ENGINE CONTROL

1128-37/1311-26/1430-05/1430-07/1430-09/1430-14/ 1443-01/1443-03/1490-01/1535-30/1628-04/1740-03/ 1740-07/2010-01/2245-02

GENERAL INFORMATION

OVERVIEW AND OPERATING PTOCESS

CONFIGURATION AND FUNCTION

REMOVAL AND INSTALLATION

ENGINE CONTROL

1490-00

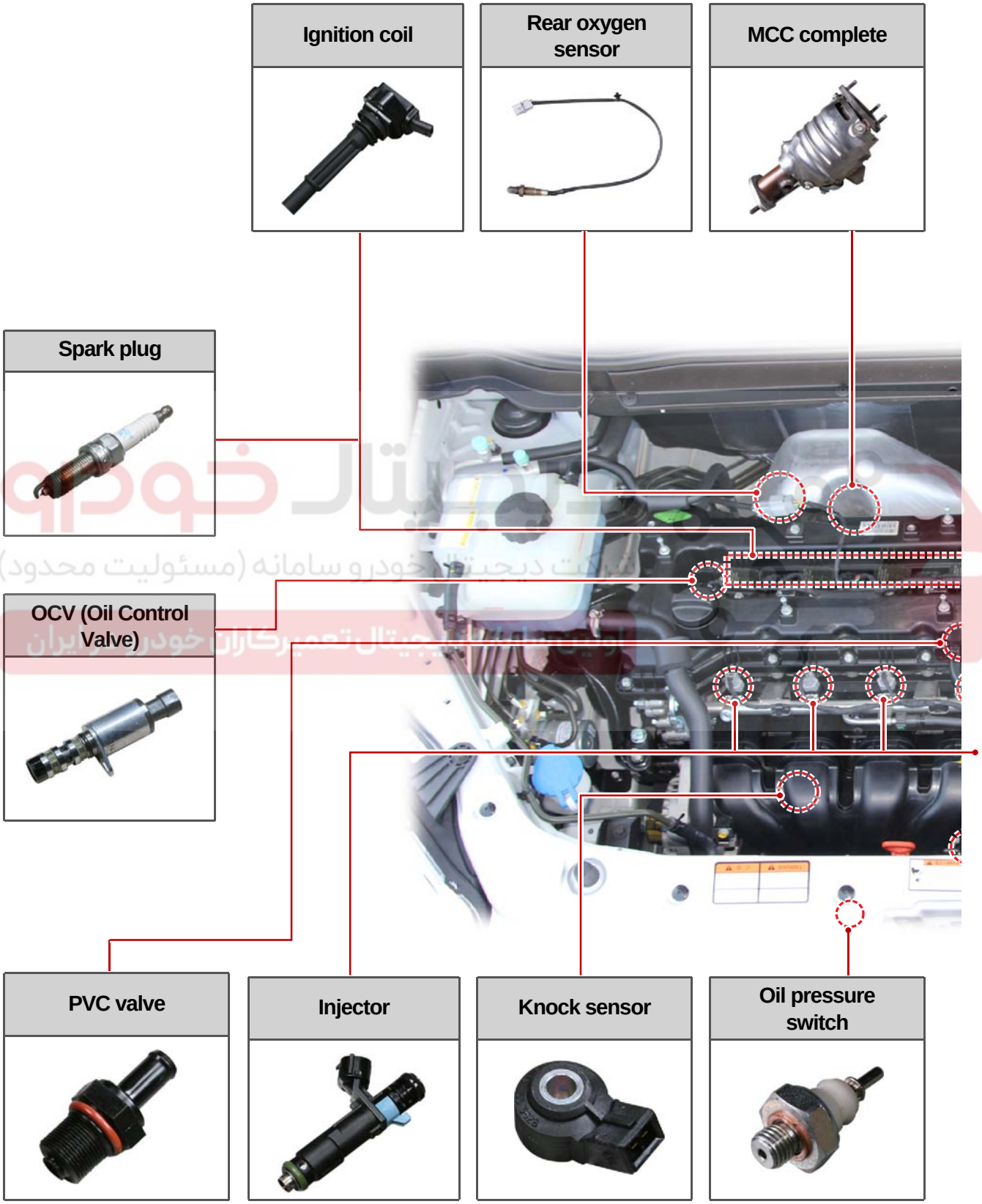
GENERAL INFORMATION

1. ENGINE DATA LIST

Data	Unit	Value
Coolant temperature	℃	0.436V (130℃) ~4.896V (-40℃)
Intake air temperature	℃	-40~130℃ (varies according to ambient air temperature or engine mode)
Idle speed	rpm	700±50(P/N), 600±(D)
Engine load	%	18~25%
Mass air flow	kg/h	16~25kg/h
Throttle position angle	°TA	0° (Full Open) ~ 78° (Close)
Engine torque	Nm	varies according to engine conditions
Injection time	Ms	-
Battery voltage	V	13.5V~14.1V
Accelerator pedal position 1	V	0.3~4.8 V
Accelerator pedal position 2	V	0.3~2.4 V
Oxygen sensor	mV	0~5 V
OCV (Oil Control Valve)	%	0~100%
VIS solenoid valve	1=ON / 0=OFF	-
A/C compressor switch	1=ON / 0=OFF	-
Full load	1=ON / 0=OFF	-
Knocking control	1=ON / 0=OFF	-
Brake switch	1=ON / 0=OFF	-
Cruise control	1=ON / 0=OFF	-

OVERVIEW AND OPERATING PTOCESS

1. MAJOR COMPONENTS



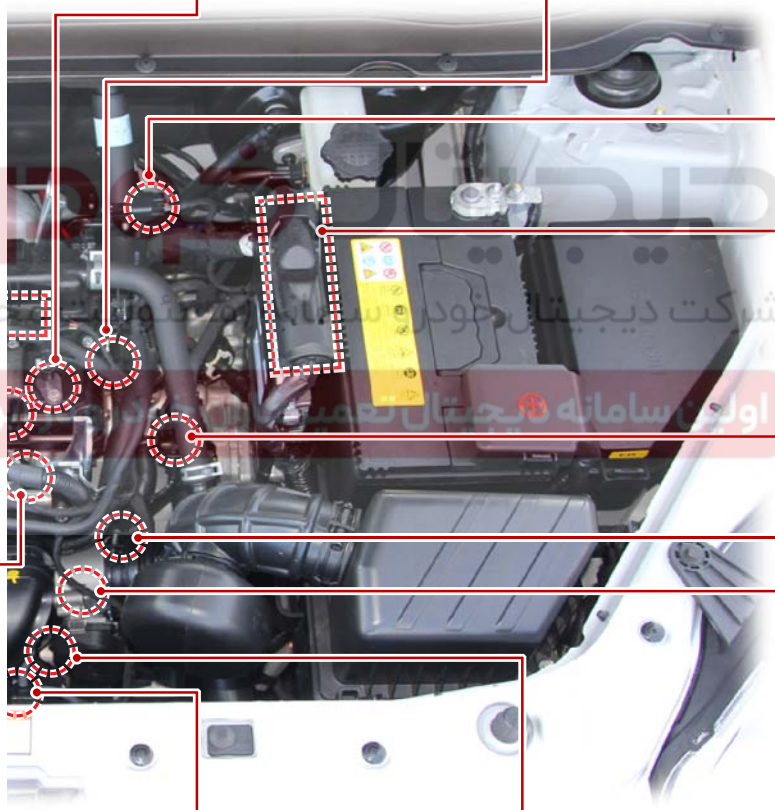
Modification basis	
Application basis	
Affected VIN	

Camshaft position sensor

Coolant Temp sensor

Front oxygen sensor

G20DF engine ECU



Purge control solenoid valve

Crankshaft position sensor

VIS solenoid valve

T-MAP sensor

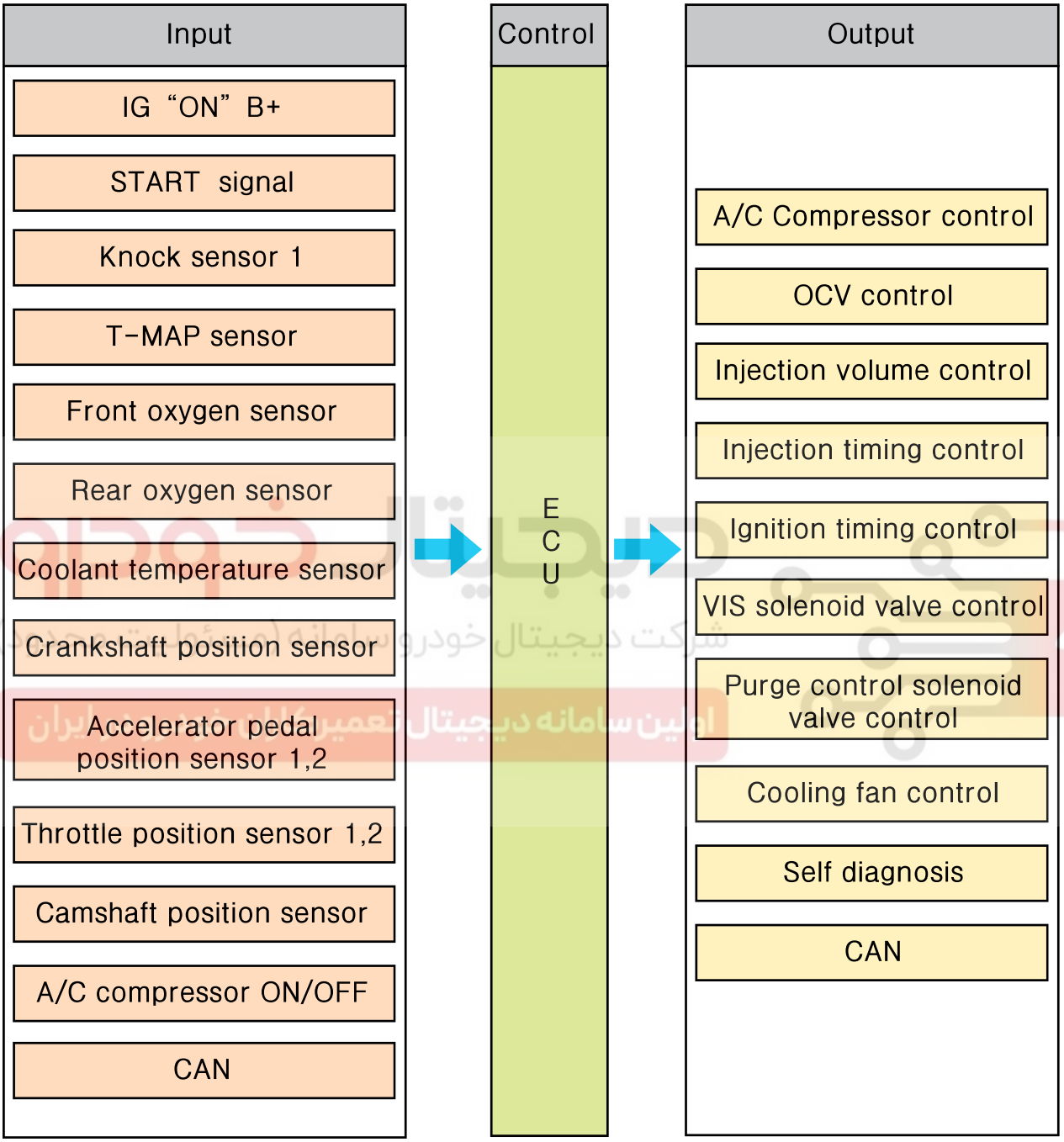
Electronic throttle body

Magnetic trigger ring

Modification basis	
Application basis	
Affected VIN	

2. SYSTEM OPERATION

1) Input/Output of ECU



Modification basis	
Application basis	
Affected VIN	

2) Components for ECU Input

Rear oxygen sensor

Coolant temperature sensor

Camshaft position sensor

Crankshaft position sensor

Front oxygen sensor

G20DF Engine ECU

Electronic throttle body

Knock sensor

Refrigerant pressure sensor
Clutch pedal signal
Blower switch signal
Brake pedal signal

T-MAP sensor

CAN

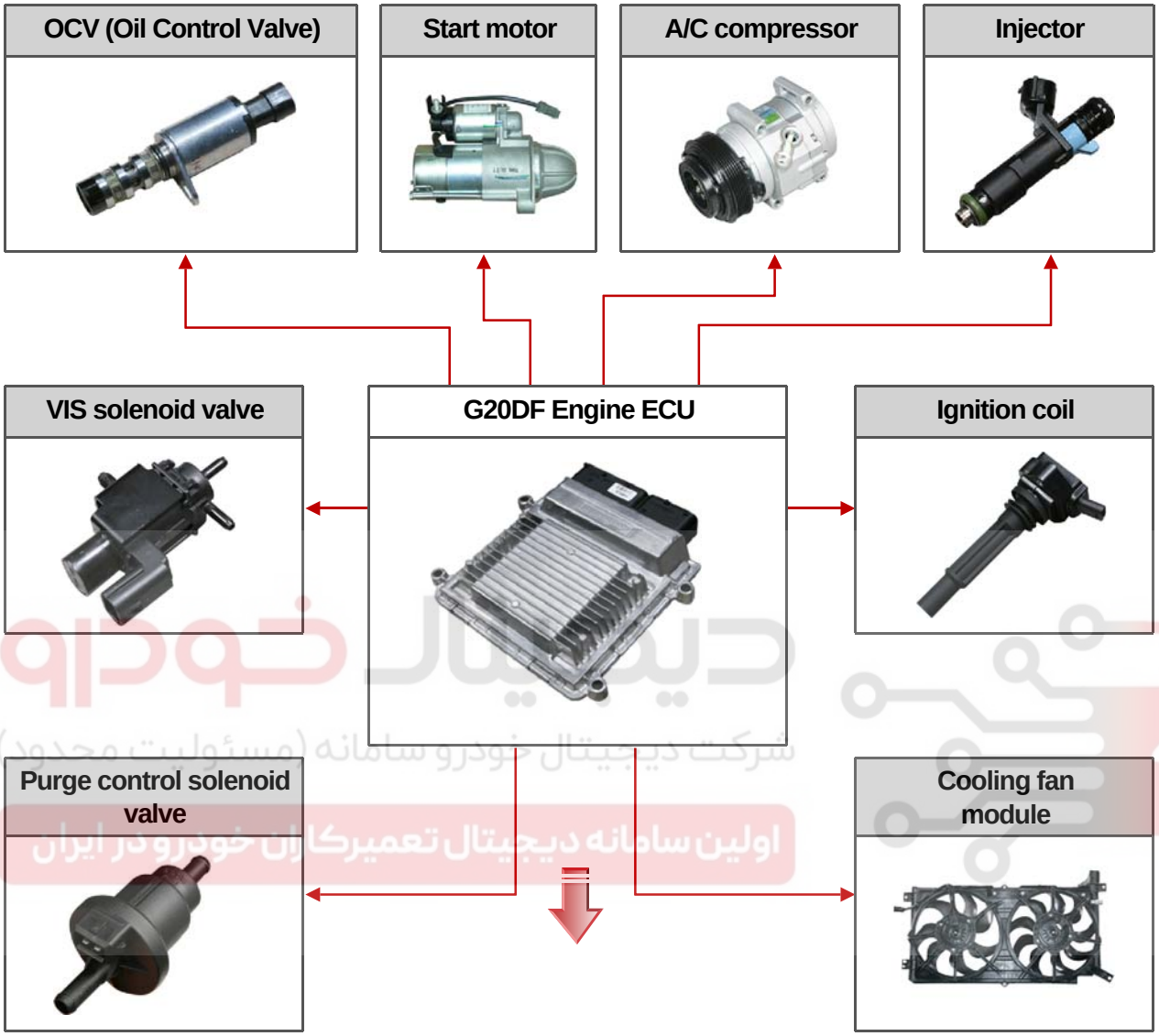
- ABS & ESP
- Instrument cluster
- TCU

Oil pressure switch

Oil pressure warning lamp

Modification basis	
Application basis	
Affected VIN	

3) Components for ECU Output



CAN

- ABS & ESP unit
- BCM
- E-coupling unit
- EPS
- Instrument cluster
- SKM
- TCU
- Diagnostic tool

Modification basis	
Application basis	
Affected VIN	

3. ECU CONTROL

1) Functions

ECU receives and analyzes signals from various sensors and then modifies those signals into permissible voltage levels and analyzes to control respective actuators.
ECU microprocessor calculates injection period and injection timing proper for engine piston speed and crankshaft angle based on input data and stored specific map to control the engine power and emission gas.
Output signal of the ECU microprocessor activates the injector solenoid valve to control the fuel injection period and injection timing; so controls various actuators in response to engine changes.
Auxiliary function of ECU has adopted to reduce emission gas, improve fuel economy and enhance safety, comforts and conveniences. For example, there are autocruise and immobilizer and adopted CAN communication to exchange data among electrical systems (automatic T/M and brake system) in the vehicle fluently. And the diagnostic tool can be used to diagnose vehicle status and defectives.
Operating temperature range of ECU is normally −40 to +85°C and protected from factors like oil, water and electromagnetism and there should be no mechanical shocks.

2) Control Functions

- Controls by operating stages:
  To make optimum combustion under every operating stage, ECU should calculate proper injection volume in each stage by considering various factors.

- Starting injection volume control:
  During initial starting, injecting fuel volume will be calculated by function of temperature and engine cranking speed. Starting injection continues from when the ignition switch is turned to ignition position to till the engine reaches to allowable minimum speed.

- Driving mode control:
  If the vehicle runs normally, fuel injection volume will be calculated by accelerator pedal travel and engine rpm and the drive map will be used to match the drivers inputs with optimum engine power.

3) Injection Volume Control

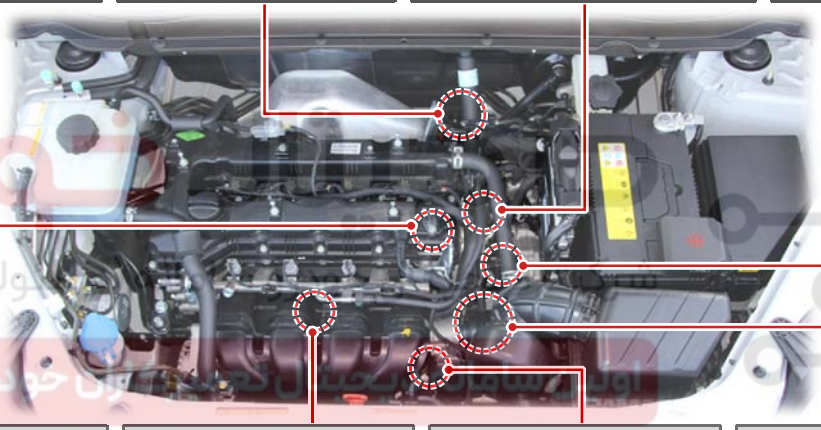
(1) Overview

To keep the best engine conditions and to reduce the emission gas, ECU determines the injection volume and timing.

(2) Components

▶ **Input Components**

Accelerator pedal position sensor	Front oxygen sensor	Coolant temperature sensor	Crankshaft position sensor
			



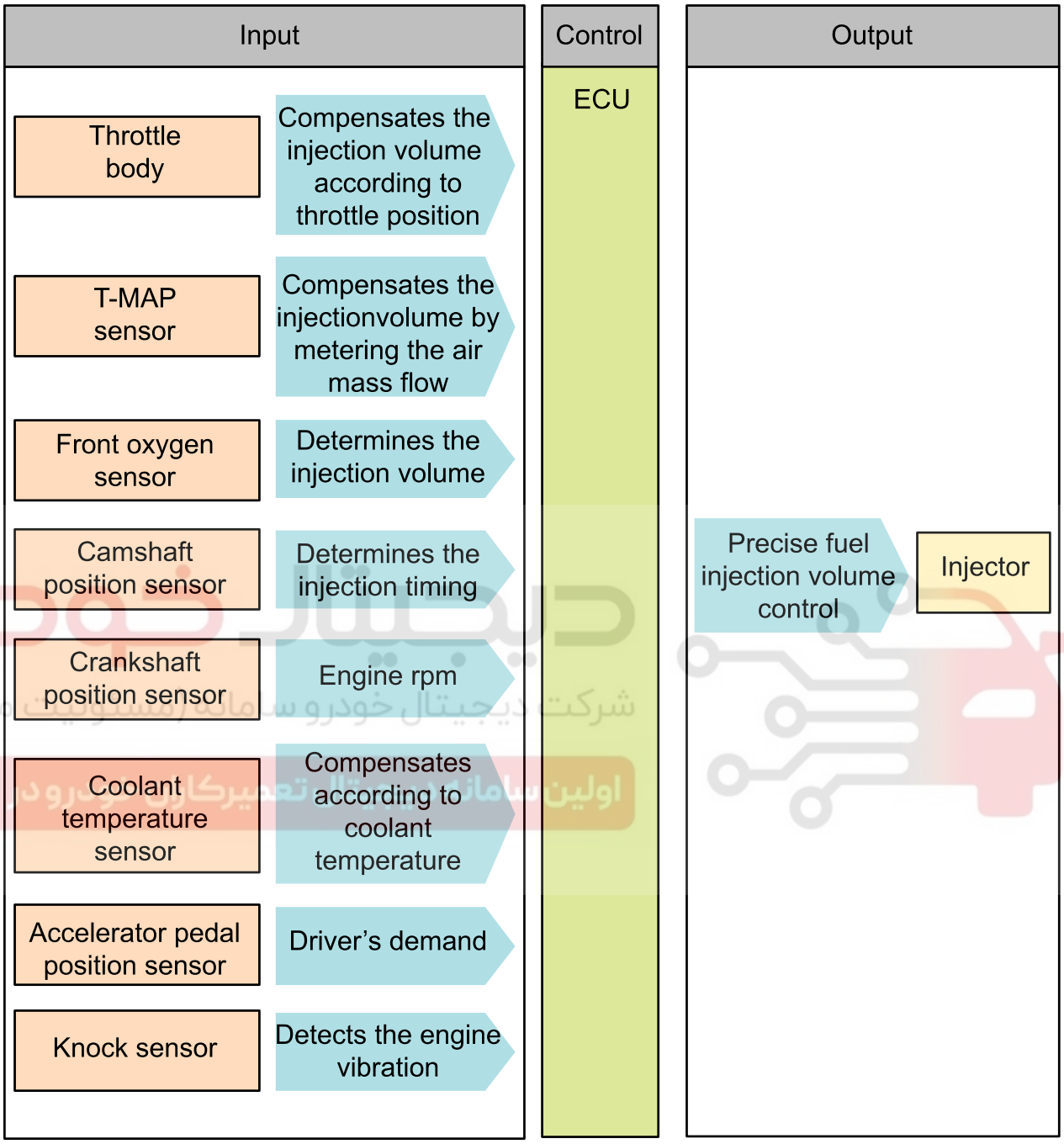
Camshaft position sensor	Knock sensor	T-MAP sensor	Electronic throttle body
			

▶ **Output Components**

Various sensor data	→	Engine ECU	→	Injector
		 Determines the basic injection volume.		 Operates the injector by receiving the signal from ECU.

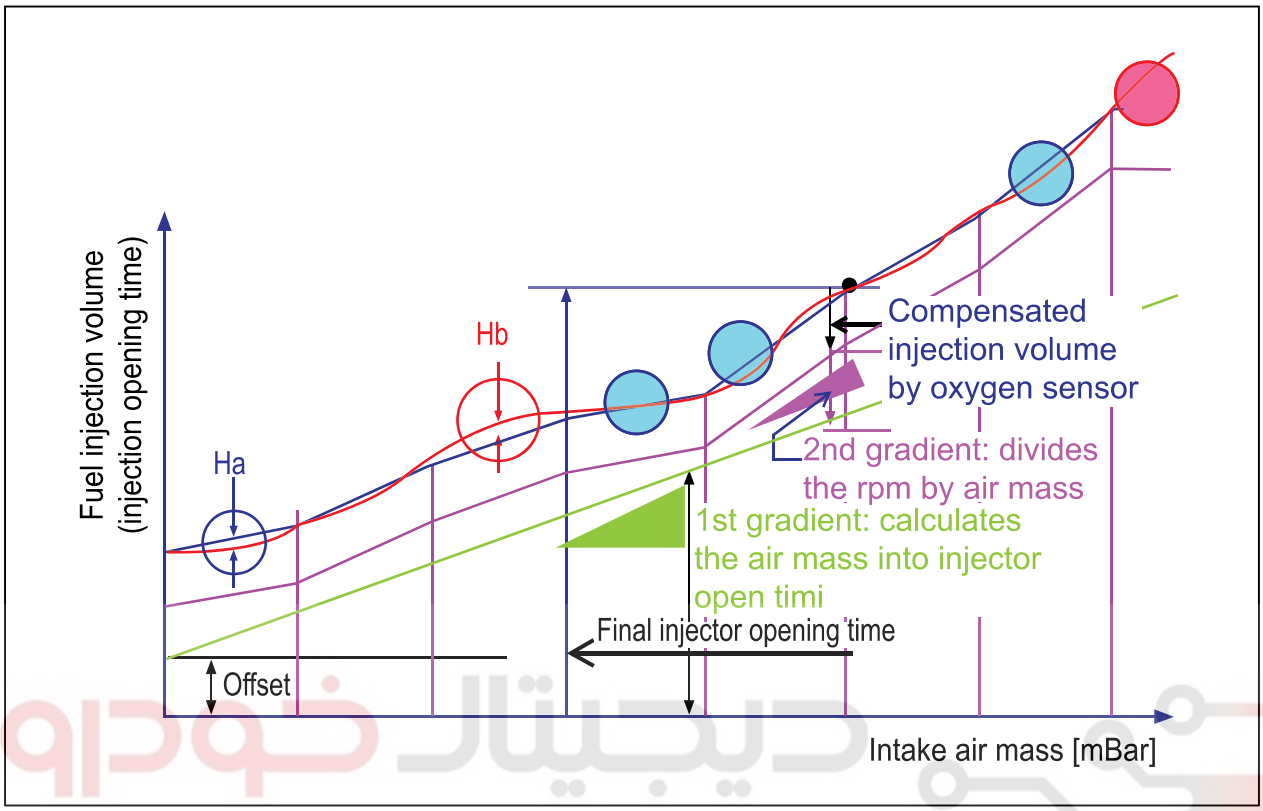
Modification basis	
Application basis	
Affected VIN	

(3) Input/Output for Injection Volume Control



Modification basis	
Application basis	
Affected VIN	

(4) Basic Injection Volume Map



Modification basis	
Application basis	
Affected VIN	

4) Ignition System Control

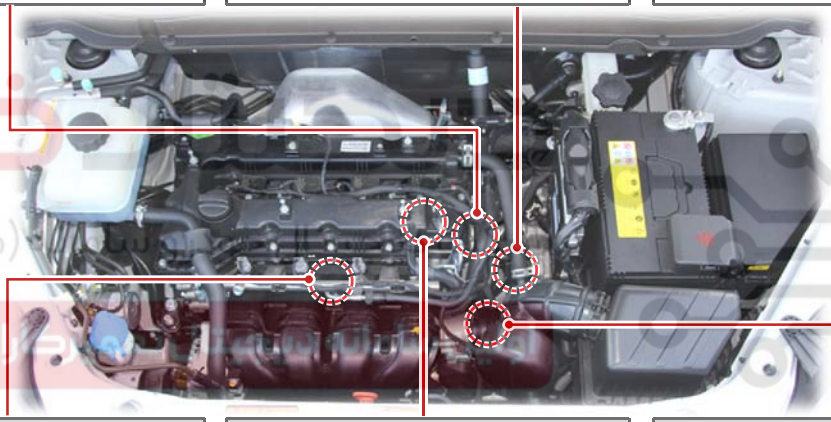
(1) Overview

G20DF engine is equipped with the single ignition system. Each spark plug is operated independently by the ECU and one ignition coil and spark plug are provided for each cylinder.

(2) Components

▶ **Input Components**

Coolant temperature sensor	Crankshaft position sensor	Accelerator pedal position sensor
		

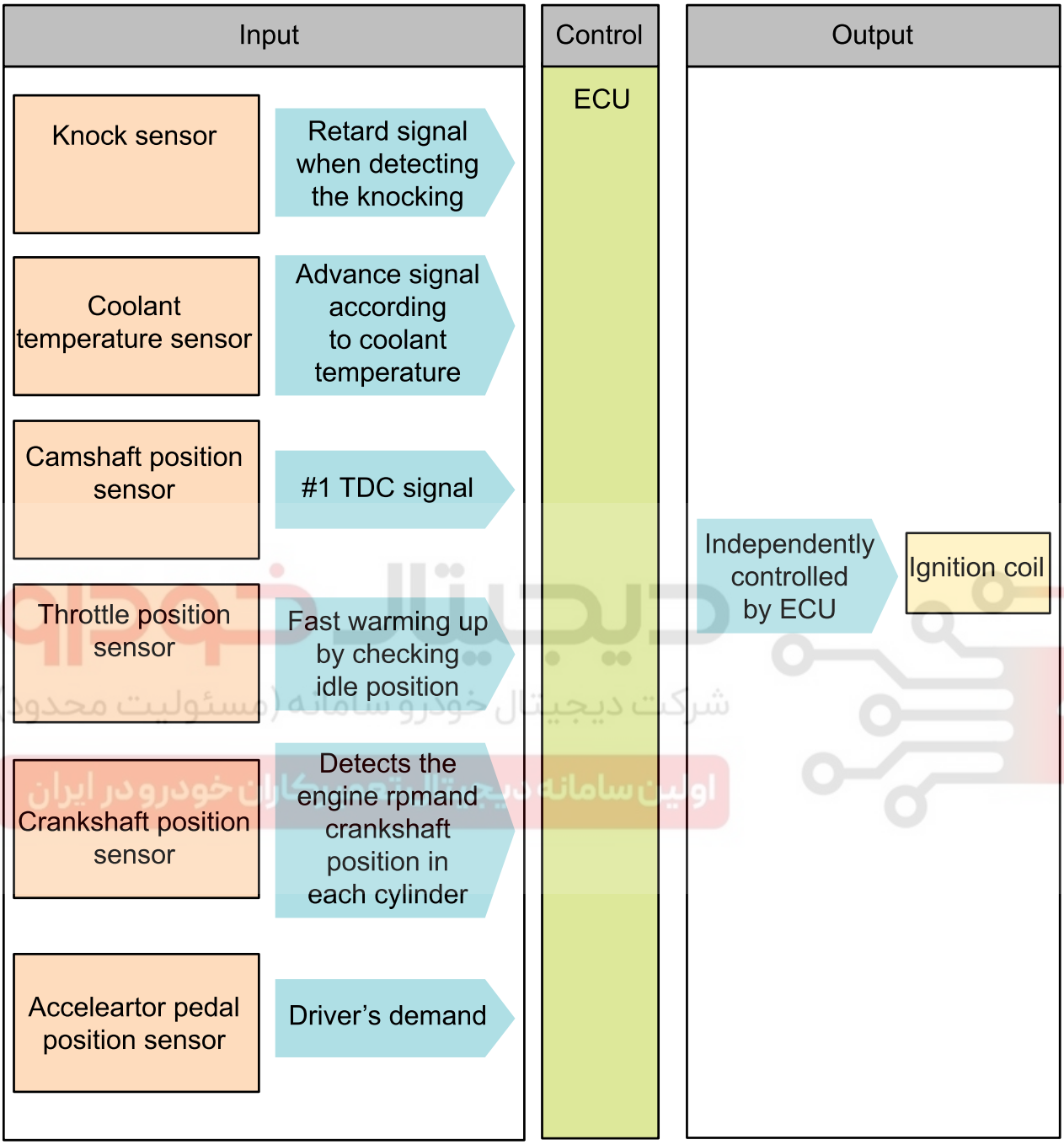


Knock sensor	Camshaft position sensor	Electronic throttle body
		

▶ **Output Components**

Modification basis	
Application basis	
Affected VIN	

(3) Input/Output for Ignition System



Modification basis	
Application basis	
Affected VIN	

(4) Features

1. Determines the ignition timing according to input signal
   The ECU always analyzes the following elements when determining the ignition timing.

   - Crankshaft position sensor
   - Camshaft position sensor
   - Coolant temperature sensor
   - Intake air temperature/air mass

2. Warm-up of catalytic converter
   The ignition timing is retarded for about 20 seconds to operate the catalytic converter according to the operating temperature under the following conditions:

   - The coolant temperature is 15°C ~ 40°C at starting.
   - The idle speed is increased by the idle speed control to help warming up of the catalytic converter

3. Idle speed control
   The ignition timing can be retarded up to 36° or advanced up to 20° to help idle speed control.
   The ignition timing control can be performed faster than the control through the throttle valve.

4. Fuel cut-off in deceleration
   The ignition timing is retarded temporarily to prevent abrupt increase of the torque when the combustion is restarted.

5. Intake air temperature/coolant temperature
   The ignition timing is retarded to prevent knocking if the intake air temperature or coolant temperature is high. The ignition timing is retarded in the following cases.

   - The intake air temperature is above 30°C.
   - The coolant temperature is above 105°C.

   The ignition timing retard for intake air temperature and for coolant temperature is added up for correction.

6. ESP/ASR control mode
   The ignition timing is retarded to reduce engine torque as fast as possible under the ESP/ASR control mode.

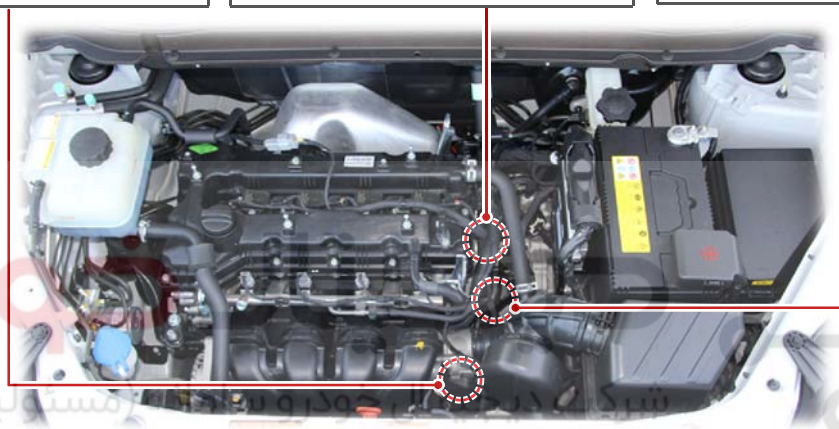
7. Knocking control
   If knocking occurs in the cylinder, the ignition angle of the corresponding cylinder is retarded. The coolant temperature is 15°C to 40°C when starting.

5) Warm-Up of Catalytic Converter

(1) Components

▶ Input Components

T-MAP sensor	Coolant temperature sensor	Crankshaft position sensor
		



▶ Output Components

Various sensor data	Engine ECU	Injector	Ignition coil
			
	- Determines the fuel injection volume - Heats the oxygen sensor	Operates the injector by receiving the signal from ECU	Retards the ignition by receiving the signal from ECU

Oxygen sensor

Heats the oxygen sensor by receiving the signal from ECU

Modification basis	
Application basis	
Affected VIN	

(2) Warm-up Control Function

▶ **Idle speed control**

The idle speed is controlled according to the fuel/air mixture when the engine load is changed, the power steering wheel is turned to its end, the selector lever is in the "D" position and the A/C compressor is in operation. It is also controlled according to the charge level during the purge control operation.

▶ **Ignition timing**

The idle speed is controlled according to the fuel/air mixture when the engine load is changed, The ignition angle can be retarded up to 36˚ or advanced up to 20˚ to help idle speed control.

▶ **Air conditioner compressor operation**

The air conditioner control unit sends the air conditioner operation signal to the ECU to increase the throttle valve opening amount in order to prevent reduction of the engine speed when the air conditioner compressor is in operation at idling.

▶ **Low voltage**

If low voltage is detected by the ECU, the idle speed increases up to 100 rpm selectively under the driving mode until the ignition switch is turned off.

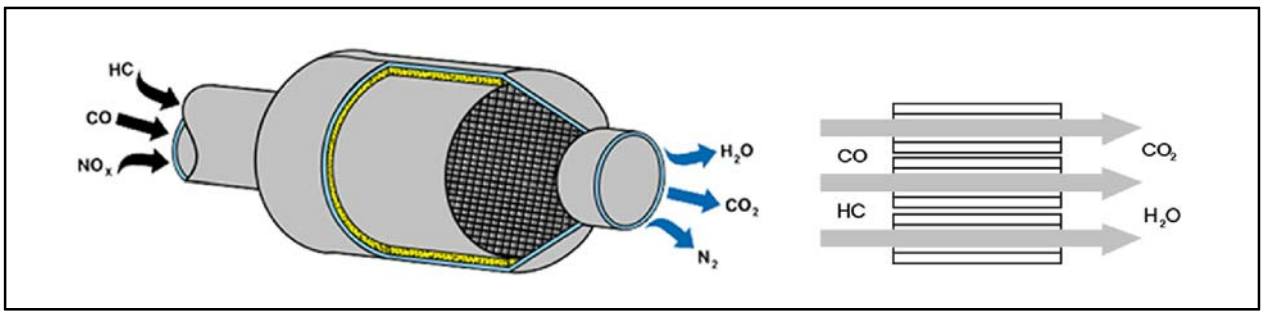
(3) Warm-up Control Operating Conditions

To make the catalytic converter reach a operating temperature, the ignition timing is retarded for about 20 seconds under the following conditions:

▶ The coolant temperature is 15°C ~ 40°C when the engine is started.
▶ **The selector lever is in the "P" or "N" position.**

Also, the idle speed increases to 1100 ~ 1500 rpm simultaneously by the idle speed control. However, as soon as the selector lever is shifted to the D position, warming up control of the catalytic converter will be inhibited. The information necessary to perform such control is as follows:

▶ **Coolant temperature**
▶ **Engine rpm**
▶ **Intake air mass**
▶ **Recognizing idling status**
▶ **Selector lever position**



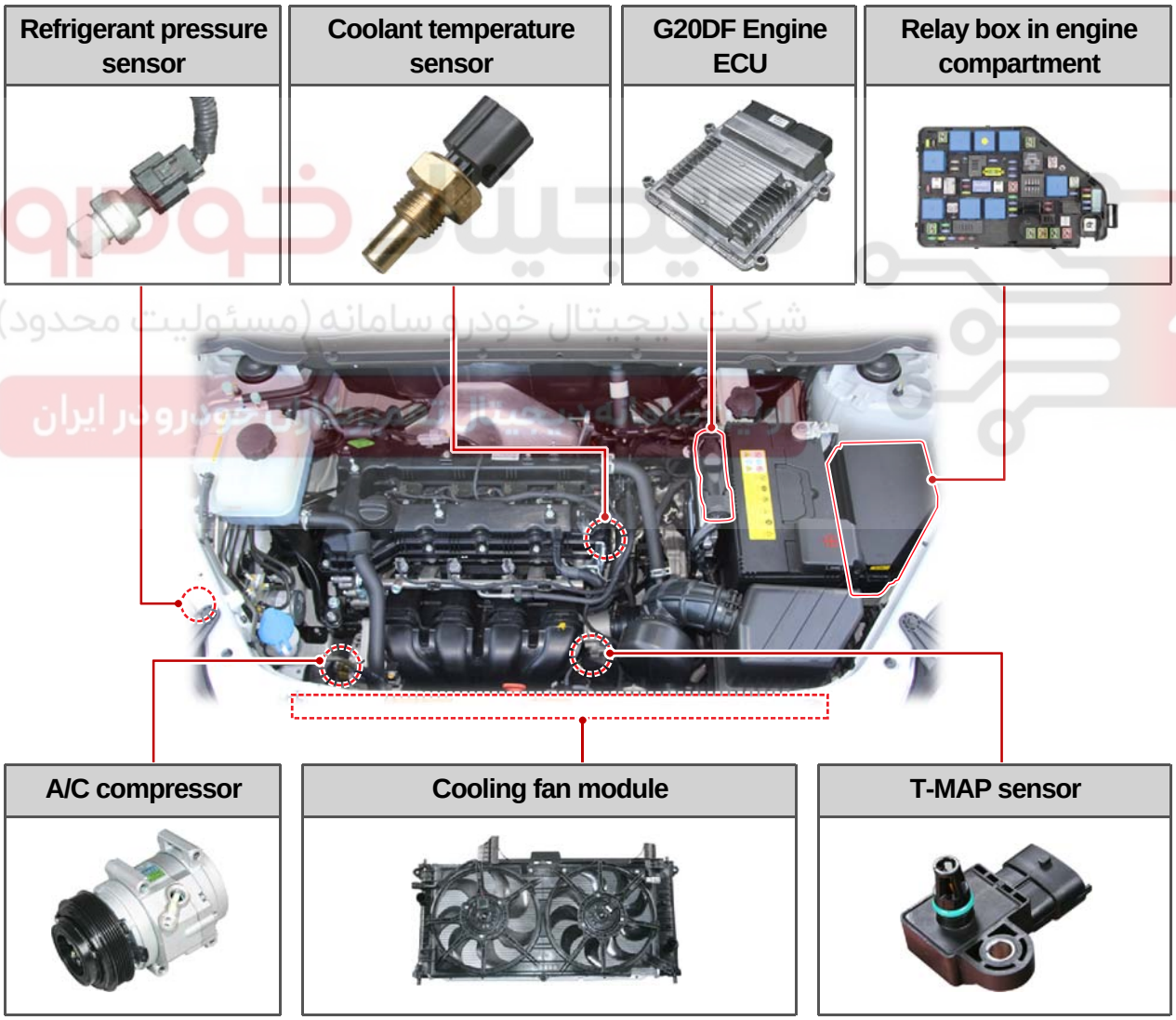
Modification basis	
Application basis	
Affected VIN	

6) Cooling Fan Control

(1) Overview of Cooling Fan and A/C Compressor

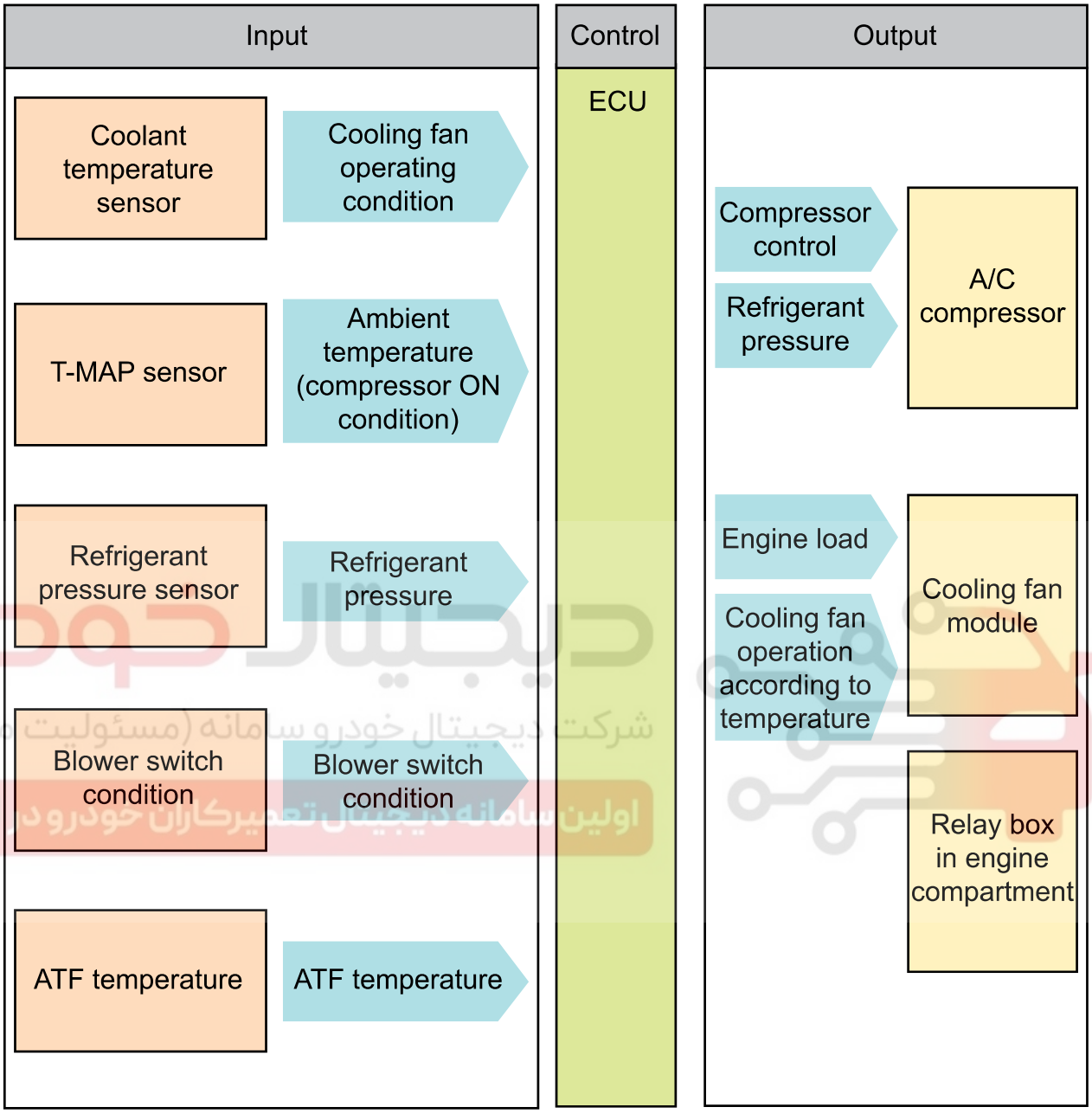
The cooling system maintains the engine temperature at an efficient level during all engine operating conditions. The water pump draws the coolant from the radiator. The coolant then circulates through water jackets in the engine block, the intake manifold, and the cylinder head. When the coolant reaches the operating temperature of the thermostat, the thermostat opens. The coolant then goes back to the radiator where it cools. The heat from automatic transaxle is also cooled down through the radiator by circulating the oil through the oil pump. There are two cooling fans (180W+120W) in G20DF engine. ECU controls the electric cooling fans with three cooling fan relays to improve the engine torque and air conditioning performance.

(2) Components



Modification basis	
Application basis	
Affected VIN	

(3) Input/Output for Cooling Fan and A/C Compressor



Modification basis	
Application basis	
Affected VIN	

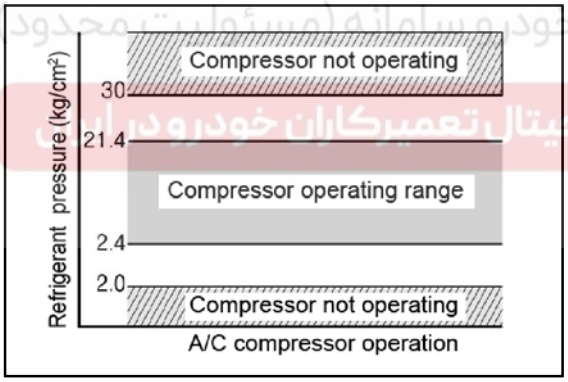
(4) Cooling Fan and A/C Compressor Control

▶ Conditions for cooling fan

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

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

▶ A/C compressor OFF conditions



- Coolant temperature: over 118℃
- Approx. 4 seconds after starting the engine
- When abrupt acceleration
- Refrigerant pressure:
  * OFF below 2.0 kg/㎠, then ON over 2.4 kg/㎠
  * OFF over 32 kg/㎠, then ON below 26.0 kg/㎠

▶ Output voltage according to refrigerant pressure

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

▶ Cooling fan control by ATF temperature

ATF temperature	Cooling fan speed	Remark
Over 110˚C	HI	-

Modification basis	
Application basis	
Affected VIN	

7) Immobilizer Control

(1) Overview

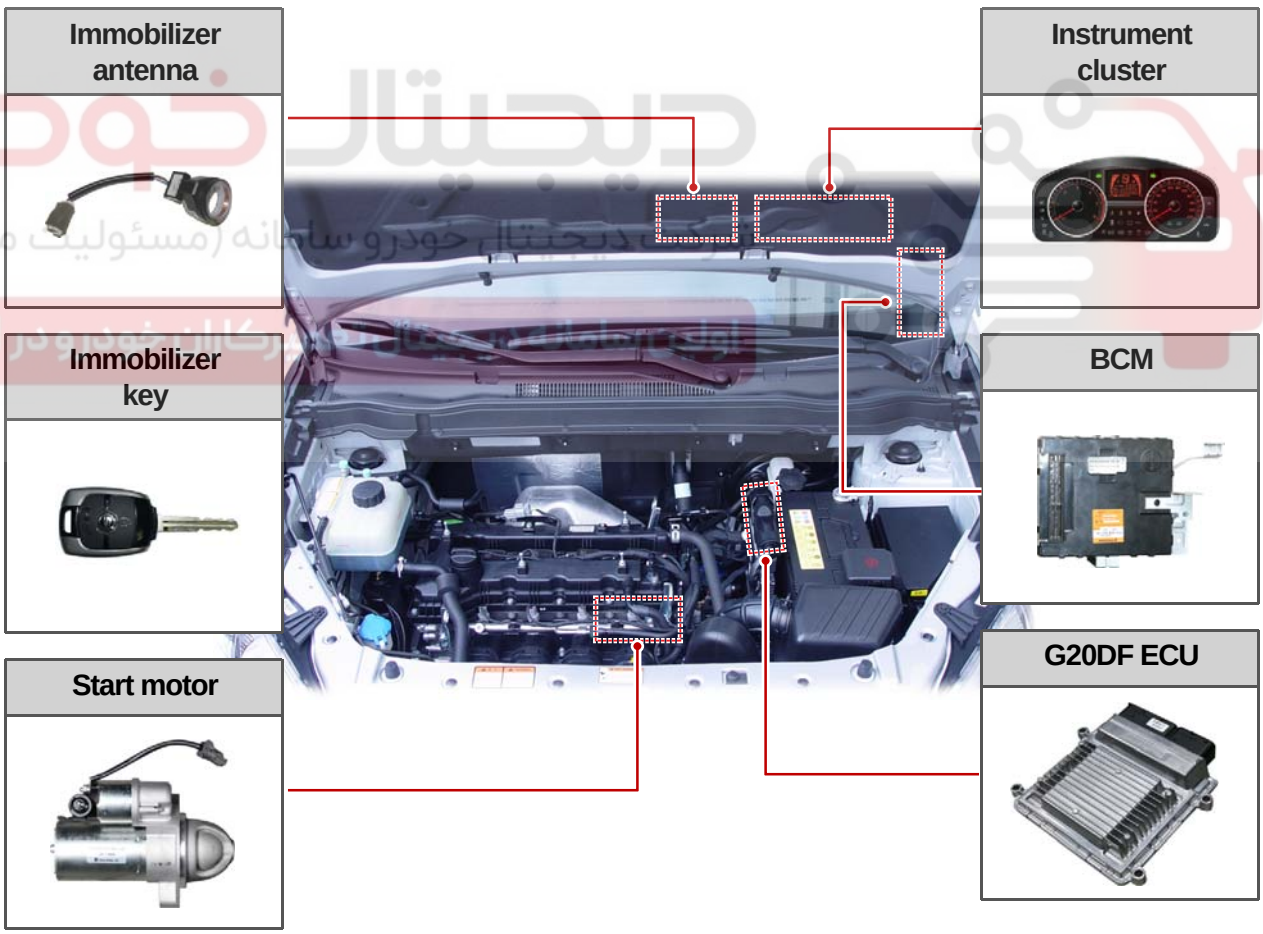
The Immobilizer System provides an additional theft deterrent to the vehicle in which it is installed and prevents it from being started by unauthorized persons. The transponder integrated in the key and the engine control unit have the same code. When the ignition key with the integrated transponder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

NOTE

For details, refer to Chapter "BCM".

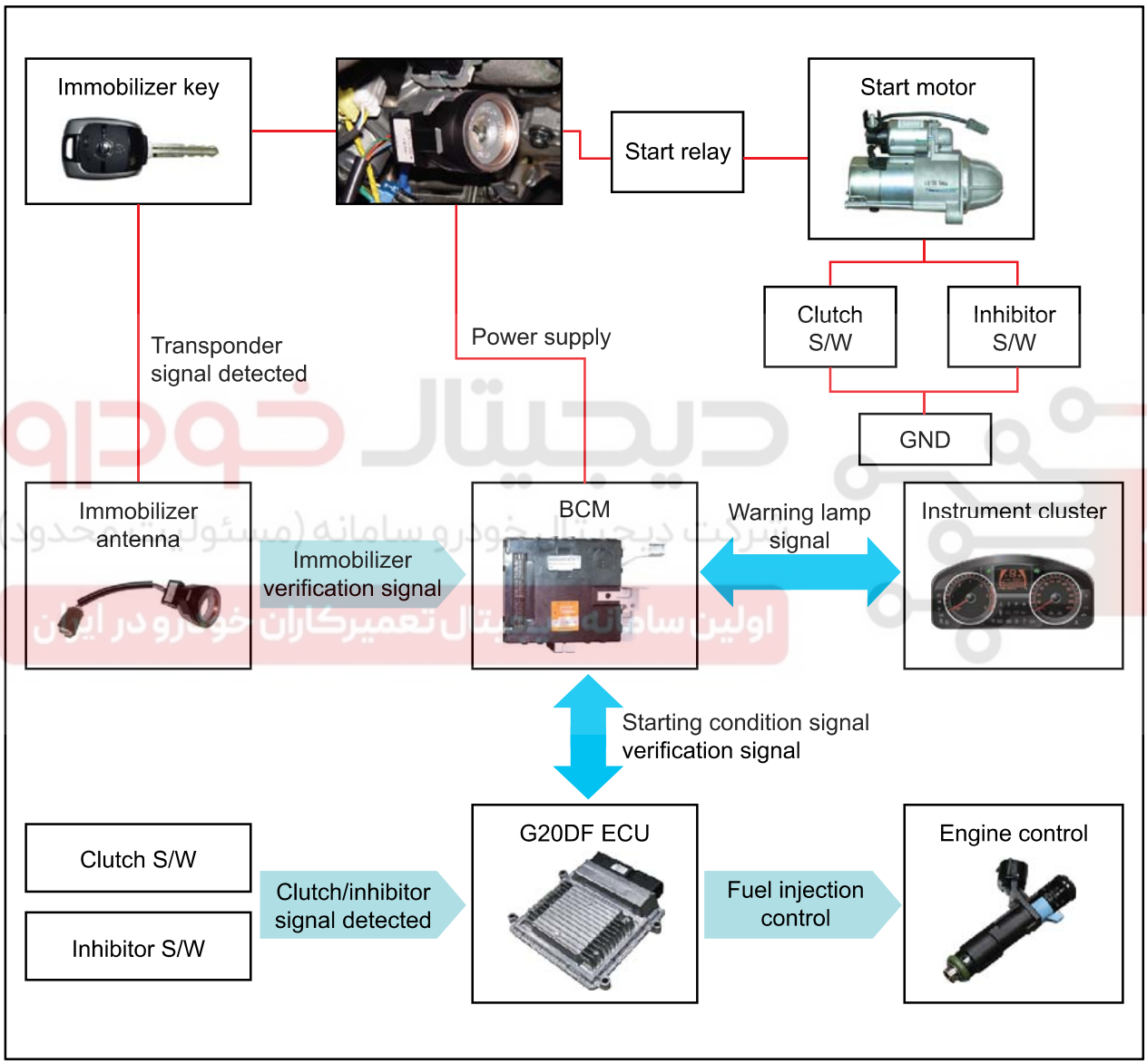
(2) Components

▶ **Conditions for cooling fan**



▶ Key approval process

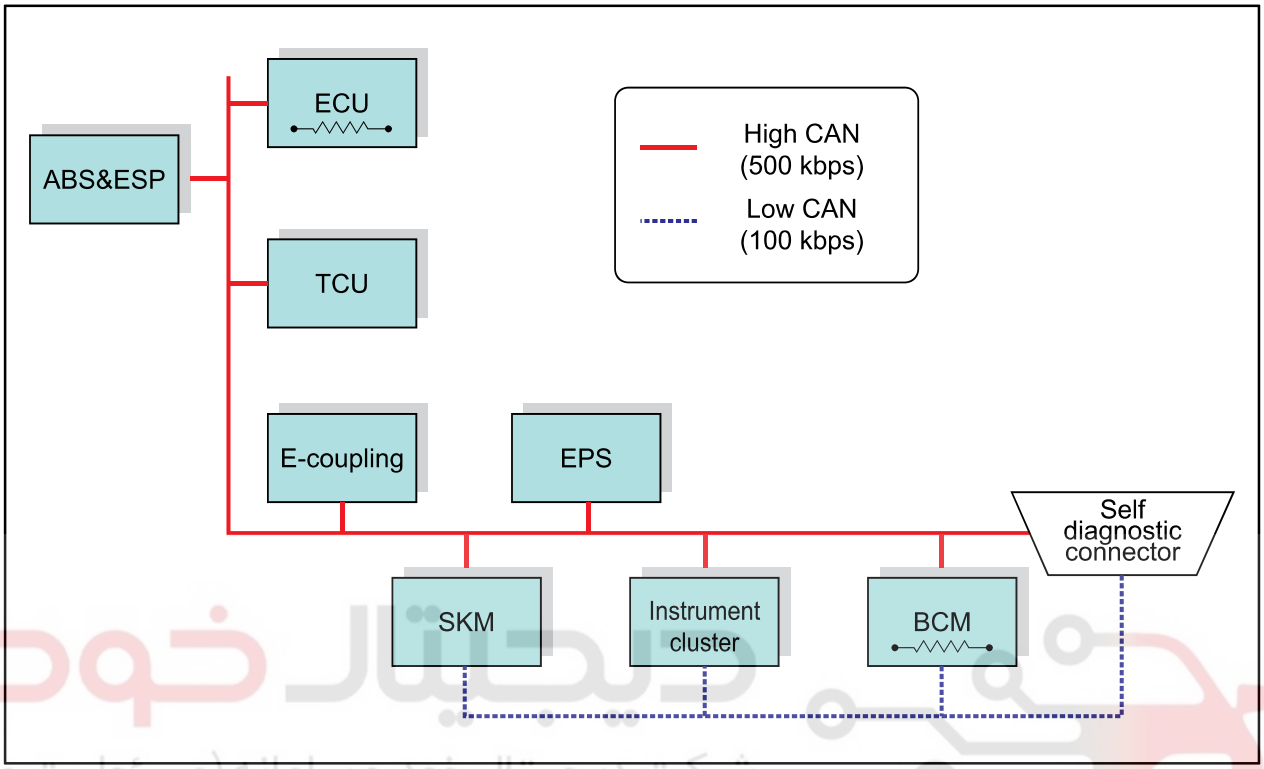
When turning the ignition switch to ON position, the power is supplied to BCM and ECU. ECU communicate with the immobilizer key to check if it is valid crypto code. If it is valid, ECU start to control the engine when turning the ignition switch to START position.
The system has 10 seconds of valid time-out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



Modification basis	
Application basis	
Affected VIN	

8) CAN Configuration (P-CAN/B-CAN)

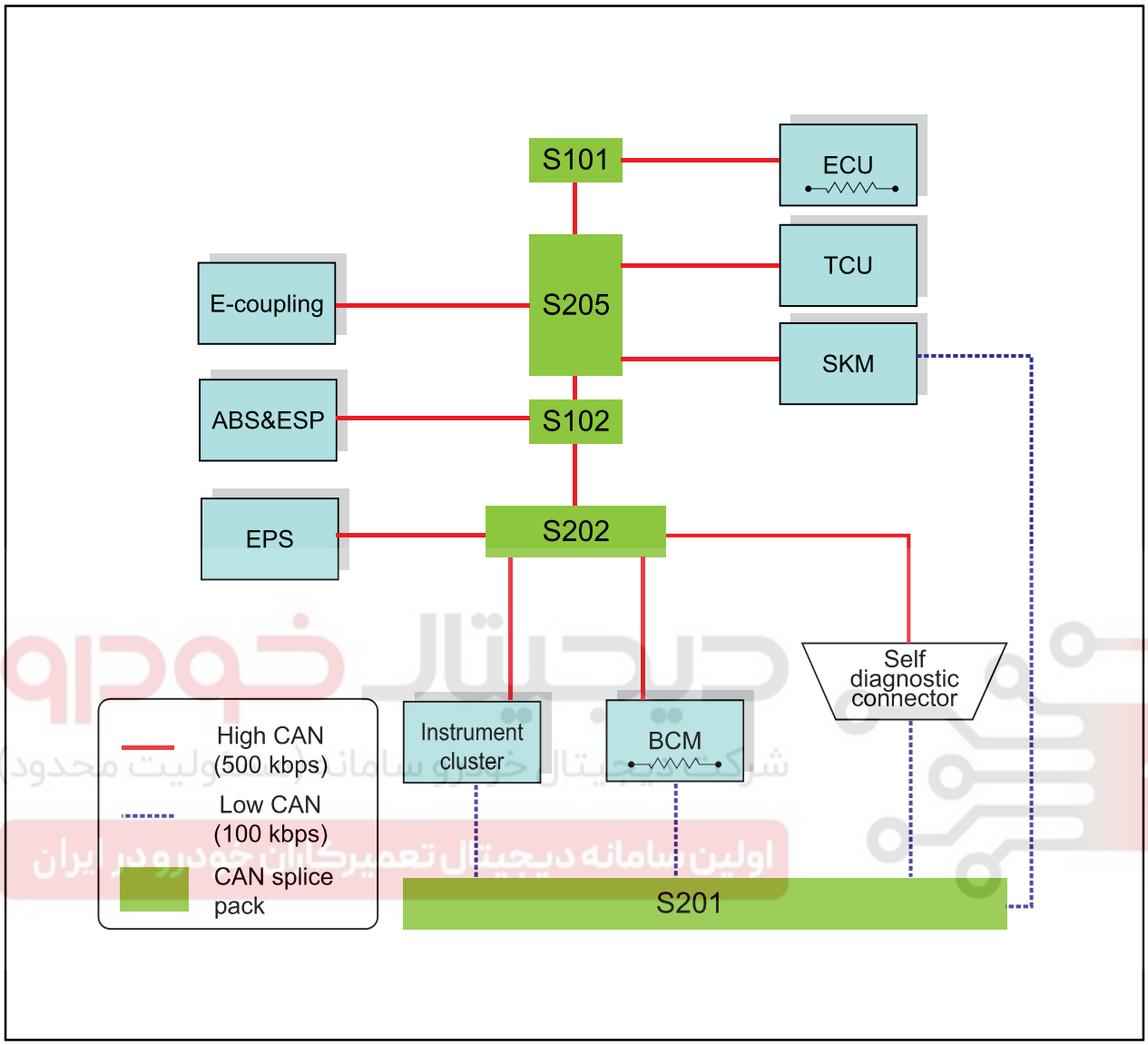
(1) CAN Configuration (P-CAN/B-CAN)



Name	Function
ECU	Electronic Control Unit
TCU	Transmission Control Unit
EPS	Electronic Power Steering Unit
BCM	Body Control Moudule
SKM	Smart Key Moudule

CAN system communicates with the system units in vehicle. It consists of P-CAN and B-CAN according to the communication speed.
P-CAN & B-CAN: SKM, Instrument cluster, BCM, Disgnostic connector
P-CAN: ECU, ABS & ESP, TCU, E-coupling, EPS unit
Terminal resistance: installed on ECU and BCM

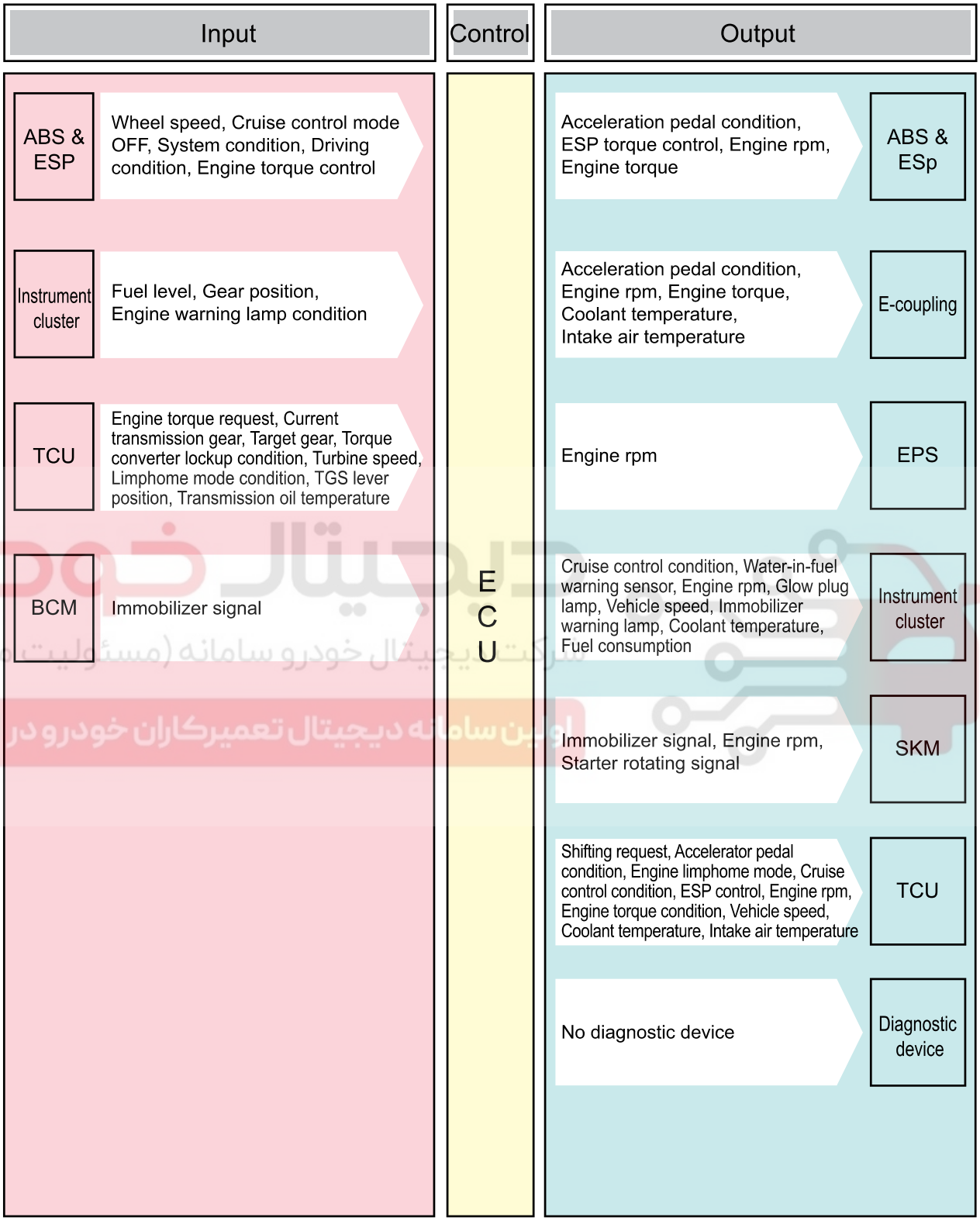
(2) Wiring Connection of CAN Communication



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

Modification basis	
Application basis	
Affected VIN	

(3) Input/Output for CAN communication



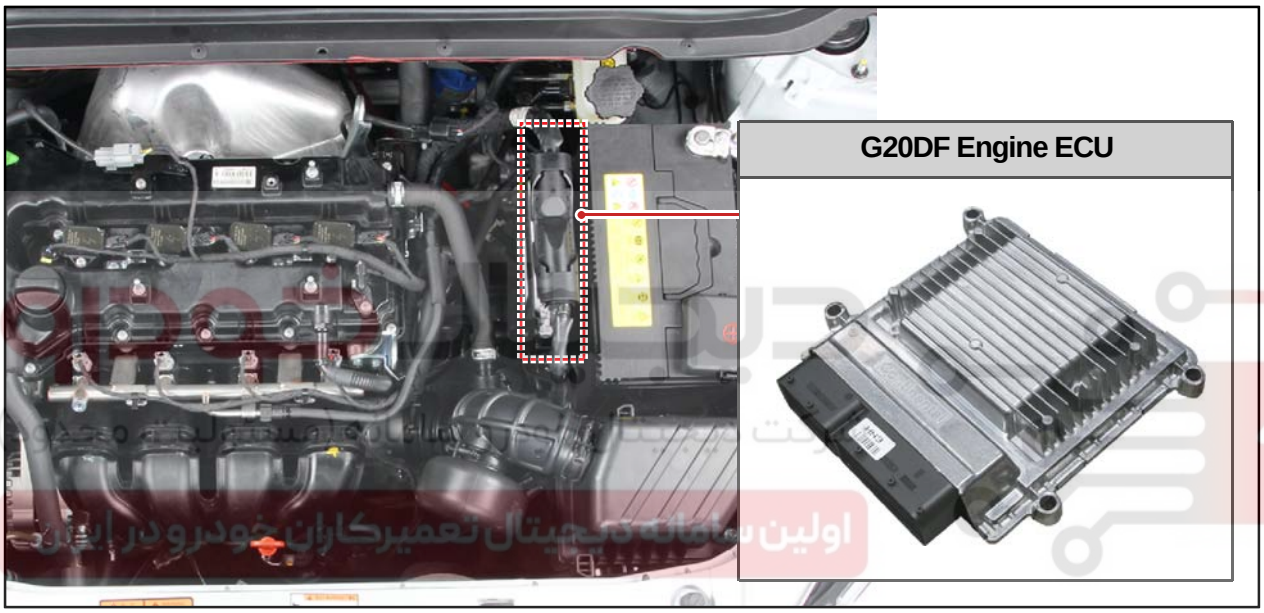
Modification basis	
Application basis	
Affected VIN	

CONFIGURATION AND FUNCTION

S.G.N. 1490-01 G20DF ENGINE ECU

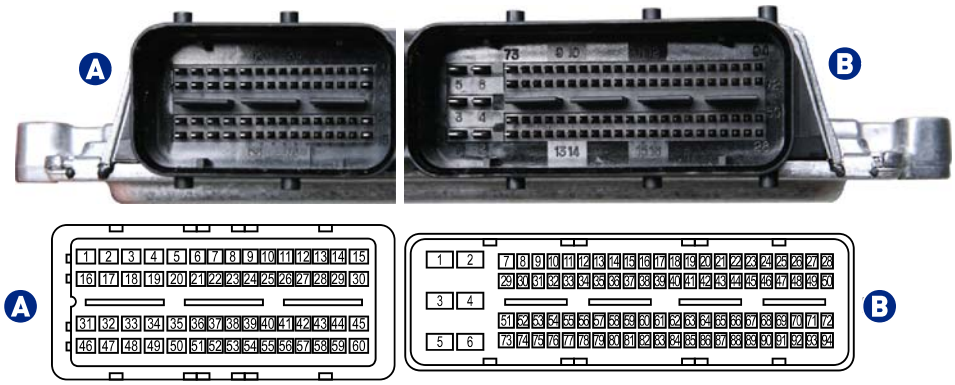
1) Overview

ECU receives and analyzes signals from various sensors and then modifies those signals into permissible voltage levels and analyzes to control respective actuators. ECU microprocessor calculates injection period and injection timing proper for engine piston speed and crankshaft angle based on input data and stored specific map to control the engine power and emission gas.



Modification basis	
Application basis	
Affected VIN	

2) Connector



G20DF(EU-V) ECU

Connector	Pin No.	Function	Connector	Pin No.	Function
A	01	IgnitionA (Cyl.1) GND	A	17	Injector 2 (Cyl. 2) GND
	02	Injector 1 (Cyl. 1) GND		18	Canister Purge Solenoid SIG
	03	-		19	Variable Intatke System SIG
	04	Starter motor control relay S/W		20	-
	05	Binary lambda sensor Heater Downstream		21	-
	06	Binary lambda sensor Downstream GND		22	Knock sensor shield GND
	07	Lambda Sensor Downstream SIG		23	Knock sensor GND
	08	Knock sensor SIG		24	MAP and TIA sensor GND
	09	Intake Air Temp SIG		25	-
	10	-		26	Crank position sensor GND
	11	-		27	Coolant Temp GND
	12	Coolant Temp SIG		28	TPS 2 SIG
	13	TPS1 SIG		29	TPS 1/2 sensor GND
	14	TPS supply 5V		30	Electric Throttle Control DC motor output -
	15	Electric Throttle Control DC motor output (+)		31	Ignition C (Cyl.4) GND
	16	Ignition B (Cyl.3) GND		32	Injector 3 (Cyl. 3) GND

Connector	Pin No.	Function	Connector	Pin No.	Function
A	33	OCV GND	A	47	Injector 4 (Cyl. 4) GND
	34	-		48	-
	35	CAM_IN sensor supply 5V		49	-
	36	-		50	Binary lambda sensor Heater Upstream
	37	-		51	Binary lambda sensor Upstream GND
	38	-		52	-
	39	Manifold Air Pressure sensor SIG		53	Binary lambda Sensor Upstream SIG
	40	-		54	T- MAP sensor supply 5V
	41	-		55	-
	42	-		56	Crank Position Sensor SIG(+)
	43	CAM_IN sensor GND		57	-
	44	-		58	CAM_IN Sensor SIG
	45	-		59	-
	46	Ignition D (Cyl.2) GND		60	-
B	01	ECU Power GND	B	14	-
	02	Battery Voltage after Main Relay		15	-
	03	ECU Power GND		16	-
	04	Battery Voltage after Main Relay		17	-
	05	ECU Logic GND		18	-
	06	Battery Voltage direct		19	-
	07	-		20	-
	08	-		21	-
	09	-		22	Cruise Control Switch
	10	-		23	-
	11	A/Con Compressor Relay		24	-
	12	-		25	-
	13	-		26	-

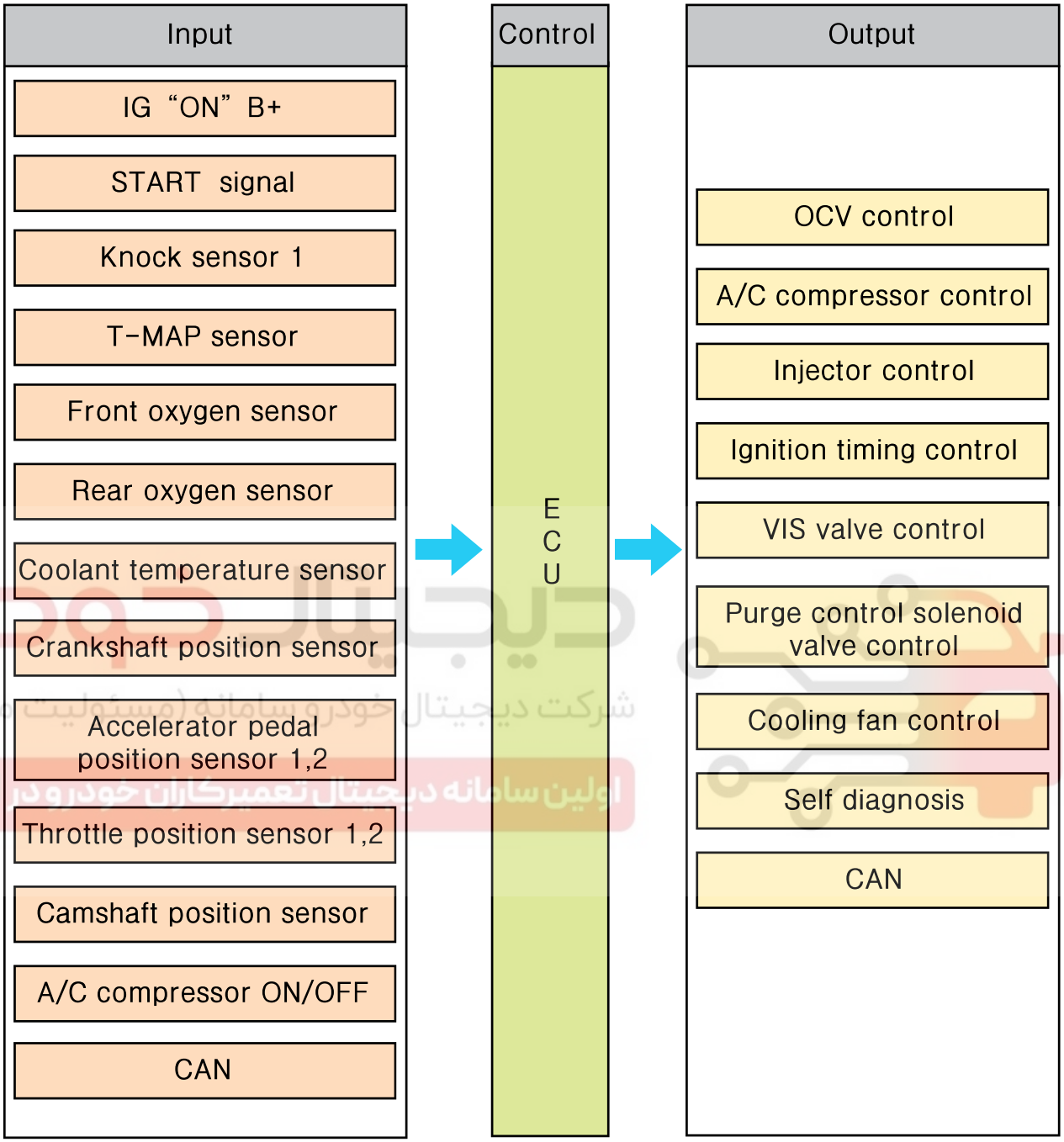
Modification basis	
Application basis	
Affected VIN	

Connector	Pin No.	Function	Connector	Pin No.	Function
B	27	-	B	53	Cooling Fan Relay High
	28	-		54	-
	29	-		55	2nd CAN High
	30	-		56	2nd CAN Low
	31	-		57	-
	32	-		58	-
	33	-		59	-
	34	-		60	-
	35	-		61	-
	36	-		62	Brake Switch(NC)
	37	-		63	Clutch Switch (NC)
	38	-		64	-
	39	-		65	-
	40	-		66	-
	41	-		67	A/C Sensor SIG
	42	-		68	-
	43	Powersteering sensor GND		69	-
	44	Cruise Control switch GND		70	-
	45	A/C sensor GND		71	Accelerate Pedal Sensor 1
	46	-		72	Accelerate Pedal Sensor 2
	47	-		73	-
	48	-		74	Main Power Relay GND
	49	Accelerate Pedal Sensor 1 sensor GND		75	Electrical Fuel Pump Relay GND
	50	Accelerate Pedal Sensor 2 sensor GND		76	-
	51	Battery Voltage after Ignition Key		77	CAN communication High
	52	Starter motor control relay, Low side		78	CAN communication Low

Modification basis	
Application basis	
Affected VIN	

Connector	Pin No.	Function	Connector	Pin No.	Function
B	79	Clutch Switch (NO)	B	87	-
	80	Vehicle Speed sensor SIG (FRT)		88	Cruise Control Sensor supply 5V
	81	-		89	-
	82	-		90	-
	83	-		91	-
	84	Brake Switch (NO)		92	-
	85	-		93	Accelerate Pedal Sensor 1 supply 5V
	86	-		94	Accelerate Pedal Sensor 2 supply 5V

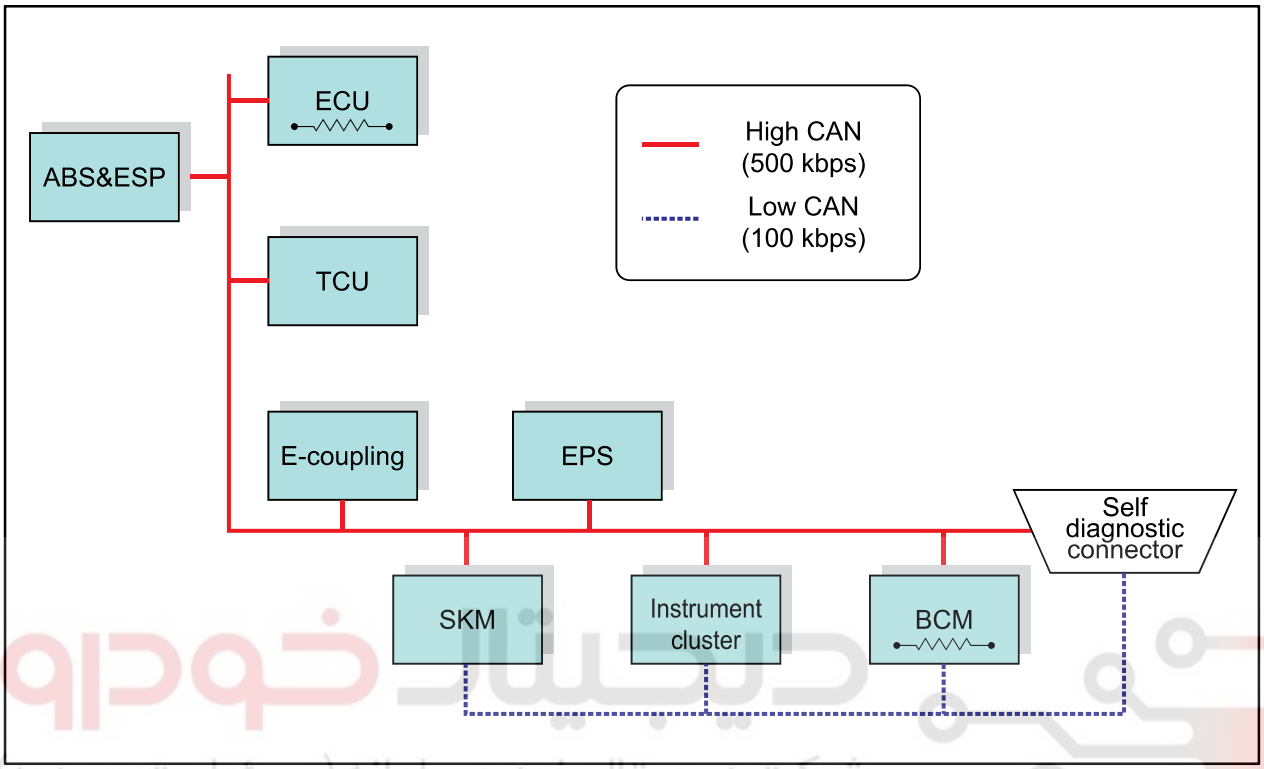
3) Input/Output for ECU



Modification basis	
Application basis	
Affected VIN	

4) CAN Configuration (P-CAN/B-CAN)

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

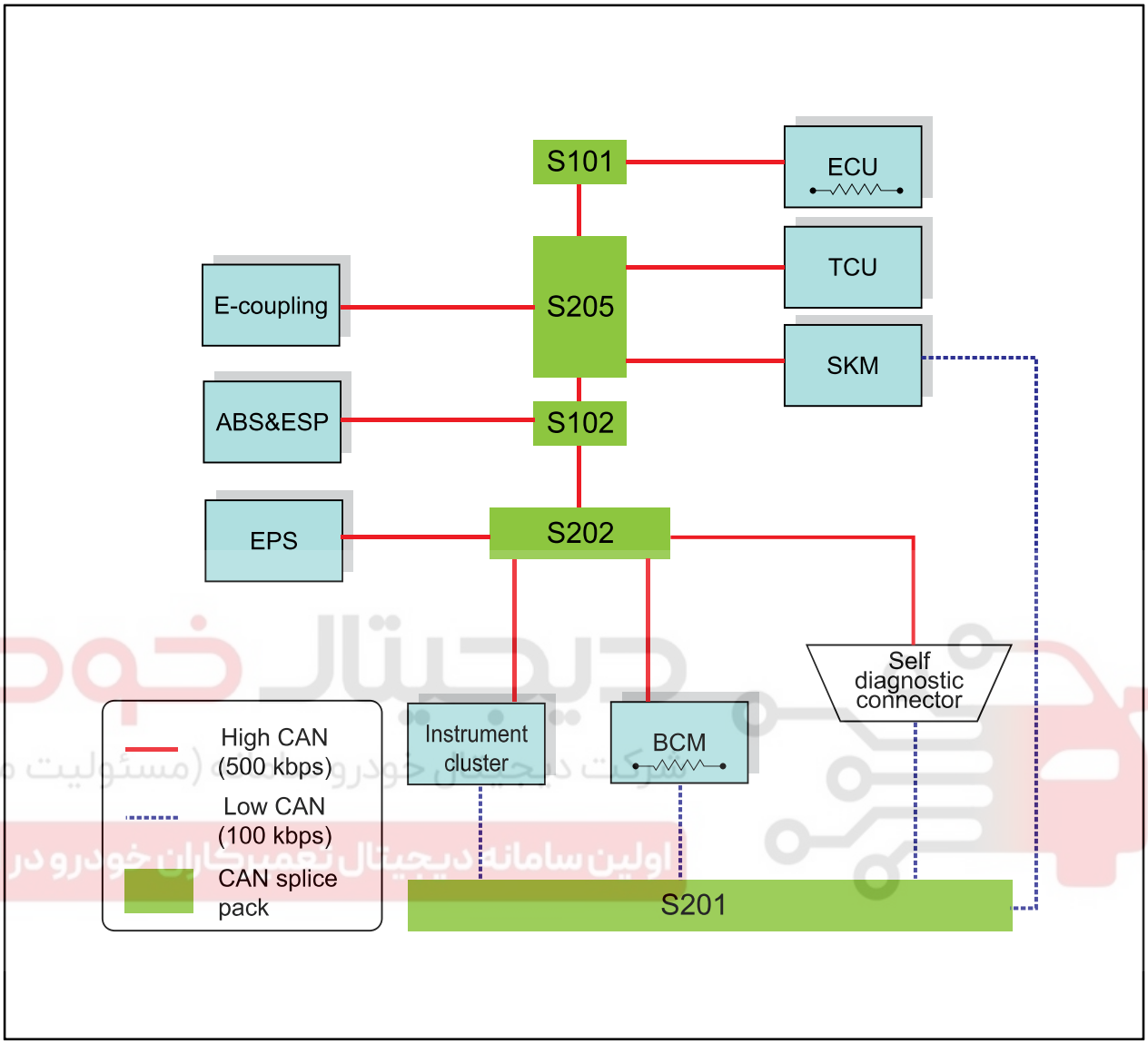


Name	Function
ECU	Electronic Control Unit
TCU	Transmission Control Unit
EPS	Electronic Power Steering Unit
BCM	Body Control Moudule
SKM	Smart Key Moudule

CAN system communicates with the system units in vehicle. It consists of P-CAN and B-CAN according to the communication speed.
P-CAN & B-CAN: SKM, Instrument cluster, BCM, Disgnostic connector
P-CAN: ECU, ABS & ESP, TCU, E-coupling, EPS unit
Terminal resistance: installed on ECU and BCM

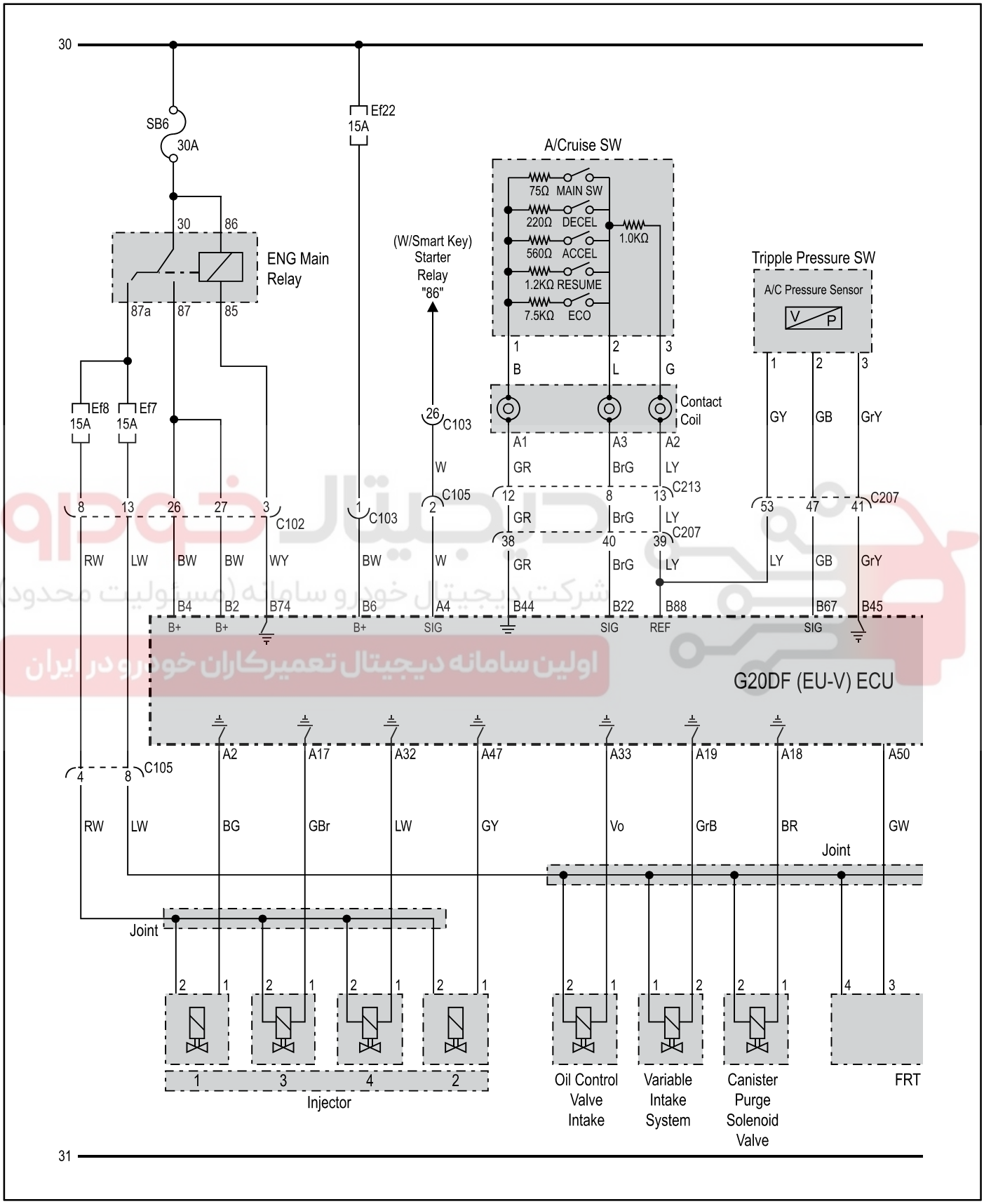
Modification basis	
Application basis	
Affected VIN	

(2) Wiring Connection of CAN Communication

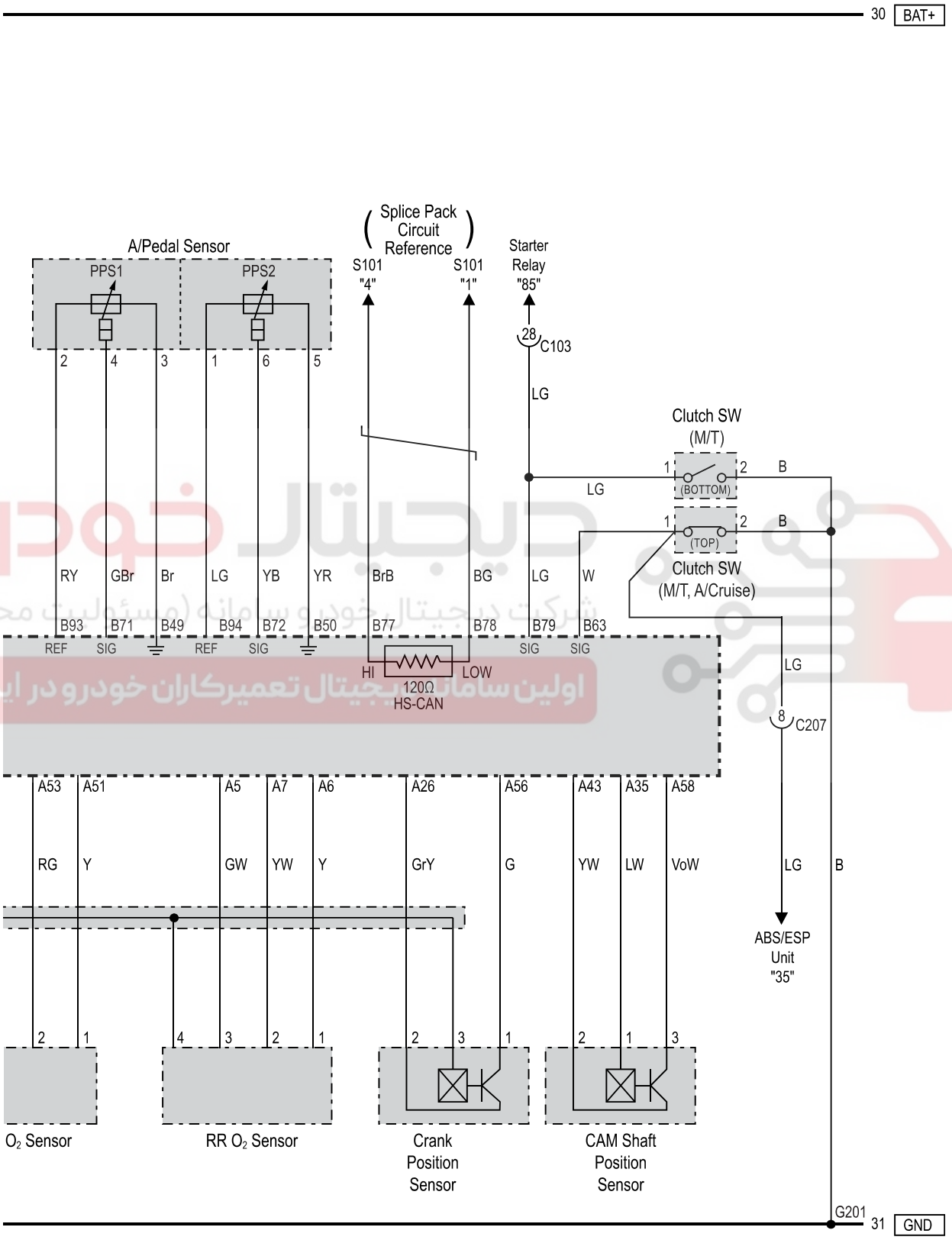


Splice pack	Wiring	Location
S101	Floor wiring (LH)	Under fuse & relay box in engine compartment
S102	Floor wiring (RH)	Inside of right fender
S201	Main wiring	Behind instrument cluster (cowl cross member)
S202	Main wiring	Behind instrument cluster (cowl cross member)
S205	Floor wiring (LH)	Under driver's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

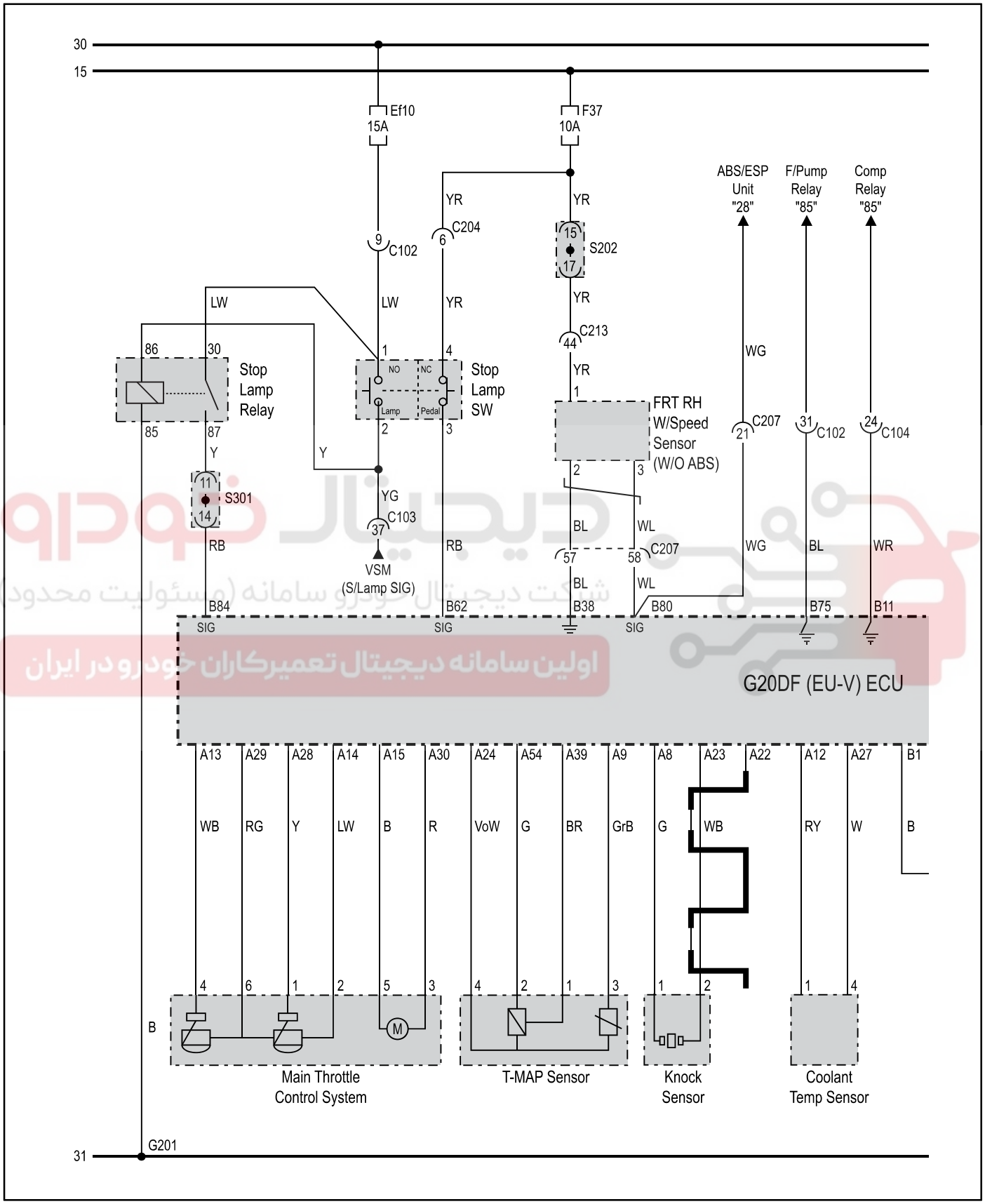
5) Circuit Diagram of G20DF ECU



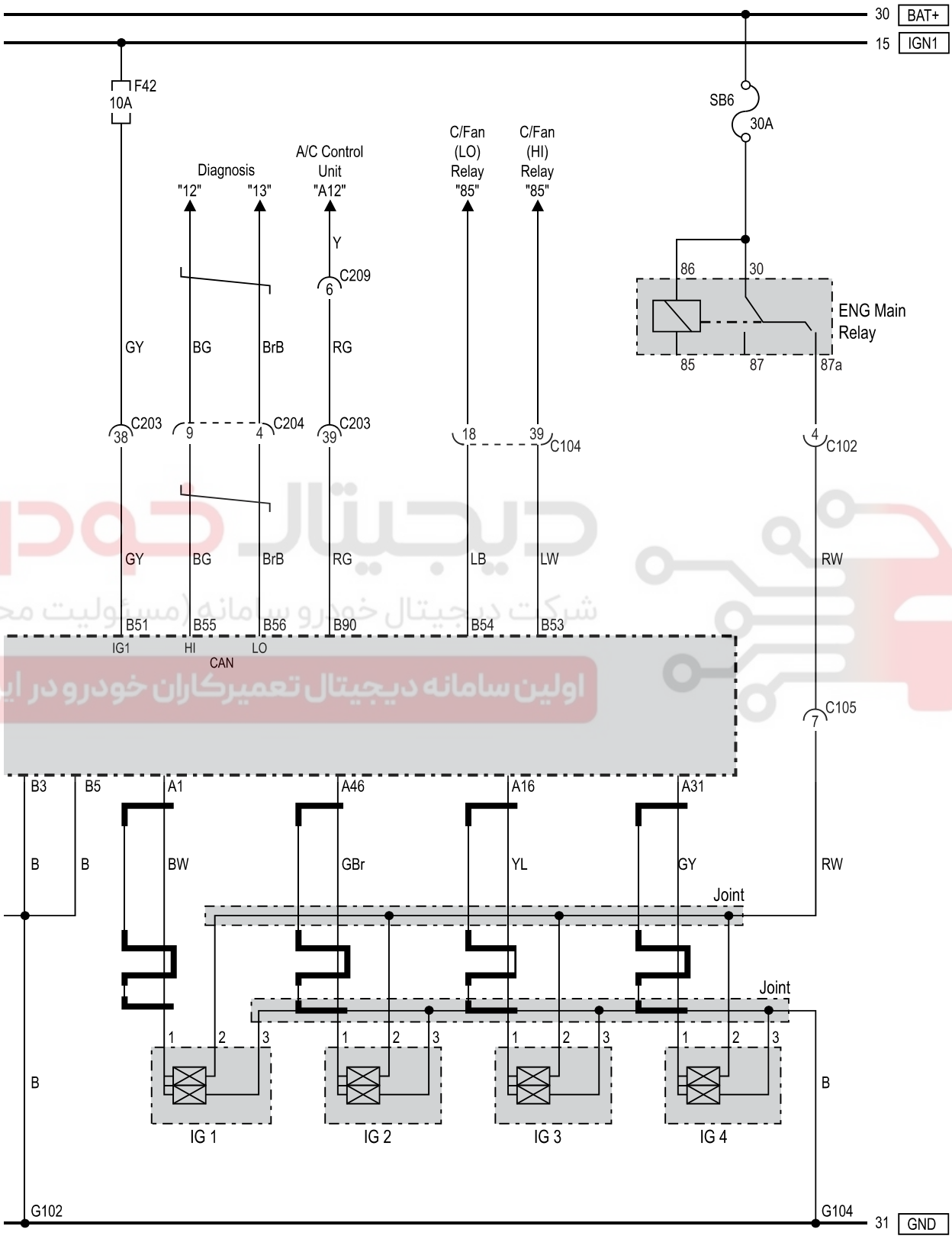
Modification basis	
Application basis	
Affected VIN	



Modification basis	
Application basis	
Affected VIN	



Modification basis	
Application basis	
Affected VIN	



Modification basis	
Application basis	
Affected VIN	

S.G.N. 2245-02

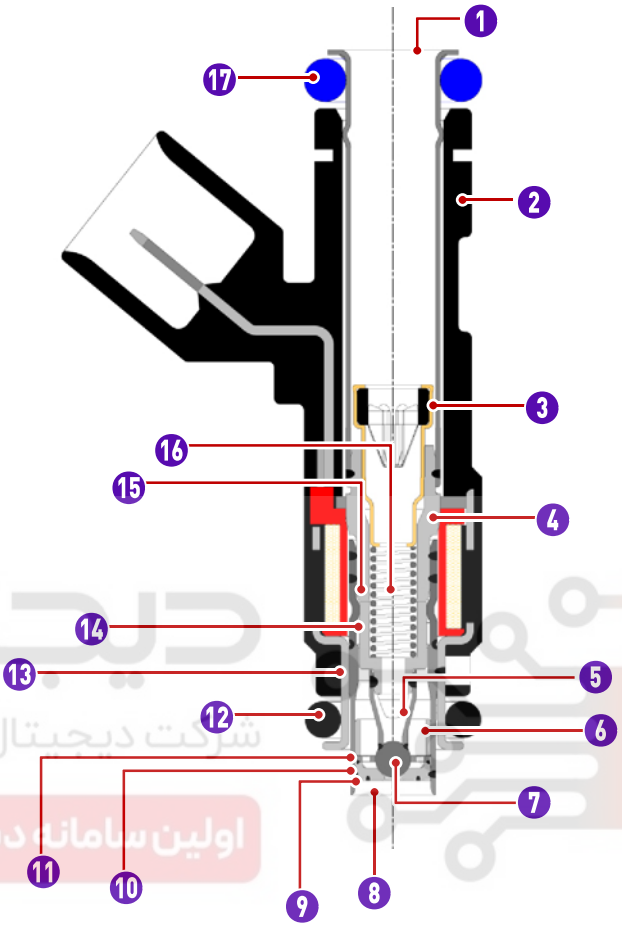
INJECTOR

1) Overview

ECU controls the injector ground in each cylinder according to the injection timing by receiving the piston position signal and engine rpm signal from crankshaft position sensor and camshaft position sensor.
ECU opens the solenoid valve in injector to inject the fuel into combustion chamber by grounding it. At this moment, the injected fuel is changed to gas from liquid.
The injection timing is controlled by ECU according to the engine rpm signal and various sensor information, and the firing order is 1-3-4-2.

Modification basis	
Application basis	
Affected VIN	

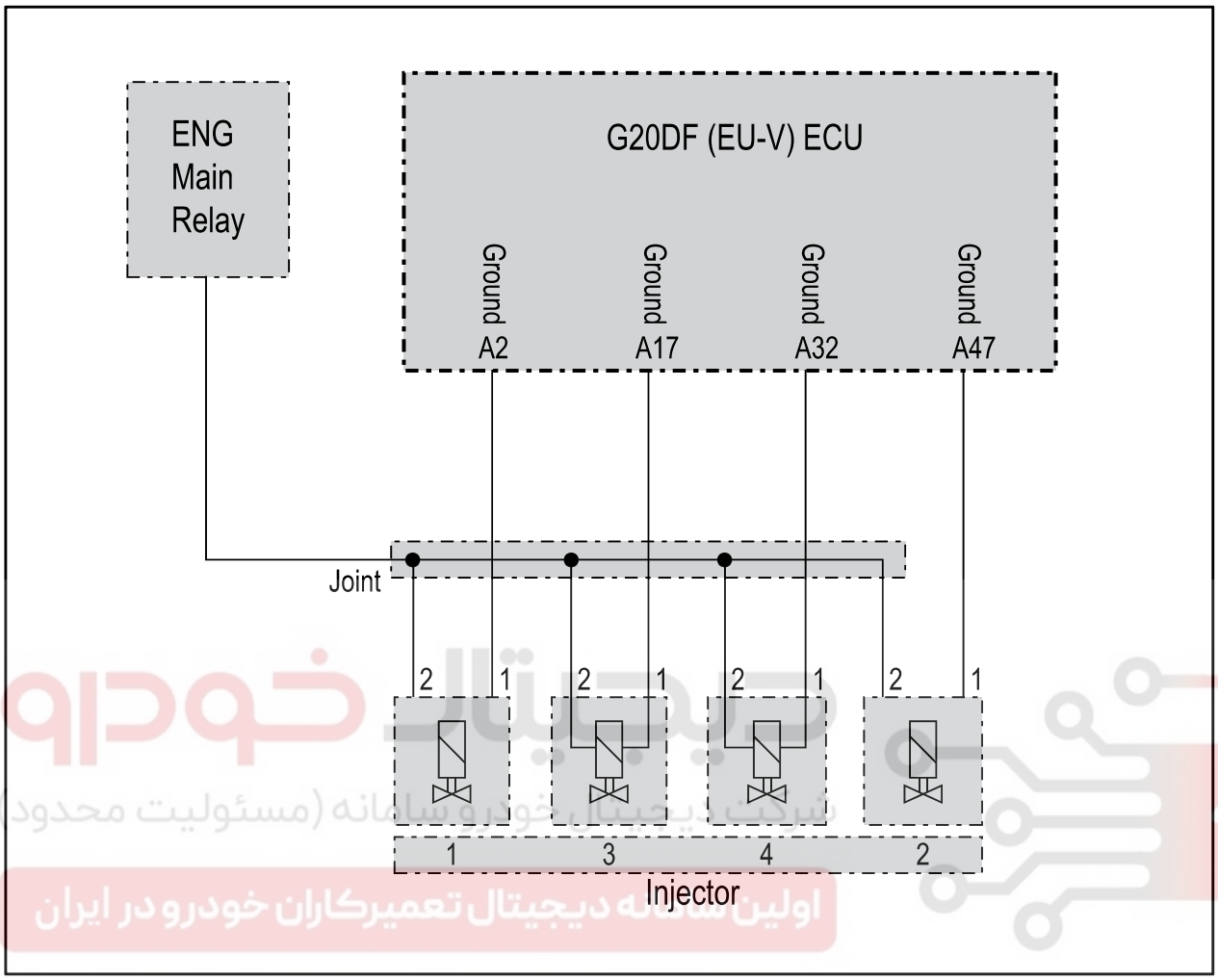
2) Components



1. Inlet tube
2. Housing
3. Filter & adjusting tube
4. Pawl piece
5. Armature tube
6. Seat sleeve
7. Ball
8. Orifice
9. Seat
10. Lower guide
11. Lower screen
12. Lower external O-ring
13. Valve body
14. Armature
15. Non-magnetic cell
16. Spring
17. Upper external O-ring

Modification basis	
Application basis	
Affected VIN	

3) Circuit Diagram



Static flow	187.2 gr/min
Specified component resistance	14.5 ± 0.7 Ω at room temperature
Service check	- It is normally supplied with battery power. However, its voltage gets close to 0 V (0 V theoretically) and fuel is sprayed through the injector when the ECU drives (grounds) the injector. When the engine control module does not ground the injector, the injector closes and peak voltage is generated in a moment. Place the injector into a transparent container (such as a beaker) - and operate the injector forcibly to check the injection pattern and droplet in order to find a cause of misfire.

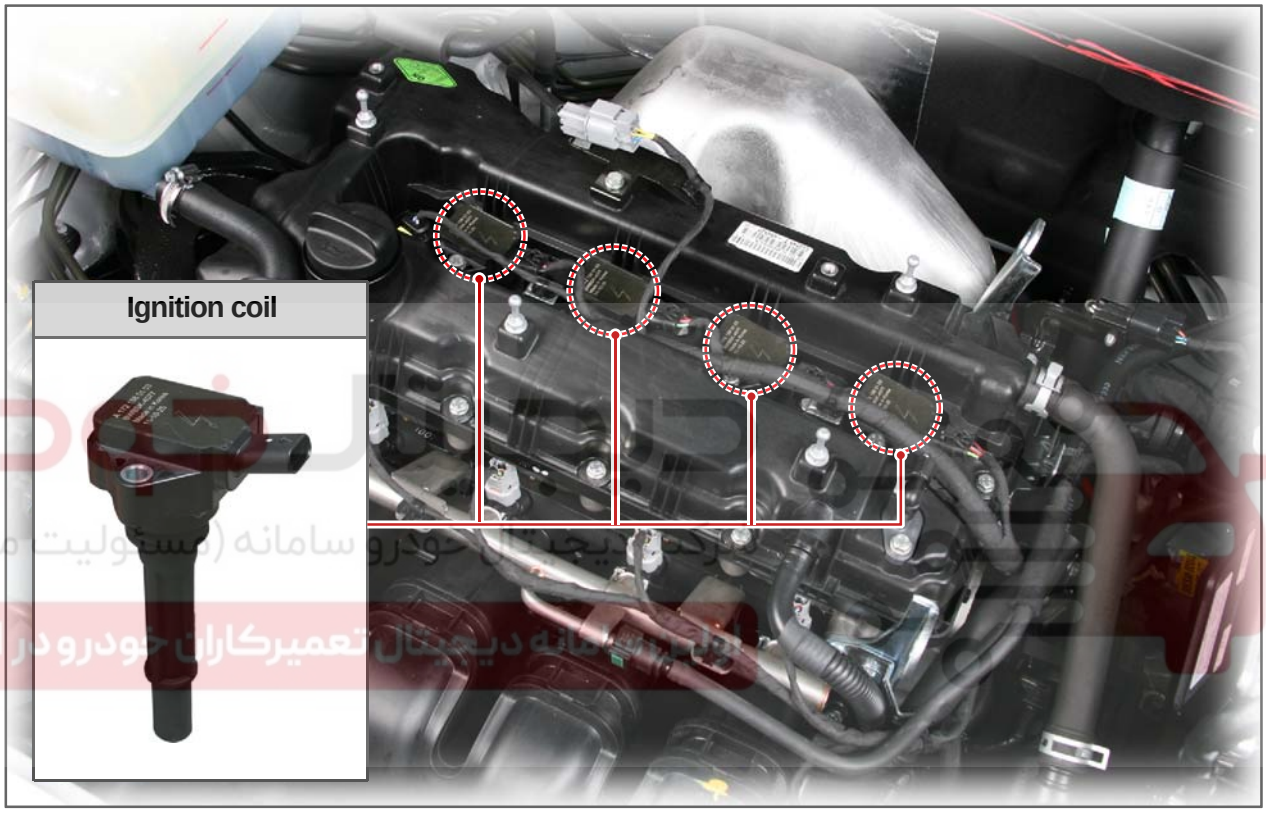
Modification basis	
Application basis	
Affected VIN	

S.G.N. 1443-01

IGNITION COIL

1) Overview

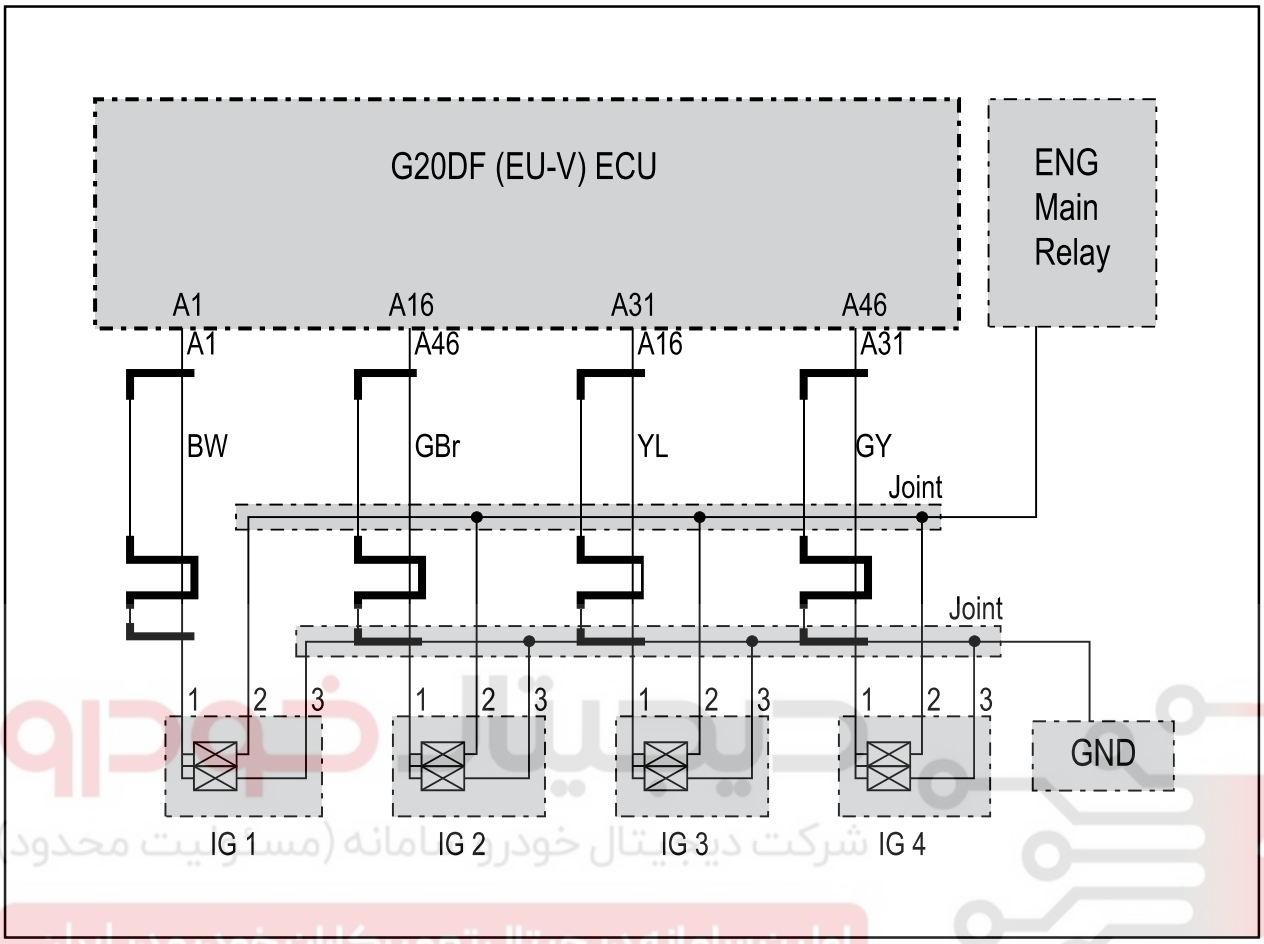
The G20DF engine is equipped with the independent type direct ignition system that the ignition coil is installed in each cylinder.
This independent type direct ignition system provides easy installation and less igntion energy loss.
The ignition coil in this system has long cylindrical shape, thus is called stick type or pencil type ignition coil.



Description	Specification	
Component resistence (20℃)	Primary coil	800 mΩ
	Secondary coil	Not measurable (High voltage Diode)
Generated voltage	Primary coil	Max 400 V
	Secondary coil	5~20 kV
Operating temperature	−40℃ ~ 130℃	
Operating current	Primary coil: 7.5 A ± 7.0 A	

Modification basis	
Application basis	
Affected VIN	

3) Circuit Diagram



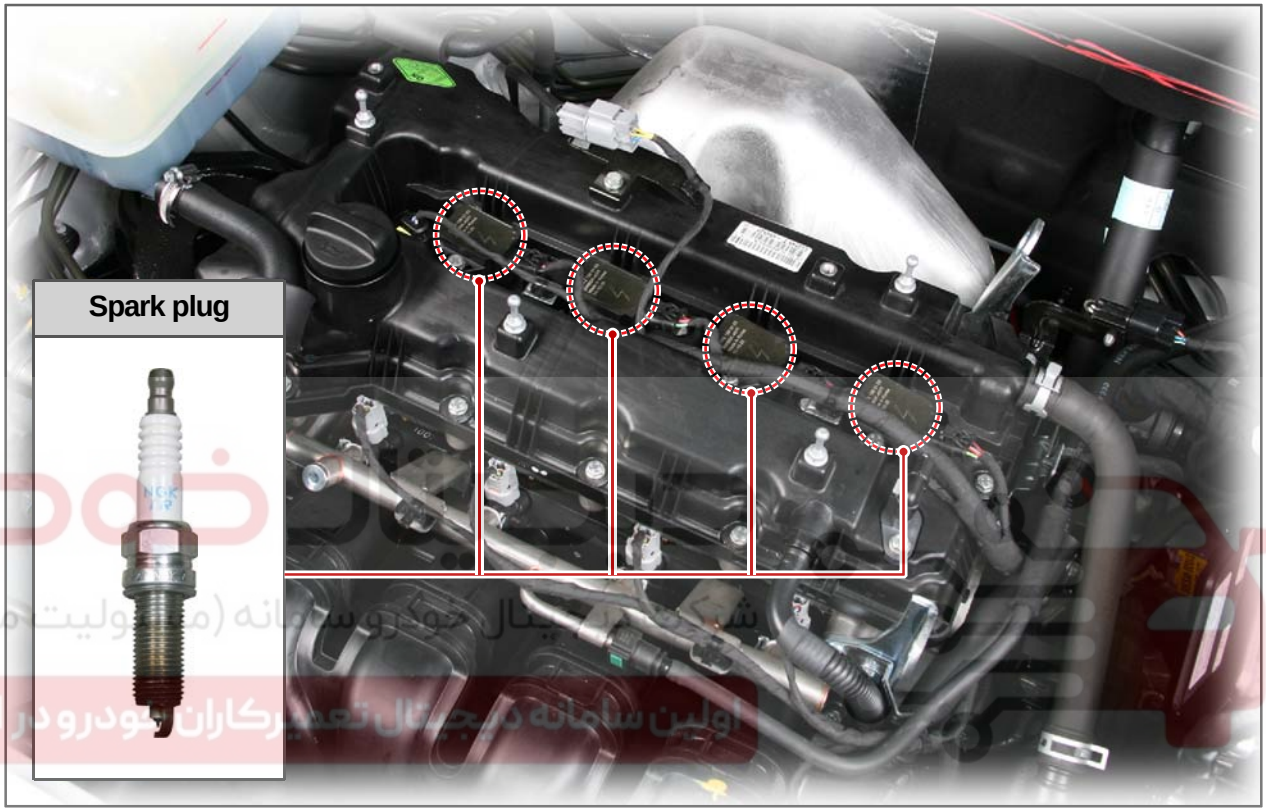
Modification basis	
Application basis	
Affected VIN	

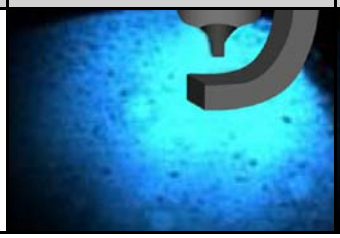
S.G.N. 1443-03

SPARK PLUG

1) Overview

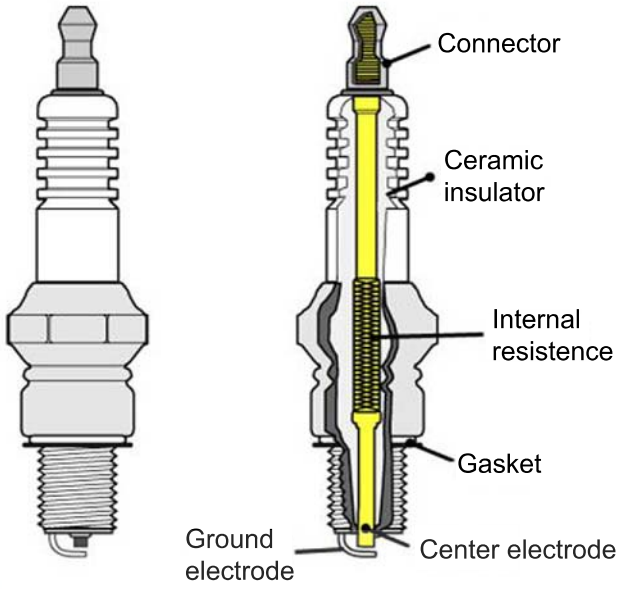
The spark plug in G20DF engine is made of iridium alloy.
The iridium spark plug improves the fuel economy and ignition efficiency with high starting performance, accelerating performance and idling safety.



Type	Appearance	At beginning of ignition	In 3 ms
Iridium spark plug (G20DF)			

Modification basis	
Application basis	
Affected VIN	

Spark plug



▶ Ceramic insulator

This isolates the high voltage at the electrode, ensuring that the spark happens at the tip of the electrode and not anywhere else on the plug.

▶ Connector

This is connected to the ignition coil to get the electric power.

▶ Gasket

Because the spark plug also seals the combustion chamber or the engine when installed, seals are required to ensure there is no leakage from the combustion chamber.

▶ Interal resistance

The sparking noise may cause RF noise in audio system. To reduce this, the internal resistance is installed in the spark plug.

▶ Center electrode

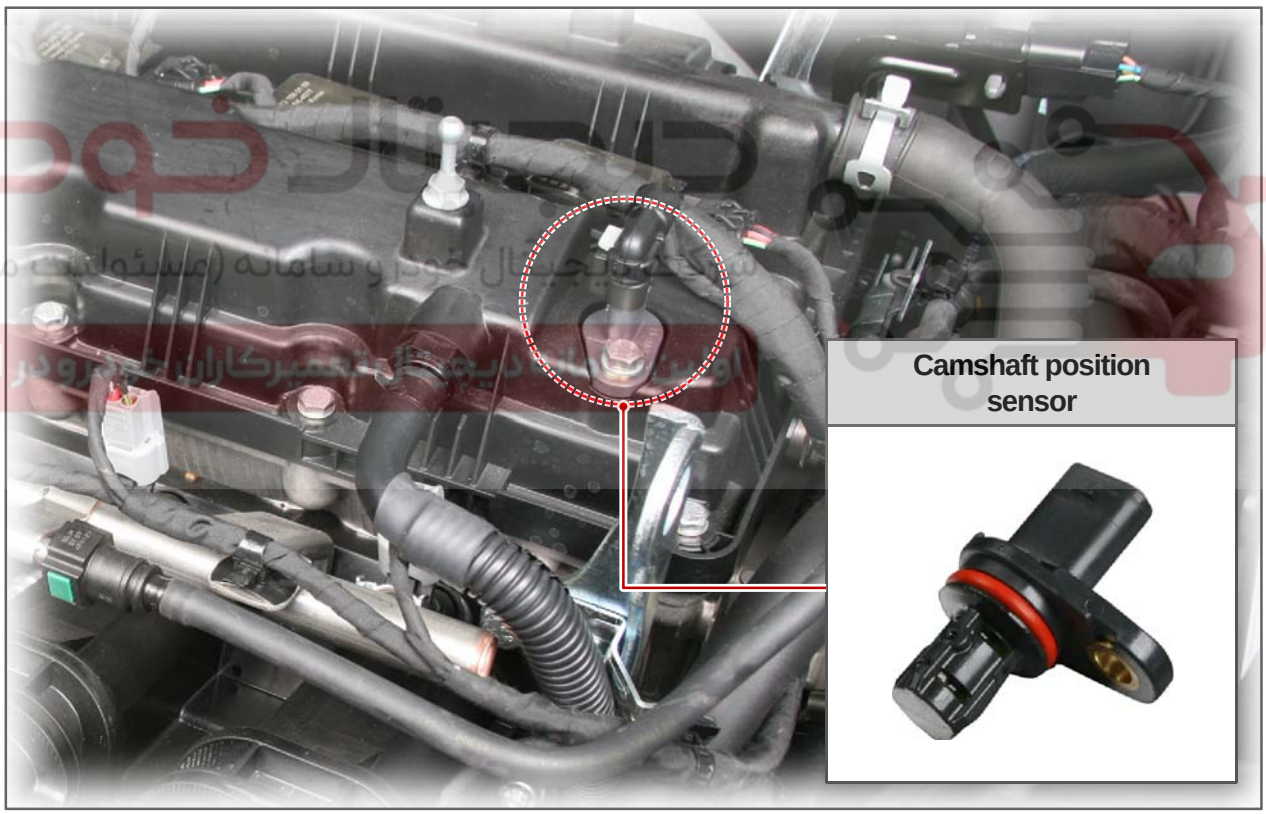
The electrode is an electrical conductor used to make a spark ti ginite the fuel in combustion chamber.

Modification basis	
Application basis	
Affected VIN	

S.G.N.
1430-14 CAMSHAFT POSITION SENSOR

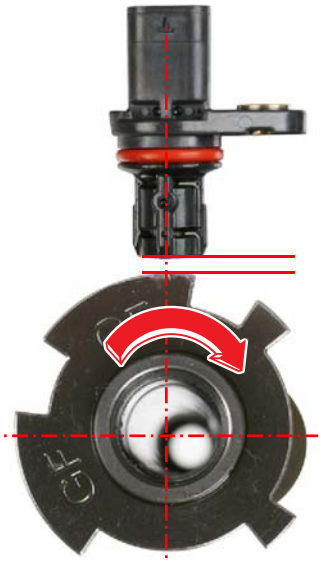
1) Overview

The camshaft position sensor is hall-effect type sensor. When the intake camshaft is rotating, the electron in hall element goes out to output line. ECU recognizes this electron to determine the camshaft position. 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.



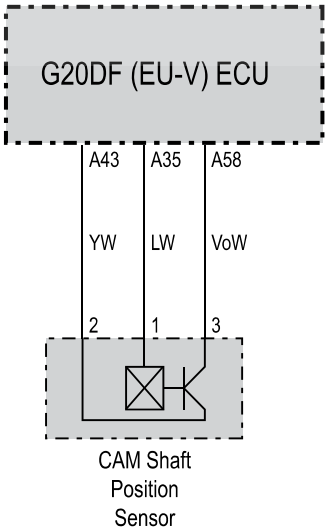
Modification basis	
Application basis	
Affected VIN	

2) Features



Air Gap	0.5 ~ 1.5 mm
Wheel Tooth	4
Sensor Type	Negative

3) Circuit Diagram



Differently from magnetic pickup type, the hall sensor type must use the reference voltage. The internal hall voltage changes the signal voltage according to external electro-magnetic field.

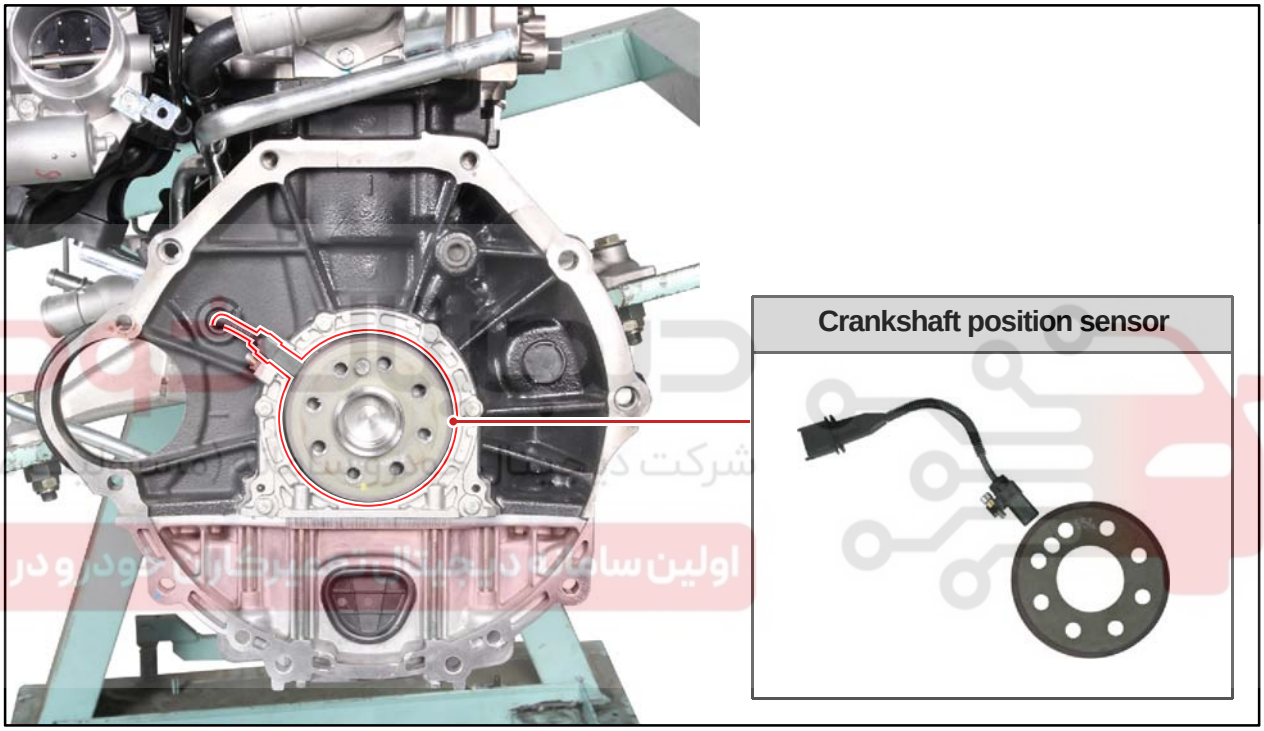
Modification basis	
Application basis	
Affected VIN	

S.G.N. 1128-37

CRANKSHAFT POSITION SENSOR

1) Overview

The crankshaft position sensor consists of the active type MR sensor and the magnetic trigger ring. The sensor is supplied 5 V of power. When the crankshaft rotates, the magnetic field is changed. Four internal resistors (MR element) in MR sensor detect the changes of resistance and converts it to the current value to determine the position/speed of the crankshaft.
The crankshaft position sensor is important signal and used to determine the injection timing and injection volume by detecting the piston position. The magnetic trigger ring sends total 58 signals. Each piston position is determined based on long tooth.



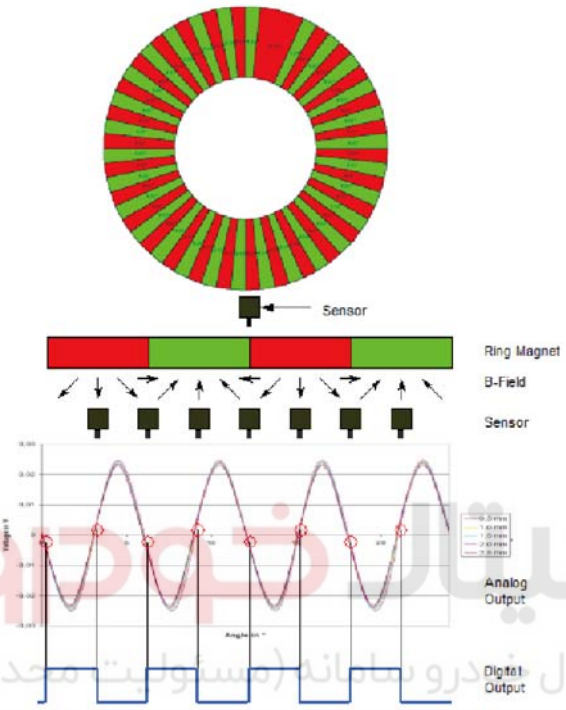
NOTE

Magneto Resistance Sensor Element
When a magnetic field is applied to the metal or semi-conductor, the resistance will be raised. This is called the magnetoresistance effect, and depends on the electron mobility of the material.

Modification basis	
Application basis	
Affected VIN	

3) Features

1. Wave for MR sensor: Rectangular type wave
2. The magnetic trigger ring has the magnetic field.
3. There is the angle difference of 114° in #1 cylinder at long tooth.



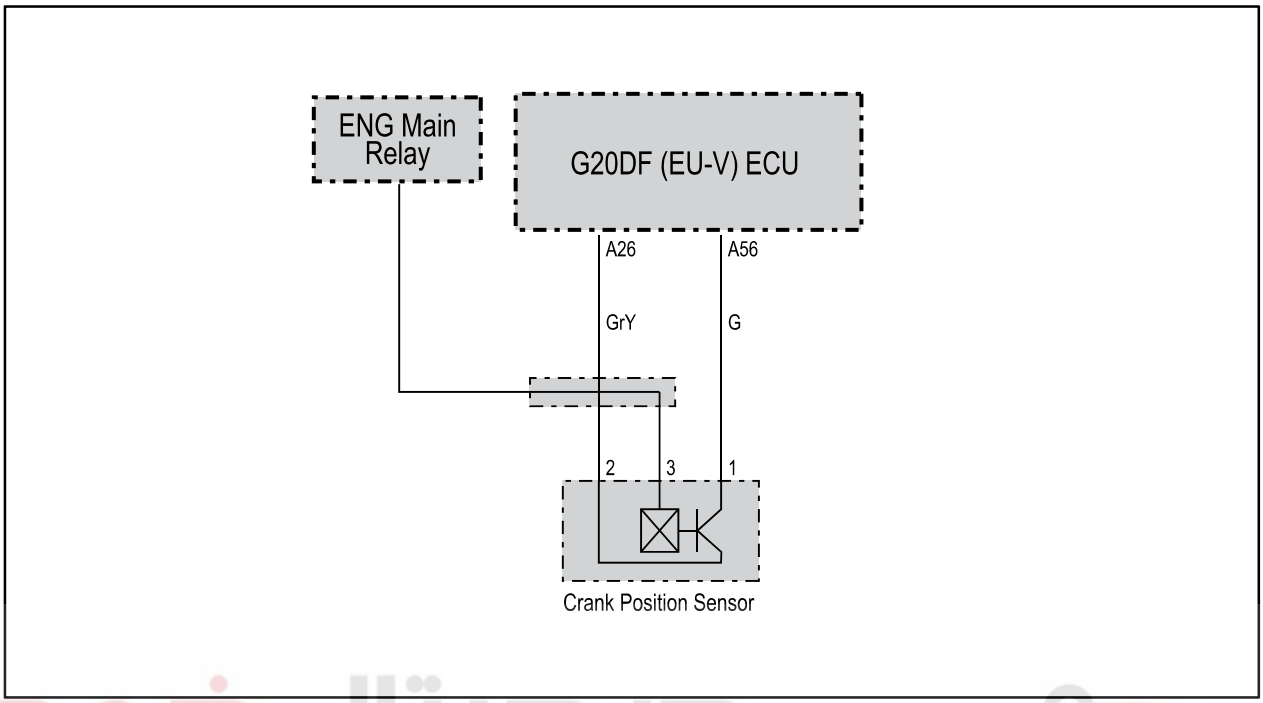
Description	Specification
Supply voltage	12 V
Output voltage	4.48 V
Air gap	0.6 to 1.4 mm

CAUTION

Do not work near the tool or equipment with magnetic field to prevent the magnetic trigger ring from losing the magnetic field.

Modification basis	
Application basis	
Affected VIN	

3) Circuit Diagram



Modification basis	
Application basis	
Affected VIN	

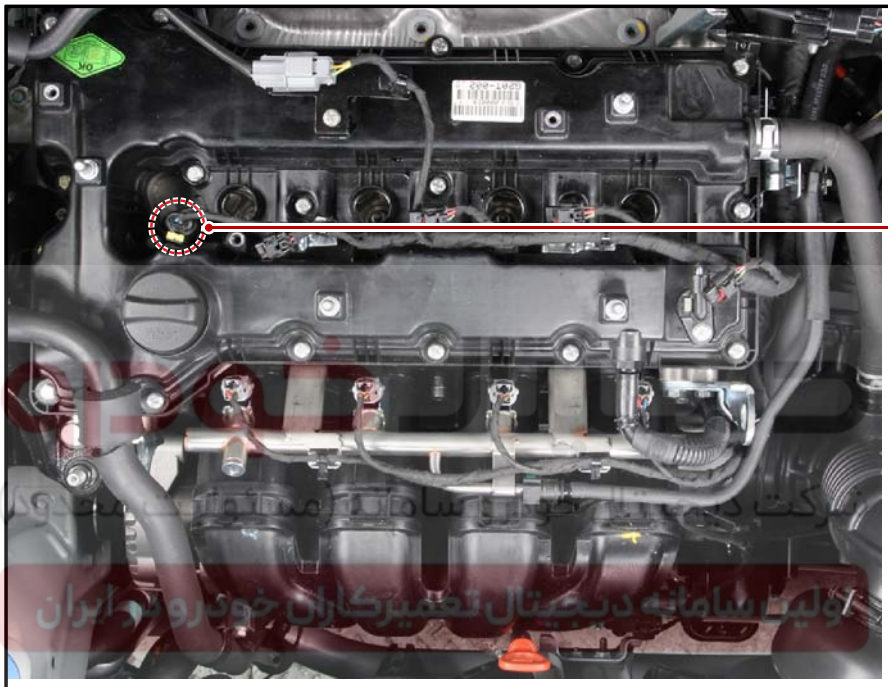
S.G.N. 1311-26

OCV (Oil Control Valve)

1) Overview

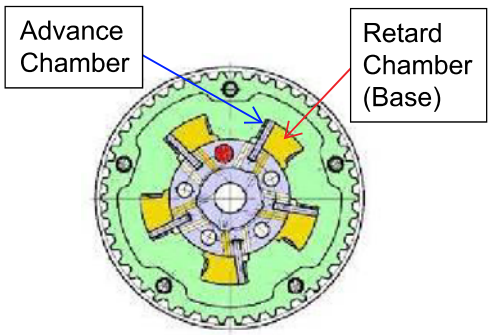
The CVVT (Continuous Variable Valve Timing) gear is installed on the intake camshaft sprocket in G20DF engine.

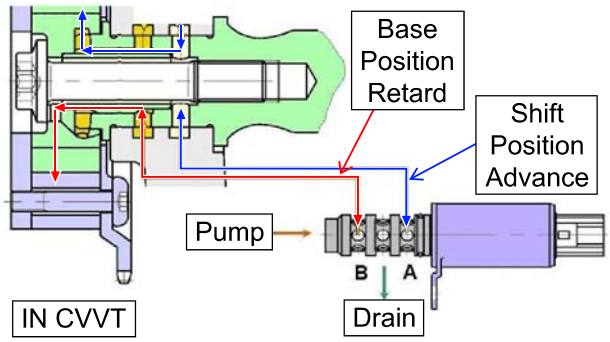
The OCV controls the oil to CVVT gear by receiving the signal from engine ECU. This controls the intake camshaft to most advance, hold, and most retard conditions resulting in valve overlap and underlap. This reduces the pumping loss, improves the combustion stability, and increases the volume efficiency. Thus, the fuel economy is improved and the emission gas is reduced.



OCV

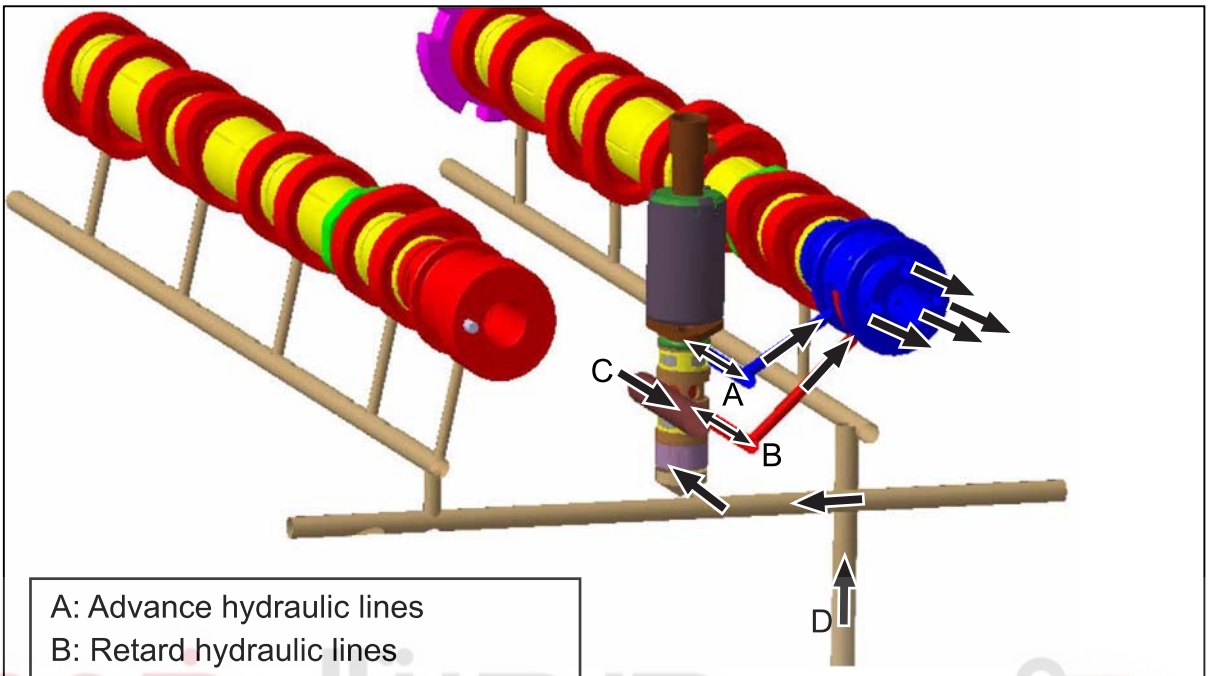
Oil supply to CVVT



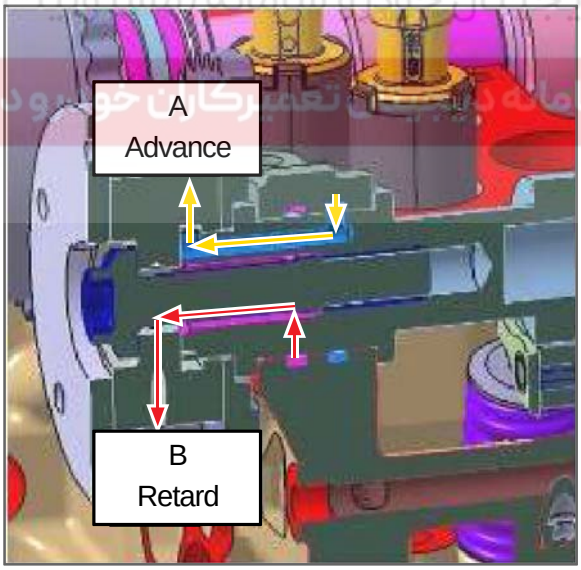


Modification basis	
Application basis	
Affected VIN	

2) Oil Flows in OCV



A: Advance hydraulic lines
B: Retard hydraulic lines
C: Oil drain hydraulic lines
D: From cylinder Block (Oil pump)



ECU changes the oil line to advance (A) or retard (B) line to send the oil to intake camshaft sprocket from oil pump.

Modification basis	
Application basis	
Affected VIN	

3) CVVT Conditions According to OCV Control

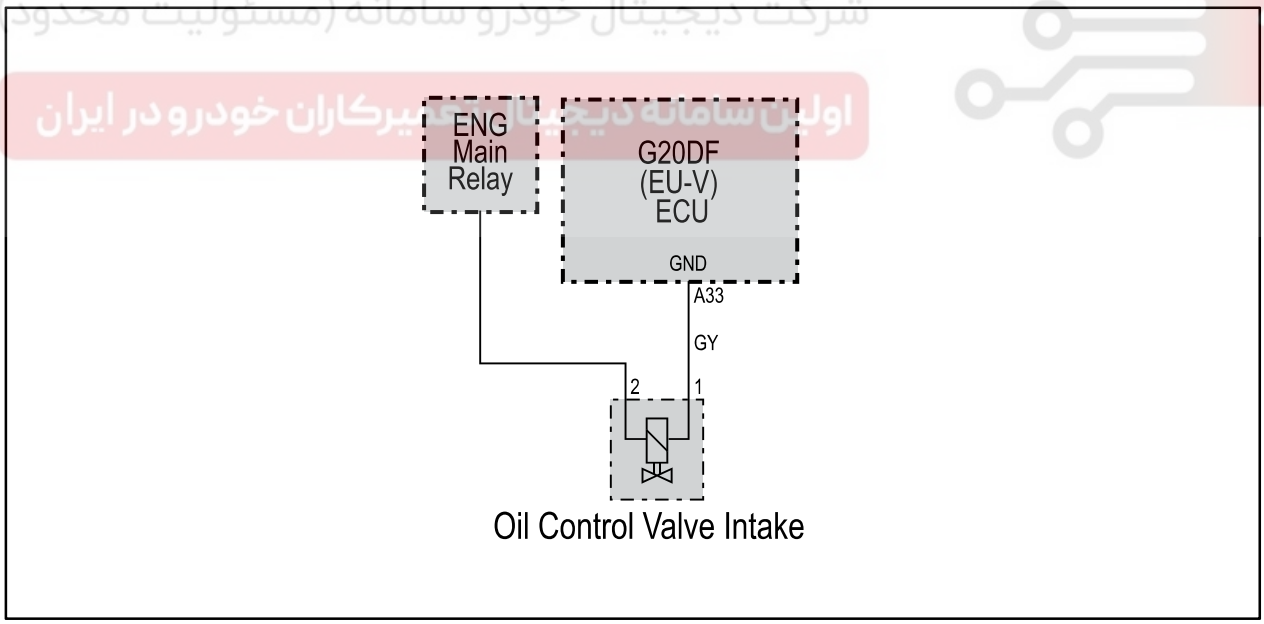
ECU controls the OCV to control the CVVT in most retard, hold and most advance conditions.

- Most retard condition
  Starts operation in idling.
  OCV control: 0% duty control
  The oil is supplied to retard chamber and CVVT housing is fixed to rotor.

- Hold condition
  Maintains current timing.
  OCV control: 50% duty control
  The oil is supplied to retard chamber and advance chamber to keep current timing.

- Most advance condition
  Increases the power.
  OCV control: 100% duty control. Intake camshaft controls by BTDC 35°
  The oil is supplied to advance chamber and the oil in retard chamber is drained. Thus, the housing is advanced by vane resulting in advance timimg.

4) Circuit Diagram



Modification basis	
Application basis	
Affected VIN	

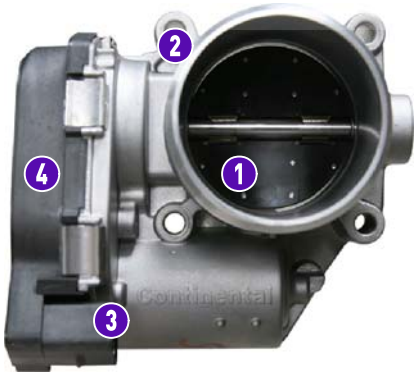
S.G.N. 1740-07

ELECTRONIC THROTTLE BODY

1) Overview

Electronic throttle body control system contains electronic throttle body, accelerator pedal position sensor and ECU as basic elements. Throttle body consists of actuator, throttle plate and throttle position sensor. The actuator is driven by motor.
The engine ECU operates the throttle actuator according to the accelerator pedal position. The electronic throttle body consists of two potentio meters to determine the various engine load conditions. The potentio meters send the throttle position signal to ECU.

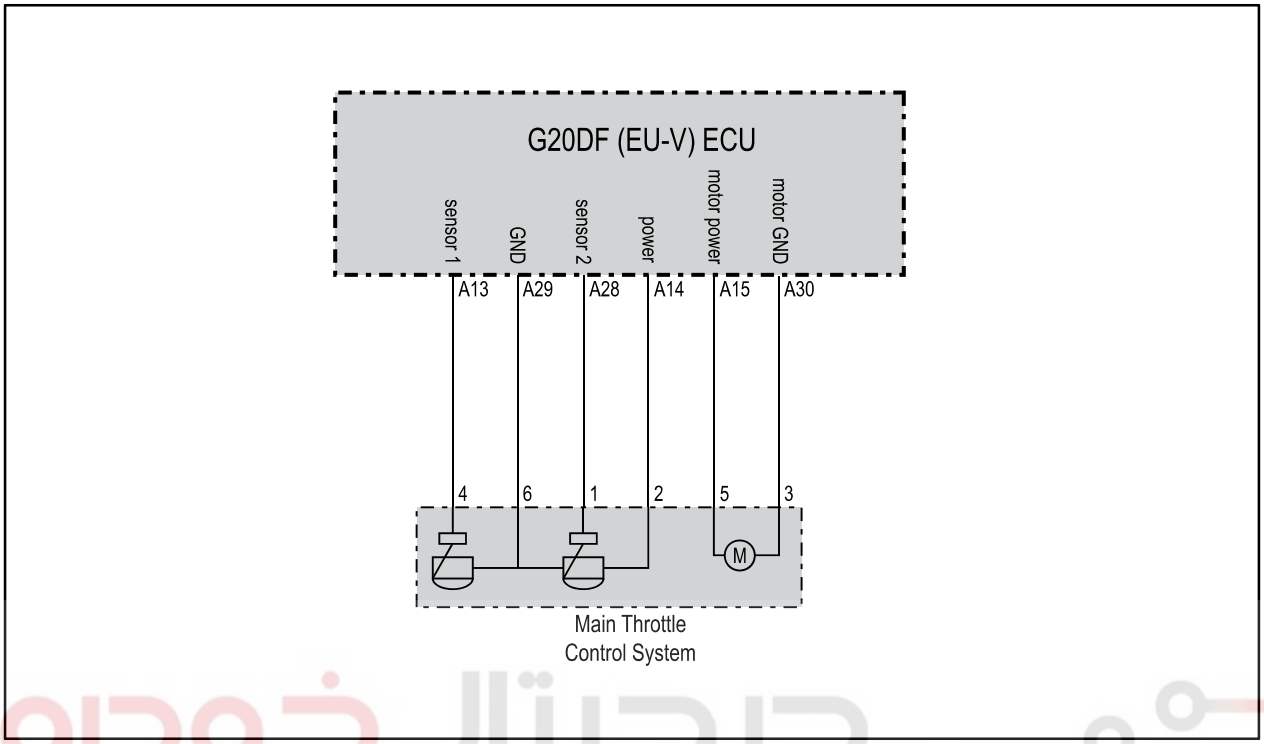
Electronic throttle body



	Name
1	Throttle plate
2	Housing
3	Connector
4	Sealing cover

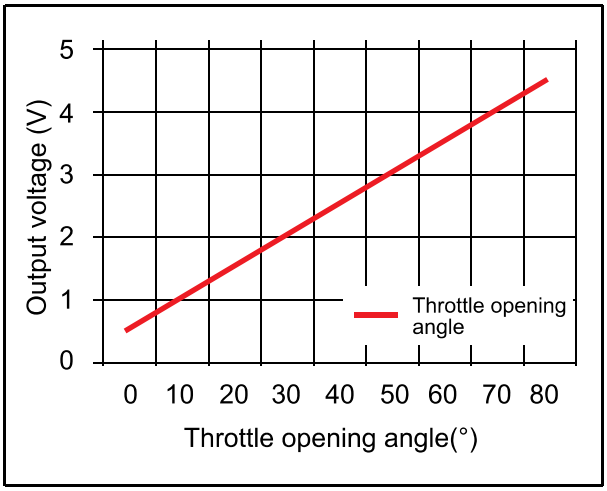
Modification basis	
Application basis	
Affected VIN	

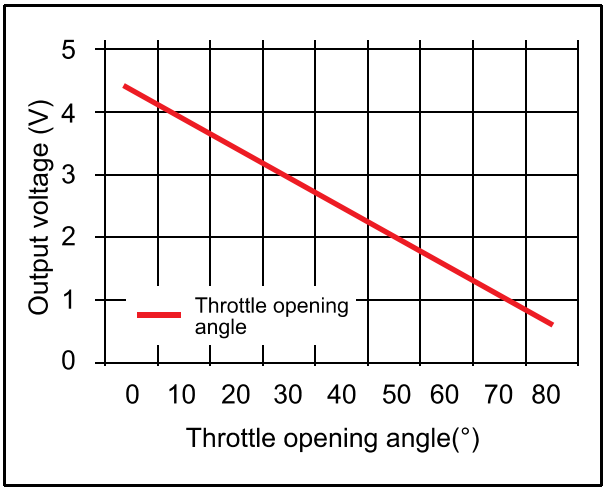
3) Circuit Diagram



Modification basis	
Application basis	
Affected VIN	

4) Output of Position Sensor





5) Specification of Throttle Motor & Position Sensor

Actuator	Item			Specification
DC motor	Resistance			1.5 Ω ± 0.3 Ω
	Inductance			0.9 mH ± 0.1 mH
	Max. continuous current			2.5 A
	Current with unloaded (at idling)			0.8 A or lower
Throttle position sensor	Resistance value (1st, 2nd measurement in parallel)			2 kΩ ± 20%
	Voltage	TPS1	Idle	0.5 V ± 0.1 V
			WOT	4.6 ± 0.1 V
		TPS2	Idle	4.5 ± 0.1 V
			WOT	0.4 ± 0.1 V

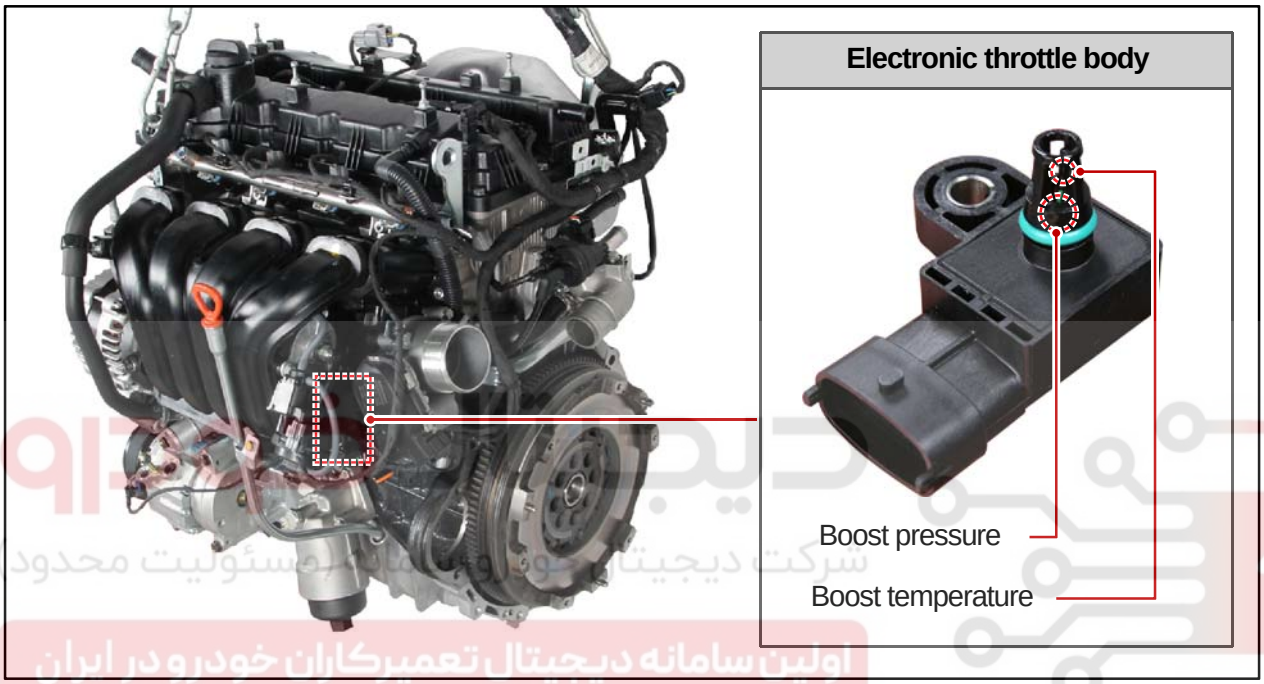
Modification basis	
Application basis	
Affected VIN	

S.G.N. 1740-03

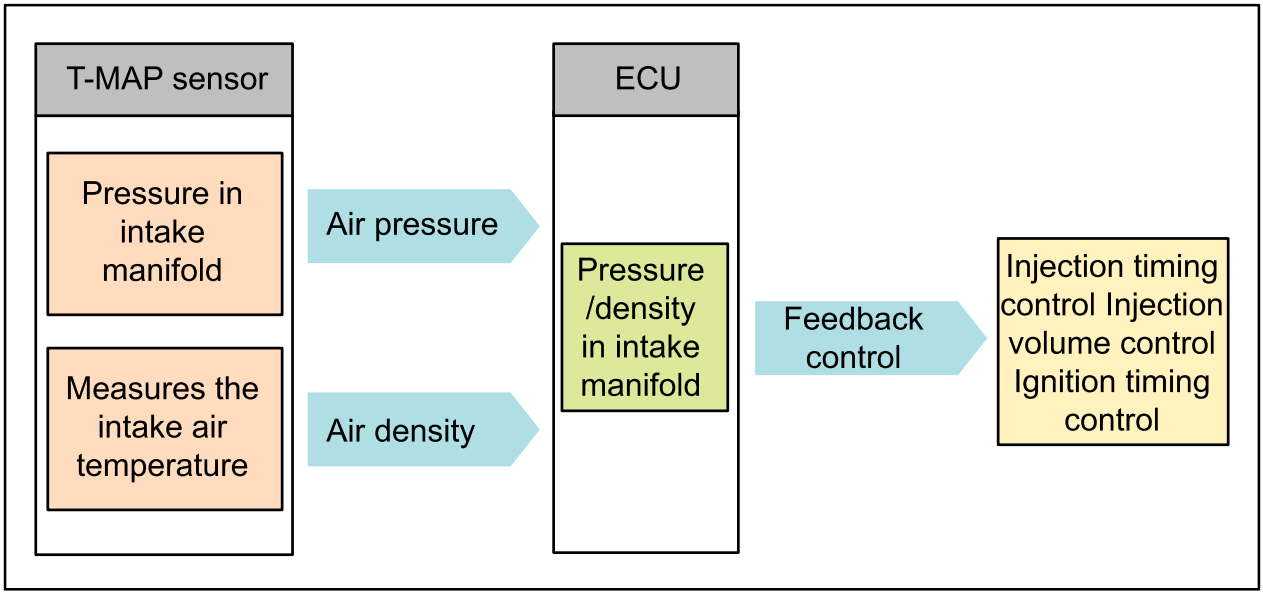
T-MAP SENSOR

1) Overview

T-MAP sensor is installed between electronic throttle body and intake manifold.
T-MAP sensor contains the pressure sensor to detect the pressure changes in intake manifold and NTC thermister to measure the air mass flow. T-MAP sensor is used to determine the basic feul injection volume, injection timing, and ignition timing.



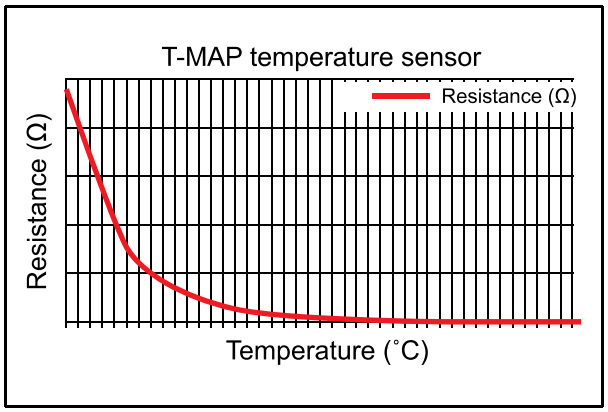
2) Input/Output for T-MAP Sensor



Modification basis	
Application basis	
Affected VIN	

3) Features

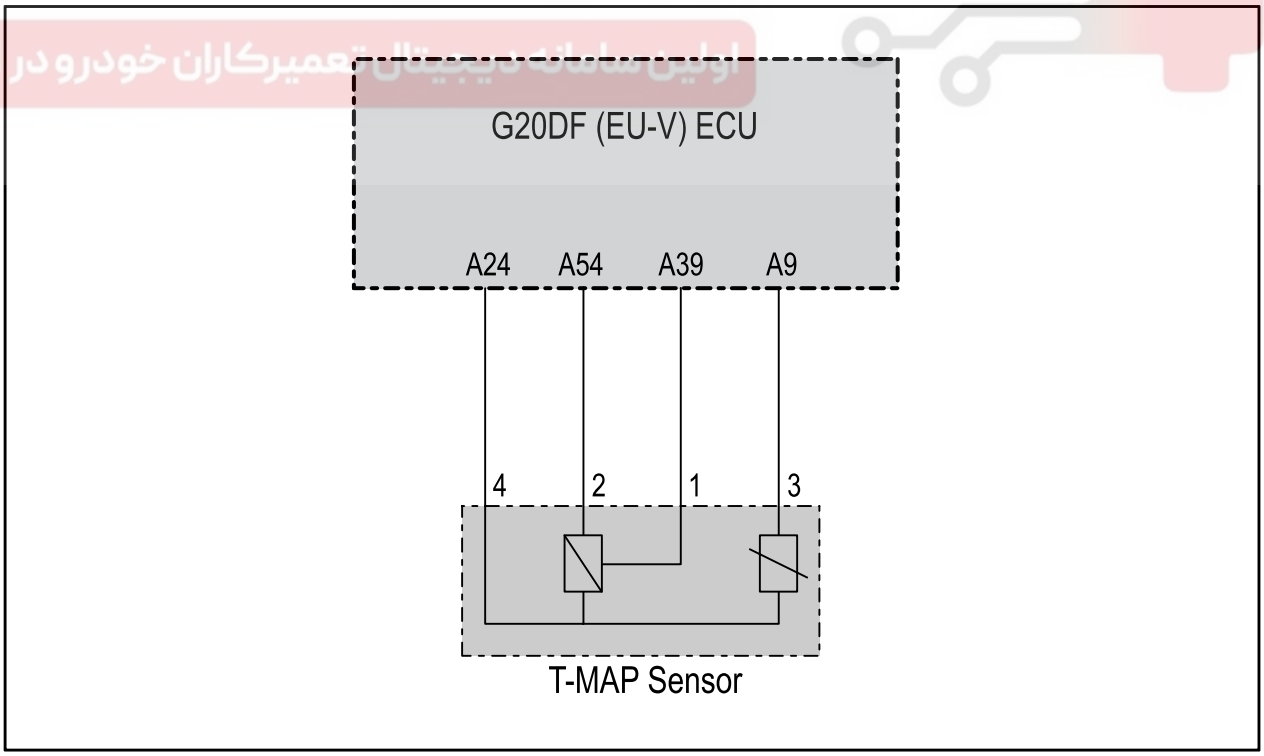
▶ **Intake air temperature sensor**



Intake air temperature (℃)	Resistance (Ω)
-40	48153
-20	15614
0	5887
20	2510
40	1199.6
60	612.3
80	329.48
100	186
130	85.45

4) Circuit Diagram

▶ **Circuit to ECU**



Modification basis	
Application basis	
Affected VIN	

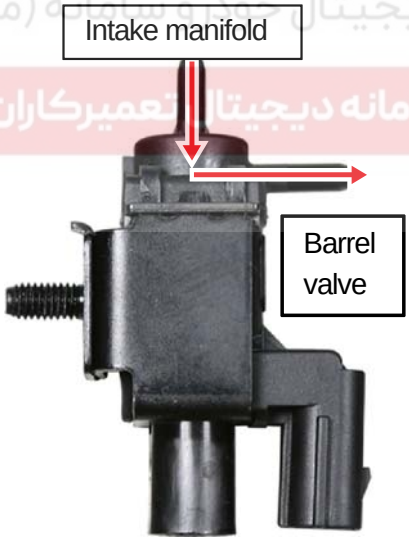
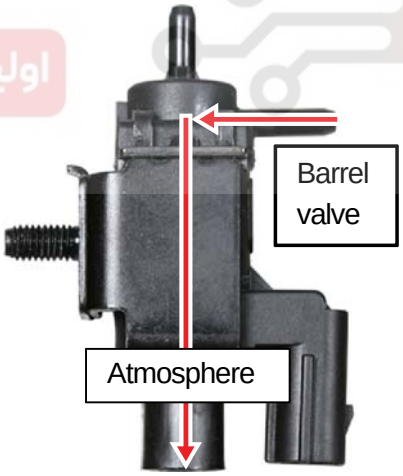
S.G.N.
1628-04

VIS (Variable Induction Manifold) SOLENOID VALVE

1) Overview

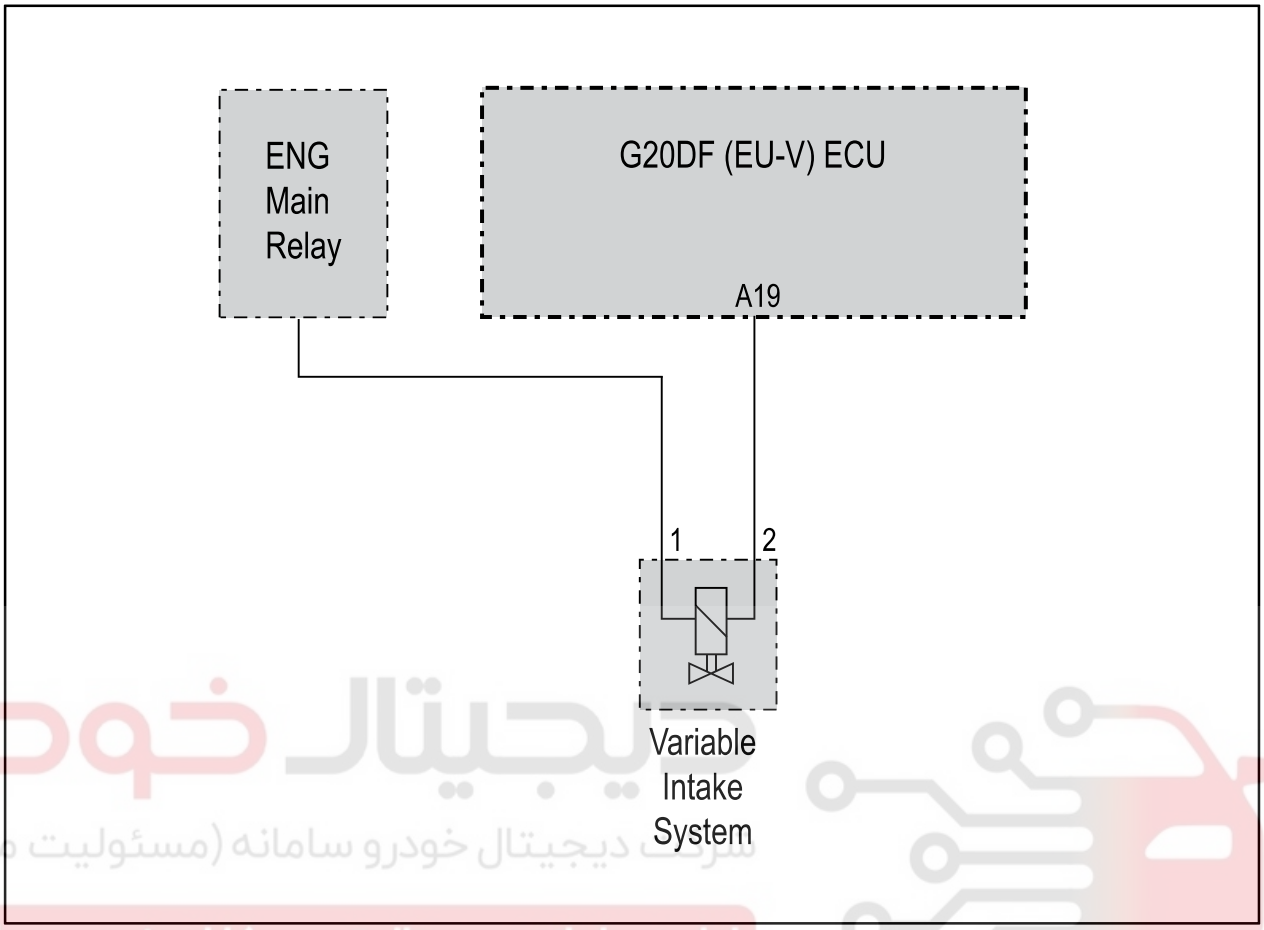
VIS solenoid valve operates the VIS barrel by receiving the signals from ECU.

VIS solenoid valve

	When operating	Not operated
Vacuum path in solenoid valve		
Barrel	OPEN	CLOSE
Flow	Short + Long	Long

Modification basis	
Application basis	
Affected VIN	

2) Circuit Diagram



Modification basis	
Application basis	
Affected VIN	

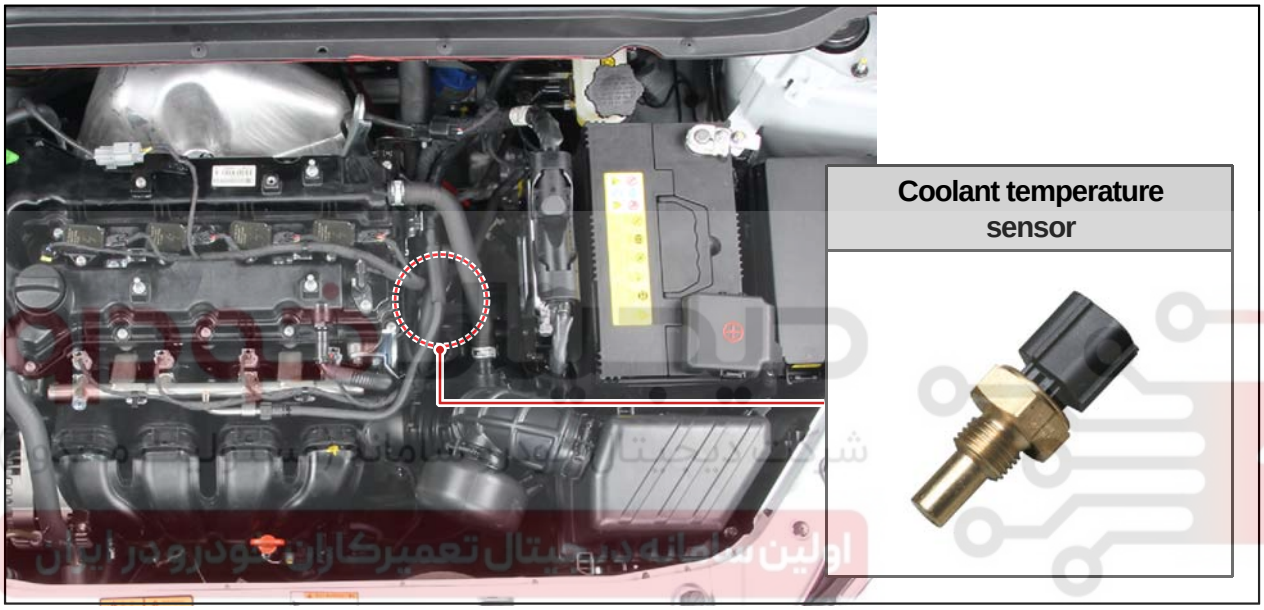
S.G.N. 1430-07

COOLANT TEMPERATURE SENSOR

1) Overview

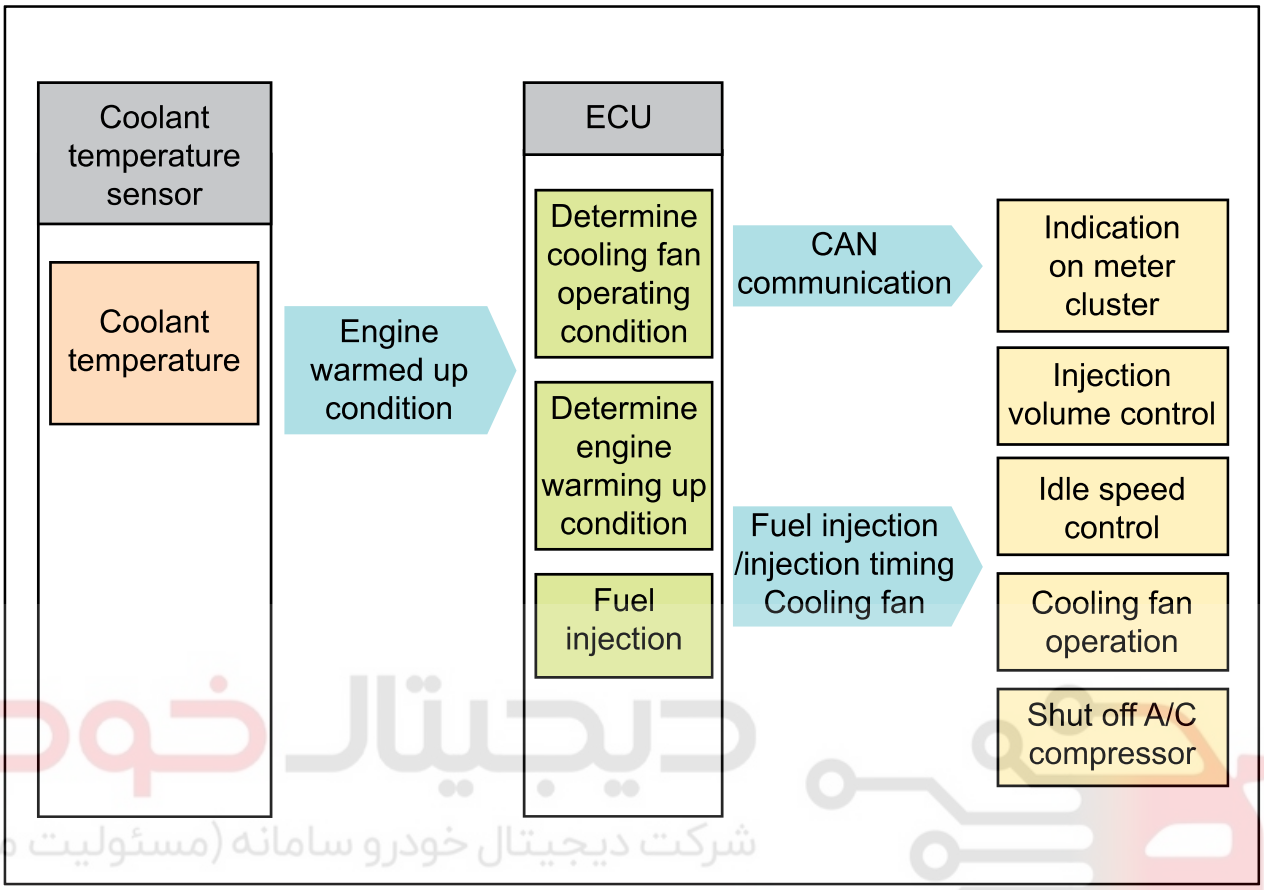
Coolant temperature sensor uses NTC thermister that the resistance goes down as the temperature goes up. Coolant temperature sensor corrects the fuel injection volume according to the coolant temperature. When the engine is cold, the engine output could be insufficient. This may cause the increase of exhaust gas volume, and accordingly, the fuel injection volume is also increased. This sensor has the functions as below (through CAN communication):

- Shows the coolant temperature on meter cluster
- Stops cooling fan and A/C compressor operation when the engine is overheated



Modification basis	
Application basis	
Affected VIN	

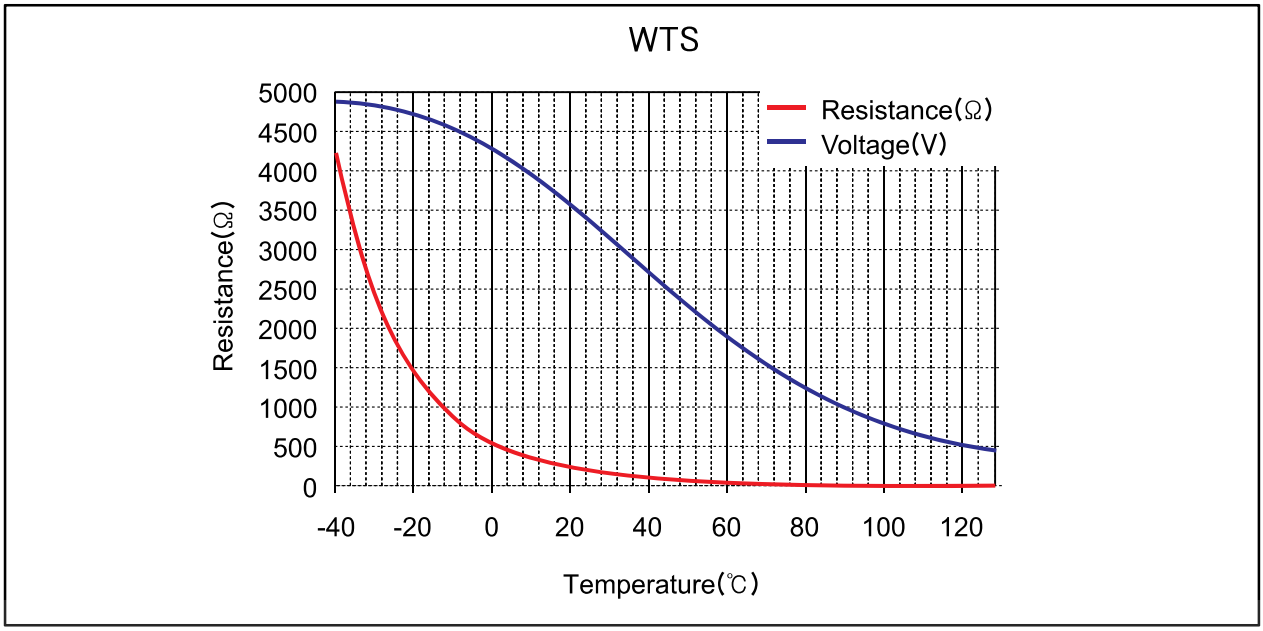
2) Input/Output for Coolant Temperature Sensor



3) Control Elements According to Coolant Temperature

- Injection period
  Idle speed is increased to 1,500 rpm from 1,140 rpm according to the coolant temperature.
- Fuel injection volume control
  Helps engine warming up by controlling the fuel injection volume according to the coolant temperature.
- Cooling fan operation
  Cools down the engine by operating the cooling fan according to the coolant temperature.
- A/C operation
  Stops the A/C compressor according to the coolant temperature.

4) Characteristic Curve

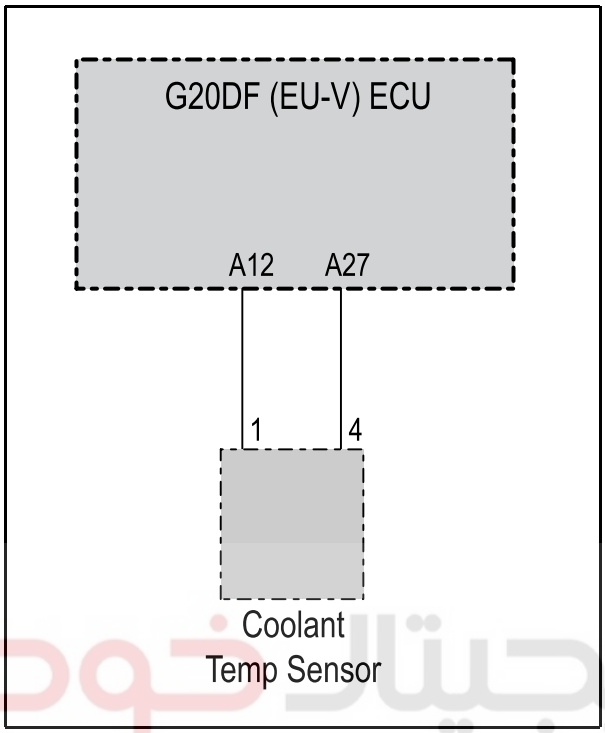


Temperature (°C)	Resistance (Ω)	Voltage (V)
-40	42695.5	4.896
-20	14641.6	4.705
0	5681.8	4.298
20	2449.9	3.615
40	1155.9	2.747
60	589.4	1.910
80	321.4	1.259
100	185.7	0.819
120	112.9	0.536
130	89.52	0.436

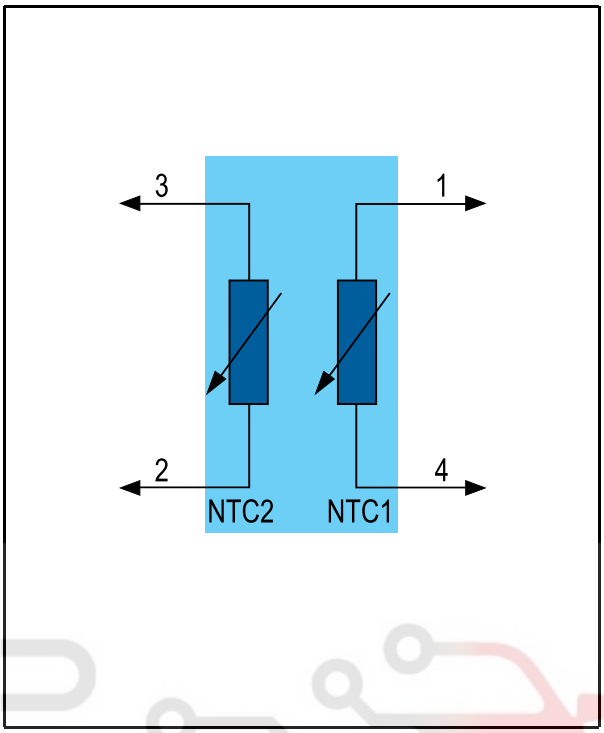
Modification basis	
Application basis	
Affected VIN	

5) Circuit Diagram

▶ Circuit to ECU



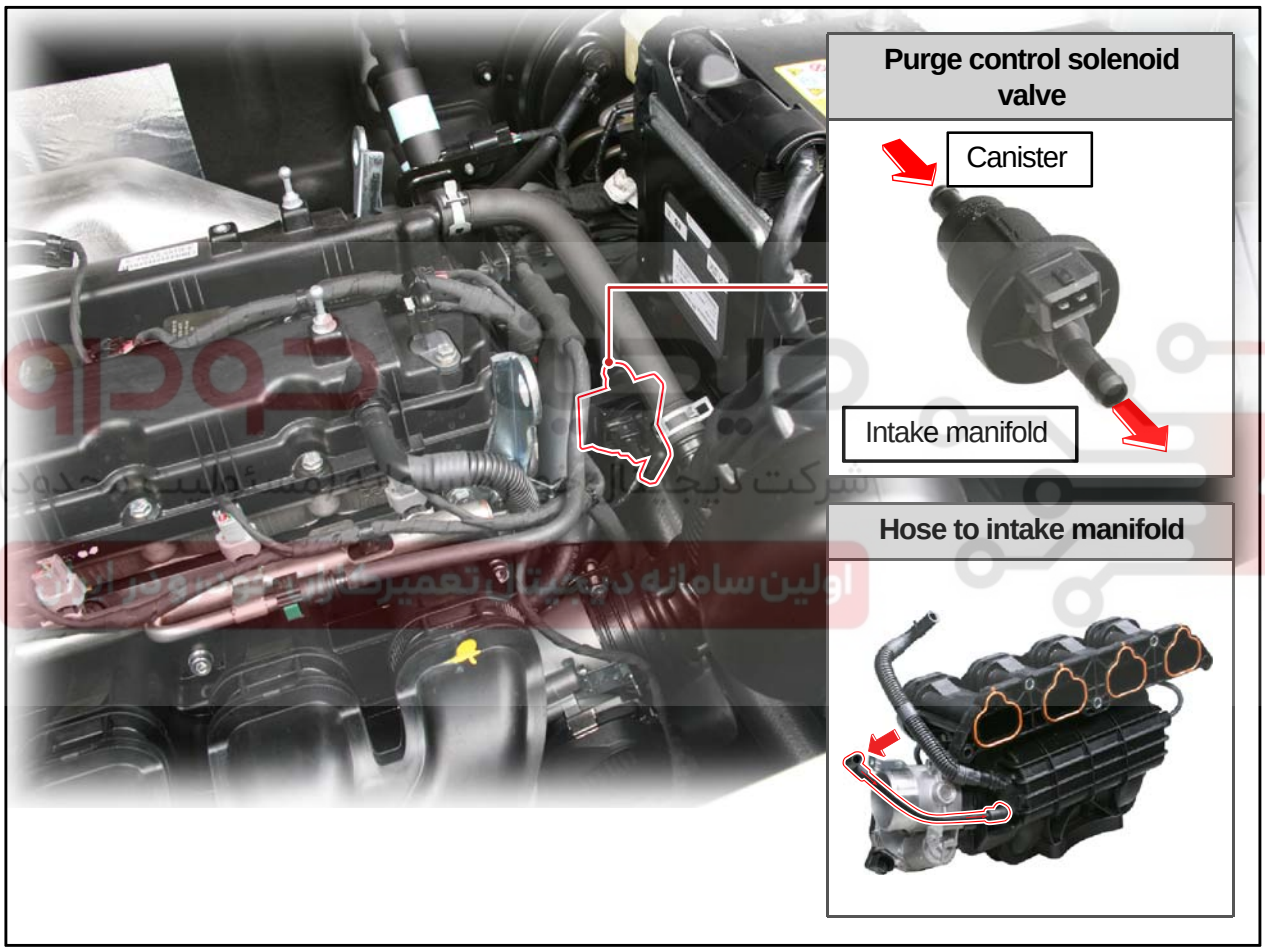
▶ Internal circuit of sensor



S.G.N.
1628-04 PURGE CONTROL SOLENOID VALVE

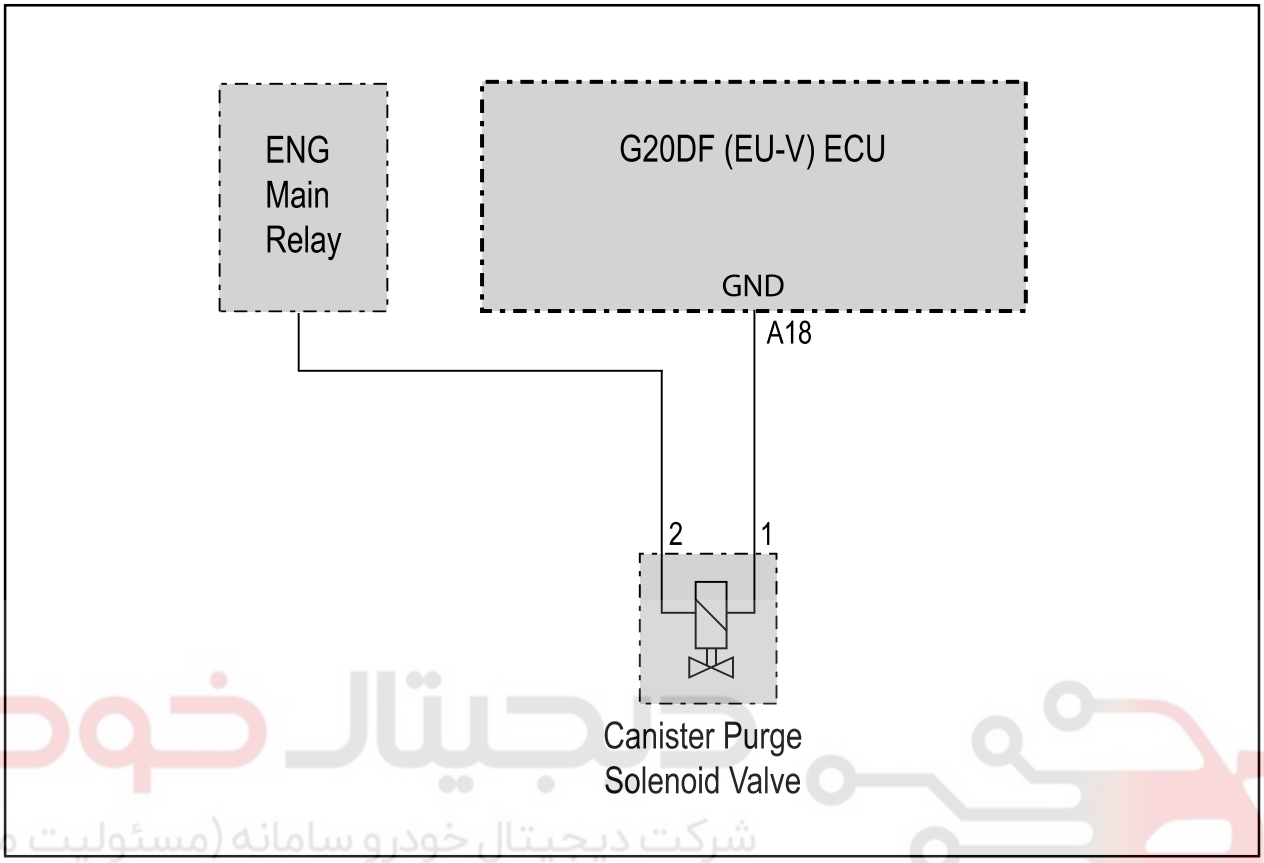
1) Overview

The purge control solenoid valve is located in the vacuum line between canister and intake manifold. It opens and closes the enclosed vacuum line according to the engine load conditions.
When the coolant temperature reaches to 80°C (normal operating temperature) or the idle speed goes over the specified rpm, the purge control solenoid valve provides the evaporative gas in canister into the combustion chamber when ECU opens the enclosed vacuum line between canister and intake manifold.



Modification basis	
Application basis	
Affected VIN	

5) Circuit Diagram

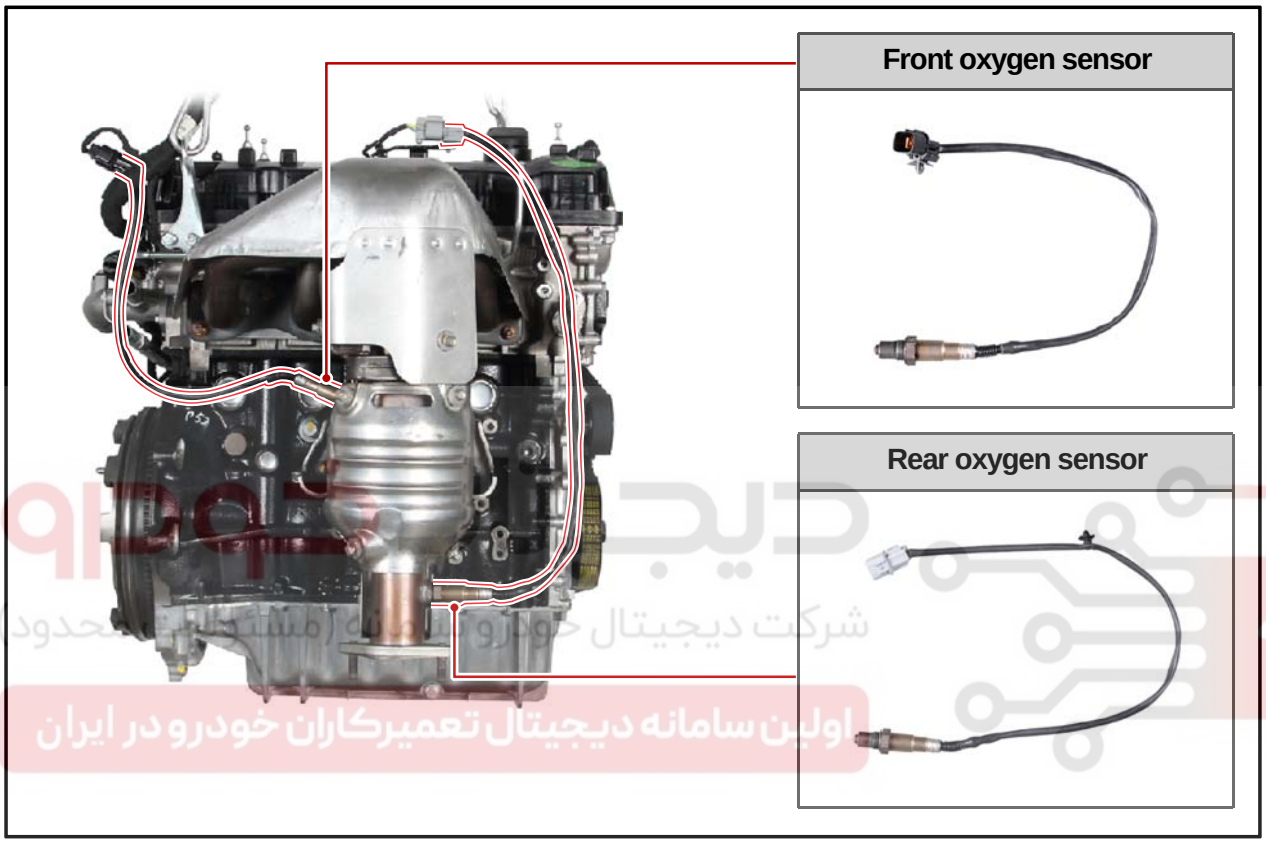


Modification basis	
Application basis	
Affected VIN	

S.G.N.
1430-09 OXYGEN SENSOR

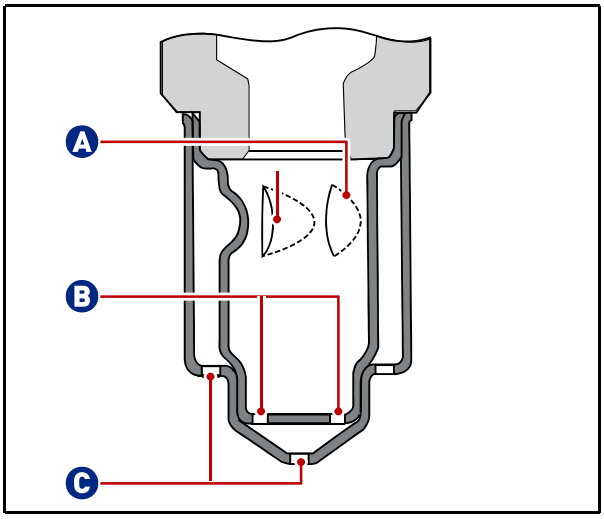
1) Overview

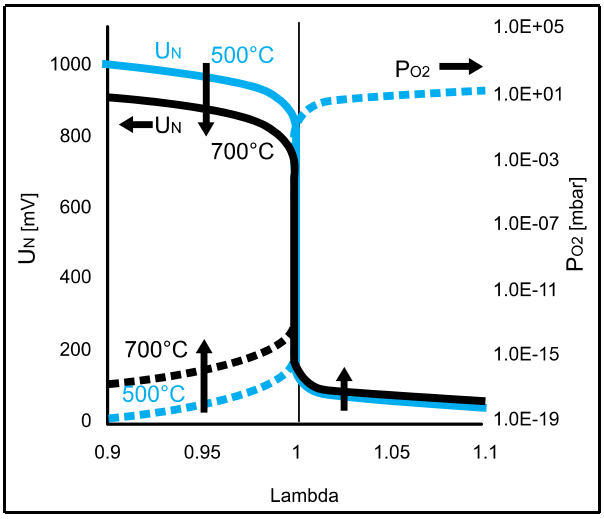
The oxygen sensors are installed to the front and rear of the WCC (Warming up Catalyst Converter) to measure oxygen content in the exhaust gas in order to check the air/fuel mixture ratio and combustion condition.



Modification basis	
Application basis	
Affected VIN	

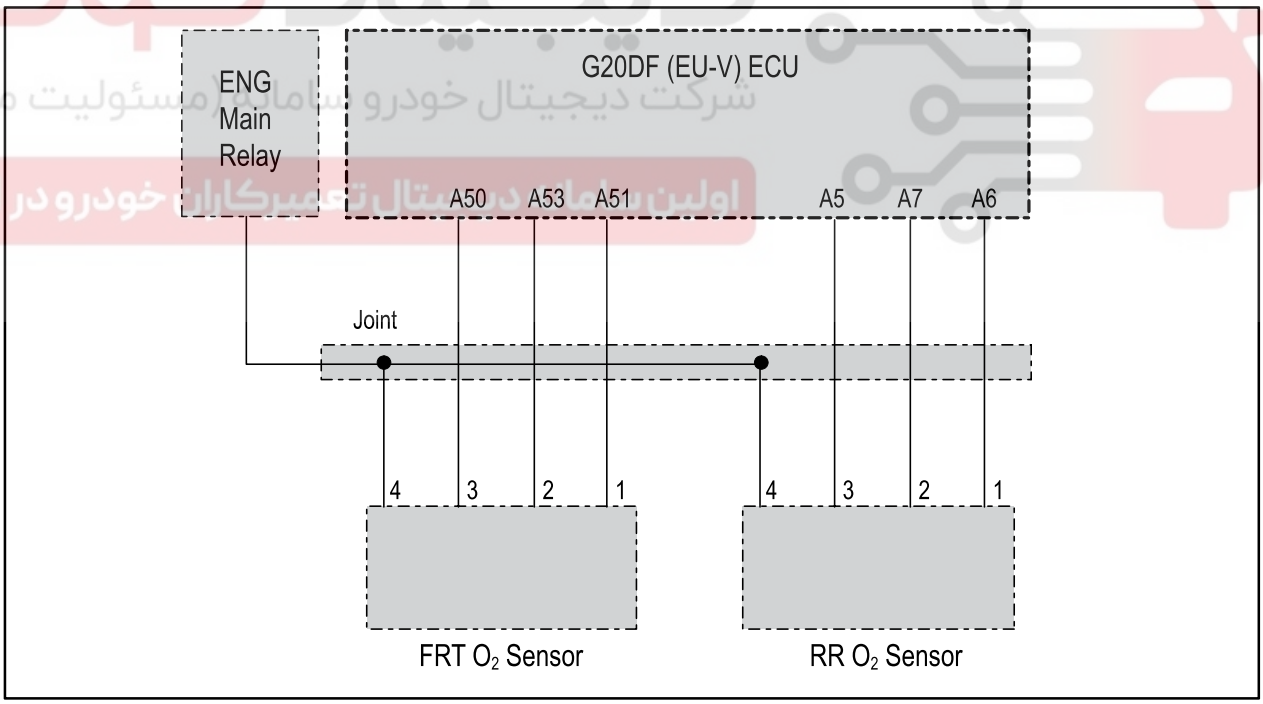
2) Function





A. Inner tube with swirl flaps creates gas rotation around sensor element.
B. Plate between sensor and front hole
C. Optimized regurding gas flow, good dynamic response

3) Circuit Diagram



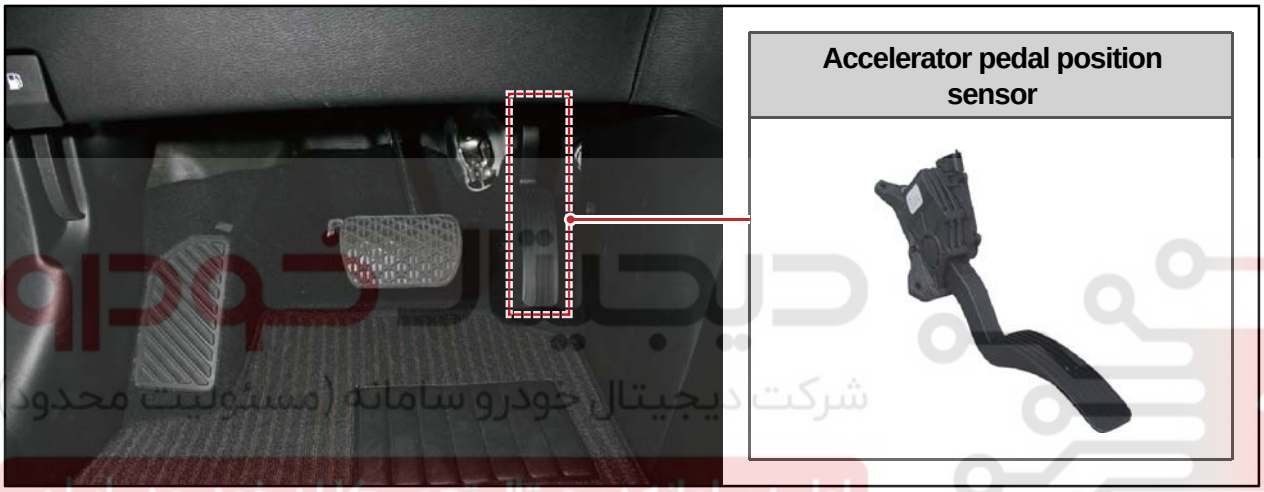
Service check
- Upstream oxygen sensor: It generates sine wave at a regular interval in a normal condition on 450 ㎷ basis. If the waveform is stretch upward, it indicates rich fuel and lean air status. - Downstream oxygen sensor: It generates constant voltage (approx. 700 mV) in a normal condition. However, it generates sine wave when the catalyst is malfunctioning.

Modification basis	
Application basis	
Affected VIN	

S.G.N.
2010-01 ACCELERATOR PEDLA POSITION SENSOR

1) Overview

The accelerator pedal sensor converts the position of the accelerator pedal into an electric signal and sends this information to the ECU. There are 2 sensors in each accelerator pedal sensor. The signal from the No. 1 accelerator pedal sensor (ACC 1) is an element used to determine the fuel injection volume and timing while the signal from the No. 2 accelerator pedal sensor (ACC 2) is used to check the validity of the signal value from the No. 1 sensor.
When the No. 1 and 2 accelerator pedal sensors are all defective, the ECU stores the output DTCS, the acceleration response becomes poor, and it becomes hard to increase the engine rpm.



Modification basis	
Application basis	
Affected VIN	

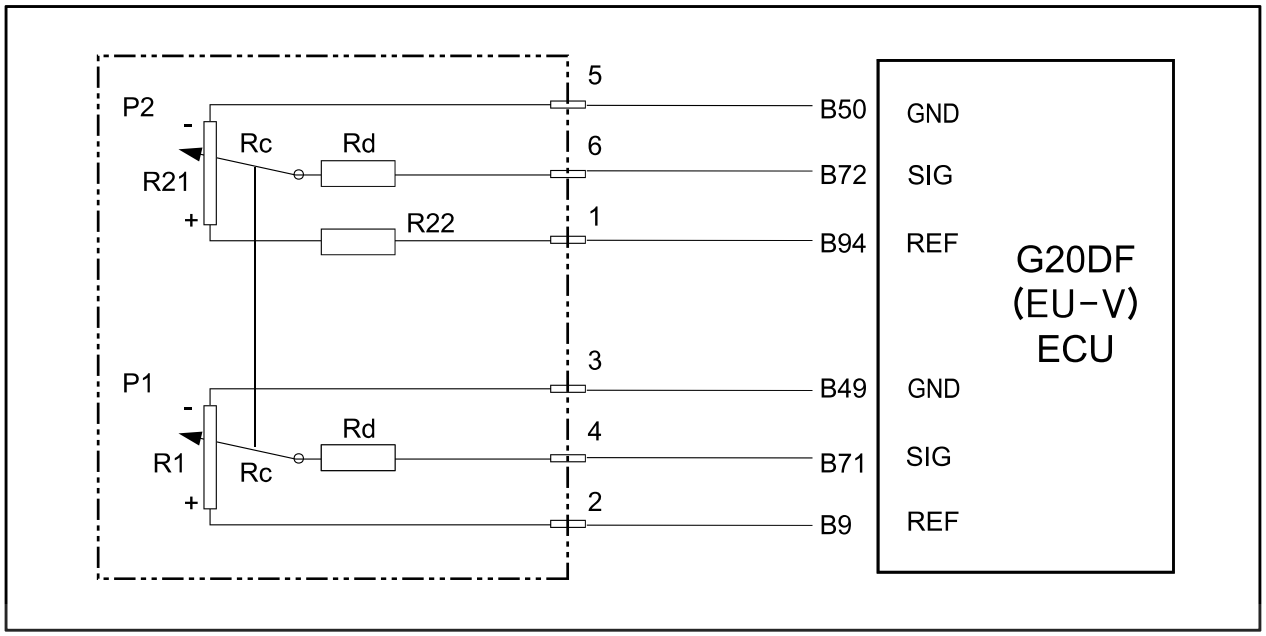
2) Features

1. Determines the injection timing and fuel injection volume
   ACC1 : Main sensor, determines injection timing and fuel injection volume (5.0 V)
   ACC2 : Checks if ACC1 is OK (2.5 V)
2. Failure in ACC1 or ACC2
   Controls the torque reduction by 50%
3. Failure in ACC1 and ACC2
   Changes to limp home mode (1,300 to 1,400 rpm)

	Accelerator pedal 1	Accelerator pedal 2
Full resistance of potentiometer	1.2 kΩ	1.7 kΩ
Maintenance	- Check the resistance of individual component. - Check the resistance changes in individual component while operating the pedal.	

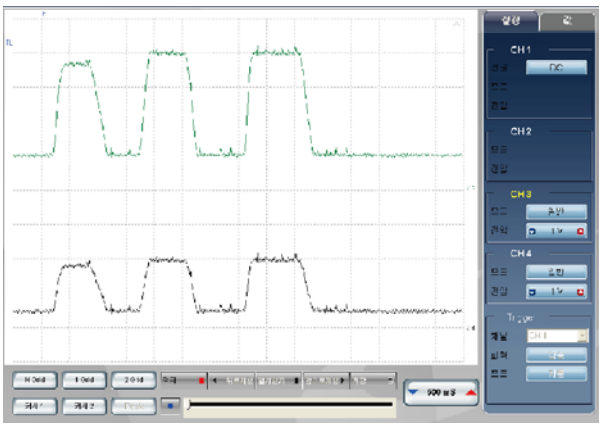
	Pedal position	Specified value
Accelerator pedal 1	Idle	0.4 V to 0.6 V
	When fully depress the pedal	4.3 V to 4.7 V
Accelerator pedal 2	Idle	0.2 V to 0.3 V
	When fully depress the pedal	2.1 V to 2.4 V

3) Circuit Diagram



4) Operating Wave

Measuring condition	Accelerating 3 times	
Measuring	Channel #3 (P1)	Channel #4 (P2)
	Measuring probe (+) B71 Measuring probe (-) B49	Measuring probe (+) B72 Measuring probe (-) B50



No.1 uses 5 V Ref, and No.2 uses 2.5 V Ref.

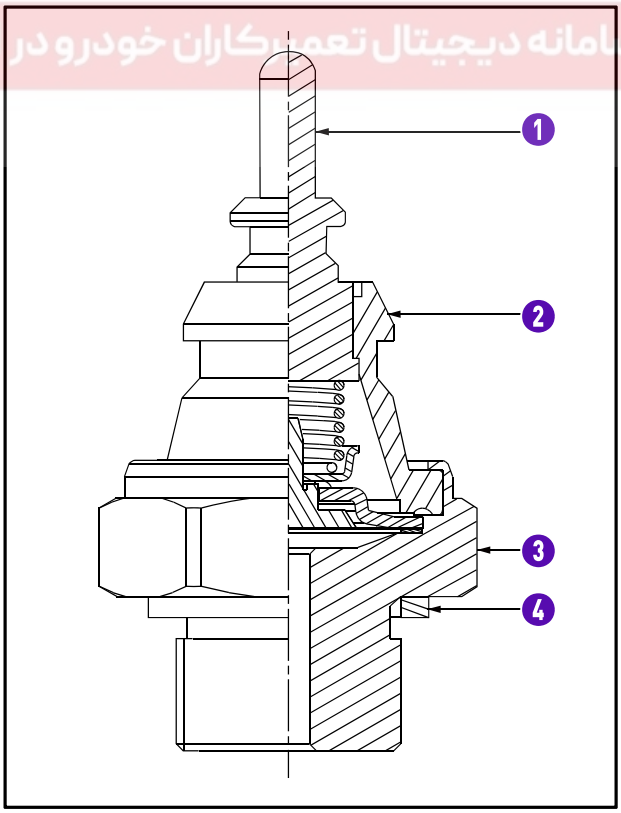
Modification basis	
Application basis	
Affected VIN	

S.G.N. 1535-30

OIL PRESSURE SWITCH

1) Overview

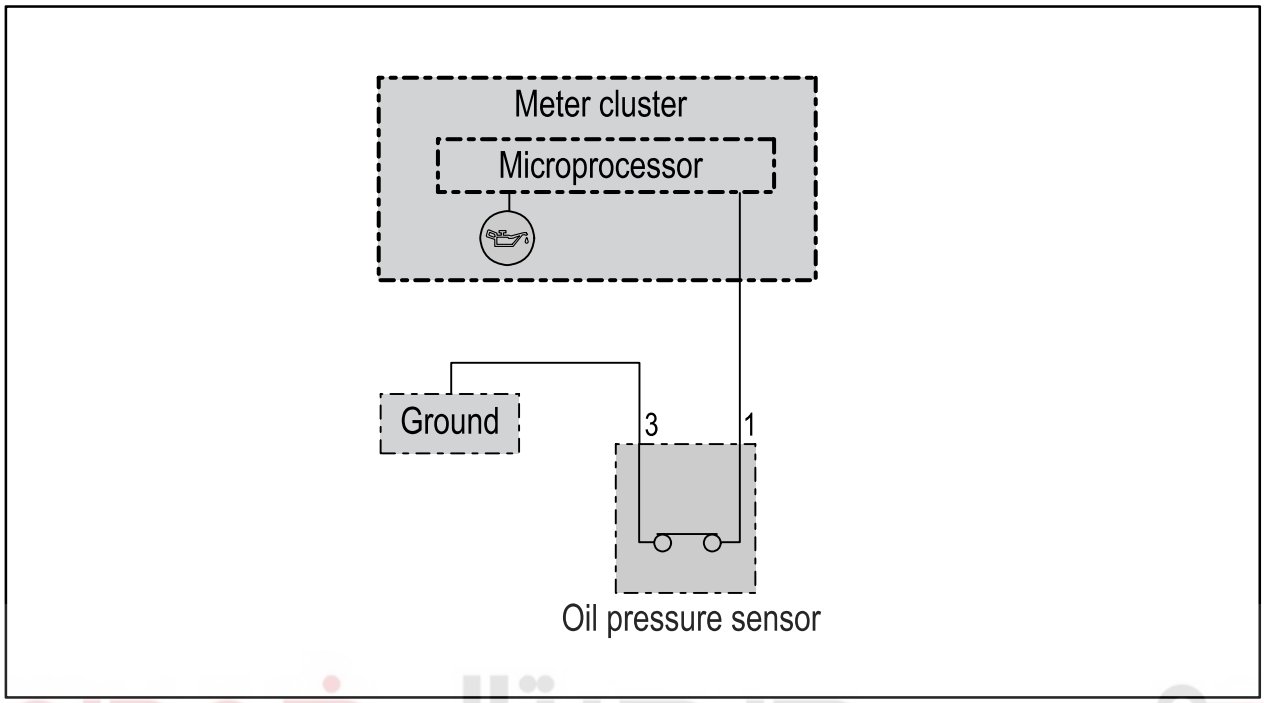
If the oil pressure in engine drops below 0.5 bar during engine running, the engine oil warning lamp in the instrument cluster comes on.



1.Adapter
2. Base
3. Seal washer
4. Body

Modification basis	
Application basis	
Affected VIN	

2) Circuit Diagram



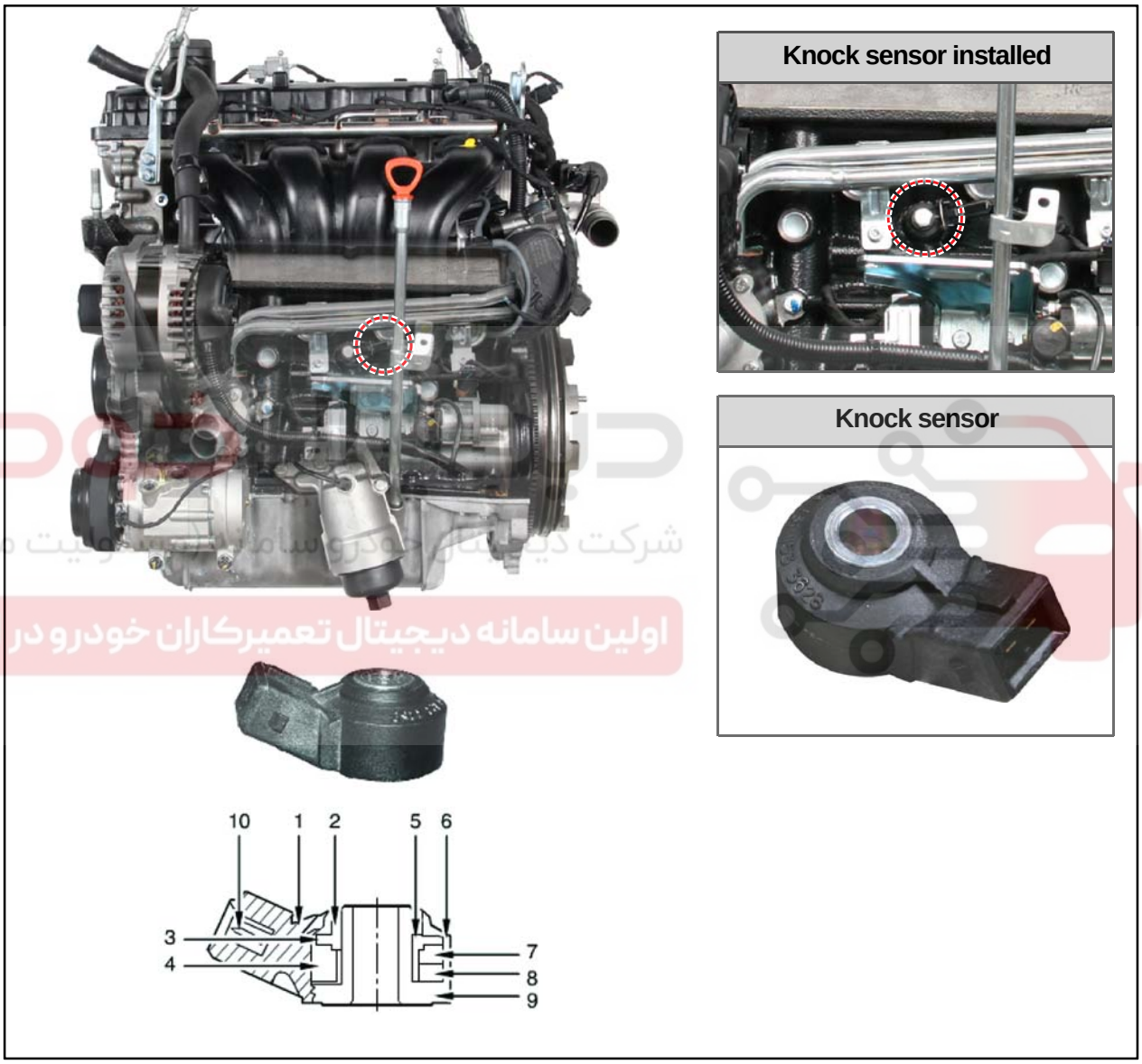
Modification basis	
Application basis	
Affected VIN	

S.G.N. 1430-05

KNOCK SENSOR

1) Overview

The knock sensor is located on the cylinder block in intake manifold side.
The knock sensor is to detect abnormal knocking in the engine. The knock sensor has Piezoelectric elements that generates a voltage when pressure or a vibration is applied to them.



1. Sensor housing
2. Nut
3. Dish spring
4. Weight
5. Isolated pipe
6. Upper contact plate
7. Piezoelectric element
8. Lower contact plate
9. Body
10. Terminal
11. Resistance

Modification basis	
Application basis	
Affected VIN	

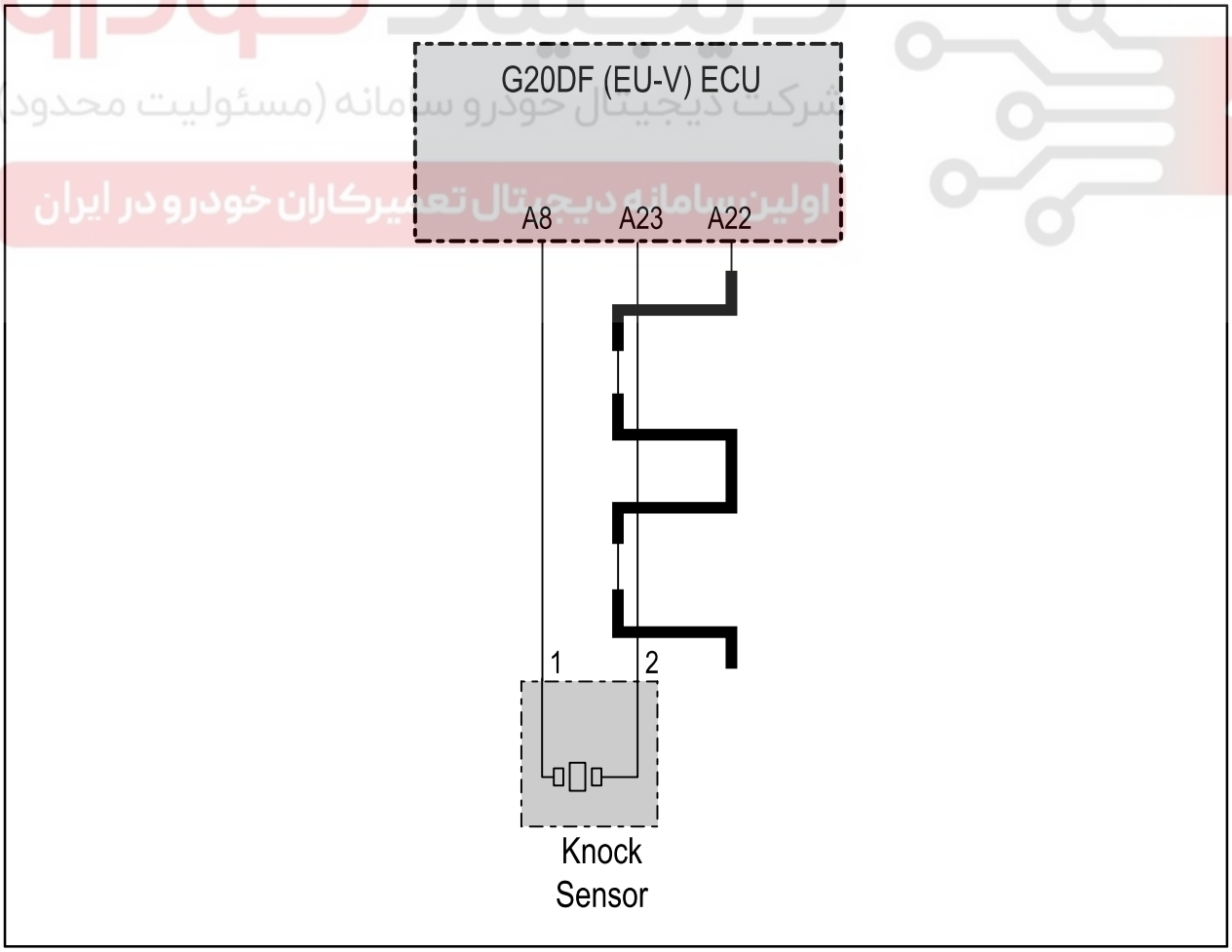
3) Features

Insulation resistance	>1 MΩ at 900 V
Resonance frequency	> 30 kHz
Operating temperature	−40 ~ 150℃
Output voltage	22 ~ 37 mV/g (3~10 kHz)
	22 ~ 57 mV/g (10~20 kHz)

- Control the idle stability
- Comes on the warning lamp when the injector is defective
- Determines the pilot injectiojn during MDP learning
- Adjusts the cylinder balancing
- When knock sensor is defective:

ECU determines the injection timimg according to MAP value (engine rpm, intake air mass, coolant temperature)

4) Circuit Diagram



Modification basis	
Application basis	
Affected VIN	

REMOVAL AND INSTALLATION

S.G.N. 1490-01 ENGINE ECU

Preceding work - Disconnect the negative cable from the battery.

1) Overview

NOTE

For a simple removal and installation, skip the coding procedures.

1. Enter into diagnosis menu on diagnostic program
2. Check and record variant coding item
3. Replace ECU
4. Check new ECU variant coding item
5. Perform EMS coding
6. Clear the DTC(s) for relevant units including engine ECU and check for any abnormality

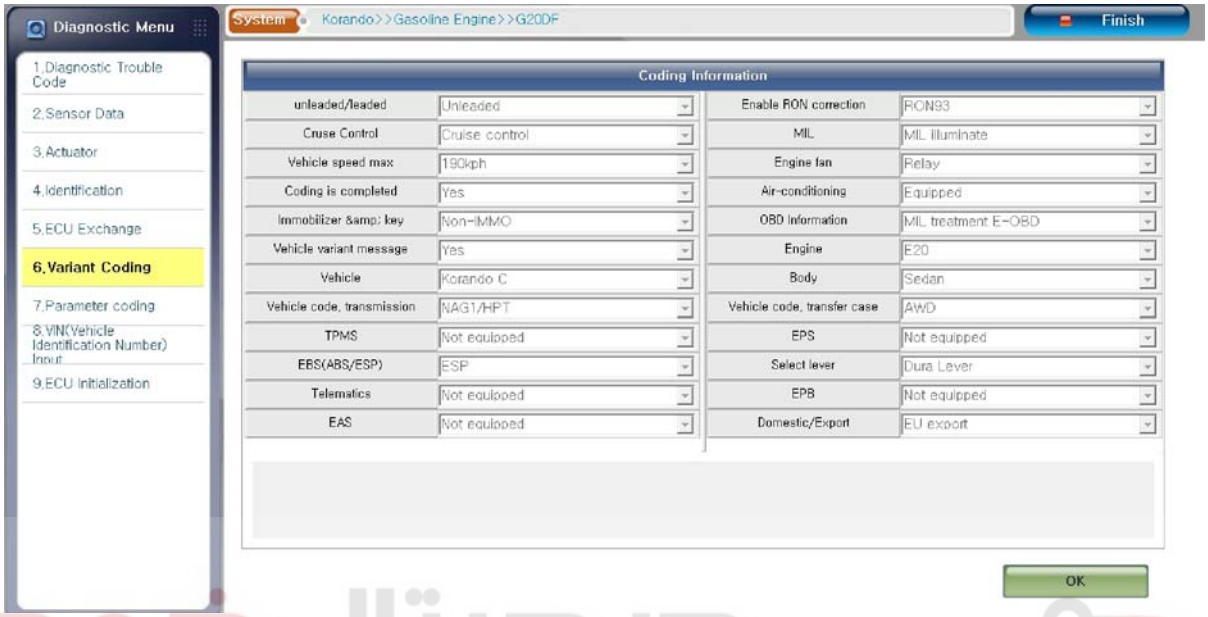
Modification basis	
Application basis	
Affected VIN	

1. Connect the diagnostic device to the diagnostic connector. Choose "Vehicle Type" and "Engine Type" on the main screen, then press the "Diagnosis" button.

2. Read the variant coding and parameter coding in diagnosis menu, and record them.

Modification basis	
Application basis	
Affected VIN	

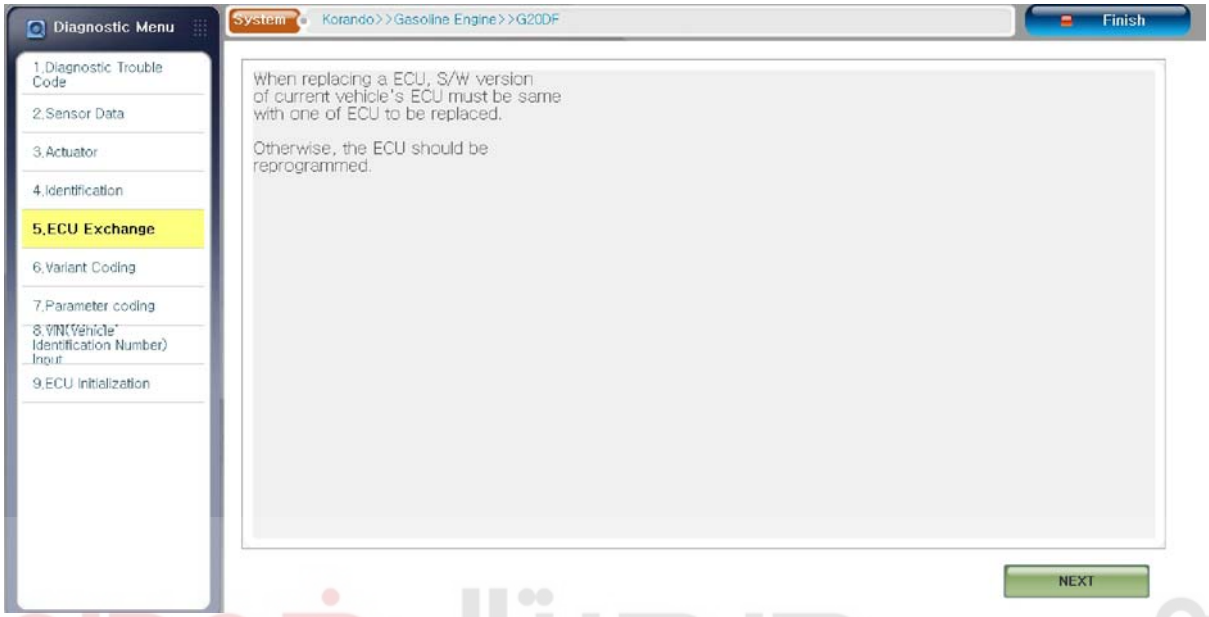
▶ Variant Coding



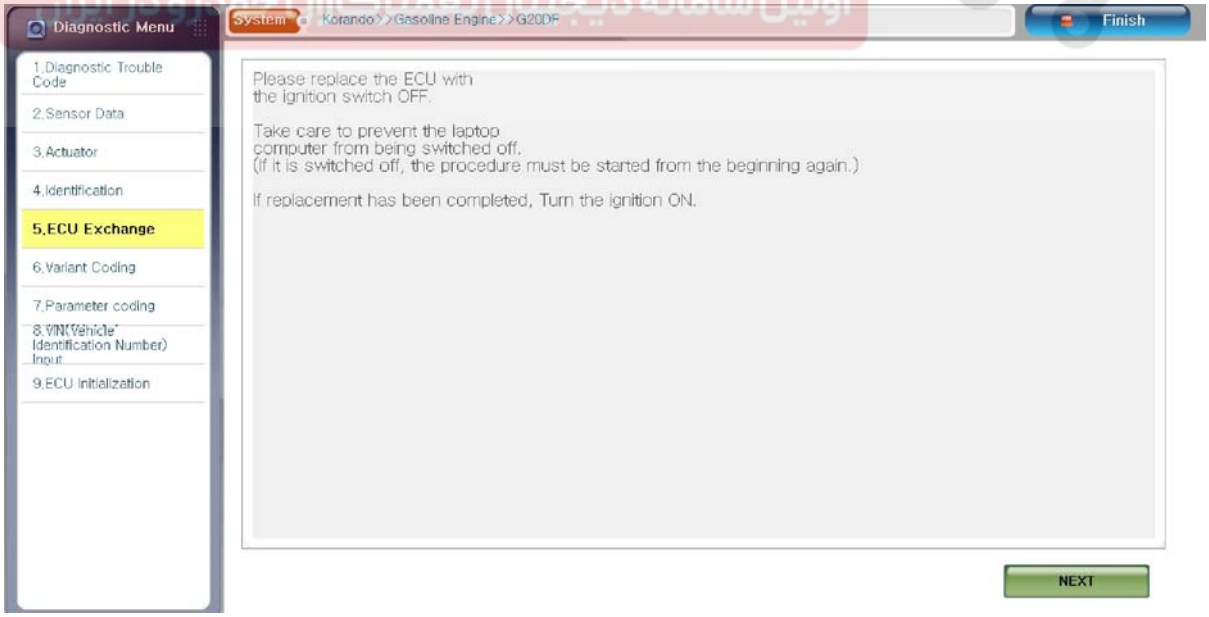
▶ Parameter coding

Modification basis	
Application basis	
Affected VIN	

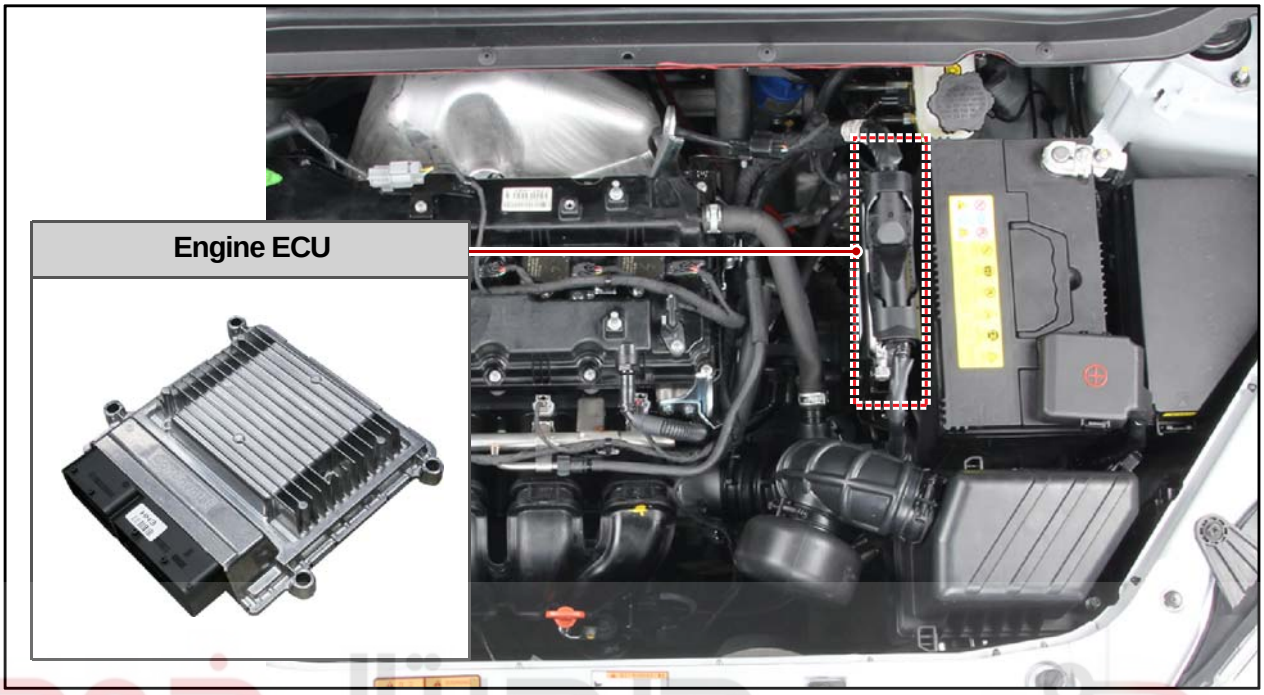
4. Choose the item "Replace ECU" on the diagnosis menu.



5. Follow the instructions on the screen to remove the ECU.



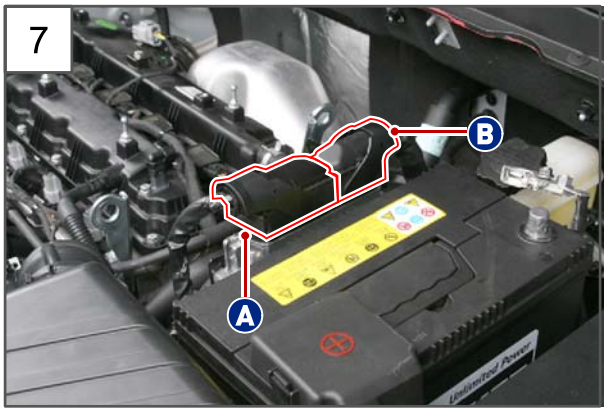
Modification basis	
Application basis	
Affected VIN	



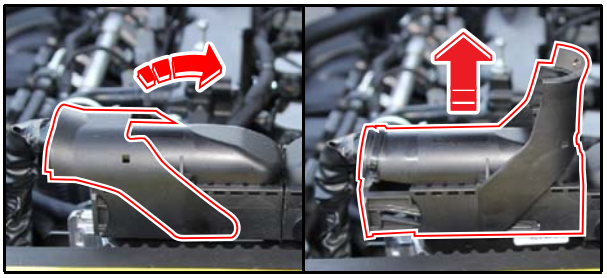
6

6. Release two clamps on engine ECU wiring harness.

7

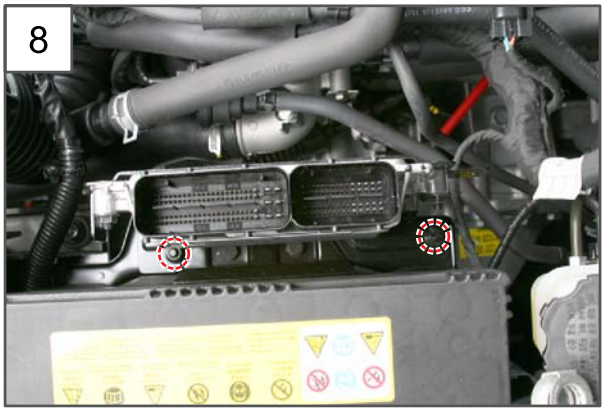


7. Disconnect the ECU connectors (A, B).



Modification basis	
Application basis	
Affected VIN	

8



8. Unscrew two nuts (12 mm) from the engine ECU bracket.

Tightening torque 9.0 ~ 10.0Nm

9

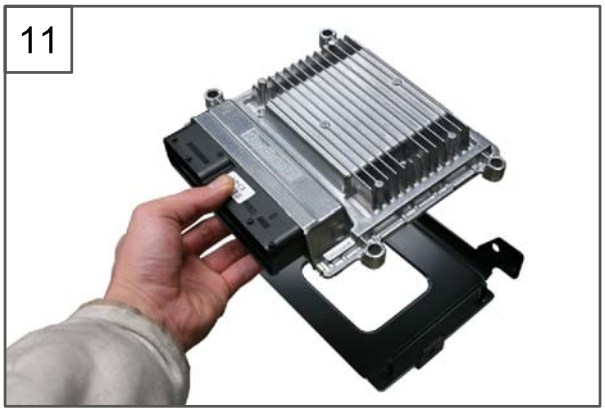
9. Remove the engine ECU assembly.

10

10. Unscrew four nuts (10 mm) on the engine ECU.

Tightening torque 9.0 ~ 10.0Nm

11



11. Separate the engine ECU from the bracket.

Modification basis	
Application basis	
Affected VIN	

12

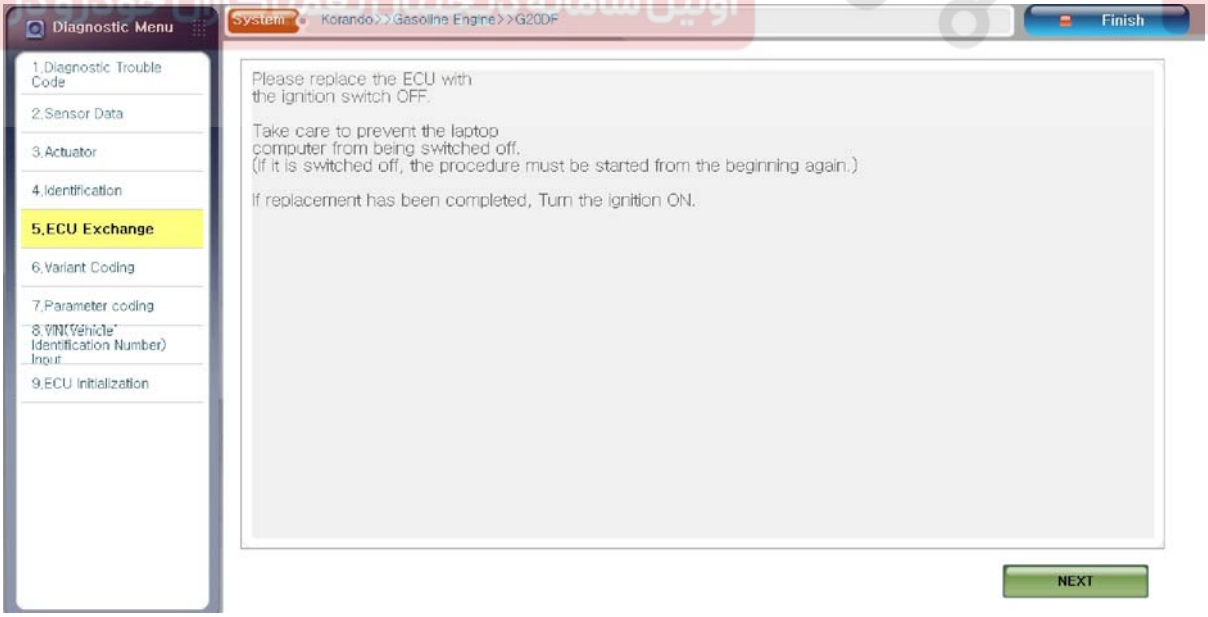
12.Install the engine ECU assembly in the reverse order of removal.

CAUTION

When replacing the engine ECU with a new one, backup the following data in advance with a diagnostic device.

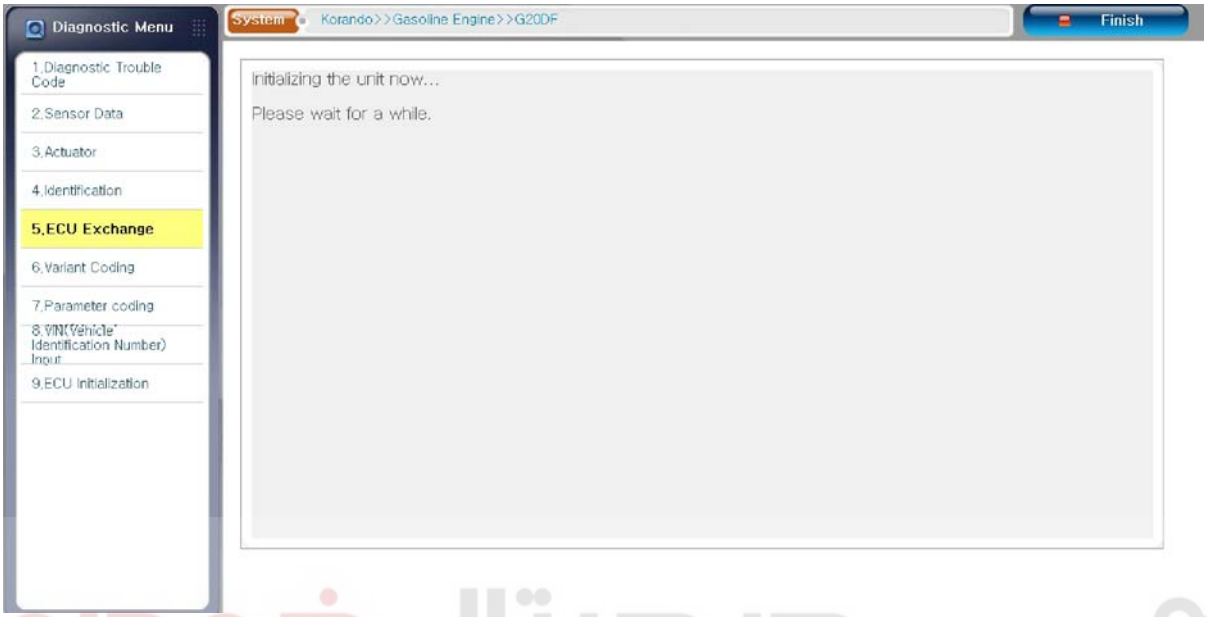
- Data from older ECU
- Chassis number
- Variant coding data

13.Replace the engine ECU and press the "Next" button on the bottom of the screen below.



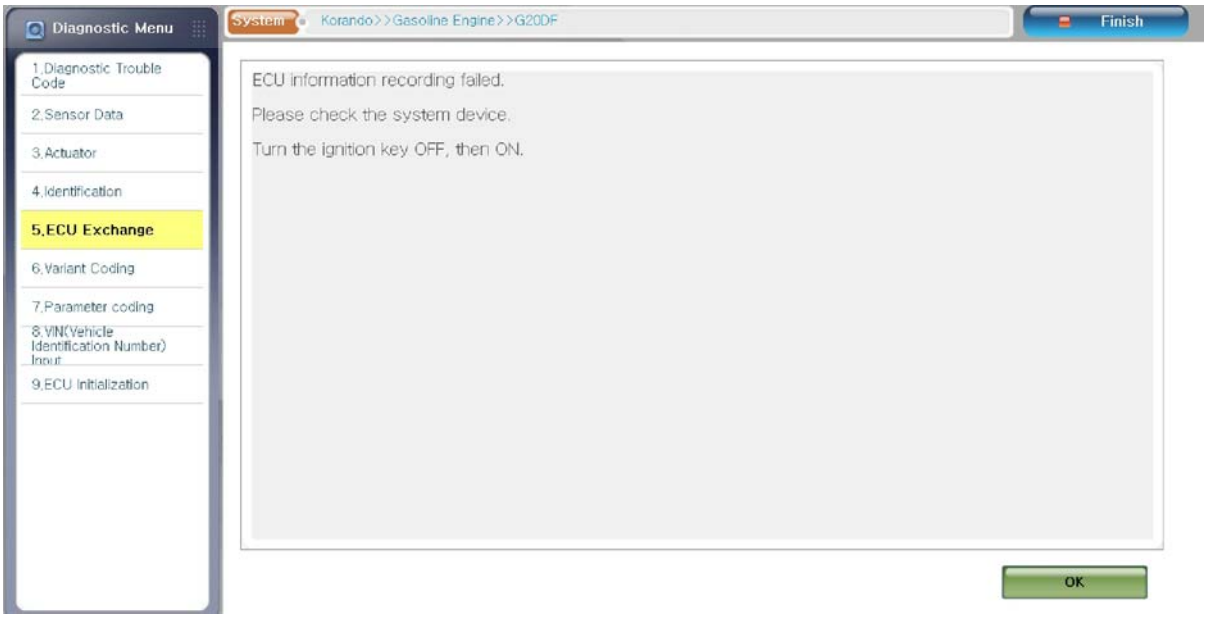
Modification basis	
Application basis	
Affected VIN	

14.Wait for a while as instructed on the screen.



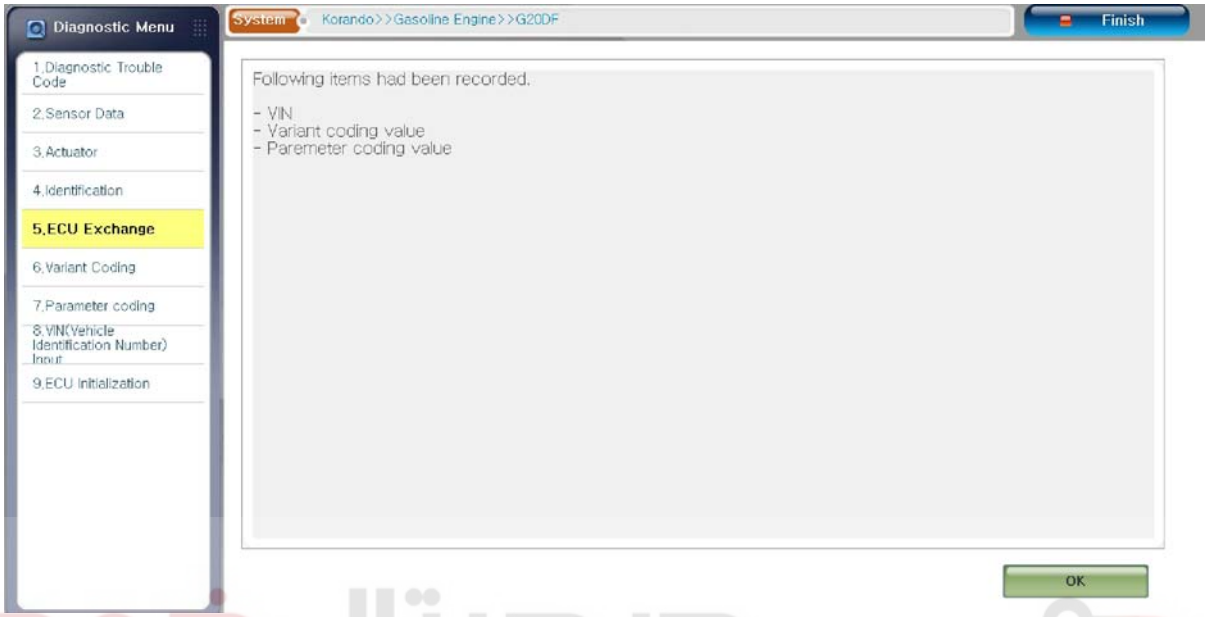
NOTE

If an error has been occurred during the replacement work, the following screen is displayed.

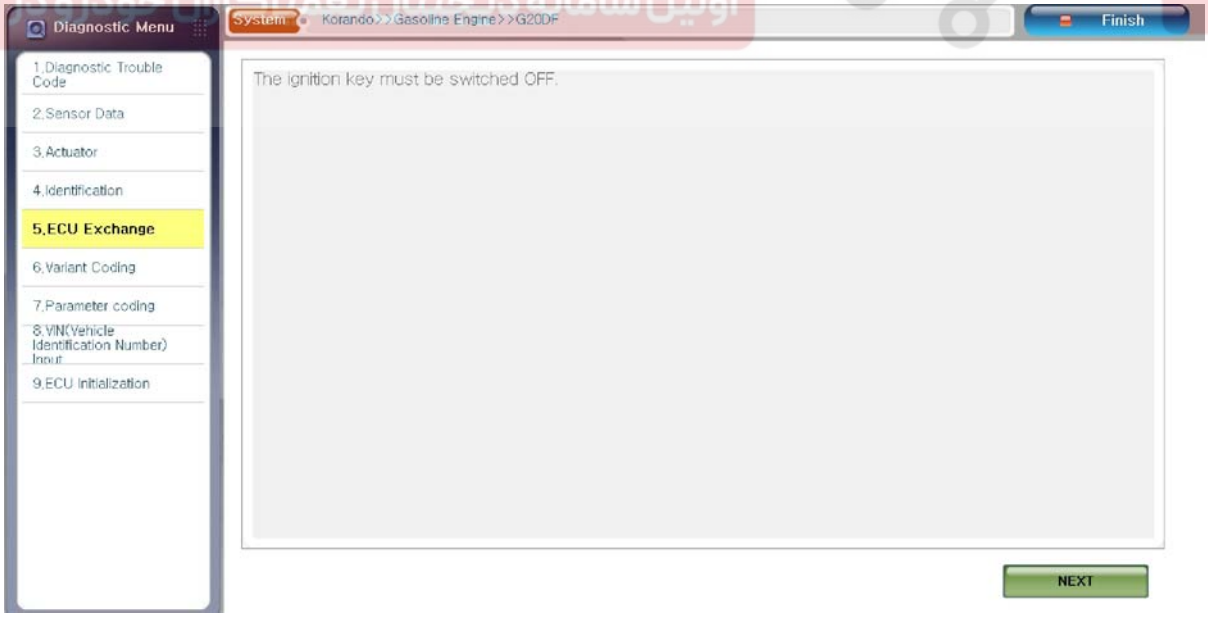


Modification basis	
Application basis	
Affected VIN	

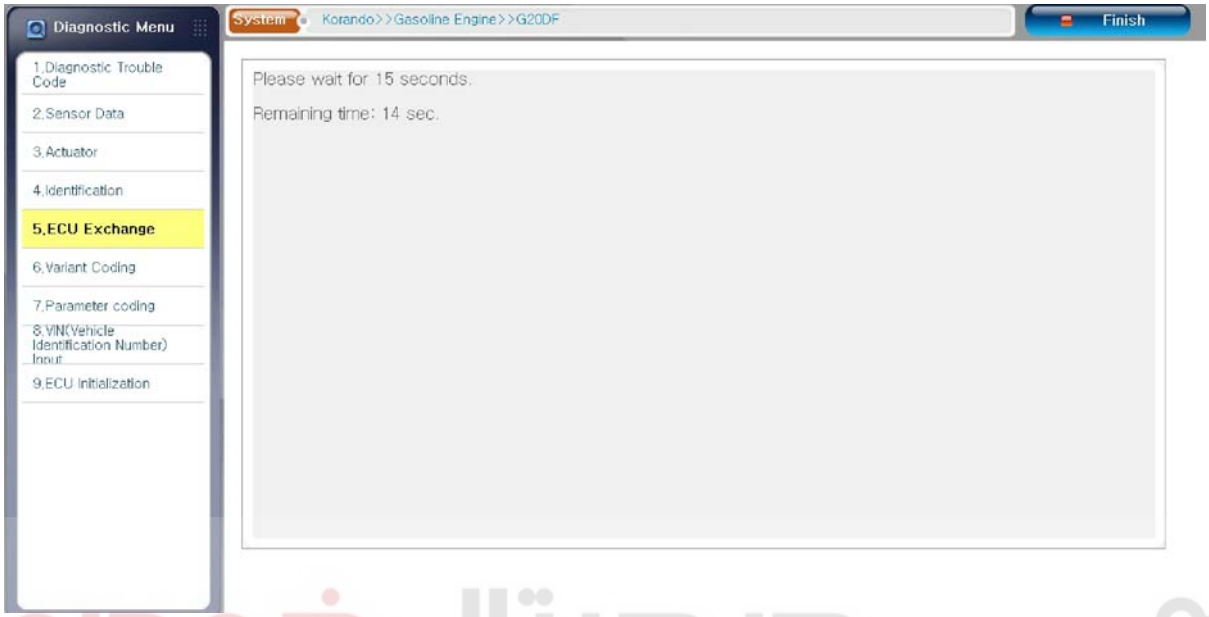
15.If the following screen is displayed, press the "OK" button.



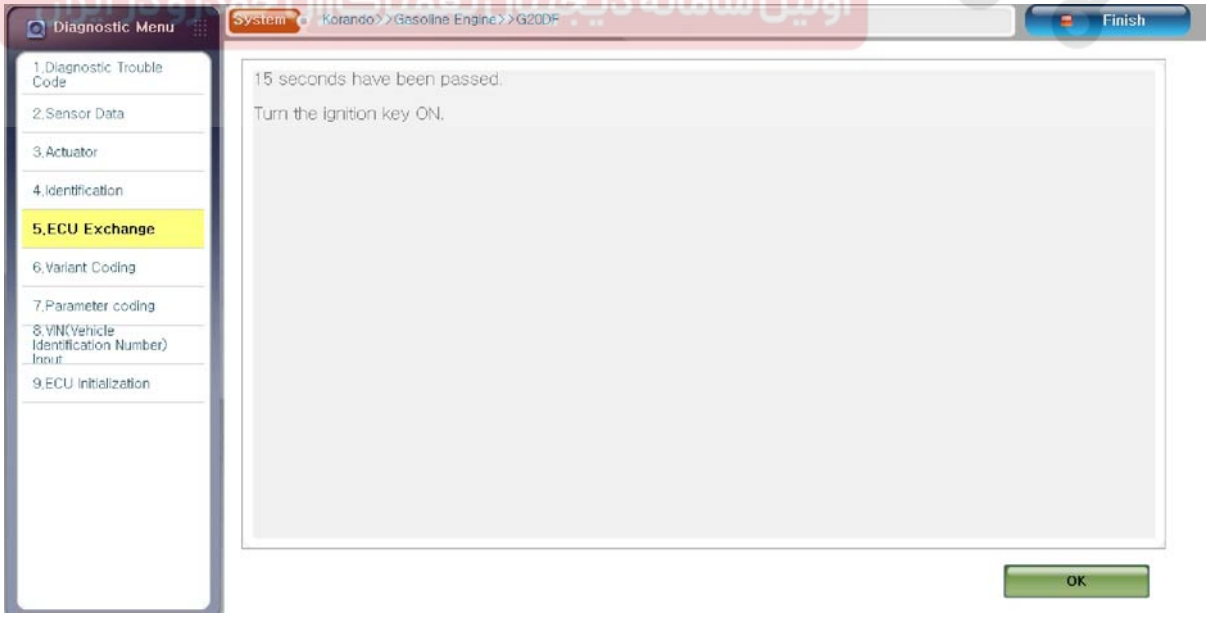
16.Turn the ignition switch to the "OFF" position, then press "Next" as instructed on the screen.



17.Wait for 15 seconds as instructed on the screen.

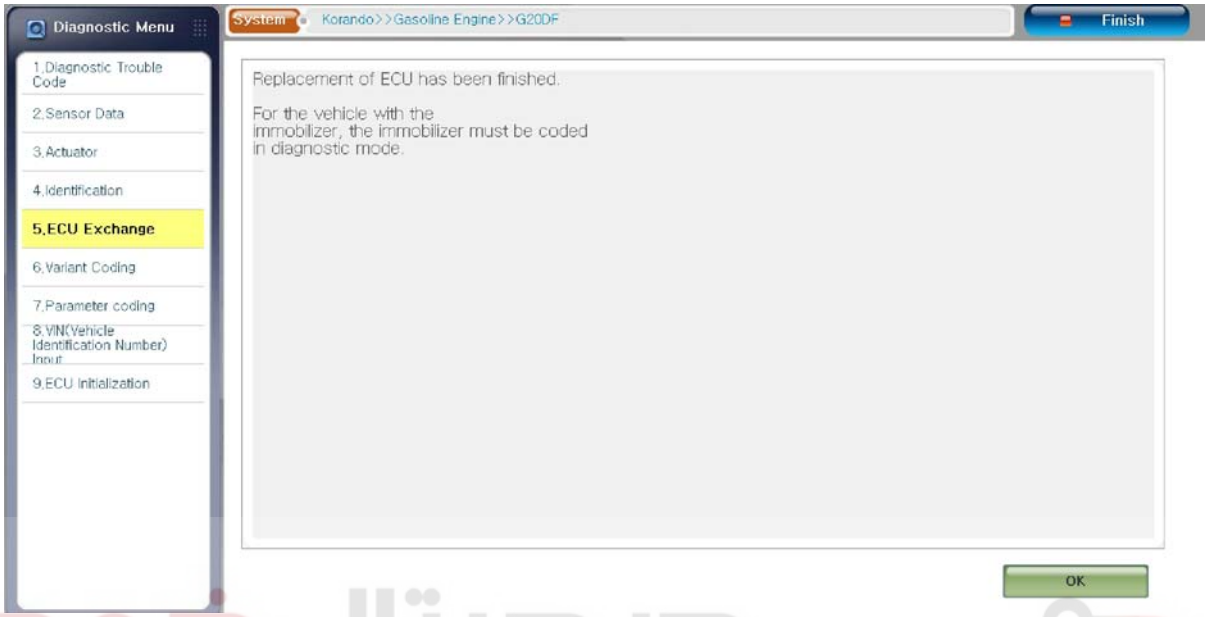


18.Turn the ignition switch to the "ON" position, then press "Next" as instructed on the screen.



Modification basis	
Application basis	
Affected VIN	

19.If the following screen is displayed, press the “Next” button and perform the immobilizer coding.



NOTE

For REKES equipped vehicle, return to Main screen and go into BCM menu. (For Smart key system equipped vehicle, go into SKM menu.)

Modification basis	
Application basis	
Affected VIN	

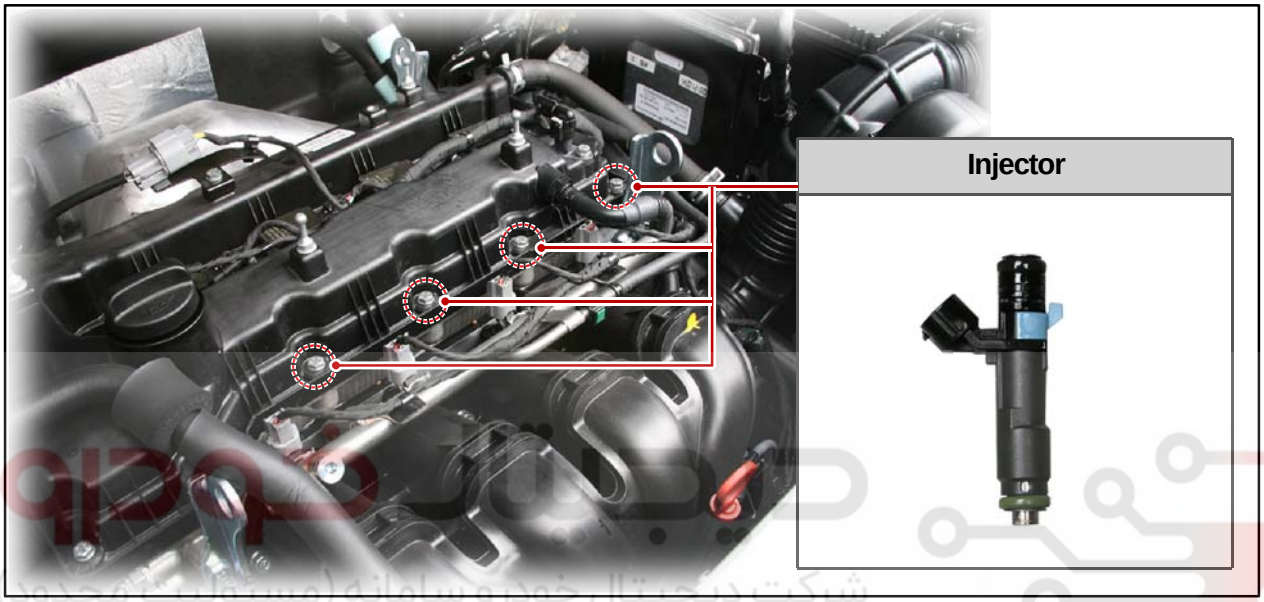
S.G.N. 2245-02

INJECTOR ASSEMBLY

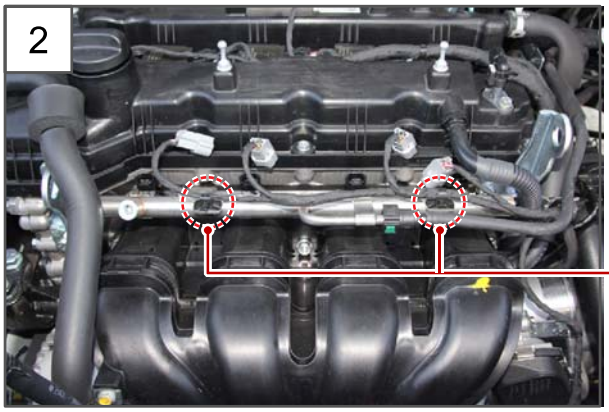
Preceding work - Disconnect the negative cable from the battery.

WARNING

To prevent the personal injury and fire, the pressure in the fuel system should be released before diconnecting the fuel lines.



1. Disconnect four injector connectors.



2. Release two clamps and separate the injector wiring.

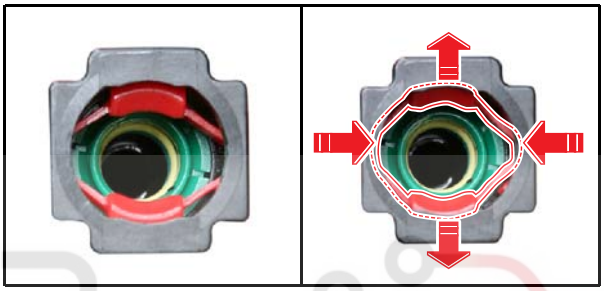
Modification basis	
Application basis	
Affected VIN	

3

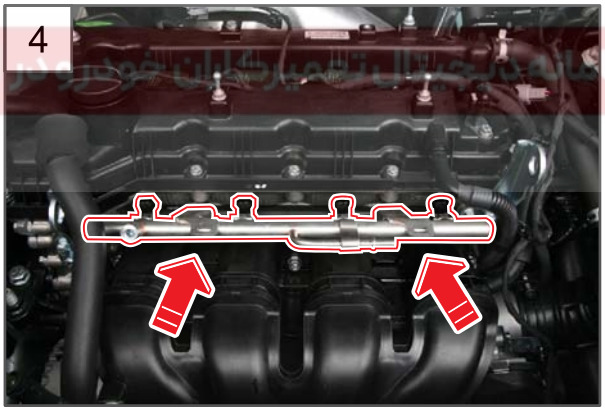
3. Release the quick connector on fuel supply hose to fuel rail assembly.

CAUTION

Make sure not to spill out the fuel from the fuel pipes.



4

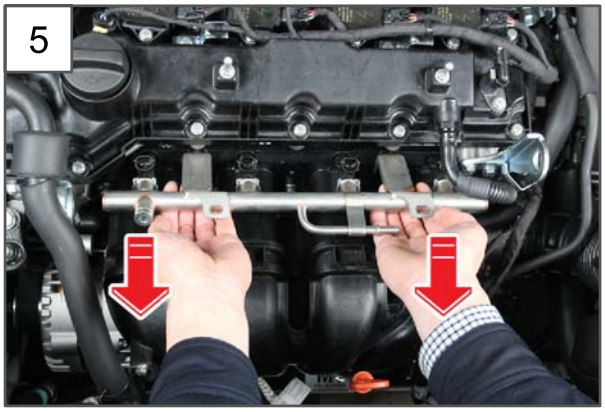


4. Unscrew two bolts (6 mm) from the fuel rail.

Tightening torque 25.0 ± 2.5Nm

Modification basis	
Application basis	
Affected VIN	

5



5. Separate the fuel rail assembly by pulling it evenly.

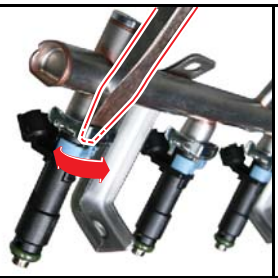
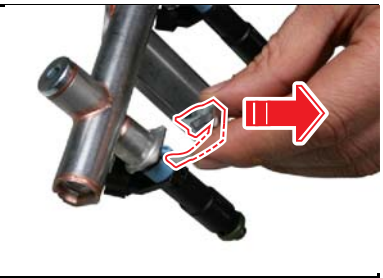
6

6. Remove the fuel rail assembly.

CAUTION
Seal the injector mounting holes so that foreign material cannot get into the hole.

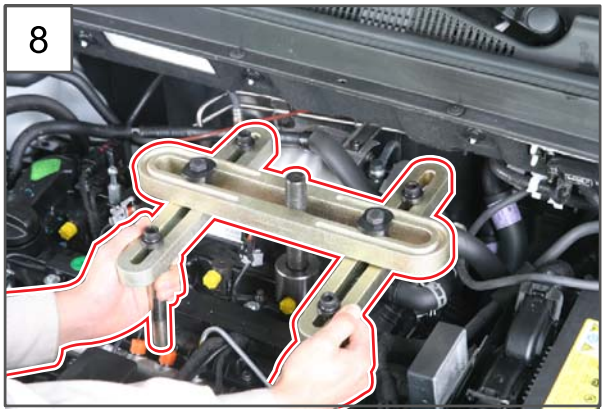
7

7. Remove the injector mounting retainer clip.

		
Insert the screwdriver into the groove (A) of injector mounting retainer.	Separate the injector mounting retainer by turning the screwdriver right and left.	Remove the injector mounting retainer.

Modification basis	
Application basis	
Affected VIN	

8



8. Remove the injectors from the fuel rail assembly.

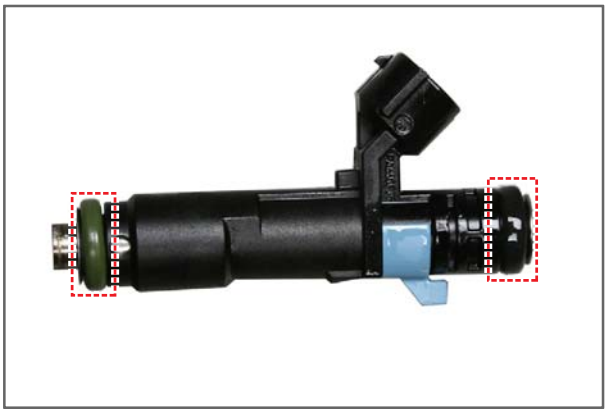
CAUTION
Replace the O-rings with new ones.

9

9. Install the injector assembly in the reverse order of removal.

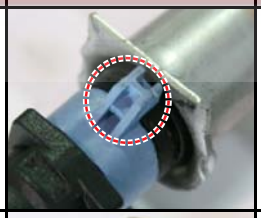
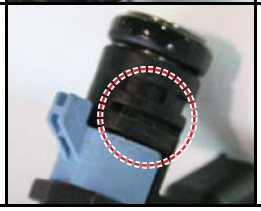
Modification basis	
Application basis	
Affected VIN	

Cautions when installing

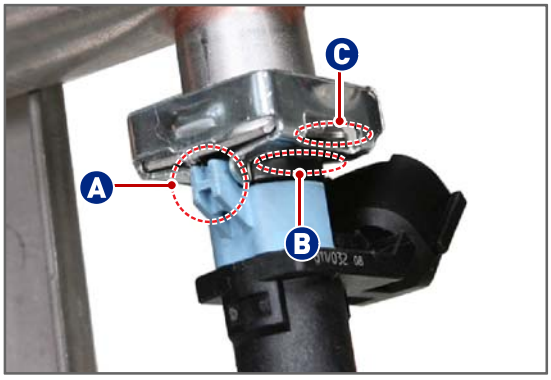


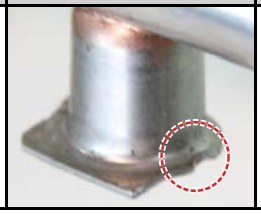
- Replace the O-rings with new ones.

- Push the injector into fuel rail assembly while turning it right and left.

	Injector	Retainer clip
A		
B		

- Check the installed conditions of injector mounting retainer clip, injector and fuel rail assembly after installation.



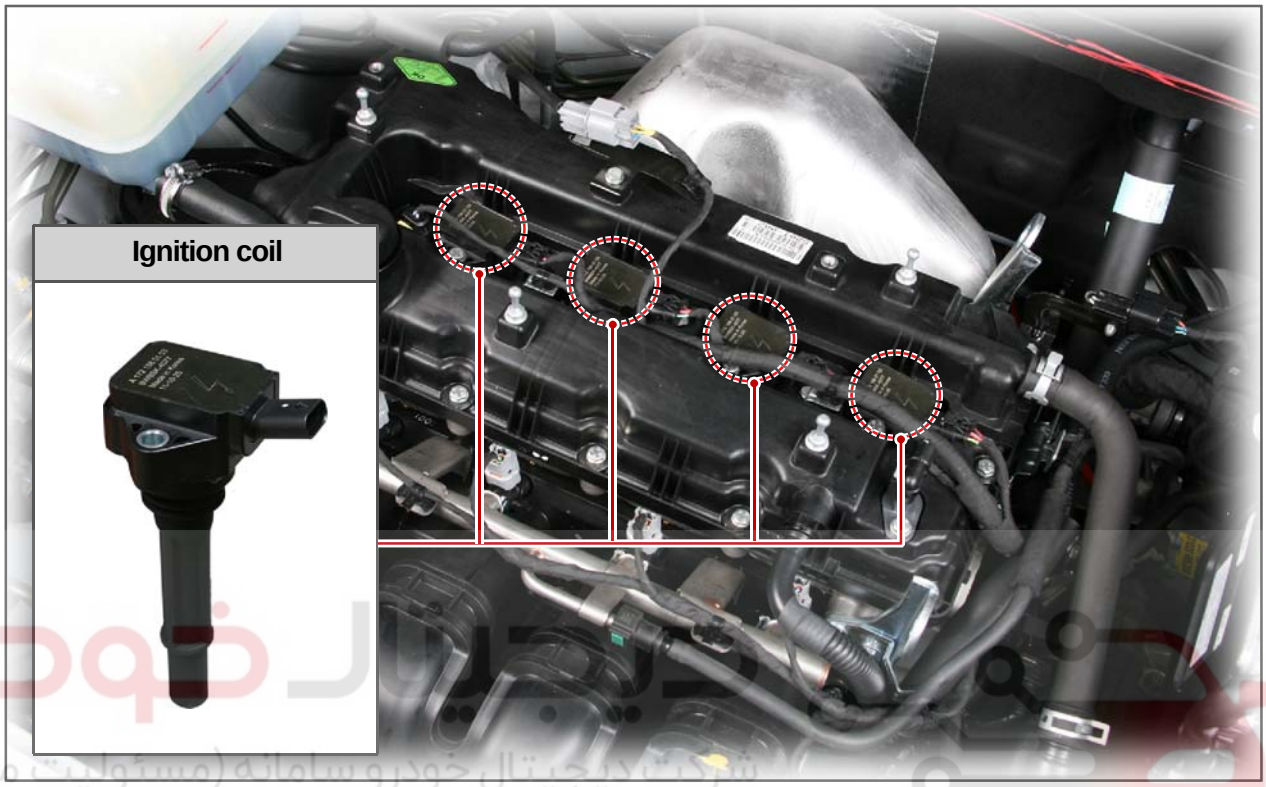
	Fuel rail	Retainer clip
C		

Modification basis	
Application basis	
Affected VIN	

S.G.N. 1443-01

IGNITION COIL ASSEMBLY

Preceding work - Disconnect the negative cable from the battery.



1. Disconnect the ignition coil connectors in order.

1. Unscrew the bolt from the No.1 ignition coil.

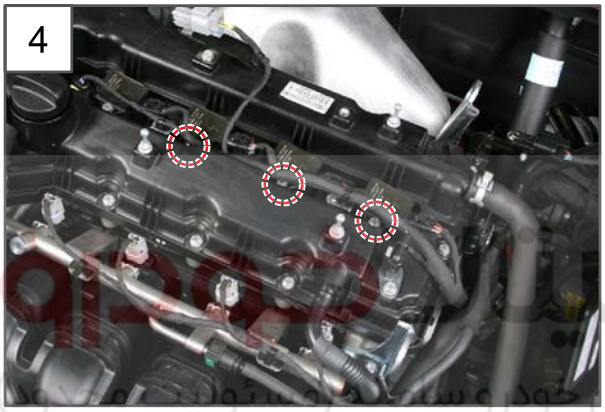
Tightening torque 7.8 ± 0.6Nm

Modification basis	
Application basis	
Affected VIN	

3

3. Remove the No.1 ignition doil.

4



4. With the same manner, remove the remaining ignition coils.

5

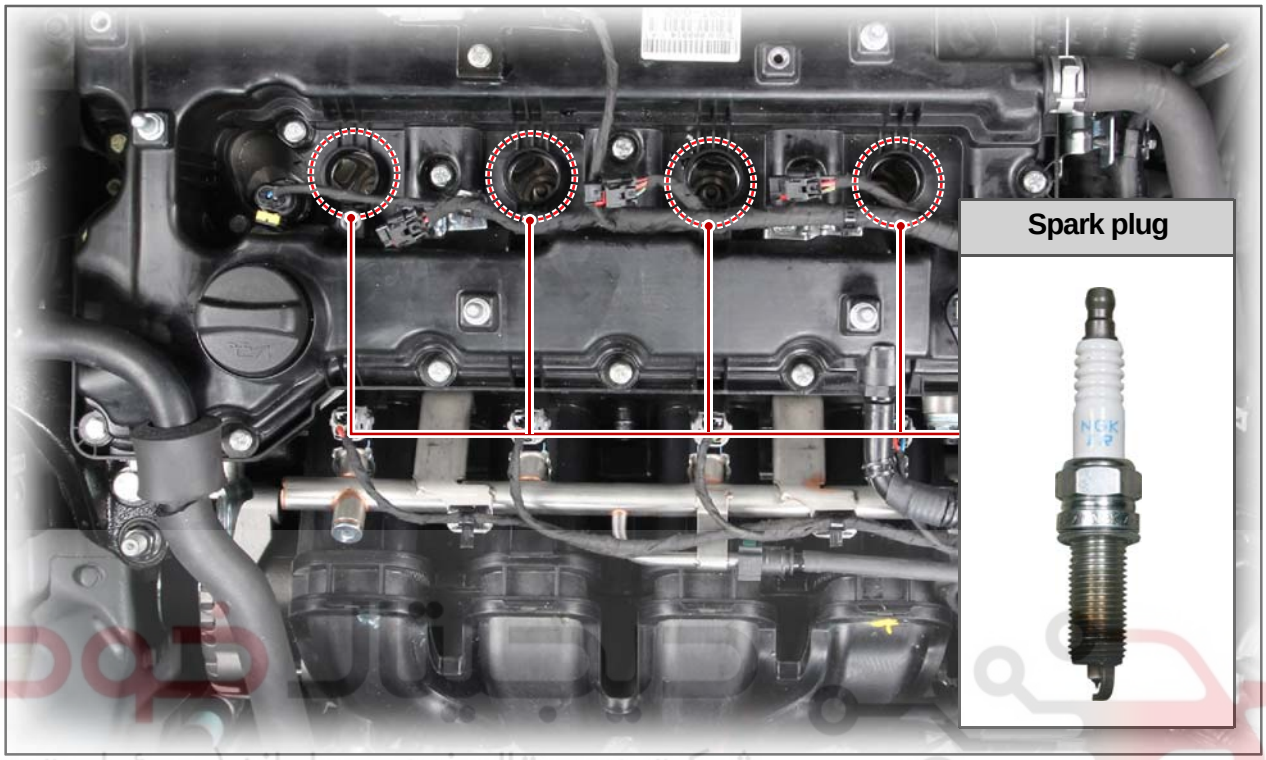
5. Install the ignition coils in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

S.G.N. 1443-03

SPARK PLUG

Preceding work - Disconnect the negative cable from the battery.

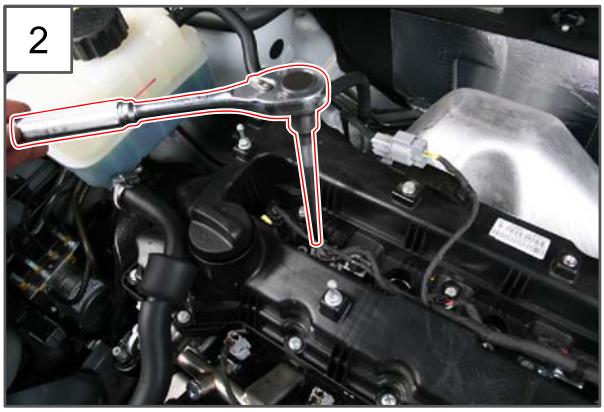


1

1. Remove the ignition coils in order.

NOTE
Refer to Chapter "Ignition System".

2



1. Unscrew the No.1 ignition coil with the specified tool.

Tightening torque 15 ~ 25Nm

3

3. Remove the No.1 spark plug.

NOTE
With the same manner, remove the remaining spark plugs.

CAUTION
Seal the injector mounting holes so that foreign material cannot get into the hole.

4

4. Install the spark plugs in the reverse order of removal.

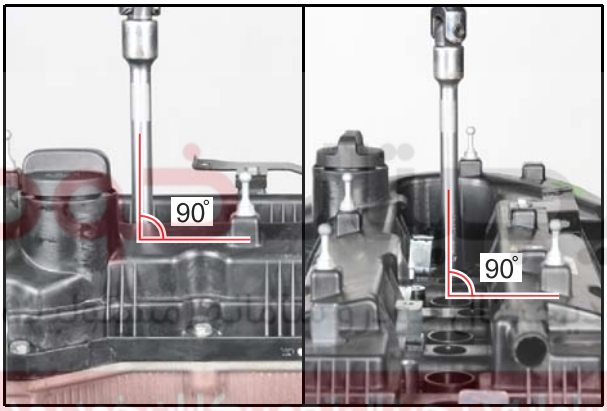
Modification basis	
Application basis	
Affected VIN	

Cautions when installing

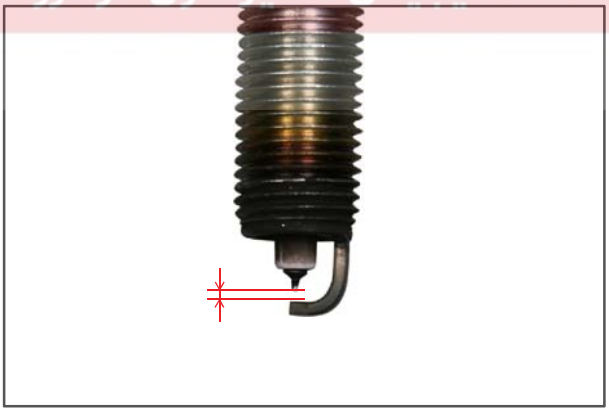
- Screw in the spark plug with hands and specified tool before tightening it.

CAUTION
If the thread is incorrectly engaged, the spark plug or thread could be damaged.

CAUTION
Do not apply excessive force to tighten it. Keep the specified tightening torque.



- The tool for spark plug should be perpendicular dueing service work.



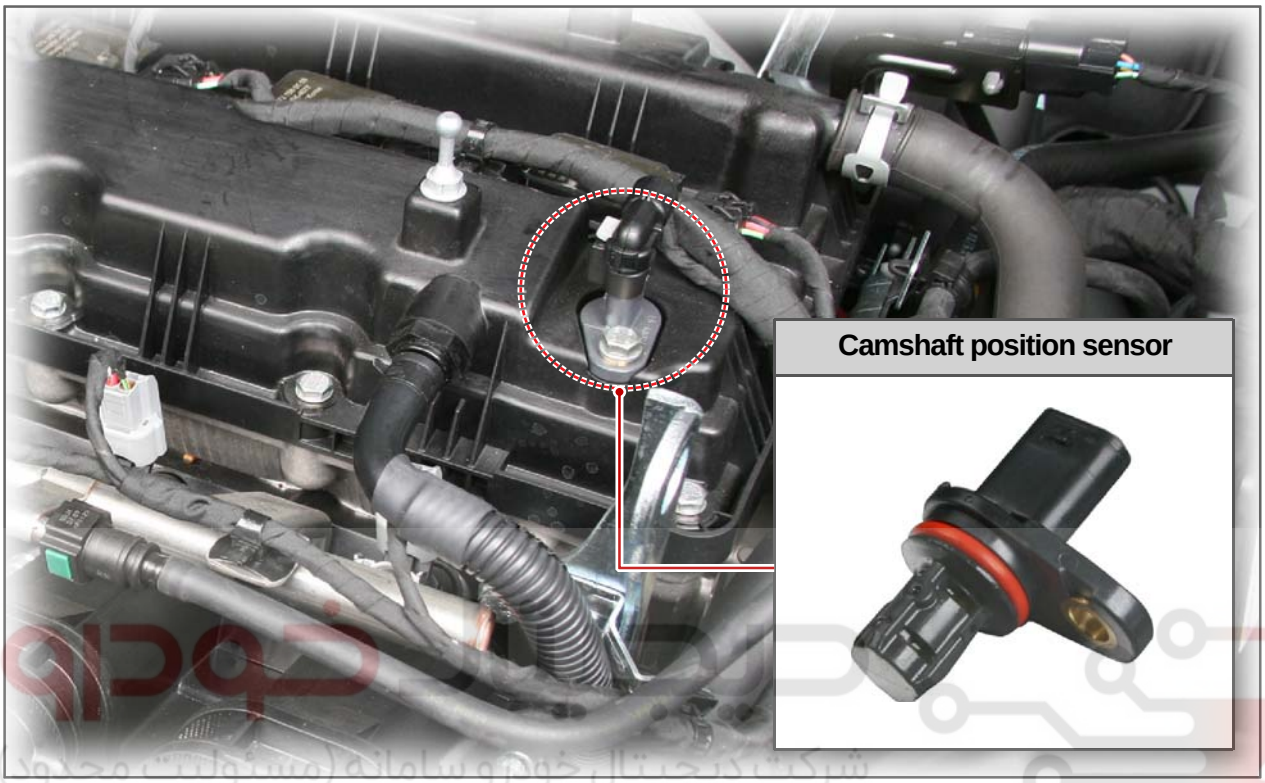
- Measure the air gap before installation.

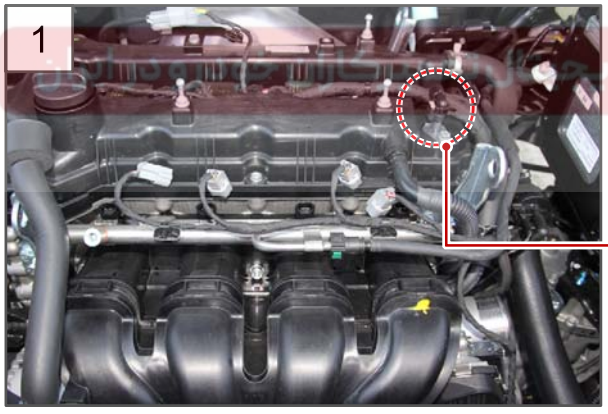
Air gap	1.1 mm

Modification basis	
Application basis	
Affected VIN	

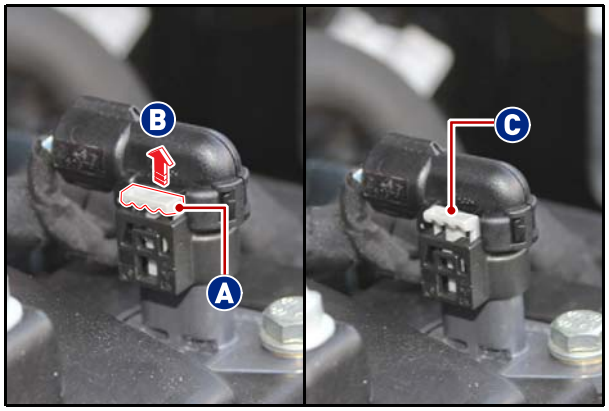
S.G.N.
1430-14 CAMSHAFT POSITION SENSOR

Preceding work - Disconnect the negative cable from the battery.





1. Disconnect the camshaft position sensor connector.



To disconnect the camshaft position sensor connector, pull the lock (A) toward direction (B) and push the lock (C).

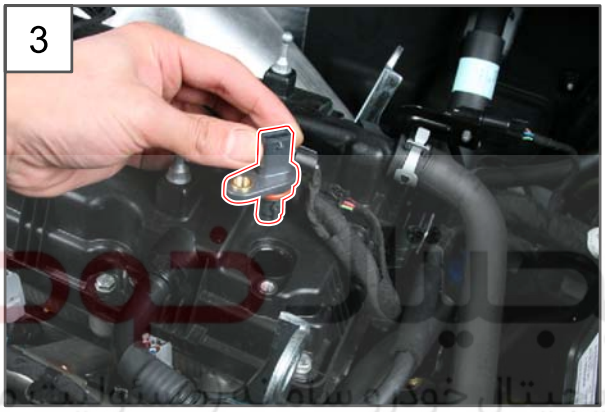
Modification basis	
Application basis	
Affected VIN	

2

2. Unscrew mounting bolt (10 mm) from the camshaft position sensor.

Tightening torque 10.0 ~ 14.0Nm

3



3. Remove the camshaft position sensor.

4

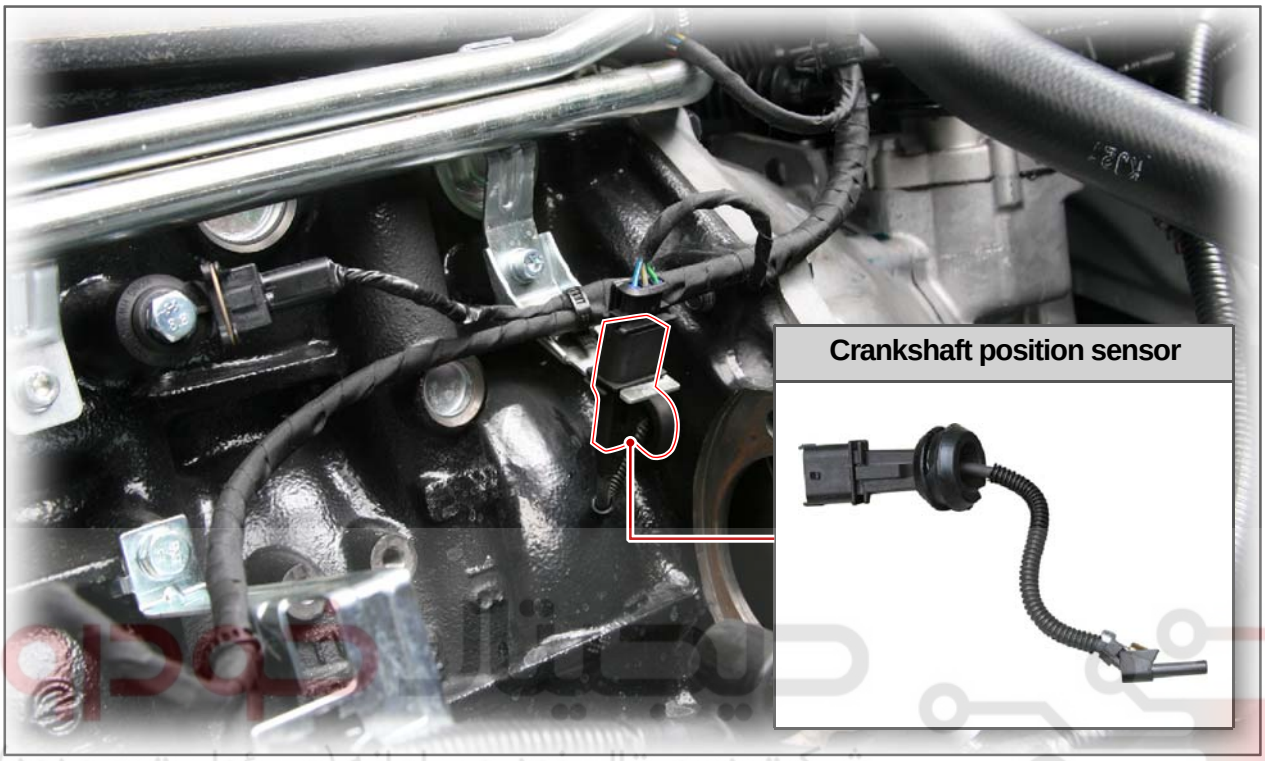
4. Install the camshaft position sensor in the reverse order of removal.

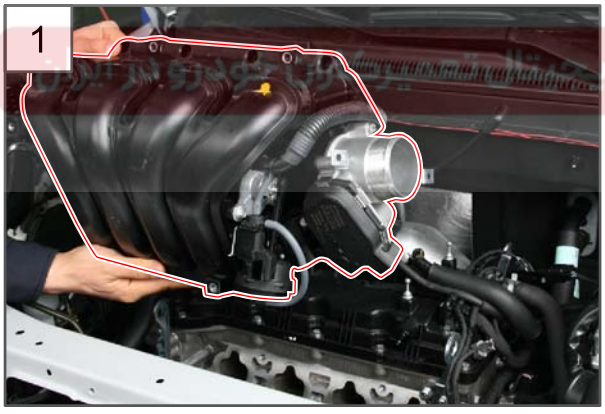
Modification basis	
Application basis	
Affected VIN	

S.G.N. 1128-37

CRANKSHAFT POSITION SENSOR

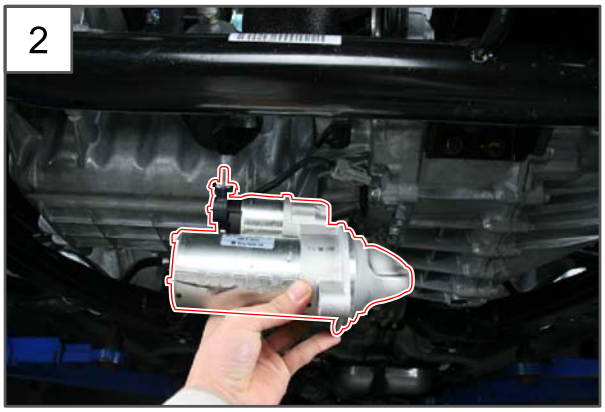
Preceding work - Disconnect the negative cable from the battery.





1. Remove the intake manifold assembly.

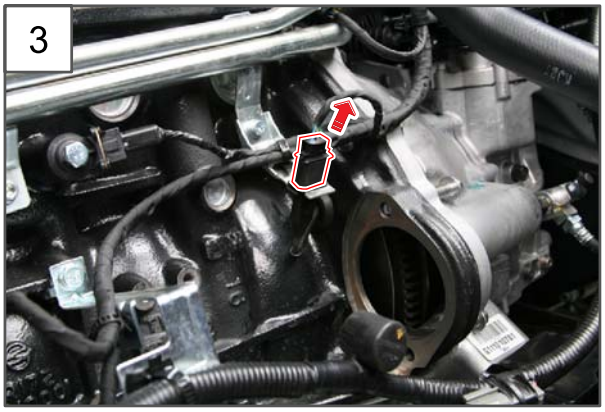
NOTE
Refer to Chapter "Intake System".



2. Remove the start motor.

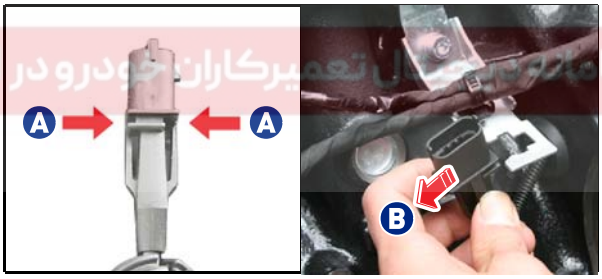
NOTE
Refer to Chapter "Starting System".

Modification basis	
Application basis	
Affected VIN	



3. Disconnect the crankshaft position sensor connector.

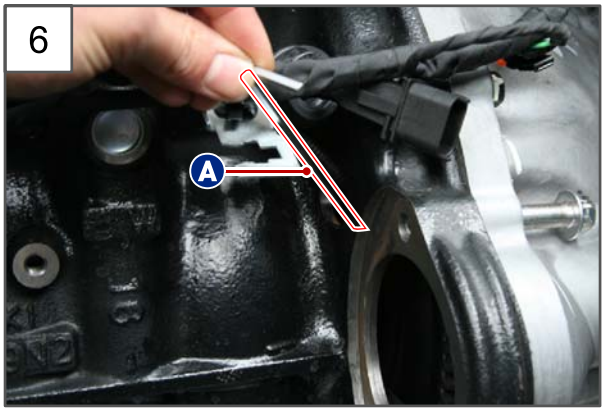
4. Remove the crankshaft position sensor connector from the bracket.



To remove the connector, push both locks (A) on connector and pull it out toward arrow direction (B).

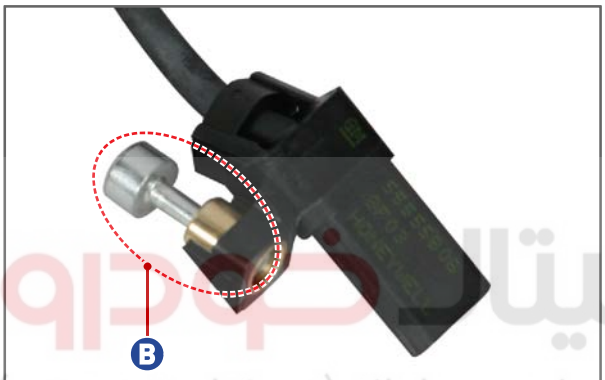
5. Remove the crankshaft position sensor dust cover.

6



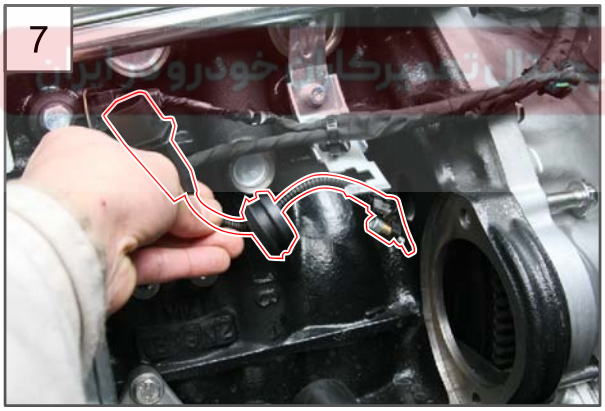
6. Unscrew hexagon mounting bolt (6 mm) with L-wrench from the crankshaft position sensor.

Tightening torque 10.0 ± 1.0Nm



Crankshaft position sensor mounting bolt (B)

7



7. Remove the crankshaft position sensor.

8

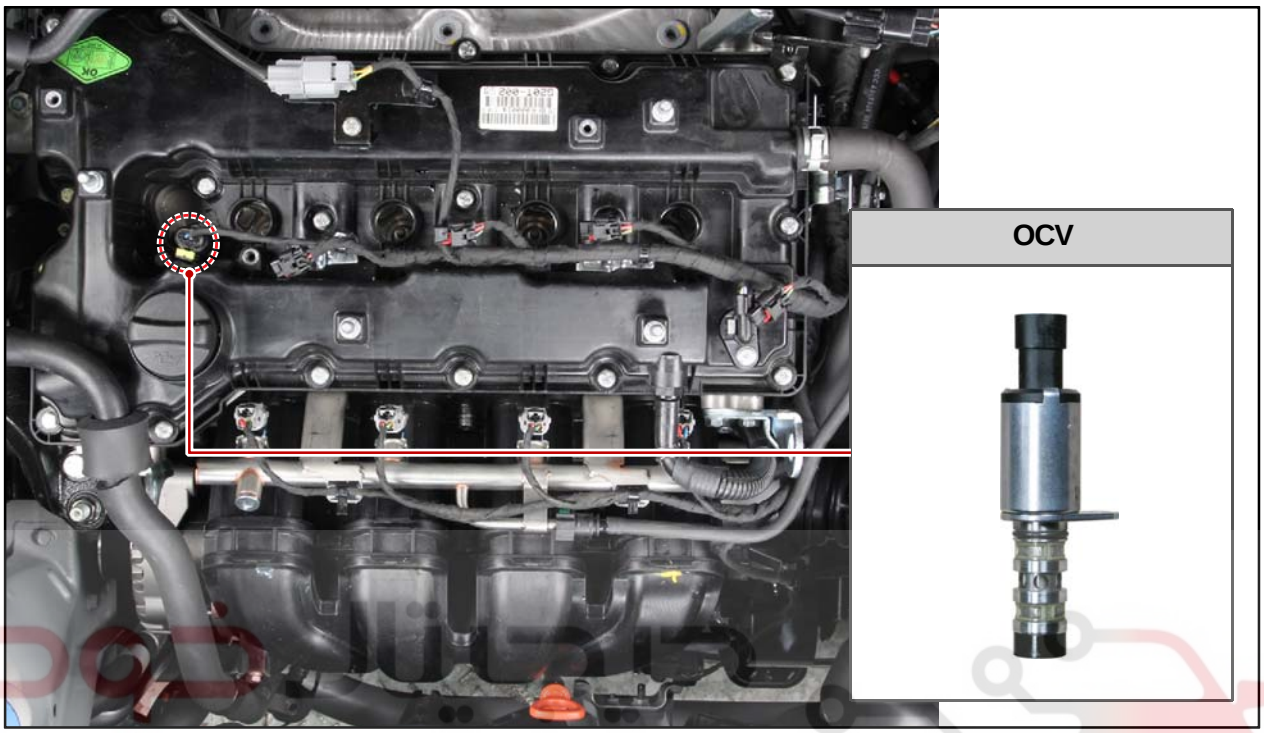
8. Install the crankshaft position sensor in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

S.G.N. 1311-26

OCV (Oil Control Valve)

Preceding work - Disconnect the negative cable from the battery.



1. Disconnect the ignition coil connectors (#1).

2. Unscrew the bolt (10 mm) from the ignition coil.

Tightening torque 7.8 ± 0.6Nm

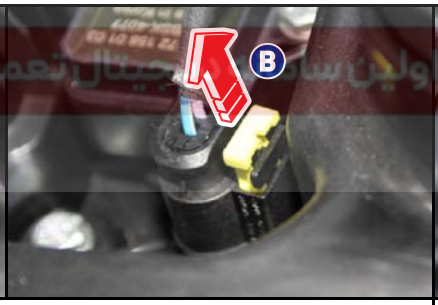
Modification basis	
Application basis	
Affected VIN	

3

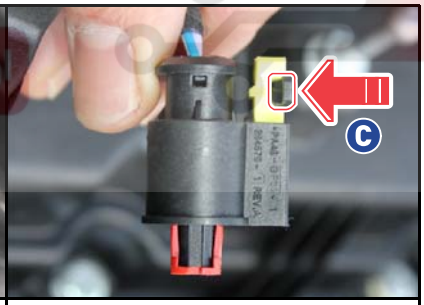
3. Pull the ignition coil straight upward to remove it.

4

4. Disconnect the OCV connectors.



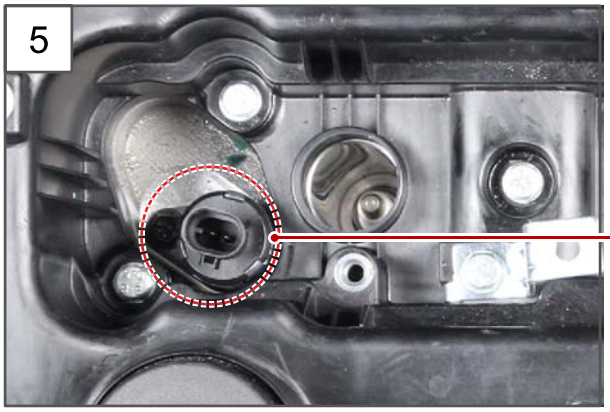
Pull up the lock (A) to direction (B).



Press the lock (C) to disconnect the connector.

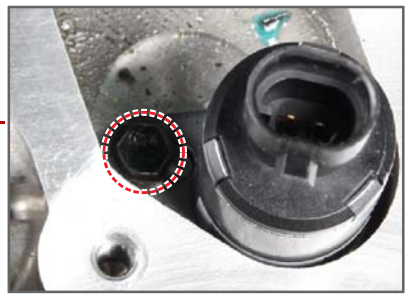
Modification basis	
Application basis	
Affected VIN	

5



5. Unscrew the OCV mounting bolt (8 mm).

Tightening torque 8.0 ± 1.0Nm



6

6. Remove the OCV from cylinder head.

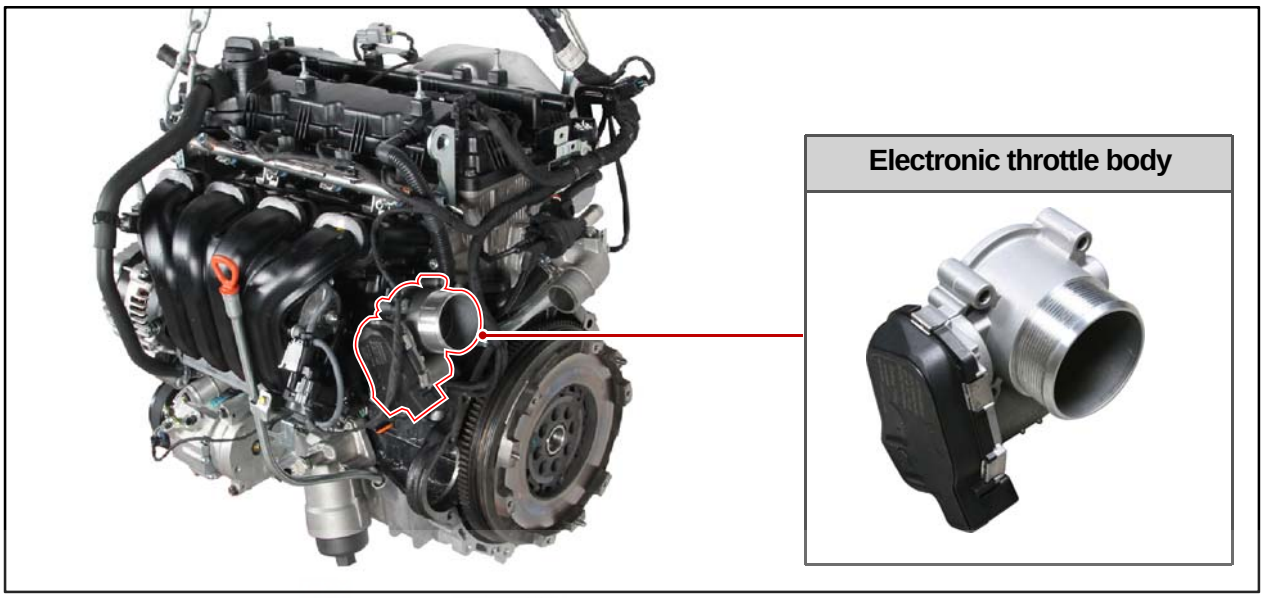
7

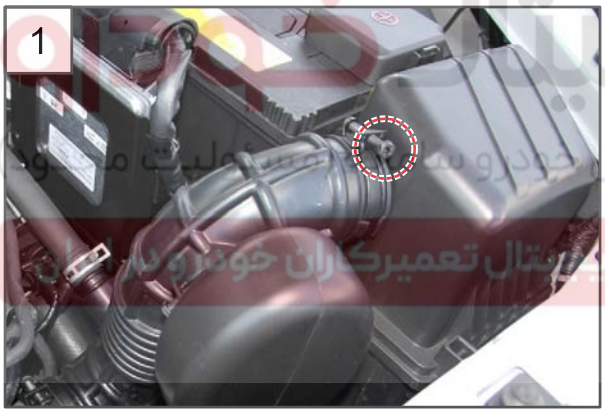
7. Install the OCV in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

S.G.N.
1740-07 ELECTRONIC THROTTLE BODY

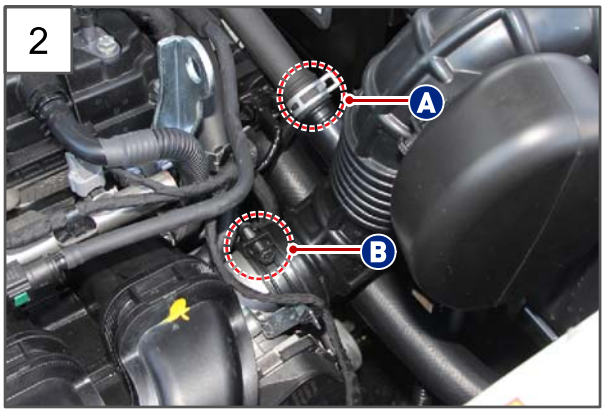
Preceding work - Disconnect the negative cable from the battery.





1. Disconnect the ignition coil connectors in order.

Tightening torque 6.0 ~ 7.0Nm



2. Release the clamp (A) for blow-by hose and the clamp (B) for electronic throttle body.

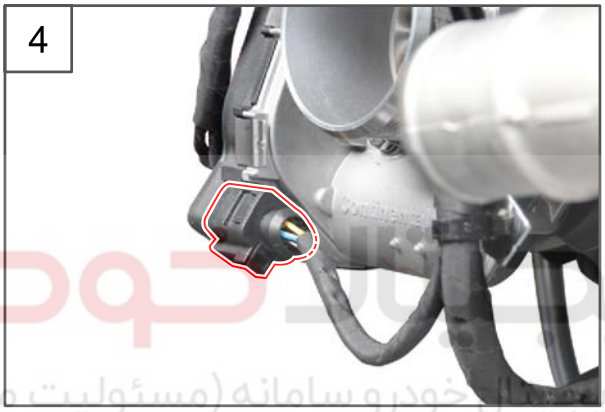
Tightening torque (B) 6.0 ~ 7.0 m

Modification basis	
Application basis	
Affected VIN	

3

3. Remove the air cleaner hose assembly.

4



4. Disconnect the electronic throttle body connector.

5

5. Unscrew four bolts (10 mm) and remove the electronic throttle body.

6

6. Install the electronic throttle body in the reverse order of removal.

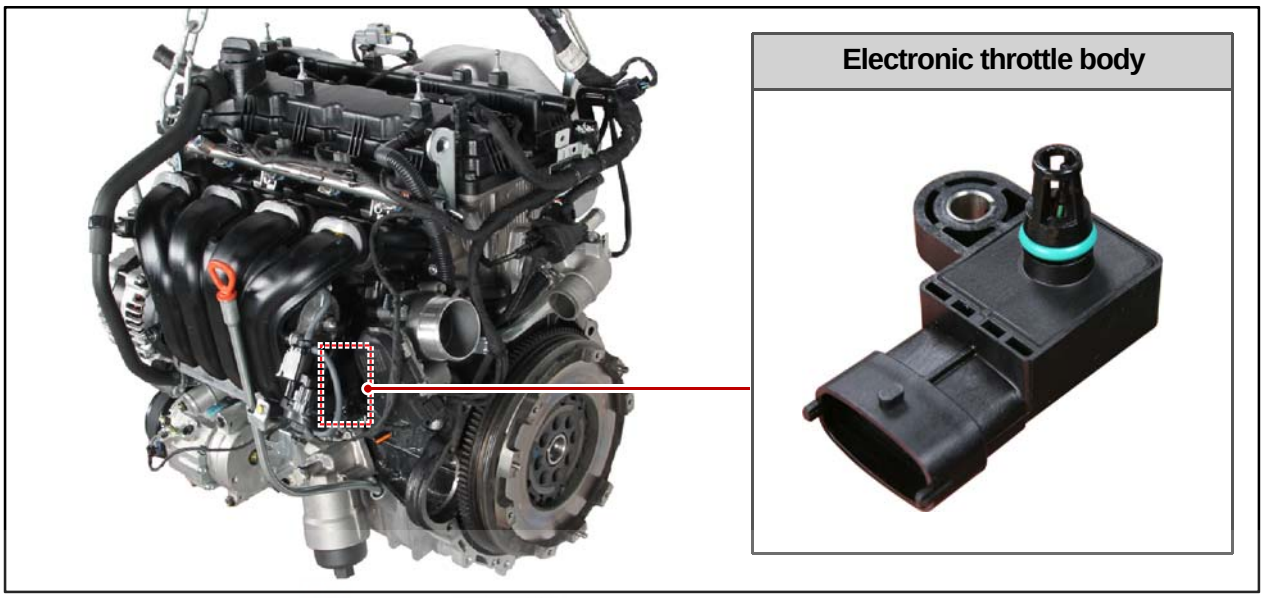
CAUTION

Replace the O-ring with new one.
Allpy the soapy water on the O-ring before installation.

Modification basis	
Application basis	
Affected VIN	

S.G.N.
1740-03 T-MAP SENSOR

Preceding work - Disconnect the negative cable from the battery.



1. Disconnect the T-MAP sensor connectors.

2. Unscrew the T-MAP sensor mounting bolt (10 mm).

Modification basis	
Application basis	
Affected VIN	

3

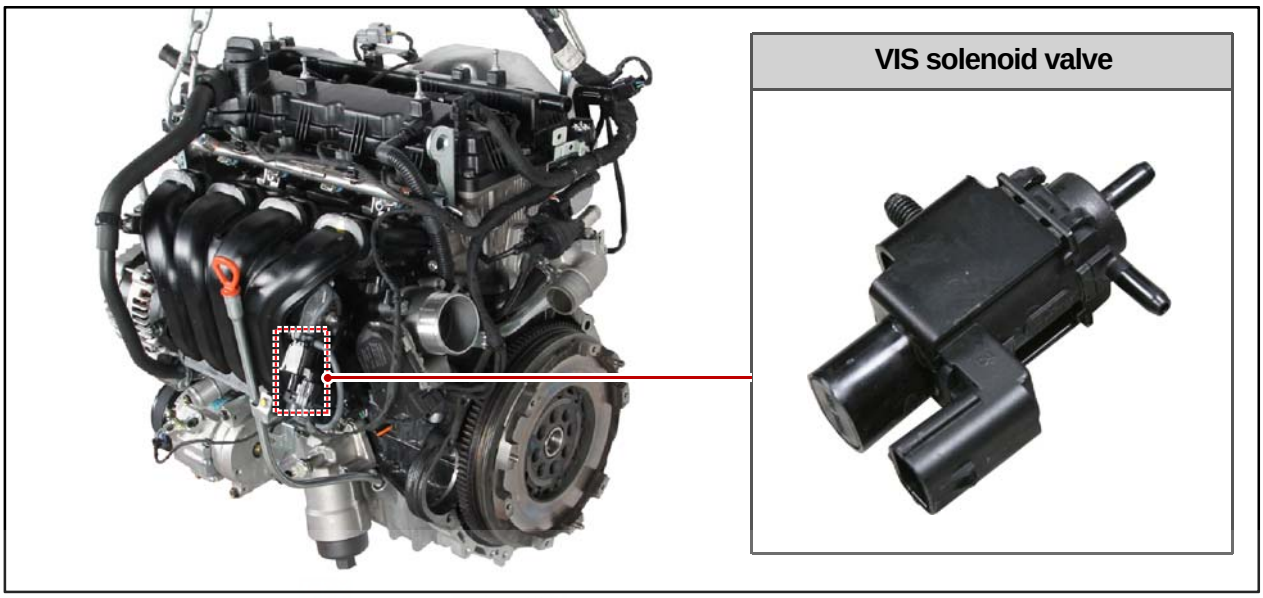
3. Remove the T-MAP sensor.

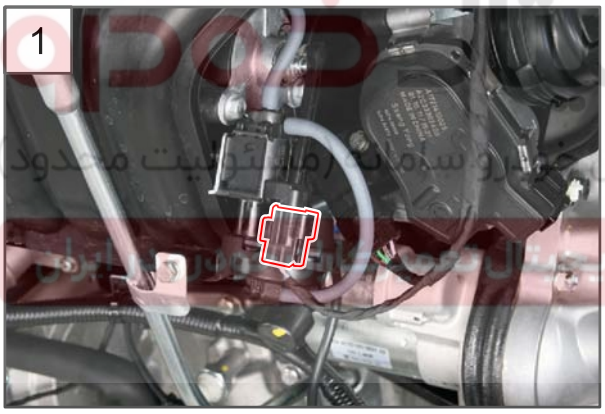
4

4. Install the T-MAP sensor in the reverse order of removal.

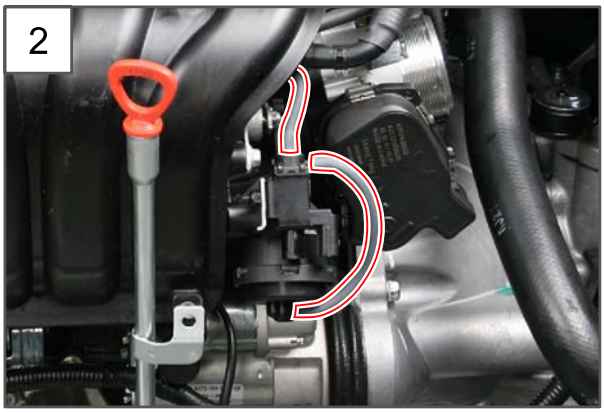
S.G.N.
1628-04 VIS SOLENOID VALVE

Preceding work - Disconnect the negative cable from the battery.





1. Disconnect the VIS solenoid valve connector.



2. Separate the VIS solenoid valve vacuum hose.

Modification basis	
Application basis	
Affected VIN	

3

3. Unscrew the bolt (10 mm) and remove the VIS solenoid valve.

Tightening torque 9.0 ~ 10.0Nm

4

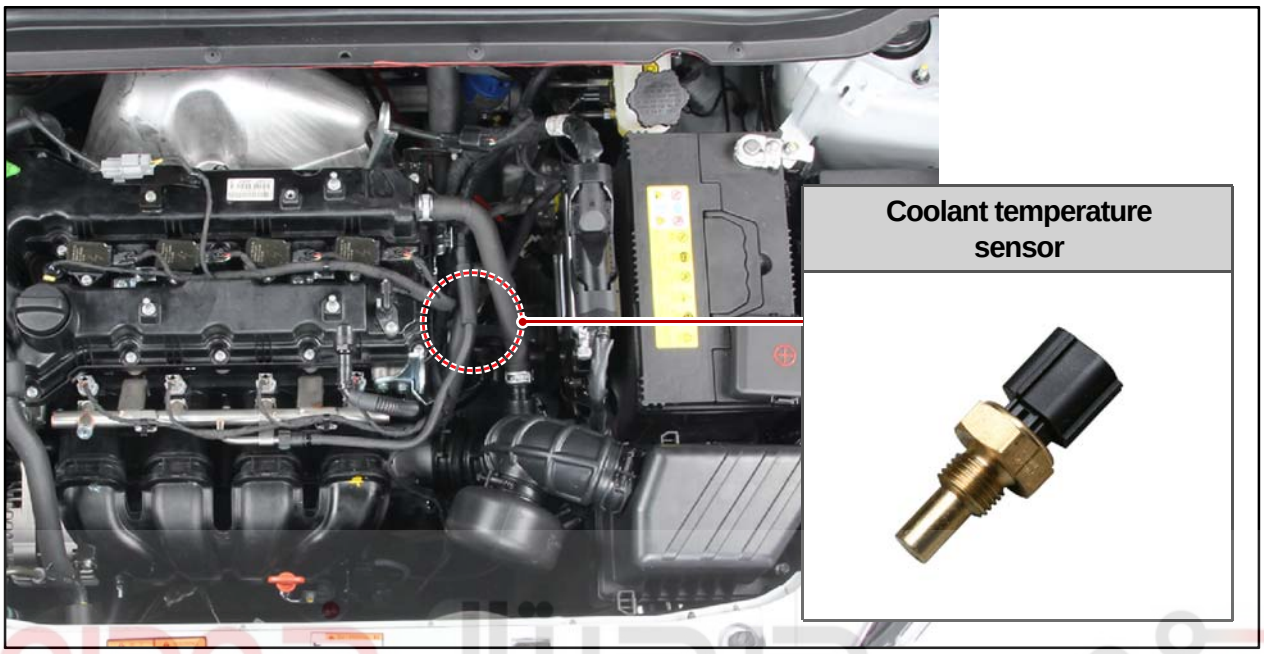
4. Install the VIS solenoid valve in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

S.G.N. 1430-07

COOLANT TEMPERATURE SENSOR

Preceding work - Disconnect the negative cable from the battery.



1. Remove the drain plug at the bottom of the radiator to drain the coolant.

NOTE

Refer to Chapter "Cooling System".

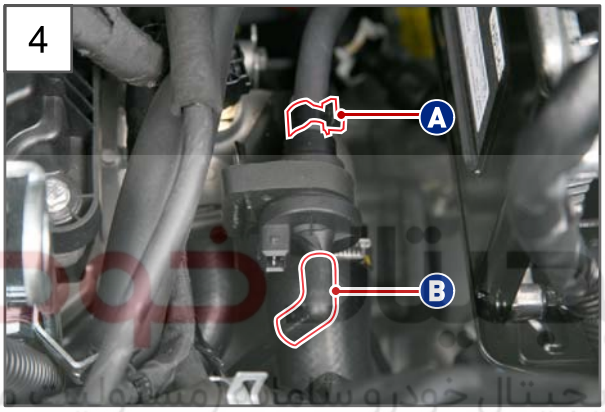
2. Release the clamps and remove the blow-by hose.

Modification basis	
Application basis	
Affected VIN	

3

3. Disconnect the purge control solenoid valve connector.

4

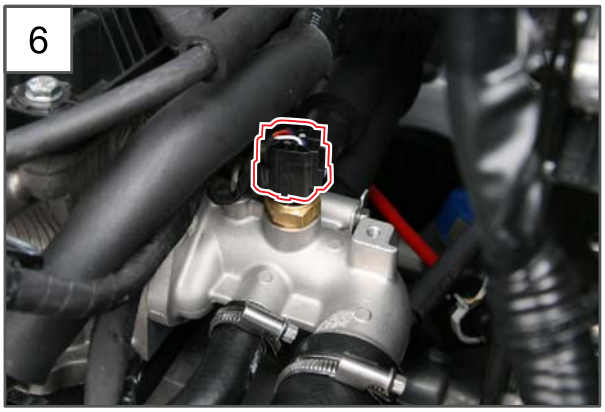


4. Separate the hose (A) to canister and the hose (B) to intake manifold.

5

5. Unscrew the bolt (10 mm) from the bracket and remove the purge control solenoid valve.

6



6. Disconnect the coolant temperature sensor connector and unscrew the coolant temperature sensor (22 mm).

Tightening torque 30.0Nm

Modification basis	
Application basis	
Affected VIN	

7

7. Remove the coolant temperature sensor.

8

8. Install the coolant temperature sensor in the reverse order of removal.

CAUTION

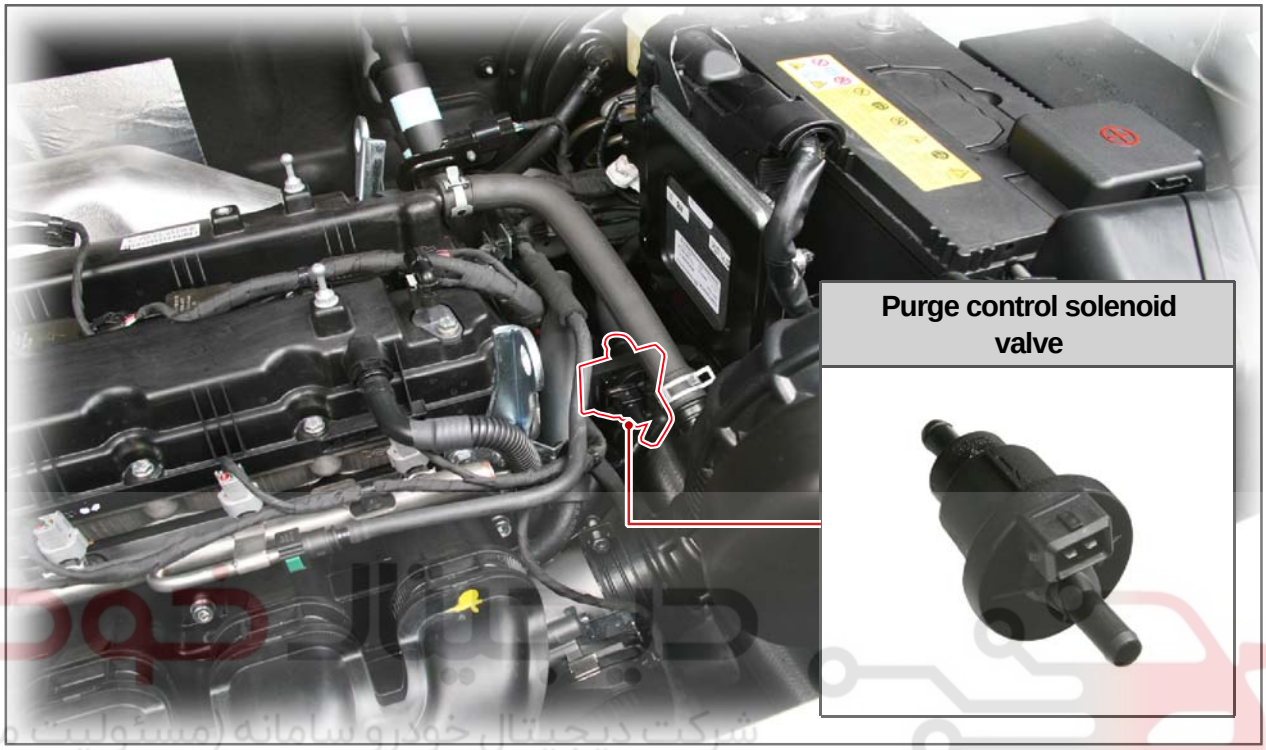
- Be careful not to damage the coolant temperature sensor.
- Check the sealing on the sensor and replace it with new one if necessary.

Modification basis	
Application basis	
Affected VIN	

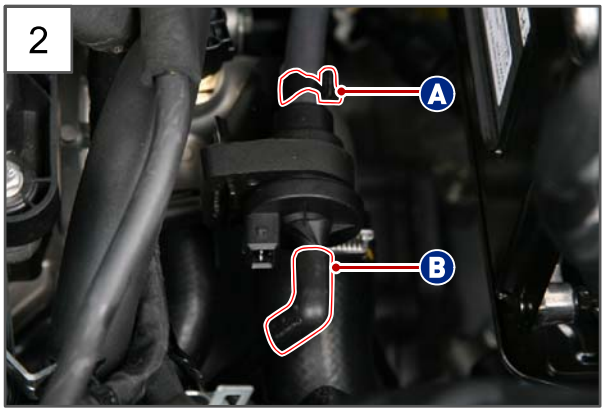
S.G.N. 1628-04

PURGE CONTROL SOLENOID VALVE

Preceding work
- Disconnect the negative cable from the battery.
- Remove the engine acoustic cover.



1. Disconnect the purge control solenoid valve connector.



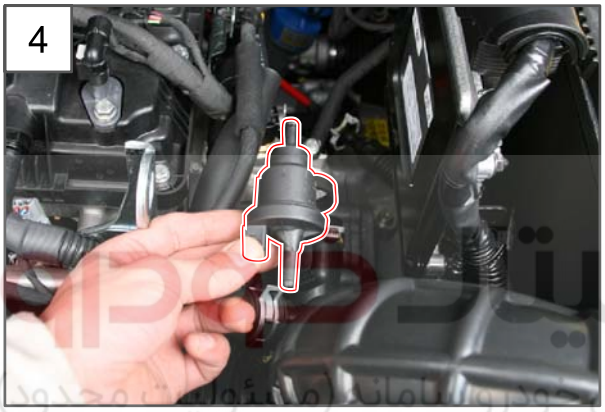
2. Separate the hose (A) to canister and the hose (B) to intake manifold.

Modification basis	
Application basis	
Affected VIN	

3

3. Pull out the purge control solenoid valve from the rubber mounting.

4



4. Remove the purge control solenoid valve.

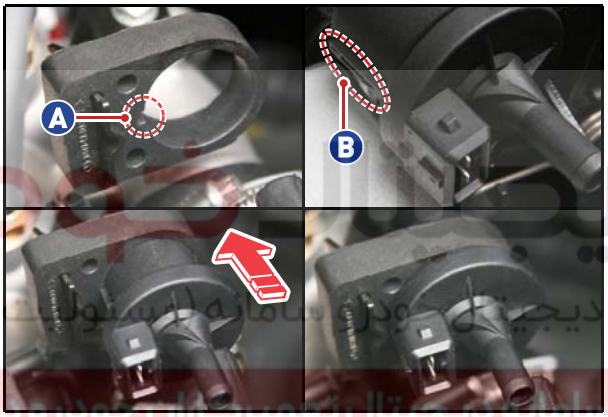
5

5. Install the purge control solenoid valve in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

Cautions when installing

- Place the arrow mark on the valve facing the intake manifold.



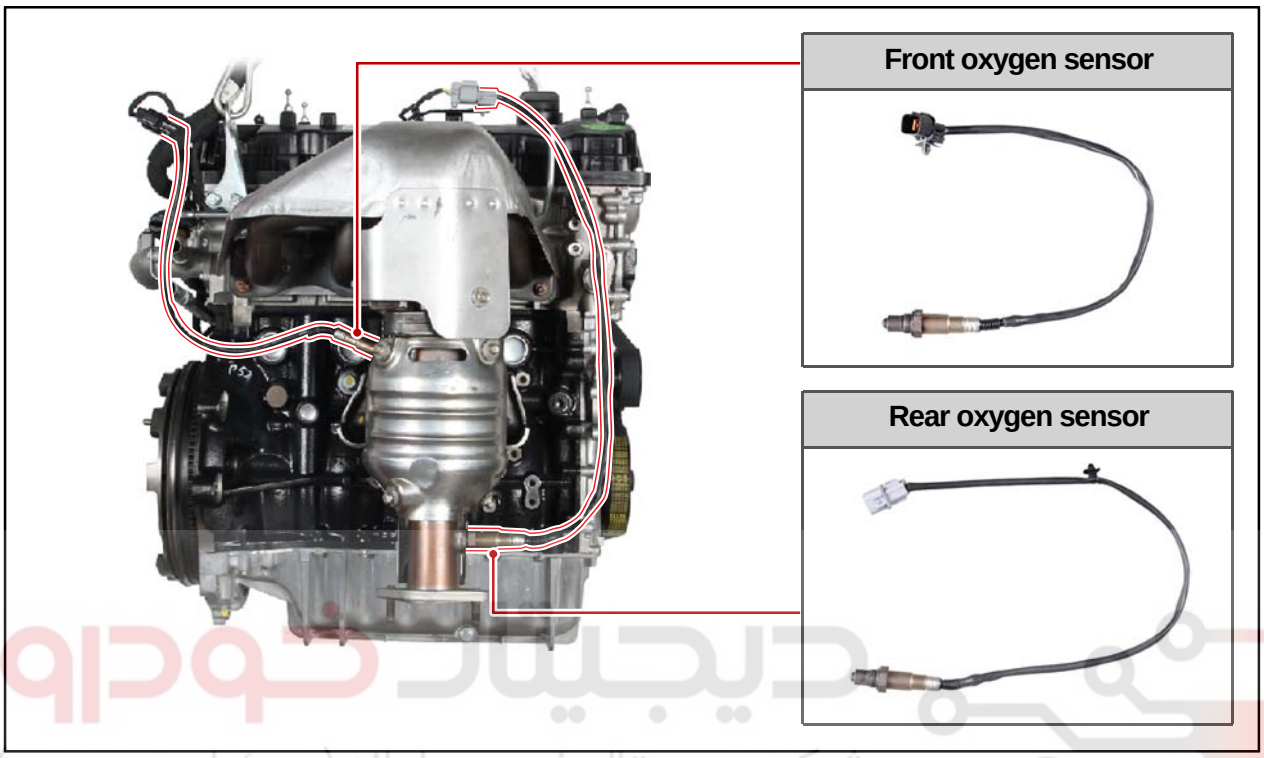
- Align the groove (A) in the rubber mounting with the arrow mark (B) on the valve.

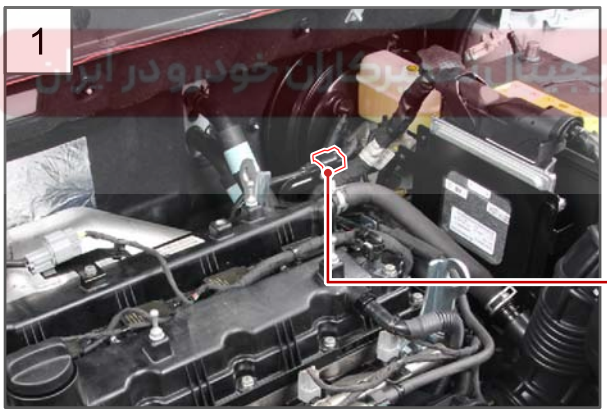
Modification basis	
Application basis	
Affected VIN	

S.G.N. 1430-09

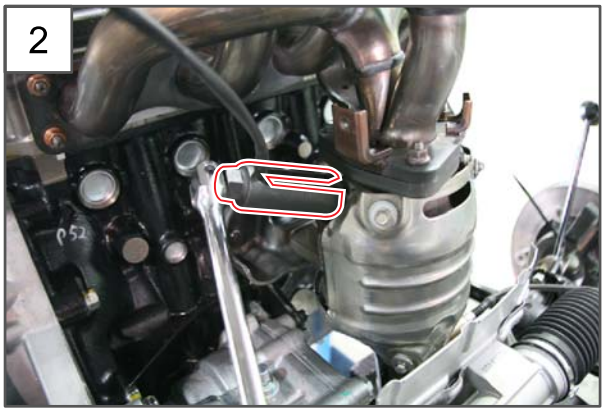
OXYGEN SENSOR

Preceding work - Disconnect the negative cable from the battery.



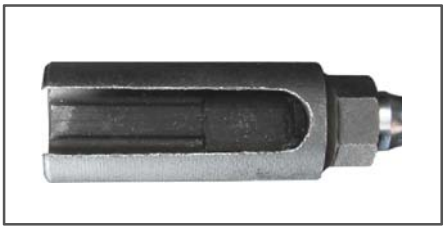


1. Remove the drain plug at the bottom of the radiator to drain the coolant.



2. Release the clamps and remove the blow-by hose.

Tightening torque 40 ~ 60Nm



Modification basis	
Application basis	
Affected VIN	

3

3. Remove the front oxygen sensor.

4

4. Install the front oxygen sensor in the reverse order of removal.

CAUTION

Be careful not to damage the oxygen sensor.

Modification basis	
Application basis	
Affected VIN	

▶ Rear oxygen sensor

1

1. Disconnect the rear oxygen sensor connector and remove it from the connector holder with a remover.

2

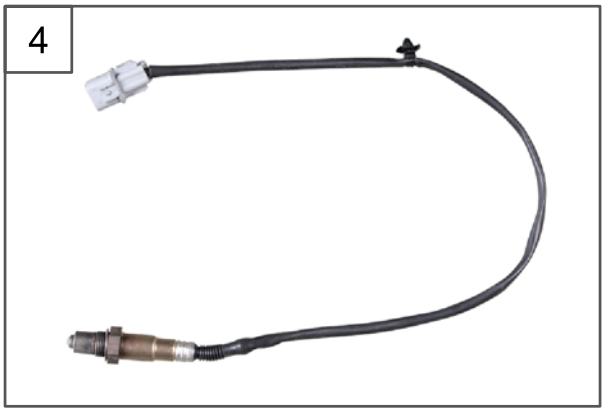
2. Unscrew the rear oxygen sensor with a specified remover.

Tightening torque 40 ~ 60Nm

3

3. Remove the rear oxygen sensor.

4



4. Install the raer oxygen sensor in the reverse order of removal.

CAUTION

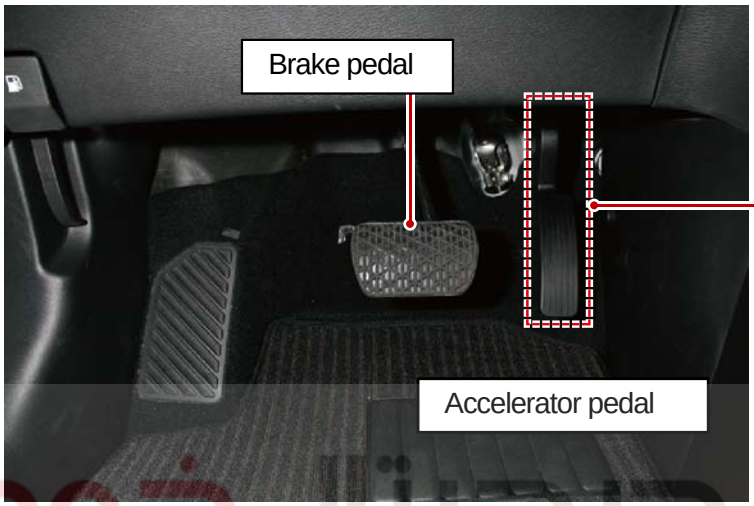
Be careful not to damage the oxygen sensor.

Modification basis	
Application basis	
Affected VIN	

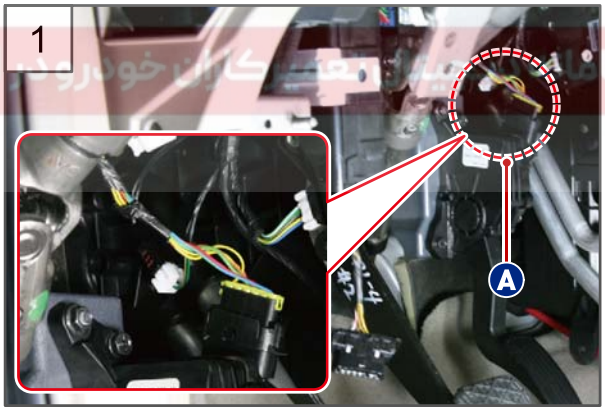
S.G.N. 2010-01

ACCELERATOR PEDAL POSITION SENSOR

Preceding work
- Disconnect the battery negative cable.
- Remove the acoustic cover.

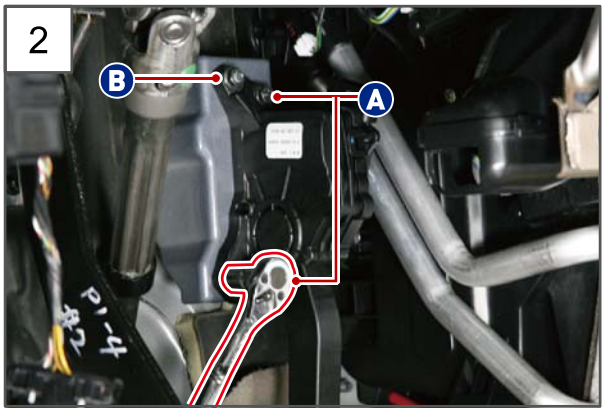


Accelerator pedal position sensor



1. Disconnect the accelerator pedal position sensor connector (A).

CAUTION
Make sure that the cable is engaged with the protrusion of the cable socket when connecting the cable.



2. Remove the accelerator pedal assembly.
   - Unscrew the bolts (A).
   - Unscrew the nut (B).

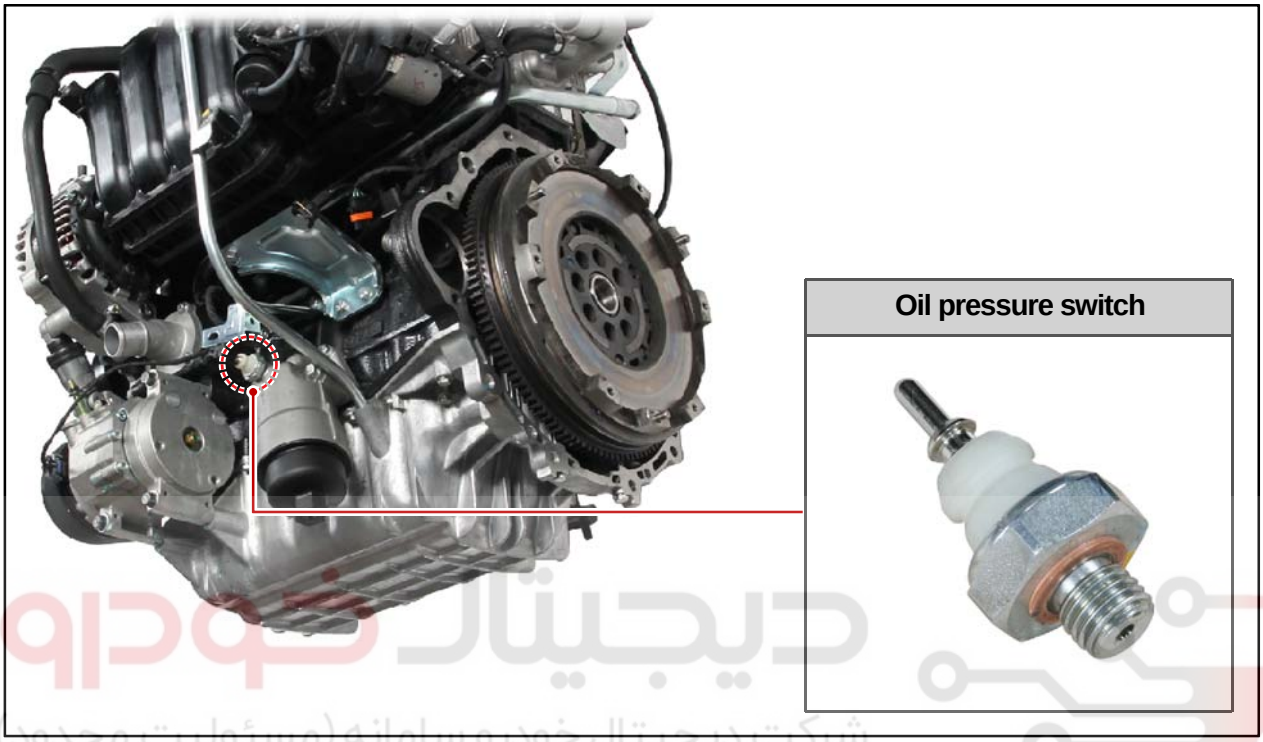
Tightening torque 10 ± 1.0Nm

3. Install the accelerator pedal position sensor in the reverse order of removal.

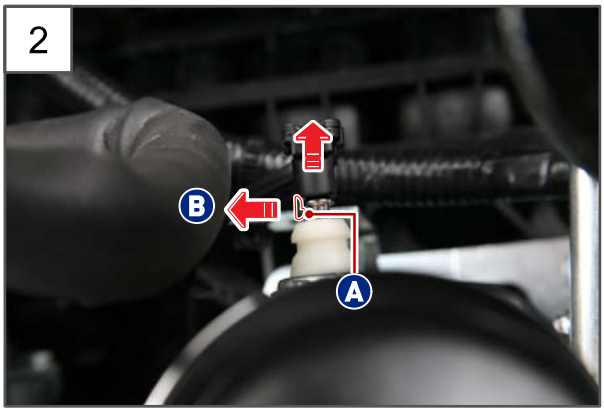
Modification basis	
Application basis	
Affected VIN	

S.G.N.
1535-30 OIL PRESSURE SENSOR

Preceding work
- Disconnect the negative cable from the battery.
- Remove the front under cover.



1. Lift up the vehicle with a lift and disconnect the oil pressure switch connector.



- Push the point (A) to direction (B) to disconnect it.

Modification basis	
Application basis	
Affected VIN	

2

2. Unscrew the oil pressure switch with a spanner (27 mm).

Tightening torque **Max.50Nm**

3

3. Remove the oil pressure switch.

CAUTION
Make sure not to spill out the engine oil.

4

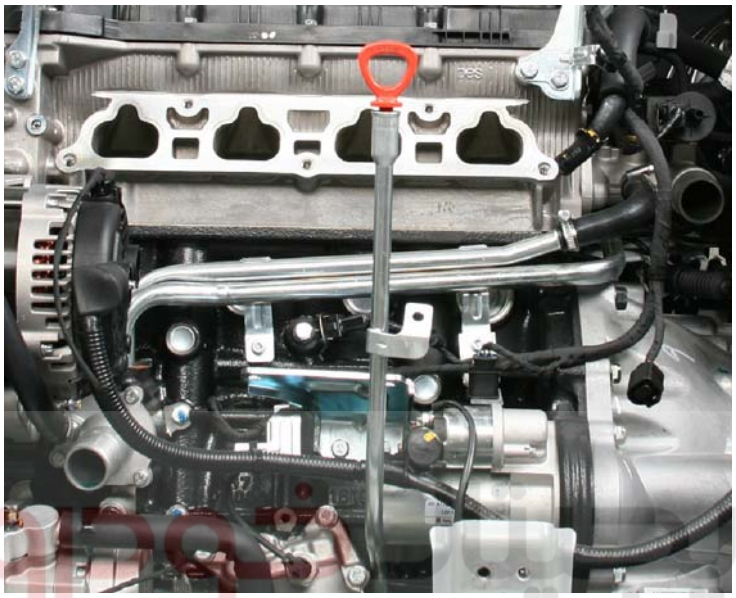
4. Install the oil pressure switch in the reverse order of removal.

CAUTION
Replace the copper washer with new one.

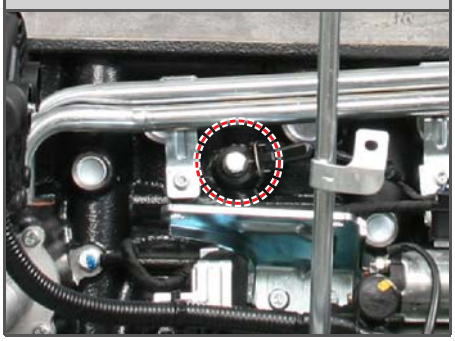
Modification basis	
Application basis	
Affected VIN	

S.G.N. 1430-05 KNOCK SENSOR

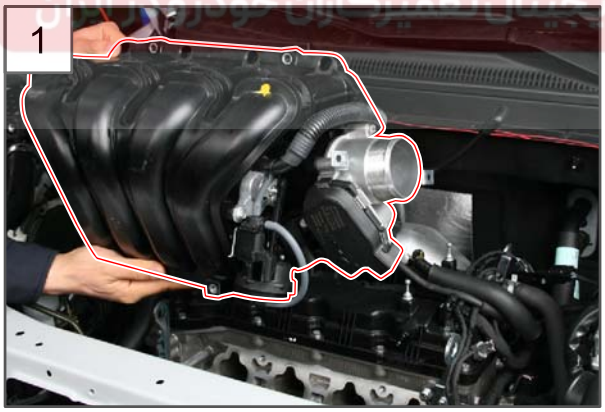
Preceding work - Disconnect the negative cable from the battery.



Knock sensor installed



Knock sensor installed



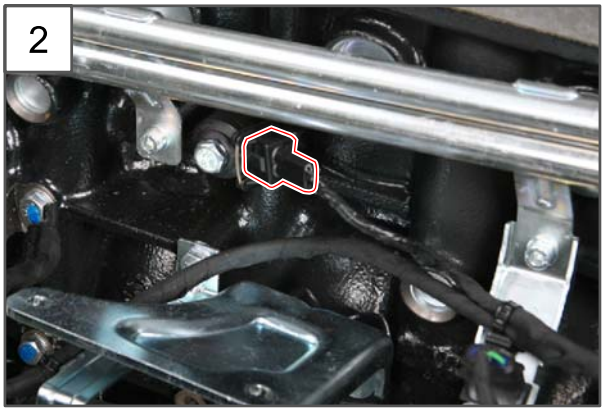
1. Remove the intake manifold assembly.

NOTE

Refer to Chapter “Intake System”.

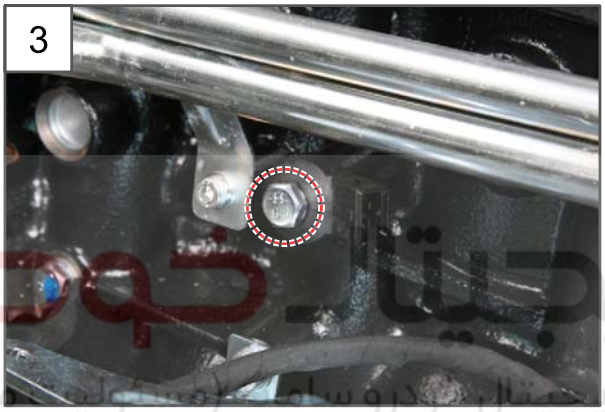
Modification basis	
Application basis	
Affected VIN	

2



2. Disconnect the knock sensor connector.

3



3. Unscrew the knock sensor mounting bolt (13 mm).

Tightening torque 20.0 ± 5.0Nm

CAUTION
The knock sensor connector should face 3 o'clock after installation.

4

4. Remove the knock sensor.

6

6. Install the knock sensor in the reverse order of removal.

Modification basis	
Application basis	
Affected VIN	

Memo