Component Procedures: Computers and Control Systems

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Component Procedures: Computers and Control Systems

Parts and Labor (itype_189)

Parts

Qualifier	Part #	Name	Price	Note
Powertrain Control	393502E200	Camshaft Position Sens?	76.61	
Powertrain Control	3922038030	Coolant Temp Sensor	68.69	
Powertrain Control	391802B000	Crankshaft Position Se?	180.13	
Powertrain Control	392502E000	Knock Sensor	58.31	
Powertrain Control > ECM	391712EFD5	Manual Trans	685.10	Order By Vehicle Applicati?
Powertrain Control > ECM > A?	391732EFD0	Sulev Emission	700.10	Order By Vehicle Applicati?
Powertrain Control > ECM > A?	391732EFE0	Ulev Emission	700.10	Order By Vehicle Applicati?
Powertrain Control > MAP Sen?	393002B100	Map Sensor	163.42	
Powertrain Control > Oxygen ?	392102ECC0	Lower	207.94	
Powertrain Control > Oxygen ?	392102E101	Upper	235.58	
Controls > Body Control Modu?	954A0F2AM0	With Smart Key	294.79	Includes Receiver.
Controls > Body Control Modu?	954A0F2AL0	With Auto Lamp Control	294.79	Includes Receiver.

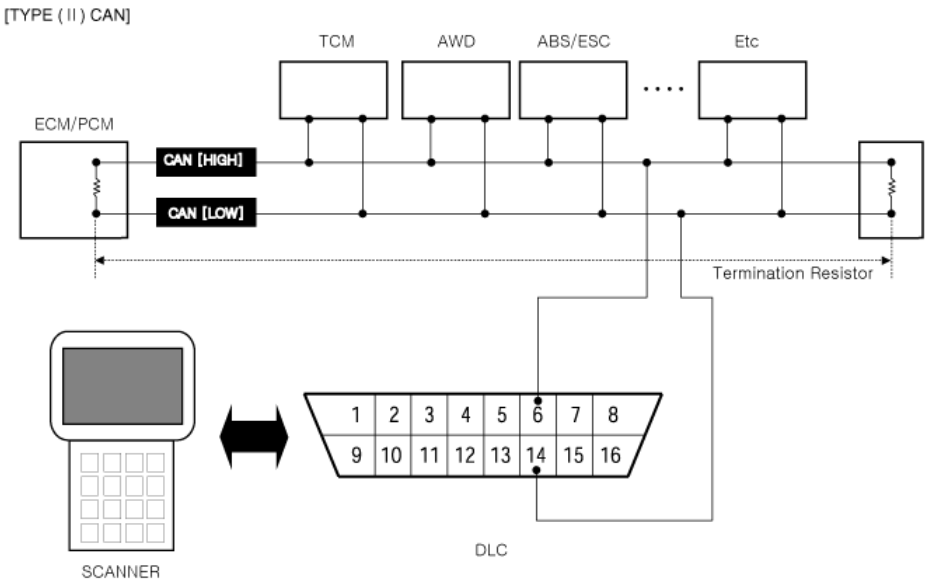
Labor

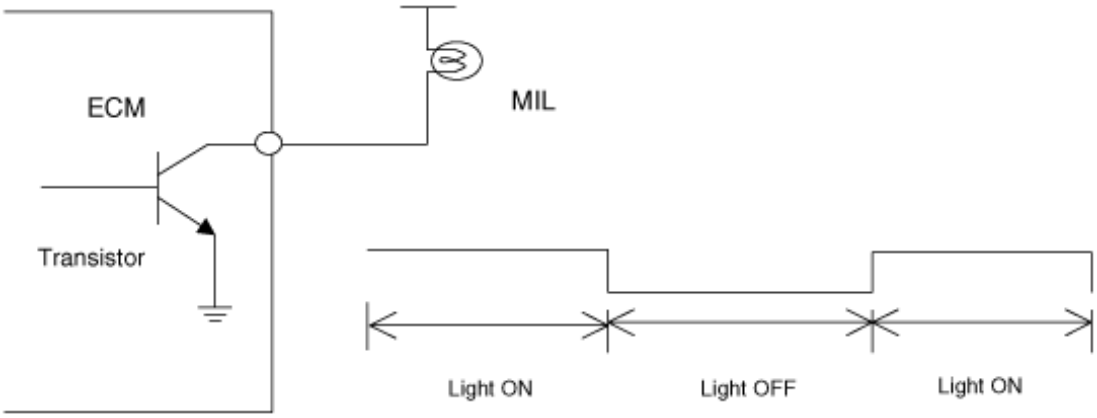
Operation	Qualifier Path	Skill	Std Hrs	Wty Hrs
Remove & Replace	Controls > Body Control Module, R&R	B	0.8	0.0
Remove & Replace	Powertrain Control > Camshaft Position Sensor?	B	0.4	0.0
Remove & Replace	Powertrain Control > Coolant Temp Sensor, R&R	B	0.5	0.0
Remove & Replace	Powertrain Control > Crankshaft Position Sens?	B	0.6	0.0
Remove & Replace	Powertrain Control > ECM, R&R	B	0.5	0.0
Remove & Replace	Powertrain Control > Knock Sensor, R&R	B	2.2	0.0
Remove & Replace	Powertrain Control > MAP Sensor, R&R	B	0.6	0.0
Remove & Replace	Powertrain Control > Oxygen Sensor, R&R > Fro?	B	0.5	0.0
Remove & Replace	Powertrain Control > Oxygen Sensor, R&R > Rear	B	0.6	0.0
Test	Powertrain Control > Pinpoint, Test	B	0.4	0.0
Inspect	Powertrain Control > Diagnostic Circuit, Insp?	B	0.5	0.0
Inspect	Powertrain Control > Diagnostic Circuit, Insp?		0.3	

Engine Control System - Description and Operation (Article 44120)

- OBD-II review

1. Overview
2. Configuration of hardware and related terms





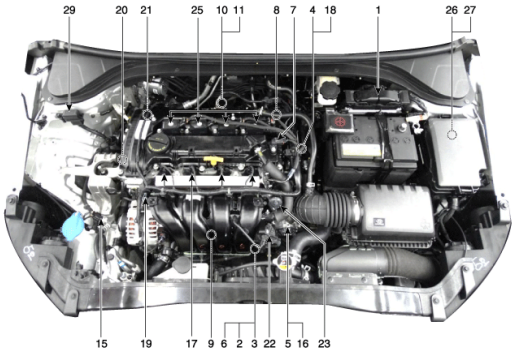
- Bus Topology : Line (bus) structure
- Wiring : Twisted pair wire
- Off Board DLC Cable Length : Max. 5m
- Data Transfer Rate
- Diagnostic : 500 kbps
- Service Mode (Upgrade, Writing VIN) : 500 or 1Mbps)
- Diagnostic Trouble Code (SAE J2012)
- DTCs used in OBD-II vehicles will begin with a letter and are followed by four numbers.
- Fuel and air metering
- Fuel and air metering(injector circuit malfunction only)
- Ignition system or misfire
- Auxiliary emission controls
- Vehicle speed controls and idle control system
- Computer output circuits
- Transmission
- Freeze Frame List
- Calculated Load Value
- Engine RPM
- Fuel Trim
- Fuel Pressure (if available)
- Vehicle Speed (if available)

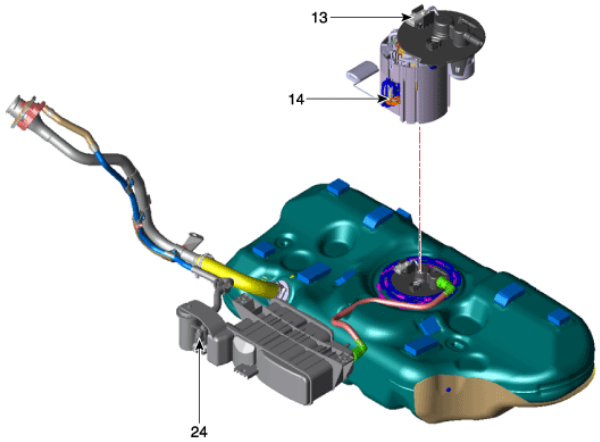
- Coolant Temperature
- Intake Manifold Pressure (if available)
- Closed-or Open-loop operation
- Fault code

3. OBD-II system readiness tests

Engine Control System - Components and Components Location (Article 44188)

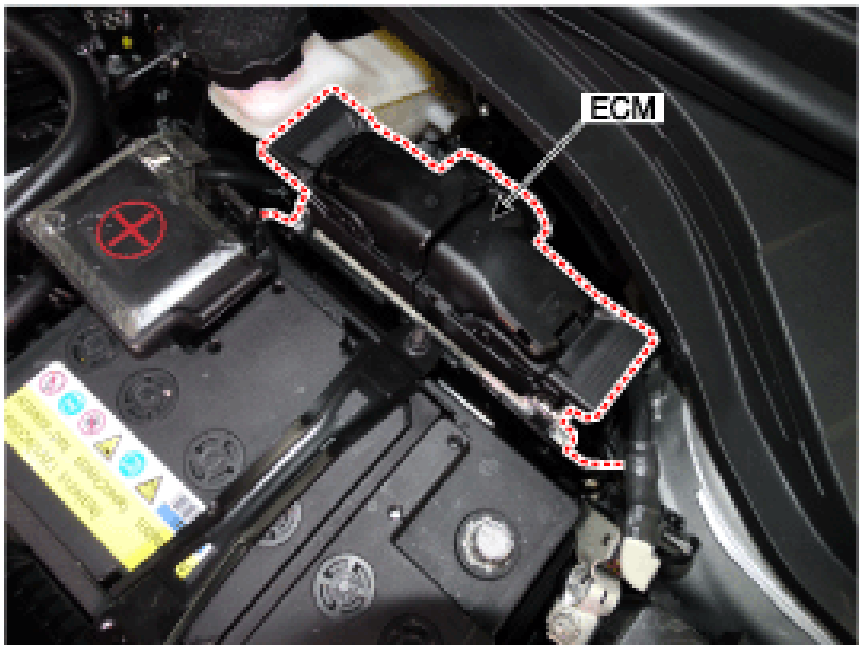
- Components Location

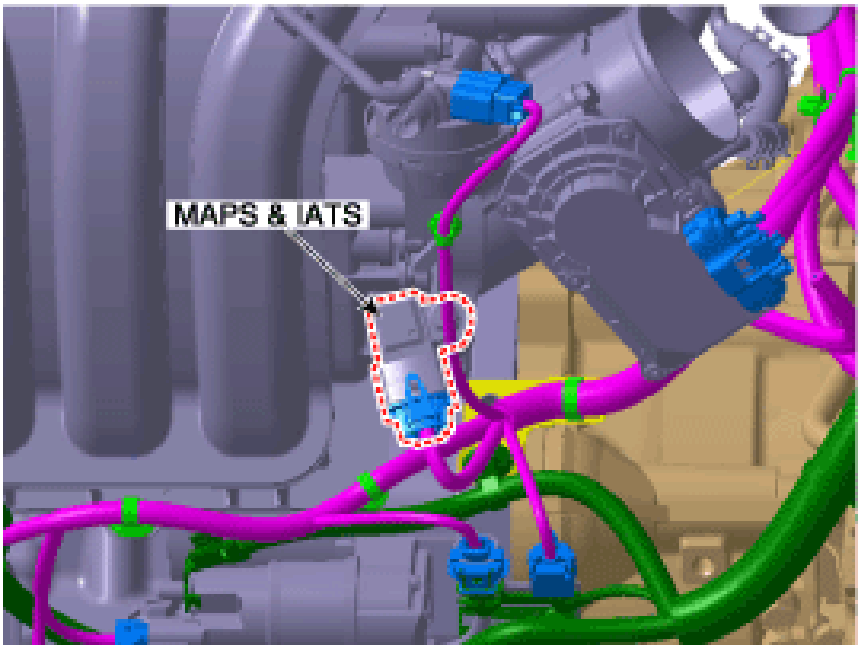




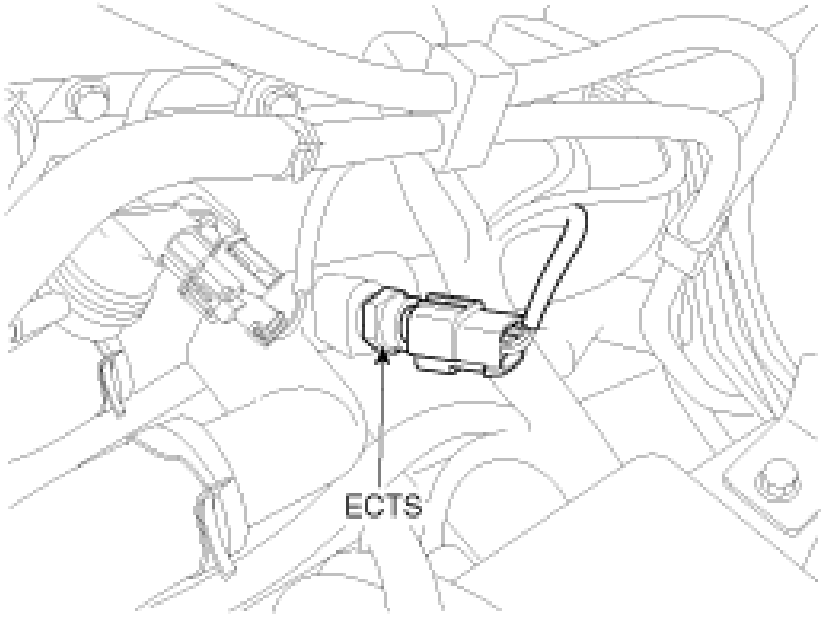
1. Engine Control Module (ECM) 2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS) 4. Engine Coolant Temperature Sensor (ECTS) 5. Throttle Position Sensor (TPS) [integrated into ETC Module] 6. Crankshaft Position Sensor (CKPS) 7. Camshaft Position Sensor (CMPS) [Bank 1 / Intake] 8. Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] 9. Knock Sensor (KS) 10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1] 11. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] 12. Accelerator Position Sensor (APS) 13. Fuel Tank Pressure Sensor (FTPS) 14. Fuel Level Sensor (FLS) 15. A/C Pressure Transducer (APT) 16. ETC Motor [integrated into ETC Module] 17. Injector 18. Purge Control Solenoid Valve (PCSV) 19. CVVT Oil Control Valve (OCV) [Bank 1 / Intake] #1 20. CVVT Oil Control Valve (OCV) [Bank 1 / Intake] #2 21. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust] 22. Variable Intake Solenoid (VIS) Valve 23. Variable Charge Motion Actuator (VCMA) 24. Canister Close Valve (CCV) 25. Ignition Coil 26. Main Relay 27. Fuel Pump Relay 28. Data Link

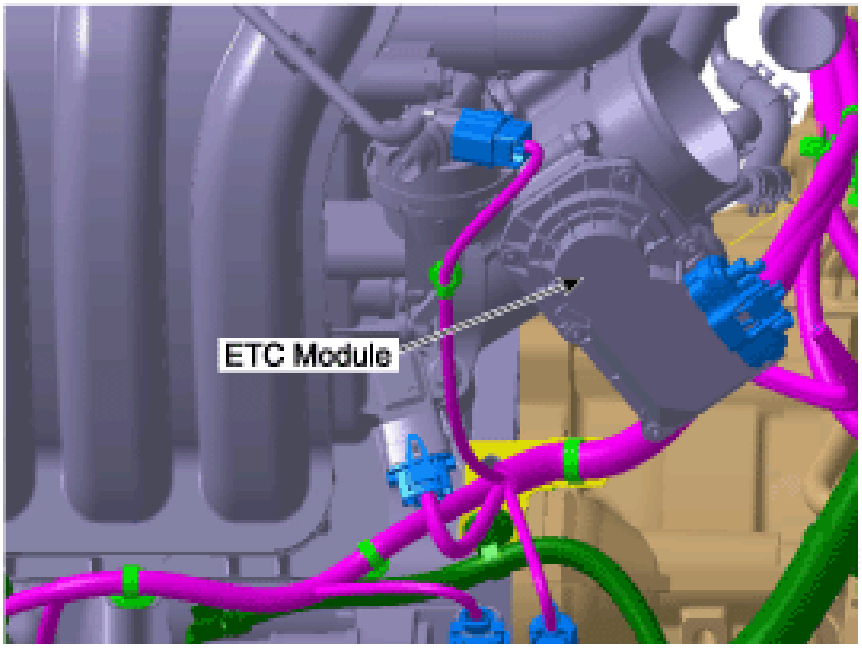
Connector (DLC) [16-Pin] 29. Multi-Purpose Check Connector [20-Pin]
1. Engine Control Module (ECM) 2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS)



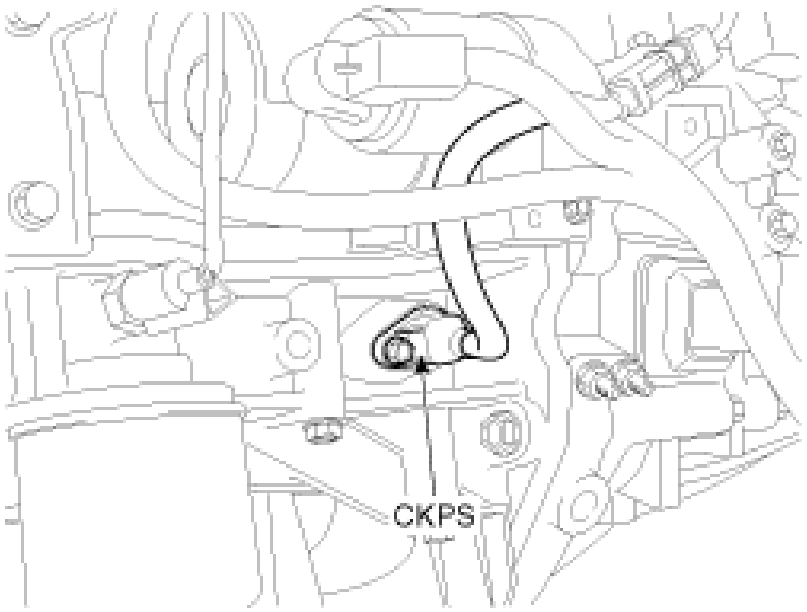


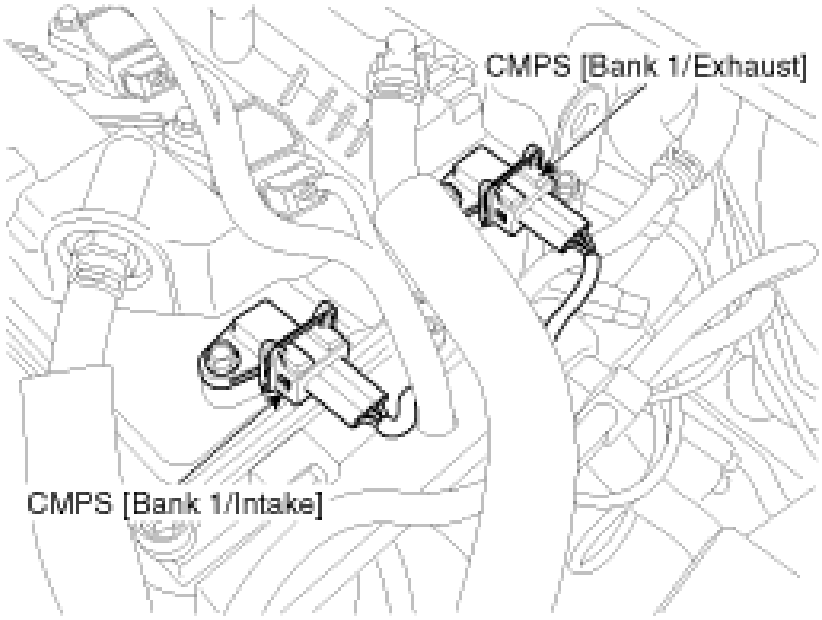
4. Engine Coolant Temperature Sensor (ECTS) 5. Throttle Position Sensor (TPS) 16. ETC Motor



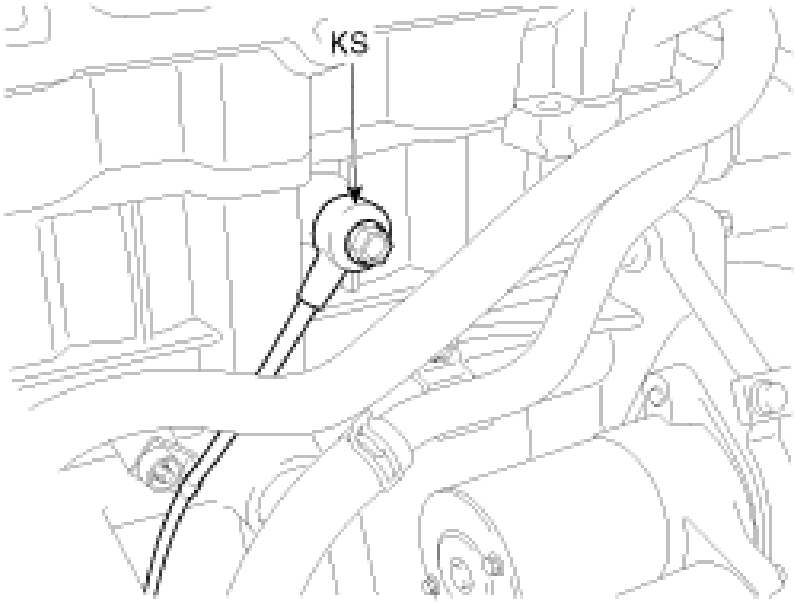


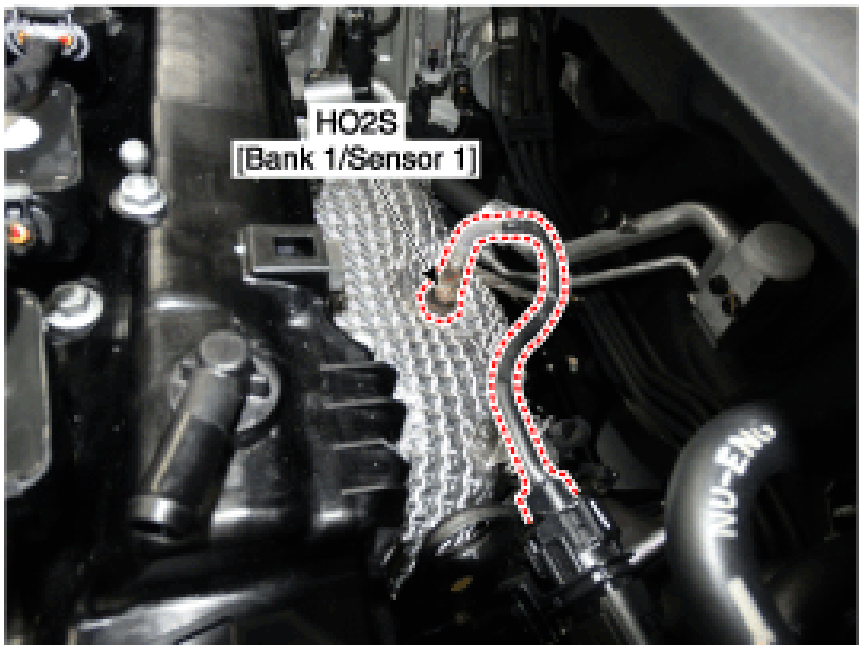
6. Crankshaft Position Sensor (CKPS) 7. Camshaft Position Sensor (CMPS) [Bank 1 / Intake] 8. Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]



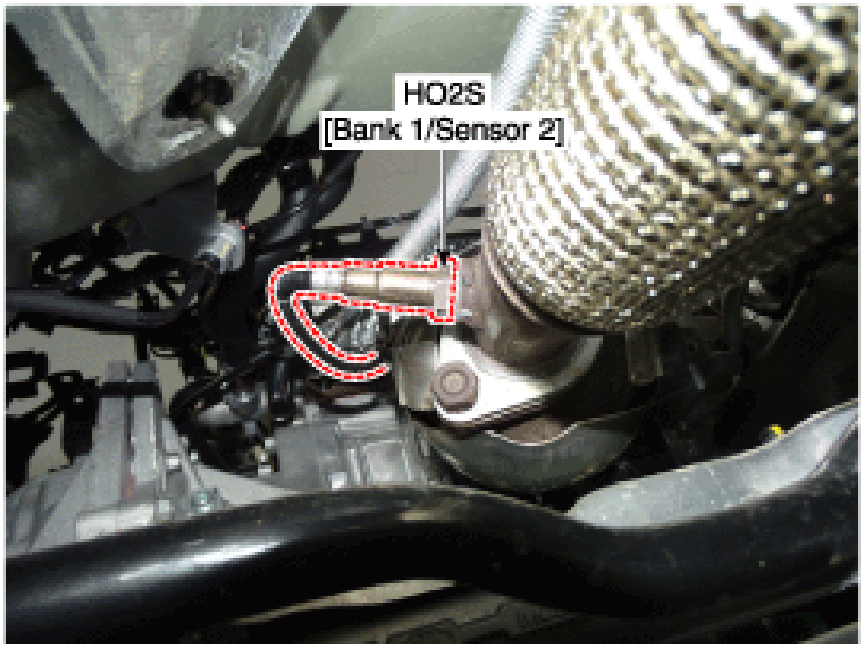


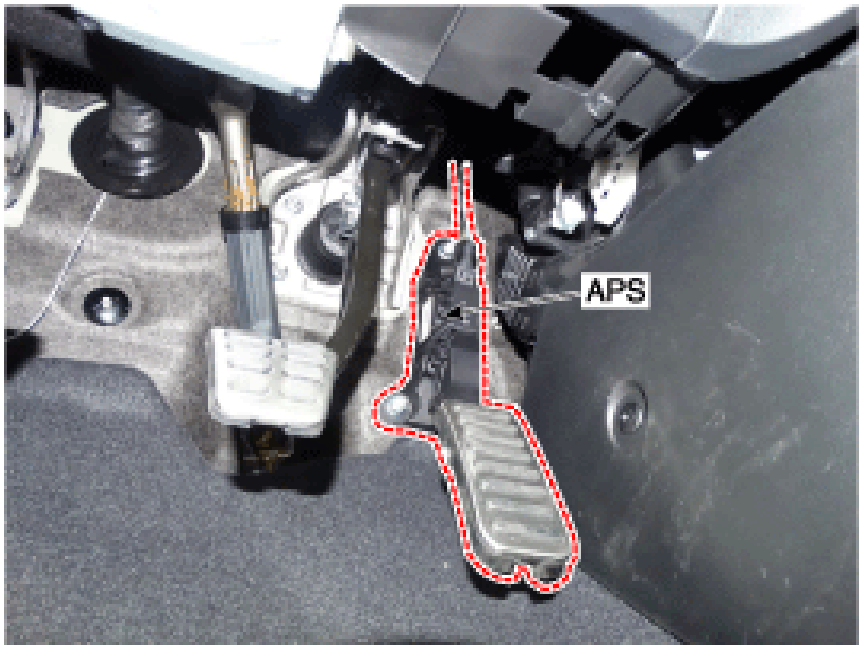
9. Knock Sensor (KS) 10. Heated Oxygen Sensor (HO2S) [Bank1/Sensor1]



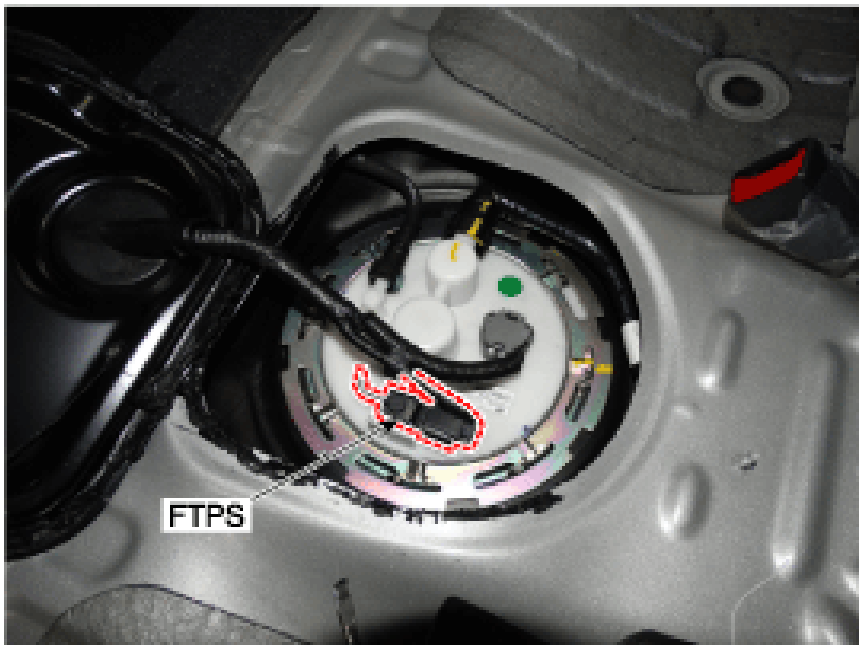


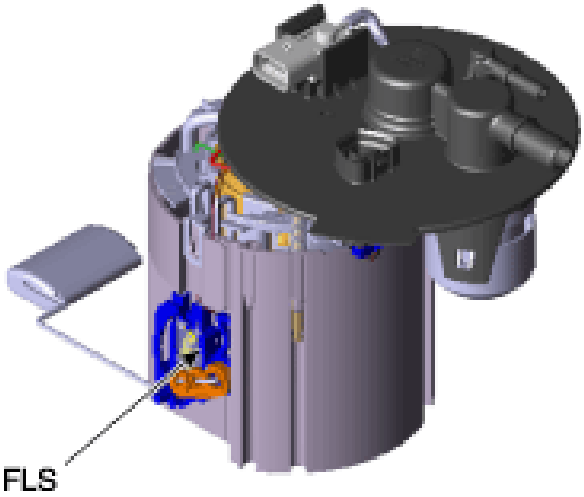
11. Heated Oxygen Sensor (HO2S) [Bank1/Sensor2] 12. Accelerator Position Sensor (APS)



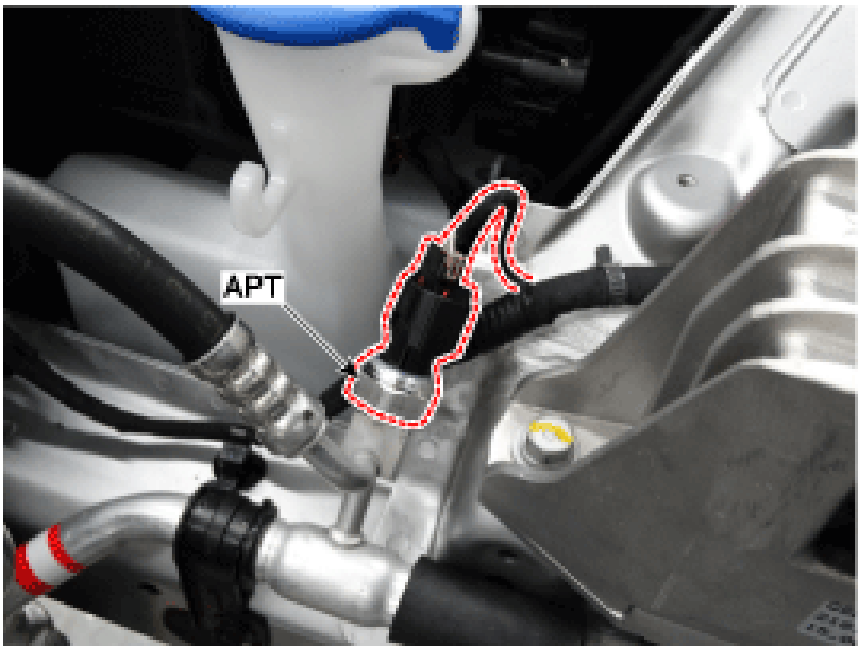


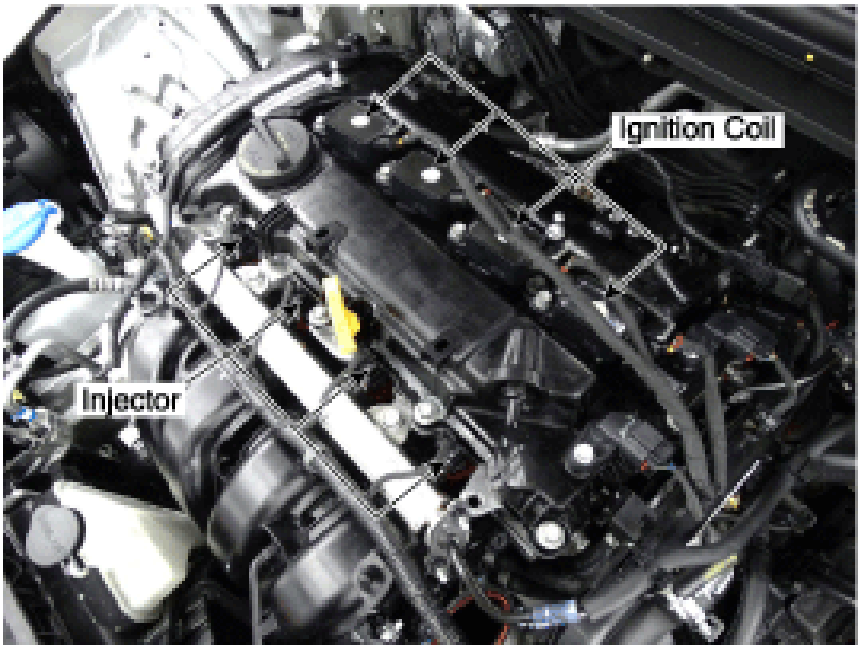
13. Fuel Tank Pressure Sensor (FTPS) 14. Fuel Level Sensor (FLS)



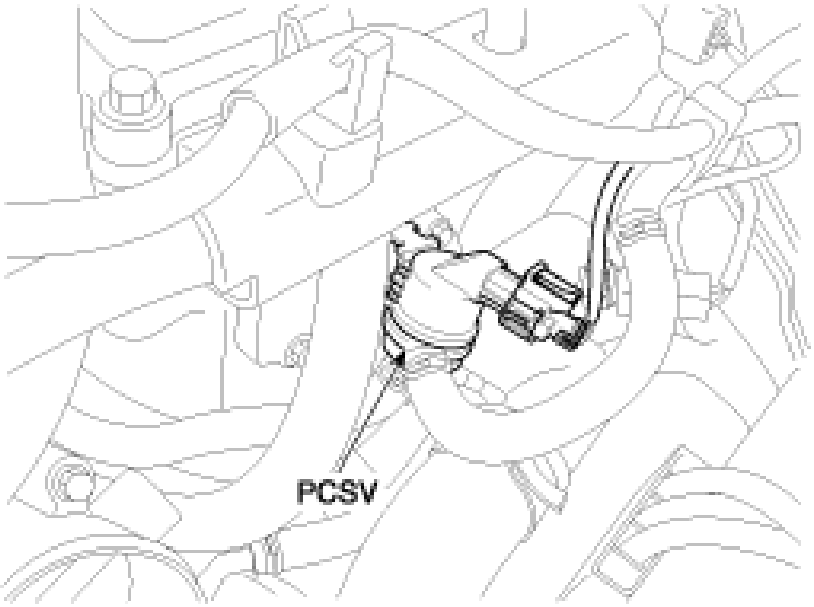


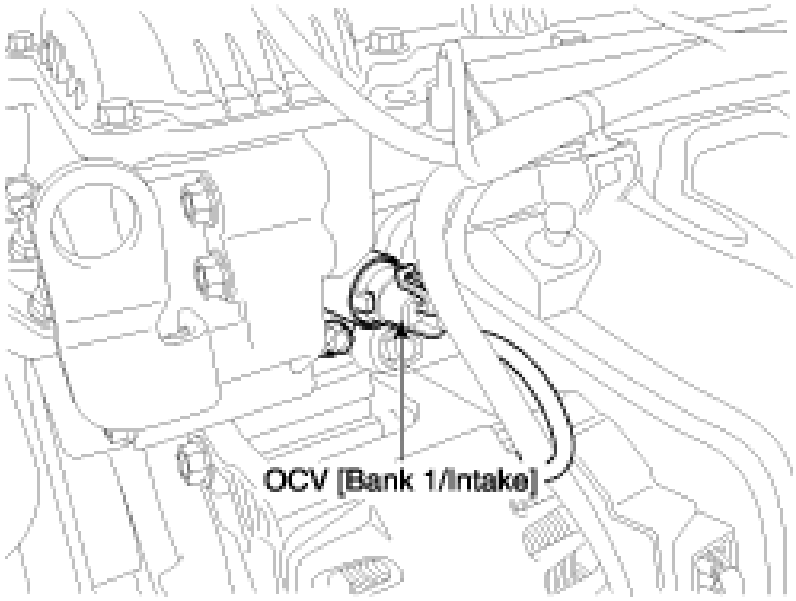
15. A/C Pressure Transducer (APT) 17. Injector 25. Ignition Coil



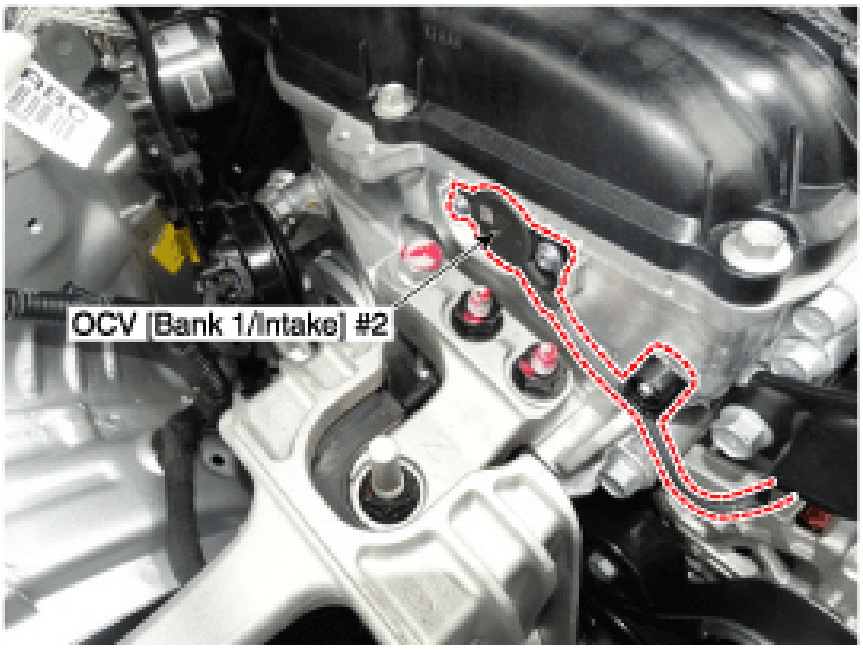


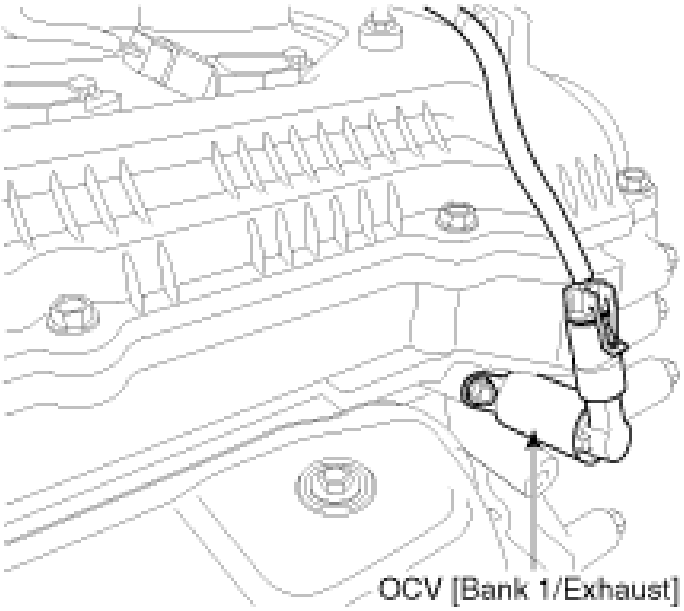
18. Purge Control Solenoid Valve (PCSV) 19. CVVT Oil Control Valve (OCV) [Bank 1 / Intake] #1



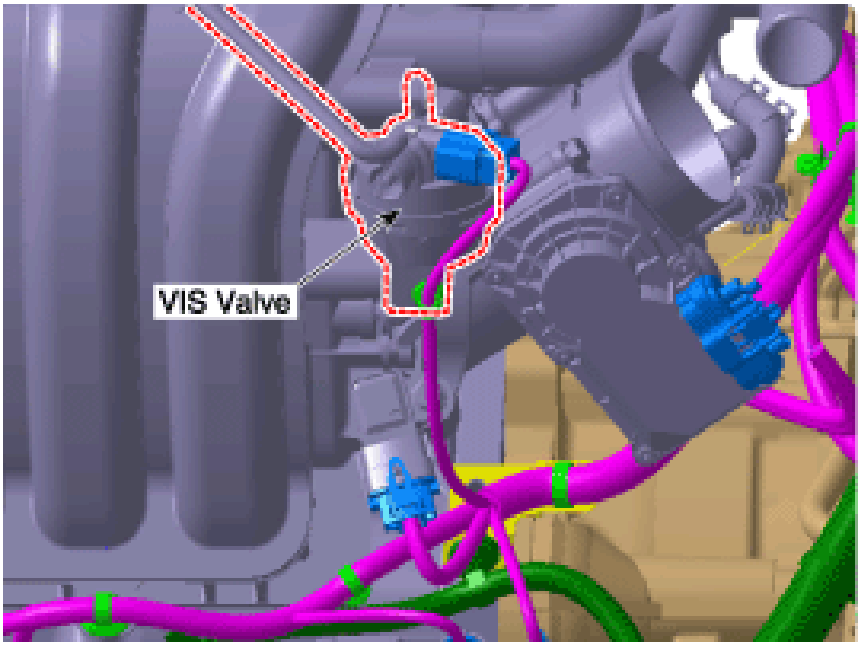


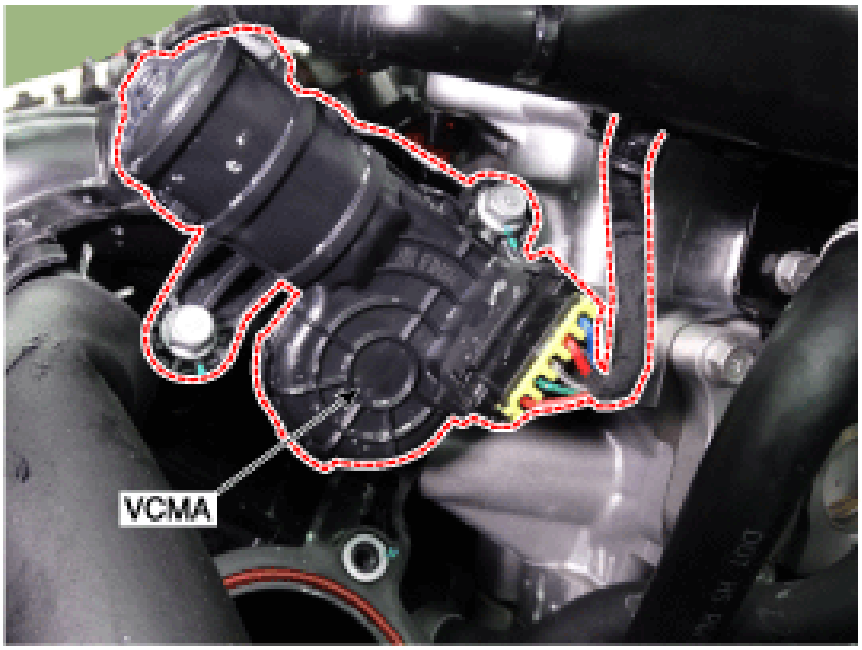
20. CVVT Oil Control Valve (OCV) [Bank 1 / Intake] #2 21. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust]



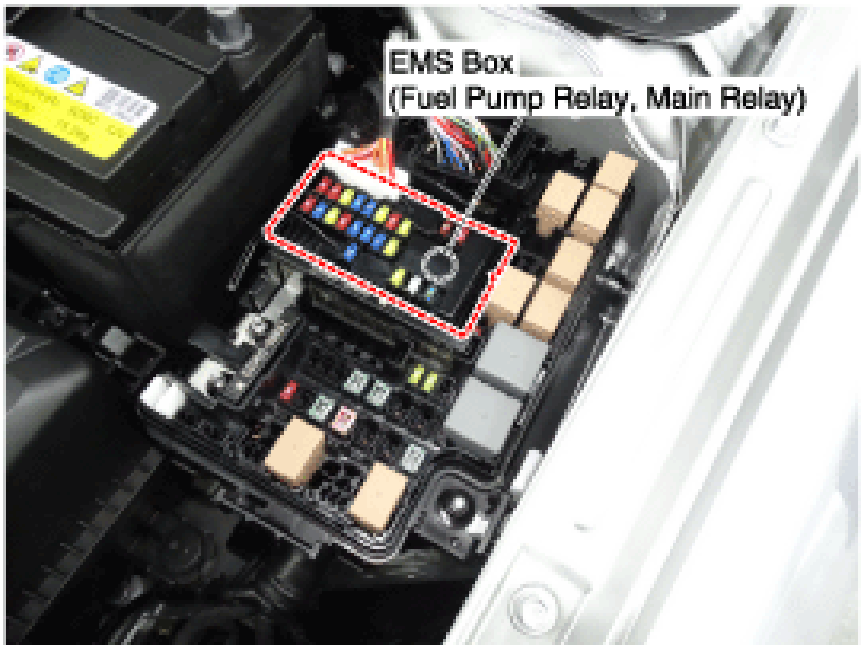


22. Variable Intake Solenoid (VIS) Valve 23. Variable Charge Motion Actuator (VCMA)

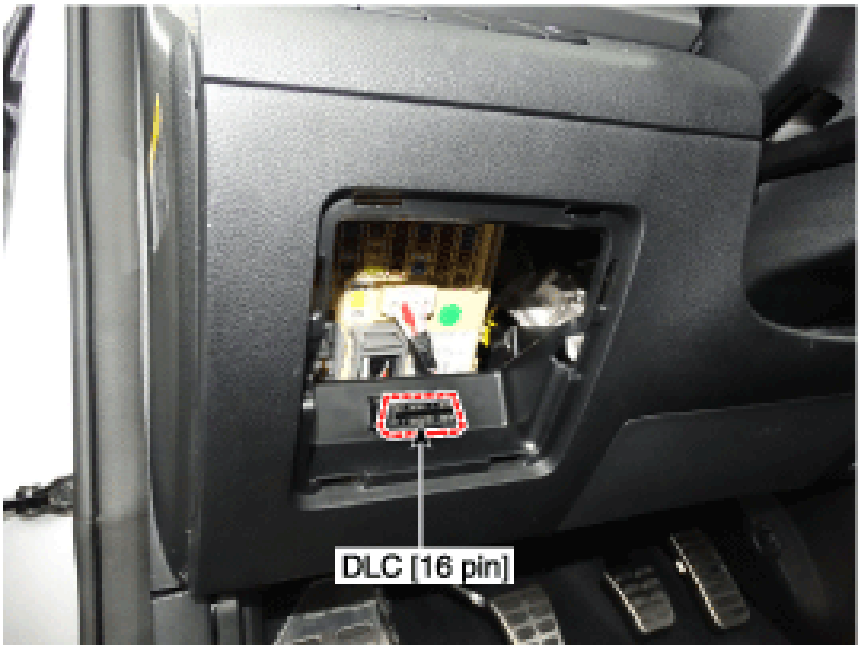


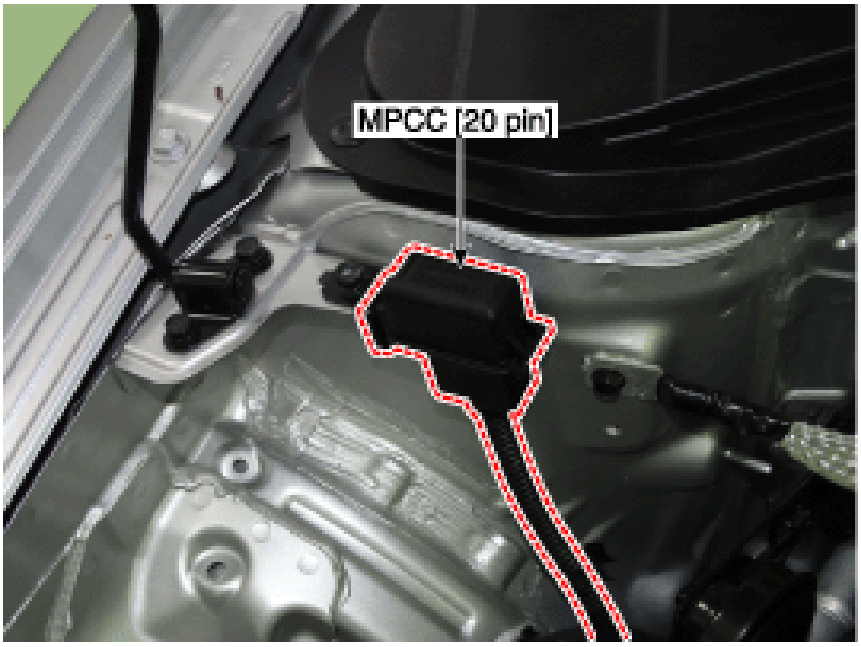


24. Canister Close Valve (CCV) 26. Main Relay 27. Fuel Pump Relay



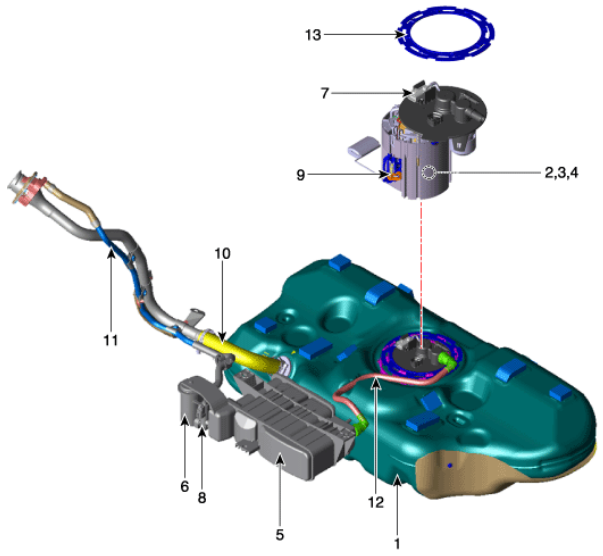
28. Data Link Connector (DLC) [16-Pin] 29. Multi-Purpose Check Connector [20-Pin]





Fuel Delivery System - Components and Components Location (Article 44225)

- Components Location



1. Fuel tank 2. Fuel pump 3. Fuel filter 4. Fuel pressure regulator 5. Canister 6. Fuel tank air filter 7. Fuel tank pressure sensor (FTPS) 8. Canister close valve (CCV) 9. Fuel level sensor (FLS) 10. Fuel filler hose 11. Ventilation tube 12. Vapor tube 13. Fuel pump plate cover

Engine Control/Fuel System - Specifications (Article 44110)

- Specifications

Fuel Delivery System

Items Specification

Fuel Tank Capacity 50 lit. (13.2 U.S.gal., 52.8 U.S.qt., 44.0 Imp.qt.)

Fuel Filter Type Paper type

Fuel Pressure Regulator Regulated Fuel Pressure 355 - 365 kPa (3.4 - 3.7 kgf/cm², 48.6 - 52.9 psi)

Fuel Pump Type Electrical, in-tank type

Driven by Electric motor

Sensors

Manifold Absolute Pressure Sensor (MAPS)

Pressure [kPa (kgf/cm², psi)] Output Voltage (V)

20.0 (0.20, 2.9) 0.79

46.7 (0.47, 6.77) 1.84

101.3 (1.03, 14.7) 4.0

Intake Air Temperature Sensor (IATS)

Temperature [°C (°F)] Resistance (kΩ)

-40 (-40) 40.93 - 48.35

-20 (-4) 13.89 - 16.03

0 (32) 5.38 - 6.09

10 (50) 3.48 - 3.90

20 (68) 2.31 - 2.57

40 (104) 1.08 - 1.21

50 (122) 0.76 - 0.85

60 (140) 0.54 - 0.62

80 (176) 0.29 - 0.34

Engine Coolant Temperature Sensor (ECTS)

-40 (-40) 48.14

-20 (-4) 14.13 - 16.83

0 (32) 5.79

20 (68) 2.31 - 2.59

40 (104) 1.15

60 (140) 0.59

80 (176) 0.32

Throttle Position Sensor (TPS) [integrated into ETC module]

Throttle angle (■) Output voltage(V) [Vref = 5.0V]
TPS1 TPS2
0 0.5 4.5
10 0.96 4.05
20 1.41 3.59
30 1.87 3.14
40 2.32 2.68
50 2.78 2.23
60 3.23 1.77
70 3.69 1.32
80 4.14 0.86
90 4.6 0.41
98 4.65 0.35
C.T (0) 0.5 4.5
W.O.T (86) 4.41 0.59
Crankshaft Position Sensor (CKPS)
Item Specification
Coil Resistance (Ω) 774 - 946 [20°C (68°F)]
Camshaft Position Sensor (CMPS)
Knock Sensor (KS)
Capacitance (pF) 850 - 1,150
Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
Heater Resistance (Ω) 2.4 - 4.0 [20°C (69.8°F)]
Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
A/F Ratio (λ) Output Voltage(V)
RICH 0.6 - 1.0
LEAN 0 - 0.4
Heater Resistance (Ω) Approx. 9.0 [20°C (68°F)]
Accelerator Position Sensor (APS)
Accelerator Position Output Voltage (V)
APS1 APS2
C.T 0.7 - 0.8 0.275 - 0.475
W.O.T 3.85 - 4.35 1.75 - 2.35
Fuel Tank Pressure Sensor (FTPS)
Pressure [kPa (kgf/cm², in H2O) Output Voltage (V)
-6.67 (-0.068, -26.8) 0.5
0 2.5
+6.67 (0.068, 26.8) 4.5
Actuators
Injector
Coil Resistance (Ω) 13.8 - 15.2 [20°C (68°F)]
ETC Motor [integrated into ETC Module]
Coil Resistance (Ω) 0.3 - 100 [20°C (68°F)]
Purge Control Solenoid Valve (PCSV)
Coil Resistance (Ω) 22.0 - 26.0 [20°C(68°F)]
CVVT Oil Control Valve (OCV)
Coil Resistance (Ω) 9.4 - 10.4 [20°C (68°F)]
Variable Intake Solenoid (VIS) Valve
Coil Resistance (Ω) 30.0 - 35.0 [20°C (68°F)]
Variable Charge Motion Actuator (VCMA)
[Motor]
Coil Resistance (Ω) 3.4 - 4.4 [20°C (68°F)]
[Position Sensor]
Coil Resistance (kΩ) 3.44 - 5.16 [20°C (68°F)]
Ignition Coil
Primary Coil Resistance (Ω) 0.75 ± 15% [20°C (68°F)]
Secondary Coil Resistance (kΩ) 5.9 ± 15% [20°C (68°F)]
Canister Close Valve (CCV)
Coil Resistance (Ω) 19.5 - 22.5 [20°C (68°F)]
- Service Standard

Ignition Timing (■) BTDC 5 ± 10
Idle Speed (rpm) A/C OFF Neutral, N, P-range 640 ± 100
D-range 640 ± 100
A/C ON Neutral, N, P-range 680 ± 100
D-range 680 ± 100
- Tightening Torques
Engine Control System
Item kgf.m N.m lb-ft
ECM installation bolt 0.8 - 1.2 7.8 - 11.8 5.8 - 8.7
ECM bracket installation bolt/nut 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Manifold absolute pressure sensor installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Engine coolant temperature sensor installation 3.0 - 4.0 29.4 - 39.2 21.7 - 28.9
Crankshaft position sensor installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Camshaft position sensor (Bank 1 / Intake) installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Camshaft position sensor (Bank 1 / Exhaust) installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Knock sensor installation bolt 1.9 - 2.4 18.6 - 23.5 13.7 - 17.4
Heated oxygen sensor (Bank 1 / sensor 1) installation [SULEV] 4.0 - 5.0 39.2 - 49.1 28.9 - 36.2
Heated oxygen sensor (Bank 1 / sensor 2) installation [SULEV] 4.0 - 5.0 39.2 - 49.1 28.9 - 36.2
Heated oxygen sensor (Bank 1 / sensor 1) installation [ULEV] 4.0 - 5.0 39.2 - 49.1 28.9 - 36.2
Heated oxygen sensor (Bank 1 / sensor 2) installation [ULEV] 4.0 - 5.0 39.2 - 49.1 28.9 - 36.2
Electronic throttle body installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Purge control solenoid valve bracket installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
CVVT oil control valve (Bank 1 / Intake) installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
CVVT oil control valve (Bank 1 / Exhaust) installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Variable intake solenoid valve bracket installtion bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Ignition coil installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Variable charge motion actuator installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Fuel tank installation nut 4.0 - 5.5 39.2 - 54.0 28.9 - 39.8
Fuel pump plate cover installation bolt [LEV2] 0.2 - 0.3 2.0 - 3.0 1.4 - 2.2
Fuel pump plate cover installation [SULEV] 8.0 - 10.0 78.5 - 98.1 57.9 - 72.4
Filler-neck assembly bracket installation bolt 0.8 - 1.2 7.8 - 11.8 5.8 - 8.7
Accelerator pedal module installation nut 1.3 - 1.6 12.8 - 15.7 9.4 - 11.6
Accelerator pedal module installation bolt 0.9 - 1.4 8.8 - 13.7 6.5 - 10.1
Delivery pipe installation bolt 1.9 - 2.4 18.6 - 23.5 13.7 - 17.4

Engine Control/Fuel System - Specifications (Article 44112)

- Specifications
Fuel Delivery System
Items Specification
Fuel Tank Capacity 50 lit. (13.2 U.S.gal., 52.8 U.S.qt., 44.0 Imp.qt.)
Fuel Filter Type Paper type
Fuel Pressure Regulator Regulated Fuel Pressure 355 - 365 kPa (3.4 - 3.7 kgf/cm², 48.6 - 52.9 psi)
Fuel Pump Type Electrical, in-tank type
Driven by Electric motor
Sensors
Manifold Absolute Pressure Sensor (MAPS)
Pressure [kPa (kgf/cm², psi)] Output Voltage (V)
20.0 (0.20, 2.9) 0.79
46.7 (0.47, 6.77) 1.84
101.3 (1.03, 14.7) 4.0
Intake Air Temperature Sensor (IATS)
Temperature [°C (°F)] Resistance (kΩ)
-40 (-40) 40.93 - 48.35
-20 (-4) 13.89 - 16.03
0 (32) 5.38 - 6.09
10 (50) 3.48 - 3.90
20 (68) 2.31 - 2.57
40 (104) 1.08 - 1.21
50 (122) 0.76 - 0.85
60 (140) 0.54 - 0.62

80 (176) 0.29 - 0.34
Engine Coolant Temperature Sensor (ECTS)
-40 (-40) 48.14
-20 (-4) 14.13 - 16.83
0 (32) 5.79
20 (68) 2.31 - 2.59
40 (104) 1.15
60 (140) 0.59
80 (176) 0.32
Throttle Position Sensor (TPS) [integrated into ETC module]
Throttle angle (■) Output voltage(V) [Vref = 5.0V]
TPS1 TPS2
0 0.5 4.5
10 0.96 4.05
20 1.41 3.59
30 1.87 3.14
40 2.32 2.68
50 2.78 2.23
60 3.23 1.77
70 3.69 1.32
80 4.14 0.86
90 4.6 0.41
98 4.65 0.35
C.T (0) 0.5 4.5
W.O.T (86) 4.41 0.59
Crankshaft Position Sensor (CKPS)
Item Specification
Coil Resistance (Ω) 774 - 946 [20°C (68°F)]
Camshaft Position Sensor (CMPS)
Knock Sensor (KS)
Capacitance (pF) 850 - 1,150
Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
Heater Resistance (Ω) 2.4 - 4.0 [20°C (69.8°F)]
Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
A/F Ratio (λ) Output Voltage(V)
RICH 0.6 - 1.0
LEAN 0 - 0.4
Heater Resistance (Ω) Approx. 9.0 [20°C (68°F)]
Accelerator Position Sensor (APS)
Accelerator Position Output Voltage (V)
APS1 APS2
C.T 0.7 - 0.8 0.275 - 0.475
W.O.T 3.85 - 4.35 1.75 - 2.35
Fuel Tank Pressure Sensor (FTPS)
Pressure [kPa (kgf/cm², in H2O) Output Voltage (V)
-6.67 (-0.068, -26.8) 0.5
0 2.5
+6.67 (0.068, 26.8) 4.5
Actuators
Injector
Coil Resistance (Ω) 13.8 - 15.2 [20°C (68°F)]
ETC Motor [integrated into ETC Module]
Coil Resistance (Ω) 0.3 - 100 [20°C (68°F)]
Purge Control Solenoid Valve (PCSV)
Coil Resistance (Ω) 22.0 - 26.0 [20°C(68°F)]
CVVT Oil Control Valve (OCV)
Coil Resistance (Ω) 9.4 - 10.4 [20°C (68°F)]
Variable Intake Solenoid (VIS) Valve
Coil Resistance (Ω) 30.0 - 35.0 [20°C (68°F)]
Variable Charge Motion Actuator (VCMA)

[Motor]
Coil Resistance (Ω) 3.4 - 4.4 [20°C (68°F)]
[Position Sensor]
Coil Resistance (kΩ) 3.44 - 5.16 [20°C (68°F)]
Ignition Coil
Primary Coil Resistance (Ω) 0.75 ± 15% [20°C (68°F)]
Secondary Coil Resistance (kΩ) 5.9 ± 15% [20°C (68°F)]
Canister Close Valve (CCV)
Coil Resistance (Ω) 19.5 - 22.5 [20°C (68°F)]
- Service Standard
Ignition Timing (■) BTDC 5 ± 10
Idle Speed (rpm) A/C OFF Neutral, N, P-range 640 ± 100
D-range 640 ± 100
A/C ON Neutral, N, P-range 680 ± 100
D-range 680 ± 100
- Tightening Torques
Engine Control System
Item kgf.m N.m lb-ft
ECM installation bolt 0.8 - 1.2 7.8 - 11.8 5.8 - 8.7
ECM bracket installation bolt/nut 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Manifold absolute pressure sensor installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Engine coolant temperature sensor installation 3.0 - 4.0 29.4 - 39.2 21.7 - 28.9
Crankshaft position sensor installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Camshaft position sensor (Bank 1 / Intake) installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Camshaft position sensor (Bank 1 / Exhaust) installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Knock sensor installation bolt 1.9 - 2.4 18.6 - 23.5 13.7 - 17.4
Heated oxygen sensor (Bank 1 / sensor 1) installation [SULEV] 4.0 - 5.0 39.2 - 49.1 28.9 - 36.2
Heated oxygen sensor (Bank 1 / sensor 2) installation [SULEV] 4.0 - 5.0 39.2 - 49.1 28.9 - 36.2
Heated oxygen sensor (Bank 1 / sensor 1) installation [ULEV] 4.0 - 5.0 39.2 - 49.1 28.9 - 36.2
Heated oxygen sensor (Bank 1 / sensor 2) installation [ULEV] 4.0 - 5.0 39.2 - 49.1 28.9 - 36.2
Electronic throttle body installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Purge control solenoid valve bracket installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
CVVT oil control valve (Bank 1 / Intake) installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
CVVT oil control valve (Bank 1 / Exhaust) installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Variable intake solenoid valve bracket installtion bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Ignition coil installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Variable charge motion actuator installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
Fuel tank installation nut 4.0 - 5.5 39.2 - 54.0 28.9 - 39.8
Fuel pump plate cover installation bolt [LEV2] 0.2 - 0.3 2.0 - 3.0 1.4 - 2.2
Fuel pump plate cover installation [SULEV] 8.0 - 10.0 78.5 - 98.1 57.9 - 72.4
Filler-neck assembly bracket installation bolt 0.8 - 1.2 7.8 - 11.8 5.8 - 8.7
Accelerator pedal module installation nut 1.3 - 1.6 12.8 - 15.7 9.4 - 11.6
Accelerator pedal module installation bolt 0.9 - 1.4 8.8 - 13.7 6.5 - 10.1
Delivery pipe installation bolt 1.9 - 2.4 18.6 - 23.5 13.7 - 17.4

Engine Control/Fuel System - Specifications (Article 44113)

- Specifications
Fuel Delivery System
Items Specification
Fuel Tank Capacity 50 lit. (13.2 U.S.gal., 52.8 U.S.qt., 44.0 Imp.qt.)
Fuel Filter Type Paper type
Fuel Pressure Regulator Regulated Fuel Pressure 355 - 365 kPa (3.4 - 3.7 kgf/cm², 48.6 - 52.9 psi)
Fuel Pump Type Electrical, in-tank type
Driven by Electric motor
Sensors
Manifold Absolute Pressure Sensor (MAPS)
Pressure [kPa (kgf/cm², psi)] Output Voltage (V)
20.0 (0.20, 2.9) 0.79
46.7 (0.47, 6.77) 1.84
101.3 (1.03, 14.7) 4.0

Intake Air Temperature Sensor (IATS)
Temperature [°C (°F)] Resistance (kΩ)
-40 (-40) 40.93 - 48.35
-20 (-4) 13.89 - 16.03
0 (32) 5.38 - 6.09
10 (50) 3.48 - 3.90
20 (68) 2.31 - 2.57
40 (104) 1.08 - 1.21
50 (122) 0.76 - 0.85
60 (140) 0.54 - 0.62
80 (176) 0.29 - 0.34
Engine Coolant Temperature Sensor (ECTS)
-40 (-40) 48.14
-20 (-4) 14.13 - 16.83
0 (32) 5.79
20 (68) 2.31 - 2.59
40 (104) 1.15
60 (140) 0.59
80 (176) 0.32
Throttle Position Sensor (TPS) [integrated into ETC module]
Throttle angle (■) Output voltage(V) [Vref = 5.0V]
TPS1 TPS2
0 0.5 4.5
10 0.96 4.05
20 1.41 3.59
30 1.87 3.14
40 2.32 2.68
50 2.78 2.23
60 3.23 1.77
70 3.69 1.32
80 4.14 0.86
90 4.6 0.41
98 4.65 0.35
C.T (0) 0.5 4.5
W.O.T (86) 4.41 0.59
Crankshaft Position Sensor (CKPS)
Item Specification
Coil Resistance (Ω) 774 - 946 [20°C (68°F)]
Camshaft Position Sensor (CMPS)
Knock Sensor (KS)
Capacitance (pF) 850 - 1,150
Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
Heater Resistance (Ω) 2.4 - 4.0 [20°C (69.8°F)]
Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
A/F Ratio (λ) Output Voltage(V)
RICH 0.6 - 1.0
LEAN 0 - 0.4
Heater Resistance (Ω) Approx. 9.0 [20°C (68°F)]
Accelerator Position Sensor (APS)
Accelerator Position Output Voltage (V)
APS1 APS2
C.T 0.7 - 0.8 0.275 - 0.475
W.O.T 3.85 - 4.35 1.75 - 2.35
Fuel Tank Pressure Sensor (FTPS)
Pressure [kPa (kgf/cm², in H2O) Output Voltage (V)
-6.67 (-0.068, -26.8) 0.5
0 2.5
+6.67 (0.068, 26.8) 4.5
Actuators
Injector

Coil Resistance (Ω) 13.8 - 15.2 [20°C (68°F)]
ETC Motor [integrated into ETC Module]
Coil Resistance (Ω) 0.3 - 100 [20°C (68°F)]
Purge Control Solenoid Valve (PCSV)
Coil Resistance (Ω) 22.0 - 26.0 [20°C(68°F)]
CVVT Oil Control Valve (OCV)
Coil Resistance (Ω) 9.4 - 10.4 [20°C (68°F)]
Variable Intake Solenoid (VIS) Valve
Coil Resistance (Ω) 30.0 - 35.0 [20°C (68°F)]
Variable Charge Motion Actuator (VCMA)
[Motor]
Coil Resistance (Ω) 3.4 - 4.4 [20°C (68°F)]
[Position Sensor]
Coil Resistance (kΩ) 3.44 - 5.16 [20°C (68°F)]
Ignition Coil
Primary Coil Resistance (Ω) 0.75 ± 15% [20°C (68°F)]
Secondary Coil Resistance (kΩ) 5.9 ± 15% [20°C (68°F)]
Canister Close Valve (CCV)
Coil Resistance (Ω) 19.5 - 22.5 [20°C (68°F)]
- Service Standard
Ignition Timing (■) BTDC 5 ± 10
Idle Speed (rpm) A/C OFF Neutral, N, P-range 640 ± 100
D-range 640 ± 100
A/C ON Neutral, N, P-range 680 ± 100
D-range 680 ± 100
- Tightening Torques
Engine Control System
Item kgf.m N.m lb-ft
ECM installation bolt 0.8 - 1.2 7.8 - 11.8 5.8 - 8.7
ECM bracket installation bolt/nut 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
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Ignition coil installation bolt 1.0 - 1.2 9.8 - 11.8 7.2 - 8.7
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Fuel pump plate cover installation bolt [LEV2] 0.2 - 0.3 2.0 - 3.0 1.4 - 2.2
Fuel pump plate cover installation [SULEV] 8.0 - 10.0 78.5 - 98.1 57.9 - 72.4
Filler-neck assembly bracket installation bolt 0.8 - 1.2 7.8 - 11.8 5.8 - 8.7
Accelerator pedal module installation nut 1.3 - 1.6 12.8 - 15.7 9.4 - 11.6
Accelerator pedal module installation bolt 0.9 - 1.4 8.8 - 13.7 6.5 - 10.1
Delivery pipe installation bolt 1.9 - 2.4 18.6 - 23.5 13.7 - 17.4

All New Technical Service Bulletins (itype_432)

Tsbs
- AFTERMARKET DONGLE INSTALLED AT DATA LINK CONNECTOR (DLC) (24-GI-011H, 2024/07/15)
- IBU/BCM ANTI-THEFT SOFTWARE UPGRADE AND DECAL APPLICATION (SERVICE CAMPAIGN 993) (24-01-009H-1, 2024/05/09)

- ECU SOFTWARE UPDATE – OBD-II FUEL SYSTEM READINESS MONITOR DIAGNOSIS (SERVICE CAMPAIGN 968) (25-01-054H, 2025/08/19)

All Technical Service Bulletins (itype_100)

Tsbs

- AUTOMATIC TRANSAXLE OIL TEMPERATURE SENSOR DTC P071100, P071200 & P071300 (20-AT-015H, 2020/04/09)
- AUTOMATIC TRANSMISSION DTC P0880/P088000 (20-AT-018H, 2020/05/21)
- AUTOMATIC TRANSAXLE SOLENOID DTC P074100, P074300, P074800, P075300, P075800, P076300, P076800, P077300 (20-AT-007H, 2020/02/21)
- ECM AND PCM VIN WRITING DURING CONTROL MODULE REPLACEMENT (19-FL-003H, 2019/04/16)
- IAU/IBU/BLE LEARNING AFTER PARTS REPLACEMENT (22-BE-004H, 2022/07/08)
- AFTERMARKET DONGLE INSTALLED AT DATA LINK CONNECTOR (DLC) (24-GI-011H, 2024/07/15)
- ENGINE THERMOSTAT REPLACEMENT DTC P0128 / P2181 (20-EM-002H, 2020/07/16)
- IBU/BCM ANTI-THEFT SOFTWARE UPGRADE AND DECAL APPLICATION (SERVICE CAMPAIGN 993) (24-01-009H-1, 2024/05/09)
- ECU SOFTWARE UPDATE – OBD-II FUEL SYSTEM READINESS MONITOR DIAGNOSIS (SERVICE CAMPAIGN 968) (25-01-054H, 2025/08/19)
- OIL PRESSURE DATA TRANSFER USING GDS MOBILE (6-SPEED TRANSMISSION) (19-AT-010H, 2019/05/08)
- ECM SOFTWARE UPDATE – MISFIRE DTC LOGIC (SERVICE CAMPAIGN T3W) (20-01-008H, 2020/02/14)
- AUTOMATIC TRANSAXLE DIAGNOSIS (6-SPEED) INHIBITOR/RANGE SWITCH DTC P0705, P0706, P0707 & P0708 (19-AT-024H, 2019/11/15)
- IDLE STOP & GO SYSTEM OPERATION, DIAGNOSTIC AND BATTERY SENSOR RECALIBRATION PROCEDURE (20-FL-004H, 2020/05/29)
- ENGINE MONITORING LOGIC (SERVICE CAMPAIGN 974) (22-01-043H, 2022/05/09)
- AUTOMATIC TRANSAXLE INPUT/OUTPUT SPEED SENSOR DTC P071700, P072100 & P072200 (20-AT-012H, 2020/03/25)
- HYUNDAI OVER-THE-AIR (OTA) SOFTWARE UPDATE INTRODUCTION AND CUSTOMER COMMUNICATION INFORMATION (23-GI-012H, 2023/12/19)

Software Update Bulletins (itype_434)

Tsbs

- IDLE STOP & GO SYSTEM OPERATION, DIAGNOSTIC AND BATTERY SENSOR RECALIBRATION PROCEDURE (20-FL-004H, 2020/05/29)
- HYUNDAI OVER-THE-AIR (OTA) SOFTWARE UPDATE INTRODUCTION AND CUSTOMER COMMUNICATION INFORMATION (23-GI-012H, 2023/12/19)

Engine Control/Fuel System - Troubleshooting (Article 44119)

- Basic Troubleshooting

Basic Troubleshooting Guide

1	**Bring Vehicle to Workshop**
2	**Analyze Customer's Problem**
	• Ask the customer about the conditions and environment relative to the issue. (Use CUSTOMER PROBLEM ANALYSIS SHEET).
3	**Verify Symptom, and then Check DTC and Freeze Frame Data**
	• Connect the GDS to Diagnostic Link Connector (DLC). • Record the DTC and Freeze Frame Data. **Information** *To erase DTC and Freeze Frame Data, refer to Step 5.*
4	**Confirm the Inspection Procedure for the System or Part**
	• Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.
5	**Erase the DTC and Freeze Frame Data**
	NOTICE **NEVER erase DTC and Freeze Frame Data before completing Step 2 : MIL/DTC in CUSTOMER PROBLEM ANALYSIS SHEET.**
6	**Inspect Vehicle Visually**
	• Go to Step 11, if you recognize the problem.
7	**Recreate (Simulate) Symptoms of the DTC**
	• Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer. • If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.
8	**Confirm Symptoms of Problem**
	• If DTC(s) is/are not displayed, go to Step 9. • If DTC(s) is/are displayed, go to Step 11.
9	**Recreate (Simulate) Symptom**
	• Try to recreate or simulate the condition of the malfunction as described by the customer.
10	**Check the DTC**
	• If DTC(s) does(do) not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE. • If DTC(s) occur(s), go to Step 11.
11	**Perform Troubleshooting Procedure for DTC**
12	**Adjust or repair the vehicle**
13	**Confirmation test**
14	**END**

Customer Problem Analysis Sheet

1. VEHICLE INFORMAITON

VIN No.		Transmission	☐ M/T ☐ A/T ☐ CVT ☐ etc.
Production date		Driving type	☐ 2WD (FF) ☐ 2WD (FR) ☐ 4WD
Odometer Reading	_____km/mile	DPF (Diesel Engine)	☐ With DPF ☐ Without DPF

2. SYMPTOMS

☐ Unable to start	☐ Engine does not turn over ☐ Incomplete combustion ☐ Initial combustion does not occur
☐ Difficult to start	☐ Engine turns over slowly ☐ Other_____
☐ Poor idling	☐ Rough idling ☐ Incorrect idling ☐ Unstable idling (High:_____ rpm, Low: _____ rpm) ☐ Other
☐ Engine stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C ON ☐ Shifting from N to D-range ☐ Other_____
☐ Others	☐ Poor driving (Surge) ☐ Knocking ☐ Poor fuel economy ☐ Back fire ☐ After fire ☐ Other_____

3. ENVIRONMENT

Problem frequency	☐ Constant ☐ Sometimes (_____) ☐ Once only ☐ Other_____
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Other_____
Outdoor temperature	Approx. _____ °C/°F
Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other_____
Engine temperature	☐ Cold ☐ Warming up ☐ After warming up ☐ Any temperature
Engine operation	☐ Starting ☐ Just after starting (____min) ☐ Idling ☐ Racing ☐ Driving ☐ Constang speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other_____

4. MIL/DTC

MIL (Malfunction Indicator Lamp)		☐ Remains ON ☐ Sometimes lights up ☐ Does not light
DTC	Normal check (Pre-check)	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Date
	Check mode	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Date

5. ECM/PCM INFORMATION

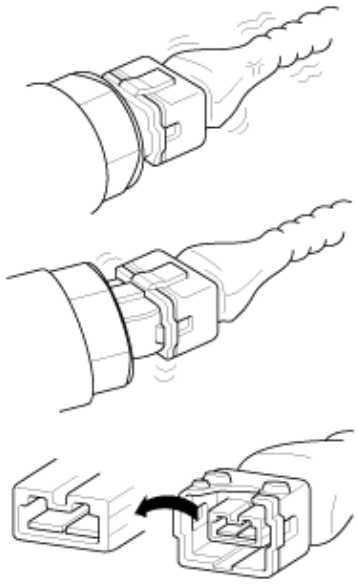
ECM/PCM Part No.	
ROM ID	

Basic Inspection Procedure

The measured resistance in except for ambient temperature (20°C, 68°F) is reference value.

NOTICE

- The measured resistance in except for ambient temperature (20°C, 68°F) is reference value.
- Clear Diagnostic Trouble Code (DTC).
- Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



- Slightly shake the connector and wiring harness vertically and horizontally.

- Repair or replace the component that has a problem.
- Verify that the problem has disappeared with the road test.
- Sensors and Actuators : Slightly vibrate sensors, actuators or relays with finger. Strong vibration may break sensors, actuators or relays
Strong vibration may break sensors, actuators or relays

WARNING

- Strong vibration may break sensors, actuators or relays
- Connectors and Harness : Lightly shake the connector and wiring harness vertically and then horizontally.
- Heat components suspected of causing the malfunction with a hair dryer or other heat source. DO NOT heat components to the point where they may be damaged. DO NOT heat the ECM directly.
DO NOT heat components to the point where they may be damaged. DO NOT heat the ECM directly.
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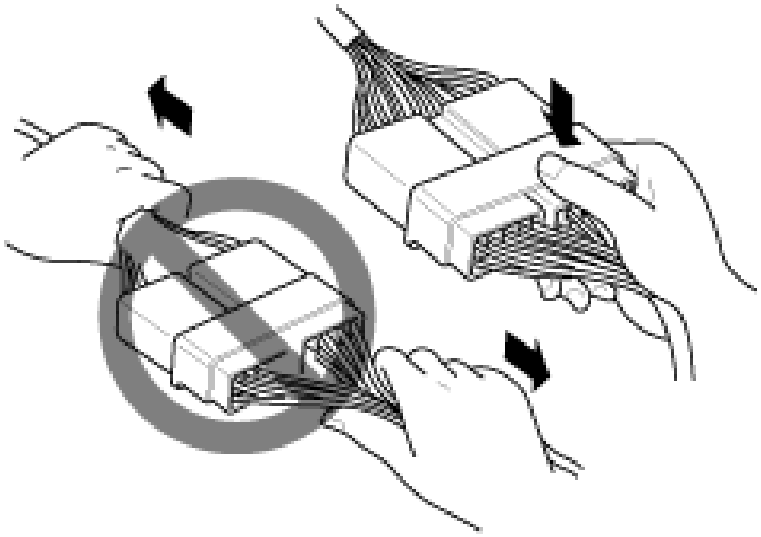
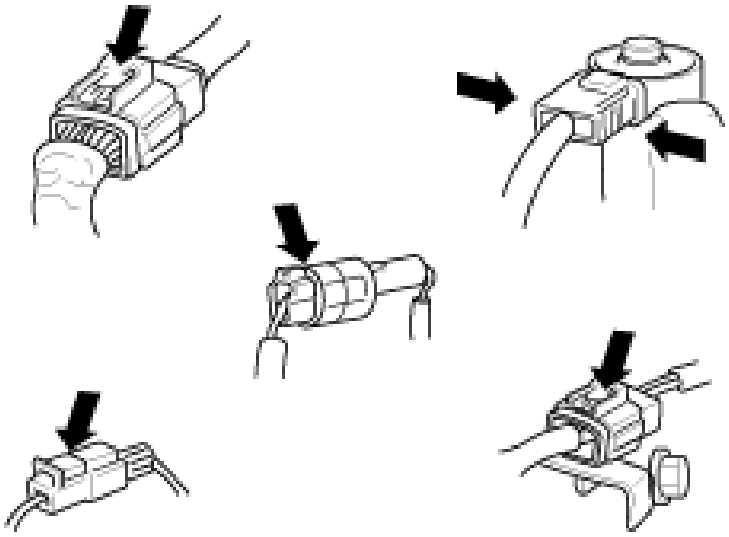
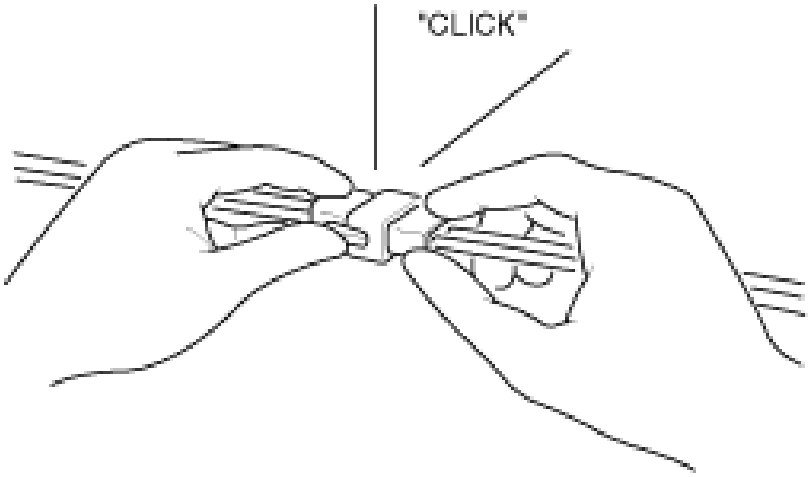
- DO NOT heat the ECM directly.
- Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition. DO NOT sprinkle water directly into the engine compartment or electronic components.
DO NOT sprinkle water directly into the engine compartment or electronic components.
- DO NOT sprinkle water directly into the engine compartment or electronic components.
- Turn on all electrical systems to simulate excessive electrical loads. (Radios, fans, lights, rear window defogger, etc .)
Connector Inspection Procedure
- Handling of Connector Never pull on the wiring harness when disconnecting connectors. When removing the connector with a lock, press or pull locking lever. Listen for a click when locking connectors. This sound indicates that they are securely locked. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side. Use a fine wire to prevent damage to the terminal. Do not damage the terminal when inserting the tester lead.
- Never pull on the wiring harness when disconnecting connectors.



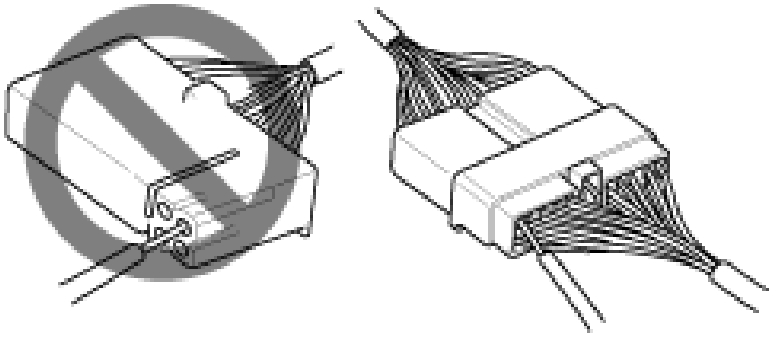
- When removing the connector with a lock, press or pull locking lever.



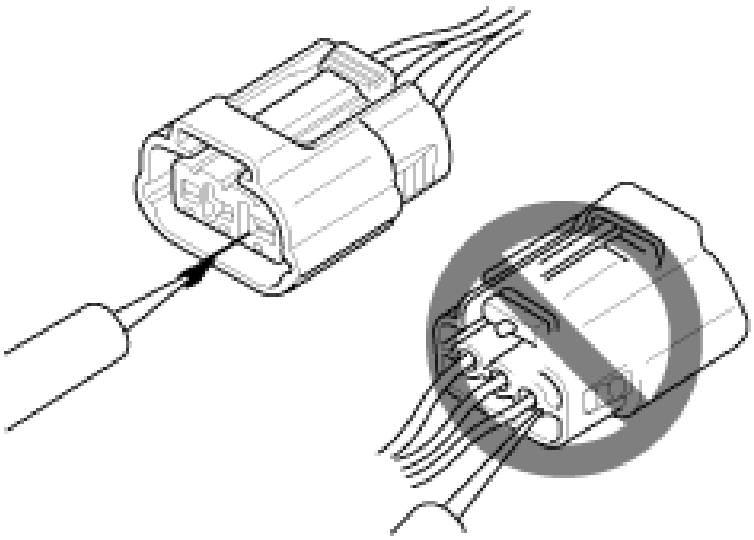
- Listen for a click when locking connectors. This sound indicates that they are securely locked.



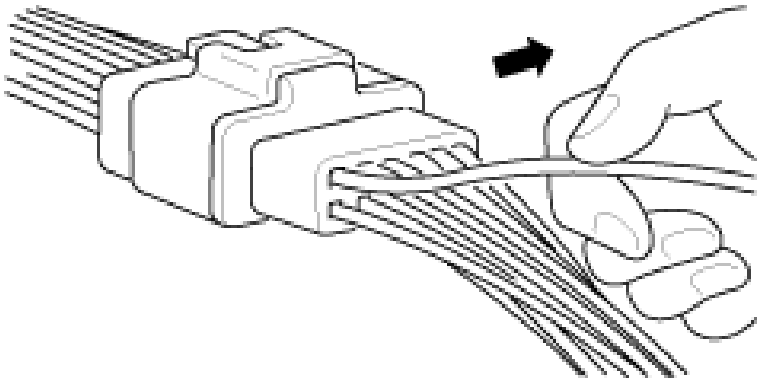
- When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



- Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side. Use a fine wire to prevent damage to the terminal. Do not damage the terminal when inserting the tester lead.



Use a fine wire to prevent damage to the terminal. Do not damage the terminal when inserting the tester lead.
- Use a fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.
- Checking Point for Connector While the connector is connected: Hold the connector, check connecting condition and locking efficiency. When the connector is disconnected: Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness. Visually check for rust, contamination, deformation and bend. Check terminal tightening condition: Insert a spare male terminal into a female terminal, and then check terminal tightening conditions. Pull lightly on individual wires to ensure that each wire is secured in the terminal.
- While the connector is connected: Hold the connector, check connecting condition and locking efficiency.
- When the connector is disconnected: Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness. Visually check for rust, contamination, deformation and bend.
- Check terminal tightening condition: Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.
- Pull lightly on individual wires to ensure that each wire is secured in the terminal.



- Repair Method of Connector Terminal Clean the contact points using air gun and/or shop rag. Never use sand paper when polishing the contact points, otherwise the contact point may be damaged. In case of abnormal contact pressure, replace the female terminal.
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- Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.
- In case of abnormal contact pressure, replace the female terminal.

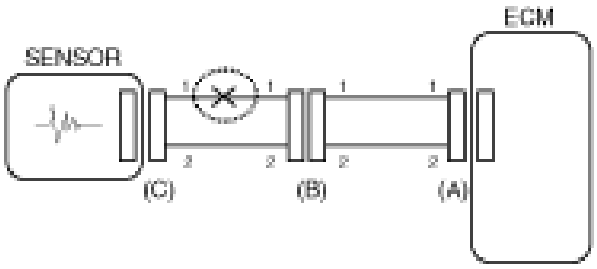
Wire Harness Inspection Procedure

- Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
- Check whether the wire harness is twisted, pulled or loosened.
- Check whether the temperature of the wire harness is abnormally high.
- Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
- Check the connection between the wire harness and any installed part.
- If the covering of wire harness is damaged; secure, repair or replace the harness.

Electrical Circuit Inspection Procedure

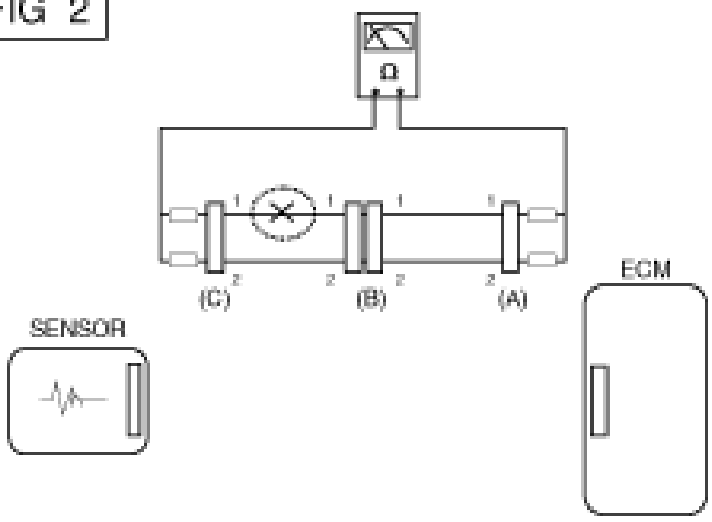
- Procedures for Open Circuit Continuity Check Voltage Check If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check Method) or Step 3 (Voltage Check Method) as shown below.
- Continuity Check
- Voltage Check

FIG 1



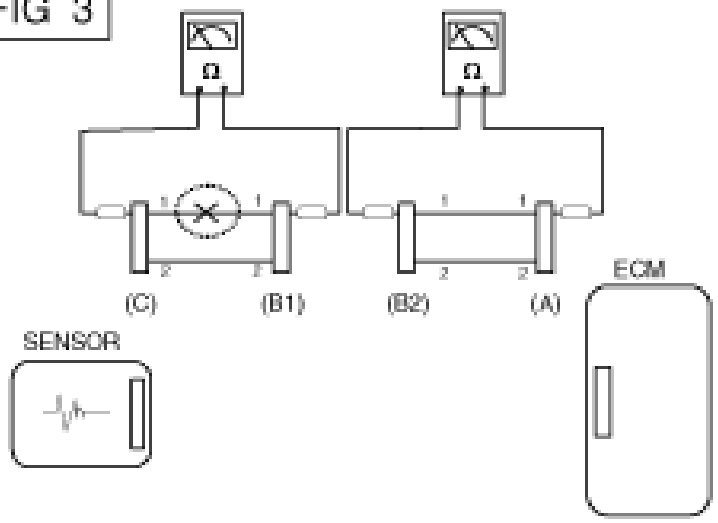
- Continuity Check Method When measuring for resistance, lightly shake the wire harness above and below or from side to side. Specification (Resistance) 1Ω or less → Normal Circuit 1MΩ or Higher → Open Circuit Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2]. In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3]. In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).
When measuring for resistance, lightly shake the wire harness above and below or from side to side.
- When measuring for resistance, lightly shake the wire harness above and below or from side to side.
- Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2]. In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.

FIG 2



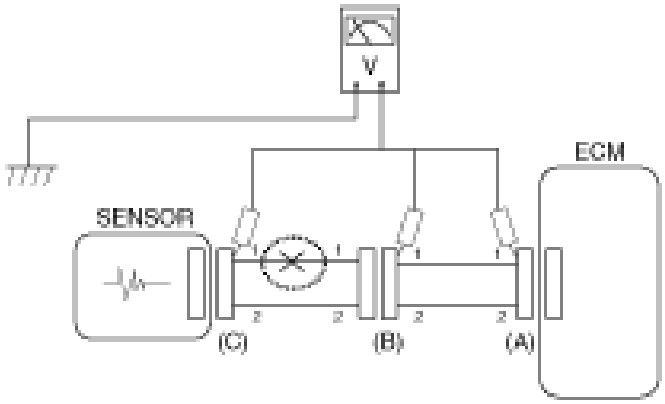
- Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3]. In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG 3



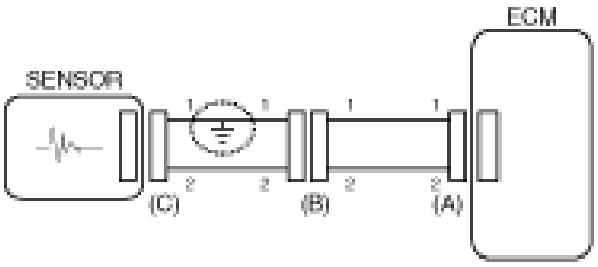
- Voltage Check Method With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4]. The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).
- With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4]. The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

FIG 4



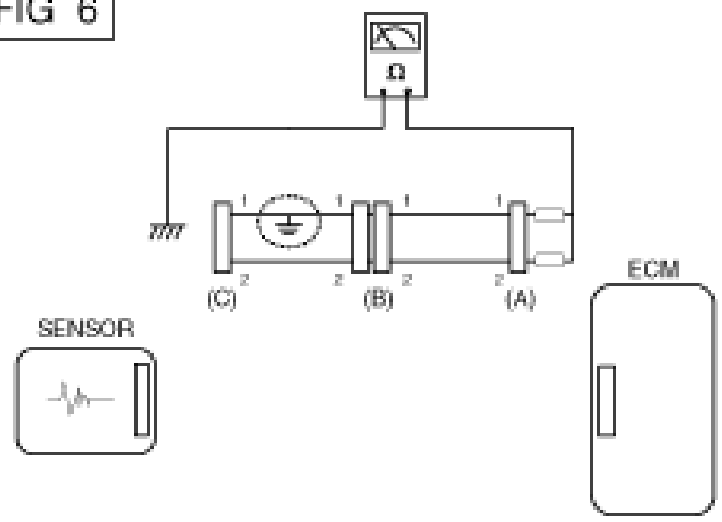
● Check Short Circuit
- Test Method for Short to Ground Circuit Continuity Check with Chassis Ground If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing Step 2 (Continuity Check Method with Chassis Ground) as shown below.
- Continuity Check with Chassis Ground

FIG 5



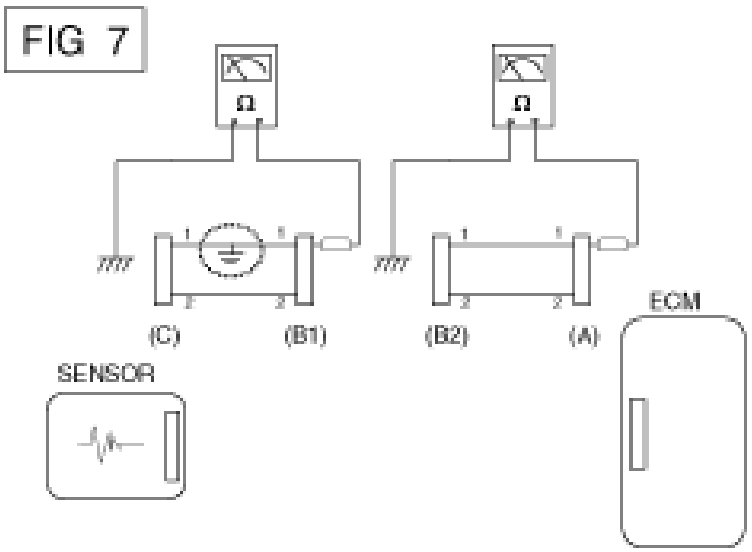
- Continuity Check Method (with Chassis Ground). Lightly shake the wire harness above and below, or from side to side when measuring the resistance. Specification (Resistance) 1Ω or less → Short to Ground Circuit 1MΩ or Higher → Normal Circuit Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6]. The measured resistance of line 1 and 2 in this example is below 1Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7]. The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).
Lightly shake the wire harness above and below, or from side to side when measuring the resistance.
- Lightly shake the wire harness above and below, or from side to side when measuring the resistance.
- Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6]. The measured resistance of line 1 and 2 in this example is below 1Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step.

FIG 6

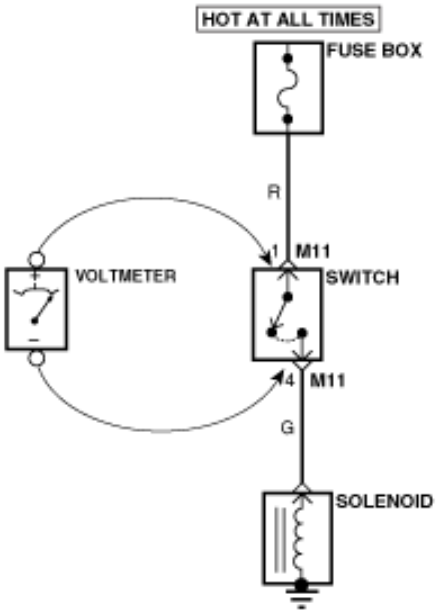


- Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7]. The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of

connector (B1).



● Testing For Voltage Drop
- Connect the positive lead of a voltmeter to the end of the wire (or to the side of the connector or switch) closest to the battery.
- Connect the negative lead to the other end of the wire. (or the other side of the connector or switch)
- Operate the circuit.
- The voltmeter will show the difference in voltage between the two points. A difference, or drop of more than 0.1 volts (50mV in 5V circuits), may indicate a problem. Check the circuit for loose or dirty connections.



Symptom Troubleshooting Guide Chart
Main symptom Diagnostic procedure Also check for
Unable to start (Engine does not turn over) Test the battery Test the starter Inhibitor switch (A/T) or clutch start switch (M/T)
- Test the battery
- Test the starter
- Inhibitor switch (A/T) or clutch start switch (M/T)
Unable to start (Incomplete combustion) Test the battery Check the fuel pressure Check the ignition circuit Troubleshooting the immobilizer system (In case of immobilizer lamp flashing) DTC Low compression Intake air leaks Slipped or broken timing belt Contaminated fuel

- Check the fuel pressure
- Check the ignition circuit
- Troubleshooting the immobilizer system (In case of immobilizer lamp flashing)
- DTC
- Low compression
- Intake air leaks
- Slipped or broken timing belt
- Contaminated fuel

Difficult to start Test the battery Check the fuel pressure Check the ECT sensor and circuit (Check DTC) Check the ignition circuit DTC Low compression Intake air leaks Contaminated fuel Weak ignition spark

- Check the ECT sensor and circuit (Check DTC)
- Weak ignition spark

Poor idling (Rough, unstable or incorrect Idle) Check the fuel pressure Check the Injector Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) Check the idle speed control circuit (Check DTC) Inspect and test the Throttle Body Check the ECT sensor and circuit (Check DTC) DTC Low compression Intake air leaks Contaminated fuel Weak ignition spark

- Check the Injector
- Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)
- Check the idle speed control circuit (Check DTC)
- Inspect and test the Throttle Body

Engine stall Test the Battery Check the fuel pressure Check the idle speed control circuit (Check DTC) Check the ignition circuit Check the CKPS Circuit (Check DTC) DTC Intake air leaks Contaminated fuel Weak ignition spark

- Test the Battery
- Check the CKPS Circuit (Check DTC)

Poor driving (Surge) Check the fuel pressure Inspect and test Throttle Body Check the ignition circuit Check the ECT Sensor and Circuit (Check DTC) Test the exhaust system for a possible restriction Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) DTC Low compression Intake air leaks Contaminated fuel Weak ignition spark

- Inspect and test Throttle Body
- Check the ECT Sensor and Circuit (Check DTC)
- Test the exhaust system for a possible restriction

Knocking Check the fuel pressure Inspect the engine coolant Inspect the radiator and the electric cooling fan Check the spark plugs DTC Contaminated fuel

- Inspect the engine coolant
- Inspect the radiator and the electric cooling fan
- Check the spark plugs

Poor fuel economy Check customer's driving habitsIs · A/C on full time or the defroster mode on? · Are tires at correct pressure? · Is excessively heavy load being carried? · Is acceleration too much, too often? Check the fuel pressure Check the injector Test the exhaust system for a possible restriction Check the ECT sensor and circuit DTC Low compression Intake air leaks Contaminated fuel Weak ignition spark

- Check customer's driving habitsIs · A/C on full time or the defroster mode on? · Are tires at correct pressure? · Is excessively heavy load being carried? · Is acceleration too much, too often?
- Check the injector
- Check the ECT sensor and circuit

Hard to refuel (Overflow during refueling) Test the canister close valve Inspect the fuel filler hose/pipe · Pinched, kinked or blocked? · Filler hose is torn Inspect the fuel tank vapor vent hose between the EVAP . canister and air filter Check the EVAP. canister Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

- Test the canister close valve
- Inspect the fuel filler hose/pipe · Pinched, kinked or blocked? · Filler hose is torn
- Inspect the fuel tank vapor vent hose between the EVAP . canister and air filter
- Check the EVAP. canister
- Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

OEM Policies and Procedures (itype_120)

Tsbs

- ECM AND PCM VIN WRITING DURING CONTROL MODULE REPLACEMENT (19-FL-003H, 2019/04/16)
- OIL PRESSURE DATA TRANSFER USING GDS MOBILE (6-SPEED TRANSMISSION) (19-AT-010H, 2019/05/08)

- IAU/IBU/BLE LEARNING AFTER PARTS REPLACEMENT (22-BE-004H, 2022/07/08)

Tools and Equipment (itype_113)

Tsbs
- OIL PRESSURE DATA TRANSFER USING GDS MOBILE (6-SPEED TRANSMISSION) (19-AT-010H, 2019/05/08)

Service Campaigns (itype_108)

Tsbs
- ECM SOFTWARE UPDATE – MISFIRE DTC LOGIC (SERVICE CAMPAIGN T3W) (20-01-008H, 2020/02/14)
- IBU/BCM ANTI-THEFT SOFTWARE UPGRADE AND DECAL APPLICATION (SERVICE CAMPAIGN 993) (24-01-009H-1, 2024/05/09)
- ECU SOFTWARE UPDATE – OBD-II FUEL SYSTEM READINESS MONITOR DIAGNOSIS (SERVICE CAMPAIGN 968) (25-01-054H, 2025/08/19)
- ENGINE MONITORING LOGIC (SERVICE CAMPAIGN 974) (22-01-043H, 2022/05/09)