No.: 08 TS-26Rev
February 3, 2009

TO: Service Locations

FROM: Technical Support Development

SUBJECT: **EPA04 DDEC® V Series 60® Engines Turbocharger Performance Diagnostic Checklist**

ISSUE

Troubleshooting guide for poor acceleration, black smoke, and flash code 39, SID 147, FMI 7 or 2

REQUIRED ACTION

Before replacing a turbocharger on an EPA04 DDEC V engine, please perform the following diagnostic test to verify that the turbocharger is the root cause for lack of power. Upon completion of the worksheet, if no other repair was made, the turbocharger will need to be replaced per warranty guidelines. If a repair was made, verify the repair, retest the truck and verify the customer complaint is resolved.

CONTACT INFORMATION

Please contact the Detroit Diesel Customer Support Center at 313-592-5800 or email csc@detroitdiesel.com if you have any questions.

DDEC V Turbocharger Troubleshooting Guide

Note: Please use Power Service Literature when referring to service manuals.

1) Visual Inspection

1. Is the exhaust system leaking?
   ☐ Not leaking ☐ Repair: _____

2. Is the air induction system leaking?
   ☐ Not leaking ☐ Repair: _____

3. What is the condition of the air filter?
   ☐ Clean ☐ Partially plugged ☐ Plugged
   If plugged, was it replaced?
   ☐ Not plugged ☐ Replaced

2) Use DDDL to Monitor the Accelerator Pedal Percentage

Refer to *Series 60 DDEC V Troubleshooting Guide,* (DDC-SVC-MAN-0012).

1. Turn the vehicle ignition switch to the ON position.

2. Perform a throttle sweep by pressing the throttle pedal to the floor. Does the TPS percent read 100%?

   Results: Min observed _____% Max observed_____%

   [a] If the percent does not read 100%, refer to the *Series 60 Workshop Manual*, (DDC-SVC-MAN-0004), section 66.2.4.
   [b] If the percent does read 100%, continue to step 3.

3) Use DDDL to Monitor Barometric Pressure

1. Turn the ignition ON but leave the engine OFF.

2. Using Detroit Diesel Diagnostic Link (DDDL) or a Diagnostic Data Reader (DDR) compare Barometric Pressure Sensor with what is consistent with your geographic area. (If the Barometric Pressure is unknown for your area, connect Diagnostic Link to three other trucks and take an average of the three readings.)

   Normal Baro for your area: _____ psi DDEC V Baro reading:_____ psi

   [a] If the two readings are within 0.6 psi, then move on to the next step.
   [b] If the two are different by more than 0.6 psi, then replace the Baro sensor.

3. Compare the DDEC V Barometric Pressure Sensor value to Intake Manifold Pressure Sensor value.

   DDEC V Baro reading: _____ psi Intake Manifold Pressure reading:_____ psi

   [a] If the two readings are within 0.6 psi, then move on to the next step.
   [b] If the two are different by more than 0.6 psi, then replace defective Intake Manifold Pressure Sensor.

4) <u>Use DDDL to Monitor Delta Pressure Sensor and Check the Counts</u>

1. Turn ignition ON (key ON, engine OFF).

2. Connect either a Detroit Diesel Diagnostic Link® (DDDL) or a Diagnostic Data Reader (DDR).

3. Read and record Delta P counts. (Normal range is 86-118)
   Results: Delta P counts _____

4. Remove the Delta P Sensor from the mounting plate. Inspect the mounting plate for cracks, plugged ports, etc.

WARNING:
PERSONAL INJURY
To avoid injury from the sudden release of a high-pressure hose connection, wear a face shield or goggles.

WARNING:
EYE INJURY
To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 40 psi (276 kPa) air pressure.

5. Use shop air to blow down through the sensor tubes. Reinstall Delta Pressure Sensor.

6. Read the Delta P counts.
   [a] If the recorded Delta P counts read 86-118, verify that the Venturi Tube hoses-to-Delta P Sensor are not damaged. Continue to step 5.
   Results: Delta P counts _____
   [b] If the Delta P counts are out of the 86-118 range, replace the sensor.
   Results: Delta P counts _____
   Delta P pressure _____

5) Check the Turbo Compressor for Damaged Wheel

Refer to the *Turbocharger Technician's Manual*, (DDC-SVC-MAN-0094).

1. Disconnect the air inlet tube and check the compressor wheel for damage.
   ☐ Damaged ☐ Not damaged

Figure 1. Damaged Compressor Wheel

[a] If damaged, replace turbocharger per warranty guidelines.
[b] If not damaged, proceed to next step.

6) Check Charge Air Cooler

Refer to Technical Service bulletin 05 TS-01.

1. Visually inspect truck frontal area for air flow restriction through the CAC and radiator.

2. Check the CAC for leaks. Refer to section 6.8.2.2 in the *Series 60 Workshop Manual*, (DDC-SVC-MAN-0004).

3. Attach air-to-air charge air cooler test kit, J-41473; refer to OEM guidelines.

4. Disconnect the air inlet pipe from the outlet side of the turbocharger compressor housing; refer to appropriate service manual, air intake system chapter.

5. Attach the air-to-air cooler test kit adaptor plug to fit into the pipe at the compressor outlet charge air connector; refer to OEM guidelines.

6. Attach an air pressure pipe to the air chuck at the regulator and gradually pressurize the air inlet system to a pressure of 207 kPa (30 psi).

7. Apply a water and soap solution to each hose connection across the face of the charge air cooler.

8. Apply a water and soap solution to the air intake manifold and cylinder head mating surface area.

9. Visually inspect all joints for air leaks and all charge air cooler welded surfaces for stress cracks.
   ☐ Leaks ☐ Does NOT leak

   [a] If the CAC leaks, replace the CAC and re-check for leaks using the above procedure.
   [b] If the CAC does NOT leak proceed to the next step.

7) Check VPOD Operation

1. Disconnect the air line from the turbo actuator.

2. Install gage at the outlet of the turbo air line. See Figure 2.
   Note: The gage should be accurate to within 1.4 kPa (0.2 psi).

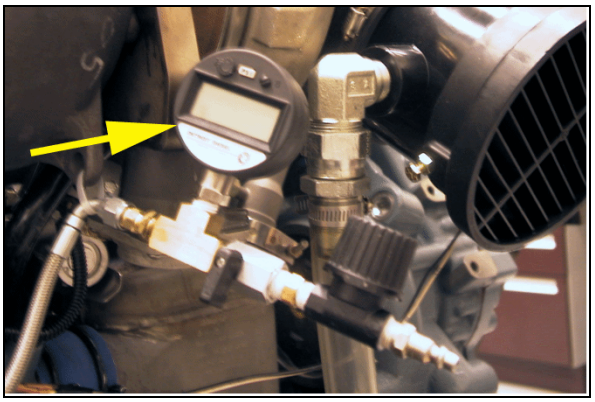


Figure 2. Gage Setup

3. Using either DDDL or DDR, activate PWM #4 duty cycles and monitor the output pressure from the VPOD. Activate the duty cycle to 90%. Pressure should equal 70-75 psi.

   Pressure with PWM4 @ 90%: _____ psi

   [a] If pressure is less than 70psi, check VPOD supply pressure. Refer to Technical Service letters 04 TS-56 and 05 TS-21.
   [b] If pressure is within specs, continue with test.

8) Checking VNT Pin and Lever

In extreme cases, the VNT lever and pin could be worn to the point where they would not function well. In some of these cases, the reason may be customer abuse or lack of maintenance. In Figure 3, the turbocharger cleanliness was not maintained and the dirt caused accelerated wear. In Figure 4, the pin on the right, from the dirty turbocharger shown in Figure 3 is compared to a new pin.

Figure 3. Dirty Turbocharger

Figure 4. VNT Pin Comparison

If the pin is worn, then replace the turbocharger actuator. Perform actuator adjustment using Diagnostic Link 6.44TA.

9) <u>Check Actuator for Leaks</u>

The two possible leak areas are the diaphragm that leaks by the shaft, or body leaks at the split between the housing and cover. See Figure 5.

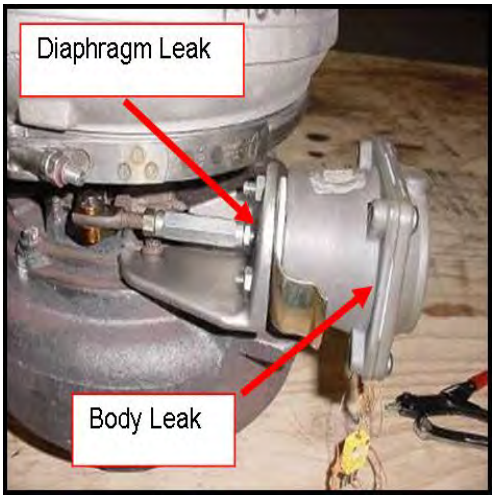


Figure 5 Actuator Leak Sites

1. Use regulated air and a high quality digital pressure gauge, such as P/N: TLZ00100, and pressurize the actuator to 60 psi.

2. Utilize soapy water to check for leaks at the fittings. If any leaks are present, repair the leak before continuing.

3. Turn off the air supply.

4. Measure the pressure drop for 15 seconds. The acceptable pressure drop is 1.0 psi or less.
   Pressure drop: _____ psi (in 15 seconds)

   If the pressure drop is greater than 1.0 psi, then replace the turbocharger actuator. Perform actuator adjustment using Diagnostic Link 6.44TA.

10) Fuel System

⚠ WARNING:
FIRE
To avoid injury from fire caused by heated diesel-fuel vapors: **• Keep those people who are not directly involved in servicing away from the engine.** **• Stop the engine immediately if a fuel leak is detected.** **• Do not smoke or allow open flames when working on an operating engine.** **• Wear adequate protective clothing (face shield, insulated gloves and apron, etc.).** **• To prevent a buildup of potentially volatile vapors, keep the engine area well ventilated during operation.**

⚠ WARNING:
FIRE
To avoid injury from fire, keep all potential ignition sources away from diesel fuel, including open flames, sparks, and electrical resistance heating elements. Do not smoke when refueling.

1. Visually inspect that the fuel tank has sufficient clean fuel.
   Results: Fuel Level_____

2. Visually inspect the fuel supply shutoff valve. Set it to full on.
   Results: Fuel Shutoff valve _____

11) Check Fuel Pressure

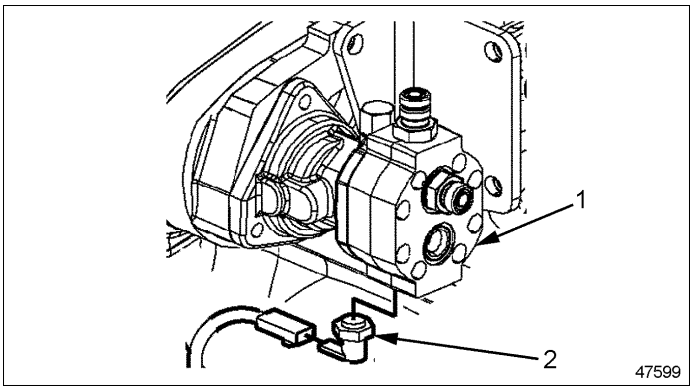
⚠ WARNING:
PERSONAL INJURY
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING:

ENGINE EXHAUST

To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

1. Remove the Supply Fuel Temperature Sensor (SFT Sensor) fitting from the fuel pump. Refer to *Series 60 Workshop Manual* (DDC-SVC-MAN-0004).



1. Fuel Pump 2. Fitting

Figure 6. Supply Fuel Temperature Sensor

2. Attach a calibrated gauge capable of reading 0 - 345 kPa (0 - 50 psi) to the fuel pump.

3. Start and run the engine to the speeds listed in Table 1 and record the fuel pressure.

Engine Speed, rpm	Average Fuel Pressure, kPa (psi)
600	124 (18)
1200	145 (21)
1800	165 (24)
2100	186 (27)

Table 1. Fuel Pressure (DDEC V with Regulator)

4. Shut down the engine.

5. Remove the calibrated gauge from the fuel pump.

6. Reinstall the SFT Sensor, refer to the *Series 60 Workshop Manual,* (DDC-SVC-MAN-0004).

Results: Fuel Pressure:
600 RPM _____ psi
1200 RRM _____ psi
1800 RPM _____ psi
2100 RPM _____ psi

12) Check for Air in the Fuel System

WARNING:
PERSONAL INJURY
To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.

WARNING:
ENGINE EXHAUST
To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.

1. Disconnect the fuel line return hose from the fitting located at the fuel tank; refer to OEM guidelines.

2. Place the open end of the fuel line into a suitable container.

3. Start and run the engine.

4. Operate the engine at 1000 rpm.

5. Visually check to see if air bubbles are rising to the surface of the fuel within the container.
   ☐ Bubbles ☐ No Bubbles
   If bubbles are present, then address the fuel system concern before moving on.

13) Final Check for All Systems

If any of the tests fail, repair as needed following the appropriate service manual and verify the repair.

DDEC V Turbocharger Performance Diagnostic Worksheet

Please fill in this worksheet for the above test and attach to the warranty repair order.

1. Visual Inspection

Exhaust System damage/ leaks?	☐ Yes	☐ No, Repairs: _____
Air Induction damage/leaks?	☐ Yes	☐ No, Repairs: _____
Air filter Restrictions?	☐ Yes	☐ No, Repairs: _____

2. Accelerator Pedal Percentage

Results: Min observed _____% Max observed_____%

3. Barometric and Intake Manifold Pressure Sensors

Results: Baro_____ psi Intake pressure _____ psi
Barometric pressure for your area _____ psi

4. Delta Pressure Sensor and Check the Counts

Results: Delta P counts _____
Delta P pressure _____

5. Turbo Compressor for Damage

Results: _____

6. Charge Air Cooler

Results: _____

7. Check VPOD Operation

Results: _____

8. Checking VNT Pin and Lever

Resutls:_____

9. Check Actuator for Leaks

Results: _____

10. Visual Inspection of the Fuel System

Results: Fuel Level_____

11. Check fuel pressure

Results: Fuel Pressure: 600 RPM _____ psi
1200 RRM _____ psi
1800 RPM _____ psi
2100 RPM _____ psi

12. Air in the Fuel System

Results: _____