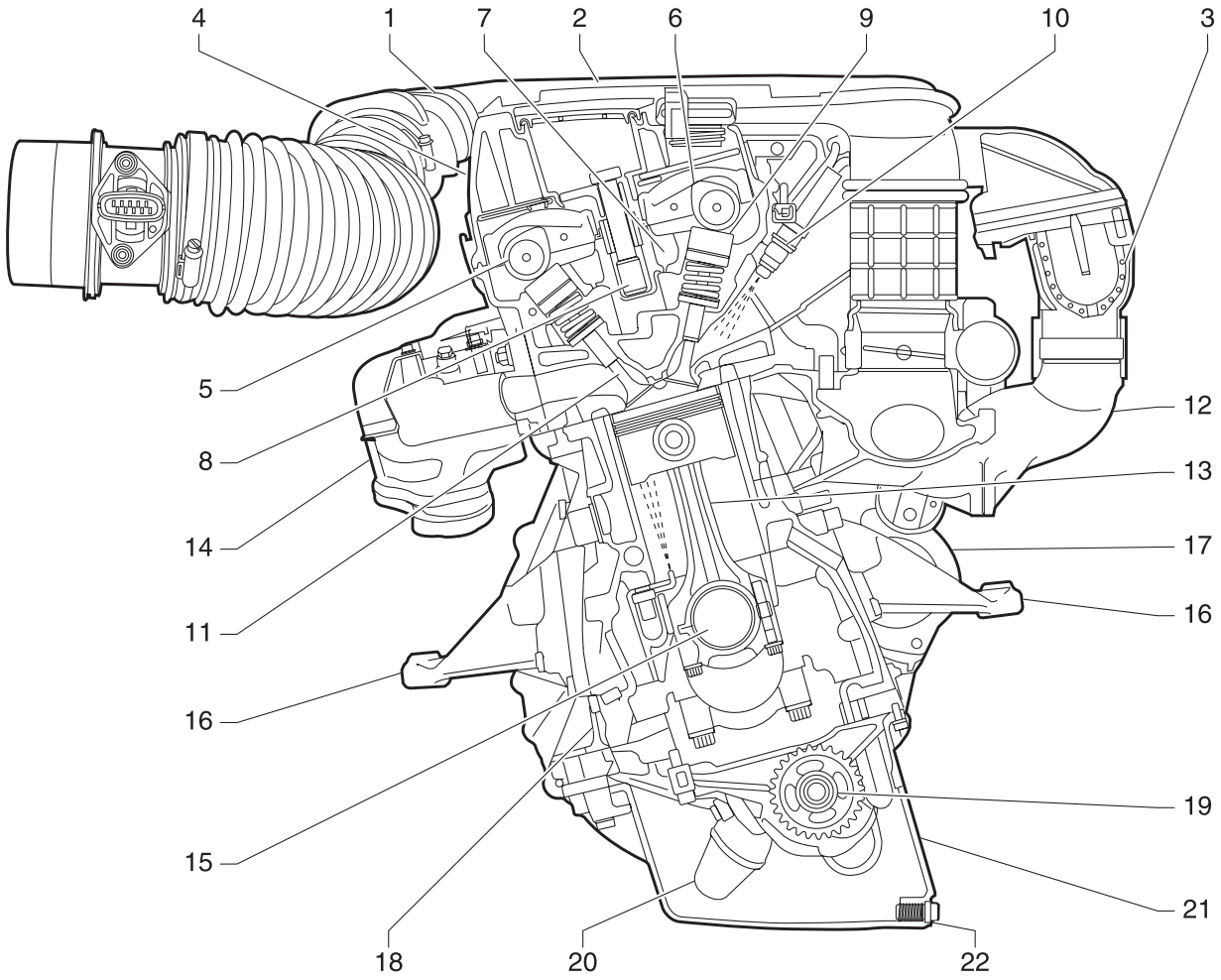
COMPONENT LOCATOR

FRONT VIEW



1. HFM sensor
2. Intake air duct
3. Resonance flap
4. Cylinder head cover
5. Exhaust camshaft
6. Intake camshaft
7. Cylinder head
8. Spark plug connector
9. Valve tappet
10. Injector
11. Exhaust valve
12. Intake manifold
13. Connecting rod
14. Exhaust manifold
15. Crankshaft
16. Engine mounting bracket
17. Starter
18. Crankcase
19. Oil pump sprocket
20. Oil strainer
21. Oil pan
22. Drain plug

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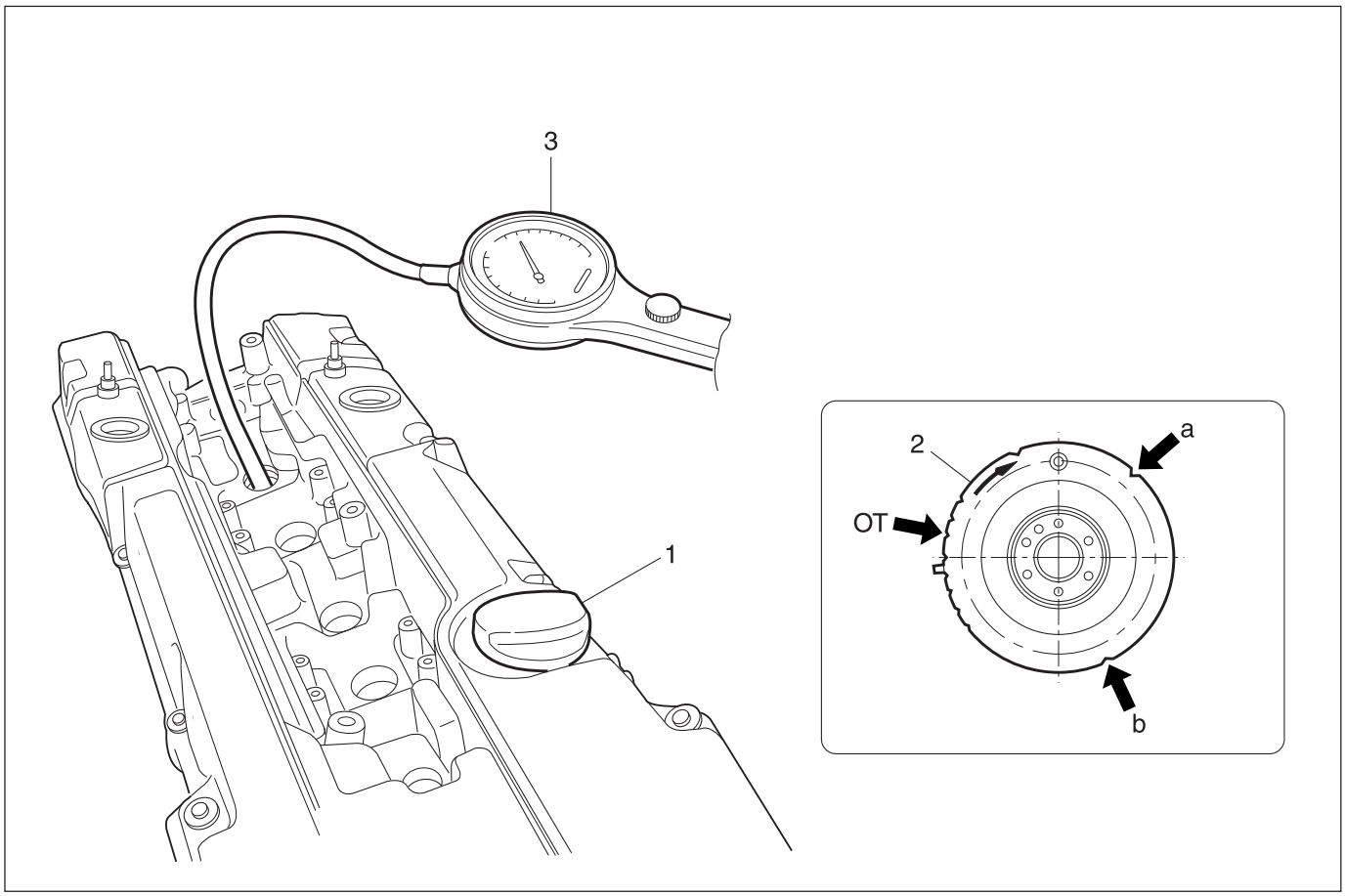
CYLINDER PRESSURE LEAKAGE TEST



1. Engine oil filler cap
2. Vibration damper
3. Cylinder pressure leakage tester with connecting hose

▶ 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 by Mark on Vibration Damper at TDC

TDC Mark	OT (TDC)	a (120°)	b (240°)
Cylinder number	1, 6	2, 5	3, 4

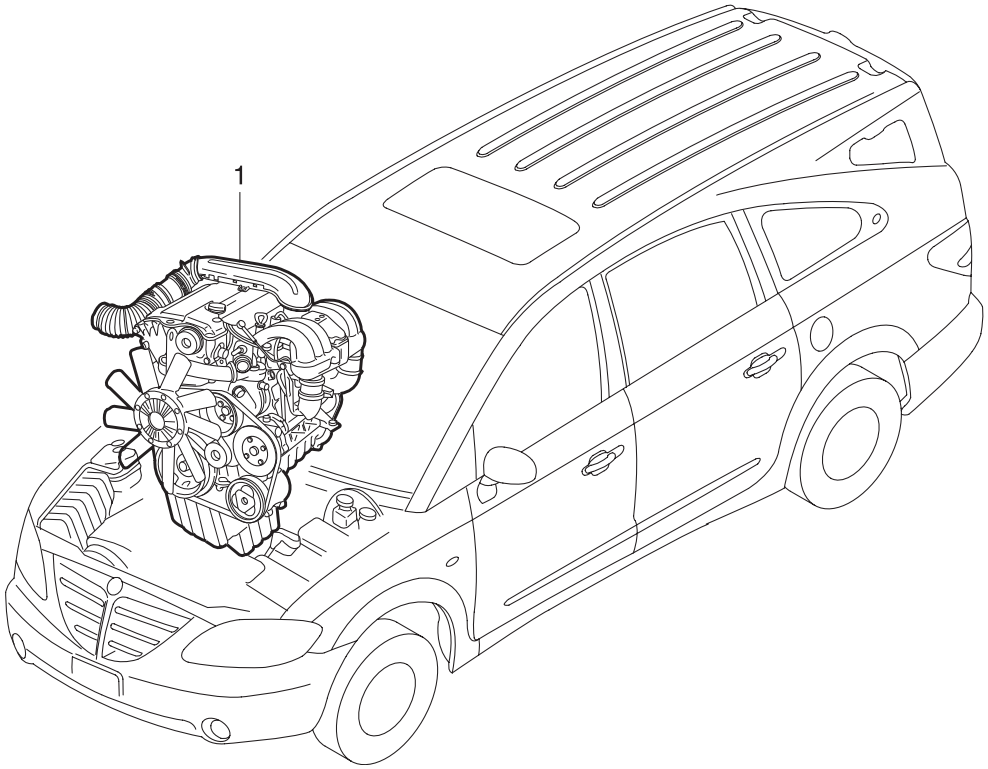
▶ Universal Tool

Cylinder pressure leakage tester	Bosch, EFAW 210A Sun, CLT 228

REPAIR INSTRUCTIONS

ON-VEHICLE SERVICE

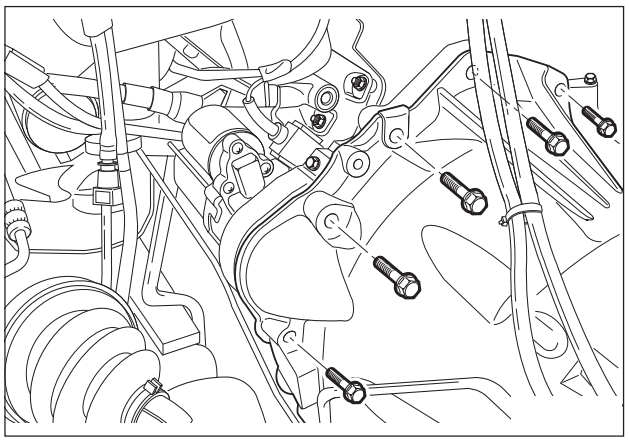
ENGINE ASSEMBLY



1. Engine assembly

Tools Required

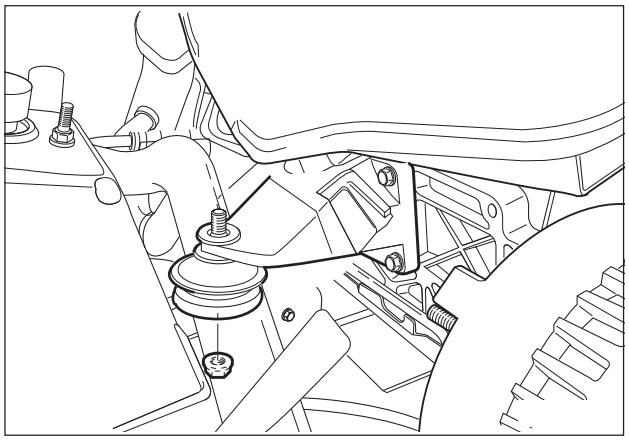
A9946 0012A (000 589 40 37 00)	Hose Clamp
W9936 0160A (112 589 00 72 00)	Oil Extractor



28. Remove the transmission mounting bolts and separate the transmission from the engine.

Installation Notice

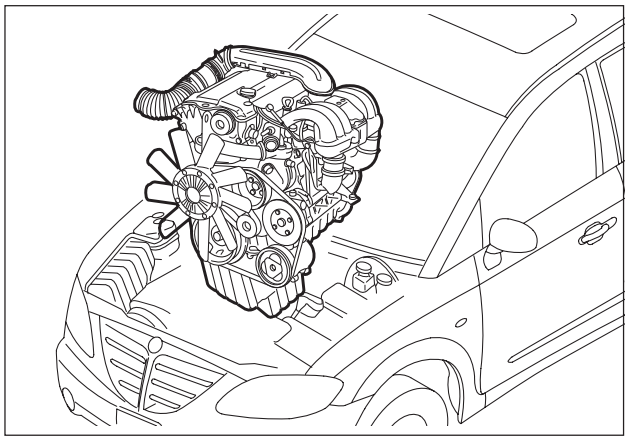
Tightening torque	54 ~ 68 Nm (40 ~ 50 lb-ft)



29. Install a chain to the bracket of engine, by using a hoist or crane.
30. Remove the engine mounting bracket nuts.

Installation Notice

Tightening torque	Upper: 70 Nm (52 lb-ft)
	Lower: 38 Nm (28 lb-ft)



31. Carefully separate the engine assembly from the vehicle.
32. Installation should follow the removal procedure in the reverse order.

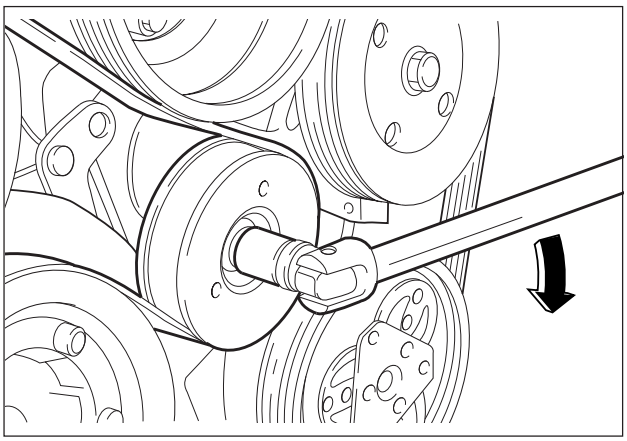
▶ Removal & Installation Procedure

1. Remove the belt tensioning pulley.

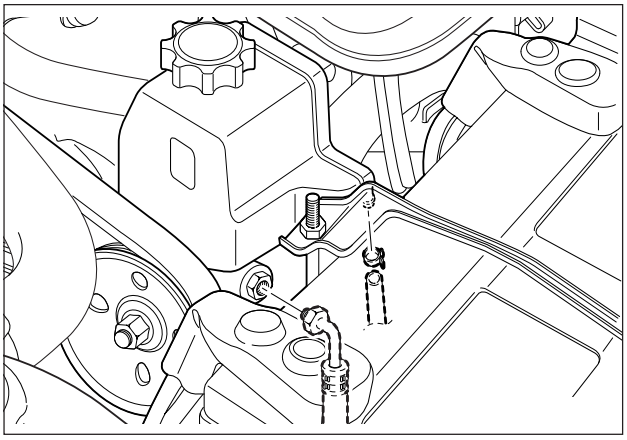
   Installation Notice

Tightening torque	40.5 ~ 49.5 Nm (29.9 ~ 36.5 lb-ft)

   Pull the tensioning pulley clockwise as shown in the figure.



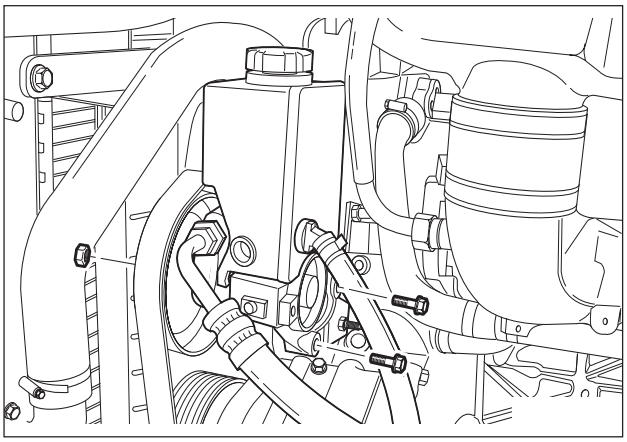
2. Disconnect the hydraulic pipe of the power steering pump and drain the oil.



3. Unscrew the bolts and remove the steering pump.

   Installation Notice

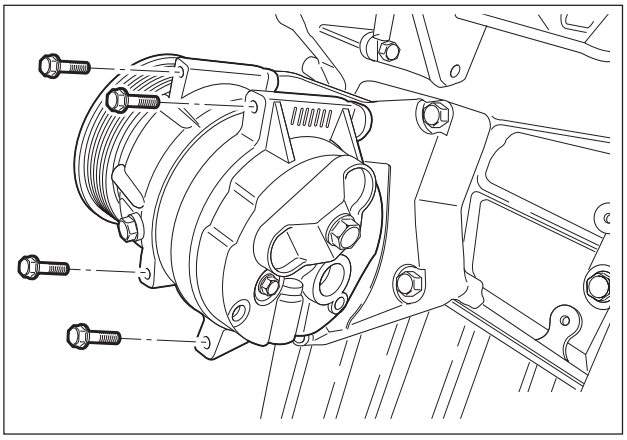
Tightening torque	22.5 ~ 27.5 Nm (16.6 ~ 20.3 lb-ft)



4. Remove the compressor after disconnecting the wiring connector and refrigerant pipe of A/C compressor.

   Notice

   Discharge all the refrigerant before removing the pipes.



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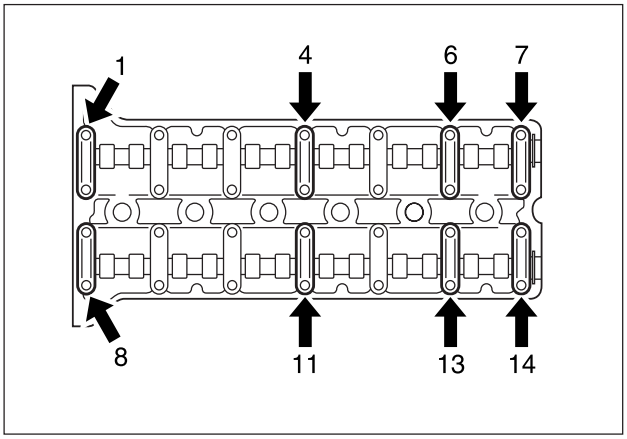
8. Unscrew the intake side bolts (8, 11, 13, 14) and the exhaust side bolts (1, 4, 6, 7).
9. Loosen the remaining bolts and unscrew the intake and exhaust side camshaft bearing cap bolts.

   Notice

   Number the camshaft bearing cap bolts when removing them, so that they don't get mixed up.

10. Remove the intake and exhaust camshafts.



▶ Installation Procedure

1. Turn the crankshaft and position the No. 1 cylinder piston at BTDC 30°.

   Notice

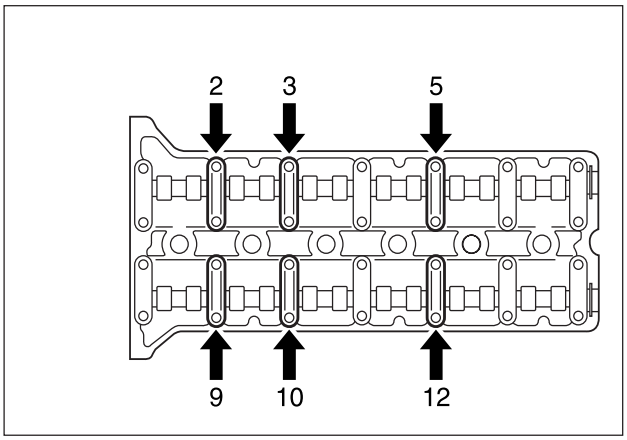
   Turn the crankshaft in the direction of engine rotation.

2. Install the exhaust camshaft bearing caps (2, 3, 5) and the intake camshaft bearing caps (9, 10, 12). Tighten the bolts with specified torque and install the remaining bearing caps.

   Installation Notice

Tightening torque	22.5 ~ 27.5 Nm (16.6 ~ 20.3 lb-ft)

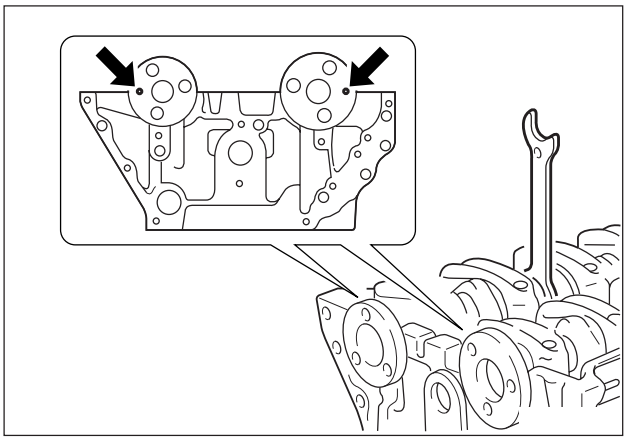
   Install the bearing caps according to the numbers on the bearing caps.



3. Turn the camshaft using the wrench so that the intake camshaft adjustment hole lines up with the cylinder head upper side (3 o'clock direction at the intake, 9 o'clock direction at the exhaust).

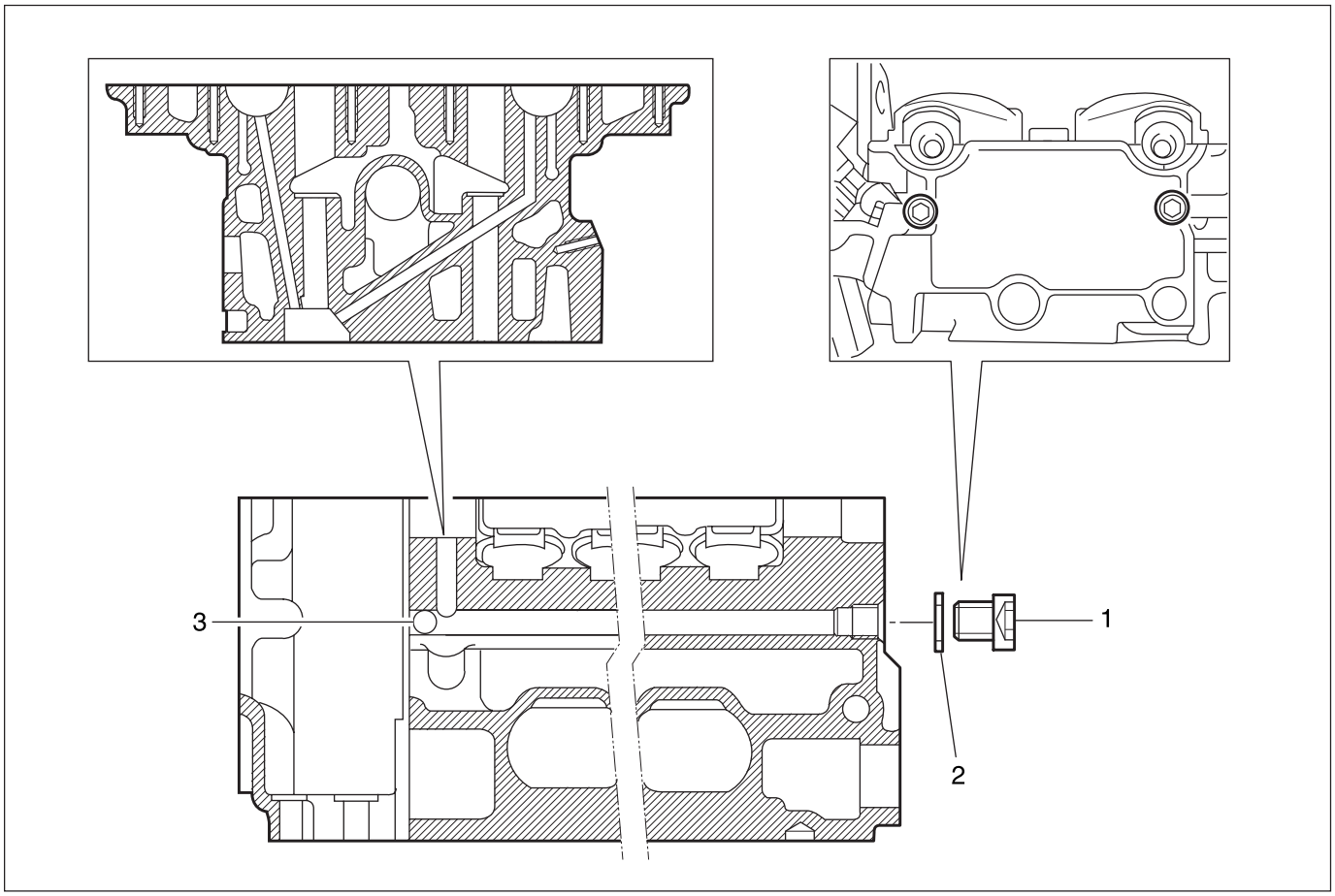
   Notice

   Turn the crankshaft and adjust it to OT so that No. 1 cylinder's piston would be at TDC.



OIL GALLERY IN CYLINDER HEAD

※ **Preceding Work:** Removal of cylinder head
Removal of camshaft
Removal of tappet



1. Screw plug ..... 15 Nm (11 lb-ft)
2. Seal
3. Steel ball (ϕ 8 mm)

▶ Cleaning Procedure

1. Remove the screw plug (1) and the seal (2).

   Installation

Tightening torque	15 Nm (11 lb-ft)

   Replace the seal with new one.

2. Clean the oil gallery using the compressed air.

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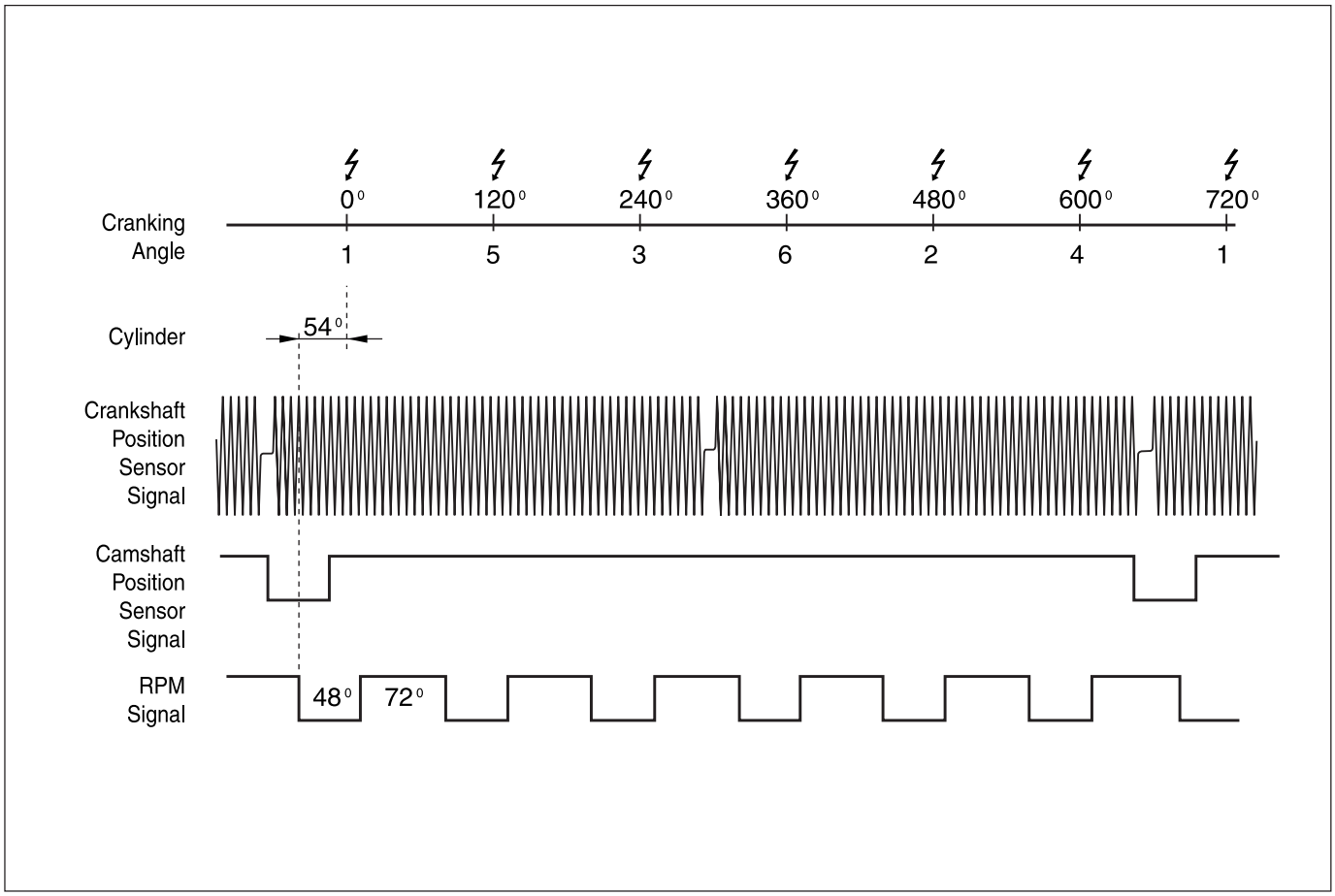
IGNITION SYSTEM

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

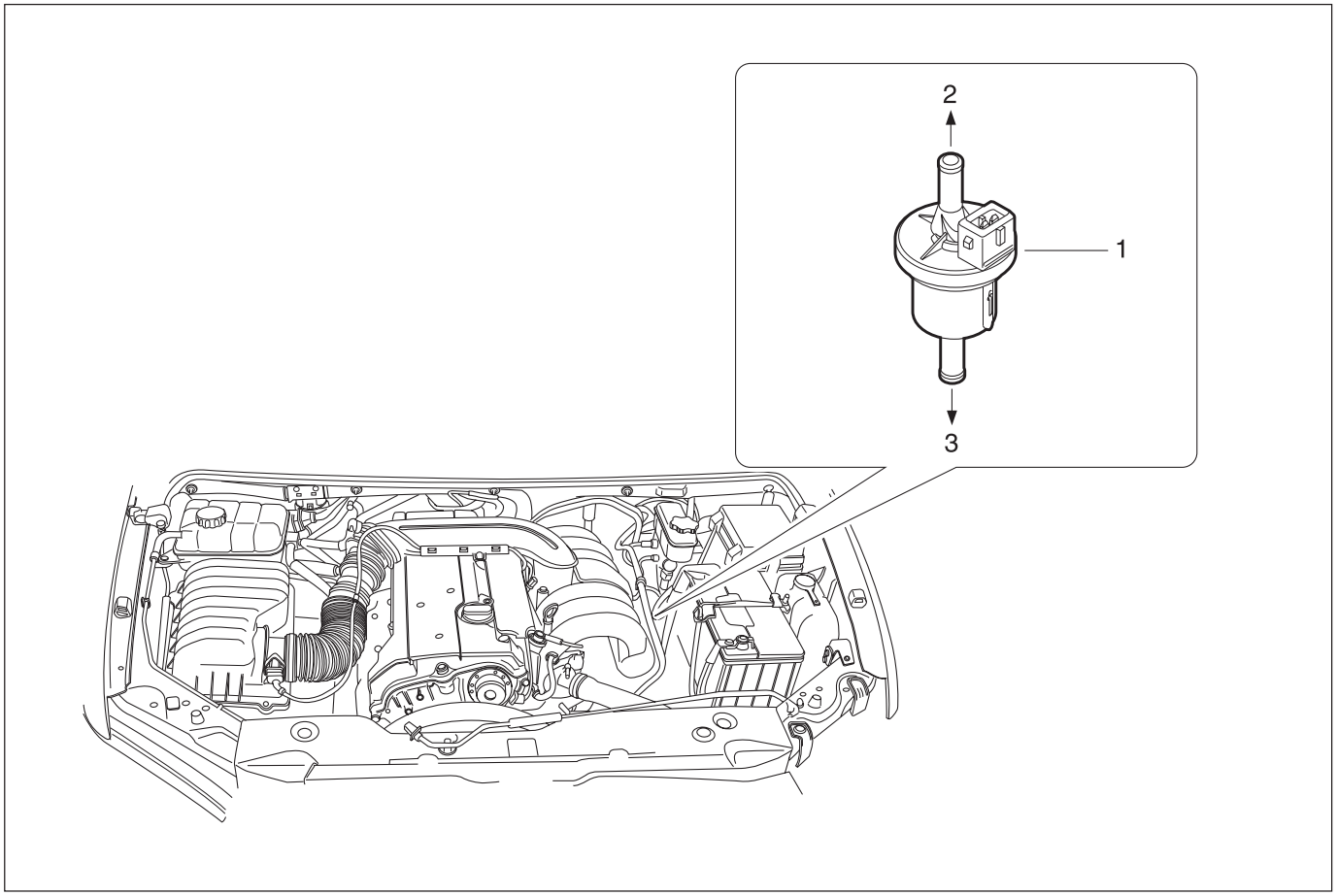
This type of distributorless ignition system uses a “waste spark” method of spark distribution. Each cylinder is paired with the cylinder that is opposite it (1-6 or 2-5 or 3-4). The spark occurs simultaneously in the cylinder coming upon the compression stroke and in the cylinder coming up on the exhaust stroke. The cylinder on the exhaust stroke requires very little of the available energy tofire the spark plug. The remaining energy is available to the spark plug in the cylinder on the compression stroke.

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

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



PURGE CONTROL VALVE



1. Purge control valve
2. Line to engine
3. Line to conister

The fuel vaporization control system is in stalled to inhibit the fuel vaporized gas from discharging into the atmosphere.

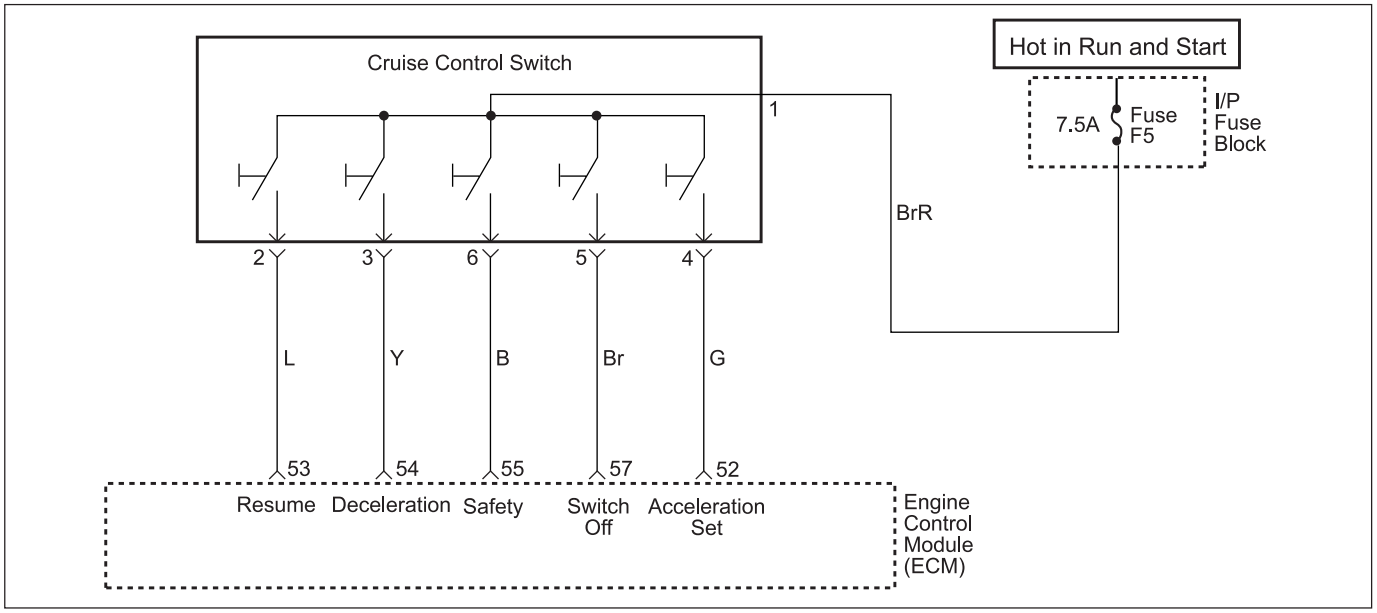
The fuel vaporized gas that is accumulated in the canister abstracts through the purge control valve purification during the engine combustion (except the decreasing mode) and coolant temperature of over 80°C. For this reason, the Engine Control Module (ECM) transacts the engine speed, air inflow quantity, coolant temperature, and intake temperature.

The purge control valve is activated by the ECM frequency according with the engine rotating speed to adjust the purification rate. The purification rate is determined by the continuous valve opening interval.

The purge control valve is activated by the ECM for the following conditions:

- Coolant temperature of over 80°C
- Engine speed of over 1,000 rpm
- 2 minutes after starting
- When the fuel cut-off mode is not activated

CRUISE CONTROL SWITCH

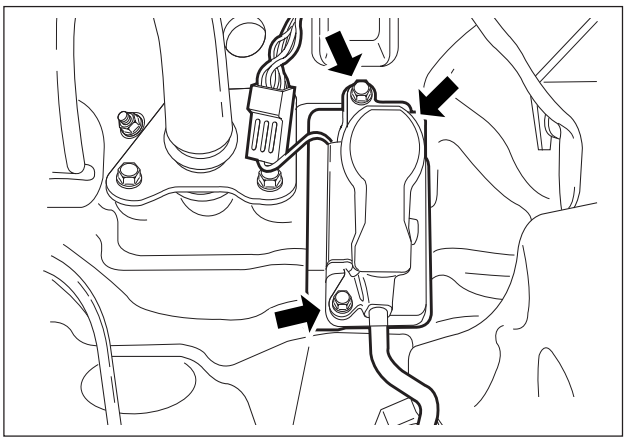


Failur Code	Description	Trouble Area	Maintenance Hint
129	Cruise control "OFF" due to message counter failure	Cruise control system message counter fault	• Monitoring the actual recognition status and vehicle speed signal through scan tool • Inspection the Engine Control Module (ECM) pin 52 53 54 55 57 about short circuit or open with bad contact • Inspection the CAN and ABS • Inspection the cruise control lever switch • Inspection the ECM
130	Vehicle speed signal failure	When malfunction of auto-cruise system Implausible condition of vehicle speed signal.	
131	Vehicle speed signal failure		
132	Cruise control lever failure	Cruise control lever defective	
133	Cruise control acceleration failure	Cruise control system Implausible condition of acceleration signal	
134	Cruise control deceleration failure	Cruise control system Implausible condition of deceleration signal	

▶ Circuit Description

Cruise control is an automatic speed control system that maintain a desired driving speed without using the accelerator pedal. The vehicle speed must be greater than 40 km/h to engage cruise control.

PEDAL POSITION SENSOR



▶ Removal and Installation Procedure

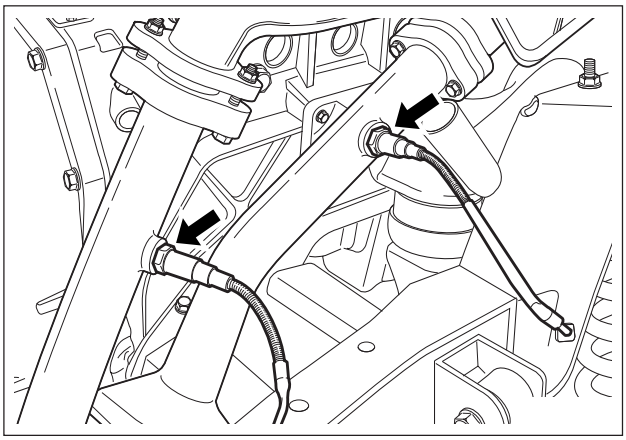
1. Disconnect the negative battery cable.
2. Disconnect the pedal position sensor connector.
3. Unscrew the bolts and nut.

Installation

Tightening torque	6 Nm (53 lb-ft)

4. Remove the pedal and sensor assembly.
5. Installation should follow the removal procedure in the reverse order.

OXYGEN SENSOR



▶ Removal and Installation Procedure

1. Disconnect the negative battery cable.

Notice

The oxygen sensor uses a permanently attached pigtail and connector. This pigtail should not be removed from the oxygen sensor. Damage or removal of the pigtail or the connector could affect proper operation of the oxygen sensor. Do not drop the oxygen sensor.

2. Disconnect the electrical connector.
3. Carefully remove the oxygen sensor from the exhaust pipe.

Installation

Tightening torque	55 Nm (41 lb-ft)

Important

A special anti-seize compound is used on the oxygen sensor threads. This compound consists of a liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove. New or serviced sensors will already have the compound applied to the threads. If a sensor is removed from any engine and is to be reinstalled, the threads must have an anti-seize compound applied before reinstallation.

4. Coat the threads of the oxygen sensor with an anti-seize compound, if needed.
5. Installation should follow the removal procedure in the reverse order.

ENGINE CONTROLS

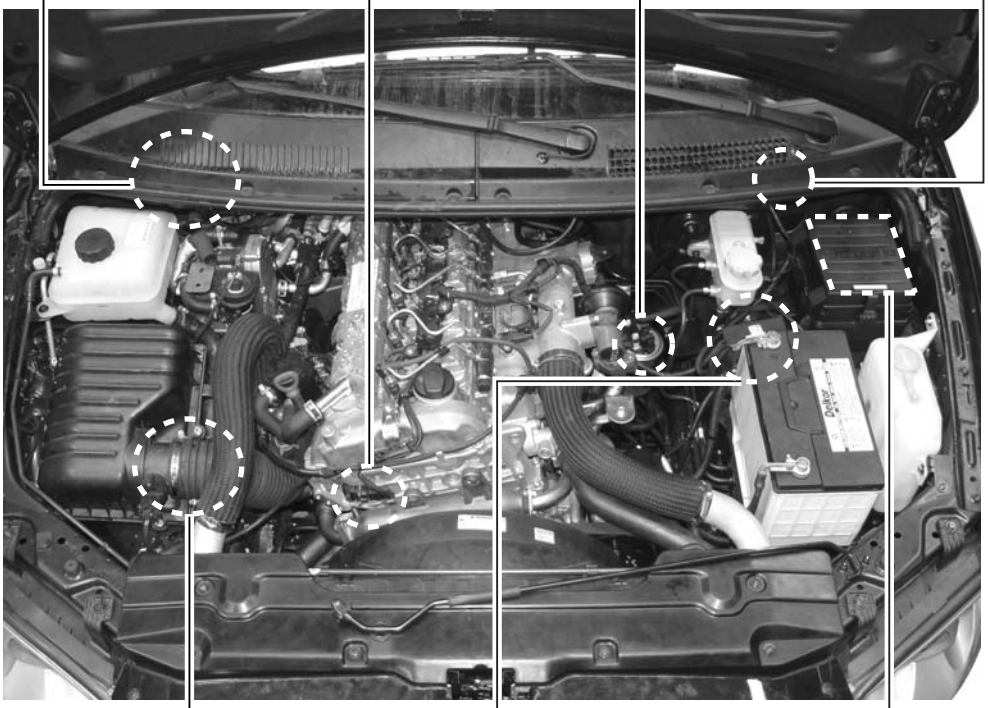
ECU RELATED COMPONENTS

ECU/barometric sensor

Cam position sensor

Fuel filter (water detection sensor)

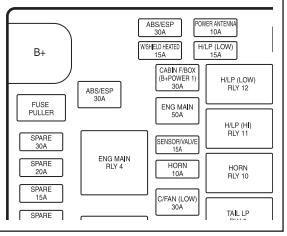
Accelerator pedal sensor



HFM sensor/intake air temperature sensor

Pre heating time relay

Main relay



VEHICLE IDENTIFICATION

VEHICLE IDENTIFICATION NUMBER (VIN)

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

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	0
*	K	P	T	N	0	B	1	9	S	Y	P	0	0	0	0	0	0	*

Digit

0 : Symbol according to no. 3. 1. 2 sentence 4 of 76/114/EEC

1 : Nation - K

2 : Maker identification - P

3 : Vehicle type
T - Passenger car

4 : Line & Models
N: STAVIC or RODIUS (LHD), V: STAVIC or RODIUS (RHD)

5 : 0: 5 Door, 1: 4 Door, 2: 3 Door

6 : A - Standard, B - Deluxe, C - Super Deluxe

7 : Restraint system — 1 - 3 points Safety Belt, 2 - 2 points Safety Belt

8 : Engine type — 6 - 2295cc, In-line 4 cylinders, Gasoline (E23)
F - 2696cc, In-line 5 cylinders, Diesel (D27DT)

9 : Check digit — S - All area except North America

10 : Model year — 4 - 2004
5 - 2005
6 - 2006
7 - 2007
8 - 2008

11 : Plant code — P - Pyungtaek plant

12 ~ 17 : Production Serial Number 000001 ~ 999999

▶ Certification Label

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

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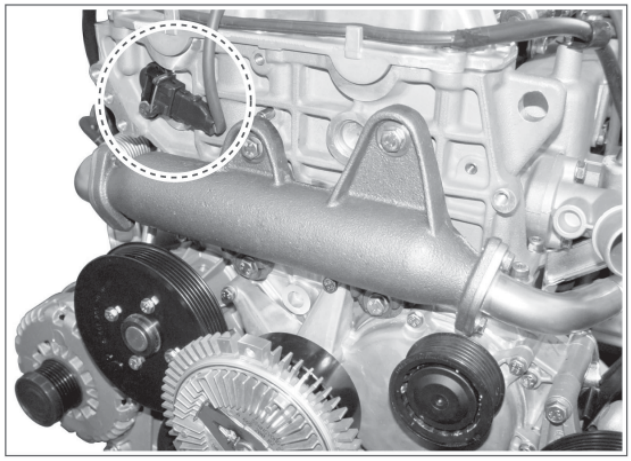
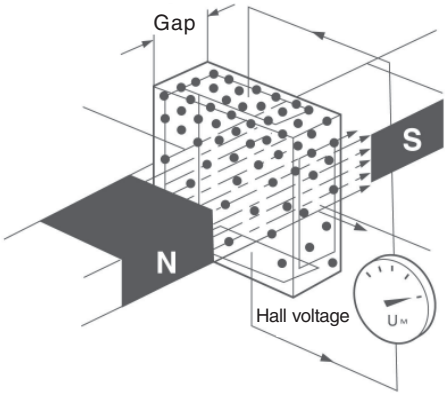
▶ Camshaft Position Sensor



<Location of camshaft position sensor>



<Operation principle of hall sensor>

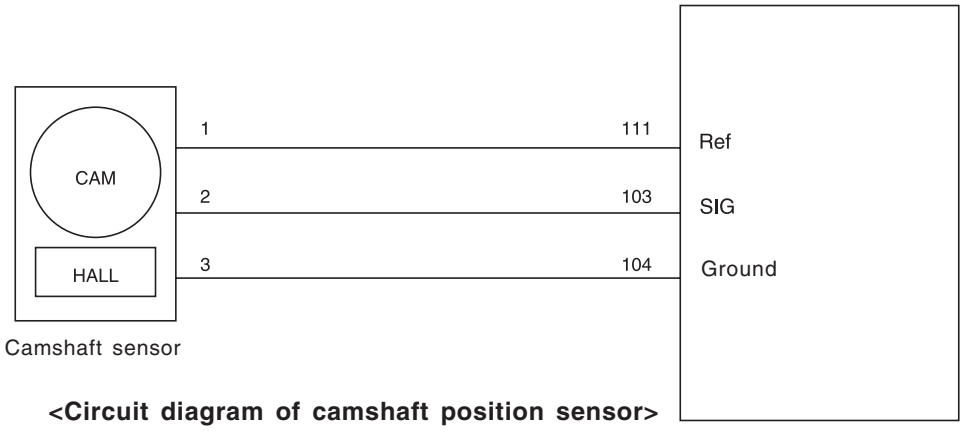
The camshaft position sensor uses hall-effect to set the camshaft position and metallic-magnetic-material sensor end is attached on the camshaft and then rotates with it. If sensor protrusion passes camshaft position sensor's semi-conductor wafer, magnetic field changes direction of electron on the semi-conductor wafer to the current flow direction that passes through wafer from the right angle. When operation power is supplied from camshaft position sensor, camshaft hall sensor generates signal voltage. The signal voltage will be 0V if protrusion and camshaft position sensor are near and 5 V if apart.

ECU can recognize that the No. 1 cylinder is under compression stroke by using this voltage signal (hall voltage).

The rotating speed of camshaft is half of the crankshaft and controls engine's intake and exhaust valves. By installing sensor on the camshaft, can recognize specific cylinder's status, compression stroke or exhaust stroke, by using camshaft position when the piston is moving toward TDC (OT). Especially when started first, it is difficult to calculate the stroke of a specific cylinder with only crankshaft position sensor.

Accordingly, camshaft position sensor is necessary to identify the cylinders correctly during initial starting. However, when engine is started, ECU learns every cylinder of the engine with crankshaft position sensor signals so can run the engine even though the camshaft position sensor is defective during engine running.

Pulse generation	Cam angle ± 6°
Sensor air gap	0.2 ~ 1.8 mm
Tightening torque	10 ~ 14 Nm
Operating temperature	- 40 ~ 130°C



<Circuit diagram of camshaft position sensor>

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2) BLOWER MOTOR (FRT, RR)