ISUZU

2011MY F SERIES

WORKSHOP MANUAL

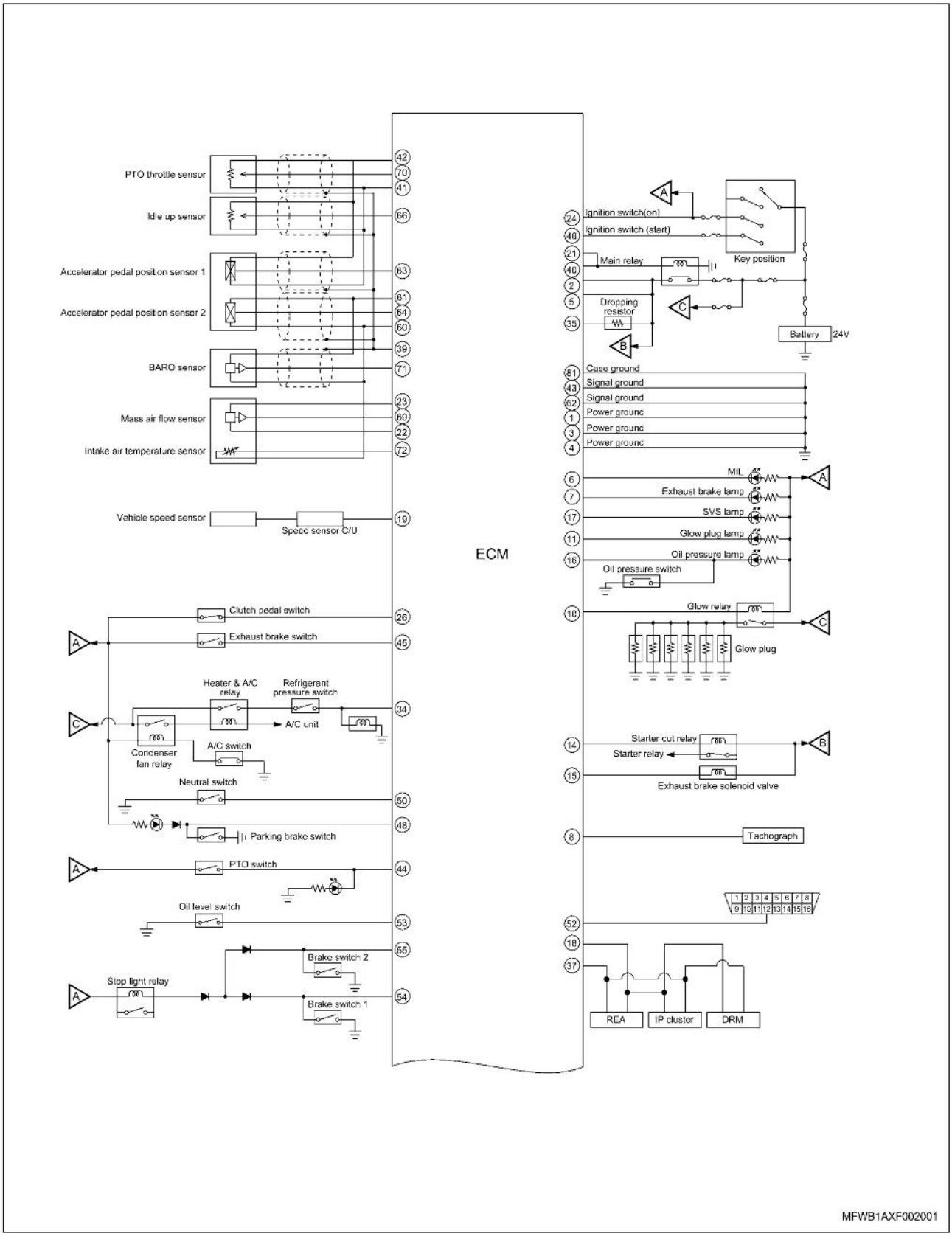
ENGINE CONTROL SYSTEM

(6HK1 model)

Overview Wirings

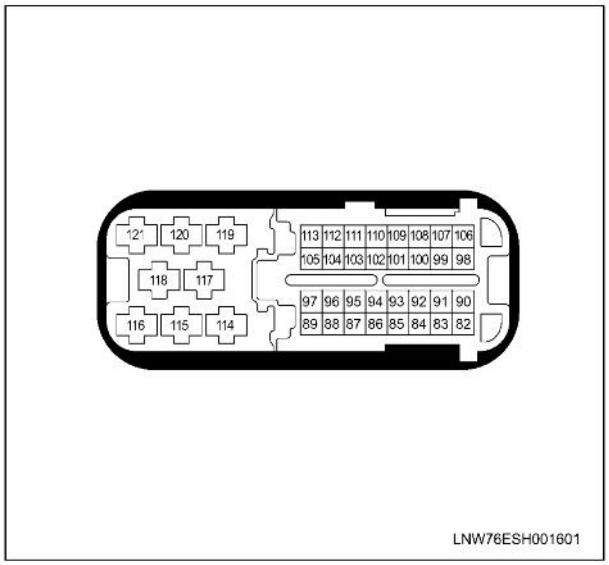
Overview Wirings

1/2



Connector No.		FB24
Connector color		Black
Test adapter No.		J-35616-64A
Pin No.	Wire color	Pin function
48	YEL	Parking brake switch signal
49	–	Not used
50	BLK/ GRN	Neutral switch signal
51	–	Not used
52	GRY/ WHT	Diagnostic request switch
53	VIO/ YEL	Engine oil level switch signal
54	GRN/ BLK	Brake switch 1 signal
55	GRN/ ORN	Brake switch 2 signal
56	–	Not used
57	–	Not used
58	GRN/ WHT	CAN high signal
59	–	Not used
60	BLU	APP sensor 2, BARO sensor and IAT sensor low reference
61	GRN	APP sensor 2 and BARO sensor 5 volts reference
62	BLK/ YEL	ECM signal ground
63	RED	APP sensor 1 signal
64	YEL	APP sensor 2 signal
65	–	Not used
66	YEL/ BRN	Idle up sensor signal
67	–	Not used
68	–	Not used
69	WHT/ BLK	MAF sensor signal
70	RED	PTO throttle sensor signal
71	WHT/ RED	BARO sensor signal
72	GRN/ WHT	IAT sensor signal
73	–	Not used
74	–	Not used
75	–	Not used
76	–	Not used
77	–	Not used
78	GRN	CAN low signal

Connector No.		FB24
Connector color		Black
Test adapter No.		J-35616-64A
Pin No.	Wire color	Pin function
79	–	Not used
80	–	Not used
81	BLK/ YEL	ECM case ground



Connector No.		E26
Connector color		Black
Test adapter No.		J-35616-64A
Pin No.	Wire color	Pin function
82	BLK	FRP sensor signal
83	LT GRN/ WHT	FT sensor signal
84	GRN/ YEL	ECT sensor signal
85	VIO/ WHT	Intake throttle position sensor signal
86	–	Not used
87	LT GRN	CMP sensor, FRP sensor and EGR position sensor 5 volts reference
88	–	Not used
89	GRN/ BLK	FRP regulator low side
90	BLK	FRP sensor signal
91	WHT	Boost pressure sensor signal
92	–	Not used
93	BRN	EGR position sensor signal 2

Diagnostic Information and Procedures

Engine Control System Check Sheet

ENGINE CONTROL SYSTEM CHECK SHEET			Inspectors Name		
Customer's Name			Model & Model Year		
Driver's Name			Chassis No.		
Date Vehicle Brought In			Engine No.		
License No.			Odometer Reading		km/miles

Problem Symptoms	☐ Engine Does Not Run	☐ Engine does not crank	☐ No initial combustion	☐ No complete combustion	
	☐ Hard Start	☐ Engine cranks slowly	☐ Other ( )		
	☐ Incorrect Idle	☐ Abnormal idling speed ☐ Rough idling ☐ Other ( )	☐ High idling speed (RPM)	☐ Low idling speed (RPM)	
	☐ Poor Driveability	☐ Hesitation, sag, stumble ☐ Lack of power, sluggishness, sponginess ☐ Other ( )	☐ Surge	☐ Cut out	
	☐ Engine Stall	☐ Soon after starting ☐ During A/C operation ☐ Other ( )	☐ After accelerator pedal depressed ☐ After accelerator pedal released	☐ Shifting from N to D	
	☐ Others	☐ Black smoke ☐ Abnormal combustion noise ☐ Other ( )	☐ White smoke	☐ Poor fuel economy	
Dates problem occurred					
Problem frequency		☐ Constant ☐ Other ( )	☐ Intermittently (times per day/month)	☐ Once only	
Condition When Problem Occurs	Weather	☐ Fine ☐ Various/Other ( )	☐ Cloudy	☐ Rainy	☐ Snow
	Outside Temperature	☐ Hot (approx.) ☐ Any temperature	☐ Warm	☐ Cool	☐ Cold (approx.)
	Place	☐ Highway ☐ Downhill	☐ Suburbs ☐ Rough road	☐ City area ☐ Other ( )	☐ Uphill
	Load Condition	☐ Over (approx. tons) ☐ Other (approx. tons)		☐ No load	
	Engine Temperature	☐ Cold ☐ Other ( )	☐ Warming up	☐ After warming up	☐ Any temperature
	Engine Operation	☐ Starting ☐ Racing ☐ Deceleration ☐ Other ( )	☐ Just after starting (Min.) ☐ Driving ☐ A/C switch On/Off	☐ Constant speed	☐ Idling ☐ Acceleration
	Fuel Amount	☐ Full	☐ Above 1/2	☐ Below 1/2	☐ Near empty
	Fuel Bland				

Condition of MIL		☐ Remains On	☐ Intermittently turns On	☐ Does not turn On
Diagnostic Trouble Code (DTC) or Flash Code	Present Code	☐ Nothing	☐ P or U Code No. ( )	
	History Code	☐ Nothing	☐ P or U Code No. ( )	

LNW91AXF000401

Exhaust Brake Valve Command
This parameter displays the commanded state of the exhaust brake solenoid valve control circuit. On indicates the exhaust brake solenoid valve is being grounded by the ECM, allowing air pressure to the exhaust brake valve.

PTO Switch
This parameter displays the state of the PTO switch to the ECM. When the PTO switch is operated by control lever or button, scan tool displays On.

PTO Remote Throttle
This parameter displays the angle of the PTO remote throttle sensor as calculated by the ECM using the signal from the PTO remote throttle sensor. The PTO remote throttle angle is a range of values indicating a low percentage when the throttle sensor is not operated to a high percentage when the throttle sensor is operated.

PTO Remote Throttle Sensor
This parameter displays the voltage signal sent to the ECM from the PTO remote throttle sensor. PTO remote throttle sensor is a range of values indicating a low voltage when the throttle sensor is not operated to a high voltage when the throttle sensor is operated.

Engine Warm Up Switch
This parameter displays the input state of the engine warm up switch to the ECM. On indicates the engine warm up switch is closed and allows energizing the exhaust brake solenoid valve and intake throttle valve depending upon engine condition.

A/C Request Signal (Air Conditioning)
This parameter displays the state of the air conditioning (A/C) compressor engagement. On indicates the ECM receiving an A/C compressor On signal. Off indicates the ECM is not receiving an A/C compressor On signal.

Refrigerator Switch
This parameter displays the state of the refrigerator compressor engagement. On indicates the ECM receiving a refrigerator compressor On signal. Off indicates the ECM is not receiving a refrigerator compressor On signal.

Oil Level
This parameter displays the state of the engine oil level switch to the ECM. Normal indicators the engine oil level is not too low for safe operation of the engine. Low indicators the engine oil level is abnormally low and has opened the engine oil level switch.

Glow Plug Relay Command
This parameter displays the commanded state of the glow relay control circuit. On indicates the glow relay control circuit is being grounded by the ECM, allowing voltage to the glow plugs.

Malfunction Indicator Lamp (MIL)
This parameter displays the commanded state of the malfunction indicator lamp (MIL) control circuit. The MIL should be On when the scan tool indicates command On. The MIL should be Off when the scan tool indicates command Off.

Distance While MIL is Activated
This parameter displays the mileage since the malfunction indicator lamp (MIL) is turned ON.

Engine Runtime With MIL Active
This parameter displays the accumulated ignition switch ON time elapsed since the malfunction indicator lamp (MIL) is turned ON. The scan tool will display the time in minutes.

Total Engine Overspeed Events
This parameter indicates counter of engine overspeed event. Counter will be zero if any DTC is cleared.

Total Engine Coolant Overtemperature Event
This parameter indicates counter of engine overheat event. The counter is active if engine coolant is over 110°C (230°F). Counter will be zero if any DTC is cleared.

Total Fuel Temperature Overtemperature Event
This parameter indicates counter of fuel temperature excessively high condition. The counter is active if fuel temperature is over 90°C (194°F). Counter will be zero if any DTC is cleared.

Total Intake Air Temperature Overtemperature Event
This parameter indicates counter of intake air temperature excessively high condition. The counter is active if intake air temperature is over 60°C (140°F). Counter will be zero if any DTC is cleared.

Vane Control Solenoid Error
This parameter displays an error state of the turbocharger nozzle control actuator from the rotary electric actuator (REA) control module. Stuck indicates the REA control module detects an open circuit on the solenoid circuit or a sticking the nozzle control actuator. Short Circuit indicates the REA control module detects a short circuit on the solenoid circuit.

Vane Position Sensor Error
This parameter displays an error status of the turbocharger nozzle position sensor from the rotary electric actuator (REA) control module. All High or All Low indicates the REA control module detects all nozzle position sensor signal are stuck low or high.

Turbocharger Control Module Error
This parameter displays an error status of the rotary electric actuator (REA) control module system voltage. High voltage indicates the REA control module detects system voltage is too high.

Step	Action	Value(s)	Yes	No
3	1. Inspect the crankshaft position (CKP) sensor and the camshaft position (CMP) sensor for the following conditions: • Physical damage of sensor • Loose or improper installation of sensor • Excessive air gap • Foreign material passing between sensor and sensor rotor or camshaft gear • Physical damage of sensor rotor or camshaft gear • Loose or improper installation of sensor rotor or camshaft gear 2. Inspect the engine mechanical timing for an incorrectly installed timing gear or camshaft. **Notice:** If the flywheel dowel pin is missing or pushed in and the flywheel is incorrectly installed, this DTC may set. 3. Repair or replace as necessary. Did you complete the repair?	—	Go to Step 4	—
4	1. Reconnect all previously disconnected harness connector(s) if disconnected. 2. Clear the DTCs with a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Start the engine. If the engine does not start, crank over the engine for 10 seconds. 5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/ Failure Records. Did the DTC fail this ignition?	—	Go to Step 2	Go to Step 5
5	Observe the DTC Information with a scan tool. Are there any DTCs that you have not diagnosed?	—	Go to DTC List	System OK

Step	Action	Value(s)	Yes	No
14	Replace the FRP sensor. Refer to Fuel Pressure Sensor (Common Rail) in Section 1D Engine Fuel. Did you complete the replacement?	—	Go to Step 17	—
15	**Important**: Replacement fuel injector must be programmed. Replace the appropriate fuel injector that does not change engine speed when commanded OFF. Refer to Cylinder Head in Section 1B Engine Mechanical. Did you complete the replacement?	—	Go to Step 17	—
16	**Important**: The fuel supply pump must be timed to the engine and adjustment value must be learned to the ECM. **Notice:** Always replace the fuel filter element when a fuel supply pump is replaced. Replace the fuel supply pump and fuel filter element. Refer to Engine Exterior Parts in Section 1B Engine Mechanical and Fuel Filter Element Replacement Procedure in Section 1D Engine Fuel. Did you complete the replacement?	—	Go to Step 17	—
17	1. Reconnect all previously disconnected harness connector(s). 2. Clear the DTCs with a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Start the engine. 5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/ Failure Records. Did the DTC fail this ignition?	—	Go to Step 2	Go to Step 18
18	Observe the DTC Information with a scan tool. Are there any DTCs that you have not diagnosed?	—	Go to DTC List	System OK

Step	Action	Value(s)	Yes	No
12	1. Inspect the fuel system line connections between the fuel tank and the fuel supply pump for tightness and all fuel hoses for cuts, cracks and for the use of proper clamps. 2. Repair or replace as necessary. Did you find and correct the condition?	—	Go to Step 20	Go to Step 13
13	1. Turn OFF the ignition. 2. Disconnect the FRP regulator harness connector. 3. Inspect for an intermittent, for poor connections and corrosion at the harness connector of the FRP regulator (pins 1 and 2 of E47). 4. Disconnect the ECM harness connector. 5. Inspect for an intermittent, for poor connections and corrosion at the harness connector of the ECM (pins 89, 97, 105 and 113 of E26). 6. Test for high resistance on each circuit. 7. Repair the connection(s) or circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 20	Go to Step 19
14	1. Turn OFF the ignition. 2. Disconnect the FRP sensor harness connector. 3. Inspect for an intermittent, for poor connections and corrosion at the harness connector of the FRP sensor (pins 1, 2 and 3 of E49). 4. Disconnect the ECM harness connector. 5. Inspect for an intermittent, for poor connections and corrosion at the harness connector of the ECM (pins 82, 87, 90 and 101 of E26). 6. Test for high resistance on each circuit. 7. Repair the connection(s) or circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 20	Go to Step 16
15	Replace the fuel filter element. Refer to Fuel Filter Element Replacement Procedure in Section 1D Engine Fuel. Did you complete the replacement?	—	Go to Step 20	—
16	Replace the FRP sensor. Refer to Fuel Pressure Sensor (Common Rail) in Section 1D Engine Fuel. Did you complete the replacement?	—	Go to Step 20	—
17	**Important**: Replacement fuel injector must be programmed. Replace the appropriate fuel injector that was leaking fuel found at Step 3 and inspect the engine mechanical for any damage or poor engine compression. Refer to Cylinder Head in Section 1B Engine Mechanical. Did you complete the replacement?	—	Go to Step 20	—

Step	Action	Value(s)	Yes	No
5	1. Test the signal circuit between the ECM (pin 72 of FB24) and the IAT sensor (pin 4 of J14) for the following conditions: • A short to ground • A short to the low reference circuit 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 9	Go to Step 7
6	Replace the IAT sensor. Refer to MAF (Mass Air Flow Sensor) in Section 1J Induction. Did you complete the replacement?	—	Go to Step 9	—
7	1. Turn OFF the ignition. 2. Disconnect the ECM harness connector. 3. Inspect connections at the harness connector of the ECM (pins 60 and 72 of FB24) for corrosion. 4. Repair or clean the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 9	Go to Step 8
8	**Important:** Replacement ECM must be programmed and learned. Replace the ECM. Refer to ECM Replacement. Did you complete the replacement?	—	Go to Step 9	—
9	1. Reconnect all previously disconnected harness connector(s). 2. Clear the DTCs with a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Start the engine. 5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/ Failure Records. Did the DTC fail this ignition?	—	Go to Step 3	Go to Step 10
10	Observe the DTC Information with a scan tool. Are there any DTCs that you have not diagnosed?	—	Go to DTC List	System OK

Circuit/ System Testing DTC P0113 (Flash Code 22)

Step	Action	Value(s)	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	—	Go to Step 2	Go to Diagnostic System Check - Engine Controls
2	1. Install a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Monitor the DTC Information with a scan tool. Is DTC P0651 also set?	—	Go to DTC P0651	Go to Step 3

Step	Action	Value(s)	Yes	No
6	**Notice:** The intake throttle position sensor shares the 5 volts reference circuit with other sensors. A fault condition in the 5 volts reference circuit may set DTCs on sensors that share this circuit. 1. Test the 5 volts reference circuit between the ECM (pin 95 of E26) and the intake throttle valve (pin 5 of E46) for an open circuit or high resistance. 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 12	Go to Step 9
7	1. Test the signal circuit between the ECM (pin 85 of E26) and intake throttle valve (pin 6 of E46) for the following conditions: • An open circuit • A short to ground • A short to the low reference circuit • High resistance 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 12	Go to Step 9
8	1. Inspect for an intermittent and for poor connections at the harness connector of the intake throttle valve (pins 5 and 6 of E46). 2. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 12	Go to Step 10
9	1. Turn OFF the ignition. 2. Disconnect the ECM harness connector. 3. Inspect for an intermittent and for poor connections at the harness connector of the ECM (pins 85 and 95 of E26). 4. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 12	Go to Step 11
10	Replace the intake throttle valve. Refer to Engine Exterior Parts in Section 1B Engine Mechanical. Did you complete the replacement?	—	Go to Step 12	—
11	**Important:** Replacement ECM must be programmed and learned. Replace the ECM. Refer to ECM Replacement. Did you complete the replacement?	—	Go to Step 12	—
12	1. Reconnect all previously disconnected harness connector(s). 2. Clear the DTCs with a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Start the engine. 5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/ Failure Records. Did the DTC fail this ignition?	—	Go to Step 3	Go to Step 13
13	Observe the DTC Information with a scan tool. Are there any DTCs that you have not diagnosed?	—	Go to DTC List	System OK

Step	Action	Value(s)	Yes	No
10	**Important:** The FRP sensor may be damaged if the sensor signal circuit is shorted to a voltage source. 1. Test the signal circuits between the ECM (pins 82 and 90 of E26) and the FRP sensor (pin 2 of E49) for a short to battery or ignition voltage. 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 15	Go to Step 14
11	1. Inspect for an intermittent and for poor connections at the harness connector of the FRP sensor (pins 1 and 2 of E49). 2. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 15	Go to Step 13
12	1. Turn OFF the ignition. 2. Disconnect the ECM harness connector. 3. Inspect for an intermittent and for poor connections at the harness connector of the ECM (pins 82, 90 and 101 of E26). 4. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 15	Go to Step 14
13	Replace the FRP sensor. Refer to Fuel Pressure Sensor (Common Rail) in Section 1D Engine Fuel. Did you complete the replacement?	—	Go to Step 15	—
14	**Important:** Replacement ECM must be programmed and learned. Replace the ECM. Refer to ECM Replacement. Did you complete the replacement?	—	Go to Step 15	—
15	1. Reconnect all previously disconnected harness connector(s). 2. Clear the DTCs with a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Start the engine. 5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/ Failure Records. Did the DTC fail this ignition?	—	Go to Step 3	Go to Step 16
16	Observe the DTC Information with a scan tool. Are there any DTCs that you have not diagnosed?	—	Go to DTC List	System OK

Step	Action	Value(s)	Yes	No
4	Connect a DMM between the cylinder #5 solenoid control circuit (pin 7 of H79 female side) and a known good ground. Is the DMM voltage less than the specified value?	16.0 volts	Go to Step 5	Go to Step 9
5	Is the DMM voltage more than the specified value at Step 4?	12.0 volts	Go to Step 6	Go to Step 10
6	1. Inspect for an intermittent and for poor connections at the in-line harness connector (pins 3 and 7 of H79). 2. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 15	Go to Step 7
7	1. Remove the cylinder head cover. Refer to Cylinder Head in Section 1B Engine Mechanical. 2. Inspect the fuel injector harness for loose injector terminal nuts, objects touching injector terminals. 3. Inspect for an intermittent and for poor connections at the in-line harness connector (pins 3 and 7 of H81). 4. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 15	Go to Step 11
8	1. Test the control circuit between the ECM (pin 120 of E26) and the in-line harness connector (pin 7 of H79 female side) for a short to the common 2 charge voltage circuit. 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 15	Go to Step 13
9	1. Test the control circuit between the ECM (pin 120 of E26) and the in-line harness connector (pin 7 of H79 female side) for a short to battery or ignition voltage. 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 15	Go to Step 13
10	1. Test the control circuit between the ECM (pin 120 of E26) and the in-line harness connector (pin 7 of H79 female side) for an open circuit or high resistance. 2. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 15	Go to Step 12
11	1. Test the cylinder #5 fuel injector circuit between the fuel injector terminals (pins 1, 2 and 3 of E75) and the in-line harness connector (pins 3 and 7 of H81) for the following conditions: • An open circuit • A short circuit each other • High resistance 2. Repair the circuit(s) or replace the fuel injector harness as necessary. Did you find and correct the condition?	—	Go to Step 15	Go to Step 13

Step	Action	Value(s)	Yes	No
8	Replace the boost pressure sensor. Refer to Engine Exterior Parts in Section 1B Engine Mechanical. Did you complete the replacement?	—	Go to Step 10	—
9	Replace the BARO sensor. Did you complete the replacement?	—	Go to Step 10	—
10	1. Reconnect all previously disconnected harness connector(s). 2. Clear the DTCs with a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Start the engine. 5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/ Failure Records. Did the DTC fail this ignition?	—	Go to Step 2	Go to Step 11
11	Observe the DTC Information with a scan tool. Are there any DTCs that you have not diagnosed?	—	Go to DTC List	System OK

Step	Action	Value(s)	Yes	No
5	Connect a DMM between the signal circuit (pin 1 of E50) and a known good ground. Is the DMM voltage more than the specified value?	5.5 volts	Go to Step 12	Go to Step 6
6	Is the DMM voltage more than the specified value at Step 5?	4.5 volts	Go to Step 7	Go to Step 11
7	1. Connect a test lamp between the signal circuit (pin 1 of E50) and a known good ground. 2. Connect a DMM between the probe of the test lamp and a known good ground. Is the DMM voltage more than the specified value?	4.5 volts	Go to Step 13	Go to Step 8
8	Connect a DMM between the 5 volts reference circuit and low reference (pins 2 and 3 of E50). Is the DMM voltage more than the specified value?	4.5 volts	Go to Step 14	Go to Step 10
9	**Notice:** The CKP sensor shares the 5 volts reference circuit with other sensors. A fault condition in the 5 volts reference circuit may set DTCs on sensors that share this circuit. 1. Test the 5 volts reference circuit between the ECM (pin 95 of E26) and the CKP sensor (pin 3 of E50) for an open circuit or high resistance. 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 19	Go to Step 15
10	**Notice:** The CKP sensor shares the low reference circuit with other sensors. A fault condition in the low reference circuit may set DTCs on sensors that share this circuit. 1. Test the low reference circuit between the ECM (pin 109 of E26) and the CKP sensor (pin 2 of E50) for an open circuit or high resistance. 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 19	Go to Step 15
11	1. Test the signal circuit between the ECM (pin 107 of E26) and the CKP sensor (pin 1 of E50) for the following conditions: • An open circuit • A short to ground • A short to the low reference circuit • High resistance 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 19	Go to Step 15
12	**Important:** The CKP sensor may be damaged if the sensor signal circuit is shorted to a voltage source. 1. Test the signal circuit between the ECM (pin 107 of E26) and the CKP sensor (pin 1 of E50) for a short to battery or ignition voltage. 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 19	Go to Step 18

Step	Action	Value(s)	Yes	No
5	1. Test the control circuit between the ECM (pin 10 of FB24) and the relay (pin 5 of X19) for the following conditions: • An open circuit • A short to ground • A short to battery or ignition voltage • High resistance 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 11	Go to Step 8
6	Repair the open circuit or high resistance between the Engine Controller (10A) fuse and the glow relay coil side (pin 3 of X19). Check the Engine Controller (10A) fuse first. Did you complete the repair?	—	Go to Step 11	—
7	1. Remove the glow relay. 2. Inspect for an intermittent and for a poor connection on each relay terminal. 3. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 11	Go to Step 9
8	1. Turn OFF the ignition. 2. Disconnect the ECM harness connector. 3. Inspect for an intermittent and for a poor connection at the harness connector of the ECM (pin 10 of FB24). 4. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 11	Go to Step 10
9	Replace the glow relay. Did you complete the replacement?	—	Go to Step 11	—
10	**Important:** Replacement ECM must be programmed and learned. Replace the ECM. Refer to ECM Replacement. Did you complete the replacement?	—	Go to Step 11	—
11	1. Reconnect all previously disconnected fuse, relay or harness connector(s). 2. Clear the DTCs with a scan tool. 3. Perform the Glow Relay Control with a scan tool. 4. Command the relay ON and OFF. Does the glow relay click with each command?	—	Go to Step 12	Go to Step 3
12	Observe the DTC Information with a scan tool. Are there any DTCs that you have not diagnosed?	—	Go to DTC List	System OK

Step	Action	Value(s)	Yes	No
6	Observe the EGR Position 1, 2 and 3 parameter with a scan tool while momentarily jumping a 3-amp fused jumper wire across the EGR valve harness connector between each signal circuit and the 5 volts reference circuit. • EGR position 1: pins 1 and 4 of E45 • EGR position 2: pins 1 and 3 of E45 • EGR position 3: pins 1 and 2 of E45 Is there parameter which did not indicate High when the circuit is jumpered?	—	Go to Step 10	Go to Step 11
7	**Important**: The EGR position sensor may be damaged if the sensor signal circuit is shorted to a voltage source. 1. Test the signal circuits (which ever parameter indicates High at Step 3) between the ECM (pins 93, 94 and 99 of E26) and the EGR valve (pins 2, 3 and 4 of E45) for the following conditions: • A short to battery or ignition voltage • A short to any 5 volts reference 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 16	Go to Step 15
8	**Notice:** The EGR position sensor shares the 5 volts reference circuit with other sensors. A fault condition in the 5 volts reference circuit may set DTCs on sensors that share this circuit. 1. Test the 5 volts reference circuit between the ECM (pin 87 of E26) and the EGR valve (pin 1 of E45) for an open circuit or high resistance. 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 16	Go to Step 13
9	**Notice:** The EGR position sensor shares the low reference circuit with other sensors. A fault condition in the low reference circuit may set DTCs on sensors that share this circuit. 1. Test the low reference circuit between the ECM (pin 101 of E26) and the EGR valve (pin 5 of E45) for an open circuit or high resistance. 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 16	Go to Step 13
10	1. Test the position sensor circuits (which ever parameter did not indicate High at Step 6) between the ECM (pins 93, 94 and 99 of E26) and the EGR valve (pins 2, 3 and 4 of E45) for the following conditions: • An open circuit • A short to ground • A short to the low reference circuit • High resistance 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 16	Go to Step 13

Step	Action	Value(s)	Yes	No
11	1. Test the vehicle speed sensor power supply circuit between the speed sensor control unit and the vehicle speed sensor for open circuits or high resistance. Refer to IP Cluster and Warning in Section 9D Wiring System. 2. Repair as necessary. Did you find and correct the condition?	—	Go to Step 28	Go to Step 14
12	1. Keep the ignition switch ON. 2. Connect a test lamp between the low reference circuit of the vehicle speed sensor and battery voltage. Refer to IP Cluster and Warning in Section 9D Wiring System. Does the test lamp illuminate?	—	Go to Step 13	Go to Step 17
13	1. Turn ON the ignition, with the engine OFF. 2. Intermittently jump the signal circuit of the vehicle speed sensor with a test lamp that is connected to 12 volts (apply form a battery) while monitoring the Vehicle Speed parameter with the scan tool. Refer to IP Cluster and Warning in Section 9D Wiring System. Does the scan tool indicate any vehicle speed when the circuit is intermittently pulled to 12 volts?	—	Go to Step 23	Go to Step 14
14	1. Turn OFF the ignition. 2. Disconnect the speed sensor control unit harness connector. 3. Connect a test lamp between the ignition voltage feed circuit of the speed sensor control unit harness (pin 1 of FU173) and a known good ground. 4. Turn ON the ignition, with the engine OFF. Does the test lamp illuminate?	—	Go to Step 15	Go to Step 18
15	1. Keep the ignition switch ON. 2. Connect a test lamp between the low reference circuit of the speed sensor control unit harness (pin 5 of FU173) and battery voltage. Does the test lamp illuminate?	—	Go to Step 16	Go to Step 19
16	1. Turn ON the ignition, with the engine OFF. 2. Intermittently jump the signal circuit of the speed sensor control unit (pin 3 of FU173) with a test lamp that is connected to 12 volts (apply form a battery) while monitoring the Vehicle Speed parameter with the scan tool. Does the scan tool indicate any vehicle speed when the circuit is intermittently pulled to 12 volts?	—	Go to Step 20	Go to Step 21
17	Repair any open circuits or high resistance in the vehicle speed sensor ground circuit between the vehicle speed sensor and the chassis ground (FU51). Refer to IP Cluster and Warning in Section 9D Wiring System. Did you complete the repair?	—	Go to Step 28	—

DTC P0601 (Flash Code 53)

Internal Control Module Memory Check Sum Error

Circuit Description

This diagnostic applies to internal microprocessor integrity conditions within the ECM.

Condition for Setting the DTC

- The ECM detects that the calculated checksum does not agree with the read only memory (ROM) internal registered checksum.

Action Taken When the DTC Sets

- The ECM illuminates the MIL when the diagnostic runs and fails. Refer to DTC Type Definitions for Action Taken When the DTC Sets - Type A.
- The ECM stops engine running. The engine will run after the key is cycled when the ignition has been turned OFF for longer than 10 seconds.

Condition for Clearing the DTC

- Refer to DTC Type Definitions for Condition for Clearing the MIL/ DTC - Type A.

Circuit/ System Testing DTC P0601 (Flash Code 53)

Step	Action	Value(s)	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	—	Go to Step 2	Go to Diagnostic System Check - Engine Controls
2	1. Install a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Monitor the DTC Information with a scan tool. Does the DTC fail this ignition?	—	Go to Step 3	Go to Step 4
3	**Important:** Replacement ECM must be programmed and learned. Replace the ECM. Refer to ECM Replacement. Did you complete the replacement?	—	Go to Step 4	—
4	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/ Failure Records. Did the DTC fail this ignition?	—	Go to Step 3	Go to Step 5
5	Observe the DTC Information with a scan tool. Are there any DTCs that you have not diagnosed?	—	Go to DTC List	System OK

DTC P0650 (Flash Code 77)

Malfunction Indicator Lamp (MIL) Control Circuit

Circuit Description

The malfunction indicator lamp (MIL) is located on the instrument panel (IP) cluster. The MIL informs the driver that an emission system fault has occurred and that the engine control system requires service.
The ECM monitors the MIL control circuit for conditions that are incorrect for the commanded state of the MIL. For example, a failure condition exists if the ECM detects low voltage when the MIL is commanded OFF, or high voltage when the MIL is commanded ON. If the ECM detects an improper voltage level on the control circuit, this DTC will set.

Condition for Running the DTC

- The battery voltage is between 18 to 32 volts.
- The ignition switch is ON.

Condition for Setting the DTC

Either of following condition is met:

- The ECM detects a low voltage condition on the MIL control circuit when the lamp is commanded OFF.
- The ECM detects a high voltage condition on the MIL control circuit when the lamp is commanded ON.

Action Taken When the DTC Sets

- The ECM illuminates the MIL when the diagnostic runs and fails. Refer to DTC Type Definitions for Action Taken When the DTC Sets - Type A.

Condition for Clearing the DTC

- Refer to DTC Type Definitions for Condition for Clearing the MIL/ DTC - Type A.

Diagnostic Aids

- If an intermittent condition is suspected, refer to Intermittent Conditions in this section.

Connector End View Reference: Engine Controls Connector End Views or ECM Connector End Views

Circuit/ System Testing DTC P0650 (Flash Code 77)

Step	Action	Value(s)	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	—	Go to Step 2	Go to Diagnostic System Check - Engine Controls
2	1. Verify whether the instrument panel (IP) cluster is operational. 2. Install a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Turn ON the ignition for 10 seconds. 5. Start the engine. 6. Monitor the DTC Information with a scan tool. Does the DTC fail this ignition?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn OFF the ignition. 2. Inspect the Meter (10A) fuse in the cabin fuse block. Is the Meter (10A) fuse open?	—	Go to Step 4	Go to Step 5
4	Replace the Meter (10A) fuse. If the fuse continues to open, repair the short to ground on one of the circuits that is fed by the Meter (10A) fuse or replace the shorted attached component. Did you complete the repair?	—	Go to Step 17	—
5	1. Turn OFF the ignition. 2. Disconnect the ECM FB24 harness connector. 3. Turn ON the ignition, with the engine OFF. Is the MIL OFF?	—	Go to Step 6	Go to Step 12

Step	Action	Value(s)	Yes	No
5	1. Leave the DMM connected to the boost pressure sensor harness connector. 2. Turn OFF the ignition. 3. Disconnect the intake throttle valve harness connector. 4. Turn ON the ignition, with the engine OFF. Does the DMM voltage change to more than the specified value?	4.5 volts	Go to Step 10	Go to Step 6
6	1. Leave the DMM connected to the boost pressure sensor harness connector. 2. Turn OFF the ignition. 3. Disconnect the crankshaft position (CKP) sensor harness connector. 4. Turn ON the ignition, with the engine OFF. Does the DMM voltage change to more than the specified value?	4.5 volts	Go to Step 11	Go to Step 7
7	1. Test the 5 volts reference circuit 4 between the ECM (pin 95 of E26) and the following components for a short to ground or short to the low reference circuit: • CKP sensor (pin 3 of E50) • Boost pressure sensor (pin 3 of E54) • Intake throttle position sensor (pin 5 of E46) 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 13	Go to Step 12
8	1. Test the 5 volts reference circuit 4 between the ECM (pin 95 of E26) and the following components for a short to battery or ignition voltage. • CKP sensor (pin 3 of E50) • Boost pressure sensor (pin 3 of E54) • Intake throttle position sensor (pin 5 of E46) 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 13	Go to Step 12
9	Replace the boost pressure sensor. Refer to Engine Exterior Parts in Section 1B Engine Mechanical. Did you complete the replacement?	—	Go to Step 13	—
10	Replace the intake throttle valve. Refer to Engine Exterior Parts in Section 1B Engine Mechanical. Did you complete the replacement?	—	Go to Step 13	—
11	Replace the CKP sensor. Refer to Engine Exterior Parts in Section 1B Engine Mechanical. Did you complete the replacement?	—	Go to Step 13	—
12	**Important:** Replacement ECM must be programmed and learned. Replace the ECM. Refer to ECM Replacement. Did you complete the replacement?	—	Go to Step 13	—

DTC P1664 (Flash Code 76)

Service Vehicle Soon Lamp Control Circuit

Circuit Description

The service vehicle soon (SVS) lamp is located on the instrument panel (IP) cluster. The SVS lamp informs the driver that a non-emission related fault has occurred and vehicle service required.
The ECM monitors the SVS lamp control circuit for conditions that are incorrect for the commanded state of the SVS lamp. For example, a failure condition exists if the ECM detects low voltage when the SVS lamp is commanded OFF, or high voltage when the SVS lamp is commanded ON. If the ECM detects an improper voltage level on the control circuit, this DTC will set.

Condition for Running the DTC

- The battery voltage is between 18 to 32 volts.
- The ignition switch is ON.

Condition for Setting the DTC

Either of following condition is met:

- The ECM detects a low voltage condition on the SVS lamp control circuit when the lamp is commanded OFF.
- The ECM detects a high voltage condition on the SVS lamp control circuit when the lamp is commanded ON.

Action Taken When the DTC Sets

- The ECM will illuminate the SVS lamp. Refer to DTC Type Definitions for Action Taken when the DTC Sets - Type C.

Condition for Clearing the DTC

- Refer to DTC Type Definitions for Condition for Clearing the SVS Lamp/ DTC - Type C.

Diagnostic Aids

- If an intermittent condition is suspected, refer to Intermittent Conditions in this section.

Connector End View Reference: Engine Controls Connector End Views or ECM Connector End Views

Circuit/ System Testing DTC P1664 (Flash Code 76)

Step	Action	Value(s)	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	—	Go to Step 2	Go to Diagnostic System Check - Engine Controls
2	1. Verify whether the instrument panel (IP) cluster is operational. 2. Install a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Turn ON the ignition for 10 seconds. 5. Start the engine. 6. Monitor the DTC Information with a scan tool. Does the DTC fail this ignition?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn OFF the ignition. 2. Inspect the Meter (10A) fuse in the cabin fuse block. Is the Meter (10A) fuse open?	—	Go to Step 4	Go to Step 5
4	Replace the Meter (10A) fuse. If the fuse continues to open, repair the short to ground on one of the circuits that is fed by the Meter (10A) fuse or replace the shorted attached component. Did you complete the repair?	—	Go to Step 17	—
5	1. Turn OFF the ignition. 2. Disconnect the ECM FB24 harness connector. 3. Turn ON the ignition, with the engine OFF. Is the SVS lamp OFF?	—	Go to Step 6	Go to Step 12

Step	Action	Value(s)	Yes	No
7	**Important:** The APP sensor 2 may be damaged if the sensor signal circuit is shorted to a voltage source. 1. Test the signal circuit between the ECM (pin 64 of FB24) and the APP sensor (pin 2 of FL1) for the following conditions: • A short to battery or ignition voltage • A short to any 5 volts reference 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 13	Go to Step 12
8	**Notice:** The APP sensor 2 shares the low reference circuit with other sensors. A fault condition in the low reference circuit may set DTCs on sensors that share this circuit. 1. Test the low reference circuit between the ECM (pin 60 of FB24) and the APP sensor (pin 3 of FL1) for an open circuit or high resistance. 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 13	Go to Step 10
9	1. Inspect for an intermittent and for a poor connection at the harness connector of the APP sensor (pin 3 of FL1). 2. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 13	Go to Step 11
10	1. Turn OFF the ignition. 2. Disconnect the ECM harness connector. 3. Inspect for an intermittent and for a poor connection at the harness connector of the ECM (pin 60 of FB24). 4. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 13	Go to Step 12
11	Replace the APP sensor. Refer to Accelerator Control Assembly in Section 1I Engine Speed Control System. Did you complete the replacement?	—	Go to Step 13	—
12	**Important:** Replacement ECM must be programmed and learned. Replace the ECM. Refer to ECM Replacement. Did you complete the replacement?	—	Go to Step 13	—
13	1. Reconnect all previously disconnected harness connector(s). 2. Clear the DTCs with a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Start the engine. 5. Fully depress and release the accelerator pedal while observing the APP Sensor 1 parameter with the scan tool. Does the scan tool indicate more than the specified value during depressing or releasing the pedal?	4.9 volts	Go to Step 3	Go to Step 14
14	Observe the DTC Information with a scan tool. Are there any DTCs that you have not diagnosed?	—	Go to DTC List	System OK

Step	Action	Value(s)	Yes	No
11	1. Reconnect all previously disconnected harness connector(s). 2. Clear the DTCs with a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Start the engine. 5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/ Failure Records. Did the DTC fail this ignition?	—	Go to Step 3	Go to Step 12
12	Observe the DTC Information with a scan tool. Are there any DTCs that you have not diagnosed?	—	Go to DTC List	System OK

Step	Action	Value(s)	Yes	No
13	**Important:** The idle up sensor may be damaged if the sensor signal circuit is shorted to a voltage source. 1. Test the signal circuit between the ECM (pin 66 of FB24) and the idle up sensor (pin 2 of FL33) for the following conditions: • A short to battery or ignition voltage • A short to any 5 volts reference 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 19	Go to Step 18
14	**Notice:** The idle up sensor shares the low reference circuit with other sensors. A fault condition in the low reference circuit may set DTCs on sensors that share this circuit. 1. Test the low reference circuit between the ECM (pin 41 of FB24) and the idle up sensor (pin 1 of FL33) for an open circuit or high resistance. 2. Repair the circuit(s) as necessary. Did you find and correct the condition?	—	Go to Step 19	Go to Step 16
15	1. Inspect for an intermittent and for poor connections at the harness connector of the Idle up sensor (pins 1, 2 and 3 of FL33). 2. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 19	Go to Step 17
16	1. Turn OFF the ignition. 2. Disconnect the ECM harness connector. 3. Inspect for an intermittent and for poor connections at the harness connector of the ECM (pins 41, 42 and 66 of FB24). 4. Repair the connection(s) as necessary. Did you find and correct the condition?	—	Go to Step 19	Go to Step 18
17	Replace the idle up sensor. Did you complete the replacement?	—	Go to Step 19	—
18	**Important:** Replacement ECM must be programmed and learned. Replace the ECM. Refer to ECM Replacement. Did you complete the replacement?	—	Go to Step 19	—
19	1. Reconnect all previously disconnected harness connector(s). 2. Clear the DTCs with a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Start the engine. 5. Fully turn the idle up sensor between lowest position (full counterclockwise direction) and highest position (full clockwise direction) while observing the Idle Up Sensor parameter with a scan tool. Does the scan tool indicate within the specified value during turning the sensor?	0.2 to 4.8 volts	Go to Step 20	Go to Step 3
20	Observe the DTC Information with a scan tool. Are there any DTCs that you have not diagnosed?	—	Go to DTC List	System OK

Glow Control System Check

Description

The glow control system consists of the ECM, the glow relay, the glow plug lamp and glow plugs. The glow control system is operated when the engine coolant temperature is low, which allows easier engine starting. The ECM commands the glow relay ON for a certain length of time at ignition switch is ON with engine OFF. In after glow phase, the glow plugs remain energized for a certain period with engine run.

Glow Control Operation

- The glow plug lamp illuminates between 1.5 seconds to approximately 10 seconds depending upon the engine coolant temperature. It illuminates 1.5 seconds at -5°C (23°F) or more.
- In pre glow phase, the glow relay energizes between 3 seconds to approximately 15 seconds depending upon the engine coolant temperature.
- In after glow phase, the glow relay energizes between 3 seconds to approximately 30 seconds depending upon the engine coolant temperature.

Connector End View Reference: Engine Controls Connector End Views or ECM Connector End Views

Circuit/ System Testing Glow Control System Check

Step	Action	Value(s)	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	—	Go to Step 2	Go to Diagnostic System Check - Engine Controls
2	1. Install a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Monitor the DTC Information with a scan tool. Is DTC P0117, P0118, P0380 or P0381 set?	—	Go to Applicable DTC	Go to Step 3
3	1. Turn OFF the ignition. 2. Make sure the metal bus bar that connects switched battery voltage supply terminal (E31) and all glow plugs is secured tightly. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between the metal bus bar (glow plug power supply E31 terminal) and a known good ground. 5. Perform the Glow Relay Control with a scan tool. 6. Command the relay ON while observing the test lamp. Does the test lamp turn ON only when commanded ON?	—	Go to Step 4	Go to Step 5
4	1. Turn OFF the ignition. 2. Remove the metal bus bar from the glow plugs. 3. Measure resistance of each glow plug between the glow plug terminals and a known good ground. Make sure to record all measurements and take them quickly as to not allow engine temperature changes between measurements. Are the resistances within the specified value each other?	1 Ω	System OK	Go to Step 15

- The MIL/ SVS lamp circuit intermittently shorted to ground
- Electrical system interference caused by a malfunctioning relay, ECM driven solenoid, or switch. The electrical component can cause a sharp electrical surge. Normally, the problem will occur when the malfunctioning component is operating.
- There are any open diodes.

Important: The following symptom tables contain groups of possible causes for each symptom. The order of these procedures is not important. If the scan tool readings do not indicate the problems, then proceed in a logical order, easiest to check or most likely to cause first. In order to determine if a specific vehicle is using a particular system or component, refer to engine control wirings for an application.

Important: Use the following tables when diagnosing a symptom complaint:

- Intermittent Conditions
- Hard Start
- Rough, Unstable, or Incorrect Idle and Stalling
- High Idle Speed
- Cuts Out
- Surges
- Lack of Power, Sluggishness or Sponginess
- Hesitation, Sag or Stumble
- Abnormal Combustion Noise
- Poor Fuel Economy
- Excessive Smoke (Black Smoke)
- Excessive Smoke (White Smoke)

Cuts Out

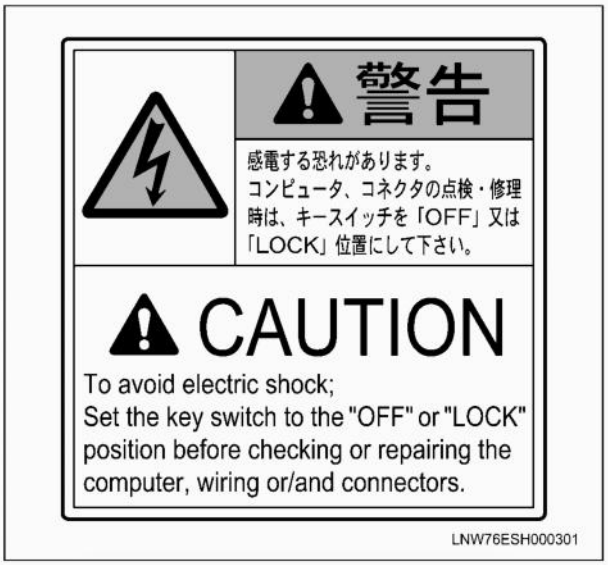
Checks	Action
Definition: A constant jerking that follows the engine speed, usually more pronounced as the engine load increase. The exhaust has a steady spitting sound at idle, low speed, or hard acceleration for the fuel starvation that can cause the engine to cut-out.	
Preliminary Check	• Diagnostic System Check - Engine Controls. • Perform the Supply Pump Functional Inspection. Refer to Fuel System in Section 1D Engine Fuel (6HK1). • Inspect that the harness connectors are correctly connected. • Inspect the ECM grounds for being clean, tight, and in their proper locations. • Inspect the Scan Tool Data List in this section. • Inspect the Service Bulletin.
Sensor Checks	Inspect the engine control sensors for the following conditions. Refer to Scan Tool Data List in this section. • Observe the Mass Air Flow (MAF) parameter for a skewed or slow MAF sensor. • Observe the Fuel Rail Pressure Sensor parameter with the engine OFF. The FRP Sensor should read 0.9 to 1.0 volt with the ignition switch ON and engine OFF after the engine has stopped running for a minimum of 1 minute. If not, check for high resistance in each circuit or for a skewed sensor. • Observe the Fuel Rail Pressure and Desired Fuel Rail Pressure parameter between idle and W.O.T. (accelerator pedal full travel) in Neutral. Fuel Rail Pressure parameter should follow within ± 5 MPa (± 725 psi) quick enough. • Observe the Accelerator Pedal Position (APP). APP parameter should change linearly from 0 to 100% according to the accelerator pedal operation. • Crankshaft position (CKP) sensor is tight and the sensor rotor is not damaged.
Fuel System Checks	Inspect the fuel system for the following conditions. Refer to Fuel System Check chart and appropriate procedure in Section 1D Engine Fuel. • Air in the fuel system. • Water contamination in the fuel. • Fuel waxing or icing. • Fuel filter clogging. • Fuel leak off from the fuel pressure limiter valve and fuel injectors. • Fuel lines between the fuel tank and fuel supply pump for being crushed, kinked, tightness, cracks and plugged. • Inside the fuel tank for any foreign material that may be getting drawn into the fuel line pickup causing a blocked condition. • Perform the Cylinder Balance Test with a scan tool. • Perform the Injector Forced Drive with a scan tool. • Observe the Fuel Compensation for each cylinder at idle on the scan tool.

Checks	Action
Air Intake System Checks	Inspect the air intake system for the following conditions. • Air cleaner, air intake ducts and charge air cooler for a restriction, holes, or leaks. • A restriction in the turbocharger inlet duct. • Intake throttle valve for a stuck condition. • A restriction or leak in the intake manifold. • A worn or damaged turbocharger turbine wheel, shaft or compressor wheel. Refer to Turbocharger Assembly in Section 1J Induction. • Turbocharger nozzle control solenoid for a stuck condition. Refer to Turbocharger Assembly in Section 1J Induction.
Exhaust System Checks	Inspect the exhaust system for a possible restriction. Refer to Exhaust System in Section 1G Engine Exhaust.
Engine Mechanical Checks	Inspect the engine mechanical for the following conditions. Refer to Section 1B Engine Mechanical. • Poor cylinder compression. • Improper valve gap. • Broken or weak valve springs. • Worn camshaft lobes.

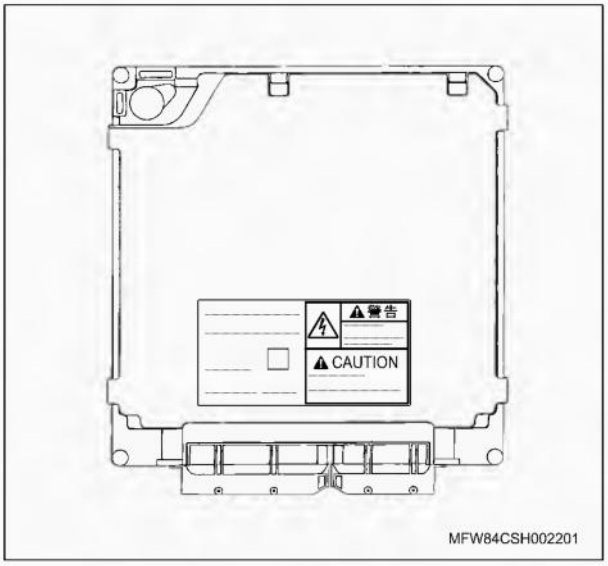
Description and Operation

Engine Control Module (ECM) Description

Engine Control Module (ECM) Service Precautions



Important: The symbol "**!**" warns you of an electric shock hazard. To avoid shock and possible serious injury, DO NOT touch the terminals. When disconnecting the harness connectors, always turn OFF the ignition switch or disconnect the battery cable.



The engine control module (ECM) is designed to withstand normal current draws associated with vehicle operation. Avoid overloading any circuit. When testing for opens and shorts, do not ground or apply voltage to any of the ECM circuits unless instructed to do so. In some cases, these circuits should only be tested using a DMM. The ECM should remain connected to the ECM harness. The ECM mainly controls the following items:

- The fuel system control
- The exhaust gas recirculation (EGR) system control
- The turbocharger system control
- The preheating (glow) system control
- The exhaust brake system control
- On-board diagnostics for engine control

The ECM constantly observes the information from various sensors. The ECM controls the systems that affect vehicle performance. The ECM performs the diagnostic function of the system. The ECM can recognize operational problems, alert the driver through the malfunction indicator lamp (MIL), and store diagnostic trouble codes (DTCs). DTCs identify the system faults to aid the technician in making repairs.