

I - SYSTEM/COMPONENT TESTS - GASOLINE

Article Text

1996 Volkswagen Golf

For Volkswagen Technical Site

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Thursday, August 19, 1999 11:38PM

ARTICLE BEGINNING

1996 ENGINE PERFORMANCE

Volkswagen System & Component Testing - Gasoline

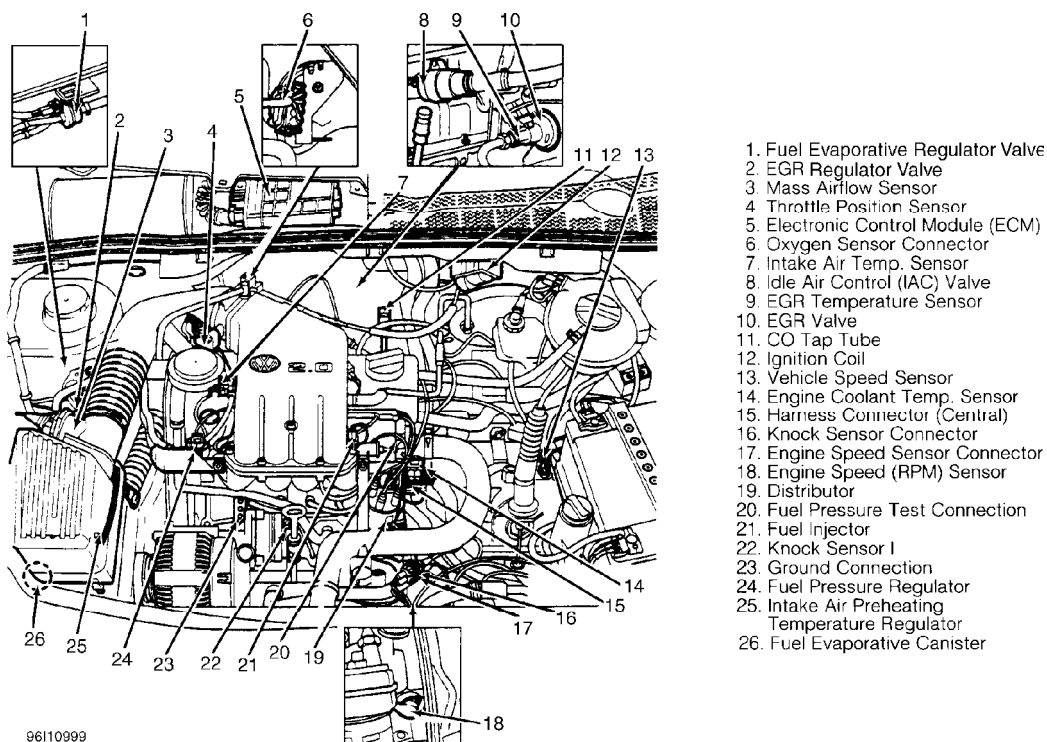
Cabrio, Golf III, GTI, Jetta III, Passat

INTRODUCTION

Since many computer-controlled and monitored components set a Diagnostic Trouble Code (DTC) if they malfunction, also perform procedures in appropriate G - TESTS W/CODES - GASOLINE article. In most instances, a scan tool must be used to test systems and/or components. See ENTERING SELF DIAGNOSTICS in appropriate G - TESTS W/CODES - GASOLINE article for additional scan tool operating instructions.

NOTE: Testing individual components does not isolate short or open circuits. Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure. Use ohmmeter to isolate shorted or open wiring harness.

COMPONENT LOCATIONS



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Fig. 1: Component Locations (2.0L)

Courtesy of Volkswagen United States, Inc.

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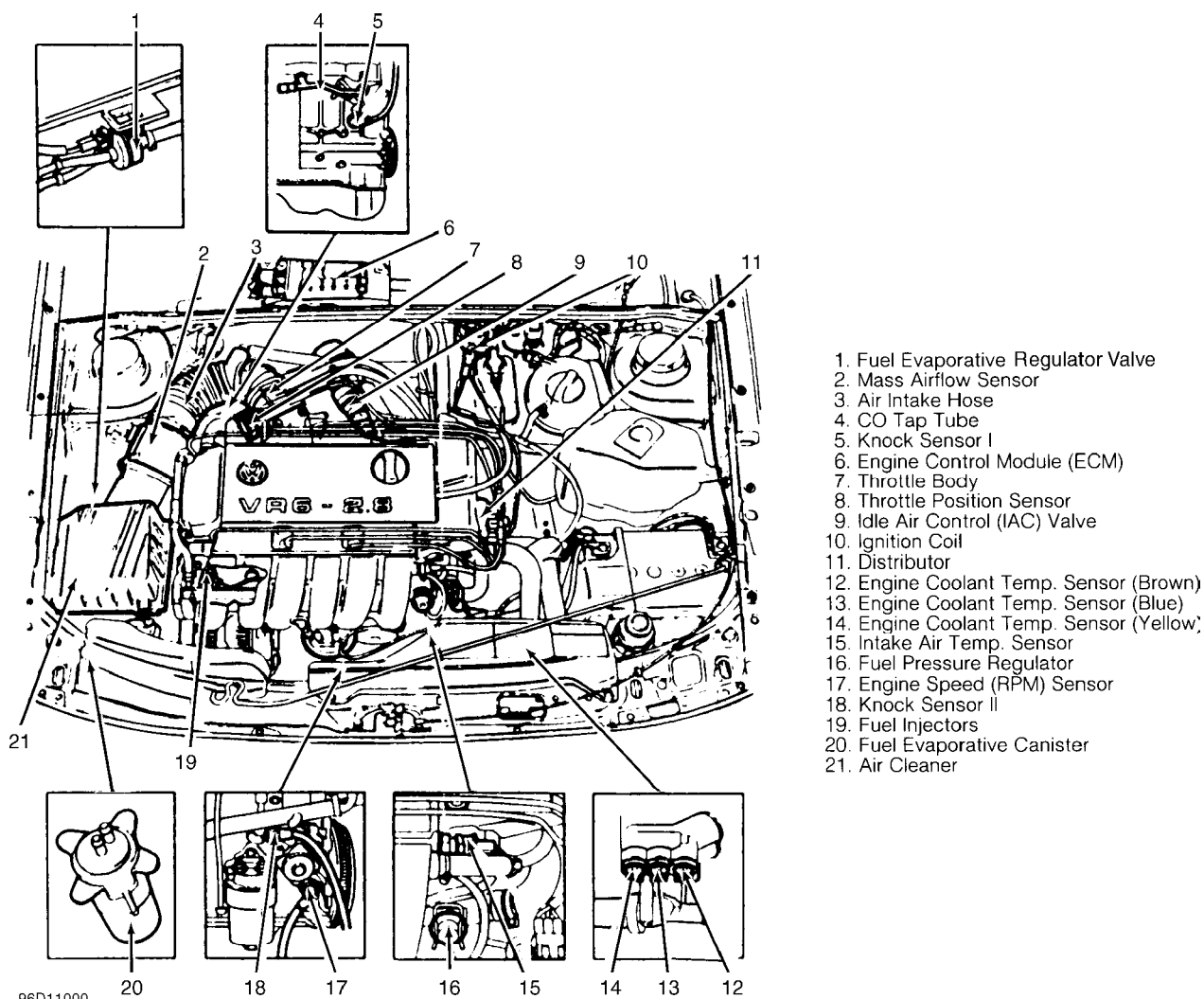


Fig. 2: Component Locations (2.8L)

Courtesy of Volkswagen United States, Inc.

AIR INDUCTION SYSTEMS

INTAKE AIR PREHEATING

Air Leak Checks (2.0L)

1) Ensure exhaust system has no leaks. Connect CO tester, using Adapter (VAG 1363/3), on CO tap tube. DO NOT remove oxygen sensor. Start engine and allow it to idle at closed throttle position.

2) Spray air intake system with Leak Detector Spray (G 001 800 A1). Air intake leaks will draw in leak detector spray. The spray reduces air/fuel mixture ignition and engine RPM, and decreases CO reading. Repair leaks as necessary.

Control Flap & Temperature Regulator (2.0L)

1) Ensure no air leaks exist in control flap vacuum reservoir. Loosen air cleaner upper section and remove air filter.

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2) Turn air cleaner upper part to access control flap in air cleaner lower section. Disconnect vacuum hose from temperature regulator. Connect hand-held vacuum pump to vacuum hose. Apply vacuum. Control flap will close cold air intake.

3) Reconnect vacuum hose to temperature regulator. Start engine and allow it to idle. Check position of control flap after 20 seconds. Replace temperature regulator if position of control flap is not as specified. See TEMPERATURE REGULATOR table.

TEMPERATURE REGULATOR TABLE

Temperature °F (°C)		Control Flap Position
Less Than 68 (20)	Cold Air Intake Closed
Between 68-86 (20-30)	...	Open To Both Hot & Cold Air Intake
More Than 86 (30)	Hot Air Intake Closed

TURBOCHARGER

WARNING: Turbocharger and related components operate at a very high temperature. Always allow system to cool or use proper protective clothing to prevent severe burns. For safety during road test, it is advisable to have a helper read tester.

CAUTION: Test duration during measurement should be limited to a maximum of 10 seconds. Before disconnecting or reconnecting turbocharger, thoroughly clean all joints, pipes unions and connections. Prevent dust and dirt contamination. Cover all components with dust-free paper or plastic. DO NOT use cloth or rags. Avoid nearby use of compressed air. DO NOT move vehicle or work in dusty conditions while turbocharger is open or removed.

NOTE: Ensure any engine related problems are corrected before testing turbocharger. Ensure no intake or exhaust system leaks exist. Engine oil temperature must be at least 176°F (80°C).

COMPUTERIZED ENGINE CONTROLS

ELECTRONIC CONTROL MODULE (ECM)

Ground & Power Circuits

Check ECM ground and power circuits using appropriate

J - PIN VOLTAGE CHARTS article.

ENGINE SENSORS & SWITCHES

CAMSHAFT POSITION (CMP) SENSOR

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See CAMSHAFT POSITION (CMP) SENSOR in appropriate
F - BASIC TESTING - GASOLINE article.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

2.0L

1) Ensure engine is cold. Connect scan tool to Data Link Connector (DLC) located below A/C-heater control panel. With scan tool in READ MEASURING VALUE BLOCK function, read coolant temperature value in field No. 2 of scan tool.

2) Temperature value must increase uniformly without interruption. If there is an interruption (open), 77.7°C will be displayed. If coolant temperature value does not change, test circuit using Ground & Power Circuits

Check ECM ground and power circuits using appropriate
J - PIN VOLTAGE CHARTS article.

3) If necessary, replace ECT sensor. After repairs, erase DTC memory (if applicable) and select END OUTPUT function on scan tool.

2.8L

1) Ensure engine is cold. Connect scan tool to Data Link connector (DLC) located in center console, in front of shift lever. Start engine and allow it to idle.

2) With scan tool in READ TEST VALUE BLOCK function, select group "01" and read coolant temperature value in field No. 2 of scan tool. Temperature value must increase uniformly without interruption. If value increases as specified, select END OUTPUT function on scan tool.

3) If displayed value does not change or if engine malfunctions during certain temperature range, turn ignition off and disconnect ECT sensor connector. Measure ECT sensor resistance. See ECT SENSOR RESISTANCE table.

4) If resistance is not as specified, check circuit using appropriate Ground & Power Circuits

Check ECM ground and power circuits using appropriate
J - PIN VOLTAGE CHARTS article. If necessary, replace ECT sensor. After repairs, erase DTC memory (if applicable) and select END OUTPUT function on scan tool.

INTAKE AIR TEMPERATURE (IAT) SENSOR

2.0L

1) Ensure engine is cold. Connect scan tool to Data Link connector (DLC) located below A/C-heater control panel. With scan tool in READ MEASURING VALUE BLOCK function, read intake air temperature value in field No. 4 of scan tool.

2) Temperature value must increase uniformly without interruption. The value, 19.6°C, will be displayed if there is an interruption (open) or if this temperature is reached. If air intake temperature value does not change, test circuit using appropriate Ground & Power Circuits

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Check ECM ground and power circuits using appropriate J - PIN VOLTAGE CHARTS article. If necessary, replace IAT sensor. After repairs, erase DTC memory (if applicable) and select END OUTPUT function.

2. 8L

1) Turn ignition off. Disconnect IAT sensor. Remove IAT sensor from intake manifold and plug opening in manifold. Reconnect IAT sensor to wiring harness.

2) Connect scan tool to Data Link connector (DLC) located in center console, in front of shift lever. Start engine and allow it to idle. With scan tool in READ TEST VALUE BLOCK function, select group "03" and read IAT sensor value in field No. 4 of scan tool.

3) Spray IAT sensor with cooling spray and observe value on scan tool. Scan tester value must decrease. If temperature value does not change, repair IAT sensor circuit or replace IAT sensor as necessary. After repairs, erase DTC memory, if applicable, and select END OUTPUT function.

FUEL SYSTEM

ACCELERATION/FULL THROTTLE ENRICHMENT & DECELERATION FUEL CUTOFF

2. 0L

1) Connect scan tool to Data Link Connectors (DLC) located below A/C-heater control panel. With scan tool in READ MEASURING VALUE BLOCK function, read closed throttle position value in field No. 4 of scan tool. Display value must be 00010.

2) Check part throttle load enrichment by gradually pressing down accelerator. Display value must be 00100. Check acceleration enrichment by accelerating quickly. Value must briefly be 10000.

3) Check full throttle enrichment by briefly flooring accelerator pedal. Value must briefly be 01000 at wide open throttle. Check deceleration fuel shutoff by briefly accelerating to 3000 RPM and then releasing throttle.

4) Value must briefly be 00001 with throttle closed and engine speed greater than 1200 RPM. If specified values are not obtained, erase DTC memory. Check THROTTLE POSITION (TP) SENSOR ADJUSTMENT in D - ADJUSTMENTS article.

2. 8L

1) Ensure engine coolant temperature is at least 176°F (80°C). Connect scan tool to Data Link connector (DLC) located in center console, in front of shift lever.

2) Start engine and allow it to idle. With scan tool in READ TEST VALUE BLOCK function, select group "04" and read value in field No. 4 of scan tool. Display value must be 00010 at idle.

3) Using accelerator pedal, increase engine speed to 3000 RPM and observe scan tool. Display value in field No. 4 of scan tool must briefly be 10100. Release accelerator pedal and observe scan tool.

4) Display value in field No. 4 of scan tool must briefly be

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00011 then return to 00010 at idle. If values are not as specified, see **THROTTLE POSITION (TP) SENSOR ADJUSTMENT** in appropriate **D - ADJUSTMENTS** article. If values are as specified, select **END OUTPUT** function on scan tool.

FUEL INJECTORS & CIRCUIT

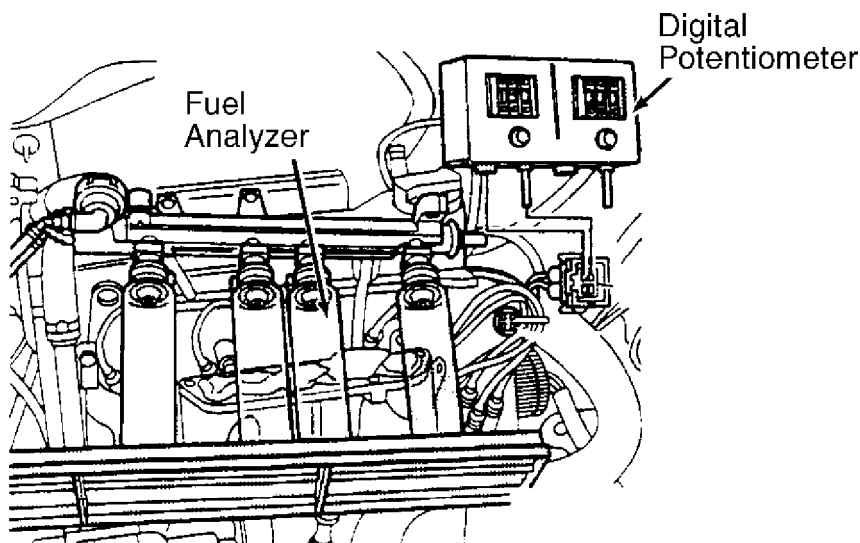
2.0L

1) Ensure engine speed sensor and its circuit are okay. Check injector triggering using **OUTPUT DIAGNOSTIC TEST MODE**. See appropriate **G - TESTS W/CODES - GASOLINE** article.

2) If necessary, disconnect Engine Coolant Temperature (ECT) sensor. Adjust Digital Potentiometer side "A" of scan tool to 15 ohms. See Fig. 3. Connect potentiometer to ECT sensor using test leads from Adapter Kit (VW 1594).

3) Remove upper part of intake manifold. Remove fuel rail, leaving fuel lines and injectors attached. Place injectors in Fuel Analyzer (VAG 1602). Disconnect ignition coil.

4) Crank engine and observe injectors. Injectors must spray uniformly while pulsating. Turn ignition off and check fuel injectors for leaks. No more than 2 drops per minute are permissible. When reinstalling fuel rail, ensure "O" rings are not damaged.



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Fig. 3: Testing Fuel Injectors & Circuit (2.0L)

Courtesy of Volkswagen United States, Inc.

2.8L

1) To access fuel injectors, remove ignition wires. Remove hose from mass airflow sensor. Disconnect hose to fuel evaporative regulator solenoid valve at throttle body.

2) Disconnect throttle position sensor and idle air control valve. Disconnect accelerator cable from throttle body. Disconnect and plug coolant hoses at throttle body.

3) Disconnect hose from air intake heated tube. Detach fuel lines at cylinder head cover and remove from fuel rail. Disconnect

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vacuum hose from fuel pressure regulator. Remove intake manifold upper section. See Fig. 4.

4) With intake manifold upper section removed, disconnect wiring harness from fuel injectors. Using a Digital Volt-Ohmmeter (DVOM) and test leads from Adapter Kit (VW 1594), check fuel injector resistance. See Fig. 5.

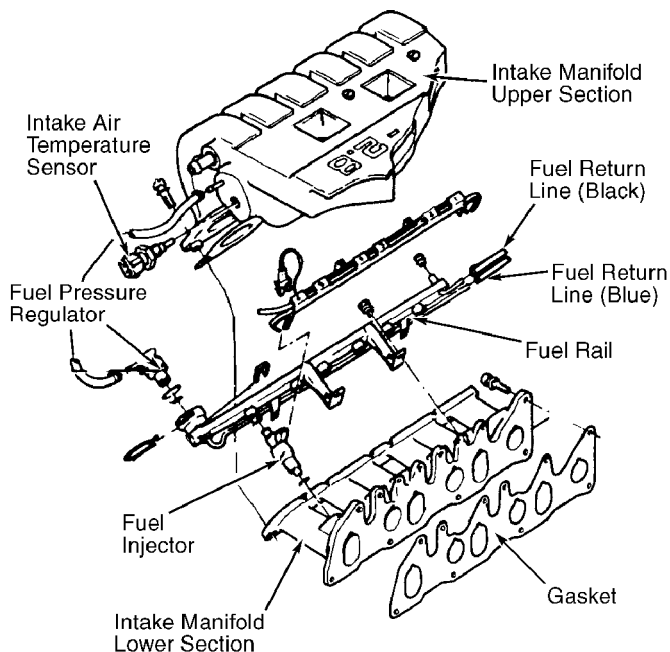
5) Fuel injector resistance should be 15.0-21.5 ohms. If resistance is zero ohms, check for short circuit in wiring harness. If wiring harness is okay, replace fuel injector(s).

6) With wiring harness and fuel injectors okay, disconnect ignition coil power output stage. Using test leads from adapter kit, check voltage supply to each injector by connecting LED tester between wiring harness connector terminals. See Fig. 5.

7) Crank engine and observe LED tester. LED tester must flicker. If LED tester does not flicker, reconnect wiring harness connector(s) to fuel injector(s). Check for open circuit in wiring harness between fuel injector(s) and Engine Control Module (ECM).

8) If LED tester flickers, remove fuel rail assembly (leaving fuel lines and injectors attached). Use test leads and fuel rail hose extensions if necessary. Disconnect Blue Engine Coolant Temperature (ECT) sensor. Connect the 15,000-ohm side of Adapter (VAG 1490) directly to ECT sensor wiring harness connector.

9) Place injectors in Fuel Analyzer (VAG 1602). Crank engine and observe injectors. Injector spray pattern must be the same on all injectors. Turn ignition on for 5 seconds, and check fuel injectors for leaks. No more than 2 drops per minute are permissible. When reinstalling fuel rail, ensure "O" rings are not damaged.



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Fig. 4: Accessing Fuel Injectors (2.8L)
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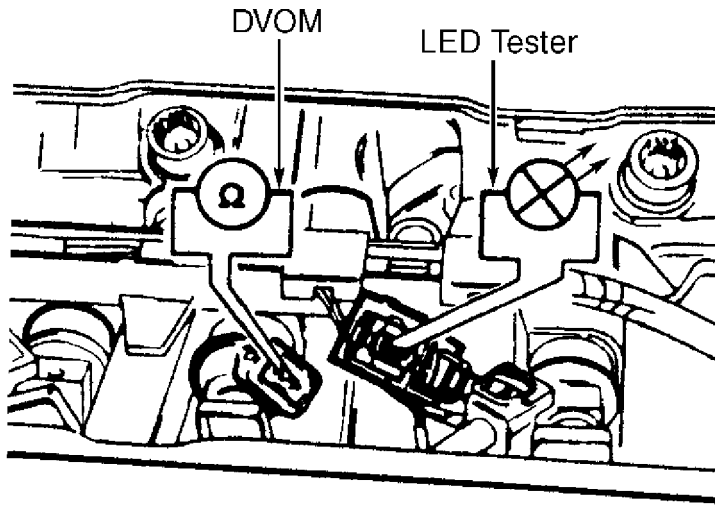
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Fig. 5: Testing Fuel Injectors & Circuit (2.8L)
Courtesy of Volkswagen United States, Inc.

OXYGEN SENSOR CONTROL

2.0L & 2.8L

- 1) Ensure base settings for ignition and idle are okay.

Ensure exhaust system is not leaking between catalytic converter and cylinder head. Ensure voltage supply for oxygen sensor heater is okay.

- 2) Connect scan tool to Data Link connector (DLC) located below A/C-heater control panel. See G - TESTS W/CODES - GASOLINE article. With scan tool in READ MEASURING VALUE BLOCK function, ensure coolant temperature is greater than 176°F (80°C), as displayed in field No. 2 of scan tool.

- 3) Allow engine to run for 2 minutes at idle, then read oxygen sensor factor (signal) in field No. 3 of scan tool. Display value must fluctuate. If value in display field No. 3 does not fluctuate, briefly accelerate engine and repeat test.

- 4) If oxygen sensor value does not change even during acceleration, disconnect engine coolant temperature sensor. Erase DTC memory. Disconnect oxygen sensor wiring harness connector.

- 5) Ground oxygen sensor wiring harness connector terminal No. 4. See Fig. 6. Value in display field No. 3 must increase. If value increases, replace oxygen sensor. If value does not change, repair circuit or replace ECM as necessary. After repairs, erase DTC memory and select END OUTPUT function.

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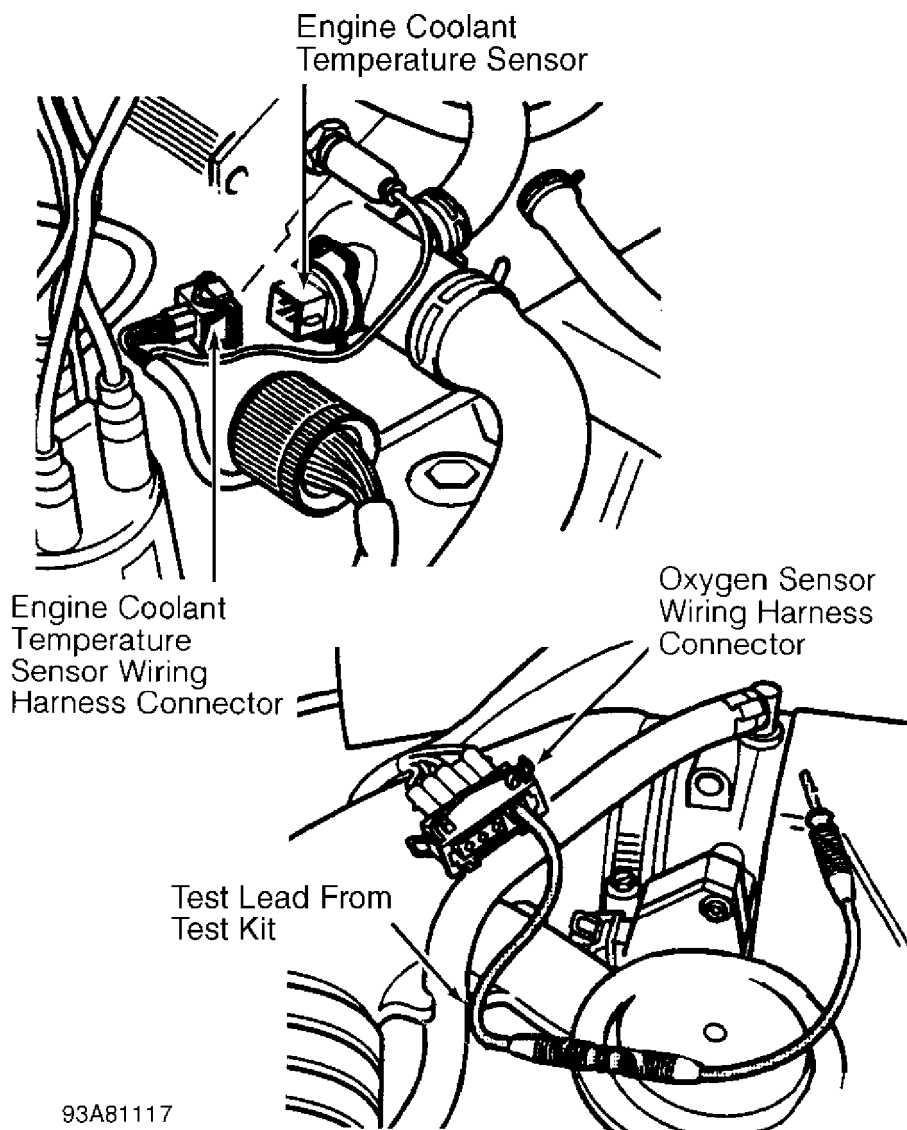


Fig. 6: Testing Oxygen Sensor Control Circuit
Courtesy of Volkswagen United States, Inc.

IDLE CONTROL SYSTEM

IDLE AIR CONTROL (IAC) VALVE

2. 0L

1) Connect scan tool to Data Link connector (DLC) located below A/C-heater control panel. Ensure no Diagnostic Trouble Codes (DTCs) are stored in memory. See G - TESTS W/CODES - GASOLINE article.

2) With scan tool in READ MEASURING VALUE BLOCK function, ensure coolant temperature is more than 176°F (80°C), displayed in field No. 2 of scan tool. Allow engine to run for 2 minutes at idle, then press "C" button on scan tool. Press "0" and "5" buttons to display group "05". Press "Q" to enter input.

3) Read and record IAC valve duty cycle, displayed in field

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No. 3 of scan tool. Disconnect engine coolant temperature sensor. IAC valve duty cycle must increase and return to previous value. If duty cycle does not change as stated, repair circuit as necessary. After repairs, erase DTC memory (if applicable) and select END OUTPUT function.

2. 8L

1) Connect scan tool to Data Link connector (DLC) located in center console, in front of shift lever. With scan tool in OUTPUT DIAGNOSTIC TEST MODE, test IAC valve. See G - TESTS W/CODES - GASOLINE article.

2) To check IAC valve triggering circuit, turn ignition off. Disconnect wiring harness connector from IAC valve. Connect LED Tester (US 1115) to wiring harness connector terminals No. 1 and 2.

3) Turn ignition on. Perform OUTPUT DIAGNOSTIC TEST MODE until IAC valve is triggered. LED tester must flash. If LED tester does not flash, check IAC valve circuit.

4) If LED tester flashes, disconnect wiring harness connector from idle air control valve. Using Test Leads from Adapter Kit (VW 1594), connect DVOM to IAC valve terminals No. 1 and 2. IAC valve resistance must be 10-20 ohms. If resistance is incorrect, replace IAC valve.

IGNITION SYSTEM

IGNITION COIL

Primary & Secondary Windings (2.0L & 2.8L)

1) Connect Digital Volt-Ohmmeter (DVOM) between coil terminals No. 1 and 15. See Fig. 7. Primary coil resistance should be 0.5-0.7 ohm.

2) Connect DVOM between coil tower and terminal No. 15. Secondary coil resistance should be 3000-4000 ohms. If resistance values are incorrect, remove ignition coil. Remove ignition coil power output stage from coil and repeat test.

Ignition Coil Power Output Stage (2.0L & 2.8L)

1) Ensure camshaft position sensor and ignition coil are okay. Disconnect 3-pin connector from ignition coil power output stage wiring harness connector. Connect DVOM to ignition coil wiring harness terminals No. 1 and 3. See Fig. 7.

2) Turn ignition on. Battery (system) voltage should be indicated on DVOM. If battery voltage is not indicated, repair supply voltage circuit as necessary. If battery voltage is indicated, supply voltage circuit is okay.

3) Turn ignition off. Disconnect cold-start injector and fuel injector wiring harness at fuel rail. Connect LED Tester (US 1115) to ignition coil wiring harness terminals No. 2 and 3 using test leads from Adapter Kit (VW 1594).

4) Crank engine and check for ignition signal from Electronic Control Module (ECM). If LED tester does not flicker, repair ignition signal circuit or replace ECM as necessary. If LED tester flickers,

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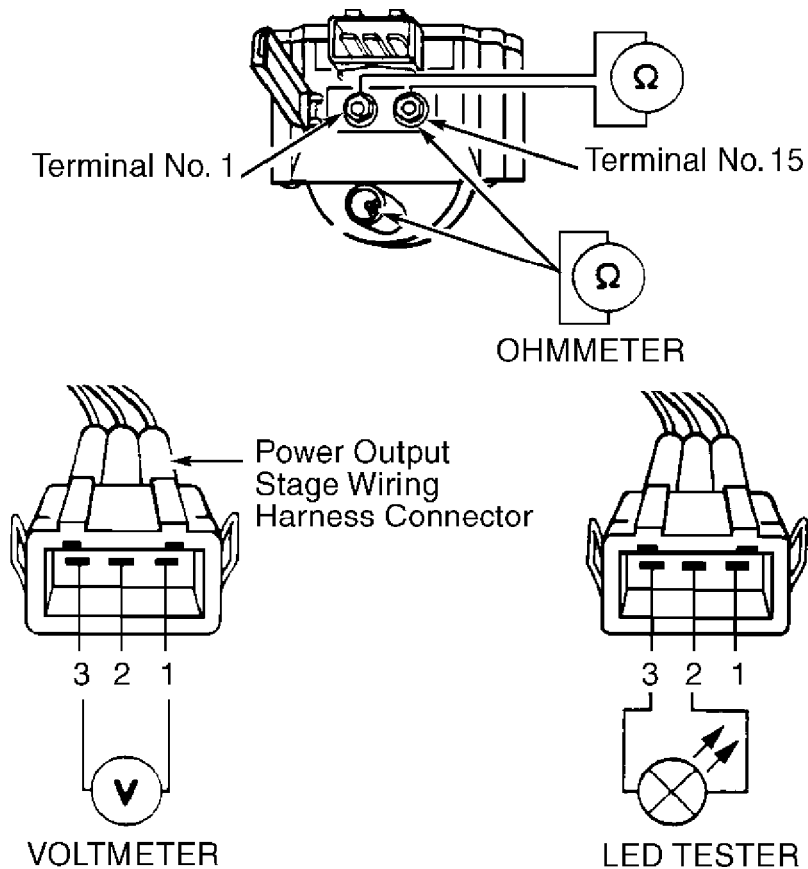
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ignition signal circuit is okay.

NOTE: A DVOM may be used in step 5). With ignition on, voltage must be 2 volts minimum and then drop to zero volts after 1-2 seconds.

5) Turn ignition off. Reconnect ignition wire and 3-pin connector to ignition coil. Connect LED tester between coil terminals No. 1 and 15. Turn ignition on. LED tester must light up for 1-2 seconds.

6) Crank engine and ensure LED tester flickers. If LED tester flickers, power output stage is okay. If LED tester does not flicker, replace power output stage.



93E81111

Fig. 7: Testing Ignition Coil & Power Output Stage
Courtesy of Volkswagen United States, Inc.

EMISSION SYSTEMS & SUB-SYSTEMS

NOTE: Other than EGR system, additional emission system and sub-system component testing information is not available from manufacturer.

EXHAUST GAS RECIRCULATION (EGR)

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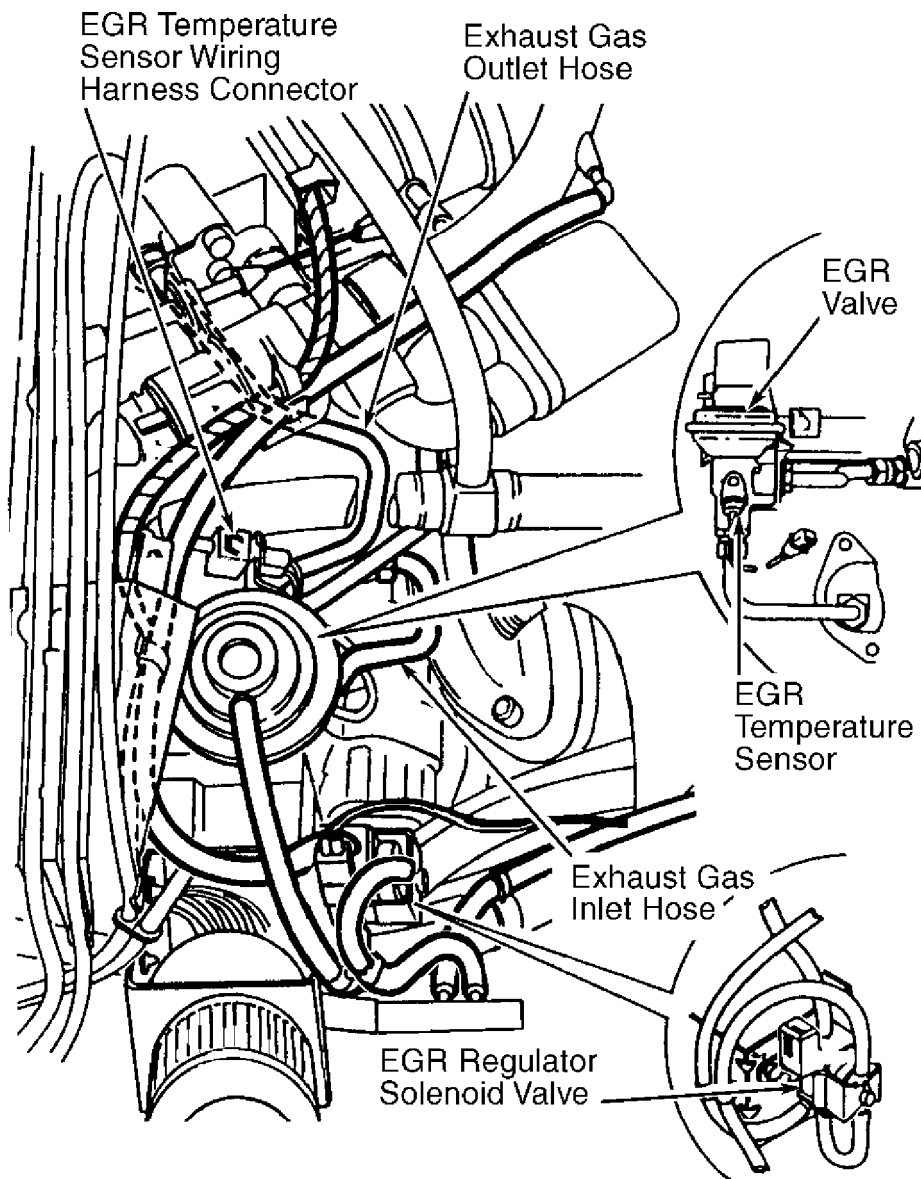
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2. 8L

1) Ensure engine coolant temperature is at least 122°F (50°C). Start engine and allow it to idle. Disconnect vacuum hose from EGR valve. See Fig. 8. Connect hand-held vacuum pump to EGR valve and apply vacuum.

2) Idle quality must deteriorate noticeably. If idle quality does not change, check EGR valve and exhaust manifold for plugging. Replace EGR valve if necessary. After repairs, erase DTC memory.



96G11003

Fig. 8: Testing Exhaust Gas Recirculation System (2.8L Is Shown)
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2. 0L

1) Connect scan tool to Data Link connector (DLC) located

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below A/C-heater control panel. See G - TESTS W/CODES - GASOLINE article. With scan tool in READ MEASURING VALUE BLOCK function, select group "02".

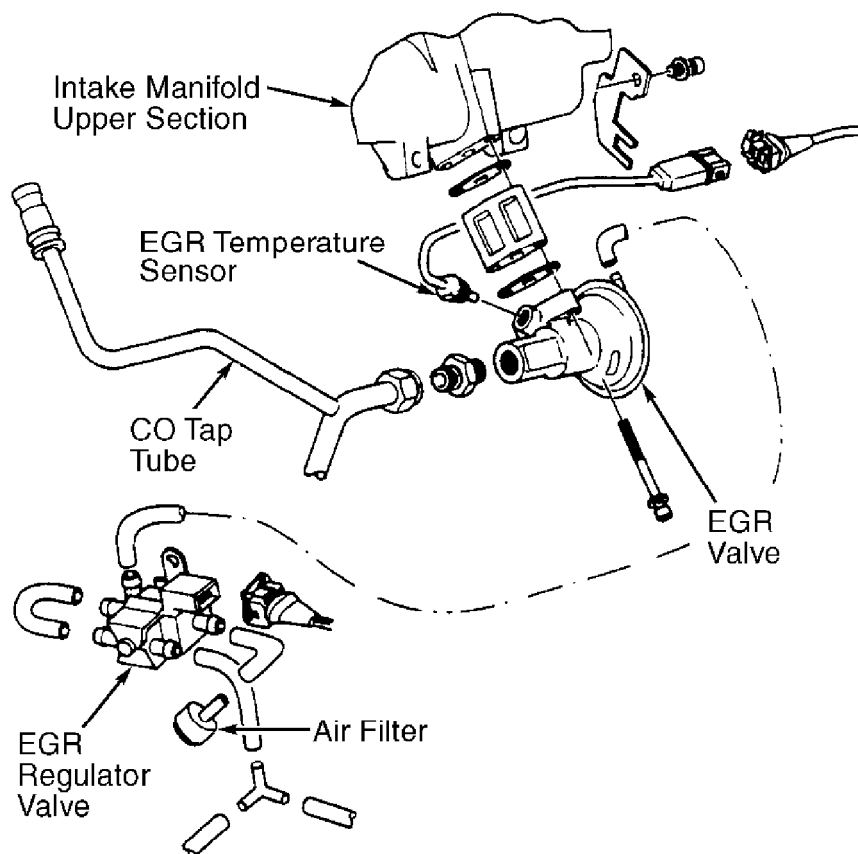
2) Ensure there are no leaks in vacuum hoses and connections. See Fig. 9. Ensure vacuum hoses are not plugged or kinked and engine oil temperature is at least 122°F (50°C). Start engine and allow it to idle.

3) Connect hand-held vacuum pump to EGR regulator solenoid, and apply vacuum. Idle quality must deteriorate noticeably. If idle quality does not change, check vacuum hoses for obstructions, and EGR valve and manifold for plugging.

4) If idle quality changes, read EGR temperature in display field No. 4 of scan tool. Temperature must rise steadily without interruption. If display is 127.4°C or less, there is an open circuit.

5) If temperature rises steadily, disconnect vacuum pump as soon as value reaches 200°C. Press right arrow button on scan tool. Press "0" and "6" buttons to select END DATA TRANSFER function. Press "Q" button to enter input.

6) If temperature value does not change, check EGR temperature sensor wiring harness for open circuit. If wiring harness is okay, replace EGR temperature sensor.



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Fig. 9: Testing EGR System (2.0L)

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FUEL EVAPORATION

2.0L & 2.8L

1) Ensure engine coolant temperature is at least 176°F (80°C). Ensure oxygen sensor and fuel/ignition system operating properly. Disconnect hose from fuel evaporative canister regulator solenoid valve (on left side of engine compartment firewall).

2) Start engine and allow to idle. No vacuum should be felt at valve connection. Increase engine speed. Vacuum must be felt at connection. If fuel evaporative canister regulator solenoid valve does not operate, perform OUTPUT DIAGNOSTIC TEST MODE. See appropriate G - TESTS W/CODES - GASOLINE article.

3) Turn ignition off. Disconnect fuel evaporative canister regulator solenoid valve wiring harness connector. Using test leads from adapter kit, connect LED tester between wiring harness connector terminals. Start engine and increase engine speed.

4) If LED tester flickers, replace fuel evaporative canister regulator solenoid valve. If LED tester does not flicker, check wiring harness for open circuit. If wiring harness is okay, replace Electronic Control Module (ECM).

END OF ARTICLE