

◀ Product: TRUCK ENGINE  
Model: C-15 TRUCK ENGINE MBN  
Configuration: C-15 Truck Engine MBN00001-UP

## **Troubleshooting**

### **C-10, C-12 and C-15 On-highway Engines**

Media Number -SEN9683-08

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## **Wastegate Solenoid - Test**

### **System Operation Description:**

The wastegate solenoid allows the engine to more precisely regulate the boost pressure to the engine. By closing or partially closing the wastegate solenoid, the ECM can increase the boost pressure. Typical wastegates will limit boost pressure to a preset limit. The wastegate solenoid blocks air from reaching the wastegate and allowing boost pressure to increase. Air is routed from the intake manifold to the wastegate solenoid. Then, the air is directed to the wastegate. A bleed orifice allows air to escape, which allows the wastegate to close when the solenoid is closed.

The following diagnostic codes indicate a problem with the circuit for the wastegate solenoid.

- 32-05 Turbo Wastegate Solenoid current low
- 32-06 Turbo Wastegate Solenoid current high
- 32-11 Turbo Wastegate Solenoid current mismatch

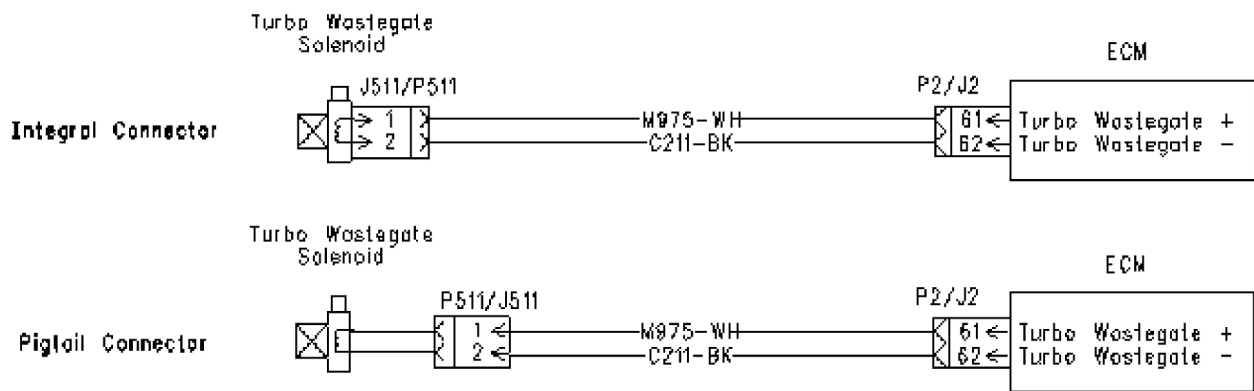
If there is a problem with the wastegate solenoid, one of the following conditions must be met in order for these diagnostic codes to be active:

- The "Turbo Wastegate Solenoid Output" is active.
- The ECM is controlling boost with the wastegate solenoid during normal operation.

**Note:** Attempting to defeat the wastegate could cause a permanent derate. Factory passwords will be required to return full power to the engine.

**Note:** The ECM will periodically activate the solenoid at idle. The solenoid will be active for less than one second. This is normal. Do not troubleshoot the wastegate solenoid for this reason.

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Note: Refer to Electrical System Schematic for More Information

Illustration 1  
Schematic

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**Note:** There are two types of solenoids. The connector for one of the solenoids is integral to the solenoid. The connector for the other solenoids is at the end of a pigtail that is connected to the solenoid.

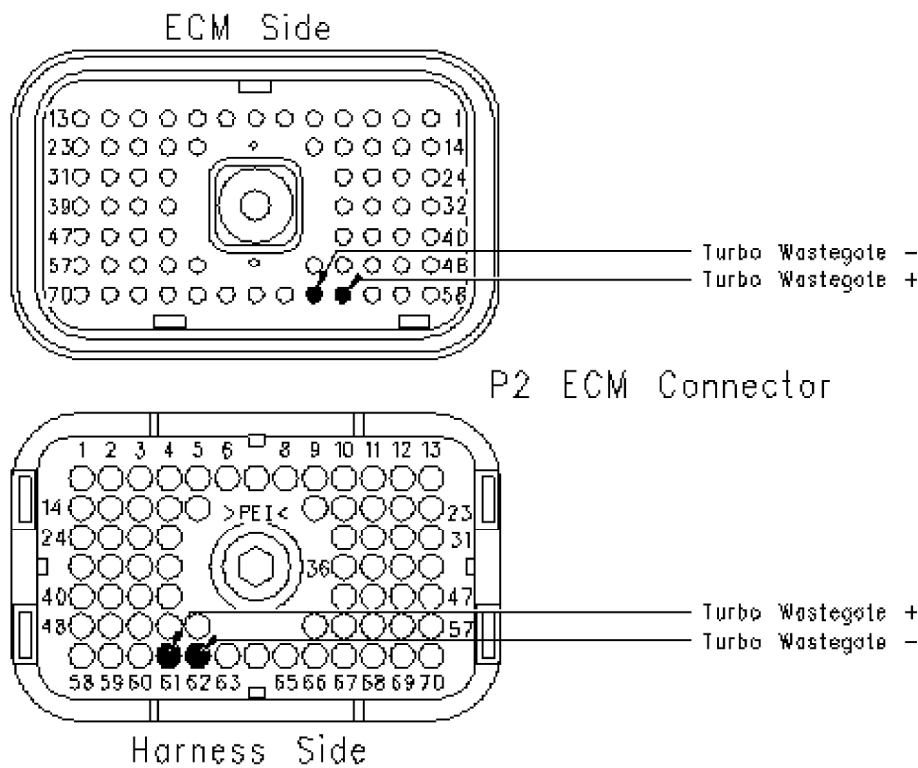
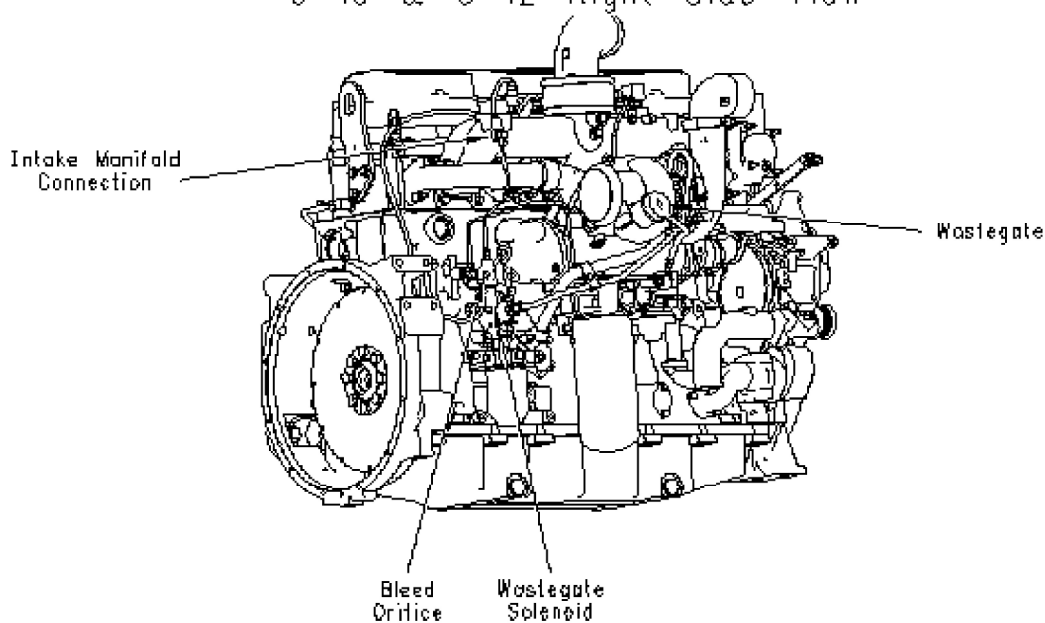


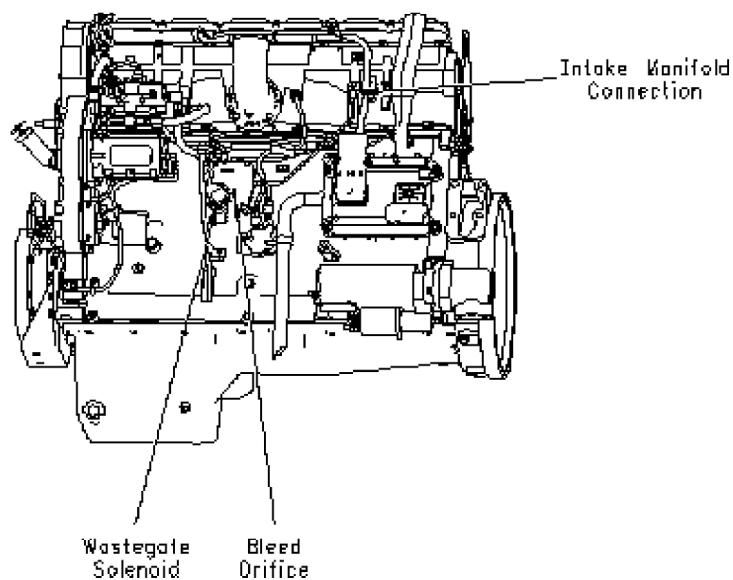
Illustration 2  
P2 ECM connector

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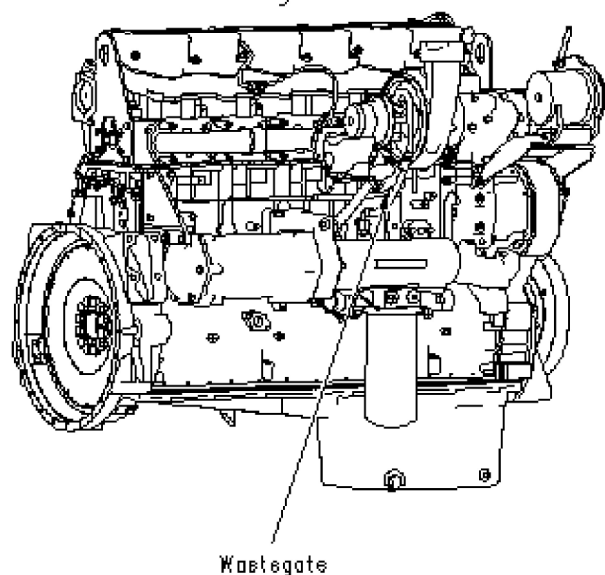
C-10 & C-12 Right Side View



C-15 Left Side View



C-15 Right Side View



### Test Step 1. Check for Diagnostic Codes

- A. Turn the key switch to the OFF position.
- B. Connect the Caterpillar Electronic Technician (Cat ET) to the data link connector.
- C. Turn the key switch to the ON position. Access the "Special Tests" under the "Diagnostics" menu on Cat ET. Activate the "Turbo Wastegate Solenoid Output" on Cat ET. Wait at least 15 seconds for activation of the diagnostic codes.
- D. Monitor Cat ET for active diagnostic codes and/or logged diagnostic codes.

**Expected Result:**

One or more diagnostic codes are active or logged.

**Results:**

- **32-05, 32-06, or 32-11 is active and/or logged** - Proceed to Test Step 2.
- **102-01, 102-02, or 102-07 is logged** - Proceed to Test Step 9.
- **No Codes - STOP**

**Test Step 2. Inspect Electrical Connectors and Wiring**

- A. Thoroughly inspect the J2/P2 ECM connector and the J511/P511 Wastegate solenoid connector. Refer to Troubleshooting, "Electrical Connectors - Inspect" for details.
- B. Perform a 45 N (10 lb) pull test on each of the wires that are associated with the wastegate solenoid.
- C. Check the ECM connector for the proper torque of 6.0 N·m (55 lb in).

**Expected Result:**

All connectors, pins, and sockets should be completely coupled and/or inserted and the harness and wiring should be free of corrosion, abrasion, or pinch points.

**Results:**

- **OK** - Proceed to Test Step 3.
- **Not OK** -

**Repair:** Repair the connectors or wiring and/or replace the connectors or wiring. Ensure that all of the seals are properly in place and ensure that the connectors are completely coupled. Verify that the repair eliminates the problem.

**STOP**

**Test Step 3. Determine the Diagnostic Code that is Active**

- A. Turn the key switch to the ON position. Access the "Special Tests" under the "Diagnostics" menu on Cat ET. Activate the "Turbo Wastegate Solenoid Output" on Cat ET. Wait at least 15 seconds for activation of the diagnostic codes.
- B. Check for active diagnostic codes on Cat ET.
- C. Determine if the problem is related to a "current low" diagnostic code (open circuit) or a "current high" diagnostic code (short circuit).

**Expected Result:**

A "current low" diagnostic code (open circuit) or a "current high" diagnostic code (short circuit) is active.

**Results:**

- **Current Low (Open)** - A "current low" diagnostic code (open circuit) is active at this time. Proceed to Test Step 4.

- **Current High (Short)** - A "current high" diagnostic code (short circuit) is active at this time. Proceed to Test Step 6.
- **Current Mismatch** - The ECM detects a short circuit to the + Battery.

**Repair:** Perform the following procedure:

1. Inspect the J2/P2 ECM connector for moisture that could cause a short circuit.
2. Inspect the wiring harness for signs of tampering.
3. Repair any problems with the circuit. Verify that the repair eliminates the problem.

**Note:** Factory Passwords are required to clear the 32-11 diagnostic code.

## STOP

### Test Step 4. Create a Short Circuit in the Harness at the Solenoid

- A. Turn the key switch to the OFF position.
- B. Disconnect the J511/P511 Turbo Wastegate Solenoid connector.
- C. Fabricate a jumper wire between J511:1 and J511:2 in order to create a short circuit.
- D. Turn the key switch to the ON position. Access the "Special Tests" under the "Diagnostics" menu on Cat ET. Activate the "Turbo Wastegate Solenoid Output" on Cat ET. Wait at least 15 seconds for activation of the diagnostic codes.
- E. Check for active diagnostic codes on Cat ET.

### Expected Result:

32-06 Turbo Wastegate Solenoid current high is now active.

### Results:

- **OK** - There is an open circuit in the solenoid.

**Repair:** Perform the following procedure:

1. Temporarily connect a new solenoid.
2. If the problem is fixed reconnect the suspect solenoid. If the problem returns, permanently install the new solenoid.

**Note:** The solenoid coil can be replaced independently of the valve. If the problem is with the coil replace only the coil. Refer to the Parts Manual for more information.

## STOP

- **Not OK** - The "current low" diagnostic code (open circuit) is still active. Proceed to Test Step 5.

### Test Step 5. Create a Short Circuit at the ECM

- A. Turn the key switch to the OFF position.

B. Remove the wires from P2:61 and P2:62.

C. Fabricate a jumper wire between P2:61 and P2:62 of the ECM connector in order to create a short circuit.

**Note:** The J2/P2 ECM connector must be connected during this step.

D. Turn the key switch to the ON position. Access the "Special Tests" under the "Diagnostics" menu on Cat ET. Activate the "Turbo Wastegate Solenoid Output" on Cat ET. Wait at least 15 seconds for activation of the diagnostic codes.

E. Check for active diagnostic codes on Cat ET.

**Expected Result:**

32-06 Turbo Wastegate Solenoid current high is now active.

**Results:**

- **OK** - There is a problem in the harness between the ECM and the solenoid. Proceed to Test Step 8.
- **Not OK** - There is still a "current low" diagnostic code (open circuit).

**Repair:** Perform the following procedure:

1. Temporarily connect a test ECM. Refer to Troubleshooting, "Programming Parameters" before replacing the ECM.
2. If the test ECM fixes the problem, reconnect the suspect ECM. If the problem returns, permanently install the new ECM.

**Note:** The solenoid coil can be replaced independently of the valve. If the problem is with the coil only replace the coil. Refer to the Parts Manual for more information.

**STOP**

**Test Step 6. Disconnect the Solenoid in order to Create an Open Circuit**

A. Turn the key switch to the OFF position.

B. Disconnect the J511/P511 Turbo Wastegate Solenoid connector in order to create an open circuit.

C. Turn the key switch to the ON position. Access the "Special Tests" under the "Diagnostics" menu on Cat ET. Activate the "Turbo Wastegate Solenoid Output" on Cat ET. Wait at least 15 seconds for activation of the diagnostic codes.

D. Check for active diagnostic codes on Cat ET.

**Expected Result:**

32-05 Turbo Wastegate Solenoid current low is now active.

**Results:**

- **OK** - There is a "current low" diagnostic code (open circuit) when the connector is disconnected.

**Repair:** There is a short in the solenoid.

1. Temporarily connect a new solenoid.
2. If the problem is fixed reconnect the suspect solenoid. If the problem returns, permanently install the new solenoid.

**Note:** The solenoid coil can be replaced independently of the valve. If the problem is with the coil replace only the coil. Refer to the Parts Manual for more information.

## **STOP**

- **Not OK** - There is still a "current high" diagnostic code (short circuit). Proceed to Test Step 7.

### **Test Step 7. Create an Open Circuit at the ECM**

- A. Turn the key switch to the OFF position.
- B. Remove the wires from J2:61 and J2:62 in order to create an open circuit at the ECM.
- C. Turn the key switch to the ON position. Access the "Special Tests" under the "Diagnostics" menu on Cat ET. Activate the "Turbo Wastegate Solenoid Output" on Cat ET. Wait at least 15 seconds for activation of the diagnostic codes.
- D. Check for active diagnostic codes on Cat ET.

### **Expected Result:**

32-05 Turbo Wastegate Solenoid current low is now active.

### **Results:**

- **OK** - There is a short circuit in the harness between the ECM and the solenoid. Proceed to Test Step 8.
- **Not OK** - The "current high" diagnostic code (short circuit) is still present.

**Repair:** Perform the following procedure:

1. Temporarily connect a test ECM. Refer to Troubleshooting, "Programming Parameters" before replacing the ECM.
2. If the test ECM fixes the problem, reconnect the suspect ECM. If the problem returns, permanently install the new ECM.

## **STOP**

### **Test Step 8. Bypass the Harness Wiring between the ECM and the Solenoid**

- A. Turn the key switch to the OFF position.
- B. Remove the wires from P2:61 and P2:62. Disconnect the J511/P511 Turbo Wastegate Solenoid connector.
- C. Fabricate a bypass harness to reach from the ECM to the wastegate solenoid. Refer to Illustration 1 for proper wiring.
- D. Turn the key switch to the ON position. Access the "Special Tests" under the "Diagnostics" menu on Cat ET. Activate the "Turbo Wastegate Solenoid Output" on Cat ET. Wait at least 15 seconds for activation of the diagnostic codes.

## Expected Result:

There are no active diagnostic codes.

## Results:

- **OK** - There was a problem in the harness.

**Repair:** Perform the following repair:

1. Permanently replace the faulty wiring.
2. Clear all diagnostic codes.
3. Verify that the repair eliminates the problem.

## STOP

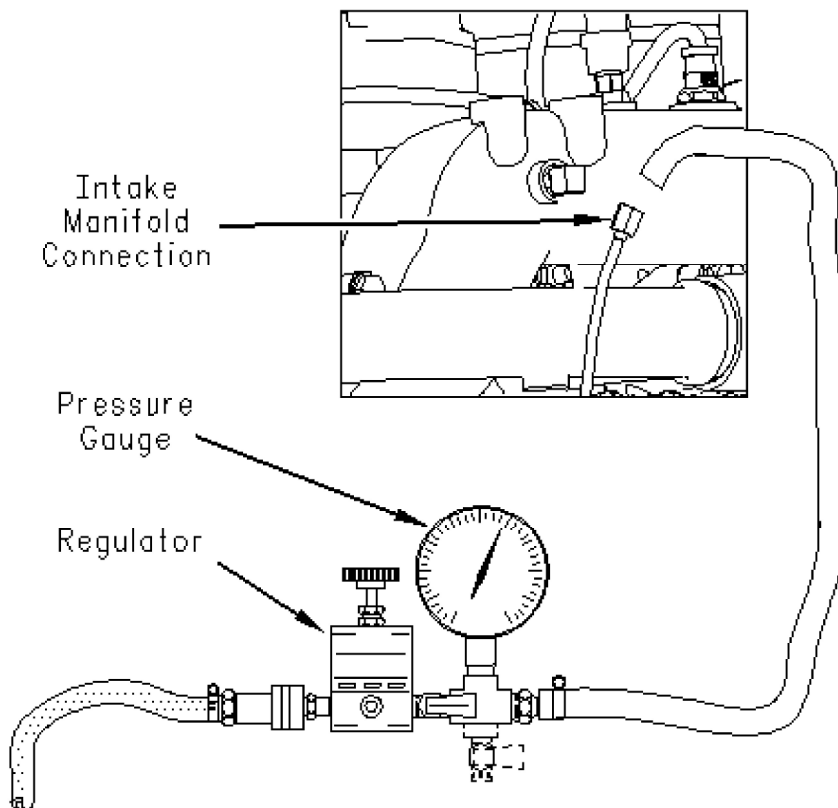
- **Not OK** - Bypassing the harness did not fix the problem.

**Repair:** If the problem is intermittent, refer to Troubleshooting, "Electrical Connectors - Inspect". Restart this procedure and carefully perform each step.

## STOP

## Test Step 9. Connect the Test Equipment

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- A. Turn the key switch to the OFF position.
- B. Disconnect the air line from the intake manifold. Refer to Illustration 3 for the location of the air lines.
- C. Connect an air hose that is regulated to 170 kPa (25 psi) to the air line that was connected to the intake manifold.

**Note:** The thread size on the nut for the air line is 7/16–20 with a 37 degree flare.

**Note:** Make sure that the air supply is regulated to 170 kPa (25 psi) before the air supply is connected to the wastegate. Damage to the wastegate could result if the air supply is not regulated.

**Expected Result:**

Air will escape from the bleed orifice, when air pressure is applied to the system.

**Results:**

- **OK** - Proceed to Test Step 10.
- **Not OK** - Air is not escaping from the bleed orifice.

**Repair:** The air lines to the solenoid are blocked or the solenoid is stuck in the closed position.

1. Remove the pressurized air from the system.
2. Inspect the air lines from the intake manifold to the wastegate. Verify that there are no restrictions in the air lines.
3. Remove the wastegate solenoid and check for debris that could cause the solenoid to stick.
4. Inspect the O-rings on the wastegate solenoid. Replace any cracked O-rings or broken O-rings.
5. Pressurize the system and verify that air is reaching the solenoid.
6. Check the air supply and verify that the equipment is working properly.
7. Verify that nothing is blocking the bleed orifice.
8. Install a new solenoid. If the new solenoid fixes the problem, reinstall the old solenoid. If the problem returns, permanently install the new solenoid.

**STOP**

**Test Step 10. Perform the "Turbo Wastegate Solenoid Output" on Cat ET**

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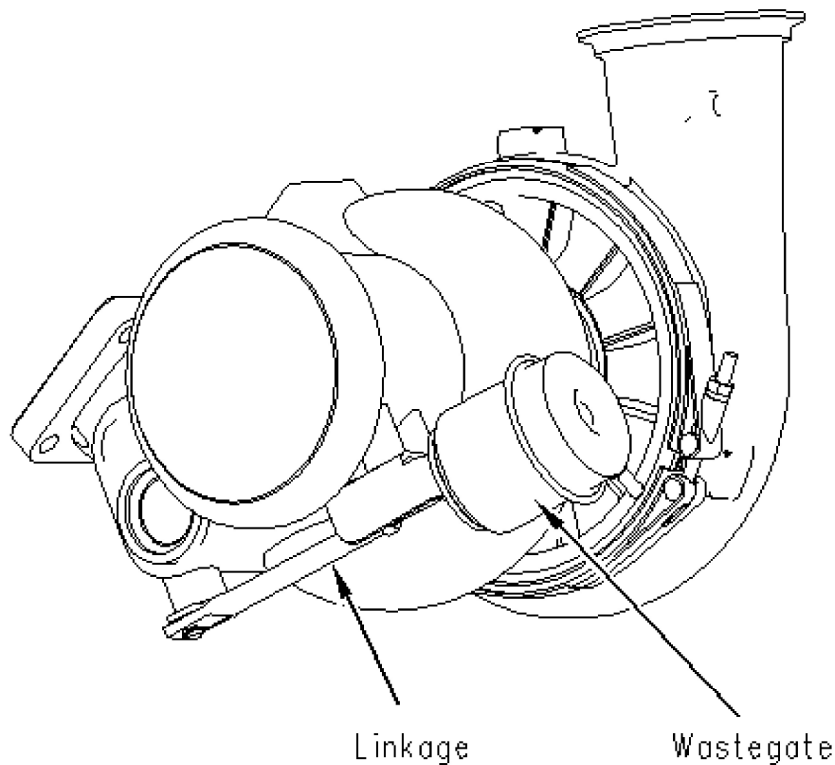


Illustration 5  
Typical example

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- A. Turn the key switch to the ON position.
- B. Access the "Special Tests" under the "Diagnostics" menu on Cat ET. Activate the "Turbo Wastegate Solenoid Output" on Cat ET.
- C. Check for movement in the linkage for the wastegate. Cycle the "Turbo Wastegate Solenoid Output" several times in order to ensure proper operation.

#### **Expected Result:**

The linkage should retract when the "Turbo Wastegate Solenoid Output" is active, and the air flow out of the bleed orifice is reduced. The linkage should extend when the "Turbo Wastegate Solenoid Output" is not active and the air flow out of the bleed orifice is increased.

#### **Results:**

- **OK** - The system is operating correctly.

**Repair:** Check the wastegate for proper calibration. Refer to Testing and Adjusting, "Wastegate" for more information.

Proceed to Test Step 11.

- **Not OK** - The system is not operating correctly.

**Repair:**

1. Inspect the O-rings on the wastegate solenoid. Replace any cracked O-rings or broken O-rings.

Proceed to Test Step 12.

### **Test Step 11. Check for Restrictions in the Intake and Exhaust Systems**

- A. Make sure that there are no restrictions to the flow of air. Also check for leaks and/or collapsed lines. Check the following areas for problems:

- Air filter
- Air intake hoses
- Exhaust
- Catalytic converter/muffler

- B. Make sure that the turbocharger is operating correctly.

#### **Expected Result:**

There are no leaks, collapsed lines, or restrictions in the air lines. Also, the turbocharger is operating correctly.

#### **Results:**

- **OK** - The system appears to be working correctly at this time.

**Repair:** Verify that the problem still exists. Repeat this test, if necessary.

**STOP**

- **Not OK** -

**Repair:** Repair the intake and/or exhaust systems. Verify that the repair eliminates the problem.

**STOP**

### **Test Step 12. Test the Wastegate Solenoid**

- A. Access the "Special Tests" under the "Diagnostics" menu on Cat ET. Activate the "Turbo Wastegate Solenoid Output" test on Cat ET.

- B. Observe the change in air flow out of the bleed orifice when the "Turbo Wastegate Solenoid Output" is active.

#### **Expected Result:**

The solenoid reduces the flow of air when the "Turbo Wastegate Solenoid Output" is active.

#### **Results:**

- **OK** - The solenoid is working correctly. Proceed to Test Step 13.
- **Not OK** - The solenoid is not working correctly.

**Repair:** Perform the following procedure:

1. Temporarily connect a new solenoid.
2. If the problem is fixed, reconnect the suspect solenoid. If the problem returns, permanently install the new solenoid.

## **STOP**

### **Test Step 13. Connect the Air Supply to the Wastegate**

- A. Connect the air supply directly to the wastegate. Use the **215-2592** Tool Kit in order to connect to the wastegate.

**Note:** Make sure that the air supply is regulated to 170 kPa (25 psi) before the air supply is connected to the wastegate.

- B. Verify that the wastegate is operating correctly.
- C. Check for leaks in the wastegate.

### **Expected Result:**

The wastegate is operating correctly and there are no leaks in the wastegate.

### **Results:**

- **OK** - The wastegate is operating correctly.

**Repair:** Check the air lines between the wastegate solenoid and the wastegate. Check for pinched lines and/or signs of tampering. Repair the air lines. Verify that the repair eliminates the problem.

## **STOP**

- **Not OK** - There is a problem with the wastegate.

**Repair:** Repair the wastegate. Refer to Testing and Adjusting, "Wastegate" for more information. Verify that the repair eliminates the problem.

## **STOP**

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