

Hard Start and No Start Diagnostics

International[®] MaxxForce[™] 7
Beginning with 2007 Model Year

Technician	Miles	Transmission:	Ambient temperature	Engine SN	ECM Calibration
Date	Hours	Manual Auto	Coolant temperature	Engine HP	Turbocharger
Unit No.	VIN	Build date	Complaint	EFRC	

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WARNING

To prevent personal injury or death, read all safety instructions in the "Safety Information" section of *Engine Diagnostics Manual* EGES-350 before doing form procedures.

Header Information and Specifications

- Look up the VIN on ISIS[®] for build date, engine hp, engine serial number, ECM calibration, and transmission.
- 2. See Performance Specifications for EFRC.
- Use Performance Specifications to fill in the specifications needed for some tests.
- 4. Detailed information on these procedures can be found in *Engine Diagnostics Manual* EGES-350.
- Do all tests in sequence unless directed otherwise. It is not necessary to complete the rest of the form after the problem has been found and corrected.

1. Visual Inspection

- ☐ Check all fluid levels
- ☐ Inspect electrical connectors
- ☐ Inspect air filter minder
- ☐ Inspect for exhaust damage

Air filter good?	☐ Yes ☐ No
Power and ground supply good?	☐ Yes ☐ No
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	Quantity	Quality
Fuel		
Oil		
Coolant		

2. Initial Ignition Switch ON (Do not crank)

- ☐ Look for WAIT TO START lamp to come on (2-10 seconds, temperature dependent).
- ☐ Check indicator for WATER IN FUEL lamp.

Comments			

- If the WAIT TO START lamp and WATER IN FUEL lamp come on and off, do Test 4 - Diagnostic Trouble Codes and KOEO Standard test.
- If the WATER IN FUEL lamp stays on, take a fuel sample and evaluate quality. If water is present, drain and service primary service filter.

3. Engine Cranking and EST Datalist

☐ Open Hard Start and No Start session with EST. ☐ Start or crank engine for no more than 20 seconds.

PID	Specification	Actual
VBAT		
RPM		
FRP		
EGRP		

- If cranking rpm is below specification, check batteries and starting system.
- If fuel rail pressure does not increase, do Test 6.1 Low Fuel Supply Pressure.
- If no rpm signal, see "CMP Sensor" and "CKP Sensor in Section 7. If any DTCs are set, correct fault code before continuing.
- EGRP should equal 0.

4.1 Diagnostic Trouble Codes

☐ Open VIN session with EST (Verify ECM software matches vehicle).

Active DTCs	Inactive DTCs

- If ECM software does not match, reprogram the ECM.
- If any DTCs are set, correct fault before continuing.

4.2 KOEO Standard Test

☐ Use EST to run KOEO Standard test

Active DTCs	Inactive DTCs		

• If any DTCs are set, correct fault code before continuing.

5.1 Glow Plug System Checks

Note: Batteries must be fully charged to run this test.

Note: This test will only remain active for two 30 second intervals before a new key cycle is required.

☐ Run Glow Plug Output State test. Record results within 30 seconds of selecting test.

Output amporago	Right	Left
Output amperage		

- If reading is 0 amps, do Test 5.2 Relay Checks.
- If reading is above or below on either side, do Test 5.3 Glow Plug Checks.

5.2 Relay Checks

- ☐ Measure voltage on BATT side of relav.
- ☐ Run Output State test.
- ☐ Measure voltage on relay output side.

Valtana	BATT Side	Output Side
Voltage		

- If reading is 0 volts on BATT side, repair open circuit.
- If reading is 0 volts on output side, replace relay.

5.3 Glow Plug Checks

 $\hfill \square$ Measure resistance of glow plugs from the failed side.

	Right			
	1	3	5	7
Resistance Specification				
0.1 to 6 ohms	Left			
	2	4	6	8

- If out of specification, replace failed glow plugs.
- \bullet If within specification, replace glow plug harness.

6.1 Low Fuel Supply Pressure

Note: Before begining, check oil level and fuel quality. If oil level is overfilled and diluted with fuel, do Test 7 - High-pressure Pump Check.

☐ Use a digital fuel pressure gauge or high resolution analog gauge to measure clean side fuel pressure at the bottom of secondary fuel filter assembly.

Pressure	Specification	Actual

- If pressure is low, measure dirty side fuel pressure at the top of secondary fuel filter housing assembly.
- If clean side is low, and dirty side is okay, replace fuel filter.
- If both sides are low, do Test 6.2 Fuel Inlet Restriction.

6.2 Fuel Inlet Restriction

☐ Measure fuel inlet restriction at the Fuel Restriction Test Cap.

Fuel Inlet	Specification	Actual
Restriction		

- If restriction is low, check for air leak on suction side of system (pick-up tube, lines, primary filter, and primer pump).
- If restriction is high, check for restriction between the tank and the pump inlet (pick-up tube, lines, primary filter, and primer pump).
- If restriction is okay, do Test 6.3 Fuel Return Inspection.

6.3 Fuel Return Inspection

☐ Disconnect fuel system return line and monitor fuel flow.

Comments			

- If no return fuel is present, install a short fuel line at inlet of of low-pressure pump to verify pump operation. If no fuel is drawn from external source, replace low-pressure pump.
- If return fuel is present, replace the secondary fuel filter assembly. The module contains the fuel pressure regulator which is not serviceable.

Note: When doing any of the following diagnostic tests, all disconnected high-pressure lines with compression fittings must be replaced. Use Fuel System Caps to cap off all fuel system components to maintain fuel system cleanliness. If FRP sensor is removed, a new sensor is required.

7. High-pressure Pump Check

- ☐ Use EST to do Output State Test low and high for FPCV and FVCV.
- ☐ Connect breakout box between ECM and harness.

 Measure voltage from E-22 to GND and E-61 to GND.

	Spec	Actual
FPCV Low	5.5 V	
FVCV Low	5.5 V	
FPCV High	12 V	
FVCV High	12 V	

- If not in spec, verify 3 ohms resistance for each circuit.
 Connect breakout box to ECM Pin E-22 to ECM PWR relay
 Pin 87 using breakout tee. Then check ECM Pin E-61 to Pin 87
 ECM PWR relay using breakout tee.
- If > 3 ohms, see "FPCV" and "FVCV" in Section 7 for wiring.

8. FRP Sensor Check

☐ Use EST to do KOEO Continuous Monitor test. ☐ Record FRP sensor reading on Diagnostic Form.

	Specification	Actual
FRP sensor		

- If not in spec, see "FRP Sensor" in Section 7.
- If in spec, do Test 9 High-pressure Fuel System Leak Test.

9. High-pressure Fuel System Leak Test

- ☐ Remove high-pressure pump left tube assembly at high-pressure pump and block off pump port. Use Fuel Rail Block-Off Plugs (ZTSE4861).
- ☐ Using breakout tee, apply 12 volts to Pin 87 of the ECM power relay and ground Pin E-22 and E-61 through the breakout box.

Note: Voltage should only be applied for a short time.

- ☐ Crank engine for 15 to 20 seconds.
- If engine does not start, reconnect the left side injectors.
 Remove high-pressure pump right tube assembly at high-pressure pump and block off pump port. Disconnect the 15-pin connector on the on the right side.
- ☐ Using breakout tee, apply 12 volts to Pin 87 of the ECM power relay and ground Pin E-22 and E-61 through the breakout box.

Note: Voltage should only be applied for a short time.

- ☐ Crank engine for 15 to 20 seconds.
- If engine starts, reconnect the 15-pin connector and cap off each injector on the right side to isolate a failed injector.
- If engine starts with left side blocked off, reconnect the left side and cap off each injector on the left side to isolate a failed injector.
- If engine does not start after both sides have been blocked off, cap off all 8 injectors, and do Test 10 - Fuel Rail Pressure Check.

Comments			

10. Fuel Rail Pressure Check

☐ Remove valve covers. Use Fuel Rail Block Off Plugs (ZTSE4861) to cap off all injectors.

Note: Ensure high-pressure fuel line from pump is installed to both rails.

☐ Install high-pressure fuel lines to the rail.

☐ Crank engine. Use EST to monitor FRP (5000 psi min).

	Specification	Actual
FRP		

 If minimum FRP is not met, and no fuel leaks are present, replace high-pressure pump.

Note: Ensure minimum fuel supply pressure is met.



Performance Diagnostics

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Unit No.	VIN	Build date	Complaint	EFRC	

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Header Information and Specifications

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1. Visual Inspection

- ☐ Check all fluid levels
- $\ \square$ Inspect electrical connectors
- ☐ Inspect air filter minder
- ☐ Inspect for exhaust damage

Air filter good?	☐ Yes ☐ No
Power and ground supply good?	☐ Yes ☐ No

	Quantity	Quality
Fuel		
Oil		
Coolant		

2. DTCs and ECM Calibration

☐ Open VIN session with EST. (Verify ECM software matches vehicle. Ensure ECM calibration is current.)

Specification		Actual
Active DTCs	InActive DTCs	

- If ECM software does not match, reprogram the ECM.
- If any DTCs are set, correct fault before continuing.

3. KOEO Standard Test

 $\hfill\square$ Use EST to run KOEO Standard test

Active DTCs	Inactive DTCs

If any DTCs are set, correct fault code before continuing.

4. Sensor Compare

- ☐ Open Sensor Compare session with EST.
- ☐ Run Continuous Monitor test.
- ☐ Verify EBP and MAP match and are in KOEO specification.
- ☐ Verify FRP and BARO are in KOEO specification.
- ☐ Verify Accelerator Pedal travels from 0% to 99%.
- ☐ Verify EBP tube is intact and not restricted.

PID	Spec	Actual	PID	Spec	Actual
EBP			EGT1		
MAP			EGT2		
FRP			EGT3		
BAP			EGDP		
APS			ITV		

 If any results are out of specification, see Section 7 in EGES-350.

5. KOER Standard Test

Note: Engine coolant temperature must be above 70 °C (158 °F).

Use EST to run KOER Standard test

Active DT	Cs		

• If any DTCs are set, correct fault code before continuing.

6. KOER Air Management Test

☐ Use EST to run Air Management Test. ☐ Monitor EGR valve position using EST.

Active DTCs	

Correct problem causing messages or DTCs before continuing.

7.1 Fuel Pressure

☐ Measure fuel pressure at the secondary fuel filter housing test port.

Fuel Pressure	Specification	Actual
Low idle		
High idle		

- If fuel pressure is low or slow to build, replace both fuel filters. Test again.
- If fuel pressure remains low, do Test 7.3 Fuel Inlet Restriction.
- If fuel pressure is in specification, continue to next test.
- If fuel pressure is low, restrict return fuel line and test pressure.
- If fuel pressure builds, the Pressure Regulator Housing is suspect.
- If fuel pressure is still low after restricting return fuel line, fuel pump and fuel lines are suspect. Inspect and repair as required.

7.2 Fuel Rail Pressure

☐ Use EST to monitor fuel rail pressure and engine speed

Condition	Specification	Actual
Low idle		
High idle (initial)		
High idle (after 2 min.)		

- If fuel rail pressure is not in specification, do Hard Start and No Start diagnostic tests 7-10 (side 1).
- If fuel rail pressure is in specification, continue to next test.

7.3 Fuel Inlet Restriction

Note: Test is only valid if engine starts and achieves high idle.

☐ Measure fuel inlet restriction at the Fuel Restriction Test Cap.

☐ Start engine and accelerate to high idle. Record results.

Restriction	Specification	Actual
0-30 in Hg		
vac gauge		

 If restriction is above specification, check lines between tank and pump for blockage.

8. Road Test (0-60 mph, full throttle)

- ☐ Connect fuel gauge to fuel filter housing test port.
- ☐ Open RoadPerformance session using EST.
- ☐ Verify coolant temperature is above 70 °C (158 °F).
- ☐ Setup EST to record a snapshot from 0 mph to 60 mph. Playback the snapshot and record results.
- ☐ Run engine at 0-60 mph, full throttle. Record max. results.

Note: Data should be collected at full load, rated speed.

Measurement	Specification	Actual
Engine load		
MAP		
EBP		
FRP		
Low supply FP		

- If not in specification, refer to Section 7 in EGES-350 for diagnostic troubleshooting procedures.
- If all measurements are in specification, the engine does not have a performance problem. Do not continue with remaining performance tests.

9. Crankcase Pressure

Note: Engine coolant temperature must be above 70 °C (158 °F).

- ☐ Measure at oil fill tube with crankcase pressure test adapter.
- $\hfill\square$ Clamp off crankcase breather hose.
- ☐ Measure at high idle and no load.

Restrictor Tool	Specification	Actual
0-30 in Hg		
vac gauge		

10. Injector Disable

☐ Use EST to run injector disable diagnostics to identify suspect cylinders.

Selected Cylinder	EOT	Average Fuel Rate	Average Engine Load	rpm
1				
2				
3				
4				
5				
6				
7				
8				

• If any cylinder is suspect, do Manual Compression Test.

11. Manual Compression Test

- □ Disconnect CKP or CMP sensor to disable engine starting.
 □ Remove left bank glow plug and install Compression Test
 Adapter and Cylinder Compression Gauge. Test cylinders individually.
- ☐ Turn ignition switch to ON. Crank no more than 4 times.
- □ Record pressure.
- ☐ Reinstall glow plug using Glow Plug Installer Sleeve and Glow Plug Socket.
- ☐ Repeat procedure for all remaining cylinders.

	Cylinder Compression	Pressure
Cyl 1		
Cyl 2		
Cyl 3		
Cyl 4		
Cyl 5		
Cyl 6		
Cyl 7		
Cyl 8		

- If pressure difference is within 10 percent of each other, continue to next test.
- If pressure difference is greater than 10 percent of each other, contact International ® Technical Services at 1-800-336-4500 to start a case file.

12. Torque Converter Stall (Automatic only)

- ☐ Set parking brake and apply service brake.
- ☐ Put transmission in drive.
- ☐ Push accelerator to the floor. Time and monitor tachometer until tachometer stops moving.
- ☐ Record rpm and time. Continue to next test.

Condition	Specification	Actual
Stall rpm		
Time (Idle to stall in sec.)		

13. Intake Restriction

☐ Check hoses and piping for damage or incorrect fit.

☐ Measure restriction at high idle, no load.

	at mgm rate, me read.	
Restriction	Specification	Actual
0-30 in Hg		
vac gauge		

14. Exhaust Restriction

☐ Inspect exhaust system.

☐ Use EST to monitor EBP at high idle, no load.

Pressure	Specification	Actual
EBP PID		

- If pressure is above specification, remove turbo outlet exhaust pipe and test again.
- If pressure is good with pipe removed, correct problem from turbocharger to tail pipe.
- If EBP is still high with turbo outlet exhaust pipe removed, repair or replace turbocharger.