

I - SYSTEM/COMPONENT TESTS

Article Text

1989 Volkswagen Golf

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Monday, August 23, 1999 11:55PM

ARTICLE BEGINNING

1989 ENGINE PERFORMANCE

Volkswagen Systems & Component Testing

Cabriolet, Fox, Golf, Golf GT, Jetta, Vanagon

INTRODUCTION

Prior to testing separate components or systems, it is highly recommended that all procedures listed in F - BASIC TESTING article be performed. Since many computer controlled and monitored components will change voltage and resistance values if they malfunction, it is also recommended that connector pin check diagnosis be performed.

NOTE: Testing of individual components does not isolate possible shorts or opens in the control harness of electronically controlled systems. Use an ohmmeter to isolate shorts or opens in harness. All voltage tests should be performed with a Digital Volt Ohmmeter (DVOM) with a minimum 10-megaohm input impedance, unless specifically stated different in testing procedures.

ENGINE SENSORS & SWITCHES

Airflow Sensor (Cabriolet & Fox)

1) Start engine to pressurized fuel system. Turn engine off and remove intake boot from top of airflow sensor. Disconnect coil secondary wire from coil and jumper to ground.

2) Check sensor play by slowly moving plate through travel range with a magnet. Resistance should be felt. Move plate back to the rest position. There should be no resistance. If binding is felt, loosen sensor plate hold-down bolt and adjust plate to center of venturi.

3) If resistance is uneven, remove airflow sensor from housing to clean and lubricate lever assembly. If resistance is caused by control plunger, remove and clean control plunger assembly. If binding continues, replace fuel distributor.

4) Check position of airflow sensor plate. Airflow sensor plate edge must be within .075" (1.9 mm) below the narrowest section of the venturi. See Fig. 1. If not, bend sensor spring until correct specification is obtained. Ensure that there is a small gap between the sensor lever and the control plunger.

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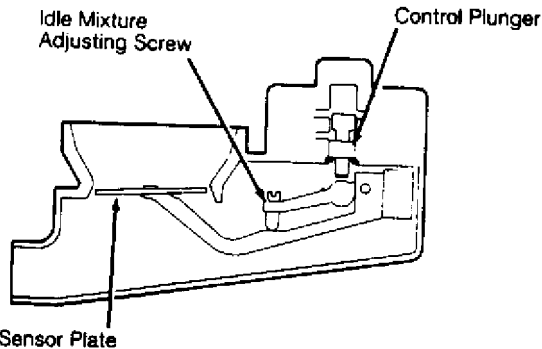


Fig. 1: Cabriolet & Fox Airflow Sensor Assembly (Golf & Jetta Are Similar)

Courtesy of Volkswagen United States, Inc.

Airflow Sensor (Golf & Jetta)

1) Start engine to pressurized fuel system. Turn engine off and remove intake boot from top of airflow sensor. Check sensor plate by lifting plate through travel cycle with magnet or pliers.

2) Continuous resistance should be felt. Move plate back to the rest position. There should be no resistance. If resistance is felt, replace airflow sensor. If sensor plate lever is difficult to move upward but moves freely downward, check sensor plate for correct centering.

3) Sensor plate should be evenly centered in the housing with plate edge at the narrowest section of the venturi while at rest position. If sensor plate adjustment is correct, check control plunger for sticking. If control plunger is sticking, replace fuel distributor.

Airflow Sensor (Vanagon)

1) Turn ignition off. Unplug connector from Electronic Control Unit (ECU). Attach ohmmeter to ECU connector. See Fig. 3. Resistance should correspond to ECU Pin Check of AIRFLOW SENSOR SPECIFICATIONS table.

2) With ignition off, unplug connector from airflow sensor. Attach ohmmeter to airflow sensor terminal. See Fig. 2. Resistance should correspond to AIRFLOW SENSOR PIN CHECK of AIRFLOW SENSOR SPECIFICATIONS table.

AIRFLOW SENSOR SPECIFICATIONS TABLE

AA
Terminal Ohms

Vanagon

ECU Pin Check

No. 6 & No. 17 500-1000

No. 17 & No. 21 (1)

Airflow Sensor Pin Check

No. 3 & No. 4 500-1000

No. 2 & No. 3 (1)

(1) - Ohms fluctuate as sensor door is operated.

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AA

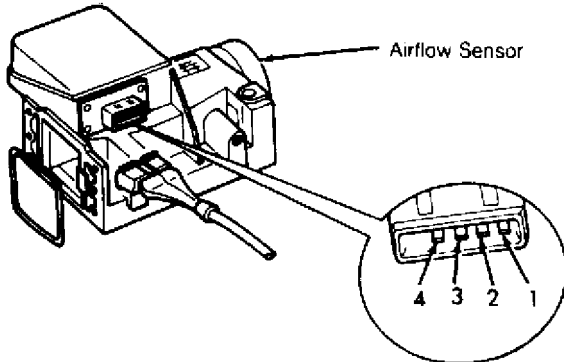


Fig. 2: Vanagon Airflow Sensor & Terminal Identification
Courtesy of Volkswagen United States, Inc.

Coolant Temperature Sensor (Vanagon)

Turn ignition off. Use a thermometer to measure temperature of coolant. Unplug connector from Electronic Control Unit (ECU). Attach an ohmmeter to terminal No. 6 and No. 10 of ECU connector. See Fig. 3. Resistance should decrease as coolant temperature increases. See COOLANT TEMPERATURE SWITCH SPECIFICATIONS table.

COOLANT TEMPERATURE SWITCH SPECIFICATIONS TABLE	
AA	
Temperature	Ohms

Vanagon	
68øF (20øC)	2200- 2700
158øF (70øC)	400- 480
194øF (90øC)	210- 280
AA	

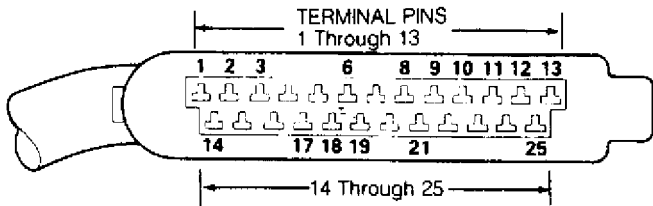


Fig. 3: Vanagon ECU Connector Terminal Identification
Courtesy of Volkswagen United States, Inc.

Coolant Temperature Sensor (Fox)

The Coolant Temperature Sensor is mounted on bottom of coolant outlet on cylinder head. Resistance measured across sensor terminals should match values represented in COOLANT TEMPERATURE SENSOR RESISTANCE table. If necessary, test circuit using charts in the J - PIN VOLTAGE CHARTS article. If resistance measured across sensor terminals does not match values COOLANT TEMPERATURE SENSOR RESISTANCE table, sensor is faulty and should be replaced. Always use new sealing washer. Replacing sensor will require draining and

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replaci ng some of engine cool ant.

COOLANT TEMPERATURE SENSOR RESISTANCE

ÄÄÄ

Temperature °F (°C) 0hms

68 (20)	3000- 2000
86 (30)	2000- 1500
104 (40)	1500- 1000
122 (50)	1000- 800
140 (60)	700- 500
158 (70)	500- 375
176 (80)	375- 275
194 (90)	275- 225

[illegible]

Hal l Sender

For information on hall sender testing, see F - BASIC TESTING article.

Oxygen Sensor (Except Vanagon)

1) Ensure that exhaust system has no leaks. Engine must be at normal operating temperature with all electrical accessories off.

Remove differential pressure regulator connector so that Wiring Harness Adapter (VW 1315 A/1) can be connected in series. See Fig. 4.

2) Attach Multimeter (US 1119) to adapter and set meter on DCA 200m scale. Remove PCV hose and vent to atmosphere. Remove 90° "T" connector and insert port with small vent hole into intake air boot. See Fig. 5.

3) Start engine and allow to run for 2 minutes. Meter reading should start fluctuating. In not, raise engine speed to 3000 RPM If meter reading fluctuates, oxygen sensor is okay. If not, check control unit and wiring harness for short or open circuit.

Oxygen Sensor (Vanagon)

1) Ensure pressure regulator is functional and engine is at normal operating temperature. Start engine and allow to run for 2 minutes. Install exhaust analyzer at vehicle tailpipe. Observe CO reading while disconnecting and plugging vacuum hose from pressure regulator.

2) If CO begins to increase and then drops to 0.3-1.0%, system is okay. If not, stop engine. Disconnect O2 sensor wire and jumper to ground. If CO reading rises, replace O2 sensor.

3) If C0 reading does not rise, check for continuity between O2 sensor wire and terminal No. 2 of ECU. See Fig. 3. If continuity exists, replace ECU. For more information, see procedure in PIN VOLTAGES & SENSOR OPERATING RANGES article.

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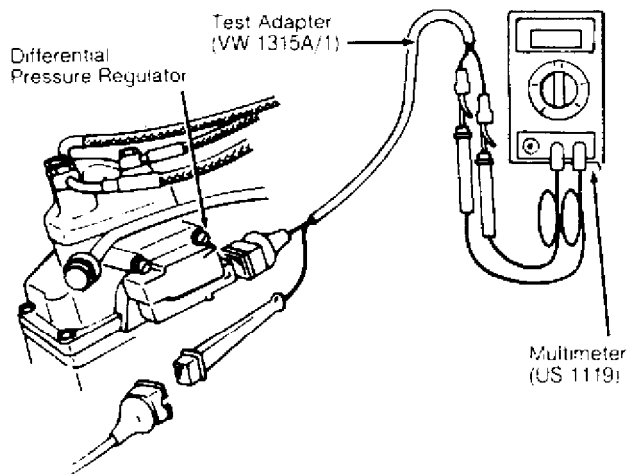


Fig. 4: Oxygen (O₂) Sensor Test Meter Arrangement (Except Vanagon)
Courtesy of Volkswagen United States, Inc.

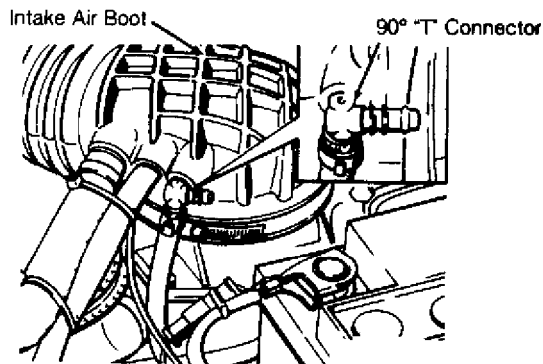


Fig. 5: Canister Hose Position For Oxygen (O₂) Sensor Test
(Except Vanagon)
Courtesy of Volkswagen United States, Inc.

Throttle Valve Switch (Vanagon)

1) Disconnect throttle valve switch connector. With ohmmeter set on 200 ohm scale, attach probes to male terminals. Ensure that the throttle valve switch is completely closed. With throttle valve closed, meter reading should be zero.

2) Position throttle valve to 1/2 open position. Ohmmeter reading should be infinite. Position throttle to full open position. Ohmmeter reading should be zero. If any reading is incorrect, perform throttle valve switch adjustment. See ON-VEHICLE ADJUSTMENTS article.

3) If correct specifications cannot be obtained, check for excessive throttle shaft play, incorrect accelerator cable adjustment and throttle switch actuating cam. If okay, replace throttle valve switch.

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RELAYS

Fuel Pump Relay (Cabriolet)

1) Ensure fuel pump fuse (No. 5) is not blown. If okay, remove fuel pump relay (No. 2) from fuse/relay panel See Fig. 6. With ignition on, check for battery voltage between the following locations:

- * terminal No. 2 and ground
- * terminal No. 4 and ground

2) If voltage is not present, current is not reaching the relay. Repair as necessary and check fuel pump operation. If voltage is present, check for battery voltage between the following locations:

- * terminal No. 1 and terminal No. 2
- * terminal No. 1 and terminal No. 4

If voltage is not present, terminal No. 1 (ground circuit) is open. Repair as necessary and check fuel pump operation.

3) If voltage is present, check for battery voltage between terminal No. 1 and terminal No. 5. If voltage is not present, the ignition signal is not making contact to the fuel pump relay. Repair as necessary and check fuel pump operation.

4) If no faults can be found but the fuel pump operates only when relay is by-passed, replace fuel pump relay.

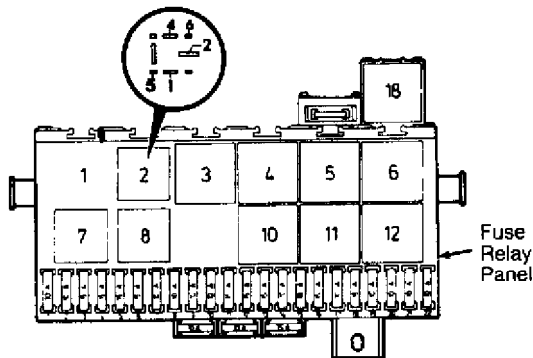


Fig. 6: Cabriolet Fuse/Relay Panel (Golf & Jetta Are Similar)
Courtesy of Volkswagen United States, Inc.

Fuel Pump Relay (Fox)

1) Ensure fuel pump fuse (No. 13) is not blown. If okay, remove fuel pump relay. Note terminals numbers molded on fuse/relay

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panel. With ignition on, check for battery voltage between the following locations:

- * terminal No. 46 and ground
- * terminal No. 48 and ground

2) If voltage is not present, current is not reaching the relay. Repair as necessary and check fuel pump operation. If voltage is present, check for battery voltage between the following locations:

- * terminal No. 48 and terminal No. 50
- * terminal No. 46 and terminal No. 50

If voltage is not present, terminal No. 50 (ground circuit) is open. Repair as necessary and check fuel pump operation.

3) If voltage is present, check for battery voltage between terminal No. 50 and terminal No. 51. If voltage is not present, the ignition signal is not making contact to the fuel pump relay. Repair as necessary and check fuel pump operation.

4) If no faults can be found but the fuel pump operates when the relay is by-passed, replace fuel pump relay.

Fuel Pump Relay (Golf & Jetta)

1) Ensure fuel pump fuse is not blown. If okay, remove fuel pump relay from fuse/relay panel See Fig. 6. Remove hall sender primary connector at ignition coil. With ignition on, check for battery voltage between the following locations:

- * terminal No. 2 and ground
- * terminal No. 1 and terminal No. 2
- * terminal No. 1 and terminal No. 4

2) If voltage is not present, current is not reaching the relay. Repair as necessary and check fuel pump operation. If voltage is present, check for battery voltage between the following locations:

- * terminal No. 1 and terminal No. 5

If voltage is not present, repair as necessary and check fuel pump operation.

3) If voltage is present, briefly touch middle wire of distributor primary wiring harness connector, at distributor, to ground. If voltage drops, replace fuel pump relay and check hall sender. If voltage does not drop, check hall sender control unit.

4) If no faults can be found but the fuel pump operates only when the relay is by-passed, replace fuel pump relay.

Fuel Pump Relay (Vanagon)

1) Check terminal No. 30 and terminal No. 86 of fuel pump relay for battery voltage. If battery voltage is not present, check circuit for short or open circuit.

2) If battery voltage is present, remove relay and attach

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ohmmeter probe to terminal No. 85. Attach other probe to ground. Continuity should be present while cranking engine.

3) If not, check for continuity between terminal No. 85 of fuel pump relay and terminal No. 3 of ECU connector. If continuity is present, circuit is okay but ECU is not switching to ground. Replace ECU and install fuel pump relay.

4) If fuel pump will not operate, turn ignition switch to the "OFF" and then "ON" position. Ensure battery voltage is present at fuel pump relay No. 87 for about 5 seconds after ignition is switched on. If not, replace fuel pump relay. If okay, check voltage supply and ground circuit of fuel pump. If okay, replace fuel pump.

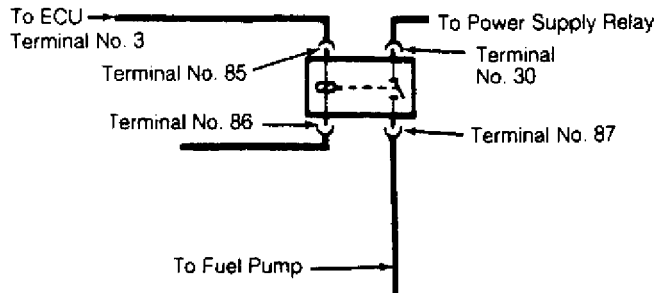


Fig. 7: Vanagon Fuel Pump Relay Circuit Schematic
Courtesy of Volkswagen United States, Inc.

FUEL SYSTEM

FUEL DELIVERY

NOTE: For Fuel System pressure testing, see F - BASIC TESTING article.

FUEL CONTROL

Cold Start Valve (Except Vanagon)

1) Engine temperature must be below 85°F (30°C). Disconnect cold start valve attaching screws and remove valve leading wiring harness connector and fuel line attached.

2) Remove ignition coil secondary wire and jumper to ground. Attach metal housing of cold start valve to ground. Direct cold start valve nozzle into a clean container. See Fig. 8. Have assistant turn ignition switch to the "START" position while observing spray pattern.

3) The valve should deliver a consistent cone shaped pattern until the thermo time switch interrupts fuel flow. Ensure that valve

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does not leak after fuel flow stops. If spray pattern is uneven or inconsistent, check for plugged or defective cold start valve. If valve does not function, proceed to THERMO TIME SWITCH.

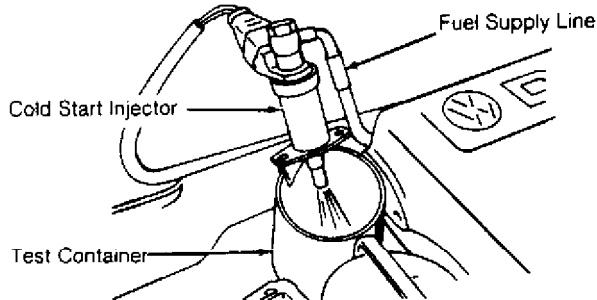


Fig. 8: Typical Cold Start Valve Test Arrangement
Courtesy of Volkswagen United States, Inc.

Thermo Time Switch (Except Vanagon)

1) Engine temperature must be below 86°F (30°C). Disconnect cold start valve wiring harness connector and attach LED test light to terminals. Have assistant hold ignition switch in the "START" position while observing test light.

2) Light should stay on for 3-8 seconds depending on coolant temperature. If light does not come on, check voltage supply to cold start valve and repair as necessary. If voltage to valve is okay, check ground circuit through thermo time switch. Replace thermo time switch if contact to ground cannot be made.

IDLE CONTROL SYSTEM

Idle Stabilization System (Vanagon)

1) Attach Test Meter (VW 1315/2) and Adapter (US 1119) to idle stabilization valve. See Fig. 11. Set meter to milliamp scale. Start engine. Observe meter while turning A/C control switch to the "ON" position. If milliamp reading increases, system is okay.

2) If milliamp reading does not increase, turn ignition coil off. Connect LED test light between terminal No. 2 and terminal No. 5 of idle stabilization control unit connector. See Fig. 9. Start engine and cycle A/C switch on and off.

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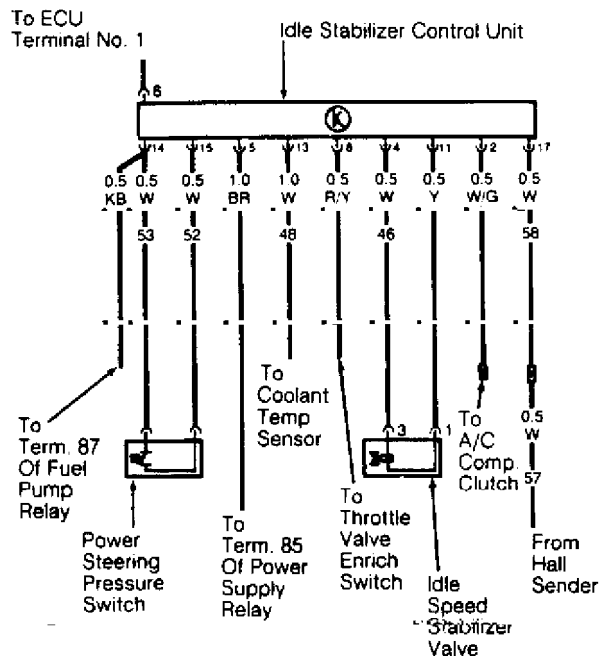


Fig. 9: Vanagon Idle Stabilization System Control Unit
Courtesy of Volkswagen United States, Inc.

3) Test light should be on when A/C switch is in the "ON" position. If okay, replace idle stabilization control valve. If light does not go on, repair wiring between idle stabilization control unit terminal No. 2 and A/C compressor clutch.

IGNITION SYSTEM

NOTE: For basic ignition checks, see F - BASIC TESTING article.

IGNITION CONTROL UNIT

Ignition Control Unit (Except Vanagon)

1) Perform SPARK check. If secondary spark is present, ignition control unit is okay. If not, turn ignition off. Disconnect ignition control unit wire harness connector. Turn ignition on. Using a voltmeter, measure voltage between terminal No. 2 (-) and terminal No. 4 (+) of connector. See Fig. 10.

2) Voltage should be present. If not, ensure continuity exists between terminal No. 2 and ground. Continuity should also exist between terminal No. 4 and ignition coil positive terminal. Repair wiring if necessary. If wiring is okay, replace ignition control unit.

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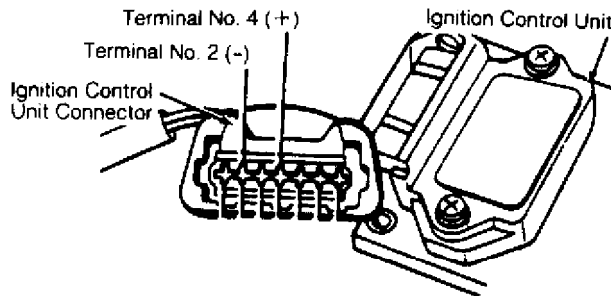


Fig. 10: Typical Ignition Control Unit Connector Identification (Except Vanagon)

Courtesy of Volkswagen United States, Inc.

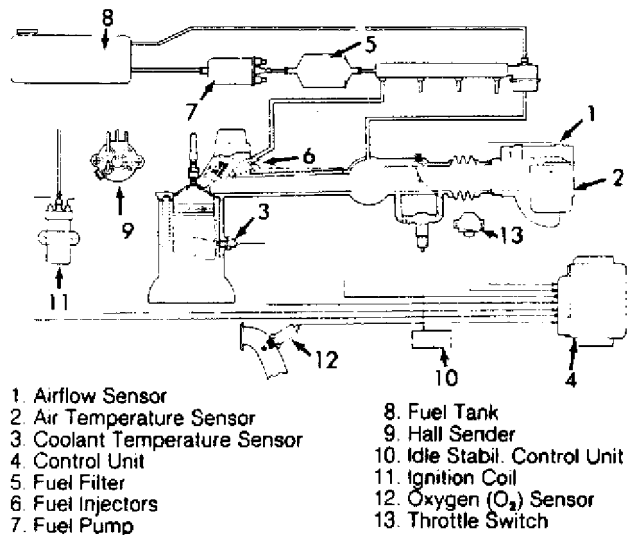


Fig. 11: Vanagon Digifant I Component Schematic

Courtesy of Volkswagen United States, Inc.

Ignition Control Unit (Vanagon)

1) Turn ignition off. Attach DVOM to primary terminals of ignition coil. Disconnect hall sender wire harness connector from distributor. Turn ignition on.

2) While observing DVOM reading, attach center terminal of

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connector to ground for 3 seconds. DVOM reading should briefly increase to 4.5 volts. If not, check wiring for short or open circuit. If wiring is okay, replace ignition control unit.

EMISSION SYSTEMS

EXHAUST GAS RECIRCULATION (EGR)

1) Run engine at idle speed. Apply about 12 in. Hg to EGR valve. Engine should run rough at idle. If not, remove EGR valve and inspect for restricted port passage. If port is okay, apply about 12 in. Hg to EGR valve with vacuum pump. If valve does not function, replace EGR valve. If okay, go to step 2).

2) Install EGR valve using new gasket. Connect vacuum gauge to EGR vacuum line using a "Y" fitting. Start engine and increase engine speed to about 3000 RPM. Vacuum gauge should indicate vacuum. If okay, test is complete. If not okay, vacuum source is plugged. Repair as necessary and repeat step 1).

FUEL EVAPORATION

EVAP Canister By-Pass Valve (Cabriolet & Fox)

1) Remove both vent hoses and vacuum hose from canister by-pass valve. Apply VERY LOW air pressure to vent hoses individually. There should be no airflow. If air does pass through, replace by-pass valve.

2) Attach vacuum pump to vacuum hose and apply 5-10 in. Hg. vacuum. Apply low air pressure to vent hoses individually. Valve should be open and airflow should be possible. If not, replace by-pass valve.

EVAP Canister By-Pass Valve (Vanagon)

1) Start engine and idle until normal operating temperature is reached. Disconnect White nylon hose from rubber boot at rear of intake manifold. Attach vacuum pump and apply 5-10 in. Hg vacuum. If vacuum is held, control valve is okay.

2) If not, disconnect Purple vacuum hose from throttle body. Attach vacuum gauge. If less than one in. Hg vacuum is present, replace control valve. If more than one in. Hg vacuum is present, adjust throttle valve stop screw and repeat test.

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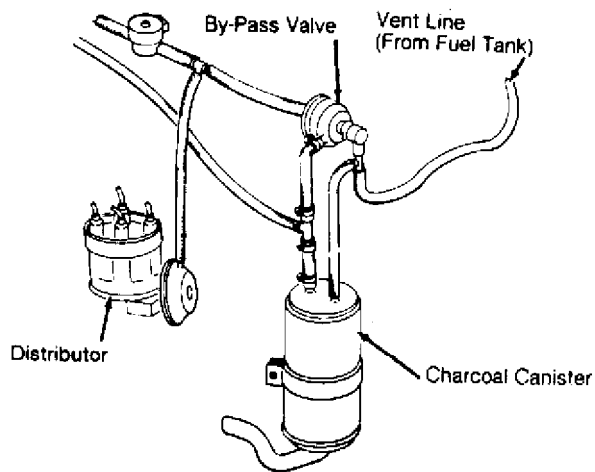


Fig. 12: Fox EVAP Canister & By-Pass Valve Arrangement (Other Models Are Similar)

Courtesy of Volkswagen United States, Inc.

MISCELLANEOUS CONTROLS

A/C CLUTCH

See IDLE CONTROL SYSTEM in this article.

END OF ARTICLE