

KA1 PRELIMINARY DIAGNOSIS

Key off.

Perform a visual inspection.

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 P0299, P0478, P132B, P2262 or P2263, GO to KA2 .

For all other DTCs, REFER to Section 4 Diagnostic Trouble Code (DTC) Descriptions. GO to KA2 .

KA2 SCAN TOOL FUNCTIONALITY

Is the vehicle build date on or before 9-29-03?

Yes No

GO to KA3 . GO to KA12 .

KA3 CHECK THE MANIFOLD ABSOLUTE PRESSURE (MAP) AND BAROMETRIC PRESSURE (BARO) SIGNAL ACCURACY

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 KA4 . GO to Pinpoint Test E .

KA4 CHECK THE ICP SENSOR FOR BIAS

Key on, engine off.

Access the ICP PID.

Is the ICP PID voltage between 0.18 and 0.24 volts?

Yes No

GO to KA5 . INSTALL a new ICP sensor.

KA5 CHECK FOR INPUT SENSOR BIAS

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 KA6 . REFER to the appropriate pinpoint test to continue sensor diagnostics.

KA6 CHECK THE TURBOCHARGER OPERATION BOOST

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 6 kPa (.87 psi) at 85% VGT duty cycle?

Yes No

GO to KA7 . GO to KA8 .

KA7 CHECK THE TURBOCHARGER OPERATION BACK PRESSURE

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 EBP_G PID.

Increase the VGT duty cycle to greater than 85%.

Record the EBP_G PID.

Decrease the VGT duty cycle to 0%.

Record the EBP_G PID.

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 KA9 . GO to KA8 .

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 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 KA10 .

KA9 CHECK THE VGT ACTUATOR STABILITY

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 and MGP PIDs 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 .

KA10 CHECK THE OPERATION OF THE VGT ACTUATOR

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 KA11 . GO to AK2 .

KA11 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.

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.

KA12 CHECK THE ICP SENSOR FOR BIAS

Key on, engine off.

Access the ICP PID.

Is the ICP PID voltage between 0.15 and 0.35 volts?

Yes No

GO to KA13 . INSTALL a new ICP sensor.

KA13 CARRY OUT THE EGR TEST

Note: Incorrect EGR valve operation may affect turbocharger diagnostics.

Using the scan tool, carry out the Powertrain Air Management Exhaust Gas Recirculation (EGR) System Test. Refer to Section 4, Performance Diagnostic Procedures, Exhaust Gas Recirculation (EGR) System Test.

Is a concern present?

Yes No

Repair as necessary. CLEAR the DTCs. REPEAT the self-test. GO to KA14 .

KA14 CARRY OUT THE TURBO BOOST TEST

Using the scan tool carry out the Powertrain Air Management Turbo Boost Test.

Are any concerns present?

Yes No

For BARO sensor failure, GO to H .

For EP sensor failure, GO to X .

For MAF sensor failure, GO to J .

For MAP sensor failure, GO to E .

For all others, GO to KA15 . GO to KA15 .

KA15 CARRY OUT THE TURBO VVT TEST

Using the scan tool carry out the Powertrain Air Management Turbo VVT

Test.

Are any concerns present?

Yes No

GO to KA16 . GO to KA17 .

KA16 CHECK THE OPERATION OF THE VGT ACTUATOR

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 a concern present?

Yes No

GO to AK2 . REMOVE the turbocharger. CHECK the turbocharger housing, vanes and unison rings for coking deposits. CLEAN as necessary. INSTALL the turbocharger and CHECK for correct operation. If the concern is still present, INSTALL a new turbocharger assembly. REFER to the Workshop Manual Section 303-04D Fuel Charging and Controls — Turbocharger.

KA17 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 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. The turbocharger system is operating correctly. REFER to Section 3, Symptom Chart Index.