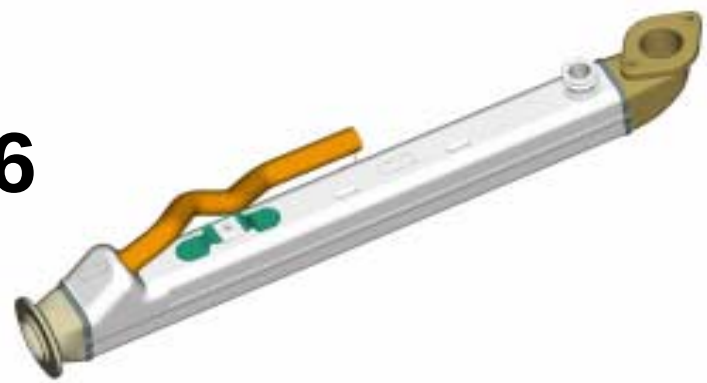
6.0L Diesel Talk *LIVE*

6.0L Air Mgmt System Diagnosis

Part 2 - EGR Sub-System

May 24, 2006



Diesel Talk Live

- **<u>Today</u> - 6.0L Air Mgmt System Diagnosis**
  - ***Part 2* - EGR Sub-System**
- **<u>June 7</u> 1:00PM - 6.0L Fuel & High Pressure Oil Sub-System Diagnosis**

EGR Valve –Specification Limits

What is the problem?

- Valve replacements within specification

EGR Valve specifications.

- KOEO closed position range 0.6V – 1.2V
- When energized:
  - EGRV minimum travel = 2.71V
  - Minimum travel: 3.31V – 3.91V (Closed position + minimum travel)
  - Maximum travel 4.9V (accommodates for variation in system)
- What to do. Only replace EGR Valve when below 0.6V or above 1.2V during KOEO test.

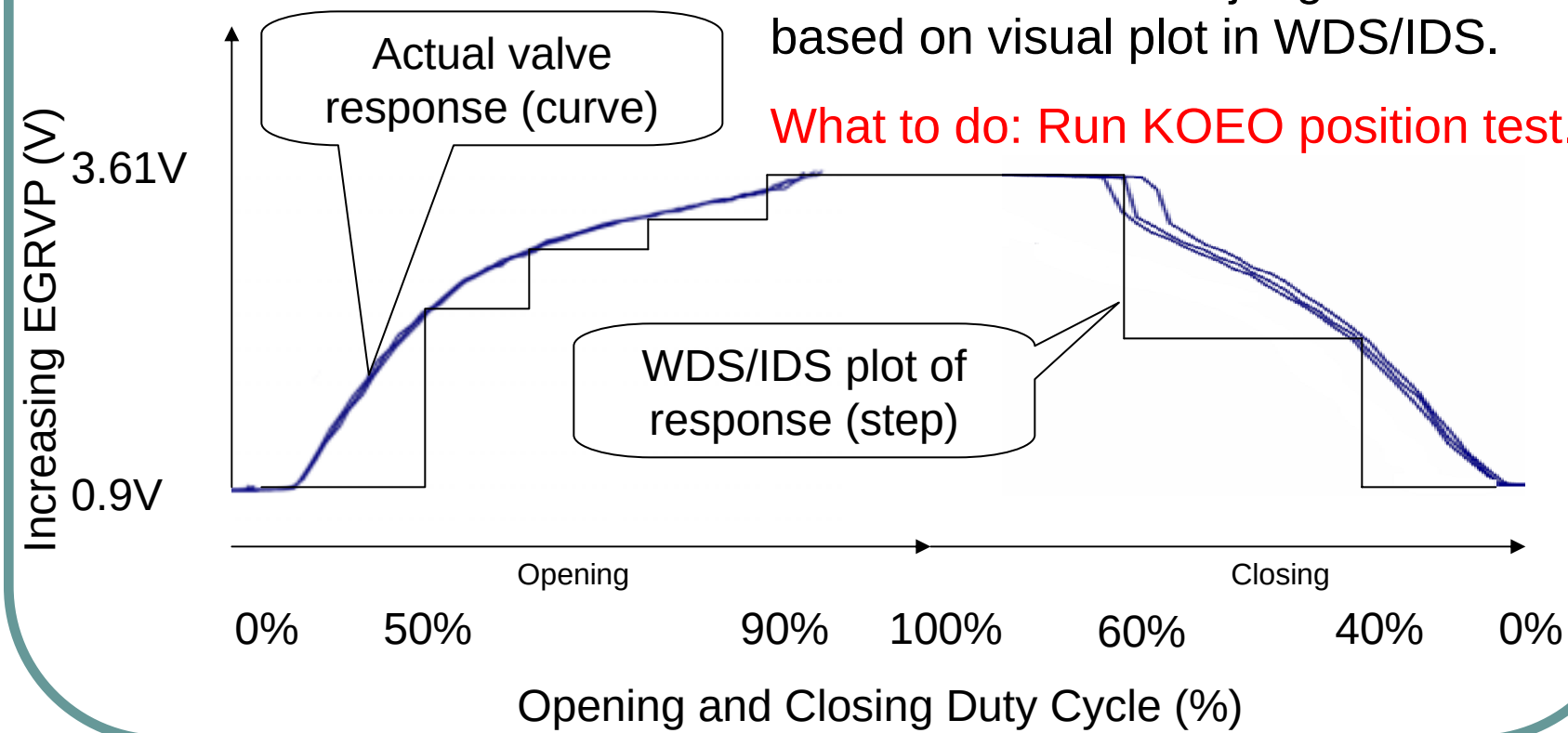
EGR Valve - Open & Close Duty Cycle

What is the problem?

- Valve position movement is not linear with increased duty cycle

What to avoid: Don't judge valve based on visual plot in WDS/IDS.

What to do: Run KOEO position test.



EGR Valve – Types of Coking

What is it?

- Varnish
  - Fuel residue or oil additives
  - Cold weather issue
  - P0404, P0401

- Sludge
  - Engine oil and soot
  - Can be hard, soft, or oily
  - No geographic preference
  - P0404, P1335, P0401

EGR Valve Coking

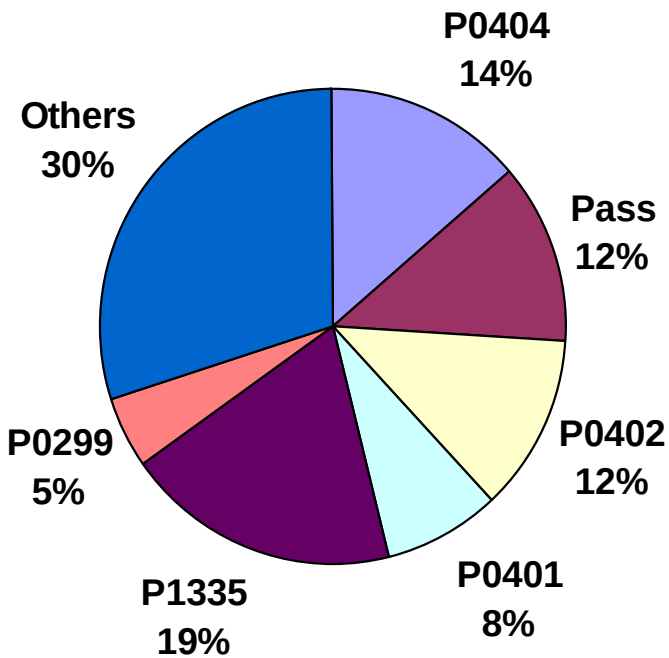
- What is the problem?
  - Only replacing EGR valves does not always solve coking issues.
- What to do:
  - Determine cause of coking
    - Long idle events, low engine temperatures, poor fuel quality.
  - Discuss actions the customer can take
    - Promote use of cetane booster (Motorcraft PM-18)
    - Recommend hot drive cycles to burn off coking build-up.
  - Perform Pinpoint Test W
  - Reference Coking Bulletin (TSB 06-04-12)

(Continued next page)

EGR Valve Coking (cont.)

- What to avoid:
  - Do not replace based on Visual Observation
  - If cleaning EGR Valve, do not use Motorcraft Cleaner PM-2 (carburetor cleaner).
    - Carburetor cleaners can swell the EGR shaft seal and cause performance issues.
    - PM-4 (brake cleaner) cleans the varnish and coking without effecting the EGR shaft seal
    - Reference Pinpoint test AK (VGT)

EGR – DTC Pie Chart



2006 MY J1 through Jan MOP

#1 = P1335

#2 = P0404

#3 = Pass

#4 = P0402

#5 = P0401

#6 = P0299

70% of EGR Valve replacements are assoc. with P0401-P0405, P0299 and P1335

Up to 60% of Valves returned to supplier are "Trouble not Found"

Issue: MILs NOT necessarily due to EGR Valve Fault. Need better diagnostics

P1335
EGR Position Min/Max Stop Performance

- What is it?
  - KOEO position check
  - Initial position between 0.6V – 1.2V
- What is the problem?
  - Sludge changes closed position and can cause the valve to stay open (>1.2 Volts)
- What to do:
  - Follow PC/ED pinpoint test in Section W
  - Reference Coking Bulletin (TSB 06-04-12)
- What to avoid:
  - Replace based on visual inspection or under 1.2V.

P0404 – Control Range / Performance

- What is it?
  - Continuous position check vs. PCM desired position
  - MY03 – MY04: Error > +/- 10% for 10 seconds
  - MY05 – beyond: Error > +/- 10% for 15 seconds
- What is the problem?
  - Excessive backpressure can set code (SSM 19116)
  - Sludge can affect performance (TSB 06-04-12)
  - Associated with P0299 – Turbo Under Boost
- What to do:
  - Perform pinpoint test KA (do not omit steps)
  - Run the KOEO self-test after dead battery or part replacement (SSM 19099)
  - Perform coking TSB & appropriate SSMs
- What to avoid:
  - Replace based on visual inspection or under 1.2V.

P0402/P0401 Excessive/Insufficient Flow

- What is it?
  - Flow measured by MAF does not meet PCM predicted flow.
    - P0401 = insufficient flow
    - P0402 = excessive flow
- What is the problem?
  - Contaminated MAF Sensor (oil, water & dust)
  - Sludge (blocking upper chamber)
  - Aftermarket Intake Systems (SSM 18872 & WAN 01-A-06)
  - Excessive Backpressure (SSM 19116)
  - Plugged EGR Cooler (TSB 06-03-08)
  - Contaminated IAT2

(Continued next page)

P0402/P0401 Excessive/Insufficient Flow

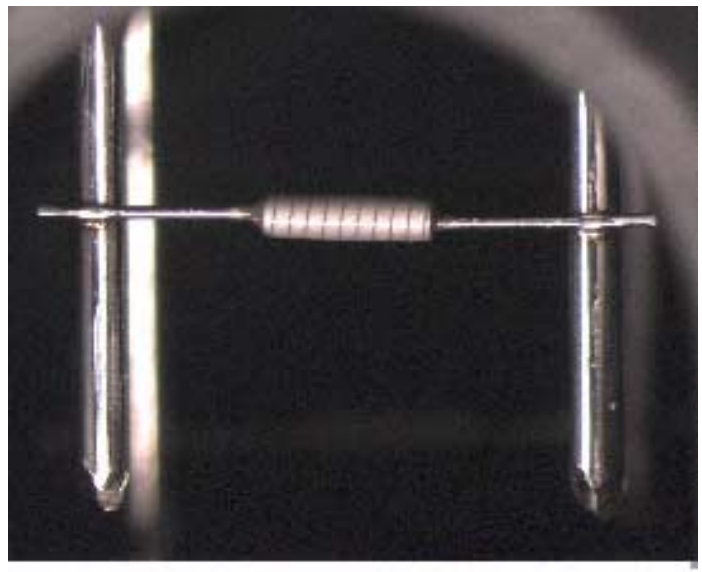
- What to do.
  - Check for aftermarket air intake systems
  - Check for leaks or restrictions in flow path (EGR valve, EGR cooler, Air intake system)
  - Inspect MAF for contamination
  - Inspect for excessive EGR Valve coking

AIS after-market induction system

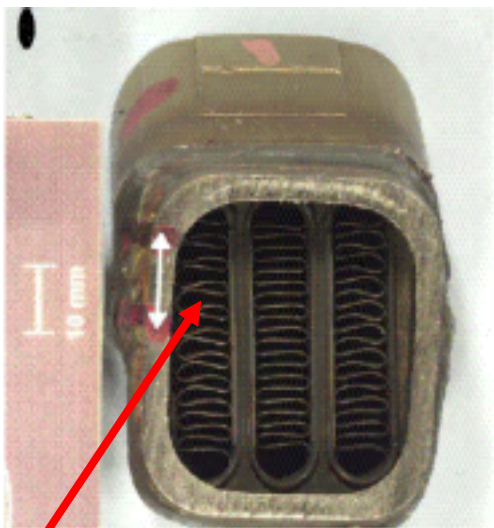
Example of oil-contaminated MAF

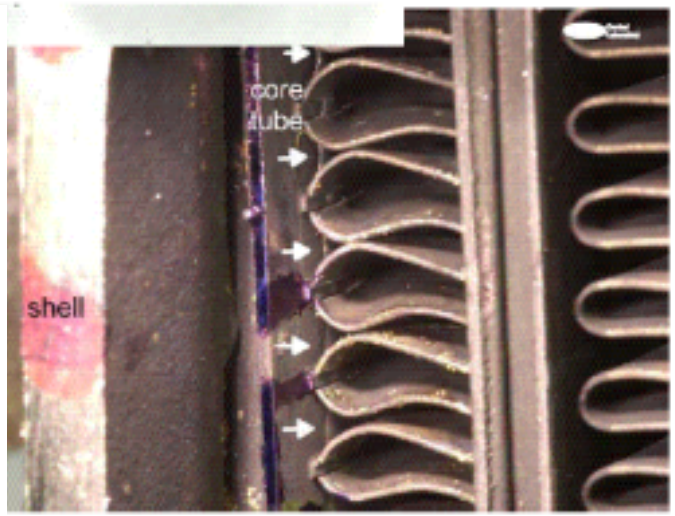
Contaminated

Clean



EGR Cooler Header Crack





Cracks on the inner surface of the core tube and the ends of the cooling fins

Issue: cracks occurring because of metal expansion during high temperature conditions.

Supplier working on new service parts.

Action: Follow TSB 06-03-08; to determine if Cyl head or Cooler Leak

Taped Rebroadcast Dates
Ford Dealer TV – *Channel 11*

Topic	***Date***	***Time (ET)***
6.0L Air Mgmt System Diagnosis ***Part 2* - EGR Sub-System**	5/30/06 5/31/06 6/1/06 6/6/06 6/7/06 6/8/06	11:00 – 12:00 pm 7:00 – 8:00 pm 8:00 – 9:00 am 9:30 – 10:30 pm 2:00 – 3:00 pm 10:30 – 11:30 am

Next 6.0L Diesel Talk *LIVE*

6.0L Fuel & High Pressure Oil Sub-System Diagnosis

Wednesday, June 7

1:00 – 2:00 PM (ET)

Channel 11 / Host 34

6.0L Diesel Talk *LIVE*

Survey

Question #1 ?

1. Prior to this presentation, were you aware that the movement of EGR Valve is not linear vs duty cycle?

    A. Yes
    B. No

Question #2?

2. Would a EGR Valve Cleaning procedure be useful to you?

    A. Yes
    B. No

Question #2?

3. If you have an EGR Valve setting the P0404 code, do you:

   A. Replace the EGR Valve
   B. Visually inspect and replace
   C. Follow Pinpoint test KA
   D. Add Cetane Booster and test drive.

6.0L Diesel Talk *LIVE*

Q & A

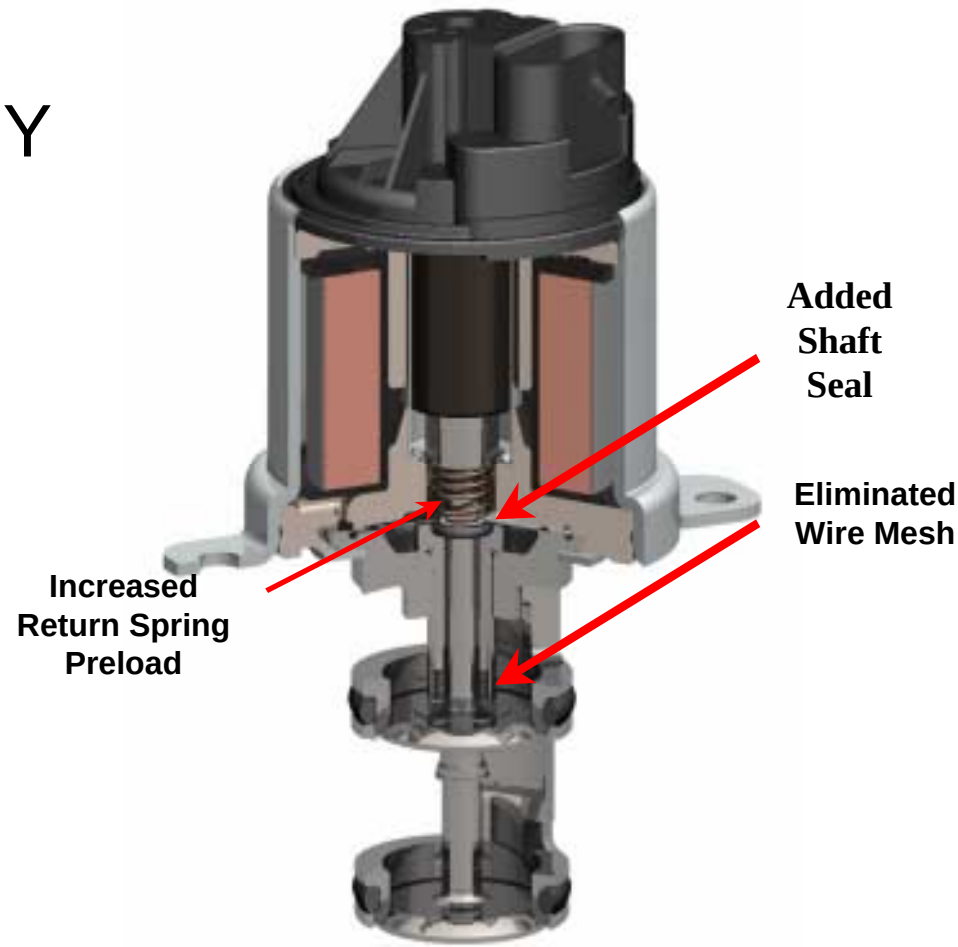
6.0L Diesel Talk *LIVE*

May 24, 2006

Back-Up

EGR Valve Cross Section

- Cross Section of 2005MY / 2006MY



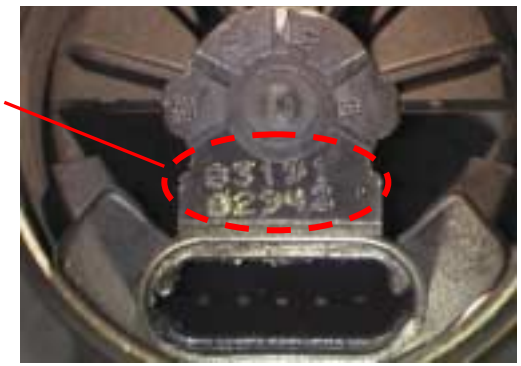
EGR System SSM & TSB Reference List

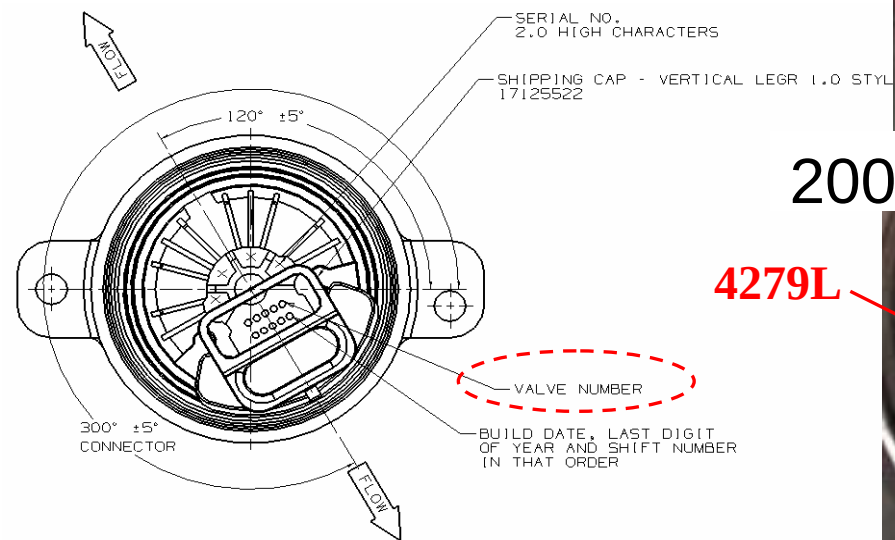
Number	Subject
SSM 17568	Re-calibration - EGR turned on at idle
SSM 17573	ICP / EBP connectors
SSM 18362	Coking - Service Valve Release
SSM 18872	P0402 - Aftermarket air filters
SSM 18898	EBP wire chafing
SSM 19099	P0404 - KAM clear or battery disconnect
SSM 19116	P0404 - Excessive back pressure
SSM 19159	EGR valve part numbers
TSB 06-03-08	EGR Cooler leak process
TSB 06-04-12	Coking Bulletin

EGR Valve Date Code Identification

2003MY - 2004MY Production

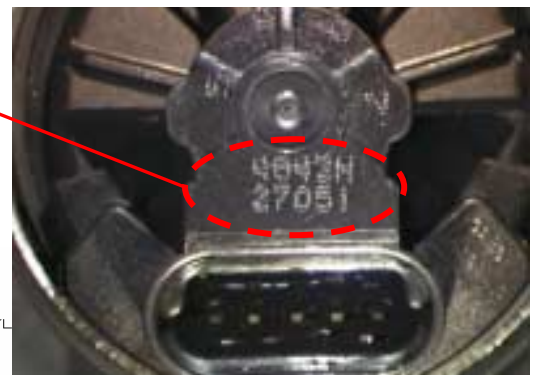
03191





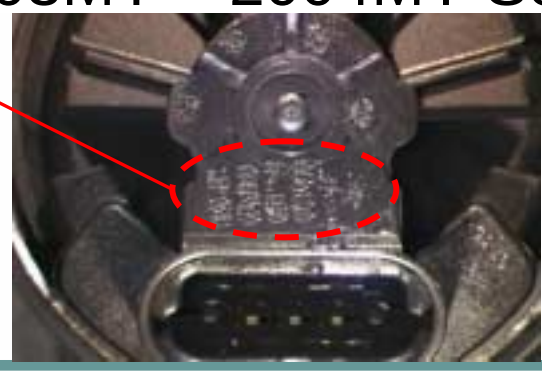
2005MY - 2006MY Production & Service

4043H



2003MY – 2004MY Service

4279L



EGR Valve History

2003MY – 2006MY

Model Year	2003 / 2004 Production	2005 / 2006 Production	2003 / 2004 Service (no shaft seal – discontinued model)	2003 / 2004 Service (w/shaft seal)	2005 / 2006 Service
Ford PN	3C34-9F452-AC	5C34-9F452-AA	3C3Z-9F452-AC	4C3Z-9F452-A	5C3Z-9F452-A
Design Content	Wire Mesh, No Shaft Seal, Standard Preload Spring, Standard Bushing & Shaft Clearances	Eliminate Wire Mesh, Add Shaft Seal, Increase Spring Preload, Reduced Clearance between Bushing & Shaft	Wire Mesh, No Shaft Seal, Standard Preload Spring, Standard Bushing & Shaft Clearances	Same as "Heavy" Design Except for use of Standard Return Spring with Retargeted Preload *(Note: Response Time Production Test Added in Manufacturing)*	Eliminate Wire Mesh, Add Shaft Seal, Increase Spring Preload, Reduced Clearance between Bushing & Shaft
PN on Valve	03191	4043H	03191	4276L	4043H

Pinpoint Test KA – 2004 ¼ - 2006 MY

Turbocharger System Performance	KA

Signal Functions

The variable geometry turbocharger (VGT) is controlled by the powertrain control module (PCM). The PCM uses an exhaust pressure (EP) sensor to monitor the pressure and adjust the VGT solenoid duty cycle. The VGT solenoid receives a pulse width modulated (PWM) signal from the PCM that controls the solenoid on/off time. The VGT solenoid directs oil to a piston within the actuator housing. The direction of oil flow to the piston increases or decreases the exhaust pressure.

Sensor Bias

The VGT solenoid control is based on input sensors. The input sensors are used to calculate the engine speed, desired fuel quantity, altitude, and exhaust pressure. The amount of voltage the sensor deviates from a calculated reference value (sensor bias) may cause a commanded versus actual pressure calculation error.

Detection/Management

The PCM monitors the exhaust pressure. A DTC is set when the difference between the commanded and the actual exhaust pressure is not within the calibrated limits.

DTC Descriptions

- P0299 = Turbo/Super Charger Underboost
- P0478 = Exhaust Pressure Control Valve High Input
- P2262 = Turbo/Super Charger Boost Pressure Not Detected
- P2263 = Turbo/Super Charger System Boost Performance

Turbocharger System Performance	KA

	Test Step	Results / Action to Take
KA1	PRELIMINARY DIAGNOSIS	
	• Key in OFF position. • Carry out a visual inspection. • Key ON, engine OFF. • Record the freeze frame data. • Retrieve the continuous memory DTCs. • Carry out the KOEO and KOER self-test. • Are any DTCs present?	Yes For DTCs P0299, P2262 or P2263, GO to KA2. For DTC P0478, GO to KA6. For all others, REFER to Section 4, Diagnostic Trouble Code (DTC) Descriptions. No GO to KA2.
KA2	CHECK THE MANIFOLD ABSOLUTE PRESSURE (MAP) SIGNAL ACCURACY	
	Note: Route the pressure gauge hose to the passenger compartment so it is not crimped and does not come in contact with any hot surface. • Inspect the MAP sensor hose and manifolds for damage, leaks, restrictions, and correct routing. • Disconnect the MAP sensor pressure hose from the sensor. • Install the pressure test adapter kit 014-00761 0-30 psi gauge between the MAP sensor and the pressure hose. • Access the PCM and monitor the MGP and EOT PIDs. • Allow the EOT to reach 70°C (158°F) and road test the vehicle. • Does the MGP PID match the actual gauge pressure?	Yes GO to KA3. No GO to Pinpoint Test E.
KA3	CHECK THE ICP SENSOR FOR BIAS	
	• Key ON, engine OFF. • Access the PCM and monitor the ICP_V PID. • Is the voltage between 0.15 - 0.35 V?	Yes GO to KA4. No INSTALL a new ICP sensor. CLEAR the DTCs. REPEAT the self-test.
KA4	CHECK FOR INPUT SENSOR BIAS	
	• Access the PCM and monitor the BARO, EGR_DC, EBP, MAF V and MAP PIDs. • Refer to Section 6 for normal operating values. • Are the BARO, EGR_DC, EBP, MAF, and MAP PIDs within specifications and is the EBP PID value within 10.34 kPa (1.5 psi) of the MAP and BARO PID values?	Yes GO to KA5. No REFER to the appropriate pinpoint test to continue sensor diagnosis.
KA5	CHECK THE EGR VALVE OPERATION	
	Note: Incorrect EGR valve operation may affect turbocharger diagnostics. • Check the EGR valve operation. Refer to Section 4 Exhaust Gas Recirculation (EGR) Position Test. • Is a concern present?	Yes REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. No GO to KA6.

Pinpoint Test KA – 2004 ¼ - 2006 MY

Turbocharger System Performance	KA

Test Step		Results / Action to Take
KA6	CHECK THE TURBOCHARGER OPERATION BOOST	
	Note: Additional DTCs may set during the use of output state control (OSC). Clear all PCM and transmission control module (TCM) DTCs after the diagnostics have been completed. Repeat the self-test to verify all DTCs have been cleared. • Key ON, engine running. • Access the PCM and monitor the RPM, MGP, EGR_DC and VGTDC PIDs. • Access the PCM and control the EGRDC, RPM_DSD, and VGTDC PIDs. • Increase the commanded engine speed to 1,200 RPM using output state control. The calibration may limit the actual RPM between 1,150 and 1,200 RPM. • Decrease the EGR duty cycle to 0%. • Decrease the VGT duty cycle to 0%. • Record the MGP PID value. • Increase the VGT duty cycle to greater than 95%. • Record the MGP PID value. • Decrease the VGT duty cycle to 0%. • Record the MGP PID value. • Is the MGP PID below 3 kPa (0.44 PSI) at 0% VGT duty cycle and above 6 kPa (.87 PSI) at 95% VGT duty cycle?	Yes GO to KA7. No GO to KA8.
KA7	CHECK THE TURBOCHARGER OPERATION BACK PRESSURE	
	Note: Additional DTCs may set during the use of output state control (OSC). Clear all PCM and transmission control module (TCM) DTCs after the diagnostics have been completed. Repeat the self-test to verify all DTCs have been cleared. • Key ON, engine running. • Access the PCM and monitor the RPM, EBP_G, EGR_DC and VGTDC PIDs. • Access the PCM and control the EGRDC, RPM_DSD, and VGTDC PIDs. • Increase the commanded engine speed to 1,200 RPM using output state control. The calibration may limit the actual RPM between 1,150 and 1,200 RPM. • Decrease the EGR duty cycle to 0%. • Decrease the VGT duty cycle to 0%. • Record the EBP_G PID value. • Increase the VGT duty cycle to greater than 95%. • Record the EBP_G PID value. • Decrease the VGT duty cycle to 0%. • Record the EBP_G PID value. • Is the EBP_G PID below 5 kPa (0.73 PSI) at 0% VGT duty cycle and above 50 kPa (7.3 PSI) at 95% VGT duty cycle?	Yes GO to KA9. No GO to KA8.

Turbocharger System Performance	KA

Test Step		Results / Action to Take
KA8	CHECK THE CHARGE AIR COOLER, AIR INTAKE AND EXHAUST SYSTEMS FOR LEAKS	
	• Key in OFF position. • Disconnect the hose from the EP sensor. • Plug the exhaust pipe. • Connect the Rotunda Smoke Machine, Fuel Evaporative Emission System Tester 218-00001 (522) or equivalent to the EP hose. • Fill the exhaust system with smoke. • Pressurize the exhaust system with 20 PSI regulated shop air. • Disconnect the hose from the MAP sensor. • Inspect the MAP sensor hose and manifolds for damage, leaks, restrictions, and correct routing. • Connect the Rotunda Smoke Machine, Fuel Evaporative Emission System Tester 218-00001 (522) or equivalent to the MAP hose. • Fill the air intake system with smoke. • Pressurize the air intake system with 20 PSI regulated shop air. • Check air intake and exhaust systems for leaks. • Are any leaks present?	Yes REPAIR the leaks. REFER to section 4, Performance Diagnostic Procedures if a driveability concern exists. CLEAR the DTCs. REPEAT the self-test. No GO to KA10.
KA9	CHECK THE VGT ACTUATOR STABILITY	
	Note: This test may cause misfire or rough idle condition. • Apply the parking brake. • Place the transmission in PARK or NEUTRAL. • Turn the A/C and defrost OFF. • Key ON, engine running. • Clear the DTCs. • Access the PCM and monitor the EBP, MGP, EGR_DC, VGTDC and IPR PIDs. • Access the PCM and control the EGRDC PID. • Decrease the EGR duty cycle to 0%. • Allow the IPR to stabilize. • Slowly press the accelerator pedal and hold for 5 seconds at each of the following RPMs: — 1,500 RPM — 1,800 RPM — 2,000 RPM — 2,200 RPM — 2,500 RPM — 2,800 RPM • Do the VGTDC, MGP, or EBP PIDs remain steady at all of the RPMs?	Yes The turbocharger system is operating correctly. REFER to Section 4, Performance Diagnostic Procedures. CLEAR the DTCs. REPEAT the self-test. No GO to AK7.

Pinpoint Test KA – 2004 ¼ - 2006 MY

Turbocharger System Performance	KA

Test Step		Results / Action to Take
KA10	CHECK THE OPERATION OF THE VGT ACTUATOR	
	⚠ CAUTION: The VGT actuator valve is sensitive to contamination. All work areas must be clean before starting this procedure. Do not allow contamination to enter the valve ports, cam follower, or turbocharger housing. Handle the VGT actuator by the solenoid body only. Do not attempt to clean or wipe oil off the valve at this time. Do not let the valve come in contact with materials that could contaminate the valve mechanism. • Key in OFF position. • VGT Actuator connector disconnected. • Remove the VGT actuator from the turbocharger assembly. • VGT Actuator connector connected. • Key ON, engine OFF. • Access the PCM and control the VGTDC PID. • Apply light pressure to the cam follower (tip of the actuator), while commanding the VGT duty cycle and check for the internal valve movement. • Increase the VGT duty cycle to greater than 70%. • Is any internal valve cam follower movement present when the VGT duty cycle is increased?	Yes GO to KA11. No GO to AK2.
KA11	CHECK THE VGT VANE OPERATION	
	• Key in OFF position. • Install a VGT actuator in the turbocharger assembly. • Remove the pipe plug from the top of the VGT actuator housing, located near the oil supply tube. • Apply an index mark on the internal valve cam follower (tip of the actuator). • Key ON, engine running. • Access the PCM and control the VGTDC PID. • Increase the VGT duty cycle from 20% to greater than 95% in 10% steps. • Check the internal valve cam follower for movement at each step while increasing the duty cycle. • Is any internal valve cam follower movement present in each step when the VGT duty cycle is increased?	Yes The turbocharger system is operating correctly. REFER to Section 4, Performance Diagnostic Procedures. CLEAR the DTCs. REPEAT the self-test. No INSTALL a new turbocharger assembly. REFER to the Workshop Manual Section 303-04D Fuel Charging and Controls — Turbocharger.

Pinpoint Test KA – 2003 MY

KA: Turbo Charger System Performance

KA: Introduction

KA1 PRELIMINARY DIAGNOSIS

Note: Diagnose all other DTCs before diagnosing P132B.

Note: For DTC P132B, allow the engine to idle for 5 minutes at normal operating temperature. Clear the DTCs. Repeat the self-test. If DTC P132B is retrieved again, continue diagnosis of P132B.

- Key off.
- Perform a visual inspection.
- Connect the scan tool.
- Key on, engine off (KOEO).
- Retrieve and record any continuous and on-demand DTCs.
- Clear DTCs.
- Run the engine until the engine temperature stabilizes.
- Carry out the KOER self-test.
- Verify EGR operation.

Are any DTCs present?

Yes	No
For DTC P132B, P2262 or P2263, GO to KA2 . For all other DTCs, REFER to Section 4 Diagnostic Trouble Code (DTC) Descriptions.	GO to KA2 .

KA2 CHECK THE MANIFOLD ABSOLUTE PRESSURE (MAP) AND BAROMETRIC PRESSURE (BARO) SIGNAL ACCURACY

Note: Route the pressure gauge hose to the passenger compartment so it is not crimped and does not come in contact with any hot surface.

Note: Diagnose any EOT sensor DTCs before continuing with this step.

- Inspect the MAP sensor hose and manifolds for damage, leaks, restrictions, and correct routing.
- Disconnect the MAP sensor pressure hose from the sensor.
- Install the pressure test adapter kit 014-00761 0-30 psi gauge between the MAP sensor and the pressure hose.
- Access the PCM and monitor the MGP and EOT PIDs.
- Allow the EOT to reach 70°C (158°F) and road test the vehicle.

Does the MGP PID match the actual gauge pressure?

Yes	No
GO to KA3 .	GO to Pinpoint Test E .

KA3 CHECK THE ICP SENSOR FOR BIAS

- Key on, engine off.
- Access the ICP PID.

Is the ICP PID voltage between 0.19 and 0.24 volts?

Yes	No
GO to KA4 .	INSTALL a new ICP sensor.

KA4 CHECK FOR INPUT SENSOR BIAS

Note: Both MAP and BARO sensors should indicate atmospheric pressure at key ON, engine OFF.

- Access the MAF PID
- Access the BARO and MAP PIDs for comparison. Refer to Section 6 for normal operating values.

Are the BARO and MAP PIDs within specifications and is the MAP and BARO PID values within 6.9 kPa (1.0 psi) of each other?

Yes	No
GO to KA5 .	REFER to the appropriate pinpoint test to continue sensor diagnostics.

KA5 CHECK THE TURBOCHARGER OPERATION BOOST

Note: Additional DTCs may set during the use of output control (OSC). Clear all the PCM and transmission control module (TCM) DTCs after the diagnostics are completed. Repeat the self-test to verify all DTCs are cleared.

- Key ON, engine running.
- Access the PCM and monitor the MGP, EGR_DC, RPM and VGTDC PIDs.
- Access the PCM and control the EGRDC, RPM_DSD, and VGTDC PIDs.
- Increase the commanded engine speed to 1,200 RPM using output state control. The calibration may limit the actual RPM between 1,150 and 1,200 RPM.
- Decrease the EGR duty cycle to 0%.
- Decrease the VGT duty cycle to 0%.
- Record the MGP PID value.
- Increase the VGT duty cycle to greater than 85%.
- Record the MGP PID value.
- Decrease the VGT duty cycle to 0%.
- Record the MGP PID value.

Is the MGP PID below 3 kPa (0.44 psi) at 0% VGT duty cycle and above 6kPa (.87 psi) at 85% VGT duty cycle?

Yes	No
GO to KA6 .	GO to KA7 .

KA6 CHECK THE TURBOCHARGER OPERATION BACK PRESSURE

Pinpoint Test KA – 2003 MY

- Key ON, engine running.
- Using the gauge bar, access the exhaust pressure sensor port.
- Access the PCM and monitor the, EGR_DC, RPM and VGTDC PIDs.
- Access the PCM and control the EGRDC, RPM_DSD, and VGTDC PIDs.
- Increase the commanded engine speed to 1,200 RPM using output state control. The calibration may limit the actual RPM between 1,150 and 1,200 RPM.
- Decrease the EGR duty cycle to 0%.
- Decrease the VGT duty cycle to 0%.
- Record the exhaust pressure.
- Increase the VGT duty cycle to greater than 85%.
- Record the exhaust pressure.
- Decrease the VGT duty cycle to 0%.
- Record the exhaust pressure.

Is the exhaust pressure gauge reading below 5 kPa (0.73 psi) at 0% VGT duty cycle and above 50 kPa (7.3 psi) at 85% VGT duty cycle?

Yes	No
GO to KA8 .	GO to KA7 .

KA7 CHECK THE CHARGE AIR COOLER, AIR INTAKE AND EXHAUST SYSTEMS FOR LEAKS

- Key in OFF position.
- Disconnect the hose from the exhaust pressure sensor.
- Plug the exhaust pipe.
- Connect the Rotunda Smoke Machine, Fuel Evaporative Emission System Tester 218-00001 (522) or equivalent to the exhaust pressure sensor hose.
- Fill the exhaust system with smoke.
- Pressurize the exhaust system with 20 psi regulated air.
- Disconnect the hose from the MAP sensor.
- Inspect the MAP sensor hose and manifolds for damage, leaks, restrictions, and correct routing.
- Connect the Rotunda Smoke Machine, Fuel Evaporative Emission System Tester 218-00001 (522) or equivalent to the MAP hose.
- Fill the air intake system with smoke.
- Pressurize the air intake system with 20 psi regulated air.
- Check the air intake and exhaust systems for leaks.

Are any leaks present?

Yes	No
REPAIR the leaks. REFER to Section 4, Performance Diagnostic Procedures if a driveability concern exists. CLEAR the DTCs. REPEAT the self-test.	GO to KA9 .

KA8 CHECK THE VGT ACTUATOR STABILITY

Note: This test may cause a misfire or rough idle condition.

- Apply the parking brake.
- Place the transmission in PARK or NEUTRAL.
- Turn the A/C and defroster OFF.
- Key ON, engine running.
- Clear the PCM DTCs.
- Access the PCM and monitor the IPR, MGP, EGR_DC and VGTDC PIDs.
- Access the PCM and control the EGRDC PID.
- Decrease the EGR duty cycle to 0%.
- Allow the IPR to stabilize.
- Slowly press the accelerator pedal and hold for 5 seconds at each of the following RPMs:
  - 1,500 RPM
  - 1,800 RPM
  - 2,000 RPM
  - 2,200 RPM
  - 2,500 RPM
  - 2,800 RPM

Do the VGTDC, MGP PIDs, and the exhaust pressure gauge reading remain steady at all of the RPMs?

Yes	No
The turbocharger system is operating correctly. REFER to Section 4, Performance Diagnostic Procedures. CLEAR the DTCs. REPEAT the self-test.	GO to AK7 .

KA9 CHECK THE OPERATION OF THE VGT ACTUATOR

⚠ CAUTION: The VGT actuator valve is sensitive to contamination. All work areas must be clean before starting this procedure. Do not allow contamination to enter the valve ports, cam follower, or turbocharger housing. Handle the VGT actuator by the solenoid body only. Do not attempt to clean or wipe oil off the valve at this time. Do not let the valve come in contact with materials that could contaminate the valve mechanism.

- Key in OFF position.
- VGT Actuator connector disconnected.
- Remove the VGT actuator from the turbocharger assembly.
- VGT Actuator connector connected.
- Key ON, engine OFF.
- Access the PCM and control the VGTDC PID.
- Apply light pressure to the cam follower (tip of the actuator), while commanding the VGT duty cycle and check for the internal valve movement.
- Increase the VGT duty cycle to greater than 70%.

Is any internal valve cam follower movement present when the VGT duty cycle is increased?

Yes	No
GO to KA10 .	GO to AK2 .

KA10 CHECK THE VGT VANE OPERATION

- Key in OFF position.
- Install the VGT actuator in the turbocharger assembly.
- Remove the pipe plug from the top of the VGT actuator housing, located near the oil supply tube.
- Apply an index mark on the internal valve cam follower (tip of the actuator).
- Key ON, engine running.
- Access the PCM and control the VGTDC PID.

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- Increase the VGT duty cycle from 20% to greater than 85%.
- Check the internal valve cam follower for movement at each step while increasing the duty cycle.

Is any internal valve cam follower movement present in each step when the VGT duty cycle is increased?

Yes	No
The turbocharger system is operating correctly. REFER to Section 4, Performance Diagnostic Procedures. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new turbocharger assembly. REFER to the Workshop Manual Section 303-04D Fuel Charging and Controls — Turbocharger.