24 - MULTIPORT FUEL INJECTION

IGNITION SYSTEM, SERVICING

Ignition System, Servicing

The following table provides quick links.

--> **Safety Precautions**
--> **Clean Working Conditions**
--> **Technical Data**

For all Simos 6 fuel injection system component locations. Refer to **24 - FUEL INJECTION SYSTEM** .

For all Simos 6 fuel injection system removal/installation procedures and torque specifications. Refer to **24 - FUEL INJECTION SYSTEM** .

Check the Technical Bulletins for information that may supersede any information included in this article.

NOTE:

- **All manufacturers special tools as well as common tools may contain a manufacturer specific part number. These tools may be substituted with an equivalent aftermarket tool or are available for purchase through Audi.**
- **Manufacturers special tools as well as common tools that contain a manufacturer specific part number may be referenced in the test procedure illustrations showing the tool use or installation. If the manufacturer specific tool is not being used, an equivalent aftermarket tool may be installed in the same manner as the manufacturers special tool.**
- **The manufacturers test box Test Box 105 Pin VAG1598/42 is available for purchase or rental.**

Safety Precautions

Safety Precautions

CAUTION: Observe the following for all installations, especially in the engine compartment due to lack of room:

- **Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.**
- **Watch for sufficient clearance to all moving or hot components.**
- **Fuel system is under pressure! Before opening system, place rags around the connection point. Then release pressure by carefully**

loosening connection.

- **Test equipment must always be secured to the rear seat and operated by a second person.**
- **Test and measuring equipment that is operated from the passenger seat, the person seated could be injured in the event of an accident involving deployment of the passenger-side airbag.**
- **Do not touch or disconnect ignition wires when engine is running or turning at starting RPM.**
- **Only disconnect and reconnect wires for injection and ignition system, including test leads, if the ignition is turned off.**

CAUTION: The use of nails, paper clips, or another unauthorized materials to back-probe electrical harness connectors is strictly prohibited and may cause damage to the electrical harness connectors, terminal ends or damage to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all electrical harness connectors.

Clean Working Conditions

Clean Working Conditions

CAUTION: CAUTION! Whenever working on fuel supply and fuel injection systems, carefully observe the following six rules of cleanliness

NOTE:

- **Thoroughly clean fuel system line and hose connections and the surrounding area before disconnecting.**
- **Place removed components on a clean surface and cover. Use plastic sheeting or paper.**
- **Do not use fluffy rags that could leave lint!**
- **Carefully cover over or seal any components that have been opened if repairs are not carried out immediately.**
- **Install only clean parts: Do not remove replacement parts from the packaging until immediately before they are to be installed. Do not use parts that have been stored without packaging (e.g. in toolboxes, etc.).**
- **When the fuel system is opened: Avoid working with compressed air whenever possible. Avoid moving the vehicle if possible.**
- **Make sure that no Diesel fuel runs onto coolant hoses. Affected hoses must be cleaned immediately. Contaminated hoses must be replaced.**

Technical Data

Technical Data

Engine code	BKH (3.2/4V/188 kW engine)
Engine idle speed	650 to 750 RPM
Fuel pressure after high-pressure pump	approx. 35 bar positive pressure
Fuel pressure before high-pressure pump	approx. 6 bar positive pressure

*Not adjustable.

COMPONENTS, CHECKING

Components, Checking

The following table provides quick links.

--> **Oxygen Sensor Heater before Catalytic Converter, Checking**
--> **Oxygen Sensor Heater after Catalytic Converter, Checking**
--> **Throttle Valve Control Module, Checking**
--> **Engine Speed Sensor, Checking**
--> **Intake Air Temperature Sensor, Checking**
--> **Engine Coolant Temperature Sensor, Checking**
--> **Fuel Pressure Sensor, Checking**
--> **Low Fuel Pressure Sensor, Checking**
--> **Fuel Metering Valve, Checking**
--> **Intake Manifold Tuning Valve Position Sensor, Checking**
--> **Intake Manifold Runner Control Valve, Checking**
--> **Intake Manifold Runner Position Sensor 1, Checking**
--> **Intake Manifold Runner Position Sensor 2, Checking**
--> **Fuel Injectors, Checking**

Oxygen Sensor Heater before Catalytic Converter, Checking

Oxygen Sensor Heater before Catalytic Converter, Checking

NOTE:

- **The Oxygen Sensor (O2S) Heater is part of Heated Oxygen Sensor (HO2S) and cannot be replaced separately.**
- **When servicing electrical harness connector terminals for the Heated Oxygen Sensor (HO2S) , use only gold-plated terminals.**

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuse (in fuse panel) SA16 OK.
- Engine Control Module (ECM) Power Supply Relay J363 OK.
- Battery voltage at least 12.5 V.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

NOTE:

- **Voltage for Oxygen Sensor (O2S) Heater -Z19- (bank 1, sensor 1) and Oxygen Sensor (O2S) Heater -Z28- (bank 2, sensor 1) is supplied through the Engine Control Module (ECM) Power Supply Relay J363.**

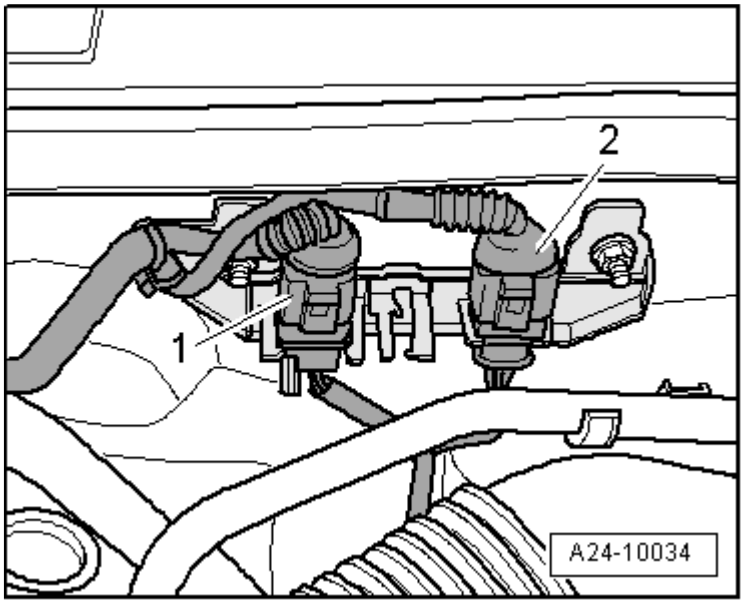

Fig. 22: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Start diagnosis

- Disconnect the 6-pin electrical harness connector - **1** - from the Heated Oxygen Sensor (HO2S) -G39- and Oxygen Sensor (O2S) Heater -Z19- (bank 1, sensor 1).

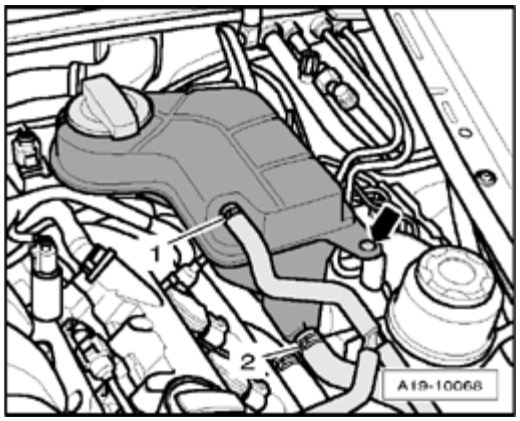

Fig. 23: Removing Coolant Hoses At Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

To test the Oxygen Sensor (O2S) Heater -Z28- (bank 2, sensor 1), perform the following steps:

- Remove the screw - **arrow** - retaining the coolant reservoir.

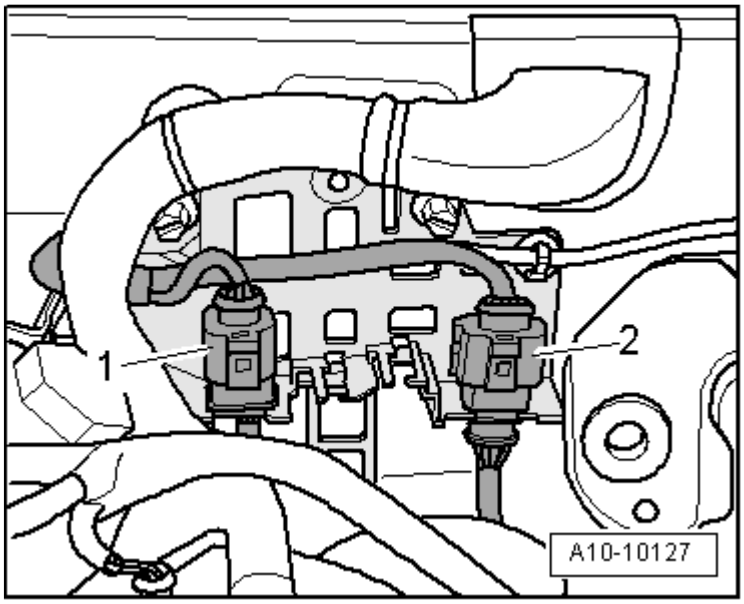

Fig. 24: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the electrical connector from Engine Coolant Level (ECL) Warning Switch F66 at the bottom of the coolant reservoir and set aside the coolant reservoir with the coolant hoses - **1** - and - **2** - connected.
- Disconnect the 6-pin electrical harness connector - **1** - from the Heated Oxygen Sensor (HO2S) -G108- and Oxygen Sensor (O2S) Heater -Z28- (bank 2, sensor 1).

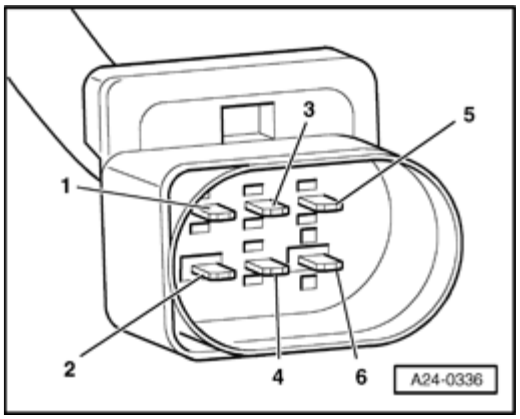

Fig. 25: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking internal resistance

- Using a multimeter , check the Heated Oxygen Sensor (HO2S) terminals 3 to 5 for an open circuit.

Heated Oxygen Sensor (HO2S) Terminals
3 to 5

Specification: 2.5 to 10 ohms (at room temperature).

If the specification is not obtained:

- Replace the Heated Oxygen Sensor (HO2S) -G39- (bank 1, sensor 1) or Heated Oxygen Sensor (HO2S) -G108- (bank 2, sensor 1) before catalytic converter. Refer to **24 - FUEL INJECTION SYSTEM** .

If the specified value is obtained:

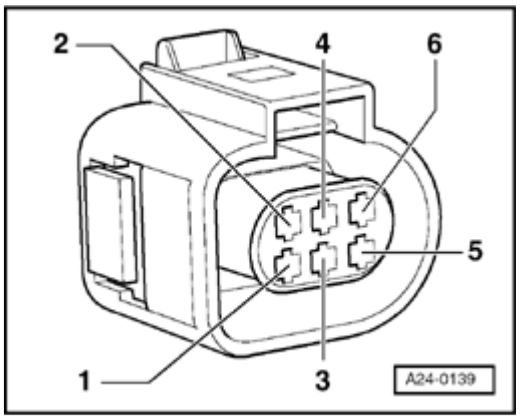

Fig. 26: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking voltage supply

- Using a Multimeter , check the electrical harness connector terminals for voltage.

Electrical harness connector	Specified value
3 to 5	Battery voltage

- Operate the starter briefly.

Specified value: battery voltage.

- Switch the ignition off.

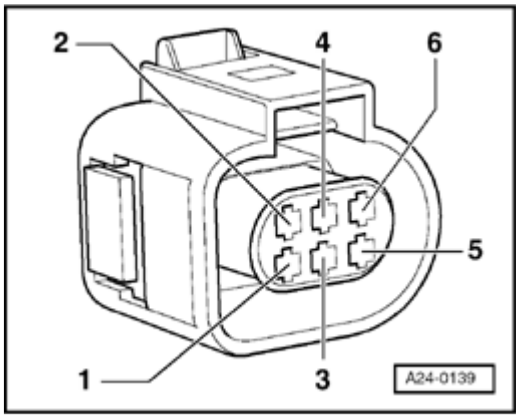

Fig. 27: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

If no voltage is present:

- Using a multimeter , check the Heated Oxygen Sensor (HO2S) electrical harness connector terminal 5 to ground (GND) for voltage.
- Turn key on.

Harness connector Terminal	Measure to
5	Engine Ground (GND)

- Operate the starter briefly.

Specified value: Battery voltage.

- Switch the ignition off.

If there is no voltage again:

- Using a multimeter , check the wiring connection from the Heated Oxygen Sensor (HO2S) electrical harness connector terminal to the Engine Control Module (ECM) Power Supply Relay J363 terminal through the fuse for resistance.

Heated Oxygen Sensor (HO2S) Electrical Harness connector terminal	Engine Control Module (ECM) Power Supply Relay J363 terminal
5	2

Wiring resistance: 1.5 ohms max.

- If necessary, repair the wiring connection.
- If the wiring is OK:

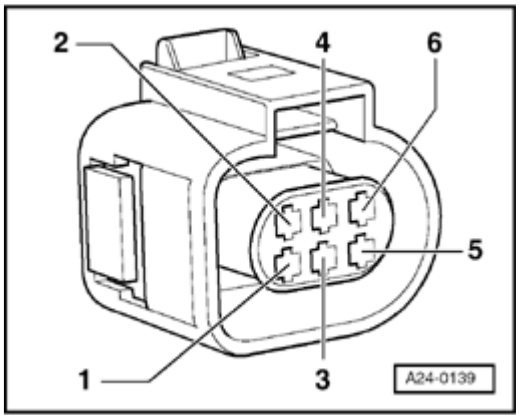

Fig. 28: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Check Ground (GND) activation

- Using a Multimeter , check the Heated Oxygen Sensor (HO2S) electrical harness connector terminal to Ground (GND) for voltage.

Harness connector terminal	Measure to
3	Ground (GND)

- Operate the starter briefly (engine can also start)

Specified value: Battery voltage, possibly fluctuating.

- Switch the ignition off.

If the specification is not obtained:

If the manufacturers test box is being used, perform the following step.

- Install the test box VAG1598/42. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

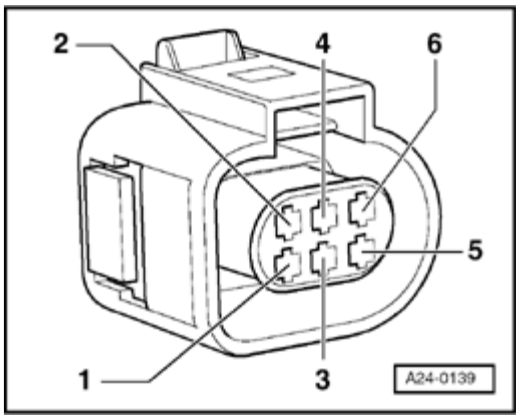

Fig. 29: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**.
- Using a multimeter , check the Heated Oxygen Sensor (HO2S) electrical harness connector to the Engine Control Module (ECM) J623 electrical harness connector for resistance.

Oxygen Sensor (O2S) Heater -Z19- (bank 1, sensor 1):

Heated Oxygen Sensor (HO2S) -Z19- Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
3	51

Oxygen Sensor (O2S) Heater -Z28- (bank 2, sensor 1):

Heated Oxygen Sensor (HO2S) -Z28- Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
3	73

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are detected:

- Replace the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Oxygen Sensor Heater after Catalytic Converter, Checking

Oxygen Sensor Heater after Catalytic Converter, Checking

NOTE:

- **The Oxygen Sensor (O2S) Heater is part of Heated Oxygen Sensor (HO2S) and cannot be replaced separately.**
- **When servicing electrical harness connector terminals for the Heated Oxygen Sensor (HO2S) , use only gold-plated terminals.**

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuse (in fuse panel) SA17 OK.
- Engine Control Module (ECM) Power Supply Relay J363 OK.
- Battery voltage at least 12.5 V.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

NOTE:

- **Voltage for Oxygen Sensor (O2S) Heater -Z29- (bank 1, sensor 2) and Oxygen Sensor (O2S) Heater -Z30- (bank 2, sensor 2) is supplied through the Engine Control Module (ECM) Power Supply Relay J363.**
- **Bank 1 = cylinder bank 1 in direction of travel, right; Bank 2 = cylinder bank 2 in direction of travel, left.**

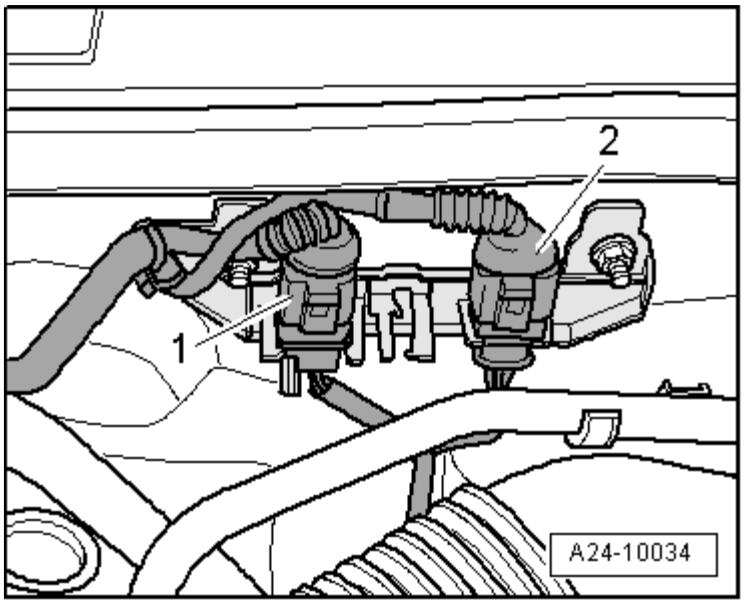

Fig. 30: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Start diagnosis

- Disconnect the 4-pin electrical harness connector - **2** - from the Heated Oxygen Sensor (HO2S) -G130- and Oxygen Sensor (O2S) Heater -Z29- (bank 1, sensor 2).

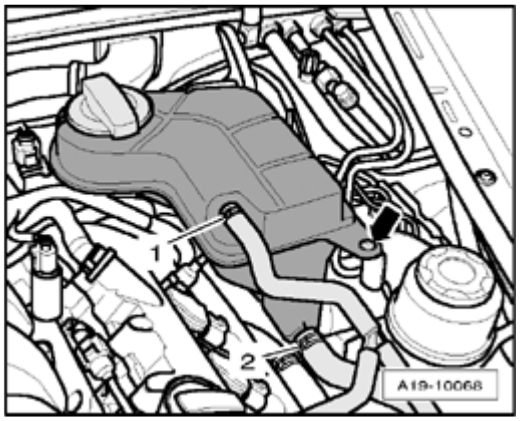

Fig. 31: Removing Coolant Hoses At Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

To test the Oxygen Sensor (O2S) Heater -Z30- (bank 2, sensor 2), perform the following steps:

- Remove the screw - **arrow** - retaining the coolant reservoir.

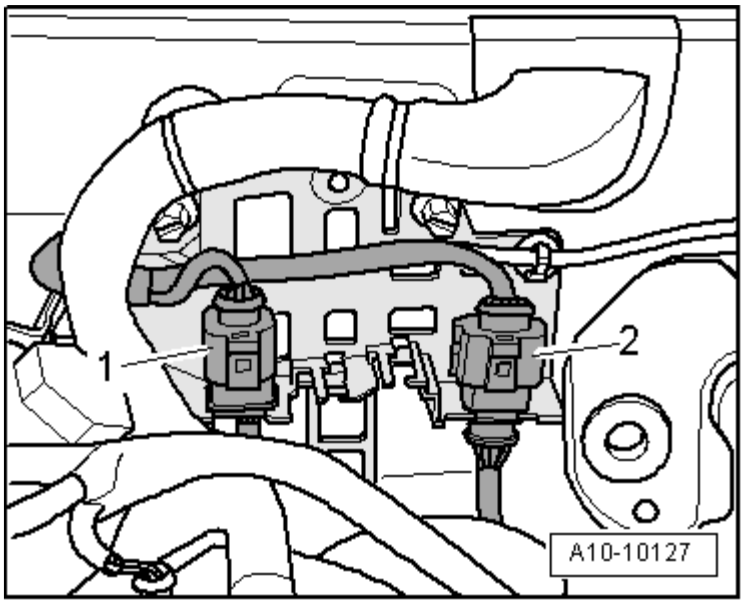

Fig. 32: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the electrical connector from Engine Coolant Level (ECL) Warning Switch F66 at the bottom of the coolant reservoir and set aside the coolant reservoir with the coolant hoses - **1** - and - **2** - connected.
- Disconnect the 4-pin electrical harness connector - **2** - from the Heated Oxygen Sensor (HO2S) -G131- and Oxygen Sensor (O2S) Heater -Z30- (bank 2, sensor 2).

Checking internal resistance

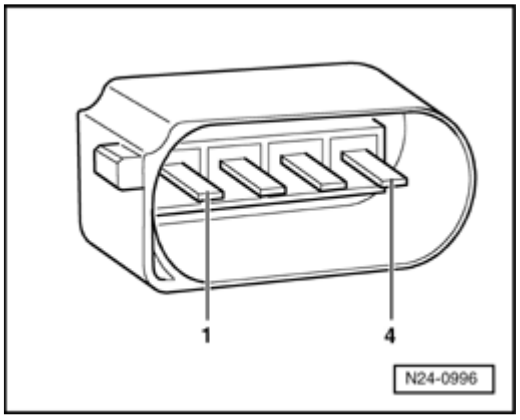

Fig. 33: Identifying 4-Pin Harness Connector Terminals 1 & 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Terminals - 2 - and - 3 - Are not called out in the graphic.**

- Using a multimeter , check the Heated Oxygen Sensor (HO2S) 2 terminals 1 to 2 for resistance.

Heated Oxygen Sensor (HO2S) Electrical Harness Connector Terminals
1 to 2

Specification: 2.5 to 10 ohms (at room temperature).

If the specification is not obtained:

- Replace the Heated Oxygen Sensor (HO2S) -G130- (bank 1, sensor 2) or Heated Oxygen Sensor (HO2S) -G131- (bank 2, sensor 2) behind Three Way Catalytic Converter (TWC).

If the specified value is obtained:

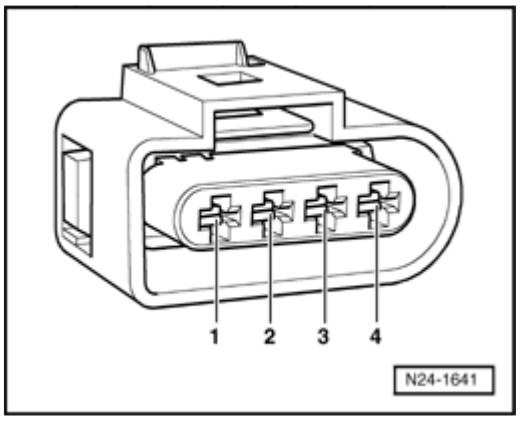

Fig. 34: Identifying 4-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking voltage supply

- Connect a multimeter between Heated Oxygen Sensor (HO2S) 2 G108 terminals 1 and 3 for voltage measurement.
- Operate the starter briefly.

Specified value: Battery voltage.

- Switch the ignition off.

If no voltage is present:

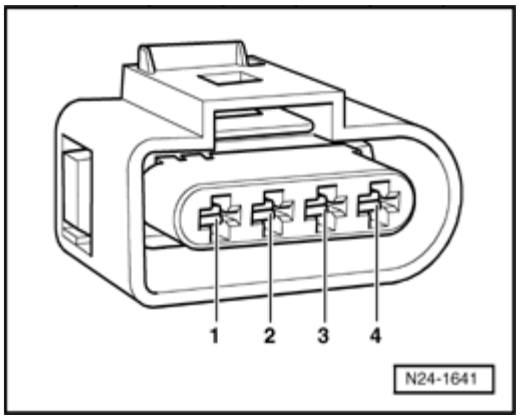

Fig. 35: Identifying 4-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a multimeter , check the Heated Oxygen Sensor (HO2S) electrical harness connector terminal 1 to engine ground (GND) for voltage.

Harness connector Terminal	Measure to
1	Engine Ground (GND)

- Operate the starter briefly.

Specified value: Battery voltage.

- Switch the ignition off.

If there is no voltage again:

- Using a Multimeter , check the wiring connection from the Heated Oxygen Sensor (HO2S) electrical harness connector terminal to the Engine Control Module (ECM) Power Supply Relay J363 terminal through the fuse for an open circuit.

Heated Oxygen Sensor (HO2S) Harness connector terminal	Engine Control Module (ECM) Power Supply Relay J363 terminal
1	2

Specified value: 1.5 ohms max.

- If necessary, repair the wiring connection.
- If the voltage supply is OK:

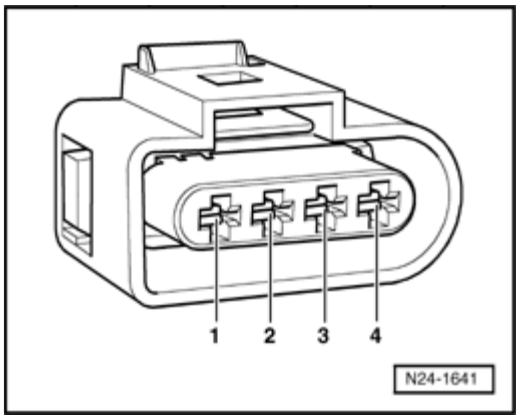

Fig. 36: Identifying 4-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Check Ground (GND) activation

- Using a Multimeter , check the electrical harness connector for voltage.

Heated Oxygen Sensor (HO2S) Harness connector terminal	Measure to
2	Engine Ground (GND)

- Operate the starter briefly (engine can also start)

Specified value: Battery voltage, possibly fluctuating.

- Switch the ignition off.

If the specification is not obtained:

If the manufacturers test box is being used, perform the following step.

- Install the test box VAG1598/42. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

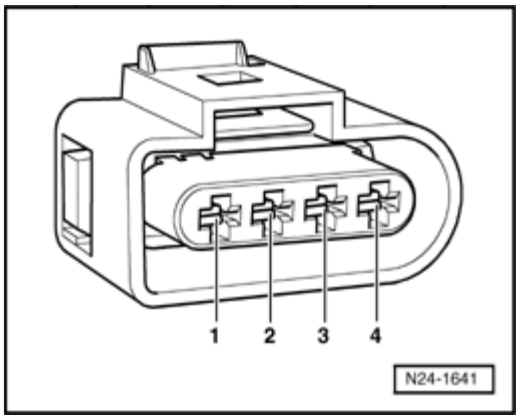

Fig. 37: Identifying 4-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**.
- Using a multimeter , check the Heated Oxygen Sensor (HO2S) electrical harness connector to the Engine Control Module (ECM) J623 electrical harness connector for resistance.

- Oxygen Sensor (O2S) Heater -Z29- (bank 1, sensor 2):

Heated Oxygen Sensor (HO2S) -Z29- Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
2	75

- Oxygen Sensor (O2S) Heater -Z30- (bank 2, sensor 2):

Heated Oxygen Sensor (HO2S) -Z30- Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
2	91

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are detected:

- Replace the Engine Control Module -J623-.

Assembly is performed in reverse order of removal, note the following:

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Throttle Valve Control Module, Checking

Throttle Valve Control Module, Checking

NOTE:

- **Use only gold-plated terminals when servicing terminals in harness connector of Throttle Valve Control Module J338.**

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- The Engine Control Module (ECM) J623 fuses OK.
- Battery voltage at least 12.5 V.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- Parking brake applied.
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Throttle valve must not be damaged or dirty.
- Coolant Temperature at least 80 C.

Function

Throttle valve operation occurs by an electric motor Throttle drive (power accelerator actuation) G186) in Throttle Valve Control Module J338. It is operated by Engine Control Module (ECM) J623 according to specifications of Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185.

Components of Throttle Valve Control Module J338 :

- Throttle drive (power accelerator actuation) G186
- Angle Sensor 1 G187
- Angle Sensor 2 G188

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**
- Connect the scan tool.
- Switch ignition on.
- Using the scan tool, check the throttle valve position (absolute) at idle stop:

Diagnostic text	Specified value
Throttle valve position (absolute)	
Idle stop	12 to 16%

- Slowly depress the accelerator pedal to Wide Open Throttle (WOT) stop while observing the percentage display. The percentage display must increase uniformly. On vehicles with automatic transmissions do not press down beyond the kickdown point when doing this.
- Using the scan tool, check the throttle valve position (absolute) at Wide Open Throttle (WOT) stop:

Diagnostic text	Specified value
Throttle valve position (absolute)	
Wide Open Throttle (WOT) stop	84 to 88%

- Switch the ignition off.

If the specified values are not obtained.

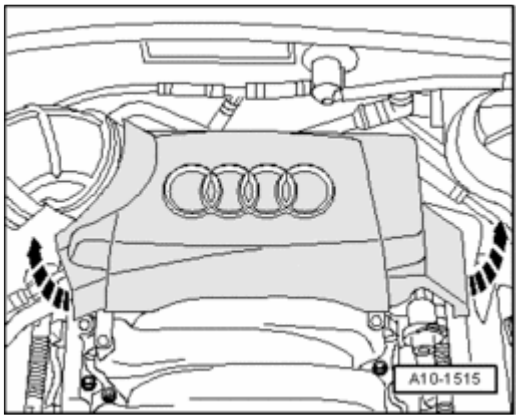

Fig. 38: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking voltage supply

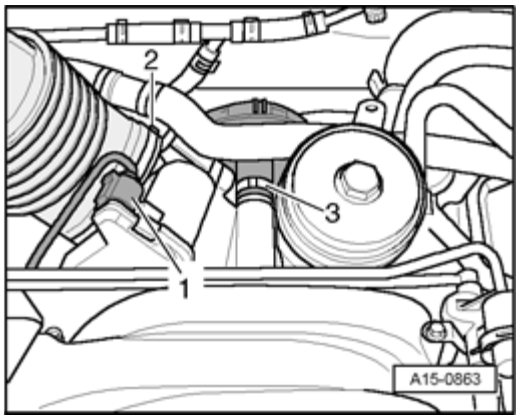

Fig. 39: Disconnecting Electrical Connection At Throttle Valve Control Module J338 & Crankcase Ventilation Hose At Intake Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the rear engine cover - **arrows** -.
- Disconnect the electrical harness connector - **1** - at the Throttle Valve Control Module J338.

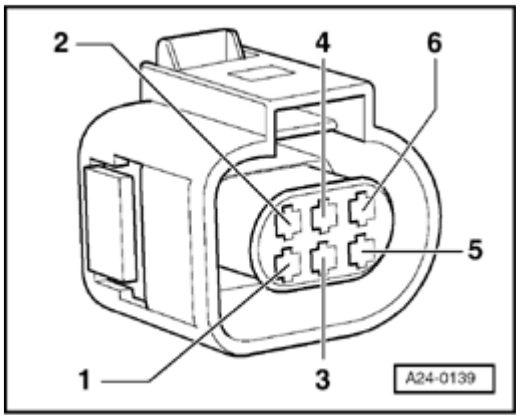

Fig. 40: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Switch the ignition on.
- Using the Multimeter , check the electrical harness connector for voltage.

Throttle Valve Control Module J338 Electrical Harness Connector terminal	Specified value
2 + Ground (GND)	about 5 V
2 + 6	about 5 V

- Switch the ignition off.

If the specified values are not obtained.

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

- Install the test box VAG1598/42. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**.
- Using a Multimeter , check the Accelerator Pedal Position Sensor 2 G185 at Throttle Valve Control Module J338 electrical harness connector terminals to the Engine Control Module (ECM) J623 electrical harness connector terminals for resistance.

Throttle Valve Control Module J338 Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
1	13
2	14
3	15
4	28
5	30
6	12

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are detected in the wiring and if the voltage supply was OK:

- Replace the Throttle Valve Control Module J338.
- After replacing the Throttle Valve Control Module J338 , it must be adapted. For this purpose switch on ignition for at least 30 Sec. without starting the engine or depressing the accelerator pedal.

If no malfunctions are detected in the wiring and if the voltage supply was not OK:

- Replace the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.
- Switch the ignition off.

The Engine Control Module (ECM) J623 now requires approx. 3 Sec. to store the learned value. At this time, the ignition must not be switched on again.

Assembly is performed in reverse order of removal, note the following:

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Engine Speed Sensor, Checking

Engine Speed Sensor, Checking

NOTE:

- **Use only gold-plated terminals when servicing terminals in the electrical harness connector of the Engine Speed (RPM) Sensor G28.**

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- The Engine Control Module (ECM) J623 fuses OK.
- Battery voltage at least 12.5 V.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**

The Engine Speed (RPM) Sensor G28 detects RPM and reference marks. Without an engine speed signal, the engine will not start. If the engine speed signal fails while the engine is running, the engine will stop immediately.

Function test

- Connect the scan tool.
- Switch the ignition on.
- Using the scan tool, check the engine speed:

Diagnostic text	Specified value
Engine rotations per minute (RPM)	Idle speed

- End diagnosis and switch ignition off.

If the specified value was not obtained:

Checking internal resistance

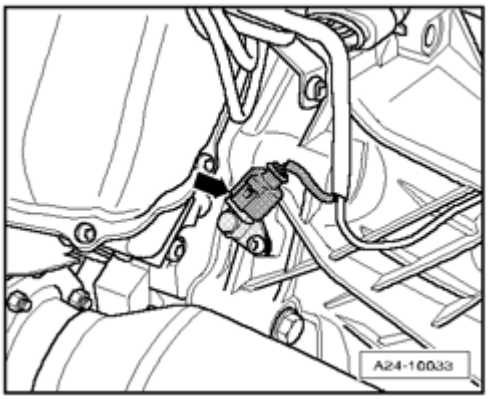

Fig. 41: Disconnecting Electrical Connector On Engine Speed (RPM) Sensor G28
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the electrical harness connector - **arrow** - from the Engine Speed (RPM) Sensor G28.

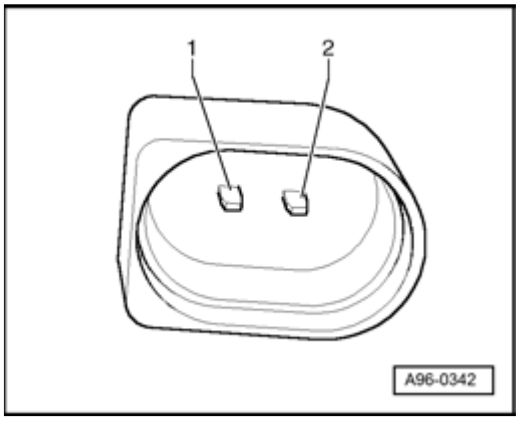

Fig. 42: Identifying Exhaust Flap Valve 1 N321 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a multimeter , check the Engine Speed (RPM) Sensor G28 terminals1 to 2 for resistance.

Specified value: 450 to 1000 ohms.

NOTE:

- **Resistance value of the engine speed (RPM) sensor is based on a temperature of 20 C. Resistance increases as temperature increases.**

If specified value is not obtained:

- Replace the Engine Speed (RPM) Sensor G28. Refer to **13 - ENGINE - CRANKSHAFT, CYLINDER BLOCK**

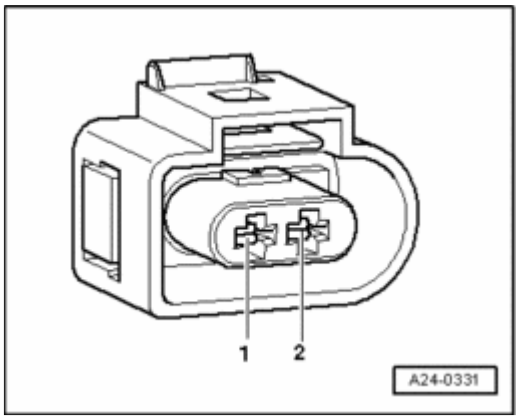

Fig. 43: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

If specified value is obtained:

- Using a Multimeter , check the electrical harness connector terminals for voltage.

Engine Speed (RPM) Sensor G28 electrical harness connector terminals	Specified value
1	Battery positive (+)
2	Battery positive (+)

Specified value: Battery voltage.

If specified value is not obtained:

- Check the wiring for short circuit to each other as well as to Battery positive (+) and Ground (GND).
- If necessary, repair the wiring connection.

If no malfunctions are detected in the wiring and if the voltage supply was OK:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to Engine Mechanical, Fuel Injection Ignition, **24 - FUEL INJECTION SYSTEM** .

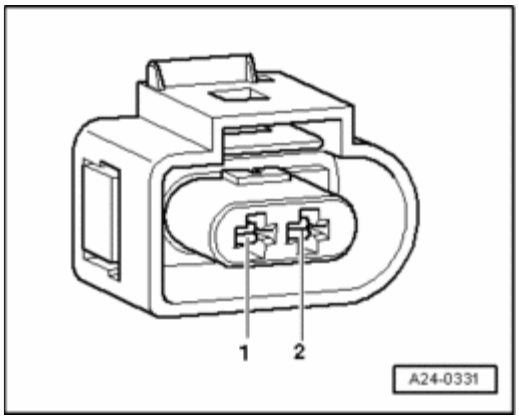

Fig. 44: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

If the manufacturers test box is not being used, perform the following step.

- Remove the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**.

Using a Multimeter , check the Engine Speed (RPM) Sensor G28 electrical harness connector terminals to the Engine Control Module (ECM) J623 electrical harness connector terminals for resistance.

Engine Speed (RPM) Sensor G28 Electrical Harness Connector Terminals	Engine Control Module (ECM) J623 Electrical Harness Connector Terminals
1	53
2	38

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are detected:

- Replace the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**

Assembly is performed in reverse order of removal, note the following:

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.

3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Intake Air Temperature Sensor, Checking

Intake Air Temperature Sensor, Checking

NOTE:

- **The Intake Air Temperature (IAT) Sensor G42 and the Manifold Absolute Pressure (MAP) Sensor G71 are integrated into one unit and cannot be serviced separately.**

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Engine Control Module (ECM) J623 fuse OK.
- Battery voltage at least 12.5 V.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

Function test

- Connect the scan tool.
- Start the engine and let run at idle.
- Using the scan tool, check the engine speed:

Diagnostic text	Specified value
Intake air temperature	approx. ambient temperature.

- End diagnosis and switch ignition off.

NOTE:

- **If a temperature is indicated which differs greatly from ambient**

temperature of sensor, check sensor and sensor wires for contact resistances and open circuit.

- End diagnosis and switch the ignition off.

If the specified value was not obtained:

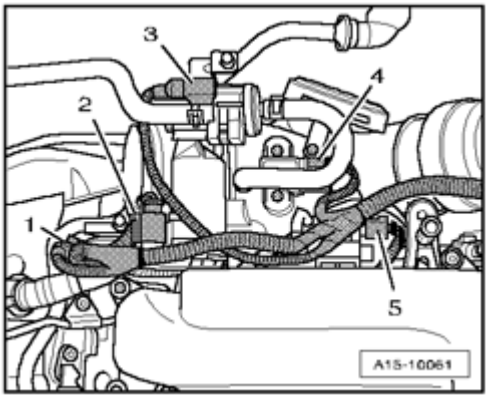

Fig. 45: Identifying Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking voltage supply

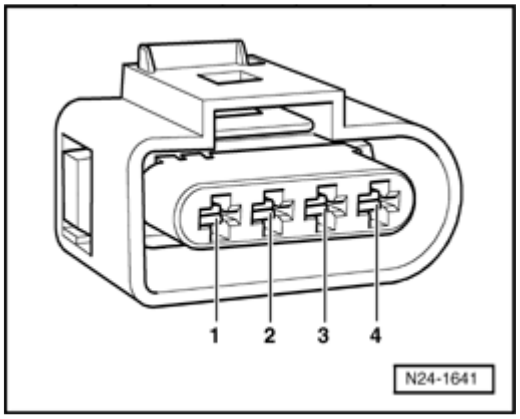

Fig. 46: Identifying 4-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the electrical harness connector - **4** - from the Intake Air Temperature (IAT) Sensor G42.
- Using a Multimeter , check the Intake Air Temperature (IAT) Sensor G42 electrical harness connector for voltage.

Intake Air Temperature (IAT) Sensor G42 Harness Connector Terminal	Specified value
1 to B+	Battery positive (+)

2 to Ground (GND)	5V or less
3 to Ground (GND)	about 5 V
4 to Ground (GND)	Battery positive (+)

If the specified value is obtained:

- Replace the Intake Air Temperature (IAT) Sensor G42.

If specified value is not obtained:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

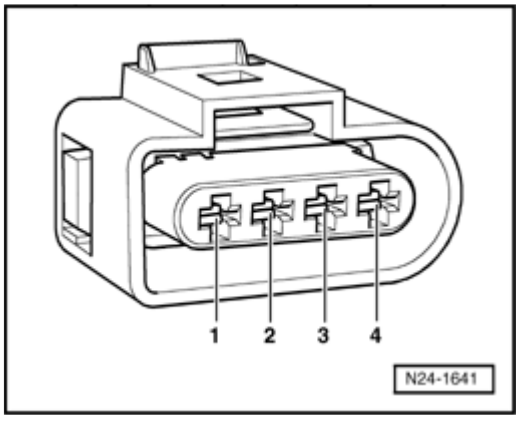

Fig. 47: Identifying 4-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

If the manufacturers test box is not being used, perform the following step.

- Using a Multimeter , check the following wire connection for an open circuit.

Intake Air Temperature (IAT) Sensor G42 Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminals
1	40
2	39
3	29
4	44

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are found in wires:

- Replace the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Engine Coolant Temperature Sensor, Checking

Engine Coolant Temperature Sensor, Checking

CAUTION:
- **Cooling system is under pressure.**
- **Danger of scalding when opening!**

NOTE:
- **Use only gold-plated terminals when servicing terminals in the electrical harness connector of Engine Coolant Temperature (ECT) Sensor G62.**

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- The Engine Control Module (ECM) J623 fuses OK.
- Battery voltage at least 12.5 V.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.
- Engine cold.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.
- Connect the scan tool.
- Switch the ignition on.
- Using the scan tool, check the coolant temperature:

Diagnostic text	Specified value
Coolant temperature	approx. ambient temperature

NOTE:

- **If a temperature is indicated which differs greatly from the ambient temperature of the sensor, check the sensor and wiring for contact resistances and open circuits.**

If the specified value is obtained:

- Start the engine and let it run at idle.

The temperature value must increase uniformly in increments of 10 C.

NOTE:

- **If the engine shows problems in certain temperature ranges and if the temperature does not climb uniformly, the temperature signal is intermittent and the sensor should be replaced.**

- Replace the Engine Coolant Temperature (ECT) Sensor G62. Refer to **19 - ENGINE - COOLING SYSTEM** .
- End diagnosis and switch the ignition off.

If the indications do not resemble description:

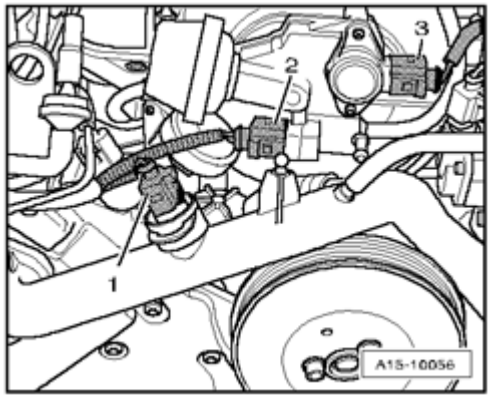

Fig. 48: Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking internal resistance

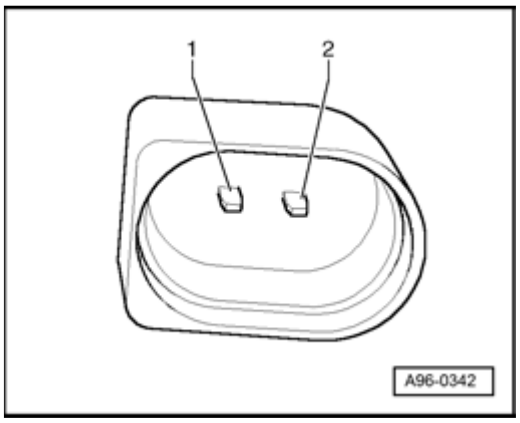

Fig. 49: Identifying Exhaust Flap Valve 1 N321 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **1** - from the Engine Coolant Temperature (ECT) Sensor G62.
- Using a multimeter, check the Engine Coolant Temperature (ECT) Sensor G62 for resistance between terminals - **1** - and - **2** -.

Specified value: 450 to 1000 ohms.

If specified value is not obtained:

- Replace the Engine Coolant Temperature (ECT) Sensor G62. Refer to **19 - ENGINE - COOLING SYSTEM** .

If specified value is obtained:

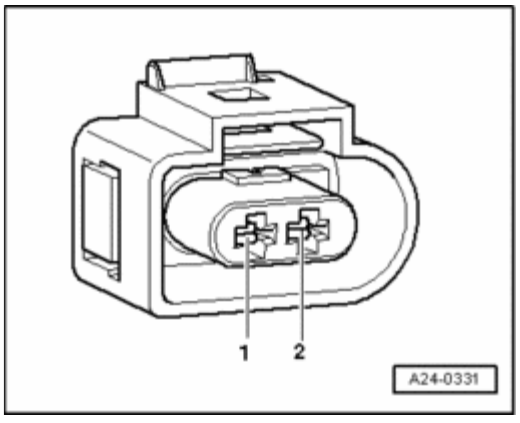

Fig. 50: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking voltage

- Using a Multimeter , check the Engine Coolant Temperature (ECT) Sensor G62 electrical harness connector for voltage.

Engine Coolant Temperature (ECT) Sensor G62 Harness Connector Terminals	Specified Value
1 to 2	Battery positive (+)

Specified value: Battery voltage.

If specified value is obtained:

- Replace the Engine Coolant Temperature (ECT) Sensor G62. --> **19 - ENGINE - COOLING SYSTEM** .

If the specified value was not obtained:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.

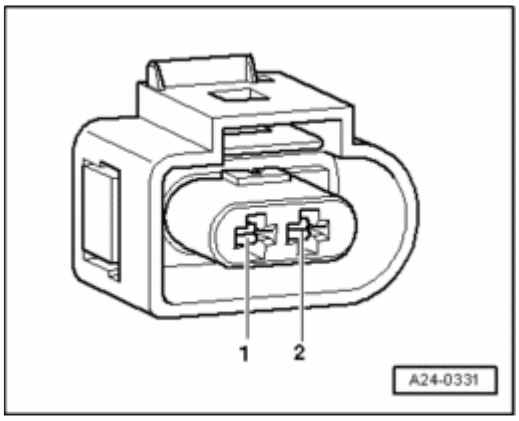

Fig. 51: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the Engine Coolant Temperature (ECT) Sensor G62 electrical harness connector terminals to the Engine Control Module (ECM) J623 electrical harness connector terminals for resistance.

Engine Coolant Temperature (ECT) Sensor G62 Harness Connector Terminal	Engine Control Module (ECM) J623
1	40
2	43

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are found in wires:

- Replace the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Fuel Pressure Sensor, Checking

Fuel Pressure Sensor, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuel Pump (FP) Control Module J538 OK
- Fuses for engine electronics OK.
- Fuel filter OK.
- Parking brake engaged.
- Battery voltage at least 12.5 V.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- All electrical consumers such as, lights and rear window defroster, switched off (radiator fan must not run during test).
- A/C switched off.

- The fuel tank at least 1/4 full.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

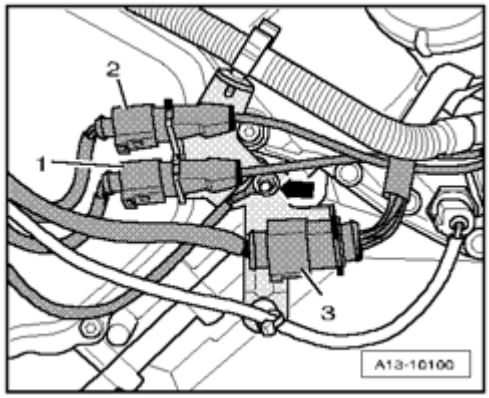

Fig. 52: Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking voltage

- Disconnect the 14 pin electrical harness connector - **3** - for Fuel Pressure Sensor G247 from the left rear of the engine.
- Using a Multimeter , check the Fuel Pressure Sensor G247 for voltage at the 14 pin electrical harness connector terminals.

Fuel Pressure Sensor G247 Electrical Harness Connector Terminal	Specified value
1 to Battery positive (+)	Battery positive (+)
2 to Ground (GND)	Battery positive (+)
3 to Ground (GND)	about 5 V

If specified value is obtained:

- Replace the Fuel Pressure Sensor G247. Refer to **15 - ENGINE - CYLINDER HEAD, VALVETRAIN**

If the specified value was not obtained:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.
- Using a Multimeter , check the following wire connections for an open circuit.

Fuel Pressure Sensor G247 Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
1	40
2	59
3	29

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are found in wiring:

- Replace the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Low Fuel Pressure Sensor, Checking

Low Fuel Pressure Sensor, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuel Pump (FP) Control Module J538 OK

- Fuses for engine electronics OK.
- Fuel filter OK.
- Parking brake engaged.

- Battery voltage at least 12.5 V.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- All electrical consumers such as, lights and rear window defroster, switched off (radiator fan must not run during test).
- A/C switched off.

- The fuel tank at least 1/4 full.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

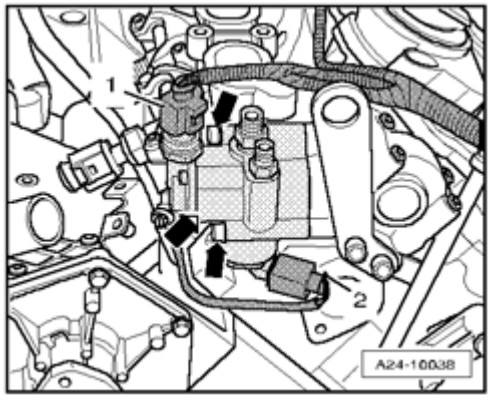

Fig. 53: Disconnecting Electrical Harness Connector From Low Fuel Pressure Sensor G410
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking voltage

- Disconnect the electrical harness connector - **1** - from the Low Fuel Pressure Sensor G410.

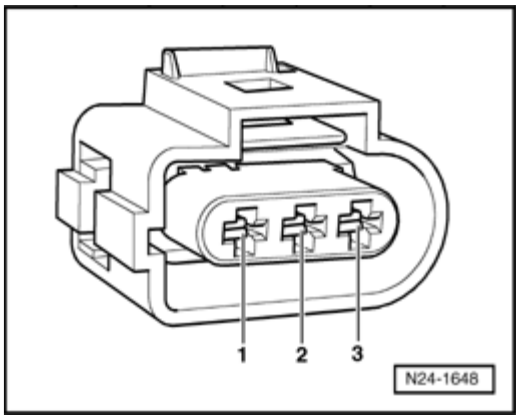

Fig. 54: Identifying 3-Pin Harness Connector Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the electrical harness connector terminals for voltage.

Low Fuel Pressure Sensor G410 Harness Connector Terminal	Specified Value
1 to Battery positive (+)	Battery positive (+)
2 to Ground (GND)	5 V or less
3 to Ground (GND)	about 5 V

If specified value is obtained:

- Replace the Low Fuel Pressure Sensor G410.

Refer to **24 - FUEL INJECTION SYSTEM** .

NOTE:

- **The 3.2L 6-Cyl. 4V (BKH) engine is equipped with two different Low Fuel Pressure Sensors G410 designs. One design is integrated into the high pressure fuel pump and must be replaced as a complete assembly. The second design is not integrated into the high pressure fuel pump and may be replaced separately.**

If the specified value was not obtained:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.
- Using a Multimeter , check the following wire connections for an open circuit.

Low Fuel Pressure Sensor G410 Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
1	40
2	49
3	29

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are found in wiring:

- Replace the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Fuel Metering Valve, Checking

Fuel Metering Valve, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuel Pump (FP) Control Module J538 OK
- Fuses for engine electronics OK.
- Fuel filter OK.
- Parking brake engaged.
- Battery voltage at least 12.5 V.

- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- All electrical consumers such as, lights and rear window defroster, switched off (radiator fan must not run during test).
- A/C switched off.

- The fuel tank at least 1/4 full.
- Ignition switched off.

Test procedure

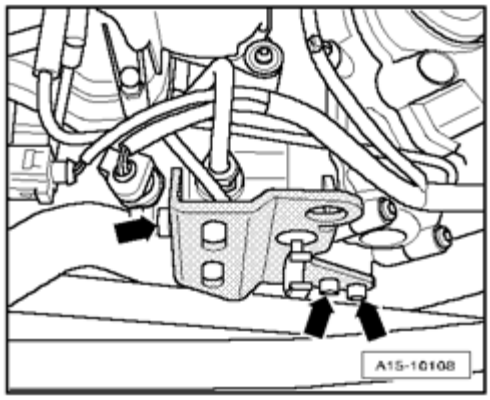

Fig. 55: Removing Large Lifting Eye
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

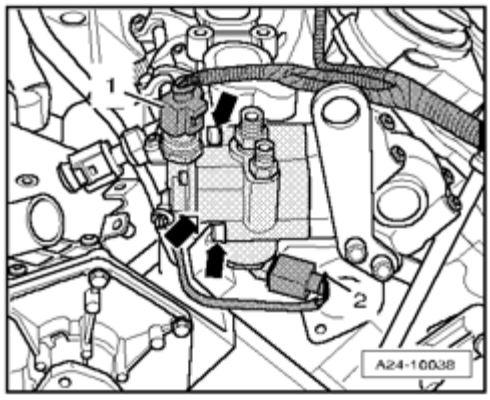

Fig. 56: Disconnecting Electrical Harness Connector From Low Fuel Pressure Sensor G410
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove three screws - **arrows** - and the engine lifting eye to gain access to the electrical harness connector.
- Disconnect the Fuel Metering Valve N290 electrical harness connector - **2** - from the Fuel Metering Valve N290.

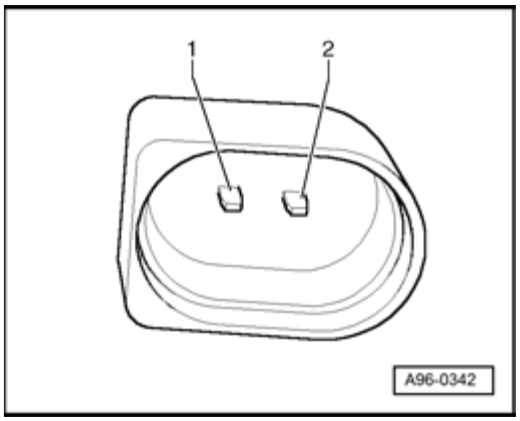

Fig. 57: Identifying Exhaust Flap Valve 1 N321 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking internal resistance

- Using a Multimeter , check the Fuel Metering Valve N290 terminals for resistance.

Fuel Metering Valve N290 Electrical Harness Terminals
1 to 2

Specified value: 450 to 1000 ohms.

If specified value is not obtained:

- Replace the Fuel Metering Valve N290.

Refer to **24 - FUEL INJECTION SYSTEM** .

If specified value is obtained:

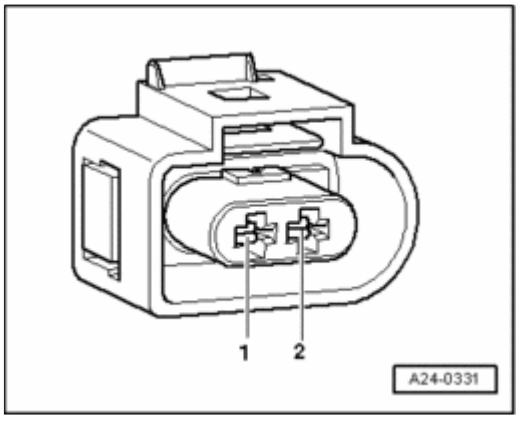

Fig. 58: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking voltage

- Using a Multimeter , check the wiring connection from the Fuel Metering Valve N290 electrical harness connector terminals for voltage.

Fuel Metering Valve N290 Electrical Harness Connector Terminal	Specified value
1 to Ground (GND)	Battery positive (+)
2 to Battery positive (+)	Battery positive (+)

- Operate the starter briefly.

Specified value: Battery voltage.

- Switch the ignition off.

If there is no voltage:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

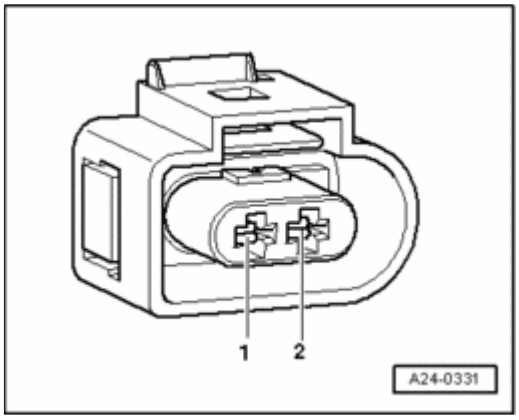

Fig. 59: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.
- Using a Multimeter , check the following wire connections for an open circuit.

Fuel Metering Valve N290 Electrical Harness	Engine Component Power Supply Relay J757

Connector Terminal	Electrical Harness Connector Terminal
1	2

Fuel Metering Valve N290 Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
2	45

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.

If specified value is not obtained:

- If necessary, repair the wiring connection.

If no malfunctions are found in wiring:

- Replace the Engine Control Module (ECM) J623.
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Intake Manifold Tuning Valve Position Sensor, Checking

Intake Manifold Tuning Valve Position Sensor, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuses for engine electronics OK.
- Parking brake engaged.
- Battery voltage at least 12.5 V.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".

- All electrical consumers such as, lights and rear window defroster, switched off (radiator fan must not run during test).
- A/C switched off.
- The fuel tank at least 1/4 full.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

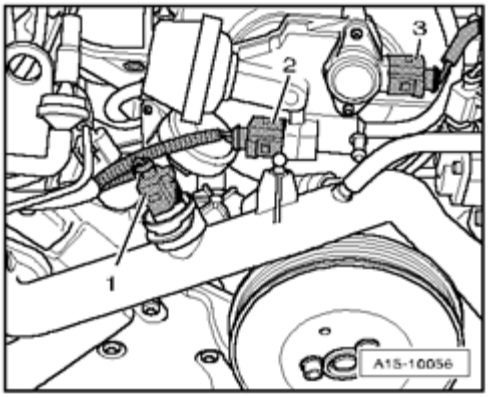

Fig. 60: Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking voltage supply

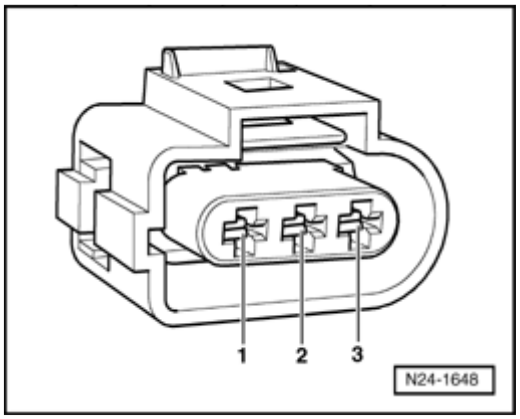

Fig. 61: Identifying 3-Pin Harness Connector Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the electrical harness connector from the Intake Manifold Tuning (IMT) Valve Position Sensor G513 - **3** -.
- Using a Multimeter , check the electrical harness connector for voltage.

Intake Manifold Tuning (IMT) Valve Position Sensor G513 Harness Connector Terminal	Specified value
1 to Ground (GND)	Battery positive (+)
2 to Ground (GND)	about 5 V
3 to Battery positive (+)	Battery positive (+)

If specified value is obtained:

- Replace the Intake Manifold Tuning (IMT) Valve Position Sensor G513. Refer to **24 - FUEL INJECTION SYSTEM** .

If specified value is not obtained:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

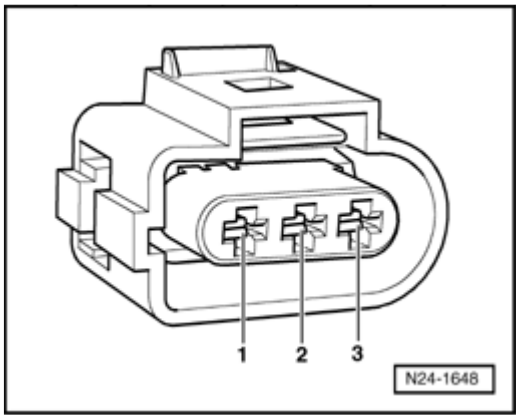

Fig. 62: Identifying 3-Pin Harness Connector Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.
- Using a Multimeter , check the following electrical wiring harness terminals for an open circuit.

Intake Manifold Tuning (IMT) Valve Position Sensor G513 Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
1	63
2	52
3	9

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are found in wires:

- Replace the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Intake Manifold Runner Control Valve, Checking

Intake Manifold Runner Control Valve, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuses for engine electronics OK.
- Parking brake engaged.
- Battery voltage at least 12.5 V.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- All electrical consumers such as, lights and rear window defroster, switched off (radiator fan must not run during test).
- A/C switched off.
- The fuel tank at least 1/4 full.
- Ignition switched off.

Test procedure

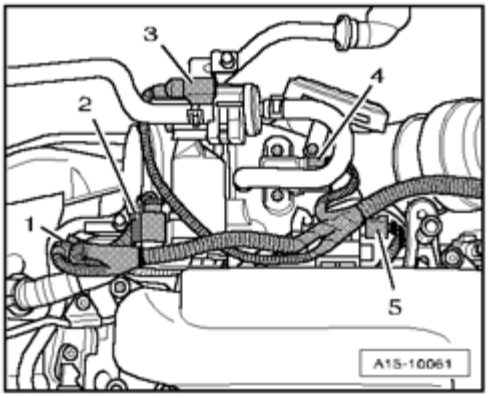

Fig. 63: Identifying Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.
- Disconnect the electrical harness connector - **5** - from the Intake Manifold Runner Control (IMRC) Valve N316.

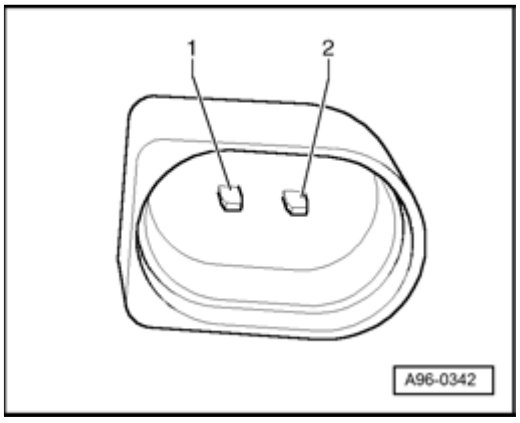

Fig. 64: Identifying Exhaust Flap Valve 1 N321 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking internal resistance

- Using a Multimeter , check the Intake Manifold Runner Control (IMRC) Valve N316 for resistance

Intake Manifold Runner Control (IMRC) Valve N316 Terminals
1 to 2

Specified value: 450 to 1000 ohms.

If specified value is not obtained:

- Replace the Intake Manifold Runner Control (IMRC) Valve N316. Refer to **24 - FUEL INJECTION SYSTEM** .

If specified value is obtained:

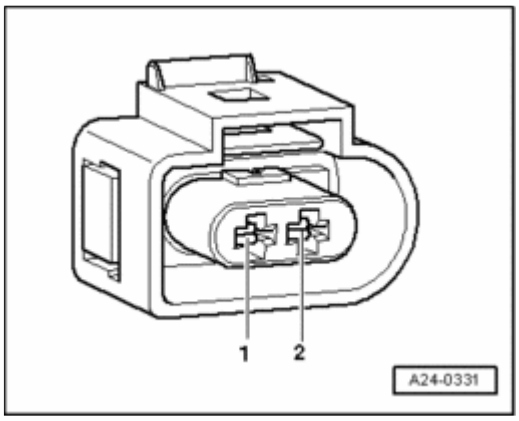

Fig. 65: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking voltage

- Using a Multimeter , Check the wiring connection from the electrical harness connector terminal to the Engine Control Module (ECM) Power Supply Relay J363 terminal through the fuse for an open circuit.

Intake Manifold Runner Control (IMRC) Valve N316 Electrical Harness Connector Terminal	Specified value
1 to Ground (GND)	Battery positive (+)
2 to Battery positive (+)	Battery positive (+)

- Operate the starter briefly.

Specified value: Battery voltage.

- Switch the ignition off.

If there is no voltage:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

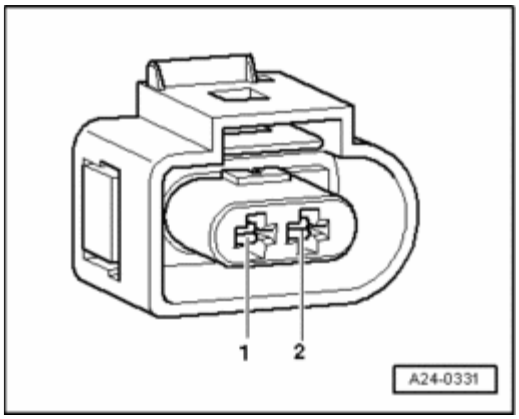

Fig. 66: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**
- Using a Multimeter , check the following wire connection for an open circuit.

Intake Manifold Runner Control (IMRC) Valve N316 Electrical Harness Connector Terminal	Engine Component Power Supply Relay J757 Electrical Harness Connector Terminal
1	2

Intake Manifold Runner Control (IMRC) Valve N316 Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
2	35

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.

If specified value is not obtained:

- If necessary, repair the wiring connection.

If no malfunctions are found in wiring:

- Replace the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**.
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.

3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Intake Manifold Runner Position Sensor 1, Checking

Intake Manifold Runner Position Sensor 1, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuses for engine electronics OK.
- Parking brake engaged.
- Battery voltage at least 12.5 V.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- All electrical consumers such as, lights and rear window defroster, switched off (radiator fan must not run during test).
- A/C switched off.
- The fuel tank at least 1/4 full.
- Ignition switched off.

Test procedure

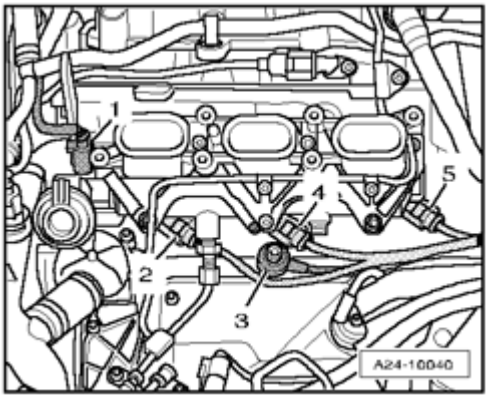

Fig. 67: Component Location Under Intake Manifold, Cylinder Bank 1 (Right)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.
- Disconnect the electrical harness connector from the Intake Manifold Runner Position Sensor G336 - **1** -.

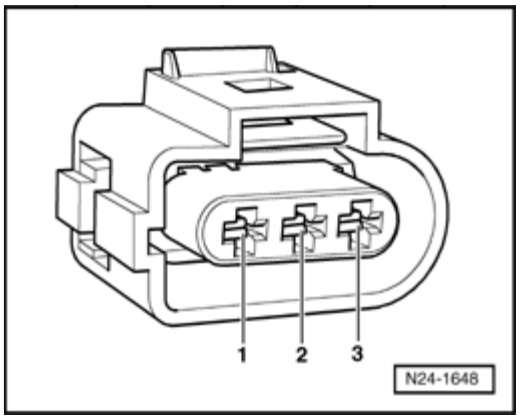

Fig. 68: Identifying 3-Pin Harness Connector Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking voltage supply

- Using a Multimeter , check the electrical harness connector for voltage.

Intake Manifold Runner Position Sensor G336 Electrical Harness Connector Terminal	Specified value
1 to Ground (GND)	Battery positive (+)
2 to Ground (GND)	about 5 V
3 to Battery positive (+)	Battery positive (+)

If specified value is obtained:

- Replace the Intake Manifold Runner Position Sensor G336. Refer to **24 - FUEL INJECTION SYSTEM** .

If specified value is not obtained:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

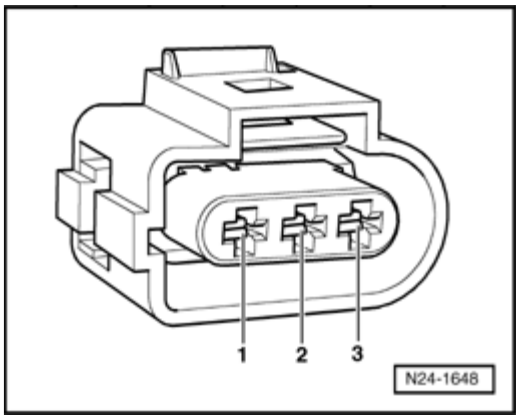

Fig. 69: Identifying 3-Pin Harness Connector Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.
- Using a Multimeter , check the following wire connector terminals for an open circuit.

Intake Manifold Runner Position Sensor G336 Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
1	29
2	55
3	40

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are found in wires:

- Replace the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.

The Intake Manifold Runner Position Sensor G336 must be adapted to the Engine Control Module (ECM) J623.

To adapt the Intake Manifold Runner Position Sensor G336 to the Engine Control Module (ECM) J623 perform the following steps:

Test requirements

- The battery voltage at least 12.5 V.
- Coolant temperature must be between 20 C and 80 C.
- No DTCs stored in DTC memory.

- Start the engine and let run at idle for at least 70 Sec.
- The Engine Control Module (ECM) J623 will automatically adapt the Intake Manifold Runner Position Sensor G336.
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Intake Manifold Runner Position Sensor 2, Checking

Intake Manifold Runner Position Sensor 2, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuses for engine electronics OK.
- Parking brake engaged.
- Battery voltage at least 12.5 V.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- All electrical consumers such as, lights and rear window defroster, switched off (radiator fan must not run during test).
- A/C switched off.
- The fuel tank at least 1/4 full.
- Ignition switched off.

Test procedure

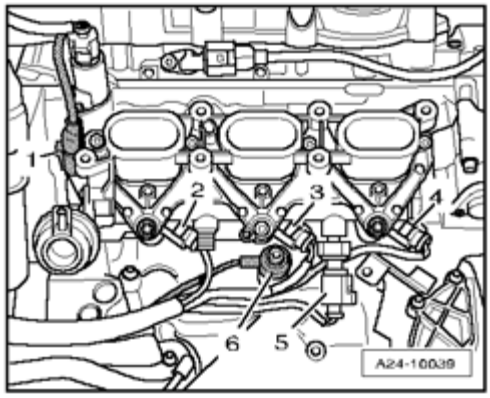

Fig. 70: Component Location Under Intake Manifold, Cylinder Bank 2 (Left)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.
- Disconnect the electrical harness connector from the Intake Manifold Runner Position Sensor 2 G512 - **1** -.

Checking voltage supply

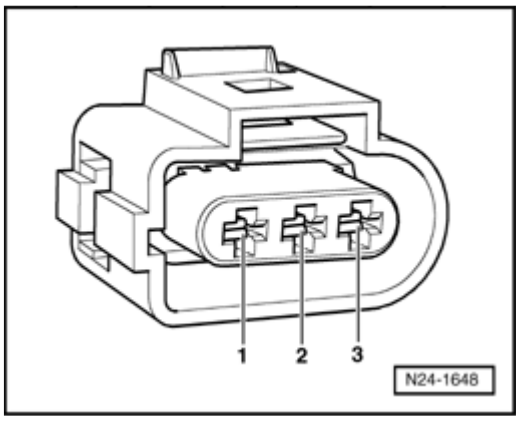

Fig. 71: Identifying 3-Pin Harness Connector Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the electrical harness connector terminals for voltage.

Intake Manifold Runner Position Sensor 2 G512 Electrical Harness Connector Terminal	Specified value
1 to Ground (GND)	about 5 V
2 to Ground (GND)	5 V or less
3 to Battery positive (+)	Battery positive (+)

If specified value is obtained:

- Replace the Intake Manifold Runner Position Sensor 2 G512. Refer to **24 - FUEL INJECTION SYSTEM** .

If specified value is not obtained:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

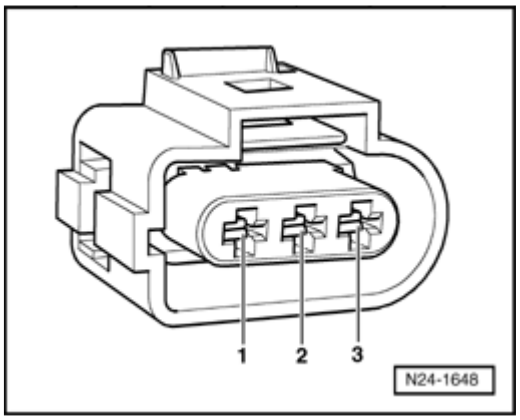

Fig. 72: Identifying 3-Pin Harness Connector Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.
- Using a Multimeter , check the following electrical harness connector terminals for an open circuit.

Intake Manifold Runner Position Sensor 2 G512 Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal
1	29
2	50
3	40

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are found in wires:

- Replace the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.

The Intake Manifold Runner Position Sensor 2 G512 must be adapted to the Engine Control Module (ECM) J623.

To adapt the Intake Manifold Runner Position Sensor 2 G512 to the Engine Control Module (ECM) J623 perform the following steps:

Test requirements

- The battery voltage at least 12.5 V.
- Coolant temperature must be between 20 C and 80 C.
- No DTCs stored in DTC memory.

- Start the engine and let run at idle for at least 70 Sec.
- The Engine Control Module (ECM) J623 will automatically adapt the Intake Manifold Runner Position Sensor 2 G512.
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Fuel Injectors, Checking

Fuel Injectors, Checking

The following test procedure is used to diagnose Fuel Injectors N30, N31, N32, N33, N83, and N84.

Special tools, testers and auxiliary items required

- Multimeter.
- Diode test lamp (12V).
- Wiring diagram.

Test requirements

- Fuses for engine electronics OK.
- Parking brake engaged.
- Battery voltage at least 12.5 V.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".

- All electrical consumers such as, lights and rear window defroster, switched off (radiator fan must not run during test).
- A/C switched off.
- The fuel tank at least 1/4 full.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

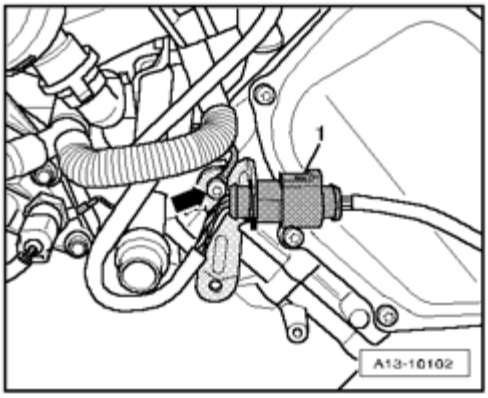

Fig. 73: Disconnecting Electrical Connector & Removing Bolt & Retainer For Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Right bank

- Disconnect the 6 pin electrical harness connector - **1** - for Fuel Injectors N30, N31, N32 from the right rear of the engine.

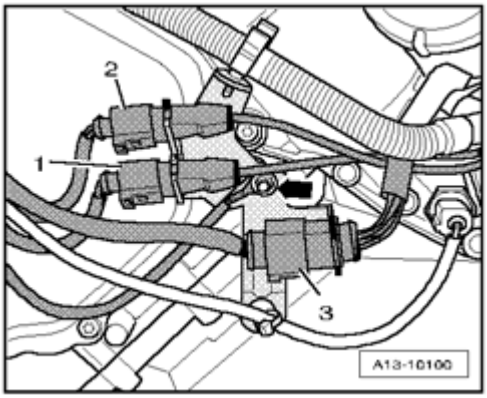

Fig. 74: Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Left bank

- Disconnect the 14 pin electrical harness connector **- 3 -** for Fuel Injectors N33, N83, N84 from the left rear of the engine.

Checking internal resistance

- Using a Multimeter , check the fuel injector electrical terminals for resistance.

Right bank

Fuel Injector	6- pin electrical harness connector terminals
N30	1 to 2
N31	3 to 4
N32	5 to 6

Left bank

Fuel Injector	14- pin electrical harness connector terminals
N33	5 to 6
N83	7 to 8
N84	9 to 10

Specified value: 12 to 13 ohms (at room temperature)

NOTE:

- **With an engine at operating temperature, the resistance of the fuel injectors increases by approx. 4 to 6 ohms.**

If the specified value is not obtained:

- Replace the faulty fuel injector. Refer to **24 - FUEL INJECTION SYSTEM** .

If the specified value is obtained:

Checking activation

- Connect a diode test lamp (12V) to the electrical harness connector terminals of the Fuel Injector to be tested.

Right bank

Fuel Injector	6- pin electrical harness connector terminals
N30	1 to 2
N31	3 to 4
N32	5 to 6

Left bank

Fuel Injector	14- pin electrical harness connector terminals
N33	5 to 6
N83	7 to 8
N84	9 to 10

- Operate the starter and test the activation of the Fuel Injector.

LED should flicker.

NOTE:

- **LEDs do not go out completely during low current pick-up between activations by the ECM, but rather continue to glow a little and then get slightly brighter during activation.**

- Switch the ignition off.

If LED flickers:

- Replace the faulty Fuel Injector. Refer to **24 - FUEL INJECTION SYSTEM** .

If LED does not flicker:

Checking voltage supply

- Using a Multimeter , check the Fuel Injector electrical harness connector terminal to ground (GND) for voltage.

Right bank

Fuel Injector	6 pin electrical harness connector terminal
N30	1
N31	3
N32	5

Left bank

Fuel Injector	14 pin electrical harness connector terminal
N33	5
N83	7
N84	9

- Operate the starter briefly.

Specified value: Battery voltage.

- Switch the ignition off.

If the specification is not obtained:

- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the wiring connection.

If no malfunctions are found in the wiring:

Checking wiring

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**

Right bank

Fuel injector	6 pin Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal or Test box Socket
N30	1	33
2	1	
N31	3	46
4	16	
N32	5	32
6	3	

Left bank

Fuel injector	14 pin Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal or Test box Socket
N33	5	31
6	18	
N83	7	47

8	17	
N84	9	48
10	2	

Using a Multimeter , check the Fuel Injector electrical harness connector terminals to the Engine Control Module (ECM) J623

Specified value: 1.5 ohms max

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are found in wiring:

- Replace the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

FUNCTIONS, CHECKING

Functions, Checking

The following table provides quick links.

--> **Heated Oxygen Sensor before Catalytic Converter, Checking**
--> **Heated Oxygen Sensor after Catalytic Converter, Checking**

Heated Oxygen Sensor before Catalytic Converter, Checking

Heated Oxygen Sensor before Catalytic Converter, Checking

This procedure is used to check both Heated Oxygen Sensors (HO2S) -G39-, -G108-

NOTE:

- **Use only gold-plated terminals when servicing terminals in the electrical harness connectors of the Heated Oxygen Sensor (HO2S) G39, G108.**

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuses for engine electronics OK.
- Battery voltage at least 12.5 V.
- All electrical consumers such as, lights and rear window defroster, switched off (radiator fan must NOT run during test).
- Ground (GND) connections between engine/transmission/chassis OK.
- Oxygen sensor heater OK.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- The exhaust system free of leaks.
- The parking brake engaged.
- The A/C switched off.
- The coolant temperature at least 80 C.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.
- Perform the function test in Diagnostic Mode 06. Refer to --> **Diagnostic Mode 06 - Checking Test Results of Components Not Continuously Monitored**.

If specified values are obtained:

- End diagnosis and switch the ignition off.

If the specified values are not obtained:

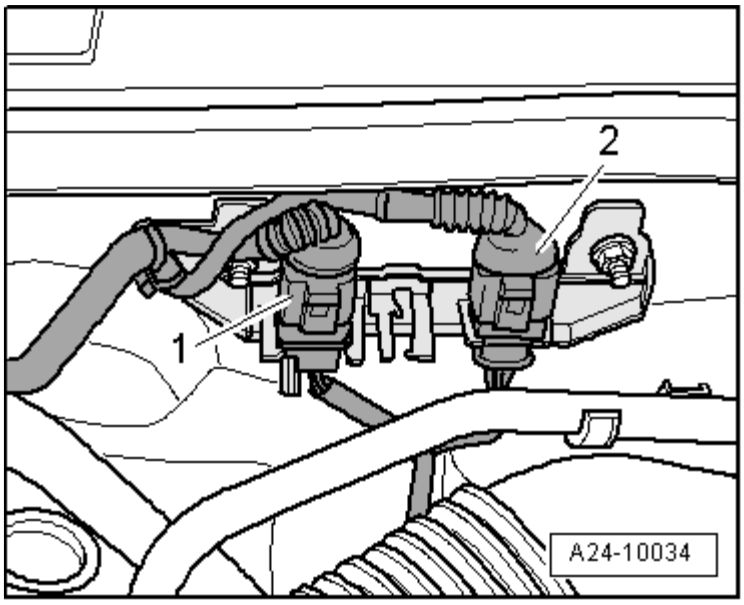

Fig. 75: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking primary voltage

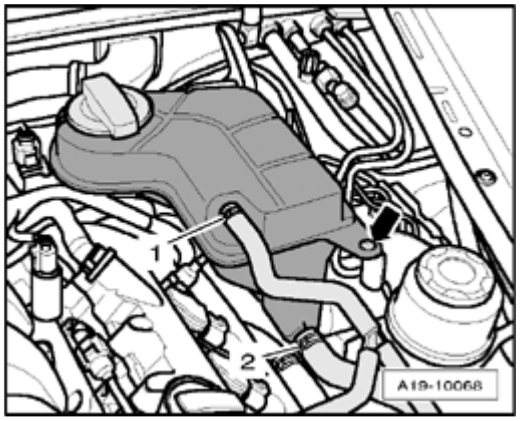

Fig. 76: Removing Coolant Hoses At Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the 6-pin electrical harness connector - **1** - from the Heated Oxygen Sensor (HO2S) -G39- and Oxygen Sensor (O2S) Heater -Z19- (bank 1, sensor 1).

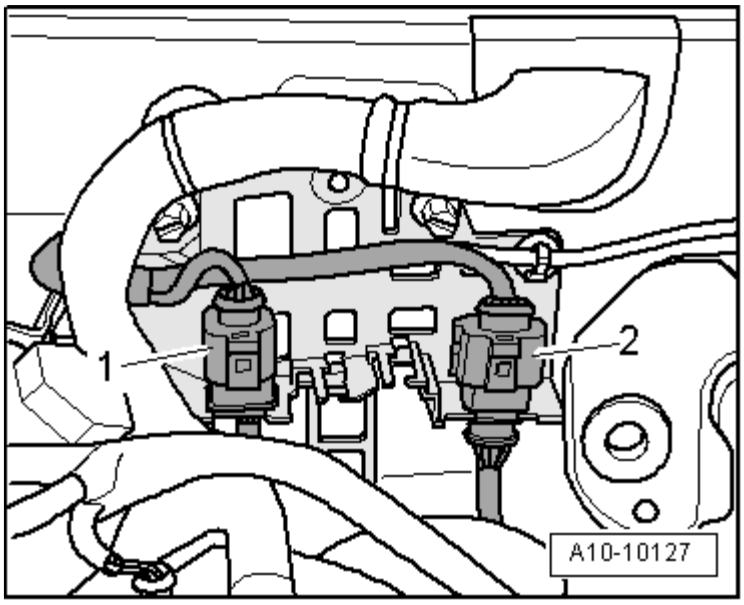

Fig. 77: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131
Courtesy of VOLKSWAGEN UNITED STATES, INC.

To test the Heated Oxygen Sensor (HO2S) -G108- (bank 2, sensor 1), perform the following steps:

- Remove the screw - **arrow** - retaining the coolant reservoir.
- Disconnect the electrical connector from Engine Coolant Level (ECL) Warning Switch F66 at the bottom of the coolant reservoir and set aside the coolant reservoir with the coolant hoses - **1** - and - **2** - connected.
- Disconnect the 6-pin electrical harness connector - **1** - from the Heated Oxygen Sensor (HO2S) -G108- and Oxygen Sensor (O2S) Heater -Z28- (bank 2, sensor 1).

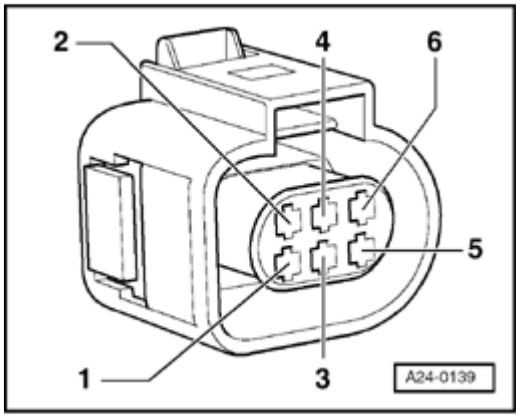

Fig. 78: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The test procedures for the Heated Oxygen Sensor (HO2S) -G39- are the same for the Heated Oxygen Sensor (HO2S) -G108-.

- Using a multimeter , check the Heated Oxygen Sensor (HO2S) G39 electrical harness connector terminals 4 to 6 for voltage.

Specified value: 0.400 to 0.500 V

- Switch the ignition off.

If the specified value was not obtained:

- Replace the Heated Oxygen Sensor (HO2S) G39. Refer to **24 - FUEL INJECTION SYSTEM** .

If the specified value was obtained:

Checking wiring

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.

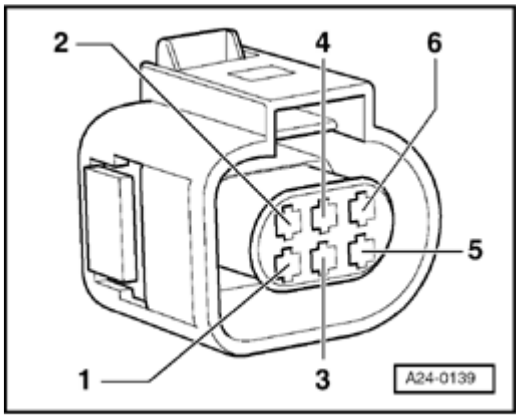

Fig. 79: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the Heated Oxygen Sensor (HO2S) 2 G108 electrical harness connector terminals to the Engine Control Module (ECM) J623 electrical harness connector terminals for resistance.

- Heated Oxygen Sensor (HO2S) -G39- (Bank 1, Sensor 1).

Heated Oxygen Sensor (HO2S) -G39- Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal or Test box Socket

1	83
2	61
3	51
4	82
6	84

- Heated Oxygen Sensor (HO2S) -G108- (Bank 2, Sensor 1).

Heated Oxygen Sensor (HO2S) -G108- Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal or Test box Socket
1	81
2	59
3	73
4	60
6	59

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are found in wiring:

- Replace Heated Oxygen Sensor (HO2S) -G139- or Heated Oxygen Sensor (HO2S) -G108-. Refer to **24 - FUEL INJECTION SYSTEM** .
- Erase the DTC memory. Refer to --> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to --> **Readiness Code**.

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**.
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.

2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Heated Oxygen Sensor after Catalytic Converter, Checking

Heated Oxygen Sensor after Catalytic Converter, Checking

This procedure is used to check both Heated Oxygen Sensors (HO2S) -G130-, -G131-

NOTE:

- **When servicing terminals in harness connector of oxygen sensor, use only gold-plated terminals.**

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuses for engine electronics OK.
- Battery voltage at least 12.5 V.
- All electrical consumers such as, lights and rear window defroster, switched off (radiator fan must NOT run during test).
- Ground (GND) connections between engine/transmission/chassis OK.
- Oxygen sensor heater OK.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- The exhaust system free of leaks.
- The parking brake engaged.
- The A/C switched off.
- The coolant temperature at least 80 C.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.
- Perform the function test in Diagnostic Mode 06. Refer to --> **Diagnostic Mode 06 - Checking Test Results of Components Not Continuously Monitored**.

If specified values are obtained:

- End diagnosis and switch the ignition off.

If the specified values are not obtained:

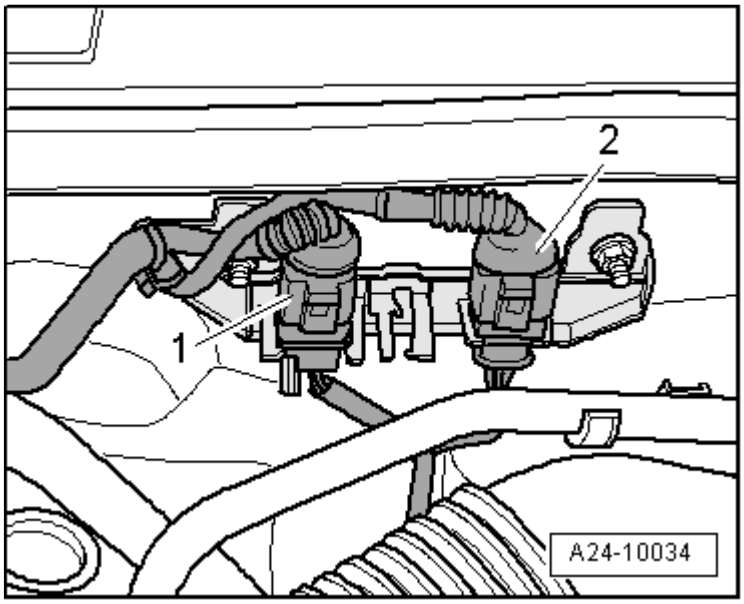

Fig. 80: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking primary voltage

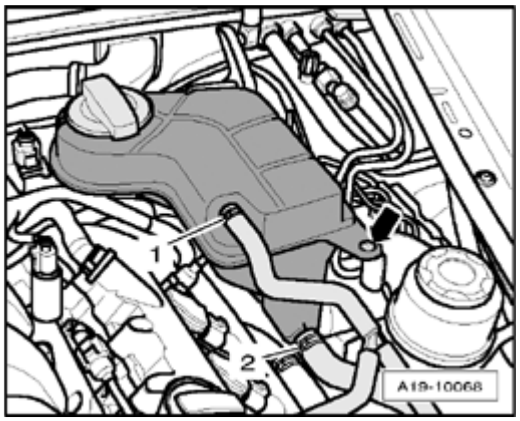

Fig. 81: Removing Coolant Hoses At Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the 4-pin electrical harness connector - **2** - from Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 and Oxygen Sensor (O2S) Heater -Z29- (bank 1, sensor 2).
- Remove the screw - **arrow** - retaining the coolant reservoir.

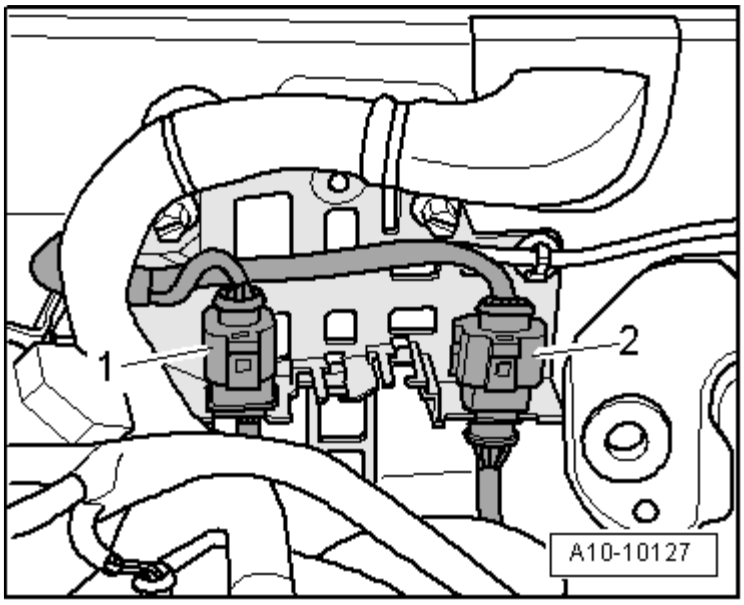

Fig. 82: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the electrical connector from Engine Coolant Level (ECL) Warning Switch F66 at the bottom of the coolant reservoir and set aside the coolant reservoir with the coolant hoses - **1** - and - **2** - connected.

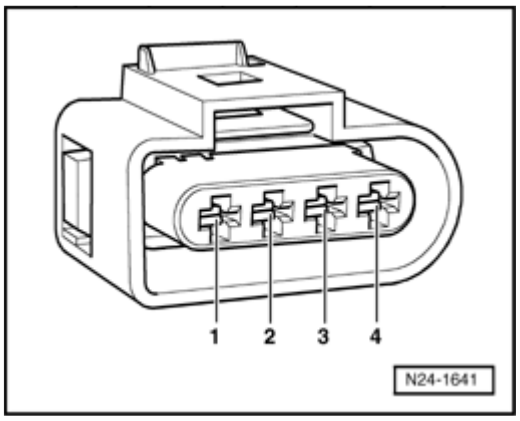

Fig. 83: Identifying 4-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the electrical 4-pin harness connector - **2** - from Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131 and Oxygen Sensor (O2S) Heater 2 (behind Three Way Catalytic Converter (TWC)) Z30 (bank 2, sensor 2).
- Using a Multimeter , check the electrical harness connector terminals 3 to 4 for voltage.
- Switch ignition on.

Specified value: 0.400 to 0.500 V

- Switch ignition off.

If specified value is obtained:

- Replace Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 or Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131. Refer to **24 - FUEL INJECTION SYSTEM** .

If specified value is not obtained:

Checking wiring

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**

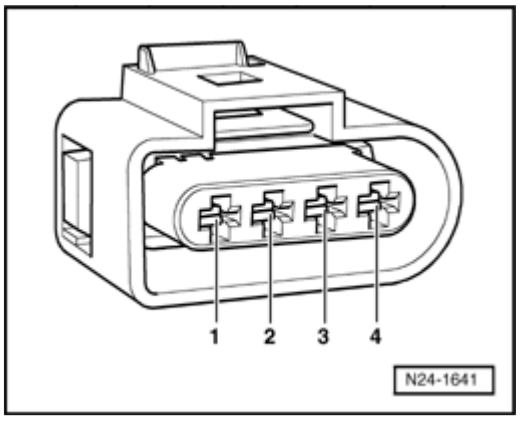

Fig. 84: Identifying 4-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Using a Multimeter , check the Heated Oxygen Sensor (HO2S) 2 G108 electrical harness connector terminals to the Engine Control Module (ECM) J623 electrical harness connector terminals for resistance.

- Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130

Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal or Test box Socket
2	75
3	76

4	77

- Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G131

Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G131 Electrical Harness Connector Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal or Test box Socket
2	91
3	54
4	55

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are found in wiring:

- Replace Heated Oxygen Sensor (HO2S) -G130- or Heated Oxygen Sensor (HO2S) -G131-. Refer to **24 - FUEL INJECTION SYSTEM** .
- Erase the DTC memory. Refer to --> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to --> **Readiness Code**.

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**.
- Assembly is performed in the reverse of the removal.

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

SIMOS CONTROL MODULE

SIMOS Control Module

The following table provides quick links.

--> **Engine Control Module Voltage Supply, Checking**
--> **Engine Control Module Power Supply Relay, Checking**
--> **Engine Control Module, Replacing**

Function

The Engine Control Module (ECM) J623 regulates fuel injection, Throttle Valve Control Module J338 , oxygen sensor regulation, ignition, knock control, Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 , engine speed limitation through fuel injectors or Fuel Pump (FP) Control Module J538 as well as On Board Diagnostics (OBD).

Engine Control Module Voltage Supply, Checking

Engine Control Module Voltage Supply, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuses SA14, SA15 and SA18 OK.
- Battery voltage at least 12.5 V.
- The Ground (GND) connections at the engine and transmission OK.
- The generator OK.
- The ignition is switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.

Checking voltage supply

Using a Multimeter , check the electrical harness connector terminals to the Engine Control Module (ECM) J623 electrical harness connector terminals for voltage.

Engine Control Module (ECM) J623 Electrical Harness Connector Terminal or Test Box Socket	Measure to
92	Engine Ground (GND)
69	Engine Ground (GND)

- Switch the ignition off.

Specified value: Battery voltage.

If the specified value was not obtained:

- Check the Engine Control Module (ECM) J623 electrical harness connector terminal 92 to the Engine Control Module (ECM) Power Supply Relay J363 terminal 3/86 for an open circuit or short to Ground (GND).
- Check the Engine Control Module (ECM) J623 electrical harness connector terminal 69 to Engine Control Module (ECM) Power Supply Relay J363 terminal 4/85 for an open circuit or short to Ground (GND).

If the specified values are not obtained:

- Check the electrical harness connectors for damage, corrosion, loose or broken terminals.
- If necessary, repair the wiring connection.

If no malfunctions are found in the wiring:

- Check the Engine Control Module (ECM) Power Supply Relay J363. --> **Engine Control Module Power Supply Relay, Checking**

Checking Ground (GND)

- Using a Multimeter , check the following wiring connections for resistance.

Engine Control Module (ECM) J623 Electrical Harness Connector Terminal or Test Box Socket	Measure to
1	Engine Ground (GND)
2	Engine Ground (GND)
4	Engine Ground (GND)

Specified value: 1.5 ohms max.

If any of the specified values are not obtained:

- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the wiring connection.

If no malfunctions are found in the wiring and the voltage supply was OK:

- Perform a road test to verify any electrical repairs.

If the fault does not return:

Repair complete, Generate readiness code. Refer to --> **Readiness Code**.

- End diagnosis.

If the fault does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**.
- Assembly is performed in the reverse of the removal.

After the repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Engine Control Module Power Supply Relay, Checking

Engine Control Module Power Supply Relay, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

NOTE:

- **The Engine Control Module (ECM) Power Supply Relay J363 supplies voltage to the ignition coils with power output stages and a few additional components. With the ignition switched on, 12 V must be present at the respective ignition coil connector, terminal 1.**

Test requirement

- Fuses SA14, SA15 and SA18 OK.
- Battery voltage at least 12.5 V.

- The Ground (GND) connections at the engine and transmission OK.
- The generator OK.
- The ignition is switched off.

Test procedure

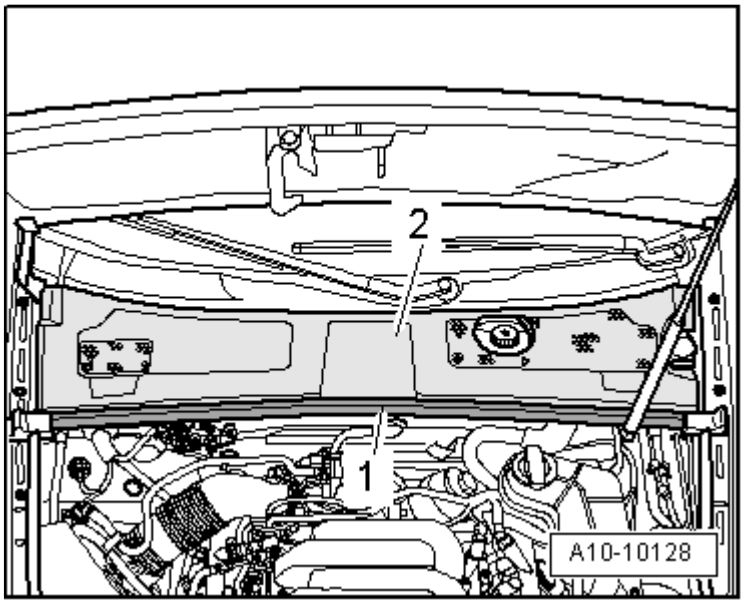

Fig. 85: Removing Rubber Seal For Plenum Chamber Cover & Plenum Chamber Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.
- Remove the rubber seal - **1** - from the plenum chamber cover.

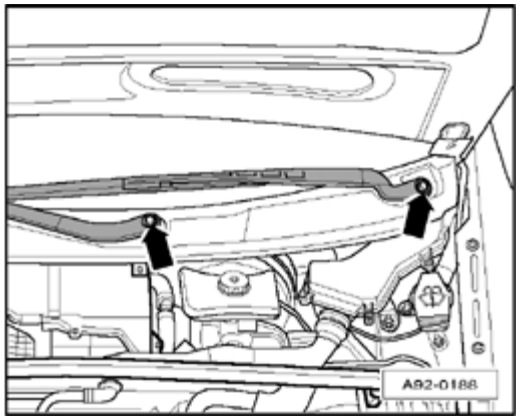

Fig. 86: Identifying Wiper Arm Nuts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the plenum chamber cover - **2** -.

- Using a screwdriver, remove the wiper arms caps - **arrows** -.
- Loosen the wiper arm nuts - **arrows** - several turns.
- Loosen wiper arms by gently rocking.

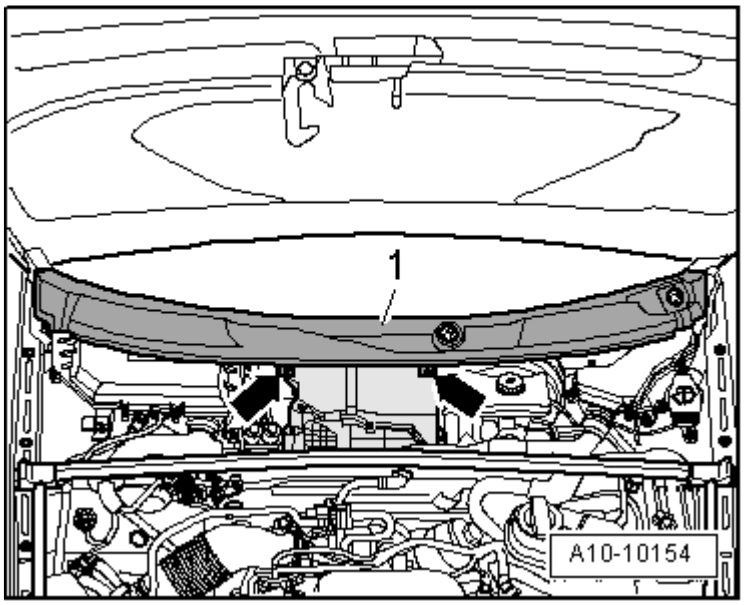

Fig. 87: Removing Bolts For Cowl Grill
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove wiper arm nuts and wiper arms.
- Remove the screws - **arrows** - retaining the cowl grill - **1** -.

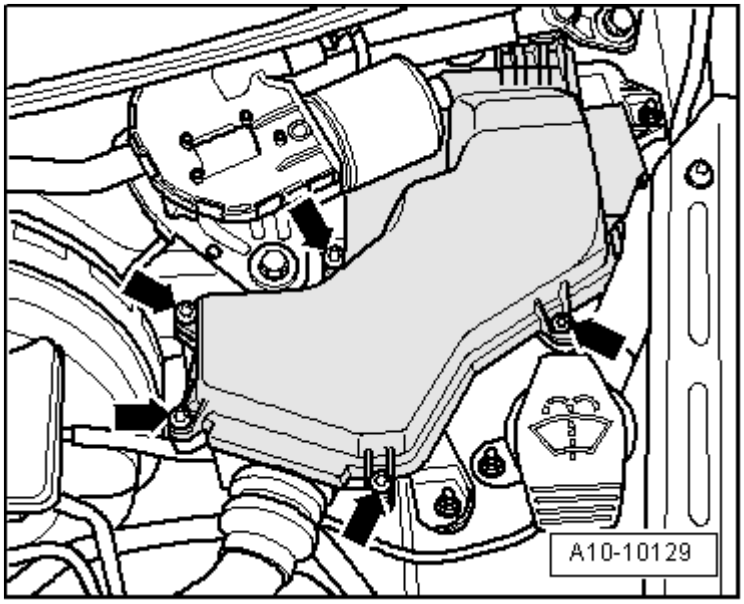

Fig. 88: Removing Bolts And Cover Form E-Box At Left In Engine Compartment
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the cowl grill from the windshield.

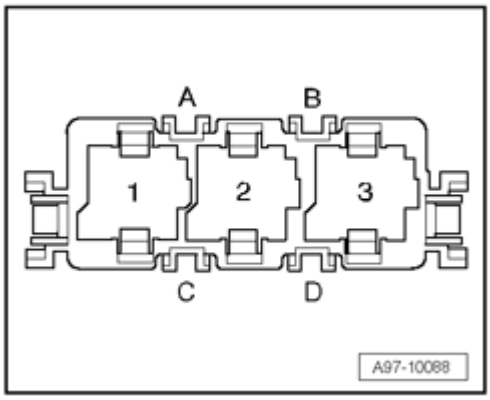

Fig. 89: Identifying Vehicles With MPI Engine: Fuel Pump (FP) Relay J17 In Relay And Fuse Carrier, In Left E-Box Is OK
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the screws - **arrows** - and electronics box cover from the electronics box.
- Remove the Engine Control Module (ECM) Power Supply Relay J363 - **3** - from the electronics box.

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**.

Checking voltage supply

- Switch the ignition on.

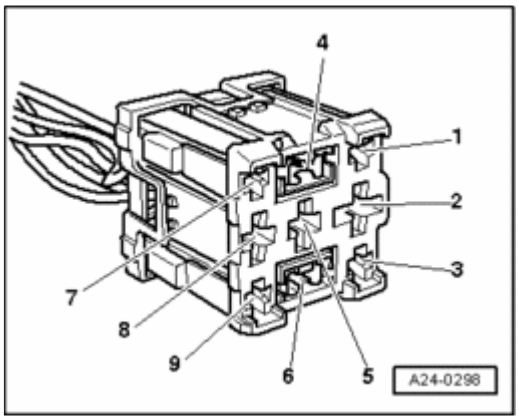

Fig. 90: Identifying Secondary Air Pump Relay Terminals

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Using a Multimeter , check the electrical harness connector terminals to the Engine Control Module (ECM) J623 electrical harness connector terminals for voltage.

Relay carrier (connector) position 3 Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal or Test Box Socket
4	69

Specified value: Battery voltage

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are found in the wiring:

- Using a Multimeter or equivalent, check the following wiring connections for voltage according to wiring diagram:

Relay carrier (connector) position 3 Terminal	Measure to
1	Engine Ground (GND)
2	Engine Ground (GND)

Switch the ignition off.

Specified value: Battery voltage.

If the specified value is not obtained:

- Check the wiring connections for an open circuit according to the wiring diagram.

Specified value: Wire resistance max 1.5 ohms.

If no malfunctions are found in the wiring:

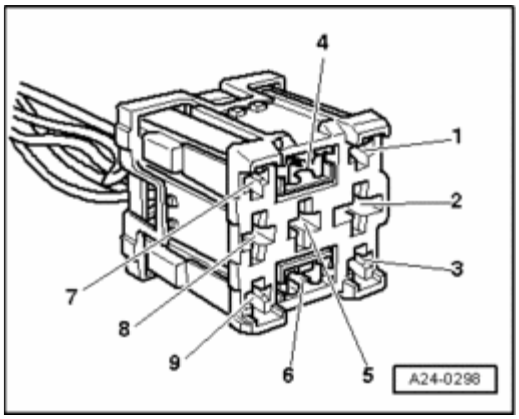

Fig. 91: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Checking wire connection

- Using a Multimeter , check the following wiring connections for resistance.

Relay Carrier (connector) Position 3 Terminal	Engine Control Module (ECM) J623 Electrical Harness Connector Terminal or Test Box Socket
2	3

Specified value: Wire resistance max 1.5 ohms

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the wiring connection.

If no malfunctions are detected:

- Replace the Engine Control Module (ECM) Power Supply Relay J363. Refer to **24 - FUEL INJECTION SYSTEM** .

Assembly is performed in the reverse order of the removal.

After the repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Engine Control Module, Replacing

Engine Control Module, Replacing

Engine Control Module (ECM) J623 Removal

Special tools, testers and auxiliary items required

- Heat gun

NOTE:

- **To achieve optimal anti-theft protection for the vehicle, an anti-theft immobilizer was installed. The anti-theft immobilizer is a system for enabling/locking the Engine Control Module (ECM) J623.**
- **So that this system cannot be circumvented, it is necessary to perform adaptation of the anti-theft immobilizer using the Vehicle Diagnosis Service Syst. VAS5052 in the On Board Diagnostic (OBD) function.**
- **The great availability of equipment options makes adaptation of the Engine Control Module (ECM) J623 necessary (e.g. cruise control system). This "writing" function is not possible with the generic scan tool, therefore it is necessary to use the Vehicle Diagnosis Service Syst. VAS5052 in On Board Diagnostic (OBD) function for this purpose.**
- **If the Engine Control Module (ECM) J623 must be replaced, the vehicle may be taken to the nearest Audi dealership**
- **When the electrical connector is disconnected from the Engine Control Module (ECM) -J623- , adaptation values are erased and content of the DTC memory remains intact.**

Check the identification of the previous Engine Control Module (ECM) J623 as follows:

- Connect the scan tool.
- Switch the ignition on.
- Using the scan tool, select "Vehicle information".
- Select " Calibration Identification" in vehicle information.

The electronic control module identification number will be displayed, e.g. 06A906032NA 4983

- Record the electronic control module identification number.

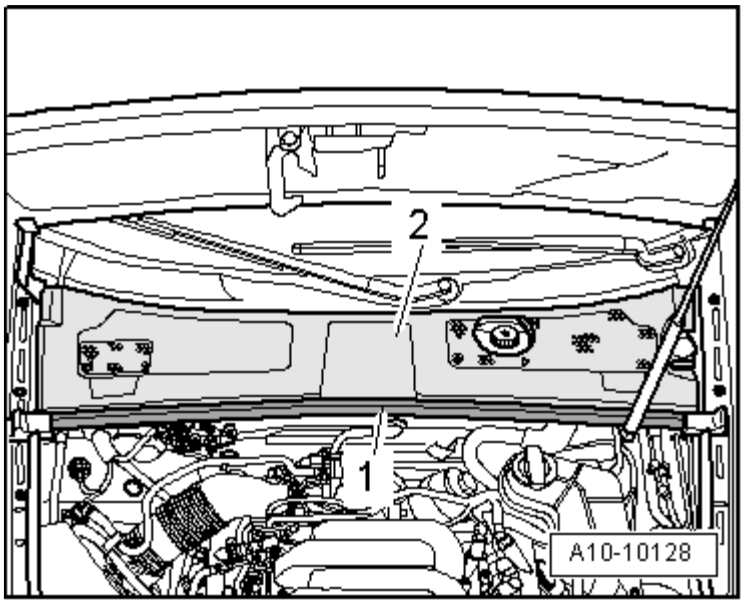

Fig. 92: Removing Rubber Seal For Plenum Chamber Cover & Plenum Chamber Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- End diagnosis and switch the ignition off.
- Remove the rubber seal - **1** - from the plenum chamber cover.

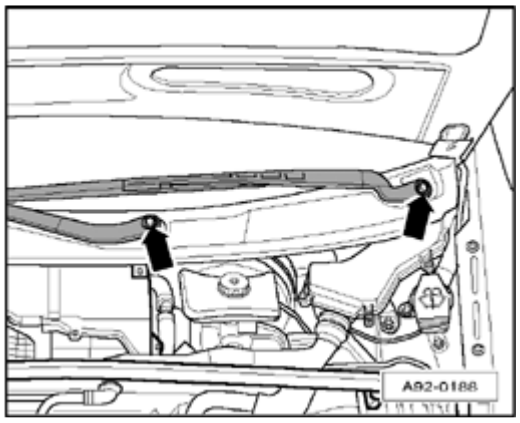

Fig. 93: Identifying Wiper Arm Nuts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the plenum chamber cover - **2** -.
- Using a screwdriver, remove the wiper arms caps - **arrows** -.
- Loosen the wiper arm nuts - **arrows** - several turns.
- Loosen wiper arms by gently rocking.

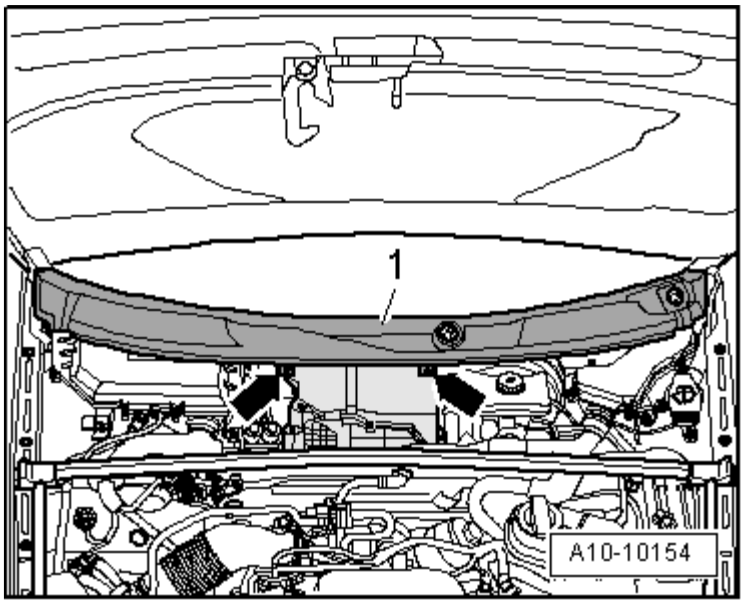

Fig. 94: Removing Bolts For Cowl Grill
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove wiper arm nuts and wiper arms.
- Remove the screws - **arrows** - retaining the cowl grill - **1** -.

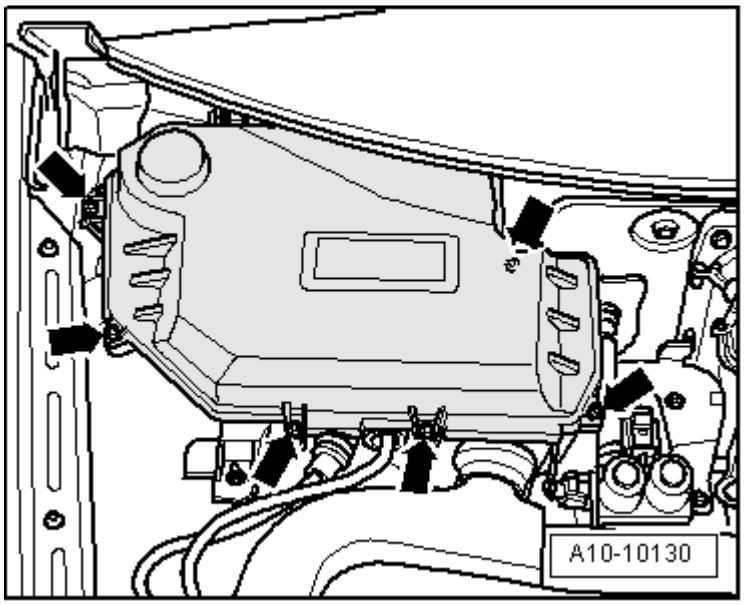

Fig. 95: Removing Bolts And Cover For E-Box At Right In Engine Compartment
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the cowl grill from the windshield.

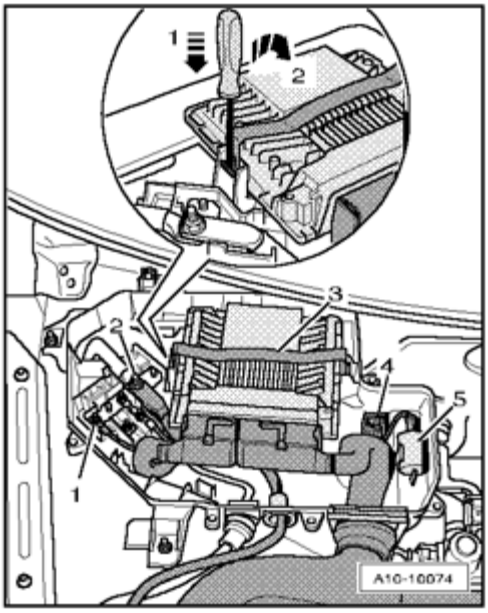

Fig. 96: Prying Off Retaining Clip With Screwdriver And Removing ECM From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the screws - **arrows** - and the electronics box cover from the electronics box.
- Using a screwdriver - **arrows 1 and 2** - , carefully remove the retaining clip - **2** -.

CAUTION: To prevent damages (burning) of wire and harness connections, insulation and control modules, perform the following work procedures exactly! Observe operating instructions for heat gun.

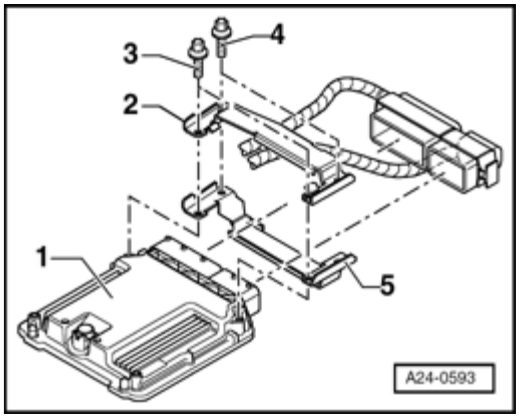

Fig. 97: Removing Protective Housing From Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **The threads of both shear bolts - 3 - , that are screwed into the ECM, are not coated with a locking compound. The threads in the ECM housing must not be heated and do not require to be heated (unintentional heating**

of the ECM).

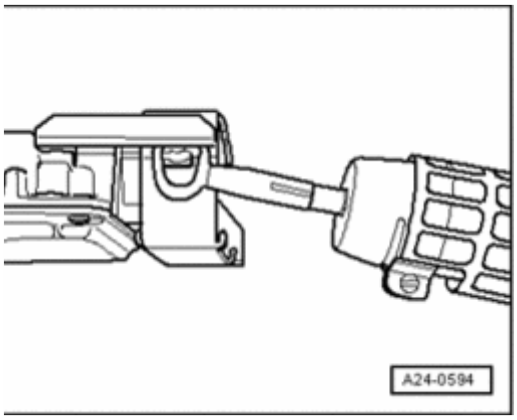

Fig. 98: Using Heat Gun To Direct Heat Gun Nozzle At Shear Bolt Of Retaining Tab
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using the heat gun , heat the shear bolts as follows:
- Direct the heat gun nozzle at the shear bolts of the protective housing.

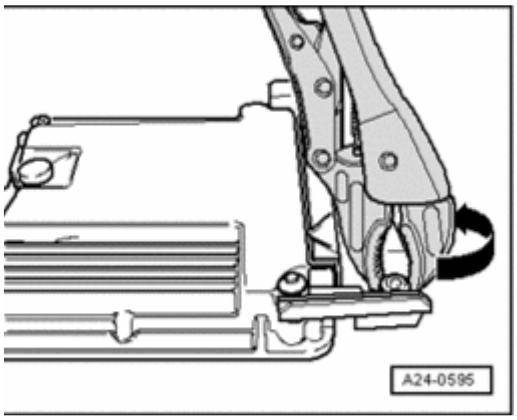

Fig. 99: Using Locking Pliers To Remove Shear Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Switch heat gun on and heat bolt for approx. 20 to 25 Sec.

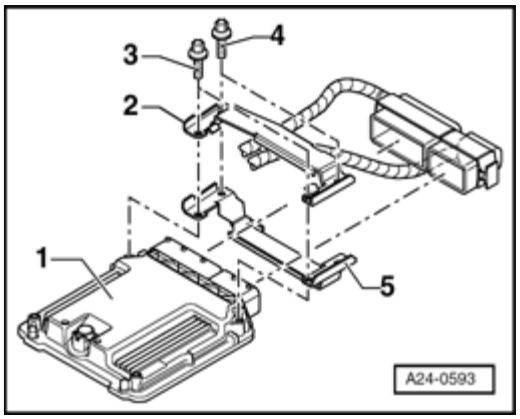

Fig. 100: Removing Protective Housing From Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove shear bolts with locking pliers - **arrow** -.
- Remove the electrical harness connector retaining brackets and the electrical harness connectors from the Engine Control Module (ECM) J623.
- Remove the Engine Control Module (ECM) J623.

Engine Control Module (ECM) J623 Installation

Installation is performed in reverse order of the removal. Note the following:

NOTE:

- **New shear bolts must be used when reinstalling the electrical harness connector retaining brackets to the Engine Control Module (ECM) J623.**

Engine Control Module (ECM) J623 reprogramming

- The new Engine Control Module (ECM) J623 and immobilizer must be activated.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

ADDITIONAL SIGNALS, CHECKING

Additional Signals, Checking

The following table provides quick links.

--> **Speed Signal, Checking**
--> **Can-Bus Terminal Resistance, Checking**

Speed Signal, Checking

Speed Signal, Checking

The following procedure requires a test drive. Observe all Safety Precautions.

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirement

- The function and display of the Speedometer OK.
- The Engine Control Module (ECM) J623 fuses OK.
- Battery voltage at least 12.5 V.
- All electrical consumers such as, lights and rear window defroster, switched off.
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.
- Connect the scan tool.
- Perform a road test with a vehicle speed greater than 5 Km/h.
- Using the scan tool, have an assistant observe the reading on the display:

Diagnostic text	Specified value
Vehicle Speed	Approx. Vehicle Speed

- Compare the vehicle speed on the scan tool to the Speedometer G21.

Specified value: a difference of no greater than 10%.

If the specified value was not obtained or no speed was displayed:

- End the diagnosis and switch ignition off.

If no speed is displayed:

The speed signal is transferred from the Engine Control Module (ECM) J623 to the instrument cluster through the wire connection or through the CAN-Bus, depending on version.

- Check the wiring connections.
- Check the terminal resistance for CAN-Bus Refer to --> **Can-Bus Terminal Resistance, Checking**

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.

Can-Bus Terminal Resistance, Checking

Can-Bus Terminal Resistance, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirement

- A CAN-Bus malfunction was recognized.
- The Engine Control Module (ECM) J623 fuses OK.
- Battery voltage at least 12.5 V.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Function

The Engine Control Module (ECM) communicates with other CAN-Bus capable control modules.

The control modules are connected by two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages). Missing information on the CAN-bus is recognized as a malfunction by the Engine Control Module (ECM) and the other control modules connected to the CAN-bus.

Trouble-free operation of the CAN-Bus requires that it have a terminal resistance. This central terminal

resistance is located inside the Engine Control Module (ECM).

If the CAN-Bus communication is interrupted. Communication from the scan tool to the Engine Control Module (ECM) may not be possible.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1 to the Engine Control Module (ECM) J623. Refer to **24 - FUEL INJECTION SYSTEM** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**.
- Using a Multimeter , check the central termination resistor by checking for resistance between terminals 58 and 60 of the Engine Control Module (ECM) J623.

Specified value: 60 to 72 ohms (at approx. 20 C)

If the specified value was not obtained:

- Replace the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**.

If the specified value was obtained:

Checking wiring

If the manufacturers test box is being used, perform the following step.

- Connect the Test Box 105 Pin VAG1598/42 with Adapter Cable 1598/39-1 to the Engine Control Module (ECM) J623 wiring harness connector. Refer to **24 - FUEL INJECTION SYSTEM** .

NOTE:

- **The Engine Control Module (ECM) J623 must remain disconnected for the following step.**

- Using a Multimeter , check the central termination resistor by checking for resistance between terminals 58 and 60 of the Engine Control Module (ECM) J623 electrical harness connector A (T81).

Engine Control Module (ECM) J623 electrical harness connector T81 terminals or test box sockets
58 (Can_Bus Low)
60 (Can_Bus High)

Specified value: 1.5 ohms Max.

If the specified value was not obtained:

- Check the wiring connection for an open circuit, short circuit to Battery (+) or Ground (GND).
- Check the wiring connection for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring:

- Erase the DTC memory. Refer to --> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to --> **Readiness Code**.

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Engine Control Module (ECM) J623. Refer to --> **Engine Control Module, Replacing**.

After repair work, the following work steps must be performed in the mentioned sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code**.