Performance Diagnostics

VT 275

Technician _____ Kilometers ____ Transmission
Date _____ Miles _____ Manual ____ Auto ____
Hours _____
Unit No. _____ VIN _____ Truck build _____

Ambient temperature _____
Coolant temperature _____
Complaint _____

Engine SN _____
Engine HP _____
Engine Family Rating Code _____

ECM calibration _____
IDM calibration _____
Injector No. _____
Turbocharger No. _____

WARNING

To avoid serious personal injury, possible death or damage to the engine or vehicle, read all safety instructions in the "Safety information" section of *Engine Diagnostics Manual* EGES-305 before doing procedures on this form.

Notes

See "Performance Diagnostics"- Section 6 in EGES-305. Use figures and additional information to do each test or procedure on this form. Record results on this form.

Do all checks in sequence unless otherwise stated. Doing a check or test out of sequence could cause incorrect results.

If a problem was found and corrected, **it is not necessary to complete the rest of the form** unless a performance concern remains.

See Appendix A in EGES-305 for engine specifications.

See Appendix B in EGES-305 or Form CGE 310-1 for Diagnostic Trouble Codes (DTCs).

1. Diagnostic Trouble Codes

☐ Install Electronic Service Tool (EST).
☐ Use EST to read DTCs.
☐ Use EST to check KOEO values for temperature and pressure sensors.

Active DTCs	
Inactive DTCs	
Abnormal sensor values Suspect sensor/value	Yes ☐ No ☐

- Correct problem causing active DTCs before continuing.
- To access DTCs without EST, see “Diagnostic Software Operation” - Section 3.

2. KOEO Standard Test

☐ Use EST to run KOEO Standard Test

Active DTCs

- Correct problem causing active DTCs before continuing.
- If an EST is not available, see “Standard Test Using Cruise Switches” in Section 3.

3. KOEO Injector Test

☐ Use EST to run KOEO Injector Test.

DTCs found

- Correct problem causing active DTCs before continuing.

4. Engine Oil

☐ Leaks
☐ Contaminated oil (fuel or coolant)
☐ Oil grade, viscosity, and level
☐ Kilometers or Miles and hours on oil

Comments

5. Fuel Supply System

☐ Measure pressure at the secondary fuel filter housing test port.
☐ If no concerns are found in test 5.1, do not continue testing fuel system.

5.1. Pressure, quality and aerated fuel	Fuel in tank	Yes ☐ No ☐
	Hear FP running	Yes ☐ No ☐
First sample	Aerated fuel	Yes ☐ No ☐
	Contaminated fuel	Yes ☐ No ☐
Second sample (if needed)	Aerated fuel	Yes ☐ No ☐
	Contaminated fuel	Yes ☐ No ☐
	Fuel pressure KOEO	Spec Actual
	Fuel pressure low idle	Spec Actual
	Fuel pressure high idle	Spec Actual
5.2. Fuel pump discharge pressure	Discharge pressure	Spec Actual
5.3. Fuel pump inlet restriction	Restriction	Spec Actual

- If a hum can not be heard from the HFCM, verify fuel pump is being powered. Repair as necessary.
- If fuel has air bubbles, check for leaks in supply lines - tank to HFCM.
- If fuel is contaminated, correct condition.
- If fuel pressure is low or slow to build, replace both filters and retest.
- If fuel pressure is still low or slow to build, do test 5.2.
- If pump discharge pressure is in specification, inspect fuel regulator valve.
- If discharge pressure is low or slow to build, do test 5.3.

6. Intake and Exhaust Restriction

☐ Air inlet and duct
☐ Hose and piping
☐ Intake and exhaust restriction
☐ Measure restriction at high idle, no load.

Instrument	Spec	Actual
Magnehelic gauge or Manometer		
Comment		

- Correct problem causing out-of-specification values, before continuing.

7. KOER Standard Test

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

☐ Use EST to run KOER Standard Test.

DTCs found

- Correct problem causing active DTCs before continuing.

8. Injection Control Pressure

☐ Use EST to monitor ICP and engine speed.

Condition	Spec	Actual
Low idle		
High idle - Initial		
High idle - After 2 minutes		
Aerated oil Yes ☐ No ☐		

- If ICP is high or unstable, hold at high idle for 2 minutes. Return to low idle, take oil sample, check for foam, and correct condition if oil is aerated.
- If oil is not aerated, disconnect ICP sensor and check for engine stability.
- If problem is corrected, see Operational Voltage checks for ICP sensor in Section 7 in EGES-305.
- If ICP still high or unstable, replace IPR and retest.

9. Injector Disable

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

Selected cylinder	EOT	Average fuel rate	Deviation	Average engine load	Deviation
Base Line					
1					
2					
3					
4					
5					
6					
Base Line					
Cut-off values:		**Fuel rate**		**Engine load**	

- If any cylinder is suspect, do **Test 12**.

10. Relative Compression

☐ Turn ignition key to ON.
☐ Use EST to run Relative Compression Test.
☐ Crank engine following EST instructions.

Relative Compression Test	Value
Cylinder 1 Relative Compression	
Cylinder 2 Relative Compression	
Cylinder 3 Relative Compression	
Cylinder 4 Relative Compression	
Cylinder 5 Relative Compression	
Cylinder 6 Relative Compression	

- If a Relative Compression Test and Injector Disable Test identify a suspect cylinder, check for a mechanical problem.
- If a Relative Compression Test does not identify a suspect cylinder, but the Injector Disable Test does, replace suspect injector(s).

11. Air Management

☐ Use EST to set engine idle speed, monitor engine load, toggle EGR valve and monitor MAF.

Idle speed	MAF	Load
EGR close	MAF	Message Set
EGR open	MAF	DTC Set
EGR close	MAF	DTC Set

- Correct problem causing messages or DTCs before restarting.

12. Boost Control

12.1. Linkage connected	Yes ☐ No ☐
12.2. Linkage movement	Yes ☐ No ☐
Air pressure - Initial movement	Spec Actual
Leaks	Yes ☐ No ☐
12.3. Linkage movement	Yes ☐ No ☐
12.4. Linkage movement	Yes ☐ No ☐
Air pressure - Initial movement	Spec Actual
Leaks	Yes ☐ No ☐

13. Torque Converter Stall

☐ Set parking brake and apply service brake.
☐ Put transmission in drive.
☐ Push accelerator to the floor, begin timing and monitor tachometer until tachometer stops moving.
☐ Record RPM and time.

Condition	Spec	Actual
Stall RPM		
Time (idle to stall in seconds)		

- If minimum RPM is reached within specified time, for a launch concern do not continue with performance diagnostics.
- If RPM is low, or was not reached within specified time, continue with performance diagnostics.

14. Crankcase Pressure

☐ Measure at oil fill tube with crankcase pressure test adapter.
☐ Clamp off crankcase breather hose.
☐ Measure at high idle, no load.

Instrument	Spec	Actual
Magnehelic gauge or Manometer		

15. Test Drive (Full load, rated speed)

☐ Use EST to monitor **boost pressure** and engine speed.

Condition	Spec	Spec	Actual
	Engine speed	Boost	EST boost reading
Peak HP			
Peak Torque			

- If boost pressure is not to specification continue performance diagnostics; **if to specification do not continue**.

☐ Use EST to monitor **Mass Air Flow (MAF)** and engine speed.

Condition	Spec	Spec	Actual
	Engine speed	MAF	EST MAF reading
Peak HP			
Peak Torque			

- If MAF is not to specification continue performance diagnostics; **if to specification do not continue**.

☐ Measure **fuel pressure** at secondary fuel filter fuel pressure test port (full load, rated speed).

Instrument	Spec	Actual
0 - 160 psi gauge		

- If fuel pressure is low, perform **Test 5** including measure fuel inlet restriction.

☐ Use EST to monitor **ICP** and engine speed

Instrument	Spec	Actual
EST		
Aerated oil Yes ☐ No ☐ After 2 min. ☐		

- Disconnect ICP and test drive vehicle.
- If problem is corrected, see Operational Voltage checks for ICP sensor in Section 7 in EGES-305.
- If still high or unstable, replace IPR and retest.

STOP

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Hard Start and No Start Diagnostics

VT 275

Technician _____ Kilometers _____ Transmission
Date _____ Miles _____ Manual ____ Auto ____
Hours _____
Unit No. _____ VIN _____ Truck build _____

Ambient temperature _____ Engine SN _____ ECM calibration _____
Coolant temperature _____ Engine HP _____ IDM calibration _____
Complaint _____ Engine Family Rating Code _____ Injector No. _____
Turbocharger No. _____

WARNING

To avoid serious personal injury, possible death or damage to the engine or vehicle, read all safety instructions in the "Safety information" section of *Engine Diagnostics Manual* EGES-305 before doing procedures on this form.

Notes

See "Hard Start and No Start Diagnostics"- Section 5 in EGES-305. Use figures and additional information to do each test or procedure on this form. Record results on this form.

For starting concerns with ECT temperatures below 16 ^{0}C (60 ^{0}F), do Tests 14 and 15. Service as necessary. If a problem was found and corrected, it is not necessary to complete the rest of this form - unless a starting concern remains.

Do all tests in sequence unless otherwise stated. Doing a test out of sequence could cause incorrect results.

If a problem was found and corrected, **it is not necessary to complete the rest of the form** unless a starting concern remains.

See Appendix A in EGES-305 for engine specifications.

See Appendix B in EGES-305 or Form CGE 310-1 for Diagnostic Trouble Codes (DTCs).

1. Initial Ignition Key On (Do not start)

- ☐ Check for WAIT TO START lamp
- ☐ Check amber WATER IN FUEL lamp
- ☐ Listen for injector precycle. (Duration is temp. dependent.)
- ☐ Listen for hum or buzz from electronic fuel pump.

Comments

2. Engine Cranking

- ☐ Does engine crank?
- ☐ Check cranking rpm. (Instrument panel)
- ☐ Check smoke color.

Check	Spec	Actual
rpm		
Smoke color		

3. Diagnostic Trouble Codes

- ☐ Install Electronic Service Tool (EST).
- ☐ Use EST to read DTCs.
- ☐ Use EST to check KOEO values for temperature and pressure sensors.

Active DTCs	
Inactive DTCs	
Abnormal sensor values Suspect sensor/value	☐ Yes ☐ No

- Correct problem causing active DTCs before continuing.
- If an EST is not available, see "Standard Test using Cruise Switches" in Section 3.

4. KOEO Standard Test

- ☐ Use EST to run KOEO Standard Test

Active DTCs

- Correct problem causing active DTCs before continuing.
- If an EST is not available, see "Standard Test using Cruise Switches" in Section 3.

5. KOEO Injector Test

- ☐ Use EST to run KOEO Injector Test.

Active DTCs

- Correct problem causing active DTCs before continuing.

6. EST Data List

- ☐ Enter data in the Cranking Spec column.
- ☐ Monitor KOEO values and enter in KOEO column.
- ☐ Crank engine and monitor DATA for 20 seconds.
- ☐ Enter data in the Actual Spec column.

PID	KOEO	Cranking spec	Actual spec
VBAT			
RPM			
ICP			
EOP			
EGRP			

- If voltage is below spec, see "ECM Power" in Section 7.
- If no rpm is noted, check DTCs.
- If ICP is below spec, do "Low ICP System Pressure - Test 13.
- If EOP is below spec, see "Engine Symptoms Diagnostics" in Section 4 and "EOP switch" in Section 7.

7. Engine Systems

- ☐ Leaks
- ☐ Loose connections

Fuel Oil Coolant Electrical Air

8. Engine Oil

- ☐ Leaks
- ☐ Contaminated oil (fuel or coolant)
- ☐ Oil grade, viscosity, and level
- ☐ Kilometers or Miles and hours on oil

Comments

9. Intake and Exhaust Restriction

- ☐ Air inlet and duct
- ☐ Hoses and piping
- ☐ Filter minder
- ☐ Intake and exhaust restriction

Comments

10. Fuel Supply System

- ☐ Measure pressure at the secondary fuel filter housing test port.
- ☐ If concerns were not found in test 10.1, do not continue testing fuel system.

10.1 Pressure, quality, and aerated fuel	Fuel in tank	Yes ☐ No ☐
	Hear FP running	Yes ☐ No ☐
First sample	Aerated fuel	Yes ☐ No ☐
	Contaminated fuel	Yes ☐ No ☐
Second sample (if needed)	Aerated fuel	Yes ☐ No ☐
	Contaminated fuel	Yes ☐ No ☐
	Fuel pressure KOEO	Spec Actual
10.2 Fuel pump discharge pressure	Discharge pressure	Spec Actual
10.3 Fuel pump inlet restriction	Restriction	Spec Actual

- If a hum can not be heard from the HFCM, verify fuel pump is being powered. Repair as necessary.
- If fuel has air bubbles, check for leaks in supply lines - tank to HFCM.
- If fuel is contaminated, correct condition.
- If fuel pressure is low or slow to build, replace both filters and retest.
- If fuel pressure is below specification, do test 10.2.
- If pump discharge pressure is in specification, inspect fuel regulator valve.
- If discharge pressure is low or slow to build, do test 10.3.

11. Main Power Relay Voltage to ECM

- ☐ Connect breakout harness between ECM main power relay and distribution box
- ☐ Crank engine and use a DMM to measure voltage to ECM. (Min 130 rpm for 20 seconds)
- ☐ Check voltage between connector Pin 5 and ground

Instrument	Spec	Actual
DMM		

12. Main Power Relay Voltage to IDM

- ☐ Connect 12 - Pin Breakout harness between engine and chassis harness
- ☐ Crank engine and use a DMM to measure voltage to IDM. (Min 130 rpm for 20 seconds)
- ☐ Check voltage between connector Pin 12 and Pin 1.

Instrument	Spec	Actual
DMM		

13. Low ICP System Pressure

- ☐ Do only the following tests, if ICP was not to spec during Test 6.
- ☐ Start and continue Test 13.1 System Function, if lube oil pressure is not a concern and terminals on the IPR valve and engine harness are not damaged or corroded.
- ☐ If test result is Yes for 13.1 System Function, **do not do Tests 13.2 through 13.5 for low ICP.**

Low ICP test	Question	Result
13.1 System function	IPR connectors: Corroded, bent or pushed back pins Over 3.45 Mpa (500 psi) (0.82V)?	☐ Yes ☐ No ☐ Yes ☐ No
13.2 IPR function	Audible air leak?	Unplugged: ☐ Yes ☐ No; B+ applied: ☐ Yes ☐ No
13.3 Under valve cover leaks	Audible air leak?	Cylinder Head: Left ☐ Yes ☐ No; Right ☐ Yes ☐ No Crankcase: Left ☐ Yes ☐ No; Right ☐ Yes ☐ No
13.4 Cylinder Head isolation	Audible air leak?	Left ☐ Yes ☐ No; Right ☐ Yes ☐ No
13.5 High-pressure pump	Over 3.45 Mpa (500 psi) (0.82V)?	☐ Yes ☐ No

14. Glow Plug System

- ☐ Use EST to do Output State Test for glow plugs. After 40 seconds, measure amperage and check for DTCs.
- ☐ If test results in 14.1 are within specification, **do not continue testing the glow plug system**.

14.1 Glow Plug system Amperage	Cylinder Head	Spec	Actual					
	Left Right	24-42 amps 24-42 amps						
14.2 Glow Plug Harness to Ground	Glow plugs LT			Glow plugs RT				
	1 Yellow	3 Red	5 White	2 Yellow	4 Red	6 White		
Spec 0.1 -6 ohms								
14.3 Glow Plug to Ground Spec 0.1 -6 ohms								
14.4 Engine Harness 3-pin to Relay Spec <5 ohms								
14.5 Relay Operation	Terminal	Spec	Actual					
	Battery feed Relay output	B+ B+						

- If results of 14.1 are not within spec, do test 14.2 for all glow plugs out of spec.
- If results of 14.1 are 0 amps for both cylinder heads and DTC 251 was not set, do test 14.5.
- If DTC 251 was set, do GPC (Glow Plug Control) circuit" in Section 7.
- If results of 14.2 are within spec, do test 14.4.
- If results of 14.2 are not within spec, do test 14.3 for all glow plugs out of spec.
- If results of 14.3 are within spec, replace failed glow plug harness
- If results of 14.3 are not within spec, replace the glow plug that was out of spec.

15. Inlet Air Heater System

- ☐ Install Amp Clamp around feed wire and use EST to do Output State Test for Inlet Air heater. After 4 seconds, measure amperage for heater wire.
- ☐ If test results in 15.1 are within specification, **do not continue testing the Inlet Air Heater System.**

Test	Air Heater Wire	
	Spec	Circuit
15.1 Amperage draw	50 +/- 5 amps	
15.2 Voltage at Element	BAT V	
15.3 Resistance or Element	< 5 ohms	
15.4 Wiring harness continuity and resistance	< 5 ohms	
15.5 Relay operation Battery feed Relay output	 B+ B+	

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