Component Procedures: Fuel Delivery and Air Induction

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Component Procedures: Fuel Delivery and Air Induction

Parts and Labor (itype_189)

Parts

Qualifier	Part #	Name	Price	Note
Fuel Supply	31150F3500	Fuel Tank	642.79	
Fuel Supply > Fuel Pump > In?	31119C9000	Fuel Pump	292.45	
Fuel Supply > Fuel Pump > In?	31120F3500	Fuel Pump Assembly	1199.26	
Fuel Supply > Pedal Travel S?	32700F2100	Metal Pad	117.40	Includes Accelerator Pedal.
Fuel Supply > Pedal Travel S?	32700F2100	Rubber Pad	117.40	Includes Accelerator Pedal.
Intake	283102EAA0	Intake Manifold	473.61	
Intake	283132EAA0	Manifold Gasket	11.48	
Intake > Motor	283212EAA0	Vcm Motor	80.55	
Fuel Injection	353402E700	Fuel Rail	130.90	
Fuel Injection	353102E000	Injector	157.87	
Throttle Body	283122E000	Gasket	5.63	
Throttle Body	351002E000	Throttle Body	847.94	
Filters	31112C9000	Fuel Filter	60.97	

Labor

Operation	Qualifier Path	Skill	Std Hrs	Wty Hrs
Remove & Replace	Filters > Fuel Filter, R&R	C	0.3	0.0
Remove & Replace	Fuel Injection > Fuel Pressure Regulator, R&R	B	1.3	0.0
Remove & Replace	Fuel Injection > Fuel Rail, R&R	B	1.5	0.0
Remove & Replace	Fuel Injection > Injector O-Ring, R&R > One O?	B	1.5	0.0
Remove & Replace	Fuel Injection > Injector, R&R > One Or All	B	1.5	0.0
Remove & Replace	Fuel Supply > Filler Neck, R&R	B	0.8	0.0
Remove & Replace	Fuel Supply > Fuel Pump, R&R > High Pressure	B	1.1	0.0
Remove & Replace	Fuel Supply > Fuel Pump, R&R > In-Tank	B	0.9	0.0
Remove & Replace	Fuel Supply > Fuel Tank, R&R	B	3.1	0.0
Remove & Replace	Fuel Supply > Pedal Travel Sensor, R&R > APP ?	B	0.5	0.0
Remove & Replace	Intake > Intake Manifold, R&R	B	2.3	0.0
Remove & Replace	Intake > Manifold Gasket, R&R	B	2.1	0.0
Remove & Replace	Throttle Body > Throttle Body, R&R	B	0.8	0.0
Test	Fuel Supply > Fuel Pump Pressure, Test	B	0.5	0.0
Service	Fuel Supply > System, Service	B	3.6	0.0
Clean	Fuel Injection > Injector, Clean > All Inject?	B	0.5	0.0

Specifications Quick Reference (itype_439)

Quick Specifications
- item

Fuel Delivery System - Repair Procedures (Article 44229)

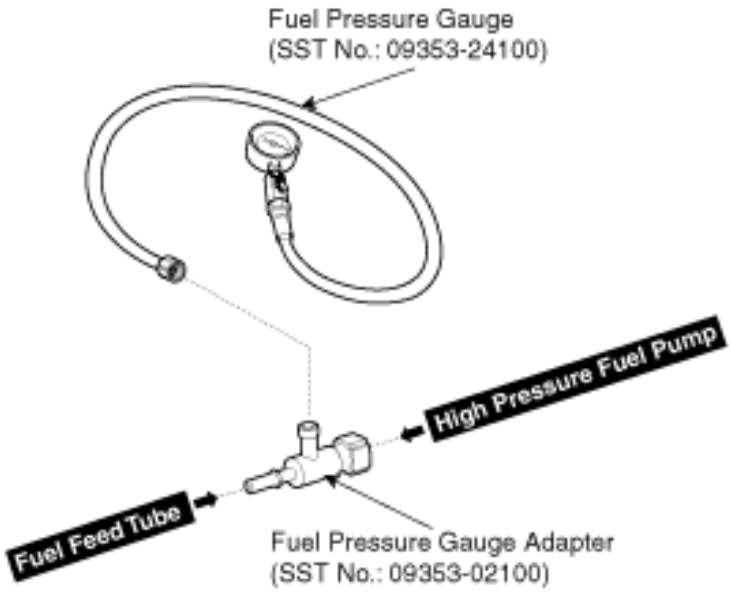
- Fuel Pressure Test

- Release the residual pressure in fuel line . When removing the fuel pump fuse, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

When removing the fuel pump fuse, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

CAUTION

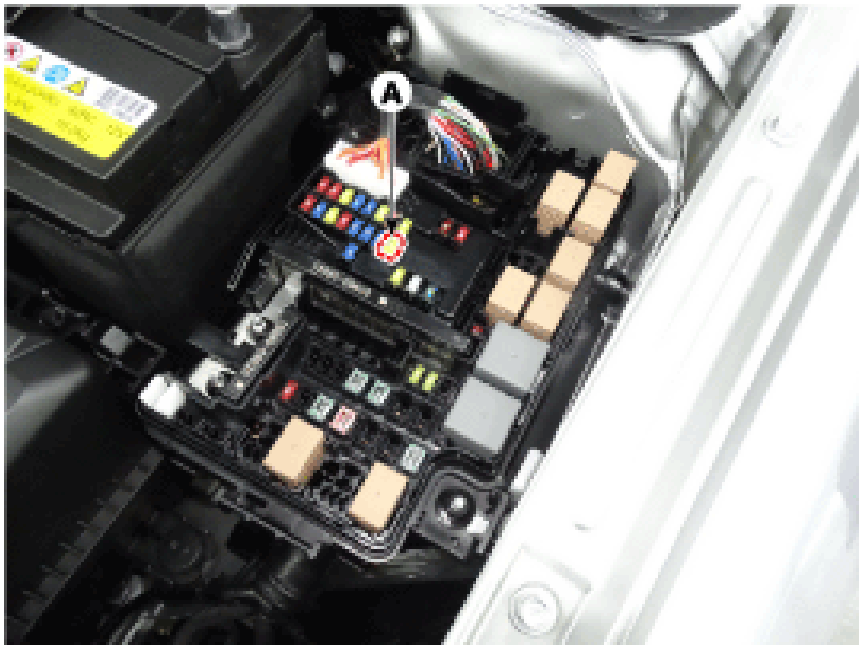
- When removing the fuel pump fuse, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.
- Install the Special Service Tool (SST). Disconnect the fuel feed tube from the delivery pipe . There may be some residual pressure even after “Release Residual Pressure in Fuel Line” work, so cover the hose connection with a shop towel to prevent residual fuel from spilling out before disconnecting any fuel connection. Install the special service tool for measuring the fuel pressure in between the fuel feed tube and the fuel delivery pipe (Refer to the figure below).
- Disconnect the fuel feed tube from the delivery pipe . There may be some residual pressure even after “Release Residual Pressure in Fuel Line” work, so cover the hose connection with a shop towel to prevent residual fuel from spilling out before disconnecting any fuel connection.
There may be some residual pressure even after “Release Residual Pressure in Fuel Line” work, so cover the hose connection with a shop towel to prevent residual fuel from spilling out before disconnecting any fuel connection.
- There may be some residual pressure even after “Release Residual Pressure in Fuel Line” work, so cover the hose connection with a shop towel to prevent residual fuel from spilling out before disconnecting any fuel connection.
- Install the special service tool for measuring the fuel pressure in between the fuel feed tube and the fuel delivery pipe (Refer to the figure below).



- Inspect fuel leakage on connections among the fuel feed tube, the delivery pipe, and the SST components with IG ON.
- Measure Fuel Pressure. Start the engine and measure the fuel pressure at idle. Fuel Pressure : 355 - 365 kPa (3.4 - 3.7 kgf/cm², 48.6 - 52.9 psi) If the fuel pressure differs from the standard value, repair or replace the related part (Refer to the table below). Fuel Pressure Cause Related Part Too Low Fuel filter clogged Fuel Filter Fuel leakage Fuel Pressure Regulator Too High Fuel pressure regulator valve stuck Fuel Pressure Regulator Stop the engine, and then check for the change in the fuel pressure gauge reading. Standard Value: The gauge reading should hold for about 5 minutes after the engine stops If the gauge reading should not be held, repair or replace the related part (Refer to the table below). Fuel Pressure (After Engine Stops) Cause Related Part Fuel Pressure Drops Slowly Leakage on injector Injector Fuel Pressure Drops Immediately Check valve of fuel pump stuck open Fuel Pump Turn the ignition switch OFF.

- Start the engine and measure the fuel pressure at idle. Fuel Pressure : 355 - 365 kPa (3.4 - 3.7 kgf/cm², 48.6 - 52.9 psi) If the fuel pressure differs from the standard value, repair or replace the related part (Refer to the table below). Fuel Pressure Cause Related Part Too Low Fuel filter clogged Fuel Filter Fuel leakage Fuel Pressure Regulator Too High Fuel pressure regulator valve stuck Fuel Pressure Regulator If the fuel pressure differs from the standard value, repair or replace the related part (Refer to the table below).

- If the fuel pressure differs from the standard value, repair or replace the related part (Refer to the table below).
Fuel Pressure Cause Related Part
Too Low Fuel filter clogged Fuel Filter
Fuel leakage Fuel Pressure Regulator
Too High Fuel pressure regulator valve stuck Fuel Pressure Regulator
- Stop the engine, and then check for the change in the fuel pressure gauge reading. Standard Value: The gauge reading should hold for about 5 minutes after the engine stops If the gauge reading should not be held, repair or replace the related part (Refer to the table below). Fuel Pressure (After Engine Stops) Cause Related Part Fuel Pressure Drops Slowly Leakage on injector Injector Fuel Pressure Drops Immediately Check valve of fuel pump stuck open Fuel Pump
If the gauge reading should not be held, repair or replace the related part (Refer to the table below).
- If the gauge reading should not be held, repair or replace the related part (Refer to the table below).
Fuel Pressure (After Engine Stops) Cause Related Part
Fuel Pressure Drops Slowly Leakage on injector Injector
Fuel Pressure Drops Immediately Check valve of fuel pump stuck open Fuel Pump
- Turn the ignition switch OFF.
- Release the residual pressure in fuel line. When removing the fuel pump fuse, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of "Release Residual Pressure in Fuel Line" work.
When removing the fuel pump fuse, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of "Release Residual Pressure in Fuel Line" work.
- When removing the fuel pump fuse, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of "Release Residual Pressure in Fuel Line" work.
- Test End Remove the Special Service Tool (SST) from the fuel feed tube and the delivery pipe. Connect the fuel feed tube and the delivery pipe.
- Remove the Special Service Tool (SST) from the fuel feed tube and the delivery pipe.
- Connect the fuel feed tube and the delivery pipe.
- Release Residual Pressure in Fuel Line
There may be some residual pressure even after "Release Residual Pressure in Fuel Line" work, so cover the hose connection with a shop towel to prevent residual fuel from spilling out before disconnecting any fuel connection.
- There may be some residual pressure even after "Release Residual Pressure in Fuel Line" work, so cover the hose connection with a shop towel to prevent residual fuel from spilling out before disconnecting any fuel connection.
- Turn the ignition sw itch OFF and disconnect the battery (-) cable.
- Remove the fuel pump fuse (A).



- Connect the battery (-) cable.
- Start the engine and let idle, and then turn the ignition switch OFF after the engine has stopped on its own.

Engine Control/Fuel System - Specifications (Article 44114)

- 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 44115)

- 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 44116)

- 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 44117)

- 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
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Coil Resistance (Ω) 9.4 - 10.4 [20°C (68°F)]
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Delivery pipe installation bolt 1.9 - 2.4 18.6 - 23.5 13.7 - 17.4

All Technical Service Bulletins (itype_100)

Tsbs
- HYUNDAI FUEL SYSTEM CLEANER PLUS ADDITIVE AND TOP TIER GAS USAGE GUIDELINES (23-FL-003H, 2023/06/20)