

# G - TESTS W/CODES - GASOLINE

## Article Text

1996 Volkswagen Golf  
For Volkswagen Technical Site  
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Thursday, August 19, 1999 11:37PM

### ARTICLE BEGINNING

#### 1996 ENGINE PERFORMANCE

#### Volkswagen Self-Diagnostics - Gasoline

Cabrio, Golf III, GTI, Jetta III, Passat

### INTRODUCTION

If no faults were found while performing preliminary inspection procedures, proceed with self-diagnostics. If no Diagnostic Trouble Codes (DTCs) or only pass DTCs are present after entering self-diagnostics, proceed to appropriate H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.).

NOTE: Scan Tool (VAG 1551) is recommended by manufacturer; however, generic scan tools may be used.

### SELF-DIAGNOSTIC SYSTEM

#### Hard Failures

All vehicles are equipped with a permanent fault memory. If a failure occurs in monitored sensors and components, they store a hard failure in memory.

Hard failures of monitored sensors and/or components cause Malfunction Indicator Light (MIL) to come on and remain on until problem is repaired. If MIL comes on and remains on during vehicle operation, cause of failure must be determined.

If failures are present for more than 5 seconds, they are stored as Diagnostic Trouble Codes (DTCs) and will be displayed as a permanent failure even if failure is not present during DTCs display. Failures affecting oxygen sensor control can only be read accurately after a test drive of at least 10 minutes.

#### Intermittent Failures

If a failure occurs for no more than 5 seconds, they are stored and considered to be "sporadic" (intermittent failures). When displayed on scan tool, intermittent failures will have "SP" (sporadic) DTC.

### RETRIEVING DTCS

NOTE: See ENTERING SELF-DIAGNOSTICS for additional scan tool operating instructions.

#### Using VAG 1551 Scan Tool (All Models)

1) Data Link Connector (DLC) is located below tachometer. See Fig. 1. On 2.0L and 2.8L, remove ashtray, and slide DLC cover to left. Ensure ignition is off. Connect scan tool to DLC. On all models, scan tool should alternately display 1-RAPID DATA TRANSFER and 2-BLINK CODE OUTPUT.

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2) Turn ignition on. Operate scan tool and observe display. Press "1" button to select RAPID DATA TRANSFER function. Press PRINT button to turn on printer. Indicator light on button should come on.

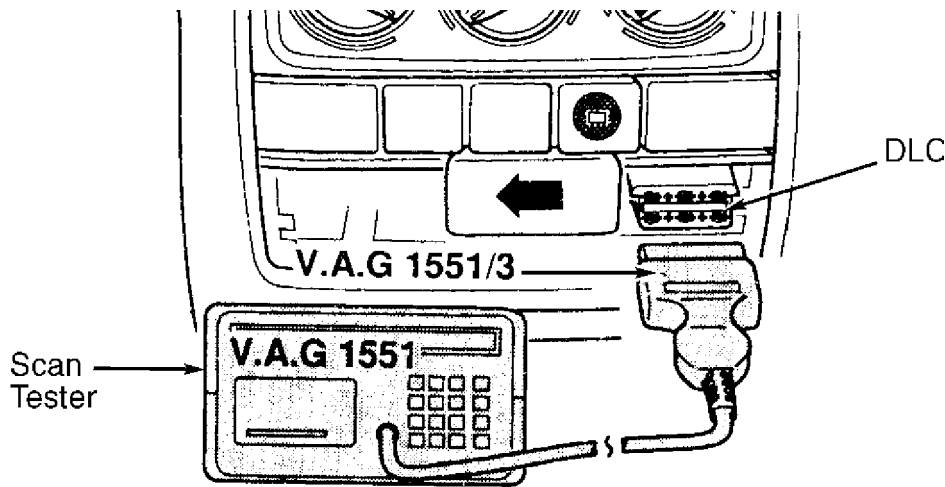
3) Press "0" and "1" buttons to select ENGINE ELECTRONICS function. Press "Q" button to enter input. Press right arrow button, then "0" and "2" buttons to select READ DTC MEMORY function. Press "Q" button to enter input.

4) Scan tool will display DTCs (if any). If NO FAULTS (DTCs) RECOGNIZED is displayed, press right arrow button to return to RAPID DATA TRANSFER function.

5) On 2.0L and 2.8L, if one or more DTCs are stored, proceed to 2.0L & 2.8L DTC IDENTIFICATION table under DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION to translate DTC to a system or affected circuit discription. To repair DTC, proceed to appropriate test number in appropriate G - TESTS W/CODES article.

6) After repairs on all models, press "0" and "5" buttons to select ERASE DTC MEMORY function. Press "Q" button to enter input. After DTCs are erased, press right arrow button.

7) Press "0" and "6" buttons to select END DATA TRANSFER function. Press "Q" button to enter input. Enter RAPID DATA TRANSFER function and test drive vehicle for at least 10 minutes.



94F51610

Fig. 1: Locating Data Link Connector  
Courtesy of Volkswagen United States, Inc.

### DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION

NOTE: For component location, see I - SYSTEM/COMPONENT TESTS article. For circuit, connector terminal No. and wire color identification, see appropriate WIRING DIAGRAM in L - WIRING DIAGRAMS article.

#### DTC IDENTIFICATION TABLE (2.0L & 2.8L)

ÚAAA¿			
³Generic Scan³	VAG 1551	³	Mal function/Affected
³ Tool DTC	³ DTC	³	Sensor Or Circuit



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P0172	3	16556	3	System Too Rich (Bank 1)
AAA'				
P0300	3	16684	3	Random Misfire Detected
AAA'				
P0301	3	16685	3	Cylinder No. 1 Misfire Detected
AAA'				
P0302	3	16686	3	Cylinder No. 2 Misfire Detected
AAA'				
P0303	3	16687	3	Cylinder No. 3 Misfire Detected
AAA'				
P0304	3	16688	3	Cylinder No. 4 Misfire Detected
AAA'				
P0305 (1)	3	16689 (1)	3	Cylinder No. 5 Misfire Detected
AAA'				
P0306 (1)	3	16690 (1)	3	Cylinder No. 6 Misfire Detected
AAA'				
P0327	3	16711	3	Knock Sensor No. 1 Circuit Low
Input (Bank 1)				
AAA'				
P0332 (1)	3	16176 (1)	3	Knock Sensor No. 2 Circuit Low
Input (Bank 2)				
AAA'				
P0341	3	16725	3	Camshaft Position Sensor Circuit
Range/Performance				
AAA'				
P0411	3	16795	3	Secondary Air Injection System
Incorrect Flow Detected				
AAA'				
P0422	3	16806	3	Main Catalyst Efficiency Below
Threshold (Bank 1)				
AAA'				
P0440	3	16824	3	EVAP System Malfunction
AAA'				
P0501	3	16885	3	Vehicle Speed Sensor
Range/Performance				
AAA'				
P0510	3	16894	3	Closed Throttle Position Switch
Mal function				
AAA'				
P0605	3	16989	3	ECM Read Only Memory (ROM) Error
AAA'				
P0715 (2)	3	17099 (2)	3	Input/Turbine Speed Sensor Circuit
Mal function				
AAA'				
P0722 (2)	3	17106 (2)	3	Output Speed Sensor Circuit
No Signal				
AAA'				
P0725 (2)	3	17109 (2)	3	Engine Speed Input Circuit
Mal function				
AAA'				
P0748 (2)	3	17132 (2)	3	Pressure Control Solenoid
Electrical				

3	3	3	Electrical	3
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AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P0753 (2) 317137 (2)3 Shift Solenoid A Electrical 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P0758 (2) 317142 (2)3 Shift Solenoid B Electrical 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P0763 (2) 317147 (2)3 Shift Solenoid C Electrical 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P0768 (2) 317152 (2)3 Shift Solenoid D Electrical 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P0773 (2) 317157 (2)3 Shift Solenoid E Electrical 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1127 3 17535 3 Long Term Fuel Trim Too Rich 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1128 3 17536 3 Long Term Fuel Trim Too Lean 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1213 3 17621 3 Cylinder No. 1 Fuel Injector 3
3 3 Circuit Short To B + 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1214 3 17622 3 Cylinder No. 2 Fuel Injector 3
3 3 Circuit Short To B+ 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1215 3 17623 3 Cylinder No. 3 Fuel Injector 3
3 3 Circuit Short To B+ 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1216 3 17624 3 Cylinder No. 4 Fuel Injector 3
3 3 Circuit Short To B+ 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1217 (1) 317625 (1)3 Cylinder No. 5 Fuel Injector 3
3 3 Circuit Short To B+ 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1218 (1) 317626 (1)3 Cylinder No. 6 Fuel Injector 3
3 3 Circuit Short To B+ 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1225 3 17633 3 Cylinder No. 1 Injector Circuit 3
3 3 Short To Ground 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1226 3 17634 3 Cylinder No. 2 Injector Circuit 3
3 3 Short To Ground 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1227 3 17635 3 Cylinder No. 3 Injector Circuit 3
3 3 Short To Ground 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1228 3 17636 3 Cylinder No. 4 Injector Circuit 3
3 3 Short To Ground 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1229 (1) 317637 (1)3 Cylinder No. 5 Injector Circuit 3
3 3 Short To Ground 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1230 (1) 317638 (1)3 Cylinder No. 6 Injector Circuit 3
3 3 Short To Ground 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3 P1237 3 17645 3 Cylinder No. 1 Injector Circuit 3

```

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```
3          3          3          Open          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1238    3  17646  3  Cylinder No. 2 Injector Circuit  3
3          3          3          Open          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1239    3  17647  3  Cylinder No. 3 Injector Circuit  3
3          3          3          Open          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1240    3  17648  3  Cylinder No. 4 Injector Circuit  3
3          3          3          Open          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1241 (1) 3 17649 (1) 3 Cylinder No. 5 Injector Circuit  3
3          3          3          Open          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1242 (1) 3 17650 (1) 3 Cylinder No. 6 Injector Circuit  3
3          3          3          Open          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1340    3  17748  3 Camshaft/Crankshaft Position Sensor 3
3          3          3          Signals Out Of Sequence  3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1410    3  17818  3 Fuel Tank Ventilation Valve  3
3          3          3          Short To B+          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1420    3  17828  3 Secondary Air Injection Control  3
3          3          3          Electrical Malfunction  3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1421    3  17829  3 Secondary Air Injection Solenoid  3
3          3          3          Valve Circuit Short To Ground  3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1422    3  17830  3 Secondary Air Injection Solenoid  3
3          3          3          Valve Circuit Short To B+  3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1425    3  17833  3 Tank Ventilation Valve  3
3          3          3          Short To Ground          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1426    3  17833  3 Tank Ventilation Valve Circuit Open  3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1450    3  17858  3 Secondary Air Injection System  3
3          3          3          Circuit Short To B+          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1451    3  17859  3 Secondary Air Injection System  3
3          3          3          Circuit Short To Ground          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1452    3  17860  3 Secondary Air Injection System  3
3          3          3          Circuit Open          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1500    3  17908  3 Fuel Pump Relay Circuit Electrical  3
3          3          3          Malfunction          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1502    3  17910  3 Fuel Pump Relay Circuit Short To B+  3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1543    3  17951  3 Throttle Actuation Potentiometer  3
```

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```
3          3          3          Too Low          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1544    3  17952  3  Throttle Actuation Potentiometer  3
3          3          3          Too High          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1580    3  17988  3  Throttle Actuator Malfunction      3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1611 (2) 3 18019 (2) 3 MIL Call-Up/TCM Short To Ground  3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1613    3  18021  3  MIL Call-Up Circuit Open Or Short  3
3          3          3          To B+          3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1778 (2) 3 18186 (2) 3 Solenoid EV7 Electrical Malfunction 3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3  P1780 (2) 3 18188 (2) 3 Engine Intervention Readable      3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
3(1) - Applies to 2.8L only.          3
3(2) - See appropriate MITCHELL(R) IMPORTED TRANSMISSION  3
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
```

#### ENTERING SELF-DIAGNOSTICS

1) Ensure battery voltage and fuse No. 21 on 2.0L or No. 22 on 2.8L are okay. Ensure engine ground connections at cylinder head cover and manifold are okay.

2) Data Link Connector (DLC) is located below tachometer. See Fig. 1. On 2.0L and 2.8L, remove ashtray and slide DLC cover to left. Ensure ignition is off. Connect scan tool to DLC. On all models, scan tool should alternately display 1-RAPID DATA TRANSFER and 2-BLINK CODE OUTPUT.

3) Turn ignition on, or start engine, depending on function being selected. See SELECTABLE FUNCTIONS table. Press "1" button to select RAPID DATA TRANSFER function.

4) Press "0" and "1" buttons to select ENGINE ELECTRONICS function. Press "Q" button to enter input. ECM identification will be displayed on scan tool.

5) If CONTROL MODULE DOES NOT ANSWER message is displayed, press HELP button to print a list of possible causes. With scan tool in RAPID DATA TRANSFER function, press right arrow button. Press "02" to "08" buttons to select desired function. Press "Q" button to enter input.

#### SELECTABLE FUNCTIONS TABLE (1)

AAA			
Function	Ignition On	Engine On	
02 (Read DTC/Fault Memory) .....	X	.....	X
03 (Output Diagnostic Test Mode) .....	X	.....	(2)
04 (Start Basic Setting) .....	X	.....	X
05 (Erase DTC/Fault Memory) .....	X	.....	X
06 (End Output) .....	X	.....	X
07 (Code Control Module) (3) .....	X	.....	X

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08 (Read Measuring Value Block) ..... X ..... X  
11 (Log-In Procedure) (3) ..... X .....

(1) - Press HELP button at any time to obtain additional scan tool operating instructions.

(2) - With engine off on 2.0L and 2.8L.

(3) - Applies to 2.0L and 2.8L only.

AA

#### OUTPUT CHECK DIAGNOSIS (OUTPUT DIAGNOSTIC TEST MODE)

NOTE: See ENTERING SELF-DIAGNOSTICS for additional scan tool operating instructions.

##### 2.0L

1) Ensure battery voltage and fuse No. 21 are okay. Ensure engine ground connections at cylinder head cover and manifold are okay.

2) Data Link Connector (DLC) is located below tachometer. See Fig. 1. Remove ashtray and slide DLC cover to left. Ensure ignition is off. Connect scan tool to DLC. Scan tool should alternately display 1-RAPID DATA TRANSFER and 2-BLINK CODE OUTPUT.

3) Turn ignition on, or start engine, depending on function being selected. See SELECTABLE FUNCTIONS table under ENTERING SELF-DIAGNOSTICS. Press "1" button to select RAPID DATA TRANSFER function.

4) Press "0" and "3" buttons to select OUTPUT DIAGNOSTIC TEST MODE (DTM) function. Press "Q" button to enter input. OUTPUT DIAGNOSTIC TEST MODE will be displayed on scan tool.

5) Output DTM actuates following components in sequence:

- \* Cylinder No. 1 fuel injector.
- \* Cylinder No. 2 fuel injector.
- \* Cylinder No. 3 fuel injector.
- \* Cylinder No. 4 fuel injector.
- \* EVAP canister purge regulator valve.
- \* EVAP canister purge solenoid valve.

##### 2.8L

1) Ensure battery voltage and fuse No. 22 are okay. Ensure engine ground connections at cylinder head cover and manifold are okay.

2) Data Link Connector (DLC) is located below tachometer. See Fig. 1. Remove ashtray and slide DLC cover to left. Ensure ignition is off. Connect scan tool to DLC. Scan tool should alternately display 1-RAPID DATA TRANSFER and 2-BLINK CODE OUTPUT.

3) Turn ignition on, or start engine, depending on function being selected. See SELECTABLE FUNCTIONS table under ENTERING SELF-DIAGNOSTICS. Press "1" button to select RAPID DATA TRANSFER function.

4) Press "0" and "3" buttons to select OUTPUT DIAGNOSTIC TEST MODE (DTM) function. Press "Q" button to enter input. OUTPUT DIAGNOSTIC TEST MODE will be displayed on scan tool.

5) Output DTM actuates following components in sequence:

- \* Cylinder No. 1 fuel injector.

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- \* Cylinder No. 2 fuel injector.
- \* Cylinder No. 3 fuel injector.
- \* Cylinder No. 4 fuel injector.
- \* Cylinder No. 5 fuel injector.
- \* Cylinder No. 6 fuel injector.
- \* EVAP canister purge regulator valve.
- \* Secondary air injection solenoid valve.
- \* Secondary air injection pump relay.
- \* EVAP canister purge solenoid valve.

#### **READ MEASUREMENT & READ MEASURING (TEST) VALUE BLOCK**

**NOTE:** See ENTERING SELF-DIAGNOSTICS for additional scan tool operating instructions.

##### **2.0L**

1) Ensure battery voltage and fuse No. 21 are okay. Ensure engine ground connections at cylinder head cover and manifold are okay.

2) Data Link Connector (DLC) is located below tachometer. See Fig. 1. Remove ashtray and slide DLC cover to left. Ensure ignition is off. Connect scan tool to DLC. Scan tool should alternately display 1-RAPID DATA TRANSFER and 2-BLINK CODE OUTPUT.

3) Turn ignition on, or start engine, depending on function being selected. See SELECTABLE FUNCTIONS table under ENTERING SELF-DIAGNOSTICS. Press "1" button to select RAPID DATA TRANSFER function.

4) Press "0" and "8" buttons to select READ MEASURING VALUE BLOCK MODE function. Press "Q" button to enter input. OUTPUT DIAGNOSTIC TEST MODE will be displayed on scan tool.

5) Press "3" button to select next higher group, "1" button to select next lower group or "C" button to skip a group. See DISPLAY GROUP (2.0L & 2.8L) table. When display group "000" is selected, only READ MEASUREMENT BLOCK is shown on display (the zeros do not appear on display). Scan tool displays a value (specification) which corresponds to operating parameters used by ECM. When READ MEASUREMENT BLOCK function is completed, select END DATA TRANSFER function on scan tool. Turn ignition off. Disconnect scan tool.

##### **2.8L**

1) Ensure battery voltage and fuse No. 22 are okay. Ensure engine ground connections at cylinder head cover and manifold are okay.

2) Data Link Connector (DLC) is located below tachometer. See Fig. 1. Remove ashtray and slide DLC cover to left. Ensure ignition is off. Connect scan tool to DLC. Scan tool should alternately display 1-RAPID DATA TRANSFER and 2-BLINK CODE OUTPUT.

3) Turn ignition on, or start engine, depending on function being selected. See SELECTABLE FUNCTIONS table under ENTERING SELF-DIAGNOSTICS. Press "1" button to select RAPID DATA TRANSFER function.

4) Press "0" and "8" buttons to select READ MEASURING VALUE BLOCK MODE function. Press "Q" button to enter input. OUTPUT DIAGNOSTIC TEST MODE will be displayed on scan tool.

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5) Press "3" button to select next higher group, "1" button to select next lower group or "C" button to skip a group. See DISPLAY GROUP (2.0L & 2.8L) table. When display group "000" is selected, only READ MEASUREMENT BLOCK is shown on display (the zeros do not appear on display). Scan tool displays a value (specification) which corresponds to operating parameters used by ECM. When READ MEASUREMENT BLOCK function is completed, select END DATA TRANSFER function on scan tool. Turn ignition off. Disconnect scan tool.

#### DISPLAY GROUP TABLE (2.0L & 2.8L)

Display	System/	(1) Repair/Parameters
Group No &	Affected Circuit	(Value Displayed)
Channel No		
000		
1	Engine Coolant Temperature	(2) 80-180°C (170-204)
2	Engine Load	(3) 1.4-2.4 ms (28-58)
3	Engine Speed	(4) (5)
4	Battery Voltage	(6) 12.0-14.0 Volts (176-212)
5	Throttle Valve Angle	(7) 0-10° (0-23)
6	Idle Control Mass Airflow	(8) -5 To 5 kg/h (112-144)
7	Mass Airflow Adaptation Value	(8) -5 To 5 kg/h (112-144)
8	Oxygen Sensor Control	(9) -5 To 5% (96-160)
9	Pre-Catalyst Oxygen Sensor	(1) (0) -10 To 10%
	Idle Adaptation Value	(241-255 Or 0-14)
10	Pre-Catalyst Oxygen Sensor	(1) (0) -7 To 7% (118-138)
	Load Adaptation Value	

- (1) - If connectors, wiring circuits and components are okay, substitute a known-good ECM and retest system.
- (2) - If reading is less than specification, check thermostat operation. If thermostat is okay, check Engine Coolant Temperature (ECT) sensor, connectors and wiring circuit. If reading is more than specification, check ECT sensor, connectors and wiring circuit.
- (3) - If reading is less than specification, check intake air system for leaks. If no leaks exist, check fuel pressure regulator. If reading is more than specification, turn off all accessories, and check pre-catalyst Heated Oxygen Sensor (H02S) heater operation. If H02S heater is okay, check H02S,

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- connectors and wiring circuit.
- (4) - 800-880 RPM (80-88) on 2.0L; 650-800 RPM (65-80) on 2.8L.
- (5) - If reading is less than specification, place gear selector in "P" or "N" position. Check Throttle Valve Control Module (TVCM) connectors and wiring circuit. If connectors and wiring circuit are okay, substitute a known-good TVCM and retest system. If reading is more than specification, check fuel pressure regulator. If fuel pressure regulator is okay, substitute a known-good TVCM and retest system.
- (6) - If reading is less than specification, check battery, generator and ECM voltage supply circuit. If reading is more than specification, check voltage regulator.
- (7) - If reading is more than specification, check throttle cable adjustment. If cable is adjusted properly, substitute a known-good throttle valve control module and retest system.
- (8) - If reading is less than specification, check intake air system for leaks. If reading is more than specification, turn off all accessories.
- (9) - If reading is less than specification, check pre-catalyst Heated Oxygen Sensor (H02S) heater operation. If H02S heater is okay, check H02S, connectors and wiring circuit. If H02S, connectors and wiring circuit are okay, check fuel pressure regulator. If reading is more than specification, check pre-catalyst Heated Oxygen Sensor (H02S) heater operation. If H02S heater is okay, check H02S, connectors and wiring circuit. If H02S, connectors and wiring circuit are okay, check intake air system for leaks. If no leaks exist, check fuel injectors. If reading is 128, check amount of fuel in tank. On 2.0L, check for secondary air injection system malfunctions. On all models, check pre-catalyst Heated Oxygen Sensor (H02S) heater operation. If H02S heater is okay, check H02S, connectors and wiring circuit.
- (10) - If reading is -5 to -16.4 percent, change engine oil, check fuel pressure regulator, fuel injectors for leaks and Heated Oxygen Sensor (H02S) heater. If reading is 5 to 16.4 percent, check intake air system for leaks, exhaust system, fuel pressure regulator, H02S heater and fuel injectors. If reading is constant at zero, check wiring circuit between H02S connector and ECM. See appropriate PIN VOLTAGE chart in PIN VOLTAGE CHARTS article. If wiring circuit is okay, check mass airflow sensor.

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#### CLEARING DTCS

See RETRIEVING DTCS.

#### ECM LOCATION

##### All Models

ECM is located underneath center of windshield cowl, directly behind engine compartment firewall.

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## **CIRCUIT TESTS**

**NOTE:** To properly diagnose vehicle, it is recommended to use Scan Tool (VAG 1551) and Test Box (VAG 1598/18).

**NOTE:** For component location, see I - SYSTEM/COMPONENT TESTS article. For circuit and wire color identification, see appropriate WIRING DIAGRAM in L - WIRING DIAGRAMS article.

### **DTC P0102/16486 - MAF CIRCUIT LOW INPUT**

**NOTE:** DTC is set when signal from Mass Airflow (MAF) sensor to Electronic Control Module (ECM) is too low.

1) Inspect MAF sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Check MAF sensor fuse. Replace if necessary. Turn ignition off. Disconnect MAF sensor connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

3) Turn ignition on. Jumper test box sockets No. 1 and 6. Using a DVOM, check voltage between MAF sensor connector terminals No. 1 and 3. Voltage should be at least 11.5 volts. If voltage is as specified, go to step 5). If voltage is not as specified, go to next step.

4) Turn ignition off. Recheck MAF sensor fuse. Replace if necessary. Check resistance between MAF sensor connector terminal No. 1 and ground. Check resistance between MAF sensor connector terminal No. 1 and test box socket No. 1. Resistance should be less than 1.5 ohms. If resistance is not as specified, go to next step. If resistance is as specified, repair open circuit between fuel pump relay and MAF sensor. Erase DTC memory and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 7).

5) Jumper MAF sensor connector terminals No. 1 and 2, and check resistance between test box sockets No. 1 and 16. Jumper MAF sensor connector terminals No. 1 and 4, and check resistance between test box sockets No. 1 and 17. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, repair open circuit between MAF sensor and ECM connector. Erase DTC memory and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 7).

6) Remove jumper and check resistance between test box sockets No. 16 and 17. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, repair short circuit between MAF sensor connector and ECM connector. Erase DTC memory and perform test drive. See CLEARING

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DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

7) Replace MAP sensor. Erase DTC memory and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

8) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P0103/16487 - MAF CIRCUIT HIGH INPUT**

**NOTE:** DTC is set when signal from Mass Airflow (MAF) sensor to Electronic Control Module (ECM) is too high.

1) Inspect MAF sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Check MAF sensor fuse. Replace if necessary. Turn ignition off. Disconnect MAF sensor connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

3) Using a DVOM, check resistance between MAF sensor connector terminal No. 1 and test box socket No. 1. Jumper MAF sensor connector terminals No. 1 and 2, and check resistance between test box sockets No. 1 and 16. Jumper MAF sensor connector terminals No. 1 and 4, and check resistance between test box sockets No. 1 and 17. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, repair open circuit between MAF sensor connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Remove jumper and check resistance between test box sockets No. 16 and 17. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, repair short circuit between MAF sensor connector and ECM connector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Replace MAF sensor. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P0117/16501 - ECT SENSOR CIRCUIT LOW INPUT**

**NOTE:** DTC is set when Electronic Control Module (ECM) detects a short circuit in Engine Coolant Temperature (ECT) sensor or in ECT sensor circuit.

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1) Inspect ECT sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect ECT sensor connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

3) Using a DVOM, check resistance between test box sockets No. 14 and 33. See ECT SENSOR RESISTANCE table. If resistance is as specified, go to step 6). If resistance is not as specified, go to next step.

#### ECT SENSOR RESISTANCE

AA	
Temperature	Ohms
86°F (30°C) .....	1500-2000
176°F (80°C) .....	275-375
AA	

4) Using DVOM, check resistance between ECT sensor connector terminal No. 1 and test box socket No. 14. Resistance should be less than 1.5 ohms. infinite (no continuity). If resistance is as specified, go to step 6). If resistance is not as specified, repair open circuit between ECT sensor and ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Check resistance between ECT sensor connector terminal No. 1 and test box socket 33. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, repair short circuit to ground between ECT sensor connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Carefully release cooling system pressure. Remove ECT sensor and plug hole in engine block. Check resistance between ECT sensor terminals No. 1 and 3 on 2.0L, or terminals No. 1 and 2 on 2.8L. Resistance must increase steadily as sensor cools or decrease as sensor is heated (such as with a hair dryer). If resistance is not as specified, replace ECT sensor. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If resistance is as specified, go to next step.

7) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

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**NOTE:** DTC is set when Electronic Control Module (ECM) detects too high resistance and/or wiring open circuit to Engine Coolant Temperature (ECT) sensor.

1) Inspect ECT sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect ECT sensor connector. Disconnect ECM. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

3) Using a DVOM, check resistance between test box sockets No. 14 and 33. See ECT SENSOR RESISTANCE table. If resistance is as specified, go to next step.

#### ECT SENSOR RESISTANCE

Temperature ..... Ohms

86°F (30°C) ..... 1500-2000

176°F (80°C) ..... 275-375

4) Using DVOM, check resistance between ECT sensor connector terminal No. 1 and test box socket No. 14. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, repair open circuit between ECT sensor and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Check resistance between ECT sensor connector terminal No. 1 and test box socket 33. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, repair short circuit to ground between ECT sensor connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Carefully release cooling system pressure. Remove ECT sensor and plug hole in engine block. Check resistance between ECT sensor terminals No. 1 and 3 on 2.0L, or terminals No. 1 and 2 on 2.8L. Resistance must increase steadily as sensor cools or decrease as sensor is heated (such as with a hair dryer). If resistance is not as specified, replace ECT sensor. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If resistance is as specified, go to next step.

7) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

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**NOTE:** DTC is set when Throttle Position (TP) sensor supplies invalid signal to Electronic Control Module (ECM).

1) Inspect TP sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect Throttle Valve Control Module (TVCM) connector. Turn ignition on. Using DVOM, check voltage between TVCM connector terminals No. 4 and 7. Voltage should be about 5 volts. Check voltage between TVCM connector terminals No. 3 and 7. Voltage should be about 10 volts. If voltage is as specified, go to step 6). If voltage is not as specified, go to next step.

3) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Check resistance between TVCM connector terminal No. 3 and test box socket No. 10, between TVCM connector terminal No. 4 and test box socket No. 41, and between TVCM connector terminal No. 7 and test box socket No. 33. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

5) Check for an open circuit between TVCM and ECM. Repair as necessary. Erase DTC memory and test drive vehicle. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If no open circuit is present, go to step 11).

6) Turn ignition off. Reconnect TVCM connector. With accelerator at Wide Open Throttle (WOT) and at closed throttle, check resistance between test box sockets No. 10 and 33. Resistance should be infinite (no continuity) at WOT and 10 ohms maximum at closed throttle. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

7) With accelerator pedal at closed throttle, check resistance between test box sockets No. 27 and 53. If resistance is 3-200 ohms, go to step 9). If resistance is not as specified, go to next step.

8) Disconnect TVCM connector. Check resistance between TVCM connector terminal No. 1 and test box socket No. 27, TVCM connector terminal No. 2 and test box socket No. 53, TVCM terminal connector No. 5 and test box socket No. 40, and TVCM connector terminal No. 8 and test box socket No. 62. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit between TVCM and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If resistance is as specified, go to next step.

9) Check resistance between test box sockets No. 10, 27, 33, 40, 41, 53, and 69. Resistance should be infinite (no continuity) between each circuit. If resistance is not as specified, repair

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circuits shorted to each other. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If no shorts are present, go to next step.

10) Substitute a known-good TVCM. Clear DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, see DTCs P0102/16486, P0103/16487, P0117/16501 and P0118/16502.

11) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0121/16505 - TP SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM

**NOTE:** DTC is set when Throttle Position (TP) sensor supplies invalid signal to Electronic Control Module (ECM).

1) Inspect Throttle Position (TP) sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect Throttle Valve Control Module (TVCM) connector. Turn ignition on. Using DVOM, check voltage between TVCM connector terminals No. 4 and 7. Voltage should be about 5 volts. Check voltage between TVCM connector terminals No. 3 and 7. Voltage should be about 10 volts. If voltage is as specified, go to step 6). If voltage is not as specified, go to next step.

3) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Check resistance between TVCM connector terminal No. 3 and test box socket No. 10, between TVCM connector terminal No. 4 and test box socket No. 41, and between TVCM connector terminal No. 7 and test box socket No. 33. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

5) Check for an open circuit between TVCM and ECM. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If no open circuit is present, go to next step.

6) Turn ignition off. Reconnect TVCM connector. With accelerator at Wide Open Throttle (WOT) and at closed throttle, check resistance between test box sockets No. 10 and 33. Resistance should be infinite (no continuity) at WOT and 10 ohms maximum at closed throttle. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

7) With accelerator pedal at closed throttle, check resistance between test box sockets No. 27 and 53. If resistance is 3-200 ohms, go to step 9). If resistance is not as specified, go to next step.

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8) Disconnect TVCM connector. Check resistance between TVCM connector terminal No. 1 and test box socket No. 27, TVCM connector terminal No. 2 and test box socket No. 53, TVCM terminal connector No. 5 and test box socket No. 40, and TVCM connector terminal No. 8 and test box socket No. 62. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit between TVCM and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If resistance is as specified, go to next step.

9) Check resistance between test box sockets No. 10, 27, 33, 40, 41, 53, and 69. Resistance should be infinite (no continuity) between each circuit. If resistance is not as specified, repair circuits shorted to each other. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If no shorts are present, go to next step.

10) Substitute a known-good TVCM. Clear DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, see DTCs P0102/16486, P0103/16487, P0117/16501 and P0118/16502.

11) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0122/16506 - TP SENSOR CIRCUIT LOW INPUT

NOTE: DTC is set when Throttle Position (TP) sensor supplies invalid signal to Electronic Control Module (ECM).

1) Inspect Throttle Position (TP) sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect Throttle Valve Control Module (TVCM) connector. Turn ignition on. Using DVOM, check voltage between TVCM connector terminals No. 4 and 7. Voltage should be about 5 volts. Check voltage between TVCM connector terminals No. 3 and 7. Voltage should be about 10 volts. If voltage is as specified, go to step 6). If voltage is not as specified, go to next step.

3) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Check resistance between TVCM connector terminal No. 3 and test box socket No. 10, between TVCM connector terminal No. 4 and test box socket No. 41, and between TVCM connector terminal No. 7 and test box socket No. 33. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

5) Check for an open circuit between TVCM and ECM. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS

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in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If no open circuit is present, go to step 11).

6) Turn ignition off. Reconnect TVCM connector. With accelerator at Wide Open Throttle (WOT) and at closed throttle, check resistance between test box sockets No. 10 and 33. Resistance should be infinite (no continuity) at WOT and 10 ohms maximum at closed throttle. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

7) With accelerator pedal at closed throttle, check resistance between test box sockets No. 27 and 53. If resistance is 3-200 ohms, go to step 9). If resistance is not as specified, go to next step.

8) Disconnect TVCM connector. Check resistance between TVCM connector terminal No. 1 and test box socket No. 27, TVCM connector terminal No. 2 and test box socket No. 53, TVCM terminal connector No. 5 and test box socket No. 40, and TVCM connector terminal No. 8 and test box socket No. 62. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit between TVCM and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If resistance is as specified, go to next step.

9) Check resistance between test box sockets No. 10, 27, 33, 40, 41, 53, and 69. Resistance should be infinite (no continuity) between each circuit. If resistance is not as specified, repair circuits shorted to each other. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If no shorts are present, go to next step.

10) Substitute a known-good TVCM. Clear DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, see DTCs P0102/16486, P0103/16487, P0117/16501 and P0118/16502.

11) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1025/16509 - INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL**

**NOTE:** DTC is set when Electronic Control Module (ECM) cannot use engine coolant temperature signal for Heated Oxygen Sensor (HO2S) control, or time taken for engine to reach normal operating temperature is too long.

1) Check Engine Coolant Temperature (ECT) sensor circuit. See DTCs P0117/16501 and P0118/16502. Repair ECT sensor circuit as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If ECT sensor circuit is okay, go to next step.

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2) Replace faulty thermostat. Clear DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

3) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P0131/16515 - HO2S CIRCUIT LOW VOLTAGE (BANK 1, SENSOR 1)**

**NOTE:** DTC is set when pre-catalyst Heated Oxygen Sensor (HO2S) or wiring to HO2S is shorted to ground for more than 200 seconds.

1) Inspect pre-catalyst HO2S connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn engine on and allow it to reach operating temperature. Using a DVOM, check voltage between pre-catalyst HO2S connector terminals No. 3 and 4. Voltage should be .2-.8 volt. If voltage is as specified, circuit is okay. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. If voltage is not as specified, go to next step.

3) Increase engine speed several times. Voltage should change from .2 volt (lean mixture) to .9 volt (rich mixture). If voltage is as specified, go to next step. If voltage is not as specified, replace HO2S. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

5) Using DVOM, check resistance between pre-catalyst HO2S connector terminal No. 3 and test box socket No. 42, and pre-catalyst HO2S connector terminal No. 4 and test box socket No. 20. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between HO2S and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Check resistance between pre-catalyst HO2S connector terminal No. 3 and test box socket No. 56, and pre-catalyst HO2S connector terminal No. 4 and test box socket No. 56. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between HO2S and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

7) Turn ignition on. Using a DVOM, check voltage between pre-catalyst HO2S connector terminals No. 3 and 4. Voltage should be .45 volt. If voltage is as specified, circuit is okay. Erase DTC memory

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and test drive vehicle. See CLEARING DTCS in this article. If voltage is not as specified, go to next step.

8) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0132/16516 - HO2S CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 1)

NOTE: DTC is set when pre-catalyst Heated Oxygen Sensor (HO2S) or wiring to HO2S is shorted to battery voltage.

1) Inspect pre-catalyst HO2S connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition on. Using a DVOM, check voltage between pre-catalyst HO2S connector terminals No. 3 and 4. Voltage should be .45 volt. If voltage is as specified, circuit is okay. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. If voltage is not as specified, go to next step.

3) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Remove fuse No. 18. Using DVOM, check resistance between fuse No. 18 connector upper terminal and test box socket No. 20. Check resistance between fuse No. 18 connector upper terminal No. 18 and test box socket No. 42. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short to battery voltage. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Check resistance between pre-catalyst HO2S connector terminals No. 1 and 3, and No. 1 and 4. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, replace HO2S. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) If vehicle was repaired, clear DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If vehicle was not repaired, go to next step.

7) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0133/16517 - HO2S CIRCUIT SLOW RESPONSE (BANK 1, SENSOR 1)

NOTE: DTC is set when pre-catalyst Heated Oxygen Sensor (HO2S) is

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dirty, aged or contaminated.

1) Inspect pre-catalyst H02S connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Run engine at 3500 RPM for at least 3 minutes. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC does not reset, H02S was dirty. If DTC resets, go to next step.

3) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Disconnect pre-catalyst H02S connector. Turn ignition on. Jumper test box sockets No. 1 and 6. Using DVOM, check voltage between pre-catalyst H02S connector terminal No. 1 and ground. Voltage must be at least 11.5 volts. If voltage is as specified, go to step 6). If voltage is not as specified, go to next step.

5) Remove fuse No. 18. Using DVOM, check resistance between fuse No. 18 connector upper terminal and pre-catalyst H02S connector terminal No. 1. Check resistance between pre-catalyst H02S connector terminal No. 2 and test box socket No. 12. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between pre-catalyst H02S connector and ECM, and go to step 7).

6) Check resistance between H02S terminals No. 1 and 2. Resistance should be 20 ohms at 68°F (20°C). If resistance is as specified, go to next step. If resistance is not as specified, replace H02S and go to next step.

7) If vehicle was repaired, clear DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If vehicle was not repaired, go to next step.

8) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

DTC P0134/16518 - H02S CIRCUIT NO ACTIVITY DETECTED  
(BANK 1, SENSOR 1)

NOTE: DTC is set when Engine Control Module (ECM) does not recognize pre-catalyst Heated Oxygen Sensor (H02S) signal.

1) Inspect pre-catalyst H02S connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect pre-catalyst H02S connector. Using a DVOM, check continuity between pre-catalyst H02S connector terminals No. 3 and 4 with engine idling at normal operating

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temperature. Voltage should be .2-.8 volt. Go to next step.

3) Increase engine speed several times. Voltage should change from .2 volt (lean mixture) to .9 volt (rich mixture). If voltage is as specified, go to next step. If voltage is not as specified, replace H02S. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

5) Using DVOM, check resistance between pre-catalyst H02S connector terminal No. 3 and test box socket No. 42, and pre-catalyst H02S connector terminal No. 4 and test box socket No. 20. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between H02S and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Check resistance between pre-catalyst H02S connector terminal No. 3 and test box socket No. 56, and pre-catalyst H02S connector terminal No. 4 and test box socket No. 56. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between H02S and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

7) Replace H02S. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

8) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P0135/16519 - H02S HEATER CIRCUIT MALFUNCTION (BANK 1, SENSOR 1)**

**NOTE:** DTC is set if pre-catalyst Heated Oxygen Sensor (H02S) heater is not functioning.

1) Inspect pre-catalyst H02S connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

3) Disconnect pre-catalyst H02S connector. Turn ignition on. Jumper test box sockets No. 1 and 6. Using DVOM, check voltage between pre-catalyst H02S connector terminal No. 1 and ground. Voltage should be at least 11.5 volts. If voltage is as specified, go to step 5). If voltage is not as specified, go to next step.

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4) Remove fuse No. 18. Check resistance between fuse No. 18 connector upper terminal and pre-catalyst H02S connector terminal No. 1. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between pre-catalyst H02S connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 7).

5) Check resistance between pre-catalyst connector terminal No. 2 and test box socket No. 12. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is as specified, locate and repair open circuit between pre-catalyst H02S connector and ECM, and go to step 7).

6) Check resistance between pre-catalyst H02S terminals No. 1 and 2. Resistance should be 20 ohms at 68°F (20°C). If resistance is as specified, go to next step. If resistance is not as specified, replace pre-catalyst H02S and go to next step.

7) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0137/16521 - H02S CIRCUIT LOW VOLTAGE (BANK 1, SENSOR 2)

NOTE: DTC is set when post-catalyst Heated Oxygen Sensor (H02S) or wiring to H02S is shorted to ground for more than 200 seconds.

1) Inspect Pre-catalyst and post-catalyst H02S connectors for looseness and/or corrosion. Repair sensor connectors as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connectors are okay, go to next step.

2) Turn ignition on. Using a DVOM, check voltage between post-catalyst H02S connector terminals No. 3 and 4. Voltage should be .45 volt. If voltage is not as specified, go to next step. If voltage is as specified, circuit is okay. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

3) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Check resistance between post-catalyst H02S connector terminal No. 3 and test box socket No. 58, and post-catalyst H02S connector terminal No. 4 and test box socket No. 13. Resistance should be less than 1.5 ohms. If resistance is as specified, go next step 6). If resistance is not as specified, go to next step.

5) Check resistance between post-catalyst H02S connector terminal No. 3 and test box socket No. 56, and post-catalyst H02S connector terminal No. 4 and test box socket No. 56. Resistance should be infinite (no continuity). If resistance is as specified, go to next

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step. If resistance is not as specified, locate and repair short circuit to ground between post-catalyst H02S and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0138/16522 - H02S CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 2)

NOTE: DTC is set when post-catalyst Heated Oxygen Sensor (H02S) or wiring to H02S is shorted to battery voltage.

1) Inspect post-catalyst H02S connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition on. Using a DVOM, check voltage between post-catalyst H02S connector terminals No. 3 and 4. Voltage should be .45 volt. If voltage is not as specified, go to next step. If voltage is as specified, circuit is okay. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

3) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Remove fuse No. 18. Using DVOM, check resistance between fuse No. 18 connector upper terminal and test box socket No. 13. Check resistance between fuse No. 18 connector upper terminal No. 18 and test box socket No. 58. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short to battery voltage. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Check resistance between post-catalyst H02S connector terminals No. 1 and 3, and No. 1 and 4. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, replace H02S. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) If vehicle was repaired, clear DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If vehicle was not repaired, go to next step.

7) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0140/16524 - H02S CIRCUIT NO ACTIVITY DETECTED

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(BANK 1, SENSOR 2)

**NOTE:** DTC is set when post-catalyst Heated Oxygen Sensor (H02S) is dirty, aged or contaminated.

1) Inspect pre-catalyst H02S connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Run engine at 3500 RPM for at least 3 minutes. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC does not reset, H02S was dirty. If DTC resets, go to next step.

3) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Disconnect post-catalyst H02S connector. Using DVOM, check resistance between post-catalyst H02S connector terminal No. 3 and test box socket No. 58, and post-catalyst H02S connector terminal No. 4 and test box socket No. 13. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between H02S and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Turn ignition on. Jumper test box sockets No. 1 and 6. Using DVOM, check voltage between pre-catalyst H02S connector terminal No. 1 and ground. Voltage must be at least 11.5 volts. If voltage is as specified, go to step 8). If voltage is not as specified, go to next step.

6) Remove fuse No. 18. Using DVOM, check resistance between fuse No. 18 connector upper terminal and post-catalyst H02S connector terminal No. 1. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between pre-catalyst H02S connector and ECM, and go to step 8).

7) Check resistance between H02S terminals No. 1 and 2. Resistance should be 20 ohms at 68°F (20°C). If resistance is as specified, go to next step. If resistance is not as specified, replace H02S and go to next step.

8) If vehicle was repaired, clear DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If vehicle was not repaired, go to next step.

9) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

DTC P0141/16525 - H02S HEATER CIRCUIT MALFUNCTION  
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**NOTE:** DTC is set if post-catalyst Heated Oxygen Sensor (H02S) heater is not functioning.

1) Inspect post-catalyst H02S connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

3) Disconnect post-catalyst H02S connector. Turn ignition on. Jumper test box sockets No. 1 and 6. Using DVOM, check voltage between post-catalyst H02S connector terminal No. 1 and ground. Voltage should be at least 11.5 volts. If voltage is as specified, go to step 5). If voltage is not as specified, go to next step.

4) Remove fuse No. 18. Check resistance between fuse No. 18 connector upper terminal and post-catalyst H02S connector terminal No. 1. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between post-catalyst H02S connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 7). If sensor connector is okay, go to next step.

5) Check resistance between post-catalyst connector terminal No. 2 and test box socket No. 66. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between post-catalyst H02S connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 7).

6) Check resistance between post-catalyst H02S terminals No. 1 and 2. Resistance should be 20 ohms at 68°F (20°C). If resistance is as specified, go to next step. If resistance is not as specified, replace post-catalyst H02S. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

7) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0171/16555 - SYSTEM TOO LEAN (BANK 1)

**NOTE:** DTC is set when mixture is so lean that Heated Oxygen Sensor (H02S) control cannot enrich mixture further.

1) Start engine and let it idle. Inspect intake system for leaks between Mass Airflow (MAF) sensor and cylinder head. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If an intake leak is not found, go to

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next step.

2) Inspect secondary air injection system operation. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If secondary air injection system is operating properly, go to next step.

3) Check MAF sensor circuit. See DTC P0102/16486 and P0103/16487. Repair MAF sensor circuit as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If MAF sensor circuit is operating properly, go to next step.

4) Disconnect test box. Test drive vehicle for performance problems. If problem occurs only at full acceleration, replace fuel filter. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets or if other performance problem(s) exist, go to next step.

5) If engine output is impaired at lower throttle openings or vehicle jerks at lower throttle openings, turn engine off. Check fuel injectors and circuit. See 2.0L or 2.8L under FUEL INJECTORS & CIRCUIT under FUEL SYSTEM in I - SYSTEM/COMPONENT TESTS article. Repair fuel injectors and circuit as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If fuel injectors and circuit are operating properly, go to next step.

6) Inspect fuel injectors for poor electronic connection or dirty/clogged injectors. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If electronic connection and injectors are okay, go to next step.

7) Replace pre-catalyst H02S. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

8) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0172/16556 - SYSTEM TOO RICH (BANK 1)

NOTE: DTC is set when mixture is so rich that Heated Oxygen Sensor (H02S) control cannot lean mixture further.

1) Check whether crankcase dilution has caused engine to run rich. Change engine oil if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If engine oil is okay, go to next step.

2) Start engine and let it idle. Inspect exhaust system for leaks between 3-way catalyst and cylinder head. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If no exhaust leak is found, go to next step.

3) Turn ignition off. Disconnect Electronic Control Module

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(ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Using a DVOM, check resistance between test box sockets No. 20 and 42. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between pre-catalyst H02S connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Check pre-catalyst H02S circuit. See DTC P0134/1658. Repair pre-catalyst H02S circuit as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If H02S circuit is okay, go to next step.

6) Turn ignition off. Check fuel delivery system. See FUEL PRESSURE and TRANSFER PUMP CHECK under FUEL SYSTEM in appropriate F - BASIC TESTING - GASOLINE article. Repair fuel delivery system as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If fuel delivery system is okay, go to next step.

7) Check fuel injectors. See 2.0L or 2.8L under FUEL INJECTORS & CIRCUIT under FUEL SYSTEM in I - SYSTEM/COMPONENT TESTS article. Repair fuel injectors and circuit as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If fuel injectors and circuit are okay, go to next step.

8) Check fuel injectors for poor electronic connection or dirty/clogged injectors. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If electronic connection and injectors are okay, go to next step.

9) Replace pre-catalyst H02S. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

10) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0300/16684 - RANDOM MISFIRE DETECTED

NOTE: DTC is set when Electronic Control Module (ECM) detects rough engine running (misfiring).

1) Check fuel condition and tank level. Drain and/or fill if necessary. If fuel is okay, go to next step. If fuel level was low or contaminated, erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

2) Run engine at idle or slightly above idle. Check spark plug cables and connectors for arcing to ground. Replace spark plug cable(s) as necessary. If spark plug cables are okay, go to next step.

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Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

3) Remove and check condition of spark plugs. Check spark plugs for correct heat range. Replace spark plug(s) as necessary. If spark plugs are okay, go to next step. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Ensure engine speed sensor is properly installed. If speed sensor is properly installed, remove speed sensor and check for metal particle contamination. If speed sensor is okay, go to next step.

5) Check crankshaft wheel for damage or contamination. If crankshaft wheel is okay, check condition of speed sensor connector. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Turn ignition off. Disconnect ignition coil connector. Turn ignition on. Using DVOM, check voltage between ignition coil connector terminals No. 1 and 3 on 2.0L or No. 1 and 5 on 2.8L. Voltage should be 11.5 volts. If voltage is as specified, go to step 10). If voltage is not as specified, go to next step.

7) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

8) Check resistance between ignition coil connector terminal No. 1 and test box socket No. 1. Resistance should be less than 1.5 ohms. If resistance is not as specified, go to next step. If resistance is as specified, locate and repair open circuit in positive wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

9) Locate and repair open circuit in ground wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

10) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

11) Check resistance between ignition coil connector terminal No. 2 and test box socket No. 8. Resistance should be less than 1.5 ohms. If resistance is as specified on 2.0L, go to step 13). If resistance is as specified on 2.8L, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

12) Check resistance between ignition coil connector terminal No. 3 and test box socket No. 60, and ignition coil connector terminal No. 4 and test box socket No. 52. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See

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CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

13) On all models, check resistance of ignition coil connector terminals to each other. On 2.0L, check between connector terminals No. 1 and 2, and No. 2 and 3. On 2.8L, check between connector terminals No. 2 and 3, and No. 3 and 4. On all models, resistance should be infinite (no continuity). If resistance is as specified, on 2.0L, go to next step. On 2.8L, go to step 16).

14) Check resistance between ignition coil terminals No. 1 and 15. Resistance should be 500-1200 ohms. If resistance is as specified, go to next step. If resistance is not as specified, go to step 16).

15) Check resistance between ignition coil terminals No. 4 and 15. Resistance should be 3000-4000 ohms. If resistance is as specified, go to next step. If resistance is not as specified, go to next step.

16) Replace ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

17) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0301/16685 - CYLINDER NO. 1 MISFIRE DETECTED

NOTE: DTC is set when Electronic Control Module (ECM) detects rough engine running (misfiring)

1) Check fuel condition and tank level. Drain and/or fill if necessary. If fuel is okay, go to next step. If fuel level was low or contaminated, erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

2) Run engine at idle or slightly above idle. Check cylinder No. 1 spark plug cable and connector for arcing to ground. Replace spark plug cable if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug cable is okay, go to next step.

3) Remove and check condition of cylinder No. 1 spark plug. Check spark plug for correct heat range. Replace spark plug if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug is okay, go to next step.

4) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

5) Disconnect ignition coil connector. Check connector for looseness or contamination. Repair connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If connector is okay, go to next step.

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6) Turn ignition off. Disconnect ignition coil connector. Turn ignition on. Using DVOM, check voltage between ignition coil connector terminals No. 1 and 3 on 2.0L or No. 1 and 5 on 2.8L. Voltage should be 11.5 volts. If voltage is as specified, go to step 8). If voltage is not as specified, go to next step.

7) Check resistance between ignition coil connector terminal No. 1 and test box socket No. 1. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit in ground wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If resistance is as specified, locate and repair open circuit in positive wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

8) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

9) Check resistance between ignition coil connector terminal No. 2 and test box socket No. 8. Resistance should be less than 1.5 ohms. If resistance is as specified on 2.0L, go to step 11). If resistance is as specified on 2.8L, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

10) Check resistance between ignition coil connector terminal No. 3 and test box socket No. 60, and ignition coil connector terminal No. 4 and test box socket No. 52. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

11) On all models, check resistance of ignition coil connector terminals to each other. On 2.0L, check between connector terminals No. 1 and 2, and No. 3 and 4. On 2.8L, check between connector terminals No. 2 and 3, and No. 3 and 4. On all models, resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, repair connectors shorted to each other. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

12) Remove fuse No. 18. Check resistance between fuse No. 18 connector lower terminal and test box socket No. 24. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, replace cylinder No. 1 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

13) Disconnect cylinder No. 1 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder

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No. 1 fuel injector connector terminal No. 1 and test box socket No. 1, and cylinder No. 1 fuel injector connector terminal No. 2 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between cylinder No. 1 fuel injector connector and ECM, and go to next step.

14) Check resistance between cylinder No. 1 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal, and cylinder No. 1 connector terminal No. 2 and test box socket No. 24. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between No. 1 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

15) Replace cylinder No. 1 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

16) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P0302/16686 - CYLINDER NO. 2 MISFIRE DETECTED**

**NOTE:** DTC is set when Electronic Control Module (ECM) detects rough engine running (misfiring)

1) Check fuel condition and tank level. Drain and/or fill if necessary. If fuel is okay, go to next step. If fuel level was low or contaminated, erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

2) Run engine at idle or slightly above idle. Check cylinder No. 2 spark plug cable and connector for arcing to ground. Replace spark plug cable if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug cable is okay, go to next step.

3) Remove and check condition of cylinder No. 2 spark plug. Check spark plug for correct heat range. Replace spark plug if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug is okay, go to next step.

4) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

5) Disconnect ignition coil connector. Check connector for looseness or contamination. Repair connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If connector is okay, go to next step.

6) Turn ignition off. Disconnect ignition coil connector.

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Turn ignition on. Using DVOM, check voltage between ignition coil connector terminals No. 1 and 3 on 2.0L or No. 1 and 5 on 2.8L. Voltage should be 11.5 volts. If voltage is as specified, go to step 8). If voltage is not as specified, go to next step.

7) Check resistance between ignition coil connector terminal No. 1 and test box socket No. 1. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit in ground wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If resistance is as specified, locate and repair open circuit in positive wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

8) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

9) Check resistance between ignition coil connector terminal No. 2 and test box socket No. 8. Resistance should be less than 1.5 ohms. If resistance is as specified on 2.0L, go to step 11). If resistance is as specified on 2.8L, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

10) Check resistance between ignition coil connector terminal No. 3 and test box socket No. 60, and ignition coil connector terminal No. 4 and test box socket No. 52. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

11) On all models, check resistance of ignition coil connector terminals to each other. On 2.0L, check between connector terminals No. 1 and 2, and No. 3 and 4. On 2.8L, check between connector terminals No. 2 and 3, and No. 3 and 4. On all models, resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, repair connectors shorted to each other. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

12) Remove fuse No. 18. Check resistance between fuse No. 18 connector lower terminal and test box socket No. 25. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, replace cylinder No. 2 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

13) Disconnect cylinder No. 2 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder No. 2 fuel injector connector terminal No. 1 and test box socket No.

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1, and cylinder No. 2 fuel injector connector terminal No. 2 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between cylinder No. 2 fuel injector connector and ECM, and go to next step.

14) Check resistance between cylinder No. 2 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal, and cylinder No. 2 connector terminal No. 2 and test box socket No. 25. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between No. 1 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

15) Replace cylinder No. 2 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

16) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0303/16687 - CYLINDER NO. 3 MISFIRE DETECTED

**NOTE:** DTC is set when Electronic Control Module (ECM) detects rough engine running (misfiring)

1) Check fuel condition and tank level. Drain and/or fill if necessary. If fuel is okay, go to next step. If fuel level was low or contaminated, erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

2) Run engine at idle or slightly above idle. Check cylinder No. 3 spark plug cable and connector for arcing to ground. Replace spark plug cable if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug cable is okay, go to next step.

3) Remove and check condition of cylinder No. 3 spark plug. Check spark plug for correct heat range. Replace spark plug if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug is okay, go to next step.

4) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

5) Disconnect ignition coil connector. Check connector for looseness or contamination. Repair connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If connector is okay, go to next step.

6) Turn ignition off. Disconnect ignition coil connector. Turn ignition on. Using DVOM, check voltage between ignition coil

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connector terminals No. 1 and 3 on 2.0L or No. 1 and 5 on 2.8L. Voltage should be 11.5 volts. If voltage is as specified, go to step 8). If voltage is not as specified, go to next step.

7) Check resistance between ignition coil connector terminal No. 1 and test box socket No. 1. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit in ground wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If resistance is as specified, locate and repair open circuit in positive wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

8) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

9) Check resistance between ignition coil connector terminal No. 2 and test box socket No. 8. Resistance should be less than 1.5 ohms. If resistance is as specified on 2.0L, go to step 11). If resistance is as specified on 2.8L, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

10) Check resistance between ignition coil connector terminal No. 3 and test box socket No. 60, and ignition coil connector terminal No. 4 and test box socket No. 52. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

11) On all models, check resistance of ignition coil connector terminals to each other. On 2.0L, check between connector terminals No. 1 and 2, and No. 3 and 4. On 2.8L, check between connector terminals No. 2 and 3, and No. 3 and 4. On all models, resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, repair connectors shorted to each other. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

12) Remove fuse No. 18. Check resistance between fuse No. 18 connector lower terminal and test box socket No. 26. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, replace cylinder No. 3 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

13) Disconnect cylinder No. 3 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder No. 3 fuel injector connector terminal No. 1 and test box socket No. 1, and cylinder No. 3 fuel injector connector terminal No. 2 and test

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box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between cylinder No. 3 fuel injector connector and ECM, and go to next step.

14) Check resistance between cylinder No. 3 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal, and cylinder No. 3 connector terminal No. 2 and test box socket No. 26. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between No. 1 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

15) Replace cylinder No. 3 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

16) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0304/16688 - CYLINDER NO. 4 MISFIRE DETECTED

NOTE: DTC is set when Electronic Control Module (ECM) detects rough engine running (misfiring)

1) Check fuel condition and tank level. Drain and/or fill if necessary. If fuel is okay, go to next step. If fuel level was low or contaminated, erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

2) Run engine at idle or slightly above idle. Check cylinder No. 4 spark plug cable and connector for arcing to ground. Replace spark plug cable if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug cable is okay, go to next step.

3) Remove and check condition of cylinder No. 4 spark plug. Check spark plug for correct heat range. Replace spark plug if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug is okay, go to next step.

4) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

5) Disconnect ignition coil connector. Check connector for looseness or contamination. Repair connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If connector is okay, go to next step.

6) Turn ignition off. Disconnect ignition coil connector. Turn ignition on. Using DVOM, check voltage between ignition coil connector terminals No. 1 and 3 on 2.0L or No. 1 and 5 on 2.8L.

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Voltage should be 11.5 volts. If voltage is as specified, go to step 8). If voltage is not as specified, go to next step.

7) Check resistance between ignition coil connector terminal No. 1 and test box socket No. 1. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit in ground wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If resistance is as specified, locate and repair open circuit in positive wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

8) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

9) Check resistance between ignition coil connector terminal No. 2 and test box socket No. 8. Resistance should be less than 1.5 ohms. If resistance is as specified on 2.0L, go to step 11). If resistance is as specified on 2.8L, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

10) Check resistance between ignition coil connector terminal No. 3 and test box socket No. 60, and ignition coil connector terminal No. 4 and test box socket No. 52. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

11) On all models, check resistance of ignition coil connector terminals to each other. On 2.0L, check between connector terminals No. 1 and 2, and No. 3 and 4. On 2.8L, check between connector terminals No. 2 and 3, and No. 3 and 4. On all models, resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, repair connectors shorted to each other. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

12) Remove fuse No. 18. Check resistance between fuse No. 18 connector lower terminal and test box socket No. 2. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, replace cylinder No. 4 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

13) Disconnect cylinder No. 4 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder No. 4 fuel injector connector terminal No. 1 and test box socket No. 1, and cylinder No. 4 fuel injector connector terminal No. 2 and test box socket No. 1. Resistance should be infinite (no continuity). If

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resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between cylinder No. 4 fuel injector connector and ECM, and go to next step.

14) Check resistance between cylinder No. 4 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal, and cylinder No. 4 connector terminal No. 2 and test box socket No. 2. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between No. 1 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

15) Replace cylinder No. 4 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

16) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0305/16689 - CYLINDER NO. 5 MISFIRE DETECTED

NOTE: DTC is set when Electronic Control Module (ECM) detects rough engine running (misfiring)

1) Check fuel condition and tank level. Drain and/or fill if necessary. If fuel is okay, go to next step. If fuel level was low or contaminated, erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

2) Run engine at idle or slightly above idle. Check cylinder No. 5 spark plug cable and connector for arcing to ground. Replace spark plug cable if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug cable is okay, go to next step.

3) Remove and check condition of cylinder No. 5 spark plug. Check spark plug for correct heat range. Replace spark plug if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug is okay, go to next step.

4) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

5) Disconnect ignition coil connector. Check connector for looseness or contamination. Repair connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If connector is okay, go to next step.

6) Turn ignition off. Disconnect ignition coil connector. Turn ignition on. Using DVOM, check voltage between ignition coil connector terminals No. 1 and 3 on 2.0L or No. 1 and 5 on 2.8L. Voltage should be 11.5 volts. If voltage is as specified, go to step

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8). If voltage is not as specified, go to next step.

7) Check resistance between ignition coil connector terminal No. 1 and test box socket No. 1. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit in ground wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If resistance is as specified, locate and repair open circuit in positive wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

8) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

9) Check resistance between ignition coil connector terminal No. 2 and test box socket No. 8. Resistance should be less than 1.5 ohms. If resistance is as specified on 2.0L, go to step 11). If resistance is as specified on 2.8L, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

10) Check resistance between ignition coil connector terminal No. 3 and test box socket No. 60, and ignition coil connector terminal No. 4 and test box socket No. 52. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

11) On all models, check resistance of ignition coil connector terminals to each other. On 2.0L, check between connector terminals No. 1 and 2, and No. 3 and 4. On 2.8L, check between connector terminals No. 2 and 3, and No. 3 and 4. On all models, resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, repair connectors shorted to each other. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

12) Remove fuse No. 18. Check resistance between fuse No. 18 connector lower terminal and test box socket No. 3. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, replace cylinder No. 5 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

13) Disconnect cylinder No. 5 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder No. 5 fuel injector connector terminal No. 1 and test box socket No. 1, and cylinder No. 5 fuel injector connector terminal No. 2 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as

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specified, locate and repair short circuit to ground between cylinder No. 5 fuel injector connector and ECM, and go to next step.

14) Check resistance between cylinder No. 5 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal, and cylinder No. 5 connector terminal No. 2 and test box socket No. 3. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between No. 1 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

15) Replace cylinder No. 5 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

16) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0306/16690 - CYLINDER NO. 6 MISFIRE DETECTED

NOTE: DTC is set when Electronic Control Module (ECM) detects rough engine running (misfiring)

1) Check fuel condition and tank level. Drain and/or fill if necessary. If fuel is okay, go to next step. If fuel level was low or contaminated, erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

2) Run engine at idle or slightly above idle. Check cylinder No. 6 spark plug cable and connector for arcing to ground. Replace spark plug cable if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug cable is okay, go to next step.

3) Remove and check condition of cylinder No. 6 spark plug. Check spark plug for correct heat range. Replace spark plug if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If spark plug is okay, go to next step.

4) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

5) Disconnect ignition coil connector. Check connector for looseness or contamination. Repair connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If connector is okay, go to next step.

6) Turn ignition off. Disconnect ignition coil connector. Turn ignition on. Using DVOM, check voltage between ignition coil connector terminals No. 1 and 3 on 2.0L or No. 1 and 5 on 2.8L. Voltage should be 11.5 volts. If voltage is as specified, go to step 8). If voltage is not as specified, go to next step.

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7) Check resistance between ignition coil connector terminal No. 1 and test box socket No. 1. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit in ground wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16). If resistance is as specified, locate and repair open circuit in positive wire to ignition coil. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

8) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

9) Check resistance between ignition coil connector terminal No. 2 and test box socket No. 8. Resistance should be less than 1.5 ohms. If resistance is as specified on 2.0L, go to step 11). If resistance is as specified on 2.8L, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

10) Check resistance between ignition coil connector terminal No. 3 and test box socket No. 60, and ignition coil connector terminal No. 4 and test box socket No. 52. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between ignition coil connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

11) On all models, check resistance of ignition coil connector terminals to each other. On 2.0L, check between connector terminals No. 1 and 2, and No. 3 and 4. On 2.8L, check between connector terminals No. 2 and 3, and No. 3 and 4. On all models, resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, repair connectors shorted to each other. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

12) Remove fuse No. 18. Check resistance between fuse No. 18 connector lower terminal and test box socket No. 4. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, replace cylinder No. 6 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

13) Disconnect cylinder No. 6 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder No. 6 fuel injector connector terminal No. 1 and test box socket No. 1, and cylinder No. 6 fuel injector connector terminal No. 2 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between cylinder

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No. 6 fuel injector connector and ECM, and go to next step.

14) Check resistance between cylinder No. 6 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal, and cylinder No. 6 connector terminal No. 2 and test box socket No. 4. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between No. 1 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 16).

15) Replace cylinder No. 6 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

16) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P0327/16711 - KNOCK SENSOR NO. 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR)**

**NOTE:** DTC is set if Knock Sensor No. 1 (KS1) test signal is too low or not recognized by Electronic Control Module (ECM).

1) Inspect KS1 connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Inspect KS1 for loose mounting to engine. Using Insert (3247), torque KS1 to 15 ft. lbs. (20 N.m) if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If KS1 mounting is okay, go to next step.

3) Turn ignition off. Disconnect KS1 connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Using DVOM, check resistance between KS1 connector terminal No. 1 and test box socket No. 56, and KS1 connector terminal No. 2 and test box socket No. 56. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between KS1 connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Using DVOM, check resistance between KS1 connector terminal No. 1 and test box socket No. 34, KS1 connector terminal No. 2 and test box socket No. 33, and KS1 connector terminal No. 3 and test box socket No. 56. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between KS1 connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC

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resets, go to next step.

6) Replace KS1. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

7) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P0332/16716 - KS2 CIRCUIT LOW INPUT (BANK 2)**

**NOTE:** DTC is set if Knock Sensor No. 2 (KS2) test signal is too low or not recognized by Electronic Control Module (ECM).

1) Inspect KS2 connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Inspect KS2 for loose mounting to engine. Using Insert (3247), torque KS2 to 15 ft. lbs. (20 N.m) if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If KS2 mounting is okay, go to next step.

3) Turn ignition off. Disconnect KS2 connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Using DVOM, check resistance between KS2 connector terminal No. 1 and test box socket No. 56, and KS2 connector terminal No. 2 and test box socket No. 56. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between KS2 connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Using DVOM, check resistance between KS2 connector terminal No. 1 and test box socket No. 57, KS2 connector terminal No. 2 and test box socket No. 33, and KS2 connector terminal No. 3 and test box socket No. 56. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between KS2 connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Replace KS2. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

7) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P0341/16725 - CAMSHAFT POSITION SENSOR CIRCUIT RANGE/PERFORMANCE**

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**NOTE:** DTC is set when Camshaft Position (CMP) sensor sends and invalid signal to Electronic Control Module (ECM).

1) Inspect CMP sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Disconnect sensor connector. Turn ignition on. Using DVOM, check voltage between sensor connector terminals No. 1 and 3. Voltage should be at least 11.5 volts. If voltage is as specified, go to step 6). If voltage is not as specified, go to next step.

3) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Check resistance between CMP sensor connector terminal No. 1 on 2.0L or No. 3 on 2.8L and test box socket No. 56. Resistance should be less than 1.5 ohms. If resistance is as specified, locate and repair open circuit between sensor connector positive terminal and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If resistance is not as specified, go to next step.

5) Locate and repair open circuit between sensor connector ground terminal and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 9).

6) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

7) Turn ignition off. Check resistance between CMP sensor connector terminal No. 2 on and test box socket No. 44. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between CMP sensor connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets on 2.0L, go to step 9). If DTC resets on 2.8L go to next step.

8) Inspect and repair sensor wheel on camshaft chain sprocket. Check ignition timing. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

9) Replace CMP sensor. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

10) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

DTC P0411/16795 - SECONDARY AIR INJECTION SYSTEM INCORRECT  
FLOW DETECTED

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**NOTE:** DTC sets if Electronic Control Module (ECM) senses Secondary Air Injection (SAI) pump functioning, but quantity of air is recognized as insufficient by Heated Oxygen Sensor (H02S).

1) Turn ignition off. Disconnect SAI solenoid valve connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Using DVOM, check resistance between solenoid valve connector terminal No. 1 and test box socket No. 50. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between solenoid valve connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 10).

3) Reconnect solenoid valve connector. Disconnect a vacuum hose from solenoid valve and connect an auxiliary hose. Turn ignition on. Jumper test box sockets No. 1 and 6. Briefly jumper test box socket No. 50 to ground while blowing into auxiliary hose. Go to next step.

4) Solenoid valve must open while activated and close when deactivated. If solenoid valve does not operate as specified, replace solenoid valve. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 10). If solenoid valve operates as specified, go to next step.

5) Remove SAI pump pressure hose at engine. Check pressure hose for damage, replace if necessary. If hose is replaced, erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 10). If hose is not replaced, go to next step.

6) Turn ignition on. Jumper test box sockets No. 1 and 6. Briefly jumper test box socket No. 49 to ground to activate SAI pump and go to next step.

7) While SAI pump is activated, check for air pressure at pump. If pump runs but no air pressure is present, replace pump. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 10). If air pressure is present, go to next step.

8) Check whether solenoid valve-to-combination valve vacuum hose is damaged or disconnected. If hose is okay, go to next step. Repair vacuum hose if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 10).

9) Connect hand-held vacuum pump to vacuum hose at combination valve. Start engine and let it idle. Operate hand-held vacuum pump several times. Combination valve must open and a noise change must be distinctly audible. If valve does not operate as specified, go to next step. If valve operates as specified, go to step 11).

10) Replace faulty combination valve. Erase DTC memory and

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test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

11) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0422/16806 - MAIN CATALYST EFFICIENCY BELOW THRESHOLD (BANK 1)

NOTE: ECM uses Heated Oxygen Sensor (H02S) in front of, and behind 3-way catalyst to determine deterioration of 3-way catalyst using oxygen storage capability of catalyst.

1) If any H02S DTCs are set in memory, perform testing for H02S DTCs first. If after repairing H02S DTCs and CLEARING DTCS, if this DTC returns, go to next step. If no H02S DTCs are set in memory, go to next step.

2) Possible cause for DTC may be catalyst is chemically or thermally aged or mechanically damaged. Replace 3-way catalyst. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0440/16824 - EVAP SYSTEM MALFUNCTION

NOTE: ECM sets DTC if it senses an Evaporative (EVAP) canister purge regulator valve malfunction.

1) Turn ignition off. Disconnect EVAP canister purge regulator valve connector. Disconnect ECM connector. Using a DVOM, check resistance between EVAP canister purge regulator valve connector terminals No. 1 and 2. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between EVAP canister purge regulator valve connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

2) Replace EVAP canister purge valve. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

3) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0501/16885 - VEHICLE SPEED SENSOR RANGE/PERFORMANCE

NOTE: DTC is set if Electronic Control Module (ECM) does not receive a usable Vehicle Speed Sensor (VSS) signal.

1) Inspect VSS and VSS connector for looseness and/or corrosion. Repair VSS or connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC

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memory and verify DTC does not reset. If DTC resets, go to next step. If VSS or connector is okay, go to next step.

2) Disconnect VSS connector. Turn ignition on. Using DVOM, check voltage between VSS connector terminals No. 1 and 3. Voltage should be at least 11.5 volts. If voltage is as specified, go to step 5). If voltage is not as specified, go to next step.

3) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Check resistance between VSS connector terminal No. 3 and test box socket No. 1. Resistance should be less than 1.5 ohms. If resistance is as specified, locate and repair open circuit between VSS connector positive terminal and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If resistance is not as specified, locate and repair open circuit between VSS connector ground terminal and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 8).

5) Turn ignition off. Connect VSS connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

6) Turn ignition on. Raise and support vehicle so left front wheel is free to rotate. Right front wheel must not rotate. Check voltage between test box sockets No. 56 and 65. Rotate left front wheel by hand. Voltage should fluctuate from zero to 10 volts. If voltage is as specified, go to step 8). If voltage is not as specified, go to next step.

7) Turn ignition off. Disconnect VSS connector. Check resistance between VSS connector terminal No. 3 and ground, VSS connector terminal No. 1 and fuse No. 15, and VSS connector terminal No. 2 and instrument cluster connector. Resistance should be less than 1.5 ohms. If resistance is not as specified, repair open circuit or circuit shorted to each other. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

8) Replace faulty VSS. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

9) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P0510/16894 - CLOSED THROTTLE POSITION SWITCH MALFUNCTION**

**NOTE:** DTC sets if Electronic Control Module (ECM) receives an unusable signal from Closed Throttle Position (CTP) switch.

1) Inspect TP sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. If sensor connector is okay, go to next step. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does

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not reset. If DTC resets, go to next step.

2) Turn ignition off. Disconnect Throttle Valve Control Module (TVCM) connector. Turn ignition on. Using DVOM, check voltage between TVCM connector terminals No. 4 and 7. Voltage should be about 5 volts. Check voltage between TVCM connector terminals No. 3 and 7. Voltage should be about 10 volts. If voltage is as specified, go to step 6). If voltage is not as specified, go to next step.

3) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Check resistance between TVCM connector terminal No. 3 and test box socket No. 10, between TVCM connector terminal No. 4 and test box socket No. 41, and between TVCM connector terminal No. 7 and test box socket No. 33. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

5) Check for an open circuit in harness between TVCM and ECM. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. If no open circuit is present, replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Turn ignition off. Reconnect TVCM connector. With accelerator at Wide Open Throttle (WOT) and at closed throttle, check resistance between test box sockets No. 10 and 33. Resistance should be infinite (no continuity) at WOT and 10 ohms maximum at closed throttle. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

7) With accelerator pedal at closed throttle, check resistance between test box sockets No. 27 and 53. If resistance is 3-200 ohms, go to step 9). If resistance is not as specified, go to next step.

8) Disconnect TVCM connector. Check resistance between TVCM connector terminal No. 1 and test box socket No. 27, TVCM connector terminal No. 2 and test box socket No. 53, TVCM terminal connector No. 5 and test box socket No. 40, and TVCM connector terminal No. 8 and test box socket No. 62. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit between TVCM and ECM. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If resistance is as specified, go to next step.

9) Check resistance between test box sockets No. 10, 27, 33, 40, 41, 53, and 69. Resistance should be infinite (no continuity) between each circuit. If resistance is not as specified, repair circuits shorted to each other. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If no shorts are present, go to next step.

10) Substitute a known-good TVCM. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

11) Replace faulty ECM. Test drive vehicle. Recheck DTC

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memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P0605/16989 - ECM READ ONLY MEMORY (ROM) ERROR

NOTE: DTC is set when Electronic Control Module (ECM) recognizes internal failures.

- 1) Inspect ECM connector for looseness and/or corrosion. Repair ECM connector as necessary. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If ECM connector is okay, go to next step.
- 2) Start and run engine for about 3 minutes. Turn ignition off and on. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.
- 3) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P1127/17535 - LONG TERM FUEL TRIM TOO RICH

NOTE: DTC sets if fuel mixture is so rich that Heated Oxygen Sensor (H02S) control is on lean limit.

- 1) If no H02S DTCs are set in memory, go to next step. If any H02S DTCs are set in memory, perform testing for H02S DTCs first. If H02S circuits are operating properly, go to next step.
- 2) Check Mass Airflow (MAF) sensor circuit for signal too high. See DTC P0103/16487. If MAF sensor circuit is operating properly, go to next step.
- 3) Check Secondary Air Injection (SAI) system. See DTC P0411/16795. If SAI system is operating properly, go to next step.
- 4) Check fuel delivery system. See FUEL PRESSURE and TRANSFER PUMP CHECK under FUEL SYSTEM in DTC P0172/16556 - SYSTEM TOO RICH (BANK 1)

NOTE: DTC is set when mixture is so rich that Heated Oxygen Sensor (H02S) control cannot lean mixture further.

- 1) Check whether crankcase dilution has caused engine to run rich. Change engine oil if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If engine oil is okay, go to next step.
- 2) Start engine and let it idle. Inspect exhaust system for leaks between 3-way catalyst and cylinder head. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If no exhaust leak is found, go to next step.
- 3) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness.

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Terminal assignments of test box are identical to ECM connector's.

4) Using a DVOM, check resistance between test box sockets No. 20 and 42. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between pre-catalyst H02S connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Check pre-catalyst H02S circuit. See DTC P0134/1658. Repair pre-catalyst H02S circuit as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If H02S circuit is okay, go to next step.

6) Turn ignition off. Check fuel delivery system. See FUEL PRESSURE and TRANSFER PUMP CHECK under FUEL SYSTEM in appropriate F - BASIC TESTING - GASOLINE article. If fuel delivery system is okay, go to next step.

5) Check fuel injectors. See 2.0L or 2.8L under FUEL INJECTORS & CIRCUIT under FUEL SYSTEM in I - SYSTEM/COMPONENT TESTS article. If fuel injectors and circuit are operating properly, go to next step.

6) Inspect fuel injectors for poor Electronic Connection or dirty/clogged injectors. If injectors and connections are okay, go to next step. If a malfunction was repaired, erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

7) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P1128/17536 - LONG TERM FUEL TRIM TOO LEAN

NOTE: DTC sets if fuel mixture is so lean than Heated Oxygen Sensor (H02S) control is on rich limit.

1) Test drive vehicle for performance problems. If problem occurs only at full acceleration, replace fuel filter. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If other performance problem(s) exist, go to next step.

2) If engine output is impaired at lower throttle openings or vehicle jerks at lower throttle openings, turn engine off. See 2.0L or 2.8L under FUEL INJECTORS & CIRCUIT under FUEL SYSTEM in appropriate I - SYSTEM/COMPONENT TESTS article. If fuel injectors and circuit are operating properly, go to next step.

3) Inspect fuel injectors for poor Electronic Connection or dirty/clogged injectors. If injectors and connections are okay, go to next step. If a malfunction was repaired, erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing

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procedure.

#### **DTC P1213/17621 - CYLINDER NO. 1 FUEL INJECTOR CIRCUIT SHORT TO B+**

**NOTE:** DTC is set when cylinder No. 1 fuel injector or wiring to fuel injector is shorted to battery voltage.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Disconnect fuel injector connector. Using a DVOM, check resistance between fuel injector connector terminal No. 2 and fuse No. 18 connector lower terminal. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between fuel injector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 4).

3) Check resistance between fuel injector connector terminals No. 1 and 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1214/17622 - CYLINDER NO. 2 FUEL INJECTOR CIRCUIT SHORT TO B+**

**NOTE:** DTC is set when cylinder No. 2 fuel injector or wiring to fuel injector is shorted to battery voltage.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Disconnect fuel injector connector. Using a DVOM, check resistance between fuel injector connector terminal No. 2 and fuse No. 18 connector lower terminal. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between fuel injector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 4).

3) Check resistance between fuel injector connector terminals No. 1 and 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

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4) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1215/17623 - CYLINDER NO. 3 FUEL INJECTOR CIRCUIT SHORT TO B+**

**NOTE:** DTC is set when cylinder No. 3 fuel injector or wiring to fuel injector is shorted to battery voltage.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Disconnect fuel injector connector. Using a DVOM, check resistance between fuel injector connector terminal No. 2 and fuse No. 18 connector lower terminal. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between fuel injector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 4).

3) Check resistance between fuel injector connector terminals No. 1 and 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1216/17624 - CYLINDER NO. 4 FUEL INJECTOR CIRCUIT SHORT TO B+**

**NOTE:** DTC is set when cylinder No. 4 fuel injector or wiring to fuel injector is shorted to battery voltage.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Disconnect fuel injector connector. Using a DVOM, check resistance between fuel injector connector terminal No. 2 and fuse No. 18 connector lower terminal. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between fuel injector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 4).

3) Check resistance between fuel injector connector terminals No. 1 and 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace fuel injector. Erase DTC memory and test drive vehicle. See CLEARING

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DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1217/17625 - CYLINDER NO. 5 FUEL INJECTOR CIRCUIT SHORT TO B+**

**NOTE:** DTC is set when cylinder No. 5 fuel injector or wiring to fuel injector is shorted to battery voltage.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Disconnect fuel injector connector. Using a DVOM, check resistance between fuel injector connector terminal No. 2 and fuse No. 18 connector lower terminal. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between fuel injector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 4).

3) Check resistance between fuel injector connector terminals No. 1 and 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1218/17626 - CYLINDER NO. 6 FUEL INJECTOR CIRCUIT SHORT TO B+**

**NOTE:** DTC is set when cylinder No. 6 fuel injector or wiring to fuel injector is shorted to battery voltage.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Disconnect fuel injector connector. Using a DVOM, check resistance between fuel injector connector terminal No. 2 and fuse No. 18 connector lower terminal. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between fuel injector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 4).

3) Check resistance between fuel injector connector terminals No. 1 and 2. Resistance should be 15-23 ohms. If resistance is as

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specified, go to next step. If resistance is not as specified, replace fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1225/17633 - CYLINDER NO. 1 FUEL INJECTOR CIRCUIT SHORT TO GROUND**

**NOTE:** DTC is set when cylinder No. 1 fuel injector or wiring to fuel injector is shorted to ground.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between test box socket No. 24 and fuse No. 18 connector lower terminal. Resistance should be 15-23 ohms. If resistance is as specified, go to step 4). If resistance is not as specified, go to next step.

3) Disconnect cylinder No. 1 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder No. 1 fuel injector connector terminal No. 1 and test box socket No. 1, and cylinder No. 1 fuel injector connector terminal No. 2 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between cylinder No. 1 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Disconnect cylinder No. 1 fuel injector connector. Check resistance between cylinder No. 1 fuel injector connector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace faulty cylinder No. 1 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1226/17634 - CYLINDER NO. 2 FUEL INJECTOR CIRCUIT SHORT TO GROUND**

**NOTE:** DTC is set when cylinder No. 2 fuel injector or wiring to fuel injector is shorted to ground.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between

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test box socket No. 25 and fuse No. 18 connector lower terminal. Resistance should be 15-23 ohms. If resistance is as specified, go to step 4). If resistance is not as specified, go to next step.

3) Disconnect cylinder No. 2 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder No. 2 fuel injector connector terminal No. 1 and test box socket No. 1, and cylinder No. 2 fuel injector connector terminal No. 2 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between cylinder No. 2 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Disconnect cylinder No. 2 fuel injector connector. Check resistance between cylinder No. 2 fuel injector connector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace faulty cylinder No. 2 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P1227/17635 - CYLINDER NO. 3 FUEL INJECTOR CIRCUIT SHORT TO GROUND

NOTE: DTC is set when cylinder No. 3 fuel injector or wiring to fuel injector is shorted to ground.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between test box socket No. 26 and fuse No. 18 connector lower terminal. Resistance should be 15-23 ohms. If resistance is as specified, go to step 4). If resistance is not as specified, go to next step.

3) Disconnect cylinder No. 3 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder No. 3 fuel injector connector terminal No. 1 and test box socket No. 1, and cylinder No. 3 fuel injector connector terminal No. 2 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between cylinder No. 3 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Disconnect cylinder No. 3 fuel injector connector. Check resistance between cylinder No. 3 fuel injector connector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace faulty cylinder No. 3 fuel injector. Erase DTC memory and test drive

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vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step

5) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1228/17636 - CYLINDER NO. 4 FUEL INJECTOR CIRCUIT SHORT TO GROUND**

**NOTE:** DTC is set when cylinder No. 4 fuel injector or wiring to fuel injector is shorted to ground.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between test box socket No. 2 and fuse No. 18 connector lower terminal. Resistance should be 15-23 ohms. If resistance is as specified, go to step 4). If resistance is not as specified, go to next step.

3) Disconnect cylinder No. 4 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder No. 4 fuel injector connector terminal No. 1 and test box socket No. 1, and cylinder No. 4 fuel injector connector terminal No. 2 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between cylinder No. 4 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Disconnect cylinder No. 4 fuel injector connector. Check resistance between cylinder No. 4 fuel injector connector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace faulty cylinder No. 4 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step

5) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1229/17637 - CYLINDER NO. 5 FUEL INJECTOR CIRCUIT SHORT TO GROUND**

**NOTE:** DTC is set when cylinder No. 5 fuel injector or wiring to fuel injector is shorted to ground.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between test box socket No. 2 and fuse No. 18 connector lower terminal. Resistance should be 15-23 ohms. If resistance is as specified, go to

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step 4). If resistance is not as specified, go to next step.

3) Disconnect cylinder No. 5 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder No. 5 fuel injector connector terminal No. 1 and test box socket No. 1, and cylinder No. 5 fuel injector connector terminal No. 2 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between cylinder No. 5 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Disconnect cylinder No. 5 fuel injector connector. Check resistance between cylinder No. 5 fuel injector connector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace faulty cylinder No. 5 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P1230/17638 - CYLINDER NO. 6 FUEL INJECTOR CIRCUIT SHORT TO GROUND

NOTE: DTC is set when cylinder No. 6 fuel injector or wiring to fuel injector is shorted to ground.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between test box socket No. 2 and fuse No. 18 connector lower terminal. Resistance should be 15-23 ohms. If resistance is as specified, go to step 4). If resistance is not as specified, go to next step.

3) Disconnect cylinder No. 6 fuel injector connector and Mass Airflow (MAF) sensor connector. Check resistance between cylinder No. 6 fuel injector connector terminal No. 1 and test box socket No. 1, and cylinder No. 6 fuel injector connector terminal No. 2 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between cylinder No. 6 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Disconnect cylinder No. 6 fuel injector connector. Check resistance between cylinder No. 6 fuel injector connector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace faulty cylinder No. 6 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

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5) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1237/17645 - CYLINDER NO. 1 FUEL INJECTOR CIRCUIT OPEN CIRCUIT**

**NOTE:** DTC is set when cylinder No. 1 fuel injector or wiring to fuel injector has an open circuit.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between fuse No. 18 connector lower terminal and test box socket No. 24. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, go to step 4).

3) Disconnect cylinder No. 1 fuel injector connector. Check resistance between cylinder No. 1 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between cylinder No. 1 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Check resistance between cylinder No. 1 fuel injector connector terminal No. 2 and test box socket No. 24. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit in activation wire between cylinder No. 1 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step. 6).

5) Check resistance between cylinder No. 1 fuel injector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace faulty cylinder No. 6 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step

6) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1238/17646 - CYLINDER NO. 2 FUEL INJECTOR CIRCUIT OPEN CIRCUIT**

**NOTE:** DTC is set when cylinder No. 2 fuel injector or wiring to fuel injector has an open circuit.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness.

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Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between fuse No. 18 connector lower terminal and test box socket No. 25. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, go to step 4).

3) Disconnect cylinder No. 2 fuel injector connector. Check resistance between cylinder No. 2 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between cylinder No. 2 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Check resistance between cylinder No. 2 fuel injector connector terminal No. 2 and test box socket No. 25. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit in activation wire between cylinder No. 2 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 6).

5) Check resistance between cylinder No. 2 fuel injector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace faulty cylinder No. 6 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step

6) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1239/17647 - CYLINDER NO. 3 FUEL INJECTOR CIRCUIT OPEN CIRCUIT**

**NOTE:** DTC is set when cylinder No. 3 fuel injector or wiring to fuel injector has an open circuit.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between fuse No. 18 connector lower terminal and test box socket No. 26. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, go to step 4).

3) Disconnect cylinder No. 3 fuel injector connector. Check resistance between cylinder No. 3 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between cylinder No. 3 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC

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memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Check resistance between cylinder No. 3 fuel injector connector terminal No. 2 and test box socket No. 26. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit in activation wire between cylinder No. 3 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step. 6).

5) Check resistance between cylinder No. 3 fuel injector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace faulty cylinder No. 6 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step

6) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P1240/17648 - CYLINDER NO. 4 FUEL INJECTOR CIRCUIT OPEN CIRCUIT

NOTE: DTC is set when cylinder No. 4 fuel injector or wiring to fuel injector has an open circuit.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between fuse No. 18 connector lower terminal and test box socket No. 2. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, go to step 4).

3) Disconnect cylinder No. 4 fuel injector connector. Check resistance between cylinder No. 4 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between cylinder No. 4 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Check resistance between cylinder No. 4 fuel injector connector terminal No. 2 and test box socket No. 2. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit in activation wire between cylinder No. 4 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step. 6).

5) Check resistance between cylinder No. 4 fuel injector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as

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specified, replace faulty cylinder No. 6 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step

6) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1241/17649 - CYLINDER NO. 5 FUEL INJECTOR CIRCUIT OPEN CIRCUIT**

**NOTE:** DTC is set when cylinder No. 5 fuel injector or wiring to fuel injector has an open circuit.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between fuse No. 18 connector lower terminal and test box socket No. 3. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, go to step 4).

3) Disconnect cylinder No. 5 fuel injector connector. Check resistance between cylinder No. 5 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between cylinder No. 5 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Check resistance between cylinder No. 5 fuel injector connector terminal No. 2 and test box socket No. 3. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit in activation wire between cylinder No. 5 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step. 6).

5) Check resistance between cylinder No. 5 fuel injector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace faulty cylinder No. 6 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step

6) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1242/17650 - CYLINDER NO. 6 FUEL INJECTOR CIRCUIT OPEN CIRCUIT**

**NOTE:** DTC is set when cylinder No. 6 fuel injector or wiring to

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fuel injector has an open circuit.

1) Turn ignition off. Disconnect Electronic Control Module (ECM) connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Remove fuse No. 18. Using a DVOM, check resistance between fuse No. 18 connector lower terminal and test box socket No. 4. Resistance should be 15-23 ohms. If resistance is not as specified, go to next step. If resistance is as specified, go to step 4).

3) Disconnect cylinder No. 6 fuel injector connector. Check resistance between cylinder No. 6 fuel injector connector terminal No. 1 and fuse No. 18 connector lower terminal. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between cylinder No. 6 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Check resistance between cylinder No. 6 fuel injector connector terminal No. 2 and test box socket No. 4. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit in activation wire between cylinder No. 6 fuel injector connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step. 6).

5) Check resistance between cylinder No. 6 fuel injector terminals No. 1 and No. 2. Resistance should be 15-23 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace faulty cylinder No. 6 fuel injector. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step

6) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1340/17748 - CAMSHAFT/CRANKSHAFT POSITION SENSOR SIGNALS OUT OF SEQUENCE**

**NOTE:** DTC is set when Engine Speed (RPM) sensor supplies invalid signals to Electronic Control Module (ECM).

1) Inspect RPM sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect ECM connector. Connect Test Box VAG 1598/19 to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

3) Using DVOM, check resistance between test box sockets No. 67 and 68. Resistance should be 500-700 ohms. If resistance is as

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specified, go to next step. If resistance is not as specified, replace RPM sensor. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 7).

4) Disconnect RPM sensor connector. Check resistance between RPM sensor connector terminal No. 1 and test box socket No. 56, and RPM sensor connector terminal No. 2 and test box socket No. 56. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between RPM sensor connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 7).

5) Check resistance between RPM sensor connector terminal No. 1 and test box socket No. 67, and RPM sensor connector terminal No. 2 and test box socket No. 68. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, locate and repair open circuit between RPM sensor connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 7).

6) Remove speed sensor and check for metal particle contamination. If speed sensor is okay, check crankshaft wheel for damage or contamination. If crankshaft wheel is okay, check condition of speed sensor connector. Repair if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, next step.

7) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P1410/17818 - FUEL TANK VENTILATION VALVE SHORT TO B+

NOTE: DTC is set when Electronic Control Module (ECM) senses and Evaporative (EVAP) canister purge regulator valve malfunction.

1) Turn ignition off. Disconnect ECM connector. Disconnect EVAP canister purge regulator valve connector. Go to next step.

2) Using DVOM, check resistance between EVAP canister purge regulator valve connector terminals No. 1 and 2. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between EVAP canister purge regulator valve connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

3) Replace EVAP canister purge regulator valve. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Replace faulty ECM. Test drive vehicle. Recheck DTC memory

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and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1420/17828 - SECONDARY AIR INJECTION CONTROL ELECTRICAL MALFUNCTION**

**NOTE:** DTC is set when Electronic Control Module (ECM) activates secondary air injection solenoid but Heated Oxygen Sensor (H02S) does not detect secondary air injection.

1) Inspect secondary air injection solenoid valve connector for looseness and/or corrosion. Repair solenoid valve connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If solenoid valve connector was not repaired, go to next step.

2) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

3) Using DVOM, check resistance between solenoid valve connector terminal No. 1 and test box socket No. 50. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 5). If resistance is not as specified, locate and repair open circuit between solenoid valve connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Turn ignition on. Jumper test box sockets No. 1 and 6. Jumper test box socket No. 50 to ground. Check voltage between solenoid valve connector terminals No. 1 and 2. Voltage should be at least 11.5 volts. If voltage is as specified, go to next step. If voltage is not as specified, locate and repair open circuit between solenoid valve connector terminal No. 2 and fuse No. 18 connector lower terminal. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 6).

5) Check resistance between solenoid valve terminals No. 1 and 2. Resistance should be 40-80 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace solenoid valve. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1421/17829 - SECONDARY AIR INJECTION SOLENOID VALVE CIRCUIT SHORT TO GROUND**

**NOTE:** DTC is set if Electronic Control Module (ECM) detects a short circuit to ground when it activates secondary air injection solenoid valve.

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1) Turn ignition off. Disconnect secondary air injection solenoid valve connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Using DVOM, check resistance between solenoid valve connector terminal No. 1 and test box socket No. 50. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 4). If resistance is not as specified, go to next step.

3) Check resistance between solenoid valve connector terminal No. 1 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between solenoid valve connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Check resistance between solenoid valve terminals No. 1 and 2. Resistance should be 20-50 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace solenoid valve. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1422/17830 - SECONDARY AIR INJECTION SOLENOID VALVE CIRCUIT SHORT TO B+**

**NOTE:** DTC is set if Electronic Control Module (ECM) detects a short circuit to battery voltage when it activates secondary air injection solenoid valve.

1) Turn ignition off. Disconnect secondary air injection solenoid valve connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Using DVOM, check resistance between solenoid valve connector terminal No. 1 and test box socket No. 50. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 4). If resistance is not as specified, go to next step.

3) Remove fuse No. 18. Check resistance between fuse No. 18 connector lower terminal and test box socket No. 50. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to battery voltage between solenoid valve connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Check resistance between solenoid valve terminals No. 1 and 2. Resistance should be 20-50 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace solenoid valve. Erase DTC memory and test drive vehicle. See CLEARING DTCS in

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this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1425/17833 - TANK VENTILATION VALVE SHORT TO GROUND**

**NOTE:** ECM sets DTC if it senses an Evaporative (EVAP) canister purge regulator valve or circuit short to ground.

1) Turn ignition off. Disconnect EVAP canister purge regulator valve connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Using DVOM, check resistance between regulator valve connector terminal No. 1 and test box socket No. 1. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 5). If resistance is not as specified, go to next step.

3) Remove fuse No. 18. Check resistance between fuse No. 18 connector upper terminal and regulator valve connector terminal No. 2. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 5). If resistance is not as specified, locate and repair open circuit between regulator valve connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Check resistance between regulator valve connector terminal No. 1 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit between regulator valve connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Check resistance between regulator valve terminals No. 1 and 2. Resistance should be 20-50 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace regulator. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1426/17834 - TANK VENTILATION VALVE CIRCUIT OPEN**

**NOTE:** ECM sets DTC if it senses an Evaporative (EVAP) canister purge regulator valve or circuit open.

1) Turn ignition off. Disconnect EVAP canister purge regulator valve connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box

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are identical to ECM connector's.

2) Jumper test box sockets No. 1 and 6. Turn ignition on. Using DVOM, check voltage between regulator valve connector terminal No. 2 and ground. Voltage should be at least 11.5 volts. If voltage is as specified, go to step 6). If voltage is not as specified, go to next step.

3) Turn ignition off. Check resistance between regulator valve connector terminal No. 1 and test box socket No. 31. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 6). If resistance is not as specified, go to next step.

4) Remove fuse No. 18. Check resistance between regulator valve connector terminal No. 2 and fuse No. 18 connector upper terminal. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 6). If resistance is not as specified, locate and repair open circuit between regulator valve connector and ECM. Go to next step.

5) Check resistance between regulator valve connector terminal No. 1 and test box socket No. 1. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between regulator valve connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Check resistance between regulator valve terminals No. 1 and 2. Resistance should be 20-50 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace regulator. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

7) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1450/17858 - SECONDARY AIR INJECTION SOLENOID VALVE CIRCUIT SHORT TO B+**

**NOTE:** DTC is set if Electronic Control Module (ECM) detects a short circuit to battery voltage when it activates Secondary Air Injection (SAI) pump relay.

1) Turn ignition off. Remove SAI pump relay. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Using DVOM, check resistance between test box socket No. 49 and relay connector terminal No. 6. Check resistance between test box socket No. 49 and positive battery terminal. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to battery voltage between relay connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to

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step 4).

3) Replace relay. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1451/17859 - SECONDARY AIR INJECTION SOLENOID VALVE CIRCUIT SHORT TO GROUND**

**NOTE:** DTC is set if Electronic Control Module (ECM) detects a short circuit to ground when it activates Secondary Air Injection (SAI) pump relay.

1) Turn ignition off. Remove SAI pump relay. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Using DVOM, check resistance between test box sockets No. 1 and 49. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between relay connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 4).

3) Replace relay. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1452/17860 - SECONDARY AIR INJECTION SOLENOID VALVE OPEN CIRCUIT**

**NOTE:** DTC is set if Electronic Control Module (ECM) activates Secondary Air Injection (SAI) pump relay and SAI pump motor does not run.

1) Turn ignition off. Remove SAI pump relay. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Using DVOM, check resistance between test box socket No. 49 and relay connector terminal No. 4. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 4). If resistance is not as specified, go to next step.

3) Remove fuse No. 18. Check resistance between relay connector terminal No. 6 and fuse No. 18 connector lower terminal. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next. If resistance is not as specified, locate and repair open circuit between relay connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC

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memory and verify DTC does not reset. If DTC resets, go to step 5).

4) Check 30-amp fuse in fuse box, next to SAI pump relay, and replace if necessary. If fuse is okay, locate and repair open circuit between fuse and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

5) Disconnect SAI pump motor connector. Check resistance between relay connector terminal No. 8 and motor connector terminal No. 2. Check resistance between motor connector terminal No. 1 and test box socket No. 1. Resistance should be less than 1.5 ohms. If resistance is as specified, go to next step. If resistance is not as specified, replace relay. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

6) Replace SAI pump motor. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

7) Replace faulty ECM. Test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1500/17908 - FUEL PUMP RELAY CIRCUIT ELECTRICAL MALFUNCTION**

**NOTE:** DTC is set when Electronic Control Module (ECM) detects an electrical malfunction in fuel pump relay.

1) Turn ignition off. Ensure fuel delivery unit is firmly attached. Remove and inspect fuse No. 18. If fuse is okay, go to next step. If fuse is open, locate and repair short circuit between ECM and transfer fuel pump, pre-catalyst or post-catalyst heated oxygen sensor heater. Replace fuse. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 6).

2) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

3) Jumper test box sockets No. 1 and 6. Transfer fuel pump must run audibly. If fuel pump runs, go to step 6). If fuel pump does not run, go to next step.

4) Remove fuel pump relay. Check resistance between test box socket No. 6 and fuel pump relay connector terminal No. 3. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 6). If resistance is not as specified, locate and repair open circuit between relay connector and ECM. Go to next step.

5) Check resistance between test box sockets No. 1 and 6. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between fuel pump relay connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

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6) Separate central connector, located near intake air temperature sensor. See Fig. 1 in I - SYSTEM/COMPONENT TESTS article. Remove secondary air injection pump relay. Disconnect Mass Airflow (MAF) sensor, Evaporative (EVAP) emission canister purge regulator valve and Secondary Air Injection (SAI) solenoid valve connectors. Remove fuse No. 18. Go to next step.

7) Check resistance between fuse No. 18 connector lower terminal and ground. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short to ground between fuse No. 18 and EVAP emission canister purge regulator and/or SAI solenoid valve. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 10).

8) Reconnect center connector. Check resistance between fuse No. 18 connector lower terminal and ground. Resistance should be infinite (no continuity). If resistance is as specified, go to step 10). If resistance is not as specified, locate and repair short to ground between fuse No. 18 and fuel injectors. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 10).

9) Replace fuel pump relay. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

10) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### DTC P1502/17910 - FUEL PUMP RELAY CIRCUIT SHORT TO B+

**NOTE:** DTC is set when Electronic Control Module (ECM) detects a short circuit to battery voltage on activation wire from fuel pump relay.

1) Turn ignition off. Disconnect fuel pump relay connector. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Check resistance between test box socket No. 6 and fuel pump relay connector terminal No. 3. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 4). If resistance is not as specified, locate and repair open circuit between relay connector and ECM. Go to next step.

3) Check resistance between test box sockets No. 1 and 6. Resistance should be infinite (no continuity). If resistance is as specified, go to next step. If resistance is not as specified, locate and repair short circuit to ground between fuel pump relay connector and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Replace fuel pump relay. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and

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verify DTC does not reset. If DTC resets, go to next step.

5) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1543/17951 - THROTTLE ACTUATION POTENTIOMETER SIGNAL TOO LOW**

**NOTE:** DTC sets if Throttle Position (TP) sensor supplies too low a signal to Electronic Control Module (ECM).

1) Inspect Throttle Position (TP) sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect Throttle Valve Control Module (TVCM) connector. Turn ignition on. Using DVOM, check voltage between TVCM connector terminals No. 4 and 7. Voltage should be about 5 volts. Check voltage between TVCM connector terminals No. 3 and 7. Voltage should be about 10 volts. If voltage is as specified, go to step 6). If voltage is not as specified, go to next step.

3) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Check resistance between TVCM connector terminal No. 3 and test box socket No. 10, between TVCM connector terminal No. 4 and test box socket No. 41, and between TVCM connector terminal No. 7 and test box socket No. 33. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

5) Check for an open circuit between TVCM and ECM. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If no open circuit is present, go to next step.

6) Turn ignition off. Reconnect TVCM connector. With accelerator at Wide Open Throttle (WOT) and at closed throttle, check resistance between test box sockets No. 10 and 33. Resistance should be infinite (no continuity) at WOT and 10 ohms maximum at closed throttle. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

7) With accelerator pedal at closed throttle, check resistance between test box sockets No. 27 and 53. If resistance is 3-200 ohms, go to step 9). If resistance is not as specified, go to next step.

8) Disconnect TVCM connector. Check resistance between TVCM connector terminal No. 1 and test box socket No. 27, TVCM connector terminal No. 2 and test box socket No. 53, TVCM terminal connector No. 5 and test box socket No. 40, and TVCM connector terminal No. 8 and test box socket No. 62. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit between

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TVCM and ECM Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If resistance is as specified, go to next step.

9) Check resistance between test box sockets No. 10, 27, 33, 40, 41, 53, and 69. Resistance should be infinite (no continuity) between each circuit. If resistance is not as specified, repair circuits shorted to each other. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If no shorts are present, go to next step.

10) Substitute a known-good TVCM Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, see DTC P0102/16486, P0103/16487, P0117/16501 and P0118/16502.

11) Replace faulty ECM Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1544/17952 - THROTTLE ACTUATION POTENTIOMETER SIGNAL TOO HIGH**

**NOTE:** DTC sets if Throttle Position (TP) sensor supplies too high a signal to Electronic Control Module (ECM).

1) Inspect Throttle Position (TP) sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect Throttle Valve Control Module (TVCM) connector. Turn ignition on. Using DVOM, check voltage between TVCM connector terminals No. 4 and 7. Voltage should be about 5 volts. Check voltage between TVCM connector terminals No. 3 and 7. Voltage should be about 10 volts. If voltage is as specified, go to step 6). If voltage is not as specified, go to next step.

3) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

4) Check resistance between TVCM connector terminal No. 3 and test box socket No. 10, between TVCM connector terminal No. 4 and test box socket No. 41, and between TVCM connector terminal No. 7 and test box socket No. 33. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

5) Check for an open circuit between TVCM and ECM Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If no open circuit is present, go to next step.

6) Turn ignition off. Reconnect TVCM connector. With accelerator at Wide Open Throttle (WOT) and at closed throttle, check

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resistance between test box sockets No. 10 and 33. Resistance should be infinite (no continuity) at WOT and 10 ohms maximum at closed throttle. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

7) With accelerator pedal at closed throttle, check resistance between test box sockets No. 27 and 53. If resistance is 3-200 ohms, go to step 9). If resistance is not as specified, go to next step.

8) Disconnect TVCM connector. Check resistance between TVCM connector terminal No. 1 and test box socket No. 27, TVCM connector terminal No. 2 and test box socket No. 53, TVCM terminal connector No. 5 and test box socket No. 40, and TVCM connector terminal No. 8 and test box socket No. 62. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit between TVCM and ECM. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If resistance is as specified, go to next step.

9) Check resistance between test box sockets No. 10, 27, 33, 40, 41, 53, and 69. Resistance should be infinite (no continuity) between each circuit. If resistance is not as specified, repair circuits shorted to each other. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If no shorts are present, go to next step.

10) Substitute a known-good TVCM. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, see DTC P0102/16486, P0103/16487, P0117/16501 and P0118/16502.

11) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

#### **DTC P1580/17988 - THROTTLE ACTUATOR MALFUNCTION**

**NOTE:** DTC sets if Electronic Control Module (ECM) detects a faulty throttle position in Throttle Valve Control Module (TVCM) output.

1) Inspect Throttle Position (TP) sensor connector for looseness and/or corrosion. Repair sensor connector as necessary. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If sensor connector is okay, go to next step.

2) Turn ignition off. Disconnect TVCM connector. Turn ignition on. Using DVOM, check voltage between TVCM connector terminals No. 4 and 7. Voltage should be about 5 volts. Check voltage between TVCM connector terminals No. 3 and 7. Voltage should be about 10 volts. If voltage is as specified, go to step 6). If voltage is not as specified, go to next step.

3) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test

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box are identical to ECM connector's.

4) Check resistance between TVCM connector terminal No. 3 and test box socket No. 10, between TVCM connector terminal No. 4 and test box socket No. 41, and between TVCM connector terminal No. 7 and test box socket No. 33. Resistance should be less than 1.5 ohms. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

5) Check for an open circuit between TVCM and ECM. Repair as necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If no open circuit is present, go to next step.

6) Turn ignition off. Reconnect TVCM connector. With accelerator at Wide Open Throttle (WOT) and at closed throttle, check resistance between test box sockets No. 10 and 33. Resistance should be infinite (no continuity) at WOT and 10 ohms maximum at closed throttle. If resistance is as specified, go to step 9). If resistance is not as specified, go to next step.

7) With accelerator pedal at closed throttle, check resistance between test box sockets No. 27 and 53. If resistance is 3-200 ohms, go to step 9). If resistance is not as specified, go to next step.

8) Disconnect TVCM connector. Check resistance between TVCM connector terminal No. 1 and test box socket No. 27, TVCM connector terminal No. 2 and test box socket No. 53, TVCM terminal connector No. 5 and test box socket No. 40, and TVCM connector terminal No. 8 and test box socket No. 62. Resistance should be less than 1.5 ohms. If resistance is not as specified, locate and repair open circuit between TVCM and ECM. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If resistance is as specified, go to next step.

9) Check resistance between test box sockets No. 10, 27, 33, 40, 41, 53, and 69. Resistance should be infinite (no continuity) between each circuit. If resistance is not as specified, repair circuits shorted to each other. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to step 11). If no shorts are present, go to next step.

10) Substitute a known-good TVCM. Erase DTCs and perform test drive. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, see DTC P0102/16486, P0103/16487, P0117/16501 and P0118/16502.

11) Replace faulty ECM. Test drive vehicle. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

DTC P1613/18021 - MIL CALL-UP CIRCUIT OPEN OR SHORT TO B+

**NOTE:** DTC sets when Electronic Control Module (ECM) Malfunction Indicator Light (MIL) does not come on due to short circuit to battery voltage.

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1) Turn ignition off. Disconnect ECM connector. Connect Test Box (VAG 1598/18) to ECM wiring harness. Terminal assignments of test box are identical to ECM connector's.

2) Jumper test box sockets No. 1 and 3 on 2.0L or No. 1 and 5 on 2.8L. Turn ignition on. If MIL comes on, go to step 4). If MIL does not come on, turn ignition off and go to next step.

3) Check MIL bulb. Replace bulb if necessary. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step. If bulb is okay, locate and repair open or short circuit between MIL and ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, go to next step.

4) Replace faulty ECM. Erase DTC memory and test drive vehicle. See CLEARING DTCS in this article. Recheck DTC memory and verify DTC does not reset. If DTC resets, repeat testing procedure.

### **SUMMARY**

If no hard DTCs (only "sporadic" DTCs) are present, driveability symptoms exist or intermittent DTCs exist, proceed to appropriate H - TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

**END OF ARTICLE**