

24 - FUEL INJECTION SYSTEM

SIMOS FUEL INJECTION SYSTEM, SERVICING

Safety precautions

To reduce the risk of personal injury and/or damage to the fuel injection and ignition system, always observe the following:

CAUTION:

- Fuel system is under high pressure! Before opening high pressure components of the fuel injection system, pressure must be relieved to residual pressure --> Procedure that must be performed before opening the high-pressure fuel injection system - Pay close attention!
- Then wrap a clean rag around the connection and relieve residual pressure by carefully loosening the connection.
- The ignition must be switched off before connecting or disconnecting injection and ignition system wiring or tester cables.
- It is possible that the control module will recognize a malfunction and store a DTC during some tests. Therefore, when all tests and repairs are completed, the DTC memory must be checked and, if necessary, erased. After DTC memory is erased, a readiness code must be generated for the engine control module using operating mode "Guided Fault-Finding".
- Clean engine only with ignition switched off.

CAUTION:

- The battery must only be disconnected and connected with the ignition switched off, since the Engine Control Module (ECM) can otherwise be damaged.
- Observe safety precautions when disconnecting the battery --> 27 - STARTER, GENERATOR, CRUISE CONTROL .

Observe the following if test and measuring instruments are required during a test drive:

CAUTION:

- Test and measuring equipment must always be secured to the rear seat and be operated from there by a second person.
- If test and measuring instruments are operated from the front passengers seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

Rules of cleanliness for performing work on fuel injection system

Even minor contaminations can lead to malfunctions in the fuel injection system. When working on the fuel supply/injection system pay careful attention to the following rules of cleanliness:

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- Before loosening, connections and surrounding areas must be cleaned thoroughly with engine or brake cleaner, and then cleaned area must be dried completely.
- Plug open lines and connections immediately with appropriate protective caps.
- Place parts that have been removed on a clean surface and cover them. Do not use fluffy cloths!
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored unpackaged (e.g. in tool boxes etc.).
- When the system is open: Do not work with compressed air. Do not move vehicle unless absolutely necessary.

Procedure that must be performed before opening the high-pressure fuel injection system - Pay close attention!

- The fuel injection system is separated into a high-pressure section (max. approx. 110 bar) and a low-pressure section (approx. 6 bar).
- Before opening the high-pressure section - e.g. removing the high-pressure pump, fuel rail, fuel injectors, the motor for intake manifold runner control valve or any other component or fuel line that is located in the high-pressure section of the fuel injection system - the fuel pressure in the high-pressure section must be relieved to a residual pressure of approx. 8 bar. The procedure for this is as follows.

Special tools, testers and auxiliary items required

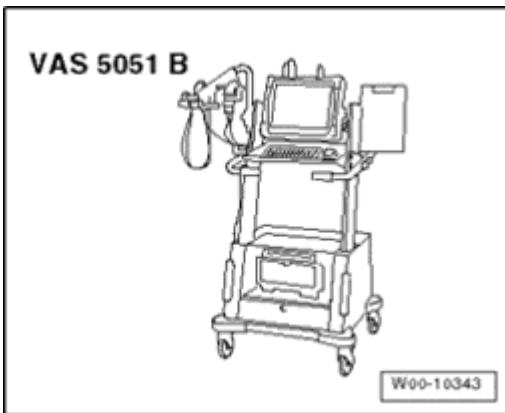


Fig. 1: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051B

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Vehicle Diagnostic, Testing and Information System VAS 5051 with Diagnostic Cable VAS 5051/5A (VAS 5051 B version shown as example only)

Work procedure

- Start engine and run at idle speed.

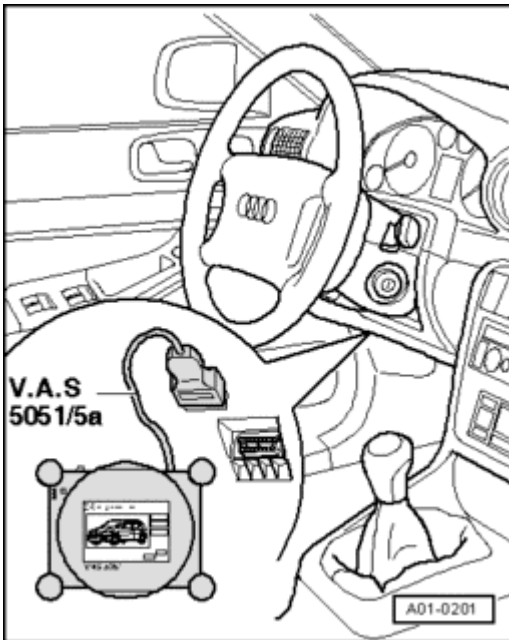


Fig. 2: Connecting Data Link Connector (DLC)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect Vehicle Diagnosis, Testing and Information System VAS 5051 with Diagnostic Cable VAS 5051/5A.

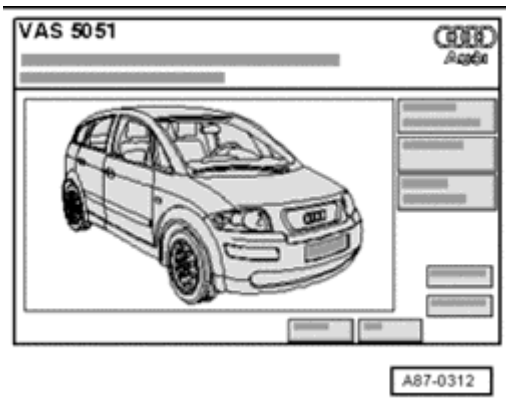


Fig. 3: Diagnostic System VAS 5051: Display

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

- Click on Vehicle Self-Diagnosis button.

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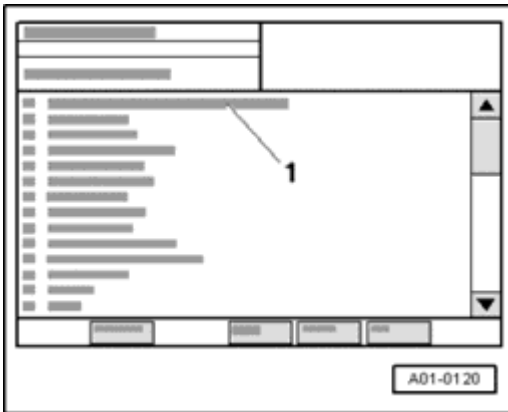


Fig. 4: Diagnostic System VAS 5051: Display - "01 - Engine Electronics"
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

- In selection - **1** - , press vehicle system "01 - Engine electronics".
- Wait until next display appears.

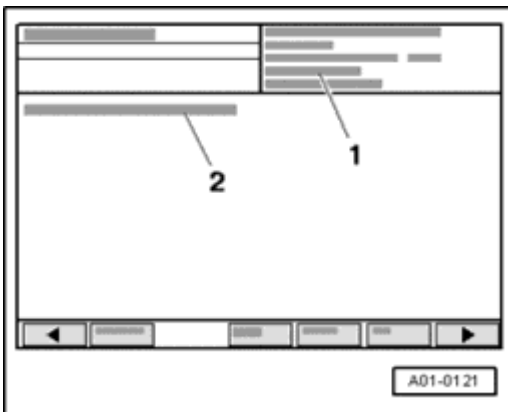


Fig. 5: VAS 5051 Tester Displaying Control Module Identification And Coding
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

1 - Control module identification of engine control module (ECM)

- Click on --> button.

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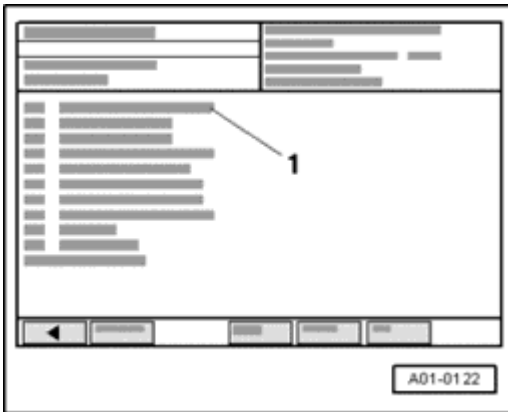


Fig. 6: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

1 - Selection of diagnostic functions

- In selection - 1 - , press diagnostic function "04- Basic Setting".

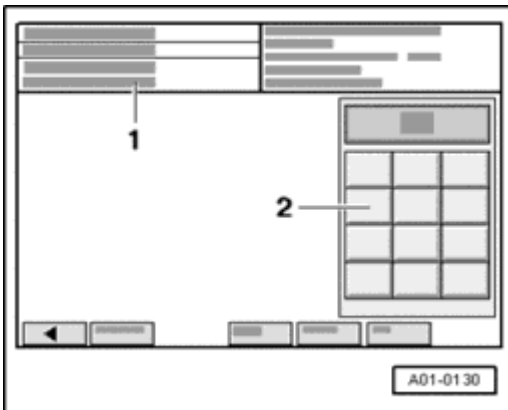


Fig. 7: Diagnostic System VAS 5051: Display - Display Group And Key Pad
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

- Select "140" in button field - 2 - for "display group 140" and confirm input by pressing Q button.

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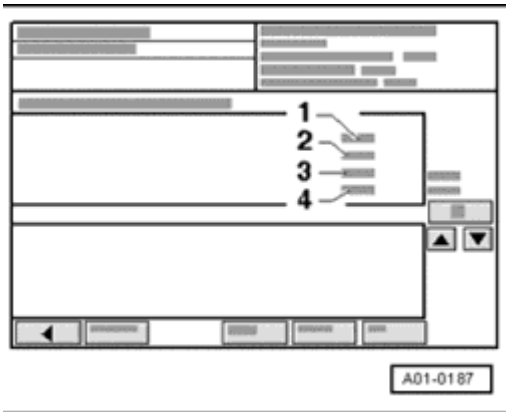


Fig. 8: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS 5051 :

Example:

1. 42%
2. 39.76 bar
3. 40.63 bar
4. Inactive

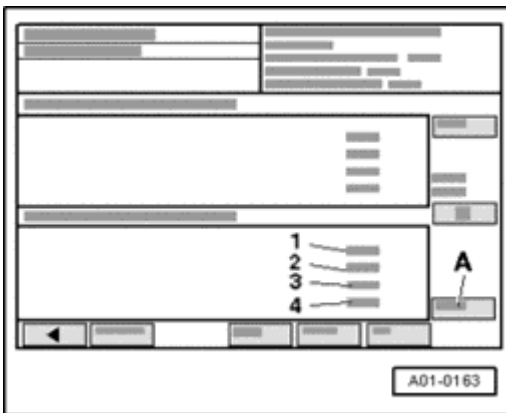


Fig. 9: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Activate basic setting by pressing button A.

Display on VAS 5051 :

Example:

1. 0%

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3. 5.46 bar
4. Lower

The fuel rail will continue to be filled with fuel, but it will no longer be under high pressure.

Now components or lines can be opened. A clean rag must be placed around connection points. Escaping fuel must be absorbed.

- In operating mode "Guided Fault-Finding" , generate readiness code for engine control module (ECM).

Technical data

Engine code	BKH (3.2 l / 4V / 188 kW engine)
Idle speed ¹⁾	650 to 750/min
Fuel pressure before high-pressure pump	approx. 6 bar positive pressure
Fuel pressure after high-pressure pump	approx. 35 bar positive pressure
• ¹⁾ Not adjustable.	

Component locations, overview

Engine compartment, right

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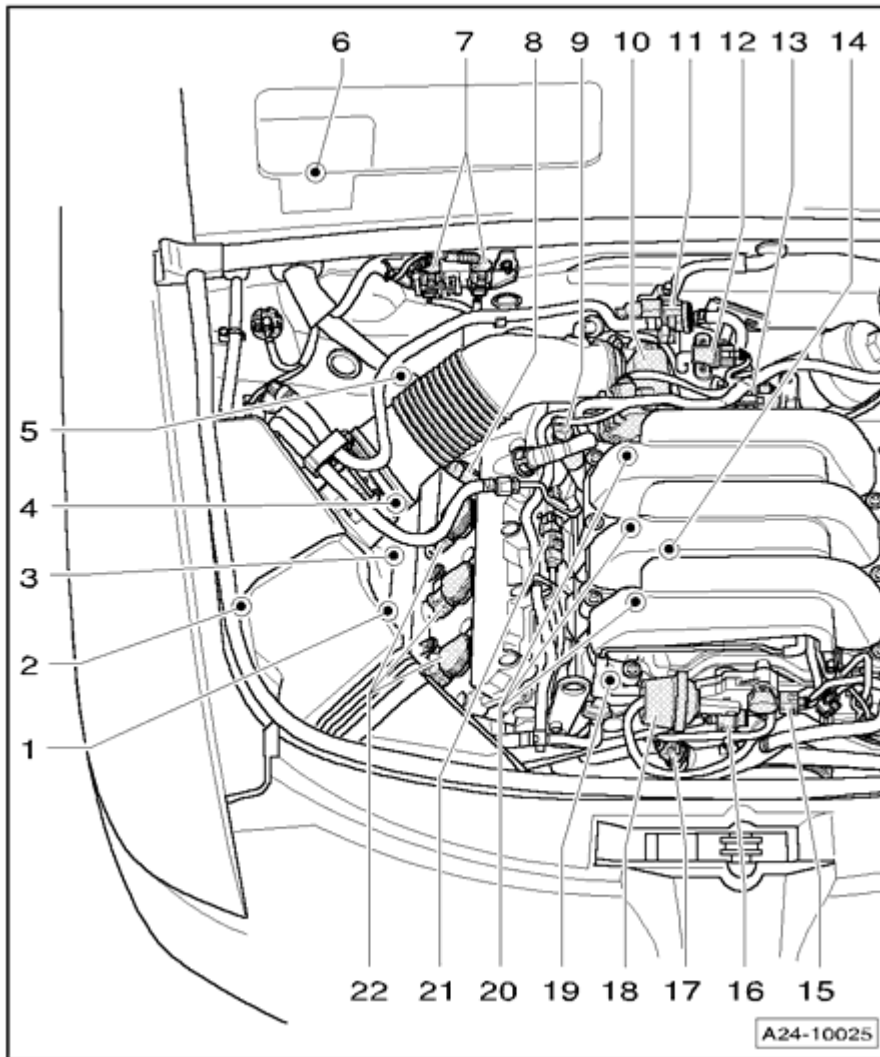


Fig. 10: Component Locations, Overview - Engine Compartment, Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Right Electro-Hydraulic Engine Mount Solenoid Valve N145

- Component location --> **Leak Detection Pump (LDP) N144 or Right Electro-Hydraulic Engine Mount Solenoid Valve N145 installation location**

2 - Intake air switch-over valve N335

- Component location --> **Location Intake Air Switch-Over valve N335**

3 - Camshaft position (CMP) sensor 3 G300

- Component location **Hall sensor and valve for camshaft adjustment, bank 1**

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- Component location Oxygen sensors location, cylinder bank 1 (right)
- Connector location Right holder for connectors on bulkhead
- Removing and installing --> Oxygen sensor before catalytic converter, bank 1 (right side), removing and installing

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

- Component location Oxygen sensors location, cylinder bank 1 (right)
- Connector location Right holder for connectors on bulkhead
- Removing and installing --> Oxygen sensor behind catalytic converter, bank 1 (right side), removing and installing

6 - SIMOS Control Module J361

- Component location --> Component location SIMOS Control Module J361
- Removing and installing --> Engine Control Module (ECM), removing and installing
- After replacement, adapt throttle valve control module in operating mode "Guided Fault-Finding" in "Adapting throttle valve control module"
- After replacement on vehicles with automatic transmissions, also perform kick-down adaptation in operating mode "Guided Fault-Finding" in "Kick-down adaptation"

7 - Right holder for connectors

- Connector locations Right holder for connectors on bulkhead

8 - Camshaft Adjustment Valve 1 (exhaust) N318

- Component location Hall sensor and valve for camshaft adjustment, bank 1

9 - Camshaft Adjustment Valve 1 N205

- Component location Hall sensor and valve for camshaft adjustment, bank 1

10 - Throttle valve control module J338

- After replacement, adapt in operating mode "Guided Fault-Finding" in "Adapting throttle valve control module"

11 - Evaporative Emission (EVAP) Canister Purge Solenoid Valve N80

12 - Intake Air Temperature (IAT) Sensor G42/Manifold Absolute Pressure (MAP) Sensor G71

- Component location Component location on rear of intake manifold

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Component location **Component location on rear of intake manifold**

14 - Knock sensor 1 G61

- Component location **Component location under intake manifold, cylinder bank 1 (right)**
- Connector location **Electrical connectors on left rear of engine**

15 - Intake Manifold Tuning (IMT) Valve Position Sensor G513

- Component location **Component location front on engine**

16 - Change-over valve for intake manifold flap N239

- Component location **Component location front on engine**

17 - Engine Coolant Temperature (ECT) Sensor G62

- Component location **Component location front on engine**

18 - Actuator for intake manifold change-over

19 - Intake Manifold Runner Position Sensor G336

- Component location **Component location under intake manifold, cylinder bank 1 (right)**
- After replacing, adapt in "Guided Fault Finding" operating mode under "Adapting intake manifold runner position sensor"

20 - Fuel injectors, Cylinder bank 1

- Cylinder 1 Fuel Injector N30
- Cylinder 2 Fuel Injector N31
- Cylinder 3 Fuel Injector N32
- Removing and installing --> **Fuel injectors, removing and installing**

21 - Camshaft Position (CMP) sensor G40

- Component location **Hall sensor and valve for camshaft adjustment, bank 1**

22 - Ignition coils, Cylinder bank 1

- Ignition Coil 1 with Power Output Stage N70
- Ignition Coil 2 with Power Output Stage N127
- Ignition Coil 3 with Power Output Stage N291
- Removing and installing --> **Ignition coils, removing and installing**

Engine compartment, left

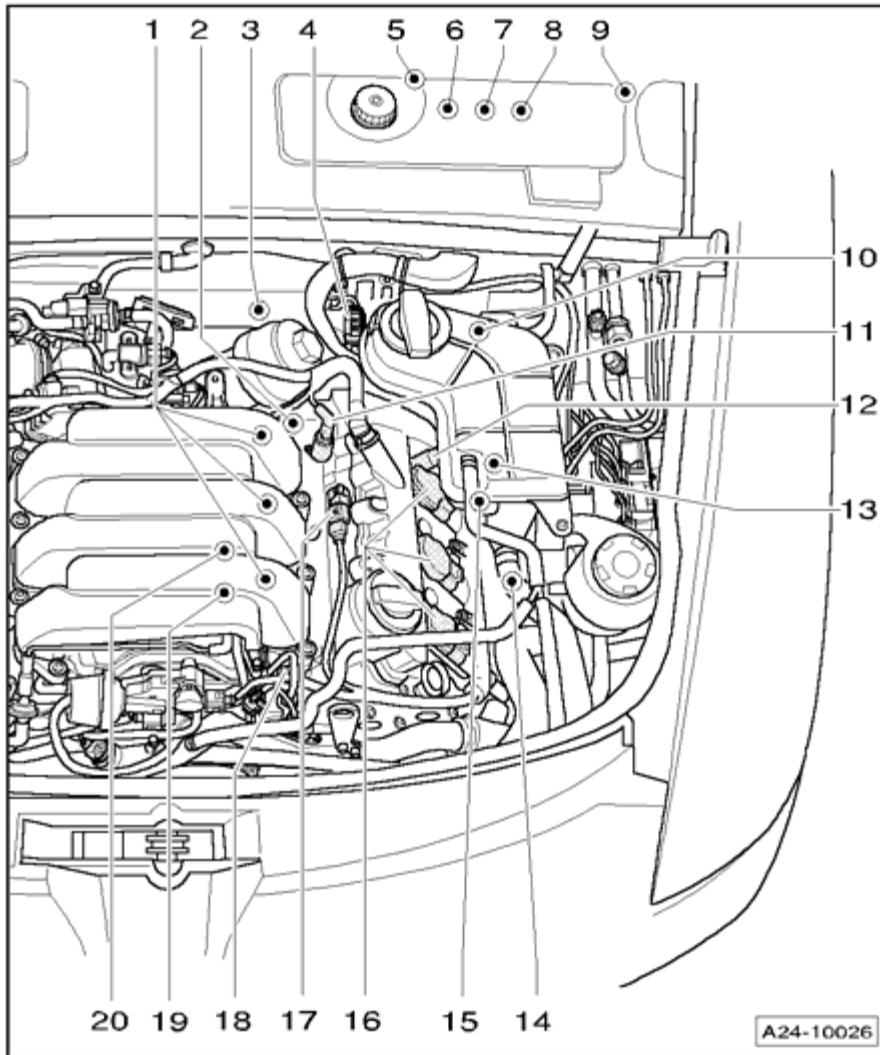


Fig. 11: Component Locations, Overview - Engine Compartment, Left
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Fuel injectors, Cylinder bank 2

- Cylinder 4 Fuel Injector N33
- Cylinder 5 Fuel Injector N83
- Cylinder 6 Fuel Injector N84
- Removing and installing --> **Fuel injectors, removing and installing**

2 - Intake Manifold Runner Position Sensor 2 G512

- Component location **Component location under intake manifold, cylinder bank 2 (left)**

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position sensor"

3 - Engine speed (RPM) sensor G28

- Component location --> **Location Engine Speed (RPM) Sensor G28**

4 - Left holder for connectors

- Connector locations **Left holder for connectors on bulkhead**

5 - Instrument cluster

- With Malfunction Indicator Lamp (MIL) K83 and Electronic Power Control (EPC) Warning Lamp K132

6 - Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185

- In accelerator pedal module, component location --> **Location Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185**

7 - Brake light switch F/Brake pedal switch F47

- Component location --> **Component location Brake Light Switch F/Brake Pedal Switch F47, Clutch Pedal Starter Interlock Switch F194 and Clutch Position Sensor G476**

8 - Clutch Pedal Starter Interlock Switch F194 and Clutch Position Sensor G476

- Component location --> **Component location Brake Light Switch F/Brake Pedal Switch F47, Clutch Pedal Starter Interlock Switch F194 and Clutch Position Sensor G476**

9 - Relay box

10 - Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131

- Component location **Oxygen sensors location, cylinder bank 2 (left)**
- Connector location **Left holder for connectors on bulkhead**

11 - Camshaft Adjustment Valve 2 N208

Component location **Hall sensor and valve for camshaft adjustment, bank 2**

12 - Camshaft Adjustment Valve 2 (exhaust) N319

- Component location **Hall sensor and valve for camshaft adjustment, bank 2**

13 - Heated Oxygen Sensor (HO2S) 2 G108

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- Component location Oxygen sensors location, cylinder bank 2 (left)
- Connector location Left holder for connectors on bulkhead

14 - Left Electro-Hydraulic Engine Mount Solenoid Valve N144

- Component location --> Leak Detection Pump (LDP) N144 or Right Electro-Hydraulic Engine Mount Solenoid Valve N145 installation location

15 - Camshaft position (CMP) sensor 4 G301

- Component location Hall sensor and valve for camshaft adjustment, bank 2

16 - Ignition coils, Cylinder bank 2

- Ignition Coil 4 with Power Output Stage N292
- Ignition Coil 5 with Power Output Stage N323
- Ignition Coil 6 with Power Output Stage N324
- Removing and installing --> Ignition coils, removing and installing

17 - Camshaft position (CMP) sensor 2 G163

- Component location Hall sensor and valve for camshaft adjustment, bank 2

18 - High pressure pump

- With Low Fuel Pressure Sensor G410 and Fuel Metering Valve N290
- Component location:
 - Older version Location on high pressure pump - older version
 - New version --> Component location Low Fuel Pressure Sensor G410 - new version

19 - Fuel Pressure Sensor G247

- Component location Component location under intake manifold, cylinder bank 2 (left)

20 - Knock sensor 2 G66

- Component location Component location under intake manifold, cylinder bank 2 (left)
- Connector location Electrical connectors on left rear of engine

Component location SIMOS Control Module J361

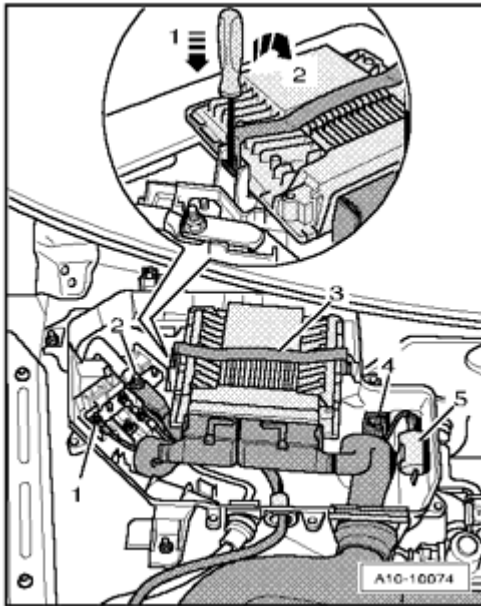


Fig. 12: Prying Off Retaining Clip With Screwdriver And Removing ECM From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In E-box in engine compartment, right

Location Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185

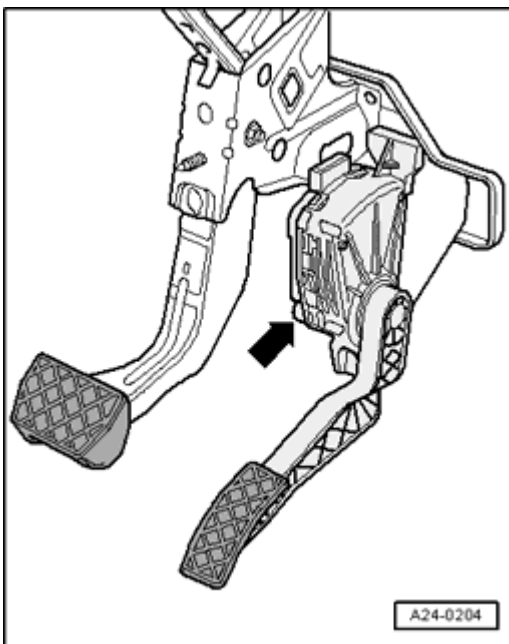


Fig. 13: Location Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In accelerator pedal module - **arrow** -.

NOTE:

- The Throttle Position (TP) Sensor G79 and Accelerator Pedal Position Sensor 2 G185 are integrated in the gas pedal module and cannot be replaced individually.

Component location Brake Light Switch F/Brake Pedal Switch F47 , Clutch Pedal Starter Interlock Switch F194 and Clutch Position Sensor G476

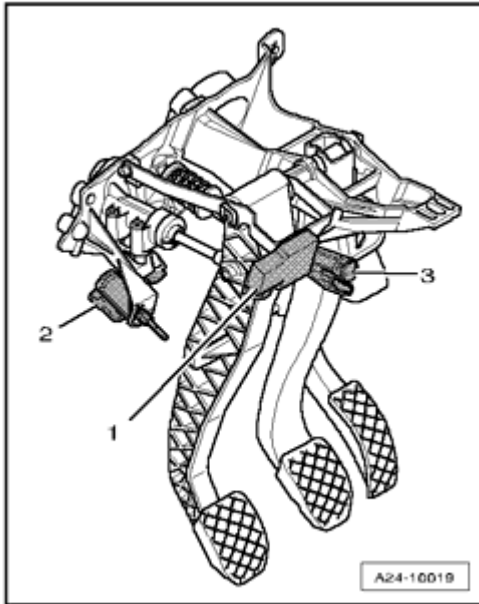


Fig. 14: Component Location Brake Light Switch F/Brake Pedal Switch F47 , Clutch Pedal Starter Interlock Switch F194 And Clutch Position Sensor G476

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- On pedal bracket.
1. Clutch Position Sensor G476
 2. Clutch Pedal Starter Interlock Switch F194
 3. Brake light switch F/Brake pedal switch F47

Right holder for connectors on bulkhead

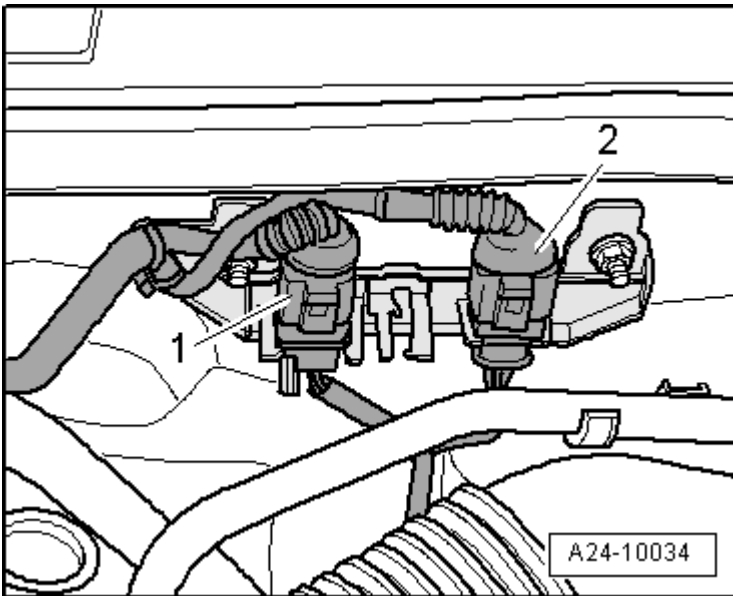


Fig. 15: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. To Heated Oxygen Sensor (HO2S) G39
2. To Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130

Left holder for connectors on bulkhead

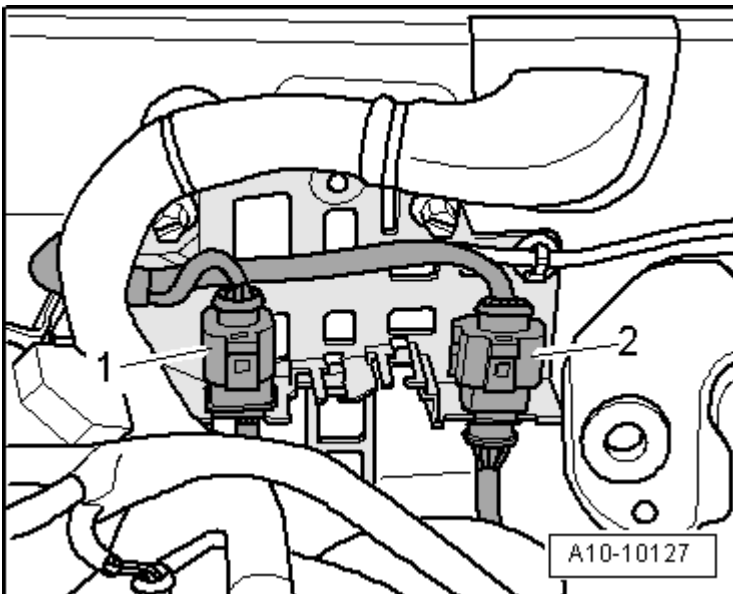


Fig. 16: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. To Heated Oxygen Sensor (HO2S) 2 G108
2. To Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131

Oxygen sensors location, cylinder bank 1 (right)

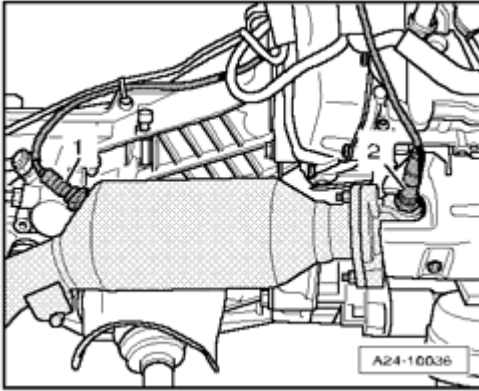


Fig. 17: Removing Oxygen Sensor Using Ring Spanner Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
2. Oxygen sensor G39

Oxygen sensors location, cylinder bank 2 (left)

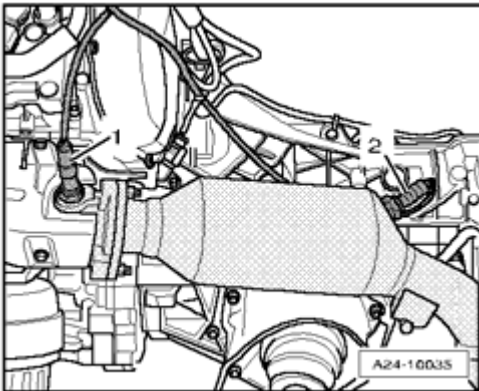


Fig. 18: Removing Oxygen Sensor Using Ring Spanner Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Heated Oxygen Sensor (HO2S) 2 G108
2. Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131

Electrical connectors on right rear of engine

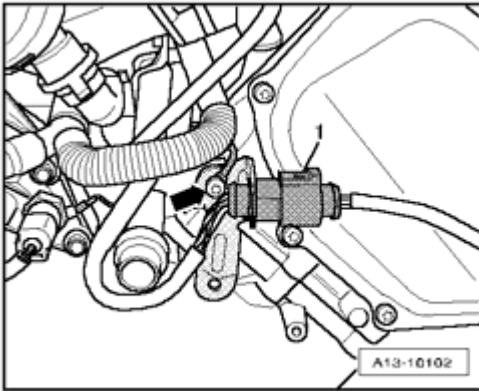


Fig. 19: Electrical Connectors On Right Rear Of Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. To fuel injectors, cylinder bank 1

NOTE: • - Arrow - indicates Ground (GND) point

Electrical connectors on left rear of engine

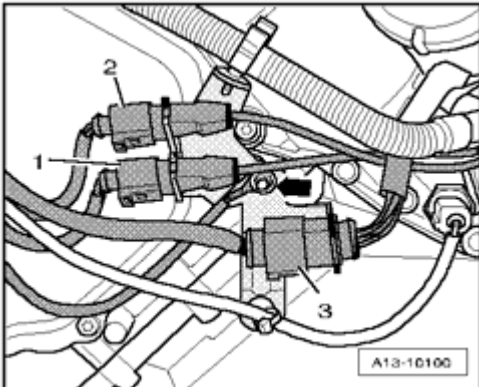


Fig. 20: Electrical Connectors On Left Rear Of Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Green; to Knock Sensor (KS) 1 G61
2. Grey; to Knock sensor (KS) 2 G66
3. To cylinder bank 2 fuel injectors and to Fuel Pressure Sensor G247

NOTE: • - Arrow - indicates Ground (GND) point

Hall sensor and valve for camshaft adjustment, bank 1

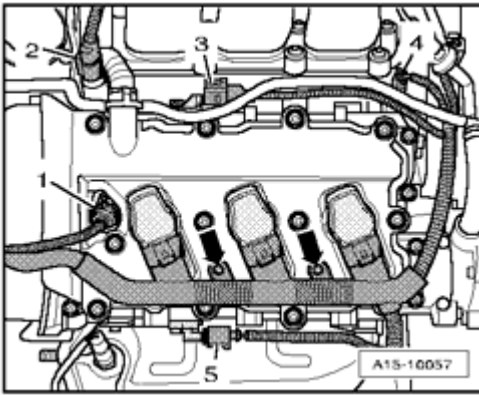


Fig. 21: Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Camshaft Adjustment Valve 1 (exhaust) N318
2. Camshaft Adjustment Valve 1 N205
3. Camshaft Position (CMP) sensor G40
4. Intake Manifold Runner Position Sensor G336
5. Camshaft position (CMP) sensor 3 G300

NOTE: • Ignore - arrows -.

Hall sensor and valve for camshaft adjustment, bank 2

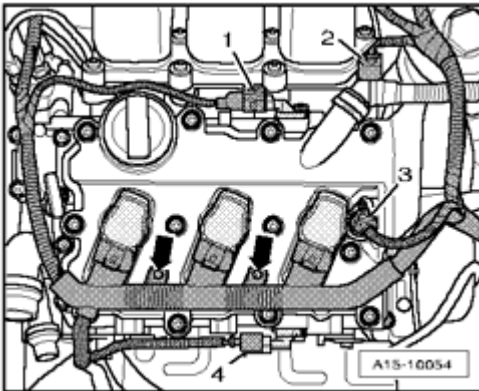


Fig. 22: Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Camshaft position (CMP) sensor 2 G163
2. Camshaft Adjustment Valve 2 N208
3. Camshaft Adjustment Valve 2 (exhaust) N319
4. Camshaft position (CMP) sensor 4 G301

NOTE:

- Ignore - arrows -.

Component location front on engine

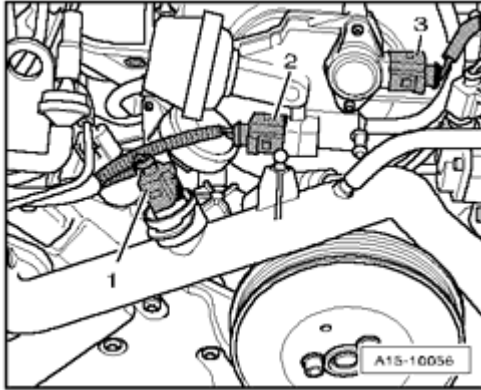


Fig. 23: Disconnecting Electrical Connectors At Engine Coolant Temperature (ECT) Sensor G62 And Intake Manifold Flap Change-Over Valve N239
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Engine Coolant Temperature (ECT) Sensor G62
2. Change-over valve for intake manifold flap N239
3. Intake Manifold Tuning (IMT) Valve Position Sensor G513

Component location on rear of intake manifold

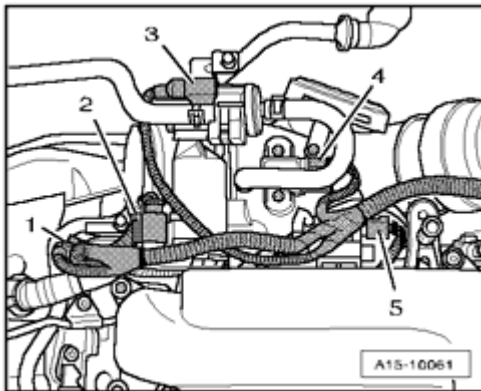


Fig. 24: Identifying Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Camshaft Adjustment Valve 1 N205
2. Throttle valve control module J338
3. Evaporative Emission (EVAP) Canister Purge Solenoid Valve N80
4. Intake Air Temperature (IAT) Sensor G42/Manifold Absolute Pressure (MAP) Sensor G71

5. Intake Manifold Runner Control (IMRC) Valve N316

Location on high pressure pump - older version

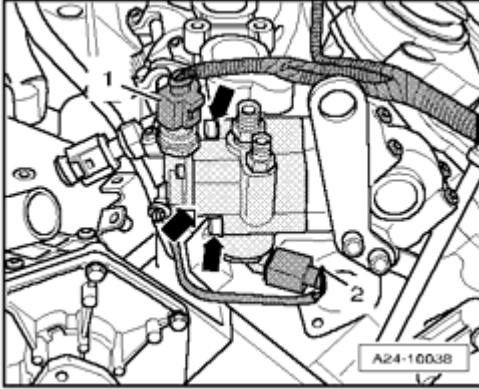


Fig. 25: Disconnecting Electrical Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Low Fuel Pressure Sensor G410
2. Fuel Metering Valve N290

NOTE: • Ignore - arrows -.

Component location Low Fuel Pressure Sensor G410 - new version

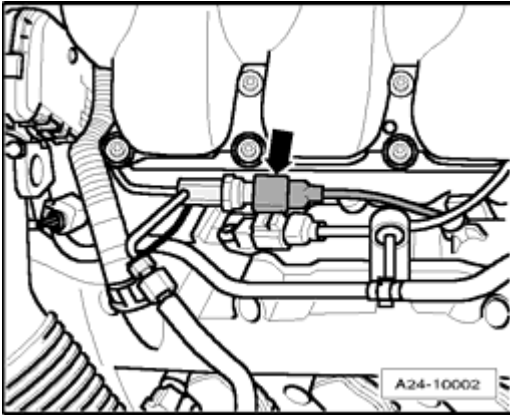


Fig. 26: Component Location Low Fuel Pressure Sensor G410 - New Version
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- On right cylinder head - arrow -.

Leak Detection Pump (LDP) N144 or Right Electro-Hydraulic Engine Mount Solenoid Valve N145 installation location

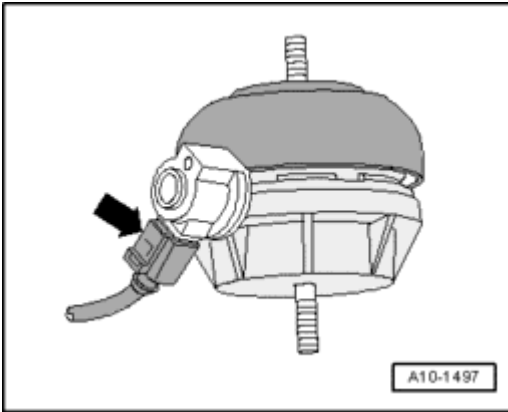


Fig. 27: Leak Detection Pump (LDP) N144 Or Right Electro-Hydraulic Engine Mount Solenoid Valve N145 Installation Location

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- On left and right engine mounts - **arrow** -.

Component location under intake manifold, cylinder bank 1 (right)

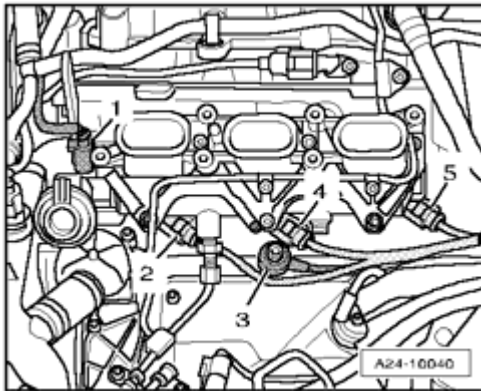


Fig. 28: Component Location Under Intake Manifold, Cylinder Bank 1 (Right)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Intake Manifold Runner Position Sensor G336
2. Cylinder 1 Fuel Injector N30
3. Knock sensor 1 G61
4. Cylinder 2 Fuel Injector N31
5. Cylinder 3 Fuel Injector N32

Component location under intake manifold, cylinder bank 2 (left)

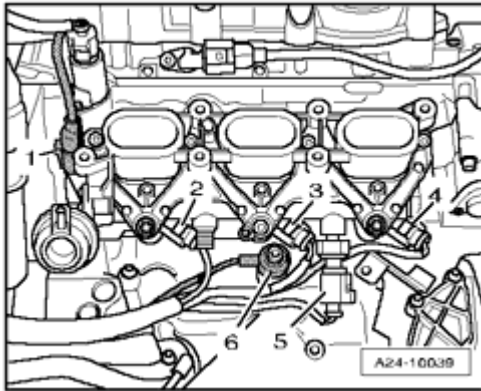


Fig. 29: Component Location Under Intake Manifold, Cylinder Bank 2 (Left)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. Intake Manifold Runner Position Sensor 2 G512
2. Cylinder 6 Fuel Injector N84
3. Cylinder 5 Fuel Injector N83
4. Cylinder 4 Fuel Injector N33
5. Fuel Pressure Sensor G247
6. Knock sensor 2 G66

Location Intake Air Switch-Over valve N335

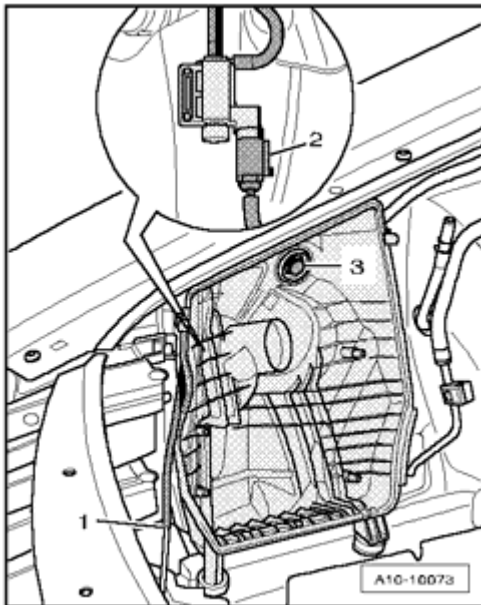


Fig. 30: Identifying Vacuum Line, Spreader Clips & Electrical Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 2 - Intake air switch-over valve N335

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NOTE:

- Ignore - 1 - and - 3 -.

Location Engine Speed (RPM) Sensor G28

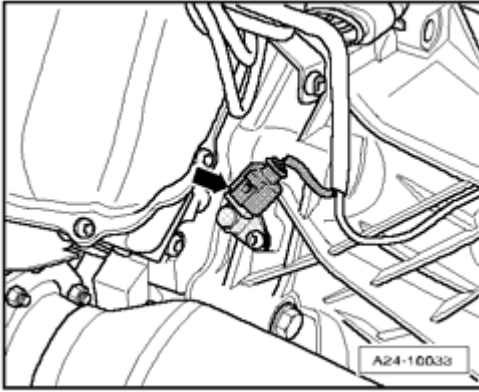


Fig. 31: Location Engine Speed (RPM) Sensor G28
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- At left front of transmission housing - **arrow** -.

Air filter, component overview

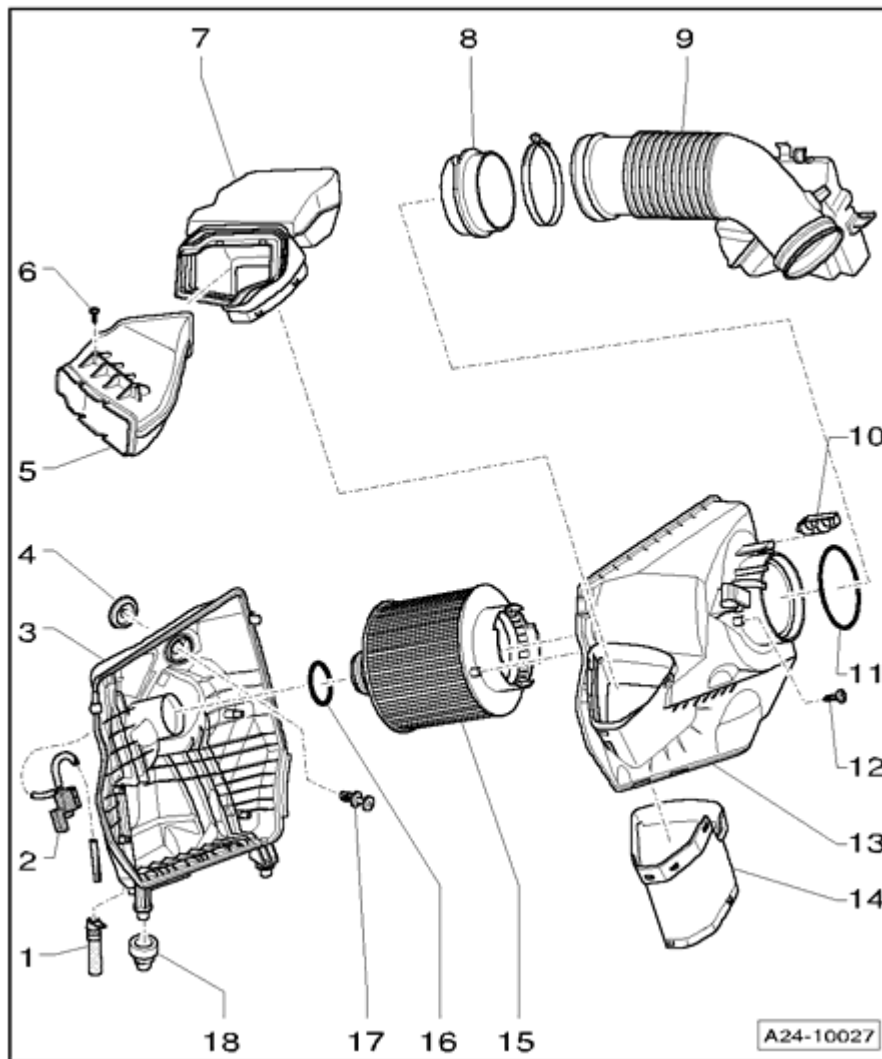


Fig. 32: Air Filter, Component Overview

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Water drain

- Check for contamination and clean if necessary (note valve)
- Water drain hose must be fully functional

2 - Air flap positioner V63

3 - Lower part of air filter housing

- Clean air filter housing-lower part of salt residue, dirt and leaves
- Check water drain for contamination and clean if necessary (note valve)

4 - Rubber grommet

5 - Air duct

- To lock carrier
- Clean air duct of dirt and leaves

6 - 1.5 Nm

7 - Air duct

- Clean air duct of dirt and leaves

8 - Connection

9 - Air duct hose to Throttle Valve Control Module J338

- With resonator

10 - Wiring router

11 - O-ring

- Replace

12 - 1.5 Nm

- For securing air filter insert - **15** -

13 - Upper part of air filter housing

- Clean air filter housing-upper part of salt residue, dirt and leaves

14 - Air duct

- Clipped into upper part of air filter housing
- Clean air duct of dirt and leaves

15 - Air filter element

- Always use a genuine air filter element
- Removing and installing --> **Air filter element, removing and installing**
- Maintenance intervals
- Clean snow screen also (if present)

16 - O-ring

- Replace

17 - Spreader clip

18 - Grommet

Air filter element, removing and installing

Removing

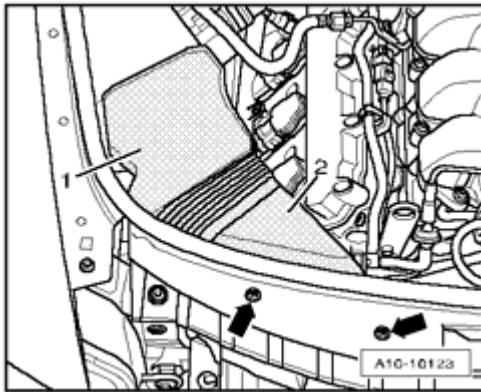


Fig. 33: Removing Air Duct Screws & Air Ducts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove air duct - **1** - and - **2** -.

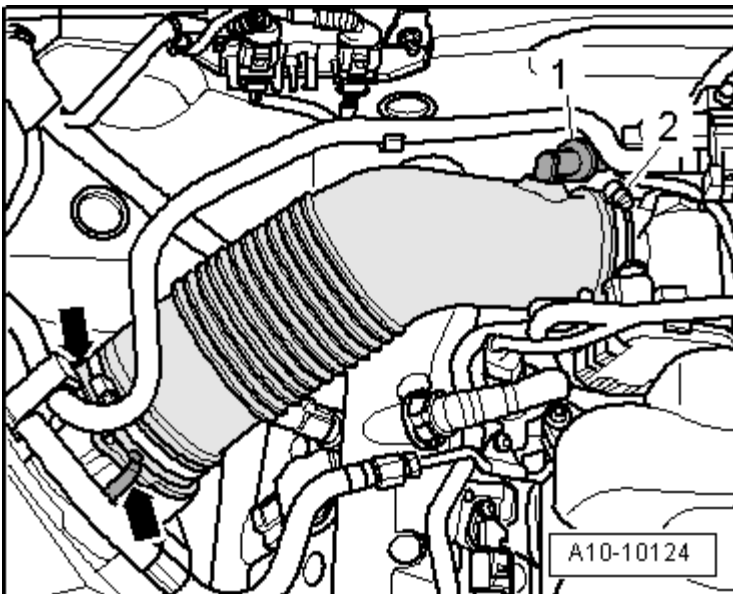


Fig. 34: Disconnecting Check Valve From Connection At Air Duct Hose & Removing Air Duct Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect check valve - **1** - from connection at air duct hose.
- Remove air duct hose, thereby loosening hose clamp - **2** - and opening clips - **arrows** -.

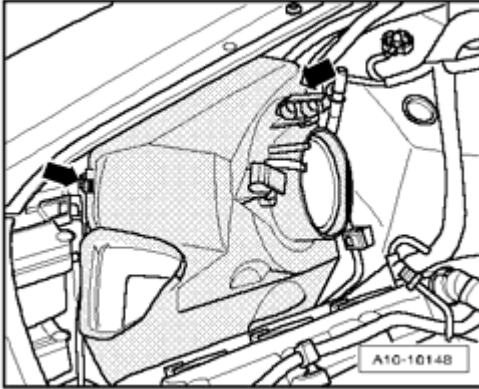


Fig. 35: Opening Clips And Removing Upper Part Of Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open clips - **arrows** - on upper part of filter housing and remove that part.

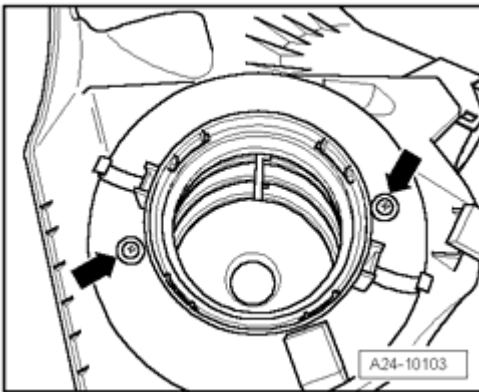


Fig. 36: Identifying Air Filter Insert Securing Screws
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove 2 bolts - **arrows** - from air filter element.

Removing lower part of air filter housing

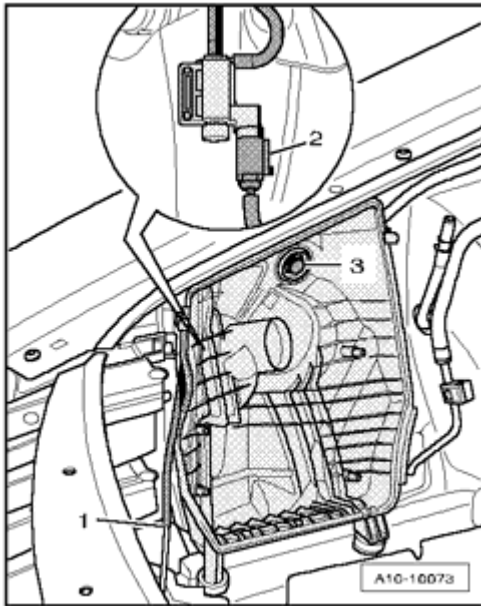


Fig. 37: Identifying Vacuum Line, Spreader Clips & Electrical Connection
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line - 1 -.
- Remove pin from spreader clips - 3 -.
- Remove lower part of air filter housing and, on backside, disconnect electrical connection - 2 - at Intake Air Switch-Over valve N335.

Installing

NOTE:

- Always use an original equipment air filter element.
 - Hose connections and hoses in intake area must be free of oil and grease before installing. When installing, do not use any lubricants containing silicone.
 - Air filter housing must always be clean.
 - Secure all hose connections using hose clamps appropriate for model type .
 - Note the following when blowing out air filter housing with compressed air: To prevent malfunctions, cover critical air-flow engine components such as air duct pipes, etc. with a clean cloth.
 - Observe disposal regulations!
- Check water drain hose in lower part of air filter for dirt and contamination (clean if necessary).
 - Clean air filter housing (upper and lower sections) of salt residue, dirt or leaves (use vacuum cleaner if necessary).
 - Check air duct hose (clean air side) for salt residue, dirt and leaves.

- Check intake ducting up to air filter element for dirt.
- Make sure that air filter element is properly centered when placed into mounting of lower part of air filter housing.
- Set upper part of air filter housing onto lower part of air filter housing, without using much force. When doing this, make sure that the upper part of air filter housing is not placed crooked onto air filter element. Pay attention to sealing lip of air filter element (false air).
- Then attach upper part of air filter housing to lower part.
- Further installation is in reverse order of removal.

Intake manifold upper-part, component overview

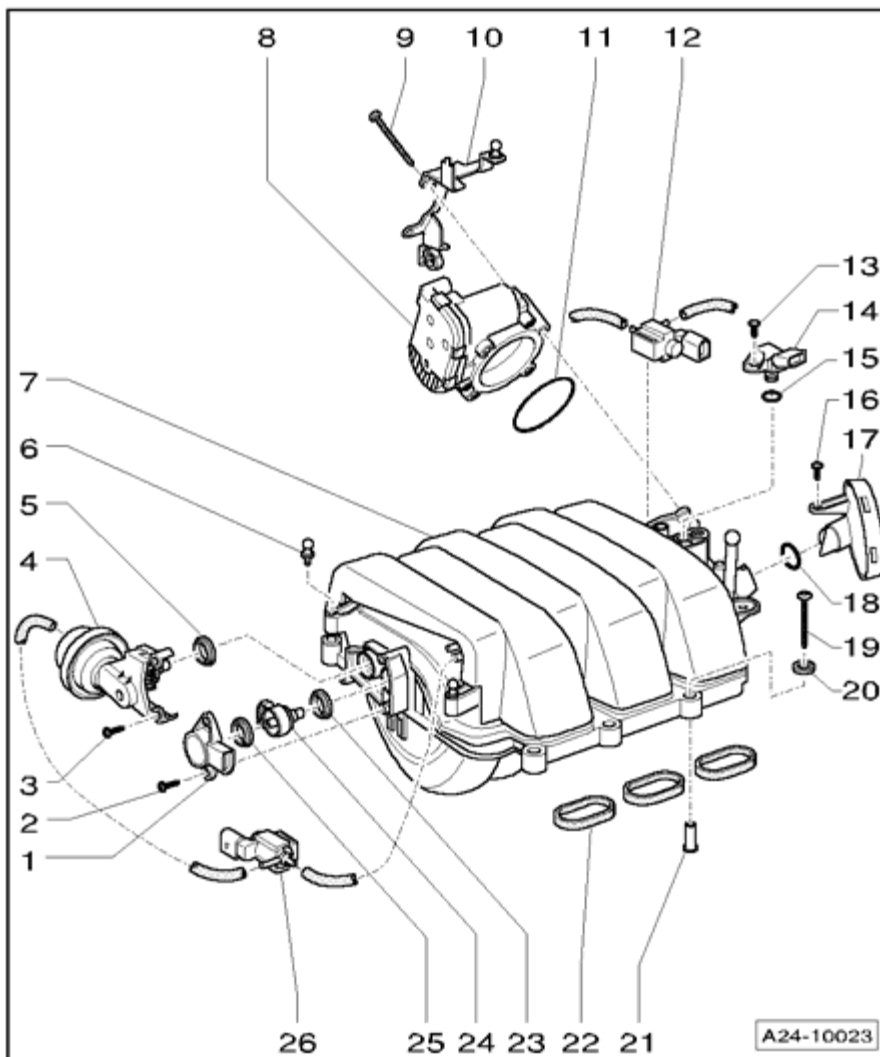


Fig. 38: Intake Manifold Upper-Part, Component Overview
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

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2 - 2.5 Nm

3 - 2.5 Nm

4 - Actuator for intake manifold change-over

- Installed location of tooth segments for variable intake manifold **Installed location of tooth segments for variable intake manifold**
- As replacement part together with - **24** -

5 - Seal

- Replace if damaged
- Lift out with screwdriver to replace
- Press in by hand

6 - Ball pin, 2.5 Nm

7 - Intake manifold upper part

- Removing and installing --> **Intake manifold upper-part, removing and installing**

8 - Throttle valve control module J338

9 - 5 Nm

10 - Wire harness retainer

11 - Seal

- Replace

12 - Intake Manifold Runner Control (IMRC) Valve N316

13 - 2.5 Nm

14 - Intake Air Temperature (IAT) Sensor G42/Manifold Absolute Pressure (MAP) Sensor G71

15 - O-ring

- Replace

16 - 2.5 Nm

17 - Crankcase housing ventilation pressure regulator valve

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18 - O-ring

- Replace

19 - 6 Nm

20 - Washer

21 - Sleeve

22 - Seals

- Replace

23 - Seal

- Replace if damaged
- Lift out with screwdriver to replace
- Press in by hand

24 - Lever with tooth segment

- For variable intake manifold
- Installed location of tooth segments **Installed location of tooth segments for variable intake manifold**
- As replacement part together with - 4 -

25 - Seal

- Replace if damaged
- Lift out with screwdriver to replace
- Press in by hand

26 - Change-over valve for intake manifold flap N239

Installed location of tooth segments for variable intake manifold

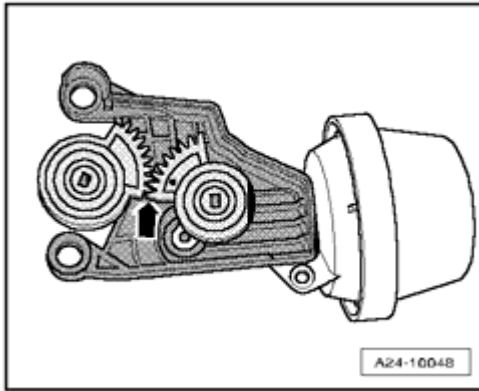


Fig. 39: Installed Location Of Tooth Segments For Variable Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The lower edges of tooth segments must be flush with one another - **arrows** -.

Intake manifold upper-part, removing and installing

Removing

NOTE:

- All cable ties which are opened or cut open when removing, must be replaced in the same position when installing.

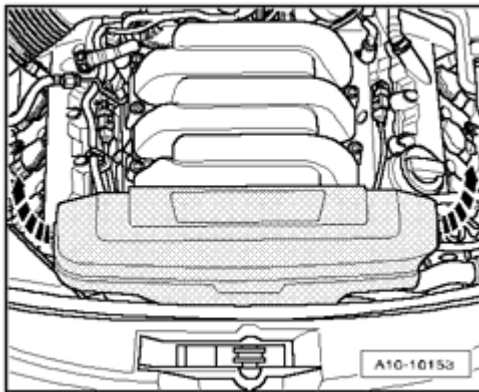


Fig. 40: Identifying Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover - **arrows** -.

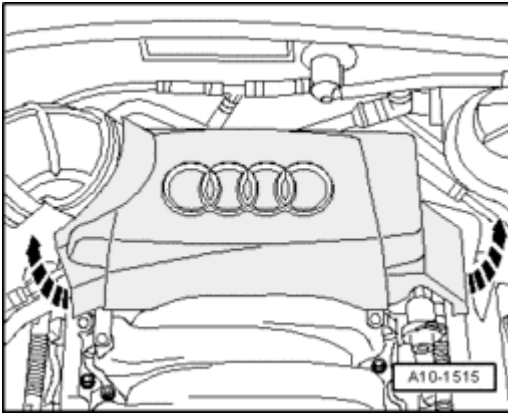


Fig. 41: Removing Rear Engine Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

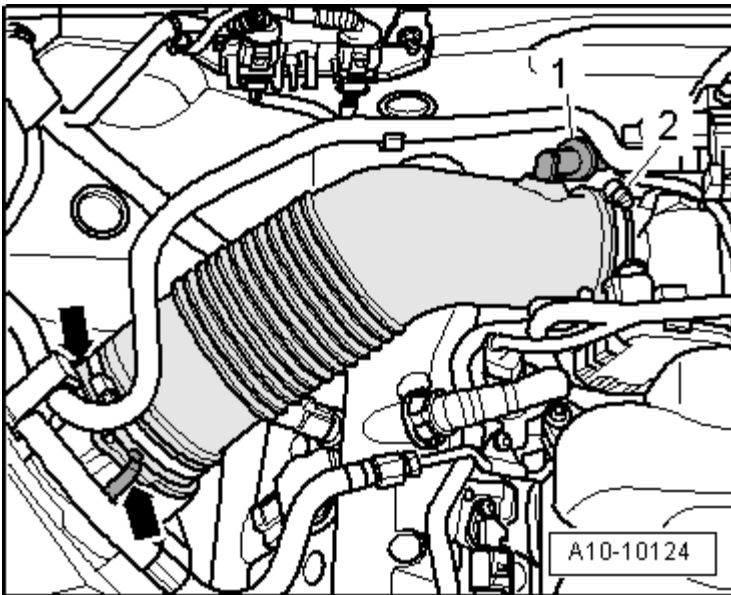


Fig. 42: Disconnecting Check Valve From Connection At Air Duct Hose & Removing Air Duct Hose

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect check valve - **1** - from air duct hose.
- Remove air duct hose, thereby loosening hose clamp - **2** - and opening clips - **arrows** -.

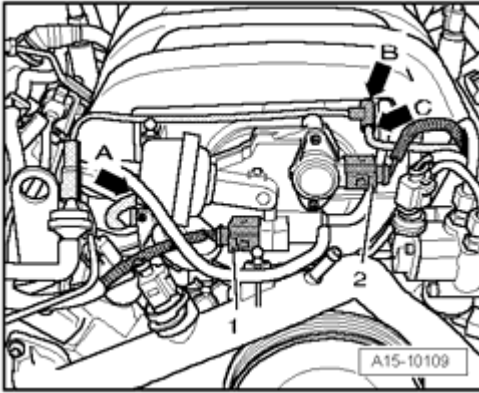


Fig. 43: Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors.
- 1. Change-over valve for intake manifold flap N239
- 2. Intake Manifold Tuning (IMT) Valve Position Sensor G513
- Remove vacuum lines - **arrow A** - and - **arrow B** -.

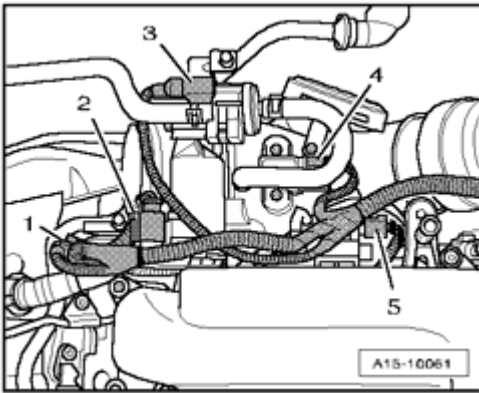


Fig. 44: Identifying Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose - **arrow C** - at leak detection pump.
- Disconnect electrical harness connectors.
- 1. Camshaft Adjustment Valve 1 N205
- 2. Throttle valve control module J338
- 3. Evaporative Emission (EVAP) Canister Purge Solenoid Valve N80
- 4. Intake Air Temperature (IAT) Sensor G42/Manifold Absolute Pressure (MAP) Sensor G71
- 5. Intake Manifold Runner Control (IMRC) Valve N316

- Free up wiring harness.

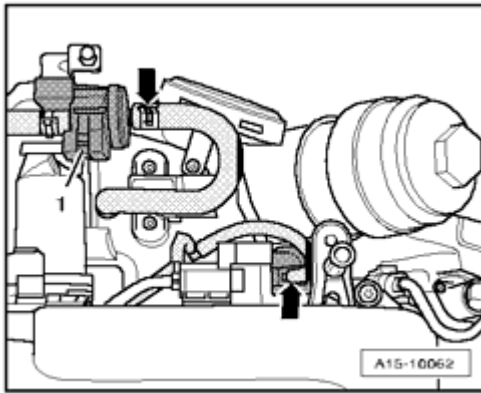


Fig. 45: Disconnecting Vacuum Hose & Removing Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 From Throttle Valve Control Module J338
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hoses - **arrows** -.
- Remove Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 - **1** - from Throttle Valve Control Module J338.

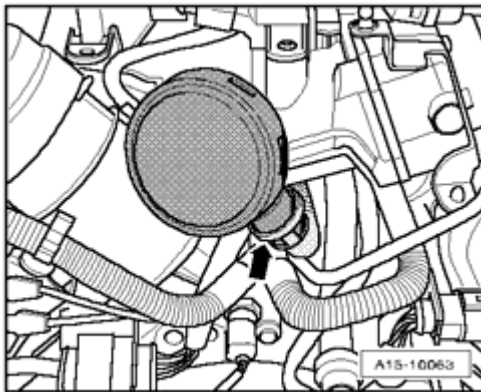


Fig. 46: Disconnecting Crankcase Breather Hose At Pressure Regulator Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect crankcase breather hose at pressure regulator valve - **arrow** -.

NOTE:

- To improve clarity, the engine is removed shown from the rear.

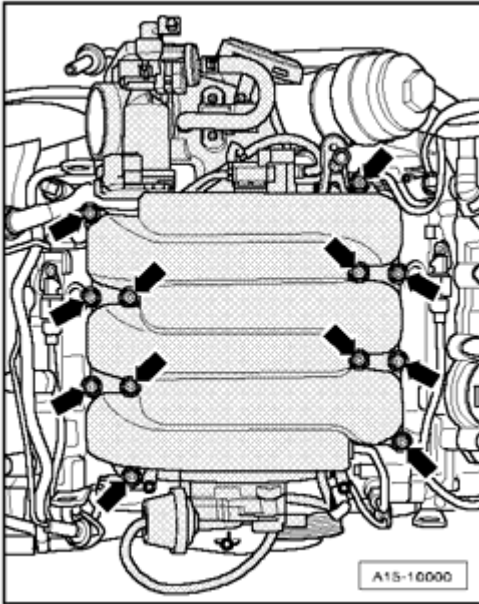


Fig. 47: Removing Bolts And Intake Manifold Upper-Part
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - and remove intake manifold upper-part.

NOTE:

- Plug the intake ports of the cylinder head with clean rags.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- Replace gaskets and O-rings.
- During installation, all cable ties must be re-installed at the same location.
- Secure all hose connections using hose clamps appropriate for the model type .

Torque specifications

Component	Nm
Intake manifold upper-part to intake manifold lower-part	6 ¹⁾
Hose clamps 9 mm wide	3
● ¹⁾ Tighten diagonally in stages.	

Intake manifold lower-part, component overview

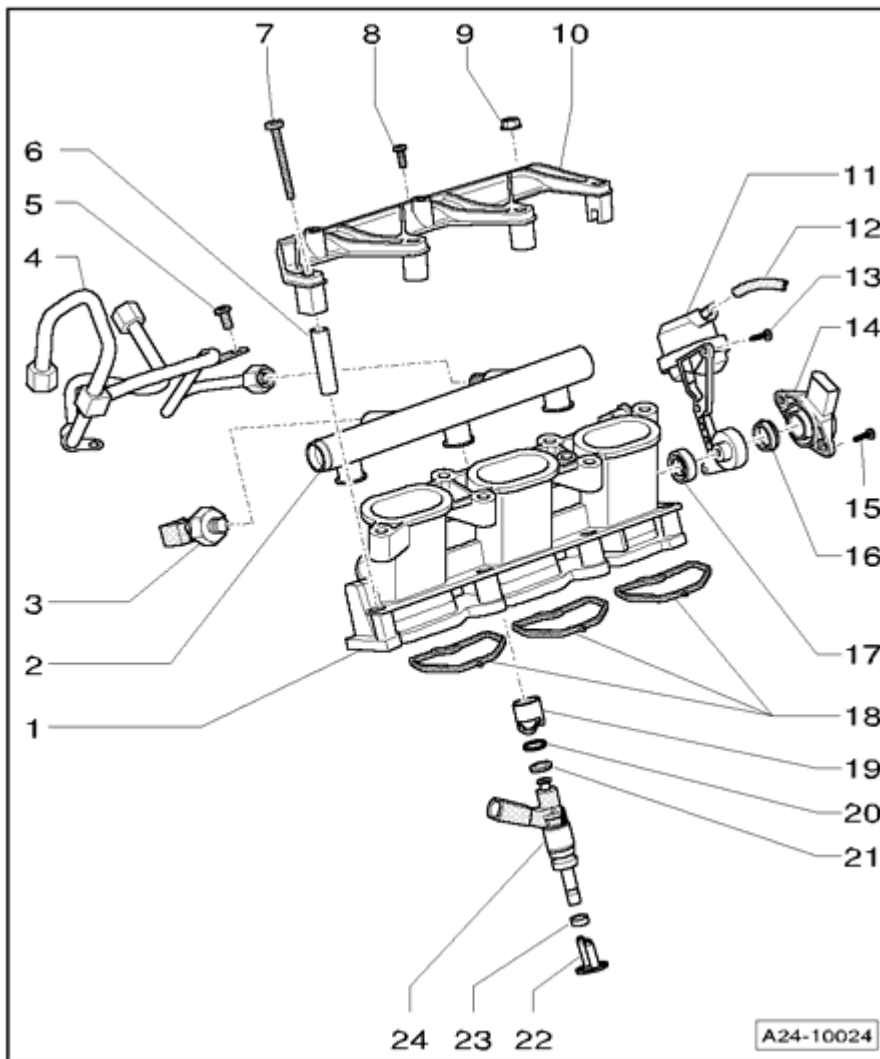


Fig. 48: Intake Manifold Lower-Part, Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Intake manifold lower part

- Removing and installing --> **Intake manifold lower-part with fuel rail, removing and installing**
- After installation, adapt both intake manifold runner position sensors in operating mode "Guided Fault-Finding" in "Adapting intake manifold runner position sensor"

2 - Fuel rail

3 - Fuel Pressure Sensor G247

4 - High-pressure lines

CAUTION: •

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system, pressure must be relieved to residual pressure --> Procedure that must be performed before opening the high-pressure fuel injection system - Pay close attention!

- Then wrap a clean rag around the connection and relieve residual pressure by carefully loosening the connection.

- Do not change bend shape
- Tighten high-pressure lines --> **Fig. 55**

5 - 10 Nm

6 - Sleeve

7 - 10 Nm

8 - 2.5 Nm

9 - 10 Nm

10 - Retaining bracket for fuel rail

11 - Vacuum actuator for intake manifold runner control

12 - Vacuum hose

- To Intake Manifold Runner Control (IMRC) Valve N316

13 - 2.5 Nm

14 - Intake Manifold Runner Position Sensor

- Left Intake Manifold Runner Position Sensor 2 G512 , right Intake Manifold Runner Position Sensor G336

15 - 2.5 Nm

16 - Seal

- Replace if damaged
- Lift out with screwdriver to replace
- Press in by hand

17 - Seal

- Replace if damaged

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- Lift out with screwdriver to replace
- Press in by hand

18 - Seals

- Replace

19 - Support ring

- Make sure it is seated properly
- The fuel rail wields force via support ring to hold fuel injector tightly in cylinder head.

20 - O-ring

- Replace
- Moisten with clean engine oil

21 - Spacer ring

- Replace if damaged

22 - Radial adjustment

- Replace if damaged
- Clip with support ring - **19** -

23 - Combustion chamber seal

- Replacing --> **Fuel injectors, removing and installing.**

24 - Fuel injector

Removing and installing --> **Fuel injectors, removing and installing**

Intake manifold lower-part with fuel rail, removing and installing

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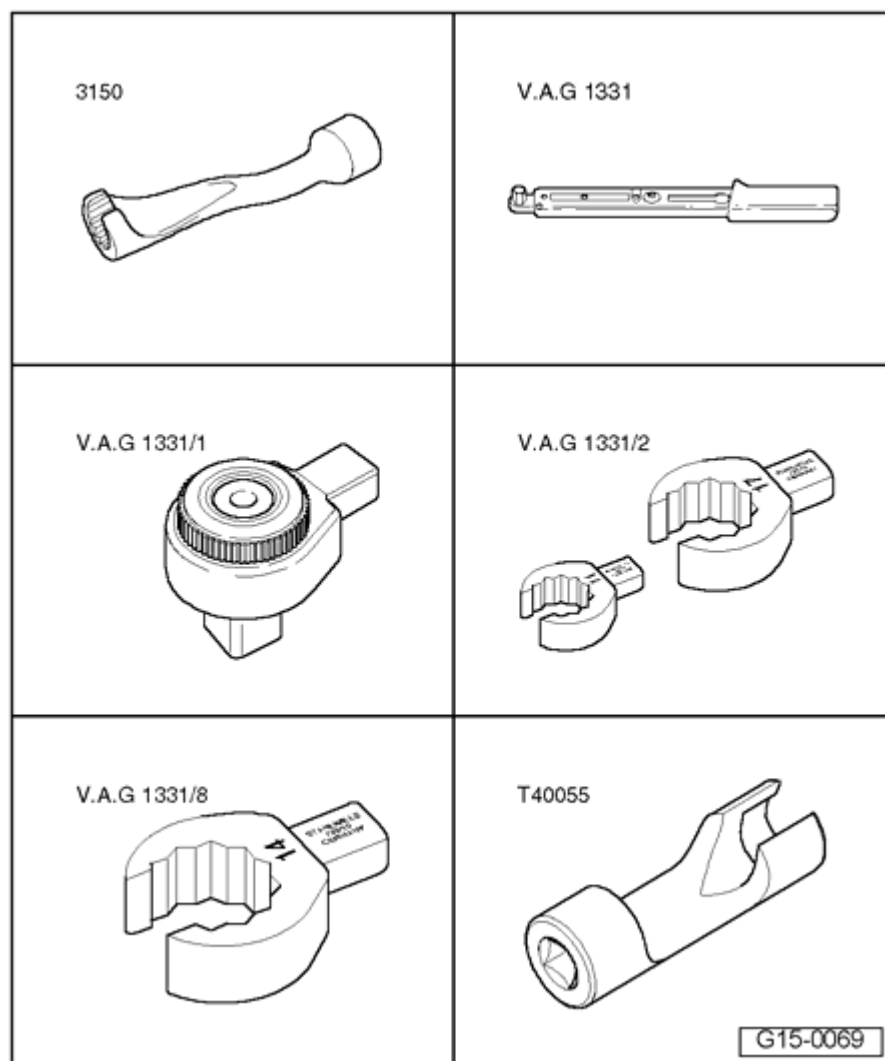


Fig. 49: Identifying Special Tools - Intake Manifold Lower-Part With Fuel Rail, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Socket 14 mm 3150
- Torque wrench V.A.G 1331
- Ratchet V.A.G 1331/1
- Open end wrench socket 17 mm V.A.G 1331/2
- SW 14 socket, open ring V.A.G 1331/8
- Socket T40055

Special tools, testers and auxiliary items required

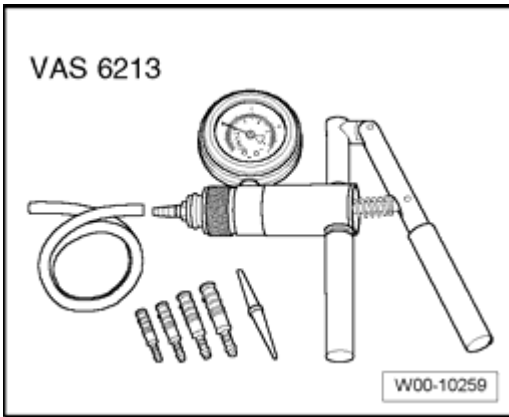


Fig. 50: Identifying Hand Vacuum Pump VAS 6213
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand vacuum pump VAS 6213

Removing

NOTE:

- The following removal and installation procedure is for the left intake manifold lower-part. The procedure for the other side is identical.

CAUTION:

- Fuel system is under high pressure! Before opening high pressure components of the fuel injection system, pressure must be relieved to residual pressure --> Procedure that must be performed before opening the high-pressure fuel injection system - Pay close attention!
- Then wrap a clean rag around the connection and relieve residual pressure by carefully loosening the connection.

- Remove upper part of intake manifold --> Intake manifold upper-part, removing and installing.

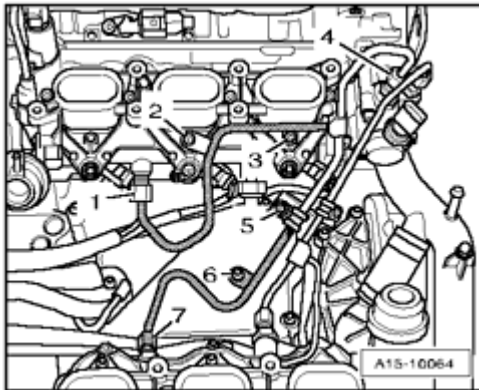


Fig. 51: Removing High-Pressure Line, Thereby Removing Bolts And Union Nuts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove high-pressure line, thereby removing bolts and union nuts - **1 through 7** -.

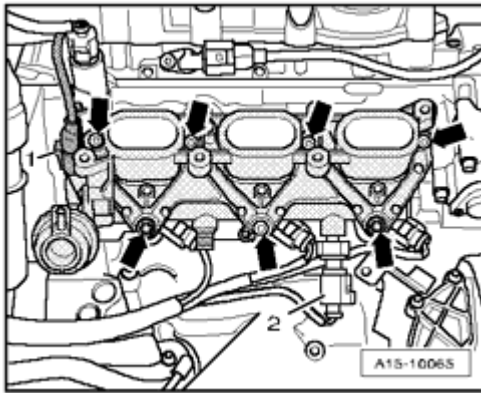


Fig. 52: Removing/Installing Intake Manifold Bolts And Nuts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors:
 1. Intake Manifold Runner Position Sensor 2 G512
 2. Fuel Pressure Sensor G247
- Remove bolts and nuts - **arrows** - and remove intake manifold lower-part with fuel rail.

NOTE: • **Plug intake ports of the cylinder head with clean rags.**

Installing

Installation is in reverse order of removal, note the following:

NOTE: • **Replace gaskets and O-rings.**
 • **Lightly moisten fuel injector O-rings with clean engine oil.**

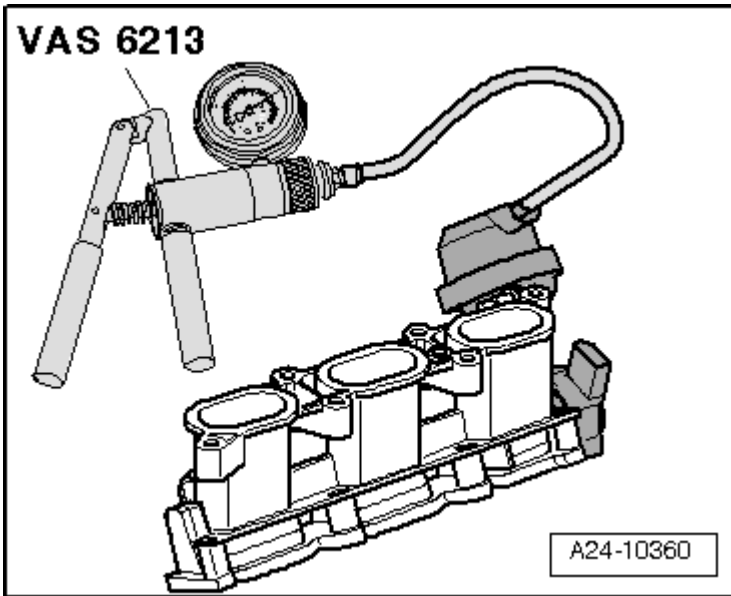


Fig. 53: Connecting Hand Vacuum Pump VAS 6213 To Intake Manifold Runner Control Vacuum Actuator

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect Hand Vacuum Pump VAS 6213 to intake manifold runner control vacuum actuator, as shown in illustration.
- Generate vacuum using hand vacuum pump.
- The intake flaps are opened.

NOTE:

- If the intake flaps are not opened, they could have seized when installing the lower part of the intake manifold in the cylinder head.

- Install lower part of intake manifold and press fuel rail evenly onto fuel injectors.

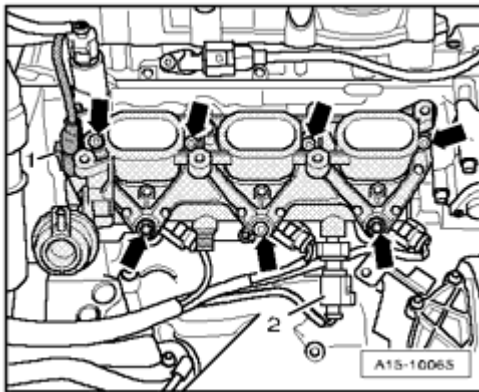


Fig. 54: Removing/Installing Intake Manifold Bolts And Nuts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Fasten bolts - **arrows** - for intake manifold lower-part in a diagonal sequence and in stages.
- Remove hand vacuum pump from intake manifold runner control vacuum actuator.
- Connect electrical harness connectors - **1** - and - **2** -.

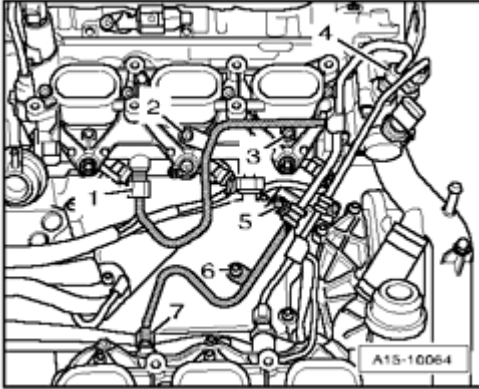


Fig. 55: Removing High-Pressure Line, Thereby Removing Bolts And Union Nuts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hand-tighten union nuts of high-pressure lines - **1** - , - **4** - and - **7** -.
- Make sure high-pressure lines are seated free of stress.

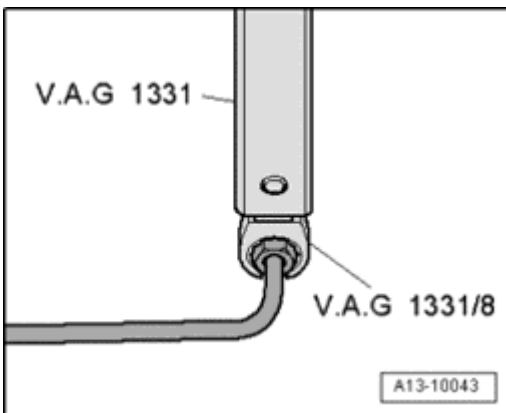


Fig. 56: Tightening Union Nut At Fuel Rail Using Torque Wrench V.A.G 1331 With 14 Mm Open End Wrench Socket V.A.G 1331/8
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To tighten SW 14 high pressure line at fuel rail, use Torque Wrench V.A.G 1331 with Socket Insert AF 14, open ring V.A.G 1331/8.

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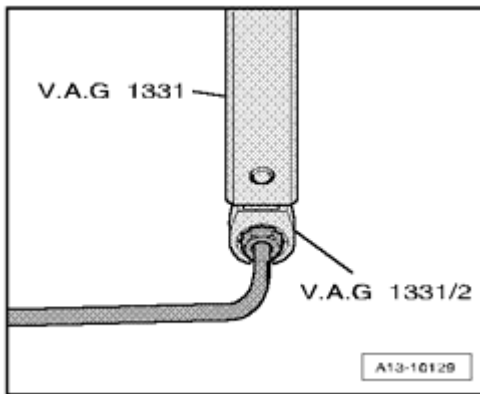


Fig. 57: Fastening High-Pressure Line At Fuel Rail Using Torque Wrench V.A.G 1331 With Open End Wrench Socket V.A.G 1331/2

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To fasten high-pressure line (17 mm) to fuel rail, use Torque Wrench V.A.G 1331 with Socket Insert AF 17 V.A.G 1331/2.

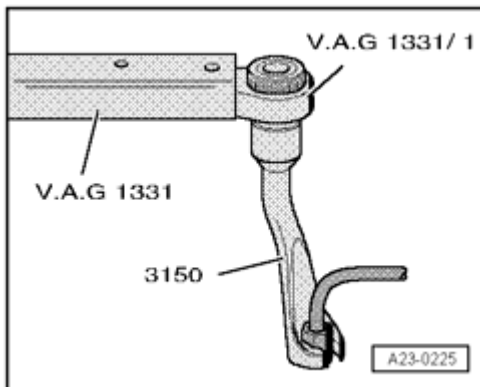


Fig. 58: Fastening High-Pressure Line (14 mm) At High Pressure Pump Use Torque Wrench V.A.G 1331 With Ratchet V.A.G 1331/1 And Socket 14 mm 3150

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To fasten high-pressure line (14 mm) at high pressure pump use torque wrench V.A.G 1331 with ratchet V.A.G 1331/1 and socket 14 mm 3150.

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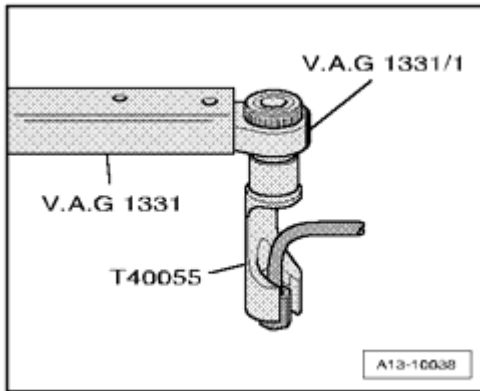


Fig. 59: Fastening High-Pressure Line At High Pressure Pump Using Torque Wrench V.A.G 1331 With Ratchet V.A.G 1331/1 And Socket 17 mm T40055

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To fasten high-pressure line (17 mm) to high pressure pump, use Torque Wrench V.A.G 1331 with Reversible Ratchet V.A.G 1331/1 and Socket T40055.

Torque specifications

Component		Nm
Intake manifold lower-part to cylinder head		10
High pressure lines to	High pressure pump	25
	Fuel rail	25

Fuel injectors, removing and installing

Special tools, testers and auxiliary items required

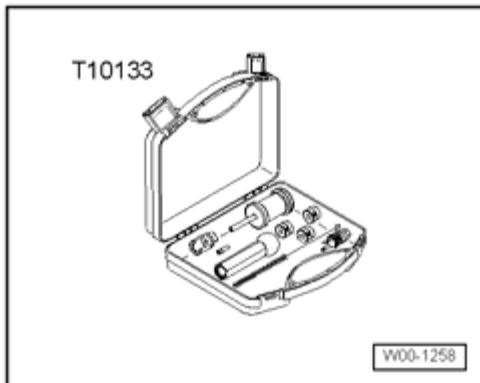


Fig. 60: Identifying Tool Set T10133

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tool set T10133

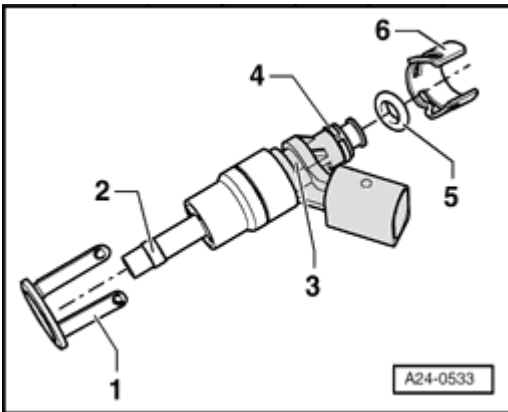


Fig. 61: High-Pressure Fuel Injector - Component Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

High-pressure fuel injector - component overview

1. Radial adjustment - Replace if damaged
2. Combustion chamber seal (Teflon seal) - replace, the seal must not be greased or be handled with any other lubricant during installation
3. Groove on fuel injector
4. Spacer ring - Replace if damaged
5. O-ring - replace, lightly coat with clean engine oil during installation
6. Support ring - fuel rail welds force via support ring to hold fuel injector tightly in cylinder head

Removing

CAUTION:

- **Fuel system is under high pressure! Before opening high pressure components of the fuel injection system, pressure must be relieved to residual pressure --> Procedure that must be performed before opening the high-pressure fuel injection system - Pay close attention!**
 - **Then wrap a clean rag around the connection and relieve residual pressure by carefully loosening the connection.**
- Remove upper part of intake manifold --> **Intake manifold upper-part, removing and installing.**
 - Remove corresponding intake manifold lower-part --> **Intake manifold lower-part with fuel rail, removing and installing.**

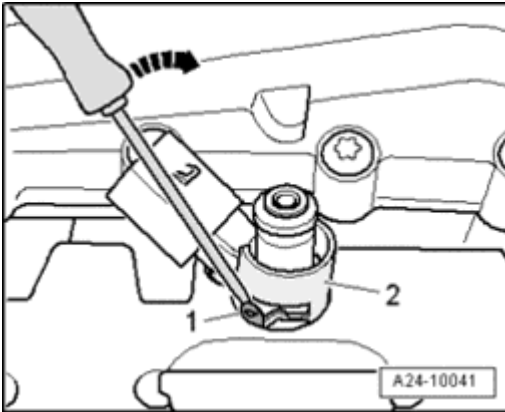


Fig. 62: Using Screwdriver To Bend Retaining Tabs Of Radial Adjustment Aside And Pull Support Ring From Fuel Injector

Courtesy of VOLKSWAGEN UNITED STATES, INC.

If fuel injectors cannot be pulled out of cylinder head by hand, proceed as follows:

- Using a screwdriver, bend retaining tabs - **1** - of radial adjustment aside - **arrow** - and pull support ring - **2** - from fuel injector.

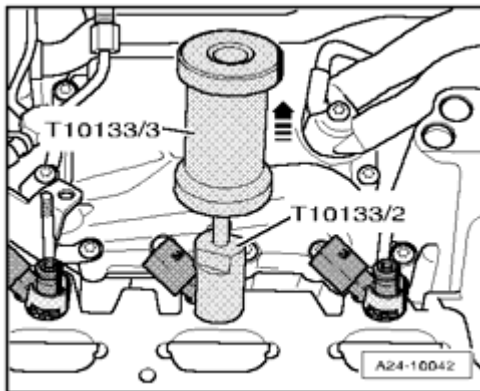


Fig. 63: Guiding Puller T10133/2 Into Groove On Fuel Injector And Carefully Drive Fuel Injector Out

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach slide wrench T10133/3 with adapter T10133/2.
- Guide puller T10133/2 into groove on fuel injector and carefully drive fuel injector out.

NOTE:

- When setting the puller in place, the radial adjustment can be destroyed, because the retaining tabs break.

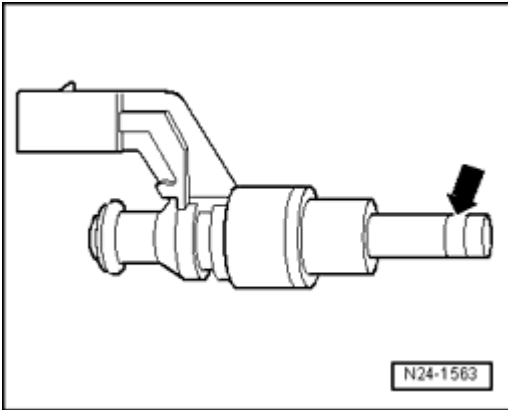


Fig. 64: Cleaning Fuel Injector In Area Of Sealing Ring
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Carefully remove old combustion chamber seal - **arrow** - , thereby cutting seal open with a knife or spreading seal open with a small screwdriver and pulling it forward and off.
- Make sure that the groove of fuel injector does not become damaged. If groove is damage, fuel injector must be replaced.

Installing

NOTE:

- Replace combustion chamber seal and O-ring.
- Replace spacer ring if damaged.
- Lightly moisten fuel injector O-rings with clean engine oil.
- Re-insert injector lines at same cylinder.

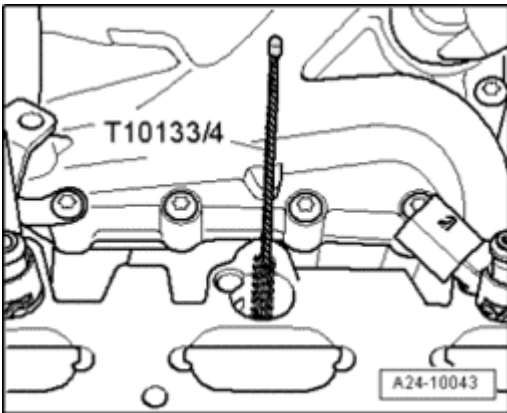


Fig. 65: Cleaning Bore In Cylinder Head With Nylon Cylinder Brush T10133/4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean bore in cylinder head with nylon cylinder brush T10133/4.

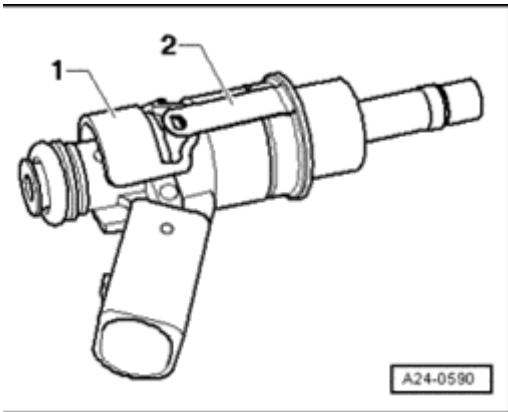


Fig. 66: Installing Fuel Injector Again With Support Ring And Clipping In Radial Compensation On Support Ring

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clip radial adjustment - 1 - to support ring - 2 -.
- When re-installing a fuel injector, use a clean cloth to clean combustion residue from groove for combustion chamber seal and shaft of fuel injector.

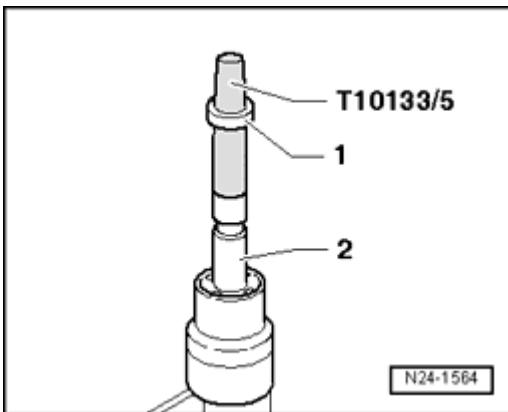


Fig. 67: Placing Assembly Cone T10133/5 With New Teflon Seal Onto Fuel Injector

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place assembly cone T10133/5 with new combustion chamber seal - 1 - on fuel injector - 2 -.

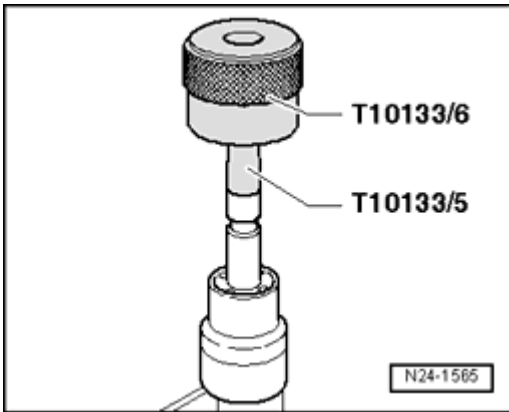


Fig. 68: Sliding Combustion Chamber Seal As Far Possible Onto Assembly Cone T10133/5 Using Assembly Sleeve T10133/6

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slide combustion chamber seal as far possible onto assembly cone T10133/5 using assembly sleeve T10133/6.
- Turn assembly sleeve T10133/6 around and slide combustion chamber seal into groove.

NOTE:

- When pushing the combustion chamber seal onto the fuel injector, the seal spreads open. Therefore after pushing it on, it must be tightened again in 2 steps, as follows.

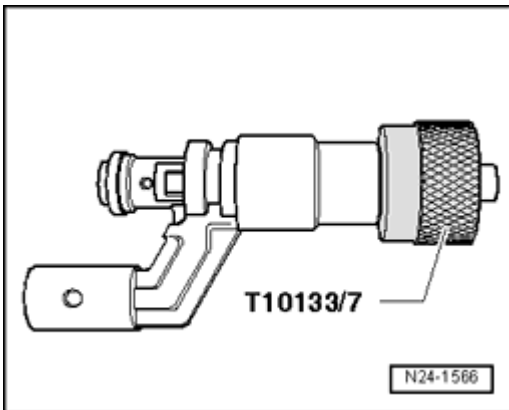


Fig. 69: Pressing Calibrating Sleeve T10133/7 On To Fuel Injector Until It Stops

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press sizing sleeve T10133/7 with a slight turning motion (approx. 180°) onto fuel injector until it stops.
- Pull sizing sleeve T10133/7 off again, turning it in opposite direction.

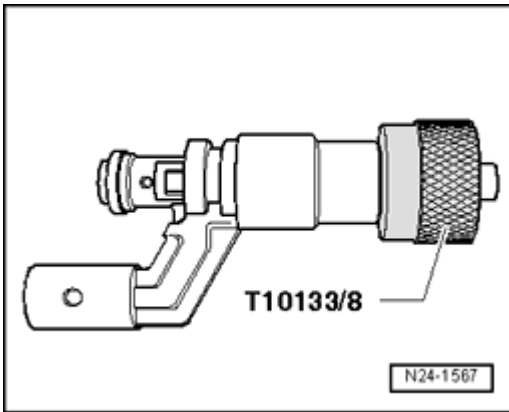


Fig. 70: Pressing Calibrating Sleeve T10133/8 On To Fuel Injector Until It Stops
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press sizing sleeve T10133/8 with a slight turning motion (approx. 180°) onto fuel injector until it stops.
- Pull sizing sleeve T10133/8 off again, turning it in opposite direction.
- Moisten new O-ring 3 with clean engine oil before installing.

NOTE:

- The combustion chamber seal must not be oiled.

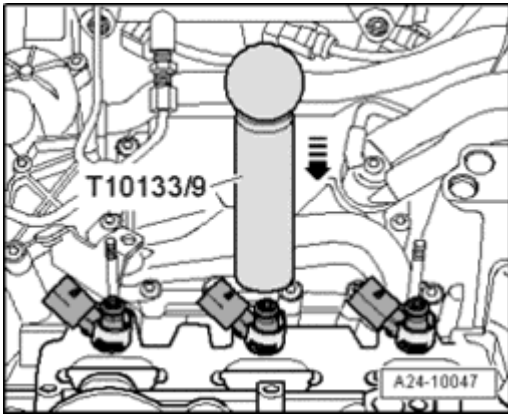


Fig. 71: Sliding Fuel Injector Into Bore Cylinder Head As Far As Stop Using Assembly Drift T10133/9
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slide fuel injector into bore cylinder head as far as stop using assembly drift T10133/9.

NOTE:

- The fuel injector must not be difficult to install. If necessary, wait as the combustion chamber seal continues to pull itself together.
- Make sure fuel injectors are correctly positioned in cylinder head.
- The electrical connection of fuel injector must engage in intended recess of cylinder head.

Further installation is in reverse order of removal. note the following:

- Install intake manifold lower-part --> **Intake manifold lower-part with fuel rail, removing and installing.**
- Install intake manifold upper-part --> **Intake manifold upper-part, removing and installing.**

Fuel pressure and residual pressure before high pressure pump, checking

Special tools, testers and auxiliary items required

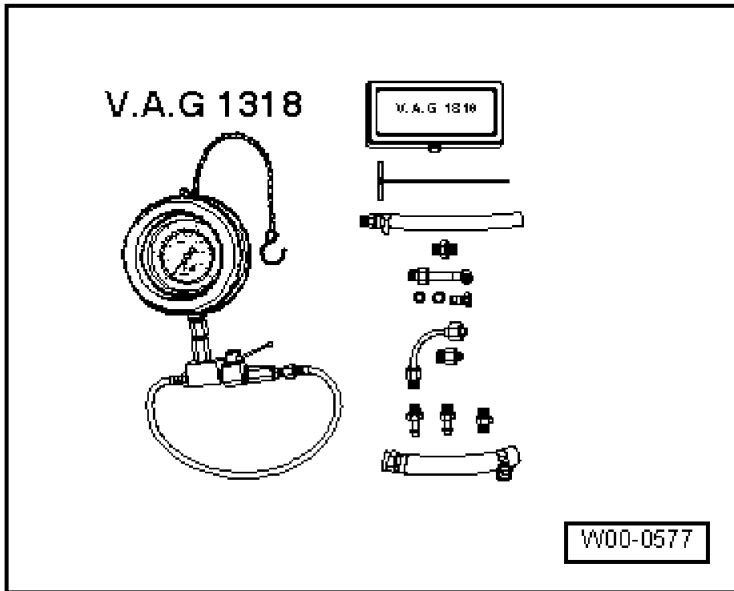


Fig. 72: Identifying Pressure Gauge V.A.G 1318
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pressure gauge K-Jetronic V.A.G 1318
- Pressure gauge adapter V.A.G 1318/10-12

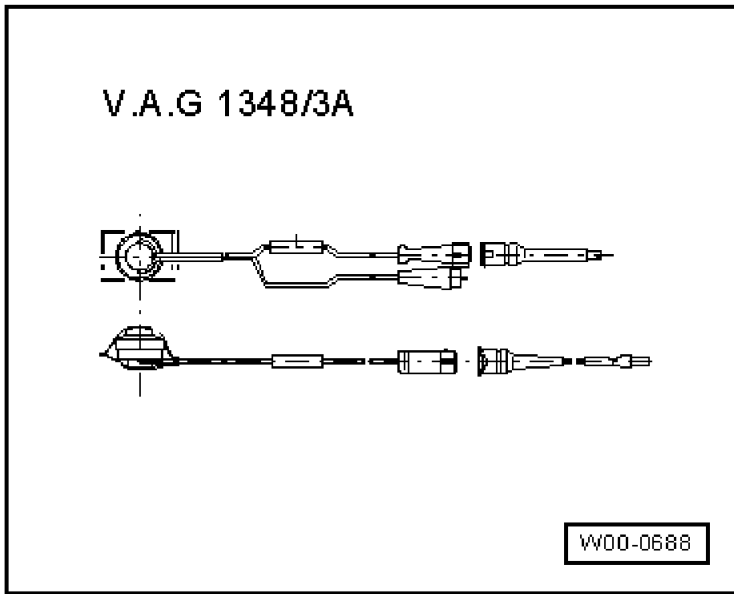


Fig. 73: Identifying Remote Control Connection V.A.G 1348/3A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remote Control V.A.G 1348/3A with adapter cable V.A.G 1348/3-3
- Measuring container, fuel-resistant

Test conditions

- Battery voltage at least 12.5 V.
- Fuel filter OK.
- Fuel tank at least $\frac{1}{4}$ filled.
- Fuel Pump (FP) Control Module J538 OK; checking --> **20 - FUEL SUPPLY** .
- Ignition switched off.

Checking fuel pressure

Vehicles with front wheel drive:

- Fold forward right backrest of rear seat, if necessary.
- Remove luggage compartment floor trim.

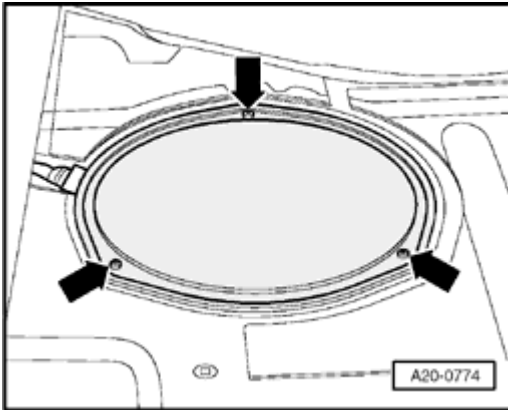


Fig. 74: Removing Cover For Locking Flange

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover for locking flange - **arrows** -.

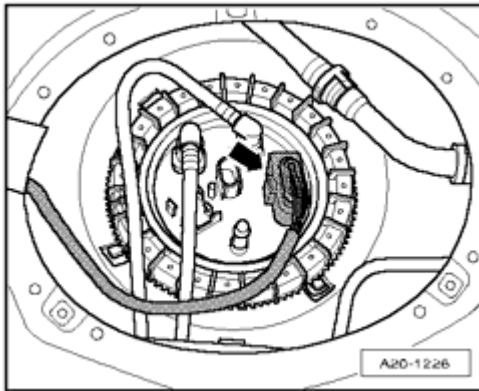


Fig. 75: Disconnecting Electrical Harness Connector At Locking Flange

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Carefully release and disconnect electrical harness connector - **arrow** - at locking flange.

Vehicles with all wheel drive:

- Remove rear seat bench --> **72 - SEAT - FRAMES**

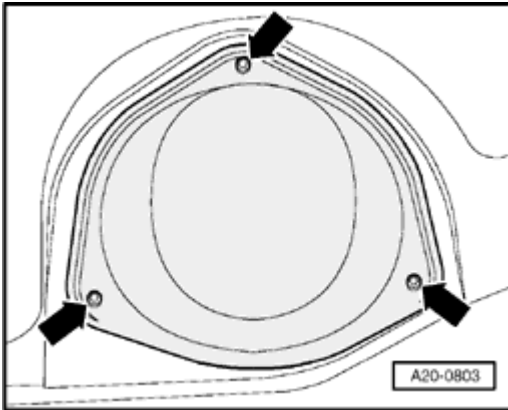


Fig. 76: Removing Right Locking Flange Cover And Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover for right locking flange - **arrows** -.

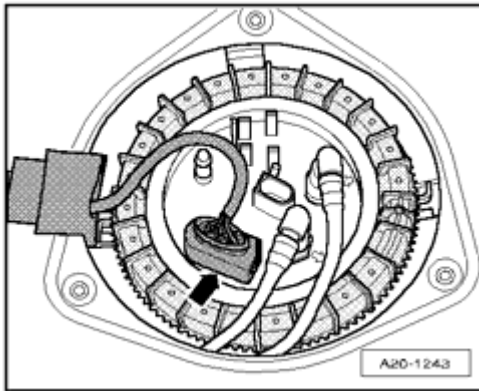


Fig. 77: Disconnecting Electrical Harness Connector At Locking Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Carefully release and disconnect electrical harness connector - **arrow** - at locking flange.

All:

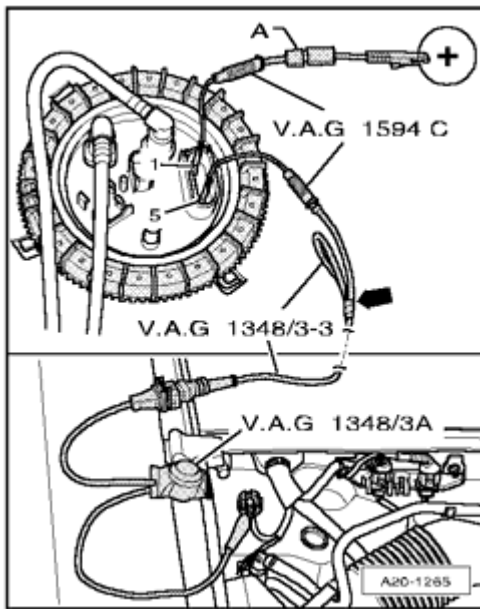


Fig. 78: Connecting Remote Control Connection V.A.G 1348/3 A With Connection V.A.G 1348/3-3 To Contact Using An Adapter Cable From Connector Test Set V.A.G 1594 C

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect Remote Control V.A.G 1348/3A with adapter cable V.A.G 1348/3-3 with an adapter cable from Connector Test Set V.A.G 1594C at terminal - 5 -.
- Cover 2nd connector terminal of adapter cable V.A.G 1348/3-3 with insulating tape to prevent short circuit - **arrow** -.
- Route Remote Control V.A.G 1348/3A switch forward in engine compartment.
- Connect alligator clip to Ground (GND) point in engine compartment.
- Connect contact - 1 - to battery "+" using a self-made adapter cable.

NOTE:

- For safety reasons, install a fuse - A - in the cable.

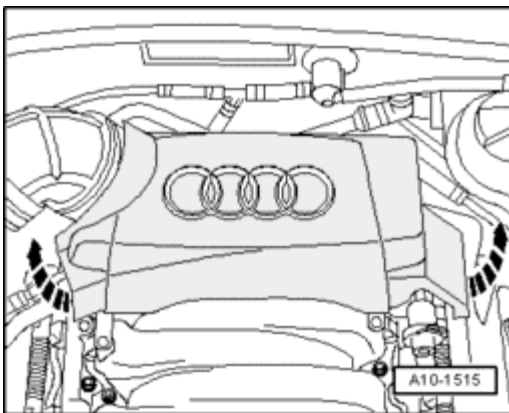


Fig. 79: Removing Rear Engine Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

CAUTION:

- Fuel system is under high pressure! Before opening high pressure components of the fuel injection system, pressure must be relieved to residual pressure --> Procedure that must be performed before opening the high-pressure fuel injection system - Pay close attention!
- Then wrap a clean rag around the connection and relieve residual pressure by carefully loosening the connection.

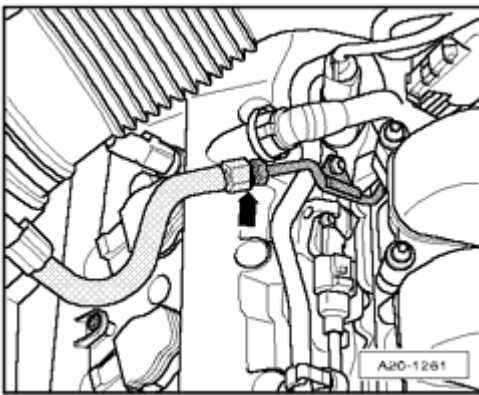


Fig. 80: Disconnecting Fuel Line

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel line - **arrow** -.

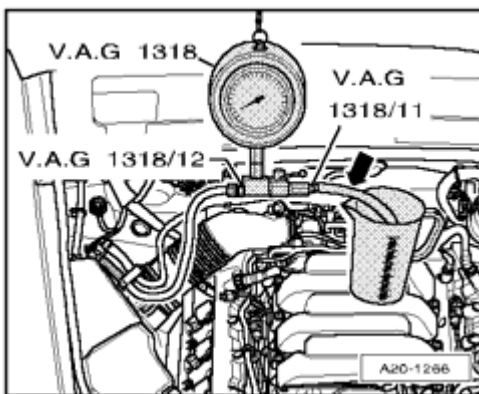


Fig. 81: Connecting Pressure Gauge V.A.G 1318 To Fuel Line Using Adapter V.A.G 1318/11 And V.A.G 1318/12

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect Fuel Inj. Pressure Gauge-CIS V.A.G 1318 with Adapter V.A.G 1318/11 and V.A.G 1318/12 in

fuel line.

- Connect assisting hose - **arrow** - to pressure gauge and hold it in a measuring container.
- Open shut-off valve of pressure gauge. The lever points in direction of flow.
- Bleed fuel system, by briefly pressing remote control.

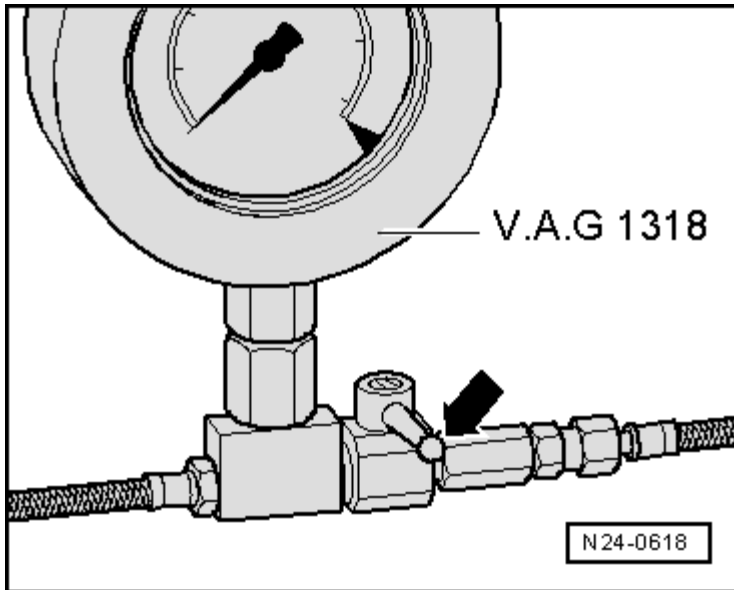


Fig. 82: Locating V.A.G 1318 Shut-Off Tap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Close shut-off valve of pressure gauge. Lever stands perpendicular to direction of flow - **arrow** -.
- Hold switch of remote control until no more pressure increase is observed on fuel pressure gauge.
- Specified value: approx. 6 bar positive pressure

If specification is not obtained:

- Check delivery quantity of Fuel Pump (FP) --> **20 - FUEL SUPPLY** .

Checking residual pressure

- Check for leaks and for residual pressure by observing the pressure loss on the pressure gauge.
- After 10 minutes there must be a residual pressure of at least 3.75 bar.

The holding pressure drops below 3.75 bar:

- Check connection between fuel pressure gauge and fuel line for leaks.
- Check pressure gauge for leaks.
- Check fuel lines and their connections for leaks.

2006 Audi A6 Quattro

ENGINE PERFORMANCE 3.2 V6 4V Fuel Injection Ignition, Engine Code(s): BKH

- Replace fuel filter with integrated fuel pressure regulator --> **20 - FUEL SUPPLY** .
- Replace fuel pump --> **20 - FUEL SUPPLY** .

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

NOTE:

- **Before disconnecting pressure gauge, release pressure by opening shut-off valve. Hold a container in front of connection for this.**

Torque specifications

Component	Nm
Fuel line to fuel rail	28

High pressure pump, removing and installing

2006 Audi A6 Quattro

ENGINE PERFORMANCE 3.2 V6 4V Fuel Injection Ignition, Engine Code(s): BKH

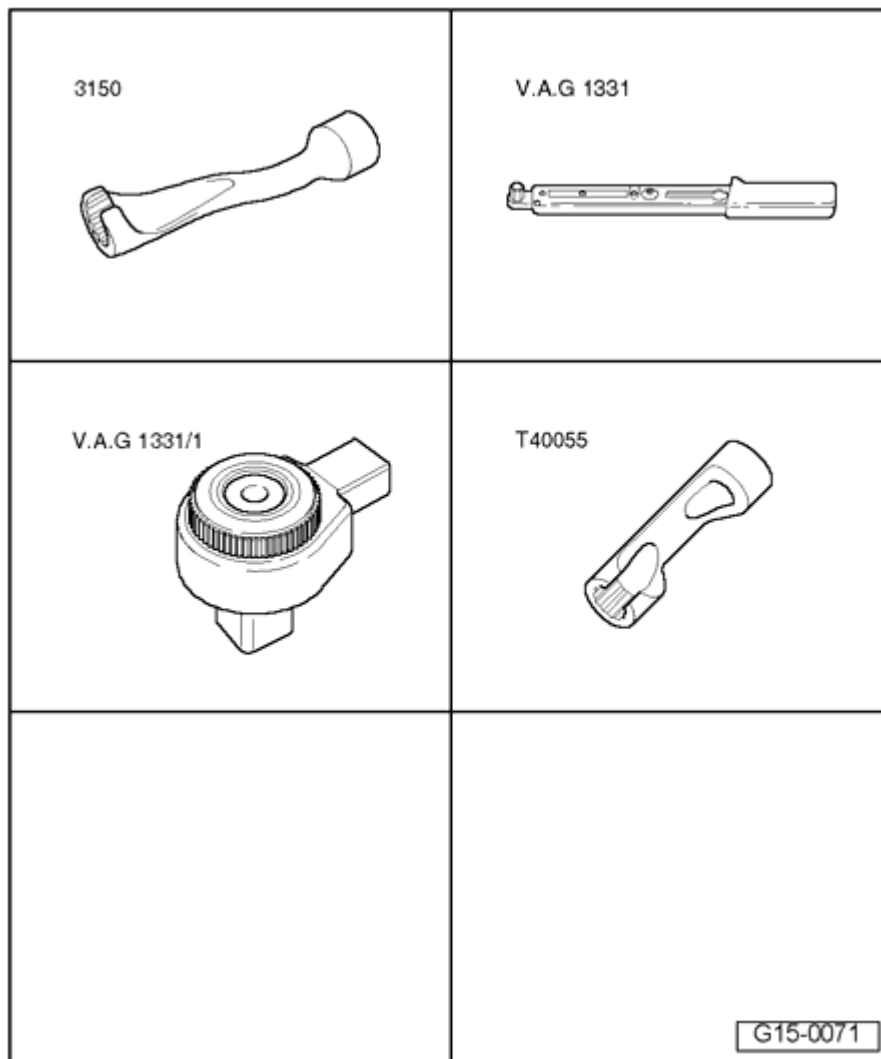


Fig. 83: Identifying Special Tools - High Pressure Pump, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools, testers and auxiliary items required

- Socket 14 mm 3150
- Torque wrench V.A.G 1331
- Ratchet V.A.G 1331/1
- Socket T40055

Removing

CAUTION:

- Fuel system is under high pressure! Before opening high pressure components of the fuel injection system, pressure must be relieved to residual pressure --> Procedure that must be performed before

opening the high-pressure fuel injection system - Pay close attention!

- Then wrap a clean rag around the connection and relieve residual pressure by carefully loosening the connection.

- Drain coolant --> **19 - ENGINE - COOLING SYSTEM** .
- Remove front coolant pipe --> **19 - ENGINE - COOLING SYSTEM** .
- Remove upper part of intake manifold --> **Intake manifold upper-part, removing and installing.**

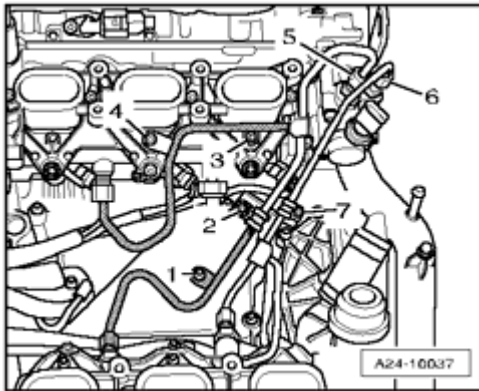


Fig. 84: Removing Bolts & Union Nuts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **1 through 4** - and - **7** -.
- Loosen union nuts - **5** - and - **6** -.

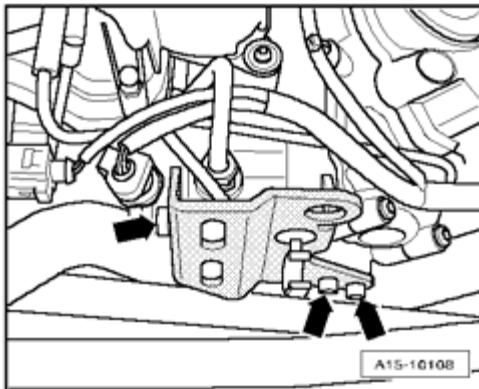


Fig. 85: Removing Large Lifting Eye

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If equipped, remove large lifting eye - **arrows** -.

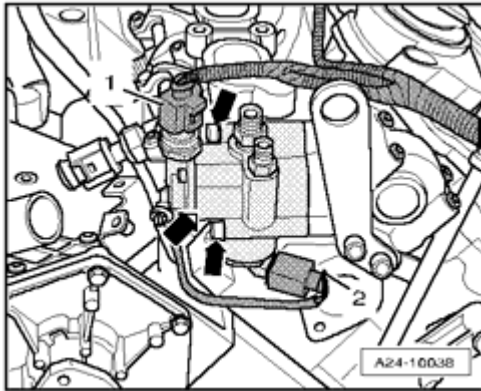


Fig. 86: Disconnecting Electrical Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical connectors - **1** - and - **2** -.

NOTE: ● - **1** - depending on version

- Remove bolts - **arrows** -.
- Carefully lift high pressure lines.

NOTE: ● **Do not change bend shape.**

- Remove high pressure pump with actuator.

Installing

Installation is in reverse order of removal, note the following:

NOTE: ● **Replace O-ring.**

- To set high pressure pump in place, lift high pressure lines only slightly.

NOTE: ● **High pressure line connections must not show any signs of damage.**
● **Do not change bend shape of high pressure lines.**

- Place high pressure pump with actuator into cylinder head and fasten.
- Hand-tighten union nuts for high-pressure lines.
- Make sure high-pressure lines are seated free of stress.

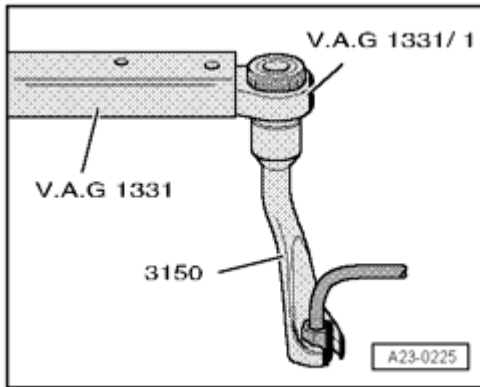


Fig. 87: Fastening High-Pressure Line (14 mm) At High Pressure Pump Use Torque Wrench V.A.G 1331 With Ratchet V.A.G 1331/1 And Socket 14 mm 3150
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To fasten high-pressure line (14 mm) at high pressure pump use torque wrench V.A.G 1331 with ratchet V.A.G 1331/1 and socket 14 mm 3150.

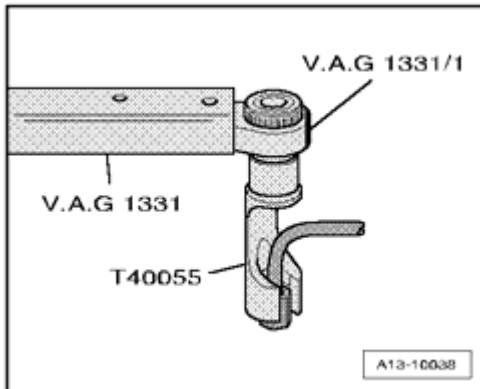


Fig. 88: Fastening High-Pressure Line At High Pressure Pump Using Torque Wrench V.A.G 1331 With Ratchet V.A.G 1331/1 And Socket 17 mm T40055
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To fasten high-pressure line (17 mm) to high pressure pump, use Torque Wrench V.A.G 1331 with Reversible Ratchet V.A.G 1331/1 and Socket T40055.
- Install intake manifold upper-part --> **Intake manifold upper-part, removing and installing.**
- Install front coolant pipe --> **19 - ENGINE - COOLING SYSTEM** .
- Fill with coolant --> **19 - ENGINE - COOLING SYSTEM** .

Torque specifications

Component	Nm
High pressure pump to cylinder head	10
High pressure lines to high pressure pump	25

2006 Audi A6 Quattro

ENGINE PERFORMANCE 3.2 V6 4V Fuel Injection Ignition, Engine Code(s): BKH

Fuel system, bleeding

To prevent damage to catalytic converter the fuel system must be bled after repair work on fuel lines or on fuel filter.

Work procedure

- Start engine and let engine run a few minutes at average RPM and then turn off again.

NOTE:

- **At the beginning, engine may run roughly due to air in fuel supply system.**

- Check fuel supply system for leaks.
- Check DTC memory and, if necessary, erase.
- Then perform a road test with at least one acceleration at Wide Open Throttle (WOT), then fuel supply system must be checked again for leaks.
- Check DTC memory and, if necessary, erase it. After DTC memory is erased, a readiness code must be generated for the engine control module using operating mode "Guided Fault-Finding".

Wiring and components, checking with Test box V.A.G 1598/42

Special tools, testers and auxiliary items required

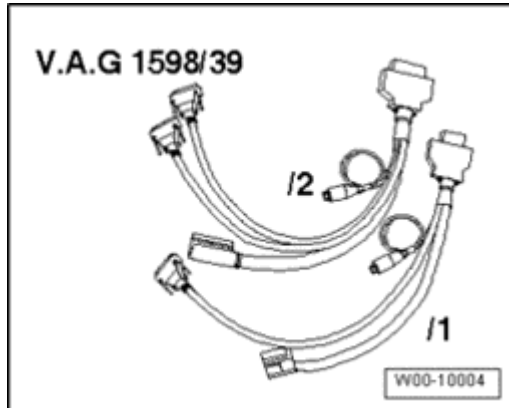


Fig. 89: V.A.G 1598/39-1/2 Adapter Cables

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Adapter cable V.A.G 1598/39

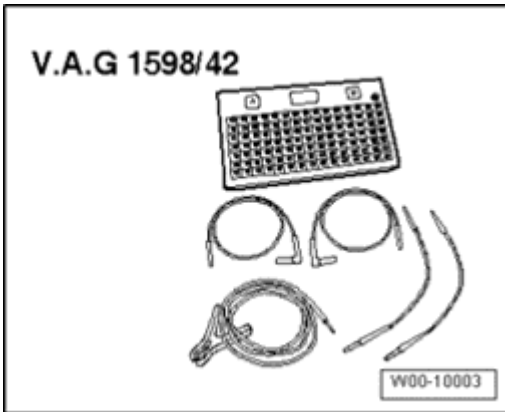


Fig. 90: V.A.G 1598/42 Test Box

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Test box V.A.G 1598/42

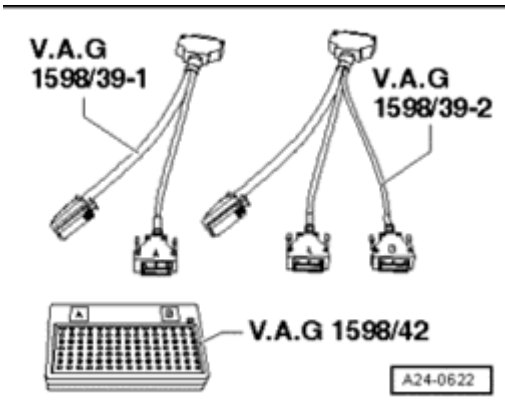


Fig. 91: Connecting Test Box V.A.G 1598/42 To Wiring Harness With Adapter Cable V.A.G 1598/39-1 Or Adapter Cable V.A.G 1598/39-2

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- The test box V.A.G 1598/42 is designed with 105 terminals. It can be connected to the engine control module (ECM) via 2 different adapter cables.
- The engine control module (ECM) is connected to the vehicle electrical harness via a 60-pin connector and a 94-pin connector.
- For testing at the 60-pin connector, the adapter cable V.A.G 1598/39-1 is connected to the test box with connector "A". Components of the 60-pin harness connection --> Electrical Wiring Diagrams, Troubleshooting and Component Locations.
- For testing at the 94-pin connector, the adapter cable V.A.G 1598/39-2 is connected to the test box with connectors "A" and "B". Components of the 94-pin harness connection --> Electrical Wiring Diagrams, Troubleshooting and Component Locations.

- The test box V.A.G 1598/42 is designed so that it can be connected simultaneously to the engine control module harness and the engine control module itself. This is advantageous because electronic engine control remains fully functional (e.g. measurement of signals with engine running) when the test box is attached.
- The procedure will indicate whether the engine control module is to remain connected to the test box or not.
- To connect measuring instruments (e.g. Voltage Tester V.A.G 1527B , Multimeter V.A.G 1526C etc.) always use Connector Test Set V.A.G 1594C.

The engine control module (ECM) must be removed to disconnect the ECM harness connectors --> **Engine Control Module (ECM), removing and installing.**

CAUTION: To avoid damaging electronic components, set measuring range before connecting test leads and observe all test requirements.

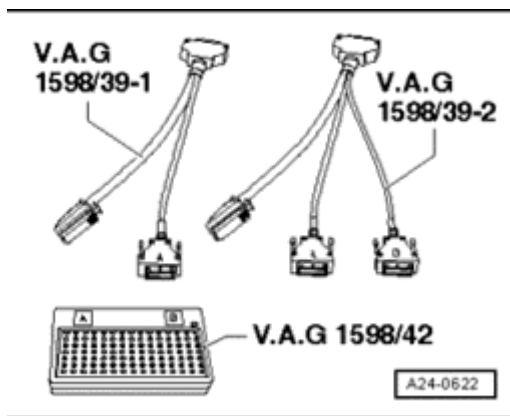


Fig. 92: Connecting Test Box V.A.G 1598/42 To Wiring Harness With Adapter Cable V.A.G 1598/39-1 Or Adapter Cable V.A.G 1598/39-2

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect Test Box V.A.G 1598/42 to wiring harness with adapter lead V.A.G 1598/39-1 or adapter lead V.A.G 1598/39-2. Clamp test box Ground (GND) clip to battery negative terminal. The procedure will indicate whether engine control module is to be connected to test box or not.
- Perform test as described in corresponding repair procedure.
- After completing test, install engine control module (ECM) --> **Engine Control Module (ECM), removing and installing.**

After installing Engine Control Module (ECM), the following work steps must be performed:

- Check DTC memory and, if necessary, erase it. After DTC memory is erased, a readiness code must be generated for engine control module using operating mode "Guided Fault-Finding".

Engine Control Module (ECM), removing and installing

Special tools, testers and auxiliary items required

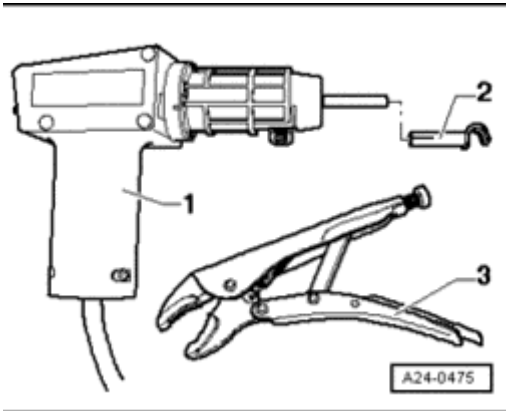


Fig. 93: Heat Gun, Adapter Nozzle And Pliers

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Heat Gun 220 V/50 Hz VAS 1978/14 - **1** - with nozzle attachment - **2** - from Wiring Harness Repair kit VAS 1978A
- Locking pliers - **3** - (commercially available)

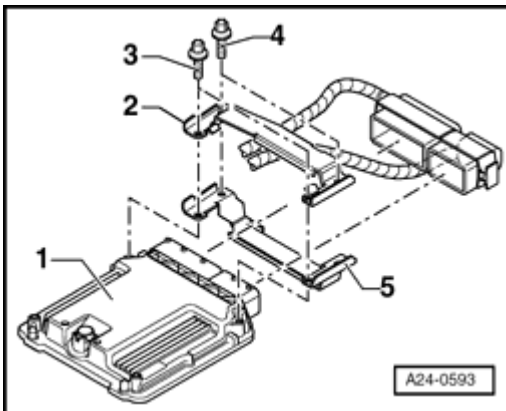


Fig. 94: Removing Protective Housing From Engine Control Module (ECM) J623

Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- The Engine Control Module (ECM) - **1** - is bolted to a protective housing - **5** -. To make removal of shear bolts - **4** - for retaining tabs - **2** - more difficult, the threads are coated with locking compound.
- To disconnect the connectors from the engine control module (ECM) (e.g. to connect the test box or to replace the ECM), the protective housing must be removed.

Removing

- If engine control module (ECM) was replaced, select diagnostic object "Replacing engine control module

- Turn ignition and remove ignition key.

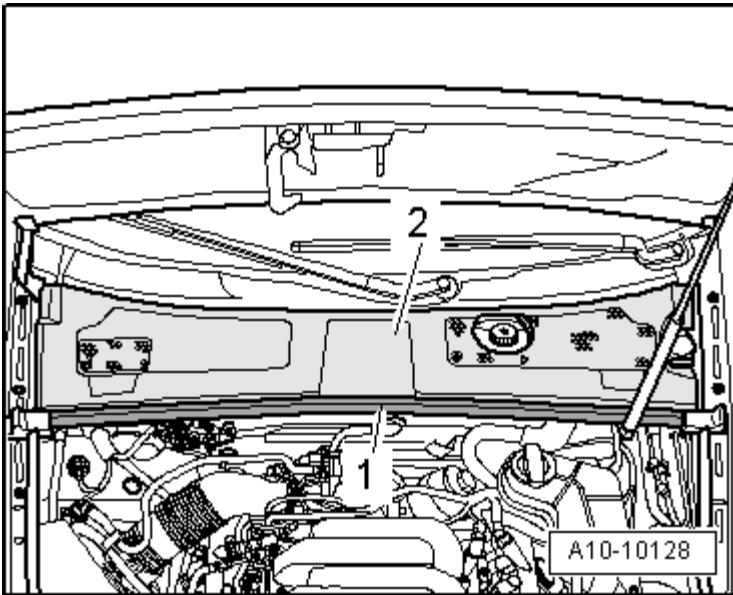


Fig. 95: Removing Rubber Seal For Plenum Chamber Cover & Plenum Chamber Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rubber seal - 1 - for plenum chamber cover.
- Remove plenum chamber cover - 2 -.

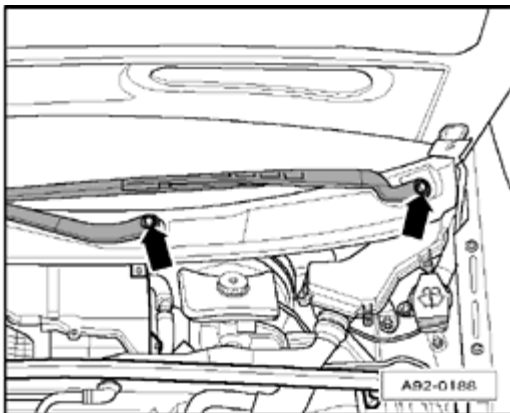


Fig. 96: Identifying Wiper Arm Nuts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off caps on wiper arms using a screwdriver.
- Loosen nuts - **arrows** - by several turns.
- Loosen wiper arms by gently rocking wiper arm. Remove nuts and remove wiper arms.

NOTE:

- If wiper arm cannot be removed in this way, use a standard puller.

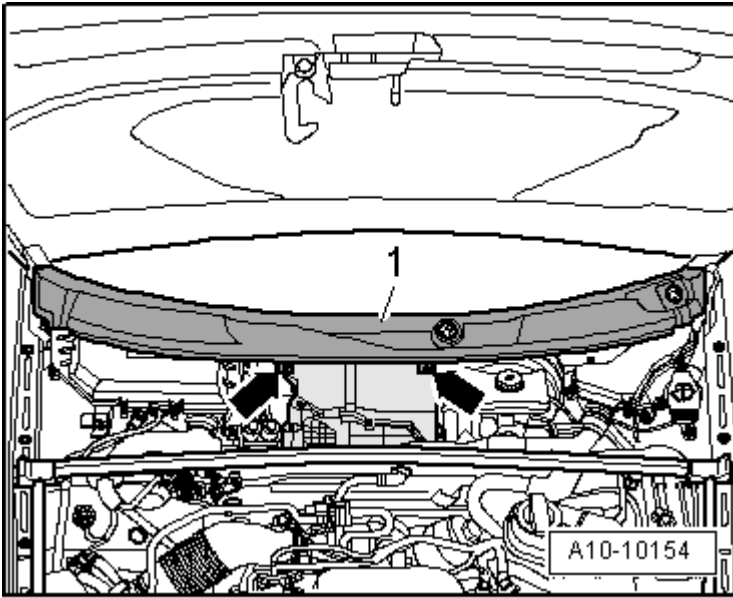


Fig. 97: Removing Bolts For Cowl Grill

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - for cowl grill - **1** -.
- Pull cowl grill off from windshield.

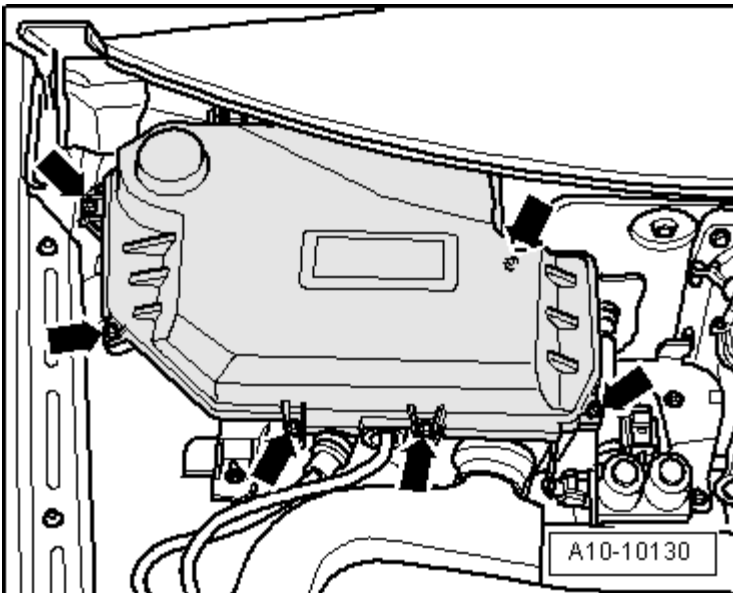


Fig. 98: Removing Bolts And Cover For E-Box At Right In Engine Compartment

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** - and remove cover for E-box at right in engine compartment.

CAUTION: The heater pump valve unit (left of E-box) becomes very hot during operation - Risk of burning!

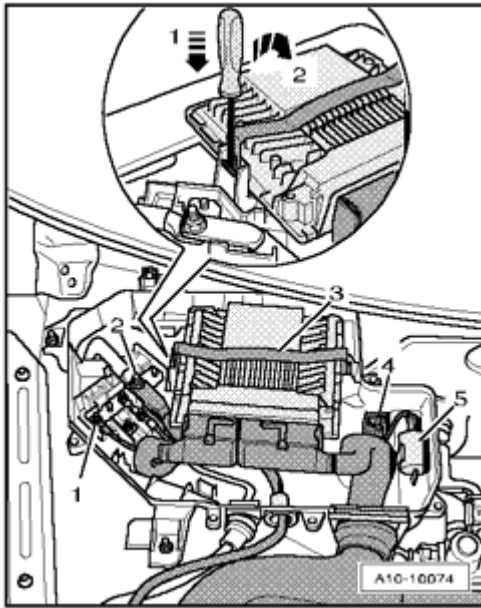


Fig. 99: Prying Off Retaining Clip With Screwdriver And Removing ECM From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Carefully pry off retaining clip - 2 - with a screwdriver - arrows 1 and 2 - and remove ECM from E-box.

CAUTION: To avoid damage (burning) of wire connections and harness connectors, insulation and control modules, the following work steps must be adhered to exactly! Observe operating instructions for heat gun.

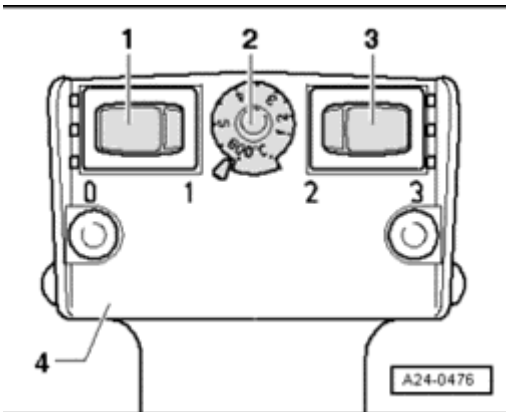


Fig. 100: Performing Adjustments On Hot Air Gun
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set adjustment on heat gun as shown in illustration, with temperature potentiometer - 2 - set to maximum heat and two-stage air flow switch - 3 - set to level "3".

NOTE:

- Next, the threads of the protective housing in which the shear bolts are threaded is heated using the heat gun. This step decreases the locking effect of the locking compound on the shear bolt thread, thus allowing the shear bolts to be removed more easily.

CAUTION: By heating the shear bolts, parts of the protective housing will become extremely hot. Do not burn yourself on this! Ensure only the shear bolts are heated and not any of the surrounding parts. Possibly cover these parts.

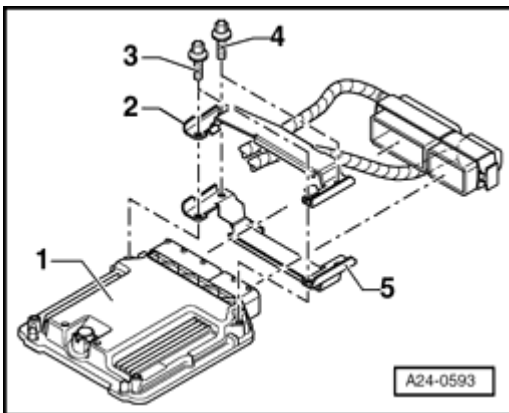


Fig. 101: Removing Protective Housing From Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Perform the following steps in order one after the other for both shear bolts - 4 -.

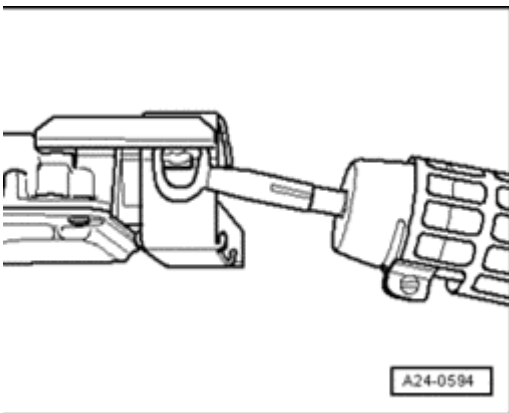


Fig. 102: Using Heat Gun To Direct Heat Gun Nozzle At Shear Bolt Of Retaining Tab
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Direct heat gun nozzle at protective housing shear bolts.
- Switch heat gun on and heat bolt for approx. 20 to 25 seconds.

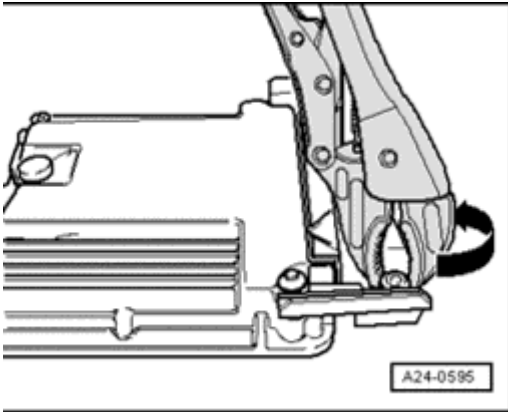


Fig. 103: Using Locking Pliers To Remove Shear Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove shear bolts with locking pliers - **arrow** -.

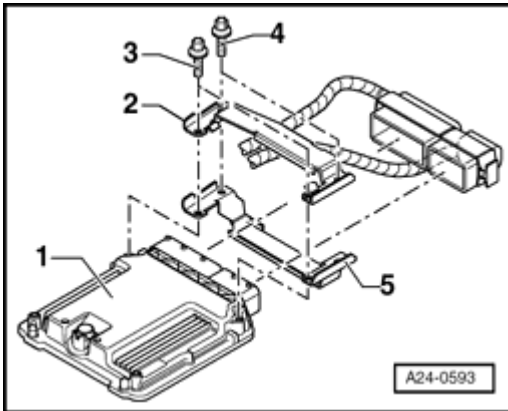


Fig. 104: Removing Protective Housing From Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- The threads of both shear bolts - 3 - that are installed in 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).

- Remove both shear bolts - 3 -.
- Separate retaining tab - 2 - of control module connector.
- Release and pull off connectors from engine control module (ECM).

NOTE:

- Adaptation values are erased when connectors are disconnected from the Engine Control Module (ECM), DTC memory content remains intact.

Installing

Installation is in reverse order of removal, note the following:

- The ECM must be equipped with protective housing again.
- Clean locking compound residue from shear bolt threaded holes. Cleaning can be performed with a thread cutter (tap).
- Use new shear bolts.

After installing a new Engine Control Module (ECM), the following work steps must be performed:

- Activate engine control module (ECM) in "Guided Fault-Finding" under "Replacing engine control module (ECM)".

Oxygen sensor before catalytic converter, bank 1 (right side), removing and installing

Special tools, testers and auxiliary items required

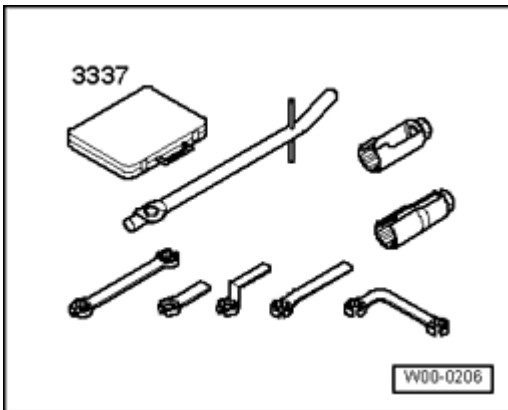


Fig. 105: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Ring spanner 7-piece set for oxygen sensor 3337

Removing

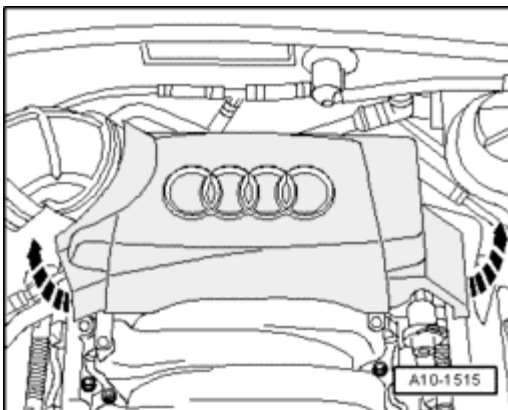


Fig. 106: Removing Rear Engine Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

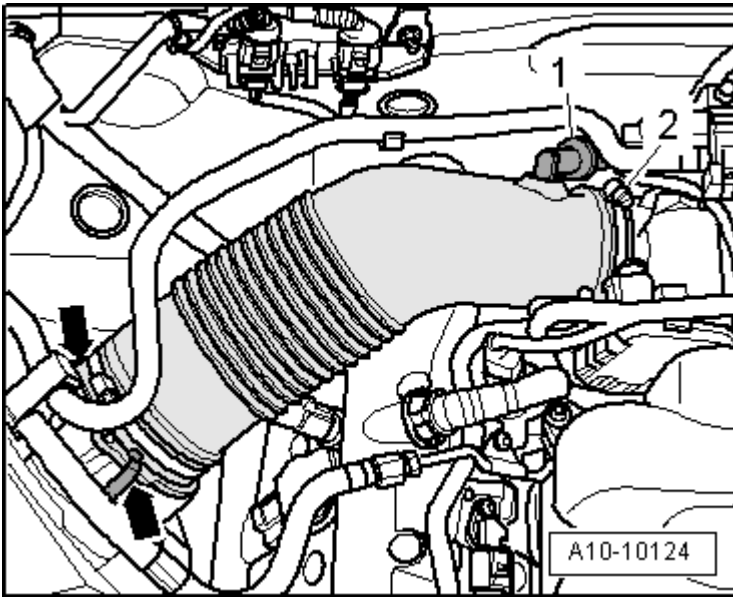


Fig. 107: Disconnecting Check Valve From Connection At Air Duct Hose & Removing Air Duct Hose

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect check valve - **1** - from air duct hose.
- Remove air duct hose, thereby loosening hose clamp - **2** - and opening clips - **arrows** -.

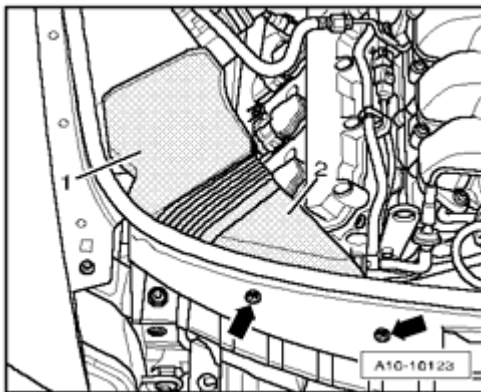


Fig. 108: Removing Air Duct Screws & Air Ducts

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts - **arrows** -.
- Remove air duct - **1** - and - **2** -.

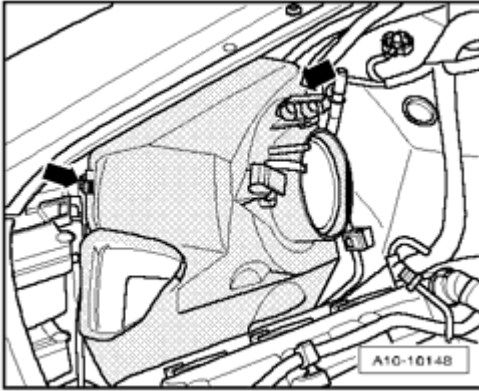


Fig. 109: Opening Clips And Removing Upper Part Of Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open clips - **arrows** - and remove upper part of air filter housing.

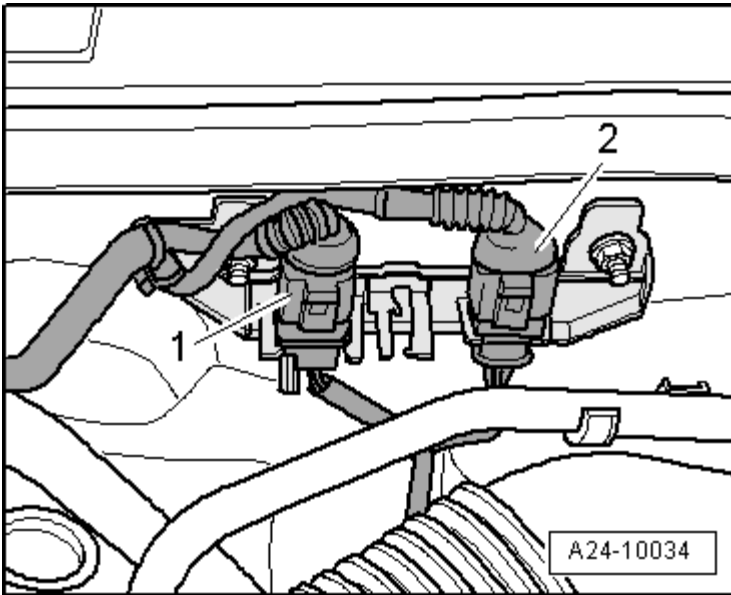


Fig. 110: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **1** - for Heated Oxygen Sensor (HO2S) G39 and free up wire.

NOTE:

- Ignore - **2** -.

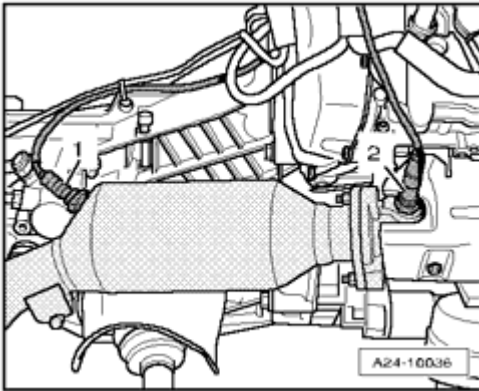


Fig. 111: Removing Oxygen Sensor Using Ring Spanner Set 3337

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oxygen sensor - 2 - using ring spanner set 3337.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- New oxygen sensors are coated with assembly paste; the paste must not get into slots of oxygen sensor body.
- When reinstalling the previously used oxygen sensor, coat thread with hot bolt paste . Paste must not get on to slits of sensor body.
- Electrical wire of oxygen sensor must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.

Torque specifications

Component	Nm
Oxygen sensor in front exhaust pipe	55

Oxygen sensor before catalytic converter, bank 2 (left side), removing and installing

Special tools, testers and auxiliary items required

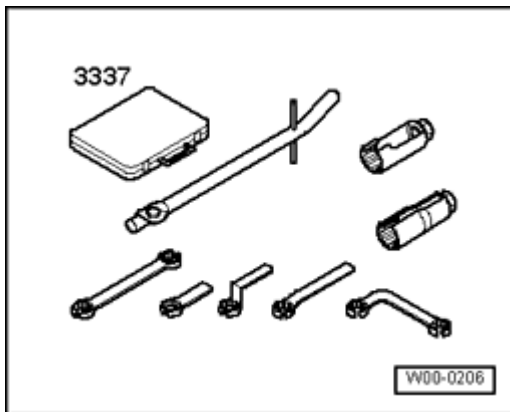


Fig. 112: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Ring spanner 7-piece set for oxygen sensor 3337

Removing

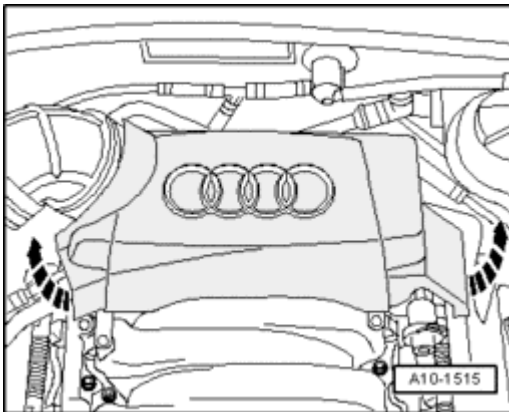


Fig. 113: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

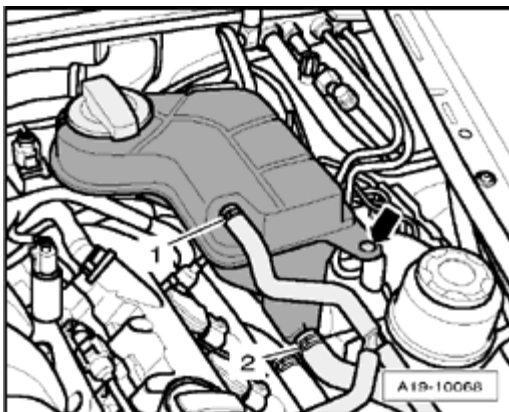


Fig. 114: Removing Coolant Hoses At Coolant Expansion Tank

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

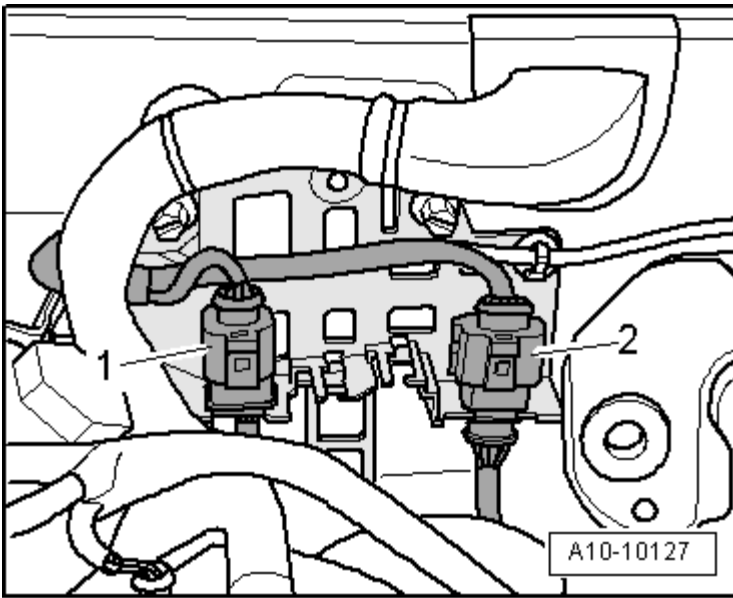


Fig. 115: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - **1** - for Heated Oxygen Sensor (HO2S) 2 G108 and free up wire.

NOTE:

- Ignore - **2** -.

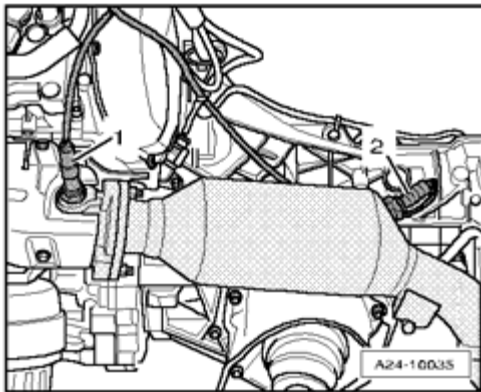


Fig. 116: Removing Oxygen Sensor Using Ring Spanner Set 3337

Courtesy of VOLKSWAGEN UNITED STATES, INC.

2006 Audi A6 Quattro

ENGINE PERFORMANCE 3.2 V6 4V Fuel Injection Ignition, Engine Code(s): BKH

- Remove oxygen sensor - 1 - using ring spanner set 3337.

NOTE:

- To improve clarity, the engine is shown removed.

Installing

Installation is in reverse order of removal, note the following:

NOTE:

- New oxygen sensors are coated with assembly paste; the paste must not get into slots of oxygen sensor body.
- When reinstalling the previously used oxygen sensor, coat thread with hot bolt paste . Paste must not get on to slits of sensor body.
- Wires of oxygen sensors must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.

Torque specifications

Component	Nm
Oxygen sensor in front exhaust pipe	55

Oxygen sensor behind catalytic converter, bank 1 (right side), removing and installing

Special tools, testers and auxiliary items required

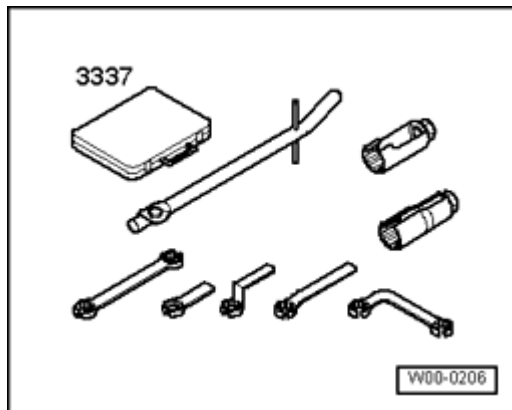


Fig. 117: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Ring spanner 7-piece set for oxygen sensor 3337

Removing

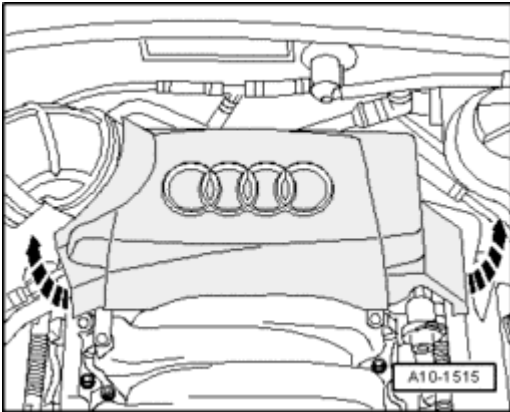


Fig. 118: Removing Rear Engine Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

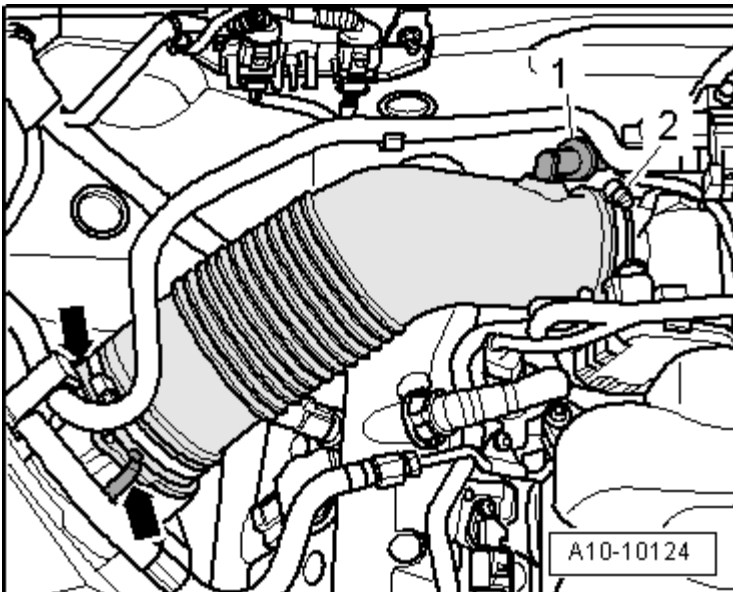


Fig. 119: Disconnecting Check Valve From Connection At Air Duct Hose & Removing Air Duct Hose

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect check valve - **1** - from air duct hose.
- Remove air duct hose, thereby loosening hose clamp - **2** - and opening clips - **arrows** -.

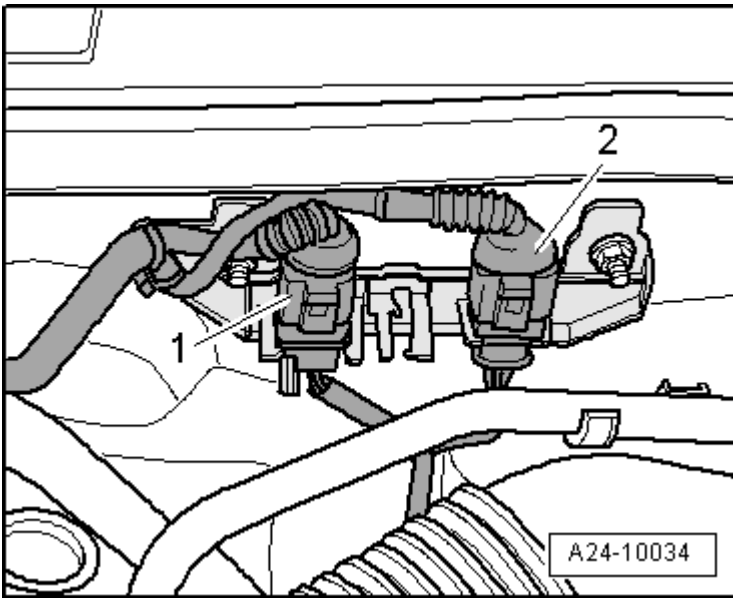


Fig. 120: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - 2 - for Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 and free up wire.

NOTE:

- Ignore - 1 -.

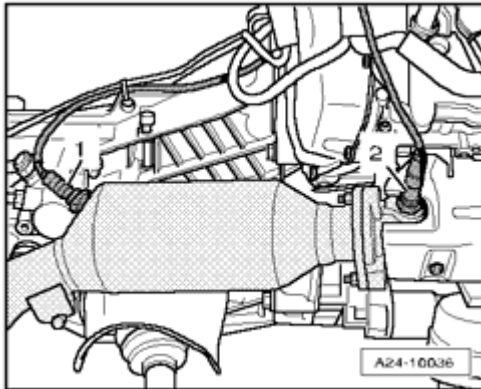


Fig. 121: Removing Oxygen Sensor Using Ring Spanner Set 3337

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oxygen sensor - 1 - using ring spanner set 3337.

NOTE:

- To improve clarity, the engine is shown removed.

Installing

2006 Audi A6 Quattro

ENGINE PERFORMANCE 3.2 V6 4V Fuel Injection Ignition, Engine Code(s): BKH

Installation is in reverse order of removal, note the following:

NOTE:

- Replace O-ring.
- New oxygen sensors are coated with assembly paste; the paste must not get into slots of oxygen sensor body.
- When reinstalling the previously used oxygen sensor, coat thread with hot bolt paste . Paste must not get on to slits of sensor body.
- Electrical wire of oxygen sensor must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.

Torque specifications

Component		Nm
Oxygen sensor in front exhaust pipe		55
Air duct to intake manifold		10
Holding plate to	Intake manifold	10
	Air duct	10

Oxygen sensor behind catalytic converter, bank 2 (left side), removing and installing

Special tools, testers and auxiliary items required

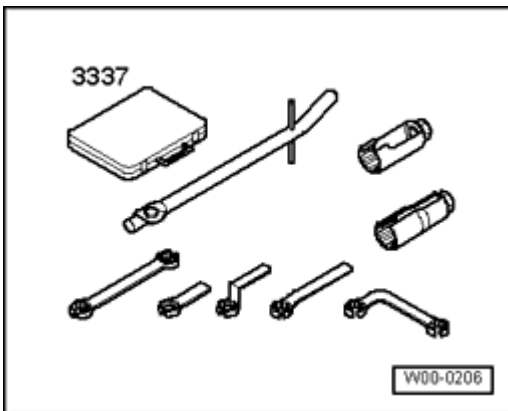


Fig. 122: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Ring spanner 7-piece set for oxygen sensor 3337

Removing

2006 Audi A6 Quattro

ENGINE PERFORMANCE 3.2 V6 4V Fuel Injection Ignition, Engine Code(s): BKH

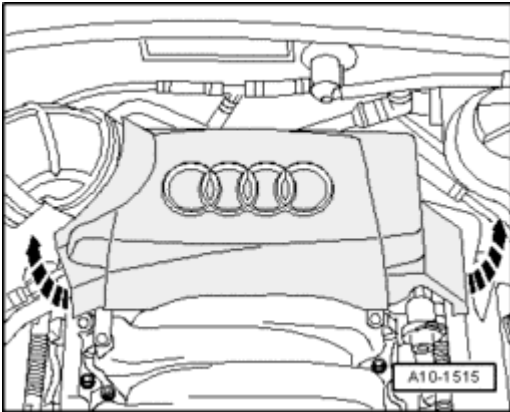


Fig. 123: Removing Rear Engine Cover

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover - **arrows** -.

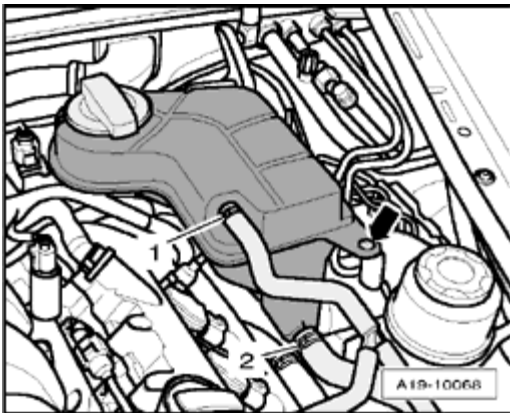


Fig. 124: Removing Coolant Hoses At Coolant Expansion Tank

Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

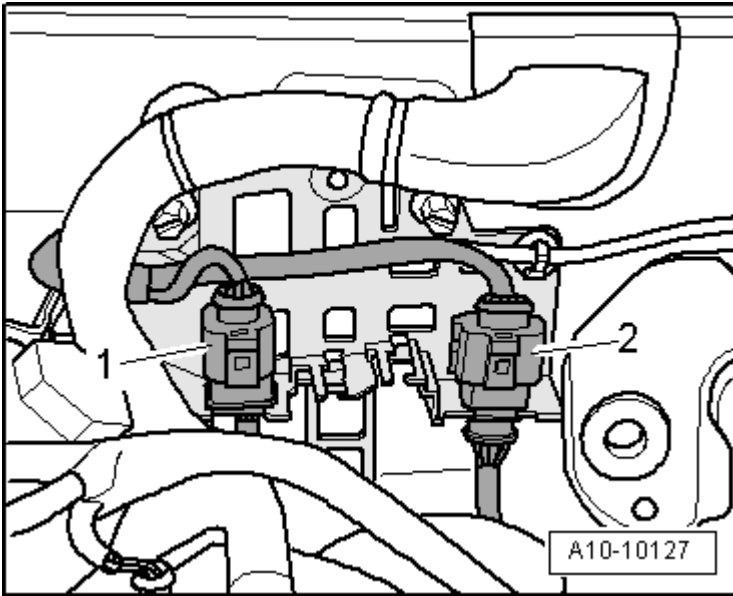


Fig. 125: Disconnecting Electrical Harness Connector For Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector - 2 - for Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131 and free up wire.

NOTE:

- Ignore - 1 -.

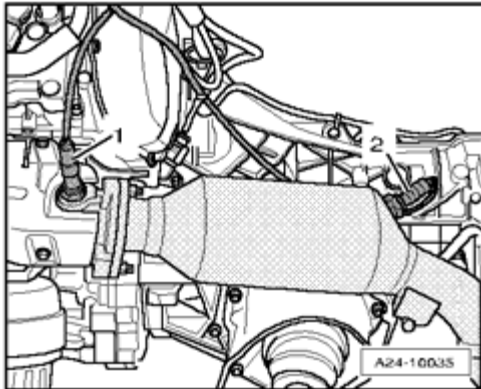


Fig. 126: Removing Oxygen Sensor Using Ring Spanner Set 3337

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oxygen sensor - 2 - using ring spanner set 3337.

NOTE:

- To improve clarity, the removed engine is shown.

Installing

2006 Audi A6 Quattro

ENGINE PERFORMANCE 3.2 V6 4V Fuel Injection Ignition, Engine Code(s): BKH

Installation is in reverse order of removal, note the following:

NOTE:

- **Replace O-ring.**
- **New oxygen sensors are coated with assembly paste; the paste must not get into slots of oxygen sensor body.**
- **When reinstalling the previously used oxygen sensor, coat thread with hot bolt paste . Paste must not get on to slits of sensor body.**
- **Electrical wire of oxygen sensor must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**

Torque specifications

Component	Nm
Oxygen sensor in front exhaust pipe	55