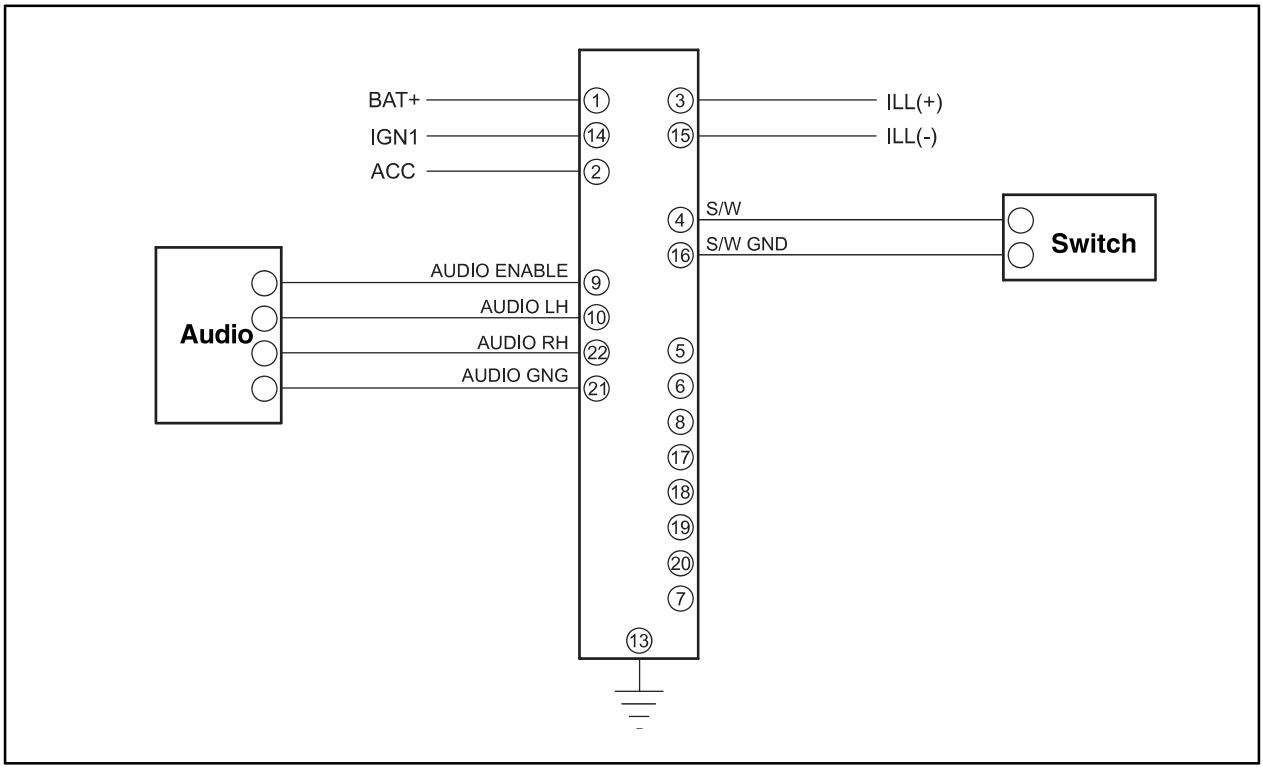
▶ **Apperance when Removed**

▶ **PCB and Internal Components**

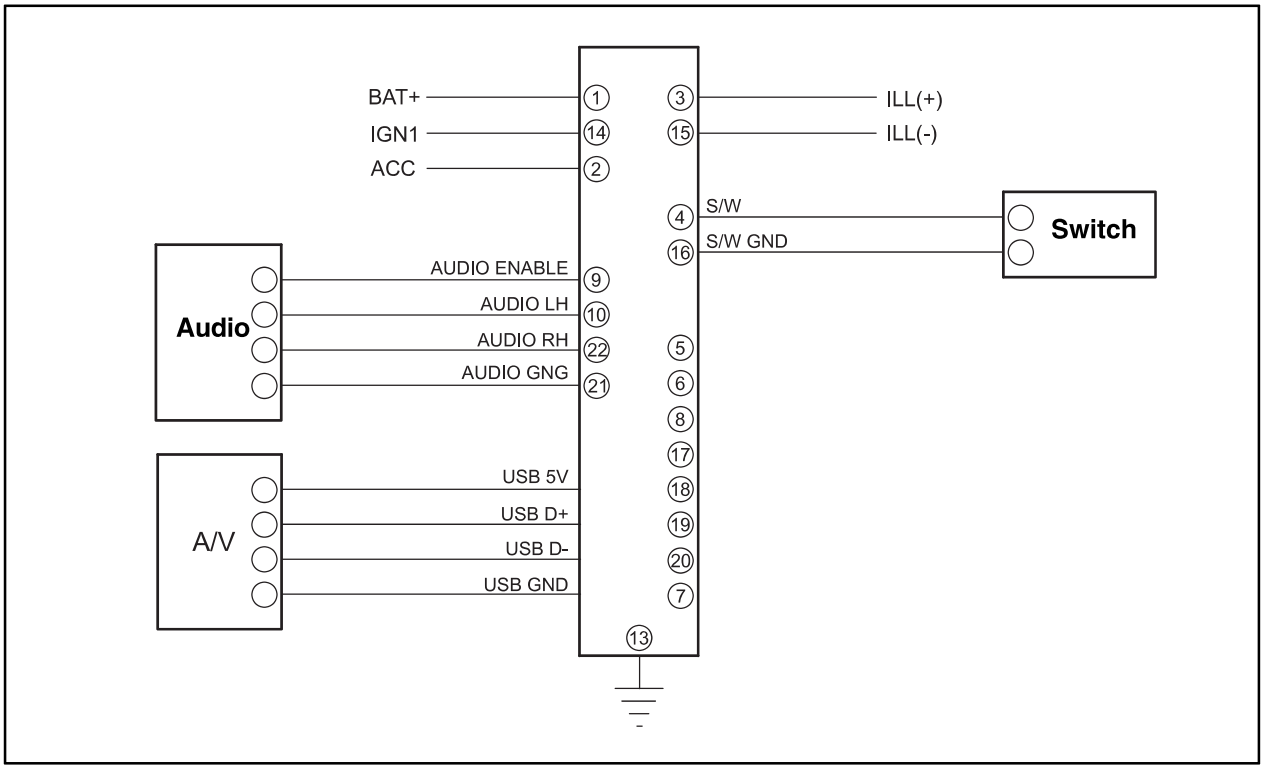


6. CIRCUIT DIAGRAM

▶ **Vehicle with MP3 Audio System**

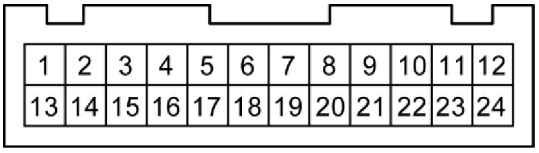


▶ **Vehicle with A/V System**



Modification basis	
Application basis	
Affected VIN	

▶ A/V Specification



Pin No	Function	Logics	Description
1	BAT (+)	ON = 12V, OFF = OPEN	Constant power (battery voltage)
2	ACC	ON = BATT, OFF = OPEN	Supply power when ACC ON
3	ILL (+)	ON = BATT, OFF = OPEN	Illumination (+)
4	S/W SIGNAL	ON = 0.1V, OFF = OPEN	A/D input (depending on pressing buttons)
		ON = 1.4V, OFF = OPEN	
		ON = 2.3V, OFF = OPEN	
		ON = 2.7V, OFF = OPEN	
5	COM1	Communication sending line with hands-free unit (0 V ~ 5 V)	Signal line from multi jack station to hands-free unit
6	H/F HOOK OUT	ON = 0V, OFF = OPEN	-
7	NC	-	-
8	RX	Analog signal	Audio signal output of other party's voice to the speaker
9	ENABLE IN	ON=5V, OFF=OPEN	Operation enabling signal from the audio system to the multi jack station
10	LEFT SOUND	Audio output (LH)	LH audio signal
11	NC	-	-
12	NC	-	-
13	GND	0V	Ground
14	IGN1	ON = BATT, OFF = OPEN	Power when the ignition key is ON or ON from START
15	ILL (-)	ON = GND, OFF = GND	Illumination (-)
16	S/W GND	0V	Switch ground
17	COM2	Communication receiving line with hands-free unit (0 V ~ 5 V)	-
18	H/F E/P TEST	Earphone in = 0V, Earphone out = OPEN	Earphone in/out signal
19	H/F GND	0V	-
20	TX	Analog input	-
21	AUDIO GND	0V	Audio ground
22	RIGHT SOUND	Audio output (RH)	RH audio signal
23	NC	-	-
24	NC	-	-

7. PANEL AND BUTTONS

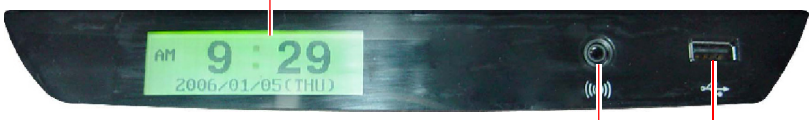
Multi Jack Station Panel

LCD panel (clock display/track indicator)

B/W LCD at 160 x 48 dots (Support 10 Korean characters for 3 lines if 16 x 16 font is used), Back Light Color

NOTICE

- **The LCD panel may display corrupted texts or operate with a certain delayed period if the interior temperature is too high or too low.**



Stereo jack

Connecting the output terminal of portable audio devices (MP3 player, CDP, etc.)

MP3 USB port

Connecting the USB flash drive which contains audio files

NOTICE

- **When cleaning the front panel of the multi jack station, turn the power off and wipe it with a dry and soft cloth. Never use any coarse cloth or volatile solvent (alcohol, benzene, thinner).**

Buttons

The buttons of the multi jack station are for clock adjustment, audio file search and play in USB flash drive. However, for the vehicle with the AV system, only the clock adjustment is available since the files in USB flash drive can be searched through the monitor.

MENU

File search, clock time adjustment and various mode change/adjustment

PLAY/STOP

Play, stop, time setting mode change

Next track (FF)

Plays the next track, fast forward, Up (+)

Previous track (REW)

Plays the previous track, fast rewind, Down (-)

Modification basis	
Application basis	
Affected VIN	

8. FUNCTIONAL SPECIFICATION

1) Functions

- Clock (including date and year) adjustment
- Audio output through the stereo jack
- File search and play through the USB flash drive

2) Multi Jack Station Specifications (Identified by USB port)

USB Flash Inserted

File selection and play

With A/V System

Mode change and file selection in AV monitor

With Audio System

Use the clock adjustment buttons to change modes and select files. The clock display also displays the file information.

Clock adjustment buttons

Clock display

For the vehicle with common audio system, press the AUX button on upper side of the audio unit to enter the multi jack station mode. The USB mode has the higher priority than the stereo jack mode.

PARKING AID SYSTEM

8790-04

GENERAL

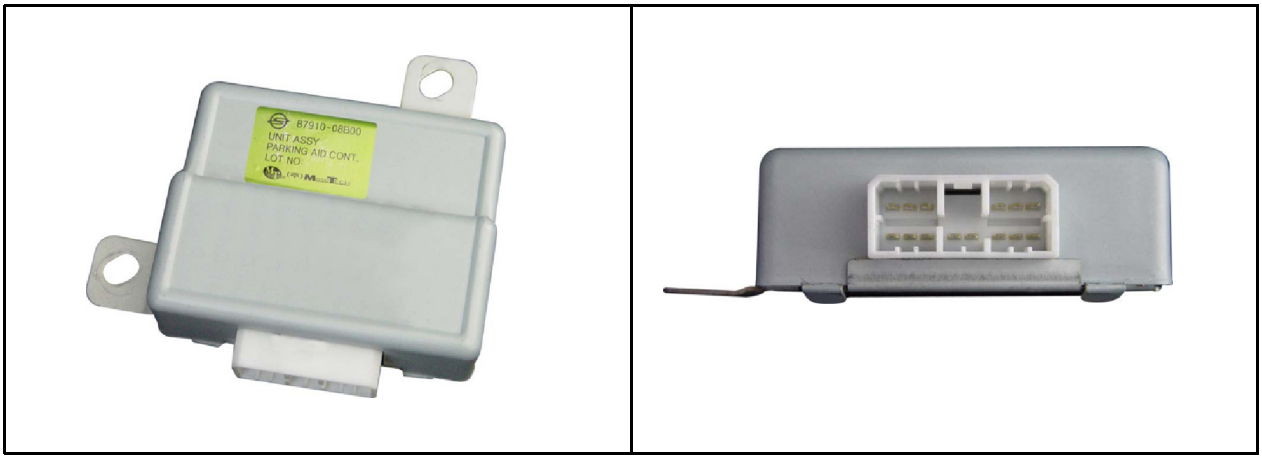
1. SPECIFICATIONS

The parking aid system emits the supersonic wave signals from the sensors on the rear bumper with a specific interval and detects the reflected signals from obstacles while the gear selector lever is in "R" position. The alarm interval increases as the obstacle approaches. This supplementary system is to secure the safety distance for parking.

Descriptions		Value	Descriptions		Value
Rated voltage		DC 12 V	Operating temperature		-30°C ~ +80°C
Operating voltage		DC 9 V ~ 16 V	Storage temperature		-40°C ~ +85°C
Maximum permissible current	Unit	Below 100 mA	Relative humidity		95% RH max
	Sensor	Below 20 mA (each)	Weight	Unit	160g ± 10g max
Sensor insulating resistance		Over 5 MΩ		Sensor	70g ± 10g max

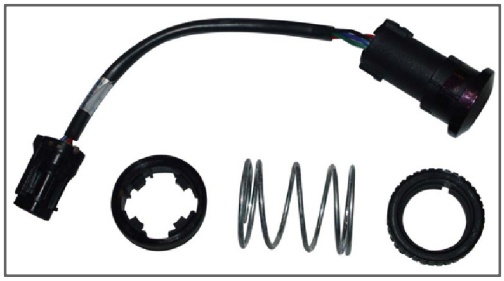
▶ Parking Aid Unit

Detecting type: Super sonic wave
Detecting distance: 25 cm ~ 120 cm (distance between sensor and obstacle)



▶ Parking Aid Sensor

- Type: Piezo ceramic element
  Calculates the distance between the sensor and the object by caculating the return time of the emitted the ultrasonic wave.
- Frequency: 40 KHz ± 1 KHz
- Detecting range: 25 cm ~ 120 cm (based on the direct distance from the sensor)
- Tolerance: ± 5 cm



2. CAUTIONS ON PARKING AID SYSTEM

CAUTION

- Note that the display does not show everything in the rear area. Always check nobody, especially animals and children, is behind the vehicle when parking or reversing.
- If you can not properly check the vehicle behind, get out of the vehicle and then visually check it.

1. The parking aid system is just a supplemental device to help your parking operation.
2. Always keep the safety precautions.
3. Do not press or shock the sensors by hitting or high-pressure water gun while washing, or the sensors will be damaged.
4. If the system is in normal operating condition, a short beep sounds when the gear selector lever is moved into "R" position with the ignition key "ON".

▶ The parking aid system will not work or improperly work under following cases

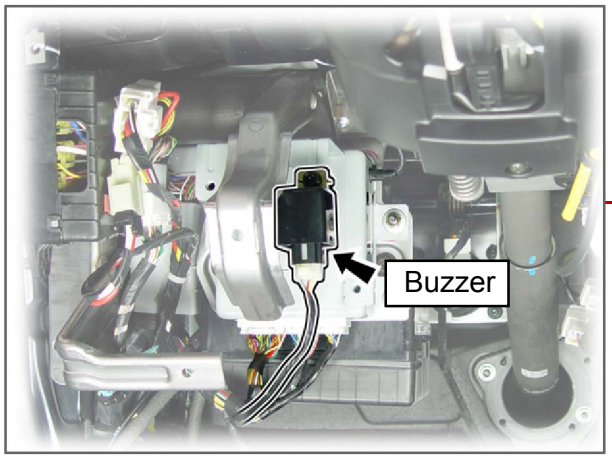
1. Certain obstacles that sensors can not detect
   - Wires, ropes, chains.
   - Cotton, sponge, clothes, snow that absorb ultrasonic waves.
   - Obstacles lower than the bumper (ex. drain ditch or mud puddle)
2. Not defective but improperly working
   - When the sensing portion is frozen (operates normally after thawed)
   - When the sensing portion is covered by rain, water drops, snow or mud (operates normally after cleaned)
   - When receiving other ultrasonic signals (metal sound or air braking noises from heavy commercial vehicles)
   - When a high-power radio is turned on
3. Narrowed sensing area
   - When the sensing portion is partially covered by snow or mud (operates normally after cleaned)
   - Surrounding temperature of sensor is too high (approx. over 80 °C) or too low (approx. below −30 °C)
4. Not defective but may occur improper working
   - When driving on the rough roads, gravel road, hill and grass
   - When the bumper height is changed due to the heavy load
   - When the sensing portion is frozen
   - When the sensing portion is covered by rain, water drops, snow or mud
   - When receiving other ultrasonic signals (metal sound or air braking noises from heavy commercial vehicles)
   - When a high-power radio is turned on
   - When some accessories are attached in detecting ranges

Modification basis	
Application basis	
Affected VIN	

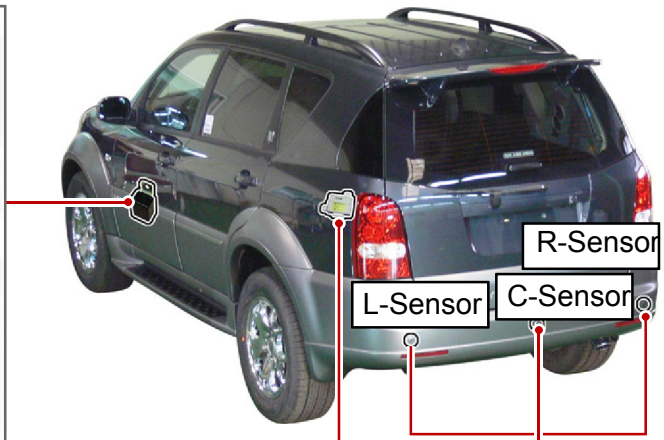
OVERVIEW AND OPERATION PROCESS

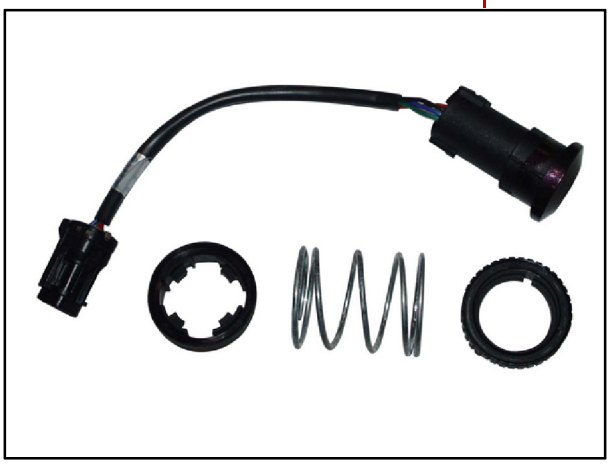
1. OVERVIEW

The parking aid device is integrated in the rear bumper and it uses three Piezoelectric elements to measure vertical and horizontal distance to obstacles.
When placing the gear selector lever to "R" position, the designated unit (PAS unit in the rear right quarter panel) activates the parking aid sensors to measure the distance to
obstacles.
If a sensor is malfunctioning, the buzzer in PAS unit sounds to warn the driver.



- The locations of buzzer and folding unit may vary according to the model.



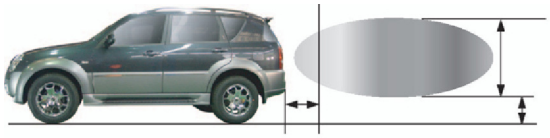


2. ALARM INTERVAL AND TROUBLESHOOTING OF SENSOR

1) Alarm Interval

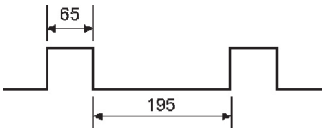
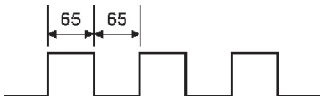
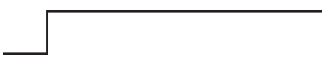
Alarm interval and display changes according to the distance as below: While reversing, if obstacles are within stage
1, the warning beep sounds with long intervals. If within stage
2, the warning beep sounds with short intervals and if within stage
3, the warning beep sounds continuously.

Detection range



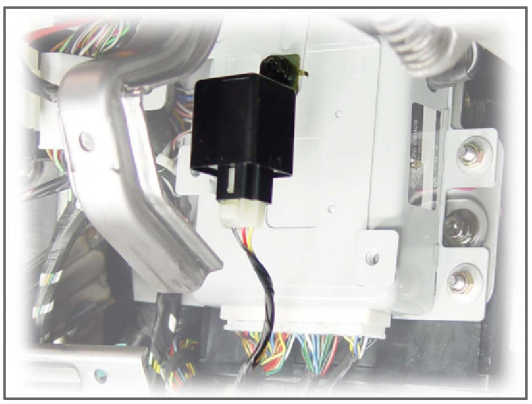
25 cm from bumper
(may not be detected.)

20 cm from ground
(may not be detected.)

Stage	L, R Sensor	C Sensor	Interval (msec)	Remark
1	90 ~ 100 cm	90 ~ 120 cm		“Beep ----- ”, “Beep ----- ”
2	60 ~ 90 cm			“Beep -, Beep -, Beep -”
3	25 ~ 60 cm			“Beep ----- ”
Tolerance	± 5 cm		±10%	

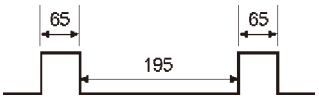
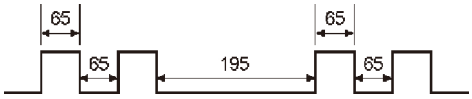
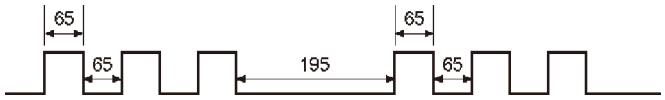
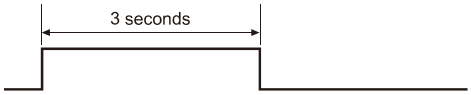
2) Troubleshooting of Sensor

When the shift lever is in the "R" position with the ignition switch on, the sensor is diagnosed once (under normal condition, the buzzer sounds once). If found any failure due to open circuit to sensor or communication error, buzzer sounds as below:
However, if more than one sensor are malfunctioning, warning buzzer sounds for 3 seconds.

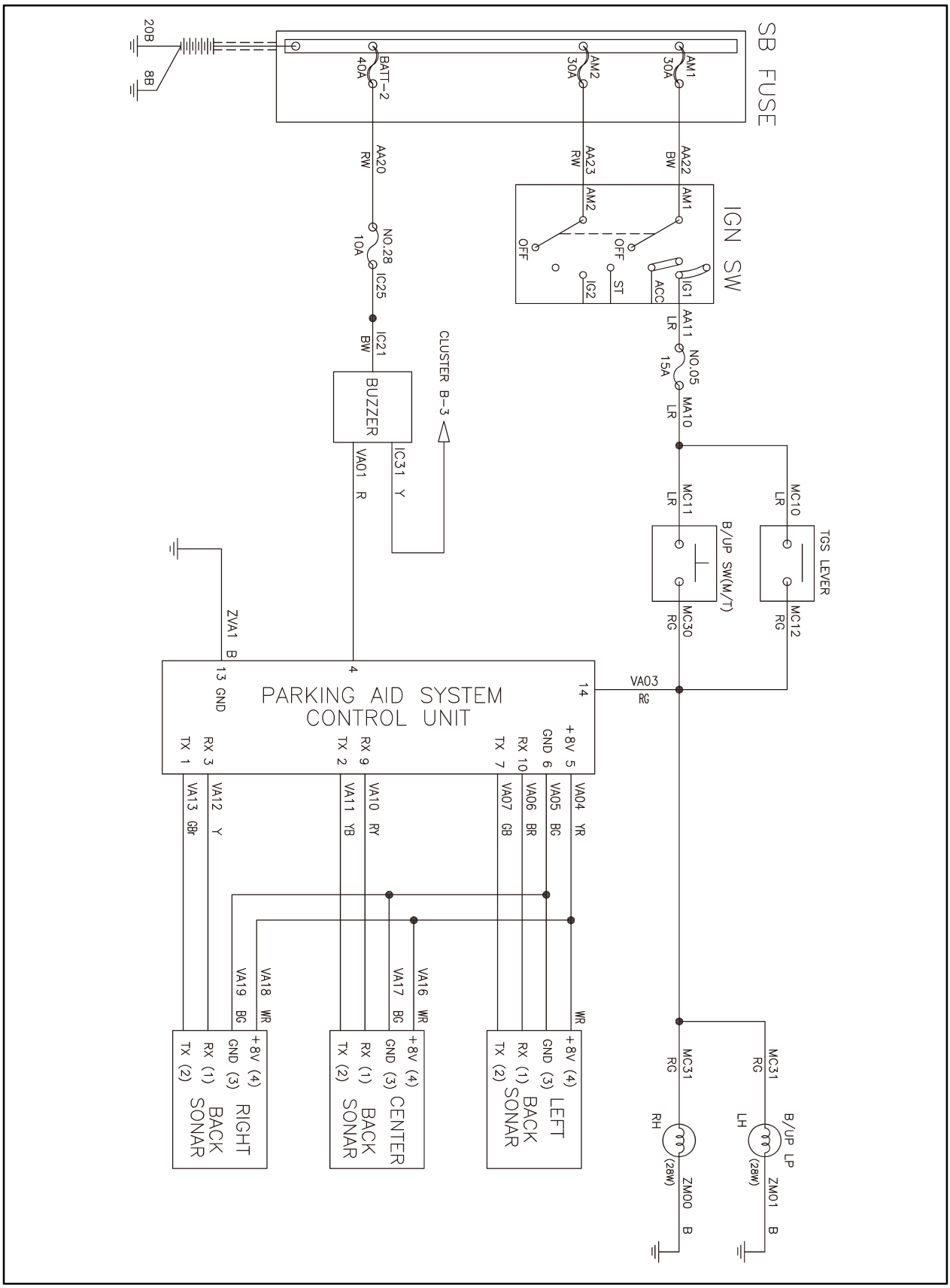


Modification basis	
Application basis	
Affected VIN	

* When sensor fails self-diagnosis

Malfunction mode	Interval (msec)	Remark
Left sensor error		"beep----beep"
Center sensor error		"beep, beep---- beep, beep"
Right sensor error		"beep, beep, beep---- beep, beep, beep"
Multiple sensor error		The buzzer sounds for 3 seconds if there is any defect in more than one sensor.

3. CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

AV SYSTEM

8931-01

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

▶ **Difference Between Audio System and AV System**

Audio Head Unit

Audio System

Standard Specification: Audio
Option 1: 2-DIN player (Radio and CD player, No cassette deck
Option 2: USB type MP3 jack (for multi jack staion)
The multi jack station includes the clock and stereo jack (MP3 USB jack is optional).
The speaker system consists of 4 speakers (one in each door) and 2 tweeter speakers (above each front door). The radio antenna is attached on the tailgate.
The integrated type antenna is not available.

AV Head Unit

AV System

Radio, CD/Cassette/MP3, TV and DVD system are available. The USB type MP3 jack is installed as the standard specification. If the navigation is installed, the GPS antenna is attached on the rear section of the roof.

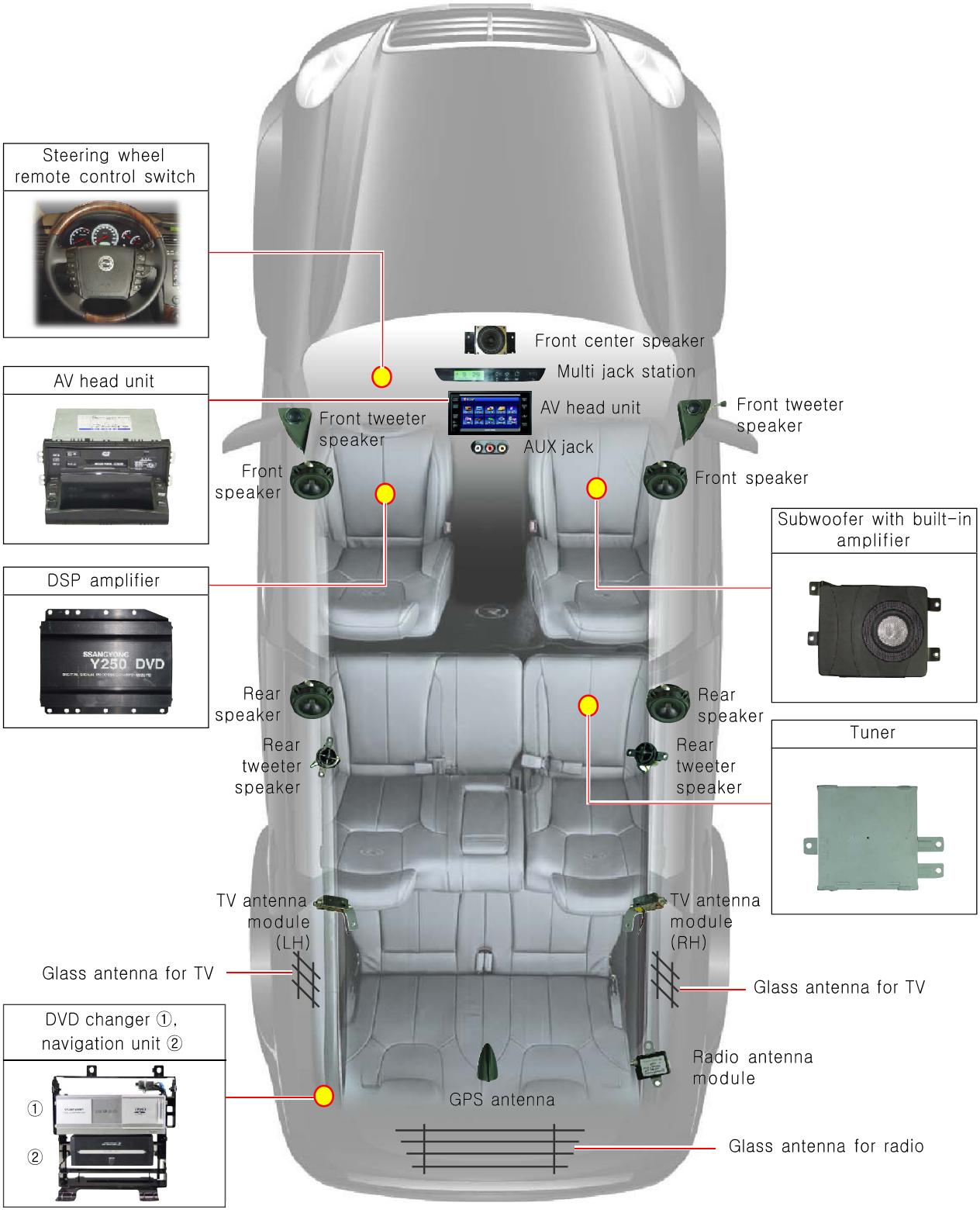
The speaker system consists of 1 center speaker, 4 door speakers (one in each door) and 2 tweeter speaker (one in each door) and 1 woofer under the passenger seat.

1. AV head unit
2. Tuner
3. DSP amplifier (10 speakers including woofer speaker)
4. Navigation unit
5. 8-DVD changer
6. Multi jack station (including MP3 USB)
7. GPS antenna
8. AUX terminal (1 video terminal, 2 audio terminals)

* Some functions may not be included according to the model.

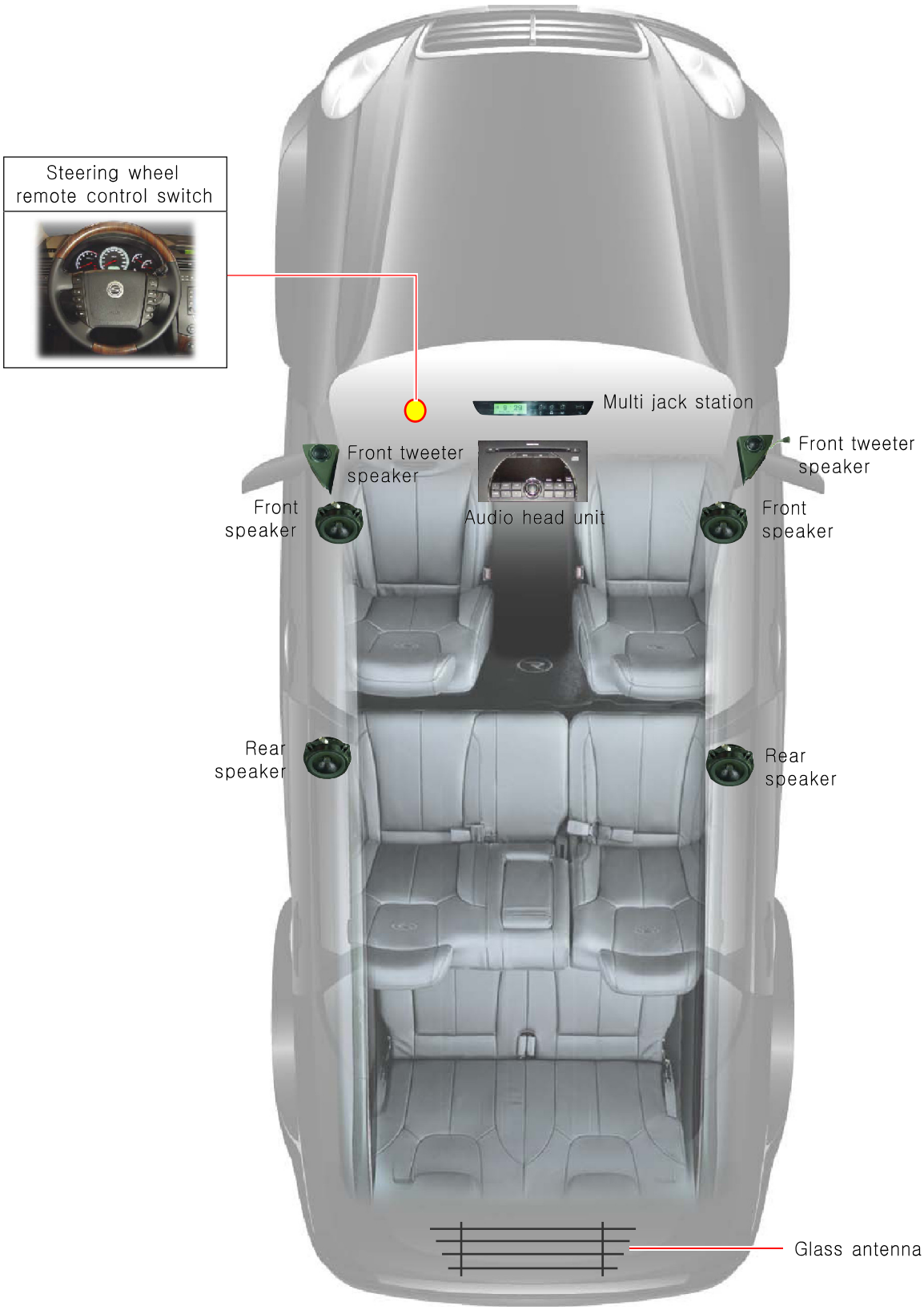
2. MAJOR COMPONENTS AND LOCATIONS OF AV SYSTEM

1) AV System



Modification basis	
Application basis	
Affected VIN	

2) Audio System



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)	

Modification basis	
Application basis	
Affected VIN	

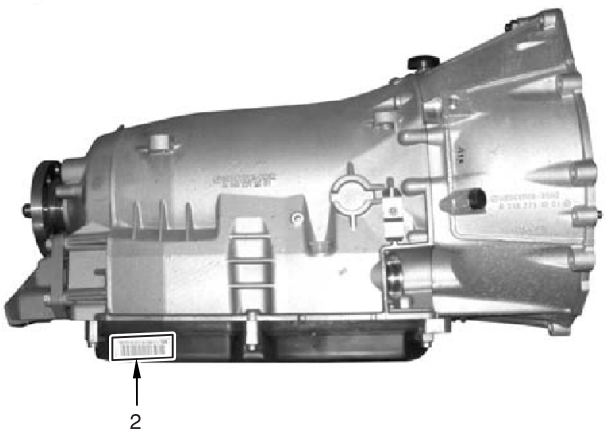
Item		W5A330 (300)	W5A580 (400)
Mode switch		W (Winter)	
		S (Standard)	
One-way clutch		F1, F2	
Planetary gear set	Plain planetary gear: 3 (number of pinion)	3, 4, 3	4, 4, 4
Disc clutch	Disc: C1*, C2, C3*	Single plate type*	
Disc brake	Disc: B1*, B2, B3	Single plate type*	

Modification basis	
Application basis	
Affected VIN	

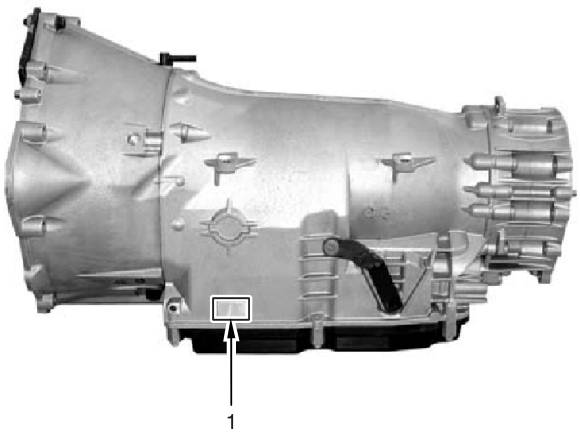
OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

2WD



4WD



1
7202700600 — DC Part Number
722 600 0 — DC Variant Number
377900 — Serial Number

3 Automatic Transmission Assembly

722 600 0
- Engine Code Number
  - 61: D27DT (4WD)
  - 62: E3.2 Engine (4WD)
- Transmission Type
- Automatic Transmission for Passenger Car

▶DC 5-Speed Automatic Transmission

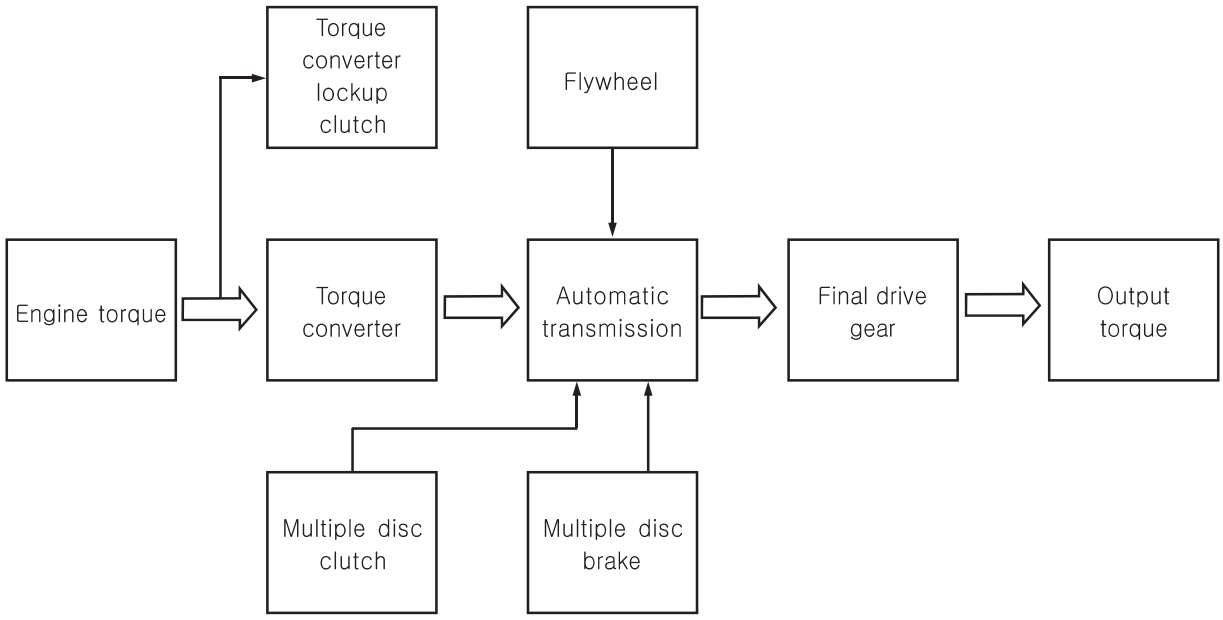
DCAG 5-speed automatic transmission is an electronically controlled 5-speed transmission with a lockup clutch in the torque converter. The ratios for the gears are realized by three planetary gear sets. The 5th gear is designed with a step-up ratio of 0.83 as an overdrive. The selector lever is controlled 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

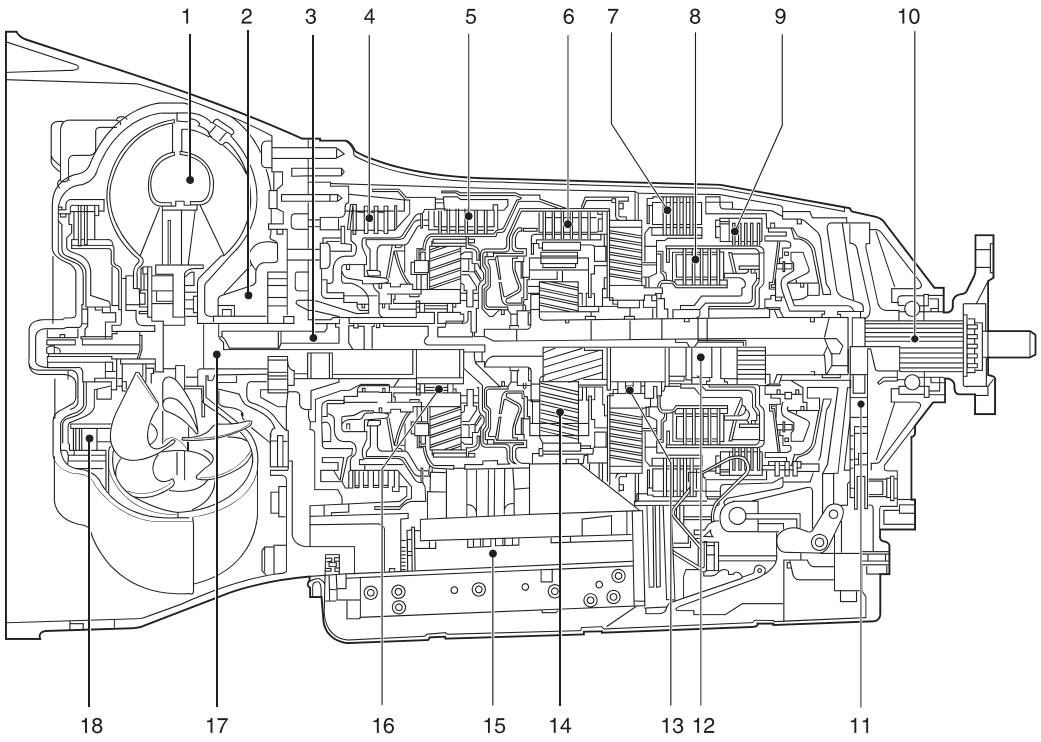
2. CHARACTERISTICS

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



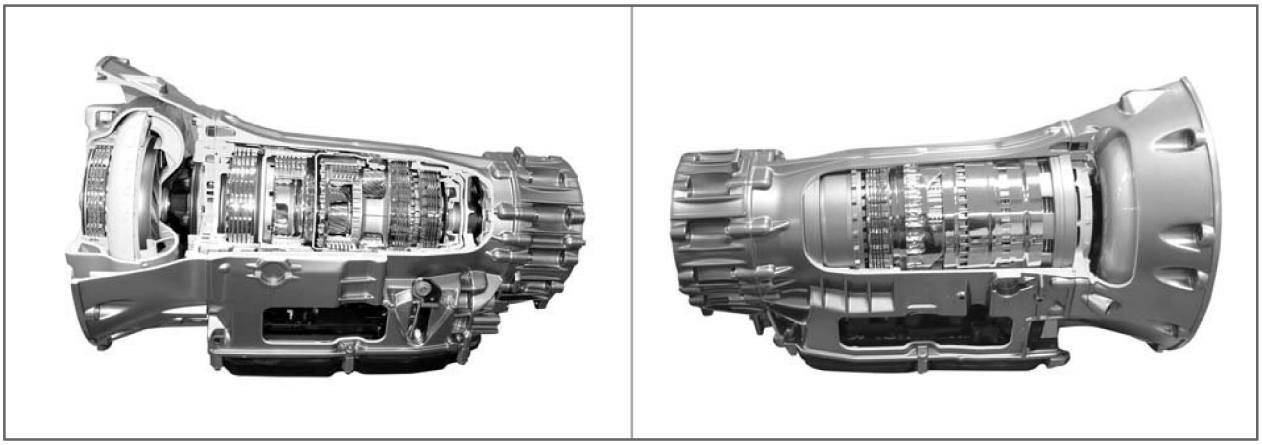
Modification basis	
Application basis	
Affected VIN	

3. STRUCTURE



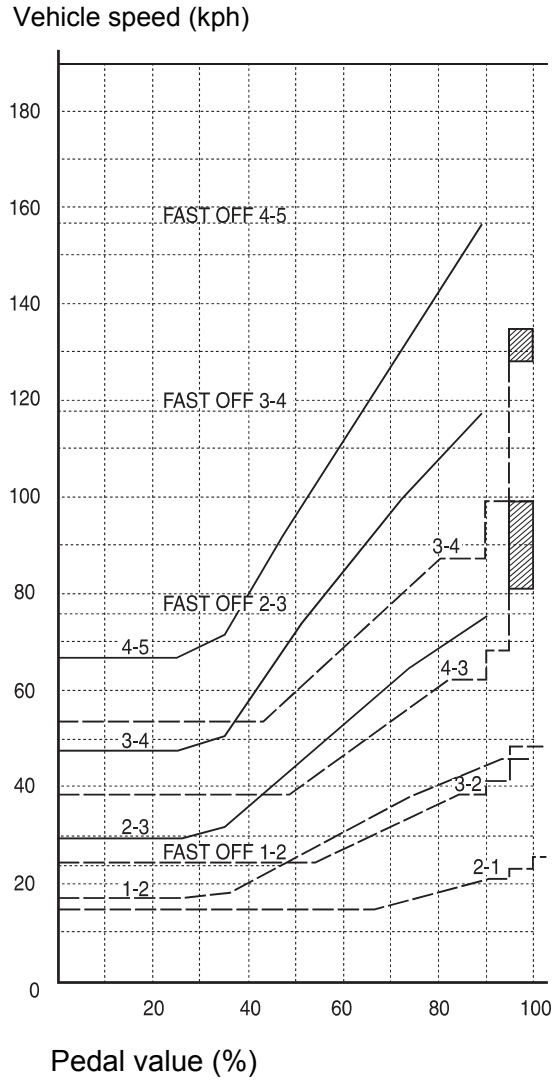
* Basic structure of DC 5-speed automatic transmission

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	

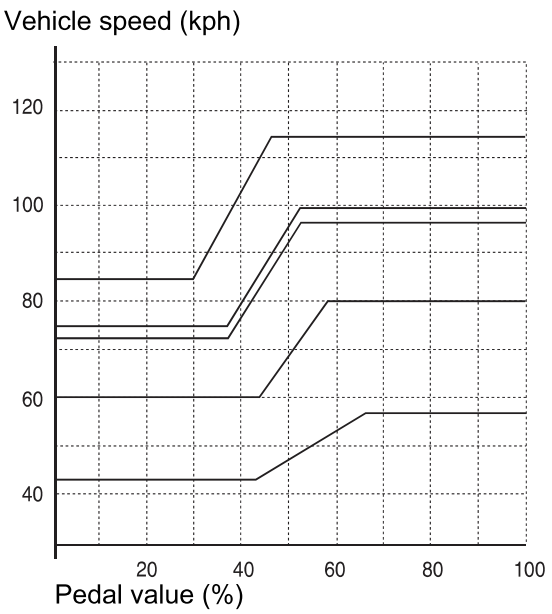
2. WINTER Mode: Standard Mode

3. Allowable shifting point:

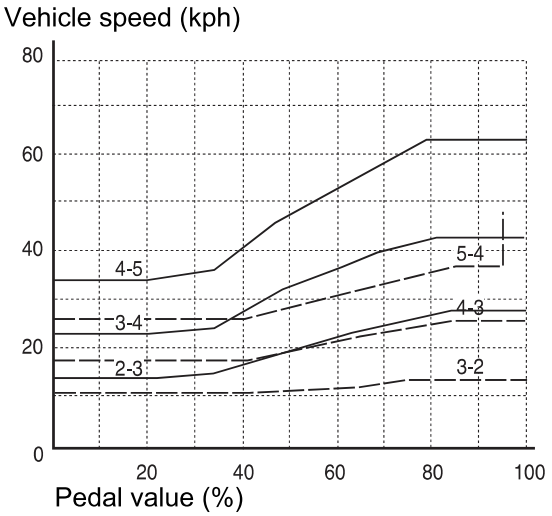
   Upshift
   Downshift
   Lockup (sleeping)
   Unlock (open)
   FAST OFF
   Dynamic shift range

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).

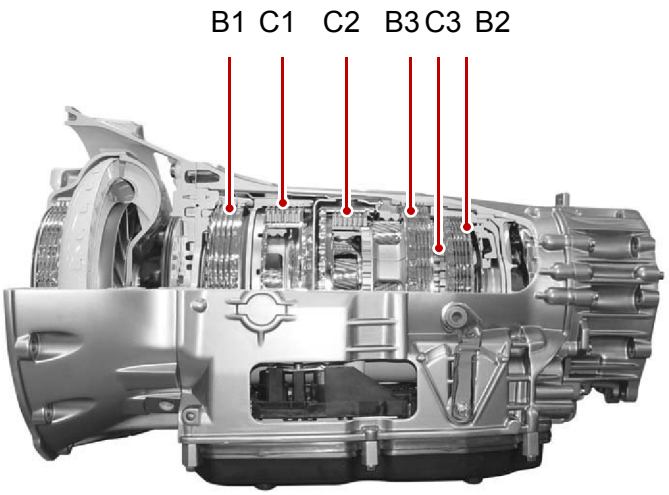
5. Dynamic shift range

- 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.

Modification basis	
Application basis	
Affected VIN	

5. POWER FLOW

▶Sectional View



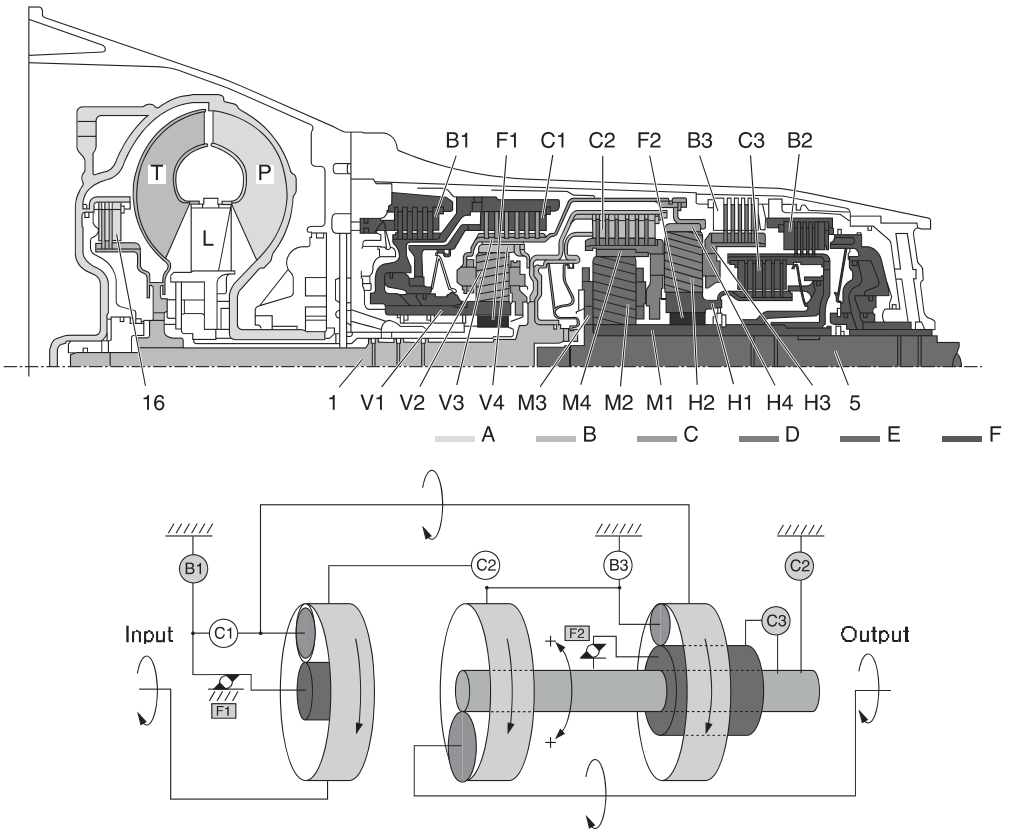
▶Shifting elements

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

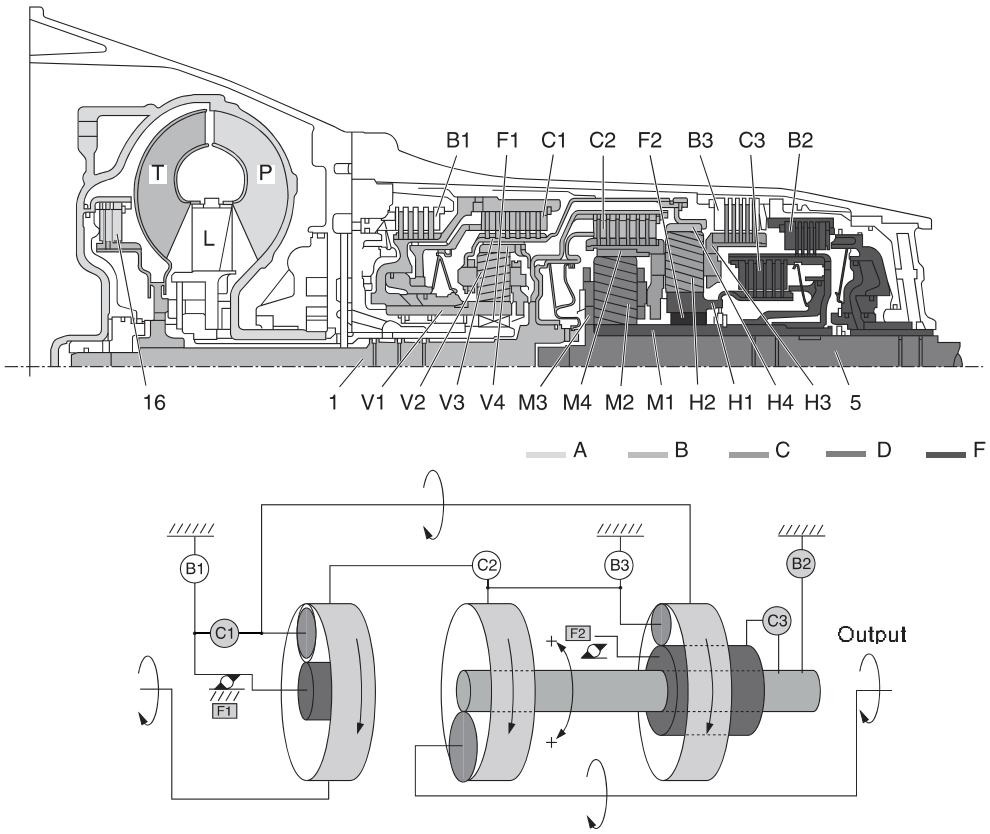
* Input shaft: Clockwise rotation
* Front sun gear: Locked by F1 and B1, Planetary gear carrier: Rotation with reduced speed
* Rear ring gear: Counterclockwise rotation
* Rear sun gear: Locked by F2 and B2, Planetary gear carrier: Clockwise rotation with reduced speed
* Center ring gear: Clockwise rotation
* 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

Modification basis	
Application basis	
Affected VIN	

▶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

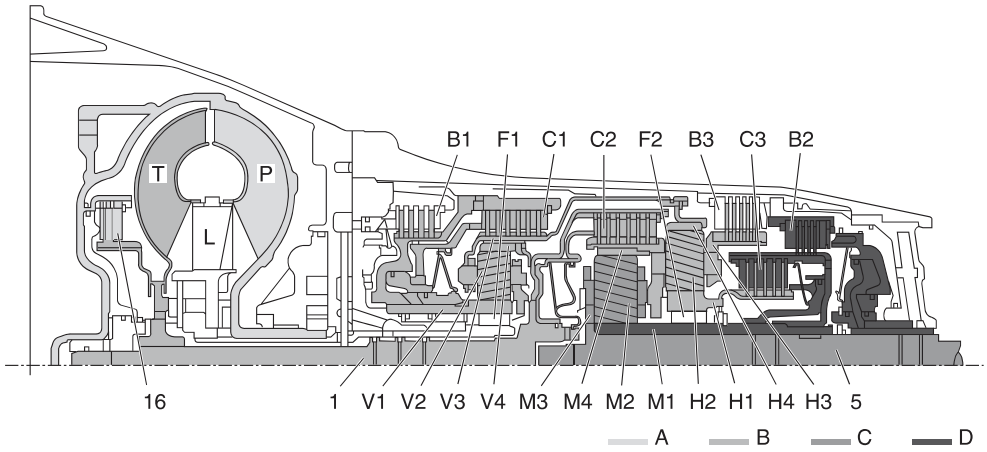
* Input shaft: Clockwise rotation
* Sun gear and planetary gear carrier: Clockwise rotation by C1 activation
* Rear ring gear: Clockwise rotation
* Rear sun gear: Locked by F2 and B2, Planetary gear carrier: Rotation with reduced speed
* Center ring gear: Clockwise rotation
* Sun gear: Locked by B2, Planetary gear carrier: Rotation with reduced speed
* Output shaft: Clockwise rotation

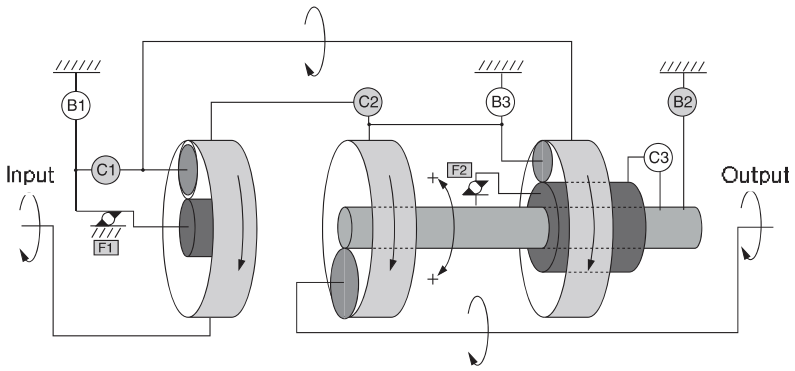
Gear	C1	C2	C3	B1	B2	B3	F1	F2
2	●		● 3)		●			●

3) Overrun

Modification basis	
Application basis	
Affected VIN	

▶3rd Gear (1.486)



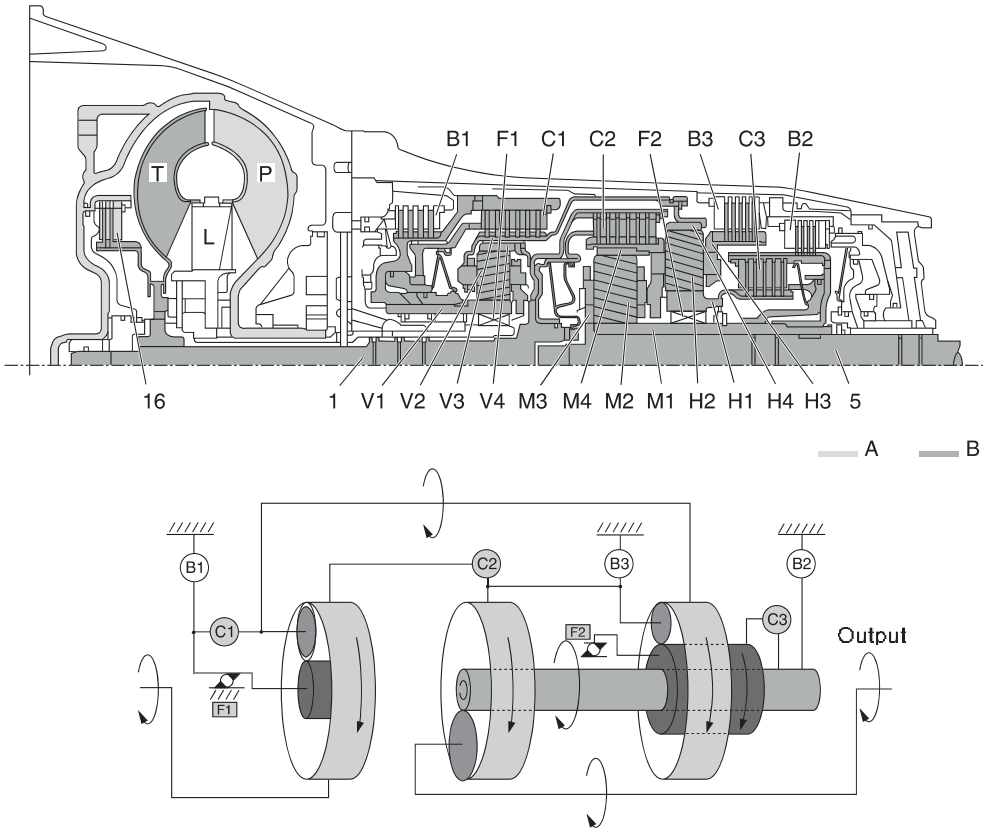


16.Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

* 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)



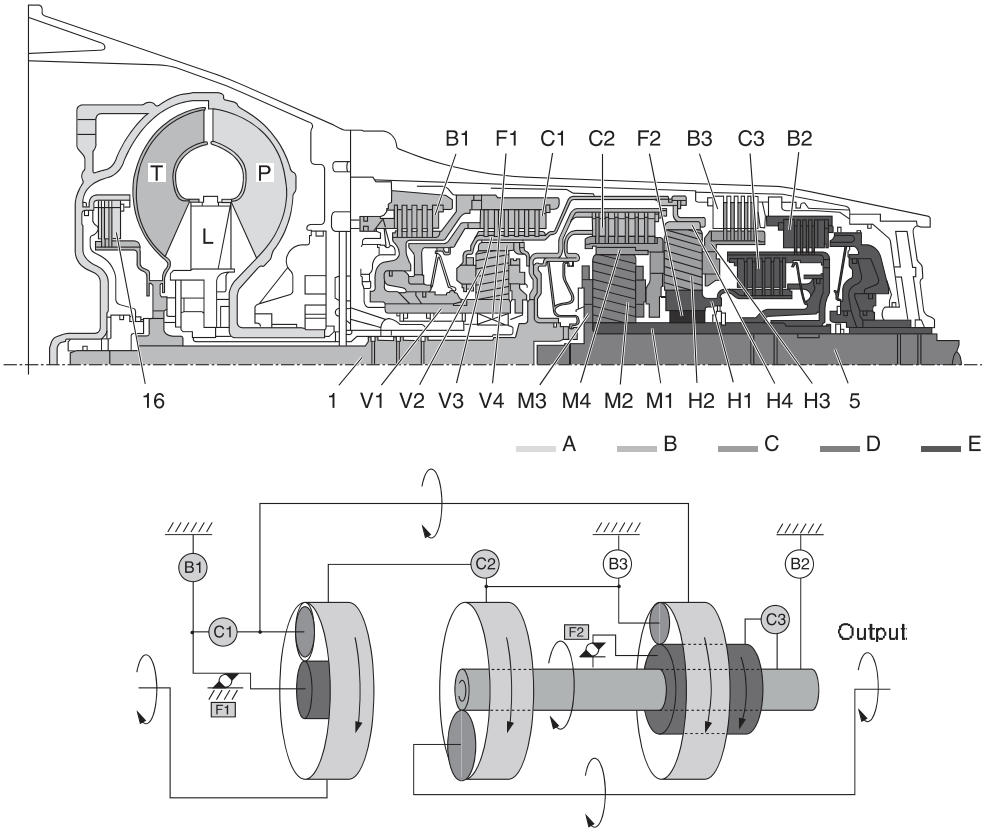
16.Torque converter lockup clutch L. Stator T. Turbine wheel
A. Engine speed M. Center planetary gear set V. Front planetary gear set
B. Planetary gear set P. Impeller

* 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)



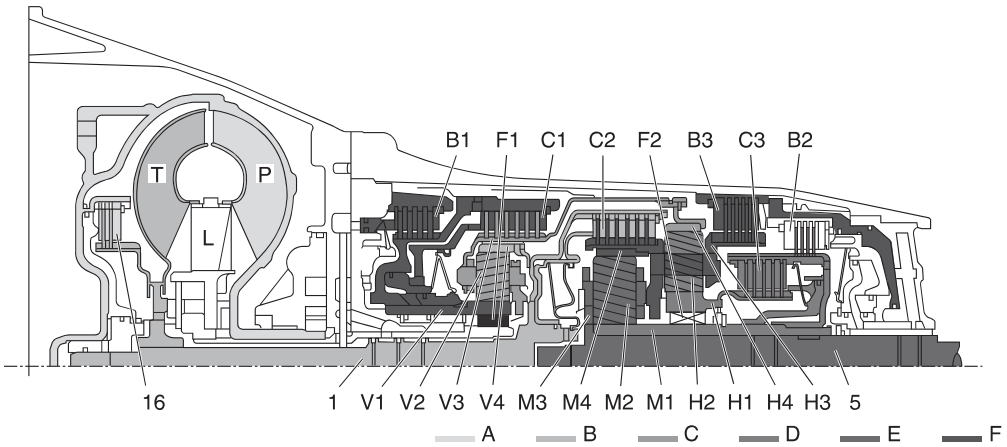
16.Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. 3rd gear ratio
F. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

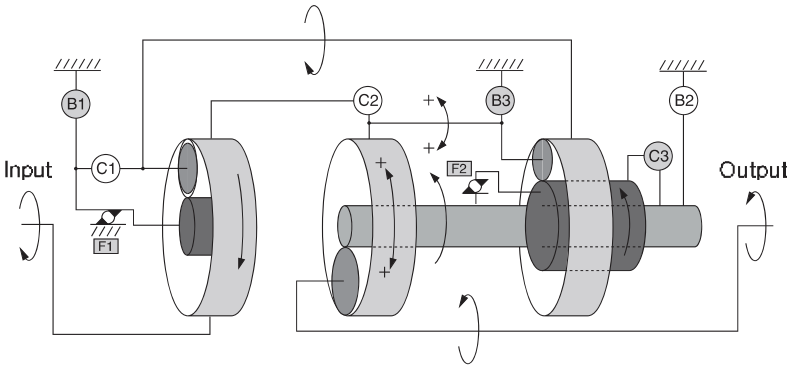
* Input shaft: Clockwise rotation
* Front sun gear: Locked, Planetary gear carrier: Rotation with reduced speed
* Rear planetary gear carrier: Clockwise rotation with reduced speed
* Center ring gear and rear planetary gear carrier: Clockwise rotation by clutch C2 activation
* Rear sun gear: Clockwise 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)





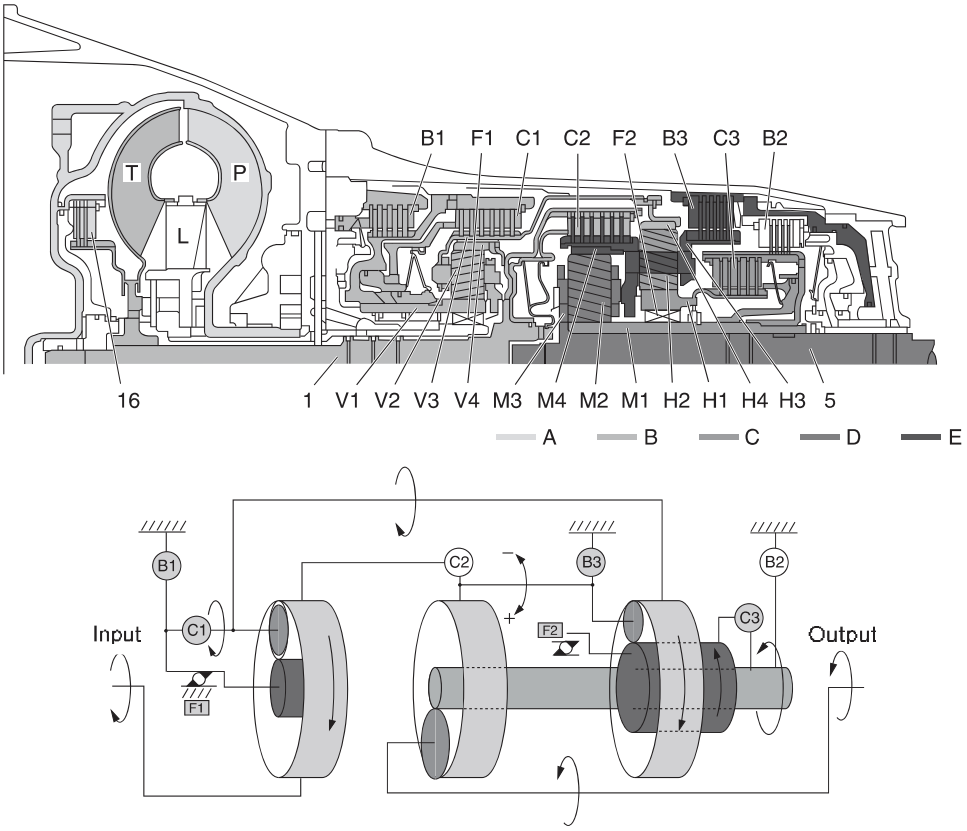
16.Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. Mounting elements
F. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

* 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)



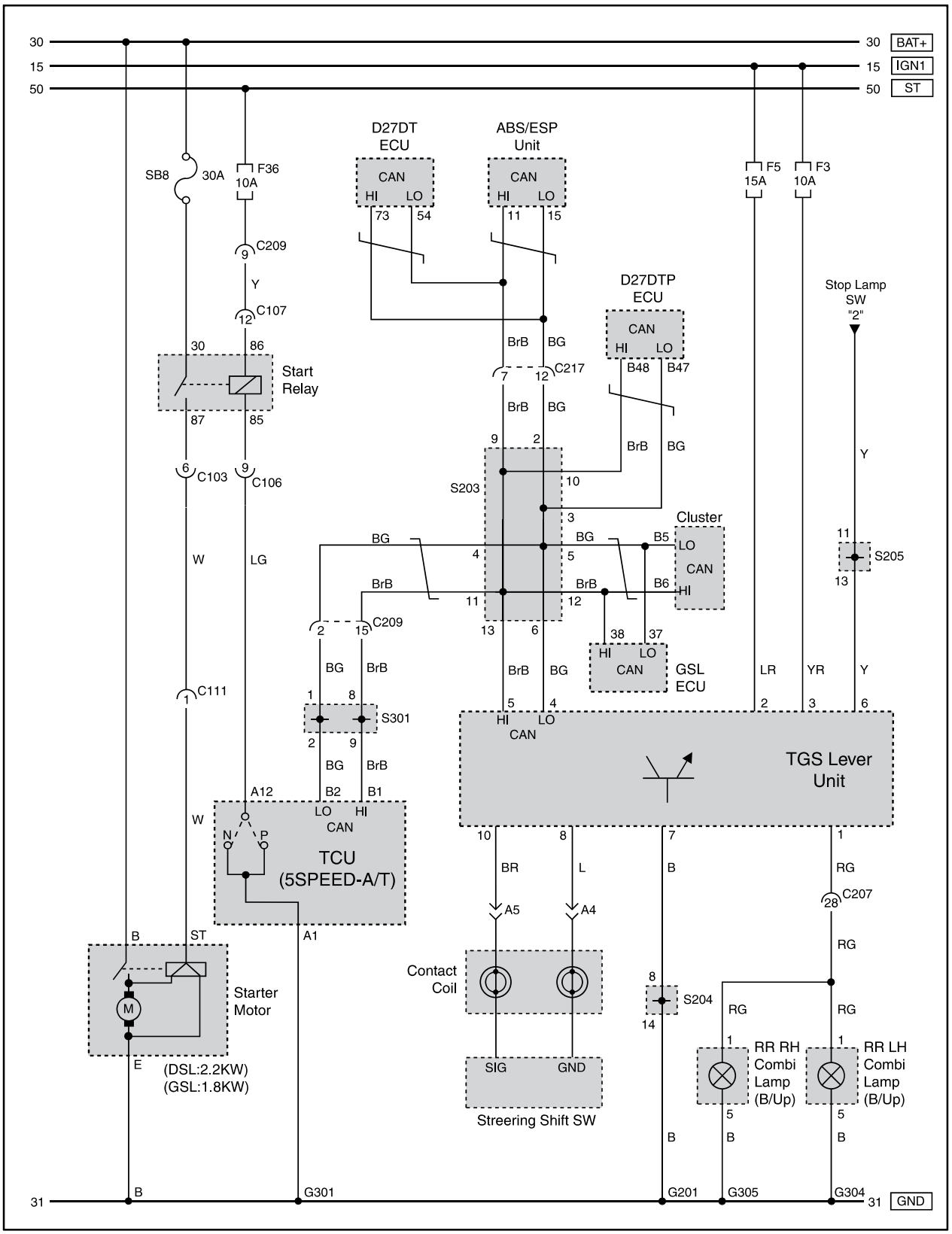
16.Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

* 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)	●		●			●		

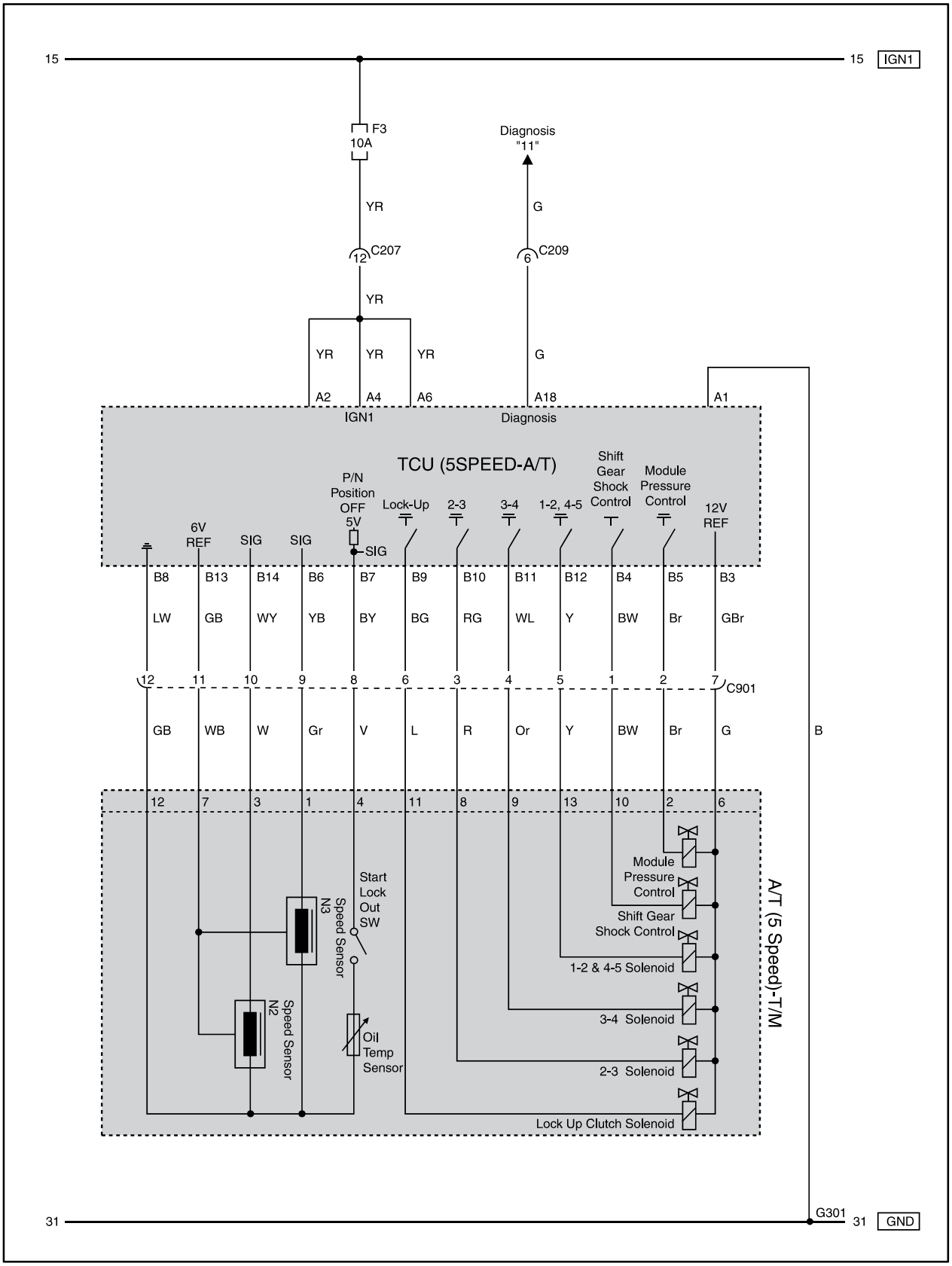
6. CIRCUIT DIAGRAM

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	

NO DATA

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)	

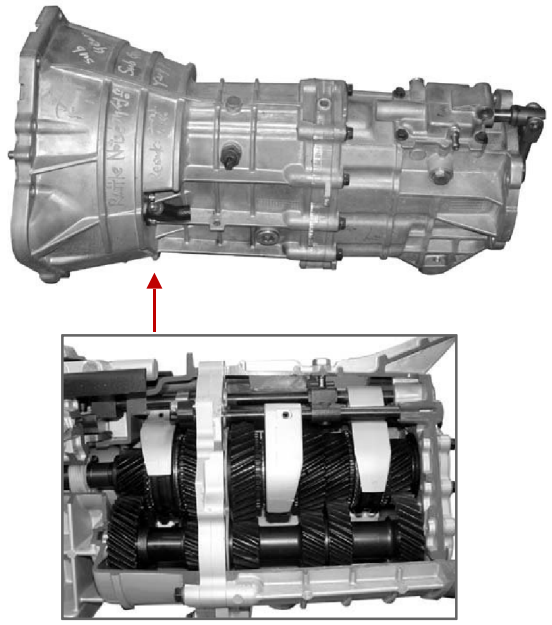
2) Tightening Torque

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

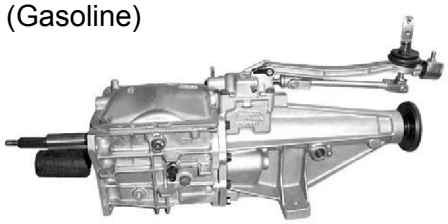
OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

4WD

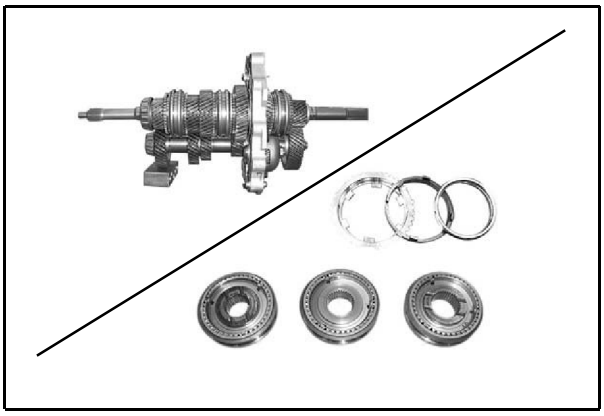


2WD (Gasoline)



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.

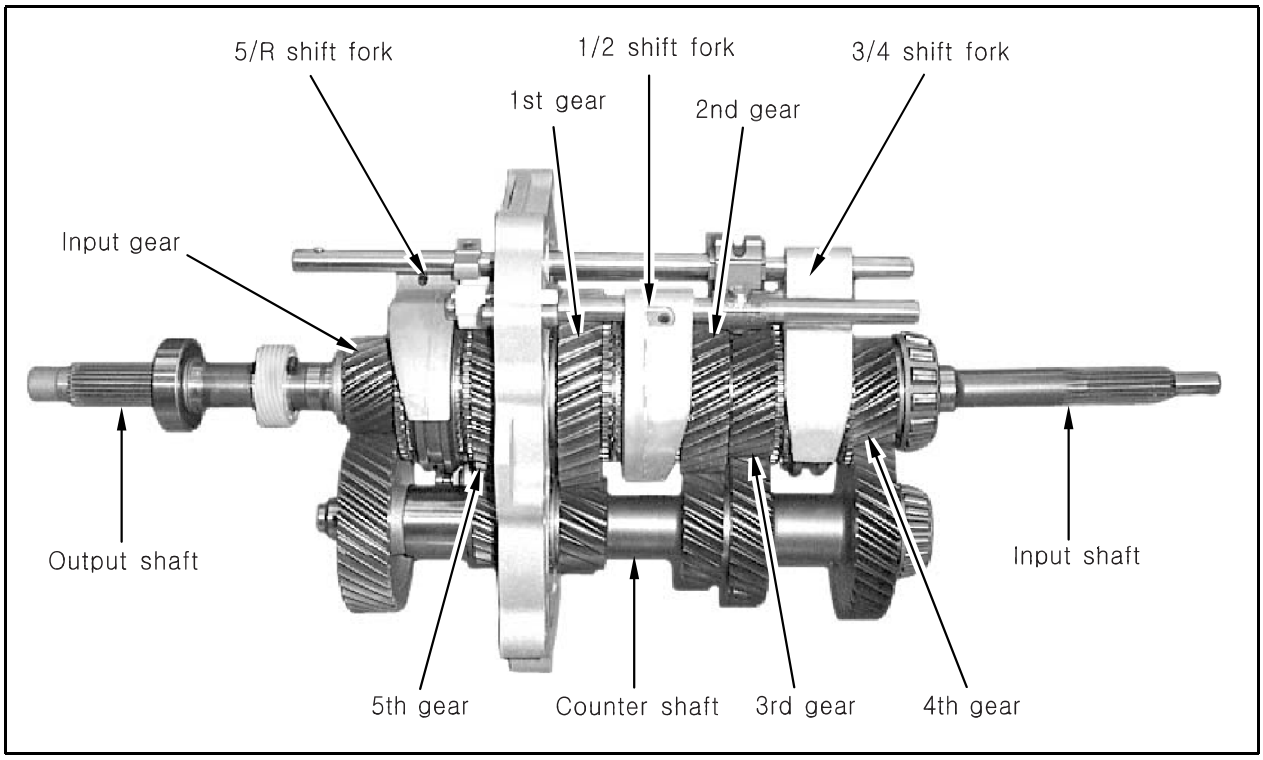
CAUTION
TSM54/52 transmission uses the inertia lock type key to make smooth gear engagement and to provide silent gear engagement.

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.

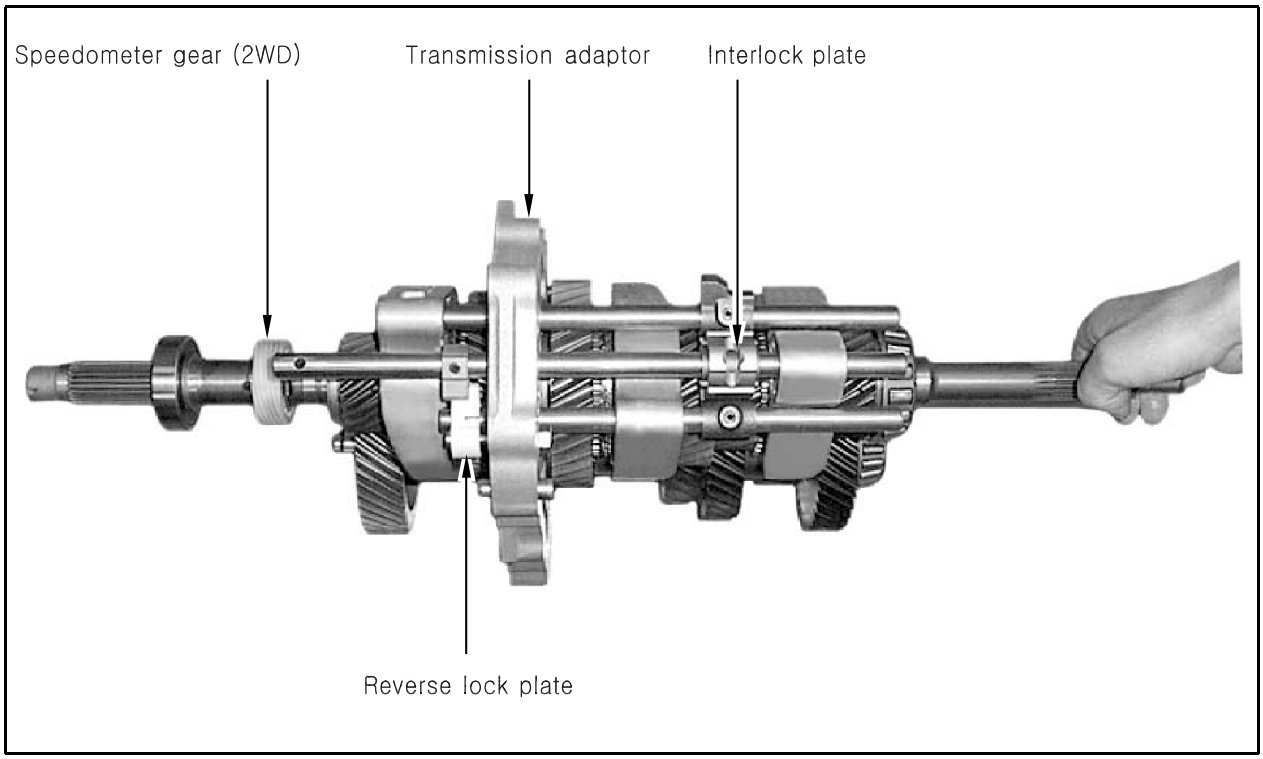
Modification basis	
Application basis	
Affected VIN	

2. SYSTEM COMPONENTS

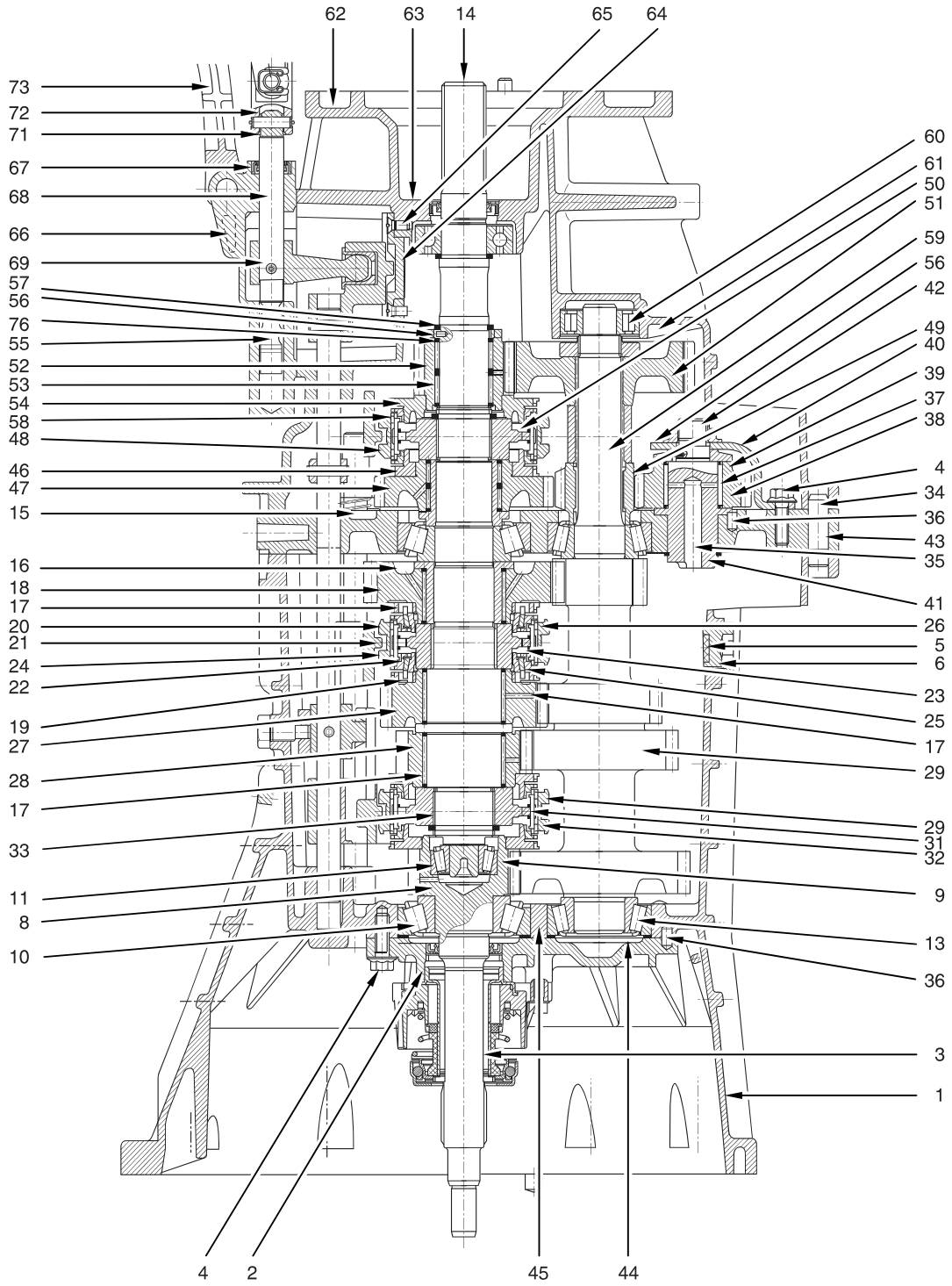
1) Gear Combinations



2) Shift Fork and Rail Combinations



3) Sectional View

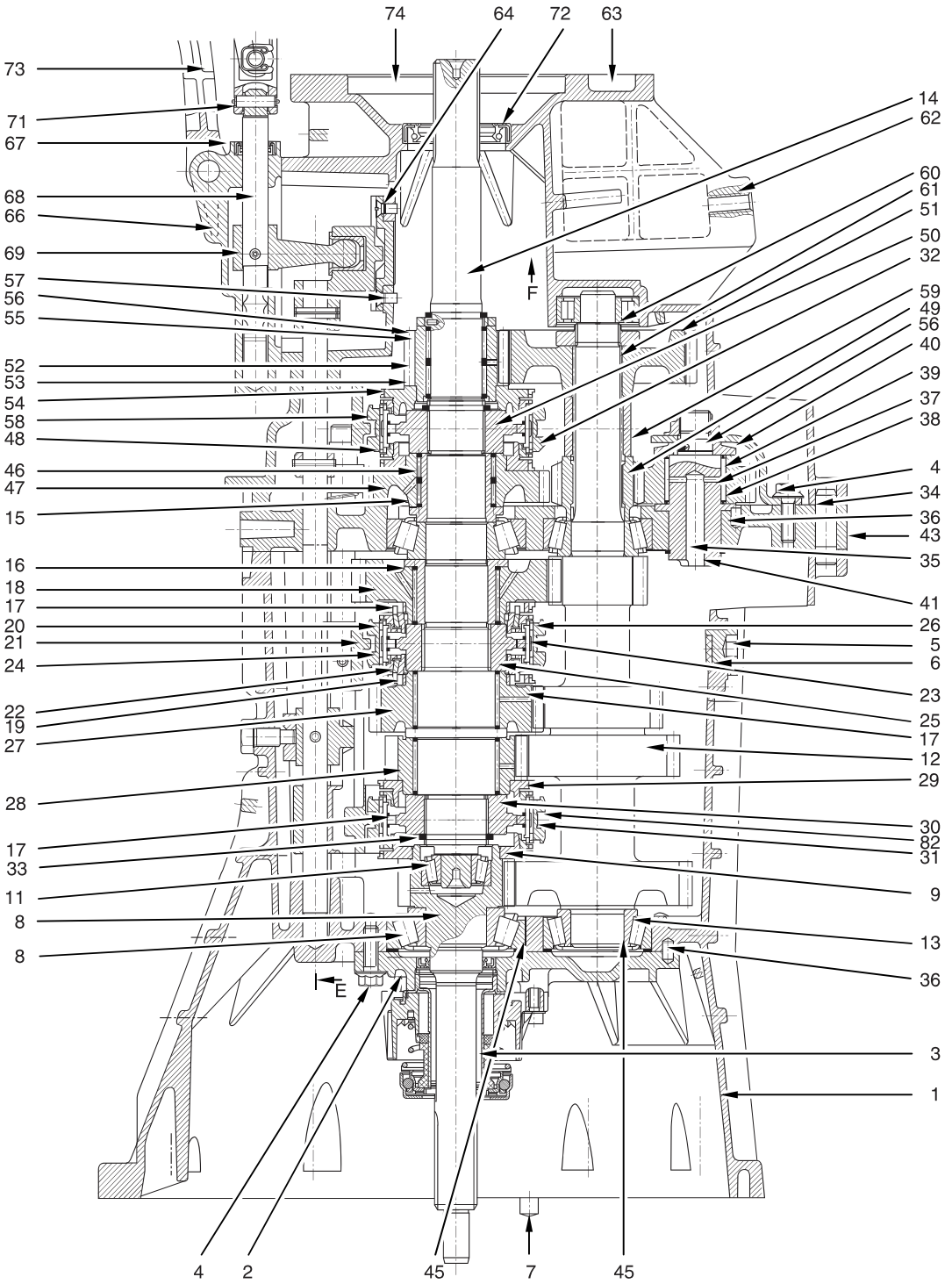


Modification basis	
Application basis	
Affected VIN	

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

Modification basis	
Application basis	
Affected VIN	

▶IDI Engine equipped vehicle - 4WD

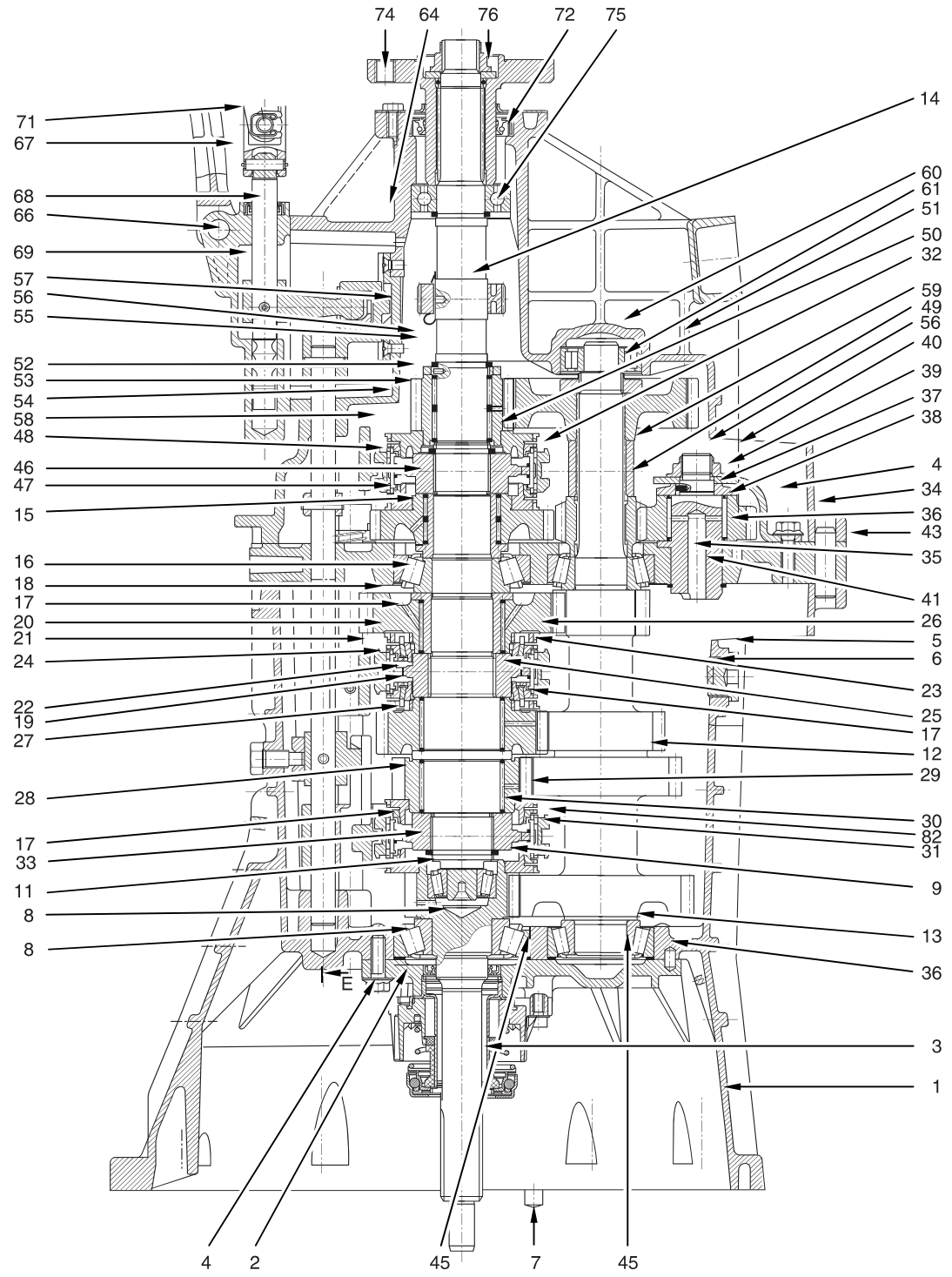


Modification basis	
Application basis	
Affected VIN	

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

Modification basis	
Application basis	
Affected VIN	

▶IDI Engine equipped vehicle - 2WD



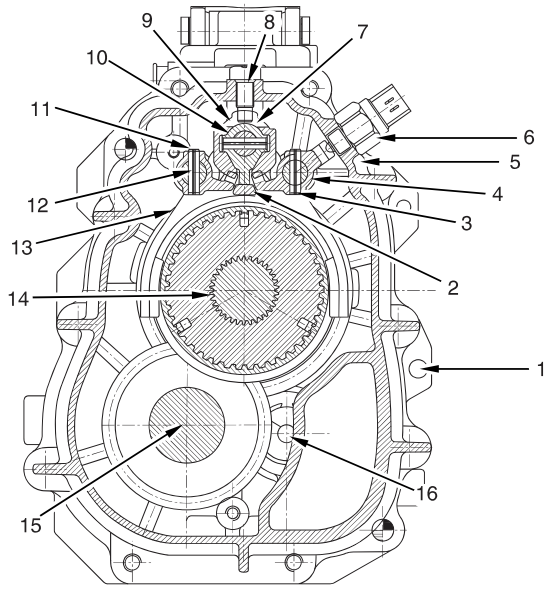
Modification basis	
Application basis	
Affected VIN	

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

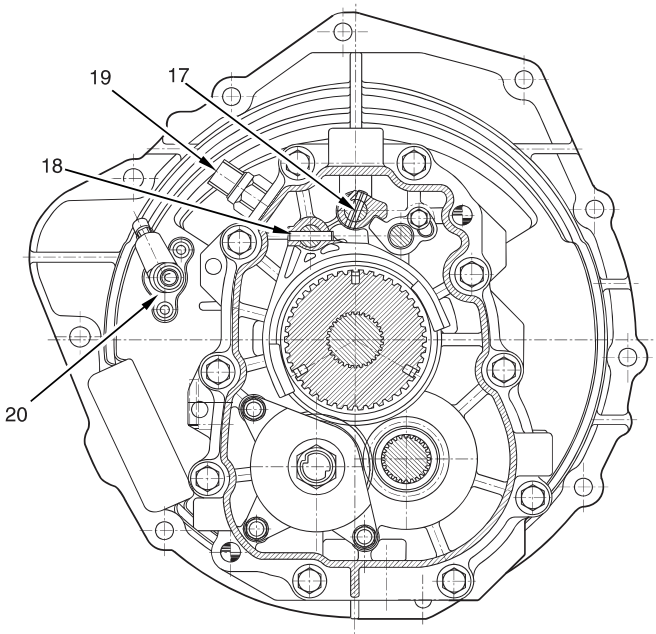
Modification basis	
Application basis	
Affected VIN	

4) Front View and Rear View

Front view



Rear view



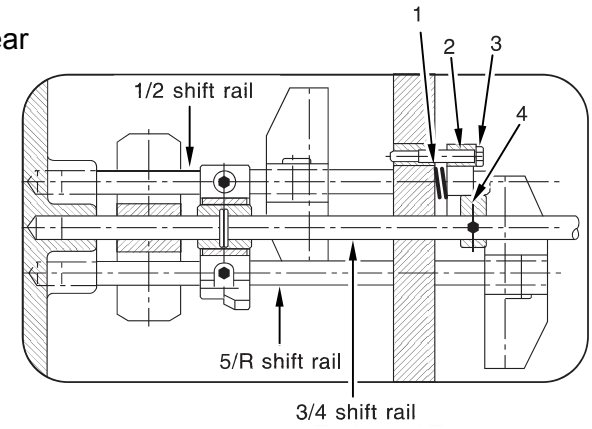
1. Oil filler plug (tightening torque: 40 ~ 50 Nm)
2. Shift rug (3 & 4th)
3. Spring pin (6 x 25)
4. Shift rug (5 & reverse)
5. Shift rail (5 & reverse)
6. Backup lamp switch (tightening torque: 30 ~ 40 Nm)
7. Shift rail (3 & 4th)
8. Interlock bolt (tightening torque: 40 ~ 50 Nm)
9. Shift lever
10. Interlock 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

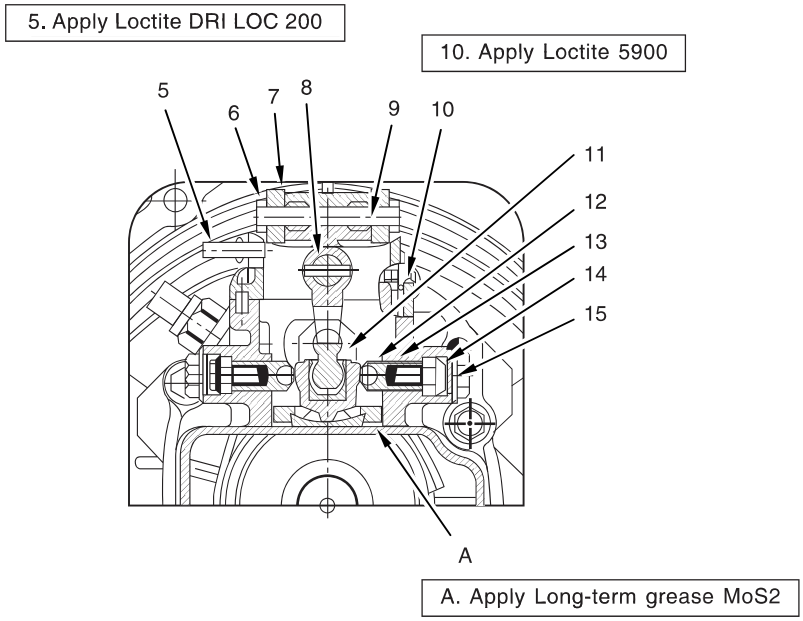
Modification basis	
Application basis	
Affected VIN	

5) Cross Sectional Diagram of Major Components

Shift rail and 5/R gear



Offset lever

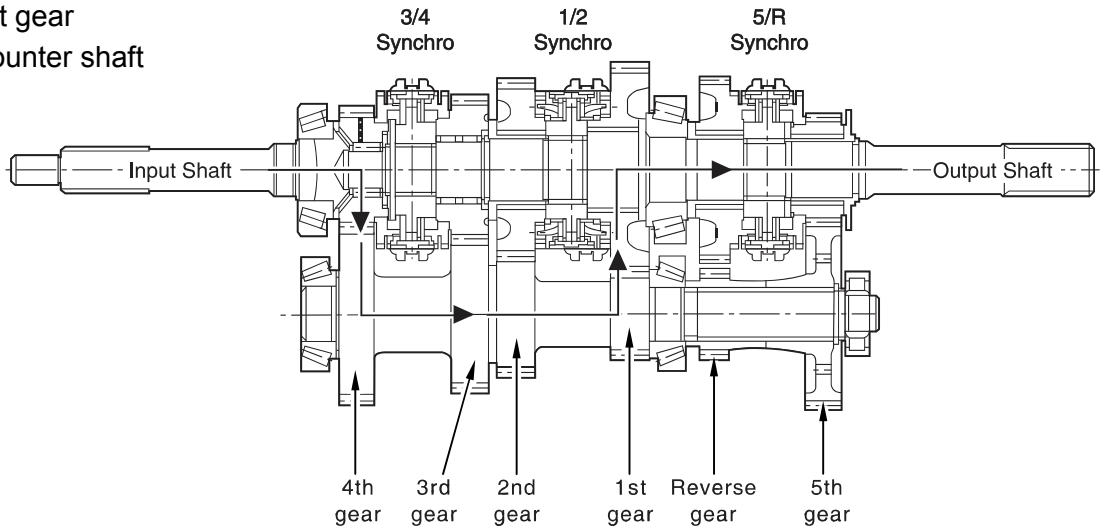


1. Reverse lock spring
2. Reverse lock plate
3. Reverse lock bolt
4. Stopper plate
5. Air vent
   (tightening torque: 30 ~ 40 Nm)
6. Lock washer
7. TGS bushing
8. Outer spring pin
9. TGS pin
10. Lock bolt
    (tightening torque: 17 ~ 26 Nm)
11. Offset lever
12. Offset lever bushing
13. Rolling plunger
14. Return spring
15. Spring plug
    (tightening torque: 30 ~ 35 Nm)

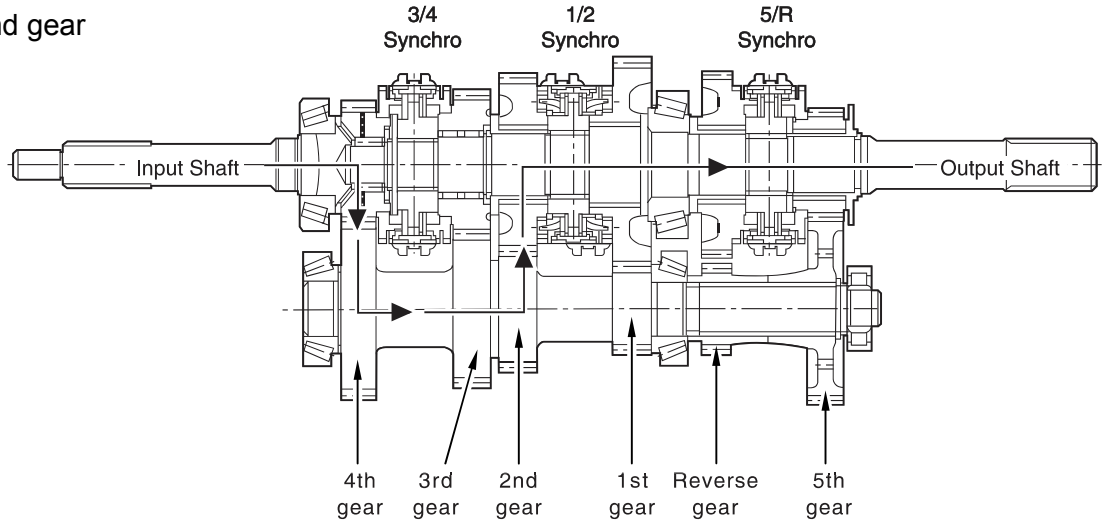
A. Apply Long-term grease MoS2 when installing the offset lever.

6) Power Flows

1st gear
Counter shaft



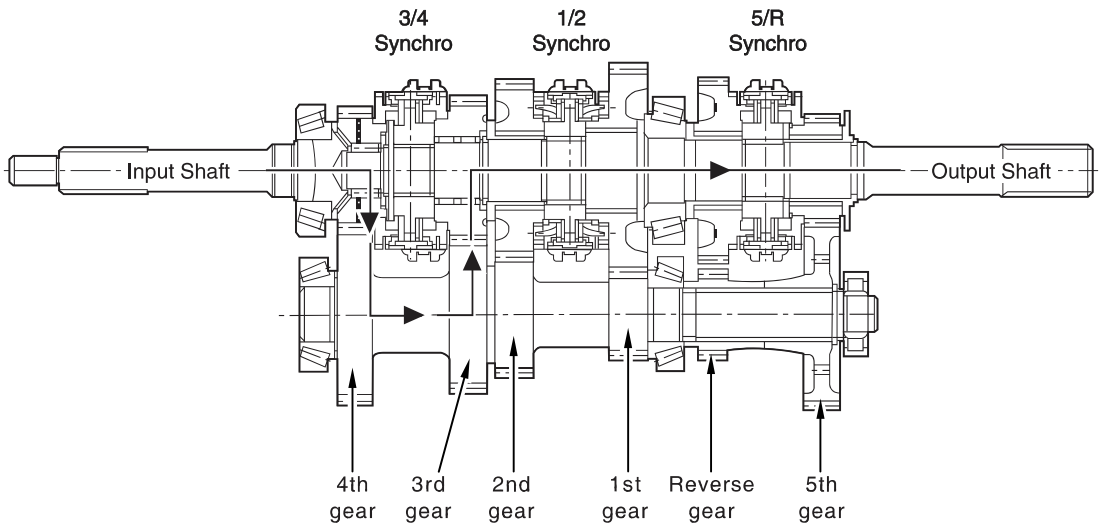
2nd gear



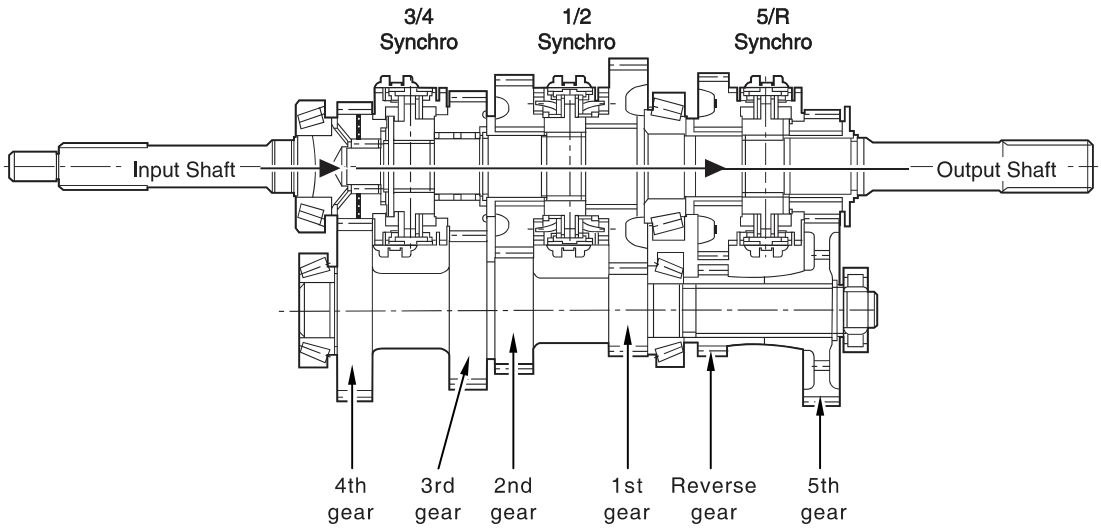
Modification basis	
Application basis	
Affected VIN	

7) Power Flows (Cont'd)

3rd gear

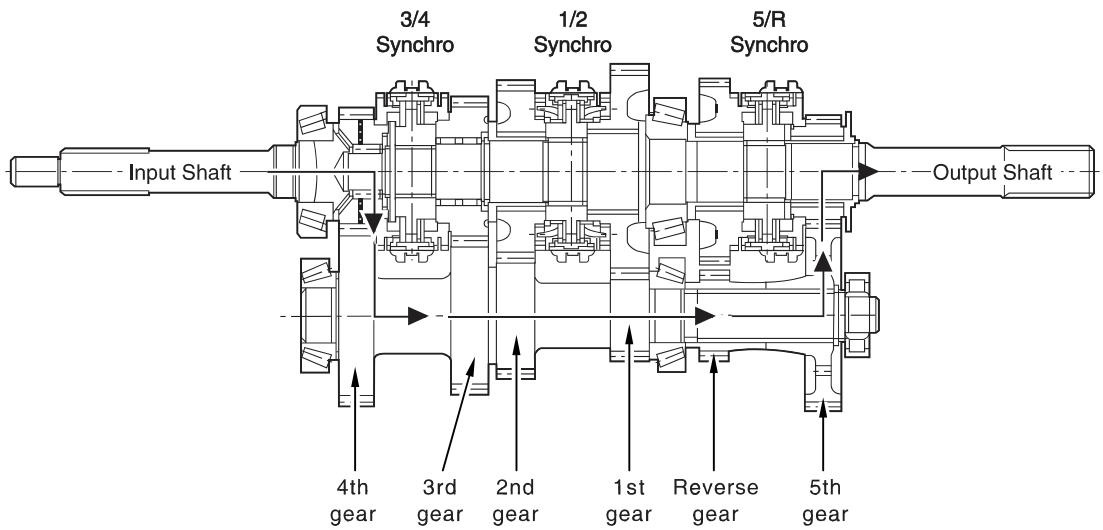


4th gear

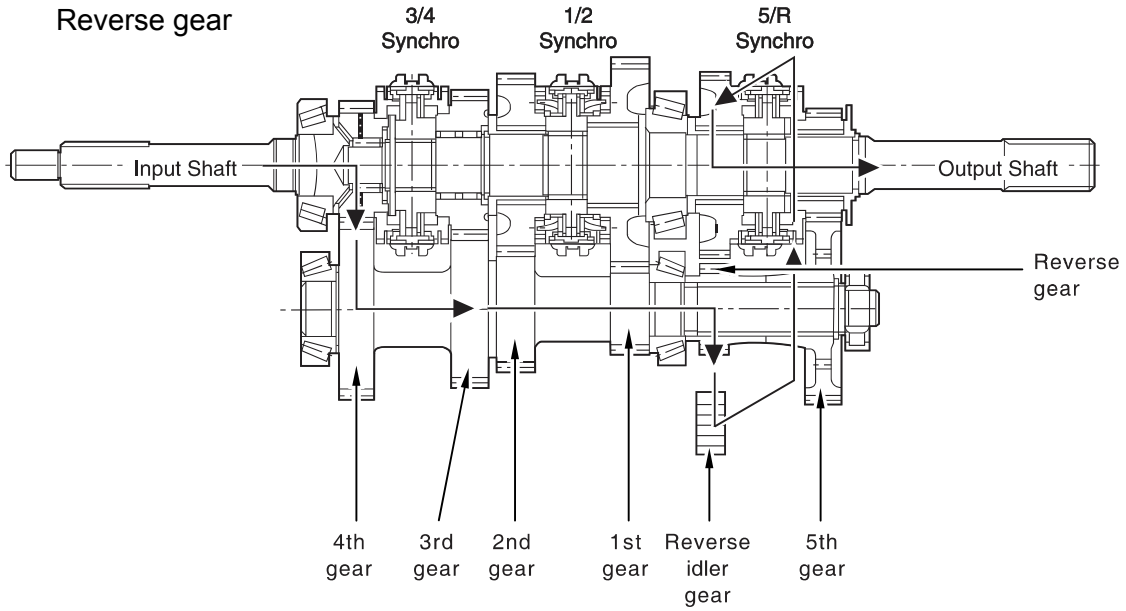


8) Power Flows (Cont'd)

5th gear



Reverse gear

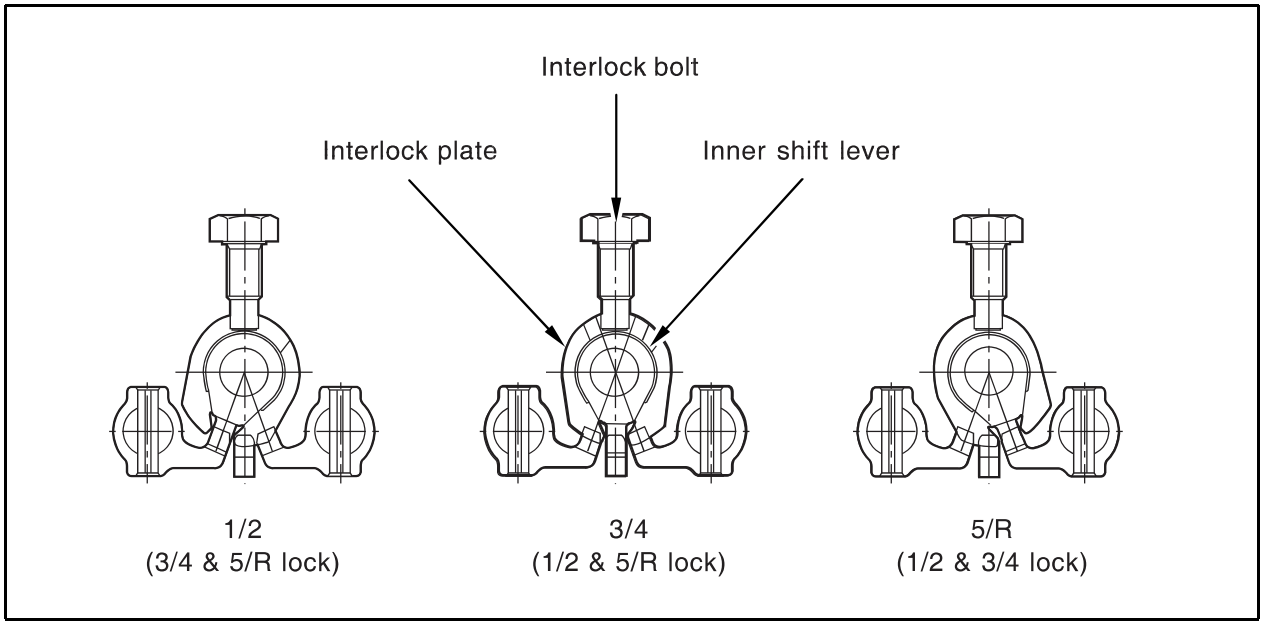


Modification basis	
Application basis	
Affected VIN	

3. SHIFTING MECHANISM

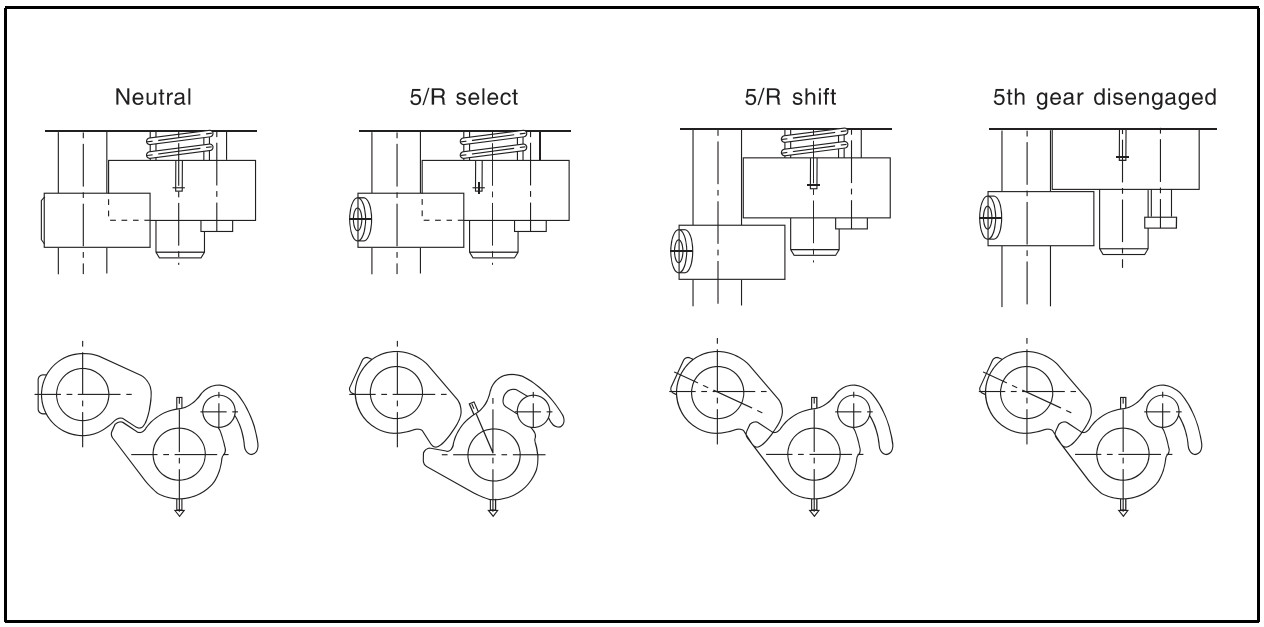
1) Interlock System

Interlock system prevents the gears from meshing over two sets.



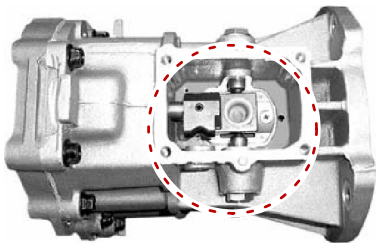
2) Reverse Interlock System

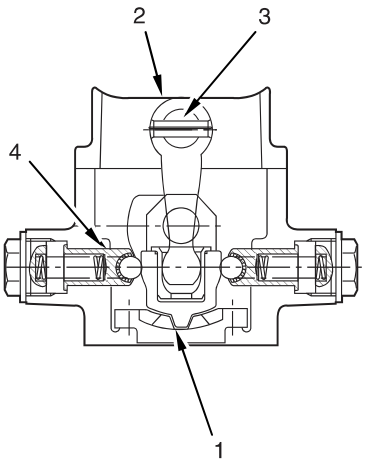
Reverse interlock system prevents the gear from shifting to reverse driving position while driving forward.

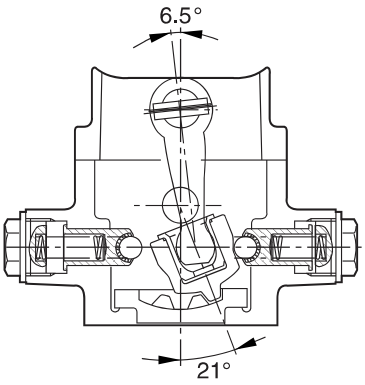


3) Offset Lever and Rolling Plunger

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.

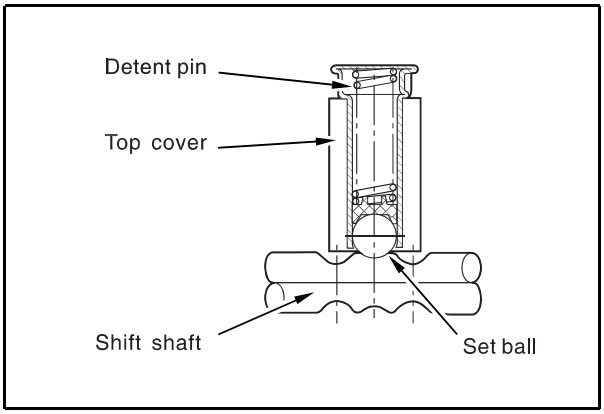




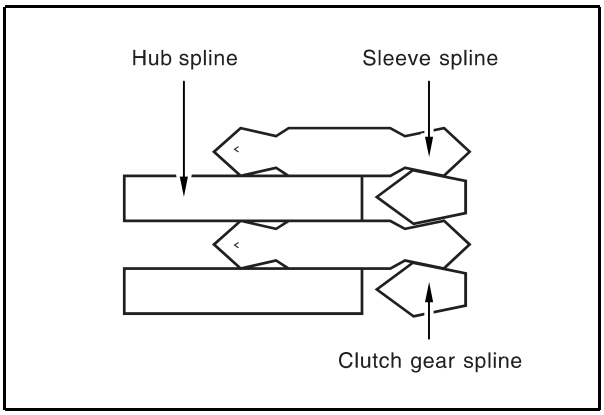


1. Offset lever	3. Shift shaft
2. Shift lever	4. Rolling plunger (rolling plunger return spring and ball)

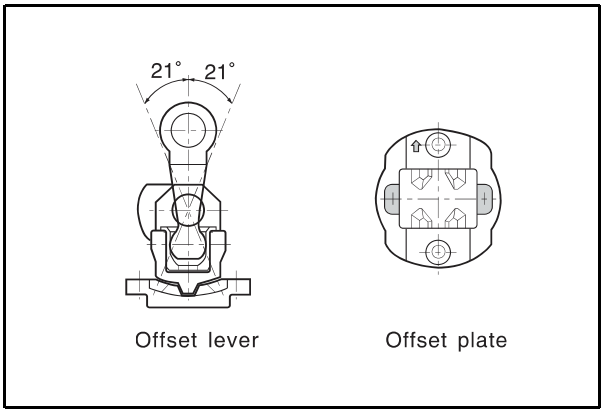
Modification basis	
Application basis	
Affected VIN	



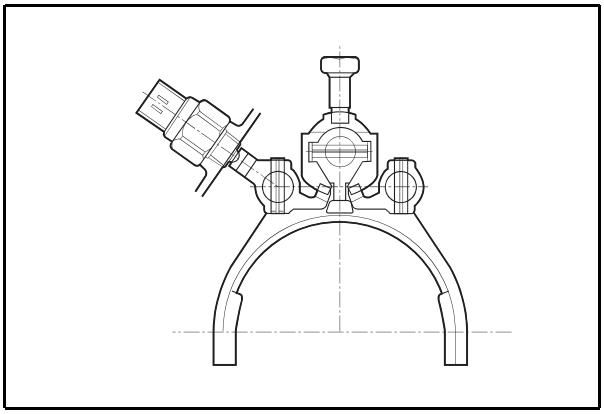
1. Shift check device
   It determines the shift fork position (N or each gear) and gives a detent movement to notice a shift lever seating when operating the shift lever.
   Also, it prevent the selected gear from getting out of its meshed position.



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

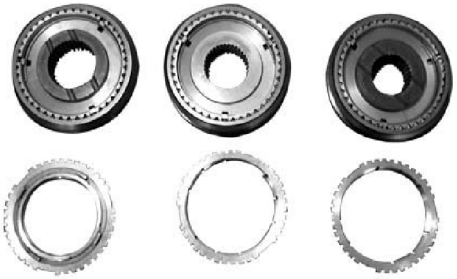
5) Synchronizer

▶Composition

It consists of synchronizer hub, sleeve, ring, key and spring (1/2, 5/R, and 3/4 synchronizer are different from each other).

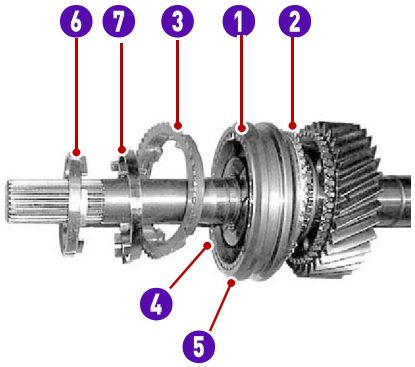
- 3/4 and 5/R shift: Single cone type
- 1/2 shift: Double cone type - Improving the capacity to bigger engine torque of 1/2 shift (added synchronizer inner cone and middle cone)

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

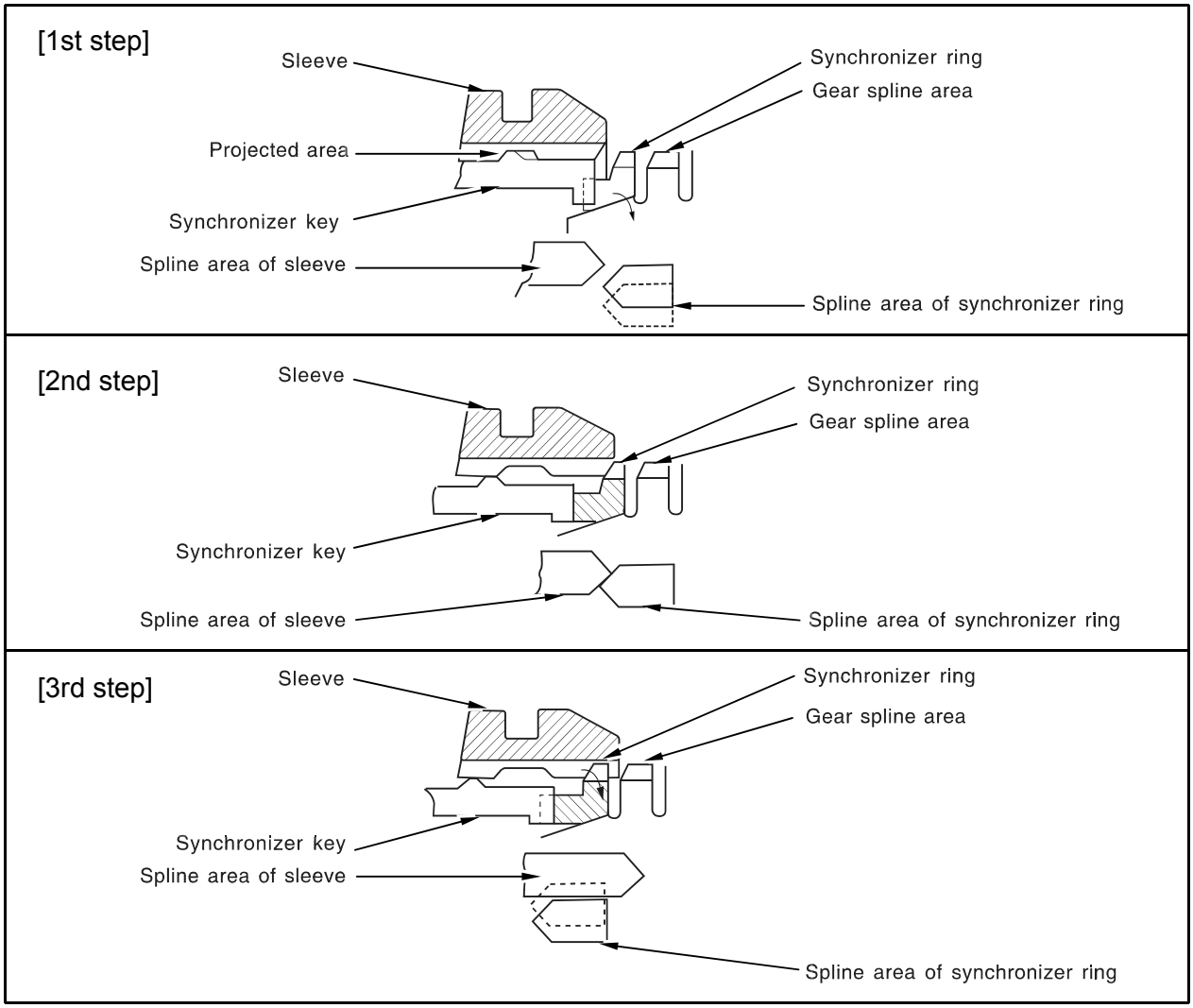
Be careful not to mix up the 1/2 shift synchronizer sleeve with 3/4 or 5/R shift synchronizer sleeve.

The 3/4 synchronizer hub also different from 1/2 and 5/R synchronizer hub (different oil gallery).

Modification basis	
Application basis	
Affected VIN	

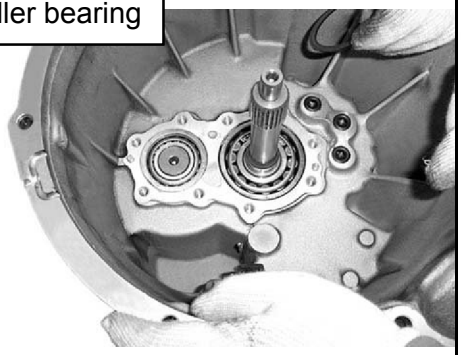
▶Synchronizer element

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.



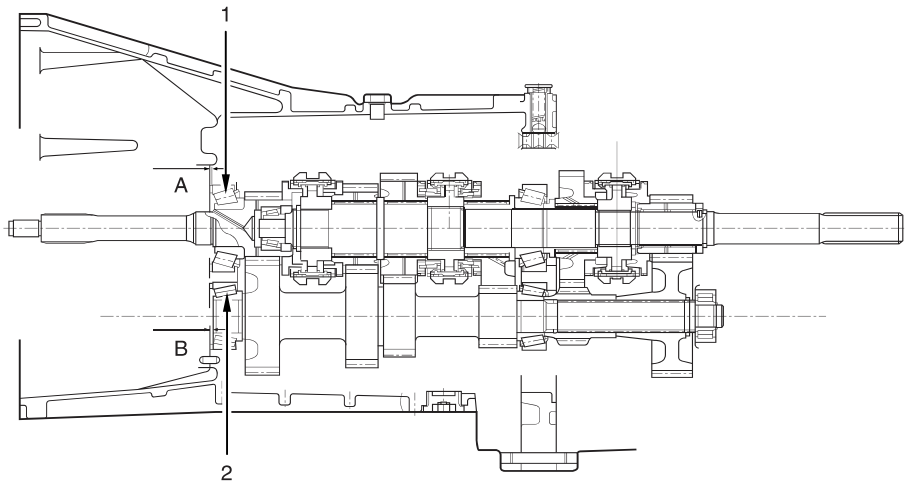
6) Bearing

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

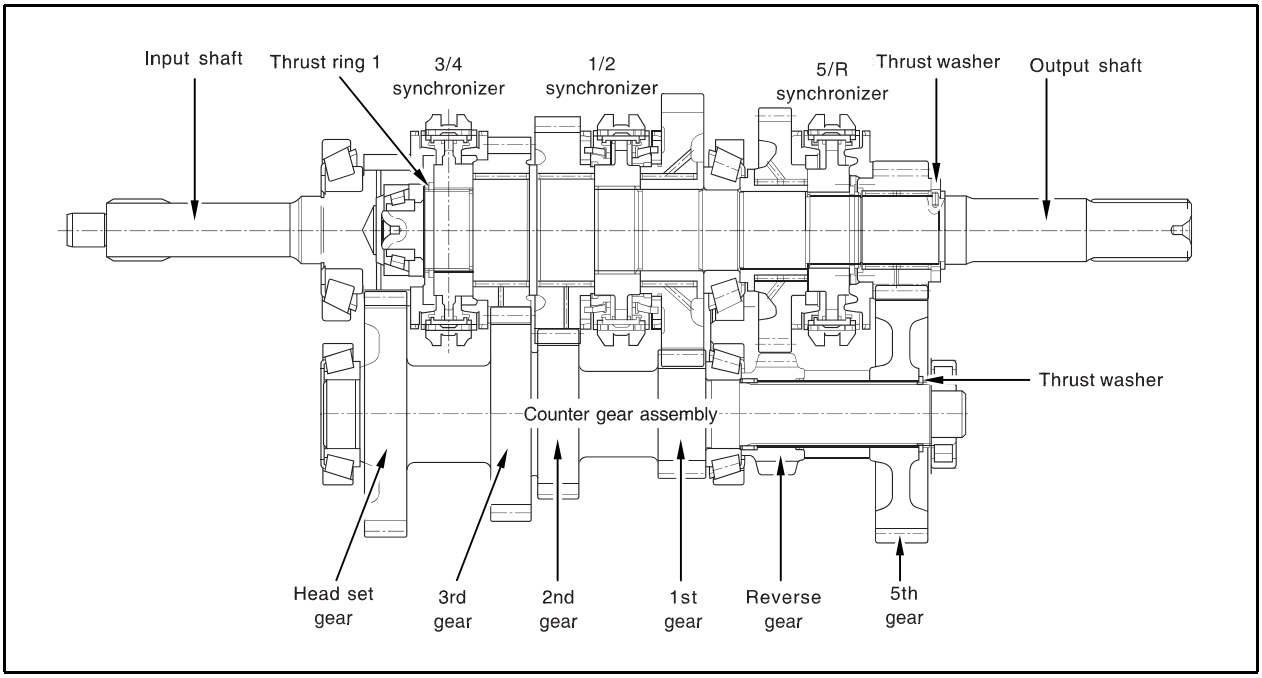
Use the following spacers to adjust the end play (A or B) between input shaft and counter shaft. (Specified range of end play: 0.05 ~ 0.1 mm)

- 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)

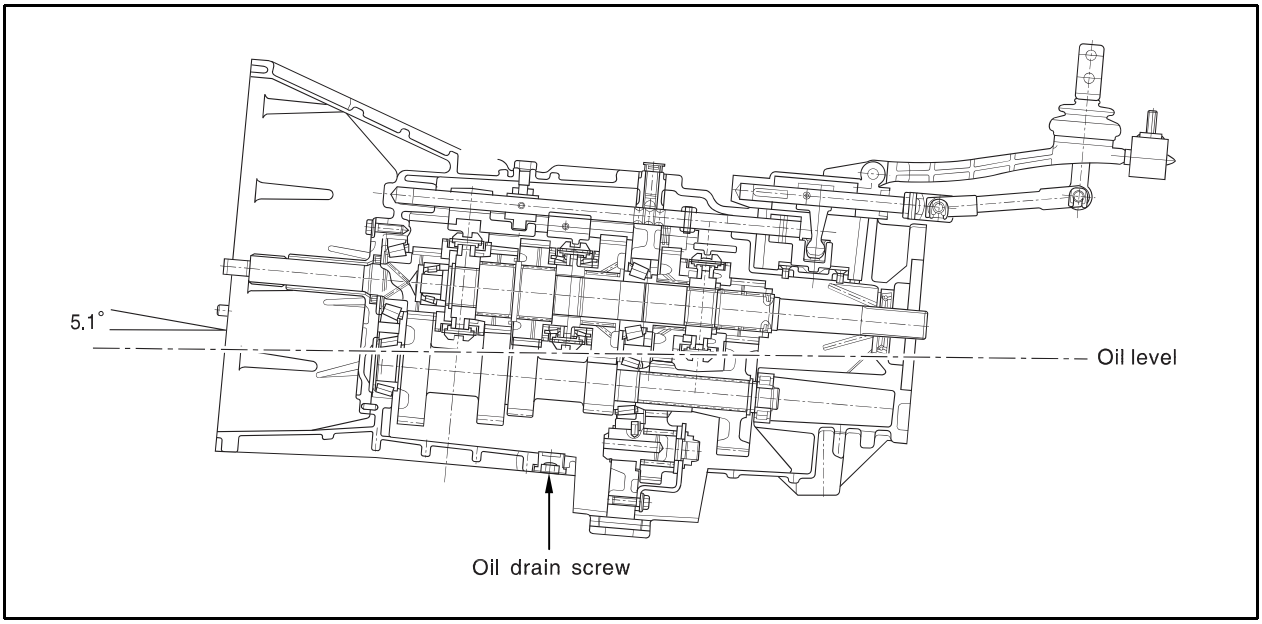
When the driving force from engine is transmitted to the output shaft of transmission, each shaft and gear assembly receives the axial force and this force acts as a resistance to rotating gears.



9) Lubrication

Transmission oil: SAE 75W/90

Initial installation for taper roller bearing and needle roller bearing, lubrication for shift rail: MoS2 Grease

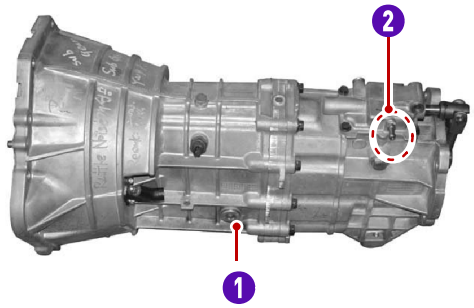
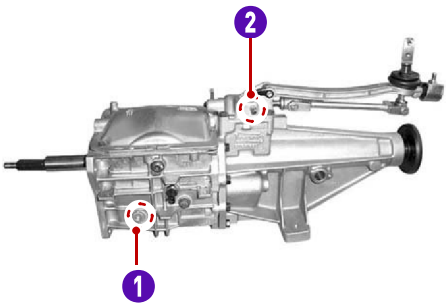


CAUTION

Sealant on oil drain screw during installation: Loctite DRI LOC 200

Tightening torque: 40 ~ 50 Nm

Modification basis	
Application basis	
Affected VIN	

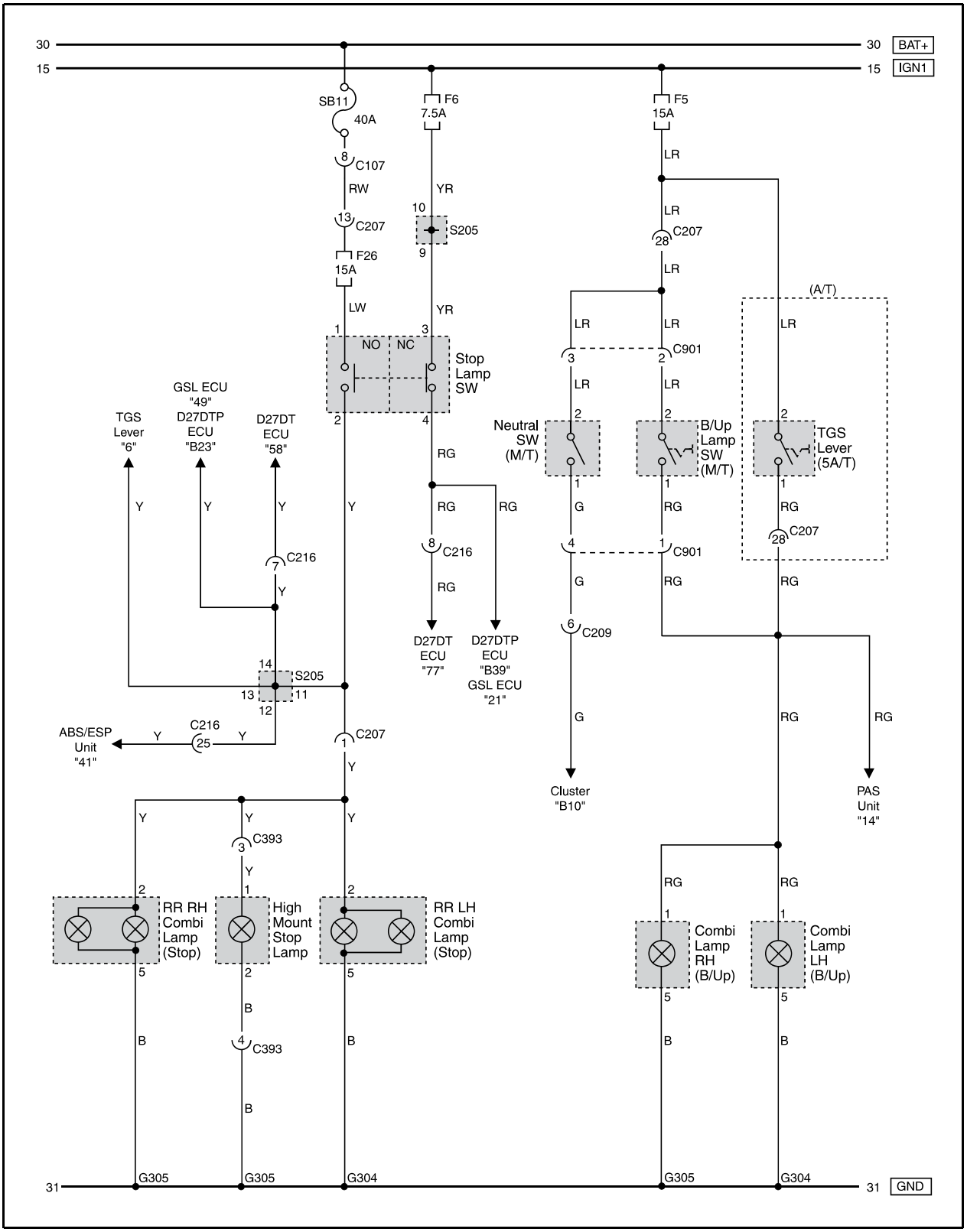
4WD	2WD
	
1. Oil filler plug	2. Air vent

CAUTION

Sealant on oil drain screw during installation: Loctite DRI LOC 200

Tightening torque: 40 ~ 50 Nm

4. CIRCUIT DIAGRAM (BACKUP LAMP)



Modification basis	
Application basis	
Affected VIN	

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

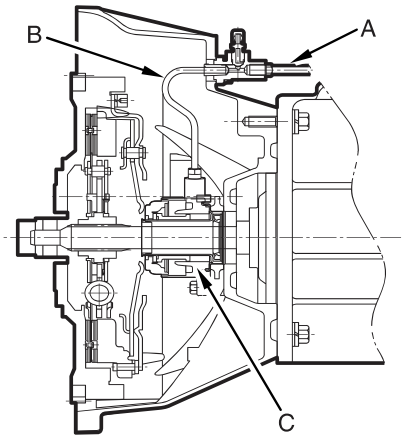
The clutch release system consists of the clutch pedal are clutch release cylinder.
This system directly releases the clutch by using hydraulic pressure while the conventional clutch system releases the clutch by using release lever and release fork.
This system provides higher efficiency than conventional 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

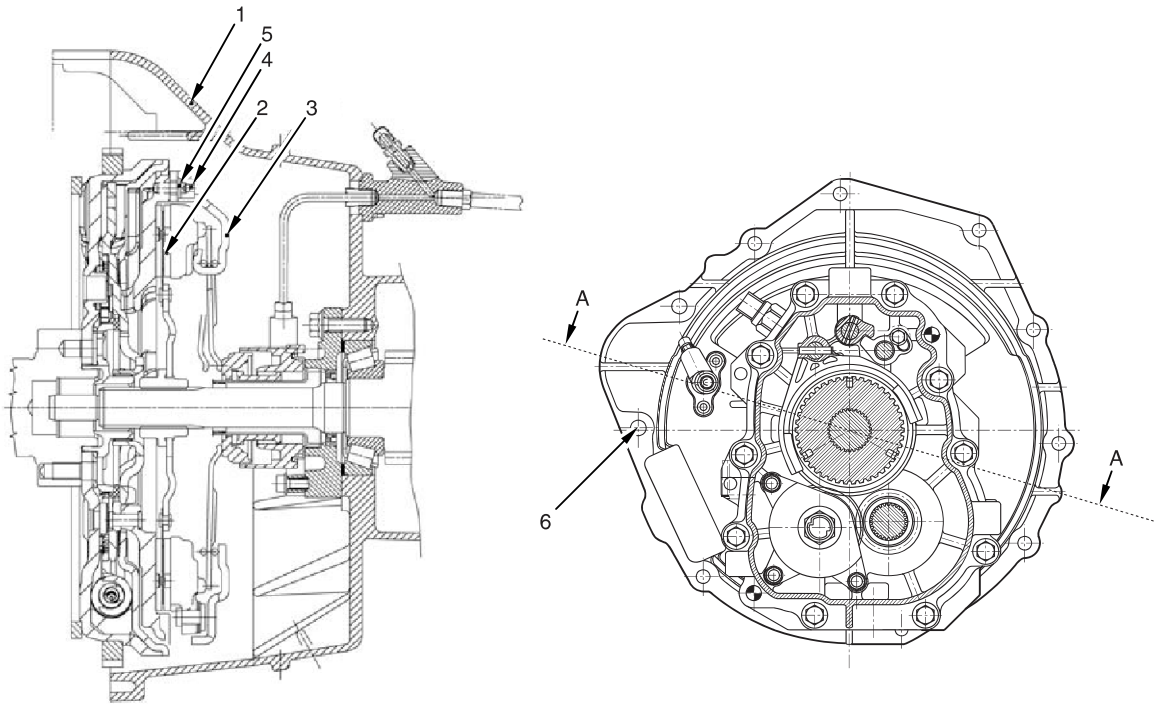


A. Adaptor

D. Clutch assembly

C. Concentric slave cylinder

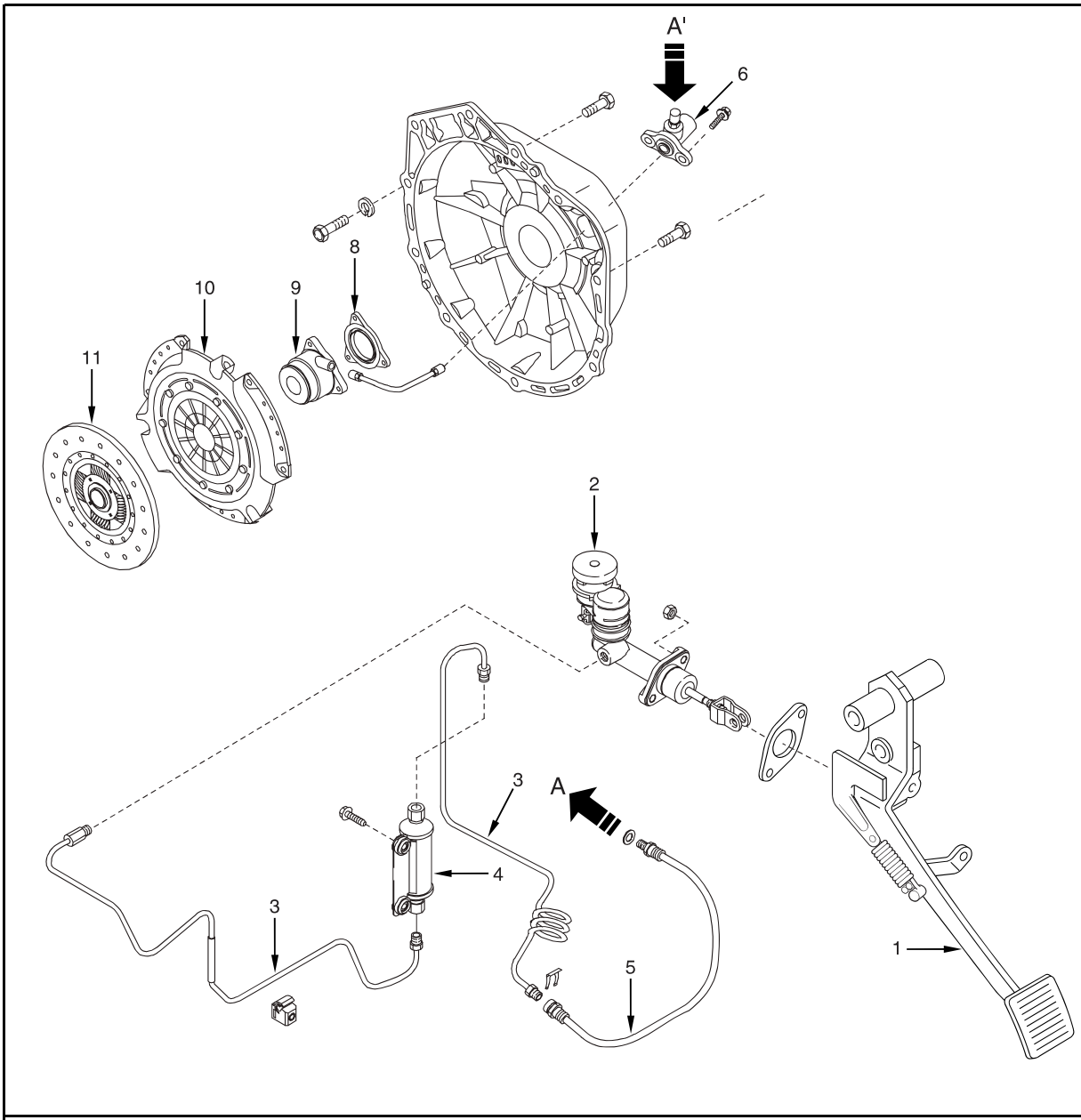
▶CROSS SECTIONAL VIEW OF CLUTCH ASSEMBLY



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

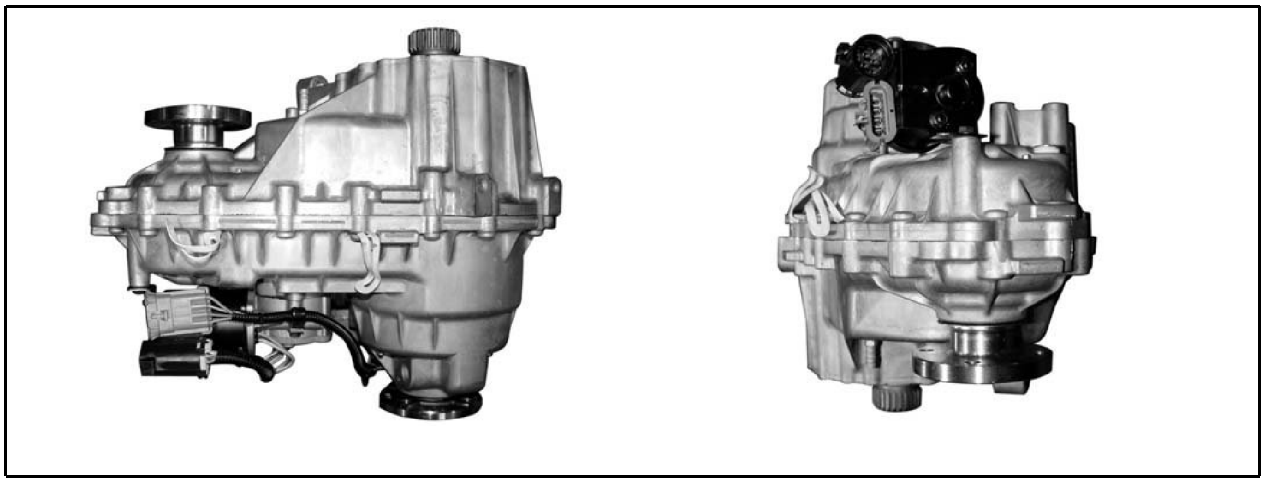
1. SPECIFICATIONS

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.

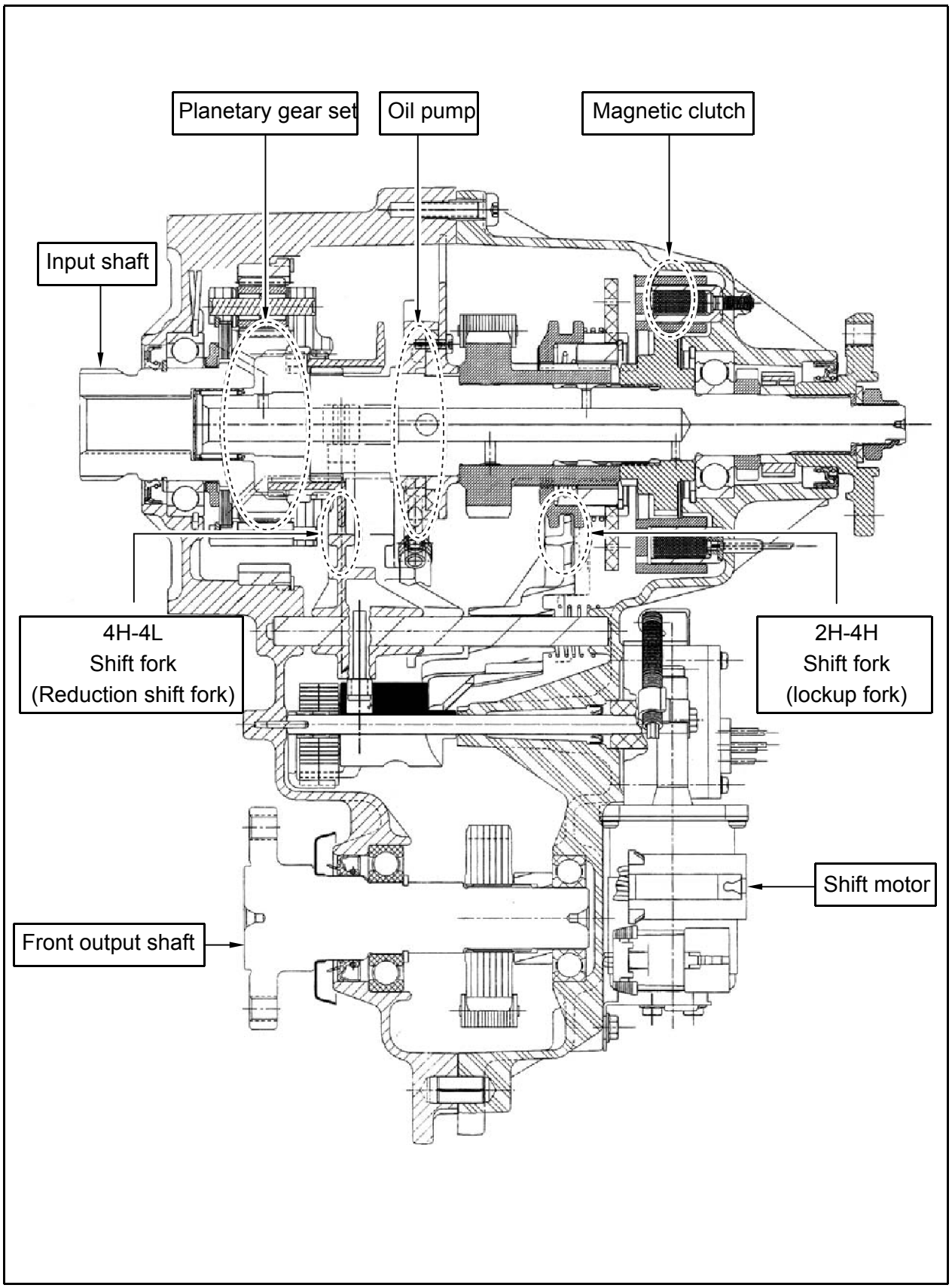


2. OPERATION

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

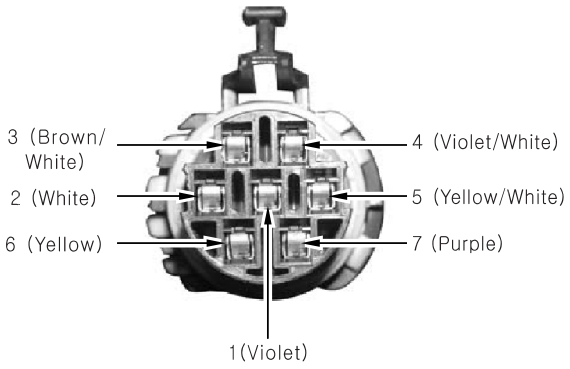


Modification basis	
Application basis	
Affected VIN	

▶ 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

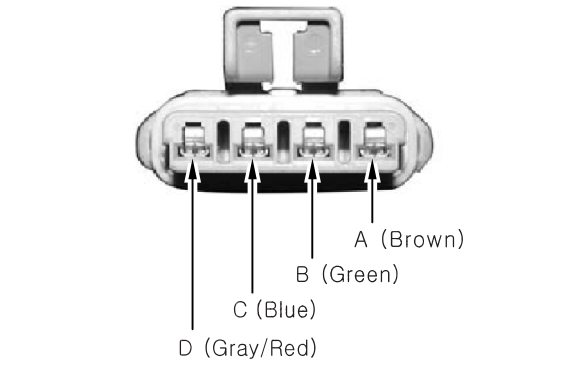


Pin	Function
1	Position A
2	Position B
3	Position C
4	Position D
5	Position ground
6	Control (4L - 4H - 2H)
7	Control (2H - 4H - 4L)

▶ 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.

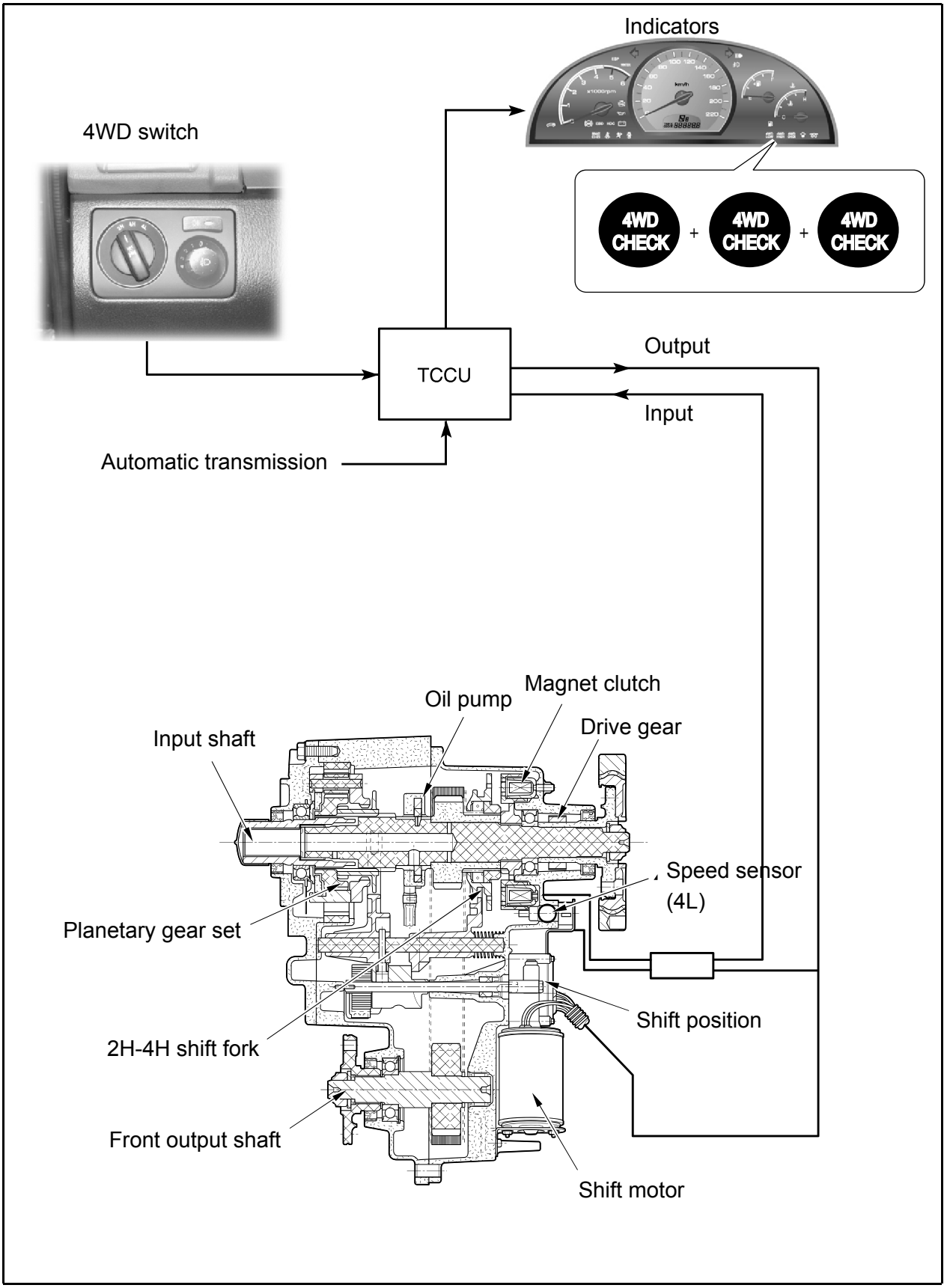
Rear view of Speed Sensor and Clutch Coilconnector



Pin	Function
A	Clutch coil
B	Sensor power (5V)
C	Sensor signal
D	Sensor ground

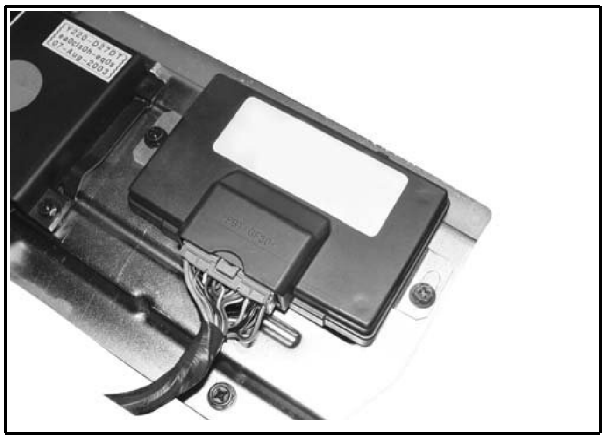
Modification basis	
Application basis	
Affected VIN	

4. SYSTEM LAYOUT



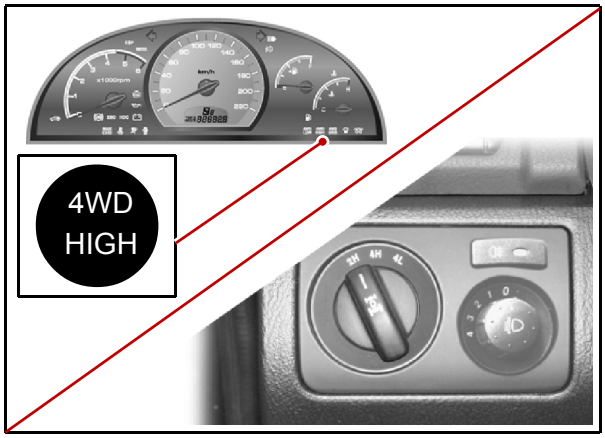
5. SYSTEM OPERATION

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).



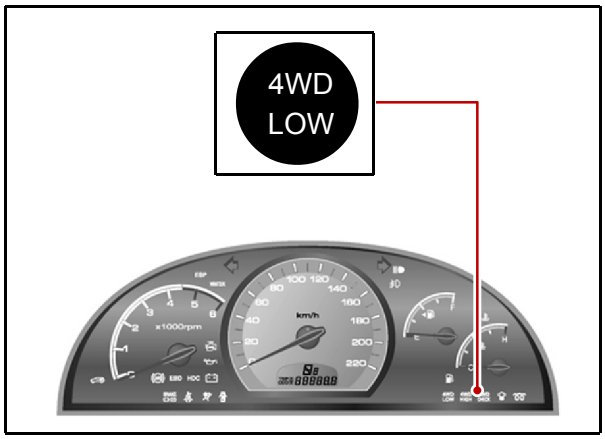
1. 2H → 4H
   - · Change the 4WD switch in instrument panel from 2H to 4H.
   - · This shift is available during driving.
   - · "4WD HIGH" indicator in meter cluster comes on.

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.

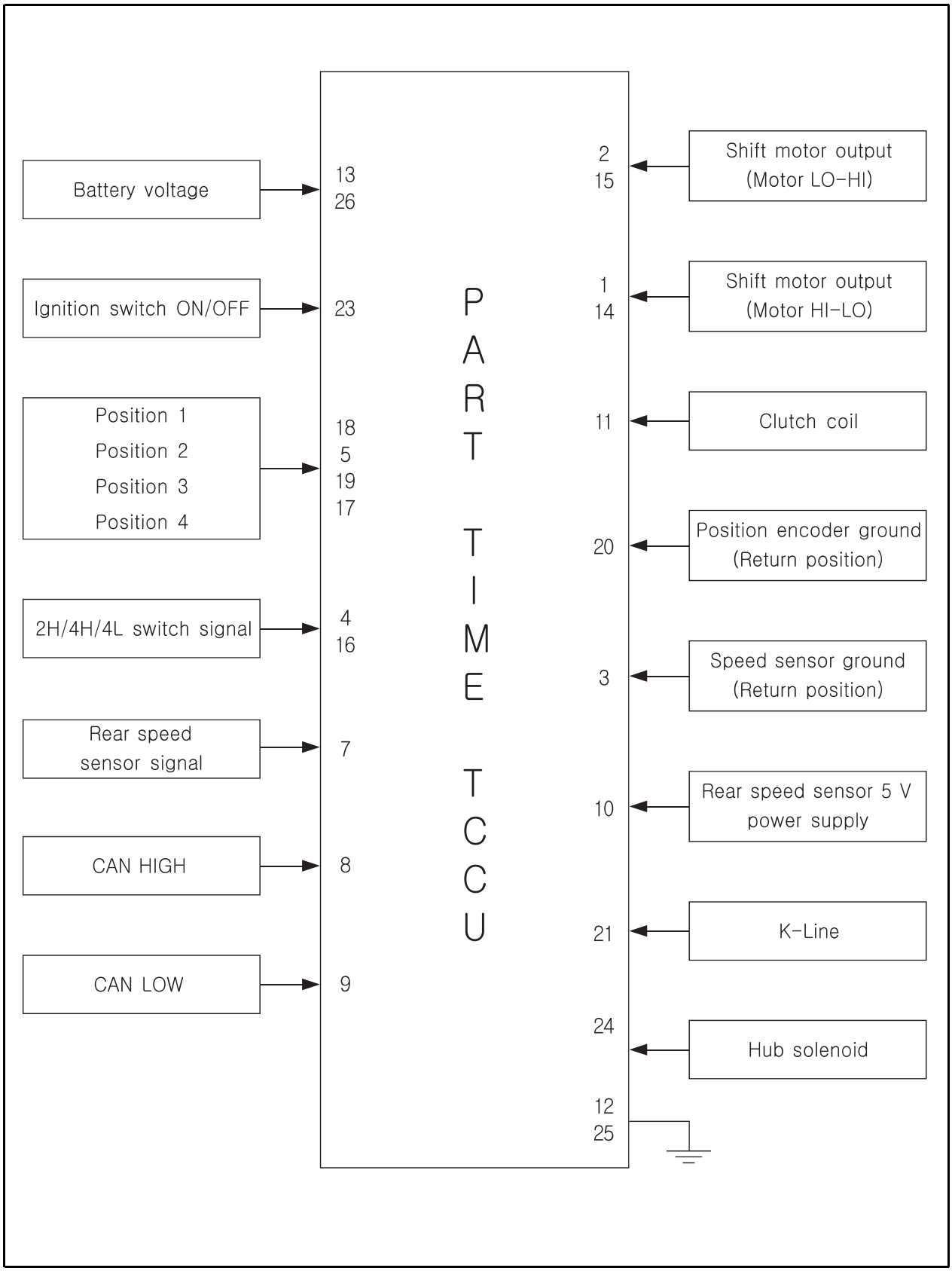
Modification basis	
Application basis	
Affected VIN	



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

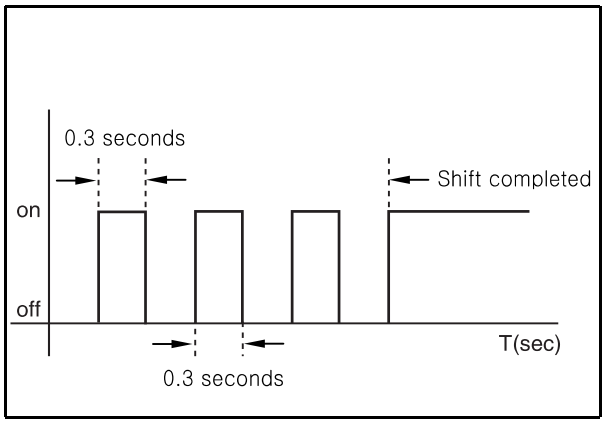
The position encoder is the code that TCCU can determine the shift motor position.

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:

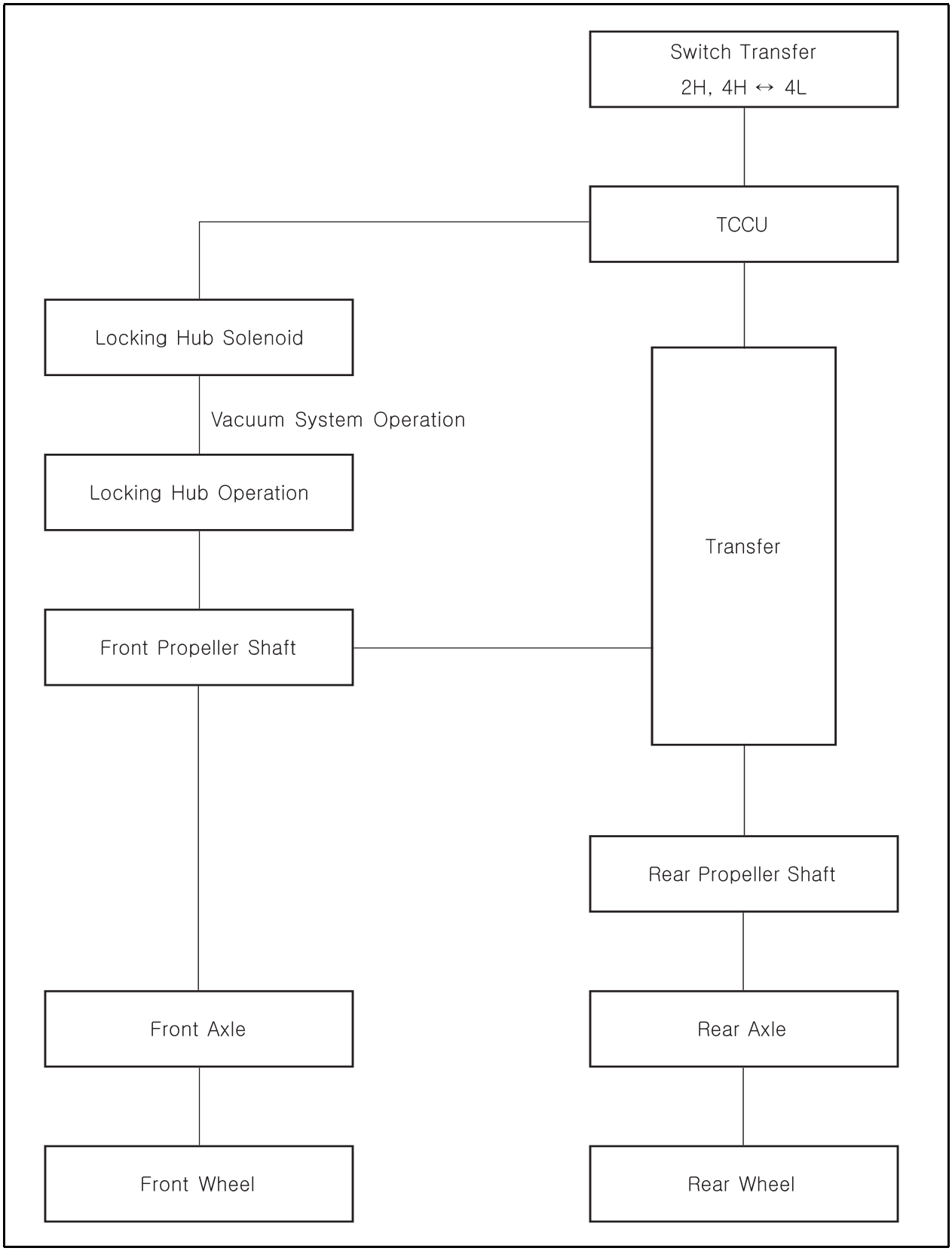
- Clutch coil operates when the selector changes from 2H to 4H/4L.
- Shift motor moves in 4H mode.
- Hub solenoid starts its operation 4 seconds after shifted to 4H.
- Clutch coil stops its operation 5 seconds after the hub solenoid is activated.

▶ 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.

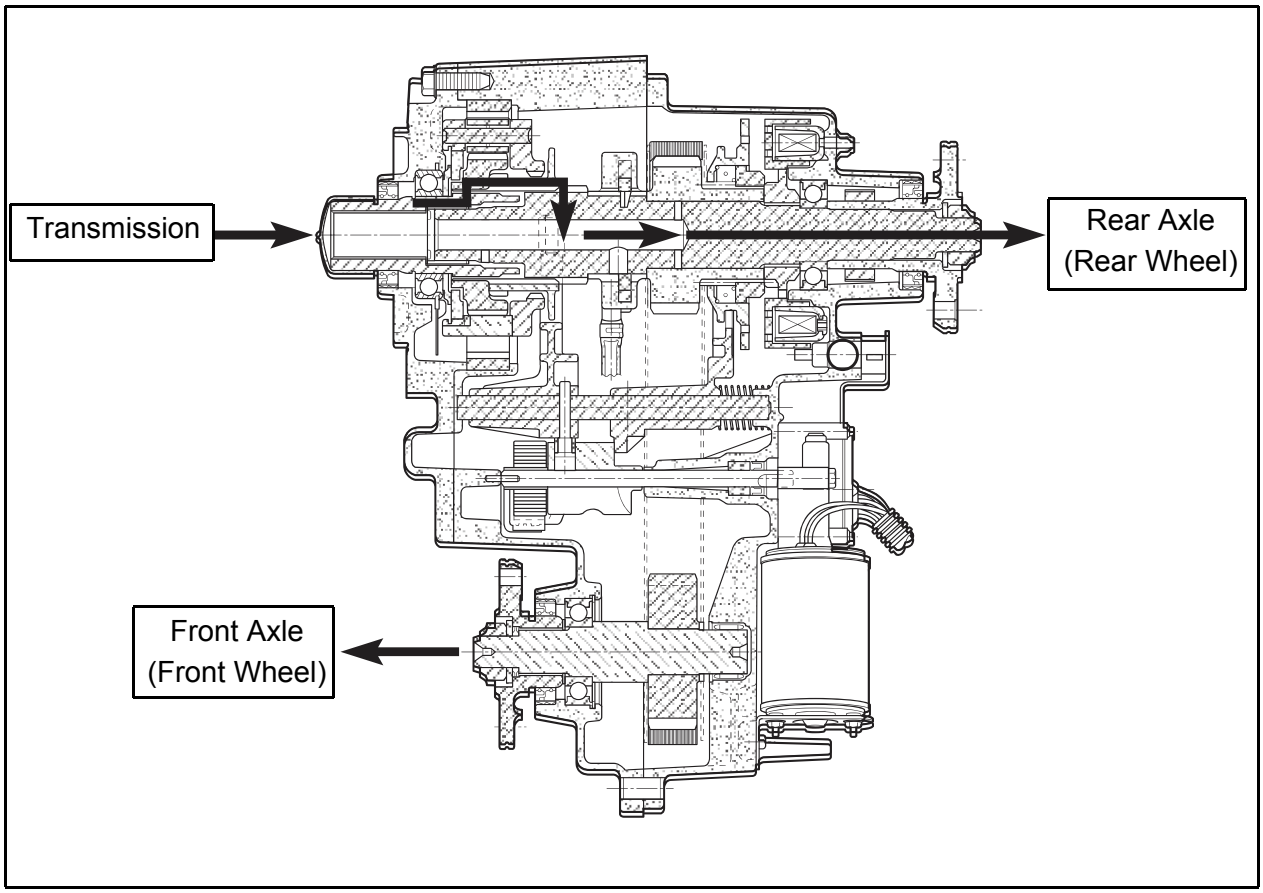
6. POWER FLOW

▶POWER FLOW

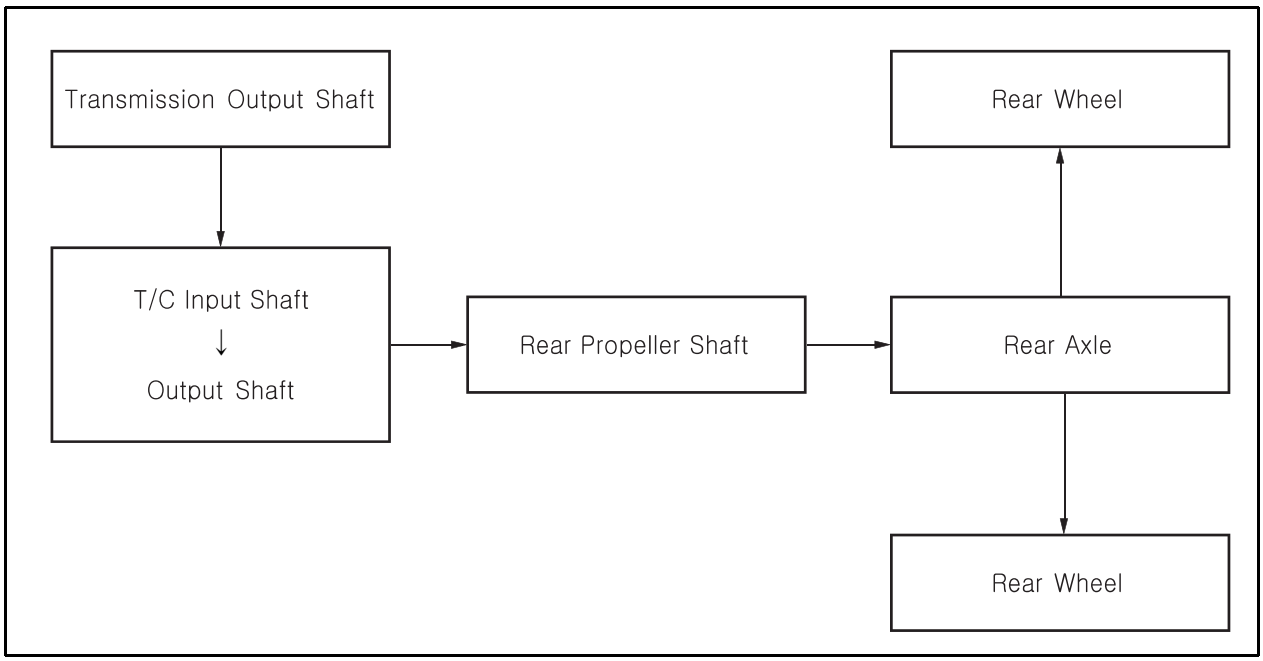


Modification basis	
Application basis	
Affected VIN	

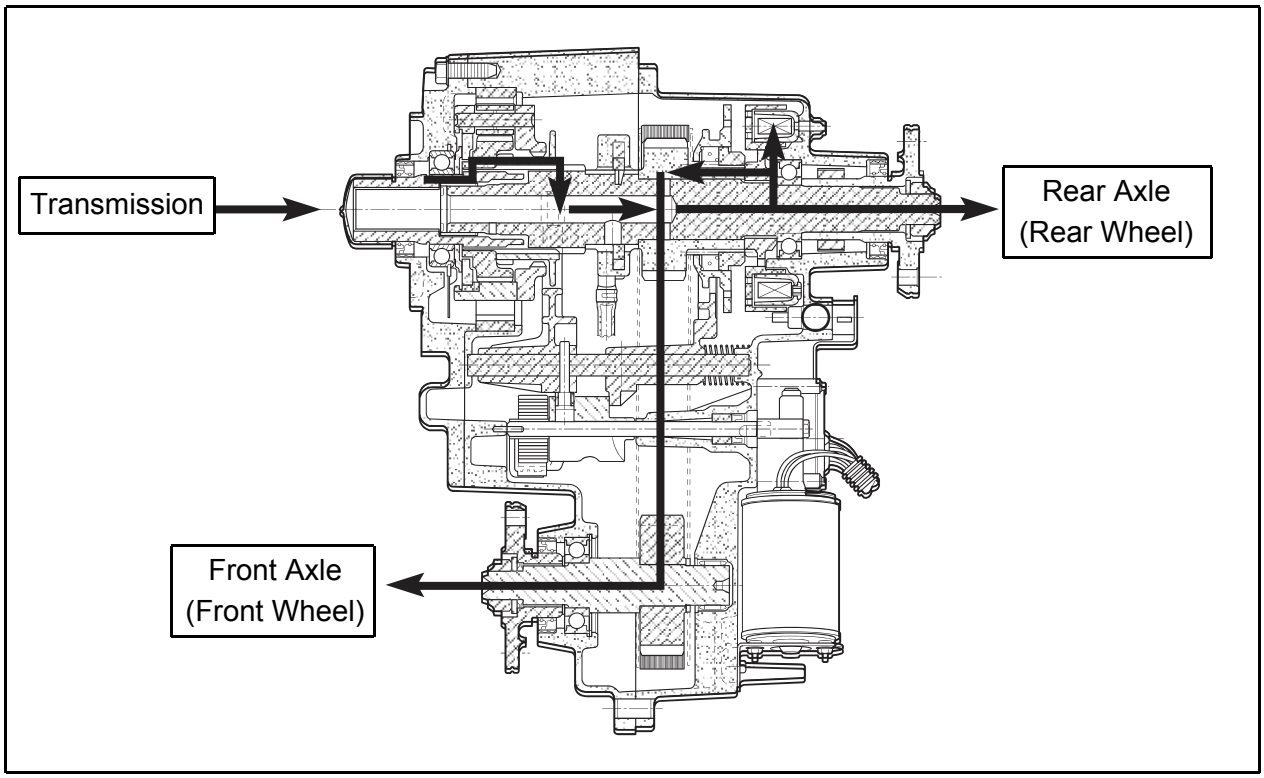
1) 2H MODE (REAR WHEEL DRIVE)



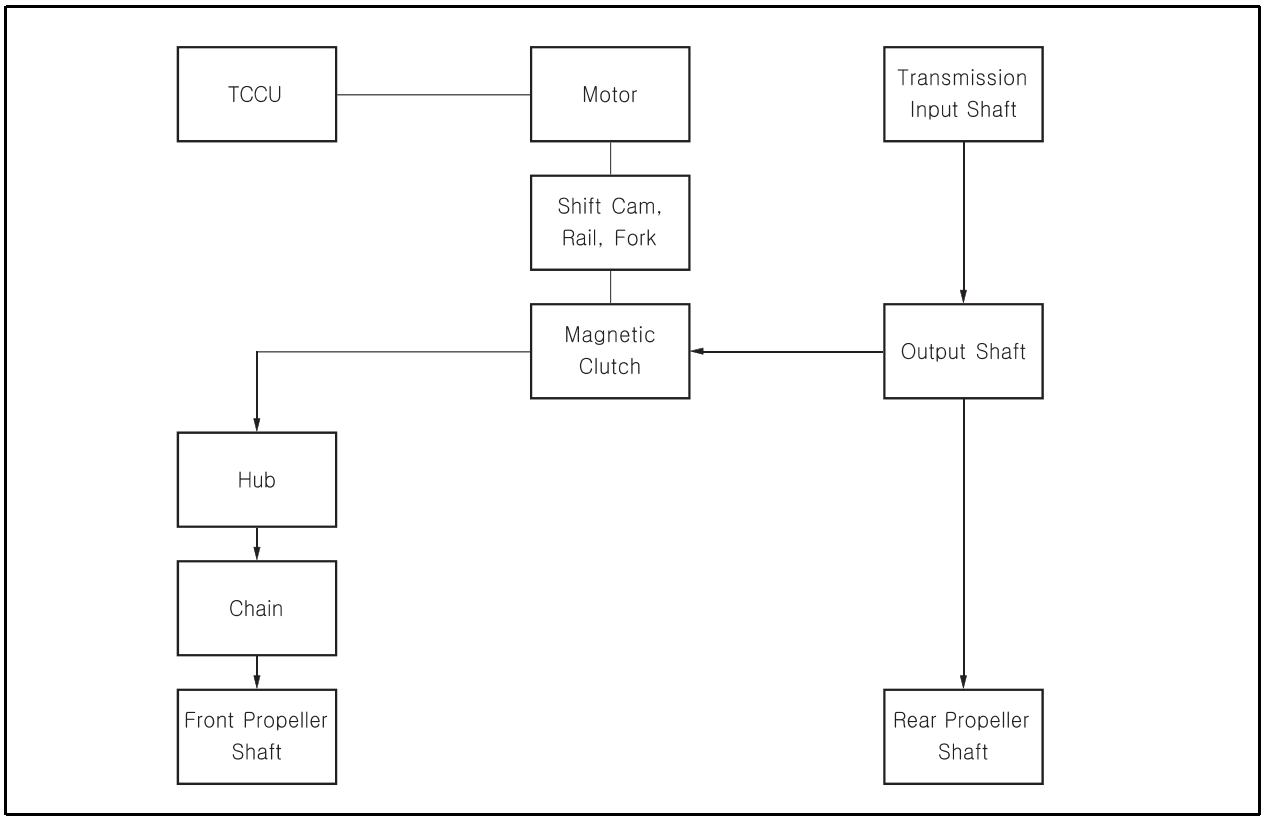
▶ Power Flow



2) 4H MODE (4WD DRIVE - HIGH SPEED)

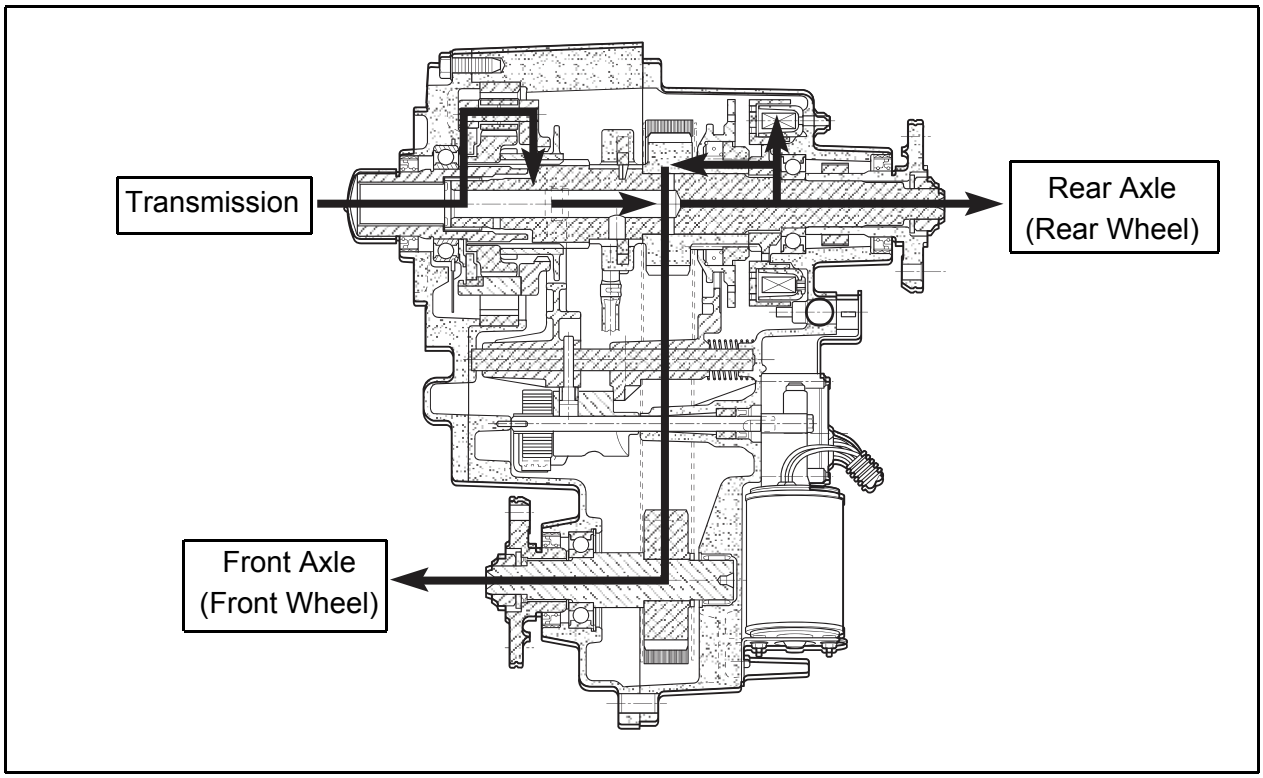


▶ Power Flow

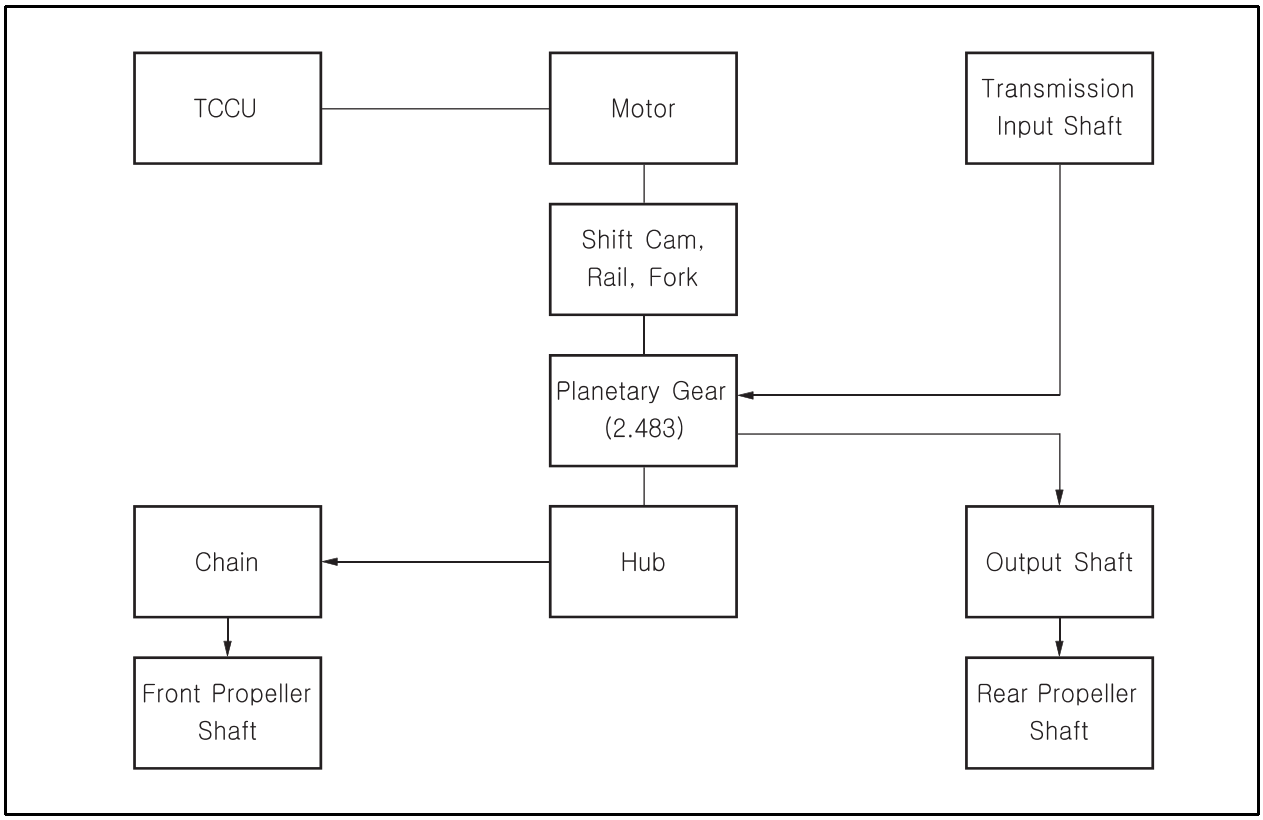


Modification basis	
Application basis	
Affected VIN	

3) 4L MODE (4WD DRIVE - LOW SPEED)

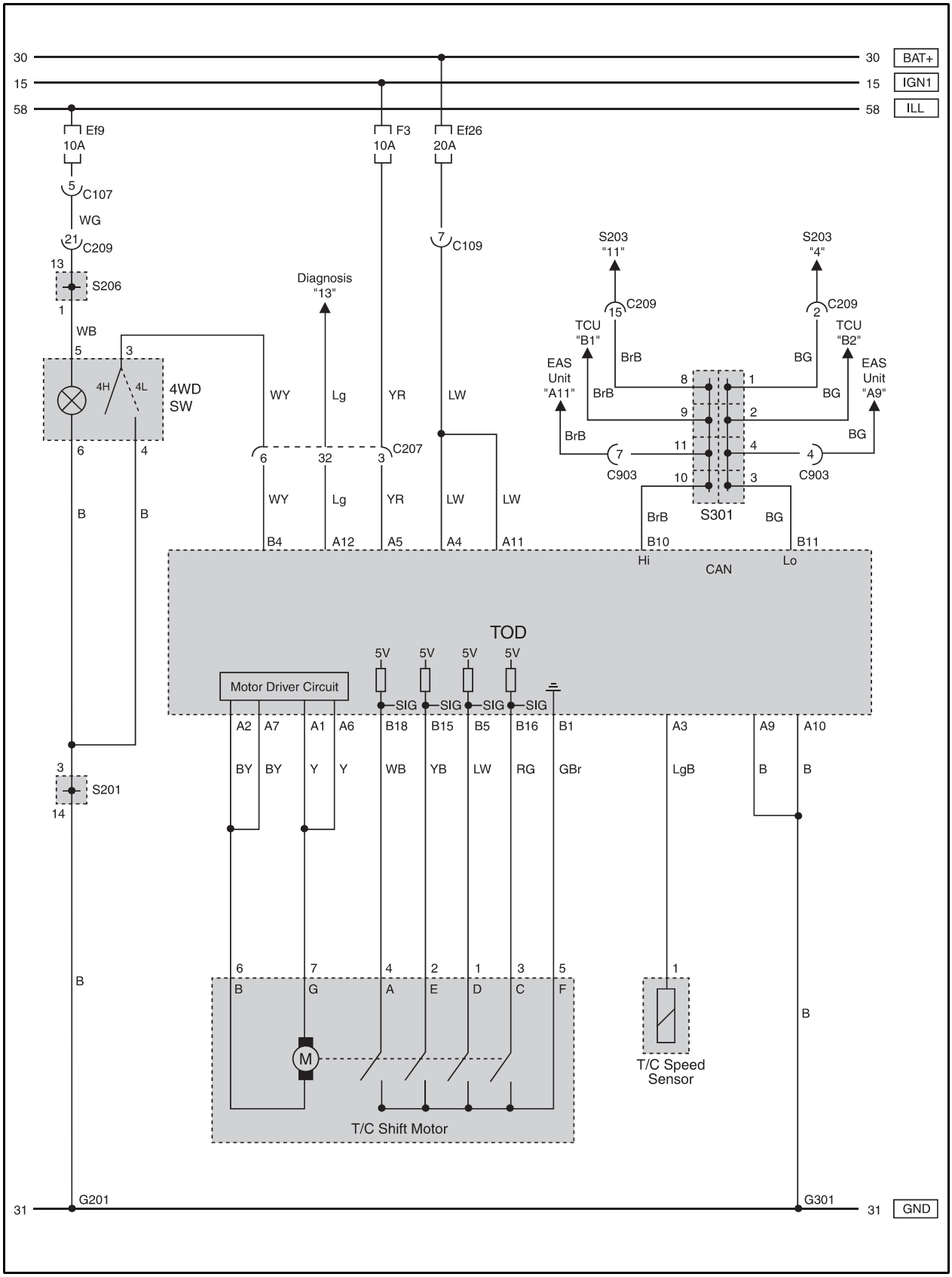


▶ Power Flow



Modification basis	
Application basis	
Affected VIN	

7. CIRCUIT DIAGRAM (DI & 5-SPEED A/T)



Modification basis	
Application basis	
Affected VIN	

TORQUE ON DEMAND(TOD)

3240-01

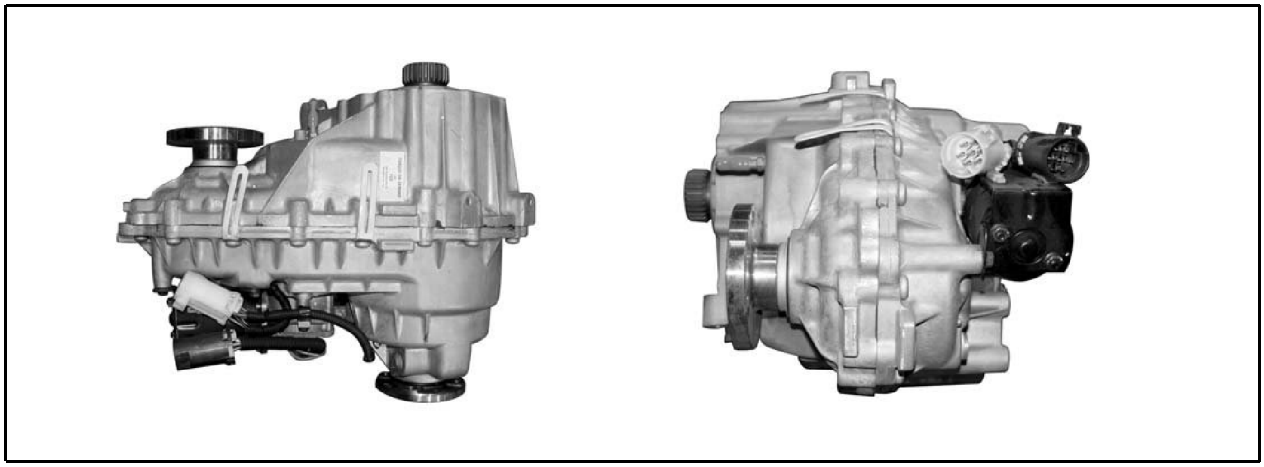
GENERAL

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.

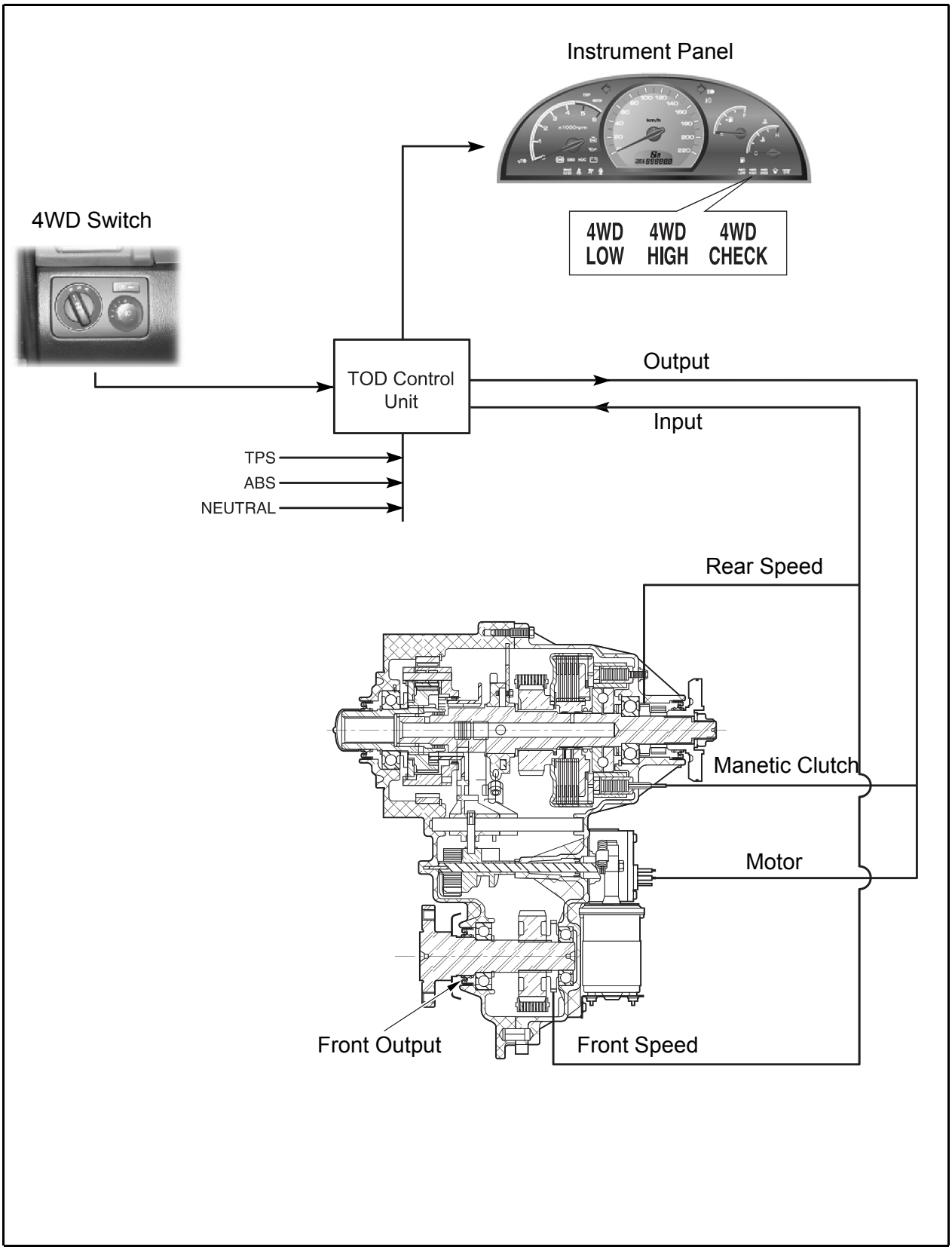
CAUTION

- 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	

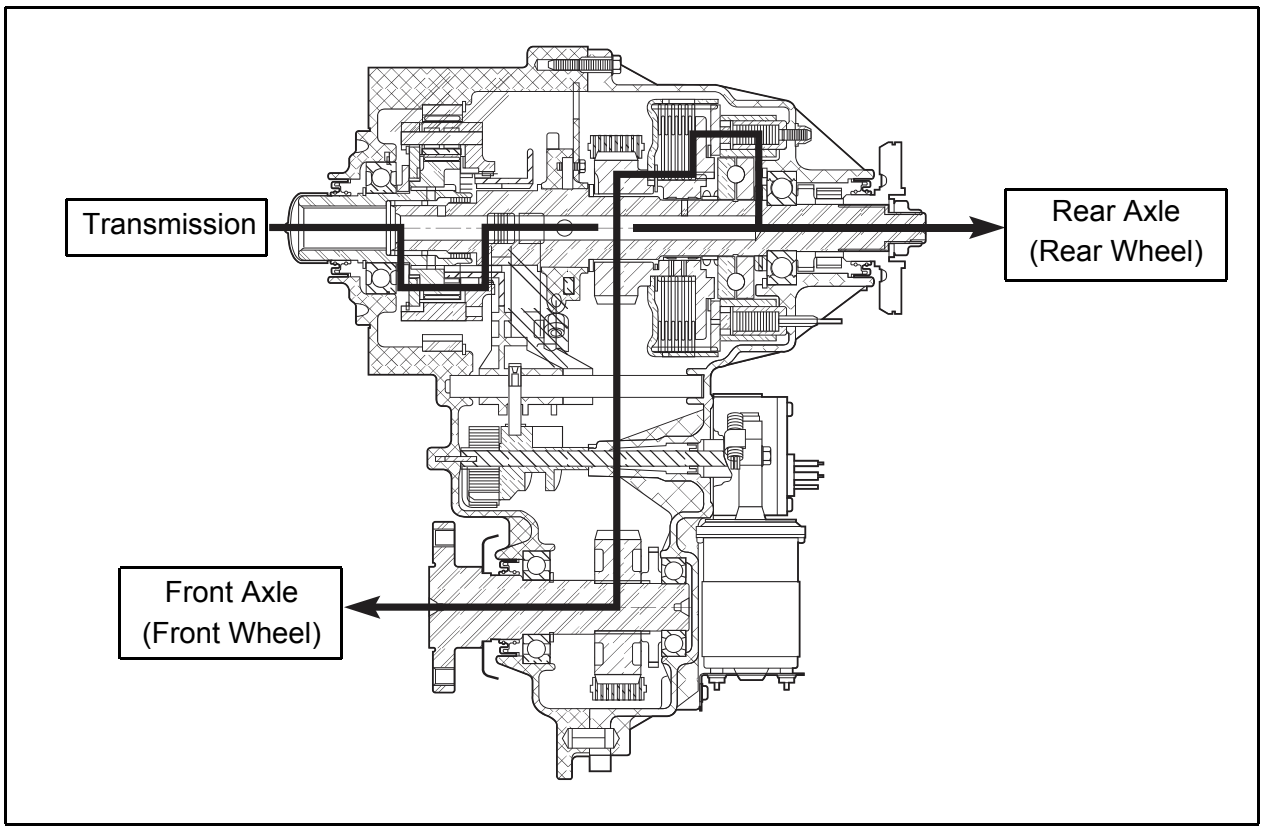
2. POWER FLOW

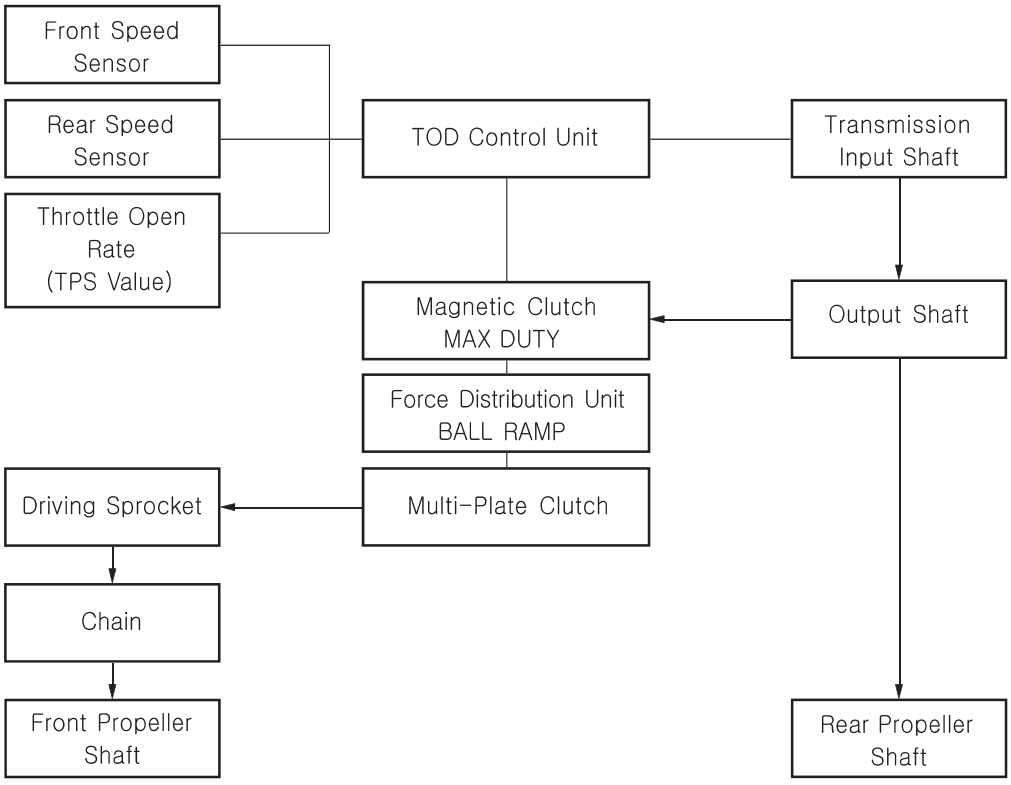
▶ System Layout



Modification basis	
Application basis	
Affected VIN	

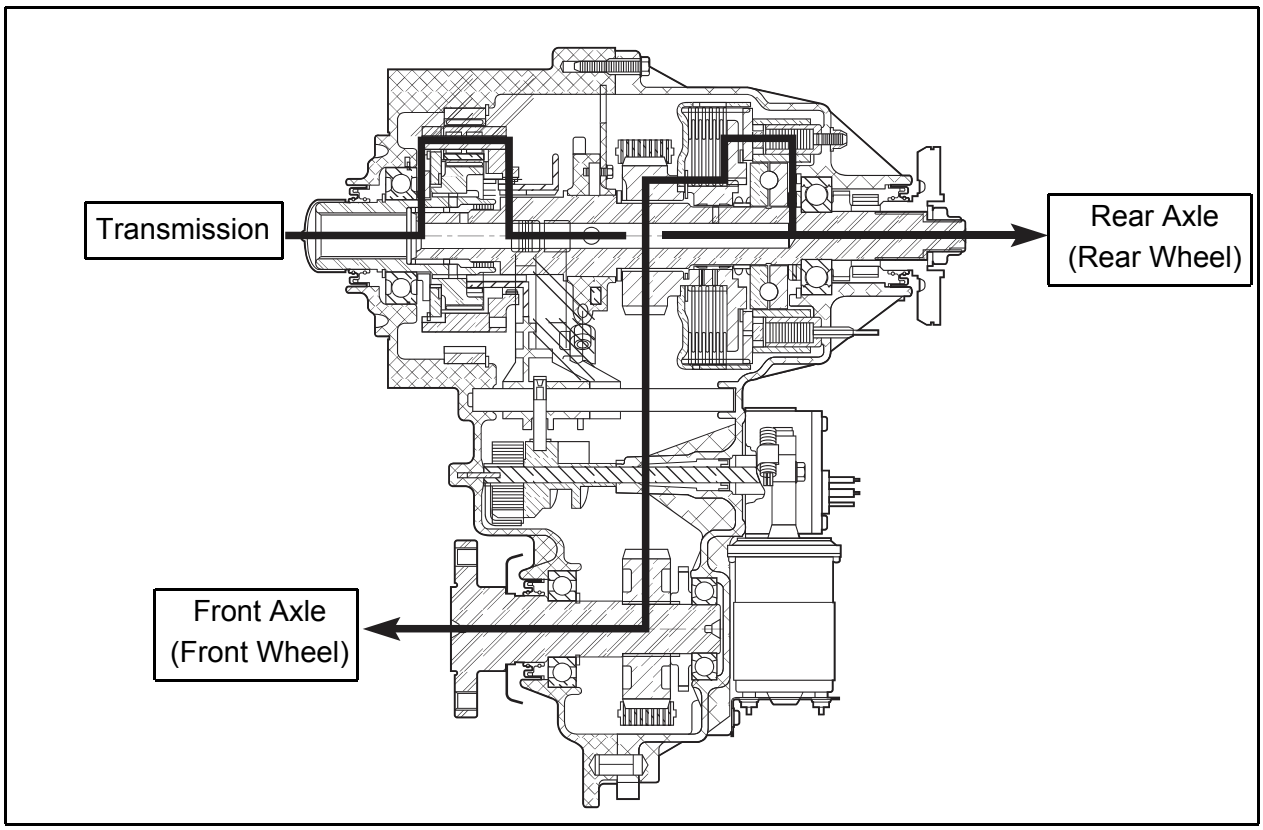
▶ 4H Mode (4WD Drive - High Speed)

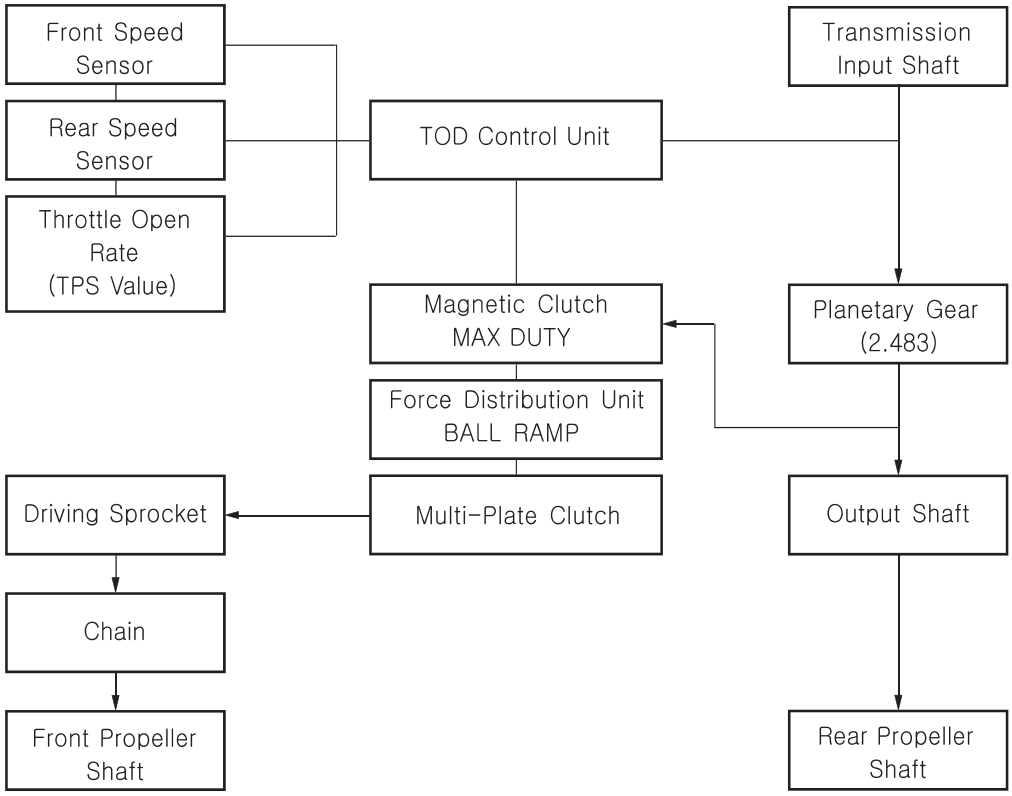




Modification basis	
Application basis	
Affected VIN	

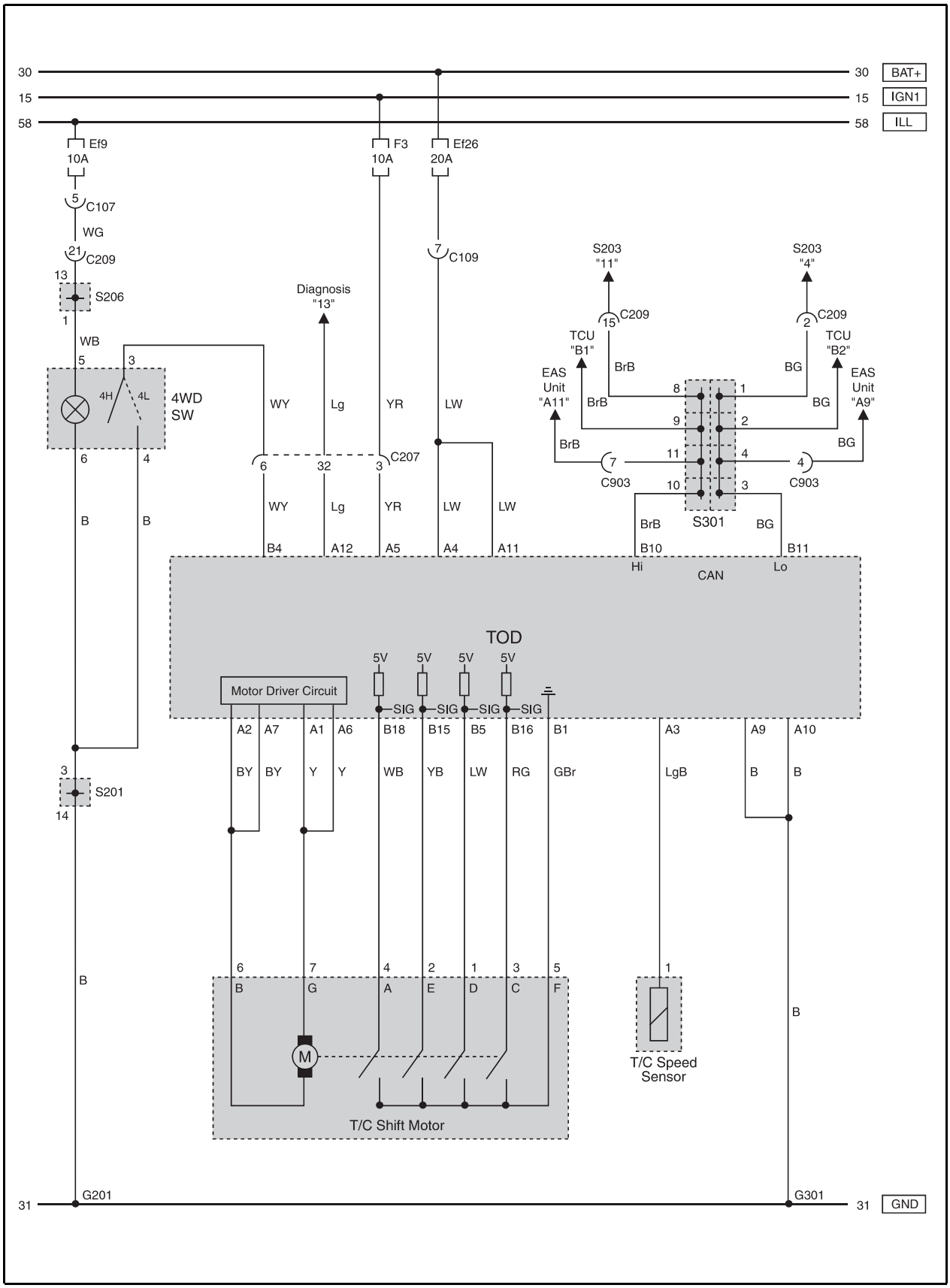
▶ 4L Mode (4WD Drive - Low Speed)





Modification basis	
Application basis	
Affected VIN	

3. CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

ALL WHEEL DRIVE

3260-01

GENERAL

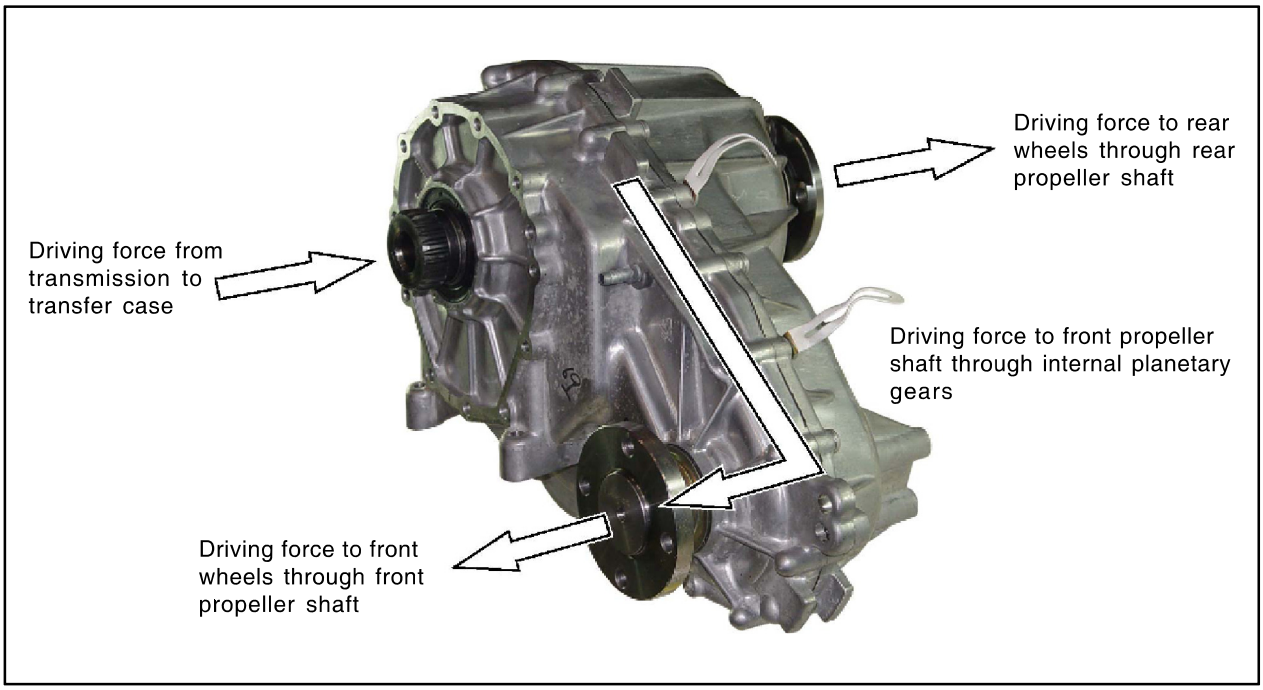
1. SPECIFICATIONS

Description	Part Time T/C	
Total length	271 mm	
Mating surface of front flange	11.9 mm	
Weight	27.1 Kg (with oil)	26.5 Kg (without oil)
Oil capacity and Service Interval	1.1 L (Inspect at every 10,000 km, Change at every 60,000 km)	
Oil specification	ATF DEXRON III	
Distribution ratio of driving force	40 (Front) : 60 (Rear)	
Bolt	11EA, M8 x 1.25	

OVERVIEW AND OPERATION PROCESS

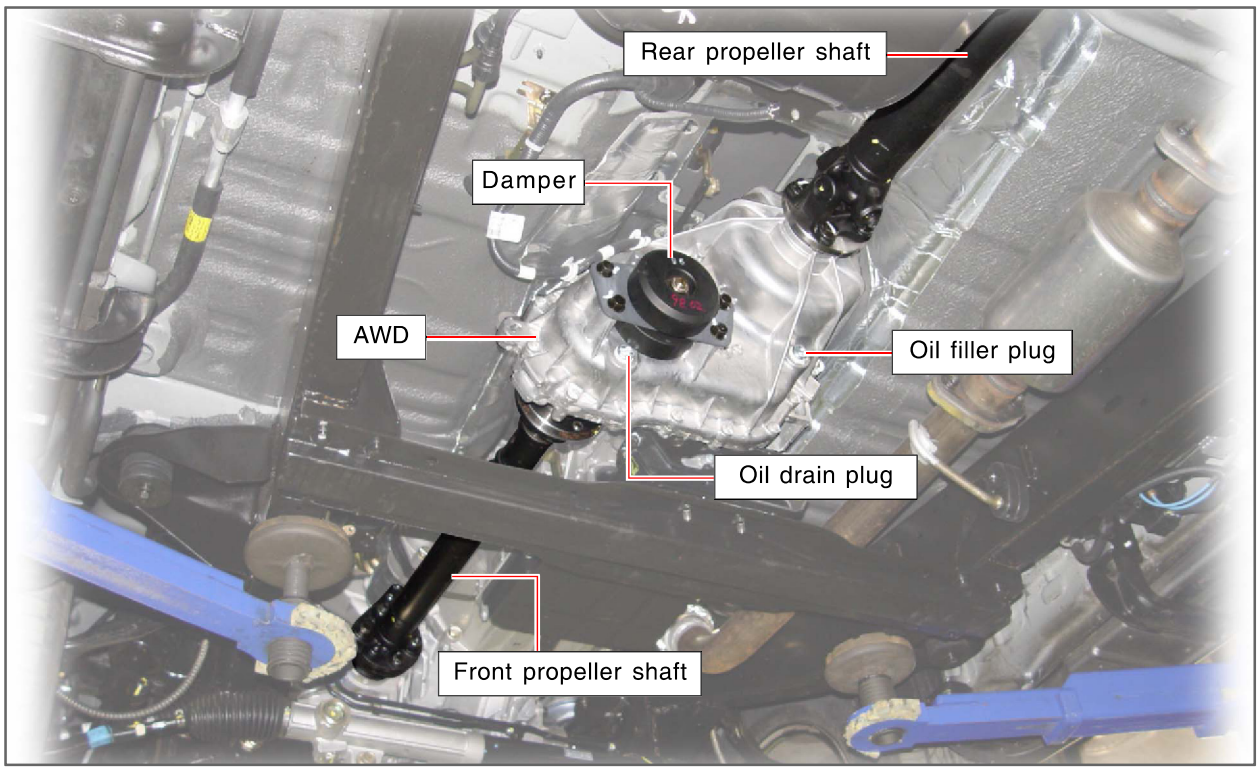
1. OVERVIEW

The AWD transfer case is installed to the full time 4WD vehicle. Unlike the TOD (Torque On Demand) transfer case, it delivers the driving force to the front wheels through the internal planetary gears without a control unit to operate AWD function. It also doesn't have the TC (Transfer Case) shift motor and 4WD transfer switch. Since it doesn't have a control unit such as TCCU (Transfer Case Control Unit), it delivers the driving force to the front and rear propeller shafts according to the gear ratio based on the gear combinations. The distribution ratio of driving force is 40:60 (front wheels:rear wheels).

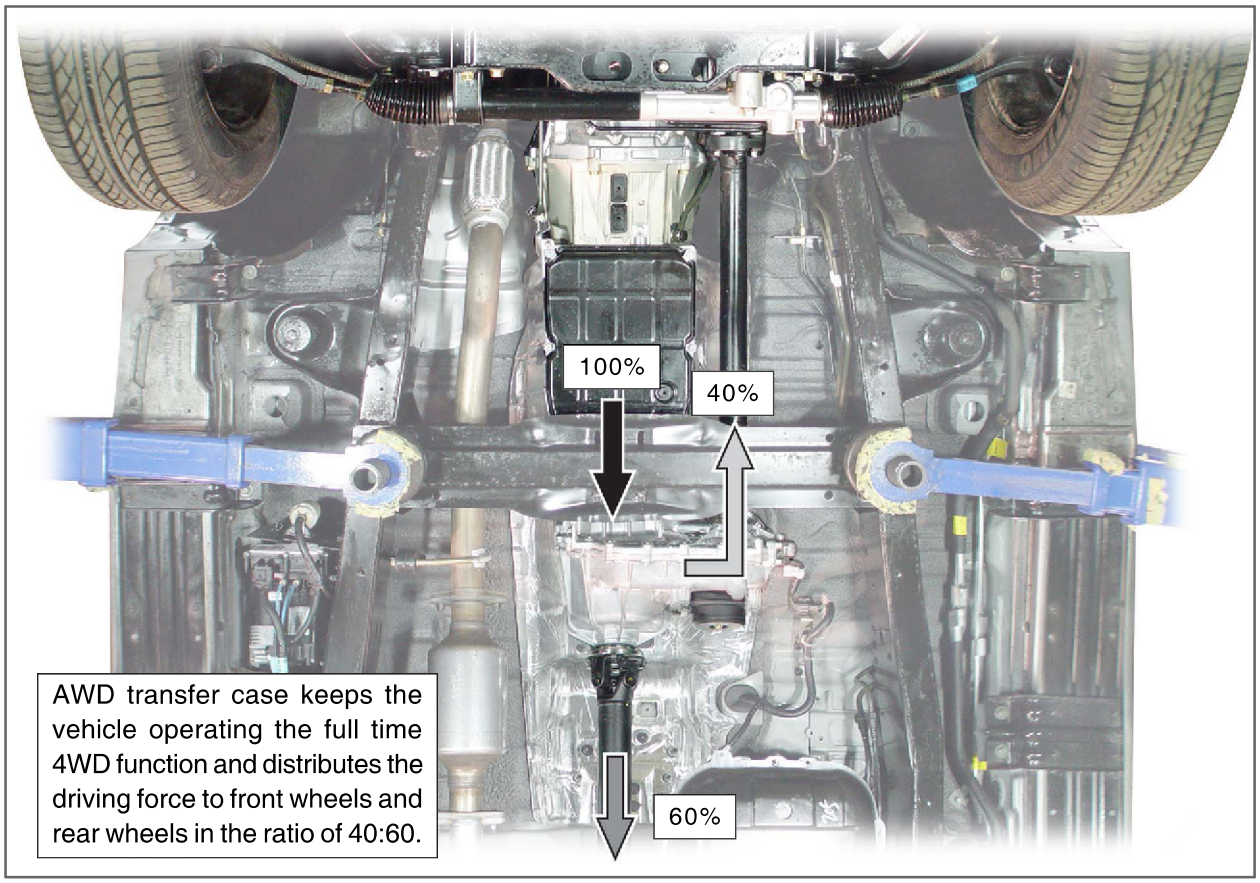


Modification basis	
Application basis	
Affected VIN	

2. LOCATION



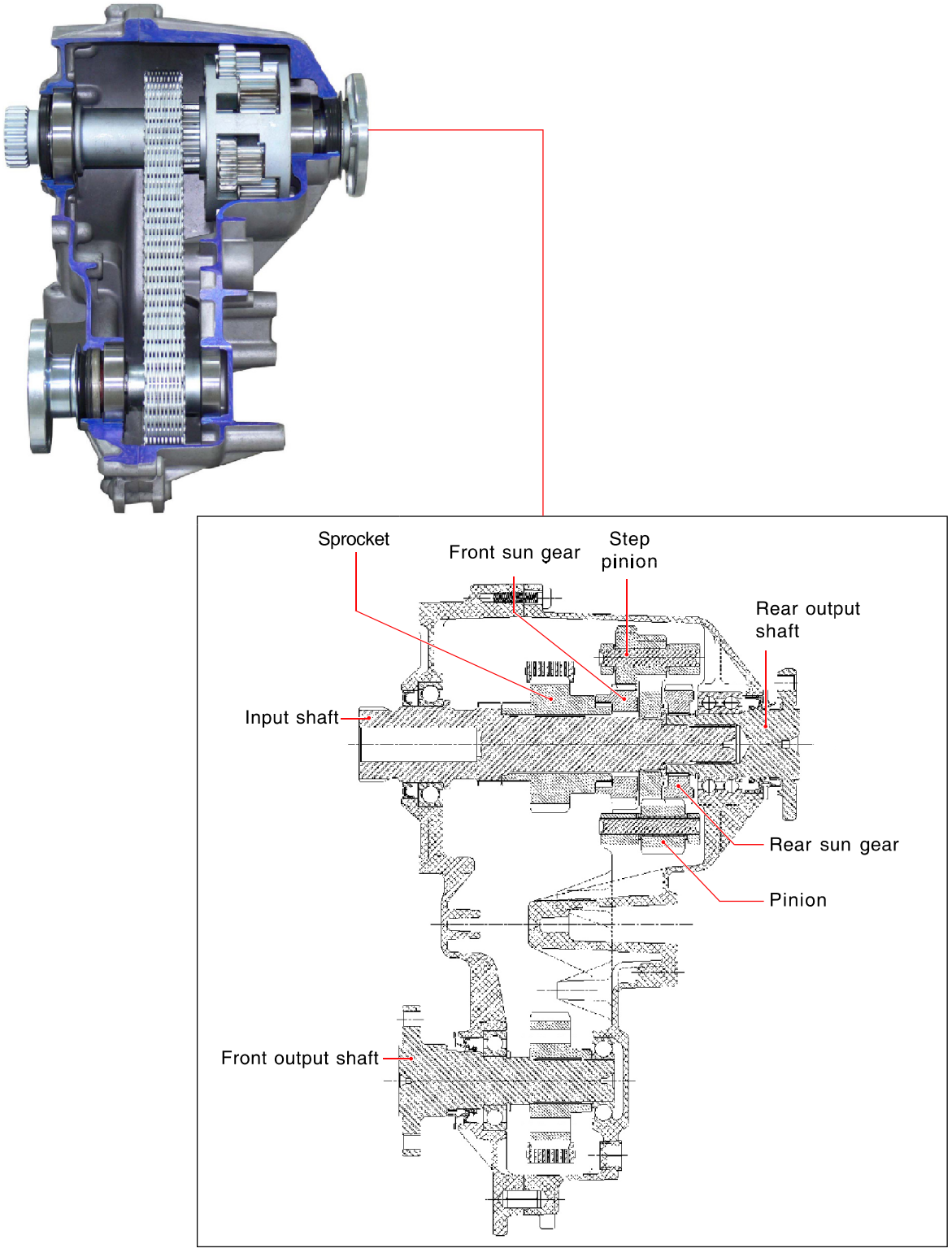
▶ **Distribution of Driving Force in AWD**



Modification basis	
Application basis	
Affected VIN	

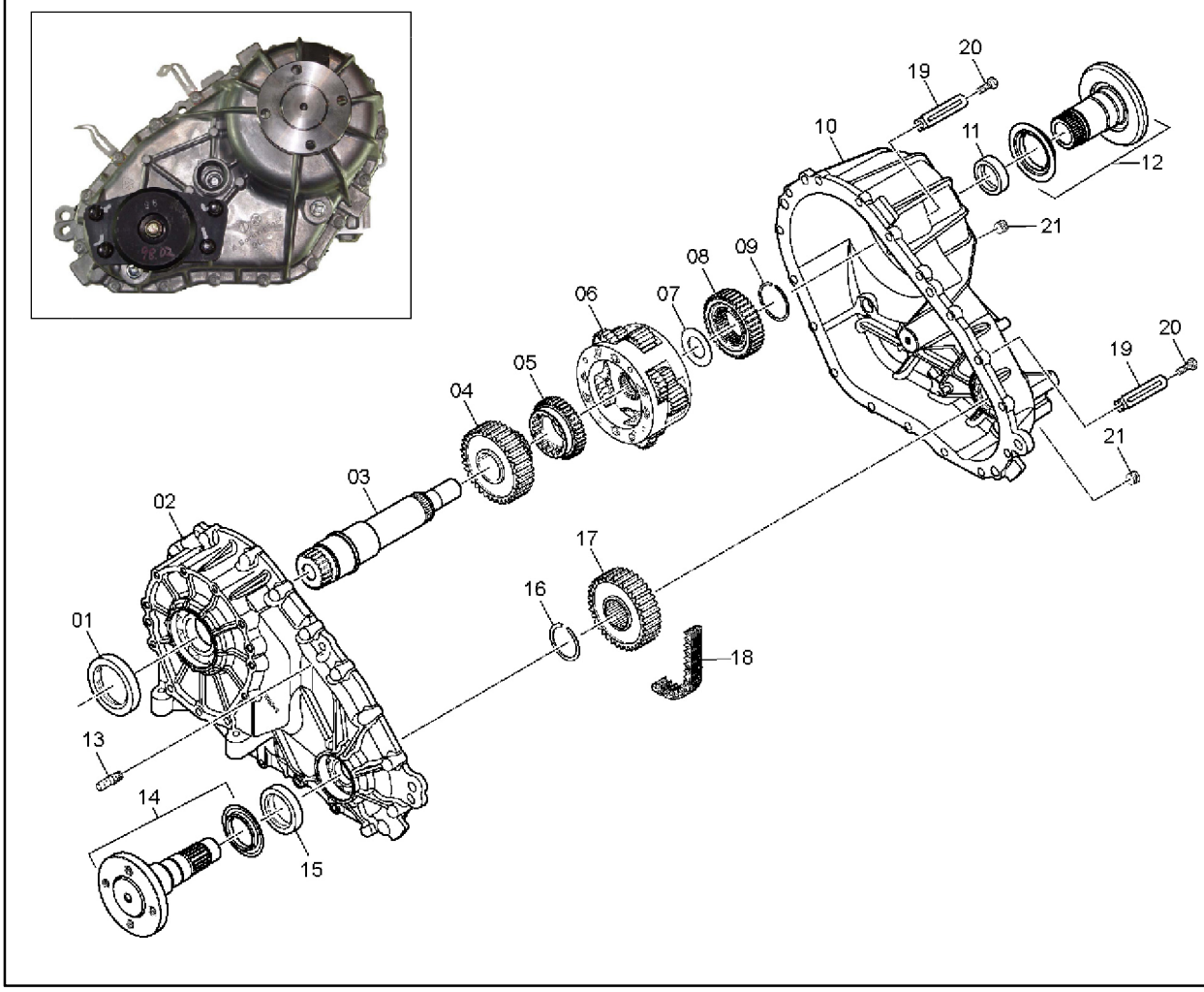
3. STRUCTURE

1) Sectional View



Modification basis	
Application basis	
Affected VIN	

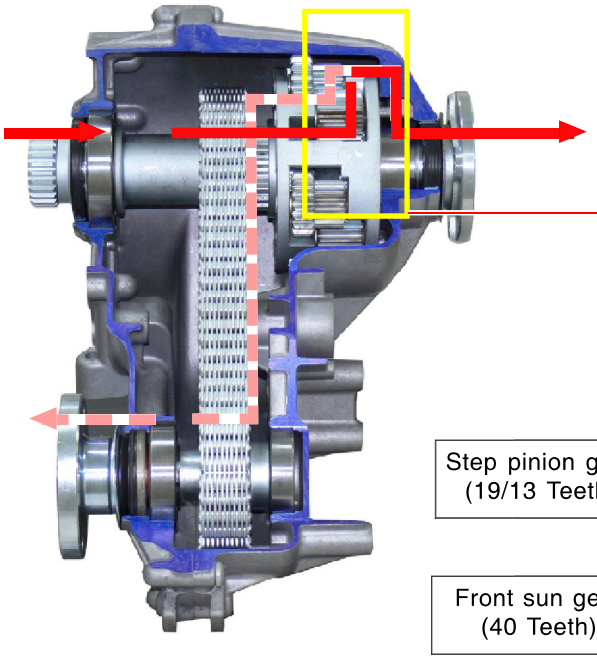
2) EXPLODED VIEW



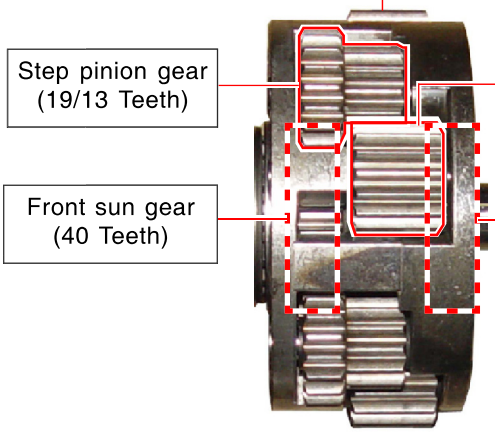
1. Oil seal
2. Case assembly
3. Input shaft
4. Sprocket
5. Front sun gear
6. Differential carrier assembly
7. Thrust washer
8. Rear sun gear
9. Snap ring
10. Cover assembly
11. Oil seal
12. Rear output shaft assembly
13. Air breather
14. Front output shaft assembly
15. Oil seal
16. Retaining ring
17. Driven sprocket
18. Chain
19. Clip
20. Bolt
21. Plug

Modification basis	
Application basis	
Affected VIN	

4. POWER FLOW



Rear output shaft
Input shaft →Carrier →Pinion (16T) →
Rear sun gear (40T) →Rear output shaft



Front output shaft
Input shaft →Carrier →Step pinion (19T/13T) →Front sun gear (40T) → Sprocket →Chain →Front output shaft

▶ Distribution of Front Output Torque

$$\frac{\dfrac{\text{Front sun gear (40T)}}{\text{Step pinion (19T)}}}{\left(\dfrac{\text{Front sun gear (40T)}}{\text{Step pinion (19T)}}\right) + \left(\dfrac{\text{Rear sun gear (40T)}}{\text{Pinion (16T)}} \times \dfrac{\text{Pinion (16T)}}{\text{Step pinion (13T)}}\right)} = 0.40625$$

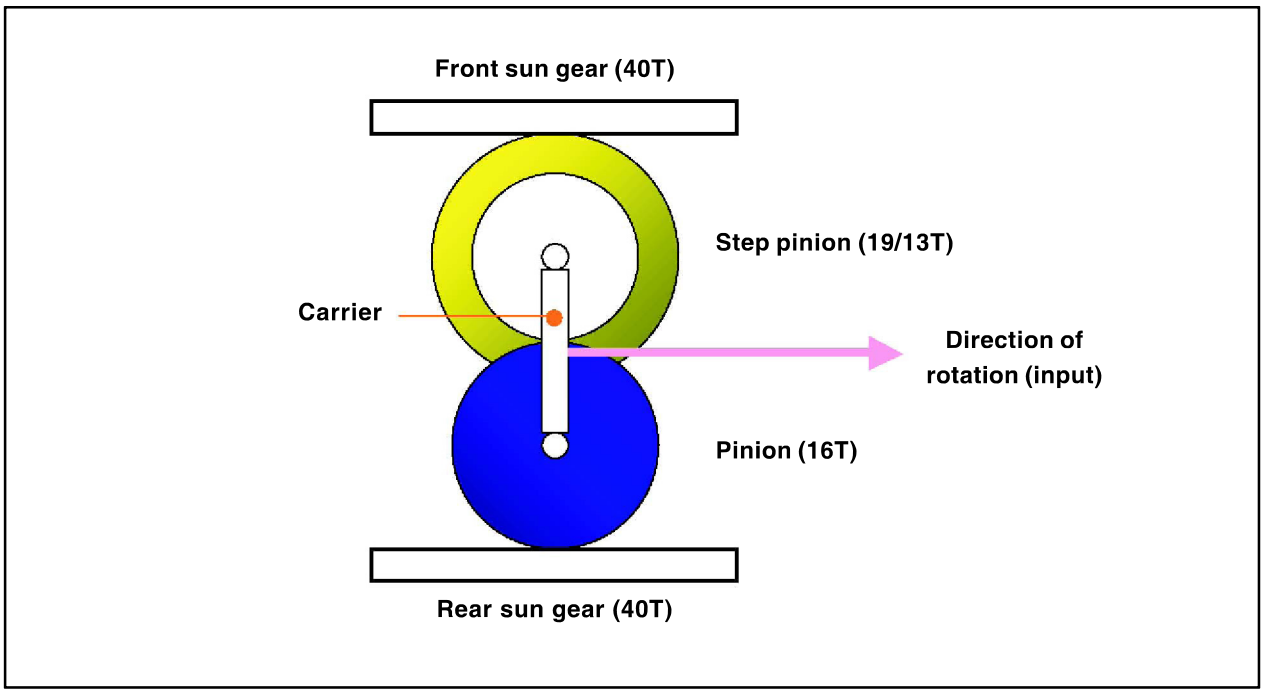
▶ Distribution of Rear Output Torque

$$\frac{\left(\dfrac{\text{Rear sun gear (40T)}}{\text{Pinion (16T)}}\right) \times \left(\dfrac{\text{Pinion (16T)}}{\text{Step pinion (13T)}}\right)}{\left(\dfrac{\text{Front sun gear (40T)}}{\text{Step pinion (19T)}}\right) + \left(\dfrac{\text{Rear sun gear (40T)}}{\text{Pinion (16T)}} \times \dfrac{\text{Pinion (16T)}}{\text{Step pinion (13T)}}\right)} = 0.59375$$

Modification basis	
Application basis	
Affected VIN	

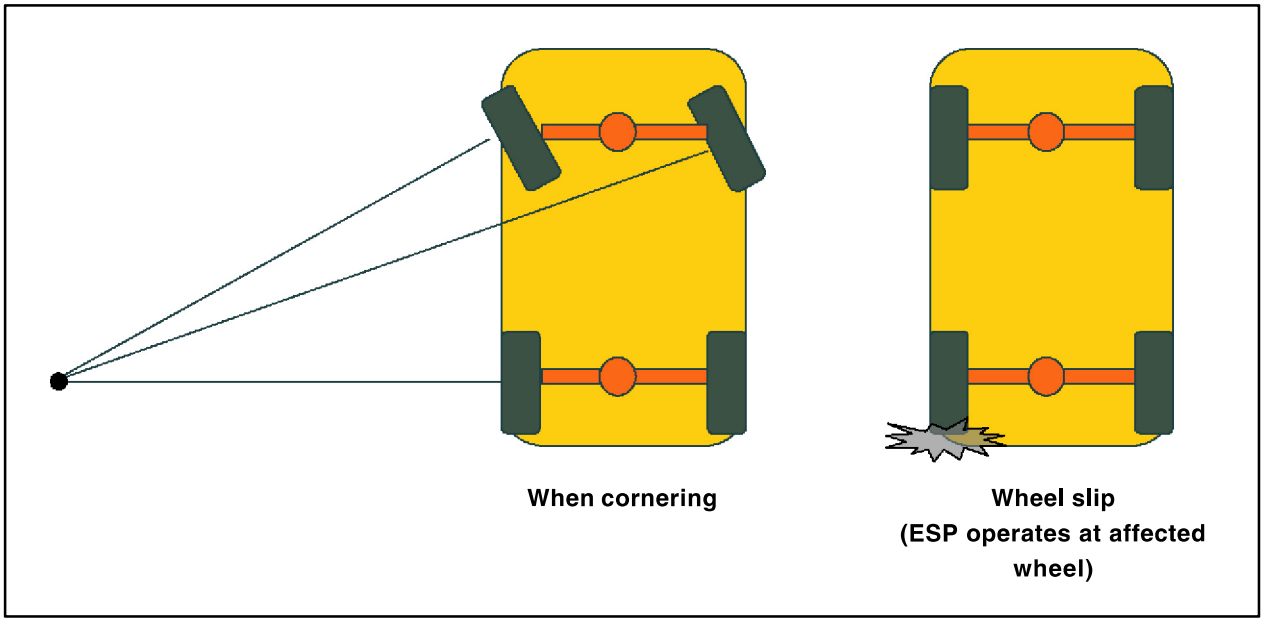
5. OPERATION OF DIFFERENTIAL

1) Systematic Diagram

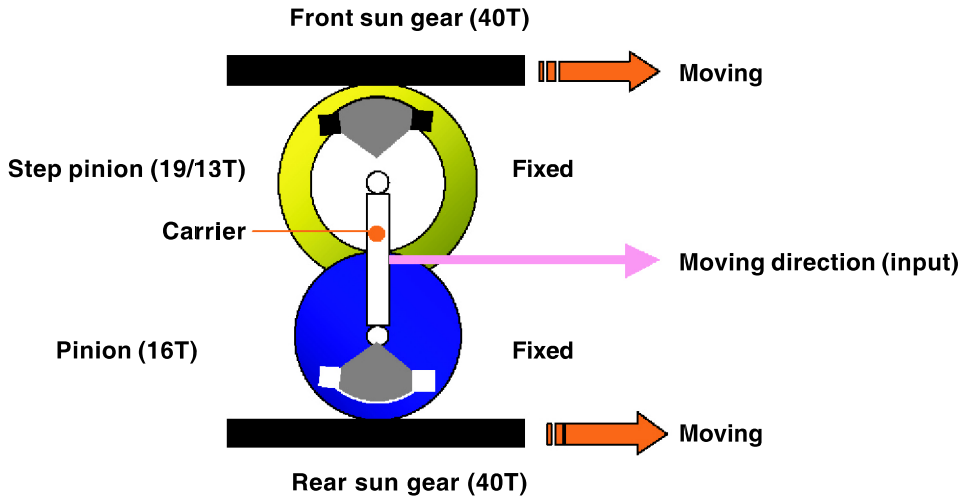


2) Revolution Control

When there is a revolution difference due to the gap of turning radius while cornering, the tight corner braking symptom occurs in part time transfer case. However, for the AWD, this gap of turning radius is compensated by the differential so that the tight corner braking symptom will not occur. The ESP also operates the wheel slip under control in order to keep the vehicle stable under severe conditions such as icy road.

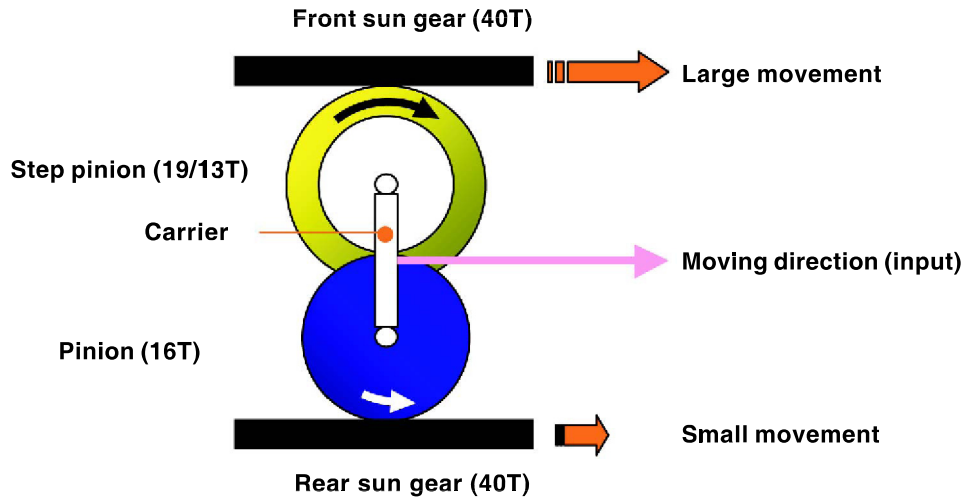


▶ When Revolution Difference Does not Occur



If there is no revolution difference in front and rear shafts, the step pinion (19T/13T) and the pinion (16T) are fixed (integrated to the carrier) even when the carrier rotates. It makes the front sun gear and the rear sun gear move toward the moving direction with the torque ratio of 40:60.

▶ When Revolution Difference Occurs



The front wheels should rotate faster than the rear wheels while cornering (including wheel slip) since the front wheels' turning radius is larger than the rear wheels'. At this moment, the step pinion (19T/13T) should rotate faster than the pinion (13T) in relation to the carrier's movement. This function is similar to the regular differential function, which also compensates the revolution difference while maintaining the torque ratio in 40:60 (front:rear).

Modification basis	
Application basis	
Affected VIN	

NO DATA

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

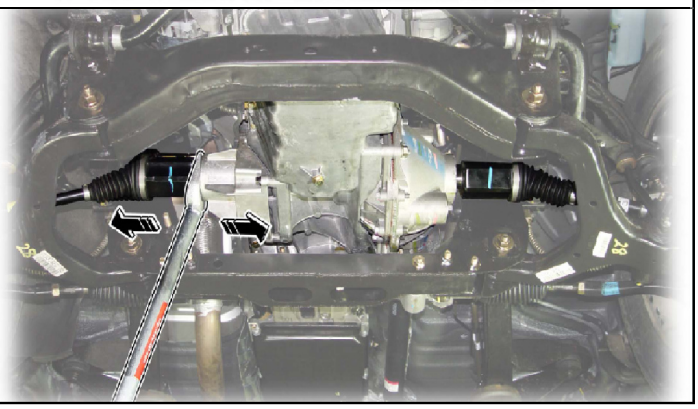
Description	Specification	
Axle shaft type	Semi-floating	
Axle housing type	Build up	
Differential	Type	Conventional type
	Gear type	Hypoid Gear
Final gear reduction ratio	DI engine + M/T	3.73
	DI engine + A/T	3.31
	Gasoline engine + A/T	4.27
Oil	Capacity	1.9ℓ (DI engine: 2.2ℓ)
	Specification	SAE 80W/90 or API GL-5

IOP/IRDA AXLE

4122-01

GENERAL

1. SPECIAL TOOLS AND EQUIPMENT

Name and Part Number	Application
Y99410030C IOP axle oil seal installation tool 	
Y99410020C IOP axle oil measuring and filling tool Oil measuring container IOP axle oil filling tool	
Y99410010C Drive shaft removal tool 	

PROPELLER SHAFT

3310-01

GENERAL

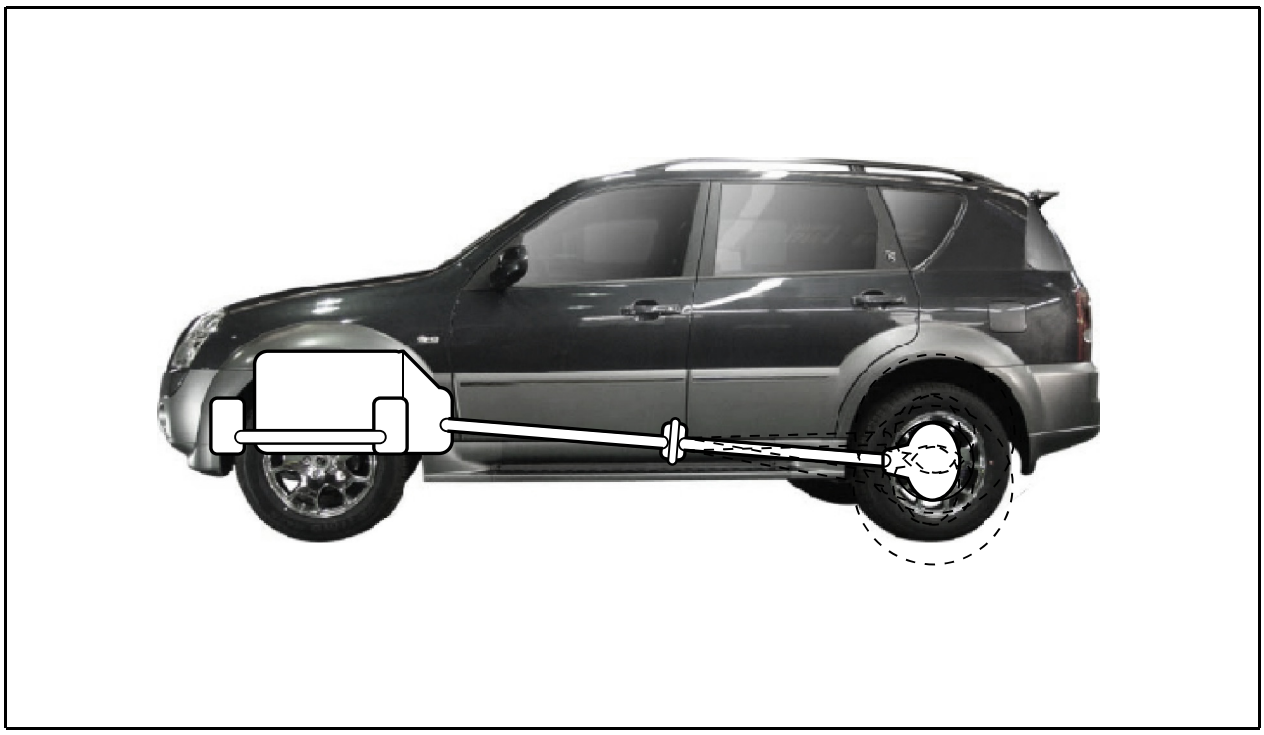
1. SPECIFICATION

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		

Modification basis	
Application basis	
Affected VIN	

OVERVIEW AND OPERATION PROCESS

1. OVERVIEW



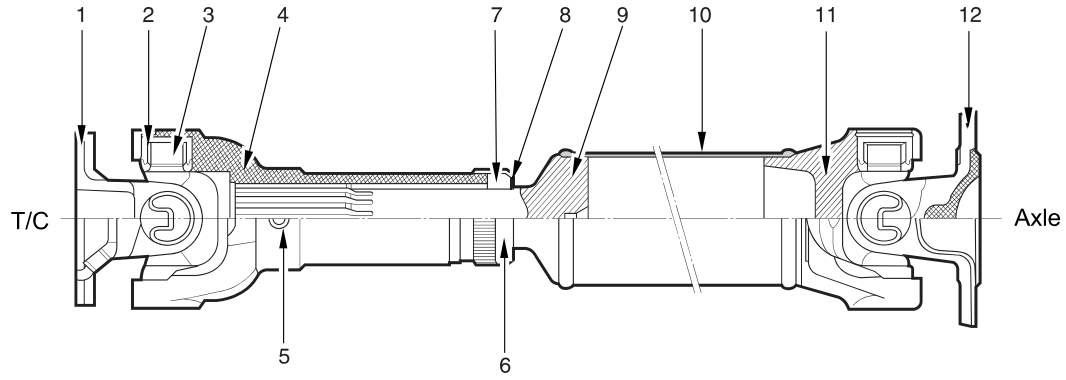
The propeller shaft transfers the power through the transmission and transfer case to the front/rear axle differential carrier (final reduction gear).
It is manufactured by a thin rounded steel pipe to have the strong resisting force against the torsion and bending.
Both ends of propeller shaft are connected 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	

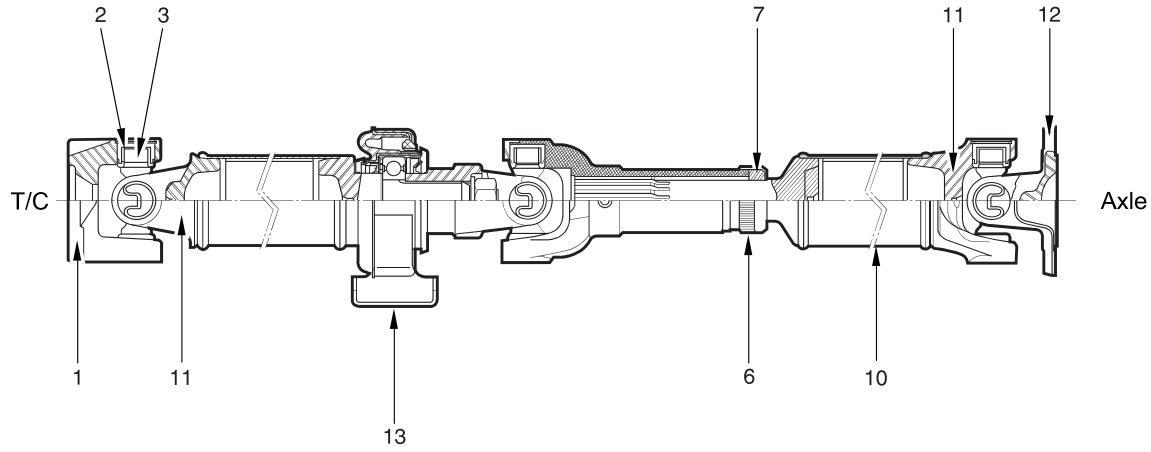
2. COMPONENT LOCATOR

▶ Cross Sectional View

Front Propeller Shaft

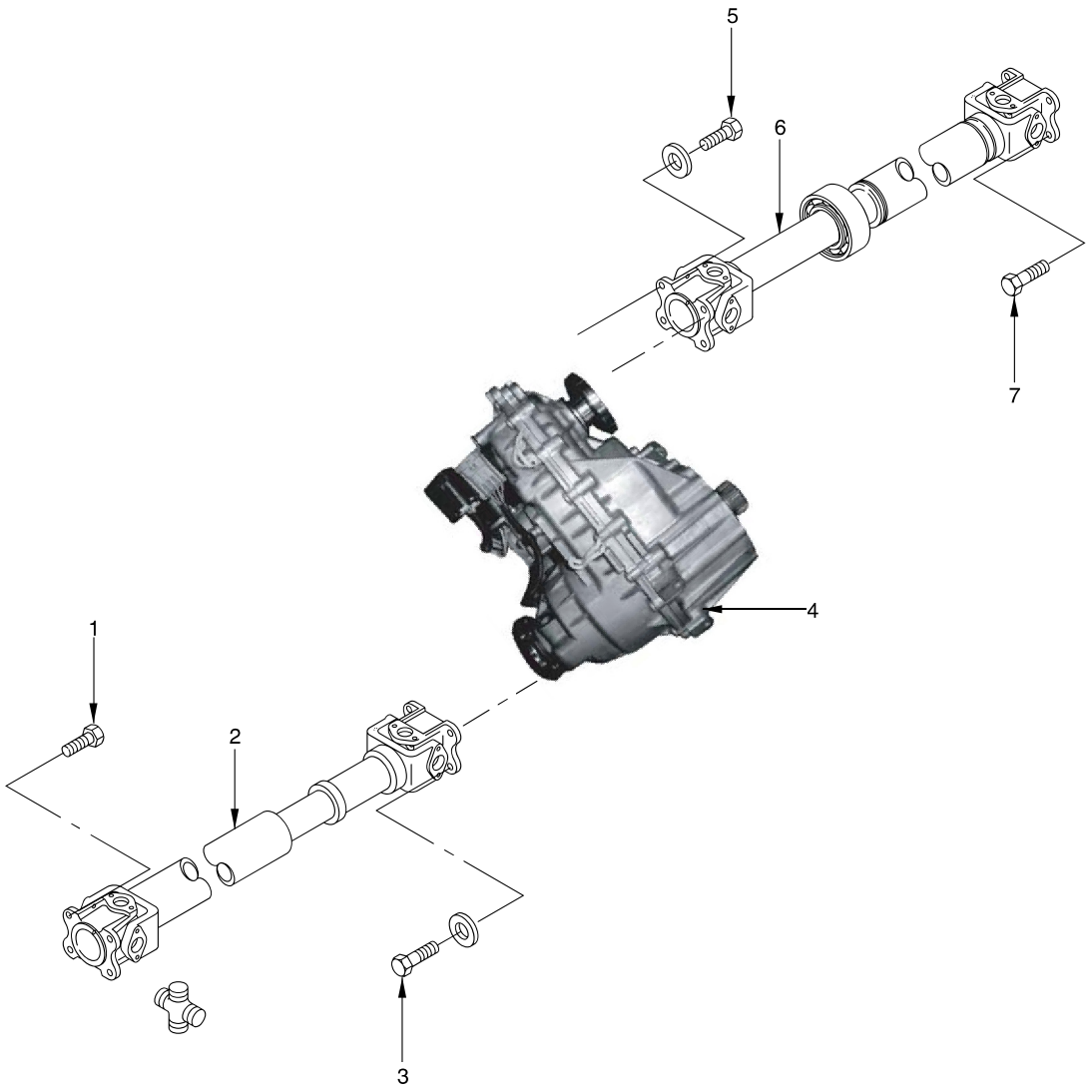


Rear Propeller Shaft



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

Modification basis	
Application basis	
Affected VIN	

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

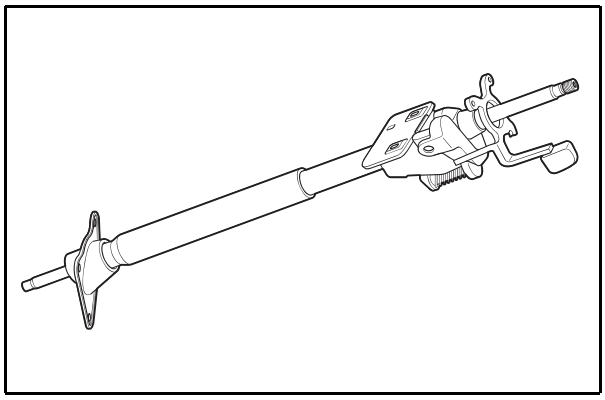
When colliding the steering wheel and column release the impact by the steering wheel and also are designed in order that the steering column shaft may be folded or absorb the impact.
The steering column has the ignition switch and lock cylinder. If removing the ignition key with the ignition switch in "LOCK" position, the lock cylinder locks the steering wheel.

1) Steering Wheel

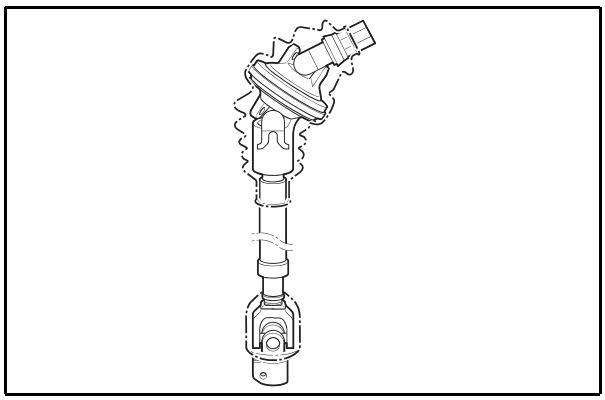
Type	4-spoke type
Outer Diameter	390 mm
Material	Forming PU/leather

The vibration damper absorbs the vibration from vehicle to minimize it.

2) Column and Shaft Assembly



3) Lower Shaft

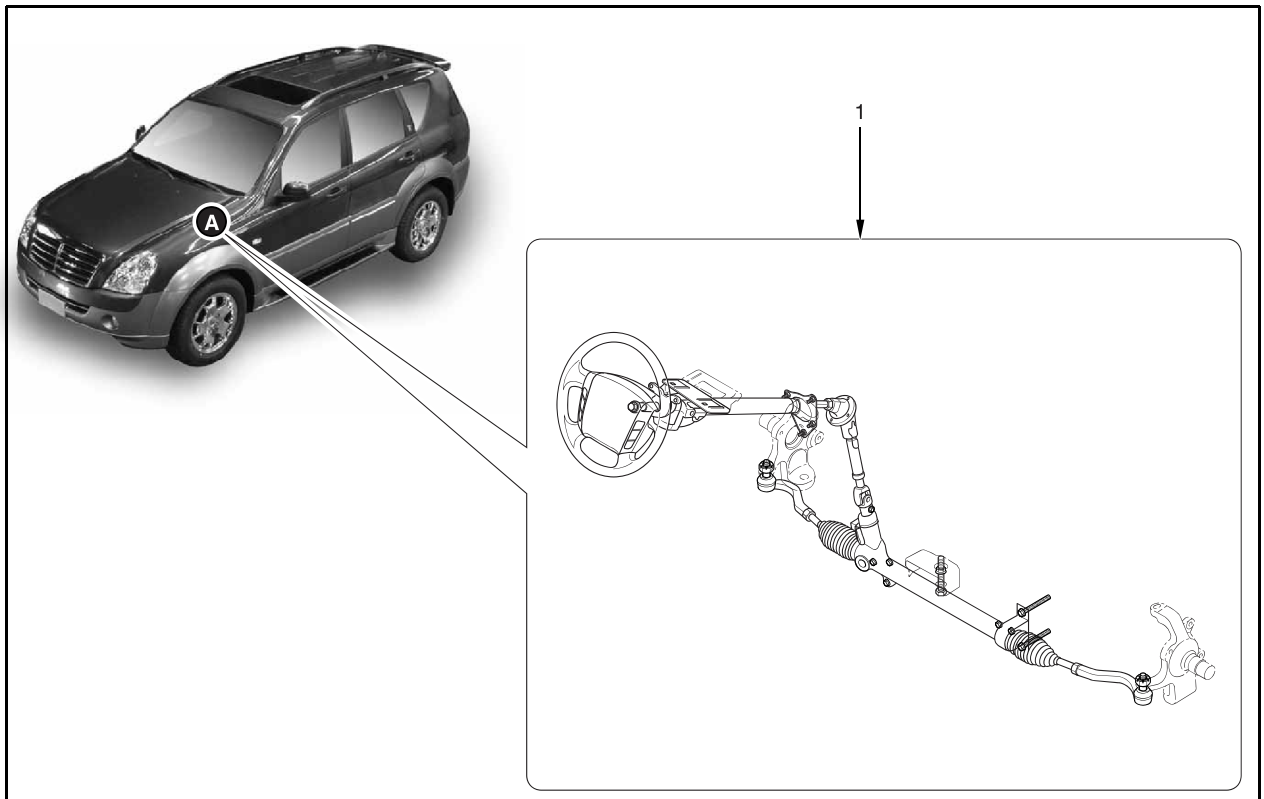


Type	Double cardan constant velocity joint
Angle	62 ~ 68°
Composition	CV joint (top) Hook joint (bottom) Elastic sleeve

This minimizes the torque changes due to angular speed changes.

2. COMPONENT LOCATOR

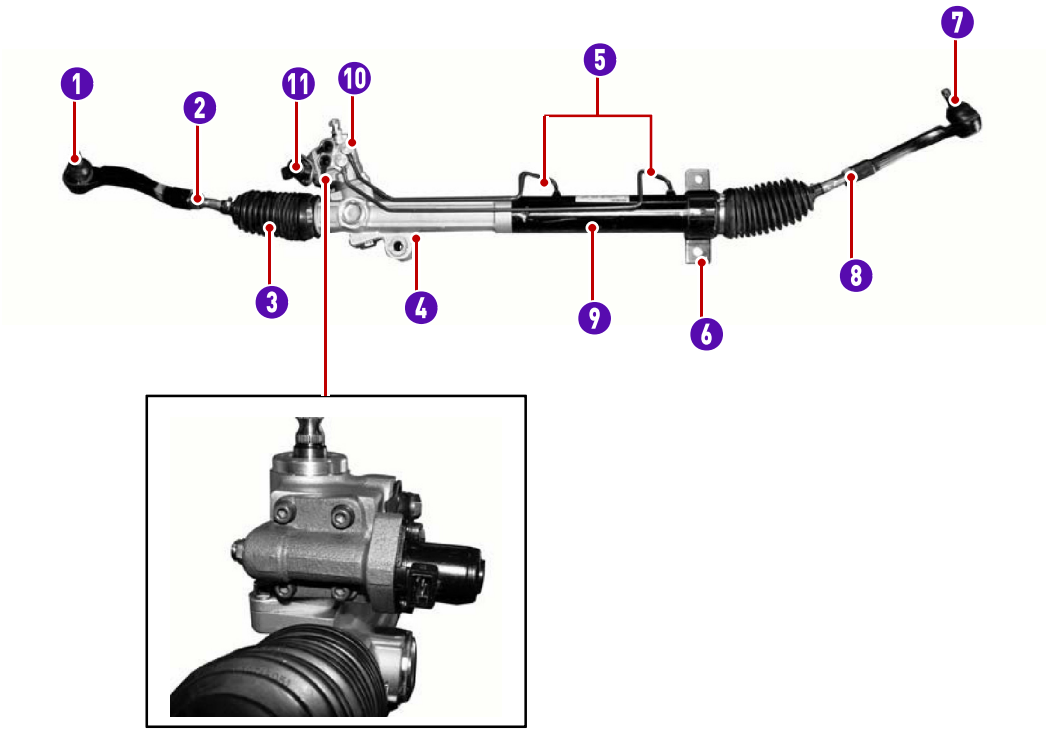
1) System Layout



A. Installation point	1. Steering components

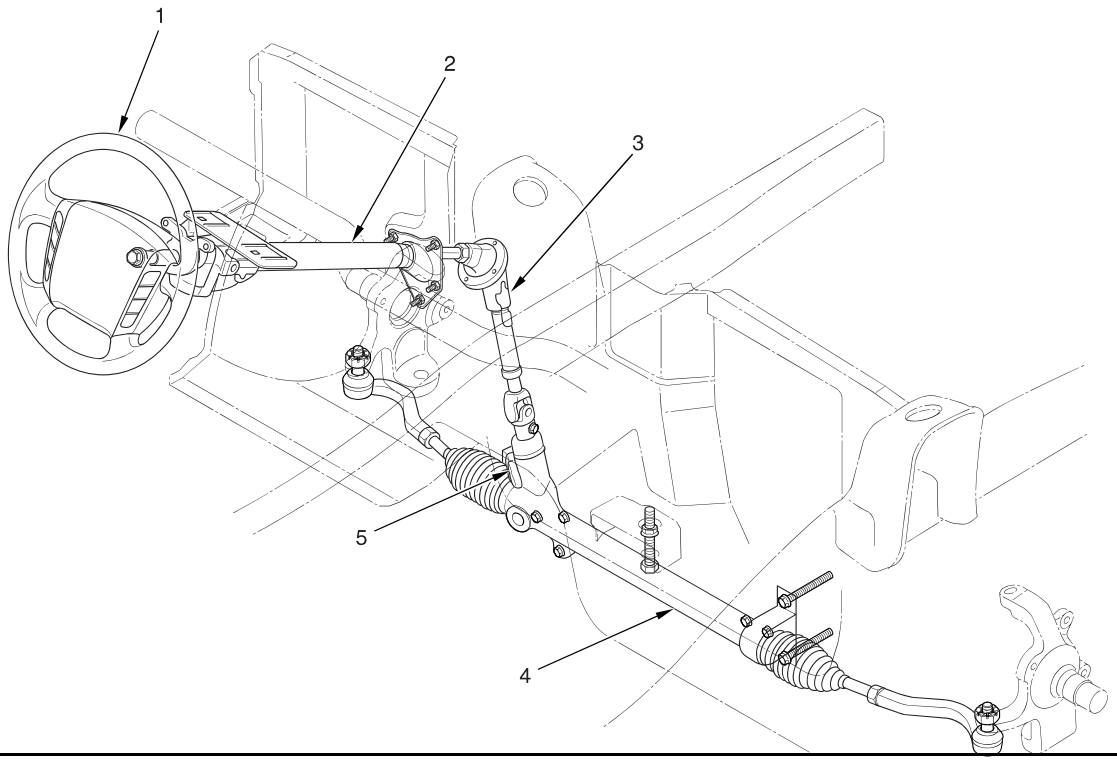
Modification basis	
Application basis	
Affected VIN	

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	

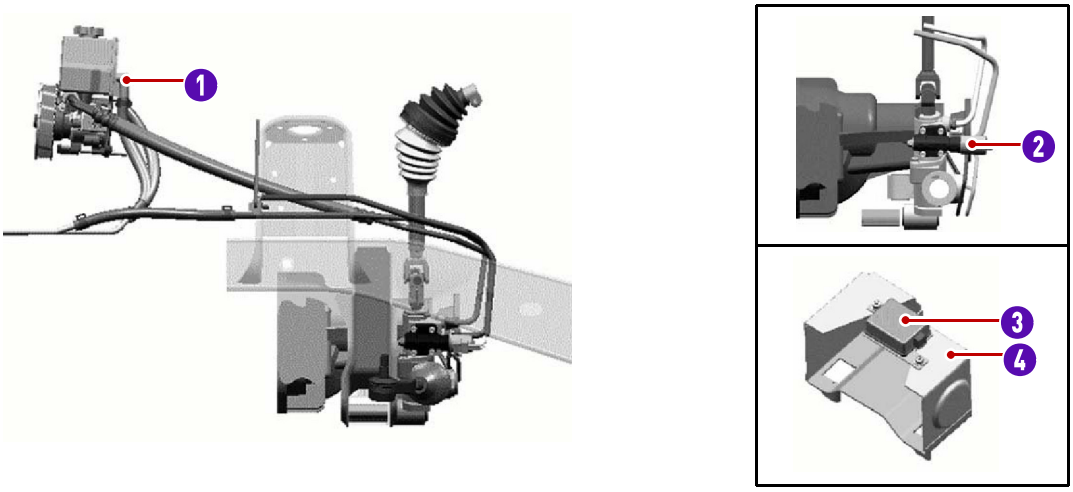
NO DATA

ECPS(ELECTRONIC CONTROL POWER STEERING) 4620-01

GENERAL

1. OVERVIEW

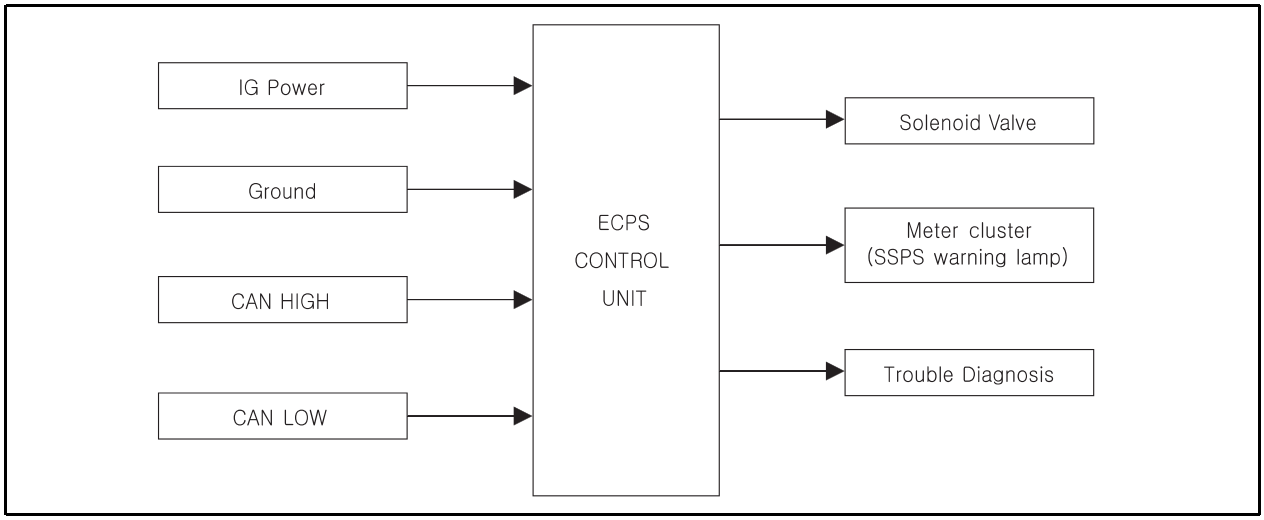
In traditional constant power assist steering system, the steerability gets lighter as vehicle speed rises, and this may cause dangerous situation. Where as having heavy steerability in high speed driving makes it difficult to manipulate the steering wheel when vehicle is in stop. This steering system 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

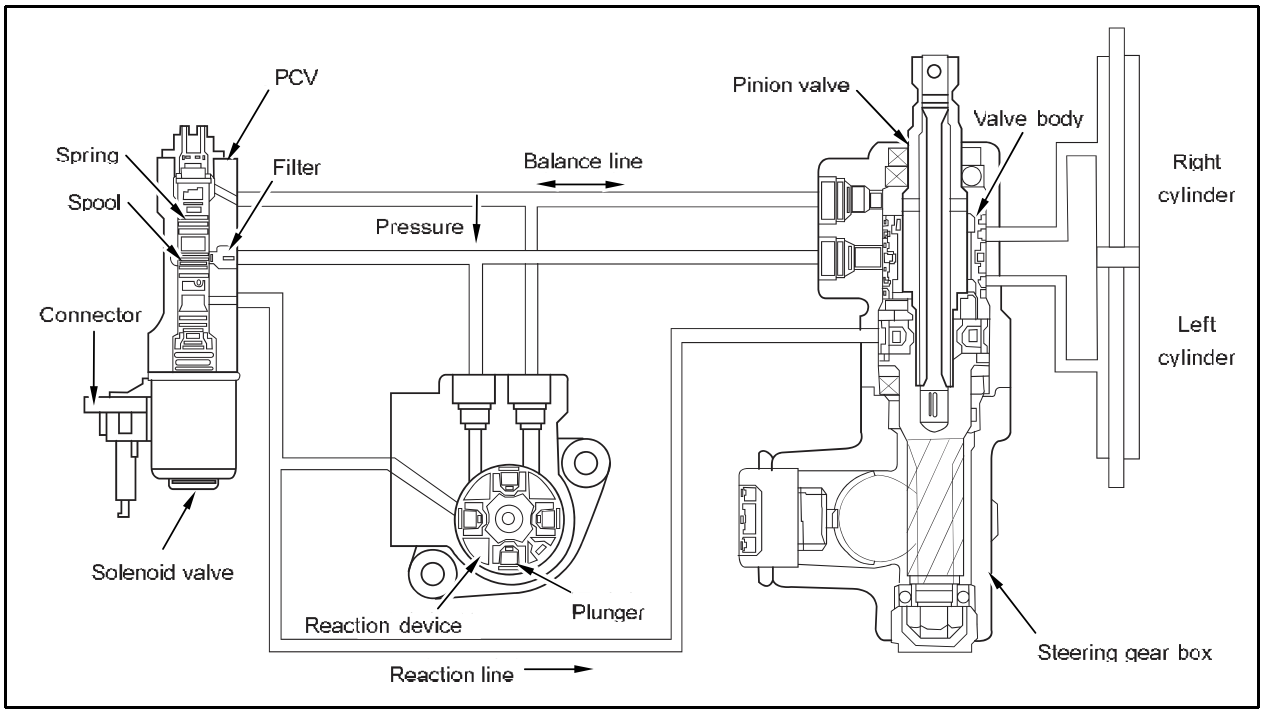
Modification basis	
Application basis	
Affected VIN	

2. INPUT/OUTPUT OF ECPS CONTROL UNIT



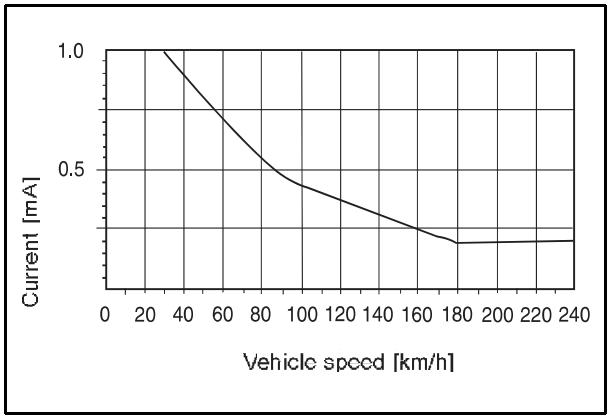
Modification basis	
Application basis	
Affected VIN	

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.

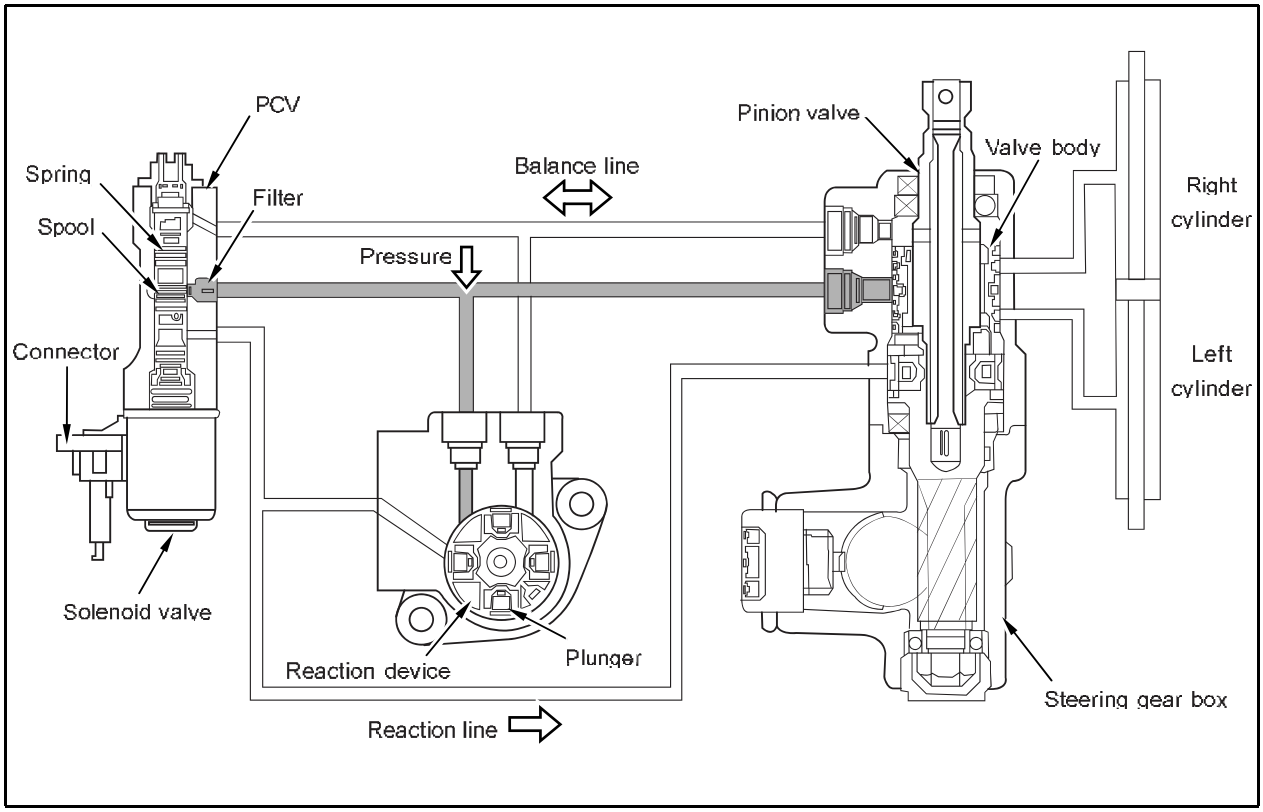
4. SYSTEM CONTROL



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**

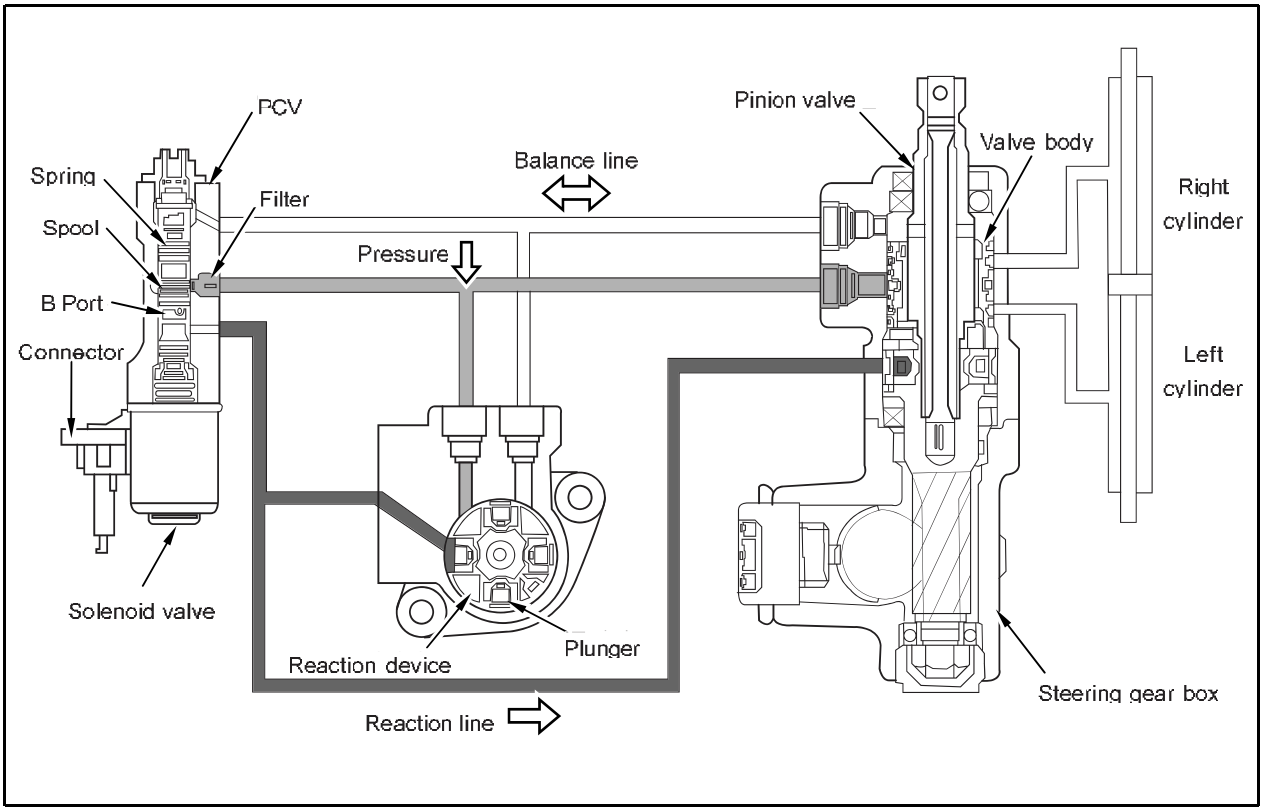
During parking and driving in low speed, the control unit supplies approx. 1 A of electric current to solenoid valve. Then, the spool located in PCV compresses the upper spring and elevates upward and, the working pressure from oil pump (A port) is not able to flow to the reaction plunger (C port). As a result, the pressing force from reaction plunger disappears and the steerability enhances.



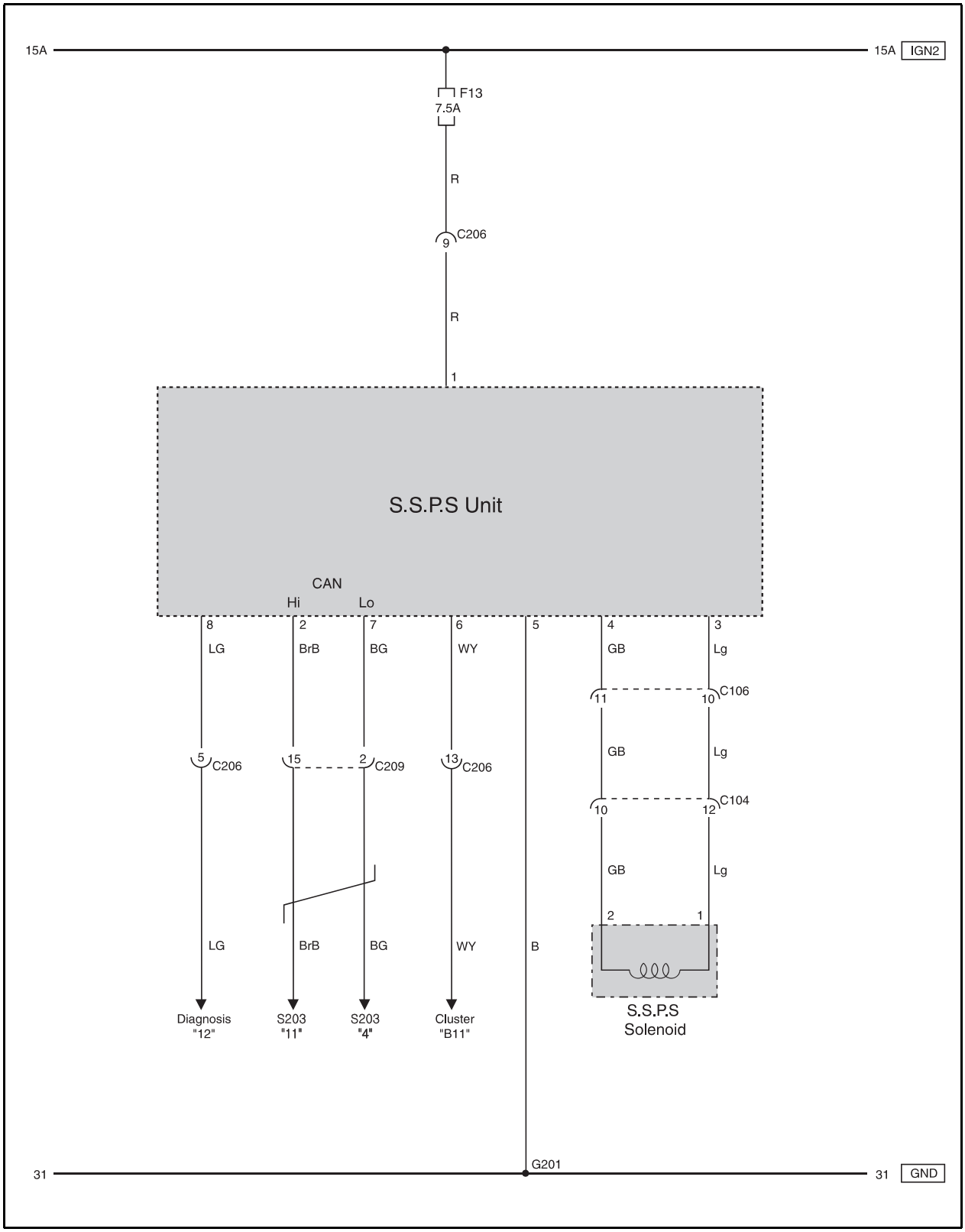
Modification basis	
Application basis	
Affected VIN	

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

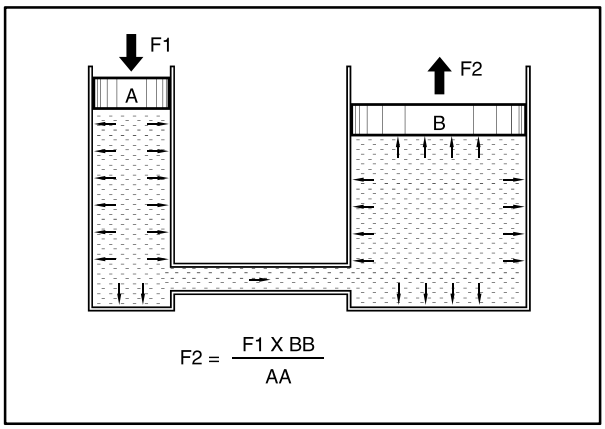
1. BRAKE SYSTEM GENERAL INFORMATION

1) DESCRIPTION AND OPERATION

(1) Brake System

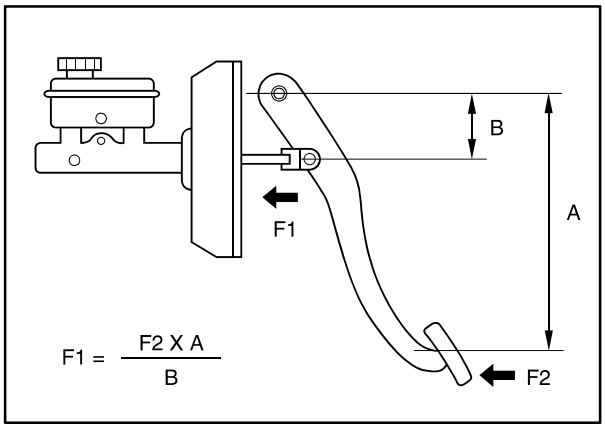
Even though a driver cuts off the power, while driving, the vehicle continues to move due to the law of inertia. Therefore, a braking device is needed to stop the vehicle. The brake system normally uses the frictional discs that converts the kinetic energy to the thermal energy by frictional operation. 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



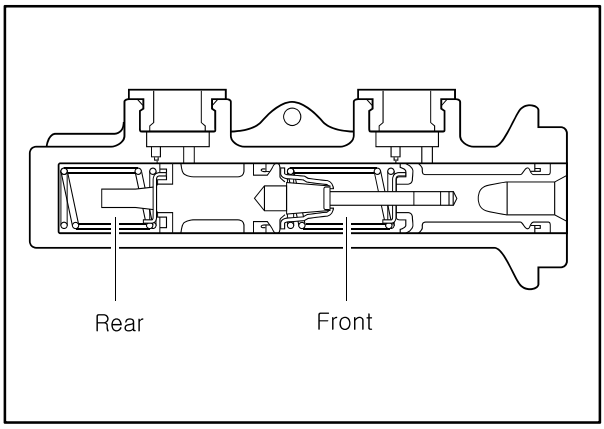
This system uses the leverage effect and Pascal's principle. When depressing the brake pedal, the pedal pressure is increased by booster and is delivered to master cylinder to generate hydraulic pressure. The hydraulic pressure generated by the master cylinder is delivered to the brake caliper through 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

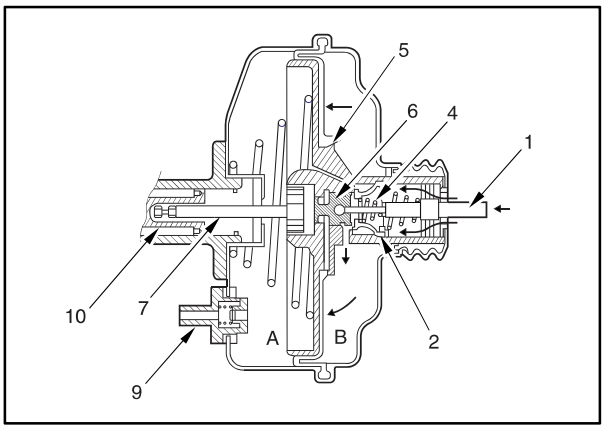


The brake master cylinder is designed to convert the force from the brake master cylinder to the high hydraulic pressure. The brake system uses the tandem type master cylinder with in-line 2 pistons.
The in-line 2 pistons generate the hydraulic pressure. The piston cup on the piston keeps the sealing 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.

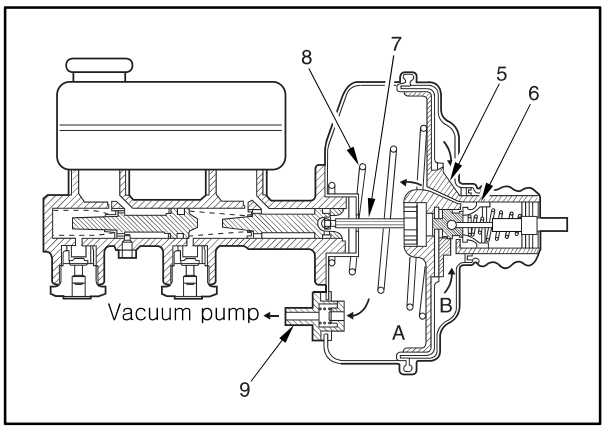
1. Pressure distribution at working



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	

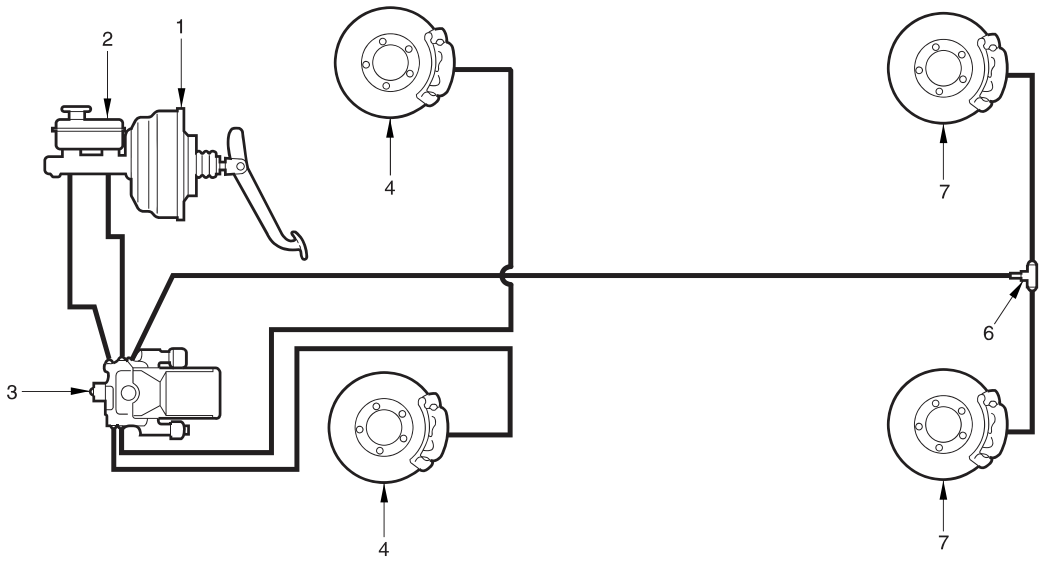
2. Pressure distribution after working



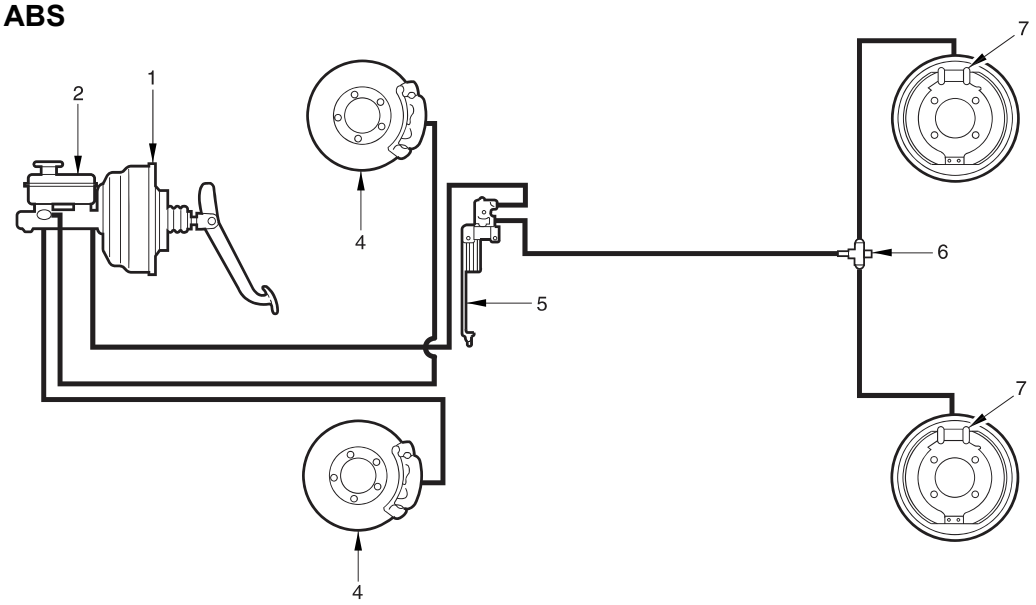
When releasing the brake pedal, the valve plunger (3) returns back to the original position by return spring (4) and the air valve (6) closes. At this time, the vacuum valve (9) opens and the pressure difference between chamber (A) and (B) in power cylinder is eliminated. Accordingly, the power piston (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



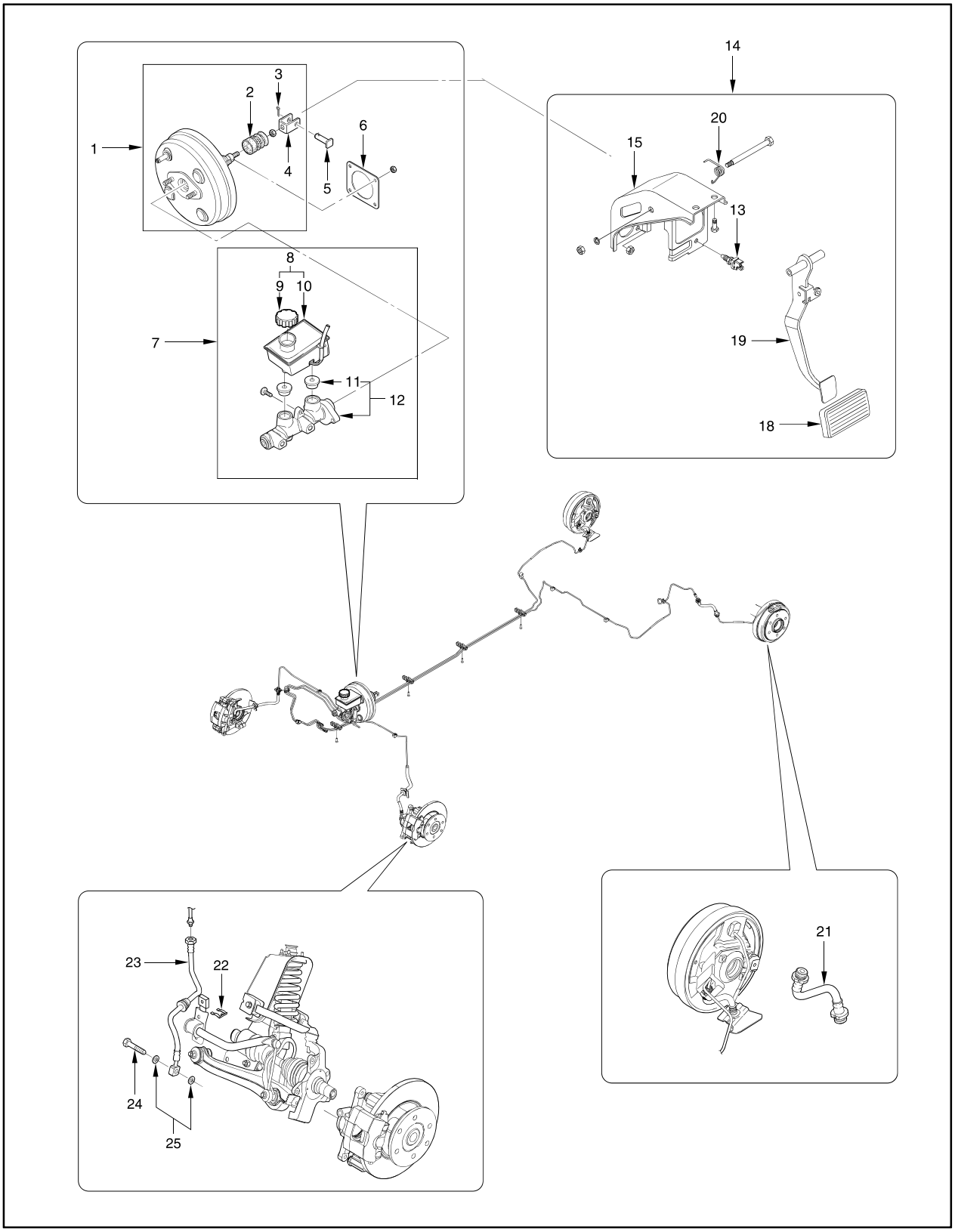
Without ABS



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



Modification basis	
Application basis	
Affected VIN	

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

Modification basis	
Application basis	
Affected VIN	

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.

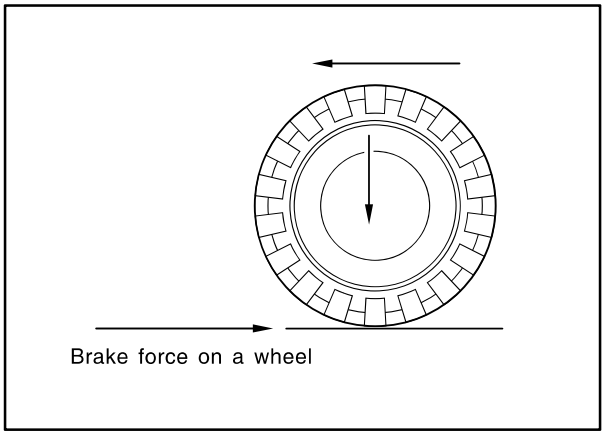
(1) The Stopping Distance

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


Brake force on a wheel

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:

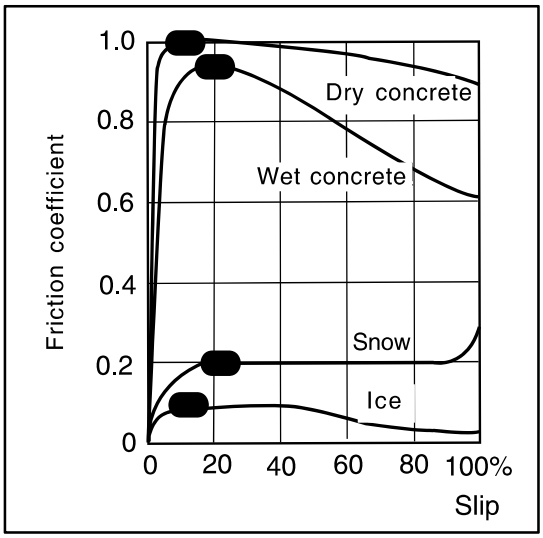
$$S = \frac{V_{veh} - V_w}{V_{veh}} \text{ X } 100\ \%$$

V_{veh} = 100 km/h, V_w = 70 km/h

$$S = \frac{100 - 70}{100} \text{ X } 100\ \%$$

Modification basis	
Application basis	
Affected VIN	

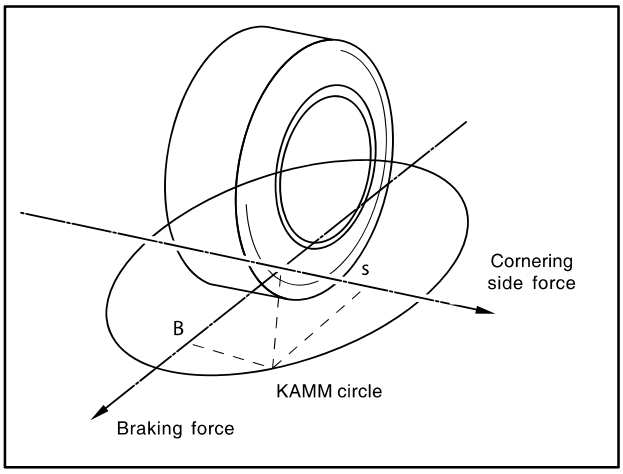
(5) Typical slip curves



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.

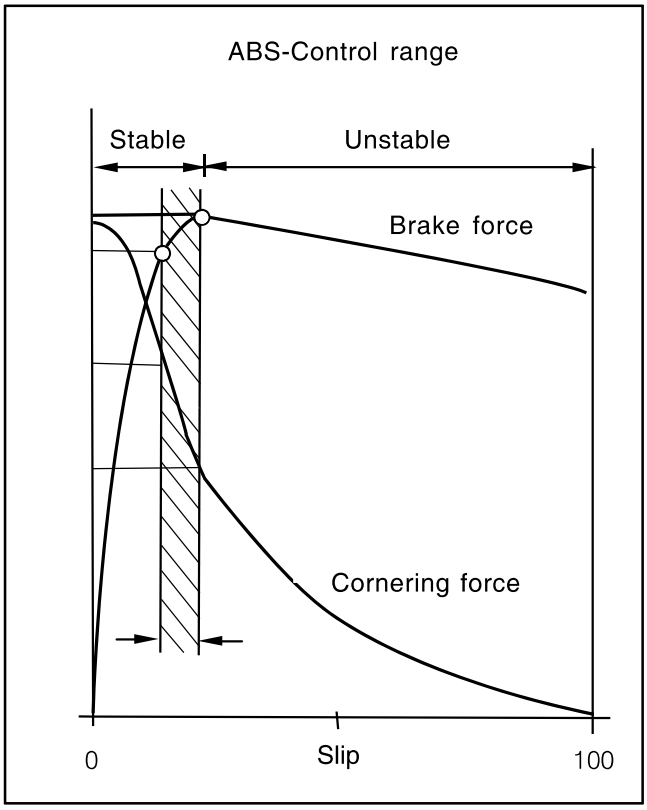
The reason for this is based in physics and not in the Anti-Lock System. However, as mentioned before, ABS is not about the stopping distance, but maneuverability and driving stability, for with ABS you can steer round an obstacle. A device with locking wheels without ABS cannot be steered. So what use 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.

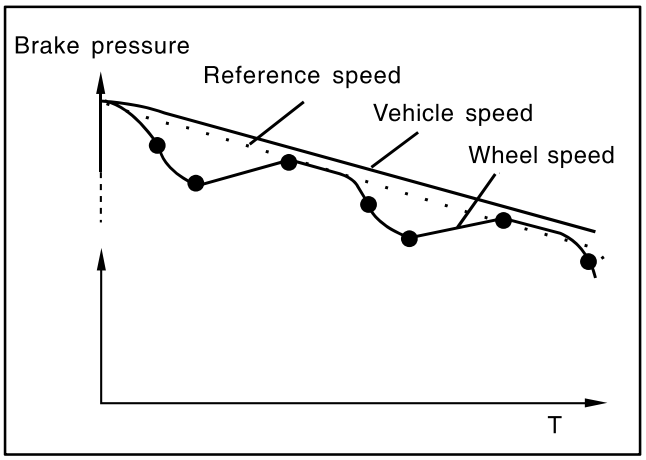
▶ **Cornering force**

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

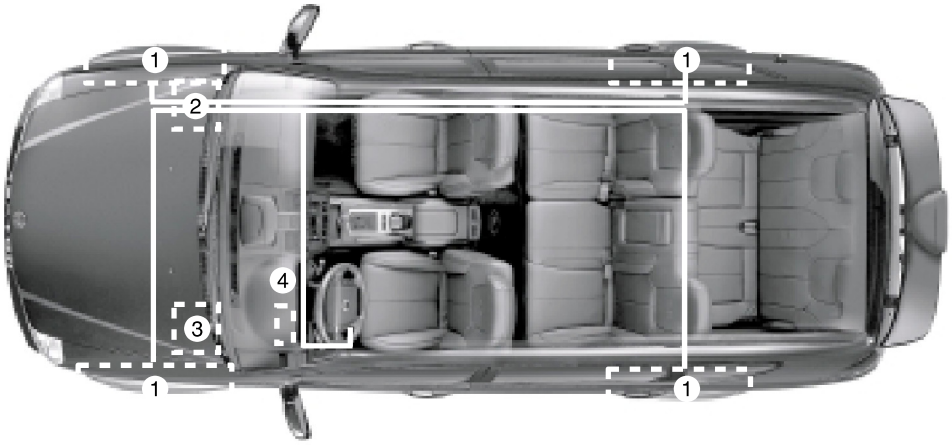
This control is used for regulating the brake pressure for rear axle during ABS operation. This control uses lower adhesion coefficient to prevent the rear wheels from locking.

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.

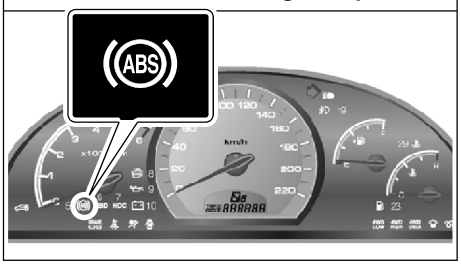
1. Wheel speed sensor

2. ABS HECU



3. Brake master cylinder

4. ABS warning lamp

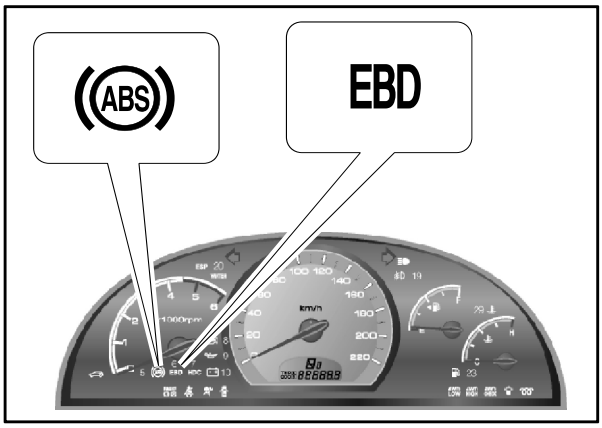


Modification basis	
Application basis	
Affected VIN	

1) SYSTEM FUSE

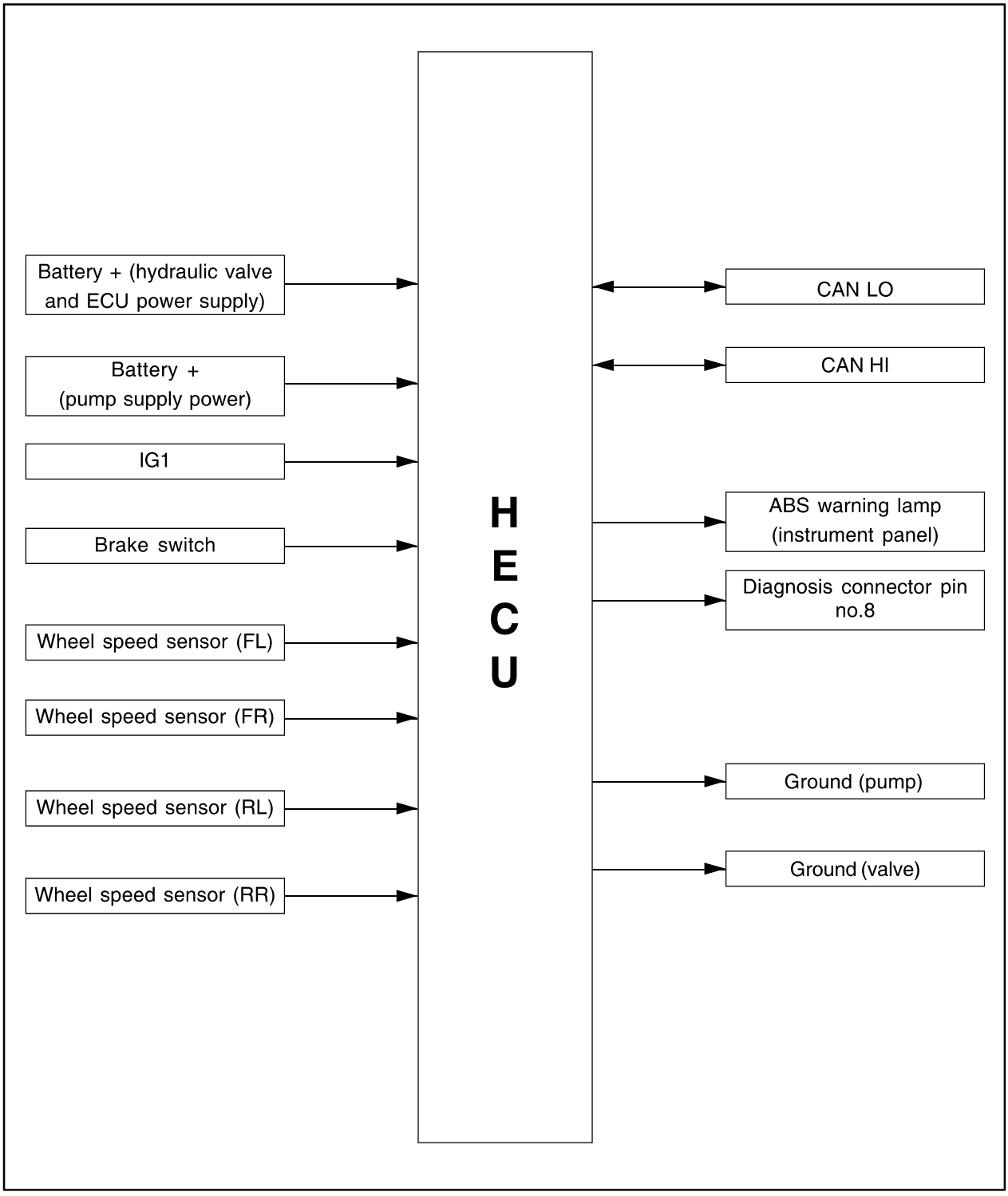
The ABS/TCS system fuse and SB2 is located at the fuse box in engine compartment.

2) INDICATORS



The ABS and TCS indicators are in instrument cluster.

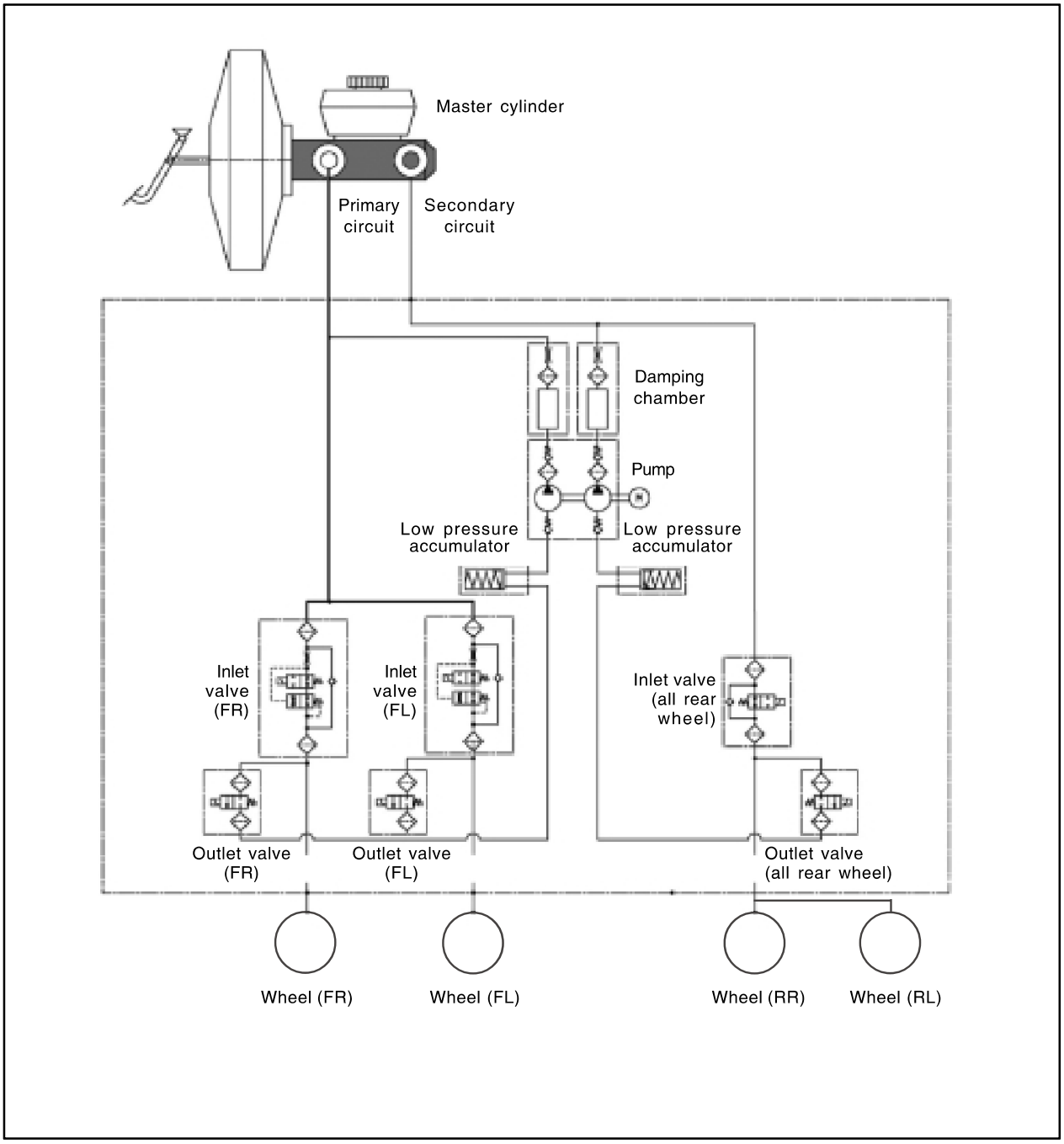
3. INPUT AND OUTPUT DIAGRAM OF ABS UNIT



Modification basis	
Application basis	
Affected VIN	

4. HYDRAULIC CIRCUIT DIAGRAM

1) ABS HYDRAULIC CIRCUIT DIAGRAM

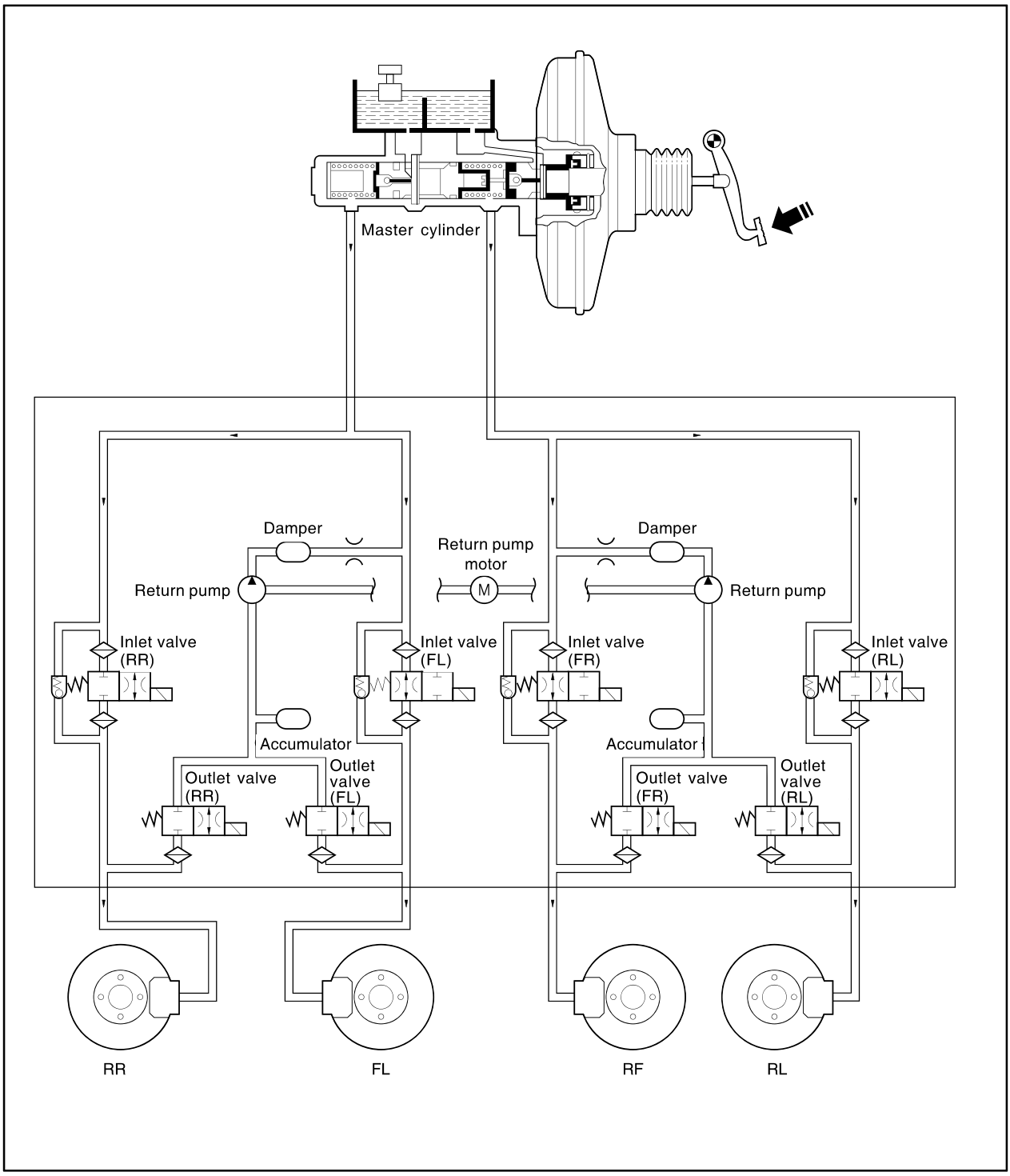


The vehicle equipped only with the ABS controls the wheel's braking force using three 3-channel 4-sensor method. The front wheels that are the primary circuit of the brake system is composed of two wheel speed sensors and two channel valves system with two inlet valves and two outlet valves. The rear 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

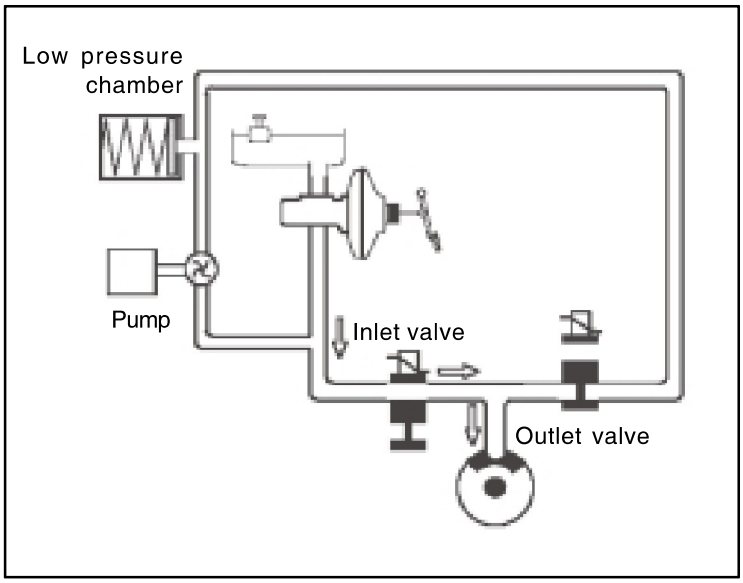
To prevent the rear wheels locking when braking, HECU receives the signals from wheel speed sensors and brake signals to calculate the reduced braking speed, and controls the brake pressure to rear wheels by operating the intake 2-channel valve to provide the optimal braking conditions.



Modification basis	
Application basis	
Affected VIN	

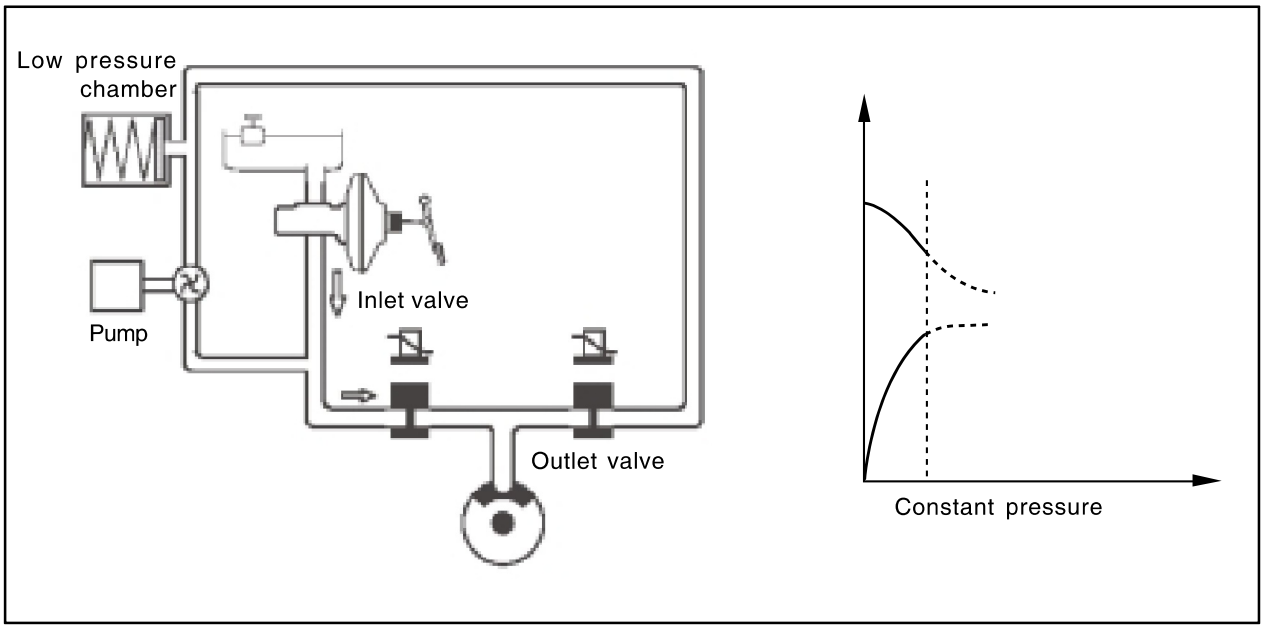
3) ABS HYDRAULIC CIRCUIT PER ABS OPERATION RANGE

▶ 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 .

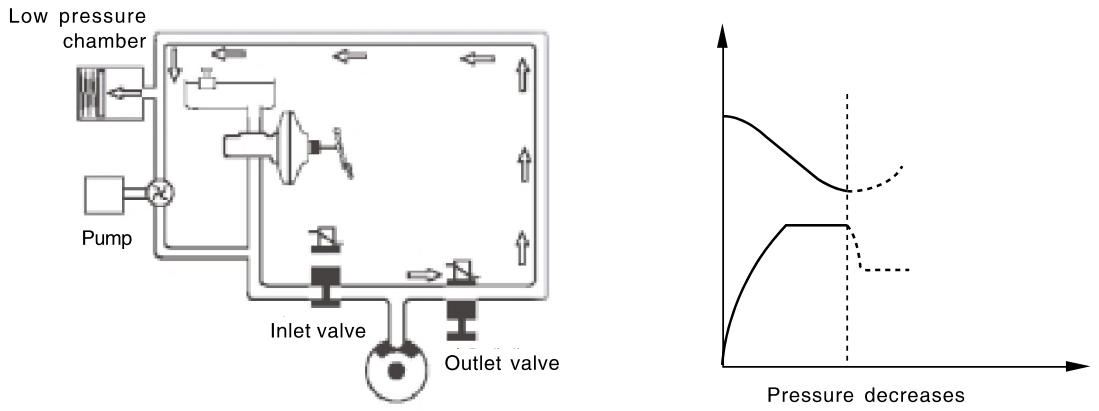
▶ No Hydraulic Pressure Circuit when ABS is Operating



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.

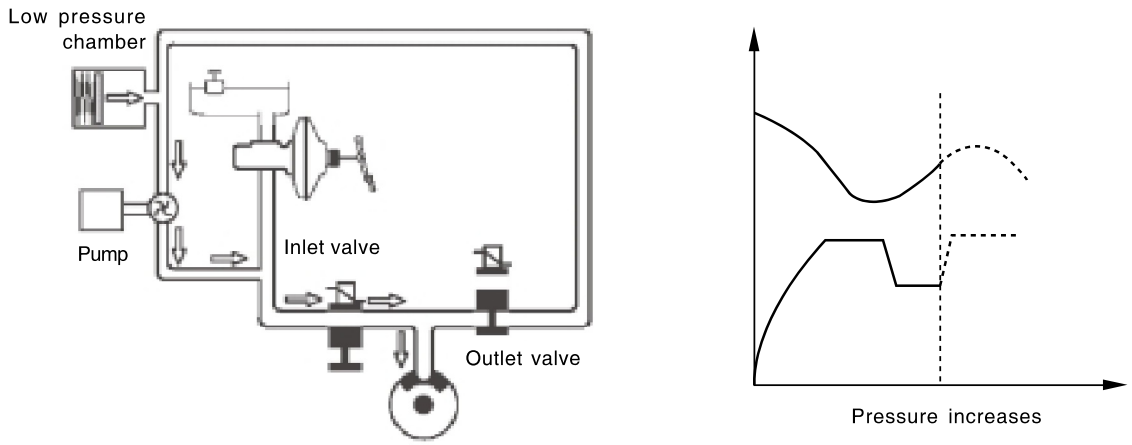
Modification basis	
Application basis	
Affected VIN	

▶ 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	

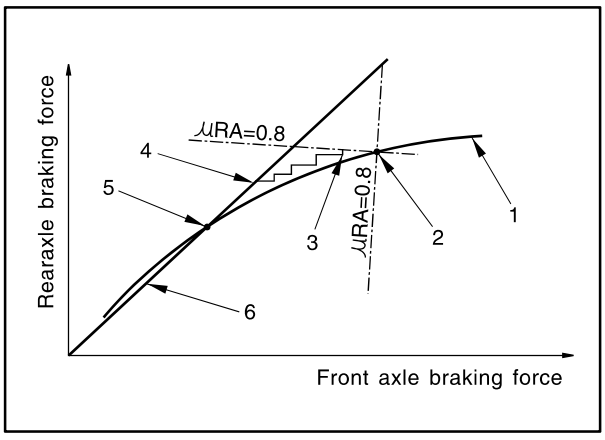
5. EBD (ELECTRONIC BRAKE FORCE DISTRIBUTION) SYSTEM

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.

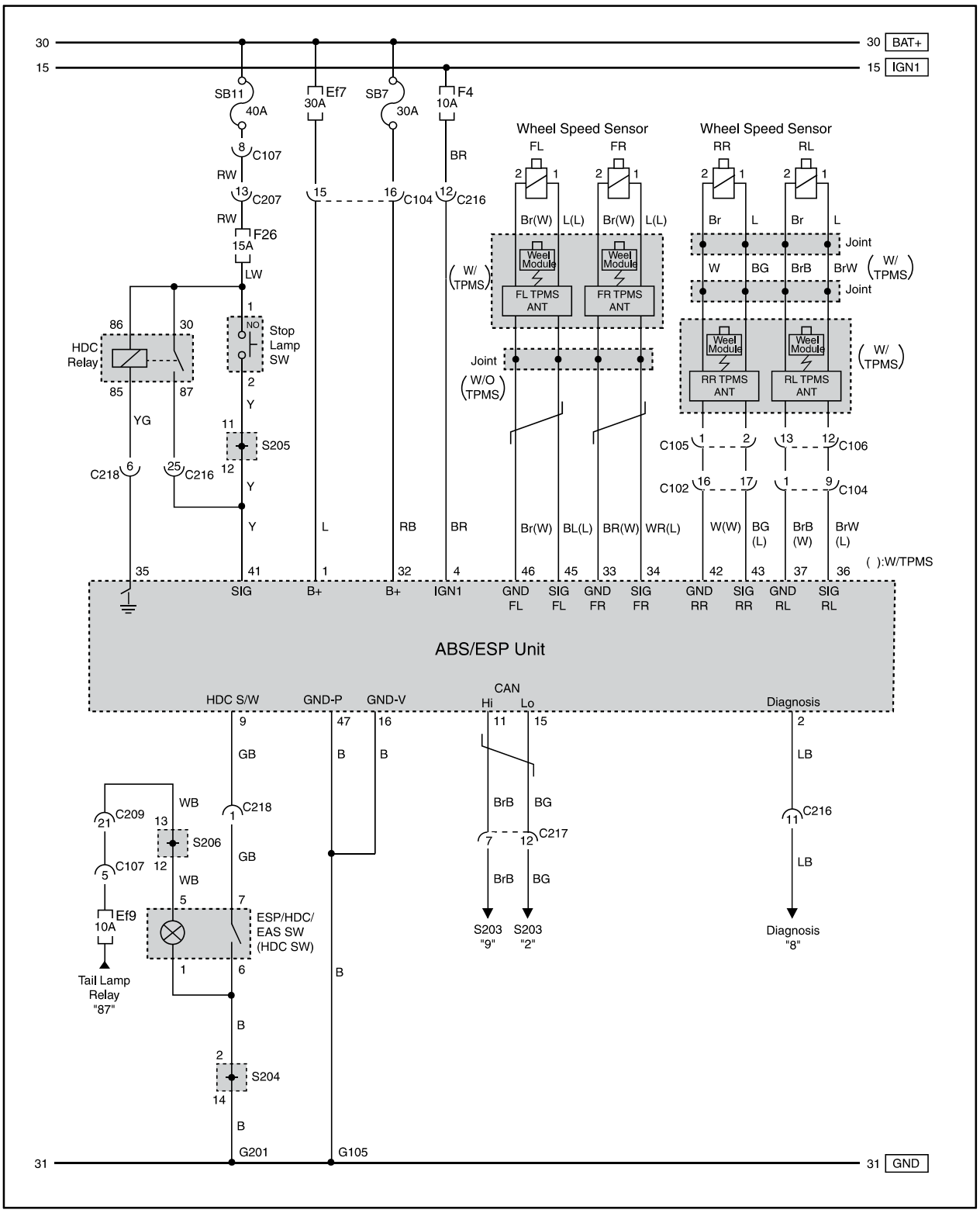
1. Disconnect the EBCM harness connector before performing the electric welding procedures.
2. Carefully note the routing of the ABS/TCS wiring and wring components during removal. The ABS/TCS components are extremely sensitive to EMI (eletromagnetic interference). Proper mounting is critical during 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

▶ W/SPEED SENSOR, STOP LAMP SW, DIAGNOSIS, HDC, TPMS (ABS/ESP)



Modification basis	
Application basis	
Affected VIN	

ESP(Electronic Stability Program) SYSTEM

4892-01

GENERAL

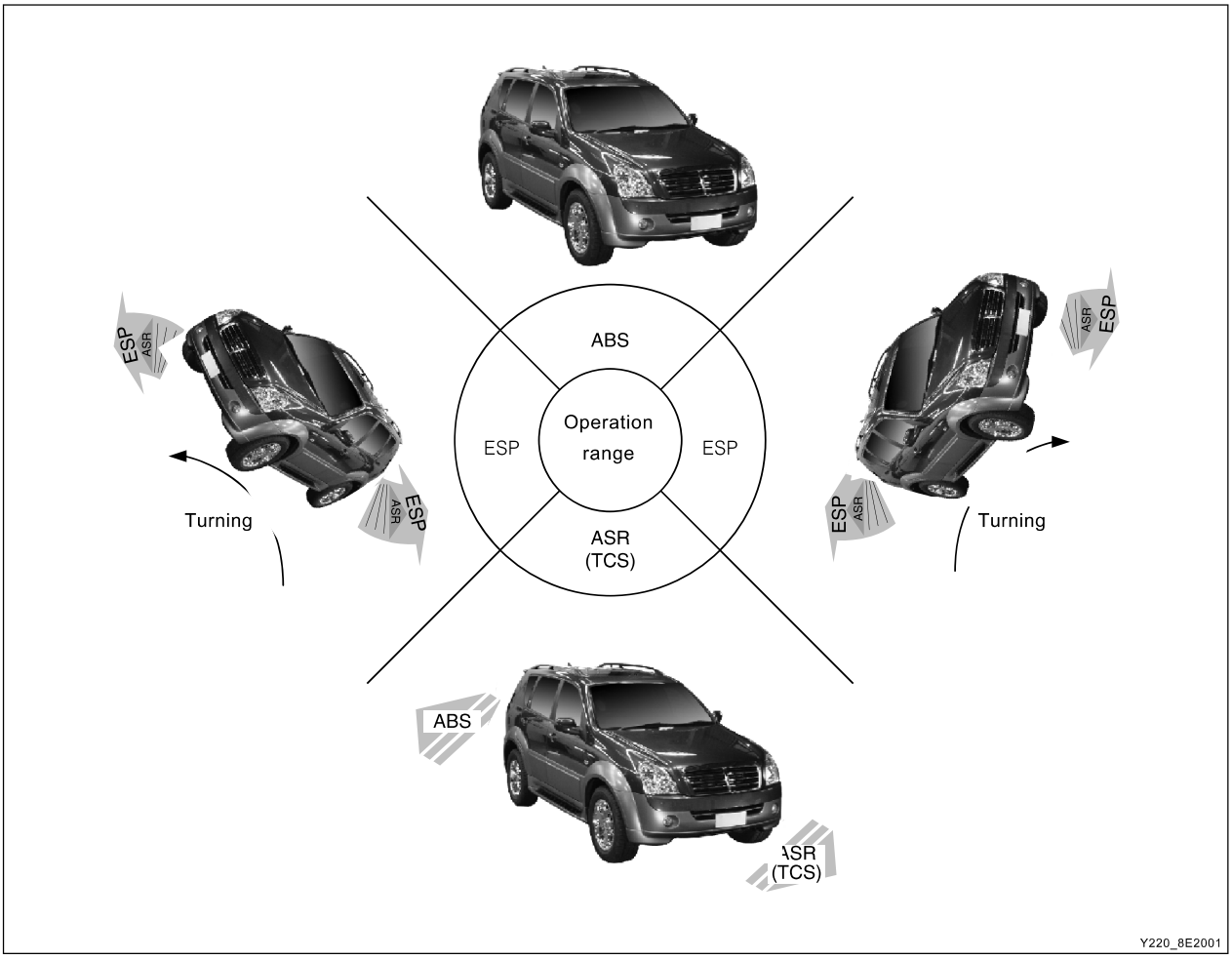
1. SPECIFICATIONSS

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

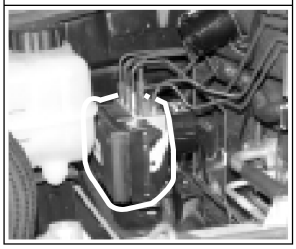
ESP (Electronic Stability Program) recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention with no need for actuating the brake. This system is developed to help the driver avoid the 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	

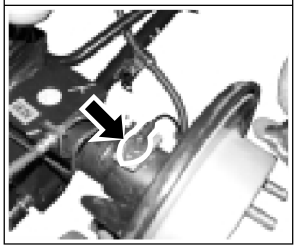
2. COMPONENTS LOCATION

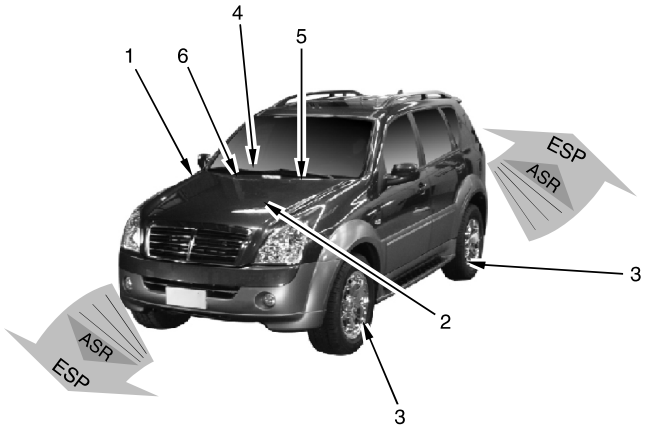
1. HECU



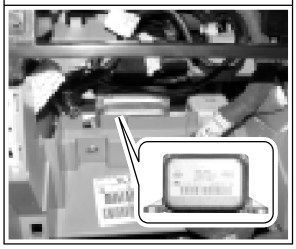
2. Pressure sensor

3. Wheel speed sensor

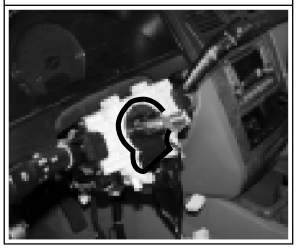




4. Sensor cluster



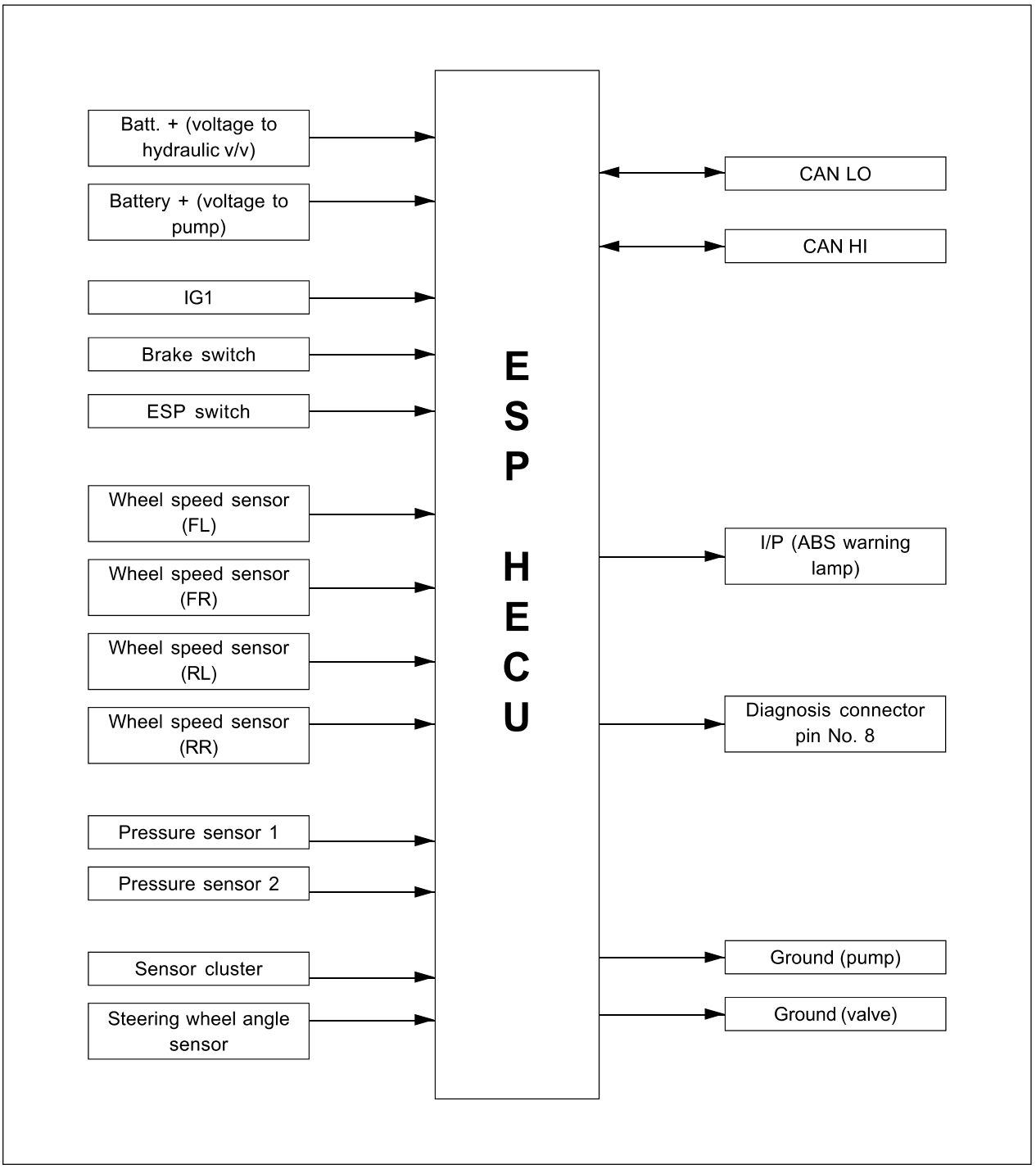
5. Steering wheel angle sensor



6. ESP OFF switch

	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

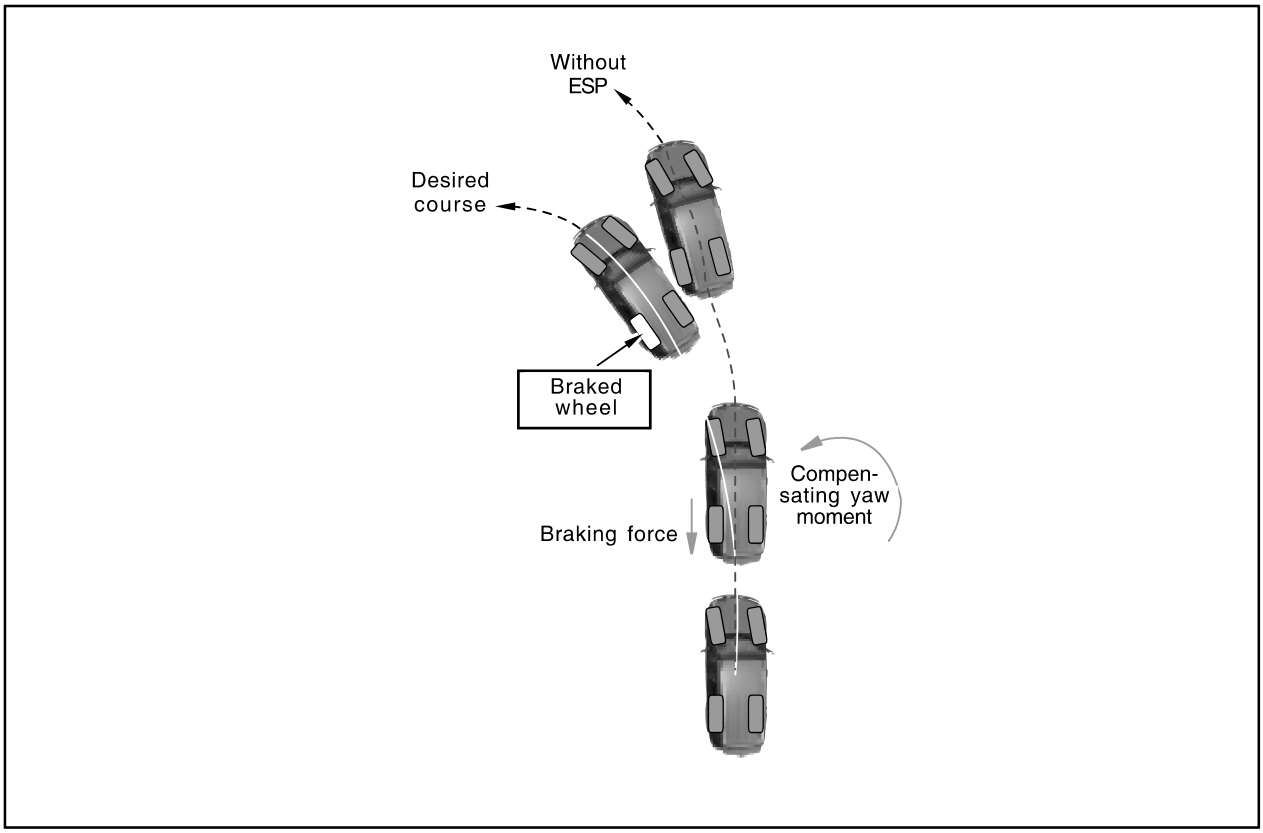


Modification basis	
Application basis	
Affected VIN	

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



Modification basis	
Application basis	
Affected VIN	

▶Understeering

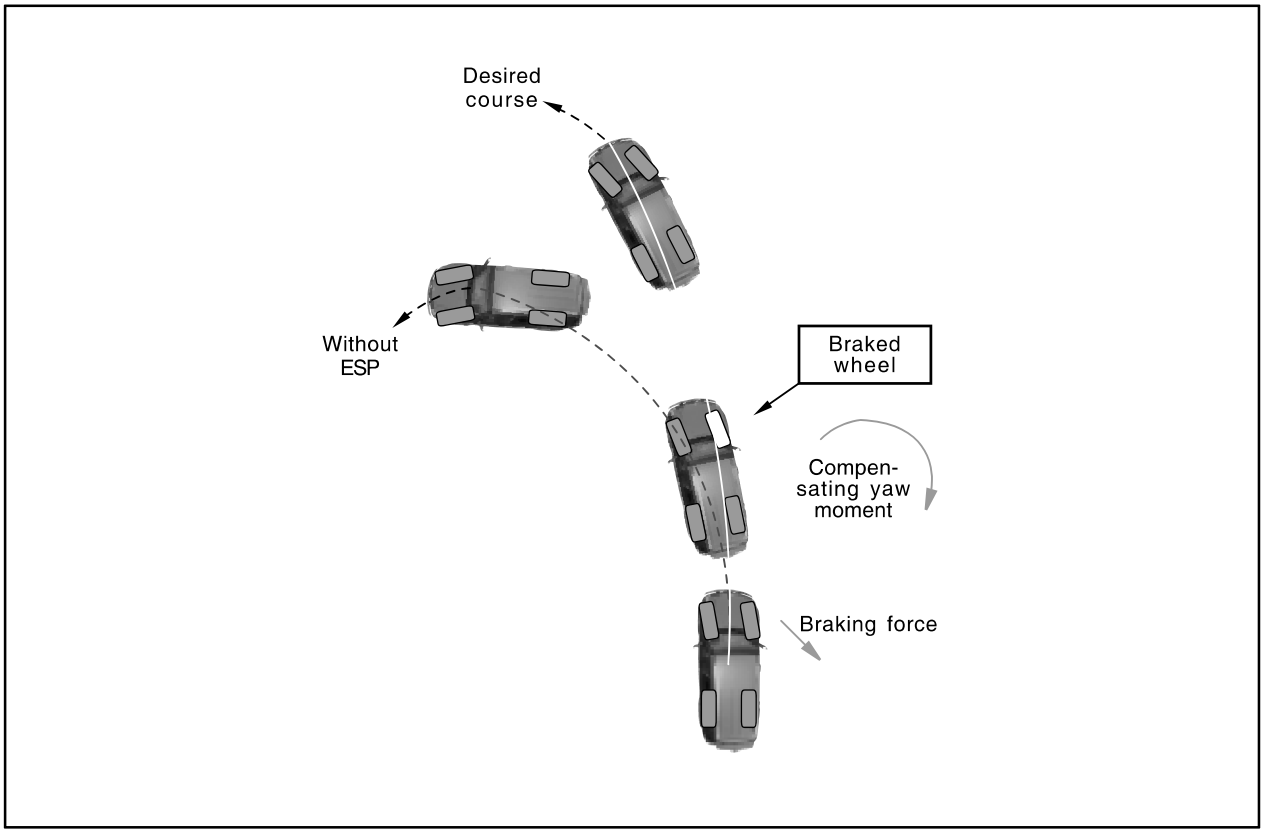
Understeering is when the steering wheel is steered to a certain angle during driving and the front tires slip toward the reverse direction of the desired direction. Generally, vehicles are designed to have under steering. The vehicle can return back to inside of cornering line when the steering wheel 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

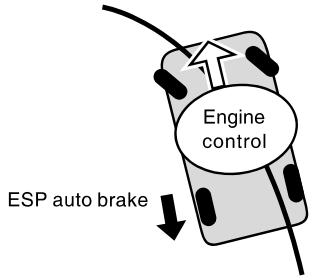
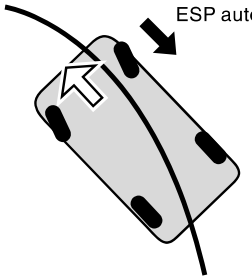
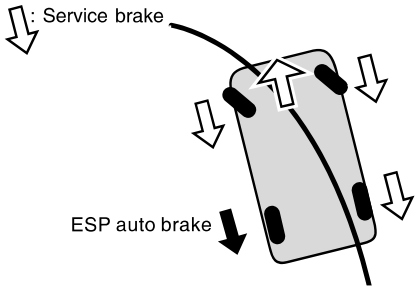
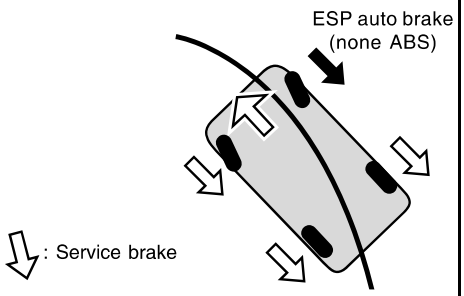
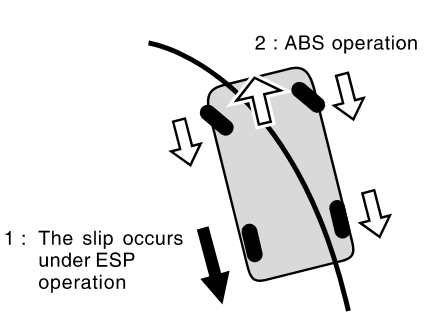
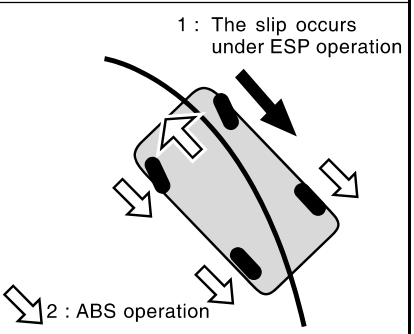
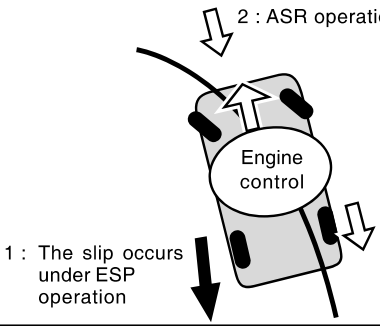
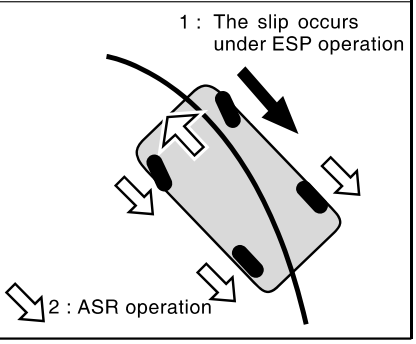
Oversteering is when the steering wheel is steered to a certain angle during driving and the rear tires slip outward losing traction. When compared with under steering vehicles, the controlling of the vehicle is difficult during cornering and the vehicle can spin due to rear wheel moment when the rear 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.

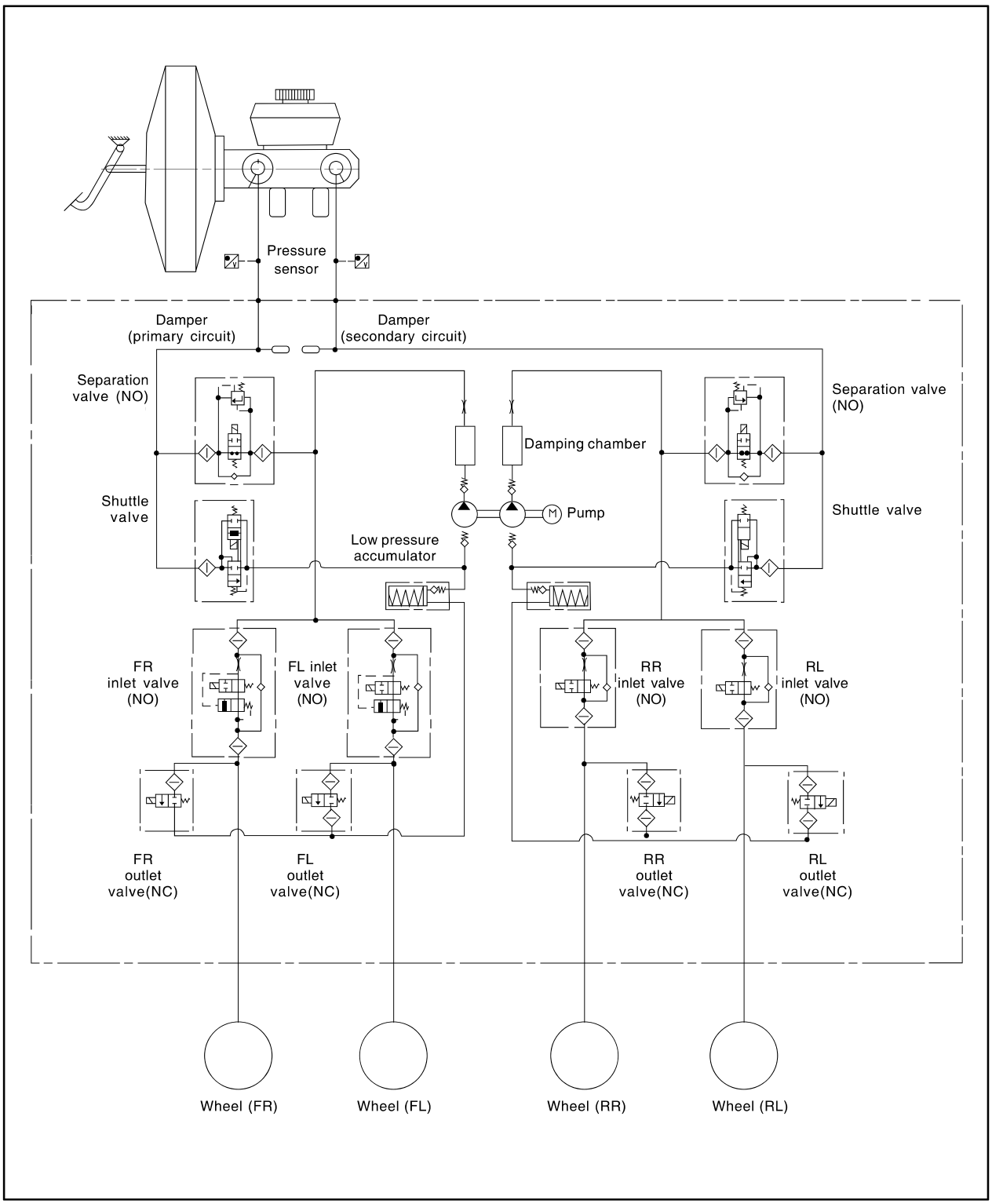
3) Vehicle Control During Cornering

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



Modification basis	
Application basis	
Affected VIN	

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

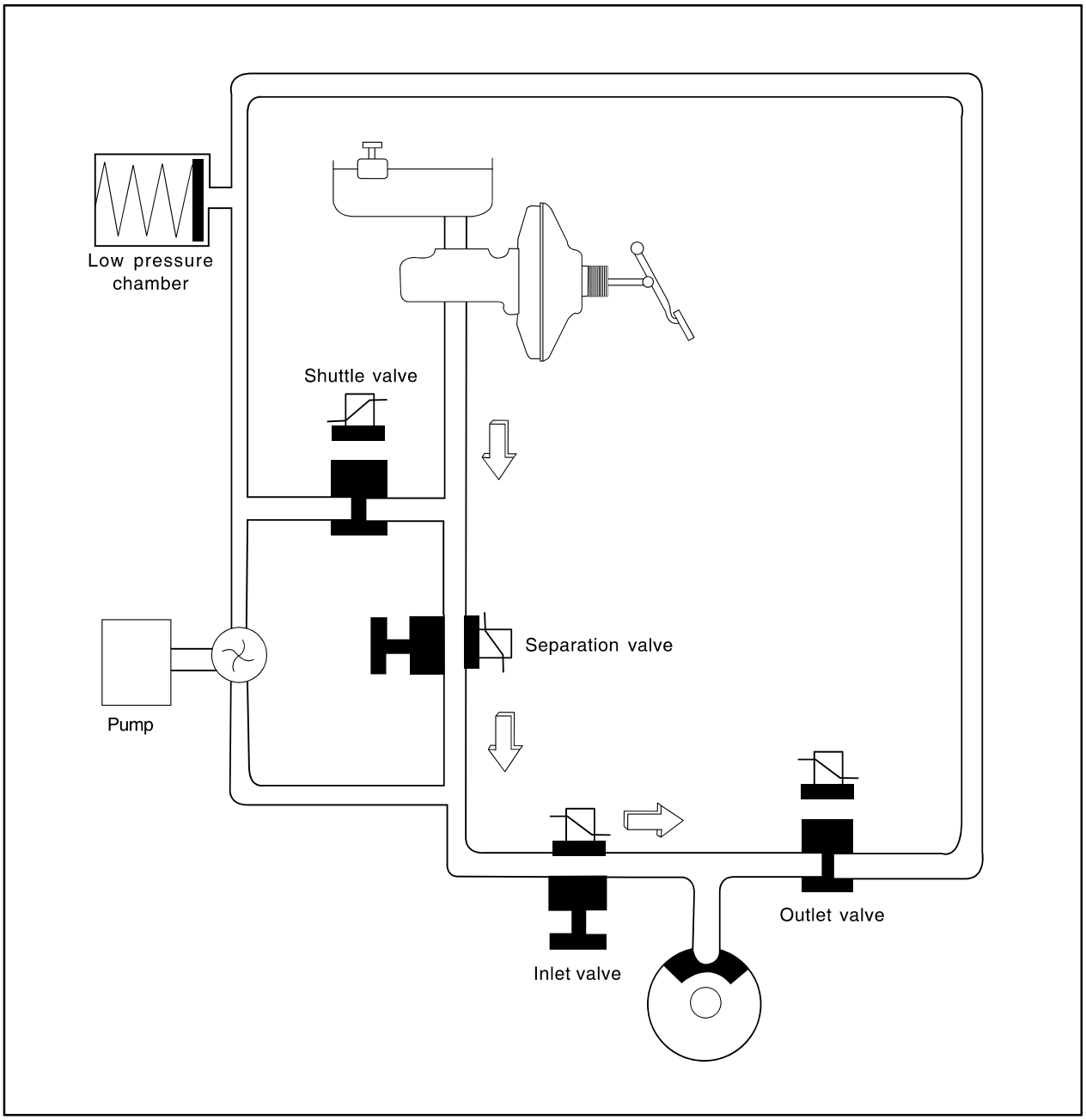
When the ESP system activates, the driving feeling can be different depending on vehicle driving conditions. For example, you will feel differently when the ESP system is activated during when ABS is operating with the brakes applied and when brakes are not applied on a curve. Thus, the ESP system would 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.

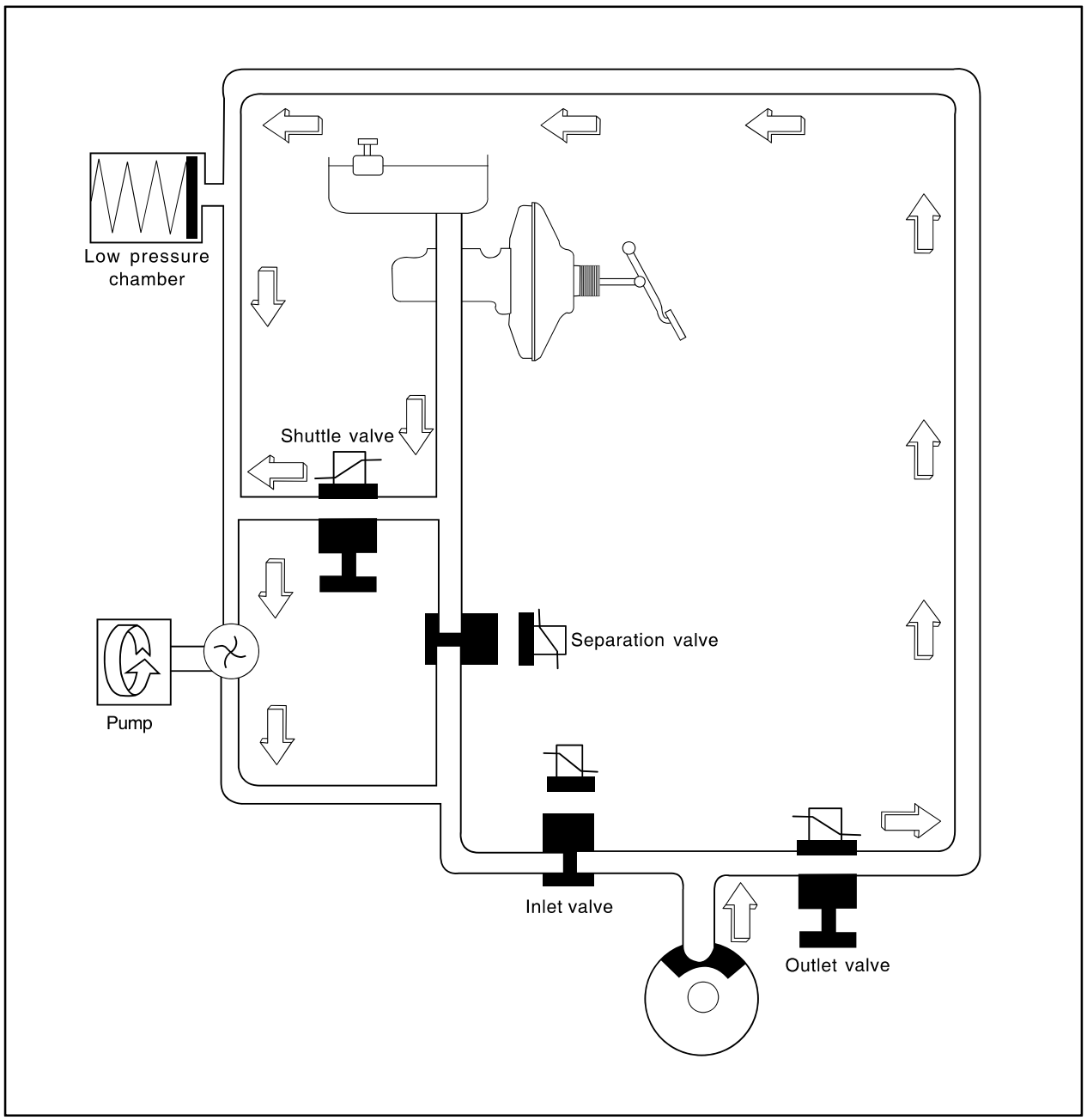
Modification basis	
Application basis	
Affected VIN	

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.

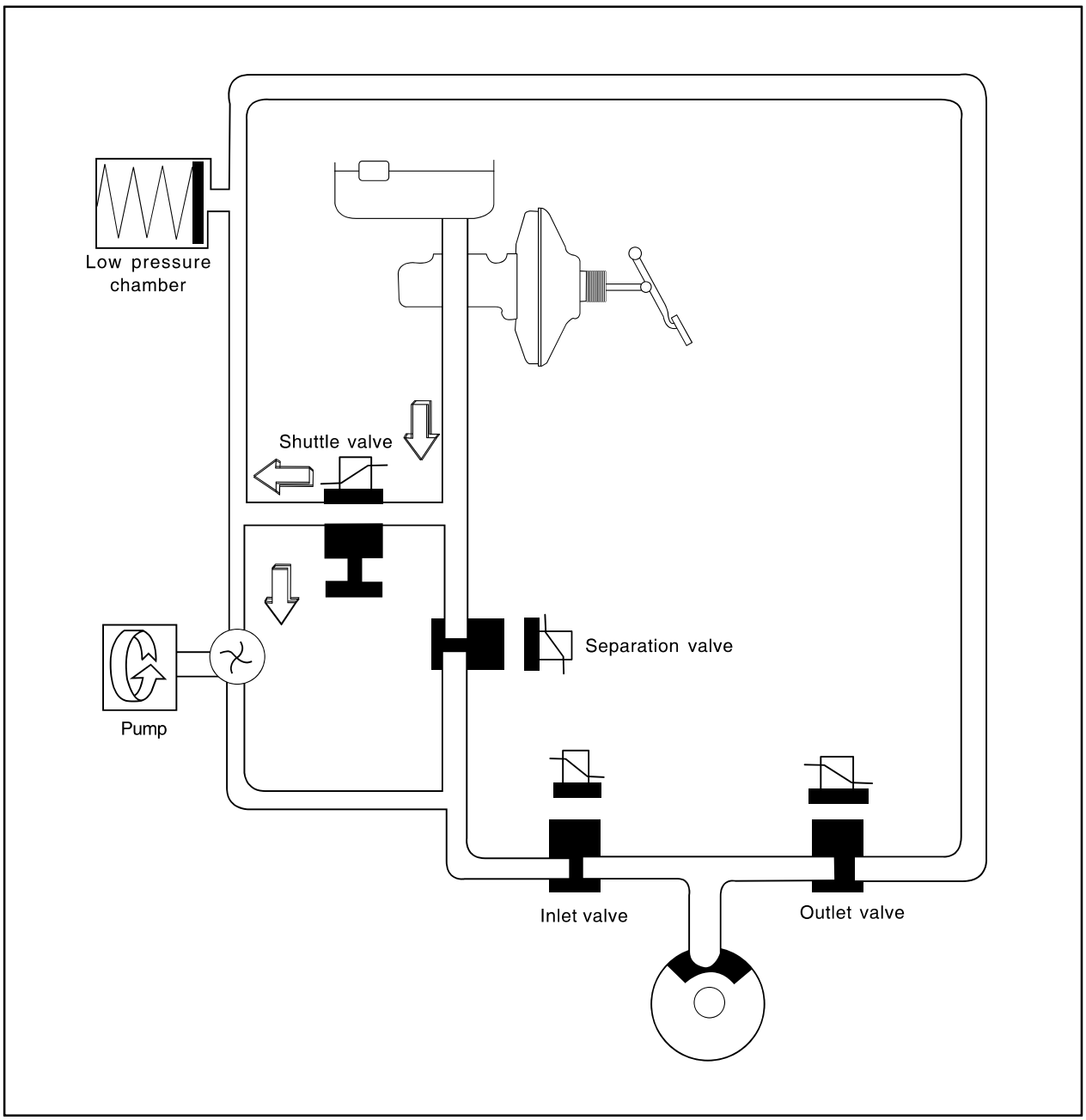
2) When applied ABS (decreased pressure)



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 .

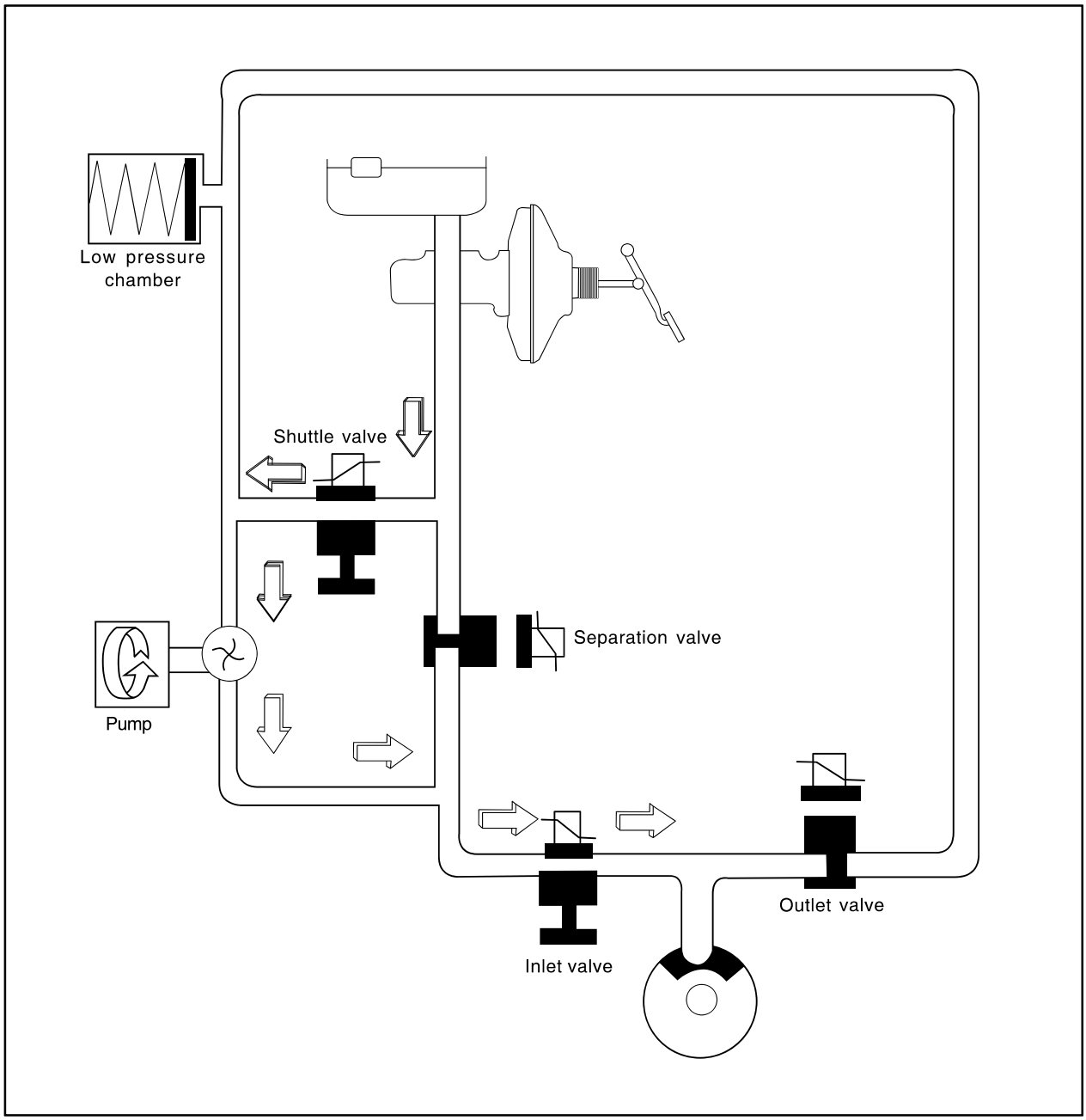
Modification basis	
Application basis	
Affected VIN	

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.

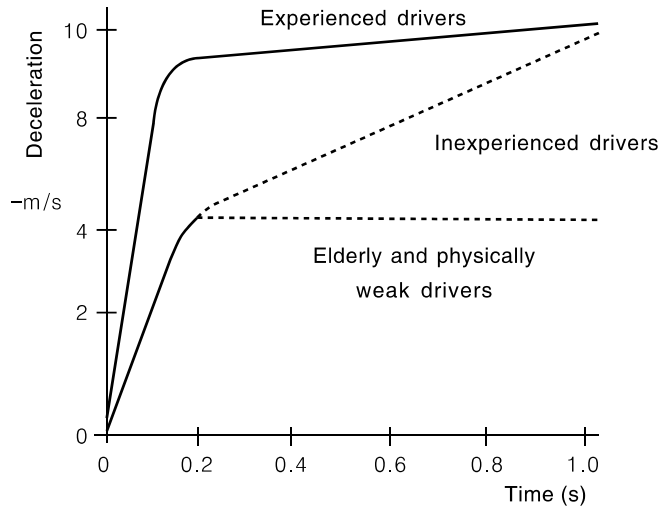
4) When applied ABS (increased pressure)



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.

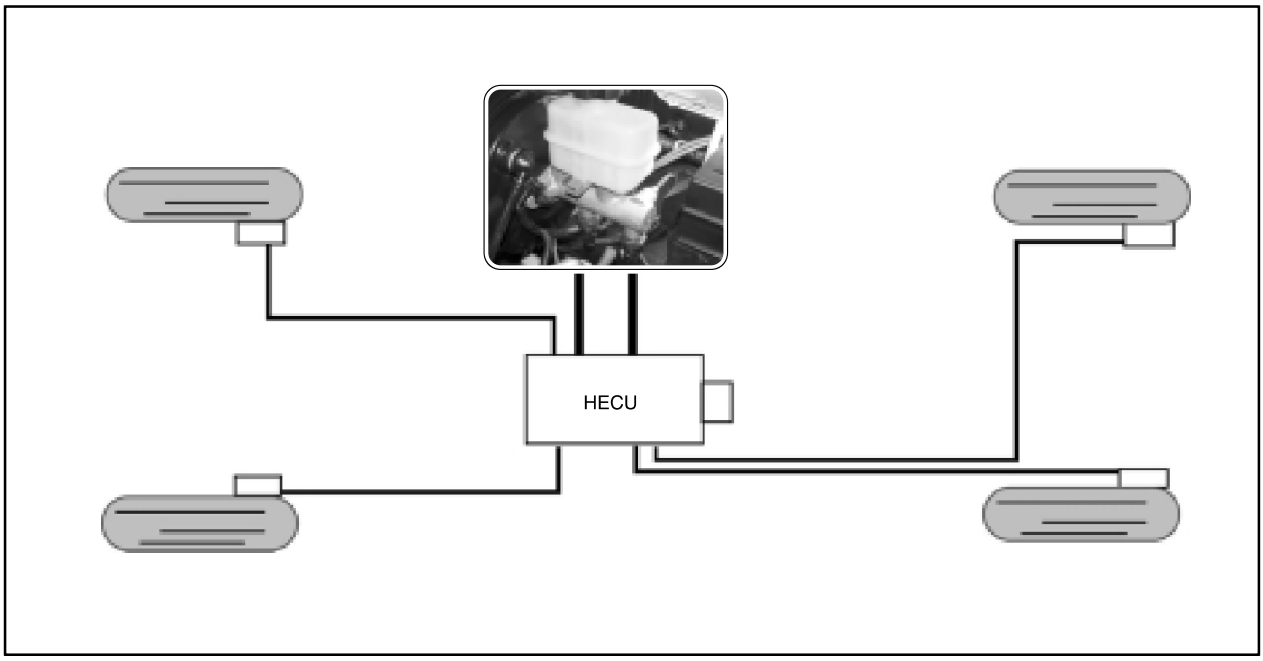
Based on the fact that some drivers depress the brake pedal too soft even under when hard braking is necessary, the HECU system is a safety supplementary system that builds high braking force during initial braking according to pressure value of the brake pressure sensor and the pressure changes of the 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

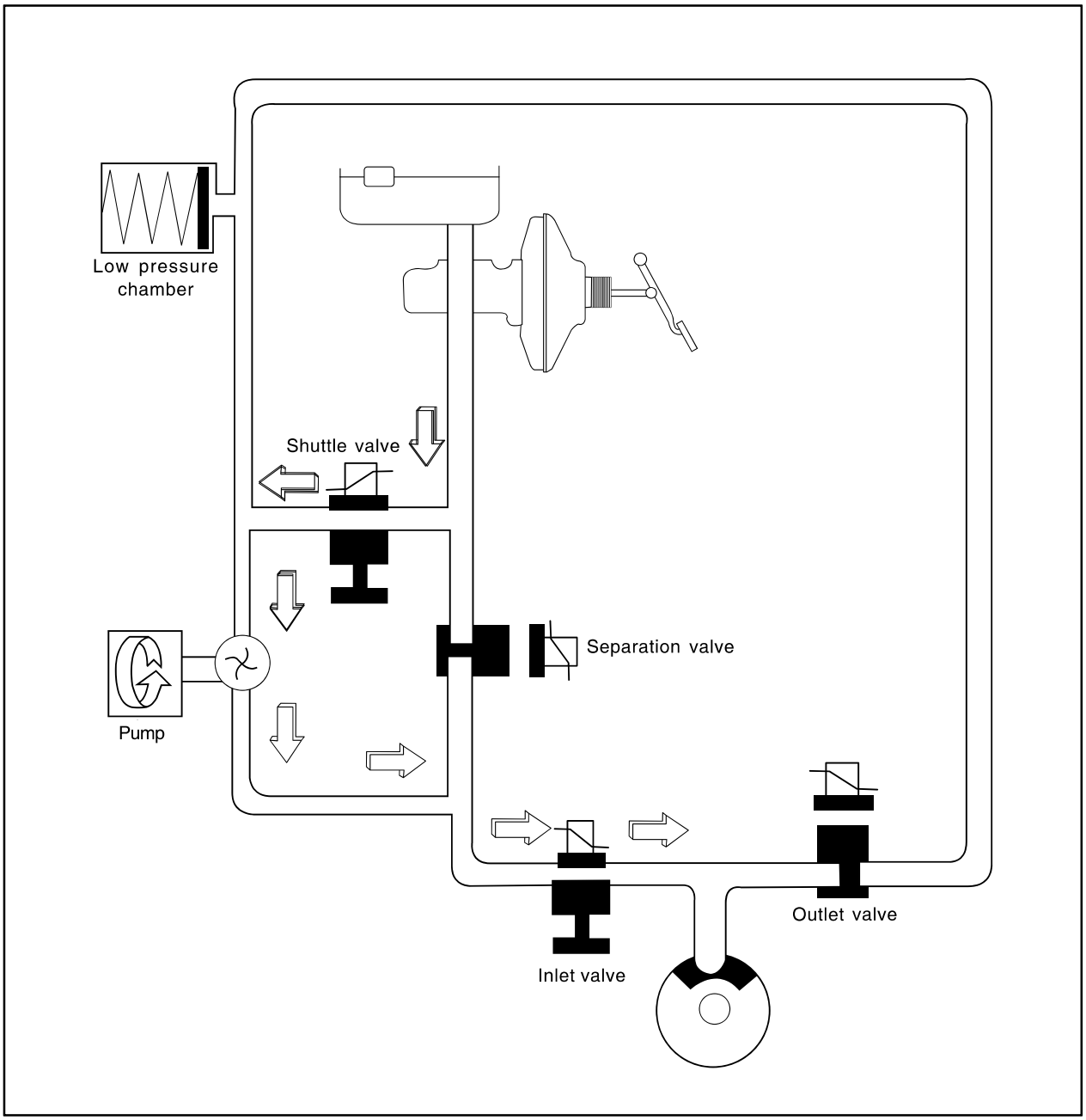
The brake pressure value and the changed value of the pressure sensor are the conditions in which the HBA System operates. There are 2 pressure sensors under the master cylinder. When the ESP ECU system determines that emergency braking is present, the pump operates, the brake fluid in the master cylinder 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

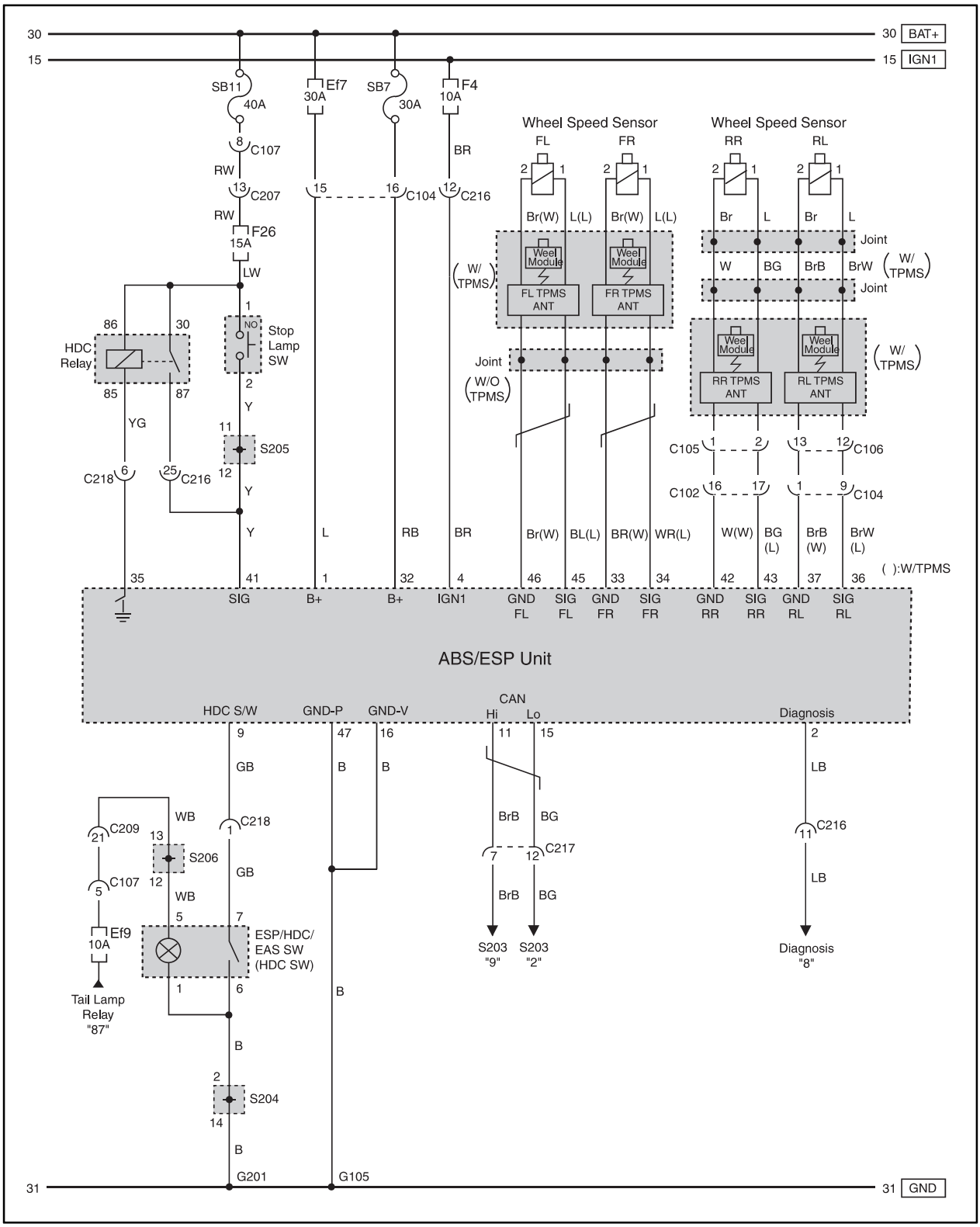


The above figure shows one front and one rear wheel and the same hydraulic circuit forms as in the ESP operation.

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

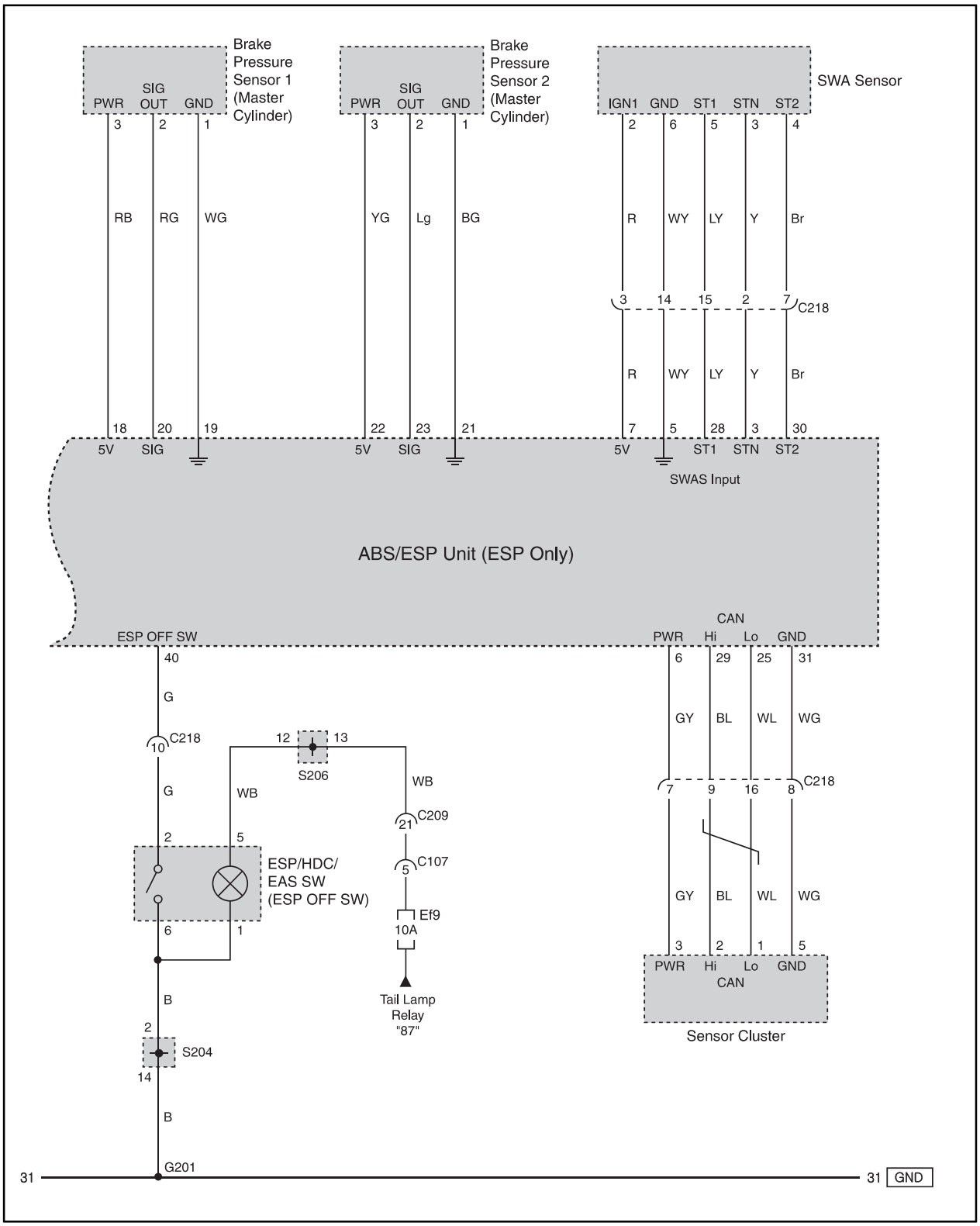
7. ELECTRIC CIRCUIT DIAGRAM

▶ 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

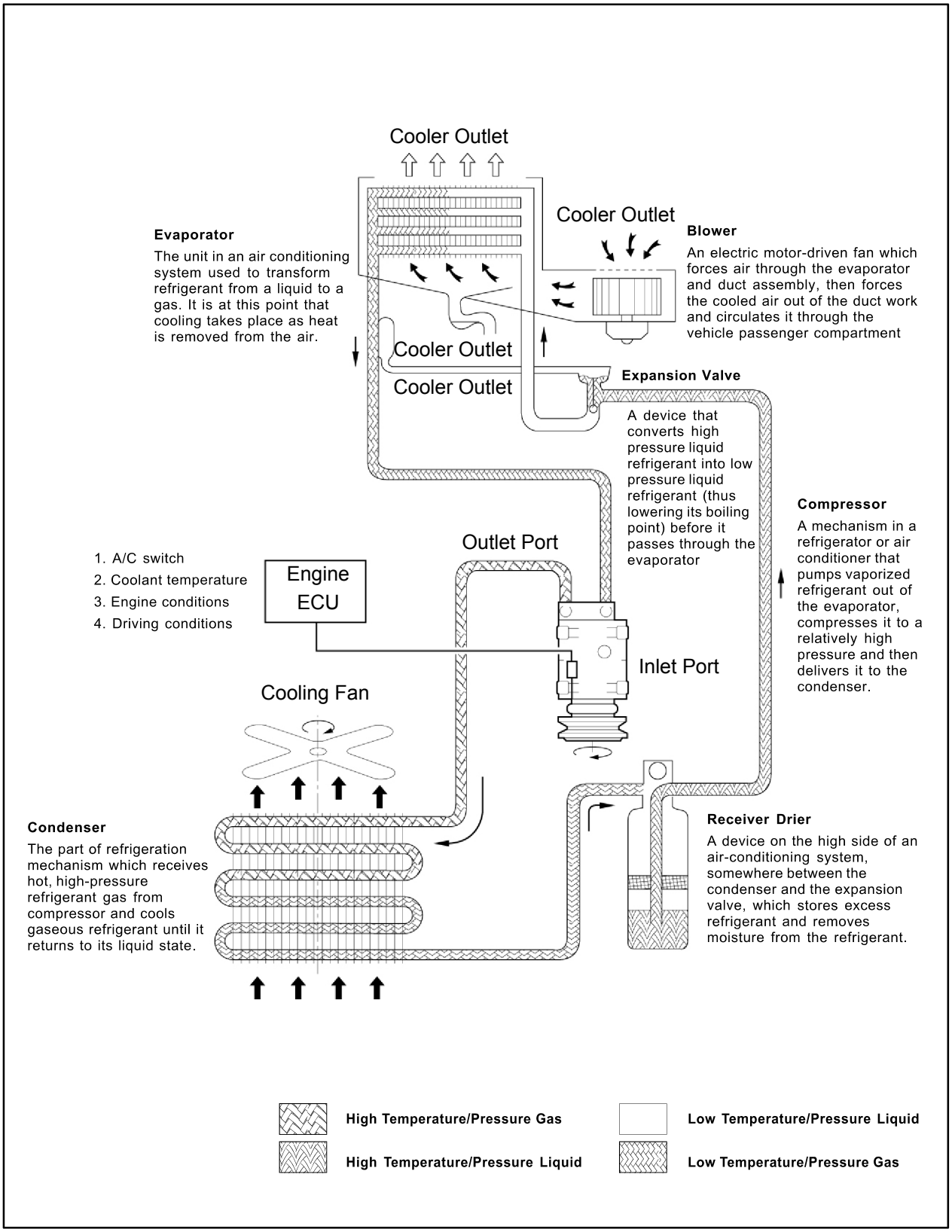
The efficient operation and life of the air conditioning system is dependent upon the chemical stability of the refrigeration system.
When foreign materials, such as dirt, air or moisture, contaminate the refrigeration system, they will change the stability of the refrigeration and the polyalkalene glycol (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	

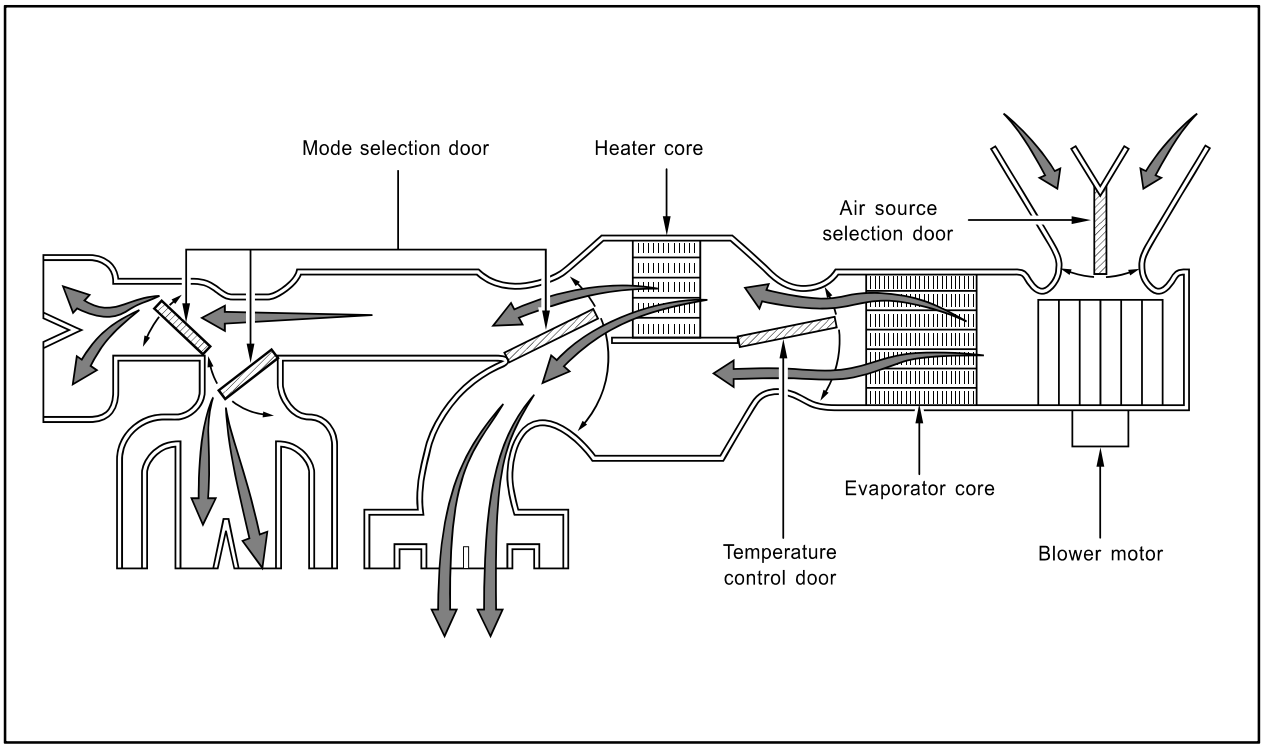
OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

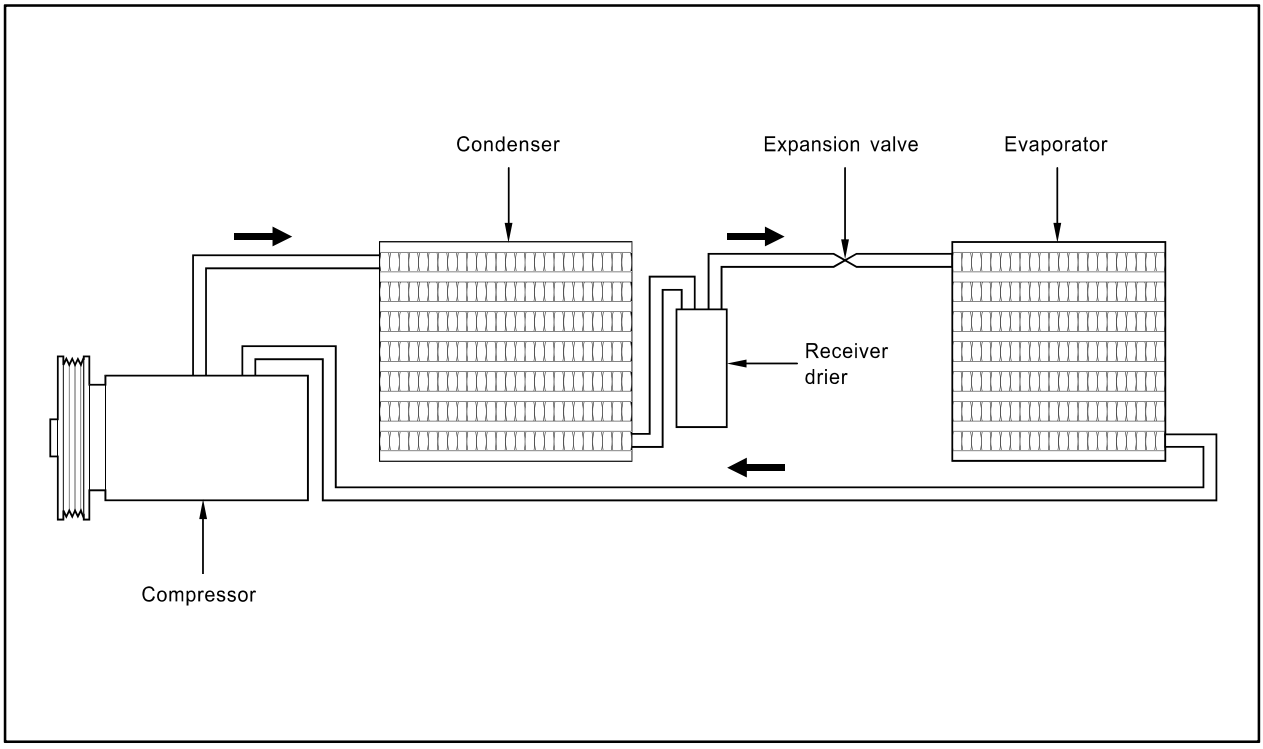


Modification basis	
Application basis	
Affected VIN	

2. AIR FLOWS



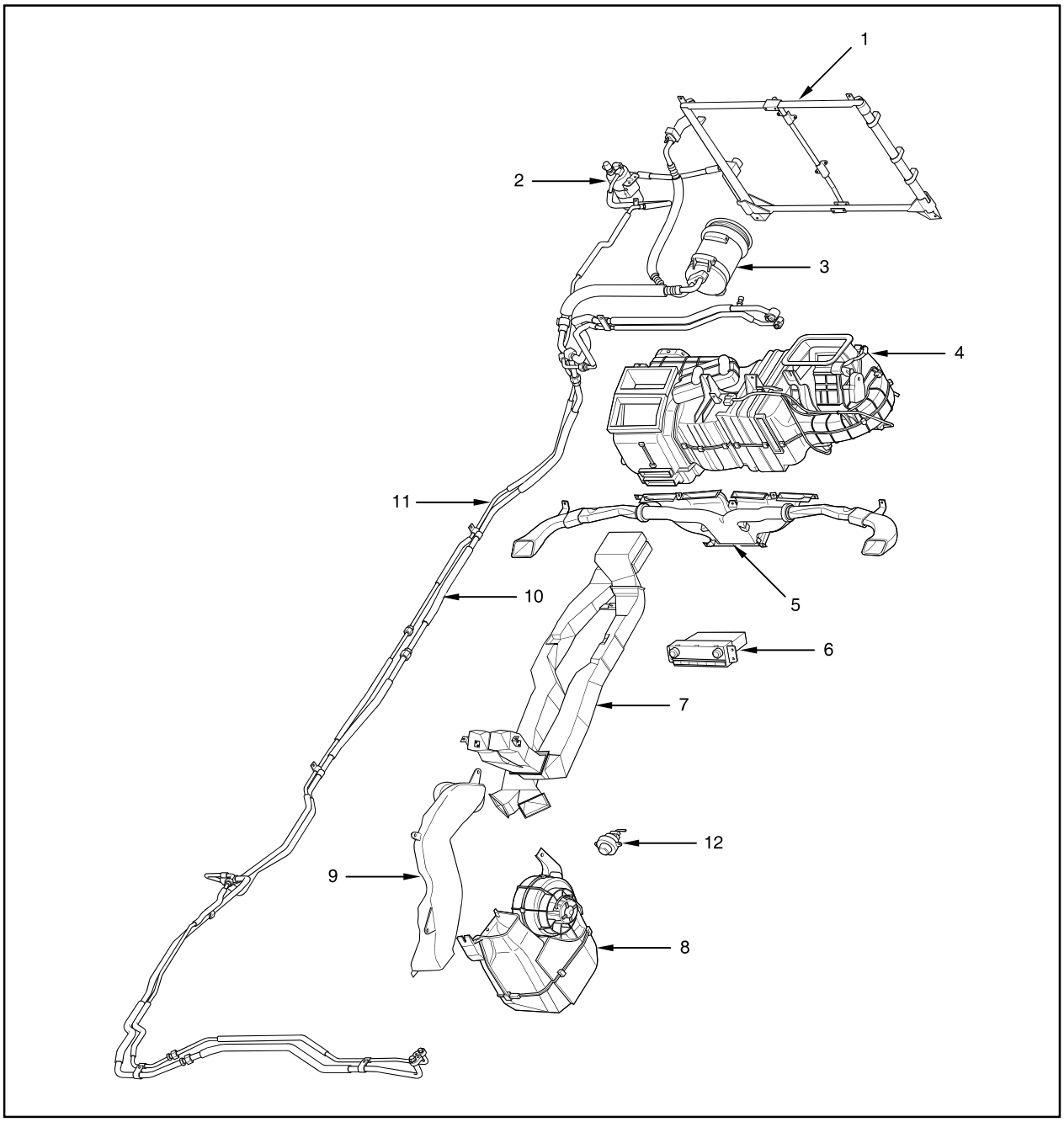
▶Refrigerant Flows



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.

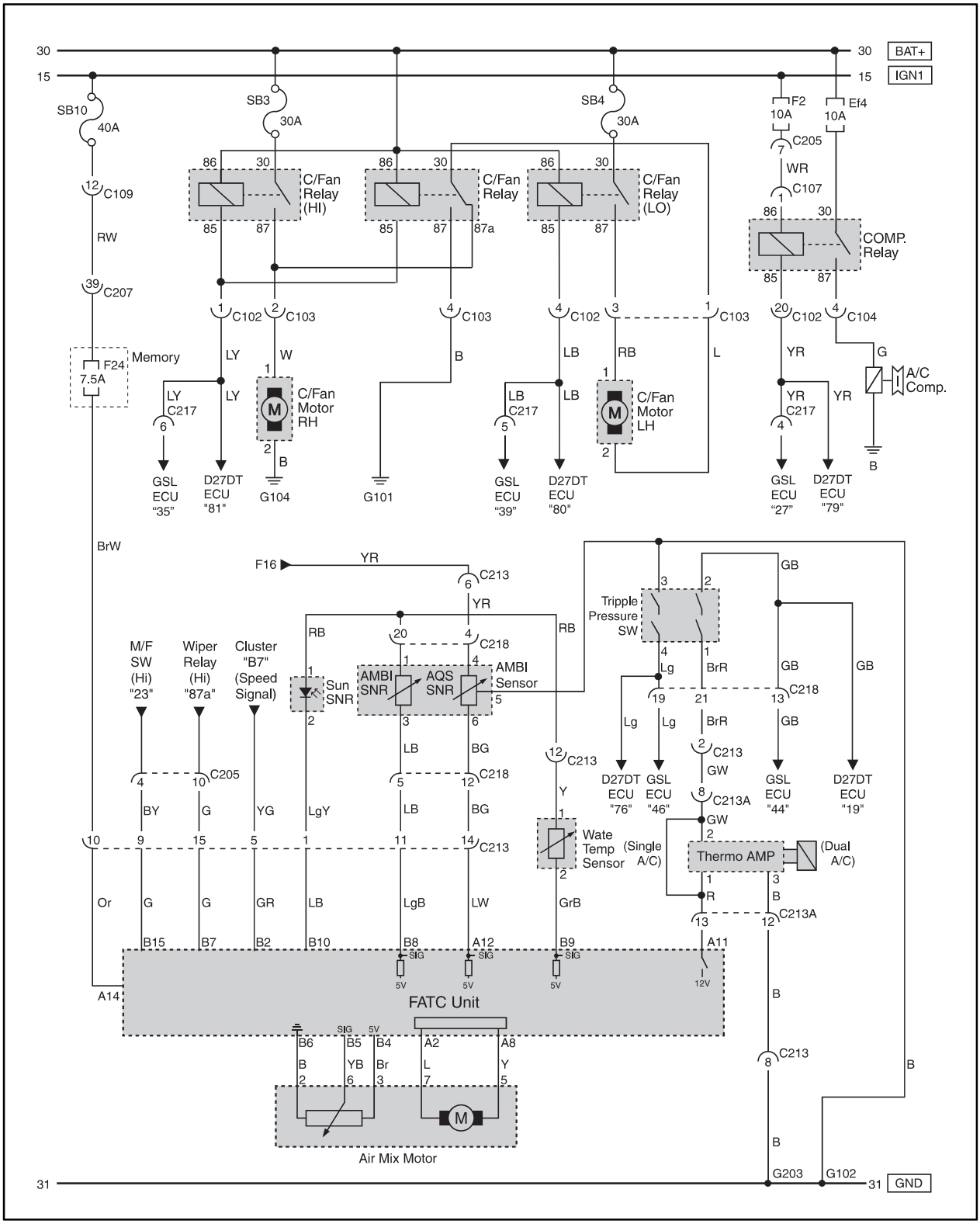
▶A/C System Delay Relay

This relay controls the current to A/C system and instantly delays the A/C operation during starting the engine.

5. CIRCUIT DIAGRAM

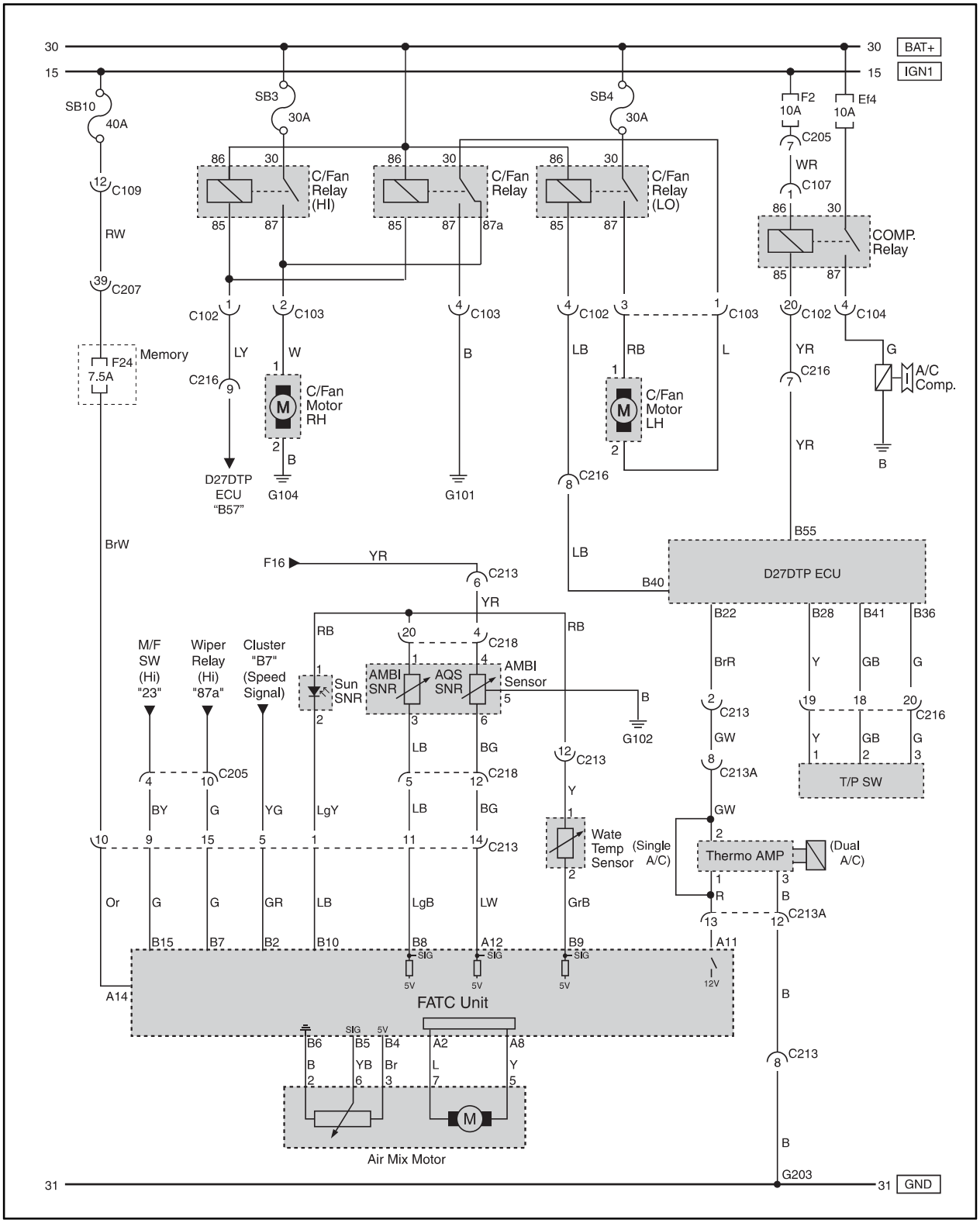
1) Automatic Air Conditioner

▶CONDENSOR FAN, SENSOR (D27DT, GSL)



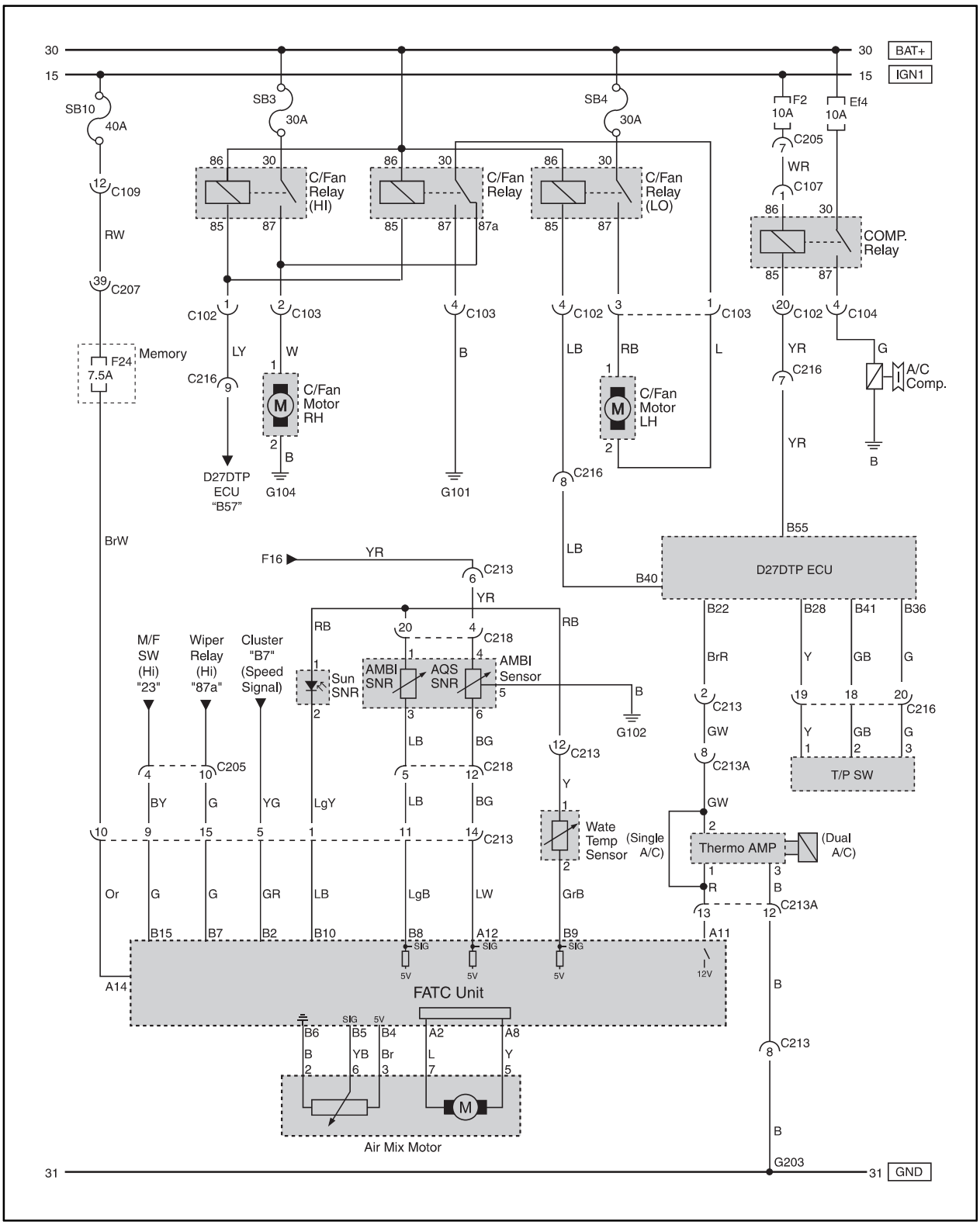
Modification basis	
Application basis	
Affected VIN	

▶CONDENSOR FAN, SENSOR (D27DTP)



Modification basis	
Application basis	
Affected VIN	

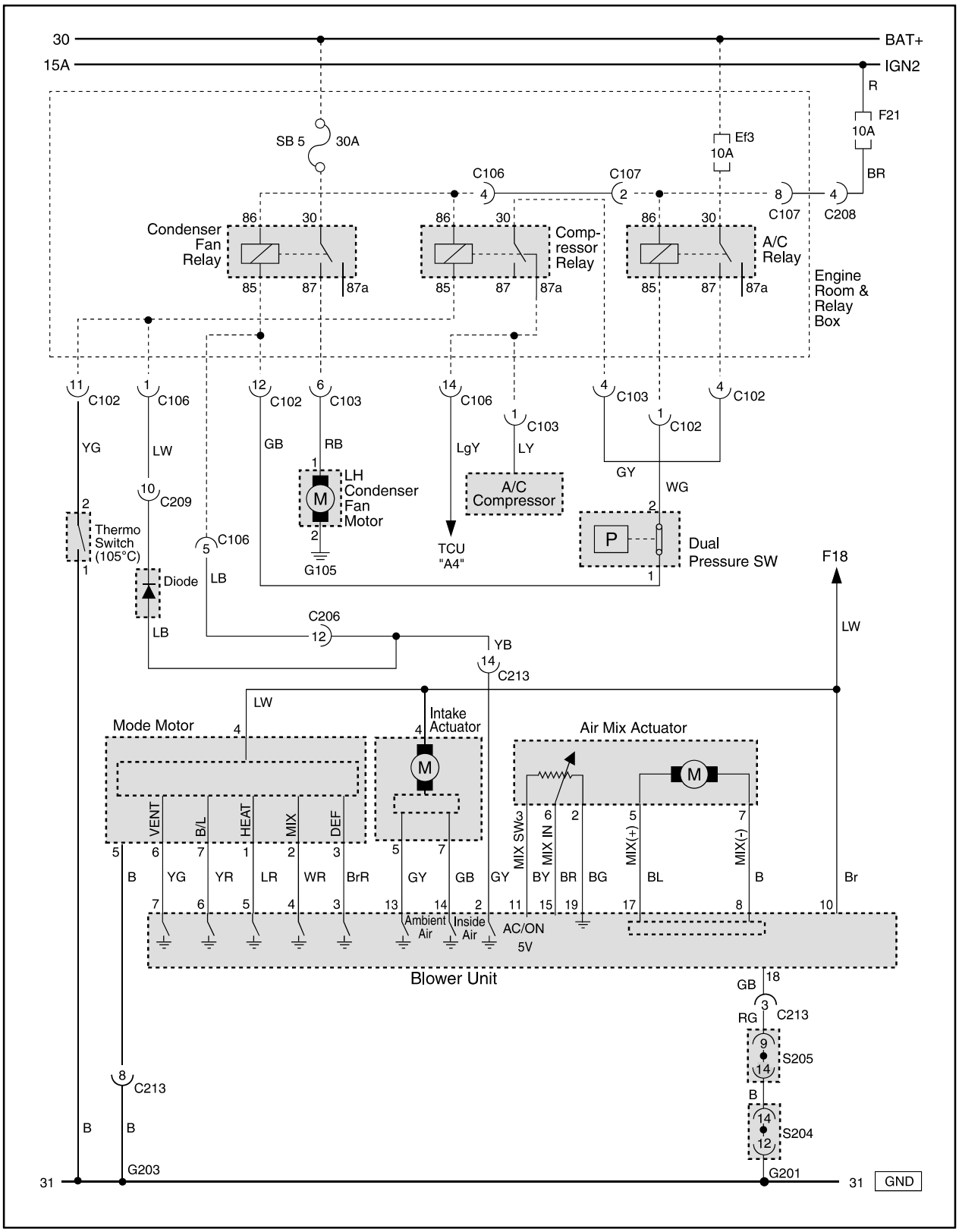
▶MOTOR (MODE, INTAKE), BLOWER, POWER TR



Modification basis	
Application basis	
Affected VIN	

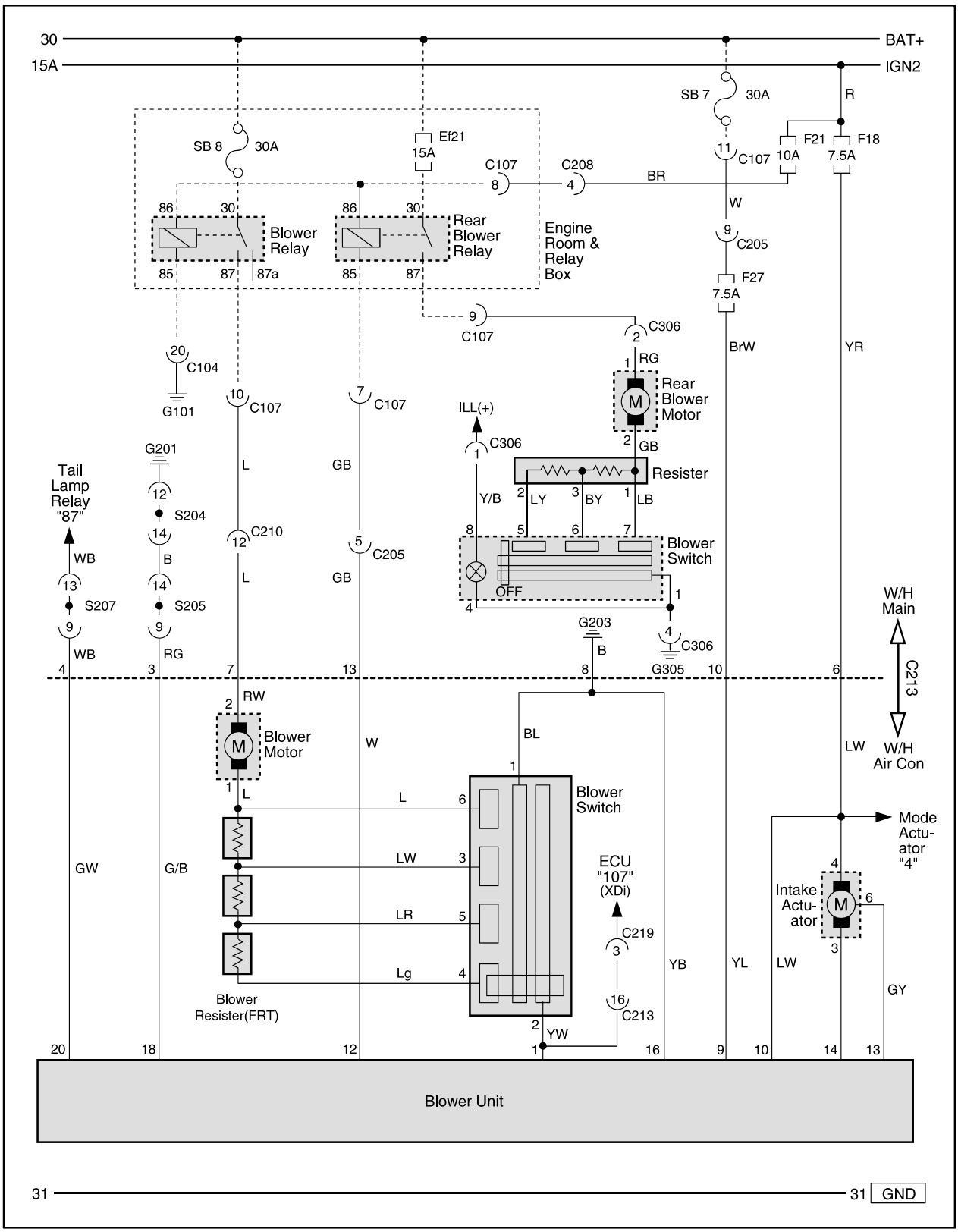
2) Manual Air Conditioner

▶Power, A/C Compressor, Motors (Mode, Interior/Ambient, Air Mix)



Modification basis	
Application basis	
Affected VIN	

▶Blower Motor (Front, Rear)



Modification basis	
Application basis	
Affected VIN	

FULL AUTO TEMPERATURE CONTROL

8511-14

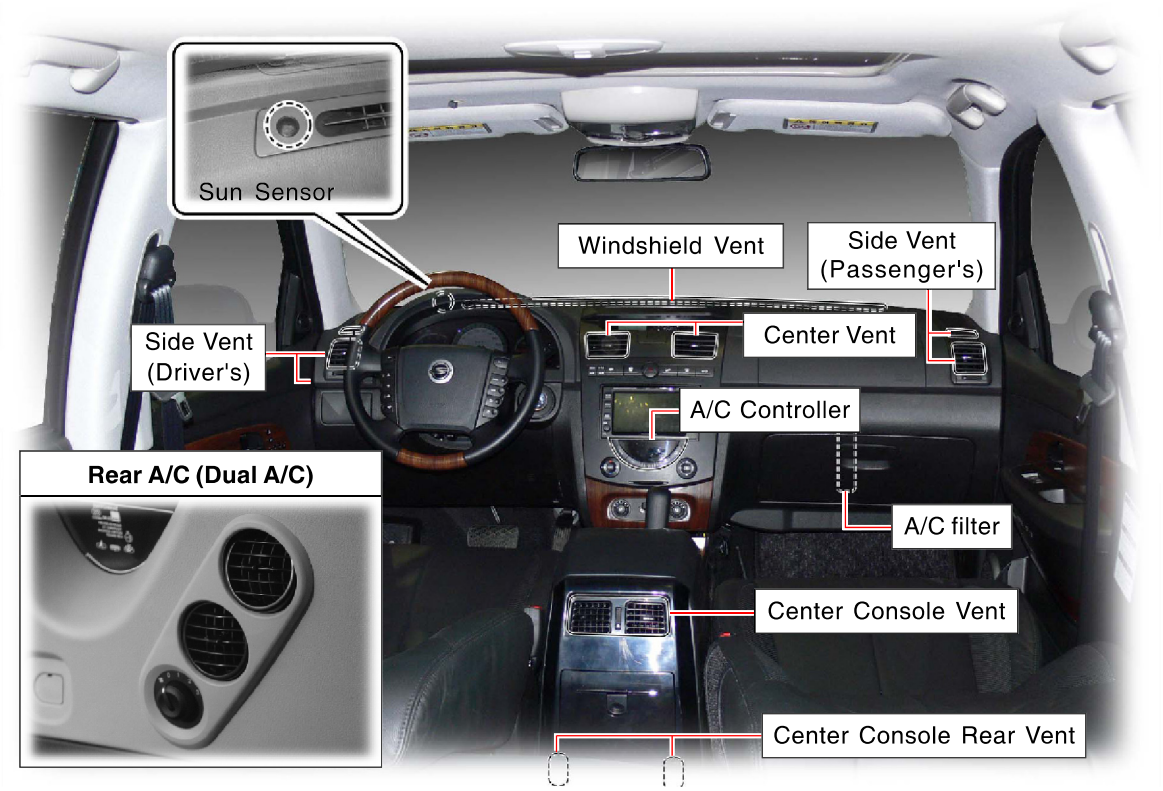
GENERAL

1. SPECIFICATIONS

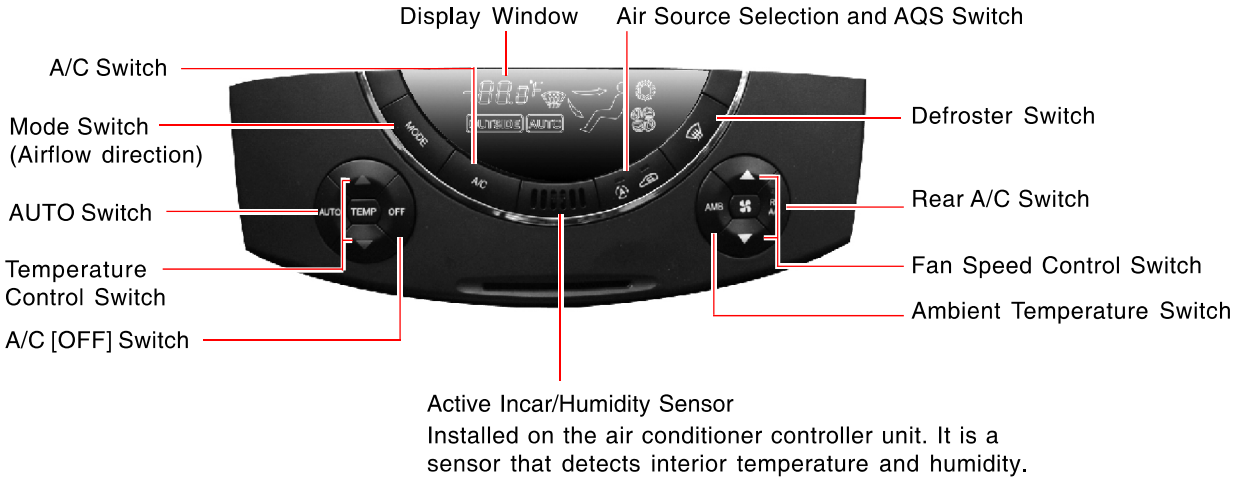
Type		Specifications	
Compressor	Model	V - 5 (single)	KC83 (dual)
	Type	Variable displacement type	Fixed type
	Disaplcement (cc/rev)	9.8 ~ 151	175.5
	Refrigerant oil	265 ml (Composite PAG oil)	220 ml (ZXL 100PG)
Condenser	Type	MFC	
	Size	656w X 455h X 16t	
Receiver Drier	Capacity	250cc	
	Moisture absorbent	XH - 9 (35g)	
	Pressure switch	Triple pressure type, Refrigerant pressure sensor	
Front Air conditioner and Heater Unit	Type	Heater + Evaporator & Blower (2 pieces)	
	Heating capability	Min. 9040 kcal/hr (340m^3/h)	
	Cooling capability	Min. 6300 kcal/hr (405m^3/h)	
	Expansion valve	Block type	
	Input power	Max. 22A(at 12V)	
Fefrigerant	Specification	R134a	
	Capacity	Single: 720 ± 30g / Dual: 1120 ± 30g	

OVERVIEW AND OPERATION PROCESS

1. FATC SYSTEM LAYOUT



▶ Configuration and Characteristic of A/C Controller



Modification basis	
Application basis	
Affected VIN	

▶ A/C System Related Devices

A/C Controller

Engine ECU - under the passenger's mat

※ Detects A/C switch position, coolant temperature, engine condition, refrigerant pressure sensor and driving condition to control the air conditioner and PWM electric fan.

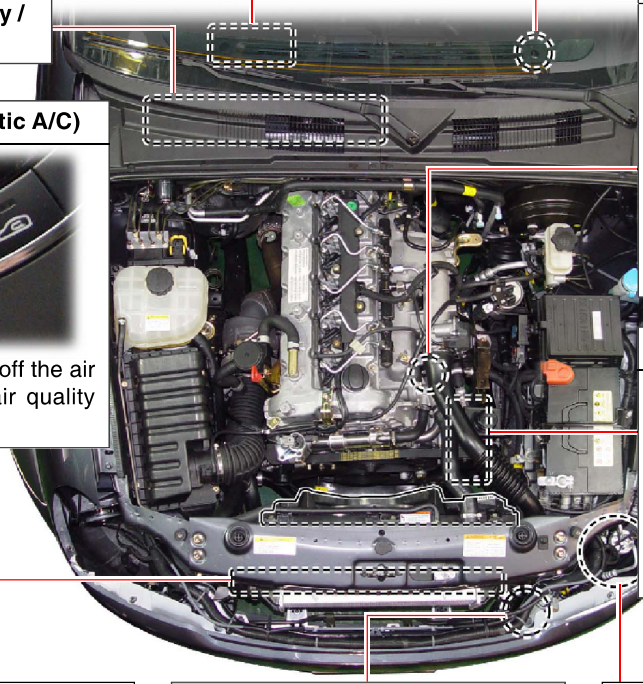
Sun Sensor -On Instrument Panel

It changes sun load coming through front windshield into current to input to FATC controller.

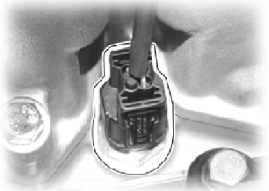
A/C module assembly / Duct sensor

AQS switch (automatic A/C)

A function that turns on/off the air source selection and air quality system.



Coolant Temperature Sensor (On Engine)



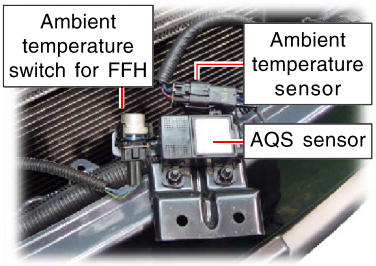
A sensor that detects coolant temperature and transmits it to engine ECU.

Compressor

Condenser

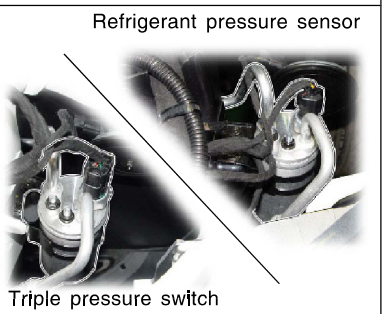
Installed in front of vehicle and condenses vapor refrigerant into low temperature and high pressure liquid refrigerant.

AQS Sensor and Ambient Temperature Sensor



This sensor is installed at the front bottom of engine compartment. This sensor senses the air polution and the ambient temperature and sends the information to FATC controller.

Receiver Drier



Absorbs moisture in the refrigerant and reserves refrigerant to supply smoothly.

2. FATC SYSTEM BASIC FUNCTION

1) 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 Incar/Ambient door, air mix door and blower motor etc.

1. Ambient Temperature Display

The ambient temperature is displayed using the ambient temperature switch in increment of 0.5°C. When pressing the AMB button, the display shows the ambient temperature and returns to the adjusted temperature. The ambient temperature switch can be affected by the heat in the engine compartment since it is installed in front of the radiator. Therefore, the display can show the correct temperature when the vehicle is driven at over a certain speed (approx. 40 km/h).

2) Blower Motor Speed 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.

1. Manual Control

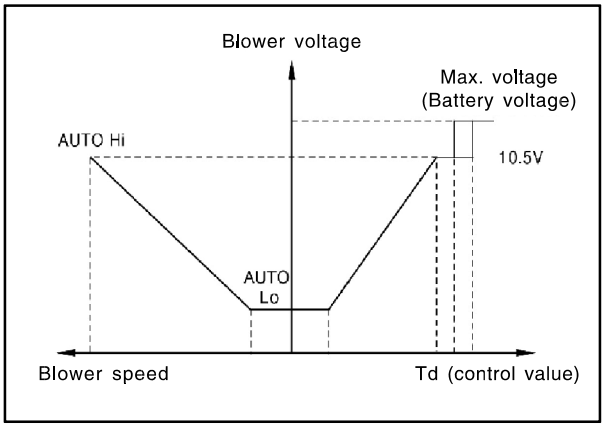
When you push the blower switch, you can control the blower motor manually and it increases or decreases each step by moving the switch to HI/LO.
(with the ignition ON)

Step	Blower Voltage
1	4.5 V
2	5.5 V
3	6.5 V
4	7.5 V
5	8.5 V
6	9.5 V
7	10.5 V
8	MAX HI

Modification basis	
Application basis	
Affected VIN	

2. Automatic Control

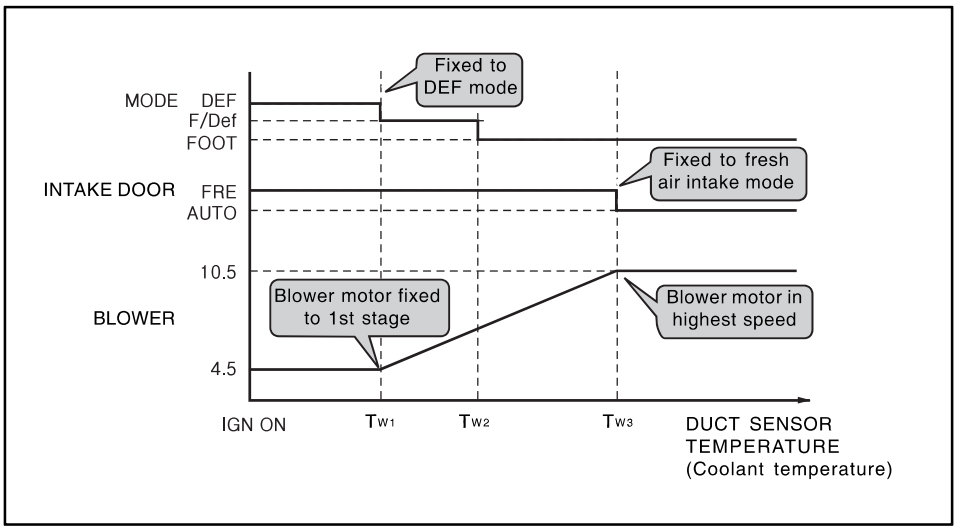
Td value can be determined by the set temperature value and Td value is set to the target voltage of the blower motor simultaneously. The blower motor can shift without step.



Blower Step	Blower Motor Voltage
1	4.0 ~ 5.0 V
2	5.0 ~ 6.0 V
3	6.0 ~ 7.0 V
4	7.0 ~ 8.0 V
5	8.0 ~ 9.0 V
6	9.0 ~ 10.0 V
7	10.0 ~ 11.0 V
8	11.0 ~ 13.5 V

3. 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.



4. 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 several time 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.

5. Defroster Calibration

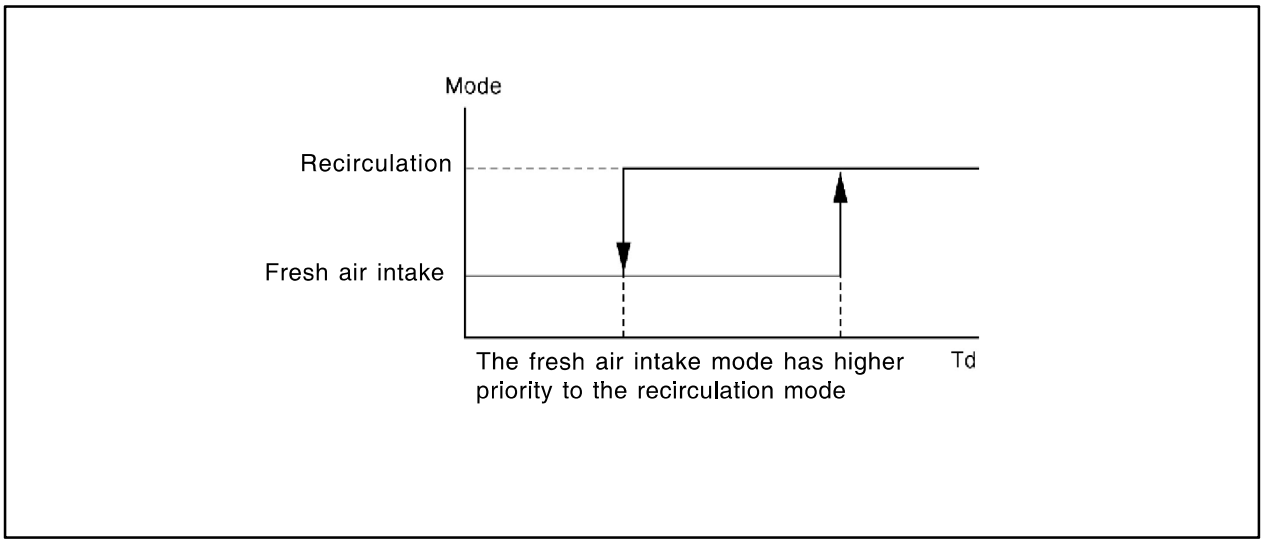
On the blower AUTO step, when the passenger sets to Defroster (Def), the system increases the blower voltage by 2 V for some intervals comparing AUTO voltage. But it is excluded the condition when the blower voltage is above 10.5 V. Also, the voltage increasing by defroster calibration is limited up to 10.5 V.

3) Vent Inlet Control

1. 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.

2. AUTO control



Modification basis	
Application basis	
Affected VIN	

3. AQS (Air Quality System) Sensor and Vehicle Speed Control

a. Basic function

The air source selection is automatically changed between the recirculation mode and the fresh air mode according to the signal from the AQS sensor (air polution).
When selecting AUTO while the AQS is in operation, the AQS is turned off.

b. Recirculation mode for 20 seconds when pressing AQS switch

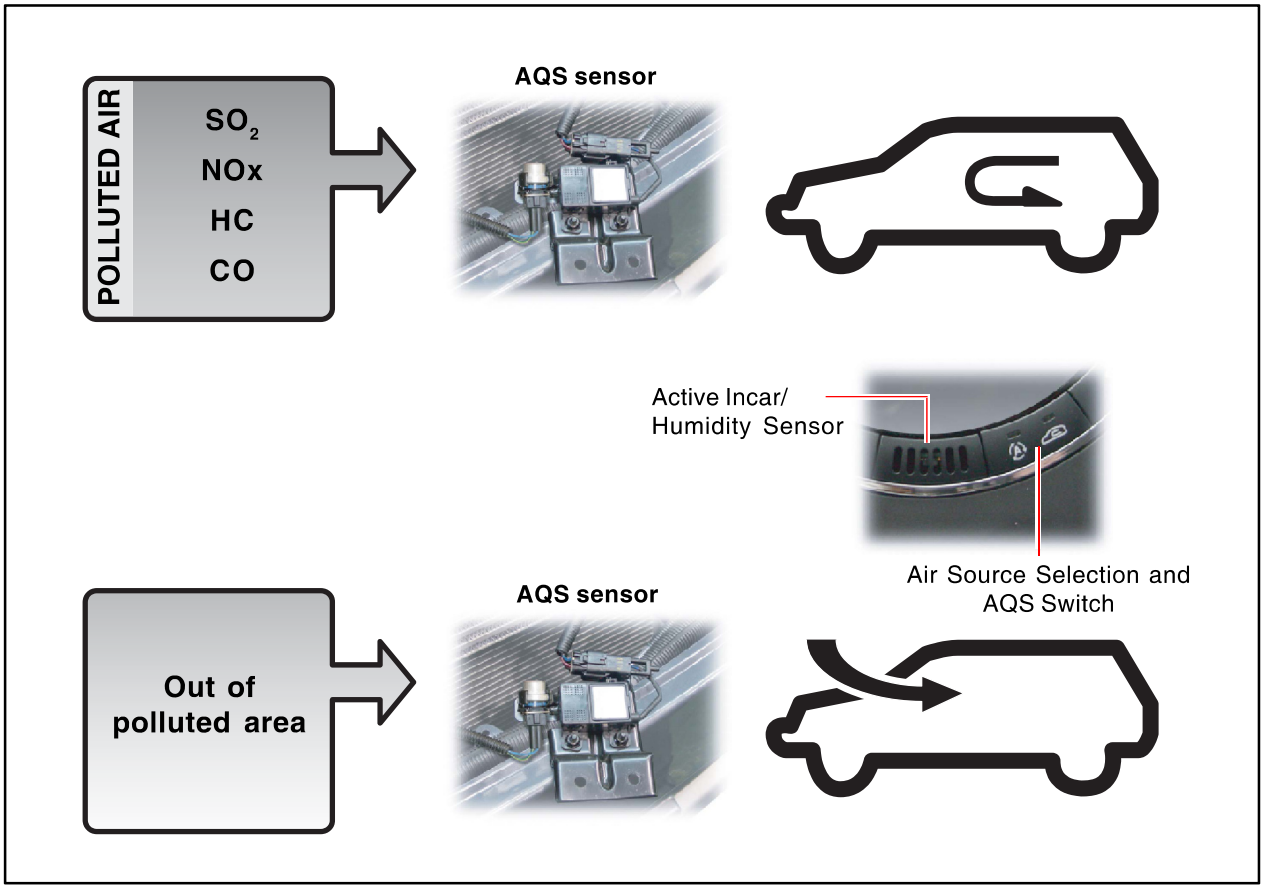
When the AQS switch is pressed in, the recirculation mode is maintained for 20 seconds regardless of the AQS sensor's input.
Then, the AQS controls the intake mode according to the air polution.
However, the signal of the AQS is overridden if the heater is controlling the fan.

c. Preheating of AQS when starting the engine

For stabilization of the AQS sensor, the signal from the AQS sensor is overridden and the recirculation mode is maintained for 1 minute after turning the ignition ON.

d. Gas detected

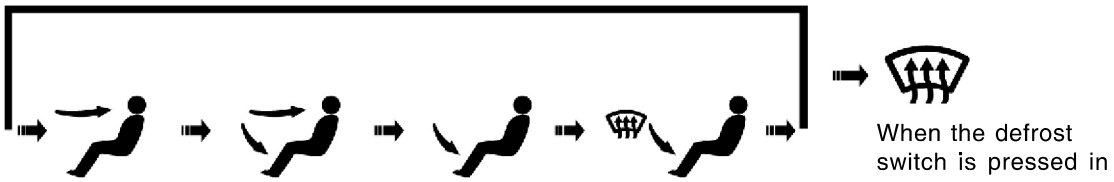
- Exhaust gas for diesel engine: NO, NOx, SO2...
- Exhaust gas for gasoline and LPG engine: CxHY, CO...



4) Vent outlet Control

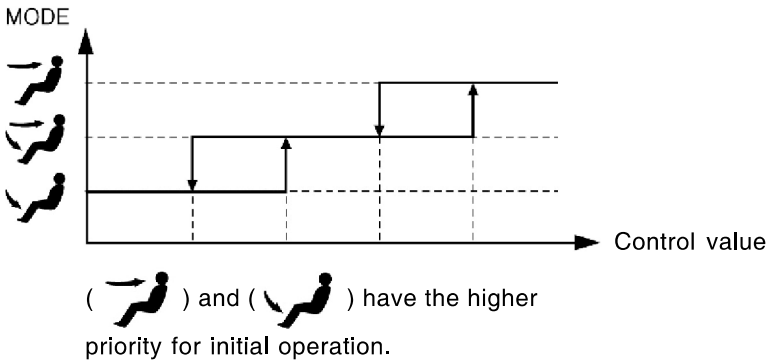
1. Manual control

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.

2. AUTO Control



5) A/C Control

1. Manual control

When you pushed the A/C switch "ON" or the Def switch "ON", A/C starts to operate.

2. AUTO control

Basic Control: A/C "ON" has the priority for the initial operation.

Modification basis	
Application basis	
Affected VIN	

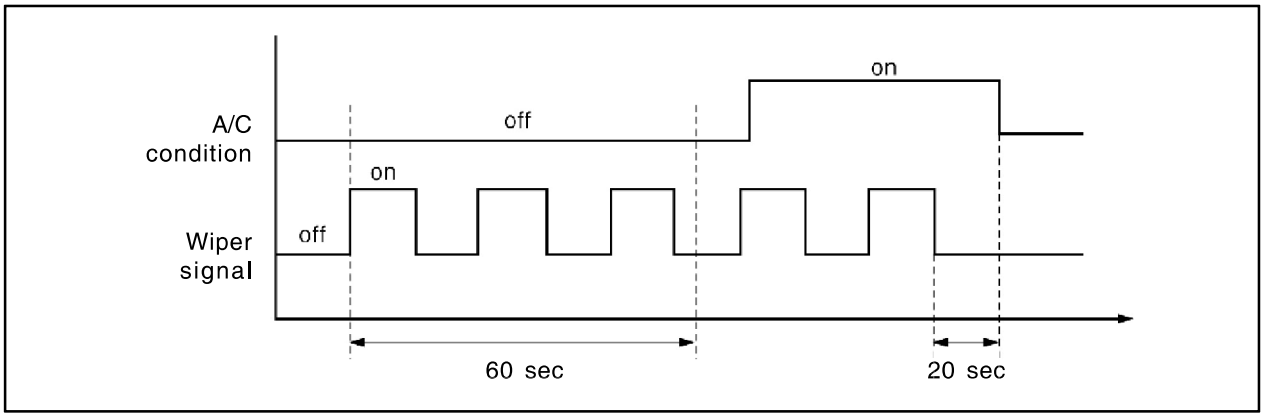
6) Full Cold/Hot Control

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.

7) 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



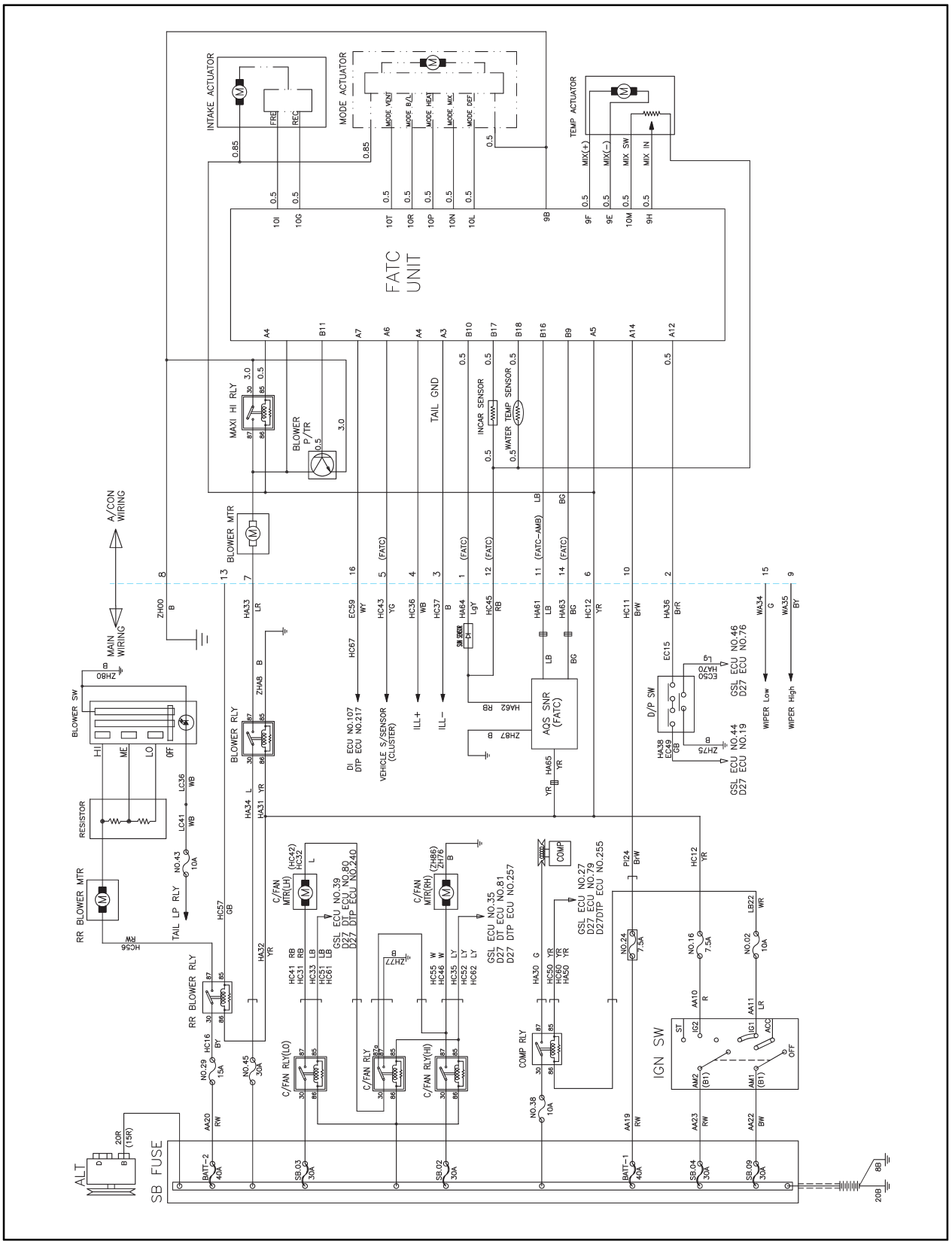
8) Dehumidifying Control

1. Basic functions

- To dehumidify the window glass before it will be fogged, the defrost timing is assumed by the ambient sensor and incar sensor and by detecting the relative humidity inside the vehicle using the humidity sensor.
- However, if it is in the auto foot mode, it is changed to the Front defrost mode.
- ? Then, if the A/C is turned off after switched to the front defrost mode, it is changed to the foot mode automatically.

3. CIRCUIT DIAGRAM

▶ FATC (Full Auto Temperature Control)



Modification basis	
Application basis	
Affected VIN	

FFH SYSTEM

6910-03

GENERAL

1. SPECIFICATIONS

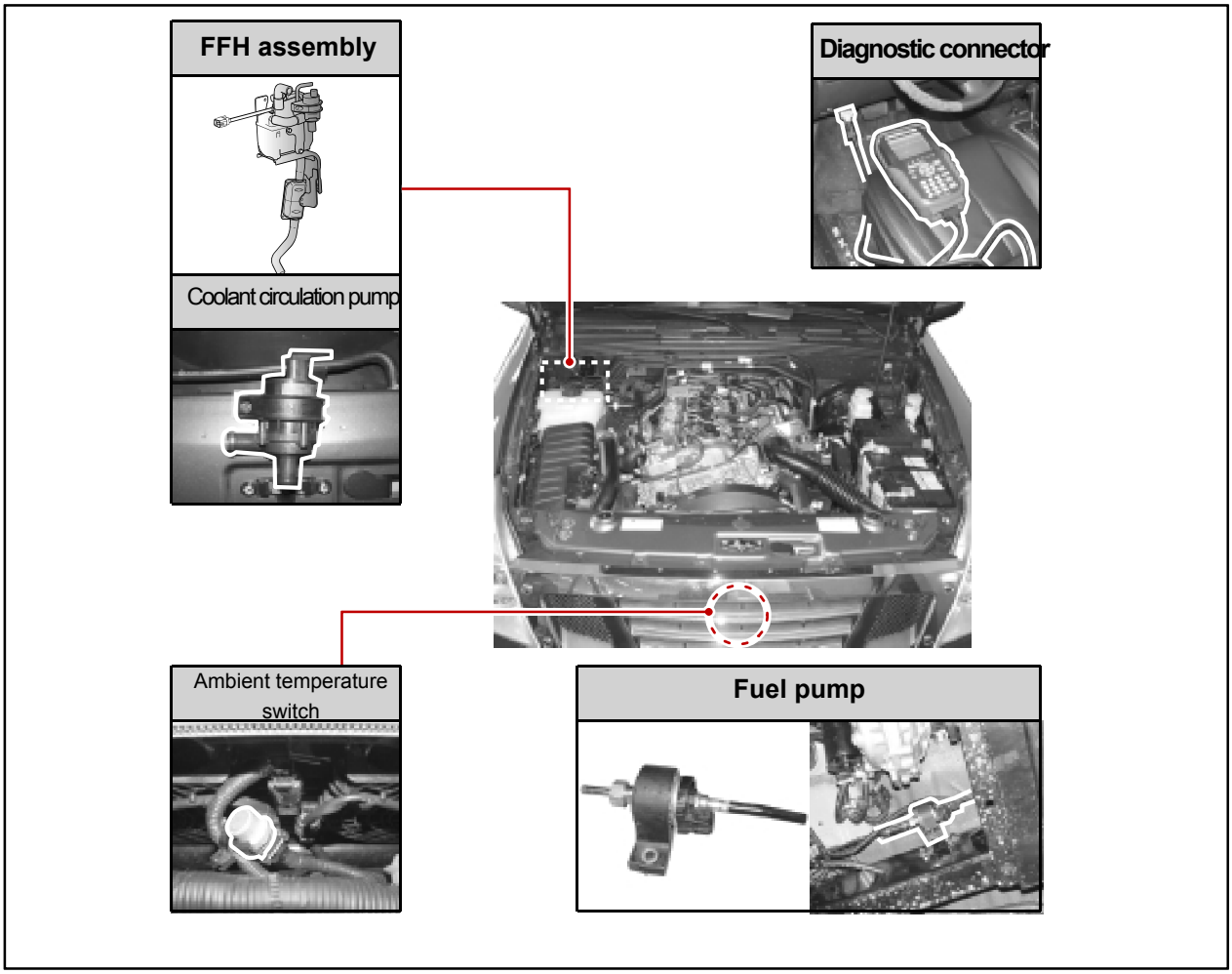
Heater		D 5 S-H	
Heating medium		Coolant	
Control of the heat flow		Large (full load)	Small (small load)
Heat flow		5000 W	2300 W
Fuel consumption per hour		≒ 0.62 ℓ	≒ 0.27 ℓ
Mean electric power consumption	in operation	35 W	11 W
	at start	100 W	
	after-running	12 W	
Rated voltage		12 V	
Operating range • 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

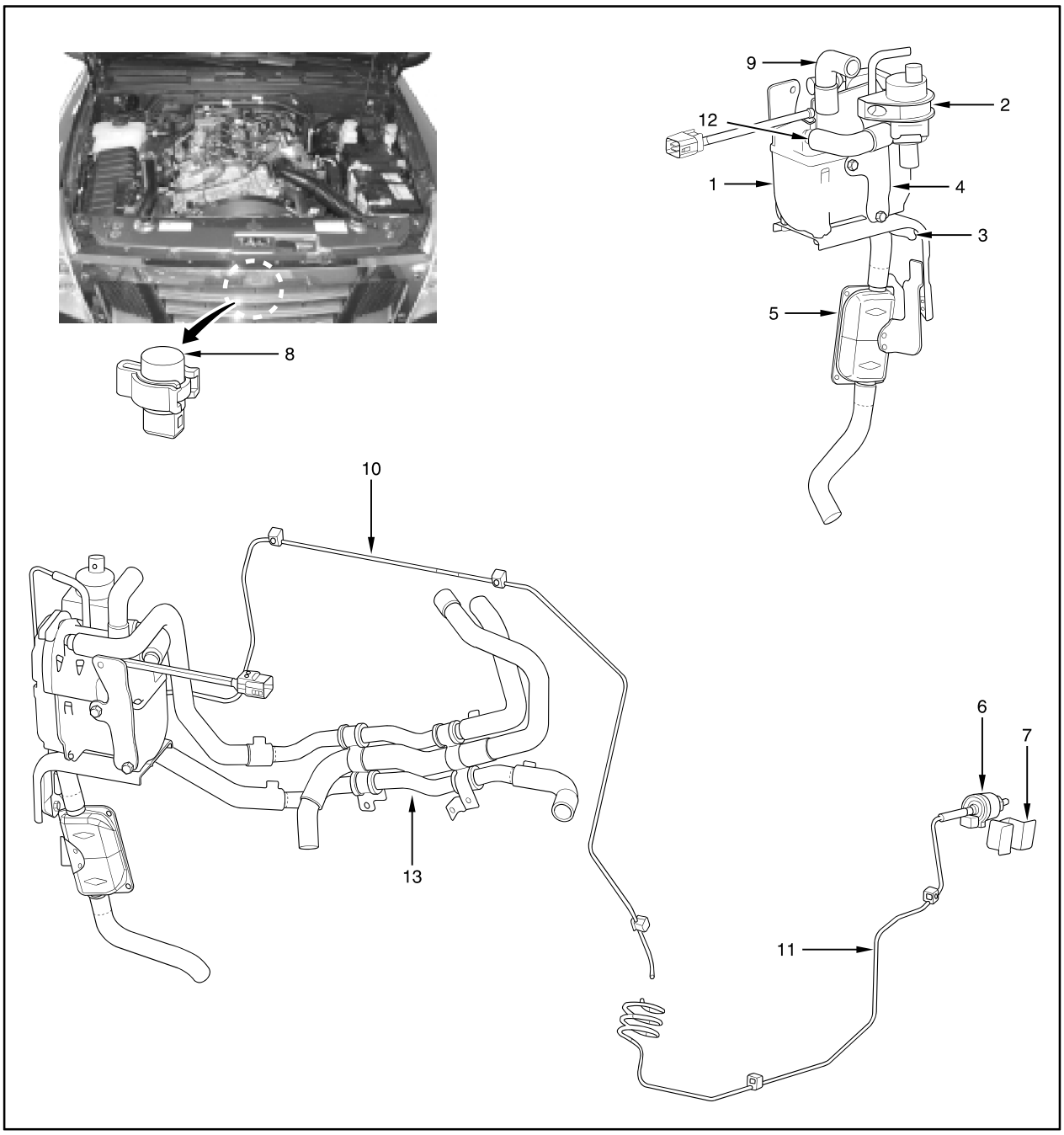
In fuel fired heater system equipped vehicle (D27DT engine equipped), when the ambient temperature and coolant temperature is low, the burner installed in engine cooling system increases the temperature of coolant that flows into heater by firing diesel fuel for a certain period of time. The D27DT engine 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



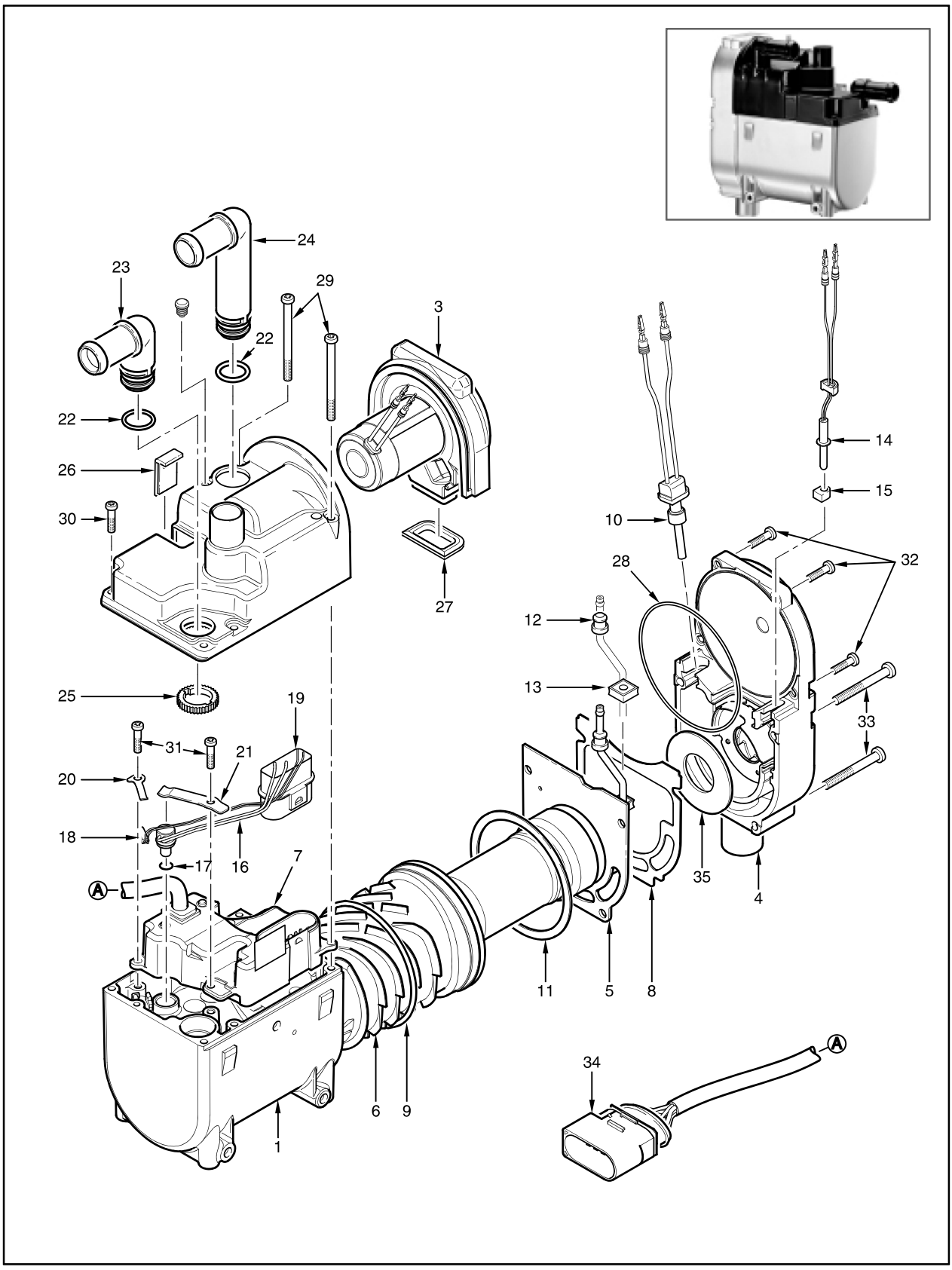
Modification basis	
Application basis	
Affected VIN	

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

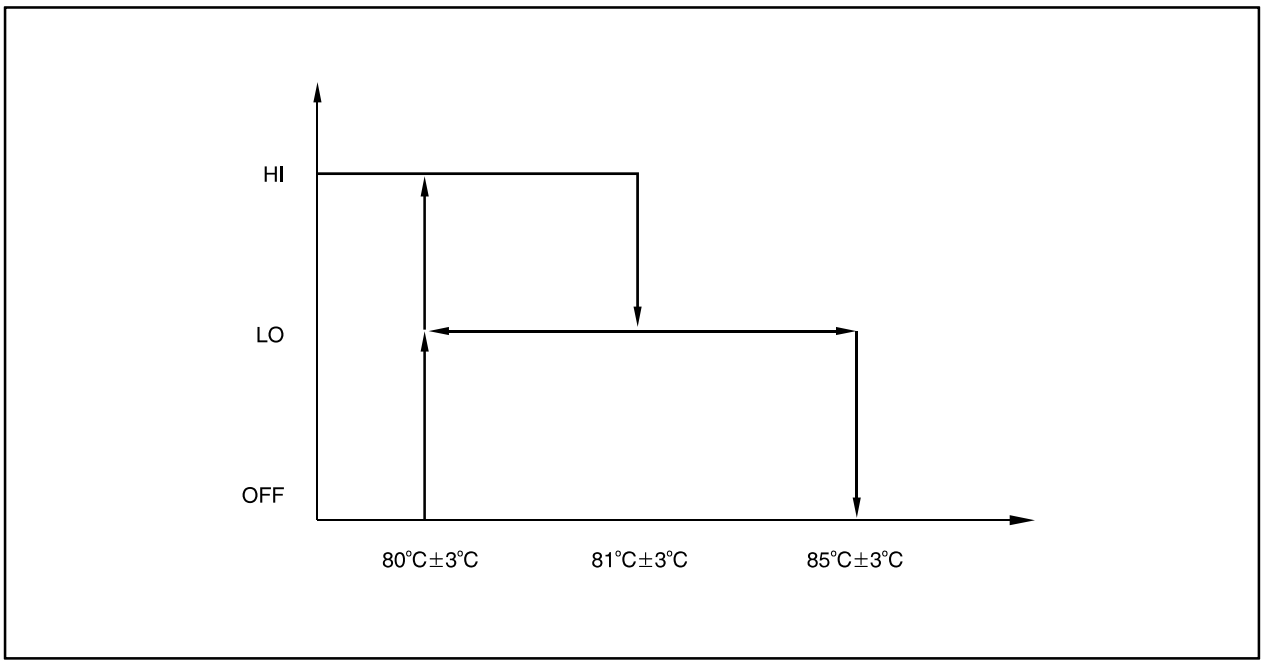
FFH (Fuel Fired Heater) is operated according to the ambient temperature and coolant temperature.

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.

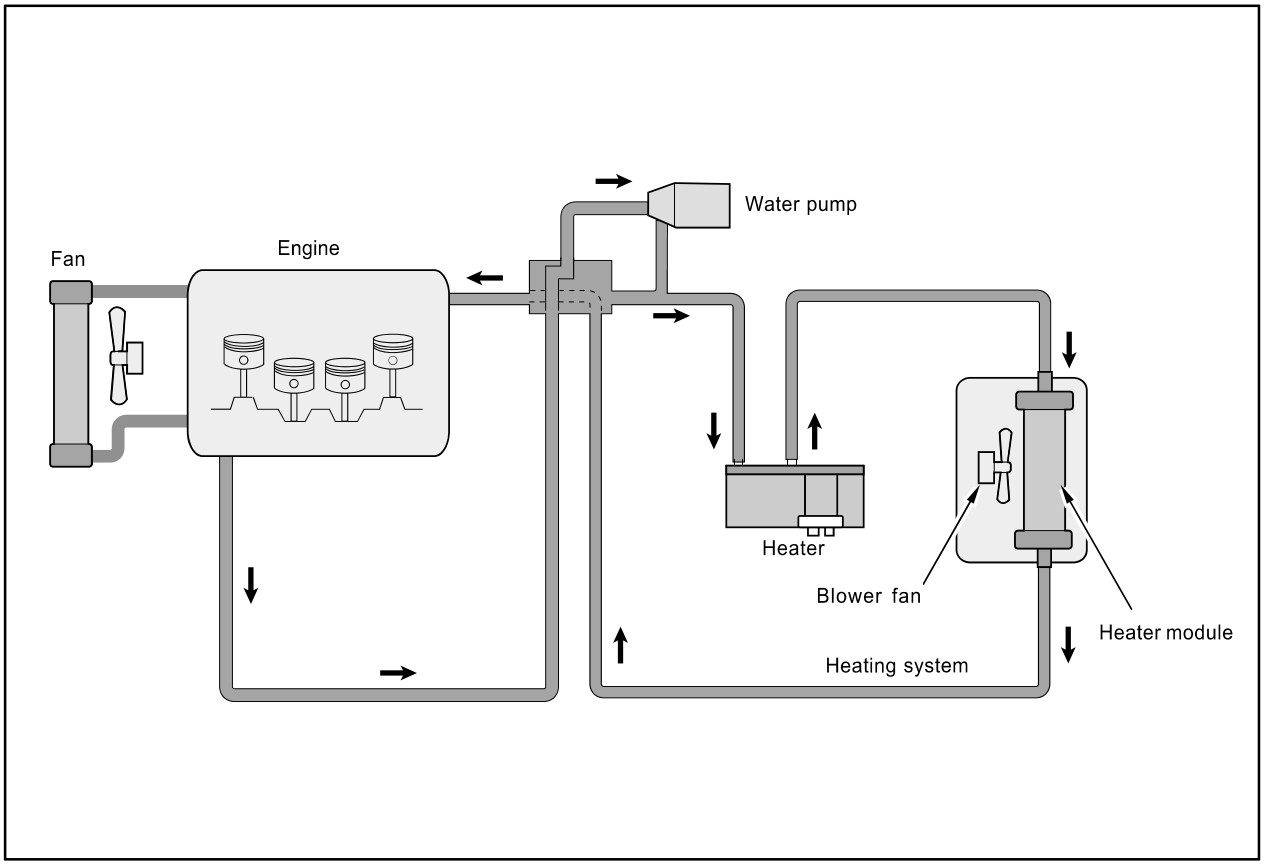
2) FFH Operations According to the Changes of Coolant Temperature



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



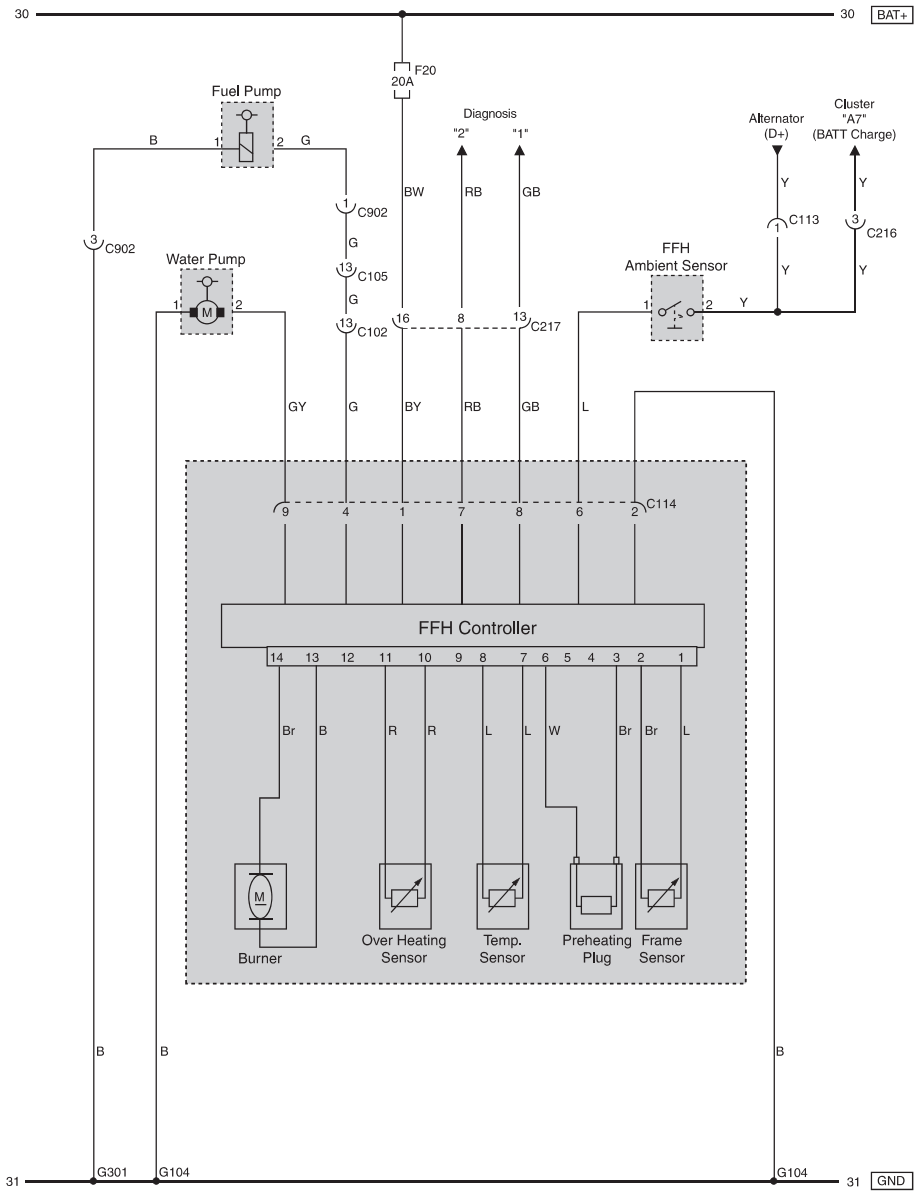
4) Connecting the Coolant Circuit

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

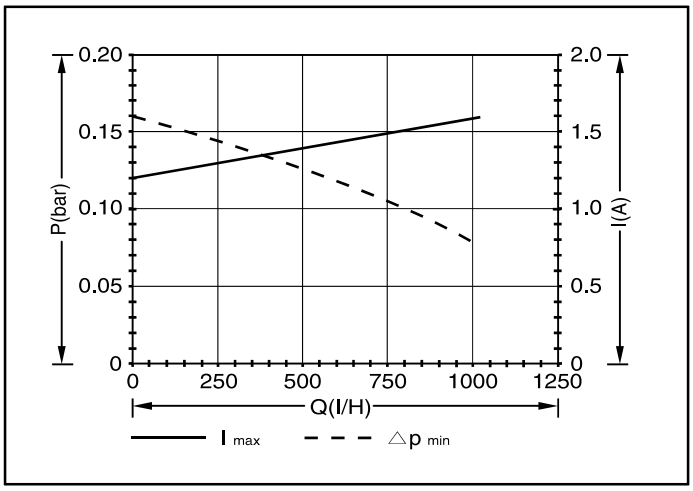
1. If the fuel pump fails to ignite within 90 seconds after fuel pumping starts, the start procedure is repeated as described. If after a further 90 seconds fuel pumping
   the fuel pump still fails to ignite, the heater is switched off in fault mode. The controller is locked after a certain number of 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.

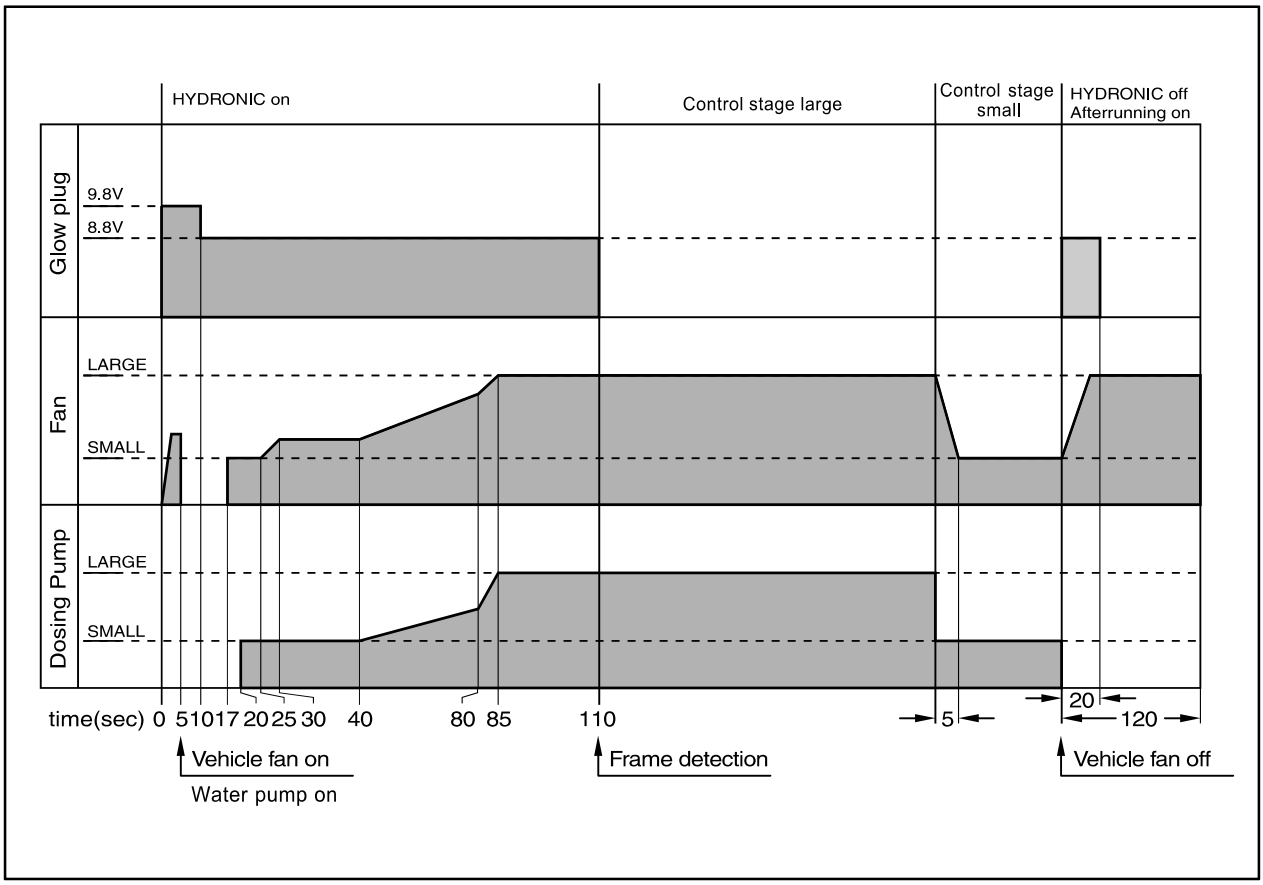
▶Technical Data – Water Pump

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)

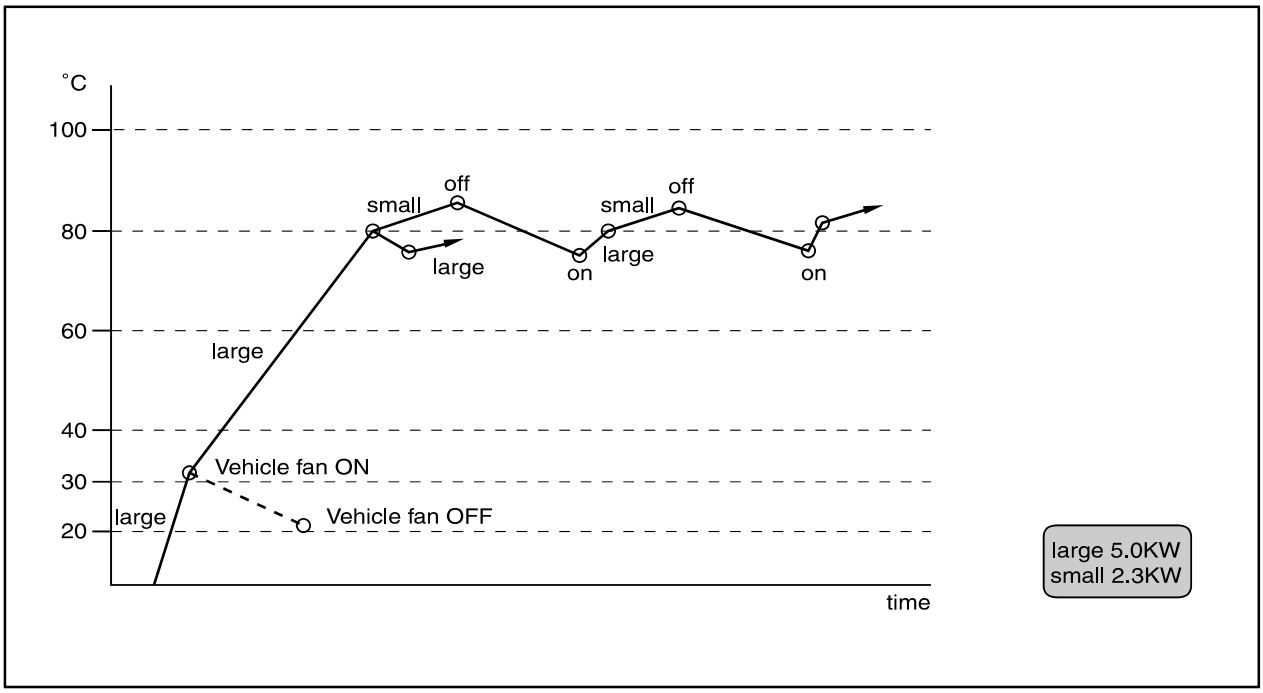


8) Function Diagram



Modification basis	
Application basis	
Affected VIN	

9) Sectional Drawing according to the Temperatures

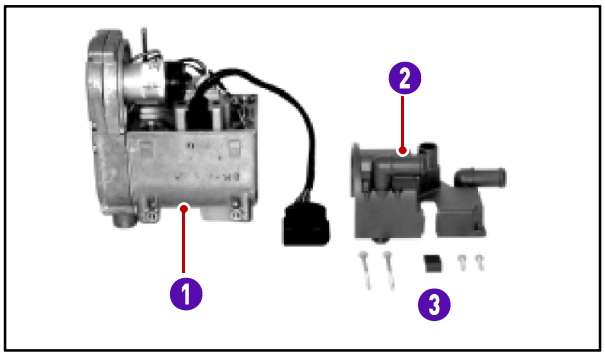


5. COMPONENTS AND COMPOSITIONS

CAUTION

There is no need to disassemble the FFH unit for repair. This section is to show the internal components of the FFH unit.

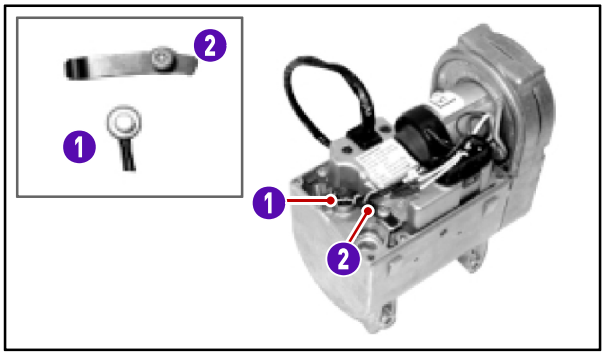
1) Jacket cover



- 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

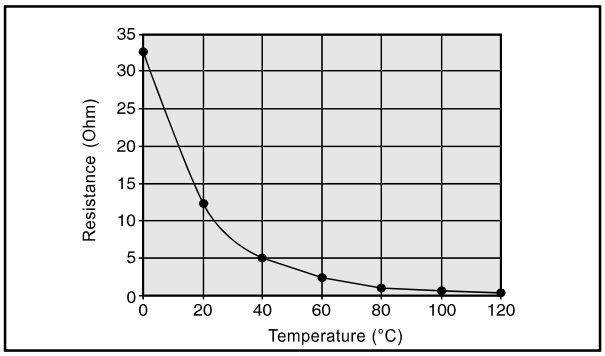
2) Control and overheating Sensor



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

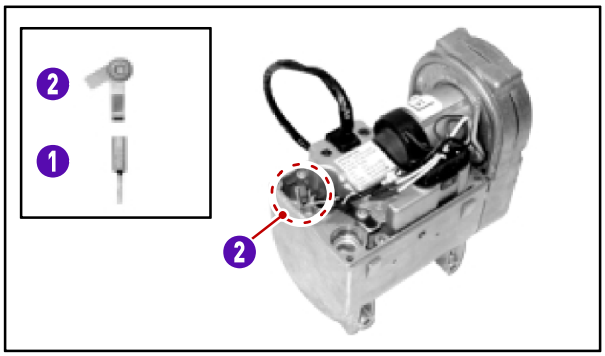


Check the control and overheating sensor with a digital multimeter. If the resistance according to the changes of flame sensor temperature is out of specified values, the flame sensor is defective.

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	

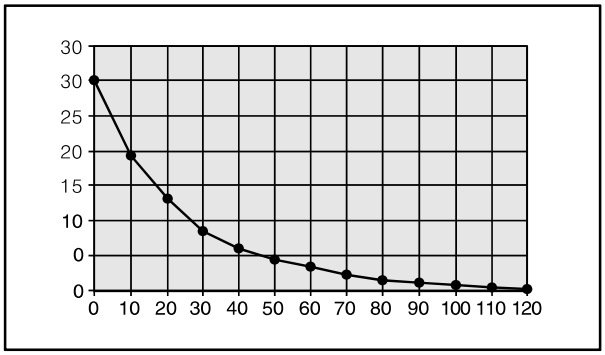
3) Surface sensor



The surface sensor and cable harness make up one component.

1. Surface sensor
2. Pressure spring

▶Check surface sensor

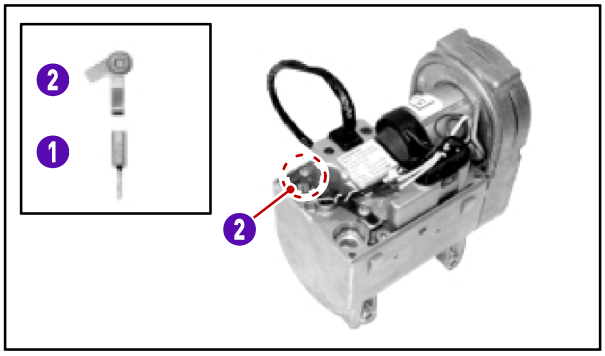


Check the surface sensor with a digital multimeter. If the resistance of flame sensor is out of specified values, the flame sensor is defective.

▶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

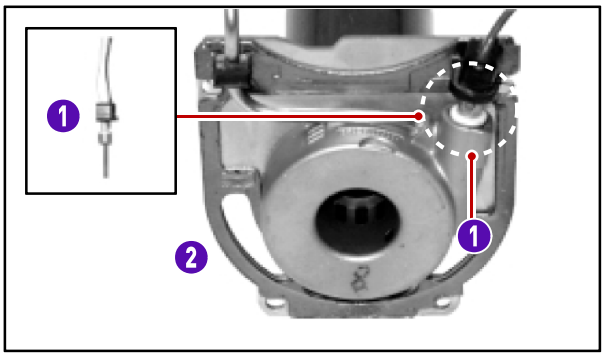
4) Controller



The surface heater and cable harness make up one component.

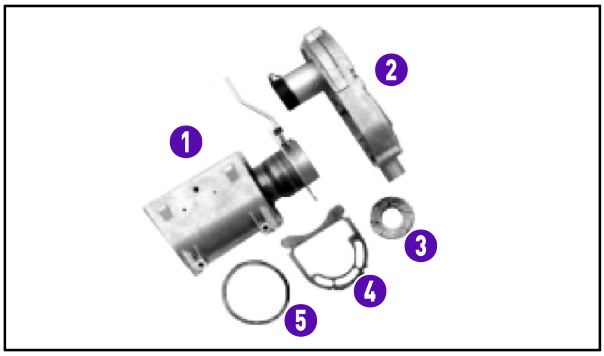
1. Controller
2. Jacket
3. Combustion chamber housing
4. Screw

5) Glow plug



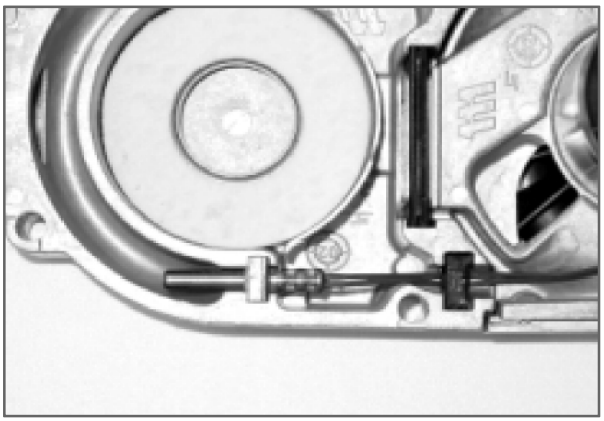
1. Glow plug
2. Combustion chamber with flame pipe

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

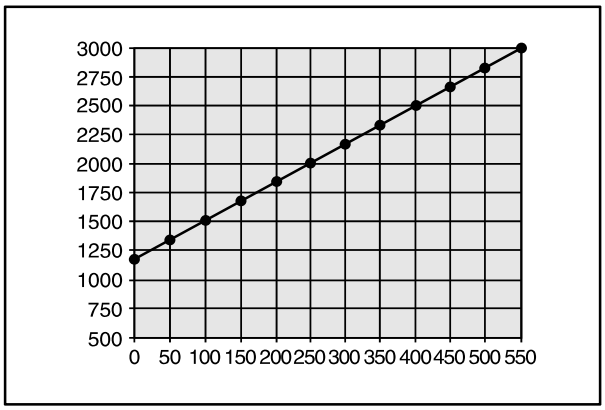
7) Flame sensor



1. Flame sensor
2. Graphite bush
3. Bush

Modification basis	
Application basis	
Affected VIN	

▶Check flame sensor

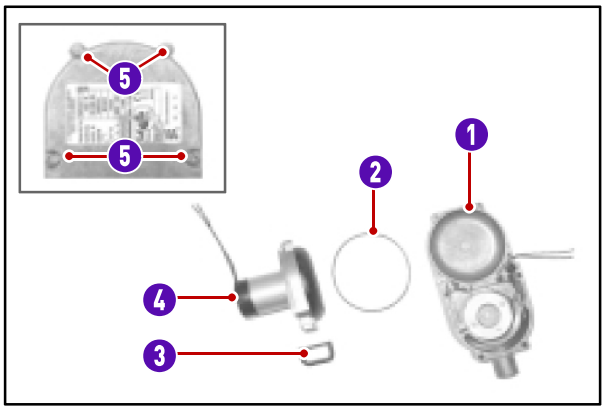


Check the surface sensor with a digital multimeter. If the resistance of flame sensor is out of specified values, the flame sensor is defective.

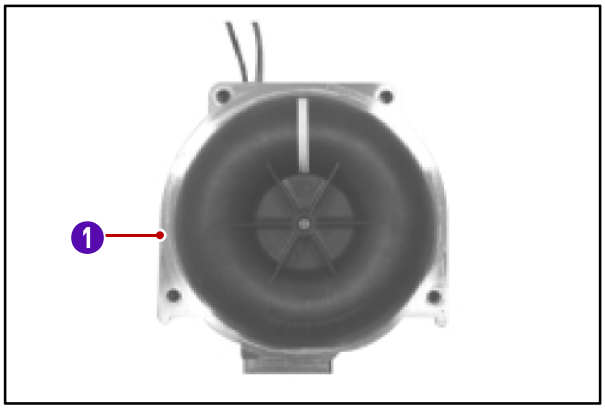
▶Specifiedl value

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

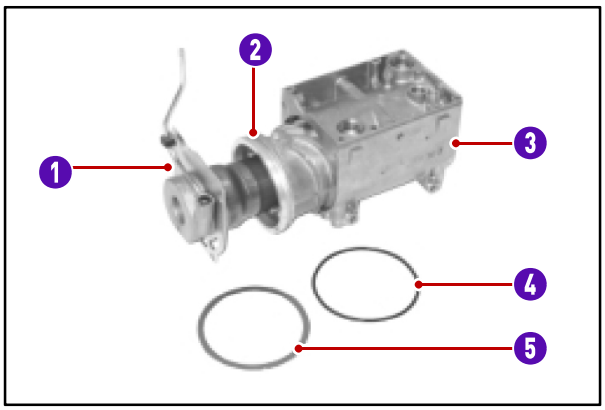
8) Combustion air fan



1. Combustion chamber
2. O-ring
3. Rubber seal
4. Combustion air fan

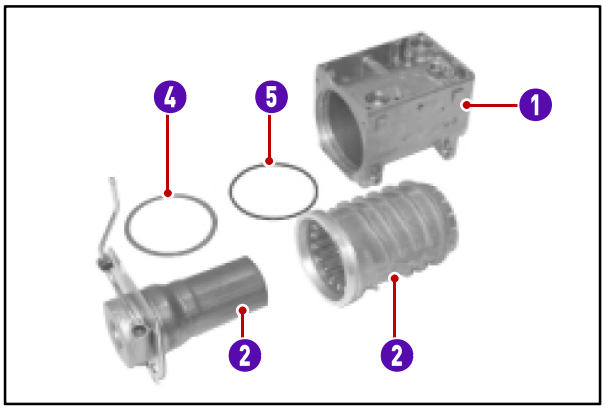


9) Combustion chamber



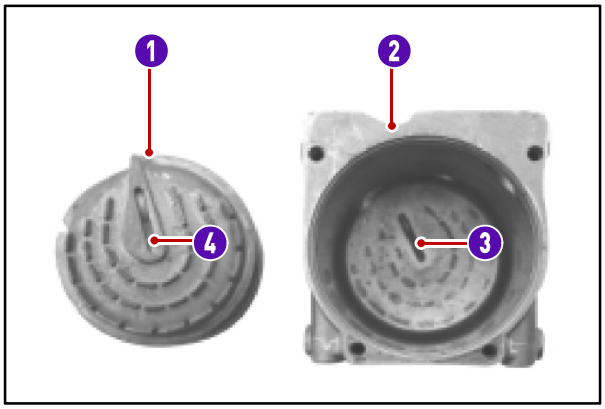
1. Combustion chamber
2. Heat exchanger
3. Jacket
4. O-ring
5. Seal - combustion chamber / heat exchanger

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

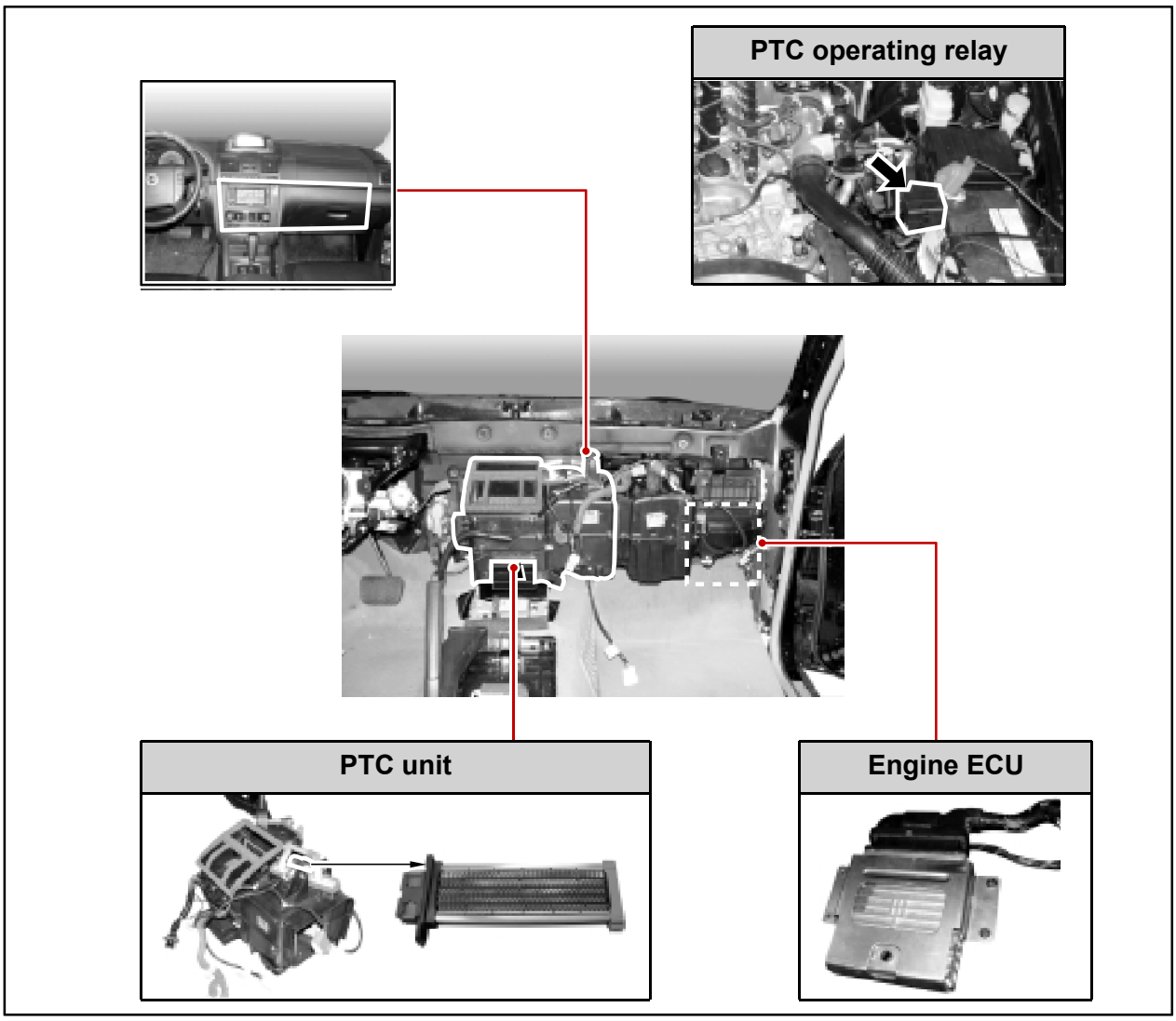
OVERVIEW AND OPERATION PROCESS

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

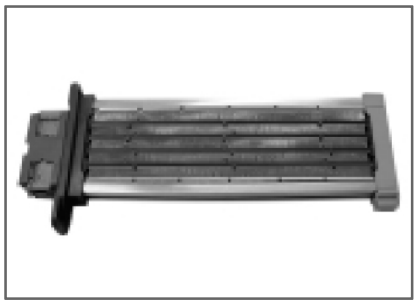
- During engine cranking
- Too low battery voltage (below 11 V)
- During preheating process of glow plugs

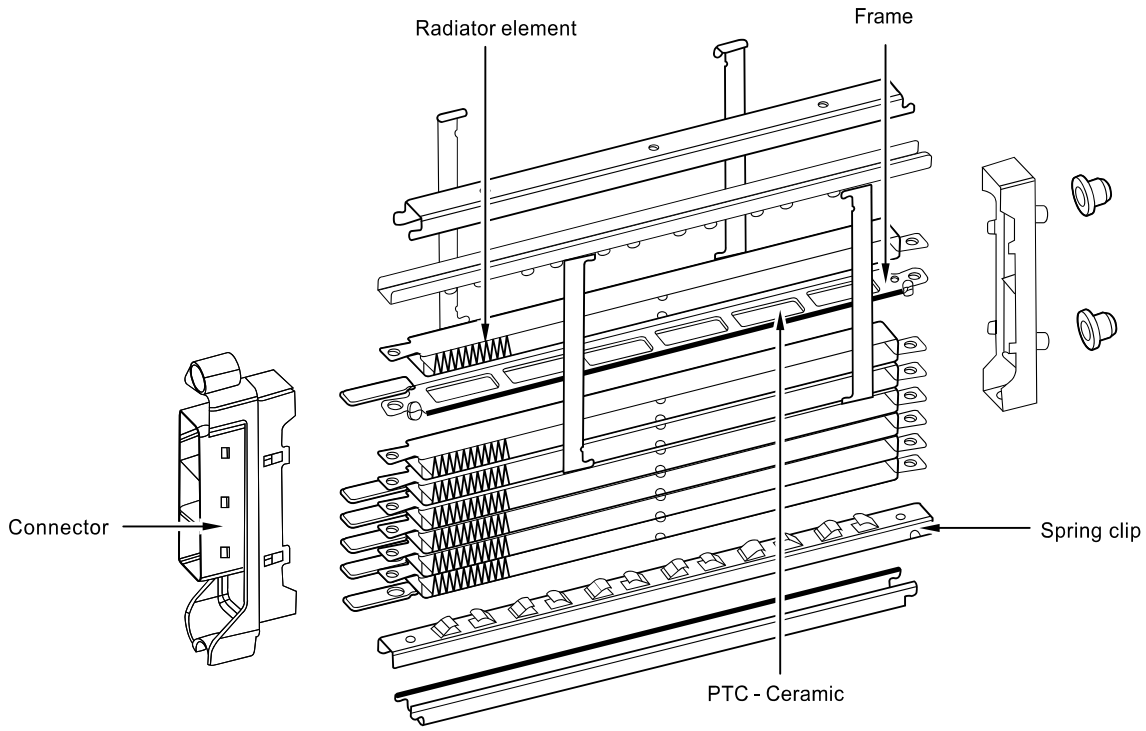
2. COMPONENTS LOCATOR



Modification basis	
Application basis	
Affected VIN	

3. COMPONENTS

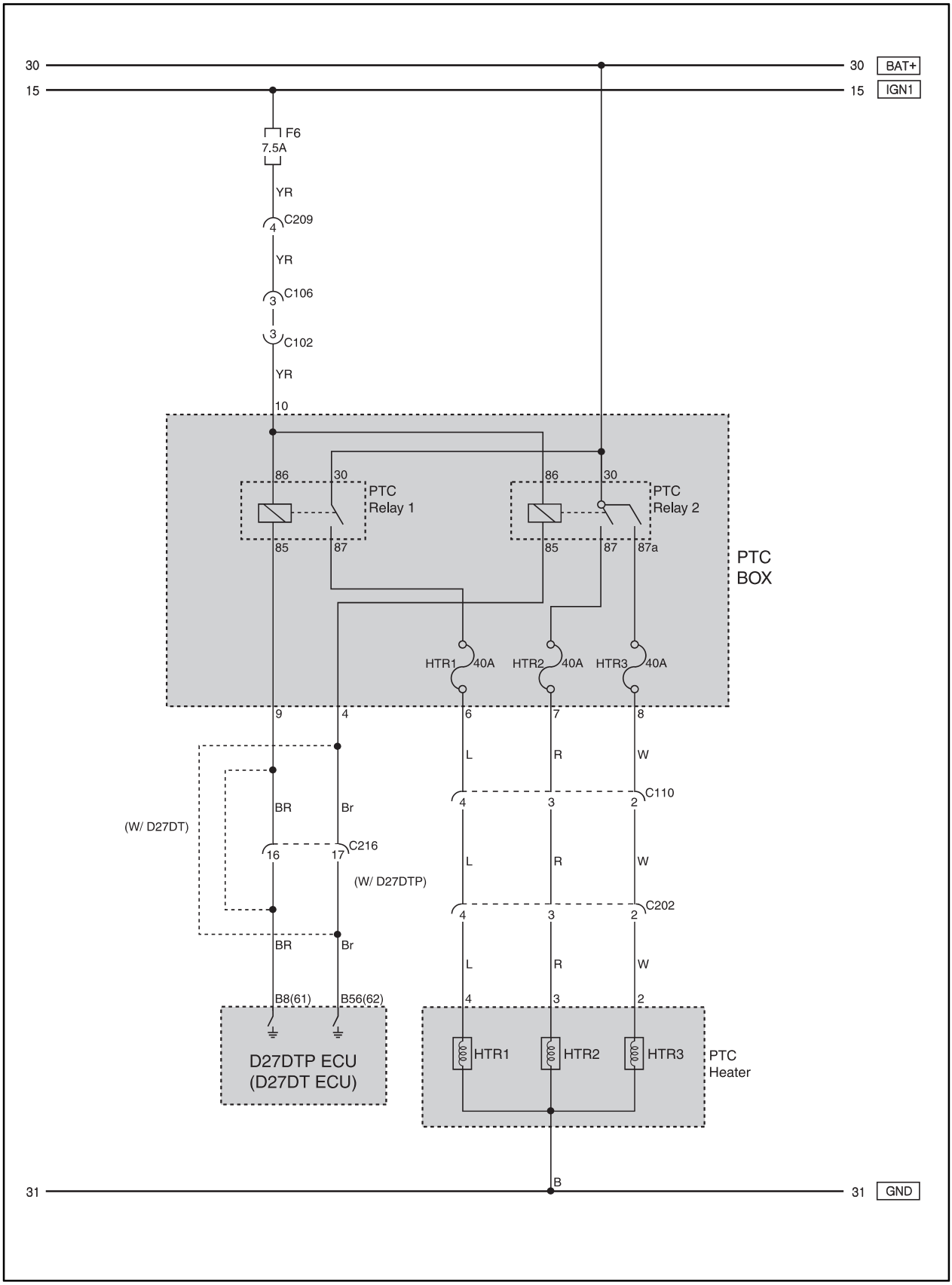




▶ CHARACTERISTICS OF PTC

	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



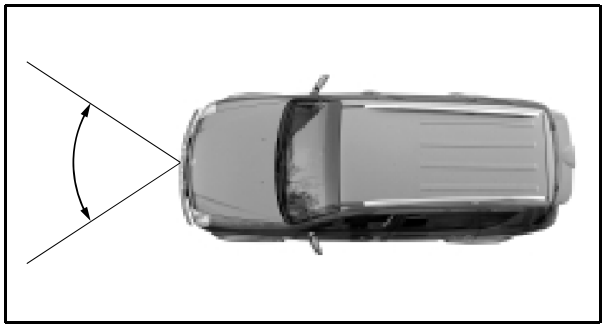
Modification basis	
Application basis	
Affected VIN	

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.

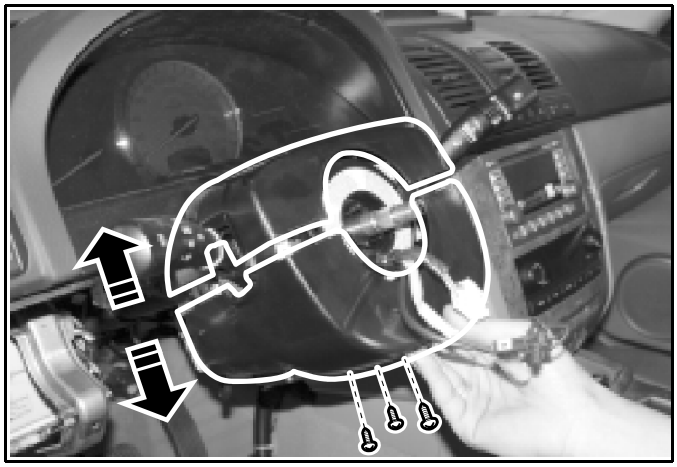
5) Airbag Module Discard (Driver)

1. Disconnect the battery cable and place the vehicle battery at least 10 meters (33 feet) away from the airbag module.

CAUTION

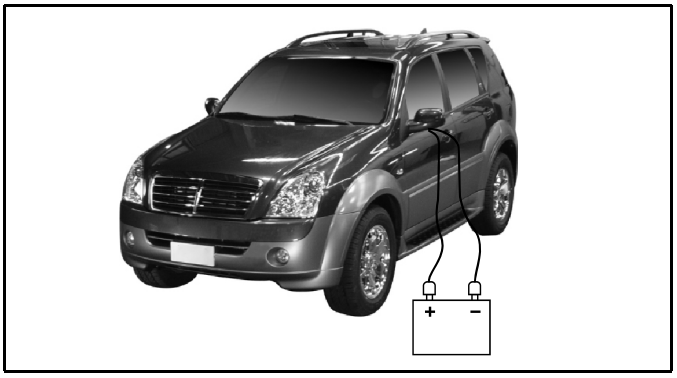
- If the airbags are not disconnected, service cannot begin until one minute has passed after disconnecting power to the SDM. If the airbags are disconnected, service can begin immediately without waiting for one-minute time period to expire. Failure to temporarily disable the SRS during service result 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.

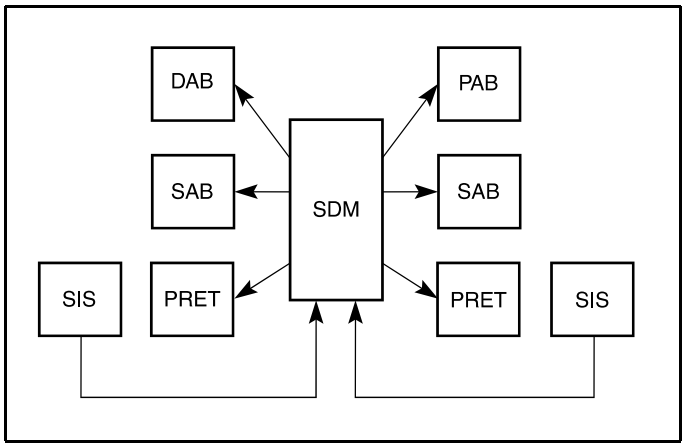
CAUTION

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

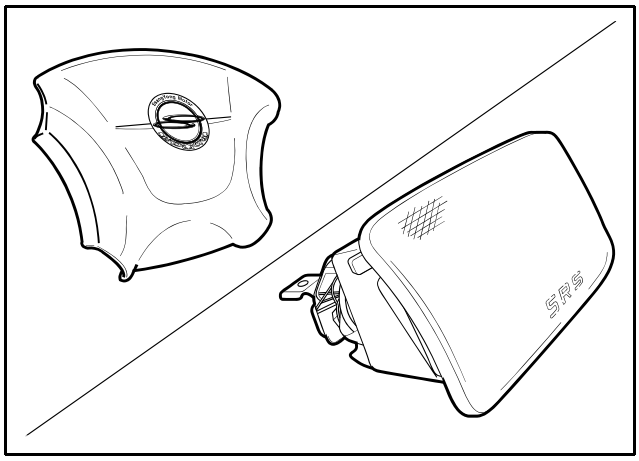
- The inflator is a type of the direct gas generated device.
- The inflator with initial low pressure provides negative restraint effect regarding passengers moving and time.
  On the contrary, the inflator with initial high pressure allows other components of the airbag to make a excessive impact resulting 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

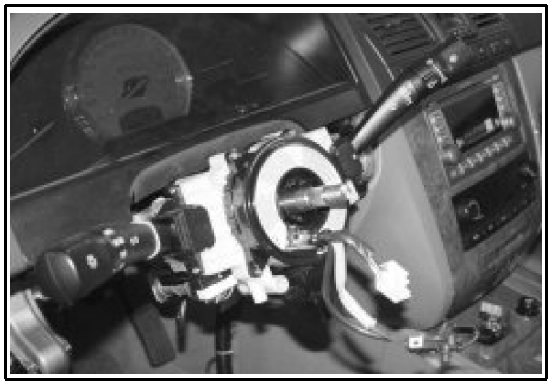
This device receives the impact signal from the sensor for vehicle impact and identifies whether the current condition is necessary for airbag deployment or not. And then the controller sends the specified currents to the airbag ignition circuit as needed.
This device always monitors the airbag system 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.



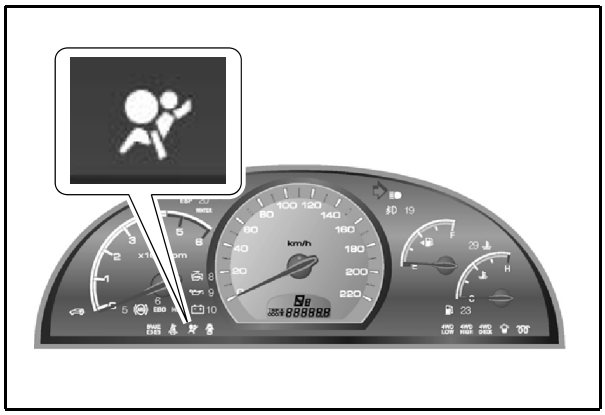
CAUTION

- 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

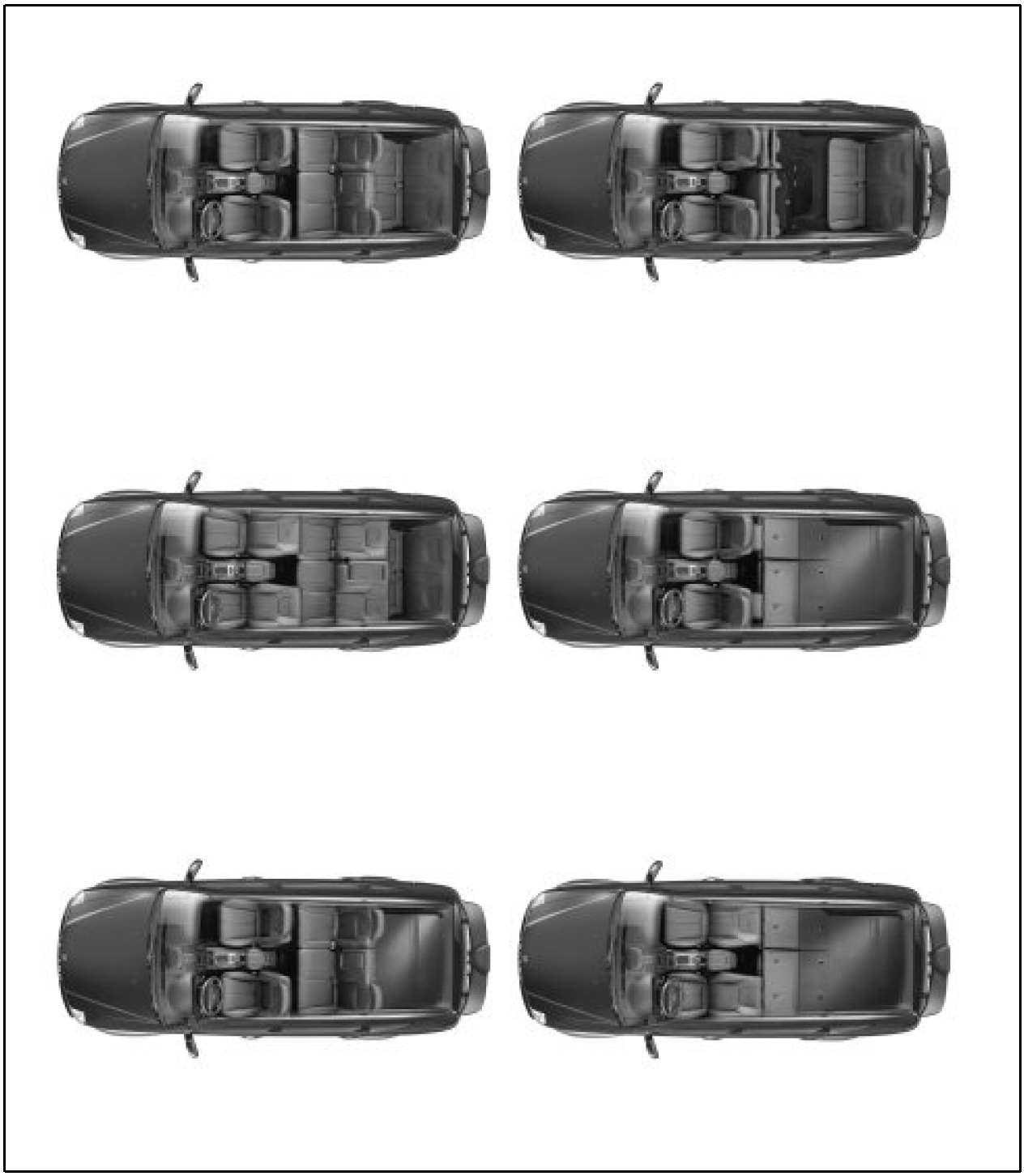
GENERAL

1. SPECIFICATION

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

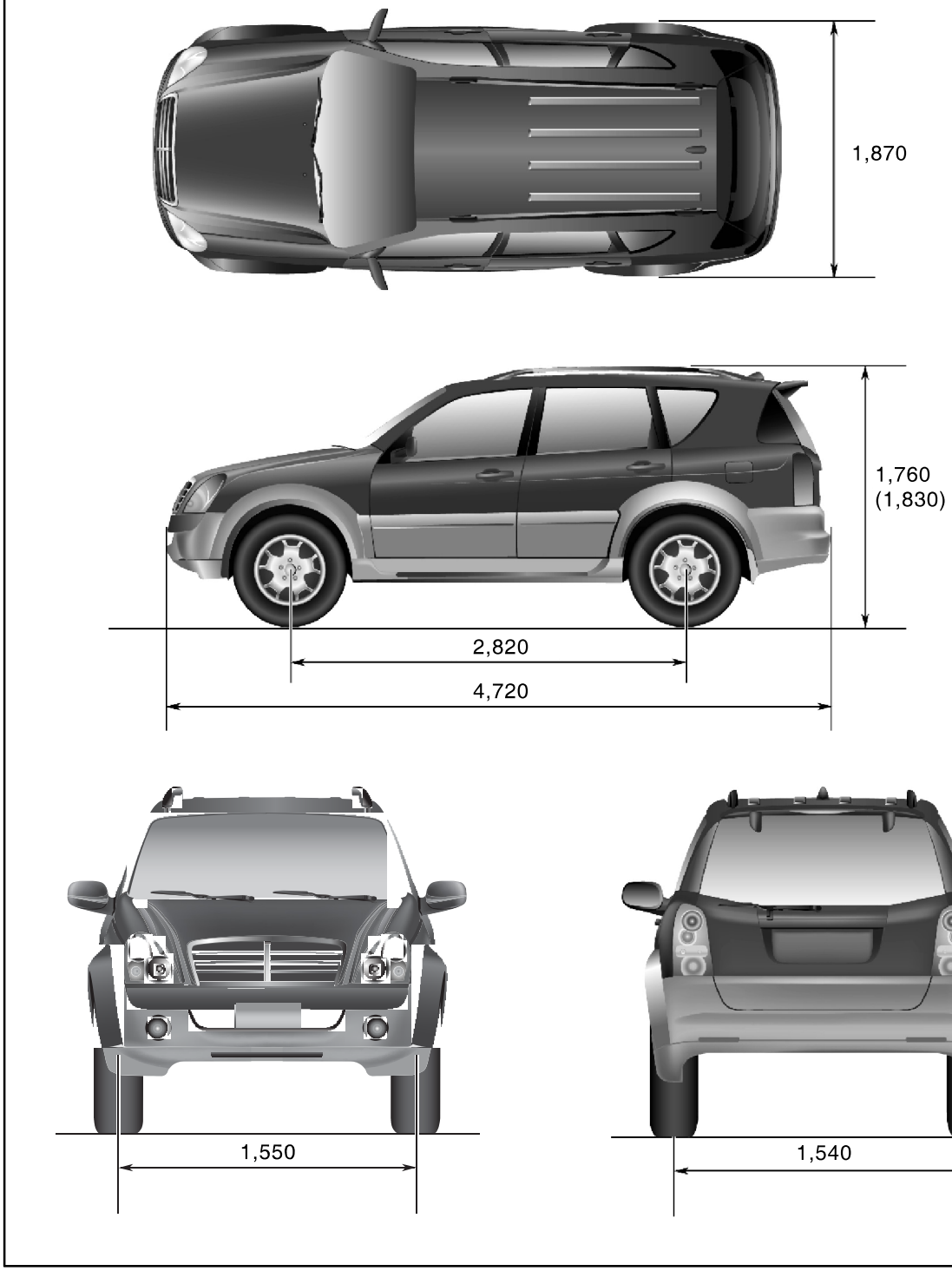
BODY DIMENSIONS

4012-01

GENERAL

1. DIMENSIONS

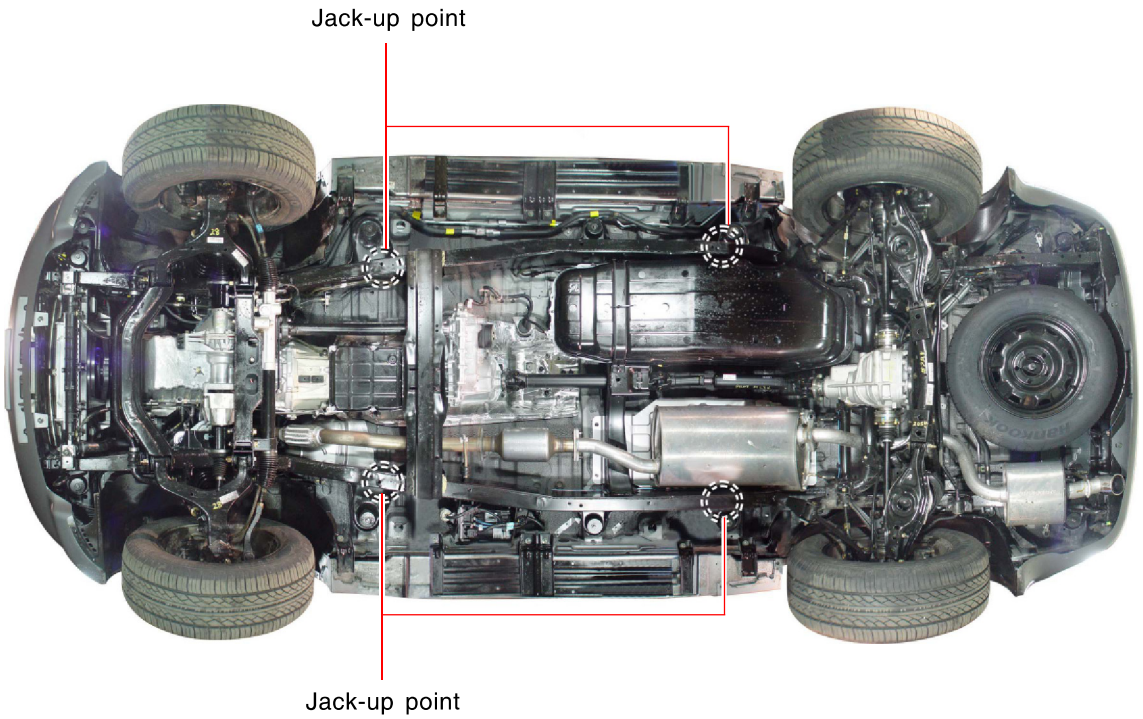
Unit: mm, ( ): Option



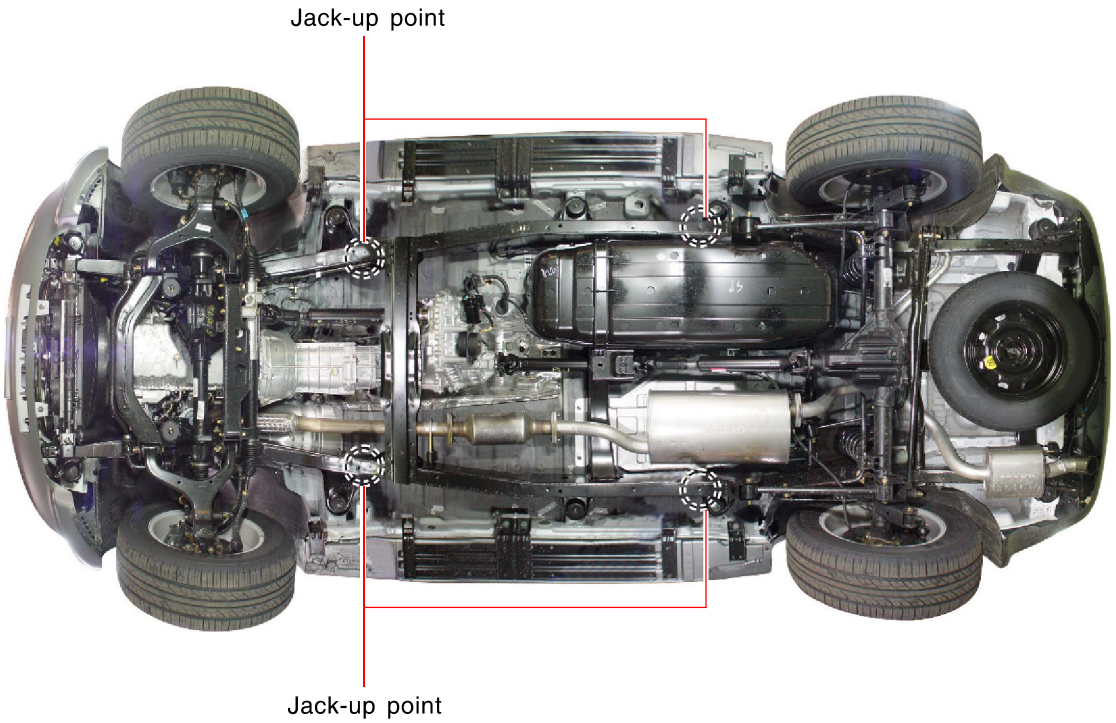
Modification basis	
Application basis	
Affected VIN	

2. JACK-UP POINTS (DOTTED CIRCLES)

IRS type

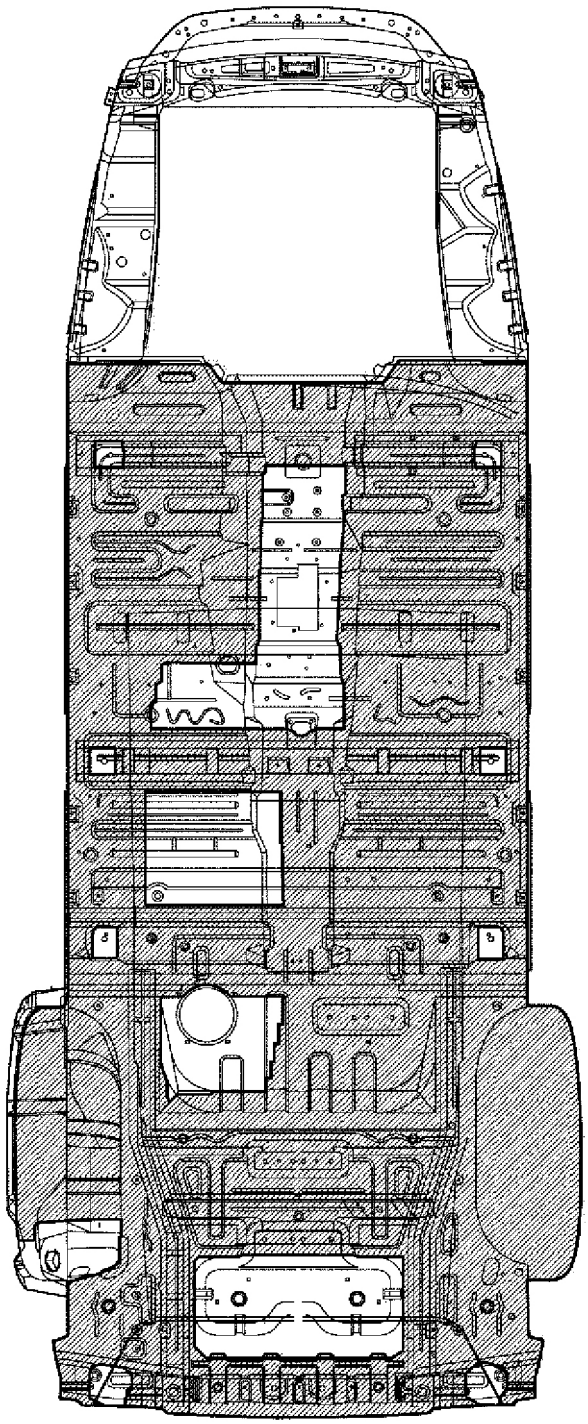


5-link type



Modification basis	
Application basis	
Affected VIN	

3. APPLIED THE ASPHALT TO THE BODY PANEL (IMPROVED ANTI-VIBRATION)



Modification basis	
Application basis	
Affected VIN	

Memo

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	
Application basis	
Affected VIN	

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	
Application basis	
Affected VIN	

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	
Application basis	
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	
Application basis	
Affected VIN	

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	
Application basis	
Affected VIN	

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	
Application basis	
Affected VIN	

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	
Application basis	
Affected VIN	

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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Affected VIN	

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

Modification basis	
Application basis	
Affected VIN	

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.	

Modification basis	
Application basis	
Affected VIN	

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

Modification basis	
Application basis	
Affected VIN	

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

Modification basis	
Application basis	
Affected VIN	

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

Modification basis	
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Affected VIN	

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. 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>
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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="5">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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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.

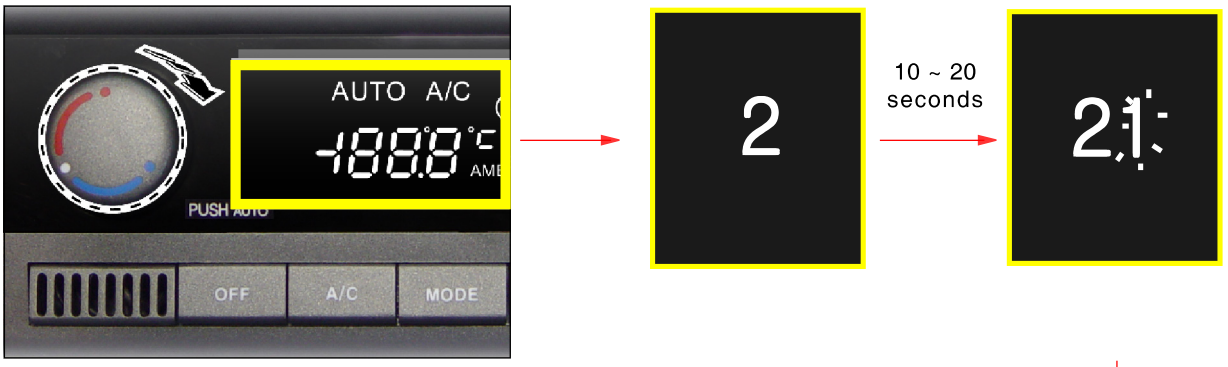
Check LED segments on the vacuum fluorescent display (VFD).

Press OFF switch more than 5 seconds.

2) Set in Trouble Diagnosis Step 2

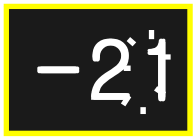
In this step, check the air mix door and sensors for defect.

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

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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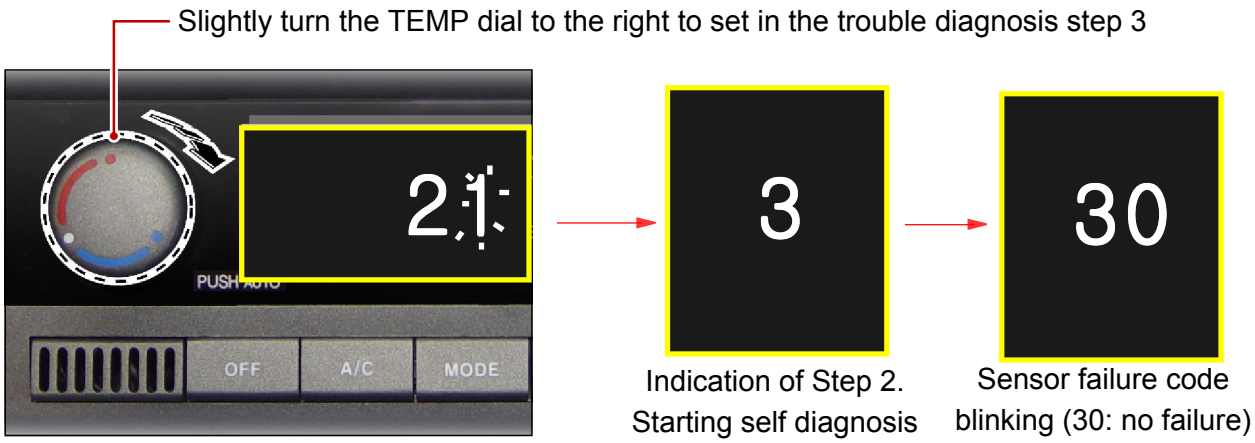
3) Set in Trouble Diagnosis Step 3

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.

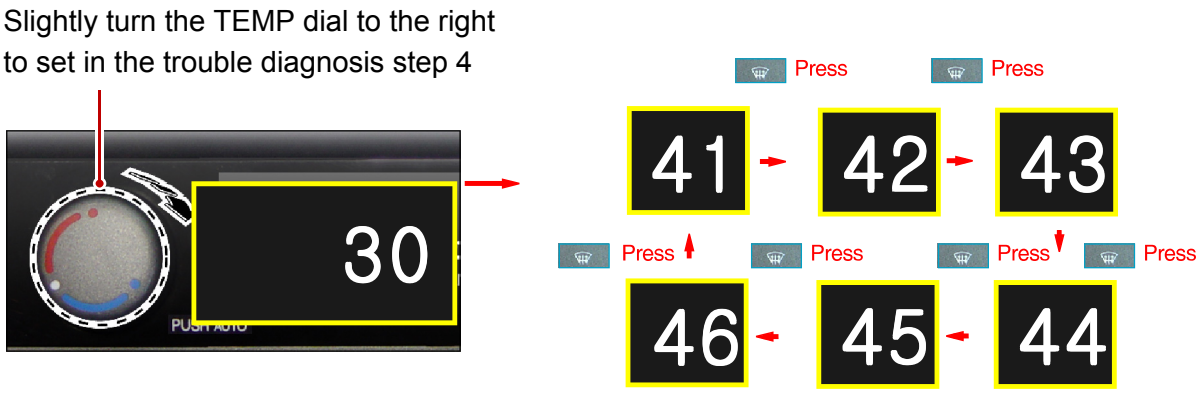


Trouble Code

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.



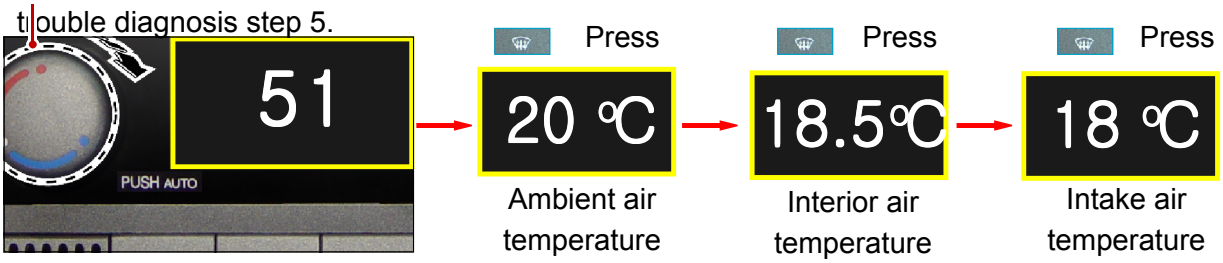
Function Check

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.

Slightly turn to right to set in trouble diagnosis step 5.



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.

Compensates the temperature by turning TEMP dial.

Starts the trouble diagnosis step 6 by turning fan speed dial.

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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.

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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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DIAGNOSIS

1. P/TRUNK

Function	System component	DTC	Description
Power Trunk Monitoring	**Power striker**	**0**	**Faulty power striker**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The micro switch is malfunctioning. - The power striker'motor is malfunctioning. **Actions** - Check the related wiring and connector for proper connection. - Replace the power striker.		
	Power latch	**1**	**Faulty power latch**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The micro switch is malfunctioning. - The power latch motor is malfunctioning. **Actions** - Check the related wiring and connector for proper connection. - Replace the power latch.		
	DC-Gear motor	**2**	**Faulty DC-gear motor**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The hall sensor is malfunctioning. - The DC-gear motor is malfunctioning. **Actions** - Check the related wiring and connector for proper connection. - Replace the DC-gear motor.		
	Power trunk lid	**3**	**Faulty power trunk lid**
	Causes - The related wiring is damaged. - The connector is poorly connected or damaged. - The PTL ECU is malfunctioning. **Actions** - Check the related wiring for proper connection. - Replace the PTL ECU.		

<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

0000-00

DIAGNOSIS

1. TROUBLE SHOOTING..... 3

RAIN SENSOR

0000-00

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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1. STICS..... 3

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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1. TC..... 3

TC

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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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TCU

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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

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DIAGNOSIS

1. TGS LEVER

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.

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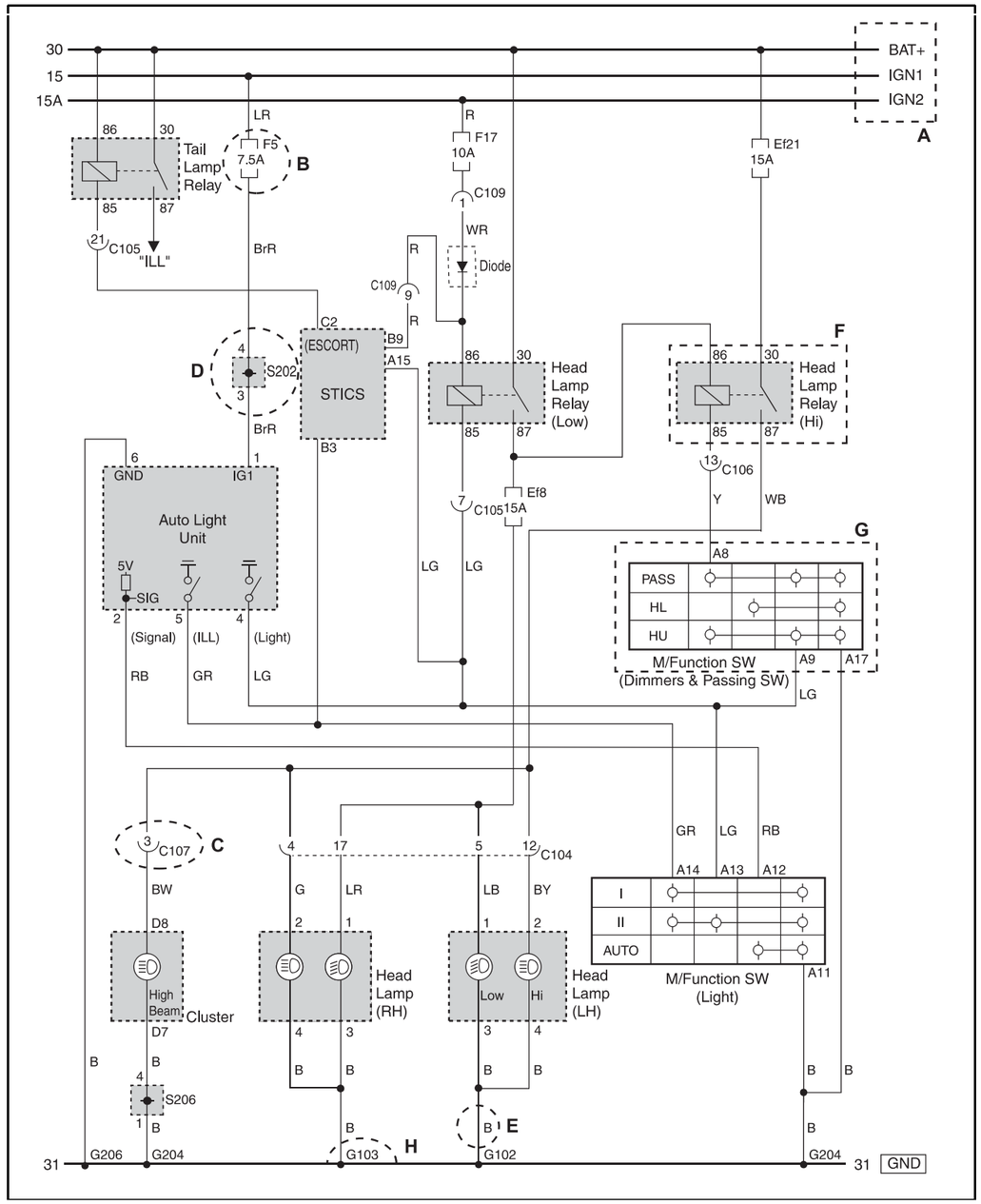
GENERAL INFORMATION

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 ~ C903) ·Connector No C203 terminal No1 ·Refer to Major Connector Position (Section 2)
D	- S201 : Splice pack (S201 ~ S207) ·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 ~ G402) ·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)

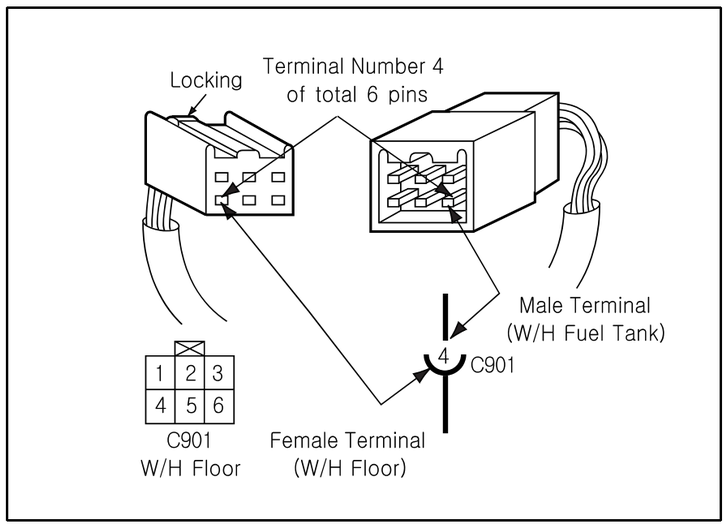
5) WIRING HARNESS COLOR IDENTIFICATION

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
Or	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	

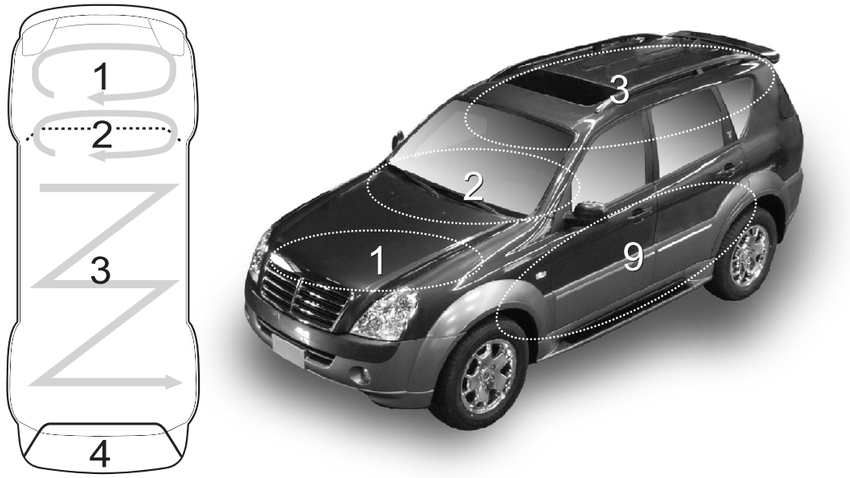
7) PART LOCATION ACCORDING TO PART NUMBER

▶ **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
☐ 4☐☐	Tailgate
☐ 9☐☐	Underbody

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

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	

Memo

Memo

8201-00/8210-00/8210-02/8210-03/8210-09/8210-10/8210-06/8210-07/8210-08

WIRING

8201-00 WIRING HARNESS,
COMPONENTS LOCATION..... 3

CONNECTOR/GROUND

8210-00 W/H ENGINE ROOM..... 24
8210-02 W/H MAIN..... 25
8210-03 W/H FLOOR..... 27
8210-09 W/H ROOF..... 29
8210-06 W/H DRIVER DOOR..... 29
8210-07 W/H PASSENGER DOOR..... 30
8210-08 W/H RR DOOR..... 30
8210-10 W/H TAIL GATE..... 31

Memo

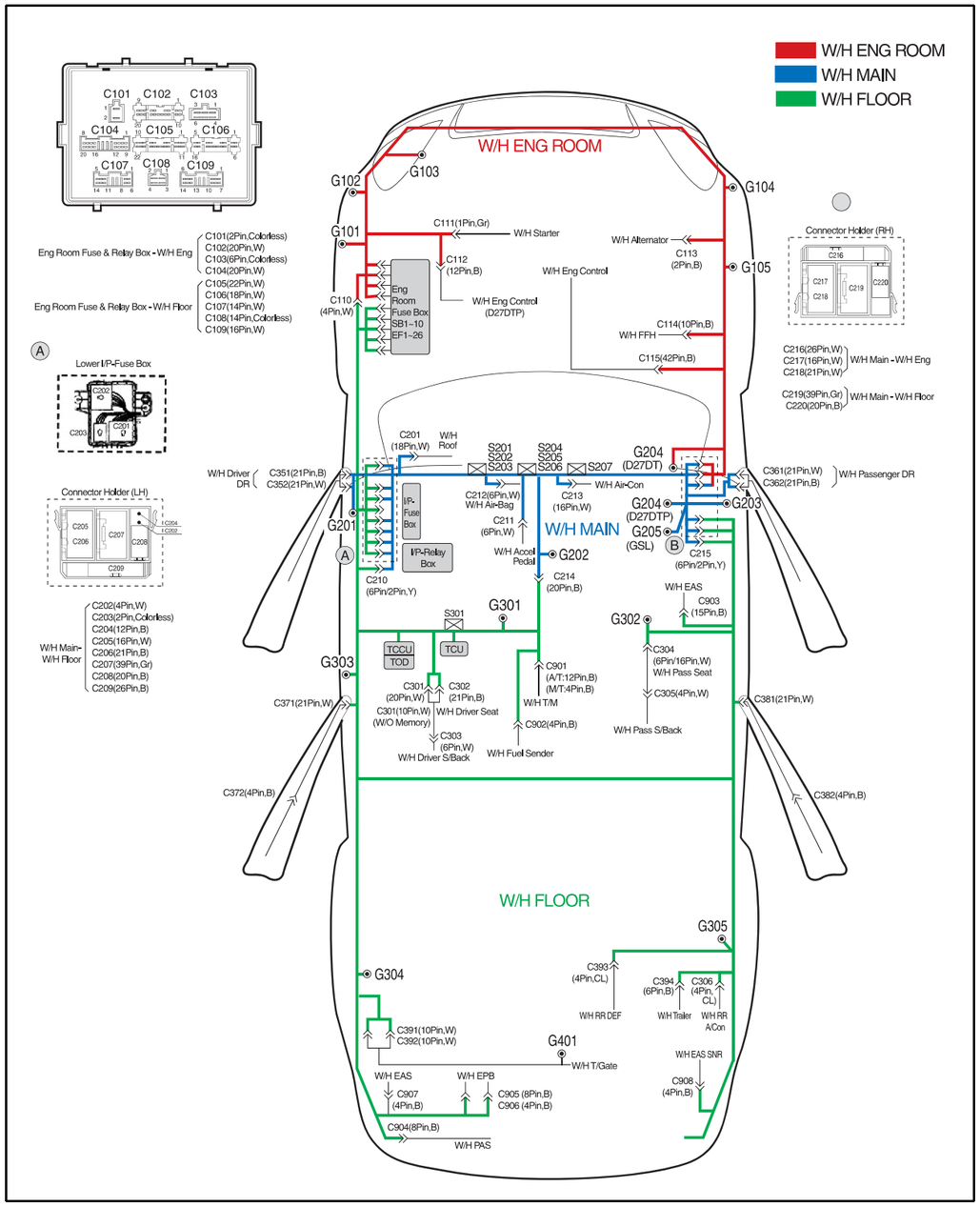
Memo

WIRING HARNESS

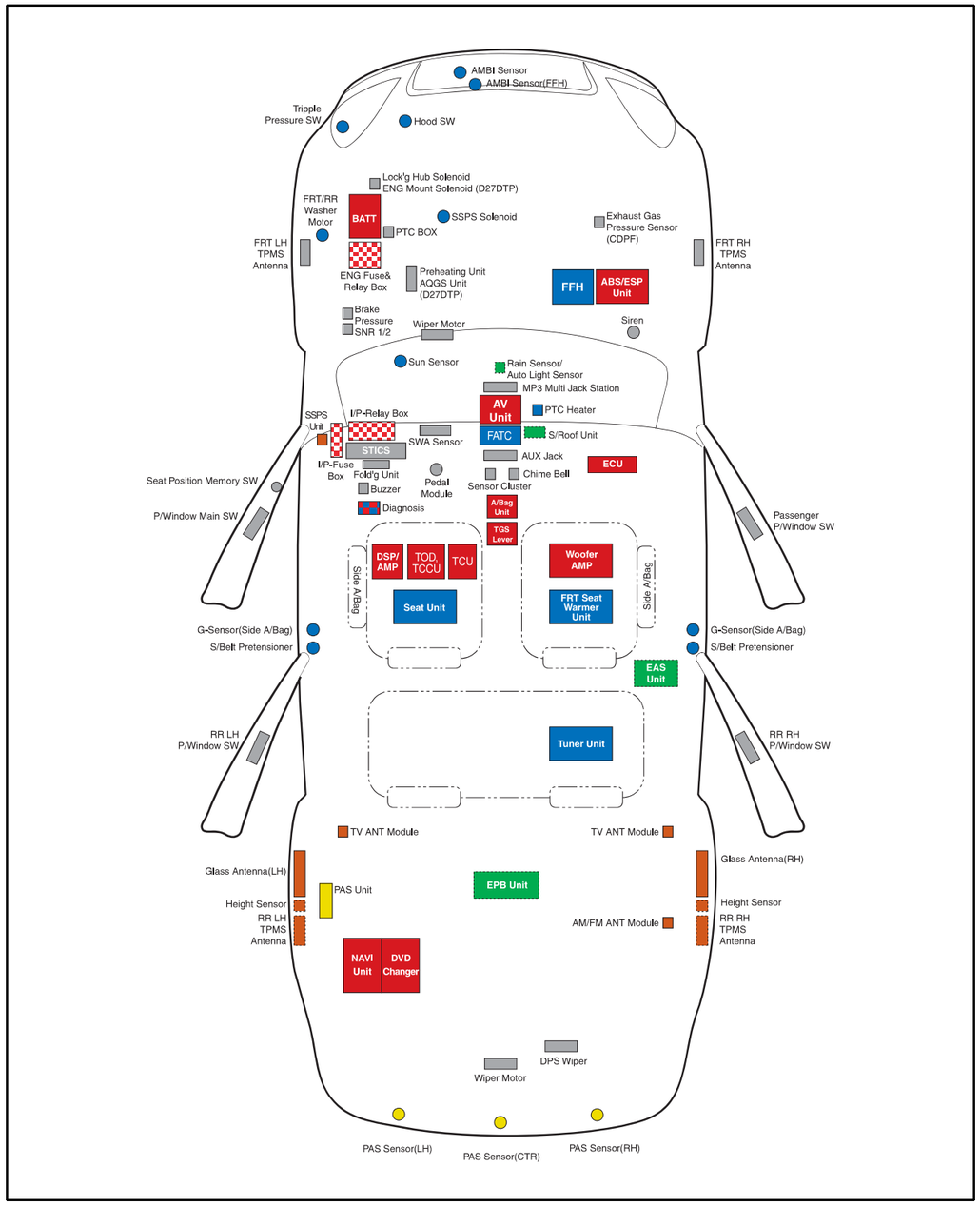
S.G.N. 8201-00

WIRING HARNESS, COMPONENTS LOCATION

1) WIRING HARNESS



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)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C103 (6Pin, Colorless)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C108 (4Pin, Colorless)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C110 (4Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C111 (1Pin, Gray)	W/H Floor - Starter Motor	Under the Preheating Time Relay	Solenoid
C112 (12Pin, Black)	W/H Eng - W/H Eng Control	Under the Preheating Time Relay	D27DTP
C113 (2Pin, Black)	W/H Eng - W/H Alternator	Under the Coolant Reserve Tank	
C114 (16Pin, Black)	W/H Eng - W/H FFH	Backside Coolant Reserve Tank	FFH
C115 (42Pin, Black)	W/H Floor - W/H Eng Control	Right Eng Room Dash PNL	
C201 (18Pin, White)	W/H Main - W/H Roof	Under the I/P Fuse Box	
C202 (4Pin, White)	W/H Main - W/H Floor	Under the I/P Fuse Box	PTC
C203 (2Pin, Colorless)	W/H Main - W/H Floor	Under the I/P Fuse Box	
C204 (12Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C208 (20Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C210 (6Pin, Yellow)	W/H Air Bag - W/H Air Bag EXTN	Driver Cowl Side C/Holder	Side A/Bag
C210 (2Pin, Yellow)	W/H Air Bag - W/H Air Bag EXTN	Driver Cowl Side C/Holder	
C211 (6Pin, White)	W/H Main - W/H Accel Pedal	Inside the Driver Under-Cover	
C212 (6Pin, White)	W/H Main - W/H Air Bag	Backside the Cluster(Inside I/P)	
C213 (16Pin, White)	W/H Main - W/H A/Con	Backside the A/V Head Unit	
C213A (13Pin, White)	W/H A/Con - W/H Blower	Backside the Glove Box	
C214 (20Pin, Black)	W/H Main - W/H Floor	Lower the Console Box	
C215 (6Pin, Yellow)	W/H Air Bag - W/H Air Bag EXTN	Passenger Cowl Side C/Holder	Side A/Bag
C215 (2Pin, Yellow)	W/H Air Bag - W/H Air Bag EXTN	Passenger Cowl Side C/Holder	
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C218 (21Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C220 (20Pin, Black)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Memory/Power
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Seat Warmer
C302 (21Pin, Black)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Memory/Power
C303 (6Pin, White)	W/H Driver Seat - W/H Seat Back	Under the Driver Seat	Memory/Power
C304 (16Pin, White)	W/H Floor - W/H Passenger Seat	Under the Passenger Seat	Power
C304 (6Pin, White)	W/H Floor - W/H Passenger Seat	Under the Passenger Seat	Seat Warmer
C305 (4Pin, White)	W/H Passenger Seat - W/H Seat Back	Under the Passenger Seat	Power
C306 (4Pin, Colorless)	W/H Floor - W/H RR A/Con	Inside the 3RD Seat RH Trim	Duel A/Con
C351 (21Pin, Black)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C352 (21Pin, White)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C361 (21Pin, White)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C362 (21Pin, Black)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C371 (21Pin, White)	W/H Floor - W/H RR LH DR	Under the Left "B" PLR	
C372 (4Pin, Black)	W/H RR LH DR - W/H DR EXTN	Inside the RR LH DR	
C381 (21Pin, White)	W/H Floor - W/H RR RH DR	Under the Right "B" PLR	
C382 (4Pin, Black)	W/H RR RH DR - W/H DR EXTN	Inside the RR RH DR	
C391 (10Pin, White)	W/H Floor - W/H Tail Gate	Inside the Tail Gate	
C392 (10Pin, White)	W/H Floor - W/H Tail Gate	Inside the Tail Gate	
C393 (4Pin, Colorless)	W/H Floor - W/H Tail Gate	Inside the RR RH Upper QTR Trim	
C394 (6Pin, Black)	W/H Floor - W/H Trailer	Under the RR Bumper (RH)	Trailer
C901 (12Pin, Black)	W/H Floor - W/H T/M	Upper the T/M	A/T
C901 (4Pin, Black)	W/H Floor - W/H T/M	Upper the T/M	M/T
C902 (4Pin, Black)	W/H Floor - W/H Fuel Sender	Upper the T/M	
C903 (15Pin, Black)	W/H Floor - W/H EAS	Lower the Passenger	
C904 (8Pin, Black)	W/H Floor - W/H PAS	Under the RR Bumper (LH)	
C905 (8Pin, Black)	W/H Floor - W/H EPB	Under the RR Bumper (LH)	
C906 (4Pin, Black)	W/H Floor - W/H EPB	Under the RR Bumper (LH)	
C907 (4Pin, Black)	W/H Floor - W/H EAS Sensor	Under the RR Bumper (LH)	
C908 (4Pin, Black)	W/H Floor - W/H EAS Sensor	Under the RR Bumper (RH)	

Modification basis	
Application basis	
Affected VIN	

▶ GROUND

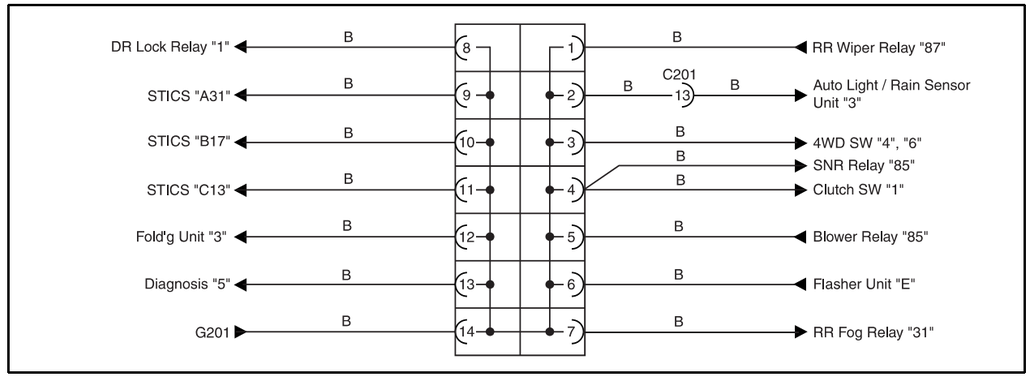
Connector Number	Connecting Wiring Harness	Connector Position	Remark
G101	W/H Eng	Center the Eng Room Fuse Box	
G102	W/H Eng	Center the Eng BATT	
G103	W/H Eng	Backside LH Head Lamp	
G104	W/H Eng	Backside RH Head Lamp	
G105	W/H Eng	Beside Coolant Reserve Tank	ABS/ESP
G201	W/H Main	Under the Driver Cowl Side PNL	
G202	W/H Main	Lower the Console Box	
G203	W/H Main	Inside the Passenger Cowl Side PNL	
G204	W/H Main	Beside Eng ECU (D27DTP)	
G205	W/H Main	Beside Eng ECU (GSL)	
G301	W/H Floor	Under the Driver Seat	
G302	W/H Floor	Under the Passenger Seat	
G303	W/H Floor	Under the LH “B” PLR	
G304	W/H Floor	Inside the LH QTR GLS Lower	
G305	W/H Floor	Inside the LH QTR GLS Lower	
G401	W/H Tail Gate	Center the Tail Gate	
G402	W/H Tail Gate	LH The Tail Gate	

▶ SPLICE PACK

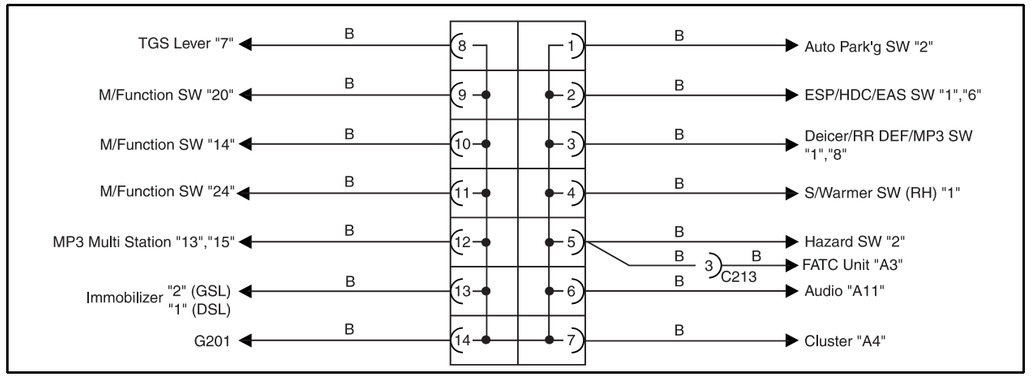
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	CAN
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S301 (14Pin, Black)	W/H Floor	Under the Driver Seat	CAN

4) SPLICE PACK CIRCUIT

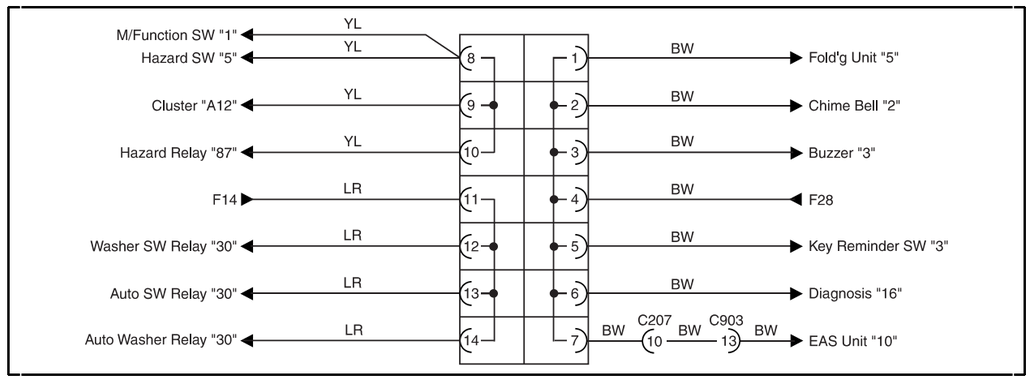
▶ S201 (GND)



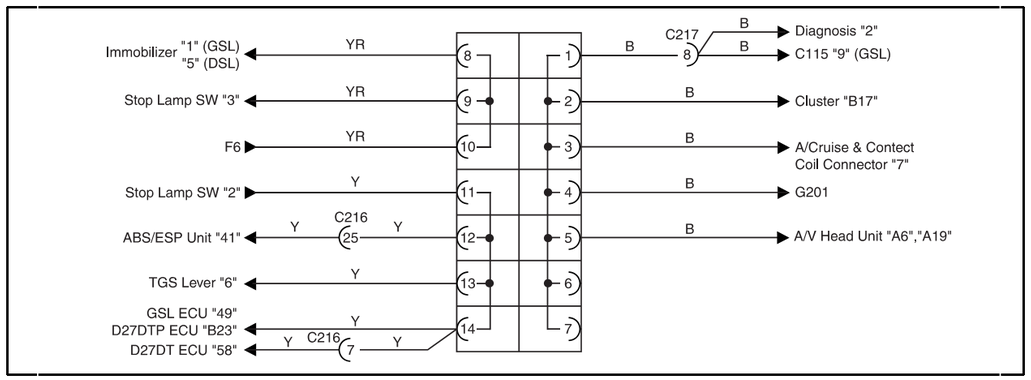
▶ S204 (GND)



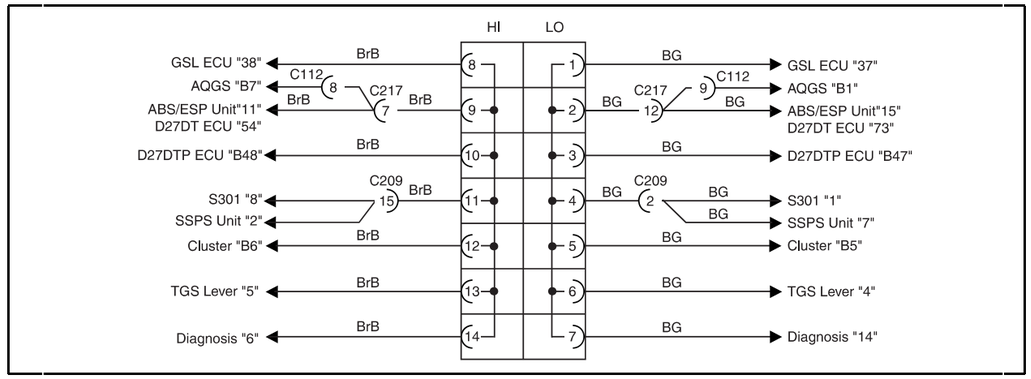
▶ S202



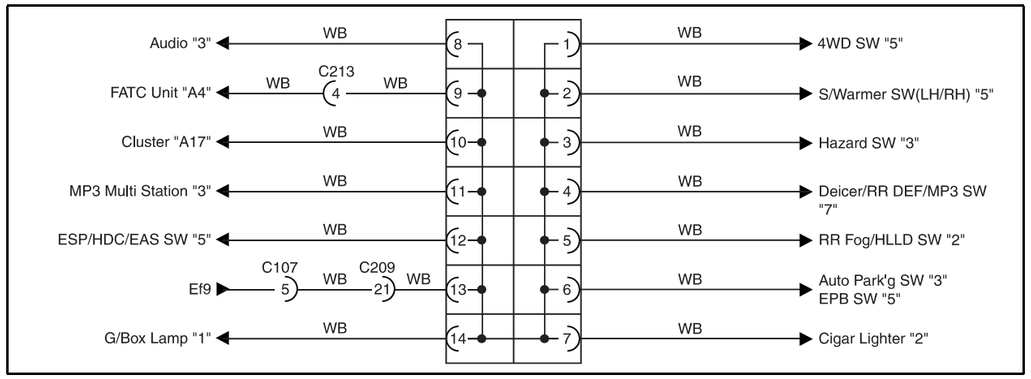
▶ S205



▶ S203 (CAN)

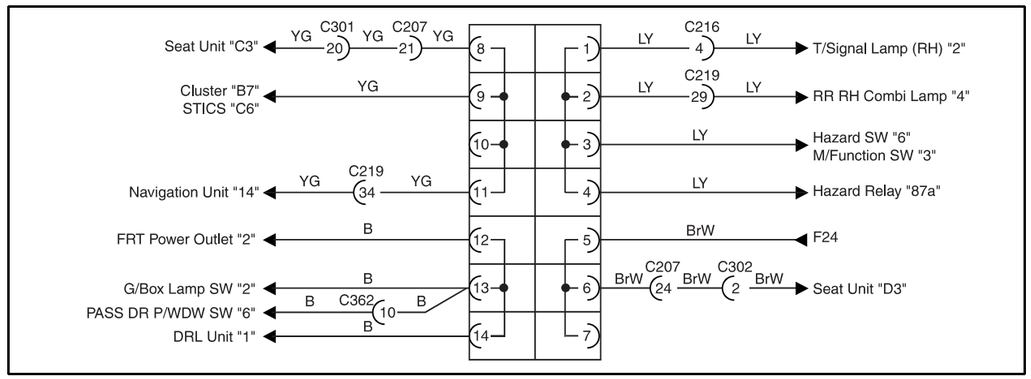


▶ S206 (ILL)

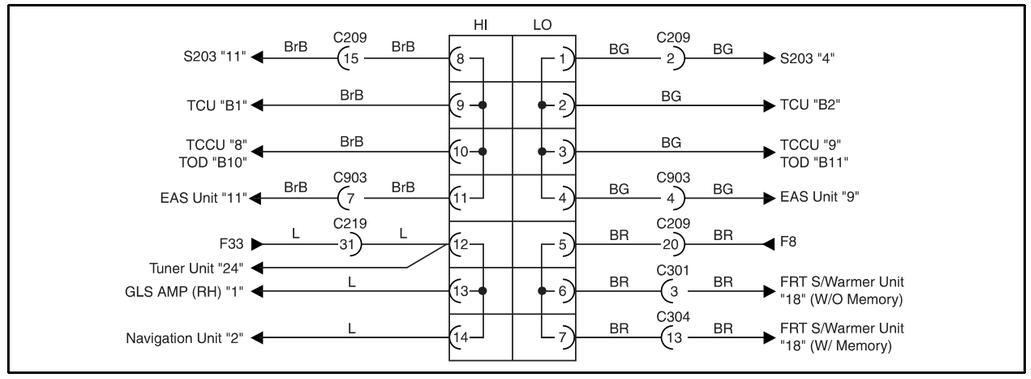


Modification basis	
Application basis	
Affected VIN	

▶ S207

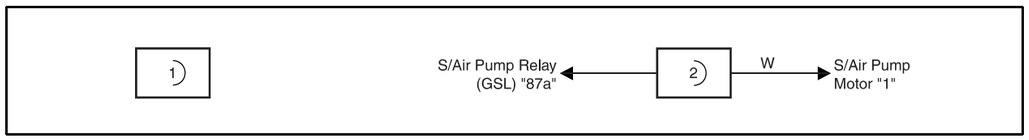


▶ S301 (CAN)

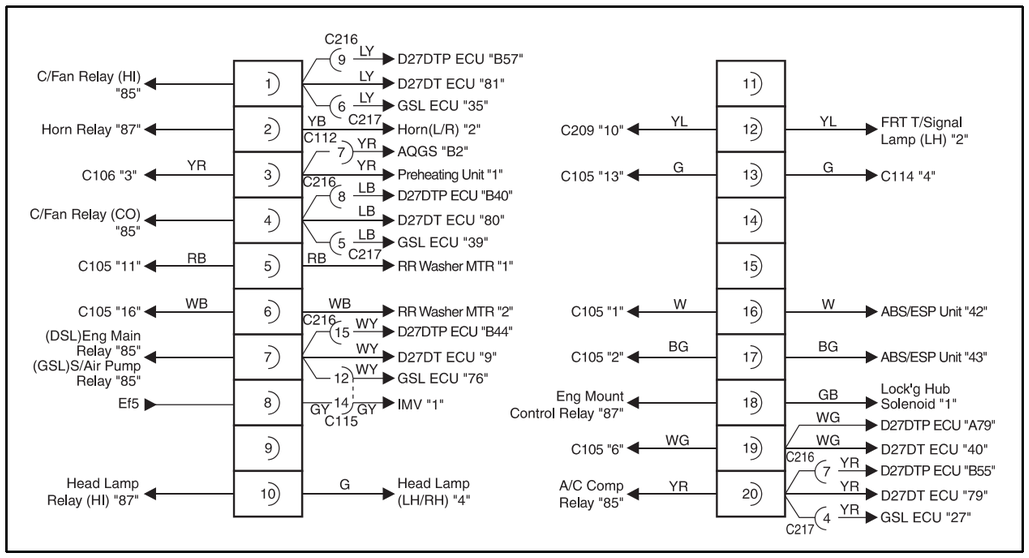


5) CONNECTOR CIRCUIT

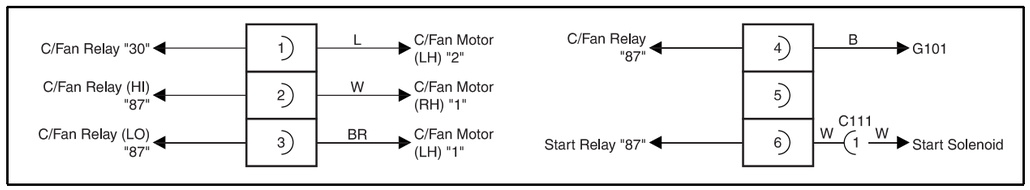
▶ C101



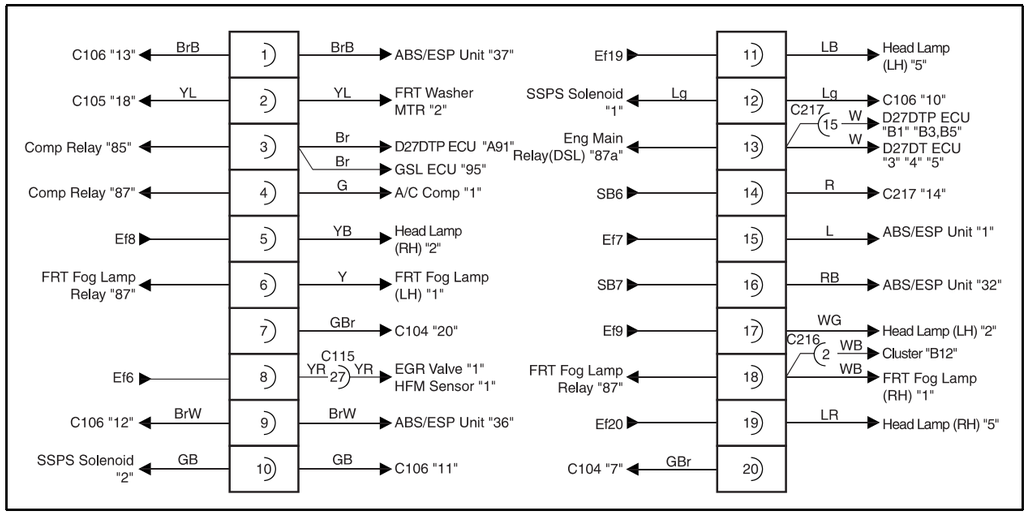
▶ C102



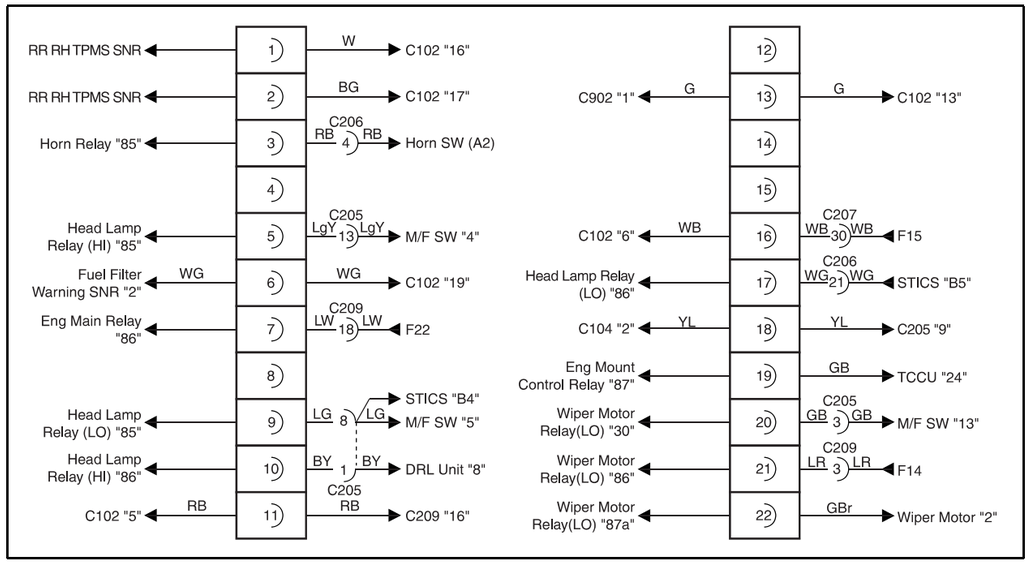
▶ C103



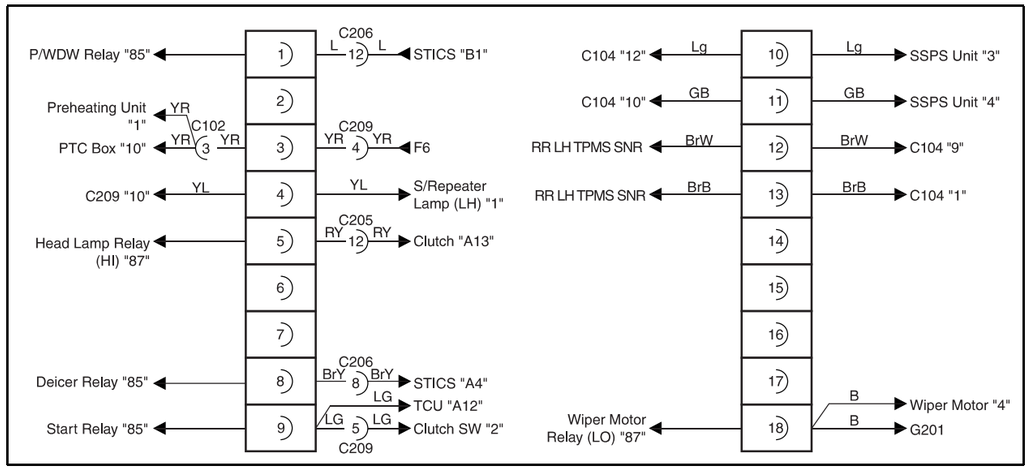
▶ C104



▶ C105

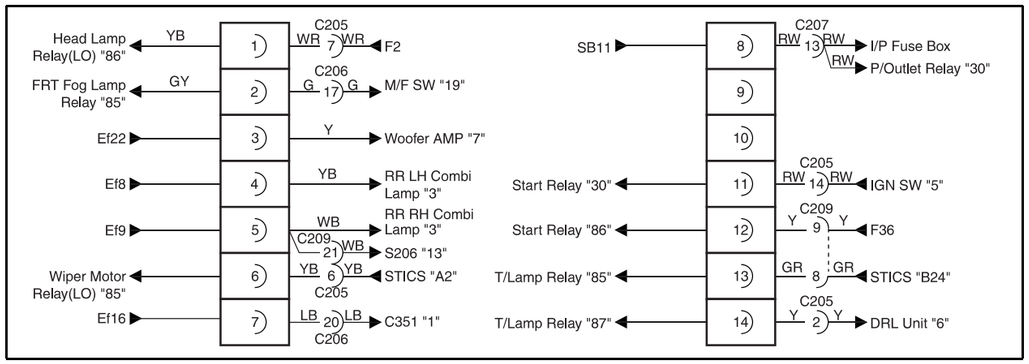


▶ C106

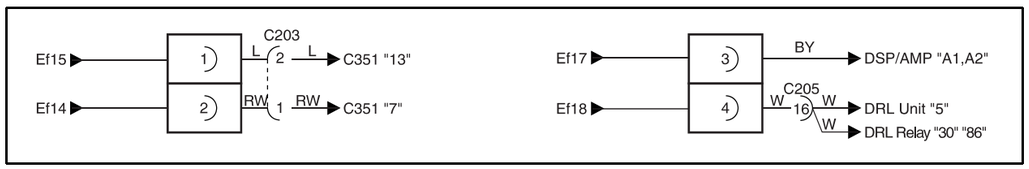


Modification basis	
Application basis	
Affected VIN	

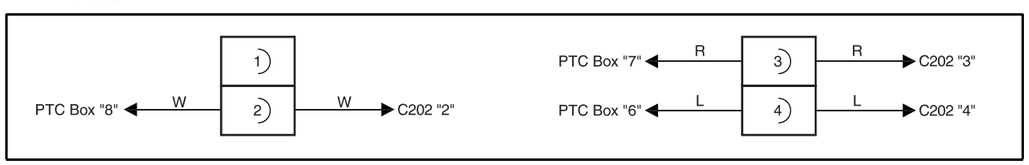
▶ C107



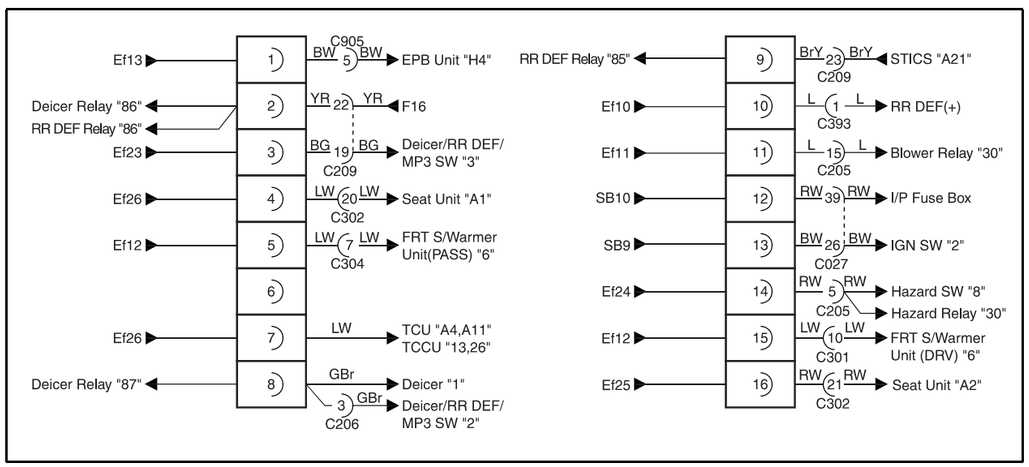
▶ C108



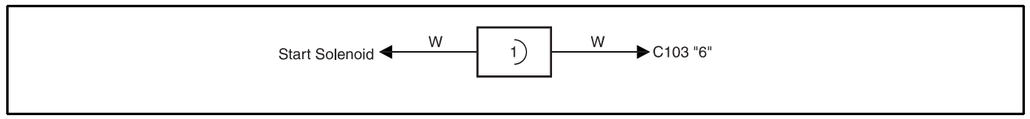
▶ C109



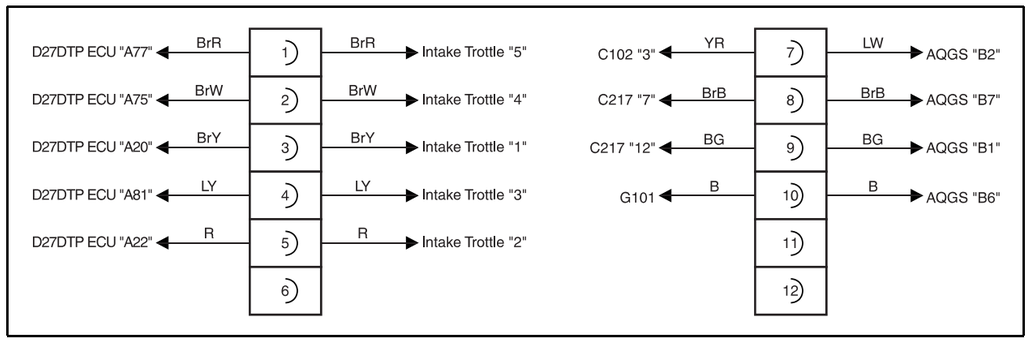
▶ C110



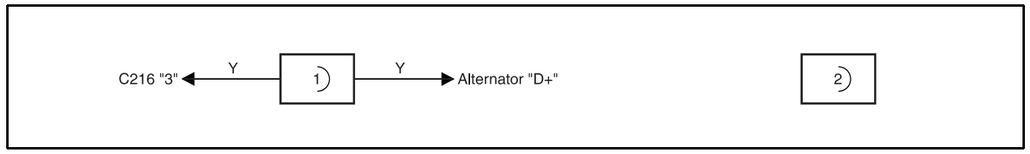
▶ C111



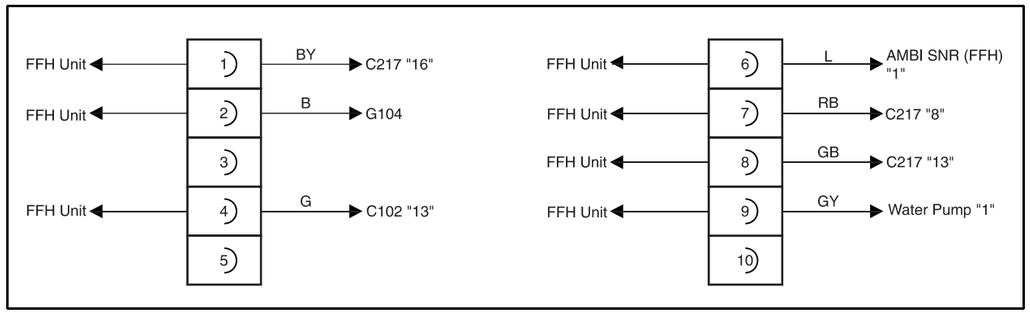
▶ C112



▶ C113



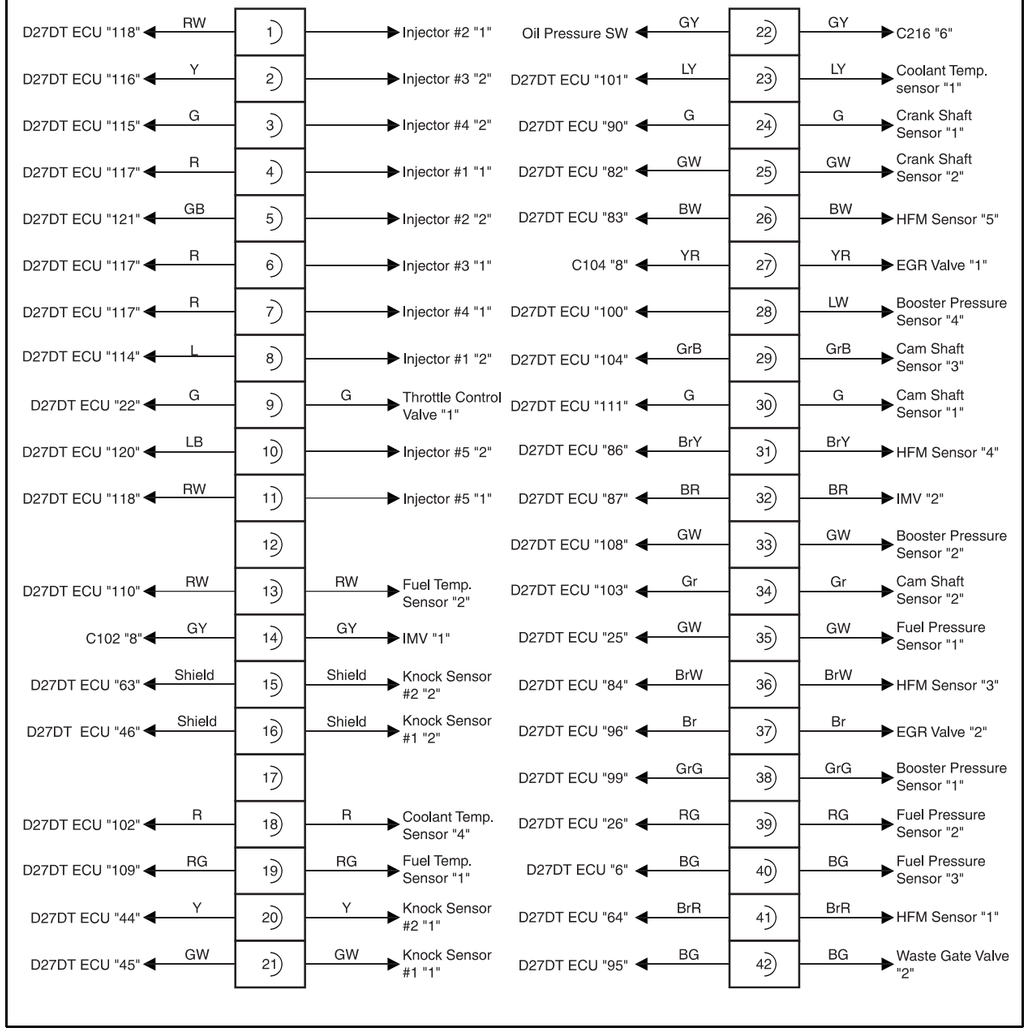
▶ C114



Modification basis	
Application basis	
Affected VIN	

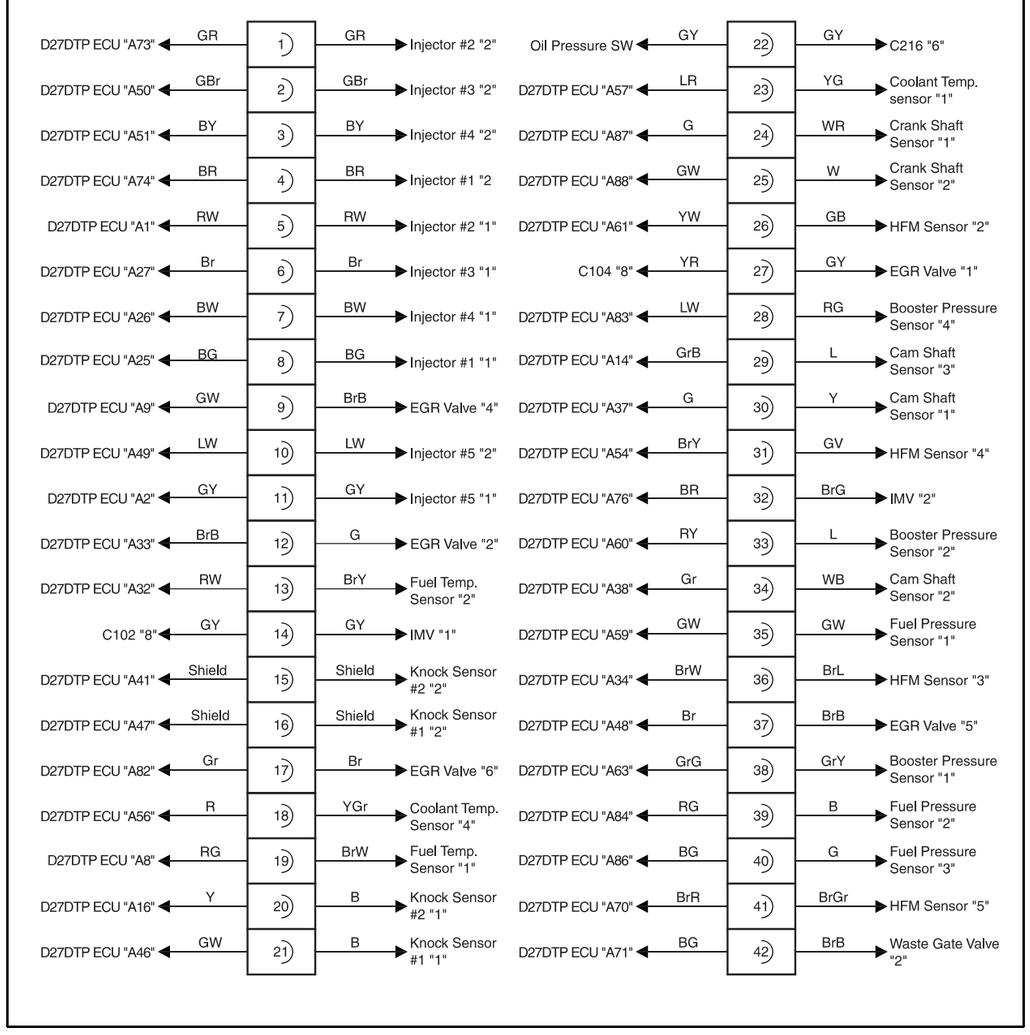
▶ **C115**

(D27DT)



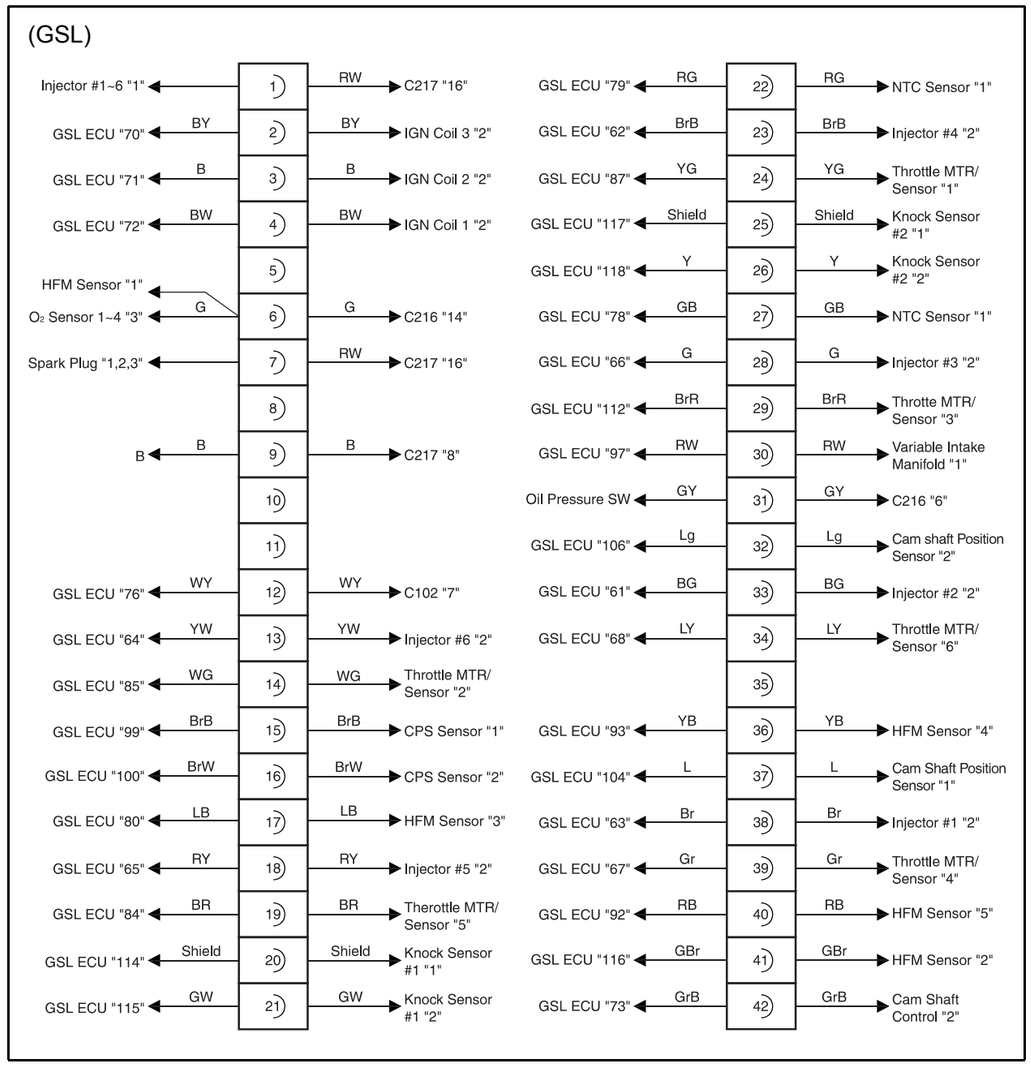
▶ **C115**

(D27DTP)

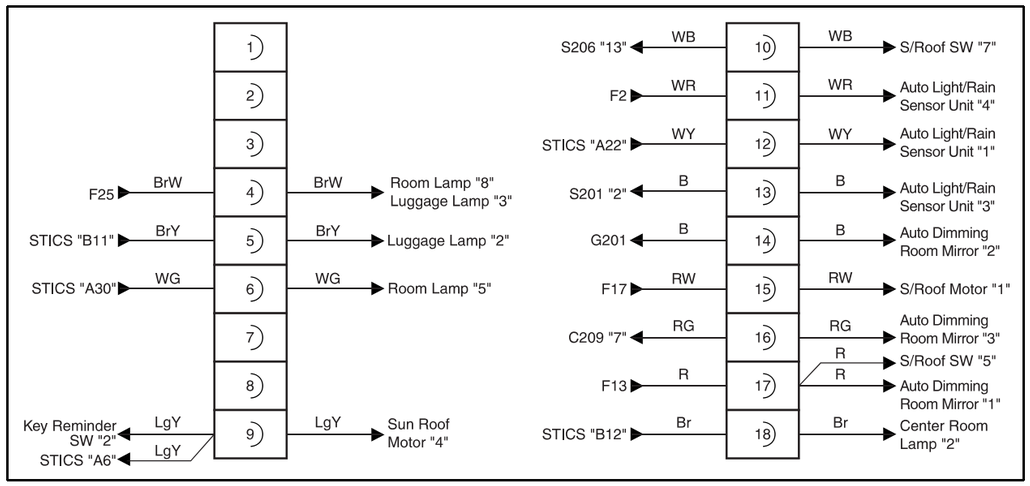


Modification basis	
Application basis	
Affected VIN	

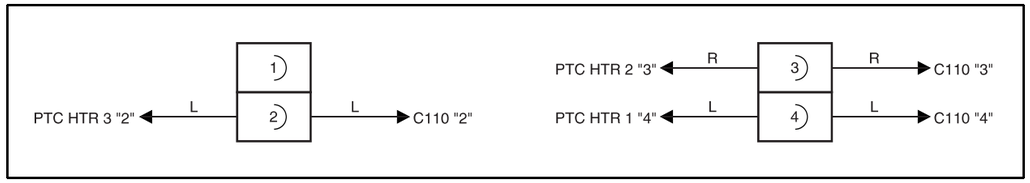
▶ C115



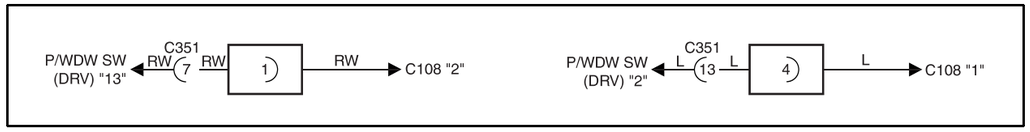
▶C201



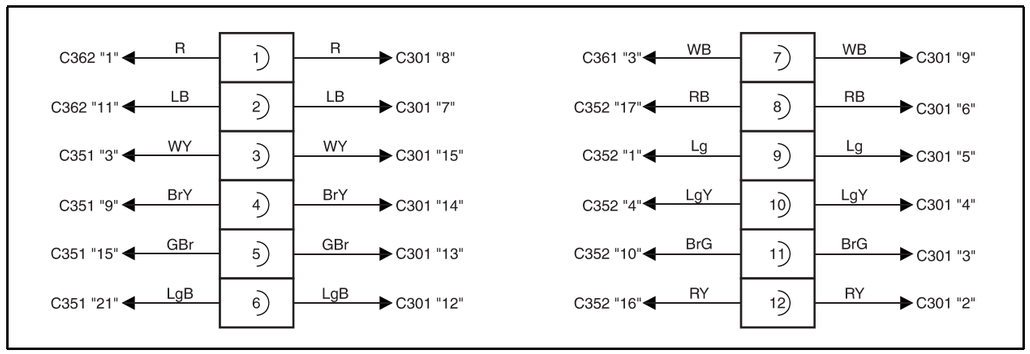
▶202



▶C203

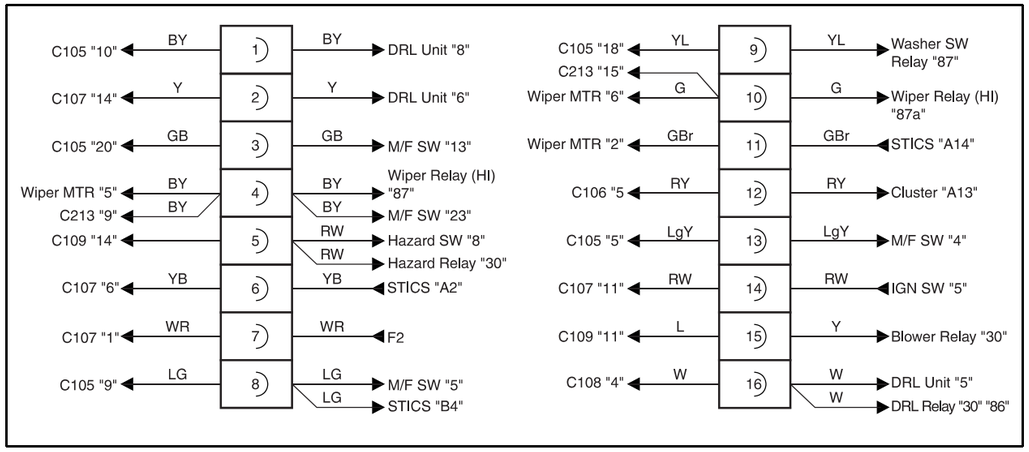


▶C204

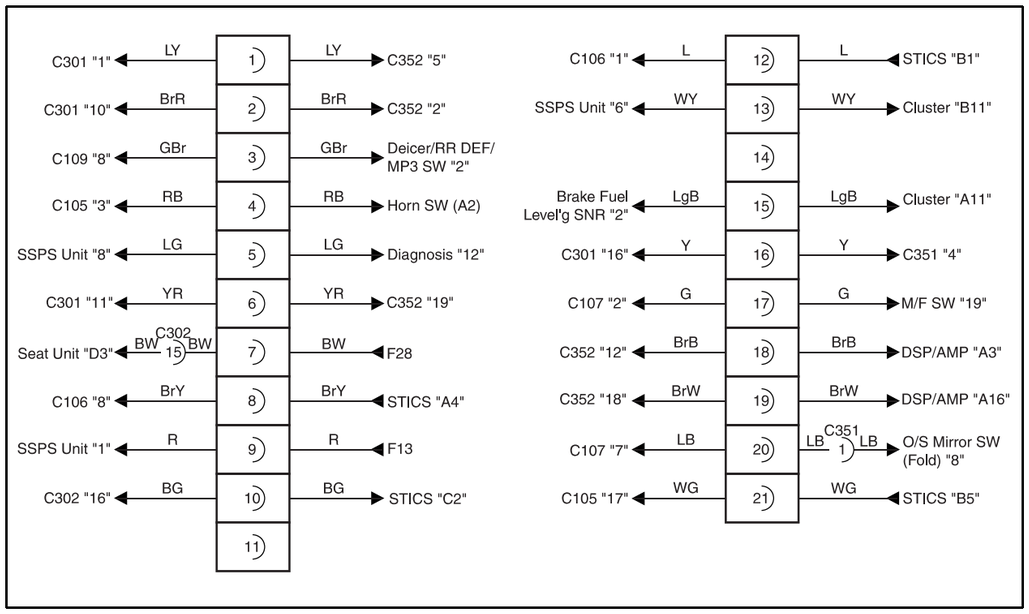


Modification basis	
Application basis	
Affected VIN	

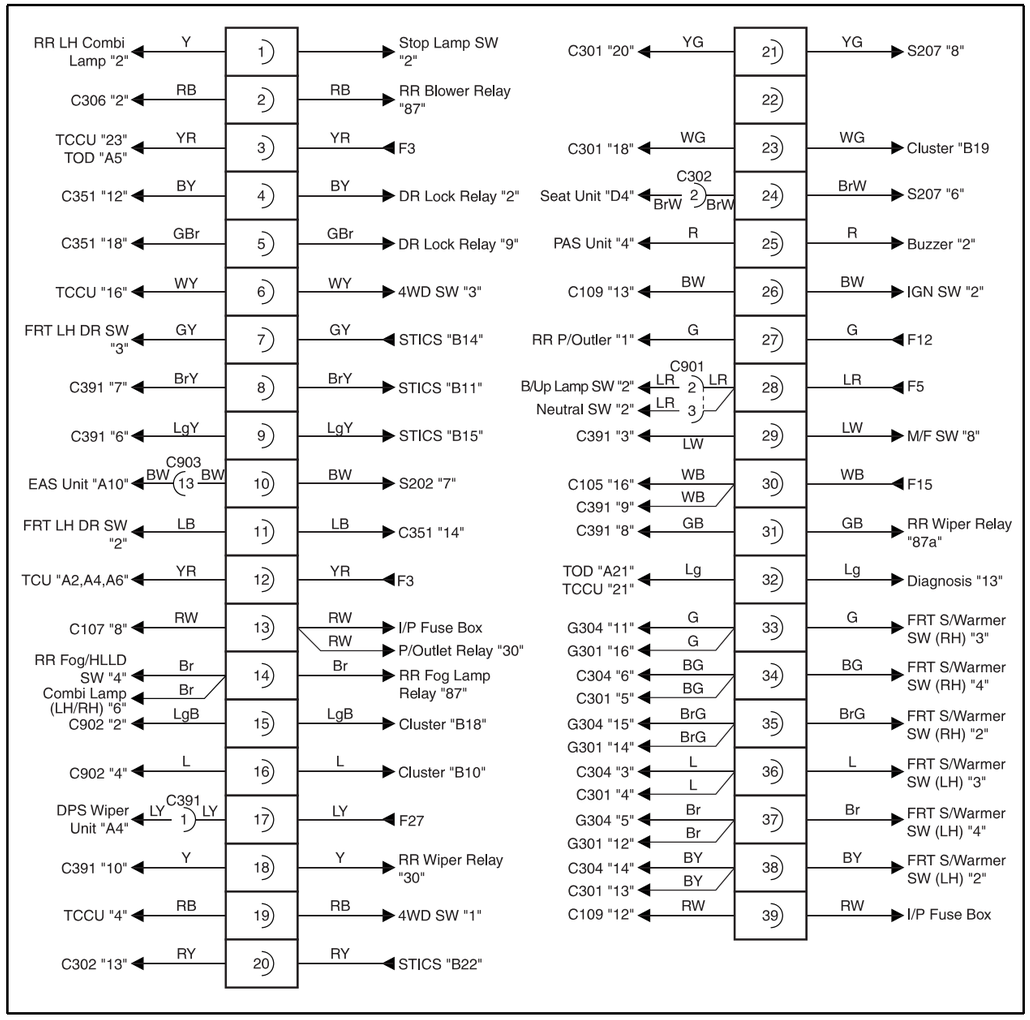
▶ C205



▶ C206

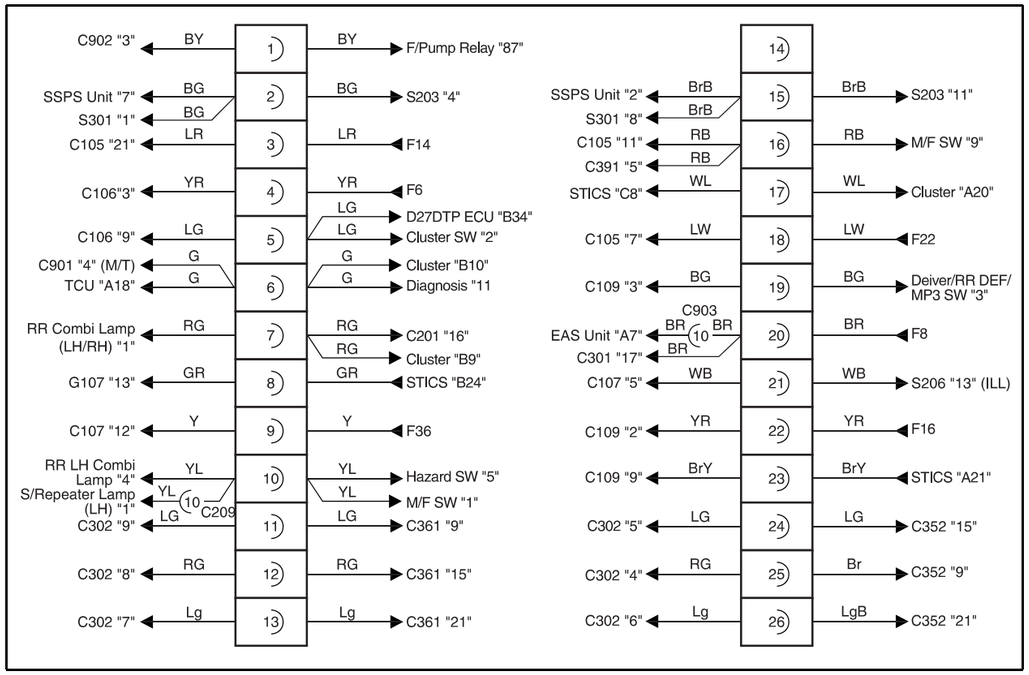


▶ C207

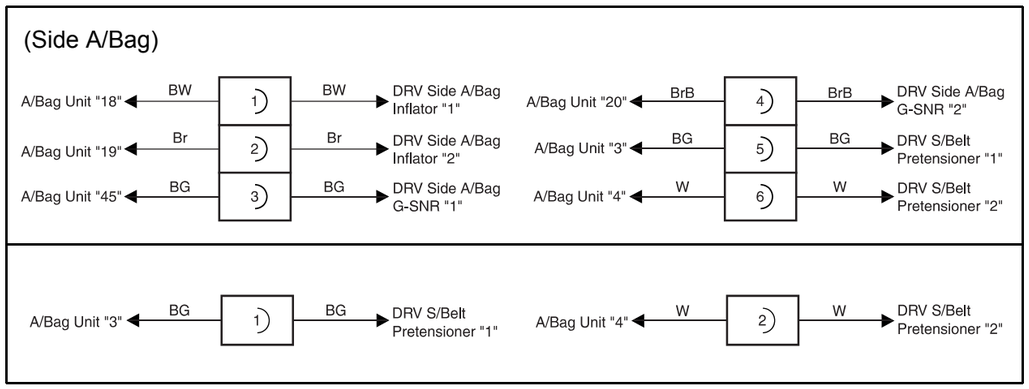


Modification basis	
Application basis	
Affected VIN	

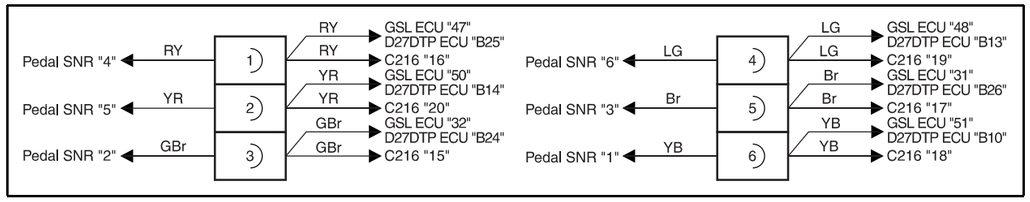
▶ C209



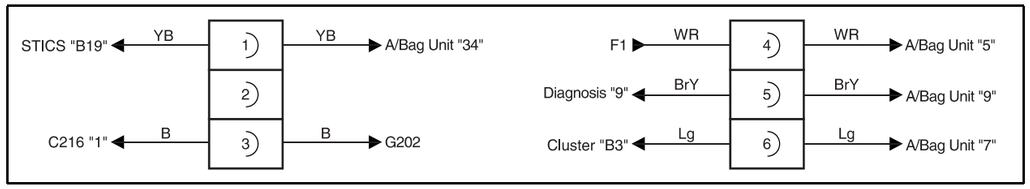
▶ C210



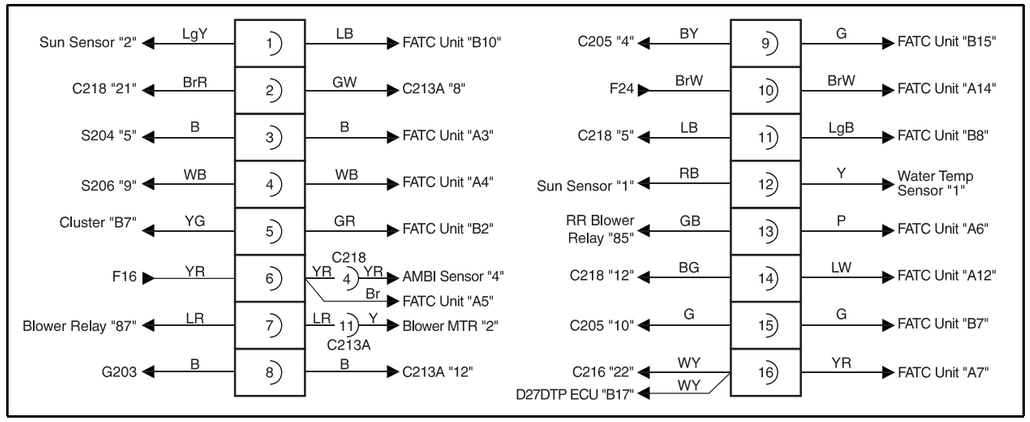
▶ C211



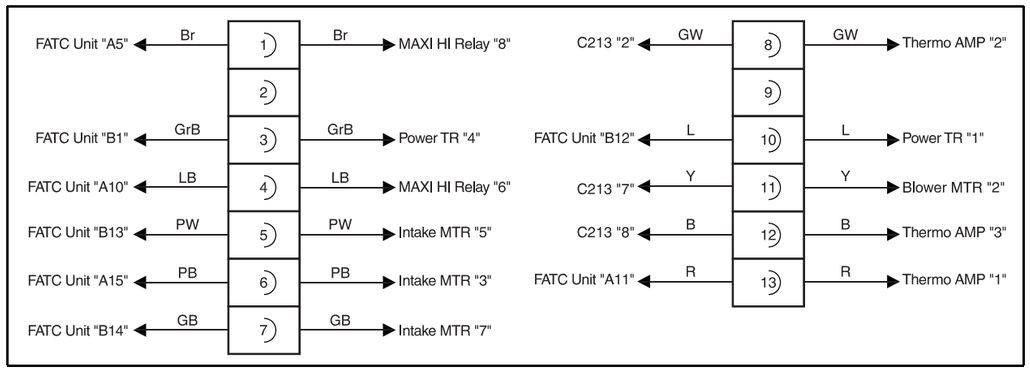
▶ C212



▶ C213

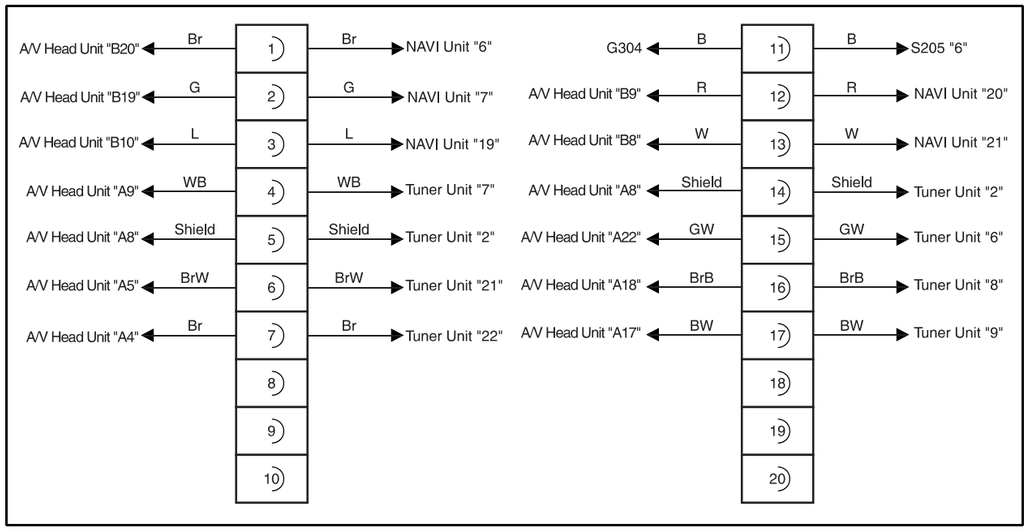


▶ C213A

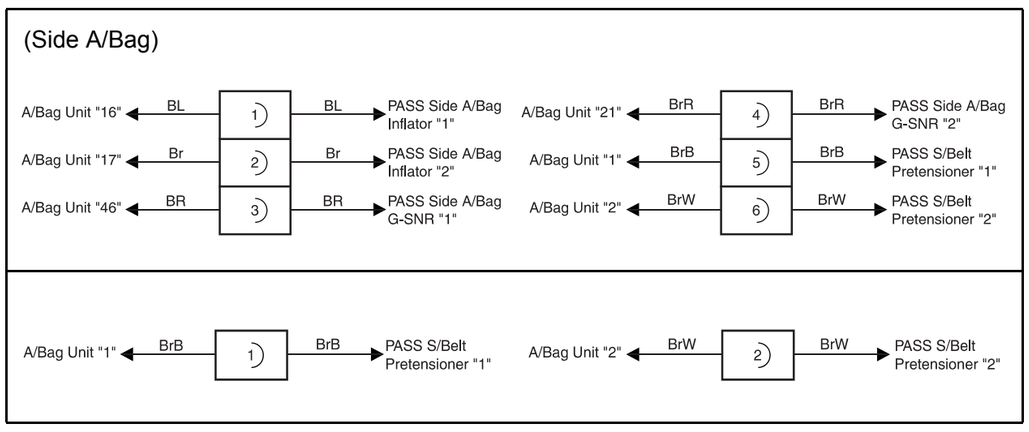


Modification basis	
Application basis	
Affected VIN	

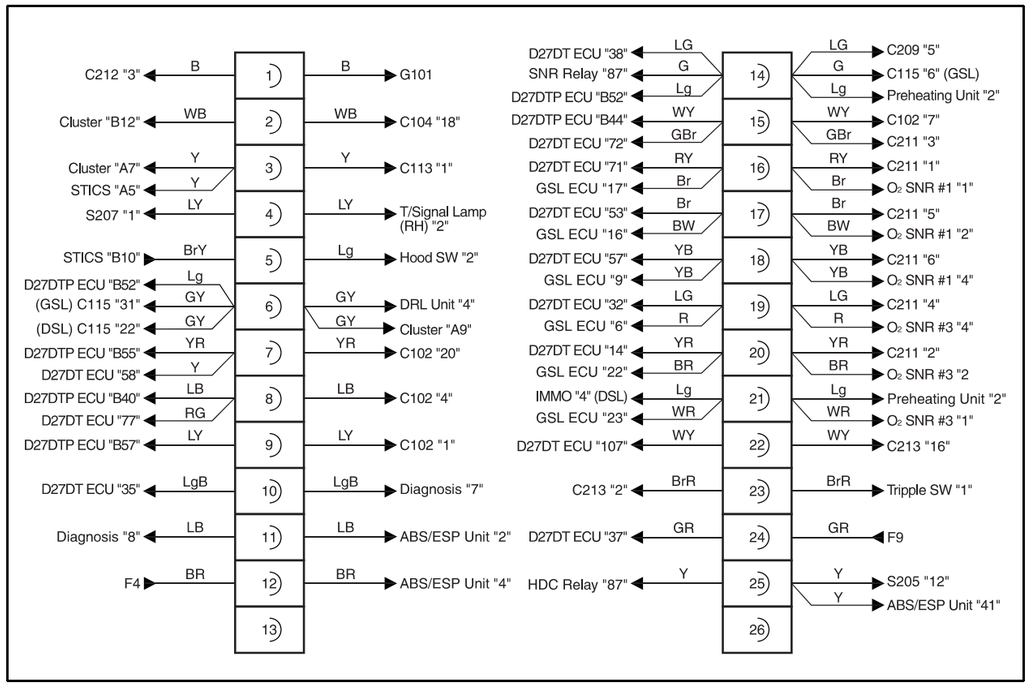
▶ C214



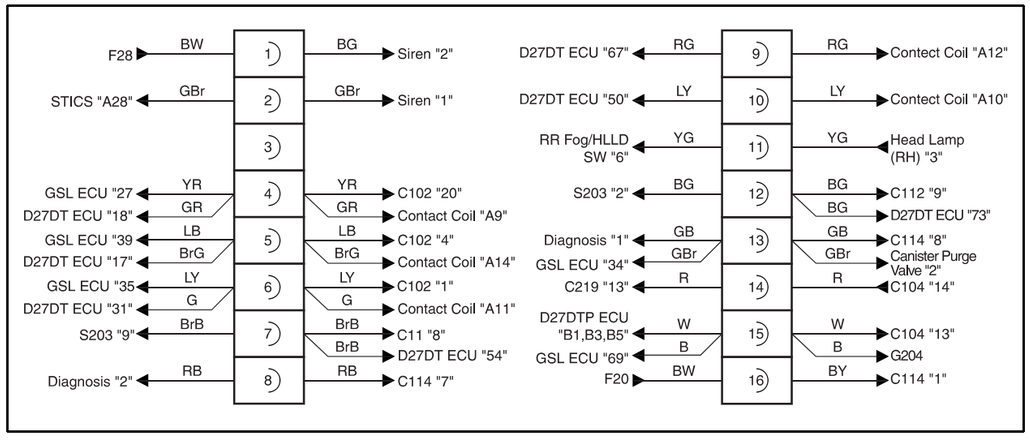
▶ C215



▶ C216

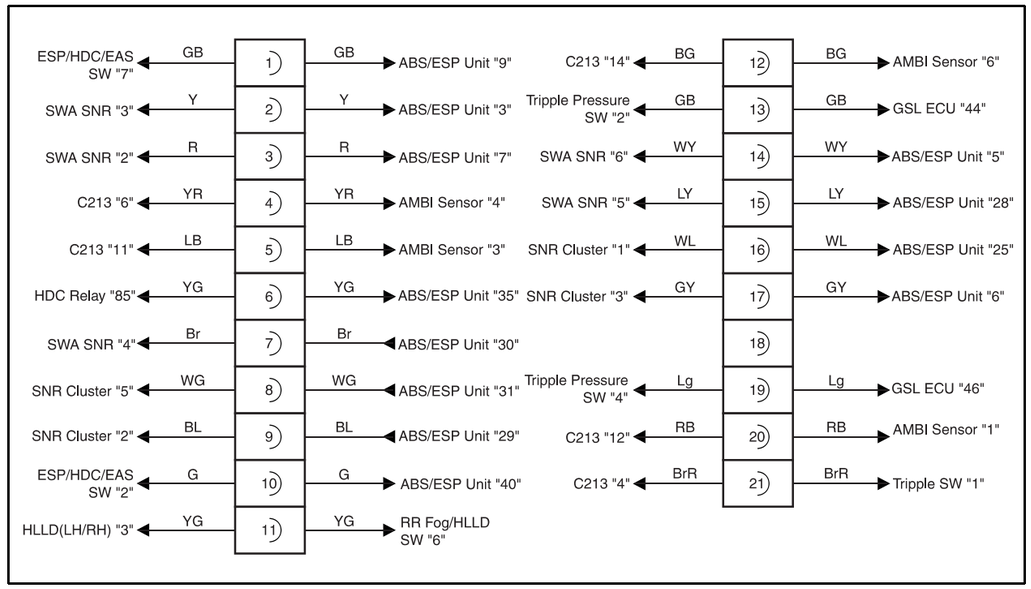


▶ C217

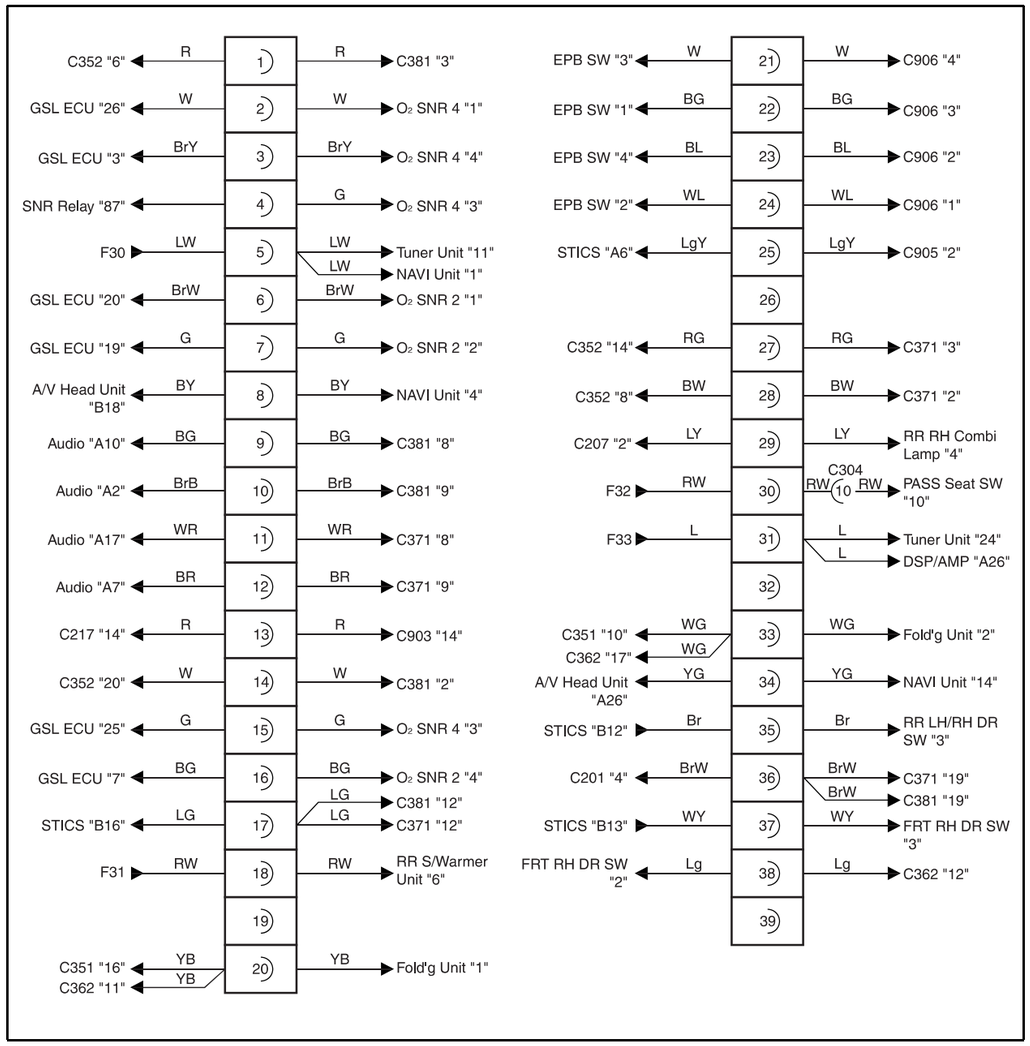


Modification basis	
Application basis	
Affected VIN	

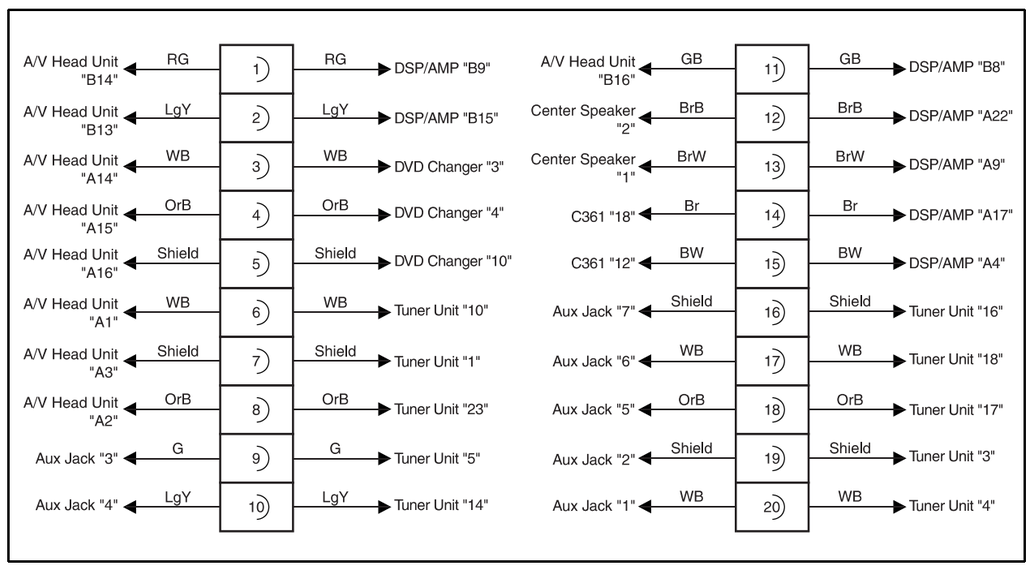
▶ C218



▶ C219

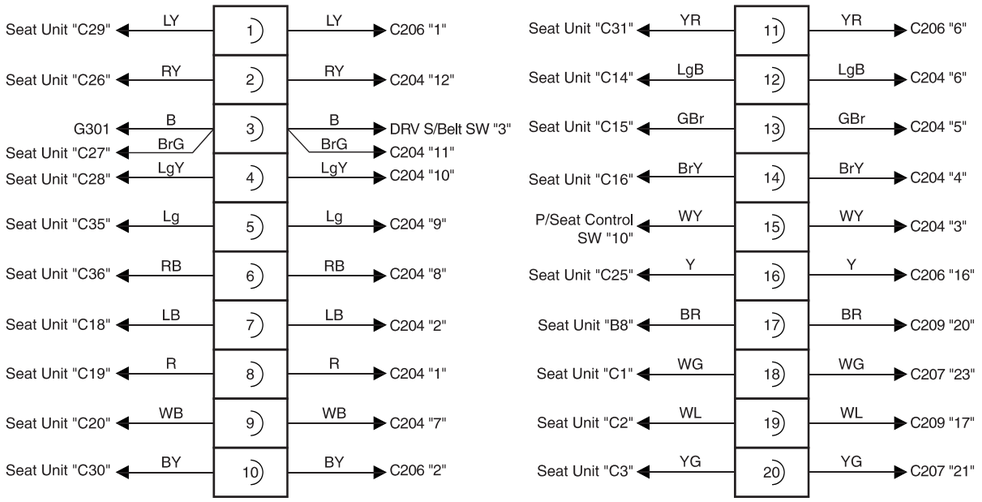


▶ C220

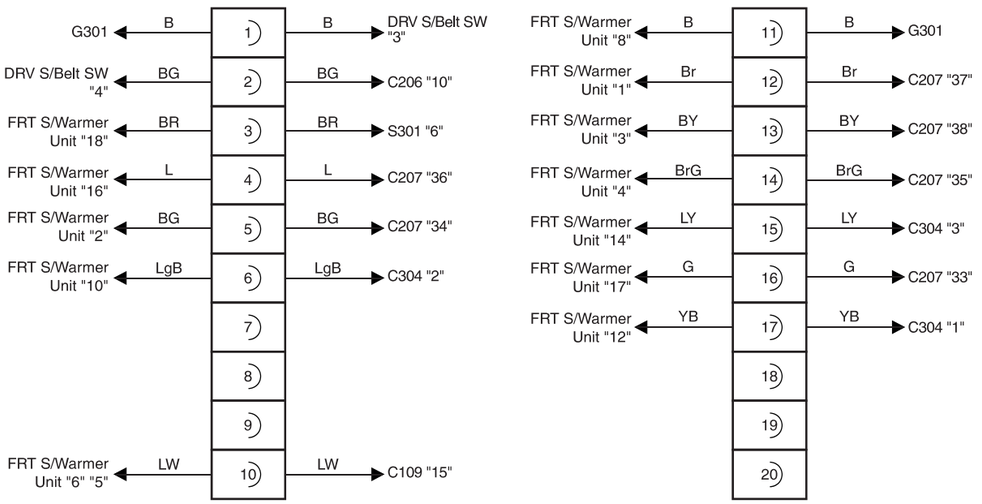


▶ C301

(W/ Memory, Power)

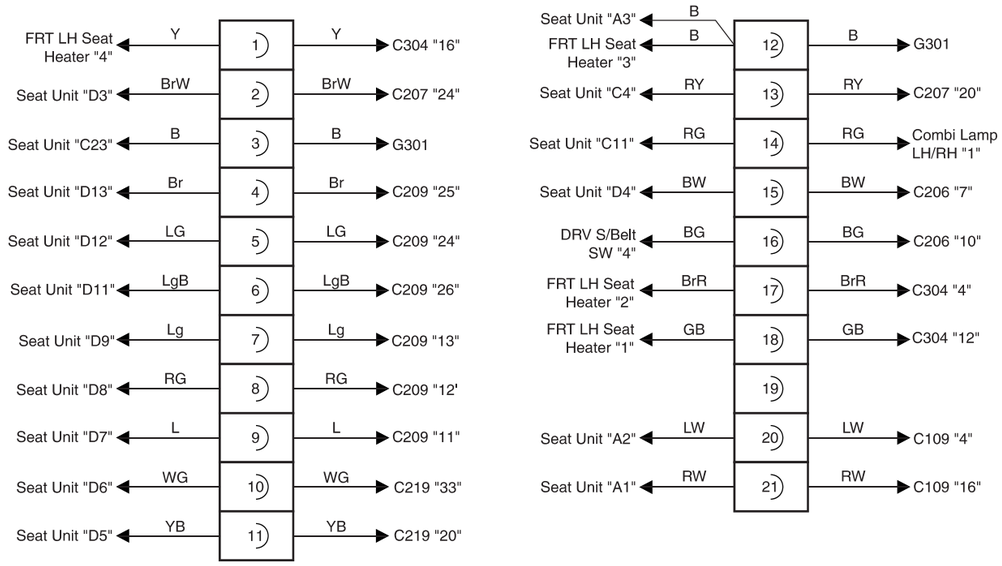


(W/O Memory)



▶ C302

(W/ Memory, Power)

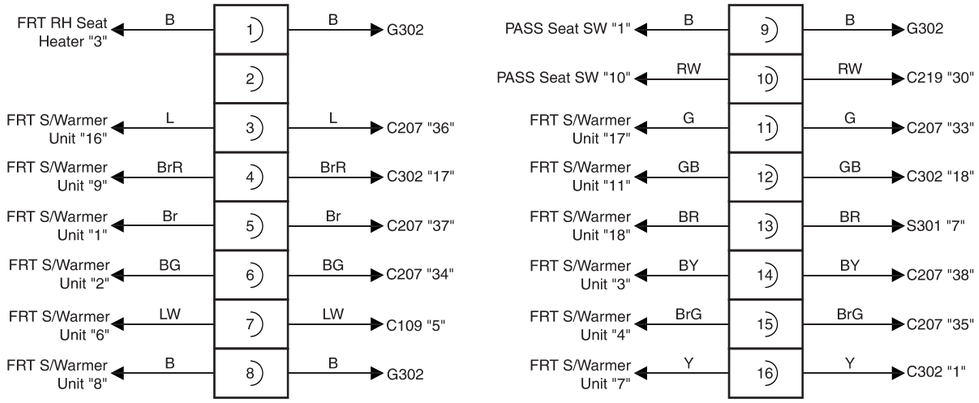


▶ C303

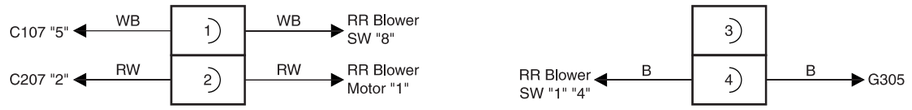
Modification basis	
Application basis	
Affected VIN	

▶C304

(W/ Memory, Power)



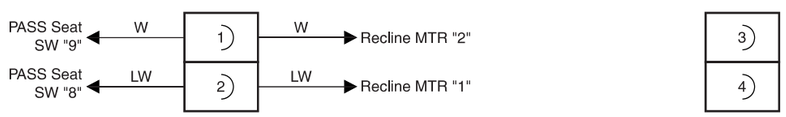
(W/O Memory)



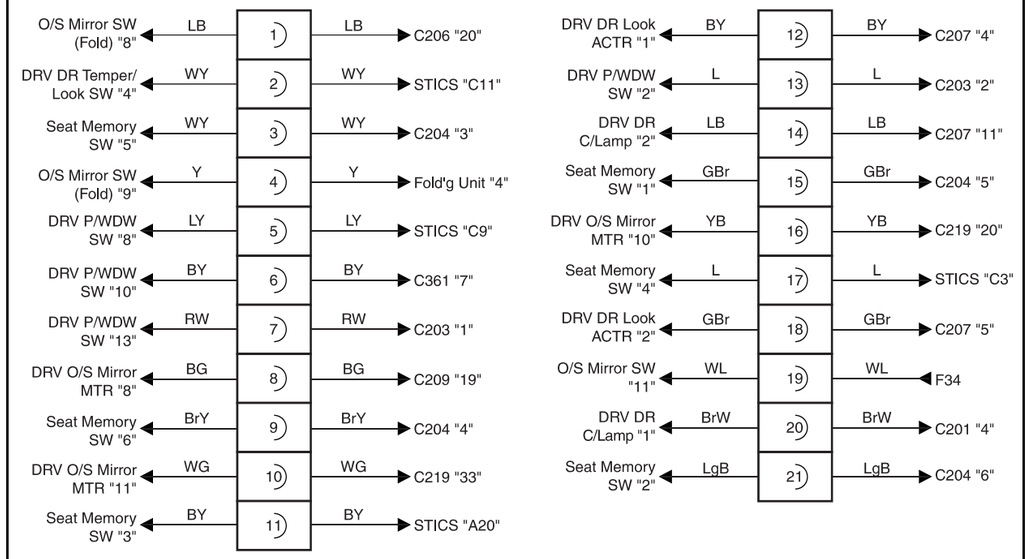
▶C305

(W/ Memory, Power)

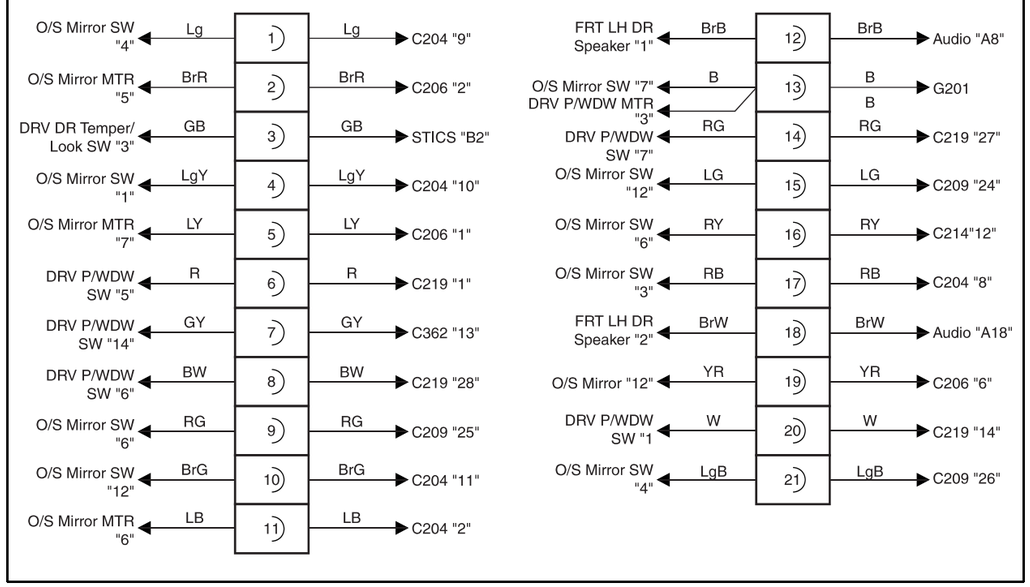
▶C306



▶C351

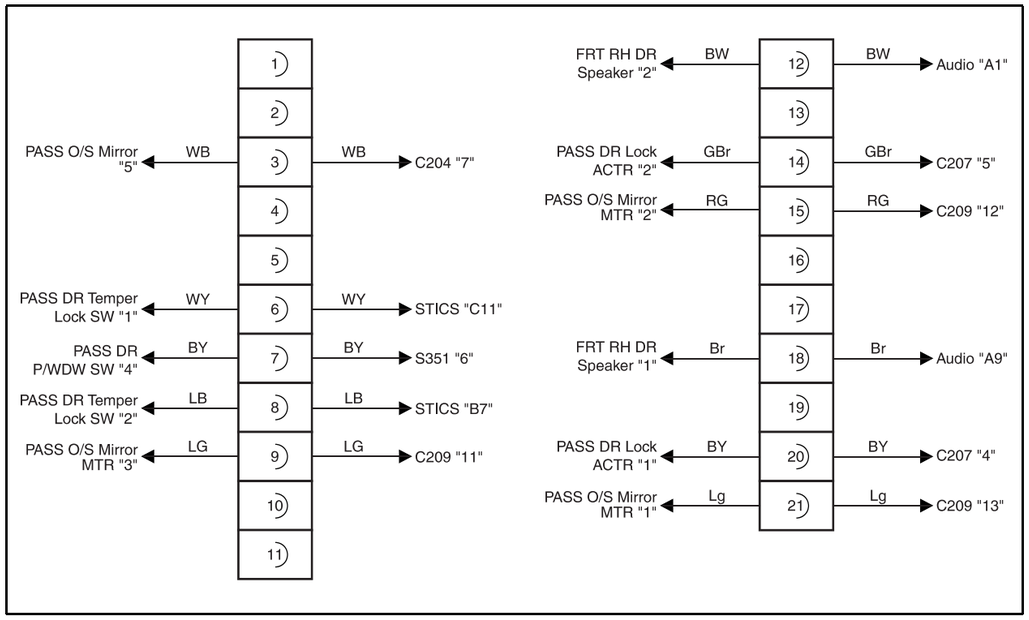


▶C352

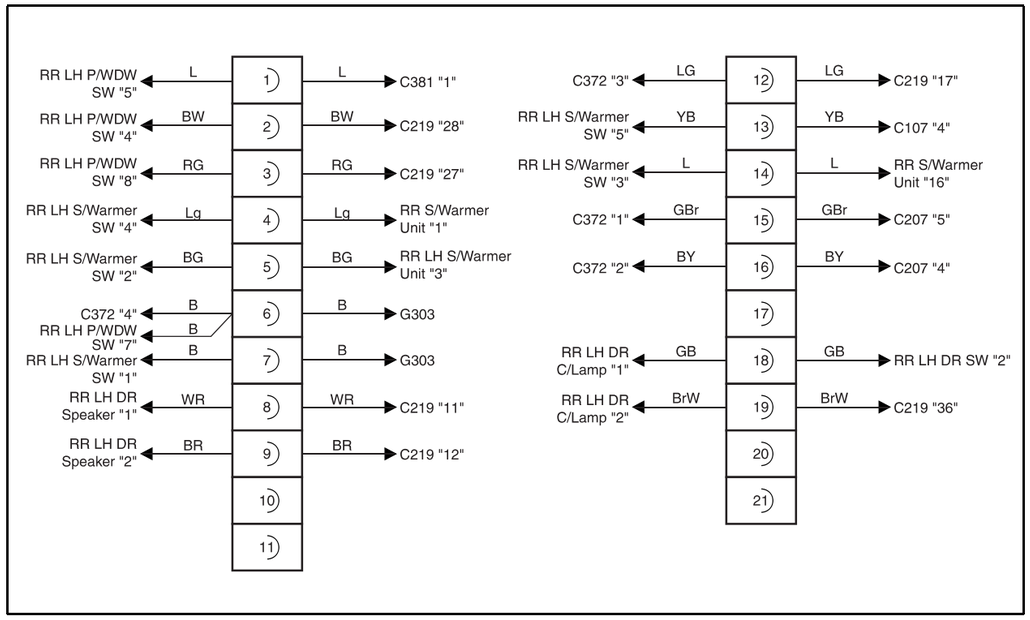


Modification basis	
Application basis	
Affected VIN	

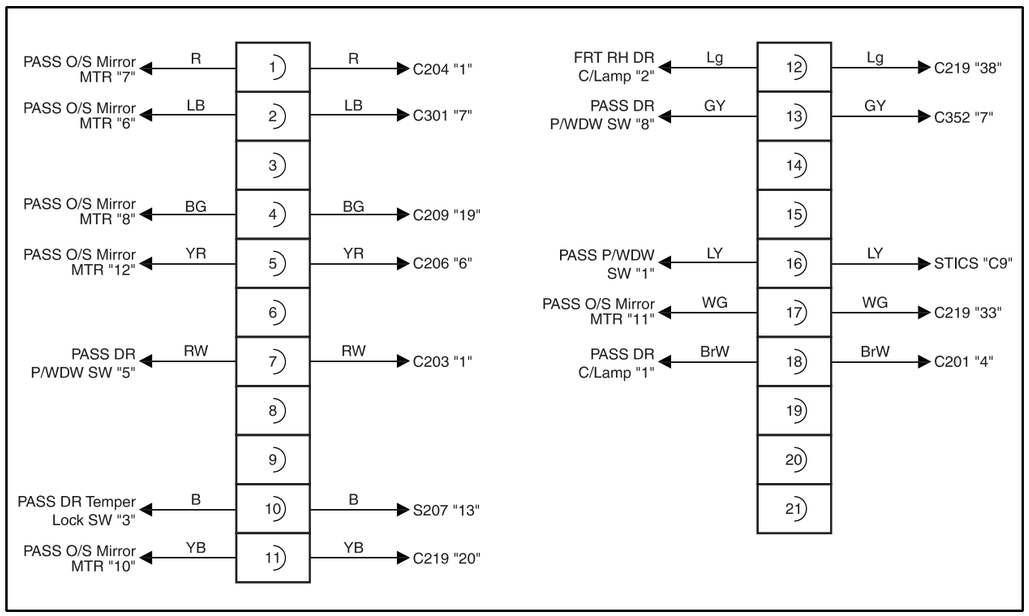
▶C361



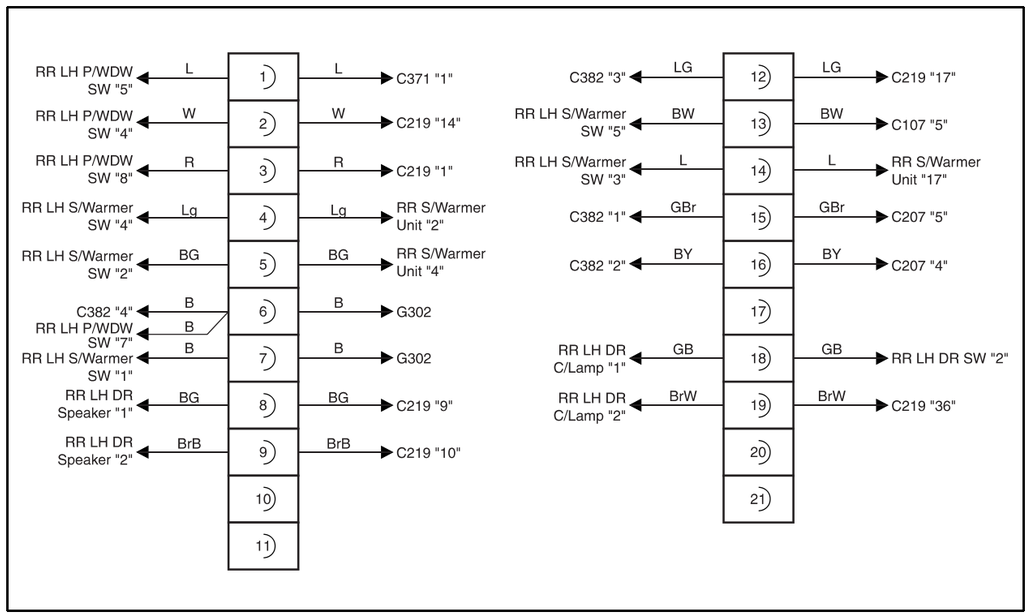
▶C371



▶C362



▶C381

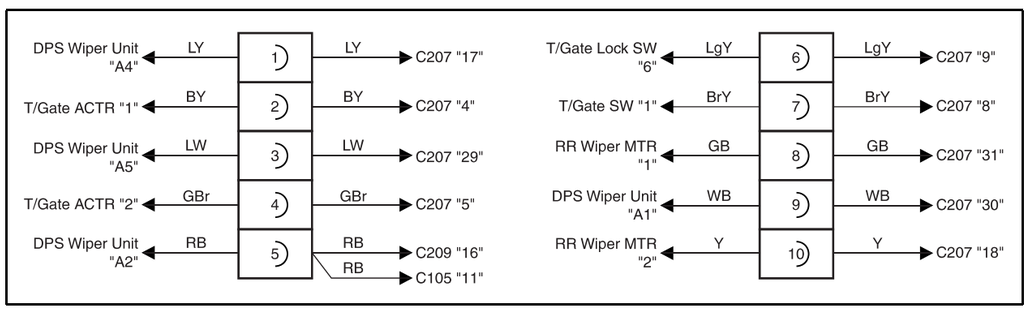


Modification basis	
Application basis	
Affected VIN	

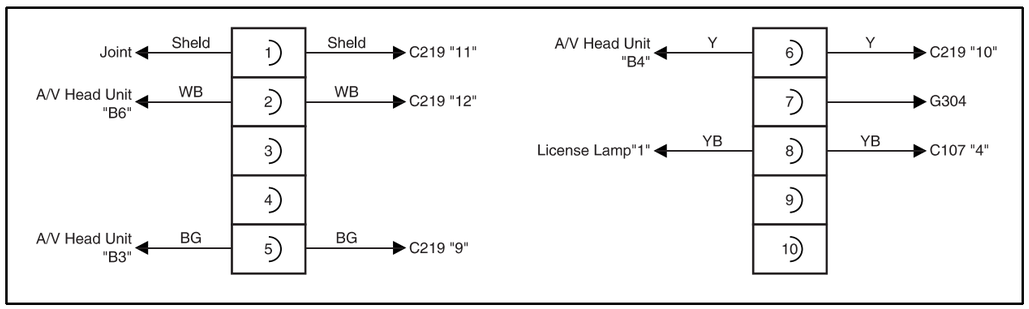
▶C372

▶C382

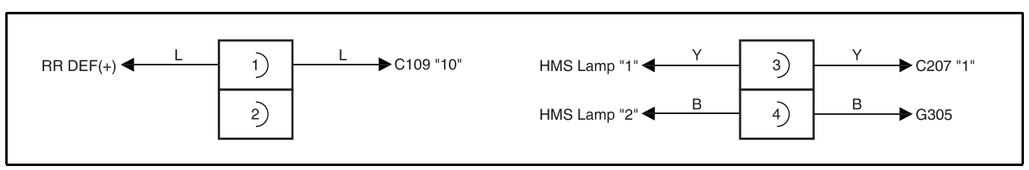
▶C391



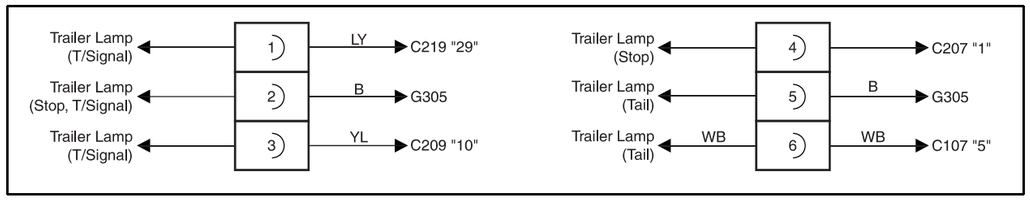
▶C392



▶C393

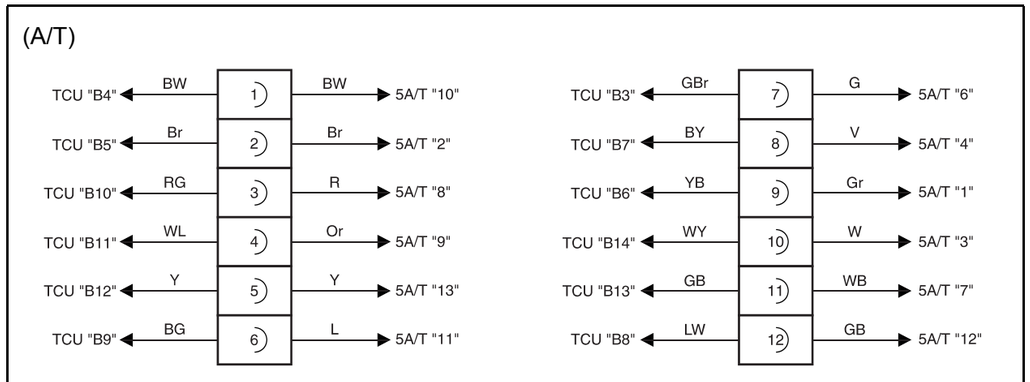


▶C394

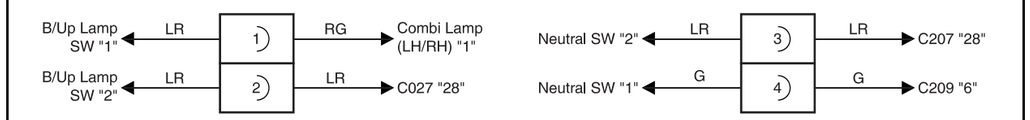


▶C901

(A/T)

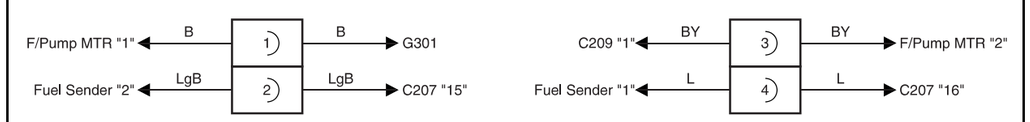


(M/T)

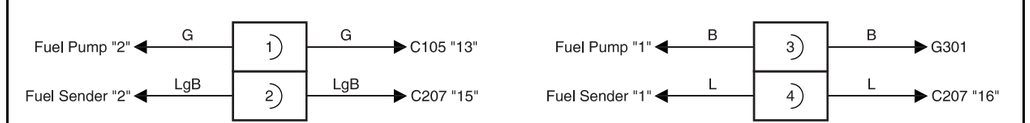


▶C902

(GSL)

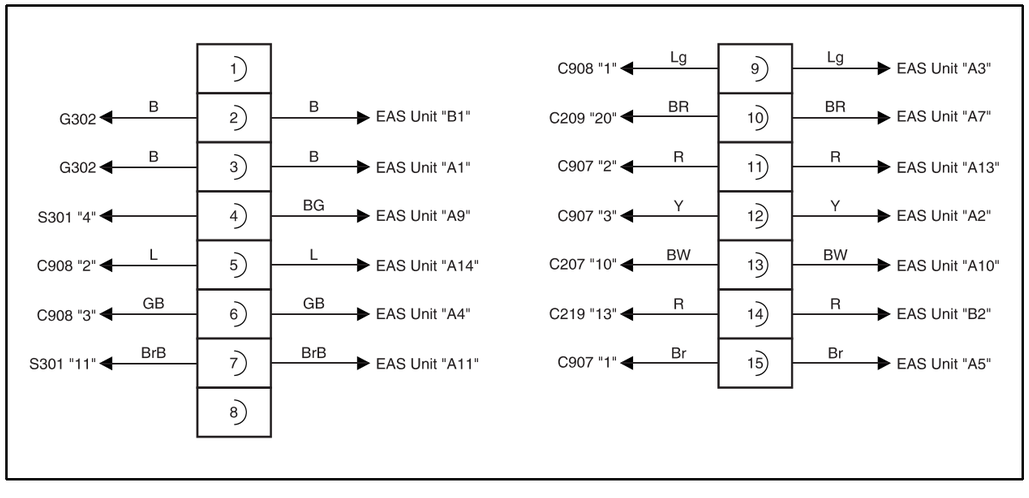


(DSL)

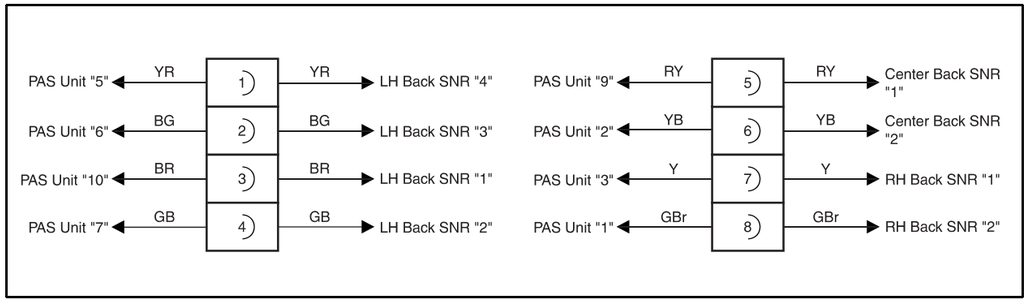


Modification basis	
Application basis	
Affected VIN	

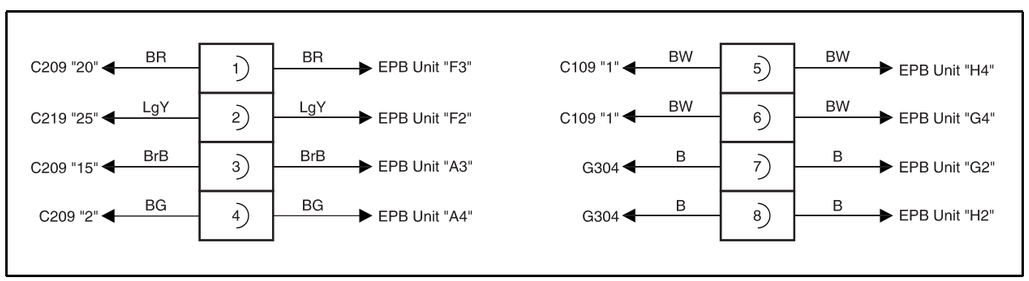
▶C903



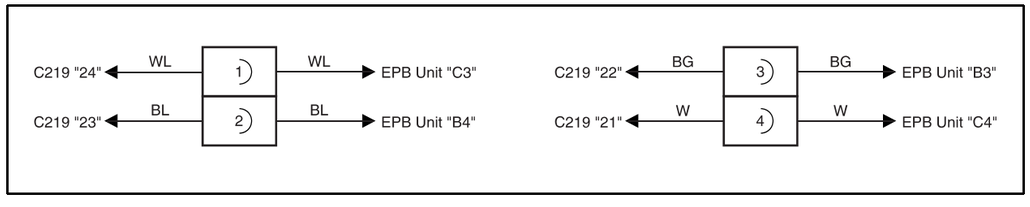
▶C904



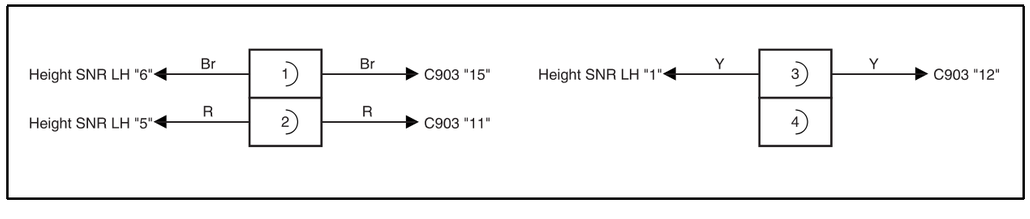
▶C905



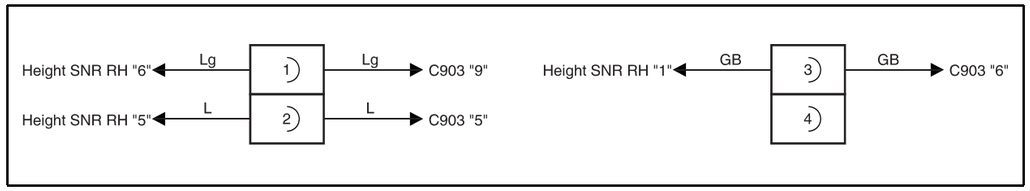
▶C906



▶C907

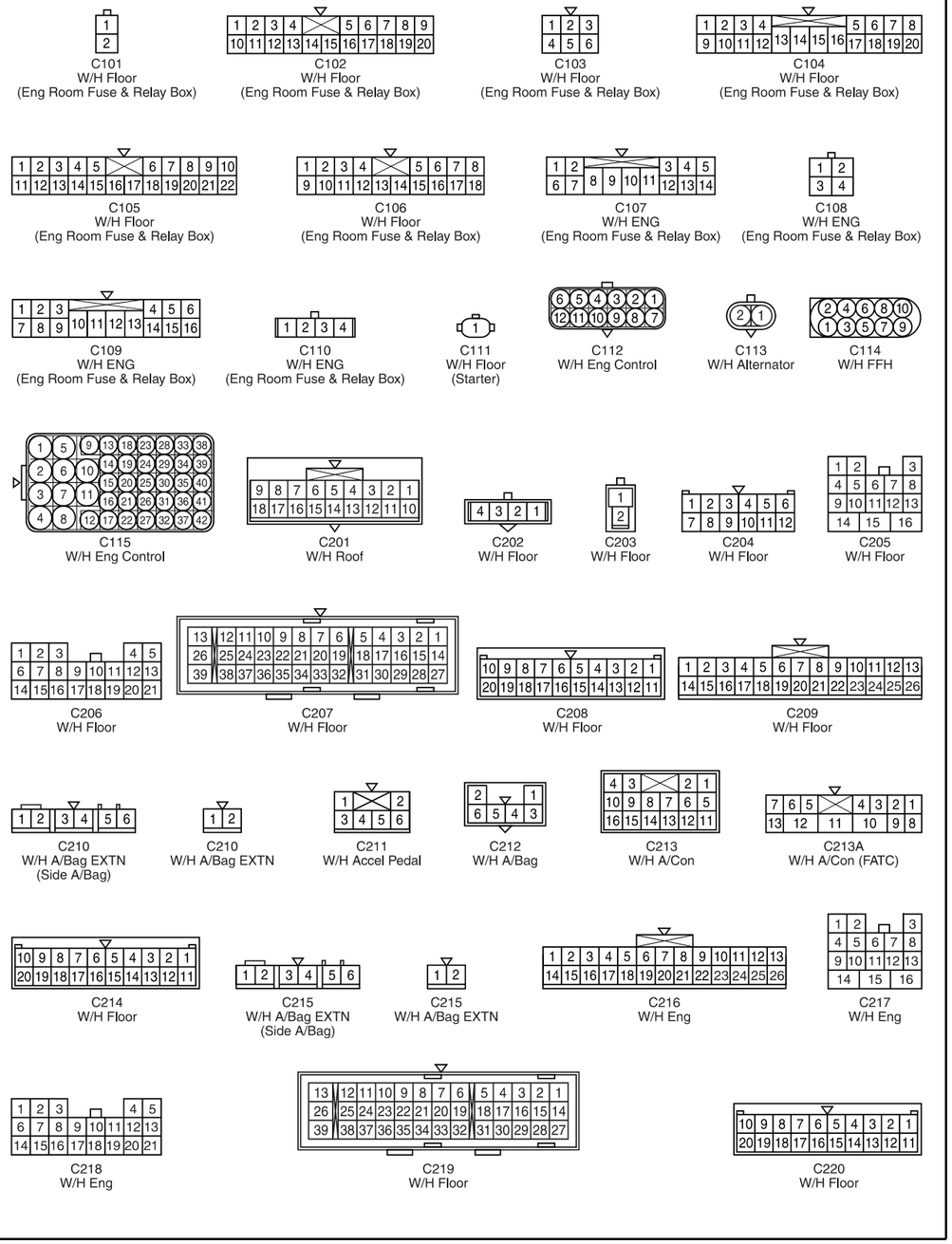


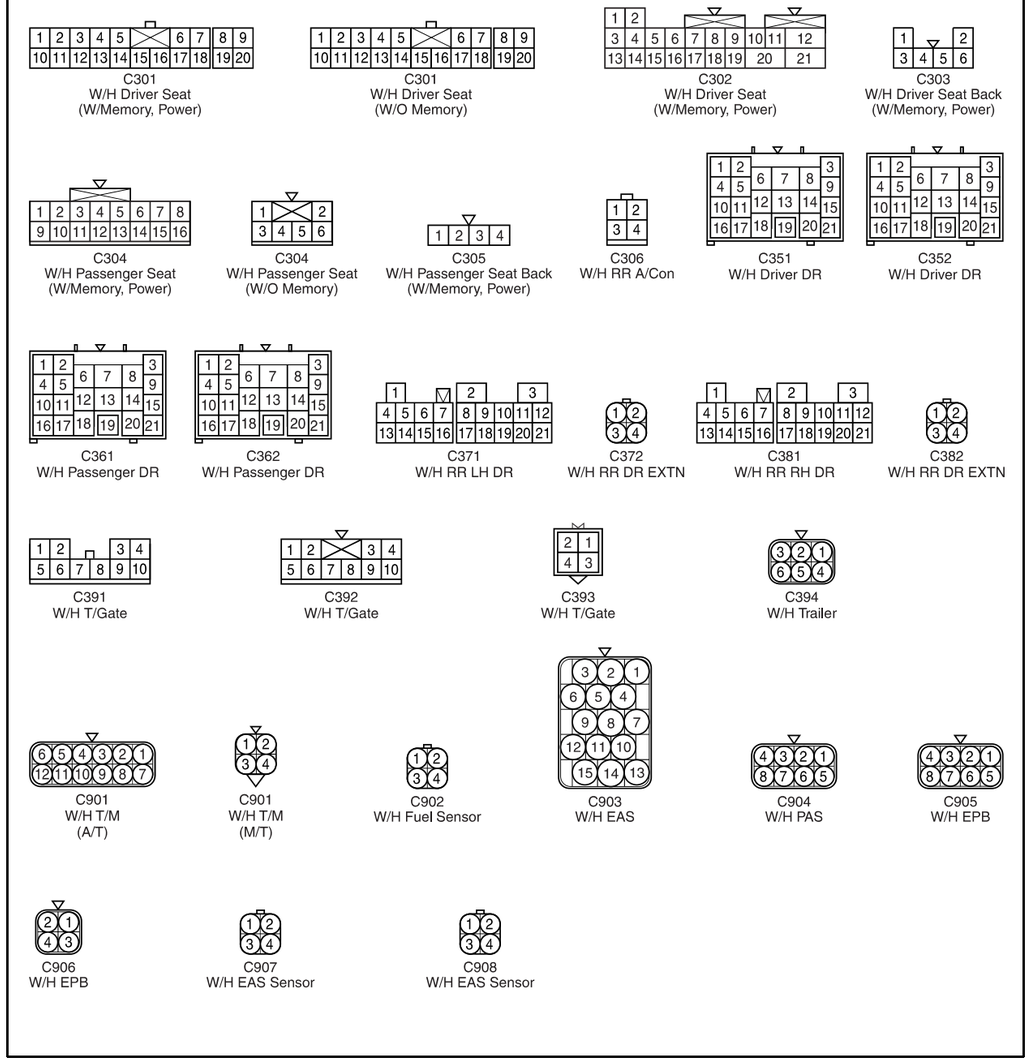
▶C908



Modification basis	
Application basis	
Affected VIN	

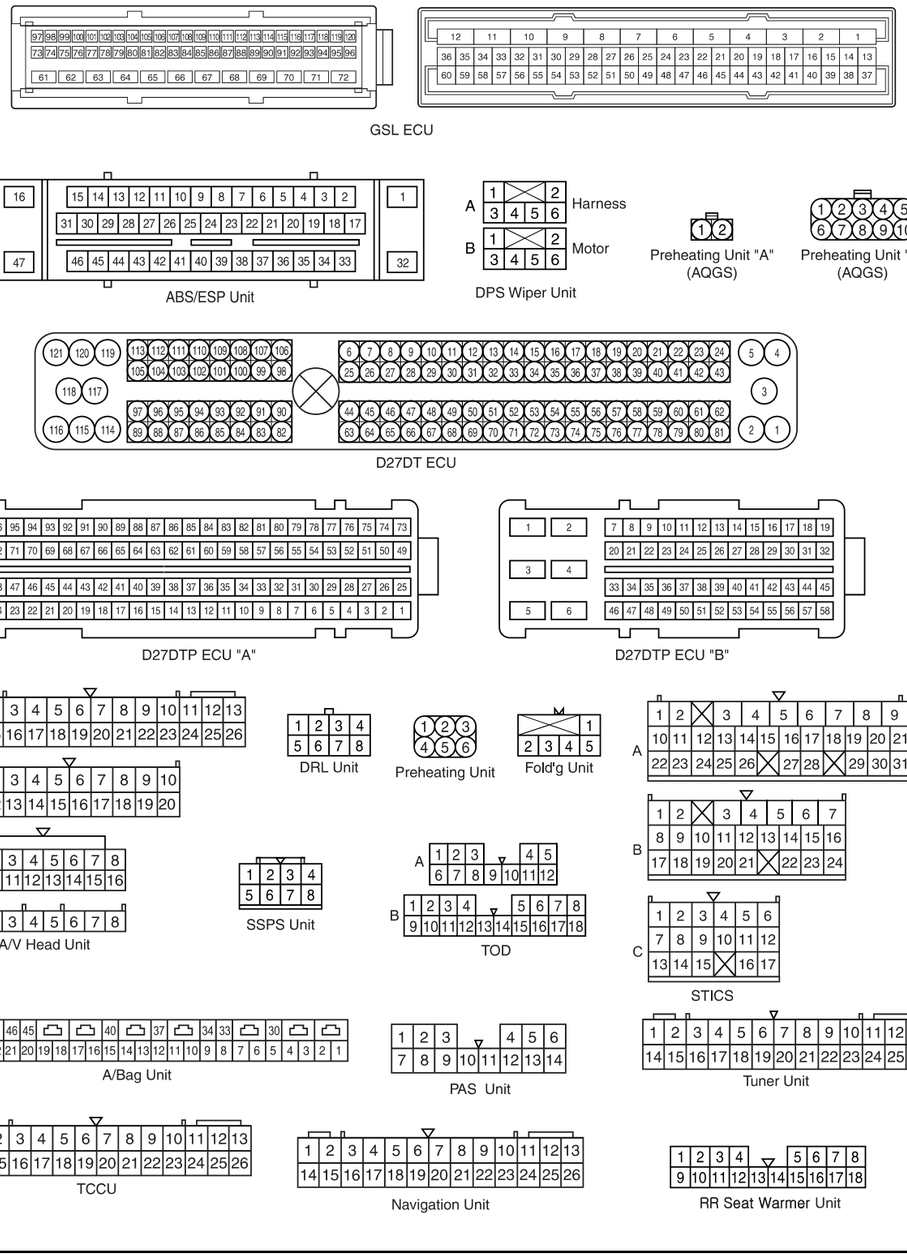
▶ WIRNING CONNECTOR

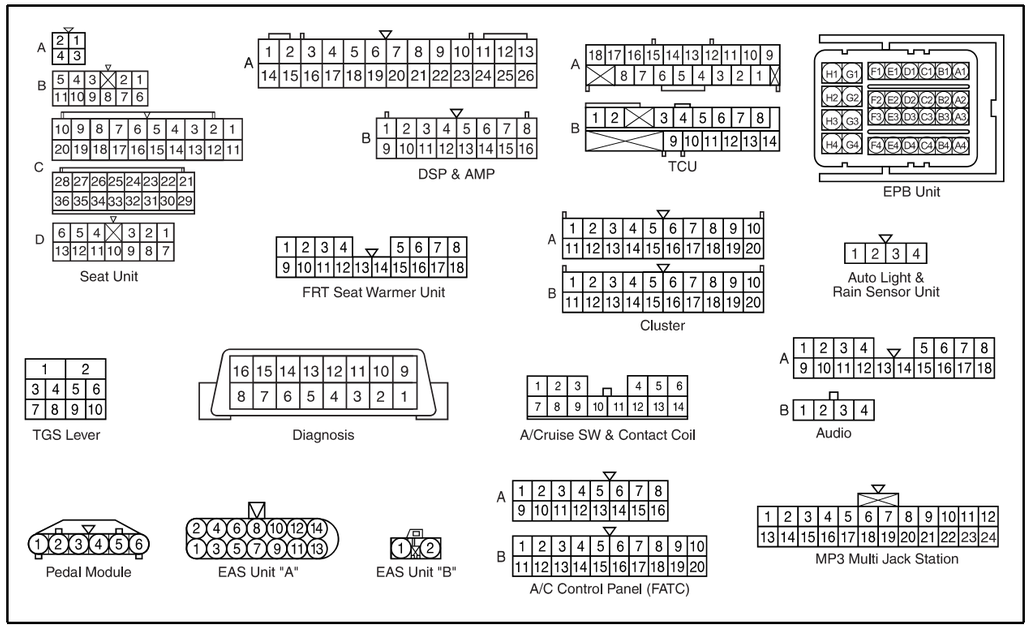




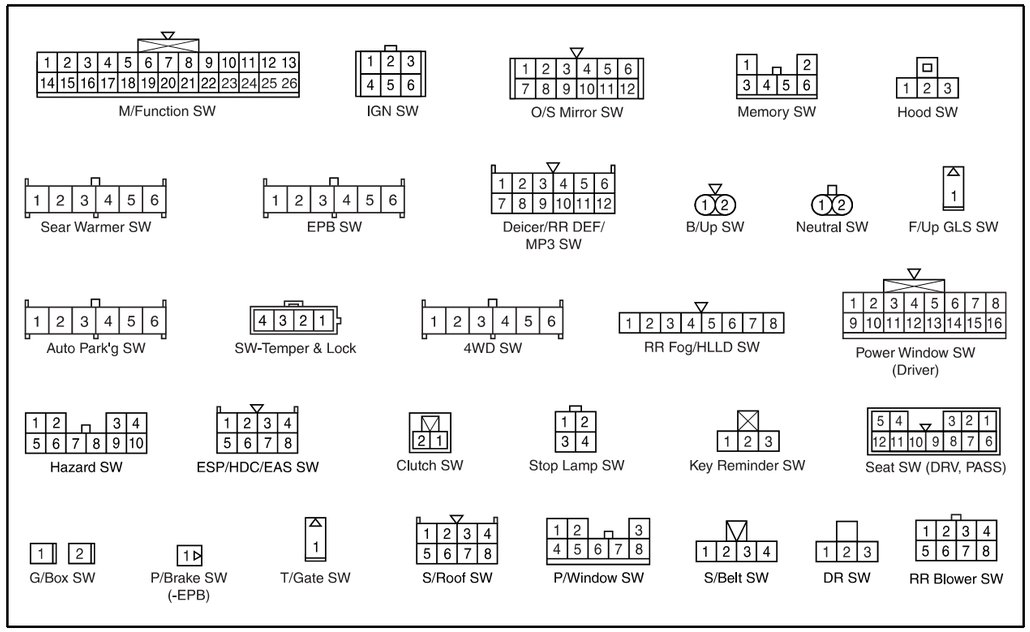
Modification basis	
Application basis	
Affected VIN	

▶UNIT CONNECTOR



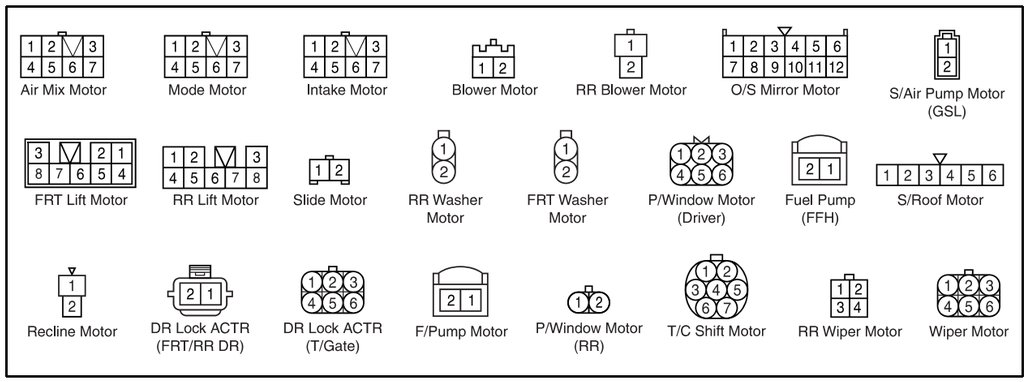


▶SWITCH CONNECTOR

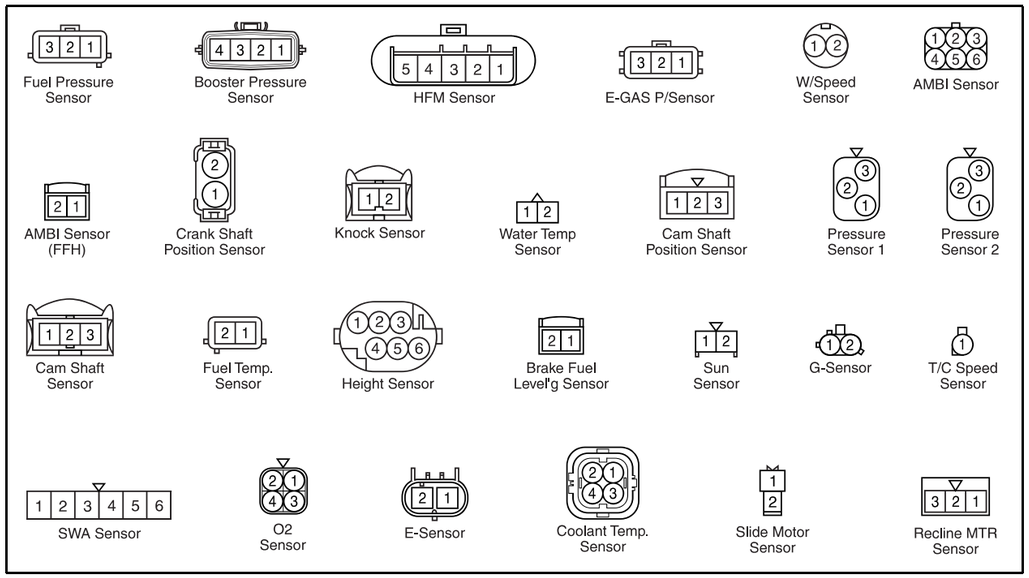


Modification basis	
Application basis	
Affected VIN	

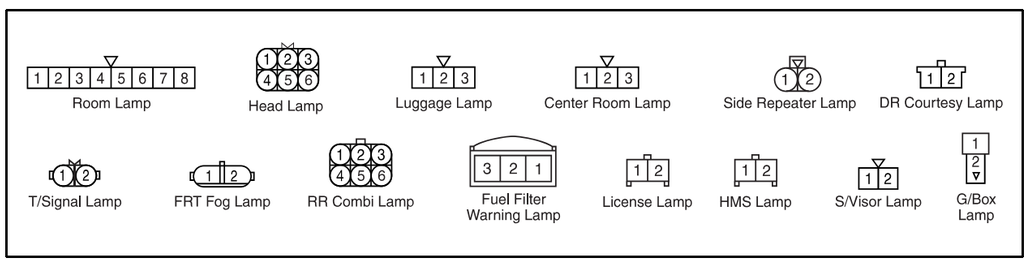
▶MODE CONNECTOR



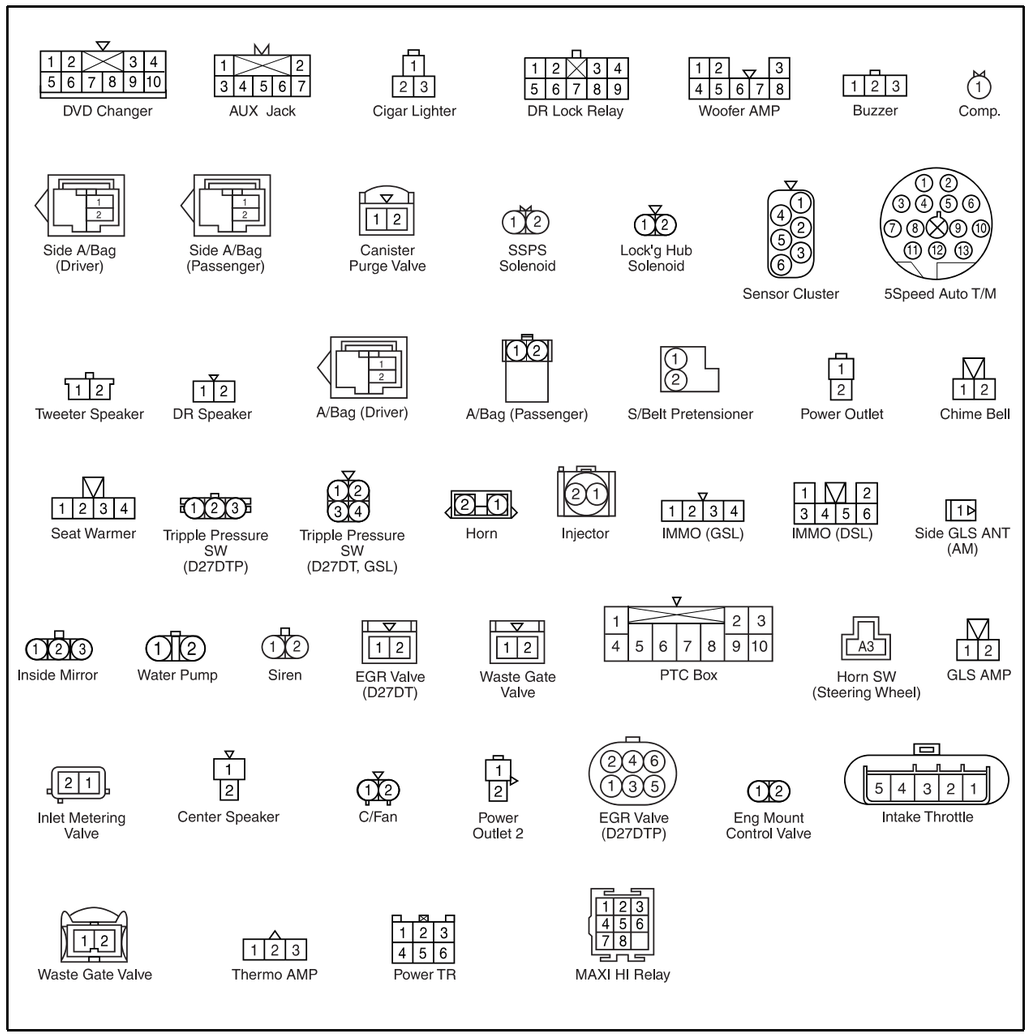
▶SENSOR CONNECTOR



▶LAMP CONNECTOR



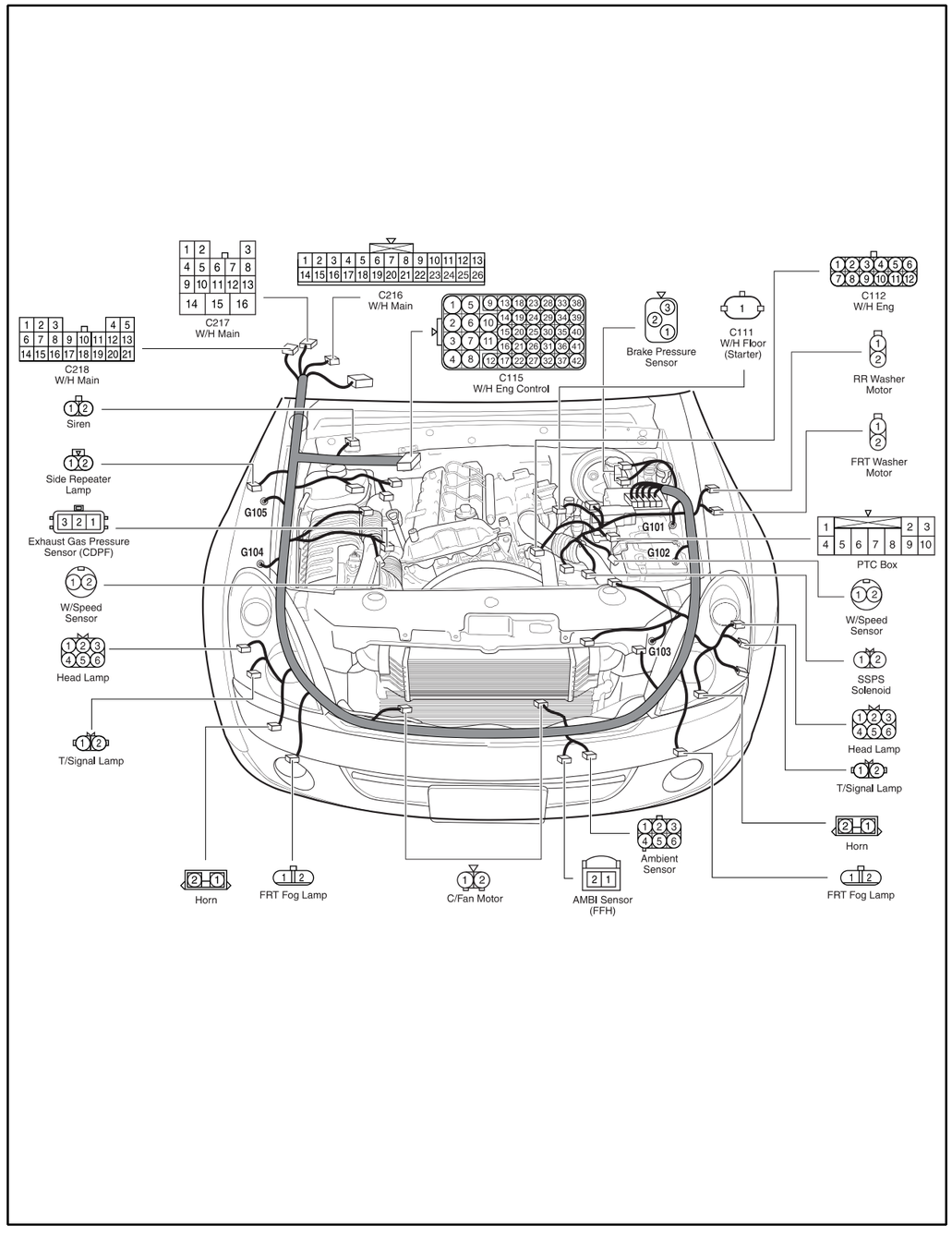
▶ETC.

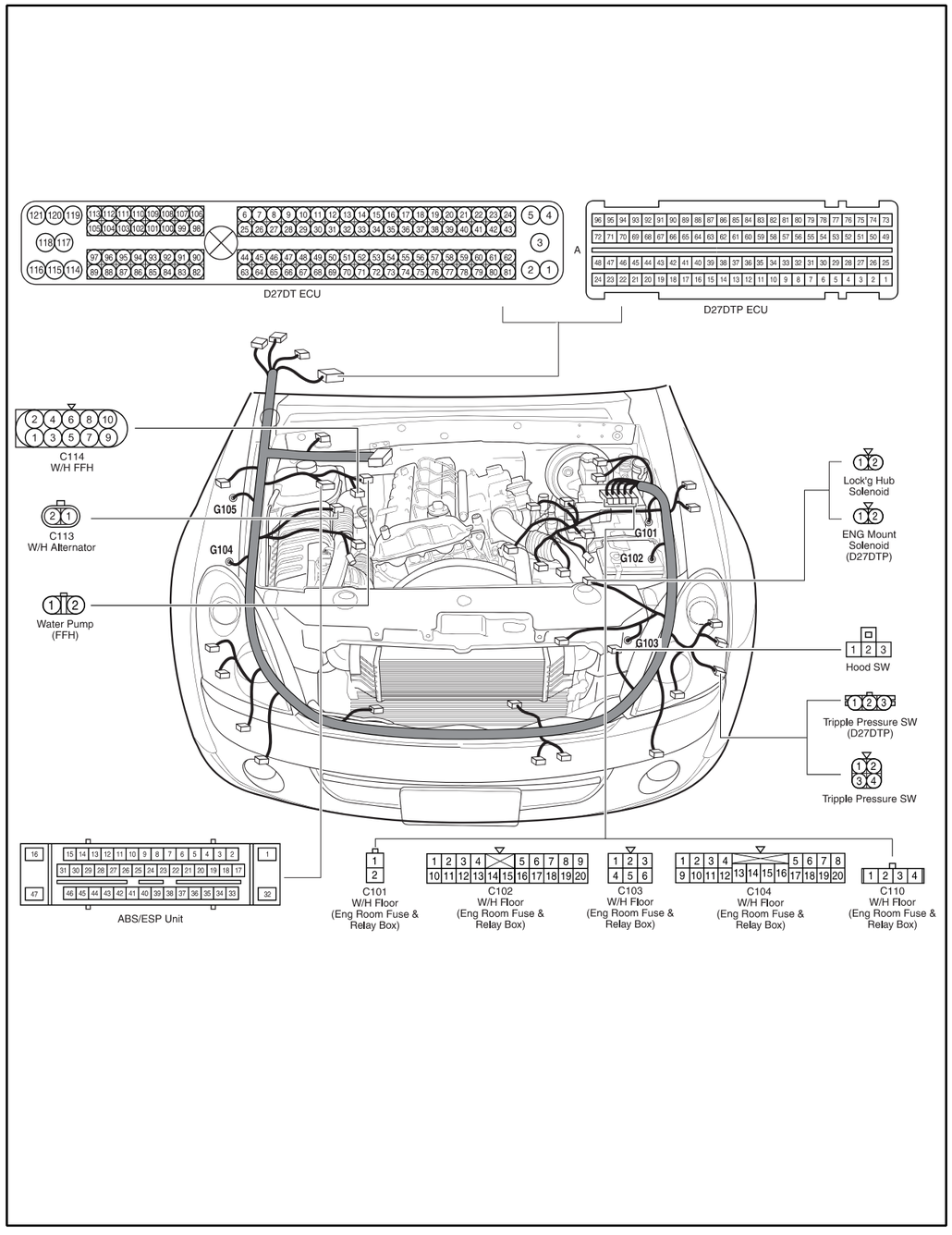


Modification basis	
Application basis	
Affected VIN	

CONNECTOR

S.G.N. 8210-00 **W/H ENGINE ROOM**

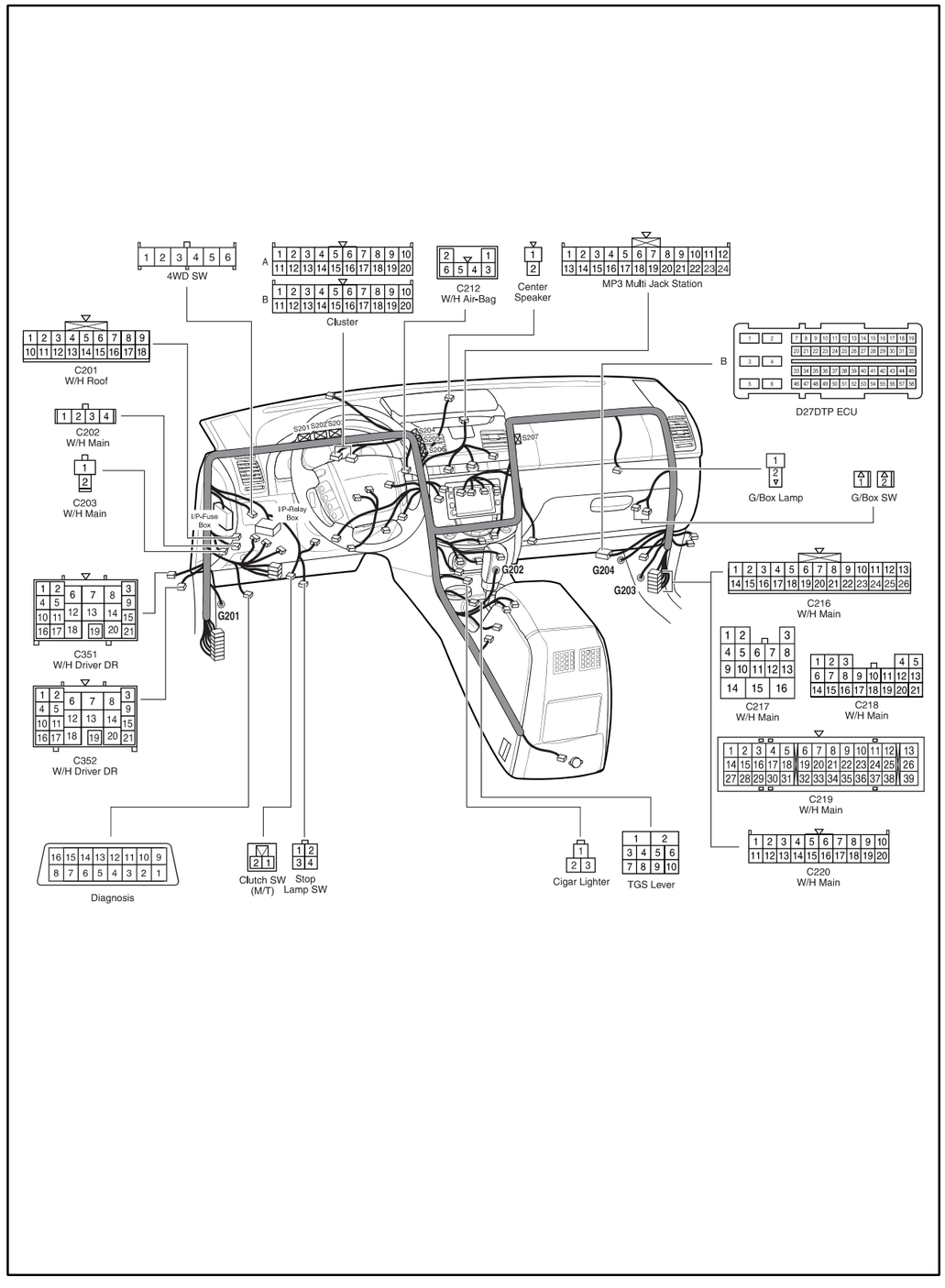


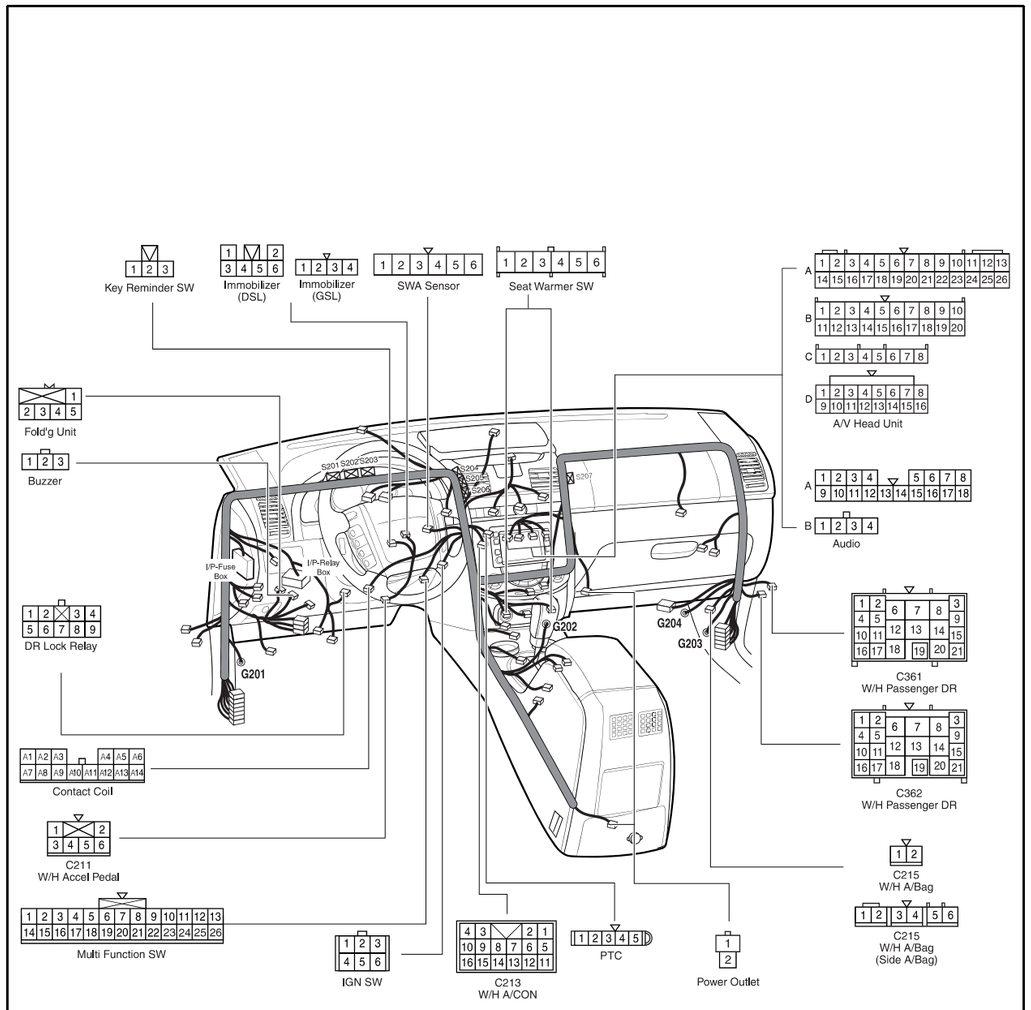


Modification basis	
Application basis	
Affected VIN	

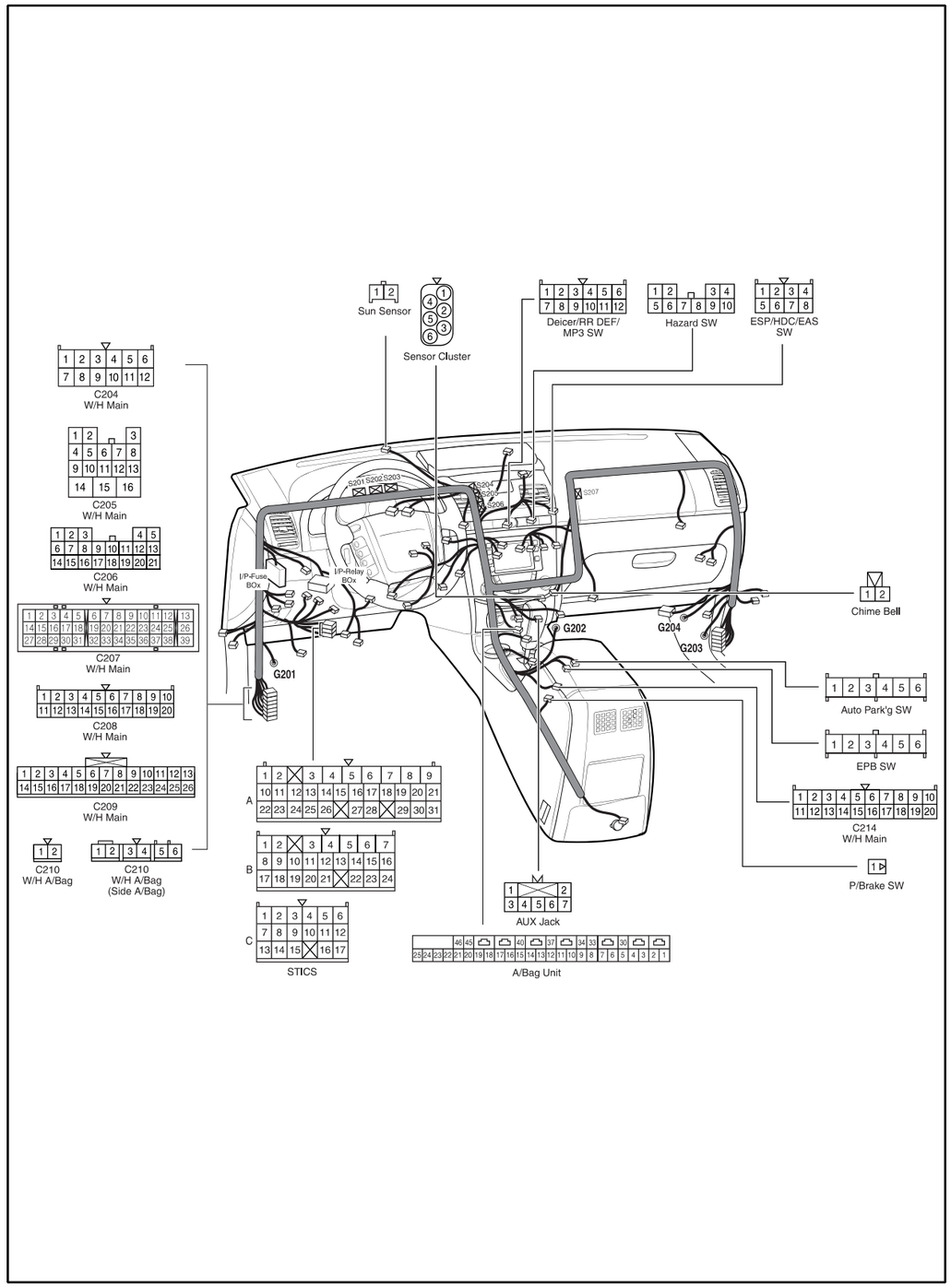
S.G.N. 8210-02

W/H MAIN





Modification basis	
Application basis	
Affected VIN	



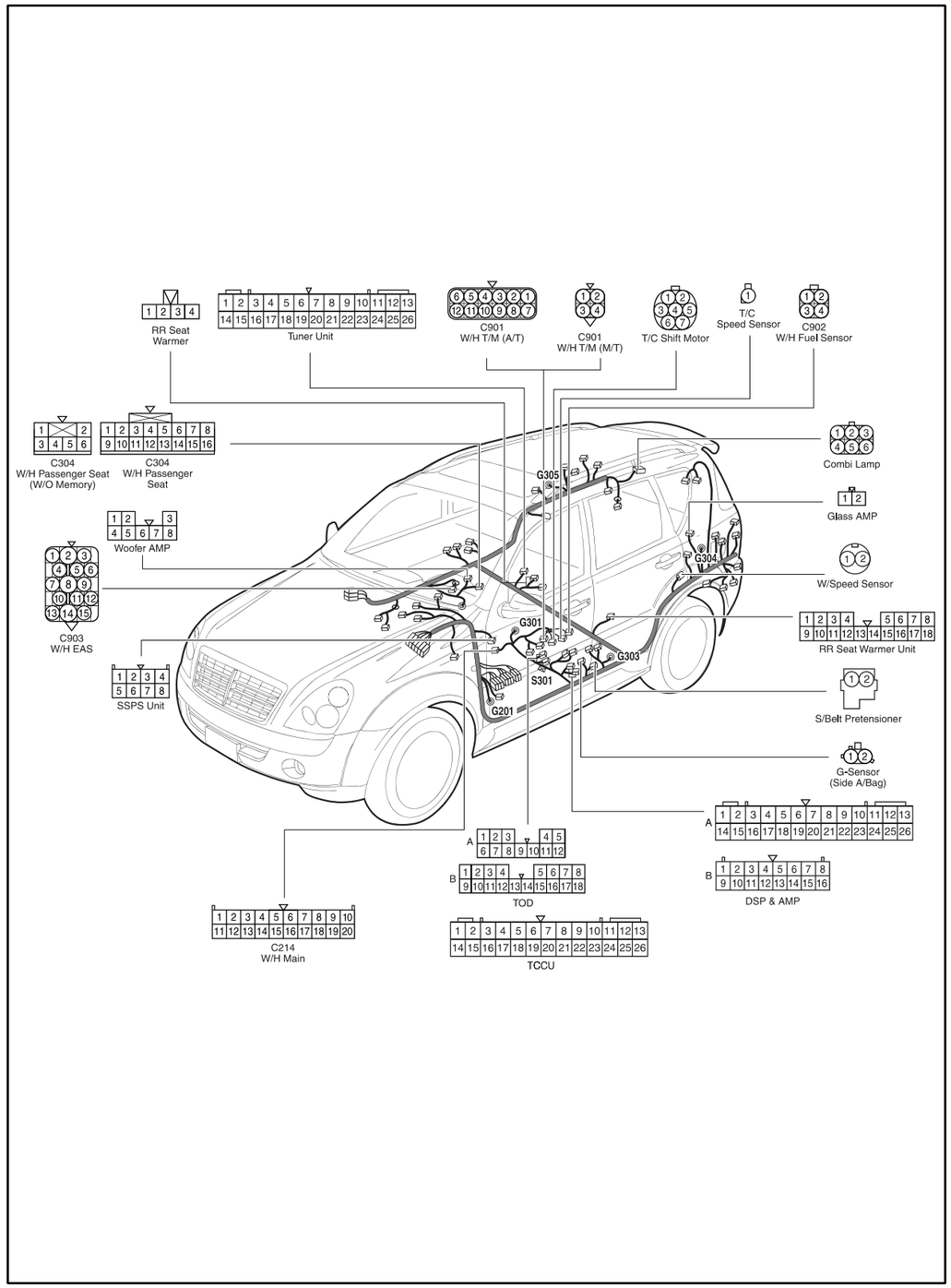
CONNECTOR/GROUND

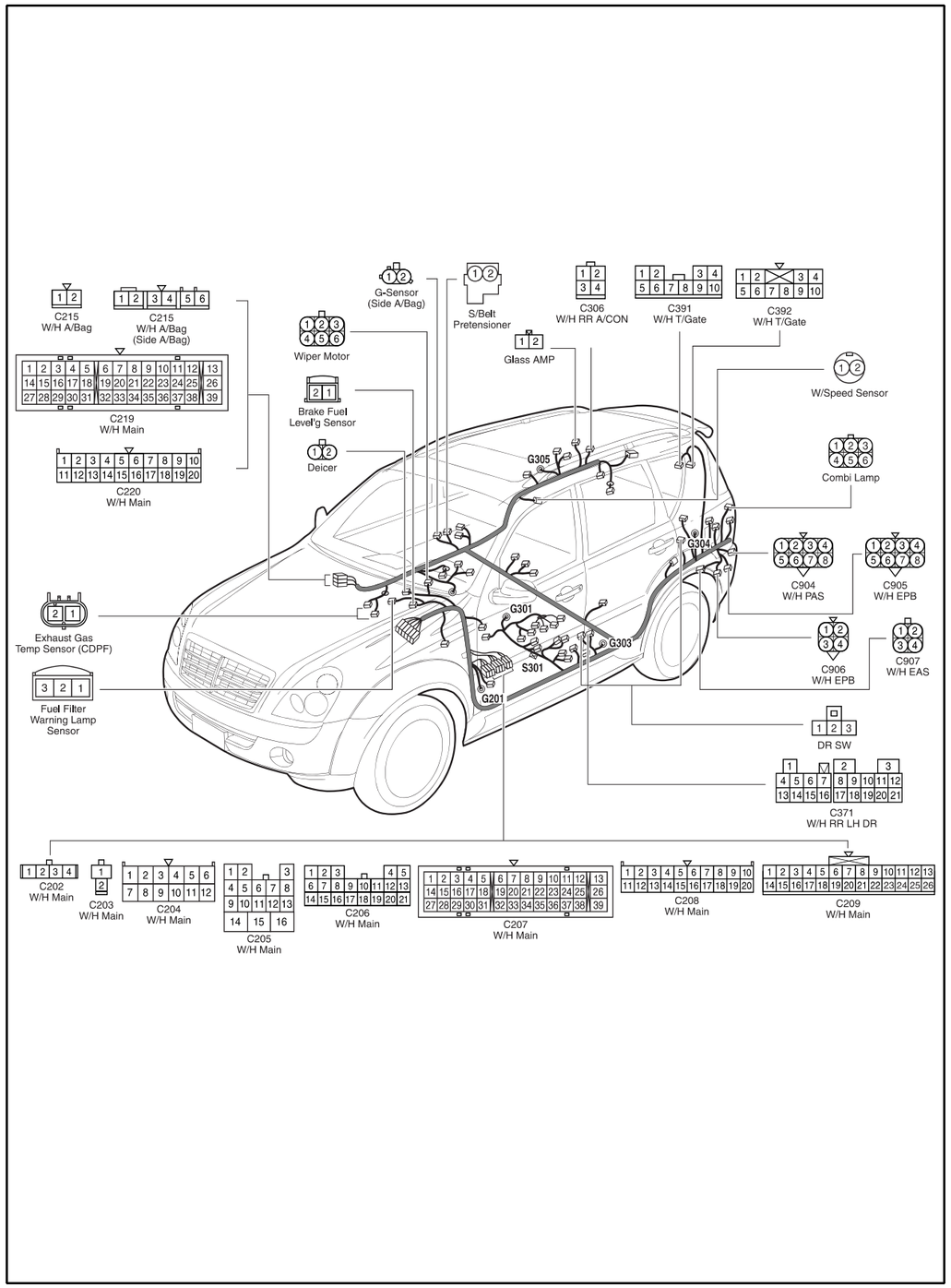
REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

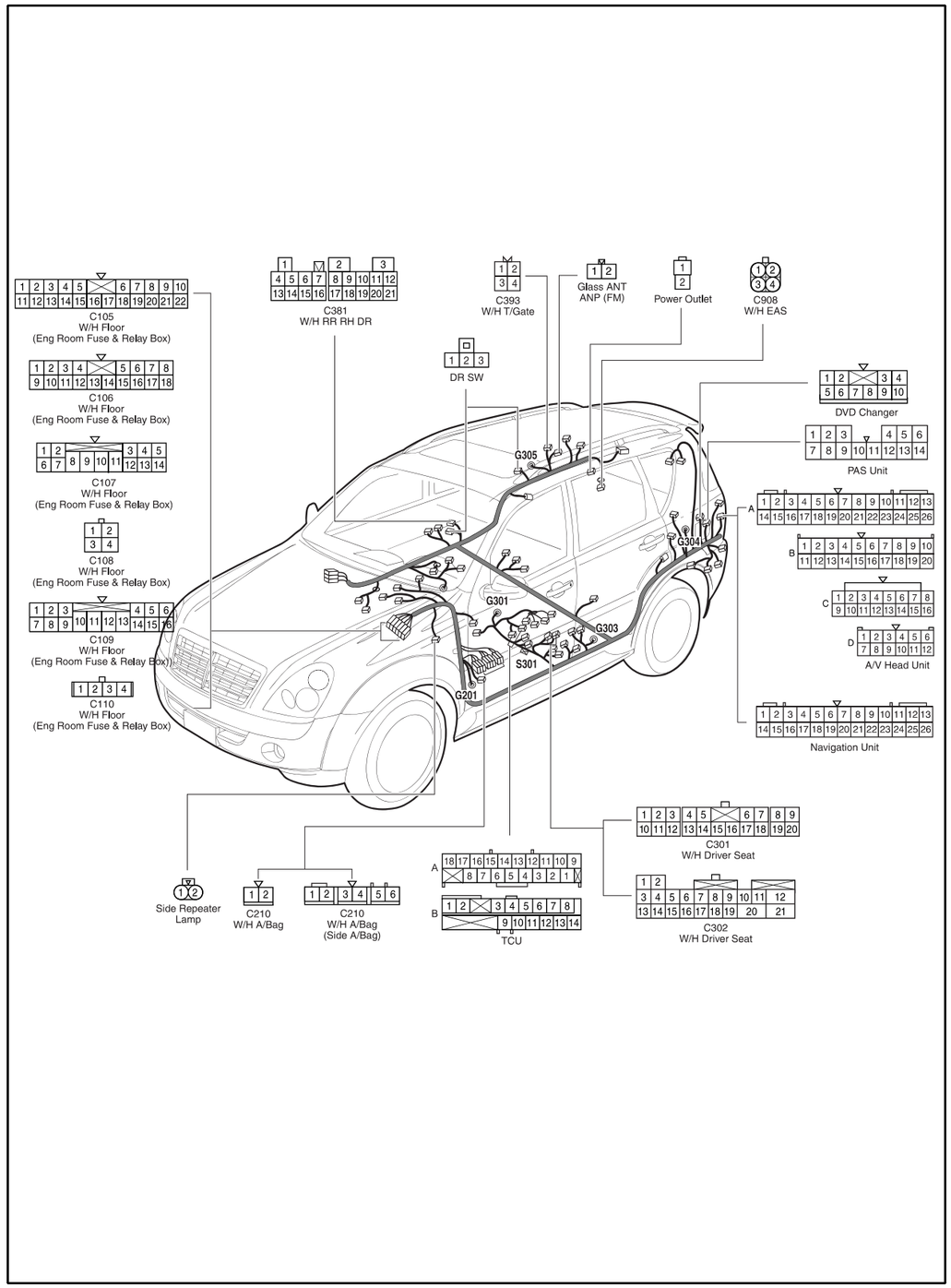
S.G.N. 8210-03

W/H FLOOR





Modification basis	
Application basis	
Affected VIN	

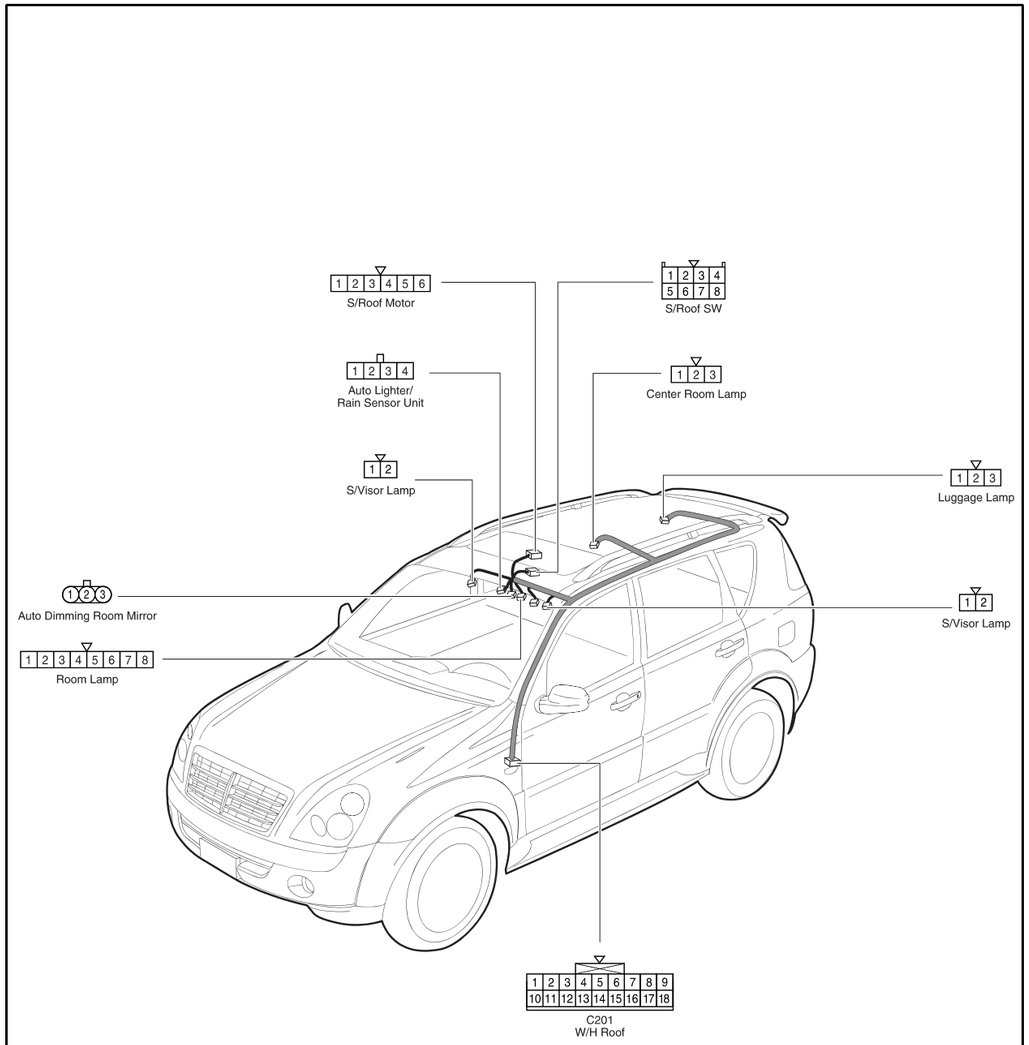


CONNECTOR/GROUND

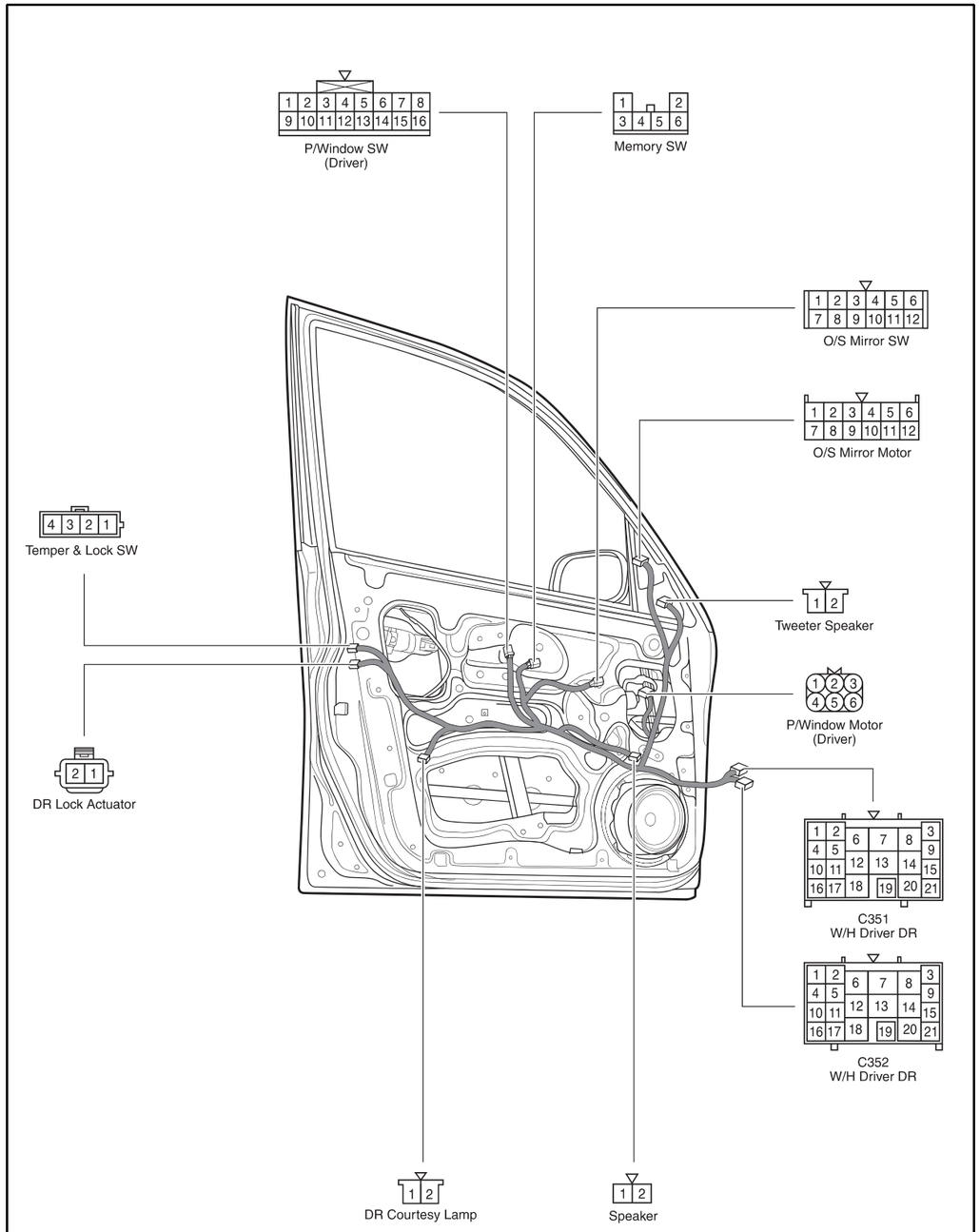
REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

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

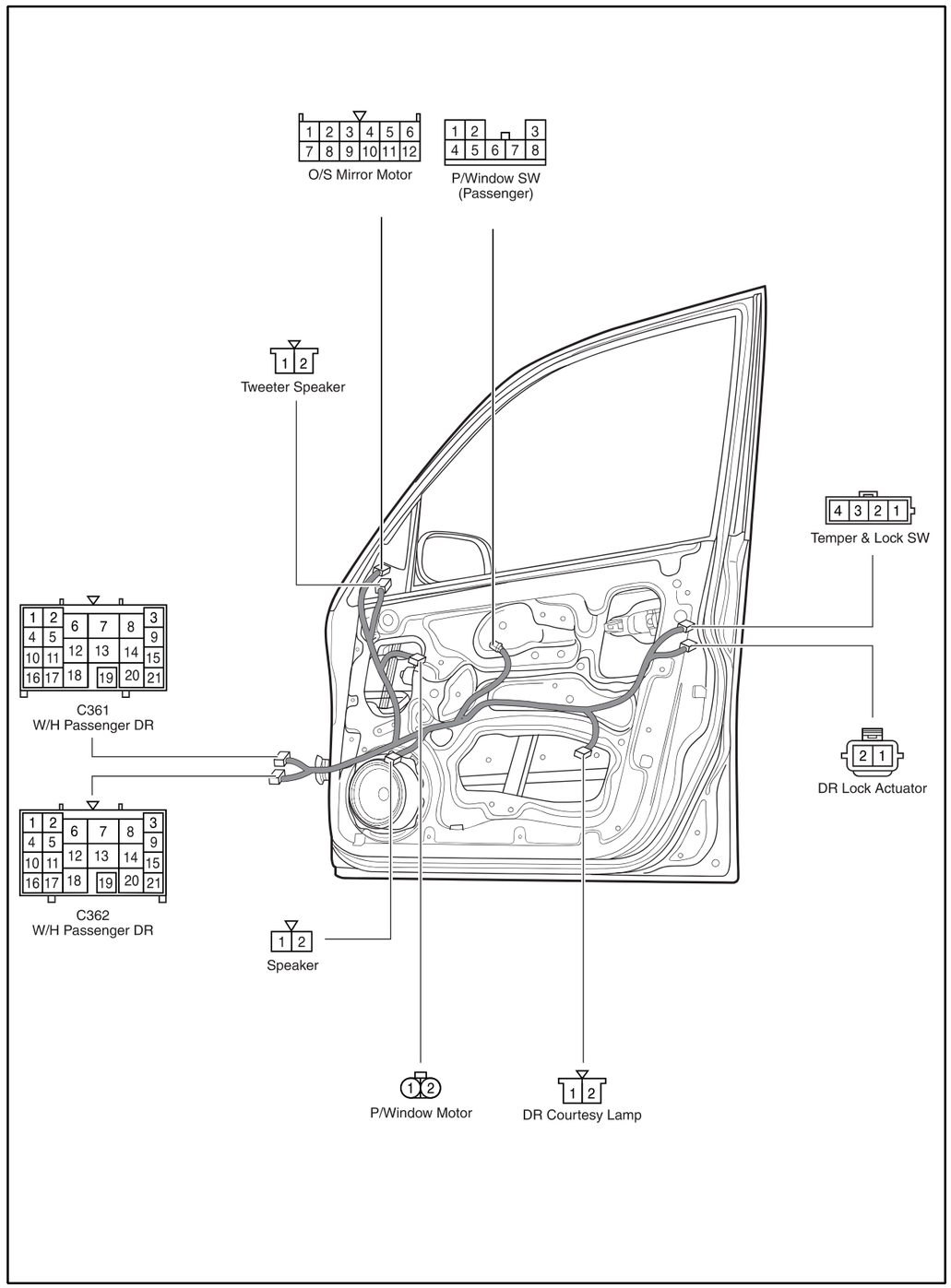


S.G.N. 8210-06 W/H DRIVER DOOR

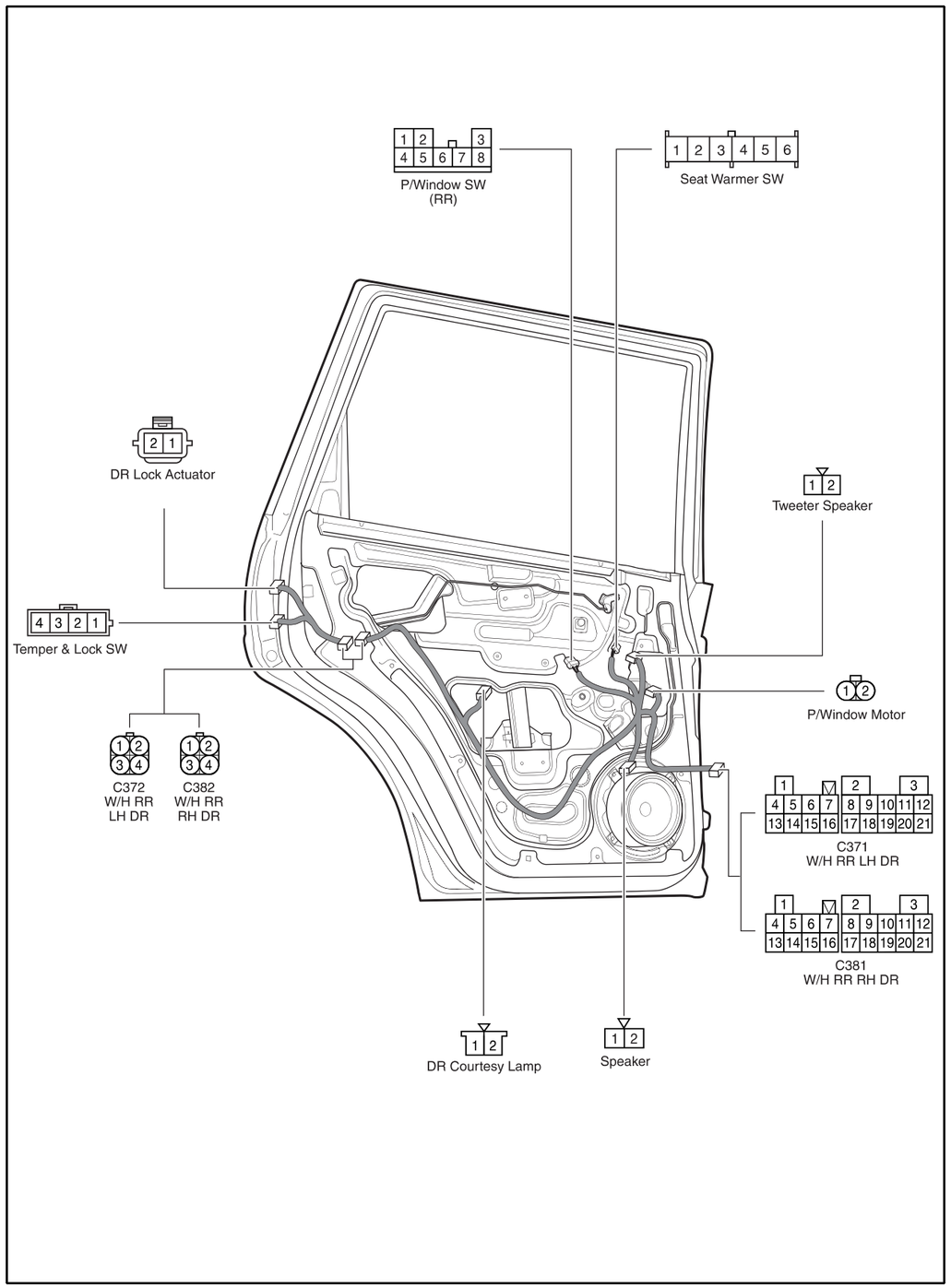


Modification basis	
Application basis	
Affected VIN	

S.G.N. 8210-07 W/H PASSENGER DOOR

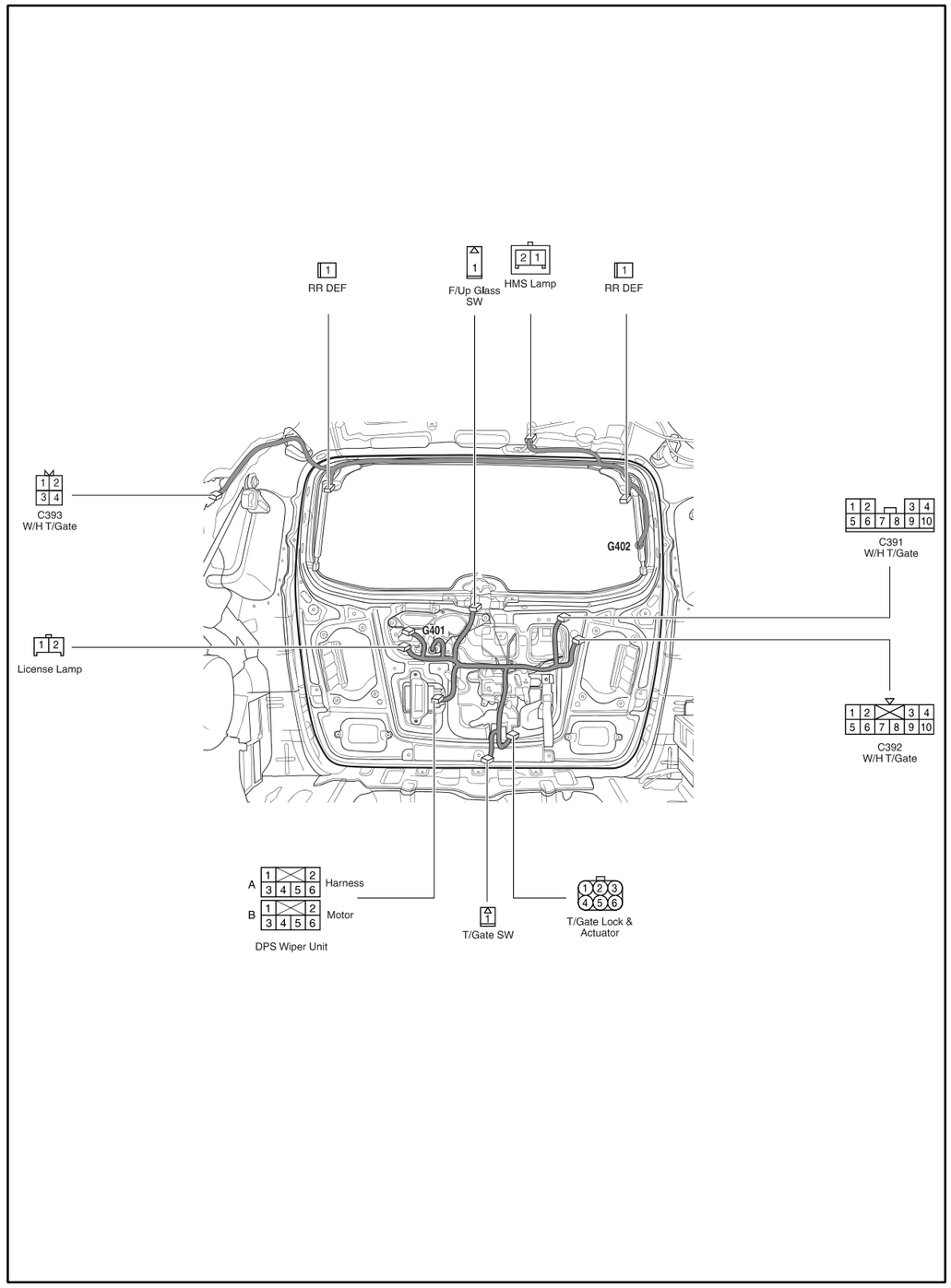


S.G.N. 8210-08 W/H RR DOOR



Modification basis	
Application basis	
Affected VIN	

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



Memo

Memo

POWER DISTRIBUTION

8410-02/8410-04/8401-06

FUSE/RELAY

8410-02 ENGINE ROOM FUSE & RELAY BOX..... 3
8410-04 I/P - FUSE BOX..... 5
8401-06 I/P - RELAY BOX..... 6

ELECTRICITY DIVIDE

8210-02 ENGINE ROOM FUSE & RELAY BOX CIRCUIT..... 7
8410-04 I/P - FUSE BOX CIRCUIT..... 11
8410-06 I/P - RELAY BOX CIRCUIT..... 15

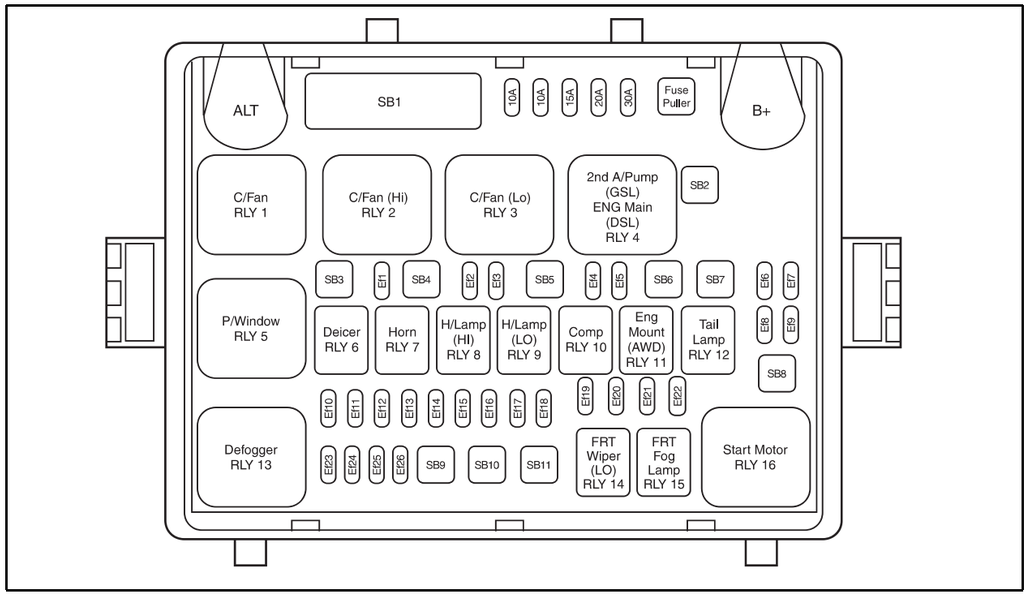
Memo

Memo

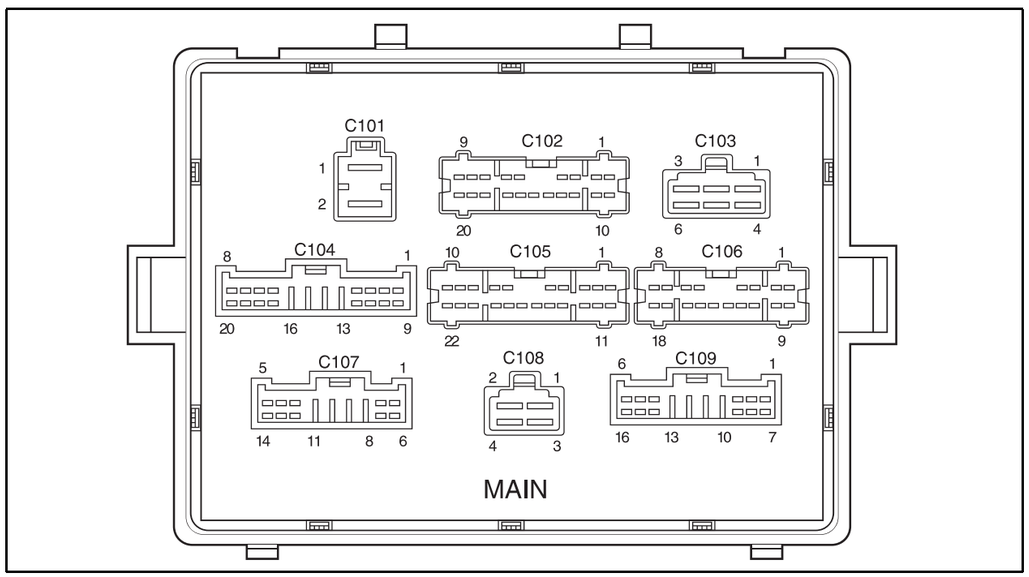
FUSE & RELAY

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

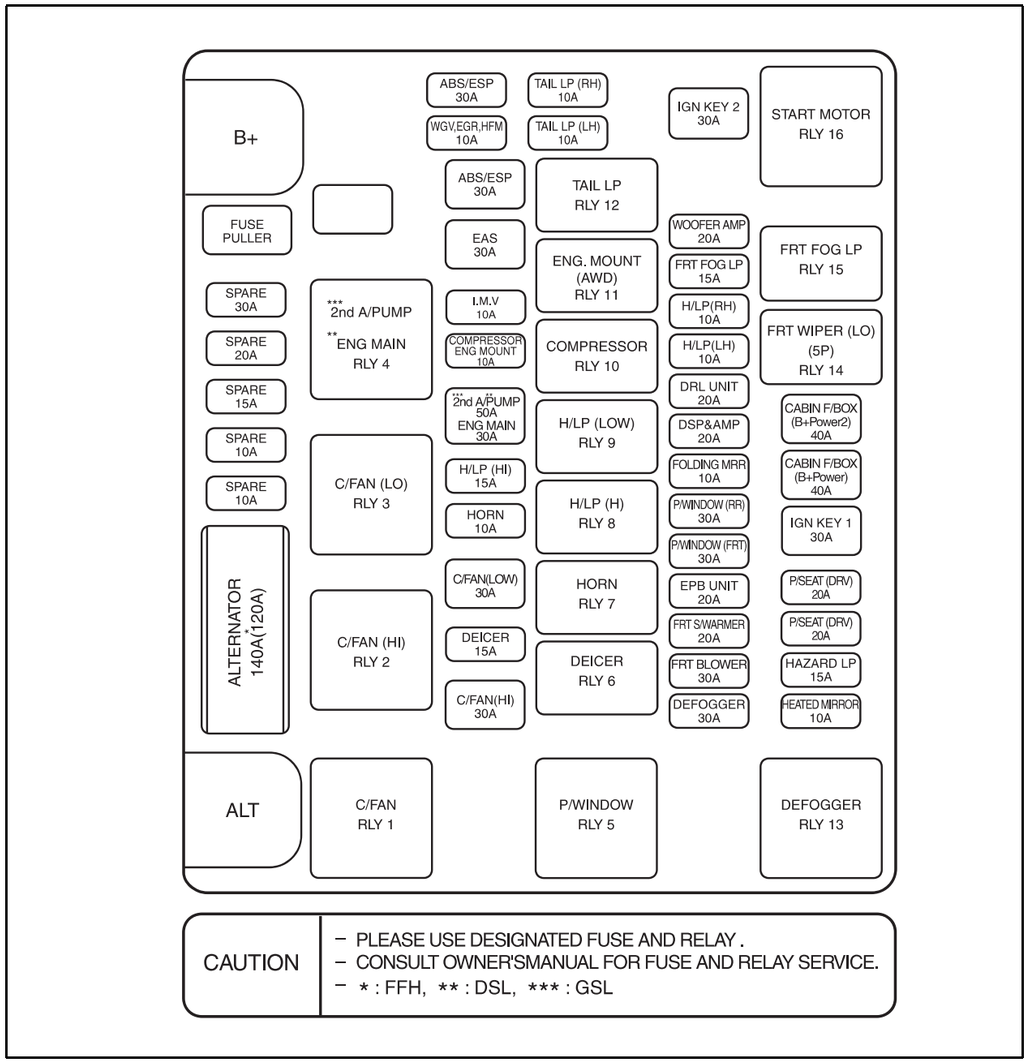
1) UPPER



2) LOWER



3) ENGINE ROOM FUSE & RELAY BOX



Modification basis	
Application basis	
Affected VIN	

4) USAGE OF FUSE IN ENGINE ROOM FUSE BOX

Fuse No.	Capacity	Usage	Fuse No.	Capacity	Usage
SB1	140A/120A	Alternator	Ef9	10A	Combi Lamp (RH)
SB2	-	-	Ef10	30A	RR DEF (B+)
SB3	30A	Condenssor Fan (HI)	Ef11	30A	Blower Relay
SB4	30A	Condenssor Fan (LO)	Ef12	20A	FRT Seat Warmer
SB5	30A/50A	ENG Main(DSL), S/Air Pump(GSL)	Ef13	20A	EPB
SB6	30A	EAS	Ef14	30A	Power Window (LH)
SB7	30A	ABS/ESP	Ef15	30A	Power Window (LH)
SB8	30A	Key SW, Start Relay	Ef16	10A	O/S Mirror SW
SB9	30A	Key SW (AM1)	Ef17	20A	DSP/AMP
SB10	40A	I/P-Fuse Box (F17~F24, F32)	Ef18	20A	DRL
SB11	40A	I/P-Fuse Box (F25~F31)	Ef19	10A	Head Lamp (LH)
Ef1	10A	Deicer Relay	Ef20	10A	Head Lamp (RH)
Ef2	10A	Horn Relay	Ef21	15A	FRT Fog Lamp Relay
Ef3	15A	Head Lamp Relay (HI)	Ef22	15A	Woofer AMP
Ef4	10A	Compressor Relay	Ef23	10A	O/S Mirror DEF
Ef5	10A	InLet Metering Valve	Ef24	15A	Hazard
Ef6	10A	EGR Valve, HFM Sensor	Ef25	20A	Seat Unit
Ef7	30A	ABS/ESP	Ef26	20A	Seat Unit
Ef8	10A	Combi Lamp (LH)			

5) ENGINE ROOM FUSE BOX CONNECTOR NUMBER

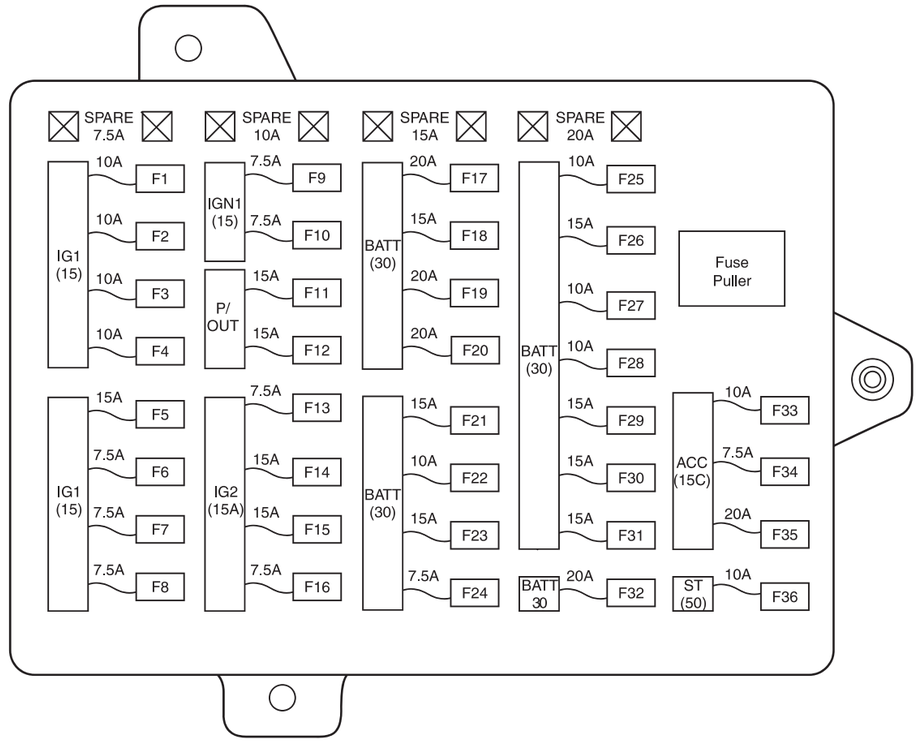
Connector No.	Pin No.	Connector Color
C101	2	Colorless
C102	20	White
C103	6	Colorless
C104	20	White
C105	22	White
C106	18	White
C107	14	White
C108	4	Colorless
C109	16	White

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8410-04

I/P - FUSE BOX

1) FUSE BOX



2) POWER SUPPLY

NO.36	10A	START MOTOR	NO.32	20A	PASS. SEAT	NO.24	7.5A	MEMORY	NO.16	7.5A	BLOWER MOTOR A/CON DEFOGGER	NO.8	7.5A	SEAT UNIT NAVIGATION EAS, EPB
NO.35	20A	C/LIGHT P/OUTLET	NO.31	-	SPARE	NO.23	15A	DOOR LOCK RR FOG LAMP	NO.15	15A	RR WIPER RR WASHER	NO.7	7.5A	CLUSTER
NO.34	7.5A	O/SIDE MRR P/OUTLET	NO.30	15A	NAVIGATION TUNER UNIT DVD CHANGER	NO.22	10A	IMMOBILIZER **GSL ECU	NO.14	15A	FRT WIPER FRT WASHER	NO.6	7.5A	ENG PREHEAT'G IMMOBILIZER PTC, STOP LAMP
NO.33	10A	AUDIO NAVIGATION DVD CHANGER	NO.29	15A	RR BLOWER	NO.21	15A	**ENG SENSOR	NO.13	7.5A	ECM MRR S/ROOF SSPS	NO.5	15A	B/UP LAMP T/SIG LAMP
			NO.28	10A	DIAGNOSIS BUZZER, C/BELL, SIREN EAS	NO.20	20A	**INJECTOR & IGN. COIL FFH	NO.12	15A	REAR POWER OUTLET	NO.4	10A	ABS/ESP
FUSE PULLER			NO.27	10A	RR WIPER	NO.19	20A	**FUEL PUMP	NO.11	15A	FRONT POWER OUTLET	NO.3	10A	TCU, TGS TCCU, TOD
			NO.26	15A	STOP LAMP	NO.18	15A	AUDIO	NO.10	7.5	STICS	NO.2	10A	H/LAMP, DRL R/SNSR &A/LIGHT COMP, ENG MOUNT
			NO.25	10A	INTERIOR LAMP	NO.17	20A	SUN ROOF	NO.9	7.5A	ENG ECU **FUEL PUMP **ENG SENSOR	NO.1	10A	AIR BAG
			20A		SPARE FUSE	15A		SPARE FUSE	10A		SPARE FUSE	7.5A		SPARE FUSE

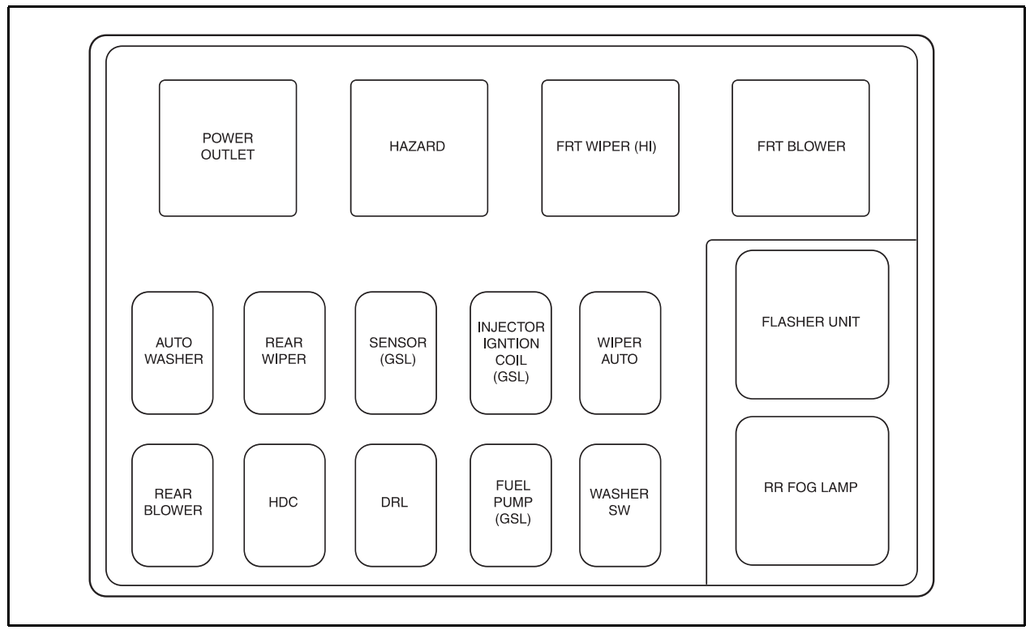
- PLEASE USE THE DESIGNATED FUSES.
- "**" GSL OPTION

Modification basis	
Application basis	
Affected VIN	

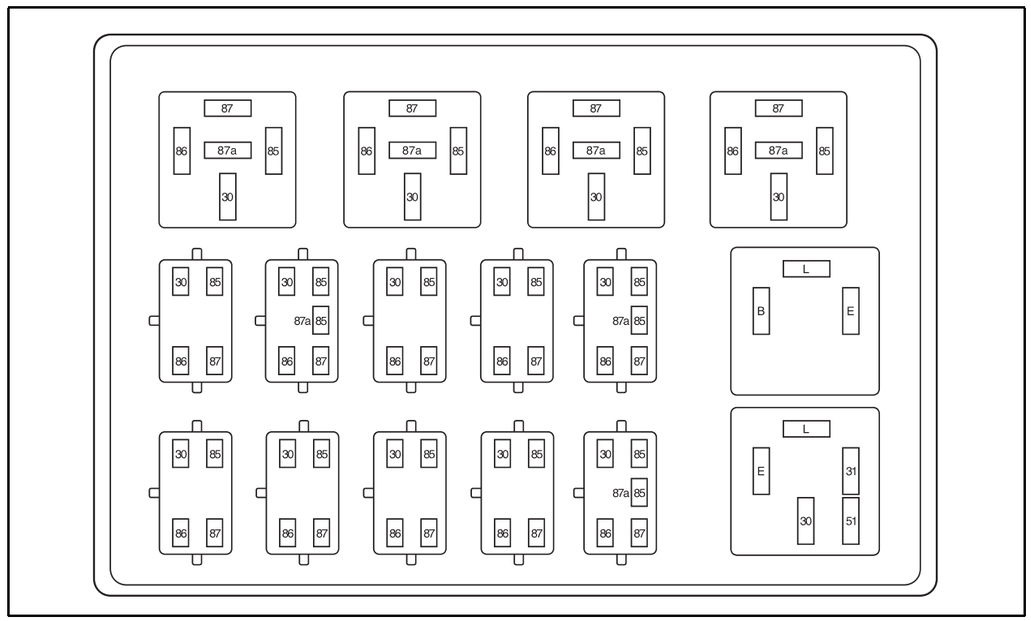
S.G.N. 8410-06

I/P - RELAY BOX

1) RELAY BOX



2) POWER SUPPLY

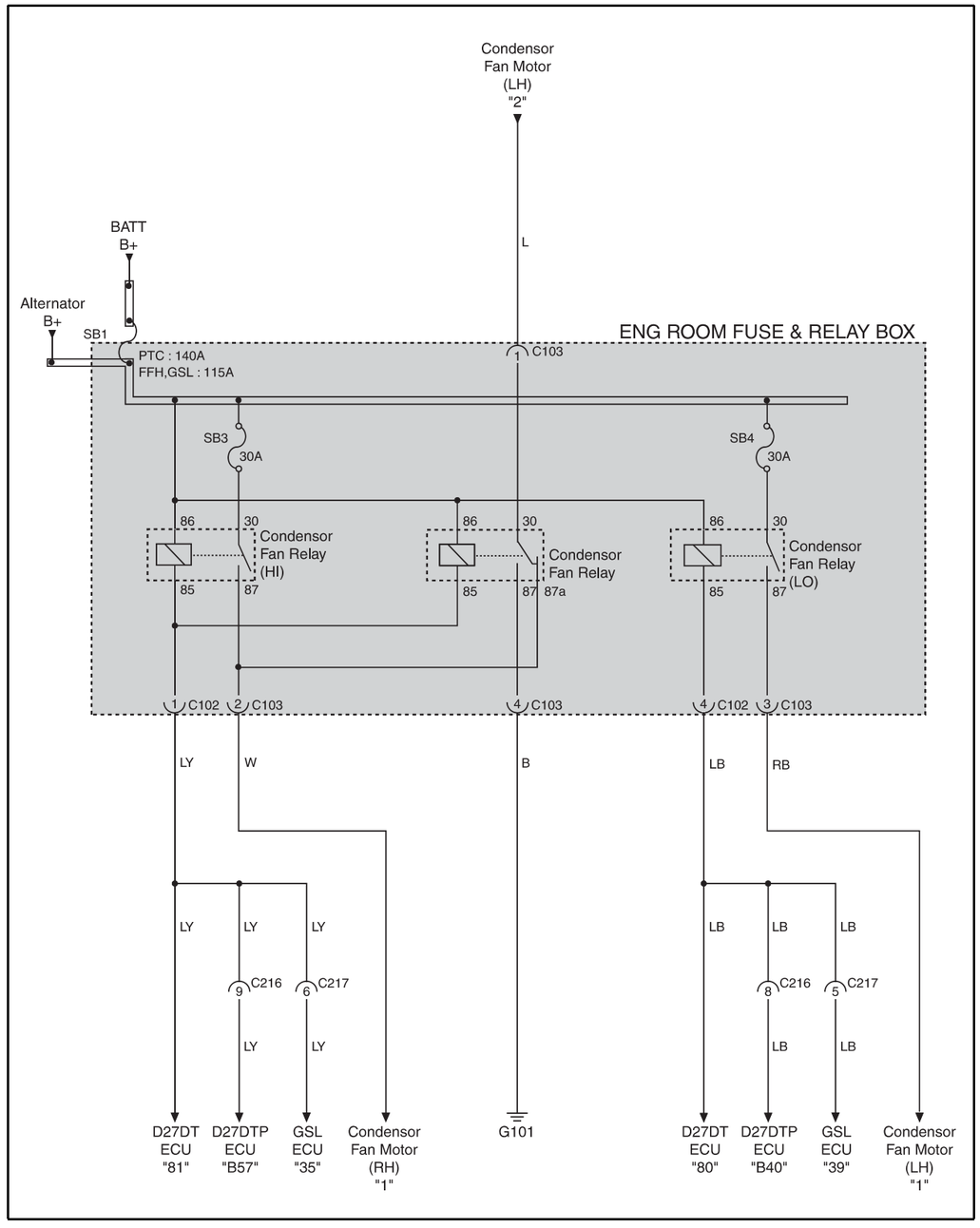


Modification basis	
Application basis	
Affected VIN	

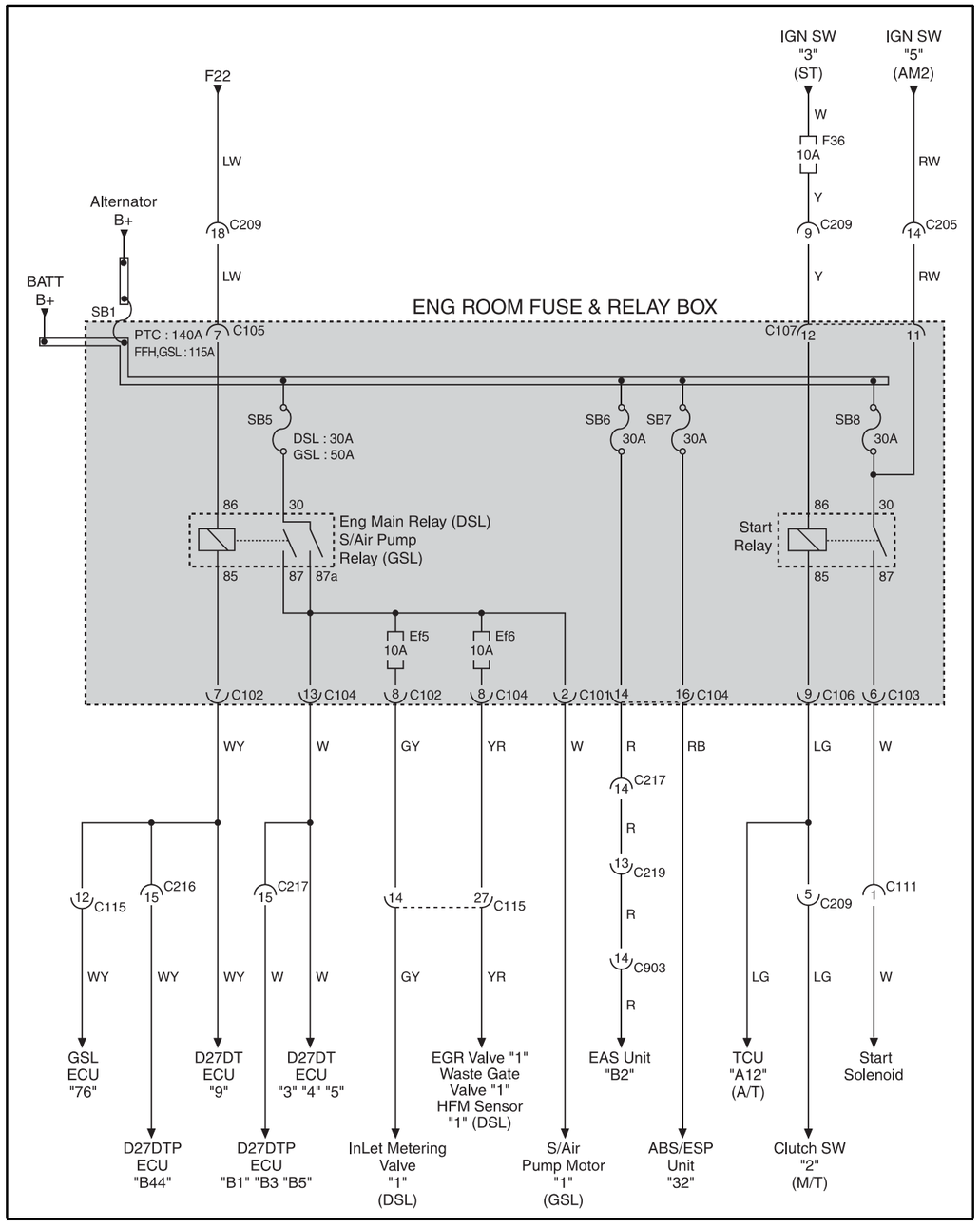
ELECTRICITY DIVIDE

SGN 8210-02 ENGINE ROOM FUSE & RELAY BOX CIRCUIT

(1) SB1, SB3, SB4, CONDENSOR FAN RELAY (HI, LO)

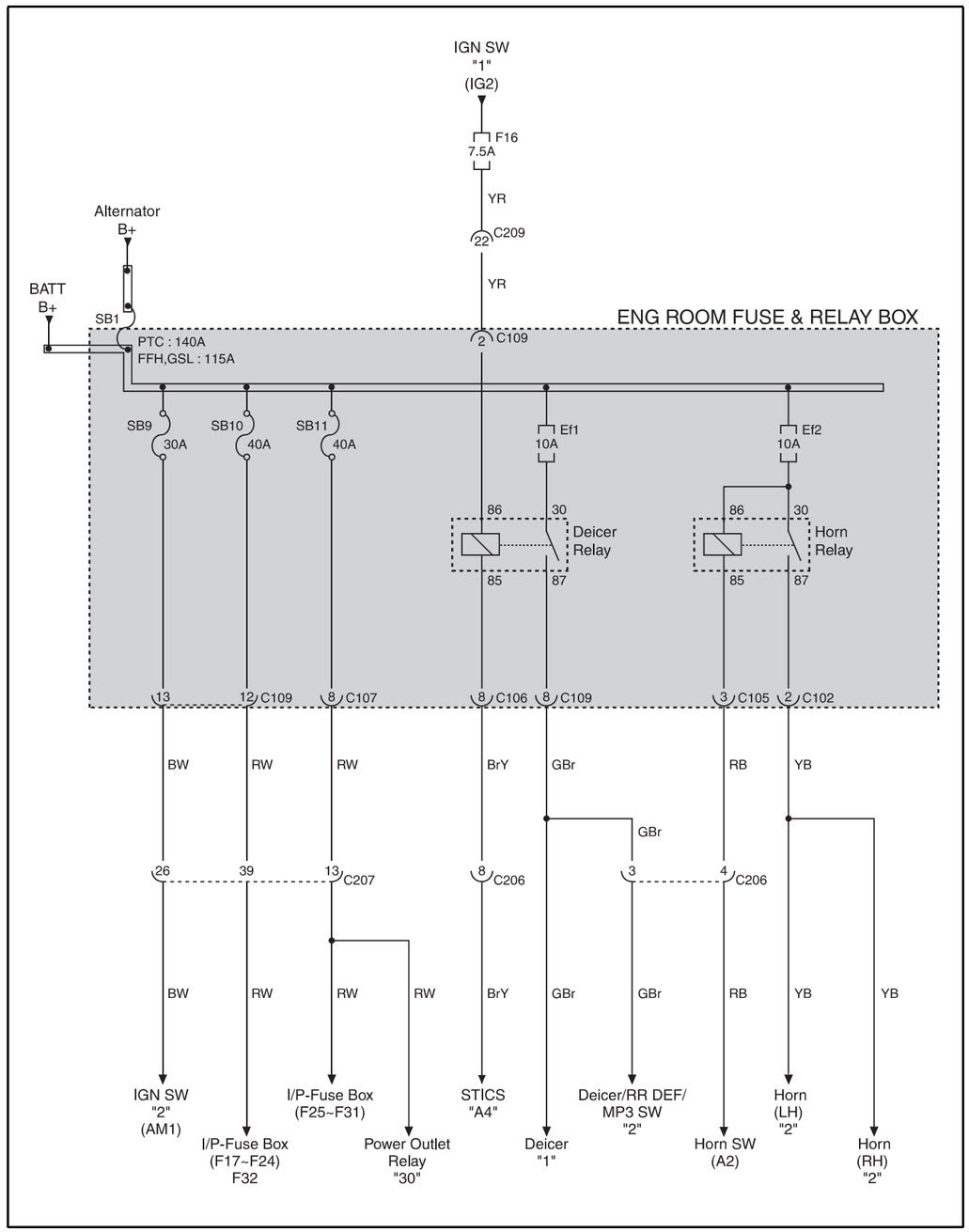


(2) SB5 ~ SB8, EF5, EF6, ENG MAIN RELAY, START RELAY

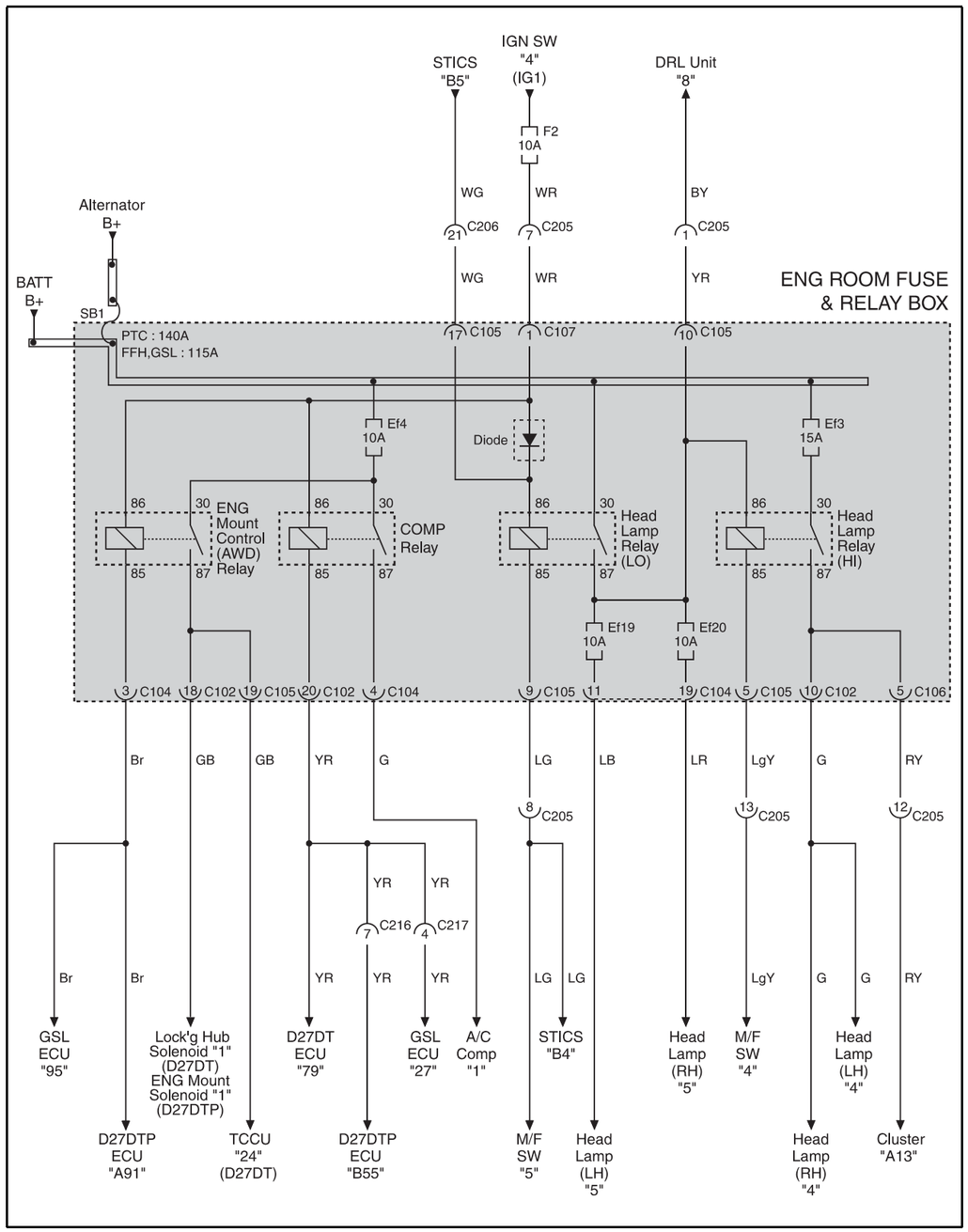


Modification basis	
Application basis	
Affected VIN	

(3) SB9 ~ SB11, EF1, EF2, DEICER RELAY, HORN RELAY

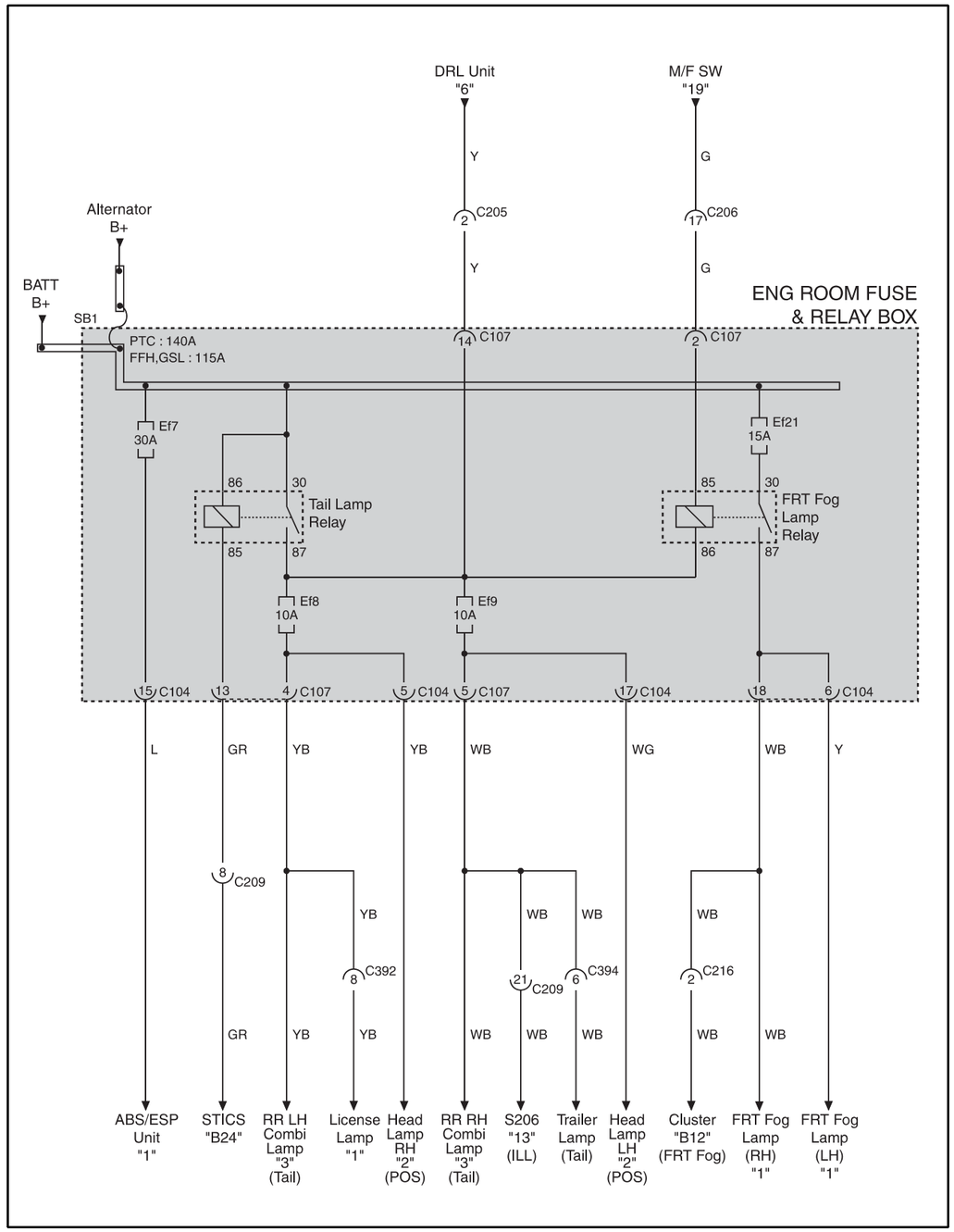


(4) EF3, EF4, EF19, EF20, HEAD LAMP RELAY(HI, LO), COMP RELAY,ENG MOUNT CONTROL RELAY

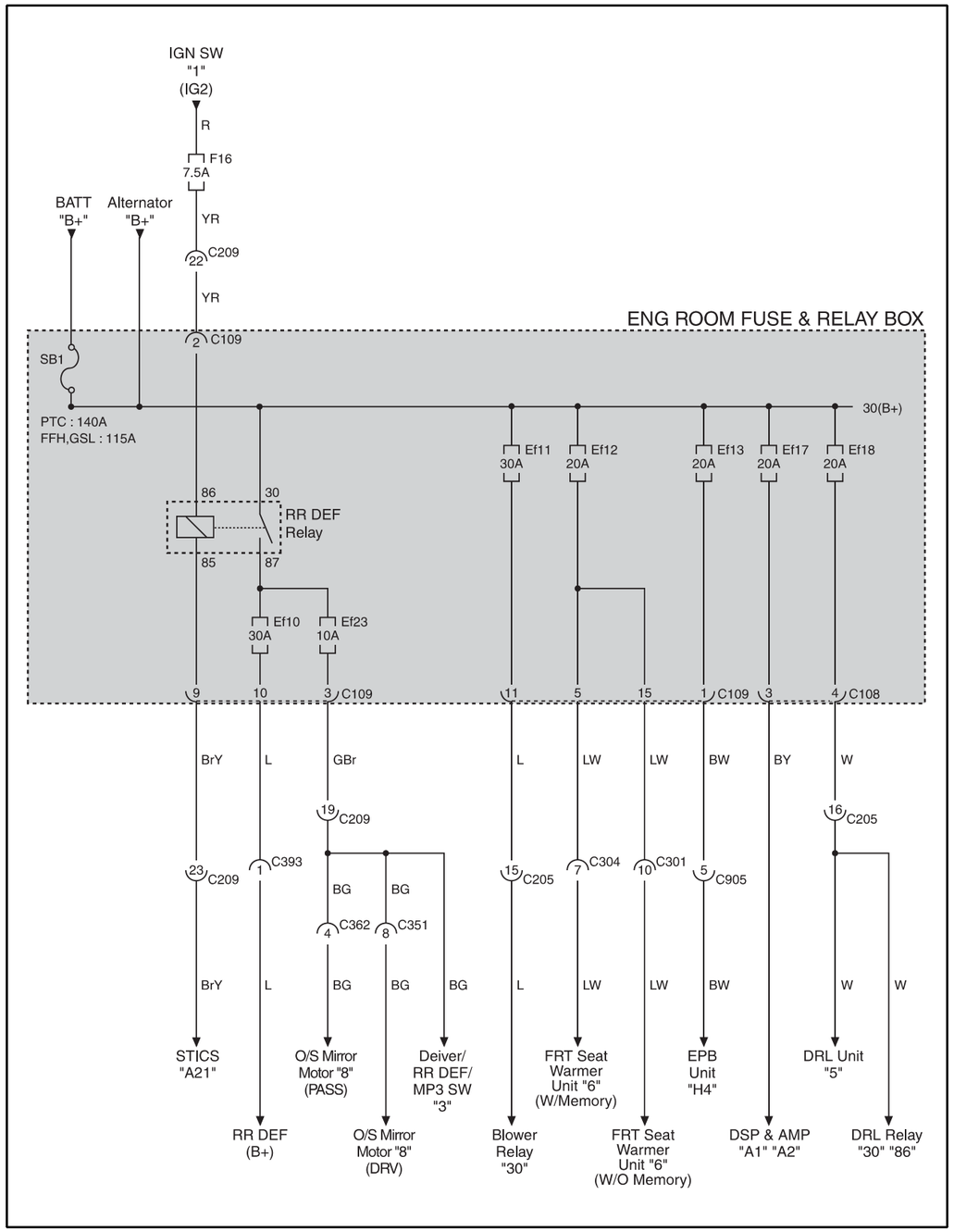


Modification basis	
Application basis	
Affected VIN	

(5) EF7 ~ EF9, EF21, TAIL LAMP RELAY, FRT FOG LAMP RELAY

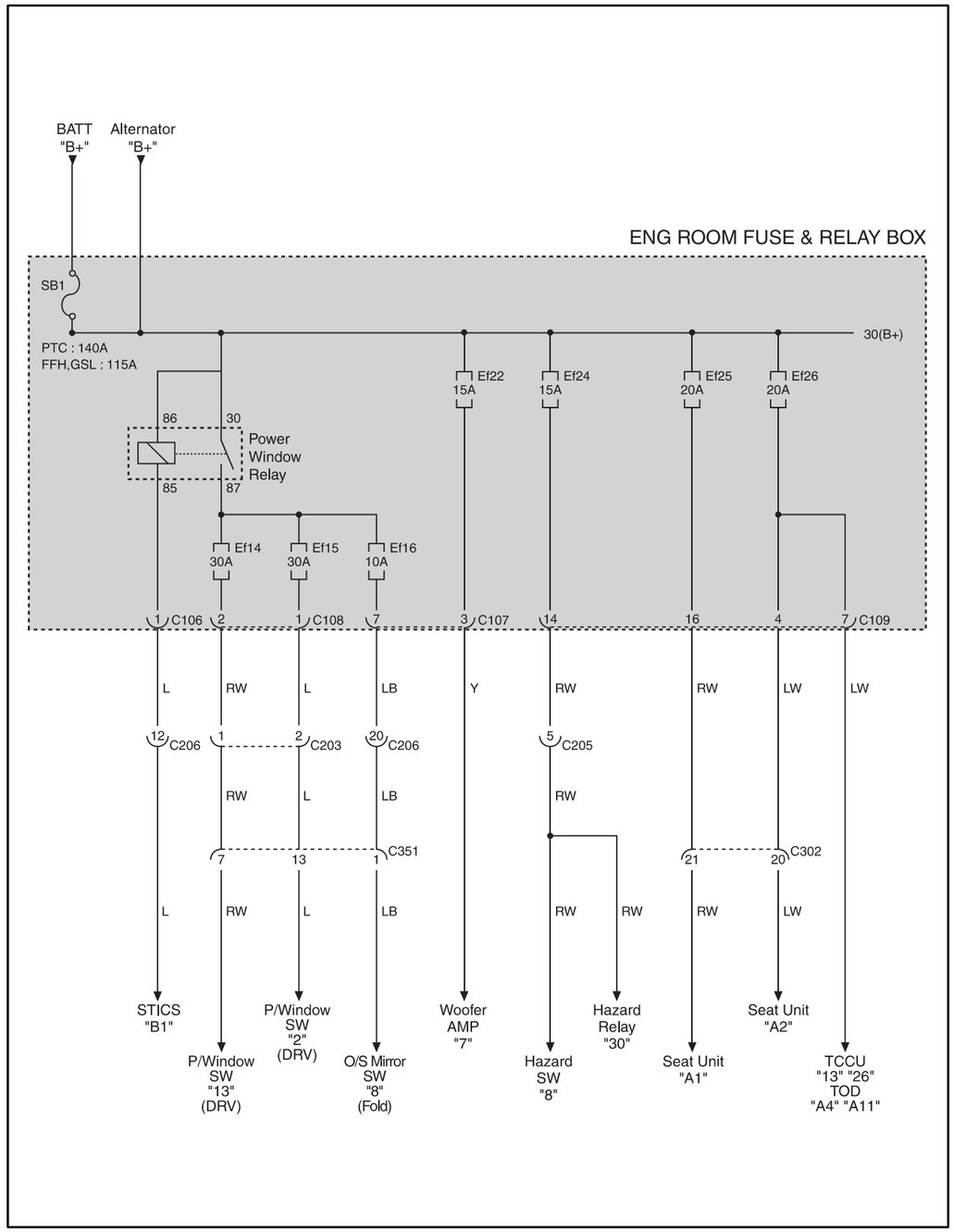


(6) EF10 ~ EF13, EF17, EF18, EF23, RR DEF RELAY

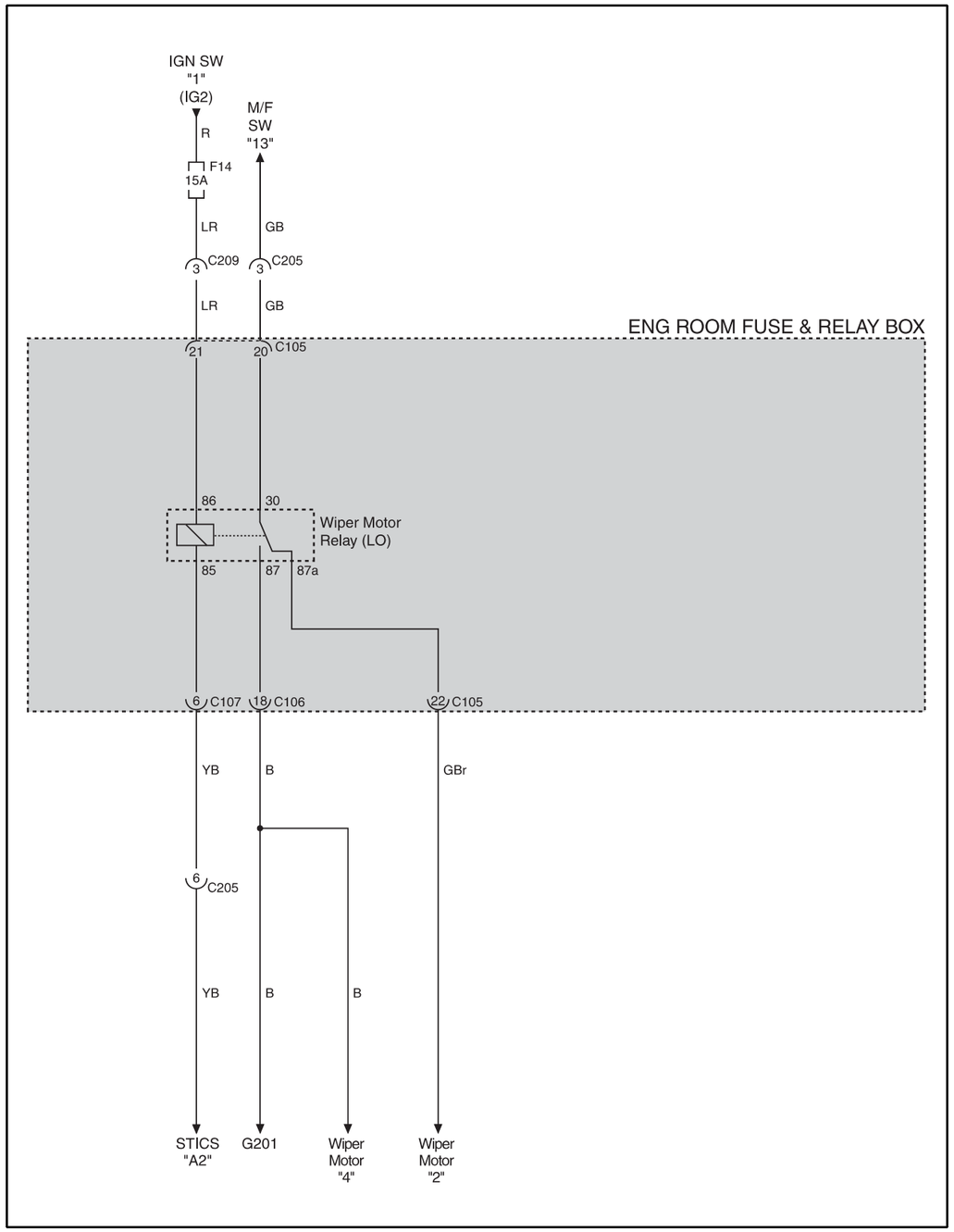


Modification basis	
Application basis	
Affected VIN	

(7) EF14 ~ EF16, EF22, EF24 ~ EF26, POWER WINDOW RELAY



(8) FRT WIPER MOTOR RELAY(LO)

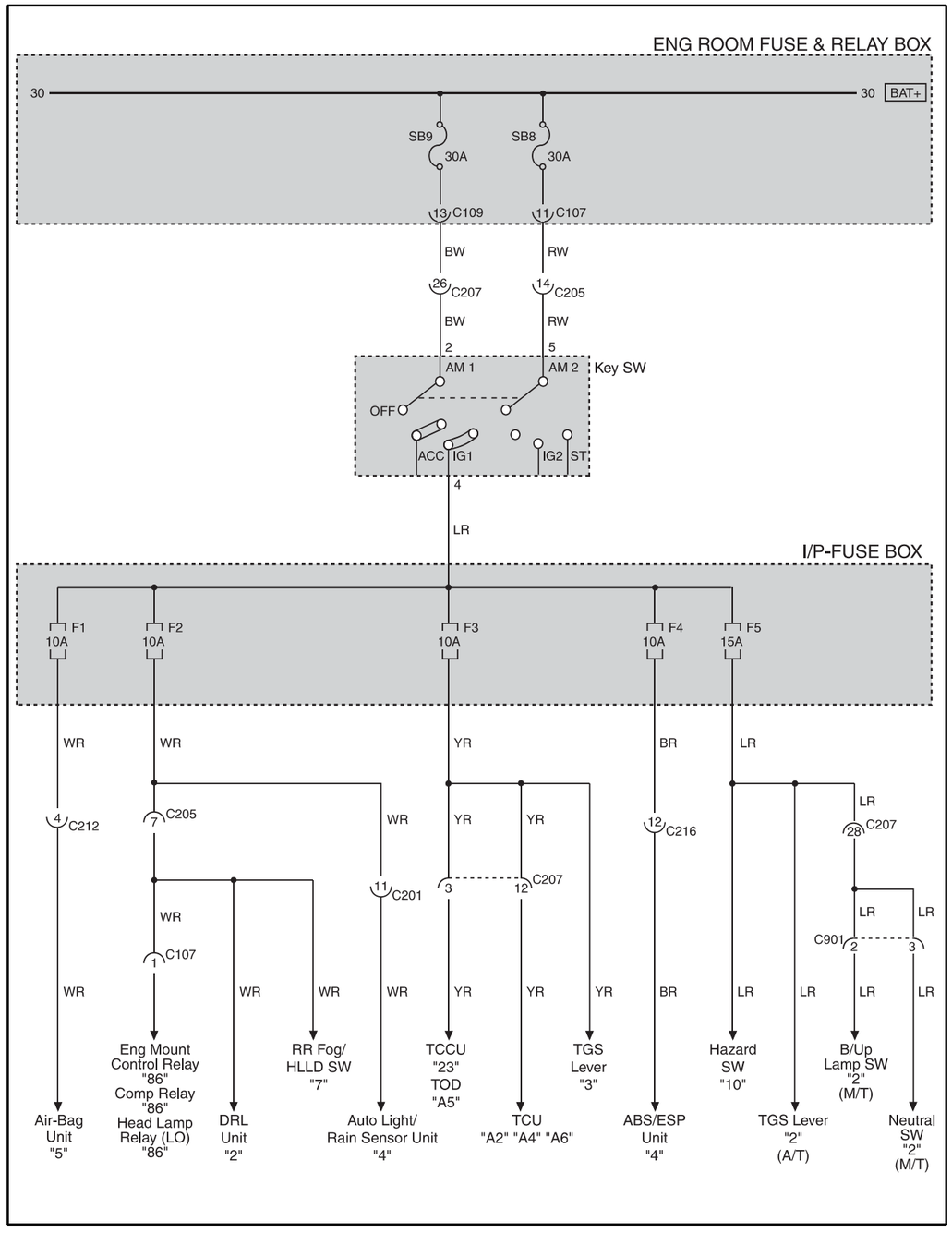


Modification basis	
Application basis	
Affected VIN	

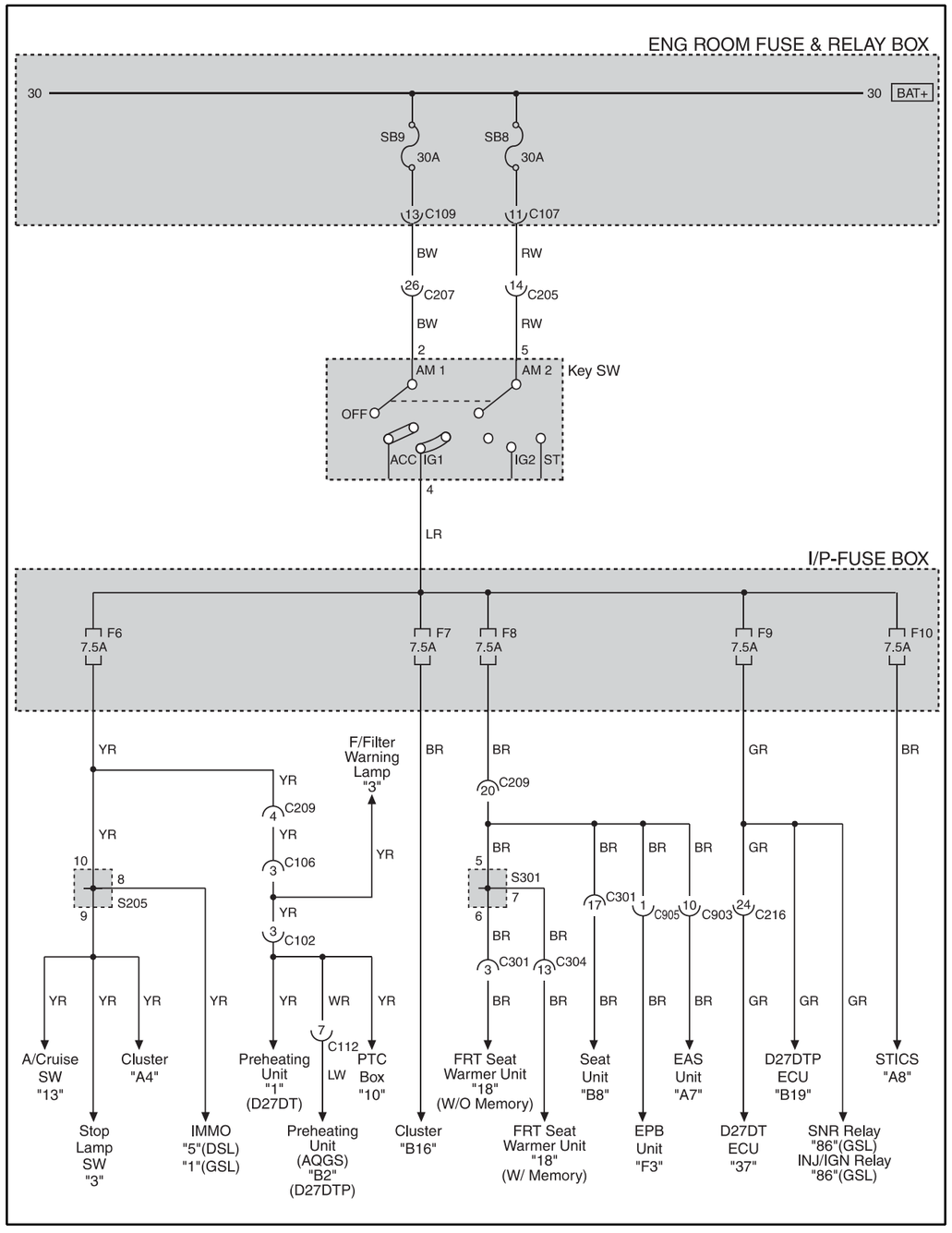
S.G.N. 8410-04

I/P - FUSE BOX CIRCUIT

(1) F1 ~ F5

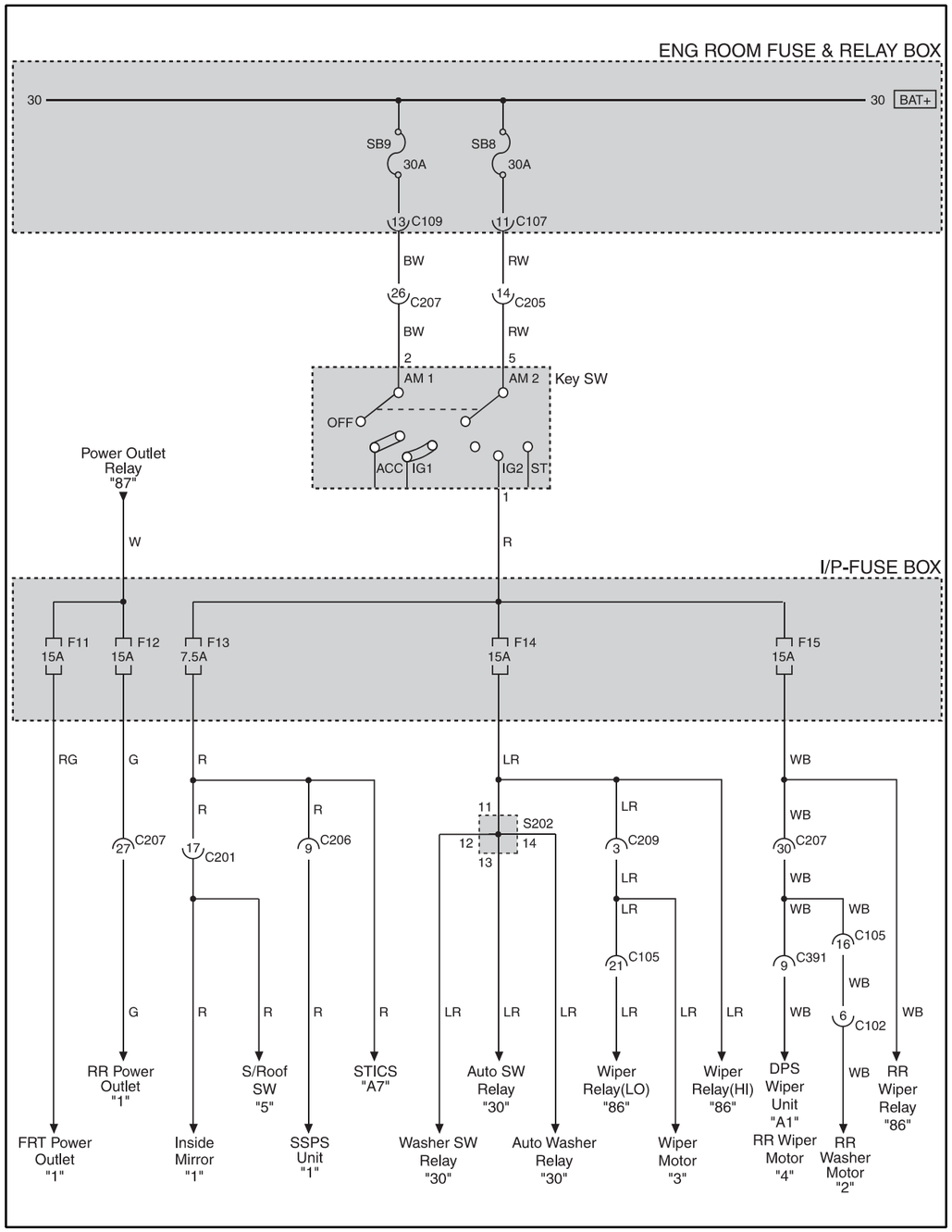


(2) F6 ~ F10

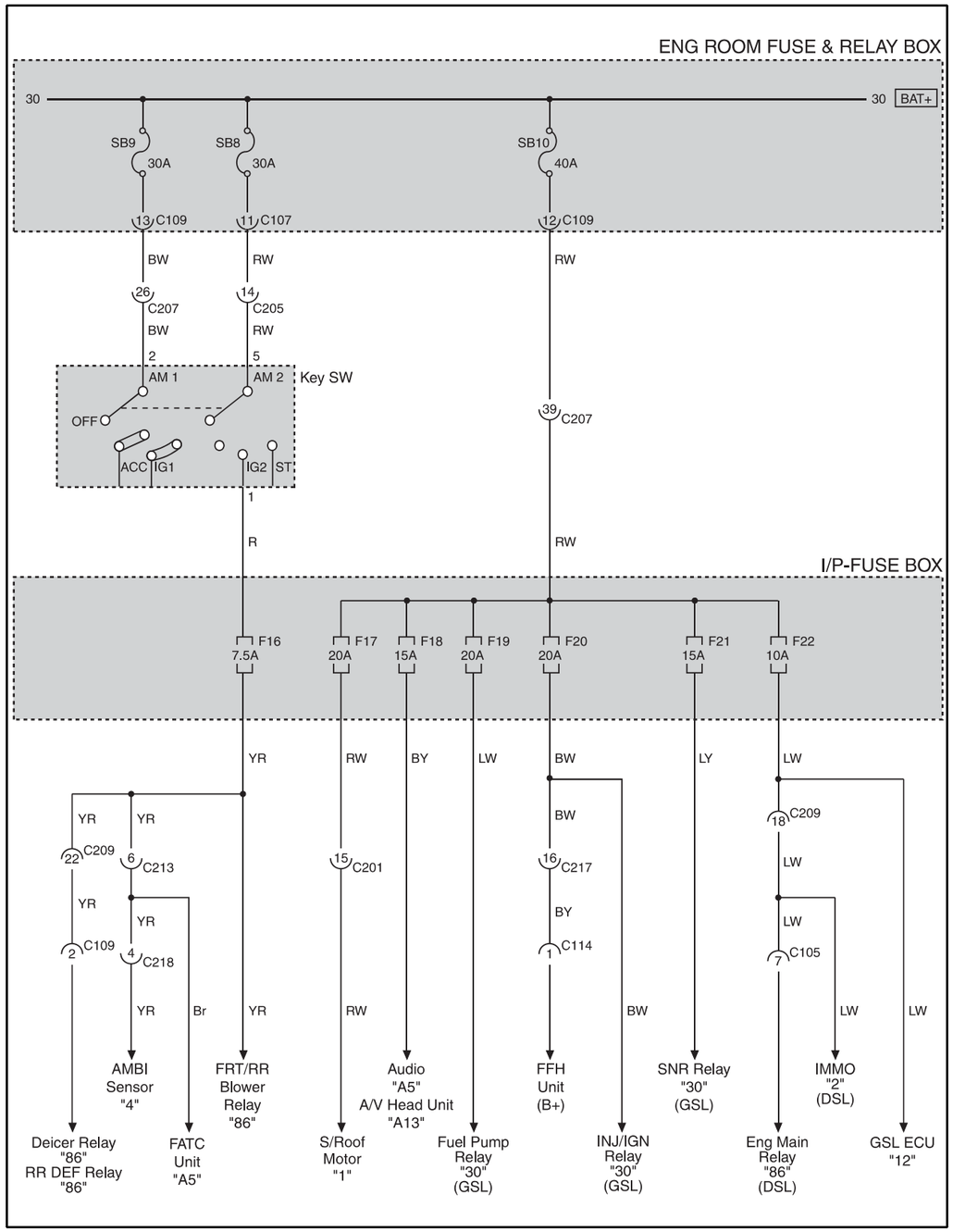


Modification basis	
Application basis	
Affected VIN	

(3) F11 ~ F15

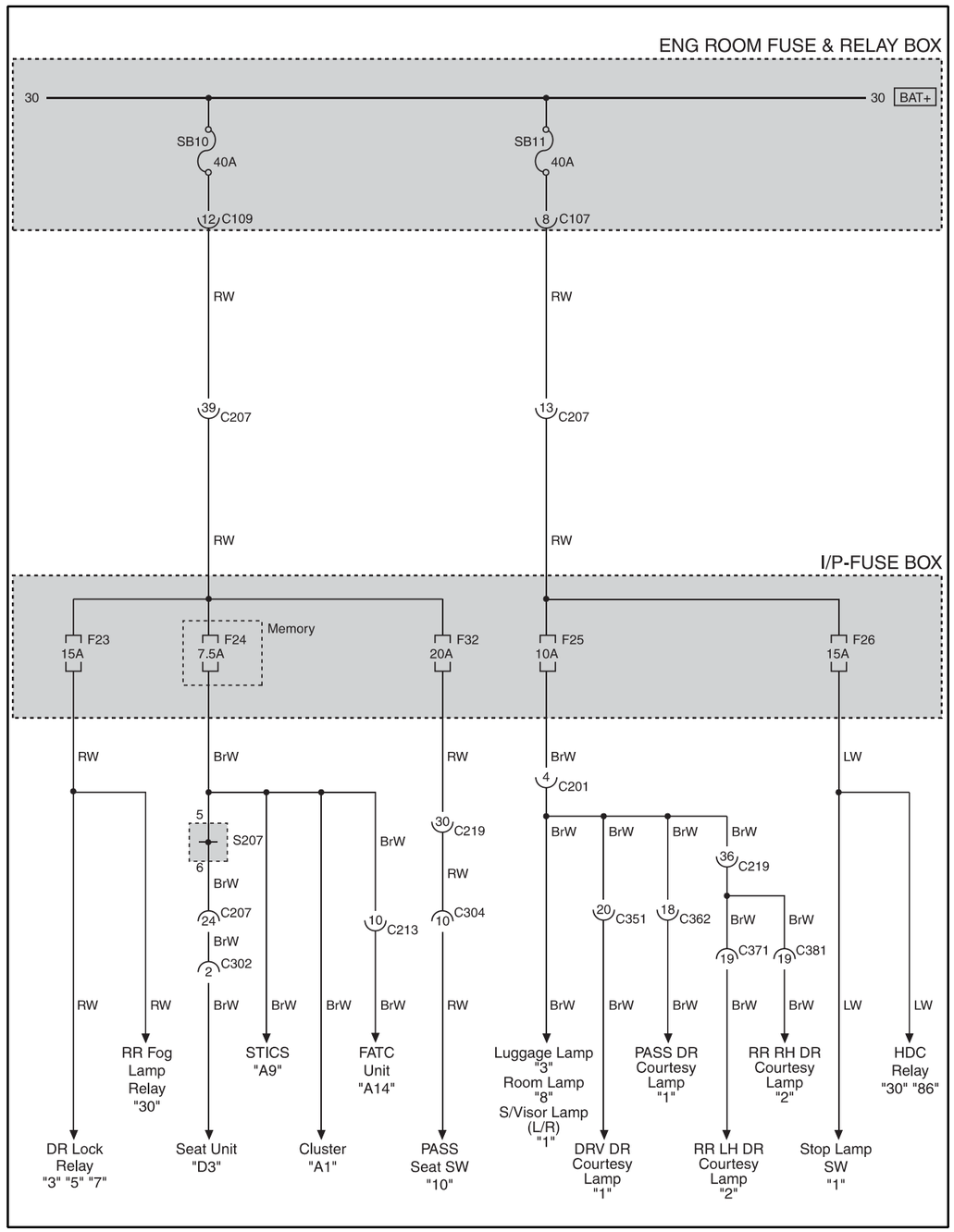


(4) F16 ~ F22

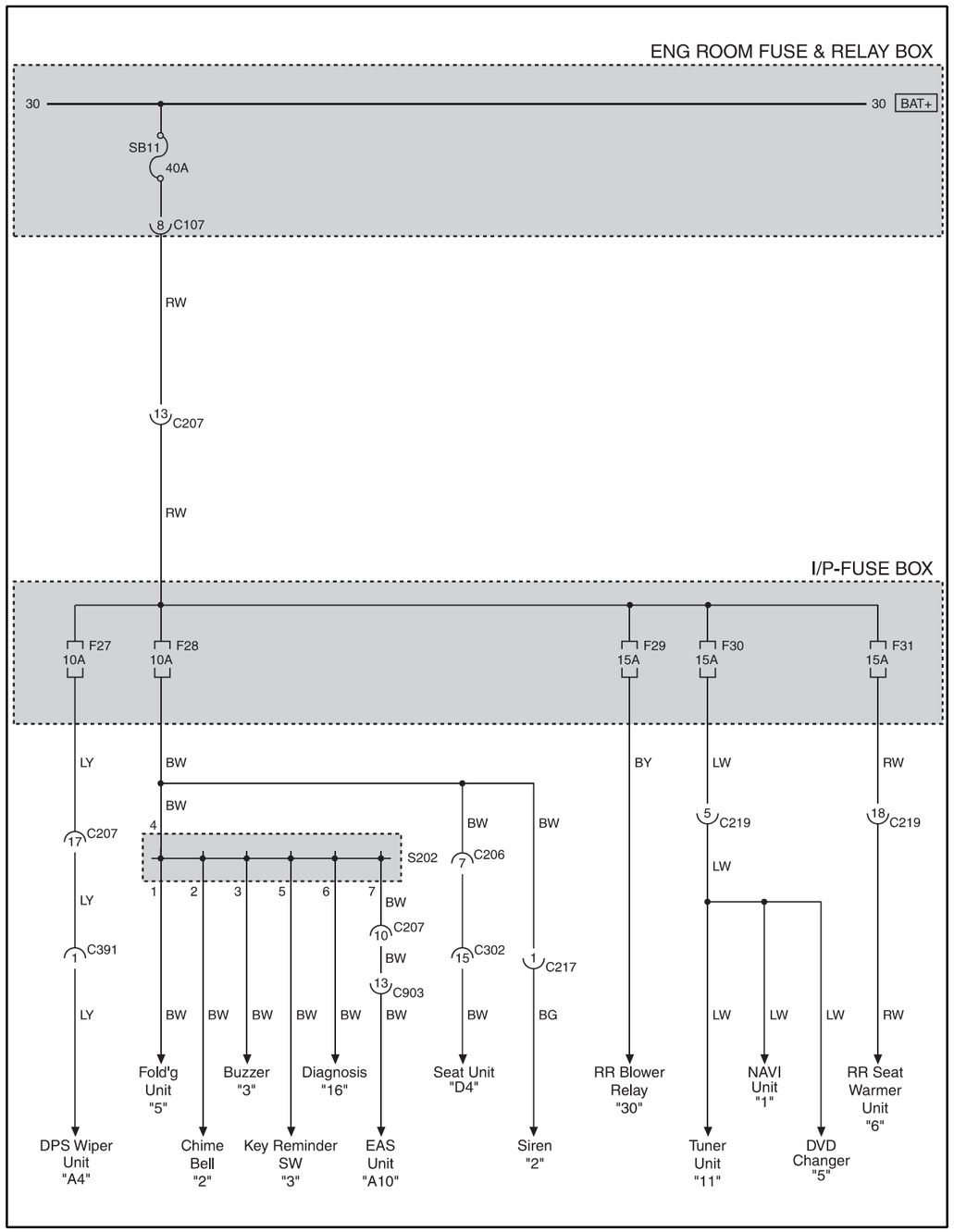


Modification basis	
Application basis	
Affected VIN	

(5) F23 ~ F26, F32

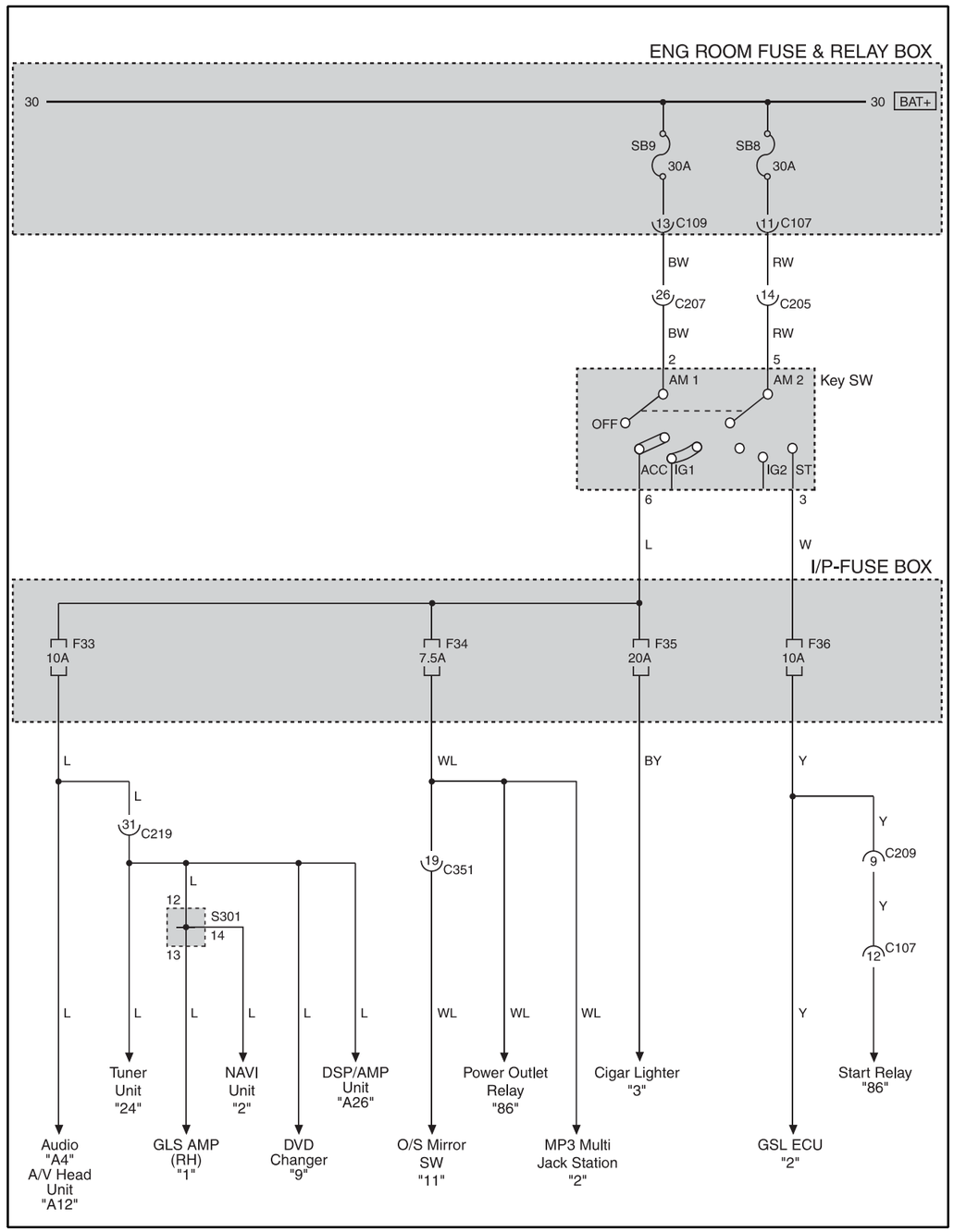


(6) F27 ~ F31



Modification basis	
Application basis	
Affected VIN	

(7) F33 ~ F36

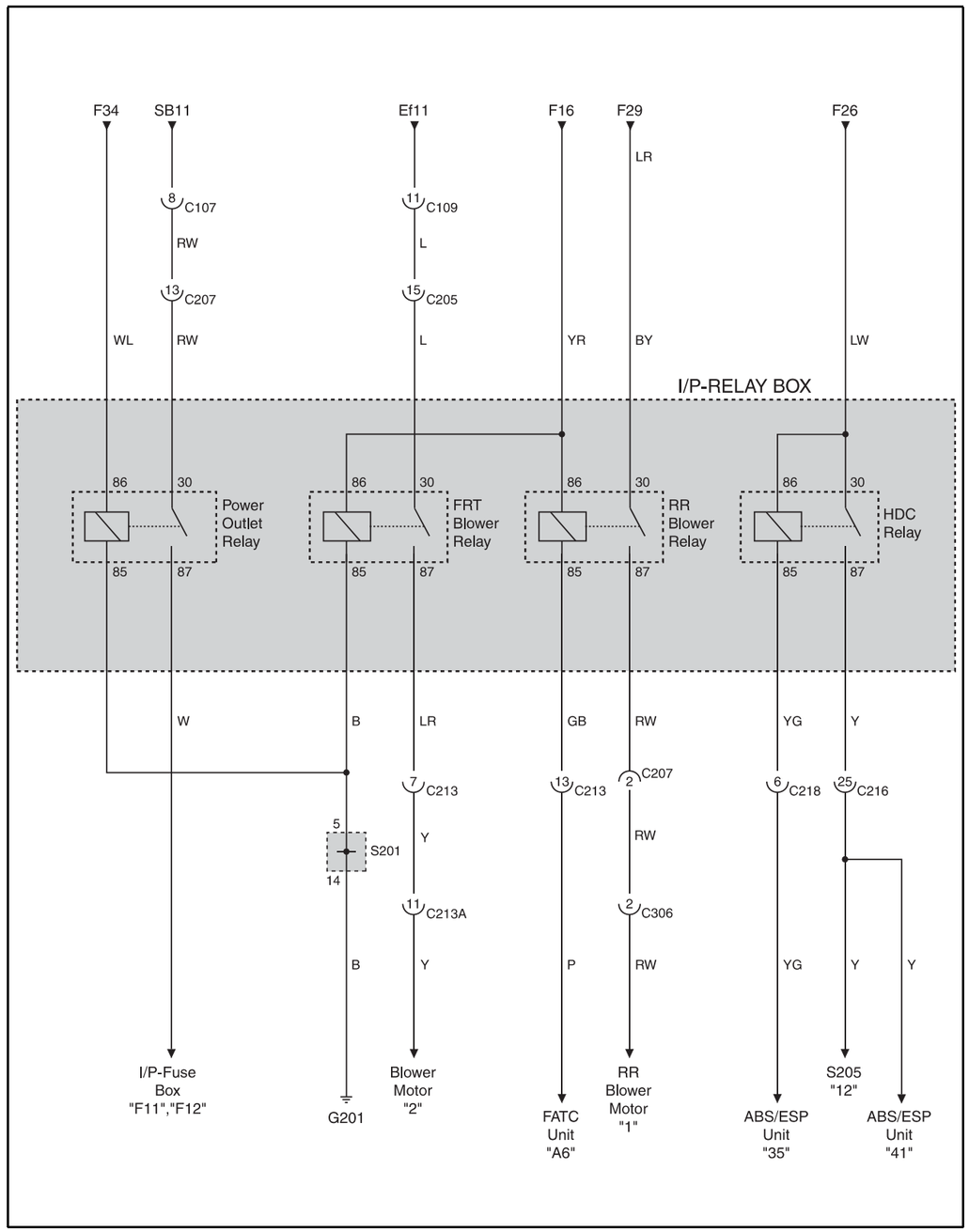


Modification basis	
Application basis	
Affected VIN	

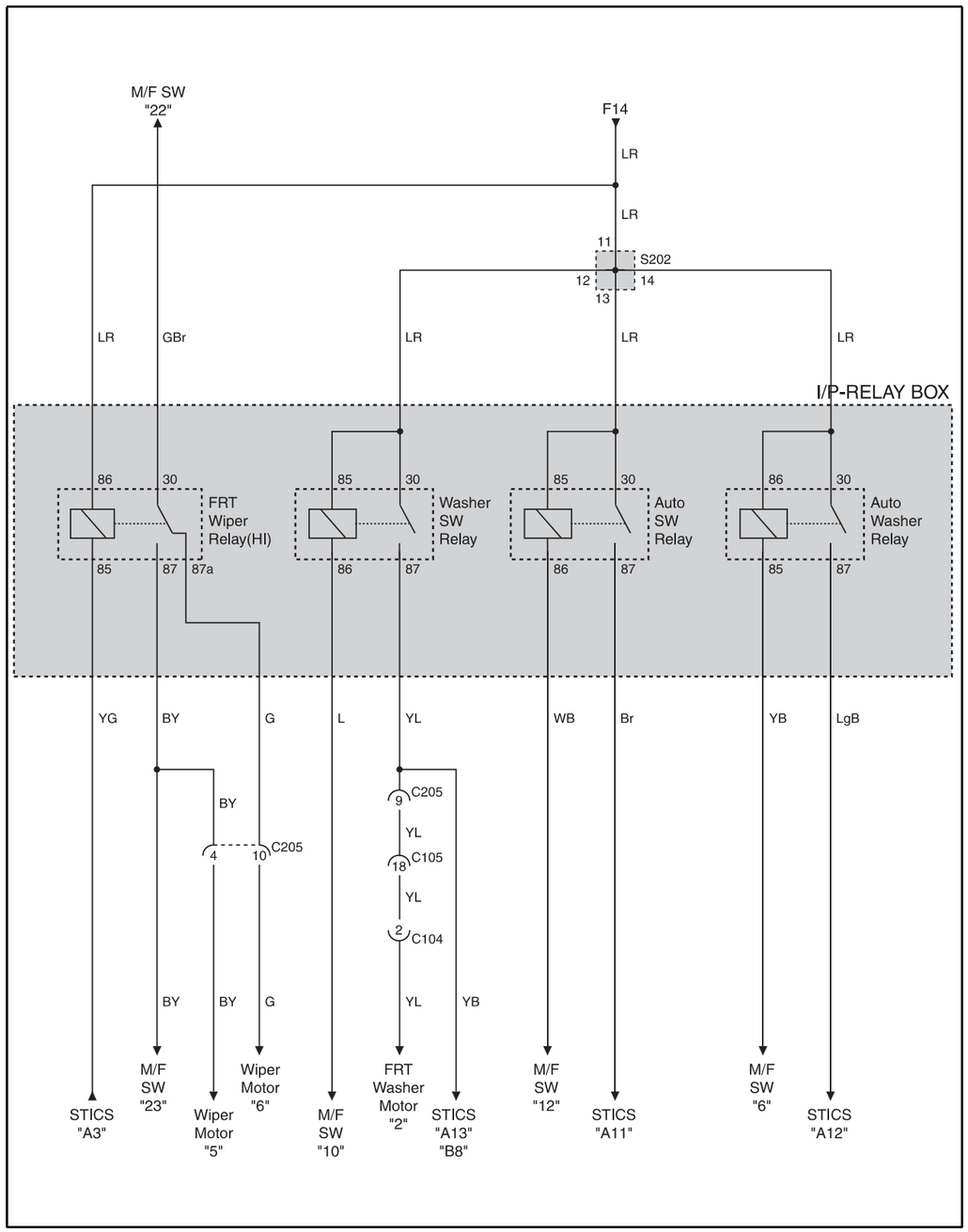
S.G.N. 8410-06

I/P - RELAY BOX CIRCUIT

(1) POWER OUTLET RELAY, BLOWER RELAY(FRT,RR), HDC RELAY

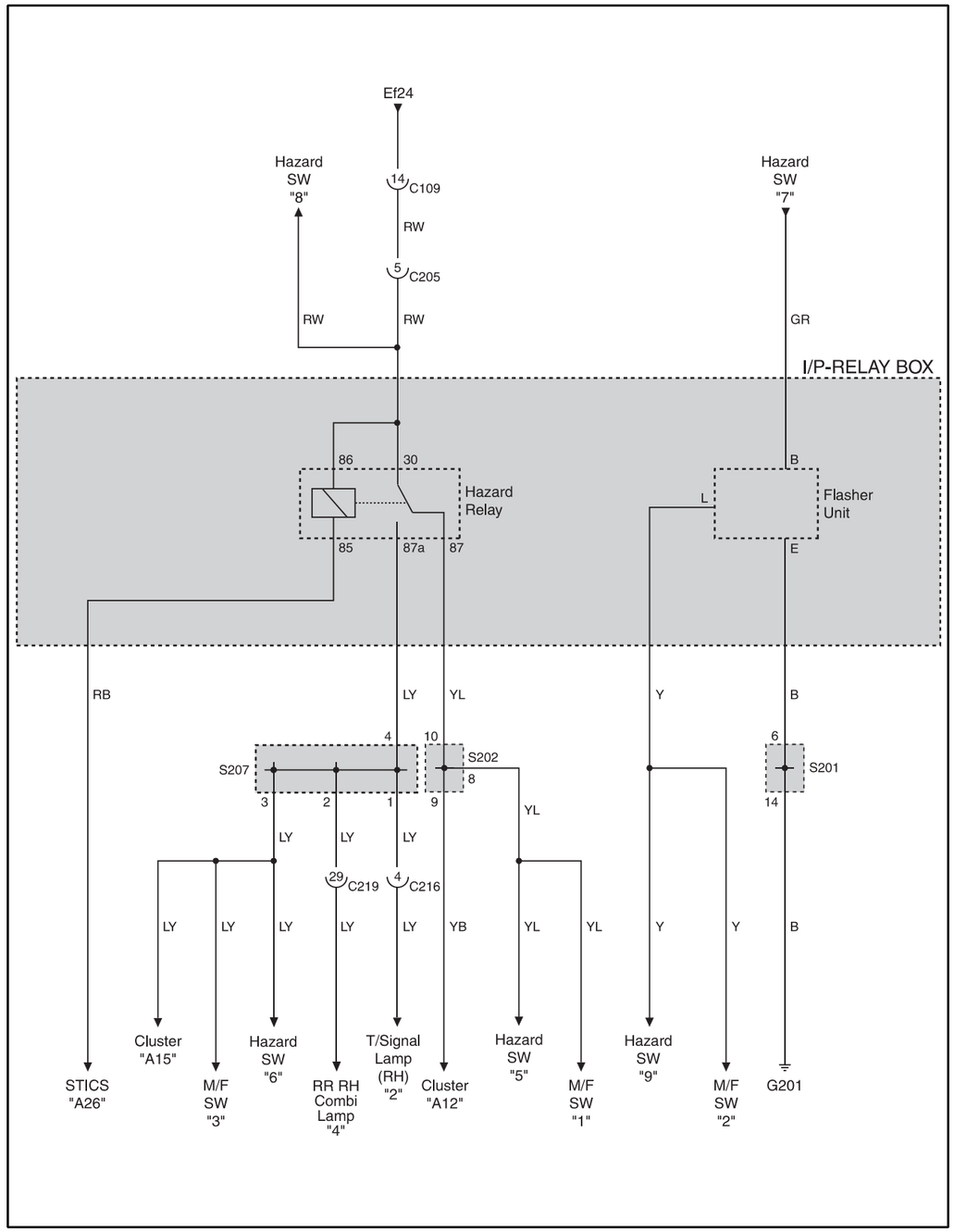


(2) WIPER RELAY(HI), WASHER SW RELAY, AUTO SW RELAY, AUTO WASHER RELAY

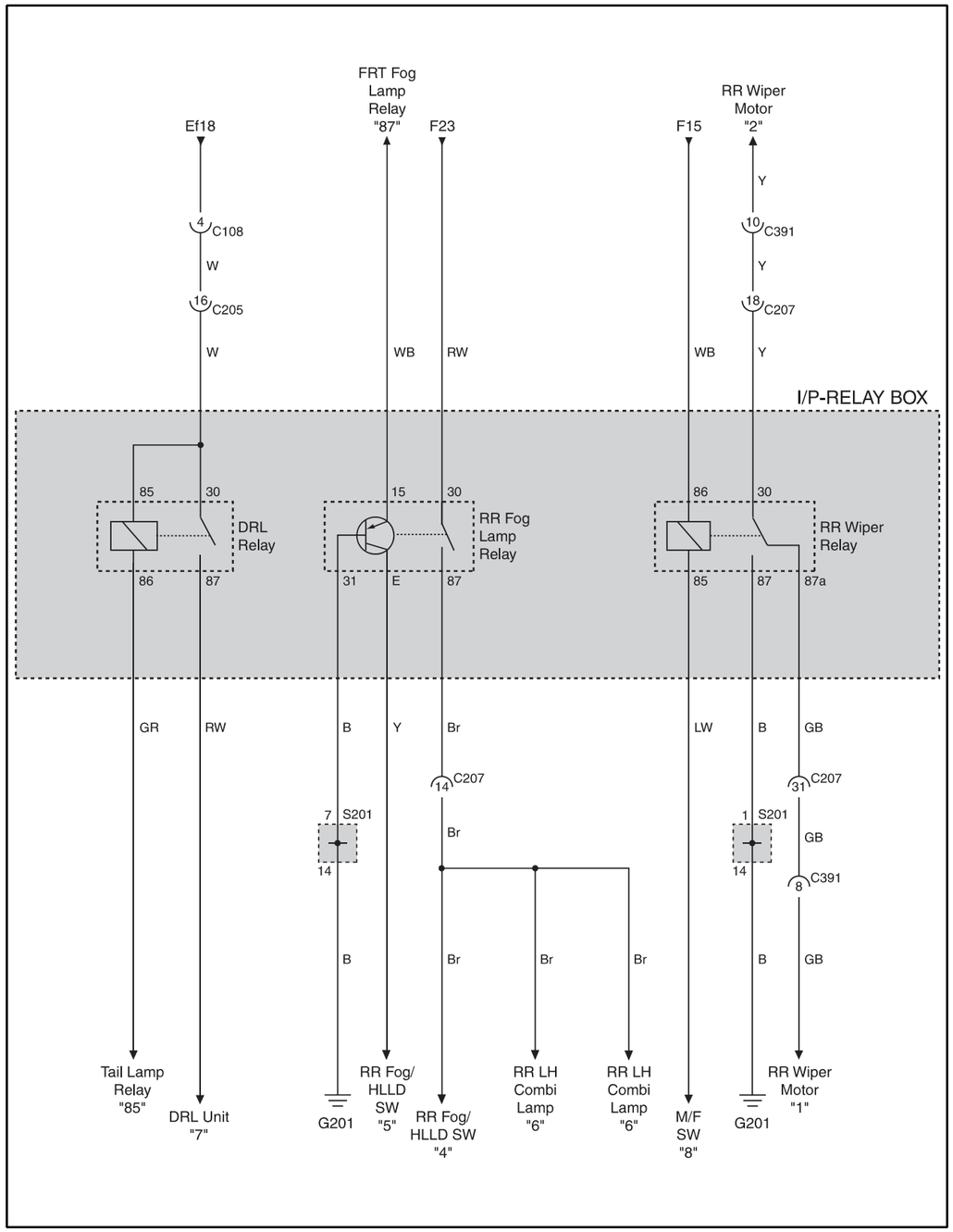


Modification basis	
Application basis	
Affected VIN	

(3) HARZARD RELAY, FLASHER UNIT

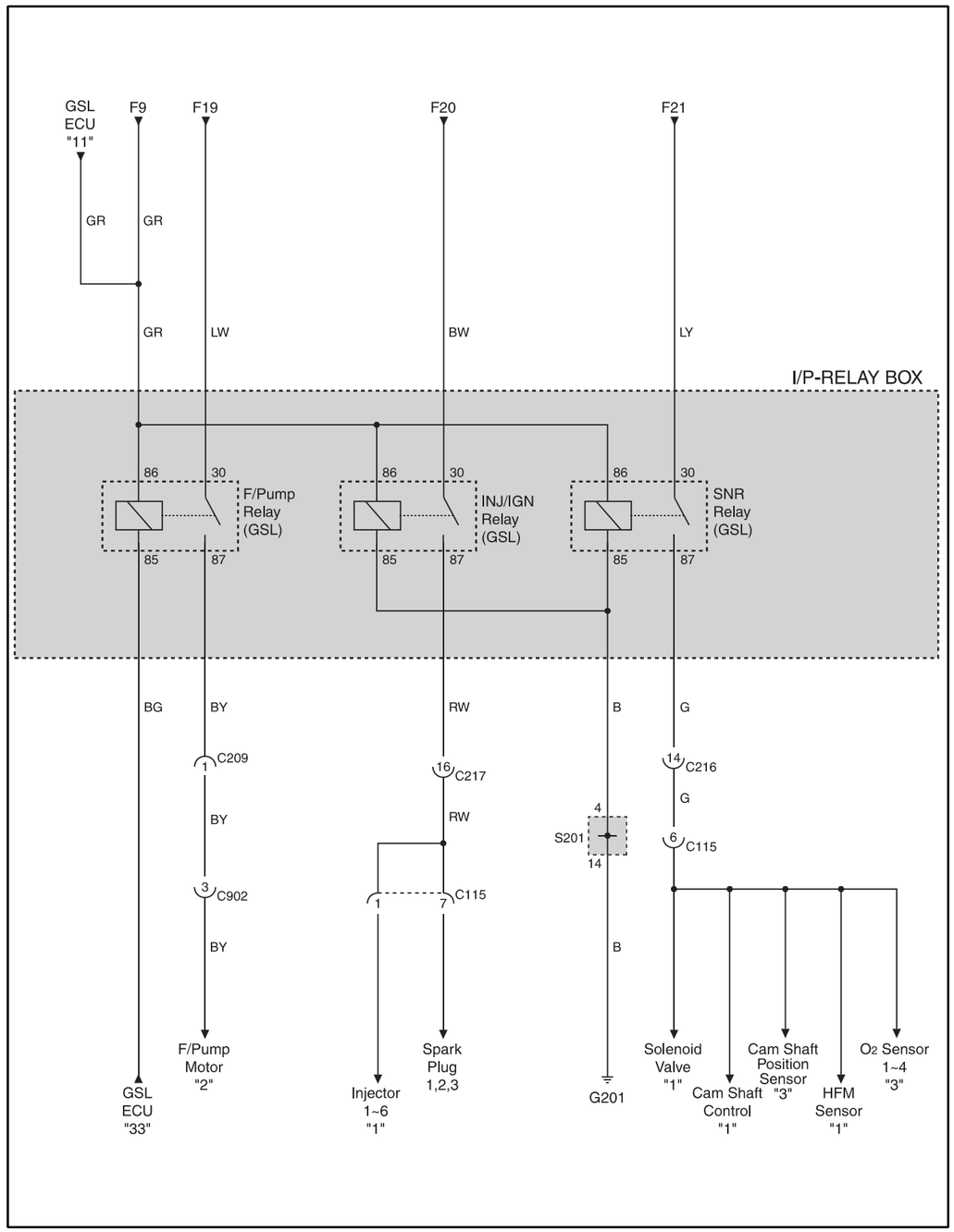


(3) DRL RELAY, RR FOG LAMP RELAY, RR WIPER RELAY



Modification basis	
Application basis	
Affected VIN	

(5) F/PUMP RELAY, INJ/IGN RELAY, SNR RELAY



Memo

Memo

1461-01/2820-01/1491-01/8210-01/3410-01/4480-01/4920-01/4892-01/4620-12/8010-01/7410-13/7410-04/8510-52/8510-48/8710-02/7830-03/8510-05/8610-06/7632-167340-03/8310-01/8510-00/8320-01/8410-01/8210-01/8310-10/4810-01/7770-02/7770-10/8910-01/8930-01/8790-01/6810-15/6910-01/6810-20

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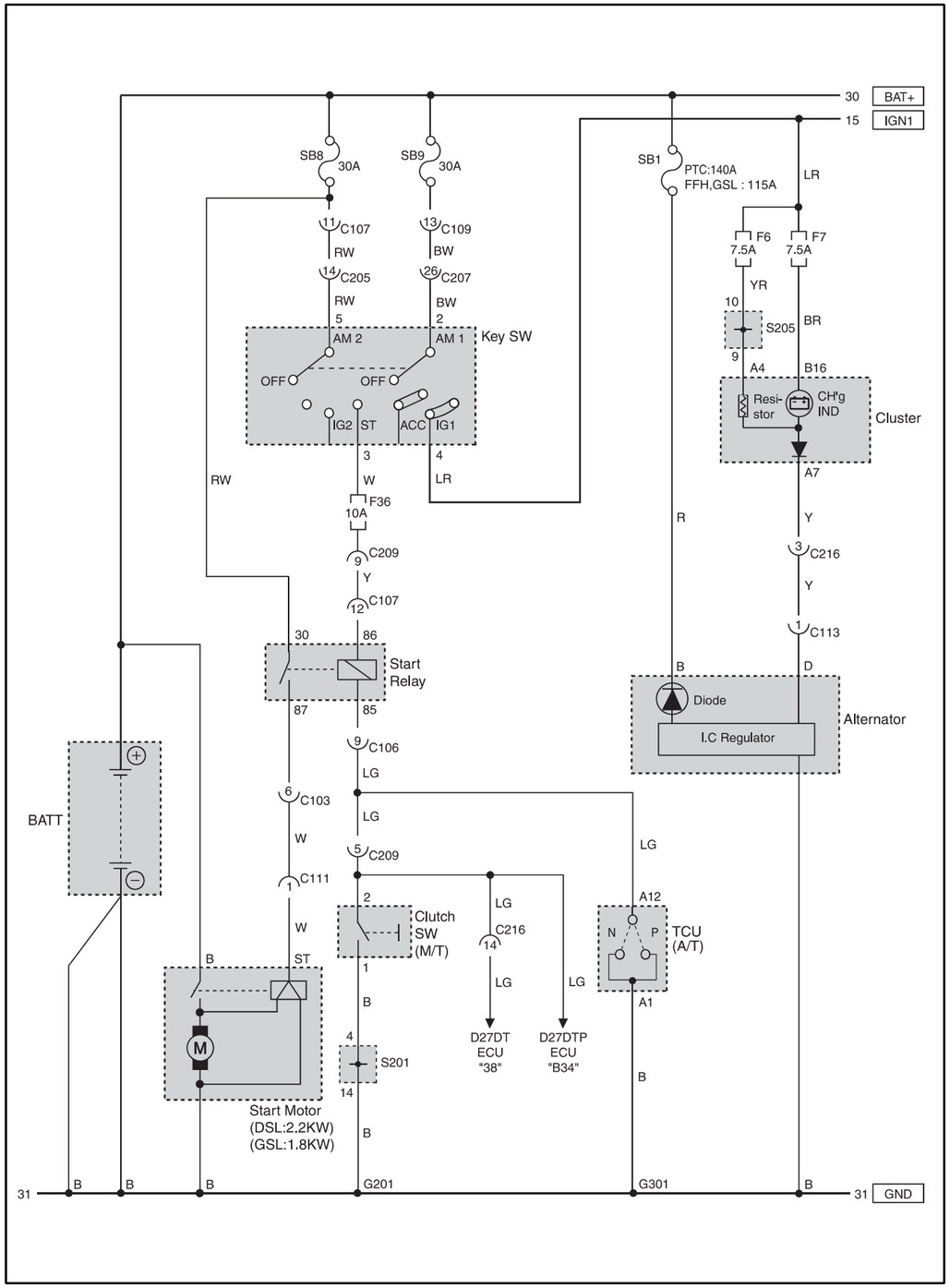
Memo

Memo

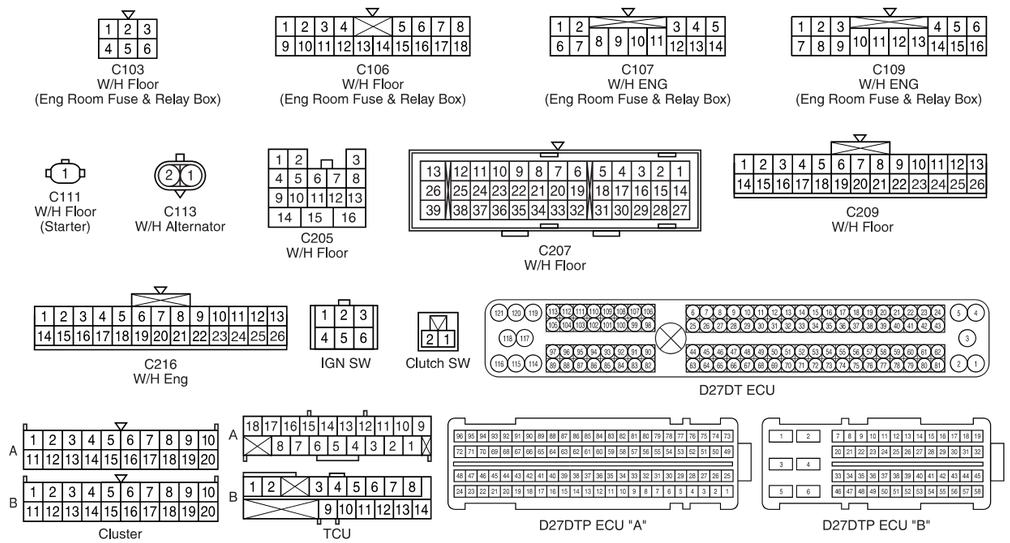
S.G.N. 1461-01 STARTING & CHARGING



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C103 (6Pin, Colorless)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C111 (1Pin, Gray)	W/H Floor - Starter Motor	Under the Preheating Time Relay	Solenoid
C113 (2Pin, Black)	W/H Eng - W/H Alternator	Under the Coolant Reserve Tank	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
G301	W/H Floor	Under the Driver Seat	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

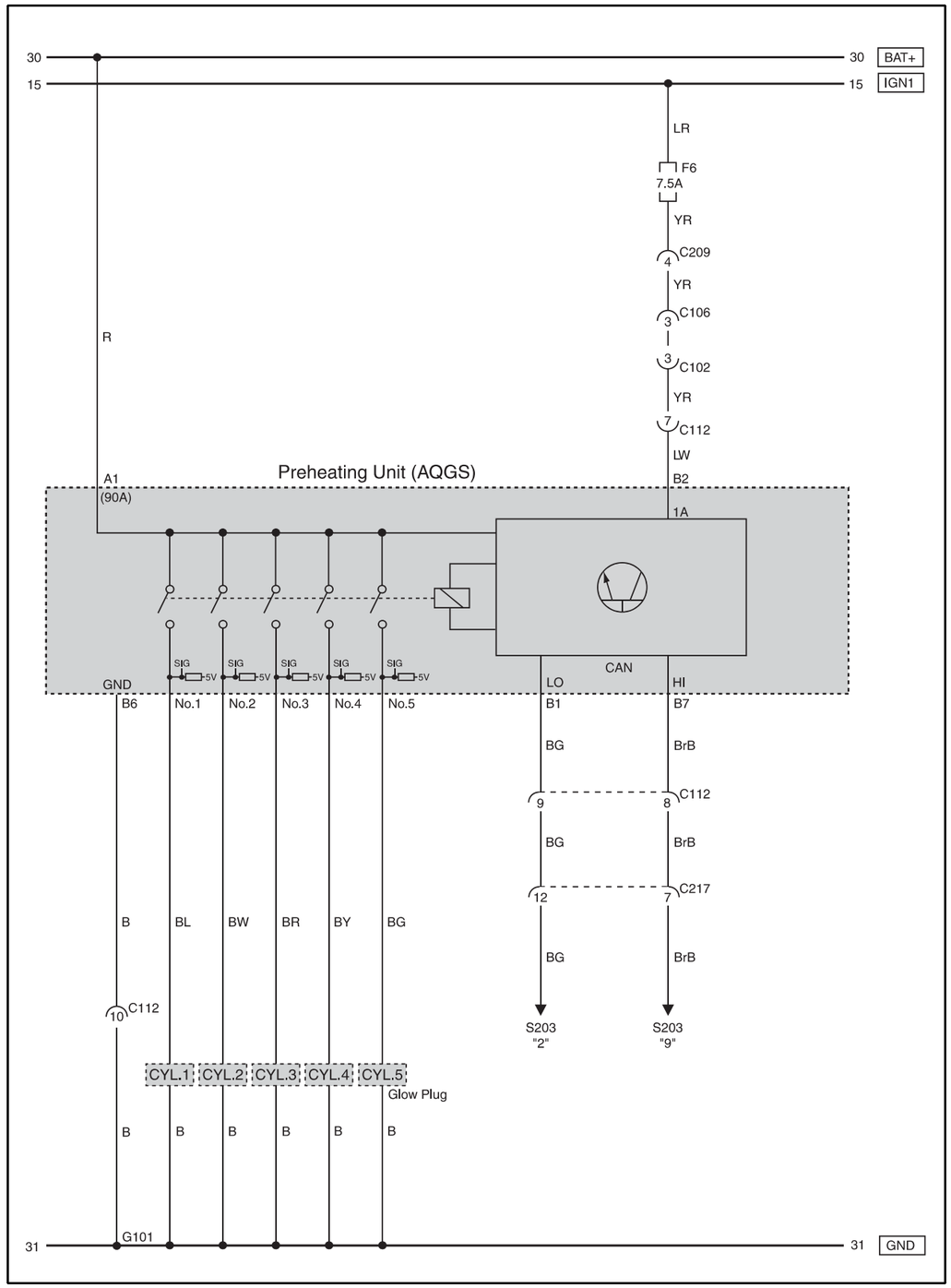
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 2820-01

PREHEATING CIRCUIT I - AQGS(D27DTP)



1) CONNECTOR INFORMATION

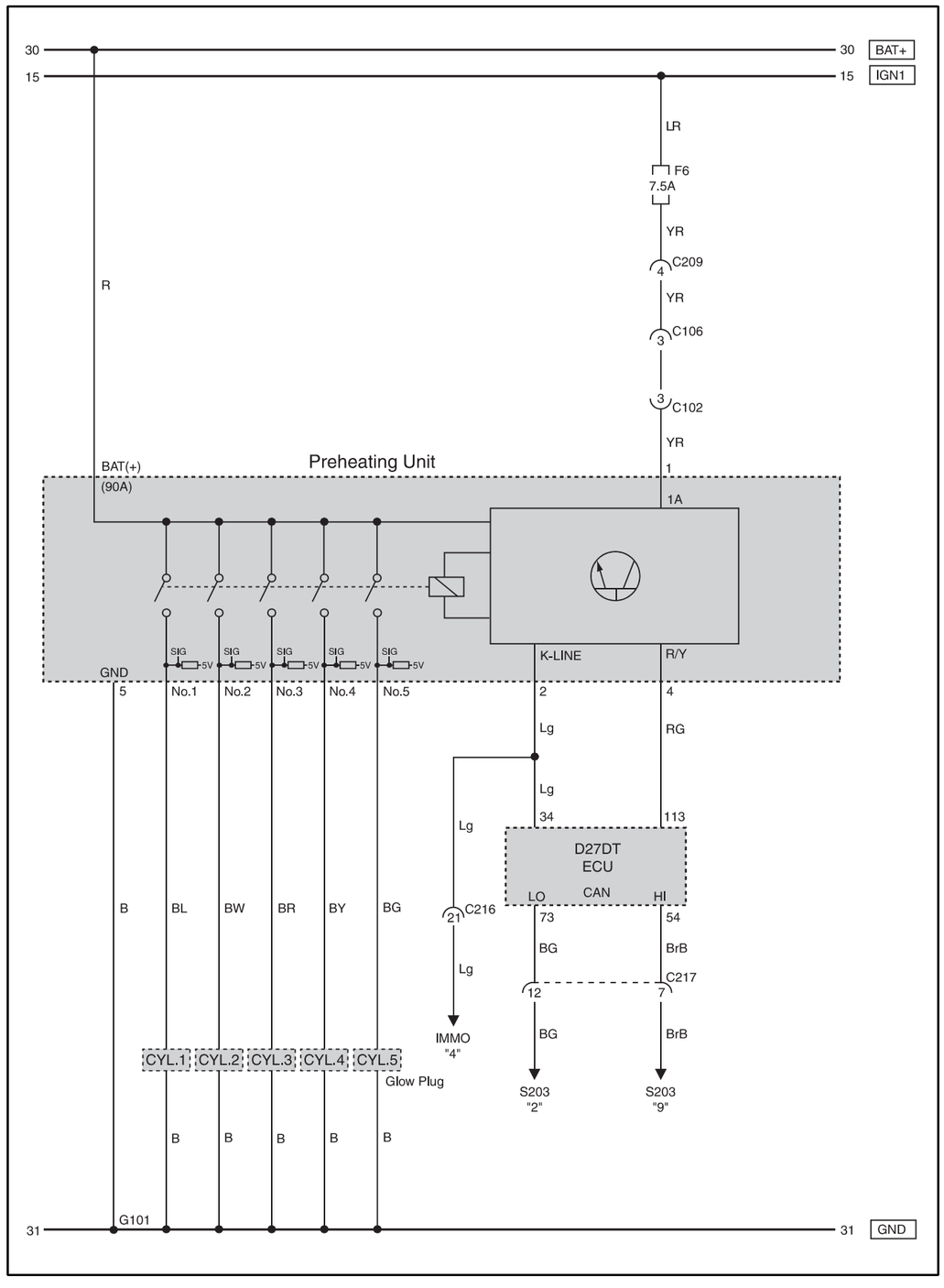
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C112 (12Pin, Black)	W/H Eng - W/H Eng Control	Under the Preheating Time Relay	D27DTP
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G101	W/H Eng	Center the Eng Room Fuse Box	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	CAN

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

Modification basis	
Application basis	
Affected VIN	

S.G.N. 2820

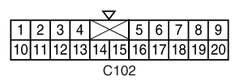
PREHEATING CIRCUIT II (D27DT)

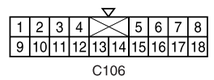


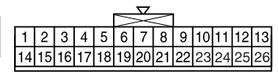
(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G101	W/H Eng	Center the Eng Room Fuse Box	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	CAN

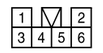
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

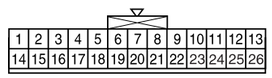

C102
W/H Floor
(Eng Room Fuse & Relay Box)

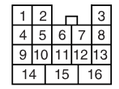

C106
W/H Floor
(Eng Room Fuse & Relay Box)

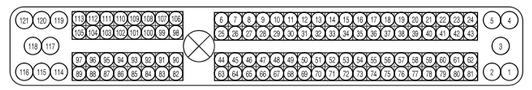

C209
W/H Floor

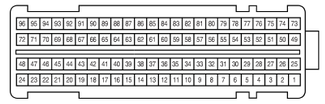
Preheating Unit

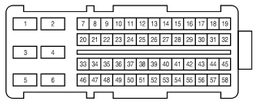

IMMO (DSL)


C216
W/H Eng


C217
W/H Eng


D27DT ECU


D27DTP ECU "A"


D27DTP ECU "B"

(3) CIRCUIT DESCRIPTION

Glow plug is installed on the cylinder head (combustion chamber) in the DSL preheating control unit system. Cold starting performance has improved and exhaust gas during cold starting has reduced. ECU receives coolant temperature and engine speed to control; after monitoring the engine preheating/post heating and glow plug diagnosis function, the fault contents will be delivered to ECU.

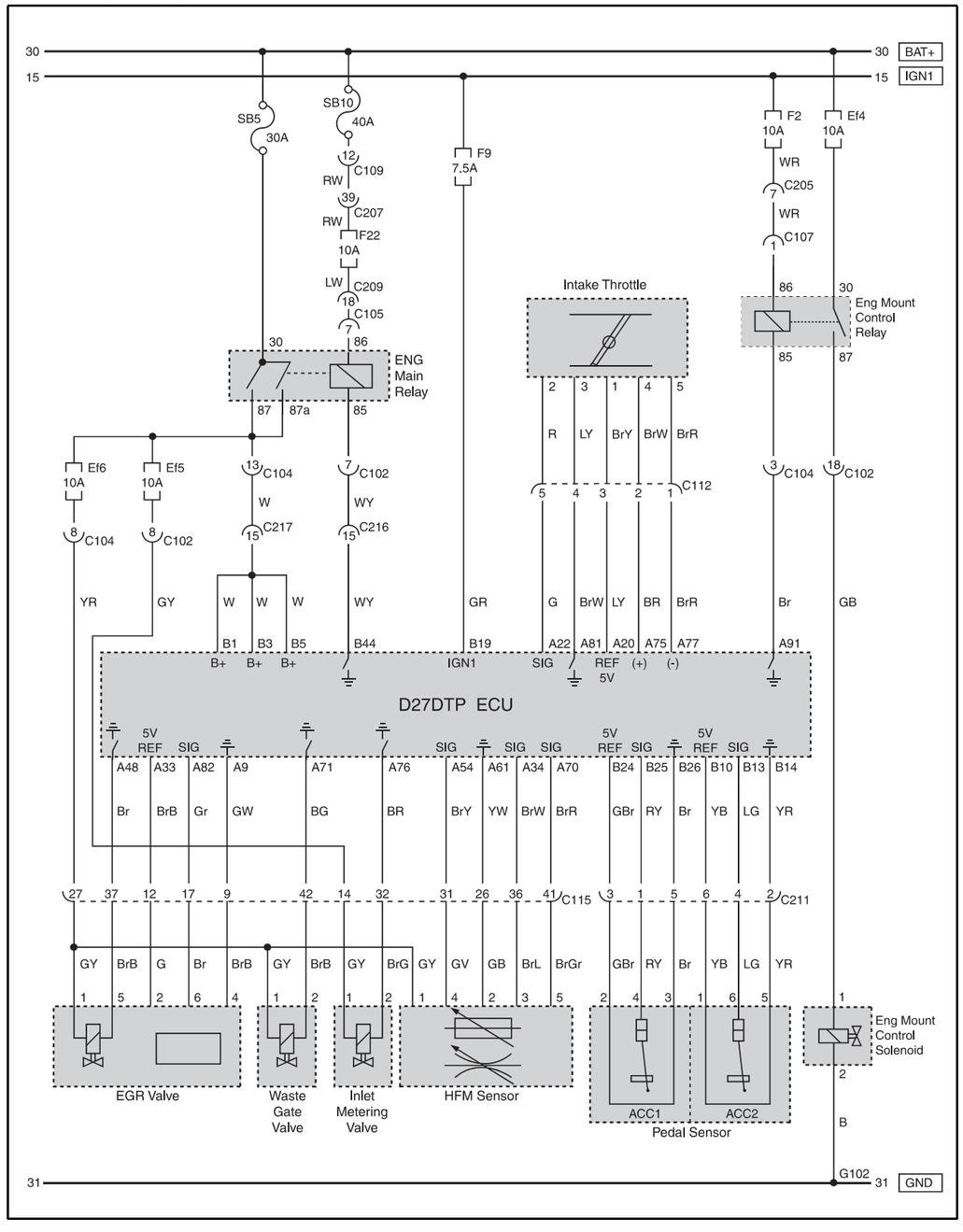
- Engine preheating/post heating functions
- Preheating relay activation by ECU controls
  · Senses engine temperature and controls the preheating/post heating time
  · Preheating warning light
- K-LINE for information exchanges between preheating unit and ECU
  · Transmits preheating unit self-diagnosis results to ECU
  · Transmits glow plug diagnosis results and operating status to ECU

Modification basis	
Application basis	
Affected VIN	

S.G.N. 1491-01

ECU (ENGINE CONTROL UNIT - D27DTP)

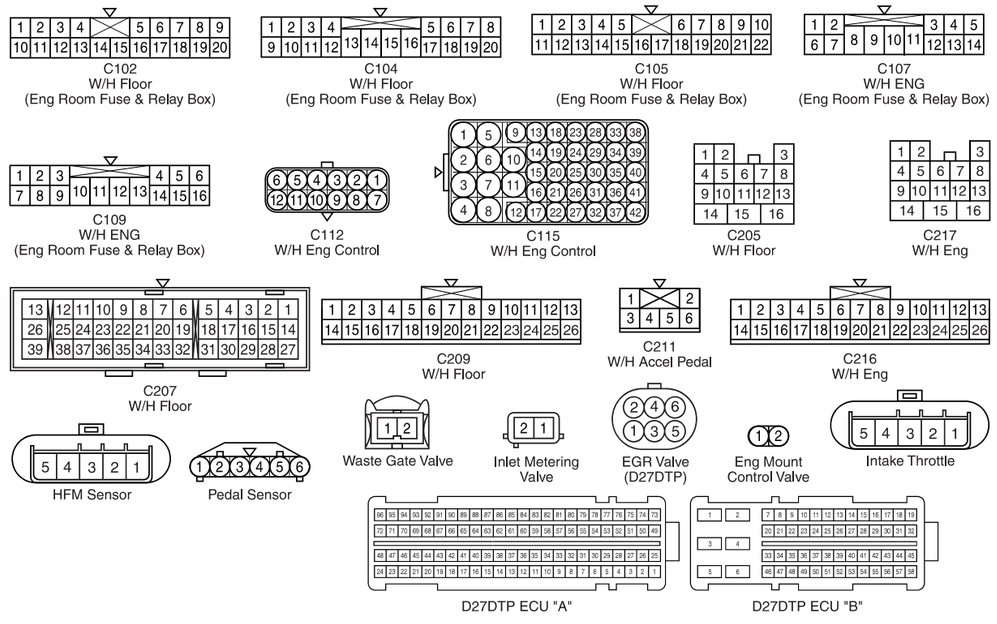
1) ENG MAIN RELAY, PEDAL MODULE, HFM SENSOR, VALVE, ENG MOUNT



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C112 (12Pin, Black)	W/H Eng - W/H Eng Control	Under the Preheating Time Relay	D27DTP
C115 (42Pin, Black)	W/H Floor - W/H Eng Control	Right Eng Room Dash PNL	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C211 (6Pin, White)	W/H Main - W/H Accel Pedal	Inside the Driver Under-Cover	
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G102	W/H Eng	Center the Eng BATT	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

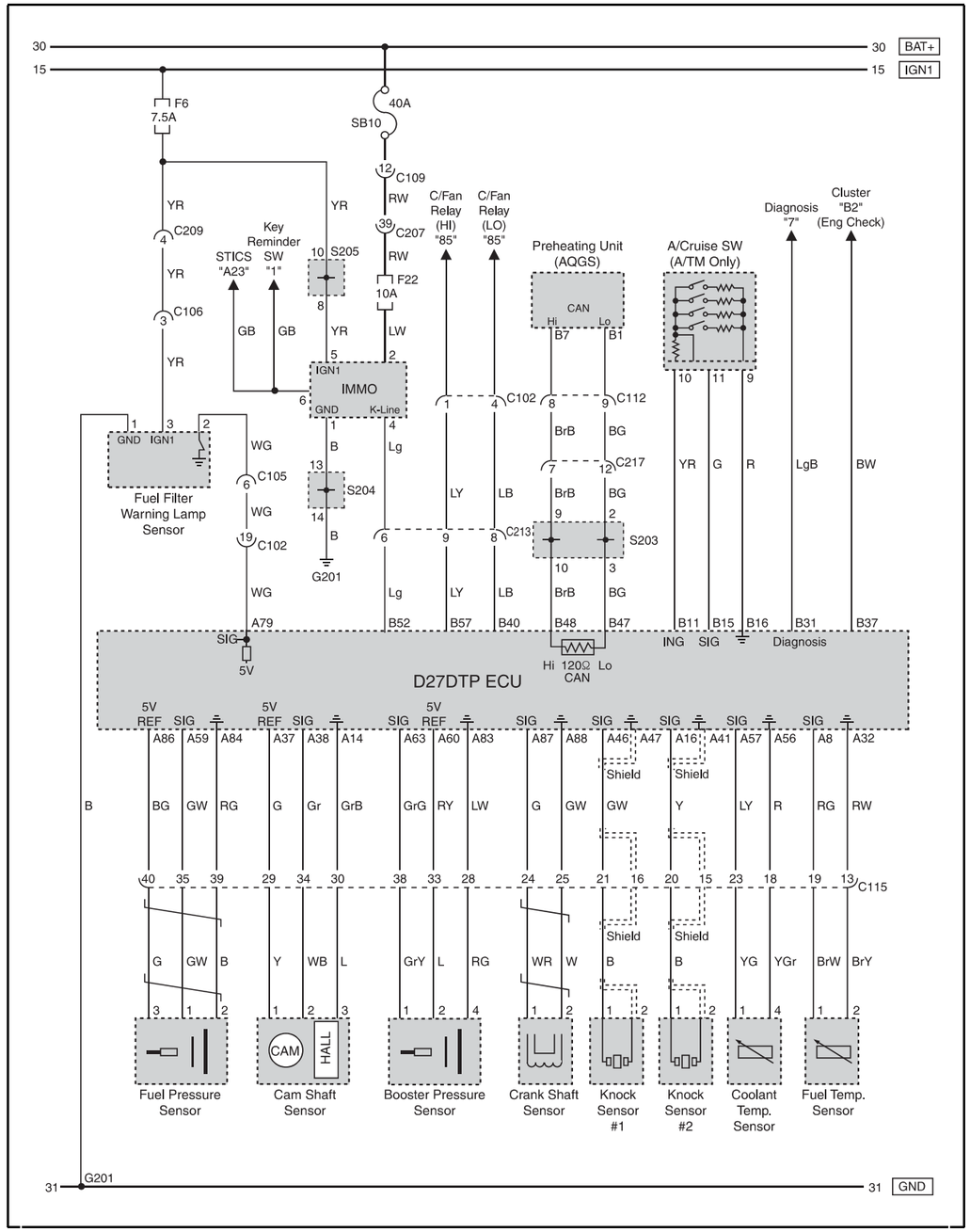


CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

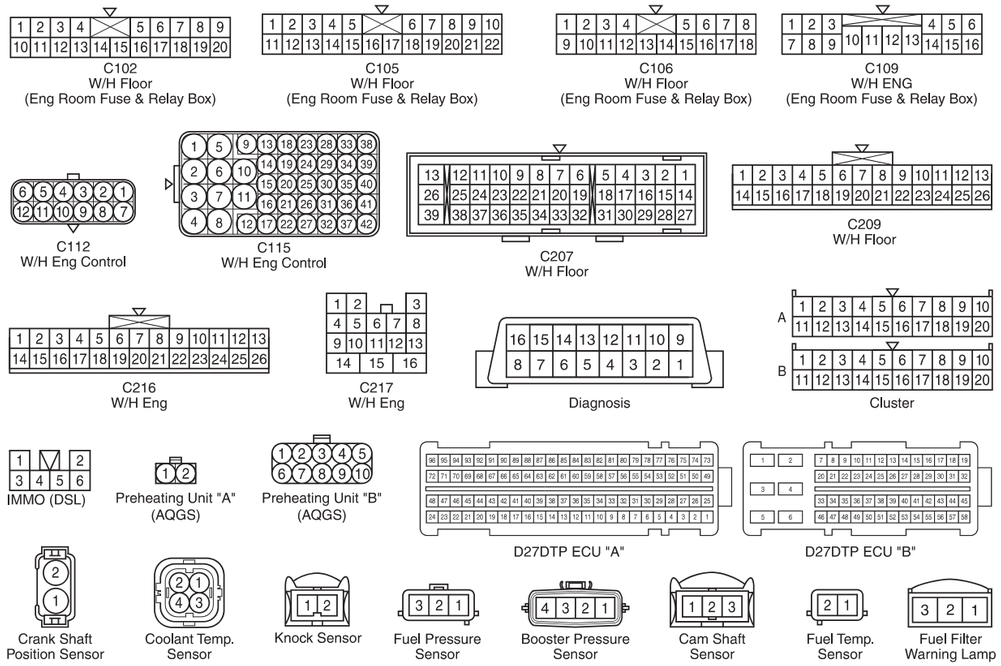
2) FUEL FILTER WARNING LAMP, IMMOBILIZER, SENSOR (FUEL PRESSURE, CAMSHAFT, BOOSTER PRESSURE, CRANKSHAFT, COOLANT/FUEL TEMP.) A/CRUISE SW



(1) CONNECTOR INFORMATION

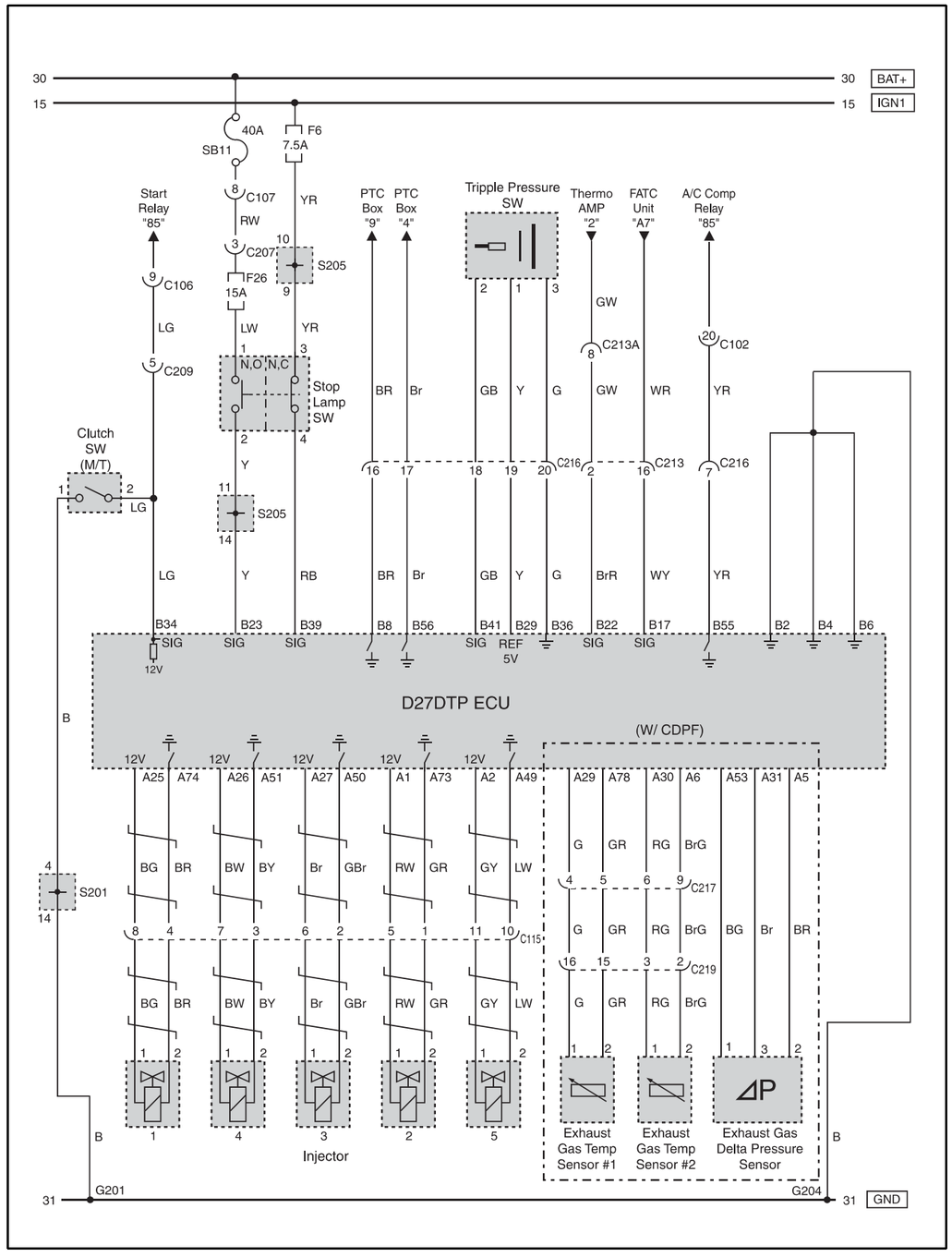
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C112 (12Pin, Black)	W/H Eng - W/H Eng Control	Under the Preheating Time Relay	D27DTP
C115 (42Pin, Black)	W/H Floor - W/H Eng Control	Right Eng Room Dash PNL	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	CAN
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

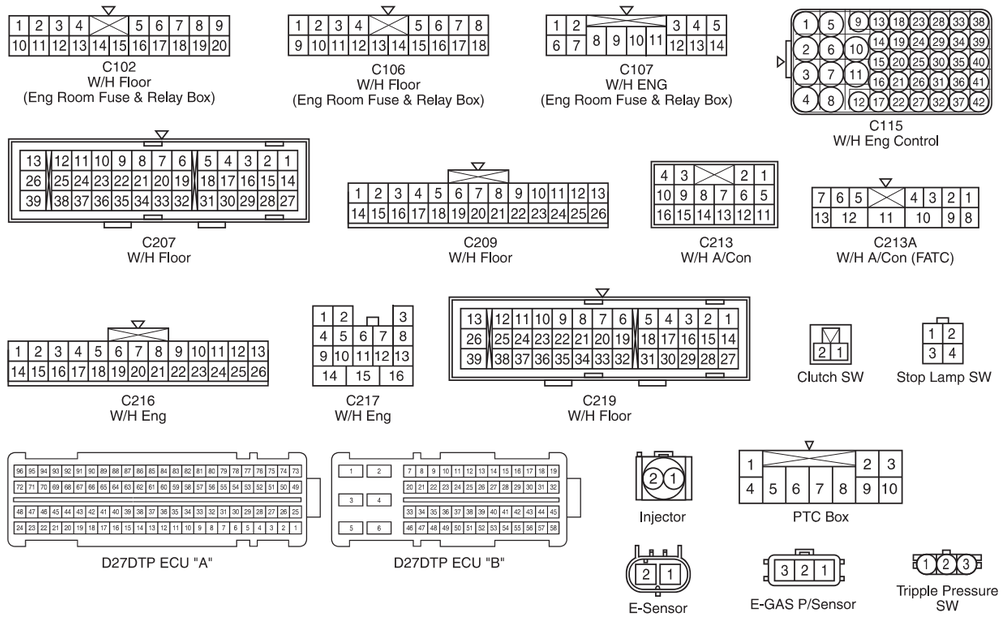
3) INJECTOR, STOP LAMP SW, SENSOR(A/CON, E-GAS), CLUTCH SW



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C115 (42Pin, Black)	W/H Floor - W/H Eng Control	Right Eng Room Dash PNL	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C213 (16Pin, White)	W/H Main - W/H A/Con	Backside the A/V Head Unit	
C213A (13Pin, White)	W/H A/Con - W/H Blower	Backside the Glove Box	
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
G204	W/H Main	Beside Eng ECU (D27DTP)	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



CIRCUIT

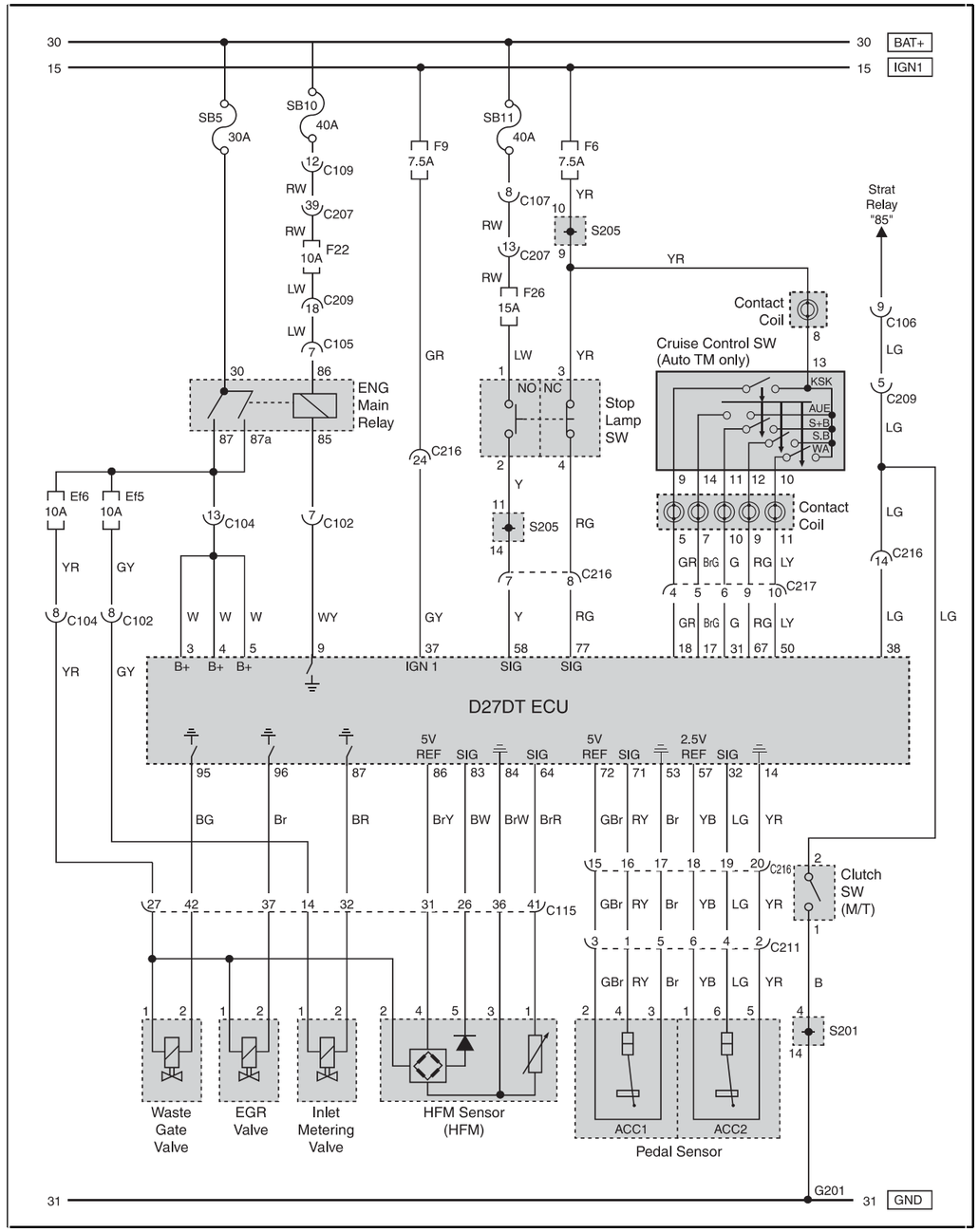
REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

S.G.N. 1491-01

ECU (ENGINE CONTROL UNIT - D27DT)

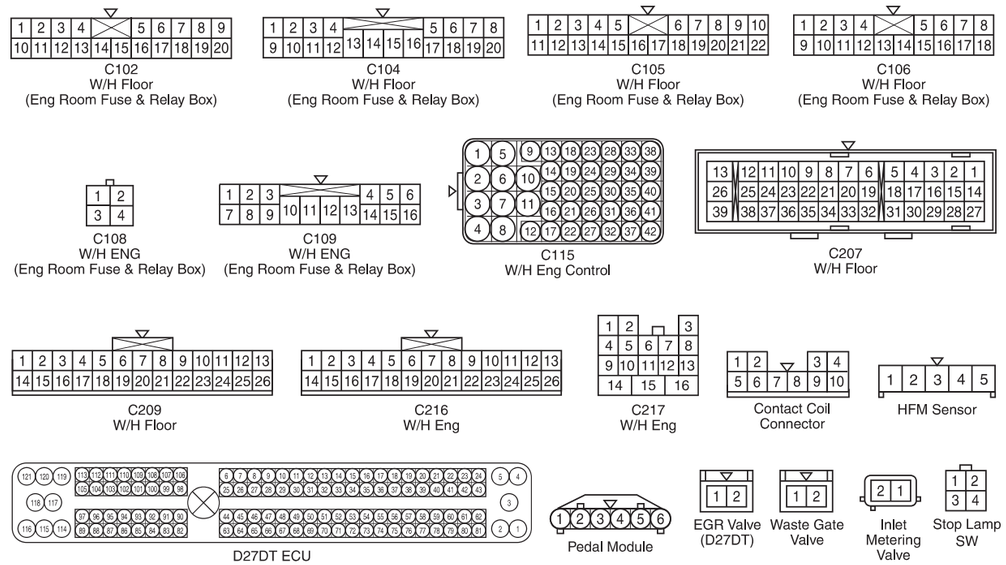
1) ENG MAIN RELAY, PEDAL MODULE, HFM SENSOR, VALVE, CRUISE CONTROL SW



(1) CONNECTOR INFORMATION

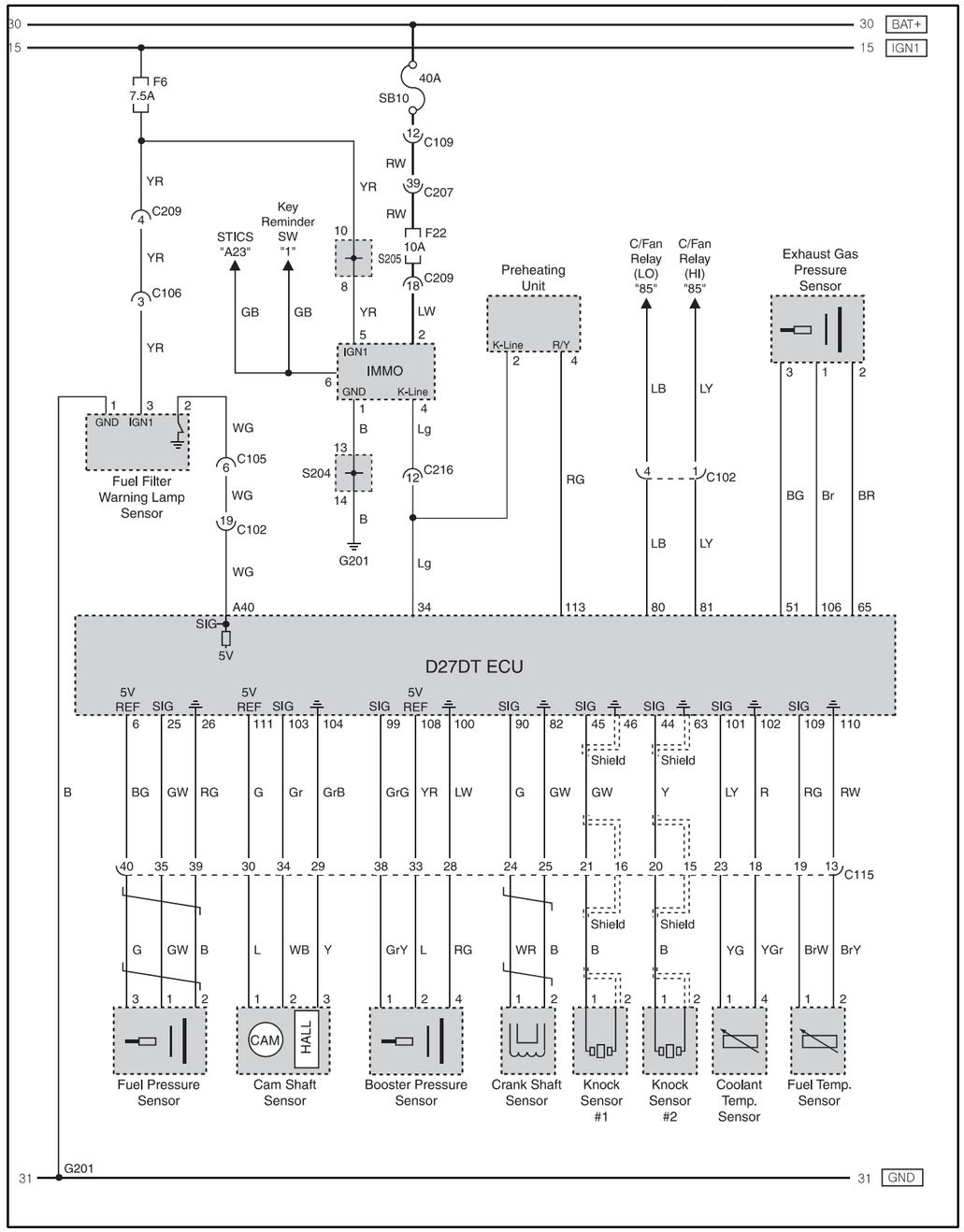
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C108 (4Pin, Colorless)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C115 (42Pin, Black)	W/H Floor - W/H Eng Control	Right Eng Room Dash PNL	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

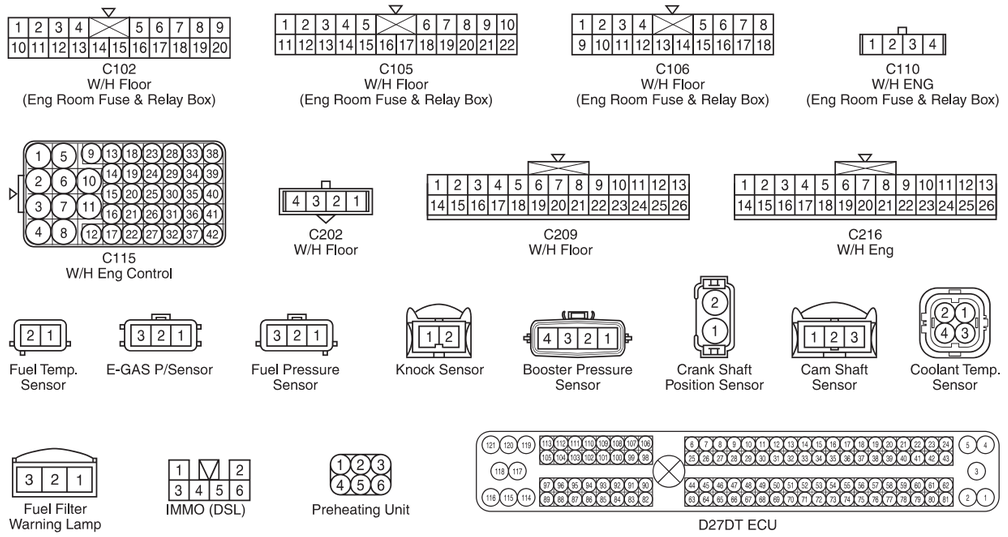
2) FUEL FILTER WARNING LAMP, IMMOBILIZER, SENSOR (FUEL PRESSURE, CAMSHAFT,BOOSTER PRESSURE, RANKSHAFT, KNOCK, COOLANT/FUEL TEMP.)



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C110 (4Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C115 (42Pin, Black)	W/H Floor - W/H Eng Control	Right Eng Room Dash PNL	
C202 (4Pin, White)	W/H Main - W/H Floor	Under the I/P Fuse Box	PTC
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

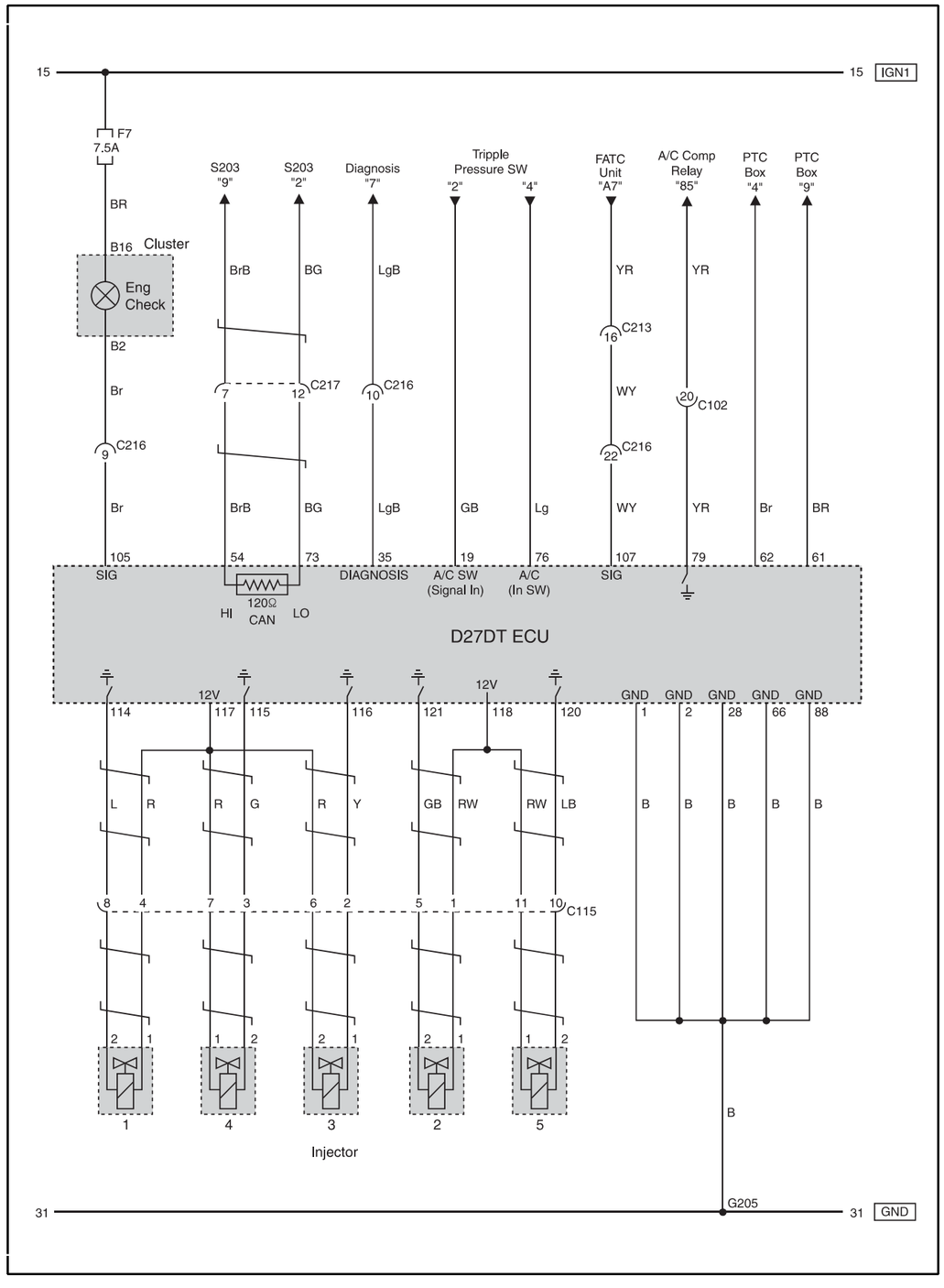


CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

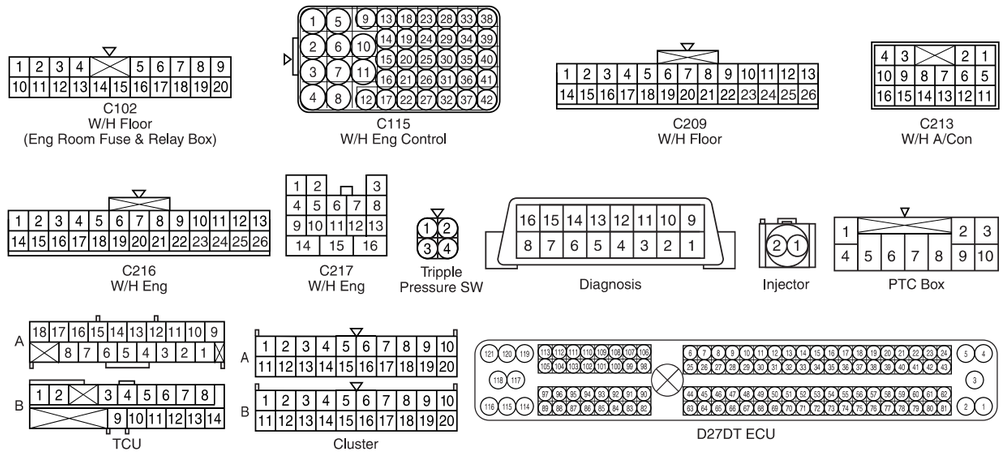
3) INJECTOR, CAN LINE



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C115 (42Pin, Black)	W/H Floor - W/H Eng Control	Right Eng Room Dash PNL	
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C213 (16Pin, White)	W/H Main - W/H A/Con	Backside the A/V Head Unit	
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G205	W/H Main	Beside Eng ECU (GSL)	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	CAN
S301 (14Pin, Black)	W/H Floor	Under the Driver Seat	CAN

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

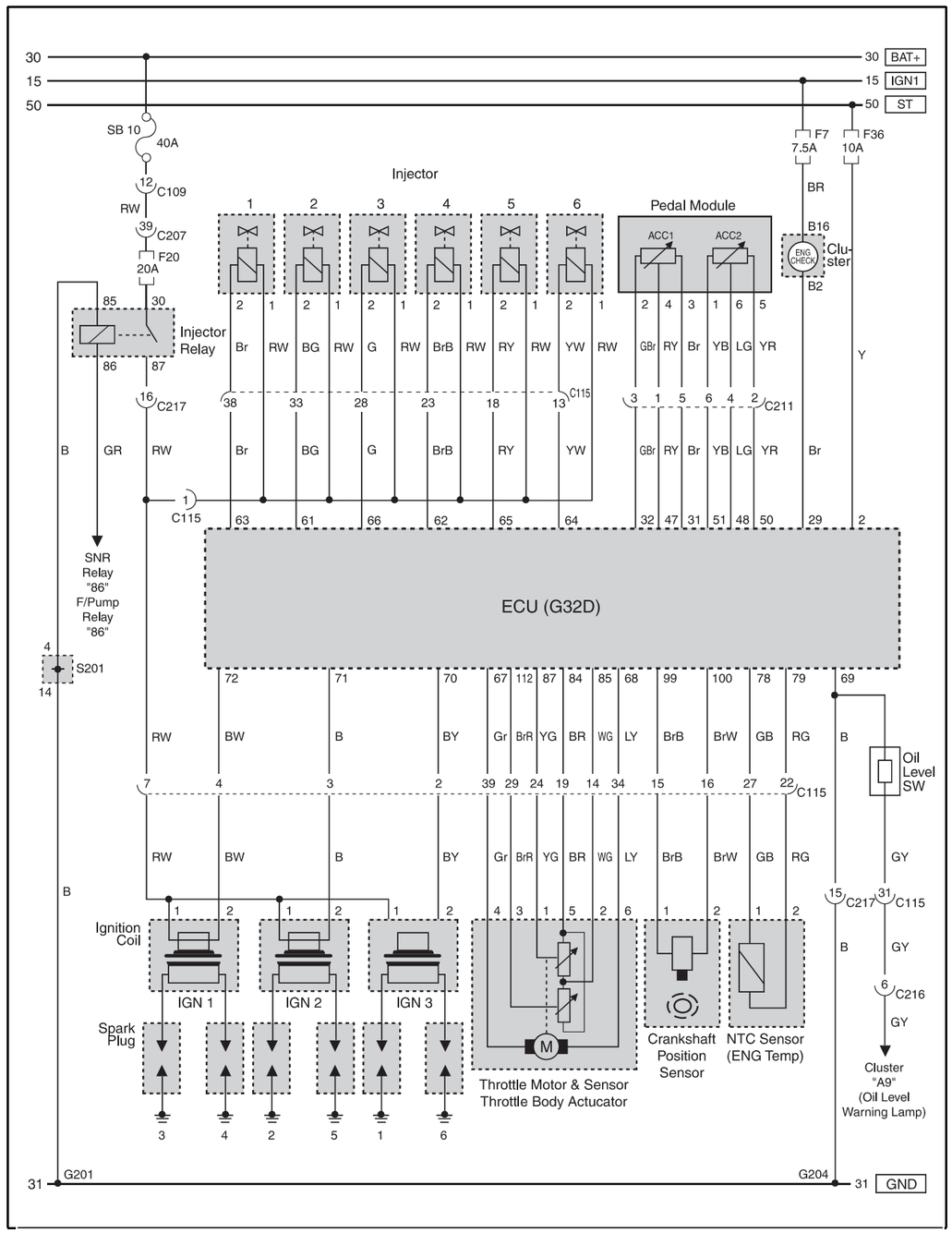


Modification basis	
Application basis	
Affected VIN	

S.G.N. 1491-01

ECU (ENGINE CONTROL UNIT - GSL G32D)

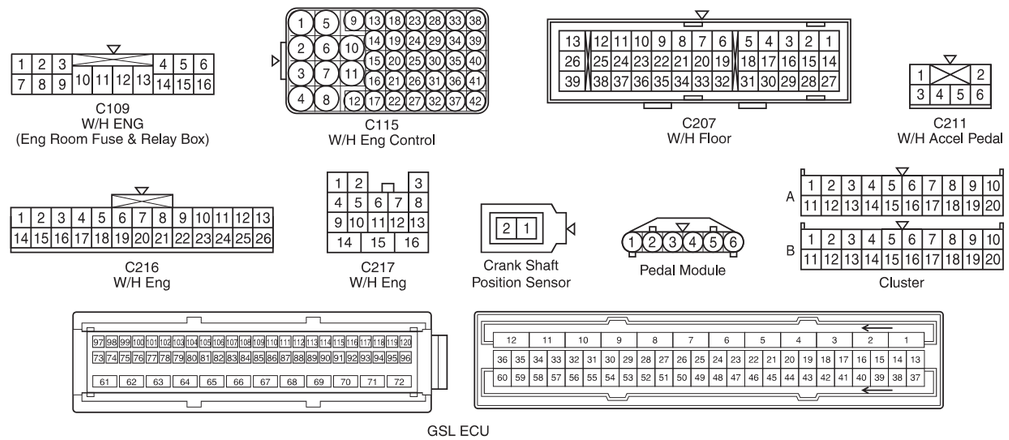
1) IGN COIL, INJECTOR, PEDAL MODULE, THROTTLE SENSOR



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C115 (42Pin, Black)	W/H Floor - W/H Eng Control	Right Eng Room Dash PNL	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C211 (6Pin, White)	W/H Main - W/H Accel Pedal	Inside the Driver Under-Cover	
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
G204	W/H Main	Beside Eng ECU (D27DTP)	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

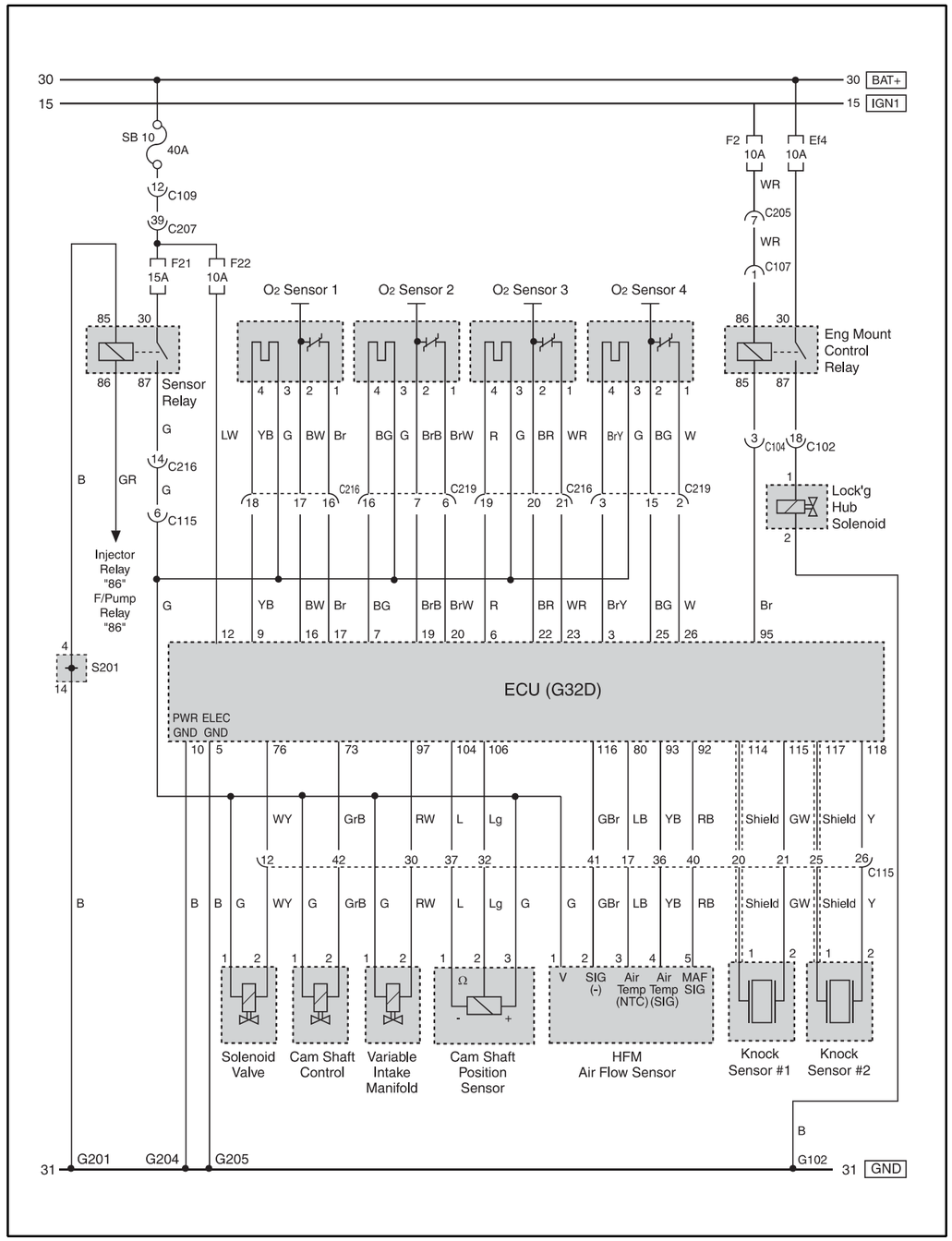


CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

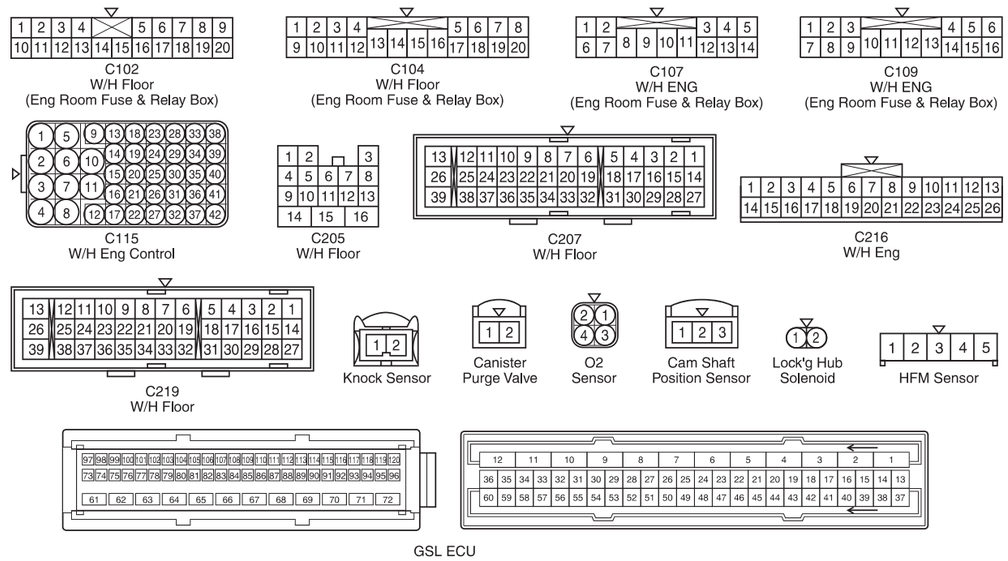
2) O2 SENSOR, CPS, KNOCK SENSOR, HFM SENSOR, CANISTER PURGE VALVE



(1) CONNECTOR INFORMATION

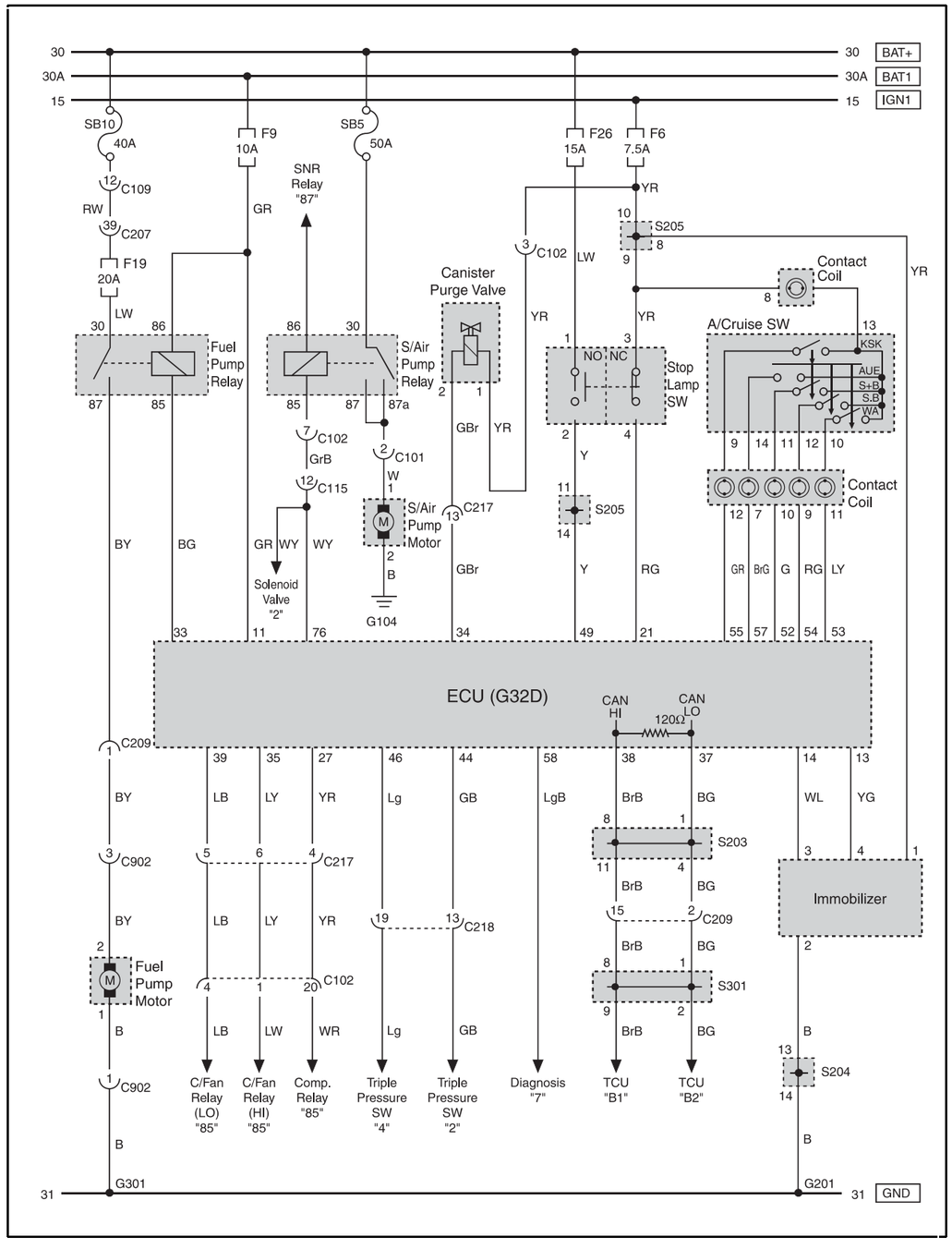
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C115 (42Pin, Black)	W/H Floor - W/H Eng Control	Right Eng Room Dash PNL	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
G102	W/H Eng	Center the Eng BATT	
G201	W/H Main	Under the Driver Cowl Side PNL	
G204	W/H Main	Beside Eng ECU (D27DTP)	
G205	W/H Main	Beside Eng ECU (GSL)	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

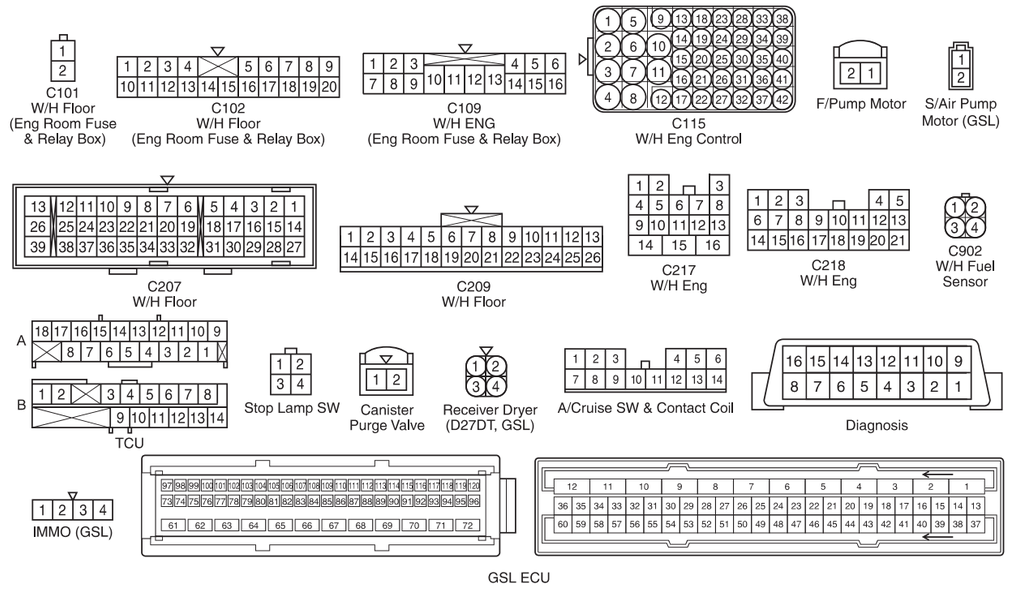
3) S/AIR PUMP, STOP LAMP, CRUISE CONTROL SW, FUEL PUMP, IMMOBILIZER



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C101 (2Pin, Colorless)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C115 (42Pin, Black)	W/H Floor - W/H Eng Control	Right Eng Room Dash PNL	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C218 (21Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C902 (4Pin, Black)	W/H Floor - W/H Fuel Sender	Upper the T/M	
G104	W/H Eng	Backside RH Head Lamp	
G201	W/H Main	Under the Driver Cowl Side PNL	
G301	W/H Floor	Under the Driver Seat	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	CAN
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S301 (14Pin, Black)	W/H Floor	Under the Driver Seat	CAN

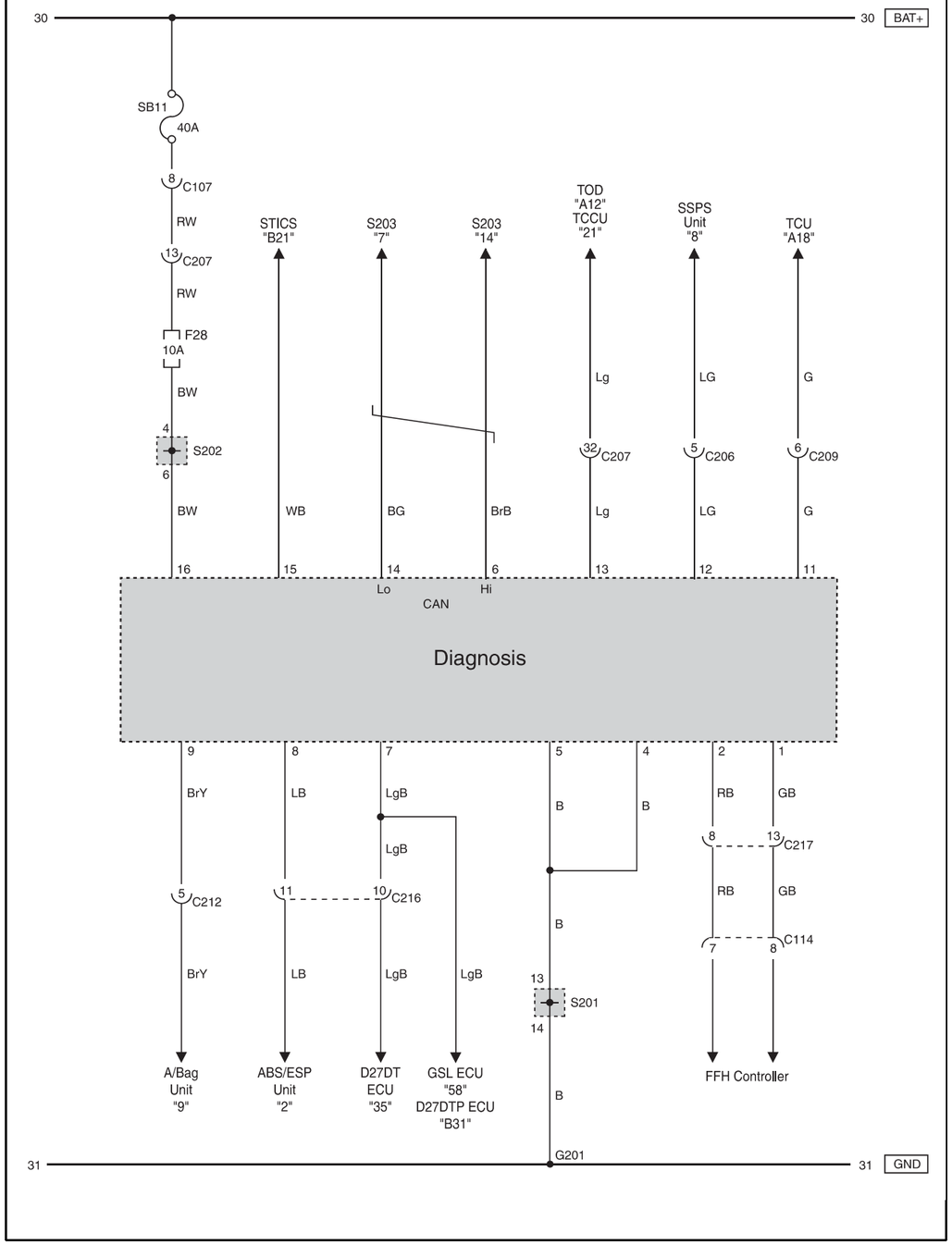
(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8210-01

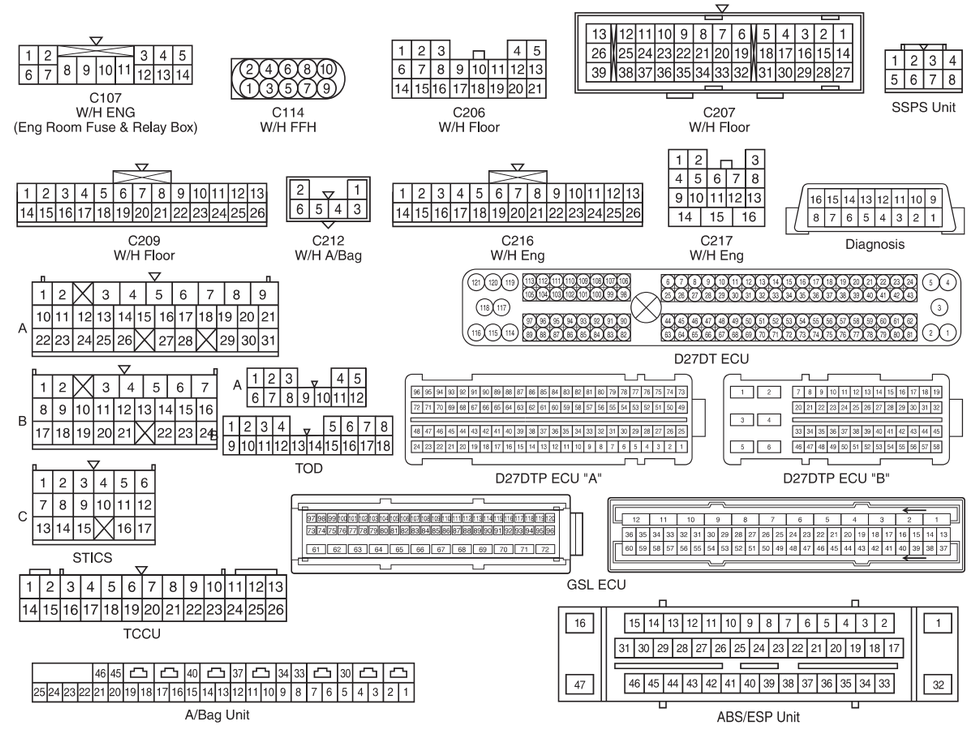
DIAGNOSIS CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C114 (16Pin, Black)	W/H Eng - W/H FFH	Backside Coolant Reserve Tank	FFH
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C212 (6Pin, White)	W/H Main - W/H Air Bag	Backside the Cluster(Inside I/P)	
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side 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	CAN

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

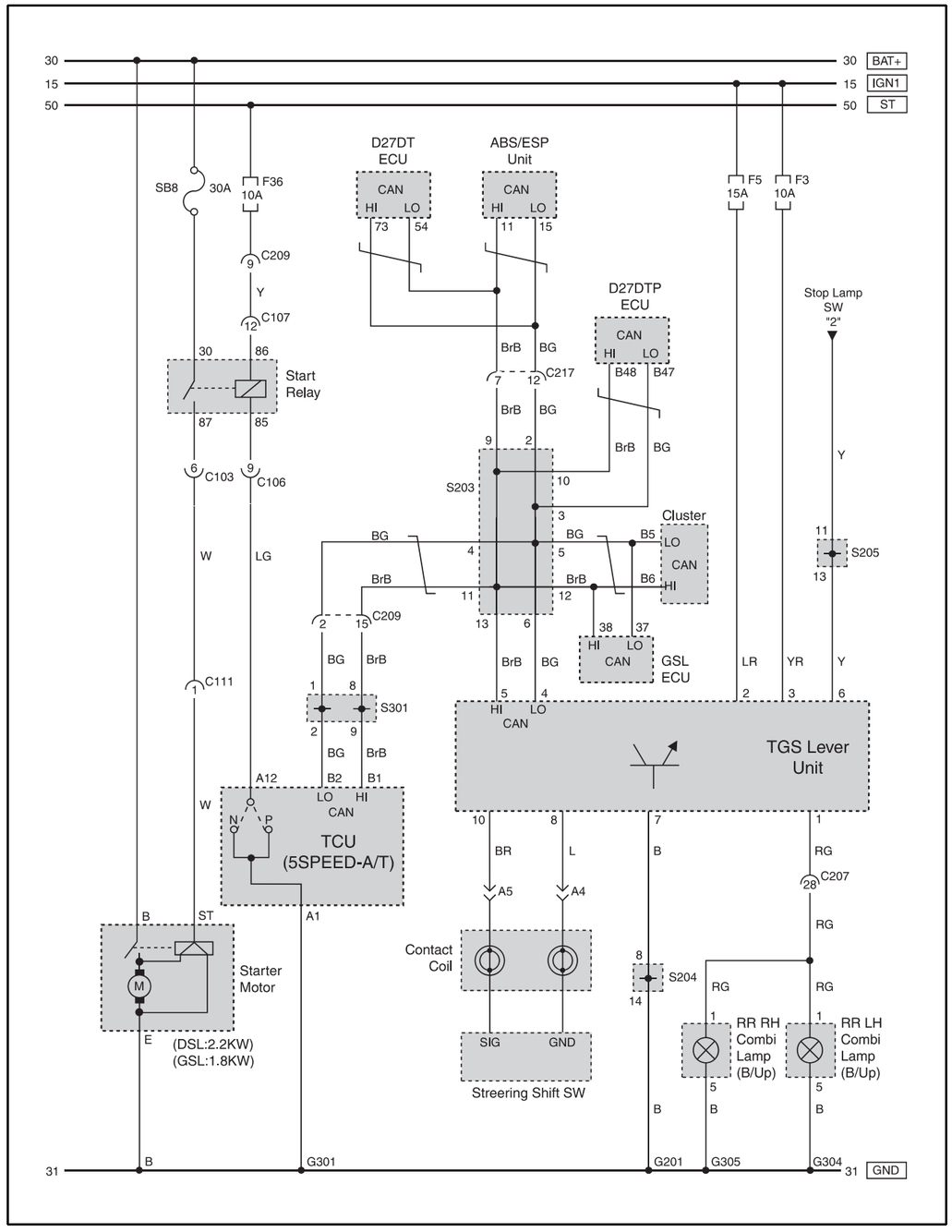


Modification basis	
Application basis	
Affected VIN	

S.G.N. 3110-01

TCU (5SPEED - A/T)

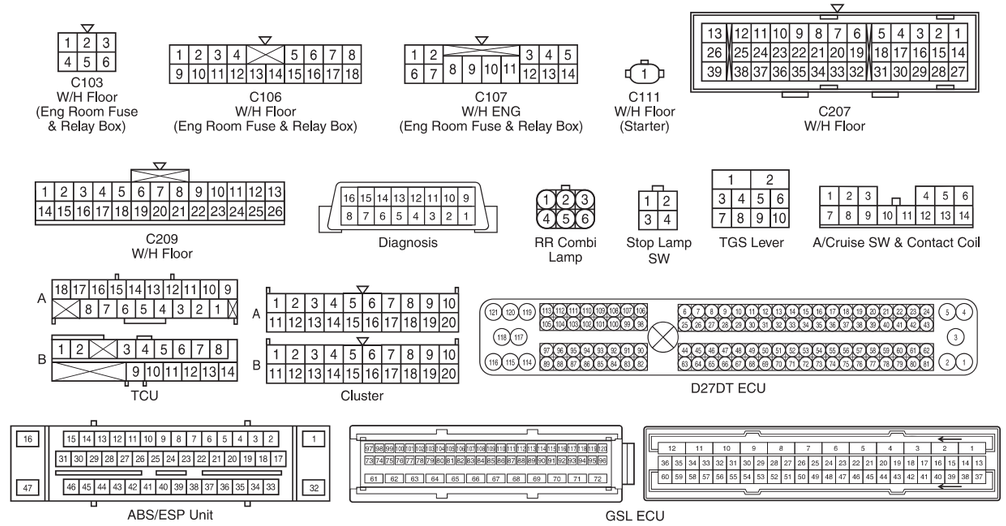
1) START MOTOR, TGS LEVER, CAN LINE



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C103 (6Pin, Colorless)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C111 (1Pin, Gray)	W/H Floor - Starter Motor	Under the Preheating Time Relay	Solenoid
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
G301	W/H Floor	Under the Driver Seat	
G304	W/H Floor	Inside the LH QTR GLS Lower	
G305	W/H Floor	Inside the LH QTR GLS Lower	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	CAN
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S301 (14Pin, Black)	W/H Floor	Under the Driver Seat	CAN

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

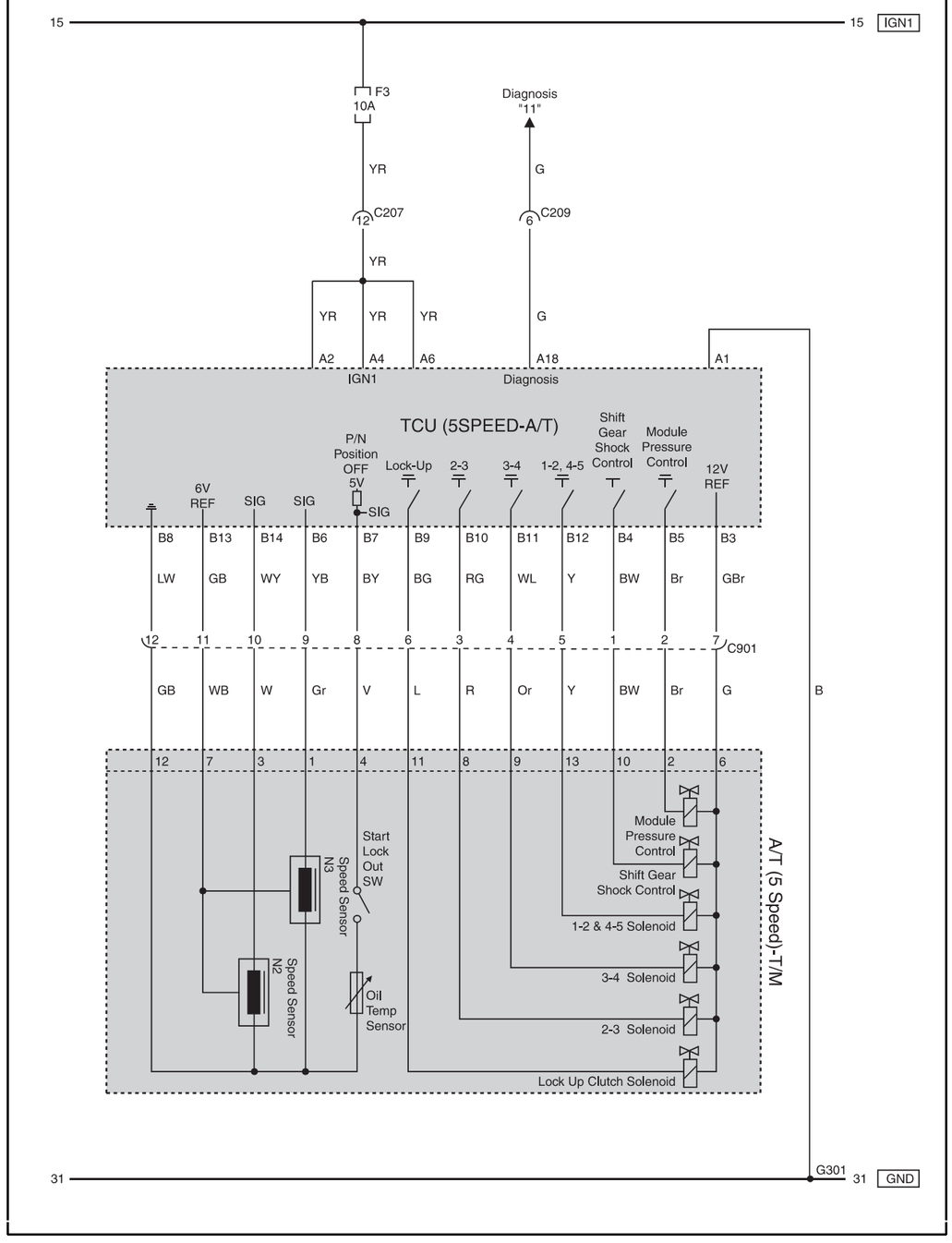


CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

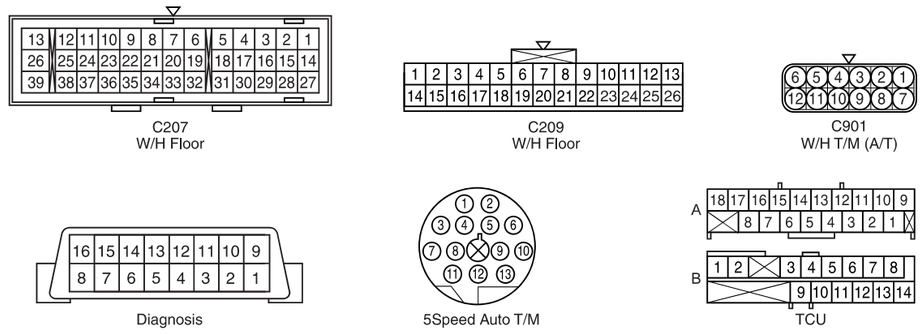
2) SOLENOID, OIL TEMP SENSOR, SPEED SENSOR (N2, N3)



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)		Connecting Wiring Harness	Connector Position	Remark
C207 (39Pin, Gray)		W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)		W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C901	(12Pin, Black)	W/H Floor - W/H T/M	Upper the T/M	A/T
	(4Pin, Black)	W/H Floor - W/H T/M	Upper the T/M	M/T
G301		W/H Floor	Under the Driver Seat	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

(3) CIRCUIT DESCRIPTION

A. FUNCTION

TCU controls the gear groups according to the driving conditions. It receives the driving data from many sensors and switches as input signals. It is also connected with ECU, HECU,instrument panel and selector lever control unit.

▶Shifting Method

Basic shift operation includes up-shift and down-shift for all gear groups. The shift control unit determines driving resistance, accelerator pedal position, vehicle speed and some parameters (road surface condition, up hill and down hill gradients, trailer driving conditions, catalytic converter conditions, driving habits and automatic transmission oil temperature) to select a shift gear.

▶Down Shift

When engine speed increases excessively, the down shift does not occur. To get an engine brake effect during downhill driving, the current gear is maintained in speed control mode.

▶Engine RPM Adjustment

During shifting, the engine torque is reduced to optimize the shift operation by delaying the ignition time.

▶Lock-Up Clutch Control

The lockup clutch in torque converter is activated in 3rd, 4th and 5th gear and operates in sequence via PWM solenoid valve.

▶Others

The transmission is automatically controlled to compensate durability and wear.
The shift control values such as shifting point, shifting time, pressure during shifting, and lockup clutch control are permanently saved and the diagnosis is partially available.

B. MODE SWITCH

▶Function

The mode switch is installed beside the selector lever and it has two modes of “S” mode (Standard Mode) and “W” mode (Winter Mode).

- “S” mode is used in normal driving (starts off with 1st gear). TCU (Transmission Control Unit) provides pleasant driving by changing the shifting pattern according to the driving habits (downhill gripping: approx. 11 ~ 13.5 %)
- When “W” mode is selected, the Winter mode indicator in meter cluster comes on, and the vehicle starts off with 2nd gear to achieve smooth starting on the icy or slippery road.

In winter mode, the up shift becomes faster and the down shift becomes slower for improving fuel consumption. The “W” mode is automatically changed to “S” mode in full throttle or kick-down operation. The vehicle can starts off with 2nd reverse gear (gear ratio: 1.92 ~ 1.93) when the “W” mode is selected. It is very useful on icy and slippery road. However, in this case, the “W” switch should be selected before placing the selector lever to “R” position.

Even though “W” mode is selected, the vehicle starts off with 1st gear in following:
When the system recognizes the mode switch operation, the selector lever control unit sends the control signal TCU via CAN communication.

- When the selector lever is in “1” position.
- When fully depressing the accelerator pedal or when starting off with kick-down condition.

Modification basis	
Application basis	
Affected VIN	

C. REVERSE/PARKING (R/P) LOCK SYSTEM

Reverse (R) lock system is a safety system that prevents the selector lever from shifting to "P" or "R" position by activating the solenoid valve when the selector lever unit determines that the vehicle speed exceeds 10 km/h by checking the speed signal from wheel speed sensor via CAN communication. Parking (P) lock system uses the signals from brake switch other than conventional cable system to shift to other positions. The wiring harness for detecting brake switch operation is connected to selector lever control unit.

D. STARTER LOCK-OUT CONTACT SWITC

The starter lock-out contact is installed beside oil temperature sensor and is actuated by a cam rail, which is located on the latching plate. In the selector lever positions "P" and "N", the permanent magnet is moved away from the reed contact. This opens the reed contact and the transmission control module receives an electrical signal. The transmission control module activates the starter lock-out relay module. This closes the electrical circuit to the starter in selector lever positions "P" and "N" via the starter lock-out relay module. In other words, when the selector lever is in driving positions, the contact is closed and the starter cannot be operated.

E. OIL TEMPERATURE SENSOR

The oil temperature sensor is installed in hydraulic control unit and is connected in series with the starter lock-out contact. This means that the temperature signal is transferred to TCU when the starter lock-out contact is closed. The oil temperature has a considerable effect on the shifting time and therefore the shift quality. By measuring the oil temperature, shift operations can be optimized in all temperature ranges.

F. SPEED SENSOR

The speed sensors are fixed to the shell of the hydraulic control unit via the contact tabs. A leaf spring, which rests against the valve body, presses the speed sensors against the transmission housing. This ensures a precise distance between speed sensors and impulse rings. speed sensor (n3) detects the speed of the front sun gear and speed sensor (n2) detects the speed of the front planetary carrier. If the speed sensor is defective, the transmission is operated in emergency driving mode. Below table shows the detection of speed sensor.

Gear	N2	N3
1	●	-
2	●	●
3	●	●
4	●	●
5	●	-
R (S mode)	●	-
R (W mode)	●	●

G. LOCKUP SOLENOID VALVE

This valve activates and releases the lockup clutch by adjusting the current to solenoid valve according to engine throttle opening value and output shaft speed. The lockup clutch operates in 3rd, 4th and 5th gear with steps to reduce shift shocks.

Working Current	1.5 ~ 2.0 A
Operating distance	0.2 mm
Resistance	2.5 ± 0.2 Ω (25°C)
Operating range	3, 4, 5 shift

H. MODULATING PRESSURE (MP) AND SHIFT PRESSURE (SP) CONTROL SOLENOID VALVE

These valves control the modulating pressure and the shift pressure by applying appropriate electric current to solenoid valves according to driving condition of engine and transmission.
When the electric current from TCU is high/low, the regulated pressure decreases/increases.

Working Curren	0 ~ 1.0 A
Operating distance	0.6 mm
Resistance	5 ± 0.2 Ω (25°C)

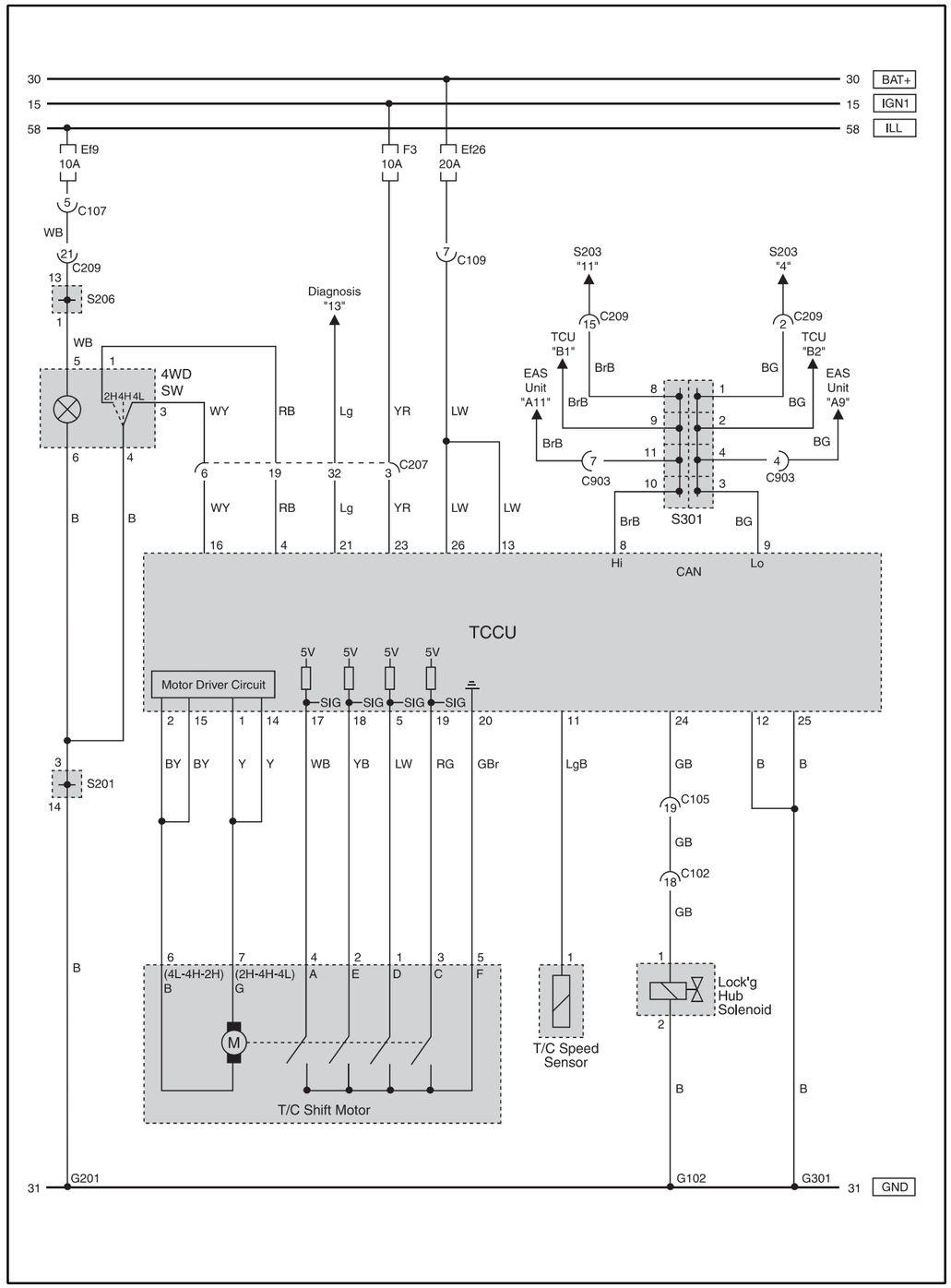
I. CHARACTERISTICS OF UP/DOWNSHIFT OLENOID VALVE

The solenoid valve remains energized and therefore open until the shift process is completed according to the engine and transmission conditions. If a solenoid valve is energized, it opens and transmits shift valve pressure to the corresponding command valve.

Working Curren	1.5 ~ 2.0 A
Operating distance	0.2 mm
Resistance	3.8 ± 0.2 Ω (25°C)

S.G.N. 3410-01

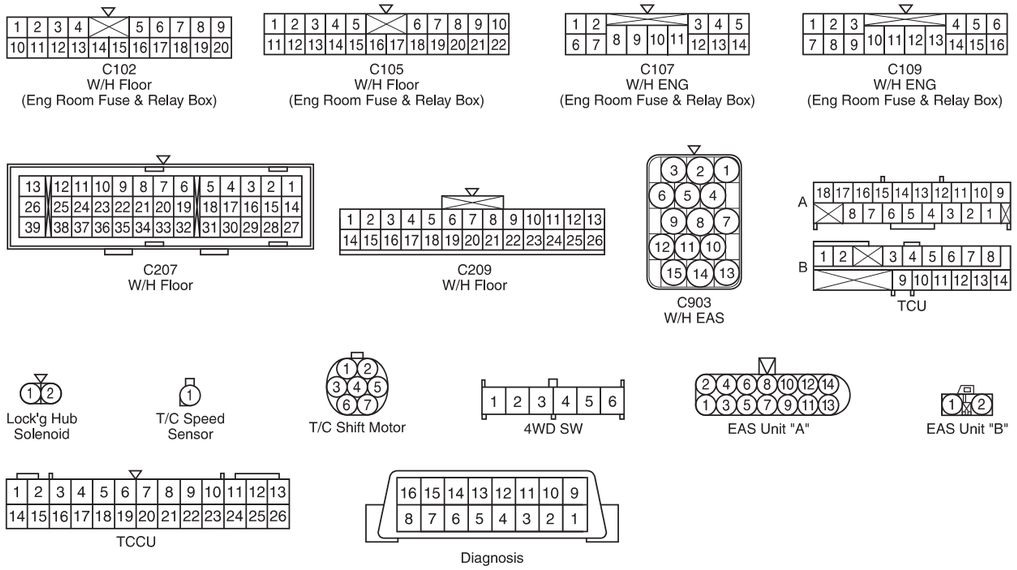
TCCU



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C903 (15Pin, Black)	W/H Floor - W/H EAS	Lower the Passenger	
G102	W/H Eng	Center the Eng BATT	
G201	W/H Main	Under the Driver Cowl Side PNL	
G301	W/H Floor	Under the Driver Seat	
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	CAN
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



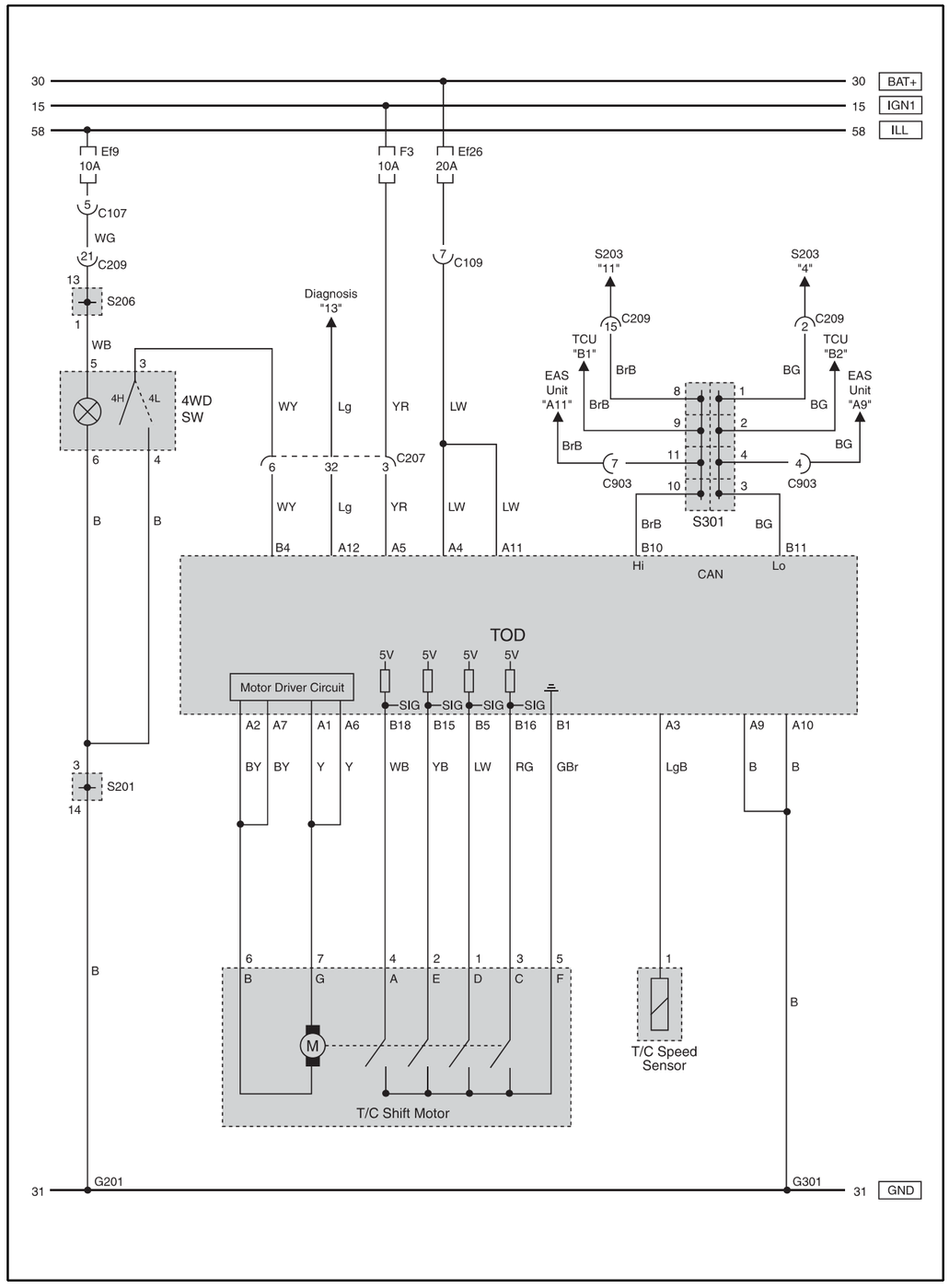
CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

S.G.N. 3410-01

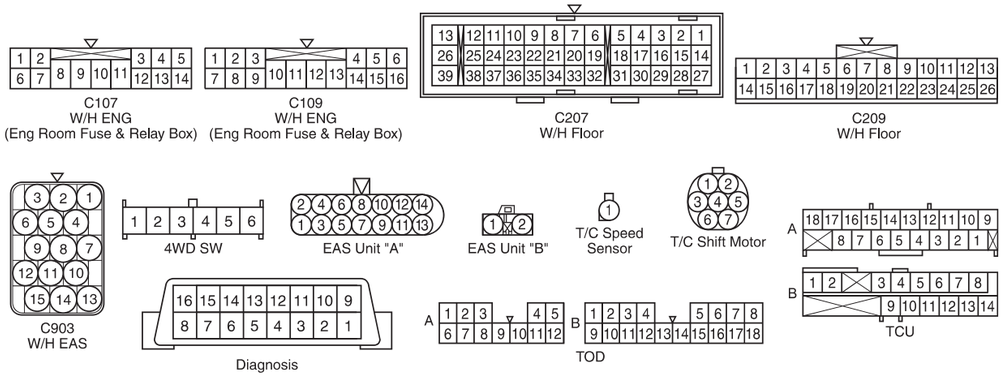
TOD



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C903 (15Pin, Black)	W/H Floor - W/H EAS	Lower the Passenger	
G201	W/H Main	Under the Driver Cowl Side PNL	
G301	W/H Floor	Under the Driver Seat	
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	CAN
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL
S301 (14Pin, Black)	W/H Floor	Under the Driver Seat	CAN

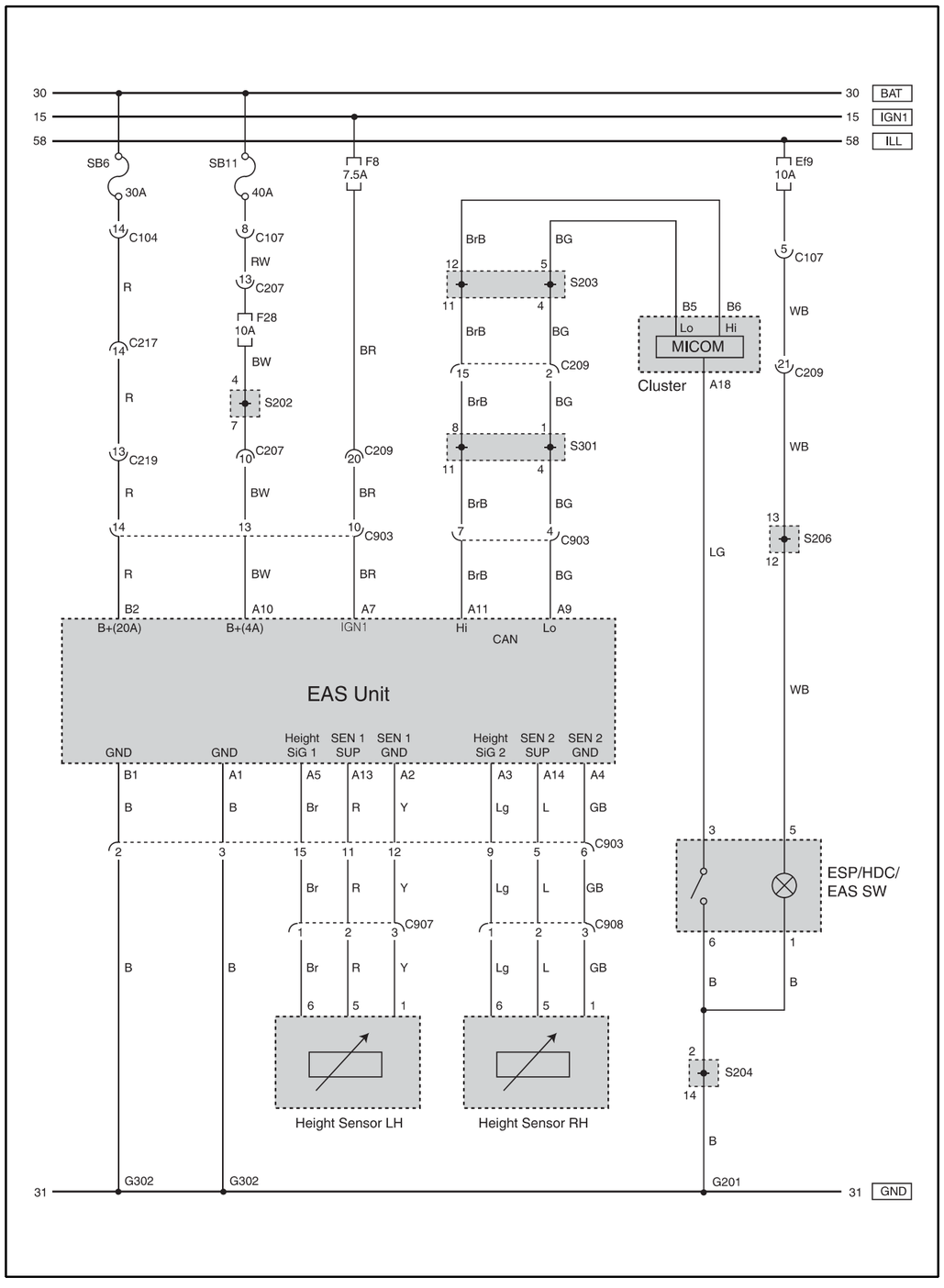
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 4480-01

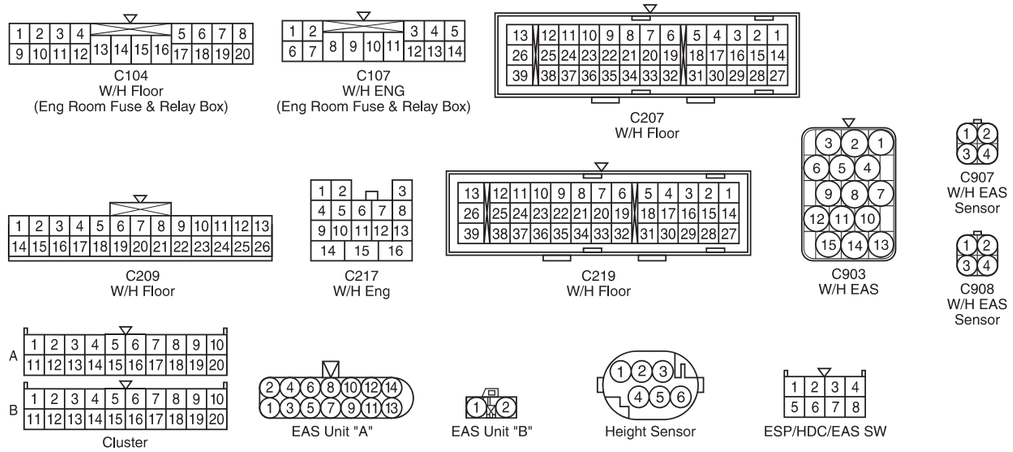
EAS



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C903 (15Pin, Black)	W/H Floor - W/H EAS	Lower the Passenger	
C907 (4Pin, Black)	W/H Floor - W/H EAS Sensor	Under the RR Bumper (LH)	
C908 (4Pin, Black)	W/H Floor - W/H EAS Sensor	Under the RR Bumper (RH)	
G201	W/H Main	Under the Driver Cowl Side PNL	
G302	W/H Floor	Under the Passenger Seat	
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	CAN
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL
S301 (14Pin, Black)	W/H Floor	Under the Driver Seat	CAN

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



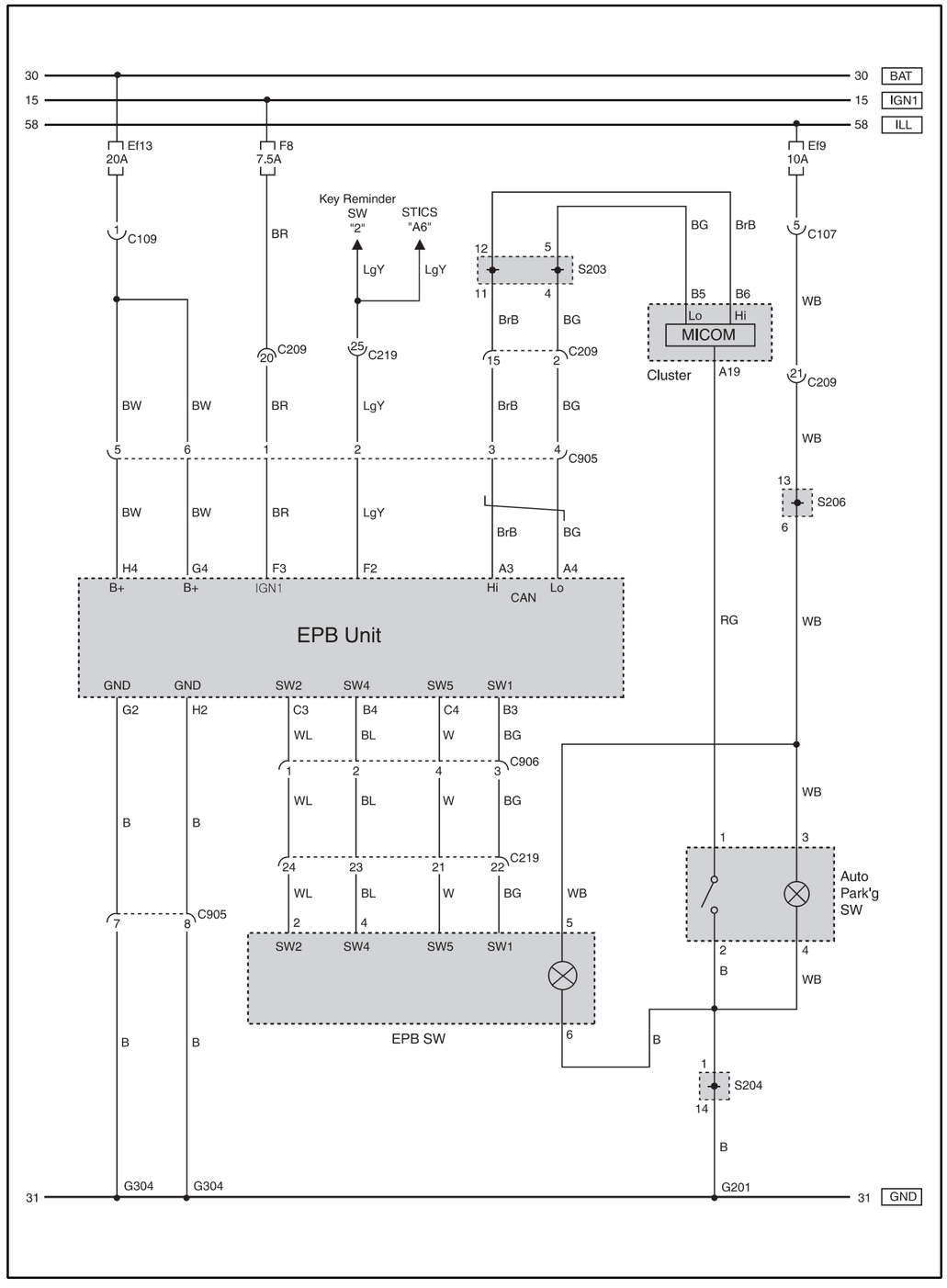
CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

S.G.N. 4920-01

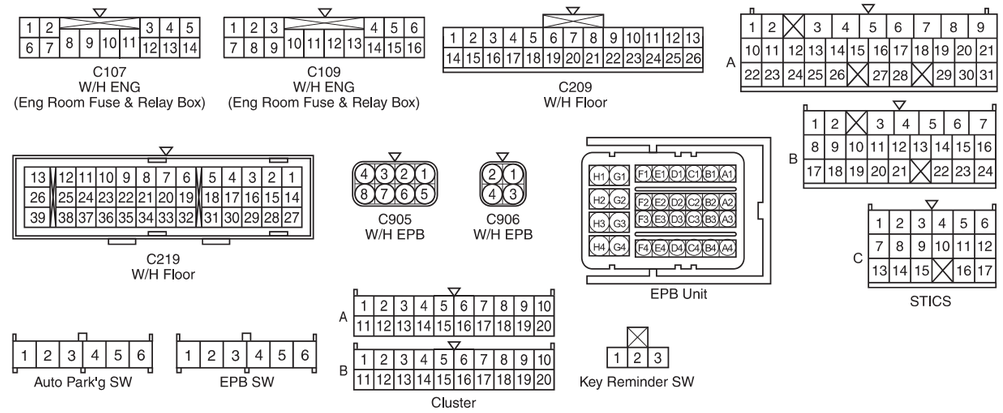
EPB



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C905 (8Pin, Black)	W/H Floor - W/H EPB	Under the RR Bumper (LH)	
C906 (4Pin, Black)	W/H Floor - W/H EPB	Under the RR Bumper (LH)	
G201	W/H Main	Under the Driver Cowl Side PNL	
G304	W/H Floor	Inside the LH QTR GLS Lower	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	CAN
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

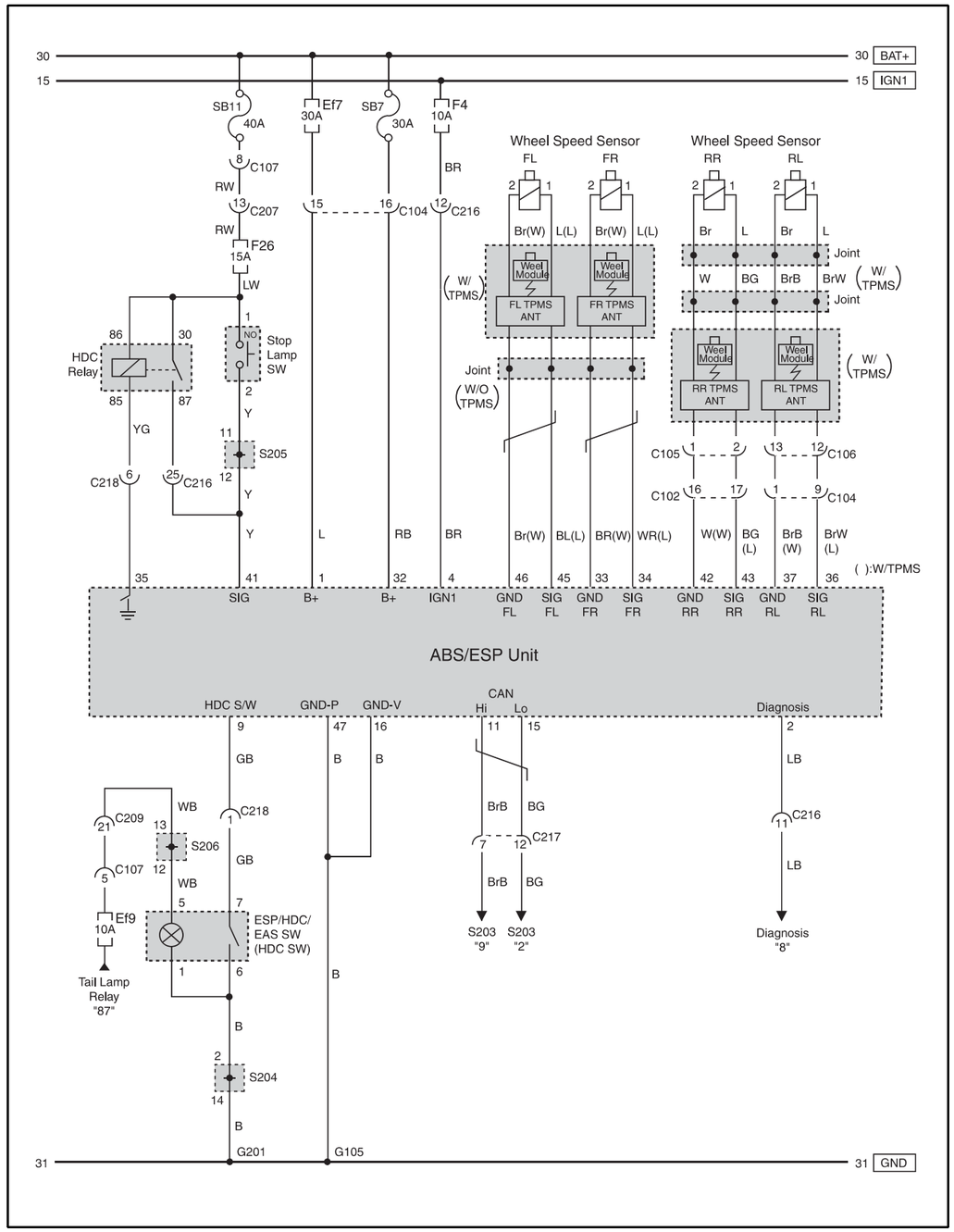


Modification basis	
Application basis	
Affected VIN	

S.G.N. 4892-01

ABS/ESP

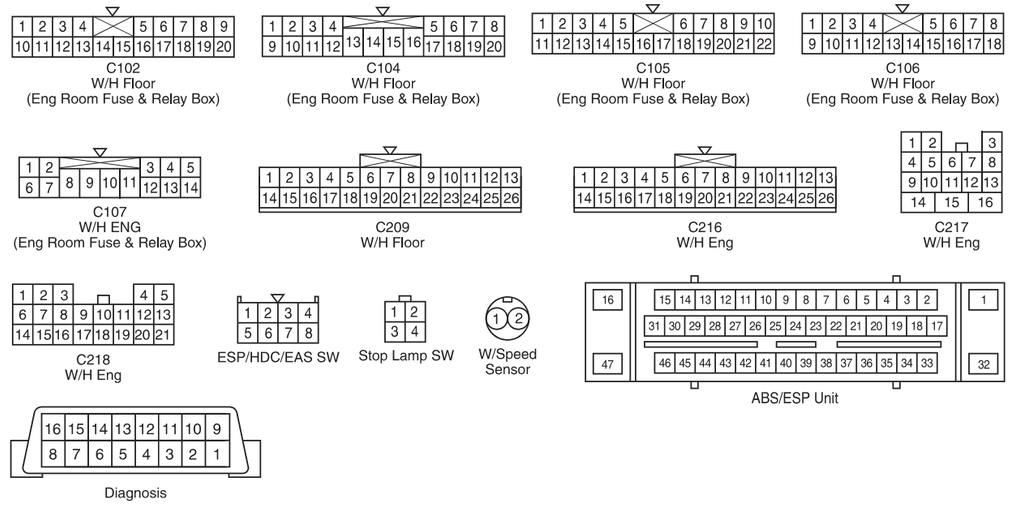
1) W/SPEED SENSOR, STOP LAMP SW, DIAGNOSIS, HDC, TPMS



(1) CONNECTOR INFORMATION

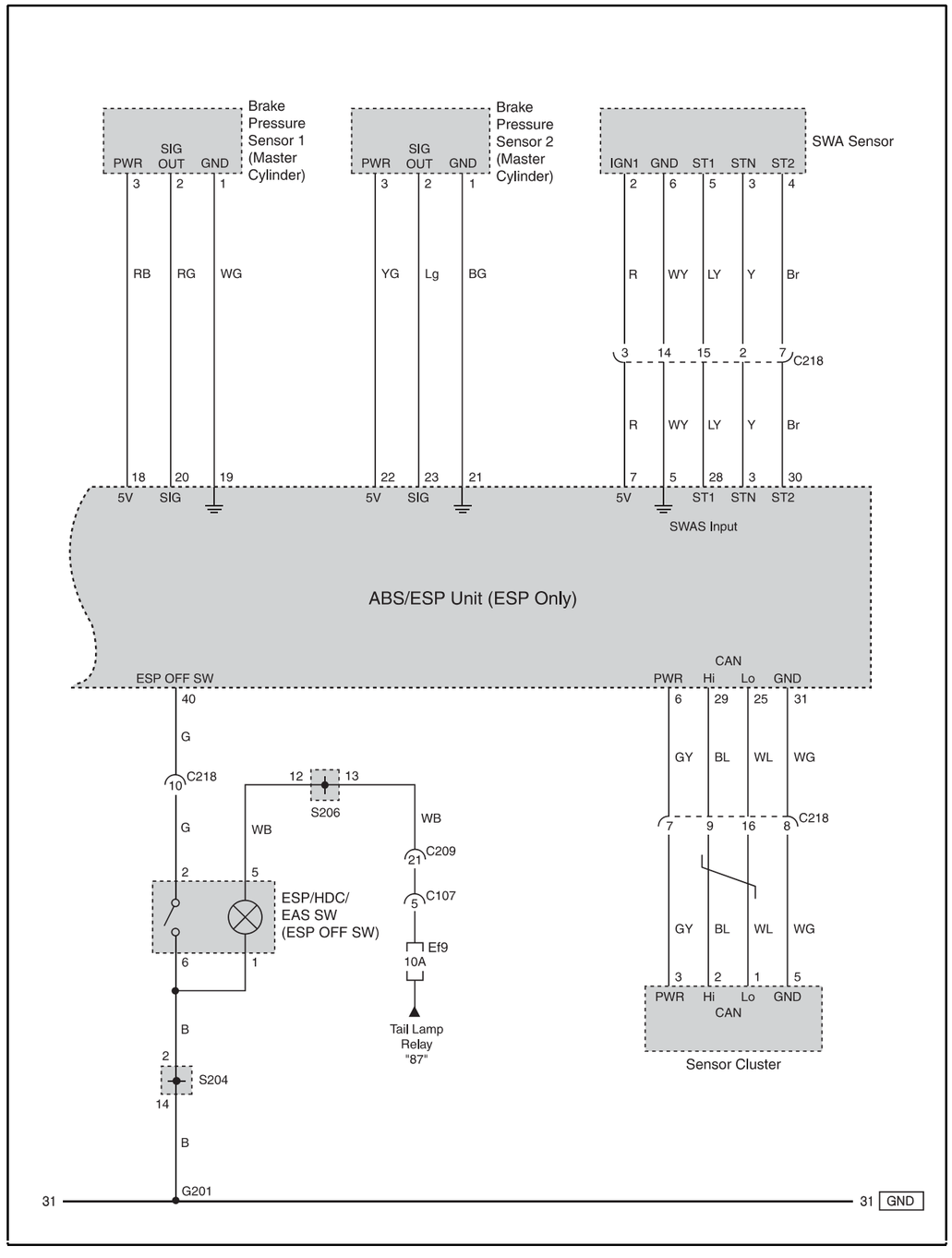
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C218 (21Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G105	W/H Eng	Beside Coolant Reserve Tank	ABS/ESP
G201	W/H Main	Under the Driver Cowl Side PNL	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

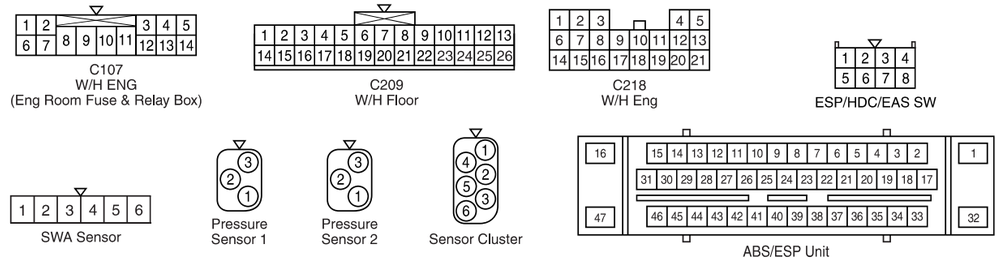
2) PRESSURE SENSOR, S.W.A SENSOR, SENSOR CLUSTER, ESP OFF SW



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C218 (21Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



(3) CIRCUIT DESCRIPTION

A. ABS COMPONENTS

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.

B. ACTIVE WHEEL SPEED SENSOR

The speed sensor used in traditional ABS is made of permanent magnet and transmits the output voltage that changes as the wheel rotor rotates to the HECU system. New wheel speed sensor detects the wheel speed through the current value that depends on the resistance that changes according to the magnetic field by using four resisters and supplying the 12 V power supply to the sensor.

▶ **Specifications**

Item	Specifications	Reference
Supplying voltage	DC 12V	
Air gap	Front: 0.335 ~ 0.945 mm	Cannot measure the air gap
	Rear: 0.309 ~ 0.958 mm	
Output current (vehicle speed: at 2.75 km/h)	7mA (Lo) ~ 14mA (Hi) +20 % / -16 %	
Tightening torque	Front: 19 ~ 25 Nm	7.5 ~ 20 V
	Rear: 6 ~ 10 Nm	

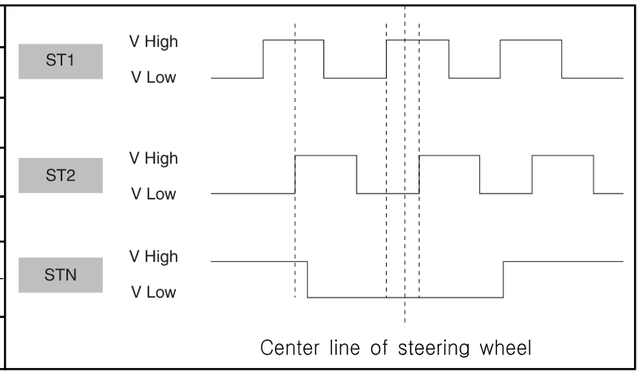
C. HBA (HYDRAULIC BRAKE ASSIST SYSTEM)

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.

D. SWAS : STEERING WHEEL ANGLE SENSOR

The steering wheel angle sensor is located between clock spring and multifunction switch. This sensor is used for recognition of driver's intends. If the sensor is replaced with new one, it can detect the neutral position after the vehicle is moving over 20 km/h for more than 5 seconds.

Working voltage	9 ~16 V
Number of pulse per revolution	45 Pulses /1rev
Duty	Approx. 50 %
High - V	3.0 ~ 4.1 V
Low - V	1.3 ~ 2.0 V
ST1 and ST2	Detects steering wheel angle and angular velocity as an average value
STN	Detects the center value of steering wheel



E. HDC (Hill Descent Control) SYSTEM

When the slope level exceeds 10%, the HDC operates until the vehicle reaches the speed condition given in step (4).

▶ **When the slope level is between 10% and 20% during the HDC operation**

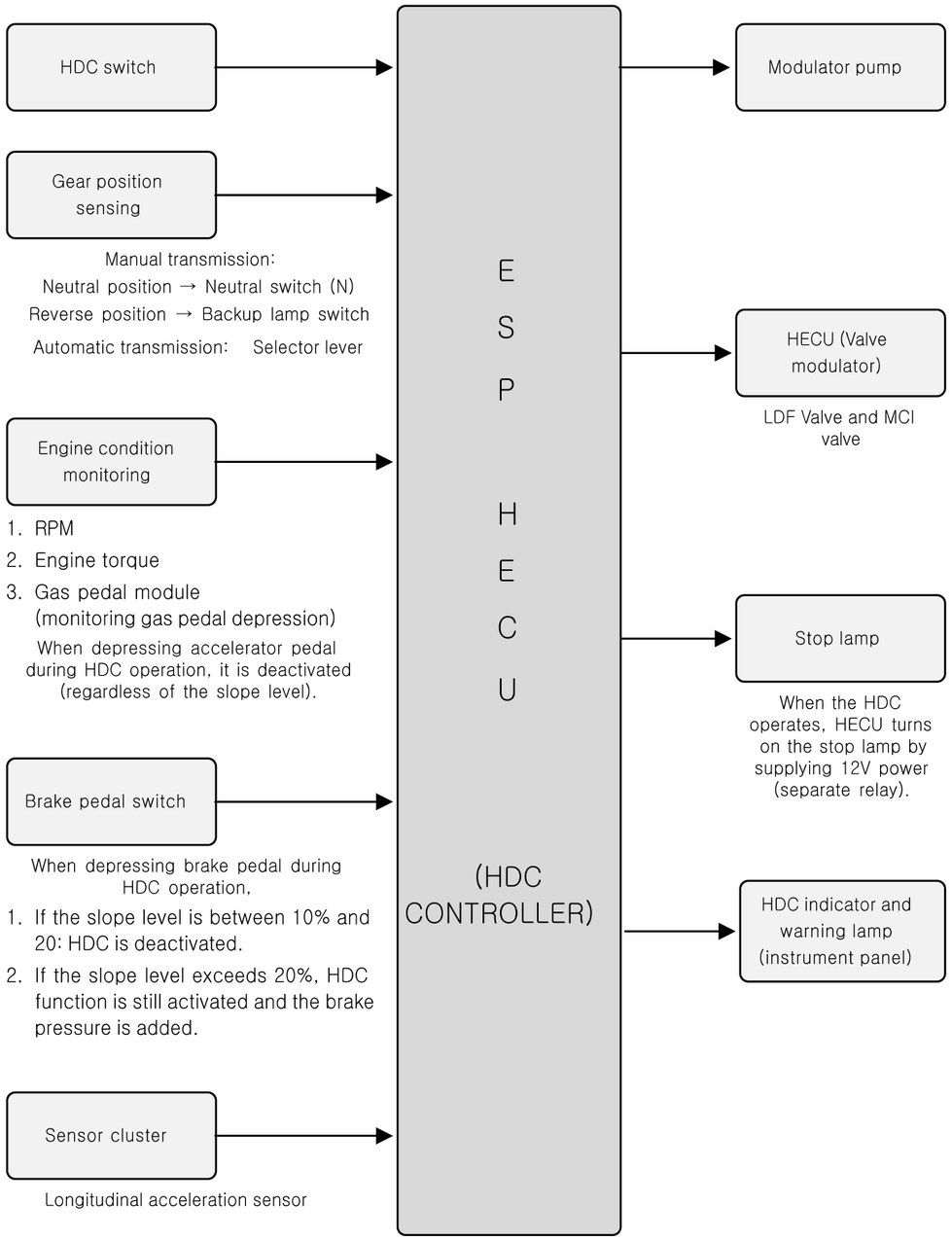
When depressing the accelerator pedal or brake pedal, HDC system is changed to stand-by mode. When depressing the accelerator pedal again, HDC starts its operation again. Therefore, drivers can control the vehicle speed to a desired level by operating the accelerator pedal.

▶ **When the slope level exceeds 20% during the HDC operation**

When depressing the accelerator pedal, HDC system is changed to stand-by mode. When depressing the brake pedal, HDC continues its operation and the braking power is increased. In this case, HECU sounds an abnormal noise and brake pedal may be very rigid, but this is a normal condition due to HDC operation.

Modification basis	
Application basis	
Affected VIN	

F. INPUT/OUTPUT SIGNALS FOR HDC OPERATION



G. OPERATION OF HDC INDICATOR CONTROLLER

This table describes the coming-on and blinking mode of HDC indicator according to the HDC switch operation (ON/OFF). The HDC indicator on the instrument panel has two modes; green (function lamp) and red (warning lamp). The HDC switch is a push & self return type switch ? when you press it once, it starts to operate and when you press it again, it stops the operation.

<table>
<tr><th colspan="4" rowspan="3">HDC Operation Mode</th><th>HDC Indicator</th><th>HDC Warning Lamp</th></tr>
<tr><th>Green</th><th>Red</th></tr>
<tr><th>HDC</th><th>HDC</th></tr>
<tr><td colspan="4">Initial ignition ON (From hence, this signifies operation mode after the engine starts. Even when HDC switch is ON, if the ignition is OFF, HDC operation stops automatically.)</td><td>OFF</td><td>ON
(goes off after 1.8 seconds)</td></tr>
<tr><td rowspan="2">Not available</td><td colspan="3">HDC switch OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td colspan="3">HDC system error</td><td>OFF</td><td>ON</td></tr>
<tr><td rowspan="2">Stand-by</td><td colspan="3">HDC switch ON</td><td>ON</td><td>OFF</td></tr>
<tr><td colspan="5">The HDC switch is turned ON, but HDC system is in stand-by mode because the operating requirements are not met.</td></tr>
<tr><td rowspan="2">In operation</td><td colspan="3">HDC system is operating.</td><td>Blinking (0.5 seconds of interval)</td><td>OFF</td></tr>
<tr><td colspan="5">The HDC switch is turned ON, and the operating requirements are met. HDC is operating with operating sound.</td></tr>
<tr><td rowspan="3">System overheat</td><td rowspan="2">High brake system temperature (over 350°C)</td><td>HDC stand-by mode</td><td colspan="2">OFF</td><td>Blinking</td></tr>
<tr><td>HDC is operating</td><td colspan="3">Alternate blinking of green and red lamp (0.5 seconds of interval)</td></tr>
<tr><td colspan="2">Too high brake system temperature (over 450°C)</td><td colspan="2">OFF</td><td>ON</td></tr>
<tr><td colspan="5">There is no specific temperature sensor in the system, but a programmed logic inside the HECU predicts the temperature based on the operating numbers and conditions of HDC (HDC cannot be operated).</td></tr>
</table>

H. ESP (ELECTRONIC STABILITY PROGRAM)

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.

I. SENSOR CLUSTER (YAW RATE SENSOR + LATERAL ACCELERATION SENSOR + LONGITUDINAL ACCELERATION SENSOR)

Descriptions	Specifications
Supplying voltage	Approx. 5 V (4.75 ~ 5.25 V)
Output voltage when stop	Approx. 2.5 V (Ignition switch “ON”)
Output range	0.2 ~ 4.8 V
Operation start speed	-75°/s ~ +75°/s

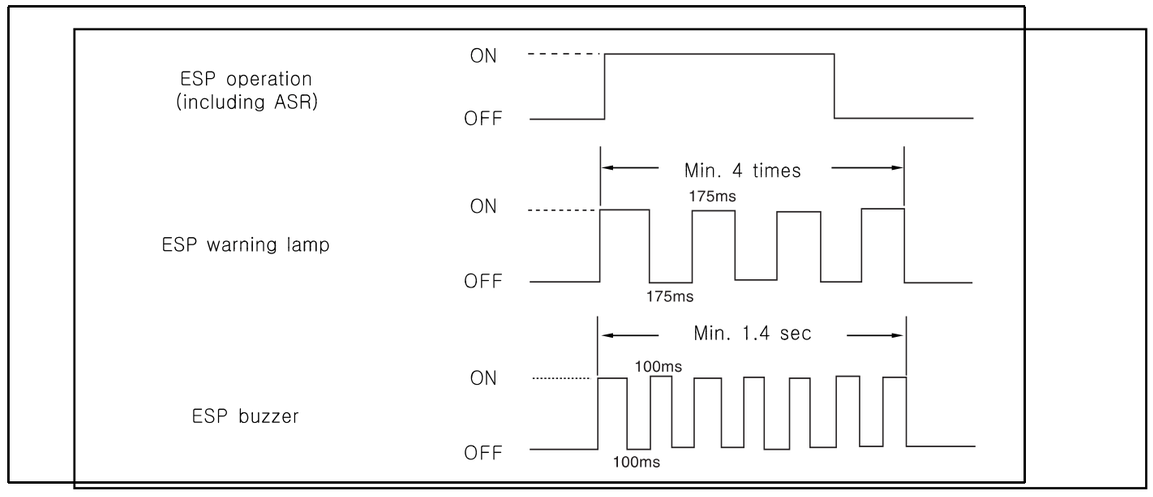
J. PRESSURE SENSOR

▶ **Specificatons**

Descriptions	Specifications
Supplying voltage	4.75 ~ 5.25 V
Output range	0.25 ~ 4.75 V
Output voltage when stop	2.5 V

K. ESP WARNING LAMP BLINKING IN CONTROL

ESP warning lamp blinks when ESP control is activated. If the activation reaches a certain limitation, a beep sounds to warn the driver. The ESP warning lamp goes off when ESP function is deactivated. Even when the ESP is operated for a very short period of time, the ESP warning lamp blinks minimum of 4 times every 175 milliseconds and the buzzer sounds for at least 1.4 seconds with 100 ms interval.



L. ESP SYSTEM CANCELLATION USING THE ESP OFF SWITCH

When the ESP switch at the center switch panel is pushed (for over approximately 150 ms), the ESP system will be cancelled and the vehicle will be driven regardless of the output values from the corresponding sensors. Then, the ESP warning lamp on the instrument panel comes on.

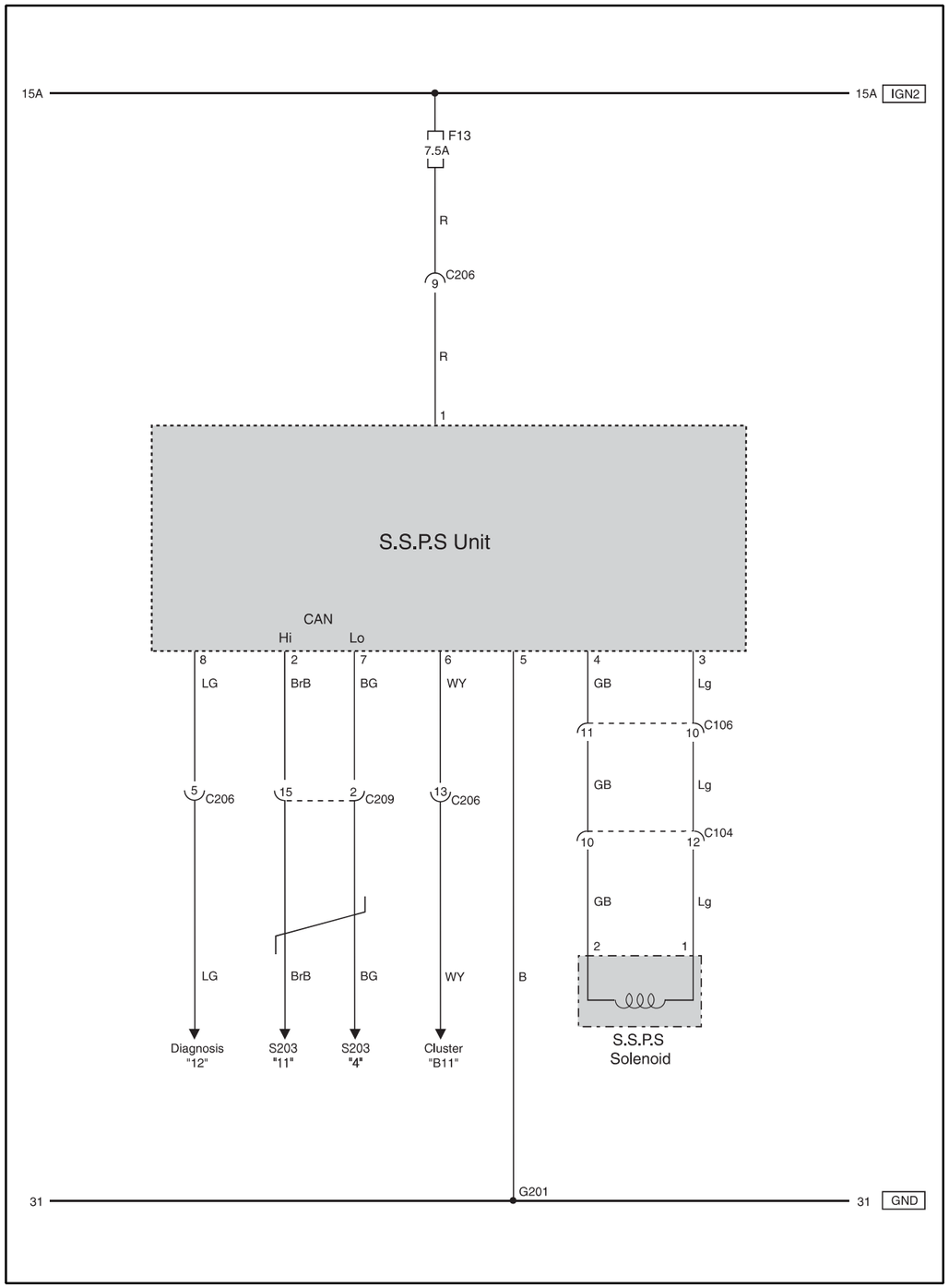
M. RESUMING THE ESP SYSTEM BY USING THE ESP OFF SWITCH

The ESP system will be resumed and the ESP warning lamp at the instrument panel goes off when the ESP switch at the center switch panel is pushed (for over approximately 150 ms) while the ESP system is not operating.

Modification basis	
Application basis	
Affected VIN	

S.G.N. 4620-12

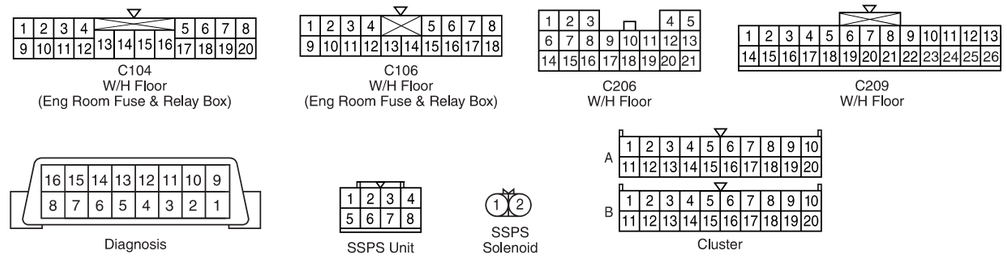
S.S.P.S (SPEED SENSITIVE POWER STEERING



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	CAN

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



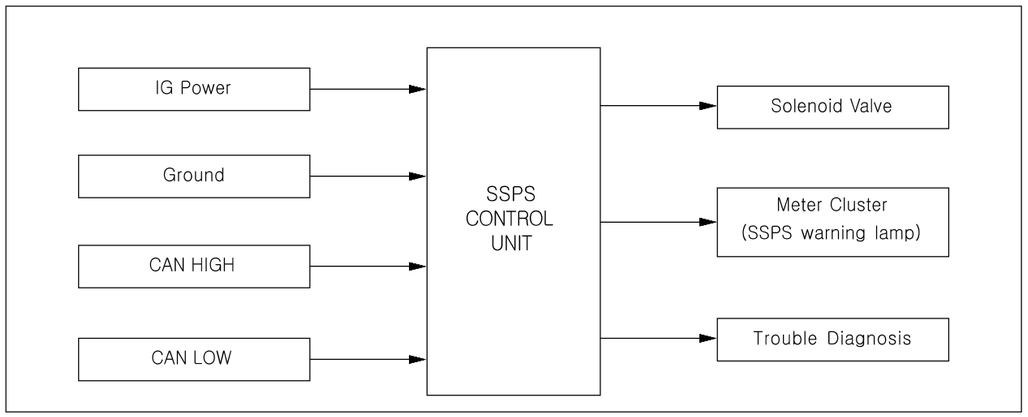
Modification basis	
Application basis	
Affected VIN	

3) CIRCUIT DESCRIPTION

(1) SSPS (SPEED SENSITIVE POWER STEERING)

In the conventional constant power assist steering system, the steerability gets lighter as vehicle speed rises, and this may cause a 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 solves 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 a driver according to the changes of vehicle speed, gives steering stability. The power steering control unit adjusts the hydraulic pressure to reaction plunger by controlling the pressure solenoid valve located in the gear box to optimize the steerability. 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.

(2) INPUT/OUTPUT OF SSPS CONTROL UNIT



(3) SSPS CONFIGURATION

A. 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.

B. Reaction device

This device increases the steerability effect by binding the input shaft with supplied hydraulic pressure from PCV.

C. Solenoid valve

The SSPS control unit controls the amount of electric current to the solenoid valve according to the vehicle speed. In other words, the solenoid valve controls the hydraulic pressure applied to reaction plunger by changing the valve spool position that is linked with solenoid valve according to the amount of electric current. The changes of hydraulic pressure applied to input shaft according to the pressure changes applied to the reaction plunger provide proper steerability based on the amount of electric current.

▶ **Specifications**

Description	Specification
Voltage Rating	DC 12 V
Current Rating	1.0 A
Resistance	6.7 ± 1Ω

▶ **Electric Current Check**

· Disconnect the solenoid valve connector (waterproof connector) and install the ammeter between the solenoid valve connector and the wiring harness.

NOTE
- Do not ground the solenoid terminal.

- When the vehicle speed is at 0 km/h, check whether the electric current for solenoid is in specified range and check that the current is reduced as the vehicle speed increases.

Current	0.9 ~ 1.1 A (vehicle speed at 0 km/h)

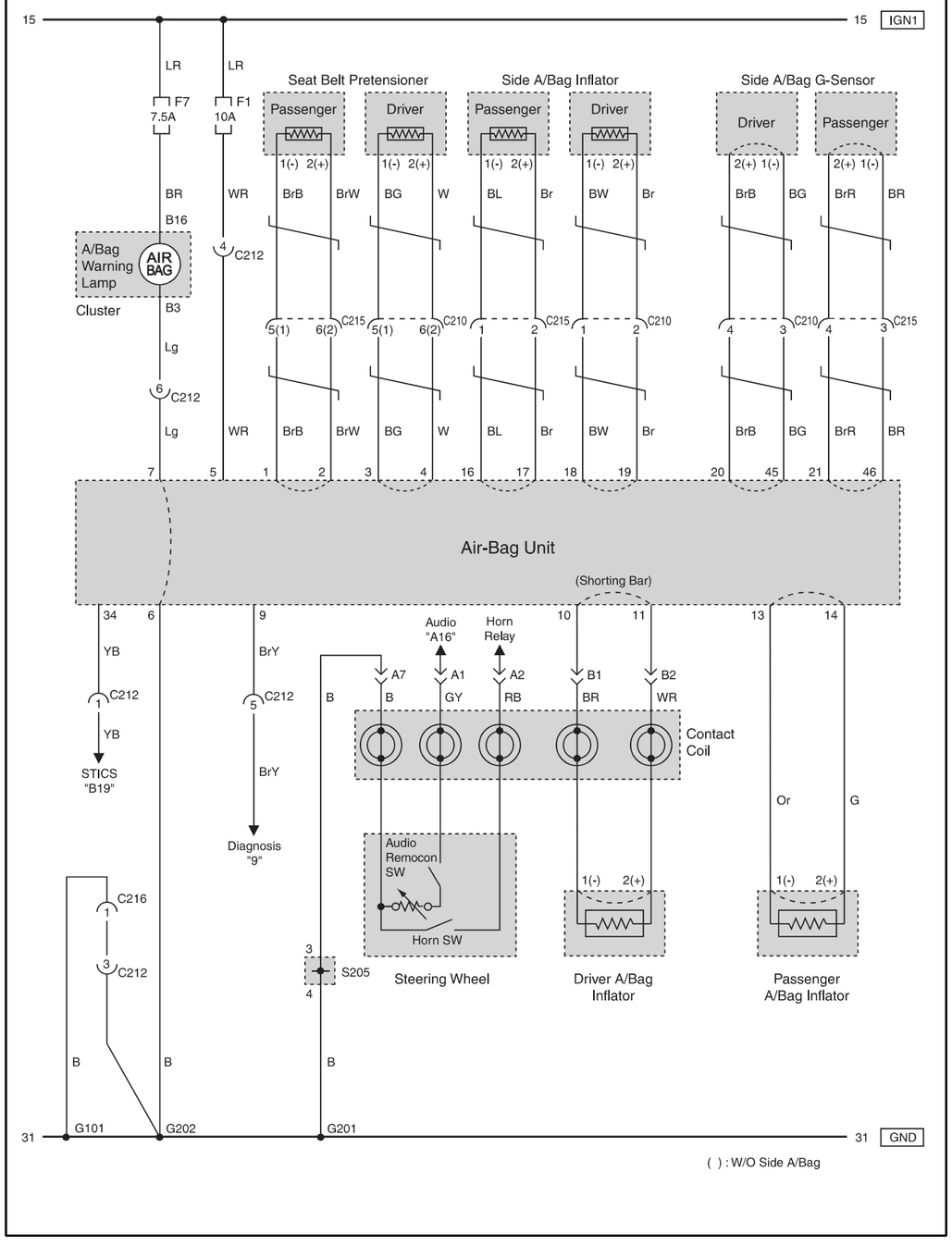
D. SSPS Control Unit

- To provide proper steerability to a driver, the SSPS control unit controls the solenoid valve by receiving the vehicle speed and the throttle position data via CAN
- communication.
  The SSPS control unit controls the working current for the solenoid valve with PWM type duty ratio of 333 Hz frequency and sets the target current to 1A during 1 second after the
- ignition is “ON”.
  When a trouble occurs in the system, the SSPS control unit generates a trouble code using fail safe function.

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8810-01

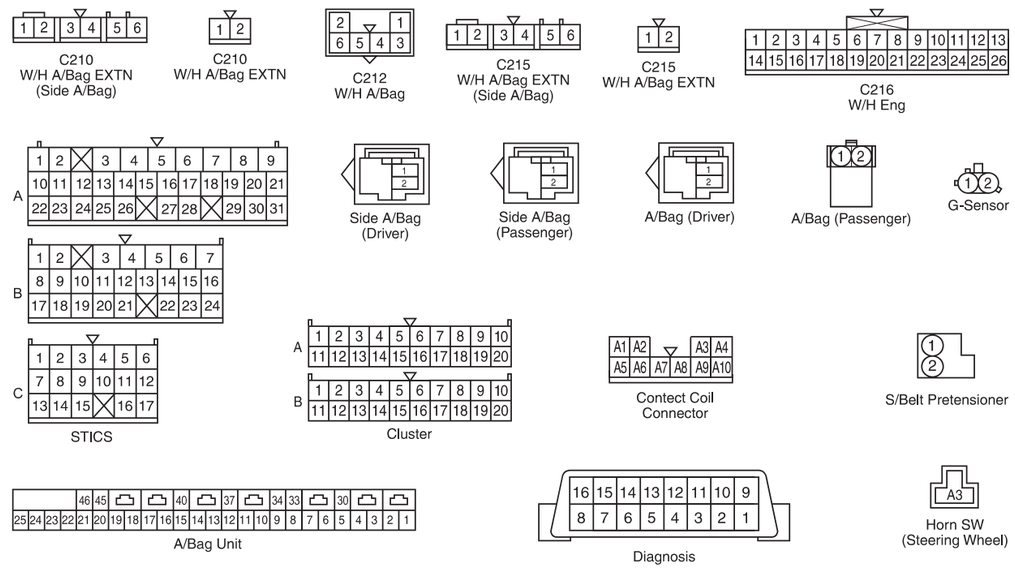
AIR-BAG (CURTAIN AIR-BAG)



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C210 (2Pin, Yellow)	W/H Air Bag - W/H Air Bag EXTN	Driver Cowl Side C/Holder	
C210 (6Pin, Yellow)	W/H Air Bag - W/H Air Bag EXTN	Driver Cowl Side C/Holder	Side A/Bag
C212 (6Pin, White)	W/H Main - W/H Air Bag	Backside the Cluster(Inside I/P)	
C215 (2Pin, Yellow)	W/H Air Bag - W/H Air Bag EXTN	Passenger Cowl Side C/Holder	
C215 (6Pin, Yellow)	W/H Air Bag - W/H Air Bag EXTN	Passenger Cowl Side C/Holder	Side A/Bag
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G101	W/H Eng	Center the Eng Room Fuse Box	
G201	W/H Main	Under the Driver Cowl Side PNL	
G202	W/H Main	Lower the Console Box	
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

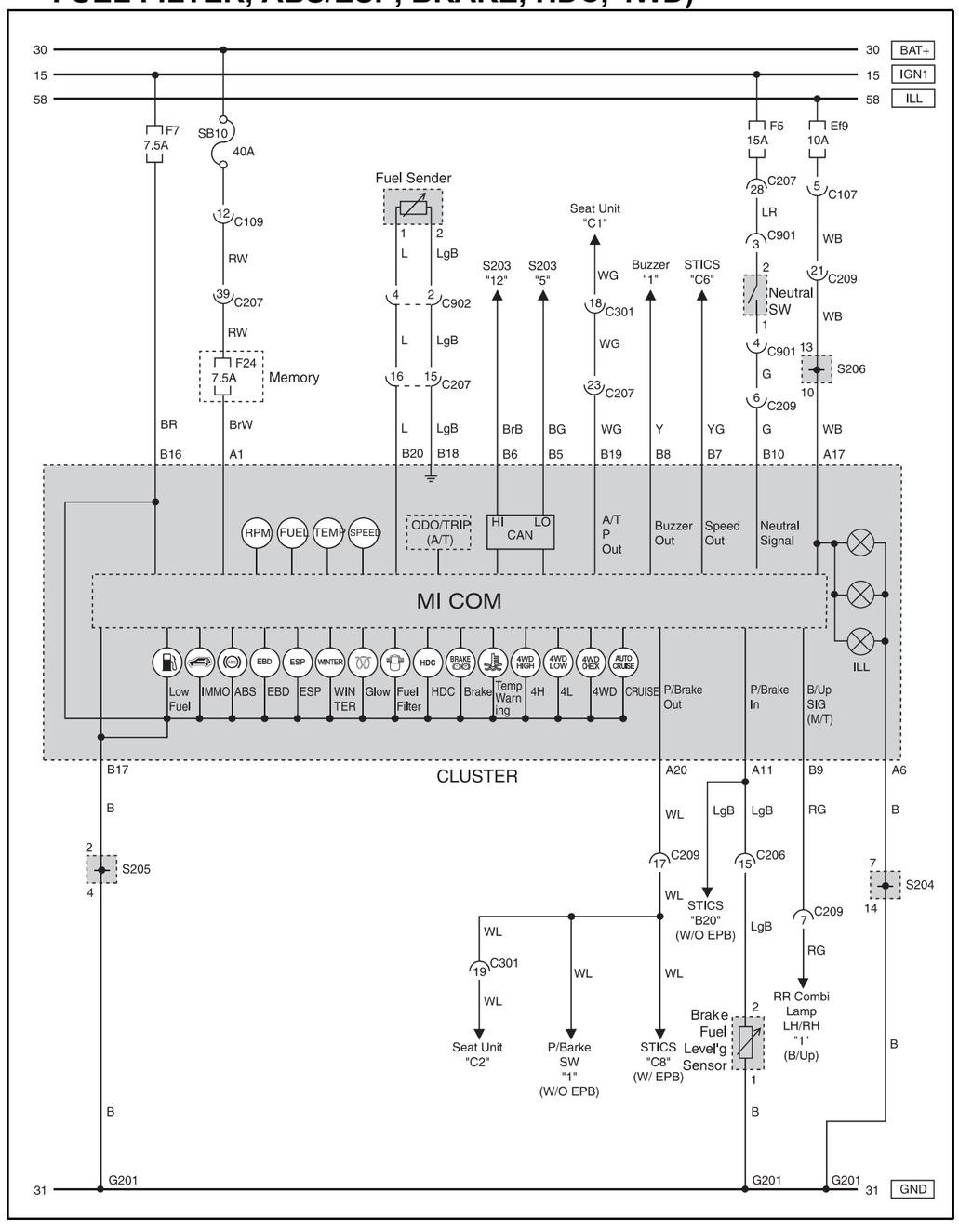


Modification basis	
Application basis	
Affected VIN	

S.G.N. 8010-01

CLUSTER

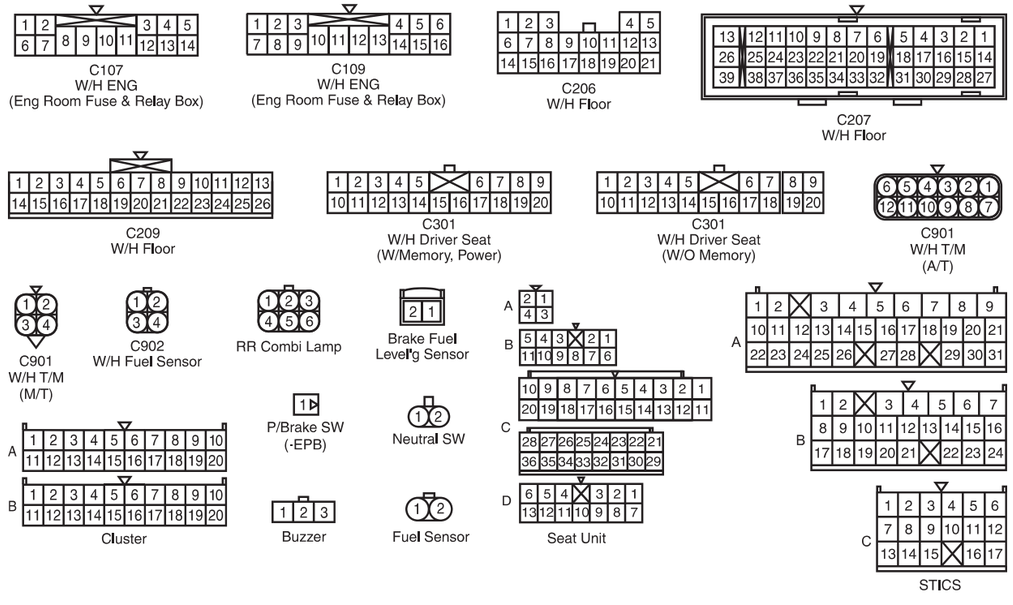
1) GAUGE (SPEED, RPM, FUEL, TEMP), WARNING LAMP (FUEL, FUEL FILTER, ABS/ESP, BRAKE, HDC, 4WD)



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Memory/Power
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Seat Warmer
C901 (12Pin, Black)	W/H Floor - W/H T/M	Upper the T/M	A/T
C901 (4Pin, Black)	W/H Floor - W/H T/M	Upper the T/M	M/T
C902 (4Pin, Black)	W/H Floor - W/H Fuel Sender	Upper the T/M	
G201	W/H Main	Under the Driver Cowl Side PNL	
S203 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	CAN
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

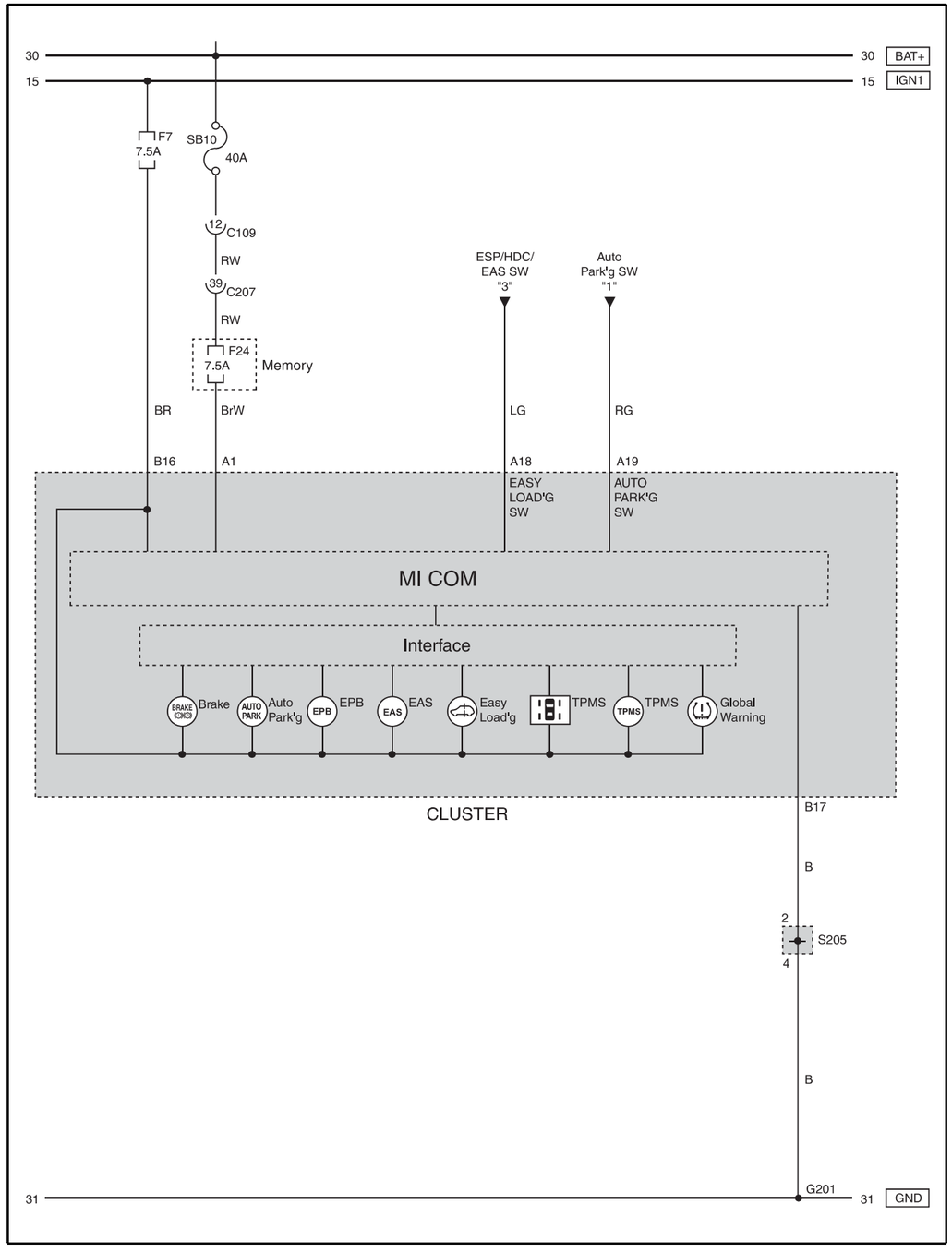


CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

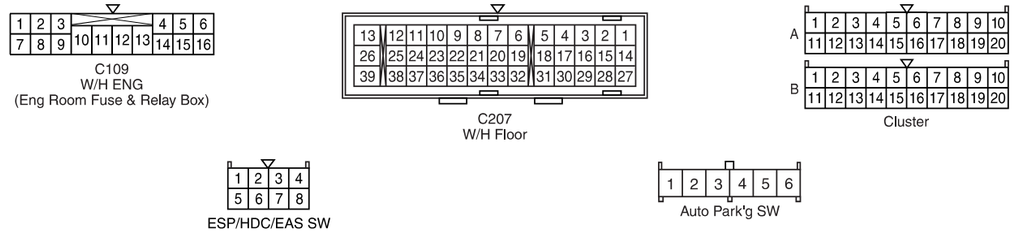
2) WARNING LAMP (EAS, EPB, AUTO PARK'G,GLOBAL), EASY LOAD'G, TPMS



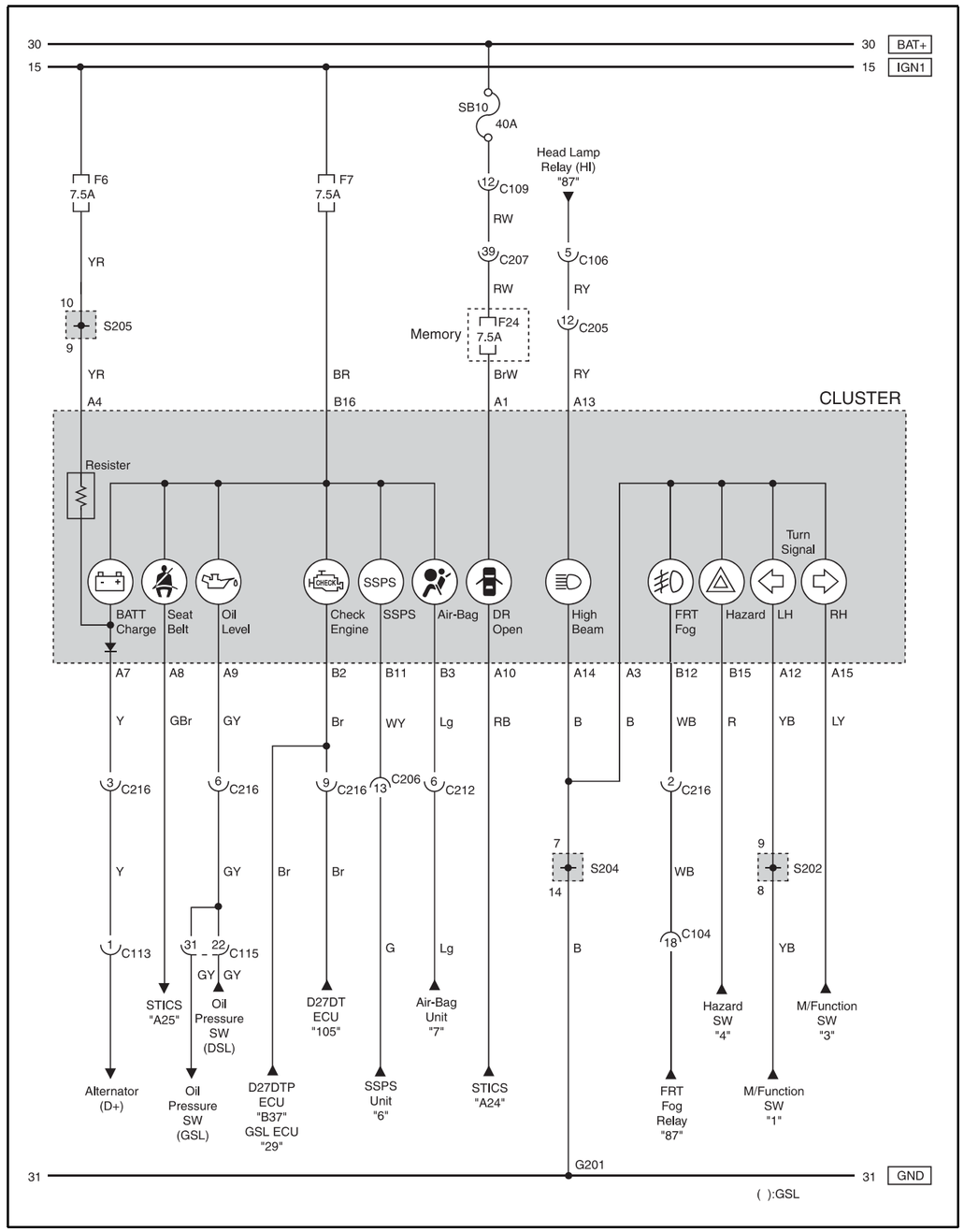
(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



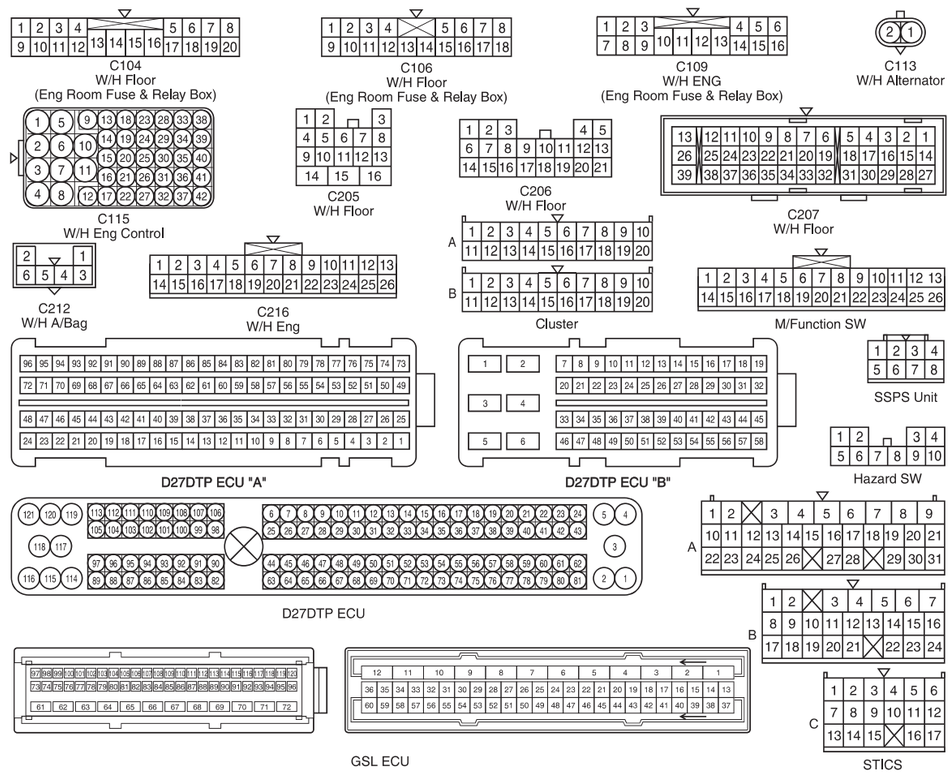
3) WARNING LAMP (BATT CHARGE, OIL, SSPS, DOOR, ENG CHECK, AIR BAG, SEAT BELT), TURN SIGNAL, FOG LAMP, HAZARD



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C113 (2Pin, Black)	W/H Eng - W/H Alternator	Under the Coolant Reserve Tank	
C115 (42Pin, Black)	W/H Floor - W/H Eng Control	Right Eng Room Dash PNL	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C212 (6Pin, White)	W/H Main - W/H Air Bag	Backside the Cluster(Inside I/P)	
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

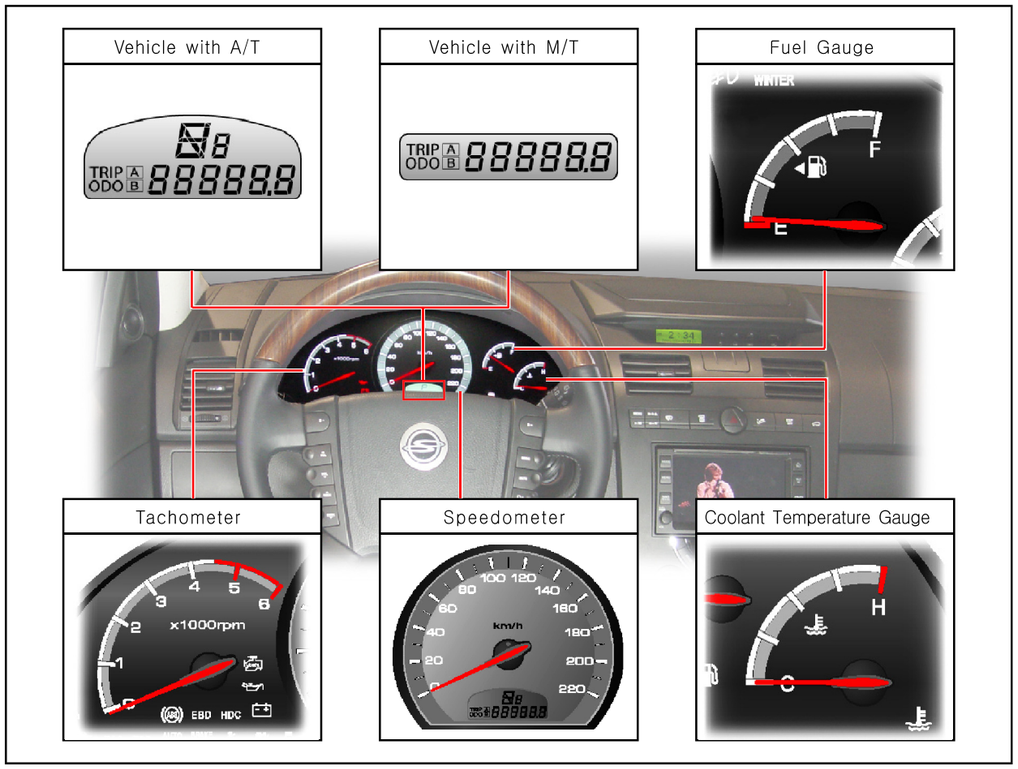
(3) CIRCUIT DESCRIPTION

A. INSTRUMENT CLUSTER

The instrument cluster uses the CAN communication.
The HDC warning lights (green & red) are added since the HDC function has been introduced into ESP system.

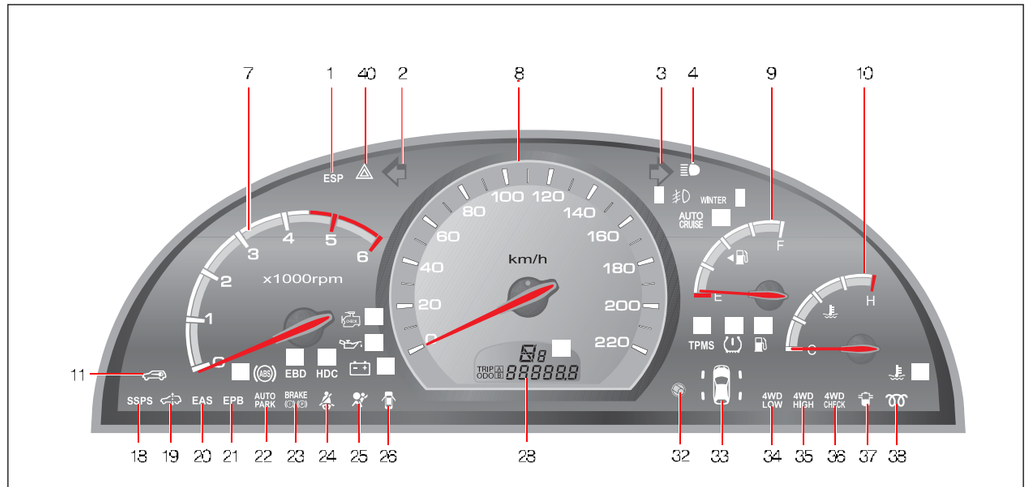
Green	Turn signal, 4WD HIGH, WINTER, Parking Brake, HDC, Front fog light
Blue	High beam
Red	Seat belt, Battery charge, 4WD CHECK, Oil pressure, Door ajar, EBD, Brake, Airbag, Water separator, HDC, Coolant temperature
Amber	Engine CHECK, ABS, Global warning, TPMS, Fuel, Pre-glow, ESP, 4WD LOW, SSPS, Immobilizer

▶Location and Configuration



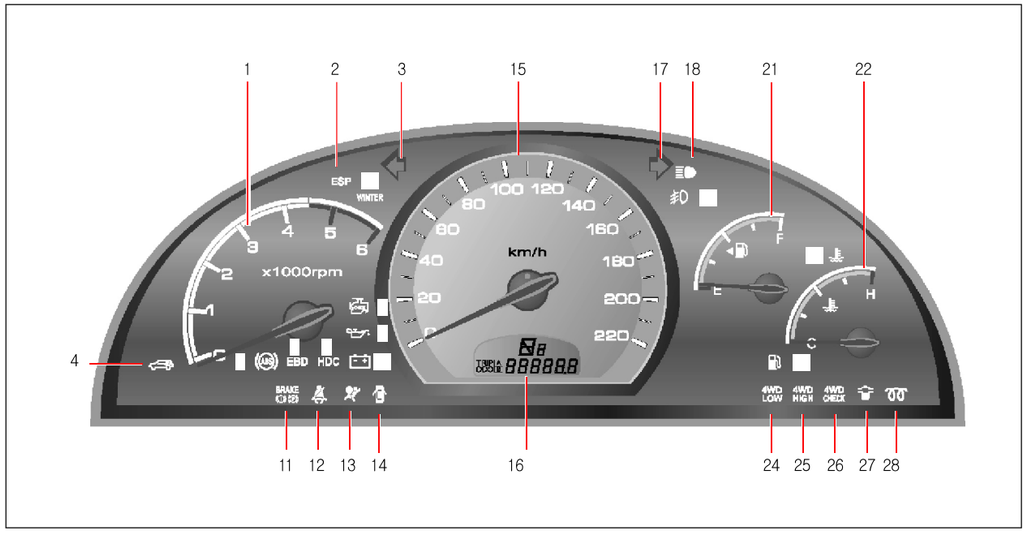
B. DESCRIPTIONS OF INDICATOR DISPLAY

▶Deluxe Version



1. ESP warning light
2. Left turn signal indicator
3. Right turn signal indicator
4. High beam indicator
5. Front fog light indicator
6. Winter mode indicator
7. Tachometer
8. Speedometer
9. Fuel gauge
10. Engine coolant temperature gauge
11. Immobilizer indicator
12. ABS warning light
13. EBD warning light
14. HDC indicator
15. Engine check warning light
16. Engine oil pressure warning light
17. Battery charge warning light
18. SSPS warning light
19. EAS level change indicator
20. EAS warning light
21. EPB warning light
22. Automatic parking brake setting indicator
23. Brake warning light
24. Seat belt reminder (driver's seat)
25. Air bag warning light
26. Door ajar warning light
27. Auto shift indicator
28. Odometer/ Trip odometer
29. TPMS warning light
30. Global warning
31. Low fuel level warning light
32. Trip switch
33. Tire inflation pressure indicator
34. 4WD LOW indicator
35. 4WD HIGH indicator
36. 4WD CHECK warning light
37. Water separator warning light
38. Glow indicator
39. Engine overheat warning light
40. Hazard indicator
41. Auto cruise indicator

▶Standard Version



1. RPM gauge
2. ESP warning light
3. Left turn signal indicator
4. Immobilizer indicator
5. ABS warning light
6. EBD warning light
7. HDC warning light
8. Engine CHECK warning light
9. Engine oil pressure warning light
10. Charge warning light
11. Brake warning light
12. Seat belt reminder
13. Air bag warning light
14. Door open warning light
15. Speedometer
16. Gear display/Odometer
17. Right turn signal indicator
18. High beam indicator
19. Front fog lamp indicator
20. Winter mode indicator
21. Fuel level gauge
22. Coolant temperature gauge
23. Low fuel level warning light
24. 4WD LOW indicator (TOD/Part time)
25. 4WD HIGH indicator (Part time)
26. 4WD CHECK warning light (TOD/Part time)
27. Water separator warning light
28. Glow indicator
29. Over temperature warning light

C. WARNING LIGHTS AND INDICATORS

▶Engine 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.
Under the normal engine operating temperature, the proper idling speed is 750 ± 50 rpm for D27DT engine. The red zone (danger rpm range) starts from 4,500 rpm.

1) Connect the tachometer for tune-up test and start the engine.
2) Eliminate the hysteresis by tapping the tachometer.
3) Compare the values on the tester and tachometer and replace the tachometer if the tolerance is excessive.

Description	Specification (VIN=13 ± 0.1V, Temperature: 25°C)						
Engine speed (rpm)	750	1000	2000	3000	4000	5000	6000
Tolerance (rpm)	–	+100	+100	+100	+100	+100	–
	–	–100	–100	–100	–100	–100	

▶Speedometer Gauge

The speedometer indicates the vehicle speed by calculating the signals from the rear wheel speed sensors through ABS or ESP unit (speed signal cycle: 21 ms). If the speedometer gauge vibrates, stops at a certain range or makes an abnormal noise, there could be defectives in speedometer. However, these symptoms also could be occured when the tire has uneven wear, different tire inflation pressures or different tire specifications. Perform the speedometer test regarding the tolerance as described. However, it is not similar simple work in field due to lack of measuring conditions such as test equipment and preciseness.

1) Check the allowable tolerance of the speedometer and operations of the trip odometer by using atester.
2) Check if the speedometer gauge is shaking and the abnormal noise sounds.
3) Eliminate the hysteresis by tapping the speedometer.

Description	(VIN = 13 ± 0.1V, Temperature: 25°C)								
Standard speed (Km/h)	20	40	(60)	80	100	120	140	(160)	(180)
Tolerance (Km/h)	+4	+4	+7	+9	+10.5	+12.5	+14.5	+16	+18
	0	0	+2.5	+3.5	+4	+6	+7.5	+8.5	+10

Modification basis	
Application basis	
Affected VIN	

▶Fuel Level Gauge

The fuel level gauge displays the resistance value of the float on the fuel sender in the fuel tank through a pointer. Note that this vehicle doesn't have a service hole for checking the fuel sender connector in the fuel tank. The fuel sender and its connector can be checked and replaced only when the fuel tank is removed. The power supply and resistance value should be measured at the connector in front of the fuel sender (refer to wiring diagram). When the power supply and output resistance are normal, the float operation by fuel level may be defective; if so, replace the fuel sender.

▶Tolerance and resistance value by indicating angle

	Specification (VIN= 13.5 ± 0.1 V, temperature: 25°C)									
Scale	Full	Full (Gauge)	7/8	3/4	5/8	1/2	1/4	Fuel warning lamp ON	Empty (Gauge)	Empty (center)
Indicating angle (°)	54	50	37.5	25	12.5	0	-25	-47	-50	-54
Tolerance (°)	+2, -2	+2, -2	-	-	-	± 5	-	± 2	+2, -2	+2, -2
Fuel sender resistance (Ω)	38	43	55.8	67	82.5	99.5	150	DSL: 266 GSL: 260	276.3	283
Fuel level in tank	78 liters	76 liters	67 liters	58 liters	49 liters	41 liters	25 liters	DSL: 9.0 GSL: 9.5 liters	5 liters	-

This table shows the tolerance and resistance value changes by fuel level in normal conditions. Therefore, the differences that can be occurred by the road conditions and fuel fluctuations are ignored.

▶Coolant Temperature Gauge

Using a needle, it displays the coolant temperature obtained from the engine coolant temperature sensor. The PTC resistance value of the coolant temperature sensor is transmitted to the engine ECU and then to the cluster as CAN signal. The angle of guage that can be varied by coolant temperature is as shown below.

		Tolerance and resistance value by indicating angle		
Indicating angle (°)	-50	0 (center)		+50
Tolerance	+0°C -5°C	+0°C -5°C	+0°C -5°C	+5°C +0°C
Coolant temperature	Less than 40°C	70 ~ 110°C (diesel)	80 ~ 110°C (gasoline)	Over 125°C

▶Measurement of coolant temperature sensor resistance

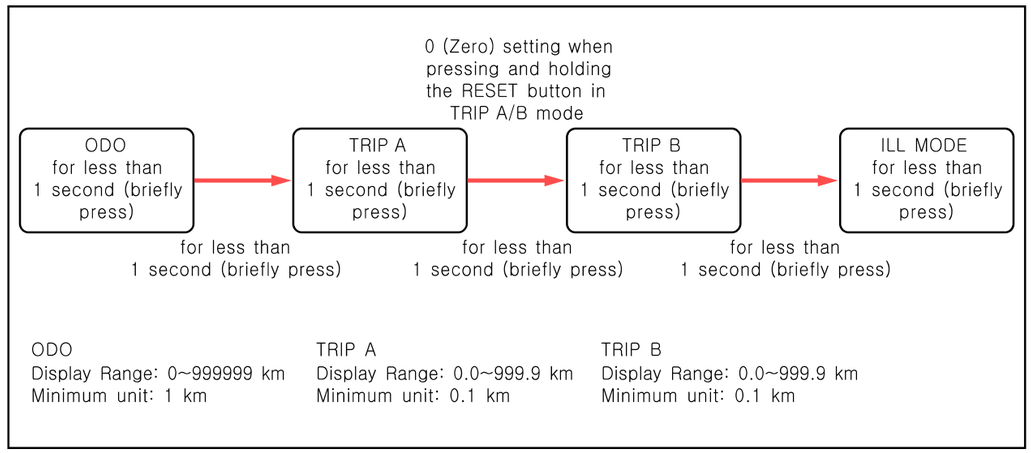
Measure the resistance between the terminal and the ground with an ohmmeter and replace if the resistance is out of specified range.

Resistance value by coolant temperature: 20°C - 2449Ω ± 5 %
50°C - 826Ω ± 5 %
80°C - 321Ω ± 5 %
100°C - 12Ω ± 5 %

- When the resistance value by coolant temperature is within the specified range, check thermostat, water pump, radiator related coolant circuit for normal operation. Also, check the wiring harnesses and connectors for proper connection (D27DT engine ECU: NO.101, 102 / D27DTP (power up) engine ECU: A56, A57).
- The time when the engine coolant temperature reaches the normal temperature (gauge indicating angle: 0°) depends on the ambient temperature and the vehicle's load. Therefore, the coolant temperature gauge should be used only for reading its movement.

▶PRESS “RESET BUTTON” TO GO THE EACH MODE

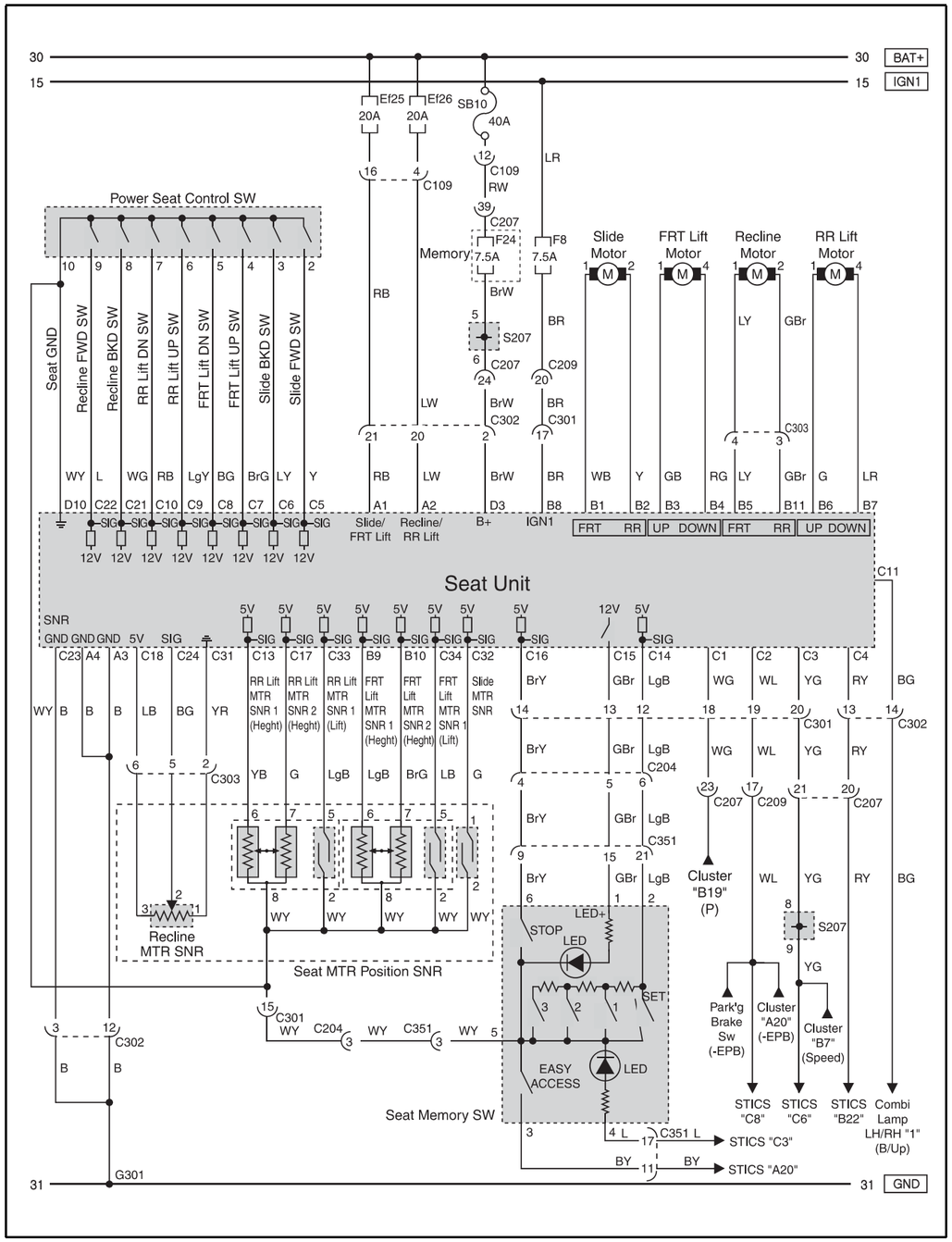
Mode changes



S.G.N. 7410-13

POWER SEAT - DRIVER (W/ MEMORY)

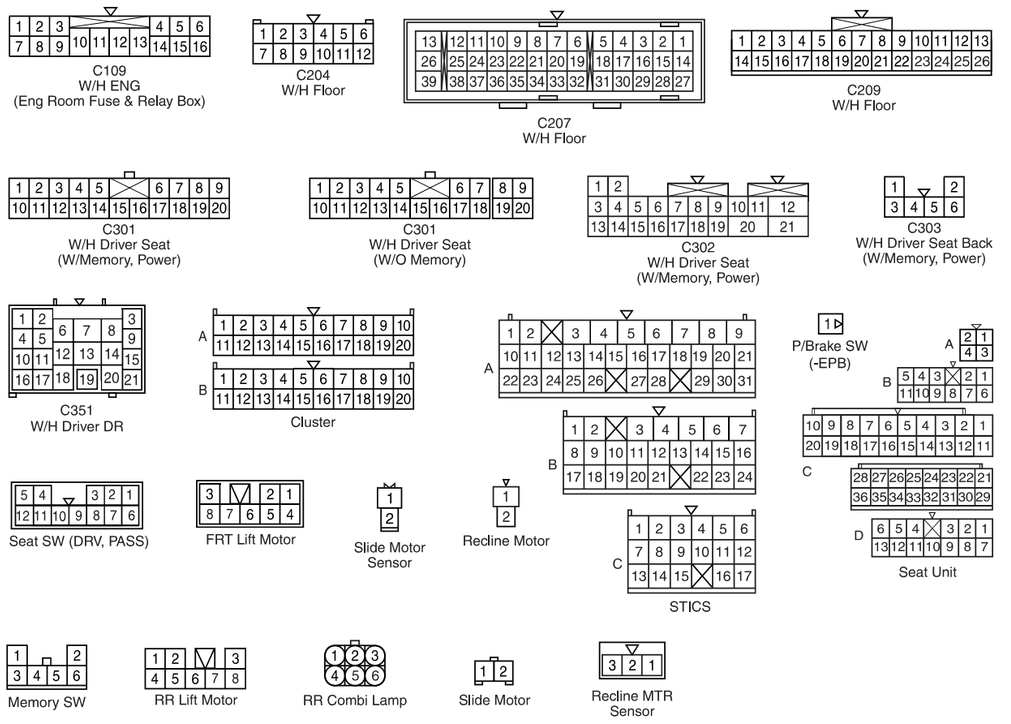
1) DRIVER POWER SEAT & SEAT MEMORY



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C204 (12Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Memory/Power
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Seat Warmer
C302 (21Pin, Black)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Memory/Power
C303 (6Pin, White)	W/H Driver Seat - W/H Seat Back	Under the Driver Seat	Memory/Power
C351 (21Pin, Black)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
G301	W/H Floor	Under the Driver Seat	
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

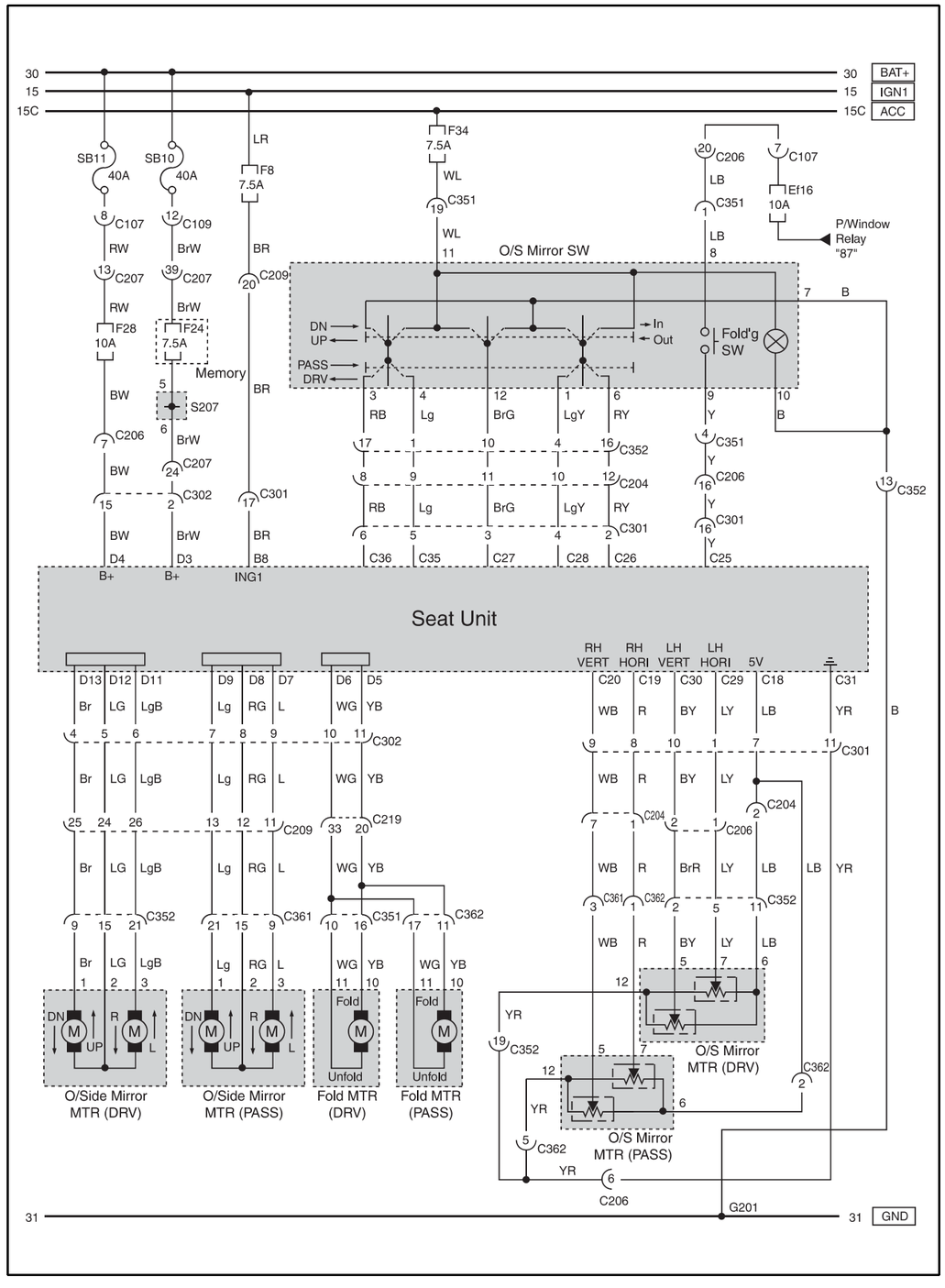


CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

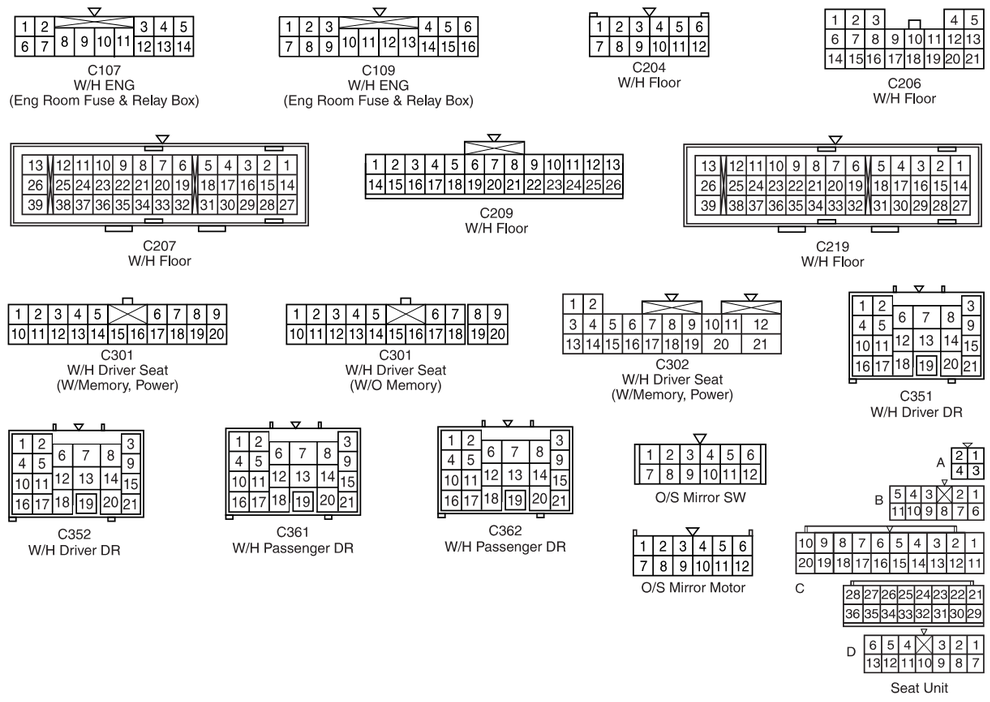
2) ELECTRIC OUTSIDE MIRROR & FOLDING



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C204 (12Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Memory/Power
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Seat Warmer
C302 (21Pin, Black)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Memory/Power
C351 (21Pin, Black)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C352 (21Pin, White)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C361 (21Pin, White)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C362 (21Pin, Black)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
G201	W/H Main	Under the Driver Cowl Side PNL	
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

(3) CIRCUIT DESCRIPTION

A. FUNCTION AND DESCRIPTION

Basic function: Adjustment and memorization of driver's seat position, Folding/Unfolding the outside rearview mirrors.
Additional function: Easy access function, Aiming down (3.5°) when reversing Deleted component: Outside rearview mirror folding unit (model with SPWM) However, for the vehicle without SPWM, the outside rearview mirror folding unit is installed in front of STICS.

B. MAJOR FUNCTIONS OF SPWM UNIT

The control the SPWM unit, the ignition ON/OFF signal is transmitted to SPWM unit from STICS. However, the parking brake signal and transmitted to SRWM unit from the instrument cluster.

- Power Seat Position Control
- Outside Rearview Mirror Control
- Driver's Seat and Outside Rearview Mirror Position Memory
- Easy Access
- Outside Rearview Mirror Auto Down

C. SPECIFICATIONS

▶ Driver's Power Seat

Inputs	Specifications		
Position sensor	Type		Reed switch type
	ON:OFF ratio		50 ± 20 %
	Contact current		Max. 0.5 A
	Chattering		Max. 0.2 msec
	Stroke	Sliding	228 mm ± 3 mm
		Reclining	23° (front) ↔ 0° ↔ 48° (rear)
		Raising (FRT/RR)	30 ± 3mm
	Total number of pulses	Sliding	1,200 Pulses
		Raising (FRT/RR)	46.93 Pulses
	Operation speed	Sliding	17.9 mm / Sec
		Reclining	3.50° / Sec
		Raising (FRT/RR)	7.0 mm / Sec
	Resolution	Sliding	0.188 / Pulse
		Raising (FRT/RR)	0.64 / Pulse
	Variable resistance		REC
SPWM memory switch	Type		Selt-return type
	Contact current		Min. 10 mA
	Chattering		Max. 10 msec
Manual switch	Type		Self-return type (Active low)
	Contact current		Max. 7A
	Chattering		Max. 10 msec

▶ Actuator

Actuator	Specifications		
For sliding/ reclining/raising front and rear (DC motor)	Rated voltage		DC 12V
	Operation current	Sliding	Max 2A (No-load)
		Reclining (REC)	Max 3.6A (AT 1.5 Nm)
			Max 8.0A (AT 12 Nm)
		Raising (FRT/RR)	Max 3A
	Limited current	Sliding	Max 16A
		Reclining	Max 13A
		Raising	Max 11A

▶ Outside Rearview Mirror

- Manual Mode (Normal): 12V

Inputs / Controls	H	C	V
UP	GND	12V	GND
DOWN	12V	GND	12V
OFF	GND	GND	GND
RIGHT	GND	12V	12V
LEFT	12V	GND	GND

- Position Sensor and Folding Switch

Inputs	Specifications	
Position sensor	Type	Variable resistance
	Rated voltage	DC 5V
	Output tolerance	± 0.1 V (± 2% from max. output)
	Supply current	Max 20 mA, 0.25W
	Operation range	Vertically and horizontally: ± 8°
Folding switch	Type	Self-return type (Active high)
	Contact current	Min. 10 mA
	Chattering	Max. 10 msec
Manual switch	Type	Self-return type (Active low)
	Contact current	Max. 7A
	Chattering	Max. 10 msec

Modification basis	
Application basis	
Affected VIN	

▶Motor

Inputs	Specifications	
Mirror drive motor	Rated voltage	DC 12V
	Operation current	Max. 0.2A
	Limited current	Max. 1.5A
	Operation speed	2.5° ± 0.5° / sec (at 12V)
Folding motor	Rated voltage	DC 12V
	Operation current	Max. 3A
	Limited current	Max. 3.4A
	Turn over torque (by hand)	Manual folding: Min 50 kgf·cm
		Electric folding: Max 100 kgf·cm

▶Motor Output (normal mode: ground)

Inputs / Controls	H	C	V
UP	GND	GND	12V
DOWN	12V	12V	GND
RIGHT (IN)	GND	12V	12V
LEFT	12V	GND	GND

▶Buzzer

Output	Specifications	
Buzzer	Rated volatage	DC 12V
	Rated current	Max. 30 mA
	Acoustic pressure	Min. 92 dB
	Base frequency	2200 ± 150 Hz

- Output time: 2Hz, DUTY 20% (ON: 0.1 sec., OFF: 0.4 sec.)
- Buzzer output conditions
  - · When the memory operation is permitted (memory switch ON): once
  - · After completing the memory recall (position switch ON): twice
  - · When starting to recall the memory (position switch ON): once
  - · When pressing the position switch button twice consecutively: three times
  - · When detecting a sensor error while recalling (position switch ON): three times
  - · No buzzer output for the easy access memory/recall operations
  - · No buzzer output for the outside mirror position recall by the auto down operation when reversing

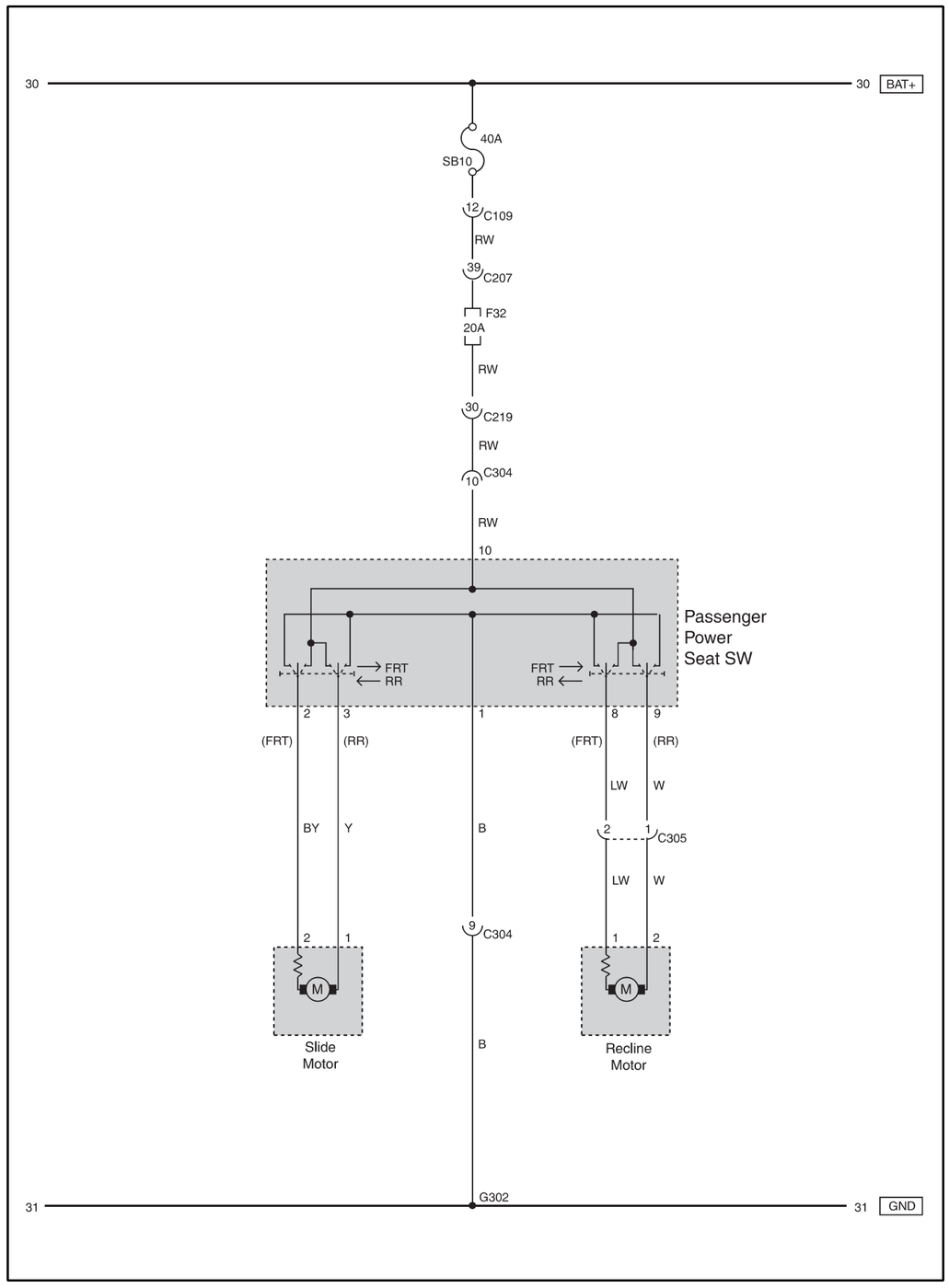
D. EASY ACCESS FUNCTION

This system is designed to provide a sufficient space for the driver to access and exit by moving the seat rearwards.

Easy access permissible conditions:

	M/T	A/T
When getting off	Parking brake switch is "ON (applied)" when removing the ignition key.	Parking brake switch is "ON (applied)" when removing the ignition key. Or. shift lever is in "P" position before turning off the ignition switch.
When getting on	Parking brake switch is "ON (applied)" when turning the ignition switch to "On" position and vehicle is stationary. Not available when the shift lever is in "R" position.	Parking brake switch is "ON (applied)" when turning the ignition switch to "On" position . Or, shift lever is in "P" position and vehicle is stationary. Not available when the shift lever is in "R" position.
Easy access permissible conditions	Permissible conditions when getting off: Only the signal between the parking brake switch and the SPWM unit (connected with wire) can be used. The vehicle speed signal is not transferred to the SPWM when the ignition key is removed. Permissible conditions when getting on: The vehicle should be stationary.	Permissible conditions when getting off: Same with the M/T's However, shift lever is in "P" position before turning off the ignition switch. * The position signal of shift lever cannot be transferred from instrument cluster when the ignition switch is turned off (IGN OFF → Cluster OFF).

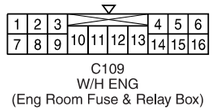
S.G.N. 7410-04 POWER SEAT - PASSENGER



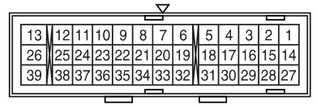
1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C304 (16Pin, White)	W/H Floor - W/H Passenger Seat	Under the Passenger Seat	Power
C304 (6Pin, White)	W/H Floor - W/H Passenger Seat	Under the Passenger Seat	Seat Warmer
C305 (4Pin, White)	W/H Passenger Seat - W/H Seat Back	Under the Passenger Seat	Power
G302	W/H Floor	Under the Passenger Seat	

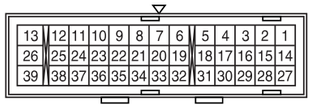
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



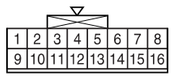
C109
W/H ENG
(Eng Room Fuse & Relay Box)



C207
W/H Floor



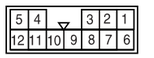
C219
W/H Floor



C304
W/H Passenger Seat
(W/Memory, Power)

C304
W/H Passenger Seat
(W/O Memory)

C305
W/H Passenger Seat Back
(W/Memory, Power)



Power Seat SW

Slide Motor

Recline Motor

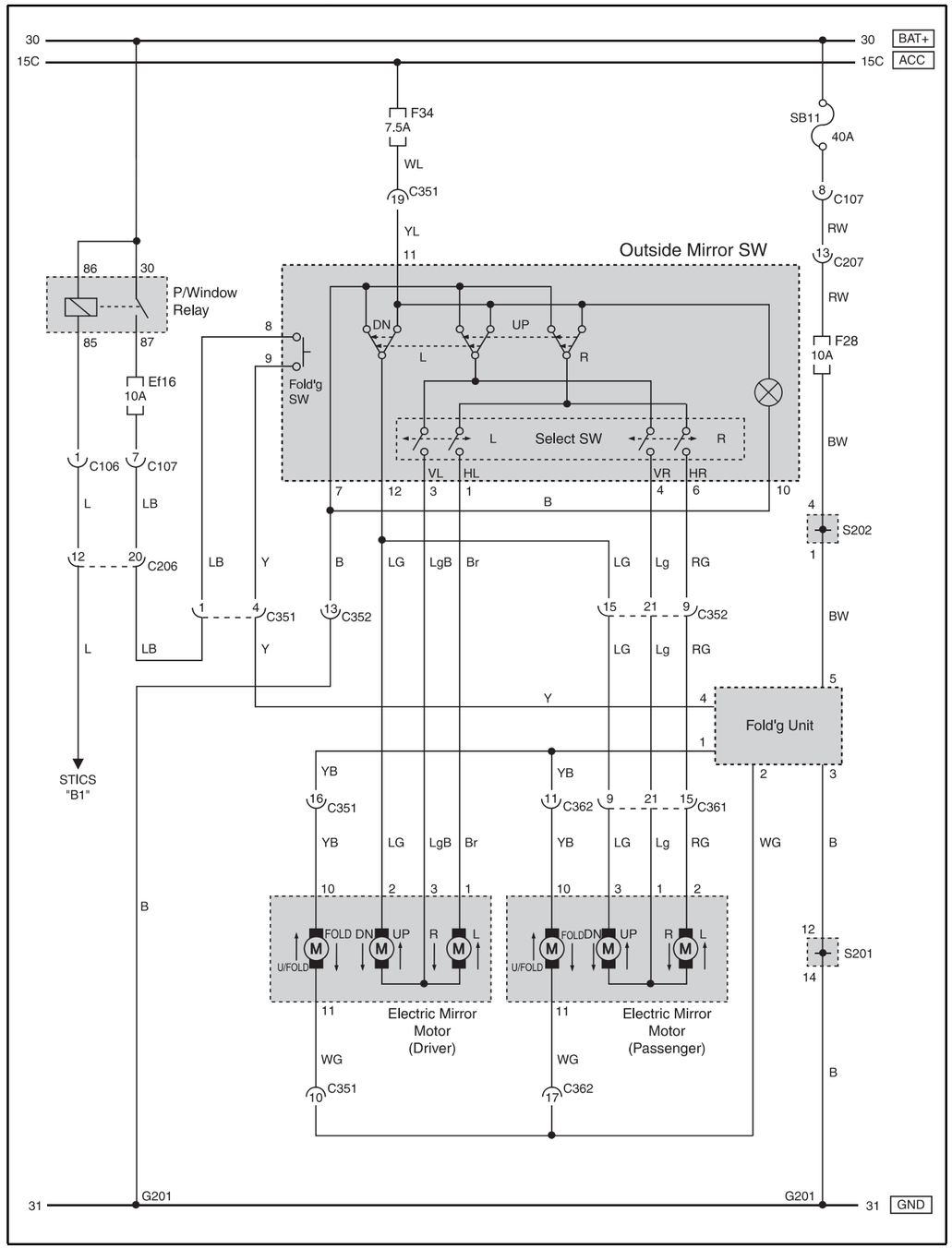
CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8510-52

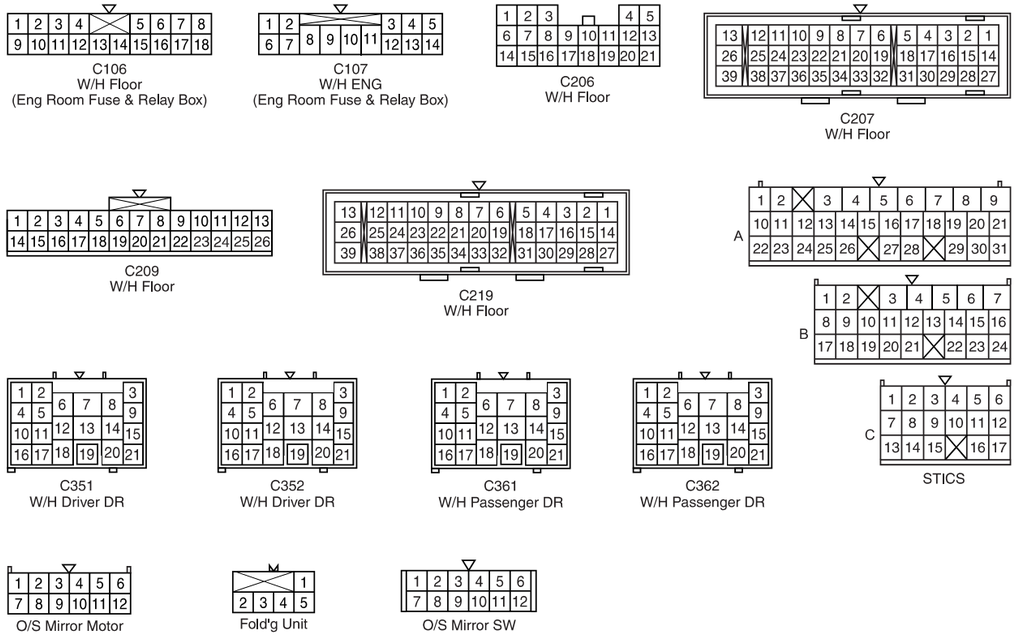
ELECTRIC OUTSIDE MIRROR & FOLDING (W/O MEMORY)



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C351 (21Pin, Black)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C352 (21Pin, White)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C361 (21Pin, White)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C362 (21Pin, Black)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
G201	W/H Main	Under the Driver Cowl Side 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	

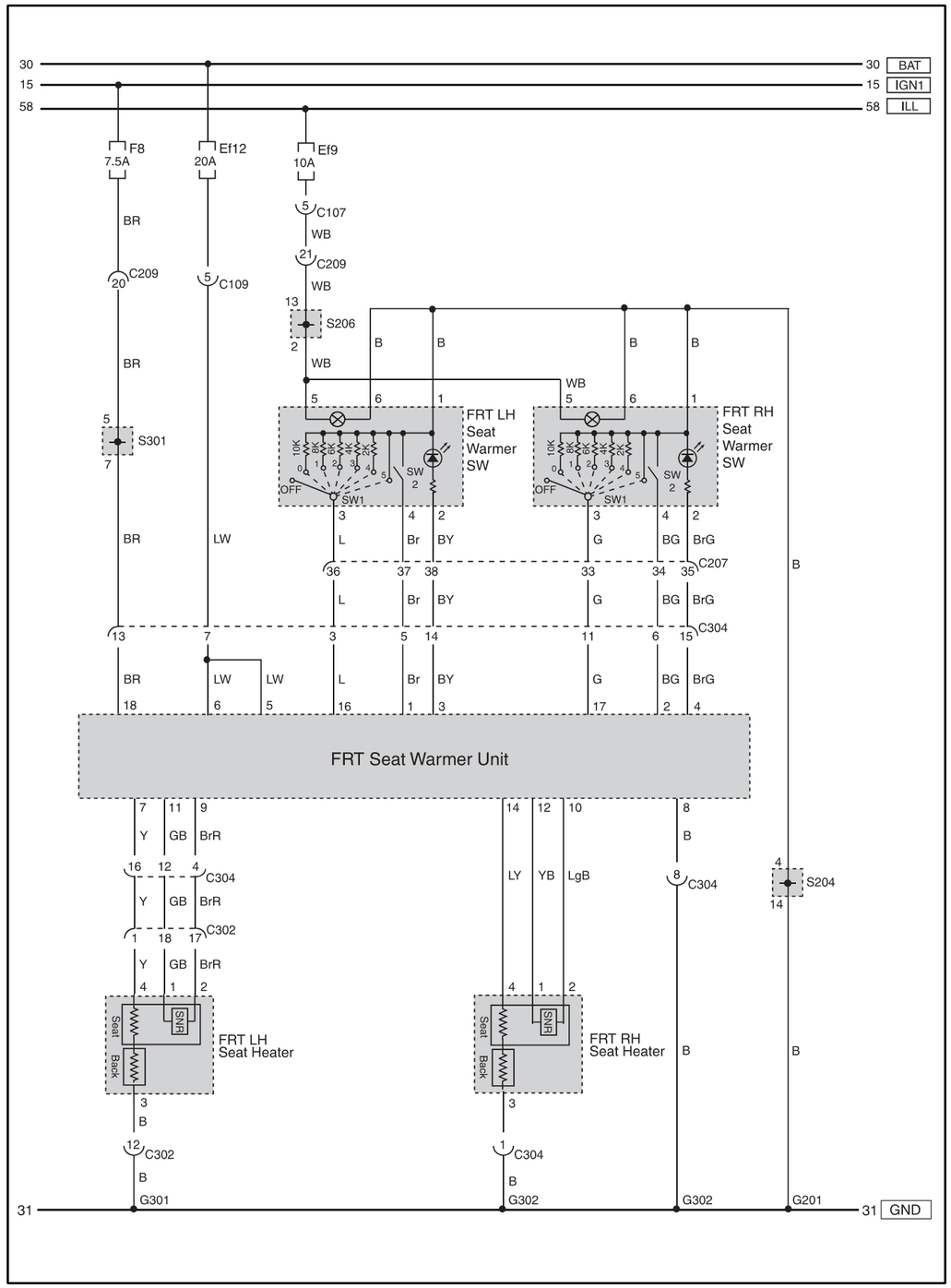
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8510-48

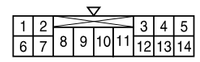
FRT SEAT WARMER (W/ MEMORY)

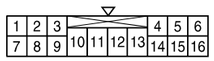


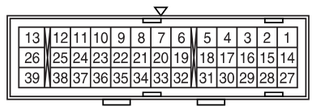
1) CONNECTOR INFORMATION

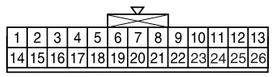
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C302 (21Pin, Black)	W/H Floor - W/H Driver Seat	W/H Floor - W/H Driver Seat	Memory/Power
C304 (16Pin, White)	W/H Floor - W/H Passenger Seat	W/H Floor - W/H Passenger Seat	Power
C304 (6Pin, White)	W/H Floor - W/H Passenger Seat	W/H Floor - W/H Passenger Seat	Seat Warmer
G201	W/H Main	Under the Driver Cowl Side PNL	
G301	W/H Floor	Under the Driver Seat	
G302	W/H Floor	Under the Passenger Seat	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL
S301 (14Pin, Black)	W/H Floor	Under the Driver Seat	CAN

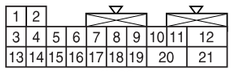
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

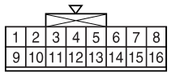

C107
W/H ENG
(Eng Room Fuse & Relay Box)

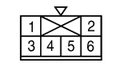

C109
W/H ENG
(Eng Room Fuse & Relay Box)

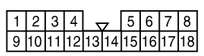

C207
W/H Floor

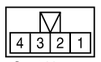

C209
W/H Floor

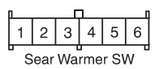

C302
W/H Driver Seat
(W/Memory, Power)


C304
W/H Passenger Seat
(W/Memory, Power)


C304
W/H Passenger Seat
(W/O Memory)


FRT Seat Warmer Unit

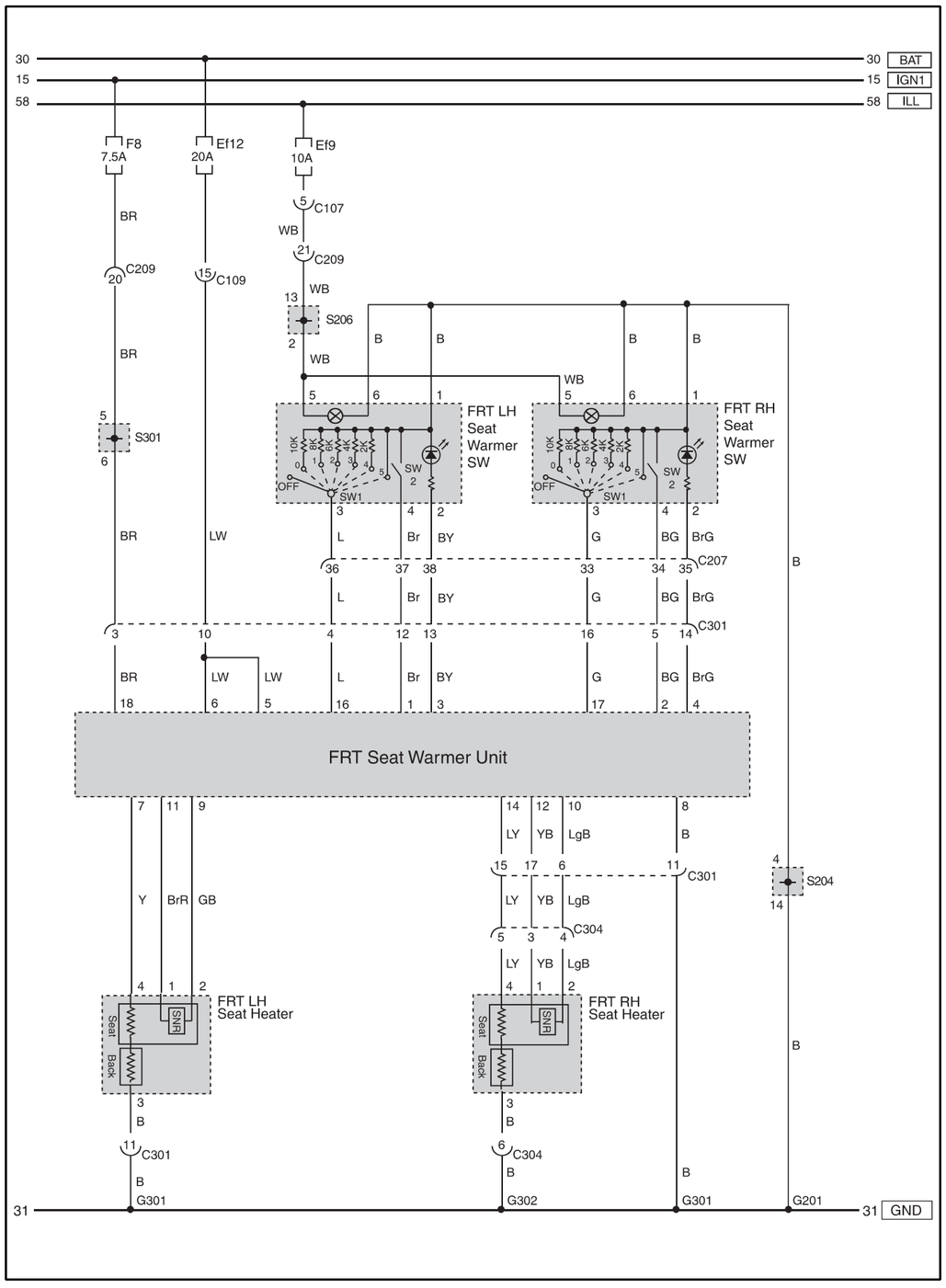

Seat Heater


Sear Warmer SW

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8510-48

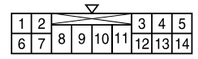
FRT SEAT WARMER (W/O MEMORY)

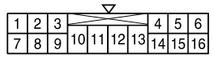


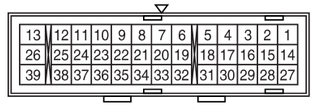
1) CONNECTOR INFORMATION

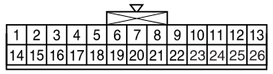
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Memory/Power
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Seat Warmer
C304 (16Pin, White)	W/H Floor - W/H Passenger Seat	W/H Floor - W/H Passenger Seat	Power
C304 (6Pin, White)	W/H Floor - W/H Passenger Seat	W/H Floor - W/H Passenger Seat	Seat Warmer
G201	W/H Main	Under the Driver Cowl Side PNL	
G301	W/H Floor	Under the Driver Seat	
G302	W/H Floor	Under the Passenger Seat	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL
S301 (14Pin, Black)	W/H Floor	Under the Driver Seat	CAN

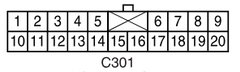
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

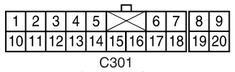

C107
W/H ENG
(Eng Room Fuse & Relay Box)


C109
W/H ENG
(Eng Room Fuse & Relay Box)

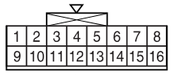

C207
W/H Floor

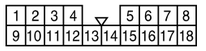

C209
W/H Floor

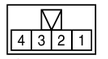

C301
W/H Driver Seat
(W/Memory, Power)

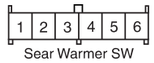

C301
W/H Driver Seat
(W/O Memory)

C304
W/H Passenger Seat
(W/O Memory)


C304
W/H Passenger Seat
(W/Memory, Power)


FRT Seat Warmer Unit

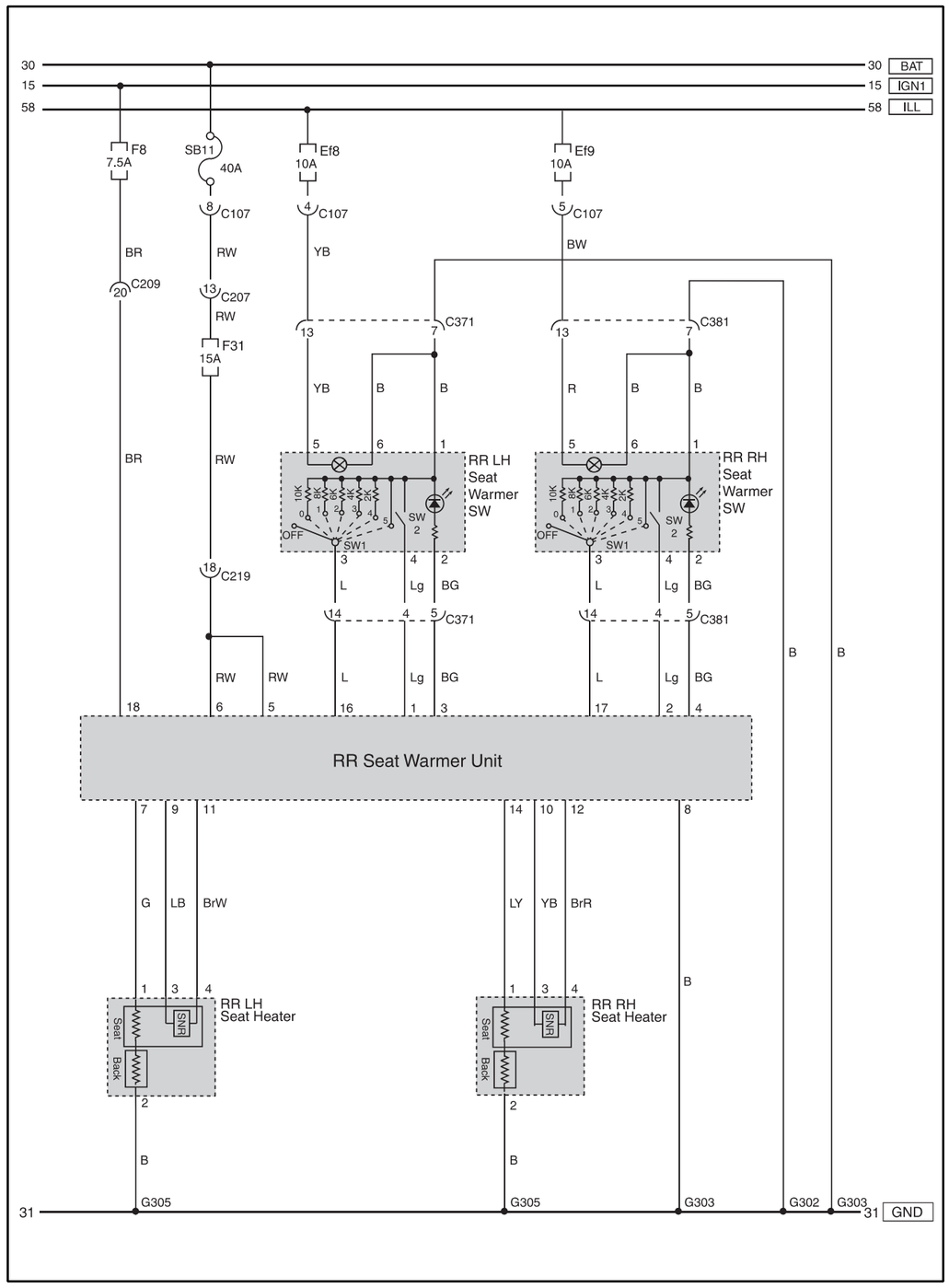

Seat Heater


Sear Warmer SW

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8510-48

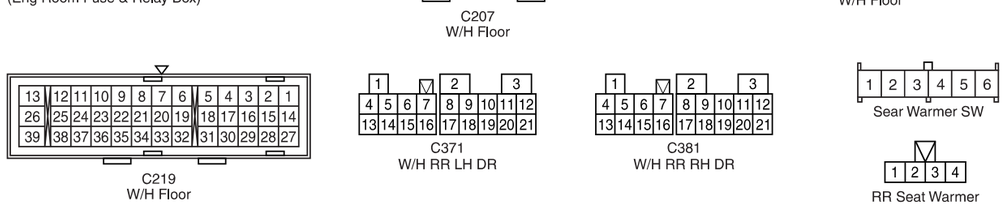
RR SEAT WARMER



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C371 (21Pin, White)	W/H Floor - W/H RR LH DR	Under the Left “B” PLR	
C381 (21Pin, White)	W/H Floor - W/H RR RH DR	Under the Right “B” PLR	
G302	W/H Floor	Under the Passenger Seat	
G303	W/H Floor	Under the LH “B” PLR	
G305	W/H Floor	Inside the LH QTR GLS Lower	

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



CIRCUIT

REXTON 2006.09

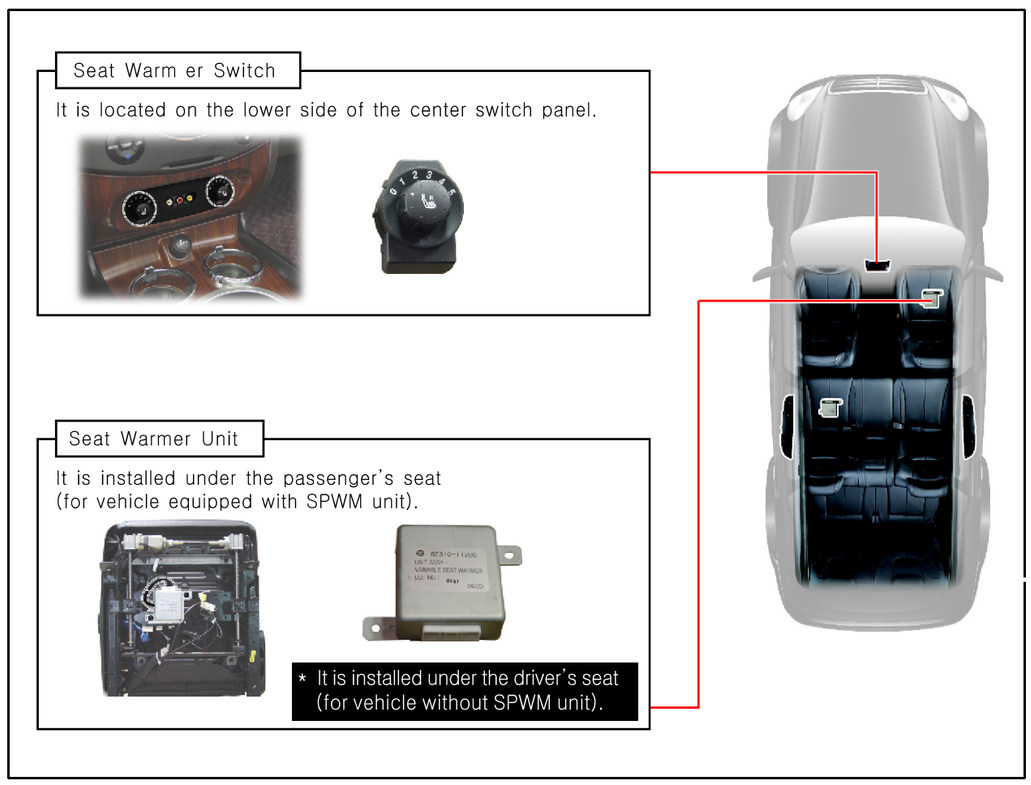
Modification basis	
Application basis	
Affected VIN	

3) CIRCUIT DESCRIPTION

A. VARIABLE SEAT WARMER SYSTEM

The variable seat warmer system controls the temperature in 5 levels.

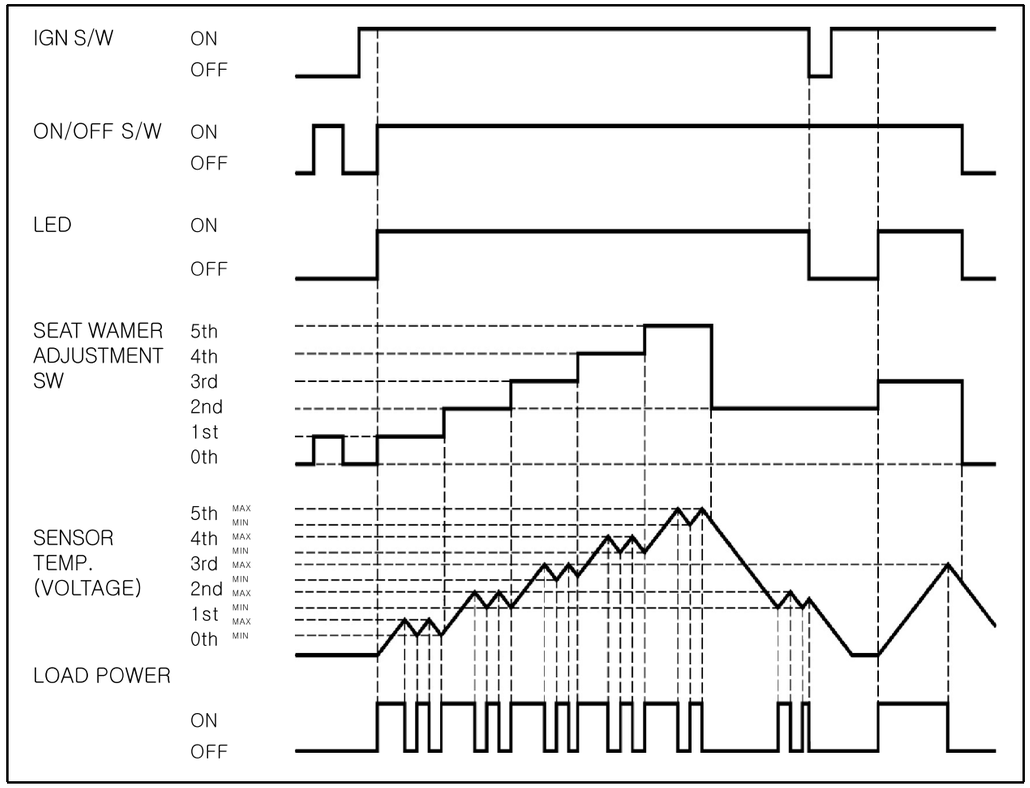
▶Location



B. OPERATING CHARACTERISTICS

The variable seat warmer system operates when the ignition is ON. The unit heats the seat in each level according to the resistance based on each switch operation.

▶Operation Characteristics



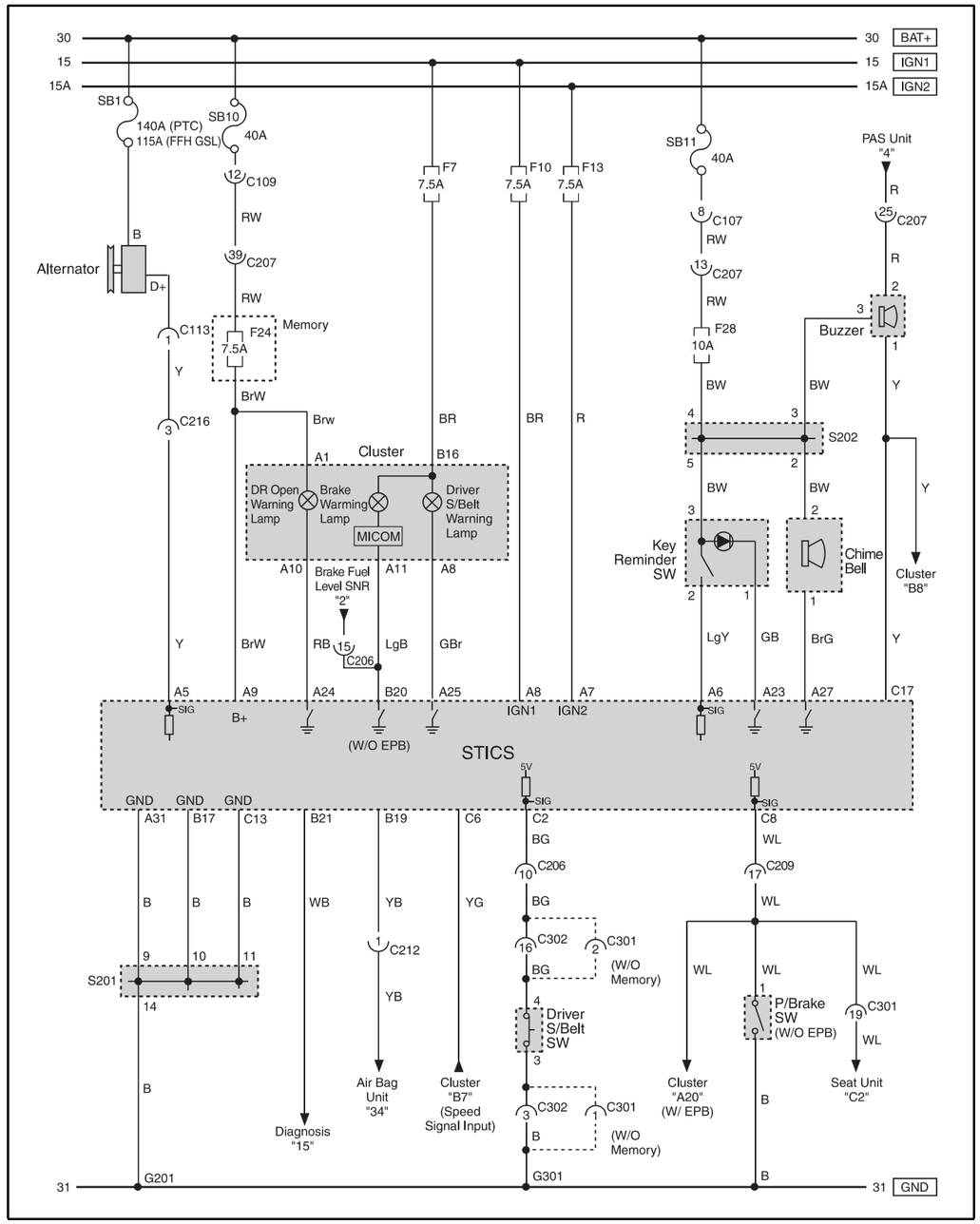
▶Temperature and sensor output value in each switch level

	Seat warmer temp. (°C)		Sensor output resistance (W)		Sensor output value (V)	
	MIN	MAX	MIN	MAX	MIN	MAX
0th	-	-	-	-	-	-
1st	39	41	5419	4982	2.01	1.91
2nd	46	48	4050	3734	1.76	1.66
3rd	54	56	2938	2717	1.53	1.44
4th	61	63	2240	2077	1.32	1.24
5th	69	71	1661	1544	1.14	1.07

S.G.N. 8710-02

STICS

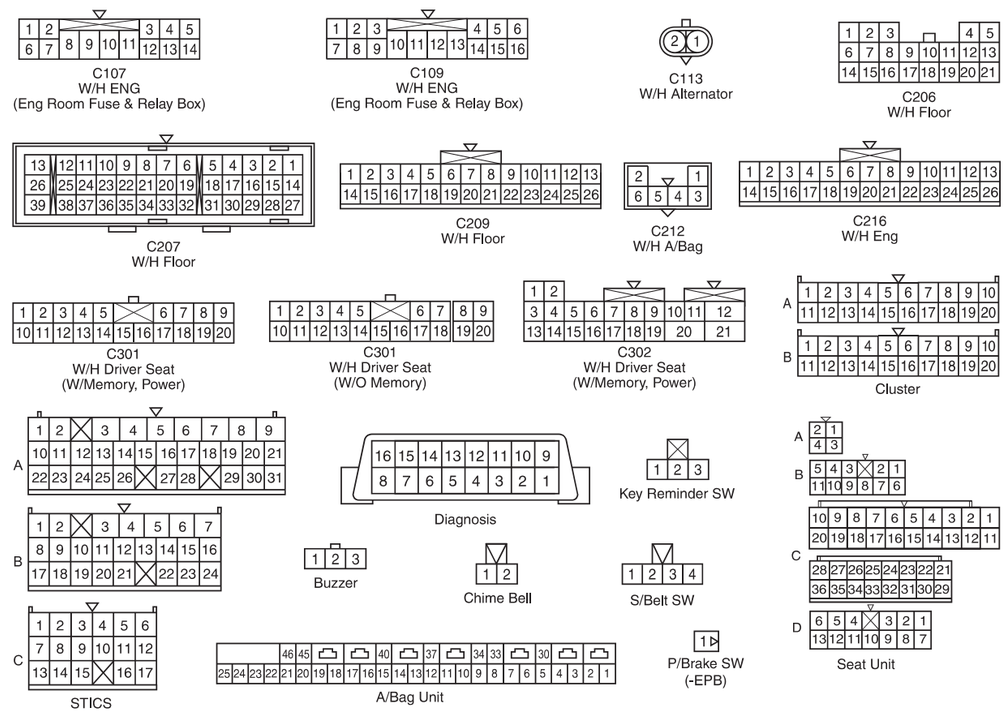
1) POWER/GROUND, CHIME BELL, BUZZER WARNING LAMP (BRAKE, S/BELT, DR OPEN)



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C113 (2Pin, Black)	W/H Eng - W/H Alternator	Under the Coolant Reserve Tank	
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C212 (6Pin, White)	W/H Main - W/H Air Bag	Backside the Cluster(Inside I/P)	
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Memory/Power
C301 (20Pin, White)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Seat Warmer
C302 (21Pin, Black)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Memory/Power
G201	W/H Main	Under the Driver Cowl Side PNL	
G301	W/H Floor	Under the Driver Seat	
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	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

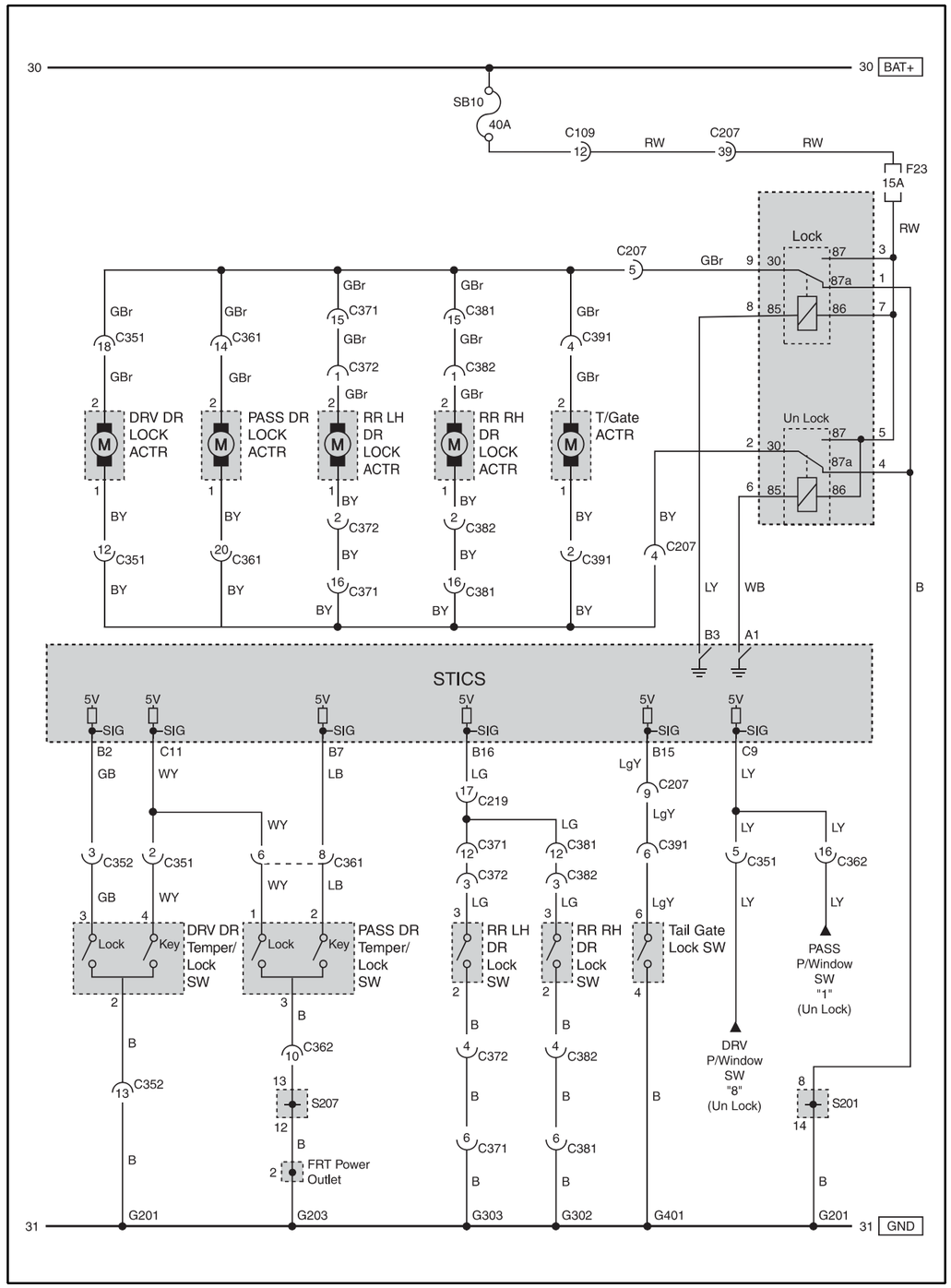


CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

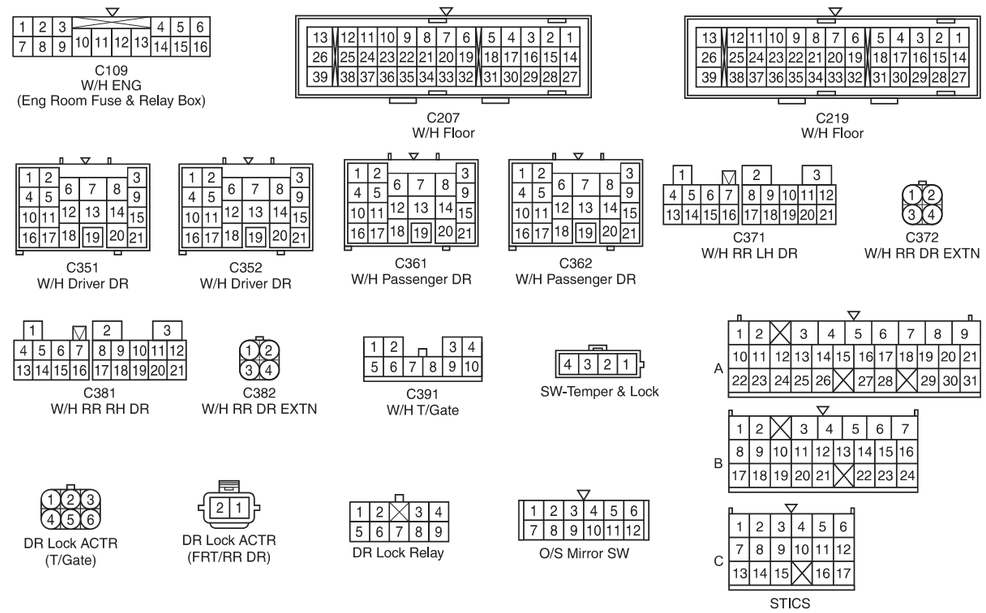
2) CENTRAL DOOR LOCK CIRCUIT



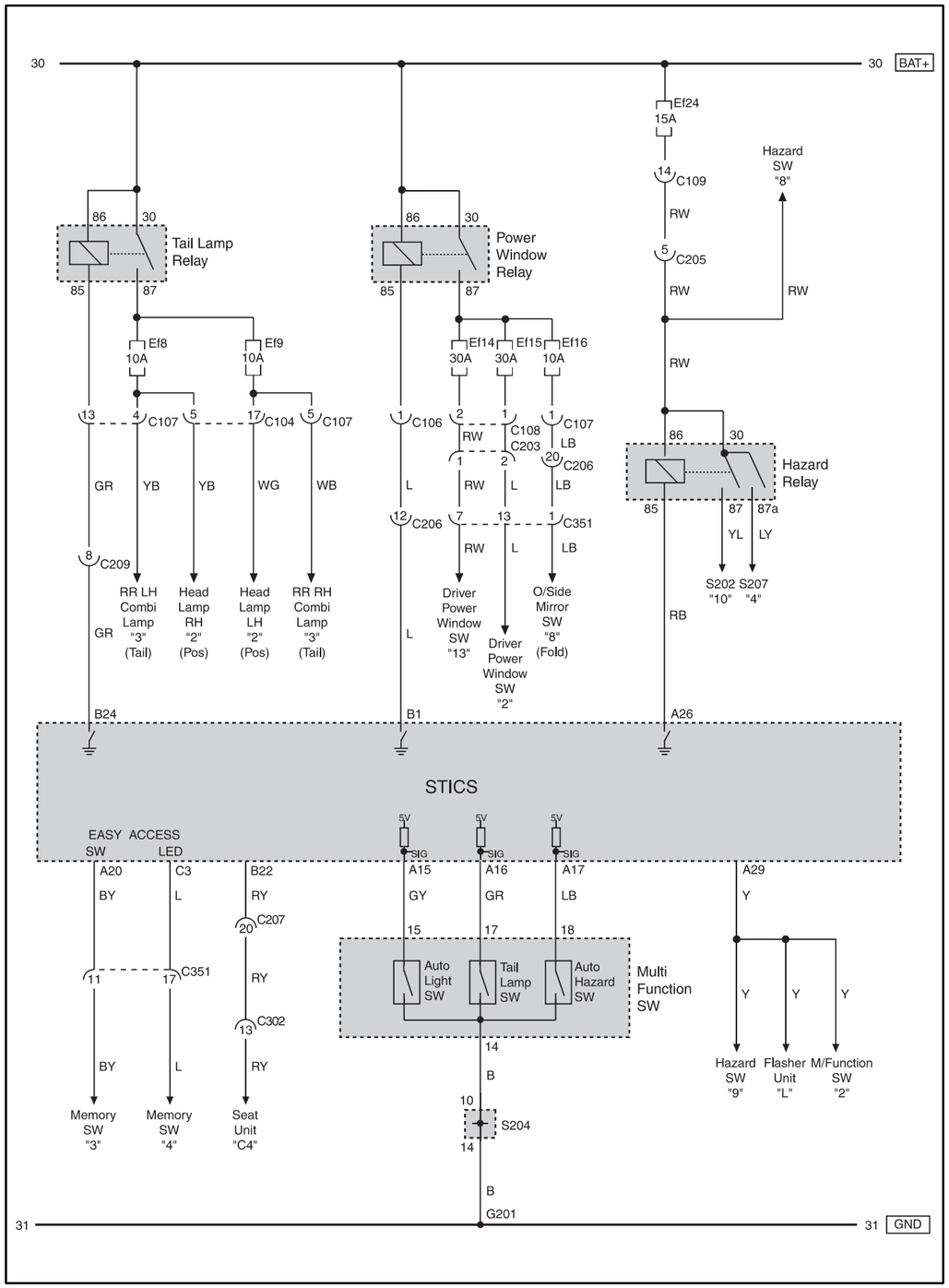
(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C351 (21Pin, Black)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C352 (21Pin, White)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C361 (21Pin, White)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C362 (21Pin, Black)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C371 (21Pin, White)	W/H Floor - W/H RR LH DR	Under the Left "B" PLR	
C372 (4Pin, Black)	W/H RR LH DR - W/H DR EXTN	Inside the RR LH DR	
C381 (21Pin, White)	W/H Floor - W/H RR RH DR	Under the Right "B" PLR	
C382 (4Pin, Black)	W/H RR RH DR - W/H DR EXTN	Inside the RR RH DR	
C391 (10Pin, White)	W/H Floor - W/H Tail Gate	Inside the Tail Gate	
G201	W/H Main	Under the Driver Cowl Side PNL	
G203	W/H Main	Inside the Passenger Cowl Side PNL	
G302	W/H Floor	Under the Passenger Seat	
G303	W/H Floor	Under the LH "B" PLR	
G401	W/H Tail Gate	Center the Tail Gate	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



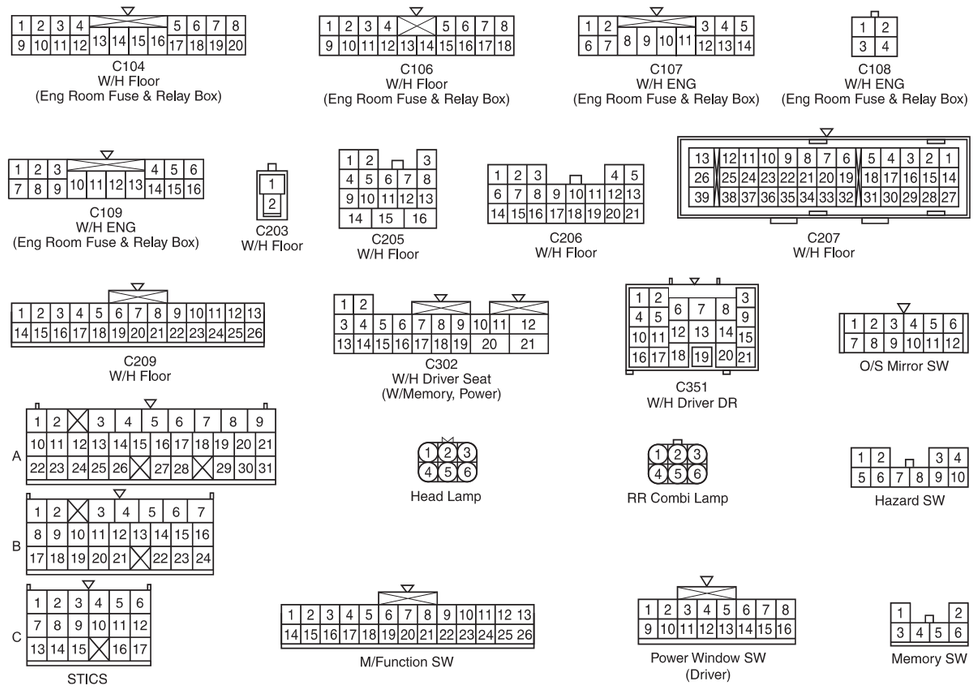
3) TAIL LAMP, HAZARD, POWER WINDOW



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C108 (4Pin, Colorless)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C203 (2Pin, Colorless)	W/H Main - W/H Floor	Under the I/P Fuse Box	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C302 (21Pin, Black)	W/H Floor - W/H Driver Seat	Under the Driver Seat	Memory/Power
C351 (21Pin, Black)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
G201	W/H Main	Under the Driver Cowl Side PNL	
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

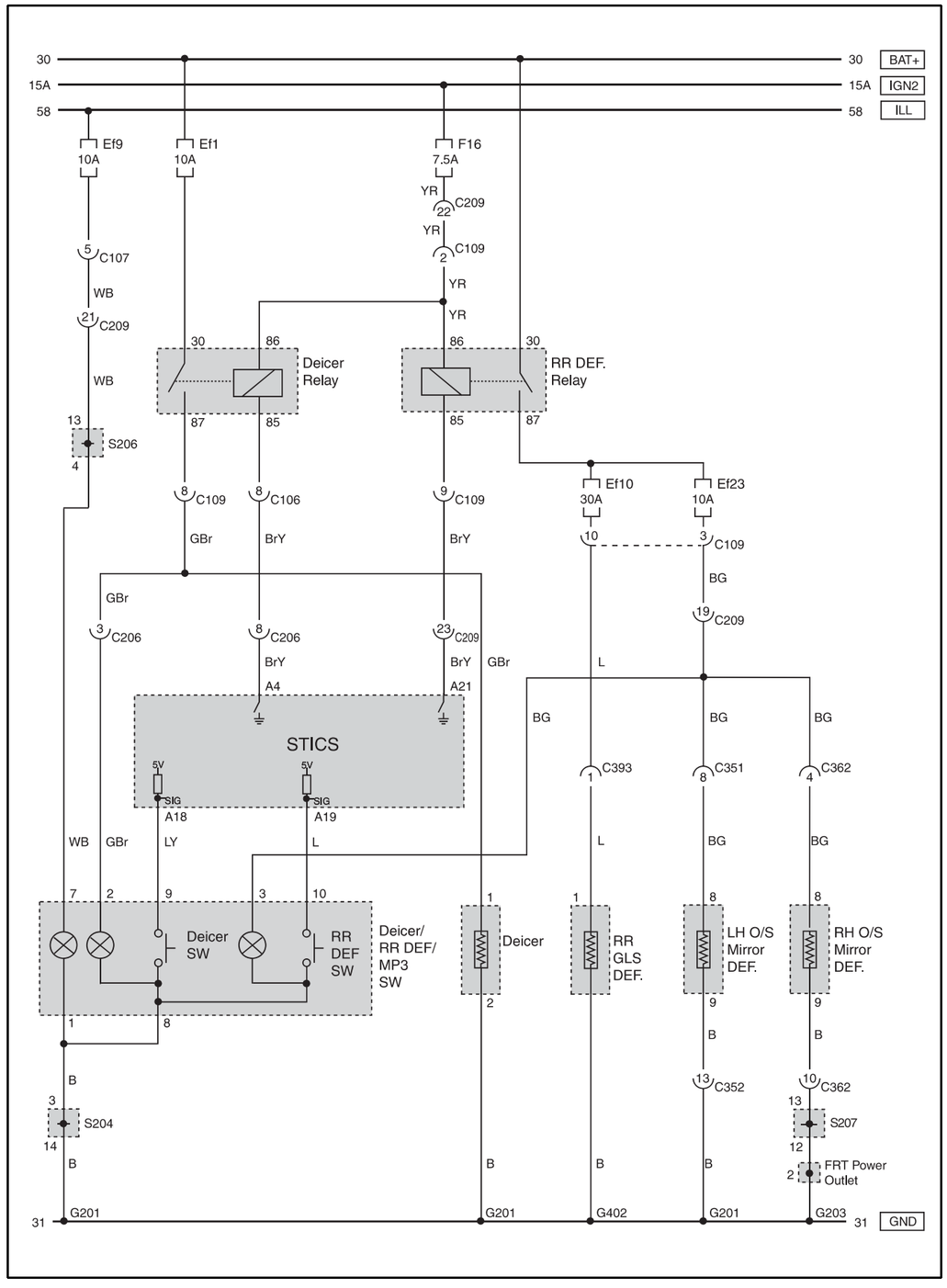


CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

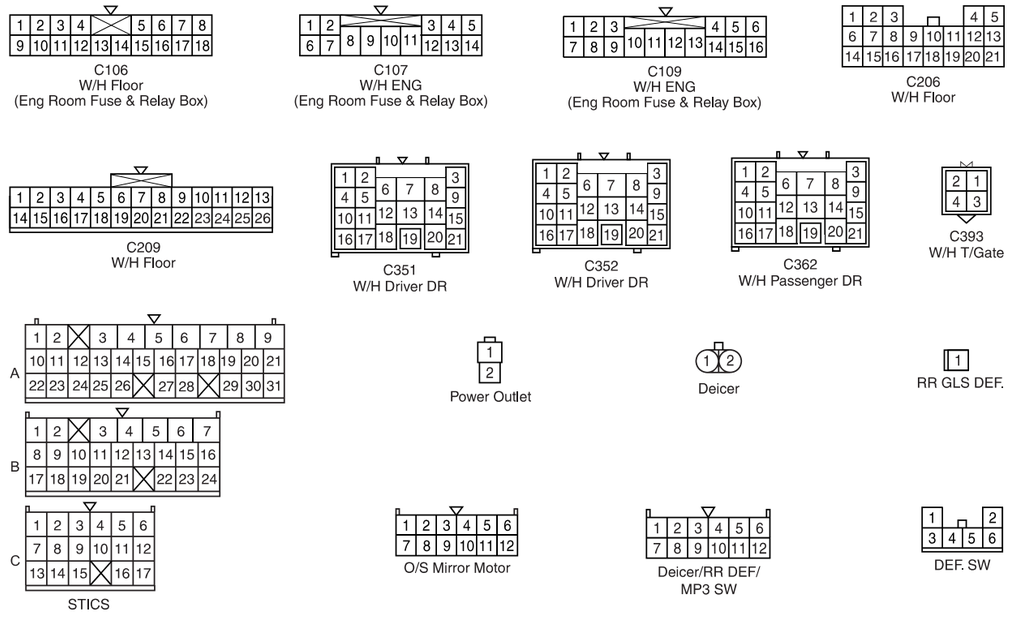
4) DEFOGGER



(1) CONNECTOR INFORMATION

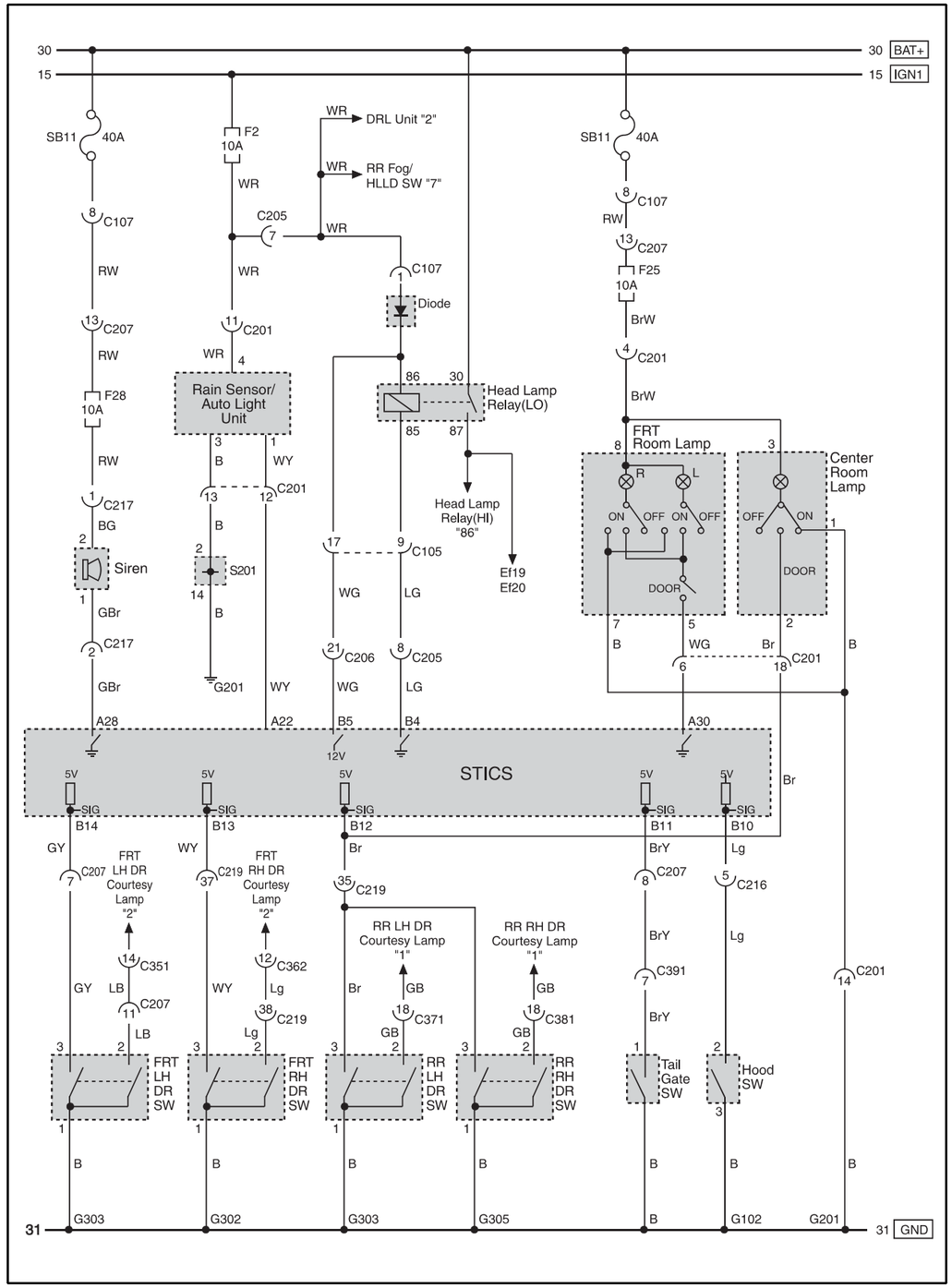
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C351 (21Pin, Black)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C352 (21Pin, White)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C362 (21Pin, Black)	W/H Main - W/H Passenger DR	Inside the Driver Cowl Side PNL	
C393 (4Pin, Colorless)	W/H Floor - W/H Tail Gate	Inside the RR RH Upper QTR Trim	
G201	W/H Main	Under the Driver Cowl Side PNL	
G203	W/H Main	Inside the Passenger Cowl Side PNL	
G402	W/H Tail Gate	LH The Tail Gate	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

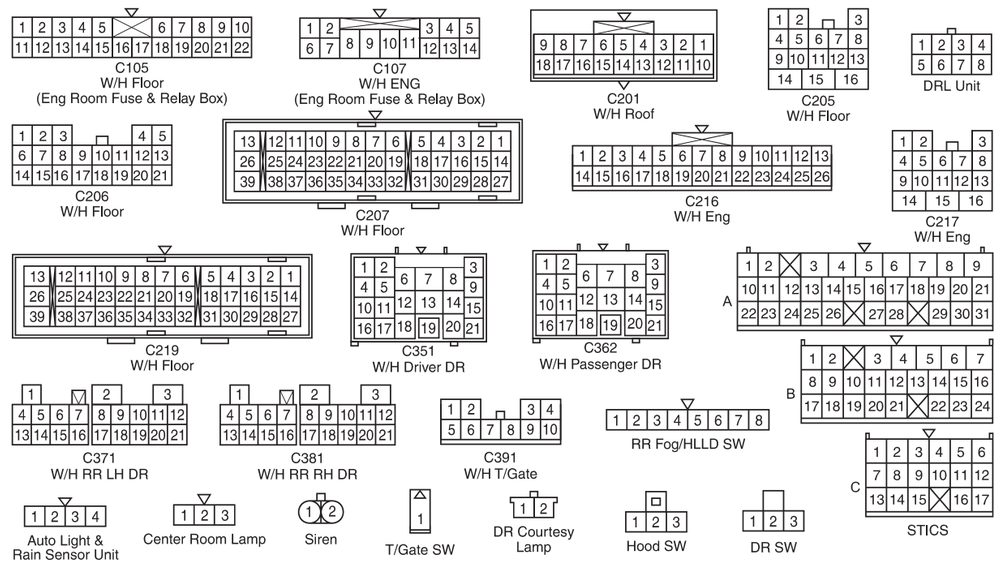
5) PANIC, AUTO LIGHT & RAIN SENSING, ROOM LAMP



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C201 (18Pin, White)	W/H Main - W/H Roof	Under the I/P Fuse Box	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C351 (21Pin, Black)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C362 (21Pin, Black)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C371 (21Pin, White)	W/H Floor - W/H RR LH DR	Under the Left “B” PLR	
C381 (21Pin, White)	W/H Floor - W/H RR RH DR	Under the Right “B” PLR	
C391 (10Pin, White)	W/H Floor - W/H Tail Gate	Inside the Tail Gate	
G102	W/H Eng	Center the Eng BATT	
G201	W/H Main	Under the Driver Cowl Side PNL	
G302	W/H Floor	Under the Passenger Seat	
G303	W/H Floor	Under the LH “B” PLR	
G305	W/H Floor	Inside the LH QTR GLS Lower	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

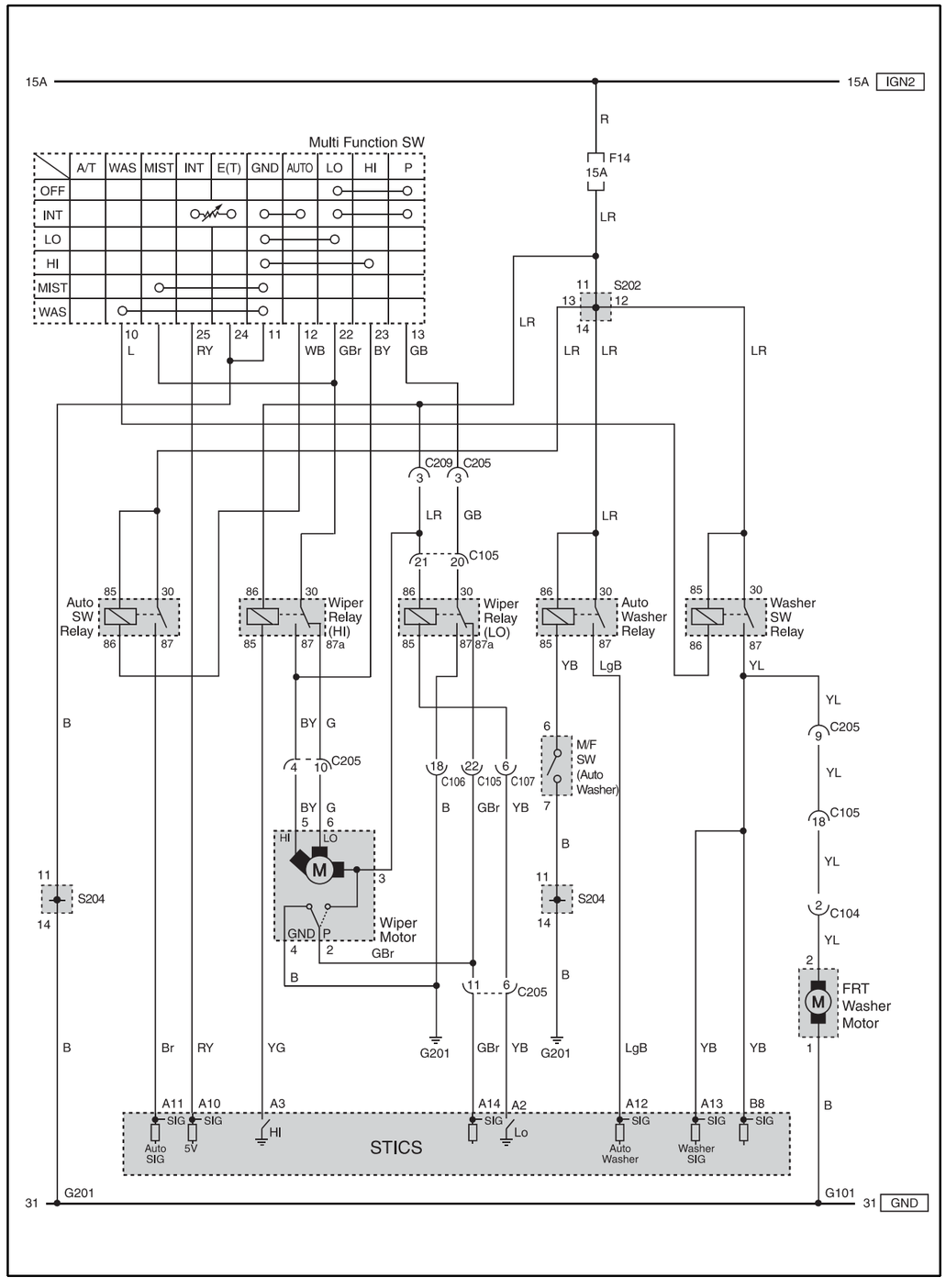


CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

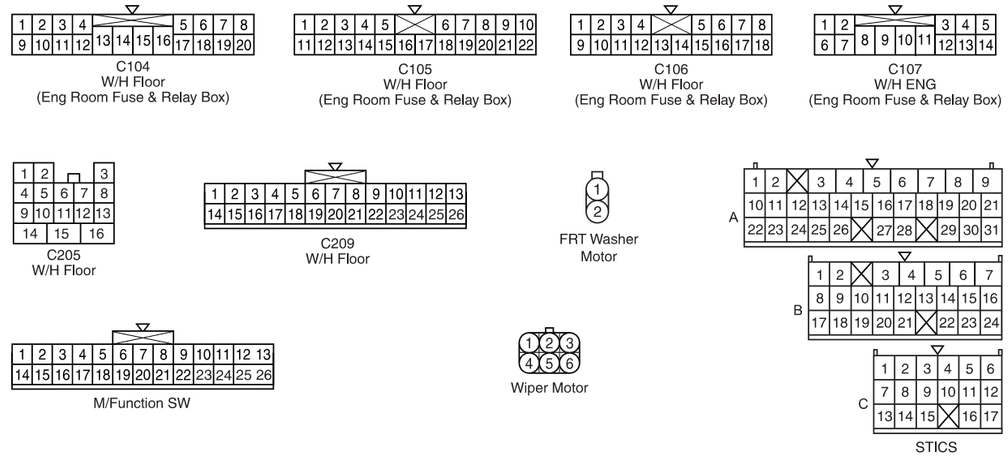
6) FRT WIPER/WASHER



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
G101	W/H Eng	Center the Eng Room Fuse Box	
G201	W/H Main	Under the Driver Cowl Side PNL	
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

(3) CIRCUIT DESCRIPTION

A. OVERVIEW

The RKSTICS (REKES + STICS (Super Time & Integrated Control System)) communicates with the transmitter (remote controller) and other electronic systems to transmit and receive the data. The STICS also includes a diagnosis function that can inspect the error for related devices.

B. MAJOR CHANGES

▶Integration of Auto Light Sensor and Rain Sensor

The auto light sensor integrated rain sensor communicates with STICS.

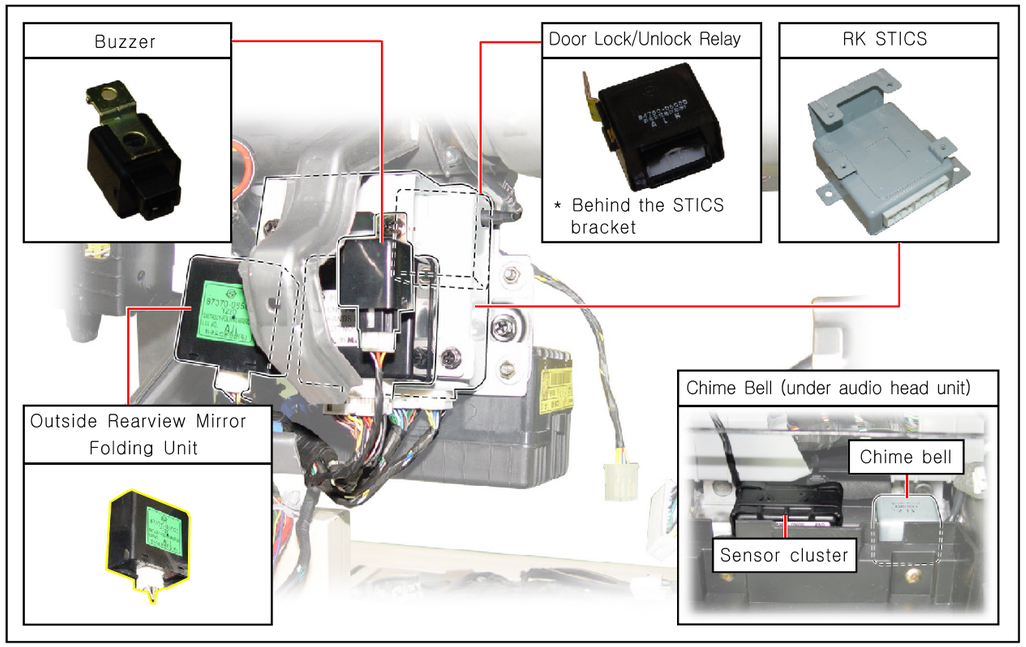
▶Auto Washer Coupled Wiper

When pressing the auto washer switch, the washer fluid is sprayed on the windshield and the wiper sweeps off 4 times, and then the washer fluid is sprayed and the wiper sweeps off 3 times again.

▶Communication with SPWM

The communication with SPWM is added due to the introduction of easy access function to SPWM.

▶SPWM Unit



C. SPECIFICATIONS

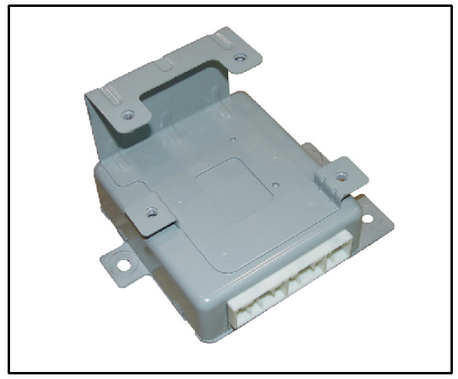
▶Electrical Performance

- Electrical Performance

Item	Requirement	Remark
Rated voltage	DC 12.0V	
Operating voltage	DC 9.0V ~ 16.0V	Should operate normally within this range. (9.5 V ~ 16.0 V only for auto hazard lamp function)
Operating temperature	-30°C ~ +80°C	Should operate normally within this range.
Reserved temperature	-40°C ~ +85°C	
Max. operating humidity	95%	
Resistible voltage	24V	
Insulating resistance	No heat and fire due to the current leaks	Confined with PCB, waterproof and coating that requires the insulation.
Dark current	below 7.0 mA	When initiating the sleep mode after removing ignition key and locking the doors
Voltage drop	below 1.0V	Pin no. 72 and 2, 7, 8, 9, 10, 11, 19, 24, 27, 28, 29, 30, 31, 32, 33, 36, 56, 57, 58, 59, 60, 61, 70, 71
	below 1.5V	Pin no. 72 and 3, 6, 17, 18, 20, 21, 37, 39, 41, 42, 43, 44, 45, 62, 64, 65, 66, 67, 68, 69

- Characteristics of Radio Wave

· Transmitting frequency: 447.800 ± 0.0125 MHz
· Channel width: below 12.5 KHz
· Frequency bandwidth: below 8.5 KHz
· Modulation method: FSK (Frequency Shift Keying)
· Receiving distance: Approx. 10 ~ 15 m (In case there are not obstacles around the system)



Modification basis	
Application basis	
Affected VIN	

D. RATED LOAD

NO.	Description	Rated Load
1	Chime bell / Buzzer	DC 12V 350 mA / DC 12V 40 mA (Inductive load)
2	Front room lamp	DC 12V 16W (Lamp load)
3	Key hole illumination	DC 12V 1.2W (Lamp load)
4	Seat belt warning lamp	DC 12V 1.2W (Lamp load)
5	Seat belt warning lamp	DC 12V 1.2W (Lamp load)
6	Parking brake warning lamp	DC 12V 1.2W (Lamp load)
7	Door ajar warning lamp	DC 12V 1.2W (Lamp load)
8	Door lock relay	DC 12V 200 mA (Inductive load)
9	Door unlock relay	DC 12V 200 mA (Inductive load)
10	Siren	DC 12V 260 mA (Inductive load)
11	Tail lamp relay	DC 12V 200 mA (Inductive load)
12	Hazard warning relay	DC 12V 200 mA (Inductive load)
13	Power window relay	DC 12V 200 mA (Inductive load)
14	Rear defogger relay	DC 12V 200 mA (Inductive load)
15	Wiper LOW relay	DC 12V 250 mA (Inductive load)
16	Wiper HIGH relay	DC 12V 250 mA (Inductive load)
17	Front washer motor	DC 12V 1.5A
18	Rear washer motor relay	DC 12V 500 mA (Inductive load)
19	Headlamp relay	DC 12V 750 mA (Inductive load)
20	Front defogger relay	DC 12V 200 mA (Inductive load)
21	SPWM easy access button illumination	DC 12V 1.2 W (Lamp load)

E. INPUT SIGNALS

NO.	Input Signal Name	Logic Status
1	IGN1	ON = BAT (IGN "ON" or "START")
2	IGN2	ON = BAT (IGN "ON")
3	ALT_D	ON = BAT (engine running)
4	Key reminder switch	IN = BAT (Key in)
5	Driver's door switch	OPEN = GND, CLOSE = OPEN
6	Passenger's door switch	OPEN = GND, CLOSE = OPEN
7	Rear door switch	- OPEN (one of rear seat) = GND - CLOSE (all rear seats) = OPEN
8	Tailgate switch	OPEN = GND, CLOSE = OPEN
9	Hood switch	OPEN = GND, CLOSE = OPEN
10	Driver's door lock/unlock switch	LOCK = OPEN, UNLOCK = GND
11	Passenger's door lock/unlock switch	LOCK = OPEN, UNLOCK = GND
12	Rear door lock/unlock switch	- UNLOCK (one of rear seat) = GND - LOCK (all rear seats) = OPEN
13	Tailgate lock/unlock switch	LOCK = OPEN, UNLOCK = GND
14	Rear defogger switch	ON = GND, OFF = OPEN
15	Seat belt switch	Unfastened = GND, Fastened = OPEN
16	Hazard warning flasher selection switch	ON = GND, OFF = OPEN
17	Parking brake switch	ON = GND, OFF = OPEN
18	Air bag collision sensor	ON = 200 ms Low signal, OFF = OPEN
19	Wiper motor (parking) switch	STOP = BAT VOLTAGE, ROTATING = GND
20	Washer switch	ON = BAT, OFF = OPEN
21	Auto switch	ON = BAT, OFF = OPEN
22	Auto washer switch	ON = BAT, OFF = OPEN
23	Auto resistance	0W ~ 51KW (for intermittent wiper)
24	Speed sensor	ON = GND (PWM), OFF = OPEN
25	IDR (Coding)	ON = BAT, OFF = OPEN
26	Front defogger switch	ON = GND, OFF = OPEN
27	Auto hazard switch	ON = GND, OFF = OPEN
28	Central door lock switch	ON = GND, OFF = OPEN
29	SPWM easy access button switch	ON = GND, OFF = OPEN
30	Multifunction auto light switch	ON = GND, OFF = OPEN
31	Indicator lamp switch	ON = BAT/GND, OFF = OPEN (Approx. 5.1V ~ 9.2V)
32	SPWM (Seat Position with Memory)	ON = GND (PWM), OFF = OPEN
33	Rain sensor	ON = GND (DATA), OFF = BAT
34	Diagnosis (SCAN-100)	ON = GND (DATA), OFF = BAT (KWP2000)
35	Immobilizer	ON = GND (DATA), OFF = BAT (KWP2000)
37	Driver/Passenger's door key cylinder switch	ON = GND, OFF = OPEN

F. FUNCTIONS AND SPECIFICATIONS

▶ Wiper MIST and Front Washer Coupled Wiper

- The wiper relay is turned on at 0.3 seconds after from the time when the washer switch is turned on for 0.1 to 0.59 seconds (T2) with the ignition switch "ON", . If the wiper parking terminal gets off, the wiper relay is turned off.
- The wiper relay is turned on at 0.3 seconds (T1) after from the time when the washer switch is turned on for more than 0.6 seconds (T2) with the ignition switch "ON". The wiper relay gets on 3 times immediately after turning off the washer
- switch.
  When the washer switch is turned on for more than 0.6 seconds during the wiper operation by AUTO switch, the wiper operates three times. When it is turned on for a certain period of time (0.1 to 0.59 seconds), the wiper operates once.

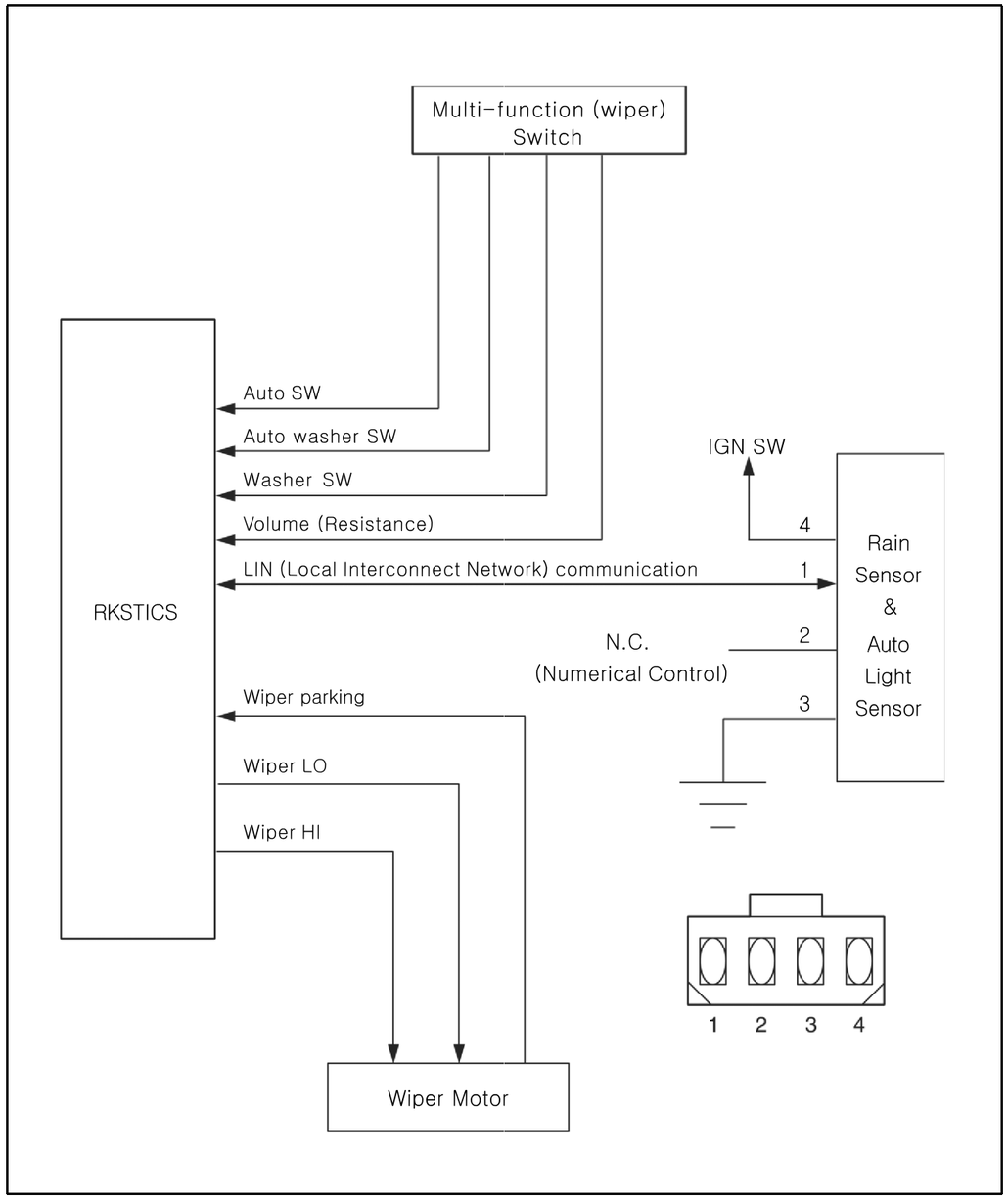
▶ Auto Washer and Wiper Switch

- When the auto washer switch is turned on with the ignition switch "ON" and the AUTO switch "OFF", the washer motor output gets ON for 1 second. If the system recognizes the output signal, the wiper relay output gets ON during 4 cycles and the washer motor output gets ON for 1 second. Then, the wiper relay output gets OFF after 3 cycles.
- The auto washer switch output is overridden during the washer coupled wiper operation.
- The auto washer switch input is overridden during the auto washer coupled wiper operation.
- The auto washer switch input is overridden during the rain sensor coupled wiper or vehicle speed sensitive AUTO wiper operation.
- When the AUTO switch input is received during the auto washer operation, the auto washer operation stops and the auto INT operation is activated.

▶Rain Sensor Coupled Wiper and Auto Light Control

If equipped with RKSTICS rain sensor, it has following operation system.

- System layout



Modification basis	
Application basis	
Affected VIN	

▶Auto Switch Position Reminder (Power-Up Reminder Wiper)

- When turning off and on the IGN2 switch with the auto switch on, the system drives the wiper motor through LOW relay one cycle regardless of communication with rain sensor.
- The wiper relay (LOW) is turned on and the wiper motor runs one cycle when changing the auto switch from "OFF" to "ON" position regardless of communication with rain sensor(while the ignition key is in the "ON" position). When the auto switch is turned to the "ON" position again from the "OFF" position, the system drives the wiper motor through LOW relay one cycle only when the rain sensor detects the "Rain Detected" signal.

▶Washer Coupled Wiper in Rain Sensing Mode

- The washer coupled wiper is operated when receiving the washer switch input with the ignition switch "ON" and the AUTO switch "ON" in the rain sensing mode. At this moment, the communication with the rain sensor is overridden. However, the washer switch input is overridden during the continuous operation.
- The operation data is sent to the rain sensor even during the washer coupled wiper's operation

▶Rain Sensing Sensitivity Control

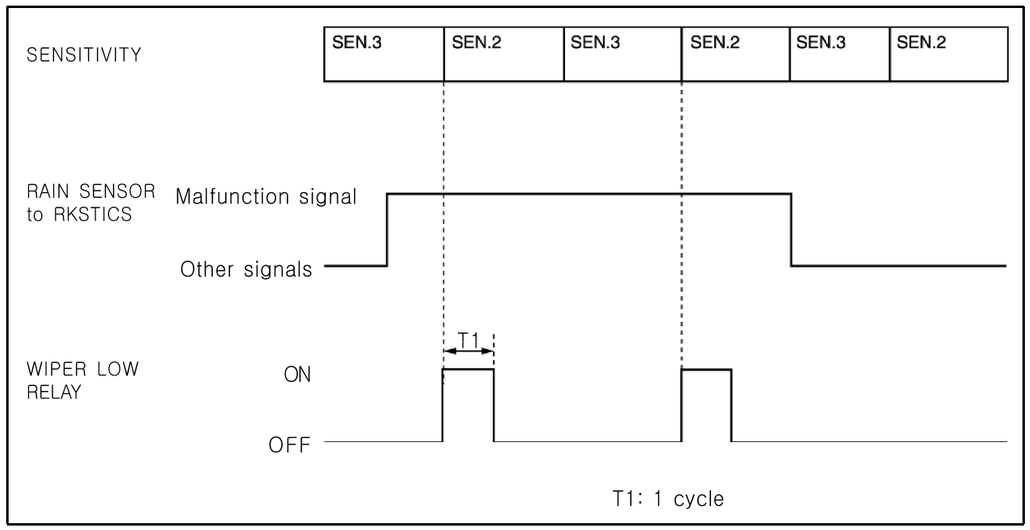
- The wiper LOW relay is turned on and the wiper motor runs one cycle when the volume sensitivity is increased (while the ignition key is in the "ON" position, the AUTO switch is in the "ON" position, and the wiper motor is in "Parked" position). However, the wiper motor can be operated only when the rain sensor detects the "Rain Detected" signal.
  · If the volume sensitivity is changed more than 2 stages within 2 seconds, the wiper motor runs only one cycle.

▶When the Wiper Parking Signal is Abnormal

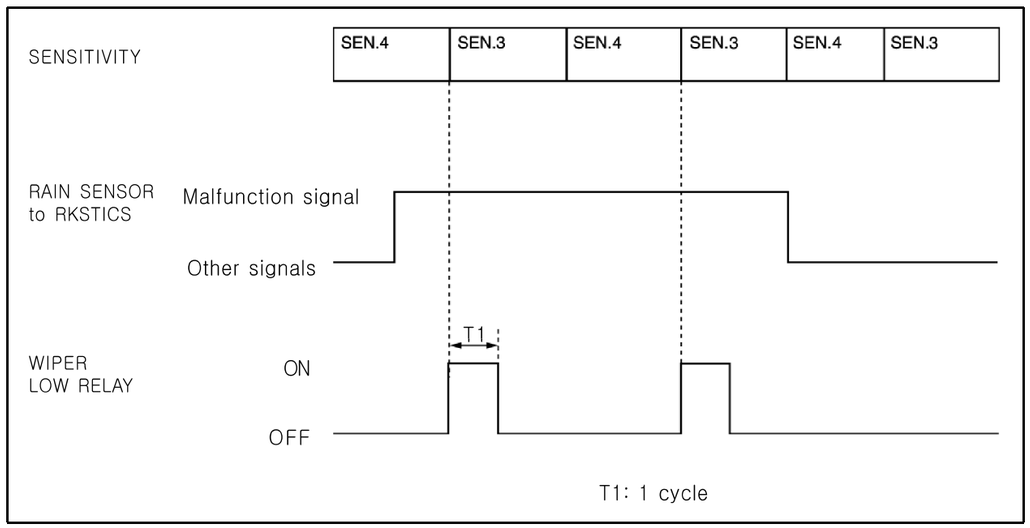
- The wiper system continuously outputs the wiper parking signal when the wiper parking terminal is grounded (while the ignition key is in "ON" position and the AUTO switch is in "ON" position).
  · The wiper motor runs only when the rain sensor requires the wiper operation.
- When the parking terminal is fixed to HIGH with the ignition key and the AUTO switch in "ON" position, the wiper system outputs the wiper operating signal for 2 seconds, then continuously outputs the wiper parking signal.
  · The wiper motor runs only when the rain sensor requires the wiper operation.

▶Defective Rain Sensor

- The wiper relay (LOW) is turned on and the wiper motor runs one cycle when the volume sensitivity is changed to 2 from 3 during receiving the malfunction signal from the rain sensor (while the ignition key is in "ON" position and the AUTO switch is in "ON" position).



- The wiper relay (LOW) is turned on and the wiper motor runs one cycle when the volume sensitivity is changed to 3 from 4 during receiving the malfunction signal from the rain sensor (while the ignition key is in "ON" position and the AUTO switch is in "ON" position).



▶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.

- 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.
- If the above operation does not occur, place the wiper switch to "AUTO" position and perform the following procedures:
  If the wiper operates one cycle when moving the variable resistance knob from 5th stage to 4th stage, replace the rain sensor or check the sensor for contamination and tightness. If the wiper does not operates, replace STICS and check if the wiper operates properly.

Symptom 2. It rains but the system does not work in "AUTO" position.

- Check if the wiper operates at high speed when grounding pin 1 and pin 2.Check whether the multifunction wiper switch is in the "AUTO" position.
- Check the power to the sensor. Check the conditions of the pin 3 (Ground) and the pin 4 (IGN).
- 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.

- 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.
- 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 responses are too fast or too slow.

Check whether the variable resistance knob on the wiper switch is set in "FAST" or "SLOW". Notify that the customer can select the sensitivity by selecting the variable resistance value. And, select a proper stage.

▶Auto Light Control

- The tail lamps and headlamps can be controlled by the communication with the rain sensor only when the auto light switch is in "AUTO" position with the ignition switch "ON".
- Rain detected headlamp: If it rains heavy which requires the highest AUTO speed, the headlamps are turned on automatically (while the light switch is in "AUTO" position and the wiper switch is in "AUTO" position).
- Night detected wiping: When the auto light control turns on the headlamps and the rain sensor detects the rain, the wiper sensitivity is automatically increased by one level. (i.e. the AUTO wiper switch is at the 3rd level, but the wiper operates at the 4th level.)

▶Speed Sensitive AUTO Wiper

For RKSTICS without the rain sensor, perform the following operation:

- Controls the wiper intermittent operation by the values from the vehicle speed and the volume.
  · Calculates and converts the Intermittent interval automatically by using the AUTO VOLUME when the ignition switch is in the "ON" position and the AUTO switch is in the "ON" position.
  · The wipers are operated in vehicle speed sensitive mode when turning the AUTO switch to the "ON" position with the engine running or starting the engine with the AUTO switch positioned to "ON".
  · Intermittent interval (at 0 km/h): 3 ± 0.5 ~ 19 ± 2 seconds

- Vehicle speed calculation

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

$$1\ [\text{PULSE/SEC}] = \frac{60\ [\text{km/h}] \times 60\ [\text{sec}]}{637 \times 4\ \text{PULSE}} \fallingdotseq 1.41\ [\text{km/h}]$$

- VOLUME calculation

  · The pause time of the vehicle speed sensitive AUTO wiper is calculated by the AUTO volume (input voltage). Each level has the hysteresis.

- 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 the VOLUME.

  ※ If the pause time is below 1.0 second, the wipers operate without pause.
  ※ If the pause time is over 1.5 seconds, the wipers operate intermittently.

Modification basis	
Application basis	
Affected VIN	

▶ **Ignition Key Reminder Warning (The ignition key reminder warning has priority over the "TAILLAMP ON WARNING".)**

- The chime bell sounds continuously with the interval of 0.3 seconds when opening the driver's door while the ignition key is in ignition switch.
- When removing the ignition key or closing the driver's door during chime buzzer operation, the buzzer stops.
- This function is not available when the ignition switch is in "ON" position.

▶ **Ignition Key Reminder**

- The system outputs "UNLOCK" signal for 5 seconds after the driver's door is opened and the door lock switch is changed to "LOCK" (while the ignition key is in ignition switch).
- The system outputs "UNLOCK" signal for 5 seconds (T2) when the door lock switch is changed to "LOCK" from "UNLOCK" and the driver's door is closed within 0.5 seconds (while the ignition key is in the ignition switch).
- If the "UNLOCK" conditions are met, the system outputs "UNLOCK" signal unconditionally. However, if the ignition key is removed after the door lock switch is changed from "UNLOCK" to "LOCK", the system does not output "UNLOCK" signal.

▶ **All Door Lock Prevention Function when a Door is Open**

- All doors, except the tailgate and hood, output "UNLOCK" signal for 5 seconds when the "LOCK" signal is inputted (while the ignition key is removed and one of any doors is open).
- When the door is closed during the UNLOCK output, the UNLOCK output stops immediately.
- When the ignition key is inserted during the UNLOCK output, the output continues for approx. 5 seconds.
- If the ignition switch is in the "ON" position or the ignition switch is removed, the above steps are performed. If the key is in the key cylinder, the ignition key reminder function is activated.
- This function does not work if the vehicle speed is over 10 km/h.

▶Tail Lamp Left On Warning

- The chime bell sounds with the interval of 0.3 second when opening the driver's door while the tail lamp is turned on and the ignition key is removed.
- The chime bell output stops when turning off the tail lamp and closing the driver's door.
- The system outputs "UNLOCK" signal for 5 seconds when the driver's and passenger's door lock switch is locked (while the tail lamp is turned on and the driver's door is open).
- This function is not available when the ignition key is in the "ON" position.

▶ **Door Ajar Warning**

- The warning light in instrument panel comes on when opening any of doors including tailgate while the vehicle speed is below 10 km/h.
- The warning light goes off when closing the door under step 1.
- The warning light blinks when the vehicle speed is over 10 km/h while the warning light is turned on.
- The warning light blinks when a door is open while the vehicle speed is over 10 km/h.
- The warning light goes off when closing the door under step 3.
- The warning light comes on when the vehicle speed goes below 10 km/h under step 3.

▶ **Seat Belt Warnin**

- The seat belt warning light comes on and the chime bell sounds for 6 seconds when turning the ignition key to "ON" from "OFF". If the seat belt is fastened before turning the ignition key to the the "ON" position, the warning light in the instrument panel blinks, however, the chime bell does not sound.
- The seat belt warning light goes off and the chime bell stops when turning the ignition switch to the "OFF" position.
- The chime bell stops and the seat belt warning light stays on for the specified period of time when fastening the seat belt during the warning operation.
- The seat belt warning light comes on and the chime bell sounds for 6 seconds again when unfastening the seat belt during fastening operation while the ignition key is "ON" position.

▶ **Parking Brake Warning**

- The parking brake warning light comes on for approx. 4 seconds when turning the ignition key from the "OFF" to the "ON" position regardless of the vehicle speed and the parking brake switch position. After this 4 seconds, the warning lamp comes on, goes off or blinks according to the vehicle speed and the parking brake switch position.
- The warning light comes on when the parking brake switch is turned on while the vehicle speed is below 10 km/h.
- The warning light goes off when turning off the parking brake switch under step 2.
- The warning light blinks and the chime bell sounds for 0.6 seconds and stops for 0.3 seconds when the vehicle speed is over 10 km/h for more than 2 seconds while the parking brake switch is turned on.
- The warning light goes off and the chime buzzer stops when turning off the parking brake switch under step 4.
- The warning light comes on and the chime buzzer stops when the vehicle speed goes down below 10 km/h under step 4.
- This function is not available when the ignition key is turned to the "OFF" position.

▶ **Front/Center Room Lamp Control**

The overhead console lamp (front room lamp) comes on when opening the door(driver's/passenger's) while the door coupled front rooom lamp switch is at the coupled operating position and the key reminder switch is "OFF".

- When the door (Driver's/Passenger's) is opened, the front room lamp comes on.
- The room lamp stays on for 2 seconds and then dims out through 3 seconds when closing the opened door.
- The dimming operation must have greater than 32 steps per one second.
- The room lamp output should stop immediately after turning on the ignition key during the dimming operation.
- The front room lamp comes on for 30 seconds when receiving the unlock signal from the remote control key while the doors are closed.
- The front room lamp and the center room lamp output period is extended by 30 seconds when receiving the unlock signal from the remote control key again during output. (The lamp stays on when unlocked by the remote control key.)
- When a door is opened during its extended period, the lamp stays on. If closed, operates as in step 2.
- The room lamp output stops immediately after receiving the lock signal from driver's/passenger's door lock switches while the driver's and passenger's doors are closed or entering into the anti-theft mode by pushing LOCK button on the remote control key.
- The front room lamp comes on when opening the driver's door or passenger's door and goes off when closing the opened door while the ignition key is in ON position.

▶ **Tail Lamp Auto Cut (Battery Saver)**

- The tail lamp is turned on or off according to the operations of the tail lamp switch.
- The tail lamp relay is turned off (auto cut) when opening and closing the driver's door after removing the ignition key without turning off the tail lamp.
- The tail lamp relay is turned on when inserting the ignition key into the ignition switch.
- The tail lamp relay is not turned off automatically (auto cut) when opening and closing the driver's door while the ignition is removed and the tail lamp is turned on.

▶ **Windshield heated glass (deicer) switch**

- The front defogger output is "ON" when turning "ON" the front defogger (heated glass) switch while the ignition switch is "ON" (with engine running).
- The output stops when turning on the front defogger (heated glass) switch again during its operation.
- The output is "ON" only for 6 minutes when turning "ON" the front defogger (heated glass) switch within 10 minutes after completion of output for 12 minutes. This can be done only once.
- The output is "OFF" when the ignition switch is "OFF".

▶ **Ignition Key Hole Illumination**

- The ignition key hole illumination comes on when opening the driver's door or passenger's door when the ignition key is removed.
- The ignition key hole illumination stays on for 10 seconds when closing the door after step 1.
- The output stops when the ignition key is turned to "ON" position.
- The output stops when receiving the lock signal from the remote control key (under anti-theft mode).

▶ **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
- output.
  The output is "ON" only for 6 minutes when turning "ON" the rear defogger switch within 10 minutes after completion of output for 12 minutes. This can be done
- only once.
  The output is "OFF" when the IGN 2 switch is "OFF".

▶ **Door Lock/Unlock Control by Door Lock Switch**

- The door lock system outputs "LOCK" signal for 0.5 seconds when positioning the driver's or passenger's door lock switch to the lock position.
- The door lock system outputs "UNLOCK" signal for 0.5 seconds when positioning the driver's or passenger's door lock switch to the unlock position.
- The door lock system outputs "LOCK" signal for 0.5 seconds when switching from LOCK to UNLOCK by the driver's or passenger's door key cylinder.
- The door lock system outputs "UNLOCK" signal for 0.5 seconds when switching from UNLOCK to LOCK by the driver's or passenger's door key cylinder.
- The alarm will not be activated when switched to UNLOCK by driver's or passenger's door key cylinder switch in theft deterrent mode.
- It does not occur abnormal operation when reconnecting the battery after disconnecting the battery cable.
- All door lock signals are "UNLOCK" for 0.5 seconds just for once when receiving the "LOCK" signal within 0.5 seconds after closing the driver's or passenger's door while the ignition key is removed.

▶ **Door Lock/Unlock by Central Door Lock Switch**

- The door lock system outputs "LOCK/UNLOCK" signal for 0.5 seconds when operating the central door lock switch. (However, if the door lock switch (front doors) is at LOCK position, the system outputs UNLOCK signal, and vice versa.)
- The "LOCK" or "UNLOCK" inputs from the central door lock switch in anti-theft mode are ignored

Modification basis	
Application basis	
Affected VIN	

▶ The door lock system outputs Door LOCK/UNLOCK by Remote Control Key

- 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

- The door lock system outputs "LOCK" when the vehicle speed maintains over 50 km/h.
- However, it doesn't output "LOCK" when all doors are locked or failed.
- If any of doors is unlocked after outputting "LOCK" in step 1, outputs "LOCK"
- up to 5 times (except step 1) at the interval of one second.
- If any of doors is unlocked after 5 times of "LOCK" outputs, the door is regarded
- as "FAIL".
- If the door that was regarded as fail changes (UNLOCK to LOCK) to unlock, only one
- "LOCK" output will be done.
- If any door is regarded as FAIL, the auto door lock function does not work (if it is occurred when the vehicle speed is over 50 km/h, the auto door lock output does not occur even if the vehicle speed falls below 50 km/h and accelerates again to over 50
- km/h.). Nonetheless, the central door lock function works properly.
- When the system receives "UNLOCK" signal from a door switch, it outputs "LOCK" signals 5 times. If additional "LOCK" signal from another door switch is detected during the period, the system outputs five "LOCK" signals 5 times for
- the door system outputs five "LOCK" signals 5 times for the door.
- The door lock system outputs "UNLOCK" automatically if the "LOCK" output conditions are established by this function or the key is cycled (IGN1=OFF) (even when there is no "LOCK" output while the vehicle speed maintains over 50 km/h under lock condition). (If the LOCK condition is established with the ignition switch ON, the system outputs UNLOCK signal unconditionally when turning the ignition switch to OFF position.) However, when the ignition key is turned to "OFF"
- position, the lock output conditions will be cancelled.
- The "FAIL" condition of the door will be erased when the ignition key is turned to "OFF" position.

▶ Description of Burglar Alarm Function

- Armed mode activation requirements

· The "LOCK" output is "ON" when receiving the "LOCK" signal from transmitter while the ignition key is removed and all doors are closed. The armed mode is activated when the door lock switch is locked (hazard relay output: twice).
· The theft deterrent horn and hazard relay outputs are "ON" when receiving the "LOCK" signal from the remote control key again in armed mode (hazard relay output: twice).
· When receiving "LOCK" signal from the remote control key while any of doors is not closed, only the "LOCK" output can be done and then activates the armed ready mode (without hazard warning flasher). 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, it cancels the armed mode and activates the normal mode. However, when closing and locking the opened door, the hazard warning lamps
· flash twice.
When the door is not opened or the ignition key is not inserted into ignition switch for 30 seconds after receiving "UNLOCK" signal, it outputs "LOCK" and then activates armed mode (RELOCK operation). Also, at this moment, the system
· outputs the hazard warning flasher twice.
The armed mode will not be activated except above conditions.
Ex) The armed mode will not be activated when the door is locked by the ignition key.

- Armed mode cancellation requirementsArmed mode cancellation requirements

· Unlocking by remote control key
· Door unlocking by the driver's and passenger's key cylinder switch
· The armed mode is cancelled when turning the ignition key "ON". The siren is deactivated in 27seconds.

- Warning operation 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 and hazard warning flasher output is "ON" for 27 seconds with the interval of 1 second.

- Warning cancellation requirements

· Cancels warning by using any signal from the remote control key (LOCK, UNLOCK, PANIC) during warning operation.
· Cancels warning after 27 seconds (remaining period) while the ignition key is turned to "ON" position.
· If the ignition switch is turned to ON position when the warning is activated in armed mode, the warning is canceled immediately and the warning buzzer stops after 27 seconds (remaining time).
· When unlocking the doors by the driver's/passenger's door key cylinder in armed mode, the armed mode is cancelled.

- Operation when warning is cancelled
  · The siren and hazard warning flasher outputs are "OFF".
- Operations when removing and installing the battery

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

If the system is in armed mode while installing a battery, the siren sounds and the emergency warning lamp blinks. (Same operations with warning in armed mode).

NOTE

RELOCK Operation: It the door is not opened or the ignition key is not inserted into the key cylinder within 30 seconds after unlocking the door with remote control key, the system outputs "LOCK" signal and activates the armed mode.

▶ Auto Door Unlock (Crash Unlock)

- The air bag collision signal input cannot be accepted within 7 seconds after turning the ignition key to "ON" position.
- After this period, the door lock system outputs "UNLOCK" for all doors for 5 seconds from 40ms after receiving the air bag collision signal.
- Even though the key is turned to "OFF" position during the output of "UNLOCK", the output continues on for remaining period.
- The function is erased when turning "OFF" the IGN switch.

▶ Time Lag Power Window Control

- The power window relay output is "ON" when turning on the ignition switch.
- The power window relay output is "ON" for 30 seconds when turning off the ignition switch. The power window relay output is "OFF" when opening the driver's door or the passenger's door.
- The power window relay is turned "OFF" when receiving the remote control key lock signal (armed mode) during its extended operation period of 30 seconds.

▶ Specifications of Remote Control Key

When any of switches on remote control key is pressed, the integrated CPU in remote control key sends the coded control message to the CPU in receiver to control the vehicle.

- Switch Functions on Remote Control Key

Door Lock Button

Lock (briefly press)

· If you press this button briefly, all doors and the tailgate are locked and the theft deterrent mode is activated.
· When the theft deterrent mode is activated, the hazard warning flashers blink twice.

Door Unlock/Panic Button

1. Unlock (briefly press)

· If you press this button briefly, all doors and the tail gate are unlocked and the theft deterrent mode is deactivated.
· When the deterrent mode is deactivated, hazard warning flashers blink once.

Panic Button (operative only when the ignition key is inserted)

2. Panic function (press and hold)

· If you are in your vehicle and feel threatened while the ignition key is inserted into the key switch, you may activate the alarm to call attention. If you press this button, the warning siren will sound for approx. 27 seconds.
· The panic function will stop when any of the buttons on the remote control key is pressed.

CAUTION

The coding signal is transmitted only if pressing the door unlock button long (approx. 2 seconds) when coding the remote control key.

Modification basis	
Application basis	
Affected VIN	

▶ **Receiver**

- Operating requirements
  IGN Key = OUT (removed)
- Code registration requirement
  Codes can be registered only through SCAN-100.
- Transmitter Code Registration
  · Up to five transmitter codes (same for REKES key) can be registered.
  · The received code cannot be output during the registration.
  · The remote control key must be encoded through the SCAN-100.

▶ **Remote Door Lock**

- All doors are locked when briefly pressing the door LOCK switch on remote control key (less than 0.5 seconds).
- The system outputs LOCK signal immediately after receiving the door lock message from the remote control key. The system activates the theft deterrent mode when all doors are locked while they are fully closed (the hazard warning lamps blink twice.).

▶ **Door Unlock**

- The door unlock operates when pressing the door unlock switch on the remote control key for less than 0.5 seconds.
- The door unlock relay is "ON" for 0.5 seconds when receiving the door unlock message from the remote control key.
- The hazard warning lamps blink once only when all the doors unlocked.

▶ **Auto Door Lock in 30 Seconds after Pressing Door Unlock Butt**

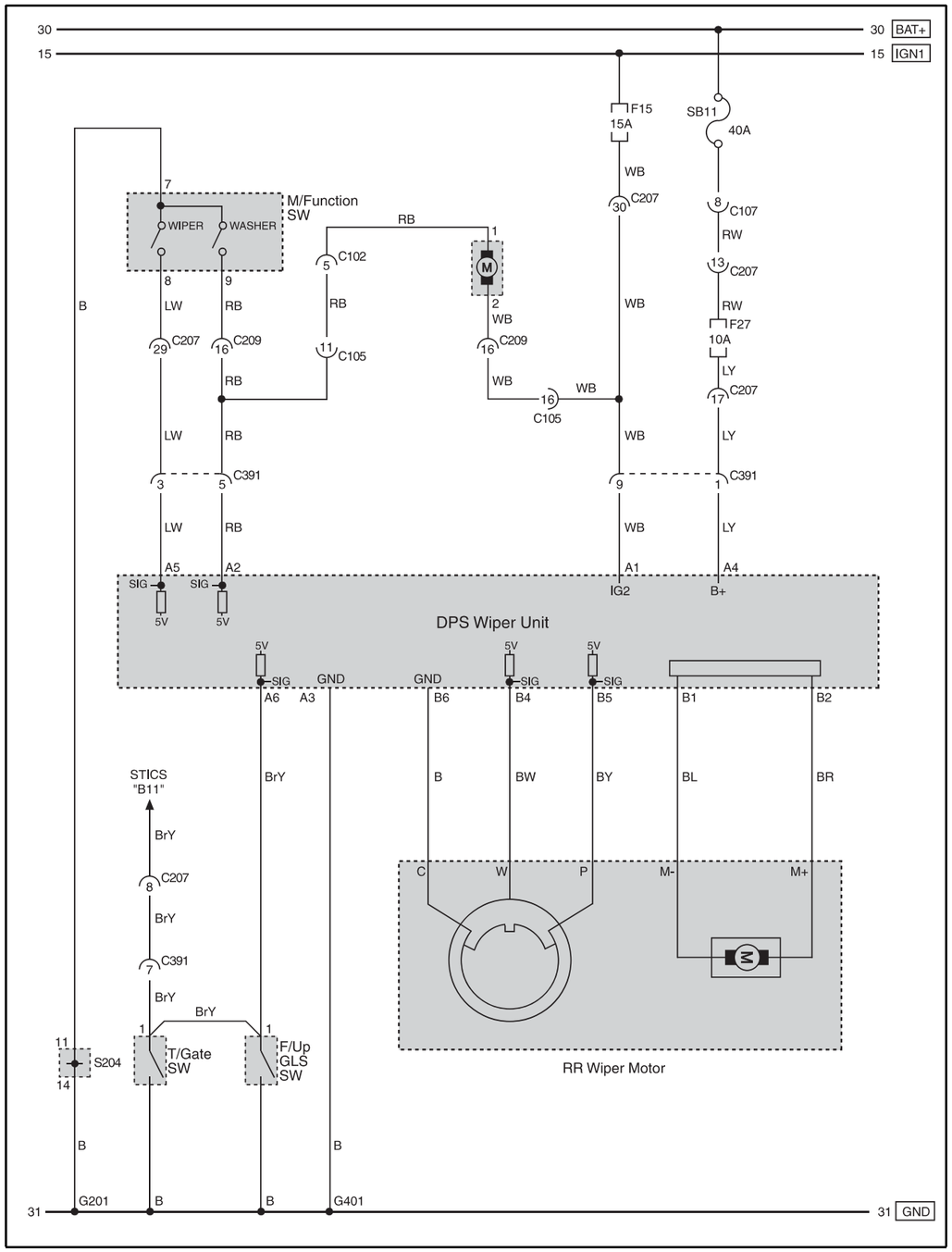
- If no door is opened for 30 seconds after inputting remote door unlock, the doors are automatically locked and the armed mode of anti-theft system is activated again.

G. DIAGNOSIS TROUBLE CODE AND HELP TIPS

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).

S.G.N. 7830-03

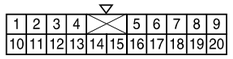
RR DPS WIPER & WASHER (W/ FLIP UP GLASS)

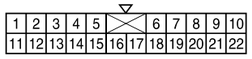


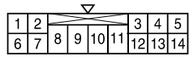
1) CONNECTOR INFORMATION

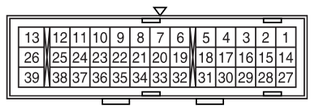
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C391 (10Pin, White)	W/H Floor - W/H Tail Gate	Inside the Tail Gate	
G201	W/H Main	Under the Driver Cowl Side PNL	
G401	W/H Tail Gate	Center the Tail Gate	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND

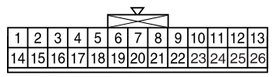
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

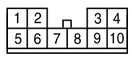

C102
W/H Floor
(Eng Room Fuse & Relay Box)


C105
W/H Floor
(Eng Room Fuse & Relay Box)


C107
W/H ENG
(Eng Room Fuse & Relay Box)


C207
W/H Floor

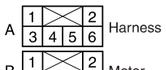

C209
W/H Floor


C391
W/H T/Gate

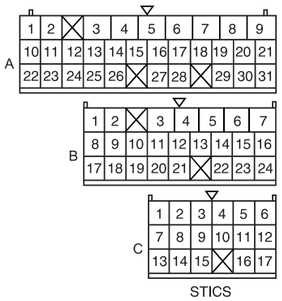
T/Gate SW

RR Washer Motor

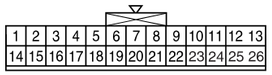
F/Up GLS SW



DPS Wiper Unit



STICS

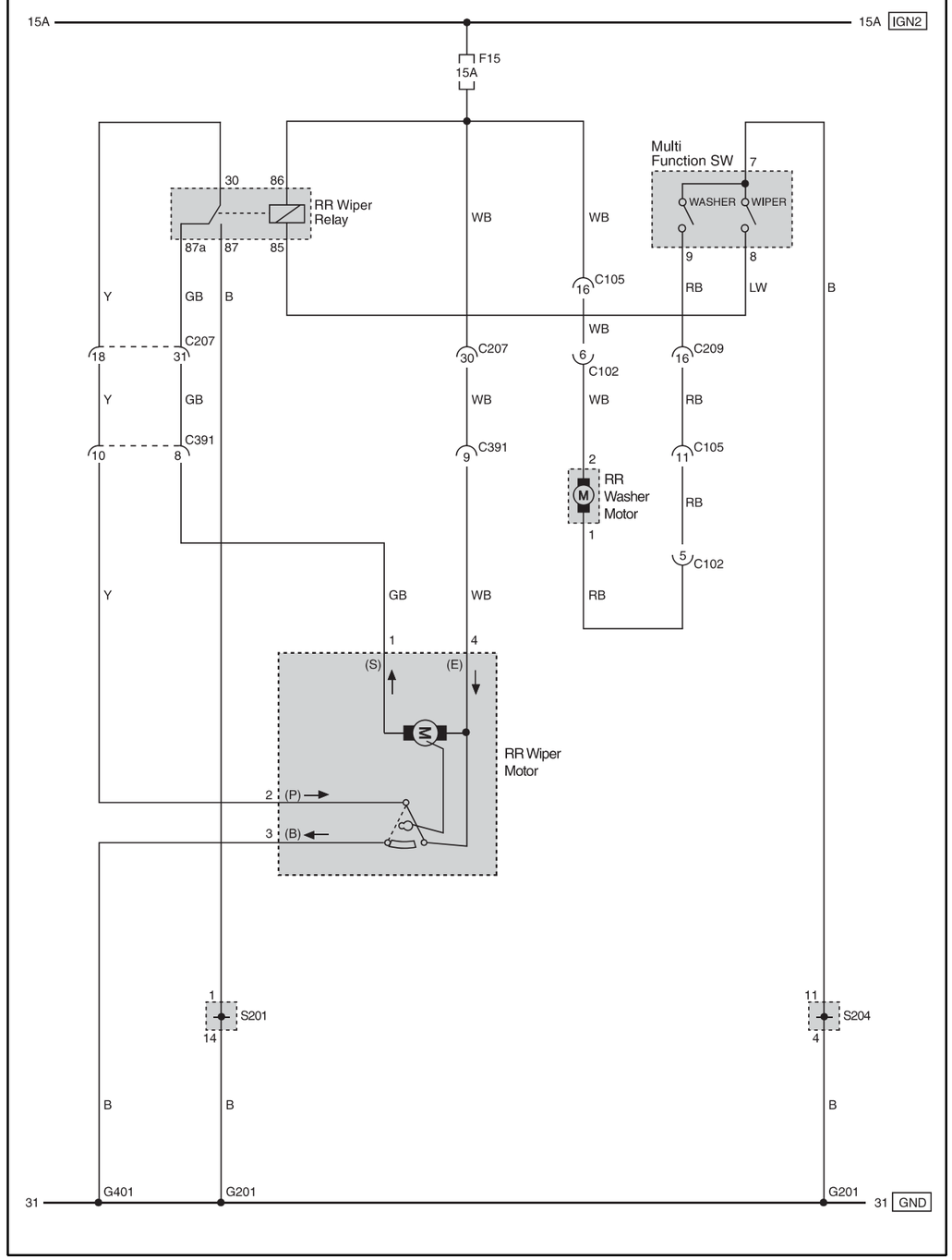

M/Function SW

CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

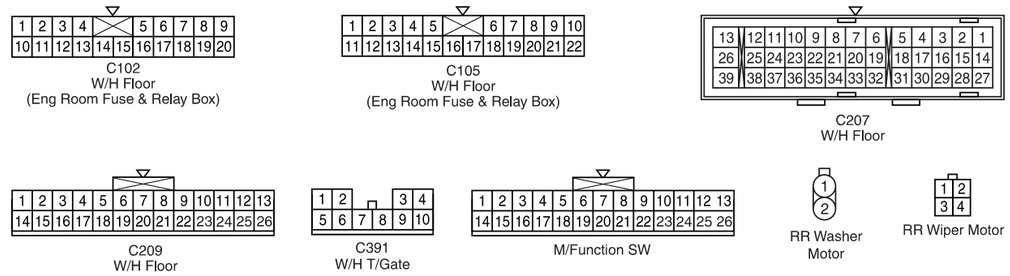
S.G.N. 7830-03 ??RR STANDARD WIPER & WASHER



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C391 (10Pin, White)	W/H Floor - W/H Tail Gate	Inside the Tail Gate	
G201	W/H Main	Under the Driver Cowl Side PNL	
G401	W/H Tail Gate	Center the Tail Gate	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND

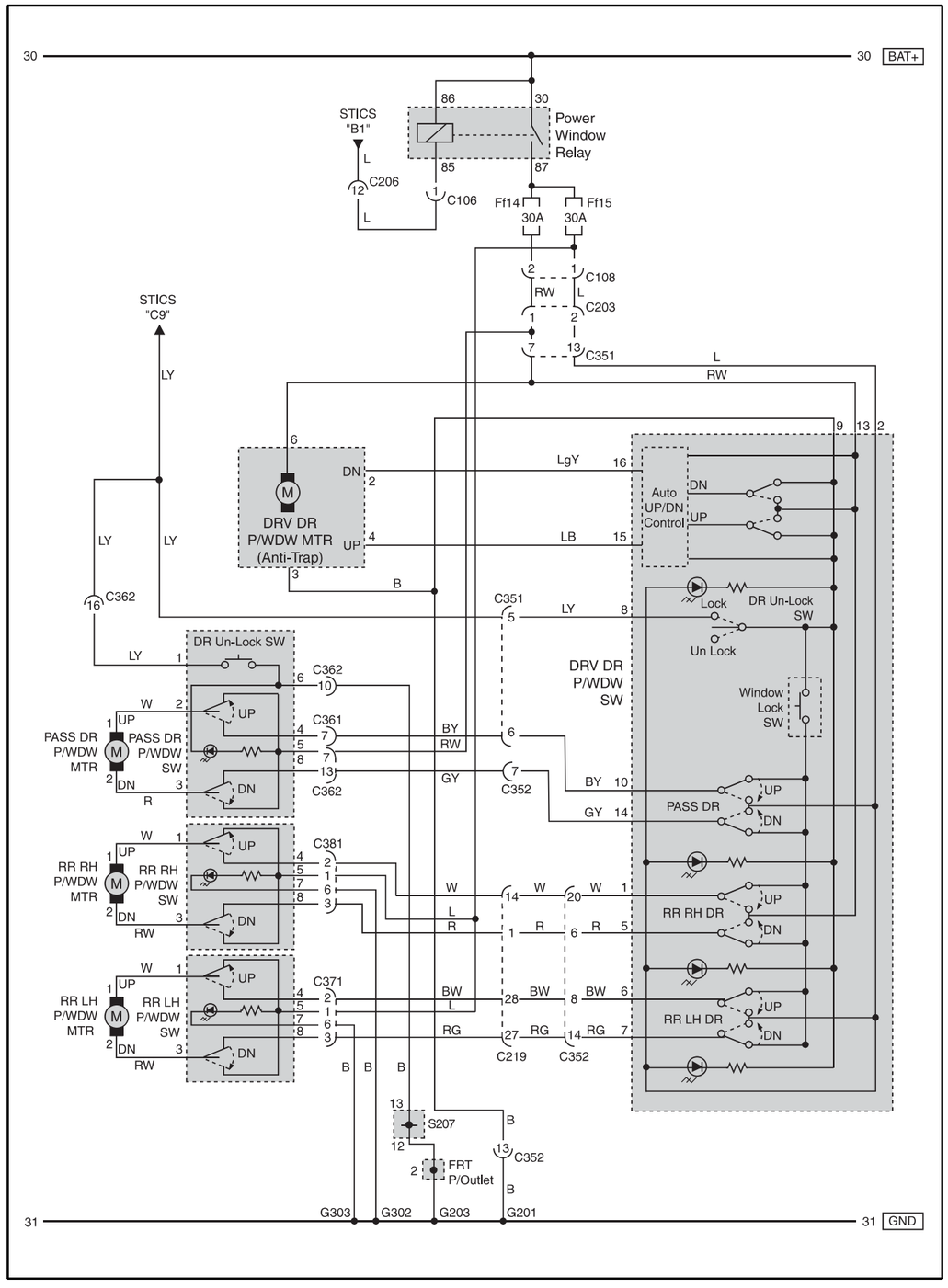
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8510-05

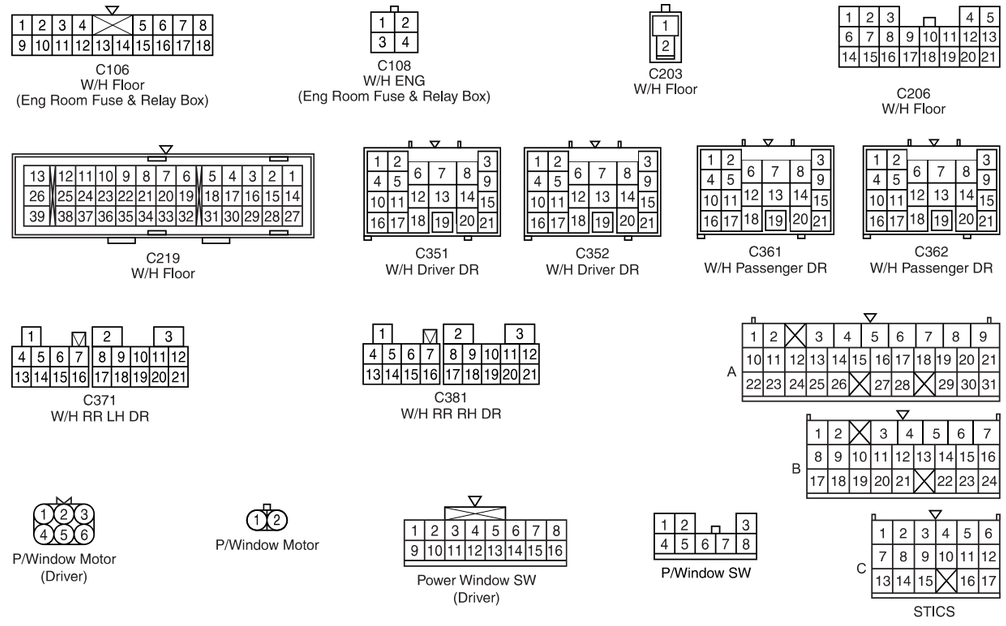
POWER WINDOW CIRCUIT



1) CONNECTOR INFORMATION

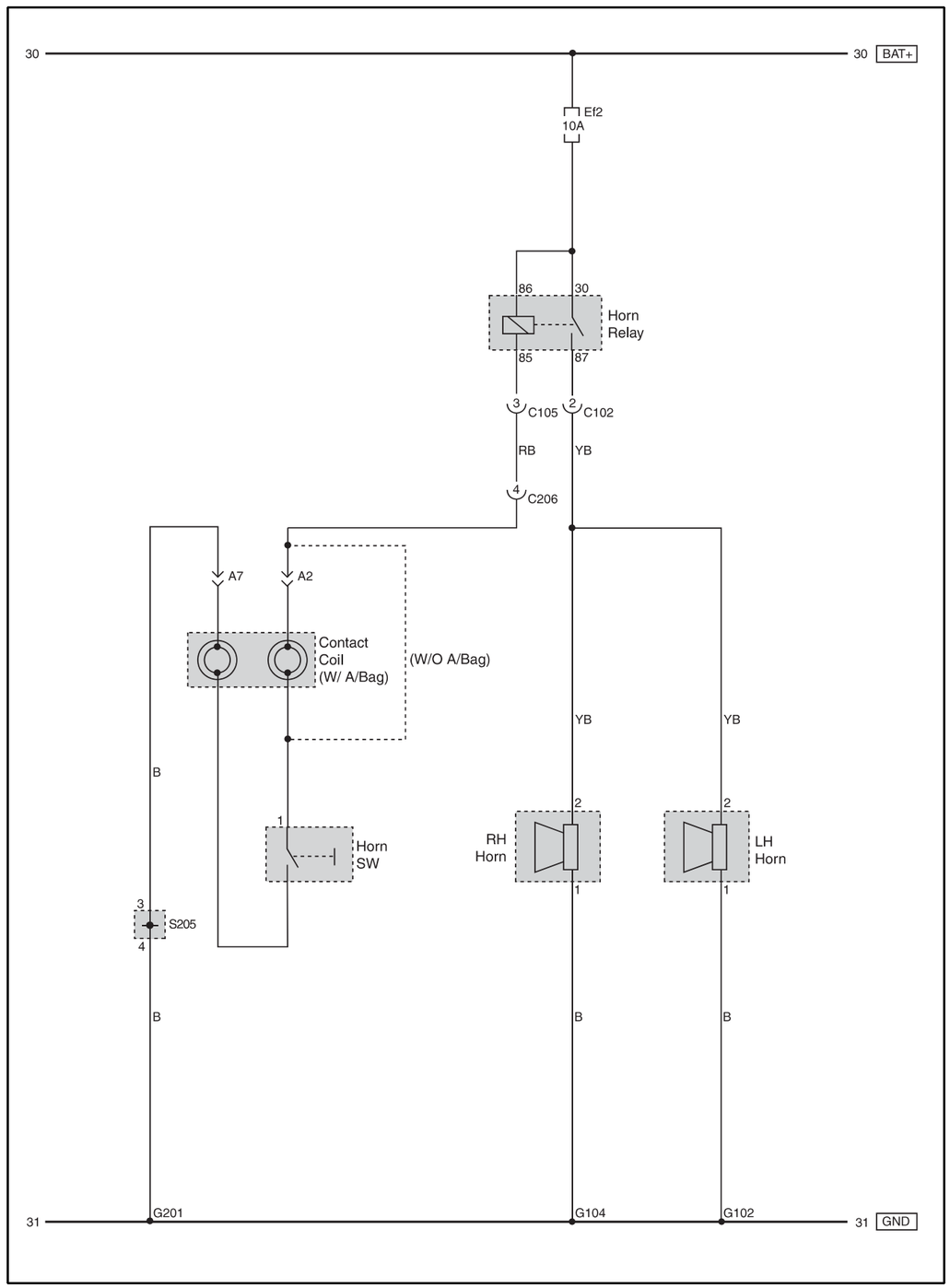
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C108 (4Pin, Colorless)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C203 (2Pin, Colorless)	W/H Main - W/H Floor	Under the I/P Fuse Box	
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C351 (21Pin, Black)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C352 (21Pin, White)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C361 (21Pin, White)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C362 (21Pin, Black)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C371 (21Pin, White)	W/H Floor - W/H RR LH DR	Under the Left “B” PLR	
C381 (21Pin, White)	W/H Floor - W/H RR RH DR	Under the Right “B” PLR	
G201	W/H Main	Under the Driver Cowl Side PNL	
G203	W/H Main	Inside the Passenger Cowl Side PNL	
G302	W/H Floor	Under the Passenger Seat	
G303	W/H Floor	Under the LH “B” PLR	
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

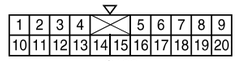
S.G.N.
8610-06 HORN



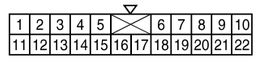
1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
G102	W/H Eng	Center the Eng BATT	
G104	W/H Eng	Backside RH Head Lamp	
G201	W/H Main	Under the Driver Cowl Side PNL	
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

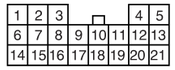
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



C102
W/H Floor
(Eng Room Fuse & Relay Box)

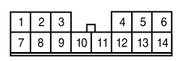


C105
W/H Floor
(Eng Room Fuse & Relay Box)



C206
W/H Floor

Horn

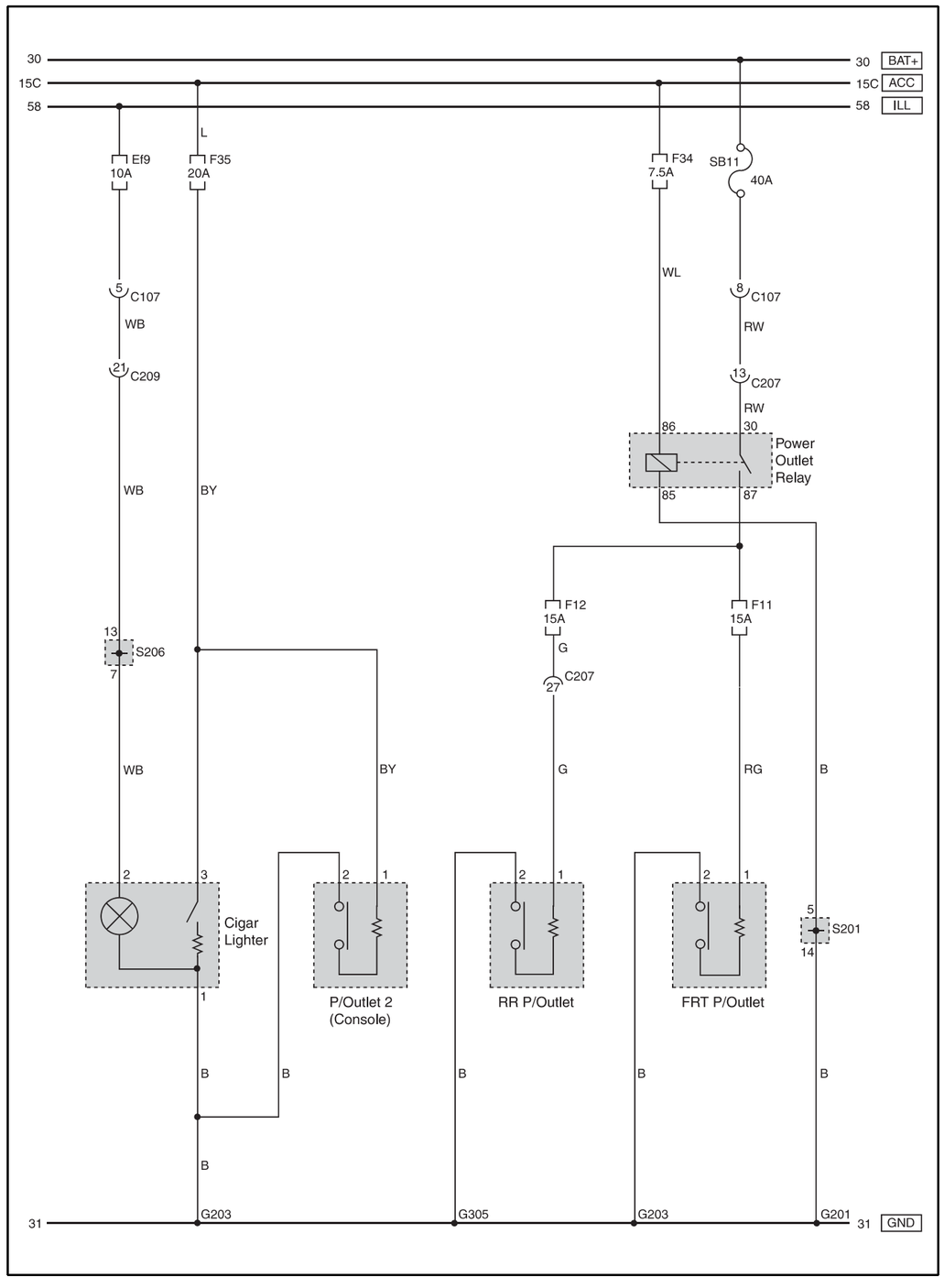


A/Cruise SW & Contact Coil

Horn SW
(Steering Wheel)

Modification basis	
Application basis	
Affected VIN	

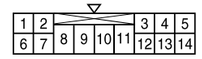
S.G.N. 7632-16 CIGAR LIGHTER & POWER OUTLET CIRCUIT



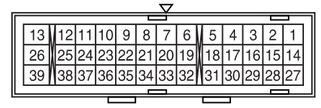
1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
G203	W/H Main	Inside the Passenger Cowl Side PNL	
G305	W/H Floor	Inside the LH QTR GLS Lower	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

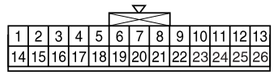
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



C107
W/H ENG
(Eng Room Fuse & Relay Box)



C207
W/H Floor



C209
W/H Floor

Cigar Lighter

Power Outlet

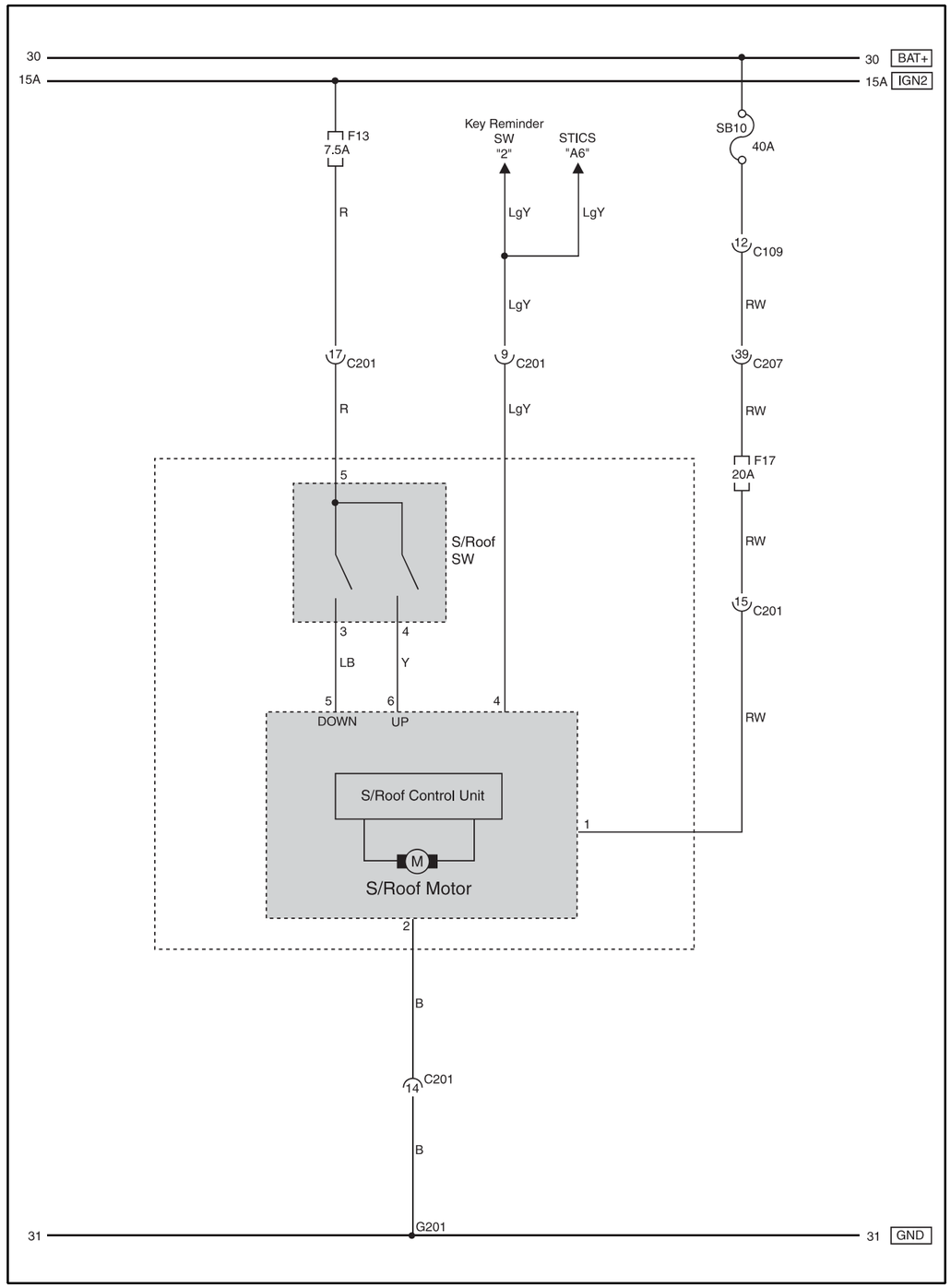
CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

S.G.N. 7340-03

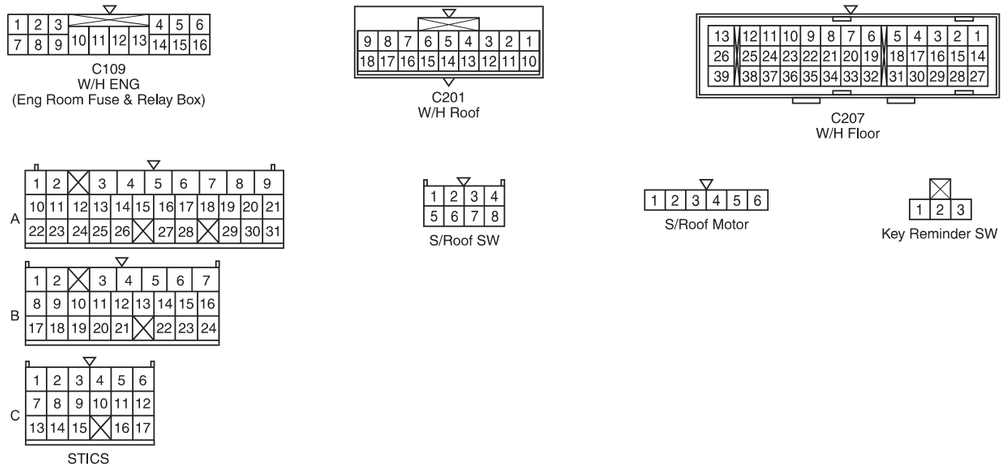
SUN ROOF CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C201 (18Pin, White)	W/H Main - W/H Roof	Under the I/P Fuse Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	

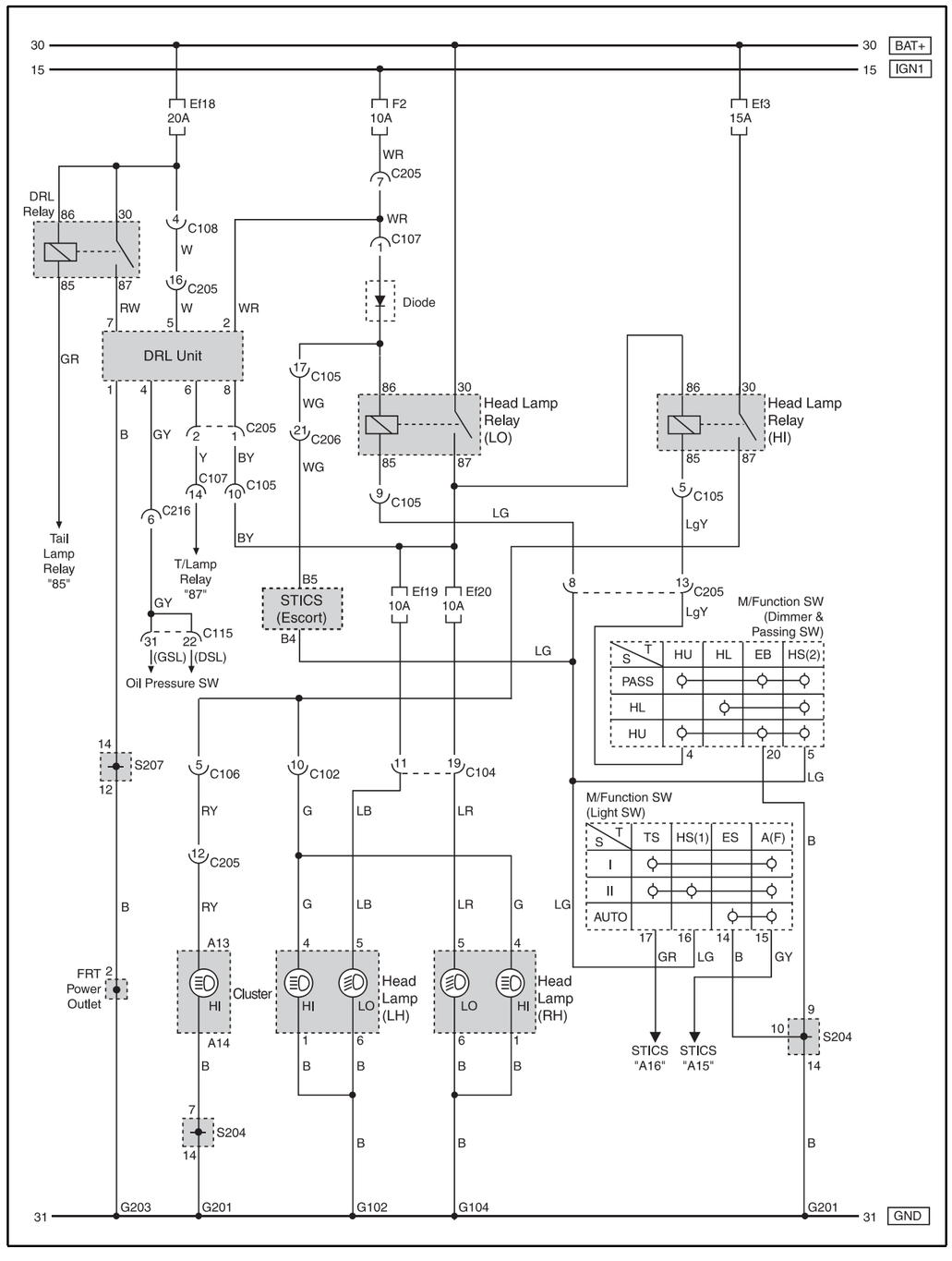
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8310-01

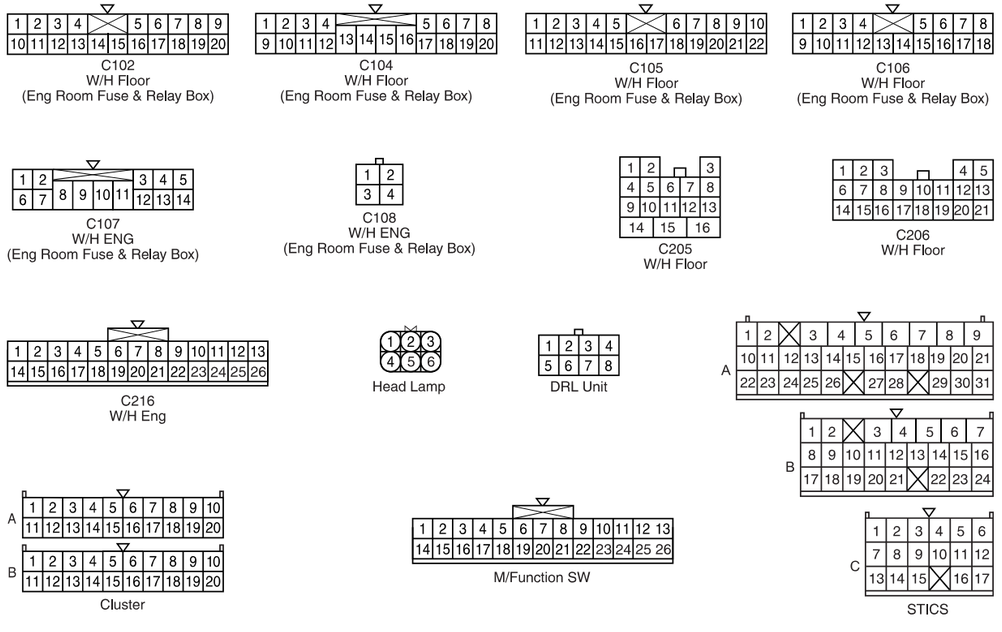
HEAD LAMP & DRL (DAY TIME RUNNING LIGHT) UNIT CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C108 (4Pin, Colorless)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G102	W/H Eng	Center the Eng BATT	
G104	W/H Eng	Backside RH Head Lamp	
G201	W/H Main	Under the Driver Cowl Side PNL	GND
G203	W/H Main	Inside the Passenger Cowl Side PNL	CAN
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

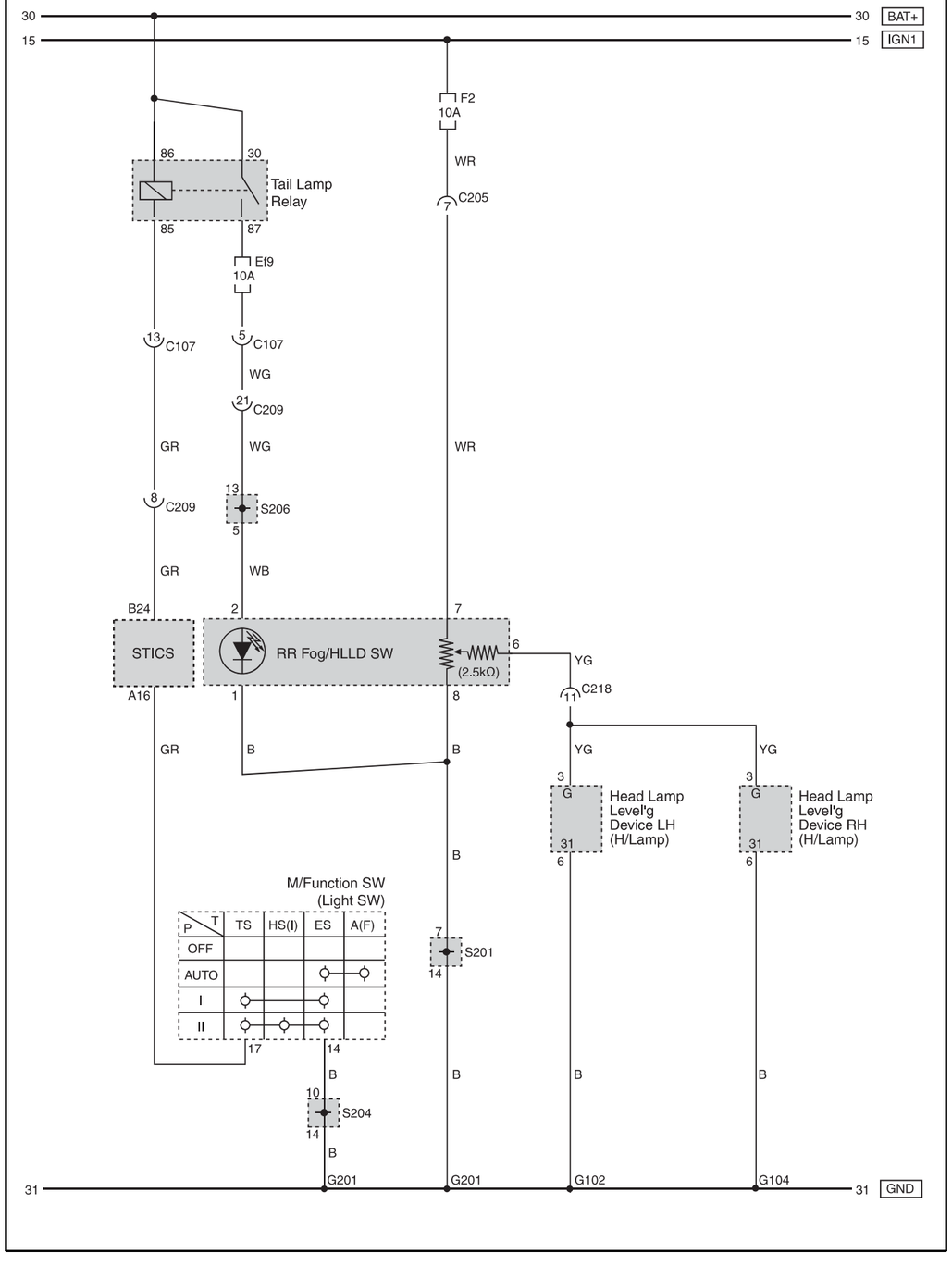
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8510-00

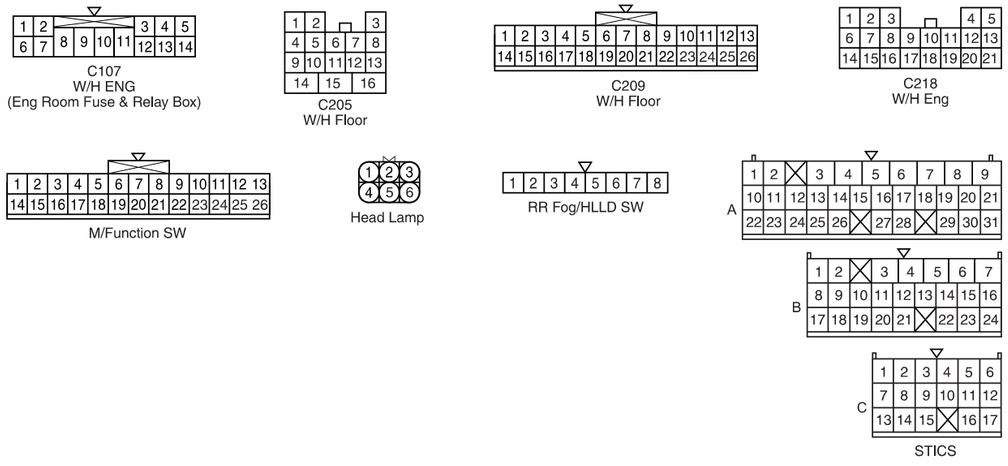
HLLD (HEAD LAMP LEVEL'G DEVICE) CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C218 (21Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G102	W/H Eng	Center the Eng BATT	
G104	W/H Eng	Backside RH Head Lamp	
G201	W/H Main	Under the Driver Cowl Side PNL	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

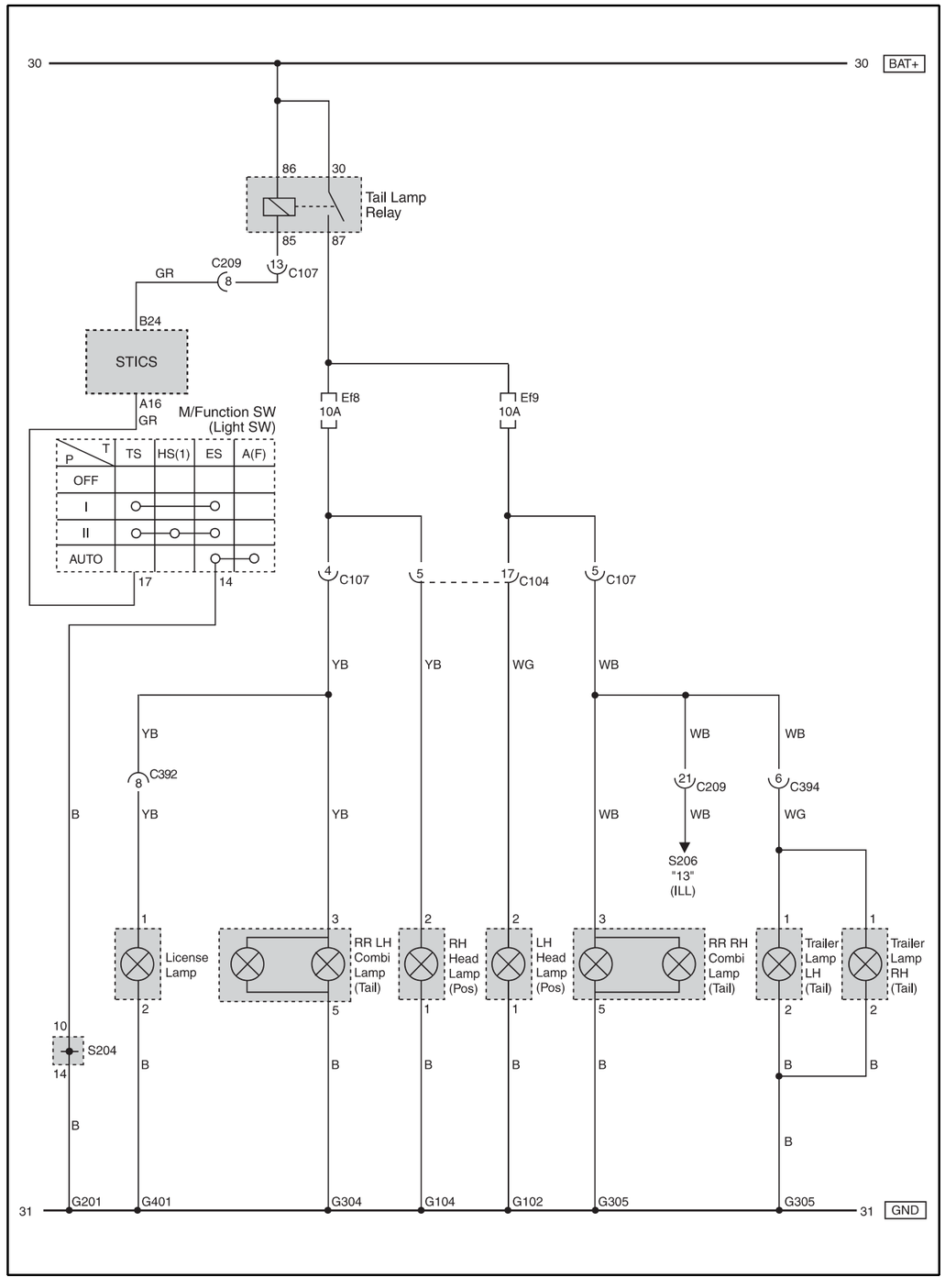
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8320-01

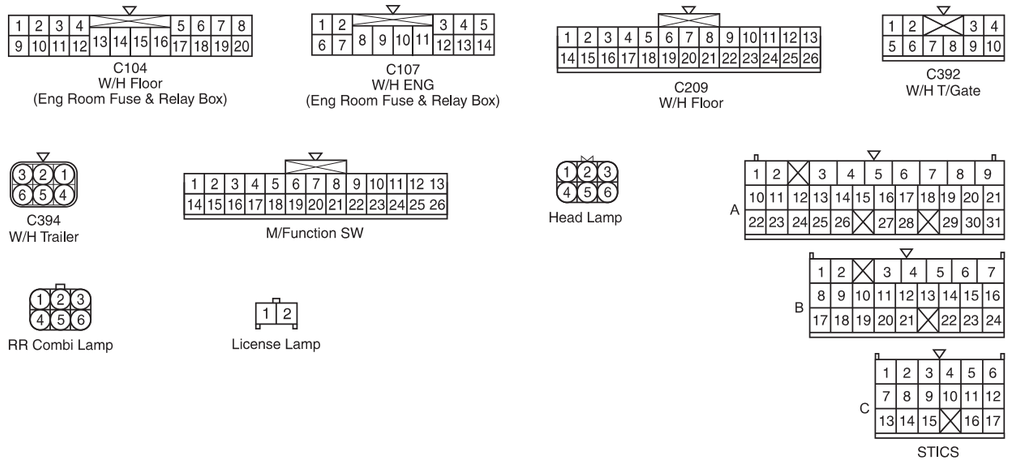
TAIL LAMP CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C392 (10Pin, White)	W/H Floor - W/H Tail Gate	Inside the Tail Gate	
C394 (6Pin, Black)	W/H Floor - W/H Trailer	Under the RR Bumper (RH)	Trailer
G102	W/H Eng	Center the Eng BATT	
G104	W/H Eng	Backside RH Head Lamp	
G201	W/H Main	Under the Driver Cowl Side PNL	
G304	W/H Floor	Inside the LH QTR GLS Lower	
G305	W/H Floor	Inside the RH QTR GLS Lower	
G401	W/H Tail Gate	Center the Tail Gate	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

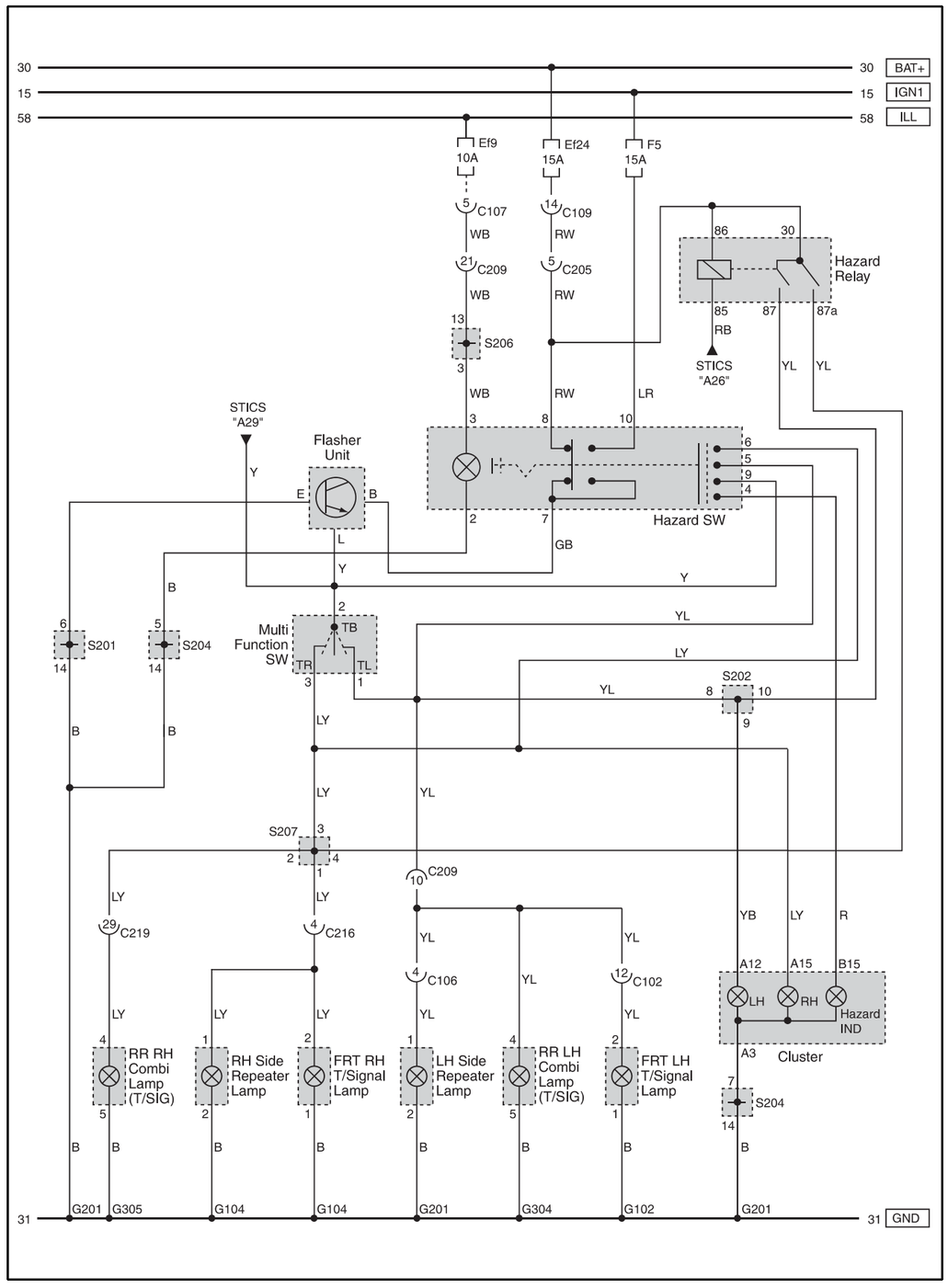
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8410-01

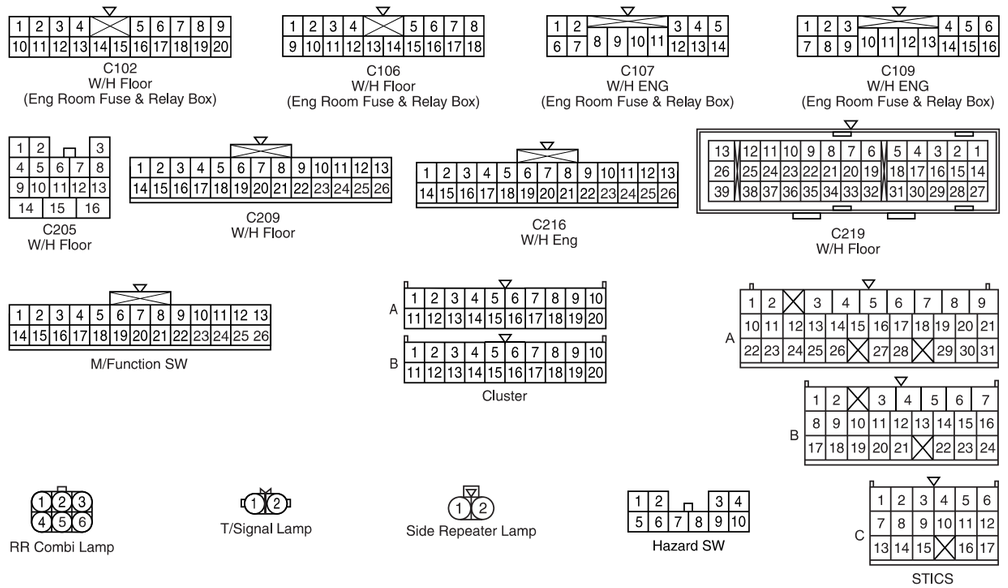
TURN SIGNAL & HAZARD LAMP CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
G102	W/H Eng	Center the Eng BATT	
G104	W/H Eng	Backside RH Head Lamp	
G201	W/H Main	Under the Driver Cowl Side PNL	
G304	W/H Floor	Inside the LH QTR GLS Lower	
G305	W/H Floor	Inside the RH QTR GLS Lower	
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	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

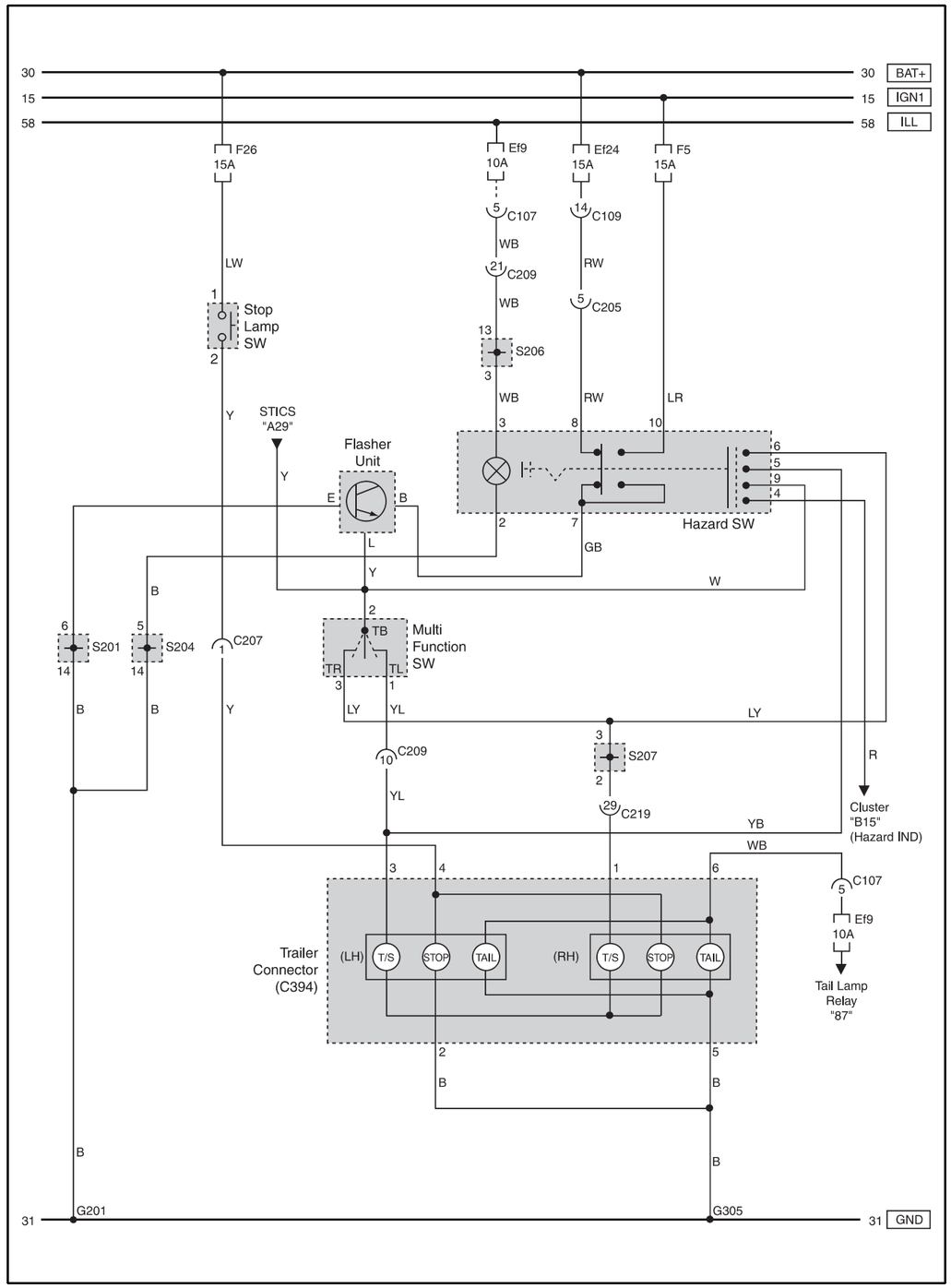
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 8210-01

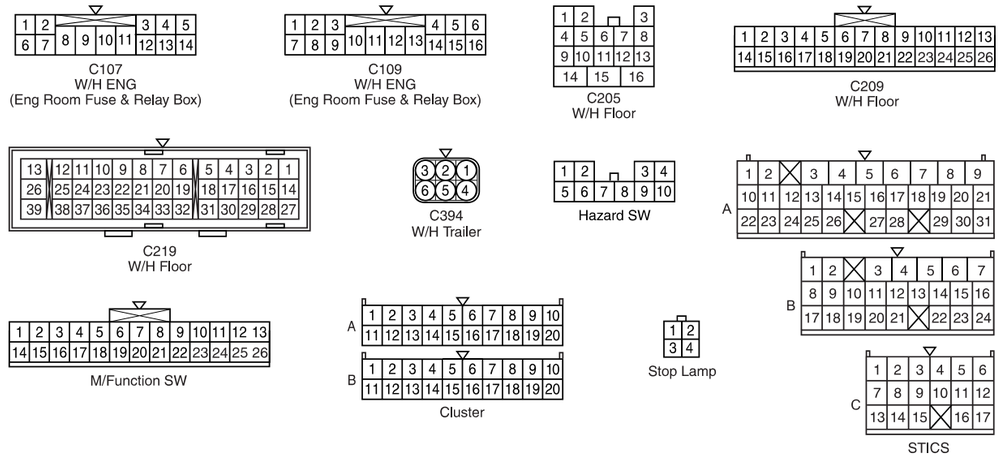
TRAILER LAMP CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C394 (6Pin, Black)	W/H Floor - W/H Trailer	Under the RR Bumper (RH)	Trailer
G201	W/H Main	Under the Driver Cowl Side PNL	
G305	W/H Floor	Inside the RH QTR GLS Lower	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



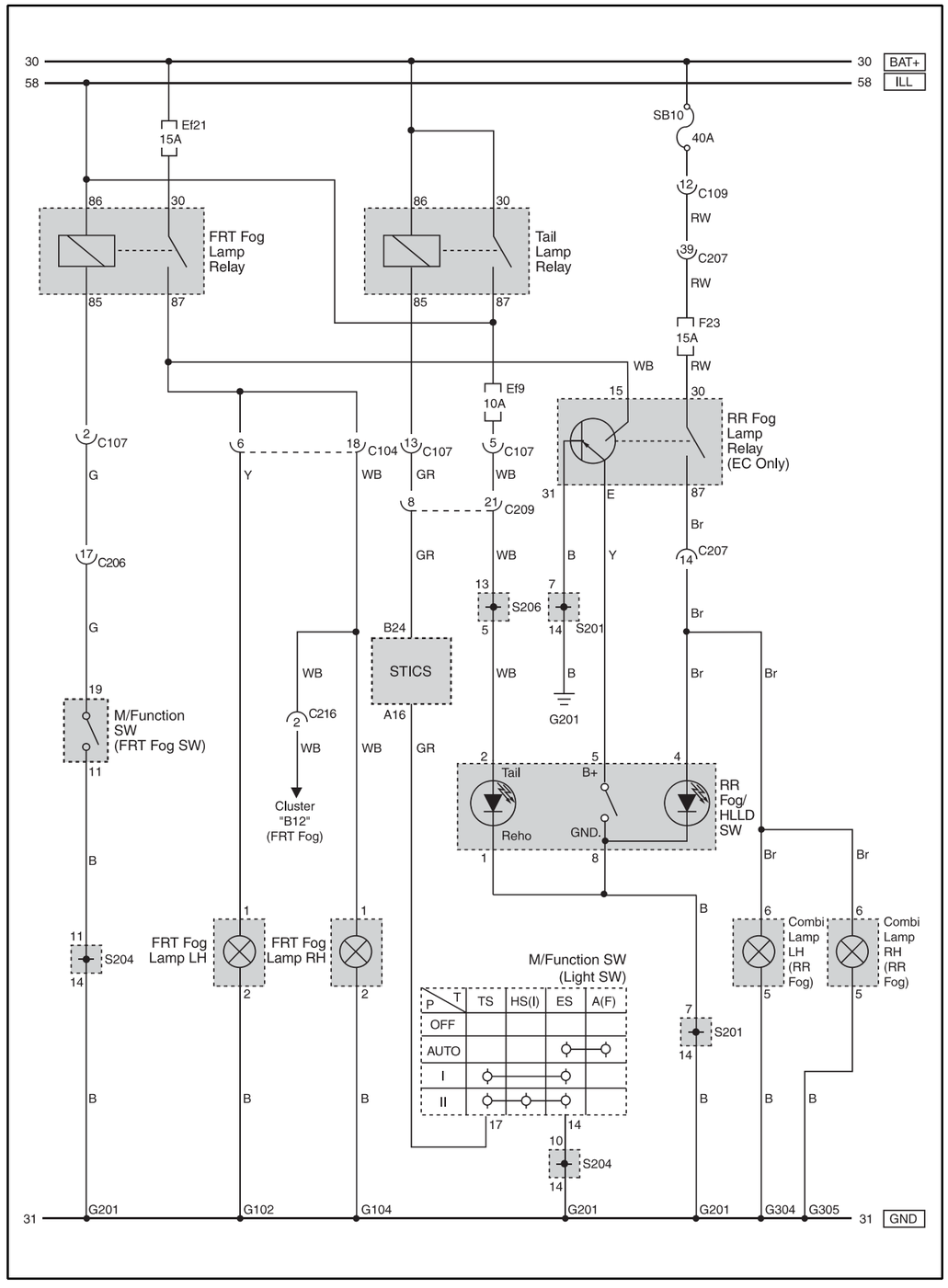
CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8310-10

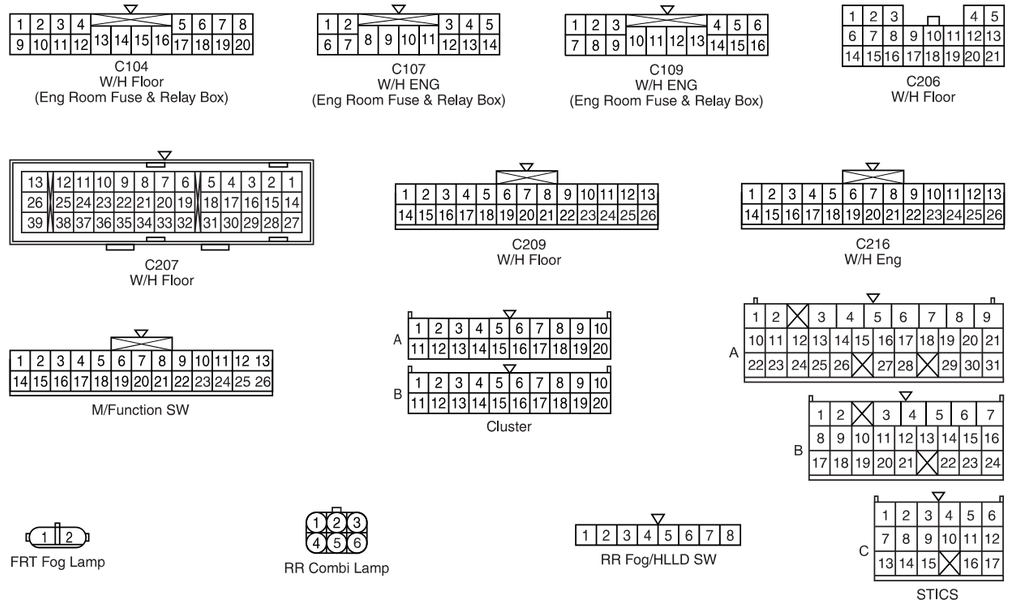
FOG LAMP CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G102	W/H Eng	Center the Eng BATT	
G104	W/H Eng	Backside RH Head Lamp	
G201	W/H Main	Under the Driver Cowl Side PNL	
G304	W/H Main	Inside the LH QTR GLS Lower	
G305	W/H Floor	Inside the RH QTR GLS Lower	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

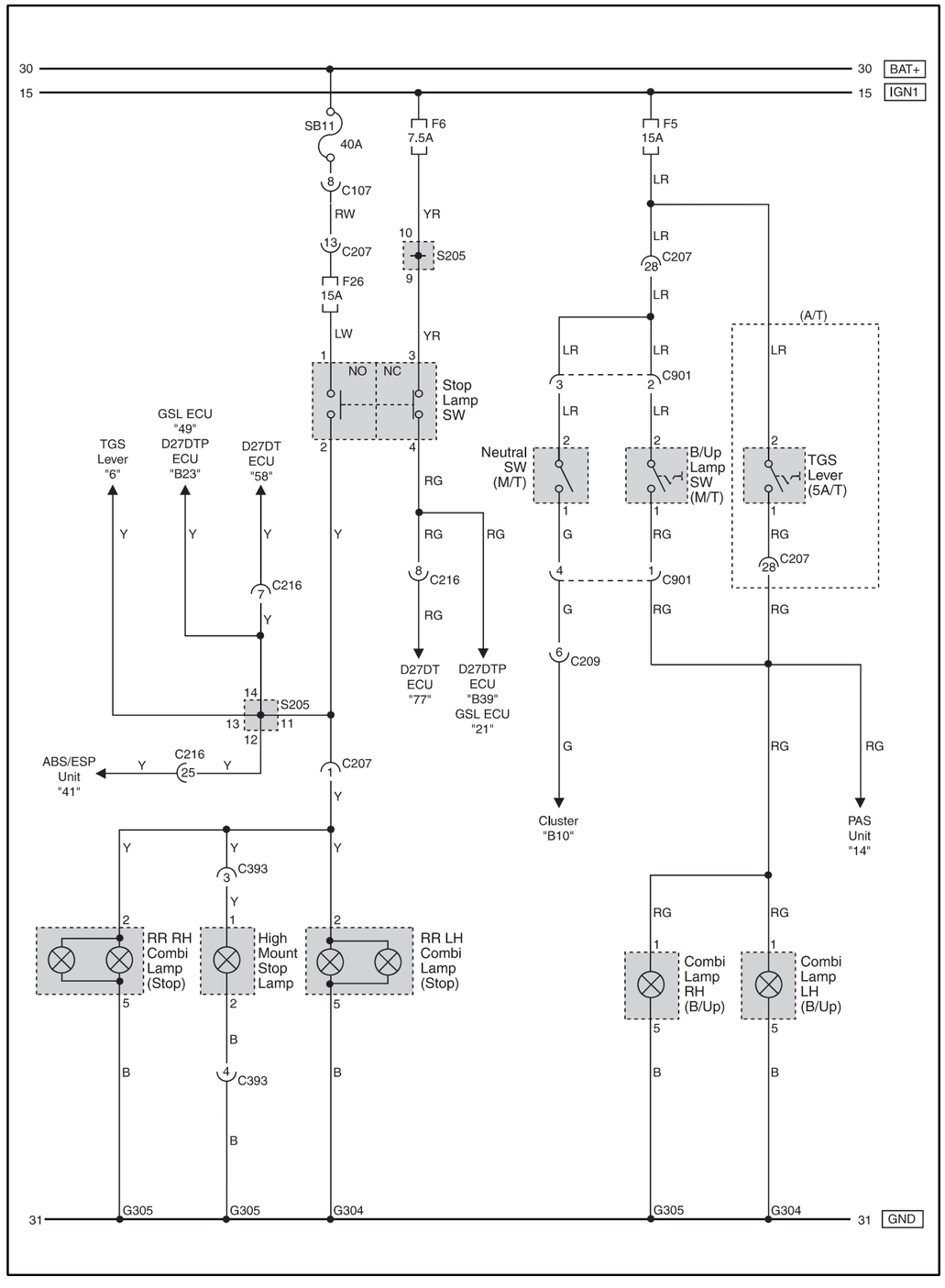
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 4810-01

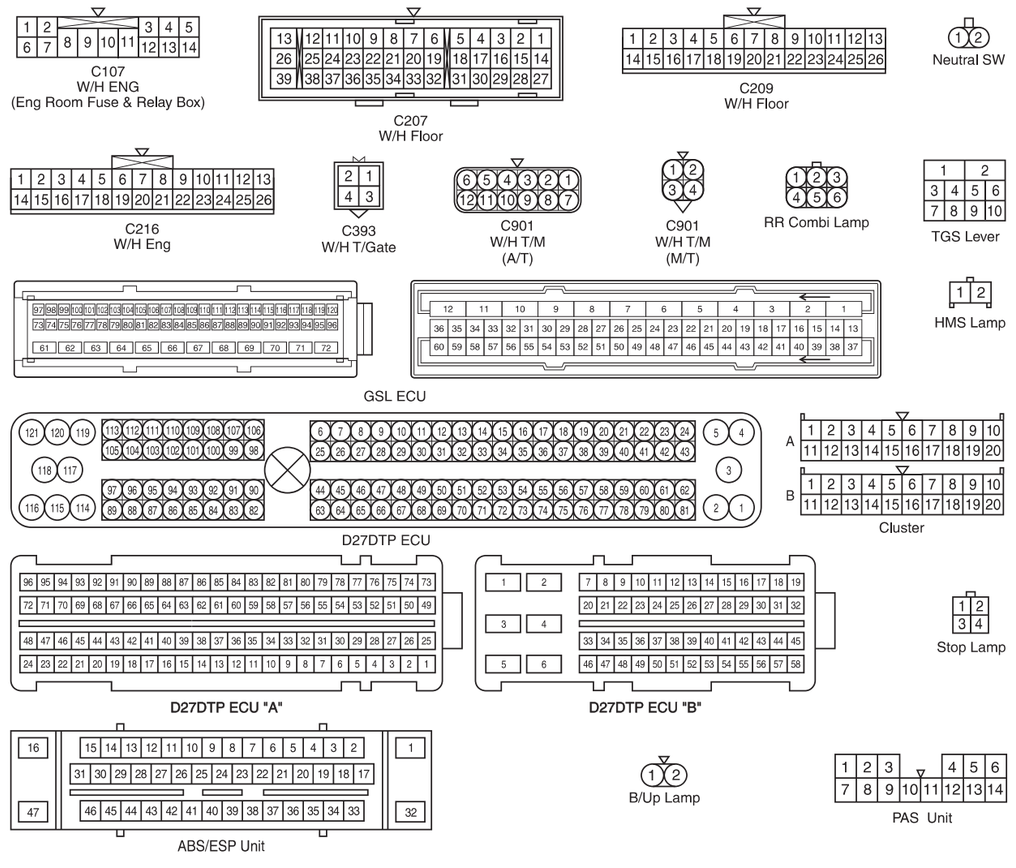
STOP & BACK-UP LAMP CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C393 (4Pin, Colorless)	W/H Floor - W/H Tail Gate	Inside the RR RH Upper QTR Trim	
C901 (12Pin, Black)	W/H Floor - W/H T/M	Upper the T/M	A/T
C901 (4Pin, Black)	W/H Floor - W/H T/M	Upper the T/M	M/T
G304	W/H Floor	Inside the LH QTR GLS Lower	
G305	W/H Floor	Inside the RH QTR GLS Lower	
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



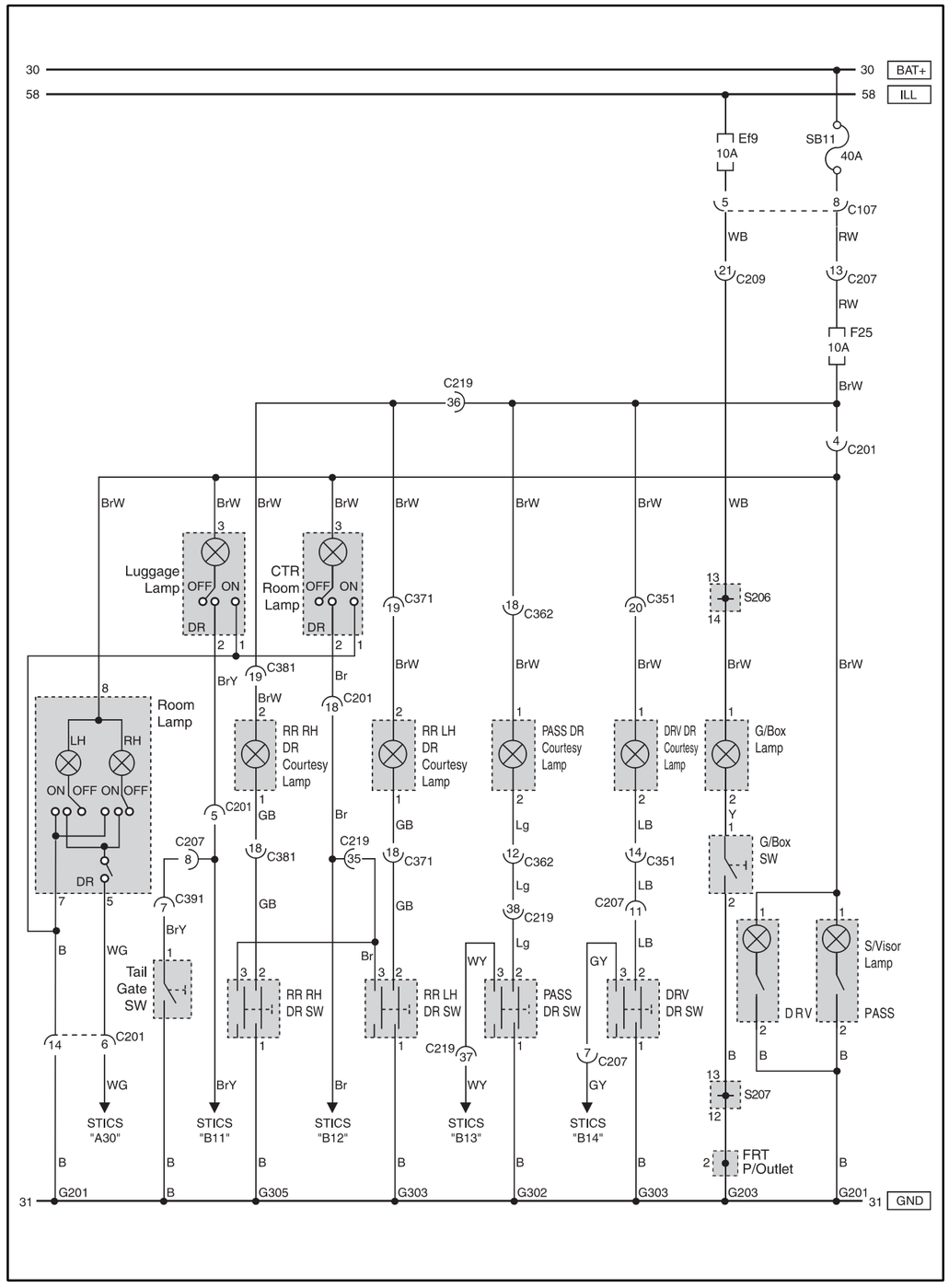
CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

S.G.N. 7770-02

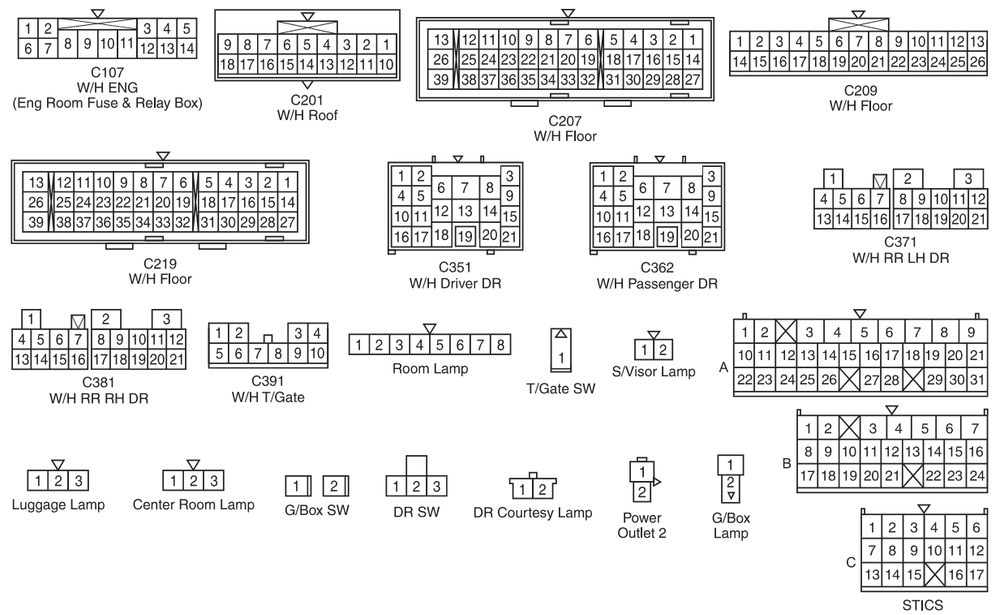
INTERIOR LAMP CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C201 (18Pin, White)	W/H Main - W/H Roof	Under the I/P Fuse Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C351 (21Pin, Black)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C362 (21Pin, Black)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C371 (21Pin, White)	W/H Floor - W/H RR LH DR	Under the Left "B" PLR	
C381 (21Pin, White)	W/H Floor - W/H RR RH DR	Under the Right "B" PLR	
C391 (10Pin, White)	W/H Floor - W/H Tail Gate	Inside the Tail Gate	
G201	W/H Main	Under the Driver Cowl Side PNL	
G203	W/H Main	Inside the Passenger Cowl Side PNL	
G302	W/H Floor	Under the Passenger Seat	
G303	W/H Floor	Under the LH "B" PLR	
G305	W/H Floor	Inside the RH QTR GLS Lower	
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	

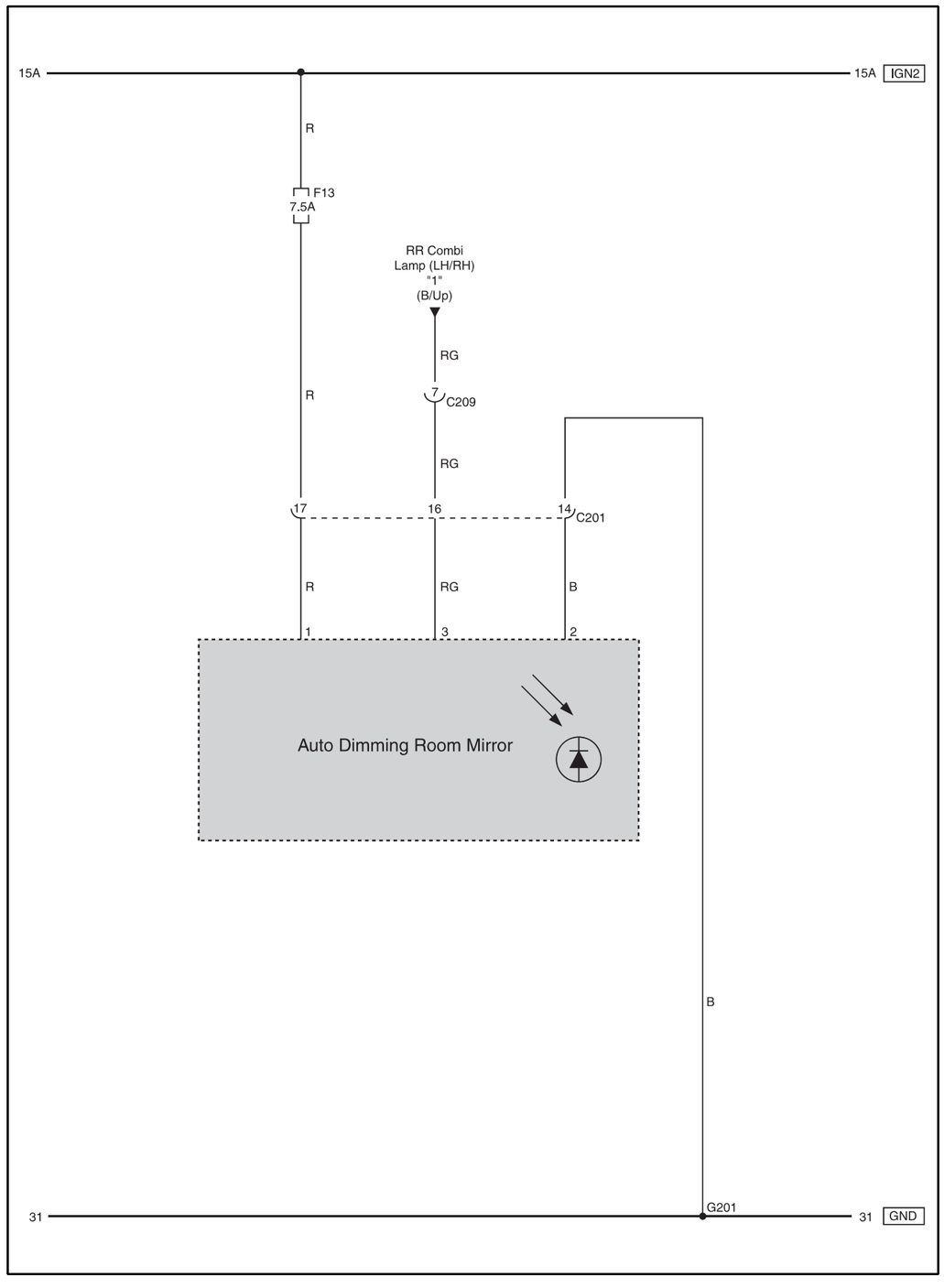
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

S.G.N. 7770-10

AUTO DIMMING ROOM MIRROR CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C201 (18Pin, White)	W/H Main - W/H Roof	Under the I/P Fuse Box	
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

C201
W/H Roof

C209
W/H Floor

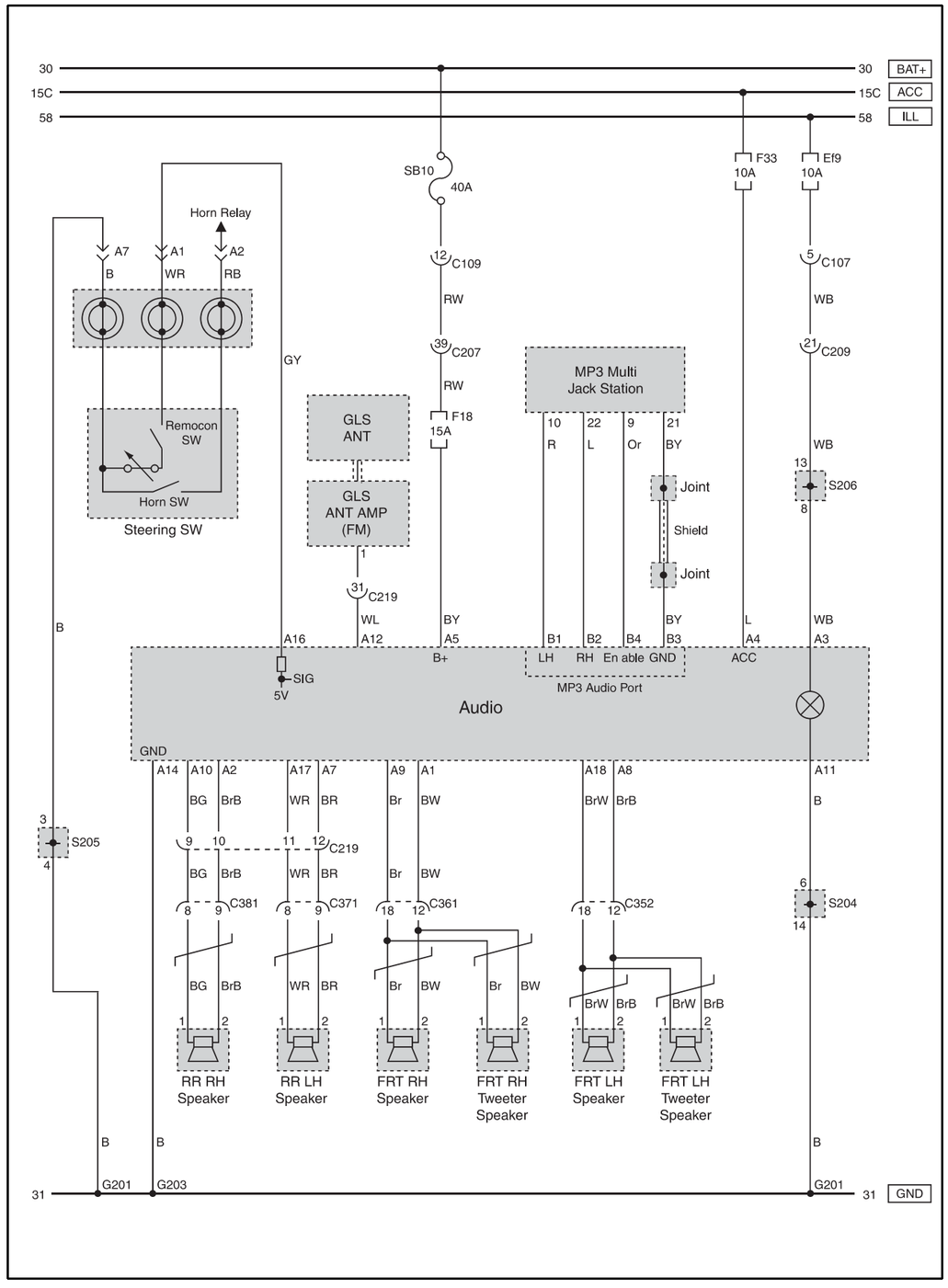
Inside Mirror

RR Combi Lamp

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8910-01

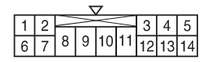
AUDIO

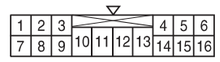


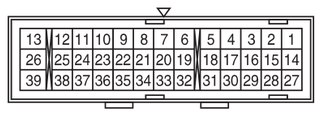
1) CONNECTOR INFORMATION

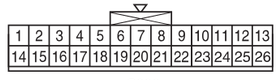
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C352 (21Pin, White)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C361 (21Pin, White)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C371 (21Pin, White)	W/H Floor - W/H RR LH DR	Under the Left "B" PLR	
C381 (21Pin, White)	W/H Floor - W/H RR RH DR	Under the Right "B" PLR	
G201	W/H Main	Under the Driver Cowl Side PNL	
G203	W/H Main	Inside the Passenger Cowl Side PNL	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

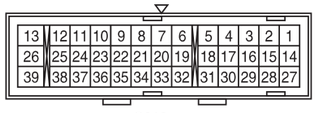
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

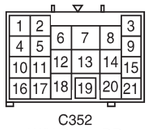

C107
W/H ENG
(Eng Room Fuse & Relay Box)

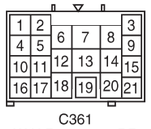

C109
W/H ENG
(Eng Room Fuse & Relay Box)

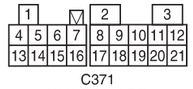

C207
W/H Floor

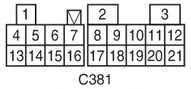

C209
W/H Floor

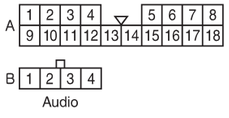

C219
W/H Floor

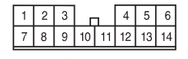

C352
W/H Driver DR

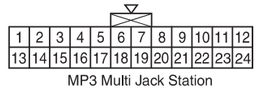

C361
W/H Passenger DR


C371
W/H RR LH DR


C381
W/H RR RH DR


Audio


A/Cruise SW & Contact Coil


MP3 Multi Jack Station

Tweeter Speaker

GLS ANT
AMP (FM)

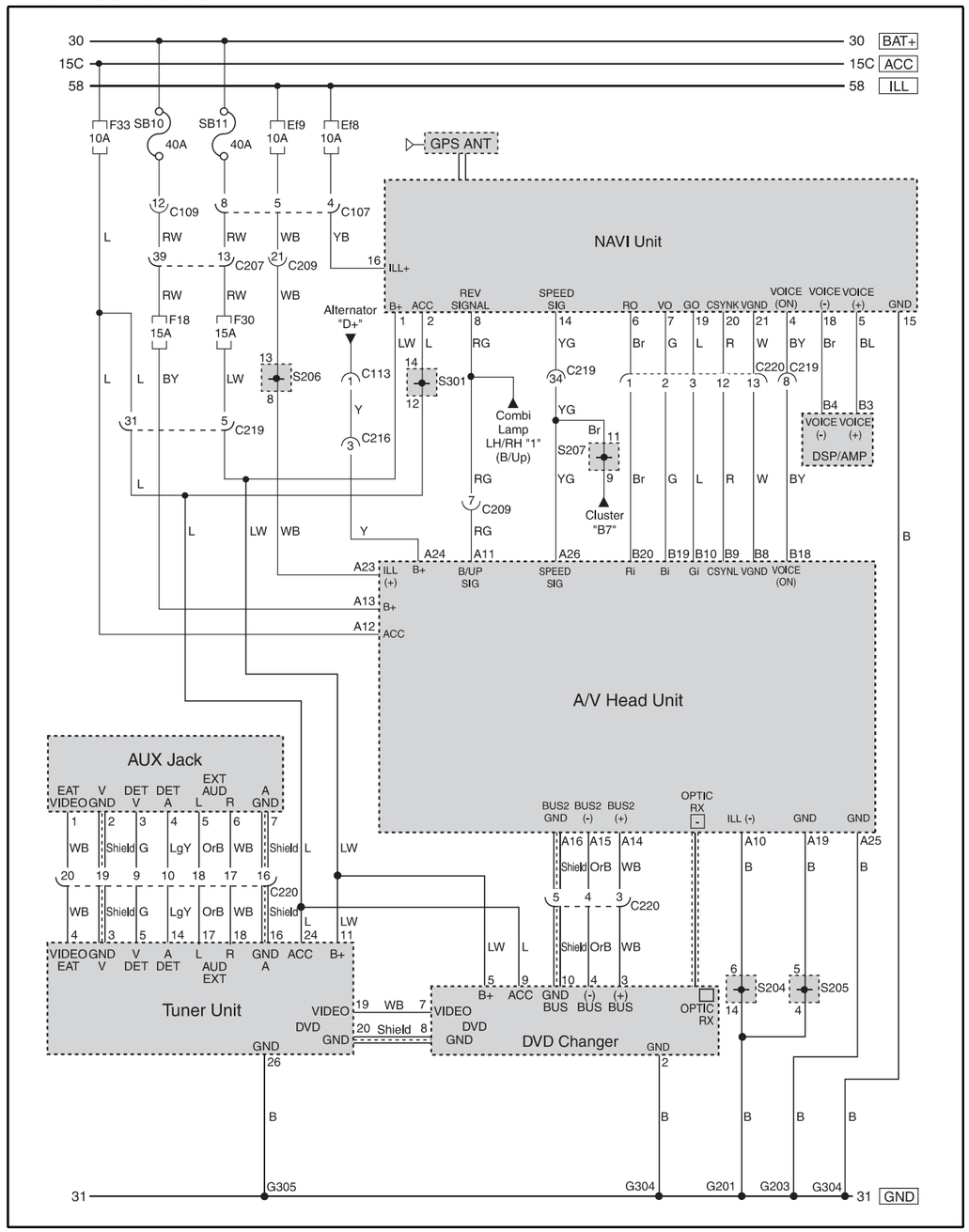
Speaker
(FRT/RR DR)

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8930-01

A/V SYSTEM

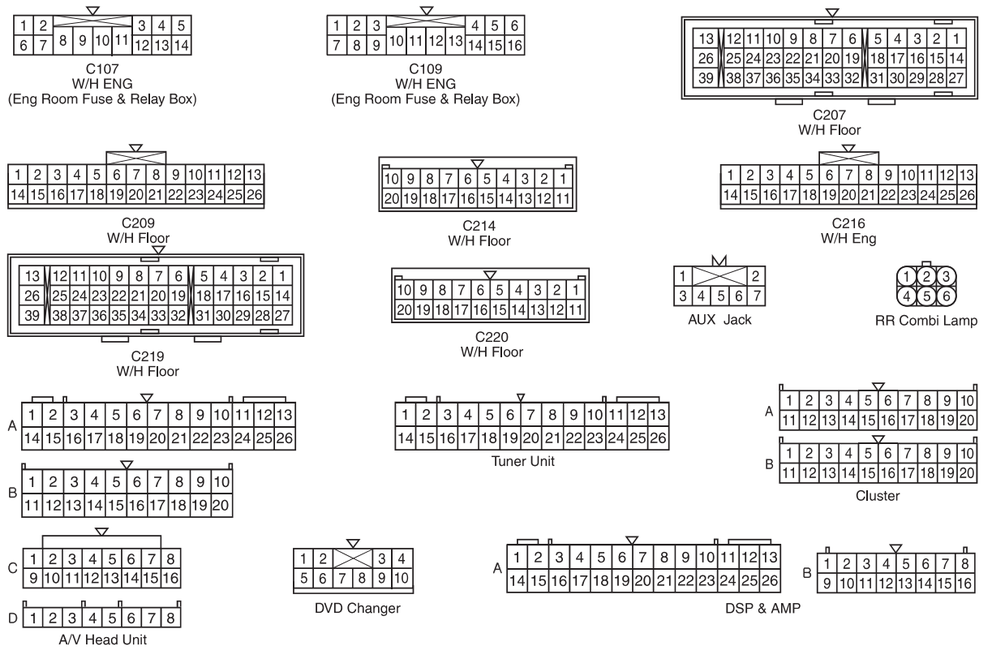
1) NAVI UNIT, A/V HEAD UNIT, DVD CHANGER, TUNER UNIT, AUX JACK



(1) CONNECTOR INFORMATION

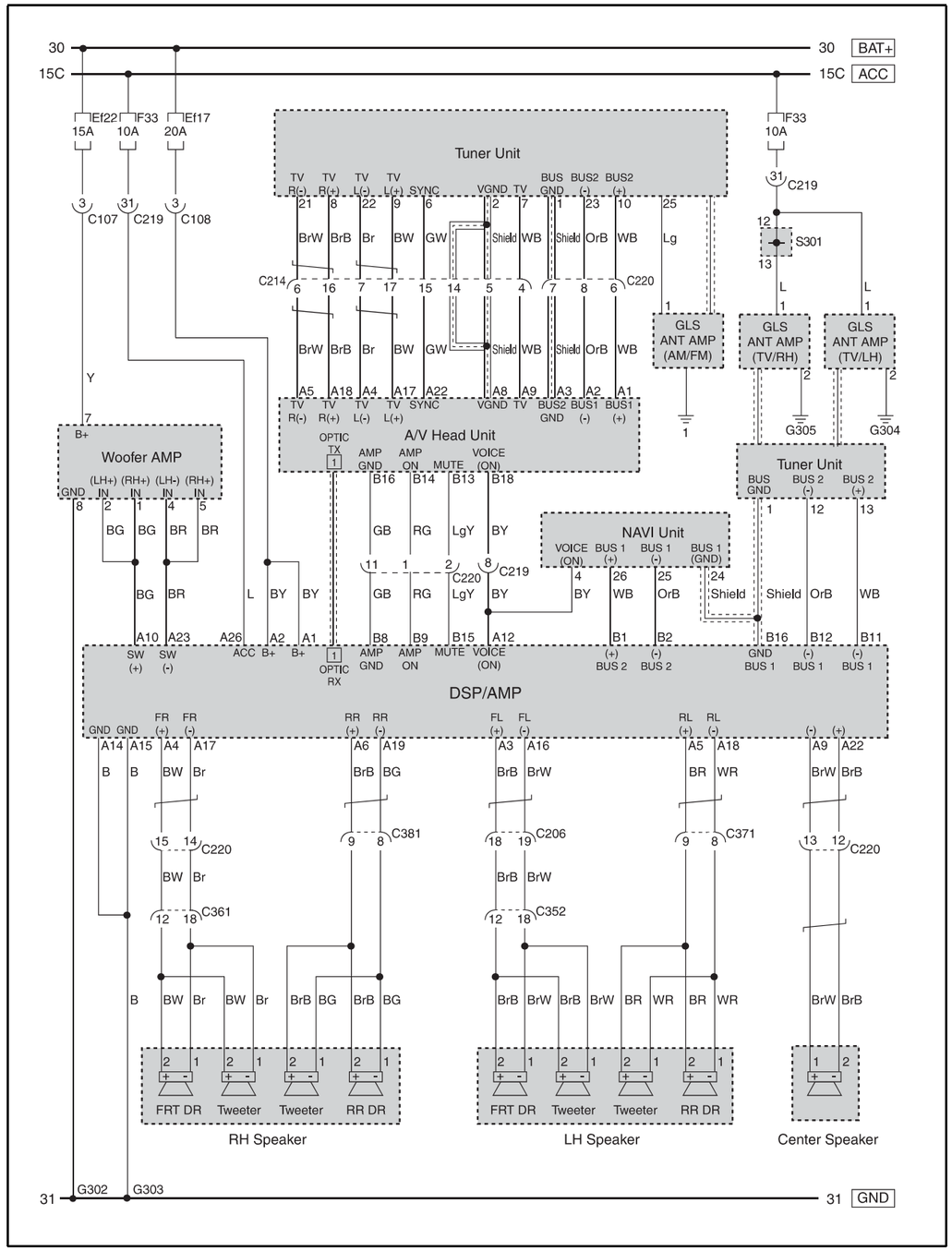
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C214 (20Pin, Black)	W/H Main - W/H Floor	Lower the Console Box	
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C220 (20Pin, Black)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
G203	W/H Main	Inside the Passenger Cowl Side PNL	
G304	W/H Floor	Inside the LH QTR GLS Lower	
G305	W/H Floor	Inside the RH QTR GLS Lower	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL
S207 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S301 (14Pin, Black)	W/H Floor	Under the Driver Seat	CAN

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

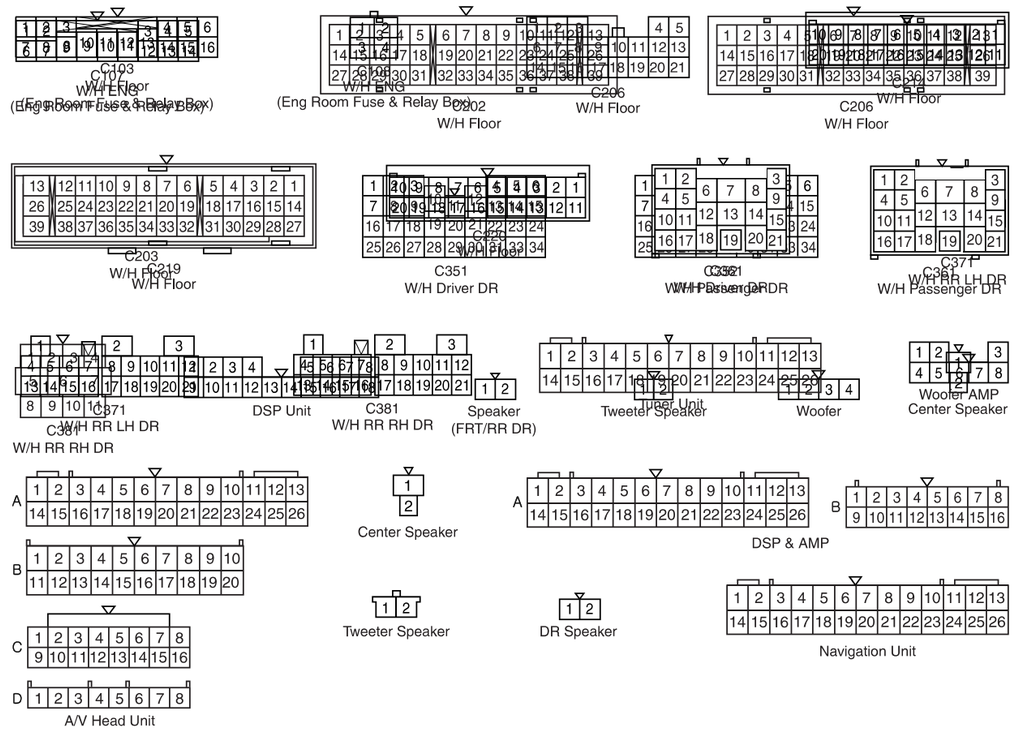
2) A/V HEAD UNIT, DSP/AMP, TUNER UNIT, WOOFER AMP, SPEAKER



(1) CONNECTOR INFORMATION

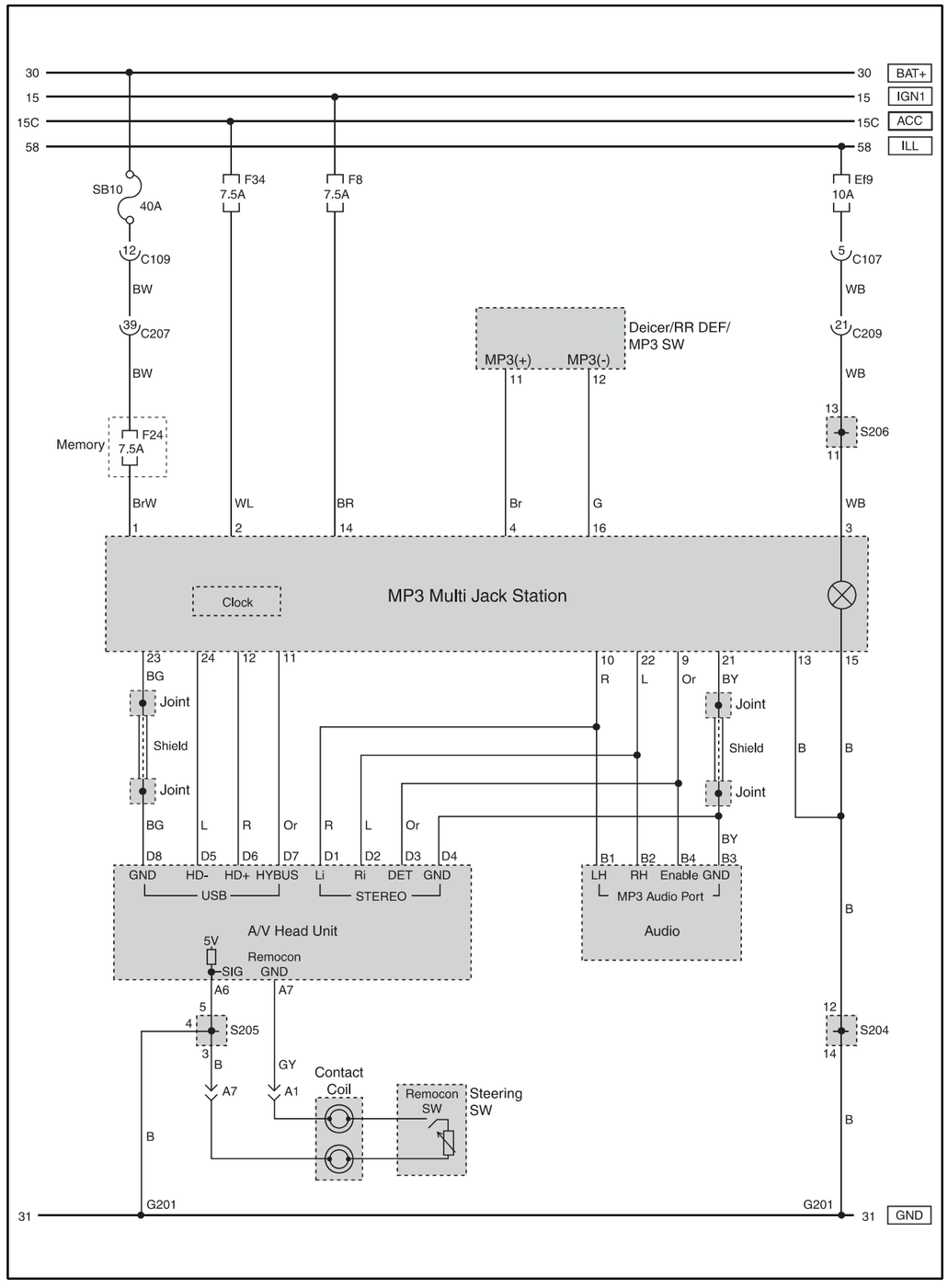
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C108 (4Pin, Colorless)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C206 (21Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C214 (20Pin, Black)	W/H Main - W/H Floor	Lower the Console Box	
C219 (39Pin, Gray)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C220 (20Pin, Black)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	C/Holder
C352 (21Pin, White)	W/H Main - W/H Driver DR	Inside the Driver Cowl Side PNL	
C361 (21Pin, White)	W/H Main - W/H Passenger DR	Inside the Passenger Cowl Side PNL	
C371 (21Pin, White)	W/H Floor - W/H RR LH DR	Under the Left “B” PLR	
C381 (21Pin, White)	W/H Floor - W/H RR RH DR	Under the Right “B” PLR	
G302	W/H Floor	Under the Passenger Seat	
G303	W/H Floor	Under the LH “B” PLR	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

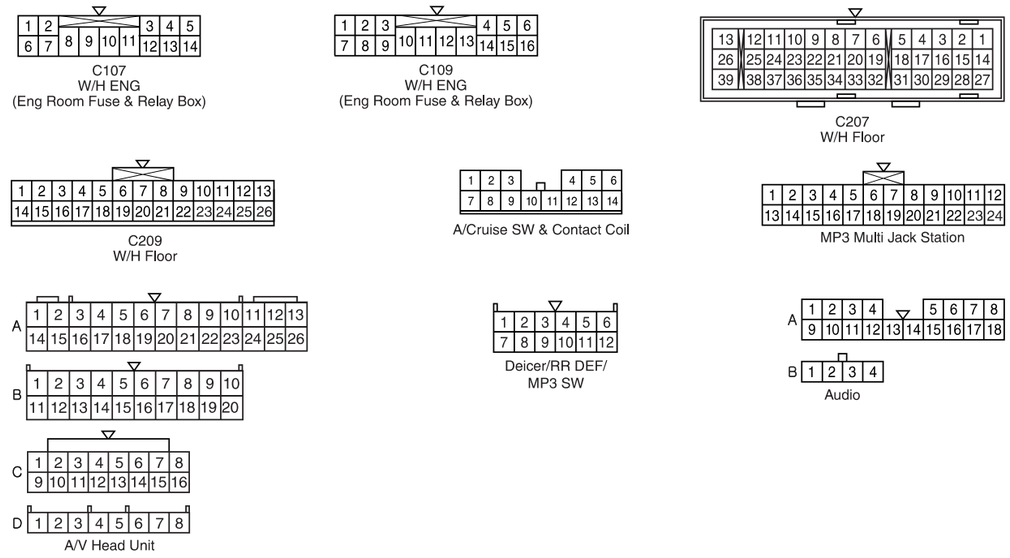
3) MP3 MULTI JACK STATION, A/V HEAD UNIT, AUDIO, MP3 SW



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
G201	W/H Main	Under the Driver Cowl Side PNL	
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S205 (14Pin, Black)	W/H Main	Backside A/V Head Unit	
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

(3) CIRCUIT DESCRIPTION

A. OVERVIEW

▶Difference Between Audio System and AV System

- Audio System

Standard Specification: Audio
Option 1: 2-DIN player (Radio and CD player, No cassette deck
Option 2: USB type MP3 jack (for multi jack staion)
The multi jack station includes the clock and stereo jack (MP3 USB jack is optional).
The speaker system consists of 4 speakers (one in each door) and 2 tweeter speakers (above each front door). The radio antenna is attached on the tailgate. The integrated type antenna is not available.

- AV System

Radio, CD/Cassette/MP3, TV and DVD system are available. The USB type MP3 jack is installed as the standard specification. If the navigation is installed, the GPS antenna is attached on the rear section of the roof.

The speaker system consists of 1 center speaker, 4 door speakers (one in each door) and 2 tweeter speakers (one in each door) and 1 woofer under the passenger seat.

1. AV head unit
2. Tuner
3. DSP amplifier (10 speakers including woofer speaker)
4. Navigation unit
5. 8-DVD changer
6. Multi jack station (including MP3 USB)
7. GPS antenna
8. AUX terminal (1 video terminal, 2 audio terminals)

* Some functions may not be included according to the model.

▶AV Head Unit

The AV head unit equipped with the DVD system has two optical input/ouput terminals; one is to receive the sound signal from the 8-DVD changer and the other is to send the sound to the amplifier with builtin DSP. The tuner unit transmits the TV and video signals to the head unit through cable.

▶Tuner

A tuner filters and cuts unnecessary signals among received signals and then precisely adjusts input signals. Connecting terminal of the tuner receives amplified signals from each TV antenna module locating rear quarter glass that receives TV signals from glass antenna. AM/FM radio module on the roof panel rear end receives amplified signals from glass antenna and then transmits to tuner input (1 channel).

- Tuner Specifications

NO	Characteristic/Function	Remarks
1	AM/FM 1PACK Tuner	
2	TV Tuner (HITACHI V1)	
3	External Video/Audio Input (SDMB Input or AUX Jack Input)	
4	Tuning: Manual, Seek, BSM, AS	
5	Preset Memory: FM1 (6), FM2 (6), AM (6), TV1 (6), TV2 (6)	

▶DSP Amplifier

DVD system displays high quality pictures and separates digital audio sources to give digital effects according to speaker arrangement. A chipset that can treat digital audio source signal is installed on the exterior AMP and has following function.

- DSP Amplifier Specifications

NO	Characteristic/Function	Remarks
1	DSP Function: Stadium, Hall, Church, Club	
2	EQ Control Function: Defeat, Classic Jazz, Rock	
3	Bass, Mid, Treble Adjustment: +/- 12dB (1dB Up/Down)	
4	Fader/Balance Function	
5	5.1CH SPDIF optical input function	

▶DVD Changer

The 8-DVD changer is connected to the AV head unit with optical fiber cable and also connected to the tuner to process the video signals. It is installed on the bracket under the rear left quarter trim with the navigation unit.

- DVD Changer Specifications

NO	Characteristic/Function	Remarks
1	Playing CD-DA, Video CD, DVD Video amd MP3 files	
2	Sound Output: L/R Output	
3	Video Output: NTSC Output	
4	Storing 8 DVDs	
5	Track Up/Down, Direct Selection Function	
6	Disc Up/Down, Direct Selection Function	
7	FF/FB, Up/Down Function	
8	Repeat	
9	PBC (Video CD ver 2.0 compatible)	
10	Scan Function	

▶AUX Termainal (for vehicle with AV system)

The AUX terminal is located between the seat warmer switches on the lower side of the AV head unit and it is installed only for the vehicle with the AV system. It is composed of AUDIO-R/AUDIO-L and VIDEO terminal which can be connected to a digital camera, camcoder and other digital devices to play the video through the AV system.

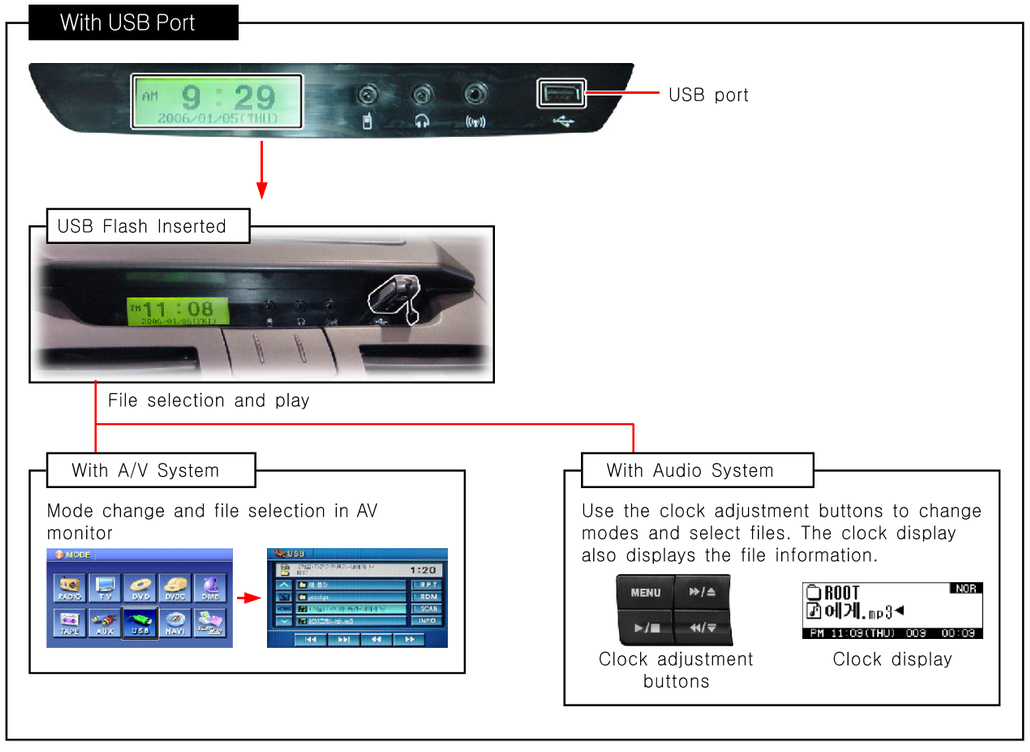
B. MULTI JACK STATION

▶Overview

The multi jack station is an integrated unit of digital clock and various audio play devices. It also includes the stereo jack which can be connected to an external audio device and the MP3 USB jack which can be connected to the USB flash drive for playing music through the speakers on vehicle.

▶Functional Specification

- Functions
  - · Clock (including date and year) adjustment
  - · Audio output through the stereo jack
  - · File search and play through the USB flash drive



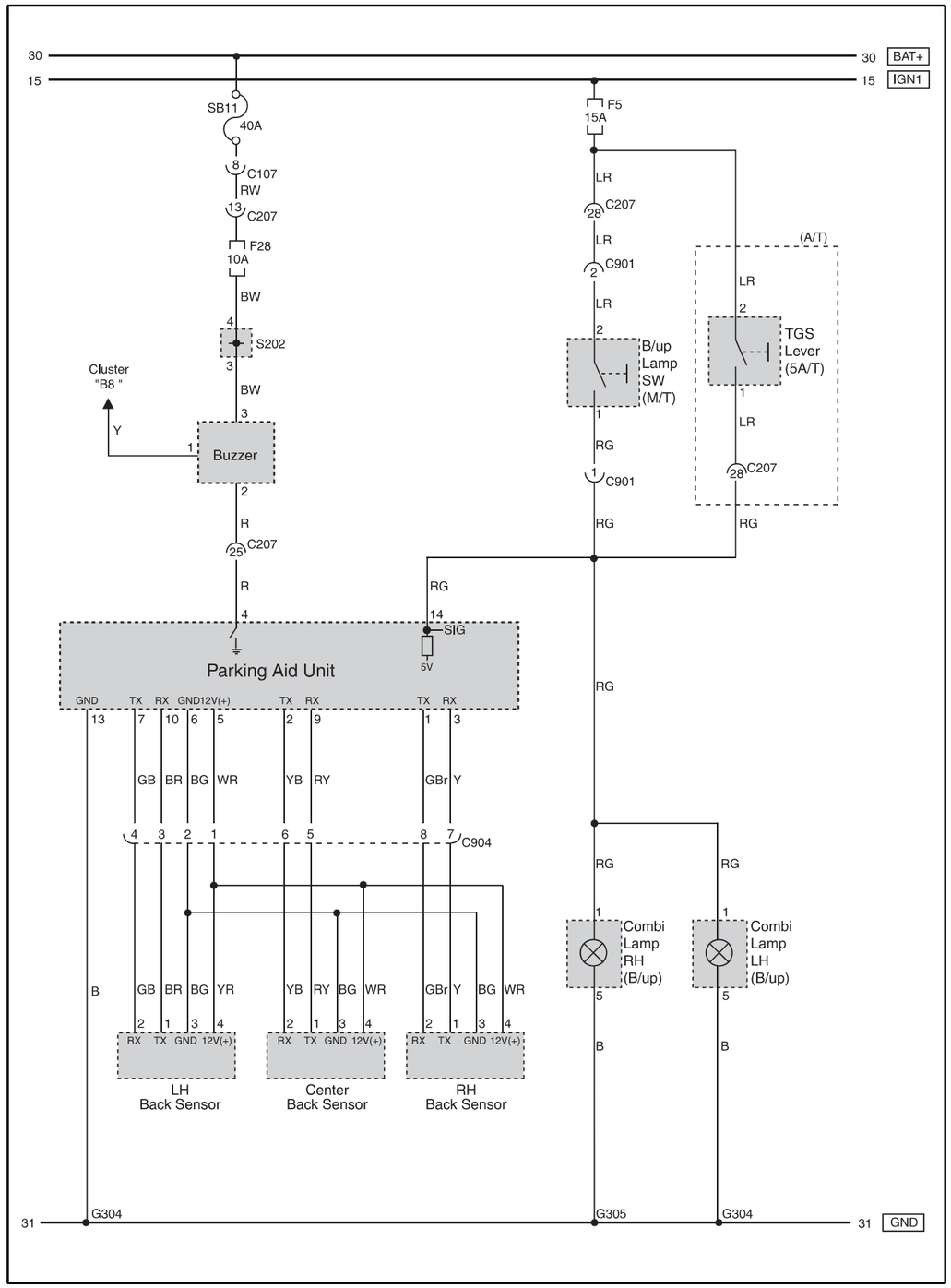
▶Electrical Performance

Items	Requirement	Remarks
Rated voltage	DC 12.0V	
Operating voltage	DC 6V ~ 16V	Should operate normally within this range.
Operating temperature	-30°C ~ +80°C	Should operate normally within this range.
Reserved temperature	-40°C ~ +90°C	
Max. operating humidity	95%	
Max. internal voltage	24V	
Insulating resistance	No heat and fire due to the current leaks.	Specified with the parts which needs insulation such as PCB, waterproof, coating, etc.
Dark current		AT DC 13V
Max. permissible current	Less than 5mA	AT DC 13V, current for illumination excluded
Number of audio channels	MAX 70 mA	
Audio frequency	STEREO (LH, RH, GND)	
Audio line output	20 Hz ~ 20 kHz	
CMR (Common Mode Rejection Ratio)	Vpp 4V 85dB	
Graphic LCD	160 X 48 BIT FSTN TYPE	
Text color	Black	
LCD size	66 X 26.5 mm	Actual display range: 60 X 16 mm
DOT pitch	0.35 X 0.33 mm	
Time tolerance	± 2s/day	

Modification basis	
Application basis	
Affected VIN	

S.G.N. 8790-01

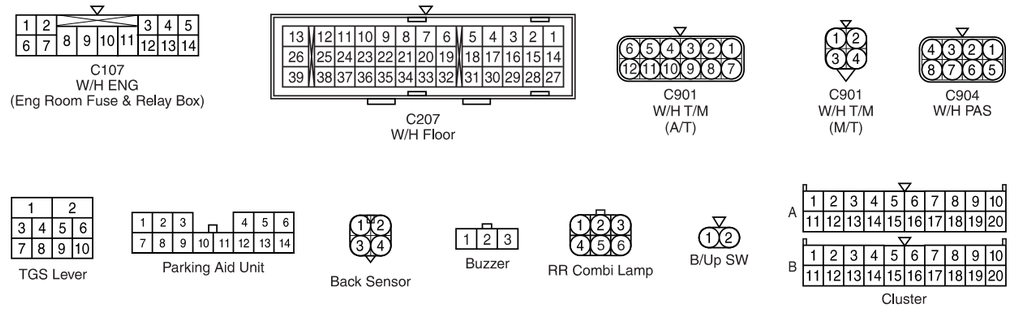
PARKING AID CIRCUIT



1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C901 (12Pin, Black)	W/H Floor - W/H T/M	Upper the T/M	A/T
C901 (4Pin, Black)	W/H Floor - W/H T/M	Upper the T/M	M/T
C904 (8Pin, Black)	W/H Floor - W/H PAS	Under the RR Bumper (LH)	
G304	W/H Floor	Inside the LH QTR GLS Lower	
G305	W/H Floor	Inside the LH QTR GLS Lower	
S202 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	

2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

3) CIRCUIT DESCRIPTION

(1) COMPONENT SPECIFICATIONS

The parking aid system emits the supersonic wave signals from the sensors on the rear bumper with a specific interval and detects the reflected signals from obstacles while the gear selector lever is in "R" position. The number of displaying bars is decreased and the alarm interval becomes faster as the obstacle approaches. This supplementary system is to secure the safety distance for parking.

Descriptions		Value	Descriptions		Value
Rated voltage		DC 12 V	Operating temperature		-30℃ ~ +80℃
Operating voltage		DC 9 V ~ 16 V	Storage temperature		-40℃ ~ +85℃
Current consumption	Unit	Below 100 mA	Relative humidity		95%RH max
	Sensor	Below 20 mA (each)	Weight	Unit	160g ± 10g max
Sensor insulating resistance		Over 5 MΩ		Sensor	70g ± 10g max

A. Parking aid unit

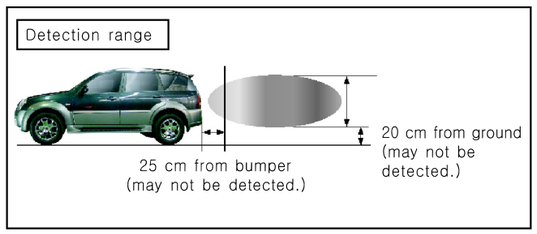
Detecting type: Super sonic wave
Detecting distance: 25 ~ 120 cm (distance between sensor and obstacle)

B. Parking aid sensor

- Type: Piezo ceramic element
- Frequency: 40 KHz ± 2 KHz
- Detecting range (13.5 V)
  - · Horizontal: Min. 20° at 110 ± 5 cm Min. 100° at 50 ± 5 cm
  - · Vertical: Min. 20° at 110 ± 5 cm Min. 60° at 50 ± 5 cm

(2) ALARM INTERVAL

Alarm interval and display changes according to the distance as below: While reversing, if obstacles are within stage 1, the warning beep sounds with long intervals. If within stage 2, the warning beep sounds with short intervals and if within stage 3, the warning beep sounds continuously.



Stage	L, R Sensor	C Sensor	Interval (msec)	Remark
1	90 ~ 100 cm	90 ~ 120 cm	65, 195	"Beep -----", "Beep -----"
2	60 ~ 90 cm		65, 65	"Beep -, Beep -, Beep -"
3	25 ~ 60 cm			"Beep -----"
Tolerance	± 5 cm		±10%	

(3) TROUBLESHOOTING OF SENSOR

When the shift lever is in the "R" position with the ignition switch on, the sensor is diagnosed once (under normal condition, the buzzer sounds once). If found any failure due to open circuit to sensor or communication error, buzzer sounds as below: However, if more than one sensor are malfunctioning, warning buzzer sounds for 3 seconds.

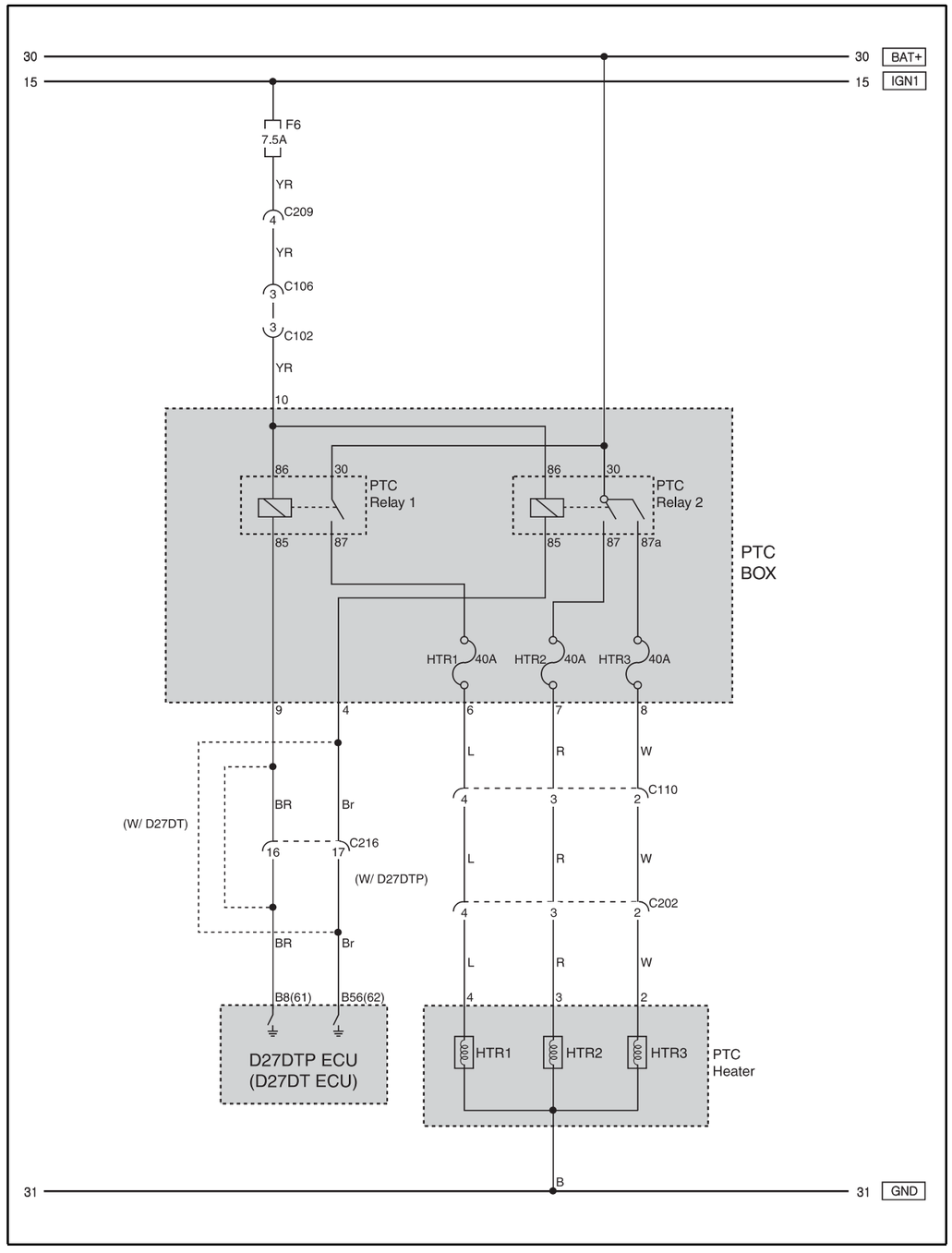
▶When sensor fails self-diagnosis

Malfunction mode	Interval (msec)	Remark
Left sensor error	65, 65, 195	"beep----beep"
Center sensor error	65, 65, 65, 195, 65	"beep, beep---- beep, beep"
Right sensor error	65, 65, 65, 195, 65	"beep, beep, beep---- beep, beep, beep"
Multiple sensor error	3 seconds	The buzzer sounds for 3 seconds if there is any defect in more than one sensor.

Modification basis	
Application basis	
Affected VIN	

S.G.N. 6810-15

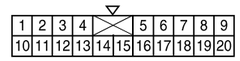
PTC (POSITIVE TEMPERATURE COEFFICIENT) HEATER

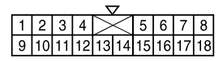


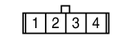
1) CONNECTOR INFORMATION

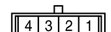
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C106 (18Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C110 (4Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C202 (4Pin, White)	W/H Main - W/H Floor	Under the I/P Fuse Box	PTC
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder

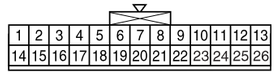
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

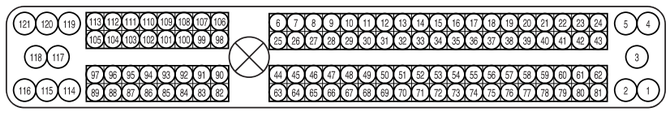

C102
W/H Floor
(Eng Room Fuse & Relay Box)

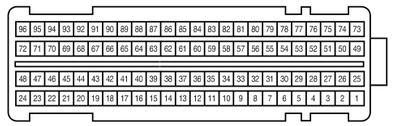

C106
W/H Floor
(Eng Room Fuse & Relay Box)

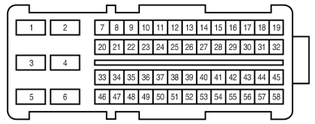

C110
W/H ENG
(Eng Room Fuse & Relay Box)

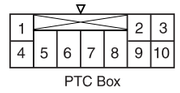

C202
W/H Floor


C216
W/H Eng


D27DTP ECU


D27DTP ECU "A"


D27DTP ECU "B"


PTC Box

Modification basis	
Application basis	
Affected VIN	

3) CIRCUIT DESCRIPTION

(1) PTC (POSITIVE TEMPERATURE COEFFICIENT) SYSTEM

The supplementary electrical heater is installed in DSL engine equipped vehicle as a basic equipment. The PTC system is operated according to two temperature values measured at the coolant temperature sensor and HFM sensor. This device is mounted in the heater air outlet and increase the temperature of air to the passenger room. Because PTC system is heated by electrical power, high capacity alternator is required. (Alternator of 12 V 75 A/90 A has changed to 12 V 140A)

(2) PTC OPERATING (ON) CONDITION

The operating condition of PTC is controlled by two step. Generally, ECU control the power relay for PTC depending on the coolant temperature and ambient temperature sensor.

▶ **1st step (Initial PTC operating condition**

- When coolant temperature < 15°C, PTC is operating (ON).
- When coolant temperature ≥ 15°C, tow conditions decribed below must be satisfied.

▶ 2nd step (Coolant temperature: 15°C)

- When coolant temperature 65°C ≤ and ambient temperature ≤ 10°C PTC operates (ON)
- When coolant temperature 65 ~ 60°C and ambient temperature −10°C ~ 0°C PTC operates (ON)
- When coolant temperature ≤ 60°C and ambient temperature ≤ 0°C ~ 5°C, PTC operates (ON)

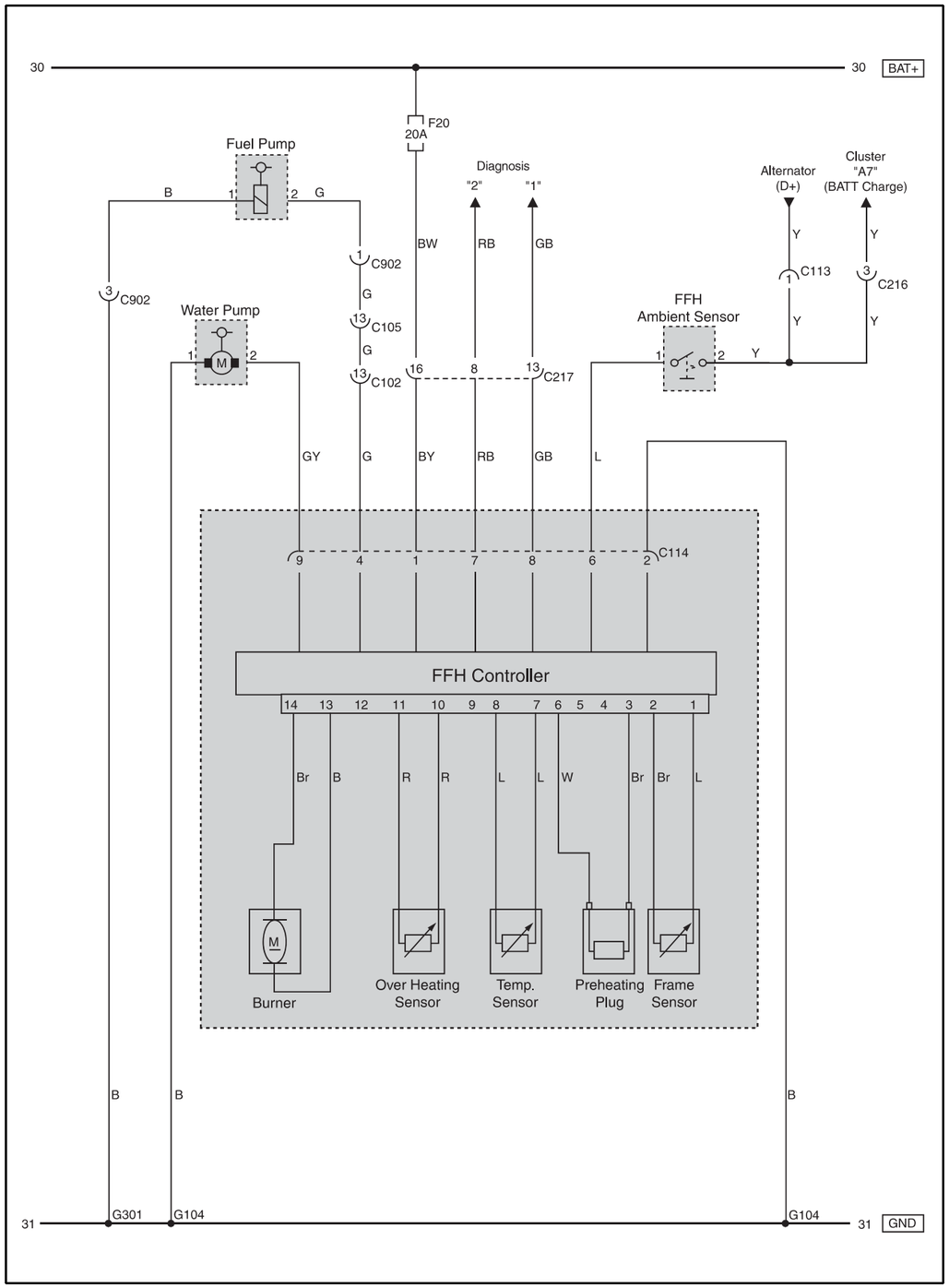
▶ PTC "OFF" CONDITION

- Airconditioner blower switch OFF
- Ambient temperature sensor error (wiring short or open)
- When engine craking
- Battery voltage is lower than 11V
- When preheating the engine (Glow indicator "ON")

Modification basis	
Application basis	
Affected VIN	

S.G.N. 6910-01

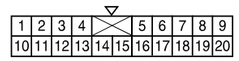
FFH (FUEL FIRED HEATER)

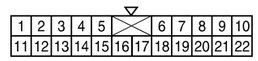


1) CONNECTOR INFORMATION

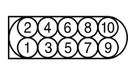
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C105 (22Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C113 (2Pin, Black)	W/H Eng - W/H Alternator	Under the Coolant Reserve Tank	
C114 (16Pin, Black)	W/H Eng - W/H FFH	Backside Coolant Reserve Tank	FFH
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C902 (4Pin, Black)	W/H Floor - W/H Fuel Sender	Upper the T/M	
G104	W/H Eng	Backside RH Head Lamp	
G301	W/H Eng	Under the Driver Seat	

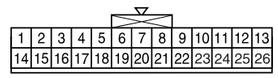
2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION

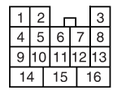

C102
W/H Floor
(Eng Room Fuse & Relay Box)


C105
W/H Floor
(Eng Room Fuse & Relay Box)

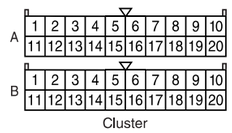
C113
W/H Alternator


C114
W/H FFH


C216
W/H Eng


C217
W/H Eng

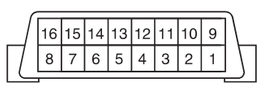
C902
W/H Fuel Sensor


Cluster

AMBI Sensor
(FFH)

Fuel Pump
(FFH)

Water Pump


Diagnosis

Modification basis	
Application basis	
Affected VIN	

3) CIRCUIT DESCRIPTION

(1) FFH (FUEL FIRED HEATER) SYSTEM

The system is to increase the coolant temperature quickly by firing diesel fuel in the burner that is installed in engine cooling system when in winter time the ambient temperature and engine coolant temperature is low.
(Option)
FFH System consists of independent fuel lines, fuel pump, coolant circuit, coolant ciculation pump, electrical glow plug and exhaust system by driver's intention because FFH system is automatically. Operated according to the coolant temperature and the ambient temperature.
FFH system operates up to more than 2 minutes to burn the residual fuel inside the system when driver stop the engine during its operation. Therefore, a certain period of FFH operation after stopping the engine is not a malfunction.

(2) CONTROL AND SAFETY MODE

▶ **Heater operations and safety mode**

- If the fuel pump

· 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.
· 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.
· 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.
· The heater is switched off if the lower or upper voltage limit is reached.
· The fuel pump does not start when the glow plug is defect or electrical lead to the dosing pump is interrupted.
· The fan motor speed is monitored continuously. If the fan motor does not start up, is blocked or if the speed falls below 40% of the nominal speed, the heater is switched off in fault mode after 60 seconds.
· It is possible to diagnose the system by connecting the diagnostic device to controller. For details, refer to the "Diagnosis Procedures" section.

NOTE

Emergency shutdown

If an emergency shutdown -EMERGENCY OFF- is necessary during operation, proceed as follows;

- Pull the fuse (Ef6: 20A) out.
- Disconnect the heater from the battery.

(3) DTC (DIAGNOSIS TROUBLE CODE)

Trouble Code	Trouble Description	Remedies
0	No faults	• Measure battery voltage (must be < 15.9V)
10	Shutdown for overvoltage	• Check alternator • Check alternator over voltage
11	Shutdown for undervoltage	• Measure battery voltage (must be > 10.2V under load) • Check alternator • Check lead
12	Overheating (software threshold)	Temperature at overheating sensor >125°C • Check cooling system: • Check the temperature sensor and overheating sensor, replace if necessary
14	Overheating (difference evaluation)	trol overheating sensor is too large. (Prerequisite for this trouble perature at the overheating sensor has reached min. 80°C) • Check cooling system • Check the temperature sensor and overheating sensor, replace if necessary
15	Overheating (operating block)	The controller is locked. • Delete the fault memory to release the controller • Check cooling system • Check the temperature sensor and overheating sensor, replace if necessary
16	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 (hardware, device)	Temperature at control overheating sensor > 125°C • Check cooling system • Check the temperature sensor and overheating sensor,replace if necessary
20	Glow plug interruption	• Check cable harness for this component for damage and through current and replace component if necessary • Check plug-in connection, replace component if necessary
21	Overload, short-circuit or ground contact, glow plug output	• Check cable harness for this component for damage, replace component if necessary
22	Glow plug output defect	• Check cable harness for this component for damage, replace component if necessary
25	Comunication line short	• Check the line

Modification basis	
Application basis	
Affected VIN	

Trouble Code	Trouble Description	Remedies
30	Speed of combustion fan motor outside tolerable range	Fan wheel or combustion air fan motor blocked (frozen, contaminated, stiff, cable harness scrapes on shaft end, …) • Eliminate blockage • Measure speed of combustion air fan motor: – dismantle combustion air fan – check with 8.2 V + 0.2 V, to do so, unclip the cable 0.75 black from chamber 13 of the 14-pin connector and the cable 0.75² brown from chamber 14. Apply marking (white paint) to the fan wheel and measure speed with contactless speed meter. If the measured speed is outside a range of 8,800 rpm to 10,400 rpm, then replace the combustion fan. If the measured speed is within a range of 8800 rpm to 10400 rpm, then replace the controller.
31	Burner motor interruption	• Check cable harness for this component for damage and through current • Check plug-in connection, replace component if necessary
32	Overload, short-circuit or ground contact, burner motor	• Fan wheel or combustion air fan motor blocked (contaminated, stiff) • Check cable harness of this component for damage, if necessary replace component
34	Burner motor output defect	• Check whether the lead to this component has a short-circuit to GND, if not, check component for ground contact, if necessary replace controller
47	Overload, short-circuit or ground contact, fuel pump	• Check cable harness to the external component for damage and through current and replace external component if necessary
48	Fuel pump interruption	• Check cable harness to the external component for damage and through current • Check plug-in connection, replace external component if necessary
49	Fuel pump output defect	• Check whether lead to this component has short-circuit to +Ub, if not, check component for ground contact, replace controller if necessary
50	Operating block because too many start attempts in vain (10 start attempts, also one start repeat for every start attempt)	Too many start attempts, the controller is locked • Delete the fault memory to release the controller • Check fuel quantity and fuel supply
51	Time exceeded for cold blowing	• During start (no flame formed yet), the flame sensor reports temperature value too high for too long • Check exhaust and combustion air • Check flame sensor
52	Safety time exceeded	• Check exhaust and combustion air system • Check fuel quantity and fuel supply • Clean or replace sieve used in fitting of fuel pump
53 54 56	Flame aborted from “power” stage Flame aborted from “large” stage Flame aborted from “small” stage	Warning *In the case of flame aborted in “power”, “large” and “small” stage and with still tolerable start attempts, the heater proceeds with a new start or with subsequent start repeat. If the new start or start repeat is successful, the trouble code display goes off.* Fault(because no more start attempt allowed) • Check exhaust and combustion air system • Check fuel quantity and fuel supply • Check flame sensor – see trouble code 64 and 65
60	Control overheating sensor interruption	• Check cable harness to this component for damage and through current • Check plug-in connection • Check sensor resistance value, replace component if necessary
61	Short circuit or ground contact control overheating sensor	• Check cable harness to this component for damage • Check sensor resistance value, replace external component if necessary
64	Flame sensor interruption	• Check cable harness to this component for damage and through current • Check plug-in connection • Check sensor resistance value, replace component if necessary
65	Short circuit flame sensor	• Check cable harness to this component for damage • Check sensor resistance value, replace external component if necessary
71	Surface sensor interruption	• Check cable harness to this component for damage and through current • Check plug-in connection • Check sensor resistance value, replace component if necessary
72	Short circuit surface sensor	• Check cable harness to this component for damage • Check sensor resistance value, replace external component if necessary
74	Overheating hardware defect, operating block	• Replace controller
87	Internal temperature sensor short-circuit	• Replace controller
88	Internal temperature sensor interruption	• Replace controller
89	CAN error	• Check CAN interface
90	Watch dog reset	• Replace controller

Trouble Code	Trouble Description	Remedies
91	Too many resets	• Replace controller
92	ROM error	• Replace controller
93	RAM error	• Replace controller
94	Transistor fault occurs too frequently – operation block	• Remedy short-circuit of the component to +Ub to GND, replace controller if necessary
95	Software stack overflow	• Replace controller
96	No valid process, operation lock	• Replace controller
97	Resonator/quartz faulty, wrong processor cycle	• Replace controller
98	Main relay faulty	• Replace controller
99	EEPROM error	• Replace controller

(4) GENERAL TROUBLE CAUSES AND REMEDIES

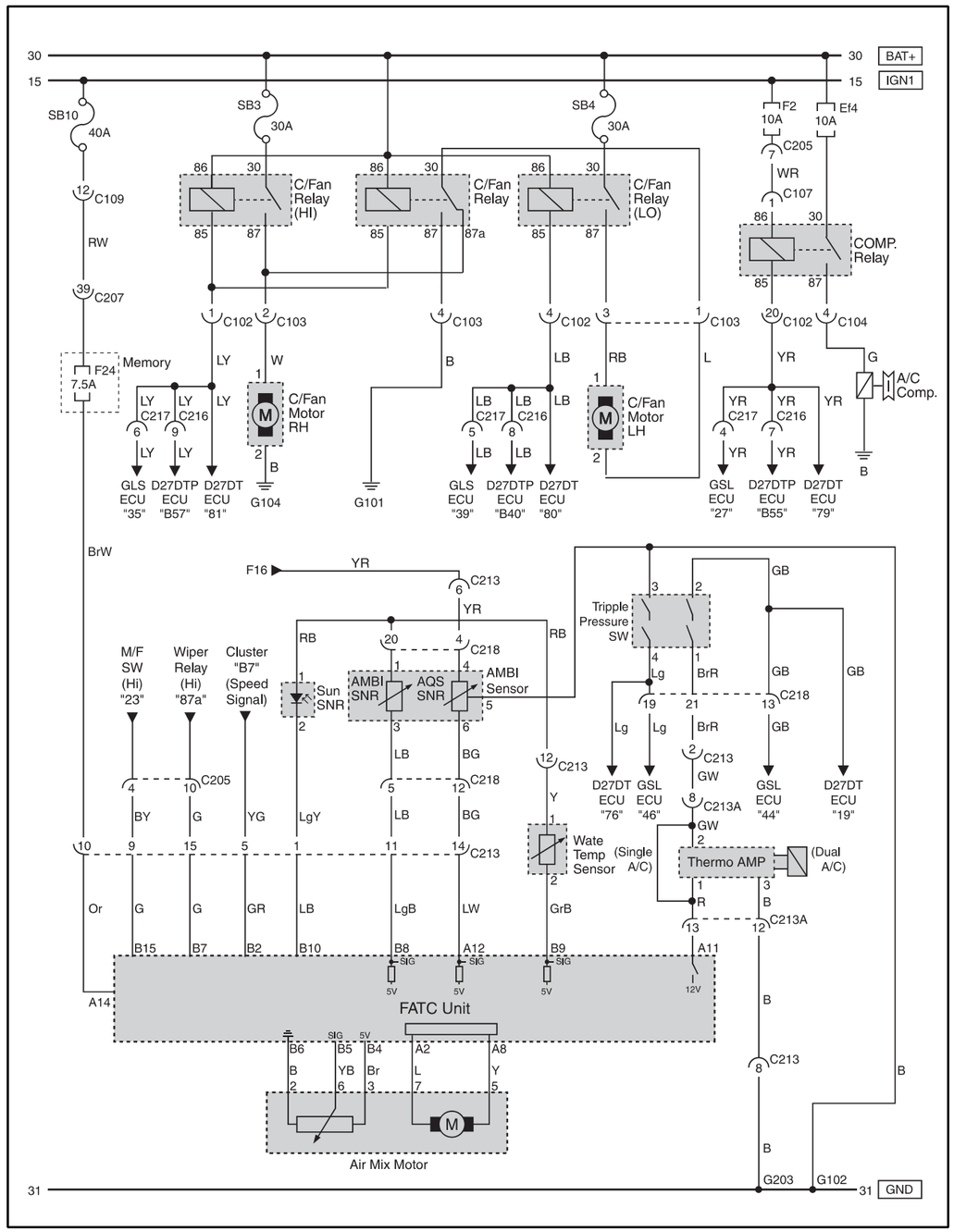
Condition	Causes	Remedies
Low coolant level	Coolant leakage	Change the radiatior
	Leakage in coolant auxiliary tank	Change the coolant auxiliary tank
	Leakage in heater core	Change heater core
	Leakage in joint junction of coolant hose	Check the condition of hose and changing clamp
	Leakage in defective coolant hose	Change the hose
	Leakage in water pump gasket	Change the gasket
	Leakage in water pump sealing	Change the water pump
	Leakage in water inlet cap	Change the water inlet cap gasket
	Leakagein thermostat housing	Change the thermostat sealing
	Insufficient tightening torque of cylinder head bolt	Fasten the bolt to specified torque
	Damaged cylinder head gasket	Change the head gasket
Abnormally high coolant temperature	The coolant leakage (Check the coolant level)	Add coolant
	excessive anti-freezer	Check the density coolant (Anti-freezer)
	Bad coolant hose condition	Check the bent area of hose or change if needed
	Defective themostat	Change thermostat
	Defective water pump	Change water pump
	Defective radiator	Change radiator
	Defective coolant auxiliary tank or tank cap	Change coolant auxiliary tank or tank cap
	Crack in cylinder head or in cylinder block	Change cylinder head or cylinder block
	Clogged water flow in cylinder head or block	Clean the coolant flow line
	Clogged water flow in radiator core	Clean the radiator core
	Defective cooling fan	Change or check the cooling fan
	Defective temp.sensor, wiring, and lamp cluster	Chaange the sensor and related area
Abnormally loow coolant temperature	Defective thermostat	Change the thermostat
	Defective cooling fan	Change or check the cooling fan
	Defective tem.sensor, wiring, and lamp cluster	Change the sensor and related area

Modification basis	
Application basis	
Affected VIN	

S.G.N. 6810-20

FATC (FULL AUTO TEMP. CONTROL) CIRCUIT

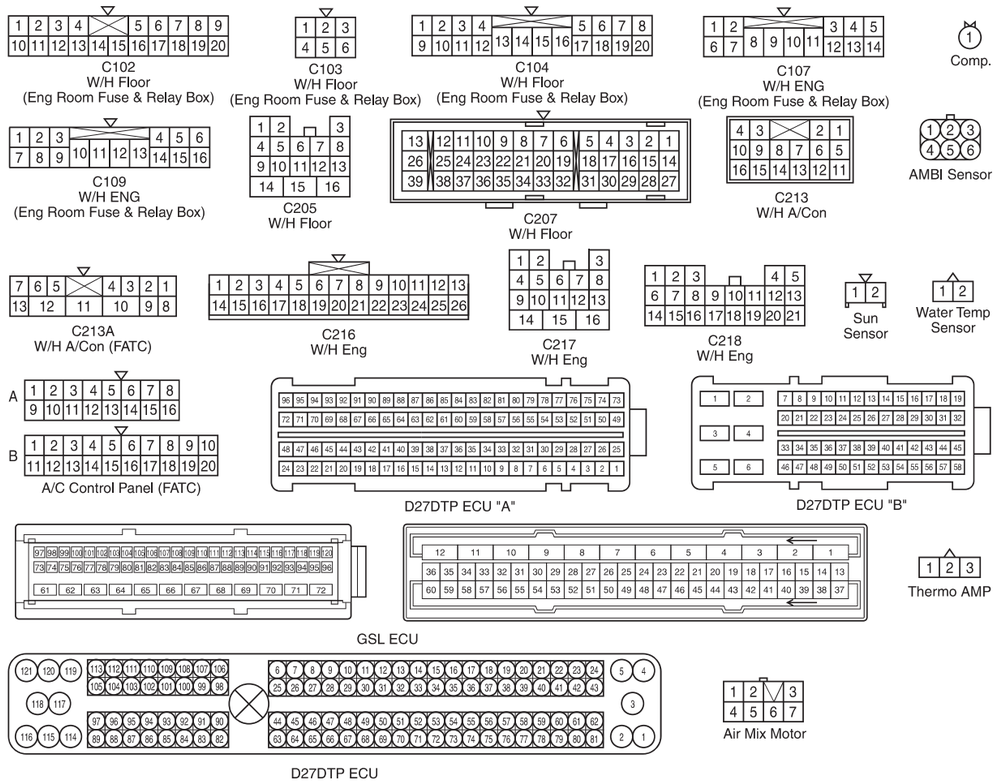
1) CONDENSOR FAN, SENSOR (SUN, AMBI, WATER TEMP)



(1) CONNECTOR INFORMATION

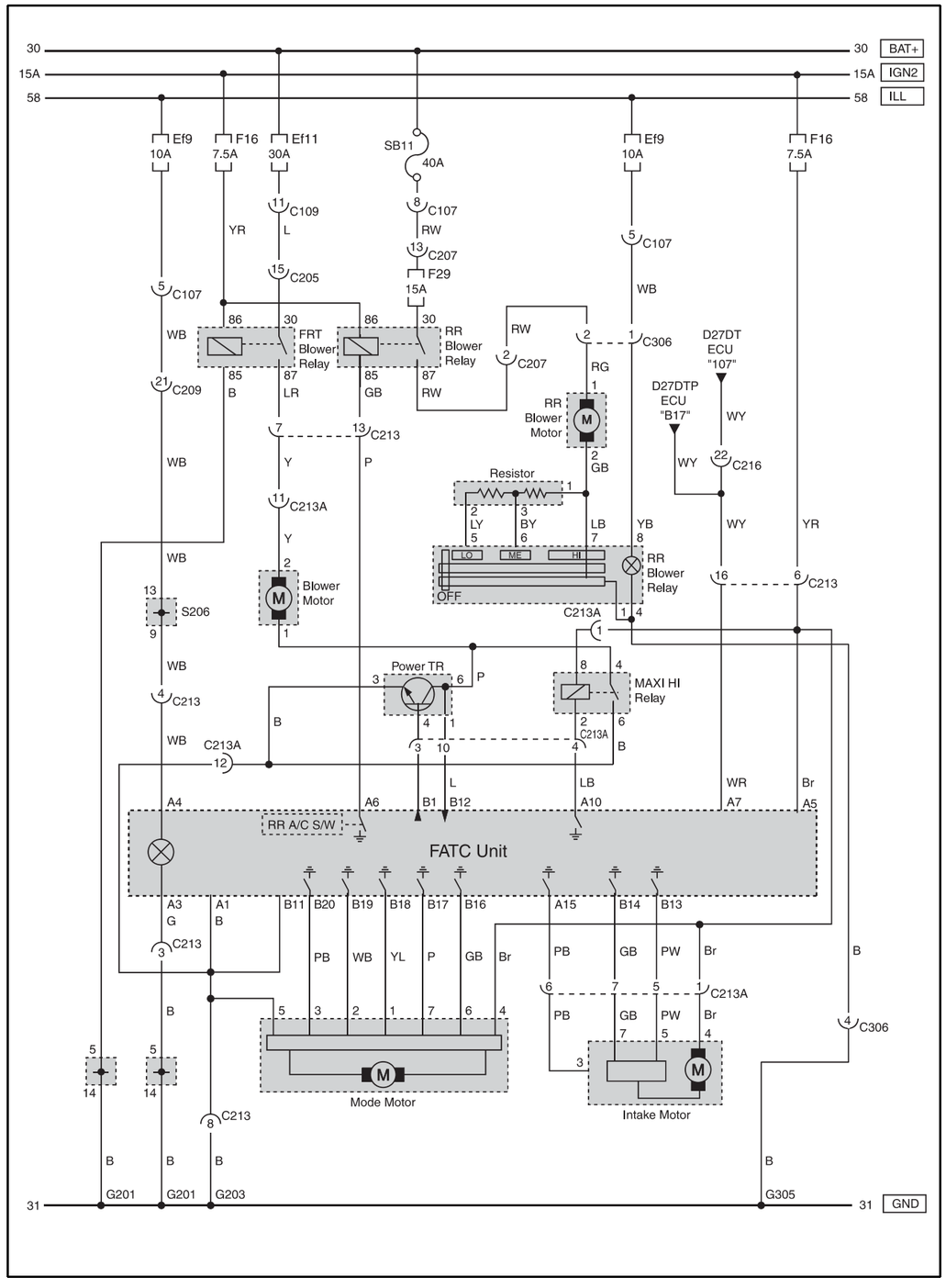
Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C102 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C103 (6Pin, Colorless)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C104 (20Pin, White)	W/H Floor - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C213 (16Pin, White)	W/H Main - W/H A/Con	Backside the A/V Head Unit	
C213A (13Pin, White)	W/H A/Con - W/H Blower	Backside the Glove Box	
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C217 (16Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C218 (21Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
G102	W/H Eng	Center the Eng BATT	
G203	W/H Main	Inside the Passenger Cowl Side PNL	

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



Modification basis	
Application basis	
Affected VIN	

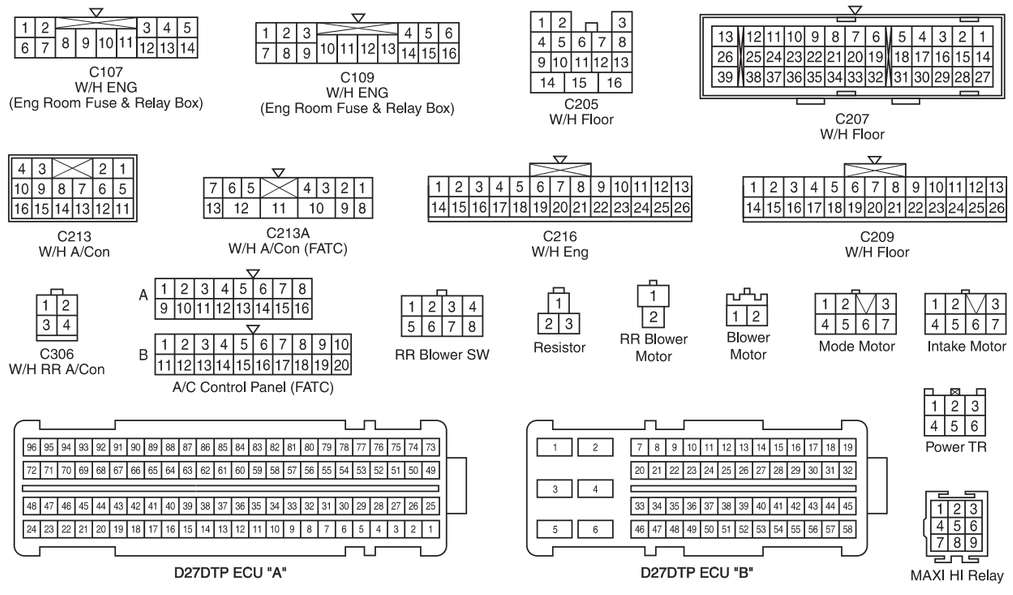
2) MOTOR (MODE, INTAKE), BLOWER, POWER TR



(1) CONNECTOR INFORMATION

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C107 (14Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C109 (16Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C205 (16Pin, White)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C207 (39Pin, Gray)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C209 (26Pin, Black)	W/H Main - W/H Floor	Driver Cowl Side C/Holder	C/Holder
C213 (16Pin, White)	W/H Main - W/H A/Con	Backside the A/V Head Unit	
C213A (13Pin, White)	W/H A/Con - W/H Blower	Backside the Glove Box	
C216 (26Pin, White)	W/H Main - W/H Eng	Passenger Cowl Side C/Holder	C/Holder
C306 (4Pin, Colorless)	W/H Floor - W/H RR A/Con	Inside the 3RD Seat RH Trim	Duel A/Con
G201	W/H Main	Under the Driver Cowl Side PNL	
G203	W/H Main	Inside the Passenger Cowl Side PNL	
G305	W/H Floor	Inside the LH QTR GLS Lower	
S201 (14Pin, Black)	W/H Main	Upper the I/P Relay Box	GND
S204 (14Pin, Black)	W/H Main	Backside A/V Head Unit	GND
S206 (14Pin, Black)	W/H Main	Backside A/V Head Unit	ILL

(2) CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION



CIRCUIT

REXTON 2006.09

Modification basis	
Application basis	
Affected VIN	

(3) CIRCUIT DESCRIPTION

A. 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 thesystem. The FATC receives driver's input signal and various input signal from sensors and controls the actuatorsto maintain driver's desired room temperature.

B. SELF DIAGNOSIS (ONLY FOR FATC AIR CONDITIONER)

▶Self Diagnosis Code

The FATC controller has the self diagnosis function. Perform the self diagnosis procedure to find the trouble code before starting the repair job.

- Starting Self Diagnosis
  - · Turn the ignition switch to ON position.
  - · Set the temperature to 26°C with the temperature setting switch.
  - · With "AUTO" switch pressed, press "OFF" switch 3 times within 3 seconds after setting the temperature. The Micom displays the trouble code on the display window after self diagnosis.

- Erasing Conditions of Trouble Code
  - · When restarting the engine
  - · When pressing "OFF" switch after self diagnosis
  - · 39 seconds after starting the self diagnosis procedure

- Fail Safe Function

If the input value from the sensor is wrong, Micom compensates the incorrect value to determine the correct setting temperature.

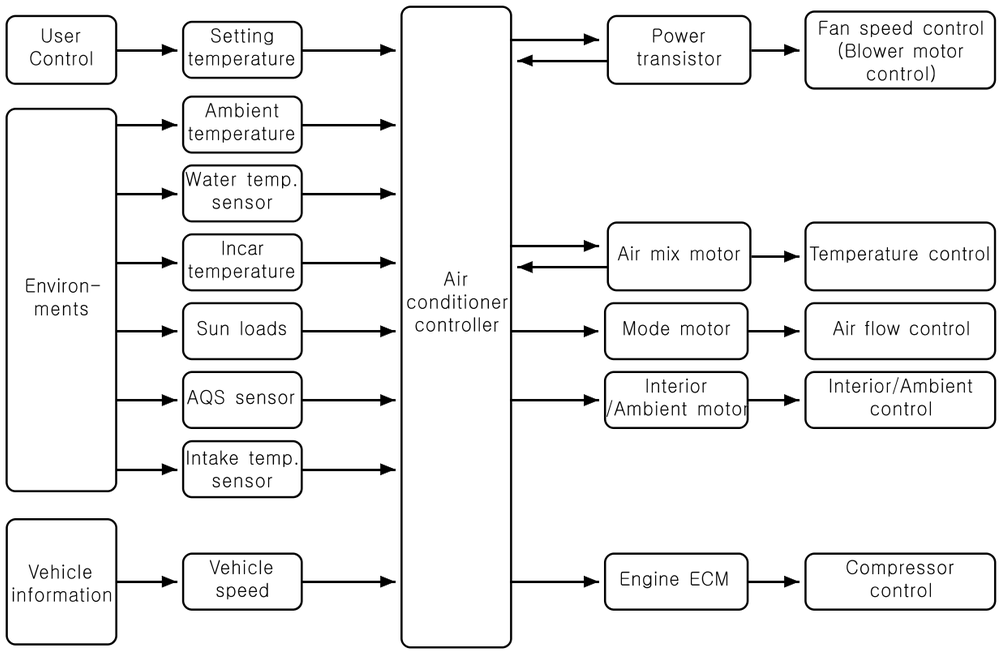
▶Self Diagnosis

- Set the temperature to 26°C with the temperature setting switch. With "AUTO" switch pressed, press "OFF" switch 3 times within 3 seconds after setting the
- temperature.
- Now, the air conditioner controller start the self diagnosis procedure.
  After self diagnosis, Micom integrated in controller displays the trouble codes in turns
- on the display window.
  The system resumes in AUTO mode after displaying the trouble code.

▶ **Specifications**

Type		Specifications	
Compressor	Model	V - 5 (single)	KC83 (dual)
	Type	Variable displacement type	Fixed type
	Disaplcement (cc/rev)	9.8 ~ 151	175.5
	Refrigerant oil	265 ml (Composite PAG oil)	220 ml (ZXL 100PG)
Condenser	Type	MFC	
	Size	656w X 455h X 16t	
Receiver Drier	Capacity	250cc	
	Moisture absorbent	XH - 9 (35g)	
	Pressure switch	Triple pressure type, Refrigerant pressure sensor	
Front Air conditioner and Heater Unit	Type	Heater + Evaporator & Blower (2 pieces)	
	Heating capability	Min. 9040 kcal/hr (340m³/h)	
	Cooling capability	Min. 6300 kcal/hr (405m³/h)	
	Expansion valve	Block type	
	Input power	Max. 22A(at 12V)	
Fefrigerant	Specification	R134a	
	Capacity	Single: 720 ± 30g / Dual: 1120 ± 30g	

C. SYSTEM DIAGRAM



▶ Air Conditioner Compressor Control by Engine ECU

In case of current vehicle models, the system turns ON/OFF the compressor switch according to refrigerant pressure, ambient temperature and condenser temperature to protect air conditioner circuits. However, for the vehicle equipped with DI engine, the engine ECU turns off air conditioner compressor as below in addition to above conditions.

- Coolant temperature: below −20°C
- Coolant temperature: over 115°C
- For approx. 4 seconds after starting the engine
- When engine speed is below 650 rpm
- When engine speed is over 4,500 rpm
- During abrupt acceleration for the vehicle equipped with manual transmission

D. ACTIVE INCAR/HUMIDITY SENSOR (AIH SENSOR)

The AIH sensor is installed at the driver side instrument panel undercover. It is a sensor that detects interiortemperature and humidity.

▶Functions

- Interior temperature sensor
  This sensor is a negative temperature coefficient (NTC) thermistor and detects the interior temperaturewith air coming from senor hole and then sends the voltage value according to the changed resistance toFATC controller.
- Humidity sensor
  This sensor detects the interior humidity with humidity cell and then sends the voltage value according tothe changed humidity to FATC controller.

▶Inspection

If the active incar sensor defect code (DTC 1) and the humidity sensor defect code (DTC 10) are set, check as below:

- Active incar sensor
  - · Remove the integrated AIH sensor and measure the resistance between terminal No. 5 and 6 on thesensor connector. (standard: approx. 25°C, 2.2 kW)
  - · If the measured value is out of the specified range, replace the AIH sensor. If the measured values arewithin the specified range, check as below.
  - · Turn the ignition switch to ON position and measure the voltage to active incar sensor from the FATCcontroller connector. (standard: approx. 2 V at 25°C)
  - · If the voltage value cannot be measured, check the circuit for open. If the measured value is within thespecified range, replace the FATC controller.

- Humidity sensor
  - · Apply 5 V to terminal No. 1 and 3 on the humidity sensor connector.
  - · Connect the positive (+) probe of a tester on No. 2 terminal and the negative (-) probe on No. 3 terminal, andmeasure the output voltage while the voltage is applied. (output voltage: approx. 0.8 ~ 3.4 V)
  - · Check whether the output voltage is changed when blowing into the inlet of the sensor. If there is avoltage change, the sensor is in normal condition. However, if the voltage is not changed, replace thehumidity sensor.
  - · In addition, if the output voltage is extremely high or low even in the specified range, replace the humid-ity sensor.

Modification basis	
Application basis	
Affected VIN	

E. AIR QUALITY SYSTEM (AQS)

▶Components of AQS

Air Quality System (AQS) changes the air source selection to recirculation mode when polluted air is detectedthrough AQS sensor. The air source selection returns back to fresh air intake mode after a specified period orthe polluted air is disappeared.

▶AQS and air source selection switch

The AQS switch is integrated with the air source selection switch.

▶AUTO Mod

The air source is not changed when pressing the AQS and air source selection switch in "AUTO" mode. However,the indicator on the switch turned ON/OFF. In other words, the air source cannot be changed to recirculationmode in AUTO mode by just pressing the switch.To change the air source to recirculation mode in AUTO mode, get into Manual mode first, then press the airsource selection switch.

▶Manual Mode

To change the AQS mode to Manual mode from AUTO mode, use the MODE switch or the fan speed controldial. In Manual mode, the "AUTO" symbol on the display is disappeared. When pressing the AQS and air sourceselection switch, the mode is changed in order of AQS LED ON, AQS LED OFF (fresh air), and air source LEDON (recirculation). The figure shows that the mode has been changed to the recirculation mode from fresh air mode under AQSmode (AQS LED ON) after detecting the polluted outside air.

▶AQS operation

To change the AQS mode to Manual mode from AUTO mode, use the MODE switch or the The AQS operates under air conditioner AUTO mode or when the AQS switch is pressed under manual mode.It requires preheating time (for seconds) for operation and the module and sensor are integrated. (However, it operates only when the DEF (defroster) switch on the air conditioner switch panel is not pressed in.)

- Self diagnosis and preheating process during initial operation of A/C controller (AUTO mode)
  - · When the air conditioner controller is operated in AUTO mode during its initial operation, the air sourceis changed to the recirculation mode and AQS LED comes on.(This is the self diagnosis and preheating process for AQS.)
  - · After completing the above process, the AQS LED is turned off and the air source is automaticallychanged to the fresh air mode.

▶AQS operation (AQS switch is pressed in): detecting the polluted outside air

- When pressing the AQS switch, the LED on the AQS switch is turned on and the AQS function is activated.
- When the polluted outside air is detected, the AQS operates and converts the air source to recirculationmode automatically. At this moment, the recirculation mode indicator comes on in the display.

▶When driving out of polluted area

- If the polluted air is disappeared, the air source is automatically changed to the fresh air mode and AQSLED stays on.
- The air source is not changed when pressing the AQS and air source selection switch in "AUTO" mode. To change the air source to recirculation mode in AUTO mode, get into Manual mode first, then pressthe air source selection switch.

F. AQS OPERATION CIRCUIT

▶AQS sensor

- Measure the voltage value of AQS. (between connector terminal No. 3 and 4.)
- If the measured voltage is out of 0.1 to 4.8 V, replace the AQS.
- If the measured voltage is out of the specified range, replace the AQS. If it is within the specified range, check as below.
- Turn the ignition key to "ON" position.
- Measure the voltage between terminal B9 and B15 on the air conditioner controller.
- If the voltage value cannot be measured, check the circuit for open. If the measured value is within thespecified range, replace the FATC controller.

▶Ambient temperature sensor

- Remove the sensor and measure the resistance between terminal No. 5 and 6 on the sensor connector. (standard: approx. 25°C, 2.2 kW)In addition, if the resistance is extremely high or low, replace the sensor.
- If the measured value is out of the specified range, replace the ambient temperature sensor. If themeasured value is within the specified range, check as below.
- Turn the ignition switch to ON position and measure the voltage to ambient temperature sensor from theFATC controller connector. (standard: approx. 2 V at
- 25°C)

  If the voltage value cannot be measured, check the circuit for open. If the measured value is within thespecified range, replace the FATC controller.

G. SUN SENSOR

It is installed on the upper left end of instrument panel. It is using characteristics that the amount of currentchanges according to amount of light on the photosensitive surface. Photo diode, converts the changes in lightintensity into electrical changes, detects the amount of light coming through windshield and changes it intocurrent and then sends the signal to FATC controller.

▶Inspection

- Remove the sun sensor and measure the current between terminals under sunlight.
- Measure the current again under shade. It is in normal conditions if the measured value is less than themeasured value under sunlight.
- Turn the ignition switch to "ON" position.
- Measure the voltage to the sun sensor from FATC connector. (approx. 2.5 V under sunlight and 4.8 Vunder shade.)
- If the voltage value cannot be measured, check the circuit for open. If the measured value is within thespecified range, replace the FATC controller.

H. WATER TEMPERATURE SENSOR

The water temperature sensor is installed on the top of heater unit. It detects the inside temperature of waterand transmits the voltage value that is changed according to resistance value (NTC) to FATC controller.

▶Inspection

If the water temperature sensor defect code (DTC 3) is set, check as below.

- Remove the water temperature sensor and measure the resistance between terminals on the sensorconnector. (standard: approx. 25°C, 2.2 kW)In addition, if the resistance is extremely high or, replace the sensor.
- 2. If the measured value is out of the specified range, replace the water temperature sensor. If the measured value is within the specified range, check as below.
- 3. Turn the ignition switch to ON position and measure the voltage to water temperature sensor from theFATC controller connector. (standard: approx. 2 V at 25°C)
- 4. If the voltage value cannot be measured, check the circuit for open. If the measured value is within thespecified range, replace the FATC controller.

I. POWER TRANSISTOR

The power transistor controls the fan speed. It controls the blower motor operating speed without stages bychanging the current value to the base of power transistor when receiving the fan control signal from FATC.

J. POWER TRANSISTOR

The intake sensor outputs the compressor ON or OFF signal to ECU to prevent evaporator from freezing. Thesensing part of the thermistor is the evaporator fin contact type.

If the air conditioner does not turn on, check as below.

- Remove the intake sensor and measure the voltage between terminal No. 1 and 2 on the connector.
- Check whether the output voltages (ON: approx. 12 V, off: 0 V).
- If the voltage value is out of the specified value, replace the intake sensor. If the circuit is in normalcondition, check as below.
- Turn the ignition switch to ON position and turn on the air conditioner by pressing the A/C button. Andmeasure the voltage between terminal A12 and A11 on the FATC controller connector. (standard: approx.12 V)
- If the voltage value cannot be measured, check the circuit for open. If the measured value is within thespecified range, replace the FATC controller.

K. VEHICLE SPEED CALIBRATION

On the Ambient or the 1/3 Ambient and the blower AUTO, the blower decreases the voltage with the vehiclespeed 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.

L. WIPER CALIBRATION CONTROL

It is possible to generate the frost on the windshield in the rainy days. At this time, FATC controller allows themode to change the AUTO defroster mode.

- Operation Condition: When the passenger operates the wiper on AUTO mode, the system controls thewiper on the A/C AUTO mode after sending the wiper signal and controlling the delay for 1 minutes.

Modification basis	
Application basis	
Affected VIN	

L. VEHICLE SPEED CALIBRATION

On the Ambient or the 1/3 Ambient and the blower AUTO, the blower decreases the voltage with the vehiclespeed 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.

M. WIPER CALIBRATION CONTROL

It is possible to generate the frost on the windshield in the rainy days. At this time, FATC controller allows themode to change the AUTO defroster mode.

- Operation Condition: When the passenger operates the wiper on AUTO mode, the system controls thewiper on the A/C AUTO mode after sending the wiper signal and controlling the delay for 1 minutes.

Memo

Memo