

Performance Diagnostics

MaxxForce[®] DT, 9, and 10 Beginning with 2010 Model Year

Technician	Date	ECM Calibration		EFRC		Hours	
VIN	Unit No	ACM Calibration		Engine SN		Miles	
Complaint			HP Rating		Transmission: Manual		Auto
				Note: Th	is form must be complete	ed before calling	for technical assistance.

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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-455 before doing form procedures.

Notes: Look up the VIN on the ISIS® network for build date, engine hp, engine serial number, ECM calibration, and transmission.

See "Performance Diagnostics" in EGES-455 for additional information to do each test or procedure. 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.

See EGES-455 Appendix A for Performance Specifications and Diagnostic Trouble Code Index.

1. Initial Key On Check

☐ Check indicator for WATER IN FUEL lamp.

Comments

 If the WATER IN FUEL lamp stays on, do Fuel Quality Check.

2. Visual Inspection

- □ Check all fluid levels.
- □ Inspect electrical connectors.
- ☐ Inspect air filter gauge
- ☐ Inspect CAC and piping.
- ☐ Inspect for visible exhaust damage.

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Fuel Level Check

- ☐ Check instrument panel gauge and look into tank to verify fuel level.
- If fuel gauge reads above empty, but tank is empty, diagnose gauge.
- If fuel tank is empty, add fuel and prime system. See Fuel System Priming in Hard Start and No Start Diagnostics.

Fuel Quality Check

- ☐ Place clear approved container under fuel drain valve and open.
- If fuel does not drain, turn ignition switch to ON to run Fuel Pump.
- ☐ Check for water, waxing, icing, sediment, gasoline, or kerosene.

Comments

 If fuel quality is questionable, correct problem. Take a sample to verify fuel quality is satisfactory.

3. EST Connection and Data Recording

 \square Use ServiceMaxx $^{\text{TM}}$ software to record KOEO pressure and temperature values.

Note: With Key ON, Engine OFF (KOEO), Fuel Pump will run for 10 seconds. Take reading after Fuel Pump shuts off.

Sensor	Spec.	Actual
Air Inlet Temp	-	
Engine Coolant Temp1	-	
Engine Oil Temp	-	
Mass Air Flow	0 kg/hr	
Injection Control Pressure	0 psi	
Exhaust Back Pressure	0 psi	
Intake Manifold Pressure	0 psi	
Barometric Pressure	14 psia	
DPF Differential Pressure	0 psi	

- If sensor is out of specification, go to suspect sensor in Electronic Control Systems Diagnostics.
- □ Use ServiceMaxx[™] software to run Output State Test High and Low. Record results.

Signal	Output State Low	Output State High
EGR Control	35%	90%
Engine Throttle Position	1.12 V	4.7 V

Note: EGR Control signal displays duty cycle and not actual valve position. EGR valve closed is 35% and valve open is

 If actuator is out of specification, go to suspect actuator in Electronic Control Systems Diagnostics.

Note: Visually monitor Éxhaust Back Pressure Valve; ServiceMaxx™ does not have a feedback position signal. Note: Verify air tanks are full before running this test. Note: Engine will cycle valve three times when engine is shut

- ☐ Start engine and idle for 5 seconds.
- ☐ Shut down engine and visually inspect for valve movement.

EBPV Movement	Yes □	No □

- If EBPV does not cycle open and closed, go to next step.
- If EBPV cycles open and closed, valve is working correctly.
 Disconnect air supply to actuator.
- ☐ Start engine and idle for 5 seconds.
- ☐ Shut down engine and verify air flow from supply line.
- If air flow cannot be heard, go to EBPV in Electronic Control Systems Diagnostics.
- If air flow can be heard when cycled high, check valve or linkage for sticking.
- ☐ Use ServiceMaxx[™] software to record DPF status signal value.

DPF	Status
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 If DPF status is "Regen needed-critical level", run an onboard filter cleanliness test.

4. Check for DTCs

☐ Use ServiceMaxx[™] software to record SPN/FMI.

Active SPN/FMI	Previously Active SPN/FMI	

- Correct any active SPN/FMI. See Diagnostic Trouble Code Index.
- Evaluate previously active faults with high counts.

5. KOER Standard Test

Note: Ensure coolant temperature is above 70°C (158°F).

☐ Use ServiceMaxx™ software to run KOER Standard Test.

Active SPN/FMI	Previously Active SPN/FMI

 Correct any active SPN/FMI. See Diagnostic Trouble Code Index.

6. Fuel Aeration Check

- ☐ Connect Fuel Pressure Gauge to intake manifold test port.
- ☐ Turn ignition switch to on. Measure fuel pressure with shutoff valve closed. Open valve to check for aeration (bubbles flowing through clear test line).

Note: Fuel Pump will only run for 10 seconds per key cycle and there must be 10 seconds between key cycles.

	Specification	Actual
Fuel Pressure	85-95 psi	
Aerated	Yes □	No □

- If fuel pressure is above or below specification, or aerated, see Fuel System in Hard Start and No Start Diagnostics.
- If fuel pressure is within specification, leave fuel gauge connected and proceed to next step.

7. Engine Low Idle to High Idle

☐ Use ServiceMaxx[™] software to load Performance session.
☐ Monitor APP signal and press accelerator to floor.

Signal	Low Idle	Actual	High Idle	Actual
APP	0%		99.6%	

- If APP signal does not go from 0% to 99.6%, see APP Sensor in Electronic Control System Diagnostics.
- If APP signal does go from 0% to 99.6%, go to next step.
 □ Press record button and start engine.
- □ Allow engine to idle for 20 seconds. Push accelerator pedal to floor and hold for 20 seconds, return to low idle.

☐ Record low idle and high idle results.

Note: FDP sensor is only capable of measuring up to 75 psi of pressure. Always use fuel gauge to measure fuel pressure.

Signal	Low Idle	High Idle
Injection Control Pressure		
Fuel Delivery Pressure	80-100 psi	80-100 psi
Exhaust Back Pressure		
Intake Manifold Pressure		
DPF Differential Pressure		

- If fuel pressure is above or below specification, see Fuel System in Hard Start and No Start Diagnostics.
- If engine does not accelerate smoothly or feels unbalanced, perform Relative Compression Test and Cylinder Cut Out Test.
- If DPFDP is above specification go to AFT System in Electronic Control Systems Diagnostics.
- If ICP is below specification, go to ICP System Test.
- If EBP is above specification, remove turbocharger intake tube and inspect for turbocharger damage.
- If IMP is below specification, check for CAC and tubing leaks, and perform Crankcase Pressure Test.

8. Torque Converter Stall Test (Automatic only) Note: Ensure engine temperature is above 70°C (158°F).

☐ Use ServiceMaxx™ software to load Performance session.
 ☐ Start engine. Set parking brake and apply service brake.

- ☐ Press record button. Push accelerator pedal firmly to floor, and measure time it takes to reach maximum RPM.
- ☐ Record stall RPM amount of time to stall, and FDP.

	Specification	Actual
Engine Speed	2000 rpm	
Time	5 seconds	
Fuel Delivery Pressure	80-100 psi	

- ☐ Review recorded results at full engine load.
- If FDP is below specification, go to Fuel System in Hard Start and No Start Diagnostics.
- If engine does not accelerate smoothly or feels unbalanced, perform Relative Compression Test and Cylinder Cut Out Test
- If stall RPM and amount of time is within specification, there is no power performance issue.

9. Injection Pressure Regulator (IPR) Circuit Test

- ☐ Start engine and lightly wiggle IPR connector.
- If engine stumbles, repair IPR connection.

10. KOER Air Management Test

Note: KOER Standard Test must be run before running KOER Air Management Test.

☐ Use ServiceMaxx[™] software to run KOER Air Management Test.

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 Correct any active SPN/FMI. See Diagnostic Trouble Code Index.

11. Turbocharger 2 Wastegate Control (TC2WC) Test

Operational Test

☐ Using Pressure Test Kit air regulator, connect regulated air to wastegate supply hose located next to ETV. (Figure 1)

- If actuator rod travel is within specification, wastegate actuator is working correctly.
- If actuator rod does not move, or actuator rod travel is not within specification, see Turbocharger 2 Wastegate Control (TC2WC) in Electronic Control Systems Diagnostics section.

Turbocharger 2 Wastegate Control Solenoid

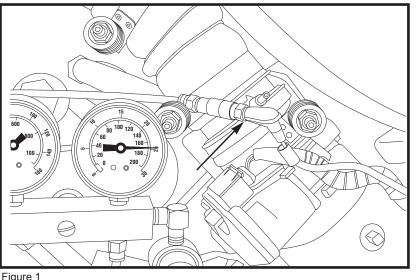
☐ Using Pressure Test Kit air regulator, connect regulated air to wastegate supply hose located next to ETV.

☐ Apply 21.5 psi of regulated air pressure.

□ Use ServiceMaxx™ software to run KOEO Output State Test High and Low.

Actuator Rod	Specification	Actual
Movement	0.5 in.	

- If actuator does not move, see Turbocharger 2 Wastegate Control (TC2WC) in Electronic Control Systems Diagnostics section.
- If actuator cycles open and closed, turbo control is working correctly.



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 $\hfill\square$ Mark actuator rod at base of actuator.

Apply regulated air pressure and measure actuator rod movement.

Actuator Rod Movement	Specification	Actual
Pressure to start movement	9 psi	
Pressure to stop movement	21 psi	
Travel Distance	0.5 in.	

Isolated Actuator Test

- ☐ Using Pressure Test Kit air regulator, connect regulated air directly to turbocharger wastegate actuator.
- ☐ Apply 21.5 psi of regulated air pressure and measure wastegate actuator rod movement.

Actuator Rod	Specification	Actual
Movement	0.5 in.	

- If actuator rod moves and stops within specification, repair leaking supply line and/or leaking solenoid.
- If actuator rod does not move, proceed to next step.
- ☐ Remove actuator rod from turbocharger wastegate arm. following procedures in Engine Service Manual.
- ☐ Attempt to move wastegate valve by hand.
- If wastegate valve moves freely, replace turbocharger wastegate actuator.
- If wastegate valve does not move freely, replace turbocharger.

12. Crankcase Oil Breather Separator Test

Note: Ensure engine temperature is above 70°C (158°F) and oil level is in specification.

- ☐ Start engine. Place the Ultrasonic Ear near Oil Separator housing.
- ☐ Shut off engine and quickly monitor for centrifugal noise. Note: Centrifuge will continue spinning for about 15 seconds after engine is shut off
- If centrifuge noise is not heard, go to Engine Service Manual for removal and replacement procedures.

13. Crankcase Pressure Test

Note: Ensure engine temperature is above 70°C (158°F) and oil level is in specification.

- ☐ Disconnect breather outlet tube at crankcase breather.
- ☐ Block off breather outlet tube using standard shop bolt. ☐ Connect Crankcase Pressure Test Tool to breather
- ☐ Connect Manometer to Crankcase Pressure Test Adapter. ☐ Start engine and press accelerator pedal fully to floor.
- ☐ Record crankcase pressure.

Manometer	Specification	Actual
Crankcase Pressure	< 6 in. H ₂ 0	

- If pressure is above specification, go to the next step to pinpoint suspect cylinder.
- If pressure is within specification, repair or replace air compressor. See Engine Service Manual for removal and replacement procedures.

14. Relative Compression Test

Note: Use a battery charger when performing this test. It is important that cranking rpm remains consistent throughout test. ☐ Turn ignition key ON, engine OFF.

- ☐ Use ServiceMaxx[™] software to run Relative Compression
- ☐ Follow on-screen instructions.

	Speed Difference
	Speed Dillerence
Cylinder 1	rpm
Cylinder 2	rpm
Cylinder 3	rpm
Cylinder 4	rpm
Cylinder 5	rpm
Cylinder 6	rpm

• If Speed Difference for one cylinder is significantly lower than others, that cylinder is suspect for compression loss.

15. Cylinder Cutout Test

Note: Verify Fuel System pressure is not below specification, fuel is not aerated, and fuel grade meets specification, before running this test.

☐ Use ServiceMaxx[™] software, to run Cylinder Cut Out Test. ☐ Follow on-screen instructions.

	Fuel Rate 1	Fuel Rate 2	Fuel Rate 3	Fuel Rate Avg
Cyl 1	gal/hr			
Cyl 2	gal/hr			
Cyl 3	gal/hr			
Cyl 4	gal/hr			
Cyl 5	gal/hr			
Cyl 6	gal/hr			

- If Cylinder Cutout Test does not identify a suspect cylinder, no action is required.
- If Cylinder Cutout Test identifies a suspect cylinder and Relative Compression Test does not, replace failed Injector. See injector replacement in Engine Service Manual.

16. Road Test (Full load, rated speed)

- ☐ Connect Fuel Pressure Gauge to intake manifold test port and secure gauge in a safe visible location.
- ☐ Use ServiceMaxx[™] software to load Performance session.
- ☐ Start engine. Find an open stretch of road. Start recording. When driving conditions are safe, select a suitable gear, press accelerator pedal fully to floor, and accelerate to rated speed at 100% load.
- ☐ When road test is complete, stop recording.
- ☐ Review recorded results at 100% engine load at rated

Gauge	Engine @ rated speed and 100% load	Actual
Fuel Delivery Pressure	85 psi	
Injection Control Pressure	4500 psi	
Exhaust Back Pressure		
Intake Manifold Pressure		

- If FDP is below specification, see Fuel System in Hard Start and No Start Diagnostics.
- If engine does not accelerate smoothly or feels unbalanced, perform Fuel Aeration Check, Relative Compression Test, and Cylinder Cut Out Test.
- If ICP is below specification, go to ICP System Test in Performance Diagnostics section.
- If EBP is above specification, remove turbocharger intake tube and inspect for turbocharger damage.

