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|---|---|---|---|
| **Countries**: | AUSTRALIA, BRAZIL, CANADA, UNITED STATES, MEXICO, PUERTO RICO, SOUTH AFRICA | **Document ID**: | IK1200163 |
| **Availability**: | ISIS, FleetISIS | **Revision**: | 7 |
| **Major System**: | ENGINES | **Created**: | 10/21/2007 |
| **Current Language**: | English | **Last Modified**: | 2/25/2014 |
| **Other Languages**: | Français, Español, | **Author**: | Randy Geweniger |
| **Viewed**: | 51089 | | |

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**Title: Updated I6 EVRT/VGT Diagnostics Check Sheet and Turbocharger Repair Procedures for engines that exibit DTC 353 / 354**

**Applies To: 2004- 2006 MY EGR DT 466 and 570 with EVRT/VGT Turbos with ESN 2,000,001 - ESN 3,000,000**

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## Customer Complaints:

1. Low Power (Can be intermittent)
2. No Acceleration
3. Excessive Smoke.
4. Engine Light on , DTC 353 and /or DTC354 Active or Inactive

### Possible Diagnostic Codes

DTC 353 - Variable Geometry Turbo control over duty cycle.
DTC 354 - Variable Geometry Turbo control under duty cycle.

## Possible Causes:

The ECM logs DTC 353 and/or DTC 354 codes when the Exhaust Back Pressure (EBP) is too high or too low for specific engine operating conditions.

- Turbocharger actuator (SRA) binding or sticking.- Repairable or Replacable
- Turbocharger linkage binding or sticking. - Repairable or Replacable
- Pivot Shaft binding in the actuator (SRA) Flange Bushings. - Replacable as Pivot Shaft Flange Kit
- Intermittent or low voltage/ground to turbo actuator (SRA). - Repairable
- Incorrect pressure reading from the EBP sensor. - Repairable
- The turbocharger vanes or other EVRT/VGT components internally binding, sticking or damaged.- May Not Be Repairable , May need the Turbocharger replaced.
- Plugged/damaged exhaust system or catalyst/muffler. - Repairable

### Diagnostic Check Sheet and Contents

Turbocharger Diagnostics are divided Into Six Steps:

1. Visual Checks
2. Bounce Test
3. Pre-cycle Check and Voltage / Ground Check
4. Actuator Part Number and Suffix Check
5. Exhaust Back Pressure (EBP) Sensor Part Number Check
6. Clear Codes and Road Test

Supplemental Procedures:

- Linkage Check

- Actuator Flange & Pivot Shaft Check
- Linkage Repair

Service Kit Procedures:

- Actuator Replacement
- Linkage Replacement
- Pivot Shaft Flange Replacement

Other References:

- Service Torque Summary
- Part Numbers

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**WARNING:**

**To prevent personal injury or death, allow engine to cool before working with components.**

**WARNING:**

**To prevent unexpected movement of the vehicle and possible serious personal injury or death, park the vehicle on a flat, level surface, set the parking brake, turn the engine off and chock the wheels to prevent vehicle from moving in both directions.**

**Step 1: Perform a quick Visual Check for:**

- CAC piping, hoses clamps for leaks or restrictions.
- Exhaust leaks before the Turbocharger
- Air filter restriction guage should not be in the red.

**Decision Step 1A:** If a problem is detected, repair as needed, clear the DTC.s and test drive to determine if the problem is corrected.

**Decision Step 1B:** If no problems are found, go to Step 2 and perform the Bounce Test Procedure

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**Step 2: Perform the Bounce Test Procedure**

Note:
Before performing this test for the first time, technicians should check a known-good turbocharger to be aware of how the linkage should feel and sound when it is working properly.

1. Turn the ignition key-switch to the OFF position.

2. Attempt to move the turbocharger linkage through its full range of motion by hand. Rotate the end-link attached to the actuator as a crank to move the linkage. The linkage should move smoothly and not chatter or hesitate.

3. Move the actuator linkage away from the engine and towards the frame rail. Release the actuator linkage. The linkage should fall back towards the engine, bounce once, and then return to its original position. Perform this test a couple of times to recognize the .bounce. characteristic of the mechanism.

**Decision Step 2A:** If the turbo fails the bounce test, perform the Linkage Check Procedure.

**Decision Step 2B:** If the turbo passes the bounce test, go to Step 3 and perform the Precycle Check and Voltage / Ground Check while the pre-cycle is occurring.

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**Step 3: Perform the Pre-cycle Check and Voltage / Ground Check to the actuator under the load of the Pre-cycle.**

EGES 270-1 VGT Pin-Point Diagnostics.

1. Connect the turbocharger breakout harness between the engine harness and the turbocharger actuator pigtail.

Note: The male/female connector has an additional retention locking feature that must be disengaged prior to separating the male/female connectors. This slide locking tab may be coated with paint that will be required to be scrapped off to ease disassembly.

2. Turn the ignition key-switch to the KEY-ON ENGINE-OFF position.

3. Setup a Voltmeter to measure engine wiring harness voltage between the actuator power and the ground terminals during the pre-cycle as follows:

Pin 1: Actuator Power (+)

Pin 2: Actuator Ground (-)

Use an assistant to cycle the key-switch. This will allow the technician to measure the voltage under the load of the pre-cycle. In addition, this will allow the technician to observe the pre-cycle operation.

4. Observe the turbocharger linkage during pre-cycle movement. The linkage should rotate through its range of motion all of the way out towards the frame rail, then rotate all of the way back in towards the engine, and then rotate back out about half way.

5. Repeat the pre-cycle three times, with at least three seconds of key-off time between the tests. Each pre-cycle should be completed in less then one second. The linkage should move through its range of motion smoothly. The linkage should not chatter, vibrate, hesitate or slow down.

6. Complete the pre-cycle tests. Make sure that the ignition key-switch is in the KEY-ON ENGINE-OFF position.

7. Attempt to move the linkage by hand after the pre-cycle is completed on the last key cycle. The linkage should not move.

**Decision Step 3A:** If the voltage is low (more than 0.5 Volts below Vbat) during the precycle, repair the circuit as needed.

**Decision Step 3B:** If the voltage is good (within 0.5 volts of Vbat) and the pre-cycle passes, go to Step 4 to Check the Actuator Part Number and Suffix.

**Decision Step 3C:** If the voltage is good (within 0.5 volts of Vbat) and the pre-cycle fails, replace the actuator (with Suffix .E. or later), retest and go to Step 5 to Check the EBP Sensor Part Number.

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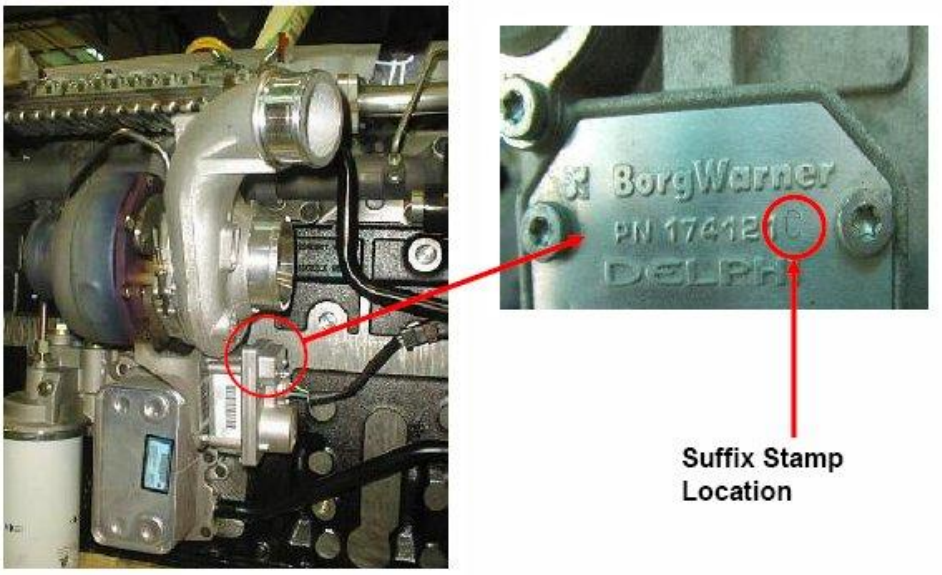
**Step 4: Check the Actuator Part Number and Suffix Stamp**
Note: Perform this step only if the turbocharger is functioning correctly and has passed all previous steps.

1. Locate the name plate stamp located on the actuator body.




2. Locate and identify the Suffix Stamp next to the Borg Warner Actuator Part Number embossed on the name plate. The Suffix Stamp will be a letter designation, but also maybe blank and not have a Suffix stamp letter.

**Decision Step 4A:** If it does not have Suffix stamp next to the part number, replace the actuator with Actuator Service Kit P/N 1847620C91.

**Decision Step 4B:** If the Suffix stamp next to the part number is A, B, C or D, replace the actuator with Actuator Service Kit P/N 1847620C91.

**Decision Step 4C:** If the Suffix stamp next to the part number is E, go to Step 5 Check the EBP Sensor Part Number.

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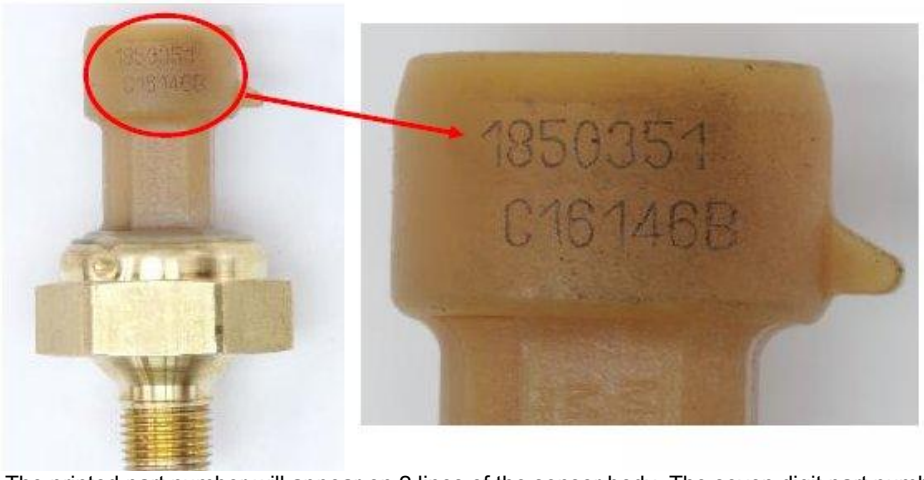
**STEP 5: Check the EBP Sensor Part Number**

1. Locate the Exhaust Backpressure Sensor (EBP) located at the right front corner of the engine just above the alternator.

2. Locate and check the EBP part number printed on the plastic portion of the sensor body.




The printed part number will appear on 2 lines of the sensor body. The seven digit part number will be on the first line, and the second line will start with the part number suffix (ex. C1).

**Decision Step 5A:** If the EBP Sensor is not part number 1850351C1, replace the sensor.

**Decision Step 5B:** If the EBP Sensor is part number 1850351C1, The sensor does not need replaced unless you suspect EBP sensor is out of range. perform the EBP diagnostics steps in the Engine Diagnostic Manual EGES 270-1 EBP Sensor to validate the EBP sensor.

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**Step 6: Clear Codes and Road Test**

1. With an EZ-Tech clear both active and inactive DTCs.

2. Road Test to bring engine up to operating temperatures and verify that original customer engine performance complaints and/or DTCs 353 / 354 are not present.

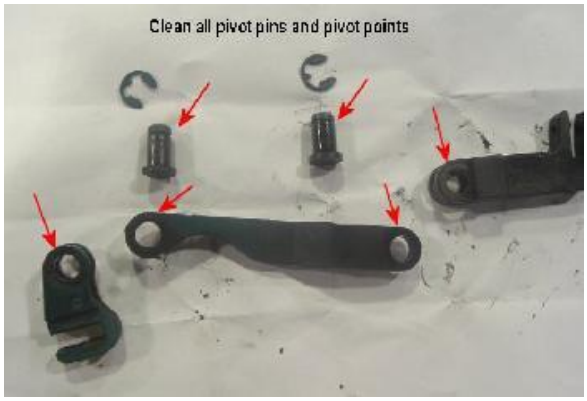
3. If turbocharger was removed for any repairs, check for any loose hardware or oil leaks after road test.

**Decision Step 6A:** If DTC 353 or 354 return during road test or performance has not improved, Submit the complete form and case file to Tech Service for further assistance.

**Decision Step 6B**: If performance is satisfactory and subject DTC 353 / 354 are not present, turbocharger repair is complete.

**Linkage Repair Procedure**

Repair procedure assumes that linkage has been removed from turbo assembly already
1. Remove the E clips from both of the fork lever pins and remove the pins.
2. Using emery cloth or a soft wire wheel, clean the inside of both fork levers, the ends of the intermediate linkage on both sides, and the fork lever pins




**Decision Step A:** If the linkages and pins are excessively worn (steps or elongated holes), replace the linkage.

**Decision Step B:** If the linkages and pins are not excessively worn, continue repair the linkage.

3. Apply anti-seize compound to all points of contact on the fork levers, pins, and the linkage using 1870706C1 Lubricant or commercially available equivalent.



PN 1870706C1
5 Grams

Retail Equivalent
28 Grams

The Nord-lock washer assembly may fall off when the top fork lever bolt on the turbo side is installed. Magnets will not help as the washers and bolts are stainless steel.

5. Install the Nord-lock washer assembly on each of the fork lever bolts. Screw the washer assemblies into the lever arms.

6. Torque each bolt on the linkage to 60 lbf-in (6.8 N-m).

7. Carefully twist the fork lever and bolt counterclockwise to realign the linkage and free it from binding. Do not reduce the fork lever bolt torque.

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**Actuator Flange & Pivot Shaft Check Procedure**

1. Remove actuator flange pivot shaft assembly per Instruction Sheet 1171915R1 Steps 1 through 5 (reference Service Kit Procedures found later in this FAQ).
2. After actuator flange and pivot shaft assembly is removed, verify free and smooth movement of the pivot shaft.

**Decision Step A:** If the pivot shaft is binding in the flange, replace the flange and shaft using kit p/n 1878103C91 using service kit instructions. If this resolves the binding issue
go to Step 4.

**Decision Step B:** If the pivot shaft is not binding in the flange bushings and the unison ring or other EVRT/VGT components in the turbo are binding, pitted, damaged components, Bad Bearings ( Turbine or Compressor wheel in contact with housing ) or excessive oil leak , submit the diagnostic form to Tech Services for possible Turbocharger replacement..

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**Service Torques**

| Item Description | Qty. | N-m | lbf-in ( 10) |
|---|---|---|---|
| Serrated Lock Nut to Actuator (SRA) Mounting Stud | 4 | 13.6 | 120 |
| Linkage Fork Lever Bolt | 2 | 6.8 | 60 |
| Actuator Flange to Turbine Housing (Outer) | 8 | 29.0 | 260 |
| Actuator Flange to Center Housing (Inner) Initial Sequence* | 4 | 11.0 | 100 |
| Actuator Flange to Center Housing (Inner) Final Sequence* | 4 | 25.0 | 220 |
| Turbo Assembly to Exhaust Manifold | 4 | 71.0 | 624 (52 lbf-ft) |
| Turbo Oil Drain Line Clamp bolt to Crankcase | 1 | | |
| Turbo Oil Feed Line to Turbo | 1 | | |

Bolt access will require use of a torque adapter and decrease torque setting.
Reference Using a Torque Wrench Extension in Appendix B of EGES-265-1 Service Manual

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**Part Numbers**

| Kit Description | Kit P/N | Turbo P/N | Turbo Mount | Engine | Model Year |
|---|---|---|---|---|---|
| Actuator (SRA) | 5010588R91 | NA | NA | DT466/570 | 2004-2006 |
| Linkage Assembly | 5010621R91 | NA | NA | DT466/571 | 2004-2007 |
| Pivot Shaft Flange Assy. | 5010620R91 | NA | NA | DT466/572 | 2004-2008 |
| Turbo Mtg. & Gasket** | 1842623C96 | NA | NA | DT466/573 | 2004-2009 |
| Anti-seize Lubricant (5g) | 1870706C1 | NA | NA | DT466/574 | 2004-2010 |
| Turbocharger | 5010313R91 | REMAN | Low | DT466 | 2004 |
| Turbocharger | 5010314R91 | REMAN | Low | DT466/570 | 2004-2006 |
| Turbocharger | 1842583C93 | 1842218C92 | High | DT466 | 2004 |
| Turbocharger | 1842584C93 | 1842338C92 | High | DT466/570 | 2004-2006 |
| Turbocharger | 1842585C93 | 1842219C92 | High | DT466 | 2004 |
| Turbocharger | 1842586C93 | 1842339C92 | High | DT466/570 | 2004-2006 |
| Turbocharger | 1850404C92 | 1832204C91 | Low | DT466 | 2005-2006 |
| Turbocharger | 1850405C91 | 1831834C91 | High | DT466 | 2005-2006 |
| Turbocharger | 1850406C91 | 1831835C91 | High | DT466 | 2005-2006 |
| Turbocharger | 1850406C92 | | High | DT466 | 2005-2006 |

** Included in all Turbocharger Kits and Pivot Shaft Flange Assembly Kit

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