00 GENERAL, TECHNICAL DATA

TECHNICAL DATA

Engine identification

NOTE: Engine identification is visible first after preparations.

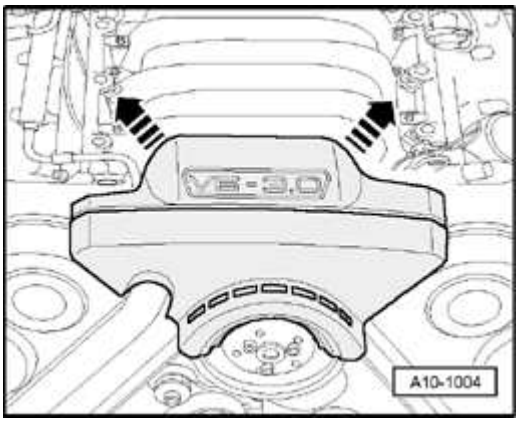


Fig. 1: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

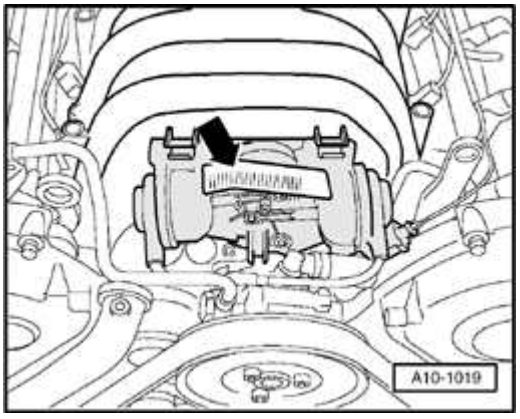


Fig. 2: Identifying "Engine Code" And "Production Number" Location
Courtesy of VOLKSWAGEN UNITED STATES, INC.

A sticker containing "engine code" and "production number" (arrow) is located on the housing for vacuum diaphragm for intake manifold adjustment.

If the sticker is not present and the "engine identification" is required, proceed as follows:

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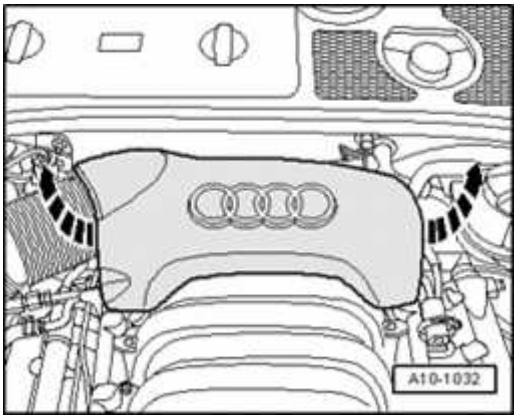


Fig. 3: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

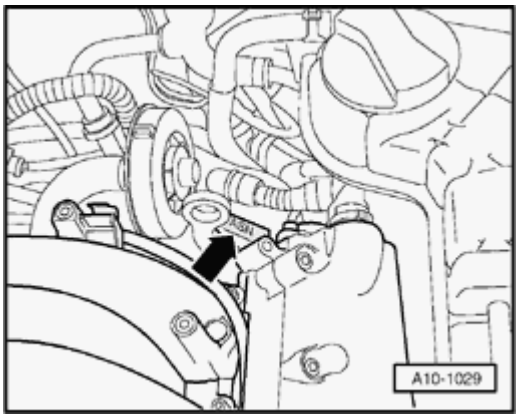


Fig. 4: Identifying Engine Codes Are Stamped On Rear Of Cylinder Block, Left Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Engine codes are stamped on rear of cylinder block, left side (arrow).

Engine codes are also included on the vehicle data plate.

If the sticker is not present and the "engine identification" and "production number" is required, proceed as follows:

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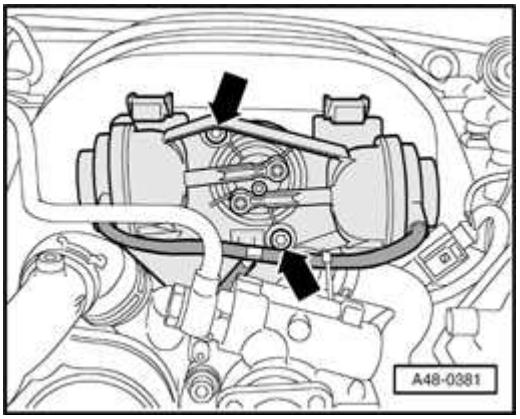


Fig. 5: Removing Bolts And Vacuum Diaphragm For Intake Manifold Adjustment
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove vacuum diaphragm for intake manifold adjustment.
- Remove compression spring which is behind it and set off to side vacuum diaphragm with connected lines.

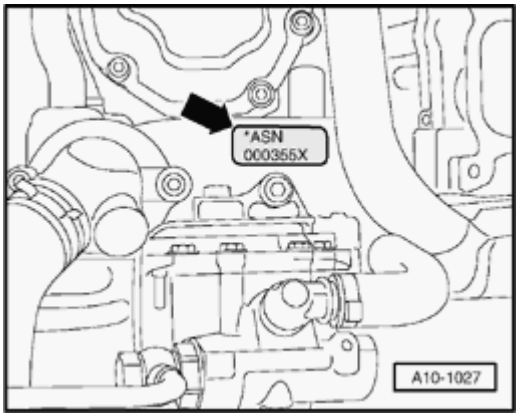


Fig. 6: Identifying Engine Code Are Located At The Front Of The Cylinder Head, On Top
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The engine code -arrow- ("engine code" and "production number") are located at the front of the cylinder head, on top.

Engine specifications

Code letters		**AVK**	**BGN**
Displacement	Liters	2.976	2.976
Output	kw @ RPM	162/6300	162/6300
Torque	Nm at RPM	300/3200	300/3200
Bore	Diameter in mm	82.5	82.5
Stroke	mm	92.8	92.8
Compression ratio		10.3	10.3

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RON	98 1)	98 1)
Injection/ignition system	Bosch Motronic	Bosch Motronic
Knock sensor control	Yes	Yes
Turbocharger	No	No
Exhaust Gas Recirculation (EGR)	No	No
Intake manifold change-over	Yes	Yes
Camshaft adjustment	Yes	Yes
Secondary Air Injection	Yes	Yes

1) Also Super-unleaded RON 95 is permissible, however with reduced performance.

Code letters	**AVK**
Valve timing	
at 1 mm valve lift and 0 mm valve lash	
Intake valve opens after TDC	20°
Intake valve closes after BDC	50°
Exhaust valve opens before BDC	47°
Exhaust valve closes before TDC	17°

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DTC INDEX

DTC Index - 3.0L (AVK Engines)

DIAGNOSTIC TROUBLE CODES (DTC) INDEX

DTC Index - 3.0L (AVK Engines)

SAE Code	VAG Code	Code Description	Corrective action
P0010	16394	Bank 1, Camshaft adjustment malfunction	○ Check valves -1- and -2- for camshaft adjustment -N205-/-N208-. See **SOLENOID VALVE FOR CAMSHAFT ADJUSTMENT, CHECKING** .
P0011	16395	Bank 1, camshaft retardation adjustment Specification not reached	
P0012	16396	Bank 1, camshaft advance adjustment Specification not reached	
P0013	16397	"B" Camshaft Position - Actuator Circuit Bank 1	
P0014	16398	"B" Camshaft Position - Timing Over-Advanced or System Performance Bank 1	
P0015	16399	"B" Camshaft Position - Timing Over-Retarded Bank 1 Specified value not obtained	
P0020	16404	"Intake" Camshaft Position Actuator Circuit, Bank 2	
P0021	16405	"Intake" Camshaft Position - Timing Over-Advanced or System Performance, Bank 2	
P0022	16406	"Intake" Camshaft Position - Timing Over-Retarded,Bank 2	
P0023	16407	"Exhaust" Camshaft Position - Actuator Circuit, Bank 2	
P0024	16408	"Exhaust" Camshaft Position - Timing Over-Advanced or System Performance, Bank 2	
P0025	16408	"Exhaust" Camshaft Position - Timing Over-Retarded,Bank 2	
P0030	16414	HO2S Heater Control Circuit, Bank 1 Sensor 1	Check Oxygen Sensor (HO2S) and oxygen sensor control before Catalytic Converter. See **CHECK OXYGEN SENSORS AND OXYGEN SENSOR CONTROL BEFORE CATALYTIC CONVERTER** . Check Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic
P0031	16415	HO2S Heater Control Circuit Low, Bank 1 Sensor 1	

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P0032	16416	HO2S Heater Control Circuit High, Bank 1 Sensor 1	Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING**
P0036	16420	HO2S Heater Control Circuit Bank, 1 Sensor 2	○ Check oxygen sensor heater for Oxygen Sensors (O2S) behind Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS BEHIND THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** . ○ Check Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSOR AND OXYGEN SENSOR CONTROL BEHIND CATALYTIC CONVERTER** .
P0037	16421	HO2S Heater Control Circuit Low, Bank 1 Sensor 2	
P0038	16422	HO2S Heater Control Circuit High, Bank 1 Sensor 2	
P0040	16424	O2 Sensor Signals Swapped Bank 1 Sensor 1/ Bank 2 Sensor 1	○ Check whether oxygen sensors have been swapped ○ Check harness connector with coding and color for affiliation to the correct catalytic converter
P0041	16425	O2 Sensor Signals Swapped Bank 1 Sensor 2/ Bank 2 Sensor 2	
P0050	16434	HO2S Heater Control Circuit Bank 2 Sensor 1	○ Check oxygen sensor heater for oxygen sensors before Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** . ○ Check Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSORS AND OXYGEN SENSOR CONTROL BEFORE CATALYTIC CONVERTER** .
P0051	16435	HO2S Heater Control Circuit Low Bank 2 Sensor 1	
P0052	16436	HO2S Heater Control Circuit High Bank 2 Sensor 1	
P0056	16440	HO2S Heater Control Circuit Bank 2 Sensor 2	○ Check oxygen sensor heater for Oxygen Sensors (O2S) behind Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS**

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P0057	16441	HO2S Heater Control Circuit Low Bank 2 Sensor 2	**BEHIND THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** . ○ Check Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSOR AND OXYGEN SENSOR CONTROL BEHIND CATALYTIC CONVERTER** .
P0058	16442	HO2S Heater Control Circuit High Bank 2 Sensor 2	
P0101	16485	Mass or Volume Air Flow Circuit Range/Performance	○ Check Mass Air Flow (MAF) Sensor -G70-. See **MASS AIR FLOW (MAF) SENSOR -G70-, CHECKING** . ○ Check intake air system for leaks (false air). See **CHECKING INTAKE SYSTEM FOR LEAKS (UNMETERED AIR)** .
P0102	16486	Mass or Volume Air Flow Circuit Low Input	
P0103	16487	Mass or Volume Air Flow Circuit High Input	
P0106	16490	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	○ Replace Engine Control Module (ECM)
P0112	16496	Intake Air Temperature Sensor 1 Circuit Low	○ Check Intake Air Temperature (IAT) Sensor -G42-. See **INTAKE AIR TEMPERATURE (IAT) SENSOR -G42-, CHECKING** .
P0113	16497	Intake Air Temperature Sensor 1 Circuit High	
P0116	16500	Engine Coolant Temperature Circuit Range/Performance	○ Check Engine Coolant Temperature (ECT) Sensor -G62-. See **ENGINE COOLANT TEMPERATURE (ECT) SENSOR -G62-, CHECKING** . ○ Check coolant regulator (thermostat): See **COOLANT THERMOSTAT, REMOVING, INSTALLING AND CHECKING** .
P0117	16501	Engine Coolant Temperature Circuit Low	
P0118	16502	Engine Coolant Temperature Circuit High	
P0121	16505	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	○ Check Throttle Valve Control Module -J338-. See **THROTTLE VALVE CONTROL MODULE -J338-, CHECKING** .
P0122	16506	Throttle/Pedal Position Sensor/Switch "A" Circuit Low	
P0123	16507	Throttle/Pedal Position Sensor/Switch "A" Circuit High	
		O2 Sensor Circuit, Bank 1 Sensor 1	○ Check oxygen sensor heater for oxygen sensors before Three Way

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P0130	16514		Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** . ○ Check Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSORS AND OXYGEN SENSOR CONTROL BEFORE CATALYTIC CONVERTER** .
P0133	16517	O2 Sensor Circuit Slow Response, Bank 1 Sensor 1	
P0135	16519	O2 Sensor Heater Circuit, Bank 1 Sensor 1	○ Check oxygen sensor heater for oxygen sensors before Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** .
P0136	16520	O2 Sensor Circuit, Bank 1 Sensor 2	○ Check oxygen sensor heater for Oxygen Sensors (O2S) behind Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS BEHIND THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** . ○ Check Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSOR AND OXYGEN SENSOR CONTROL BEHIND CATALYTIC CONVERTER** .
P0137	16521	O2 Sensor Circuit Low Voltage, Bank 1 Sensor 2	
P0138	16522	O2 Sensor Circuit High Voltage, Bank 1 Sensor 2	
P0139	16523	O2 Sensor Circuit Slow Response, Bank 1 Sensor 2	
P0140	16524	O2 Sensor Circuit No Activity Detected, Bank 1 Sensor 2	
P0141	16525	O2 Sensor Heater Circuit, Bank 1 Sensor 2	○ Check oxygen sensor heater for Oxygen Sensors (O2S) behind Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS BEHIND THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** .
		O2 Sensor Circuit Bank 2 Sensor 1	○ Check oxygen sensor heater for

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P0150	16534		oxygen sensors before Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** .
P0153	16537	O2 Sensor Circuit Slow Response Bank 2 Sensor 1	○ Check Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSORS AND OXYGEN SENSOR CONTROL BEFORE CATALYTIC CONVERTER** .
P0155	16539	O2 Sensor Heater Circuit Bank 2 Sensor 1	○ Check oxygen sensor heater for oxygen sensors before Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** .
P0156	16540	O2 Sensor Circuit Bank 2 Sensor 2	○ Check oxygen sensor heater for Oxygen Sensors (O2S) behind Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS BEHIND THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** . ○ Check Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSOR AND OXYGEN SENSOR CONTROL BEHIND CATALYTIC CONVERTER** .
P0157	16541	O2 Sensor Circuit Low Voltage Bank 2 Sensor 2	
P0158	16542	O2 Sensor Circuit High Voltage Bank 2 Sensor 2	
P0159	16543	O2 Sensor Circuit Slow Response Bank 2 Sensor 2	
P0160	16544	O2 Sensor Circuit No Activity Detected Bank 2 Sensor 2	
P0161	16545	O2 Sensor Heater Circuit Bank 2 Sensor 2	○ Check oxygen sensor heater for Oxygen Sensors (O2S) behind Three Way Catalytic Converter (TWC). See **OXYGEN SENSOR HEATER FOR OXYGEN SENSORS BEHIND THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** .

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P0171	16555	System Too Lean, Bank 1	○ Check fuel pressure regulator and residual pressure. See **FUEL PRESSURE REGULATOR AND RESIDUAL PRESSURE, CHECKING** . ○ Check fuel injectors. See **CHECK FUEL INJECTORS** . ○ Check intake air system for leaks (false air). See **CHECKING INTAKE SYSTEM FOR LEAKS (UNMETERED AIR)** . ○ Check Fuel Pump (FP). See **FUEL PUMP (FP), ELECTRICAL TESTING** for front wheel drive. See **FUEL PUMP (FP), ELECTRICAL TESTING** for all wheel drive. ○ Check exhaust system for proper seal. See **CHECK EXHAUST SYSTEM FOR PROPER SEAL** . ○ Check Secondary Air Injection (AIR) system for proper seal. See **CHECKING SECONDARY AIR SYSTEM FOR PROPER SEAL** . ○ Check vacuum lines for proper seal
P0172	16556	System Too Rich, Bank 1	○ Check fuel pressure regulator and residual pressure. See **FUEL PRESSURE REGULATOR AND RESIDUAL PRESSURE, CHECKING** . ○ Check fuel injectors. See **CHECK FUEL INJECTORS** . ○ Check Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSORS AND OXYGEN SENSOR CONTROL BEFORE CATALYTIC CONVERTER** . ○ Check Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSOR AND OXYGEN SENSOR**

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			CONTROL BEHIND CATALYTIC CONVERTER . o Check Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-. See **CHECKING EVAPORATIVE EMISSION (EVAP) CANISTER PURGE REGULATOR VALVE -N80-** .
P0174	16558	System Too Lean Bank 2	o Check fuel pressure regulator and residual pressure. See **FUEL PRESSURE REGULATOR AND RESIDUAL PRESSURE, CHECKING** . o Check fuel injectors. See **CHECK FUEL INJECTORS** . o Check intake air system for leaks (false air). See **CHECKING INTAKE SYSTEM FOR LEAKS (UNMETERED AIR)** . o Check Fuel Pump (FP). See **FUEL PUMP (FP), ELECTRICAL TESTING** for front wheel drive. See **FUEL PUMP (FP), ELECTRICAL TESTING** for all wheel drive. o Check exhaust system for proper seal. See **CHECK EXHAUST SYSTEM FOR PROPER SEAL** . o Check Secondary Air Injection (AIR) system for proper seal. See **CHECKING SECONDARY AIR SYSTEM FOR PROPER SEAL** . o Check vacuum lines for proper seal
		System Too Rich Bank 2	o Check fuel pressure regulator and residual pressure. See **FUEL PRESSURE REGULATOR AND RESIDUAL PRESSURE, CHECKING** . o Check fuel injectors. See **CHECK FUEL INJECTORS** . o Check Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSORS**

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P0175	16559		**AND OXYGEN SENSOR CONTROL BEFORE CATALYTIC CONVERTER** . o Check Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSOR AND OXYGEN SENSOR CONTROL BEHIND CATALYTIC CONVERTER** . o Check Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-. See **CHECKING EVAPORATIVE EMISSION (EVAP) CANISTER PURGE REGULATOR VALVE -N80-** .
P0201	16585	Injector Circuit/Open - Cylinder 1	o Check fuel injectors. See **CHECK FUEL INJECTORS** .
P0202	16586	Injector Circuit/Open - Cylinder 2	
P0203	16587	Injector Circuit/Open - Cylinder 3	
P0204	16588	Injector Circuit/Open - Cylinder 4	
P0205	16589	Cylinder 5 Fuel Injector N83 Electrical malfunction	
P0206	16590	Cylinder 6 Fuel Injector N84 Electrical malfunction	
P0221	16605	Throttle/Pedal Position Sensor/Switch "B" Circuit Range/Performance	o Check Throttle Valve Control Module -J338-. See **THROTTLE VALVE CONTROL MODULE -J338-, CHECKING** .
P0222	16606	Throttle/Pedal Position Sensor/Switch "B" Circuit Low	
P0223	16607	Throttle/Pedal Position Sensor/Switch "B" Circuit High	
P0230	16614	Fuel Pump Primary Circuit	o Check Fuel Pump (FP) Relay -J17- and activation. See **FUEL PUMP (FP) RELAY -J17- AND ACTIVATION, CHECKING** .
P0261	16645	Cylinder 1 Injector Circuit Low	o Check fuel injectors. See **CHECK FUEL INJECTORS** .
P0262	16646	Cylinder 1 Injector Circuit High	
P0264	16648	Cylinder 2 Injector Circuit Low	
P0265	16649	Cylinder 2 Injector Circuit High	
P0267	16651	Cylinder 3 Injector Circuit Low	
P0268	16652	Cylinder 3 Injector Circuit High	
P0270	16654	Cylinder 4 Injector Circuit Low	
P0271	16655	Cylinder 4 Injector Circuit High	
P0273	16657	Cylinder 5 Fuel Injector N83 Short to	

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		Ground (GND)	
P0274	16658	Cylinder 5 Fuel Injector N83 Short to positive	
P0276	16660	Cylinder 6 Fuel Injector N84 Short to Ground (GND)	
P0277	16661	Cylinder 6 Fuel Injector N84 Short to positive	
P0300	16684	Random/Multiple Cylinder Misfire Detected	○ Check fuel injectors. See **CHECK FUEL INJECTORS** . ○ Check ignition coils with power output stages. See **IGNITION COILS WITH POWER OUTPUT STAGES, CHECKING** .
P0301	16685	Cylinder 1 Misfire Detected	
P0302	16686	Cylinder 2 Misfire Detected	
P0303	16687	Cylinder 3 Misfire Detected	
P0304	16688	Cylinder 4 Misfire Detected	
P0305	16689	Cyl. 5 misfire detected	
P0306	16690	Cyl. 6 misfire detected	
P0321	16705	Ignition/Distributor Engine Speed Input Circuit Range/Performance	○ Check Engine Speed (RPM) Sensor -G28-. See **ENGINE SPEED (RPM) SENSOR -G28-, CHECKING** .
P0322	16706	Ignition/Distributor Engine Speed Input Circuit No Signal	
P0340	16724	Camshaft Position Sensor "A" Circuit, Bank 1 or Single Sensor	○ Check Camshaft Position (CMP) sensor. See **CHECK CAMSHAFT POSITION (CMP) SENSOR** .
P0341	16725	Camshaft Position Sensor "A" Circuit Range/Performance, Bank 1 or Single Sensor	
P0342	16726	Camshaft Position Sensor "A" Circuit Low, Bank 1 or Single Sensor	
P0343	16727	Camshaft Position Sensor "A" Circuit High, Bank 1 or Single Sensor	
P0345	16729	Camshaft Position Sensor "A" Circuit Bank 2	
P0346	16730	Camshaft Position Sensor "A" Circuit Range/Performance Bank 2	
P0347	16731	Camshaft Position Sensor "A" Circuit Low Bank 2	
P0348	16732	Camshaft Position Sensor "A" Circuit High Bank 2	
P0351	16735	Ignition Coil "A" Primary/Secondary Circuit	○ Check ignition coils with power output stages. See **IGNITION COILS WITH POWER OUTPUT**
P0352	16736	Ignition Coil "B" Primary/Secondary Circuit	
P0353	16737	Ignition Coil "C" Primary/Secondary Circuit	
P0354	16738	Ignition Coil "D" Primary/Secondary	

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		Circuit	**STAGES, CHECKING** .
P0355	16739	Ignition Coil "E" Primary/Secondary Circuit	
P0356	16740	Ignition Coil "F" Primary/Secondary Circuit	
P0365	16749	Camshaft Position Sensor "B" Circuit Bank 1	○ Check Camshaft Position (CMP) sensor. See **CHECK CAMSHAFT POSITION (CMP) SENSOR** .
P0366	16750	Camshaft Position Sensor "B" Circuit Range/Performance Bank 1	
P0367	16751	Camshaft Position Sensor "B" Circuit Low Bank 1	
P0368	16752	Camshaft Position Sensor "B" Circuit High Bank 1 Signal too large	
P0390		Camshaft Position Sensor "B" Circuit, Bank 2	
P0391	16775	Camshaft Position Sensor "B" Circuit Range/Performance Bank 2	
P0392	16776	Camshaft Position Sensor "B" Circuit Low Bank 2	
P0393	16777	Camshaft Position Sensor "B" Circuit High Bank 2	
P0413	16797	Secondary Air Injection solenoid valve N112 Open	○ Check Secondary Air Injection (AIR) Solenoid Valve -N112-. See **SECONDARY AIR INJECTION (AIR) SOLENOID VALVE -N112-, CHECKING** .
P0414	16798	Secondary Air Injection solenoid valve N112 Short circuit	
P0418	16802	Secondary Air Injection System Control "A" Circuit	○ Check Secondary Air Injection (AIR) Pump Relay -J299- and activation. See **SECONDARY AIR INJECTION (AIR) PUMP RELAY -J299- AND ACTIVATION, CHECKING** .
P0421	16805	Warm Up Catalyst Efficiency Below Threshold, Bank 1	○ Check Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSORS AND OXYGEN SENSOR CONTROL BEFORE CATALYTIC CONVERTER** . ○ Check Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSOR**
		Warm Up Catalyst Efficiency Below Threshold, Bank 2	

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P0431	16815		**AND OXYGEN SENSOR CONTROL BEHIND CATALYTIC CONVERTER** . o Check catalytic conversion. See **TEST-ID 01: CATALYTIC CONVERTER** .
P0441	16825	Evaporative Emission System Incorrect Purge Flow	o Check Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-. See **CHECKING EVAPORATIVE EMISSION (EVAP) CANISTER PURGE REGULATOR VALVE -N80-** . o EVAP canister system, check for proper seal. See **EVAP CANISTER SYSTEM, CHECKING FOR PROPER SEAL** .
P0442	16826	Evaporative Emission System Leak Detected (small leak)	
P0444	16828	Evaporative Emission System Purge Control Valve Circuit Open	
P0445	16829	Evaporative Emission System Purge Control Valve Circuit Shorted	
P0455	16839	Evaporative Emission System Leak Detected (large leak)	
P0456	16840	Evaporative Emission System Leak Detected (very small leak)	
P0491	16875	Secondary Air Injection System Insufficient Flow Bank 1	o Check Secondary Air Injection (AIR) system for proper seal. See **CHECKING SECONDARY AIR SYSTEM FOR PROPER SEAL** . o Check Secondary Air Injection (AIR) Solenoid Valve -N112-. See **SECONDARY AIR INJECTION (AIR) SOLENOID VALVE -N112-, CHECKING** . o Check Secondary Air Injection (AIR) Pump Relay -J299- and activation. See **SECONDARY AIR INJECTION (AIR) PUMP RELAY -J299- AND ACTIVATION, CHECKING** .
P0492	16876	Secondary Air Injection System Insufficient Flow Bank 2	
P0501	16885	Vehicle Speed Sensor "A" Range/Performance	o Check speed signal. See **CHECKING SPEED SIGNAL** .
P0506	16890	Idle Air Control System RPM Lower Than Expected	o Check Throttle Valve Control Module -J338-. See **THROTTLE VALVE CONTROL MODULE -J338-, CHECKING** .
P0507	16891	Idle Air Control System RPM Higher Than Expected	
P0601	16985	Internal Control Module Memory Check Sum Error	o Replace Engine Control Module (ECM)
P0604	16988	Internal Control Module Random Access Memory (RAM) Error	
		Internal Control Module Read Only	

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P0605	16989	Memory (ROM) Error	
P0606	16990	ECM/PCM Processor	
P0638	17022	Throttle Actuator Control Range/Performance	○ Check Throttle Valve Control Module -J338-. See **THROTTLE VALVE CONTROL MODULE -J338-, CHECKING** . ○ Check Throttle Position (TP) sensor. See **THROTTLE POSITION (TP) SENSOR, CHECKING** .
P0685	17069	ECM/PCM Power Relay Control Circuit/Open	○ Check voltage supply for Engine Control Module (ECM). See **VOLTAGE SUPPLY FOR ENGINE CONTROL MODULE (ECM** . ○ Check Motronic Engine Control Module (ECM) Power Supply Relay -J271- and activation. See **CHECK MOTRONIC ENGINE CONTROL MODULE (ECM) POWER SUPPLY RELAY -J271- AND ACTIVATION** .
P0686	17070	ECM/PCM Power Relay Control Circuit Low	
P0687	17071	ECM/PCM Power Relay Control Circuit High	
P0688	17072	Power supply relay J271 , load circuit open	
P0704	17088	Clutch Switch Input Circuit Malfunction	○ Check Clutch Vacuum Vent Valve Switch -F36-. See **CLUTCH VACUUM VENT VALVE SWITCH -F36-, CHECKING** .
P1176	17584	Bank 1 oxygen sensor correction behind cat. control limit reached Control limit reached	○ Check Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSORS AND OXYGEN SENSOR CONTROL BEFORE CATALYTIC CONVERTER** . ○ Check Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC). See **CHECK OXYGEN SENSOR AND OXYGEN SENSOR CONTROL BEHIND CATALYTIC CONVERTER** . ○ Check intake air system for leaks (false air). See **CHECKING INTAKE SYSTEM FOR LEAKS (UNMETERED AIR)** .
P1177	17585	O2 Correction Behind Catalyst,B2 Limit Attained Control limit reached	
P2096	18528	Post Catalyst Fuel Trim System Too Lean, Bank 1	
P2097	18529	Post Catalyst Fuel Trim System Too Rich	
P2098	18530	Post Catalyst Fuel Trim System Too Lean Bank 2	
P2099	18531	Post Catalyst Fuel Trim System Too Rich Bank 2	
P2101	18533	Throttle Actuator Control Motor	○ Check Throttle Valve Control

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		Circuit Range/Performance	Module -J338-. See **THROTTLE VALVE CONTROL MODULE -J338-, CHECKING** .
P2106	18538	Throttle Actuator Control System, Forced Limited Power	
P2122	18554	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	○ Check Throttle Position (TP) sensor. See **THROTTLE POSITION (TP) SENSOR, CHECKING** .
P2123	18555	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	
P2127	18559	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	
P2128	18560	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	
P2138	18570	Throttle/Pedal Position Sensor/Switch "D" / "E" Voltage Correlation	
P2181	18613	Cooling System Performance	○ Check Engine Coolant Temperature (ECT) Sensor -G62-. See **ENGINE COOLANT TEMPERATURE (ECT) SENSOR -G62-, CHECKING** . ○ Check coolant regulator (thermostat) See **COOLANT THERMOSTAT, REMOVING, INSTALLING AND CHECKING** .
P2400	18832	Evaporative Emission System Leak Detection Pump Control Circuit/Open	○ Check Leak Detection Pump (LDP) -V144-. See **LEAK DETECTION PUMP (LDP) -V144-, CHECKING** . ○ EVAP canister system, check for proper seal. See **EVAP CANISTER SYSTEM, CHECKING FOR PROPER SEAL** .
P2401	18833	Evaporative Emission System Leak Detection Pump Control Circuit Low	
P2402	18834	Evaporative Emission System Leak Detection Pump Control Circuit High	
P2403	18835	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	
P2404	18836	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	○ Check vacuum hose setup from engine compartment to leak detection pump for proper seal
P3081	19537	Engine Temperature Too Low	○ Let engine warm up: • Coolant temperature must be at least 50 °C. See **MODE 1: CHECK MEASURING VALUES** .

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ENGINE

3.0 Liter 6-Cyl. 5V Engine Mechanical, Engine Code(s): AVK, BGN

00 GENERAL, TECHNICAL DATA

TECHNICAL DATA

Engine identification

NOTE: Engine identification is visible first after preparations.

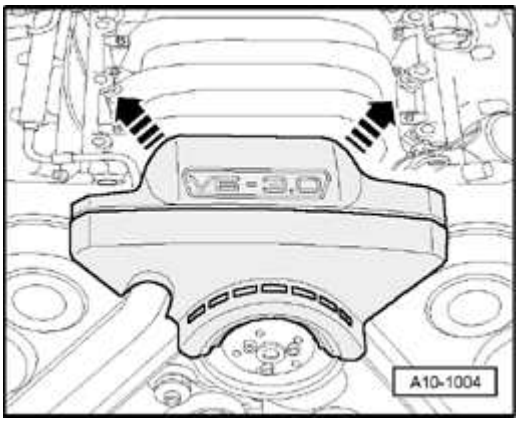


Fig. 1: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

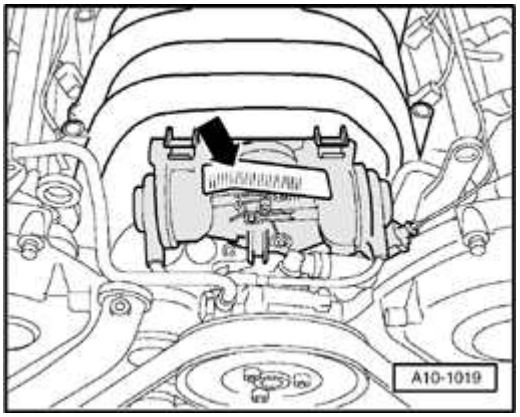


Fig. 2: Identifying "Engine Code" And "Production Number" Location
Courtesy of VOLKSWAGEN UNITED STATES, INC.

A sticker containing "engine code" and "production number" (arrow) is located on the housing for vacuum diaphragm for intake manifold adjustment.

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If the sticker is not present and the "engine identification" is required, proceed as follows:

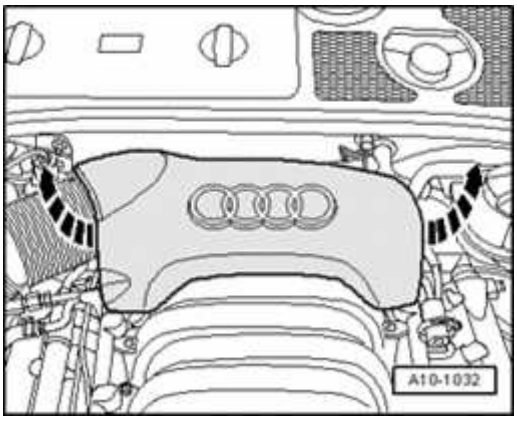


Fig. 3: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

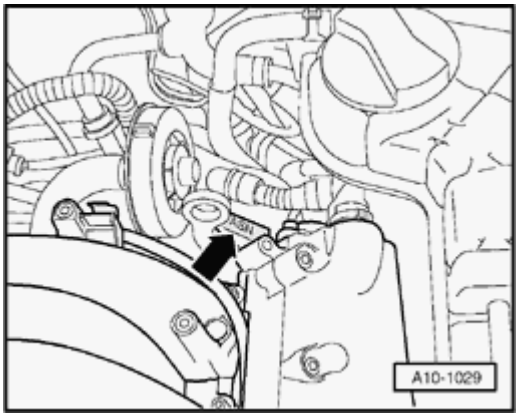


Fig. 4: Identifying Engine Codes Are Stamped On Rear Of Cylinder Block, Left Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Engine codes are stamped on rear of cylinder block, left side (arrow).

Engine codes are also included on the vehicle data plate.

If the sticker is not present and the "engine identification" and "production number" is required, proceed as follows:

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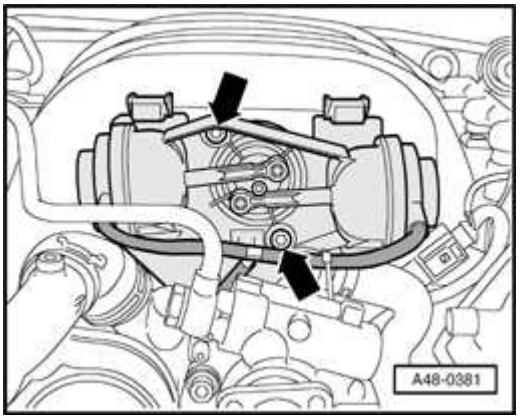


Fig. 5: Removing Bolts And Vacuum Diaphragm For Intake Manifold Adjustment
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove vacuum diaphragm for intake manifold adjustment.
- Remove compression spring which is behind it and set off to side vacuum diaphragm with connected lines.

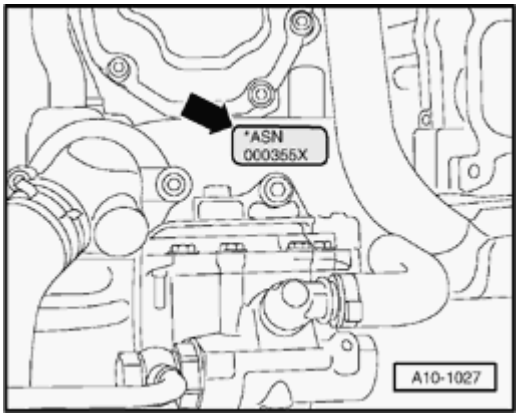


Fig. 6: Identifying Engine Code Are Located At The Front Of The Cylinder Head, On Top
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The engine code -arrow- ("engine code" and "production number") are located at the front of the cylinder head, on top.

Engine specifications

Code letters		**AVK**	**BGN**
Displacement	Liters	2.976	2.976
Output	kw @ RPM	162/6300	162/6300
Torque	Nm at RPM	300/3200	300/3200
Bore	Diameter in mm	82.5	82.5
Stroke	mm	92.8	92.8
Compression ratio		10.3	10.3

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RON	98 1)	98 1)
Injection/ignition system	Bosch Motronic	Bosch Motronic
Knock sensor control	Yes	Yes
Turbocharger	No	No
Exhaust Gas Recirculation (EGR)	No	No
Intake manifold change-over	Yes	Yes
Camshaft adjustment	Yes	Yes
Secondary Air Injection	Yes	Yes

1) Also Super-unleaded RON 95 is permissible, however with reduced performance.

Code letters	**AVK**
Valve timing	
at 1 mm valve lift and 0 mm valve lash	
Intake valve opens after TDC	20°
Intake valve closes after BDC	50°
Exhaust valve opens before BDC	47°
Exhaust valve closes before TDC	17°

10 ENGINE - ASSEMBLY

ENGINE, REMOVING AND INSTALLING

Engine, removing and installing

CAUTION: Before beginning repairs on the electrical system:

- **Obtain the anti-theft radio security code.**
- **Switch the ignition off.**
- **Disconnect the battery Ground (GND) strap.**
- **On vehicles equipped with Audi Telematics by OnStar ® , switch-off the emergency (back-up) battery for the Telematic/Telephone Control Module prior to disconnecting vehicle battery. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

  .
- **After reconnecting vehicle battery, re-code and check operation of anti-theft radio. Also check operation of clock and power windows according to Repair Article and/or Owner's Manual.**

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- **After reconnecting vehicle battery on vehicles equipped with Audi Telematics by OnStar ® , switch-on the emergency (back-up) battery for the Telematic/Telephone Control Module. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

.

Engine, removing and installing

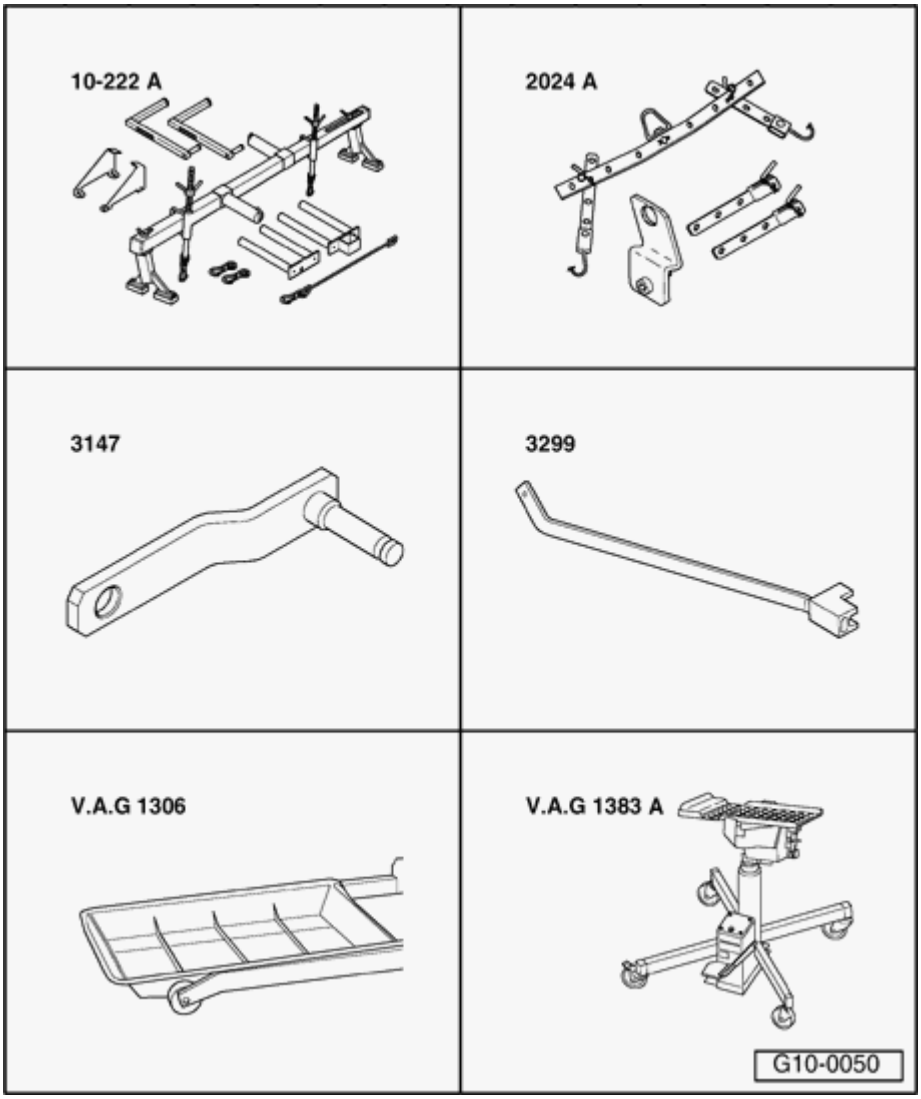


Fig. 7: Identifying Special Tools - Engine, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

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- 10-222A Engine support bridge
- 2024A Engine Sling
- 3147 Engine support adapter
- 3299 Ribbed belt installation tool with 3299/1 claw for tensioner
- VAG1306 Drip tray for VAG1202A
- VAG1383A Engine/transmission hoist



Fig. 8: Identifying Special Tools - Workshop Hoist V.A.G 1202 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1202A Workshop crane

or

- VAS 6100 Workshop crane

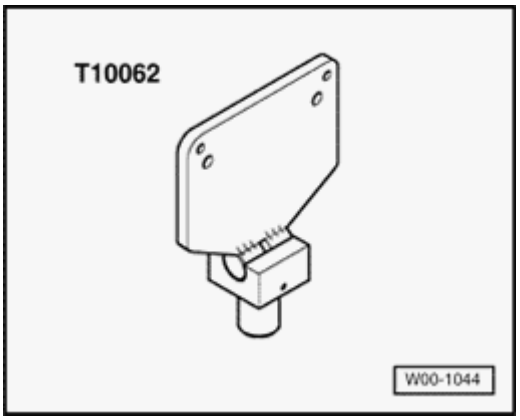


Fig. 9: Support T10062
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T10062 Support
- Oil receptacle

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Removing

NOTE:

- **Engine is removed toward the front without transmission and with the lock carrier removed.**
- **All cable ties opened or cut during engine removal must be reinstalled at the same locations.**
- **Heat boots, which are removed during engine removal must be reinstalled at the same locations when re-installing engine.**
- **Drained coolant must be stored in a clean container for disposal or reuse.**

Vehicles with automatic transmission

- Shift selector lever into position "N".

All

WARNING: Observe safety precautions when disconnecting the battery.

Refer to 27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL

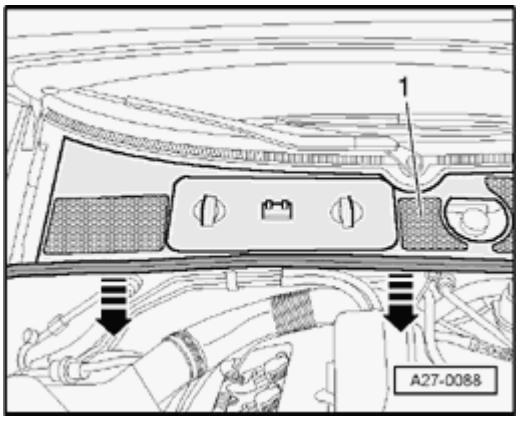


Fig. 10: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off rubber seal of plenum chamber cover in direction of arrow.
- Remove cover -1- toward front.

See Caution before beginning repairs on the electrical system. Refer to **Engine, removing and installing**

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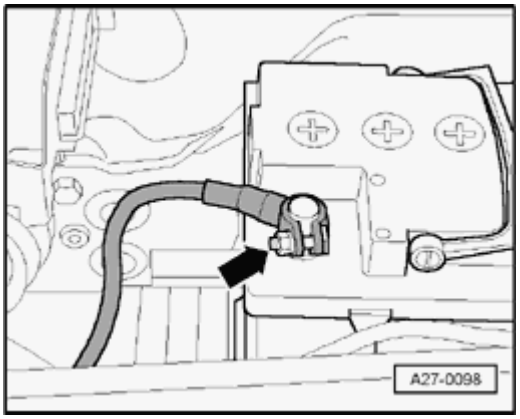


Fig. 11: Disconnecting Battery Ground (GND) Strap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect battery Ground (GND) strap (arrow) with ignition switched off.

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open cap of coolant expansion tank.
- Remove both front wheels.

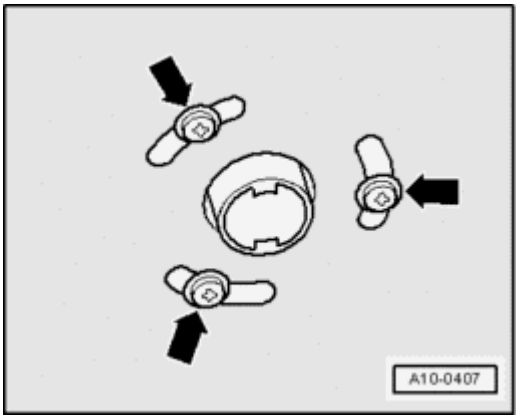


Fig. 12: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

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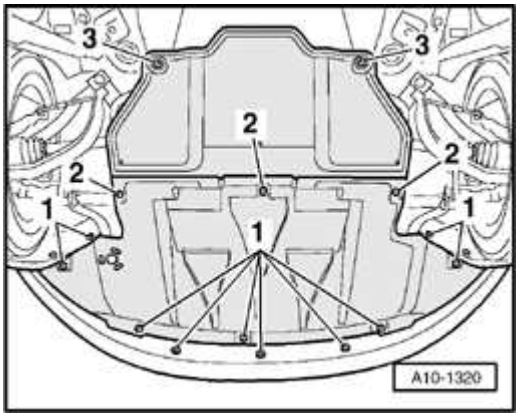


Fig. 13: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.

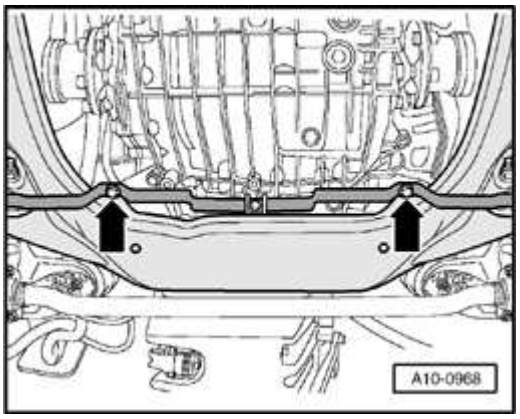


Fig. 14: Removing Bracket For Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for sound insulation (arrows).
- Remove front bumper:

Refer to

- **63 BUMPER**
- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

- Place VAG1306 drip tray beneath engine.

Vehicles with drain plug

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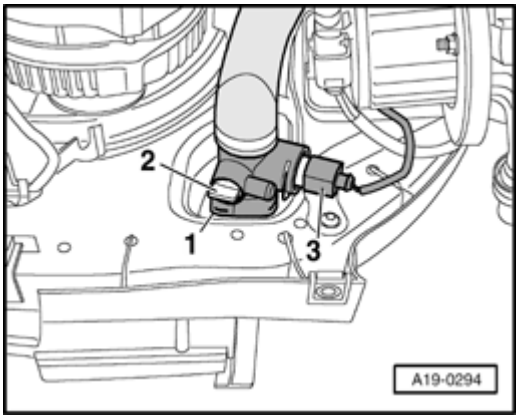


Fig. 15: Identifying Drain Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn radiator drain plug -2- counterclockwise, if needed attach accessory hose to connection flange and drain coolant.

Vehicles without drain plug

- Remove retaining clamp for Engine Coolant Temperature (ECT) sensor (on radiator) -G83-.
- Remove Engine Coolant Temperature (ECT) sensor from outlet and drain coolant.

All

- Pull off retaining clip -1- for lower coolant hose and disconnect coolant hose from radiator.

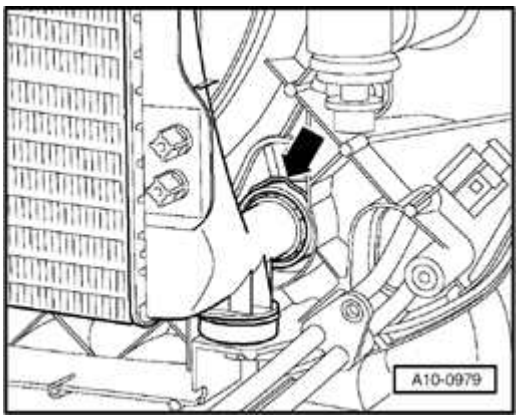


Fig. 16: Disconnecting Lower Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect left coolant hose from radiator (arrow).

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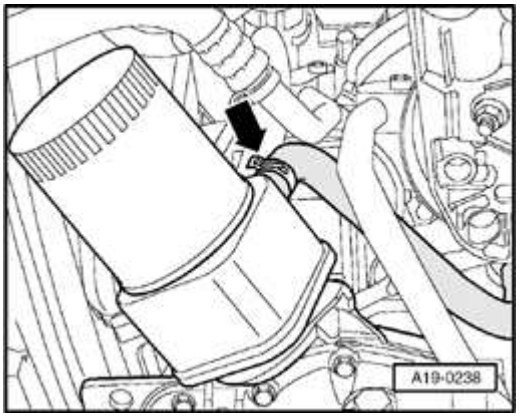


Fig. 17: Disconnecting Coolant Hose At Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In addition, disconnect coolant hose at oil cooler (arrow) and drain remaining coolant.
- Place oil pan underneath.

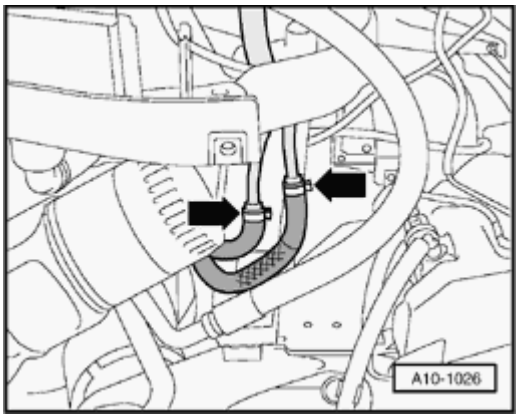


Fig. 18: Disconnecting Hydraulic Lines To Cooling Coil At Rear Of Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hydraulic lines to cooling coil at rear of bumper (arrows).

Vehicles with automatic transmission

NOTE: Observe the rules of cleanliness for working on automatic transmissions:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

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- Place oil pan underneath.

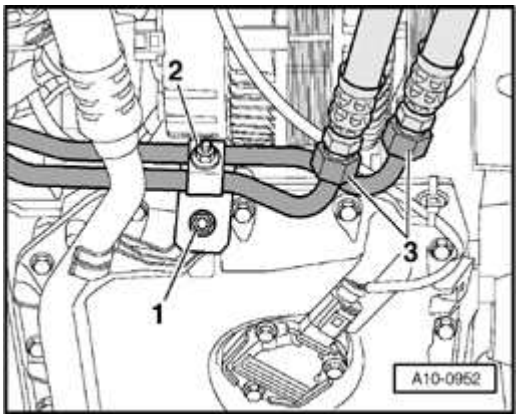


Fig. 19: Removing Union Nuts And Disconnect ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove union nuts -3- and disconnect ATF lines.
- Remove bracket for ATF lines, to do so remove nuts -1- and -2-.

All

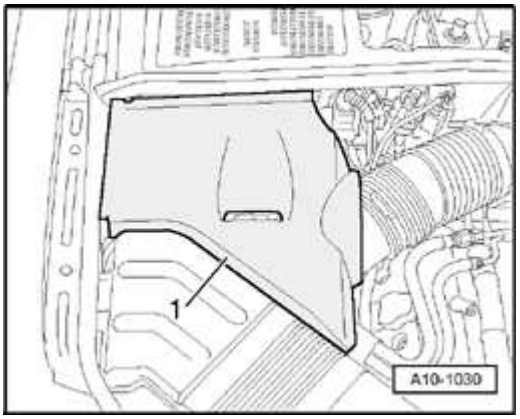


Fig. 20: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

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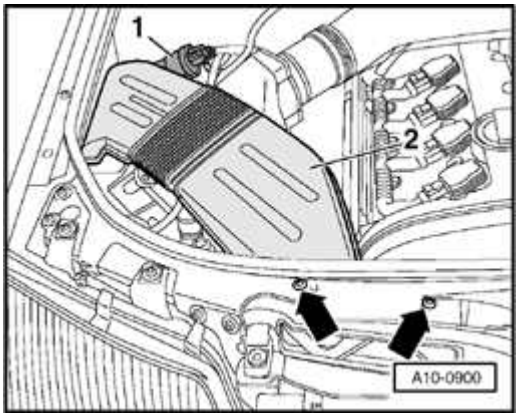


Fig. 21: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

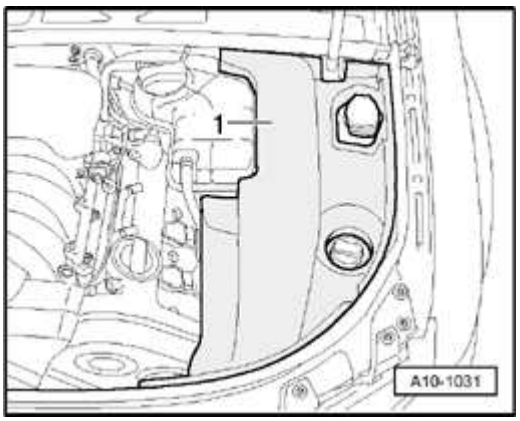
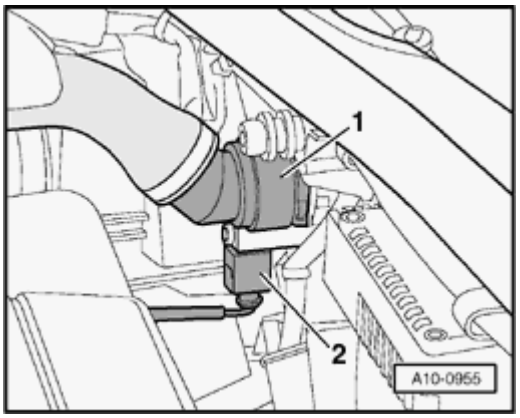


Fig. 22: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).



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Fig. 23: Disconnecting Top Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect top coolant hose -1- from radiator.
- Remove electrical harness connector -2- for left and right airbag sensors on bumper.....
- ....and move cables clear.

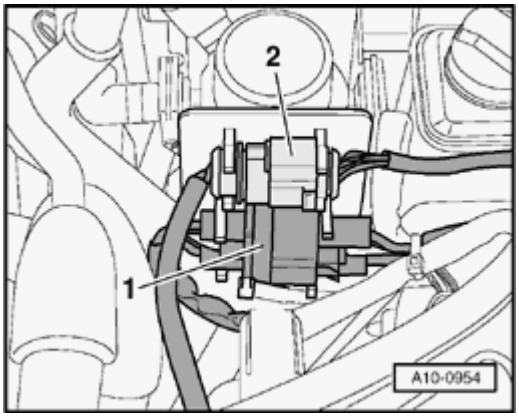


Fig. 24: Removing Electrical Harness Connectors And From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors -1- and -2- from bracket and disconnect them.

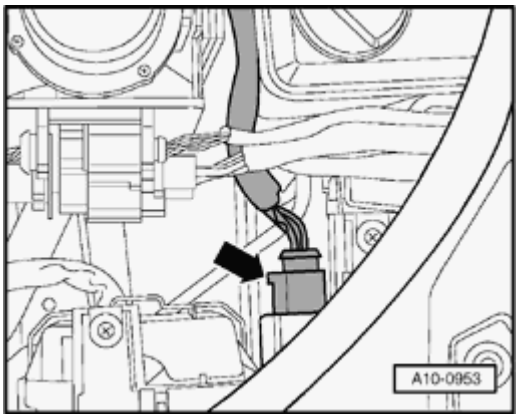


Fig. 25: Disconnecting Electrical Harness Connector For Headlights At Both Sides Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector (arrow) for headlights at both sides of vehicle.

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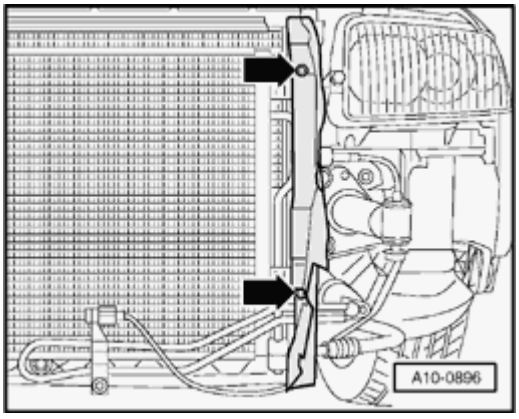


Fig. 26: Removing Air Ducts On Left/Right Of Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air guides from left and right of radiator (arrows).

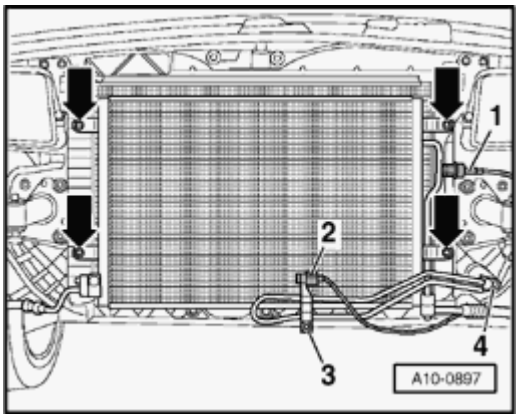


Fig. 27: Identifying Outside Air Temperature Sensor G17, Bolts & High Pressure Sensor G65 Electrical Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip temperature sensor -2- for outside temperature display from bracket.
- Unscrew bolts -3- and -4- and remove power steering cooling coil.
- Disconnect harness connector -1- at High pressure sensor -G65-.

WARNING: Do not open refrigerant circuit for A/C system.

- Remove condenser mounting bolts (arrows).

NOTE: Do not bend or stretch lines or hoses as condenser and/or refrigerant lines/hoses may be damaged.

- Carefully swing condenser downward and move aside.

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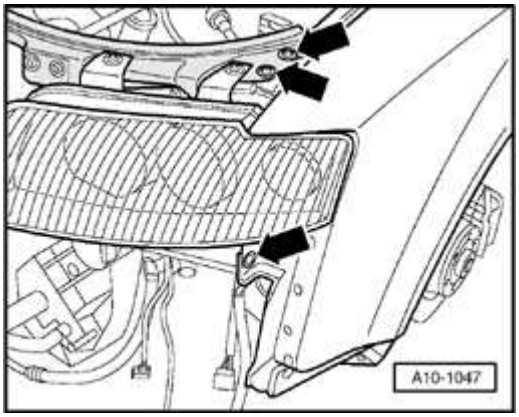


Fig. 28: Removing Bolts At Left/Right Side Of Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) on left and right sides of bumper.
- Unhook hood cable from lock and move cable free.

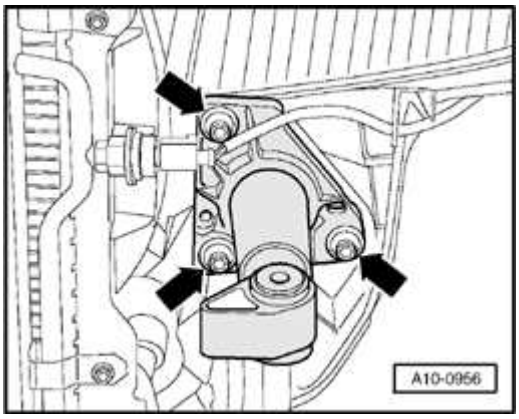


Fig. 29: Unscrewing Bolts At Impact Absorbers At Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts at impact absorbers (arrows) at left and right.

NOTE: A second technician is required to remove the lock carrier.

- Remove lock carrier and set aside so it cannot topple.

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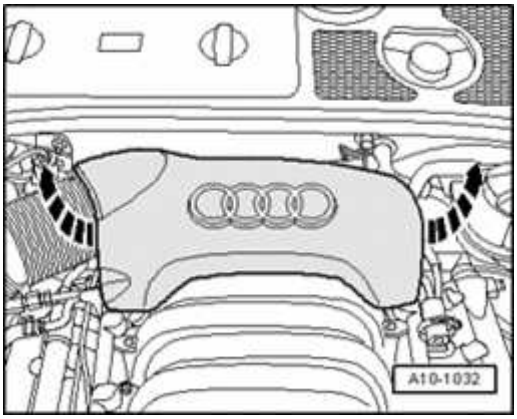


Fig. 30: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

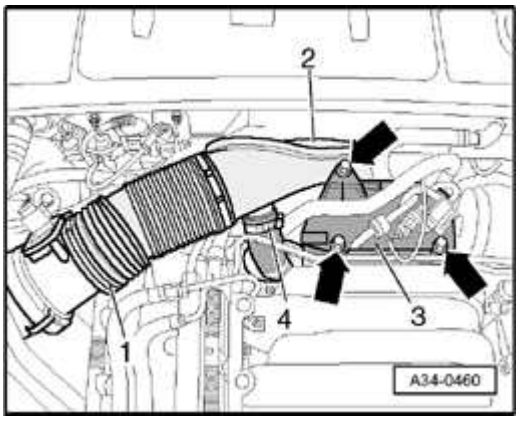
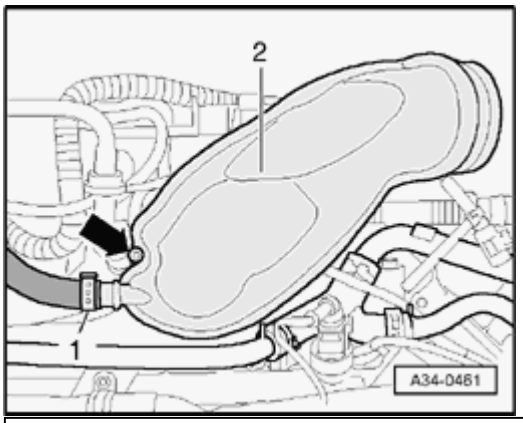


Fig. 31: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air hose -1- at Mass Air Flow (MAF) sensor.
- Remove hose -4- of crankshaft housing ventilation from air duct -2-.



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Fig. 32: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air guide if installed.

NOTE: Illustration depicts air guide with the removed engine from rear.

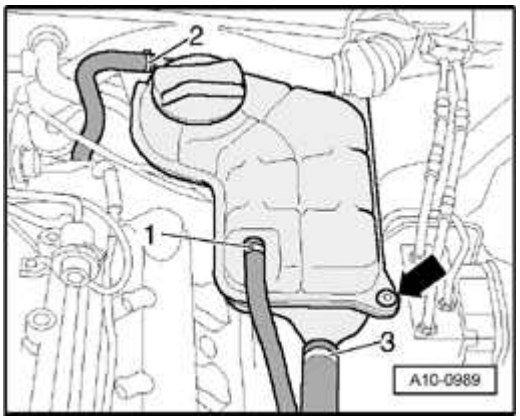


Fig. 33: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant hoses -1- and -2-.

NOTE: Coolant hose -3- remains connected.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of expansion tank.

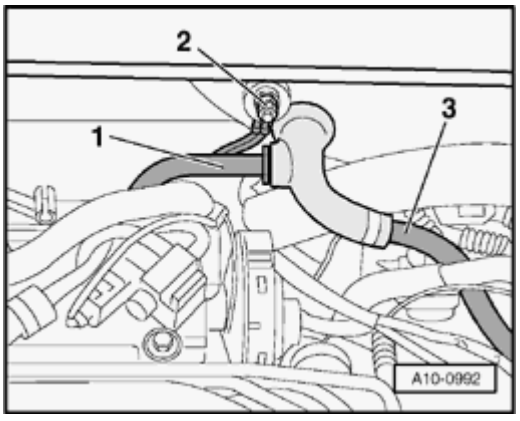


Fig. 34: Identifying Ground (GND) & Vacuum Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect ground (GND) -2-.

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- Disconnect vacuum hoses -1- and -3-.

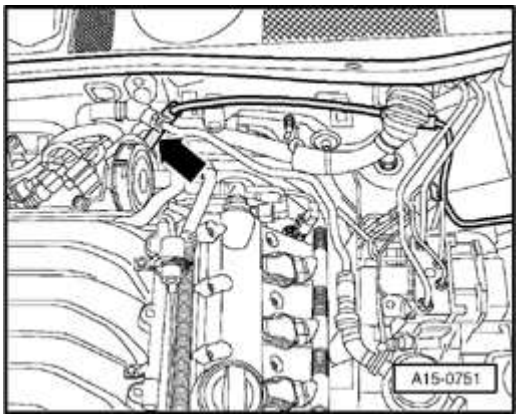


Fig. 35: Disconnecting Vacuum Line To Leak Detection Pump At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line (arrow) to leak detection pump at throttle valve control module.

Vehicles with automatic transmission

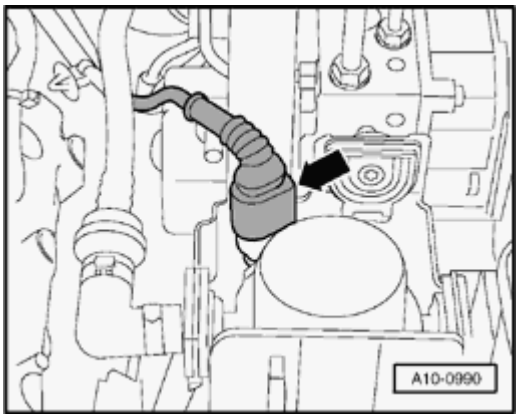


Fig. 36: Disconnecting Electrical Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector (arrow).

All

- Place oil pan underneath.

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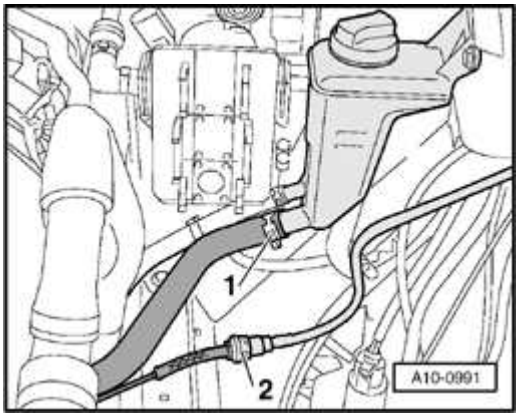


Fig. 37: Disconnecting Hose From Power Steering Fluid Reservoir & Vacuum Hose To Vacuum Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose -1- from power steering fluid reservoir.
- Disconnect vacuum hose -2- to vacuum reservoir.

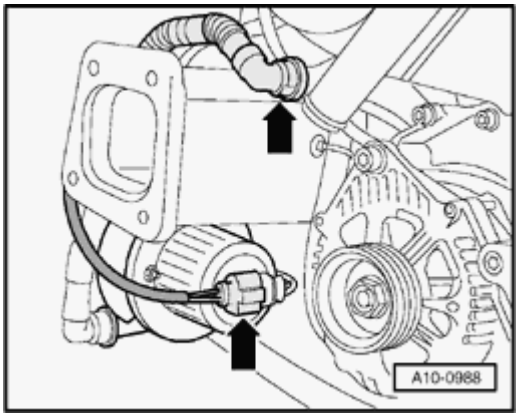


Fig. 38: Disconnecting Connector From Secondary Air Injection (AIR) Pump Motor V101 & Hose From Pipe To Secondary Air Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector (lower arrow) at Secondary Air Injection (AIR) pump motor -V101- and move cable free.
- Disconnect hose at tube to combination valve for Secondary Air Injection (AIR) (upper arrow).

Vehicles up to 06.03:

WARNING: Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.

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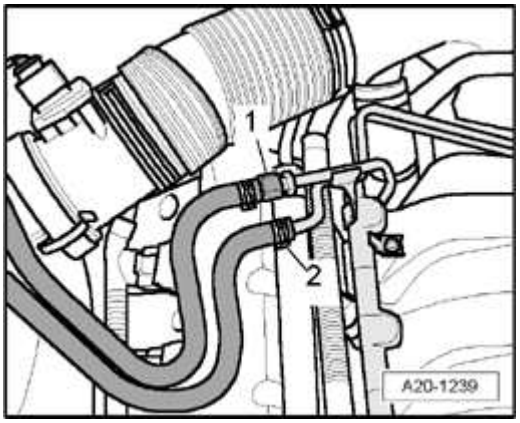


Fig. 39: Disconnecting/Tightening Fuel Supply Line And Fuel Return Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel supply line -1- and fuel return line -2- and set aside.

Vehicles as of 07.03:

WARNING: Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.

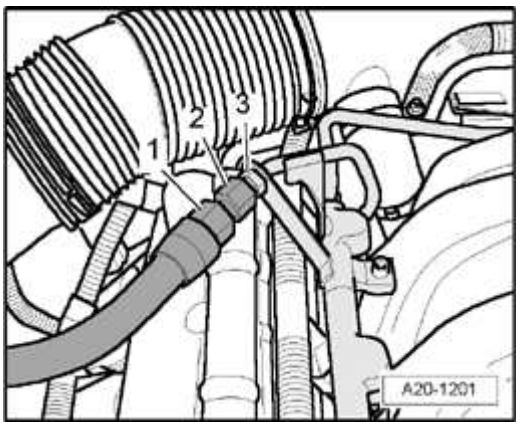


Fig. 40: Unscrewing/Screwing Fuel Hose From Connection On Fuel Rail Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew fuel hose from connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and unscrew union nut -2-.

All:

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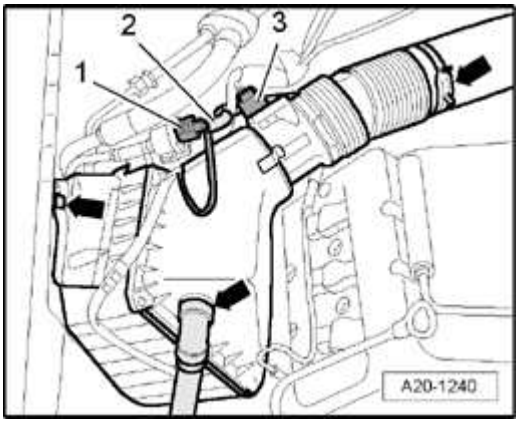


Fig. 41: Removing Lines/Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the following lines/harness connectors:

1 - At Evaporative Emission (EVAP) canister purge regulator valve -N80-

2 - Vacuum hose at Evaporative Emission (EVAP) canister purge regulator valve -N80-

3 - at Mass Air Flow (MAF) sensor -G70-

- Disconnect hose connections, move wires free and remove air filter housing (arrows).

NOTE: Place a rag under the hydraulic pressure lines, to catch escaping hydraulic fluid.

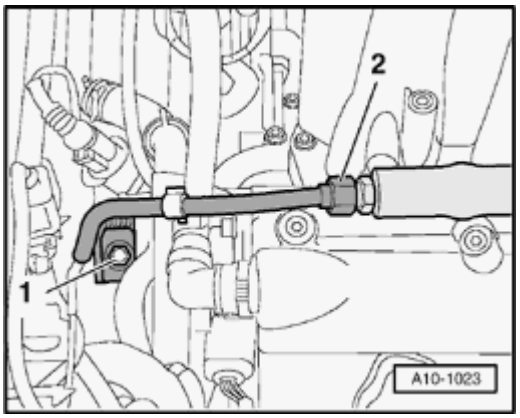


Fig. 42: Unbolting Hydraulic Pressure Line For Power Steering At Rear Coolant Pipe And Disconnecting Line At Height Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt hydraulic pressure line for power steering at rear coolant pipe -1- and disconnect line at height of right cylinder head -2-.

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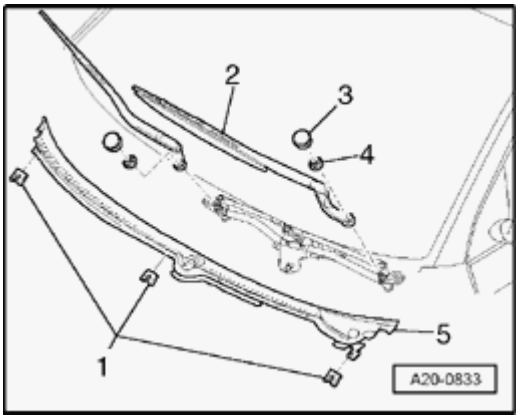


Fig. 43: Removing Securing Clips And Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off both covers -3- using a screwdriver.
- Loosen hex-nuts -4- by several turns.
- Loosen wiper arm -2- by lightly tilting from wiper axle.
- Remove hex nuts completely and remove wiper arms.

- Disconnect securing clips -1- and remove cowl grill -5-.

Vehicles with automatic transmission

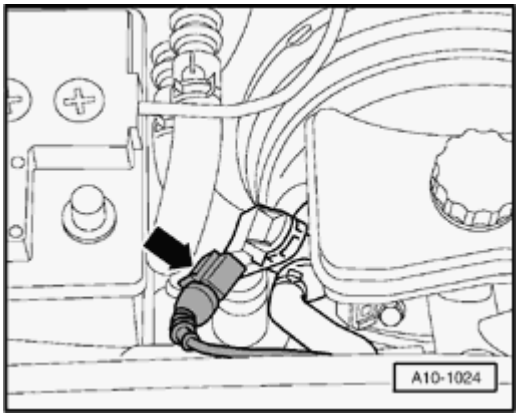


Fig. 44: Disconnecting Electrical Harness Connector At Brake Booster Pressure Sensor -G294-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector (arrow) at Brake booster pressure sensor -G294-.

All

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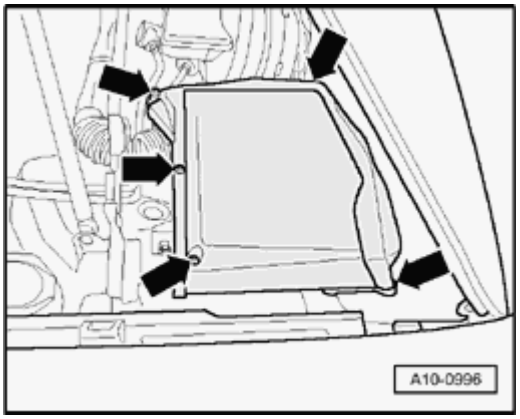


Fig. 45: Removing Screws And Cover From E-Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heater core E-box cover (arrows).

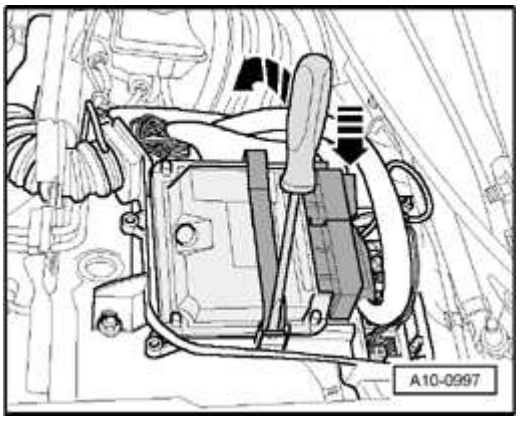


Fig. 46: Using Screwdriver To Remove Retainer Bar And Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a screwdriver, pry off retaining bracket (arrow).

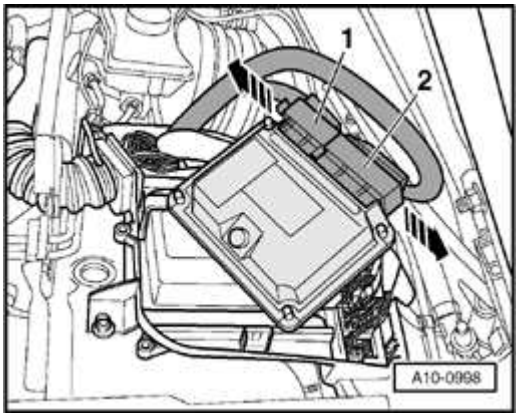


Fig. 47: Releasing Connector Latches And Pulling Off Connectors On Engine Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Disengage connector catches (arrows) and disconnect harness connectors -1- and -2- from Engine Control Module (ECM).

Vehicles with automatic transmission 01V

- Unclip Transmission Control Module (TCM) retaining bracket.

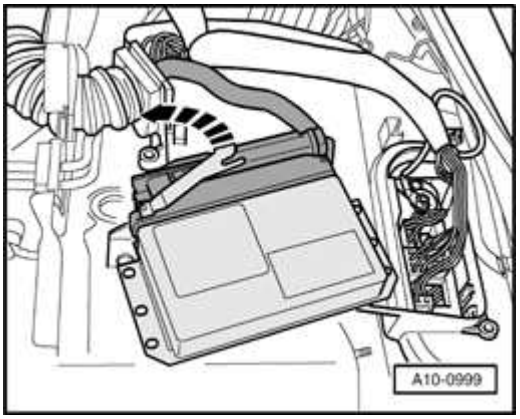


Fig. 48: Disengaging Harness Connector And Disconnecting It From Transmission Control Module (TCM)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage harness connector (arrow) and disconnect it from Transmission Control Module (TCM).

All

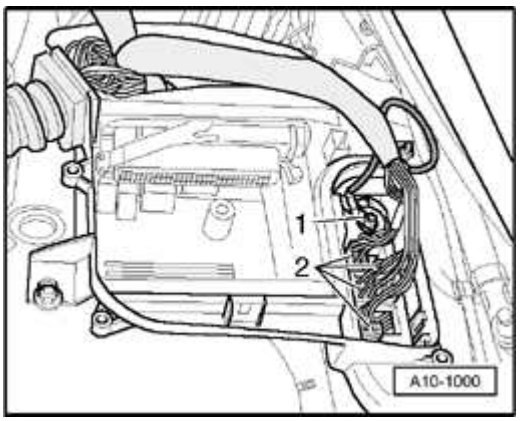


Fig. 49: Disconnecting Rear Connectors On Connector Strip & Unbolt Electrical Wire Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect rear connectors -2- on connector strip and set wiring harness aside.
- Unbolt electrical wire connection -1-.

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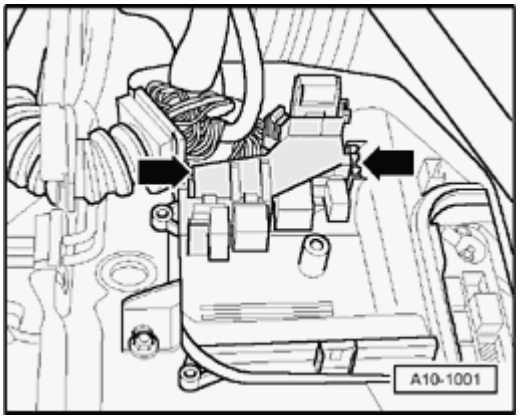


Fig. 50: Locating Auxiliary Relay Carrier Catches
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage locking mechanisms (arrows) and remove secondary relay carrier in E-box toward top.
- Unhook engine wiring harness at E-box and at bulkhead and move it free.
- Remove heat shield for harness connectors at left of bulkhead, if installed.

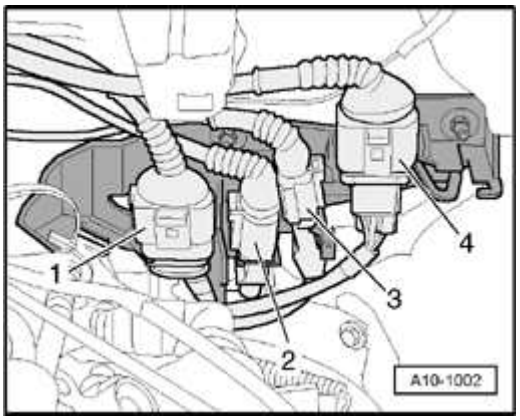


Fig. 51: Removing Harness Connectors From Bracket At Left Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at left of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Expose oxygen sensor wires.
- Remove bracket for harness connectors.

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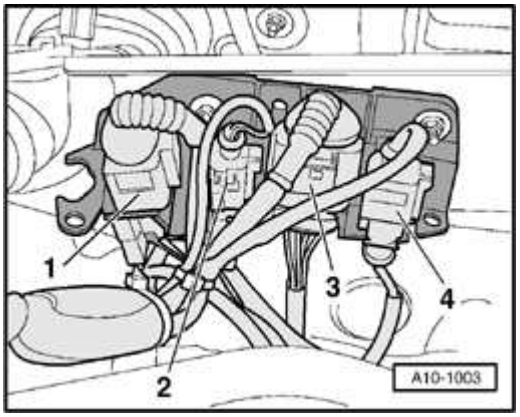


Fig. 52: Removing Harness Connectors From Bracket At Right Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at right of bulkhead.
- Disconnect electrical harness connectors -1-, -3- and -4-.
- Expose oxygen sensor wires.
- Remove bracket for harness connectors.

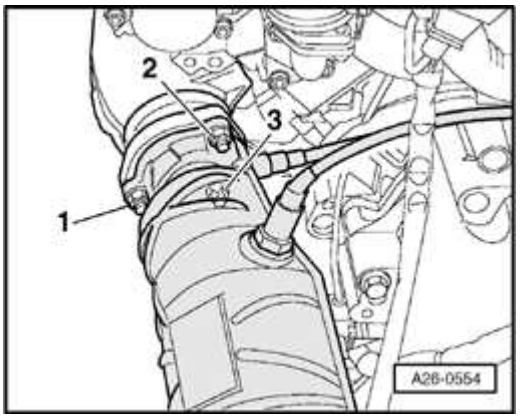


Fig. 53: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for left exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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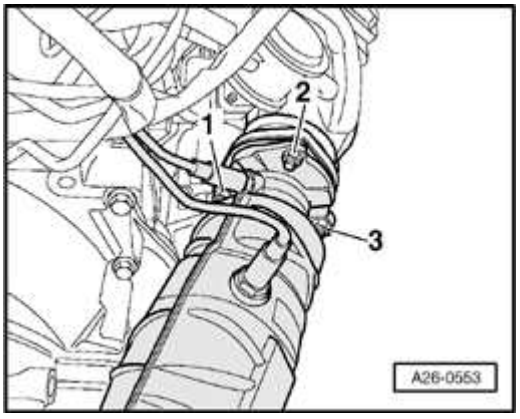


Fig. 54: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for right exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Disconnect coolant hoses to heater core at rear coolant pipe and at right coolant pipe. To do so, remove wiring harness screw clip on right side of vehicle.
- Remove upper mounting bolts for engine/transmission. One bolt remains tightened by hand.

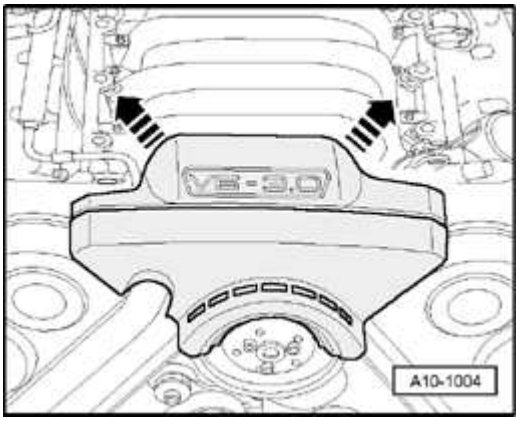


Fig. 55: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

NOTE: Before removing ribbed belt, mark direction of rotation with chalk or felt-tip marker. Reversing the direction of rotation of a run-in belt can destroy the belt.

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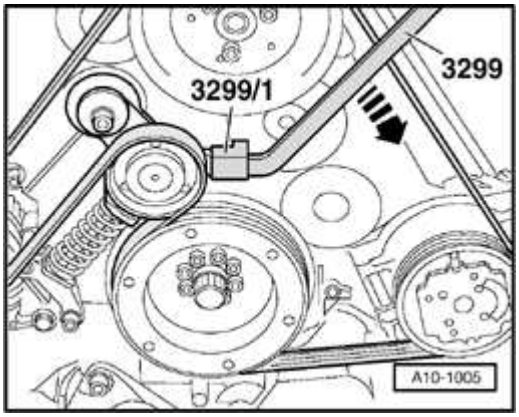


Fig. 56: Swinging Ribbed Belt Tensioner To Release Tension On Ribbed Belt Using 3299 Ribbed Belt Installation Tool And 3299/1 Claw For Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Swing ribbed belt tensioner in direction of arrow to release tension on ribbed belt using 3299 ribbed belt installation tool and 3299/1 claw for tensioner.
- Remove ribbed belt from pulley of power steering pump.
- Place engine oil drip tray beneath engine.
- Drain engine oil.

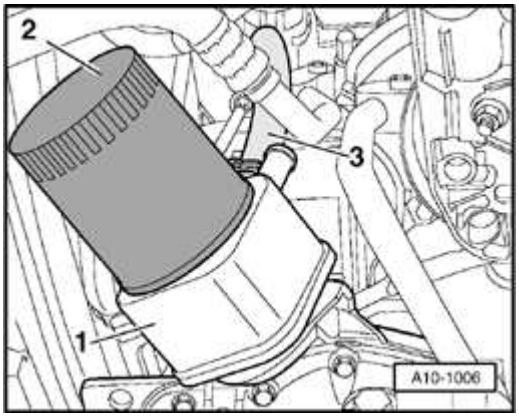


Fig. 57: Identifying Oil Filter, Coolant Hose & Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil filter -2-.
- Place VAG1306 drip tray beneath engine.
- Remove coolant hose -3- from oil cooler.
- Remove oil cooler -1-.

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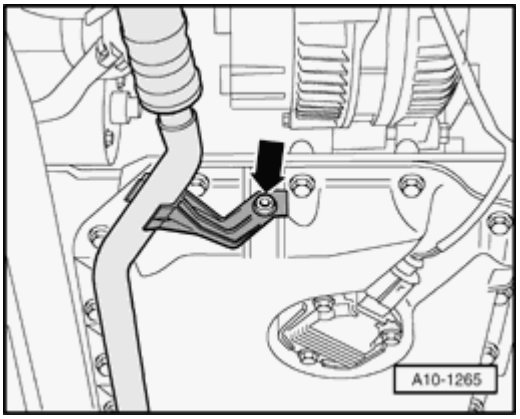


Fig. 58: Unbolting Bracket For Refrigerant Line At Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for refrigerant line at oil pan (arrow).

NOTE: Depicted in illustration for a vehicle with manual transmission.

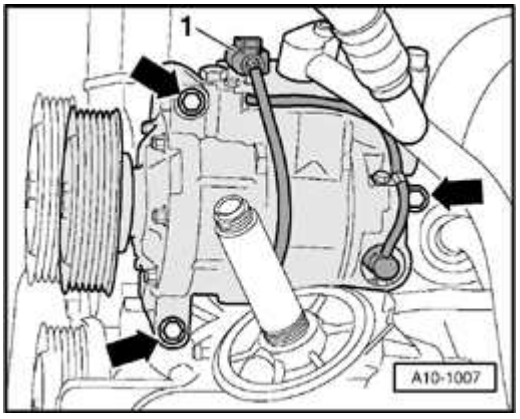


Fig. 59: Disconnecting Harness Connector Of Electrical Wire To A/C Compressor Clutch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect harness connector -1- of electrical wire to A/C compressor clutch.

WARNING: Do not open refrigerant circuit for A/C system.

- Unbolt A/C compressor from bracket (arrows).
- Hang A/C compressor together with condenser with connected lines at right side of vehicle.
- Disconnect electrical lines from generator.

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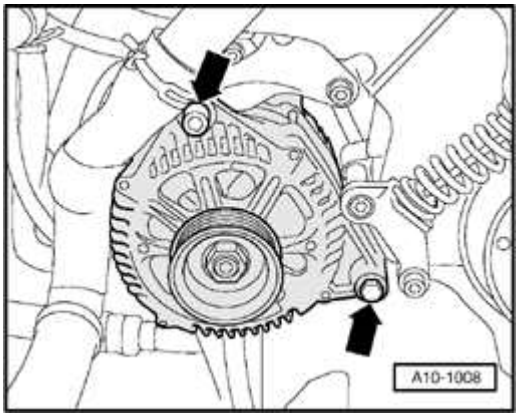


Fig. 60: Unscrewing Bolts And Removing Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts (arrows) and remove generator.

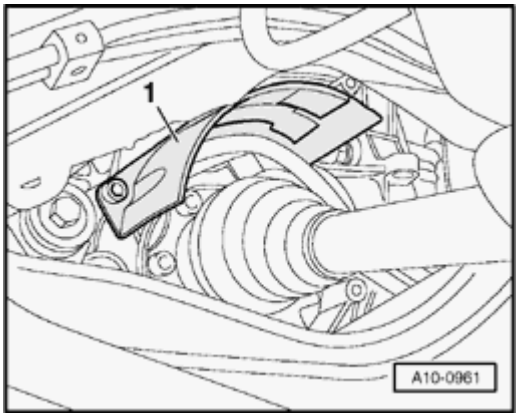


Fig. 61: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left and right heat shields for drive axles -1-.

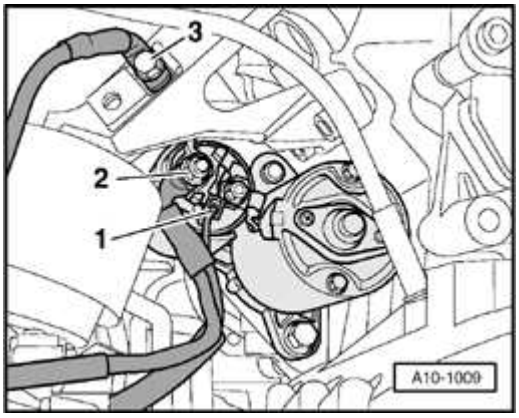


Fig. 62: Removing Electrical Wires From Starter & Disconnecting Ground (GND) Wire
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove electrical wires -1- and -2- from starter.
- Disconnect Ground (GND) wire -3-.

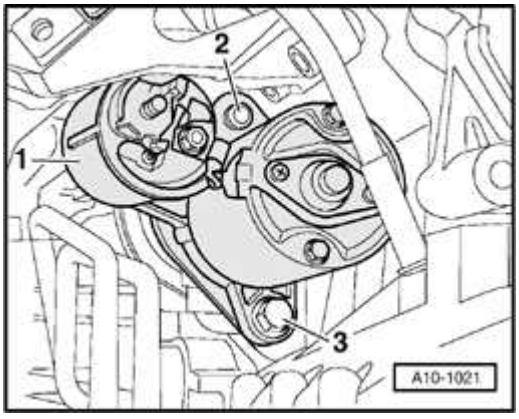


Fig. 63: Removing Heat Shield From Solenoid, Unscrewing Bolts & Removing Starter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- from solenoid.
- Unscrew bolts -2- and -3- and remove starter.

Vehicles with automatic transmission 01V

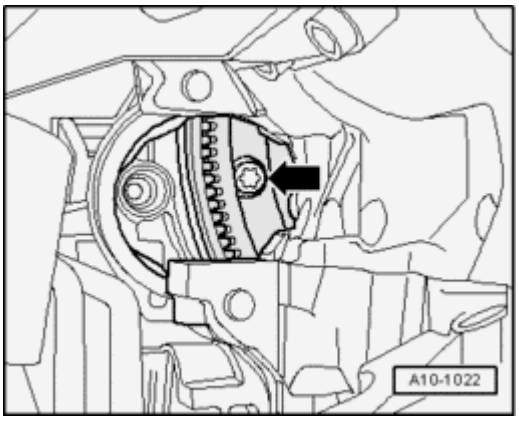


Fig. 64: Torque Converter Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew 3 Torx bolts (arrow) of torque converter in opening of removed starter (turn crankshaft 1/3 rotation in each case).

NOTE: To loosen the torque converter bolts counterhold the main harmonic balancer bolt.

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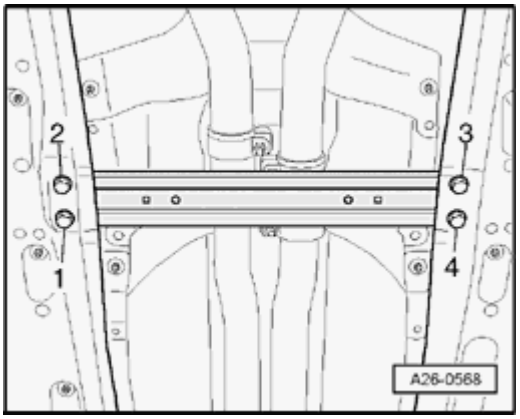


Fig. 65: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for front vehicle floor crossmember -1- to -4-.

All

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

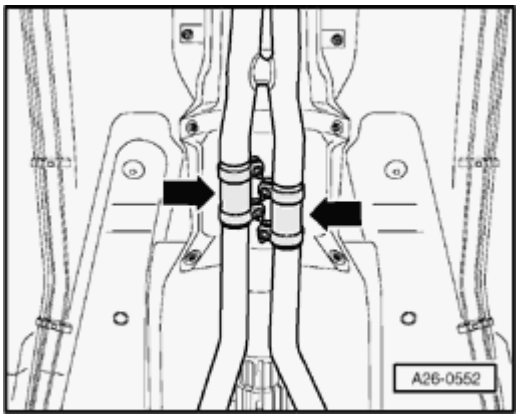


Fig. 66: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at double clamps (arrows).

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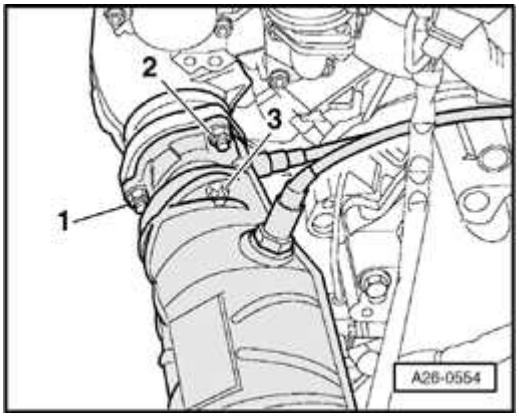


Fig. 67: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/left exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Pull front exhaust pipe off of left exhaust manifold.

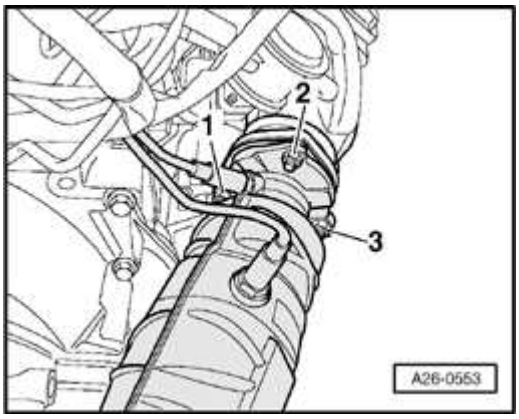


Fig. 68: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/right exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Pull front exhaust pipe off of right exhaust manifold.
- Where installed, unbolt heat shield for engine speed (RPM) sensor.

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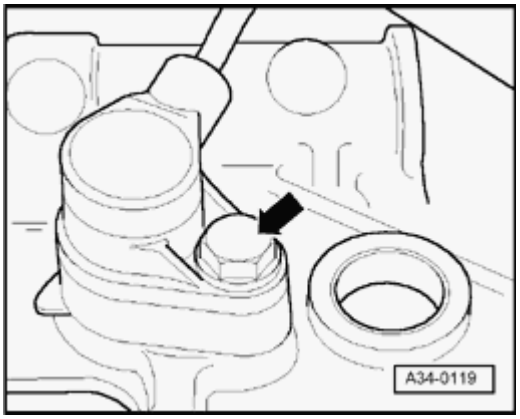


Fig. 69: Location Of Engine Speed (RPM) Sensor G28 On Coupling Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Engine Speed (RPM) sensor -G28- on left of transmission (arrow) and lay to side.

Vehicles with manual transmission

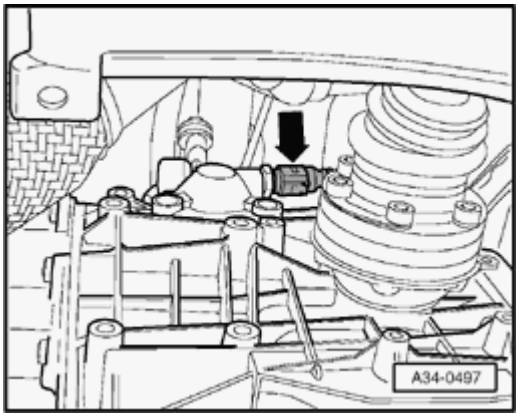


Fig. 70: Disconnecting Harness Connector For Back-Up Light Switch At Right Of Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect harness connector for back-up light switch at right of transmission and set aside electrical wire.

NOTE: Depicted in illustration for a vehicle with manual transmission 01E all wheel drive.

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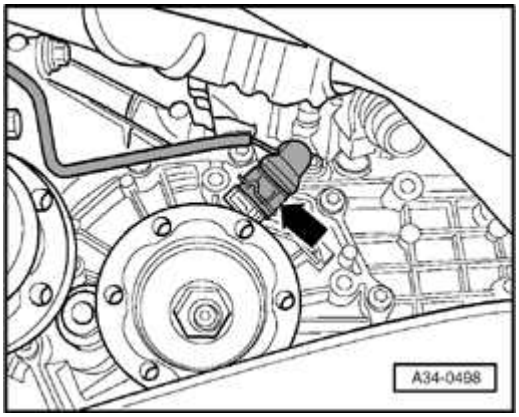


Fig. 71: Disconnecting Harness Connector From Speedometer Vehicle Speed Sensor (VSS) -G22- At Left Of Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect harness connector (arrow) from Speedometer Vehicle Speed Sensor (VSS) -G22- at left of transmission.

NOTE: Depicted in illustration for a vehicle with manual transmission 01E all wheel drive.

Vehicles with automatic transmission 01J

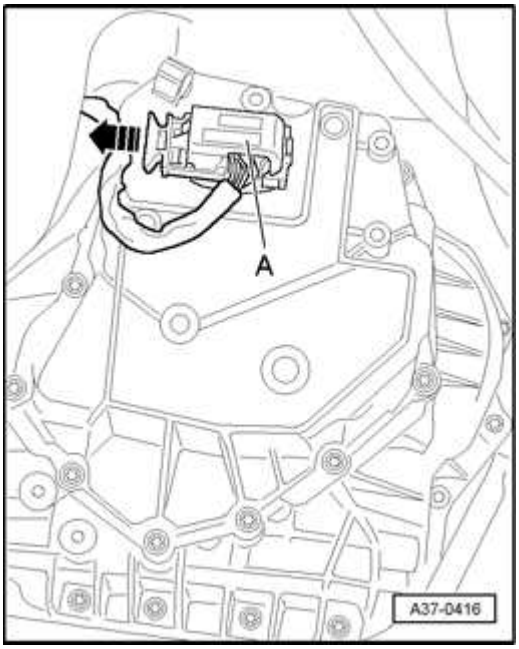


Fig. 72: Disengaging Harness Connector From Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage harness connector -A- in direction of arrow and disconnect it from transmission.
- Move wiring harness clear.

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Vehicles with automatic transmission 01V

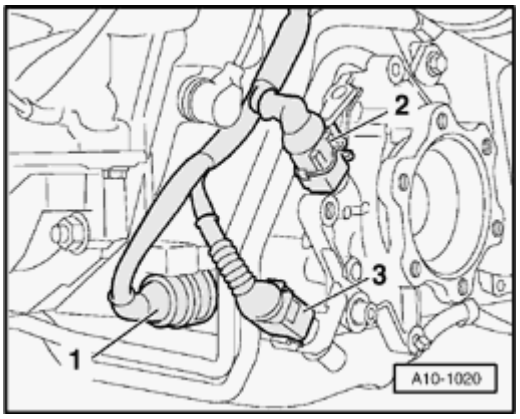


Fig. 73: Identifying Transmission Wiring Harness, Speedometer Vehicle Speed Sensor (VSS) -G22- Harness Connector, Multi-Function Switch Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Swing securing lever and disconnect harness connector for transmission wiring harness -1-.
- Disconnect harness connector -2- on Speedometer Vehicle Speed Sensor (VSS) -G22-.
- Disconnect harness connector -3- from wire for multi-function switch.

All

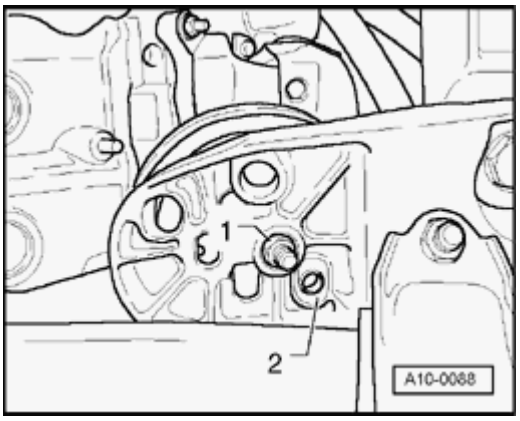


Fig. 74: Threaded Connections And Positioning Sleeves On Lower Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark installation positions for threaded assemblies -1- and positioning sleeves -2-.

NOTE: Different mounting holes are available depending upon the installed engine.

- Remove lower nuts -1- on left and right engine mounts.

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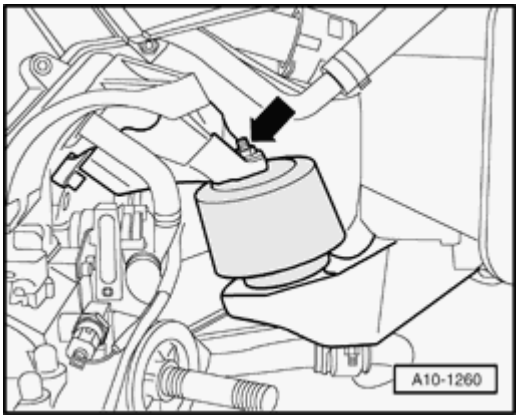


Fig. 75: Loosening Upper Nuts On Left/Right Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slightly loosen upper nuts (arrow) on left and right engine mounts.

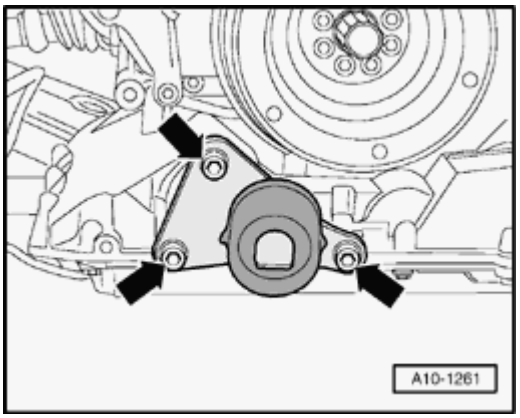


Fig. 76: Unbolting Torque Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt torque support (arrows).

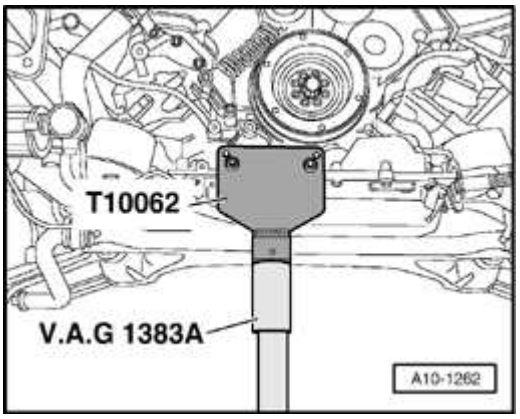


Fig. 77: Tightening T10062 Support On Threaded Holes For Torque Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Tighten T10062 support on threaded holes for torque support to 20 Nm.
- Lift engine using VAG1383A engine/transmission jack just far enough so that lower connecting bolts at engine/transmission can be removed.

NOTE: When working on a vehicle with all wheel drive, make sure the front constant velocity joint of driveshaft is not damaged when lifting engine.

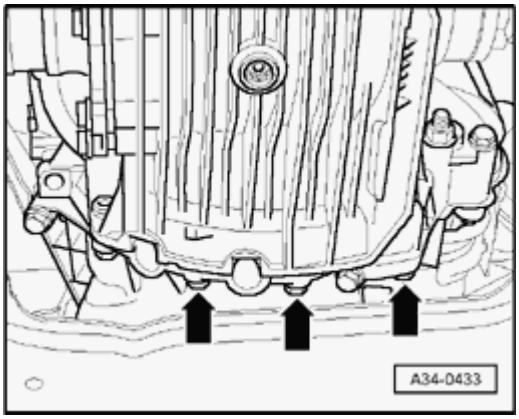


Fig. 78: Three Lower Engine And Transmission Connecting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bottom engine/transmission connecting bolts (arrows).
- Lower engine again.

Vehicles with manual transmission and automatic transmission 01J

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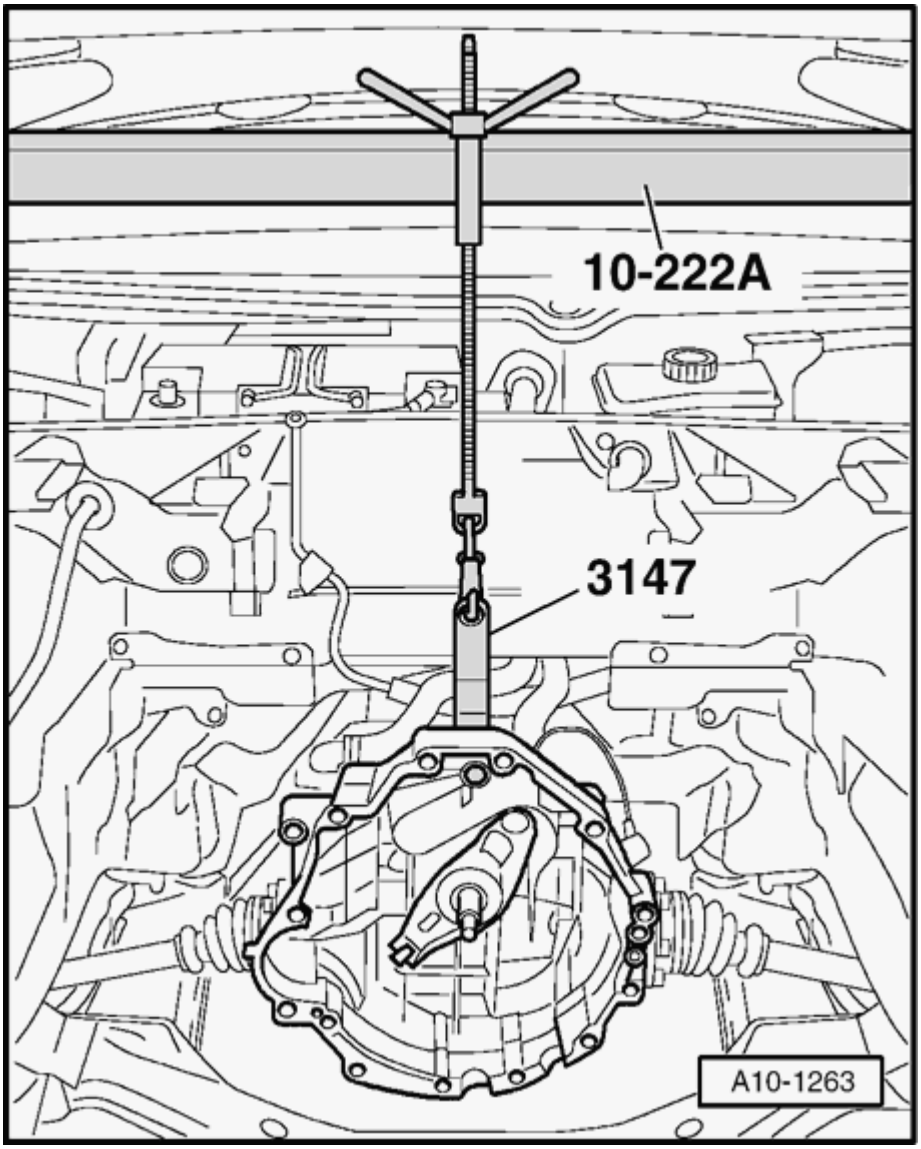


Fig. 79: Positioning 10-222A Engine Support Bridge On Bolted Flanges Of Fenders Behind Gas-Filled Strut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position 10-222A engine support bridge on bolted flanges of fenders behind gas-filled strut. Spindle is at front.
- Hook 3147 engine support adapter into bolt hole at left of transmission housing.
- Connect 3147 engine support adapter and 10222A engine support bridge with 10222A/2 additional hook.

NOTE:

- **Illustration is shown with engine removed.**
- **If the engine support adapter 3147 can not be inserted far enough into the hole on transmission bell housing due to a change in wire routing, use a long bolt M10 and additional hook 10-222 A/2 in place of engine support adapter.**

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Vehicles with automatic transmission 01V

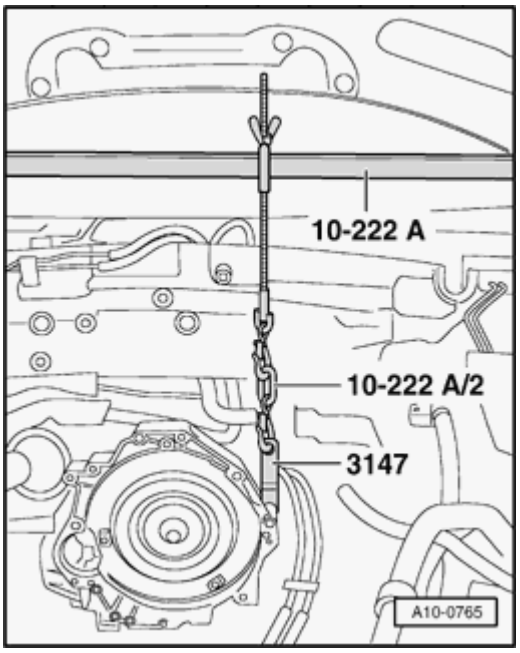


Fig. 80: Positioning 10-222A Engine Support Bridge On Bolted Flanges Of Fenders Behind Gas-Filled Strut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position 10-222A engine support bridge on bolted flanges of fenders behind gas-filled strut. Spindle is at front.
- Hook 3147 engine support adapter into middle bolt hole in transmission housing.
- Connect engine support adapter 3147 using engine support bridge 10-222 A.

NOTE: Illustration is shown with engine removed.

All

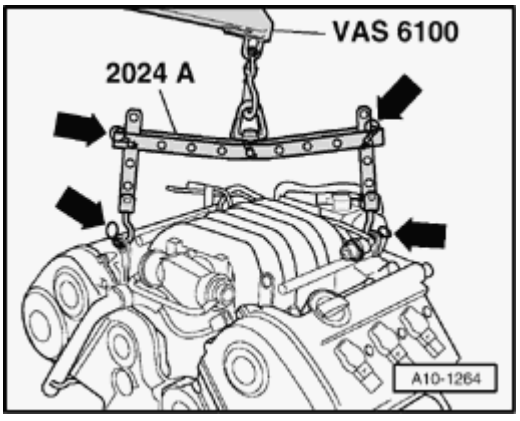


Fig. 81: Hooking In 2024A Engine Sling At Engine And At VAS6100

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hook in 2024A engine sling at engine and at VAS6100 or 1202A workshop crane as depicted in illustration.

NOTE: To properly balance assembly, mounting hooks must be inserted in rails as shown in illustration.

WARNING: Take-up hooks and pins at engine sling must be secured using securing pins (arrows) as shown in illustration.

- Remove final mounting bolt.

NOTE: Verify that all hoses and lines between engine and body have been disconnected.

- Using VAS6100 or VAG1202A workshop crane, lift engine far enough until threaded bolts of engine mount are free.
- Turn 10-222A engine support bridge shaft.

NOTE: Make sure no lines are damaged at bulkhead.

Vehicles with automatic transmission 01V

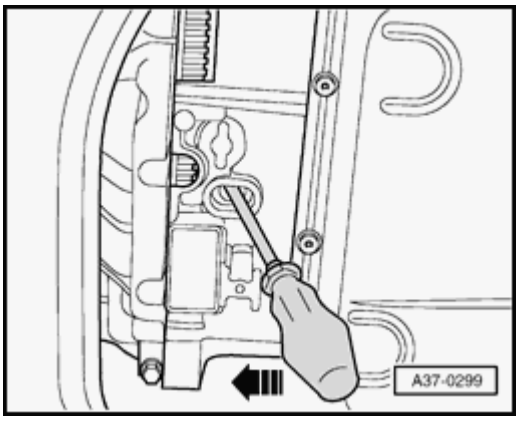


Fig. 82: Pressing Transmission Off Engine, While Pressing Torque Converter Off Of Drive Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press transmission off engine, while pressing torque converter off of drive plate.

All

- Pull engine off of transmission and lift it out of engine compartment toward front.

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Vehicles with automatic transmission 01V

- If necessary, secure torque converter in transmission from falling out using wire.

Installing

Installation is reverse of removal, note the following:

NOTE:

- **During installation, all cable ties must be re-installed at the same locations.**
- **Heat boots, which are removed during engine removal must be reinstalled at the same locations when re-installing engine.**
- **Secure all hose connections using hose clamps appropriate for the model type**
- **Replace self-locking nuts and bolts during assembly work.**
- **Always replace bolts that are secured with tightening torque as well as O-rings and gaskets.**

- Make sure centering sleeves for engine to transmission are correctly installed in cylinder block. Install or replace if necessary.
- Slide intermediate plate or intermediate panel onto sleeves.

Vehicles with manual transmission

- Clean input shaft splines and (in case of used clutch plates) clean hub splines. Remove corrosion and apply only a very thin coating of lubricant G 000 100 on splines. Do not grease guide sleeve.
- Check centering of clutch disc.
- Check clutch release bearing for wear and replace if necessary.

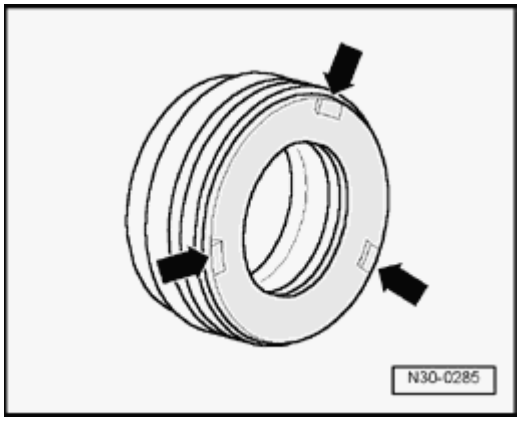


Fig. 83: Servicing Release Bearing With Plastic Ring
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If plastic ring of release bearing is loose, adhere it to bearing ring again using adhesive AMV-195-KD1-

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01.

- 3 rectangular tabs (arrows) of plastic ring reach into cutouts of bearing ring.
- If grooves with depth of more than 0.5 mm are present, release bearing must be replaced.

Vehicles with SAC clutch pressure plate

When installing a new clutch disc in combination with a used SAC pressure plate (self-adjusting pressure plate), the adjustment ring of the pressure plate must be turned back to impact. Otherwise the pressure plate works with decreased contact pressure (clutch slips).

Refer to **30 CLUTCH**

If the clutch disc is not replaced, the adjustment ring does not have to be turned back.

New SAC pressure plates are already pre-adjusted and must not be turned back.

Vehicles with automatic transmission 01V

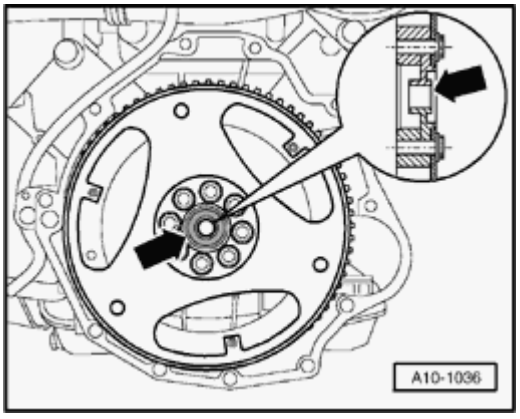


Fig. 84: Bolting Drive Plate To Crankshaft With Centering Bushing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive plate is bolted to crankshaft with a centering bushing (arrow).
- Use original bolts when securing torque converter to drive plate:

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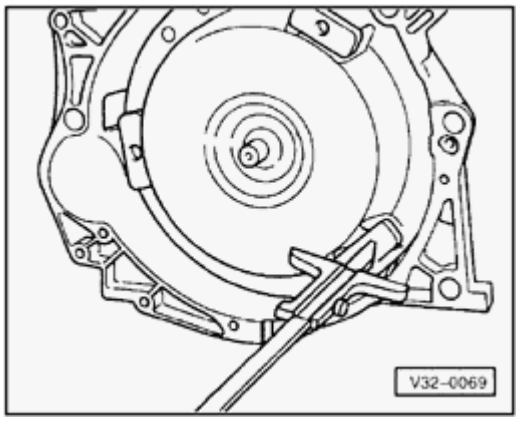


Fig. 85: Checking Torque Converter Is Correctly Positioned
Courtesy of VOLKSWAGEN UNITED STATES, INC.

When torque converter is installed correctly, distance between lower contact surface of threaded holes at torque converter and contact surface of converter housing on Automatic Transmission 01V is approx. 23 mm.

If the torque converter is not inserted completely, this distance will be approx. 11 mm.

WARNING: In case of an incorrectly inserted torque converter, the coupling plate of the torque converter or the ATF pump will be destroyed, if the transmission is flanged to the engine.

All

- Carefully guide engine with transmission into chassis.
- Set engine onto engine mounts.

WARNING: For vehicles with automatic transmission 01V, keep checking whether the torque converter behind the drive plate can be turned before and during tightening of the bolts at engine/transmission flange. If the torque converter cannot be turned, it must be assumed that it has not been inserted properly and that the coupling plate of the torque converter or the ATF pump will be destroyed during final tightening of the bolts.

- Bolt transmission to engine, from. Refer to **Tightening torques**.

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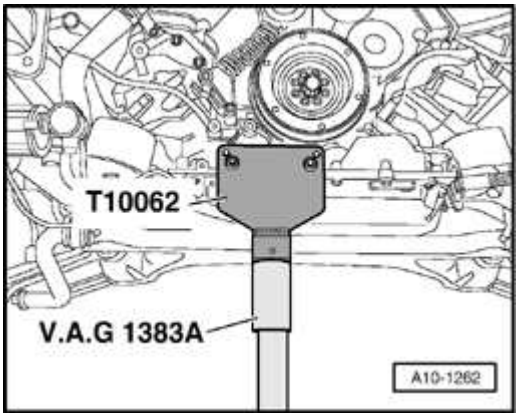


Fig. 86: Tightening T10062 Support On Threaded Holes For Torque Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten T10062 support on threaded holes for torque support to 20 Nm.
- Lift engine using VAG1383A engine/transmission jack just far enough so that lower connecting bolts at engine/transmission can be installed.

NOTE: When working on a vehicle with all wheel drive, make sure the front constant velocity joint of the driveshaft is not damaged when lifting the engine.

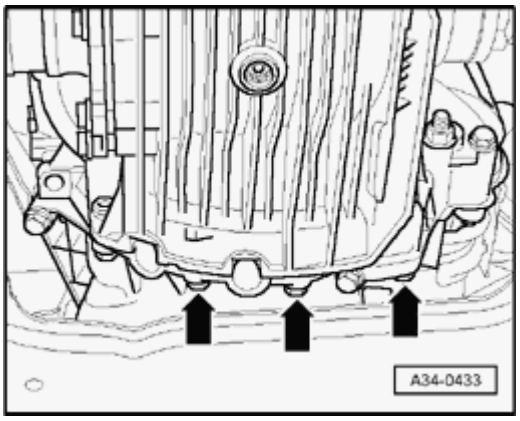


Fig. 87: Three Lower Engine And Transmission Connecting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten lower engine/transmission connecting bolts (arrows).
- Lower engine again.
- Install and align exhaust system free of tension. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** or **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.
- Install starter.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

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- Install generator. Refer to **Ribbed belt for power steering pump, generator and A/C system**.
- Install A/C compressor. Refer to **Ribbed belt for power steering pump, generator and A/C system**.
- Install ribbed belt. Refer to **Installing**.
- Install lock carrier. Refer to **Lock carrier, moving into service position**.

Vehicles up to 06.03:

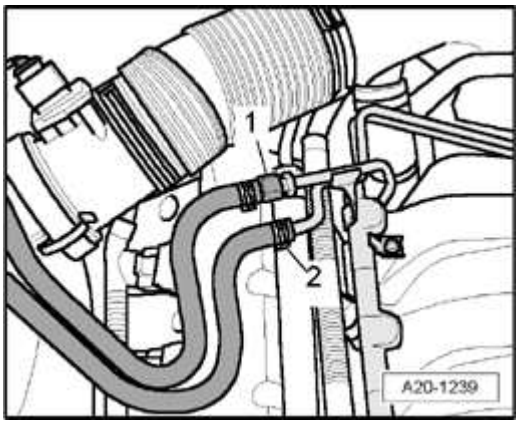


Fig. 88: Disconnecting/Tightening Fuel Supply Line And Fuel Return Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten union nut of fuel supply line -1- to 22 Nm.
- Secure fuel return line -2- with a hose clamp.

Vehicles as of 07.03:

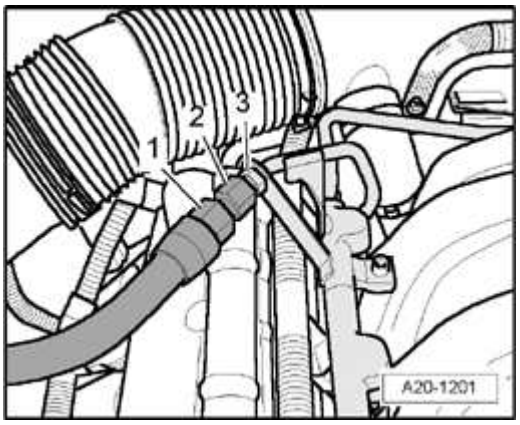


Fig. 89: Unscrewing/Screwing Fuel Hose From Connection On Fuel Rail Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure fuel hose to connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and tighten union nut -2- to 22 Nm.

Vehicles with automatic transmission

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- Secure ATF lines:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

All

- Check harness connectors and routing:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

See Caution for connecting Telematics battery. Refer to **Engine, removing and installing**

- Observe safety precautions after connecting battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

WARNING: Do not use a battery charger for starting assistance! There is risk of damage at the vehicle control modules.

- Check engine oil level before starting engine.
- Top off coolant. Refer to **Filling**.

NOTE:

- **Only reuse drained coolant if cylinder head or engine block were not replaced.**
- **Dirty coolant cannot be reused.**

- Fill up power steering fluid and bleed steering system:

Refer to **48 - STEERING**

Vehicles with automatic transmission

- Check ATF level:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY

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VARIABLE TRANSMISSION (CVT) 01J

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

All

- Adjust headlights:

Refer to **94 LIGHTS, SWITCHES - EXTERIOR** .

Tightening torques

NOTE:

- **Tightening torques are valid only for nuts and bolts that are lightly greased, oiled, covered with a thin coat of phosphate or blackened.**
- **Other lubricants are permitted, e.g. engine oil or transmission fluid, however they may not contain graphite.**
- **Do not use any degreased parts.**
- **Tightening torque tolerance ± 15%.**

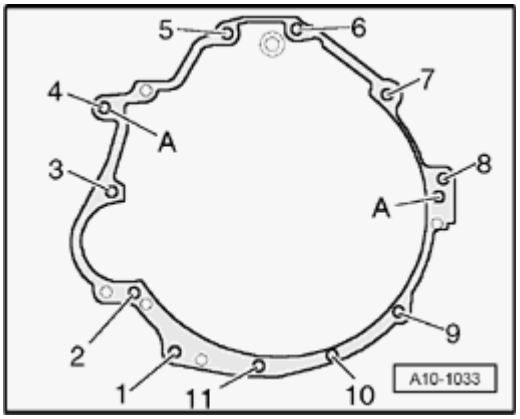


Fig. 90: Identifying Engine/Transmission Tightening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Securing engine/transmission for manual transmission

Item no.	Bolt	Nm
1, 9, 10, 11	M10 x 60	45
2	M10 x 150	45
3	M12 x 130	65
4	M12 x 80	65
5, 6, 8	M12 x 90	65

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7	M10 x 100	45

A: Alignment bushing

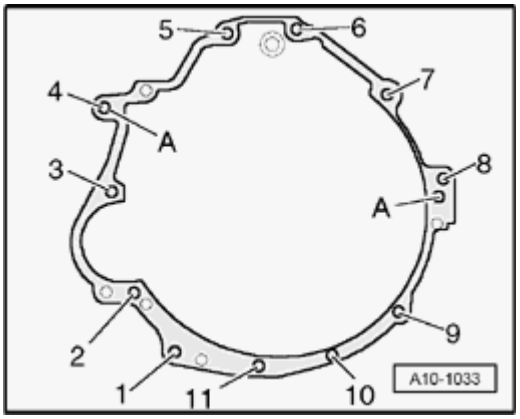


Fig. 91: Identifying Engine/Transmission Tightening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Securing engine/transmission with automatic transmission 01J

Item no.	Bolt	Nm
1, 10, 11	M10 x 60	45
2	M12 x 90	65
3	M12 x 110	65
4	M12 x 80	65
5, 6	M12 x 90	65
7	M10 x 100	45
8	M12 x 75	65
9	M10 x 70	45

A: Alignment bushing

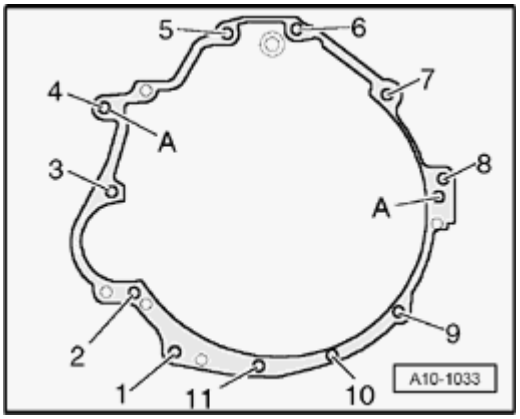


Fig. 92: Identifying Engine/Transmission Tightening Sequence

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

Securing engine/transmission with automatic transmission 01V

Item no.	Bolt	Nm
1, 9, 10, 11	M10 x 60	45
2	M10 x 90	45
3	M12 x 110	65
4	M12 x 80	65
5, 6, 8	M12 x 90	65
7	M10 x 100	45

A: Alignment bushing

Component			Nm
Nuts/Bolts		M6	10
		M8	20
		M10	45
		M12	65

Component			Nm
Except for the following:			
Drive plate to torque converter		M10 x1	85
Torque support to oil pan (upper part)			40
Engine mount to	Engine support		23
	Carrier		23
Heat shield for driveshaft to transmission			23
Oil cooler to oil pan (upper part)			30
Power steering pressure line to			
	Pressure hose		40
	Coolant pipe		20
Air guide to intake manifold			10
Fuel supply line to fuel rail			22
Wiper arm to wiper axle			21
ATF hose to ATF tube			29

Engine, attaching to engine stand

Special tools and equipment

- VAS 6095 Engine and transmission holding fixture

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Procedure

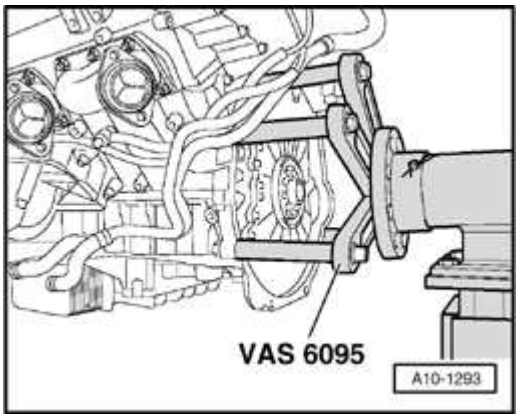


Fig. 93: Securing Engine To VAS6095 Engine And Transmission Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure engine to VAS6095 engine and transmission support as depicted in illustration.

13 ENGINE - CRANKSHAFT, CYLINDER BLOCK

ENGINE, DISASSEMBLING AND ASSEMBLING

Lock carrier in service position, overview

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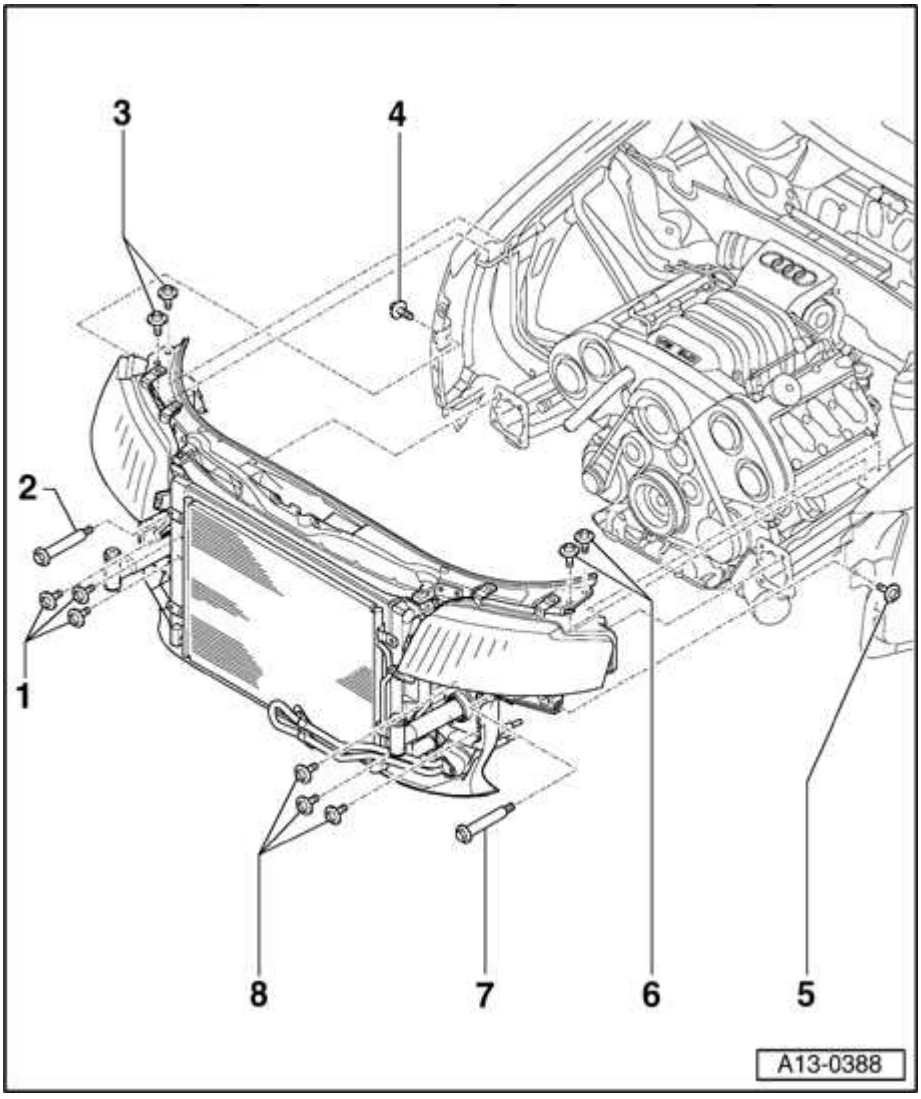


Fig. 94: Lock Carrier In Service Position, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 50 Nm

2 - 3369 support tool

- Tighten to 10 Nm

3 - 10 Nm

4 - 10 Nm

5 - 10 Nm

6 - 10 Nm

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7 - 3369 support tool

- Tighten to 10 Nm

8 - 50 Nm

Lock carrier, moving into service position

Special tools and equipment

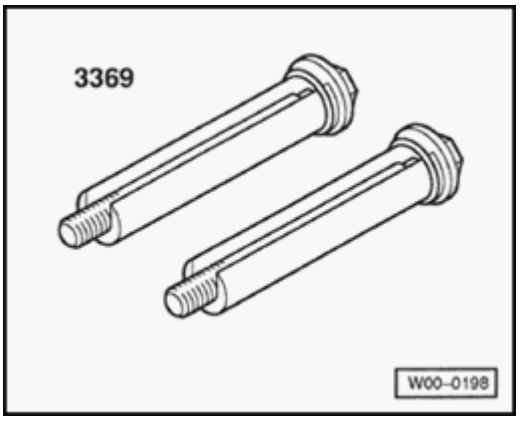


Fig. 95: 3369 Support Tool
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3369 Support tool

Removing

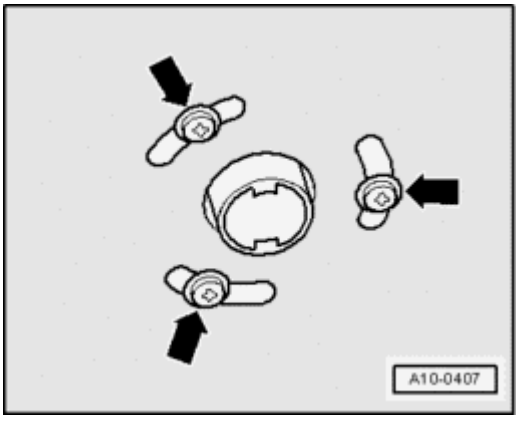


Fig. 96: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

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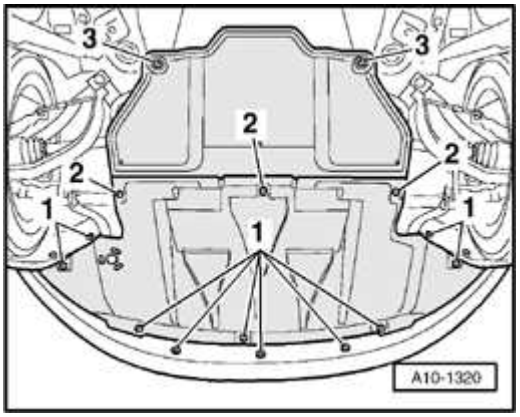


Fig. 97: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.

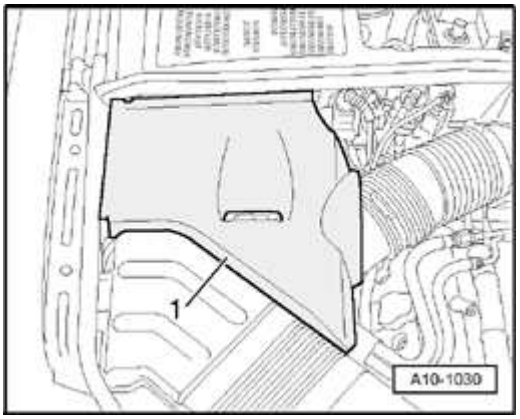


Fig. 98: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

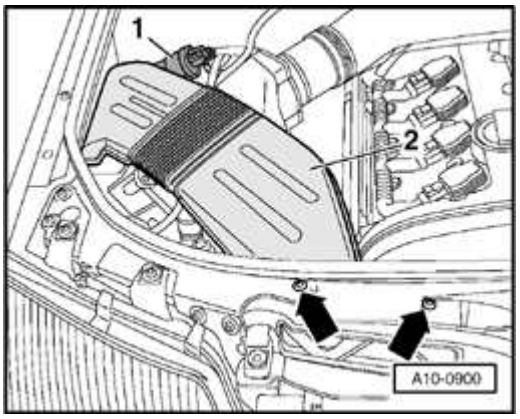


Fig. 99: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

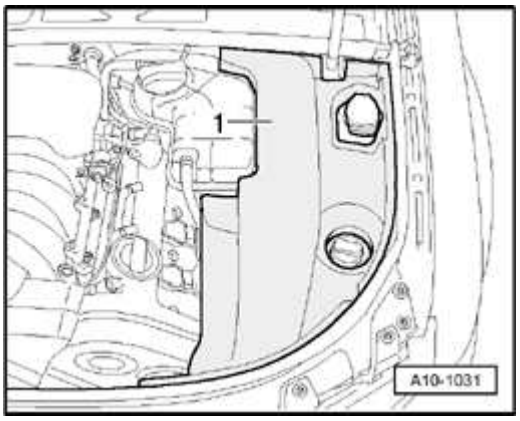


Fig. 100: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).
- Pull off hood seal from lock carrier and fender edges.
- Remove front bumper:

Refer to

- **63 BUMPER**
- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

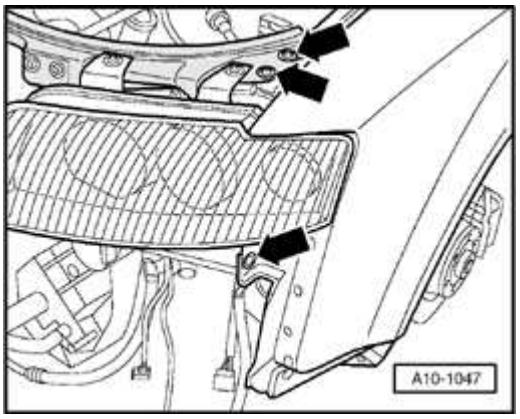


Fig. 101: Removing Bolts At Left/Right Side Of Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) on left and right sides of bumper.

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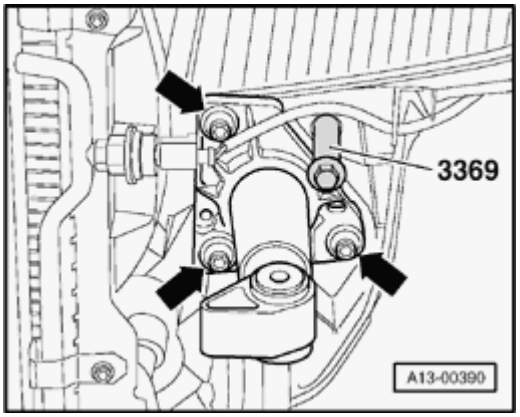


Fig. 102: Threading 3369 Support Tool Into Empty Holes At Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread 3369 support tool into empty holes at left and right.
- Unscrew bolts at impact absorbers (arrows) at left and right.
- Carefully pull lock carrier toward front.

Installing

Installation is reverse of removal, noting the following:

- Tighten bolts for lock carrier to longmembers to 50 Nm and at fenders to 10 Nm.

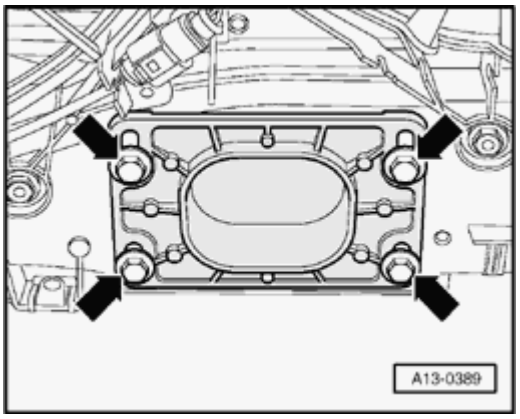


Fig. 103: Placing Impact For Torque Support On Rubber Buffer For Torque Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place impact for torque support on rubber buffer for torque support, letting it rest under its own weight and tighten bolts (arrows) to 28 Nm.
- Install front bumper:

Refer to

- **63 BUMPER**

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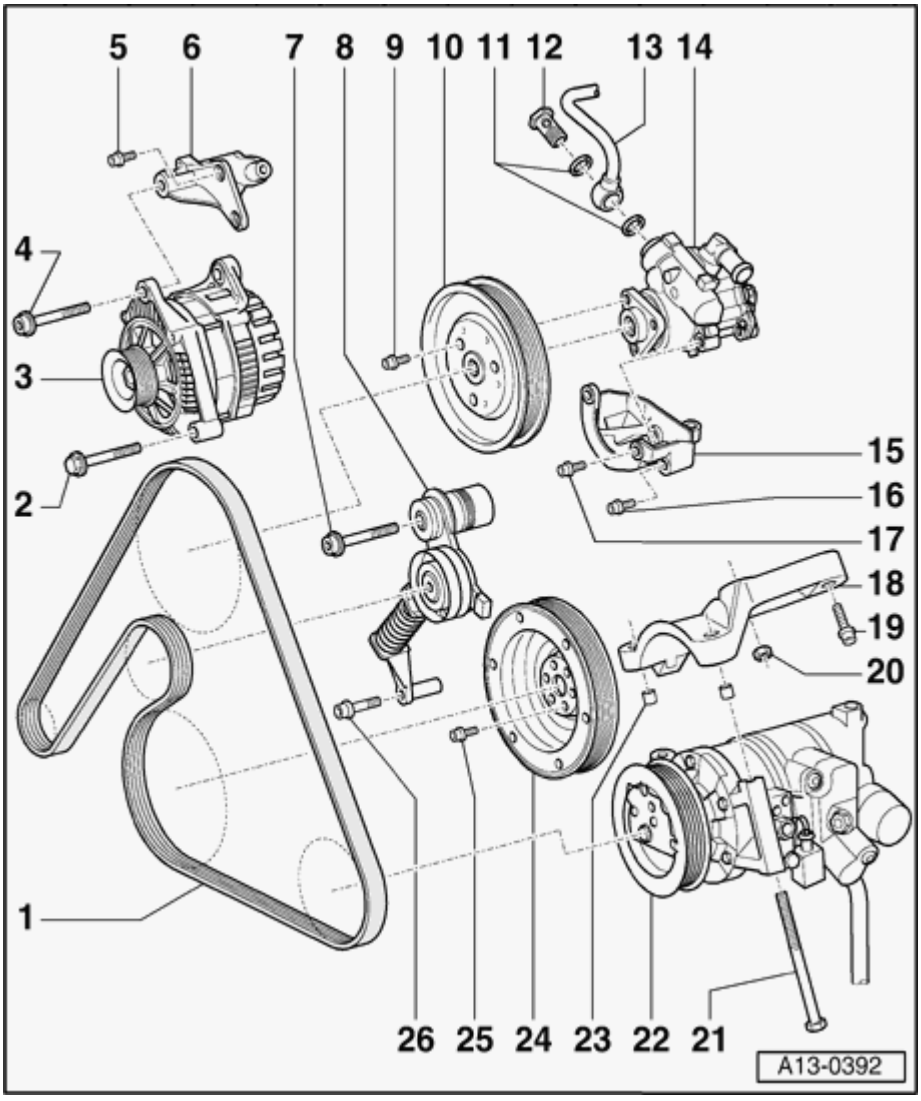
- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET
  - Adjust headlights:

Refer to **94 LIGHTS, SWITCHES - EXTERIOR** .

Tightening torques

Component		Nm
Bumper to	Longmember	50
	Fender	10
Torque support stop to lock carrier		28

Ribbed belt for power steering pump, generator and A/C system



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Fig. 104: Ribbed Belt For Power Steering Pump, Generator And A/C System Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: Before removing ribbed belt, note direction of rotation with chalk or felt-tip marker. Reversing the direction of rotation of a run-in belt can destroy the belt.

1 - Ribbed belt

- Removing and installing. Refer to **Ribbed belt, removing and installing**
- Check for wear

2 - 23 Nm

3 - Generator

- Removing:

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

4 - 45 Nm

5 - 23 Nm

6 - Bracket

- For generator

7 - 40 Nm

8 - Ribbed belt tensioner

- Removing and installing. Refer to **Ribbed belt tensioner, removing and installing** .

9 - 23 Nm

10 - Belt pulley

- For power steering pump
- Use 3212 spanner wrench to counterhold when removing and installing
- Identification: Front

11 - Seal

- Always replace

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12 - Banjo fitting, 47 Nm

13 - Pressurized line

- To power steering

14 - Power steering pump

- Removing and installing:

Refer to **48 - STEERING**

15 - Bracket

- For power steering pump

16 - 23 Nm

17 - 23 Nm

18 - Bracket

- For A/C compressor

19 - 23 Nm

20 - 23 Nm

21 - 25 Nm

22 - A/C compressor

- Do not unscrew or disconnect refrigerant lines
- After removing, secure compressor to chassis (i.e. with wire) Do not hang on refrigerant lines

23 - Socket

- For A/C compressor
- 2x

24 - Harmonic balancer

- Version dependent with/without thrust washer between harmonic balancer and toothed belt gear. Refer to **Vibration damper, removing and installing**
- Removing and installing. Refer to **Vibration damper, removing and installing**

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25 - 23 Nm

26 - 23 Nm

Ribbed belt, removing and installing

Special tools and equipment

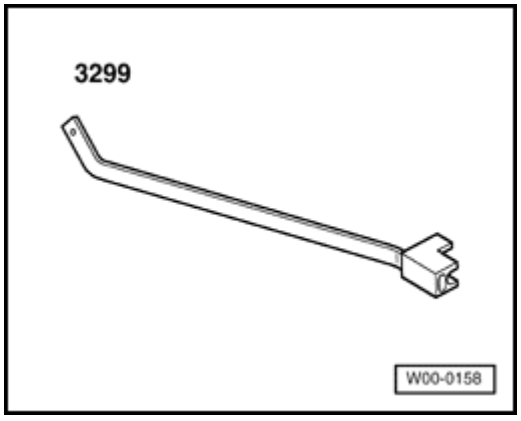


Fig. 105: 3299 Ribbed Belt Installation Tool With 3299/1 Claw For Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3299 Ribbed belt installation tool with 3299/1 claw for tensioner

Removing

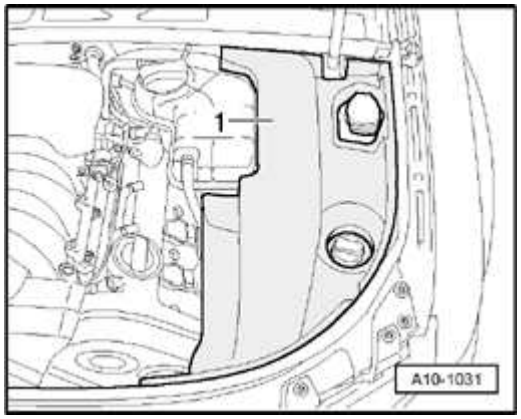


Fig. 106: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

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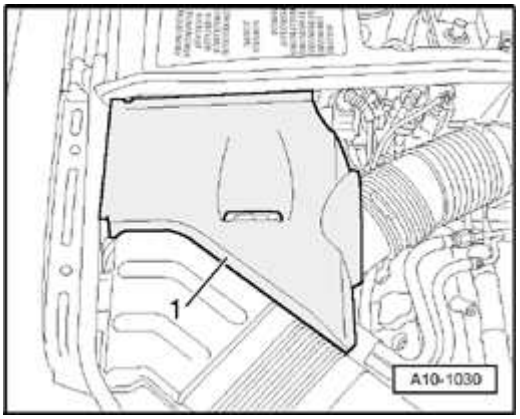


Fig. 107: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

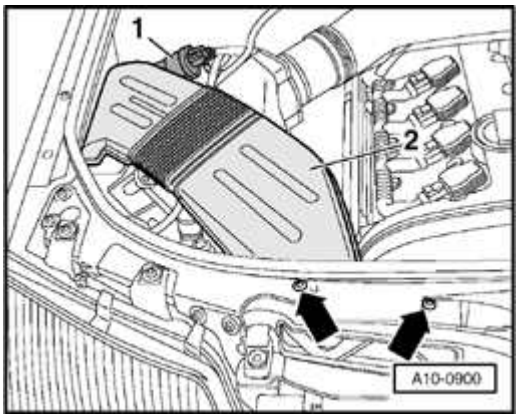
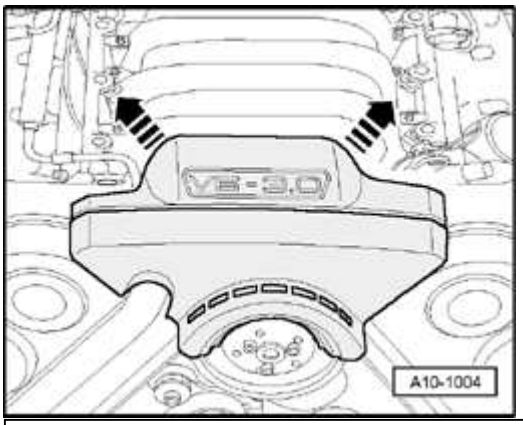


Fig. 108: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.



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Fig. 109: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

NOTE: Before removing ribbed belt, mark direction of rotation with chalk or felt-tip marker. Reversing the direction of rotation of a run-in belt can destroy the belt.

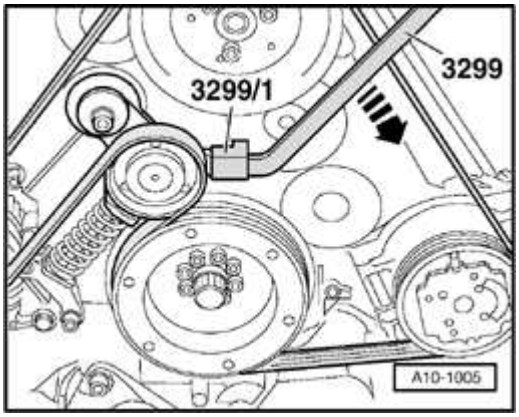


Fig. 110: Swinging Ribbed Belt Tensioner To Release Tension On Ribbed Belt Using 3299 Ribbed Belt Installation Tool And 3299/1 Claw For Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

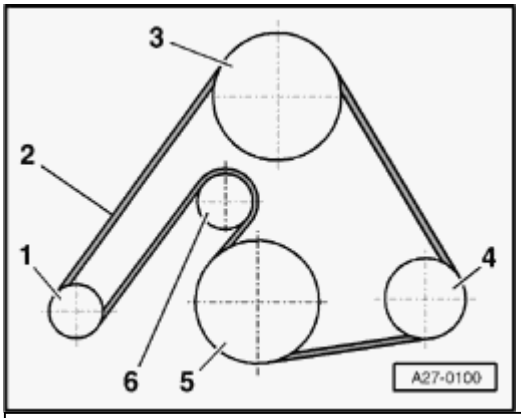
- Swing ribbed belt tensioner in direction of arrow to release tension on ribbed belt using 3299 ribbed belt installation tool and 3299/1 claw for tensioner.
- Remove ribbed belt from pulley of power steering pump.

Installing

Installation is reverse of removal, noting the following:

- First install ribbed belt on crankshaft pulley. Slide belt onto tensioning roller last.

Belt path



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Fig. 111: Belt Path
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Generator

2 - Ribbed belt

3 - Power steering pump

4 - A/C compressor

5 - Crankshaft

6 - Tensioner roller

NOTE: When installing ribbed belt, ensure correct seating on belt pulley.

- Start engine and check path of belt.

Ribbed belt tensioner, removing and installing

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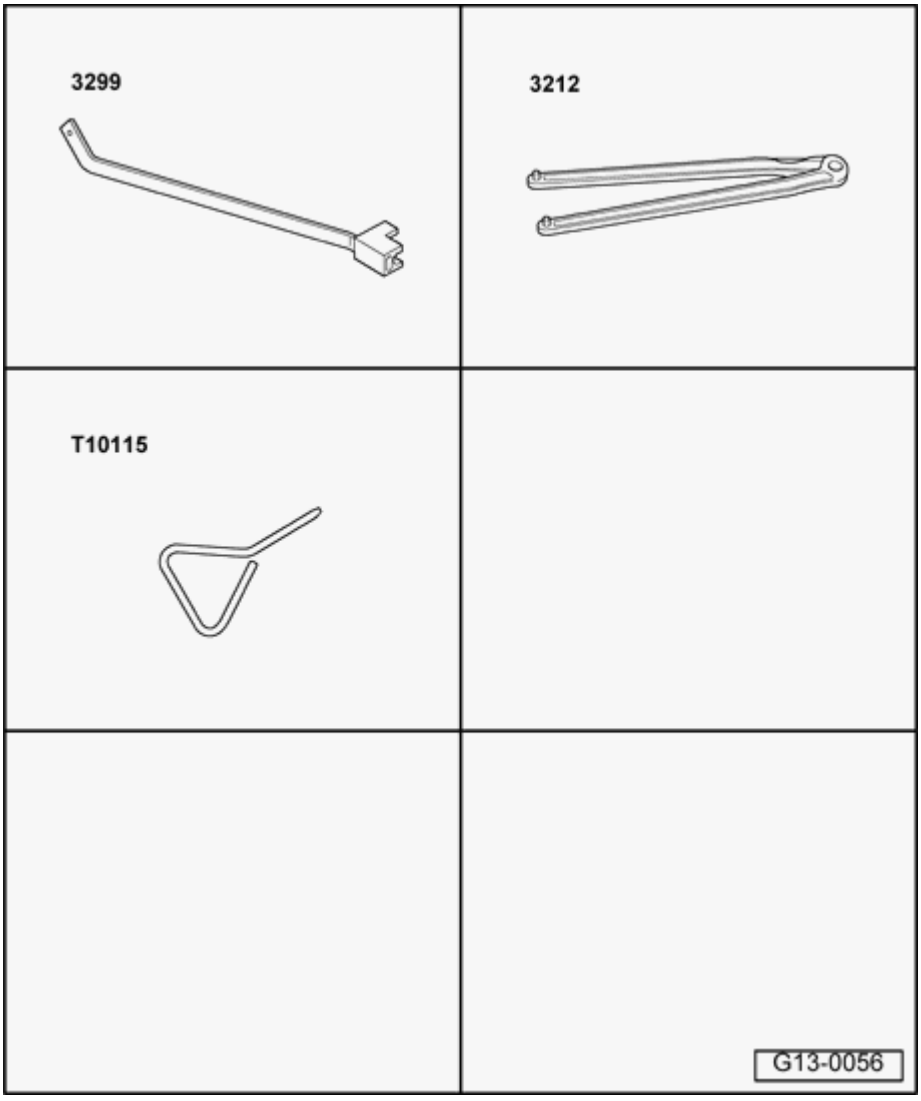


Fig. 112: Identifying Special Tools - Ribbed Belt Tensioner, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special Tools and Equipment

- 3299 ribbed belt installation tool with 3299/1 claw for tensioner
- 3212 spanner wrench
- T10115 pin

Removing

- Lock carrier in service position. Refer to **Lock carrier, moving into service position**.
- Ribbed belt removed. Refer to **Ribbed belt, removing and installing** .

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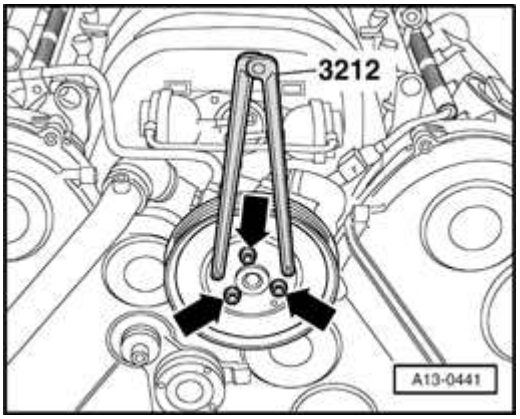


Fig. 113: Removing Ribbed Belt Gear Of Vane Pump Using 3212 Spanner Wrench As Retainer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove ribbed belt gear of vane pump (arrows) using 3212 spanner wrench as retainer.
- Swing ribbed belt tensioner in direction of arrow using 3299 ribbed belt installation tool and 3299/1 claw for tensioner to secure, secure using T10115 pin and release installation tool.
- Unscrew bolts -1- and -2- and remove the secured ribbed belt tensioner.

Installing

Installation is performed in the reverse order of removal.

Tightening torques

Component	Nm
Ribbed belt tensioner to generator bracket	23
Ribbed belt tensioner to cylinder block.	40

Vibration damper, removing and installing

- Lock carrier in service position. Refer to **Lock carrier, moving into service position**.
- Ribbed belt removed. Refer to **Ribbed belt, removing and installing** .

Removing

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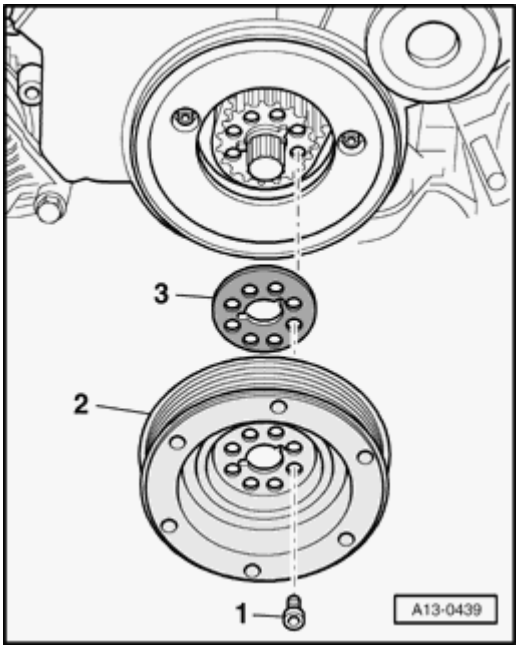


Fig. 114: Removing Bolts, Harmonic Balancer And Thrust Washer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove 8 bolts -1-.
- Remove harmonic balancer -2- and thrust washer -3-.

NOTE:

- **Thrust washer -3- is only installed on toothed belt gear with part number 06C 105 063 A.**
- **No thrust washer must be installed for toothed belt gear with part number 06C 105 063 B.**

Installing

Installation is reverse of removal, noting the following:

- Insert thrust washer in such a way that convex edge points toward harmonic balancer.

NOTE:

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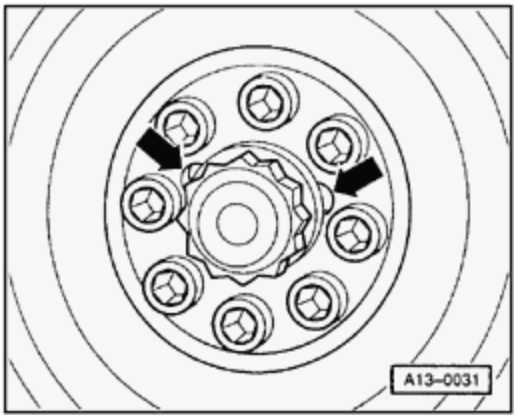


Fig. 115: Vibration Damper And Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

When installing the harmonic balancer, make sure notches (arrows) in harmonic balancer are aligned with locating lugs on toothed belt sprocket.

Tightening torque

Component	Nm
Harmonic balancer to crankshaft	23

Toothed belt cover, removing and installing

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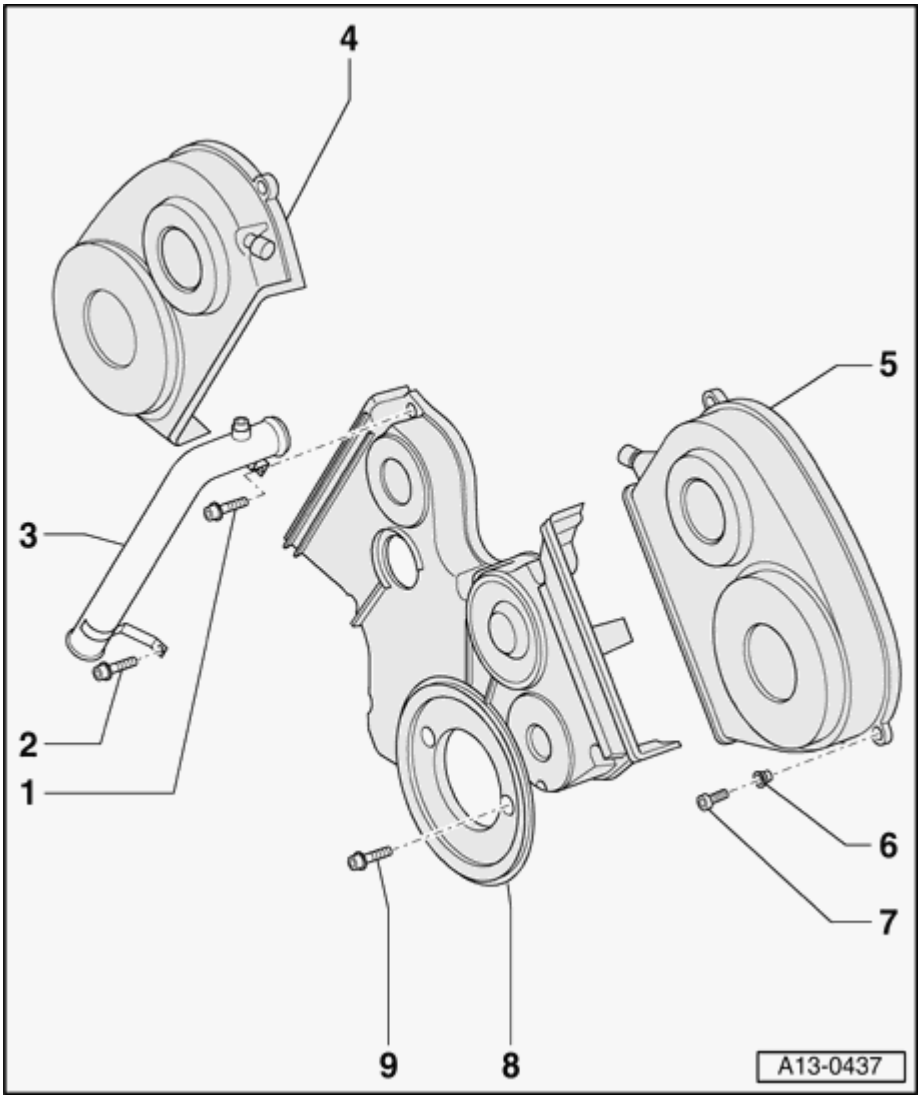


Fig. 116: Toothed Belt Cover Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - 10 Nm

3 - Front coolant pipe

- Only remove bolts item -1- and item -2- to remove toothed belt guide
- Coolant hoses remain connected at coolant pipe

4 - Toothed belt guard, front right

5 - Toothed belt guard, front left

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6 - Socket

7 - 6 Nm

- Self-locking
- Always replace

8 - Lower toothed belt cover

9 - 10 Nm

Toothed belt drive, assembly overview

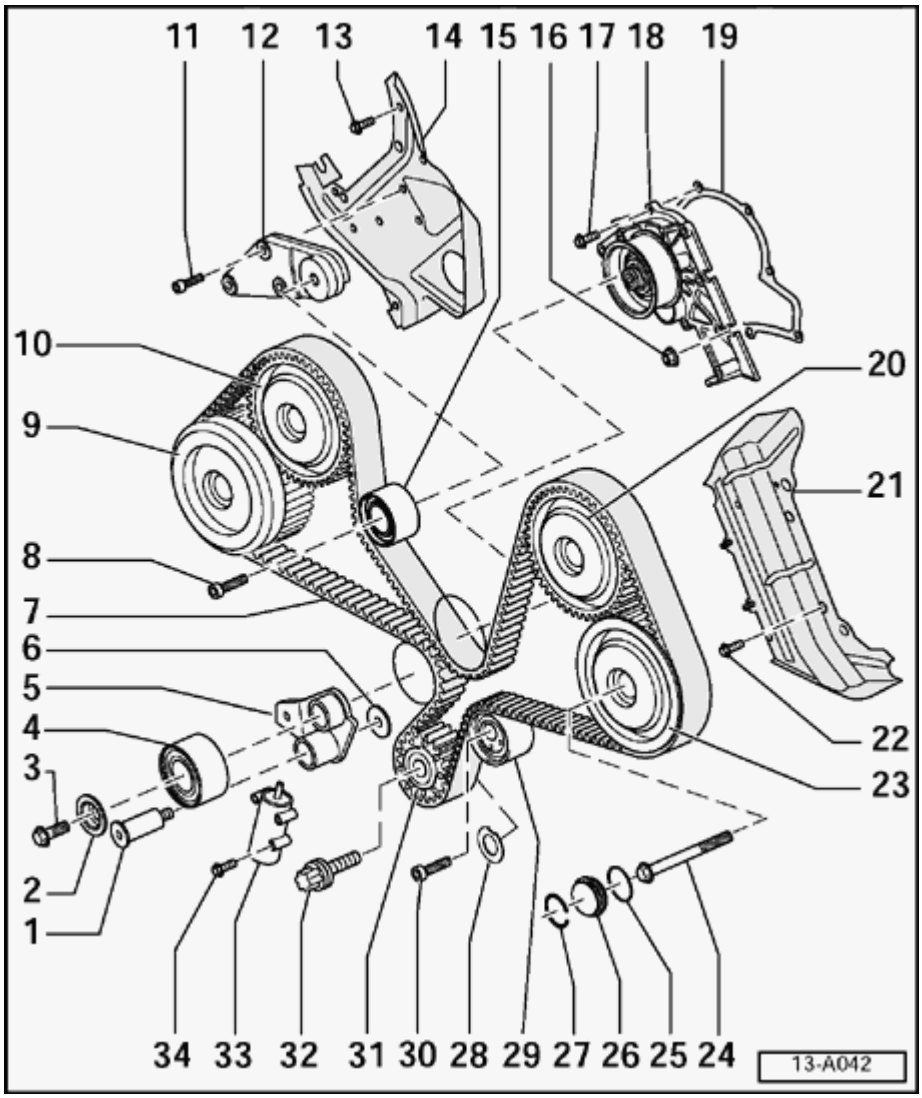


Fig. 117: Toothed Belt Drive, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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NOTE: Before removing toothed belt, note direction of rotation with chalk or felt-tip marker. Reversing the direction of rotation of a run-in belt can destroy the belt.

1 - 45 Nm

- Self-locking
- Always replace

2 - Washer

3 - 45 Nm

4 - Tensioner roller

5 - Tensioning lever

- Insert shim item - 6

6 - Washer

- For tensioner lever

7 - Toothed belt

- Before removing, note direction of rotation using chalk or felt-tip marker
- Check for wear
- Removing. Refer to **Toothed belt, removing and installing**
- Installing (adjusting timing). Refer to **Installing (adjusting valve timing)**

8 - 45 Nm

9 - Exhaust camshaft, toothed belt gear

- For cylinder bank 1 (right) with vibration damper
- With camshaft adjuster
- Identification "Exhaust"

10 - Intake camshaft, toothed belt gear

- For cylinder bank 1 (right)
- With camshaft adjuster
- Identification "Intake"

11 - 10 Nm

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- Self-locking
- Always replace

12 - Bracket

- For idler roller

13 - 10 Nm

- Self-locking
- Always replace

14 - Toothed belt guard, rear right

15 - Idler roller

16 - 10 Nm

17 - 10 Nm

18 - Mechanical coolant pump

- Removing and installing. Refer to **Coolant pump, removing and installing**

19 - Gasket

- Always replace

20 - Intake camshaft, toothed belt gear

- For cylinder bank 2 (left)
- With camshaft adjuster
- Identification "Intake"

21 - Toothed belt guard, rear left

22 - 10 Nm

- Self-locking
- Always replace

23 - Exhaust camshaft, toothed belt gear

- For cylinder bank 2 (left) with vibration damper
- With camshaft adjuster

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- Identification "Exhaust"

24 - 100 Nm

- Use T40030 camshaft adjuster gauge when loosening or tightening

25 - O-ring

- Always replace

26 - Cap

27 - Snap ring

28 - Diamond disc

- For toothed belt gear
- Replace after removing toothed belt

29 - Eccentric pulley

30 - 45 Nm

31 - Toothed belt gear for crankshaft

- Replace diamond disc item - 28 after removal
- Contact surface between toothed belt gear, diamond disc and crankshaft must be free of oil.
- Installation only possible in one position
- Version dependent with/without thrust washer. Observe note. Refer to **Vibration damper, removing and installing**

32 - Central bolt, 200 Nm plus an addition 180° (1/2 turn)

- Always replace
- Do not oil additionally
- Use T40026 locking pin when loosening or tightening
- Thread in T40026 locking pin. Refer to **Toothed belt, removing and installing**

33 - Toothed belt tensioner

34 - 10 Nm

Toothed belt, removing and installing

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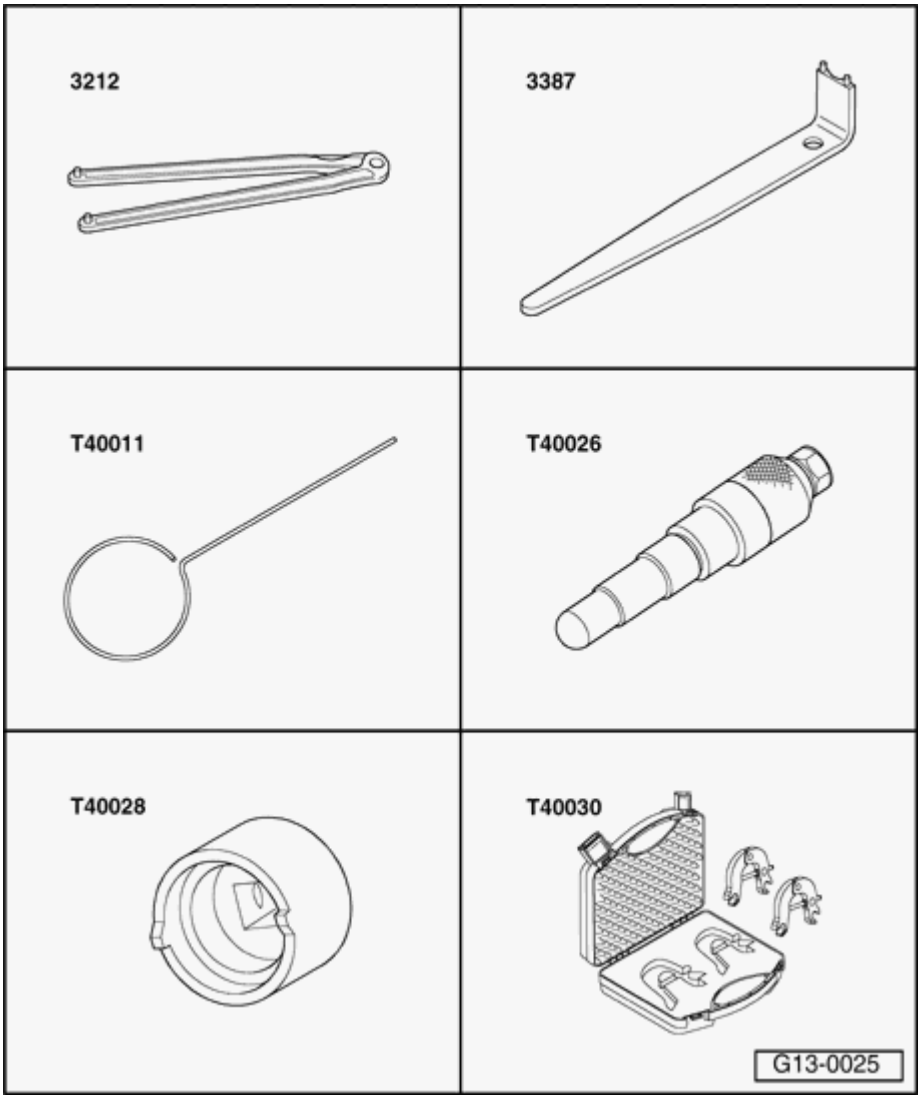


Fig. 118: Identifying Special Tools - Toothed Belt, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- 3212 Spanner wrench
- 3387 Pin wrench
- T40011 Pin
- T40026 Locking pin
- T40028 Socket
- T40030 Camshaft adjuster gauge

Removing

- Lock carrier in service position. Refer to **Lock carrier, moving into service position**.

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- Ribbed belt removed. Refer to **Ribbed belt, removing and installing** .
- Ribbed belt tensioner removed. Refer to **Ribbed belt tensioner, removing and installing** .

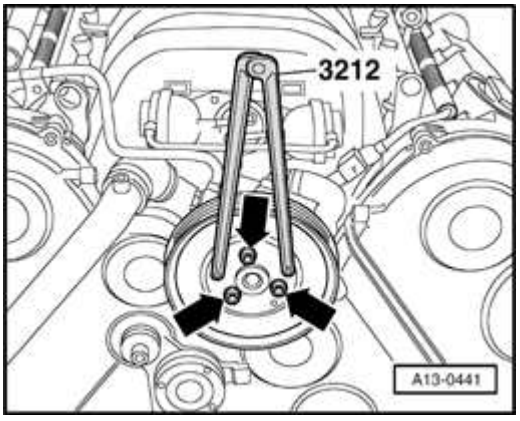


Fig. 119: Removing Ribbed Belt Gear Of Vane Pump Using 3212 Spanner Wrench As Retainer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove ribbed belt gear of power steering pump (arrows) using 3212 spanner wrench as retainer.

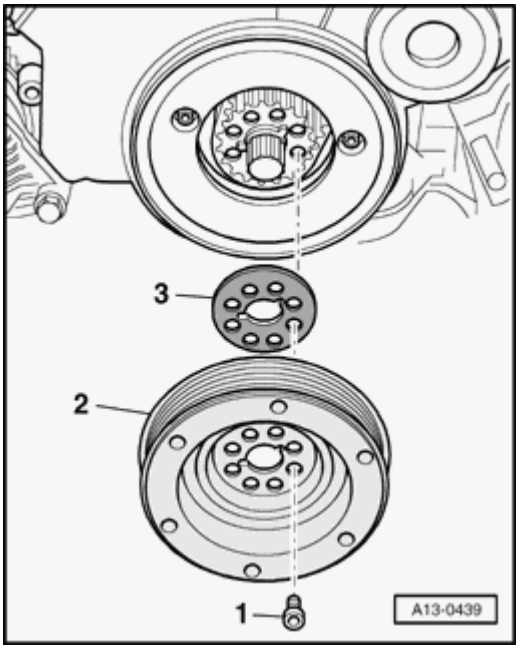


Fig. 120: Removing Bolts, Harmonic Balancer And Thrust Washer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove 8 bolts -1-.
- Remove harmonic balancer -2- and thrust washer -3-.

NOTE:

- **Thrust washer -3- is only installed on toothed belt gear with part number 06C 105 063 A.**

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- **No thrust washer must be installed for toothed belt gear with part number 06C 105 063 B.**

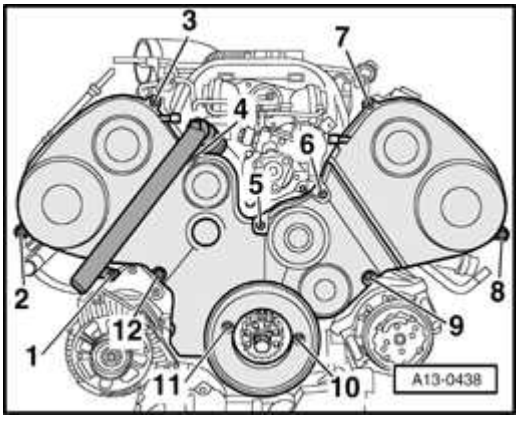


Fig. 121: Unscrewing Bolts And Removing Toothed Belt Guards
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1 to 12- and remove toothed belt guards.

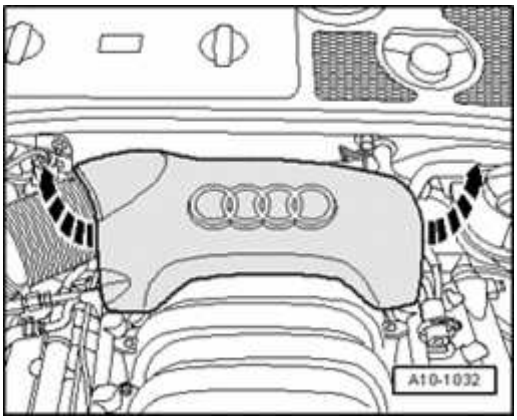


Fig. 122: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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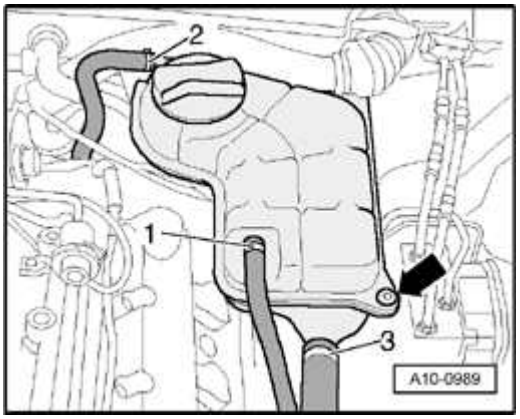


Fig. 123: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of expansion tank.
- Tie coolant expansion tank with connected coolant hoses -1 to 3- to side.

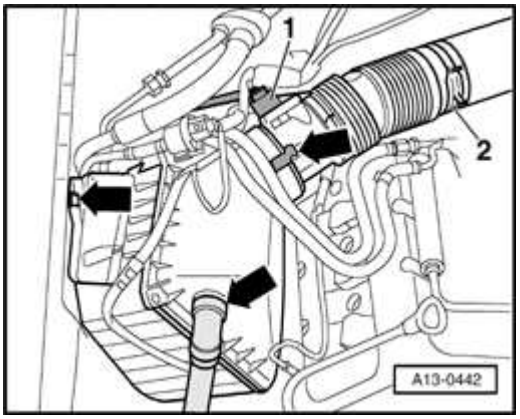


Fig. 124: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).
- Disconnect electrical harness connector -1- at Mass Air Flow (MAF) sensor.
- Remove air guide hose -2- together with Mass Air Flow (MAF) sensor.

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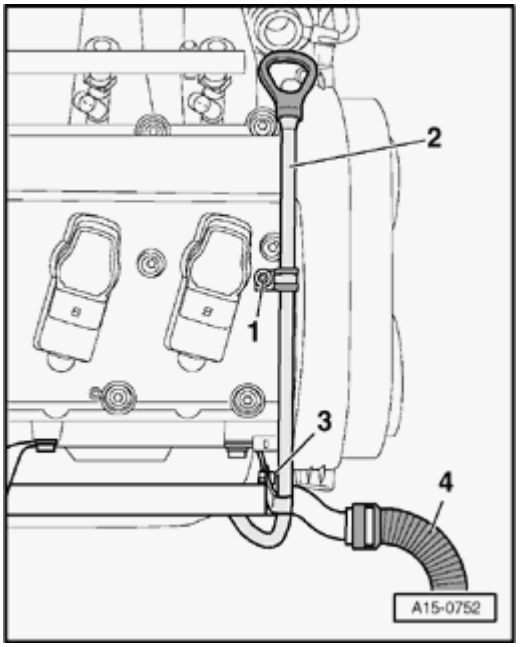


Fig. 125: Identifying Bolts, Hose From Line Of Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -3-.
- Disconnect hose -4- from line of secondary air injection.
- Pull out guide tube for oil dipstick 2 from the oil pan (upper part) toward top and swing it forward for removal.

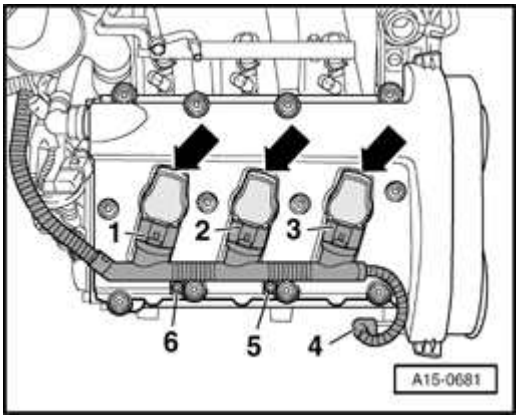


Fig. 126: Removing Bolts At Right Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -5- and -6- at right cylinder head cover.
- Disconnect electrical harness connectors -1- to -4-.
- Remove ignition coils (arrows).

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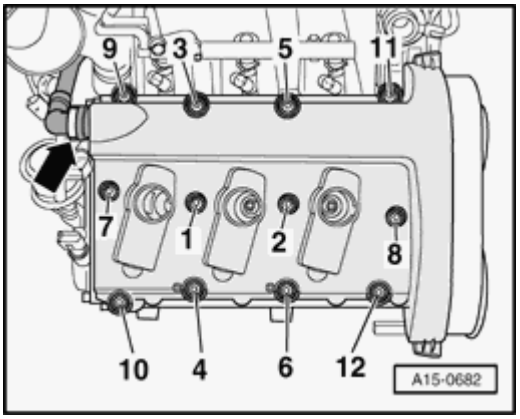


Fig. 127: Removing/Installing Hose Of Crankshaft Housing Ventilation & Unscrewing/Screwing Bolts For Right Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove hose of crankshaft housing ventilation (arrow).
- Unscrew bolts for right cylinder head cover in sequence -12- to -1-.
- Remove cylinder head cover.

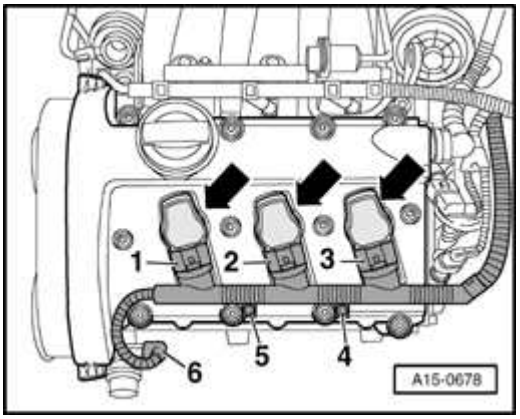


Fig. 128: Removing Bolts At Left Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -4- and -5- at left cylinder head cover.
- Disconnect electrical harness connectors -1- to -3- and -6-.
- Remove ignition coils (arrows).

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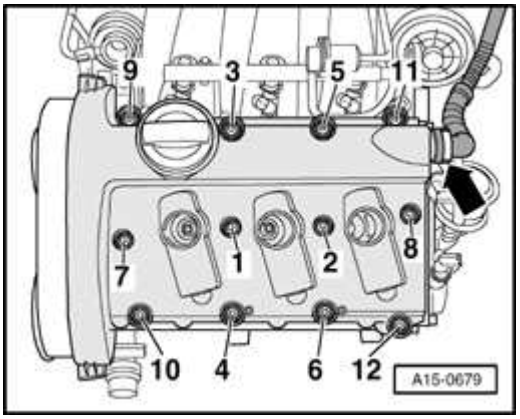


Fig. 129: Removing Hose Of Crankshaft Housing Ventilation & Unscrewing Bolts For Left Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove hose of crankshaft housing ventilation (arrow).
- Unscrew bolts for left cylinder head cover in sequence -12- to -1-.
- Remove cylinder head cover.

WARNING: Turning of the engine must only occur in direction of engine rotation (clockwise) at the crankshaft.

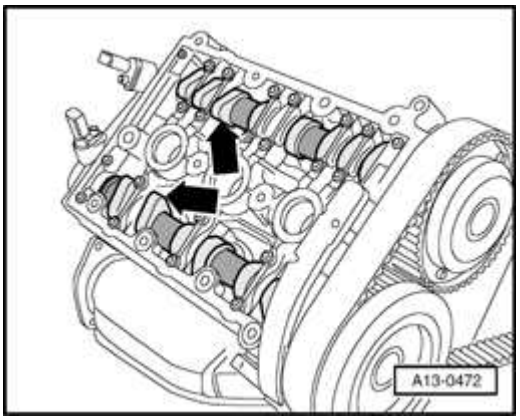


Fig. 130: Turning Engine Until Cams At Intake And Exhaust Camshaft Of Cylinder 3 (Right Cylinder Bank) Point Upward Uniformly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn engine until cams (arrows) at intake and exhaust camshaft of cylinder 3 (right cylinder bank) point upward uniformly.

NOTE: Turn engine at crankshaft central bolt.

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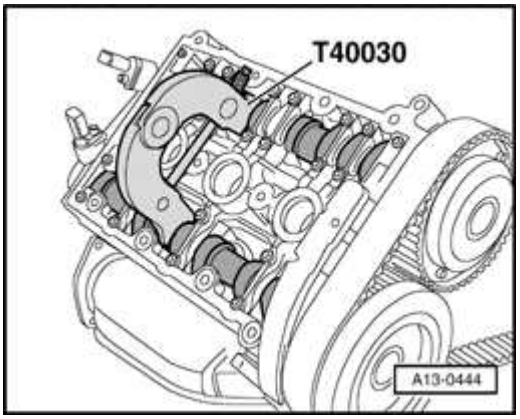


Fig. 131: Inserting T40030 Camshaft Adjuster Gauge At Camshafts Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert T40030 camshaft adjuster gauge at camshafts of right cylinder head.

NOTE: Slightly turn crankshaft back and forth so that the claw of T40030 camshaft adjuster gauge can properly grab the camshafts.

- Spread T40030 camshaft adjuster gauge with threaded shaft (tightening torque 10 Nm) until it is seated without axial play.

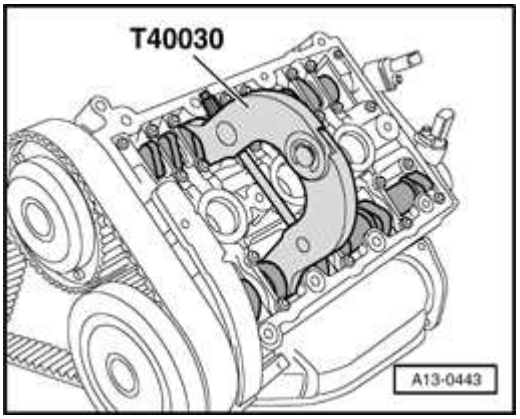


Fig. 132: Inserting T40030 Camshaft Adjuster Gauge At Left Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert T40030 camshaft adjuster gauge at left cylinder head in same manner.
- If installed, disconnect electrical harness connector at after-run coolant pump.
- Unscrew sealing plug of TDC mark at cylinder block.

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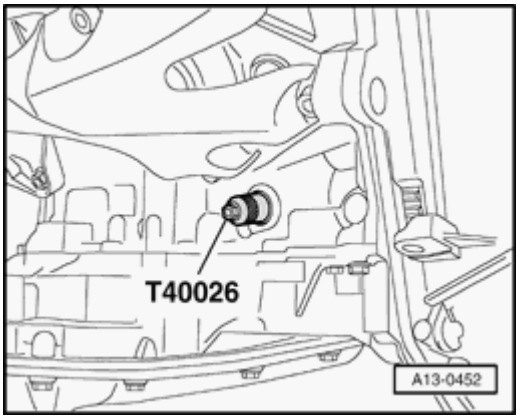


Fig. 133: Threading T40026 Locking Pin Into Hole Of Removed Sealing Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread T40026 locking pin into hole of removed sealing plug and tighten.

NOTE: Slightly turn crankshaft back and forth to do so.

NOTE: Catch escaping oil using a rag.

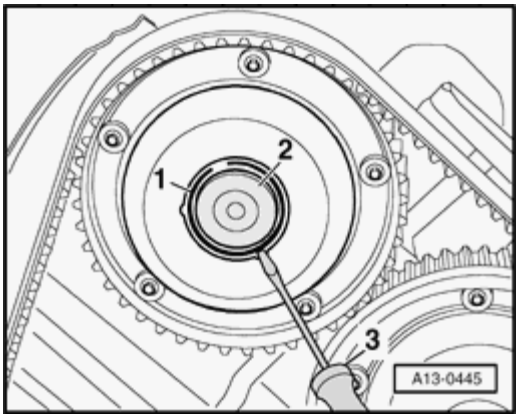


Fig. 134: Prying Off Securing Rings For Caps At All Camshaft Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off securing rings -1- for caps -2- at all camshaft gears.

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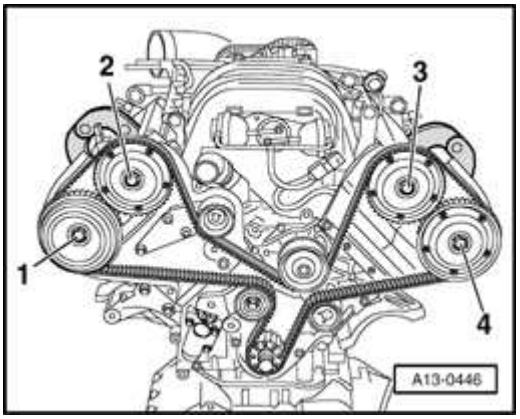


Fig. 135: Loosening Bolts For Camshaft Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen but do not remove bolts -1- to -4- for camshaft gears.

NOTE: The bolts remain loosely threaded in.

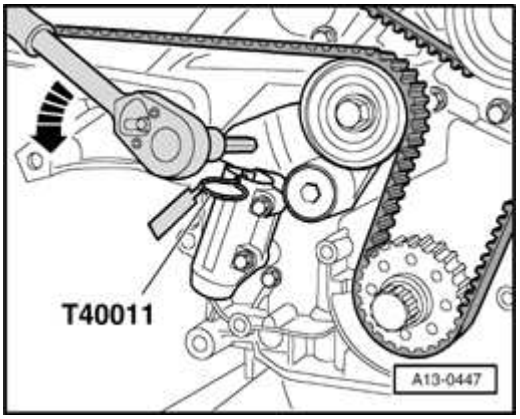


Fig. 136: Turning Toothed Belt Tensioner Until Tensioning Lever Pushes Tensioner Together Far Enough So That T40011 Pin Can Be Inserted Into Bore Of Pistons And Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using an 8 mm hex socket wrench, turn toothed belt tensioner in direction of arrow until tensioning lever pushes tensioner together far enough so that T40011 pin can be inserted into bore of pistons and housing.

NOTE:

- **The toothed belt tensioner is oil-dampened. Compress it by slowly applying constant pressure.**
- **Mark rotational direction of toothed belt. Reversing the direction in which it runs can ruin it.**

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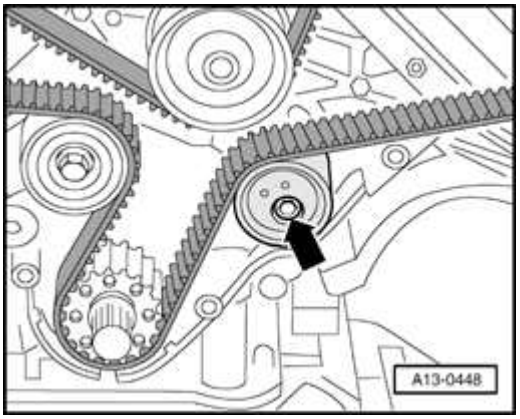


Fig. 137: Loosening Bolt Of Eccentric Pulley
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolt (arrow) of eccentric pulley.
- Remove toothed belt.

Installing (adjusting valve timing)

- Camshafts aligned using T40030 camshaft adjuster gauge
- Crankshaft aligned using T40026 locking pin
- Camshaft gears loosened.

NOTE:

- **Replace gaskets, O-rings and self-locking bolts.**
- **When turning camshaft, crankshaft must not be at TDC for any cylinder. Valves and/or pistons may be damaged.**

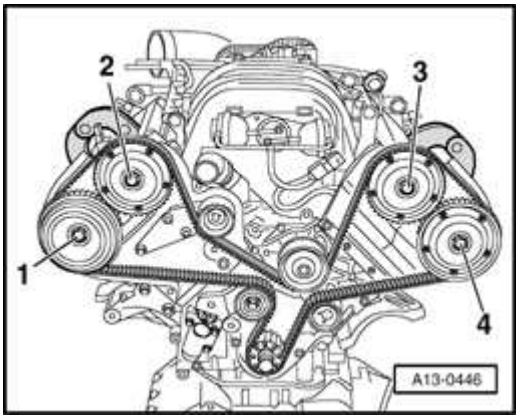


Fig. 138: Loosening Bolts For Camshaft Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolt in camshaft gears -1- to -4- far enough so they can still just be turned without canting.
- Install toothed belt as depicted in illustration.

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- For exact valve timing adjustment, toothed belt must make exact contact with front edge of all toothed belt gears.

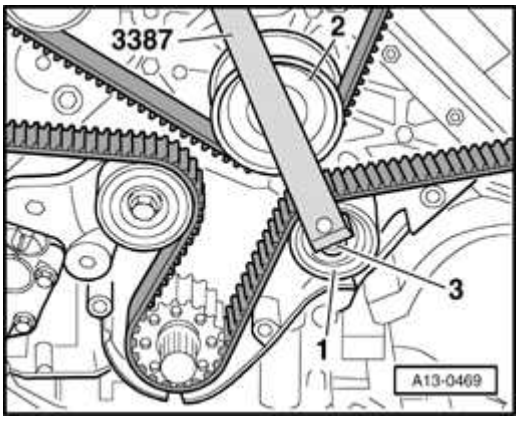


Fig. 139: Using 3387 Pin Wrench To Turn Eccentric Pulley Until Handle Of Pin Wrench Is Exactly Above Center Axle Of Coolant Pump Gear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using 3387 pin wrench, turn eccentric pulley -1- in clockwise direction until handle of pin wrench is exactly above center axle of coolant pump gear -2-.
- Hold pin wrench in this position and tighten bolt -3- to 45 Nm.

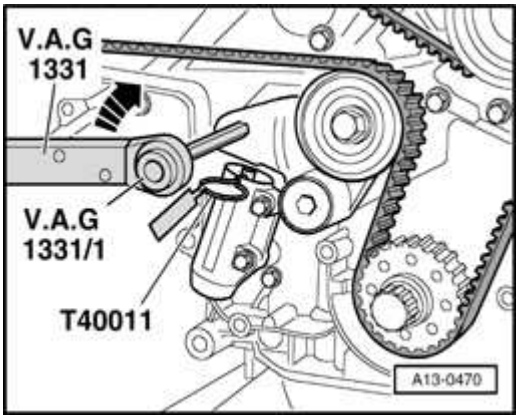


Fig. 140: Pre-Tension Toothed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque wrench horizontally on socket-head of tensioning lever.
- Turn with 45 Nm in direction of arrow to pre-tension toothed belt.

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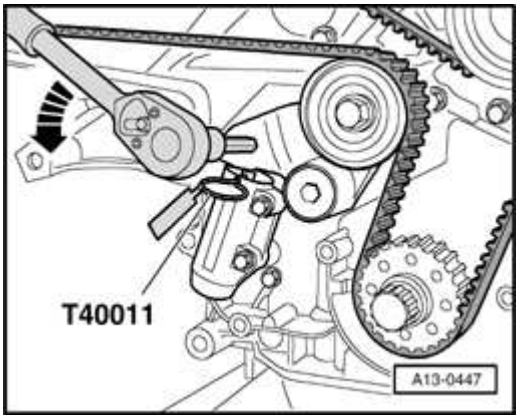


Fig. 141: Turning Toothed Belt Tensioner Until Tensioning Lever Pushes Tensioner Together Far Enough So That T40011 Pin Can Be Inserted Into Bore Of Pistons And Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using 8 mm socket head wrench, turn toothed belt tensioning roller in direction of arrow until T40011 pin can pulled out.

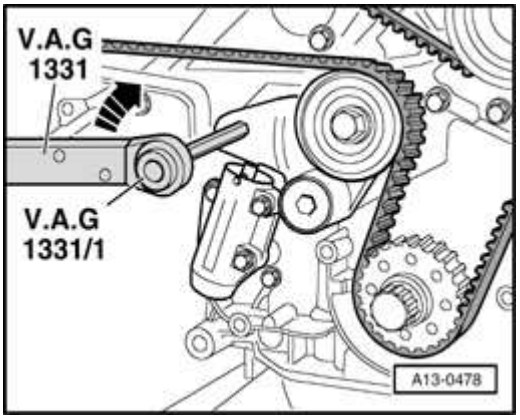


Fig. 142: Tensioning Toothed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque wrench horizontally on socket-head of tensioning lever.
- Turn with 25 Nm in direction of arrow to tension toothed belt.

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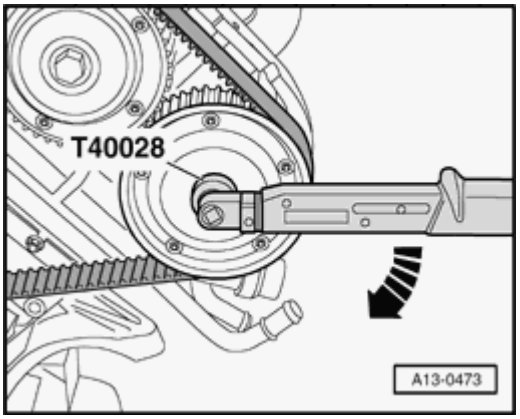


Fig. 143: Inserting T40028 Socket At Camshaft Adjuster Of Exhaust Camshaft On Left Cylinder Bank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert T40028 socket at camshaft adjuster of exhaust camshaft on left cylinder bank.
- Turn rotor of camshaft adjuster clockwise to 10 Nm up to stop (arrow).

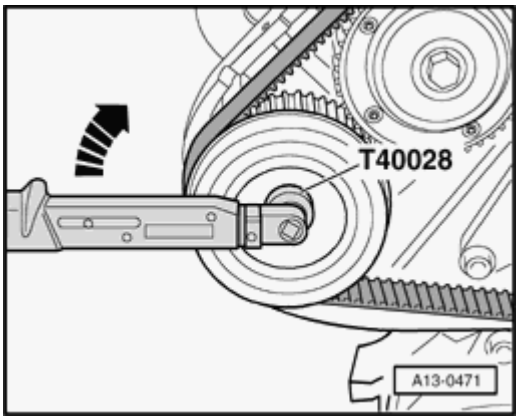
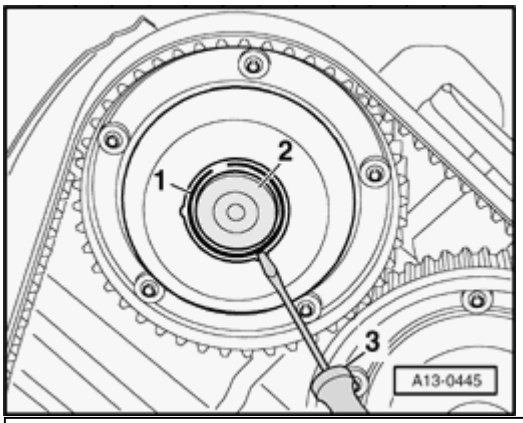


Fig. 144: Turning Rotor Of Camshaft Adjuster At Right Cylinder Bank Clockwise
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn rotor of camshaft adjuster at right cylinder bank clockwise to 10 Nm up to stop (arrow).
- Tighten bolts for all four camshaft gears to 100 Nm.



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Fig. 145: Prying Off Securing Rings For Caps At All Camshaft Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert caps -2- with new O-rings -1- at camshaft gears and secure them with securing ring.
- Remove T40030 camshaft adjuster gauge.
- Remove T10026 alignment bolt and thread sealing plug of TDC marking with new O-ring into cylinder block.

Installation is reverse of removal, noting the following:

- Install cylinder head covers. Refer to **Installing** for Left cylinder head cover or **Installing** for Right cylinder head cover.
- Install toothed belt guards. Refer to **Toothed belt cover, removing and installing**.
- Install harmonic balancer. Refer to **Vibration damper, removing and installing**.
- Install ribbed belt. Refer to **Installing**.

Tightening torques

Component		Nm
Eccentric pulley to front sealing flange		45
Camshaft gear to camshaft		100
Sealing plug in cylinder block		25
Ribbed belt tensioner to cylinder block.	M8	23
	M10	40
Belt pulley to power steering pump		23

SEALING FLANGES AND FLYWHEEL/DRIVE PLATE, REMOVING AND INSTALLING

Sealing flanges and flywheel/drive plate, removing and installing

NOTE: Servicing clutch.

Refer to

- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **30 CLUTCH** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

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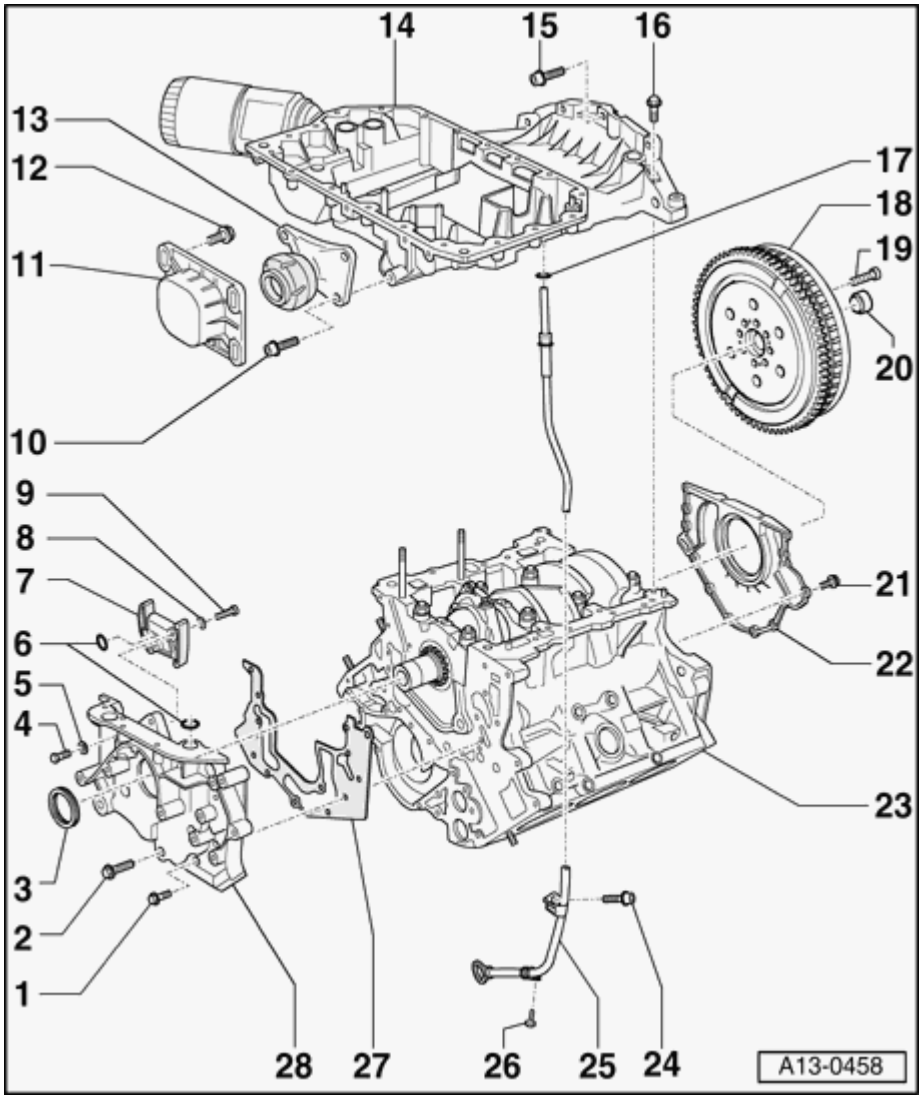


Fig. 146: Sealing Flanges And Flywheel/Drive Plate Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - 30 Nm

- Self-locking
- Always replace

3 - Seal

- For crankshaft
- Removing and installing. Refer to **Seal for crankshaft (ribbed belt side), replacing**

4 - Locking bolt - 10 Nm

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5 - Seal

- Always replace

6 - O-ring

- Always replace

7 - Chain tensioner

- Removing and installing. Refer to **Drive chain or chain tensioner for oil pump, removing and installing**

8 - Washer

9 - 12 Nm

10 - 40 Nm

11 - Stop

- For torque support

12 - 28 Nm

13 - Torque support

14 - Oil pan (upper part)

- Removing and installing. Refer to **Oil pan (upper part), removing and installing**

15 - 45 Nm

16 - M7 = 16 Nm, M8 = 22 Nm

17 - O-ring

- Always replace

18 - Dual-mass flywheel or drive plate

- Flywheel, removing and installing. Refer to **Flywheel and drive plate, removing and installing**
- Drive plate, removing and installing. Refer to **Drive plate for automatic transmission 01V**

19 - Special bolt

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- Always replace
- Tightening torque. Refer to **Tightening torques** for Dual-mass flywheel or flywheel for automatic transmission 01J or **Tightening torques** for Drive plate for automatic transmission 01V

20 - Needle bearing

- Removing and installing. Refer to **Dual-mass flywheel pilot needle bearing, removing and installing**
- Not for automatic transmission 01V
- For automatic transmission 01V, a centering bushing is bolted into crankshaft instead of needle bearing. See **Centering bushing of drive plate for automatic transmission 01V**

21 - 10 Nm

22 - Sealing flange rear with oil seal

- Removing and installing. Refer to **Rear sealing flange, removing and installing**
- Lightly oil lip of O-ring.
- To install, slide guide sleeve from kit onto crankshaft

23 - Cylinder block

- Crankshaft, removing and installing. Refer to **Crankshaft, removing and installing**
- Pistons and connecting rods, disassembling and assembling. Refer to **Pistons and connecting rods, disassembling and assembling**

24 - 20 Nm

25 - Guide tube for oil dipstick

26 - Sheet metal screw

27 - Gasket

- Always replace

28 - Sealing flange, front

- Removing and installing. Refer to **Front sealing flange, removing and installing**

Centering bushing of drive plate for automatic transmission 01V

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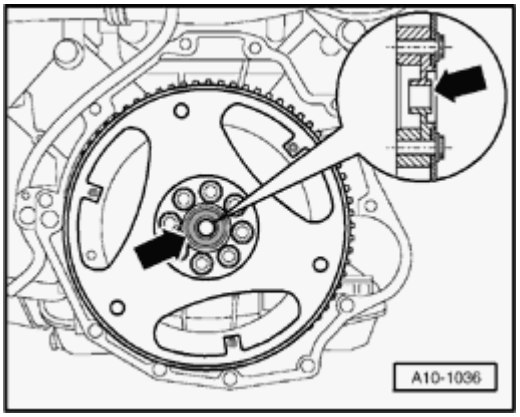


Fig. 147: Bolting Drive Plate To Crankshaft With Centering Bushing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

For vehicles with an automatic transmission, the drive plate is bolted to the crankshaft with a centering bushing (arrow).

Seal for crankshaft (ribbed belt side), replacing

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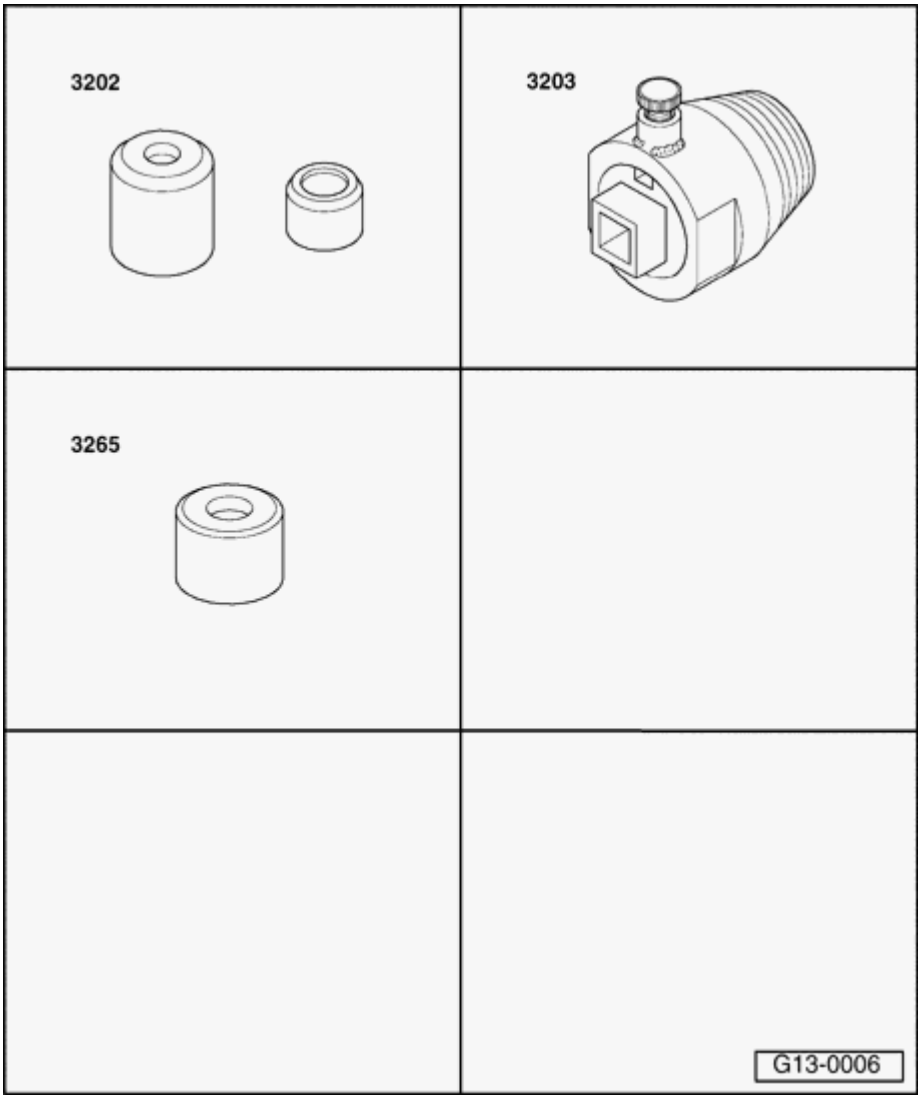


Fig. 148: Identifying Special Tools - Seal For Crankshaft (Ribbed Belt Side), Replacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- 3202/1 Pull sleeve
- 3203 Seal remover
- 3265 Seal installer

Removing

- Engine installed.

  - Remove toothed belt. Refer to **Toothed belt, removing and installing**.

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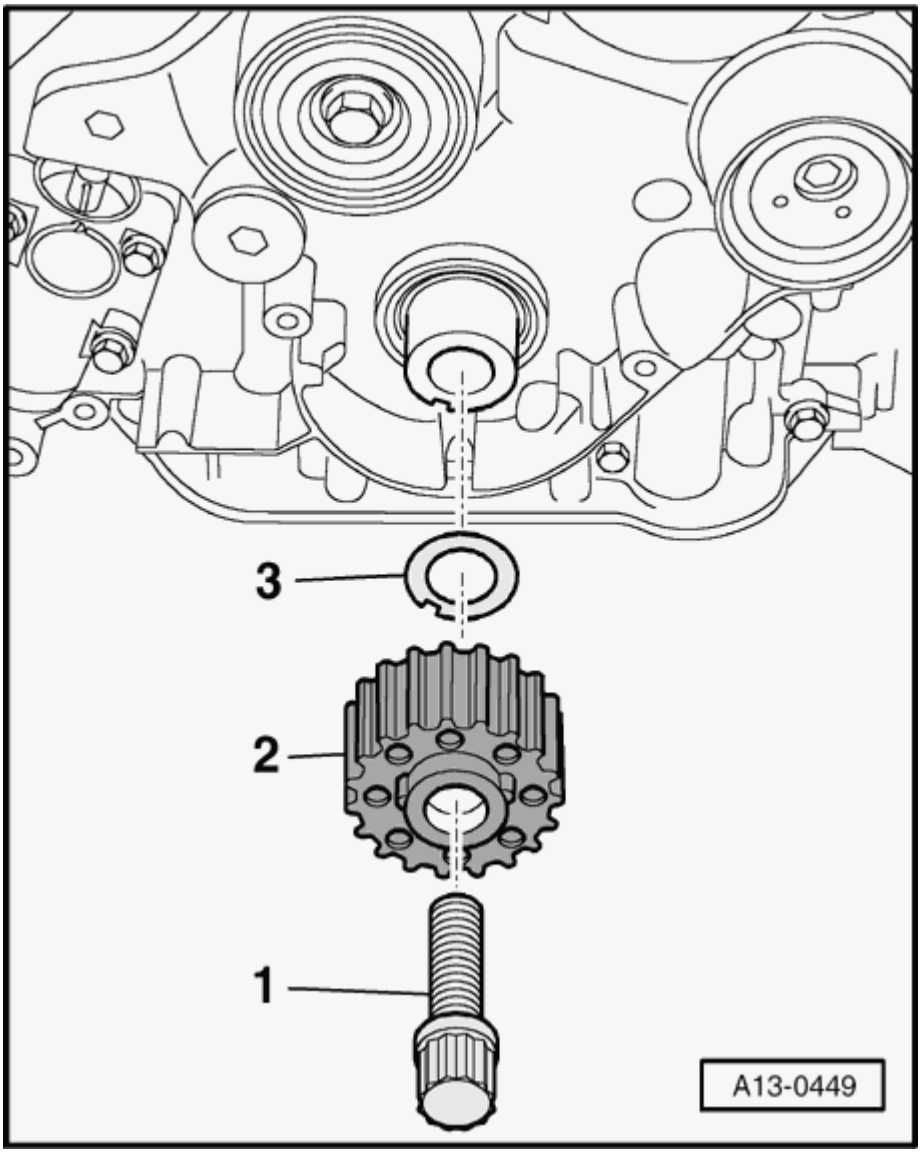


Fig. 149: Identifying Center Bolt, Crankshaft Toothed Belt Gear & Diamond Disc
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center bolt -1- for crankshaft toothed belt gear -2-.
- Remove toothed belt gear.
- Remove diamond disc -3- from toothed belt gear.
- Unscrew inner portion of 3203 seal remover six rotations from outer portion and secure with knurled-head screw.

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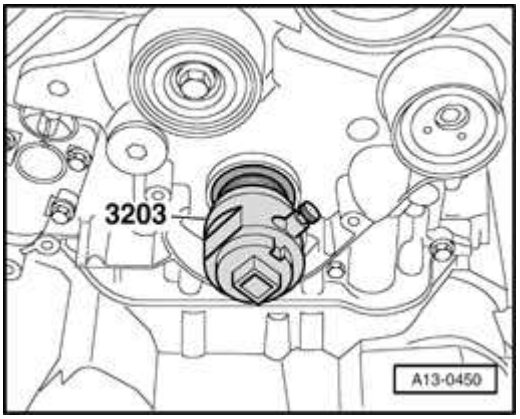


Fig. 150: Oil Threaded Head Of 2085 Seal Puller Positioning
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Oil threaded head of 2085 seal puller, position and with forced pressure screw into oil seal as far as possible.
- Loosen knurled bolt and turn inner part against crankshaft until oil seal is removed.
- Clamp seal puller into vise at flattened regions. Remove O-ring with pliers.

Installing

- Clean contact surface and sealing surface.

NOTE: Do not oil sealing lip or outer edge of sealing ring before pressing in.

- Slide on sealing ring using 3202/1 pull sleeve.

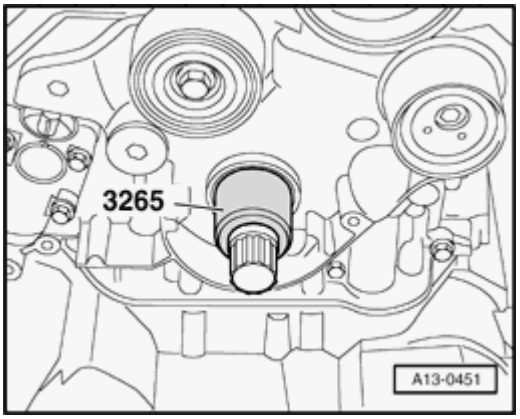


Fig. 151: Pressing In Sealing Ring Using 3265 Seal Installer And Central Bolt Up To Stop
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press in sealing ring using 3265 seal installer and central bolt up to stop.

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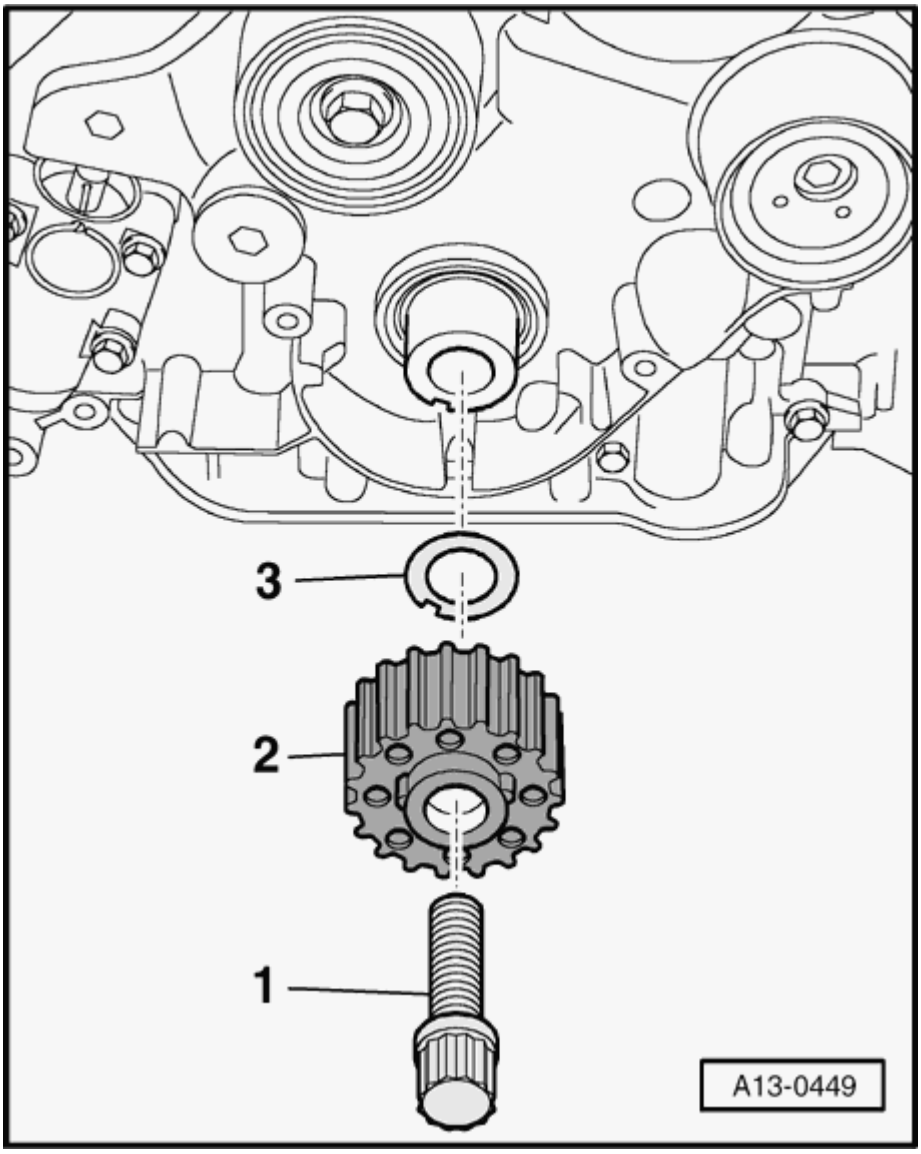


Fig. 152: Identifying Center Bolt, Crankshaft Toothed Belt Gear & Diamond Disc
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft toothed belt gear -2- with new diamond disc -3- and new center bolt -1-.

NOTE:

- **Contact surfaces between toothed belt gear, diamond disc and crankshaft must be free of oil.**
- **Do not additionally oil bolt for toothed belt gear for crankshaft.**

- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.

Tightening torque

Component	Nm

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Toothed belt gear to crankshaft	200 + 180°1)2)

1) Always replace bolt

2) 180°= one half-turn

Front sealing flange, removing and installing

Special tools and equipment

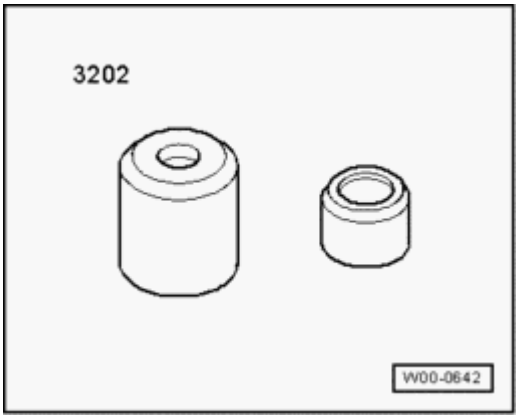


Fig. 153: 3202/1 Pull Sleeve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3202/1 Pull sleeve

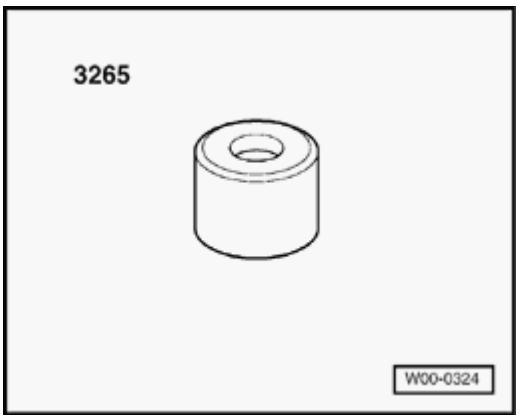


Fig. 154: 3265 Seal Installer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3265 Seal installer

Removing

- Lock carrier in service position. Refer to **Lock carrier, moving into service position**.

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- Remove toothed belt. Refer to **Toothed belt, removing and installing**.
- Remove camshaft gears from right cylinder head.

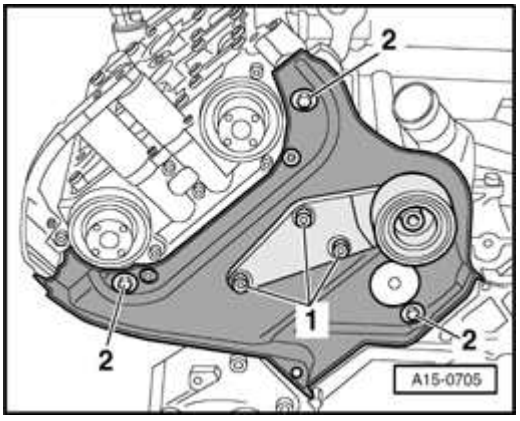


Fig. 155: Unscrewing Bolts And Removing Bracket With Idler Roller & Toothed Belt Guard At Right Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and remove bracket with idler roller.
- Unscrew bolts -2- and remove toothed belt guard at right rear.
- Remove oil pan (upper part). Refer to **Oil pan (upper part), removing and installing**.

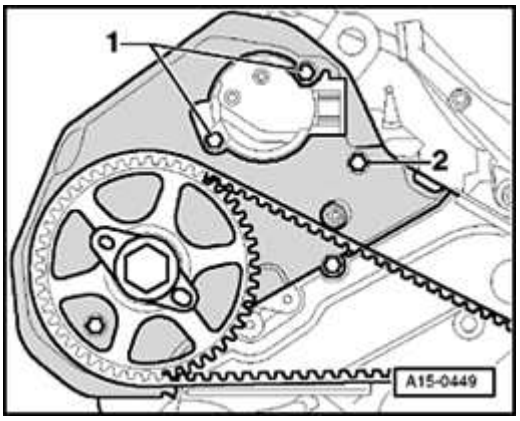


Fig. 156: Removing Center Bolt For Crankshaft Toothed Belt Gear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center bolt -1- for crankshaft toothed belt gear -2-.
- Remove toothed belt gear and diamond disc -3-.

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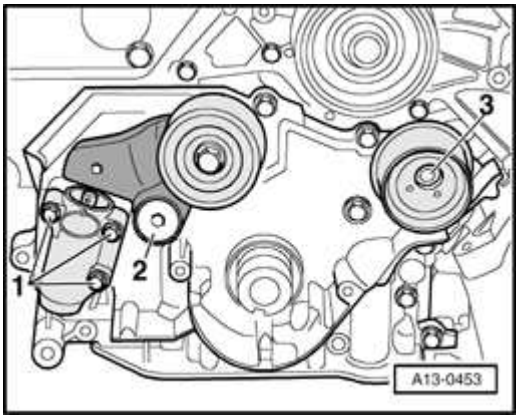


Fig. 157: Installing Eccentric Roller Loosely
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt eccentric roller -3-, tensioning lever -2- with tensioning roller and tensioner -1-.

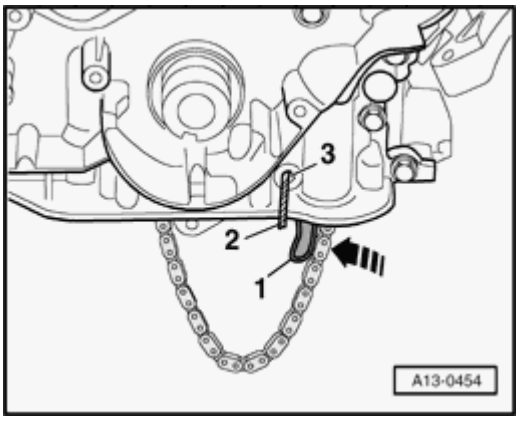


Fig. 158: Pressing Chain Tensioner Until Drill Bit Can Be Slid Into Alignment Hole Of Sealing Flange And Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew locking bolt from adjustment hole -3-.
- Press chain tensioner -1- in direction of arrow until a 3 mm drill bit -2- can be slid into alignment hole of sealing flange and chain tensioner.

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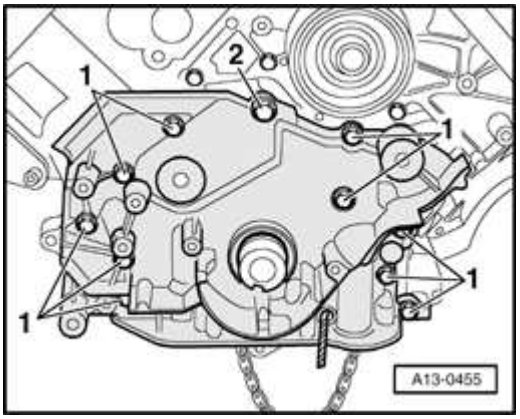


Fig. 159: Removing Bolts & Front Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-.
- Remove front sealing flange.
- Drive out sealing ring with the flange removed.

NOTE: Remove chain tensioner to replace sealing flange. Refer to Drive chain or chain tensioner for oil pump, removing and installing.

Installing

Installation is reverse of removal, noting the following:

NOTE: Always replace seals, sealing rings and self-locking bolts.

- Clean sealing surfaces before installing sealing flange.
- Install front sealing flange with secured chain tensioner.

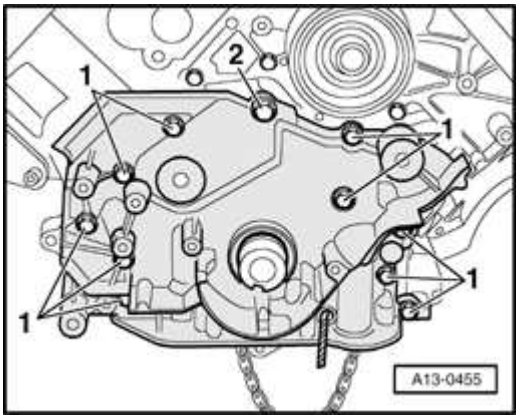


Fig. 160: Removing Bolts & Front Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Replace bolt -2-.
- Tighten bolts -1- to 10 Nm and bolt -2- to 30 Nm.
- Do not oil sealing lip or outer edge of sealing ring before pressing in.
- Slide on sealing ring using 3202/1 pull sleeve.

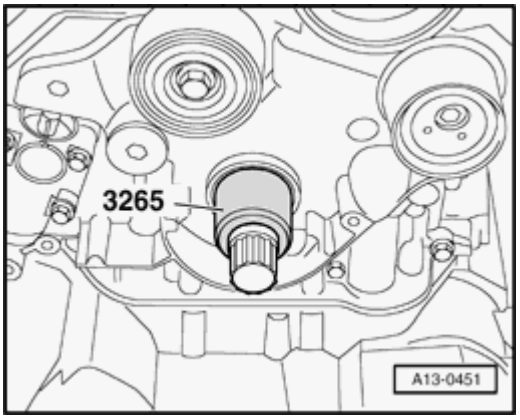


Fig. 161: Pressing In Sealing Ring Using 3265 Seal Installer And Central Bolt Up To Stop
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press in sealing ring using 3265 seal installer and central bolt up to stop.

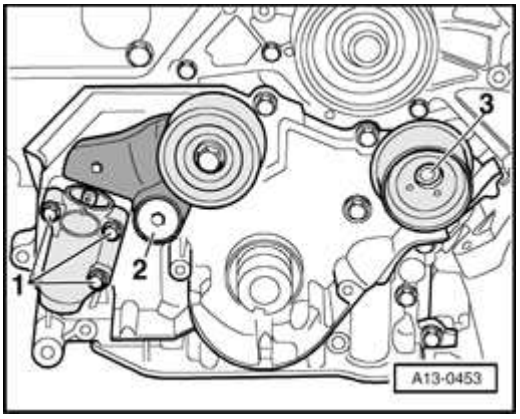


Fig. 162: Installing Eccentric Roller Loosely
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install eccentric roller 3 loosely.

NOTE: Note washer below tensioning lever -2-.

- Install tensioning lever -2- using tensioner roller and tensioner -1-.

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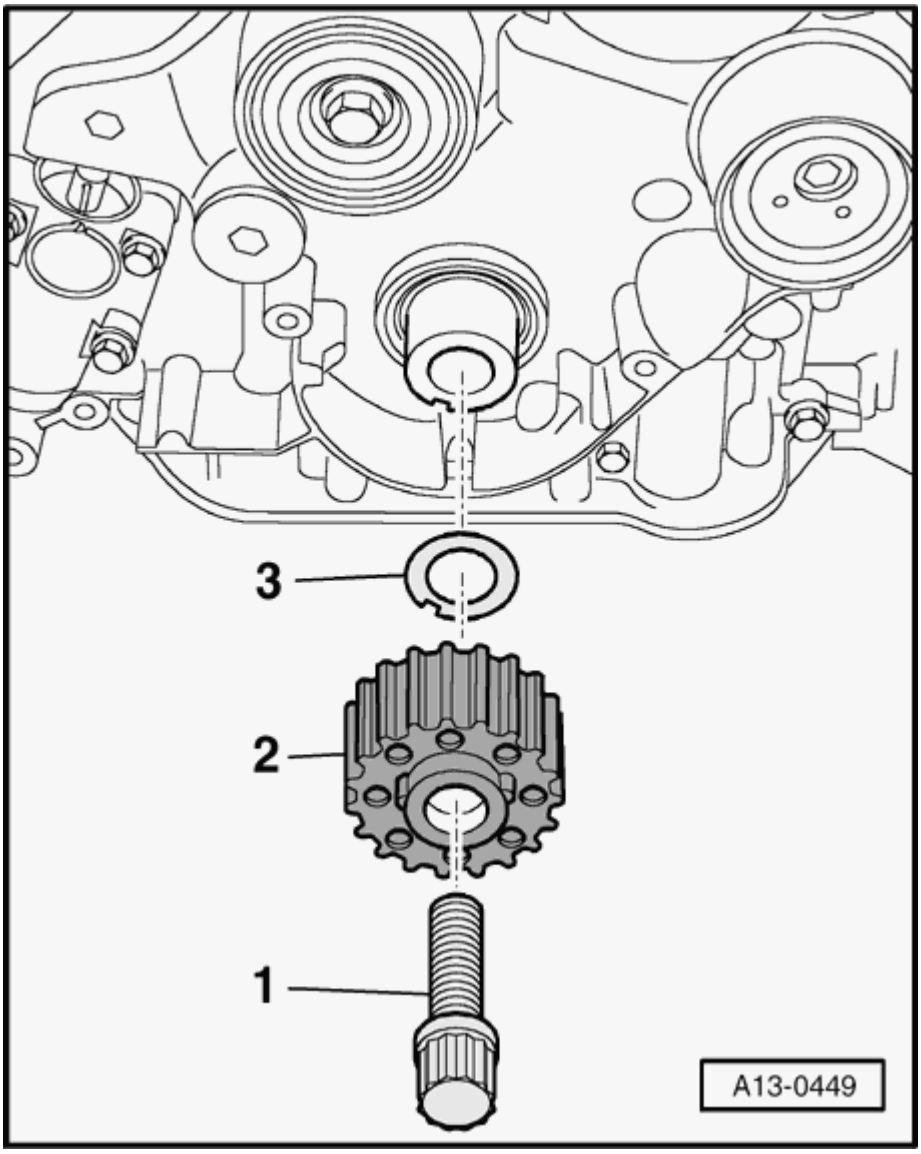


Fig. 163: Identifying Center Bolt, Crankshaft Toothed Belt Gear & Diamond Disc
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft toothed belt gear -2- with new diamond disc -3- and new central bolt -1-.

NOTE:

- **Contact surfaces between toothed belt gear, diamond disc and crankshaft must be free of oil.**
- **Do not additionally oil bolt for toothed belt gear for crankshaft.**

- Remove oil pan (upper part). Refer to **Removing**.
- After installing oil pump, remove drill bit from adjusting hole and thread in locking bolt with new sealing ring.
- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.

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Tightening torques

Component		Nm
Front sealing flange to	M6	10
Cylinder block	M8	30 1)
Tensioning lever to front sealing flange		45 1)
Tensioning lever to front sealing flange		10
Toothed belt gear to crankshaft		200 + 180°1)2)
Locking bolt for adjustment hole to front sealing flange		10

1) Replace bolts.

2) 180°= one half-turn

Rear sealing flange, removing and installing

Required equipment

- Drill with plastic brush attachment
- Protective glasses
- Silicone sealant

Removing

- Engine removed

  - Remove flywheel. Refer to **Removing** for Dual-mass flywheel or flywheel for automatic transmission 01J or remove drive plate. Refer to **Removing** for Drive plate for automatic transmission 01V.
  - Remove oil pan (upper part). Refer to **Oil pan (upper part), removing and installing**.

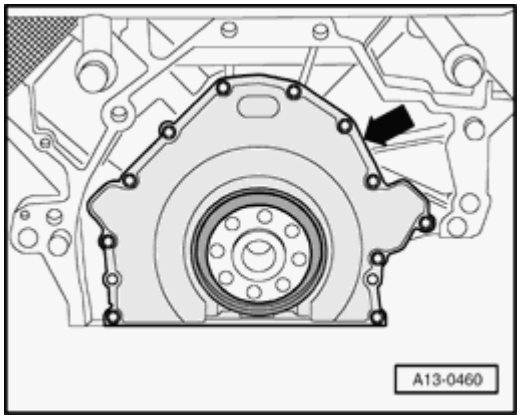


Fig. 164: Unbolting Rear Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Unbolt rear sealing flange (arrow).

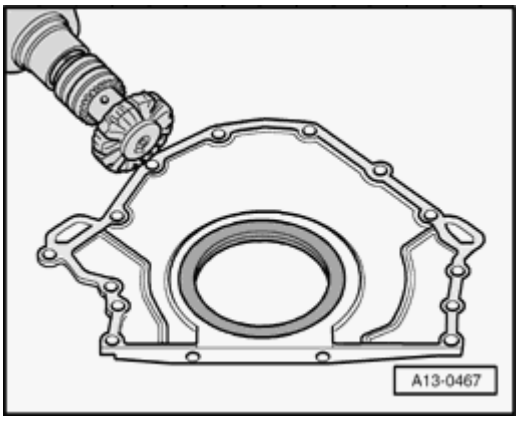


Fig. 165: Using Rotating Plastic Brush To Remove Remaining Sealant From Rear Sealing Flange And At Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using rotating plastic brush, remove remaining sealant from rear sealing flange and at cylinder block.

  WARNING: Wear protective glasses.

- Clean sealing surfaces so they are completely free of any oil or grease.

Installing

Installation is reverse of removal, noting the following:

NOTE: The rear sealing flange must be installed within 5 minutes after application of silicon sealant.

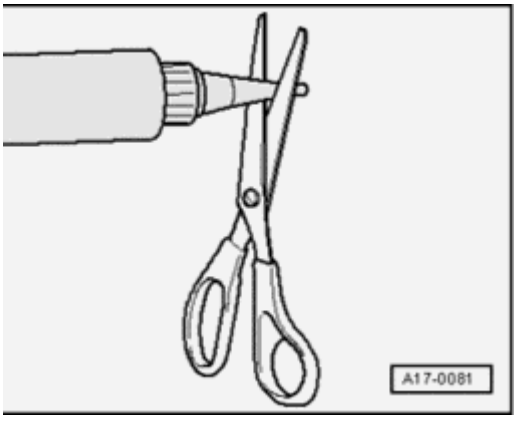


Fig. 166: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Cut tube nozzle at front marking (jet diameter approx. 1 mm).

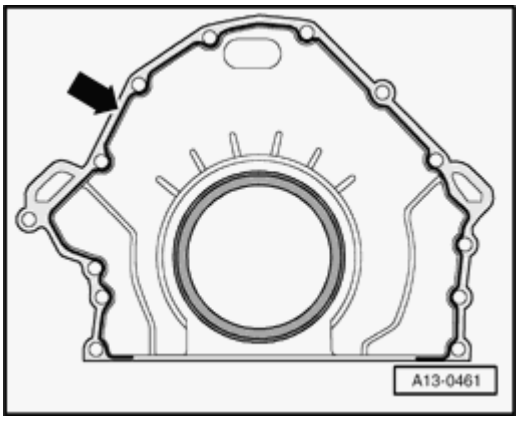


Fig. 167: Applying Silicone Sealant Bead To Clean Sealing Surfaces Of Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply silicone sealant bead to clean sealing surfaces of sealing flange as shown in illustration.

- Thickness of sealant bead (arrows): approx. 1.5 mm

NOTE: Sealant bead must not be thicker than specified, otherwise sealant could get into oil pan and clog the oil pump strainer.

- To install, slide guide sleeve from kit onto crankshaft.
- Remove oil pan (upper part). Refer to **Removing**.
- Install flywheel. Refer to **Installing** for Dual-mass flywheel or flywheel for automatic transmission 01J or install drive plate. Refer to **Installing** for Drive plate for automatic transmission 01V.

Tightening torque

Component	Nm
Rear sealing flange to cylinder block	10

Damper unit, removing and installing

Automatic transmission (CVT) 01J

With reciprocating engines, torsional vibrations are produced at the crankshaft due to irregularity of the combustion process.

The torsional vibrations are transmitted to the transmission where they cause resonant vibrations. This results in noise and excessive stress on the components.

In 6-cylinder engines the engine torque is transmitted to the transmission via a flywheel damper unit in order to prevent the torsional vibrations from entering the transmission.

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Removing

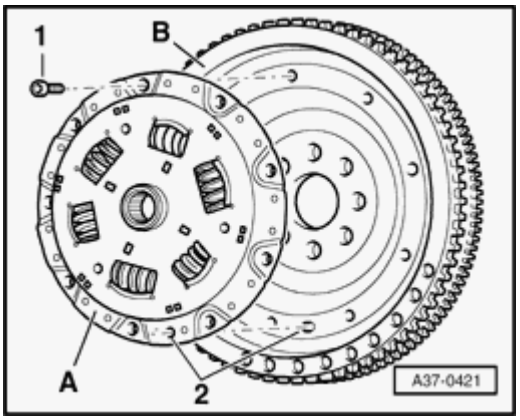


Fig. 168: Unscrewing/Screwing Bolts And Removing/Installing Damper Unit From Flywheel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and remove damper unit -A- from flywheel -B-.

NOTE: For removal and installation of the flywheel -B-. Refer to Flywheel and drive plate, removing and installing.

Installing

Install in reverse order, paying attention to following:

NOTE: The part number of the damper unit is assigned to the transmission code letter.

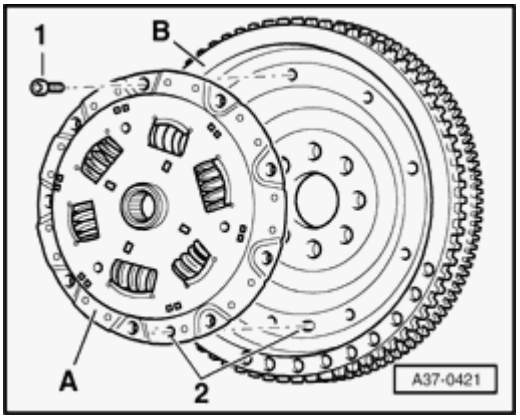


Fig. 169: Unscrewing/Screwing Bolts And Removing/Installing Damper Unit From Flywheel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align damper unit -A- with flywheel -B-.

- Two lugs -2- must line up with each other

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- Hand-tighten bolts -1- (9 pcs.).
- Tighten bolts to 25 Nm in diagonal sequence.

Flywheel and drive plate, removing and installing

Special tools and equipment

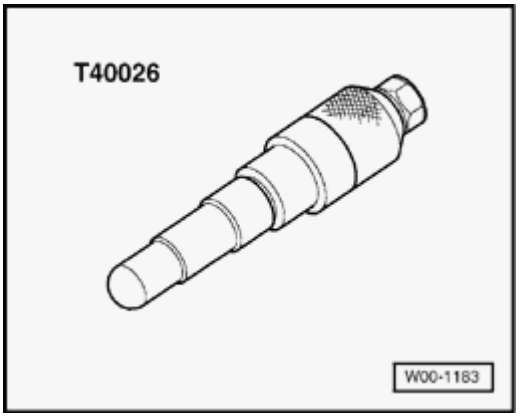


Fig. 170: T40026 Locking Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T40026 Locking pin

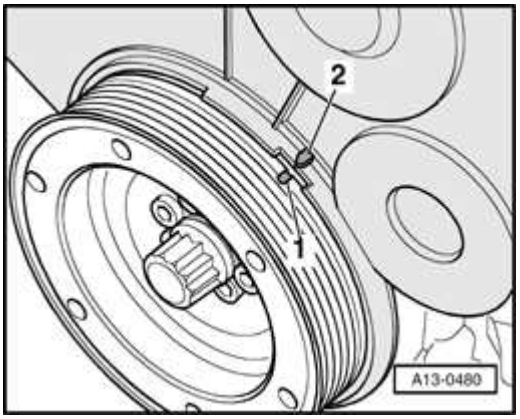
Dual-mass flywheel or flywheel for automatic transmission 01J

Removing

- Transmission removed

WARNING: Turning of the engine must only occur in direction of engine rotation (clockwise) at the crankshaft.

- Turn crankshaft via center bolt of toothed belt gear in direction of engine rotation to TDC Cyl. 3 marking.



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Fig. 171: Identifying Notch Lines Up With Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Notch -1- lines up with marking -2-

- If installed, disconnect electrical harness connector at after-run coolant pump.
- Unscrew sealing plug of TDC mark at cylinder block.

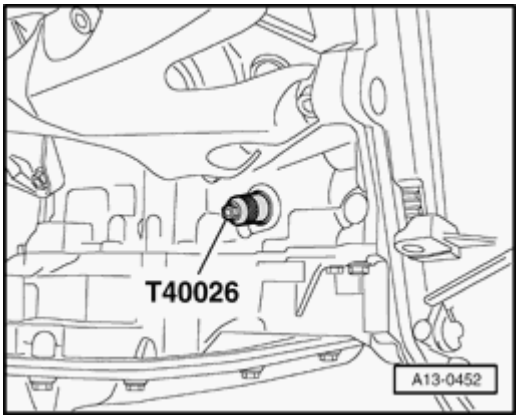


Fig. 172: Threading T40026 Locking Pin Into Hole Of Removed Sealing Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread T40026 locking pin into hole of removed sealing plug and tighten.

NOTE: Slightly turn crankshaft back and forth to do so.

- Remove clutch pressure plate.

Refer to

- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **30 CLUTCH** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

- Remove damper unit: Refer to **Damper unit, removing and installing**.
- Mark flywheel to engine.
- Unbolt flywheel.

Installing

Installation is reverse of removal, noting the following:

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NOTE: **Needle bearing is located in the flywheel and must be driven in when flywheel is replaced. Refer to Dual-mass flywheel pilot needle bearing, removing and installing**

- Replace bolts and tighten.
- Install clutch pressure plate.

Refer to

- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **30 CLUTCH** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

- Install damper unit: Refer to **Installing**.
- Remove T10026 alignment bolt and thread sealing plug of TDC marking with new O-ring into cylinder block.

Tightening torques

Component		Nm
Flywheel to crankshaft		
Bolt length	22.5 mm	60 + 90°1)2)
Bolt length	35.0 mm	60 + 180°2)3)
Bolt length	43.0 mm	60 + 180°2)3)
Sealing plug in cylinder block		25

1) 90° corresponds to one quarter-turn

2) Replace bolts.

3) 180° = one half-turn

Drive plate for automatic transmission 01V

Removing

- Transmission removed

WARNING: **Turning of the engine must only occur in direction of engine rotation (clockwise) at the crankshaft.**

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- Turn crankshaft via center bolt of toothed belt gear in direction of engine rotation to TDC Cyl. 3 marking.

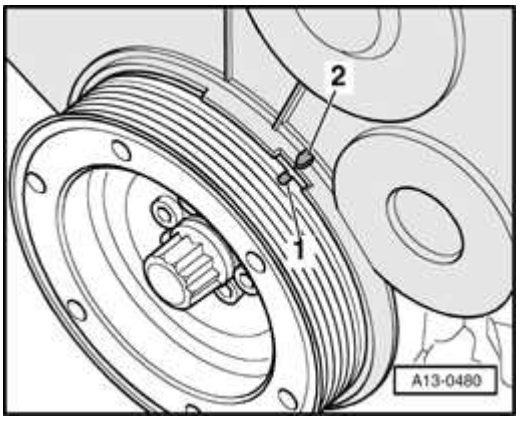


Fig. 173: Identifying Notch Lines Up With Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Notch -1- lines up with marking -2-

- If installed, disconnect electrical harness connector at after-run coolant pump.
- Unscrew sealing plug of TDC mark at cylinder block.

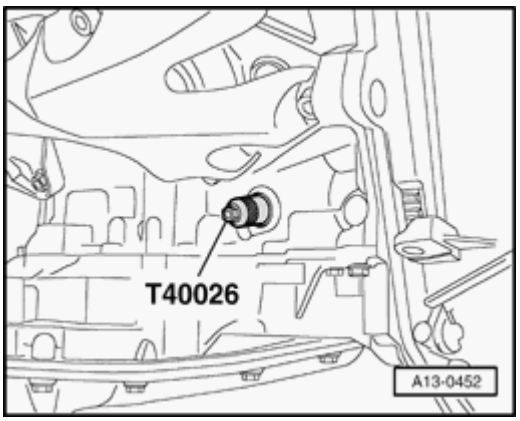


Fig. 174: Threading T40026 Locking Pin Into Hole Of Removed Sealing Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread T40026 locking pin into hole of removed sealing plug and tighten.

NOTE: Slightly turn crankshaft back and forth to do so.

- Mark drive plate to engine.
- Remove drive plate.

Installing

Installation is reverse of removal, noting the following:

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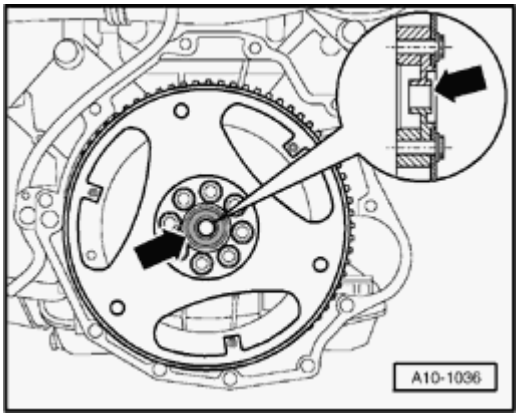


Fig. 175: Bolting Drive Plate To Crankshaft With Centering Bushing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolt drive plate to crankshaft with a centering bushing (arrow).
- Replace bolts and tighten.
- Remove T10026 alignment bolt and thread sealing plug of TDC marking with new O-ring into cylinder block.

Tightening torques

Component		Nm
Drive plate to crankshaft		
Bolt length	22.5 mm	60 + 90°1)2)
Bolt length	35.0 mm	60 + 180°2)3)
Sealing plug in cylinder block		25

1) 90° = one quarter-turn

2) Replace bolts.

3) 180° = one half-turn

Dual-mass flywheel pilot needle bearing, removing and installing

Special tools and equipment

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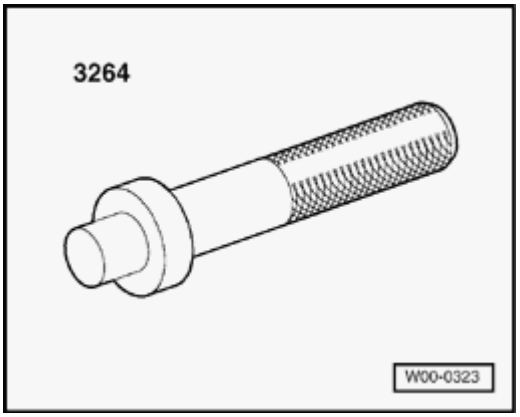


Fig. 176: 3264 Bearing Driver
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3264 Bearing driver

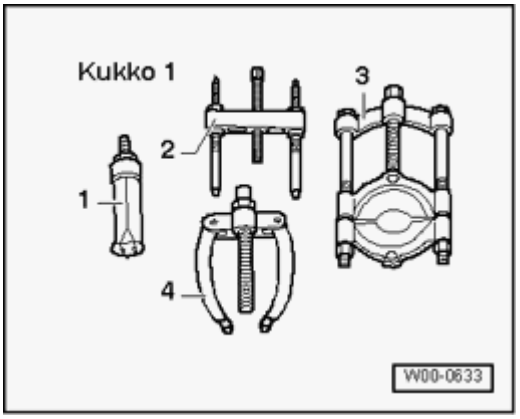


Fig. 177: Kukko 21/2 Internal puller, Kukko 21/4 Internal puller, Kukko 22/2 Counter support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Special tool Kukko 21/1 (Item -1-) and Kukko 22/1 (Item -4-)

Procedure

- Transmission removed
  - Remove clutch pressure plate.

Refer to

- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **30 CLUTCH** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE

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- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

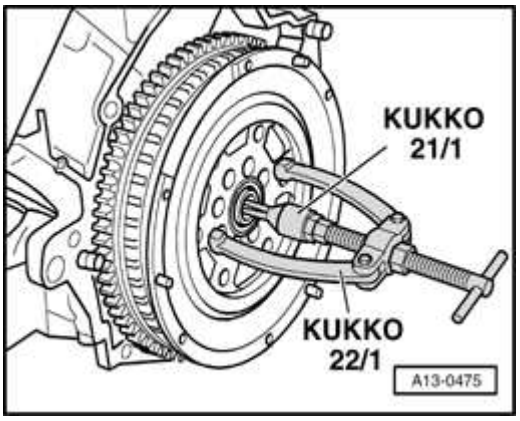


Fig. 178: Pulling Out Needle Bearing Using Kukko 21/1 And Kukko 22/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull out needle bearing using Kukko 21/1 and Kukko 22/1.

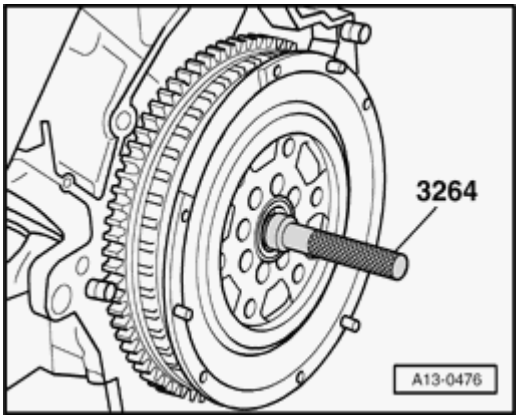


Fig. 179: Driving Needle Bearing Into Flywheel Using 3264 Bearing Driver
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive needle bearing into flywheel using 3264 bearing driver.

- Installation depth. Refer to **Needle bearing installation depth**

Needle bearing installation depth

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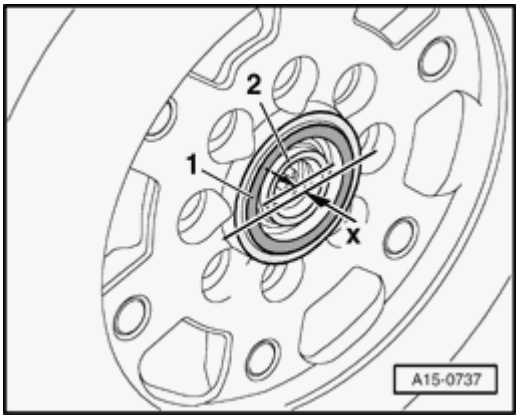


Fig. 180: Needle Bearing Installation Depth
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To measure installation depth, place a metal ruler onto plastic ring -1- of dual-mass flywheel.
- Measurement -x- = 0.5 mm.

NOTE: Plastic ring is sensitive to hits. If the plastic ring is damaged, dual-mass flywheel must be replaced.

CRANKSHAFT, REMOVING AND INSTALLING

Crankshaft, removing and installing

NOTE: For engine disassembly and assembly, mount engine to assembly stand using VAS6095 holding fixture. Refer to Engine, attaching to engine stand.

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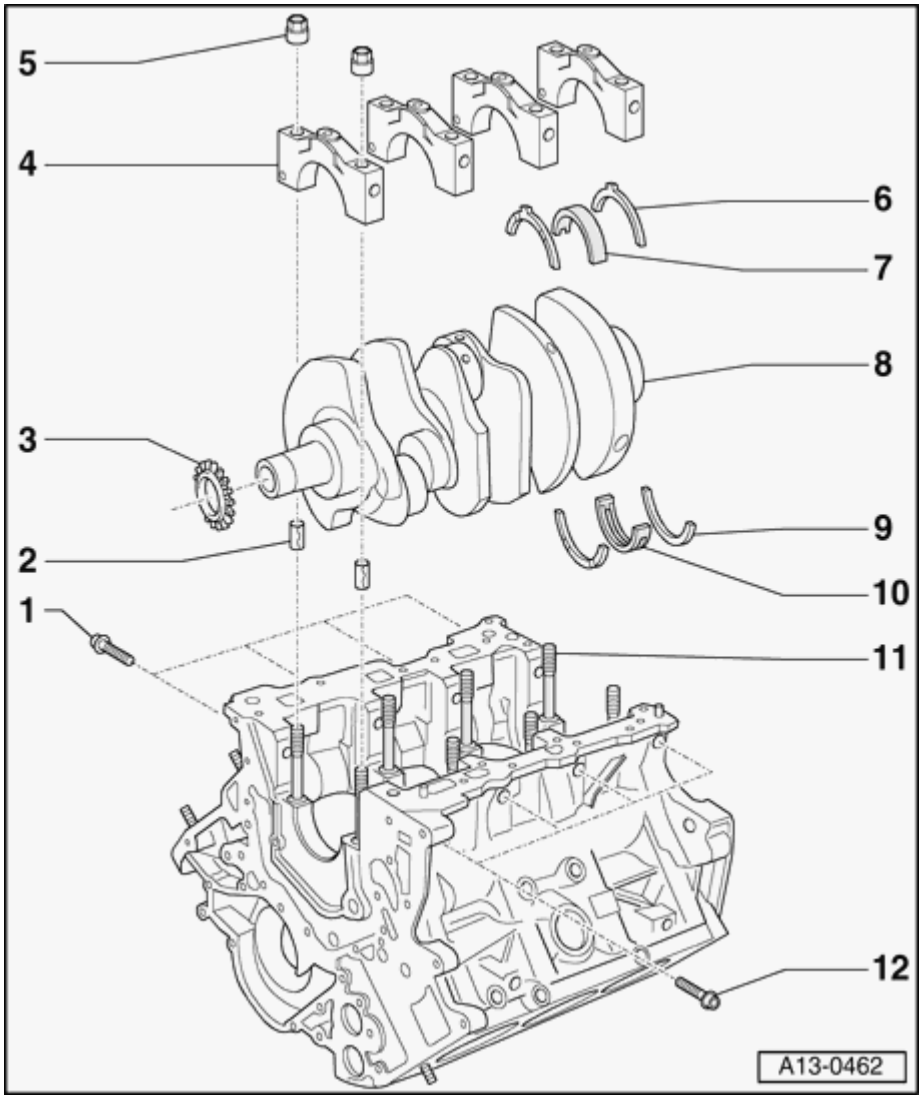


Fig. 181: Crankshaft Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt

- For bearing cap
- Always replace
- Tightening sequence. See **Fig. 186**

2 - Bushing

- Insert in cylinder block

3 - Drive chain gear for oil pump

- Removing and installing. Refer to **Drive chain gear for oil pump, removing and installing**

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4 - Bearing caps

- Observe number markings. See **Fig. 182**
- Removing. See **Fig. 183**
- Installing. See **Fig. 186**

5 - Nut

- For bearing cap
- Always replace
- Tightening sequence. See **Fig. 186**

6 - Thrust washer

- Only on 4th crankshaft bearing
- Lubricating grooves face outward
- Check locating point
- Measuring crankshaft axial clearance. Refer to **Axial and radial play, measuring**

7 - Bearing shell

- For bearing cap without lubrication groove
- Do not interchange run-in connecting rod bearing shells (mark)
- Insert new bearing shells for cylinder block with proper color marking. See **Fig. 185**

8 - Crankshaft

- Measuring axial and radial clearance. Refer to **Axial and radial play, measuring**
- Do not turn crankshaft when measuring radial play.
- Crankshaft dimensions. Refer to **Crankshaft measurements**

9 - Thrust washer

- Only on 4th crankshaft bearing
- Lubricating grooves face outward
- Measuring crankshaft axial clearance. Refer to **Axial and radial play, measuring**

10 - Bearing shell

- For engine block with lubrication groove
- Do not interchange run-in connecting rod bearing shells (mark)
- Insert new bearing shells for cylinder block with proper color marking. See **Fig. 184**

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11 - Stud

12 - Bolt

- For bearing cap
- Always replace
- Tightening sequence. See **Fig. 186**

Number markings on crankshaft bearing cap

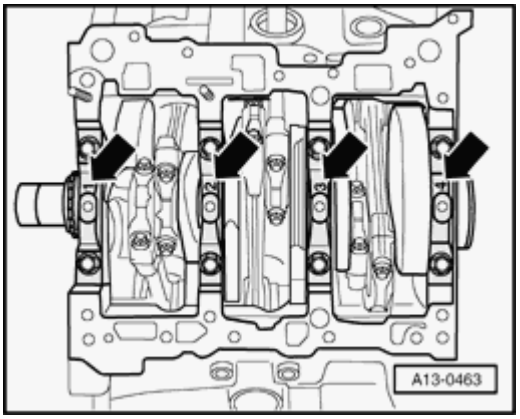
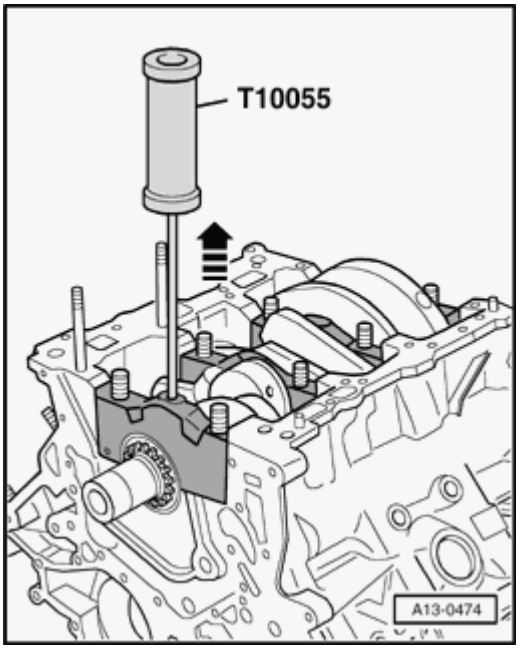


Fig. 182: Number Markings On Crankshaft Bearing Cap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bearing 1 is located on the belt pulley side

Removing crankshaft bearing cap



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Fig. 183: Removing Crankshaft Bearing Cap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts or nuts for crankshaft bearing caps.
- Remove crankshaft bearing caps from cylinder block using T10055 extractor.

Application of crankshaft bearing shells for cylinder block

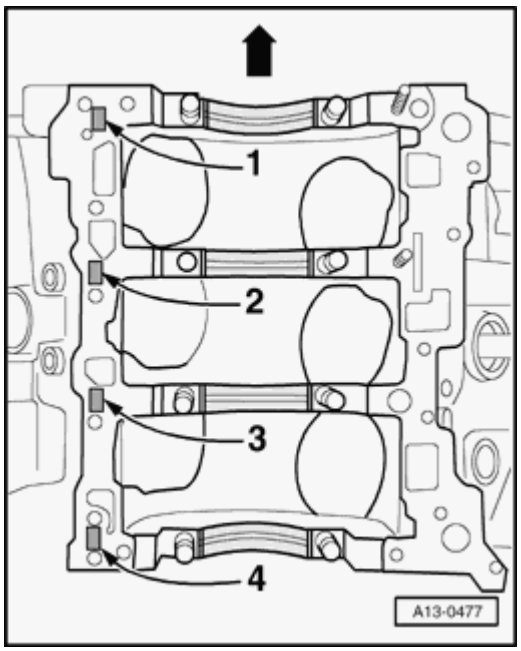


Fig. 184: Application Of Crankshaft Bearing Shells For Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Bearing shells with the correct thickness are allocated to the cylinder block in the factory. Colored dots on the bearing shells serve for identifying bearing shell thickness.

NOTE: The arrow points to the belt pulley side.

Application of bearing shells to cylinder block is marked by a letter beside the respective bearing.

Letter at Cylinder block		Color of bearing
G	=	Yellow
B	=	Blue
S	=	Black

Application of crankshaft bearing shells for bearing caps

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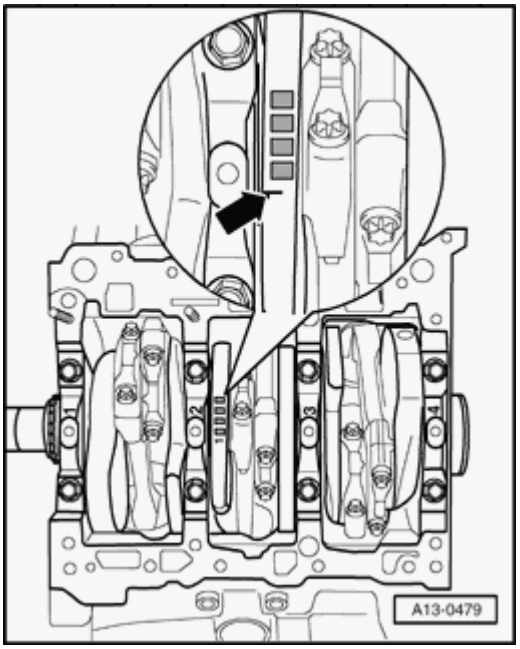


Fig. 185: Application Of Crankshaft Bearing Shells For Bearing Caps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Bearing shells with the correct thickness are allocated to the bearing caps in the factory. Colored dots on the bearing shells serve for identifying bearing shell thickness.

Application of bearing shells to crankshaft is marked with a letter sequence at the crankshaft flank. The first digit, "1" (arrow) identifies the color coding for bearing 1.

Letter to Crankshaft		Color of bearing
G	=	Yellow
B	=	Blue
S	=	Black

Installing crankshaft bearing cap

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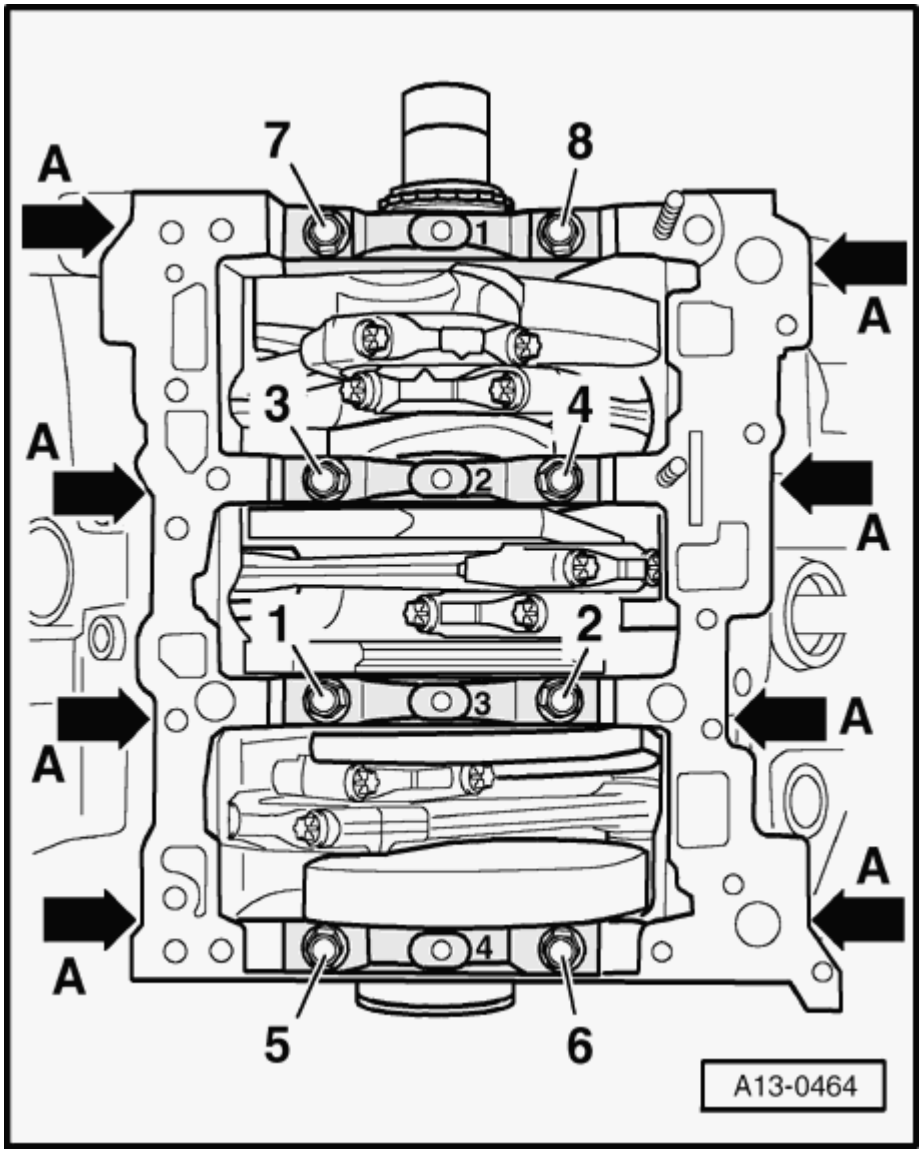


Fig. 186: Installing Crankshaft Bearing Cap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace bolts -A- and nuts -1- to -8-.
- Inserting alignment bushings into cylinder block
- Tighten bearing cap nuts or bolts in following sequence:

1. - Screw in bolts -A- hand tight.

2. - Tighten nuts -1- to -8- to 35 Nm.

3. - Tighten nuts -1- to -8- 90° (1/4 turn) further using rigid wrench.

4. - Tighten bolts -A- to 20 Nm.

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5. - Tighten bolts -A- 90° (1/4 turn) further using rigid wrench.

Crankshaft measurements

(Distance in mm)

Grind distance	Crankshaft journal diameter	Connecting rod journal diameter
Basic dimension	- 0.022 65.00 - 0.042	- 0.022 54.00 - 0.042
1st undersize	- 0.022 64.75 - 0.042	- 0.022 53.75 - 0.042
2nd undersize	- 0.022 64.50 - 0.042	- 0.022 53.50 - 0.042
3rd undersize	- 0.022 64.25 - 0.042	- 0.022 53.25 - 0.042

Axial and radial play, measuring

Special tools and equipment

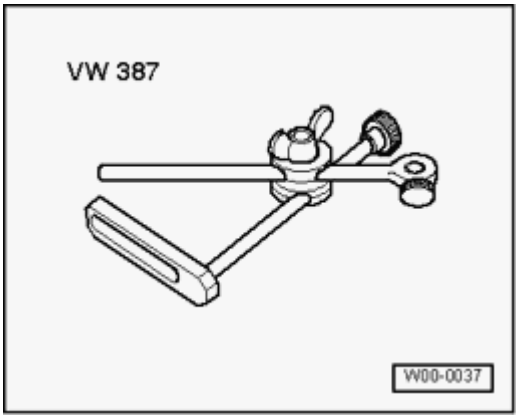


Fig. 187: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VW387 Dial gauge holder
- Dial gauge

Axial clearance

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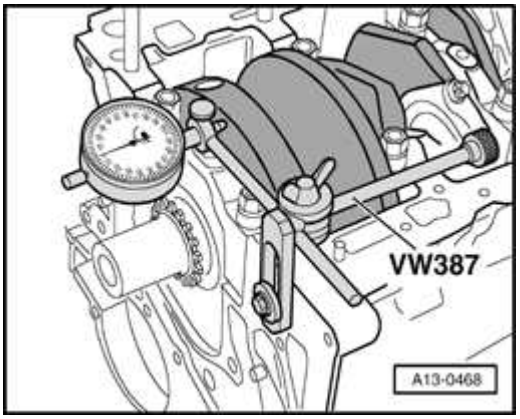


Fig. 188: Attaching Dial Indicator Together With VW387 Dial Gauge Holder To Cylinder Block And Set Indicator Against Crankshaft Counterweight
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach dial indicator together with VW387 dial gauge holder to cylinder block and set indicator against crankshaft counterweight.
- Press crankshaft against dial indicator by hand, set indicator to 0.
- Press crankshaft away from dial indicator.
- Read clearance.

Clearance when new	Wear limit
0.07 to 0.23 mm	0.25 mm

Radial clearance

NOTE:

- **Never interchange used bearing shells.**
- **Bearing shells that are worn through the nickel coating must be replaced**

Required equipment

- Plastigage

- Remove main bearing caps. Clean bearing caps and journals.
- Place Plastigage over entire width of bearing journal or into bearing shells.

- Plastigage must rest in center of bearing shell

- Install main bearing caps and tighten to 30 Nm. DO NOT turn crankshaft.
- Remove main bearing caps again.
- Compare width of Plastigage with calibrated scale.
- Read clearance.

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Clearance when new	Wear limit
0.018 to 0.045 mm	0.08 mm

Drive chain gear for oil pump, removing and installing

Special tools and equipment

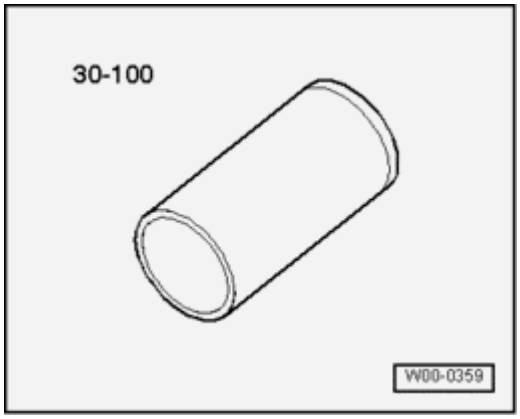


Fig. 189: Press Tube 30-100
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 30-100 Press tube

Removing

- Remove front sealing flange. Refer to **Front sealing flange, removing and installing**.

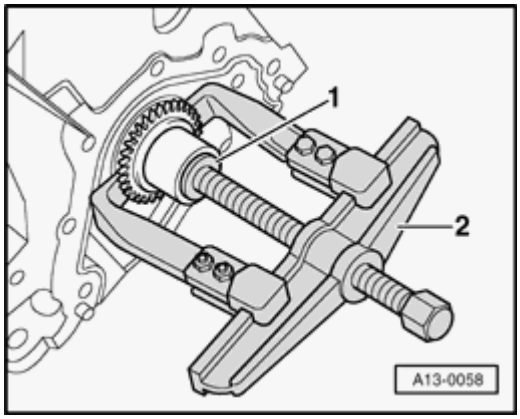


Fig. 190: Pulling Off Chain Sprocket From Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using claw remover -2-, remove crankshaft chain sprocket while protecting crankshaft end with appropriate washer -1-.

Installing

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Installation is reverse of removal, noting the following:

- Warm chain sprocket in oven at 220°C for approx. 15 minutes.

WARNING: Wear protective gloves!

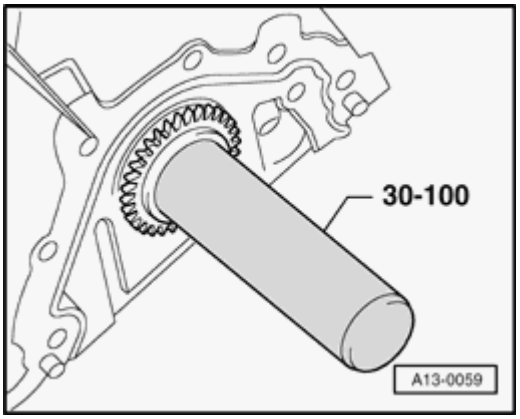


Fig. 191: Installing Chain Sprocket Onto Crankshaft Up To Limit Stop Using Press Tube 30-100
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using pliers install chain sprocket on crankshaft end and slide onto crankshaft to stop using 30-100 press tube.

PISTONS AND CONNECTING RODS, DISASSEMBLING AND ASSEMBLING

Pistons and connecting rods, disassembling and assembling

NOTE: Oil injector jet for piston cooling. See Fig. 200.

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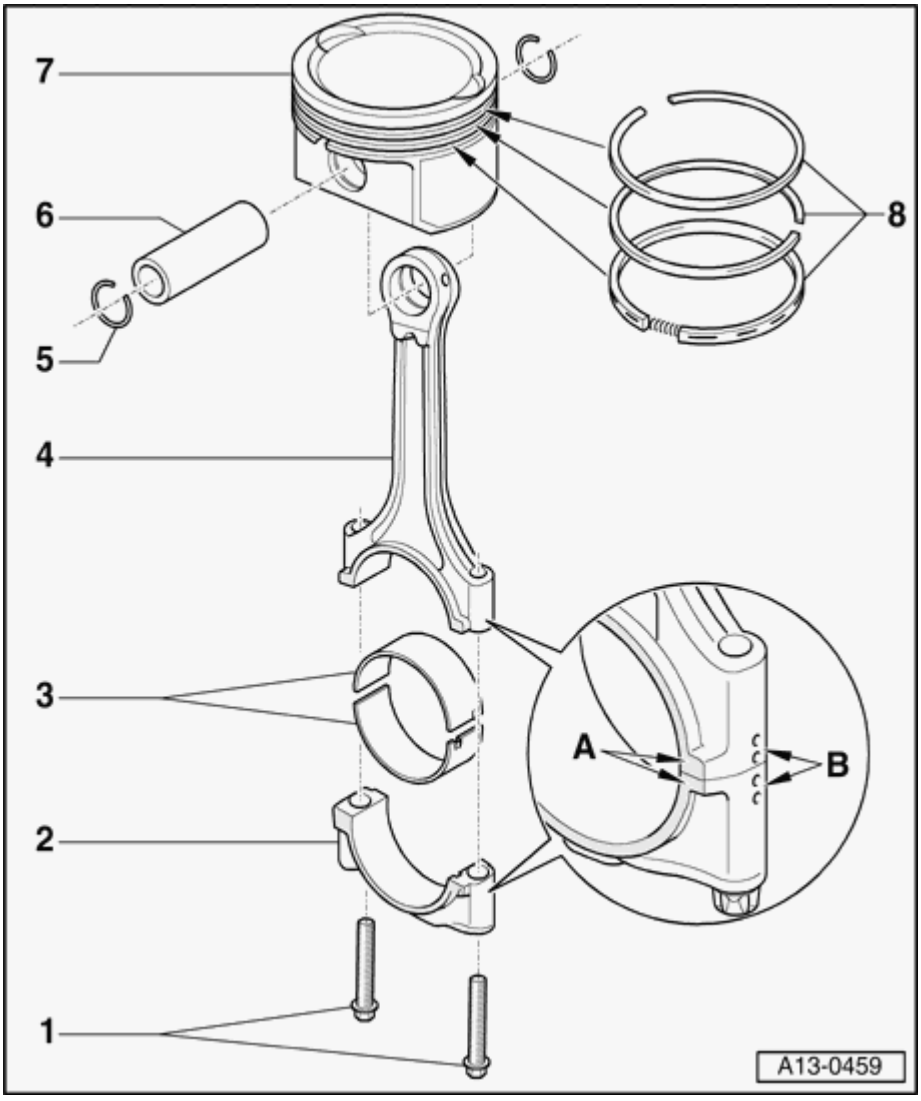


Fig. 192: Pistons And Connecting Rods, Disassembling And Assembling Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Connecting rod bolt, 30 Nm plus an additional 90° (1/4 turn)

- Always replace
- Grease thread and contact surface
- Tighten to 30 Nm when measuring radial clearance, but do not turn further

2 - Connecting rod bearing cap

- Do not interchange
- Mark allocation to cylinder using a color marker -B-. See **Fig. 198**
- Observe when installing bearing cap: Tabs at contact surfaces at face of connecting rod must be aligned -A-

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- Installed position of connecting rod pairs. See **Fig. 199**

3 - Bearing shell

- Note installed position
- Do not interchange run-in connecting rod bearing shells (mark)
- Measuring radial play. Refer to **Connecting rod radial play, checking**
- Tighten bolts item - 1 to 30 Nm when measuring radial clearance, but do not turn further

4 - Connecting rod

- Replace only as a set
- Mark allocation to cylinder using a color marker -B-. See **Fig. 200**
- Observe when installing bearing cap: Tabs at contact surfaces at face of connecting rod must be aligned - A-
- Installed position of connecting rod pairs. See **Fig. 199**

5 - Snap ring

6 - Piston pins

- In case of difficulty of movement, warm piston to approx. 60°C
- When removing and installing, use VW222a Pilot drift

7 - Pistons

- Installed position and allocation piston/cylinder. See **Fig. 197**
- Arrow on piston head points to belt pulley side
- Checking. See **Fig. 195**
- Install with piston ring tension strip

- Piston and cylinder dimensions. Refer to **Piston and cylinder measurements**
- Checking cylinder bore hole. See **Fig. 196**

8 - Piston rings

- Offset gaps by 120°
- Use piston ring pliers to remove and install
- Marking or identification "TOP" i.e. marked side must face toward piston head
- End play, checking. See **Fig. 193**

- Height play, checking. See **Checking piston ring side clearance**

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Checking piston ring end gap

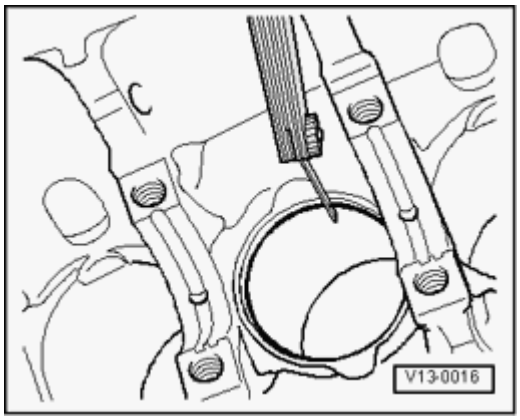


Fig. 193: Checking Piston Ring Gap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert ring at right angle to cylinder wall from above to lower cylinder opening approx. 15 mm from cylinder edge. Use piston without rings to insert.

Piston ring (Distance in mm)	**New**	**Wear limit**
1. Compression ring	0.35 to 0.50	0.8
2. Compression ring	0.60 to 0.80	1.0
Oil scraper ring	0.25 to 0.50	0.8

Checking piston ring side clearance

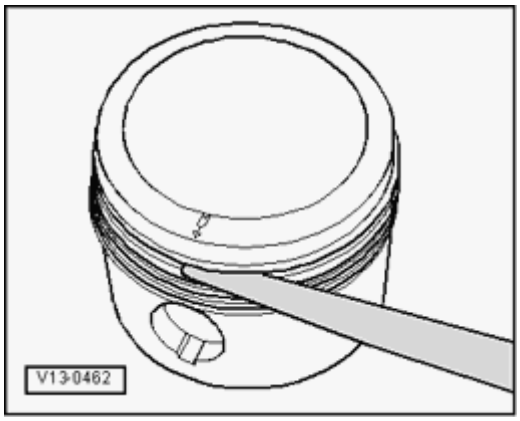


Fig. 194: Checking Piston Ring Side Clearance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Before measuring, clean piston ring groove

Piston ring (Distance in mm)	**New**	**Wear limit**

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Compression rings	0.02 to 0.08	0.20
Oil scraper ring	0.02 to 0.08	0.15

Checking pistons

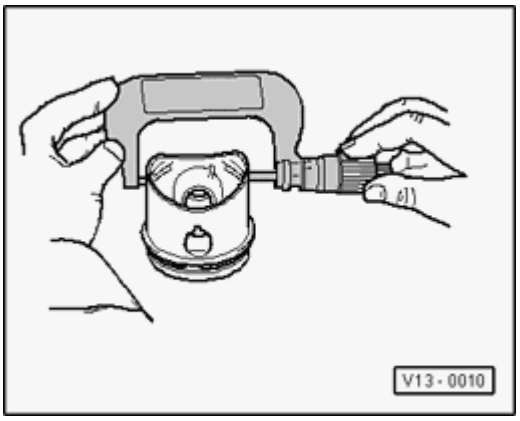


Fig. 195: Checking Piston
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- External micrometer 75-100 mm
  - Measure approx. 10 mm from lower edge, at a 90° angle to piston pin axis.
- Deviation from nominal dimension: max. 0.04 mm

Specified dimension. Refer to **Piston and cylinder measurements**

Checking cylinder bore

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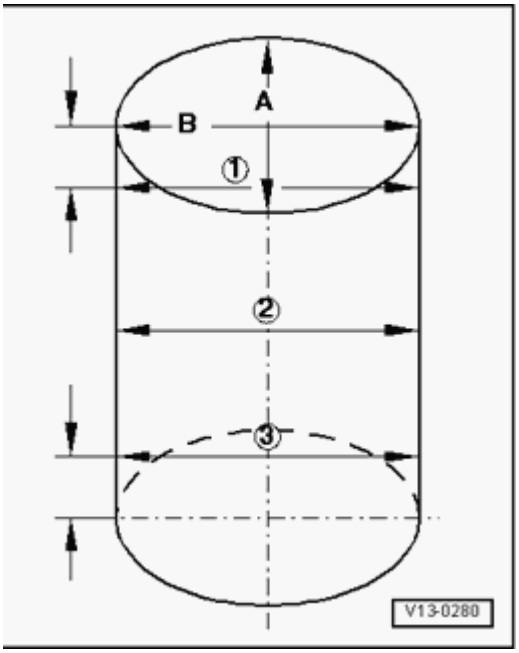


Fig. 196: Checking Cylinder Bores
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- Inner bore gauge 50-100 mm
  - Measure diagonally at 3 positions, horizontally -A- and lengthwise -B-.
- Deviation from nominal dimension: max. 0.08 mm

Specified dimension. Refer to **Piston and cylinder measurements**

Piston installed position and application piston/cylinder

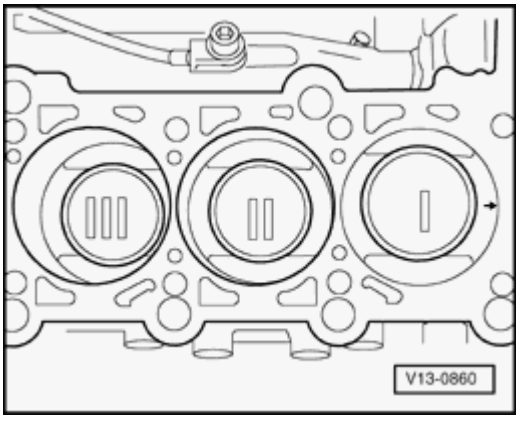


Fig. 197: Piston Installed Position And Application Piston/Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Mark installed position and allocation to cylinder on piston head using chalk or waterproof felt pen.

NOTE: Do not use a center punch or scribe, since the piston head coating will be damaged.

- Installed position:

Arrow on piston head points to belt pulley side

Marking connecting rods

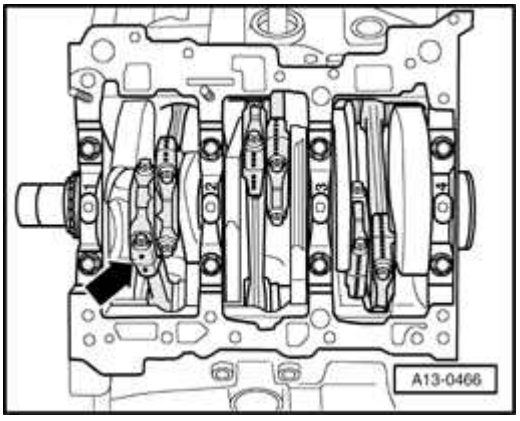


Fig. 198: Marking Connecting Rods
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Replace the connecting rods only as a set.**
- **Do not interchange the connecting rod bearings.**
- **Before removing, mark allocation of connecting rod and connecting rod bearing caps to each other and to cylinder using a color marker (arrow).**

Installed position of connecting rods

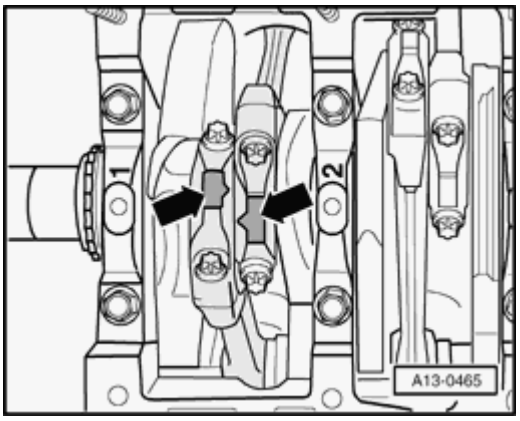


Fig. 199: Installed Position Of Connecting Rods

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Molded tabs (arrows) at the bevelled surfaces of the connecting rod pairs 1 and 2, 3 and 4 as well as 5 and 6 must point toward each other.

Oil injector jet for piston cooling

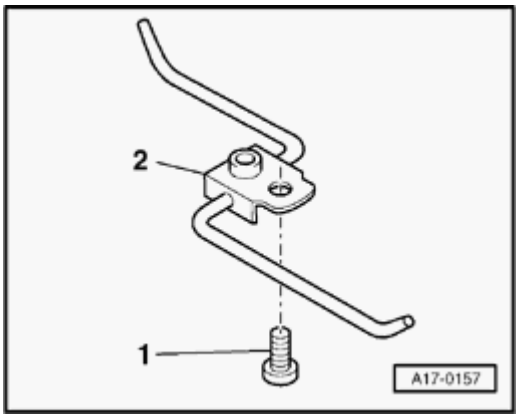


Fig. 200: Oil Injector Jet For Piston Cooling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt, 10 Nm

2 - Oil injector jet for piston cooling

Piston and cylinder measurements

Honing dimension		Piston Diameter	Cylinder bore diameter
Basic dimension	mm	82.455 1)	82.51
Repair stage	mm	82.955 1)	83.01

1) Dimensions exclude graphite coating (thickness 0.02 mm). The graphite coating wears off.

Connecting rod radial play, checking

Special tools and equipment

- Plastigage

Work sequence

- Remove connecting rod bearing caps. Clean bearing caps and journals.
- Place Plastigage over entire width of bearing journal or into bearing shells.
- Install connecting rod bearing caps and tighten to 30 Nm. DO NOT turn crankshaft.

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- Remove connecting rod bearing caps again.
- Compare width of Plastigage with calibrated scale.

Clearance when new	Wear limit
0.015 to 0.062 mm	0.12 mm

- Always replace connecting rod bolts.

15 ENGINE - CYLINDER HEAD, VALVETRAIN

CYLINDER HEAD, REMOVING AND INSTALLING

Cylinder head, removing and installing

CAUTION: Before beginning repairs on the electrical system:

- **Obtain the anti-theft radio security code.**
- **Switch the ignition off.**
- **Disconnect the battery Ground (GND) strap.**
- **On vehicles equipped with Audi Telematics by OnStar ® , switch-off the emergency (back-up) battery for the Telematic/Telephone Control Module prior to disconnecting vehicle battery. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

  .
- **After reconnecting vehicle battery, re-code and check operation of anti-theft radio. Also check operation of clock and power windows according to Repair Article and/or Owner's Manual.**
- **After reconnecting vehicle battery on vehicles equipped with Audi Telematics by OnStar ® , switch-on the emergency (back-up) battery for the Telematic/Telephone Control Module. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

  .

Cylinder head, removing and installing

NOTE:

- **Replace cylinder head bolts.**

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- **Replace self-locking nuts and bolts during assembly work.**
- **Always replace bolts that are secured with tightening torque as well as O-rings and gaskets.**
- **After installing a replacement cylinder head with camshafts installed, oil contact surfaces between valve lifters and cam lubricating surfaces after installing cylinder head.**
- **Do not remove plastic bases protecting exposed valves until immediately before installing cylinder head.**
- **When replacing the cylinder head or cylinder head gasket, coolant must be completely replaced.**
- **If a cylinder head is replaced, a cap must be driven in on the front part of the respective head. See Fig. 205.**
- **Cylinder heads with cracks between valve seats or between valve seat and spark plug thread can still be used without loss of service life if the cracks are minute (max. 0.3 mm width) or only the first four threads of a spark plug thread are cracked.**

Part I

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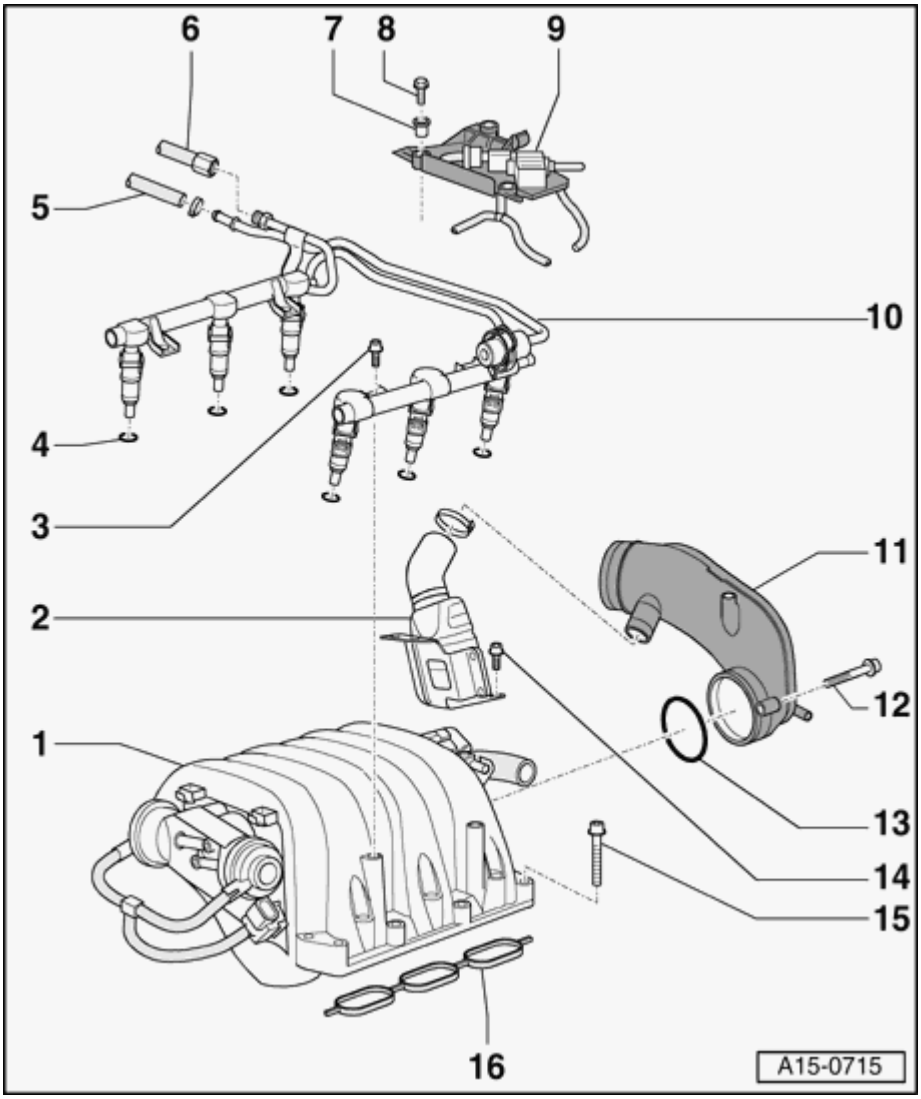


Fig. 201: Cylinder Head, Removing And Installing Overview - Part I
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Intake manifold

- Removing and installing. Refer to **Intake manifold, removing and installing**

2 - Resonator

3 - 10 Nm

4 - O-Rings

- Always replace

5 - Fuel return line

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- Only in vehicles up to 06.03

6 - Fuel supply line

- For vehicles up to 06.03, tighten union nut to 22 Nm
- Loosening and tightening union nut in vehicles as of 07.03. See **Fig. 206**

WARNING: Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.

7 - Socket

8 - 10 Nm

9 - Holding plate

- For solenoid valves

10 - Fuel distributor

11 - Air duct

12 - 10 Nm

13 - O-ring

- Always replace

14 - 10 Nm

15 - 10 Nm

- Tighten diagonally in sequence

16 - Gasket

- For intake manifold
- Always replace

Part II

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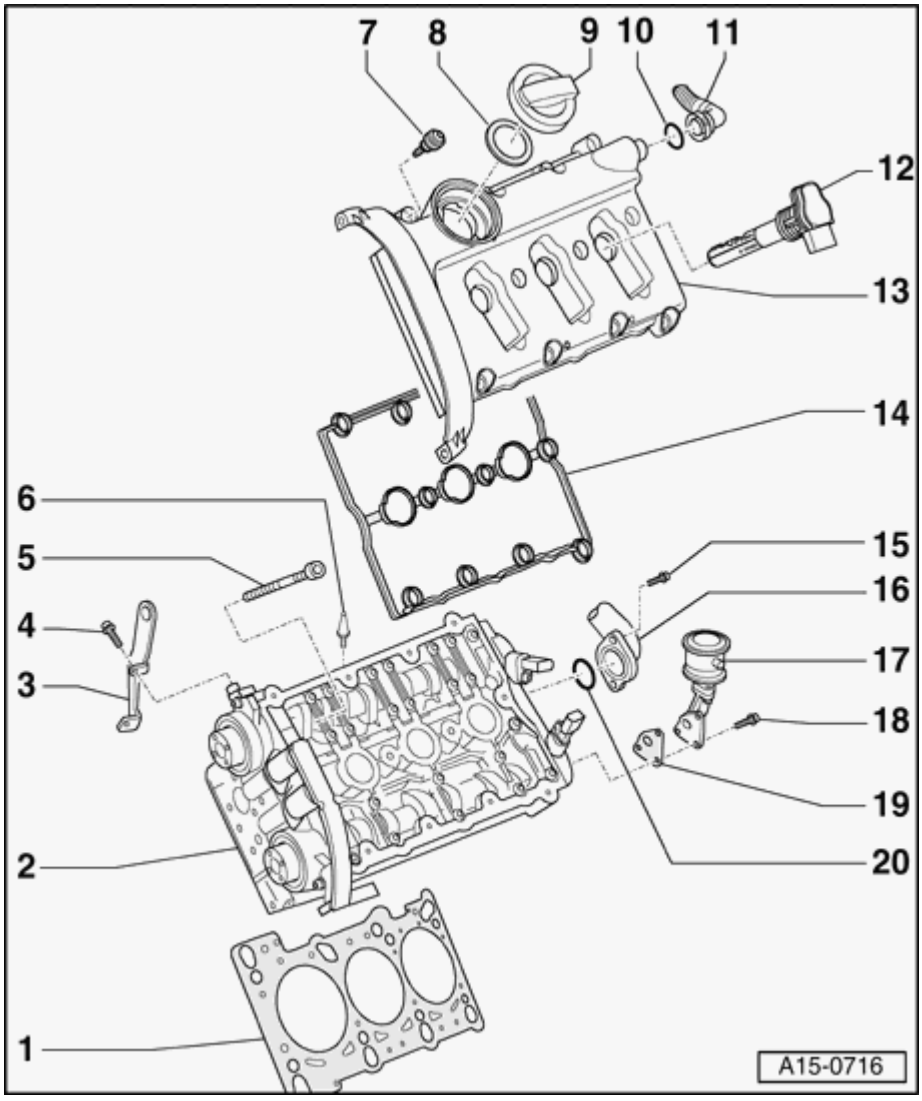


Fig. 202: Cylinder Head, Removing And Installing Overview - Part II
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Cylinder head gasket

- Replacing. Refer to **Left cylinder head, removing**
- Installed position: Part number to cylinder head
- After replacing, replace coolant

2 - Cylinder head

- Removing left cylinder head. Refer to **Left cylinder head, removing**
- Removing right cylinder head. Refer to **Right cylinder head, removing**
- Check for warpage. See **Fig. 203**
- Refacing dimension. See **Fig. 204**

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- Sealing cap (core plug) in cylinder head, installing. See **Fig. 205**
- Installing. Refer to **Cylinder head, installing**
- After replacing, replace coolant

3 - Lifting eye

4 - 23 Nm

5 - Cylinder head bolt

- Always replace
- Follow order of removal. Refer to **Left cylinder head, removing** or **Right cylinder head, removing**
- Follow tightening order. Refer to **Cylinder head, installing**

6 - Centering pin

- For intake manifold

7 - Special bolt, 10 Nm

- Follow order of tightening. Refer to **Tightening torques** or **Installing**

8 - Gasket

- Replace if damaged or leaking

9 - Cap

10 - O-ring

- Always replace

11 - Hose of crankcase housing ventilation

12 - Ignition coil

13 - Cylinder head cover

- Left cylinder head cover, removing and installing. Refer to **Left cylinder head cover, removing and installing**
- Right cylinder head cover, removing and installing. Refer to **Right cylinder head cover, removing and installing**

14 - Cylinder head cover gasket

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- Replace if damaged or leaking

15 - 10 Nm

16 - Rear coolant pipe

17 - Combination valve for secondary air injection (AIR)

18 - 10 Nm

19 - Gasket

- Always replace

20 - O-ring

- Always replace

Check cylinder head for warpage

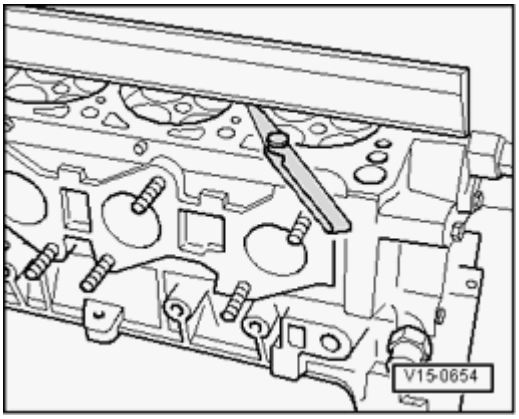


Fig. 203: Checking Cylinder Head For Distortion
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using straightedge and feeler gauge, check cylinder head for warpage at multiple points.

- Maximum permissible warpage: 0.1 mm

Cylinder head refacing dimension

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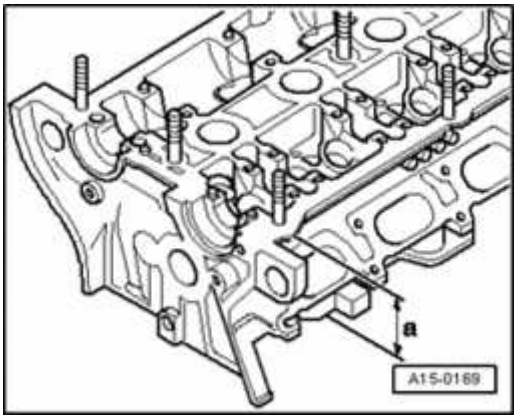


Fig. 204: Cylinder Head Refacing Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Refacing cylinder head can only be done to minimum dimension -a-.
- Minimum dimension: a = 139.25 mm

Sealing cap (core plug) in cylinder head, driving in

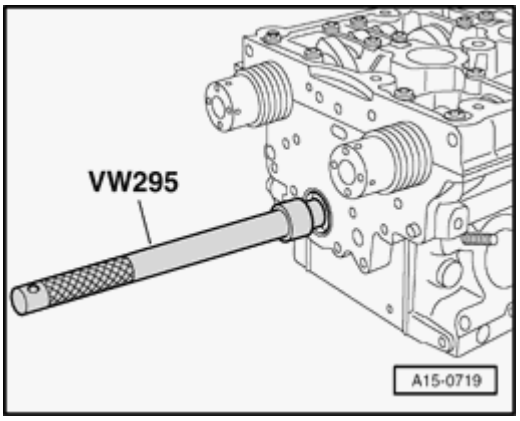


Fig. 205: Sealing Cap (Core Plug) In Cylinder Head, Driving In
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VW295 Needle bearing drift

Cylinder heads which are supplied as replacement parts can be used on left or right and a cap must be installed on the respective front side.

- Coat lip of sealing cap with sealant.
- Sealant
- Drive sealing cap flush into cylinder block using VW295 needle bearing drift.

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Loosening and tightening union nut for fuel supply line in vehicles as of 07.03

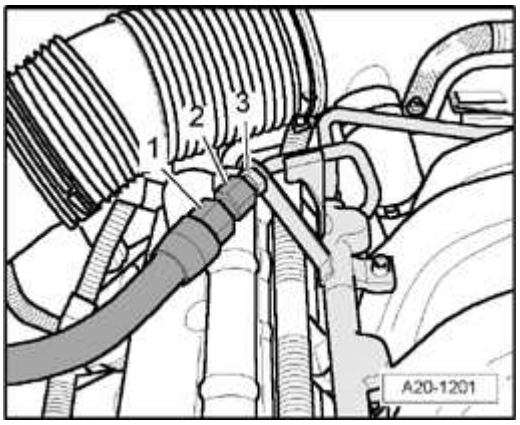


Fig. 206: Unscrewing/Screwing Fuel Hose From Connection On Fuel Rail Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

WARNING: Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.

Loosening:

- Unscrew fuel hose from connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and unscrew union nut -2-.

Tightening:

- Secure fuel hose to connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and tighten union nut -2- to 22 Nm.

Intake manifold, removing and installing

Removing

NOTE: All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.

- Drain coolant. Refer to **Coolant, draining and refilling**.

WARNING: Observe safety precautions when disconnecting the battery.

Refer to 27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL

See Caution before beginning repairs on the electrical system. Refer to **Cylinder head, removing and installing**

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- Switch ignition off and disconnect battery Ground (GND) strap.

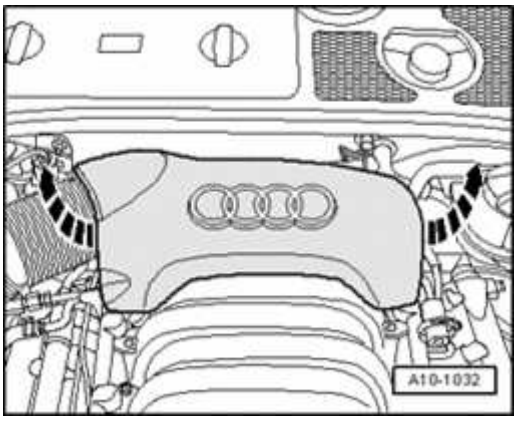


Fig. 207: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

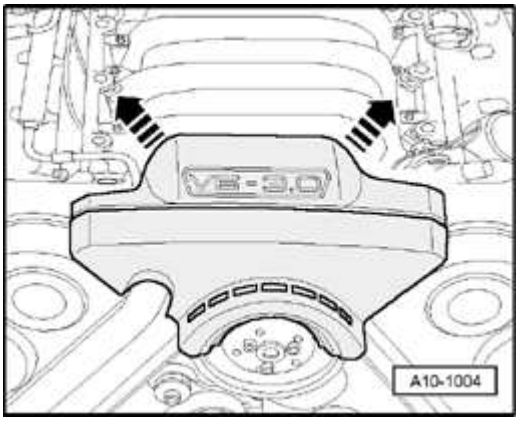
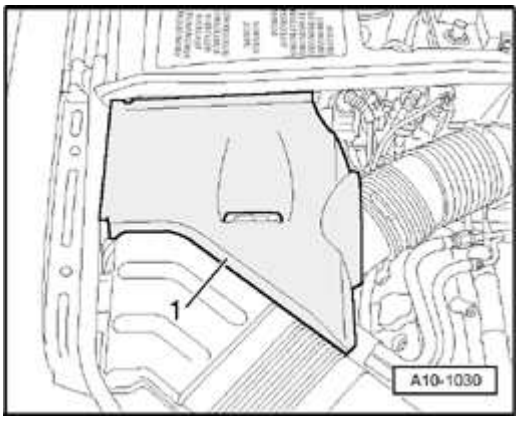


Fig. 208: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).



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Fig. 209: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

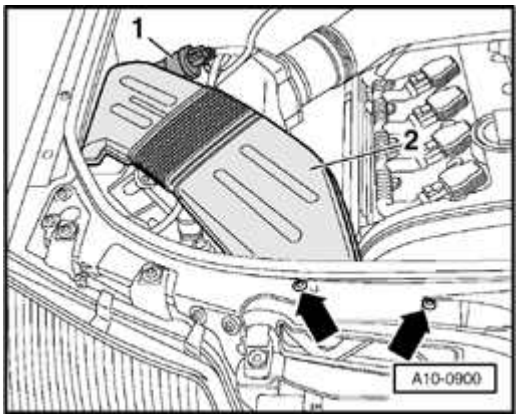


Fig. 210: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

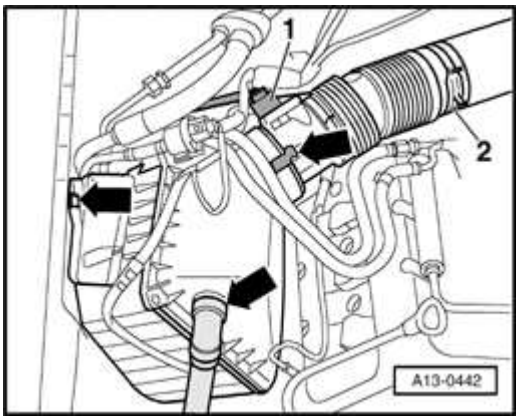


Fig. 211: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).
- Disconnect electrical harness connector -1- at Mass Air Flow (MAF) sensor.
- Remove air guide hose -2- together with Mass Air Flow (MAF) sensor.

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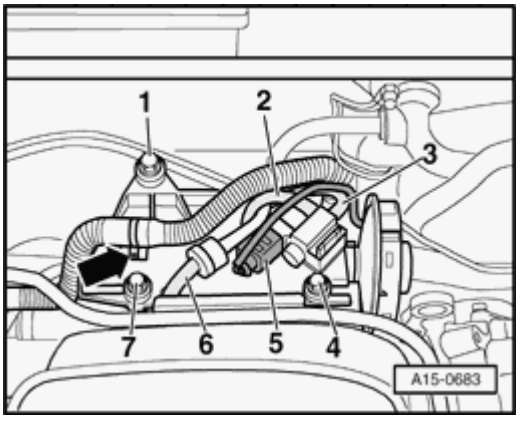


Fig. 212: Identifying Vacuum Hoses & Electrical Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hoses -2- and -3- at Intake manifold change-over valve -N156-.
- Disconnect vacuum hose -6- from check valve.
- Disconnect electrical harness connector -5-.
- Set aside hose of crankshaft housing ventilation (arrow).

- Remove bolts -1-, -4- and -7- for holding plate for solenoid valves.
- Remove holding plate for solenoid valves.

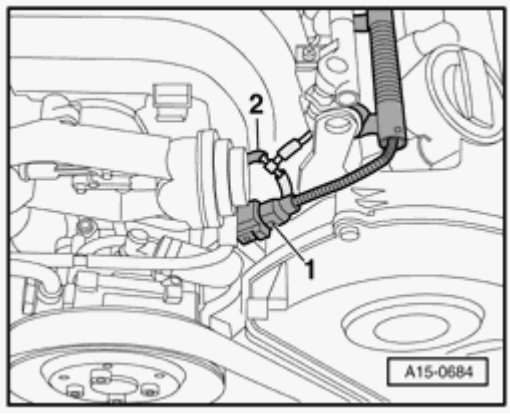


Fig. 213: Disconnecting Electrical Harness Connector & Pulling Off Vacuum Hose At T-Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector -1-.
- Pull off vacuum hose -2- at T-connector.
- Remove all harness connectors to injectors.

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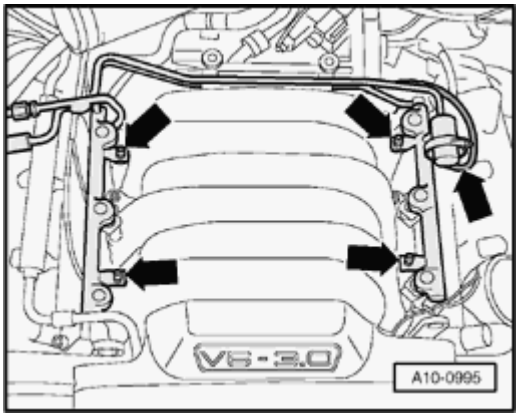


Fig. 214: Disconnecting Vacuum Line At Fuel Pressure Regulator And Removing Mounting Bolts Of Fuel Pressure Regulator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line at fuel pressure regulator and remove mounting bolts of fuel pressure regulator (arrows).
- Remove fuel distributor together with fuel injectors from intake manifold simultaneously upward and place it on a clean rag in engine compartment.

NOTE: Carefully protect removed fuel injectors from contamination.

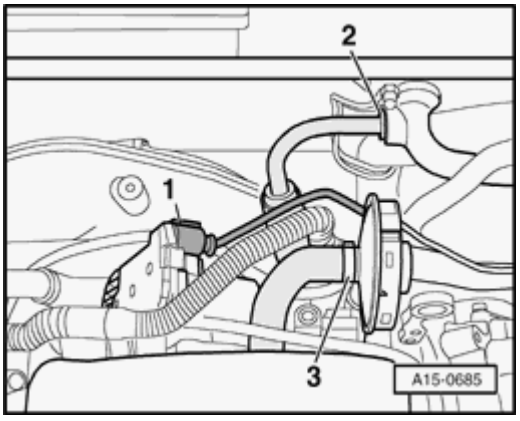


Fig. 215: Identifying Throttle Valve Control Module -J338- Electrical Harness Connector & Vacuum Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector -1- at Throttle valve control module -J338-.
- Disconnect vacuum hoses -2- and -3-.

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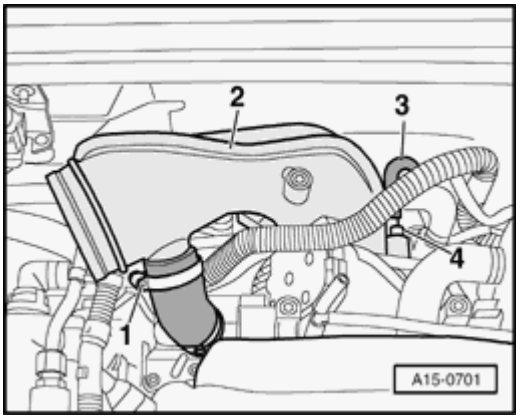


Fig. 216: Identifying Air Duct Hose, Bolt, Air Duct & Vacuum Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose -1- from air duct.
- Remove bolt -4- and disconnect air duct -2- at throttle valve control module.
- If installed, disconnect vacuum hose -3- from air guide at bottom.

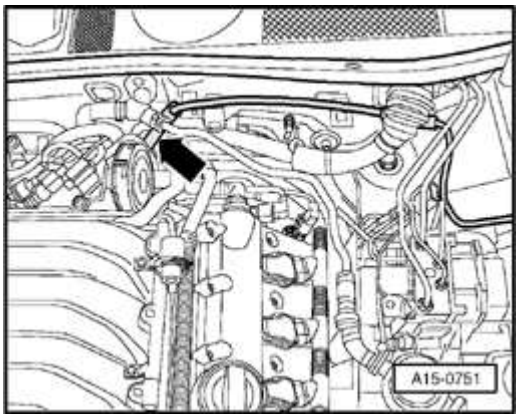


Fig. 217: Disconnecting Vacuum Line To Leak Detection Pump At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line (arrow) to leak detection pump at throttle valve control module.

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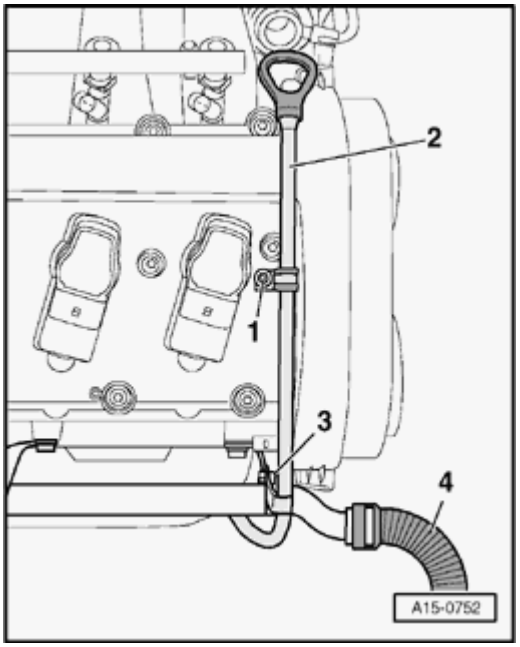


Fig. 218: Identifying Bolts, Hose From Line Of Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -3-.
- Pull out guide tube for oil dipstick 2 from the oil pan (upper part) toward top and swing it forward for removal.

NOTE: Hose -4- remains connected.

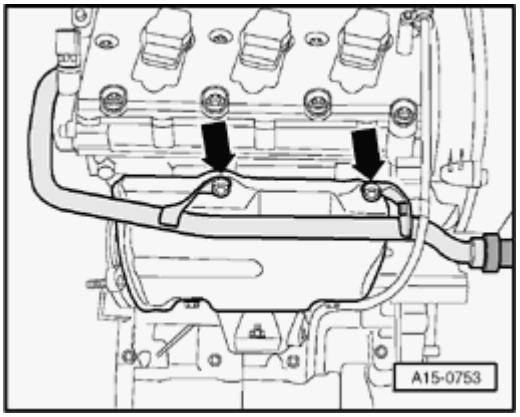


Fig. 219: Removing Bolts At Right Side Of Engine At Line For Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts at right side of engine (arrows) at line for secondary air injection.

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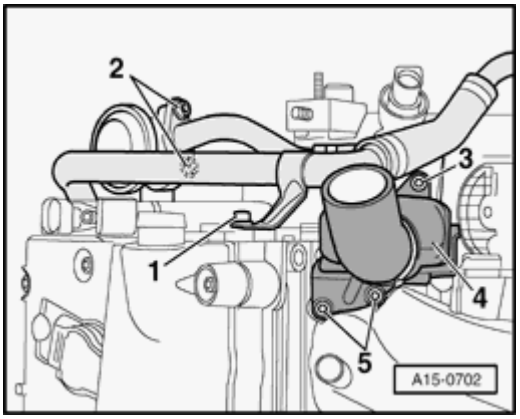


Fig. 220: Removing Bolts At Lines Of Secondary Air Injection & Resonator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- at lines of secondary air injection.
- Remove bolts -3- and -5- and remove resonator -4-.

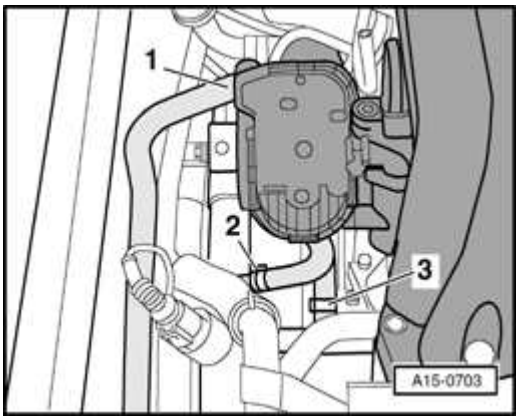
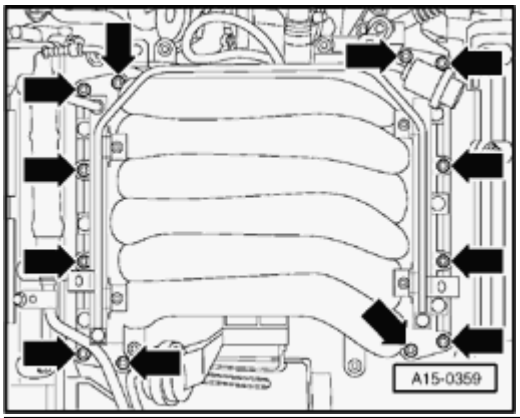


Fig. 221: Identifying Vacuum Hose At EVAP Valve & Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose -1- at EVAP valve.
- Remove coolant hoses -2- and -3-.



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Fig. 222: Unbolt/Bolting Intake Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt intake pipe (arrows) and remove.

NOTE: Plug intake channels in the cylinder heads with clean rags.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type:**
- **Always replace seals and gaskets.**

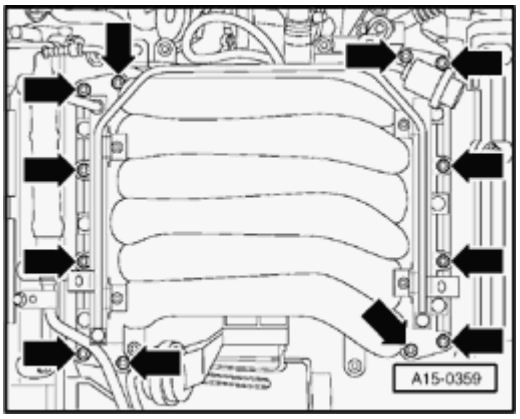


Fig. 223: Unbolt/Bolting Intake Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolt in intake manifold in diagonal sequence in stages (arrows).
- Replace O-ring at guide tube for oil dipstick and insert guide tube into hole in oil pan (upper part).

See Caution for connecting Telematics battery. Refer to **Cylinder head, removing and installing**

- Observe safety precautions after connecting battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

- Top off coolant. Refer to **Filling**.

Tightening torques

Component		Nm
Intake manifold to cylinder head		10

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Resonator to coolant pipe or to cylinder head		10
Secondary air injection line to cylinder head	M6	10
	M8	23
Secondary air injection line to combination valve for secondary air injection		10
Air guide to intake manifold		10
Holding plate for solenoid valves to intake manifold or air guide		10
Guide tube for oil dipstick to secondary air line		10

Left cylinder head cover, removing and installing

Removing

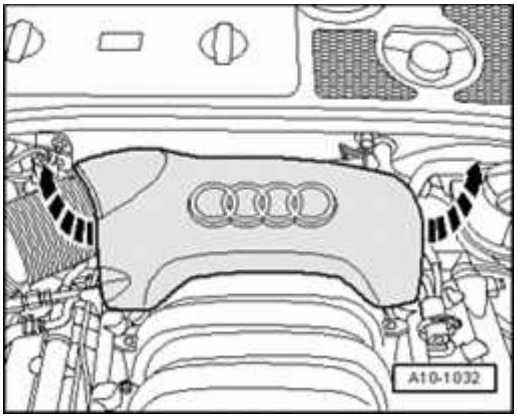


Fig. 224: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

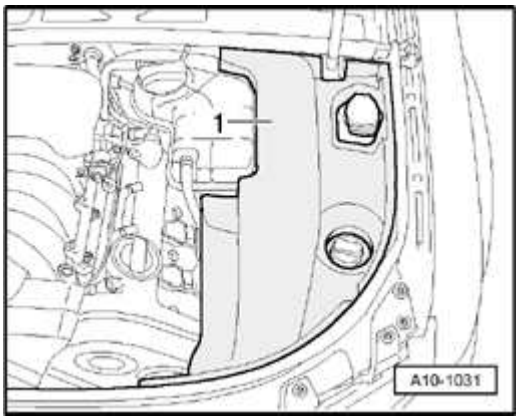


Fig. 225: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove cover -1- in engine compartment (left side).

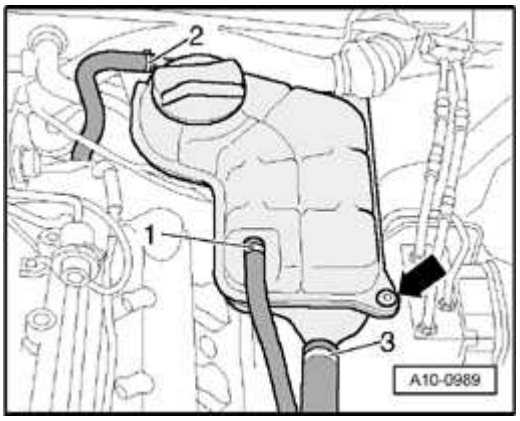


Fig. 226: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of expansion tank.
- Tie coolant expansion tank with connected coolant hoses -1- to -3- to side.

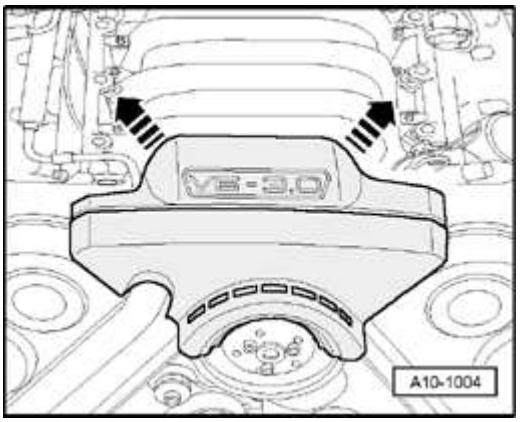


Fig. 227: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

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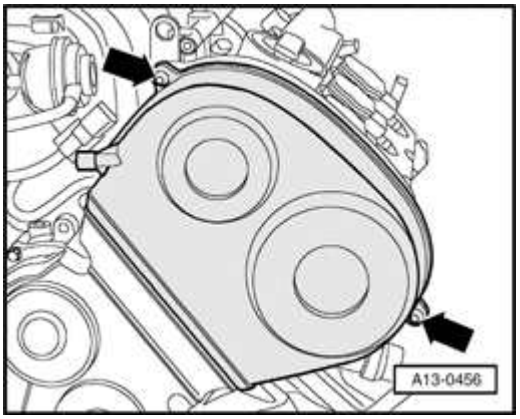


Fig. 228: Unbolting Toothed Belt Guard At Front Left From Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt toothed belt guard at front left from cylinder head cover (arrows).

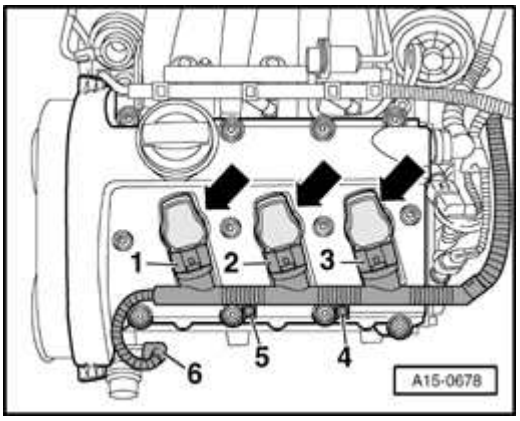
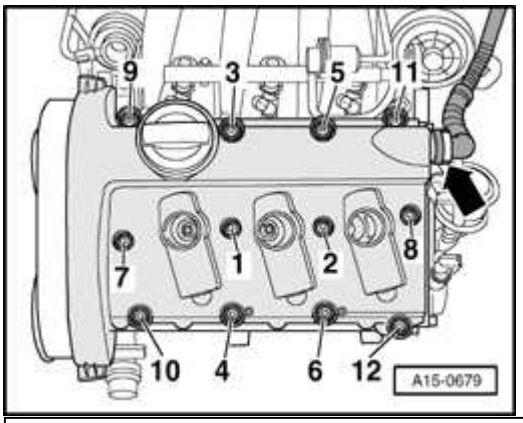


Fig. 229: Removing Bolts At Left Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -4- and -5-.
- Disconnect electrical harness connectors -1- to -3- and -6-.
- Remove ignition coils (arrows).



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Fig. 230: Removing Hose Of Crankshaft Housing Ventilation & Unscrewing Bolts For Left Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove hose of crankshaft housing ventilation (arrow).
- Unscrew bolts for left cylinder head cover in the sequence -12- to -1-.
- Remove cylinder head cover.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **Always replace self-locking bolts.**
- **Replace cylinder head cover gasket if damaged.**

- Tighten cylinder head cover in sequence -1- to -12-.

Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
Front toothed belt guard to cylinder head cover	6 1)

1) Replace bolts.

Right cylinder head cover, removing and installing

Removing

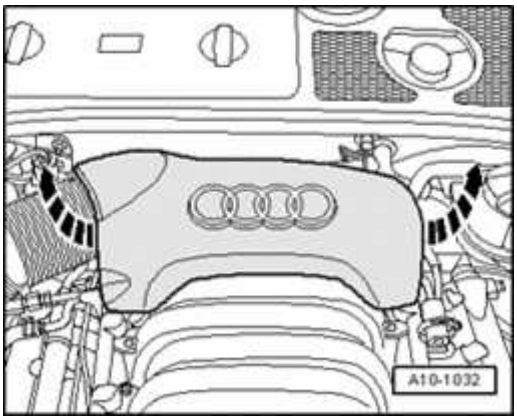


Fig. 231: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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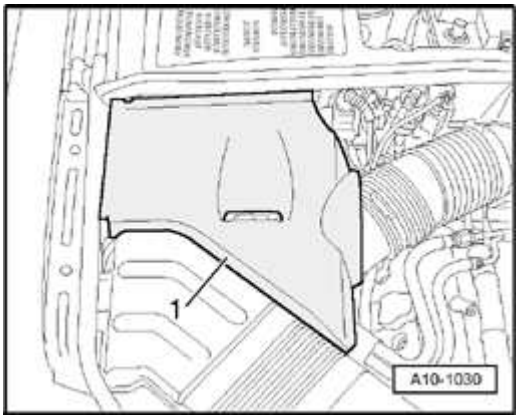


Fig. 232: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

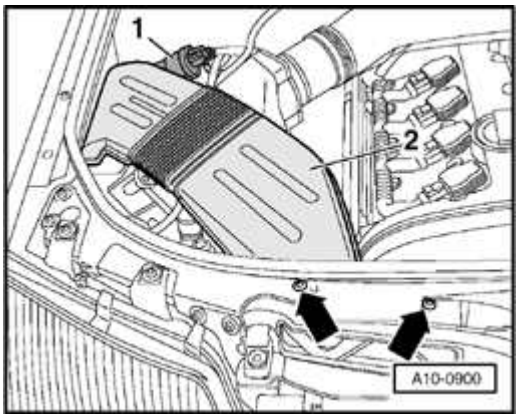
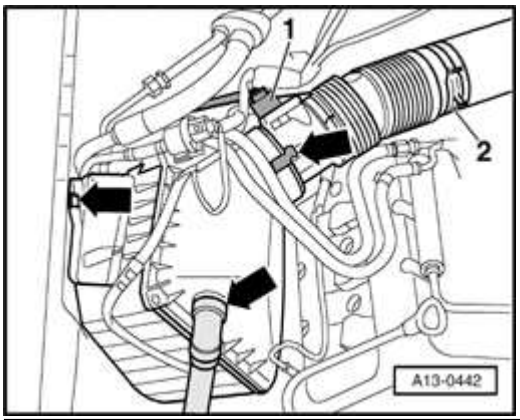


Fig. 233: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.



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Fig. 234: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).
- Disconnect electrical harness connector -1- at Mass Air Flow (MAF) sensor.
- Remove air guide hose -2- together with Mass Air Flow (MAF) sensor.

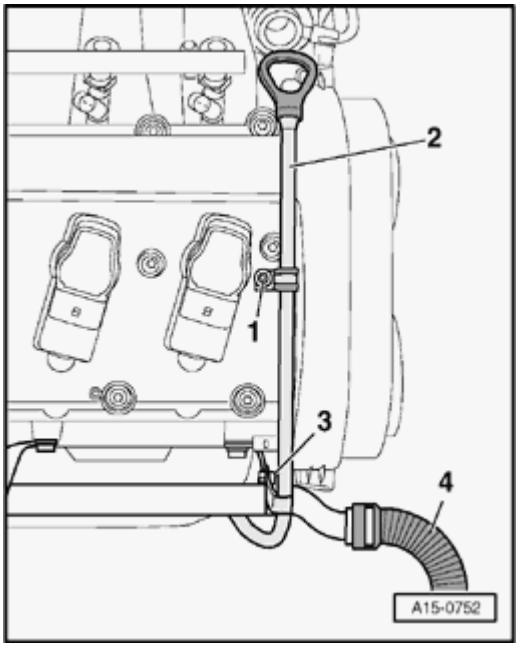


Fig. 235: Identifying Bolts, Hose From Line Of Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -3-.
- Disconnect hose -4- from line of secondary air injection.
- Pull out guide tube for oil dipstick -2- from the oil pan (upper part) toward top and swing it forward for removal.

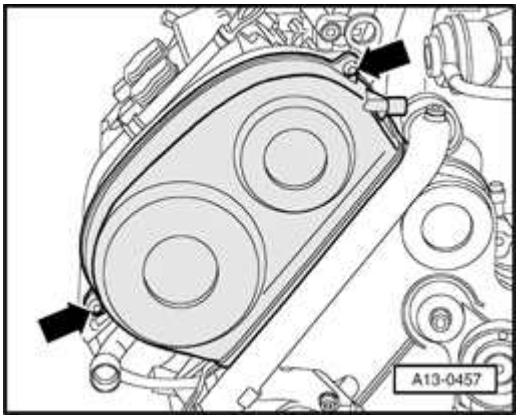


Fig. 236: Unbolting Toothed Belt Guard At Front Right From Cylinder Head Cover

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt toothed belt guard at front right from cylinder head cover (arrows).

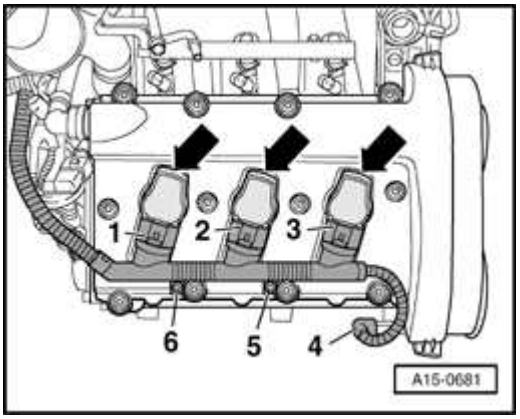


Fig. 237: Removing Bolts At Right Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -5- and -6-.
- Disconnect electrical harness connectors -1- to -4-.
- Remove ignition coils (arrows).

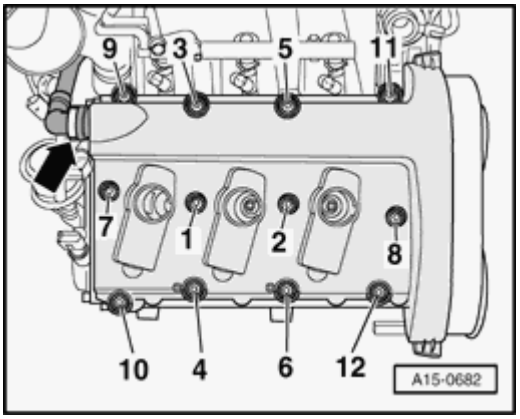


Fig. 238: Removing/Installing Hose Of Crankshaft Housing Ventilation & Unscrewing/Screewing Bolts For Right Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove hose of crankshaft housing ventilation (arrow).
- Unscrew bolts for right cylinder head cover in the sequence -12- to -1-.
- Remove cylinder head cover.

Installing

Installation is reverse of removal, noting the following:

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NOTE:

- **Always replace self-locking bolts.**
- **Replace cylinder head cover gasket if damaged.**

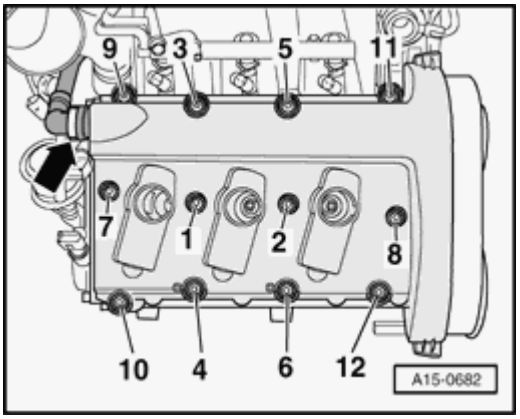


Fig. 239: Removing/Installing Hose Of Crankshaft Housing Ventilation & Unscrewing/Screwing Bolts For Right Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten cylinder head cover in sequence -1- to -12-.

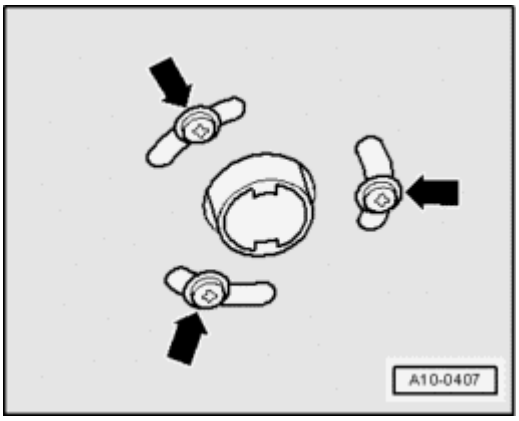


Fig. 240: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

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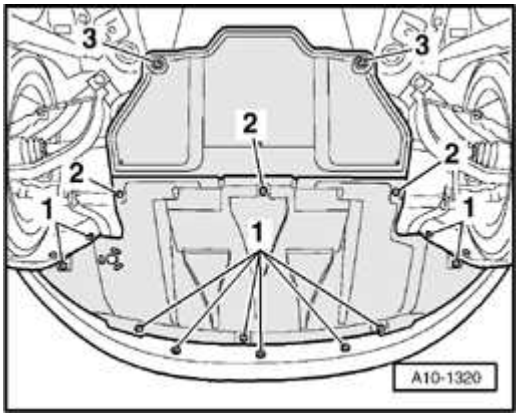


Fig. 241: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.
- Replace O-ring at guide tube for oil dipstick and insert guide tube into hole in oil pan (upper part).

Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
Front toothed belt guard to cylinder head cover	6 1)
Guide tube for oil dipstick to secondary air line	10

1) Replace bolts.

Left cylinder head, removing

Special tools and equipment

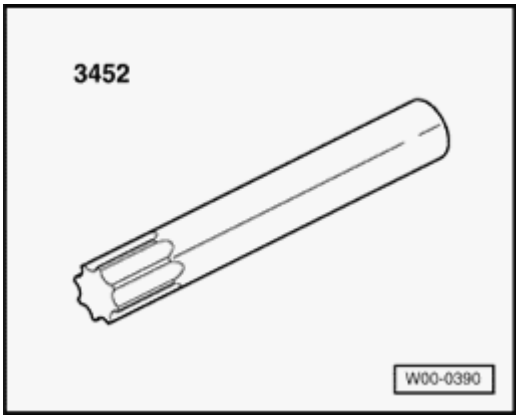


Fig. 242: 3452 Polydrive Key
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3452 Polydrive key

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Removing

- Engine installed.

NOTE: All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.

- Remove intake manifold. Refer to **Intake manifold, removing and installing**.

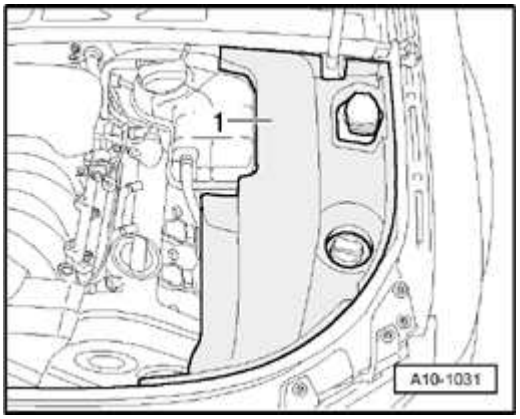


Fig. 243: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

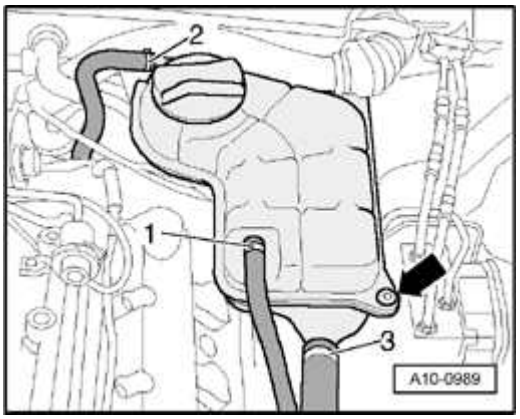


Fig. 244: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant hoses -1- to -3-.
- Remove coolant reservoir (arrow).
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of expansion tank.

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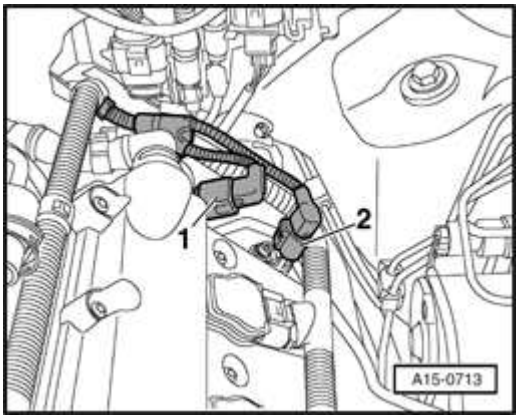


Fig. 245: Disconnecting Electrical Harness Connectors And At Camshaft Position (CMP) Sensor 2 -G163- And Camshaft Position (CMP) Sensor 4 -G301-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors -1- and -2- at Camshaft Position (CMP) sensor 2 -G163- and Camshaft Position (CMP) sensor 4 -G301-.
- Unbolt Ground (GND) wire at rear of cylinder head.
- Toothed belt, removing. Refer to **Toothed belt, removing and installing**.
- Remove camshaft gears from left cylinder head.

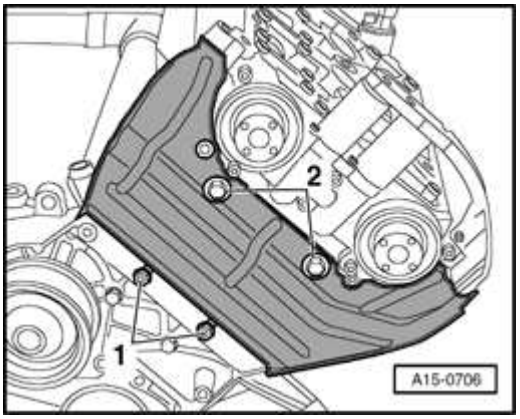


Fig. 246: Unscrewing Bolts And Removing Toothed Belt Guard At Left Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and -2- and remove toothed belt guard at left rear.

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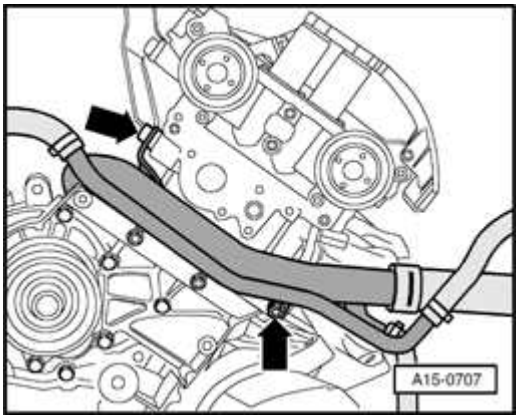


Fig. 247: Removing Front Coolant Pipe From Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front coolant pipe from cylinder head (arrows).

Vehicles with automatic transmission

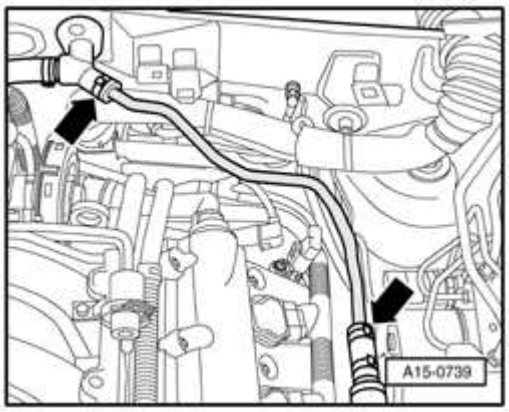


Fig. 248: Disconnecting Vacuum Hose To Brake Booster
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose to brake booster (arrows).

All

- Remove heat shield for harness connectors at left of bulkhead, if installed.

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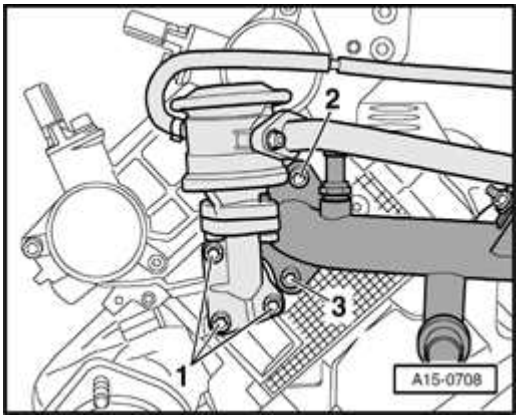


Fig. 249: Removing Bolts At Flange Of Combination Valve For Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- at flange of combination valve for secondary air injection.
- Unbolt coolant pipe at rear of cylinder head (bolts -2- and -3-).

NOTE:

- **Coolant pipe and combination valve remain installed.**
- **Illustration is shown with engine removed.**

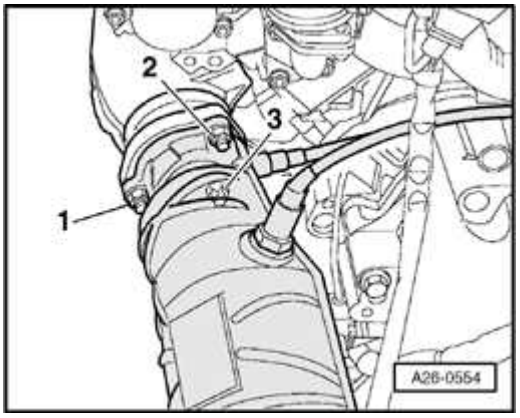


Fig. 250: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for left exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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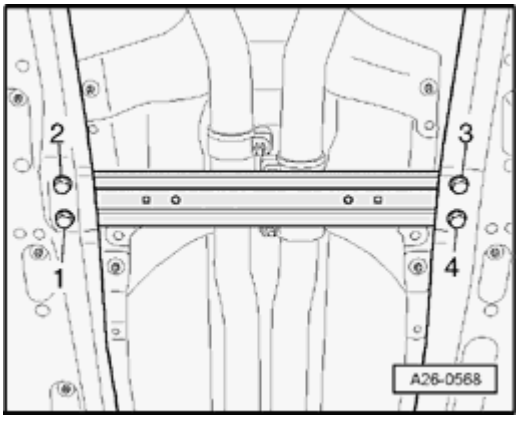


Fig. 251: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front vehicle floor crossmember -1- to -4-.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

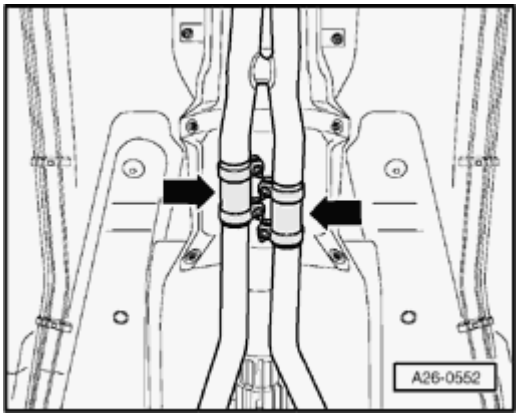


Fig. 252: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at left double clamp (left arrow).

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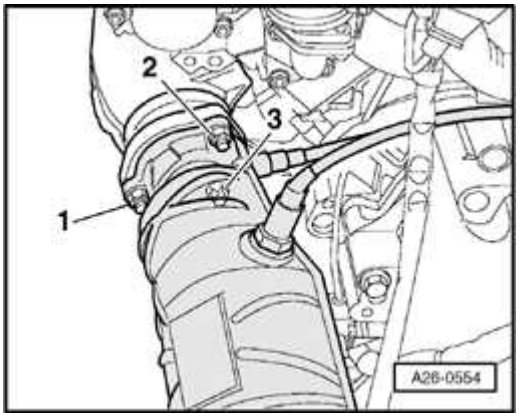


Fig. 253: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/left exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Press front exhaust pipe off of exhaust manifold.

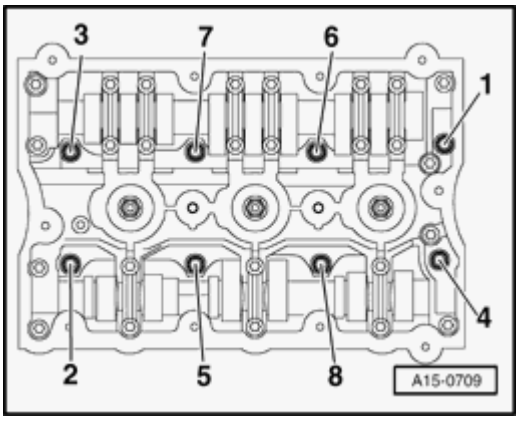


Fig. 254: Identifying Cylinder Head Bolts Loosening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Follow sequence -1- to -8- when loosening cylinder head bolts.
- Carefully remove cylinder head.

Right cylinder head, removing

Special tools and equipment

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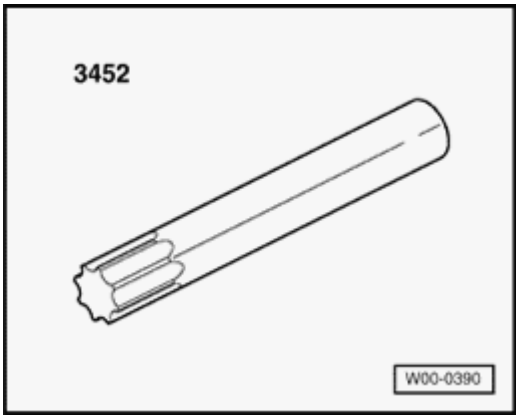


Fig. 255: 3452 Polydrive Key
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3452 Polydrive key

Removing

- Engine installed.

NOTE: All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.

- Remove intake manifold. Refer to **Intake manifold, removing and installing**.

NOTE: Place a rag under the hydraulic pressure lines, to catch escaping hydraulic fluid.

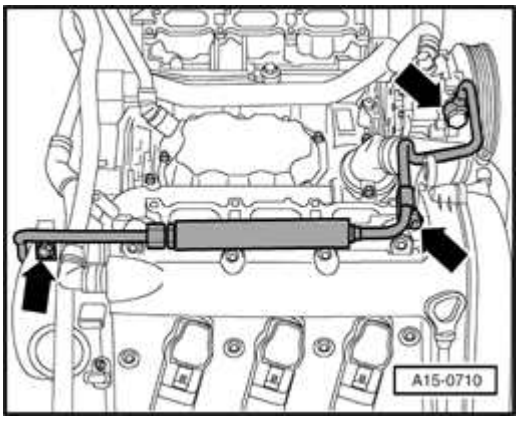


Fig. 256: Removing Power Steering Pressure Line From Power Steering Pump At Cylinder Head And At Rear Of Coolant Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove power steering pressure line from power steering pump at cylinder head and at rear of coolant pipe (arrows).

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- Lay pressure line to side.

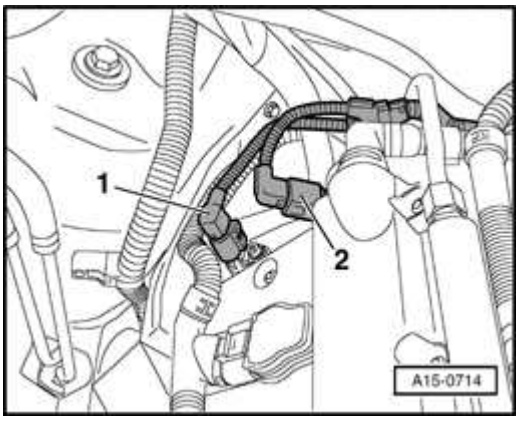


Fig. 257: Disconnecting Electrical Harness Connectors At Camshaft Position (CMP) Sensor -G40- And Camshaft Position (CMP) Sensor 3 -G300-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors -1- and -2- at Camshaft Position (CMP) sensor -G40- and Camshaft Position (CMP) sensor 3 -G300-.
- Toothed belt, removing. Refer to **Toothed belt, removing and installing**.
- Remove camshaft gears from right cylinder head.

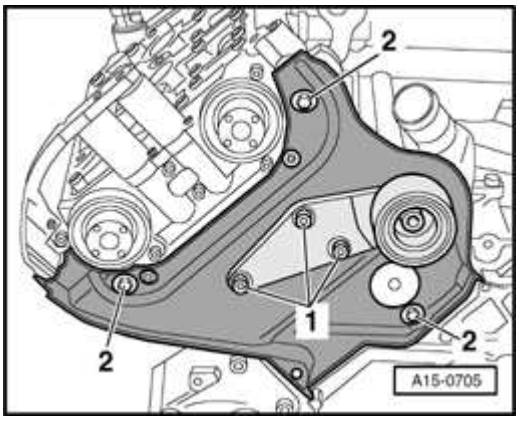


Fig. 258: Unscrewing Bolts And Removing Bracket With Idler Roller & Toothed Belt Guard At Right Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and remove bracket with idler roller.
- Unscrew bolts -2- and remove toothed belt guard at right rear.

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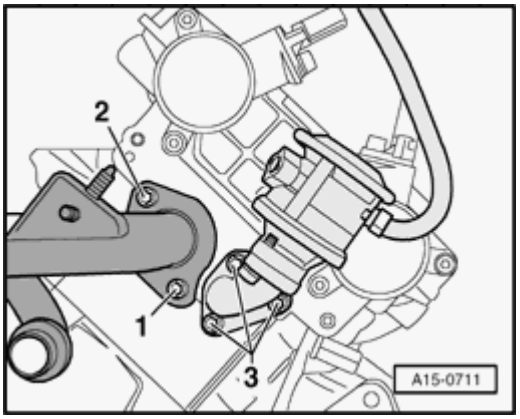


Fig. 259: Removing Bolts And Combination Valve For Secondary Air Injection With Flange From Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -3- and remove combination valve for secondary air injection with flange from cylinder head.
- Unbolt coolant pipe at rear of cylinder head (bolts -1- and -2-).

NOTE:

- **Coolant pipe remains installed.**
- **Illustration is shown with engine removed.**

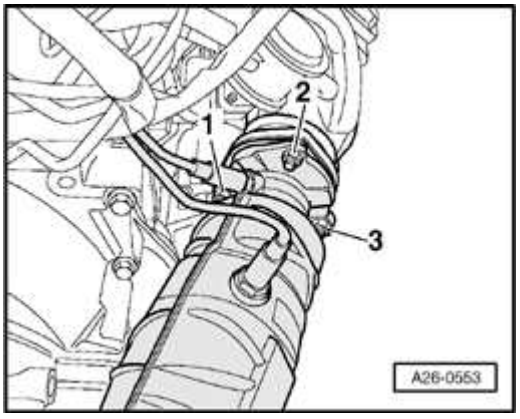


Fig. 260: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for right exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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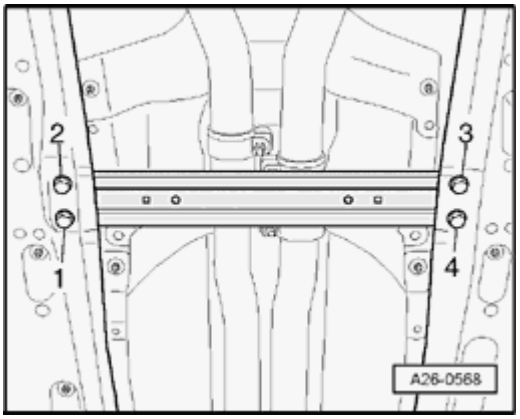


Fig. 261: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front vehicle floor crossmember -1- to -4-.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

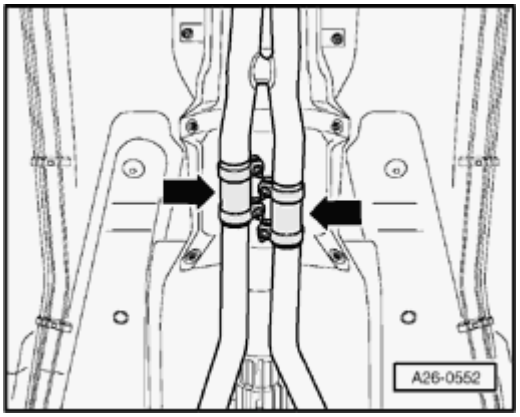


Fig. 262: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at right double clamp (right arrow).

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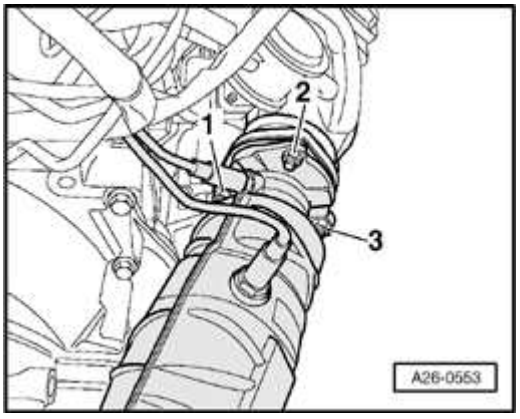


Fig. 263: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/right exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Press front exhaust pipe off of exhaust manifold.

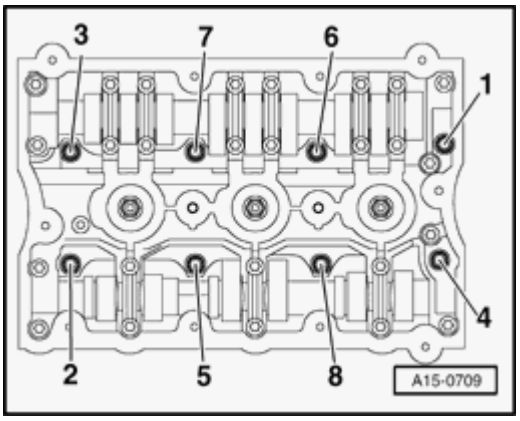


Fig. 264: Identifying Cylinder Head Bolts Loosening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Follow sequence -1- to -8- and loosen cylinder head bolts.
- Carefully remove cylinder head.

Cylinder head, installing

NOTE:

- **Replace cylinder head bolts.**
- **Replace self-locking nuts and bolts during assembly work.**
- **Always replace bolts that are secured with tightening torque as well as O-rings and gaskets.**

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- **In case of repairs, carefully remove sealant residue from cylinder head and cylinder block. Avoid introducing any scratches or scoring.**
- **Thoroughly remove all sanding and grinding residue.**
- **Pocket holes in cylinder block for cylinder head bolts must be free of oil and coolant.**
- **Do not remove new cylinder head gasket from package until immediately before installing.**
- **Handle gasket with extra care. Damage in silicon layer and recessed area lead to leakage.**
- **Install cylinder head gasket onto guide sleeves. Marking "open" (top) or part number must face toward cylinder head.**
- **Secure all hose connections using hose clamps appropriate for the model type:**

Installation is reverse of removal, noting the following:

- Before installing cylinder head, set crankshaft and camshafts to TDC cylinder 3:

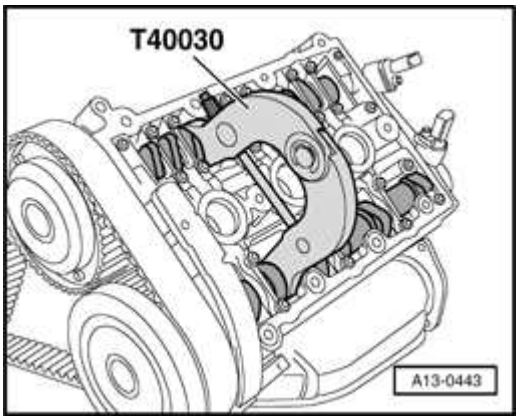


Fig. 265: Inserting T40030 Camshaft Adjuster Gauge At Left Cylinder Head In Same Manner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T40030 camshaft adjuster gauge must be inserted at both cylinder heads...

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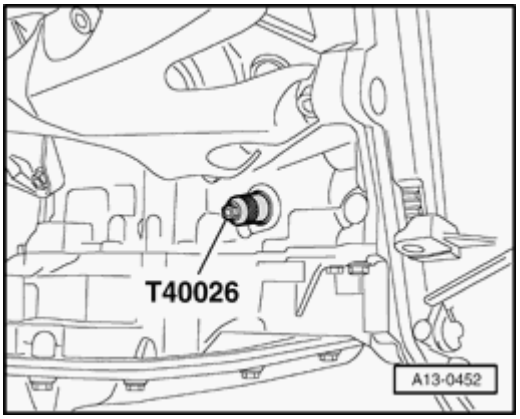


Fig. 266: Threading T40026 Locking Pin Into Hole Of Removed Sealing Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- .. and T40026 locking pin must be threaded in.

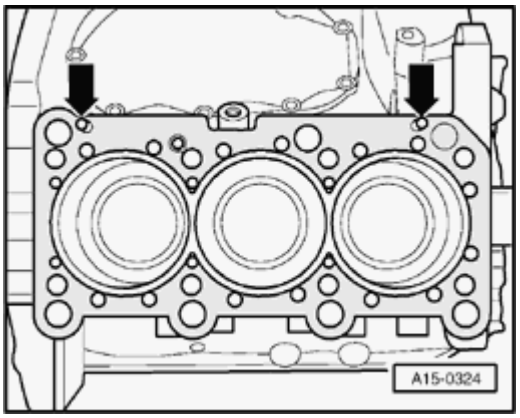


Fig. 267: Installing Cylinder Head Gasket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install cylinder head gasket.

- Observe centering pins (arrows) in cylinder block.
- Pay attention to installed position of cylinder head gasket, marking "open" (top) or part number must face toward cylinder head.

- Install cylinder head.
- Insert new cylinder head bolts and hand-tighten.

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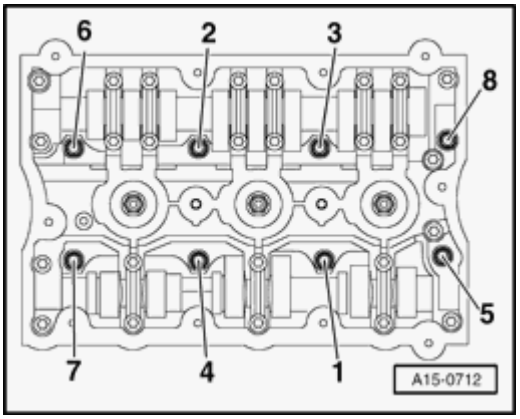


Fig. 268: Tightening Cylinder Head Bolts In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten cylinder head bolts in sequence, in two stages.
- Tighten using torque wrench:
- 1. Stage: 40 Nm
- Tighten using a solid wrench:
- 2. Stage: 180° (1/2 turn) further

NOTE:

- **Two additional turns of 90° are permissible.**
- **It is not necessary to re-tighten the cylinder head bolts.**

- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.

NOTE: **After working on the valvetrain, carefully rotate engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when starting.**

- Install left front exhaust pipe with catalytic converter. Refer to **Installing** for vehicles with manual transmission and **Installing** for vehicles with automatic transmission 01V.
- Install right front exhaust pipe with catalytic converter. Refer to **Installing** for vehicles with manual transmission and **Installing** for vehicles with automatic transmission 01V.
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.
- Install centering pin for intake manifold.
- Install intake manifold. Refer to **Installing**.

See Caution for connecting Telematics battery. Refer to **Cylinder head, removing and installing**

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- Observe safety precautions after connecting the battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

- Replace coolant. Refer to **Filling**.
- Fill up power steering fluid and bleed steering system:

Refer to **48 - STEERING**

Tightening torques

Component		Nm
Rear coolant pipe to cylinder head		10
Combination valve to cylinder head		10
Rear toothed belt guard to cylinder head or cylinder block		10 1)
Bracket for idler roller to cylinder head		10 1)
Front coolant pipe	M6	10
To cylinder head	M8	23
Power steering pressure line to hydraulic pump		47
Power steering pressure line to cylinder head		10
Power steering pressure line to rear coolant pipe		20

1) Replace bolts.

Compression pressure, checking

Special tools and equipment

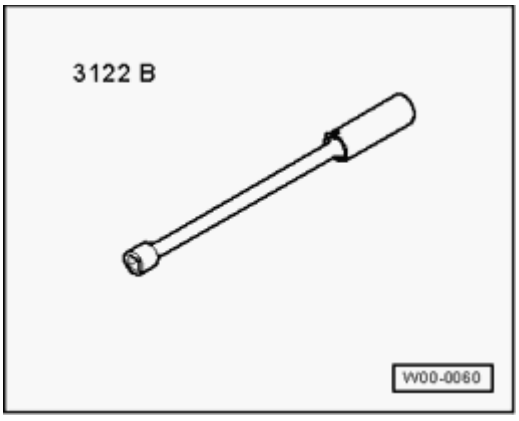


Fig. 269: Identifying Spark Plug Wrench 3122 B
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3122B Spark plug removal tool

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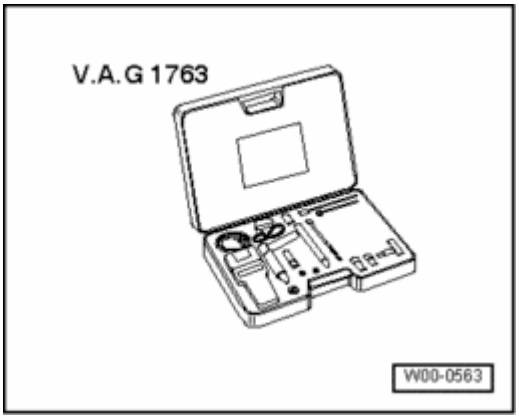


Fig. 270: Compression Tester VAG1381 Or VAG1763
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1381 or VAG1763 Compression tester

Requirements

- Minimum engine oil temperature: 30°C
- Battery voltage at least 12.7 V

Work sequence

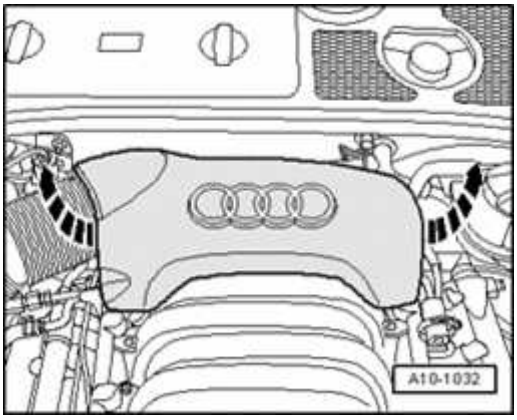


Fig. 271: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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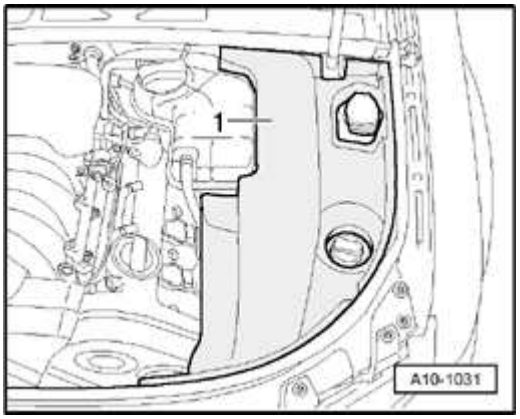


Fig. 272: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

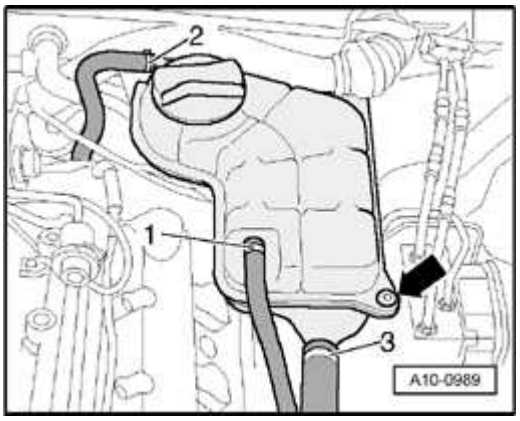


Fig. 273: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of expansion tank.
- Tie coolant expansion tank with connected coolant hoses -1 to 3- to side.

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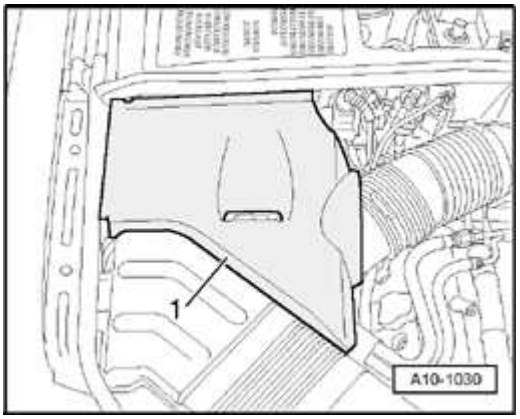


Fig. 274: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

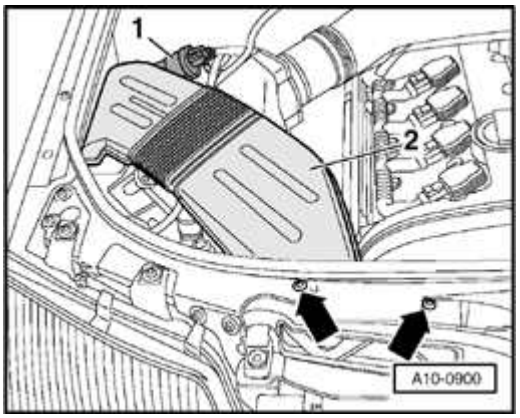
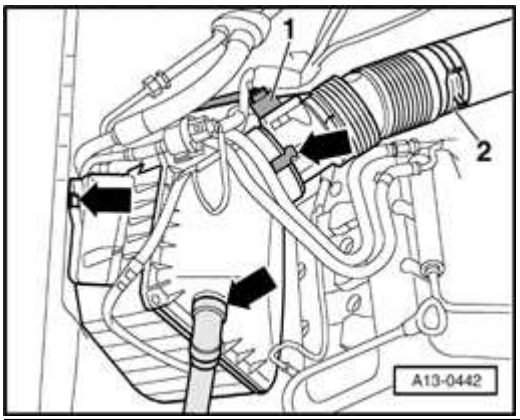


Fig. 275: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.



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Fig. 276: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).
- Disconnect electrical harness connector -1- at Mass Air Flow (MAF) sensor.
- Remove air guide hose -2- together with Mass Air Flow (MAF) sensor.

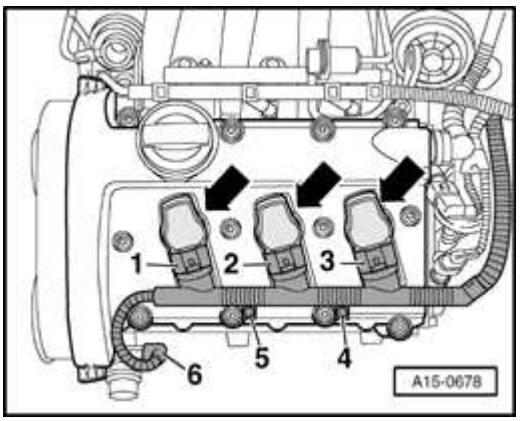


Fig. 277: Removing Bolts At Left Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -4- and -5- at left cylinder head cover.
- Disconnect electrical harness connectors -1- to -3- and -6-.
- Remove ignition coils (arrows).

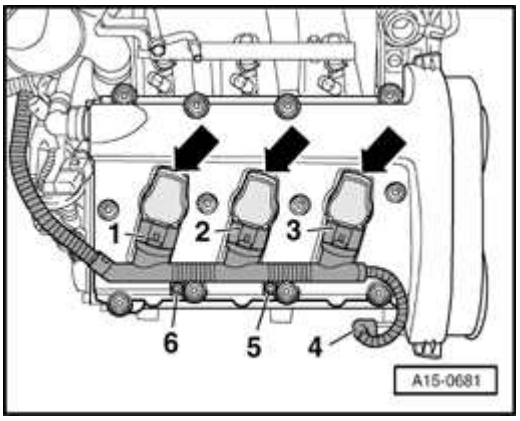


Fig. 278: Removing Bolts At Right Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -5- and -6- at right cylinder head cover.
- Disconnect electrical harness connectors -1- to -4-.
- Remove ignition coils (arrows).
- Using 3122B spark plug removal tool, remove spark plugs.

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- Remove all harness connectors to injectors.
- Open throttle fully.
- Test engine compression using VAG1381 or VAG1763 compression tester.

NOTE: Using VAG1381 or VAG1763 Compression Tester:

Refer to Operating instructions

- Activate starter until no further pressure increases are indicated by VAG1381 or VAG1763 compression tester.

Compression values

New Bar gauge pressure	Wear limit Bar gauge pressure	Difference between cylinders bar Gauge pressure
10.0 to 14.0	9.0	max. 3.0

- Install spark plugs and ignition coils.

The following work step must be performed after the engine compression test.

- Check DTC and erasing if necessary.

Use VAS5051 tester.

Tightening torque

Component	Nm
Spark plugs into cylinder head	30

VALVE TRAIN, SERVICING

Valve train, servicing

NOTE:

- **Cylinder heads with cracks between valve seats or between valve seat and spark plug thread can still be used without loss of service life if the cracks are minute (max. 0.3 mm width) or only the first four threads of a spark plug thread are cracked.**
- **After installing camshafts, do not start engine for at least 30 minutes. The hydraulic valve lifters have to settle (otherwise valves will strike the pistons).**
- **After working on the valvetrain, carefully rotate engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when**

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starting.

- **Replace gaskets and O-rings.**
- **Illustration depicts the left cylinder bank.**

Part I

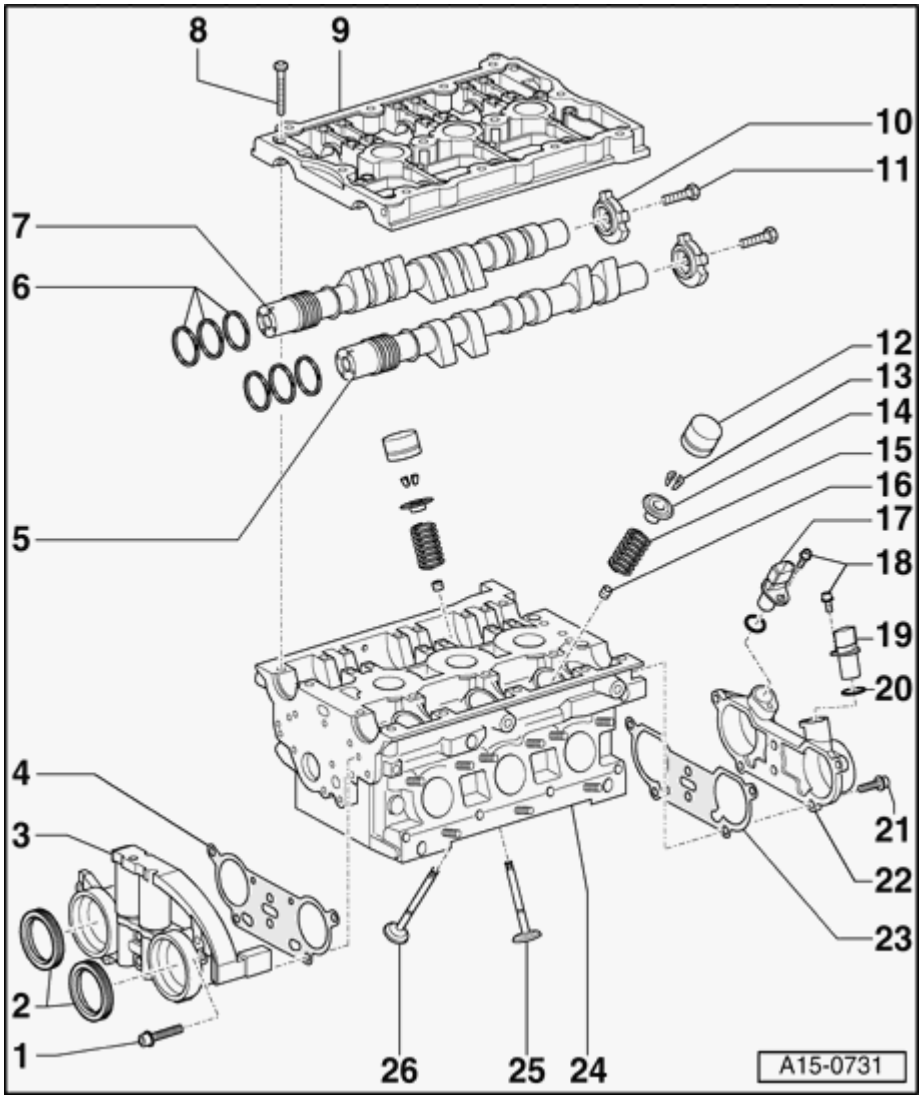


Fig. 279: Valve Train, Servicing Remove/Install Components - Part I
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - Seals

- Always replace. Refer to **Camshaft oil seals, replacing**

3 - Housing

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- For camshaft adjustment valves

4 - Gasket

- Always replace

5 - Exhaust camshaft

- Checking axial clearance. Refer to **Camshaft axial play, checking**
- Removing and installing. Refer to **Camshafts and camshaft adjusters, removing and installing**

Check radial clearance using Plastigage (hydraulic valve lifters removed):

- Wear limit: 0.1 mm
- Max. run-out: 0.01 mm

6 - Piston rings

- For camshaft adjuster
- Engage piston ring ends with each other. See **Fig. 282**
- If ring ends are not of locking ring type (cannot be locked together) align all ring gaps at top and install camshaft housing using a gentle side to side motion (do not rock top to bottom)

7 - Intake camshaft

- Checking axial clearance. Refer to **Camshaft axial play, checking**
- Removing and installing. Refer to **Camshafts and camshaft adjusters, removing and installing**

Check radial clearance using Plastigage (hydraulic valve lifters removed):

- Wear limit: 0.1 mm
- Max. run-out: 0.01 mm

8 - 10 Nm

- Tighten in several stages from inside out

9 - Guide frame

- With integrated camshaft bearings
- Removing and installing. Refer to **Camshafts and camshaft adjusters, removing and installing**

10 - Sensor wheel

- Note position (notch on camshaft)

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11 - 23 Nm

12 - Hydraulic valve lifter

- Checking. Refer to **Hydraulic valve lifters, checking**
- Removing and installing. Refer to **Valve stem oil seals, replacing**
- Do not interchange
- Install with journal surface facing down

- Before installing, check axial play of camshaft. Refer to **Camshaft axial play, checking**
- Oil contact surface

13 - Valve keepers

14 - Valve spring retainer

15 - Valve spring

16 - Valve stem oil seal

- Always replace. Refer to **Valve stem oil seals, replacing**

17 - Camshaft Position (CMP) sensor

- Cylinder bank 1 (right) Camshaft Position (CMP) sensor -G40-:
- Cylinder bank 2 (left) Camshaft Position (CMP) sensor 2 -G163-

18 - 10 Nm

19 - Camshaft Position (CMP) sensor for exhaust camshaft

- Cylinder bank 1 (right) Camshaft Position (CMP) sensor 3 -G300-
- Cylinder bank 2 (left) Camshaft Position (CMP) sensor 4 -G301-

20 - O-ring

- Always replace

21 - 10 Nm

22 - Camshaft Position (CMP) sensor housing

23 - Gasket

- Always replace

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24 - Cylinder head

- Observe note. Refer to **Valve train, servicing**
- Check valve guides, hand-lap valve seats. Refer to **Valve guides, checking**
- Reface valve seats. Refer to **Valve seats, refacing**

25 - Intake valve

- Do not reface, only hand-lapping is permitted
- Mark installation position for reinstalling
- Valve dimensions. See **Valve dimensions**
- Check valve guides, hand-lap valve seats. Refer to **Valve guides, checking**

26 - Exhaust valves

- Do not reface, only hand-lapping is permitted
- Mark installation position for reinstalling
- Valve dimensions. See **Valve dimensions**
- Check valve guides, hand-lap valve seats. Refer to **Valve guides, checking**

Part II

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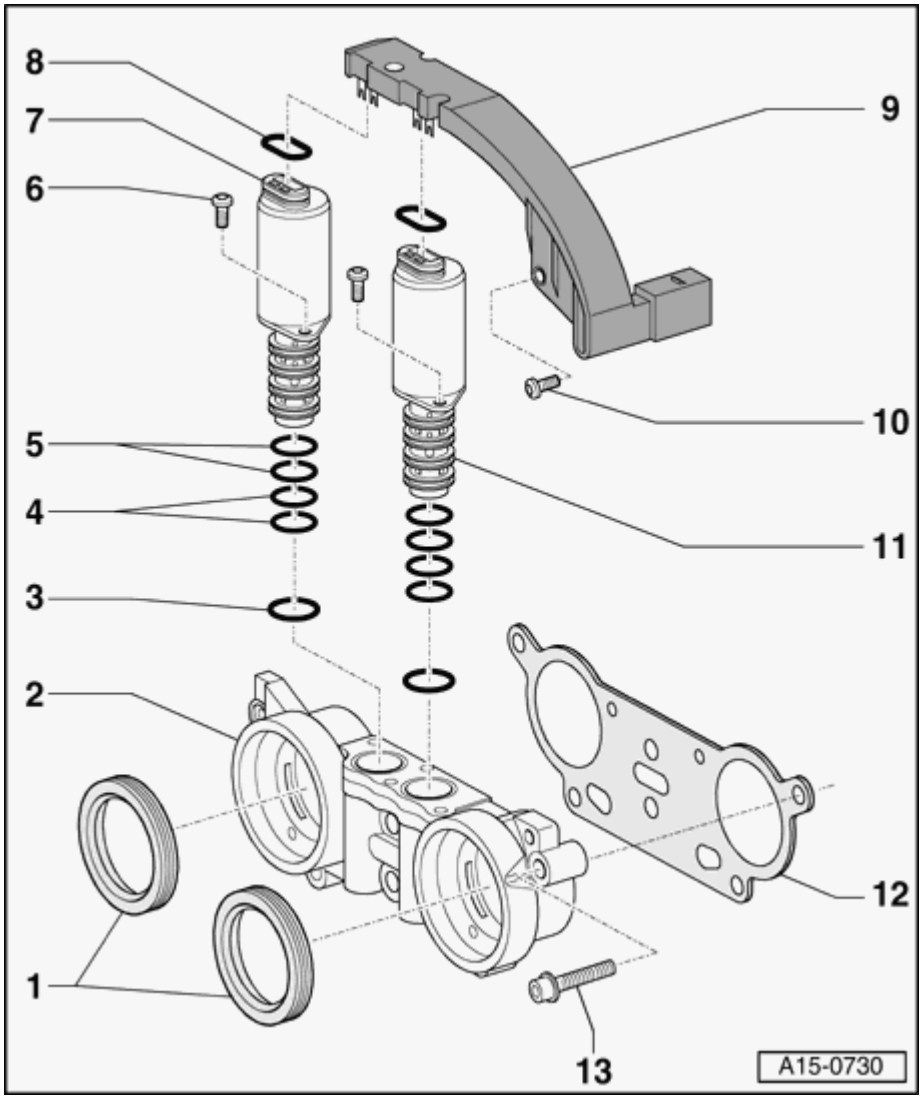


Fig. 280: Valve Train, Servicing Remove/Install Components - Part II
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Seals

- Always replace. Refer to **Camshaft oil seals, replacing**

2 - Housing

- For camshaft adjustment valves

3 - O-Rings

- Green
- Between solenoid valve housing and solenoid valves
- Always replace

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4 - O-Rings

- Black
- Always replace

5 - O-Rings

- Green
- Always replace

6 - 4 Nm

7 - Camshaft adjustment valve - intake side

- Cylinder bank 1 (right) Valve -1- for camshaft adjustment -N205-
- Cylinder bank 2 (left) Valve -2- for camshaft adjustment -N208-
- Do not interchange with a valve for camshaft adjustment (exhaust side)
- Note identification 12. 100 338

8 - Gasket

- Replace if damaged

9 - Connector adapter

- Must be replaced after disconnecting from camshaft adjustment valves
- Carefully press onto harness connectors of camshaft adjustment valves until they engage

10 - 4 Nm

11 - Camshaft adjustment valve - exhaust side

- Cylinder bank 1 (right) Camshaft Adjustment Valve 1 (exhaust) -N318-
- Cylinder bank 2 (left) - Camshaft Adjustment Valve 2 (exhaust) -N319-
- Do not interchange with a camshaft adjustment valve (intake side)
- Note identification 12. 100 339

12 - Gasket

- Always replace

13 - 10 Nm

Valve dimensions

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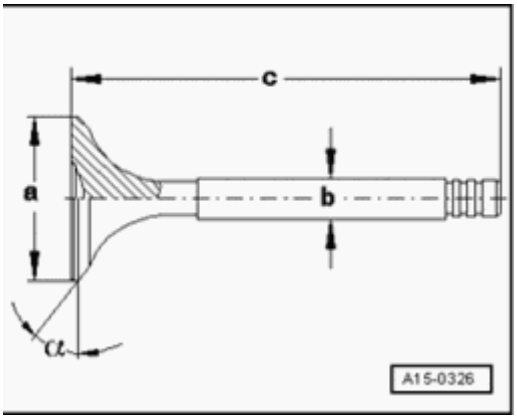


Fig. 281: Valve Dimensions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: Valves must not be refaced. Only hand-lapping is permitted.

Dimension		Intake valve	Exhaust valves
| a	mm	26.80 to 27.00	29.80 to 30.00
| b	mm	5.96 to 5.97	5.94 to 5.95
c	mm	104.84 to 105.34	103.64 to 104.14
a	Angle°	45	45

WARNING:

- **Sodium-filled exhaust valves must not be scrapped without first being properly treated.**
- **Using a metal saw, the valves must be cut in half between the shaft center and valve plate. They must not come into contact with water while being cut. After cutting open valves, throw not more than 10 at a time into a bucket of water. Then step back. A sudden chemical reaction will occur during which the sodium filling is consumed.**
- **Valves that have been treated in this manner can then be disposed of as normal scrap metal.**

Engage piston ring ends, if necessary, or line up ring gaps at top

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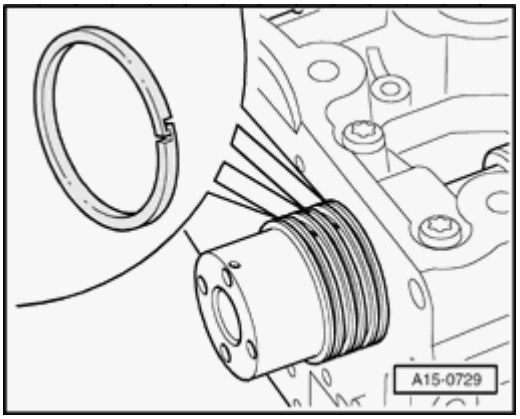


Fig. 282: Checking Whether Piston Rings At Camshafts Are Installed
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check whether piston rings at camshafts are installed and whether piston ring ends are engaged with each other.

NOTE: If ends of installed piston are not of the locking type (cannot be locked together):

- Always orient the rings so that the gaps (of all three rings) are at the top of the camshaft prior to installation of the camshaft adjustment housing.

With all ring gaps aligned at the top of camshaft:

- Install camshaft adjustment housing using a gentle side to side motion (do not rock top to bottom).

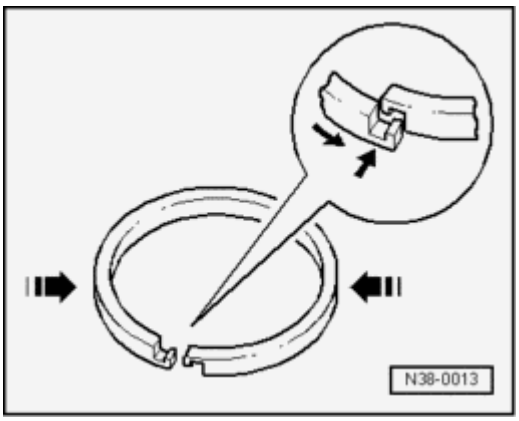


Fig. 283: Hooking Ends Of Piston Ring Together
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If necessary, engage ends of installed piston rings (arrows), as depicted in illustration.

Camshaft axial play, checking

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Special tools and equipment

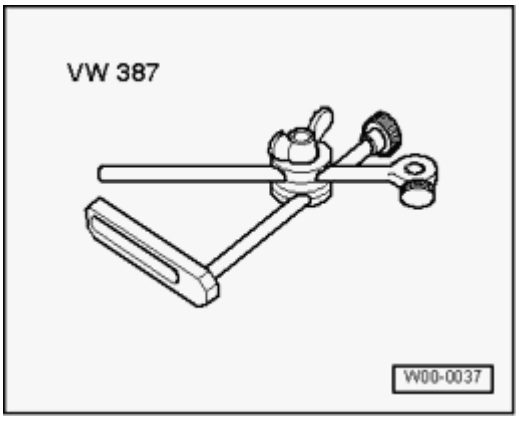


Fig. 284: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VW387 Dial gauge holder
- Dial gauge

Work sequence

- Remove camshafts. Refer to **Camshafts and camshaft adjusters, removing and installing**.
- Remove hydraulic valve lifters.
- Insert camshafts into cylinder head and install guide frame.

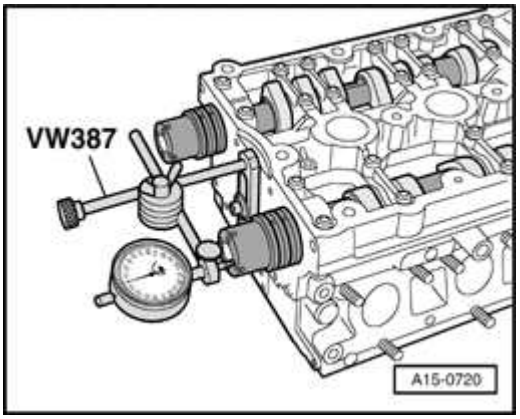


Fig. 285: Securing Dial Indicator To Cylinder Head Using VW387 Dial Gauge Holder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure dial indicator to cylinder head using VW387 dial gauge holder.
- Press camshaft to be checked against dial indicator by hand.
- Set dial indicator to 0.
- Press crankshaft away from dial indicator.

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- Read clearance.

New	Wear limit
0.08 to 0.16 mm	0.20 mm

Camshaft oil seals, replacing

Special tools and equipment

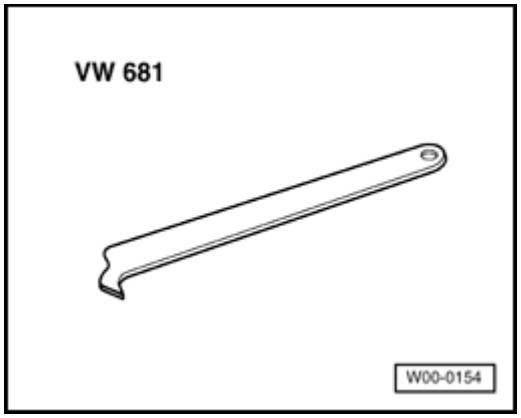


Fig. 286: Special Tool - Oil Seal Extractor Lever VW 681
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VW681 Extractor lever

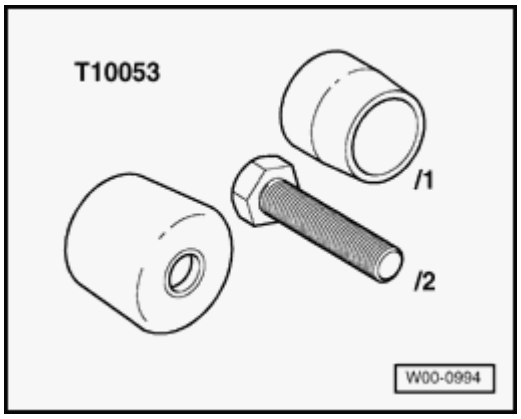


Fig. 287: T10053 Assembly Tool
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T10053 Assembly tool

Removing

- Remove toothed belt. Refer to **Toothed belt, removing and installing**.
- Mark installed position of camshaft gears for re-installation.

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- Remove camshaft gears.

NOTE:

- **In case of leaks of one shaft seal, replace sealing rings at both cylinder heads.**
- **Be careful not to damage seating surface when pressing out sealing rings.**

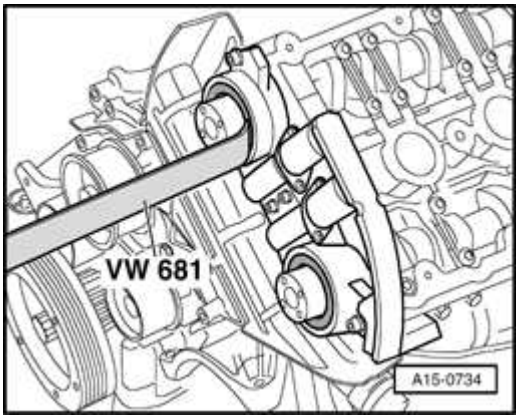


Fig. 288: Installing Camshaft Sealing Rings Using VW681 Extractor Lever
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install camshaft sealing rings using VW681 extractor lever.
- Clean seating surfaces.

Installing

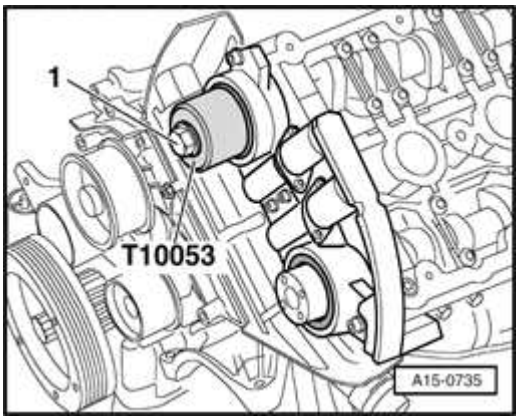


Fig. 289: Pressing In Sealing Ring For Camshaft Gear Flush To Housing Using T10053 Assembly Tool And Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press in sealing ring for camshaft gear flush to housing using T10053 assembly tool and bolt -1-.
- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.

Camshafts and camshaft adjusters, removing and installing

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Special tools and equipment

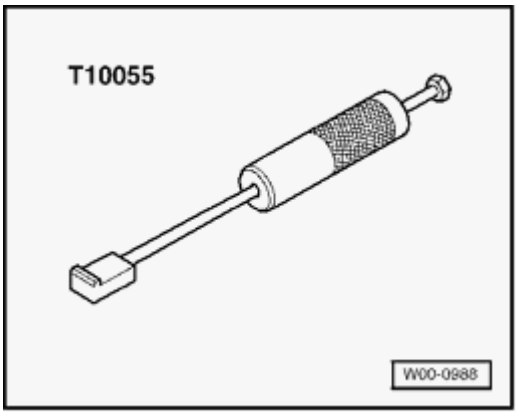


Fig. 290: Identifying Puller T10055 With Adapter T10055/3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T10055 Extractor

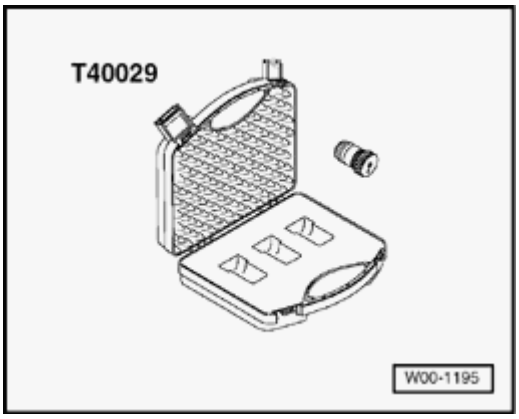


Fig. 291: T40029 Locating Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T40029 Locating pin
- Drill with plastic brush attachment
- Protective glasses
- Sealants

Removing

- Toothed belt, removing. Refer to **Toothed belt, removing and installing**.
- Remove respective camshaft gears.
- Remove combination valve for Secondary Air Injection. Refer to **Left combination valve for secondary air injection, removing and installing** or **Right combination valve for secondary air injection, removing and installing**.

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Right cylinder head

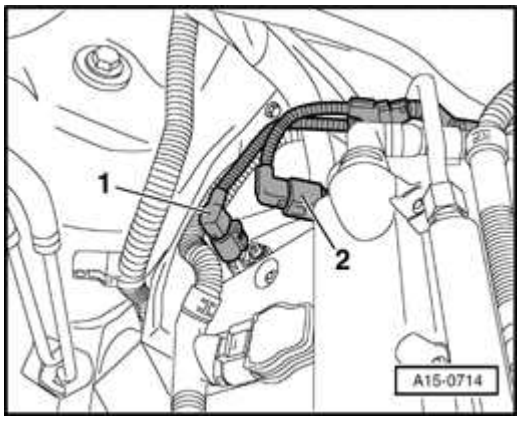


Fig. 292: Disconnecting Electrical Harness Connectors At Camshaft Position (CMP) Sensor -G40- And Camshaft Position (CMP) Sensor 3 -G300-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors -1- and -2- at Camshaft Position (CMP) sensor -G40- and Camshaft Position (CMP) sensor 3 -G300-.

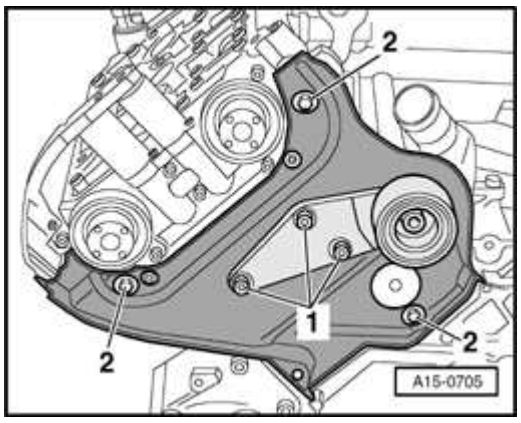


Fig. 293: Unscrewing Bolts And Removing Bracket With Idler Roller & Toothed Belt Guard At Right Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and remove bracket with idler roller.
- Unscrew bolts -2- and remove toothed belt guard at right rear.

Left cylinder head

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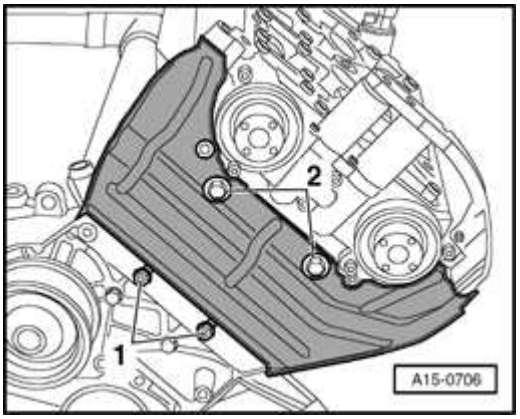


Fig. 294: Unscrewing Bolts And Removing Toothed Belt Guard At Left Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and -2- and remove toothed belt guard at left rear.

All

- Remove T40030 camshaft adjuster gauge from camshafts.

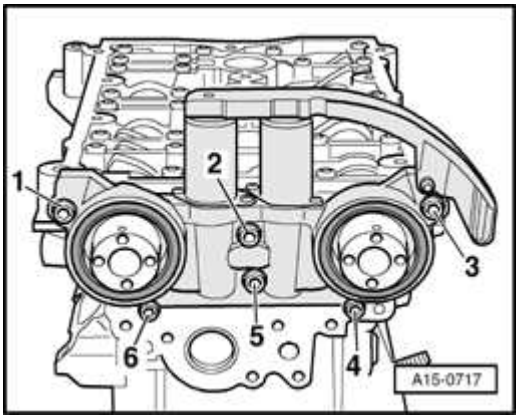


Fig. 295: Unscrewing Bolts And Removing Housing For Camshaft Adjustment Valves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- to -6- and remove housing for camshaft adjustment valves.

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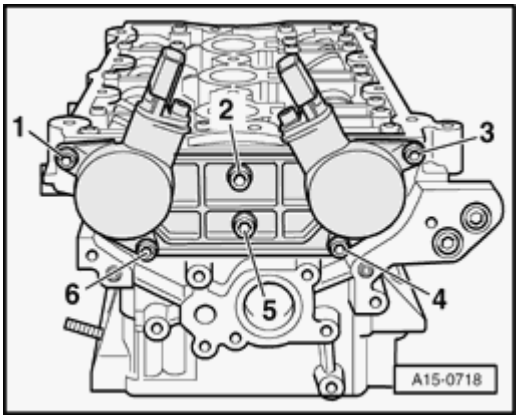


Fig. 296: Unscrewing Bolts And Removing Housing For Camshaft Position (CMP) Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- to -6- and remove housing for Camshaft Position (CMP) sensor.

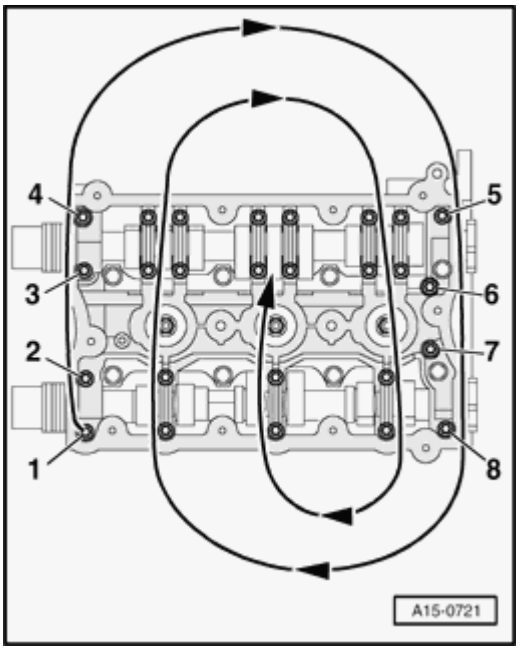


Fig. 297: Loosening Bolts Of Guide Frame In Sequence Of Numbers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolts of guide frame in sequence of numbers and follow arrows.

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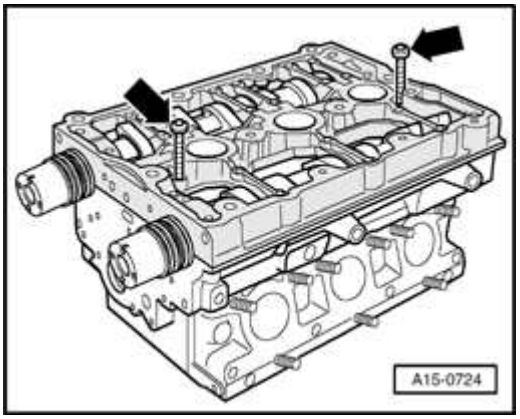


Fig. 298: Pressing Off Guide Frame With M6 Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press off guide frame with M6 bolts (arrows).
- Carefully remove guide frame.

WARNING: Wear protective glasses.

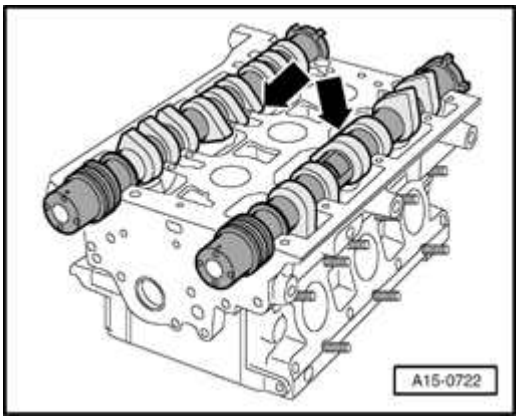
- Using rotating plastic brush, remove remaining sealant from cylinder head and guide frame.
- Clean sealing surfaces so they are completely free of any oil or grease.

Installing

NOTE: Replace gaskets and O-rings.

- Crankshaft aligned using T40026 locking pin
- Oil camshaft journal surface.

Left cylinder head



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Fig. 299: Inserting Camshaft Into Left Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft into cylinder head as depicted in illustration.
- Cams at cylinder 5 point downward evenly (arrows).

Right cylinder head

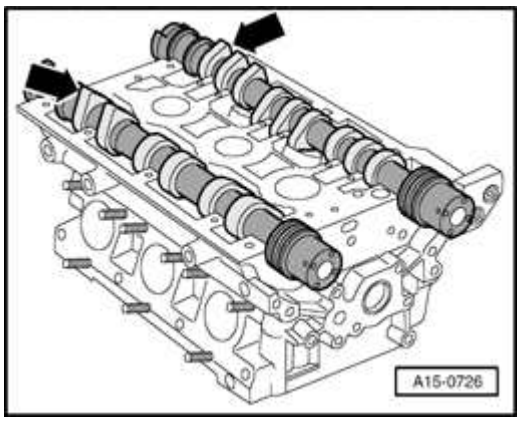


Fig. 300: Inserting Camshaft Into Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft into cylinder head as depicted in illustration.
- Cams at cylinder 3 point upward evenly (arrows)

All

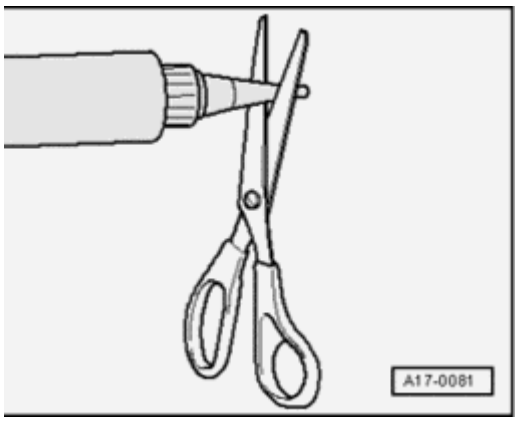


Fig. 301: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut tube nozzle at front marking (jet diameter approx. 1 mm).

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NOTE: Sealant bead must be applied according to exact specifications, otherwise excess sealant could get into the camshaft bearings.

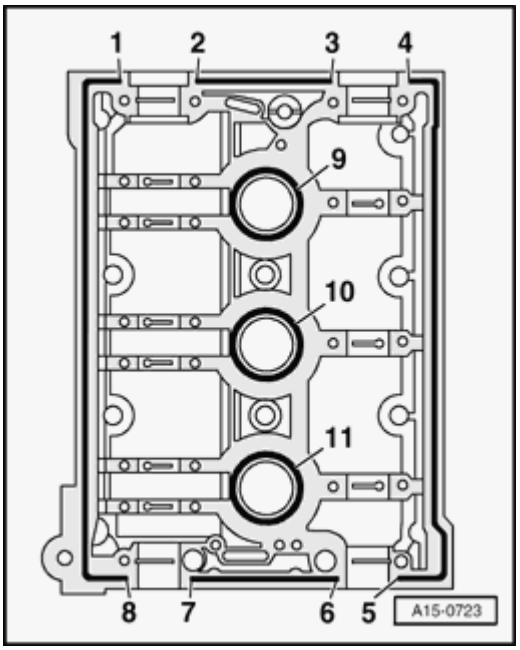


Fig. 302: Applying Sealant To Clean Sealing Surface Of Guide Frame
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant to clean sealing surface of guide frame as depicted in illustration.

- Thickness of sealant bead: Approx. 1.2 mm
- Distance of sealant bead to camshaft bearings at specified locations -1- to -8-: at least 5 mm
- In addition, sealing surfaces around spark plug holes obtain a sealant ring each, -9- to -11-

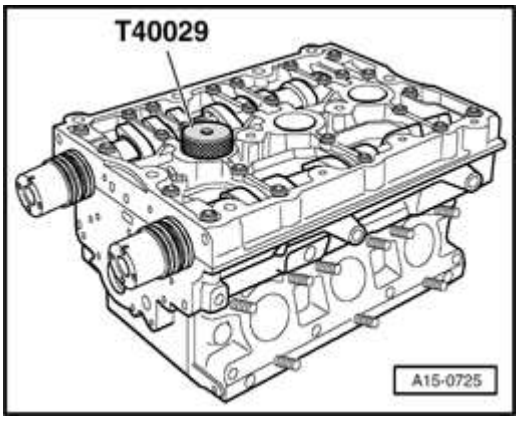


Fig. 303: Setting Guide Frame In Place And Align Using T40029 Locating Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Immediately set guide frame in place and align using T40029 locating pin.

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NOTE:

- **Setting in place and tightening the guide frame should occur without interruptions since the sealant starts to harden immediately.**
- **After installing guide frame, allow sealant to dry for approx. 30 minutes.**

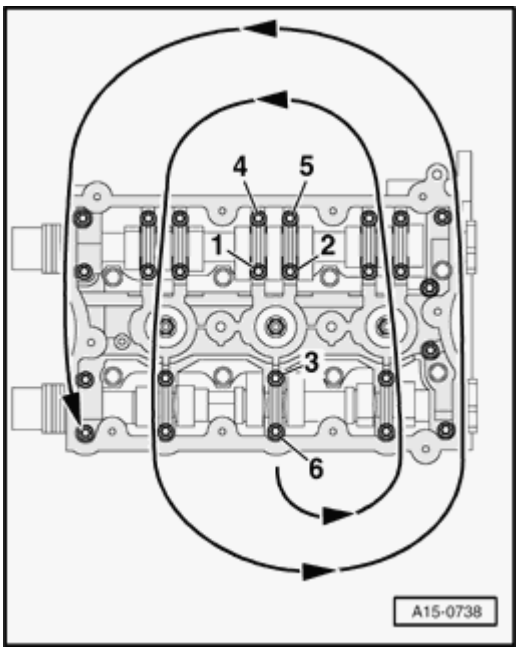


Fig. 304: Tightening Bolts Of Guide Frame In Sequence Of Numbers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten bolts of guide frame in sequence of numbers and follow arrows uniformly by hand.
- Guide frame must make full contact with cylinder head surface
- Tighten bolts of guide frame to final tightening torque (10 Nm).

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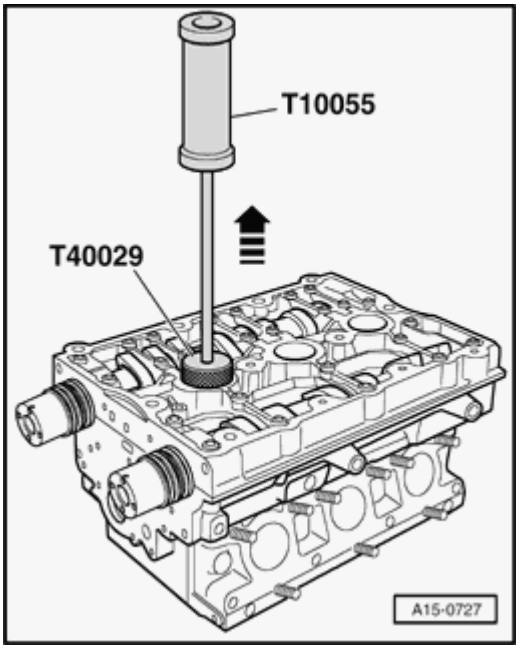


Fig. 305: Using T10055 Extractor To Remove T40029 Locating Pin From Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using T10055 extractor, remove T40029 locating pin from cylinder head.

Left cylinder head

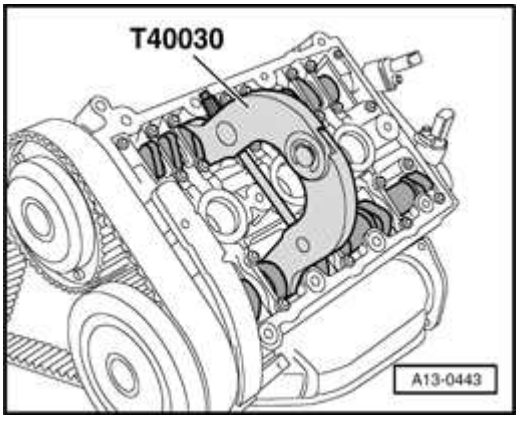


Fig. 306: Inserting T40030 Camshaft Adjuster Gauge At Left Cylinder Head In Same Manner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert T40030 camshaft adjuster gauge at camshafts.
- Spread T40030 camshaft adjuster gauge with threaded shaft (tightening torque 10 Nm) until it is seated without axial play.

Right cylinder head

- Install camshaft gear of exhaust camshaft.

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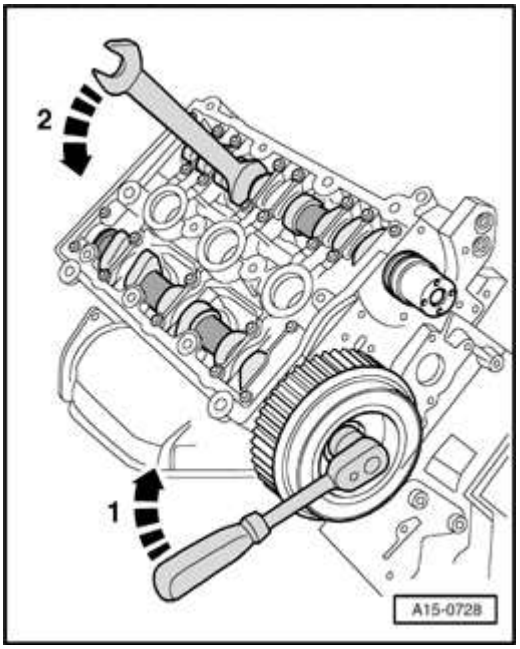


Fig. 307: Turning Exhaust Camshaft And Intake Camshaft 30°
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn exhaust camshaft (arrow -1-) and intake camshaft (arrow -2-) 30° in direction of arrow at same time...

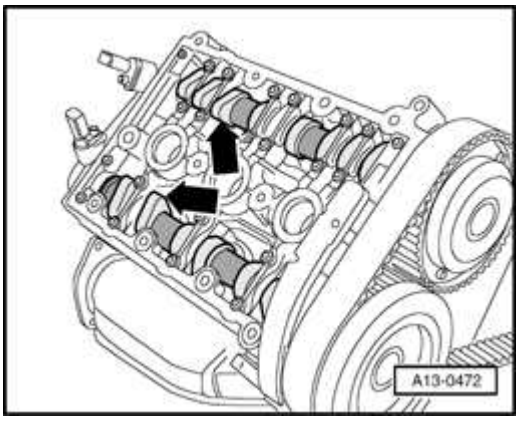


Fig. 308: Turning Engine Until Cams At Intake And Exhaust Camshaft Of Cylinder 3 (Right Cylinder Bank) Point Upward Uniformly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ..until cams (arrows) of cylinder 3 at intake and exhaust camshafts are as shown in illustration.

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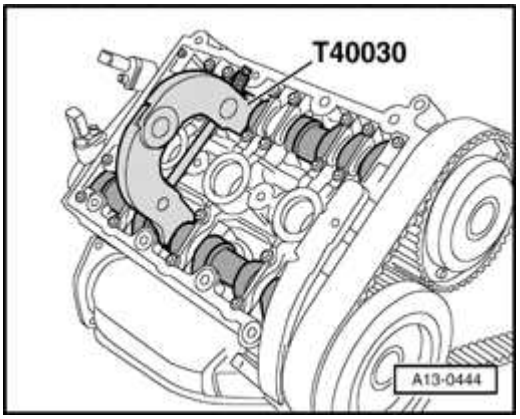


Fig. 309: Inserting T40030 Camshaft Adjuster Gauge At Camshafts Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert T40030 camshaft adjuster gauge at camshafts.
- Remove exhaust camshaft gear again.

All

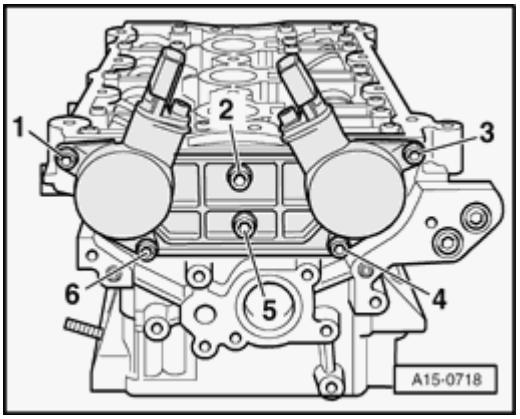


Fig. 310: Installing Camshaft Position (CMP) Sensor Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install Camshaft Position (CMP) sensor housing and tighten bolts -1- to -6-.

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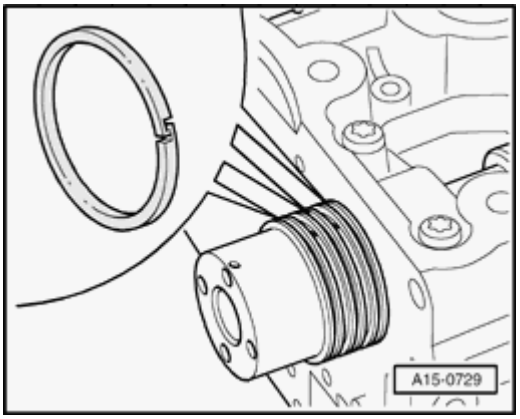


Fig. 311: Checking Whether Piston Rings At Camshafts Are Installed
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check whether piston rings at camshafts are installed and whether piston ring ends are engaged with each other.

NOTE: If ends of installed piston are not of the locking type (cannot be locked together):

- Always orient the rings so that the gaps (of all three rings) are at the top of the camshaft prior to installation of the camshaft adjustment housing.

With all ring gaps aligned at the top of camshaft:

- Install camshaft adjustment housing using a gentle side to side motion (do not rock top to bottom).

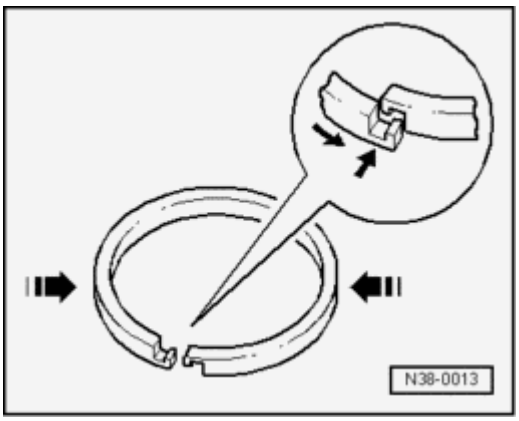


Fig. 312: Hooking Ends Of Piston Ring Together
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If necessary, engage ends of installed piston rings (arrows), as depicted in illustration.

NOTE:

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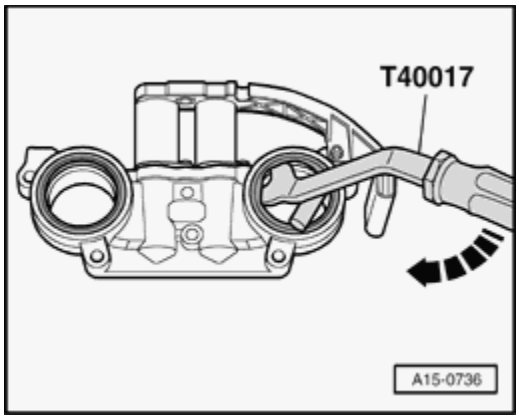


Fig. 313: Installing Camshaft Sealing Rings Using T40017 Lever
Courtesy of VOLKSWAGEN UNITED STATES, INC.

If the camshaft sealing rings are being replaced, they must be removed from camshaft adjustment housing before installation, using T40017 lever. Installing camshaft sealing rings. Refer to Camshaft oil seals, replacing.

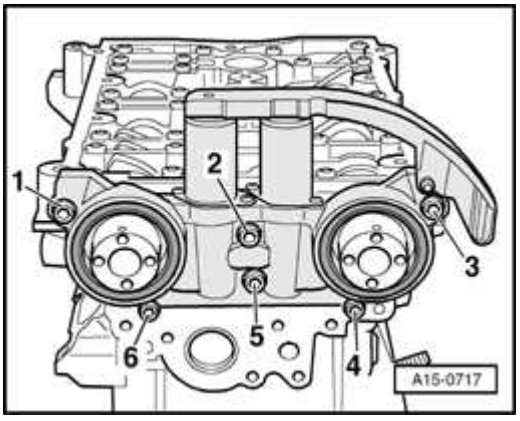


Fig. 314: Unscrewing Bolts And Removing Housing For Camshaft Adjustment Valves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install camshaft adjustment housing and tighten bolts -1- to -6-.

Installation is reverse of removal, noting the following:

- Install combination valve for Secondary Air Injection. Refer to **Left combination valve for secondary air injection, removing and installing**or **Right combination valve for secondary air injection, removing and installing**.
- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.

NOTE:

- **After installing camshafts, do not start engine for at least 30 minutes. The hydraulic valve lifters have to settle (otherwise valves will strike the**

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pistons).

- **After working on the valvetrain, carefully rotate engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when starting.**

Tightening torques

Component	Nm
Guide frame to cylinder head	10
Housing for Camshaft Position (CMP) sensor to cylinder head	10
Housing for camshaft adjustment valve to cylinder head	10
Rear toothed belt guard to cylinder head or cylinder block	10 1)

1) Replace bolts.

Hydraulic valve lifters, checking

Special tools and equipment

- Feeler gauge
- Wooden or plastic wedge

NOTE:

- **Hydraulic valve lifters cannot be serviced.**
- **Irregular valve noise when starting engine is normal.**

Work sequence

- Start engine and let run until coolant temperature reaches at least 80°C.
- Increase RPM to 2500 for approx. 2 minutes, if necessary road test vehicle.

NOTE: **If unusual valve noises disappear but then reappear during drive, replace oil retaining valve. Oil retaining valve, component location: Below cover at intake manifold. Refer to Oil check valves and spray jet valve, overview.**

If hydraulic valve lifters are still loud, locate faulty valve lifter as follows:

- Remove cylinder head cover. Refer to **Left cylinder head cover, removing and installing** or **Right cylinder head cover, removing and installing**.

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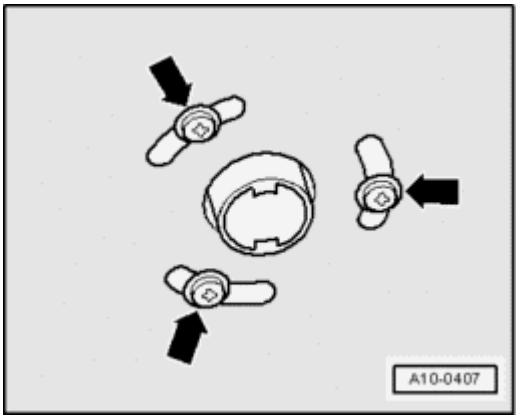


Fig. 315: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

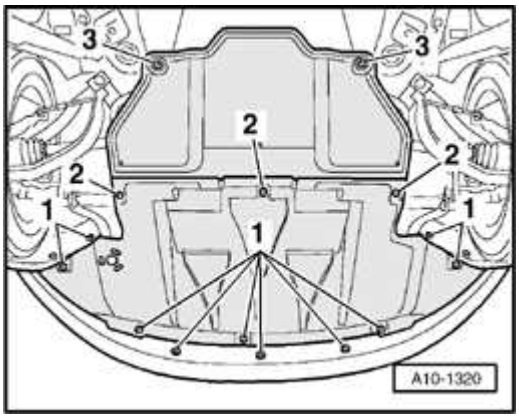


Fig. 316: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.

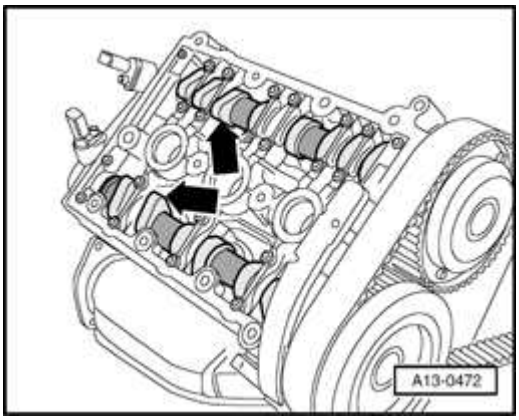


Fig. 317: Turning Engine Until Cams At Intake And Exhaust Camshaft Of Cylinder 3 (Right Cylinder

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Bank) Point Upward Uniformly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn crankshaft at center bolt of toothed belt gear clockwise until cams of cylinder to be checked point upward (arrows).
- Determine play between cams and valve lifters.

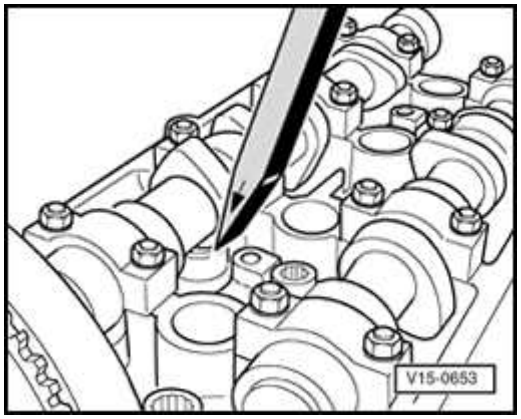


Fig. 318: Pressing Valve Lifter Downward Using Wedge
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press valve lifter downward using wooden or plastic wedge. If 0.20 mm feeler gauge can be inserted between camshaft and valve lifter, replace valve lifter. Valve lifters, replacing. Refer to **Camshafts and camshaft adjusters, removing and installing**.

NOTE:

- **After installing camshaft, do not start engine for at least 30 minutes. The hydraulic valve lifters have to settle (otherwise valves will strike the pistons).**
- **After working on the valvetrain, carefully rotate engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when starting.**

Valve stem oil seals, replacing

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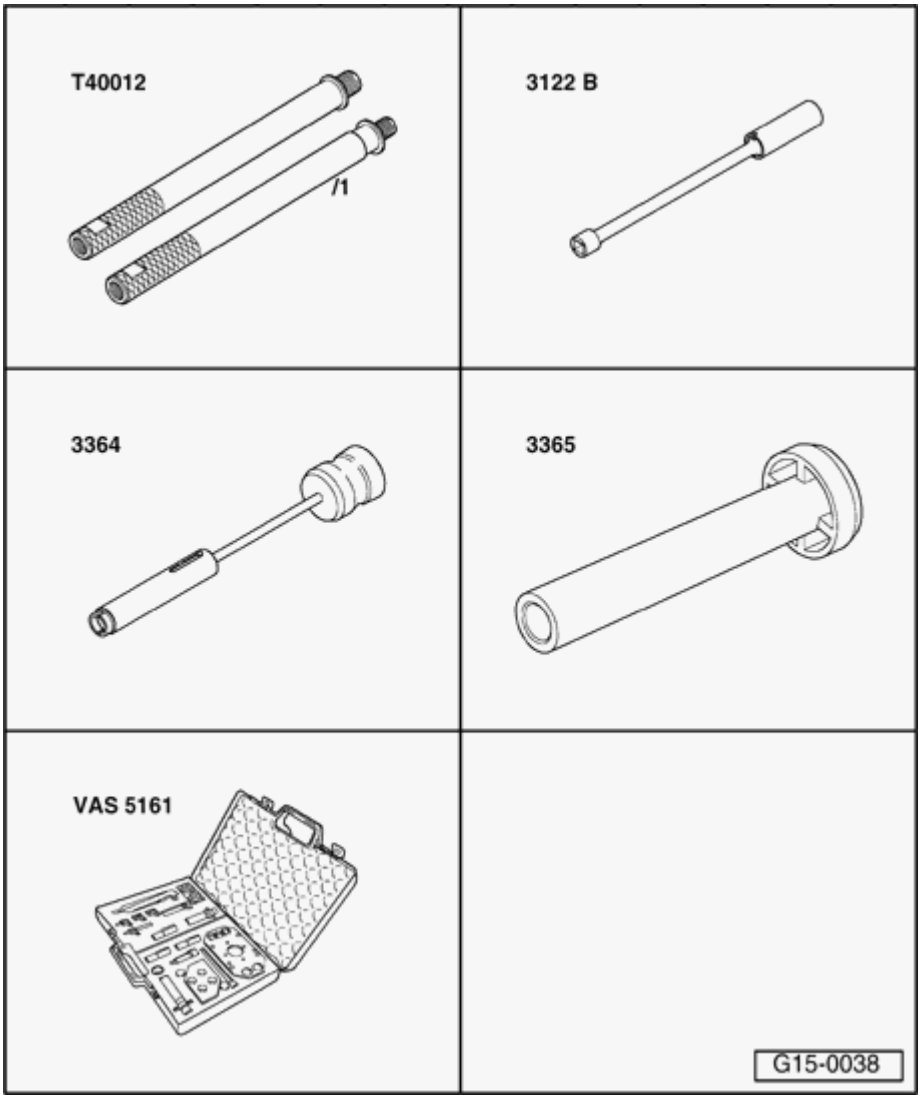


Fig. 319: Identifying Special Tools - Valve Stem Oil Seals, Replacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- Adapter T40012
- 3122B Spark plug removal tool
- 3364 Valve Seat Tool
- 3365 Valve Stem Seat Fitting Tool
- VAS 5161 Removal and installation device

Removing

- Cylinder head installed

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- Remove camshafts. Refer to **Camshafts and camshaft adjusters, removing and installing**.

NOTE:

- **Be careful not to switch valve lifters.**
- **Mark allocation of the valve lifters on back side using a waterproof felt-tip marker.**

- Remove valve lifters from guides and place aside with contact surface facing down.
- Using 3122B spark plug removal tool, remove spark plugs.
- Adjust piston of respective cylinder to BDC.

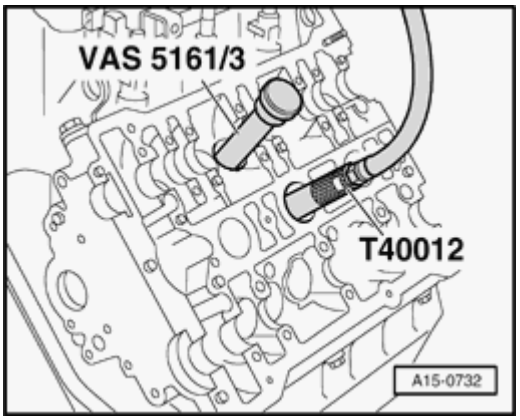


Fig. 320: Threading T40012 Adapter Into Spark Plug Thread
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread T40012 adapter into spark plug thread and apply constant pressure; at least 6 bar positive pressure.
- Insert VAS5161/3 drift into valve lifter guide.
- Loosen by hitting all stuck valve keys at all five valves using a plastic hammer.

Intake side

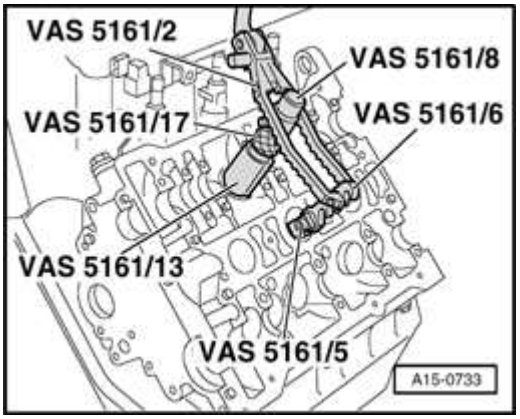


Fig. 321: Removing/Installing VAS5161/6, VAS5161/5 In Threaded Hole At Cylinder Head (Intake Side)

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread VAS5161/6 engaging device with VAS5161/5 engaging fork into one threaded hole at cylinder head.
- At valve to be removed, slide VAS5161/13 guide bushing into valve lifter guide up to stop.

- Installed position: Hatched areas point horizontally to direction of travel

- Slide VAS5161/17 knurled spacer ring onto VAS5161/8 installation cartridge.
- Slide installation cartridge into guide bushing.
- Hook in VAS5161/2 pressure fork at VAS 5161/6 engaging device and press installation cartridge downward.
- At same time, turn knurled bolt of installation cartridge toward right, until points engage in valve keys.

- Lightly move knurled bolt back and forth, this causes valve keys to be pressed apart and captured in cartridge.

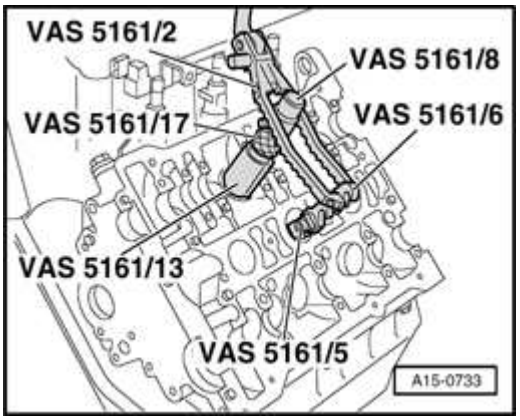


Fig. 322: Removing/Installing VAS5161/6, VAS5161/5 In Threaded Hole At Cylinder Head (Intake Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release pressure fork.
- Remove installation cartridge with spacer ring, guide bushing, valve plate and valve spring.

Exhaust side

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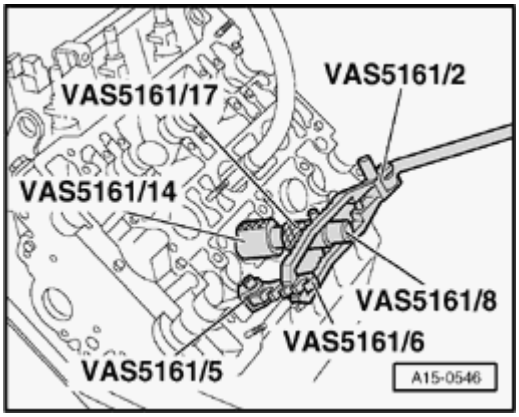


Fig. 323: Removing/Installing VAS5161/6, VAS5161/5 In Threaded Hole At Cylinder Head (Exhaust Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread VAS5161/6 engaging device with VAS5161/5 engaging fork into one threaded hole at cylinder head.
- At valve to be removed, slide VAS5161/14 guide bushing into valve lifter guide up to stop.

- Installed position: Hatched areas point horizontally to direction of travel

- Slide VAS5161/17 knurled spacer ring onto VAS5161/8 installation cartridge.
- Slide installation cartridge into guide bushing.
- Hook in VAS5161/2 pressure fork at VAS 5161/6 engaging device and press installation cartridge downward.
- At same time, turn knurled bolt of installation cartridge toward right, until points engage in valve keys.

- Lightly move knurled bolt back and forth, this causes valve keys to be pressed apart and captured in cartridge.
- Release pressure fork.
- Remove installation cartridge with spacer ring, guide bushing, valve plate and valve spring.

All

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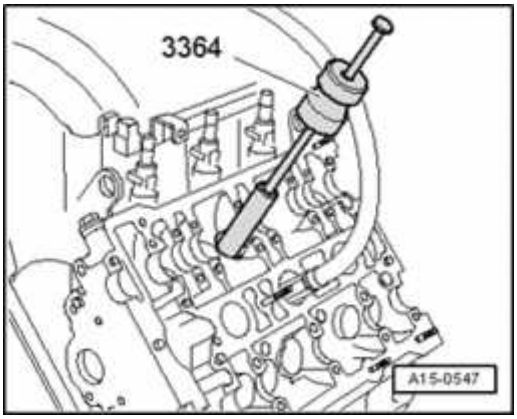


Fig. 324: Removing Valve Stem Oil Seals Using 3364 Valve Seat Tool
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove valve stem oil seals using 3364 valve seat tool.

If due to limited space 3364 valve stem removal tool cannot be used at some valve stem oil seals, continue as follows:

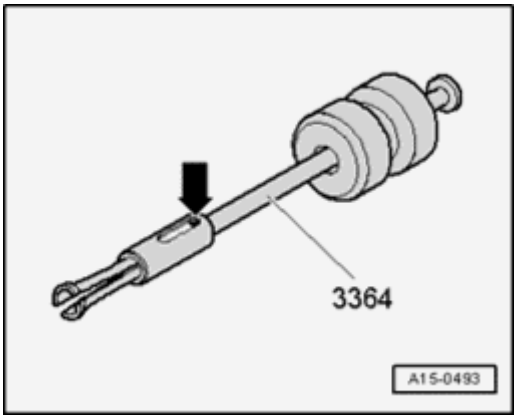


Fig. 325: Identifying Valve Seal Removal Tool 3364
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive out spring dowel sleeve (arrow) at 3364 valve stem removal tool using a drift and remove impact extractor device.

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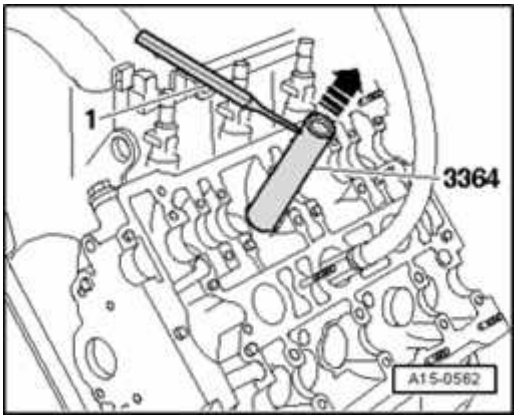


Fig. 326: Positioning Lower Part Of 3364 Valve Stem Removal Tool At Valve Stem Oil Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position lower part of 3364 valve stem removal tool at valve stem oil seal.
- Secure 3364 valve stem removal tool using a drift or cotter pin driver -1- as shown in illustration.
- Position a lever at 3364 valve stem removal tool and remove valve stem oil seal (arrow).

Installing

NOTE: A plastic sleeve -A- supplements the new valve shaft seals.

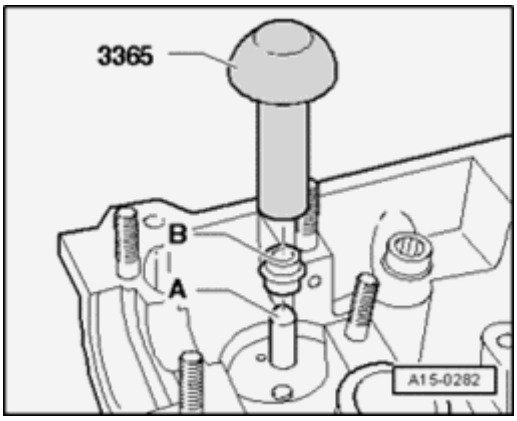


Fig. 327: Identifying Plastic Sleeve, Valve Stem Oil Seal & Valve Stem Seal Driver 3365
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place plastic sleeve -A- on valve stem to prevent damage to new valve stem oil seals -B-.
- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using 3365 valve stem seal driver.
- Remove plastic sleeve.

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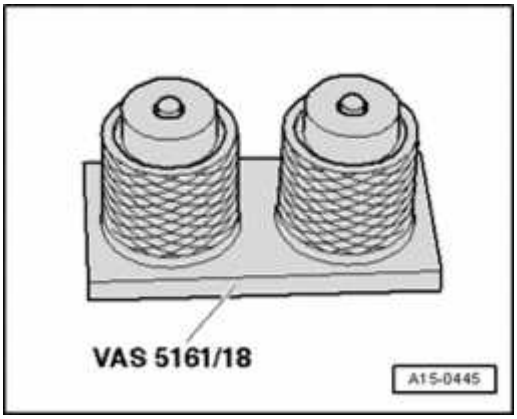


Fig. 328: Identifying Installation Cartridge VAS 5161/8
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If valve keepers were removed from installation cartridge, they must be inserted into VAS5161/18 insertion device next.

NOTE: The large diameter of the valve keepers points upward.

- Press VAS5161/8 installation cartridge onto insertion device from top and take up valve keepers.

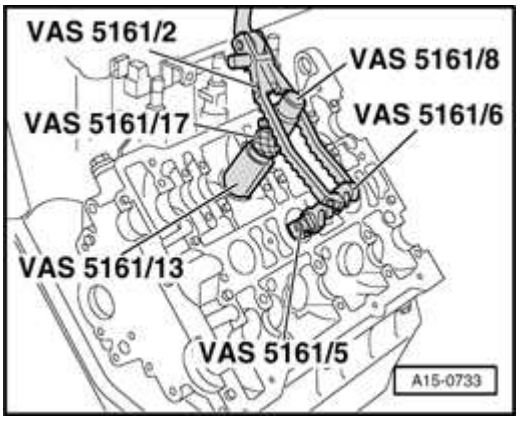


Fig. 329: Removing/Installing VAS5161/6, VAS5161/5 In Threaded Hole At Cylinder Head (Intake Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set VAS5161/8 installation cartridge into VAS5161/13 guide sleeve or VAS5161/14.
- Press down pressure fork and pull knurled bolt upward while turning left and right - valve keepers are inserted in this manner.
- Release pressure fork with the knurled bolt still pulled.
- Insert valve lifters.

- Install camshafts. Refer to **Installing**.

NOTE:

- **After installing camshafts, do not start engine for at least 30 minutes. The**

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hydraulic valve lifters have to settle (otherwise valves will strike the pistons).

- **After working on the valvetrain, carefully rotate engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when starting.**

Valve guides, checking

Special tools and equipment

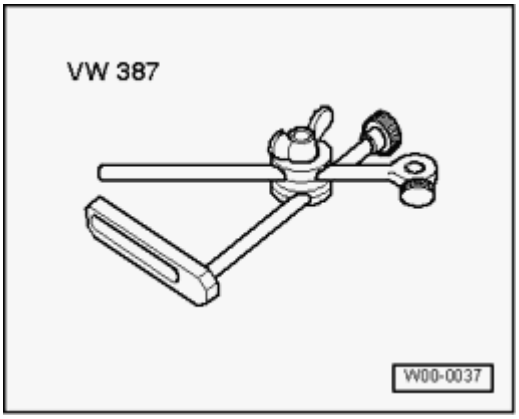


Fig. 330: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VW387 Dial gauge holder
- Dial gauge

Work sequence

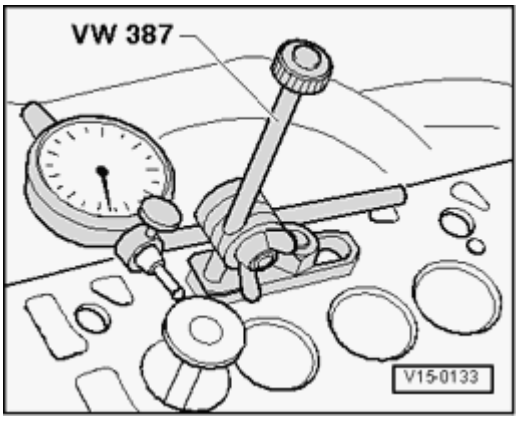


Fig. 331: Identifying Special Tool - VW 387 Installed
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert valve into guide. Valve stem tip must seal with guide. Due to differences in valve stem diameter, make sure that only intake valves are used to check intake guides, and only exhaust valves are used to

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check exhaust guides.

- Measure side play.

Wear limit

1024 Intake valve guide	1024 Exhaust valve guide
0.80 mm	0.80 mm

NOTE:

- **If wear limit is exceeded, re-measure using new valves. If wear limit is still exceeded, replace cylinder head. Valve guides cannot be replaced.**
- **If valve is to be replaced during repair, use a new valve for measurement.**

Valves, checking

- Visual check for signs of wear at stem and at seating surface. Replace valves in case of significant signs of wear.

Valve seats, refacing

NOTE: **If a perfect contact pattern is not created after hand-lapping valve seats, reface valve seats.**

Special tools and equipment

- Depth gauge
- Valve seat refacing tool

NOTE:

- **When servicing engines with leaking valves, refacing or replacing valve seats and valves is not sufficient. It is particularly important to check valve guides for wear on engines with higher running performance. Refer to Valve guides, checking.**
- **Only reface valve seats enough until a perfect contact pattern is obtained.**
- **Before refacing, determine maximum refacing dimension.**
- **If refaced dimension is exceeded, hydraulic valve lifter function is no longer guaranteed and cylinder head must be replaced.**

Determining maximum allowable refacing dimension

- Insert valve and press tightly against valve seat.

NOTE: **If valve is replaced during repair, use new valve for measurement.**

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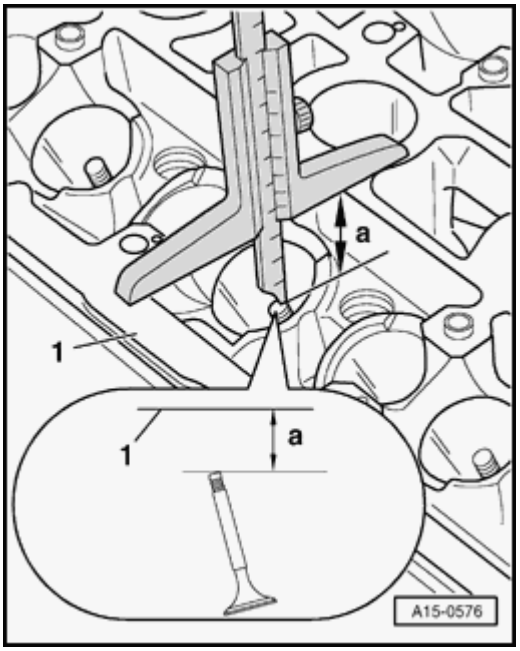


Fig. 332: Measuring Distance Between Valve Stem End (Upper Edge) And Top Surface Of Cylinder Head Using Depth Gauge
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure distance -a- between valve stem end (upper edge) and upper cylinder head surface using a depth gauge.
- Determine maximum allowable refacing dimension using distance measured and minimum dimension.

Minimum dimensions		
Outer intake valves	Center intake valve	Exhaust valves
31.0 mm	32.2 mm	31.9 mm

Measured distance minus minimum dimension = max. permissible refaced dimension.

Example for outer intake valve:		
	Distance measured	31.4 mm
-	Minimum dimension	- 31.0 mm
=	Maximum allowable refaced dimension	= 0.4 mm

NOTE: If the maximum allowed refaced dimension is 0 mm or less than 0 mm, repeat measurement using new valve. If measurement result is still 0 mm or less than 0 mm, replace cylinder head.

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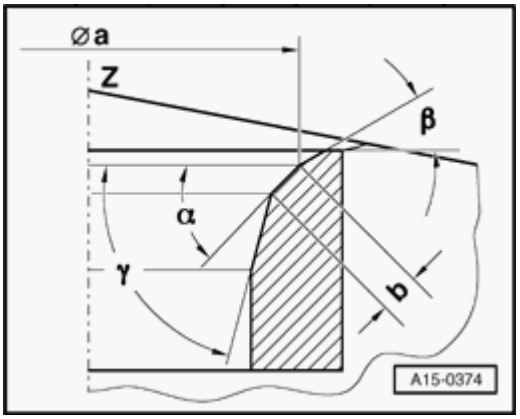


Fig. 333: Valve Seats, Refacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Valve seats, refacing

Dimension		Intake valve seat
Dia.a	mm	26.2
b	mm	1.5 to 1.8
Z		Lower edge of cylinder head
a	45°	Valve seat angle
ß	30°	Upper correction angle
gamma	60°	Lower correction angle

Dimension		Exhaust valve seat
Dia.a	mm	29.0
b	mm	1.8
Z		Lower edge of cylinder head
a	45°	Valve seat angle
ß	30°	Upper correction angle
gamma	60°	Lower correction angle

CAMSHAFT ADJUSTMENT, CHECKING

Camshaft adjustment, checking

The Engine Control Module (ECM) can adapt the instantaneous load- and RPM situation by adjusting the timing.

To do so, the total of four valves for camshaft adjustment allow more or less oil pressure to impact the mechanical adjustment mechanism.

While the exhaust camshafts only have control over a single stage adjustment, intake camshafts can be adjusted variably.

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System test, initiating

Special tools and equipment

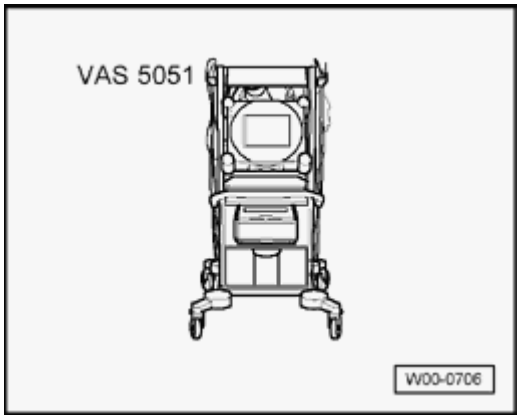


Fig. 334: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 Vehicle diagnosis, testing and information system with VAG5051/1 Adapter

WARNING:

- **Test equipment must always be secured to the rear seat and operated from there by a second person.**
- **If test and measuring equipment is operated from the passenger seat, the person seated there could be injured in the event of an accident involving deployment of the passenger-side airbag.**

Requirements

- VAS5051 tester connected and vehicle On Board Diagnostic (OBD) -01 Engine electronics- selected.
- Coolant Temperature at least 80°C.
- Vehicles with automatic transmission selector lever in P or N.

Work sequence

- Start engine, and let run at idle.

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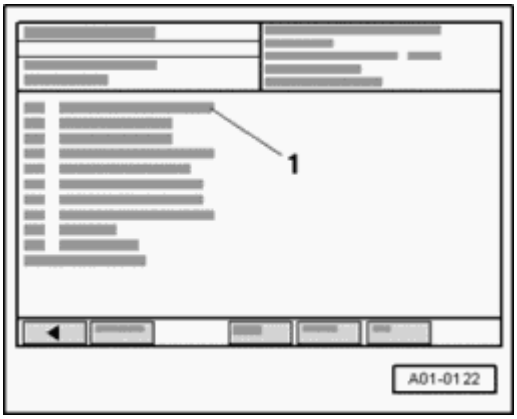


Fig. 335: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- In selection -1-, click on the diagnostic function "04 - Basic setting".



Fig. 336: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

max. input value = 255

- Select function "094" in button field -2- for "display group number 094" and press Q button to confirm input.

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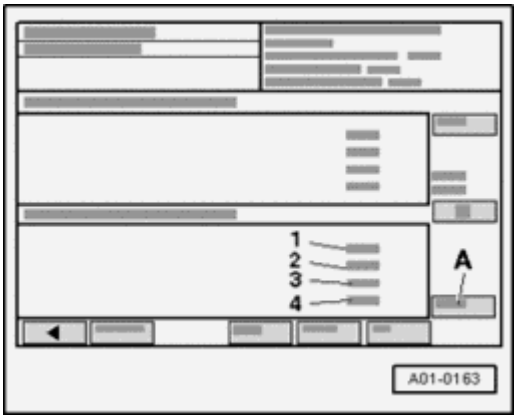


Fig. 337: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing button A.
- Depress accelerator pedal and brake pedal at same time; engine speed increases to approx. 1900 RPM.

Requirement

- Accelerator pedal and brake pedal depressed at same time, engine runs at approx. 1900 RPM.

- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 094: Camshaft adjustment (intake)				
Display	xxxx/min	---	---	---
Indicated	Engine speed (RPM)	Camshaft adjustment	**Diagnostic condition**	**Diagnostic condition**
Functional range			**Test OFF Test ON System OK System not OK**	**Test OFF Test ON System OK System not OK**
Specified value	1900 RPM	°Crankshaft rotation	**System OK**	**System OK**
Note			If "System not OK" is displayed: Check camshaft adjustment (intake). Refer to **Camshaft adjustment (intake), checking**	

- Click on <-- button

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Fig. 338: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

max. input value = 255

- Select function "096" in button field -2- for "display group number 096" and press Q button to confirm input.

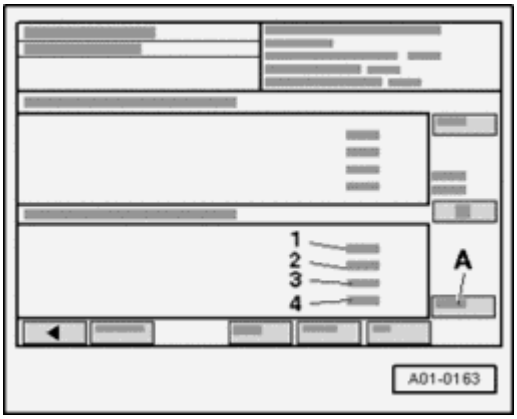


Fig. 339: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Indicated on display of VAS 5051:

- Activate basic setting by pressing button -A-.
- Depress accelerator pedal and brake pedal at same time, engine speed increases to approx. 1900 RPM.

Requirement

- Accelerator pedal and brake pedal depressed at the same time, engine runs at approx. 1900 RPM.

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- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 096: Valve for camshaft adjustment (exhaust)				
Display	xxxx/min	---	---	---
Display	Engine speed	Camshaft adjustment	**Diagnostic condition**	**Diagnostic condition**
Functional range		Off On	**Test OFF** **Test ON** **System OK** **System not OK**	**Test OFF** **Test ON** **System OK** **System not OK**
Specification	1900 RPM	On	**System OK**	**System OK**
Note			If "System not OK" is displayed: Check camshaft adjustment (exhaust). Refer to **Camshaft adjustment (exhaust), checking**	

- Click on <-- button.
- Switch over to Read measured value block.

Camshaft adjustment (exhaust), checking



Fig. 340: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Indicated on display of VAS 5051:

1 - Enter display group:

max. input value = 255

- Select function "090" in button field -2- for "display group number 090" and press Q button to confirm input.

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Fig. 341: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Indicated on display of VAS 5051:

Requirement

- Engine running at idle.

  - Check specified values in display fields -2-, -3- and -4-.

	Display fields			
	1	2	3	4
Display group 090: Camshaft adjustment (exhaust)				
Display	xxxx/min	**---**	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	**Camshaft adjustment**	**Adjustment bank 1**	**Adjustment bank 2**
Specification	Idle	**off**	**-3 to 3**	**-3 to 3**

  - Perform a road test.
  - Accelerate vehicle in 3rd gear at wide open throttle from 2000 RPM.
  - Check specified values in display fields -2-, -3- and -4-.

	Display fields			
	1	2	3	4
Display group 090: Camshaft adjustment (exhaust)				
Display	xxxx/min	**---**	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	**Camshaft adjustment**	**Adjustment bank 1**	**Adjustment bank 2**
Specification		**on**	**19 to 25**	**19 to 25**

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Note			If specified value is not obtained: Check respective valve for camshaft adjustment (exhaust). Refer to **Solenoid valve for camshaft adjustment, checking**

NOTE: If display field indicates a value between 3.0° crankshaft rotation and 19.0° crankshaft rotation during a road test, the electrical valve for camshaft adjustment is correctly switching the oil pressure to mechanical camshaft adjuster, but the mechanical camshaft adjuster cannot reach its end position (e.g. due to difficulty of movement).

Camshaft adjustment (intake), checking



Fig. 342: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Indicated on display of VAS 5051:

- Press s button to change into display group 091.

Requirement

- Engine running at idle.
- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 091: Camshaft adjustment (intake), Bank 1				
Display	xxxx/min	%	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	Duty cycle	**Specified adjustment**	**Current adjustment**
Specification	Idle	15 to 17	**-3 to 3**	**-3 to 3**

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- Perform a road test.
- Accelerate vehicle in 3rd gear at wide open throttle from 2000 RPM.
- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 091: Camshaft adjustment (intake), Bank 1				
Display	xxxx/min	%	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	Duty cycle	**Specified adjustment**	**Current adjustment**
Specification		60 to 100	**39 to 45**	**39 to 45**
Note			If specified value is not obtained: Check valve for camshaft adjustment (intake) bank 1. Refer to **Solenoid valve for camshaft adjustment, checking**	

NOTE: If display field only indicates a value between 3.0°crankshaft rotation and 39.0° crankshaft rotation during a road test, the electrical valve for camshaft adjustment is correctly switching the oil pressure to mechanical camshaft adjuster, but the mechanical camshaft adjuster cannot reach its end position (e.g. due to difficulty of movement).



Fig. 343: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Indicated on display of VAS 5051:

- Press s button to change into display group 092.

Requirement

- Engine running at idle.

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- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 092: Camshaft adjustment (intake), bank 2				
Display	xxxx/min	%	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	Duty cycle	**Specified adjustment**	**Current adjustment**
Specification	Idle	15 to 17	**-3 to 3**	**-3 to 3**

- Perform a road test.
- Accelerate vehicle in 3rd gear at wide open throttle from 2000 RPM.
- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 092: Camshaft adjustment (intake), bank 2				
Display	xxxx/min	%	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	Duty cycle	**Specified adjustment**	**Current adjustment**
Specification		60 to 100	**39 to 45**	**39 to 45**
Note			If specified value is not obtained: Check valve for camshaft adjustment (intake) bank 2. Refer to **Solenoid valve for camshaft adjustment, checking**	

NOTE: If display field only indicates a value between 3.0° crankshaft rotation and 39.0° crankshaft rotation during a road test, the electrical valve for camshaft adjustment is correctly switching the oil pressure to mechanical camshaft adjuster, but the mechanical camshaft adjuster cannot reach its end position (e.g. due to difficulty of movement).

Solenoid valve for camshaft adjustment, checking

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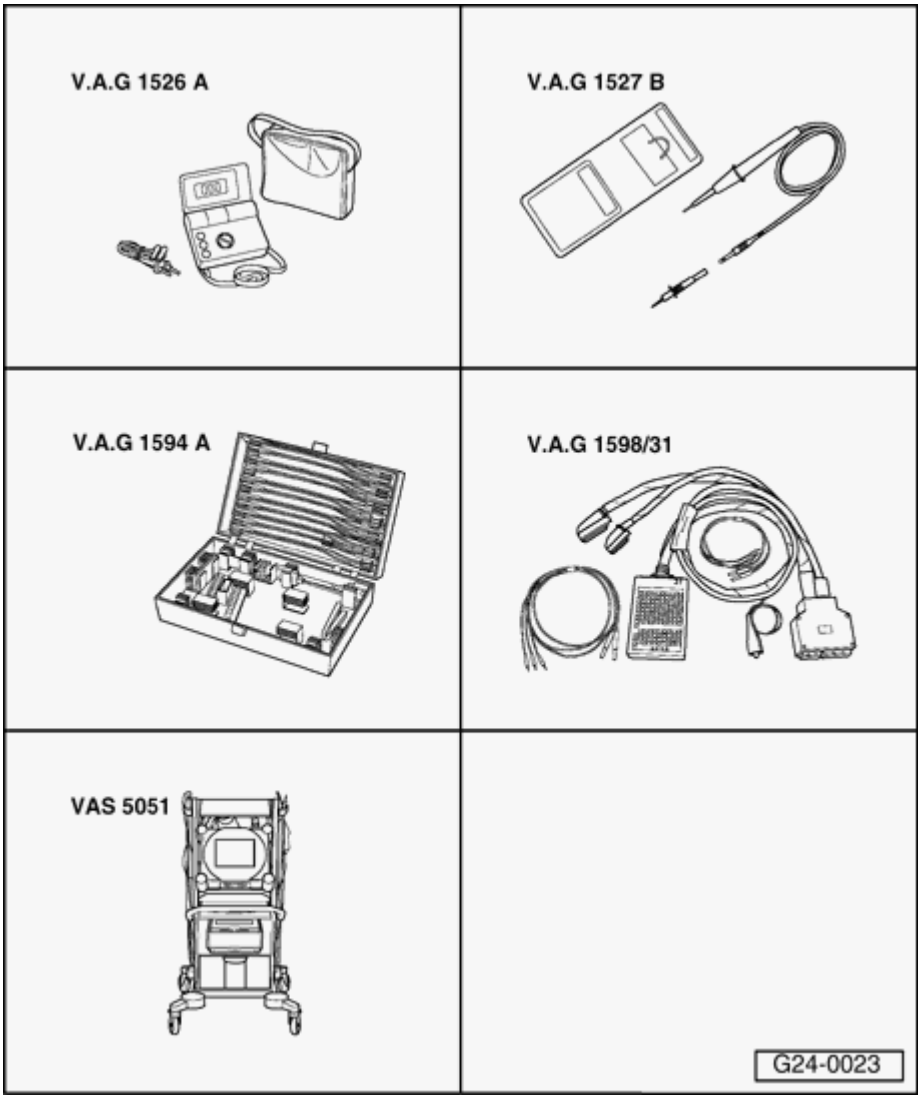


Fig. 344: Identifying Special Tools - Solenoid Valve For Camshaft Adjustment, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG 1526 A Multimeter
- VAG 1527 B Voltage tester
- VAG 1594 A Connector test kit
- VAG 1598/31 Test box
- VAS 5051 Vehicle diagnosis, testing and information system with VAS 5051/1 Adapter

Requirement

- VAS5051 tester connected and vehicle On Board Diagnostic (OBD) -01 Engine electronics- selected.

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Valves for camshaft adjustment (intake), activating

- Initiate output Diagnostic Test Mode (DTM) and activate valve for camshaft adjustment bank 1:

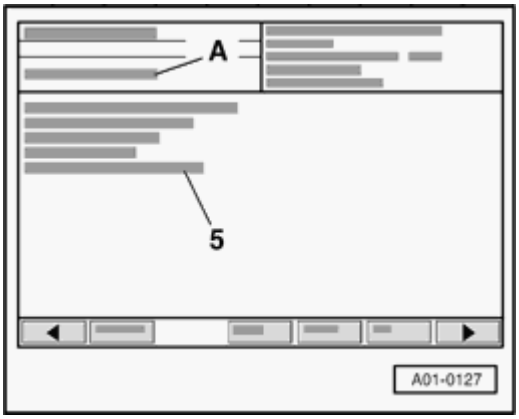


Fig. 345: Display On VAS 5051 - (4th Control Element In Test & Charge Pressure Control Valve -N75)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Actuator test is waiting Advancing by switching required

5 - Bank 1, camshaft adjustment. Refer to -N205-

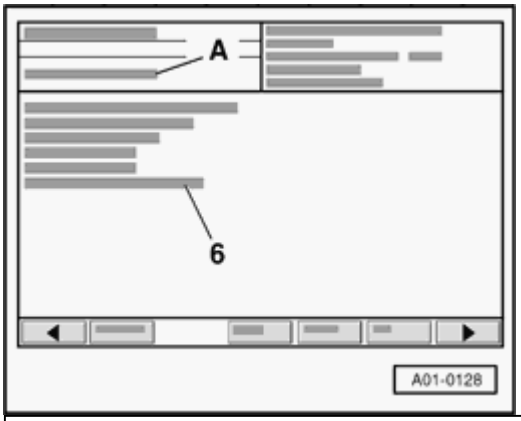
- Click on delta button

Display on VAS5051:

A - Actuator test is running Advancing by switching allowed

- This valve is activated for approx. 1 minute (clicks), unless delta button is pressed first to switch to the next actuator.

- Click on delta button



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Fig. 346: Display On VAS 5051 - (Actuator In Test & Leak Detection Pump Tank Ventilation System)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Actuator test is waiting Advancing by switching required

6 - Bank 2, camshaft adjustment. Refer to -N208-

- Click on delta button

Display on VAS5051:

A - Actuator test is running Advancing by switching allowed

- This valve is activated for approx. 1 minute (clicks), unless delta button is pressed first to switch to the next actuator.

- End function "03 - output Diagnostic Test Mode (DTM)" by pressing <-- button.

If one of the valves is not being activated (does not click).

- Switch ignition off.
- Perform an electrical test for valves for camshaft adjustment. Refer to **Electrical test of solenoid valve for camshaft adjustment**.

Valves for camshaft adjustment (exhaust), activating

- Initiate output Diagnostic Test Mode (DTM) and activate valve for camshaft adjustment (exhaust) bank 1:

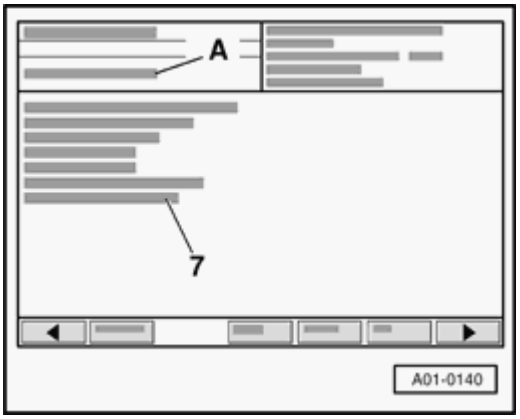


Fig. 347: Display On VAS 5051 - (7th Control Element In Test & Recirculating Valve For Turbocharger - N249-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

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A - Actuator test is waiting Advancing by switching required

7 - Bank 1, valve for camshaft adjustment (exhaust)

- Click on delta button

Display on VAS5051:

A - Actuator test is running Advancing by switching allowed

- This valve is activated for approx. 1 minute (clicks), unless delta button is pressed first to switch to the next actuator.

- Click on delta button

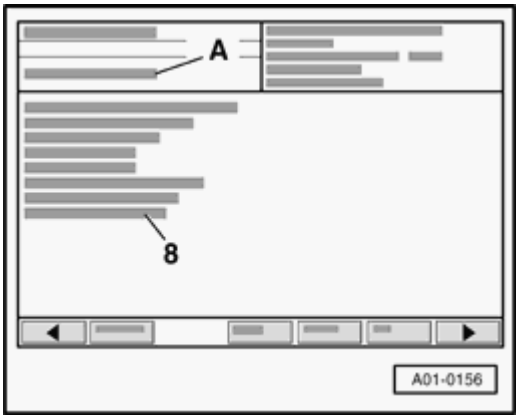


Fig. 348: Display On VAS 5051 - (Activation Of Brake System Vacuum Pump)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Actuator test is waiting Advancing by switching required

8 - Bank 2, valve for camshaft adjustment (exhaust)

- Click on delta button

Display on VAS5051:

A - Actuator test is running Advancing by switching allowed

- This valve is activated for approx. 1 minute (clicks), unless delta button is pressed first to switch to the next actuator.

- End function "03 - output Diagnostic Test Mode (DTM)" by pressing <-- button.

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If one of the valves is not being activated (does not click).

- Switch ignition off.
- Perform an electrical test for valves for camshaft adjustment. Refer to **Electrical test of solenoid valve for camshaft adjustment**.

Electrical test of solenoid valve for camshaft adjustment

Cylinder bank 2 (left):

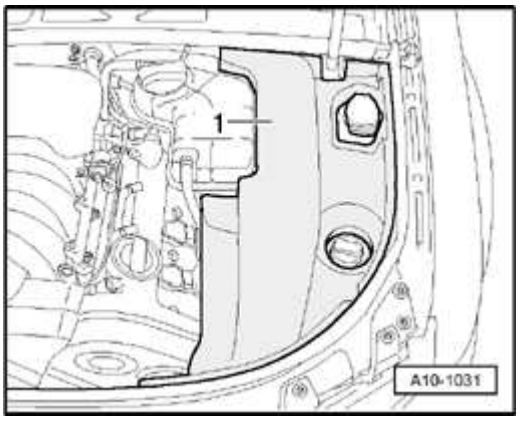


Fig. 349: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

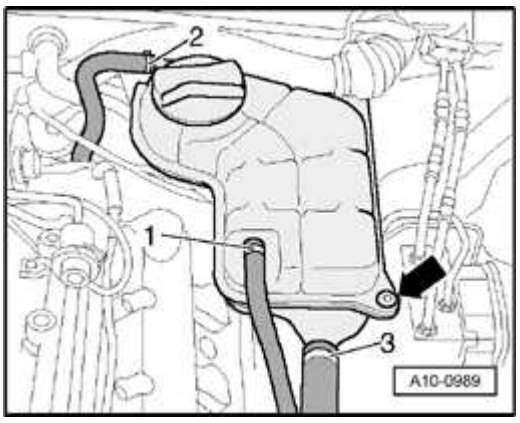


Fig. 350: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Remove line from Engine Coolant Level (ECL) warning switch -F66- and lay coolant reservoir to side.

NOTE: Coolant hoses 1 to 3 remain connected.

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Cylinder bank 1 (right)

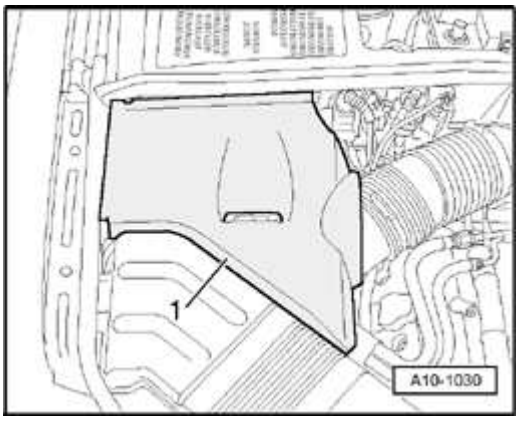


Fig. 351: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

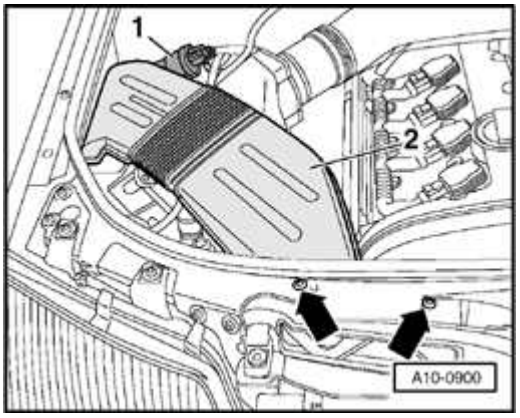


Fig. 352: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

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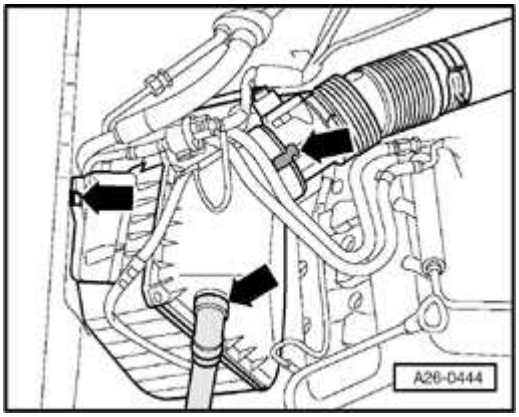


Fig. 353: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).

Continuation for both cylinder banks

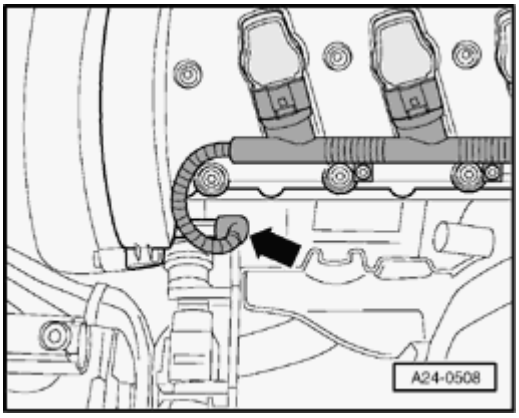


Fig. 354: Disconnecting Harness Connector From Connector Adapter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect harness connector (arrow) from connector adapter.

NOTE: Illustration depicts cylinder bank 2 (left).

Checking internal resistance

Valve for camshaft adjustment (intake)

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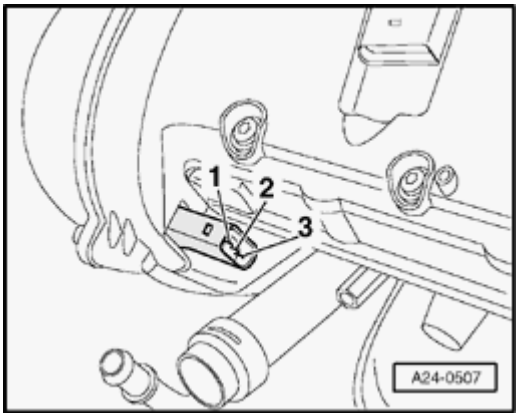


Fig. 355: Connecting Multimeter Between Terminals 1 And 2 For Resistance Measurement
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 1 and 2 for resistance measurement.
- Specification: 7.4 to 8.2 ohms

Valve for camshaft adjustment (exhaust)

- Connect multimeter between terminal 2 and 3 for resistance measurement.
- Specification: 12.8 to 14.2 ohms

All

If specified value is not obtained:

- Replace valve.

If specified value is obtained:

Checking voltage supply

Requirement

- Fuse for valves for camshaft adjustment OK.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

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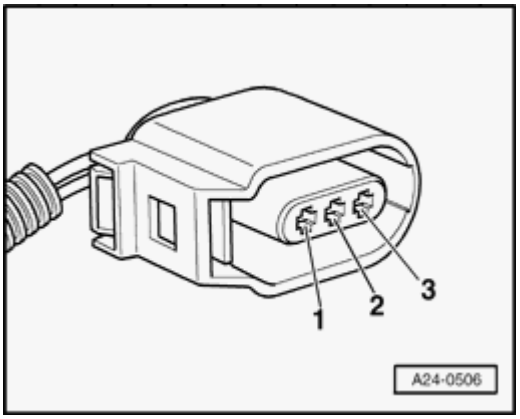


Fig. 356: Identifying Harness Connector & 3 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
2	Engine Ground (GND)

- Switch ignition on.
- LED must light up

If LED does not light up:

- Check wire connection from terminal 2 of connector via fuse to Motronic Engine Control Module (ECM) power supply relay -J271- for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Repair open circuit if necessary.

If LED lights up:

Checking activation

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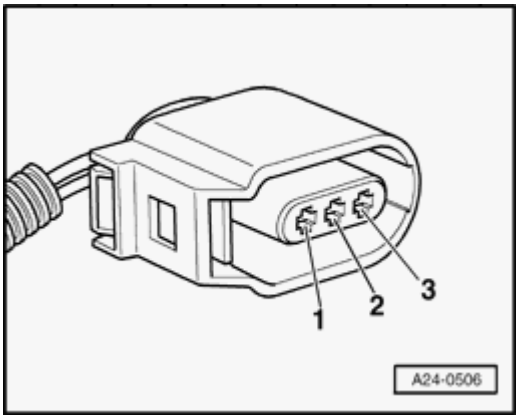


Fig. 357: Identifying Harness Connector & 3 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester as follows:

Valve for camshaft adjustment	Harness connector Terminal
Intake bank 1, Valve -1- for camshaft adjustment -N205-	1 + 2
Intake bank 2, Valve -1- for camshaft adjustment -N208-	1 + 2
Exhaust bank 1, Camshaft Adjustment Valve 1 (exhaust) -N318-	2 + 3
Exhaust bank 2, Camshaft Adjustment Valve 1 (exhaust) -N319-	2 + 3

- Initiate output Diagnostic Test Mode (DTM) and activate valve for camshaft adjustment.

- LED must blink

If LED does not blink or if it remains constantly lit:

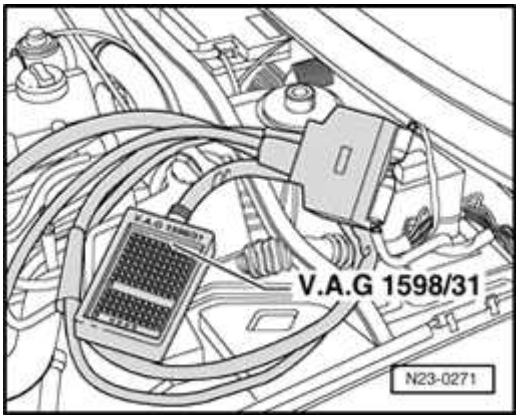


Fig. 358: VAG1598/31 Test Box Connected To Control Module Wiring Harness

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1598/31 test box to harness connectors of wiring harness (do not connect ECM). Connect Ground (GND) clip at test box (not visible in illustration) to Ground (GND).

Refer to **24 MULTIPORT FUEL INJECTION (MFI)**

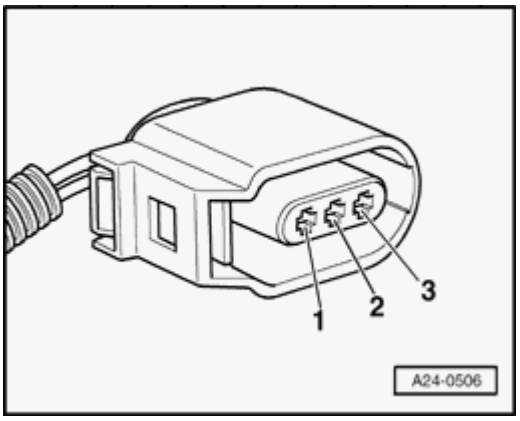


Fig. 359: Identifying Harness Connector & 3 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check following wire connections for open circuit and short circuit to Ground (GND) and B+:

Valve for camshaft adjustment	Harness connector Terminal	VAG1598/31 test box Socket
Intake bank 1, Valve -1- for camshaft adjustment -N205-	1	115
Intake bank 2, Valve -1- for camshaft adjustment -N208-	1	120
Exhaust bank 1, Camshaft Adjustment Valve 1 (exhaust) - N318-	1	22
Exhaust bank 2, Camshaft Adjustment Valve 1 (exhaust) - N319-	1	18

- Repair short circuit to Ground (GND) connection or open circuit if necessary.

If wire connection is OK:

- Replace Engine Control Module (ECM).

If no malfunctions are detected:

- Replace mechanical camshaft adjuster. Refer to **Valve train, servicing**, i.e. camshafts, removing and

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installing: Refer to **Camshafts and camshaft adjusters, removing and installing**.

17 ENGINE - LUBRICATION

LUBRICATION SYSTEM COMPONENTS, REMOVING AND INSTALLING

Lubrication system components, removing and installing

CAUTION: Before beginning repairs on the electrical system:

- **Obtain the anti-theft radio security code.**
- **Switch the ignition off.**
- **Disconnect the battery Ground (GND) strap.**
- **On vehicles equipped with Audi Telematics by OnStar ® , switch-off the emergency (back-up) battery for the Telematic/Telephone Control Module prior to disconnecting vehicle battery. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

  .
- **After reconnecting vehicle battery, re-code and check operation of anti-theft radio. Also check operation of clock and power windows according to Repair Article and/or Owner's Manual.**
- **After reconnecting vehicle battery on vehicles equipped with Audi Telematics by OnStar ® , switch-on the emergency (back-up) battery for the Telematic/Telephone Control Module. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

  .

Lubrication system components, removing and installing

NOTE:

- **If large quantities of metal shavings or abraded material are found in the engine oil while servicing the engine, the oil passages must be carefully cleaned to prevent resulting damage and the oil cooler must be replaced.**
- **Oil level must not exceed max. marking - risk of catalytic converter damage!**
- **Oil injector jet for piston cooling. See Fig. 362.**

Viscosity classes and oil specifications:

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Refer to Additional Information, Fluid Capacity Chart

Part I - Oil pan (lower part), oil pump

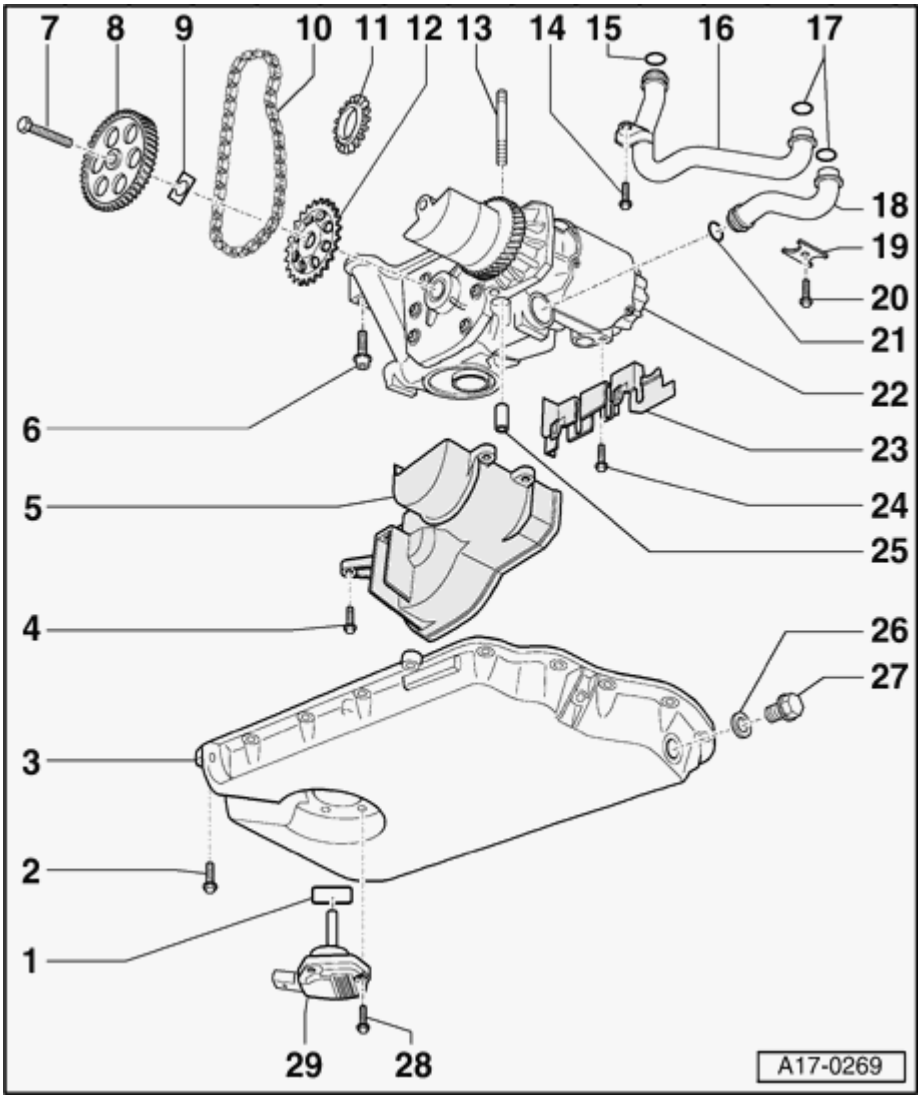


Fig. 360: Lubrication System Components Remove/Install Components (Part I - Oil Pan (Lower Part), Oil Pump)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Seal

- Always replace

2 - 10 Nm

- Tighten diagonally in sequence

3 - Oil pan (lower part)

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- Removing and installing. Refer to **Oil pan (lower part), removing and installing**

4 - 10 Nm

5 - Front baffle plate

6 - 22 Nm

- Always replace

7 - 20 Nm plus and additional 90° (1/4 turn)

- Always replace
- Insert a new diamond disc item - 9 between gear and chain sprocket.

8 - Gear for differential gear shaft drive

- Insert a new diamond disc item - 9 between gear and chain sprocket.

9 - Diamond disc

- Always replace

10 - Drive chain for oil pump

- Removing and installing. Refer to **Drive chain or chain tensioner for oil pump, removing and installing**
- Chain tensioner for drive chain. Refer to item - 16

11 - Drive chain gear for oil pump

- Removing and installing. Refer to **Drive chain gear for oil pump, removing and installing**

12 - Chain sprocket for oil pump

- Installed position: Marking faces rear
- Insert a new diamond disc item - 9 **Lubrication system components, removing and installing** between gear and chain sprocket.
- Removing and installing. Refer to **Oil pump, removing and installing**

13 - Stud

- Self-locking
- Short threaded side to cylinder block

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14 - 10 Nm

15 - O-ring

- Always replace

16 - Oil tube

17 - O-Rings

- Always replace

18 - Oil tube

19 - Bracket

- For oil tubes

20 - 10 Nm

21 - O-ring

- Always replace

22 - Oil pump

- With differential shaft
- Removing and installing. Refer to **Oil pump, removing and installing**

23 - Rear baffle plate

24 - 10 Nm

- Self-locking
- Always replace

25 - 20 Nm plus an additional 120° (1/3 turn)

- Always replace
- Insert with locking fluid
- Locking fluid:

26 - Seal

- Always replace

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27 - Oil drain plug, 30 Nm

28 - 10 Nm

29 - Oil level thermal sensor -G266-

Part II - Oil pan (upper part), oil filter

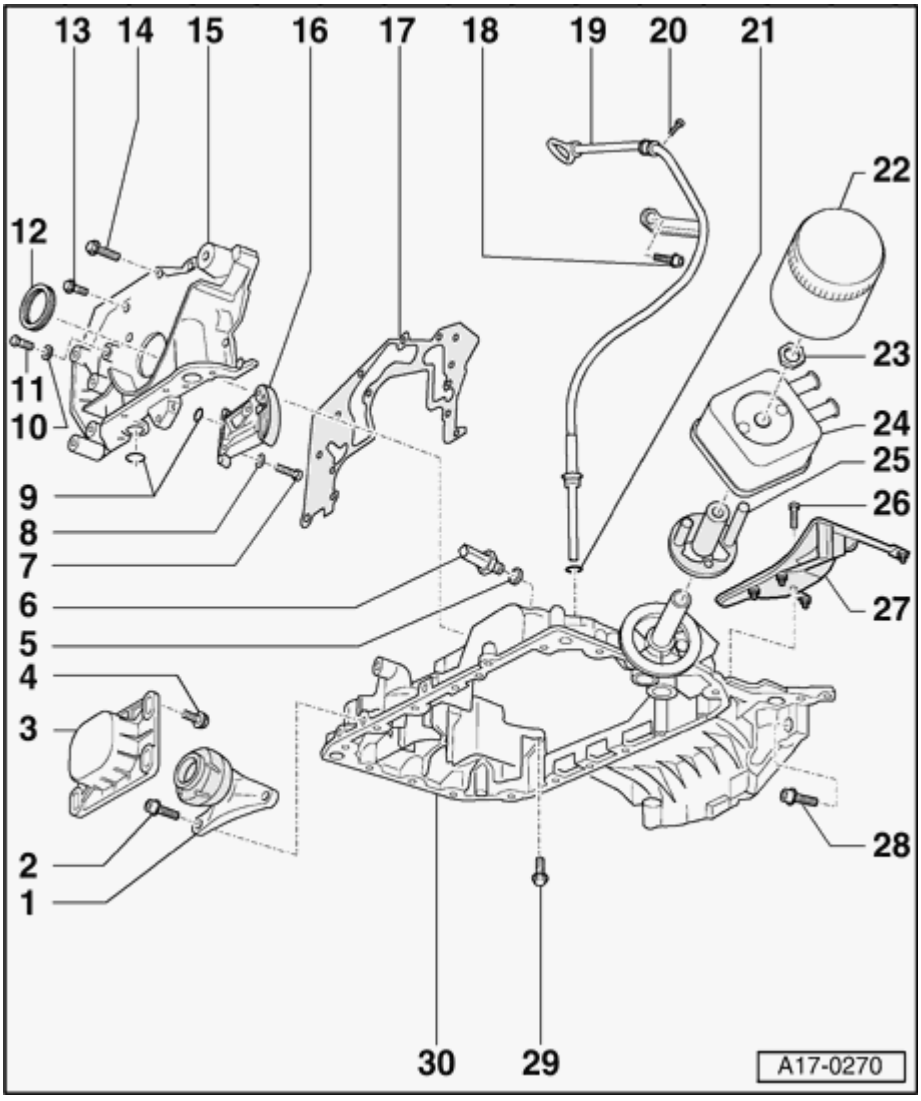


Fig. 361: Lubrication System Components Remove/Install Components (Part II - Oil Pan (Upper Part), Oil Filter)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Torque support

2 - 40 Nm

3 - Stop

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- For torque support
- Adjusting:

  - Place impact for torque support on rubber buffer for torque support, letting it rest under its own weight and tighten bolts to 28 Nm.

4 - 28 Nm

5 - Seal

- Always replace

6 - Oil pressure switch -F1-, 1.4 bar, 25 Nm

- Black insulation
- Checking. Refer to **Oil pressure and oil pressure switch, checking**
- Always replace O-ring

7 - 12 Nm

8 - Washer

9 - O-ring

- Always replace

10 - Seal

- Always replace

11 - Locking bolt, 10 Nm

12 - Seal

- For crankshaft
- Removing and installing. Refer to **Seal for crankshaft (ribbed belt side), replacing**

13 - 10 Nm

14 - 30 Nm

- Self-locking
- Always replace

15 - Sealing flange, front

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- Removing and installing. Refer to **Front sealing flange, removing and installing**

16 - Chain tensioner

- Removing and installing. Refer to **Drive chain or chain tensioner for oil pump, removing and installing**
- Use a diameter 3 mm drill bit to secure

17 - Gasket

- Always replace

18 - 20 Nm

19 - Guide tube for oil dipstick

20 - Sheet metal screw

21 - O-ring

- Always replace

22 - Oil filter housing

- Follow filter change intervals

Refer to

- **01 - MAINTENANCE**
- **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

- Use 3417 Oil filter wrench to remove
- Follow installation notes found on oil filter
- Tighten to 20 Nm

23 - 30 Nm

24 - Oil cooler

- Observe note. Refer to **Lubrication system components, removing and installing**

25 - Guide piece

- With seal
- Always replace

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26 - 10 Nm

- Self-locking
- Always replace

27 - Top baffle plate

28 - 45 Nm

29 - M7 = 16 Nm, M8 = 22 Nm

30 - Oil pan (upper part)

- Removing and installing. Refer to **Oil pan (upper part), removing and installing**

Oil injector jet for piston cooling

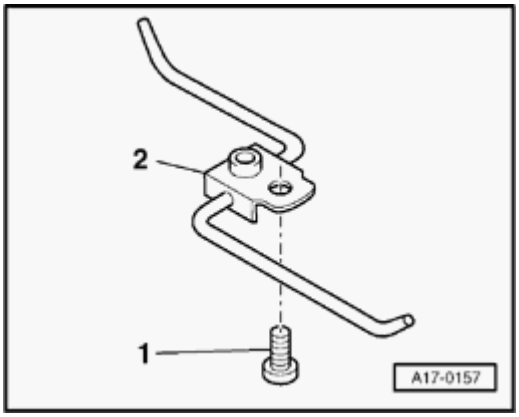


Fig. 362: Oil Injector Jet For Piston Cooling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt, 10 Nm

2 - Oil injector jet for piston cooling

Oil pan (lower part), removing and installing

Required equipment

- Catch reservoir
- Drill with plastic brush attachment
- Protective glasses
- Silicone sealant:

Removing

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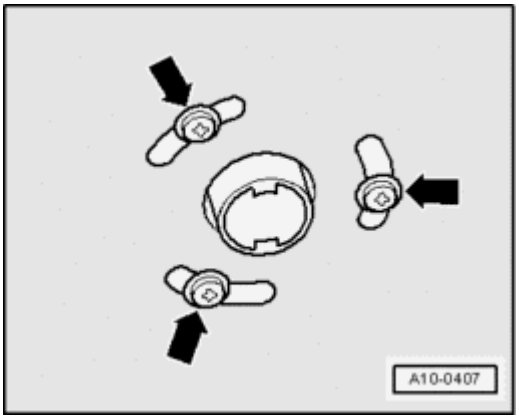


Fig. 363: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

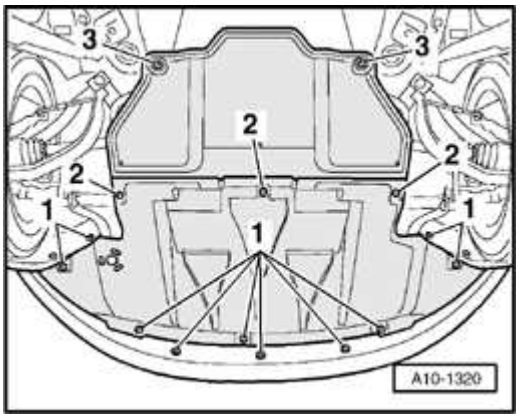


Fig. 364: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front noise insulation.
- Place engine oil drip tray beneath engine.
- Drain engine oil.

Vehicles with automatic transmission

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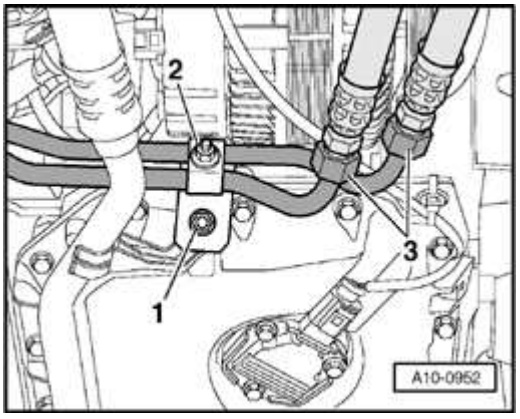


Fig. 365: Removing Union Nuts And Disconnect ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for ATF lines, to do so remove nuts -1- and -2-.

NOTE: Union nuts -3- of ATF lines must not be disconnected.

All

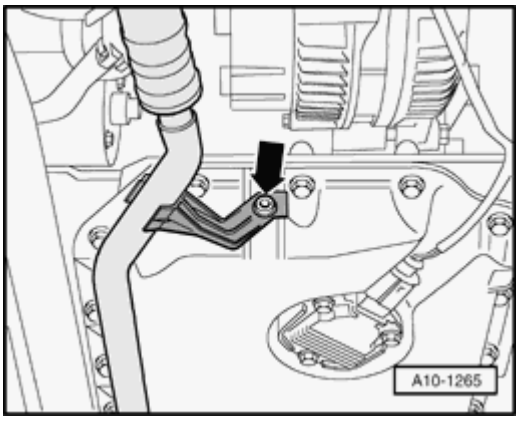


Fig. 366: Unbolting Bracket For Refrigerant Line At Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for refrigerant line at oil pan (arrows).

NOTE: Depicted in illustration for a vehicle with manual transmission.

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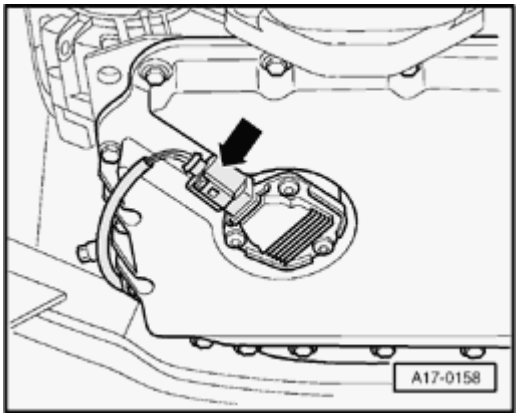


Fig. 367: Disconnecting Electrical Harness Connector At Oil Level Thermal Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector at Oil level thermal sensor (arrow) and move wiring clear.
- Place engine oil drip tray beneath engine, since oil will escape again.

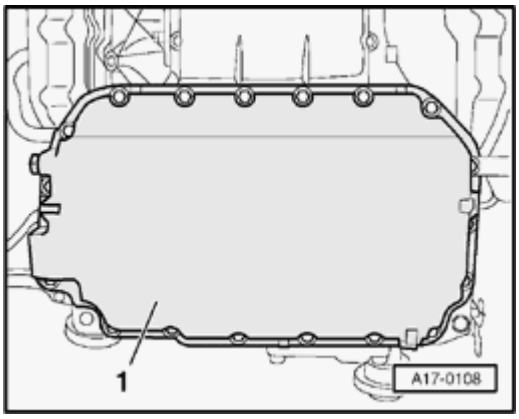


Fig. 368: Unbolting Oil Pan (Lower Part) And Carefully Remove
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt oil pan (lower part) -1- and carefully remove.

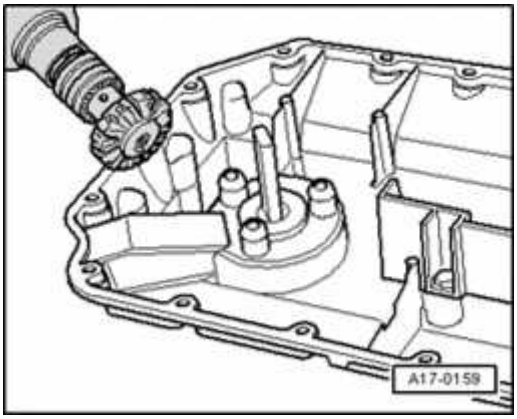


Fig. 369: Using Rotating Plastic Brush To Remove Any Remaining Sealant From Oil Pan (Lower Part)

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And At Upper Part
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using rotating plastic brush, remove any remaining sealant from oil pan (lower part) and at upper part.

  WARNING: Wear protective glasses.

- Clean sealing surfaces so they are completely free of any oil or grease.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and O-rings.

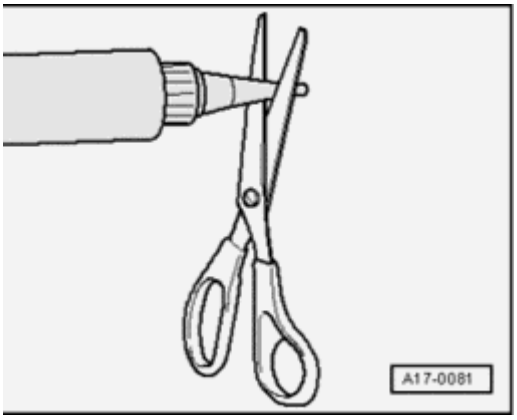


Fig. 370: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut tube nozzle at front marking (jet diameter approx. 1 mm).

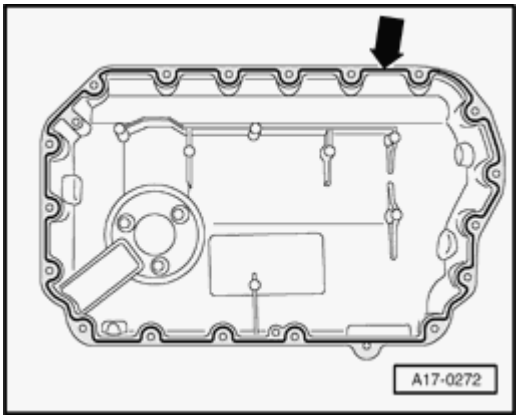


Fig. 371: Applying Silicon Sealant Bead To Clean Sealing Surfaces Of Oil Pan (Lower Part)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Apply silicon sealant bead to clean sealing surfaces of oil pan (lower part) as shown in illustration.

- Thickness of sealant bead (arrow): approx. 1.5 mm

NOTE:

- **The oil pan (lower part) must be installed within 5 minutes after application of silicon sealant.**
- **Sealant bead must not be thicker than specified, otherwise sealant could get into oil pan and clog the oil pump strainer.**

- Install oil pan (lower part) and pre-tighten all bolts diagonally to 5 Nm.
- Tighten bolts of oil pan (lower part) in diagonal pattern to 10 Nm.
- Add engine oil and check oil level.

Tightening torques

Component	Nm
Oil pan (lower part) to oil pan (upper part)	10
Oil drain plug	30

Oil pump, removing and installing

Special tools and equipment

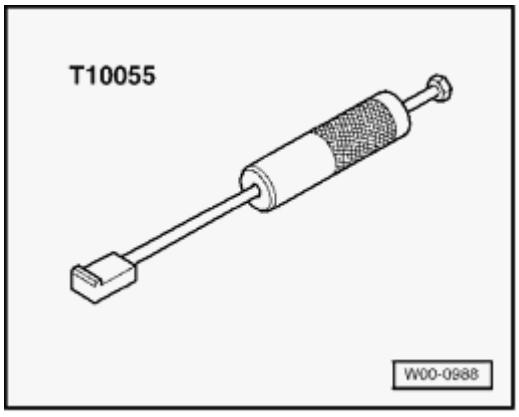


Fig. 372: Identifying Puller T10055 With Adapter T10055/3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T10055 Extractor

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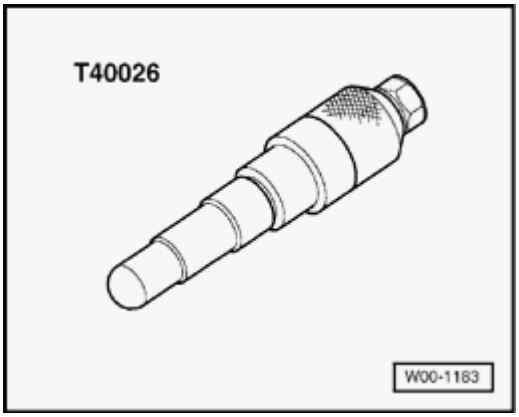


Fig. 373: T40026 Locking Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T40026 Locking pin
- Drill bit, 3 mm diameter
- Sealants
- Locking fluid

Removing

- Remove oil pan (lower part). Refer to **Removing**.
- Turn crankshaft via center bolt of toothed belt gear in direction of engine rotation to TDC Cyl. 3 marking.

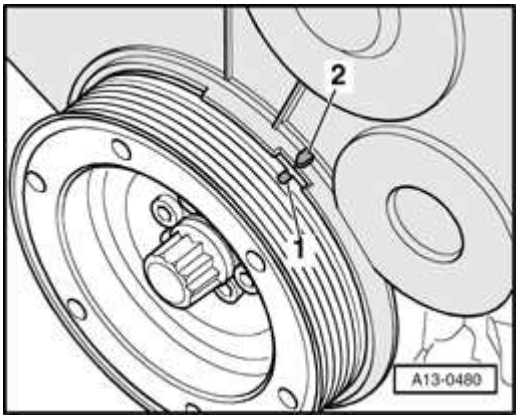


Fig. 374: Identifying Notch Lines Up With Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Notch -1- lines up with marking -2-

- If installed, disconnect electrical harness connector at after-run coolant pump.
- Unscrew sealing plug of TDC mark at cylinder block.

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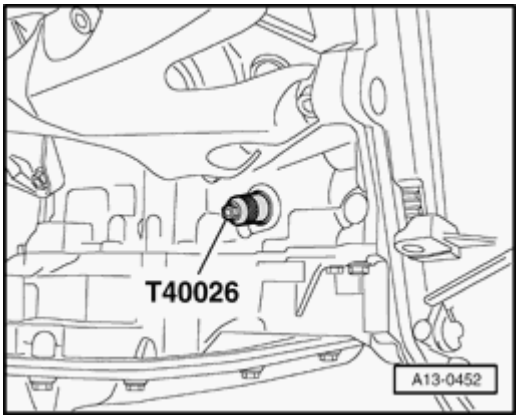


Fig. 375: Threading T40026 Locking Pin Into Hole Of Removed Sealing Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread T40026 locking pin into hole of removed sealing plug and tighten.

NOTE: To do so, turn crankshaft back and forth slightly.

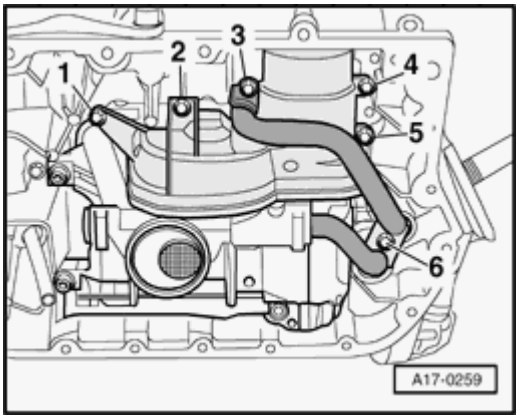


Fig. 376: Unscrewing Bolts Removing Oil Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -3- and -6- and remove oil lines.

NOTE: Oil escapes from oil tubes when removing.

- Unscrew bolts -1-, -2-, -4- and -5- and remove front baffle plate.

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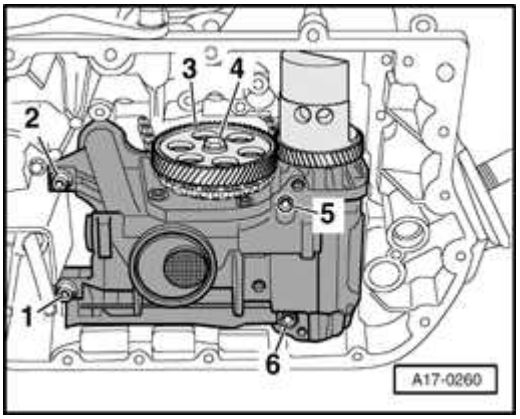


Fig. 377: Identifying Bolts, Gear, Nuts, Diamond Disc & Toothed Gear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt -4- and remove gear -3- for differential gear shaft drive.
- Remove diamond disc from toothed gear.
- Remove bolts -1- and -2- and nuts -5- and -6-.

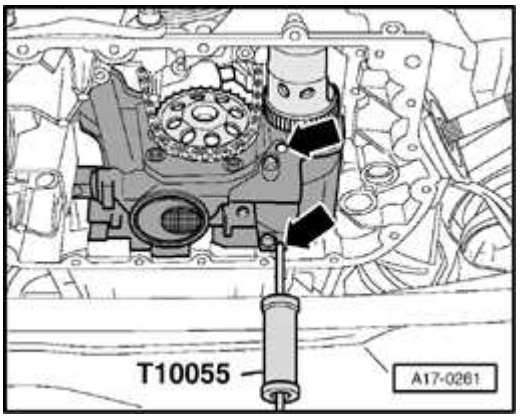


Fig. 378: Installing T10055 Extractor Into M8 Holes Alternating At Oil Pan And Pull Oil Pump Off Of Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install T10055 extractor into M8 holes alternating (arrows) at oil pan and pull oil pump off of cylinder block.

Installing

Installation is reverse of removal, noting the following:

NOTE: Always replace seals and gaskets.

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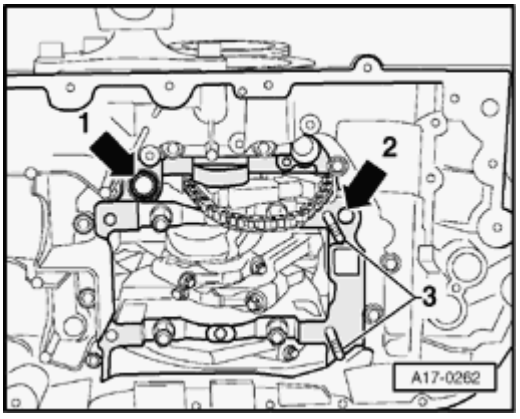


Fig. 379: Clean Threads Of Studs 3 Of Remaining Locking Fluid, Replace O-Ring & Coat Circumference Of Hole With Sealant
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean threads of studs 3 of remaining locking fluid.
- Replace O-ring (arrow -1-).
- Coat circumference of hole (arrow -2-) with sealant.

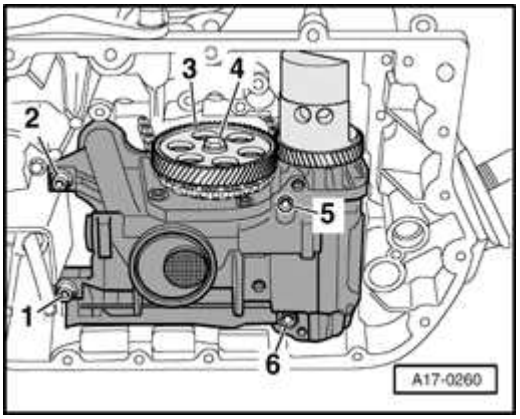


Fig. 380: Identifying Bolts, Gear, Nuts, Diamond Disc & Toothed Gear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace bolts -1- and -2- and nuts -5- and -6- for oil pump threaded connection.
- Insert nuts -5- and -6- with locking fluid.
- Bolt in oil pump uniformly at all mounting points, so that shear pin does not cant.
- Tighten threaded connection to final torque.

- Replace diamond disc on toothed gear -3- for differential gear shaft drive.
- Insert collar of toothed gear for differential gear shaft drive through chain sprocket onto oil pump shaft.
- Loosely thread in bolt -4-.

NOTE:

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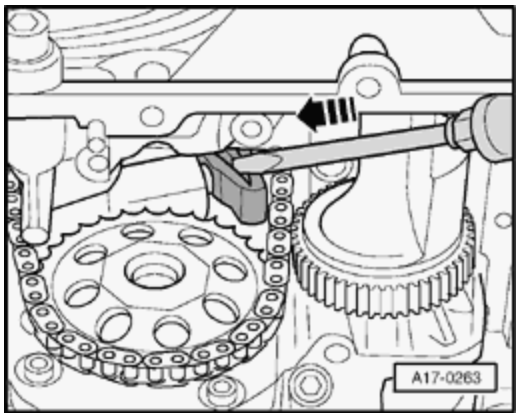


Fig. 381: Pressing Piston Of Chain Tensioner Back Using Screwdriver
Courtesy of VOLKSWAGEN UNITED STATES, INC.

To install toothed gear, press piston of chain tensioner back using a screwdriver (arrow).

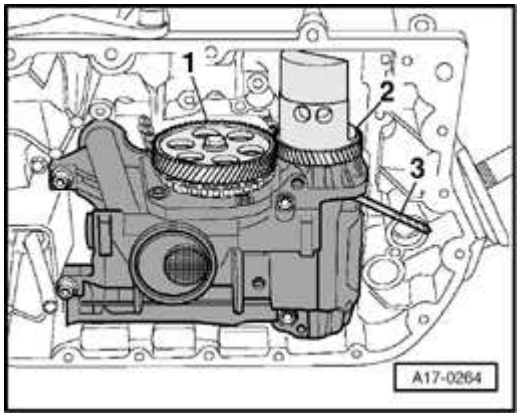


Fig. 382: Turning Differential Shaft Until Pin Can Be Slid Into Alignment Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn differential shaft -2-, until a pin diameter 5 mm item -3- (e.g. drill bit) can be slid into alignment hole.
- Tighten bolt -1-.
- Remove pin (drill bit) from alignment hole.
- Remove T10026 alignment bolt and thread sealing plug of TDC marking with new O-ring into cylinder block.

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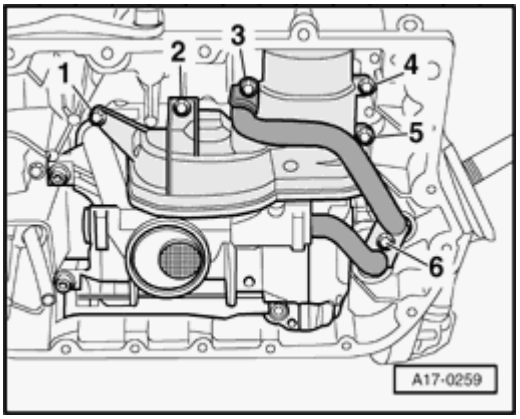


Fig. 383: Unscrewing/Screwing Bolts Removing/Installing Oil Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install front baffle plate -bolts -1-, -2-, -4- and -5-.
- Install oil tubes -bolts -3- and -6-.
- Install oil pan (lower part). Refer to **Oil pan (lower part), removing and installing** .

Tightening torques

Component		Nm
Oil pump to cylinder block	Nuts	20 + 120°1)2)
	Bolts	22 3)
Gear for differential gear shaft drive to oil pump		20 + 90°3)4)
Front baffle plate to oil pan (upper part)		10
Oil pressure line to oil pan (upper part)		10
Sealing plug in cylinder block		25

1) 120° corresponds to one third-turn

2) Insert nuts with locking fluid; locking fluid:

3) Replace bolts

4) 90° corresponds to one quarter-turn

Drive chain or chain tensioner for oil pump, removing and installing

Removing

- Remove oil pan (upper part). Refer to **Oil pan (upper part), removing and installing**.
- Remove front sealing flange. Refer to **Front sealing flange, removing and installing**.

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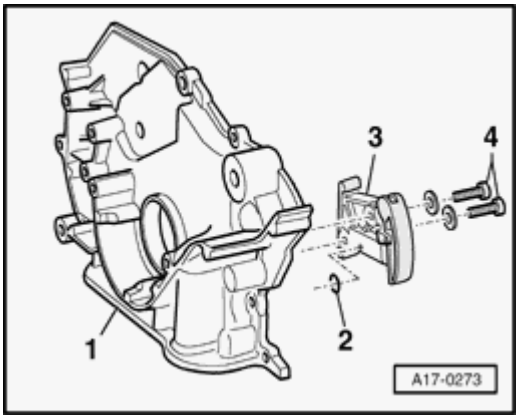


Fig. 384: Unscrewing/Screwing Bolts And Removing/Installing Chain Tensioner From Front Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -4- and remove chain tensioner -3- from front sealing flange -1-.
- Remove chain from drive chain gear.

Installing

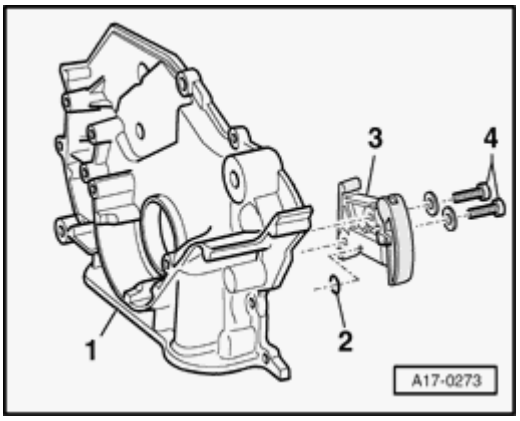


Fig. 385: Unscrewing/Screwing Bolts And Removing/Installing Chain Tensioner From Front Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace O-ring -2-.
- Bolt in chain tensioner -3- with bolts -4- (with washers) to front sealing flange -1-.

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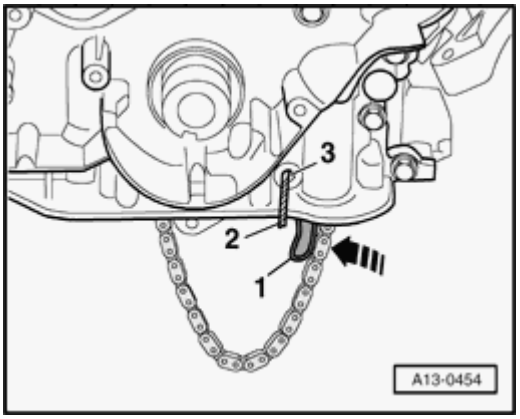


Fig. 386: Pressing Chain Tensioner Until Drill Bit Can Be Slid Into Alignment Hole Of Sealing Flange And Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew locking bolt from adjustment hole -3-.
- Press chain tensioner -1- in direction of arrow until 3 mm diameter drill bit -2- can be slid into alignment hole of sealing flange and chain tensioner.
- Install front sealing flange. Refer to **Installing**.
- Remove oil pan (upper part). Refer to **Removing**.

Tightening torque

Component	Nm
Chain tensioner to front sealing flange	12

Oil pan (upper part), removing and installing

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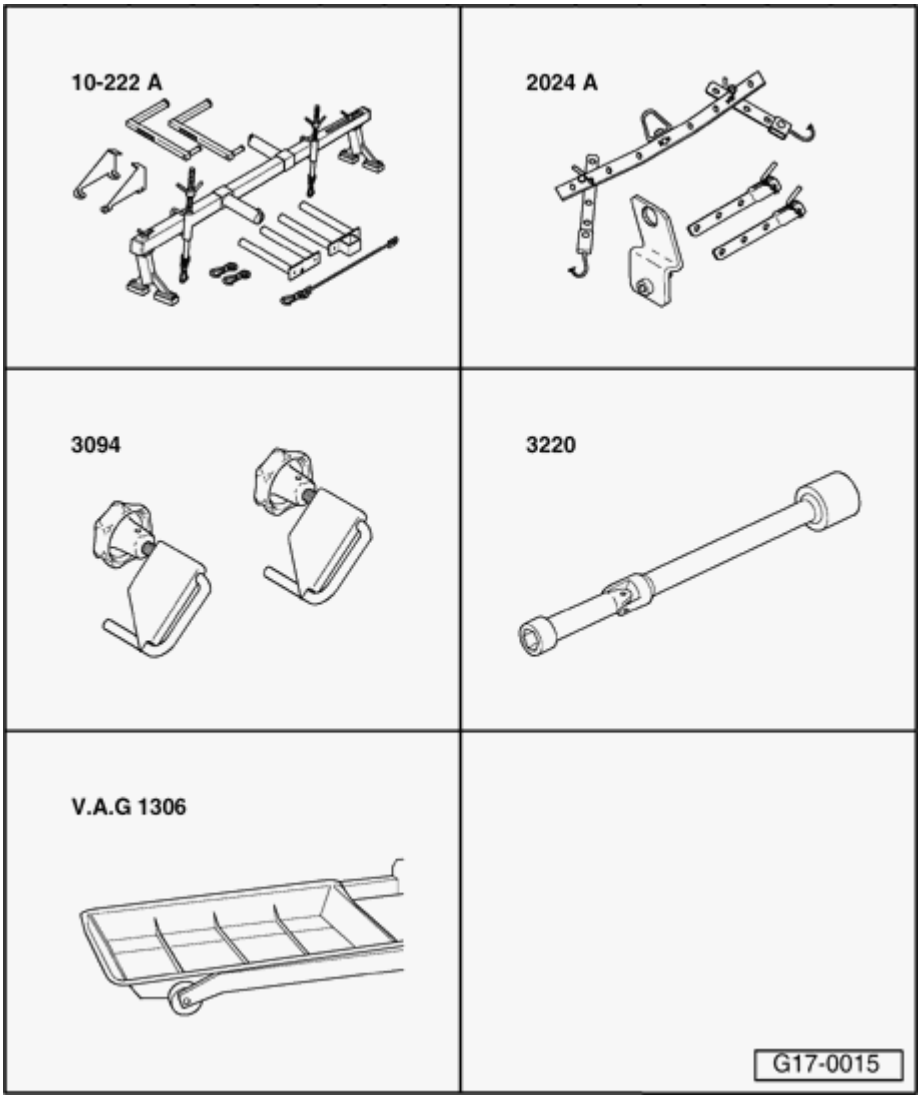


Fig. 387: Identifying Special Tools - Oil Pan (Upper Part), Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- 10-222A Engine support bridge
- 2024A Engine Sling
- 3094 Hose clamps
- 3220 Hinged socket

- VAG1306 Drip tray for VAG1202A
- Catch reservoir
- Drill with plastic brush attachment
- Protective glasses

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- Silicone sealant

Removing

- Lock carrier in service position. Refer to **Lock carrier, moving into service position**.

WARNING: Observe safety precautions when disconnecting the battery.

Refer to 27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL

See Caution before beginning repairs on the electrical system. Refer to **Lubrication system components, removing and installing**

- Switch ignition off and disconnect battery Ground (GND) strap.
- Remove ribbed belt. Refer to **Ribbed belt, removing and installing** .

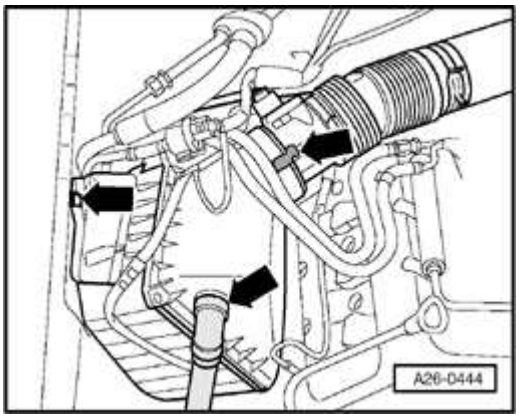


Fig. 388: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).

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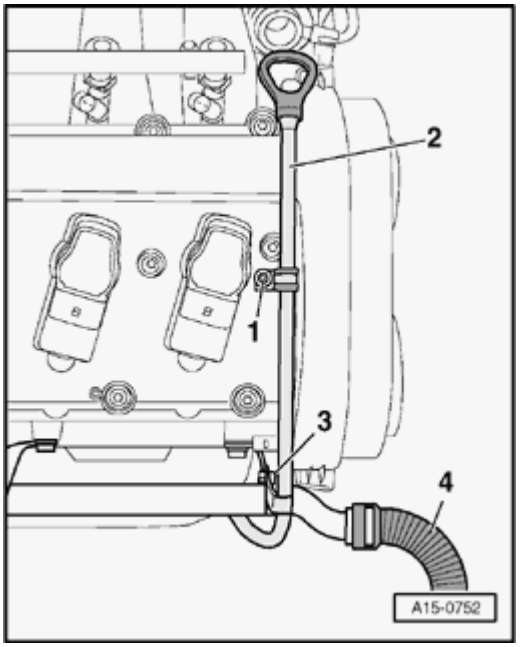


Fig. 389: Identifying Bolts, Hose From Line Of Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -3-.
- Disconnect hose -4- from line of secondary air injection.
- Pull out guide tube for oil dipstick -2- from oil pan (upper part) toward top and swing it forward for removal.

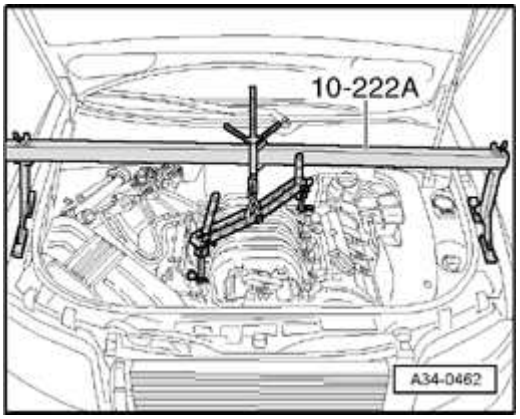


Fig. 390: Positioning 10-222A Engine Support Bridge On Bolted Flanges Of Fenders
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position 10-222A engine support bridge on bolted flanges of fenders.

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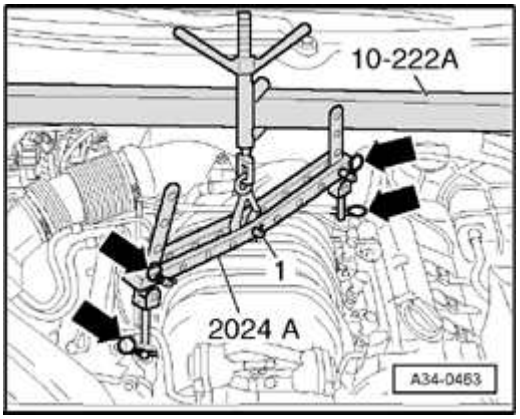


Fig. 391: Removing Eyelet For 2024A Engine Sling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove eyelet for 2024A engine sling.
- Insert bolt -1- in center hole of 2024A Engine sling and secure with a cotter pin.
- Attach bolt for 2024A Engine sling at 10-222A Engine support bridge spindle.
- Attach 2024A Engine sling to sling clamps at front and rear of engine.

WARNING: Take-up hooks and pins at engine sling must be secured using securing pins (arrows) as shown in illustration.

- Slightly pre-tension engine using engine support bridge spindle.
- Place engine oil drip tray beneath engine.
- Drain engine oil.

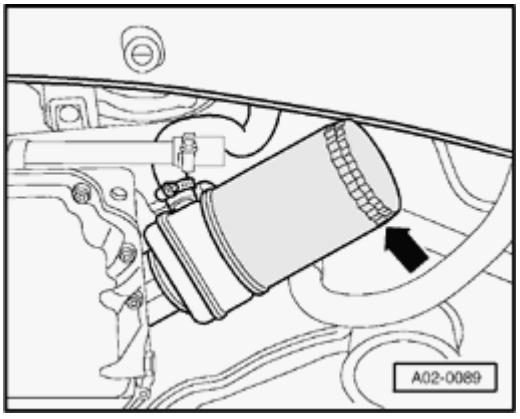


Fig. 392: Loosening Oil Filter Using Tension Strap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen oil filter (arrow) using tension strap; e.g. Hazet 2171-1.
- Place VAG1306 Drip tray beneath engine.

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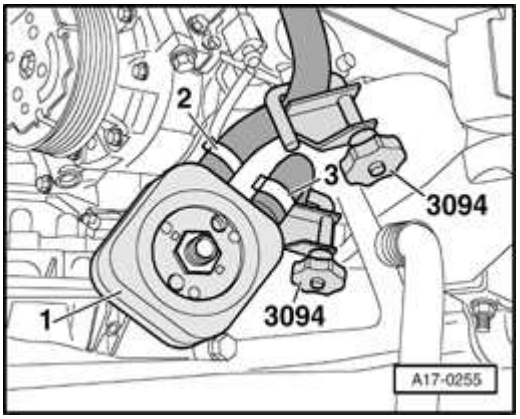


Fig. 393: Clamping Coolant Hoses Using 3094 Hose Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clamp coolant hoses -2- and -3- using 3094 hose clamps.
- Disconnect coolant hoses from oil cooler -1-.
- Remove oil cooler.

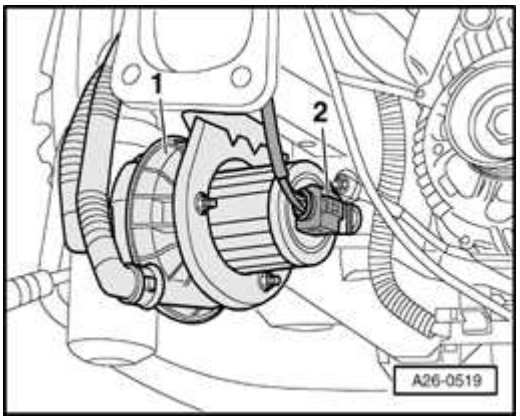


Fig. 394: Disconnecting Electrical Harness Connector At Secondary Air Injection (AIR) Pump Motor -V101-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector -2- at Secondary Air Injection (AIR) pump motor -V101- ,-1-.
- Remove Secondary Air Injection (AIR) pump at longmember.

WARNING: Do not open refrigerant circuit for A/C system.

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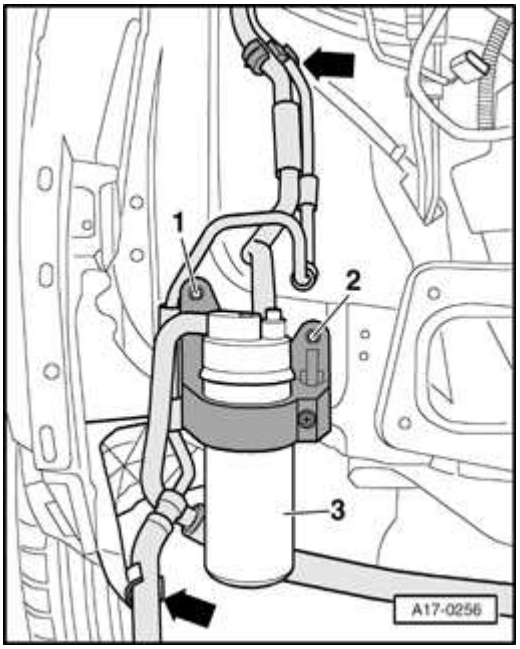


Fig. 395: Removing Bolts, Unclip Refrigerant Lines & Allowing Catch Reservoir With Connected Refrigerant Lines To Remain Hanging In Installed Position
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-.
- Unclip refrigerant lines (arrows).
- Allow catch reservoir -3- with connected refrigerant lines to remain hanging in installed position.

Vehicles with automatic transmission

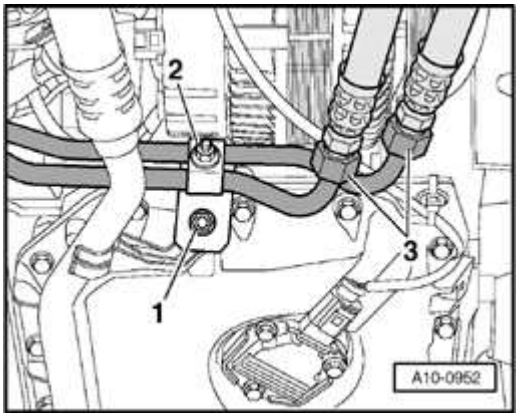


Fig. 396: Removing Union Nuts And Disconnect ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for ATF lines, to do so remove nuts -1- and -2-.

NOTE: Union nuts -3- of ATF lines must not be disconnected.

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All

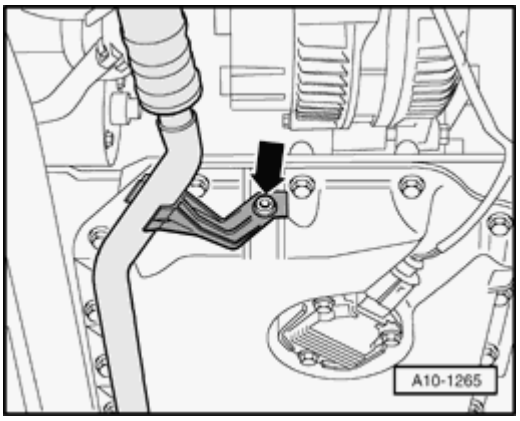


Fig. 397: Unbolting Bracket For Refrigerant Line At Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for refrigerant line at oil pan (arrow).

NOTE: Depicted in the illustration for a vehicle with manual transmission.

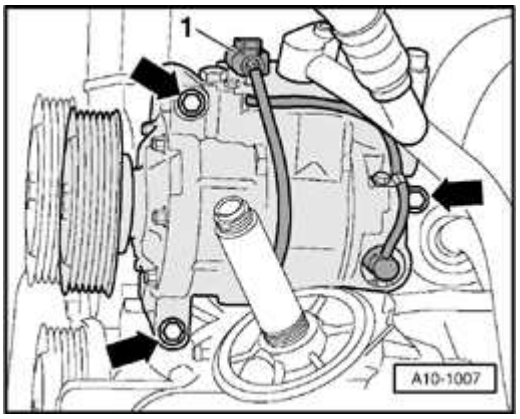


Fig. 398: Disconnecting Harness Connector Of Electrical Wire To A/C Compressor Clutch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect harness connector -1- of electrical wire to A/C compressor clutch.
- Unbolt A/C compressor from bracket (arrows).

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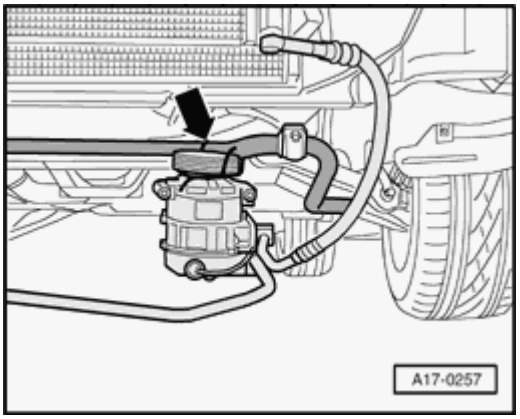


Fig. 399: Hanging A/C Compressor With Connected Refrigerant Lines To Stabilizer Using Wire
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hang A/C compressor (arrow) with connected refrigerant lines to stabilizer using wire.

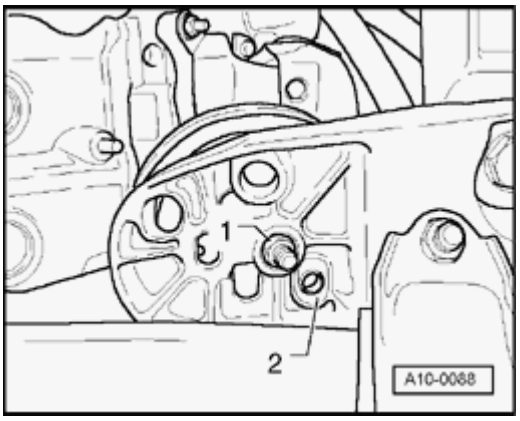


Fig. 400: Threaded Connections And Positioning Sleeves On Lower Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark installed positions for threaded assemblies -1- and positioning sleeves -2-.

NOTE: Different mounting holes are available depending upon the installed engine.

- Remove lower nuts -1- on left and right engine mounts.

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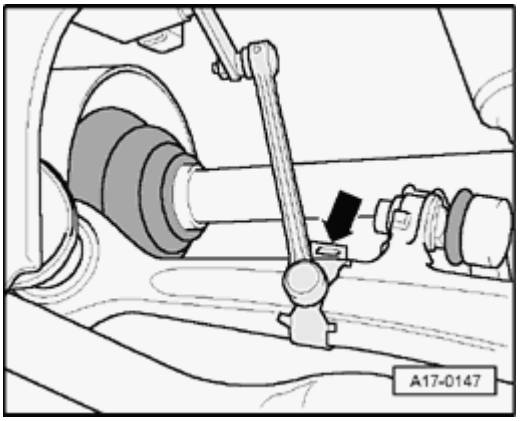


Fig. 401: Unclipping Operating Rod For Vehicle Level Sensor At Lower Lateral Control Arm
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If installed, unclip operating rod for vehicle level sensor at lower lateral control arm (arrow).

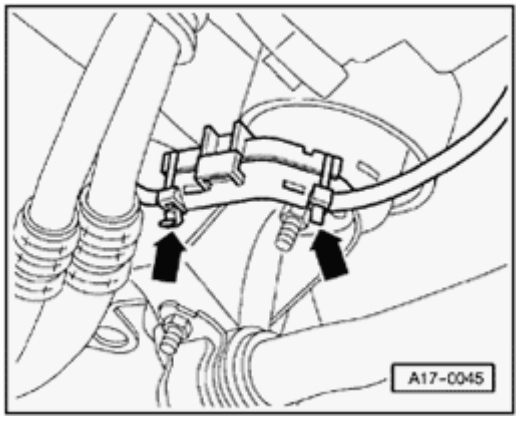


Fig. 402: Starter Wiring Bracket Cable Ties
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut cable ties (arrows), open bracket for starter wiring and remove electrical wiring.

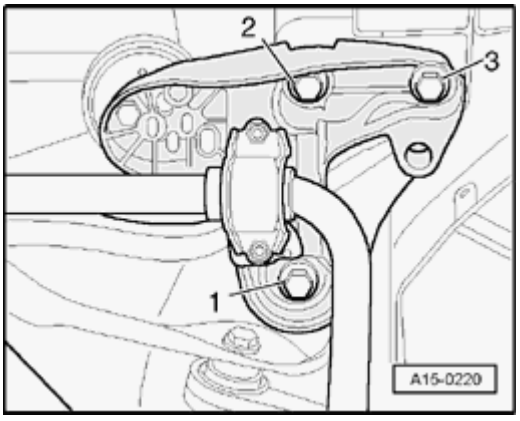


Fig. 403: Removing Front Bolts From Left And Right Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove front bolts -2- and -3- from left and right sides of subframe. Then remove bolt -1-.

NOTE: Only loosen or lower subframe at front side to avoid having to perform a wheel alignment.

- Lower front subframe.

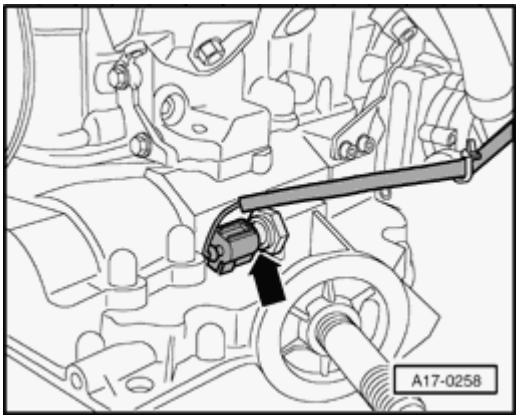


Fig. 404: Disconnecting Electrical Harness Connector At Oil Pressure Switch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector at oil pressure switch (arrow).

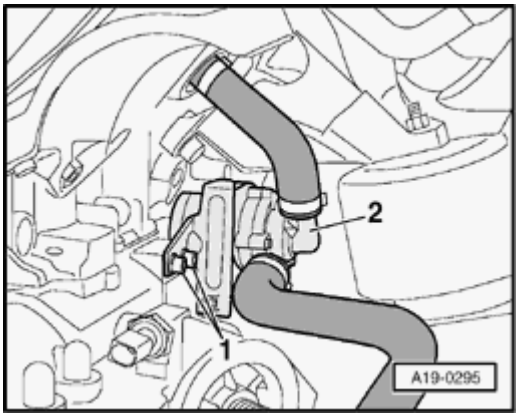


Fig. 405: Unscrewing Bolts And Removing After-Run Coolant Pump At Oil Pan (Upper Part)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If installed, unscrew bolts -1- and remove after-run coolant pump -2- at oil pan (upper part).

NOTE: Coolant hose to cylinder block can remain connected.

- Disconnect electrical lines from generator.

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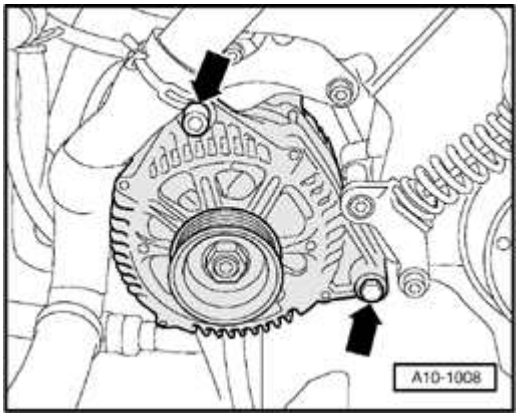


Fig. 406: Unscrewing Bolts And Removing Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove generator.

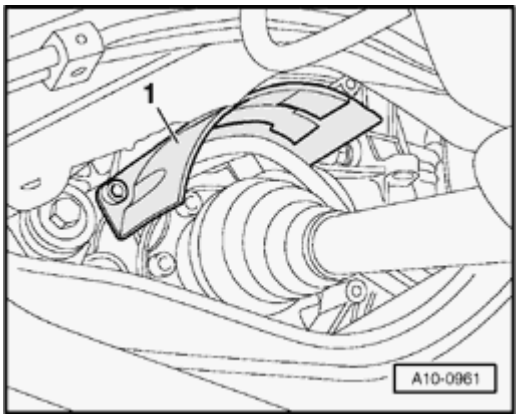


Fig. 407: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If necessary, remove heat shield for right drive axle -1-.

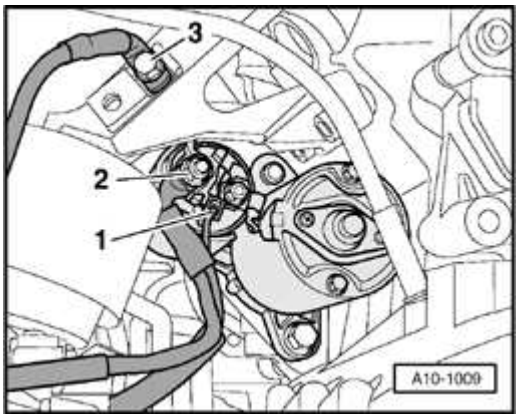


Fig. 408: Removing Electrical Wires From Starter & Disconnecting Ground (GND) Wire
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove electrical wires -1- and -2- from starter.

NOTE: Ground (GND) wire -3- remains connected.

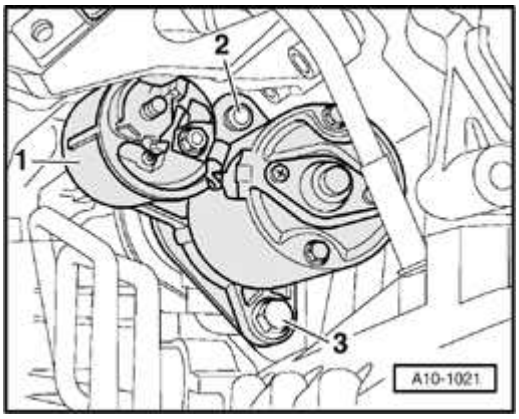


Fig. 409: Removing Heat Shield From Solenoid, Unscrewing Bolts & Removing Starter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- from solenoid.
- Remove bolts -2- and -3- and remove starter.

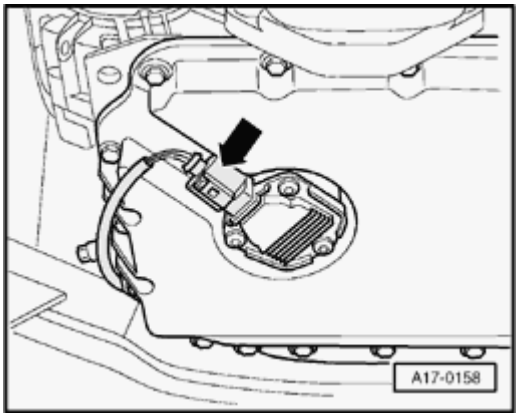


Fig. 410: Disconnecting Electrical Harness Connector At Oil Level Thermal Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector at Oil level thermal sensor (arrow) and move wiring clear.
- Place engine oil drip tray beneath engine, since oil will escape again.

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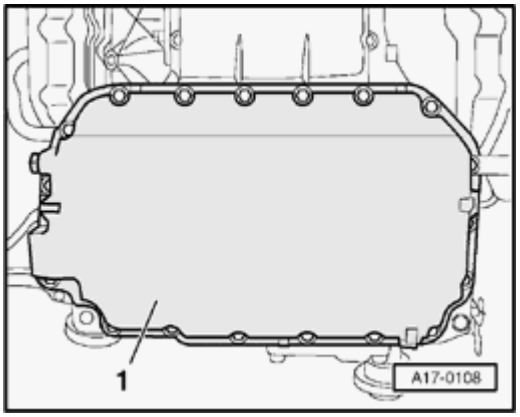


Fig. 411: Lower Portion Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt oil pan (lower part) -1- and carefully remove.
- Remove oil pump. Refer to **Oil pump, removing and installing**.

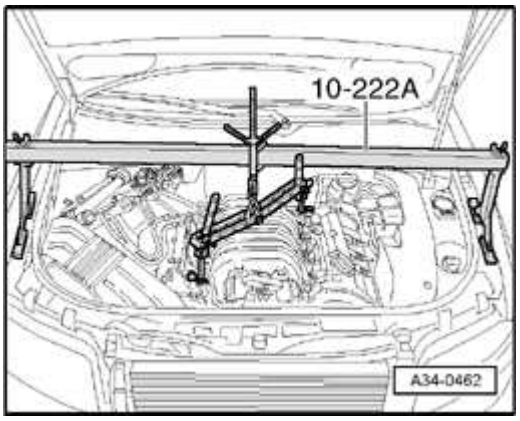


Fig. 412: Positioning 10-222A Engine Support Bridge On Bolted Flanges Of Fenders
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using 10-222A engine support bridge spindle, lift engine slightly.

NOTE: Make sure rear air guide at intake manifold is not damaged when lifting engine.

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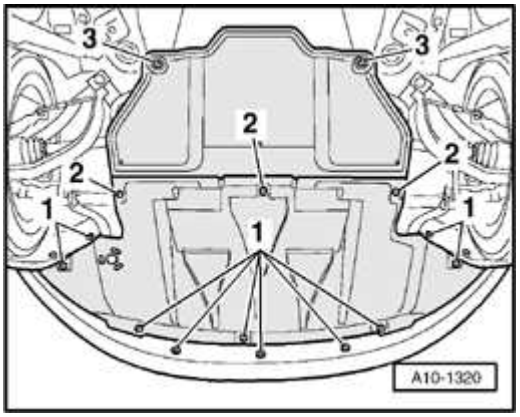


Fig. 413: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove quick-release screws -2- and -3- and remove rear sound insulation, if present.

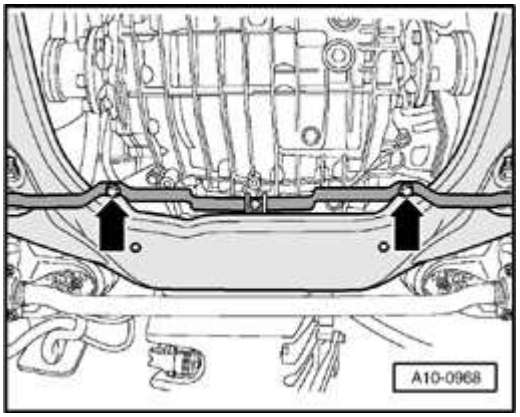


Fig. 414: Removing Bracket For Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for sound insulation (arrows).

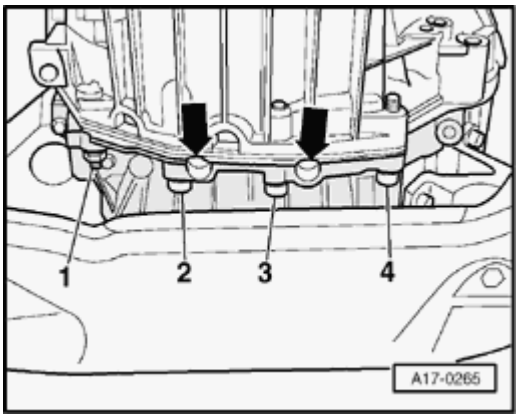


Fig. 415: Removing Bottom Engine/Transmission Connecting Bolts In Area Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bottom engine/transmission connecting bolts in area of oil pan (upper part).
- Check whether a 10 mm wrench socket, e.g. 3220 hinged socket, can be slid in through assembly hole (arrows). If necessary rework assembly hole.

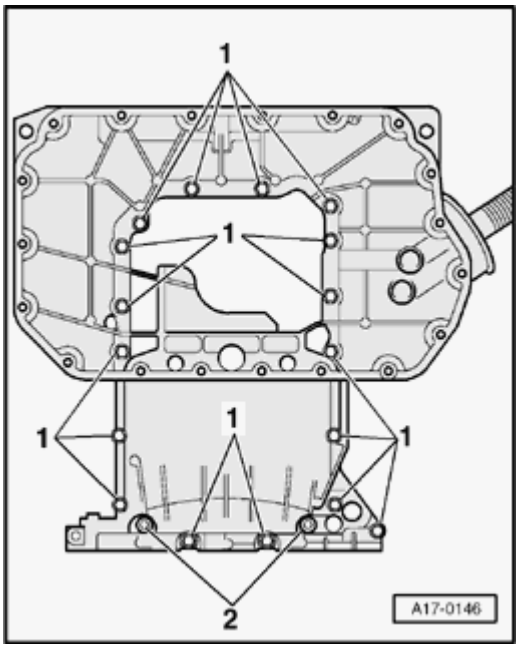


Fig. 416: Identifying Engine/Transmission Fasteners In Area Of Upper Part Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- for oil pan (upper part).
- Press oil pan (upper part) off of cylinder block roll pins.

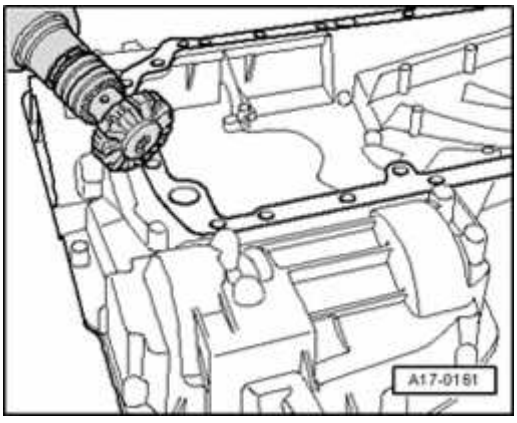


Fig. 417: Using Rotating Plastic Brush To Remove Remaining Sealant From Oil Pan (Upper Part) And At Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using rotating plastic brush, remove remaining sealant from oil pan (upper part) and at cylinder block.

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WARNING: Wear protective glasses.

- Clean sealing surfaces so they are completely free of any oil or grease.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and O-rings.

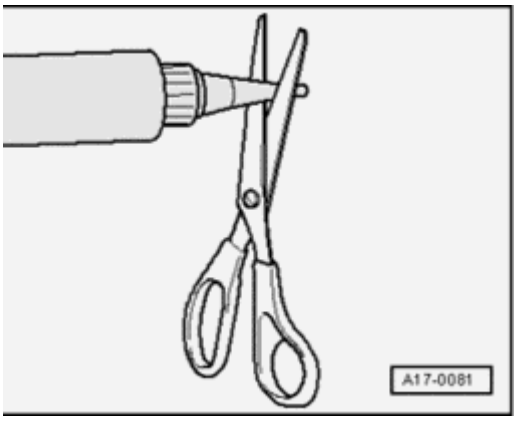


Fig. 418: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut tube nozzle at front marking (jet diameter approx. 1 mm).

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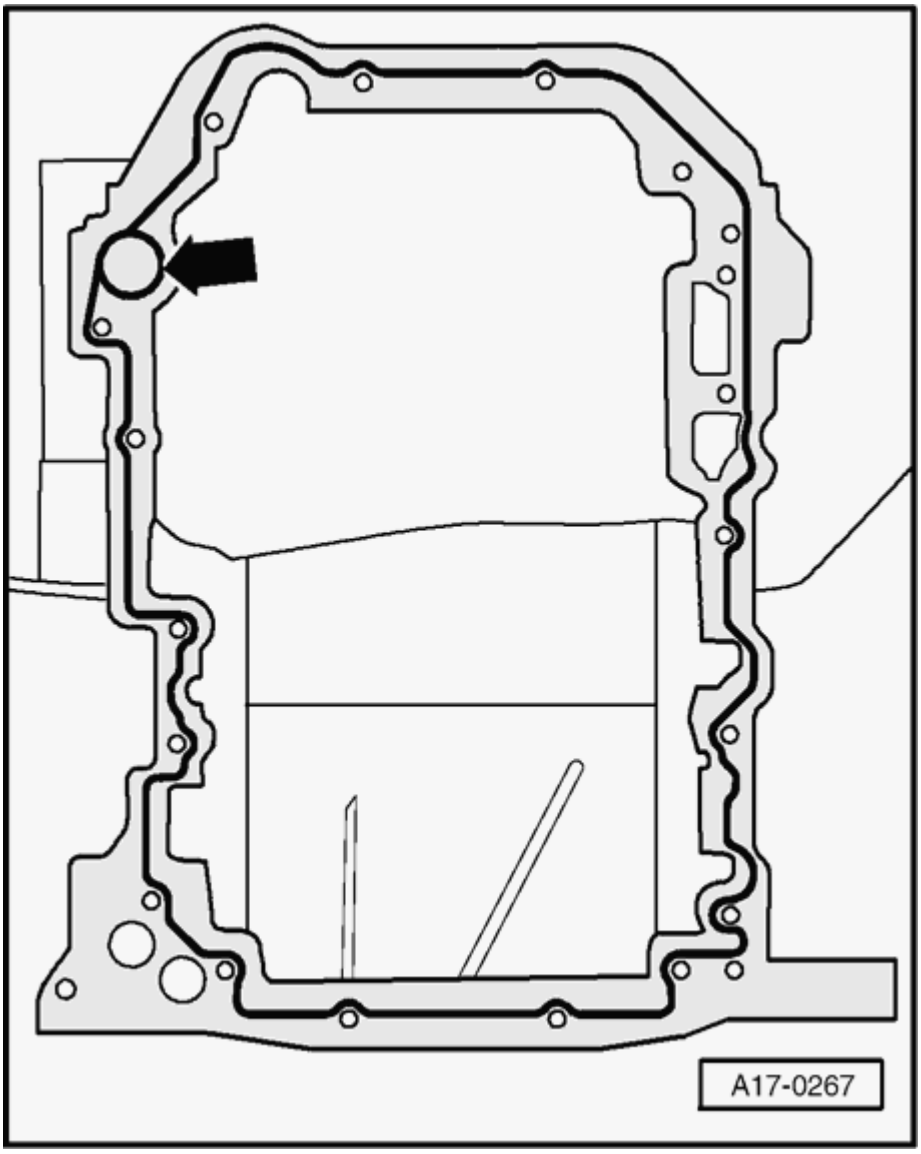


Fig. 419: Applying Silicon Sealant Bead To Clean Sealing Surfaces Of Oil Pan (Upper Part)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply silicon sealant bead to clean sealing surfaces of oil pan (upper part) as shown in illustration.
- Thickness of sealant bead (arrows): approx. 1.5 mm

NOTE:

- **The oil pan (upper part) must be installed within 5 minutes after application of silicon sealant.**
- **Sealant bead must not be thicker than specified, otherwise sealant could get into oil pan and clog the oil pump strainer.**
- **Apply sealant bead in area of hole (arrow) in cylinder block with special care.**

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- Install oil pan (upper part) and pre-tighten all bolts for oil pan (upper part)/cylinder block in diagonal sequence to 5 Nm.
- Tighten bolts of oil pan (upper part)/transmission to 45 Nm.

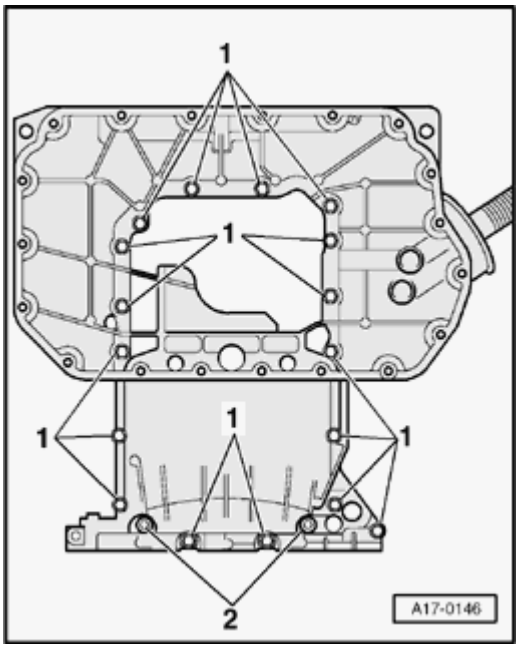


Fig. 420: Identifying Engine/Transmission Fasteners In Area Of Upper Part Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten diagonally bolts -1- to 16 Nm and bolts -2- to 22 Nm.
- Install oil pump. Refer to **Oil pump, removing and installing**.
- Install oil pan (lower part). Refer to **Oil pan (lower part), removing and installing** .
- Replace O-ring at guide tube for oil dipstick and insert guide tube into hole in oil pan (upper part).
- Install starter:

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

- Install generator. Refer to **Ribbed belt for power steering pump, generator and A/C system**.
- Install subframe:

Refer to **40 - FRONT SUSPENSION**

- Install A/C compressor. Refer to **Ribbed belt for power steering pump, generator and A/C system**.
- Install ribbed belt. Refer to **Installing**.
- Install radiator support. Refer to **Lock carrier, moving into service position**.
- Add engine oil and check oil level.

See Caution for connecting Telematics battery. Refer to **Lubrication system components, removing and**

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installing

- Observe safety precautions after connecting the battery:

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

- Top up with coolant. Refer to **Filling**.

NOTE:

- **Only reuse drained coolant if cylinder head or engine block were not replaced.**
- **Dirty coolant cannot be reused.**

Tightening torques

Component		Nm
Oil pan (upper part) to	M7	16
Cylinder block and sealing flanges	M8	22
Oil pan (upper part) to transmission		45
Bracket for sound insulation to subframe		10
Electrical coolant pump to oil pan (upper part)		10
Engine mount to subframe		23
Bracket for catch container to chassis		10

Component	Nm
Bracket for refrigerant line to oil pan	10
Bracket for Secondary Air Injection (AIR) pump to longmember	10
Oil cooler to oil pan (upper part)	30
Guide tube for oil dipstick to secondary air line	10

Oil check valves and spray jet valve, overview

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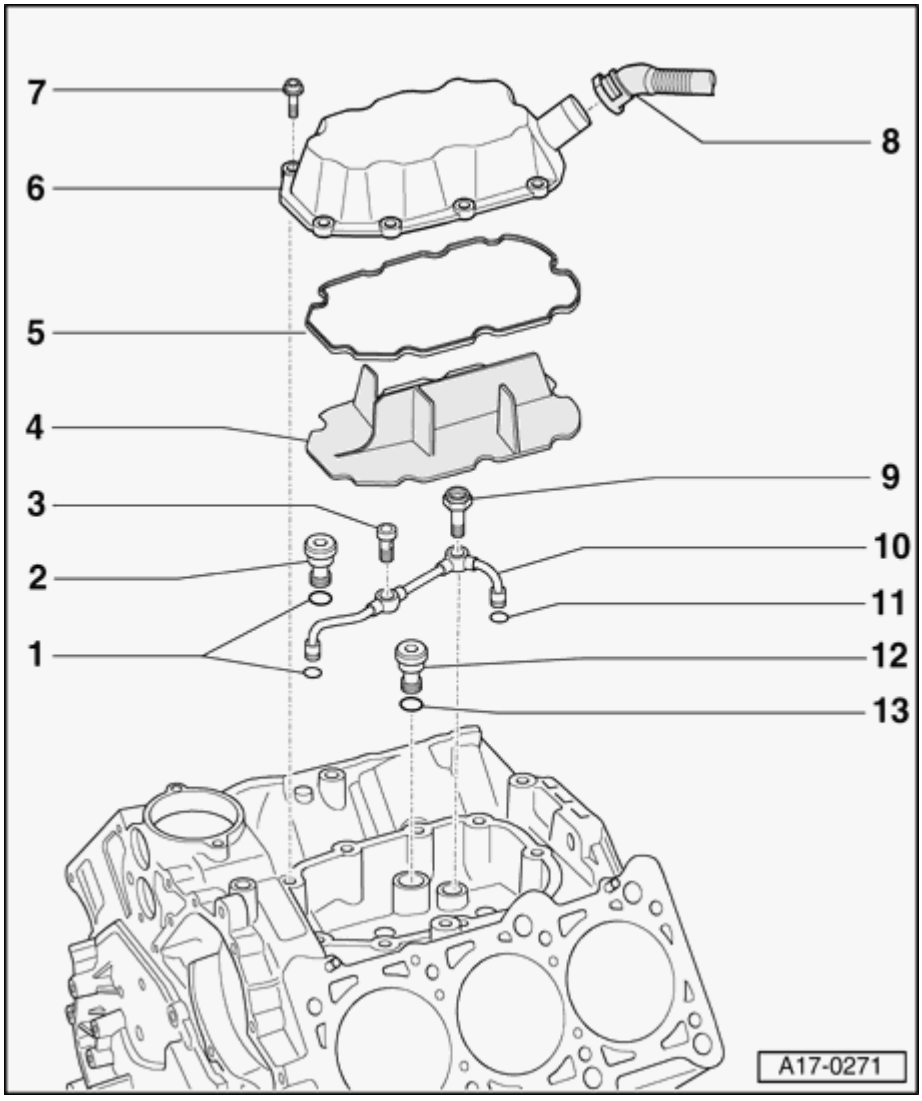


Fig. 421: Identifying Special Tools - Oil Check Valves And Spray Jet Valve, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: If irregular valve noise occurs repeatedly during short journeys and disappears after extended driving, the oil check valves must be replaced.

1 - O-Rings

- Always replace

2 - Oil check valve, 20 Nm

- For oil supply at left cylinder head

3 - Banjo fitting, 15 Nm

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4 - Baffle

5 - Gasket

- Always replace

6 - Cover

- With connection for crankshaft housing ventilation
- Removing. Refer to intake manifold, removing and installing: Refer to **Intake manifold, removing and installing**

7 - 10 Nm

8 - Hose

- To pressure regulation valve of crankshaft housing ventilation

9 - Spray jet valve, 25 Nm

- For piston cooling

10 - Oil line

11 - O-ring

- Always replace

12 - Oil check valve, 20 Nm

- For oil supply at right cylinder head

13 - O-ring

- Always replace

Oil pressure and oil pressure switch, checking

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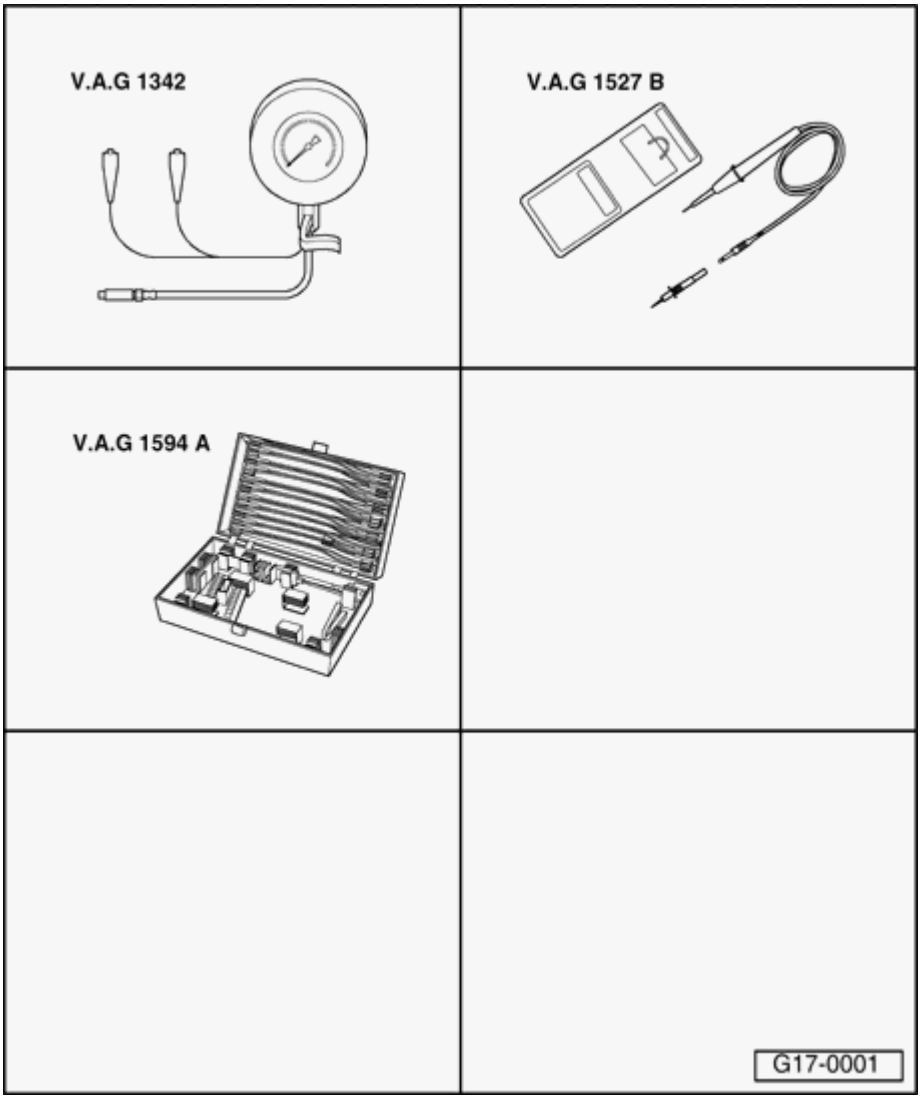


Fig. 422: Identifying Special Tools - Oil Pressure And Oil Pressure Switch, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1342 Oil pressure gauge
- VAG1527B Voltage tester
- VAG1594A Connector test kit

Requirements

- Oil level OK
- Engine oil temperature approximately 80 C.
- With ignition on, Oil pressure warning light -K3- must be lit.
- For vehicles with Auto Check System, "OK" indicator must be lit (call up symbol).

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Oil pressure switch, checking

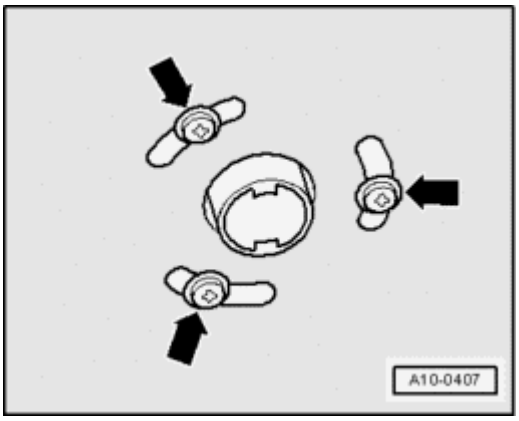


Fig. 423: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

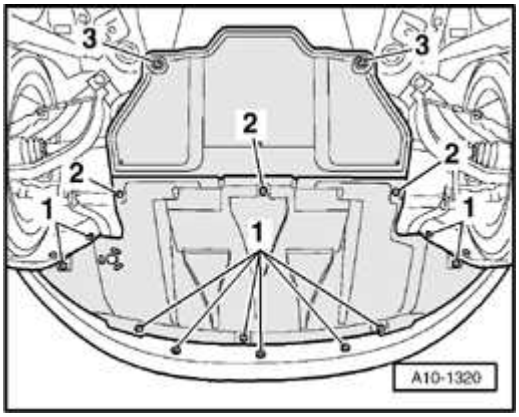


Fig. 424: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.

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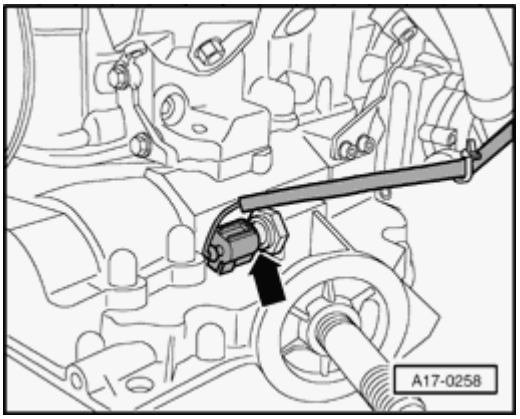


Fig. 425: Disconnecting Electrical Harness Connector At Oil Pressure Switch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector at oil pressure switch (arrow).

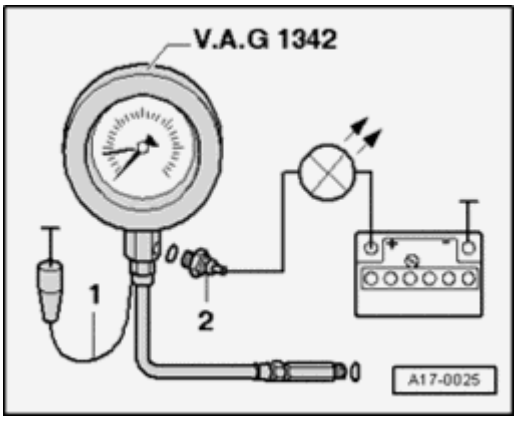


Fig. 426: Removing Oil Pressure Switch And Installing VAG1342 Oil Pressure Tester
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil pressure switch and install VAG1342 oil pressure tester.
- Install oil pressure switch -2- on VAG 1342.
- Connect brown wire -1- of tester to ground (GND).
- Using VAG1594A connector test kit, connect VAG1527B voltage tester to oil pressure switch and Battery positive (+).

- LED must not be lit

If LED is lit:

- Replace oil pressure switch.
- Start engine.

NOTE: While starting engine, watch pressure tester and LED as oil pressure switch

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may open during start.

Black oil pressure switch

- At 1.2 to 1.6 bar pressure, LED must light up

If LED does not light up:

- Replace oil pressure switch.

Oil pressure, checking

- Disconnect electrical wire from oil pressure switch.

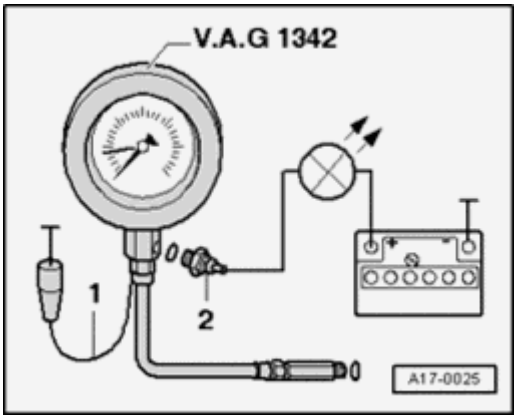


Fig. 427: Removing Oil Pressure Switch And Installing VAG1342 Oil Pressure Tester
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil pressure switch and install VAG1342 oil pressure tester.
- Install oil pressure switch -2- on VAG 1342.
- Start engine (engine oil temperature approximately 80°C).

- Oil pressure at idle: at least 1.5 bar
- Oil pressure at 2000 RPM: at least 3.0 bar

If specified values are not obtained:

- Pressure relief valve or oil pump faulty, replace oil pump.

Engine oil specification

Viscosity classes and oil specifications

Refer to Additional Information, Fluid Capacity Chart

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Oil level, checking

Requirements

- Minimum engine oil temperature: 60°C
- Vehicle on level ground.
- After stopping engine, wait a few minutes to allow oil to flow back into oil pan.

- Pull out oil dipstick, wipe off with a clean cloth and re-insert dipstick again up to stop.
- Withdraw dipstick again and read oil level.

Range of markings on dipstick:

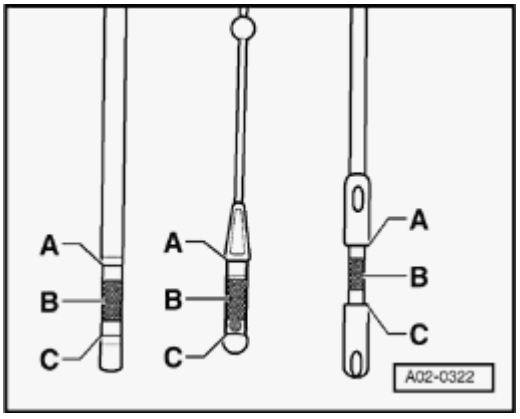


Fig. 428: Range Of Markings On Dipstick
Courtesy of VOLKSWAGEN UNITED STATES, INC.

a - Oil must not be topped up.

b - Oil may be topped up. After topping up, oil may reach range -a-.

c - Oil must be topped up. After topping up, it is sufficient if oil level is somewhere in range -b- (shaded area).

NOTE: Oil level must not exceed mark -a- on oil dipstick.

19 ENGINE - COOLING SYSTEM

COOLING SYSTEM COMPONENTS, REMOVING AND INSTALLING

Cooling system components, removing and installing

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

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NOTE:

- **The cooling system is under pressure when engine is warm. If necessary reduce pressure before repair.**
- **Secure all hose connections using hose clamps appropriate for the model type:**
- **VAG1921 hose clip pliers are recommended for installing spring-type clamps.**
- **Always replace gaskets, seals and O-rings.**
- **The arrows which are marked on coolant lines and hoses must face each other.**

Cooling system components

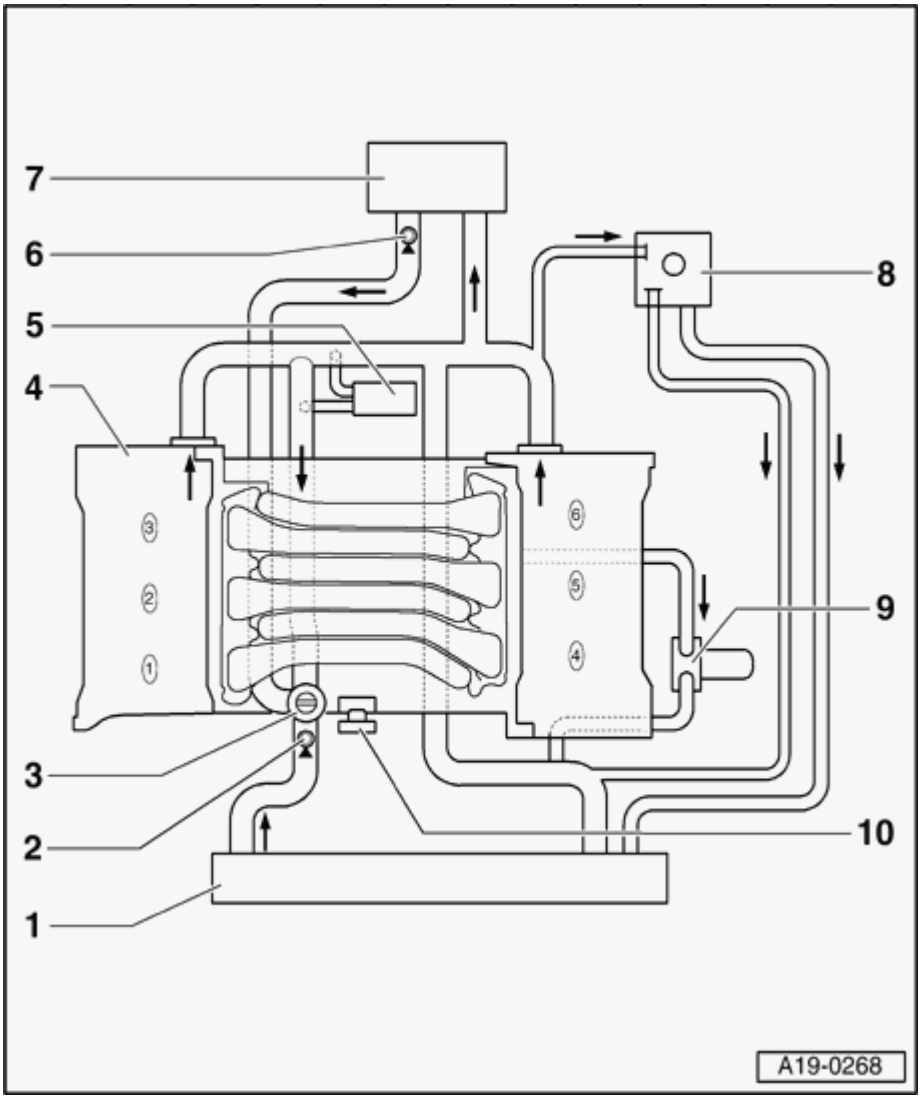


Fig. 429: Cooling System Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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Coolant hose connection diagram

1 - Radiator

- Removing and installing. Refer to **Radiator, removing and installing**
- After replacing, replace coolant

2 - Bleeder screw, 15 Nm

3 - Coolant thermostat

- Removing and installing. Refer to **Coolant thermostat, removing, installing and checking**
- Checking. Refer to **Check coolant thermostat**

4 - Cylinder head/Cylinder block

- After replacing, replace coolant

5 - Throttle valve control module -J338-

6 - Bleeder hole

- At coolant hose to heater core

7 - Heater core

- After replacing, replace coolant

8 - Expansion tank

- With cap
- Pressure relief valve in cap, checking. Refer to **Pressure relief valve in cap, checking**

9 - Oil cooler

10 - Coolant pump

- Removing and installing. Refer to **Coolant pump, removing and installing**
- Check for ease of movement

Coolant, draining and refilling

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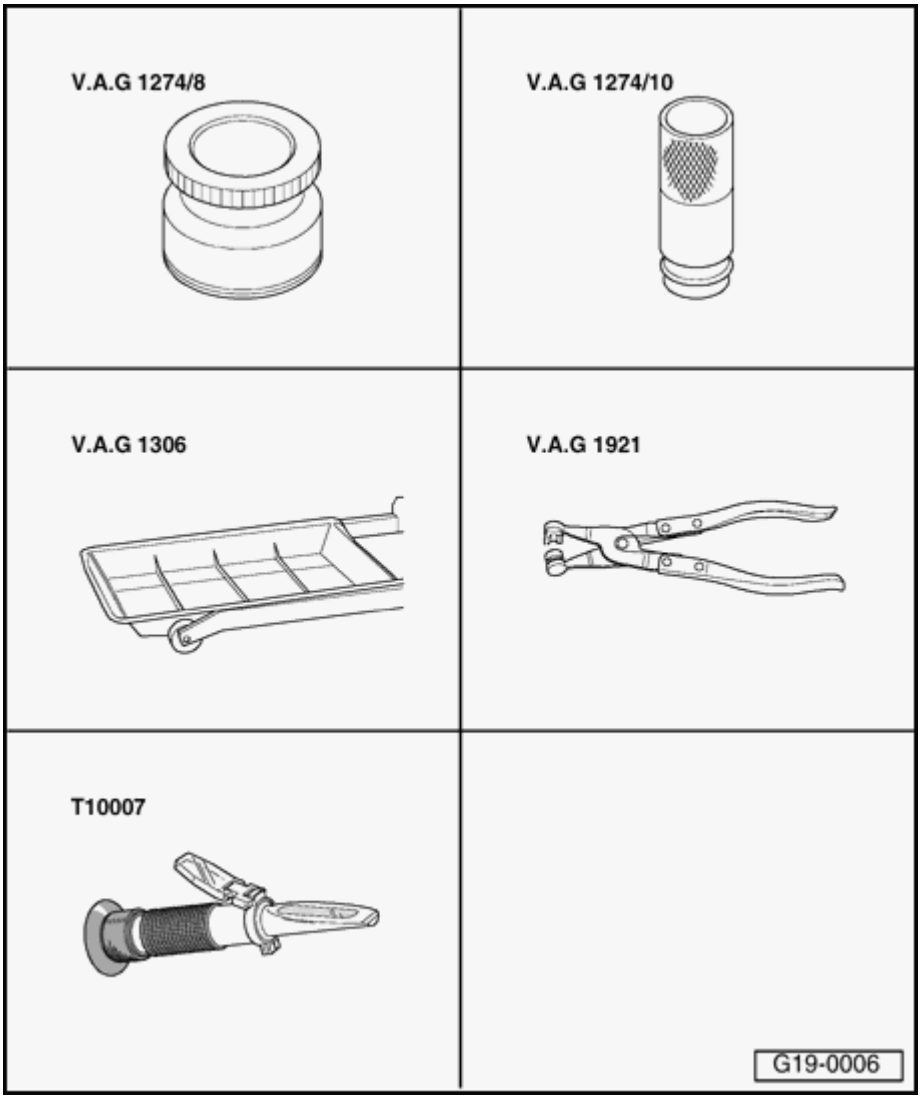


Fig. 430: Identifying Special Tools - Coolant, Draining And Refilling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1274/8 Adapter
- VAG1274/10 Adapter for VAG1274 Cooling system tester
- VAG1306 Drip tray for VAG1202A
- VAG1921 Hose clip pliers
- T10007 Refractometer

Draining

NOTE: Drained coolant must be stored in a clean container for disposal or reuse.

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WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open cap of coolant expansion tank.

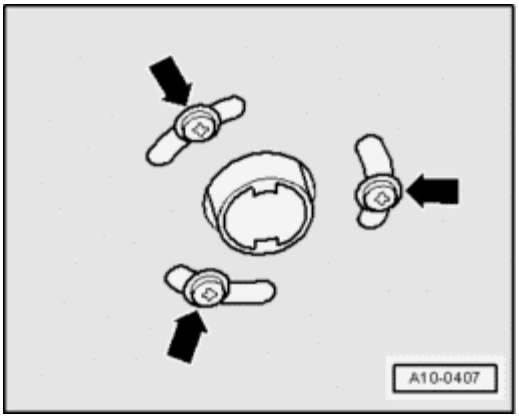


Fig. 431: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

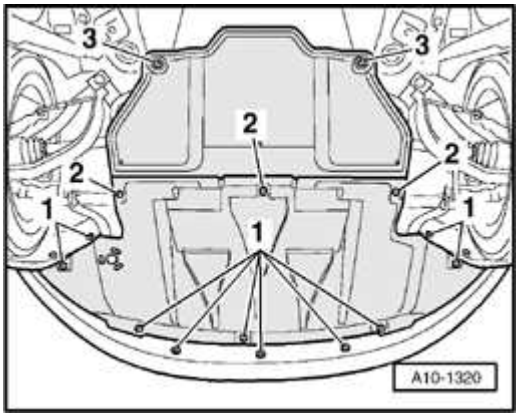


Fig. 432: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.
- Place VAG1306 drip tray beneath engine.

Vehicles with drain plug

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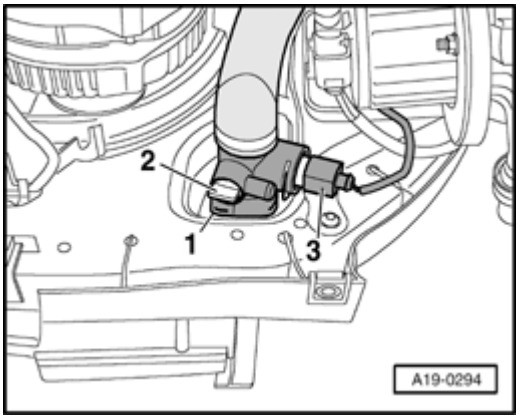


Fig. 433: Identifying Drain Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn radiator drain plug -2- counterclockwise. If needed, attach accessory hose to connection flange and drain coolant.

Vehicles without drain plug

- Remove retaining clamp for Engine Coolant Temperature (ECT) sensor (on radiator) -G83-.
- Remove Engine Coolant Temperature (ECT) sensor from outlet and drain coolant.

All

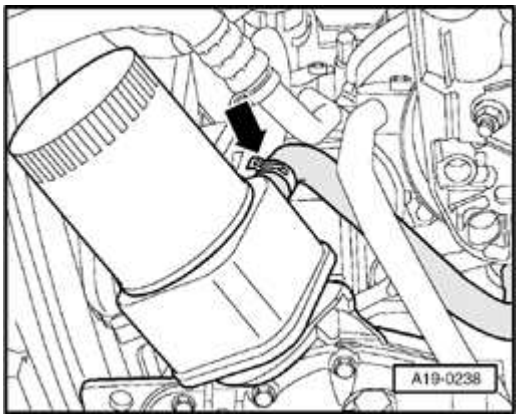


Fig. 434: Disconnecting Coolant Hose At Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In addition, disconnect coolant hose at oil cooler (arrow) and drain remaining coolant.

Filling

NOTE:

- **The cooling system must be filled year round with frost and corrosion protection additives.**
- **Only use coolant additive G 012 A8 D (according to TL VW 774 D).**

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Characteristic color: red

CAUTION: G 012 A8 D and other coolant additives must not be mixed. If mixed, major engine damage will occur.

- If the fluid in expansion tank is brown, G 012 A8 D has been mixed with other coolant. In this case, flush the cooling system and change the coolant. To flush, fill the cooling system with clear water and let the engine run for approx. 2 minutes. Flushing the system should remove most of the old coolant.
- G 012 A8 D and coolant additives marked with "according to TL VW 774 D" prevent frost and corrosion damage as well as lime deposits. They also raise the boiling point. Therefore, the cooling system must be filled year round with frost and corrosion protection additives.
- A higher boiling point improves engine reliability under heavy load particularly in countries with tropical climates.
- Frost protection must be ensured to about -25°C (about -35°C in countries with arctic climates).
- The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant additive portion must be at least 40%.
- If for climatic reasons greater frost protection is required, the amount of G 012 A8 D can be increased, but only up to 60% (frost protection to about -40°C), otherwise frost protection and cooling effectiveness will be reduced again.
- Use only clean drinking water for mixing with the coolant.
- If the radiator, heater core, cylinder head or cylinder head gasket is replaced, completely replace the engine coolant.
- For coolant G 012 A8 D, use T10007 refractometer to test frost protection in cooling system.

Recommended mixture ratios:

Frost protection to	Anti-freeze amount	G 012 A8 D1)	Water1)
-25°C	40%	3.2 L	4.8 L
-35°C	50%	4.0 l	4.0 l

1) Coolant quantity: 8.0 liters; can vary depending upon vehicle options.

Vehicles with drain plug

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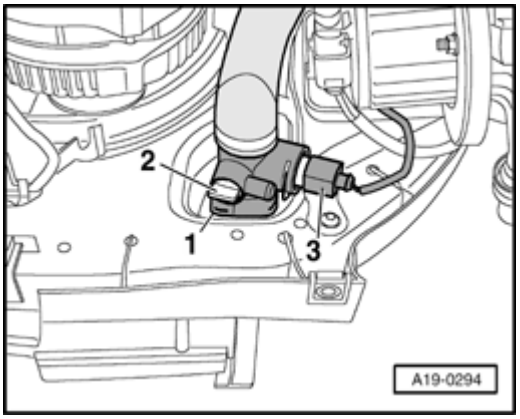


Fig. 435: Identifying Drain Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew drain plug -2- at radiator clockwise.

Vehicles without drain plug

- Insert Engine Coolant Temperature (ECT) sensor (on radiator) -G83- with new O-ring into outlet and secure it with retaining clamps.

All

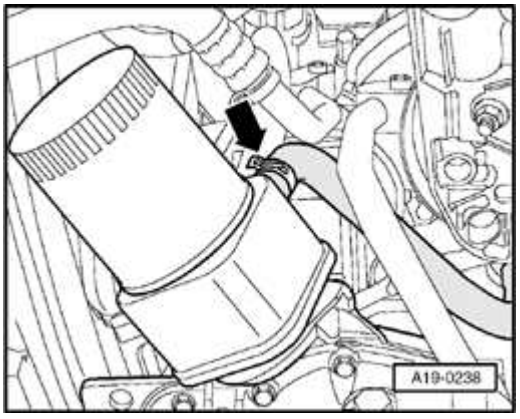


Fig. 436: Disconnecting Coolant Hose At Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect coolant hose to oil cooler (arrow).

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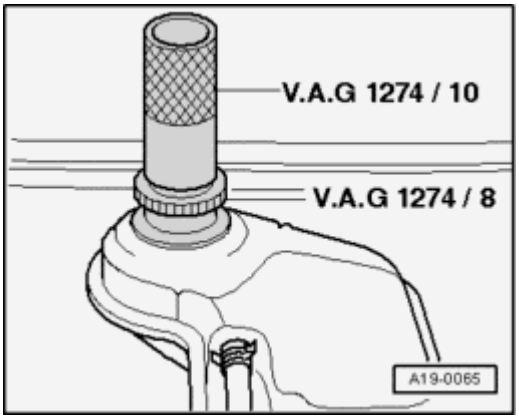


Fig. 437: Screw Adapter VAG1274/8 Onto Coolant Expansion Tank & Fit Special Tool VAG1274/10 Onto Adapter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw VAG1274/8 adapter onto expansion tank.
- Attach VAG1274/10 special tool to VAG1274/1 adapter.

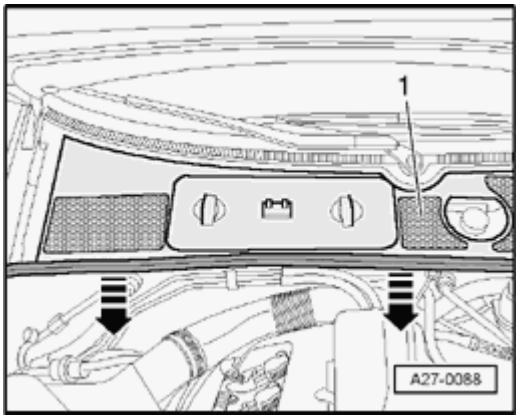


Fig. 438: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off rubber seal of plenum chamber cover in direction of (arrow).
- Remove cover -1- toward front.

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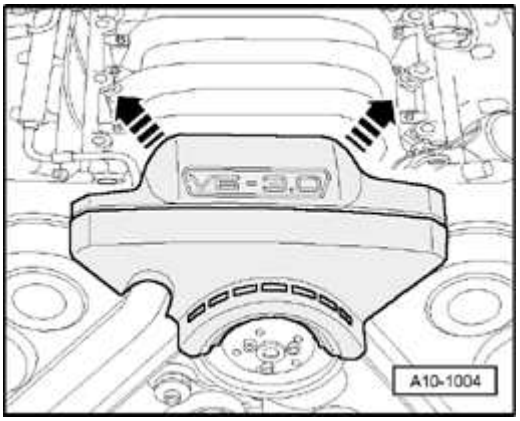


Fig. 439: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

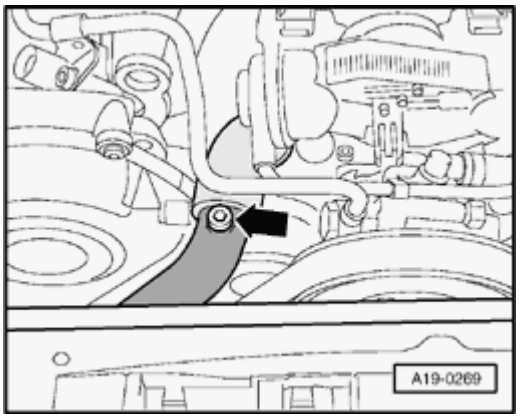


Fig. 440: Removing Bleeder Screw
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bleeder screw (arrow).
- Fill with coolant until it escapes from coolant hose bleeder hole.
- Tighten bleeder screw to 15 Nm.

NOTE: Always replace sealing ring.

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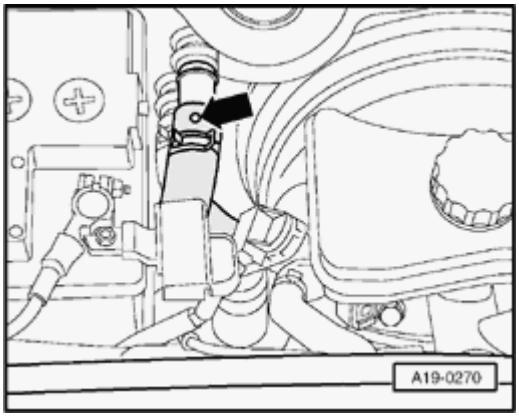


Fig. 441: Loosening Coolant Hose To Heater Core
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen coolant hose to heater core and pull back hose sufficiently so that bleeder hole (arrow) is no longer sealed by connection.
- Fill with coolant until it escapes from coolant hose bleeder hole.
- Slide coolant hose onto connection sleeve and secure using spring-type clamp.
- Install coolant expansion tank cap.

- Start engine and maintain an engine speed of about 2000 RPM for approx. 3 minutes.
- Allow engine to idle until lower coolant hose at radiator is hot.

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Check coolant level and top up if necessary. With engine at operating temperature, coolant level must be at max. marking, with engine cold, it must be between min. and max. marking.
- Turn engine off.

Tightening torque

Component	Nm
Bleeder screw at coolant line	15

Coolant pump and coolant regulator

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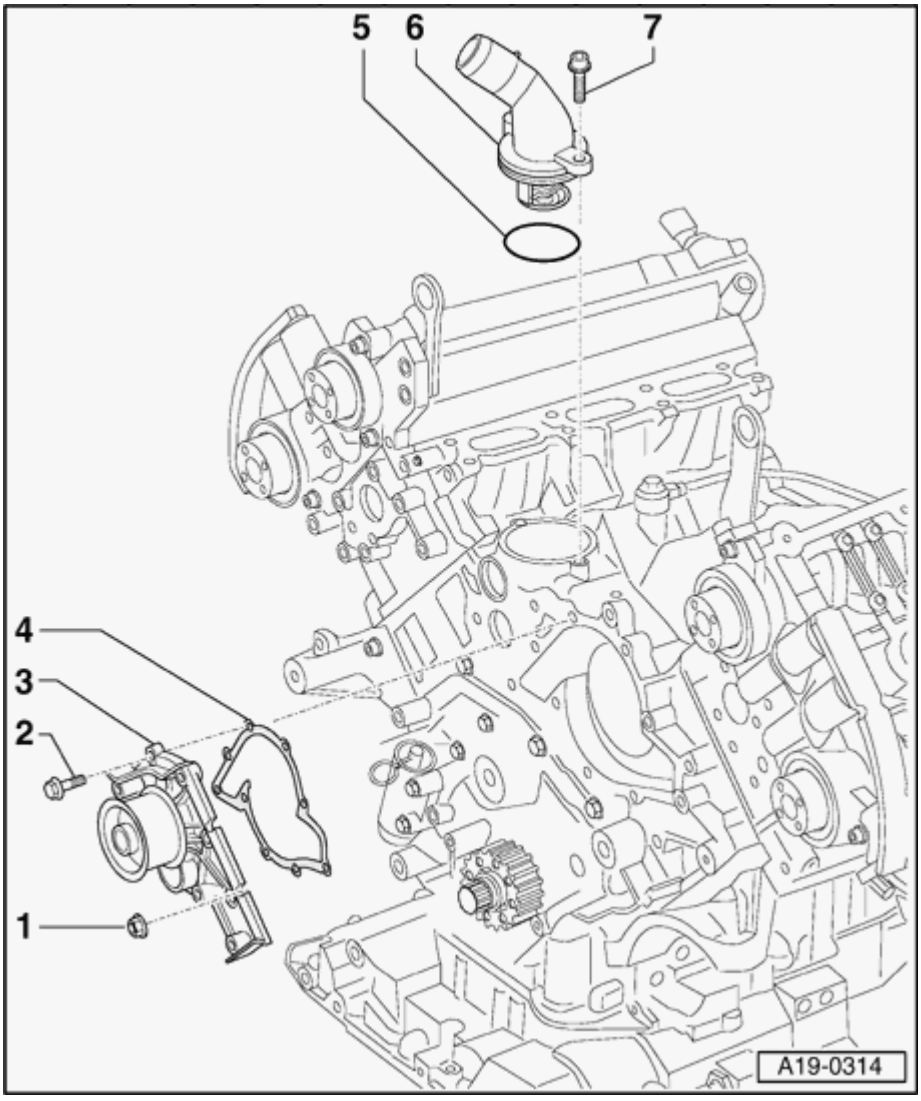


Fig. 442: Coolant Pump And Coolant Regulator Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - 10 Nm

3 - Coolant pump

- Removing and installing. Refer to **Coolant pump, removing and installing**
- Check for ease of movement

4 - Gasket

- Always replace

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5 - O-ring

- Always replace

6 - Coolant regulator/thermostat

- With connecting piece
- Can only be replaced together
- Removing and installing. Refer to **Coolant thermostat, removing, installing and checking**
- Checking. Refer to **Check coolant thermostat**

7 - 10 Nm

Coolant pump, removing and installing

Removing

- Drain coolant. Refer to **Coolant, draining and refilling**.
- Remove toothed belt. Refer to **Toothed belt, removing and installing**.
- Remove camshaft gears from right cylinder head.

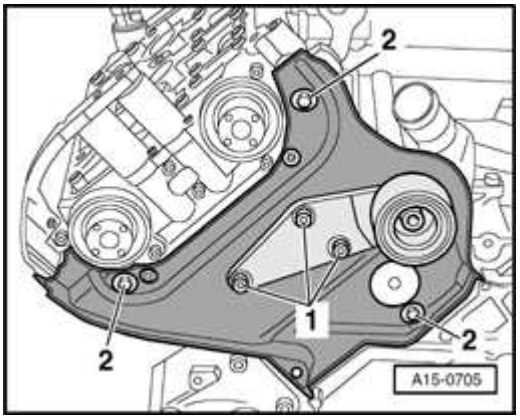


Fig. 443: Unscrewing Bolts And Removing Bracket With Idler Roller & Toothed Belt Guard At Right Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and remove bracket with idler roller.
- Unscrew bolts -2- and remove toothed belt guard at right rear.
- Remove eccentric pulley for toothed belt.

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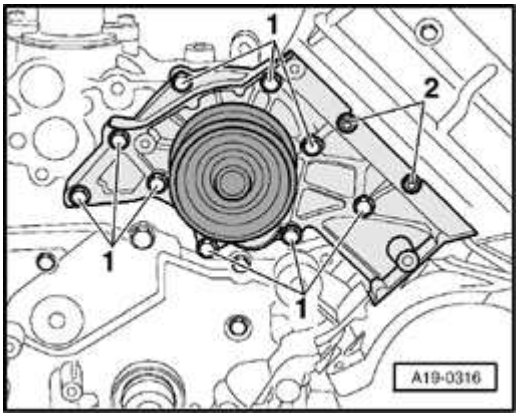


Fig. 444: Removing Nuts For Toothed Belt Guard At Left Rear & Bolts For Coolant Pump And Remove Coolant Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -2- for toothed belt guard at left rear.
- Remove bolts -1- for coolant pump and remove coolant pump.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and O-rings.

- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.
- Top up coolant. Refer to **Filling**.

Tightening torques

Component	Nm
Coolant pump to cylinder block	10
Rear toothed belt guard to coolant pump	10
Right rear toothed belt guard to engine	10 1)
Bracket for idler roller to cylinder head	10 1)

1) Always replace bolt

Coolant thermostat, removing, installing and checking

Removing

- Drain coolant. Refer to **Coolant, draining and refilling**.
- Remove intake manifold. Refer to **Intake manifold, removing and installing**.

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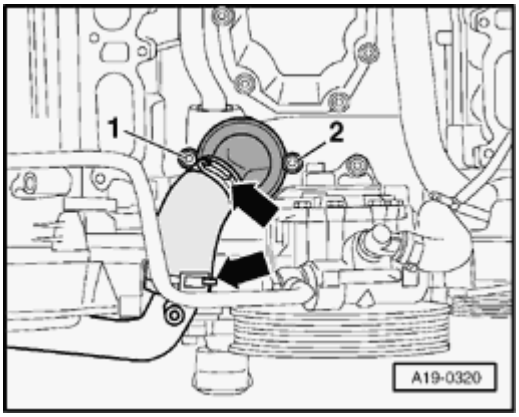


Fig. 445: Removing Bolts & Disconnecting Coolant Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-.
- Disconnect coolant hose (arrows).
- Remove coolant regulator with connection.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace O-ring.

- Clean and/or smooth O-ring sealing surface before installing.
- Install coolant regulator with coolant regulator housing.
- Install intake manifold. Refer to **Installing**.

Tightening torque

Component	Nm
Coolant regulator housing to cylinder block	10

Check coolant thermostat

- Warm thermostat in hot water bath.

Starts to open	Opening end	Opens
approx. 87°C	approx. 102°C1)	min. 8 mm

1) cannot be checked

Coolant lines, overview

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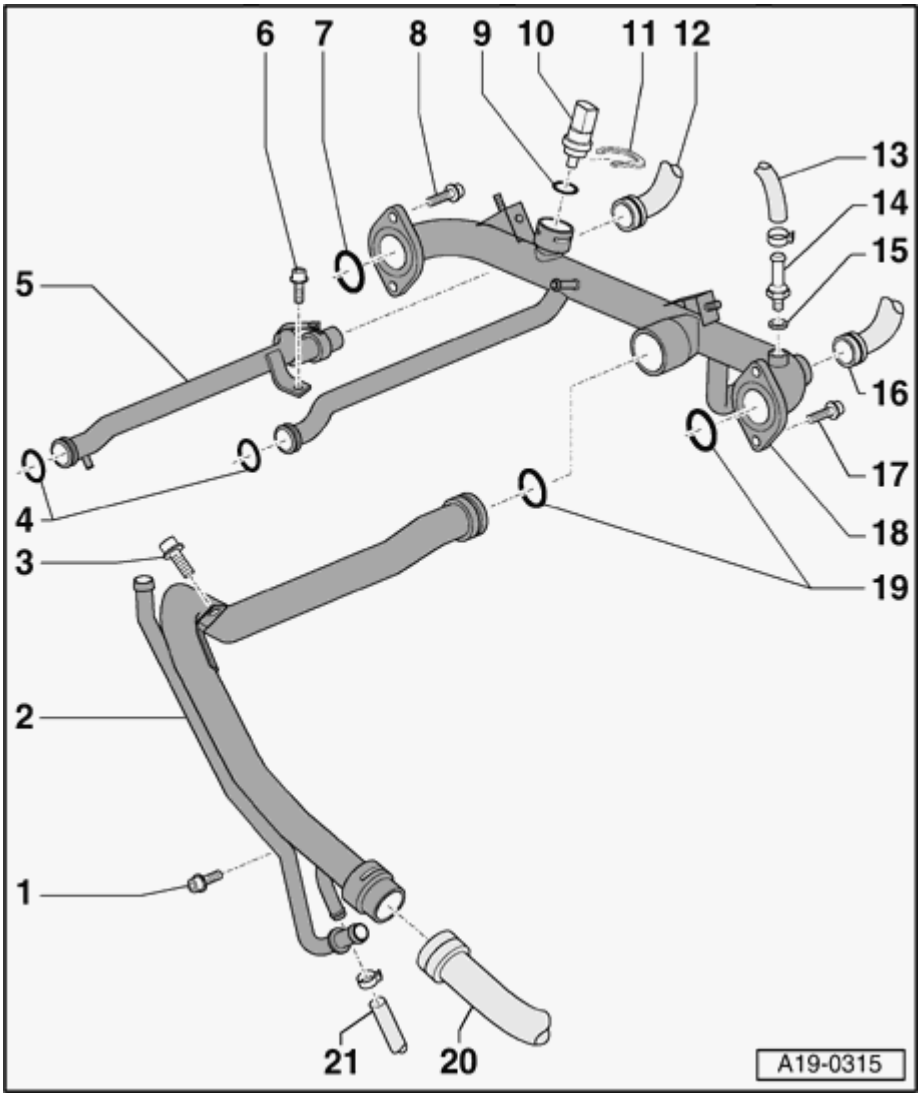


Fig. 446: Coolant Lines, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - Front coolant line

- Removing and installing. Refer to **Front coolant line, removing and installing**

3 - 22 Nm

4 - O-ring

- Always replace

5 - Coolant line, right

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- Removing and installing. Refer to **Right coolant line, removing and installing**

6 - 10 Nm

7 - O-ring

- Always replace

8 - 10 Nm

9 - O-ring

- Always replace

10 - Engine Coolant Temperature (ECT) sensor -G2-/-G62-

11 - Retaining clip

12 - Coolant hose

- To heater core

13 - Coolant hose

- To expansion tank

14 - Connecting piece

- Tighten to 15 Nm

15 - Seal

- Always replace

16 - Coolant hose

- To heater core

17 - 10 Nm

18 - Rear coolant line

- Removing and installing. Refer to **Rear coolant line, removing and installing**

19 - O-ring

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- Always replace

20 - Coolant hose

- To top of radiator

21 - Coolant hose

- To oil cooler

Front coolant line, removing and installing

Special tools and equipment

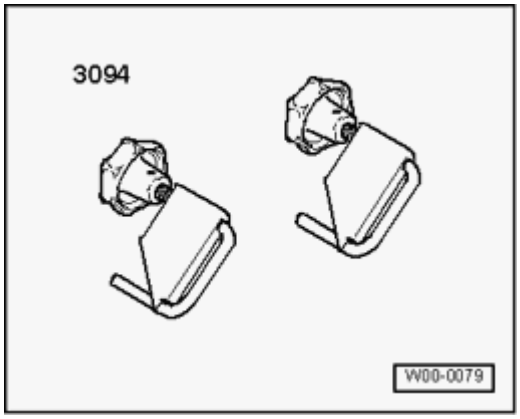


Fig. 447: Identifying Hose Clamps 3094
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3094 Hose clamps
- Oil receptacle

Removing

NOTE: All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.

- Remove intake manifold. Refer to **Intake manifold, removing and installing**.
- Remove toothed belt. Refer to **Toothed belt, removing and installing**.
- Remove camshaft gears from left cylinder head.

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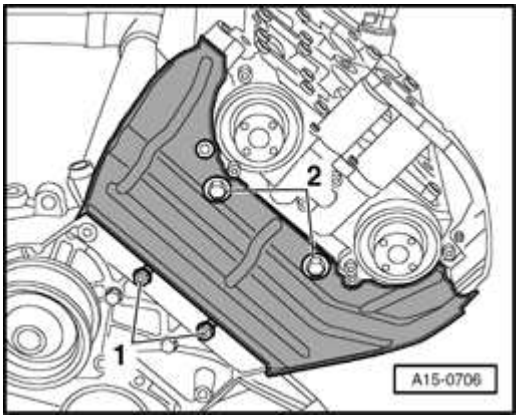


Fig. 448: Unscrewing Bolts And Removing Toothed Belt Guard At Left Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and -2- and remove toothed belt guard at left rear.
- Place oil pan underneath.

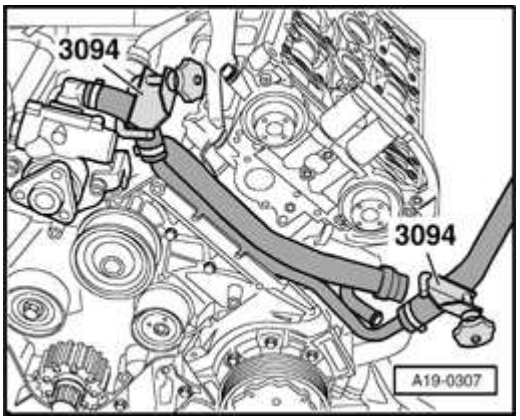


Fig. 449: Clamping Off Two Hoses At Hydraulic Fluid Supply Line Using 3094 Hose Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clamp off two hoses at hydraulic fluid supply line using 3094 hose clamps.
- Disconnect both hydraulic hoses from supply line.
- Disconnect coolant hoses at front coolant line.

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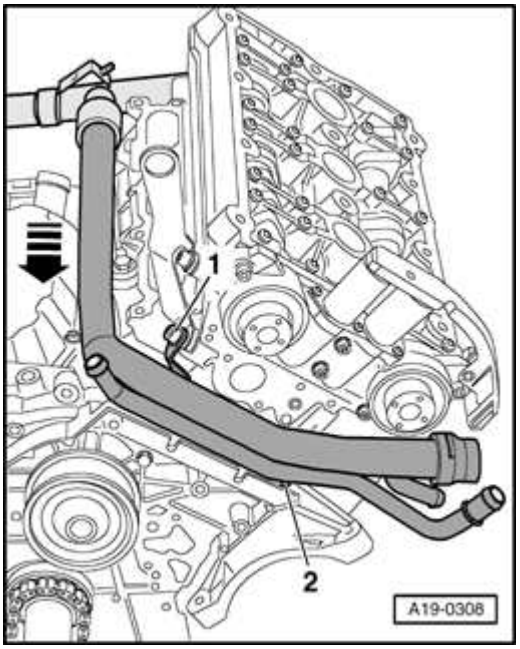


Fig. 450: Removing Coolant Line Toward Front
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and move pipes at coolant line to side.
- Remove coolant line toward front (arrow).

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type:**
- **Replace O-rings.**

- Clean and/or smooth O-ring sealing surface before installing.
- Coat new O-ring with G12 and slide onto coolant line.
- Slide front coolant line into hole at rear coolant line.
- Install intake manifold. Refer to **Installing**.

- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.
- Fill power steering with fluid and bleed steering system:

Refer to **48 - STEERING**

Tightening torques

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Component		Nm
Front coolant line	M6	10
To cylinder head	M8	22
Rear toothed belt guard to cylinder head or cylinder block		10 1)

1) Replace bolts.

Right coolant line, removing and installing

Removing

- Remove intake manifold. Refer to **Intake manifold, removing and installing**.

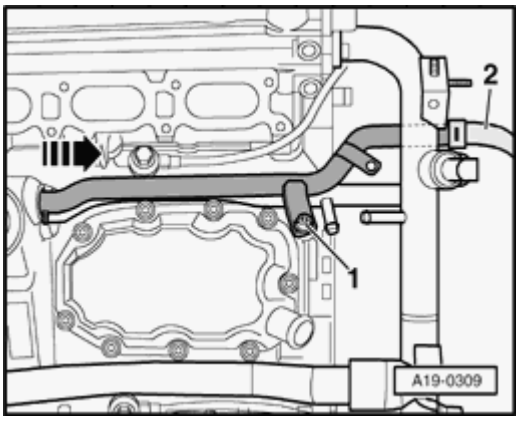


Fig. 451: Disconnecting Rear Coolant Hose From Right Coolant Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect rear coolant hose -2- from right coolant line.
- Remove bolts -1-.
- Pull right coolant line out of cylinder block toward rear (arrow).
- Remove catalytic converter upward.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type:**
- **Replace O-rings.**
- **Clean and/or smooth O-ring sealing surface before installing.**
- **Coat new O-ring with G12 and slide onto coolant line.**
- **Slide coolant line into hole at cylinder block.**
- **Install intake manifold. Refer to Installing.**

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Tightening torque

Component	Nm
Right coolant line to cylinder block	10

Rear coolant line, removing and installing

Removing

NOTE: All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.

- Remove right coolant line. Refer to **Right coolant line, removing and installing**.
- Expose wires at hose of crankshaft housing ventilation.

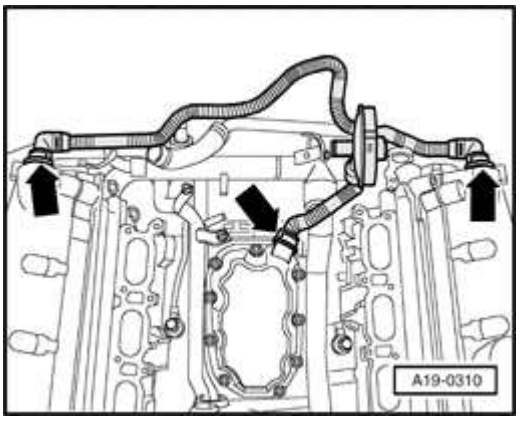


Fig. 452: Removing Hose Of Crankshaft Housing Ventilation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove hose of crankshaft housing ventilation (arrow).

Vehicles with automatic transmission

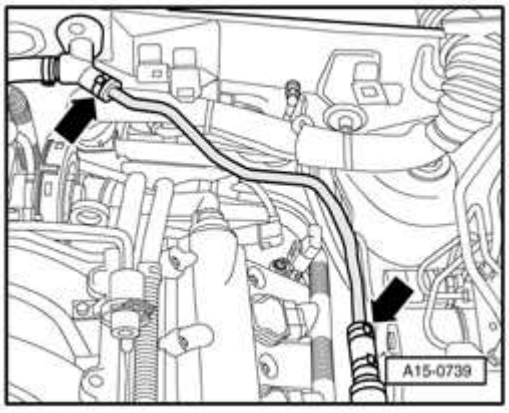


Fig. 453: Disconnecting Vacuum Hose To Brake Booster

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose to brake booster (arrows).

All

- Remove heat shield for harness connectors at left of bulkhead, if installed.

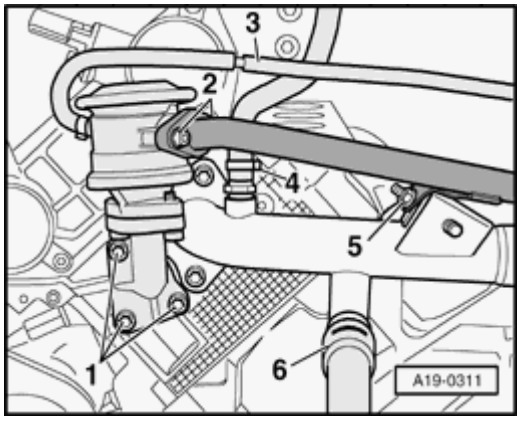


Fig. 454: Identifying Coolant Hose, Bolts, Nut & Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant hose -4-.
- Remove bolts -2- and nut -5- and remove hose for secondary air injection.
- Disconnect vacuum hose -3- from combination valve.
- Remove bolts -1- and remove combination valve for secondary air injection.

- Remove coolant hose -6-.

NOTE: The illustration is shown with the engine removed.

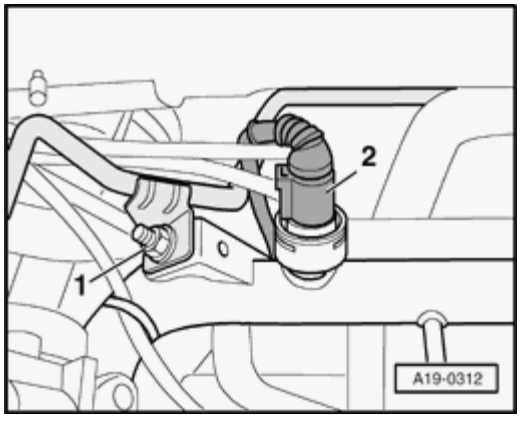


Fig. 455: Disconnecting Electrical Harness Connector At Engine Coolant Temperature (ECT) Sensor -G2-/-G62-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Disconnect electrical harness connector -2- at Engine Coolant Temperature (ECT) sensor -G2-/-G62-.
- Disconnect hydraulic line of power steering at rear coolant line -1-.
- Remove screw clips for electrical wiring harness at rear coolant line.
- Expose electrical wires at rear coolant line.

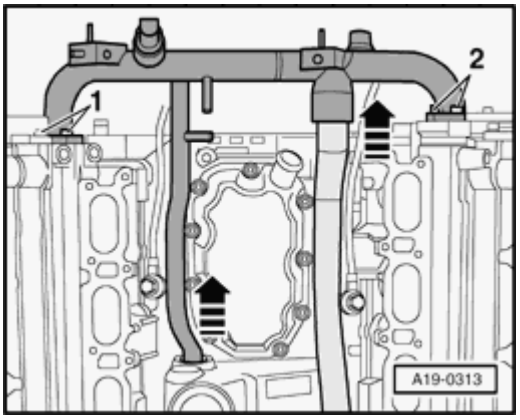


Fig. 456: Removing Bolts & Catalytic Converter Toward Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-.
- Remove catalytic converter toward rear.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type:**
- **Replace seals and O-rings.**

- Clean and/or smooth O-rings sealing surface before installing.
- Coat new O-rings with G12 and slide onto coolant line.
- Install right coolant line. Refer to **Installing**.

Tightening torques

Component	Nm
Rear coolant line to cylinder head	10
Power steering pressure line to coolant line	20
Connecting tube to combination valve	10
Connecting tube to rear coolant line	10

Radiator, removing and installing

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Special tools and equipment

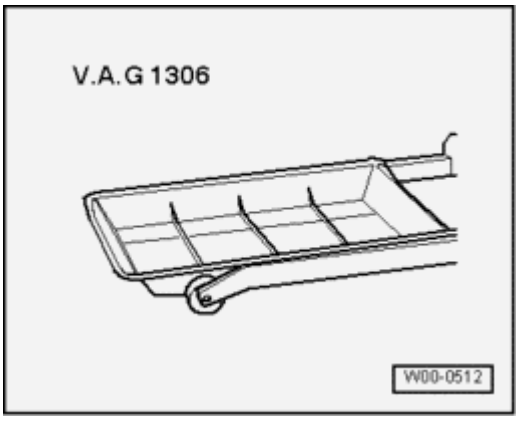


Fig. 457: Identifying Drip Tray V.A.G 1306
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1306 Drip tray for VAG1202A

Removing

- Remove front bumper:

Refer to

- **63 BUMPER**
- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

NOTE: Drained coolant must be stored in a clean container for disposal or reuse.

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open cap of coolant expansion tank.

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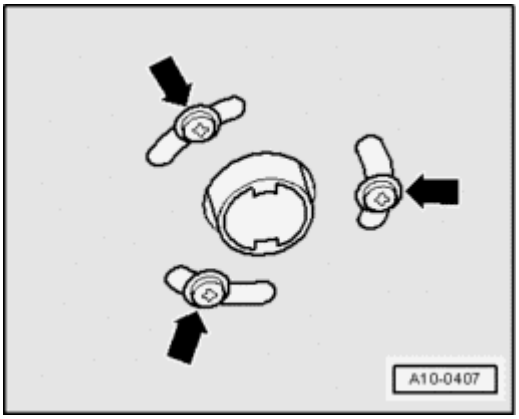


Fig. 458: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

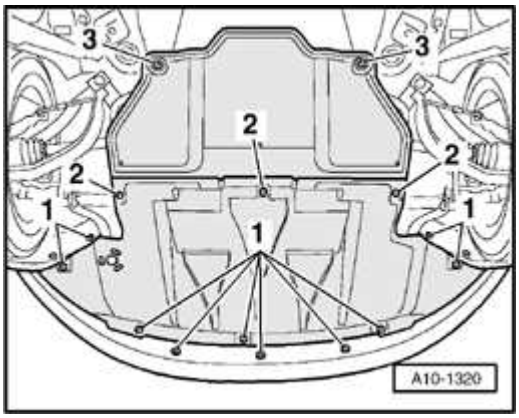


Fig. 459: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.
- Place VAG1306 drip tray beneath engine.

Vehicles with drain plug

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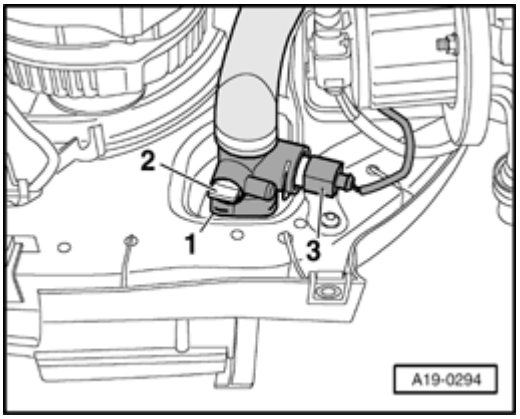


Fig. 460: Identifying Drain Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn radiator drain plug -2- counterclockwise. If needed, attach accessory hose to connection flange and drain coolant.

Vehicles without drain plug

- Remove retaining clamp for Engine Coolant Temperature (ECT) sensor (on radiator) -G83-.
- Remove Engine Coolant Temperature (ECT) sensor from outlet and drain coolant.

All

- Pull off retaining clip -1- for lower coolant hose and disconnect coolant hose from radiator.

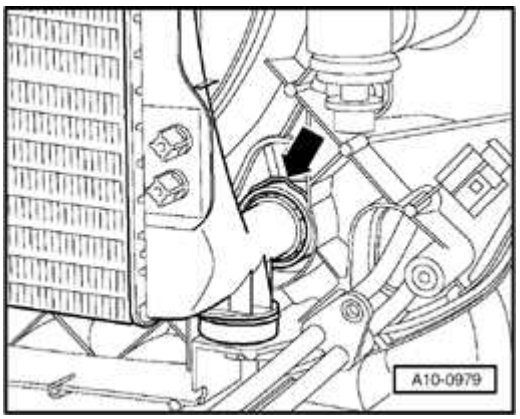


Fig. 461: Disconnecting Lower Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect left coolant hose from radiator (arrow).

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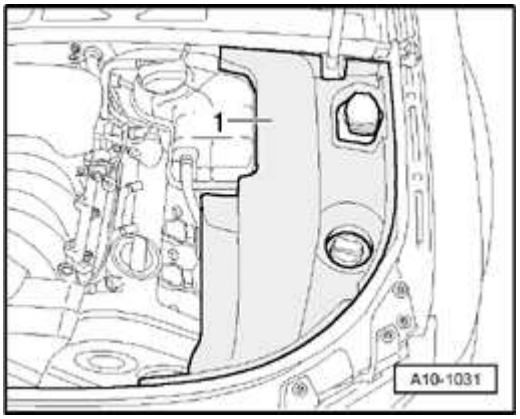


Fig. 462: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

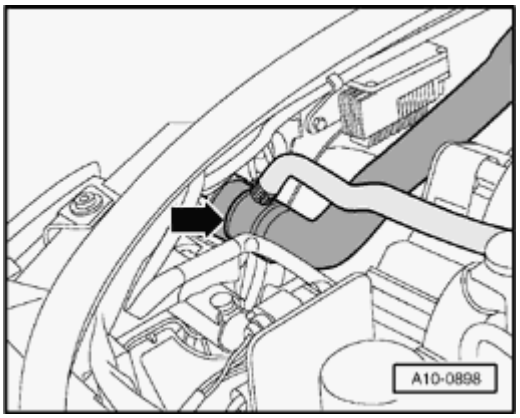
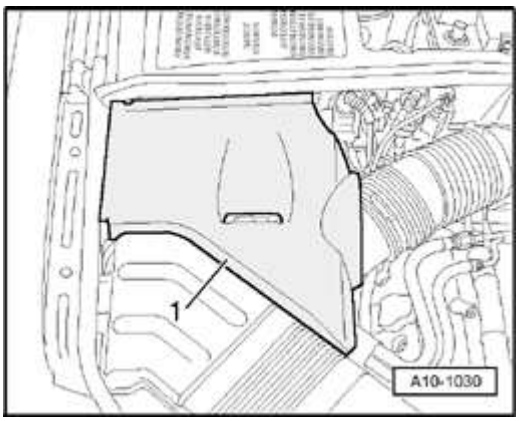


Fig. 463: Disconnecting Top Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect top coolant hose (arrow) from radiator.

Vehicles with automatic transmission



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Fig. 464: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

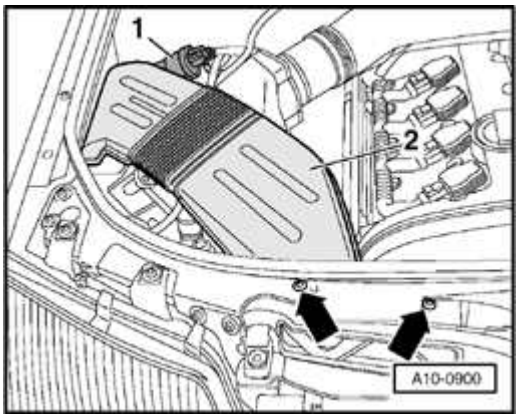


Fig. 465: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

NOTE: Observe the rules of cleanliness for working on automatic transmissions:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

- Place an oil receptacle underneath.

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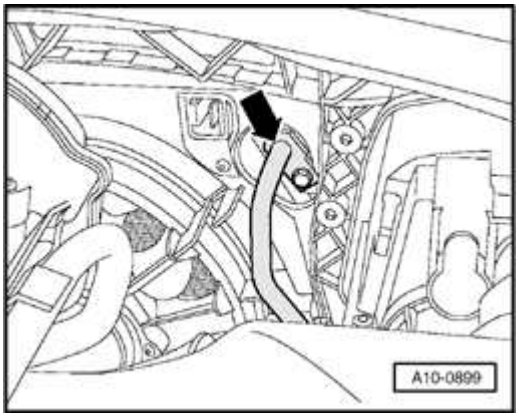


Fig. 466: Disconnecting ATF-Lines At Top And Bottom Of Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect top (arrow) and bottom ATF lines from radiator:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

- Tie up ATF lines to top of longmember to prevent fluid from escaping.

All

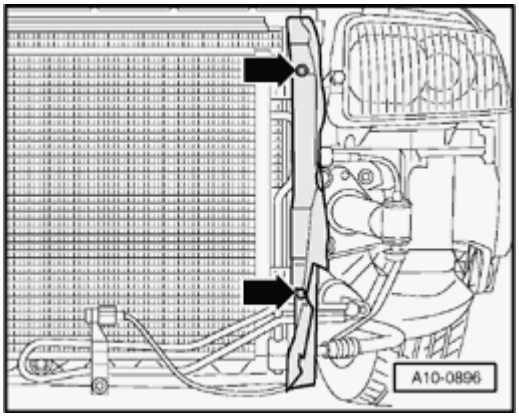


Fig. 467: Removing Air Ducts On Left/Right Of Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air guides from left and right of radiator (arrows).

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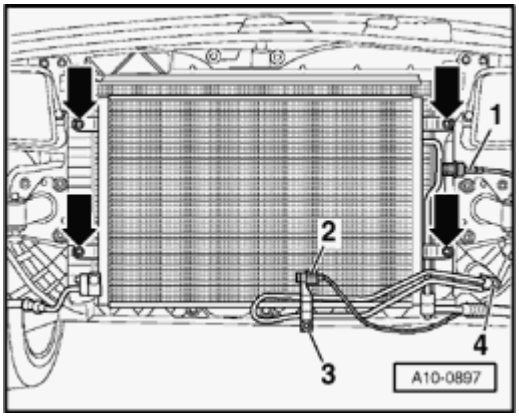


Fig. 468: Identifying Outside Air Temperature Sensor G17, Bolts & High Pressure Sensor G65 Electrical Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip temperature sensor -2- for outside temperature display from bracket.
- Remove bolts -3- and -4- and remove power steering cooling coil. Hoses remain connected.
- Disconnect harness connector -1- at High pressure sensor -G65-.

CAUTION: Do not open refrigerant circuit for A/C system.

- Remove condenser mounting bolts (arrows).

NOTE: Do not bend or stretch lines or hoses as condenser and/or refrigerant lines/hoses may be damaged.

- Carefully swing condenser downward and move aside.

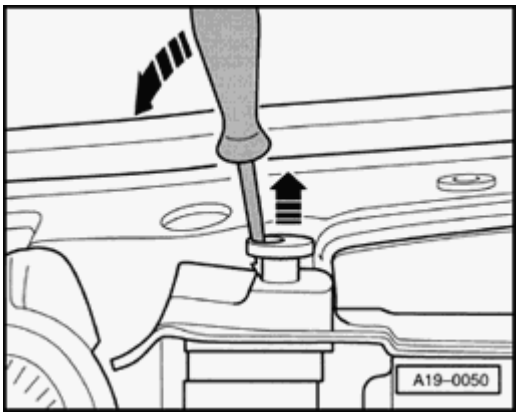


Fig. 469: Loosening Both Radiator Retaining Bolts, Pulling Up And Removing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen both radiator retaining bolts, pull up and remove (arrows).

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- Tilt radiator forward, pull up and remove.

Installing

Installation is reverse of removal, noting the following:

- Install front bumper:

Refer to

- **63 BUMPER**
- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

- Top up coolant. Refer to **Filling**.

NOTE: Complete quantity of coolant must be replaced if the radiator was replaced.

Vehicles with automatic transmission

- Secure ATF lines:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Check ATF level:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

Tightening torque

Component	Nm
Condenser to radiator	10

Coolant fan motor, replacing

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Special tools and equipment

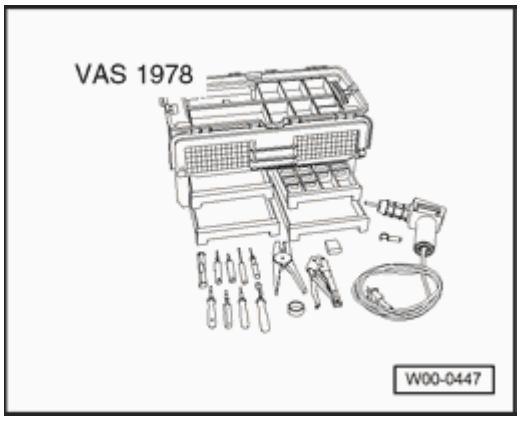


Fig. 470: Wiring Harness Repair Kit V.A.S 1978
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS1978 Wiring harness repair kit

NOTE:

- **Coolant FC (Fan Control) Control Module and coolant fan motor are supplied as a replacement part without the harness connector.**
- **Repairs to wiring harnesses and connectors must only be performed using the VAS1978 wiring harness repair kit.**

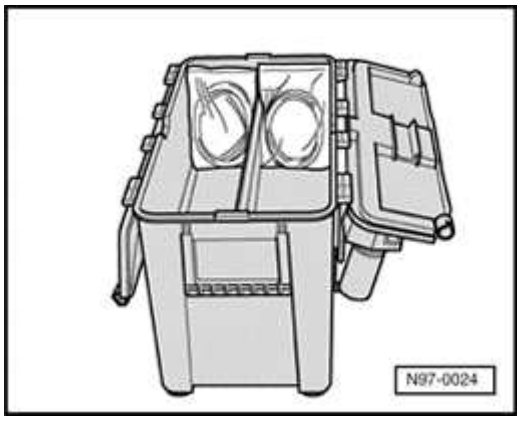


Fig. 471: Opened Wiring Harness Repair Kit VAS 1978
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Detailed instructions on how to use VAS1978 are supplied with the repair kit.

The manual also explains how to repair open circuits and faulty connectors.

Cooling system, checking for leaks

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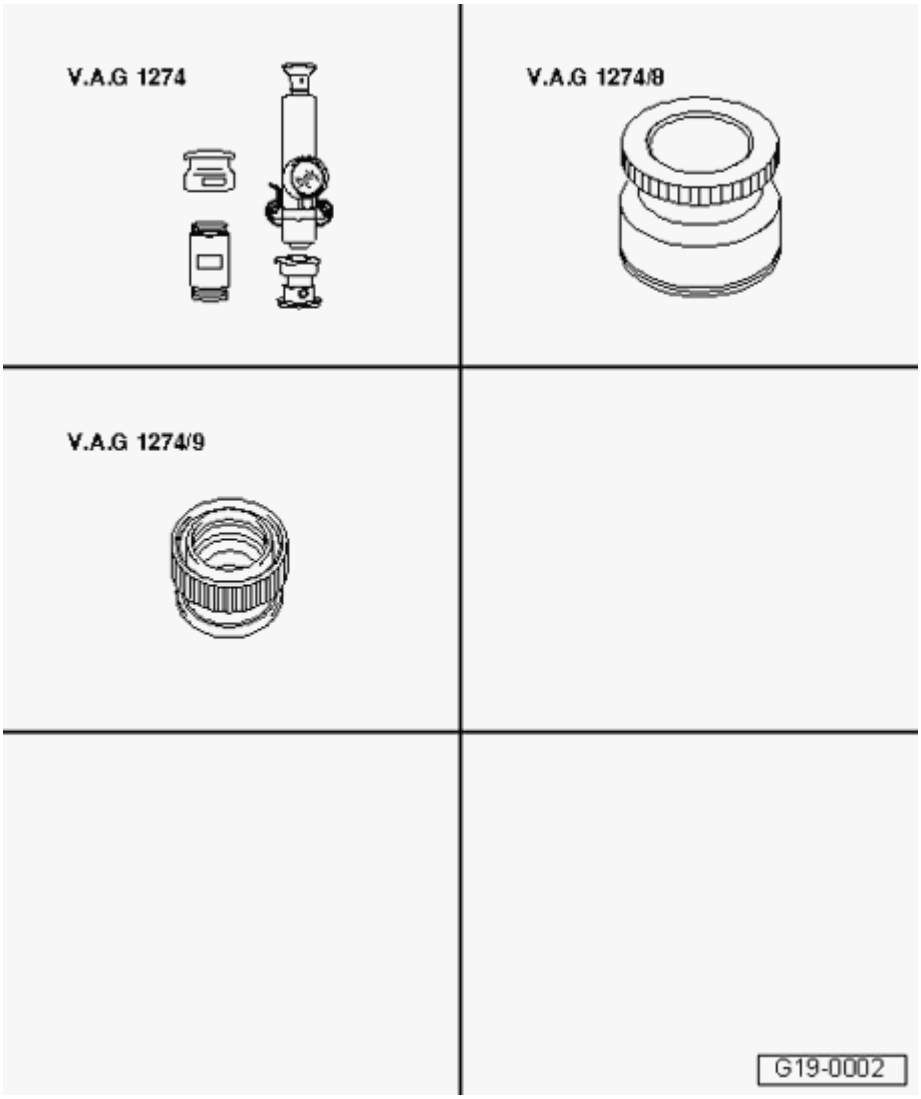


Fig. 472: Identifying Special Tools - Cooling System, Checking For Leaks
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1274 Cooling system tester
- VAG1274/8 Adapter
- VAG1274/9 Adapter

Requirement

- Engine at operating temperature.

Work sequence

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e.

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hot coolant may escape when opening.

- Open cap of coolant expansion tank.

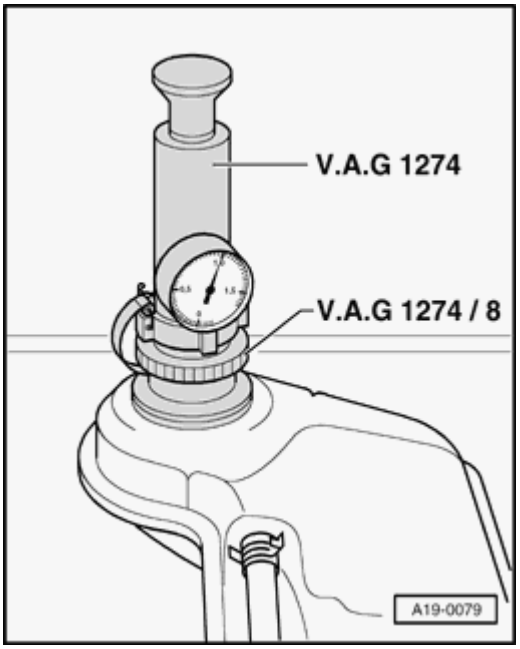


Fig. 473: Attaching VAG1274 Cooling System Tester Together With VAG1274/8 Adapter To Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach VAG1274 cooling system tester together with VAG1274/8 adapter to coolant expansion tank.
- Use tester hand pump to create a pressure of approx. 1.0 bar.
- If pressure drops, detect leak and repair malfunction.

Pressure relief valve in cap, checking

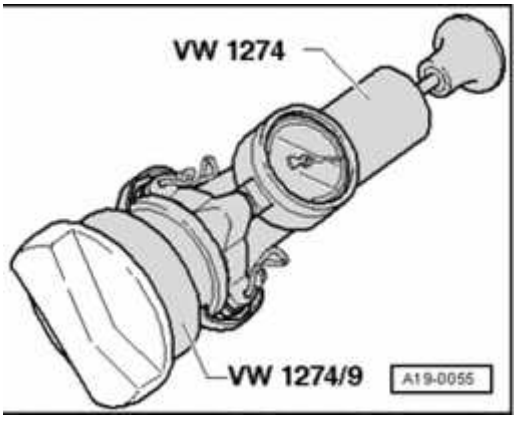


Fig. 474: Checking Pressure Relief Valve In Filler Cap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Using VAG1274/9 adapter attach VAG1274 cooling system tester to coolant reservoir tank cap.
- Pump using hand pump.

- Pressure release valve must open at a positive pressure of 1.4 to 1.6 bar

26 EXHAUST SYSTEM, EMISSION CONTROLS

EXHAUST SYSTEM, SERVICING

Exhaust system, servicing

NOTE:

- **Always replace gaskets and self-locking nuts.**
- **After exhaust system repairs, make sure the exhaust system is not under stress and is far enough from the body. If necessary, loosen clamps and align mufflers and exhaust pipes so that there is adequate distance to the vehicle body, and weight is evenly distributed among the exhaust hangers.**
- **The flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.**

Exhaust system components, overview (vehicles with front wheel drive)

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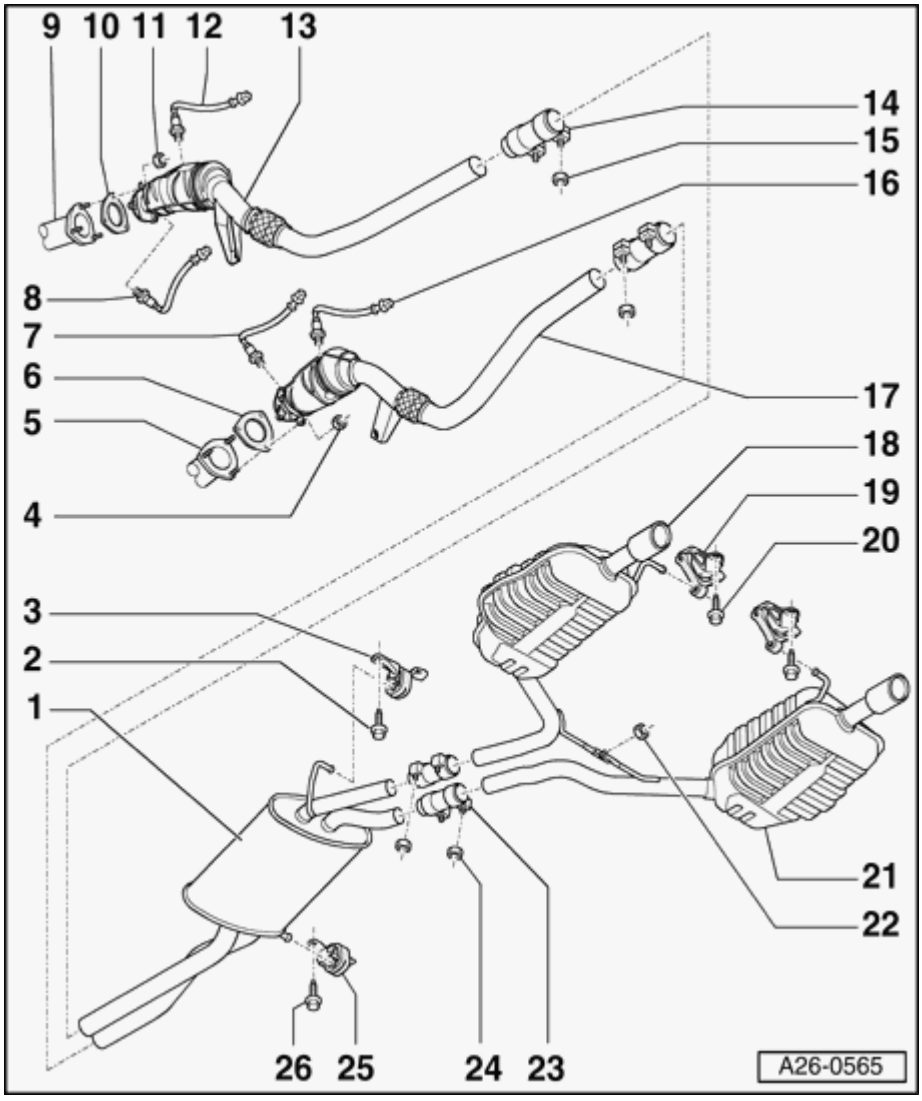


Fig. 475: Exhaust System Components, Overview (Vehicles With Front Wheel Drive)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Center muffler

- Factory installed with rear muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**

2 - 23 Nm

3 - Support ring

- Replace if damaged

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4 - 27 Nm

- Always replace

5 - Exhaust manifold

- For cylinder bank 1 (right)
- Removing and installing. Refer to **Right exhaust manifold, removing and installing**

6 - Gasket

- Always replace

7 - Oxygen sensor, 55 Nm

- Before catalytic converter
- For cylinder bank 1 (right)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

8 - Oxygen sensor, 55 Nm

- Before catalytic converter
- For cylinder bank 2 (left)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

9 - Exhaust manifold

- For cylinder bank 2 (left)
- Removing and installing. Refer to **Left exhaust manifold, removing and installing**

10 - Gasket

- Always replace

11 - 27 Nm

- Always replace

12 - Oxygen sensor, 55 Nm

- Behind catalytic converter
- For cylinder bank 2 (left)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

13 - Front exhaust pipe with catalytic converter

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- For cylinder bank 2 (left)
- With decoupling element
- Decoupling element must not be bent more than 10°, otherwise it may be damaged
- Protect from hit and impact stress

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**
- Individual mounting components for vehicles with manual transmission. See **Fig. 479**
- Individual mounting components for vehicles with automatic transmission 01J. See **Fig. 483**
- Vehicles with manual transmission, removing and installing. Refer to **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)**

- Vehicles with automatic transmission 01J, removing and installing. Refer to **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)**

14 - Front clamping sleeve

- Before tightening ensure exhaust system is free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**
- Installed position. See **Fig. 477**
- Tighten bolts evenly

15 - 40 Nm

16 - Oxygen sensor, 55 Nm

- Behind catalytic converter
- For cylinder bank 1 (right)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

17 - Front exhaust pipe with catalytic converter

- For cylinder bank 1 (right)
- With decoupling element
- Decoupling element must not be bent more than 10°, otherwise it may be damaged
- Protect from hit and impact stress

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**
- Individual mounting components for vehicles with manual transmission. See **Fig. 480**
- Individual mounting components for vehicles with automatic transmission 01J. See **Fig. 484**
- Vehicles with manual transmission, removing and installing. Refer to **Right front exhaust pipe with**

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catalytic converter, removing and installing (vehicles with manual transmission)

- Vehicles with automatic transmission 01J, removing and installing. Refer to **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)**

18 - Rear muffler

- For left side of vehicle
- Factory-installed with center muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Replacing end pipes. See **Fig. 485**

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**

19 - Support ring

- Replace if damaged

20 - 23 Nm

21 - Rear muffler

- For right side of vehicle
- Factory-installed with center muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Replacing end pipes. See **Fig. 485**

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**

22 - 23 Nm

23 - Rear clamping sleeve

- Used when center or rear muffler is replaced separately.
- Before tightening ensure exhaust system is free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**
- Installed position. See **Fig. 478**
- Tighten bolts evenly

24 - 40 Nm

25 - Support ring

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- Replace if damaged

26 - 23 Nm

Exhaust system components, overview, (vehicles with all wheel drive)

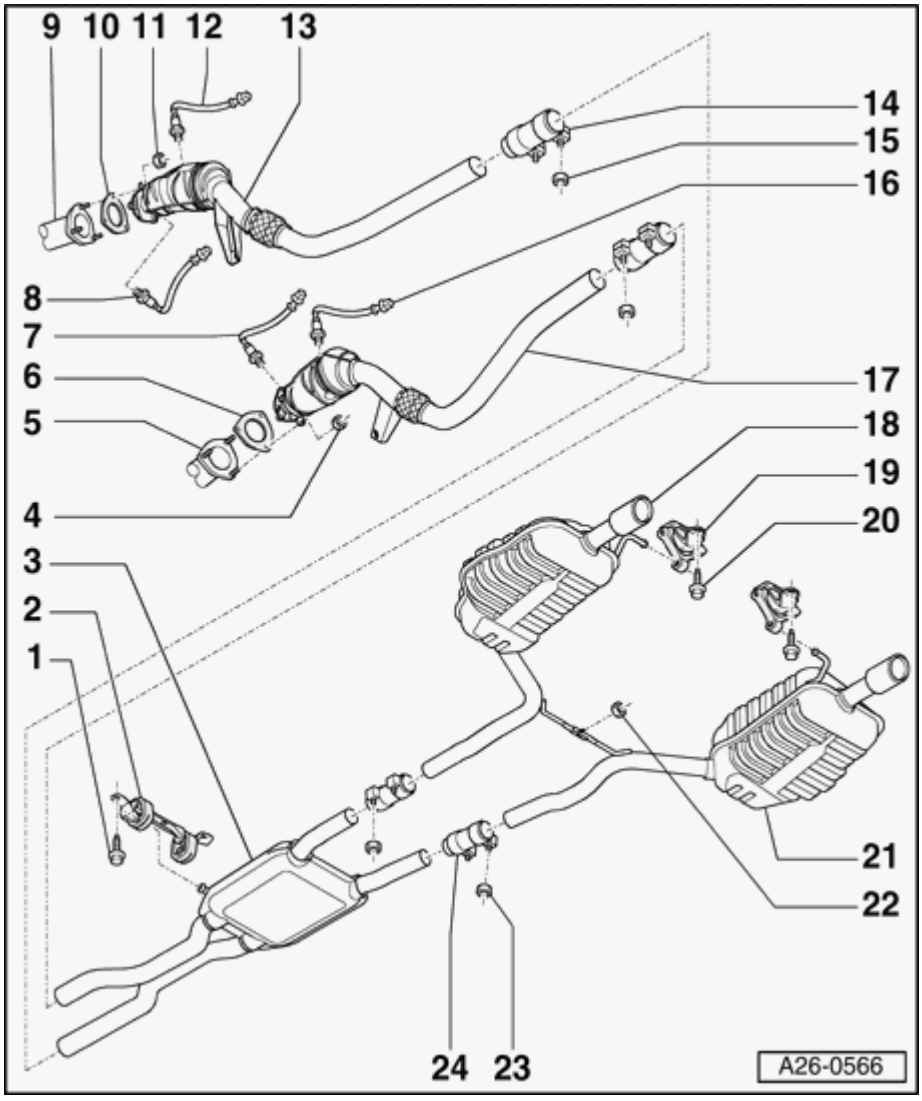


Fig. 476: Exhaust System Components, Overview, (Vehicles With All Wheel Drive)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 23 Nm

2 - Support ring

- Replace if damaged

3 - Center muffler

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- Factory-installed with rear muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**

4 - 27 Nm

- Always replace

5 - Exhaust manifold

- For cylinder bank 1 (right)
- Removing and installing. Refer to **Right exhaust manifold, removing and installing**

6 - Gasket

- Always replace

7 - Oxygen sensor, 55 Nm

- Before catalytic converter
- For cylinder bank 1 (right)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

8 - Oxygen sensor, 55 Nm

- Before catalytic converter
- For cylinder bank 2 (left)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

9 - Exhaust manifold

- Cylinder bank 2 (left)
- Removing and installing. Refer to **Left exhaust manifold, removing and installing**

10 - Gasket

- Always replace

11 - 27 Nm

- Always replace

12 - Oxygen sensor, 55 Nm

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- Behind catalytic converter
- For cylinder bank 2 (left)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

13 - Front exhaust pipe with catalytic converter

- For cylinder bank 2 (left)
- With decoupling element
- Decoupling element must not be bent more than 10°, otherwise it may be damaged
- Protect from hit and impact stress

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**
- Individual mounting components for vehicles with manual transmission. See **Fig. 480**
- Individual mounting components for vehicles with automatic transmission 01V. See **Fig. 482**
- Vehicles with manual transmission, removing and installing. Refer to **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)**

- Vehicles with automatic transmission 01V, removing and installing. Refer to **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)**

14 - Front clamping sleeve

- Before tightening ensure exhaust system is free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**
- Installed position. See **Fig. 477**
- Tighten bolts evenly

15 - 40 Nm

16 - Oxygen sensor, 55 Nm

- Behind catalytic converter
- For cylinder bank 1 (right)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

17 - Front exhaust pipe with catalytic converter

- For cylinder bank 1 (right)
- With decoupling element
- Decoupling element must not be bent more than 10°, otherwise it may be damaged
- Protect from hit- and impact stress

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- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**
- Individual mounting components for vehicles with manual transmission. See **Fig. 479**
- Individual mounting components for vehicles with automatic transmission 01V. See **Fig. 481**
- Vehicles with manual transmission, removing and installing. Refer to **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)**
- Vehicles with automatic transmission 01V, removing and installing. Refer to **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)**

18 - Rear muffler

- For left side of vehicle
- Factory-installed with center muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Replacing end pipes. See **Fig. 485**
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**

19 - Support ring

- Replace if damaged

20 - 23 Nm

21 - Rear muffler

- For right side of vehicle
- Factory-installed with center muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Replacing end pipes. See **Fig. 485**
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**

22 - 23 Nm

23 - 40 Nm

24 - Rear clamping sleeve

- Used when center or rear muffler is replaced separately.
- Before tightening ensure exhaust system is free of stress. Refer to **Exhaust system, aligning free of**

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stress (vehicles with all wheel drive)

- Installed position. See **Fig. 478**
- Tighten bolts evenly

Installed position of front clamping sleeves

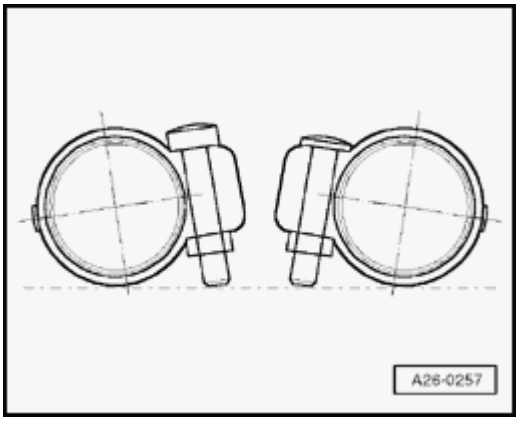


Fig. 477: Identifying Installed Position Of Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install double clamps so that bolt ends do not project over lower edge of double clamp.
- Threaded connections face each other

Installed position of rear clamping sleeves

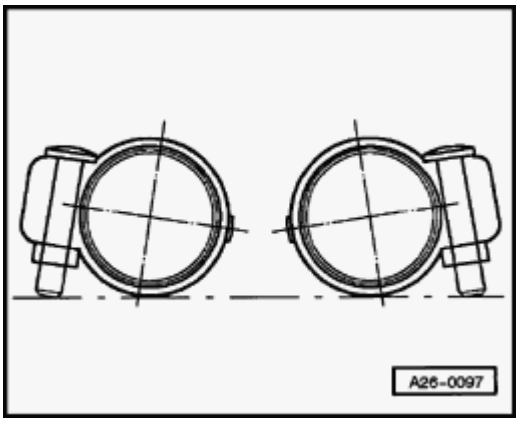


Fig. 478: Installation Position Of Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install double clamps so that bolt ends do not project over lower edge of double clamp.
- Threaded connections face outward

Individual left mounting components for vehicles with manual transmission

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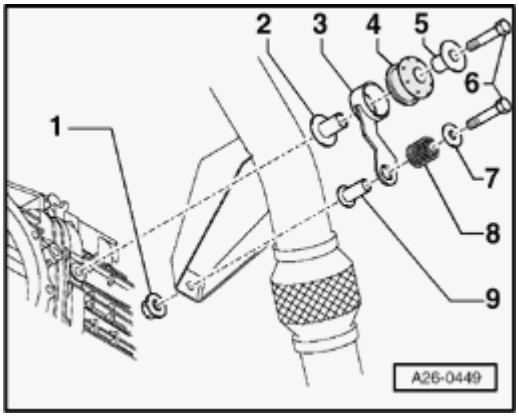


Fig. 479: Individual Left Mounting Components For Vehicles With Manual Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Self-locking nut (25Nm)

2 - Spacer sleeve

3 - Strap

4 - Buffer

5 - Spacer sleeve

6 - Bolt (25Nm)

7 - Washer

8 - Compression spring

9 - Spacer sleeve

Individual right mounting components for vehicles with manual transmission

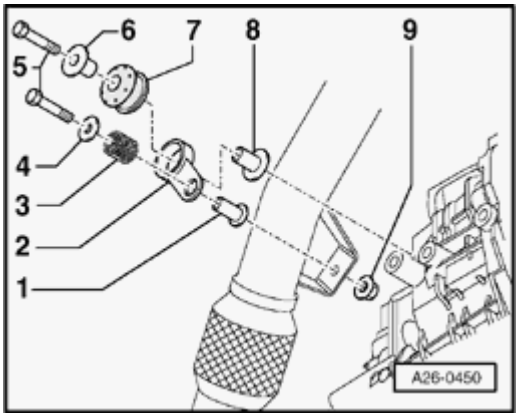


Fig. 480: Individual Right Mounting Components For Vehicles With Manual Transmission

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Spacer sleeve

2 - Strap

3 - Compression spring

4 - Washer

5 - Bolt (25Nm)

6 - Spacer sleeve

7 - Buffer

8 - Spacer sleeve

9 - Self-locking nut (25Nm)

Individual left mounting components for vehicles with automatic transmission 01V

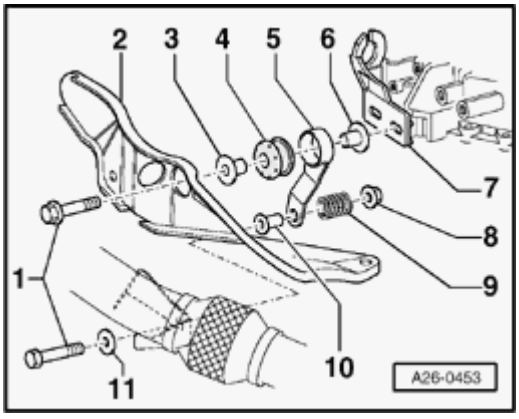


Fig. 481: Individual Left Mounting Components For Vehicles With Automatic Transmission 01V
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt (25Nm)

2 - Heat shield for selector lever cable

3 - Spacer sleeve

4 - Buffer

5 - Strap

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6 - Spacer sleeve

7 - Pivot

8 - Self-locking nut (25Nm)

9 - Compression spring

10 - Spacer sleeve

11 - Washer

Individual right mounting components for vehicles with automatic transmission 01V

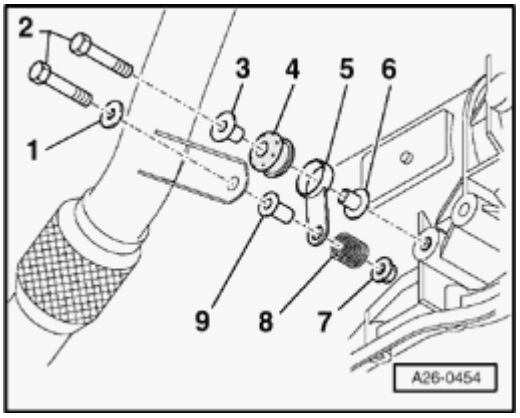


Fig. 482: Individual Right Mounting Components For Vehicles With Automatic Transmission 01V
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Washer

2 - Bolt (25Nm)

3 - Spacer sleeve

4 - Buffer

5 - Strap

6 - Spacer sleeve

7 - Self-locking nut (25Nm)

8 - Compression spring

9 - Spacer sleeve

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Individual left mounting components for vehicles with automatic transmission 01J

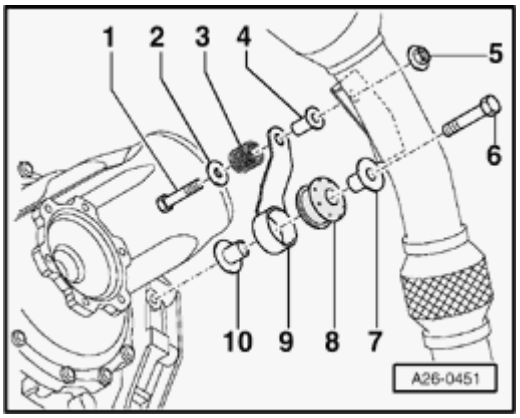


Fig. 483: Individual Left Mounting Components For Vehicles With Automatic Transmission 01J
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt (25Nm)

2 - Washer

3 - Compression spring

4 - Spacer sleeve

5 - Self-locking nut (25Nm)

6 - Bolt (25Nm)

7 - Spacer sleeve

8 - Buffer

9 - Strap

10 - Spacer sleeve

Individual right mounting components for vehicles with automatic transmission 01J

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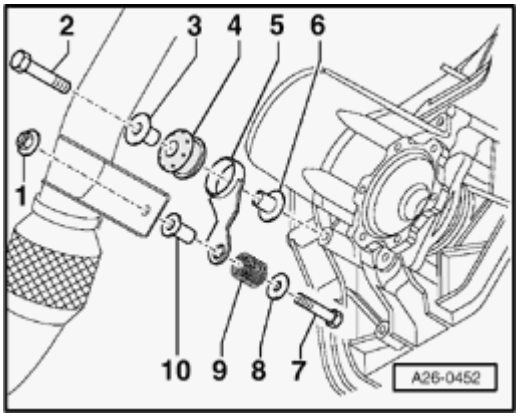


Fig. 484: Individual Right Mounting Components For Vehicles With Automatic Transmission 01J
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Self-locking nut (25Nm)

2 - Bolt (25Nm)

3 - Spacer sleeve

4 - Buffer

5 - Strap

6 - Spacer sleeve

7 - Bolt (25Nm)

8 - Washer

9 - Compression spring

10 - Spacer sleeve

Replacing end pipe

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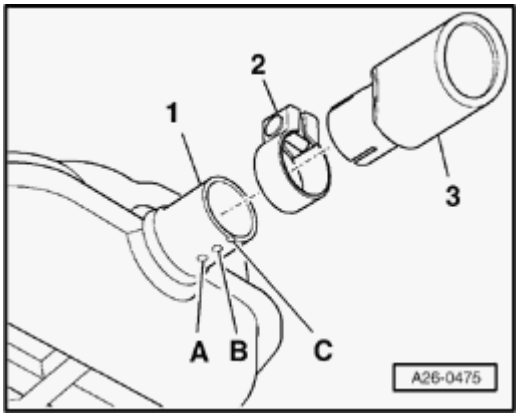


Fig. 485: Replacing End Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

WARNING: Wear protective glasses.

- Using VAG1523 saw, cut end pipe -1- at cutting point -C- at right angle.
- Connect end pipe -3- up to marking -A-, so that slot on end pipe lines up with marking -B- on cover.
- Tighten mounting bolt of clamp -2- to 25 Nm.

Center and rear muffler, separating

- A separating point has been provided in the connecting pipe for individual replacement of the center or rear muffler.
- Separating point is marked by a depression around the circumference of the exhaust pipe.

Special tools and equipment

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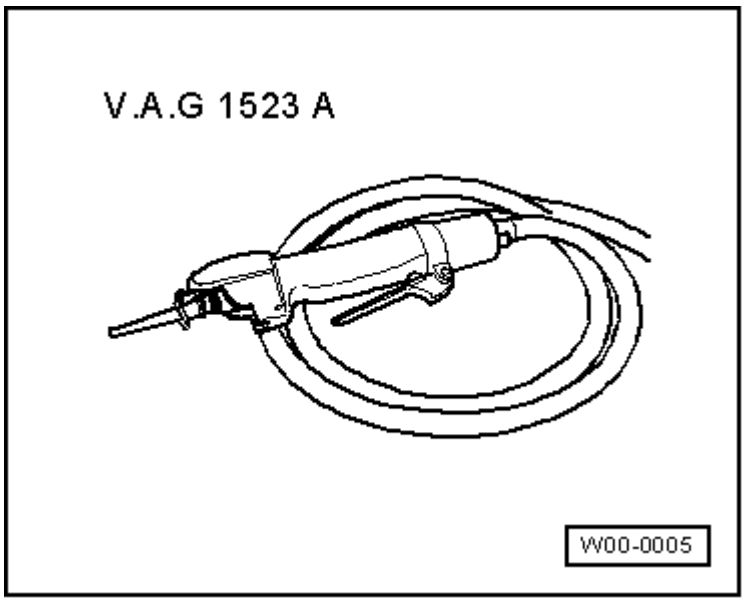


Fig. 486: Identifying Body Repair Saw V.A.G 1523 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1523A Body repair saw
- Protective glasses

NOTE:

- **An All Wheel Drive (AWD) vehicle is shown in the illustrations.**
- **For vehicles with Front Wheel Drive (FWD), the work steps are the same as for vehicles with All Wheel Drive (AWD).**

Work sequence

WARNING: Wear protective glasses.

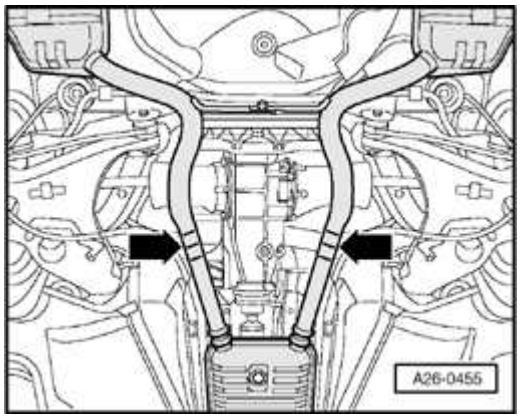


Fig. 487: Using VAG1523 A Saw To Cut Exhaust Pipes At Separating Point At Right Angle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Using VAG1523 A saw, cut exhaust pipes at separating point (arrow) at a right angle.

NOTE: Separating point is the middle one of the 3 depressions on the exhaust pipe.

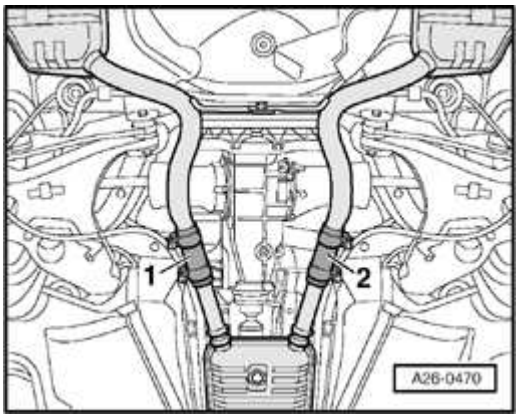


Fig. 488: Positioning Clamping Sleeves At Center On Separating Cut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- When installing, center double clamps -1- and -2- on separation cut.

- Installed position of double clamps. See **Fig. 478**

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.
- Align rear muffler horizontally.
- Tighten double clamp bolts uniformly to 40 Nm.

Left front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)

Removing

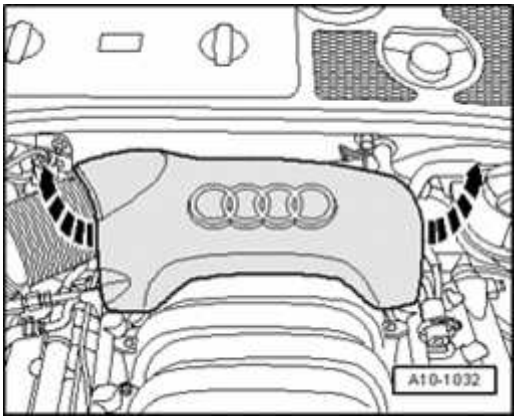


Fig. 489: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove rear engine cover (arrows).

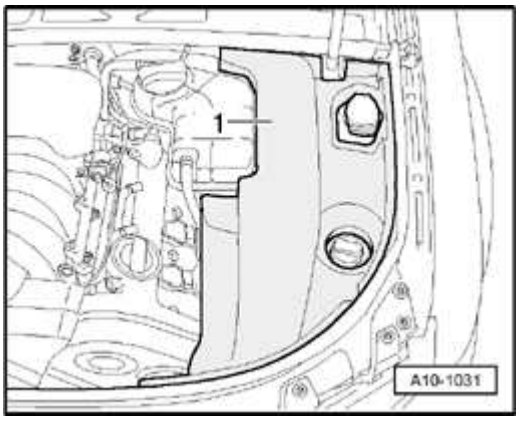


Fig. 490: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

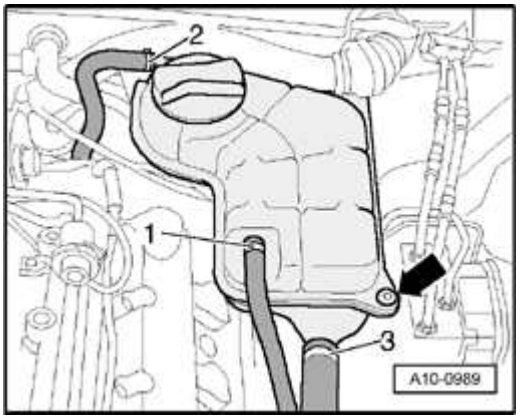


Fig. 491: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of coolant reservoir.
- Tie coolant reservoir with connected coolant hoses -1 to 3- to side.
- Remove heat shield for harness connectors at left of bulkhead, if installed.

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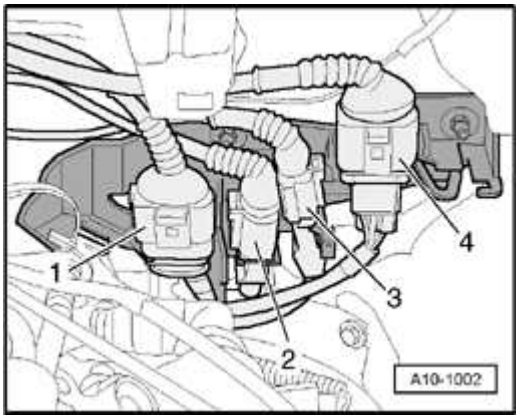


Fig. 492: Removing Harness Connectors From Bracket At Left Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at left of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Guide wires to oxygen sensors downward.

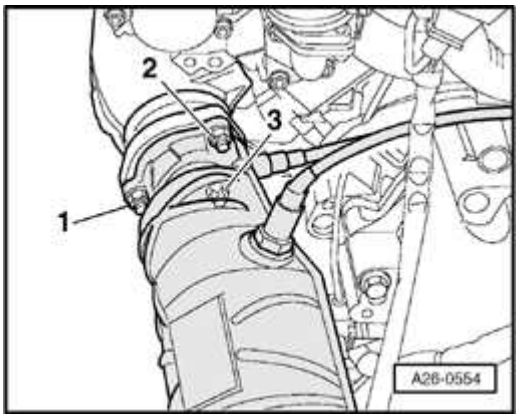


Fig. 493: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove left front wheel.

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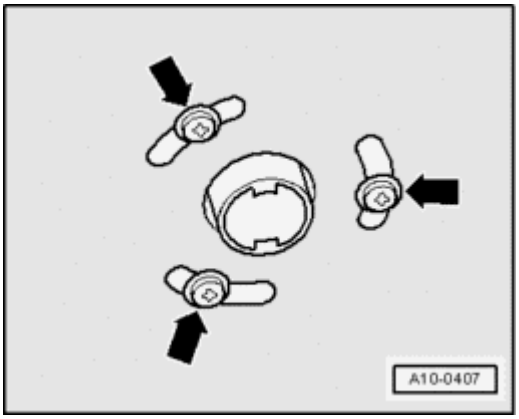


Fig. 494: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

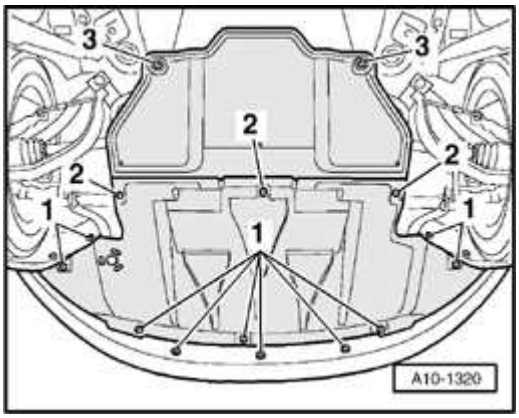
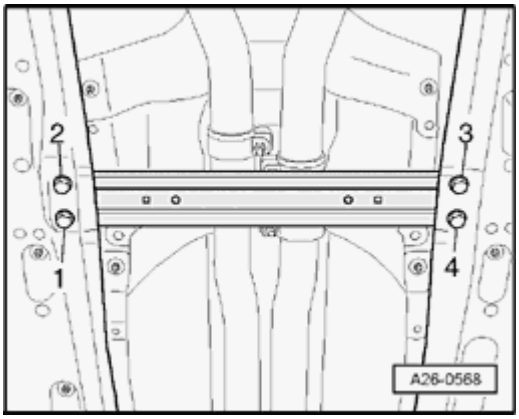


Fig. 495: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Release quick-release screws -3- and remove rear sound insulation, if present.



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Fig. 496: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

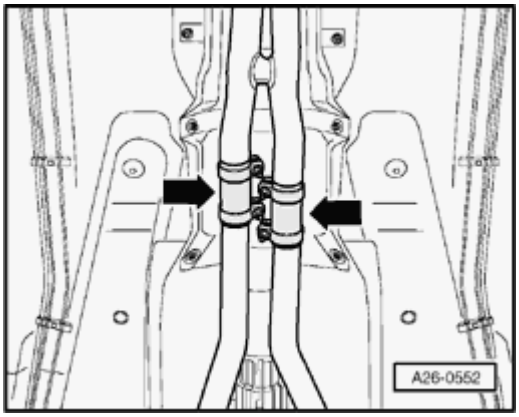


Fig. 497: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at left double clamp (left arrow).

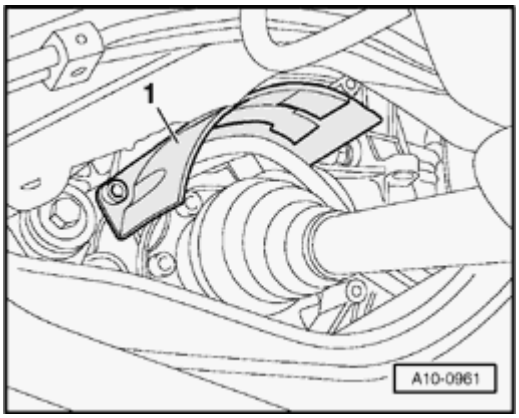


Fig. 498: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for left drive axle.

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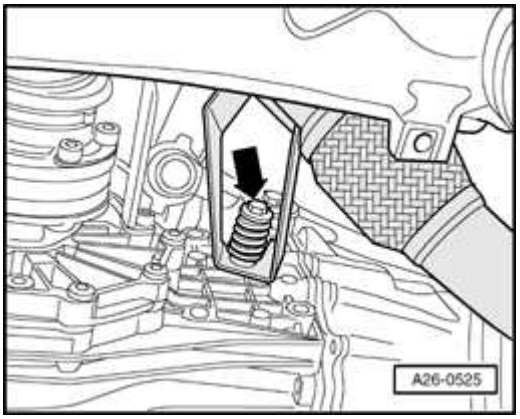


Fig. 499: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrow).
- Expose oxygen sensor wires.

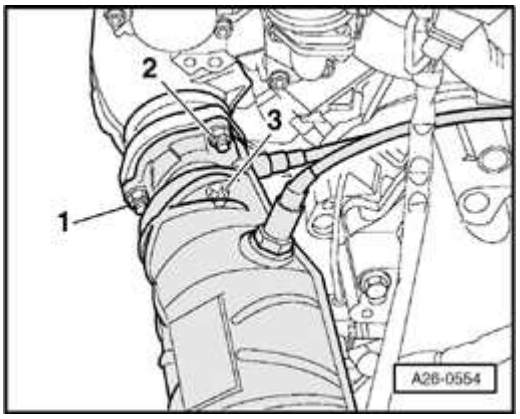


Fig. 500: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor wiring must always be secured in the same position when**

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installing so that contact with the exhaust pipe is avoided.

- **Replace gaskets and self-locking nuts.**

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

NOTE: Individual mounting components for exhaust system to transmission on vehicles with manual transmission. See Fig. 479.

Tightening torques

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Drive axle protection to transmission	23

Right front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)

Removing

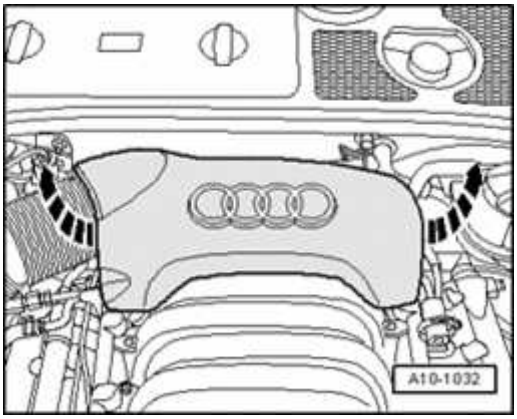


Fig. 501: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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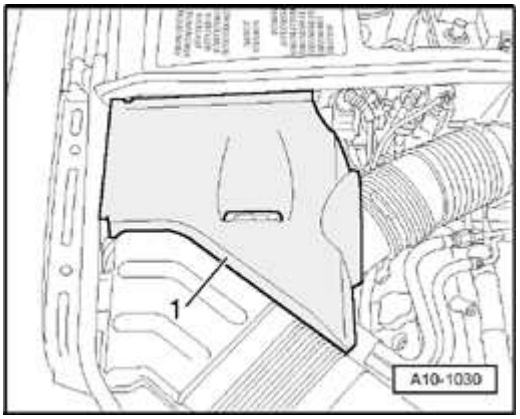


Fig. 502: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

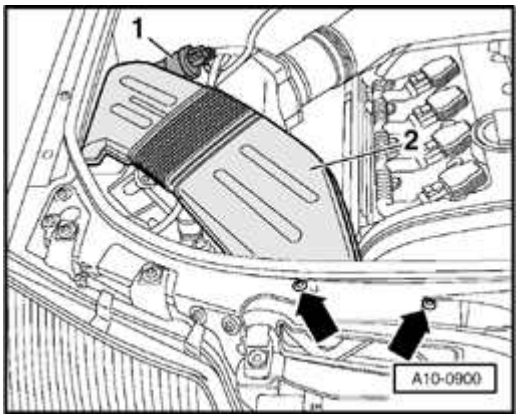
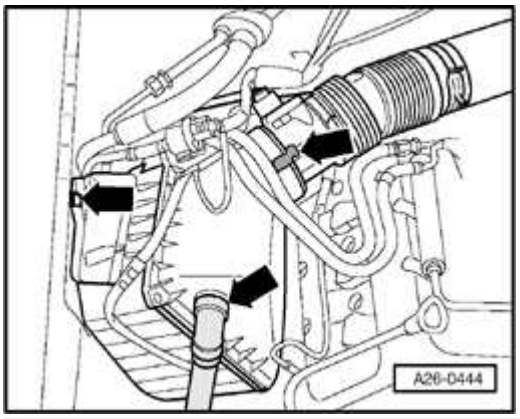


Fig. 503: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.



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Fig. 504: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).

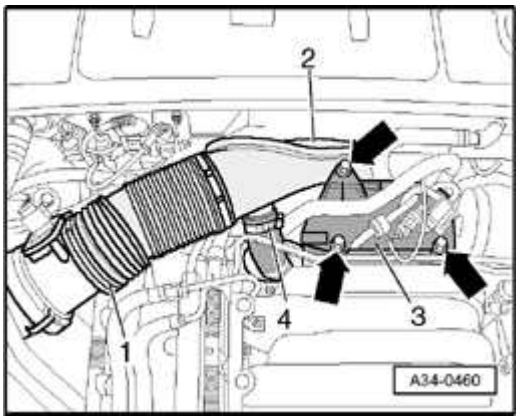


Fig. 505: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect electrical harness connector at Mass Air Flow (MAF) sensor.
- Remove hose -4- from air duct -2-.

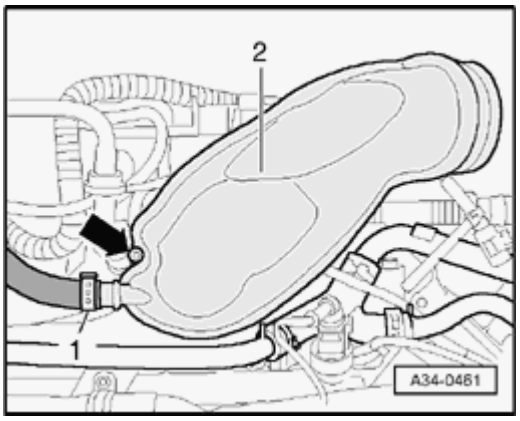


Fig. 506: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

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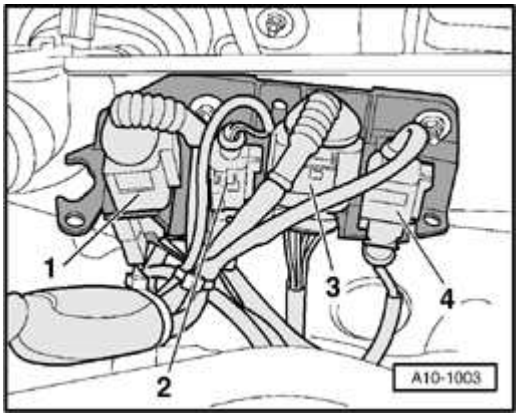


Fig. 507: Removing Harness Connectors From Bracket At Right Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at right of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Guide wires to oxygen sensors downward.

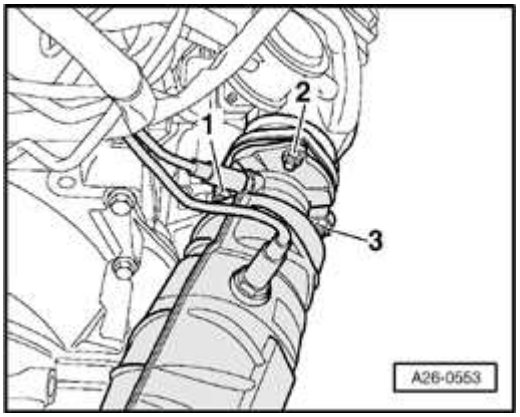


Fig. 508: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove right front wheel

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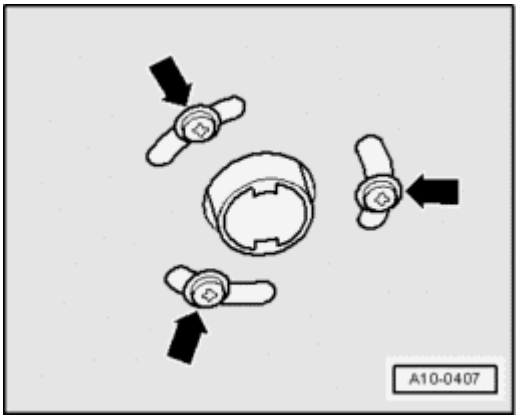


Fig. 509: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

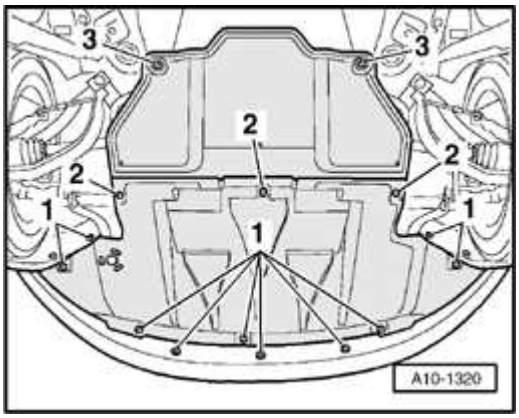
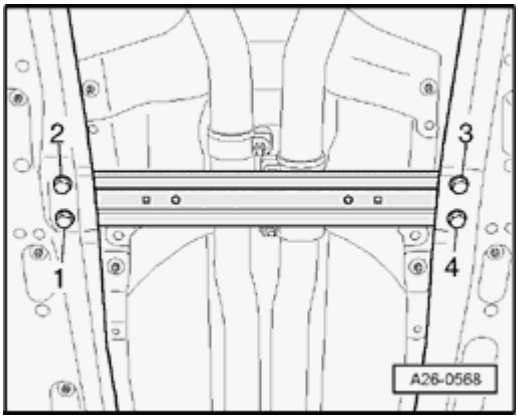


Fig. 510: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.



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Fig. 511: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged..

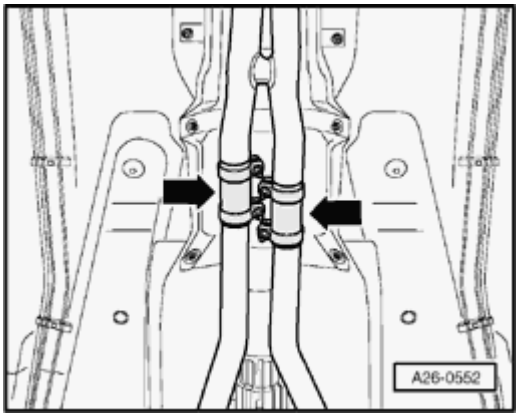


Fig. 512: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at right double clamp (right arrow).

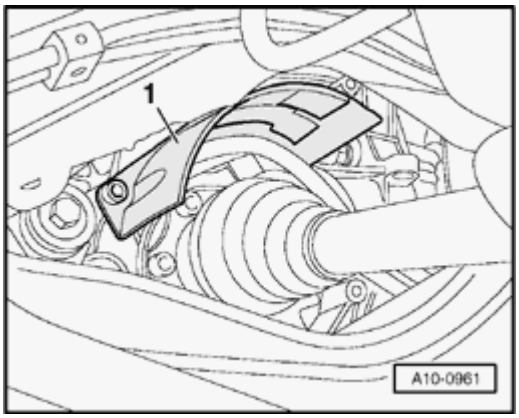


Fig. 513: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for right drive axle.

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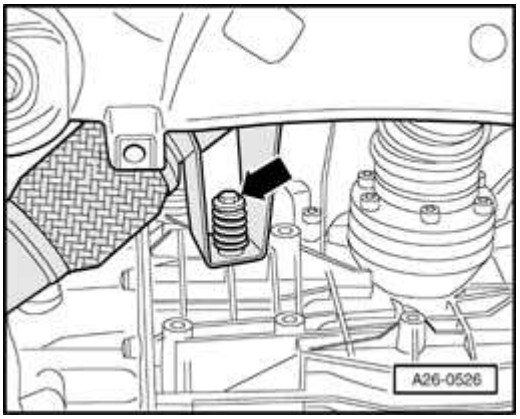


Fig. 514: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrow).
- Expose oxygen sensor wires.

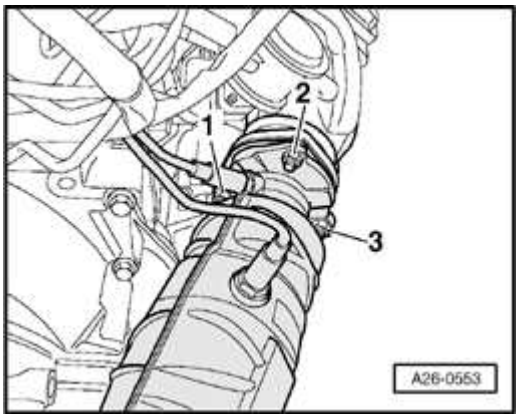


Fig. 515: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor wiring must always be secured in the same position when**

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installing so that contact with the exhaust pipe is avoided.

- **Replace gaskets and self-locking nuts.**

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

NOTE: Individual mounting components for exhaust system to transmission on vehicles with manual transmission. See Fig. 480.

Tightening torques

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Drive axle protection to transmission	23

Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)

Special tools and equipment

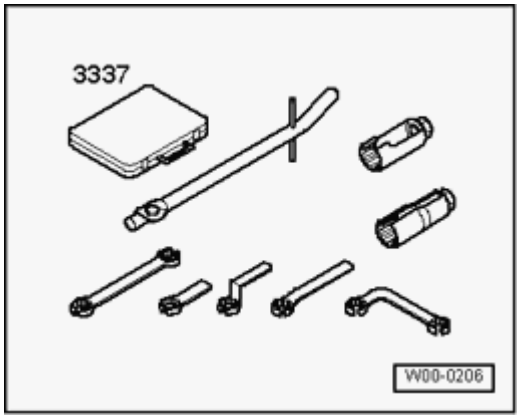


Fig. 516: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3337 Wrench, 7-piece set

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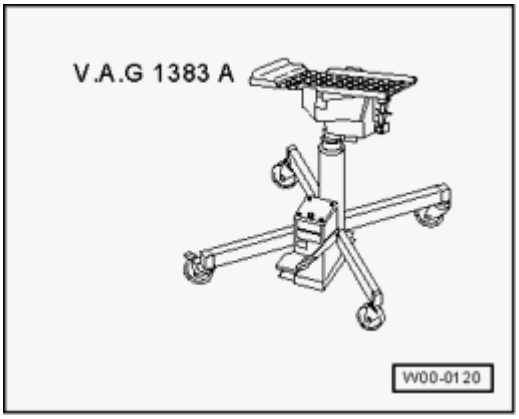


Fig. 517: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engine/transmission hoist
- Locking compound G 052 112 A3

Removing

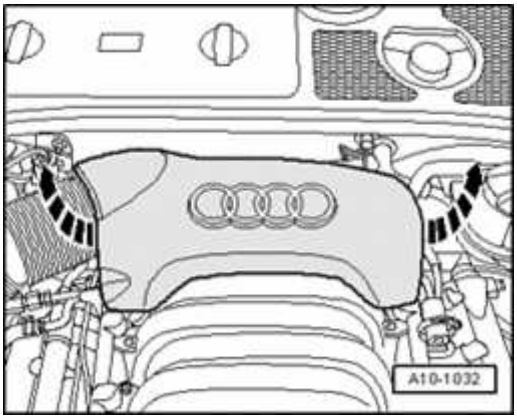


Fig. 518: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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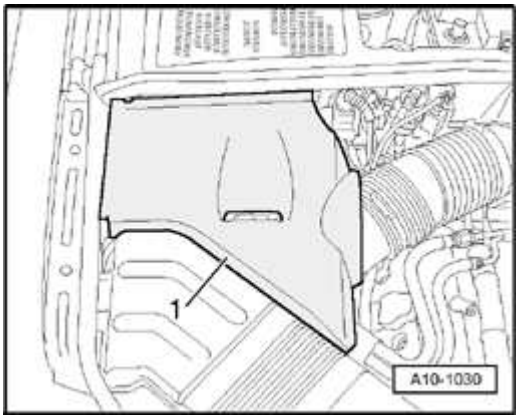


Fig. 519: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

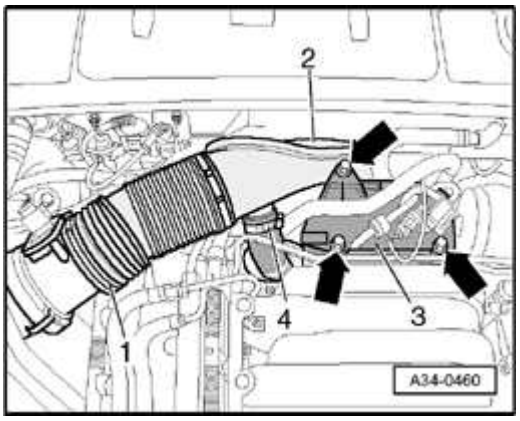
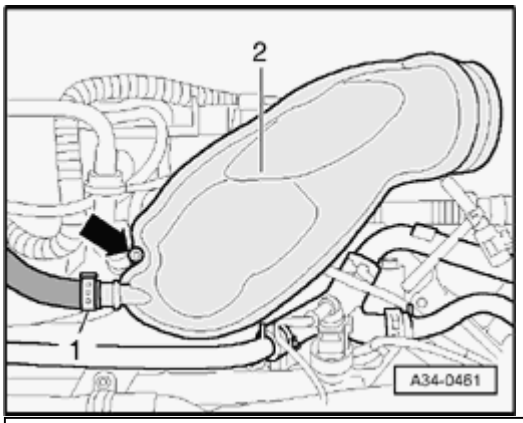


Fig. 520: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air hose -1- at Mass Air Flow (MAF) sensor.
- Remove hose -4- from air duct -2-.



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Fig. 521: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

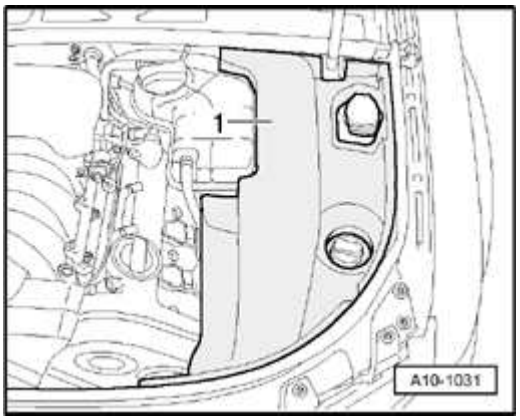


Fig. 522: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

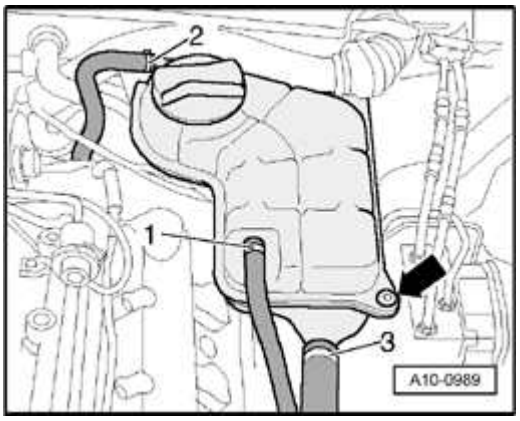


Fig. 523: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of coolant reservoir.
- Tie coolant reservoir with connected coolant hoses -1 to 3- to side.

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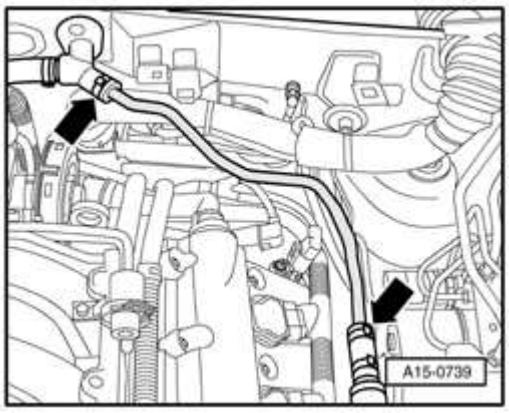


Fig. 524: Disconnecting Vacuum Hose To Brake Booster
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose to brake booster (arrows).
- Remove heat shield for harness connectors at left of bulkhead, if installed.

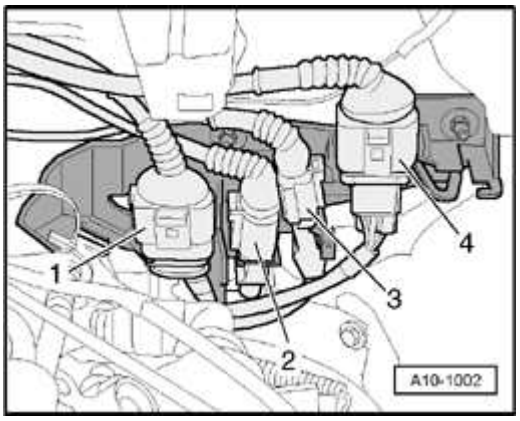


Fig. 525: Removing Harness Connectors From Bracket At Left Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at left of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

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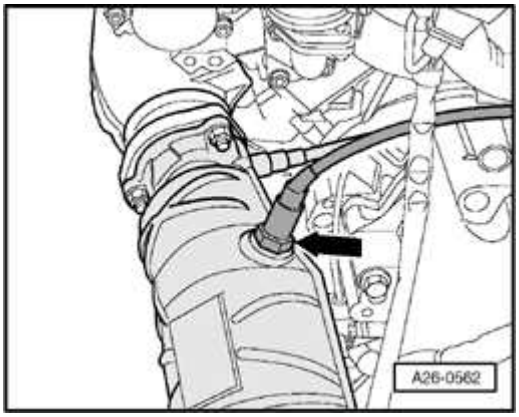


Fig. 526: Unscrewing Oxygen Sensor Behind Catalytic Converter Using Special Tool 3337/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: Illustration is shown with engine removed.

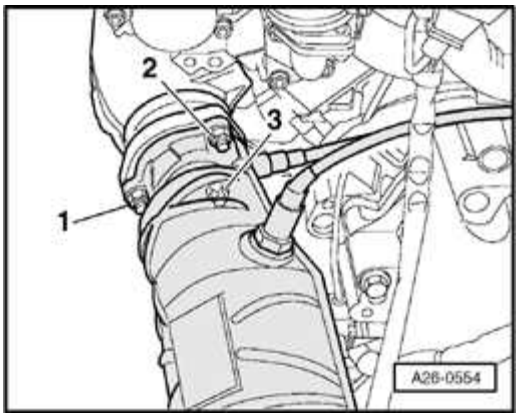


Fig. 527: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove left front wheel.

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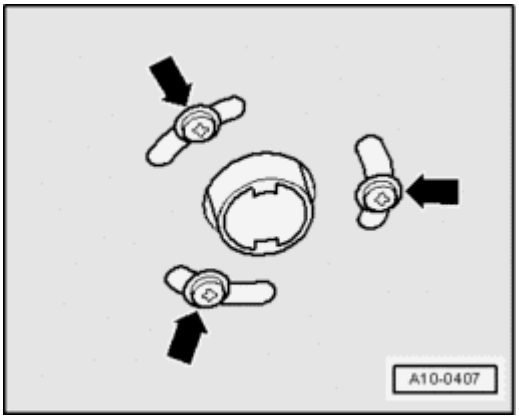


Fig. 528: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

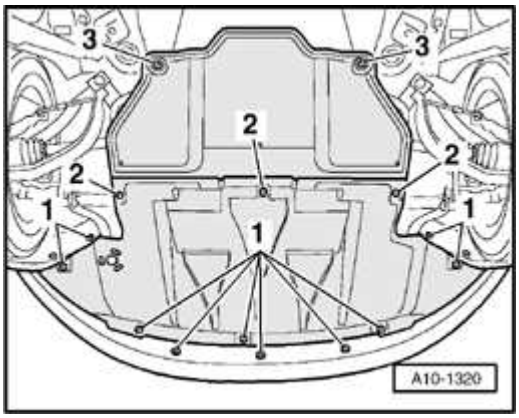
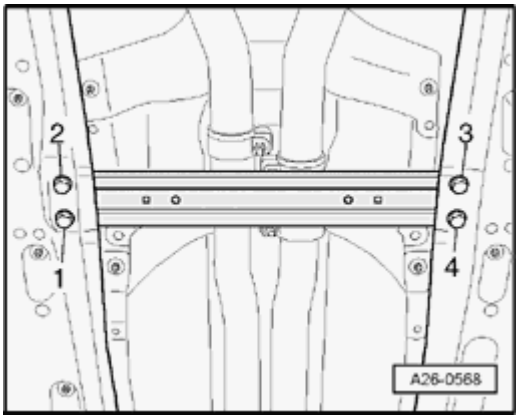


Fig. 529: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.



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Fig. 530: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged..

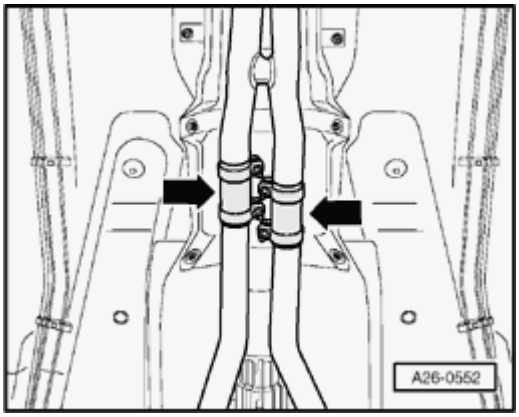


Fig. 531: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at both double clamps (arrows).

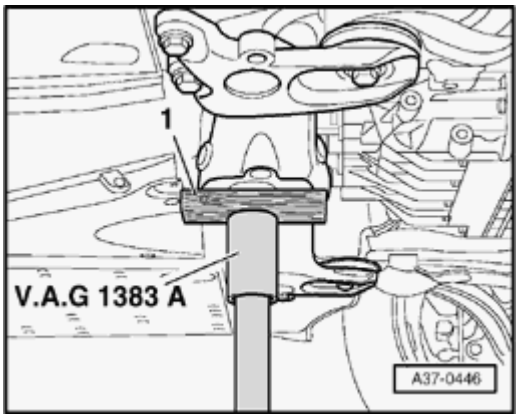


Fig. 532: Removing VAG1359/2 Universal Mount From VAG1383A Engine/Transmission Jack And Inserting Piece Of Wood Instead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove VAG1359/2 universal mount from VAG1383A engine/transmission jack and insert a piece of wood -1- instead.
- Support rear crossmember using VAG1383A engine/transmission jack.

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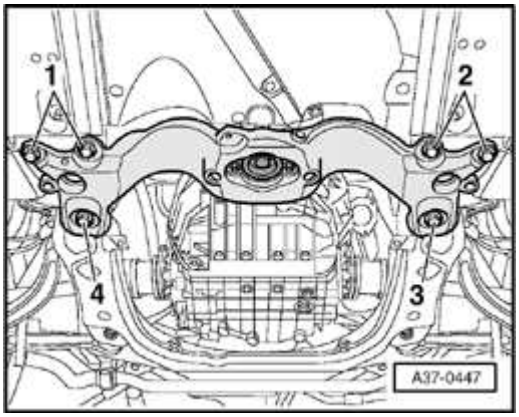


Fig. 533: Removing Bolts & Slowly Release Rear Crossmember Using VAG1383A Engine/Transmission Jack
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-, then bolts -3- and -4-.
- Slowly release rear crossmember using VAG1383A engine/transmission jack.
- Set aside VAG1383A engine/transmission jack.

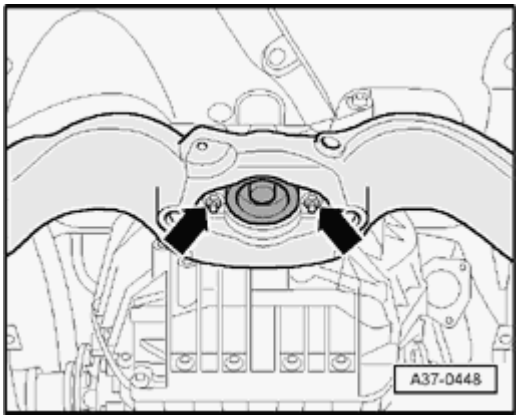


Fig. 534: Removing Nuts And Rear Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts (arrows) and rear crossmember.

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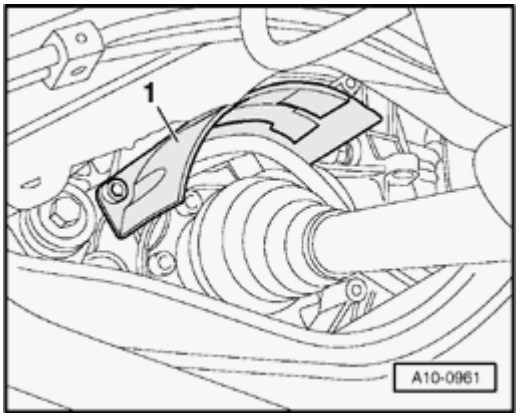


Fig. 535: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for left drive axle.

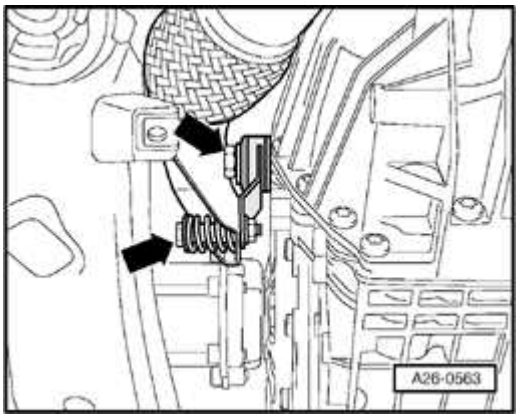


Fig. 536: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrows).
- Expose oxygen sensor wire.

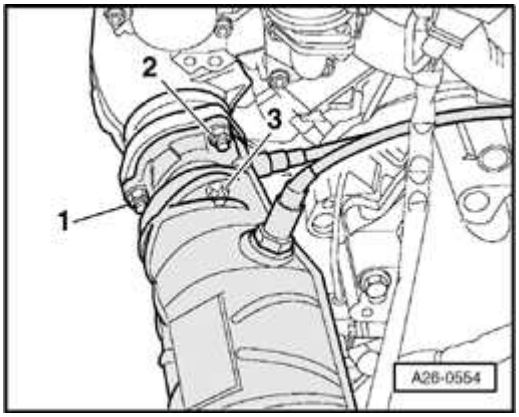


Fig. 537: Removing Nut For Left Exhaust Pipe/Exhaust Manifold

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

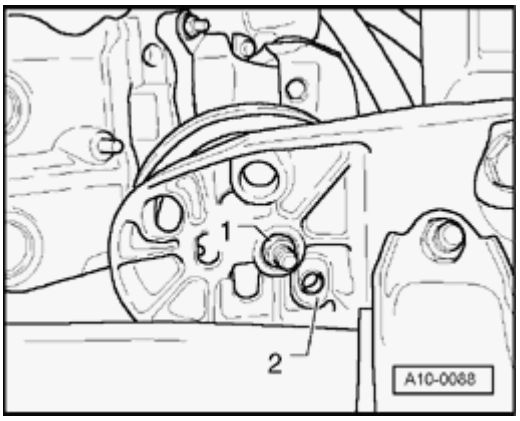


Fig. 538: Threaded Connections And Positioning Sleeves On Lower Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen lower nuts -1- several turns on left and right of engine mount.
- Press transmission to right.
- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**
- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Install subframe:

Refer to **40 - FRONT SUSPENSION**

- Install engine free of stress.
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

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NOTE: Individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01J. See Fig. 483 .

Tightening torques

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55
Engine mount to console	23

Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)

Special tools and equipment

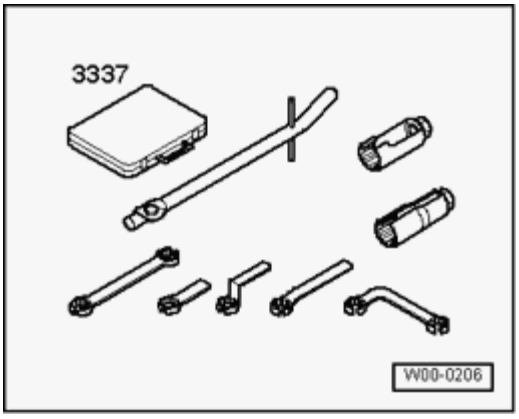


Fig. 539: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3337 Wrench, 7-piece set

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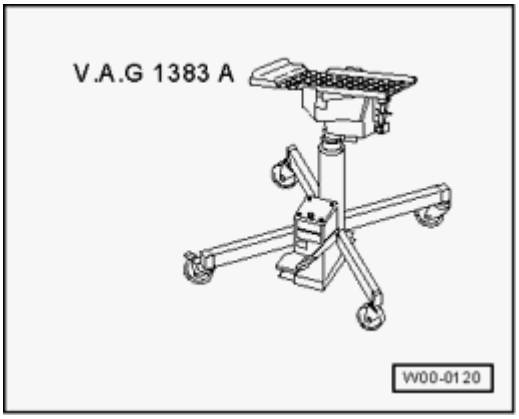


Fig. 540: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engine/transmission hoist
- Locking compound G 052 112 A3

Removing

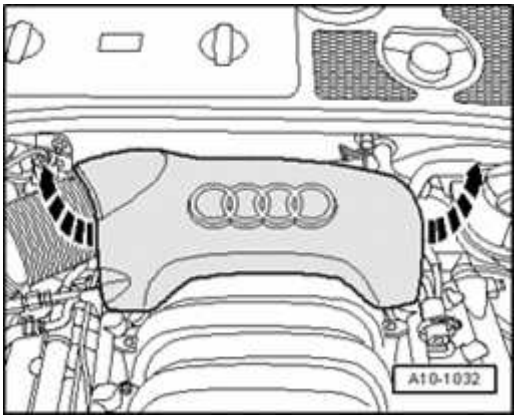


Fig. 541: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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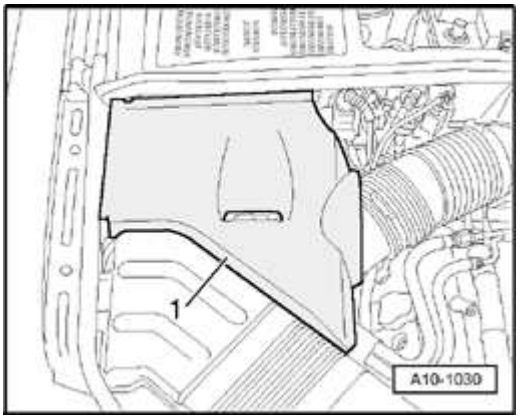


Fig. 542: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

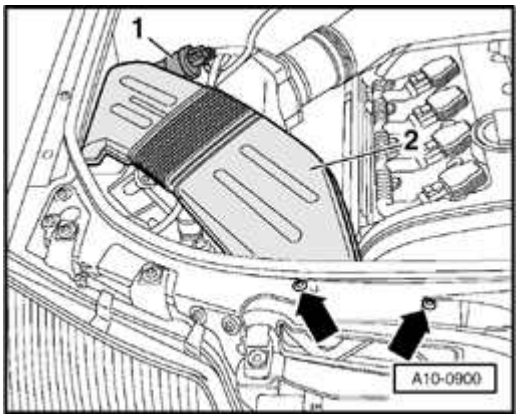
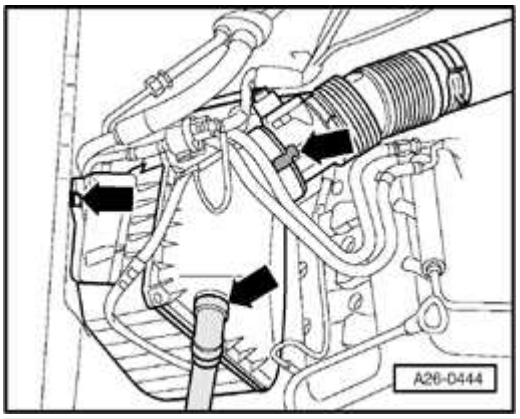


Fig. 543: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.



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Fig. 544: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).

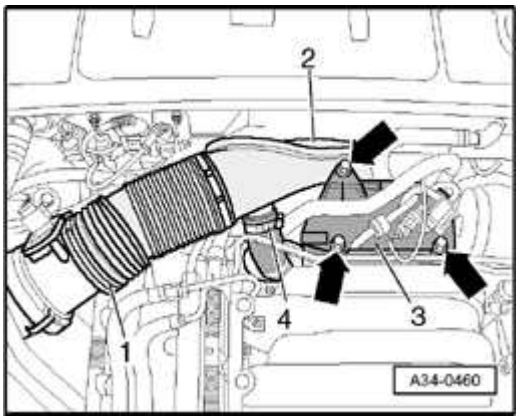


Fig. 545: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect electrical harness connector at Mass Air Flow (MAF) sensor.
- Remove hose -4- from air duct -2-.

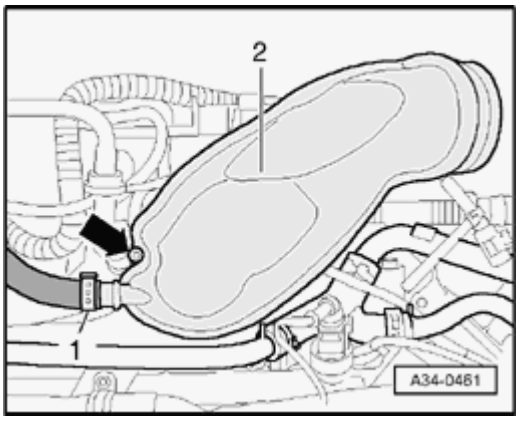


Fig. 546: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

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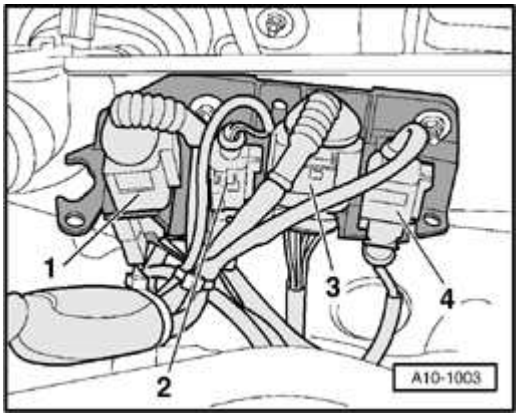


Fig. 547: Removing Harness Connectors From Bracket At Right Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at right of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

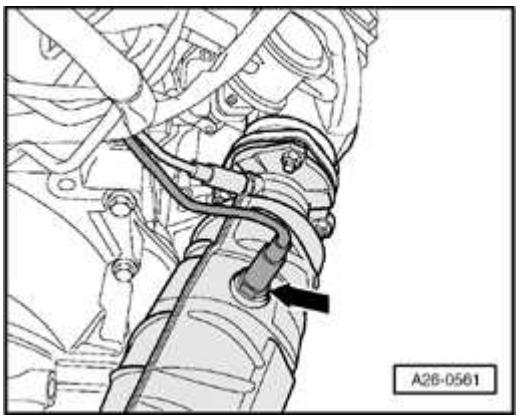


Fig. 548: Unscrewing Oxygen Sensor Behind Catalytic Converter Using Special Tool 3337/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: Illustration is shown with engine removed.

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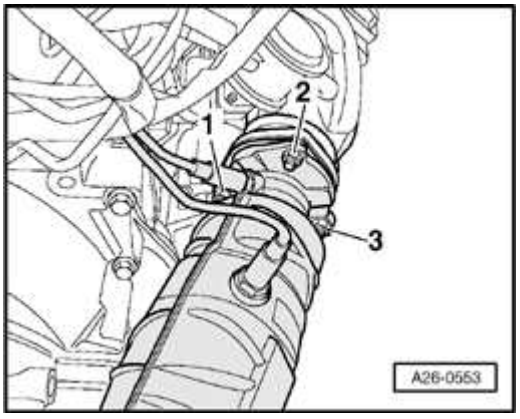


Fig. 549: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove right front wheel

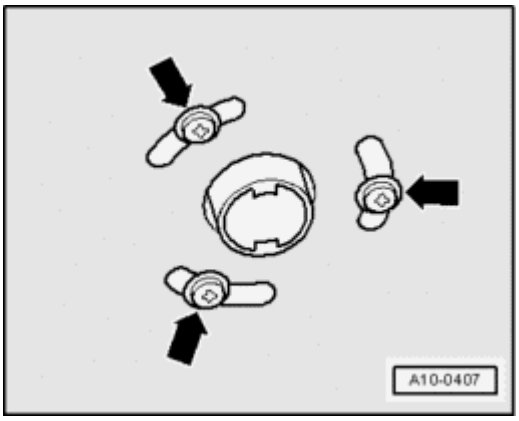


Fig. 550: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

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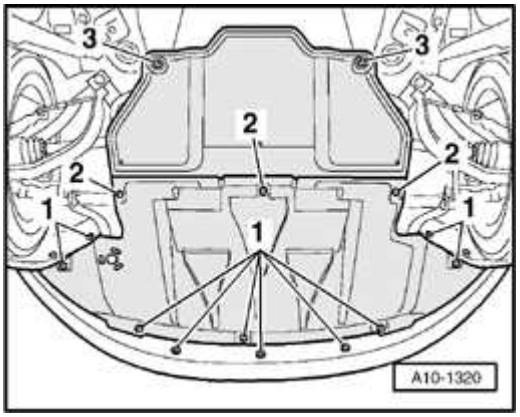


Fig. 551: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.

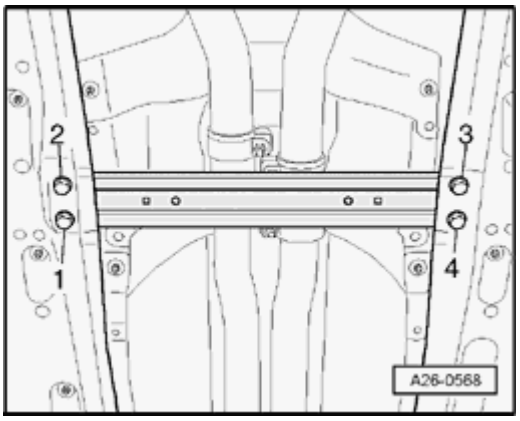


Fig. 552: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

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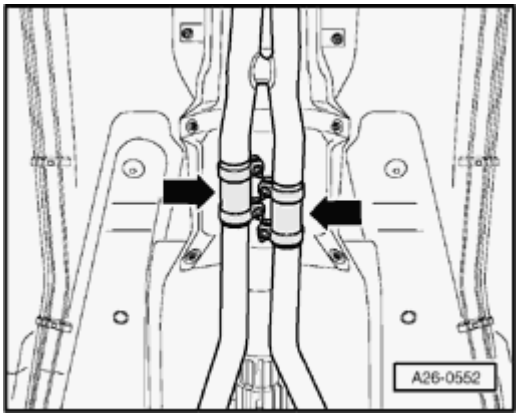


Fig. 553: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at both double clamps (arrows).

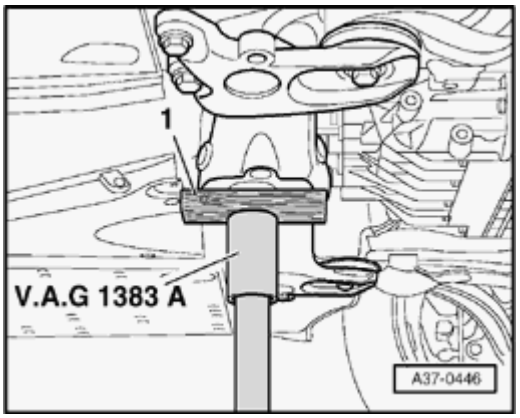


Fig. 554: Removing VAG1359/2 Universal Mount From VAG1383A Engine/Transmission Jack And Inserting Piece Of Wood Instead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove VAG1359/2 universal mount from VAG1383A engine/transmission jack and insert a piece of wood -1- instead.
- Support rear crossmember using VAG1383A engine/transmission jack.

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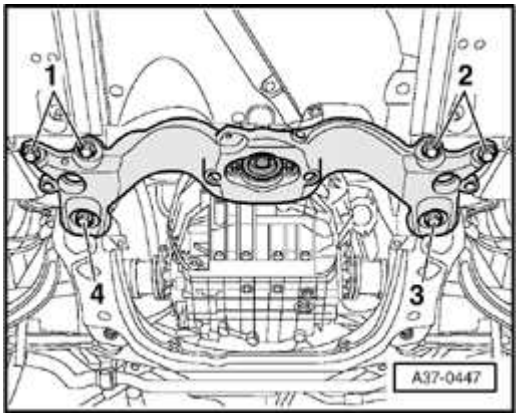


Fig. 555: Removing Bolts & Slowly Release Rear Crossmember Using VAG1383A Engine/Transmission Jack
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-, then bolts -3- and -4-.
- Slowly release rear crossmember using VAG1383A engine/transmission jack.
- Set aside VAG1383A engine/transmission jack.

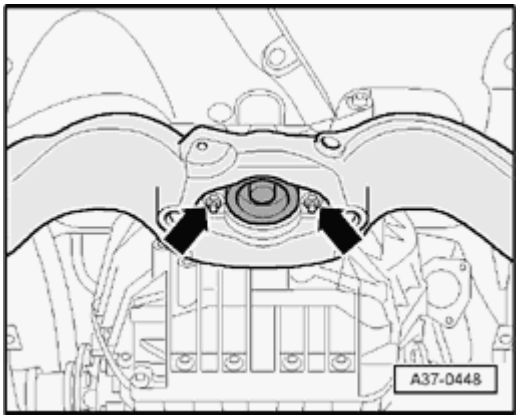


Fig. 556: Removing Nuts And Rear Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts (arrows) and rear crossmember.

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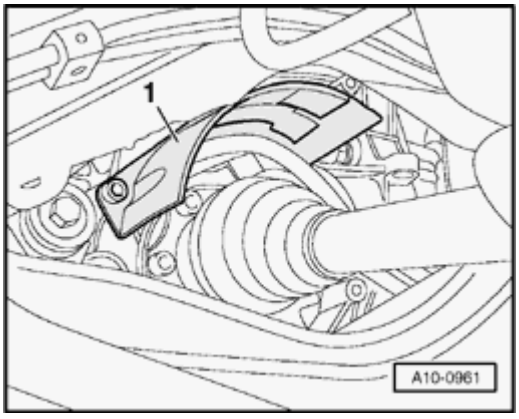


Fig. 557: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for right drive axle.
- Remove right drive axle.

Refer to **40 - FRONT SUSPENSION**

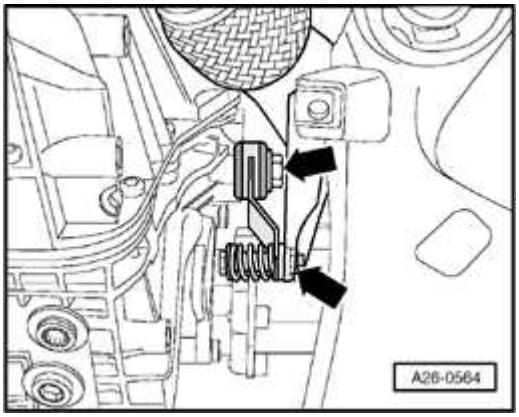


Fig. 558: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrows).

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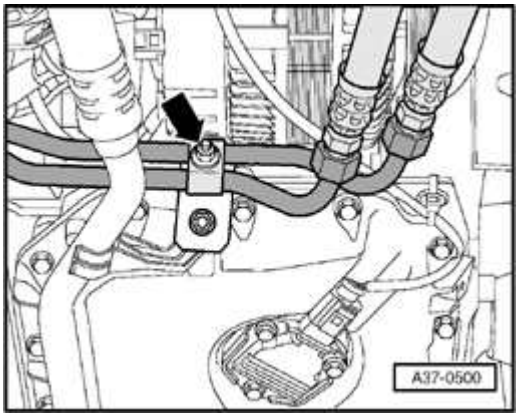


Fig. 559: Unbolting Bracket For ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for ATF lines (arrow).

NOTE: Observe the rules of cleanliness for working on automatic transmissions:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Place oil pan underneath.

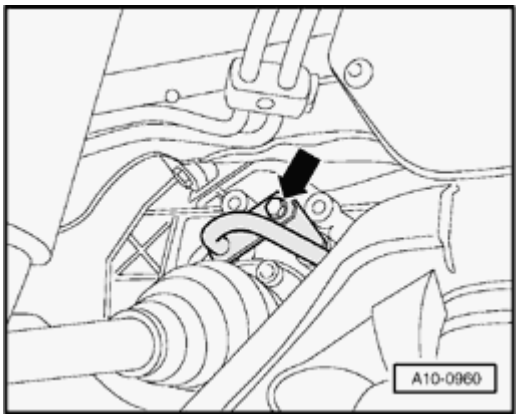


Fig. 560: Removing Bolt And Disconnecting ATF Lines From Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect ATF lines from transmission.
- Tie up ATF lines off to side.
- Expose oxygen sensor wire.

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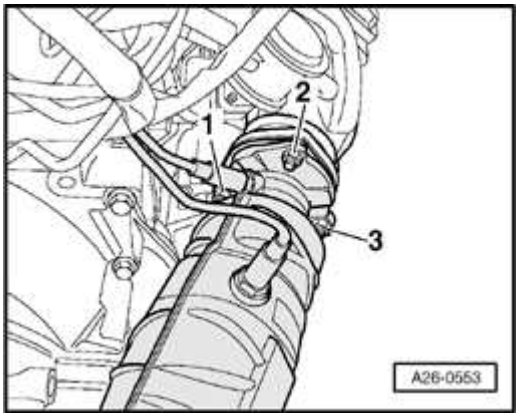


Fig. 561: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

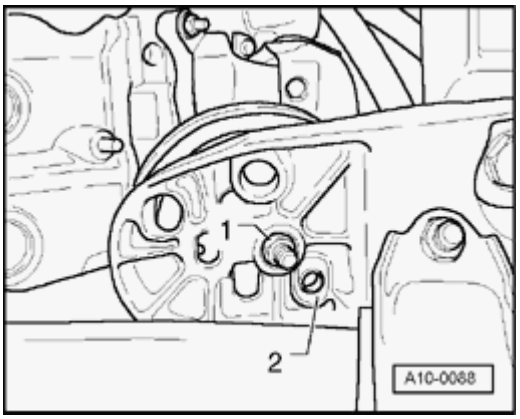


Fig. 562: Threaded Connections And Positioning Sleeves On Lower Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen lower nuts -1- (on left and right engine mounts) several turns.
- Press transmission to left.
- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**

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- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Secure ATF lines:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Install subframe:

Refer to **40 - FRONT SUSPENSION**

- Install drive axle.

Refer to **40 - FRONT SUSPENSION**

- Install engine free of stress.
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

NOTE: Individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01J. See Fig. 484.

- Check ATF level:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Tightening torques

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25

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Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55
Engine mount to console	23

Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)

Special tools and equipment

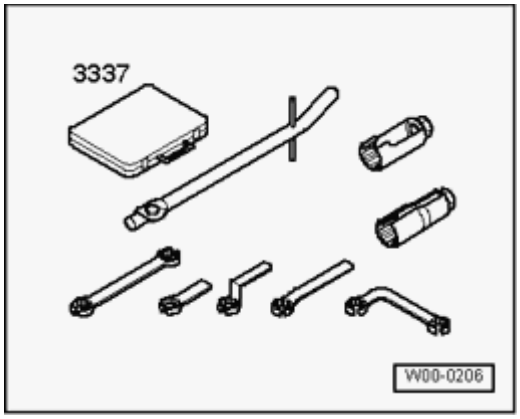


Fig. 563: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3337 Wrench, 7-piece set

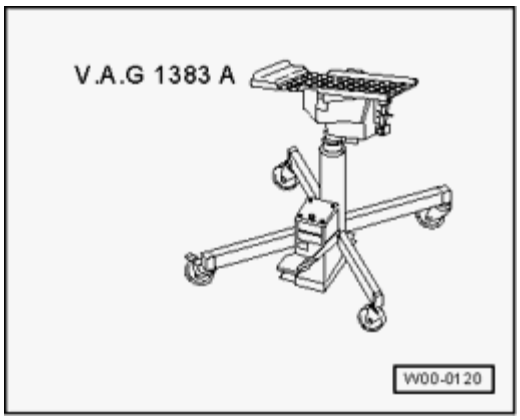


Fig. 564: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1383A Engine/transmission hoist
- Locking compound G 052 112 A3

Removing

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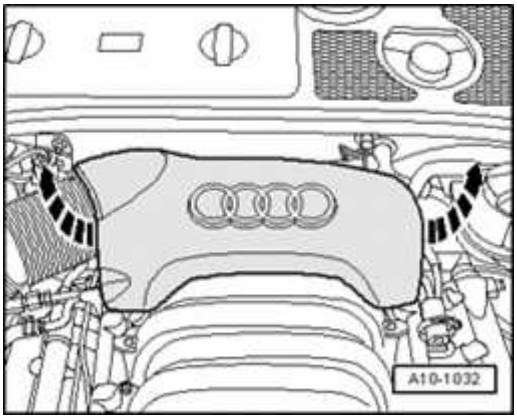


Fig. 565: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

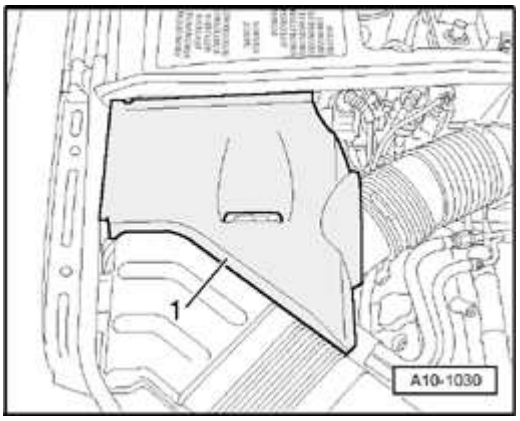


Fig. 566: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

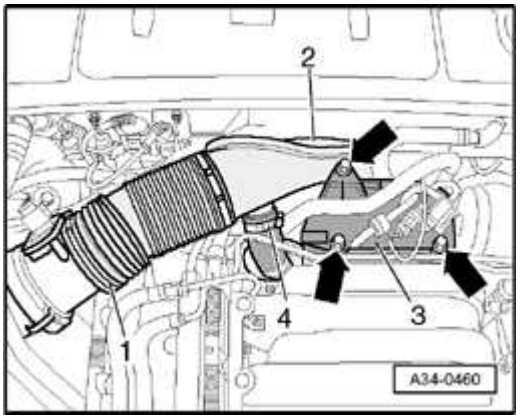


Fig. 567: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air duct -1- at Mass Air Flow (MAF) sensor.
- Remove hose -4- for crankcase ventilation from air duct -2-.

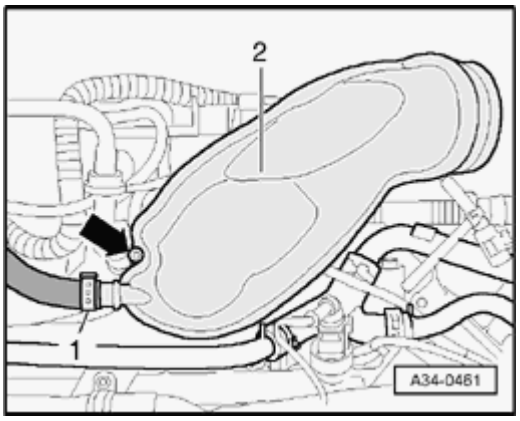


Fig. 568: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

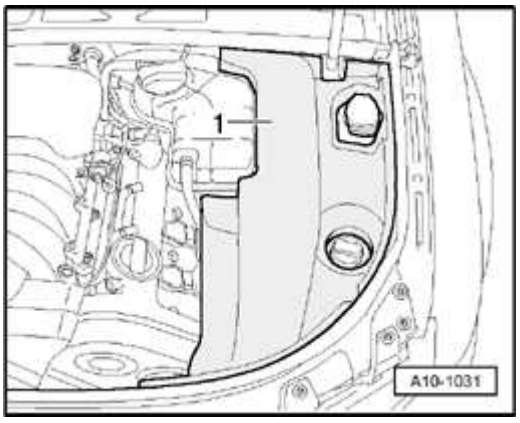


Fig. 569: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

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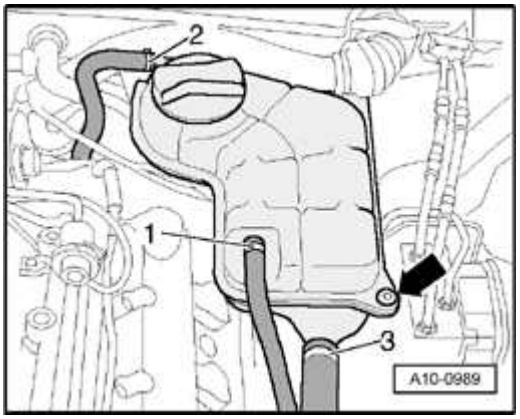


Fig. 570: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of coolant reservoir.
- Tie coolant reservoir with connected coolant hoses -1 to 3- to side.

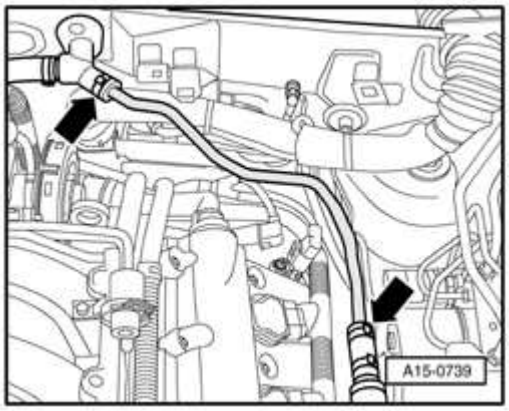


Fig. 571: Disconnecting Vacuum Hose To Brake Booster
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose to brake booster (arrows).
- Remove heat shield for harness connectors at left of bulkhead, if installed.

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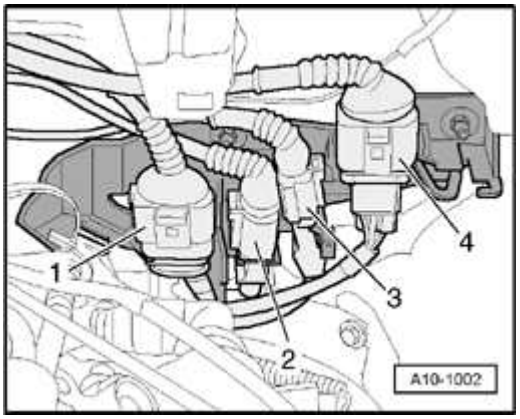


Fig. 572: Removing Harness Connectors From Bracket At Left Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at left of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

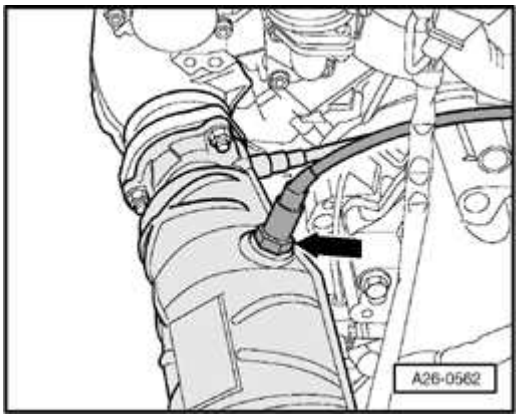


Fig. 573: Unscrewing Oxygen Sensor Behind Catalytic Converter Using Special Tool 3337/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: Illustration is shown with engine removed.

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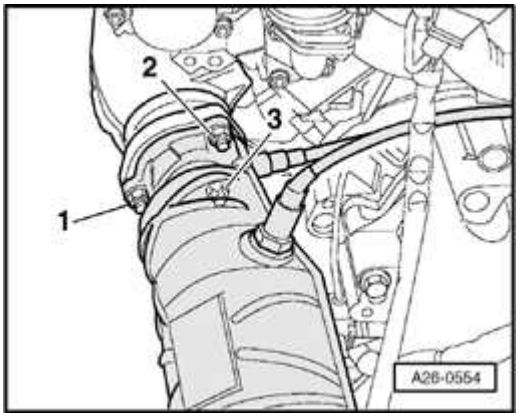


Fig. 574: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove left front wheel.

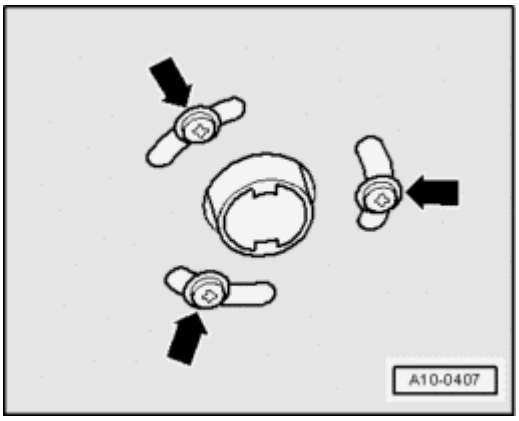


Fig. 575: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

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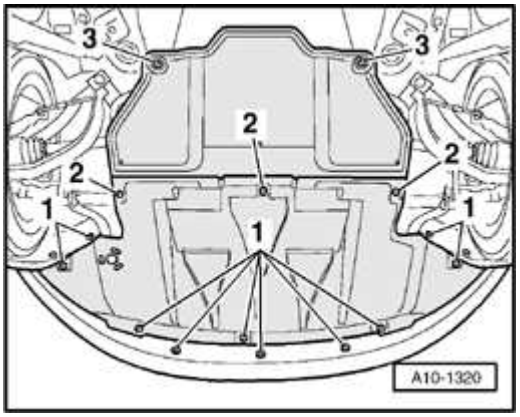


Fig. 576: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.

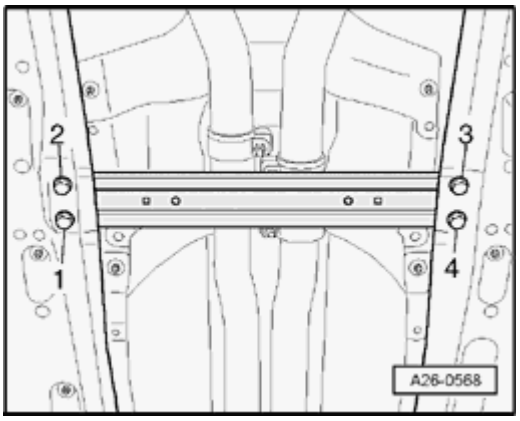


Fig. 577: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged..

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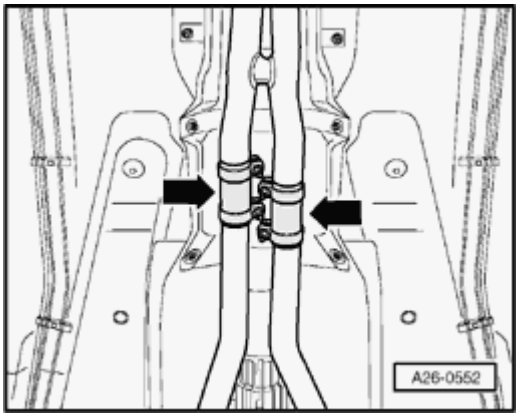


Fig. 578: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at both double clamps (arrows).
- Remove heat shield above exhaust system.

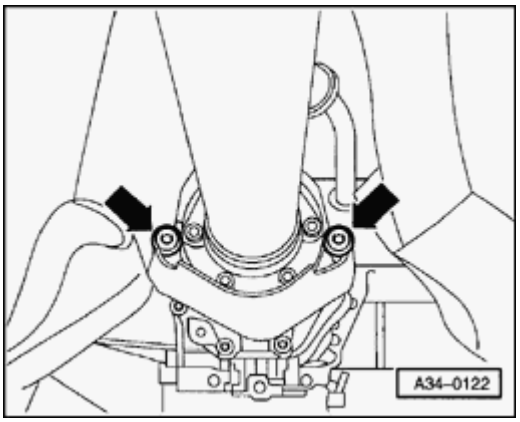


Fig. 579: Identifying Heat Shield Fasteners For Torsen Differential
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield for driveshaft from cover for Torsen differential (arrows).
- Remove bolts at flange of transmission/driveshaft.
- Push driveshaft to rear final drive together. Constant velocity joints can be adjusted axially.
- Rest driveshaft on exhaust system.

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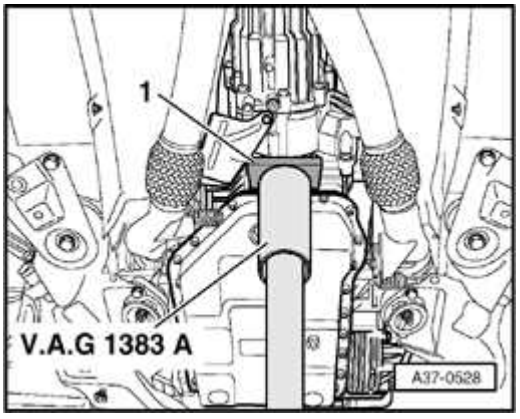


Fig. 580: Positioning Engine/Transmission Jack VAG1383A Directly Behind ATF Drip Tray
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position engine/transmission jack VAG1383A directly behind ATF drip tray. Insert a wood block -1- to protect transmission housing.

WARNING: The lock carrier must be installed.

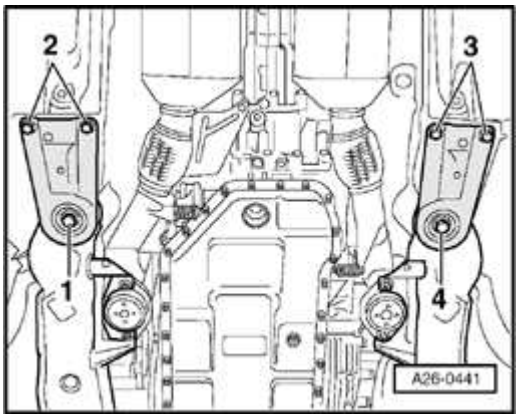


Fig. 581: Removing Bolts And Mounting Bolts Of Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -2- and -3- and then mounting bolts -1- and -4- of subframe.
- Lower transmission and subframe slightly using VAG1383A engine/transmission jack.

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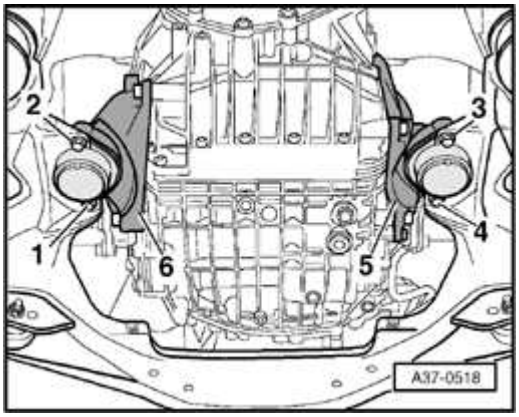


Fig. 582: Removing Bolts 1 To 4 For Transmission Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts 1 to 4 for transmission mount.
- Unbolt both transmission mounts -5- and -6- at transmission housing and remove transmission supports with transmission mounts.
- Lower transmission slowly.

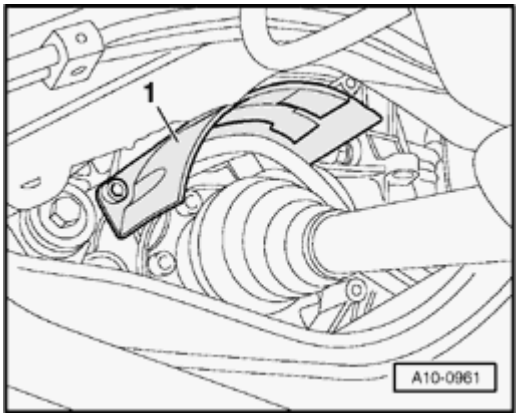


Fig. 583: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for left drive axle.

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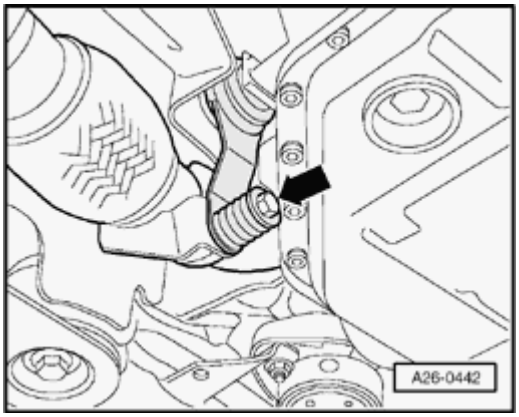


Fig. 584: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrow).

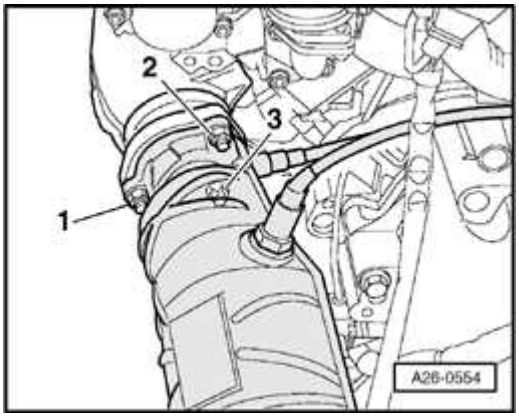


Fig. 585: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**

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- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Install transmission supports:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Install subframe:

Refer to **40 - FRONT SUSPENSION**

- Installing driveshaft:

Refer to

- **39 FINAL DRIVE, DIFFERENTIAL** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **39F - FRONT FINAL DRIVE, DIFFERENTIAL** for 6 SPD. MANUAL TRANSMISSION 0A3 ALL WHEEL DRIVE, INTERNAL COMPONENT SERVICING
- **39 FINAL DRIVE - DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **39 FINAL DRIVE - FRONT DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

NOTE: Individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01V. See Fig. 481.

Tightening torques

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Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55

Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)

Special tools and equipment

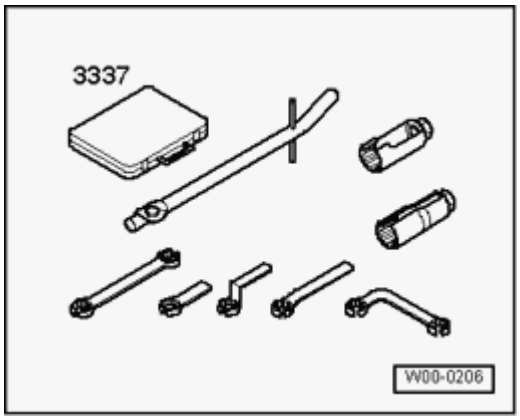


Fig. 586: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3337 Wrench, 7-piece set

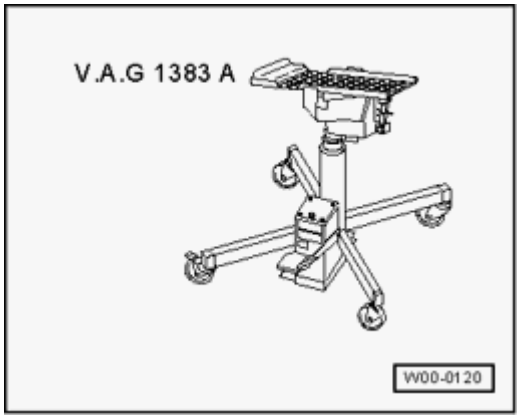


Fig. 587: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1383A Engine/transmission hoist

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- Locking compound G 052 112 A3

Removing

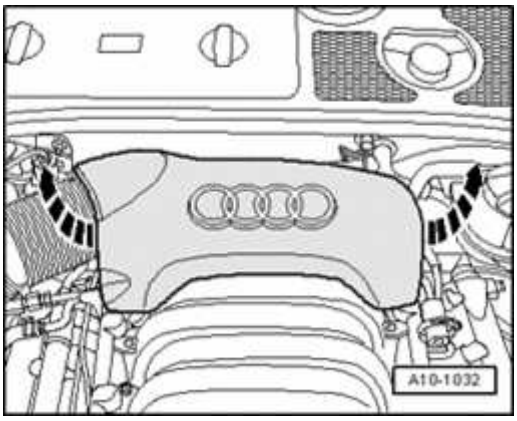


Fig. 588: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

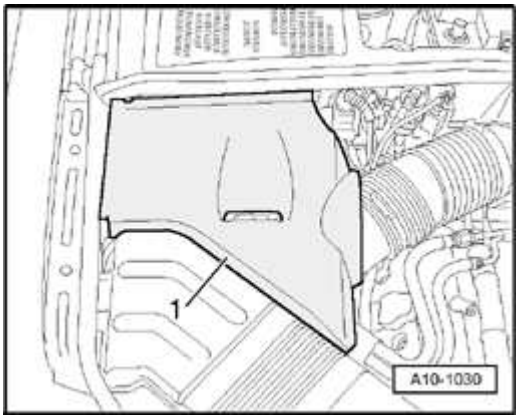


Fig. 589: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

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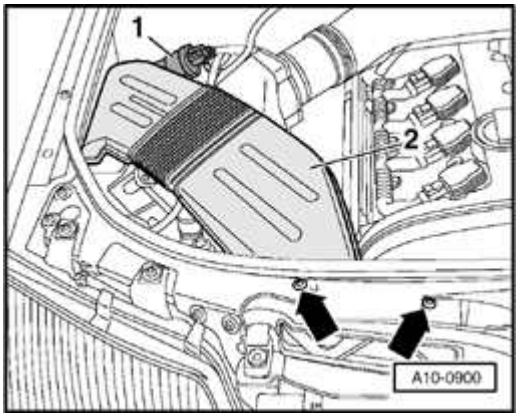


Fig. 590: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

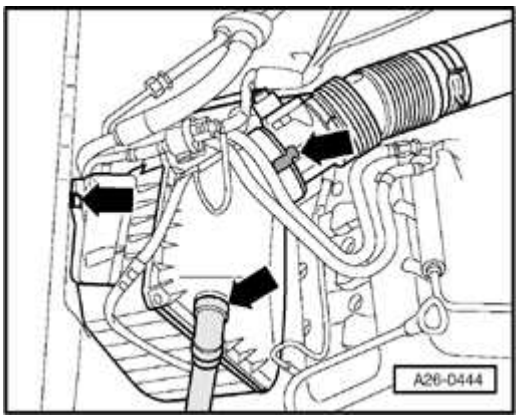
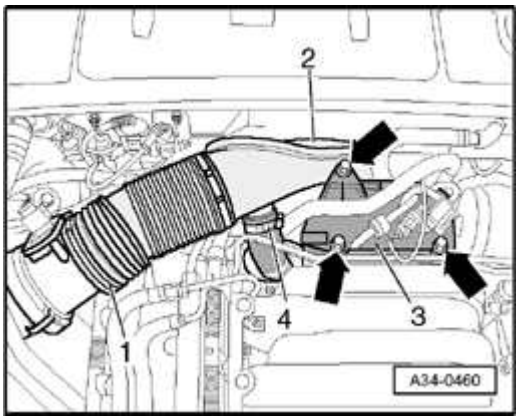


Fig. 591: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).



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Fig. 592: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect electrical harness connector at Mass Air Flow (MAF) sensor.
- Remove hose -4- of crankcase ventilation from air duct -2-.

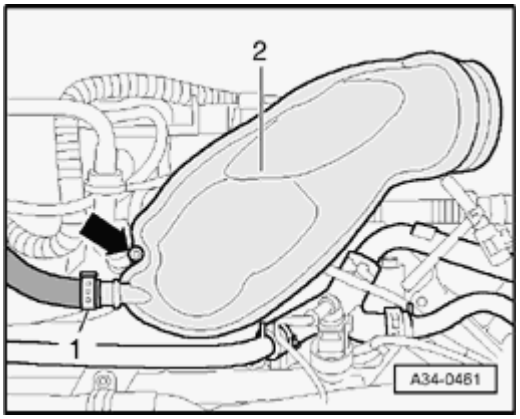


Fig. 593: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

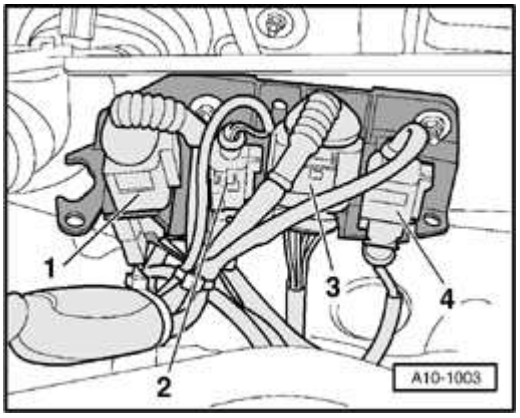


Fig. 594: Removing Harness Connectors From Bracket At Right Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at right of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

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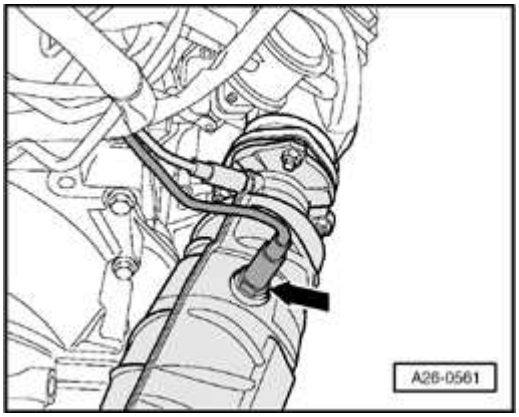


Fig. 595: Unscrewing Oxygen Sensor Behind Catalytic Converter Using Special Tool 3337/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: The illustration is shown with the engine removed.

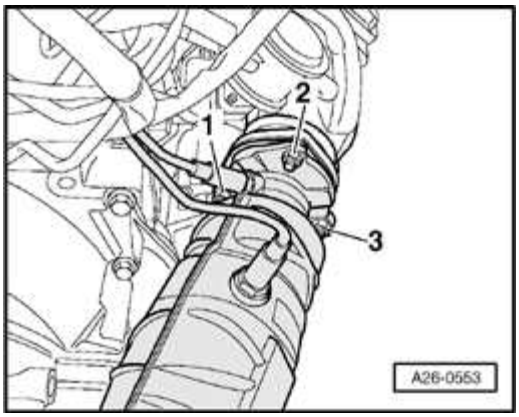


Fig. 596: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove right front wheel

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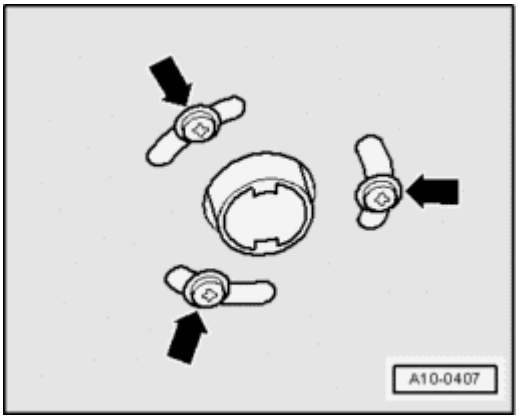


Fig. 597: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

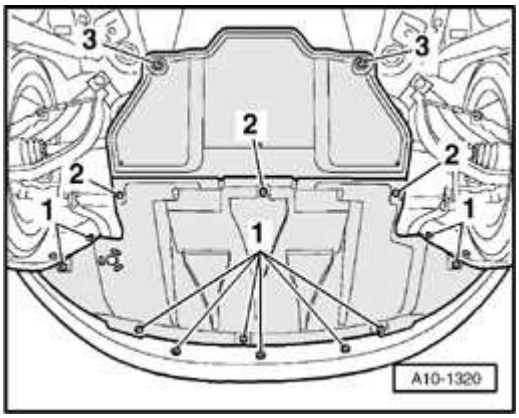
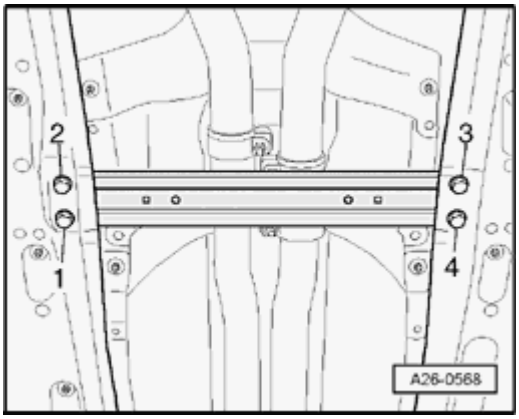


Fig. 598: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.



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Fig. 599: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be cant more than 10°, otherwise it may be damaged.

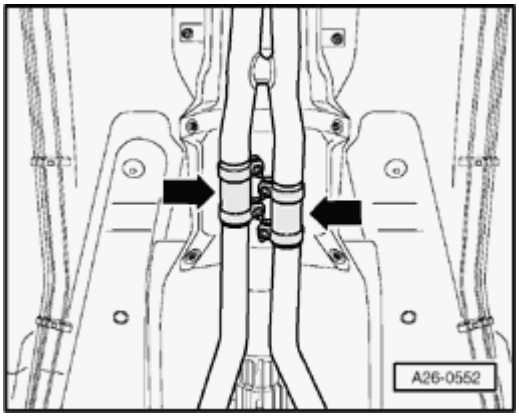


Fig. 600: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at both double clamps -arrows-.
- Remove heat shield above exhaust system.

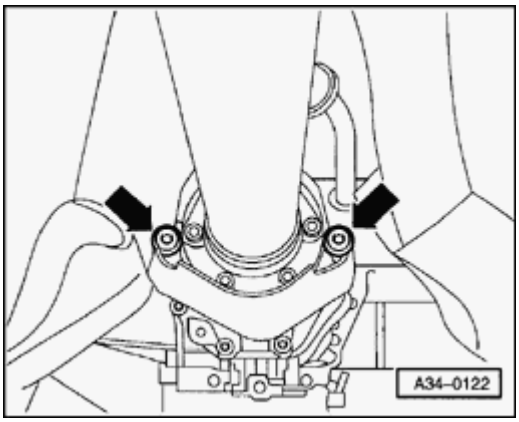


Fig. 601: Identifying Heat Shield Fasteners For Torsen Differential
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield for driveshaft from cover for Torsen differential (arrows).
- Remove bolts at flange of transmission/driveshaft.
- Push driveshaft to rear final drive together. Constant velocity joints can be adjusted axially.
- Rest driveshaft on exhaust system.

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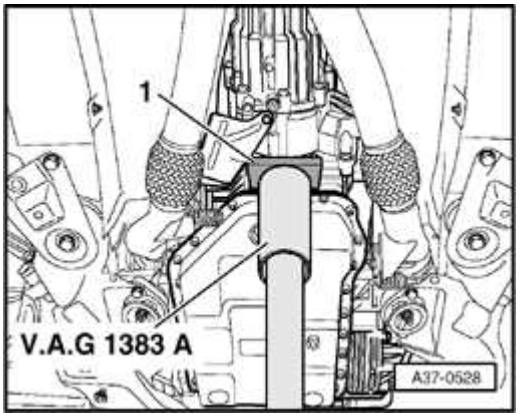


Fig. 602: Positioning Engine/Transmission Jack VAG1383A Directly Behind ATF Drip Tray
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position engine/transmission jack VAG1383A directly behind ATF drip tray. Insert a wood block -1- to protect transmission housing.

WARNING: The lock carrier must be installed.

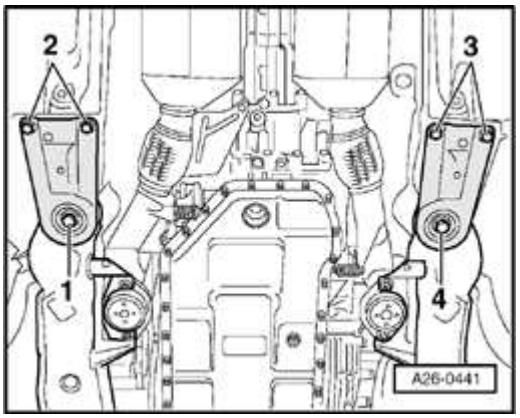


Fig. 603: Removing Bolts And Mounting Bolts Of Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -2- and -3- and then mounting bolts -1- and -4- of subframe.
- Lower transmission and subframe slightly using VAG1383A engine/transmission jack.

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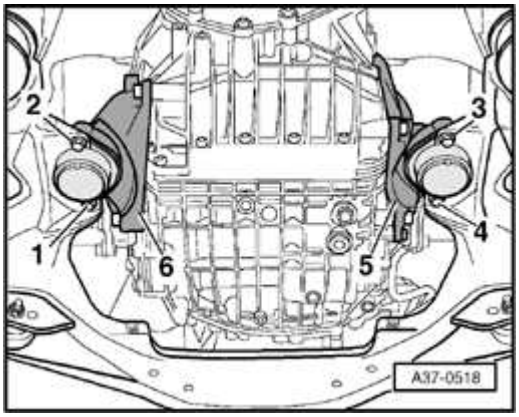


Fig. 604: Removing Bolts 1 To 4 For Transmission Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- to -4- for transmission mount.
- Unbolt both transmission mounts -5- and -6- at transmission housing and remove transmission supports with transmission mounts.
- Lower transmission slowly.

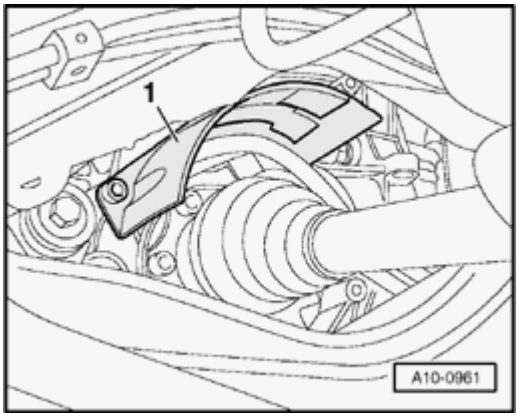


Fig. 605: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for right drive axle.
- Remove right drive axle.

Refer to **40 - FRONT SUSPENSION**

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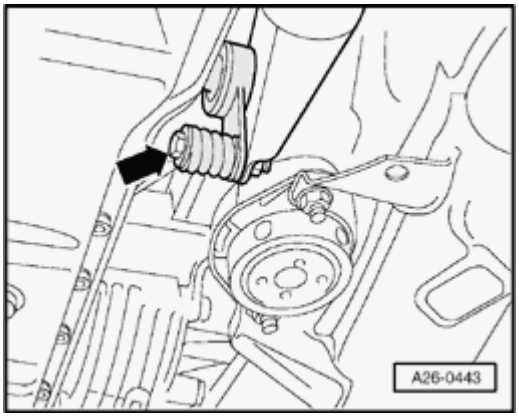


Fig. 606: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrow).

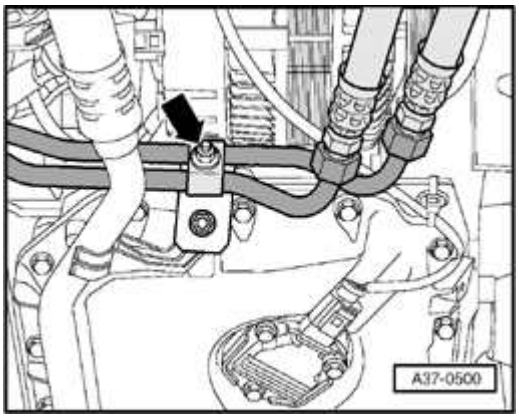


Fig. 607: Unbolting Bracket For ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for ATF lines (arrow).

NOTE: Observe the rules of cleanliness for working on automatic transmissions:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Place oil pan underneath.

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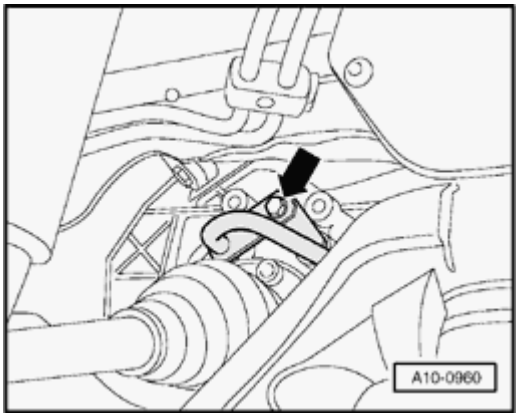


Fig. 608: Removing Bolt And Disconnecting ATF Lines From Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect ATF lines from transmission.
- Tie up ATF lines off to side.
- Expose oxygen sensor wire.

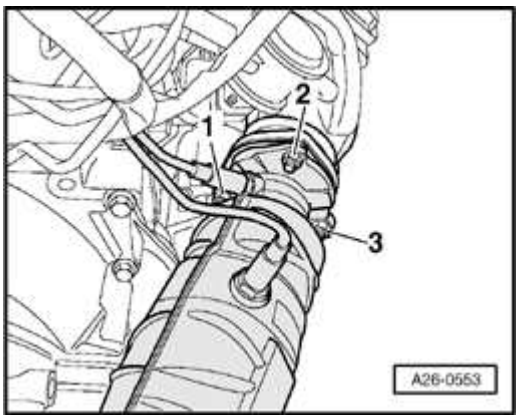


Fig. 609: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: The illustration is shown with the engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

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- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**
- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Install transmission supports:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Install subframe:

Refer to **40 - FRONT SUSPENSION**

- Install drive axle.

Refer to **40 - FRONT SUSPENSION**

- Installing driveshaft:

Refer to

- **39 FINAL DRIVE, DIFFERENTIAL** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **39F - FRONT FINAL DRIVE, DIFFERENTIAL** for 6 SPD. MANUAL TRANSMISSION 0A3 ALL WHEEL DRIVE, INTERNAL COMPONENT SERVICING
- **39 FINAL DRIVE - DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **39 FINAL DRIVE - FRONT DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

- Secure ATF lines:

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Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

NOTE: Individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01V. See Fig. 478.

- Check ATF level:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Tightening torques

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55

Left exhaust manifold, removing and installing

Removing

- Remove left front exhaust pipe with catalytic converter. Refer to **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)**, **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)** and **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)**.

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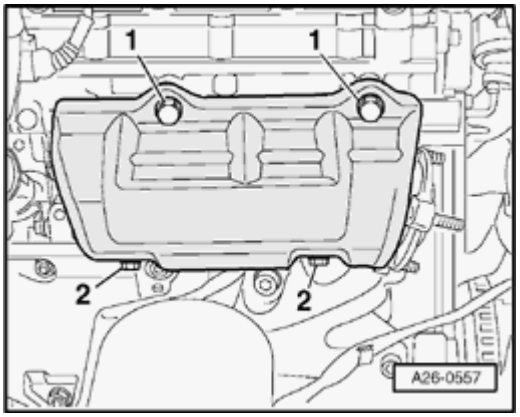


Fig. 610: Removing Threaded Connection At Heat Shield Which Is Accessible From Bottom
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove threaded connection -2- at heat shield which is accessible from bottom.
- Unscrew threaded connection -1- which is accessible from top and remove heat shield.

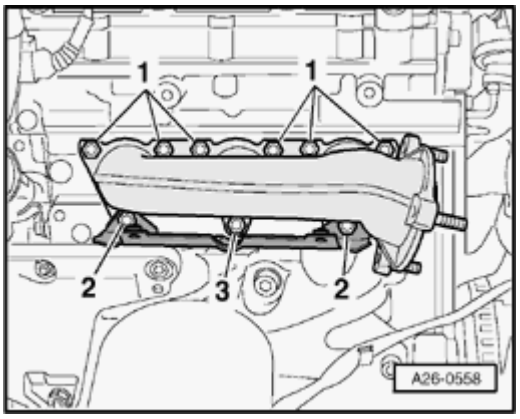


Fig. 611: Identifying Threaded Connections, Nuts, Heat Shield Bracket & Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew threaded connections -1- of exhaust manifold which is accessible from top.
- Remove nuts -2- from bottom and remove heat shield bracket.
- Remove nut -3- and remove exhaust manifold.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and self-locking nuts.

- Install left front exhaust pipe with catalytic converter. Refer to **Installing** for vehicles with manual transmission, **Installing** for vehicles with automatic transmission 01J and **Installing** for vehicles with automatic transmission 01V.

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- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

Tightening torques

Component		Nm
Exhaust manifold to cylinder head		25
Heat shield	M6	10
for exhaust manifold	M8	25

Right exhaust manifold, removing and installing

Removing

- Remove right front exhaust pipe with catalytic converter. Refer to **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)**, **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)** and **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)**.

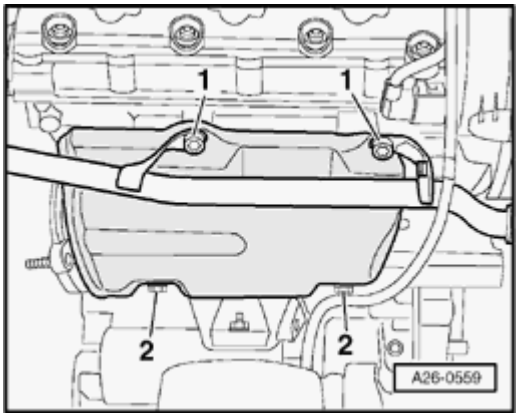


Fig. 612: Removing Threaded Connection At Heat Shield & Unscrewing Threaded Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove threaded connection -2- at heat shield which is accessible from bottom.
- Unscrew threaded connection -1- which is accessible from top.

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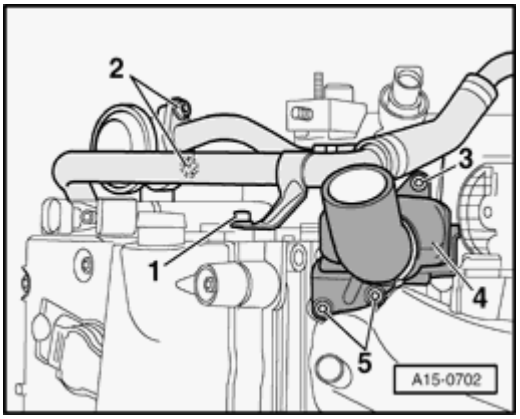


Fig. 613: Removing Bolts At Lines Of Secondary Air Injection & Resonator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- at secondary air injection lines.

NOTE: Resonator -4- remains installed with bolts -3- and -5-.

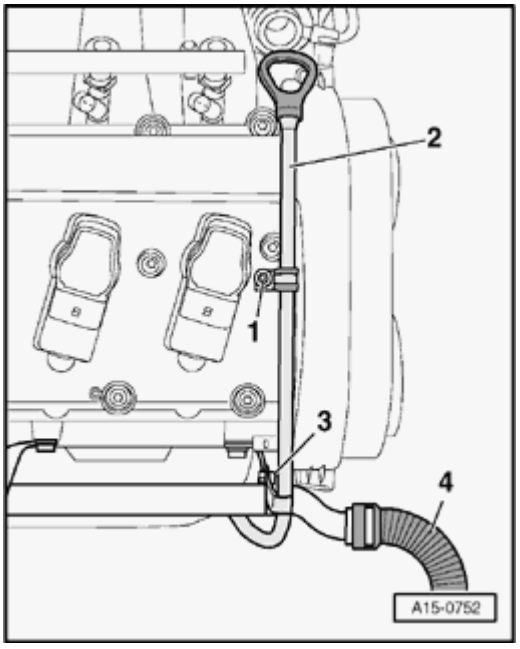


Fig. 614: Identifying Bolts, Hose From Line Of Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -3-.
- Disconnect hose -4- from secondary air injection line.
- Pull out guide tube for oil dipstick -2- toward top from oil pan (upper part) and swing it forward.
- Remove heat shield.

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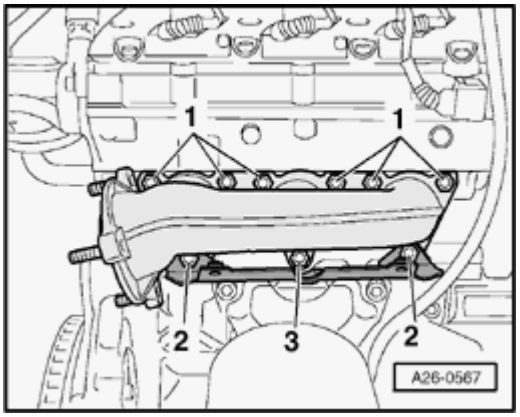


Fig. 615: Unscrewing Threaded Connection On Exhaust Manifold & Removing Nuts, Heat Shield Bracket & Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew threaded connection -1- on exhaust manifold which is accessible from top.
- Remove nuts -2- from bottom and remove heat shield bracket.
- Remove nut -3- and remove exhaust manifold.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and self-locking nuts.

- Replace O-ring at guide tube for oil dipstick and insert guide tube into hole in oil pan (upper part).
- Install right front exhaust pipe with catalytic converter. Refer to **Installing** for vehicles with automatic transmission 01J or **Installing** for vehicles with automatic transmission 01V.
- Align exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** or **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

Tightening torque

Component		Nm
Exhaust manifold to cylinder head		25
Heat shield to heat shield bracket		10
Tube for	M6	10
Secondary Air Injection	M8	25
Guide tube for oil dipstick to line for secondary air injection		10

Exhaust system, aligning free of stress (vehicles with front wheel drive)

NOTE: Align exhaust system when cold.

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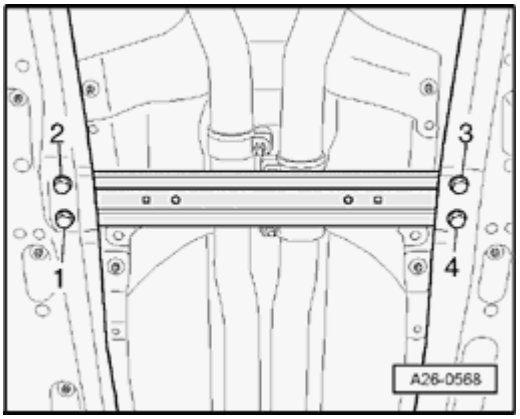


Fig. 616: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember (55 Nm).

- Vehicles without clamping sleeve between center and rear muffler

- Loosen double clamp bolts, item - 14.

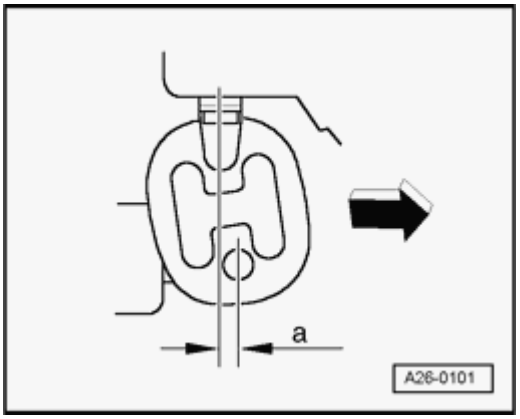


Fig. 617: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push exhaust system far enough forward (arrow) so that pre-tension at retaining loop at center muffler -a- = 5 to 9 mm.
- Tighten double clamp bolts uniformly to 40 Nm.
- Align end pipes. Refer to **Tailpipes, aligning** .

- Vehicles with clamping sleeve between center and rear muffler

NOTE: Only for vehicles with double clamp between center and rear mufflers, the rear muffler must also be aligned.

- Loosen double clamp bolts at front, item - 14 and rear, item - 23

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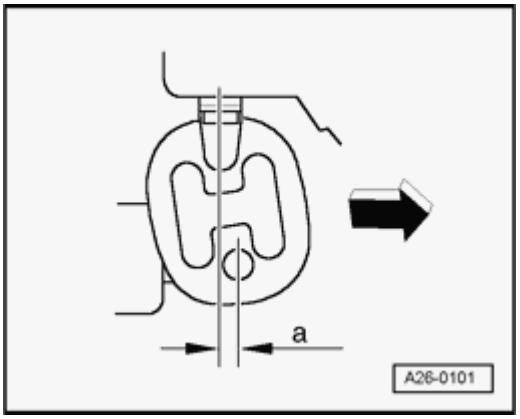


Fig. 618: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push front part of exhaust system far enough forward (arrow) so that pre-tension at retaining loop at center muffler -a- = 5 to 9 mm.
- Tighten front double clamp bolts, item - 14 evenly to 40 Nm.

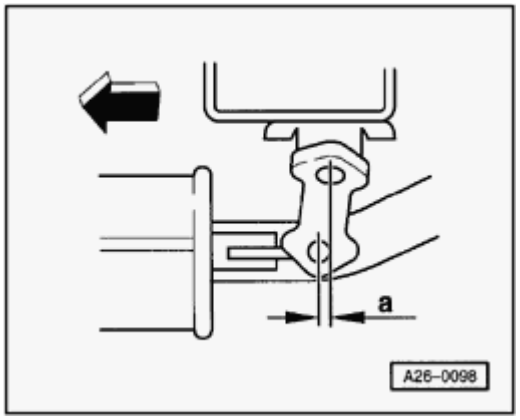


Fig. 619: Pushing Rear Section Of Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push rear part of exhaust system far enough forward (arrow) so that pre-tension at rear retaining loops at rear muffler -a- = 7 to 11 mm.
- Align rear muffler horizontally.
- Tighten rear double clamp bolts, item - 23 evenly to 40 Nm.
- Align end pipes. Refer to **Tailpipes, aligning** .

Exhaust system, aligning free of stress (vehicles with all wheel drive)

NOTE: Align exhaust system when cold.

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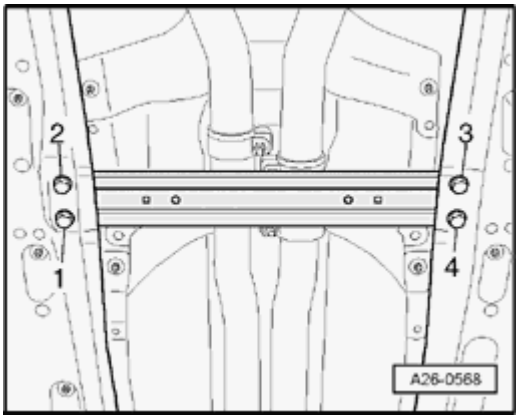


Fig. 620: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember (55 Nm).

- Vehicles without clamping sleeve between center and rear muffler

- Loosen double clamp bolts, item - 14.

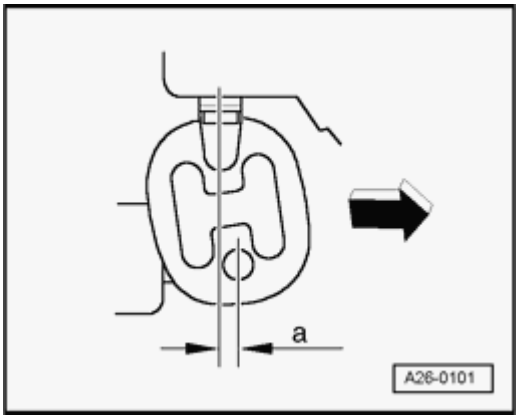


Fig. 621: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push exhaust system far enough forward (arrow) so that pre-tension at right retaining loop at center muffler -a- = 5 to 9 mm.
- Tighten double clamp bolts uniformly to 40 Nm.
- Align end pipes. Refer to **Tailpipes, aligning** .

- Vehicles with clamping sleeve between center and rear muffler

NOTE: Only for vehicles with double clamp between center and rear mufflers, the center muffler must also be aligned.

- Loosen double clamp bolts, item - 14, and item - 24.

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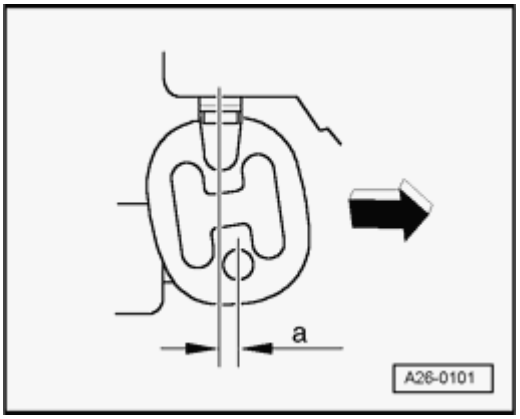


Fig. 622: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push front part of exhaust system far enough forward (arrow) so that pre-tension at retaining loop at center muffler -a- = 5 to 9 mm.
- Tighten front double clamp bolts, item - 14 evenly to 40 Nm.

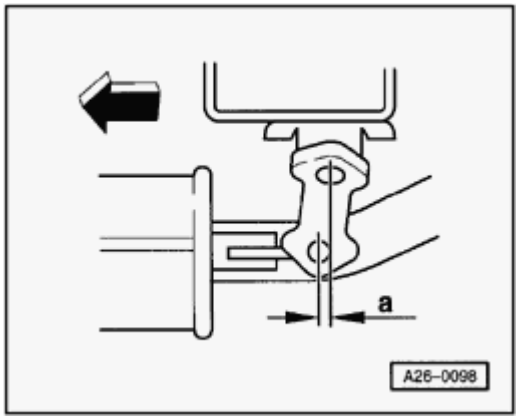


Fig. 623: Pushing Rear Section Of Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push rear part of exhaust system far enough forward (arrow) so that pre-tension at rear retaining loops at rear muffler -a- = 7 to 11 mm.
- Align rear muffler horizontally.
- Tighten rear double clamp bolts, item - 24 evenly to 40 Nm.
- Align end pipes. Refer to **Tailpipes, aligning** .

Tailpipes, aligning

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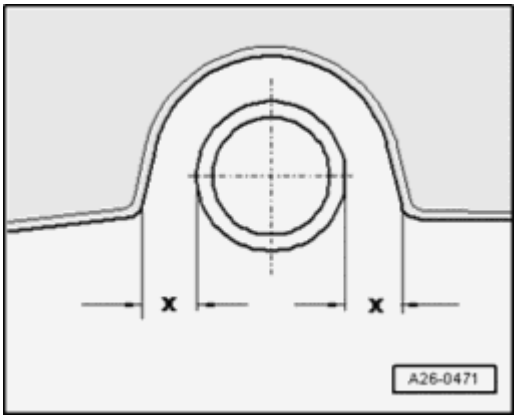


Fig. 624: Checking Distance Of End Pipes At Left/Right To Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check distance of end pipes at left and right to bumper:

- Dimension -x- left = dimension -x- right

If necessary, correct dimension -x- as follows:

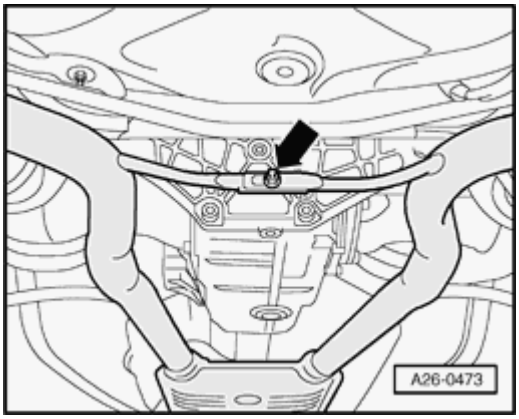


Fig. 625: Loosening Nut Of Brace Between Exhaust Pipes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen nuts (arrows) of brace between exhaust pipes.
- Change distance of rear mufflers to each other.
- Tighten nut to 23 Nm.

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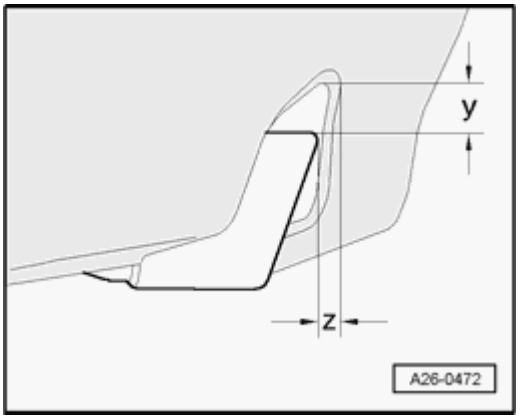


Fig. 626: Checking Distances Of End Pipes To Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check distances -y- and -z- of end pipes to bumper:

- Dimension -y- = greater than 20 mm
- Dimension -z- = 9 to 14 mm

- If necessary, check whether exhaust system is installed free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** or **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

Exhaust system, checking for proper seal

- Start engine and let run at idle.
- Seal tailpipes with cloths or plug for duration of leak test.
- Check for leaks by listening at cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe etc.
- Repair leaks.

SECONDARY AIR SYSTEM

Secondary air system

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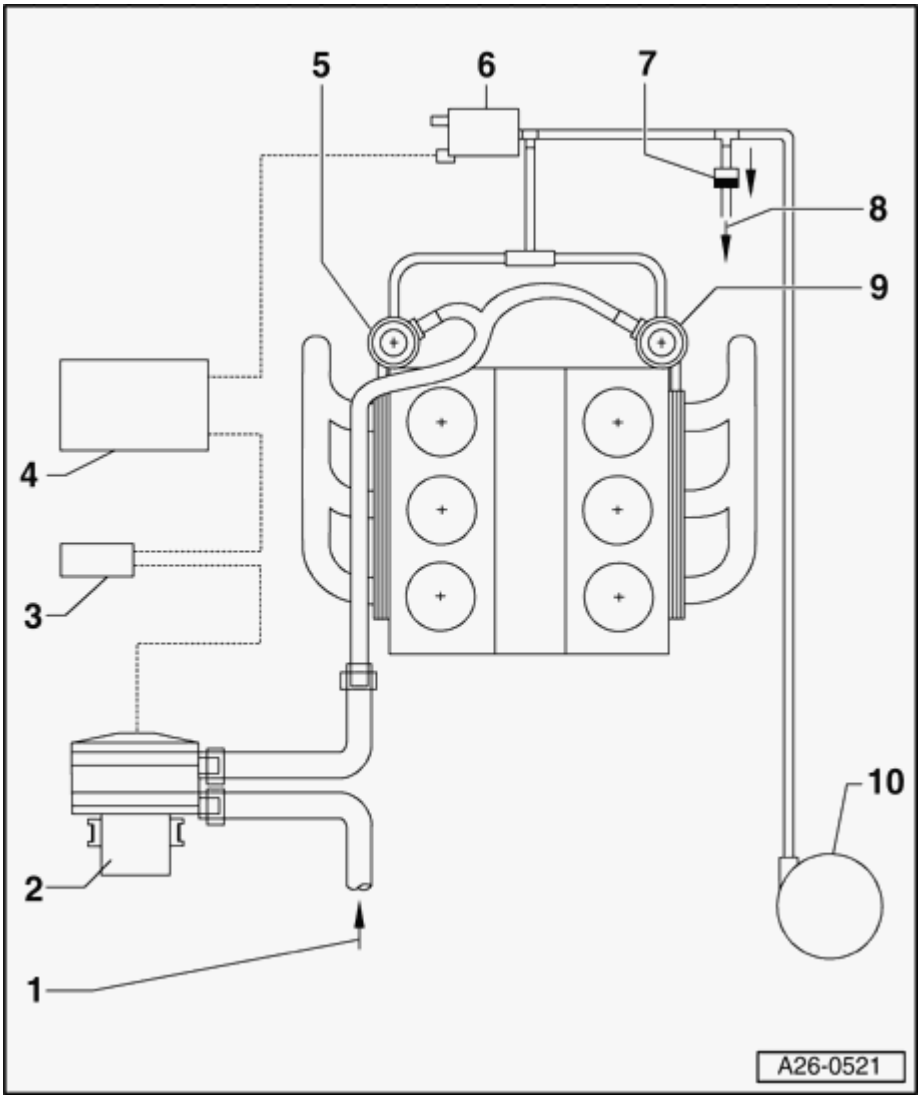


Fig. 627: Identifying Secondary Air System
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The Secondary Air Injection (AIR) system causes the catalytic converter to heat up more quickly, resulting in earlier operating readiness following cold start.

Principle

Due to over-enrichment of the mixture during the cold start phase, there is an increased amount of uncombusted carbon monoxide in the exhaust. Secondary Air Injection (AIR) improves secondary oxidation in the catalytic converter and therefore reduces emissions. The heat produced by secondary oxidation greatly reduces start-up time for the catalytic converter, therefore improving exhaust quality during the cold start phase significantly.

Function

- In the cold start phase, the ECM -4- activates the secondary air pump -2- via the relay for secondary air

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injection -3-. Air reaches the combination valves for secondary air injection -5- and -9-.

- The Secondary Air Injection (AIR) valve -6- is activated in parallel, which allows the vacuum to reach the combination valves for secondary air injection -5- and -9-. The appropriate combination valve for secondary air injection thereby opens the path for secondary air to the exhaust channels of the cylinder head.

1 - From air filter housing

2 - Secondary Air Injection (AIR) pump motor -V101-

- Component location. See **Fig. 629**
- Removing and installing. Refer to **Secondary Air Injection (AIR) pump motor -V101-, removing and installing**

3 - Secondary Air Injection (AIR) pump relay -J299-

- Component location. See **Fig. 630**

4 - Motronic Engine Control Module (ECM) -J220-

5 - Combination valve for secondary air injection (right)

- Component location. See **Fig. 631**
- Checking. Refer to **Combination valve for Secondary Air Injection (AIR), checking function and proper seal**
- Removing and installing. Refer to **Right combination valve for secondary air injection, removing and installing**

6 - Secondary Air Injection (AIR) solenoid valve -N112-

- Component location. See **Fig. 628**

7 - Check-valve

- Installed position (light/dark side): Arrow points in direction of flow, as shown in .

8 - To Intake manifold

9 - Combination valve for secondary air injection (left)

- Component location. See **Fig. 631**
- Checking. Refer to **Combination valve for Secondary Air Injection (AIR), checking function and proper seal**
- Removing and installing. Refer to **Left combination valve for secondary air injection, removing and installing**

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10 - Vacuum reservoir

- Installed location: Under wheelhousing liner in left front wheelhousing

Component location Secondary Air Injection (AIR) solenoid valve -N112-

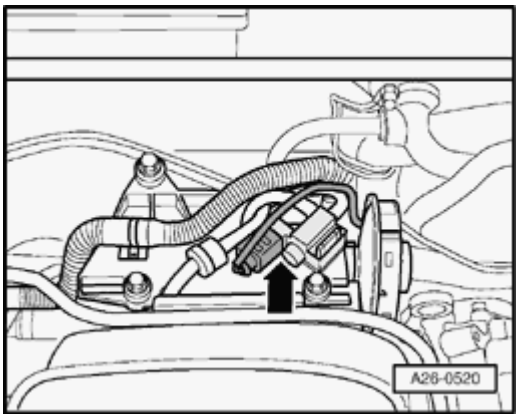


Fig. 628: Disconnecting Hoses From Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolted to holding plate for solenoid valves at rear of engine (arrow).

Secondary Air Injection (AIR) pump motor -V101-

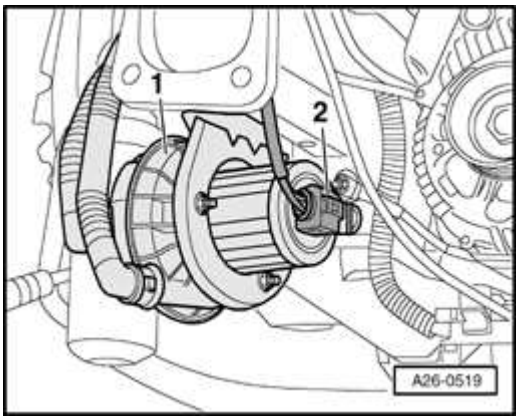


Fig. 629: Secondary Air Injection (AIR) Pump Motor -V101-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- At front right in engine compartment below air filter housing

1 - Secondary Air Injection (AIR) pump motor -V101-

2 - Electrical harness connector for Secondary Air Injection (AIR) pump motor -V101-

Secondary Air Injection (AIR) pump relay -J299-

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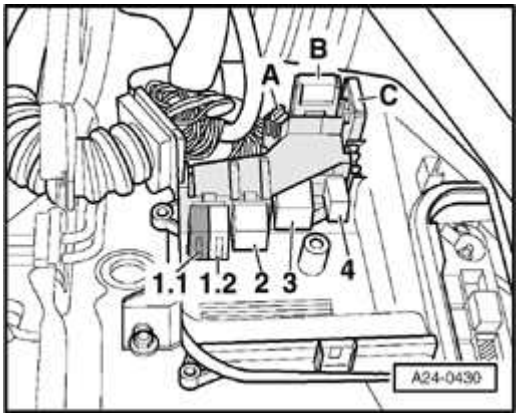


Fig. 630: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In E-box, plenum chamber

3 - Secondary Air Injection (AIR) pump relay -J299-

B - Fuse for secondary air pump -S130-

Combination valve for Secondary Air Injection (AIR)

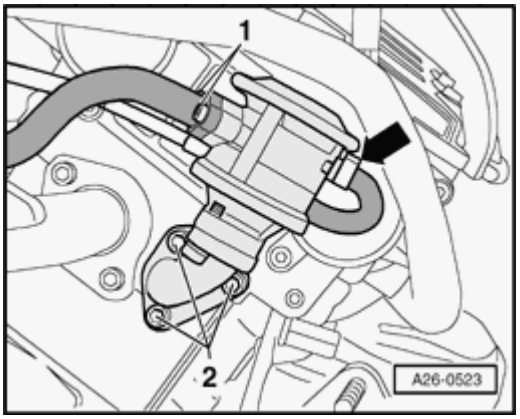


Fig. 631: Combination Valve For Secondary Air Injection (AIR)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- At rear of cylinder heads

NOTE: Right valve is shown in illustration.

Secondary Air Injection (AIR) solenoid valve -N112-, checking

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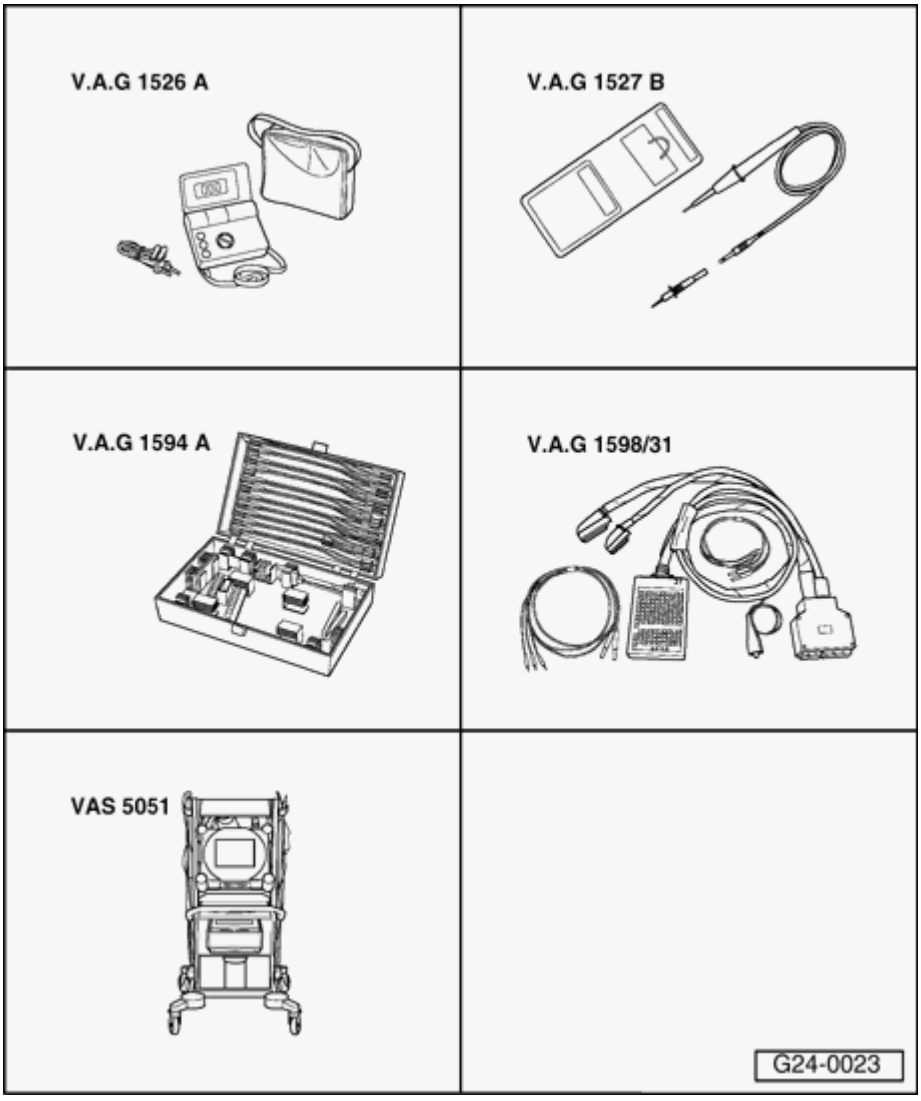


Fig. 632: Identifying Special Tools - Secondary Air Injection (AIR) Solenoid Valve -N112-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526A Multimeter
- VAG1527B Voltage tester
- VAG1594A Connector test kit
- VAG1598/31 Test box
- VAS5051 Vehicle diagnosis, testing and information system with VAG5051/1 Adapter

Requirement

- VAS5051 tester connected and vehicle On Board Diagnostic (OBD) function 01 "Engine electronics" selected.

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Work sequence

NOTE: The Secondary Air Injection (AIR) solenoid valve -N112- and wire connections are monitored by the Engine Control Module (ECM).

- Check DTC memory of Engine Control Module (ECM).

If a malfunction regarding Secondary Air Injection (AIR) solenoid valve -N112- is displayed:

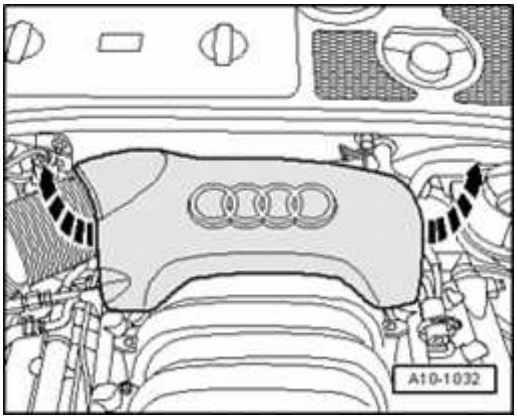


Fig. 633: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

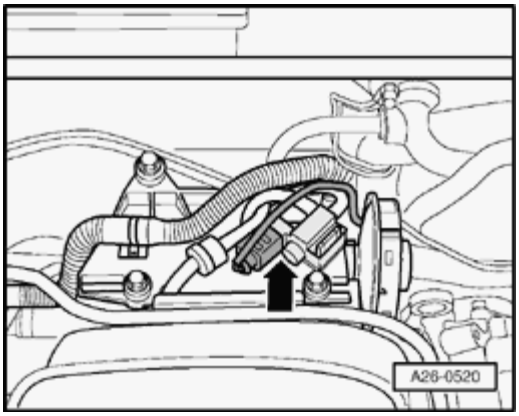


Fig. 634: Disconnecting Hoses From Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hoses from Secondary Air Injection (AIR) solenoid valve -N112- (arrow); electrical harness connector remains connected.

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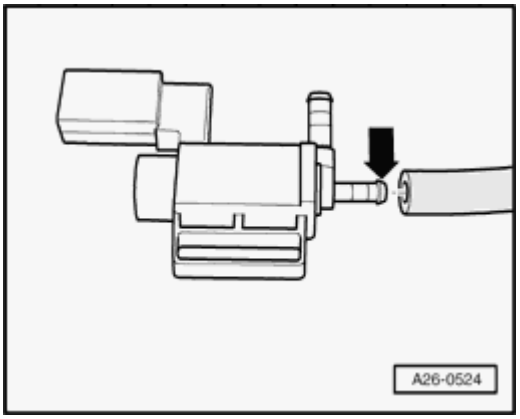


Fig. 635: Attaching Assisting Hose To Connection Of Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach assisting hose to connection of valve (indicated by an arrow).
- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) Solenoid Valve -N112-:

- Valve must click...
- ..and must open and close (can be tested by blowing into assisting hose).

If valve does not open or close properly:

- Replace Secondary Air Injection (AIR) solenoid valve -N112-.

If valve does not click during output Diagnostic Test Mode (DTM):

Checking internal resistance

- Switch ignition off.

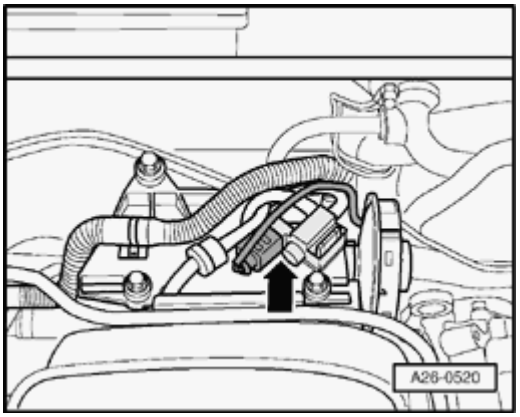


Fig. 636: Disconnecting Hoses From Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Disconnect harness connector from Secondary Air Injection (AIR) solenoid valve -N112- (arrow).

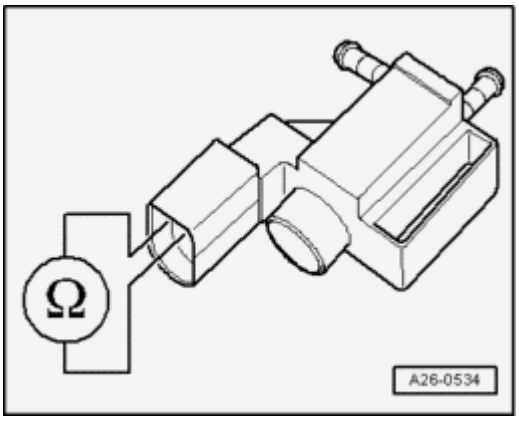


Fig. 637: Measuring Valve Resistance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter at valve for resistance measurement.
- Specification: 25 to 35 ohms

If specified value is not obtained:

- Replace Secondary Air Injection (AIR) solenoid valve -N112-.

If specified value is obtained:

Checking voltage supply

Requirements

- Fuse for Secondary Air Injection (AIR) OK

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Fuel Pump (FP) relay OK

NOTE: Voltage is supplied to Secondary Air Injection (AIR) solenoid valve -N112- via the Fuel Pump (FP) relay.

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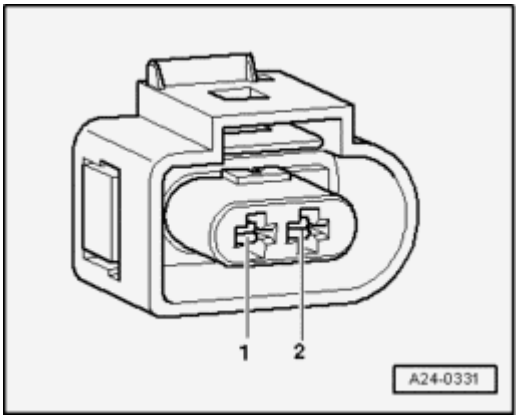


Fig. 638: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
1	Engine Ground (GND)

- Operate starter briefly.
- LED must light up

If LED does not light up:

- Check wire connection from terminal 1 of connector to Fuel Pump (FP) relay via fuse for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Repair open circuit if necessary.

If LED lights up:

Checking activation

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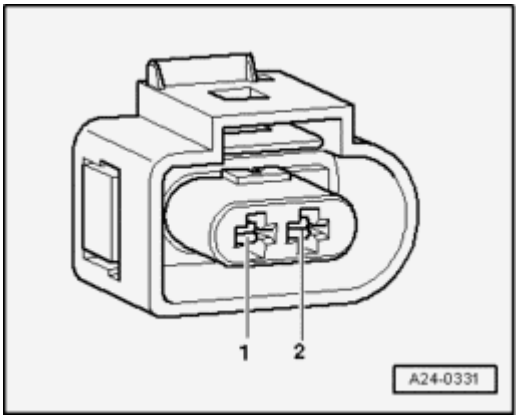


Fig. 639: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester to connector terminals 1 (B+) and 2.
- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) solenoid valve - N112-:

- LED must blink

If LED does not blink or if it remains constantly lit:

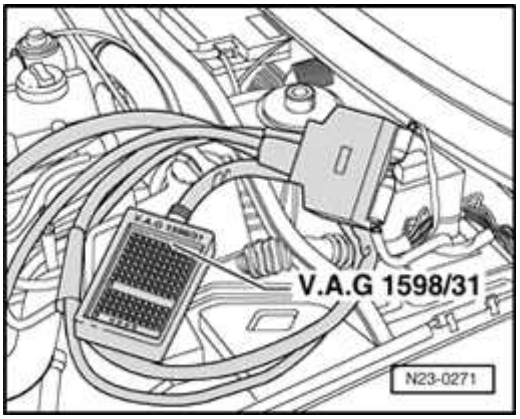


Fig. 640: VAG1598/31 Test Box Connected To Control Module Wiring Harness
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1598/31 test box to harness connectors of wiring harness (do not connect ECM). Connect Ground (GND) clip at test box (not visible in illustration) to Ground (GND).

Refer to **24 MULTIPORT FUEL INJECTION (MFI)**

- Check following wire connection for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket

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2	44

- Repair open circuit or short circuit if necessary.

Secondary Air Injection (AIR) pump relay -J299- and activation, checking

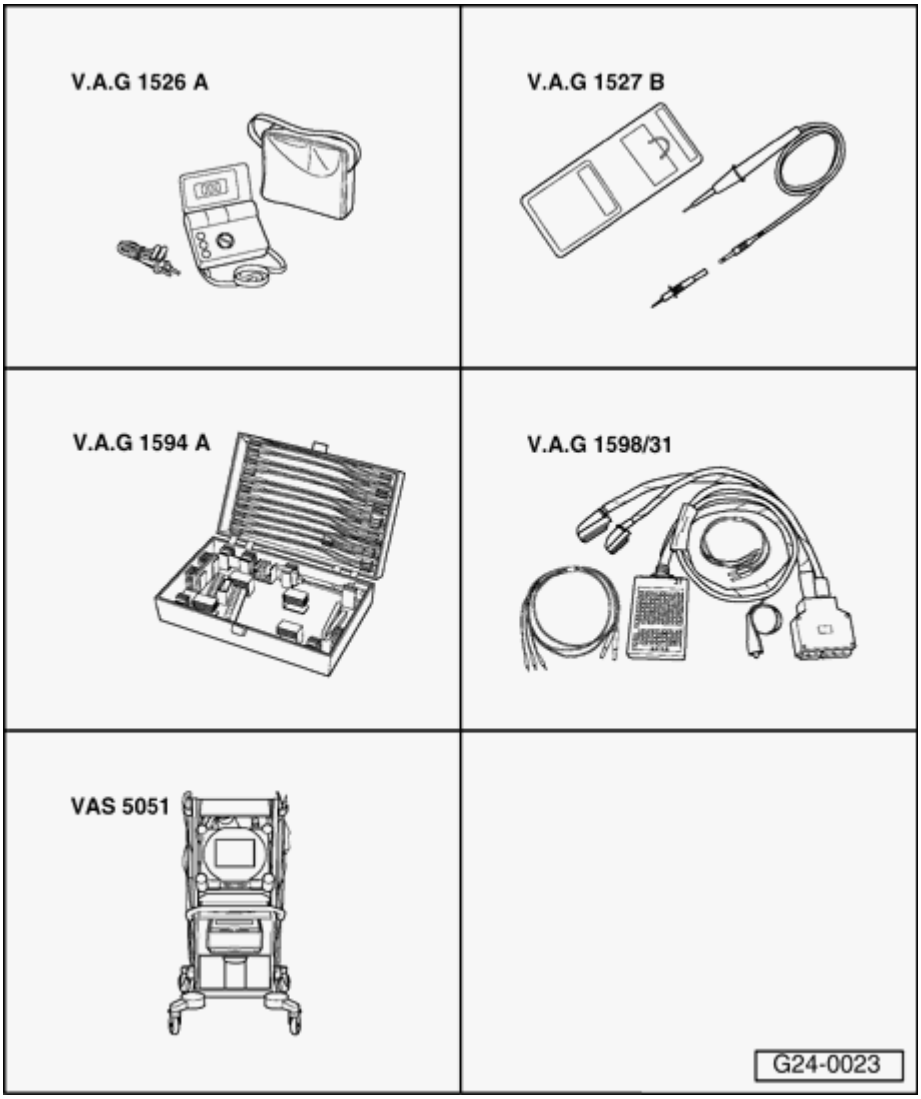


Fig. 641: Identifying Special Tools - Secondary Air Injection (AIR) Pump Relay -J299- And Activation, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526A Multimeter
- VAG1527B Voltage tester
- VAG1594A Connector test kit

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- VAG1598/31 Test box
- VAS5051 Vehicle diagnosis, testing and information system with VAG5051/1 Adapter

Requirement

- VAS5051 tester connected and vehicle On Board Diagnostic (OBD) function 01 "Engine electronics" selected.

Work sequence

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) pump relay -J299-.

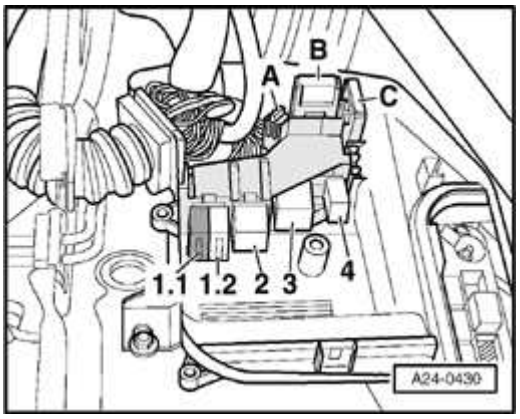


Fig. 642: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secondary Air Injection (AIR) pump relay -3- (in E-box, plenum chamber) must engage and Secondary Air Injection (AIR) pump relay -J299- must run in intervals

A - Does not engage relay:

- Check voltage supply of Secondary Air Injection (AIR) pump relay. Refer to **Checking voltage supply of Secondary Air Injection (AIR) pump relay**.
- Check activation of Secondary Air Injection (AIR) pump relay. Refer to **Check activation of the Secondary Air Injection (AIR) pump relay**.

B - If relay triggers, but Secondary Air Injection (AIR) pump motor does not run:

- Check voltage supply of Secondary Air Injection (AIR) pump motor. Refer to **Check voltage supply of the Secondary Air Injection (AIR) pump motor**.

Checking voltage supply of Secondary Air Injection (AIR) pump relay

- Switch ignition off.

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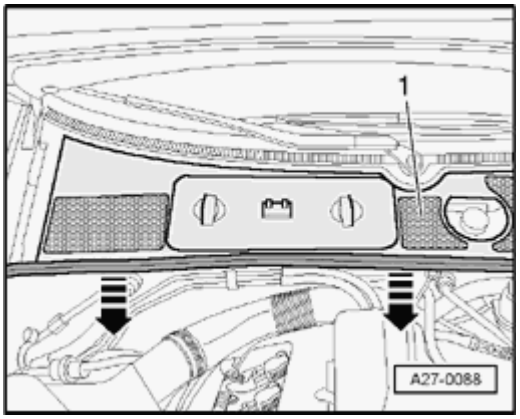


Fig. 643: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull rubber seal off of plenum chamber cover in direction of arrow.
- Remove plenum chamber cover -1- toward front.

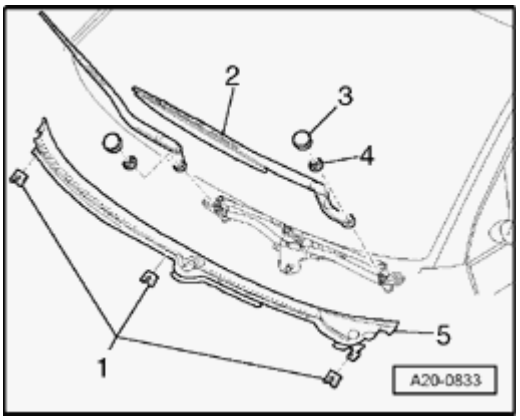


Fig. 644: Removing Securing Clips And Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off both covers -3- using a screwdriver.
- Loosen hex-nuts -4- by several turns.
- Loosen wiper arm -2- by lightly tilting from wiper axle.
- Remove hex nuts completely and remove wiper arms.

- Disconnect securing clips -1- and remove cowl grille -5-.

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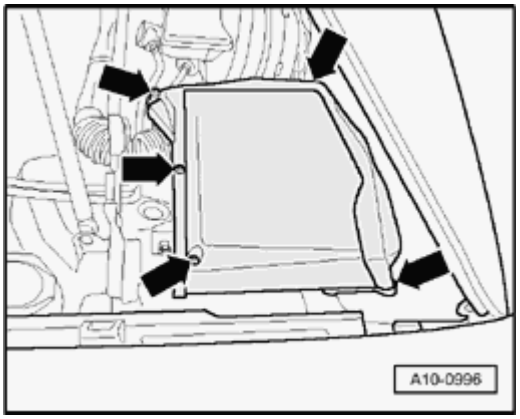


Fig. 645: Removing Screws And Cover From E-Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove E-box cover in plenum chamber (arrows).

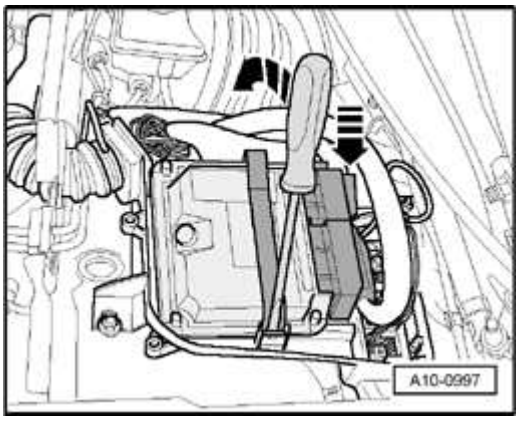
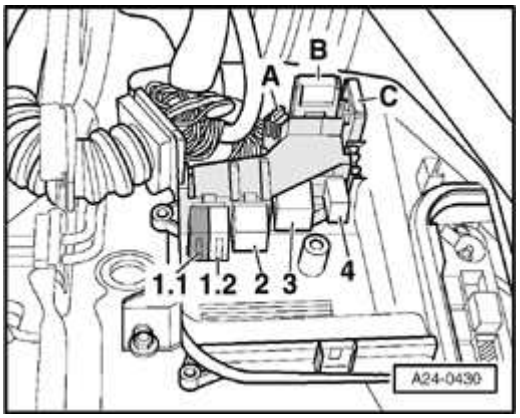


Fig. 646: Using Screwdriver To Remove Retainer Bar And Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off Engine Control Module (ECM) retaining bracket (arrows) using a screwdriver and set control module aside.
- If installed, unclip Transmission Control Module (TCM) retaining bracket and set control module aside.



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Fig. 647: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Secondary Air Injection (AIR) pump relay -3-.

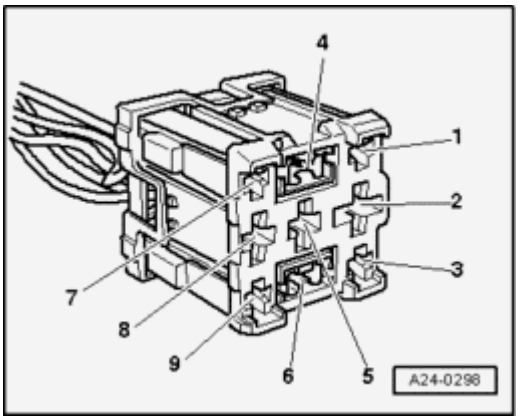


Fig. 648: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter for voltage measurement as follows.

Relay carrier in E-box, plenum chamber, Position 3 Terminal	Measure to
8	Engine Ground (GND)

- Specification: approx. battery voltage

If specified value is not obtained:

- Perform following tests marked with dots:

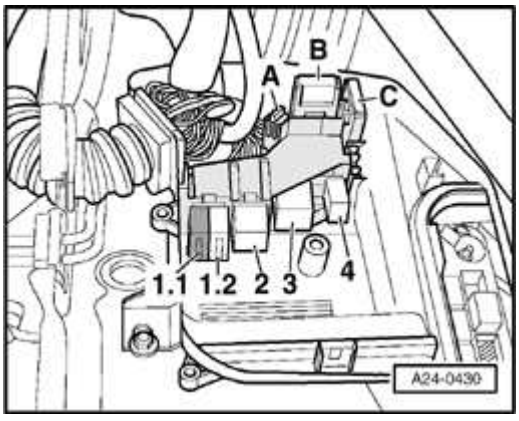


Fig. 649: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Check Fuse for secondary air pump -S130- (40 A) in E-Box, plenum chamber, position B.
- Check wire connection from battery + (terminal 30) via Fuse for secondary air pump -S130- to Secondary Air Injection (AIR) pump relay -J299- (in relay and fuse carrier in E-Box, plenum chamber, position 3) for open circuit.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

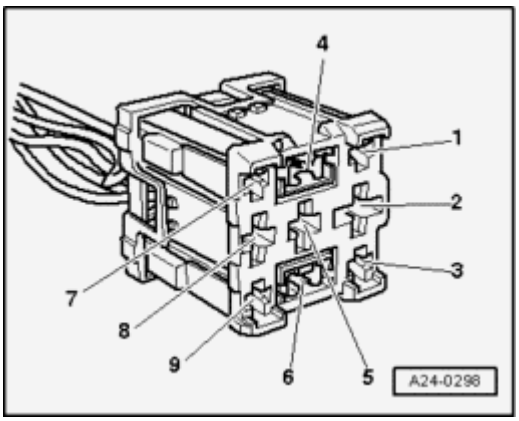


Fig. 650: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter for voltage measurement as follows.

Relay carrier in E-box, plenum chamber, Position 3 Terminal	Measure to
4	Engine Ground (GND)

- Operate starter briefly.

- Specification: approx. battery voltage

If specified value is not obtained:

- Perform following tests marked with dots:

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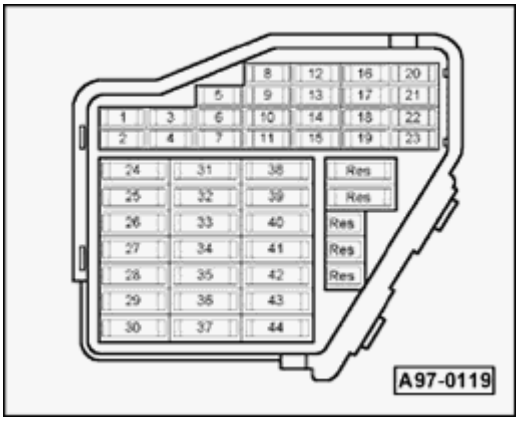


Fig. 651: Main Fuse Case
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check fuse -S234- in fuse holder (position 34).
- Check wire connection from Secondary Air Injection (AIR) pump relay -J299- (in 3-socket relay carrier in E-box, plenum chamber) via Fuse in fuse holder -S234- (position 34) to Fuel Pump (FP) relay for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

Check activation of the Secondary Air Injection (AIR) pump relay

- Switch ignition off.
- Remove Secondary Air Injection (AIR) pump relay

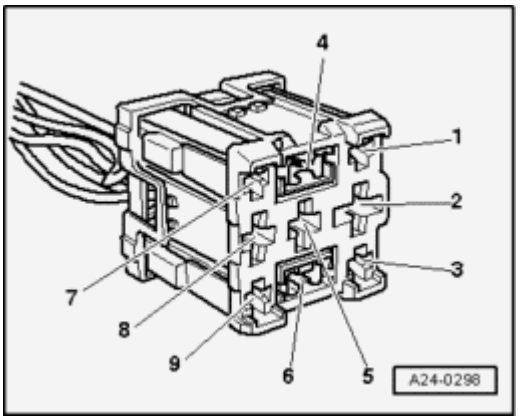


Fig. 652: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester as follows:

Relay carrier in E-box, plenum chamber, Position 3 Terminal	Measure to

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6	Engine Ground (GND)

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) rump relay - J299-.

- LED must blink

If LED does not blink:

- Switch ignition off.

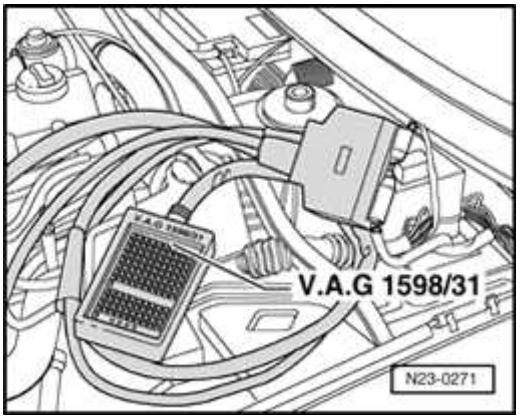


Fig. 653: VAG1598/31 Test Box Connected To Control Module Wiring Harness
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1598/31 test box to harness connectors of wiring harness (do not connect ECM). Connect Ground (GND) clip at test box (not visible in illustration) to Ground (GND).

Refer to **24 MULTIPORT FUEL INJECTION (MFI)**

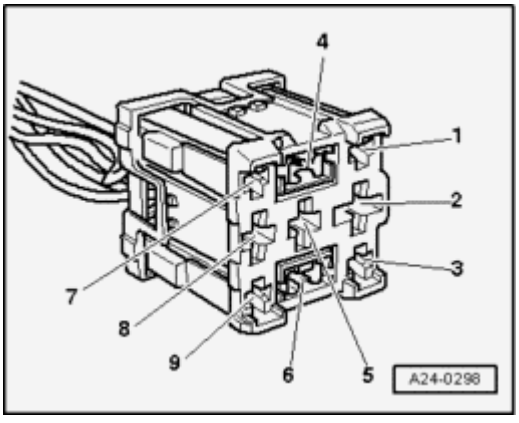


Fig. 654: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check following wire connection for open circuit and short circuit to Ground (GND) and B+:

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Relay carrier in E-box, Plenum chamber, Position 3 Terminal	VAG1598/31 test box Socket
6	46

- Repair open circuit or short circuit if necessary.

If no malfunctions are detected:

- Replace Secondary Air Injection (AIR) pump relay -J299-.

Check voltage supply of the Secondary Air Injection (AIR) pump motor

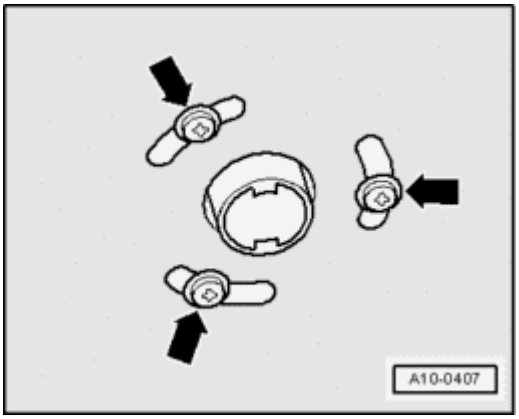


Fig. 655: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater at sound insulation.

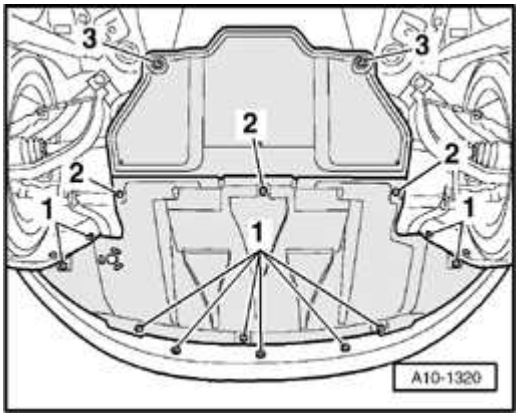


Fig. 656: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.

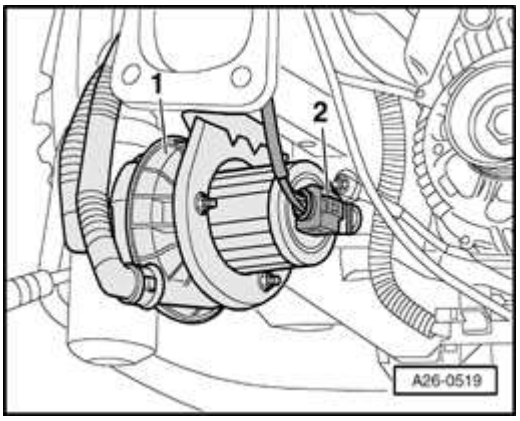


Fig. 657: Disconnecting Electrical Harness Connector At Secondary Air Injection (AIR) Pump Motor -V101-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector -2- at Secondary Air Injection (AIR) pump motor -V101-, -1-.

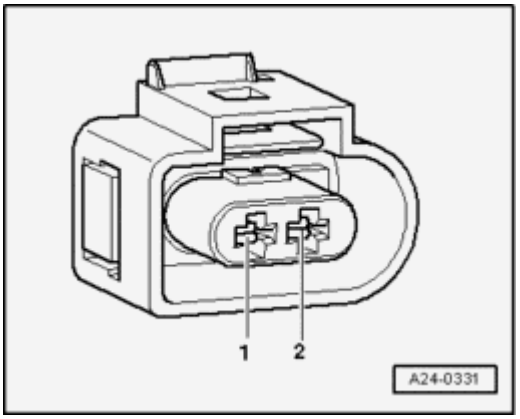


Fig. 658: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester between terminals 1 and 2
- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) pump relay -J299-.

- LED must blink

If LED does not blink:

- Perform following tests marked with dots:

- Check wire connection from terminal 2 of connector to Secondary Air Injection (AIR) pump relay -J299- (in relay carrier in E-Box, plenum chamber, position 3) for open circuit.

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Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Check wire connection from terminal 1 of connector to Ground (GND) for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

If no malfunctions are detected:

- Replace Secondary Air Injection (AIR) pump motor -V101-.

Secondary Air Injection (AIR) pump motor -V101-, removing and installing

Removing

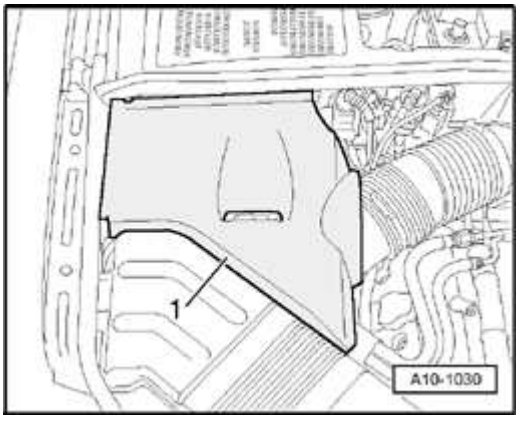


Fig. 659: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

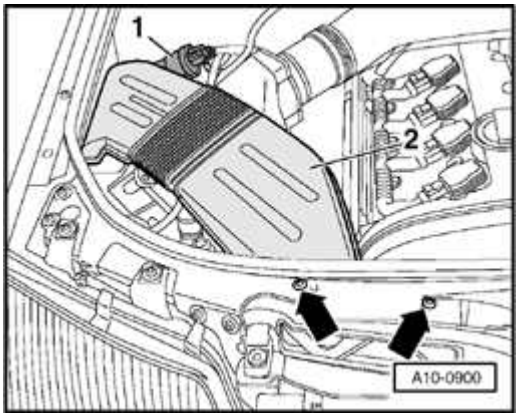


Fig. 660: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).

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- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

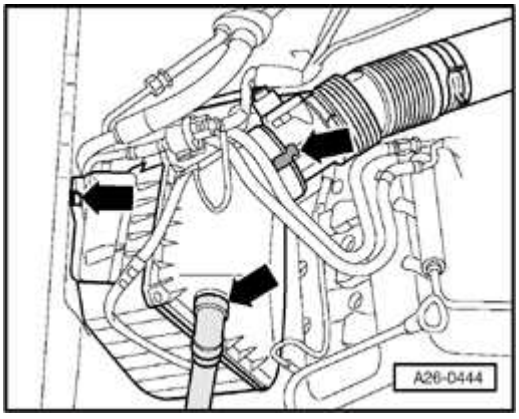


Fig. 661: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).
- Remove both bolts on Secondary Air Injection (AIR) pump bracket, which are accessible from top.

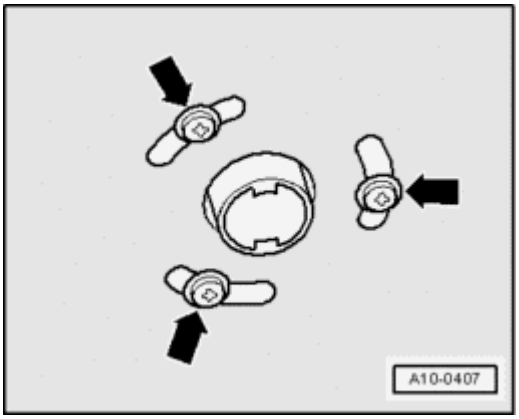


Fig. 662: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater at sound insulation.

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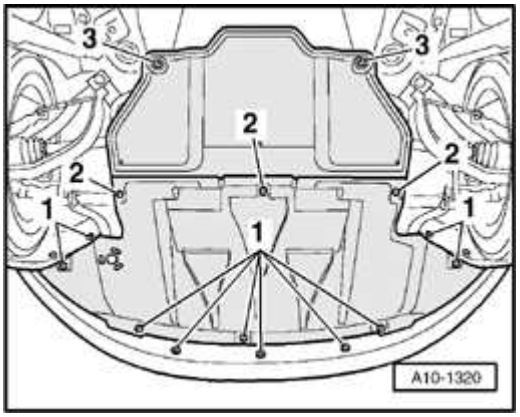


Fig. 663: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.

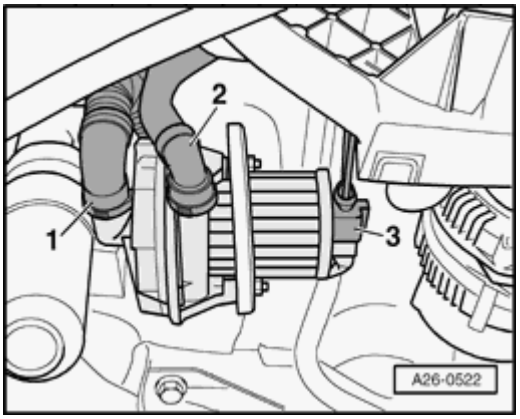


Fig. 664: Disconnecting Electrical Harness Connector & Air Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector -3-.
- Disconnect air hoses -1- and -2-.
- Remove bolts for Secondary Air Injection (AIR) pump bracket, which are accessible from bottom.
- Remove Secondary Air Injection (AIR) pump motor -V101- with bracket.

- If necessary, separate Secondary Air Injection (AIR) pump motor -V101- from bracket.

Installing

Installation is the reverse of removal.

Tightening torques

Component	Nm

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Secondary Air Injection (AIR) pump motor to bracket	10
Bracket for Secondary Air Injection (AIR) pump motor to chassis	10

Combination valve for Secondary Air Injection (AIR), checking function and proper seal

Special tools and equipment

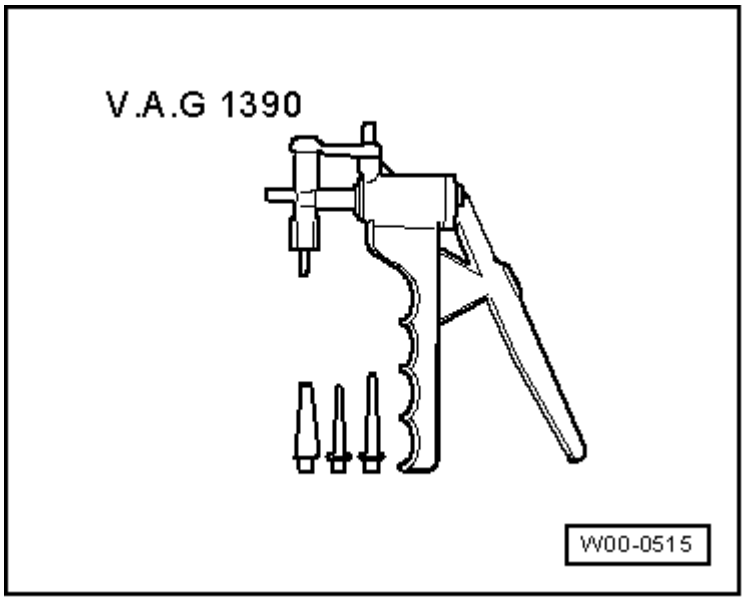


Fig. 665: Identifying Hand Vacuum Pump V.A.G. 1390
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1390 Hand vacuum pump

Requirements

- Vacuum lines and hose connections leak-free.
- Vacuum lines not clogged.

Work sequence

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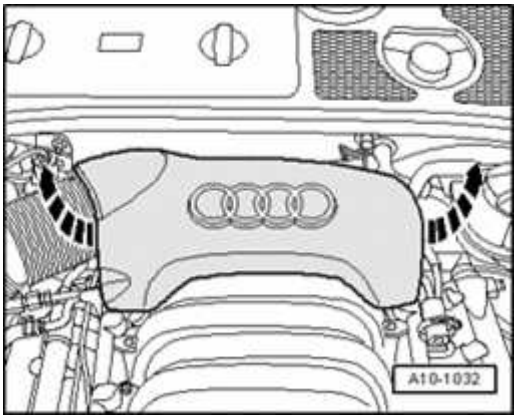


Fig. 666: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

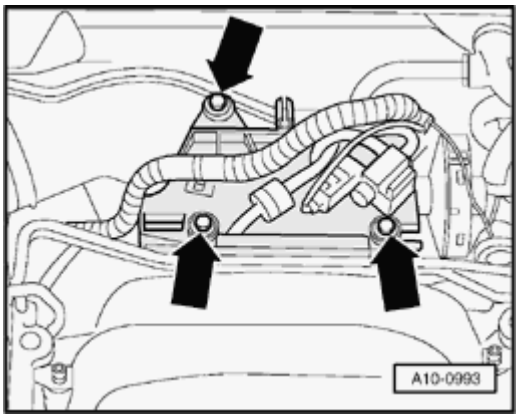
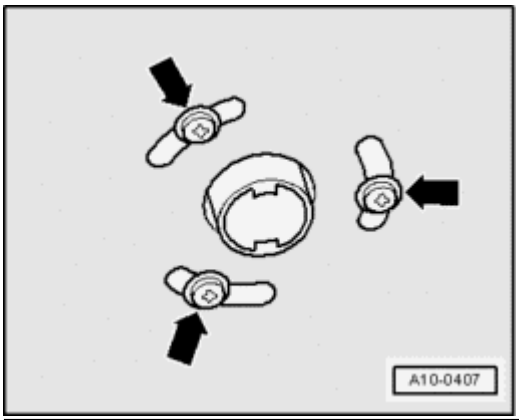


Fig. 667: Removing Bolts For Holding Plate For Solenoid Valves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate for solenoid valves (arrows).
- Lift up holding plate and disconnect vacuum hose from Y-piece of combination valve to be checked.
- Connect VAG1390 hand vacuum pump to vacuum hose of combination valve to be checked.



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Fig. 668: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater at sound insulation.

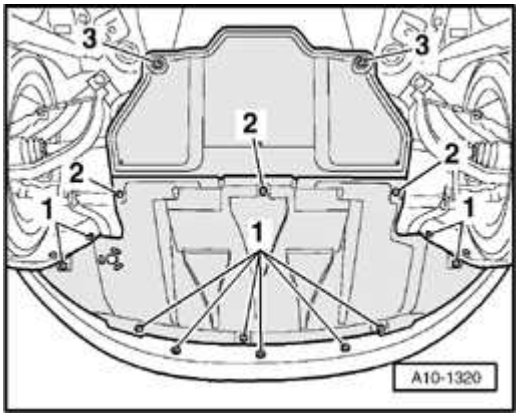


Fig. 669: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.

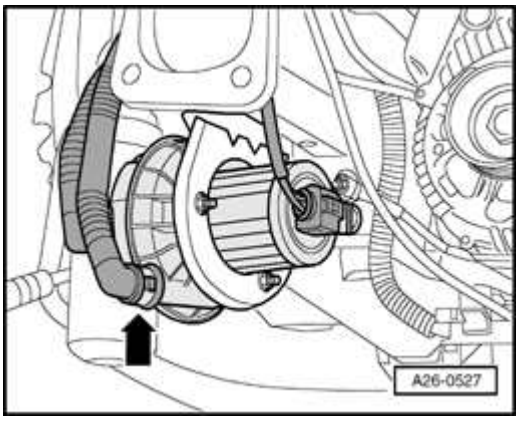


Fig. 670: Disconnecting Pressure Hose At Secondary Air Injection (AIR) Pump Motor And Blow Into It With Light Pressure
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect pressure hose (arrow) at Secondary Air Injection (AIR) pump motor and blow into it with light pressure (do not use pressurized air).

- Both combination valves must be closed, it must not be possible to blow through hose

- Operate hand vacuum pump.

- Relevant combination valve must open, it must be possible to blow through

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If the relevant combination valve does not open:

- Replace combination valve. Refer to **Left combination valve for secondary air injection, removing and installing** or **Right combination valve for secondary air injection, removing and installing**.

Left combination valve for secondary air injection, removing and installing

Removing

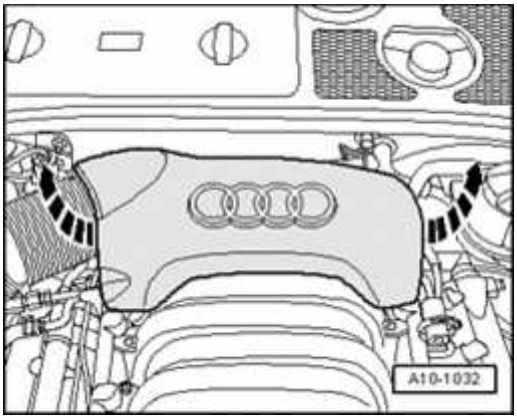


Fig. 671: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

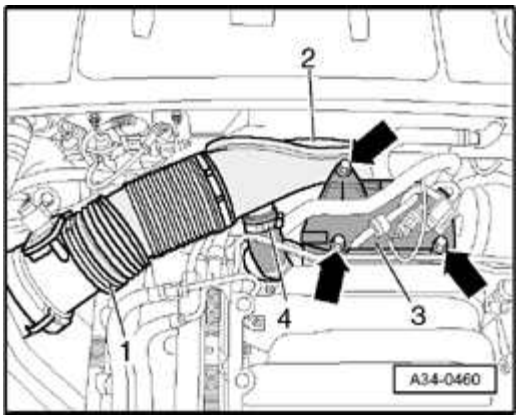


Fig. 672: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air hose -1- at Mass Air Flow (MAF) sensor.
- Disconnect hose -4- for crankcase ventilation from air guide -2-.

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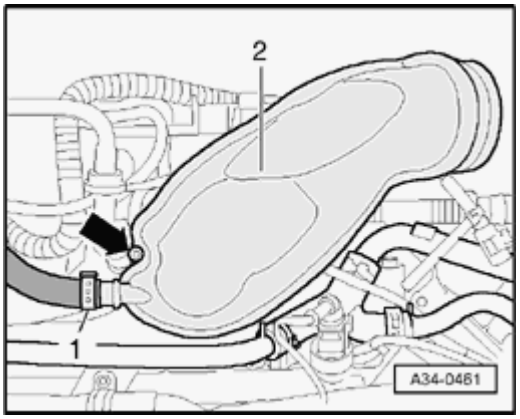


Fig. 673: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air guide -2- at throttle valve control module.
- Disconnect hose -1- from air guide.

NOTE: The illustration shows the air guide from the rear with the engine removed.

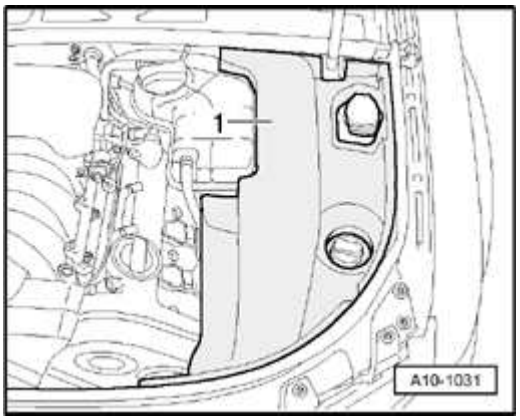


Fig. 674: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

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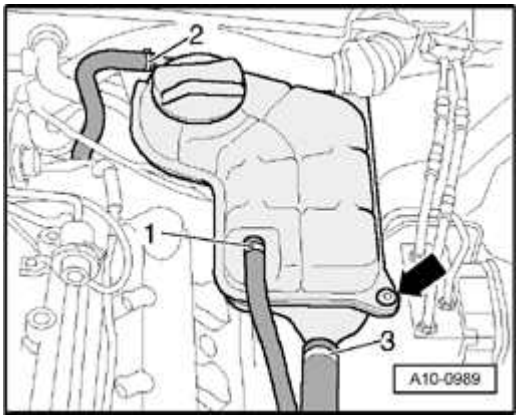


Fig. 675: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clamp coolant hose -2- using 3094 hose clamps and disconnect coolant hose from coolant reservoir.
- Unbolt coolant reservoir (arrow).
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of coolant reservoir.
- Lay coolant reservoir with connected coolant hoses -1- and -3- to side.

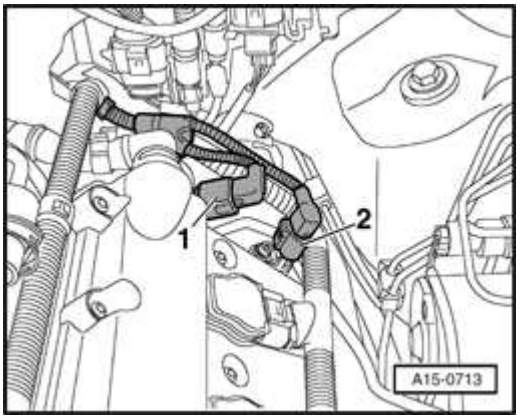


Fig. 676: Disconnecting Electrical Harness Connectors And At Camshaft Position (CMP) Sensor 2 -G163- And Camshaft Position (CMP) Sensor 4 -G301-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors -1- and -2- at Camshaft Position (CMP) sensor 2 -G163- and Camshaft Position (CMP) sensor 4 -G301-.
- Disconnect hose -3- from crankcase ventilation at cylinder head cover.

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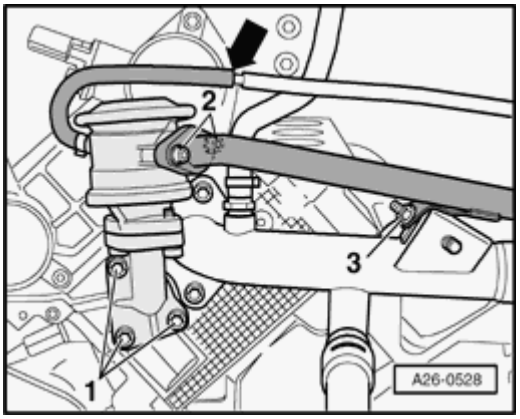


Fig. 677: Identifying Bolts At Flange Of Combination Valve For Secondary Air Injection, Nut, Combination Valve & Vacuum Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- at flange of combination valve for secondary air injection.
- Loosen nut -3- several turns.
- Remove bolts -2- and and disconnect vacuum hose (arrow).
- Remove combination valve.

NOTE: Illustration is shown with engine removed.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and O-rings.

- Top up coolant. Refer to **Filling**.

Tightening torques

Component		Nm
Combination valve to cylinder head		10
Connector tube to	Combination valve	10
	Coolant line	10

Right combination valve for secondary air injection, removing and installing

Removing

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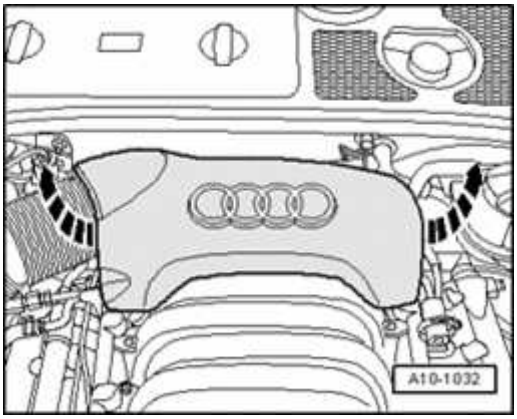


Fig. 678: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

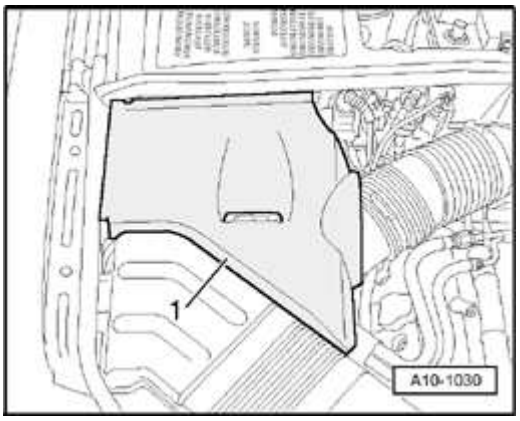


Fig. 679: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

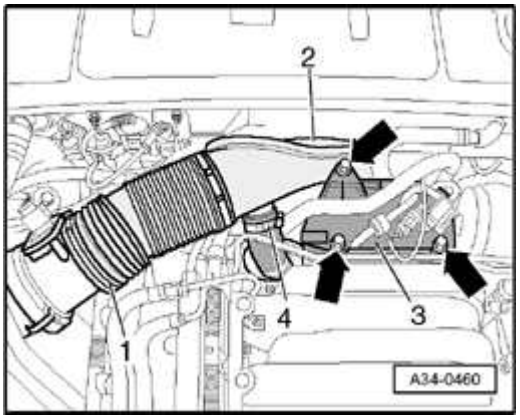


Fig. 680: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air hose -1- at Mass Air Flow (MAF) sensor.
- Disconnect hose -4- for crankcase ventilation from air guide -2-.

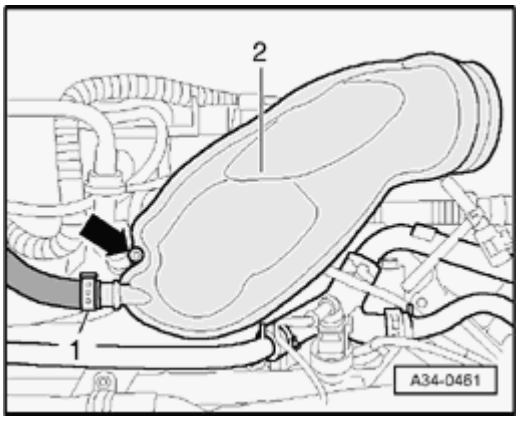


Fig. 681: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air guide -2- at throttle valve control module.
- Disconnect hose -1- from air guide.

NOTE: The illustration shows the air guide from the rear with the engine removed.

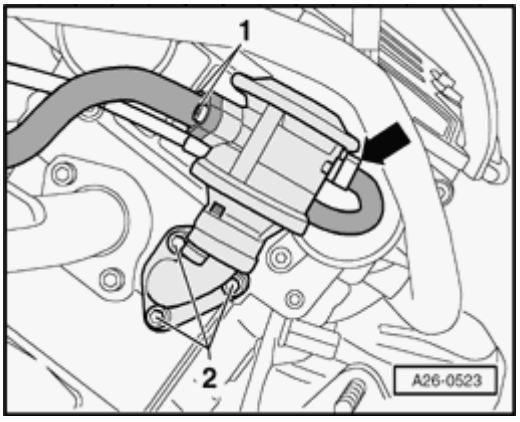


Fig. 682: Unscrewing Bolts And Removing Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and -2- and remove combination valve.
- Disconnect vacuum hose (arrow).

Installing

Installation is reverse of removal, noting the following:

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NOTE: Replace gaskets and O-rings.

Tightening torques

Component	Nm
Combination valve to cylinder head	10
Connecting tube to combination valve	10

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10 ENGINE - ASSEMBLY

ENGINE, REMOVING AND INSTALLING

Engine, removing and installing

CAUTION: Before beginning repairs on the electrical system:

- **Obtain the anti-theft radio security code.**
- **Switch the ignition off.**
- **Disconnect the battery Ground (GND) strap.**
- **On vehicles equipped with Audi Telematics by OnStar ® , switch-off the emergency (back-up) battery for the Telematic/Telephone Control Module prior to disconnecting vehicle battery. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

  .
- **After reconnecting vehicle battery, re-code and check operation of anti-theft radio. Also check operation of clock and power windows according to Repair Article and/or Owner's Manual.**
- **After reconnecting vehicle battery on vehicles equipped with Audi Telematics by OnStar ® , switch-on the emergency (back-up) battery for the Telematic/Telephone Control Module. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

  .

Engine, removing and installing

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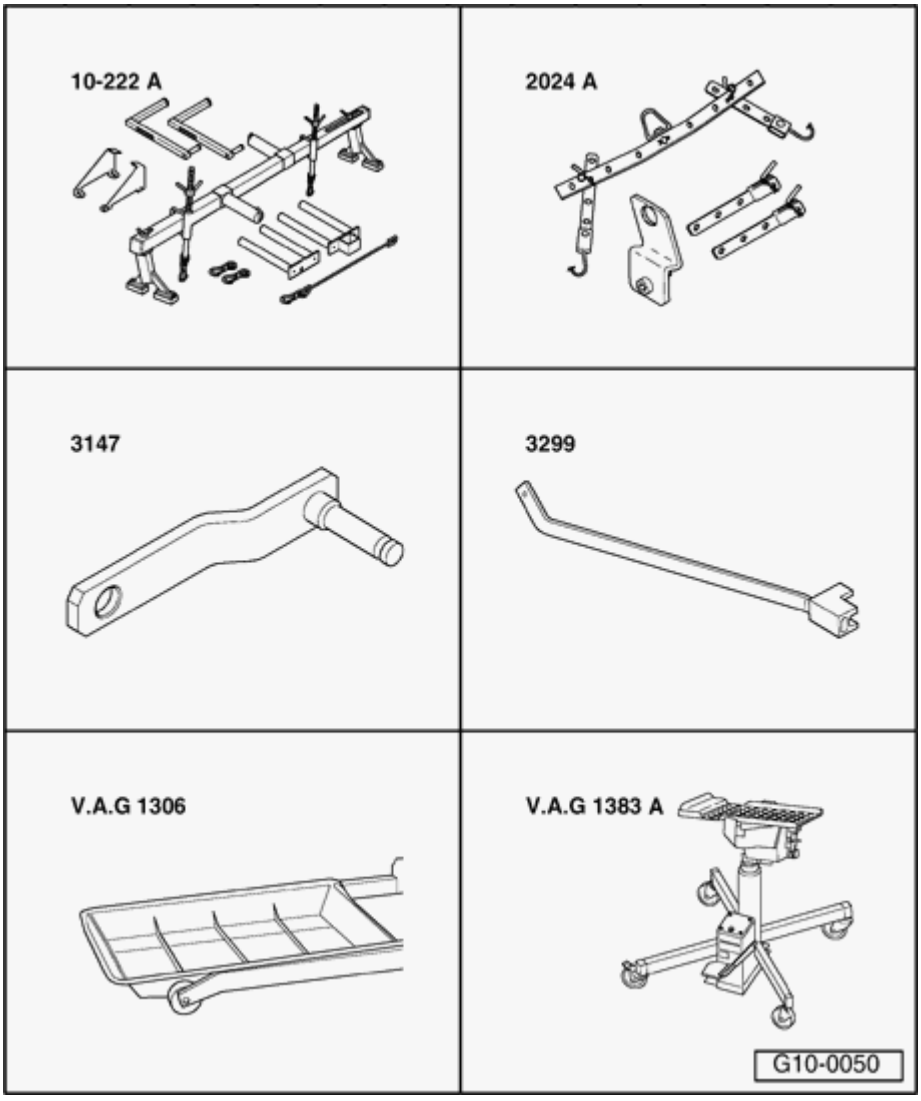


Fig. 7: Identifying Special Tools - Engine, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- 10-222A Engine support bridge
- 2024A Engine Sling
- 3147 Engine support adapter
- 3299 Ribbed belt installation tool with 3299/1 claw for tensioner
- VAG1306 Drip tray for VAG1202A
- VAG1383A Engine/transmission hoist

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Fig. 8: Identifying Special Tools - Workshop Hoist V.A.G 1202 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1202A Workshop crane

or

- VAS 6100 Workshop crane

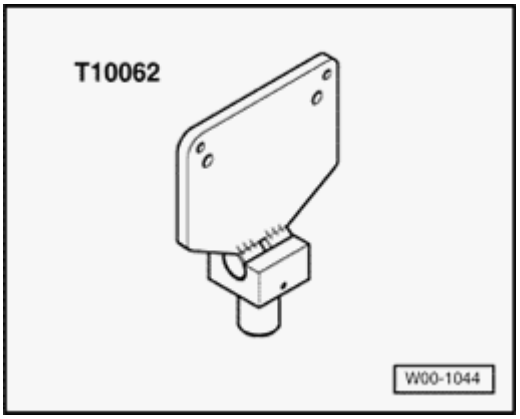


Fig. 9: Support T10062
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T10062 Support
- Oil receptacle

Removing

NOTE:

- **Engine is removed toward the front without transmission and with the lock carrier removed.**
- **All cable ties opened or cut during engine removal must be reinstalled at the same locations.**
- **Heat boots, which are removed during engine removal must be reinstalled**

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at the same locations when re-installing engine.

- **Drained coolant must be stored in a clean container for disposal or reuse.**

Vehicles with automatic transmission

- Shift selector lever into position "N".

All

WARNING: Observe safety precautions when disconnecting the battery.

Refer to 27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL

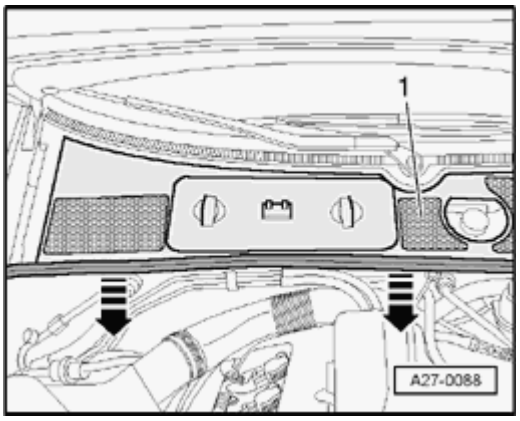


Fig. 10: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off rubber seal of plenum chamber cover in direction of arrow.
- Remove cover -1- toward front.

See Caution before beginning repairs on the electrical system. Refer to **Engine, removing and installing**

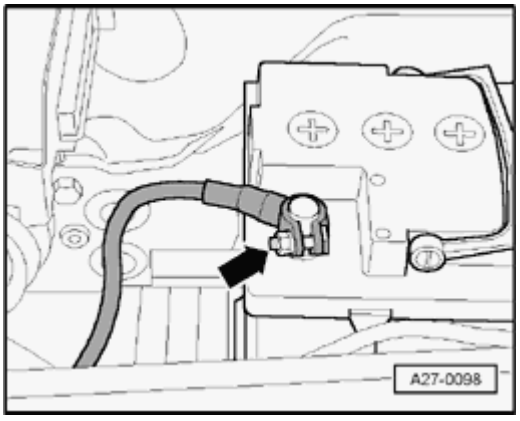


Fig. 11: Disconnecting Battery Ground (GND) Strap

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect battery Ground (GND) strap (arrow) with ignition switched off.

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open cap of coolant expansion tank.
- Remove both front wheels.

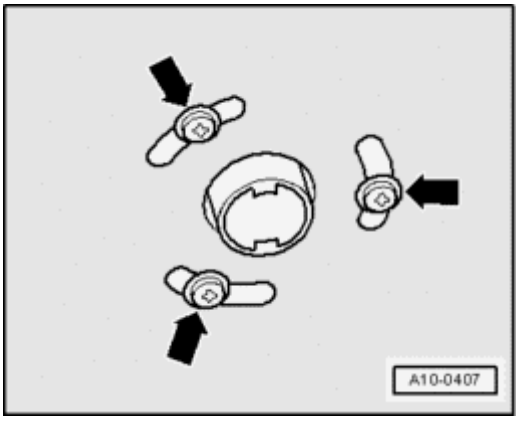


Fig. 12: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

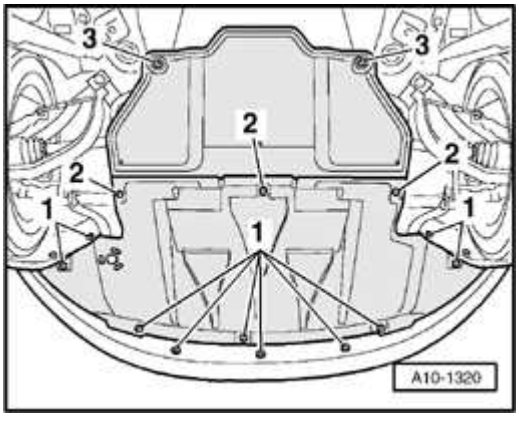


Fig. 13: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.

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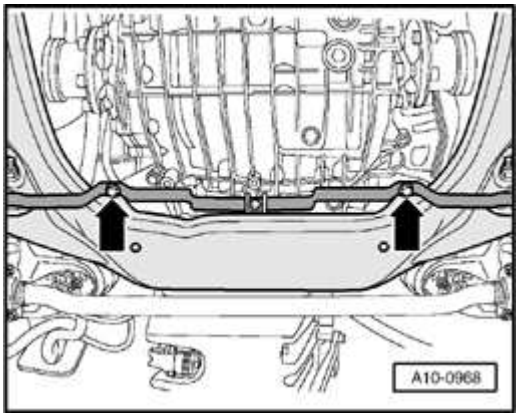


Fig. 14: Removing Bracket For Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for sound insulation (arrows).
- Remove front bumper:

Refer to

- **63 BUMPER**
- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

- Place VAG1306 drip tray beneath engine.

Vehicles with drain plug

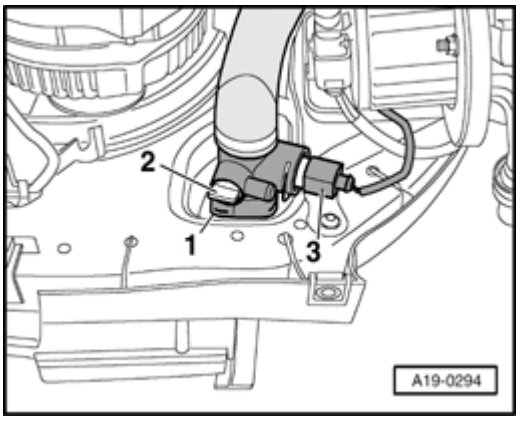


Fig. 15: Identifying Drain Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn radiator drain plug -2- counterclockwise, if needed attach accessory hose to connection flange and drain coolant.

Vehicles without drain plug

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- Remove retaining clamp for Engine Coolant Temperature (ECT) sensor (on radiator) -G83-.
- Remove Engine Coolant Temperature (ECT) sensor from outlet and drain coolant.

All

- Pull off retaining clip -1- for lower coolant hose and disconnect coolant hose from radiator.

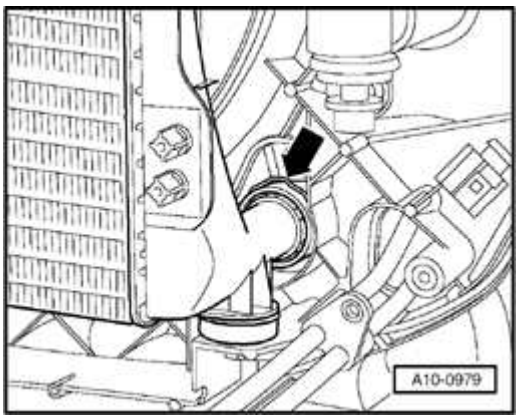


Fig. 16: Disconnecting Lower Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect left coolant hose from radiator (arrow).

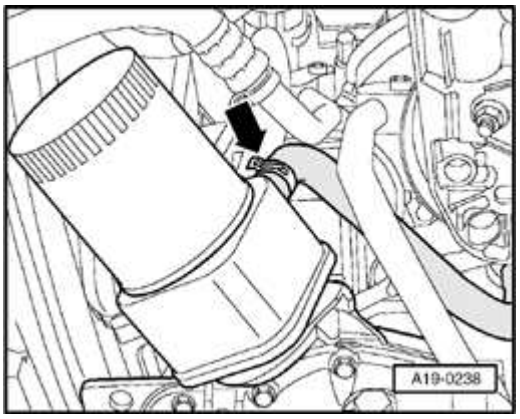


Fig. 17: Disconnecting Coolant Hose At Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In addition, disconnect coolant hose at oil cooler (arrow) and drain remaining coolant.
- Place oil pan underneath.

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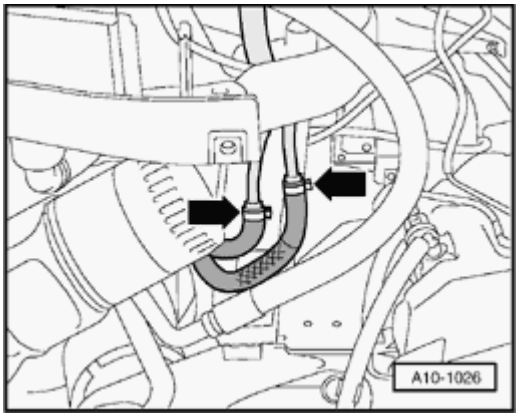


Fig. 18: Disconnecting Hydraulic Lines To Cooling Coil At Rear Of Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hydraulic lines to cooling coil at rear of bumper (arrows).

Vehicles with automatic transmission

NOTE: Observe the rules of cleanliness for working on automatic transmissions:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

- Place oil pan underneath.

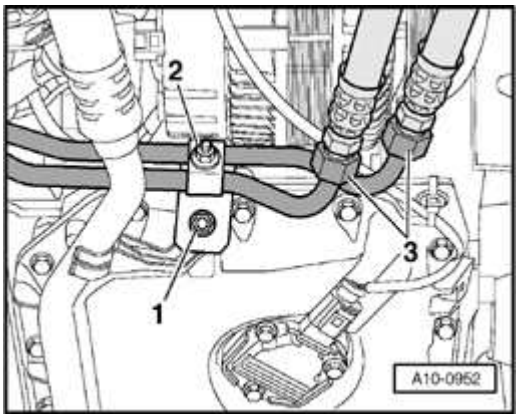


Fig. 19: Removing Union Nuts And Disconnect ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove union nuts -3- and disconnect ATF lines.
- Remove bracket for ATF lines, to do so remove nuts -1- and -2-.

All

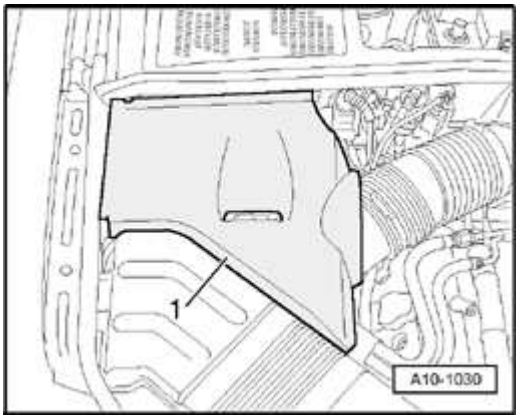


Fig. 20: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

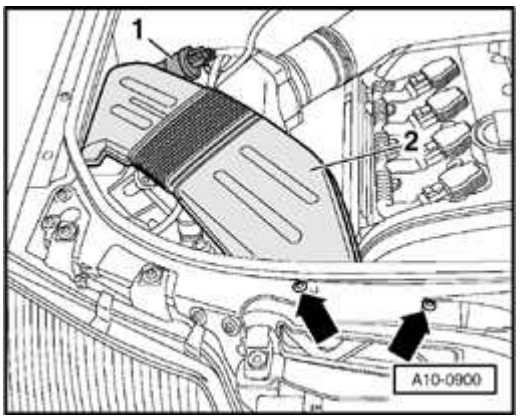


Fig. 21: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

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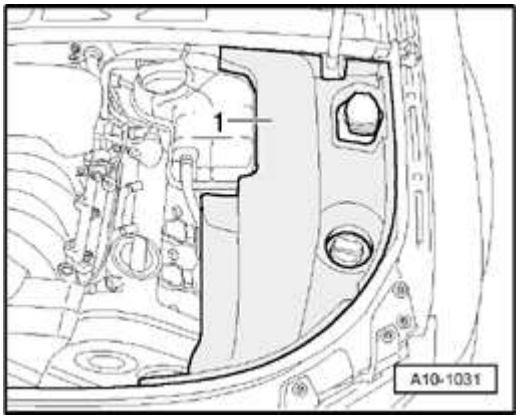


Fig. 22: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

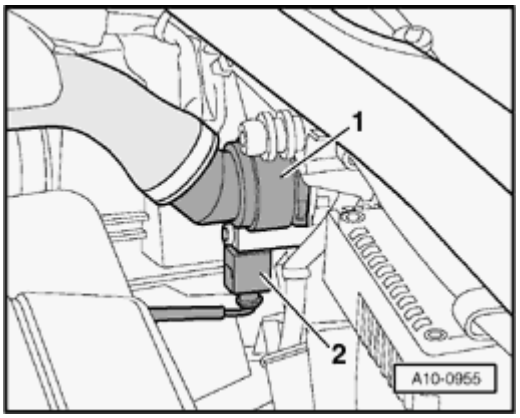
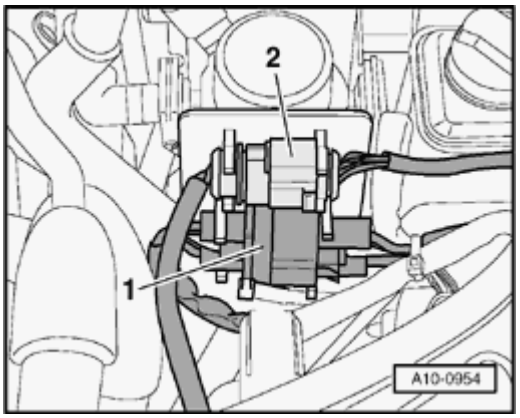


Fig. 23: Disconnecting Top Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect top coolant hose -1- from radiator.
- Remove electrical harness connector -2- for left and right airbag sensors on bumper.....
- ....and move cables clear.



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Fig. 24: Removing Electrical Harness Connectors And From Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove electrical harness connectors -1- and -2- from bracket and disconnect them.

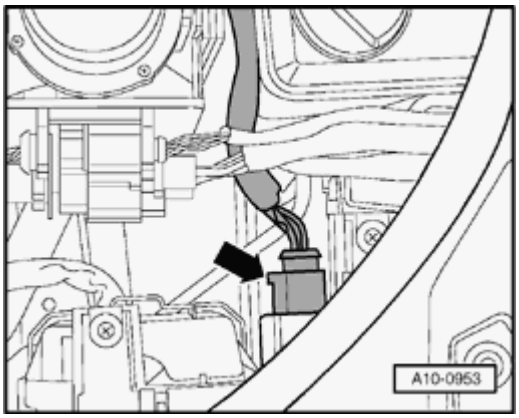


Fig. 25: Disconnecting Electrical Harness Connector For Headlights At Both Sides Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector (arrow) for headlights at both sides of vehicle.

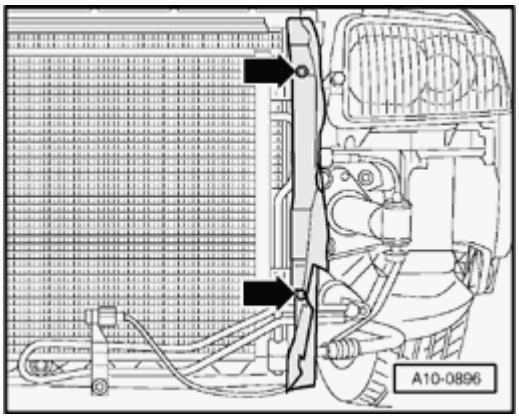


Fig. 26: Removing Air Ducts On Left/Right Of Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air guides from left and right of radiator (arrows).

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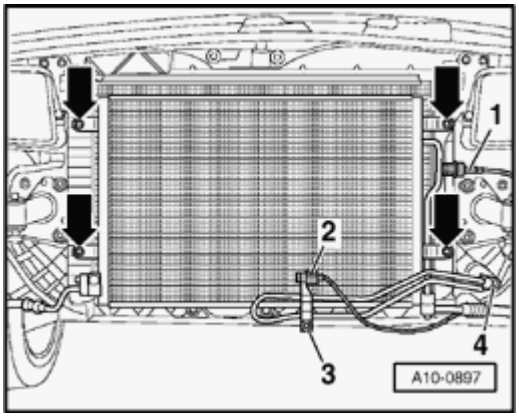


Fig. 27: Identifying Outside Air Temperature Sensor G17, Bolts & High Pressure Sensor G65 Electrical Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip temperature sensor -2- for outside temperature display from bracket.
- Unscrew bolts -3- and -4- and remove power steering cooling coil.
- Disconnect harness connector -1- at High pressure sensor -G65-.

WARNING: Do not open refrigerant circuit for A/C system.

- Remove condenser mounting bolts (arrows).

NOTE: Do not bend or stretch lines or hoses as condenser and/or refrigerant lines/hoses may be damaged.

- Carefully swing condenser downward and move aside.

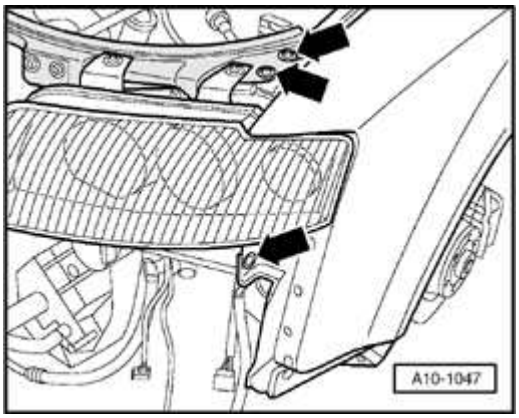


Fig. 28: Removing Bolts At Left/Right Side Of Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) on left and right sides of bumper.

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- Unhook hood cable from lock and move cable free.

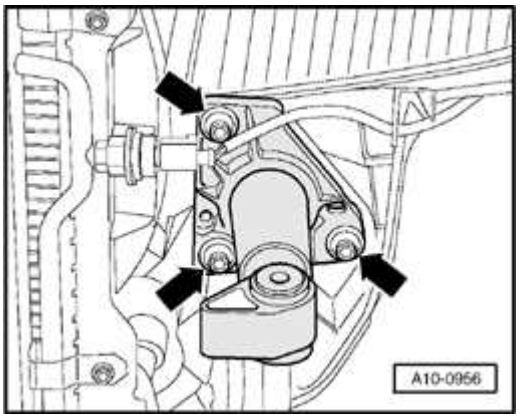


Fig. 29: Unscrewing Bolts At Impact Absorbers At Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts at impact absorbers (arrows) at left and right.

NOTE: A second technician is required to remove the lock carrier.

- Remove lock carrier and set aside so it cannot topple.

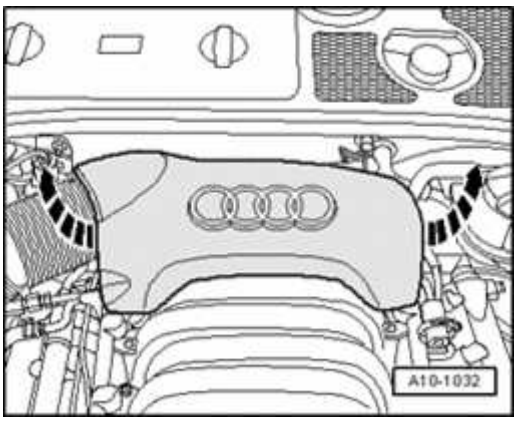


Fig. 30: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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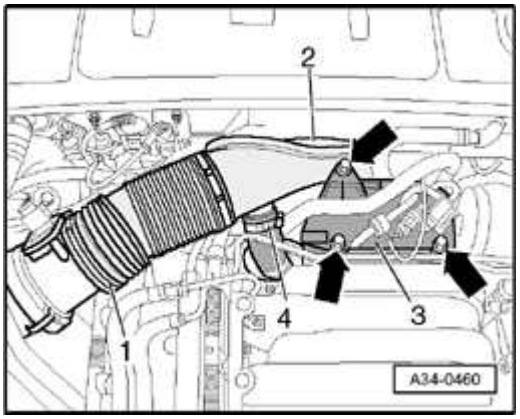


Fig. 31: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air hose -1- at Mass Air Flow (MAF) sensor.
- Remove hose -4- of crankshaft housing ventilation from air duct -2-.

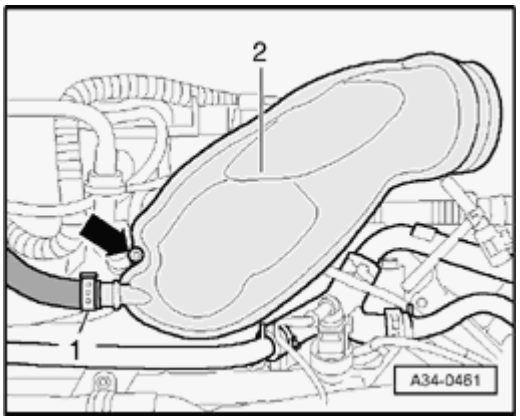


Fig. 32: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air guide if installed.

NOTE: Illustration depicts air guide with the removed engine from rear.

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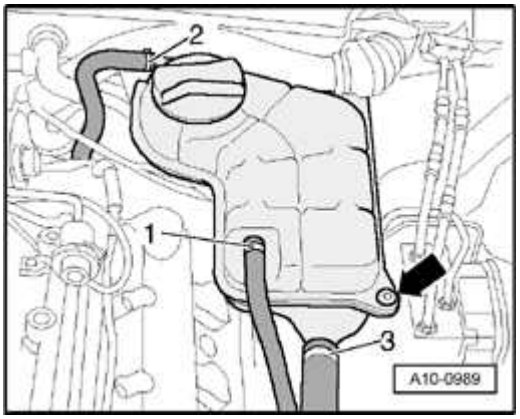


Fig. 33: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant hoses -1- and -2-.

NOTE: Coolant hose -3- remains connected.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of expansion tank.

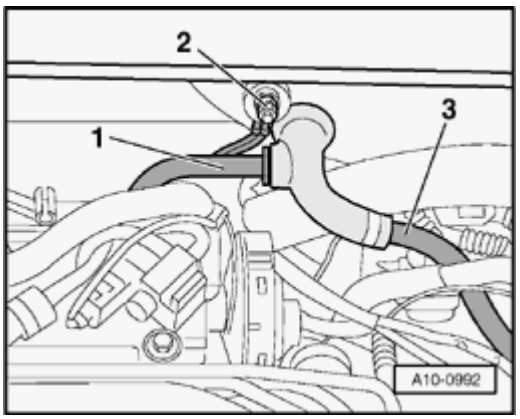


Fig. 34: Identifying Ground (GND) & Vacuum Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect ground (GND) -2-.
- Disconnect vacuum hoses -1- and -3-.

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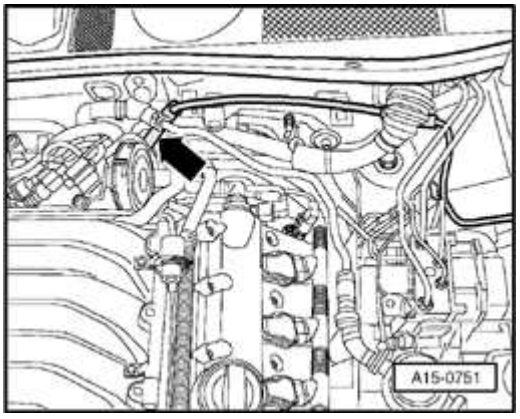


Fig. 35: Disconnecting Vacuum Line To Leak Detection Pump At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line (arrow) to leak detection pump at throttle valve control module.

Vehicles with automatic transmission

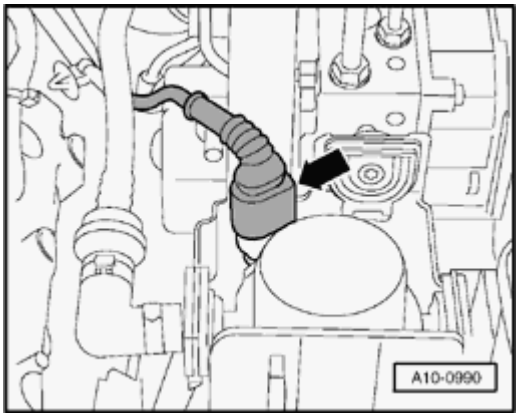


Fig. 36: Disconnecting Electrical Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector (arrow).

All

- Place oil pan underneath.

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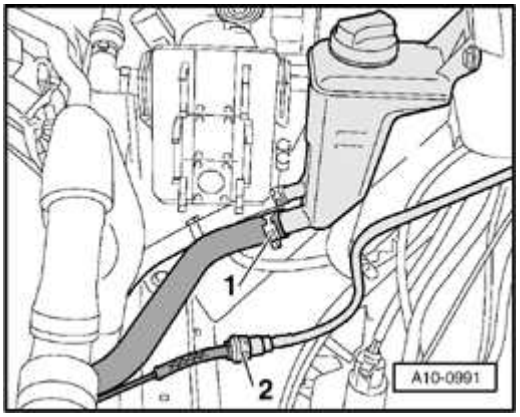


Fig. 37: Disconnecting Hose From Power Steering Fluid Reservoir & Vacuum Hose To Vacuum Reservoir
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose -1- from power steering fluid reservoir.
- Disconnect vacuum hose -2- to vacuum reservoir.

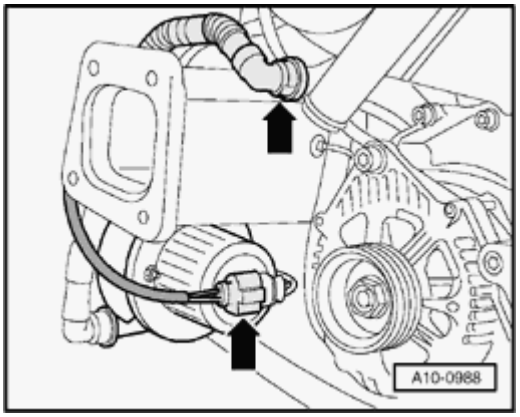


Fig. 38: Disconnecting Connector From Secondary Air Injection (AIR) Pump Motor V101 & Hose From Pipe To Secondary Air Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector (lower arrow) at Secondary Air Injection (AIR) pump motor -V101- and move cable free.
- Disconnect hose at tube to combination valve for Secondary Air Injection (AIR) (upper arrow).

Vehicles up to 06.03:

WARNING: Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.

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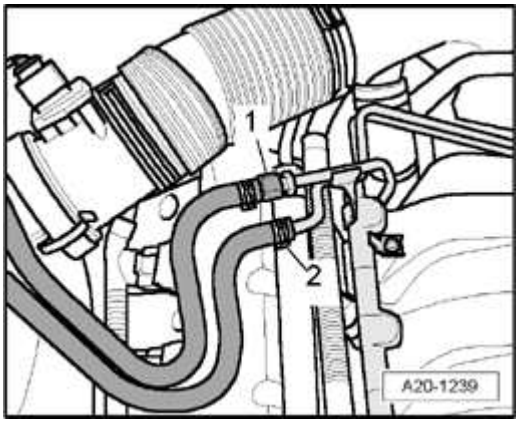


Fig. 39: Disconnecting/Tightening Fuel Supply Line And Fuel Return Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel supply line -1- and fuel return line -2- and set aside.

Vehicles as of 07.03:

WARNING: Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.

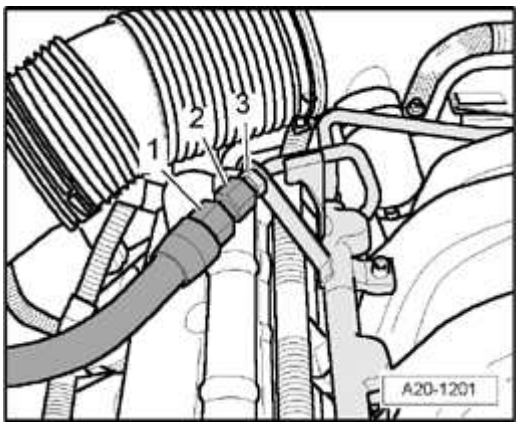


Fig. 40: Unscrewing/Screwing Fuel Hose From Connection On Fuel Rail Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew fuel hose from connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and unscrew union nut -2-.

All:

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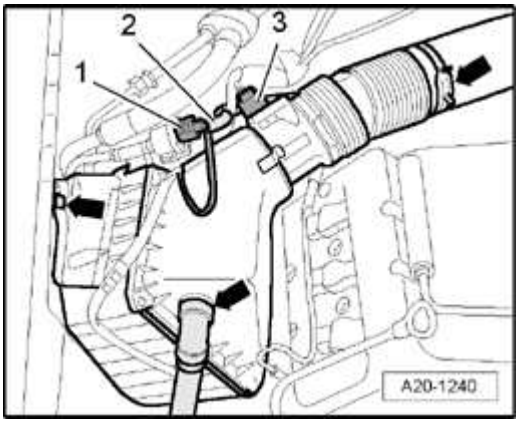


Fig. 41: Removing Lines/Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the following lines/harness connectors:

1 - At Evaporative Emission (EVAP) canister purge regulator valve -N80-

2 - Vacuum hose at Evaporative Emission (EVAP) canister purge regulator valve -N80-

3 - at Mass Air Flow (MAF) sensor -G70-

- Disconnect hose connections, move wires free and remove air filter housing (arrows).

NOTE: Place a rag under the hydraulic pressure lines, to catch escaping hydraulic fluid.

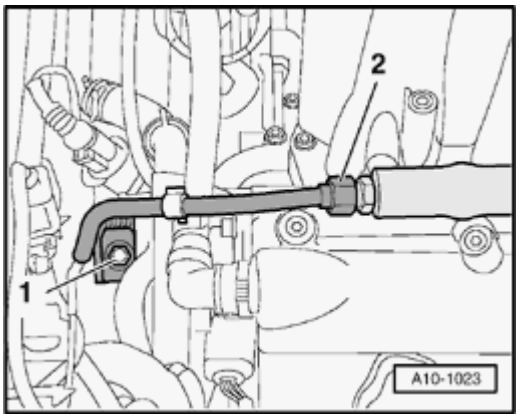


Fig. 42: Unbolting Hydraulic Pressure Line For Power Steering At Rear Coolant Pipe And Disconnecting Line At Height Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt hydraulic pressure line for power steering at rear coolant pipe -1- and disconnect line at height of right cylinder head -2-.

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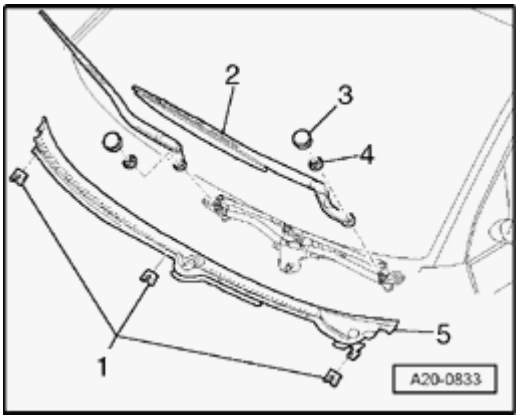


Fig. 43: Removing Securing Clips And Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off both covers -3- using a screwdriver.
- Loosen hex-nuts -4- by several turns.
- Loosen wiper arm -2- by lightly tilting from wiper axle.
- Remove hex nuts completely and remove wiper arms.

- Disconnect securing clips -1- and remove cowl grill -5-.

Vehicles with automatic transmission

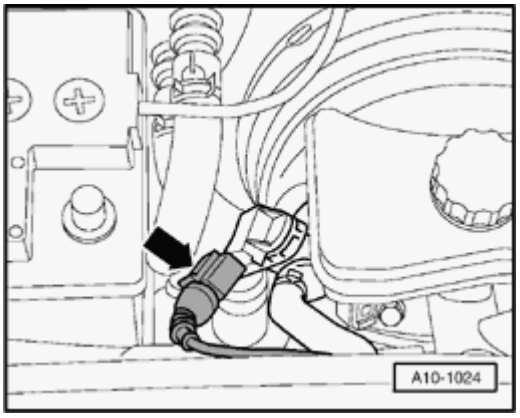


Fig. 44: Disconnecting Electrical Harness Connector At Brake Booster Pressure Sensor -G294-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector (arrow) at Brake booster pressure sensor -G294-.

All

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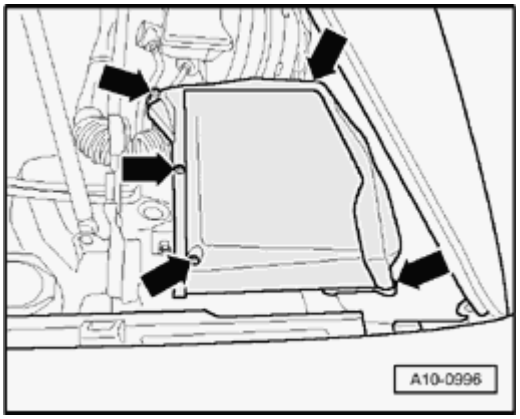


Fig. 45: Removing Screws And Cover From E-Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heater core E-box cover (arrows).

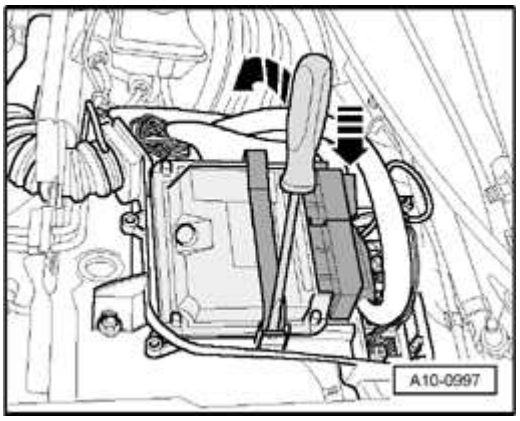


Fig. 46: Using Screwdriver To Remove Retainer Bar And Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a screwdriver, pry off retaining bracket (arrow).

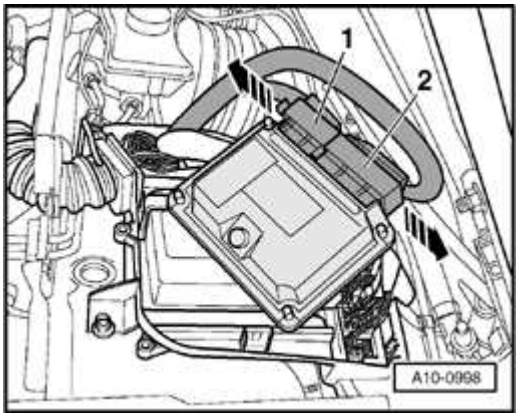


Fig. 47: Releasing Connector Latches And Pulling Off Connectors On Engine Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Disengage connector catches (arrows) and disconnect harness connectors -1- and -2- from Engine Control Module (ECM).

Vehicles with automatic transmission 01V

- Unclip Transmission Control Module (TCM) retaining bracket.

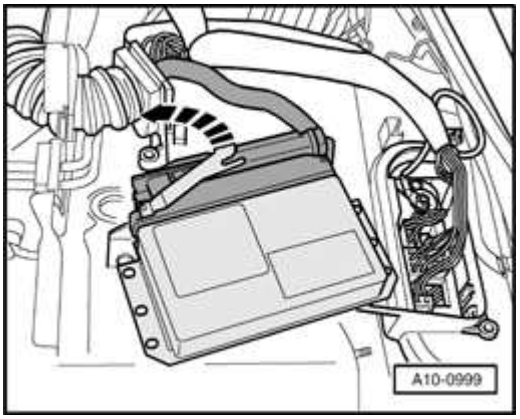


Fig. 48: Disengaging Harness Connector And Disconnecting It From Transmission Control Module (TCM)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage harness connector (arrow) and disconnect it from Transmission Control Module (TCM).

All

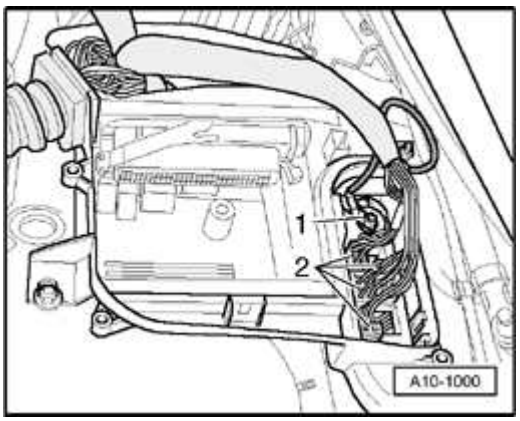


Fig. 49: Disconnecting Rear Connectors On Connector Strip & Unbolt Electrical Wire Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect rear connectors -2- on connector strip and set wiring harness aside.
- Unbolt electrical wire connection -1-.

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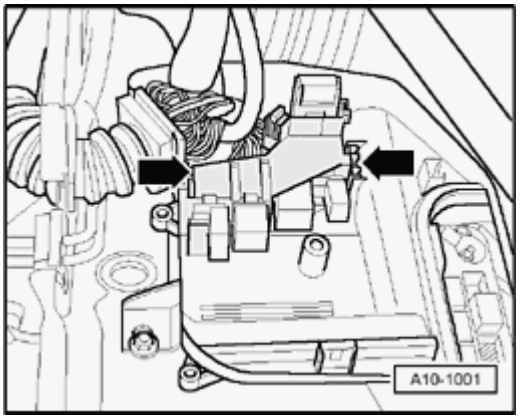


Fig. 50: Locating Auxiliary Relay Carrier Catches
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage locking mechanisms (arrows) and remove secondary relay carrier in E-box toward top.
- Unhook engine wiring harness at E-box and at bulkhead and move it free.
- Remove heat shield for harness connectors at left of bulkhead, if installed.

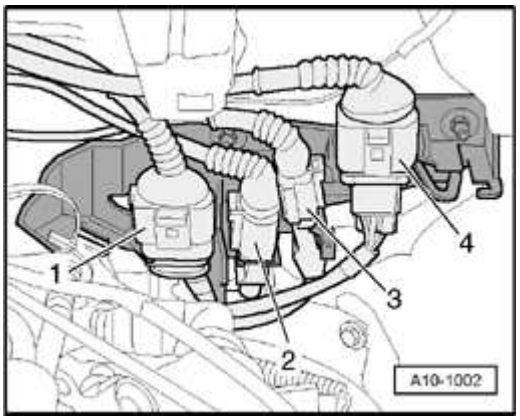


Fig. 51: Removing Harness Connectors From Bracket At Left Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at left of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Expose oxygen sensor wires.
- Remove bracket for harness connectors.

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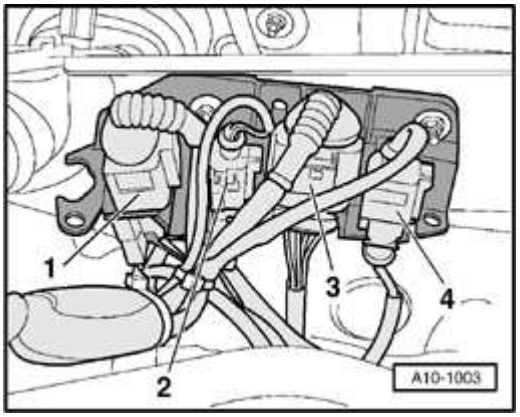


Fig. 52: Removing Harness Connectors From Bracket At Right Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at right of bulkhead.
- Disconnect electrical harness connectors -1-, -3- and -4-.
- Expose oxygen sensor wires.
- Remove bracket for harness connectors.

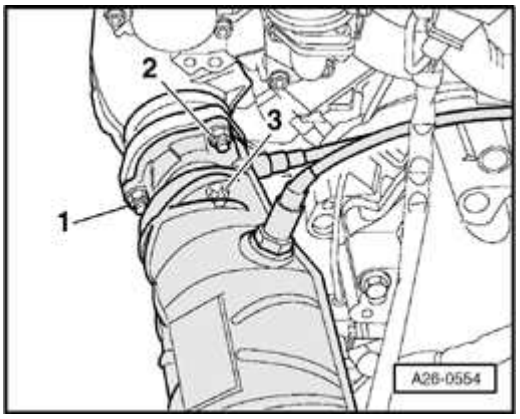


Fig. 53: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for left exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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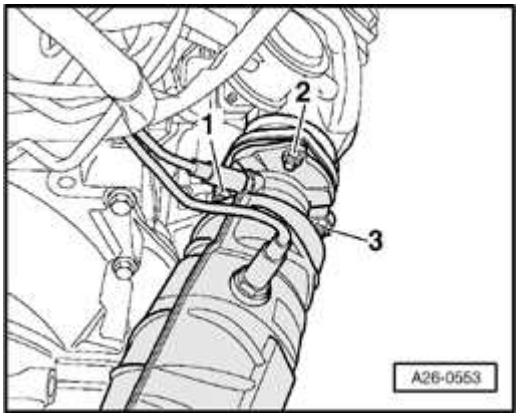


Fig. 54: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for right exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Disconnect coolant hoses to heater core at rear coolant pipe and at right coolant pipe. To do so, remove wiring harness screw clip on right side of vehicle.
- Remove upper mounting bolts for engine/transmission. One bolt remains tightened by hand.

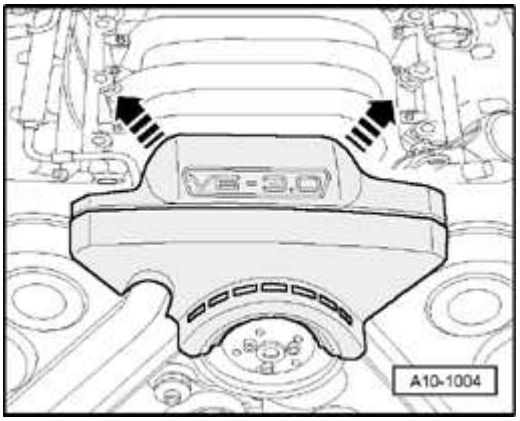


Fig. 55: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

NOTE: Before removing ribbed belt, mark direction of rotation with chalk or felt-tip marker. Reversing the direction of rotation of a run-in belt can destroy the belt.

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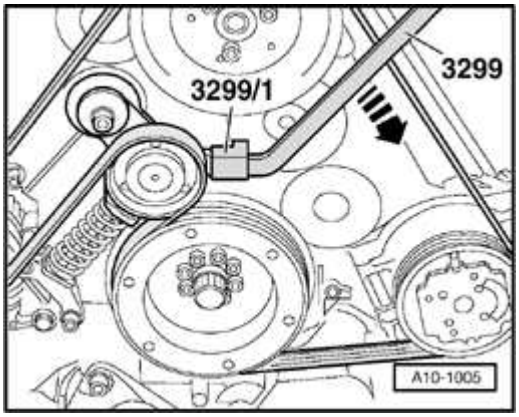


Fig. 56: Swinging Ribbed Belt Tensioner To Release Tension On Ribbed Belt Using 3299 Ribbed Belt Installation Tool And 3299/1 Claw For Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Swing ribbed belt tensioner in direction of arrow to release tension on ribbed belt using 3299 ribbed belt installation tool and 3299/1 claw for tensioner.
- Remove ribbed belt from pulley of power steering pump.
- Place engine oil drip tray beneath engine.
- Drain engine oil.

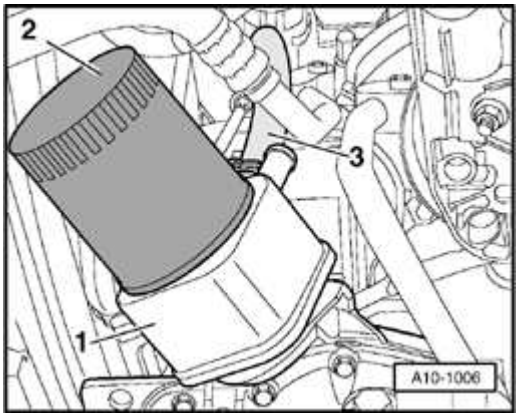


Fig. 57: Identifying Oil Filter, Coolant Hose & Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil filter -2-.
- Place VAG1306 drip tray beneath engine.
- Remove coolant hose -3- from oil cooler.
- Remove oil cooler -1-.

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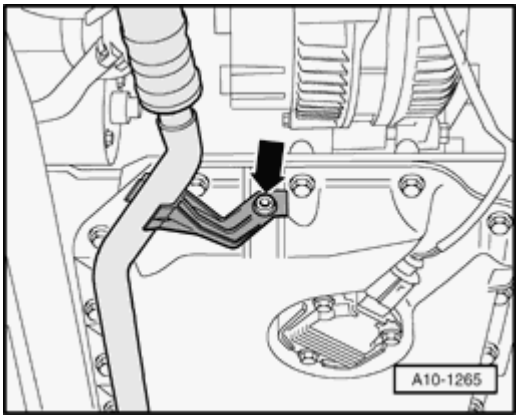


Fig. 58: Unbolting Bracket For Refrigerant Line At Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for refrigerant line at oil pan (arrow).

NOTE: Depicted in illustration for a vehicle with manual transmission.

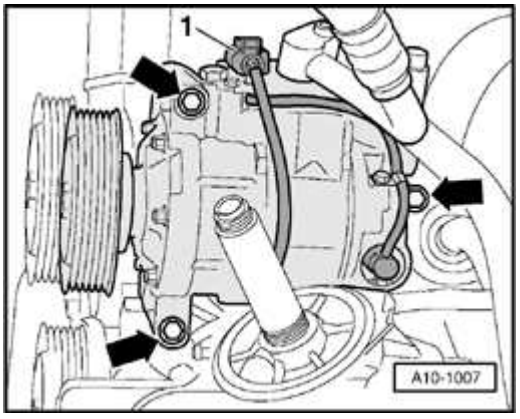


Fig. 59: Disconnecting Harness Connector Of Electrical Wire To A/C Compressor Clutch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect harness connector -1- of electrical wire to A/C compressor clutch.

WARNING: Do not open refrigerant circuit for A/C system.

- Unbolt A/C compressor from bracket (arrows).
- Hang A/C compressor together with condenser with connected lines at right side of vehicle.
- Disconnect electrical lines from generator.

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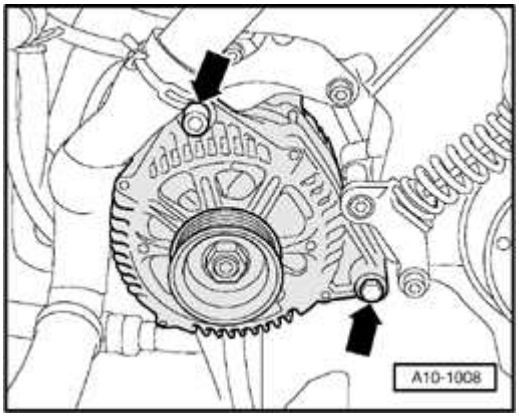


Fig. 60: Unscrewing Bolts And Removing Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts (arrows) and remove generator.

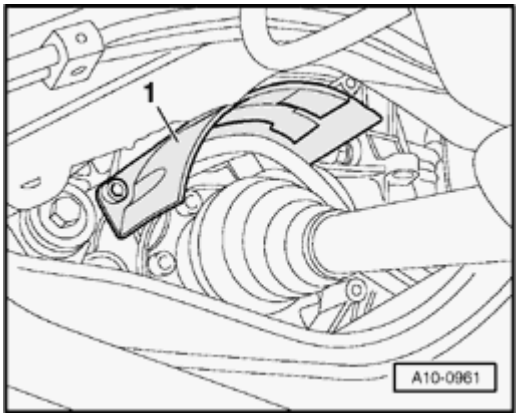


Fig. 61: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove left and right heat shields for drive axles -1-.

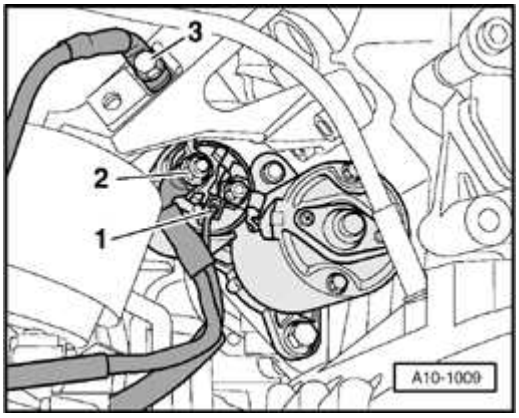


Fig. 62: Removing Electrical Wires From Starter & Disconnecting Ground (GND) Wire
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove electrical wires -1- and -2- from starter.
- Disconnect Ground (GND) wire -3-.

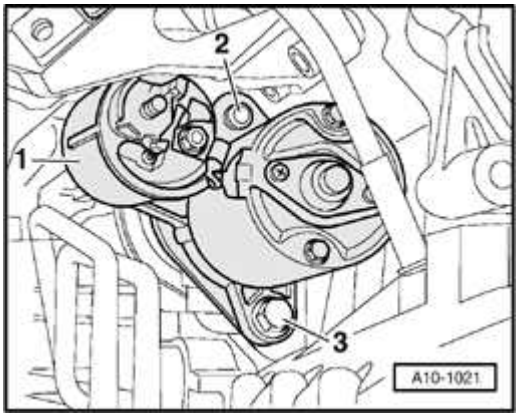


Fig. 63: Removing Heat Shield From Solenoid, Unscrewing Bolts & Removing Starter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- from solenoid.
- Unscrew bolts -2- and -3- and remove starter.

Vehicles with automatic transmission 01V

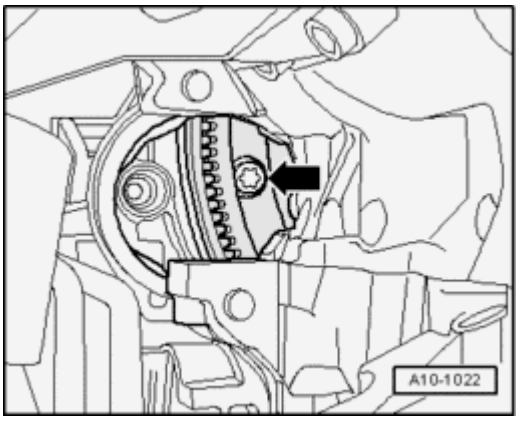


Fig. 64: Torque Converter Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew 3 Torx bolts (arrow) of torque converter in opening of removed starter (turn crankshaft 1/3 rotation in each case).

NOTE: To loosen the torque converter bolts counterhold the main harmonic balancer bolt.

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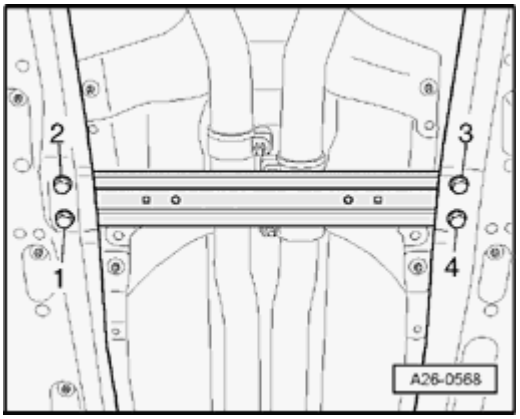


Fig. 65: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for front vehicle floor crossmember -1- to -4-.

All

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

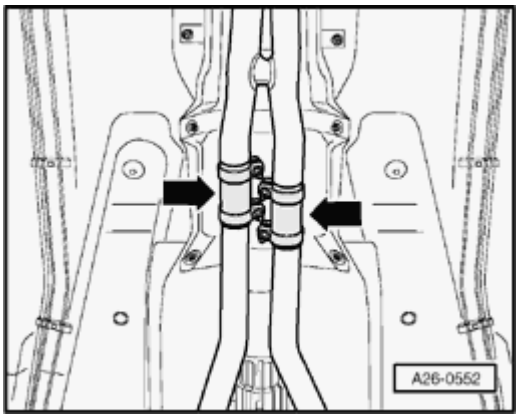


Fig. 66: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at double clamps (arrows).

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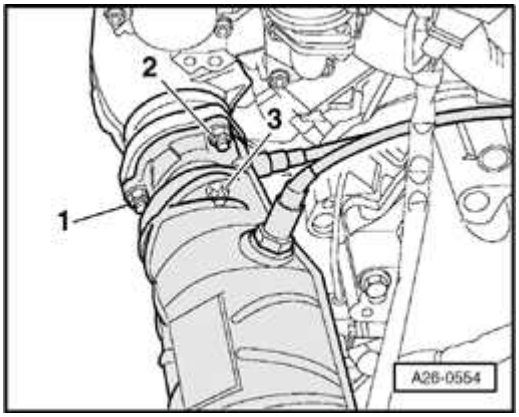


Fig. 67: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/left exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Pull front exhaust pipe off of left exhaust manifold.

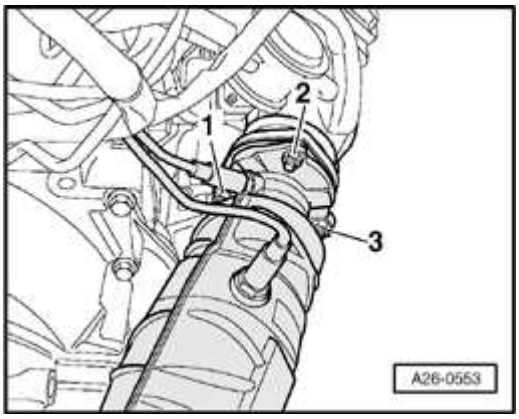


Fig. 68: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/right exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Pull front exhaust pipe off of right exhaust manifold.
- Where installed, unbolt heat shield for engine speed (RPM) sensor.

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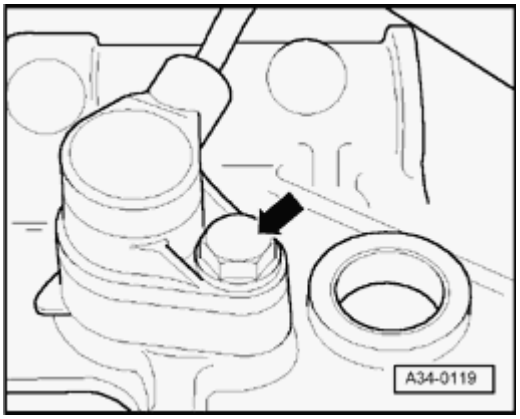


Fig. 69: Location Of Engine Speed (RPM) Sensor G28 On Coupling Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Engine Speed (RPM) sensor -G28- on left of transmission (arrow) and lay to side.

Vehicles with manual transmission

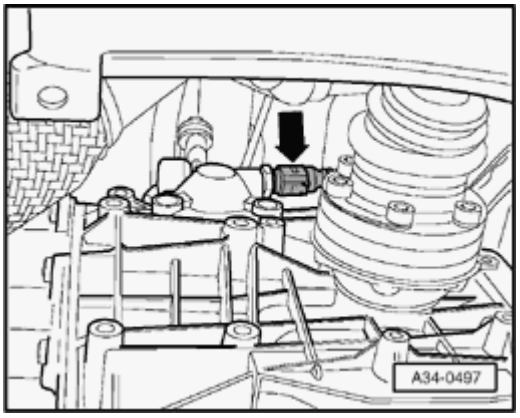


Fig. 70: Disconnecting Harness Connector For Back-Up Light Switch At Right Of Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect harness connector for back-up light switch at right of transmission and set aside electrical wire.

NOTE: Depicted in illustration for a vehicle with manual transmission 01E all wheel drive.

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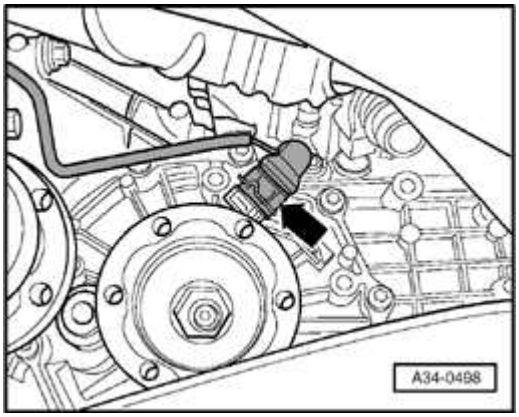


Fig. 71: Disconnecting Harness Connector From Speedometer Vehicle Speed Sensor (VSS) -G22- At Left Of Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect harness connector (arrow) from Speedometer Vehicle Speed Sensor (VSS) -G22- at left of transmission.

NOTE: Depicted in illustration for a vehicle with manual transmission 01E all wheel drive.

Vehicles with automatic transmission 01J

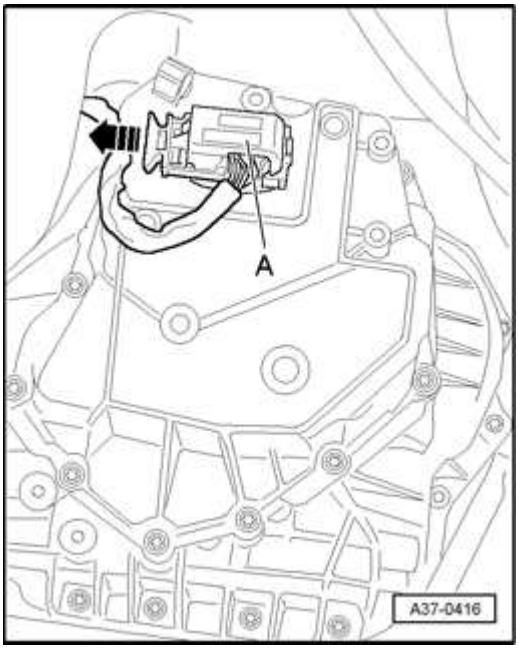


Fig. 72: Disengaging Harness Connector From Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disengage harness connector -A- in direction of arrow and disconnect it from transmission.
- Move wiring harness clear.

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Vehicles with automatic transmission 01V

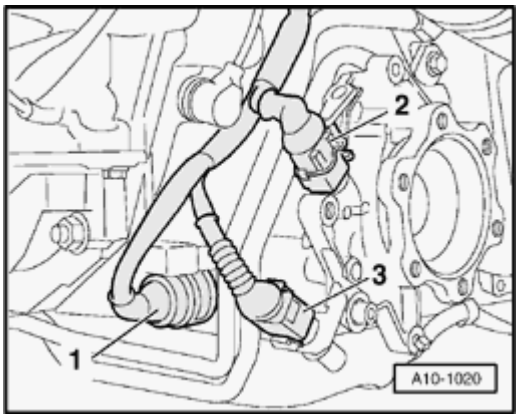


Fig. 73: Identifying Transmission Wiring Harness, Speedometer Vehicle Speed Sensor (VSS) -G22- Harness Connector, Multi-Function Switch Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Swing securing lever and disconnect harness connector for transmission wiring harness -1-.
- Disconnect harness connector -2- on Speedometer Vehicle Speed Sensor (VSS) -G22-.
- Disconnect harness connector -3- from wire for multi-function switch.

All

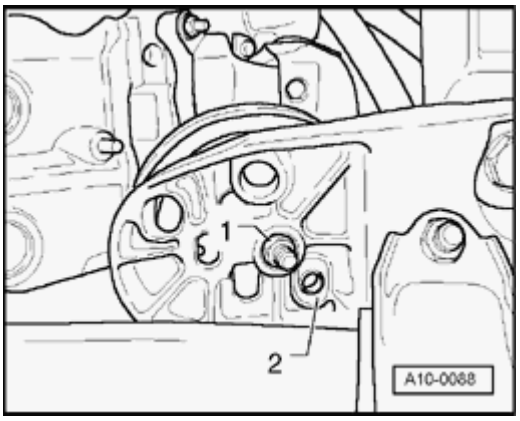


Fig. 74: Threaded Connections And Positioning Sleeves On Lower Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark installation positions for threaded assemblies -1- and positioning sleeves -2-.

NOTE: Different mounting holes are available depending upon the installed engine.

- Remove lower nuts -1- on left and right engine mounts.

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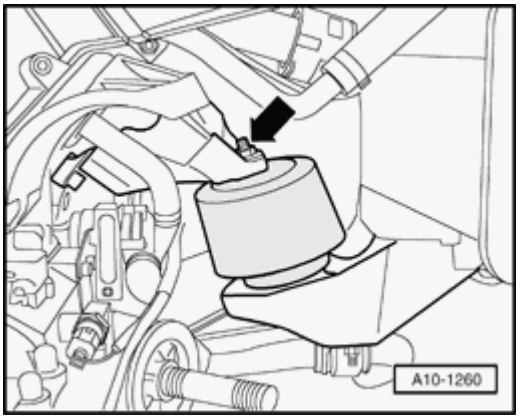


Fig. 75: Loosening Upper Nuts On Left/Right Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Slightly loosen upper nuts (arrow) on left and right engine mounts.

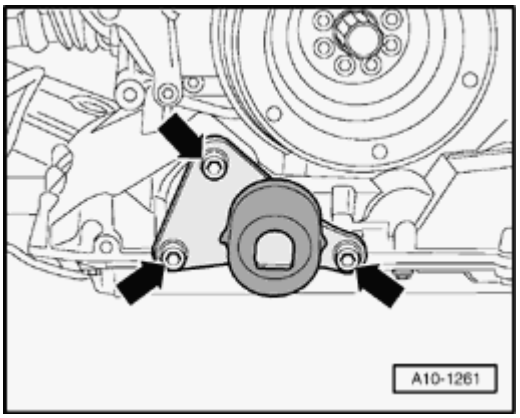


Fig. 76: Unbolting Torque Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt torque support (arrows).

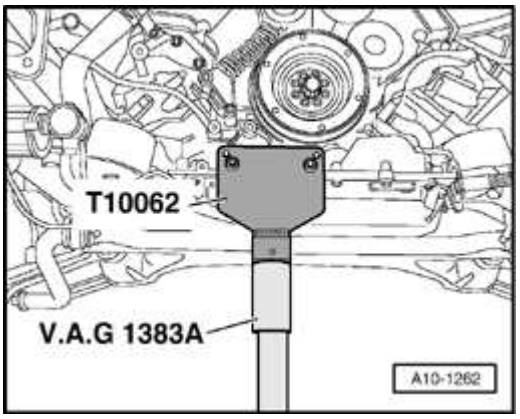


Fig. 77: Tightening T10062 Support On Threaded Holes For Torque Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Tighten T10062 support on threaded holes for torque support to 20 Nm.
- Lift engine using VAG1383A engine/transmission jack just far enough so that lower connecting bolts at engine/transmission can be removed.

NOTE: When working on a vehicle with all wheel drive, make sure the front constant velocity joint of driveshaft is not damaged when lifting engine.

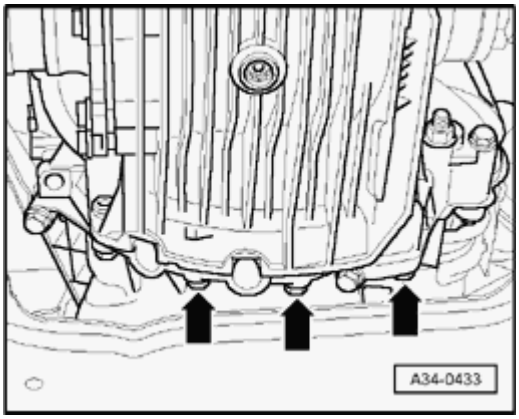


Fig. 78: Three Lower Engine And Transmission Connecting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bottom engine/transmission connecting bolts (arrows).
- Lower engine again.

Vehicles with manual transmission and automatic transmission 01J

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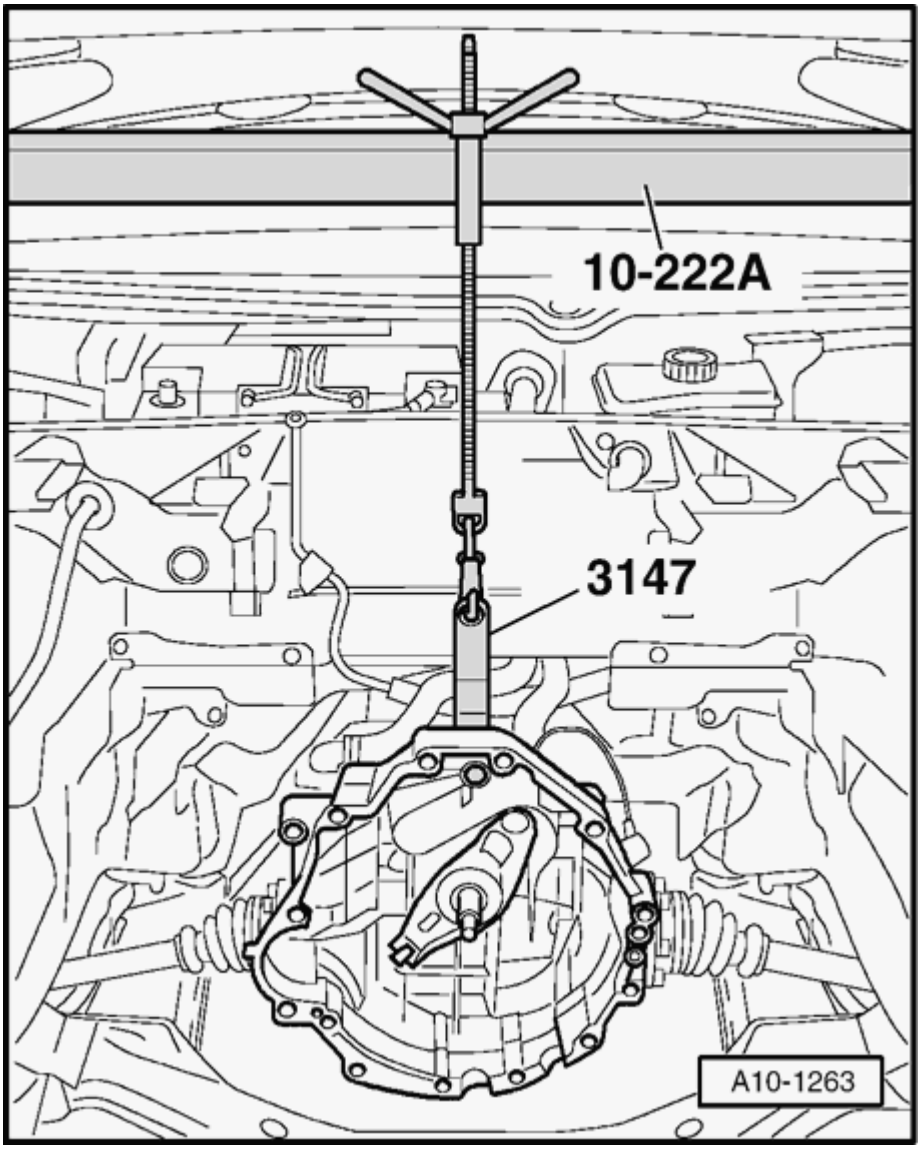


Fig. 79: Positioning 10-222A Engine Support Bridge On Bolted Flanges Of Fenders Behind Gas-Filled Strut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position 10-222A engine support bridge on bolted flanges of fenders behind gas-filled strut. Spindle is at front.
- Hook 3147 engine support adapter into bolt hole at left of transmission housing.
- Connect 3147 engine support adapter and 10222A engine support bridge with 10222A/2 additional hook.

NOTE:

- **Illustration is shown with engine removed.**
- **If the engine support adapter 3147 can not be inserted far enough into the hole on transmission bell housing due to a change in wire routing, use a long bolt M10 and additional hook 10-222 A/2 in place of engine support adapter.**

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Vehicles with automatic transmission 01V

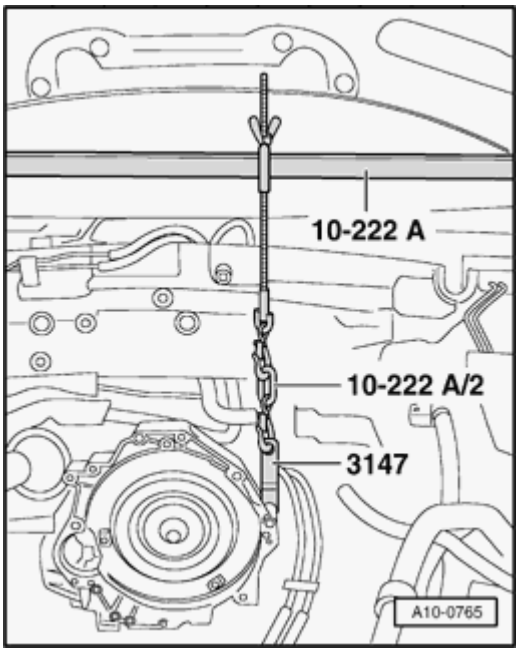


Fig. 80: Positioning 10-222A Engine Support Bridge On Bolted Flanges Of Fenders Behind Gas-Filled Strut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position 10-222A engine support bridge on bolted flanges of fenders behind gas-filled strut. Spindle is at front.
- Hook 3147 engine support adapter into middle bolt hole in transmission housing.
- Connect engine support adapter 3147 using engine support bridge 10-222 A.

NOTE: Illustration is shown with engine removed.

All

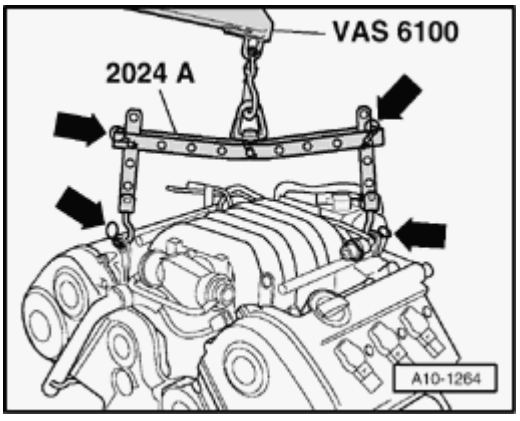


Fig. 81: Hooking In 2024A Engine Sling At Engine And At VAS6100

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hook in 2024A engine sling at engine and at VAS6100 or 1202A workshop crane as depicted in illustration.

NOTE: To properly balance assembly, mounting hooks must be inserted in rails as shown in illustration.

WARNING: Take-up hooks and pins at engine sling must be secured using securing pins (arrows) as shown in illustration.

- Remove final mounting bolt.

NOTE: Verify that all hoses and lines between engine and body have been disconnected.

- Using VAS6100 or VAG1202A workshop crane, lift engine far enough until threaded bolts of engine mount are free.
- Turn 10-222A engine support bridge shaft.

NOTE: Make sure no lines are damaged at bulkhead.

Vehicles with automatic transmission 01V

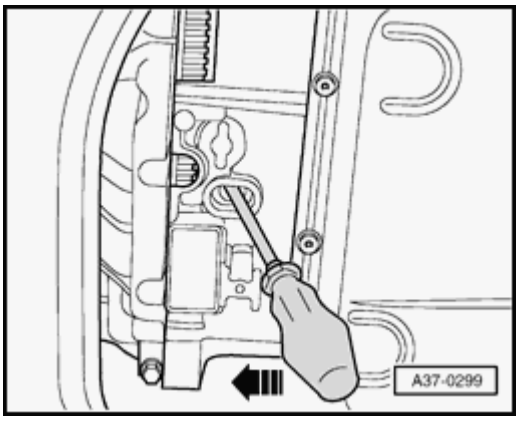


Fig. 82: Pressing Transmission Off Engine, While Pressing Torque Converter Off Of Drive Plate
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press transmission off engine, while pressing torque converter off of drive plate.

All

- Pull engine off of transmission and lift it out of engine compartment toward front.

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Vehicles with automatic transmission 01V

- If necessary, secure torque converter in transmission from falling out using wire.

Installing

Installation is reverse of removal, note the following:

NOTE:

- **During installation, all cable ties must be re-installed at the same locations.**
- **Heat boots, which are removed during engine removal must be reinstalled at the same locations when re-installing engine.**
- **Secure all hose connections using hose clamps appropriate for the model type**
- **Replace self-locking nuts and bolts during assembly work.**
- **Always replace bolts that are secured with tightening torque as well as O-rings and gaskets.**

- Make sure centering sleeves for engine to transmission are correctly installed in cylinder block. Install or replace if necessary.
- Slide intermediate plate or intermediate panel onto sleeves.

Vehicles with manual transmission

- Clean input shaft splines and (in case of used clutch plates) clean hub splines. Remove corrosion and apply only a very thin coating of lubricant G 000 100 on splines. Do not grease guide sleeve.
- Check centering of clutch disc.
- Check clutch release bearing for wear and replace if necessary.

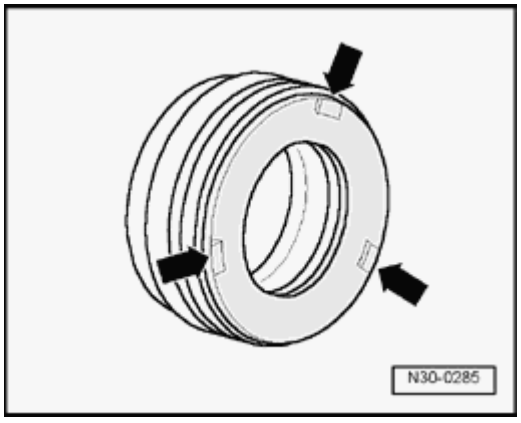


Fig. 83: Servicing Release Bearing With Plastic Ring
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If plastic ring of release bearing is loose, adhere it to bearing ring again using adhesive AMV-195-KD1-

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01.

- 3 rectangular tabs (arrows) of plastic ring reach into cutouts of bearing ring.
- If grooves with depth of more than 0.5 mm are present, release bearing must be replaced.

Vehicles with SAC clutch pressure plate

When installing a new clutch disc in combination with a used SAC pressure plate (self-adjusting pressure plate), the adjustment ring of the pressure plate must be turned back to impact. Otherwise the pressure plate works with decreased contact pressure (clutch slips).

Refer to **30 CLUTCH**

If the clutch disc is not replaced, the adjustment ring does not have to be turned back.

New SAC pressure plates are already pre-adjusted and must not be turned back.

Vehicles with automatic transmission 01V

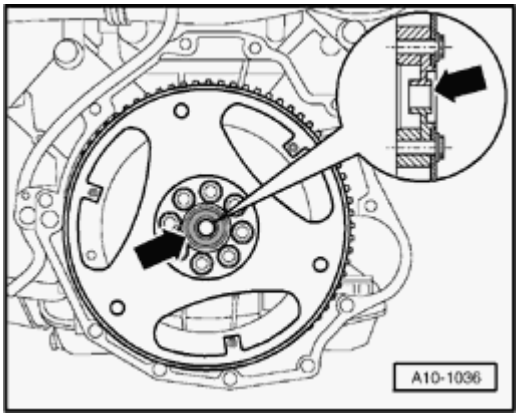


Fig. 84: Bolting Drive Plate To Crankshaft With Centering Bushing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive plate is bolted to crankshaft with a centering bushing (arrow).
- Use original bolts when securing torque converter to drive plate:

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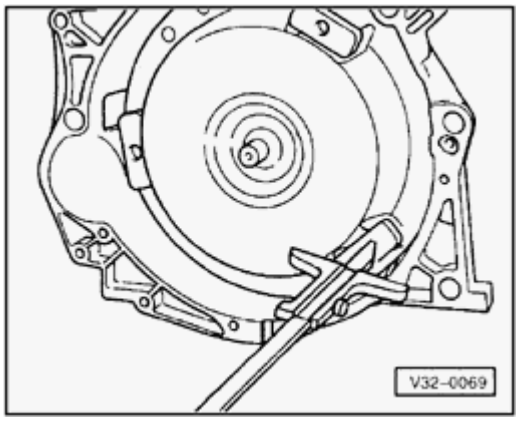


Fig. 85: Checking Torque Converter Is Correctly Positioned
Courtesy of VOLKSWAGEN UNITED STATES, INC.

When torque converter is installed correctly, distance between lower contact surface of threaded holes at torque converter and contact surface of converter housing on Automatic Transmission 01V is approx. 23 mm.

If the torque converter is not inserted completely, this distance will be approx. 11 mm.

WARNING: In case of an incorrectly inserted torque converter, the coupling plate of the torque converter or the ATF pump will be destroyed, if the transmission is flanged to the engine.

All

- Carefully guide engine with transmission into chassis.
- Set engine onto engine mounts.

WARNING: For vehicles with automatic transmission 01V, keep checking whether the torque converter behind the drive plate can be turned before and during tightening of the bolts at engine/transmission flange. If the torque converter cannot be turned, it must be assumed that it has not been inserted properly and that the coupling plate of the torque converter or the ATF pump will be destroyed during final tightening of the bolts.

- Bolt transmission to engine, from. Refer to **Tightening torques**.

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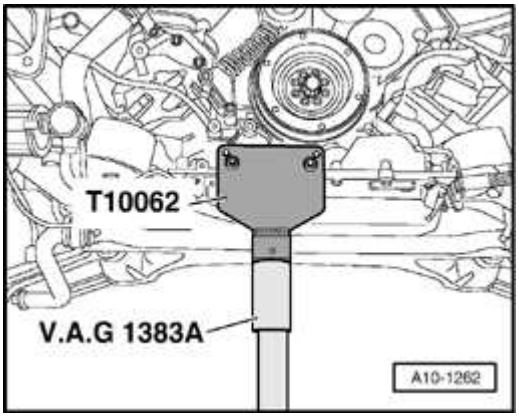


Fig. 86: Tightening T10062 Support On Threaded Holes For Torque Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten T10062 support on threaded holes for torque support to 20 Nm.
- Lift engine using VAG1383A engine/transmission jack just far enough so that lower connecting bolts at engine/transmission can be installed.

NOTE: When working on a vehicle with all wheel drive, make sure the front constant velocity joint of the driveshaft is not damaged when lifting the engine.

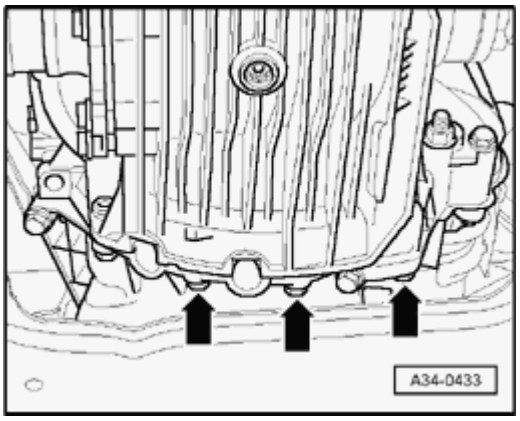


Fig. 87: Three Lower Engine And Transmission Connecting Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten lower engine/transmission connecting bolts (arrows).
- Lower engine again.
- Install and align exhaust system free of tension. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** or **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.
- Install starter.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

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- Install generator. Refer to **Ribbed belt for power steering pump, generator and A/C system**.
- Install A/C compressor. Refer to **Ribbed belt for power steering pump, generator and A/C system**.
- Install ribbed belt. Refer to **Installing**.
- Install lock carrier. Refer to **Lock carrier, moving into service position**.

Vehicles up to 06.03:

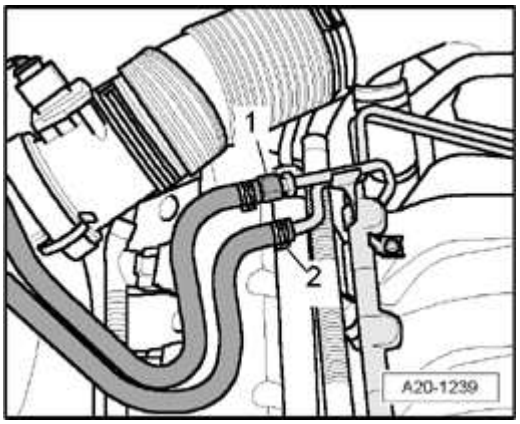


Fig. 88: Disconnecting/Tightening Fuel Supply Line And Fuel Return Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten union nut of fuel supply line -1- to 22 Nm.
- Secure fuel return line -2- with a hose clamp.

Vehicles as of 07.03:

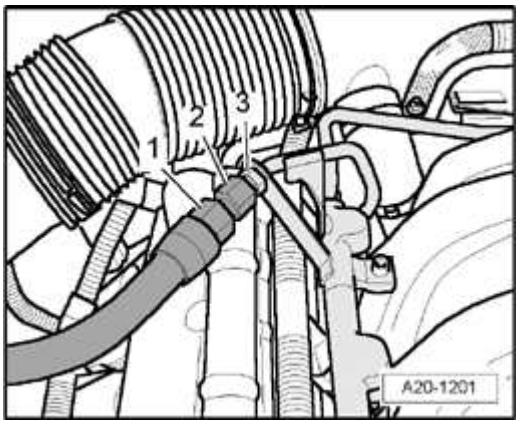


Fig. 89: Unscrewing/Screwing Fuel Hose From Connection On Fuel Rail Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure fuel hose to connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and tighten union nut -2- to 22 Nm.

Vehicles with automatic transmission

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- Secure ATF lines:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

All

- Check harness connectors and routing:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

See Caution for connecting Telematics battery. Refer to **Engine, removing and installing**

- Observe safety precautions after connecting battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

WARNING: Do not use a battery charger for starting assistance! There is risk of damage at the vehicle control modules.

- Check engine oil level before starting engine.
- Top off coolant. Refer to **Filling**.

NOTE:

- **Only reuse drained coolant if cylinder head or engine block were not replaced.**
- **Dirty coolant cannot be reused.**

- Fill up power steering fluid and bleed steering system:

Refer to **48 - STEERING**

Vehicles with automatic transmission

- Check ATF level:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY

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VARIABLE TRANSMISSION (CVT) 01J

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

All

- Adjust headlights:

Refer to **94 LIGHTS, SWITCHES - EXTERIOR** .

Tightening torques

NOTE:

- **Tightening torques are valid only for nuts and bolts that are lightly greased, oiled, covered with a thin coat of phosphate or blackened.**
- **Other lubricants are permitted, e.g. engine oil or transmission fluid, however they may not contain graphite.**
- **Do not use any degreased parts.**
- **Tightening torque tolerance ± 15%.**

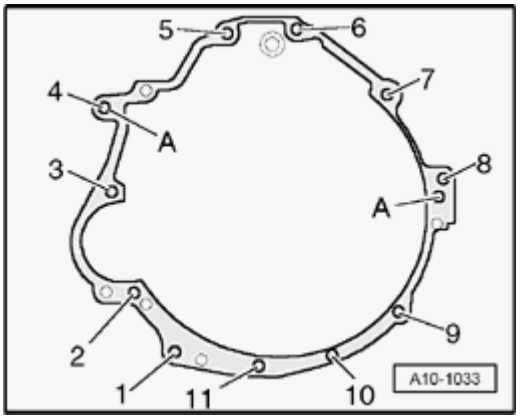


Fig. 90: Identifying Engine/Transmission Tightening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Securing engine/transmission for manual transmission

Item no.	Bolt	Nm
1, 9, 10, 11	M10 x 60	45
2	M10 x 150	45
3	M12 x 130	65
4	M12 x 80	65
5, 6, 8	M12 x 90	65

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7	M10 x 100	45

A: Alignment bushing

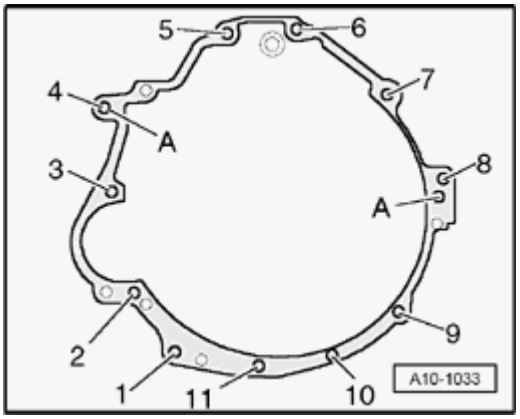


Fig. 91: Identifying Engine/Transmission Tightening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Securing engine/transmission with automatic transmission 01J

Item no.	Bolt	Nm
1, 10, 11	M10 x 60	45
2	M12 x 90	65
3	M12 x 110	65
4	M12 x 80	65
5, 6	M12 x 90	65
7	M10 x 100	45
8	M12 x 75	65
9	M10 x 70	45

A: Alignment bushing

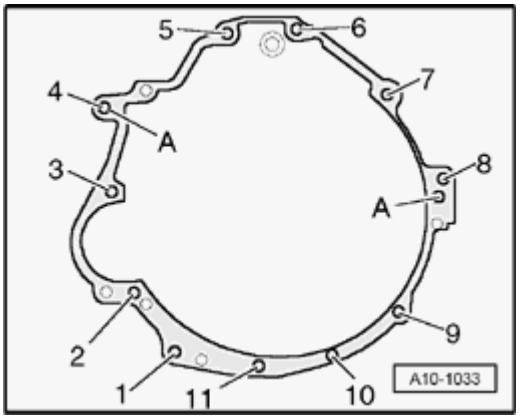


Fig. 92: Identifying Engine/Transmission Tightening Sequence

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

Securing engine/transmission with automatic transmission 01V

Item no.	Bolt	Nm
1, 9, 10, 11	M10 x 60	45
2	M10 x 90	45
3	M12 x 110	65
4	M12 x 80	65
5, 6, 8	M12 x 90	65
7	M10 x 100	45

A: Alignment bushing

Component			Nm
Nuts/Bolts		M6	10
		M8	20
		M10	45
		M12	65

Component			Nm
Except for the following:			
Drive plate to torque converter		M10 x1	85
Torque support to oil pan (upper part)			40
Engine mount to	Engine support		23
	Carrier		23
Heat shield for driveshaft to transmission			23
Oil cooler to oil pan (upper part)			30
Power steering pressure line to			
	Pressure hose		40
	Coolant pipe		20
Air guide to intake manifold			10
Fuel supply line to fuel rail			22
Wiper arm to wiper axle			21
ATF hose to ATF tube			29

Engine, attaching to engine stand

Special tools and equipment

- VAS 6095 Engine and transmission holding fixture

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Procedure

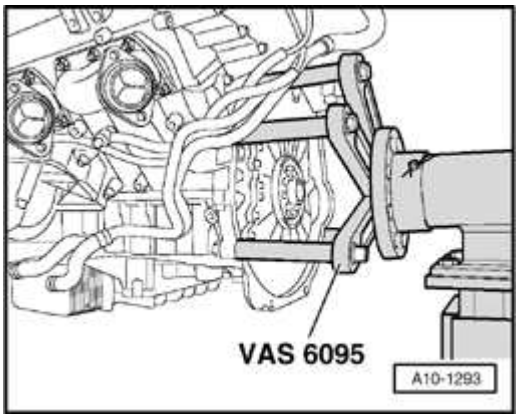


Fig. 93: Securing Engine To VAS6095 Engine And Transmission Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure engine to VAS6095 engine and transmission support as depicted in illustration.

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13 ENGINE - CRANKSHAFT, CYLINDER BLOCK

ENGINE, DISASSEMBLING AND ASSEMBLING

Lock carrier in service position, overview

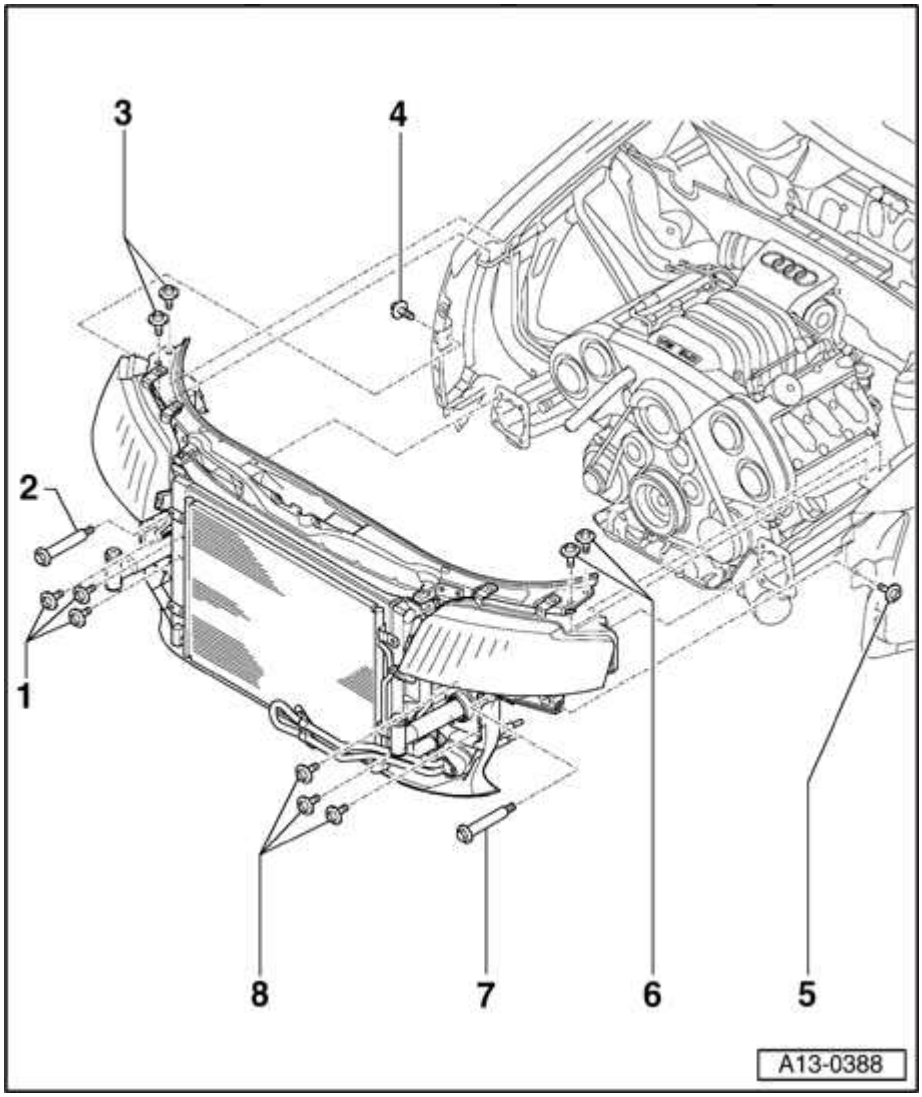


Fig. 94: Lock Carrier In Service Position, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 50 Nm

2 - 3369 support tool

- Tighten to 10 Nm

3 - 10 Nm

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4 - 10 Nm

5 - 10 Nm

6 - 10 Nm

7 - 3369 support tool

- Tighten to 10 Nm

8 - 50 Nm

Lock carrier, moving into service position

Special tools and equipment

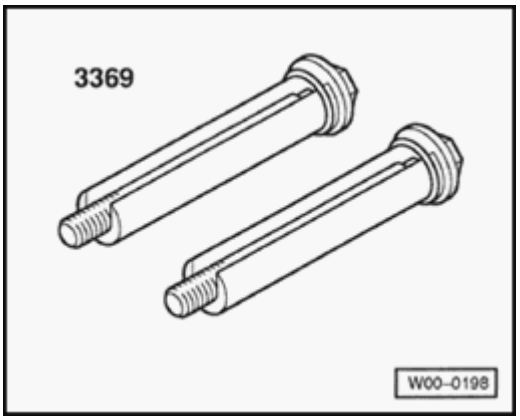


Fig. 95: 3369 Support Tool
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3369 Support tool

Removing

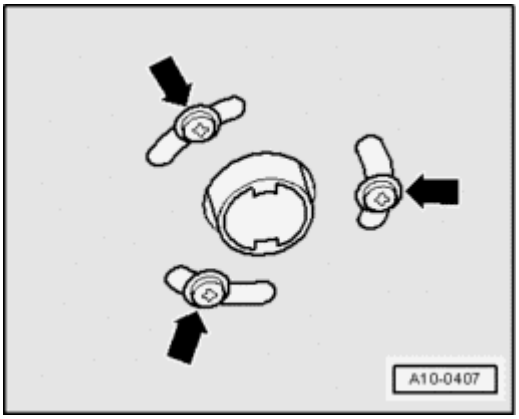


Fig. 96: Identifying Exhaust Pipe Fasteners

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

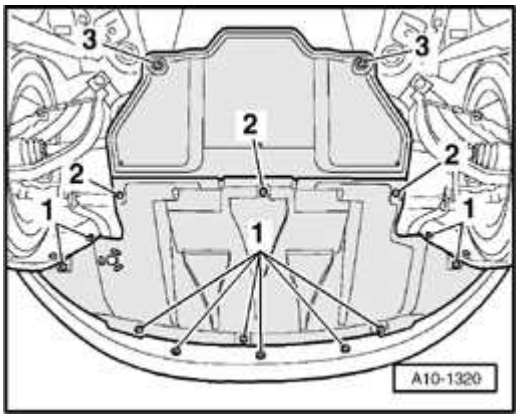


Fig. 97: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.

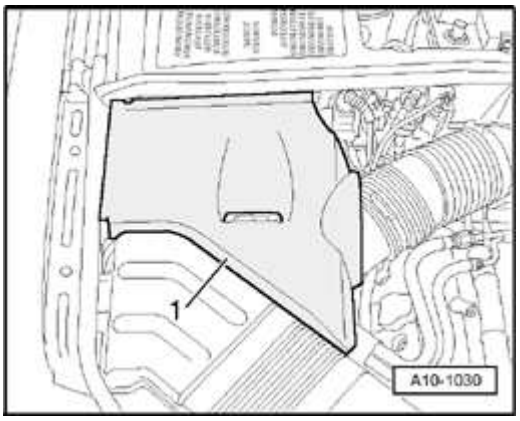


Fig. 98: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

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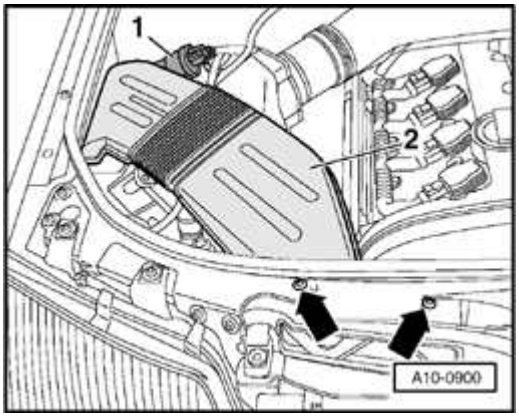


Fig. 99: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

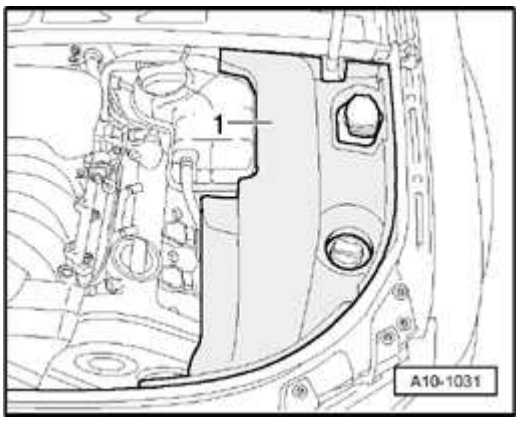


Fig. 100: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).
- Pull off hood seal from lock carrier and fender edges.
- Remove front bumper:

Refer to

- **63 BUMPER**
- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

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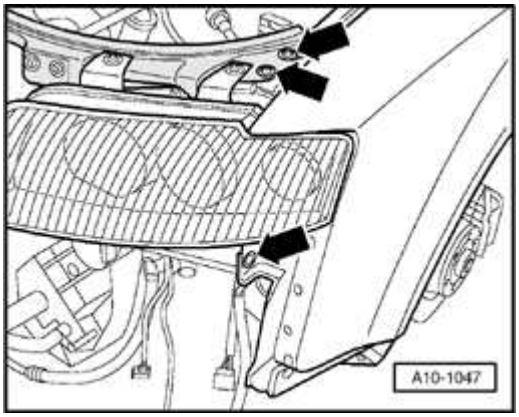


Fig. 101: Removing Bolts At Left/Right Side Of Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) on left and right sides of bumper.

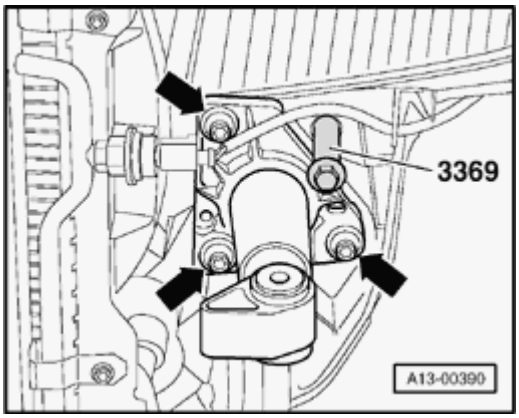


Fig. 102: Threading 3369 Support Tool Into Empty Holes At Left/Right
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread 3369 support tool into empty holes at left and right.
- Unscrew bolts at impact absorbers (arrows) at left and right.
- Carefully pull lock carrier toward front.

Installing

Installation is reverse of removal, noting the following:

- Tighten bolts for lock carrier to longmembers to 50 Nm and at fenders to 10 Nm.

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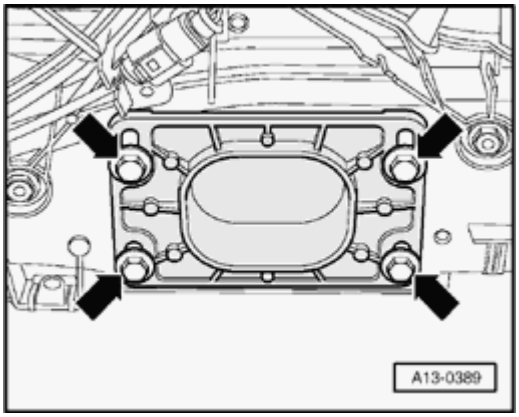


Fig. 103: Placing Impact For Torque Support On Rubber Buffer For Torque Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place impact for torque support on rubber buffer for torque support, letting it rest under its own weight and tighten bolts (arrows) to 28 Nm.
- Install front bumper:

Refer to

- **63 BUMPER**
- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

- Adjust headlights:

Refer to **94 LIGHTS, SWITCHES - EXTERIOR** .

Tightening torques

Component		Nm
Bumper to	Longmember	50
	Fender	10
Torque support stop to lock carrier		28

Ribbed belt for power steering pump, generator and A/C system

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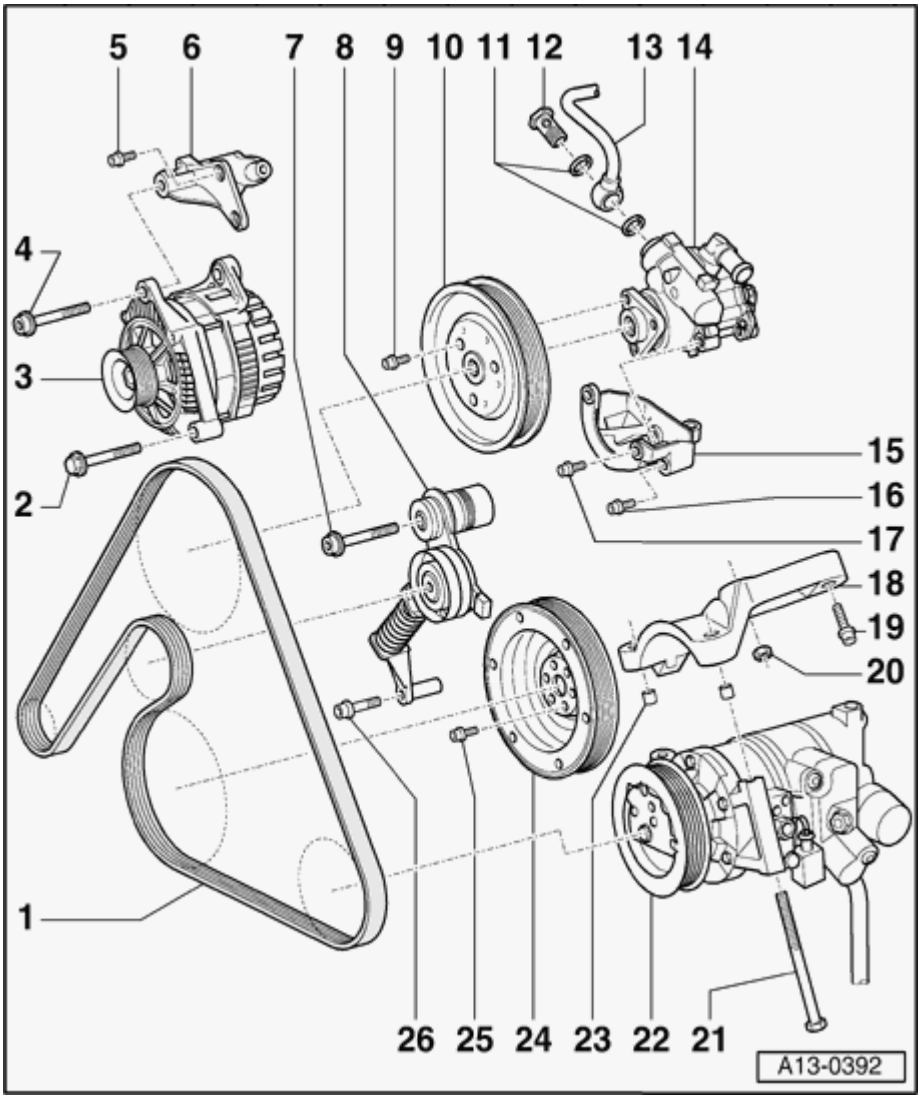


Fig. 104: Ribbed Belt For Power Steering Pump, Generator And A/C System Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: Before removing ribbed belt, note direction of rotation with chalk or felt-tip marker. Reversing the direction of rotation of a run-in belt can destroy the belt.

1 - Ribbed belt

- Removing and installing. Refer to **Ribbed belt, removing and installing**
- Check for wear

2 - 23 Nm

3 - Generator

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- Removing:

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**

4 - 45 Nm

5 - 23 Nm

6 - Bracket

- For generator

7 - 40 Nm

8 - Ribbed belt tensioner

- Removing and installing. Refer to **Ribbed belt tensioner, removing and installing** .

9 - 23 Nm

10 - Belt pulley

- For power steering pump
- Use 3212 spanner wrench to counterhold when removing and installing
- Identification: Front

11 - Seal

- Always replace

12 - Banjo fitting, 47 Nm

13 - Pressurized line

- To power steering

14 - Power steering pump

- Removing and installing:

Refer to **48 - STEERING**

15 - Bracket

- For power steering pump

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16 - 23 Nm

17 - 23 Nm

18 - Bracket

- For A/C compressor

19 - 23 Nm

20 - 23 Nm

21 - 25 Nm

22 - A/C compressor

- Do not unscrew or disconnect refrigerant lines
- After removing, secure compressor to chassis (i.e. with wire) Do not hang on refrigerant lines

23 - Socket

- For A/C compressor
- 2x

24 - Harmonic balancer

- Version dependent with/without thrust washer between harmonic balancer and toothed belt gear. Refer to **Vibration damper, removing and installing**
- Removing and installing. Refer to **Vibration damper, removing and installing**

25 - 23 Nm

26 - 23 Nm

Ribbed belt, removing and installing

Special tools and equipment

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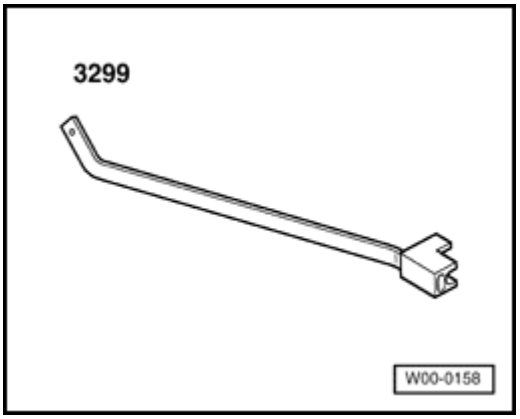


Fig. 105: 3299 Ribbed Belt Installation Tool With 3299/1 Claw For Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3299 Ribbed belt installation tool with 3299/1 claw for tensioner

Removing

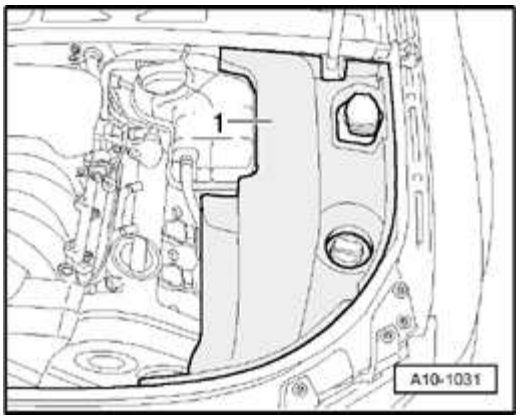
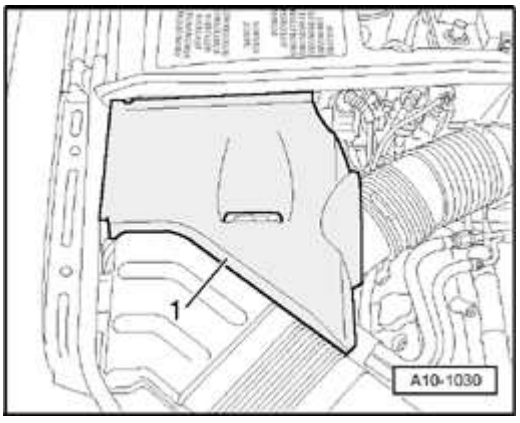


Fig. 106: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).



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Fig. 107: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

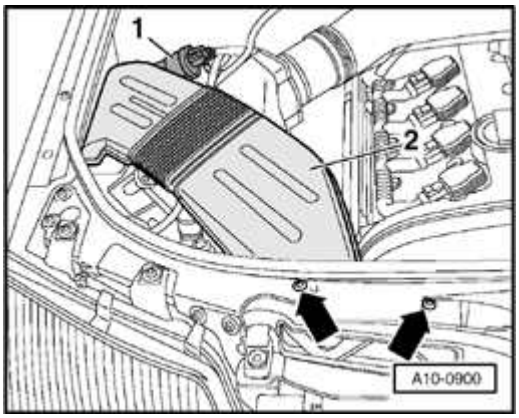


Fig. 108: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

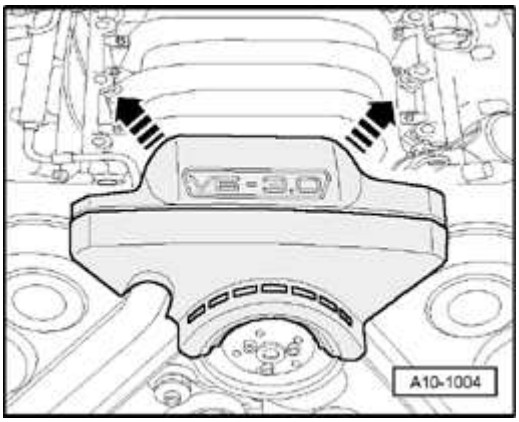


Fig. 109: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

NOTE: Before removing ribbed belt, mark direction of rotation with chalk or felt-tip marker. Reversing the direction of rotation of a run-in belt can destroy the belt.

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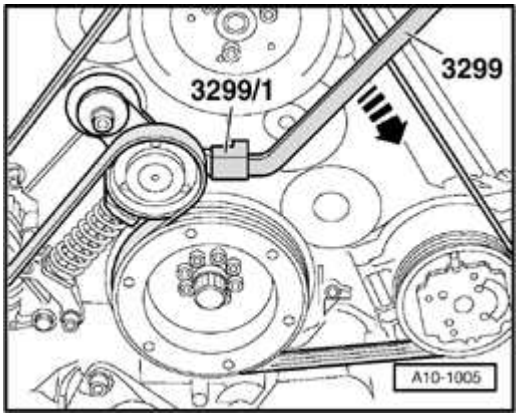


Fig. 110: Swinging Ribbed Belt Tensioner To Release Tension On Ribbed Belt Using 3299 Ribbed Belt Installation Tool And 3299/1 Claw For Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Swing ribbed belt tensioner in direction of arrow to release tension on ribbed belt using 3299 ribbed belt installation tool and 3299/1 claw for tensioner.
- Remove ribbed belt from pulley of power steering pump.

Installing

Installation is reverse of removal, noting the following:

- First install ribbed belt on crankshaft pulley. Slide belt onto tensioning roller last.

Belt path

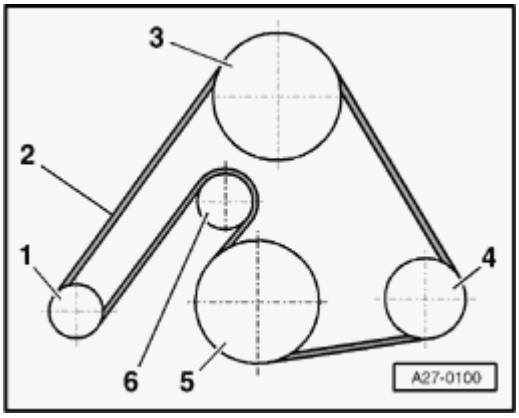


Fig. 111: Belt Path
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Generator

2 - Ribbed belt

3 - Power steering pump

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4 - A/C compressor

5 - Crankshaft

6 - Tensioner roller

NOTE: When installing ribbed belt, ensure correct seating on belt pulley.

- Start engine and check path of belt.

Ribbed belt tensioner, removing and installing

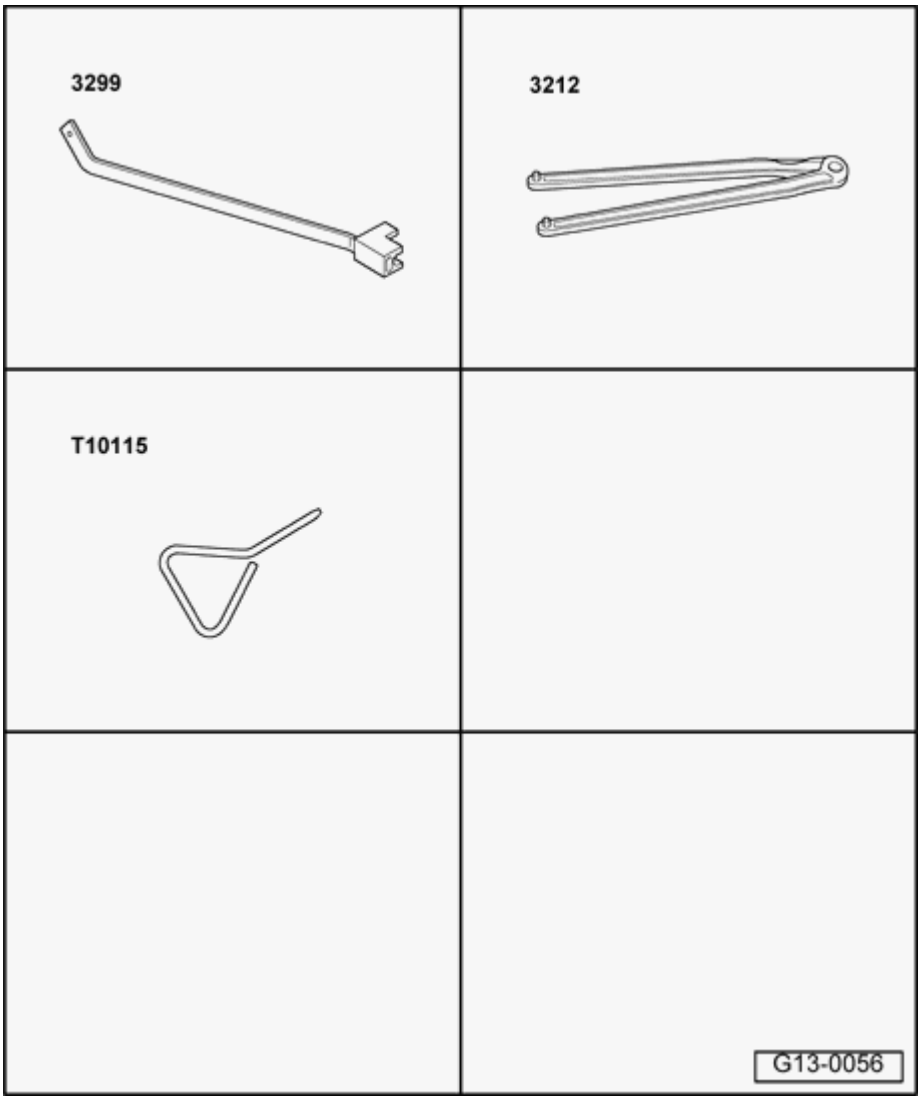


Fig. 112: Identifying Special Tools - Ribbed Belt Tensioner, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special Tools and Equipment

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- 3299 ribbed belt installation tool with 3299/1 claw for tensioner
- 3212 spanner wrench
- T10115 pin

Removing

- Lock carrier in service position. Refer to **Lock carrier, moving into service position**.
- Ribbed belt removed. Refer to **Ribbed belt, removing and installing** .

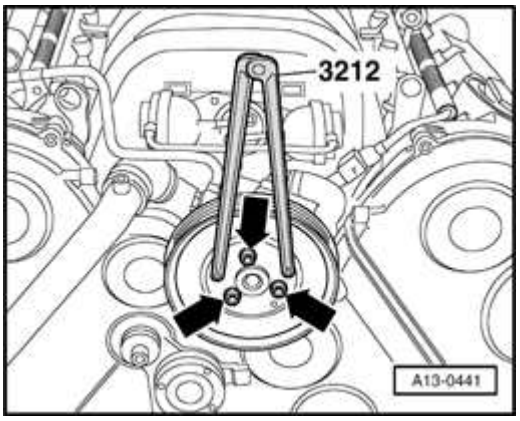


Fig. 113: Removing Ribbed Belt Gear Of Vane Pump Using 3212 Spanner Wrench As Retainer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove ribbed belt gear of vane pump (arrows) using 3212 spanner wrench as retainer.
- Swing ribbed belt tensioner in direction of arrow using 3299 ribbed belt installation tool and 3299/1 claw for tensioner to secure, secure using T10115 pin and release installation tool.
- Unscrew bolts -1- and -2- and remove the secured ribbed belt tensioner.

Installing

Installation is performed in the reverse order of removal.

Tightening torques

Component	Nm
Ribbed belt tensioner to generator bracket	23
Ribbed belt tensioner to cylinder block.	40

Vibration damper, removing and installing

- Lock carrier in service position. Refer to **Lock carrier, moving into service position**.
- Ribbed belt removed. Refer to **Ribbed belt, removing and installing** .

Removing

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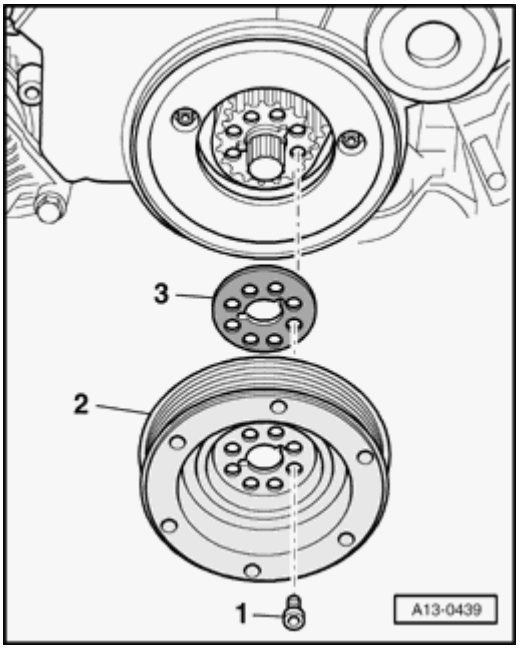


Fig. 114: Removing Bolts, Harmonic Balancer And Thrust Washer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove 8 bolts -1-.
- Remove harmonic balancer -2- and thrust washer -3-.

NOTE:

- **Thrust washer -3- is only installed on toothed belt gear with part number 06C 105 063 A.**
- **No thrust washer must be installed for toothed belt gear with part number 06C 105 063 B.**

Installing

Installation is reverse of removal, noting the following:

- Insert thrust washer in such a way that convex edge points toward harmonic balancer.

NOTE:

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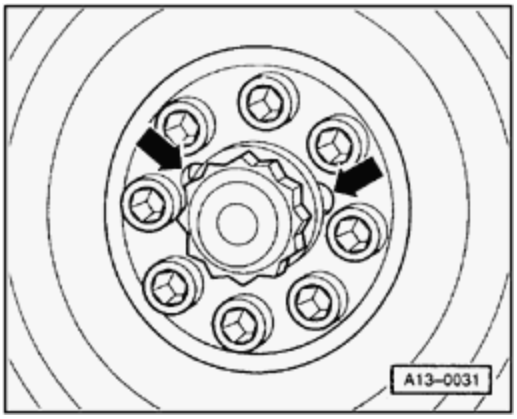


Fig. 115: Vibration Damper And Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

When installing the harmonic balancer, make sure notches (arrows) in harmonic balancer are aligned with locating lugs on toothed belt sprocket.

Tightening torque

Component	Nm
Harmonic balancer to crankshaft	23

Toothed belt cover, removing and installing

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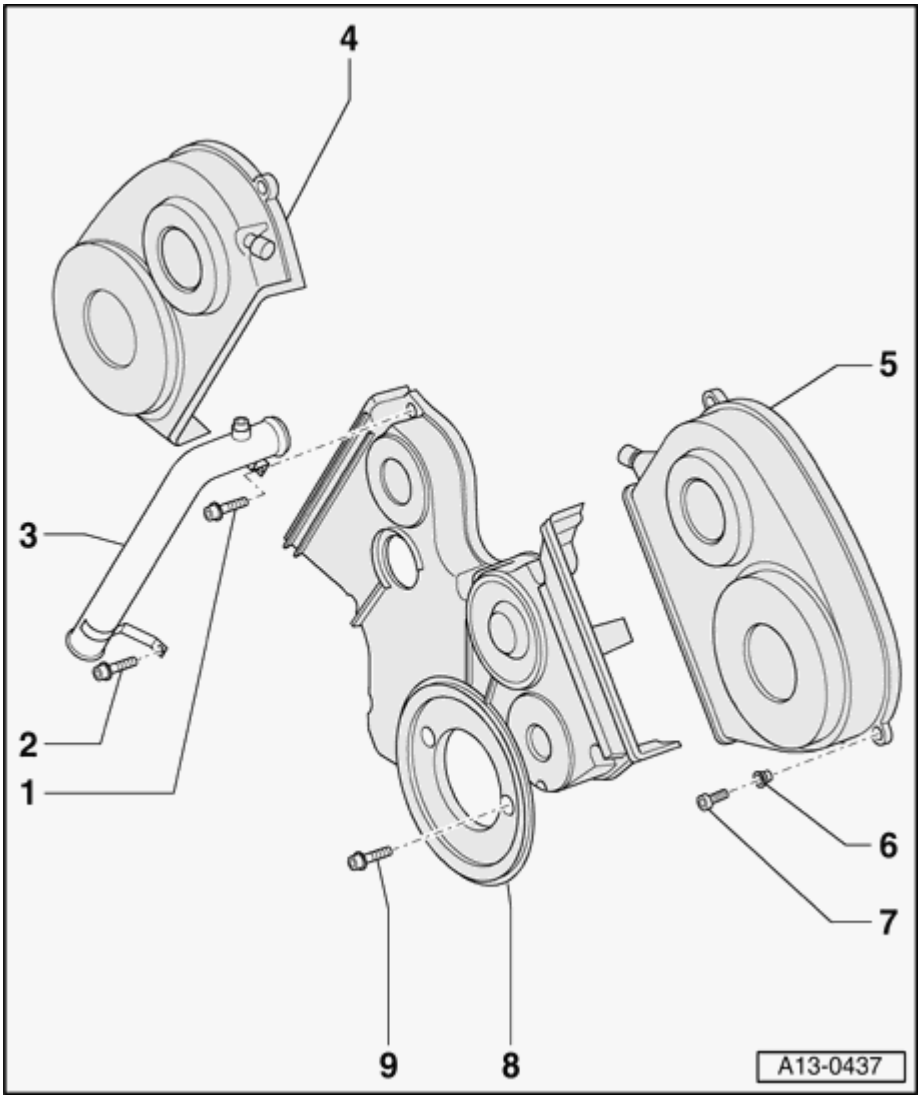


Fig. 116: Toothed Belt Cover Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - 10 Nm

3 - Front coolant pipe

- Only remove bolts item -1- and item -2- to remove toothed belt guide
- Coolant hoses remain connected at coolant pipe

4 - Toothed belt guard, front right

5 - Toothed belt guard, front left

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6 - Socket

7 - 6 Nm

- Self-locking
- Always replace

8 - Lower toothed belt cover

9 - 10 Nm

Toothed belt drive, assembly overview

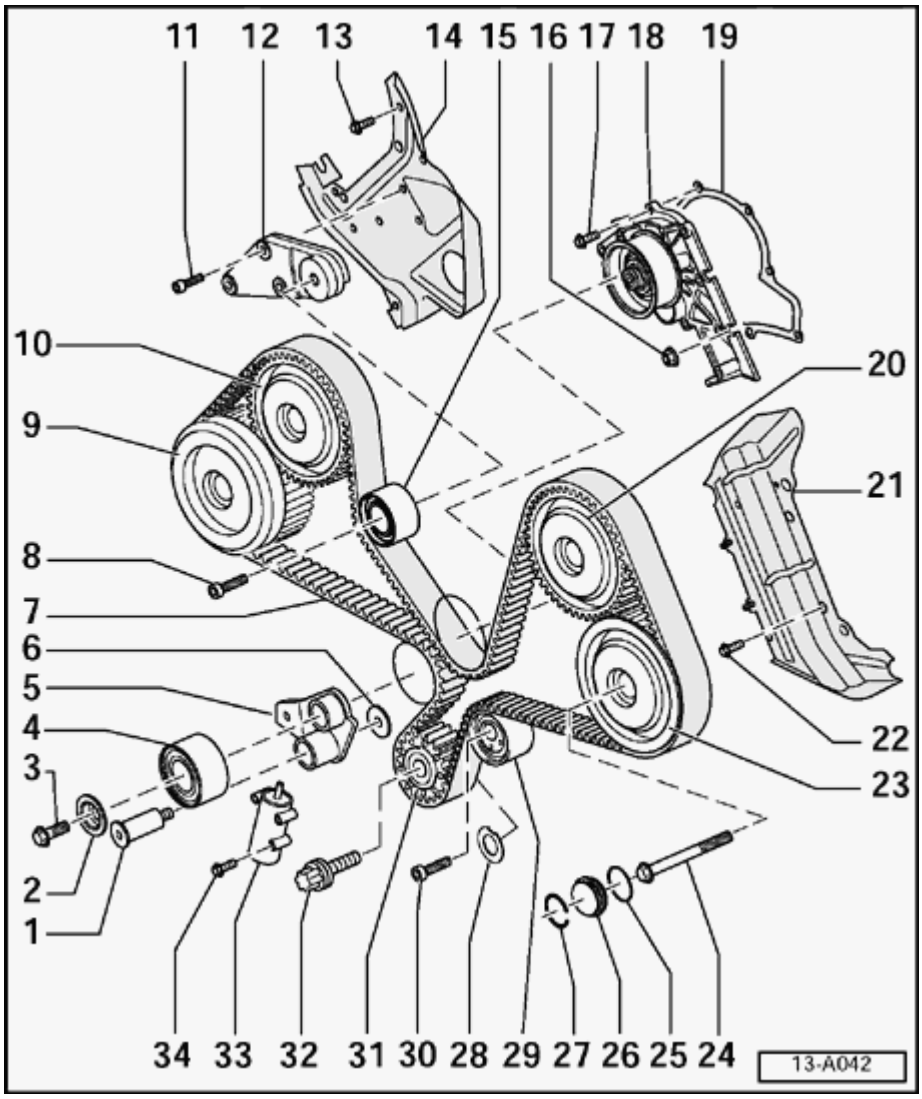


Fig. 117: Toothed Belt Drive, Assembly Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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NOTE: Before removing toothed belt, note direction of rotation with chalk or felt-tip marker. Reversing the direction of rotation of a run-in belt can destroy the belt.

1 - 45 Nm

- Self-locking
- Always replace

2 - Washer

3 - 45 Nm

4 - Tensioner roller

5 - Tensioning lever

- Insert shim item - 6

6 - Washer

- For tensioner lever

7 - Toothed belt

- Before removing, note direction of rotation using chalk or felt-tip marker
- Check for wear
- Removing. Refer to **Toothed belt, removing and installing**
- Installing (adjusting timing). Refer to **Installing (adjusting valve timing)**

8 - 45 Nm

9 - Exhaust camshaft, toothed belt gear

- For cylinder bank 1 (right) with vibration damper
- With camshaft adjuster
- Identification "Exhaust"

10 - Intake camshaft, toothed belt gear

- For cylinder bank 1 (right)
- With camshaft adjuster
- Identification "Intake"

11 - 10 Nm

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- Self-locking
- Always replace

12 - Bracket

- For idler roller

13 - 10 Nm

- Self-locking
- Always replace

14 - Toothed belt guard, rear right

15 - Idler roller

16 - 10 Nm

17 - 10 Nm

18 - Mechanical coolant pump

- Removing and installing. Refer to **Coolant pump, removing and installing**

19 - Gasket

- Always replace

20 - Intake camshaft, toothed belt gear

- For cylinder bank 2 (left)
- With camshaft adjuster
- Identification "Intake"

21 - Toothed belt guard, rear left

22 - 10 Nm

- Self-locking
- Always replace

23 - Exhaust camshaft, toothed belt gear

- For cylinder bank 2 (left) with vibration damper
- With camshaft adjuster

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- Identification "Exhaust"

24 - 100 Nm

- Use T40030 camshaft adjuster gauge when loosening or tightening

25 - O-ring

- Always replace

26 - Cap

27 - Snap ring

28 - Diamond disc

- For toothed belt gear
- Replace after removing toothed belt

29 - Eccentric pulley

30 - 45 Nm

31 - Toothed belt gear for crankshaft

- Replace diamond disc item - 28 after removal
- Contact surface between toothed belt gear, diamond disc and crankshaft must be free of oil.
- Installation only possible in one position
- Version dependent with/without thrust washer. Observe note. Refer to **Vibration damper, removing and installing**

32 - Central bolt, 200 Nm plus an addition 180° (1/2 turn)

- Always replace
- Do not oil additionally
- Use T40026 locking pin when loosening or tightening
- Thread in T40026 locking pin. Refer to **Toothed belt, removing and installing**

33 - Toothed belt tensioner

34 - 10 Nm

Toothed belt, removing and installing

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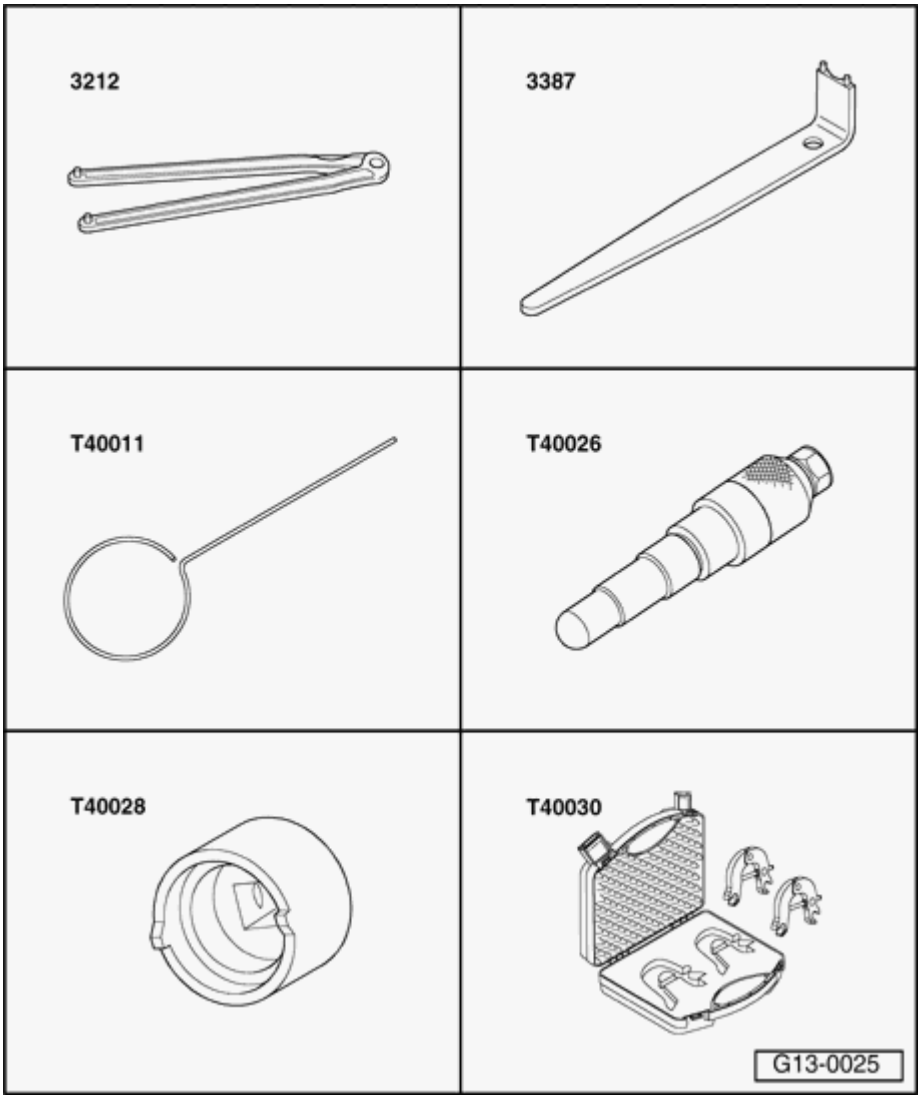


Fig. 118: Identifying Special Tools - Toothed Belt, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- 3212 Spanner wrench
- 3387 Pin wrench
- T40011 Pin
- T40026 Locking pin
- T40028 Socket
- T40030 Camshaft adjuster gauge

Removing

- Lock carrier in service position. Refer to **Lock carrier, moving into service position**.

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- Ribbed belt removed. Refer to **Ribbed belt, removing and installing** .
- Ribbed belt tensioner removed. Refer to **Ribbed belt tensioner, removing and installing** .

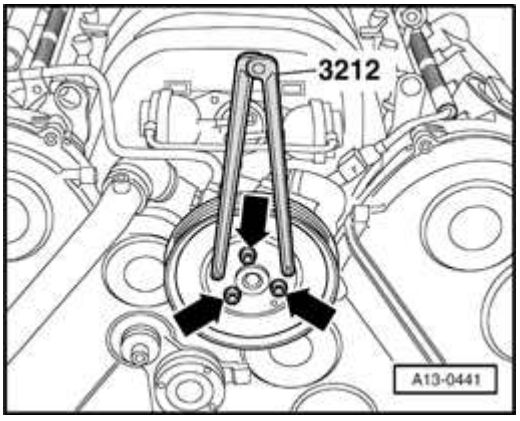


Fig. 119: Removing Ribbed Belt Gear Of Vane Pump Using 3212 Spanner Wrench As Retainer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove ribbed belt gear of power steering pump (arrows) using 3212 spanner wrench as retainer.

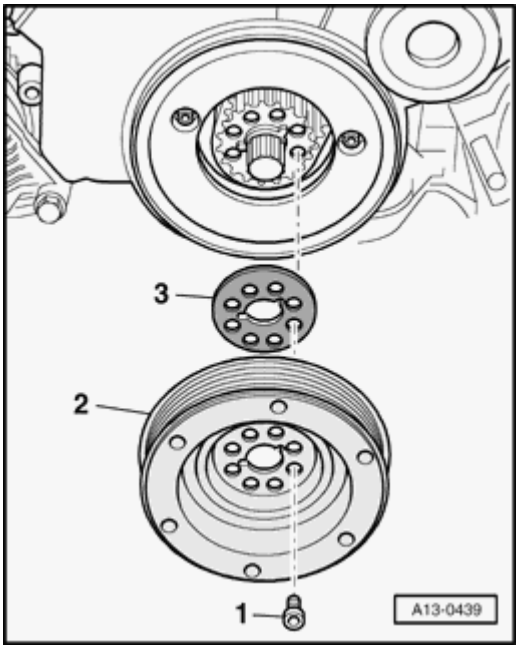


Fig. 120: Removing Bolts, Harmonic Balancer And Thrust Washer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove 8 bolts -1-.
- Remove harmonic balancer -2- and thrust washer -3-.

NOTE:

- **Thrust washer -3- is only installed on toothed belt gear with part number 06C 105 063 A.**

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- **No thrust washer must be installed for toothed belt gear with part number 06C 105 063 B.**

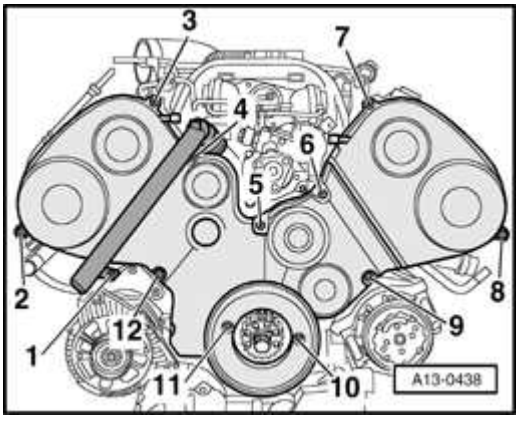


Fig. 121: Unscrewing Bolts And Removing Toothed Belt Guards
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1 to 12- and remove toothed belt guards.

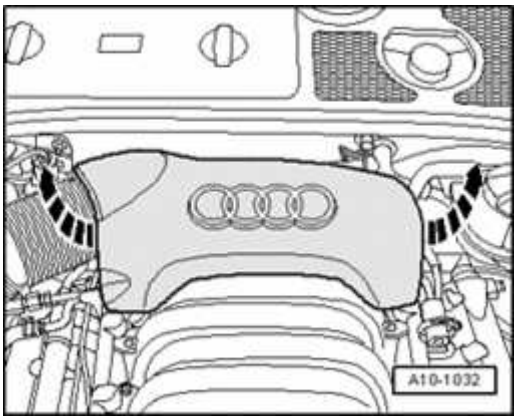


Fig. 122: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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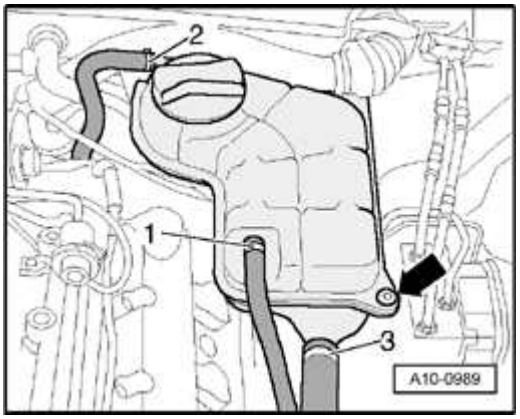


Fig. 123: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of expansion tank.
- Tie coolant expansion tank with connected coolant hoses -1 to 3- to side.

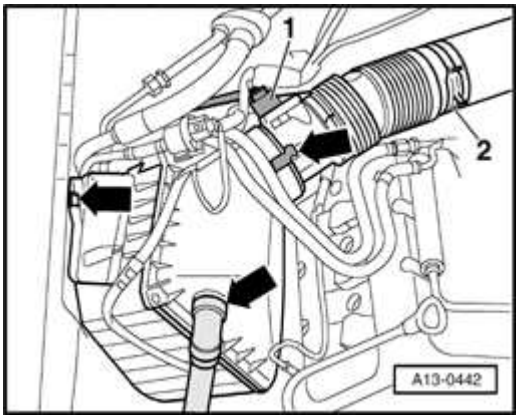


Fig. 124: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).
- Disconnect electrical harness connector -1- at Mass Air Flow (MAF) sensor.
- Remove air guide hose -2- together with Mass Air Flow (MAF) sensor.

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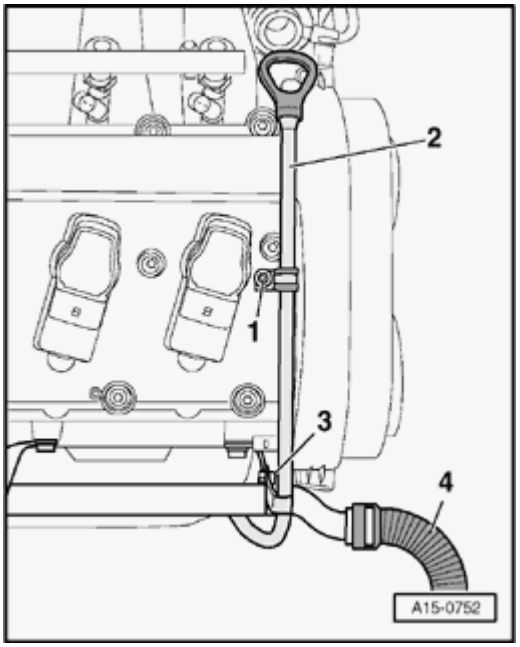


Fig. 125: Identifying Bolts, Hose From Line Of Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -3-.
- Disconnect hose -4- from line of secondary air injection.
- Pull out guide tube for oil dipstick 2 from the oil pan (upper part) toward top and swing it forward for removal.

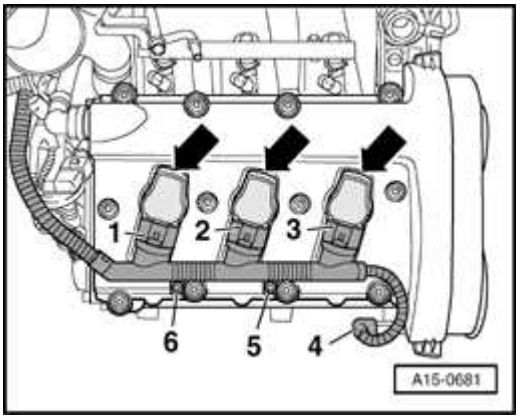


Fig. 126: Removing Bolts At Right Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -5- and -6- at right cylinder head cover.
- Disconnect electrical harness connectors -1- to -4-.
- Remove ignition coils (arrows).

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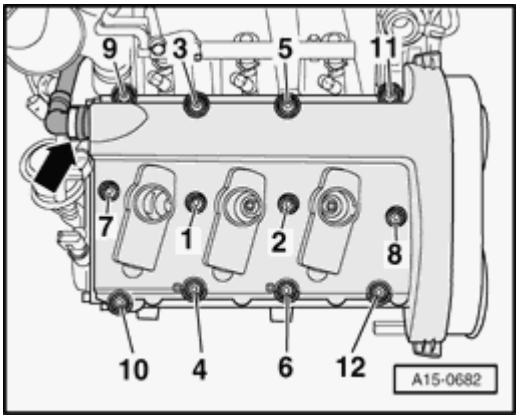


Fig. 127: Removing/Installing Hose Of Crankshaft Housing Ventilation & Unscrewing/Screwing Bolts For Right Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove hose of crankshaft housing ventilation (arrow).
- Unscrew bolts for right cylinder head cover in sequence -12- to -1-.
- Remove cylinder head cover.

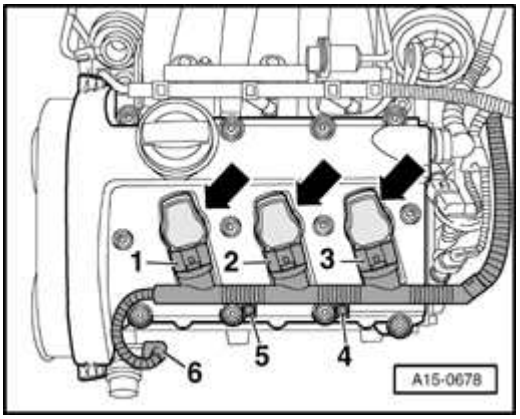


Fig. 128: Removing Bolts At Left Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -4- and -5- at left cylinder head cover.
- Disconnect electrical harness connectors -1- to -3- and -6-.
- Remove ignition coils (arrows).

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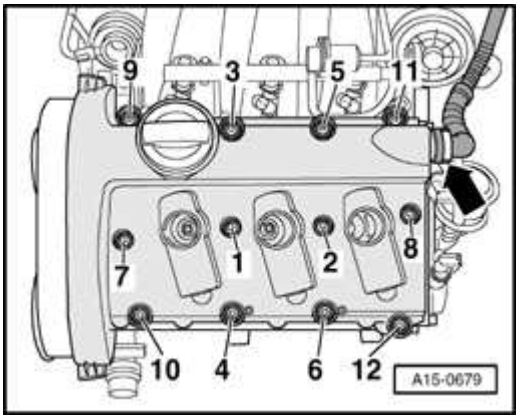


Fig. 129: Removing Hose Of Crankshaft Housing Ventilation & Unscrewing Bolts For Left Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove hose of crankshaft housing ventilation (arrow).
- Unscrew bolts for left cylinder head cover in sequence -12- to -1-.
- Remove cylinder head cover.

WARNING: Turning of the engine must only occur in direction of engine rotation (clockwise) at the crankshaft.

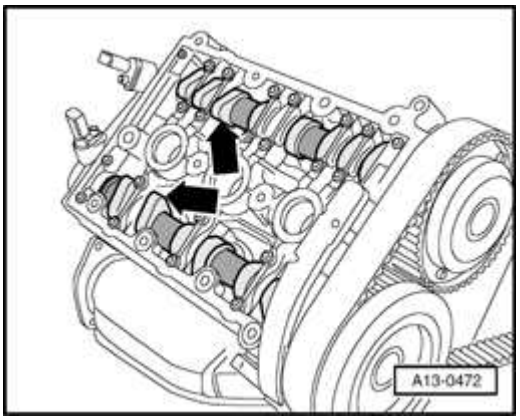


Fig. 130: Turning Engine Until Cams At Intake And Exhaust Camshaft Of Cylinder 3 (Right Cylinder Bank) Point Upward Uniformly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn engine until cams (arrows) at intake and exhaust camshaft of cylinder 3 (right cylinder bank) point upward uniformly.

NOTE: Turn engine at crankshaft central bolt.

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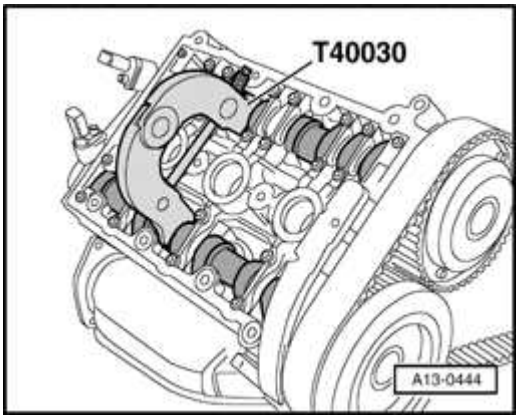


Fig. 131: Inserting T40030 Camshaft Adjuster Gauge At Camshafts Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert T40030 camshaft adjuster gauge at camshafts of right cylinder head.

NOTE: Slightly turn crankshaft back and forth so that the claw of T40030 camshaft adjuster gauge can properly grab the camshafts.

- Spread T40030 camshaft adjuster gauge with threaded shaft (tightening torque 10 Nm) until it is seated without axial play.

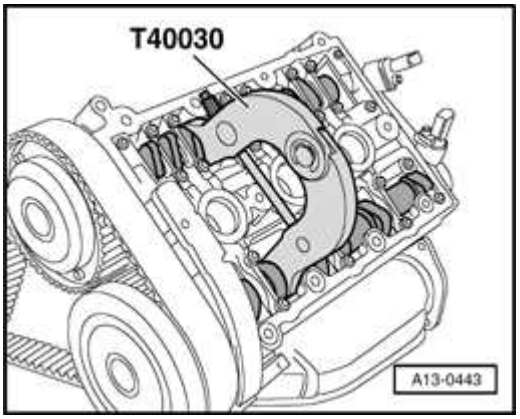


Fig. 132: Inserting T40030 Camshaft Adjuster Gauge At Left Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert T40030 camshaft adjuster gauge at left cylinder head in same manner.
- If installed, disconnect electrical harness connector at after-run coolant pump.
- Unscrew sealing plug of TDC mark at cylinder block.

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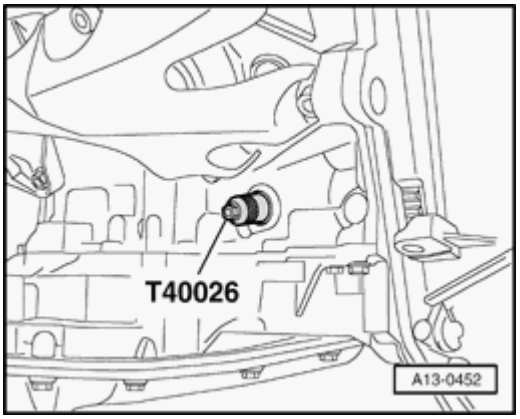


Fig. 133: Threading T40026 Locking Pin Into Hole Of Removed Sealing Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread T40026 locking pin into hole of removed sealing plug and tighten.

NOTE: Slightly turn crankshaft back and forth to do so.

NOTE: Catch escaping oil using a rag.

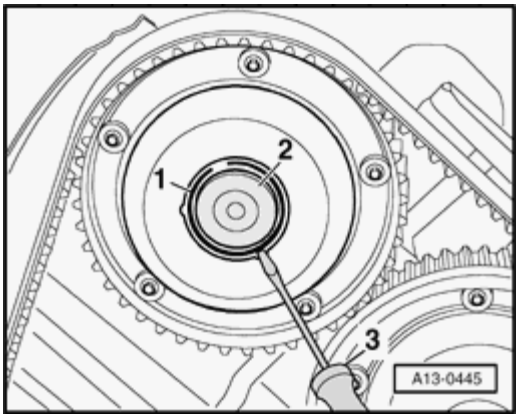


Fig. 134: Prying Off Securing Rings For Caps At All Camshaft Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off securing rings -1- for caps -2- at all camshaft gears.

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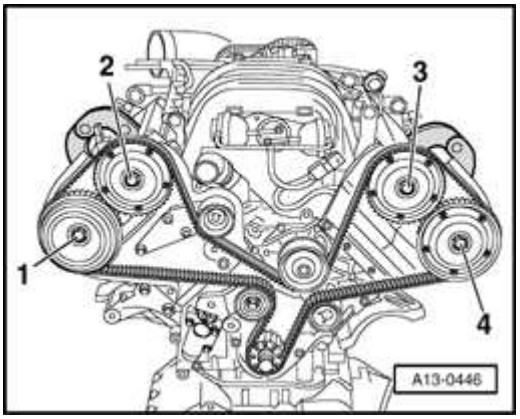


Fig. 135: Loosening Bolts For Camshaft Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen but do not remove bolts -1- to -4- for camshaft gears.

NOTE: The bolts remain loosely threaded in.

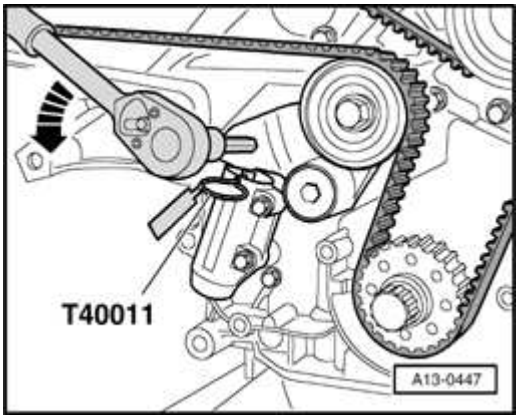


Fig. 136: Turning Toothed Belt Tensioner Until Tensioning Lever Pushes Tensioner Together Far Enough So That T40011 Pin Can Be Inserted Into Bore Of Pistons And Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using an 8 mm hex socket wrench, turn toothed belt tensioner in direction of arrow until tensioning lever pushes tensioner together far enough so that T40011 pin can be inserted into bore of pistons and housing.

NOTE:

- **The toothed belt tensioner is oil-dampened. Compress it by slowly applying constant pressure.**
- **Mark rotational direction of toothed belt. Reversing the direction in which it runs can ruin it.**

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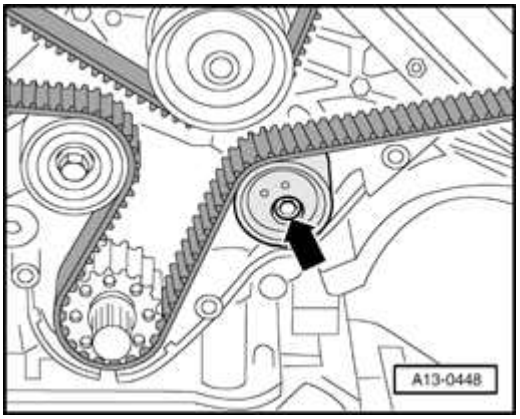


Fig. 137: Loosening Bolt Of Eccentric Pulley
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolt (arrow) of eccentric pulley.
- Remove toothed belt.

Installing (adjusting valve timing)

- Camshafts aligned using T40030 camshaft adjuster gauge
- Crankshaft aligned using T40026 locking pin
- Camshaft gears loosened.

NOTE:

- **Replace gaskets, O-rings and self-locking bolts.**
- **When turning camshaft, crankshaft must not be at TDC for any cylinder. Valves and/or pistons may be damaged.**

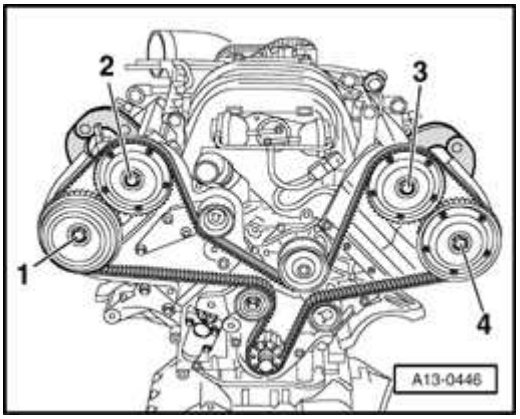


Fig. 138: Loosening Bolts For Camshaft Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolt in camshaft gears -1- to -4- far enough so they can still just be turned without canting.
- Install toothed belt as depicted in illustration.

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- For exact valve timing adjustment, toothed belt must make exact contact with front edge of all toothed belt gears.

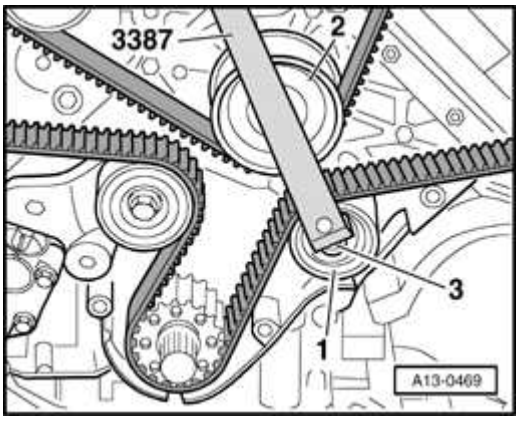


Fig. 139: Using 3387 Pin Wrench To Turn Eccentric Pulley Until Handle Of Pin Wrench Is Exactly Above Center Axle Of Coolant Pump Gear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using 3387 pin wrench, turn eccentric pulley -1- in clockwise direction until handle of pin wrench is exactly above center axle of coolant pump gear -2-.
- Hold pin wrench in this position and tighten bolt -3- to 45 Nm.

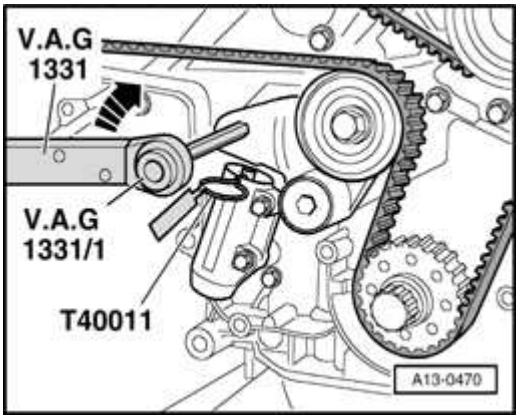


Fig. 140: Pre-Tension Toothed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque wrench horizontally on socket-head of tensioning lever.
- Turn with 45 Nm in direction of arrow to pre-tension toothed belt.

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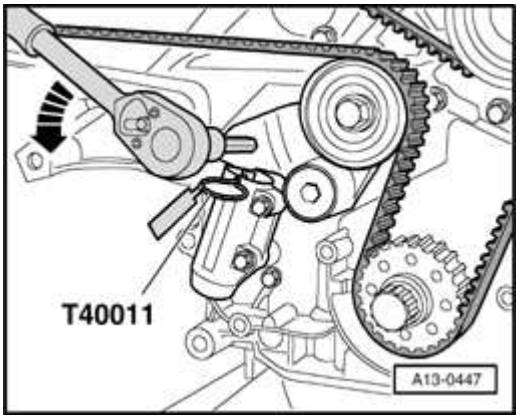


Fig. 141: Turning Toothed Belt Tensioner Until Tensioning Lever Pushes Tensioner Together Far Enough So That T40011 Pin Can Be Inserted Into Bore Of Pistons And Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using 8 mm socket head wrench, turn toothed belt tensioning roller in direction of arrow until T40011 pin can pulled out.

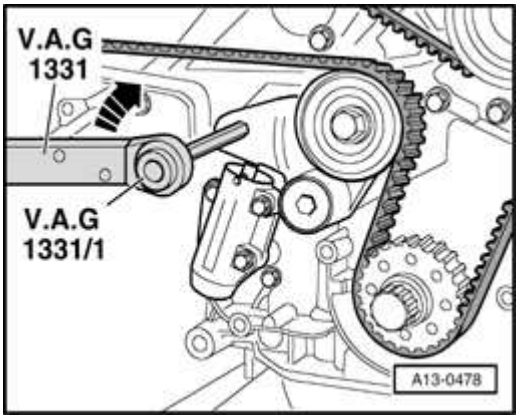


Fig. 142: Tensioning Toothed Belt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place torque wrench horizontally on socket-head of tensioning lever.
- Turn with 25 Nm in direction of arrow to tension toothed belt.

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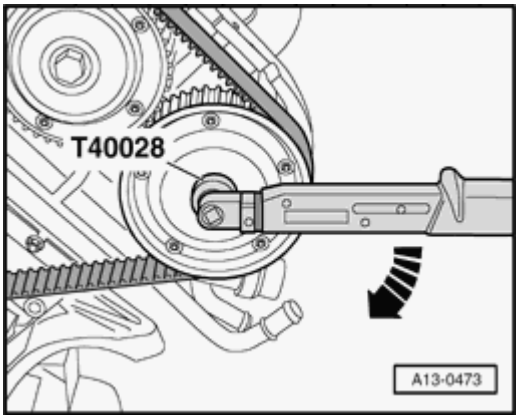


Fig. 143: Inserting T40028 Socket At Camshaft Adjuster Of Exhaust Camshaft On Left Cylinder Bank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert T40028 socket at camshaft adjuster of exhaust camshaft on left cylinder bank.
- Turn rotor of camshaft adjuster clockwise to 10 Nm up to stop (arrow).

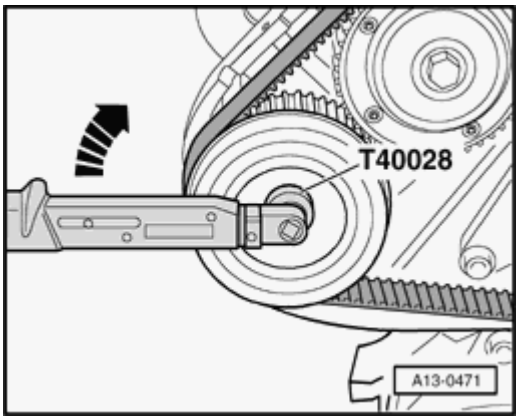
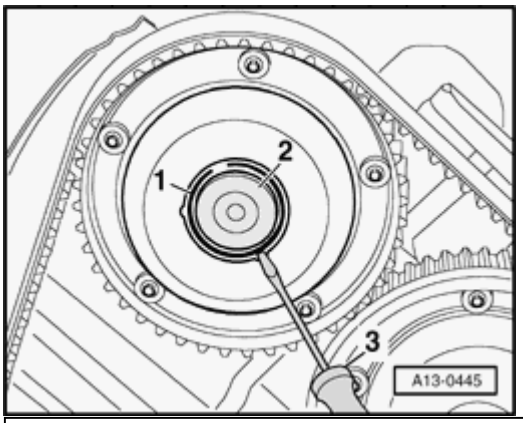


Fig. 144: Turning Rotor Of Camshaft Adjuster At Right Cylinder Bank Clockwise
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn rotor of camshaft adjuster at right cylinder bank clockwise to 10 Nm up to stop (arrow).
- Tighten bolts for all four camshaft gears to 100 Nm.



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Fig. 145: Prying Off Securing Rings For Caps At All Camshaft Gears
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert caps -2- with new O-rings -1- at camshaft gears and secure them with securing ring.
- Remove T40030 camshaft adjuster gauge.
- Remove T10026 alignment bolt and thread sealing plug of TDC marking with new O-ring into cylinder block.

Installation is reverse of removal, noting the following:

- Install cylinder head covers. Refer to **Installing** for Left cylinder head cover or **Installing** for Right cylinder head cover.
- Install toothed belt guards. Refer to **Toothed belt cover, removing and installing**.
- Install harmonic balancer. Refer to **Vibration damper, removing and installing**.
- Install ribbed belt. Refer to **Installing**.

Tightening torques

Component		Nm
Eccentric pulley to front sealing flange		45
Camshaft gear to camshaft		100
Sealing plug in cylinder block		25
Ribbed belt tensioner to cylinder block.	M8	23
	M10	40
Belt pulley to power steering pump		23

SEALING FLANGES AND FLYWHEEL/DRIVE PLATE, REMOVING AND INSTALLING

Sealing flanges and flywheel/drive plate, removing and installing

NOTE: Servicing clutch.

Refer to

- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **30 CLUTCH** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

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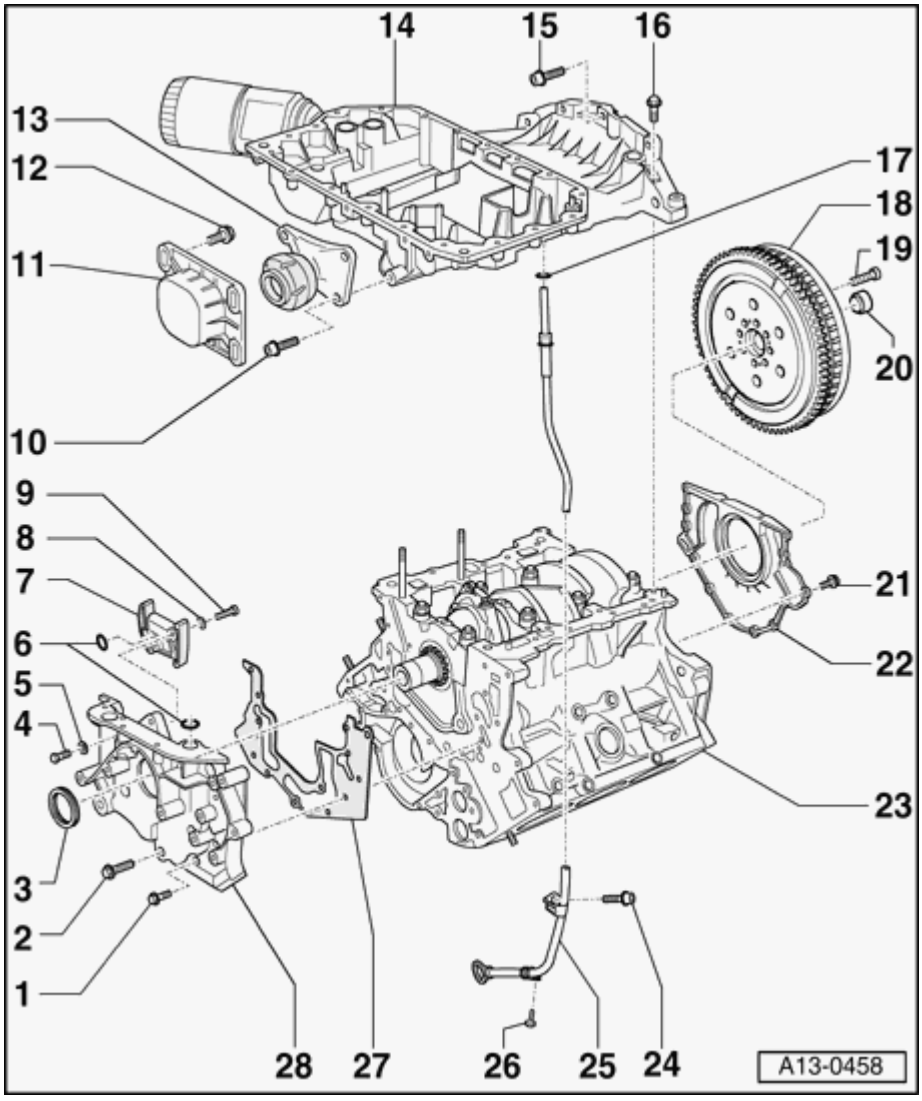


Fig. 146: Sealing Flanges And Flywheel/Drive Plate Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - 30 Nm

- Self-locking
- Always replace

3 - Seal

- For crankshaft
- Removing and installing. Refer to **Seal for crankshaft (ribbed belt side), replacing**

4 - Locking bolt - 10 Nm

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5 - Seal

- Always replace

6 - O-ring

- Always replace

7 - Chain tensioner

- Removing and installing. Refer to **Drive chain or chain tensioner for oil pump, removing and installing**

8 - Washer

9 - 12 Nm

10 - 40 Nm

11 - Stop

- For torque support

12 - 28 Nm

13 - Torque support

14 - Oil pan (upper part)

- Removing and installing. Refer to **Oil pan (upper part), removing and installing**

15 - 45 Nm

16 - M7 = 16 Nm, M8 = 22 Nm

17 - O-ring

- Always replace

18 - Dual-mass flywheel or drive plate

- Flywheel, removing and installing. Refer to **Flywheel and drive plate, removing and installing**
- Drive plate, removing and installing. Refer to **Drive plate for automatic transmission 01V**

19 - Special bolt

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- Always replace
- Tightening torque. Refer to **Tightening torques** for Dual-mass flywheel or flywheel for automatic transmission 01J or **Tightening torques** for Drive plate for automatic transmission 01V

20 - Needle bearing

- Removing and installing. Refer to **Dual-mass flywheel pilot needle bearing, removing and installing**
- Not for automatic transmission 01V
- For automatic transmission 01V, a centering bushing is bolted into crankshaft instead of needle bearing. See **Centering bushing of drive plate for automatic transmission 01V**

21 - 10 Nm

22 - Sealing flange rear with oil seal

- Removing and installing. Refer to **Rear sealing flange, removing and installing**
- Lightly oil lip of O-ring.
- To install, slide guide sleeve from kit onto crankshaft

23 - Cylinder block

- Crankshaft, removing and installing. Refer to **Crankshaft, removing and installing**
- Pistons and connecting rods, disassembling and assembling. Refer to **Pistons and connecting rods, disassembling and assembling**

24 - 20 Nm

25 - Guide tube for oil dipstick

26 - Sheet metal screw

27 - Gasket

- Always replace

28 - Sealing flange, front

- Removing and installing. Refer to **Front sealing flange, removing and installing**

Centering bushing of drive plate for automatic transmission 01V

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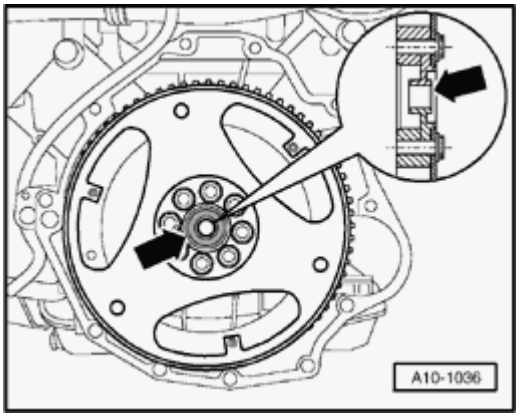


Fig. 147: Bolting Drive Plate To Crankshaft With Centering Bushing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

For vehicles with an automatic transmission, the drive plate is bolted to the crankshaft with a centering bushing (arrow).

Seal for crankshaft (ribbed belt side), replacing

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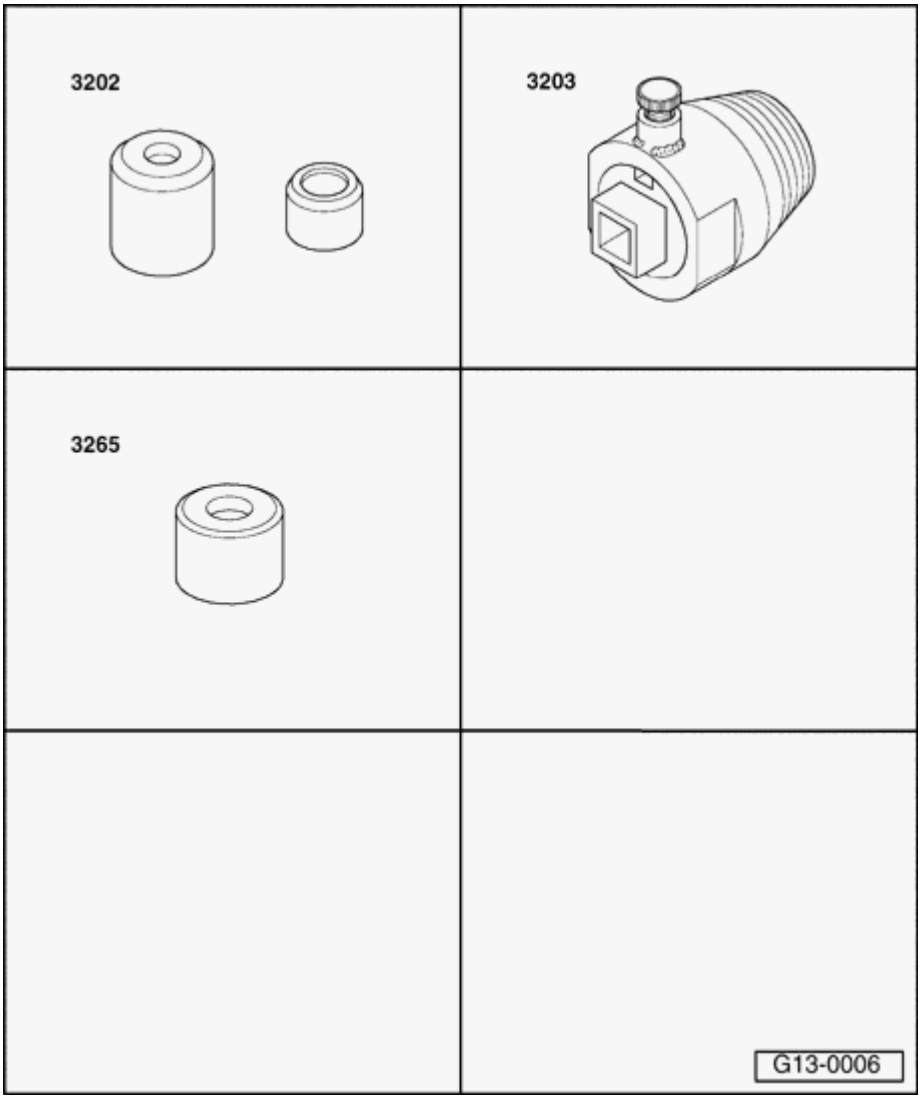


Fig. 148: Identifying Special Tools - Seal For Crankshaft (Ribbed Belt Side), Replacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- 3202/1 Pull sleeve
- 3203 Seal remover
- 3265 Seal installer

Removing

- Engine installed.

  - Remove toothed belt. Refer to **Toothed belt, removing and installing**.

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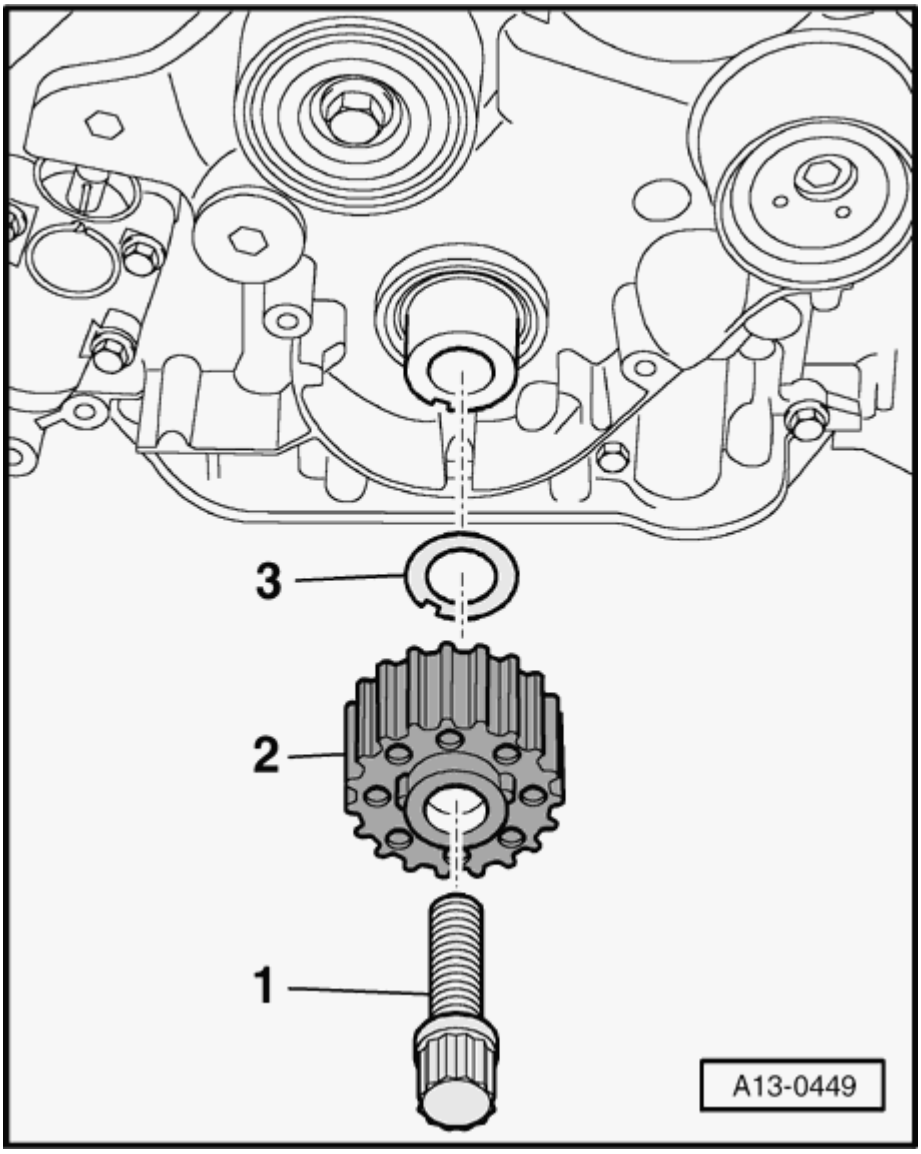


Fig. 149: Identifying Center Bolt, Crankshaft Toothed Belt Gear & Diamond Disc
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center bolt -1- for crankshaft toothed belt gear -2-.
- Remove toothed belt gear.
- Remove diamond disc -3- from toothed belt gear.
- Unscrew inner portion of 3203 seal remover six rotations from outer portion and secure with knurled-head screw.

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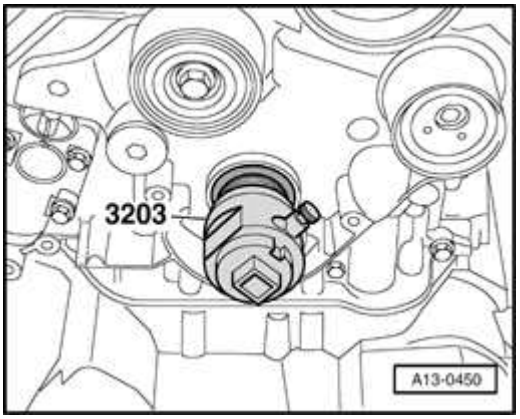


Fig. 150: Oil Threaded Head Of 2085 Seal Puller Positioning
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Oil threaded head of 2085 seal puller, position and with forced pressure screw into oil seal as far as possible.
- Loosen knurled bolt and turn inner part against crankshaft until oil seal is removed.
- Clamp seal puller into vise at flattened regions. Remove O-ring with pliers.

Installing

- Clean contact surface and sealing surface.

NOTE: Do not oil sealing lip or outer edge of sealing ring before pressing in.

- Slide on sealing ring using 3202/1 pull sleeve.

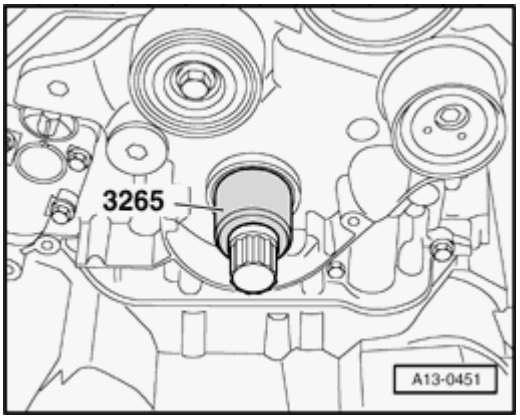


Fig. 151: Pressing In Sealing Ring Using 3265 Seal Installer And Central Bolt Up To Stop
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press in sealing ring using 3265 seal installer and central bolt up to stop.

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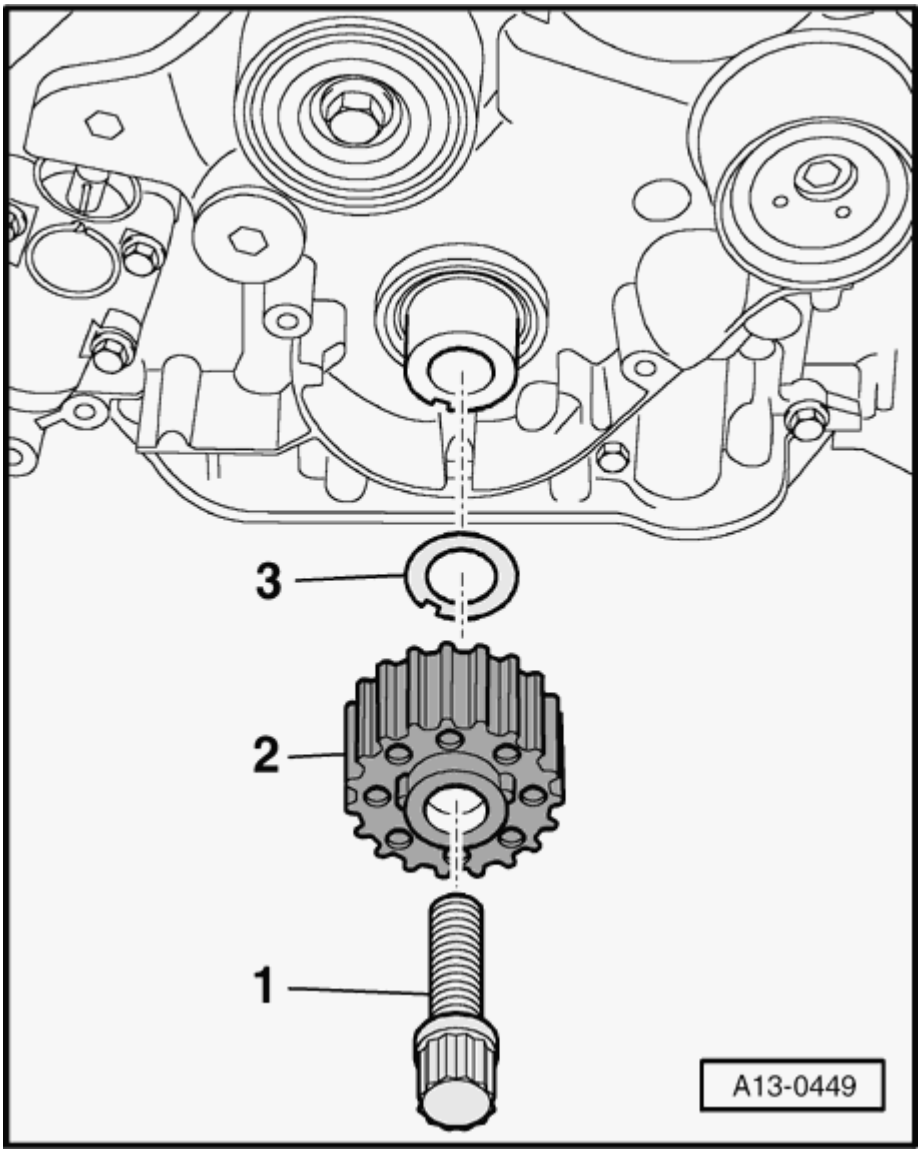


Fig. 152: Identifying Center Bolt, Crankshaft Toothed Belt Gear & Diamond Disc
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft toothed belt gear -2- with new diamond disc -3- and new center bolt -1-.

NOTE:

- **Contact surfaces between toothed belt gear, diamond disc and crankshaft must be free of oil.**
- **Do not additionally oil bolt for toothed belt gear for crankshaft.**

- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.

Tightening torque

Component	Nm

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Toothed belt gear to crankshaft	200 + 180°1)2)

1) Always replace bolt

2) 180°= one half-turn

Front sealing flange, removing and installing

Special tools and equipment

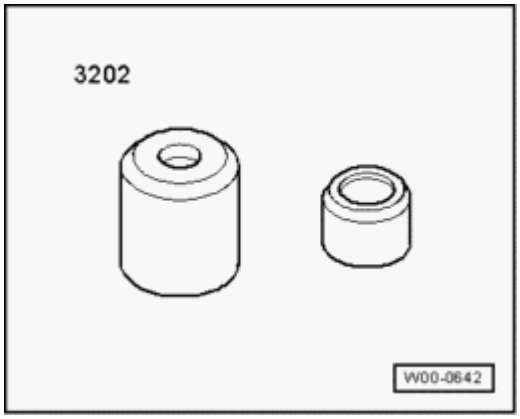


Fig. 153: 3202/1 Pull Sleeve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3202/1 Pull sleeve

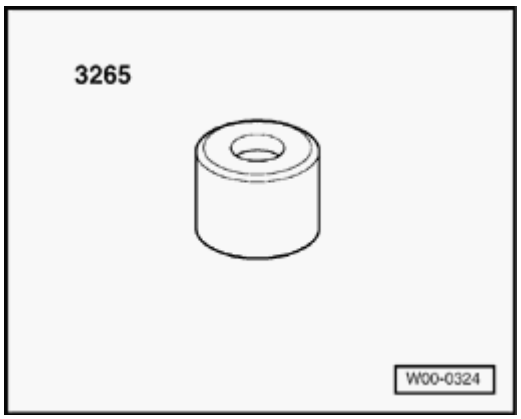


Fig. 154: 3265 Seal Installer
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3265 Seal installer

Removing

- Lock carrier in service position. Refer to **Lock carrier, moving into service position**.

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- Remove toothed belt. Refer to **Toothed belt, removing and installing**.
- Remove camshaft gears from right cylinder head.

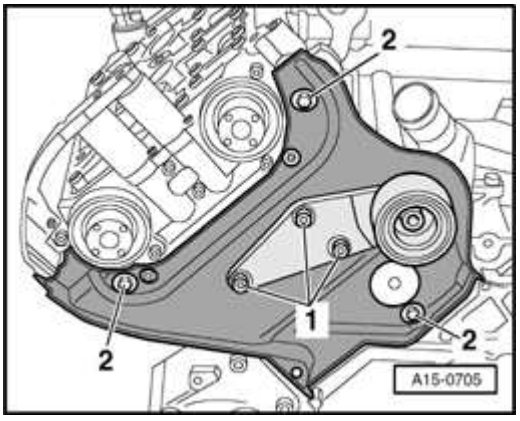


Fig. 155: Unscrewing Bolts And Removing Bracket With Idler Roller & Toothed Belt Guard At Right Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and remove bracket with idler roller.
- Unscrew bolts -2- and remove toothed belt guard at right rear.
- Remove oil pan (upper part). Refer to **Oil pan (upper part), removing and installing**.

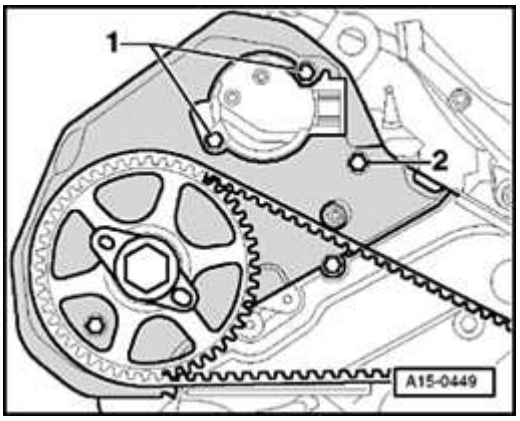


Fig. 156: Removing Center Bolt For Crankshaft Toothed Belt Gear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove center bolt -1- for crankshaft toothed belt gear -2-.
- Remove toothed belt gear and diamond disc -3-.

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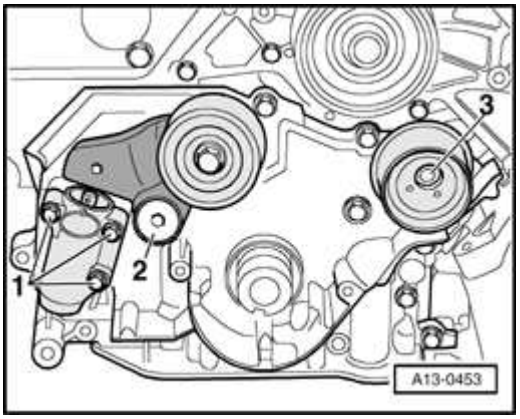


Fig. 157: Installing Eccentric Roller Loosely
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt eccentric roller -3-, tensioning lever -2- with tensioning roller and tensioner -1-.

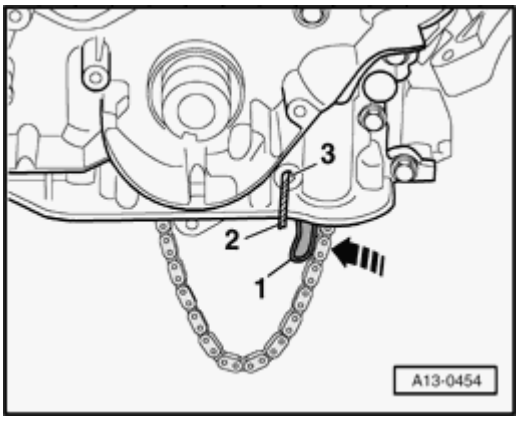


Fig. 158: Pressing Chain Tensioner Until Drill Bit Can Be Slid Into Alignment Hole Of Sealing Flange And Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew locking bolt from adjustment hole -3-.
- Press chain tensioner -1- in direction of arrow until a 3 mm drill bit -2- can be slid into alignment hole of sealing flange and chain tensioner.

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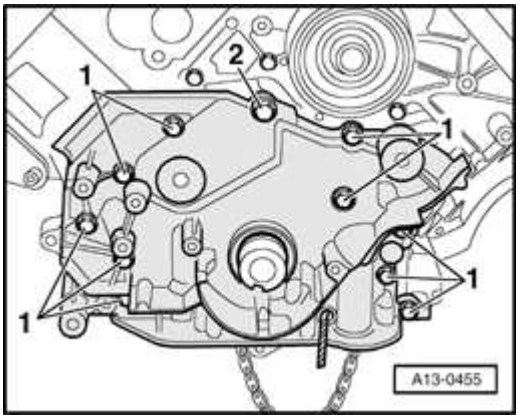


Fig. 159: Removing Bolts & Front Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-.
- Remove front sealing flange.
- Drive out sealing ring with the flange removed.

NOTE: Remove chain tensioner to replace sealing flange. Refer to Drive chain or chain tensioner for oil pump, removing and installing.

Installing

Installation is reverse of removal, noting the following:

NOTE: Always replace seals, sealing rings and self-locking bolts.

- Clean sealing surfaces before installing sealing flange.
- Install front sealing flange with secured chain tensioner.

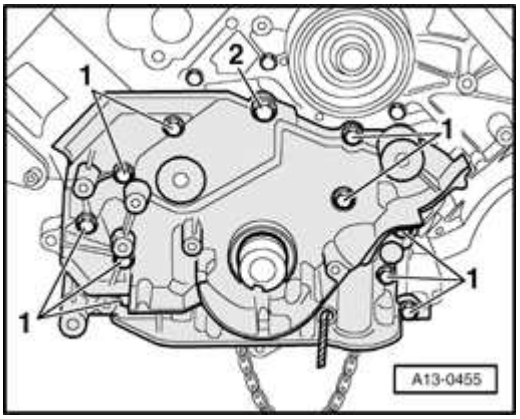


Fig. 160: Removing Bolts & Front Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Replace bolt -2-.
- Tighten bolts -1- to 10 Nm and bolt -2- to 30 Nm.
- Do not oil sealing lip or outer edge of sealing ring before pressing in.
- Slide on sealing ring using 3202/1 pull sleeve.

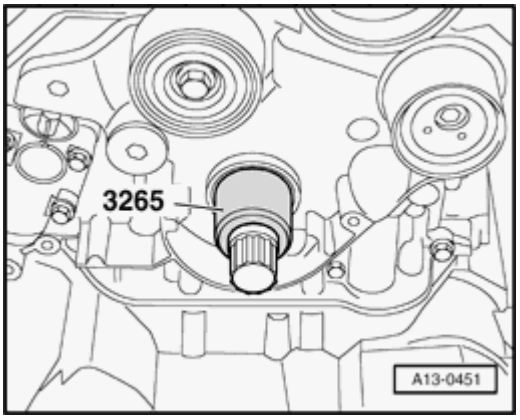


Fig. 161: Pressing In Sealing Ring Using 3265 Seal Installer And Central Bolt Up To Stop
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press in sealing ring using 3265 seal installer and central bolt up to stop.

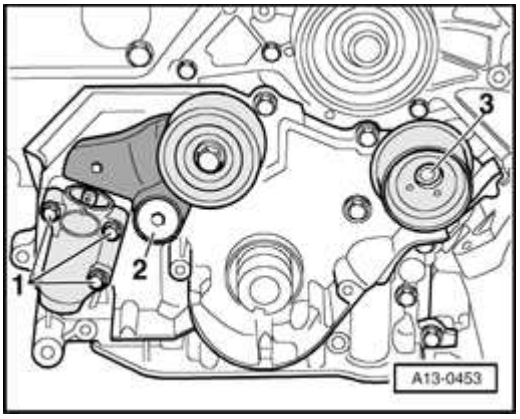


Fig. 162: Installing Eccentric Roller Loosely
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install eccentric roller 3 loosely.

NOTE: Note washer below tensioning lever -2-.

- Install tensioning lever -2- using tensioner roller and tensioner -1-.

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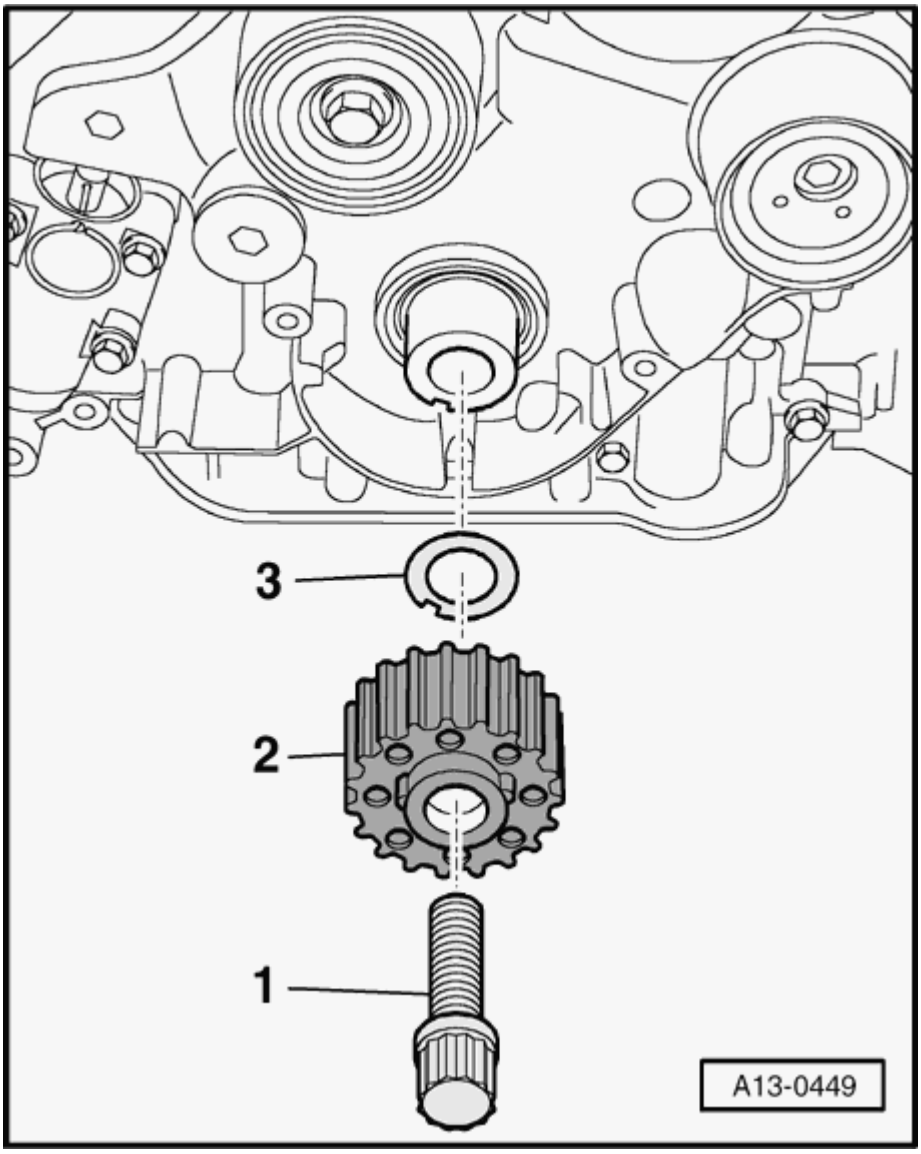


Fig. 163: Identifying Center Bolt, Crankshaft Toothed Belt Gear & Diamond Disc
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install crankshaft toothed belt gear -2- with new diamond disc -3- and new central bolt -1-.

NOTE:

- **Contact surfaces between toothed belt gear, diamond disc and crankshaft must be free of oil.**
- **Do not additionally oil bolt for toothed belt gear for crankshaft.**

- Remove oil pan (upper part). Refer to **Removing**.
- After installing oil pump, remove drill bit from adjusting hole and thread in locking bolt with new sealing ring.
- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.

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Tightening torques

Component		Nm
Front sealing flange to	M6	10
Cylinder block	M8	30 1)
Tensioning lever to front sealing flange		45 1)
Tensioning lever to front sealing flange		10
Toothed belt gear to crankshaft		200 + 180°1)2)
Locking bolt for adjustment hole to front sealing flange		10

1) Replace bolts.

2) 180°= one half-turn

Rear sealing flange, removing and installing

Required equipment

- Drill with plastic brush attachment
- Protective glasses
- Silicone sealant

Removing

- Engine removed

  - Remove flywheel. Refer to **Removing** for Dual-mass flywheel or flywheel for automatic transmission 01J or remove drive plate. Refer to **Removing** for Drive plate for automatic transmission 01V.
  - Remove oil pan (upper part). Refer to **Oil pan (upper part), removing and installing**.

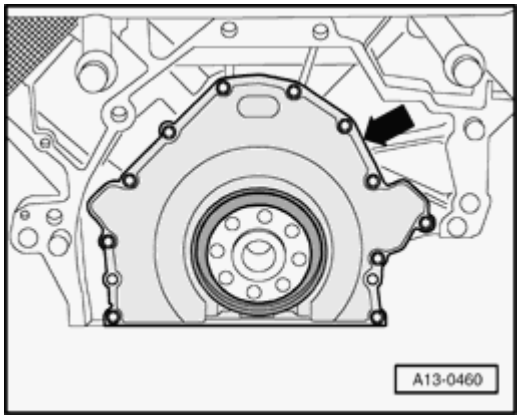


Fig. 164: Unbolting Rear Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Unbolt rear sealing flange (arrow).

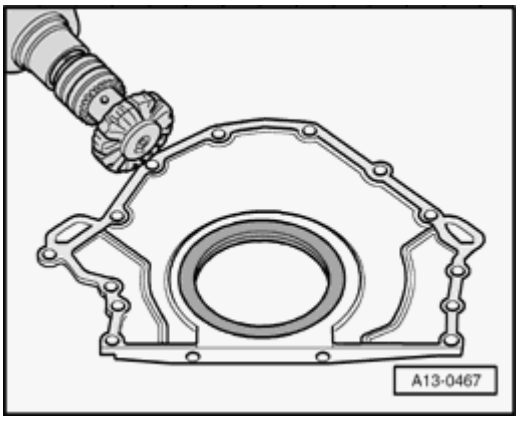


Fig. 165: Using Rotating Plastic Brush To Remove Remaining Sealant From Rear Sealing Flange And At Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using rotating plastic brush, remove remaining sealant from rear sealing flange and at cylinder block.

  WARNING: Wear protective glasses.

- Clean sealing surfaces so they are completely free of any oil or grease.

Installing

Installation is reverse of removal, noting the following:

NOTE: The rear sealing flange must be installed within 5 minutes after application of silicon sealant.

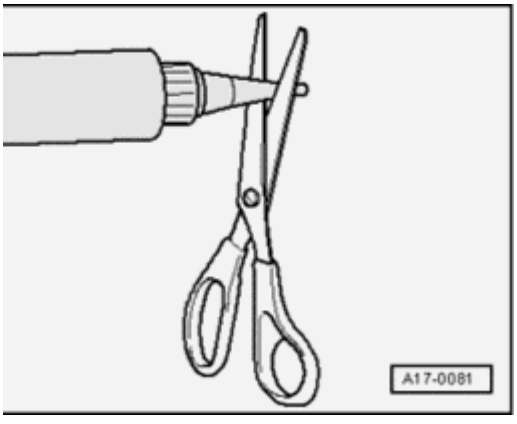


Fig. 166: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Cut tube nozzle at front marking (jet diameter approx. 1 mm).

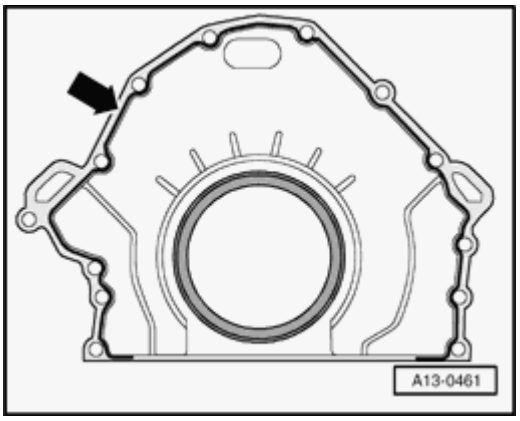


Fig. 167: Applying Silicone Sealant Bead To Clean Sealing Surfaces Of Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply silicone sealant bead to clean sealing surfaces of sealing flange as shown in illustration.

- Thickness of sealant bead (arrows): approx. 1.5 mm

NOTE: Sealant bead must not be thicker than specified, otherwise sealant could get into oil pan and clog the oil pump strainer.

- To install, slide guide sleeve from kit onto crankshaft.
- Remove oil pan (upper part). Refer to **Removing**.
- Install flywheel. Refer to **Installing** for Dual-mass flywheel or flywheel for automatic transmission 01J or install drive plate. Refer to **Installing** for Drive plate for automatic transmission 01V.

Tightening torque

Component	Nm
Rear sealing flange to cylinder block	10

Damper unit, removing and installing

Automatic transmission (CVT) 01J

With reciprocating engines, torsional vibrations are produced at the crankshaft due to irregularity of the combustion process.

The torsional vibrations are transmitted to the transmission where they cause resonant vibrations. This results in noise and excessive stress on the components.

In 6-cylinder engines the engine torque is transmitted to the transmission via a flywheel damper unit in order to prevent the torsional vibrations from entering the transmission.

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Removing

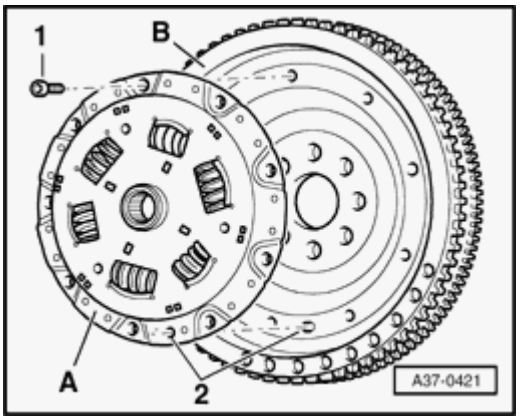


Fig. 168: Unscrewing/Screwing Bolts And Removing/Installing Damper Unit From Flywheel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and remove damper unit -A- from flywheel -B-.

NOTE: For removal and installation of the flywheel -B-. Refer to Flywheel and drive plate, removing and installing.

Installing

Install in reverse order, paying attention to following:

NOTE: The part number of the damper unit is assigned to the transmission code letter.

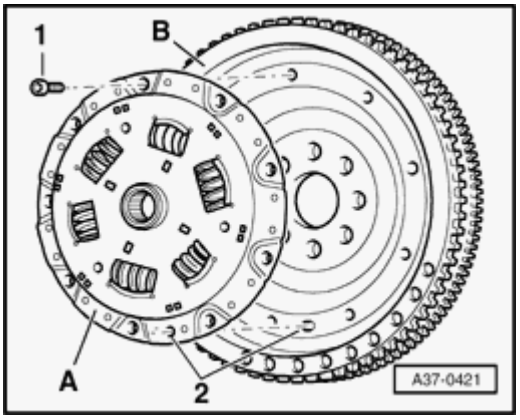


Fig. 169: Unscrewing/Screwing Bolts And Removing/Installing Damper Unit From Flywheel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Align damper unit -A- with flywheel -B-.

- Two lugs -2- must line up with each other

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- Hand-tighten bolts -1- (9 pcs.).
- Tighten bolts to 25 Nm in diagonal sequence.

Flywheel and drive plate, removing and installing

Special tools and equipment

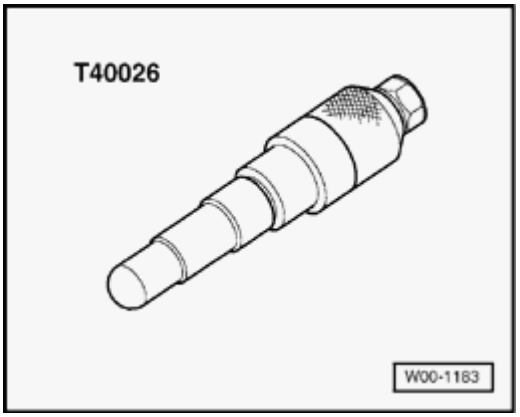


Fig. 170: T40026 Locking Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T40026 Locking pin

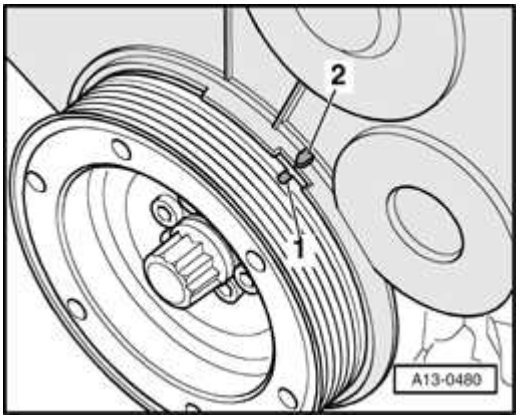
Dual-mass flywheel or flywheel for automatic transmission 01J

Removing

- Transmission removed

WARNING: Turning of the engine must only occur in direction of engine rotation (clockwise) at the crankshaft.

- Turn crankshaft via center bolt of toothed belt gear in direction of engine rotation to TDC Cyl. 3 marking.



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Fig. 171: Identifying Notch Lines Up With Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Notch -1- lines up with marking -2-

- If installed, disconnect electrical harness connector at after-run coolant pump.
- Unscrew sealing plug of TDC mark at cylinder block.

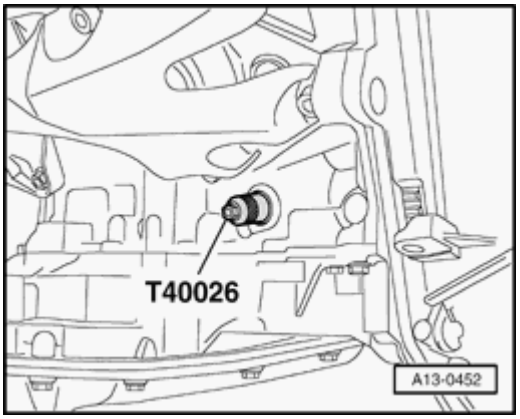


Fig. 172: Threading T40026 Locking Pin Into Hole Of Removed Sealing Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread T40026 locking pin into hole of removed sealing plug and tighten.

NOTE: Slightly turn crankshaft back and forth to do so.

- Remove clutch pressure plate.

Refer to

- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **30 CLUTCH** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

- Remove damper unit: Refer to **Damper unit, removing and installing**.
- Mark flywheel to engine.
- Unbolt flywheel.

Installing

Installation is reverse of removal, noting the following:

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NOTE: **Needle bearing is located in the flywheel and must be driven in when flywheel is replaced. Refer to Dual-mass flywheel pilot needle bearing, removing and installing**

- Replace bolts and tighten.
- Install clutch pressure plate.

Refer to

- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **30 CLUTCH** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

- Install damper unit: Refer to **Installing**.
- Remove T10026 alignment bolt and thread sealing plug of TDC marking with new O-ring into cylinder block.

Tightening torques

Component		Nm
Flywheel to crankshaft		
Bolt length	22.5 mm	60 + 90°1)2)
Bolt length	35.0 mm	60 + 180°2)3)
Bolt length	43.0 mm	60 + 180°2)3)
Sealing plug in cylinder block		25

1) 90° corresponds to one quarter-turn

2) Replace bolts.

3) 180° = one half-turn

Drive plate for automatic transmission 01V

Removing

- Transmission removed

WARNING: **Turning of the engine must only occur in direction of engine rotation (clockwise) at the crankshaft.**

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- Turn crankshaft via center bolt of toothed belt gear in direction of engine rotation to TDC Cyl. 3 marking.

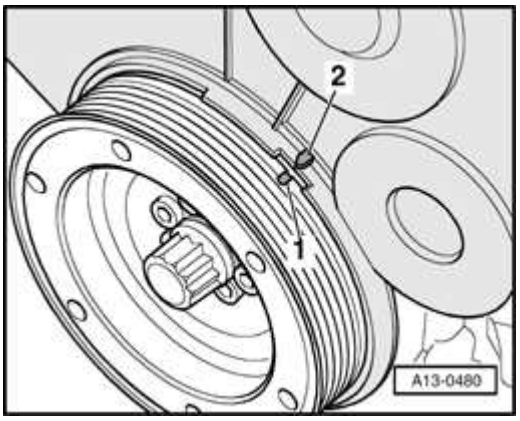


Fig. 173: Identifying Notch Lines Up With Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Notch -1- lines up with marking -2-

- If installed, disconnect electrical harness connector at after-run coolant pump.
- Unscrew sealing plug of TDC mark at cylinder block.

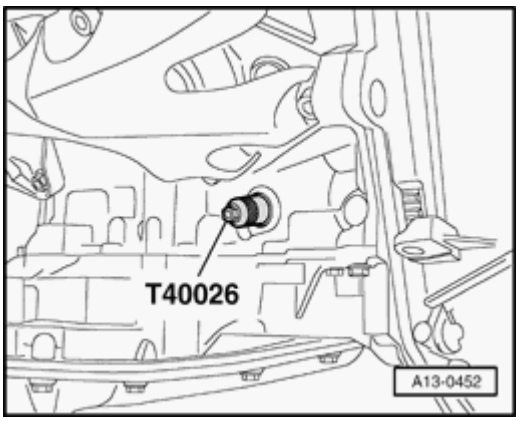


Fig. 174: Threading T40026 Locking Pin Into Hole Of Removed Sealing Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread T40026 locking pin into hole of removed sealing plug and tighten.

NOTE: Slightly turn crankshaft back and forth to do so.

- Mark drive plate to engine.
- Remove drive plate.

Installing

Installation is reverse of removal, noting the following:

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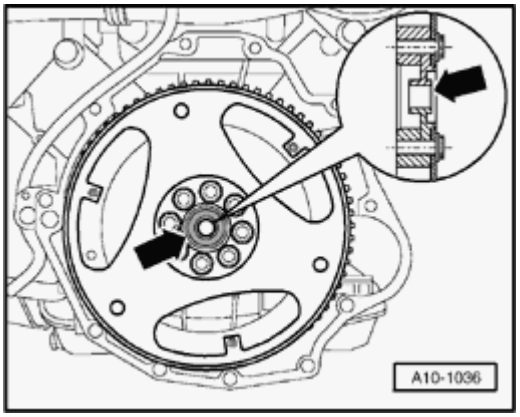


Fig. 175: Bolting Drive Plate To Crankshaft With Centering Bushing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolt drive plate to crankshaft with a centering bushing (arrow).
- Replace bolts and tighten.
- Remove T10026 alignment bolt and thread sealing plug of TDC marking with new O-ring into cylinder block.

Tightening torques

Component		Nm
Drive plate to crankshaft		
Bolt length	22.5 mm	60 + 90°1)2)
Bolt length	35.0 mm	60 + 180°2)3)
Sealing plug in cylinder block		25

1) 90° = one quarter-turn

2) Replace bolts.

3) 180° = one half-turn

Dual-mass flywheel pilot needle bearing, removing and installing

Special tools and equipment

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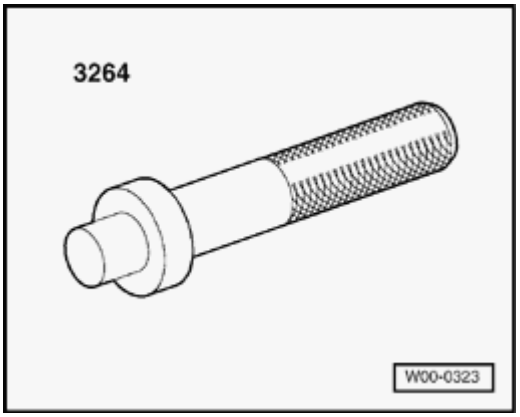


Fig. 176: 3264 Bearing Driver
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3264 Bearing driver

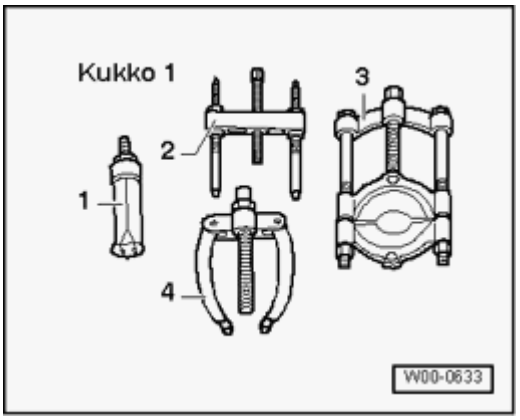


Fig. 177: Kukko 21/2 Internal puller, Kukko 21/4 Internal puller, Kukko 22/2 Counter support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Special tool Kukko 21/1 (Item -1-) and Kukko 22/1 (Item -4-)

Procedure

- Transmission removed
  - Remove clutch pressure plate.

Refer to

- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **30 CLUTCH** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE

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- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

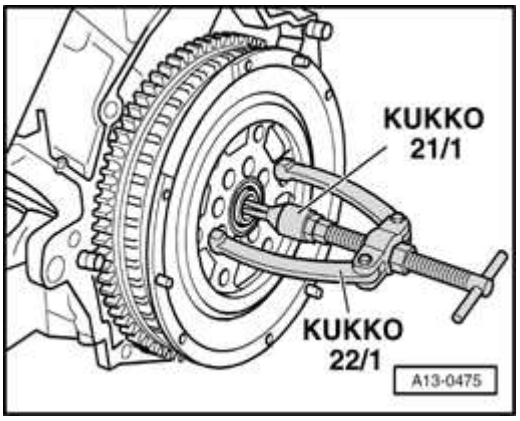


Fig. 178: Pulling Out Needle Bearing Using Kukko 21/1 And Kukko 22/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull out needle bearing using Kukko 21/1 and Kukko 22/1.

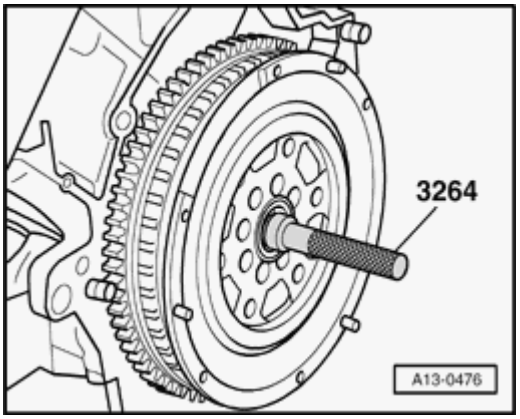


Fig. 179: Driving Needle Bearing Into Flywheel Using 3264 Bearing Driver
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive needle bearing into flywheel using 3264 bearing driver.

- Installation depth. Refer to **Needle bearing installation depth**

Needle bearing installation depth

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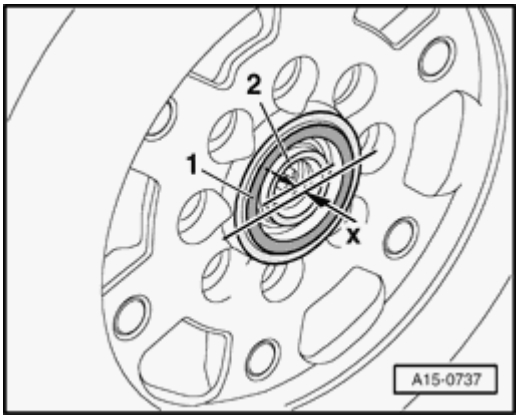


Fig. 180: Needle Bearing Installation Depth
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To measure installation depth, place a metal ruler onto plastic ring -1- of dual-mass flywheel.
- Measurement -x- = 0.5 mm.

NOTE: Plastic ring is sensitive to hits. If the plastic ring is damaged, dual-mass flywheel must be replaced.

CRANKSHAFT, REMOVING AND INSTALLING

Crankshaft, removing and installing

NOTE: For engine disassembly and assembly, mount engine to assembly stand using VAS6095 holding fixture. Refer to Engine, attaching to engine stand.

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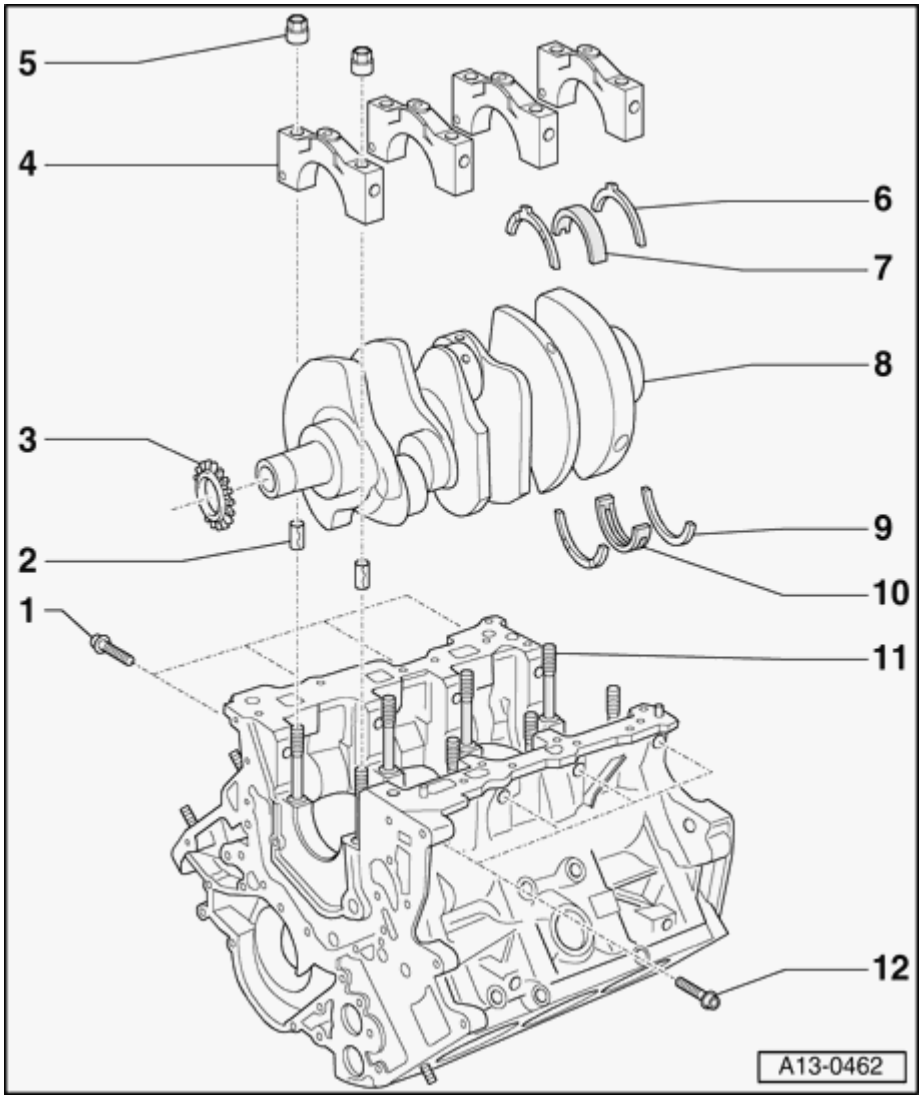


Fig. 181: Crankshaft Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt

- For bearing cap
- Always replace
- Tightening sequence. See **Fig. 186**

2 - Bushing

- Insert in cylinder block

3 - Drive chain gear for oil pump

- Removing and installing. Refer to **Drive chain gear for oil pump, removing and installing**

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4 - Bearing caps

- Observe number markings. See **Fig. 182**
- Removing. See **Fig. 183**
- Installing. See **Fig. 186**

5 - Nut

- For bearing cap
- Always replace
- Tightening sequence. See **Fig. 186**

6 - Thrust washer

- Only on 4th crankshaft bearing
- Lubricating grooves face outward
- Check locating point
- Measuring crankshaft axial clearance. Refer to **Axial and radial play, measuring**

7 - Bearing shell

- For bearing cap without lubrication groove
- Do not interchange run-in connecting rod bearing shells (mark)
- Insert new bearing shells for cylinder block with proper color marking. See **Fig. 185**

8 - Crankshaft

- Measuring axial and radial clearance. Refer to **Axial and radial play, measuring**
- Do not turn crankshaft when measuring radial play.
- Crankshaft dimensions. Refer to **Crankshaft measurements**

9 - Thrust washer

- Only on 4th crankshaft bearing
- Lubricating grooves face outward
- Measuring crankshaft axial clearance. Refer to **Axial and radial play, measuring**

10 - Bearing shell

- For engine block with lubrication groove
- Do not interchange run-in connecting rod bearing shells (mark)
- Insert new bearing shells for cylinder block with proper color marking. See **Fig. 184**

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11 - Stud

12 - Bolt

- For bearing cap
- Always replace
- Tightening sequence. See **Fig. 186**

Number markings on crankshaft bearing cap

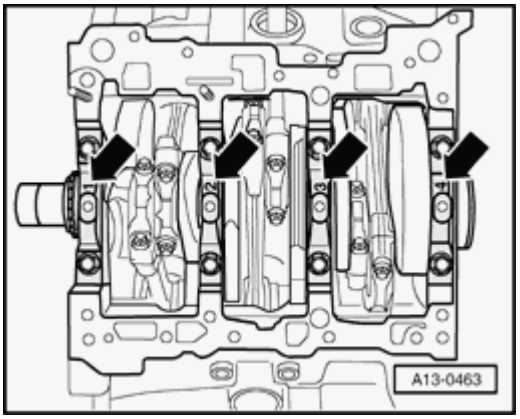
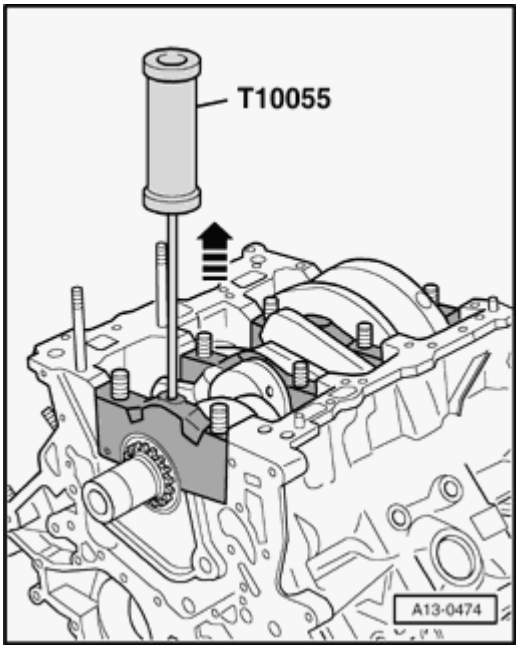


Fig. 182: Number Markings On Crankshaft Bearing Cap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bearing 1 is located on the belt pulley side

Removing crankshaft bearing cap



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Fig. 183: Removing Crankshaft Bearing Cap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts or nuts for crankshaft bearing caps.
- Remove crankshaft bearing caps from cylinder block using T10055 extractor.

Application of crankshaft bearing shells for cylinder block

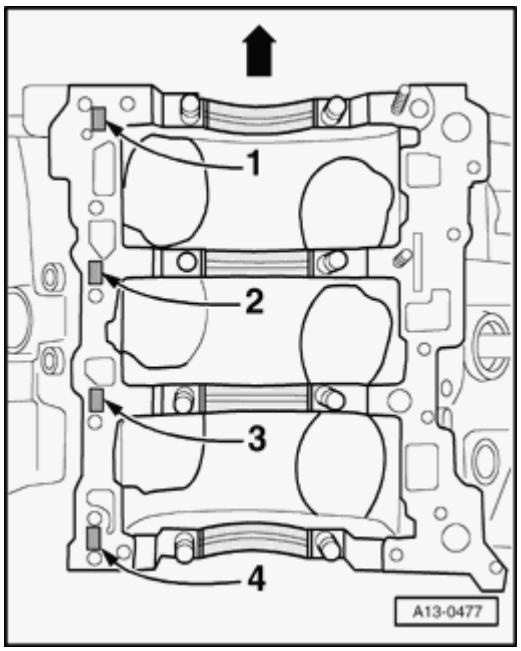


Fig. 184: Application Of Crankshaft Bearing Shells For Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Bearing shells with the correct thickness are allocated to the cylinder block in the factory. Colored dots on the bearing shells serve for identifying bearing shell thickness.

NOTE: The arrow points to the belt pulley side.

Application of bearing shells to cylinder block is marked by a letter beside the respective bearing.

Letter at Cylinder block		Color of bearing
G	=	Yellow
B	=	Blue
S	=	Black

Application of crankshaft bearing shells for bearing caps

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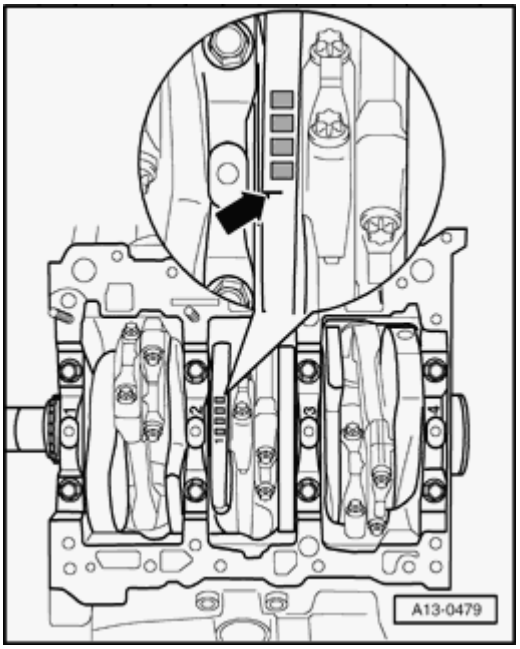


Fig. 185: Application Of Crankshaft Bearing Shells For Bearing Caps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Bearing shells with the correct thickness are allocated to the bearing caps in the factory. Colored dots on the bearing shells serve for identifying bearing shell thickness.

Application of bearing shells to crankshaft is marked with a letter sequence at the crankshaft flank. The first digit, "1" (arrow) identifies the color coding for bearing 1.

Letter to Crankshaft		Color of bearing
G	=	Yellow
B	=	Blue
S	=	Black

Installing crankshaft bearing cap

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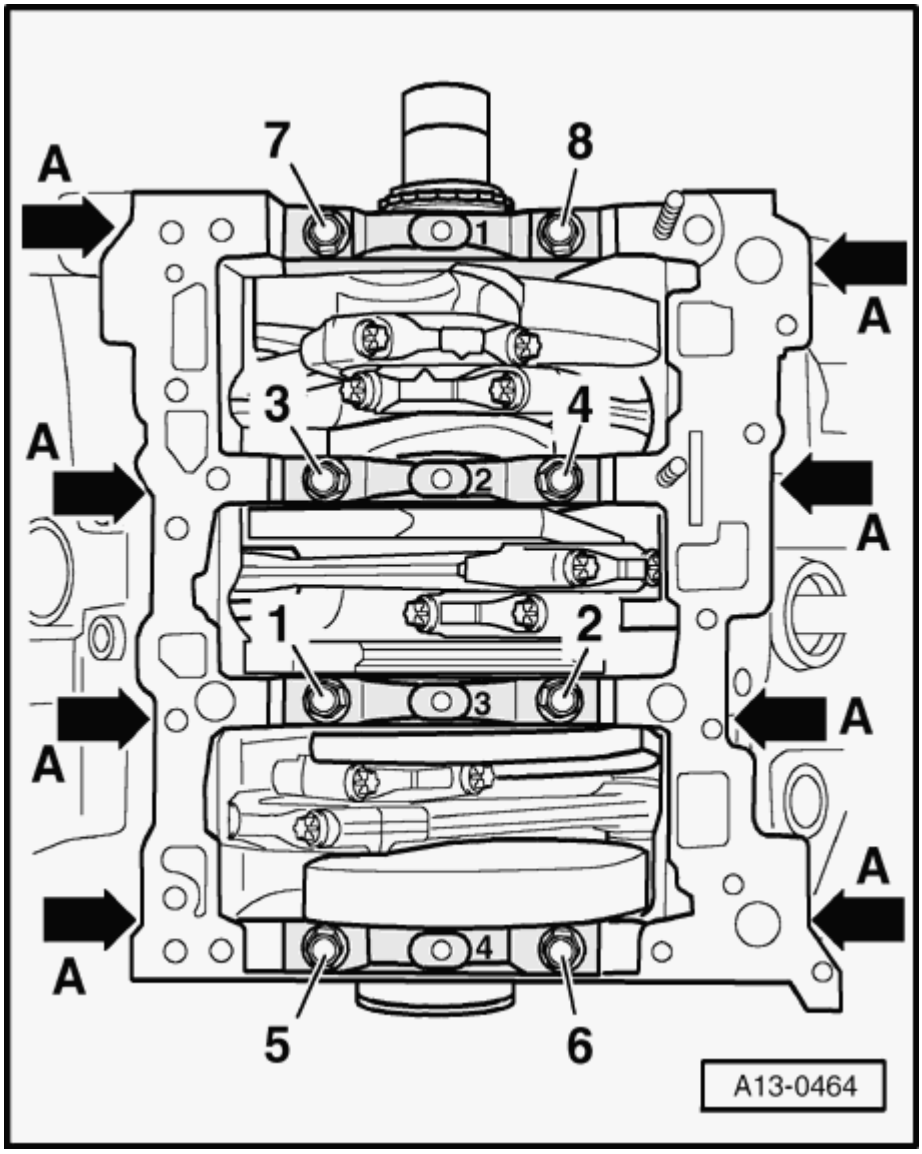


Fig. 186: Installing Crankshaft Bearing Cap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace bolts -A- and nuts -1- to -8-.
- Inserting alignment bushings into cylinder block
- Tighten bearing cap nuts or bolts in following sequence:

1. - Screw in bolts -A- hand tight.

2. - Tighten nuts -1- to -8- to 35 Nm.

3. - Tighten nuts -1- to -8- 90° (1/4 turn) further using rigid wrench.

4. - Tighten bolts -A- to 20 Nm.

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5. - Tighten bolts -A- 90° (1/4 turn) further using rigid wrench.

Crankshaft measurements

(Distance in mm)

Grind distance	Crankshaft journal diameter	Connecting rod journal diameter
Basic dimension	- 0.022 65.00 - 0.042	- 0.022 54.00 - 0.042
1st undersize	- 0.022 64.75 - 0.042	- 0.022 53.75 - 0.042
2nd undersize	- 0.022 64.50 - 0.042	- 0.022 53.50 - 0.042
3rd undersize	- 0.022 64.25 - 0.042	- 0.022 53.25 - 0.042

Axial and radial play, measuring

Special tools and equipment

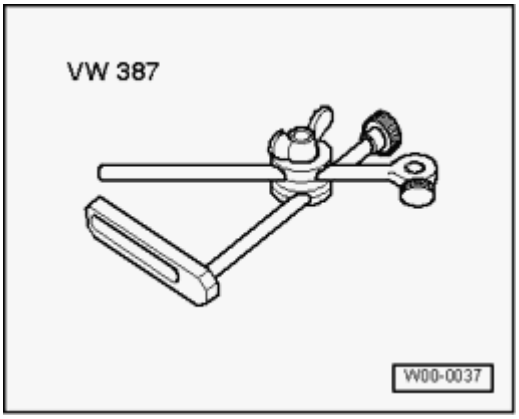


Fig. 187: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VW387 Dial gauge holder
- Dial gauge

Axial clearance

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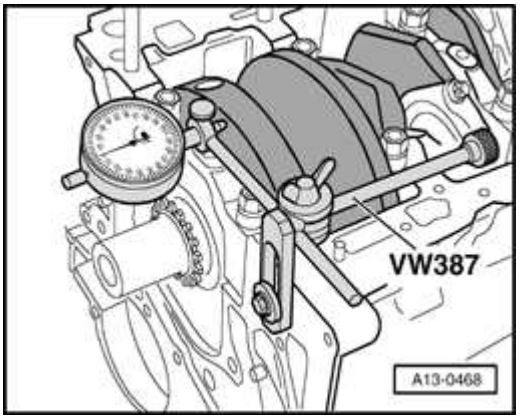


Fig. 188: Attaching Dial Indicator Together With VW387 Dial Gauge Holder To Cylinder Block And Set Indicator Against Crankshaft Counterweight
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach dial indicator together with VW387 dial gauge holder to cylinder block and set indicator against crankshaft counterweight.
- Press crankshaft against dial indicator by hand, set indicator to 0.
- Press crankshaft away from dial indicator.
- Read clearance.

Clearance when new	Wear limit
0.07 to 0.23 mm	0.25 mm

Radial clearance

NOTE:

- **Never interchange used bearing shells.**
- **Bearing shells that are worn through the nickel coating must be replaced**

Required equipment

- Plastigage

- Remove main bearing caps. Clean bearing caps and journals.
- Place Plastigage over entire width of bearing journal or into bearing shells.

- Plastigage must rest in center of bearing shell

- Install main bearing caps and tighten to 30 Nm. DO NOT turn crankshaft.
- Remove main bearing caps again.
- Compare width of Plastigage with calibrated scale.
- Read clearance.

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Clearance when new	Wear limit
0.018 to 0.045 mm	0.08 mm

Drive chain gear for oil pump, removing and installing

Special tools and equipment

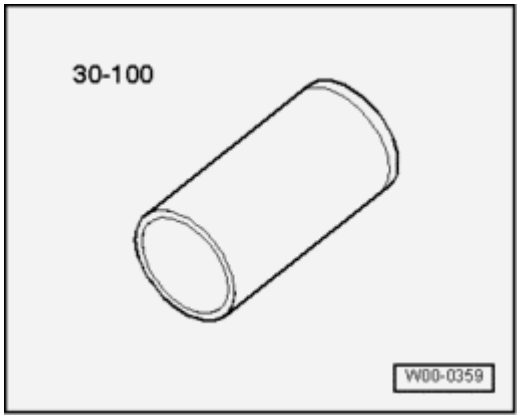


Fig. 189: Press Tube 30-100
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 30-100 Press tube

Removing

- Remove front sealing flange. Refer to **Front sealing flange, removing and installing**.

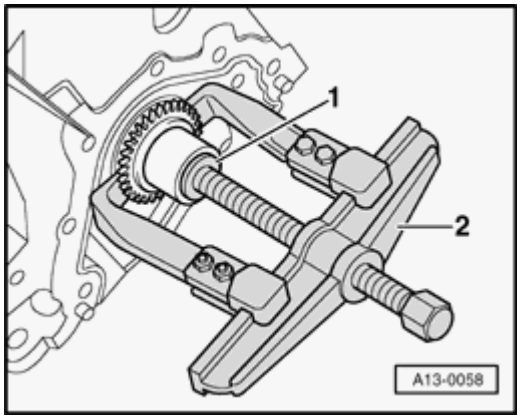


Fig. 190: Pulling Off Chain Sprocket From Crankshaft
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using claw remover -2-, remove crankshaft chain sprocket while protecting crankshaft end with appropriate washer -1-.

Installing

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Installation is reverse of removal, noting the following:

- Warm chain sprocket in oven at 220°C for approx. 15 minutes.

WARNING: Wear protective gloves!

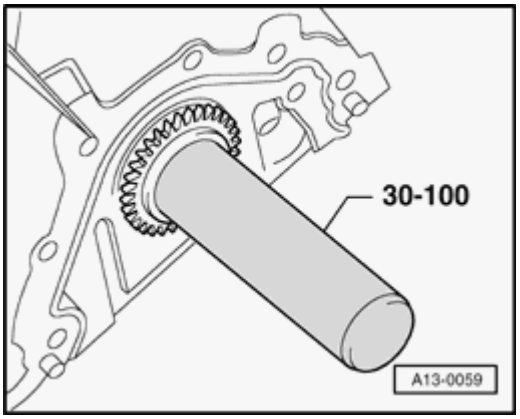


Fig. 191: Installing Chain Sprocket Onto Crankshaft Up To Limit Stop Using Press Tube 30-100
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using pliers install chain sprocket on crankshaft end and slide onto crankshaft to stop using 30-100 press tube.

PISTONS AND CONNECTING RODS, DISASSEMBLING AND ASSEMBLING

Pistons and connecting rods, disassembling and assembling

NOTE: Oil injector jet for piston cooling. See Fig. 200.

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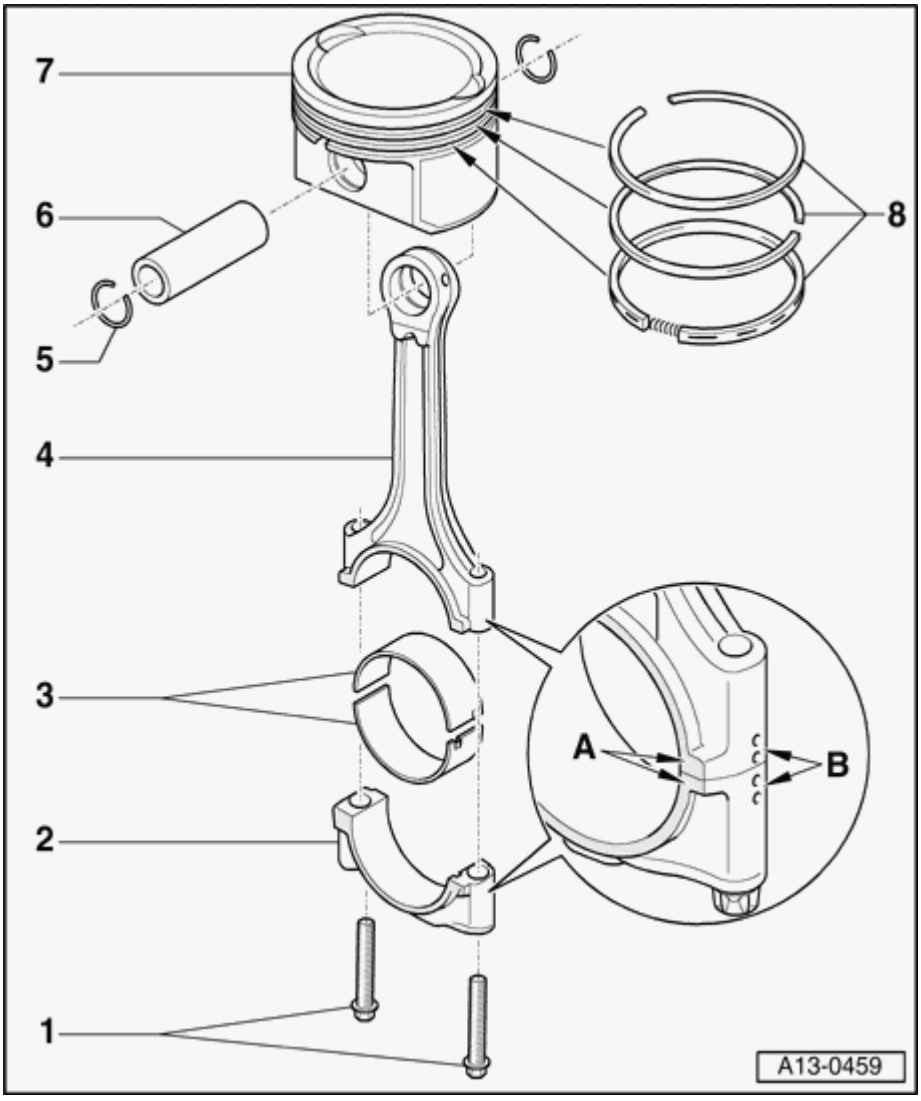


Fig. 192: Pistons And Connecting Rods, Disassembling And Assembling Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Connecting rod bolt, 30 Nm plus an additional 90° (1/4 turn)

- Always replace
- Grease thread and contact surface
- Tighten to 30 Nm when measuring radial clearance, but do not turn further

2 - Connecting rod bearing cap

- Do not interchange
- Mark allocation to cylinder using a color marker -B-. See **Fig. 198**
- Observe when installing bearing cap: Tabs at contact surfaces at face of connecting rod must be aligned -A-

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- Installed position of connecting rod pairs. See **Fig. 199**

3 - Bearing shell

- Note installed position
- Do not interchange run-in connecting rod bearing shells (mark)
- Measuring radial play. Refer to **Connecting rod radial play, checking**
- Tighten bolts item - 1 to 30 Nm when measuring radial clearance, but do not turn further

4 - Connecting rod

- Replace only as a set
- Mark allocation to cylinder using a color marker -B-. See **Fig. 200**
- Observe when installing bearing cap: Tabs at contact surfaces at face of connecting rod must be aligned - A-
- Installed position of connecting rod pairs. See **Fig. 199**

5 - Snap ring

6 - Piston pins

- In case of difficulty of movement, warm piston to approx. 60°C
- When removing and installing, use VW222a Pilot drift

7 - Pistons

- Installed position and allocation piston/cylinder. See **Fig. 197**
- Arrow on piston head points to belt pulley side
- Checking. See **Fig. 195**
- Install with piston ring tension strip

- Piston and cylinder dimensions. Refer to **Piston and cylinder measurements**
- Checking cylinder bore hole. See **Fig. 196**

8 - Piston rings

- Offset gaps by 120°
- Use piston ring pliers to remove and install
- Marking or identification "TOP" i.e. marked side must face toward piston head
- End play, checking. See **Fig. 193**

- Height play, checking. See **Checking piston ring side clearance**

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Checking piston ring end gap

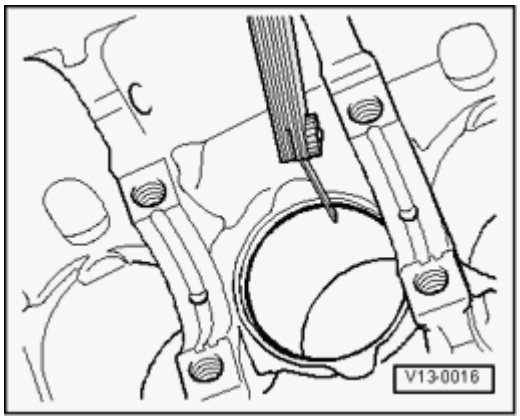


Fig. 193: Checking Piston Ring Gap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert ring at right angle to cylinder wall from above to lower cylinder opening approx. 15 mm from cylinder edge. Use piston without rings to insert.

Piston ring (Distance in mm)	**New**	**Wear limit**
1. Compression ring	0.35 to 0.50	0.8
2. Compression ring	0.60 to 0.80	1.0
Oil scraper ring	0.25 to 0.50	0.8

Checking piston ring side clearance

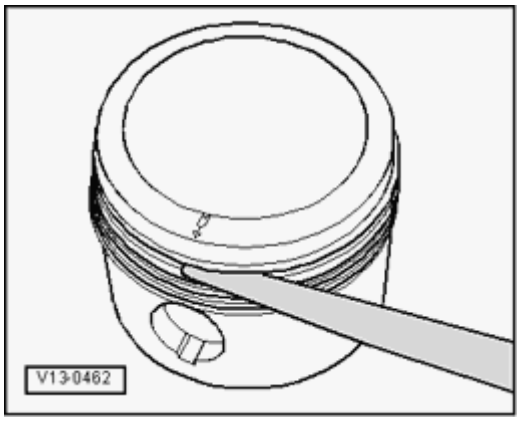


Fig. 194: Checking Piston Ring Side Clearance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Before measuring, clean piston ring groove

Piston ring (Distance in mm)	**New**	**Wear limit**

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Compression rings	0.02 to 0.08	0.20
Oil scraper ring	0.02 to 0.08	0.15

Checking pistons

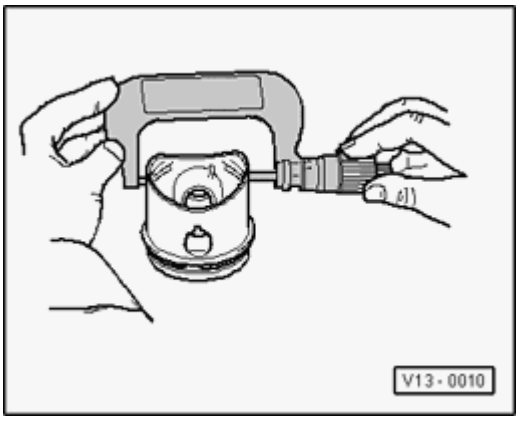


Fig. 195: Checking Piston
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- External micrometer 75-100 mm
  - Measure approx. 10 mm from lower edge, at a 90° angle to piston pin axis.
- Deviation from nominal dimension: max. 0.04 mm

Specified dimension. Refer to **Piston and cylinder measurements**

Checking cylinder bore

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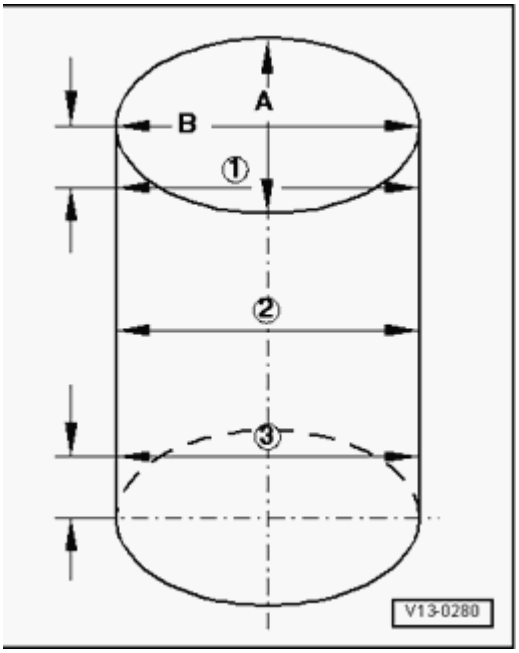


Fig. 196: Checking Cylinder Bores
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- Inner bore gauge 50-100 mm
  - Measure diagonally at 3 positions, horizontally -A- and lengthwise -B-.
- Deviation from nominal dimension: max. 0.08 mm

Specified dimension. Refer to **Piston and cylinder measurements**

Piston installed position and application piston/cylinder

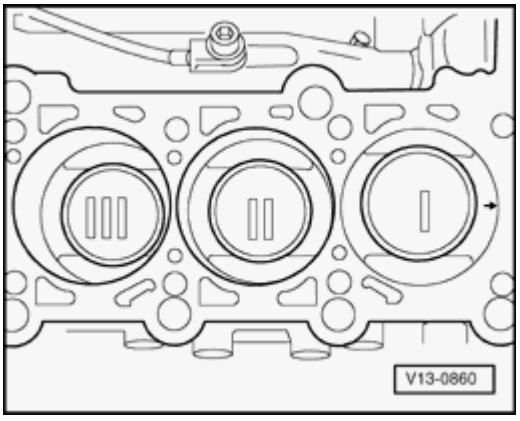


Fig. 197: Piston Installed Position And Application Piston/Cylinder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Mark installed position and allocation to cylinder on piston head using chalk or waterproof felt pen.

NOTE: Do not use a center punch or scribe, since the piston head coating will be damaged.

- Installed position:

Arrow on piston head points to belt pulley side

Marking connecting rods

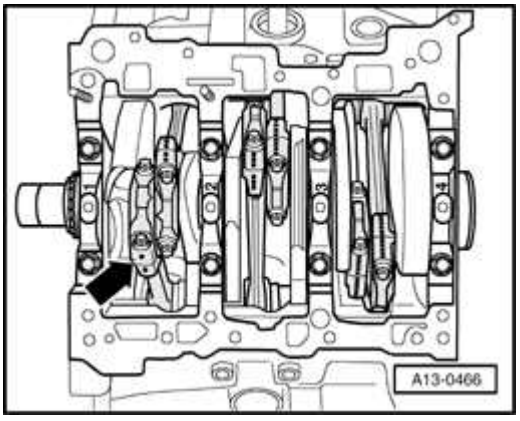


Fig. 198: Marking Connecting Rods
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE:

- **Replace the connecting rods only as a set.**
- **Do not interchange the connecting rod bearings.**
- **Before removing, mark allocation of connecting rod and connecting rod bearing caps to each other and to cylinder using a color marker (arrow).**

Installed position of connecting rods

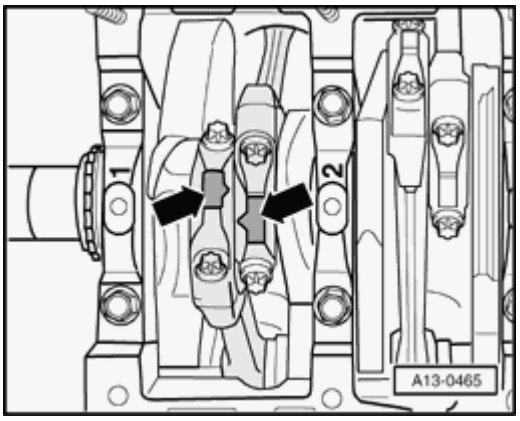


Fig. 199: Installed Position Of Connecting Rods

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Molded tabs (arrows) at the bevelled surfaces of the connecting rod pairs 1 and 2, 3 and 4 as well as 5 and 6 must point toward each other.

Oil injector jet for piston cooling

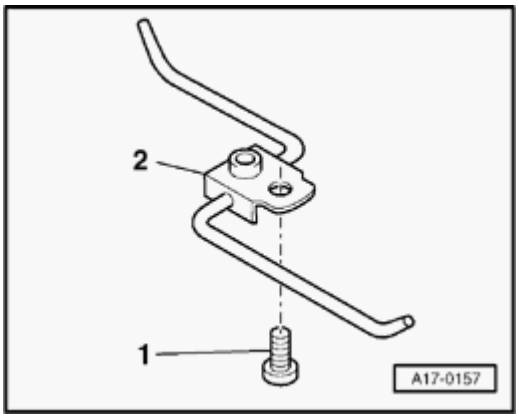


Fig. 200: Oil Injector Jet For Piston Cooling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt, 10 Nm

2 - Oil injector jet for piston cooling

Piston and cylinder measurements

Honing dimension		Piston Diameter	Cylinder bore diameter
Basic dimension	mm	82.455 1)	82.51
Repair stage	mm	82.955 1)	83.01

1) Dimensions exclude graphite coating (thickness 0.02 mm). The graphite coating wears off.

Connecting rod radial play, checking

Special tools and equipment

- Plastigage

Work sequence

- Remove connecting rod bearing caps. Clean bearing caps and journals.
- Place Plastigage over entire width of bearing journal or into bearing shells.
- Install connecting rod bearing caps and tighten to 30 Nm. DO NOT turn crankshaft.

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- Remove connecting rod bearing caps again.
- Compare width of Plastigage with calibrated scale.

Clearance when new	Wear limit
0.015 to 0.062 mm	0.12 mm

- Always replace connecting rod bolts.

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15 ENGINE - CYLINDER HEAD, VALVETRAIN

CYLINDER HEAD, REMOVING AND INSTALLING

Cylinder head, removing and installing

CAUTION: Before beginning repairs on the electrical system:

- **Obtain the anti-theft radio security code.**
- **Switch the ignition off.**
- **Disconnect the battery Ground (GND) strap.**
- **On vehicles equipped with Audi Telematics by OnStar ® , switch-off the emergency (back-up) battery for the Telematic/Telephone Control Module prior to disconnecting vehicle battery. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

  .
- **After reconnecting vehicle battery, re-code and check operation of anti-theft radio. Also check operation of clock and power windows according to Repair Article and/or Owner's Manual.**
- **After reconnecting vehicle battery on vehicles equipped with Audi Telematics by OnStar ® , switch-on the emergency (back-up) battery for the Telematic/Telephone Control Module. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

  .

Cylinder head, removing and installing

NOTE:

- **Replace cylinder head bolts.**
- **Replace self-locking nuts and bolts during assembly work.**
- **Always replace bolts that are secured with tightening torque as well as O-rings and gaskets.**
- **After installing a replacement cylinder head with camshafts installed, oil contact surfaces between valve lifters and cam lubricating surfaces after installing cylinder head.**
- **Do not remove plastic bases protecting exposed valves until immediately before installing cylinder head.**

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- **When replacing the cylinder head or cylinder head gasket, coolant must be completely replaced.**
- **If a cylinder head is replaced, a cap must be driven in on the front part of the respective head. See Fig. 205.**
- **Cylinder heads with cracks between valve seats or between valve seat and spark plug thread can still be used without loss of service life if the cracks are minute (max. 0.3 mm width) or only the first four threads of a spark plug thread are cracked.**

Part I

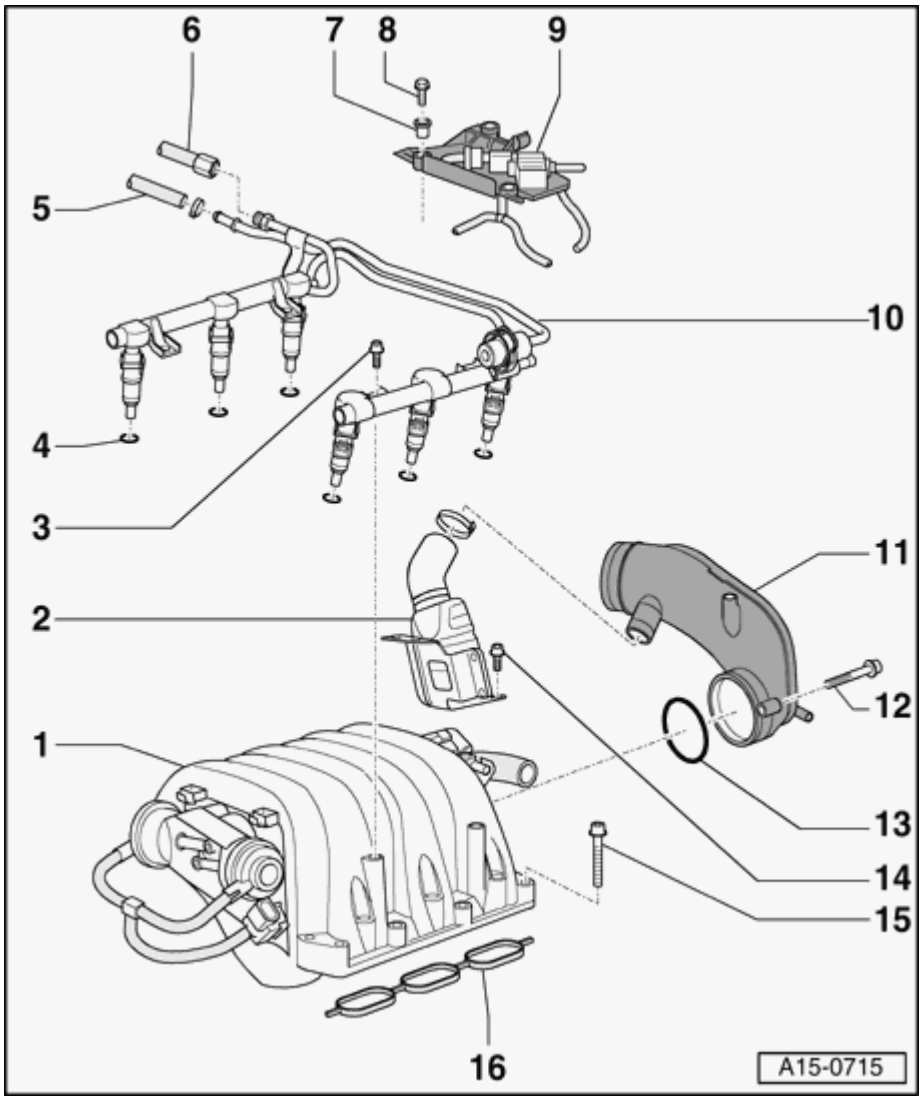


Fig. 201: Cylinder Head, Removing And Installing Overview - Part I
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Intake manifold

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- Removing and installing. Refer to **Intake manifold, removing and installing**

2 - Resonator

3 - 10 Nm

4 - O-Rings

- Always replace

5 - Fuel return line

- Only in vehicles up to 06.03

6 - Fuel supply line

- For vehicles up to 06.03, tighten union nut to 22 Nm
- Loosening and tightening union nut in vehicles as of 07.03. See **Fig. 206**

WARNING: Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.

7 - Socket

8 - 10 Nm

9 - Holding plate

- For solenoid valves

10 - Fuel distributor

11 - Air duct

12 - 10 Nm

13 - O-ring

- Always replace

14 - 10 Nm

15 - 10 Nm

- Tighten diagonally in sequence

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16 - Gasket

- For intake manifold
- Always replace

Part II

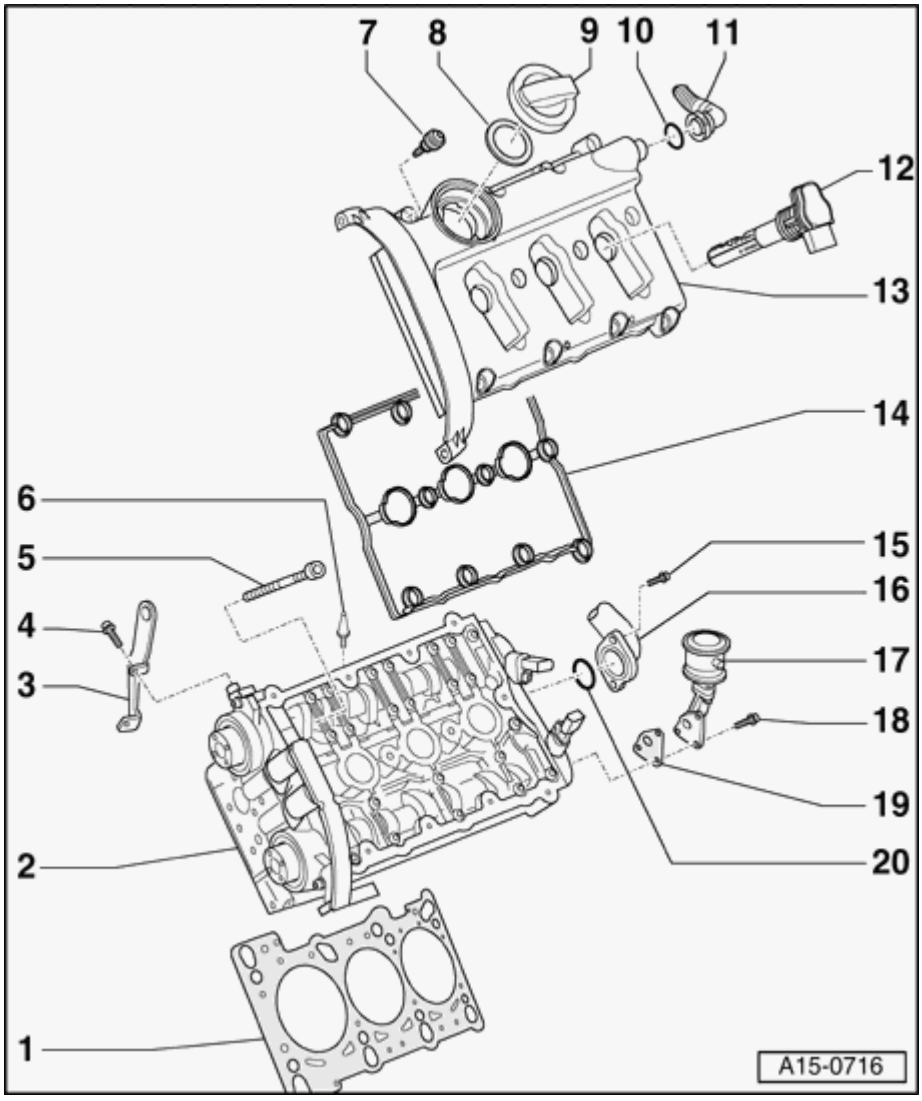


Fig. 202: Cylinder Head, Removing And Installing Overview - Part II
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Cylinder head gasket

- Replacing. Refer to **Left cylinder head, removing**
- Installed position: Part number to cylinder head
- After replacing, replace coolant

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2 - Cylinder head

- Removing left cylinder head. Refer to **Left cylinder head, removing**
- Removing right cylinder head. Refer to **Right cylinder head, removing**
- Check for warpage. See **Fig. 203**
- Refacing dimension. See **Fig. 204**

- Sealing cap (core plug) in cylinder head, installing. See **Fig. 205**
- Installing. Refer to **Cylinder head, installing**
- After replacing, replace coolant

3 - Lifting eye

4 - 23 Nm

5 - Cylinder head bolt

- Always replace
- Follow order of removal. Refer to **Left cylinder head, removing** or **Right cylinder head, removing**
- Follow tightening order. Refer to **Cylinder head, installing**

6 - Centering pin

- For intake manifold

7 - Special bolt, 10 Nm

- Follow order of tightening. Refer to **Tightening torques** or **Installing**

8 - Gasket

- Replace if damaged or leaking

9 - Cap

10 - O-ring

- Always replace

11 - Hose of crankcase housing ventilation

12 - Ignition coil

13 - Cylinder head cover

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- Left cylinder head cover, removing and installing. Refer to **Left cylinder head cover, removing and installing**
- Right cylinder head cover, removing and installing. Refer to **Right cylinder head cover, removing and installing**

14 - Cylinder head cover gasket

- Replace if damaged or leaking

15 - 10 Nm

16 - Rear coolant pipe

17 - Combination valve for secondary air injection (AIR)

18 - 10 Nm

19 - Gasket

- Always replace

20 - O-ring

- Always replace

Check cylinder head for warpage

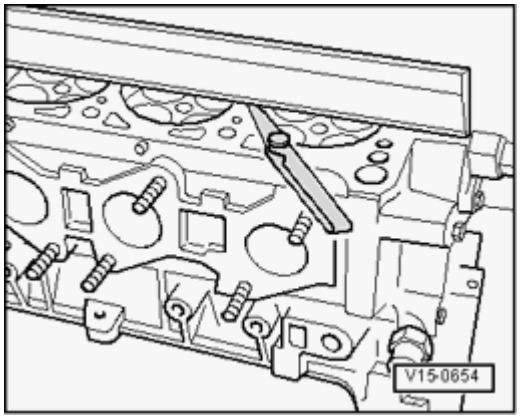


Fig. 203: Checking Cylinder Head For Distortion
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using straightedge and feeler gauge, check cylinder head for warpage at multiple points.

- Maximum permissible warpage: 0.1 mm

Cylinder head refacing dimension

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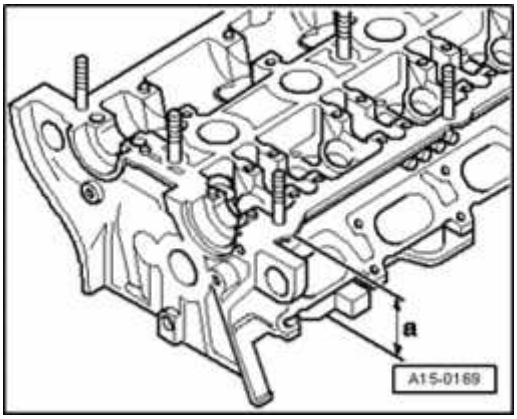


Fig. 204: Cylinder Head Refacing Dimension
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Refacing cylinder head can only be done to minimum dimension -a-.
- Minimum dimension: a = 139.25 mm

Sealing cap (core plug) in cylinder head, driving in

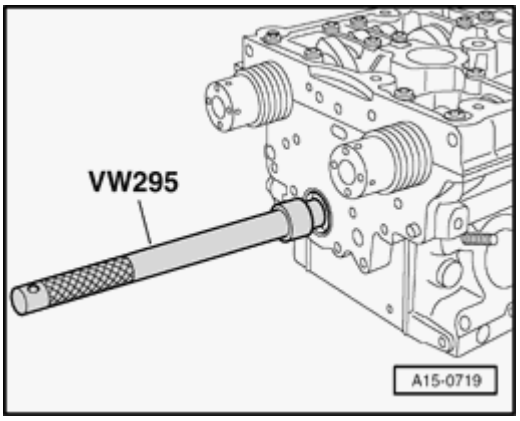


Fig. 205: Sealing Cap (Core Plug) In Cylinder Head, Driving In
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VW295 Needle bearing drift

Cylinder heads which are supplied as replacement parts can be used on left or right and a cap must be installed on the respective front side.

- Coat lip of sealing cap with sealant.
- Sealant
- Drive sealing cap flush into cylinder block using VW295 needle bearing drift.

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Loosening and tightening union nut for fuel supply line in vehicles as of 07.03

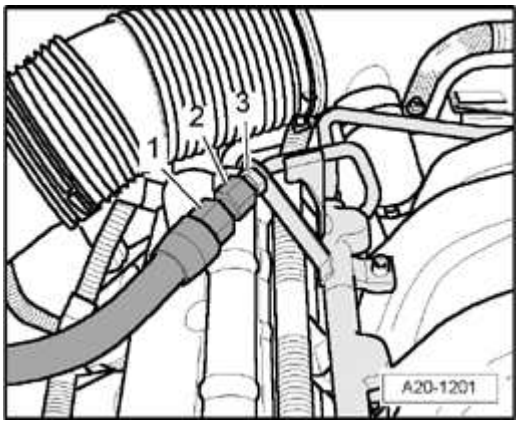


Fig. 206: Unscrewing/Screwing Fuel Hose From Connection On Fuel Rail Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

WARNING: Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.

Loosening:

- Unscrew fuel hose from connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and unscrew union nut -2-.

Tightening:

- Secure fuel hose to connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and tighten union nut -2- to 22 Nm.

Intake manifold, removing and installing

Removing

NOTE: All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.

- Drain coolant. Refer to **Coolant, draining and refilling**.

WARNING: Observe safety precautions when disconnecting the battery.

Refer to 27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL

See Caution before beginning repairs on the electrical system. Refer to **Cylinder head, removing and installing**

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- Switch ignition off and disconnect battery Ground (GND) strap.

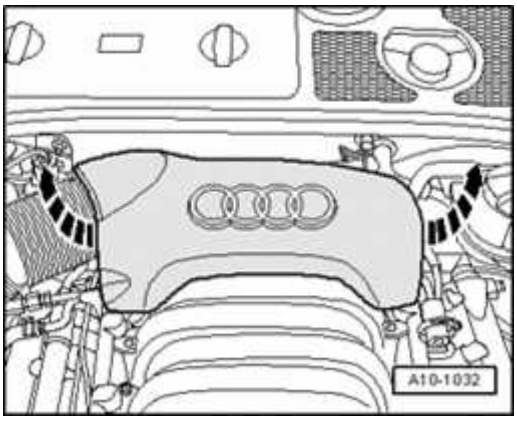


Fig. 207: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

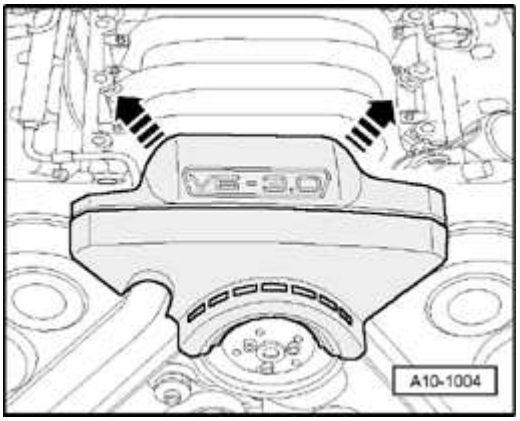
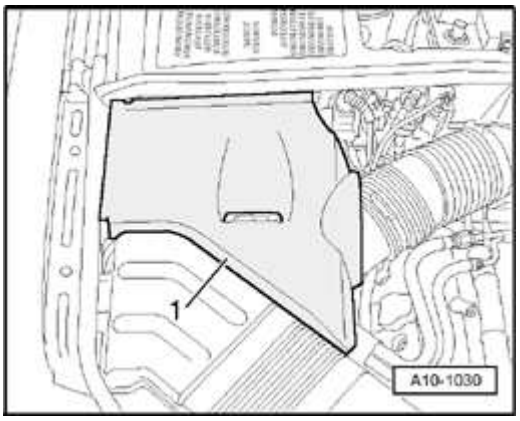


Fig. 208: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).



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Fig. 209: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

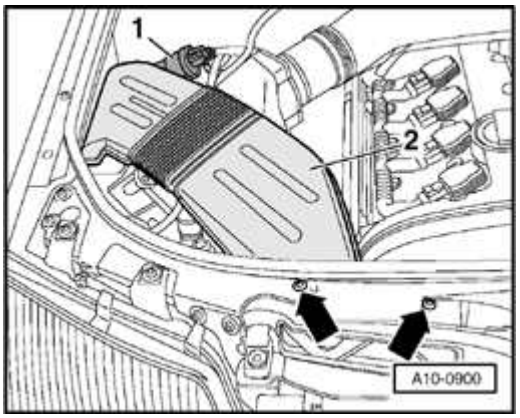


Fig. 210: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

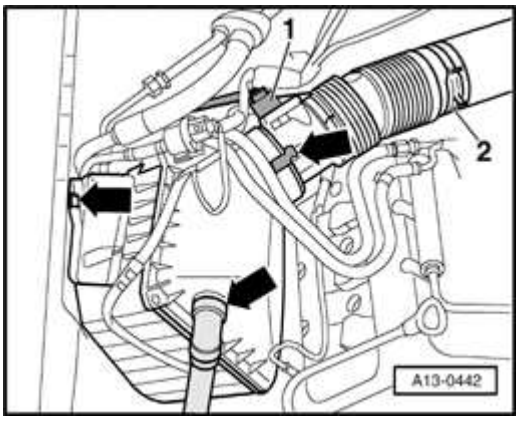


Fig. 211: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).
- Disconnect electrical harness connector -1- at Mass Air Flow (MAF) sensor.
- Remove air guide hose -2- together with Mass Air Flow (MAF) sensor.

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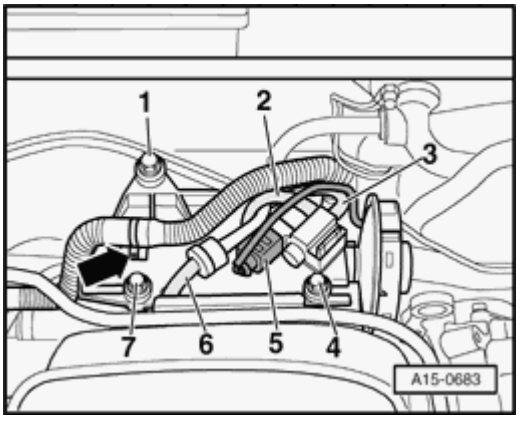


Fig. 212: Identifying Vacuum Hoses & Electrical Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hoses -2- and -3- at Intake manifold change-over valve -N156-.
- Disconnect vacuum hose -6- from check valve.
- Disconnect electrical harness connector -5-.
- Set aside hose of crankshaft housing ventilation (arrow).

- Remove bolts -1-, -4- and -7- for holding plate for solenoid valves.
- Remove holding plate for solenoid valves.

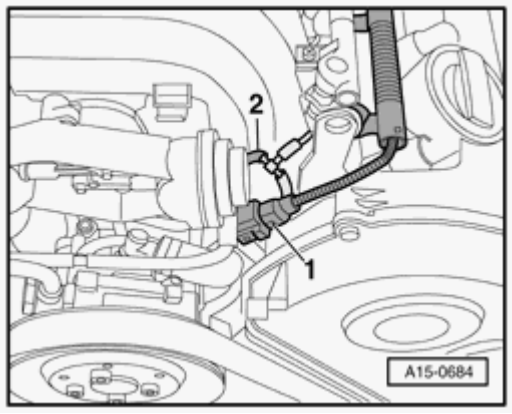


Fig. 213: Disconnecting Electrical Harness Connector & Pulling Off Vacuum Hose At T-Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector -1-.
- Pull off vacuum hose -2- at T-connector.
- Remove all harness connectors to injectors.

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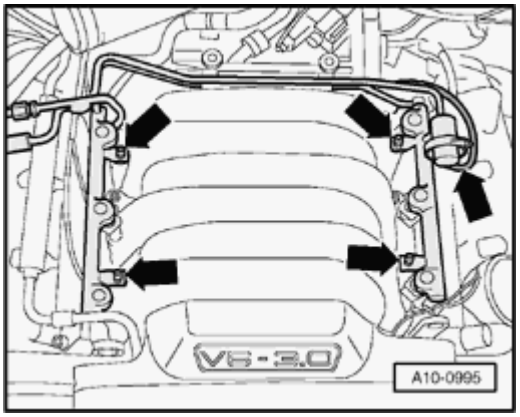


Fig. 214: Disconnecting Vacuum Line At Fuel Pressure Regulator And Removing Mounting Bolts Of Fuel Pressure Regulator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line at fuel pressure regulator and remove mounting bolts of fuel pressure regulator (arrows).
- Remove fuel distributor together with fuel injectors from intake manifold simultaneously upward and place it on a clean rag in engine compartment.

NOTE: Carefully protect removed fuel injectors from contamination.

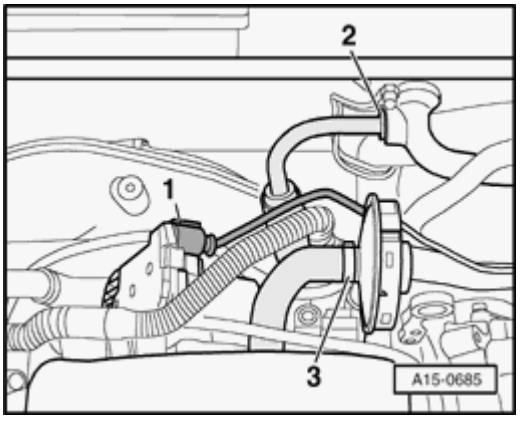


Fig. 215: Identifying Throttle Valve Control Module -J338- Electrical Harness Connector & Vacuum Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector -1- at Throttle valve control module -J338-.
- Disconnect vacuum hoses -2- and -3-.

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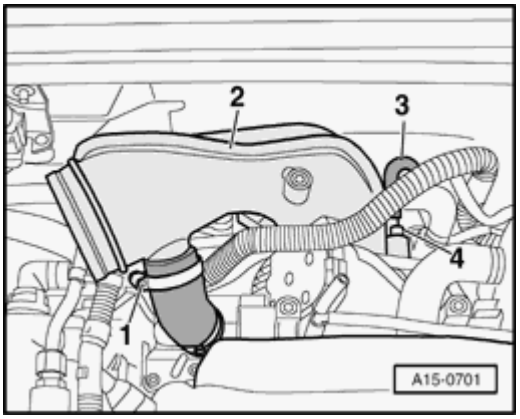


Fig. 216: Identifying Air Duct Hose, Bolt, Air Duct & Vacuum Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hose -1- from air duct.
- Remove bolt -4- and disconnect air duct -2- at throttle valve control module.
- If installed, disconnect vacuum hose -3- from air guide at bottom.

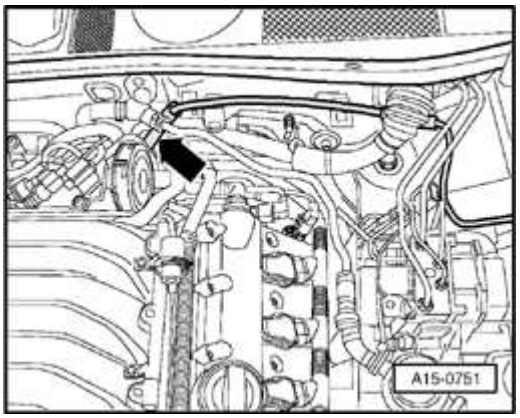


Fig. 217: Disconnecting Vacuum Line To Leak Detection Pump At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum line (arrow) to leak detection pump at throttle valve control module.

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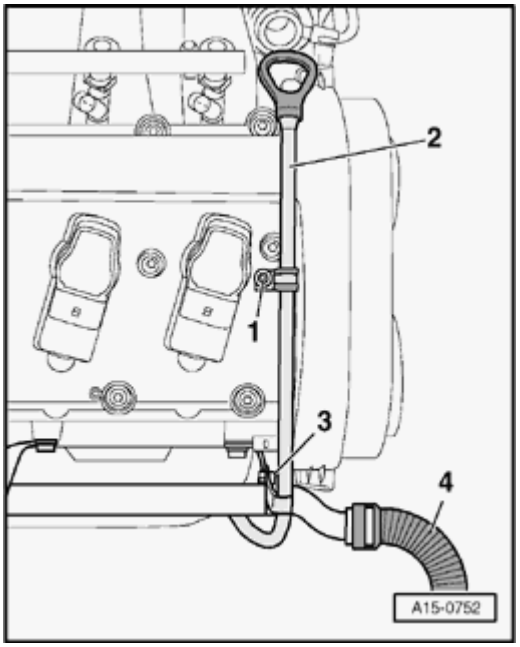


Fig. 218: Identifying Bolts, Hose From Line Of Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -3-.
- Pull out guide tube for oil dipstick 2 from the oil pan (upper part) toward top and swing it forward for removal.

NOTE: Hose -4- remains connected.

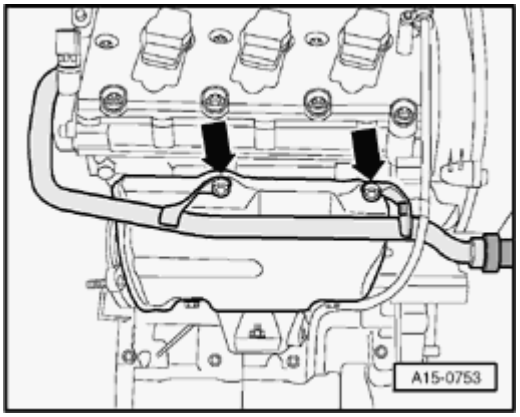


Fig. 219: Removing Bolts At Right Side Of Engine At Line For Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts at right side of engine (arrows) at line for secondary air injection.

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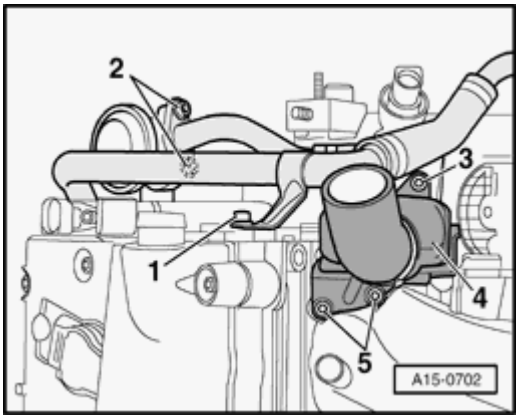


Fig. 220: Removing Bolts At Lines Of Secondary Air Injection & Resonator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- at lines of secondary air injection.
- Remove bolts -3- and -5- and remove resonator -4-.

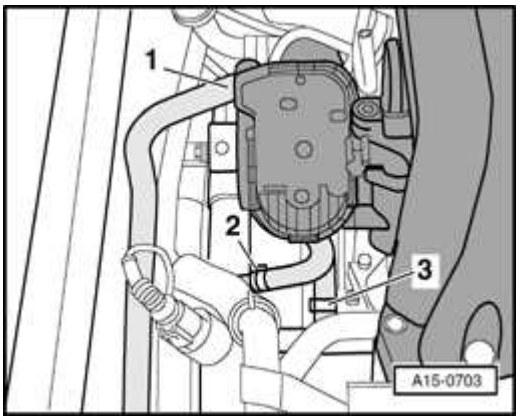
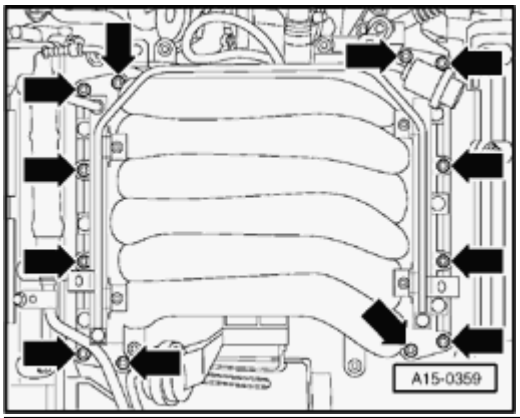


Fig. 221: Identifying Vacuum Hose At EVAP Valve & Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose -1- at EVAP valve.
- Remove coolant hoses -2- and -3-.



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Fig. 222: Unbolt/Bolting Intake Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt intake pipe (arrows) and remove.

NOTE: Plug intake channels in the cylinder heads with clean rags.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type:**
- **Always replace seals and gaskets.**

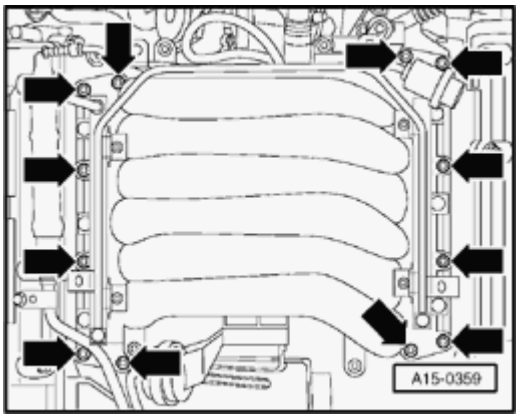


Fig. 223: Unbolt/Bolting Intake Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolt in intake manifold in diagonal sequence in stages (arrows).
- Replace O-ring at guide tube for oil dipstick and insert guide tube into hole in oil pan (upper part).

See Caution for connecting Telematics battery. Refer to **Cylinder head, removing and installing**

- Observe safety precautions after connecting battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

- Top off coolant. Refer to **Filling**.

Tightening torques

Component		Nm
Intake manifold to cylinder head		10

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Resonator to coolant pipe or to cylinder head		10
Secondary air injection line to cylinder head	M6	10
	M8	23
Secondary air injection line to combination valve for secondary air injection		10
Air guide to intake manifold		10
Holding plate for solenoid valves to intake manifold or air guide		10
Guide tube for oil dipstick to secondary air line		10

Left cylinder head cover, removing and installing

Removing

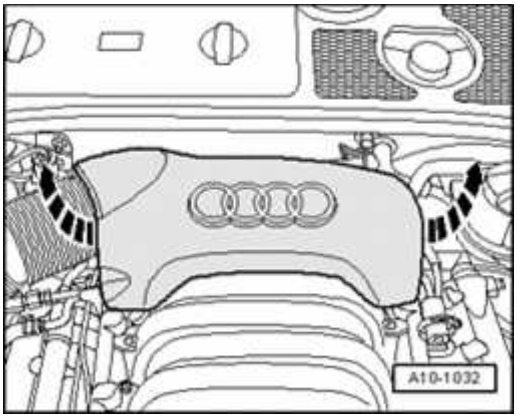


Fig. 224: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

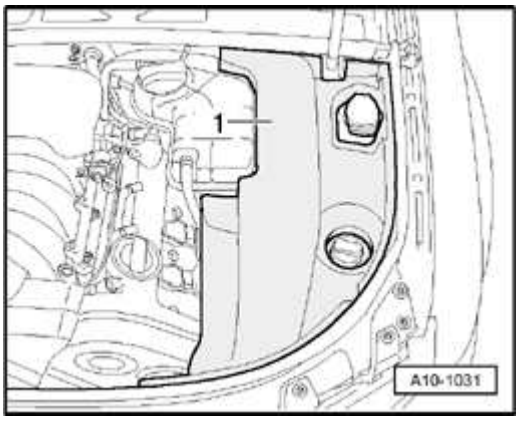


Fig. 225: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove cover -1- in engine compartment (left side).

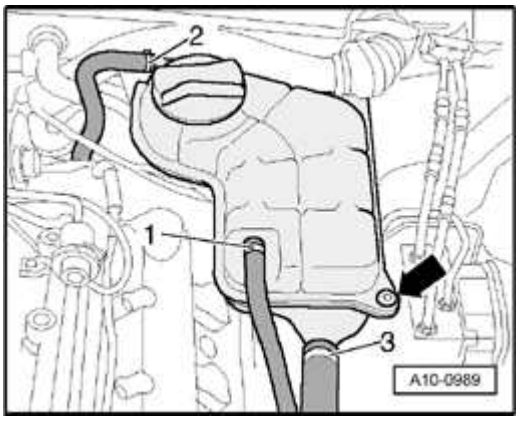


Fig. 226: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of expansion tank.
- Tie coolant expansion tank with connected coolant hoses -1- to -3- to side.

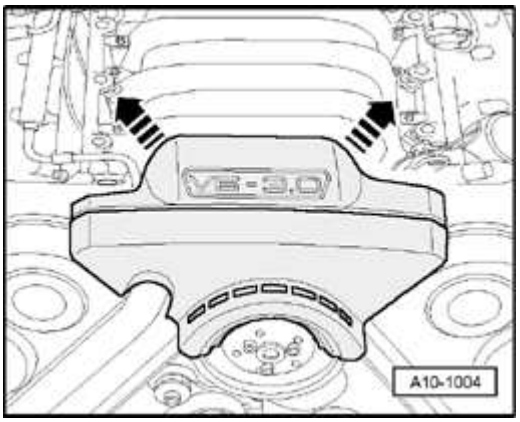


Fig. 227: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

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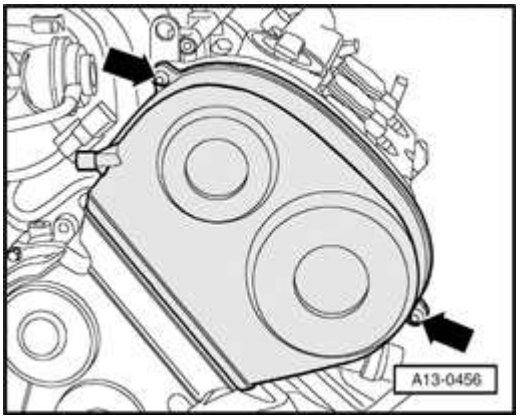


Fig. 228: Unbolting Toothed Belt Guard At Front Left From Cylinder Head Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt toothed belt guard at front left from cylinder head cover (arrows).

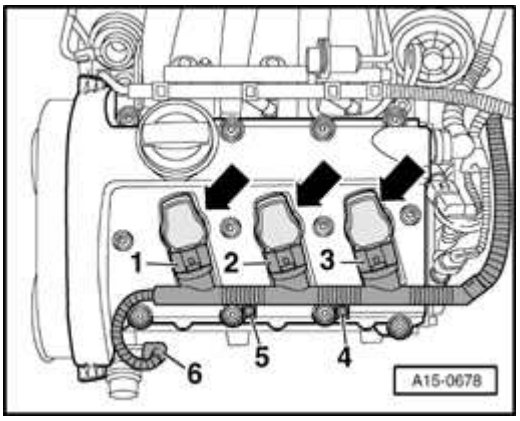
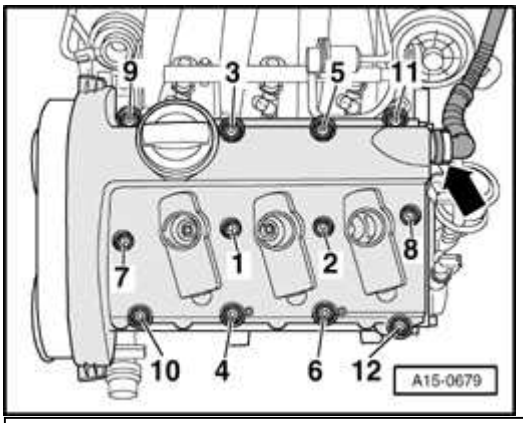


Fig. 229: Removing Bolts At Left Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -4- and -5-.
- Disconnect electrical harness connectors -1- to -3- and -6-.
- Remove ignition coils (arrows).



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Fig. 230: Removing Hose Of Crankshaft Housing Ventilation & Unscrewing Bolts For Left Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove hose of crankshaft housing ventilation (arrow).
- Unscrew bolts for left cylinder head cover in the sequence -12- to -1-.
- Remove cylinder head cover.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **Always replace self-locking bolts.**
- **Replace cylinder head cover gasket if damaged.**

- Tighten cylinder head cover in sequence -1- to -12-.

Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
Front toothed belt guard to cylinder head cover	6 1)

1) Replace bolts.

Right cylinder head cover, removing and installing

Removing

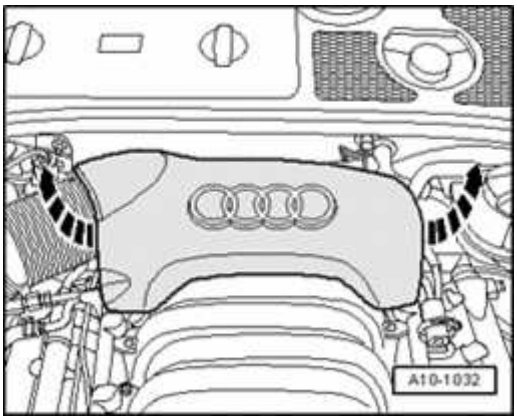


Fig. 231: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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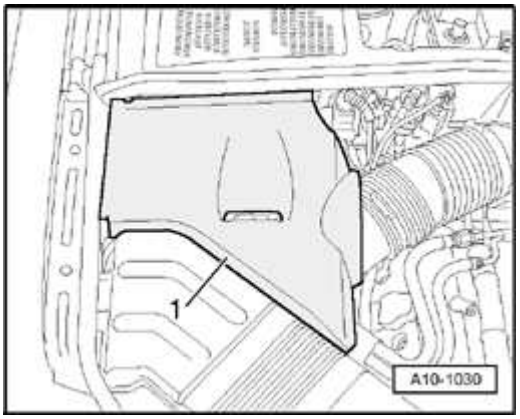


Fig. 232: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

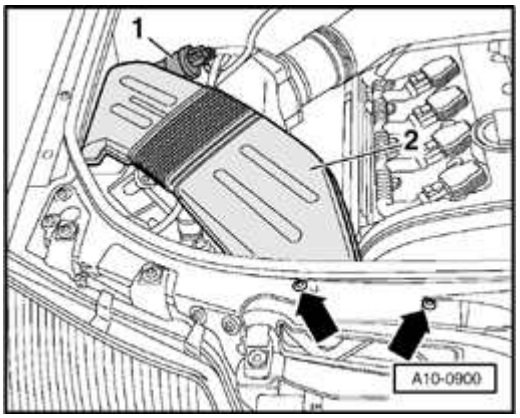
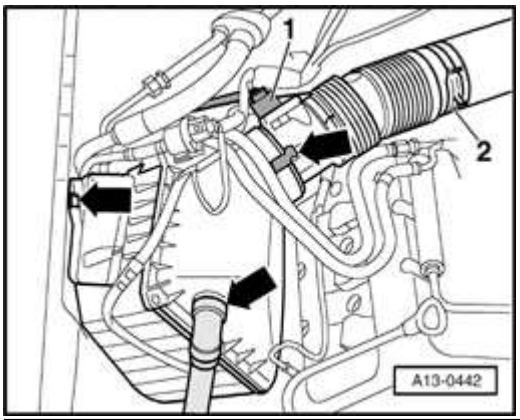


Fig. 233: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.



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Fig. 234: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).
- Disconnect electrical harness connector -1- at Mass Air Flow (MAF) sensor.
- Remove air guide hose -2- together with Mass Air Flow (MAF) sensor.

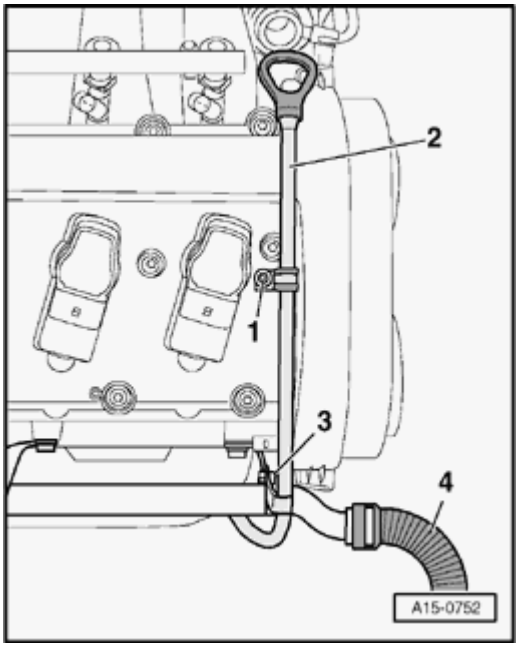


Fig. 235: Identifying Bolts, Hose From Line Of Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -3-.
- Disconnect hose -4- from line of secondary air injection.
- Pull out guide tube for oil dipstick -2- from the oil pan (upper part) toward top and swing it forward for removal.

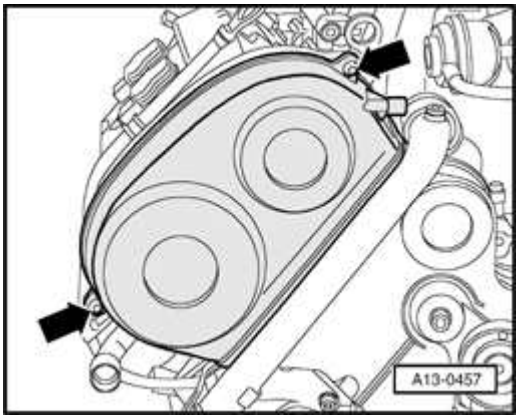


Fig. 236: Unbolting Toothed Belt Guard At Front Right From Cylinder Head Cover

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt toothed belt guard at front right from cylinder head cover (arrows).

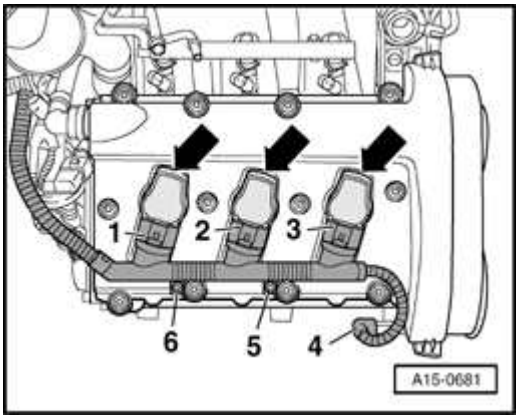


Fig. 237: Removing Bolts At Right Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -5- and -6-.
- Disconnect electrical harness connectors -1- to -4-.
- Remove ignition coils (arrows).

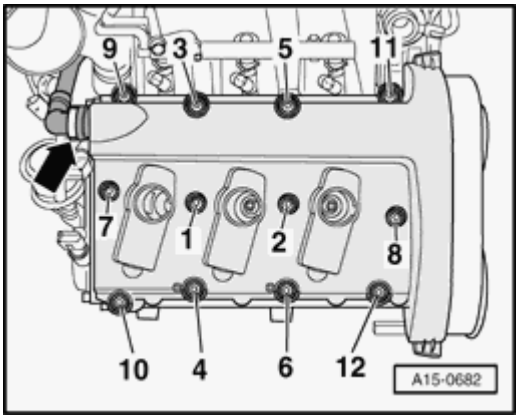


Fig. 238: Removing/Installing Hose Of Crankshaft Housing Ventilation & Unscrewing/Screewing Bolts For Right Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove hose of crankshaft housing ventilation (arrow).
- Unscrew bolts for right cylinder head cover in the sequence -12- to -1-.
- Remove cylinder head cover.

Installing

Installation is reverse of removal, noting the following:

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NOTE:

- **Always replace self-locking bolts.**
- **Replace cylinder head cover gasket if damaged.**

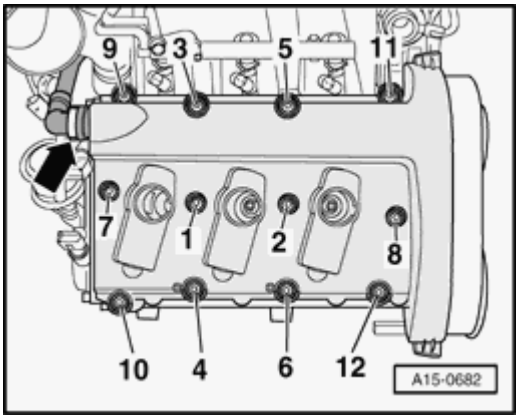


Fig. 239: Removing/Installing Hose Of Crankshaft Housing Ventilation & Unscrewing/Screwing Bolts For Right Cylinder Head Cover In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten cylinder head cover in sequence -1- to -12-.

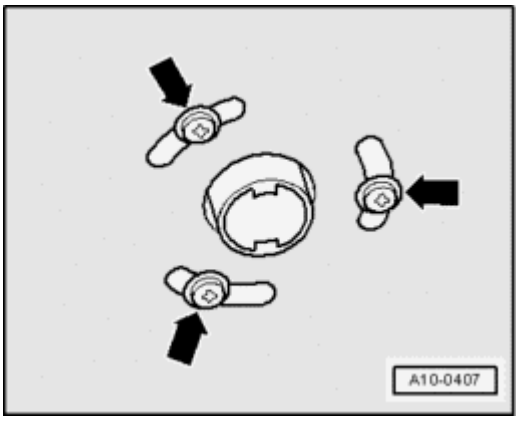


Fig. 240: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

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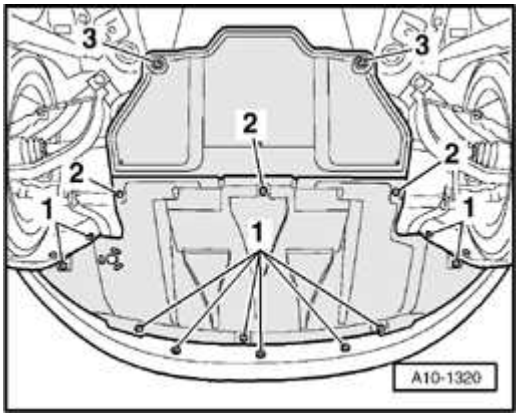


Fig. 241: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.
- Replace O-ring at guide tube for oil dipstick and insert guide tube into hole in oil pan (upper part).

Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
Front toothed belt guard to cylinder head cover	6 1)
Guide tube for oil dipstick to secondary air line	10

1) Replace bolts.

Left cylinder head, removing

Special tools and equipment

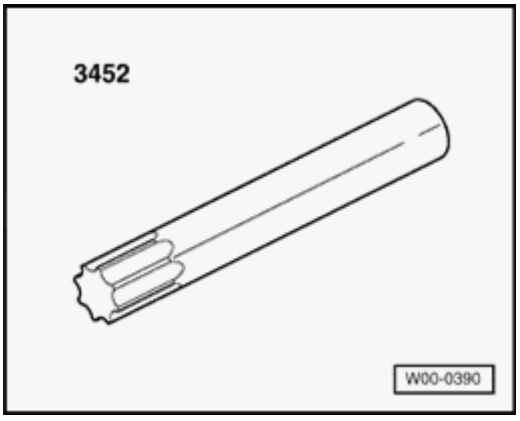


Fig. 242: 3452 Polydrive Key
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3452 Polydrive key

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Removing

- Engine installed.

NOTE: All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.

- Remove intake manifold. Refer to **Intake manifold, removing and installing**.

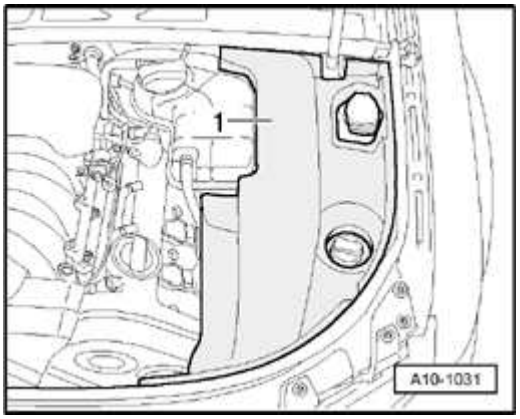


Fig. 243: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

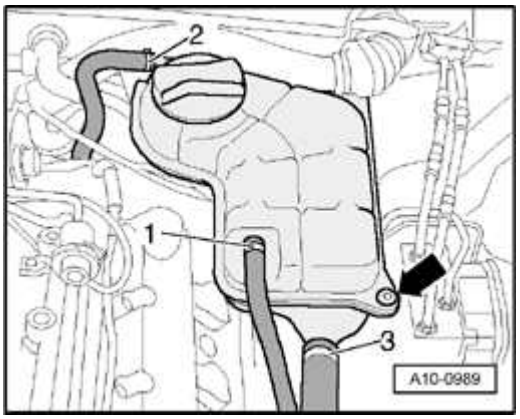


Fig. 244: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant hoses -1- to -3-.
- Remove coolant reservoir (arrow).
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of expansion tank.

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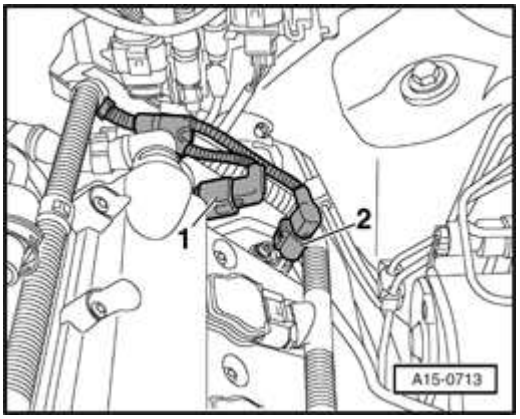


Fig. 245: Disconnecting Electrical Harness Connectors And At Camshaft Position (CMP) Sensor 2 -G163- And Camshaft Position (CMP) Sensor 4 -G301-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors -1- and -2- at Camshaft Position (CMP) sensor 2 -G163- and Camshaft Position (CMP) sensor 4 -G301-.
- Unbolt Ground (GND) wire at rear of cylinder head.
- Toothed belt, removing. Refer to **Toothed belt, removing and installing**.
- Remove camshaft gears from left cylinder head.

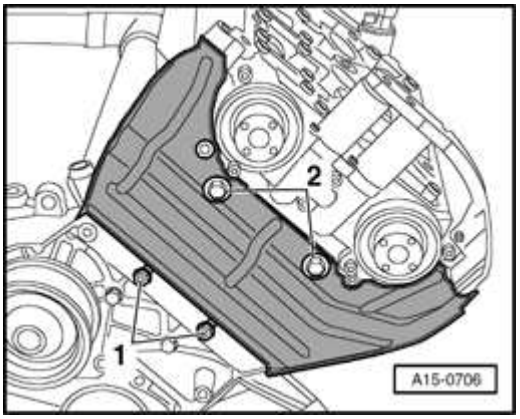


Fig. 246: Unscrewing Bolts And Removing Toothed Belt Guard At Left Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and -2- and remove toothed belt guard at left rear.

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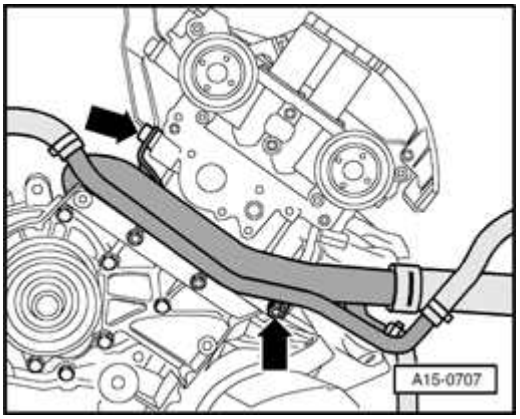


Fig. 247: Removing Front Coolant Pipe From Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front coolant pipe from cylinder head (arrows).

Vehicles with automatic transmission

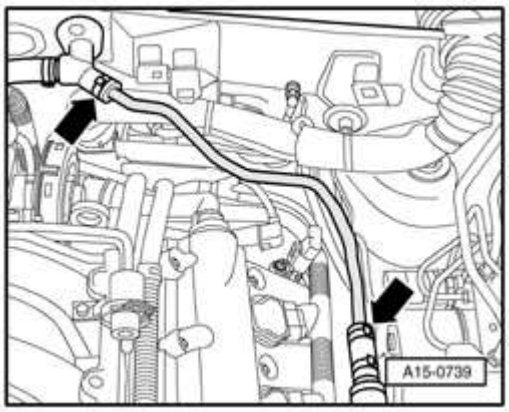


Fig. 248: Disconnecting Vacuum Hose To Brake Booster
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose to brake booster (arrows).

All

- Remove heat shield for harness connectors at left of bulkhead, if installed.

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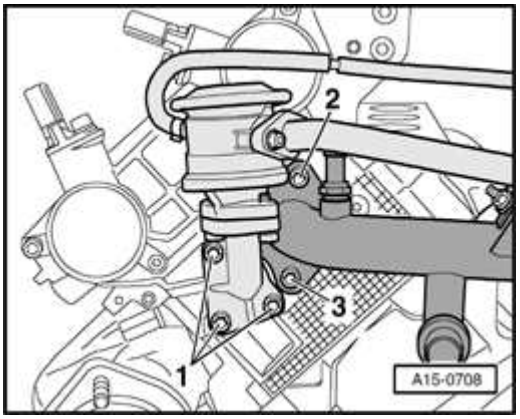


Fig. 249: Removing Bolts At Flange Of Combination Valve For Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- at flange of combination valve for secondary air injection.
- Unbolt coolant pipe at rear of cylinder head (bolts -2- and -3-).

NOTE:

- **Coolant pipe and combination valve remain installed.**
- **Illustration is shown with engine removed.**

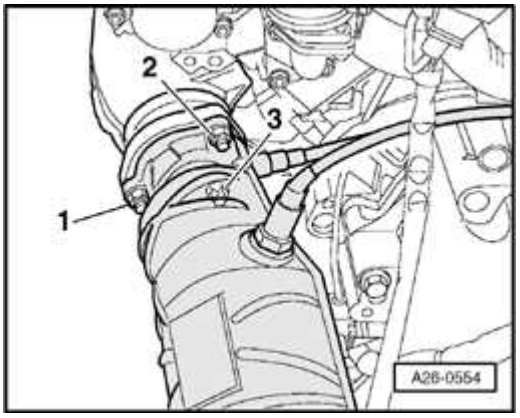


Fig. 250: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for left exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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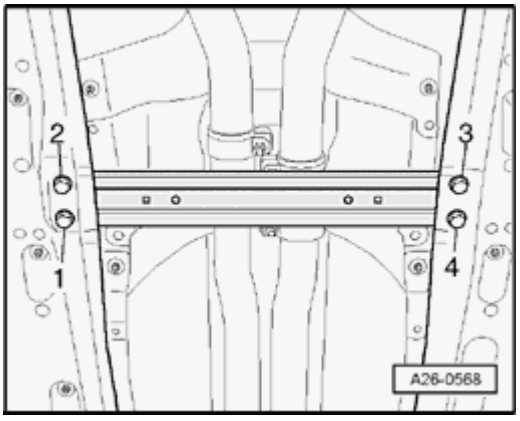


Fig. 251: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front vehicle floor crossmember -1- to -4-.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

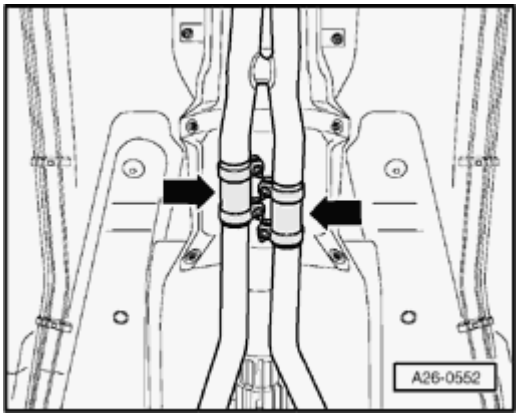


Fig. 252: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at left double clamp (left arrow).

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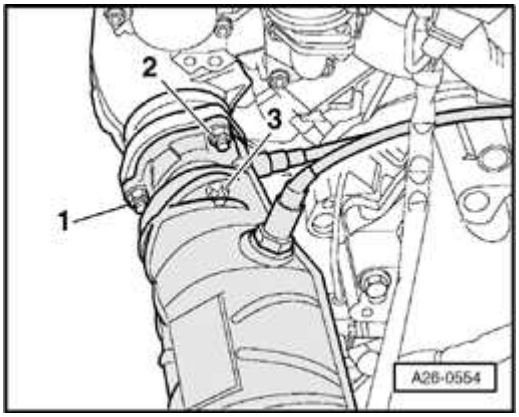


Fig. 253: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/left exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Press front exhaust pipe off of exhaust manifold.

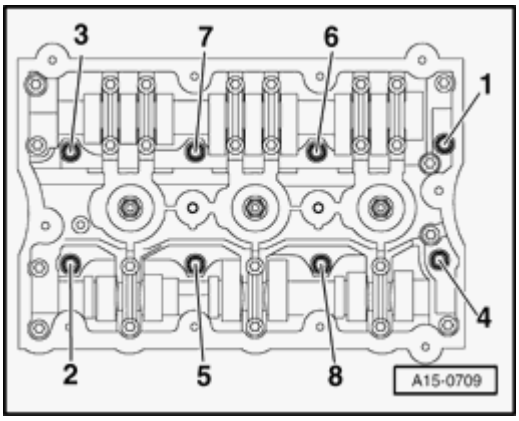


Fig. 254: Identifying Cylinder Head Bolts Loosening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Follow sequence -1- to -8- when loosening cylinder head bolts.
- Carefully remove cylinder head.

Right cylinder head, removing

Special tools and equipment

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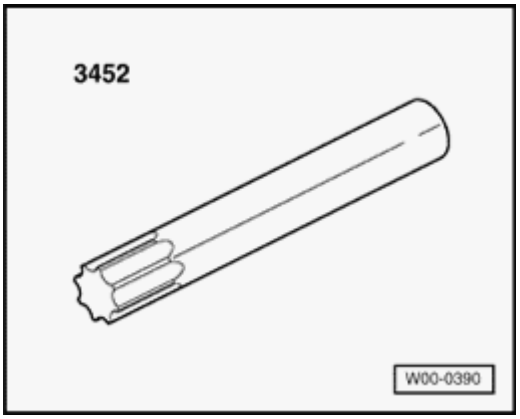


Fig. 255: 3452 Polydrive Key
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3452 Polydrive key

Removing

- Engine installed.

NOTE: All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.

- Remove intake manifold. Refer to **Intake manifold, removing and installing**.

NOTE: Place a rag under the hydraulic pressure lines, to catch escaping hydraulic fluid.

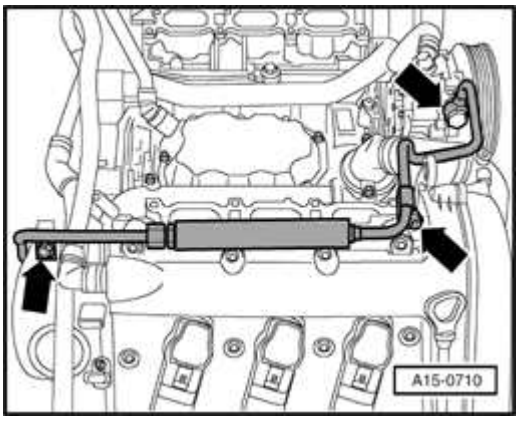


Fig. 256: Removing Power Steering Pressure Line From Power Steering Pump At Cylinder Head And At Rear Of Coolant Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove power steering pressure line from power steering pump at cylinder head and at rear of coolant pipe (arrows).

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- Lay pressure line to side.

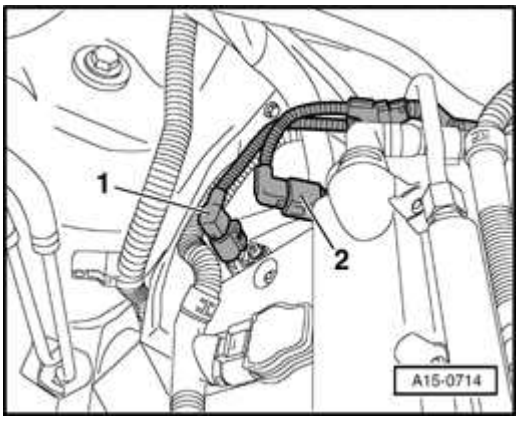


Fig. 257: Disconnecting Electrical Harness Connectors At Camshaft Position (CMP) Sensor -G40- And Camshaft Position (CMP) Sensor 3 -G300-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors -1- and -2- at Camshaft Position (CMP) sensor -G40- and Camshaft Position (CMP) sensor 3 -G300-.
- Toothed belt, removing. Refer to **Toothed belt, removing and installing**.
- Remove camshaft gears from right cylinder head.

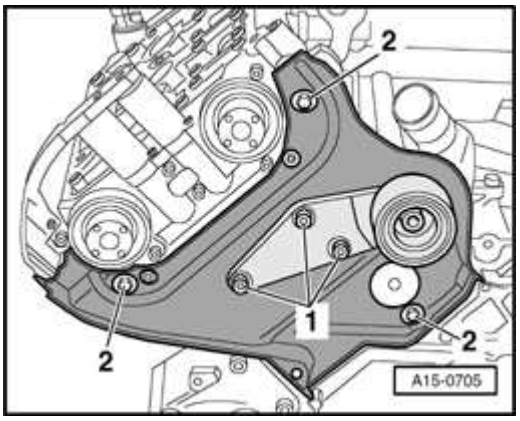


Fig. 258: Unscrewing Bolts And Removing Bracket With Idler Roller & Toothed Belt Guard At Right Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and remove bracket with idler roller.
- Unscrew bolts -2- and remove toothed belt guard at right rear.

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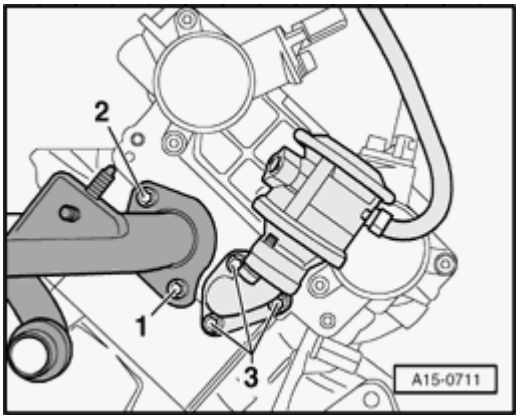


Fig. 259: Removing Bolts And Combination Valve For Secondary Air Injection With Flange From Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -3- and remove combination valve for secondary air injection with flange from cylinder head.
- Unbolt coolant pipe at rear of cylinder head (bolts -1- and -2-).

NOTE:

- **Coolant pipe remains installed.**
- **Illustration is shown with engine removed.**

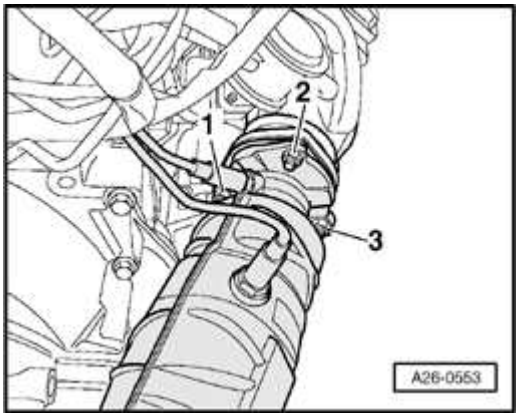


Fig. 260: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for right exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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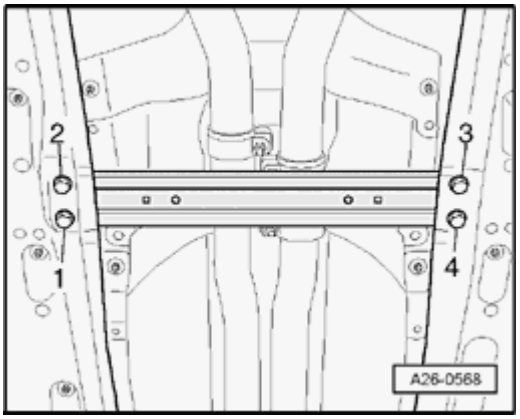


Fig. 261: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front vehicle floor crossmember -1- to -4-.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

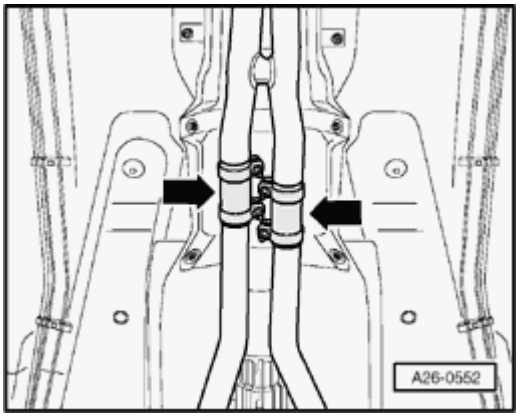


Fig. 262: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at right double clamp (right arrow).

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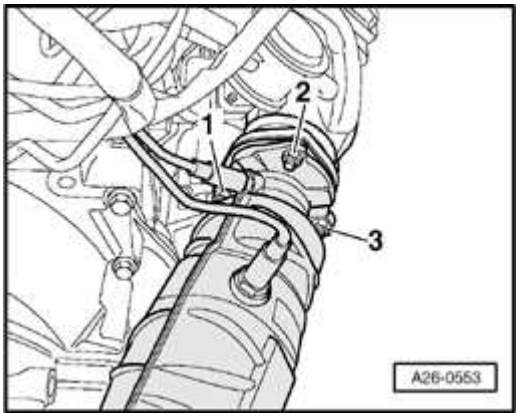


Fig. 263: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/right exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Press front exhaust pipe off of exhaust manifold.

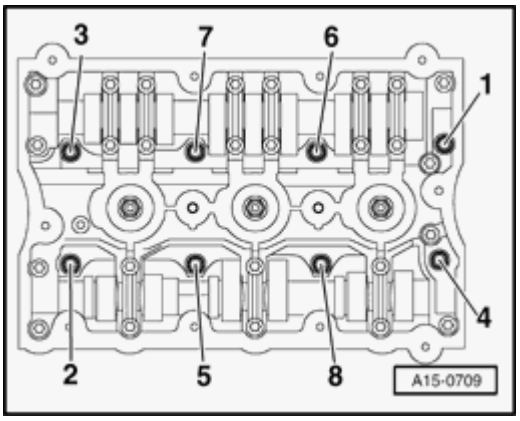


Fig. 264: Identifying Cylinder Head Bolts Loosening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Follow sequence -1- to -8- and loosen cylinder head bolts.
- Carefully remove cylinder head.

Cylinder head, installing

NOTE:

- **Replace cylinder head bolts.**
- **Replace self-locking nuts and bolts during assembly work.**
- **Always replace bolts that are secured with tightening torque as well as O-rings and gaskets.**

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- **In case of repairs, carefully remove sealant residue from cylinder head and cylinder block. Avoid introducing any scratches or scoring.**
- **Thoroughly remove all sanding and grinding residue.**
- **Pocket holes in cylinder block for cylinder head bolts must be free of oil and coolant.**
- **Do not remove new cylinder head gasket from package until immediately before installing.**
- **Handle gasket with extra care. Damage in silicon layer and recessed area lead to leakage.**
- **Install cylinder head gasket onto guide sleeves. Marking "open" (top) or part number must face toward cylinder head.**
- **Secure all hose connections using hose clamps appropriate for the model type:**

Installation is reverse of removal, noting the following:

- Before installing cylinder head, set crankshaft and camshafts to TDC cylinder 3:

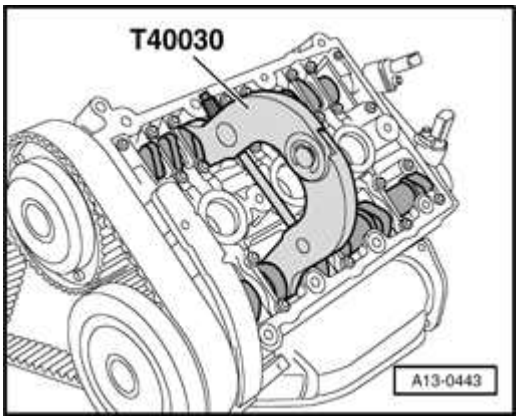


Fig. 265: Inserting T40030 Camshaft Adjuster Gauge At Left Cylinder Head In Same Manner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T40030 camshaft adjuster gauge must be inserted at both cylinder heads...

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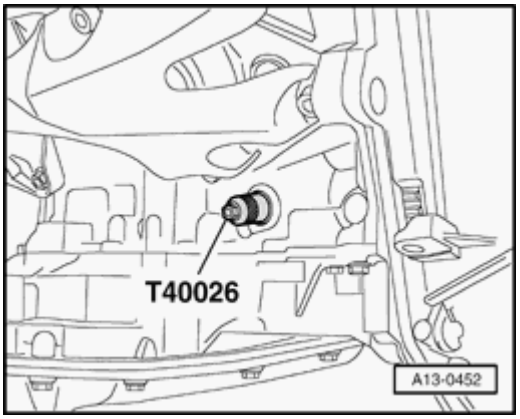


Fig. 266: Threading T40026 Locking Pin Into Hole Of Removed Sealing Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- .. and T40026 locking pin must be threaded in.

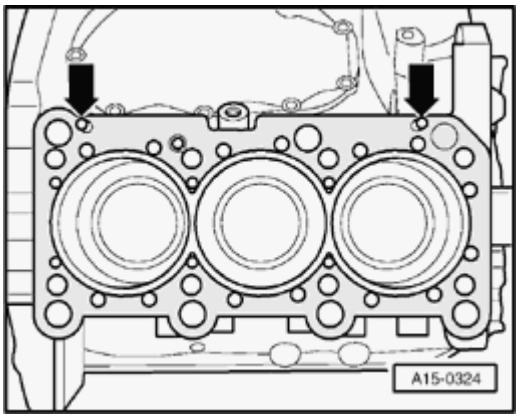


Fig. 267: Installing Cylinder Head Gasket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install cylinder head gasket.

- Observe centering pins (arrows) in cylinder block.
- Pay attention to installed position of cylinder head gasket, marking "open" (top) or part number must face toward cylinder head.

- Install cylinder head.
- Insert new cylinder head bolts and hand-tighten.

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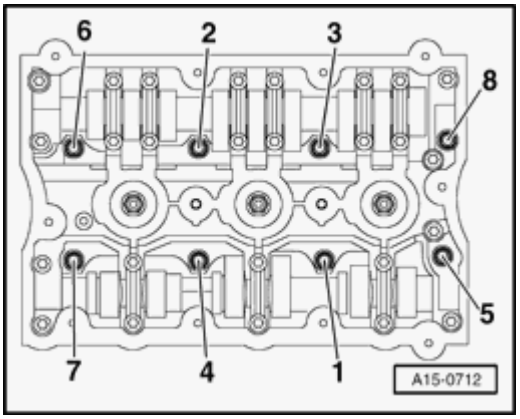


Fig. 268: Tightening Cylinder Head Bolts In Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten cylinder head bolts in sequence, in two stages.
- Tighten using torque wrench:
- 1. Stage: 40 Nm
- Tighten using a solid wrench:
- 2. Stage: 180° (1/2 turn) further

NOTE:

- **Two additional turns of 90° are permissible.**
- **It is not necessary to re-tighten the cylinder head bolts.**

- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.

NOTE: After working on the valvetrain, carefully rotate engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when starting.

- Install left front exhaust pipe with catalytic converter. Refer to **Installing** for vehicles with manual transmission and **Installing** for vehicles with automatic transmission 01V.
- Install right front exhaust pipe with catalytic converter. Refer to **Installing** for vehicles with manual transmission and **Installing** for vehicles with automatic transmission 01V.
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.
- Install centering pin for intake manifold.
- Install intake manifold. Refer to **Installing**.

See Caution for connecting Telematics battery. Refer to **Cylinder head, removing and installing**

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- Observe safety precautions after connecting the battery.

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

- Replace coolant. Refer to **Filling**.
- Fill up power steering fluid and bleed steering system:

Refer to **48 - STEERING**

Tightening torques

Component		Nm
Rear coolant pipe to cylinder head		10
Combination valve to cylinder head		10
Rear toothed belt guard to cylinder head or cylinder block		10 1)
Bracket for idler roller to cylinder head		10 1)
Front coolant pipe	M6	10
To cylinder head	M8	23
Power steering pressure line to hydraulic pump		47
Power steering pressure line to cylinder head		10
Power steering pressure line to rear coolant pipe		20

1) Replace bolts.

Compression pressure, checking

Special tools and equipment

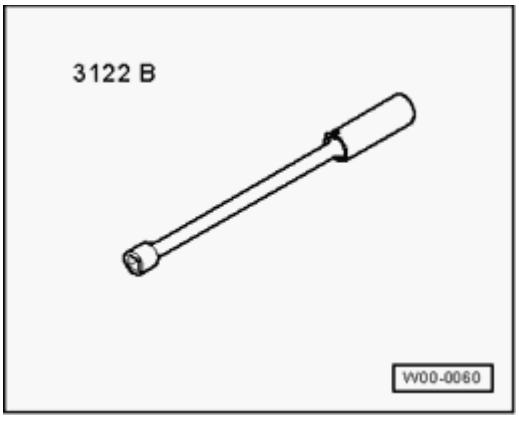


Fig. 269: Identifying Spark Plug Wrench 3122 B
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3122B Spark plug removal tool

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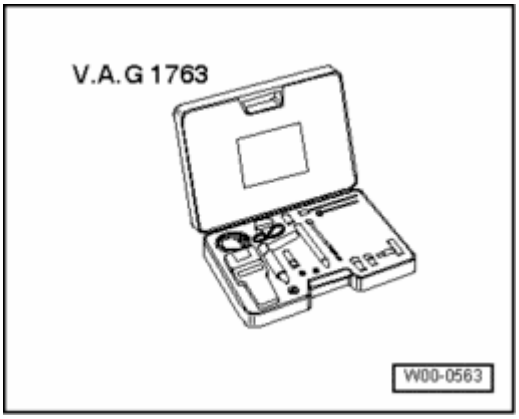


Fig. 270: Compression Tester VAG1381 Or VAG1763
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1381 or VAG1763 Compression tester

Requirements

- Minimum engine oil temperature: 30°C
- Battery voltage at least 12.7 V

Work sequence

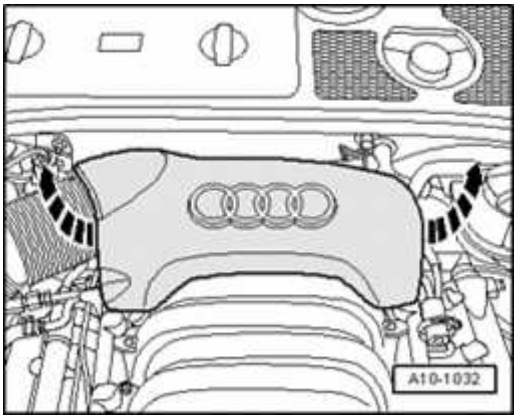


Fig. 271: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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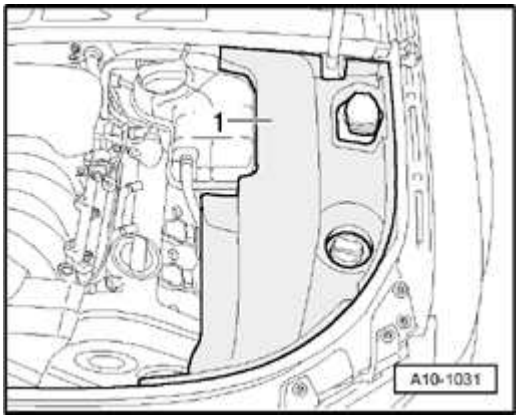


Fig. 272: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

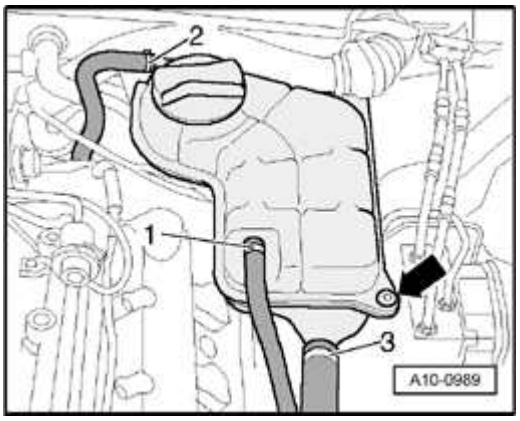


Fig. 273: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of expansion tank.
- Tie coolant expansion tank with connected coolant hoses -1 to 3- to side.

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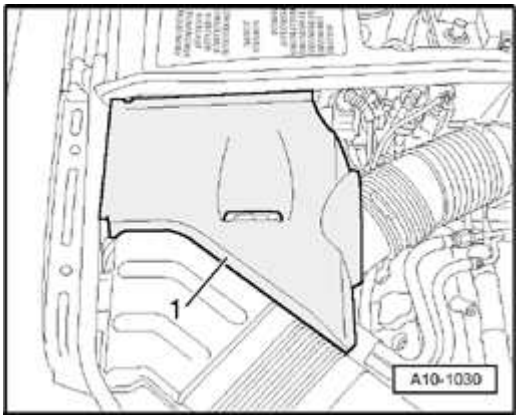


Fig. 274: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

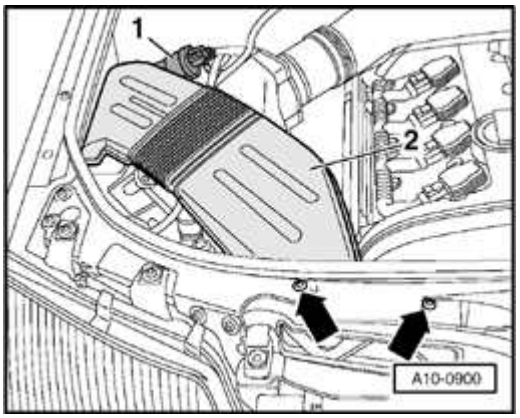
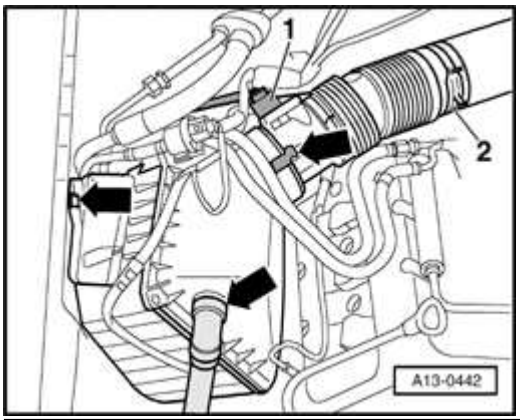


Fig. 275: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.



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Fig. 276: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).
- Disconnect electrical harness connector -1- at Mass Air Flow (MAF) sensor.
- Remove air guide hose -2- together with Mass Air Flow (MAF) sensor.

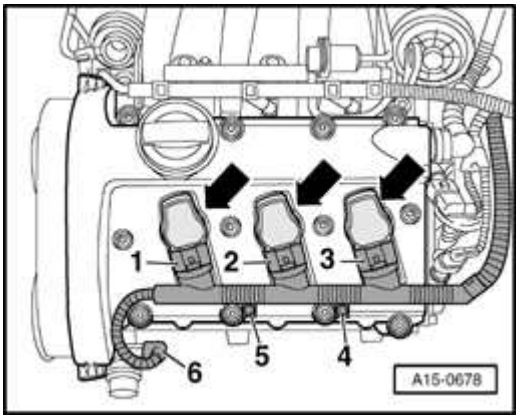


Fig. 277: Removing Bolts At Left Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -4- and -5- at left cylinder head cover.
- Disconnect electrical harness connectors -1- to -3- and -6-.
- Remove ignition coils (arrows).

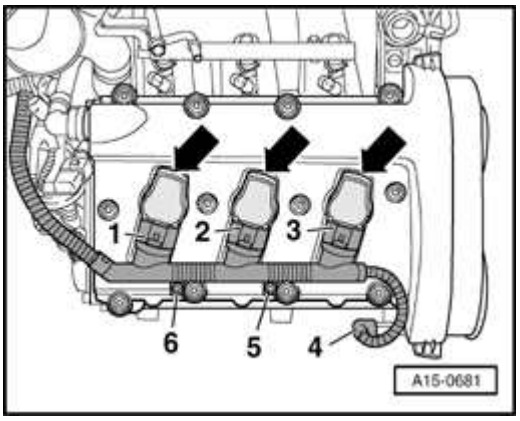


Fig. 278: Removing Bolts At Right Cylinder Head Cover & Disconnecting Electrical Harness Connectors
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -5- and -6- at right cylinder head cover.
- Disconnect electrical harness connectors -1- to -4-.
- Remove ignition coils (arrows).
- Using 3122B spark plug removal tool, remove spark plugs.

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- Remove all harness connectors to injectors.
- Open throttle fully.
- Test engine compression using VAG1381 or VAG1763 compression tester.

NOTE: Using VAG1381 or VAG1763 Compression Tester:

Refer to Operating instructions

- Activate starter until no further pressure increases are indicated by VAG1381 or VAG1763 compression tester.

Compression values

New Bar gauge pressure	Wear limit Bar gauge pressure	Difference between cylinders bar Gauge pressure
10.0 to 14.0	9.0	max. 3.0

- Install spark plugs and ignition coils.

The following work step must be performed after the engine compression test.

- Check DTC and erasing if necessary.

Use VAS5051 tester.

Tightening torque

Component	Nm
Spark plugs into cylinder head	30

VALVE TRAIN, SERVICING

Valve train, servicing

NOTE:

- **Cylinder heads with cracks between valve seats or between valve seat and spark plug thread can still be used without loss of service life if the cracks are minute (max. 0.3 mm width) or only the first four threads of a spark plug thread are cracked.**
- **After installing camshafts, do not start engine for at least 30 minutes. The hydraulic valve lifters have to settle (otherwise valves will strike the pistons).**
- **After working on the valvetrain, carefully rotate engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when**

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starting.

- **Replace gaskets and O-rings.**
- **Illustration depicts the left cylinder bank.**

Part I

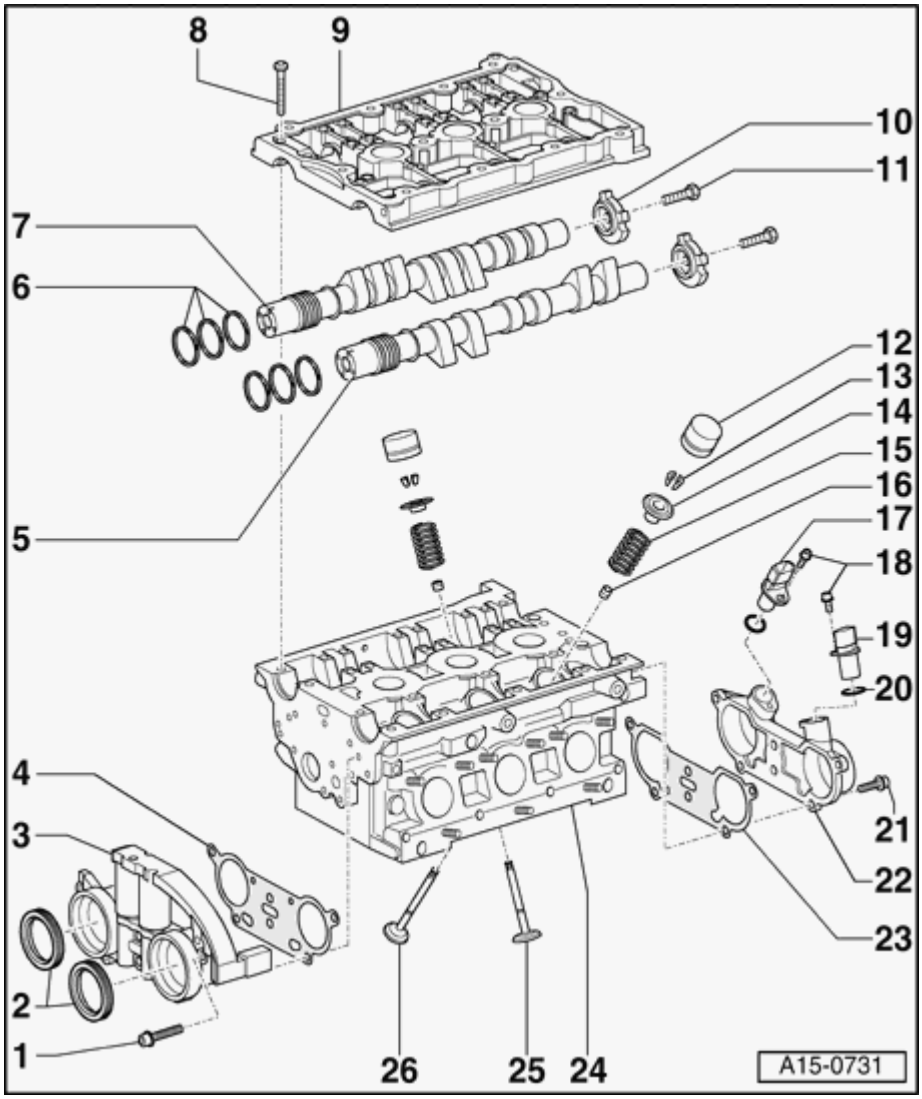


Fig. 279: Valve Train, Servicing Remove/Install Components - Part I
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - Seals

- Always replace. Refer to **Camshaft oil seals, replacing**

3 - Housing

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- For camshaft adjustment valves

4 - Gasket

- Always replace

5 - Exhaust camshaft

- Checking axial clearance. Refer to **Camshaft axial play, checking**
- Removing and installing. Refer to **Camshafts and camshaft adjusters, removing and installing**

Check radial clearance using Plastigage (hydraulic valve lifters removed):

- Wear limit: 0.1 mm
- Max. run-out: 0.01 mm

6 - Piston rings

- For camshaft adjuster
- Engage piston ring ends with each other. See **Fig. 282**
- If ring ends are not of locking ring type (cannot be locked together) align all ring gaps at top and install camshaft housing using a gentle side to side motion (do not rock top to bottom)

7 - Intake camshaft

- Checking axial clearance. Refer to **Camshaft axial play, checking**
- Removing and installing. Refer to **Camshafts and camshaft adjusters, removing and installing**

Check radial clearance using Plastigage (hydraulic valve lifters removed):

- Wear limit: 0.1 mm
- Max. run-out: 0.01 mm

8 - 10 Nm

- Tighten in several stages from inside out

9 - Guide frame

- With integrated camshaft bearings
- Removing and installing. Refer to **Camshafts and camshaft adjusters, removing and installing**

10 - Sensor wheel

- Note position (notch on camshaft)

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11 - 23 Nm

12 - Hydraulic valve lifter

- Checking. Refer to **Hydraulic valve lifters, checking**
- Removing and installing. Refer to **Valve stem oil seals, replacing**
- Do not interchange
- Install with journal surface facing down

- Before installing, check axial play of camshaft. Refer to **Camshaft axial play, checking**
- Oil contact surface

13 - Valve keepers

14 - Valve spring retainer

15 - Valve spring

16 - Valve stem oil seal

- Always replace. Refer to **Valve stem oil seals, replacing**

17 - Camshaft Position (CMP) sensor

- Cylinder bank 1 (right) Camshaft Position (CMP) sensor -G40-:
- Cylinder bank 2 (left) Camshaft Position (CMP) sensor 2 -G163-

18 - 10 Nm

19 - Camshaft Position (CMP) sensor for exhaust camshaft

- Cylinder bank 1 (right) Camshaft Position (CMP) sensor 3 -G300-
- Cylinder bank 2 (left) Camshaft Position (CMP) sensor 4 -G301-

20 - O-ring

- Always replace

21 - 10 Nm

22 - Camshaft Position (CMP) sensor housing

23 - Gasket

- Always replace

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24 - Cylinder head

- Observe note. Refer to **Valve train, servicing**
- Check valve guides, hand-lap valve seats. Refer to **Valve guides, checking**
- Reface valve seats. Refer to **Valve seats, refacing**

25 - Intake valve

- Do not reface, only hand-lapping is permitted
- Mark installation position for reinstalling
- Valve dimensions. See **Valve dimensions**
- Check valve guides, hand-lap valve seats. Refer to **Valve guides, checking**

26 - Exhaust valves

- Do not reface, only hand-lapping is permitted
- Mark installation position for reinstalling
- Valve dimensions. See **Valve dimensions**
- Check valve guides, hand-lap valve seats. Refer to **Valve guides, checking**

Part II

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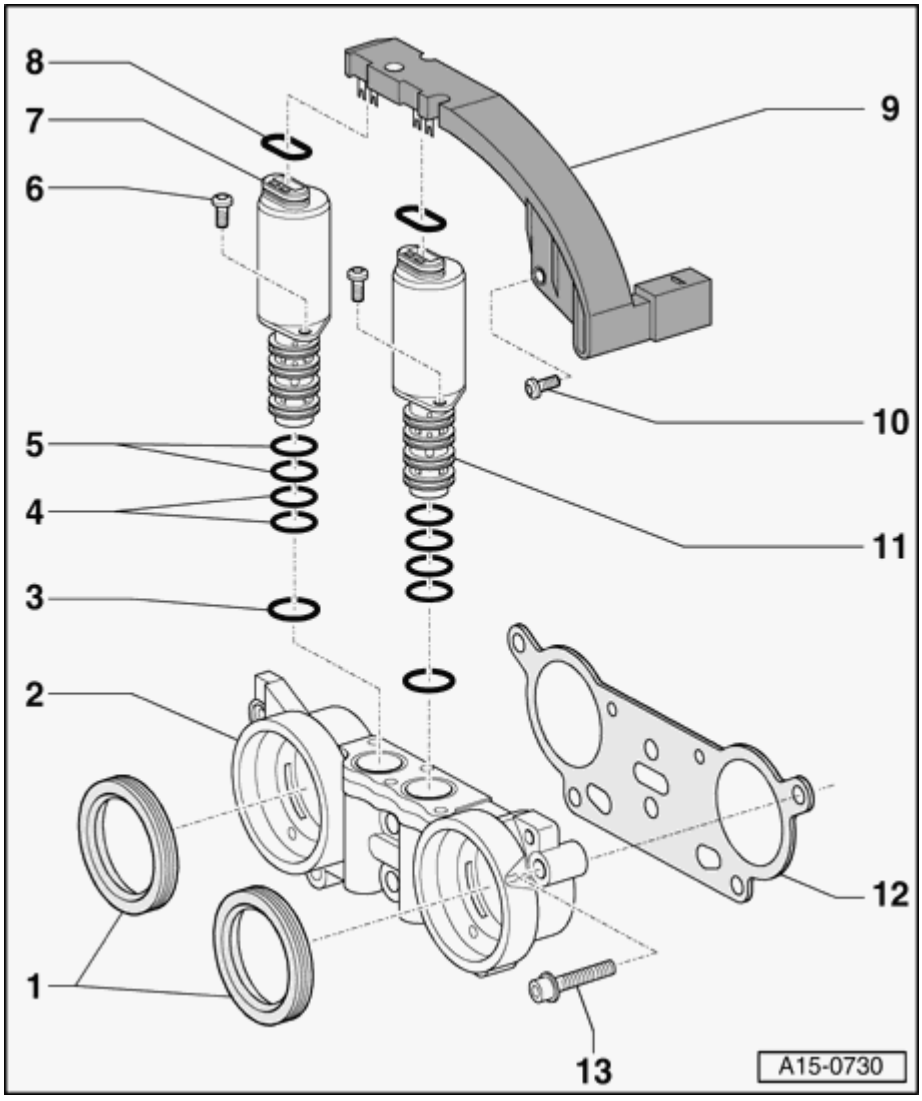


Fig. 280: Valve Train, Servicing Remove/Install Components - Part II
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Seals

- Always replace. Refer to **Camshaft oil seals, replacing**

2 - Housing

- For camshaft adjustment valves

3 - O-Rings

- Green
- Between solenoid valve housing and solenoid valves
- Always replace

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4 - O-Rings

- Black
- Always replace

5 - O-Rings

- Green
- Always replace

6 - 4 Nm

7 - Camshaft adjustment valve - intake side

- Cylinder bank 1 (right) Valve -1- for camshaft adjustment -N205-
- Cylinder bank 2 (left) Valve -2- for camshaft adjustment -N208-
- Do not interchange with a valve for camshaft adjustment (exhaust side)
- Note identification 12. 100 338

8 - Gasket

- Replace if damaged

9 - Connector adapter

- Must be replaced after disconnecting from camshaft adjustment valves
- Carefully press onto harness connectors of camshaft adjustment valves until they engage

10 - 4 Nm

11 - Camshaft adjustment valve - exhaust side

- Cylinder bank 1 (right) Camshaft Adjustment Valve 1 (exhaust) -N318-
- Cylinder bank 2 (left) - Camshaft Adjustment Valve 2 (exhaust) -N319-
- Do not interchange with a camshaft adjustment valve (intake side)
- Note identification 12. 100 339

12 - Gasket

- Always replace

13 - 10 Nm

Valve dimensions

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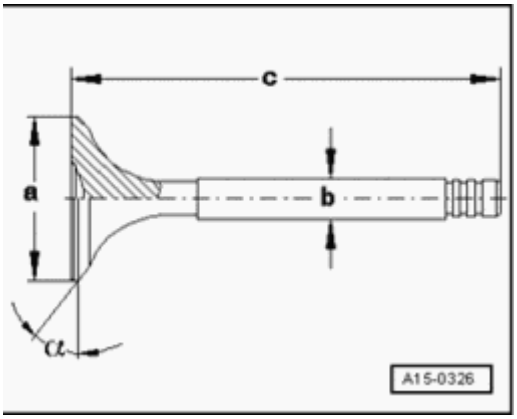


Fig. 281: Valve Dimensions
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: Valves must not be refaced. Only hand-lapping is permitted.

Dimension		Intake valve	Exhaust valves
| a	mm	26.80 to 27.00	29.80 to 30.00
| b	mm	5.96 to 5.97	5.94 to 5.95
c	mm	104.84 to 105.34	103.64 to 104.14
a	Angle°	45	45

WARNING:

- **Sodium-filled exhaust valves must not be scrapped without first being properly treated.**
- **Using a metal saw, the valves must be cut in half between the shaft center and valve plate. They must not come into contact with water while being cut. After cutting open valves, throw not more than 10 at a time into a bucket of water. Then step back. A sudden chemical reaction will occur during which the sodium filling is consumed.**
- **Valves that have been treated in this manner can then be disposed of as normal scrap metal.**

Engage piston ring ends, if necessary, or line up ring gaps at top

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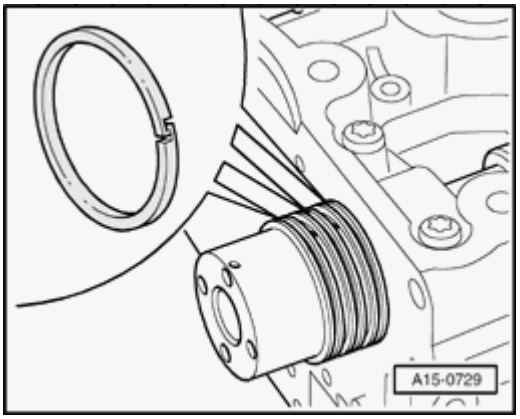


Fig. 282: Checking Whether Piston Rings At Camshafts Are Installed
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check whether piston rings at camshafts are installed and whether piston ring ends are engaged with each other.

NOTE: If ends of installed piston are not of the locking type (cannot be locked together):

- Always orient the rings so that the gaps (of all three rings) are at the top of the camshaft prior to installation of the camshaft adjustment housing.

With all ring gaps aligned at the top of camshaft:

- Install camshaft adjustment housing using a gentle side to side motion (do not rock top to bottom).

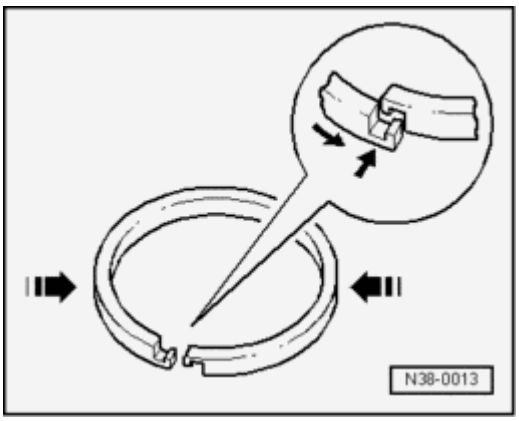


Fig. 283: Hooking Ends Of Piston Ring Together
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If necessary, engage ends of installed piston rings (arrows), as depicted in illustration.

Camshaft axial play, checking

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Special tools and equipment

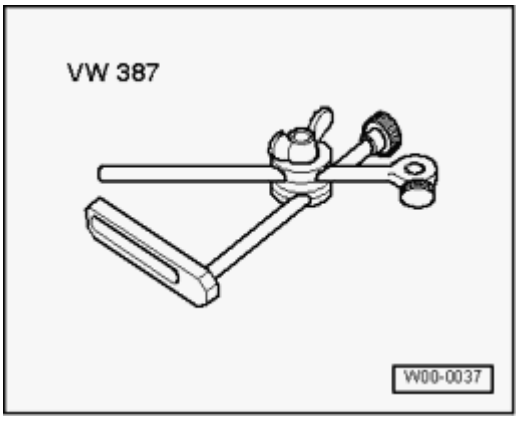


Fig. 284: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VW387 Dial gauge holder
- Dial gauge

Work sequence

- Remove camshafts. Refer to **Camshafts and camshaft adjusters, removing and installing**.
- Remove hydraulic valve lifters.
- Insert camshafts into cylinder head and install guide frame.

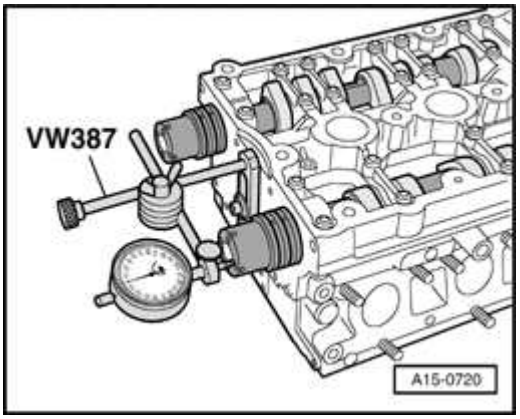


Fig. 285: Securing Dial Indicator To Cylinder Head Using VW387 Dial Gauge Holder
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure dial indicator to cylinder head using VW387 dial gauge holder.
- Press camshaft to be checked against dial indicator by hand.
- Set dial indicator to 0.
- Press crankshaft away from dial indicator.

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- Read clearance.

New	Wear limit
0.08 to 0.16 mm	0.20 mm

Camshaft oil seals, replacing

Special tools and equipment

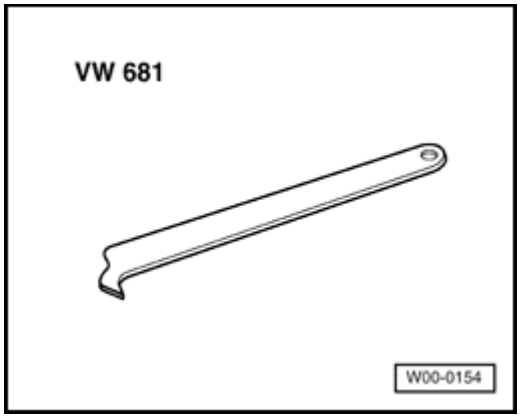


Fig. 286: Special Tool - Oil Seal Extractor Lever VW 681
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VW681 Extractor lever

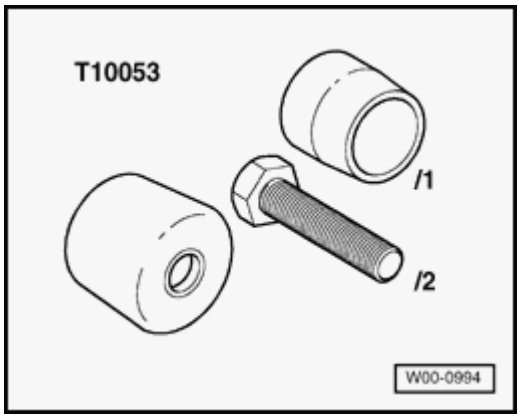


Fig. 287: T10053 Assembly Tool
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T10053 Assembly tool

Removing

- Remove toothed belt. Refer to **Toothed belt, removing and installing**.
- Mark installed position of camshaft gears for re-installation.

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- Remove camshaft gears.

NOTE:

- **In case of leaks of one shaft seal, replace sealing rings at both cylinder heads.**
- **Be careful not to damage seating surface when pressing out sealing rings.**

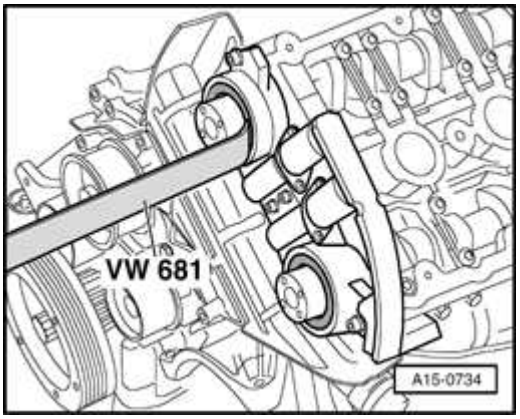


Fig. 288: Installing Camshaft Sealing Rings Using VW681 Extractor Lever
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install camshaft sealing rings using VW681 extractor lever.
- Clean seating surfaces.

Installing

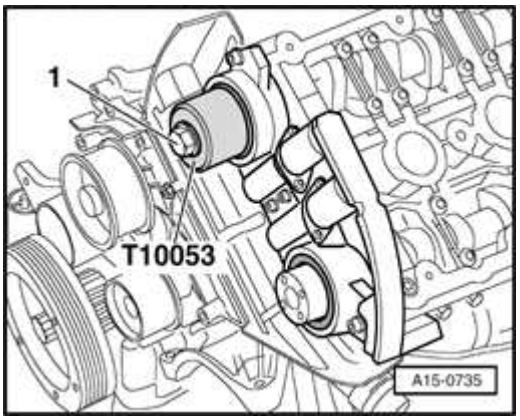


Fig. 289: Pressing In Sealing Ring For Camshaft Gear Flush To Housing Using T10053 Assembly Tool And Bolt
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press in sealing ring for camshaft gear flush to housing using T10053 assembly tool and bolt -1-.
- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.

Camshafts and camshaft adjusters, removing and installing

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Special tools and equipment

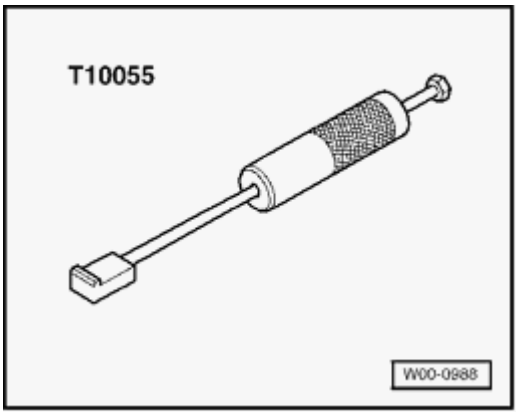


Fig. 290: Identifying Puller T10055 With Adapter T10055/3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T10055 Extractor

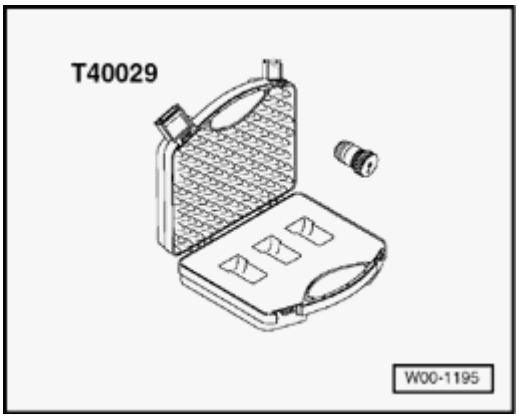


Fig. 291: T40029 Locating Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T40029 Locating pin
- Drill with plastic brush attachment
- Protective glasses
- Sealants

Removing

- Toothed belt, removing. Refer to **Toothed belt, removing and installing**.
- Remove respective camshaft gears.
- Remove combination valve for Secondary Air Injection. Refer to **Left combination valve for secondary air injection, removing and installing** or **Right combination valve for secondary air injection, removing and installing**.

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Right cylinder head

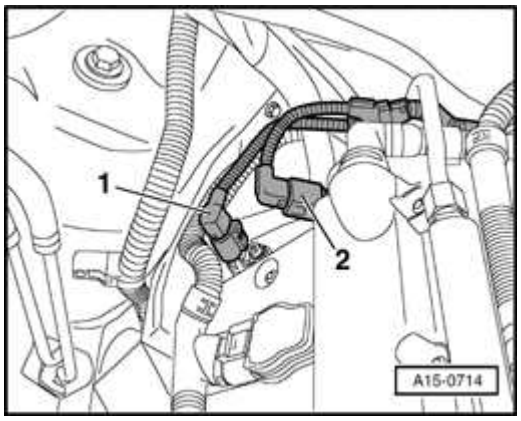


Fig. 292: Disconnecting Electrical Harness Connectors At Camshaft Position (CMP) Sensor -G40- And Camshaft Position (CMP) Sensor 3 -G300-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors -1- and -2- at Camshaft Position (CMP) sensor -G40- and Camshaft Position (CMP) sensor 3 -G300-.

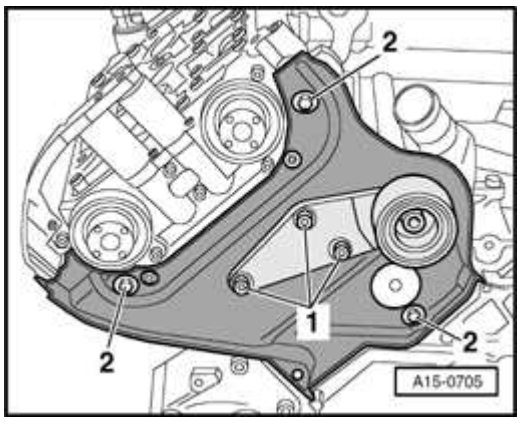


Fig. 293: Unscrewing Bolts And Removing Bracket With Idler Roller & Toothed Belt Guard At Right Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and remove bracket with idler roller.
- Unscrew bolts -2- and remove toothed belt guard at right rear.

Left cylinder head

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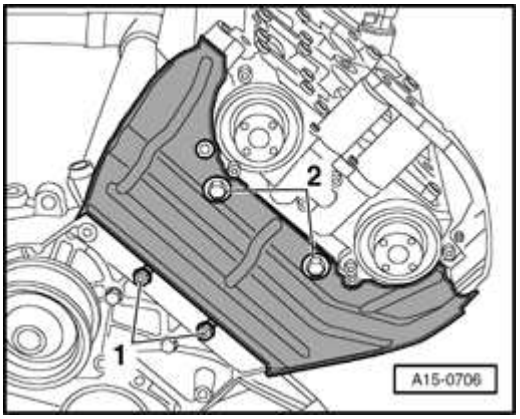


Fig. 294: Unscrewing Bolts And Removing Toothed Belt Guard At Left Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and -2- and remove toothed belt guard at left rear.

All

- Remove T40030 camshaft adjuster gauge from camshafts.

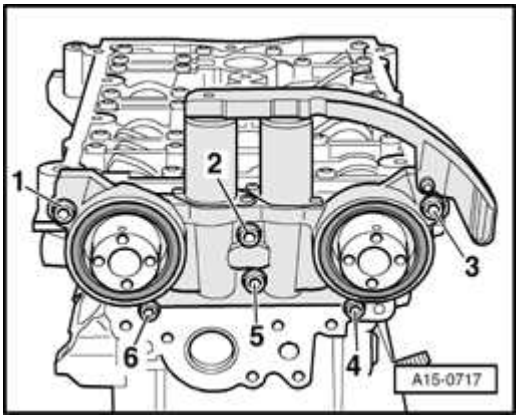


Fig. 295: Unscrewing Bolts And Removing Housing For Camshaft Adjustment Valves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- to -6- and remove housing for camshaft adjustment valves.

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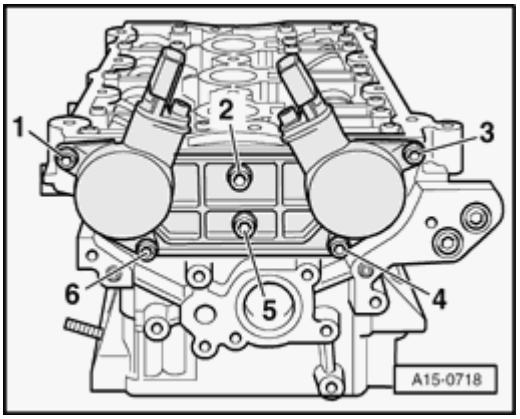


Fig. 296: Unscrewing Bolts And Removing Housing For Camshaft Position (CMP) Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- to -6- and remove housing for Camshaft Position (CMP) sensor.

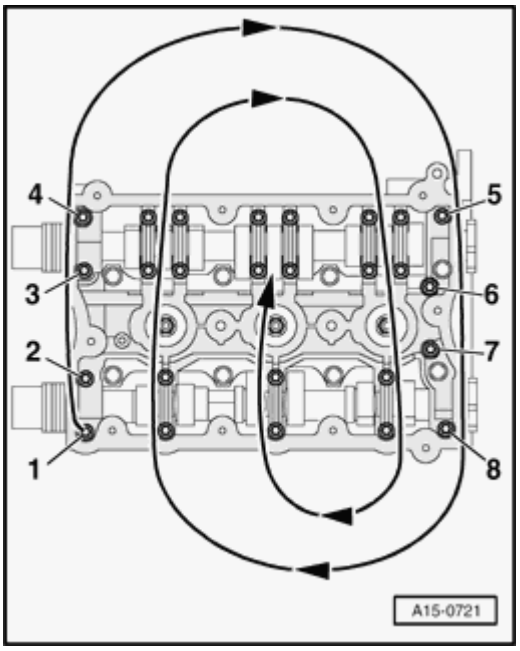


Fig. 297: Loosening Bolts Of Guide Frame In Sequence Of Numbers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen bolts of guide frame in sequence of numbers and follow arrows.

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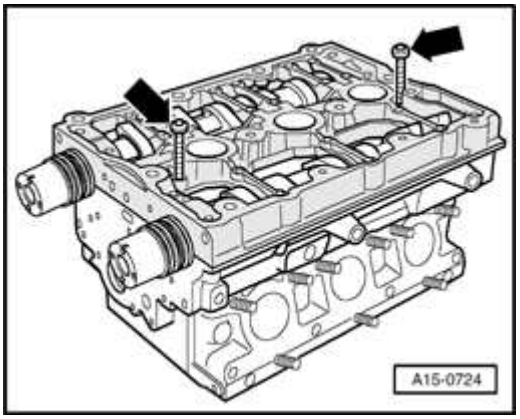


Fig. 298: Pressing Off Guide Frame With M6 Bolts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press off guide frame with M6 bolts (arrows).
- Carefully remove guide frame.

WARNING: Wear protective glasses.

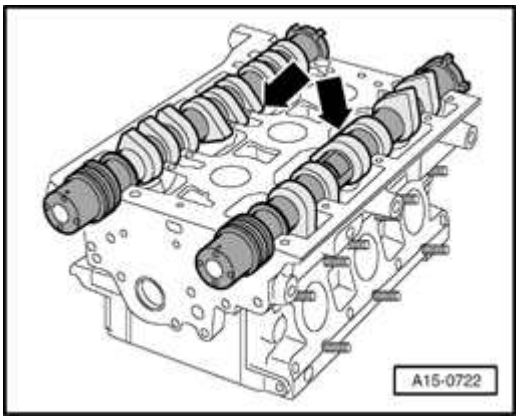
- Using rotating plastic brush, remove remaining sealant from cylinder head and guide frame.
- Clean sealing surfaces so they are completely free of any oil or grease.

Installing

NOTE: Replace gaskets and O-rings.

- Crankshaft aligned using T40026 locking pin
- Oil camshaft journal surface.

Left cylinder head



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Fig. 299: Inserting Camshaft Into Left Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft into cylinder head as depicted in illustration.
- Cams at cylinder 5 point downward evenly (arrows).

Right cylinder head

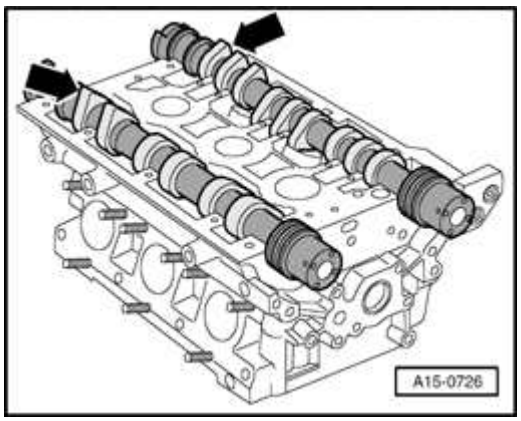


Fig. 300: Inserting Camshaft Into Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert camshaft into cylinder head as depicted in illustration.
- Cams at cylinder 3 point upward evenly (arrows)

All

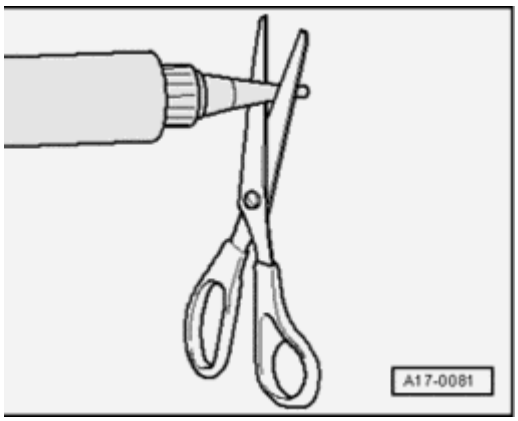


Fig. 301: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut tube nozzle at front marking (jet diameter approx. 1 mm).

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NOTE: Sealant bead must be applied according to exact specifications, otherwise excess sealant could get into the camshaft bearings.

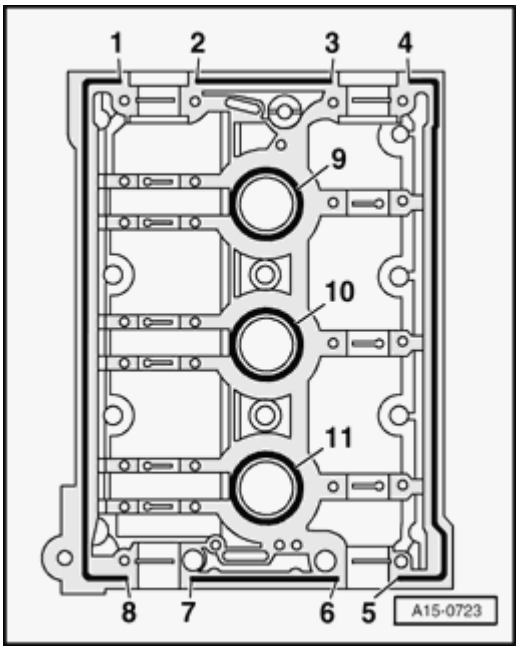


Fig. 302: Applying Sealant To Clean Sealing Surface Of Guide Frame
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply sealant to clean sealing surface of guide frame as depicted in illustration.

- Thickness of sealant bead: Approx. 1.2 mm
- Distance of sealant bead to camshaft bearings at specified locations -1- to -8-: at least 5 mm
- In addition, sealing surfaces around spark plug holes obtain a sealant ring each, -9- to -11-

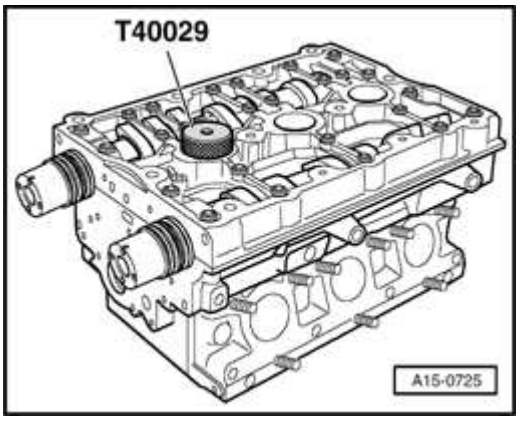


Fig. 303: Setting Guide Frame In Place And Align Using T40029 Locating Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Immediately set guide frame in place and align using T40029 locating pin.

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NOTE:

- **Setting in place and tightening the guide frame should occur without interruptions since the sealant starts to harden immediately.**
- **After installing guide frame, allow sealant to dry for approx. 30 minutes.**

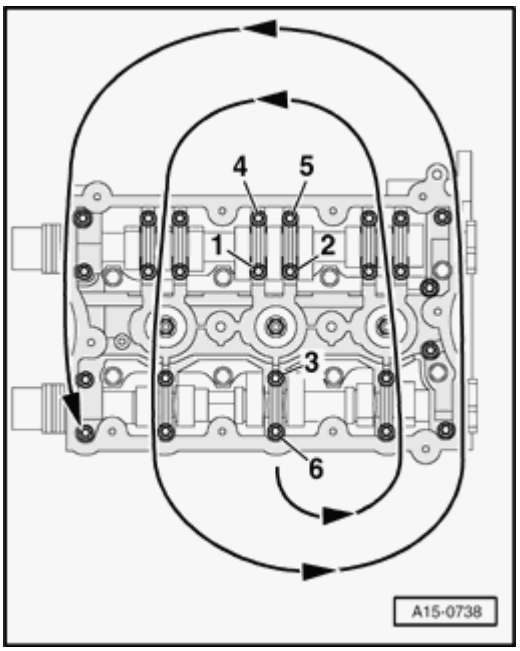


Fig. 304: Tightening Bolts Of Guide Frame In Sequence Of Numbers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten bolts of guide frame in sequence of numbers and follow arrows uniformly by hand.
- Guide frame must make full contact with cylinder head surface
- Tighten bolts of guide frame to final tightening torque (10 Nm).

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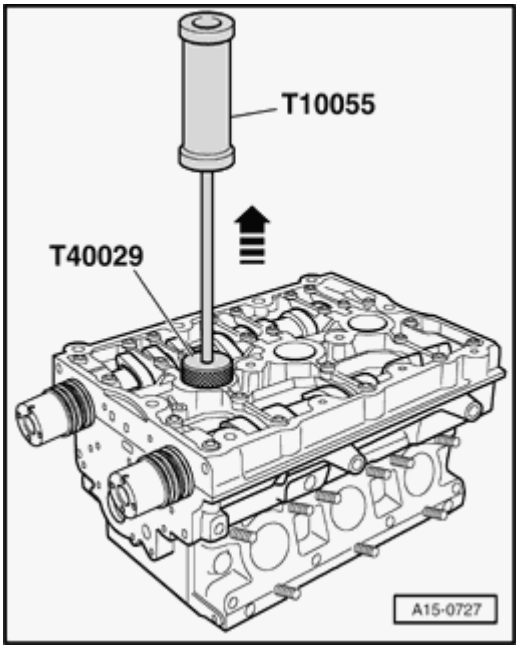


Fig. 305: Using T10055 Extractor To Remove T40029 Locating Pin From Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using T10055 extractor, remove T40029 locating pin from cylinder head.

Left cylinder head

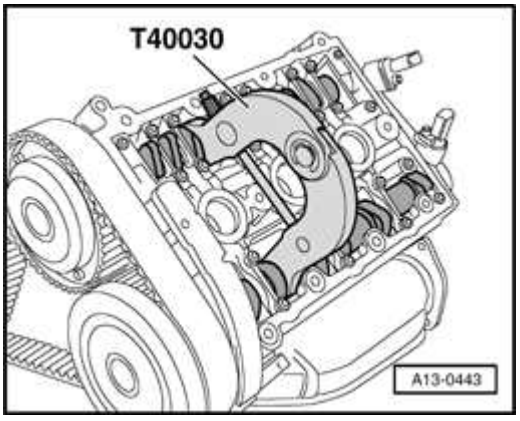


Fig. 306: Inserting T40030 Camshaft Adjuster Gauge At Left Cylinder Head In Same Manner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert T40030 camshaft adjuster gauge at camshafts.
- Spread T40030 camshaft adjuster gauge with threaded shaft (tightening torque 10 Nm) until it is seated without axial play.

Right cylinder head

- Install camshaft gear of exhaust camshaft.

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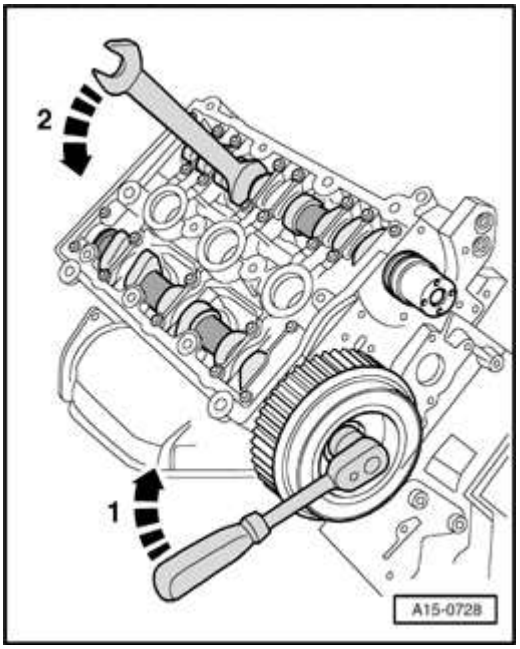


Fig. 307: Turning Exhaust Camshaft And Intake Camshaft 30°
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn exhaust camshaft (arrow -1-) and intake camshaft (arrow -2-) 30° in direction of arrow at same time...

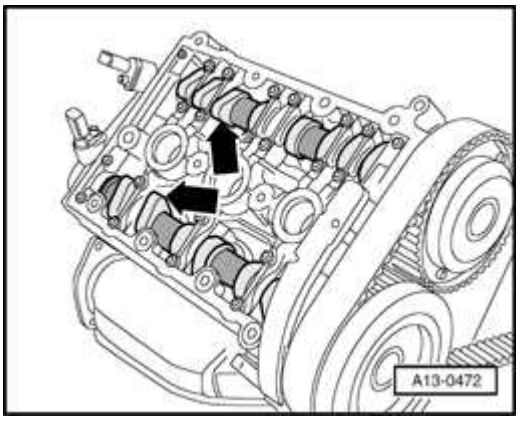


Fig. 308: Turning Engine Until Cams At Intake And Exhaust Camshaft Of Cylinder 3 (Right Cylinder Bank) Point Upward Uniformly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ..until cams (arrows) of cylinder 3 at intake and exhaust camshafts are as shown in illustration.

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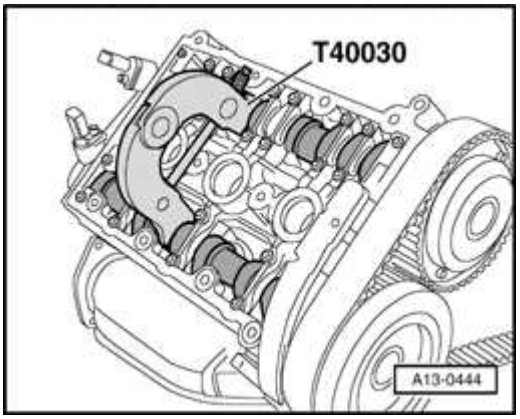


Fig. 309: Inserting T40030 Camshaft Adjuster Gauge At Camshafts Of Right Cylinder Head
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert T40030 camshaft adjuster gauge at camshafts.
- Remove exhaust camshaft gear again.

All

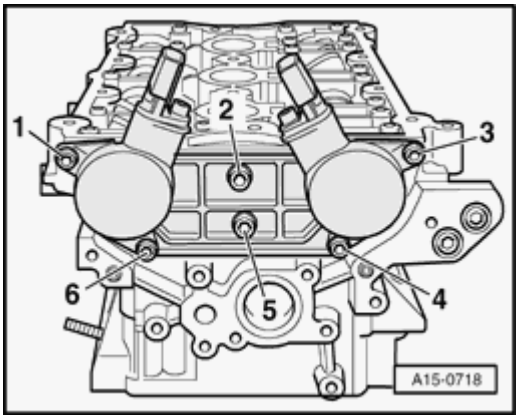


Fig. 310: Installing Camshaft Position (CMP) Sensor Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install Camshaft Position (CMP) sensor housing and tighten bolts -1- to -6-.

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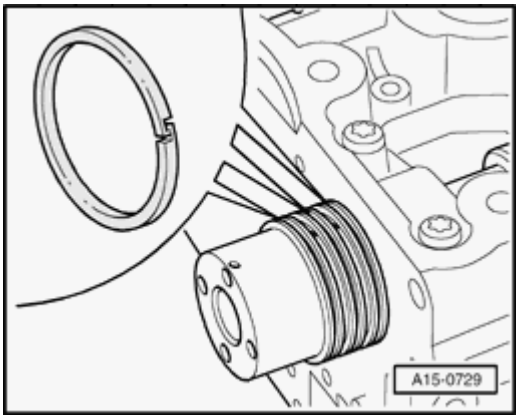


Fig. 311: Checking Whether Piston Rings At Camshafts Are Installed
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check whether piston rings at camshafts are installed and whether piston ring ends are engaged with each other.

NOTE: If ends of installed piston are not of the locking type (cannot be locked together):

- Always orient the rings so that the gaps (of all three rings) are at the top of the camshaft prior to installation of the camshaft adjustment housing.

With all ring gaps aligned at the top of camshaft:

- Install camshaft adjustment housing using a gentle side to side motion (do not rock top to bottom).

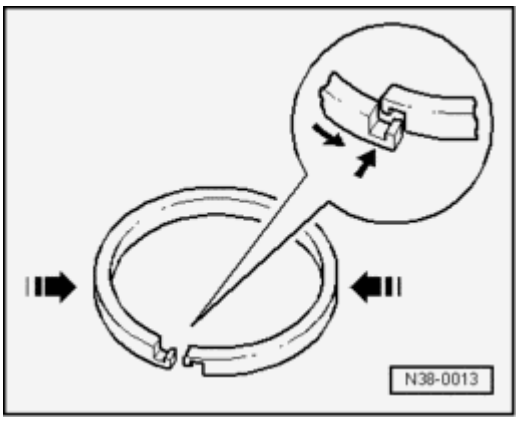


Fig. 312: Hooking Ends Of Piston Ring Together
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If necessary, engage ends of installed piston rings (arrows), as depicted in illustration.

NOTE:

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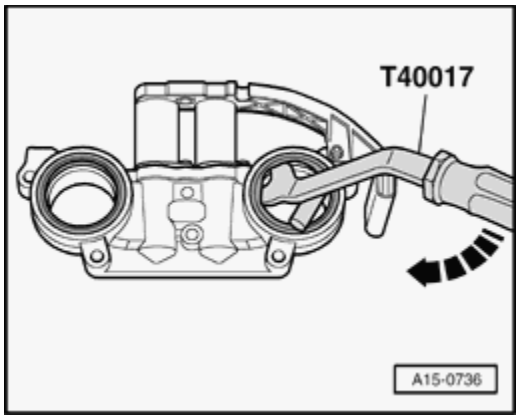


Fig. 313: Installing Camshaft Sealing Rings Using T40017 Lever
Courtesy of VOLKSWAGEN UNITED STATES, INC.

If the camshaft sealing rings are being replaced, they must be removed from camshaft adjustment housing before installation, using T40017 lever. Installing camshaft sealing rings. Refer to Camshaft oil seals, replacing.

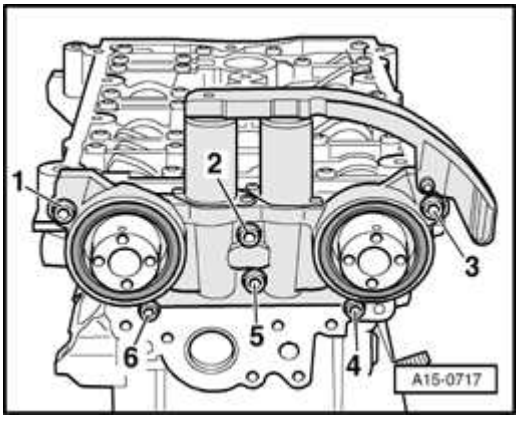


Fig. 314: Unscrewing Bolts And Removing Housing For Camshaft Adjustment Valves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install camshaft adjustment housing and tighten bolts -1- to -6-.

Installation is reverse of removal, noting the following:

- Install combination valve for Secondary Air Injection. Refer to **Left combination valve for secondary air injection, removing and installing**or **Right combination valve for secondary air injection, removing and installing**.
- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.

NOTE:

- **After installing camshafts, do not start engine for at least 30 minutes. The hydraulic valve lifters have to settle (otherwise valves will strike the**

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pistons).

- **After working on the valvetrain, carefully rotate engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when starting.**

Tightening torques

Component	Nm
Guide frame to cylinder head	10
Housing for Camshaft Position (CMP) sensor to cylinder head	10
Housing for camshaft adjustment valve to cylinder head	10
Rear toothed belt guard to cylinder head or cylinder block	10 1)

1) Replace bolts.

Hydraulic valve lifters, checking

Special tools and equipment

- Feeler gauge
- Wooden or plastic wedge

NOTE:

- **Hydraulic valve lifters cannot be serviced.**
- **Irregular valve noise when starting engine is normal.**

Work sequence

- Start engine and let run until coolant temperature reaches at least 80°C.
- Increase RPM to 2500 for approx. 2 minutes, if necessary road test vehicle.

NOTE: **If unusual valve noises disappear but then reappear during drive, replace oil retaining valve. Oil retaining valve, component location: Below cover at intake manifold. Refer to Oil check valves and spray jet valve, overview.**

If hydraulic valve lifters are still loud, locate faulty valve lifter as follows:

- Remove cylinder head cover. Refer to **Left cylinder head cover, removing and installing** or **Right cylinder head cover, removing and installing**.

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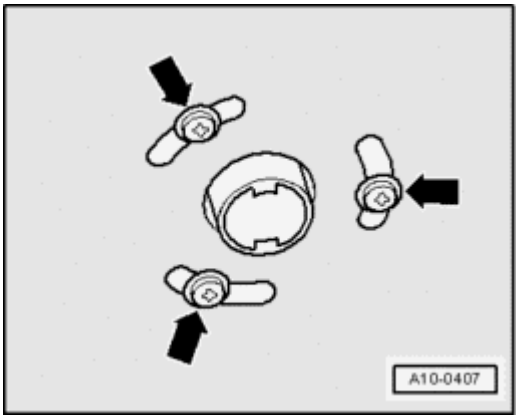


Fig. 315: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

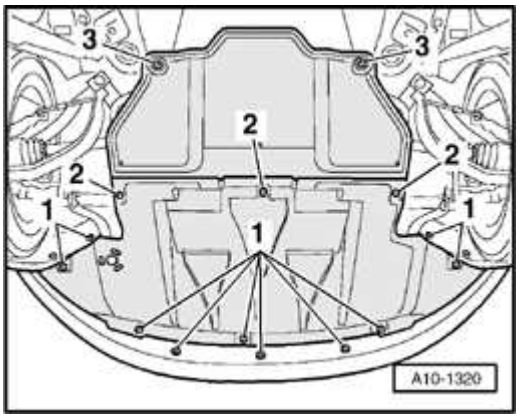


Fig. 316: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.

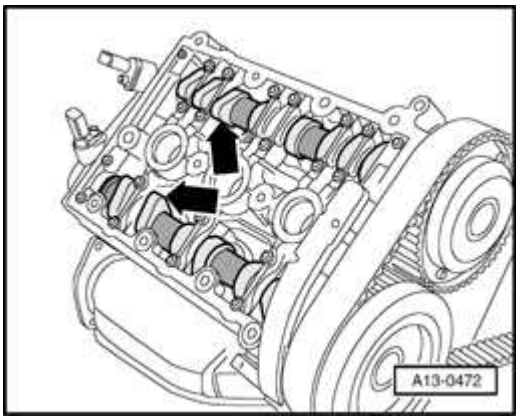


Fig. 317: Turning Engine Until Cams At Intake And Exhaust Camshaft Of Cylinder 3 (Right Cylinder

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Bank) Point Upward Uniformly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn crankshaft at center bolt of toothed belt gear clockwise until cams of cylinder to be checked point upward (arrows).
- Determine play between cams and valve lifters.

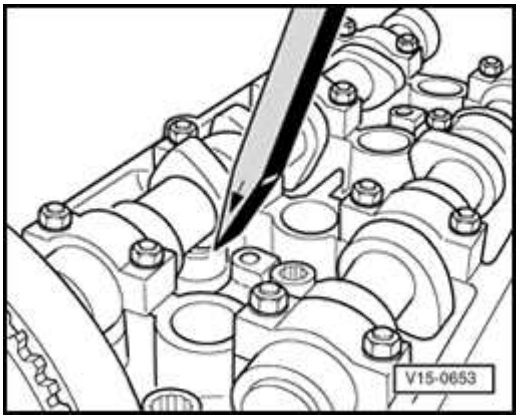


Fig. 318: Pressing Valve Lifter Downward Using Wedge
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press valve lifter downward using wooden or plastic wedge. If 0.20 mm feeler gauge can be inserted between camshaft and valve lifter, replace valve lifter. Valve lifters, replacing. Refer to **Camshafts and camshaft adjusters, removing and installing**.

NOTE:

- **After installing camshaft, do not start engine for at least 30 minutes. The hydraulic valve lifters have to settle (otherwise valves will strike the pistons).**
- **After working on the valvetrain, carefully rotate engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when starting.**

Valve stem oil seals, replacing

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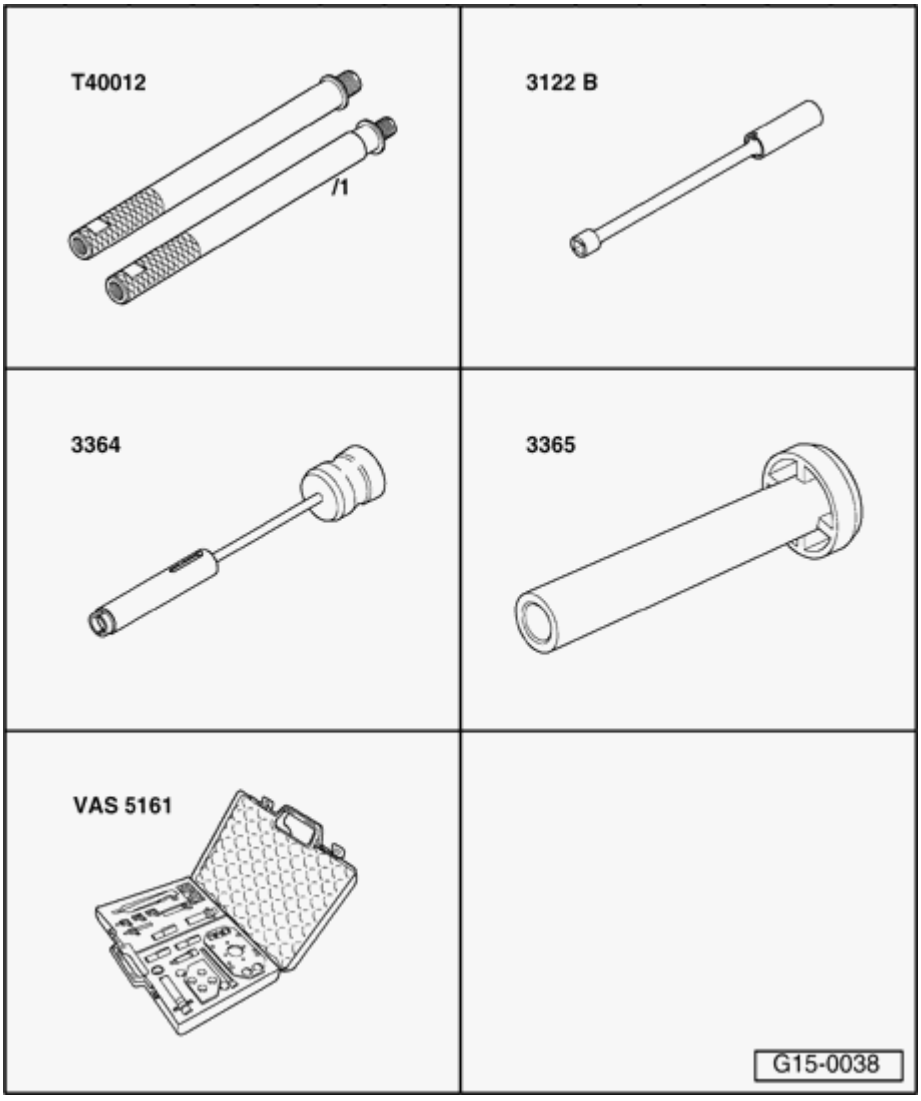


Fig. 319: Identifying Special Tools - Valve Stem Oil Seals, Replacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- Adapter T40012
- 3122B Spark plug removal tool
- 3364 Valve Seat Tool
- 3365 Valve Stem Seat Fitting Tool
- VAS 5161 Removal and installation device

Removing

- Cylinder head installed

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- Remove camshafts. Refer to **Camshafts and camshaft adjusters, removing and installing**.

NOTE:

- **Be careful not to switch valve lifters.**
- **Mark allocation of the valve lifters on back side using a waterproof felt-tip marker.**

- Remove valve lifters from guides and place aside with contact surface facing down.
- Using 3122B spark plug removal tool, remove spark plugs.
- Adjust piston of respective cylinder to BDC.

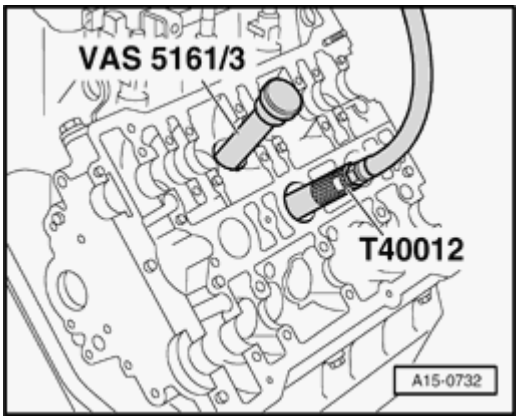


Fig. 320: Threading T40012 Adapter Into Spark Plug Thread
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread T40012 adapter into spark plug thread and apply constant pressure; at least 6 bar positive pressure.
- Insert VAS5161/3 drift into valve lifter guide.
- Loosen by hitting all stuck valve keys at all five valves using a plastic hammer.

Intake side

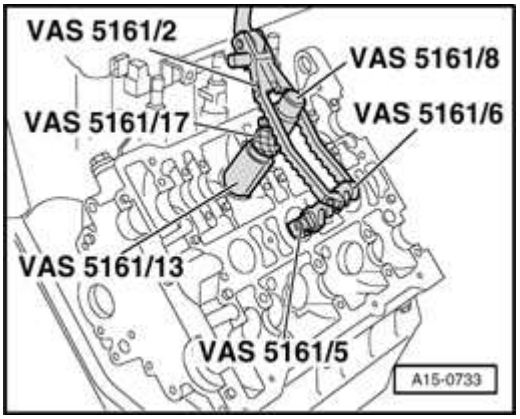


Fig. 321: Removing/Installing VAS5161/6, VAS5161/5 In Threaded Hole At Cylinder Head (Intake Side)

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread VAS5161/6 engaging device with VAS5161/5 engaging fork into one threaded hole at cylinder head.
- At valve to be removed, slide VAS5161/13 guide bushing into valve lifter guide up to stop.

- Installed position: Hatched areas point horizontally to direction of travel

- Slide VAS5161/17 knurled spacer ring onto VAS5161/8 installation cartridge.
- Slide installation cartridge into guide bushing.
- Hook in VAS5161/2 pressure fork at VAS 5161/6 engaging device and press installation cartridge downward.
- At same time, turn knurled bolt of installation cartridge toward right, until points engage in valve keys.

- Lightly move knurled bolt back and forth, this causes valve keys to be pressed apart and captured in cartridge.

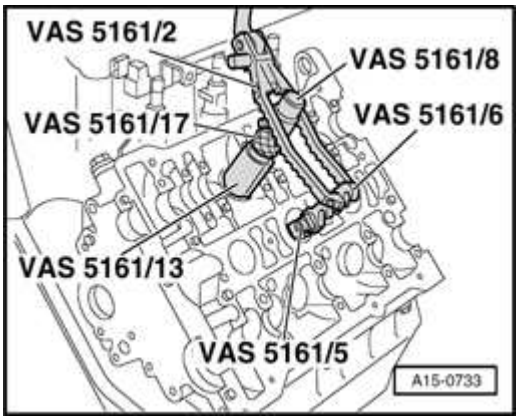


Fig. 322: Removing/Installing VAS5161/6, VAS5161/5 In Threaded Hole At Cylinder Head (Intake Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release pressure fork.
- Remove installation cartridge with spacer ring, guide bushing, valve plate and valve spring.

Exhaust side

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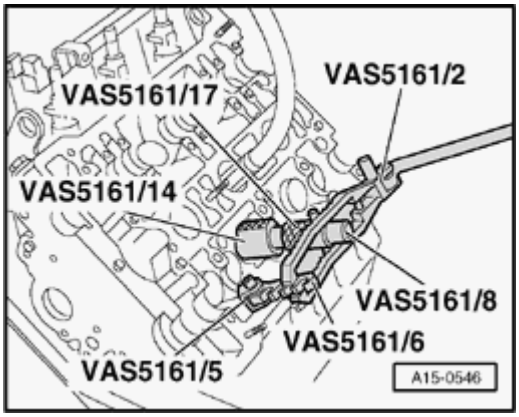


Fig. 323: Removing/Installing VAS5161/6, VAS5161/5 In Threaded Hole At Cylinder Head (Exhaust Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread VAS5161/6 engaging device with VAS5161/5 engaging fork into one threaded hole at cylinder head.
- At valve to be removed, slide VAS5161/14 guide bushing into valve lifter guide up to stop.

- Installed position: Hatched areas point horizontally to direction of travel

- Slide VAS5161/17 knurled spacer ring onto VAS5161/8 installation cartridge.
- Slide installation cartridge into guide bushing.
- Hook in VAS5161/2 pressure fork at VAS 5161/6 engaging device and press installation cartridge downward.
- At same time, turn knurled bolt of installation cartridge toward right, until points engage in valve keys.

- Lightly move knurled bolt back and forth, this causes valve keys to be pressed apart and captured in cartridge.
- Release pressure fork.
- Remove installation cartridge with spacer ring, guide bushing, valve plate and valve spring.

All

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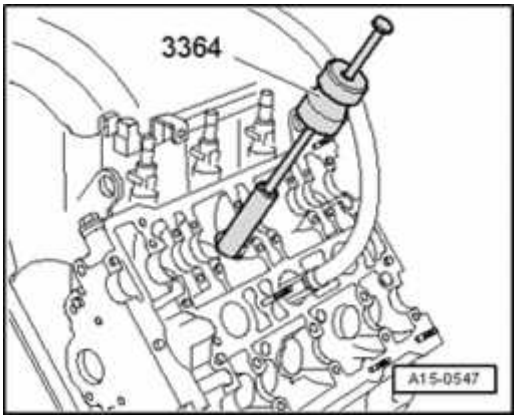


Fig. 324: Removing Valve Stem Oil Seals Using 3364 Valve Seat Tool
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove valve stem oil seals using 3364 valve seat tool.

If due to limited space 3364 valve stem removal tool cannot be used at some valve stem oil seals, continue as follows:

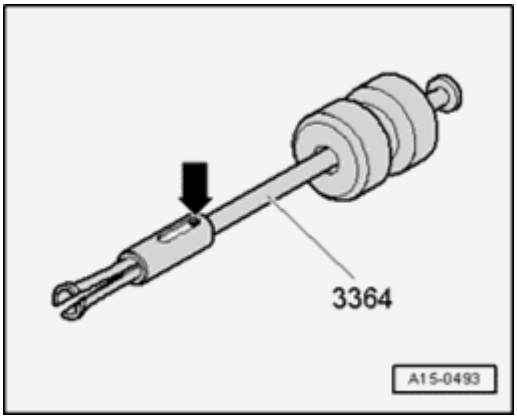


Fig. 325: Identifying Valve Seal Removal Tool 3364
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drive out spring dowel sleeve (arrow) at 3364 valve stem removal tool using a drift and remove impact extractor device.

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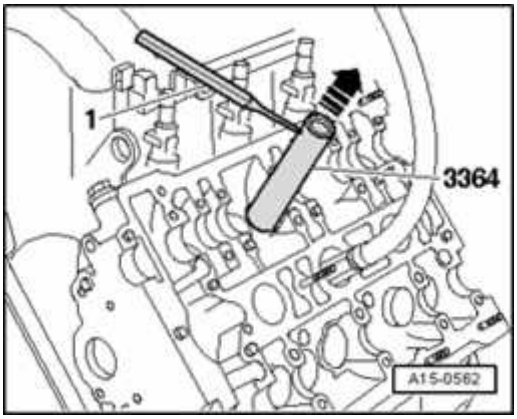


Fig. 326: Positioning Lower Part Of 3364 Valve Stem Removal Tool At Valve Stem Oil Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position lower part of 3364 valve stem removal tool at valve stem oil seal.
- Secure 3364 valve stem removal tool using a drift or cotter pin driver -1- as shown in illustration.
- Position a lever at 3364 valve stem removal tool and remove valve stem oil seal (arrow).

Installing

NOTE: A plastic sleeve -A- supplements the new valve shaft seals.

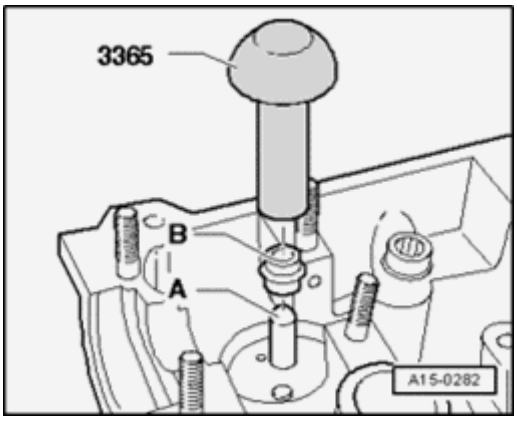


Fig. 327: Identifying Plastic Sleeve, Valve Stem Oil Seal & Valve Stem Seal Driver 3365
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place plastic sleeve -A- on valve stem to prevent damage to new valve stem oil seals -B-.
- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using 3365 valve stem seal driver.
- Remove plastic sleeve.

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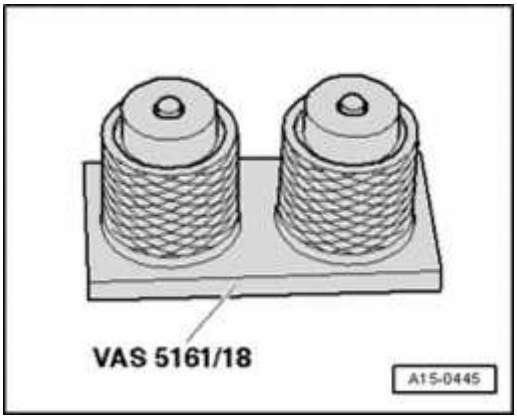


Fig. 328: Identifying Installation Cartridge VAS 5161/8
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If valve keepers were removed from installation cartridge, they must be inserted into VAS5161/18 insertion device next.

NOTE: The large diameter of the valve keepers points upward.

- Press VAS5161/8 installation cartridge onto insertion device from top and take up valve keepers.

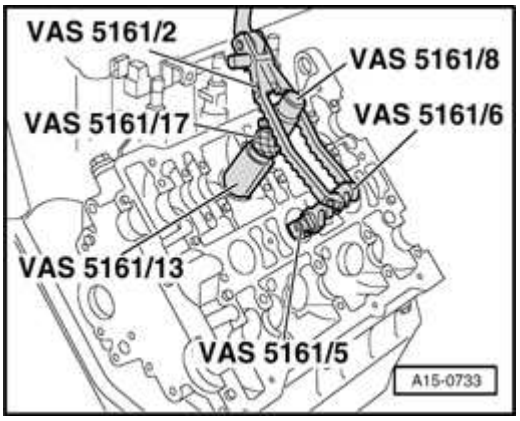


Fig. 329: Removing/Installing VAS5161/6, VAS5161/5 In Threaded Hole At Cylinder Head (Intake Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Set VAS5161/8 installation cartridge into VAS5161/13 guide sleeve or VAS5161/14.
- Press down pressure fork and pull knurled bolt upward while turning left and right - valve keepers are inserted in this manner.
- Release pressure fork with the knurled bolt still pulled.
- Insert valve lifters.

- Install camshafts. Refer to **Installing**.

NOTE:

- **After installing camshafts, do not start engine for at least 30 minutes. The**

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hydraulic valve lifters have to settle (otherwise valves will strike the pistons).

- **After working on the valvetrain, carefully rotate engine by hand at least 2 full revolutions to ensure that valves do not strike the pistons when starting.**

Valve guides, checking

Special tools and equipment

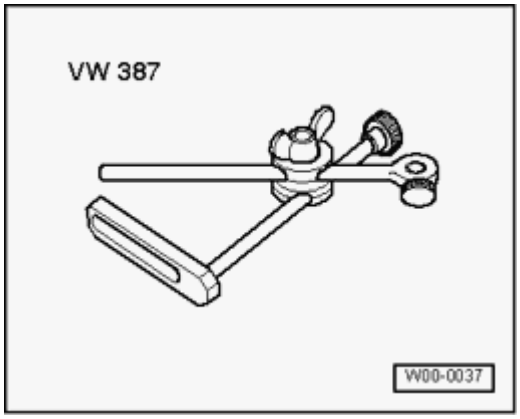


Fig. 330: Identifying Dial Gauge Holder VW 387
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VW387 Dial gauge holder
- Dial gauge

Work sequence

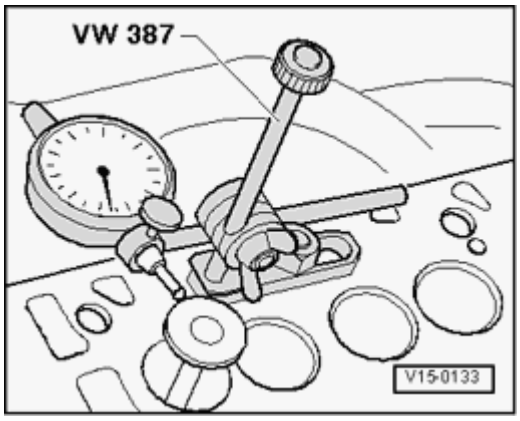


Fig. 331: Identifying Special Tool - VW 387 Installed
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert valve into guide. Valve stem tip must seal with guide. Due to differences in valve stem diameter, make sure that only intake valves are used to check intake guides, and only exhaust valves are used to

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check exhaust guides.

- Measure side play.

Wear limit

1024 Intake valve guide	1024 Exhaust valve guide
0.80 mm	0.80 mm

NOTE:

- **If wear limit is exceeded, re-measure using new valves. If wear limit is still exceeded, replace cylinder head. Valve guides cannot be replaced.**
- **If valve is to be replaced during repair, use a new valve for measurement.**

Valves, checking

- Visual check for signs of wear at stem and at seating surface. Replace valves in case of significant signs of wear.

Valve seats, refacing

NOTE: **If a perfect contact pattern is not created after hand-lapping valve seats, reface valve seats.**

Special tools and equipment

- Depth gauge
- Valve seat refacing tool

NOTE:

- **When servicing engines with leaking valves, refacing or replacing valve seats and valves is not sufficient. It is particularly important to check valve guides for wear on engines with higher running performance. Refer to Valve guides, checking.**
- **Only reface valve seats enough until a perfect contact pattern is obtained.**
- **Before refacing, determine maximum refacing dimension.**
- **If refaced dimension is exceeded, hydraulic valve lifter function is no longer guaranteed and cylinder head must be replaced.**

Determining maximum allowable refacing dimension

- Insert valve and press tightly against valve seat.

NOTE: **If valve is replaced during repair, use new valve for measurement.**

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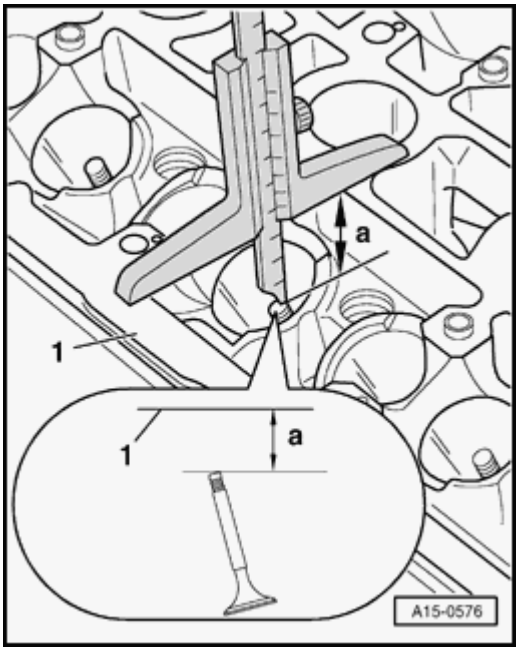


Fig. 332: Measuring Distance Between Valve Stem End (Upper Edge) And Top Surface Of Cylinder Head Using Depth Gauge
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Measure distance -a- between valve stem end (upper edge) and upper cylinder head surface using a depth gauge.
- Determine maximum allowable refacing dimension using distance measured and minimum dimension.

Minimum dimensions		
Outer intake valves	Center intake valve	Exhaust valves
31.0 mm	32.2 mm	31.9 mm

Measured distance minus minimum dimension = max. permissible refaced dimension.

Example for outer intake valve:		
	Distance measured	31.4 mm
-	Minimum dimension	- 31.0 mm
=	Maximum allowable refaced dimension	= 0.4 mm

NOTE: If the maximum allowed refaced dimension is 0 mm or less than 0 mm, repeat measurement using new valve. If measurement result is still 0 mm or less than 0 mm, replace cylinder head.

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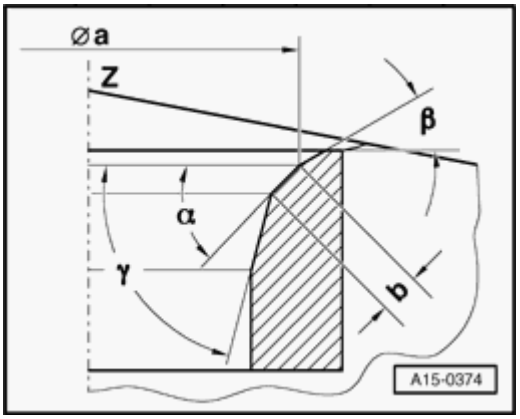


Fig. 333: Valve Seats, Refacing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Valve seats, refacing

Dimension		Intake valve seat
Dia.a	mm	26.2
b	mm	1.5 to 1.8
Z		Lower edge of cylinder head
a	45°	Valve seat angle
ß	30°	Upper correction angle
gamma	60°	Lower correction angle

Dimension		Exhaust valve seat
Dia.a	mm	29.0
b	mm	1.8
Z		Lower edge of cylinder head
a	45°	Valve seat angle
ß	30°	Upper correction angle
gamma	60°	Lower correction angle

CAMSHAFT ADJUSTMENT, CHECKING

Camshaft adjustment, checking

The Engine Control Module (ECM) can adapt the instantaneous load- and RPM situation by adjusting the timing.

To do so, the total of four valves for camshaft adjustment allow more or less oil pressure to impact the mechanical adjustment mechanism.

While the exhaust camshafts only have control over a single stage adjustment, intake camshafts can be adjusted variably.

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System test, initiating

Special tools and equipment

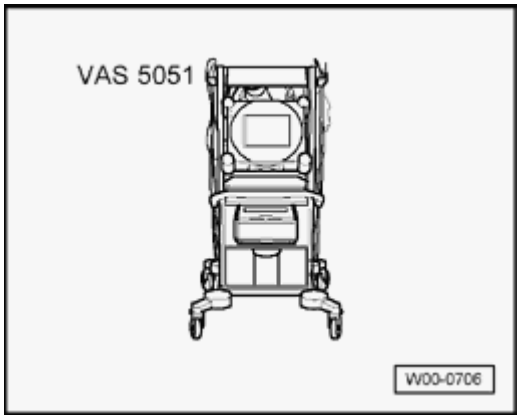


Fig. 334: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 Vehicle diagnosis, testing and information system with VAG5051/1 Adapter

WARNING:

- **Test equipment must always be secured to the rear seat and operated from there by a second person.**
- **If test and measuring equipment is operated from the passenger seat, the person seated there could be injured in the event of an accident involving deployment of the passenger-side airbag.**

Requirements

- VAS5051 tester connected and vehicle On Board Diagnostic (OBD) -01 Engine electronics- selected.
- Coolant Temperature at least 80°C.
- Vehicles with automatic transmission selector lever in P or N.

Work sequence

- Start engine, and let run at idle.

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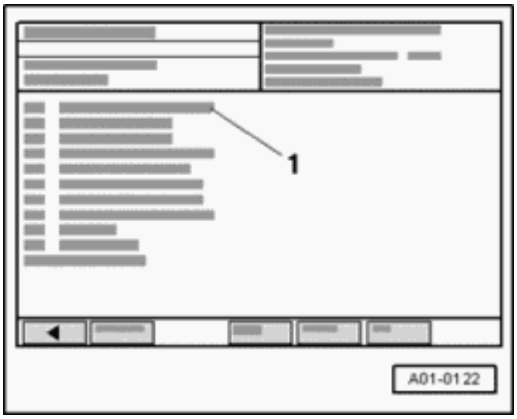


Fig. 335: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- In selection -1-, click on the diagnostic function "04 - Basic setting".



Fig. 336: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

max. input value = 255

- Select function "094" in button field -2- for "display group number 094" and press Q button to confirm input.

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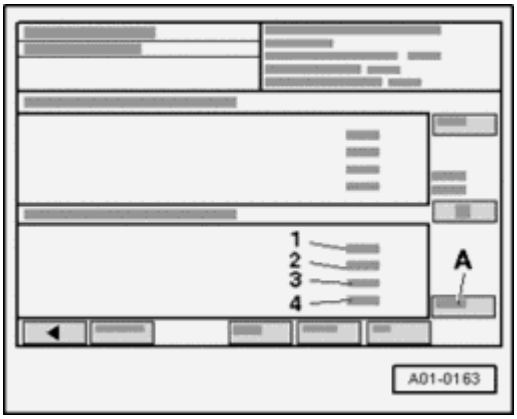


Fig. 337: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing button A.
- Depress accelerator pedal and brake pedal at same time; engine speed increases to approx. 1900 RPM.

Requirement

- Accelerator pedal and brake pedal depressed at same time, engine runs at approx. 1900 RPM.

- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 094: Camshaft adjustment (intake)				
Display	xxxx/min	---	---	---
Indicated	Engine speed (RPM)	Camshaft adjustment	**Diagnostic condition**	**Diagnostic condition**
Functional range			**Test OFF Test ON System OK System not OK**	**Test OFF Test ON System OK System not OK**
Specified value	1900 RPM	°Crankshaft rotation	**System OK**	**System OK**
Note			If "System not OK" is displayed: Check camshaft adjustment (intake). Refer to **Camshaft adjustment (intake), checking**	

- Click on <-- button

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Fig. 338: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

max. input value = 255

- Select function "096" in button field -2- for "display group number 096" and press Q button to confirm input.

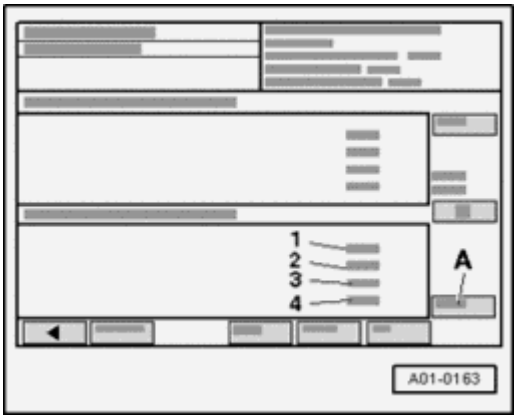


Fig. 339: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Indicated on display of VAS 5051:

- Activate basic setting by pressing button -A-.
- Depress accelerator pedal and brake pedal at same time, engine speed increases to approx. 1900 RPM.

Requirement

- Accelerator pedal and brake pedal depressed at the same time, engine runs at approx. 1900 RPM.

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- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 096: Valve for camshaft adjustment (exhaust)				
Display	xxxx/min	---	---	---
Display	Engine speed	Camshaft adjustment	**Diagnostic condition**	**Diagnostic condition**
Functional range		Off On	**Test OFF** **Test ON** **System OK** **System not OK**	**Test OFF** **Test ON** **System OK** **System not OK**
Specification	1900 RPM	On	**System OK**	**System OK**
Note			If "System not OK" is displayed: Check camshaft adjustment (exhaust). Refer to **Camshaft adjustment (exhaust), checking**	

- Click on <-- button.
- Switch over to Read measured value block.

Camshaft adjustment (exhaust), checking



Fig. 340: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Indicated on display of VAS 5051:

1 - Enter display group:

max. input value = 255

- Select function "090" in button field -2- for "display group number 090" and press Q button to confirm input.

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Fig. 341: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Indicated on display of VAS 5051:

Requirement

- Engine running at idle.

  - Check specified values in display fields -2-, -3- and -4-.

	Display fields			
	1	2	3	4
Display group 090: Camshaft adjustment (exhaust)				
Display	xxxx/min	**---**	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	**Camshaft adjustment**	**Adjustment bank 1**	**Adjustment bank 2**
Specification	Idle	**off**	**-3 to 3**	**-3 to 3**

  - Perform a road test.
  - Accelerate vehicle in 3rd gear at wide open throttle from 2000 RPM.
  - Check specified values in display fields -2-, -3- and -4-.

	Display fields			
	1	2	3	4
Display group 090: Camshaft adjustment (exhaust)				
Display	xxxx/min	**---**	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	**Camshaft adjustment**	**Adjustment bank 1**	**Adjustment bank 2**
Specification		**on**	**19 to 25**	**19 to 25**

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Note			If specified value is not obtained: Check respective valve for camshaft adjustment (exhaust). Refer to **Solenoid valve for camshaft adjustment, checking**

NOTE: If display field indicates a value between 3.0° crankshaft rotation and 19.0° crankshaft rotation during a road test, the electrical valve for camshaft adjustment is correctly switching the oil pressure to mechanical camshaft adjuster, but the mechanical camshaft adjuster cannot reach its end position (e.g. due to difficulty of movement).

Camshaft adjustment (intake), checking



Fig. 342: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Indicated on display of VAS 5051:

- Press s button to change into display group 091.

Requirement

- Engine running at idle.
- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 091: Camshaft adjustment (intake), Bank 1				
Display	xxxx/min	%	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	Duty cycle	**Specified adjustment**	**Current adjustment**
Specification	Idle	15 to 17	**-3 to 3**	**-3 to 3**

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- Perform a road test.
- Accelerate vehicle in 3rd gear at wide open throttle from 2000 RPM.
- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 091: Camshaft adjustment (intake), Bank 1				
Display	xxxx/min	%	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	Duty cycle	**Specified adjustment**	**Current adjustment**
Specification		60 to 100	**39 to 45**	**39 to 45**
Note			If specified value is not obtained: Check valve for camshaft adjustment (intake) bank 1. Refer to **Solenoid valve for camshaft adjustment, checking**	

NOTE: If display field only indicates a value between 3.0°crankshaft rotation and 39.0° crankshaft rotation during a road test, the electrical valve for camshaft adjustment is correctly switching the oil pressure to mechanical camshaft adjuster, but the mechanical camshaft adjuster cannot reach its end position (e.g. due to difficulty of movement).



Fig. 343: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Indicated on display of VAS 5051:

- Press s button to change into display group 092.

Requirement

- Engine running at idle.

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- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 092: Camshaft adjustment (intake), bank 2				
Display	xxxx/min	%	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	Duty cycle	**Specified adjustment**	**Current adjustment**
Specification	Idle	15 to 17	**-3 to 3**	**-3 to 3**

- Perform a road test.
- Accelerate vehicle in 3rd gear at wide open throttle from 2000 RPM.
- Check specified values in display fields -3- and -4-.

	Display fields			
	1	2	3	4
Display group 092: Camshaft adjustment (intake), bank 2				
Display	xxxx/min	%	**°Crankshaft rotation**	**°Crankshaft rotation**
Display	Engine speed	Duty cycle	**Specified adjustment**	**Current adjustment**
Specification		60 to 100	**39 to 45**	**39 to 45**
Note			If specified value is not obtained: Check valve for camshaft adjustment (intake) bank 2. Refer to **Solenoid valve for camshaft adjustment, checking**	

NOTE: If display field only indicates a value between 3.0° crankshaft rotation and 39.0° crankshaft rotation during a road test, the electrical valve for camshaft adjustment is correctly switching the oil pressure to mechanical camshaft adjuster, but the mechanical camshaft adjuster cannot reach its end position (e.g. due to difficulty of movement).

Solenoid valve for camshaft adjustment, checking

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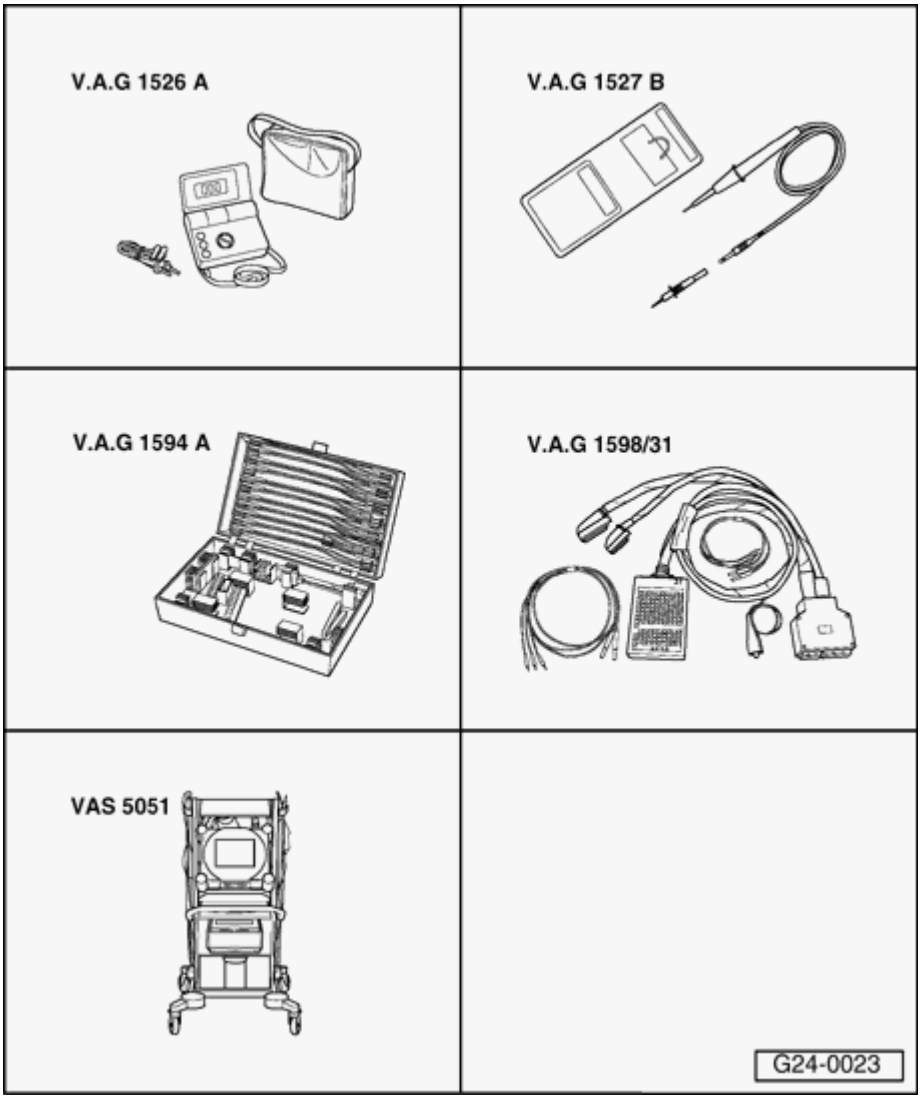


Fig. 344: Identifying Special Tools - Solenoid Valve For Camshaft Adjustment, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG 1526 A Multimeter
- VAG 1527 B Voltage tester
- VAG 1594 A Connector test kit
- VAG 1598/31 Test box
- VAS 5051 Vehicle diagnosis, testing and information system with VAS 5051/1 Adapter

Requirement

- VAS5051 tester connected and vehicle On Board Diagnostic (OBD) -01 Engine electronics- selected.

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Valves for camshaft adjustment (intake), activating

- Initiate output Diagnostic Test Mode (DTM) and activate valve for camshaft adjustment bank 1:

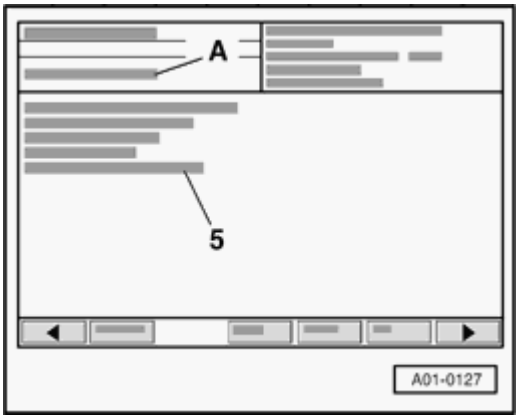


Fig. 345: Display On VAS 5051 - (4th Control Element In Test & Charge Pressure Control Valve -N75)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Actuator test is waiting Advancing by switching required

5 - Bank 1, camshaft adjustment. Refer to -N205-

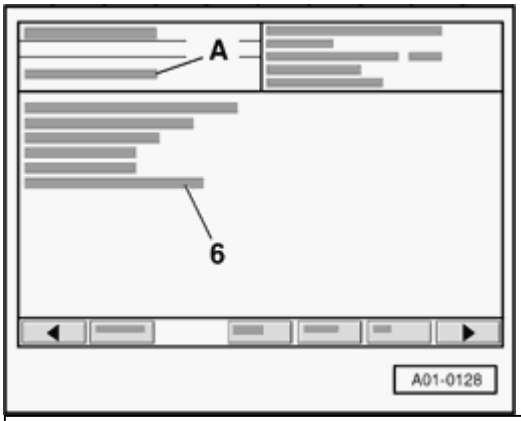
- Click on delta button

Display on VAS5051:

A - Actuator test is running Advancing by switching allowed

- This valve is activated for approx. 1 minute (clicks), unless delta button is pressed first to switch to the next actuator.

- Click on delta button



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Fig. 346: Display On VAS 5051 - (Actuator In Test & Leak Detection Pump Tank Ventilation System)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Actuator test is waiting Advancing by switching required

6 - Bank 2, camshaft adjustment. Refer to -N208-

- Click on delta button

Display on VAS5051:

A - Actuator test is running Advancing by switching allowed

- This valve is activated for approx. 1 minute (clicks), unless delta button is pressed first to switch to the next actuator.

- End function "03 - output Diagnostic Test Mode (DTM)" by pressing <-- button.

If one of the valves is not being activated (does not click).

- Switch ignition off.
- Perform an electrical test for valves for camshaft adjustment. Refer to **Electrical test of solenoid valve for camshaft adjustment**.

Valves for camshaft adjustment (exhaust), activating

- Initiate output Diagnostic Test Mode (DTM) and activate valve for camshaft adjustment (exhaust) bank 1:

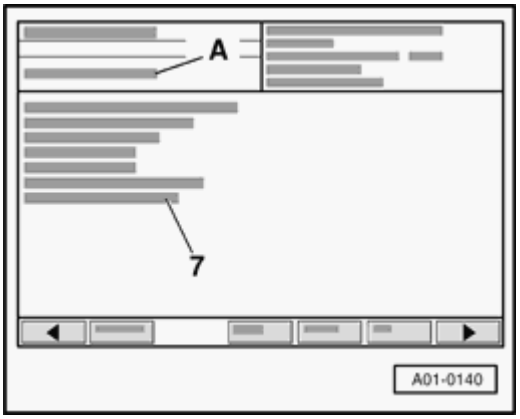


Fig. 347: Display On VAS 5051 - (7th Control Element In Test & Recirculating Valve For Turbocharger - N249-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

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A - Actuator test is waiting Advancing by switching required

7 - Bank 1, valve for camshaft adjustment (exhaust)

- Click on delta button

Display on VAS5051:

A - Actuator test is running Advancing by switching allowed

- This valve is activated for approx. 1 minute (clicks), unless delta button is pressed first to switch to the next actuator.

- Click on delta button

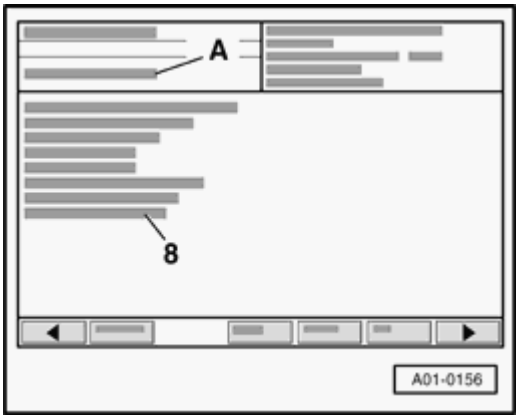


Fig. 348: Display On VAS 5051 - (Activation Of Brake System Vacuum Pump)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Actuator test is waiting Advancing by switching required

8 - Bank 2, valve for camshaft adjustment (exhaust)

- Click on delta button

Display on VAS5051:

A - Actuator test is running Advancing by switching allowed

- This valve is activated for approx. 1 minute (clicks), unless delta button is pressed first to switch to the next actuator.

- End function "03 - output Diagnostic Test Mode (DTM)" by pressing <-- button.

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If one of the valves is not being activated (does not click).

- Switch ignition off.
- Perform an electrical test for valves for camshaft adjustment. Refer to **Electrical test of solenoid valve for camshaft adjustment**.

Electrical test of solenoid valve for camshaft adjustment

Cylinder bank 2 (left):

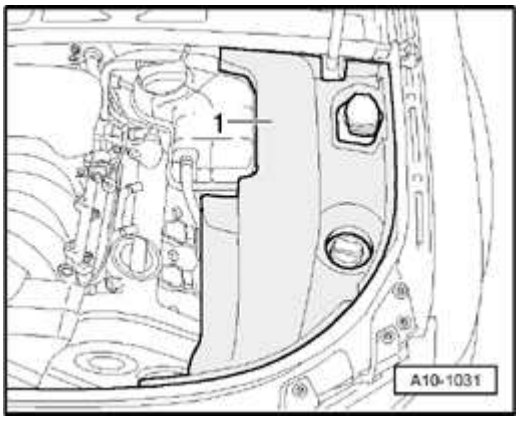


Fig. 349: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

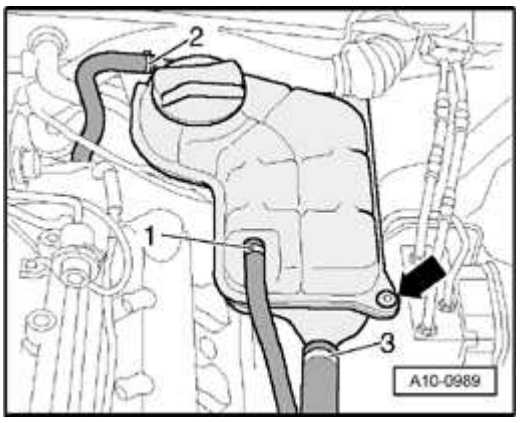


Fig. 350: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Remove line from Engine Coolant Level (ECL) warning switch -F66- and lay coolant reservoir to side.

NOTE: Coolant hoses 1 to 3 remain connected.

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Cylinder bank 1 (right)

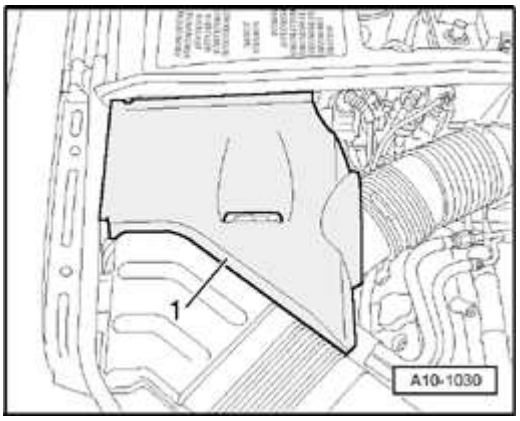


Fig. 351: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

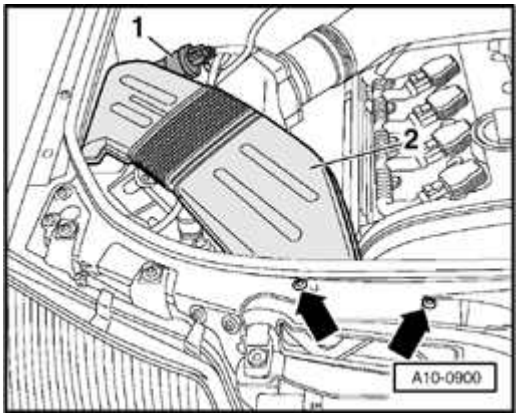


Fig. 352: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

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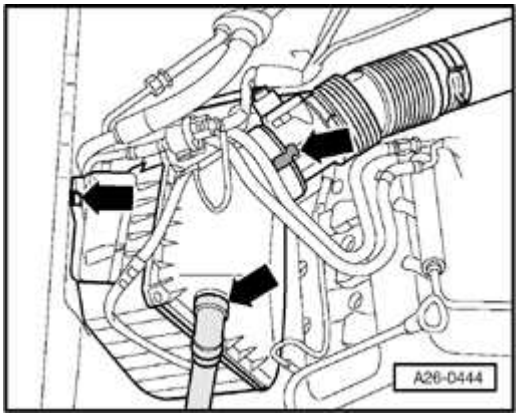


Fig. 353: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).

Continuation for both cylinder banks

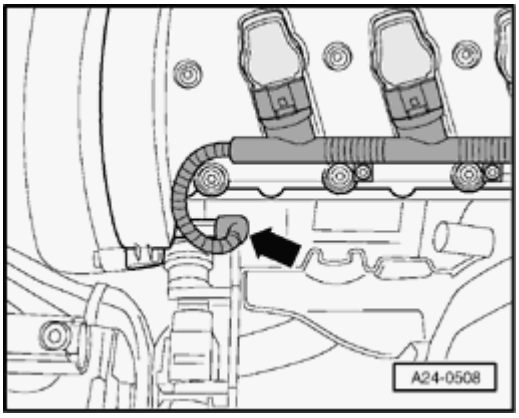


Fig. 354: Disconnecting Harness Connector From Connector Adapter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect harness connector (arrow) from connector adapter.

NOTE: Illustration depicts cylinder bank 2 (left).

Checking internal resistance

Valve for camshaft adjustment (intake)

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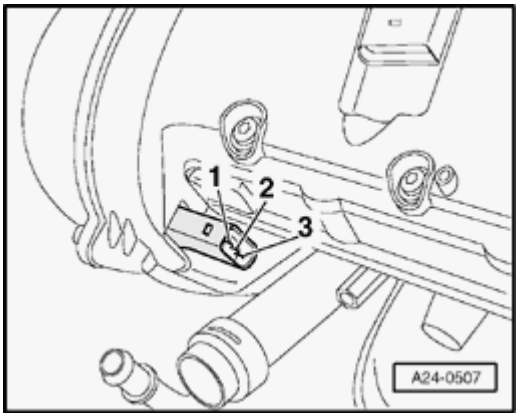


Fig. 355: Connecting Multimeter Between Terminals 1 And 2 For Resistance Measurement
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 1 and 2 for resistance measurement.
- Specification: 7.4 to 8.2 ohms

Valve for camshaft adjustment (exhaust)

- Connect multimeter between terminal 2 and 3 for resistance measurement.
- Specification: 12.8 to 14.2 ohms

All

If specified value is not obtained:

- Replace valve.

If specified value is obtained:

Checking voltage supply

Requirement

- Fuse for valves for camshaft adjustment OK.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

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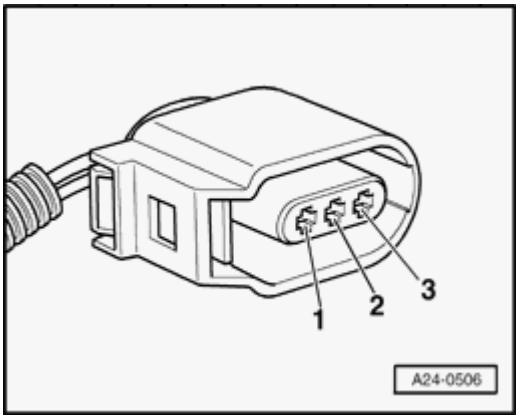


Fig. 356: Identifying Harness Connector & 3 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
2	Engine Ground (GND)

- Switch ignition on.
- LED must light up

If LED does not light up:

- Check wire connection from terminal 2 of connector via fuse to Motronic Engine Control Module (ECM) power supply relay -J271- for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Repair open circuit if necessary.

If LED lights up:

Checking activation

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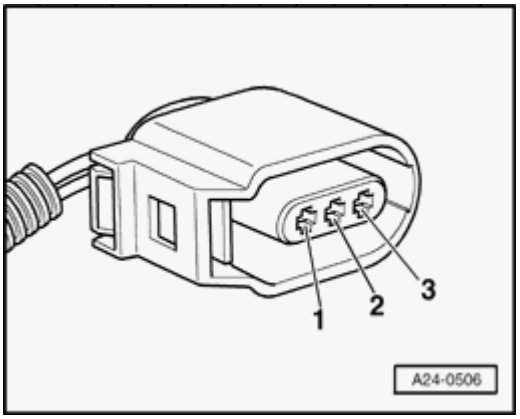


Fig. 357: Identifying Harness Connector & 3 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester as follows:

Valve for camshaft adjustment	Harness connector Terminal
Intake bank 1, Valve -1- for camshaft adjustment -N205-	1 + 2
Intake bank 2, Valve -1- for camshaft adjustment -N208-	1 + 2
Exhaust bank 1, Camshaft Adjustment Valve 1 (exhaust) -N318-	2 + 3
Exhaust bank 2, Camshaft Adjustment Valve 1 (exhaust) -N319-	2 + 3

- Initiate output Diagnostic Test Mode (DTM) and activate valve for camshaft adjustment.

- LED must blink

If LED does not blink or if it remains constantly lit:

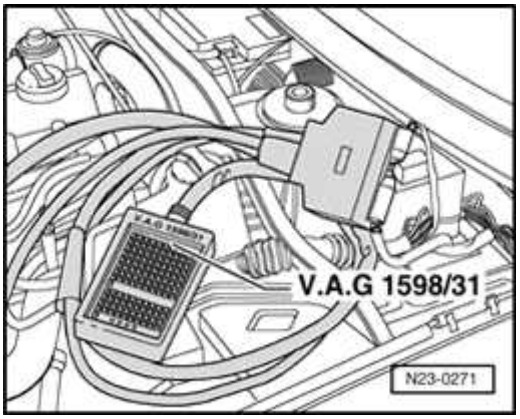


Fig. 358: VAG1598/31 Test Box Connected To Control Module Wiring Harness

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1598/31 test box to harness connectors of wiring harness (do not connect ECM). Connect Ground (GND) clip at test box (not visible in illustration) to Ground (GND).

Refer to **24 MULTIPORT FUEL INJECTION (MFI)**

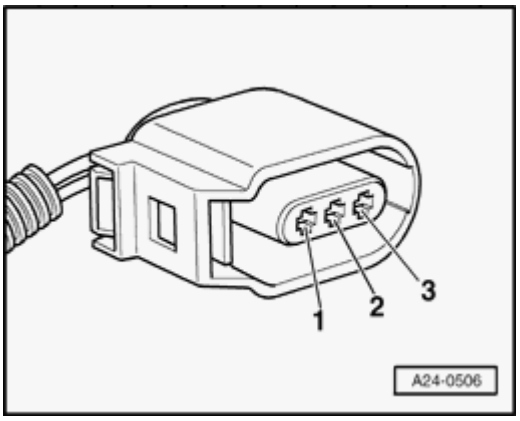


Fig. 359: Identifying Harness Connector & 3 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check following wire connections for open circuit and short circuit to Ground (GND) and B+:

Valve for camshaft adjustment	Harness connector Terminal	VAG1598/31 test box Socket
Intake bank 1, Valve -1- for camshaft adjustment -N205-	1	115
Intake bank 2, Valve -1- for camshaft adjustment -N208-	1	120
Exhaust bank 1, Camshaft Adjustment Valve 1 (exhaust) - N318-	1	22
Exhaust bank 2, Camshaft Adjustment Valve 1 (exhaust) - N319-	1	18

- Repair short circuit to Ground (GND) connection or open circuit if necessary.

If wire connection is OK:

- Replace Engine Control Module (ECM).

If no malfunctions are detected:

- Replace mechanical camshaft adjuster. Refer to **Valve train, servicing**, i.e. camshafts, removing and

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installing: Refer to **Camshafts and camshaft adjusters, removing and installing**.

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17 ENGINE - LUBRICATION

LUBRICATION SYSTEM COMPONENTS, REMOVING AND INSTALLING

Lubrication system components, removing and installing

CAUTION: Before beginning repairs on the electrical system:

- **Obtain the anti-theft radio security code.**
- **Switch the ignition off.**
- **Disconnect the battery Ground (GND) strap.**
- **On vehicles equipped with Audi Telematics by OnStar ® , switch-off the emergency (back-up) battery for the Telematic/Telephone Control Module prior to disconnecting vehicle battery. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

  .
- **After reconnecting vehicle battery, re-code and check operation of anti-theft radio. Also check operation of clock and power windows according to Repair Article and/or Owner's Manual.**
- **After reconnecting vehicle battery on vehicles equipped with Audi Telematics by OnStar ® , switch-on the emergency (back-up) battery for the Telematic/Telephone Control Module. Refer to**
  - **91 - COMMUNICATION**
  - **91 RADIO, TELEPHONE, NAVIGATION, TRIP COMPUTER for COMMUNICATION, CABRIOLET**

  .

Lubrication system components, removing and installing

NOTE:

- **If large quantities of metal shavings or abraded material are found in the engine oil while servicing the engine, the oil passages must be carefully cleaned to prevent resulting damage and the oil cooler must be replaced.**
- **Oil level must not exceed max. marking - risk of catalytic converter damage!**
- **Oil injector jet for piston cooling. See Fig. 362.**

Viscosity classes and oil specifications:

Refer to Additional Information, Fluid Capacity Chart

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Part I - Oil pan (lower part), oil pump

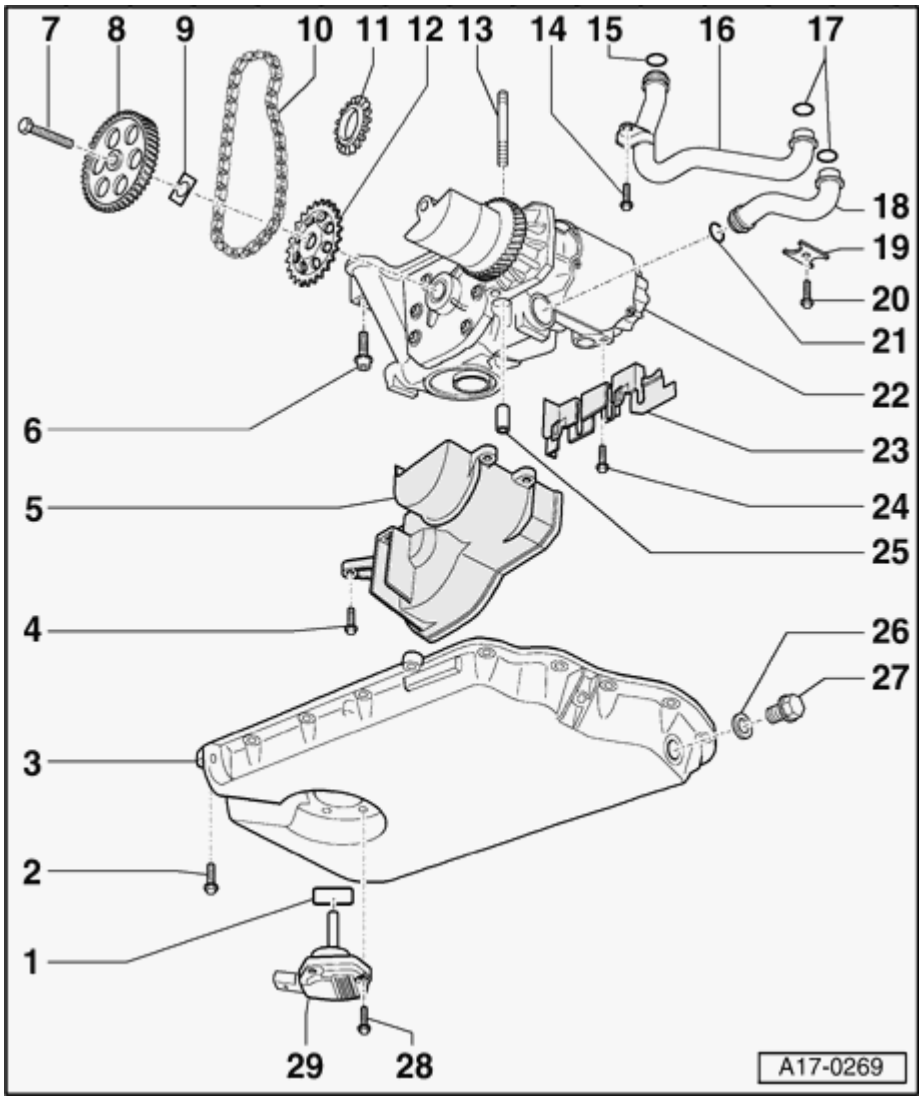


Fig. 360: Lubrication System Components Remove/Install Components (Part I - Oil Pan (Lower Part), Oil Pump)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Seal

- Always replace

2 - 10 Nm

- Tighten diagonally in sequence

3 - Oil pan (lower part)

- Removing and installing. Refer to **Oil pan (lower part), removing and installing**

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4 - 10 Nm

5 - Front baffle plate

6 - 22 Nm

- Always replace

7 - 20 Nm plus and additional 90° (1/4 turn)

- Always replace
- Insert a new diamond disc item - 9 between gear and chain sprocket.

8 - Gear for differential gear shaft drive

- Insert a new diamond disc item - 9 between gear and chain sprocket.

9 - Diamond disc

- Always replace

10 - Drive chain for oil pump

- Removing and installing. Refer to **Drive chain or chain tensioner for oil pump, removing and installing**
- Chain tensioner for drive chain. Refer to item - 16

11 - Drive chain gear for oil pump

- Removing and installing. Refer to **Drive chain gear for oil pump, removing and installing**

12 - Chain sprocket for oil pump

- Installed position: Marking faces rear
- Insert a new diamond disc item - 9 **Lubrication system components, removing and installing** between gear and chain sprocket.
- Removing and installing. Refer to **Oil pump, removing and installing**

13 - Stud

- Self-locking
- Short threaded side to cylinder block

14 - 10 Nm

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15 - O-ring

- Always replace

16 - Oil tube

17 - O-Rings

- Always replace

18 - Oil tube

19 - Bracket

- For oil tubes

20 - 10 Nm

21 - O-ring

- Always replace

22 - Oil pump

- With differential shaft
- Removing and installing. Refer to **Oil pump, removing and installing**

23 - Rear baffle plate

24 - 10 Nm

- Self-locking
- Always replace

25 - 20 Nm plus an additional 120° (1/3 turn)

- Always replace
- Insert with locking fluid
- Locking fluid:

26 - Seal

- Always replace

27 - Oil drain plug, 30 Nm

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28 - 10 Nm

29 - Oil level thermal sensor -G266-

Part II - Oil pan (upper part), oil filter

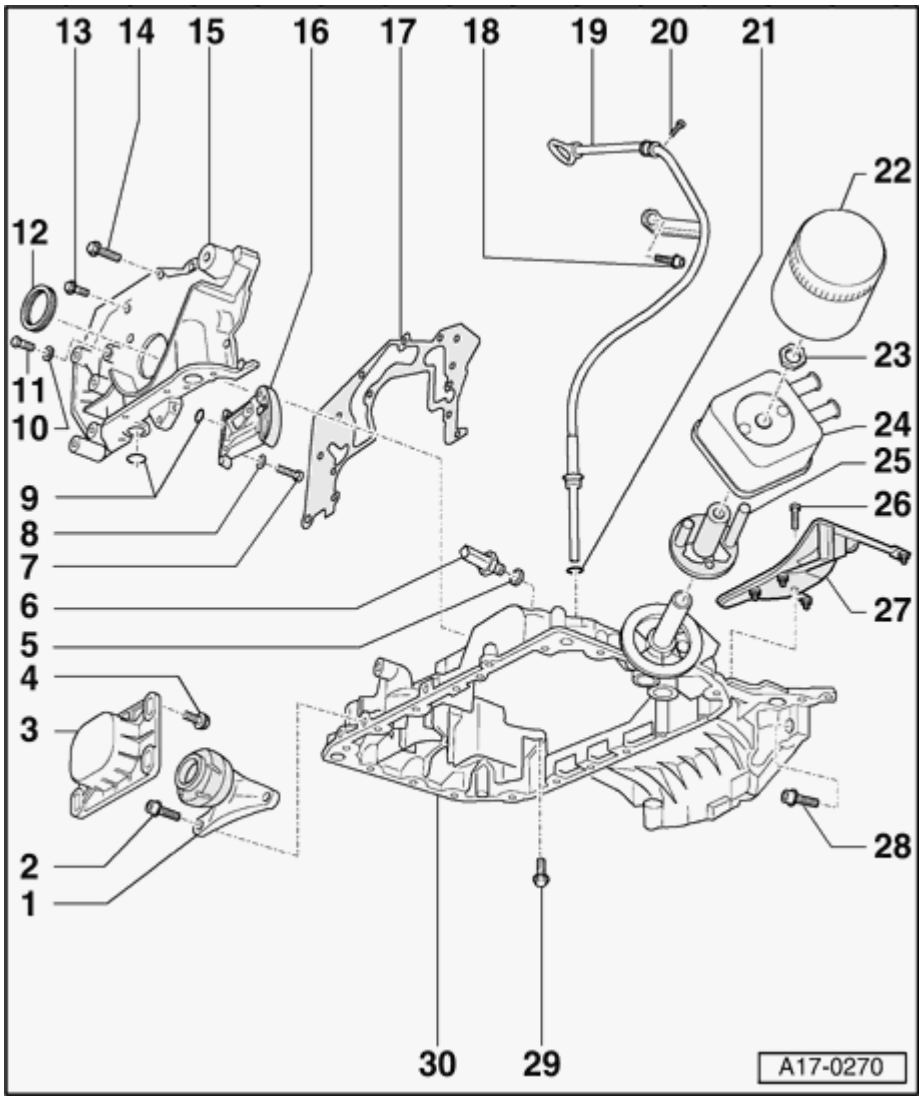


Fig. 361: Lubrication System Components Remove/Install Components (Part II - Oil Pan (Upper Part), Oil Filter)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Torque support

2 - 40 Nm

3 - Stop

- For torque support

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- Adjusting:

  - Place impact for torque support on rubber buffer for torque support, letting it rest under its own weight and tighten bolts to 28 Nm.

4 - 28 Nm

5 - Seal

- Always replace

6 - Oil pressure switch -F1-, 1.4 bar, 25 Nm

- Black insulation
- Checking. Refer to **Oil pressure and oil pressure switch, checking**
- Always replace O-ring

7 - 12 Nm

8 - Washer

9 - O-ring

- Always replace

10 - Seal

- Always replace

11 - Locking bolt, 10 Nm

12 - Seal

- For crankshaft
- Removing and installing. Refer to **Seal for crankshaft (ribbed belt side), replacing**

13 - 10 Nm

14 - 30 Nm

- Self-locking
- Always replace

15 - Sealing flange, front

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- Removing and installing. Refer to **Front sealing flange, removing and installing**

16 - Chain tensioner

- Removing and installing. Refer to **Drive chain or chain tensioner for oil pump, removing and installing**
- Use a diameter 3 mm drill bit to secure

17 - Gasket

- Always replace

18 - 20 Nm

19 - Guide tube for oil dipstick

20 - Sheet metal screw

21 - O-ring

- Always replace

22 - Oil filter housing

- Follow filter change intervals

Refer to

- **01 - MAINTENANCE**
- **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

- Use 3417 Oil filter wrench to remove
- Follow installation notes found on oil filter
- Tighten to 20 Nm

23 - 30 Nm

24 - Oil cooler

- Observe note. Refer to **Lubrication system components, removing and installing**

25 - Guide piece

- With seal
- Always replace

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26 - 10 Nm

- Self-locking
- Always replace

27 - Top baffle plate

28 - 45 Nm

29 - M7 = 16 Nm, M8 = 22 Nm

30 - Oil pan (upper part)

- Removing and installing. Refer to **Oil pan (upper part), removing and installing**

Oil injector jet for piston cooling

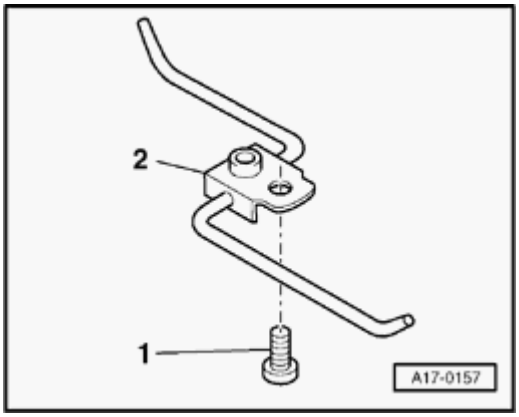


Fig. 362: Oil Injector Jet For Piston Cooling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt, 10 Nm

2 - Oil injector jet for piston cooling

Oil pan (lower part), removing and installing

Required equipment

- Catch reservoir
- Drill with plastic brush attachment
- Protective glasses
- Silicone sealant:

Removing

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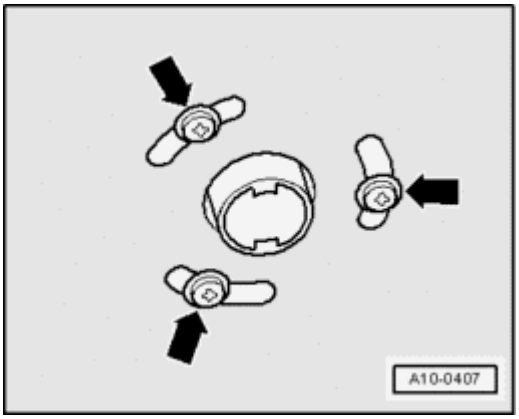


Fig. 363: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

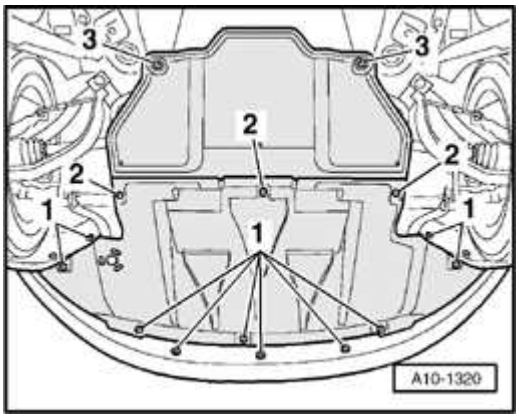


Fig. 364: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front noise insulation.
- Place engine oil drip tray beneath engine.
- Drain engine oil.

Vehicles with automatic transmission

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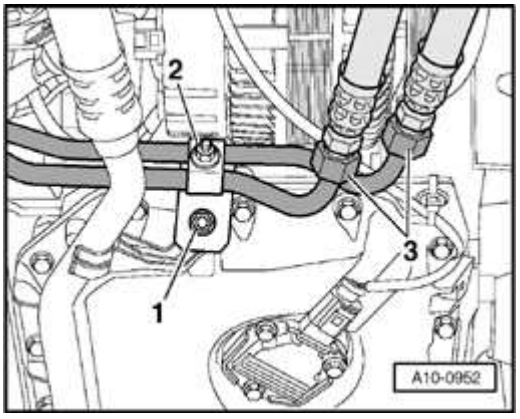


Fig. 365: Removing Union Nuts And Disconnect ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for ATF lines, to do so remove nuts -1- and -2-.

NOTE: Union nuts -3- of ATF lines must not be disconnected.

All

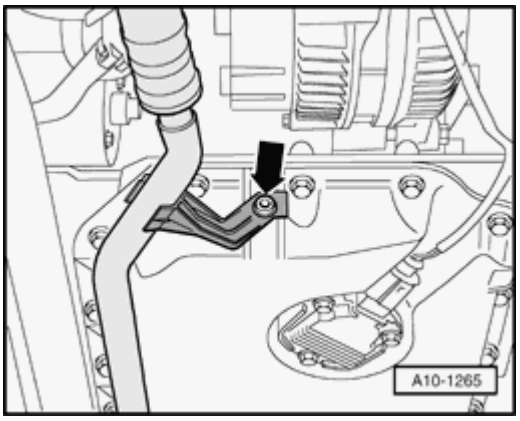


Fig. 366: Unbolting Bracket For Refrigerant Line At Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for refrigerant line at oil pan (arrows).

NOTE: Depicted in illustration for a vehicle with manual transmission.

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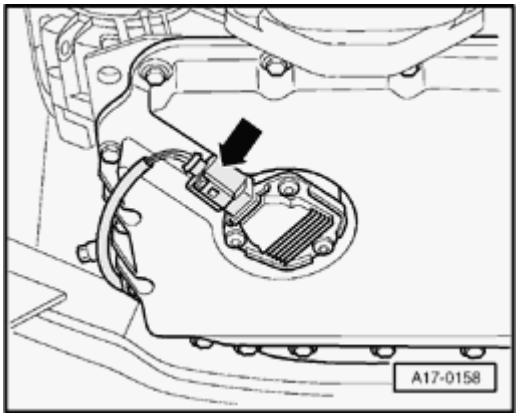


Fig. 367: Disconnecting Electrical Harness Connector At Oil Level Thermal Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector at Oil level thermal sensor (arrow) and move wiring clear.
- Place engine oil drip tray beneath engine, since oil will escape again.

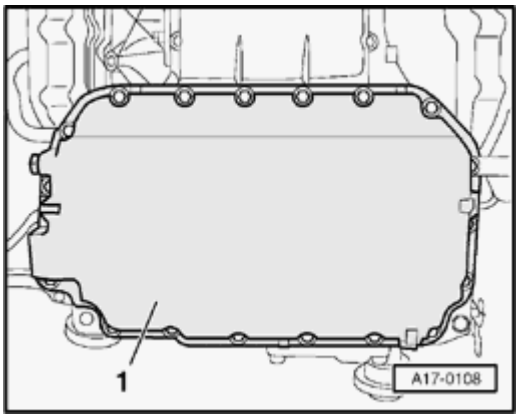


Fig. 368: Unbolting Oil Pan (Lower Part) And Carefully Remove
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt oil pan (lower part) -1- and carefully remove.

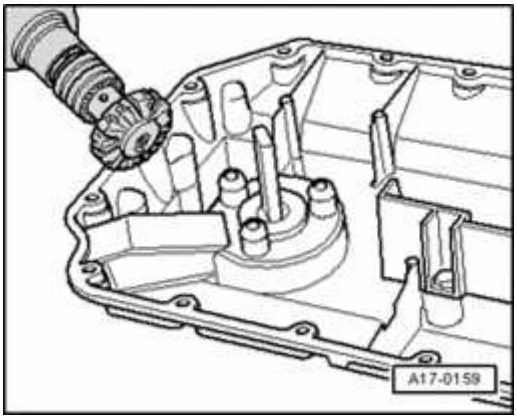


Fig. 369: Using Rotating Plastic Brush To Remove Any Remaining Sealant From Oil Pan (Lower Part)

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And At Upper Part
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using rotating plastic brush, remove any remaining sealant from oil pan (lower part) and at upper part.

  WARNING: Wear protective glasses.

- Clean sealing surfaces so they are completely free of any oil or grease.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and O-rings.

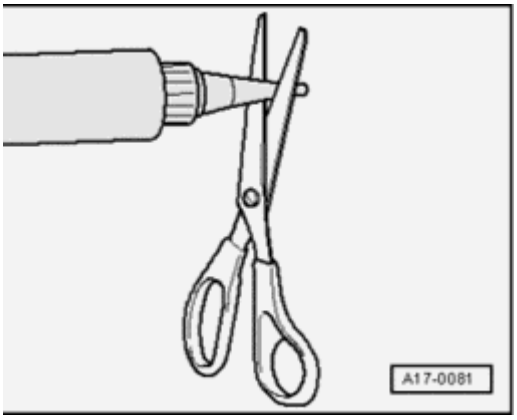


Fig. 370: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut tube nozzle at front marking (jet diameter approx. 1 mm).

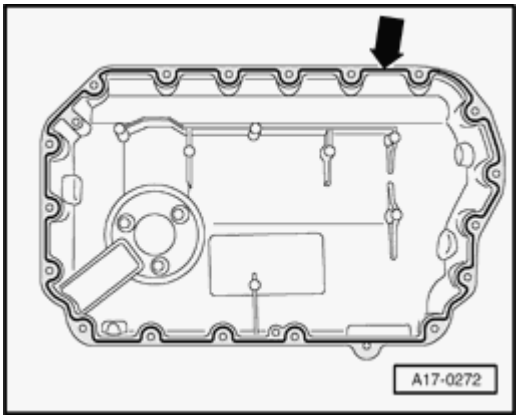


Fig. 371: Applying Silicon Sealant Bead To Clean Sealing Surfaces Of Oil Pan (Lower Part)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Apply silicon sealant bead to clean sealing surfaces of oil pan (lower part) as shown in illustration.

- Thickness of sealant bead (arrow): approx. 1.5 mm

NOTE:

- **The oil pan (lower part) must be installed within 5 minutes after application of silicon sealant.**
- **Sealant bead must not be thicker than specified, otherwise sealant could get into oil pan and clog the oil pump strainer.**

- Install oil pan (lower part) and pre-tighten all bolts diagonally to 5 Nm.
- Tighten bolts of oil pan (lower part) in diagonal pattern to 10 Nm.
- Add engine oil and check oil level.

Tightening torques

Component	Nm
Oil pan (lower part) to oil pan (upper part)	10
Oil drain plug	30

Oil pump, removing and installing

Special tools and equipment

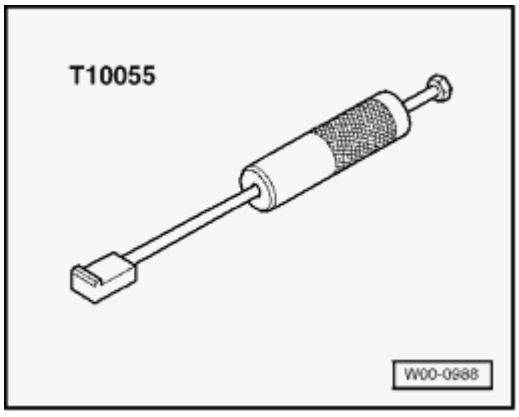


Fig. 372: Identifying Puller T10055 With Adapter T10055/3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T10055 Extractor

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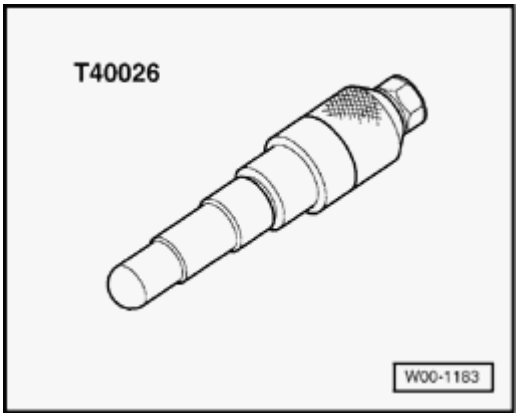


Fig. 373: T40026 Locking Pin
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- T40026 Locking pin
- Drill bit, 3 mm diameter
- Sealants
- Locking fluid

Removing

- Remove oil pan (lower part). Refer to **Removing**.
- Turn crankshaft via center bolt of toothed belt gear in direction of engine rotation to TDC Cyl. 3 marking.

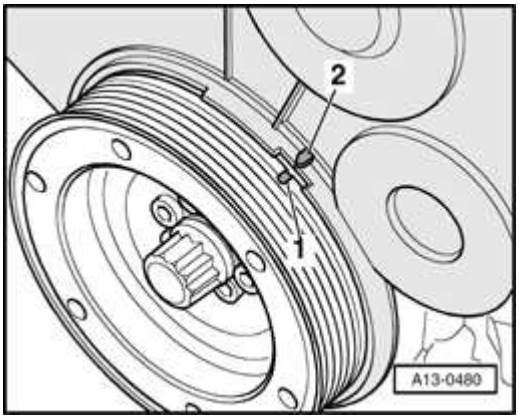


Fig. 374: Identifying Notch Lines Up With Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Notch -1- lines up with marking -2-

- If installed, disconnect electrical harness connector at after-run coolant pump.
- Unscrew sealing plug of TDC mark at cylinder block.

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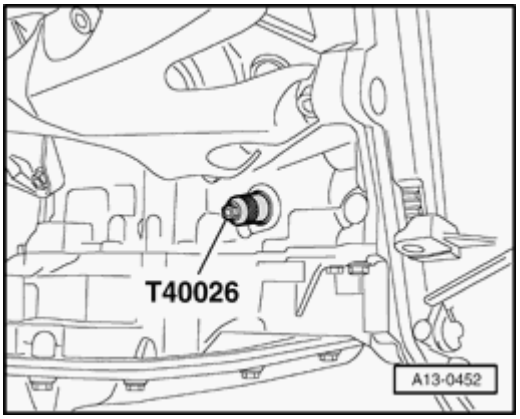


Fig. 375: Threading T40026 Locking Pin Into Hole Of Removed Sealing Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Thread T40026 locking pin into hole of removed sealing plug and tighten.

NOTE: To do so, turn crankshaft back and forth slightly.

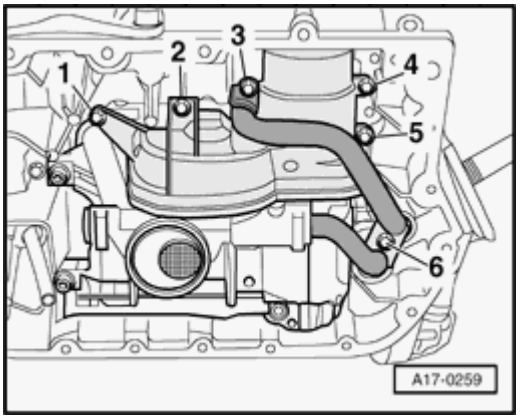


Fig. 376: Unscrewing Bolts Removing Oil Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -3- and -6- and remove oil lines.

NOTE: Oil escapes from oil tubes when removing.

- Unscrew bolts -1-, -2-, -4- and -5- and remove front baffle plate.

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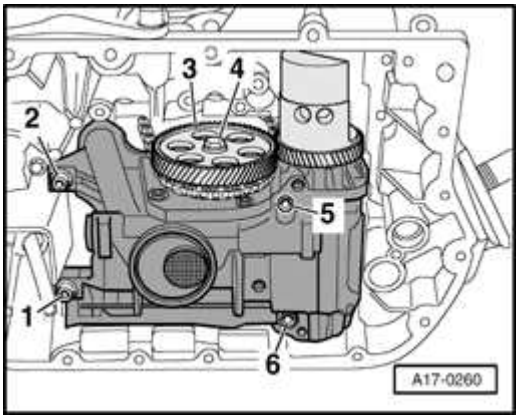


Fig. 377: Identifying Bolts, Gear, Nuts, Diamond Disc & Toothed Gear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt -4- and remove gear -3- for differential gear shaft drive.
- Remove diamond disc from toothed gear.
- Remove bolts -1- and -2- and nuts -5- and -6-.

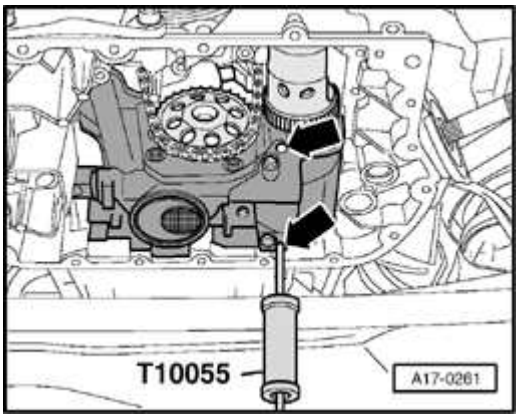


Fig. 378: Installing T10055 Extractor Into M8 Holes Alternating At Oil Pan And Pull Oil Pump Off Of Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install T10055 extractor into M8 holes alternating (arrows) at oil pan and pull oil pump off of cylinder block.

Installing

Installation is reverse of removal, noting the following:

NOTE: Always replace seals and gaskets.

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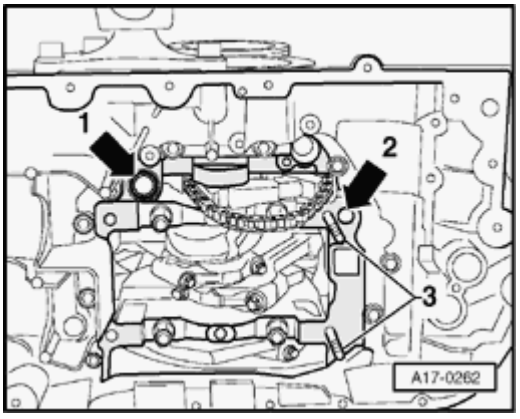


Fig. 379: Clean Threads Of Studs 3 Of Remaining Locking Fluid, Replace O-Ring & Coat Circumference Of Hole With Sealant
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clean threads of studs 3 of remaining locking fluid.
- Replace O-ring (arrow -1-).
- Coat circumference of hole (arrow -2-) with sealant.

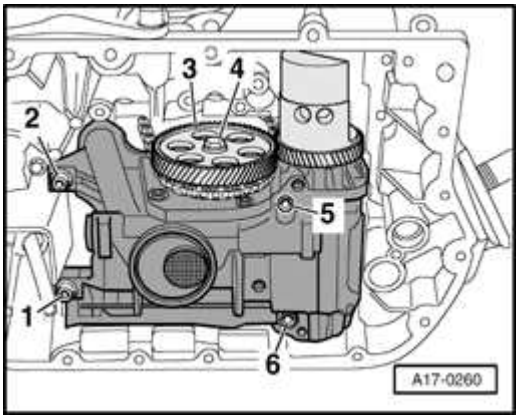


Fig. 380: Identifying Bolts, Gear, Nuts, Diamond Disc & Toothed Gear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace bolts -1- and -2- and nuts -5- and -6- for oil pump threaded connection.
- Insert nuts -5- and -6- with locking fluid.
- Bolt in oil pump uniformly at all mounting points, so that shear pin does not cant.
- Tighten threaded connection to final torque.

- Replace diamond disc on toothed gear -3- for differential gear shaft drive.
- Insert collar of toothed gear for differential gear shaft drive through chain sprocket onto oil pump shaft.
- Loosely thread in bolt -4-.

NOTE:

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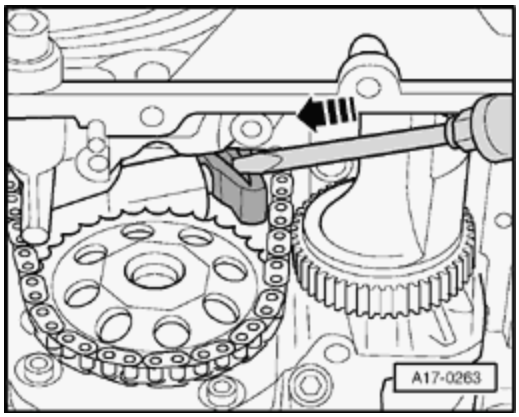


Fig. 381: Pressing Piston Of Chain Tensioner Back Using Screwdriver
Courtesy of VOLKSWAGEN UNITED STATES, INC.

To install toothed gear, press piston of chain tensioner back using a screwdriver (arrow).

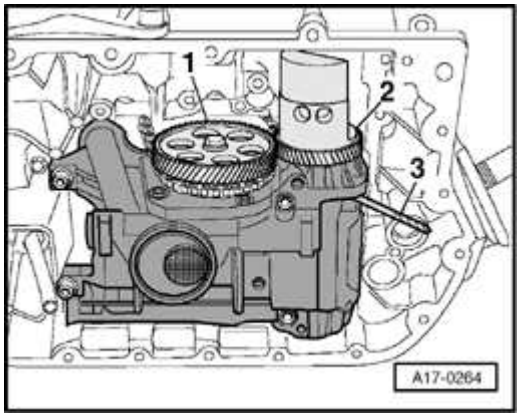


Fig. 382: Turning Differential Shaft Until Pin Can Be Slid Into Alignment Hole
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn differential shaft -2-, until a pin diameter 5 mm item -3- (e.g. drill bit) can be slid into alignment hole.
- Tighten bolt -1-.
- Remove pin (drill bit) from alignment hole.
- Remove T10026 alignment bolt and thread sealing plug of TDC marking with new O-ring into cylinder block.

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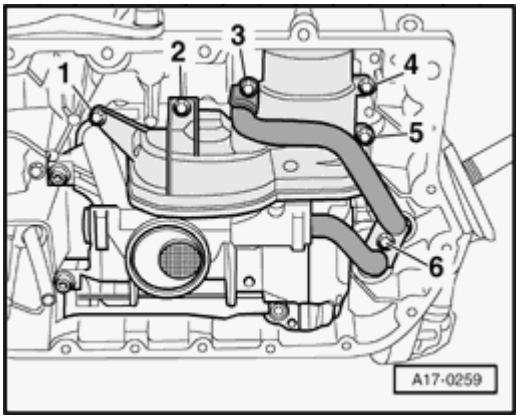


Fig. 383: Unscrewing/Screwing Bolts Removing/Installing Oil Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install front baffle plate -bolts -1-, -2-, -4- and -5-.
- Install oil tubes -bolts -3- and -6-.
- Install oil pan (lower part). Refer to **Oil pan (lower part), removing and installing** .

Tightening torques

Component		Nm
Oil pump to cylinder block	Nuts	20 + 120°1)2)
	Bolts	22 3)
Gear for differential gear shaft drive to oil pump		20 + 90°3)4)
Front baffle plate to oil pan (upper part)		10
Oil pressure line to oil pan (upper part)		10
Sealing plug in cylinder block		25

1) 120° corresponds to one third-turn

2) Insert nuts with locking fluid; locking fluid:

3) Replace bolts

4) 90° corresponds to one quarter-turn

Drive chain or chain tensioner for oil pump, removing and installing

Removing

- Remove oil pan (upper part). Refer to **Oil pan (upper part), removing and installing**.
- Remove front sealing flange. Refer to **Front sealing flange, removing and installing**.

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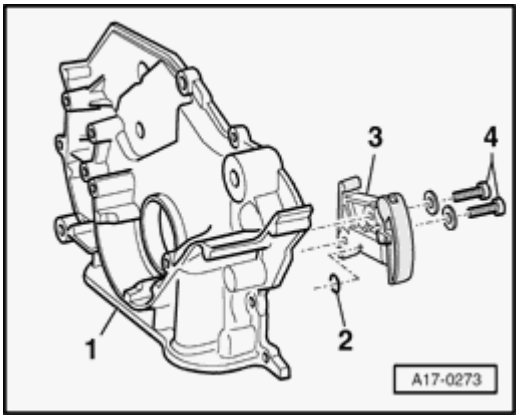


Fig. 384: Unscrewing/Screwing Bolts And Removing/Installing Chain Tensioner From Front Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -4- and remove chain tensioner -3- from front sealing flange -1-.
- Remove chain from drive chain gear.

Installing

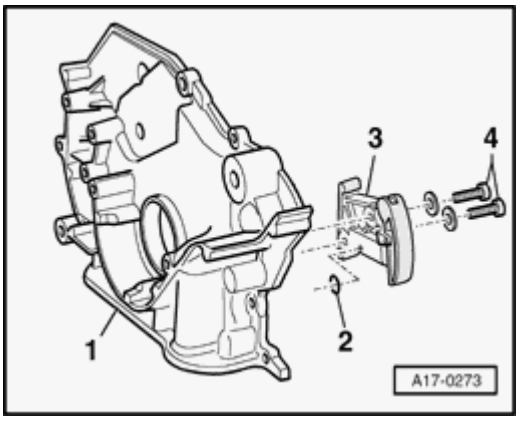


Fig. 385: Unscrewing/Screwing Bolts And Removing/Installing Chain Tensioner From Front Sealing Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Replace O-ring -2-.
- Bolt in chain tensioner -3- with bolts -4- (with washers) to front sealing flange -1-.

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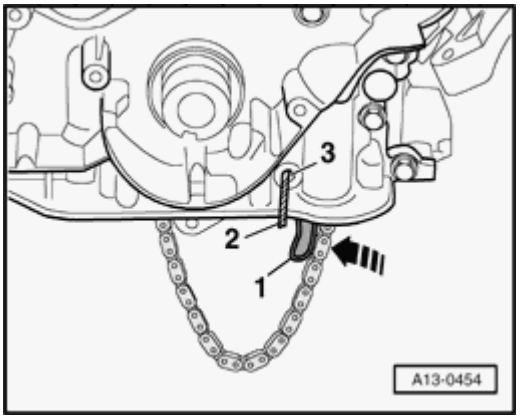


Fig. 386: Pressing Chain Tensioner Until Drill Bit Can Be Slid Into Alignment Hole Of Sealing Flange And Chain Tensioner
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew locking bolt from adjustment hole -3-.
- Press chain tensioner -1- in direction of arrow until 3 mm diameter drill bit -2- can be slid into alignment hole of sealing flange and chain tensioner.
- Install front sealing flange. Refer to **Installing**.
- Remove oil pan (upper part). Refer to **Removing**.

Tightening torque

Component	Nm
Chain tensioner to front sealing flange	12

Oil pan (upper part), removing and installing

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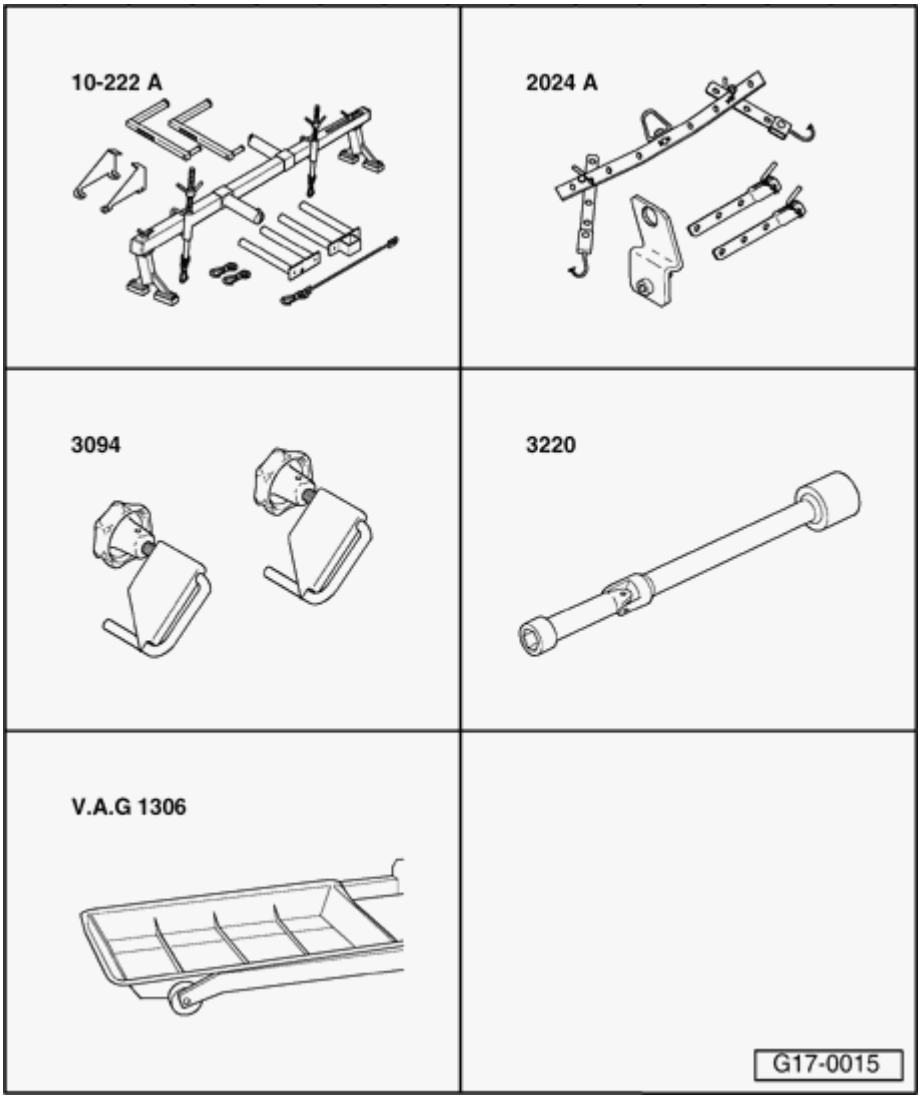


Fig. 387: Identifying Special Tools - Oil Pan (Upper Part), Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- 10-222A Engine support bridge
- 2024A Engine Sling
- 3094 Hose clamps
- 3220 Hinged socket

- VAG1306 Drip tray for VAG1202A
- Catch reservoir
- Drill with plastic brush attachment
- Protective glasses

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- Silicone sealant

Removing

- Lock carrier in service position. Refer to **Lock carrier, moving into service position**.

WARNING: Observe safety precautions when disconnecting the battery.

Refer to 27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL

See Caution before beginning repairs on the electrical system. Refer to **Lubrication system components, removing and installing**

- Switch ignition off and disconnect battery Ground (GND) strap.
- Remove ribbed belt. Refer to **Ribbed belt, removing and installing** .

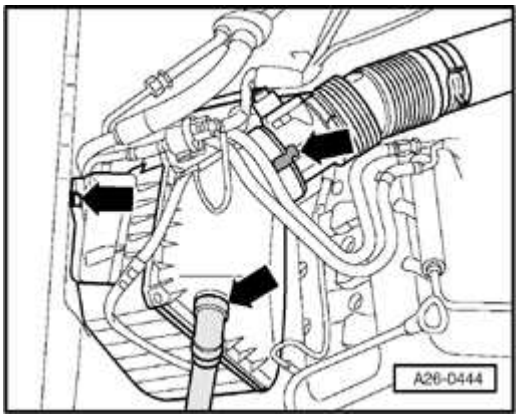


Fig. 388: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).

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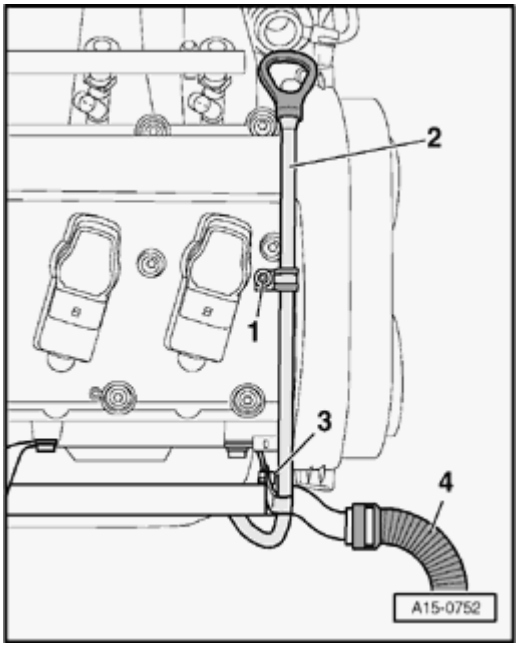


Fig. 389: Identifying Bolts, Hose From Line Of Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -3-.
- Disconnect hose -4- from line of secondary air injection.
- Pull out guide tube for oil dipstick -2- from oil pan (upper part) toward top and swing it forward for removal.

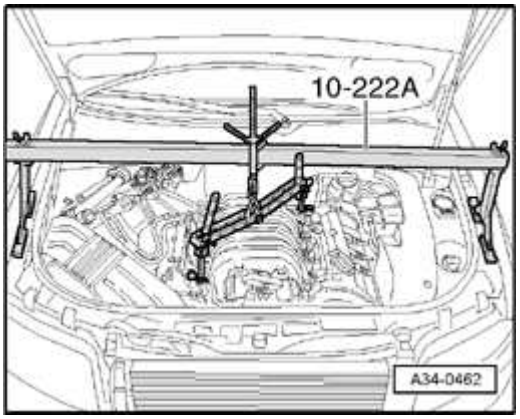


Fig. 390: Positioning 10-222A Engine Support Bridge On Bolted Flanges Of Fenders
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position 10-222A engine support bridge on bolted flanges of fenders.

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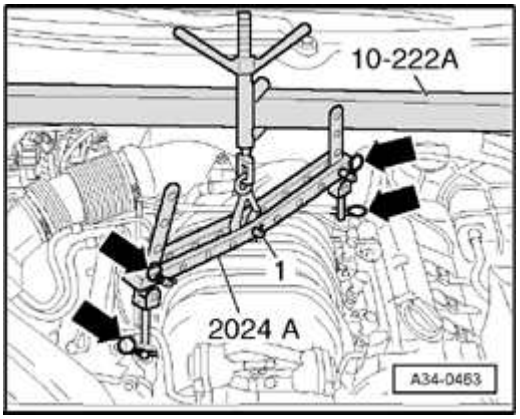


Fig. 391: Removing Eyelet For 2024A Engine Sling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove eyelet for 2024A engine sling.
- Insert bolt -1- in center hole of 2024A Engine sling and secure with a cotter pin.
- Attach bolt for 2024A Engine sling at 10-222A Engine support bridge spindle.
- Attach 2024A Engine sling to sling clamps at front and rear of engine.

WARNING: Take-up hooks and pins at engine sling must be secured using securing pins (arrows) as shown in illustration.

- Slightly pre-tension engine using engine support bridge spindle.
- Place engine oil drip tray beneath engine.
- Drain engine oil.

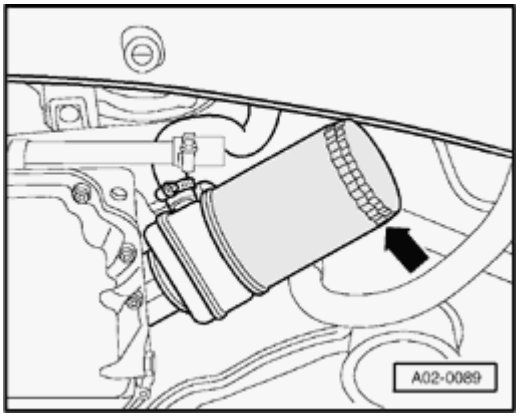


Fig. 392: Loosening Oil Filter Using Tension Strap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen oil filter (arrow) using tension strap; e.g. Hazet 2171-1.
- Place VAG1306 Drip tray beneath engine.

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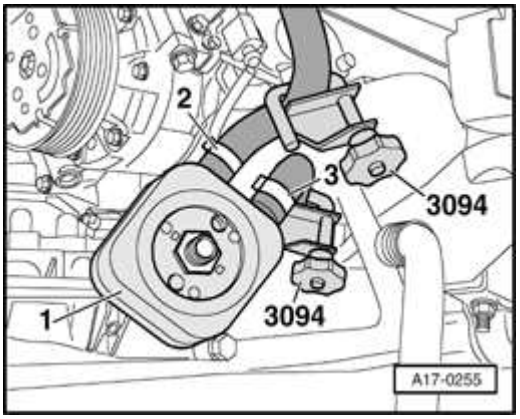


Fig. 393: Clamping Coolant Hoses Using 3094 Hose Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clamp coolant hoses -2- and -3- using 3094 hose clamps.
- Disconnect coolant hoses from oil cooler -1-.
- Remove oil cooler.

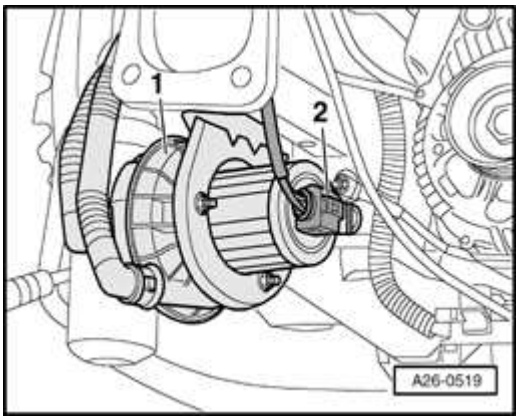


Fig. 394: Disconnecting Electrical Harness Connector At Secondary Air Injection (AIR) Pump Motor -V101-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector -2- at Secondary Air Injection (AIR) pump motor -V101- ,-1-.
- Remove Secondary Air Injection (AIR) pump at longmember.

WARNING: Do not open refrigerant circuit for A/C system.

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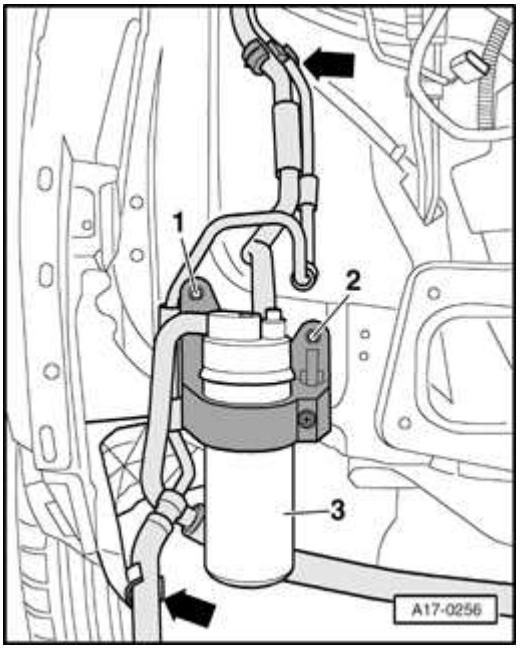


Fig. 395: Removing Bolts, Unclip Refrigerant Lines & Allowing Catch Reservoir With Connected Refrigerant Lines To Remain Hanging In Installed Position
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-.
- Unclip refrigerant lines (arrows).
- Allow catch reservoir -3- with connected refrigerant lines to remain hanging in installed position.

Vehicles with automatic transmission

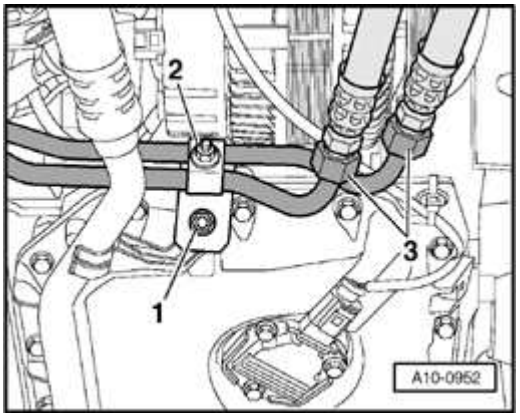


Fig. 396: Removing Union Nuts And Disconnect ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for ATF lines, to do so remove nuts -1- and -2-.

NOTE: Union nuts -3- of ATF lines must not be disconnected.

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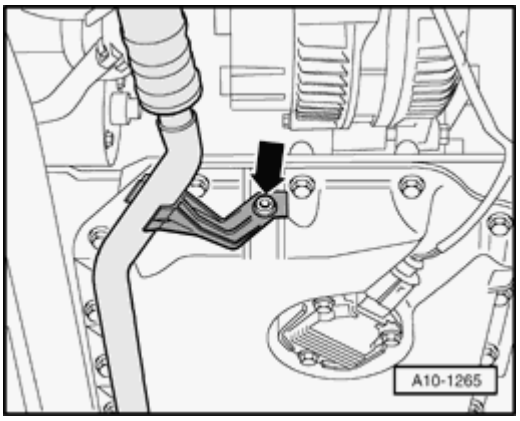


Fig. 397: Unbolting Bracket For Refrigerant Line At Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for refrigerant line at oil pan (arrow).

NOTE: Depicted in the illustration for a vehicle with manual transmission.

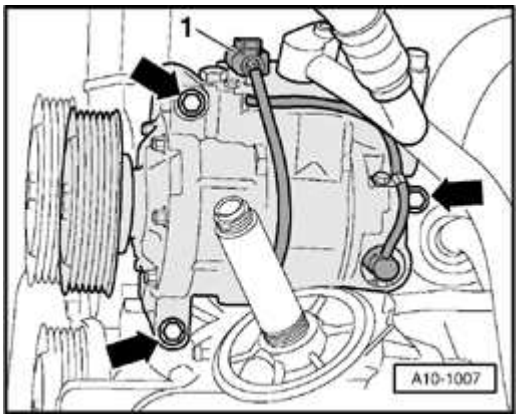


Fig. 398: Disconnecting Harness Connector Of Electrical Wire To A/C Compressor Clutch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect harness connector -1- of electrical wire to A/C compressor clutch.
- Unbolt A/C compressor from bracket (arrows).

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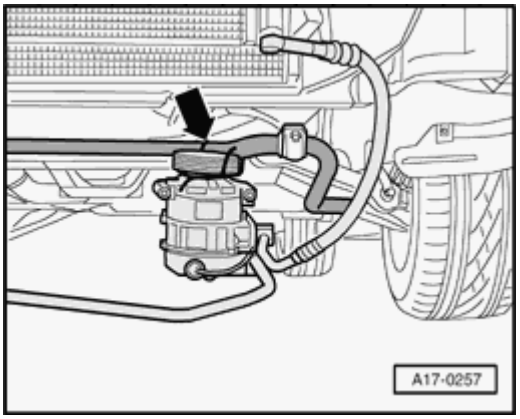


Fig. 399: Hanging A/C Compressor With Connected Refrigerant Lines To Stabilizer Using Wire
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hang A/C compressor (arrow) with connected refrigerant lines to stabilizer using wire.

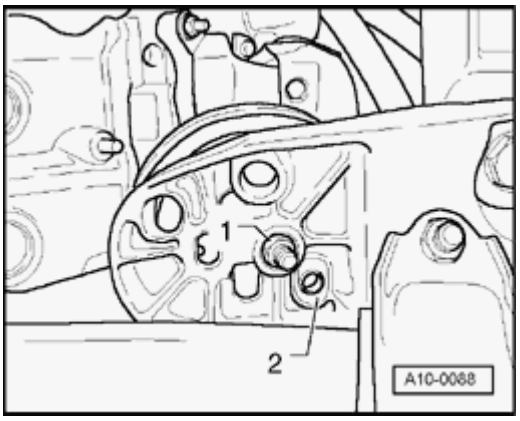


Fig. 400: Threaded Connections And Positioning Sleeves On Lower Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mark installed positions for threaded assemblies -1- and positioning sleeves -2-.

NOTE: Different mounting holes are available depending upon the installed engine.

- Remove lower nuts -1- on left and right engine mounts.

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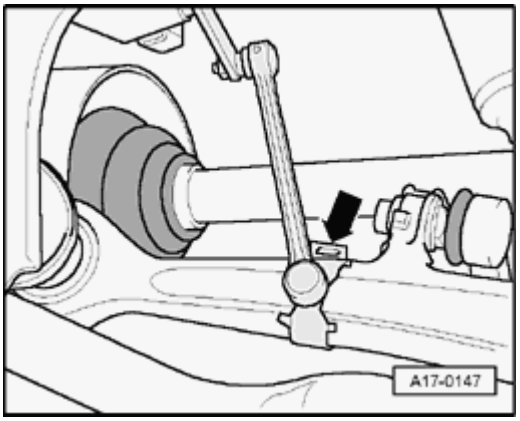


Fig. 401: Unclipping Operating Rod For Vehicle Level Sensor At Lower Lateral Control Arm
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If installed, unclip operating rod for vehicle level sensor at lower lateral control arm (arrow).

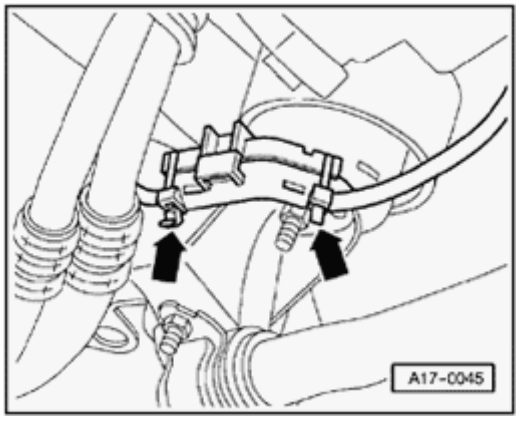


Fig. 402: Starter Wiring Bracket Cable Ties
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut cable ties (arrows), open bracket for starter wiring and remove electrical wiring.

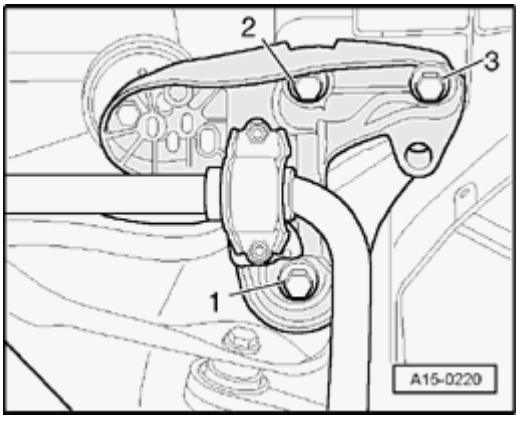


Fig. 403: Removing Front Bolts From Left And Right Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove front bolts -2- and -3- from left and right sides of subframe. Then remove bolt -1-.

NOTE: Only loosen or lower subframe at front side to avoid having to perform a wheel alignment.

- Lower front subframe.

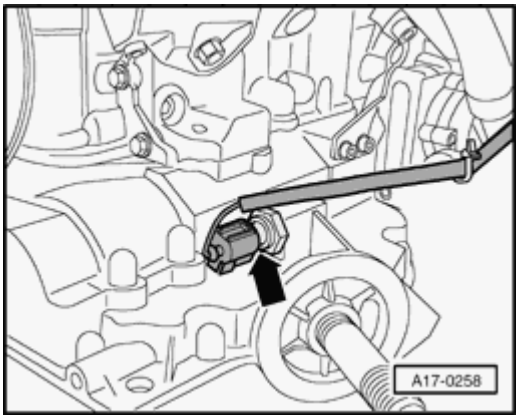


Fig. 404: Disconnecting Electrical Harness Connector At Oil Pressure Switch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector at oil pressure switch (arrow).

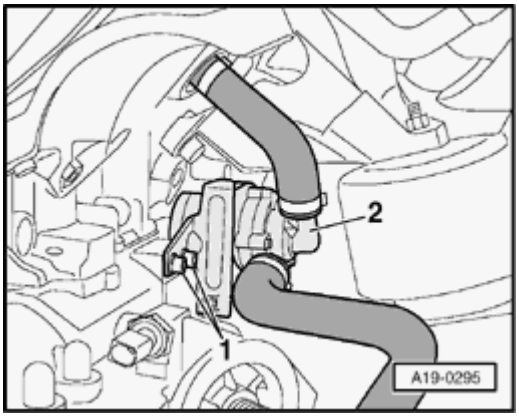


Fig. 405: Unscrewing Bolts And Removing After-Run Coolant Pump At Oil Pan (Upper Part)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If installed, unscrew bolts -1- and remove after-run coolant pump -2- at oil pan (upper part).

NOTE: Coolant hose to cylinder block can remain connected.

- Disconnect electrical lines from generator.

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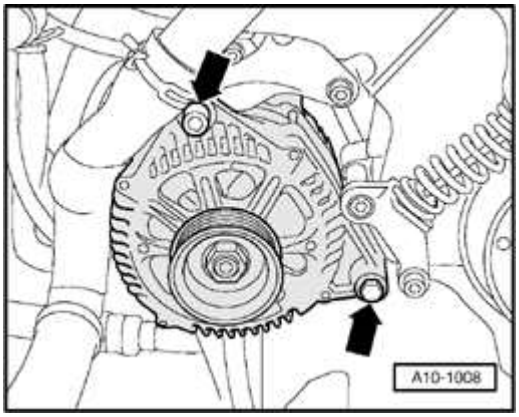


Fig. 406: Unscrewing Bolts And Removing Generator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) and remove generator.

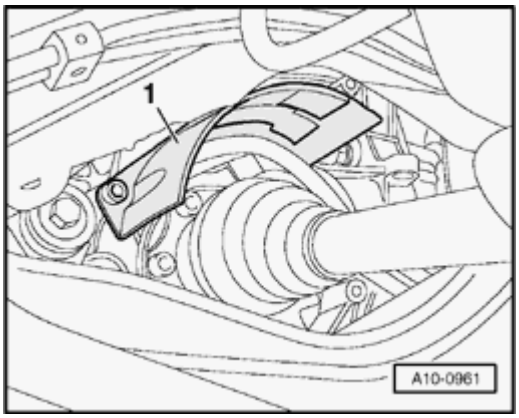


Fig. 407: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- If necessary, remove heat shield for right drive axle -1-.

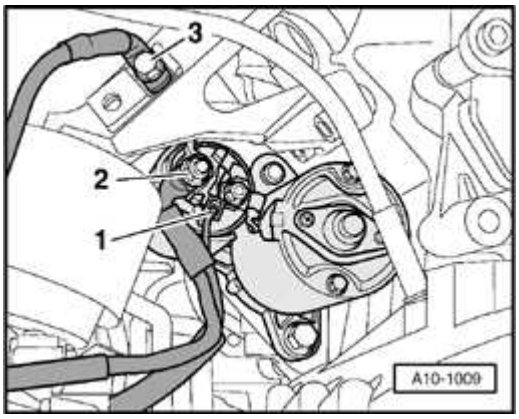


Fig. 408: Removing Electrical Wires From Starter & Disconnecting Ground (GND) Wire
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove electrical wires -1- and -2- from starter.

NOTE: Ground (GND) wire -3- remains connected.

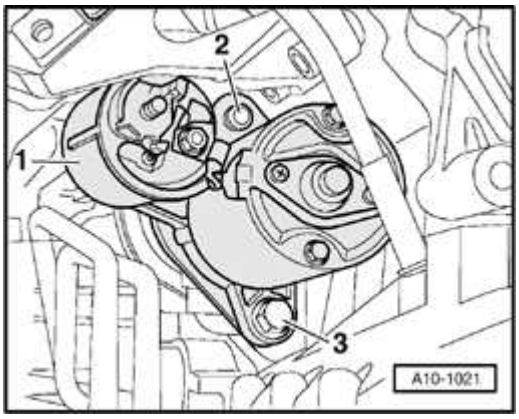


Fig. 409: Removing Heat Shield From Solenoid, Unscrewing Bolts & Removing Starter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- from solenoid.
- Remove bolts -2- and -3- and remove starter.

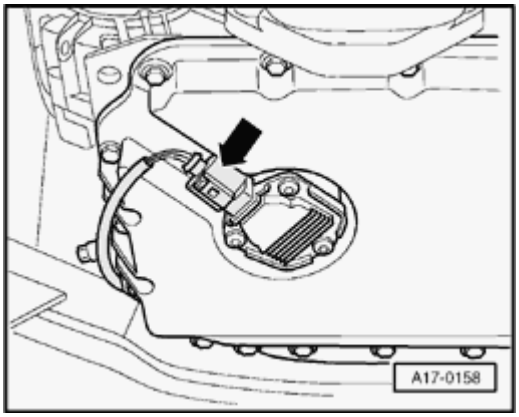


Fig. 410: Disconnecting Electrical Harness Connector At Oil Level Thermal Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector at Oil level thermal sensor (arrow) and move wiring clear.
- Place engine oil drip tray beneath engine, since oil will escape again.

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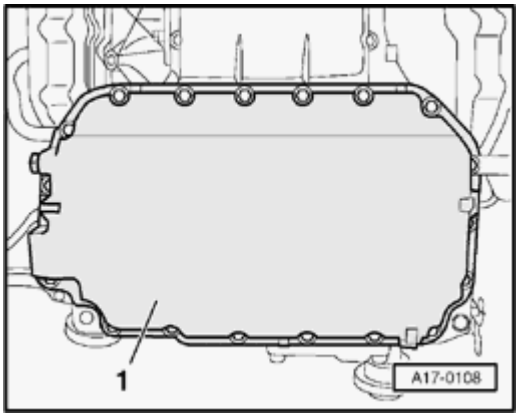


Fig. 411: Lower Portion Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt oil pan (lower part) -1- and carefully remove.
- Remove oil pump. Refer to **Oil pump, removing and installing**.

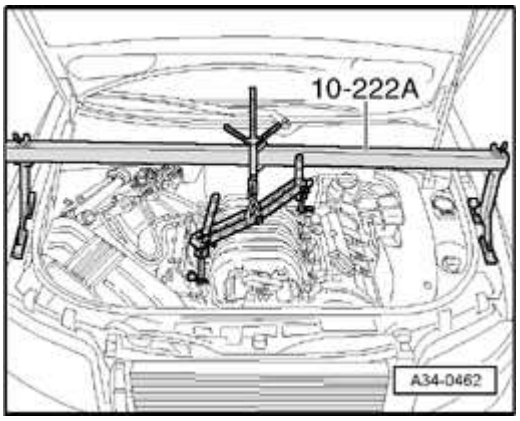


Fig. 412: Positioning 10-222A Engine Support Bridge On Bolted Flanges Of Fenders
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using 10-222A engine support bridge spindle, lift engine slightly.

NOTE: Make sure rear air guide at intake manifold is not damaged when lifting engine.

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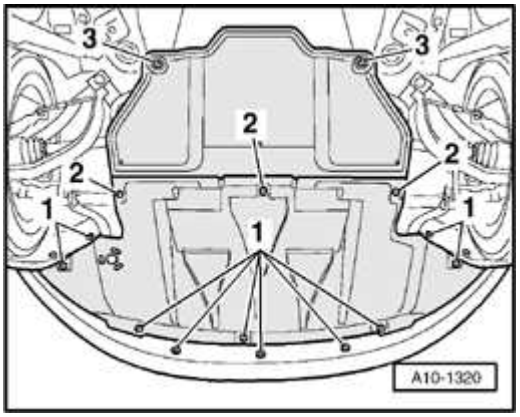


Fig. 413: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove quick-release screws -2- and -3- and remove rear sound insulation, if present.

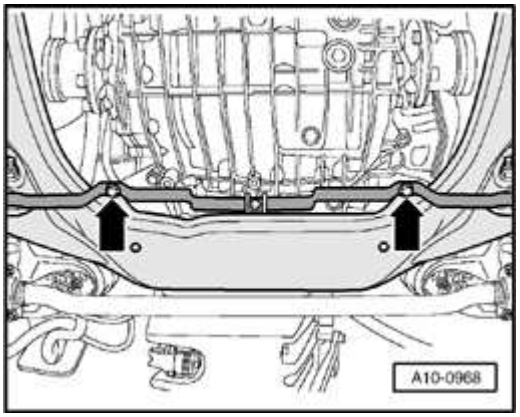


Fig. 414: Removing Bracket For Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for sound insulation (arrows).

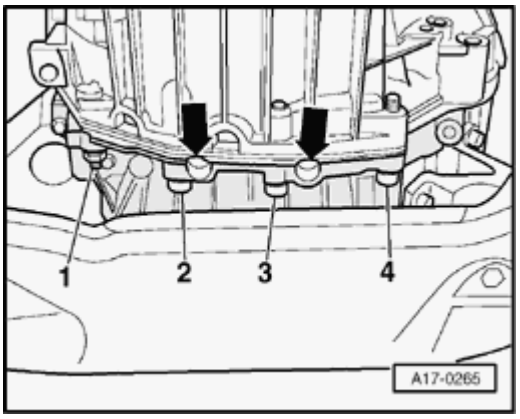


Fig. 415: Removing Bottom Engine/Transmission Connecting Bolts In Area Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bottom engine/transmission connecting bolts in area of oil pan (upper part).
- Check whether a 10 mm wrench socket, e.g. 3220 hinged socket, can be slid in through assembly hole (arrows). If necessary rework assembly hole.

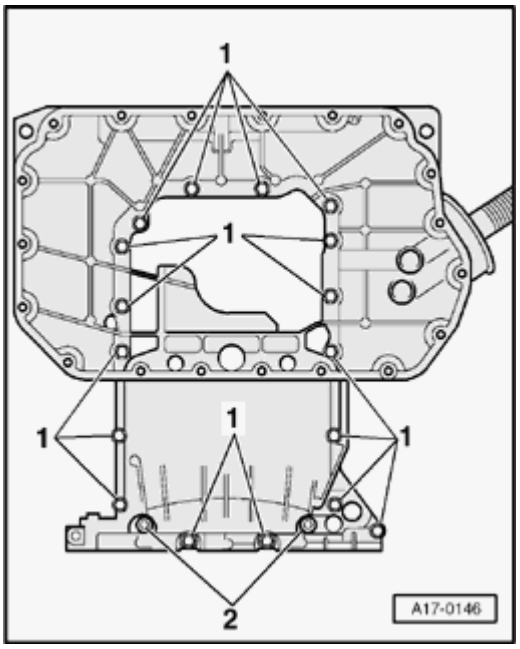


Fig. 416: Identifying Engine/Transmission Fasteners In Area Of Upper Part Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- for oil pan (upper part).
- Press oil pan (upper part) off of cylinder block roll pins.

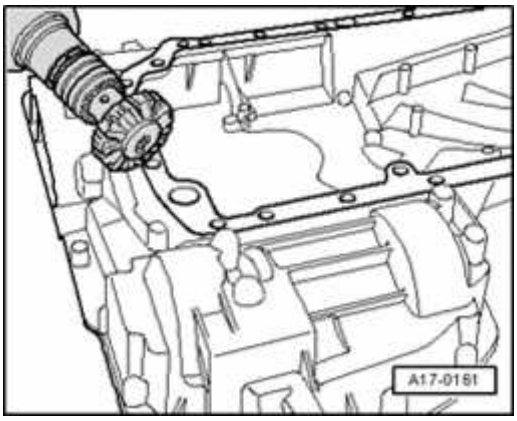


Fig. 417: Using Rotating Plastic Brush To Remove Remaining Sealant From Oil Pan (Upper Part) And At Cylinder Block
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using rotating plastic brush, remove remaining sealant from oil pan (upper part) and at cylinder block.

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WARNING: Wear protective glasses.

- Clean sealing surfaces so they are completely free of any oil or grease.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and O-rings.

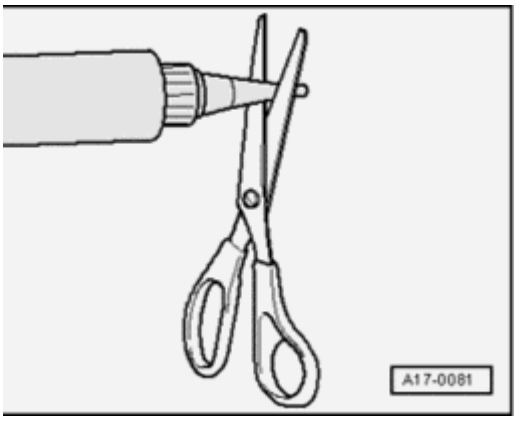


Fig. 418: Cutting Tube Nozzle At Front Marking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut tube nozzle at front marking (jet diameter approx. 1 mm).

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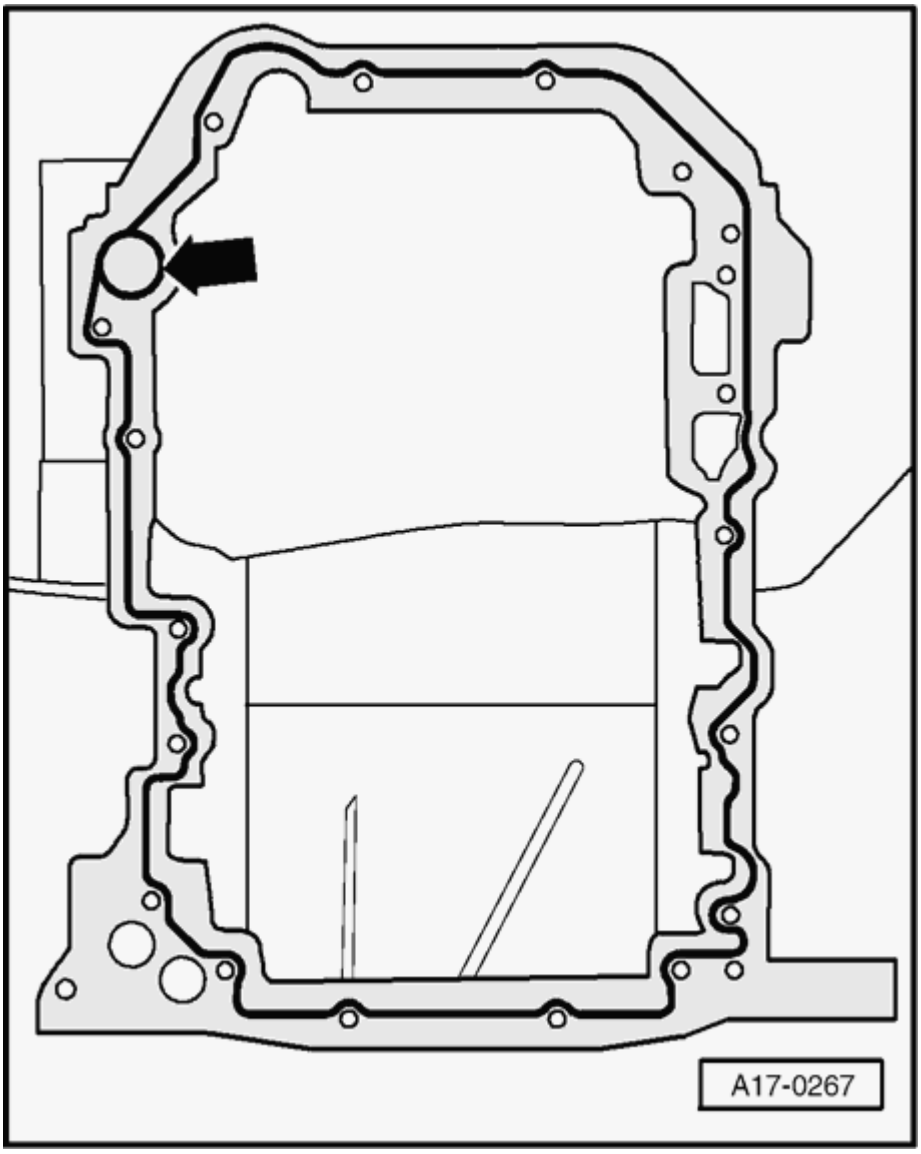


Fig. 419: Applying Silicon Sealant Bead To Clean Sealing Surfaces Of Oil Pan (Upper Part)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply silicon sealant bead to clean sealing surfaces of oil pan (upper part) as shown in illustration.

- Thickness of sealant bead (arrows): approx. 1.5 mm

NOTE:

- **The oil pan (upper part) must be installed within 5 minutes after application of silicon sealant.**
- **Sealant bead must not be thicker than specified, otherwise sealant could get into oil pan and clog the oil pump strainer.**
- **Apply sealant bead in area of hole (arrow) in cylinder block with special care.**

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- Install oil pan (upper part) and pre-tighten all bolts for oil pan (upper part)/cylinder block in diagonal sequence to 5 Nm.
- Tighten bolts of oil pan (upper part)/transmission to 45 Nm.

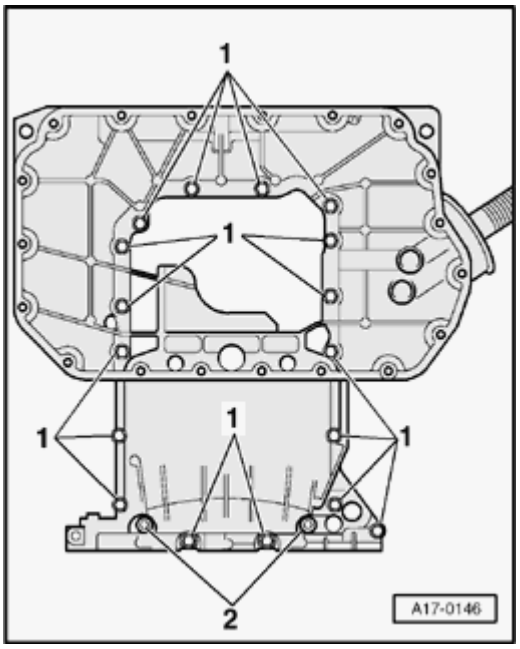


Fig. 420: Identifying Engine/Transmission Fasteners In Area Of Upper Part Of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Tighten diagonally bolts -1- to 16 Nm and bolts -2- to 22 Nm.
- Install oil pump. Refer to **Oil pump, removing and installing**.
- Install oil pan (lower part). Refer to **Oil pan (lower part), removing and installing** .
- Replace O-ring at guide tube for oil dipstick and insert guide tube into hole in oil pan (upper part).
- Install starter:

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

- Install generator. Refer to **Ribbed belt for power steering pump, generator and A/C system**.
- Install subframe:

Refer to **40 - FRONT SUSPENSION**

- Install A/C compressor. Refer to **Ribbed belt for power steering pump, generator and A/C system**.
- Install ribbed belt. Refer to **Installing**.
- Install radiator support. Refer to **Lock carrier, moving into service position**.
- Add engine oil and check oil level.

See Caution for connecting Telematics battery. Refer to **Lubrication system components, removing and**

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installing

- Observe safety precautions after connecting the battery:

Refer to **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** .

- Top up with coolant. Refer to **Filling**.

NOTE:

- **Only reuse drained coolant if cylinder head or engine block were not replaced.**
- **Dirty coolant cannot be reused.**

Tightening torques

Component		Nm
Oil pan (upper part) to	M7	16
Cylinder block and sealing flanges	M8	22
Oil pan (upper part) to transmission		45
Bracket for sound insulation to subframe		10
Electrical coolant pump to oil pan (upper part)		10
Engine mount to subframe		23
Bracket for catch container to chassis		10

Component	Nm
Bracket for refrigerant line to oil pan	10
Bracket for Secondary Air Injection (AIR) pump to longmember	10
Oil cooler to oil pan (upper part)	30
Guide tube for oil dipstick to secondary air line	10

Oil check valves and spray jet valve, overview

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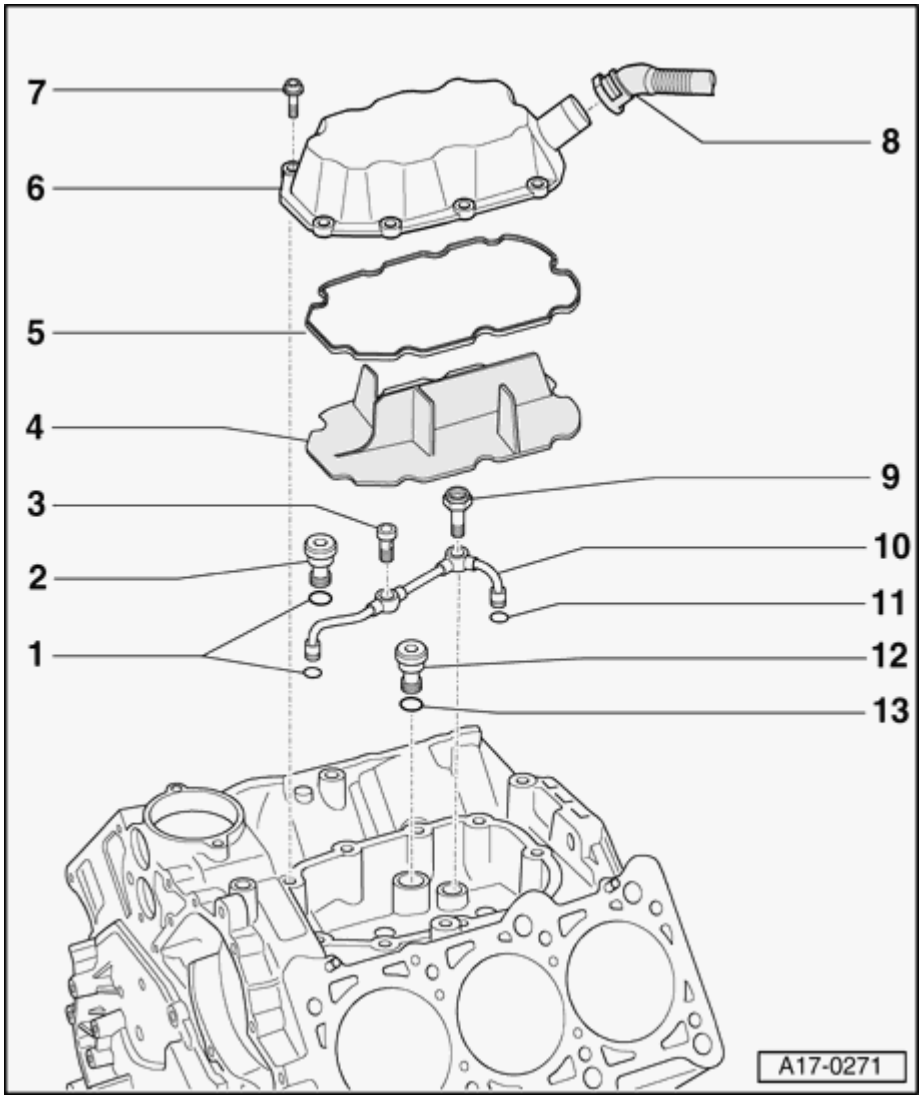


Fig. 421: Identifying Special Tools - Oil Check Valves And Spray Jet Valve, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: If irregular valve noise occurs repeatedly during short journeys and disappears after extended driving, the oil check valves must be replaced.

1 - O-Rings

- Always replace

2 - Oil check valve, 20 Nm

- For oil supply at left cylinder head

3 - Banjo fitting, 15 Nm

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4 - Baffle

5 - Gasket

- Always replace

6 - Cover

- With connection for crankshaft housing ventilation
- Removing. Refer to intake manifold, removing and installing: Refer to **Intake manifold, removing and installing**

7 - 10 Nm

8 - Hose

- To pressure regulation valve of crankshaft housing ventilation

9 - Spray jet valve, 25 Nm

- For piston cooling

10 - Oil line

11 - O-ring

- Always replace

12 - Oil check valve, 20 Nm

- For oil supply at right cylinder head

13 - O-ring

- Always replace

Oil pressure and oil pressure switch, checking

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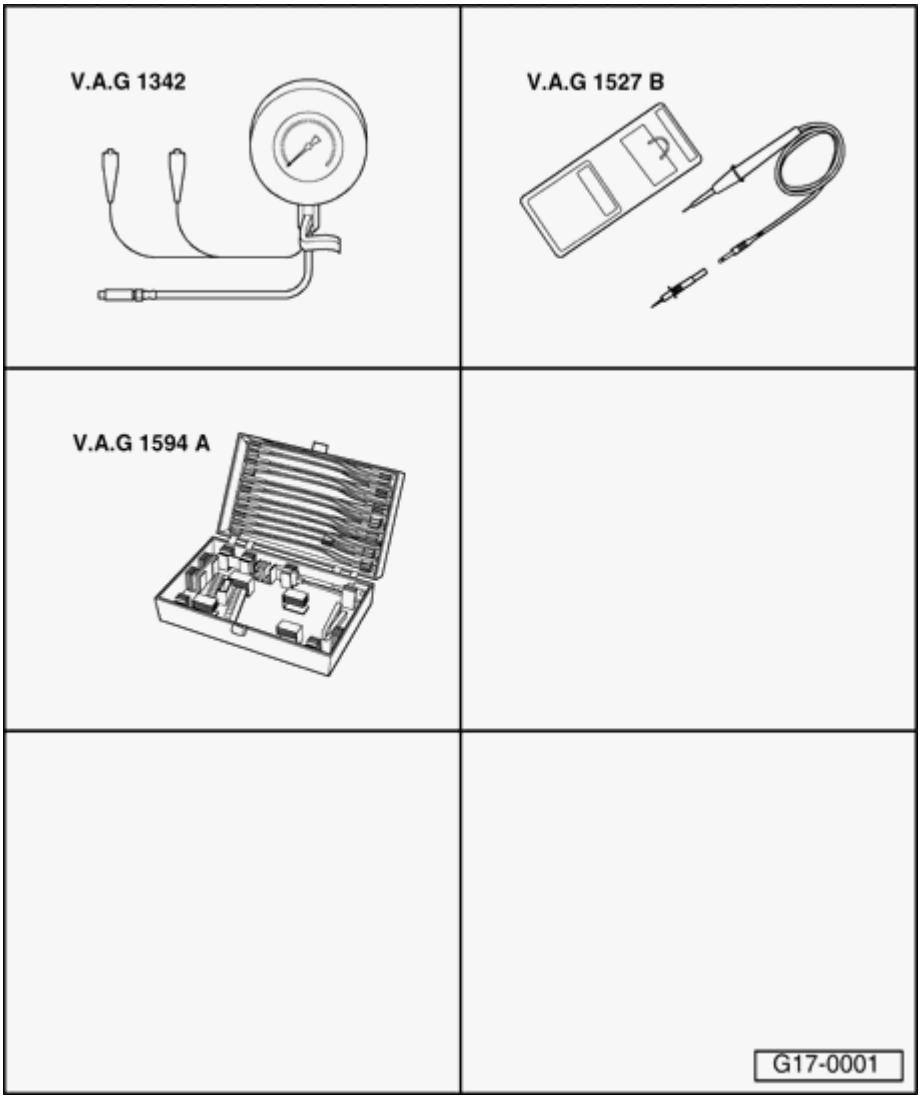


Fig. 422: Identifying Special Tools - Oil Pressure And Oil Pressure Switch, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1342 Oil pressure gauge
- VAG1527B Voltage tester
- VAG1594A Connector test kit

Requirements

- Oil level OK
- Engine oil temperature approximately 80 C.
- With ignition on, Oil pressure warning light -K3- must be lit.
- For vehicles with Auto Check System, "OK" indicator must be lit (call up symbol).

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Oil pressure switch, checking

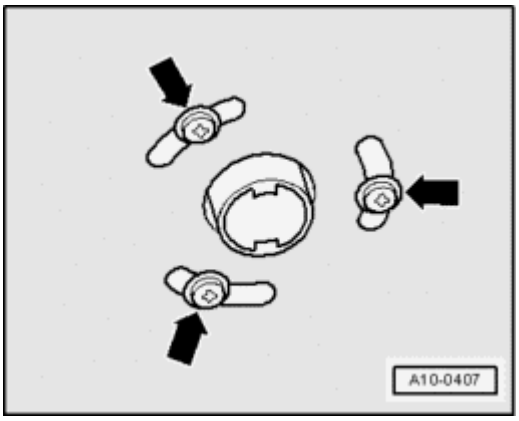


Fig. 423: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

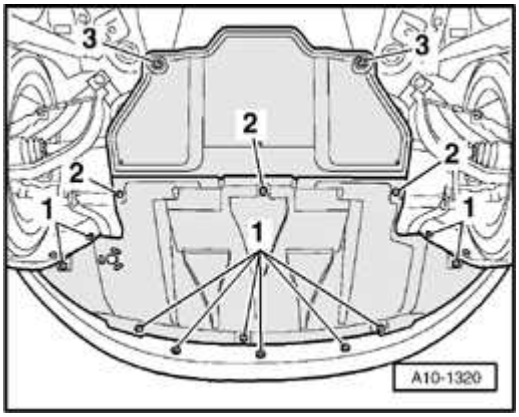


Fig. 424: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.

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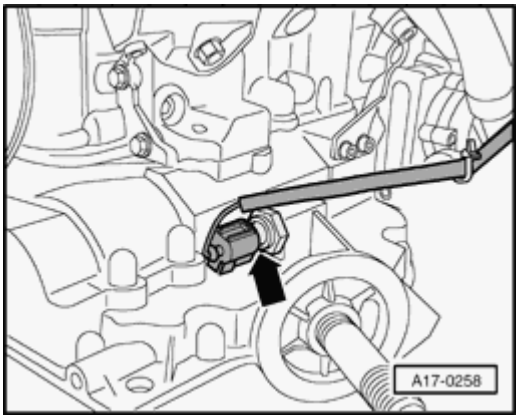


Fig. 425: Disconnecting Electrical Harness Connector At Oil Pressure Switch
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector at oil pressure switch (arrow).

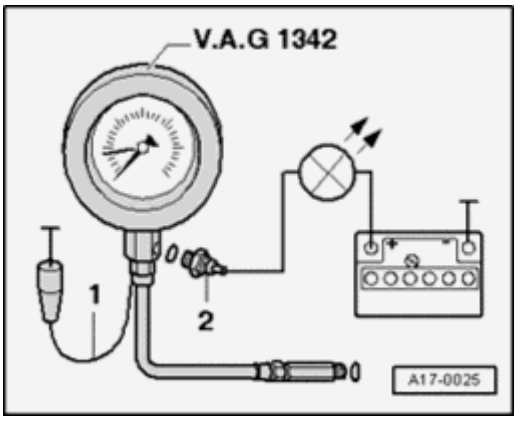


Fig. 426: Removing Oil Pressure Switch And Installing VAG1342 Oil Pressure Tester
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil pressure switch and install VAG1342 oil pressure tester.
- Install oil pressure switch -2- on VAG 1342.
- Connect brown wire -1- of tester to ground (GND).
- Using VAG1594A connector test kit, connect VAG1527B voltage tester to oil pressure switch and Battery positive (+).

- LED must not be lit

If LED is lit:

- Replace oil pressure switch.
- Start engine.

NOTE: While starting engine, watch pressure tester and LED as oil pressure switch

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may open during start.

Black oil pressure switch

- At 1.2 to 1.6 bar pressure, LED must light up

If LED does not light up:

- Replace oil pressure switch.

Oil pressure, checking

- Disconnect electrical wire from oil pressure switch.

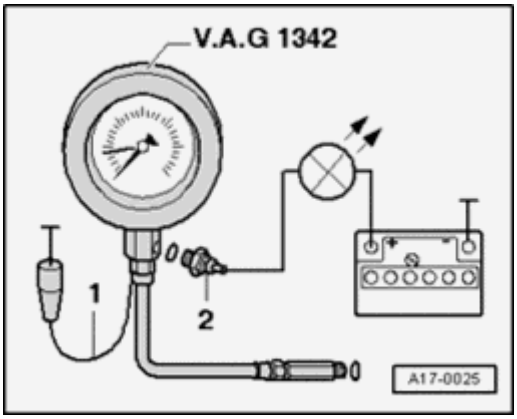


Fig. 427: Removing Oil Pressure Switch And Installing VAG1342 Oil Pressure Tester
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oil pressure switch and install VAG1342 oil pressure tester.
- Install oil pressure switch -2- on VAG 1342.
- Start engine (engine oil temperature approximately 80°C).

- Oil pressure at idle: at least 1.5 bar
- Oil pressure at 2000 RPM: at least 3.0 bar

If specified values are not obtained:

- Pressure relief valve or oil pump faulty, replace oil pump.

Engine oil specification

Viscosity classes and oil specifications

Refer to Additional Information, Fluid Capacity Chart

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Oil level, checking

Requirements

- Minimum engine oil temperature: 60°C
- Vehicle on level ground.
- After stopping engine, wait a few minutes to allow oil to flow back into oil pan.

- Pull out oil dipstick, wipe off with a clean cloth and re-insert dipstick again up to stop.
- Withdraw dipstick again and read oil level.

Range of markings on dipstick:

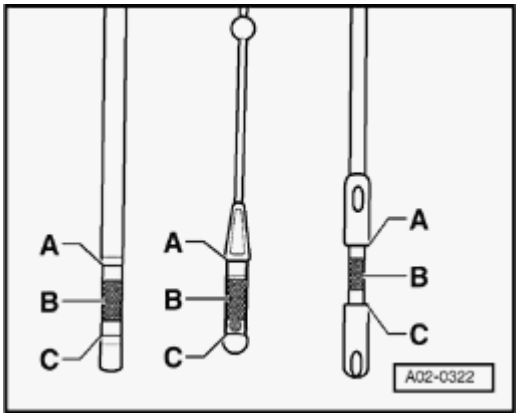


Fig. 428: Range Of Markings On Dipstick
Courtesy of VOLKSWAGEN UNITED STATES, INC.

a - Oil must not be topped up.

b - Oil may be topped up. After topping up, oil may reach range -a-.

c - Oil must be topped up. After topping up, it is sufficient if oil level is somewhere in range -b- (shaded area).

NOTE: Oil level must not exceed mark -a- on oil dipstick.

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19 ENGINE - COOLING SYSTEM

COOLING SYSTEM COMPONENTS, REMOVING AND INSTALLING

Cooling system components, removing and installing

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

NOTE:

- **The cooling system is under pressure when engine is warm. If necessary reduce pressure before repair.**
- **Secure all hose connections using hose clamps appropriate for the model type:**
- **VAG1921 hose clip pliers are recommended for installing spring-type clamps.**
- **Always replace gaskets, seals and O-rings.**
- **The arrows which are marked on coolant lines and hoses must face each other.**

Cooling system components

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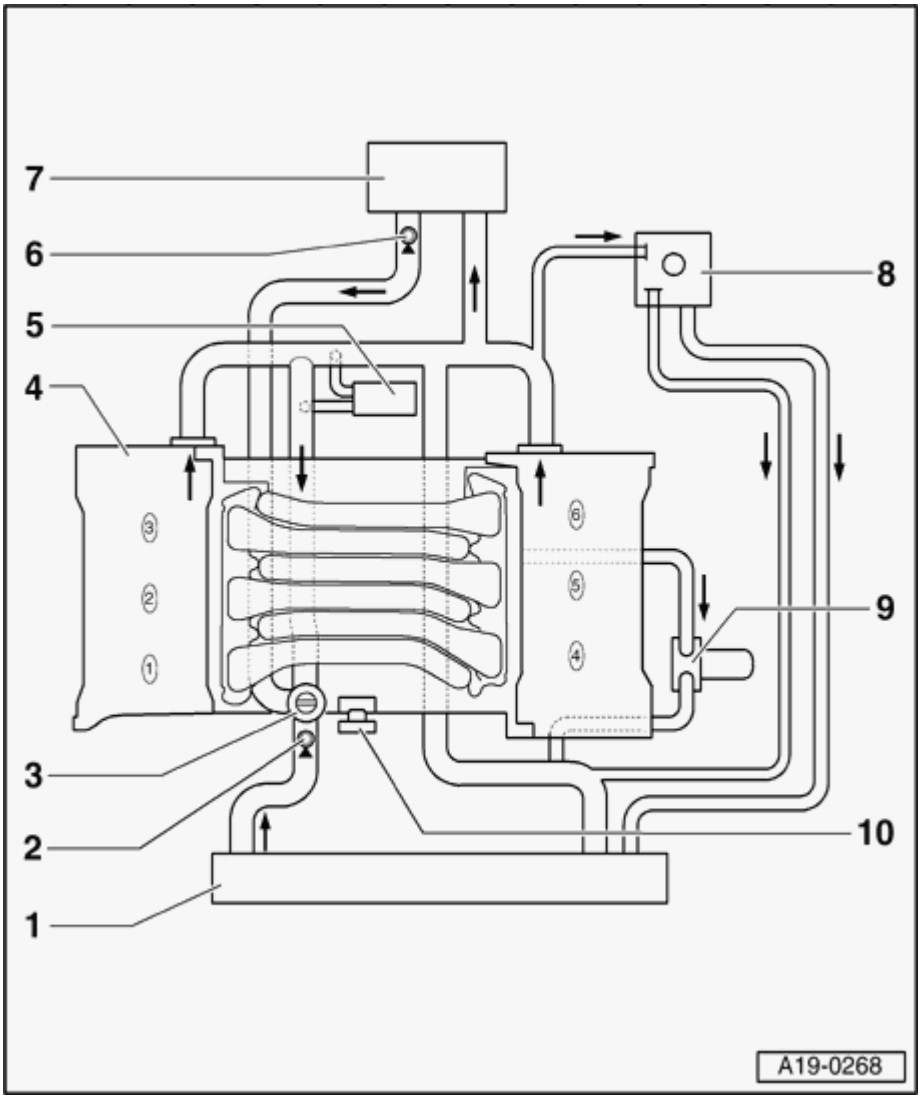


Fig. 429: Cooling System Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Coolant hose connection diagram

1 - Radiator

- Removing and installing. Refer to **Radiator, removing and installing**
- After replacing, replace coolant

2 - Bleeder screw, 15 Nm

3 - Coolant thermostat

- Removing and installing. Refer to **Coolant thermostat, removing, installing and checking**
- Checking. Refer to **Check coolant thermostat**

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4 - Cylinder head/Cylinder block

- After replacing, replace coolant

5 - Throttle valve control module -J338-

6 - Bleeder hole

- At coolant hose to heater core

7 - Heater core

- After replacing, replace coolant

8 - Expansion tank

- With cap
- Pressure relief valve in cap, checking. Refer to **Pressure relief valve in cap, checking**

9 - Oil cooler

10 - Coolant pump

- Removing and installing. Refer to **Coolant pump, removing and installing**
- Check for ease of movement

Coolant, draining and refilling

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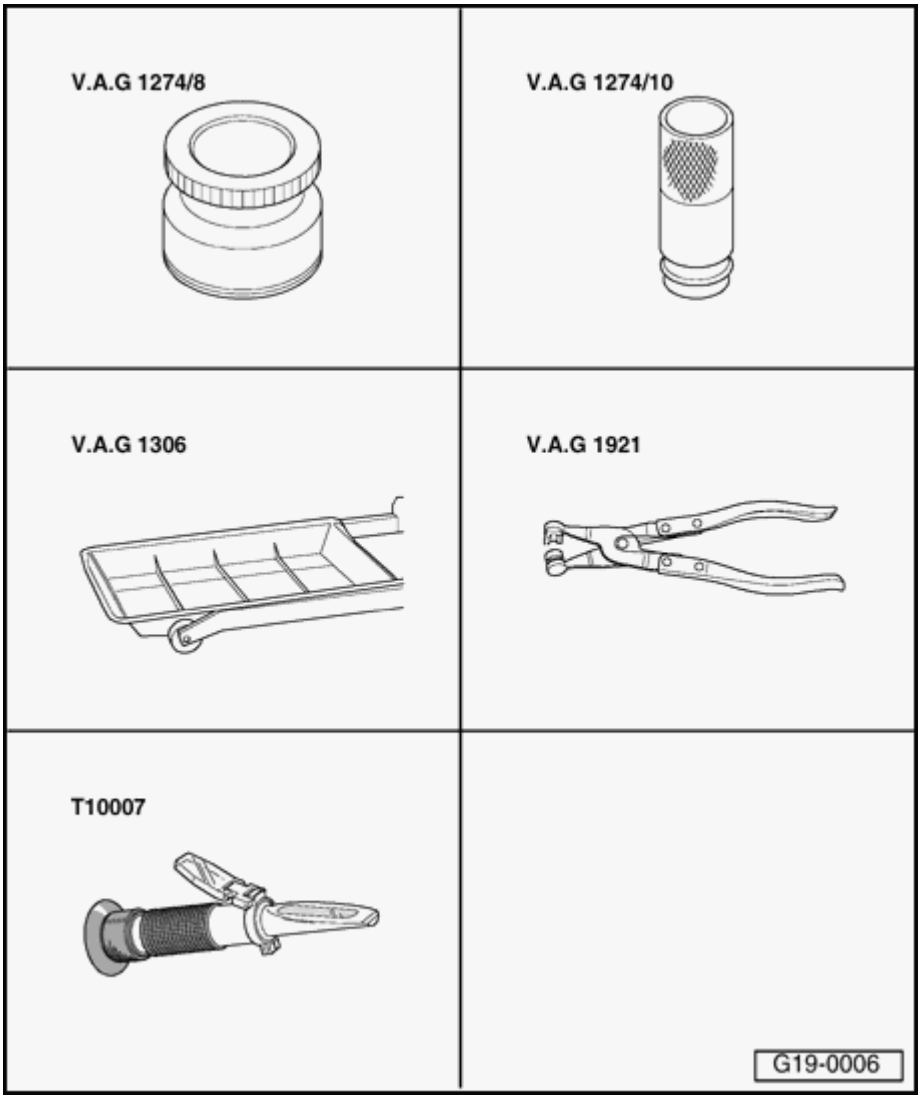


Fig. 430: Identifying Special Tools - Coolant, Draining And Refilling
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1274/8 Adapter
- VAG1274/10 Adapter for VAG1274 Cooling system tester
- VAG1306 Drip tray for VAG1202A
- VAG1921 Hose clip pliers
- T10007 Refractometer

Draining

NOTE: Drained coolant must be stored in a clean container for disposal or reuse.

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WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open cap of coolant expansion tank.

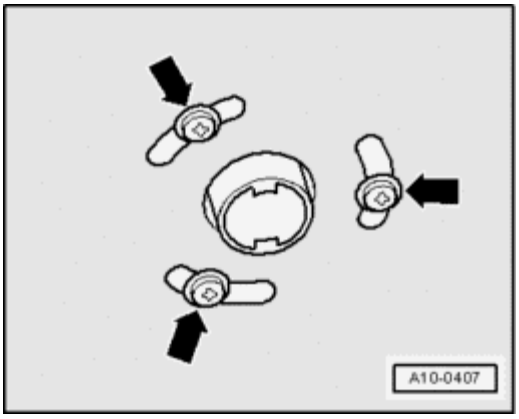


Fig. 431: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

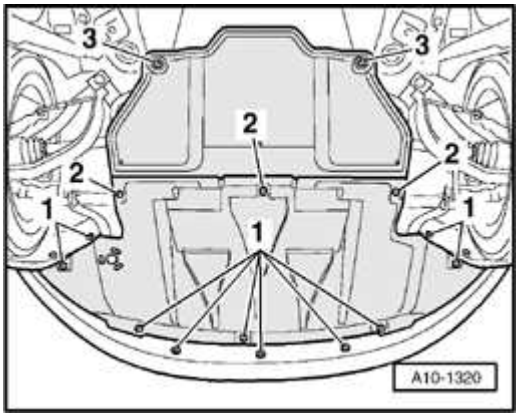


Fig. 432: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.
- Place VAG1306 drip tray beneath engine.

Vehicles with drain plug

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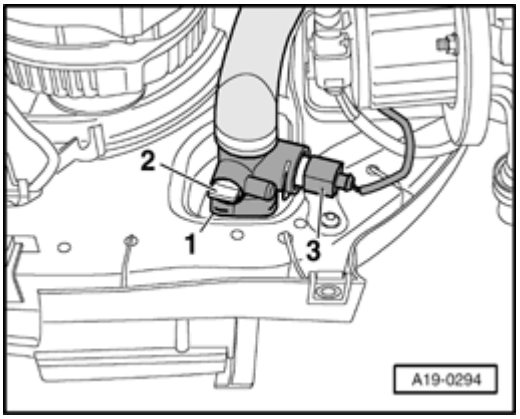


Fig. 433: Identifying Drain Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn radiator drain plug -2- counterclockwise. If needed, attach accessory hose to connection flange and drain coolant.

Vehicles without drain plug

- Remove retaining clamp for Engine Coolant Temperature (ECT) sensor (on radiator) -G83-.
- Remove Engine Coolant Temperature (ECT) sensor from outlet and drain coolant.

All

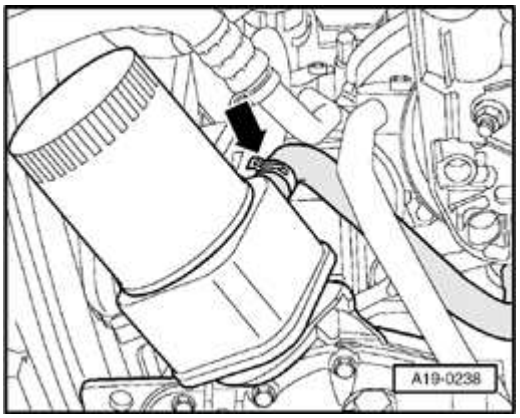


Fig. 434: Disconnecting Coolant Hose At Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In addition, disconnect coolant hose at oil cooler (arrow) and drain remaining coolant.

Filling

NOTE:

- **The cooling system must be filled year round with frost and corrosion protection additives.**
- **Only use coolant additive G 012 A8 D (according to TL VW 774 D).**

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Characteristic color: red

CAUTION: G 012 A8 D and other coolant additives must not be mixed. If mixed, major engine damage will occur.

- If the fluid in expansion tank is brown, G 012 A8 D has been mixed with other coolant. In this case, flush the cooling system and change the coolant. To flush, fill the cooling system with clear water and let the engine run for approx. 2 minutes. Flushing the system should remove most of the old coolant.
- G 012 A8 D and coolant additives marked with "according to TL VW 774 D" prevent frost and corrosion damage as well as lime deposits. They also raise the boiling point. Therefore, the cooling system must be filled year round with frost and corrosion protection additives.
- A higher boiling point improves engine reliability under heavy load particularly in countries with tropical climates.
- Frost protection must be ensured to about -25°C (about -35°C in countries with arctic climates).
- The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant additive portion must be at least 40%.
- If for climatic reasons greater frost protection is required, the amount of G 012 A8 D can be increased, but only up to 60% (frost protection to about -40°C), otherwise frost protection and cooling effectiveness will be reduced again.
- Use only clean drinking water for mixing with the coolant.
- If the radiator, heater core, cylinder head or cylinder head gasket is replaced, completely replace the engine coolant.
- For coolant G 012 A8 D, use T10007 refractometer to test frost protection in cooling system.

Recommended mixture ratios:

Frost protection to	Anti-freeze amount	G 012 A8 D1)	Water1)
-25°C	40%	3.2 L	4.8 L
-35°C	50%	4.0 l	4.0 l

1) Coolant quantity: 8.0 liters; can vary depending upon vehicle options.

Vehicles with drain plug

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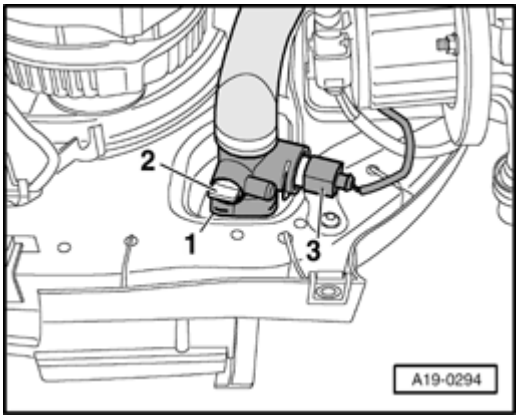


Fig. 435: Identifying Drain Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew drain plug -2- at radiator clockwise.

Vehicles without drain plug

- Insert Engine Coolant Temperature (ECT) sensor (on radiator) -G83- with new O-ring into outlet and secure it with retaining clamps.

All

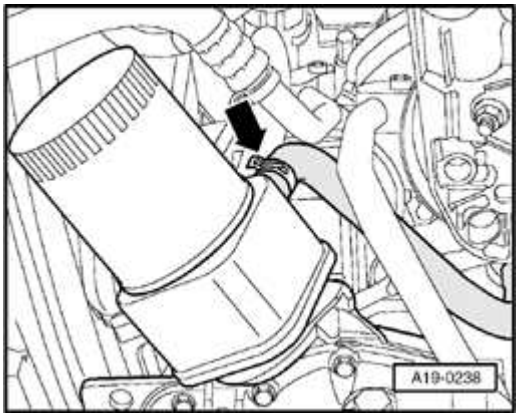


Fig. 436: Disconnecting Coolant Hose At Oil Cooler
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect coolant hose to oil cooler (arrow).

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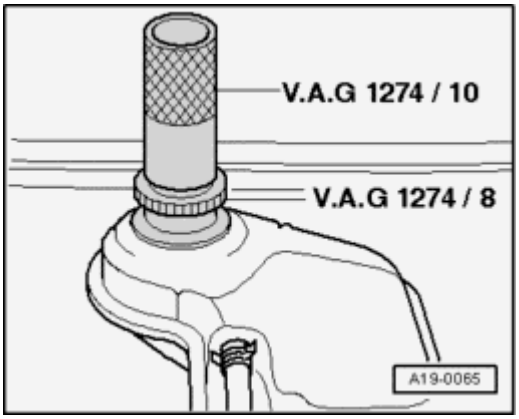


Fig. 437: Screw Adapter VAG1274/8 Onto Coolant Expansion Tank & Fit Special Tool VAG1274/10 Onto Adapter
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Screw VAG1274/8 adapter onto expansion tank.
- Attach VAG1274/10 special tool to VAG1274/1 adapter.

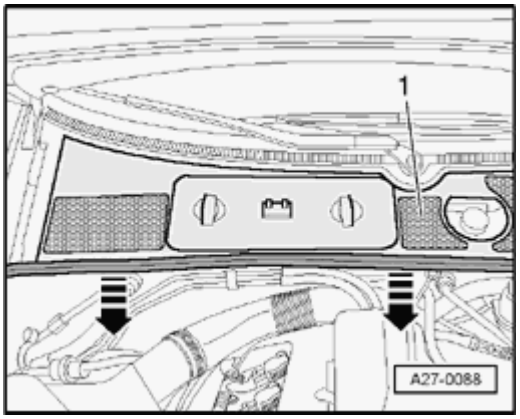


Fig. 438: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off rubber seal of plenum chamber cover in direction of (arrow).
- Remove cover -1- toward front.

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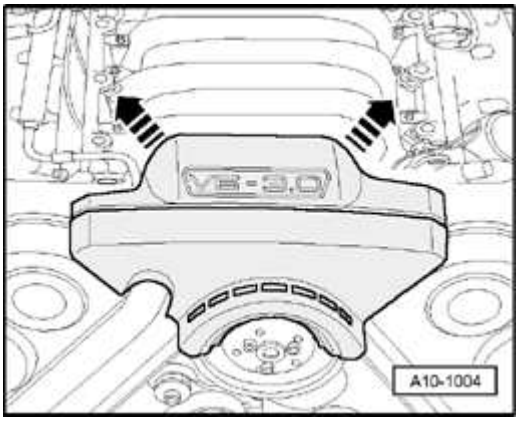


Fig. 439: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

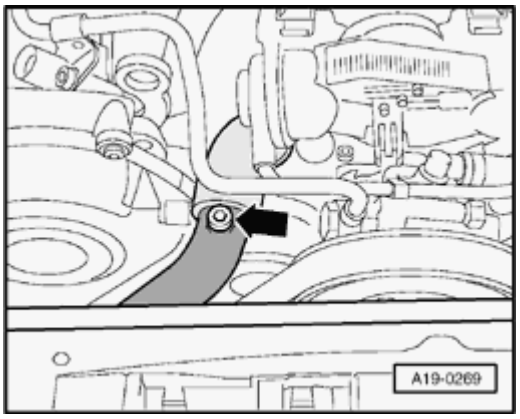


Fig. 440: Removing Bleeder Screw
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bleeder screw (arrow).
- Fill with coolant until it escapes from coolant hose bleeder hole.
- Tighten bleeder screw to 15 Nm.

NOTE: Always replace sealing ring.

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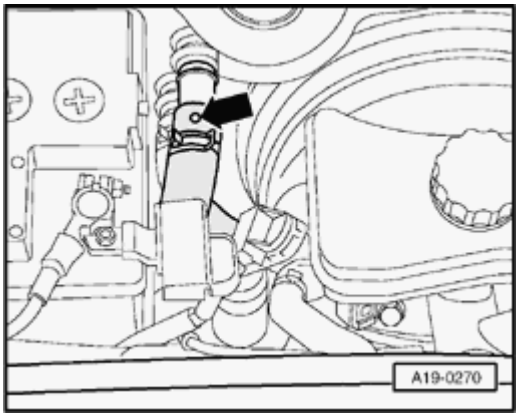


Fig. 441: Loosening Coolant Hose To Heater Core
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen coolant hose to heater core and pull back hose sufficiently so that bleeder hole (arrow) is no longer sealed by connection.
- Fill with coolant until it escapes from coolant hose bleeder hole.
- Slide coolant hose onto connection sleeve and secure using spring-type clamp.
- Install coolant expansion tank cap.

- Start engine and maintain an engine speed of about 2000 RPM for approx. 3 minutes.
- Allow engine to idle until lower coolant hose at radiator is hot.

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Check coolant level and top up if necessary. With engine at operating temperature, coolant level must be at max. marking, with engine cold, it must be between min. and max. marking.
- Turn engine off.

Tightening torque

Component	Nm
Bleeder screw at coolant line	15

Coolant pump and coolant regulator

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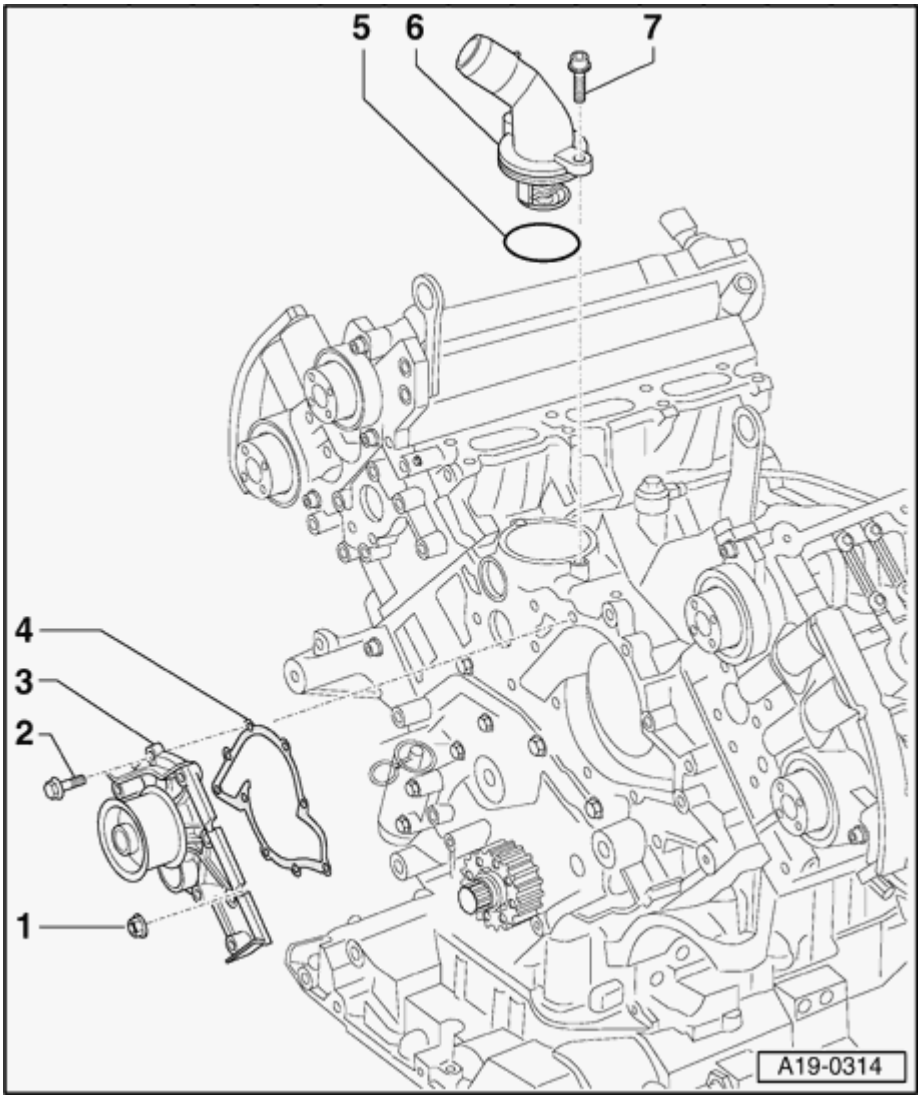


Fig. 442: Coolant Pump And Coolant Regulator Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - 10 Nm

3 - Coolant pump

- Removing and installing. Refer to **Coolant pump, removing and installing**
- Check for ease of movement

4 - Gasket

- Always replace

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5 - O-ring

- Always replace

6 - Coolant regulator/thermostat

- With connecting piece
- Can only be replaced together
- Removing and installing. Refer to **Coolant thermostat, removing, installing and checking**
- Checking. Refer to **Check coolant thermostat**

7 - 10 Nm

Coolant pump, removing and installing

Removing

- Drain coolant. Refer to **Coolant, draining and refilling**.
- Remove toothed belt. Refer to **Toothed belt, removing and installing**.
- Remove camshaft gears from right cylinder head.

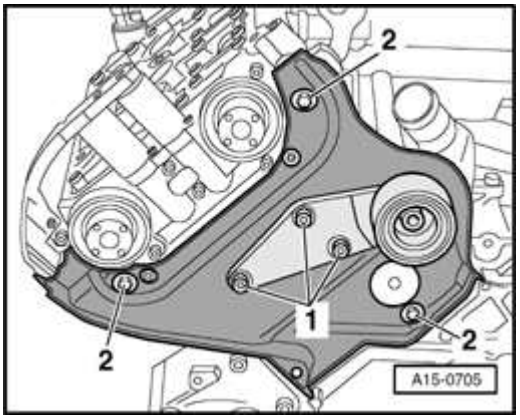


Fig. 443: Unscrewing Bolts And Removing Bracket With Idler Roller & Toothed Belt Guard At Right Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and remove bracket with idler roller.
- Unscrew bolts -2- and remove toothed belt guard at right rear.
- Remove eccentric pulley for toothed belt.

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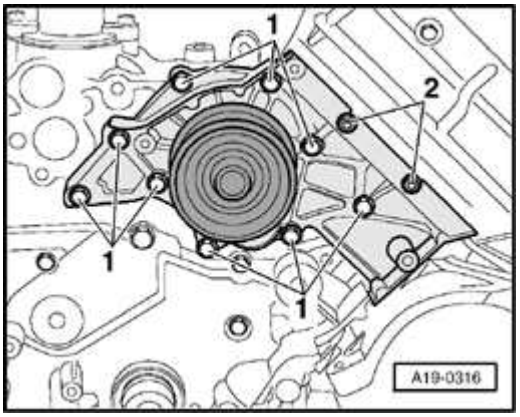


Fig. 444: Removing Nuts For Toothed Belt Guard At Left Rear & Bolts For Coolant Pump And Remove Coolant Pump
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -2- for toothed belt guard at left rear.
- Remove bolts -1- for coolant pump and remove coolant pump.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and O-rings.

- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.
- Top up coolant. Refer to **Filling**.

Tightening torques

Component	Nm
Coolant pump to cylinder block	10
Rear toothed belt guard to coolant pump	10
Right rear toothed belt guard to engine	10 1)
Bracket for idler roller to cylinder head	10 1)

1) Always replace bolt

Coolant thermostat, removing, installing and checking

Removing

- Drain coolant. Refer to **Coolant, draining and refilling**.
- Remove intake manifold. Refer to **Intake manifold, removing and installing**.

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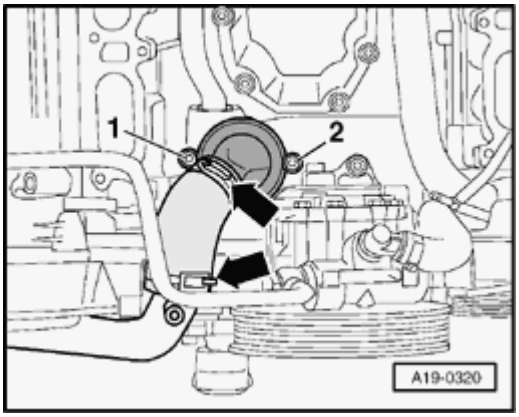


Fig. 445: Removing Bolts & Disconnecting Coolant Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-.
- Disconnect coolant hose (arrows).
- Remove coolant regulator with connection.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace O-ring.

- Clean and/or smooth O-ring sealing surface before installing.
- Install coolant regulator with coolant regulator housing.
- Install intake manifold. Refer to **Installing**.

Tightening torque

Component	Nm
Coolant regulator housing to cylinder block	10

Check coolant thermostat

- Warm thermostat in hot water bath.

Starts to open	Opening end	Opens
approx. 87°C	approx. 102°C1)	min. 8 mm

1) cannot be checked

Coolant lines, overview

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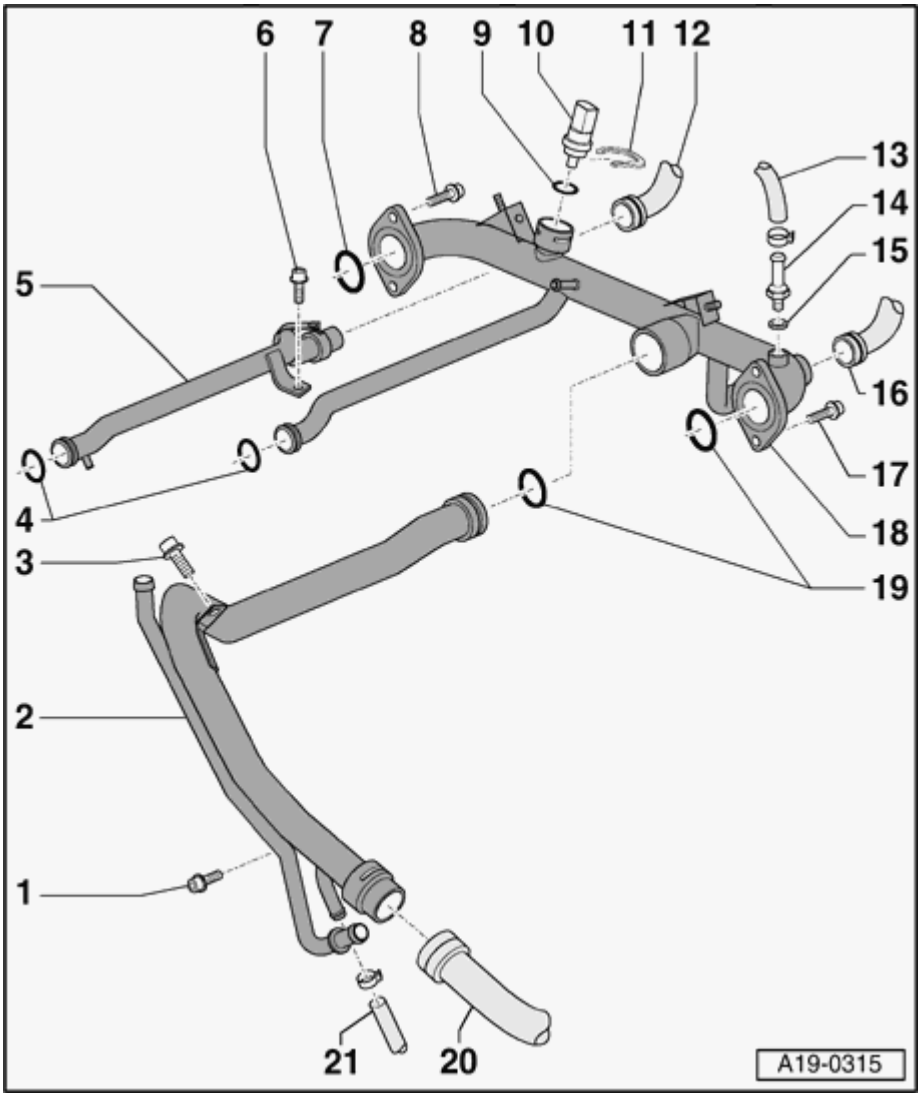


Fig. 446: Coolant Lines, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 10 Nm

2 - Front coolant line

- Removing and installing. Refer to **Front coolant line, removing and installing**

3 - 22 Nm

4 - O-ring

- Always replace

5 - Coolant line, right

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- Removing and installing. Refer to **Right coolant line, removing and installing**

6 - 10 Nm

7 - O-ring

- Always replace

8 - 10 Nm

9 - O-ring

- Always replace

10 - Engine Coolant Temperature (ECT) sensor -G2-/-G62-

11 - Retaining clip

12 - Coolant hose

- To heater core

13 - Coolant hose

- To expansion tank

14 - Connecting piece

- Tighten to 15 Nm

15 - Seal

- Always replace

16 - Coolant hose

- To heater core

17 - 10 Nm

18 - Rear coolant line

- Removing and installing. Refer to **Rear coolant line, removing and installing**

19 - O-ring

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- Always replace

20 - Coolant hose

- To top of radiator

21 - Coolant hose

- To oil cooler

Front coolant line, removing and installing

Special tools and equipment

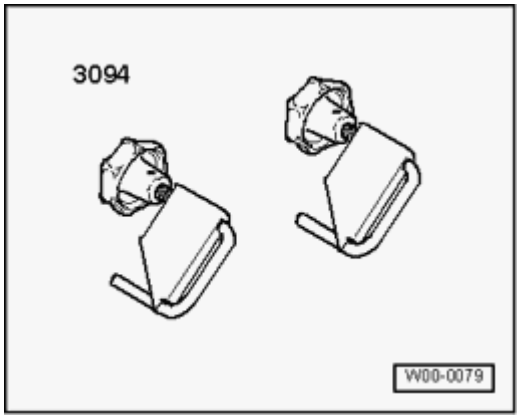


Fig. 447: Identifying Hose Clamps 3094
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3094 Hose clamps
- Oil receptacle

Removing

NOTE: All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.

- Remove intake manifold. Refer to **Intake manifold, removing and installing**.
- Remove toothed belt. Refer to **Toothed belt, removing and installing**.
- Remove camshaft gears from left cylinder head.

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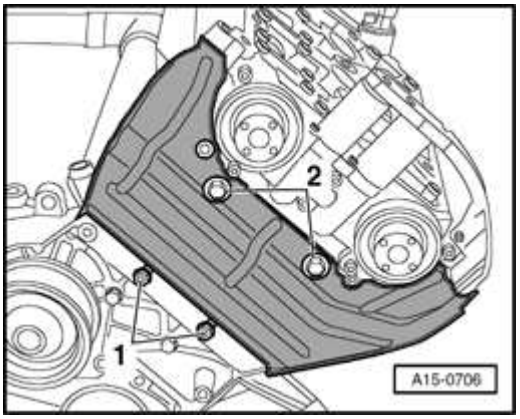


Fig. 448: Unscrewing Bolts And Removing Toothed Belt Guard At Left Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and -2- and remove toothed belt guard at left rear.
- Place oil pan underneath.

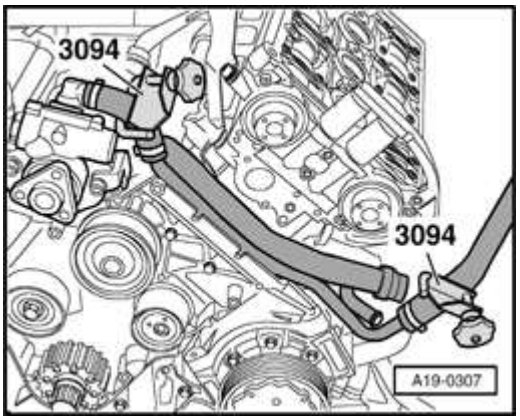


Fig. 449: Clamping Off Two Hoses At Hydraulic Fluid Supply Line Using 3094 Hose Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clamp off two hoses at hydraulic fluid supply line using 3094 hose clamps.
- Disconnect both hydraulic hoses from supply line.
- Disconnect coolant hoses at front coolant line.

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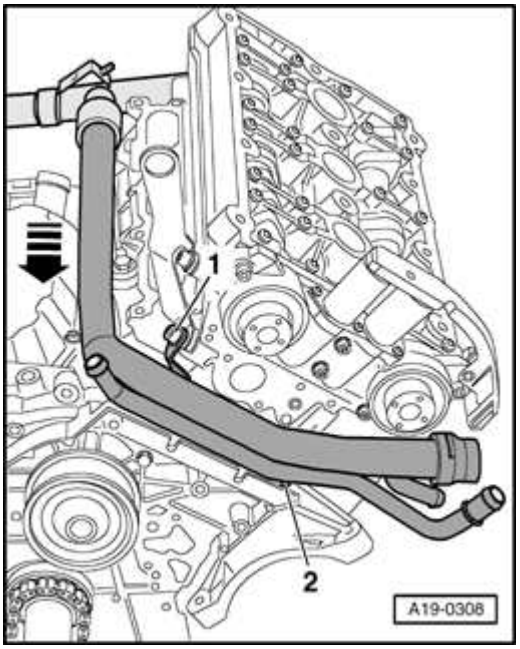


Fig. 450: Removing Coolant Line Toward Front
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- and move pipes at coolant line to side.
- Remove coolant line toward front (arrow).

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type:**
- **Replace O-rings.**

- Clean and/or smooth O-ring sealing surface before installing.
- Coat new O-ring with G12 and slide onto coolant line.
- Slide front coolant line into hole at rear coolant line.
- Install intake manifold. Refer to **Installing**.

- Install toothed belt (adjust timing). Refer to **Installing (adjusting valve timing)**.
- Fill power steering with fluid and bleed steering system:

Refer to **48 - STEERING**

Tightening torques

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Component		Nm
Front coolant line	M6	10
To cylinder head	M8	22
Rear toothed belt guard to cylinder head or cylinder block		10 1)

1) Replace bolts.

Right coolant line, removing and installing

Removing

- Remove intake manifold. Refer to **Intake manifold, removing and installing**.

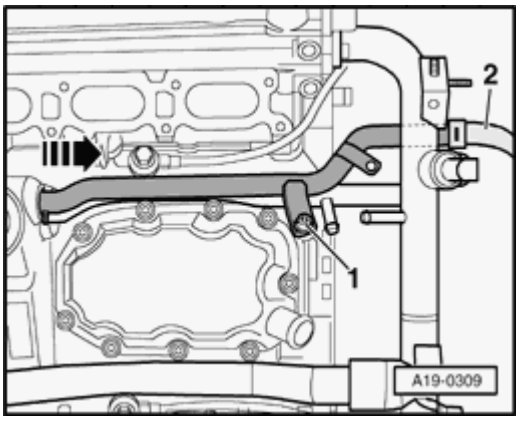


Fig. 451: Disconnecting Rear Coolant Hose From Right Coolant Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect rear coolant hose -2- from right coolant line.
- Remove bolts -1-.
- Pull right coolant line out of cylinder block toward rear (arrow).
- Remove catalytic converter upward.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type:**
- **Replace O-rings.**
- **Clean and/or smooth O-ring sealing surface before installing.**
- **Coat new O-ring with G12 and slide onto coolant line.**
- **Slide coolant line into hole at cylinder block.**
- **Install intake manifold. Refer to Installing.**

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Tightening torque

Component	Nm
Right coolant line to cylinder block	10

Rear coolant line, removing and installing

Removing

NOTE: All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.

- Remove right coolant line. Refer to **Right coolant line, removing and installing**.
- Expose wires at hose of crankshaft housing ventilation.

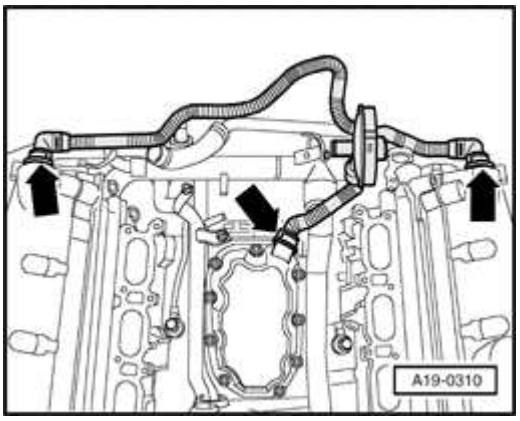


Fig. 452: Removing Hose Of Crankshaft Housing Ventilation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove hose of crankshaft housing ventilation (arrow).

Vehicles with automatic transmission

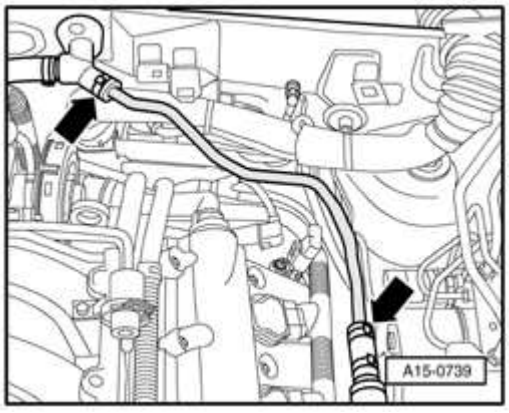


Fig. 453: Disconnecting Vacuum Hose To Brake Booster

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose to brake booster (arrows).

All

- Remove heat shield for harness connectors at left of bulkhead, if installed.

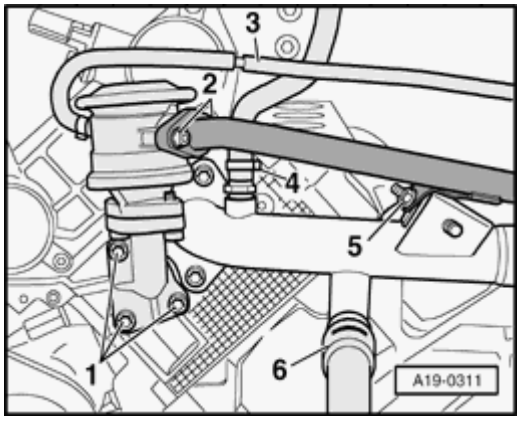


Fig. 454: Identifying Coolant Hose, Bolts, Nut & Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant hose -4-.
- Remove bolts -2- and nut -5- and remove hose for secondary air injection.
- Disconnect vacuum hose -3- from combination valve.
- Remove bolts -1- and remove combination valve for secondary air injection.

- Remove coolant hose -6-.

NOTE: The illustration is shown with the engine removed.

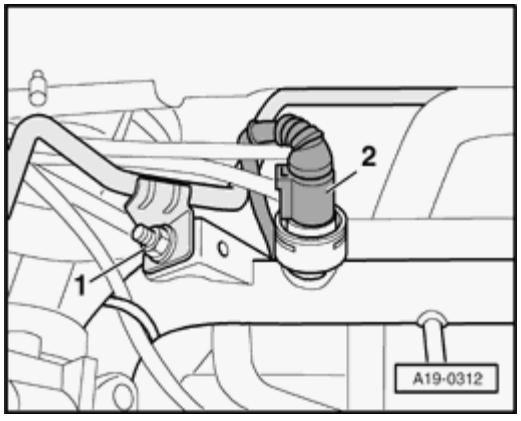


Fig. 455: Disconnecting Electrical Harness Connector At Engine Coolant Temperature (ECT) Sensor -G2-/-G62-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Disconnect electrical harness connector -2- at Engine Coolant Temperature (ECT) sensor -G2-/-G62-.
- Disconnect hydraulic line of power steering at rear coolant line -1-.
- Remove screw clips for electrical wiring harness at rear coolant line.
- Expose electrical wires at rear coolant line.

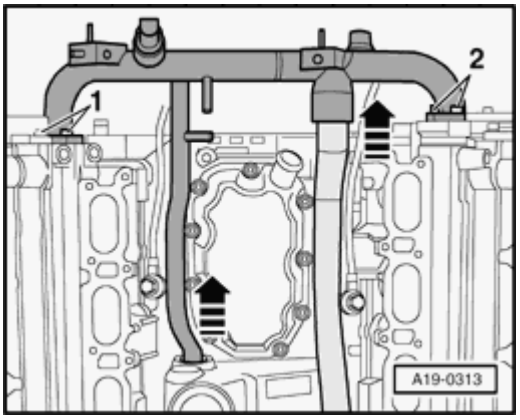


Fig. 456: Removing Bolts & Catalytic Converter Toward Rear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-.
- Remove catalytic converter toward rear.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type:**
- **Replace seals and O-rings.**

- Clean and/or smooth O-rings sealing surface before installing.
- Coat new O-rings with G12 and slide onto coolant line.
- Install right coolant line. Refer to **Installing**.

Tightening torques

Component	Nm
Rear coolant line to cylinder head	10
Power steering pressure line to coolant line	20
Connecting tube to combination valve	10
Connecting tube to rear coolant line	10

Radiator, removing and installing

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Special tools and equipment

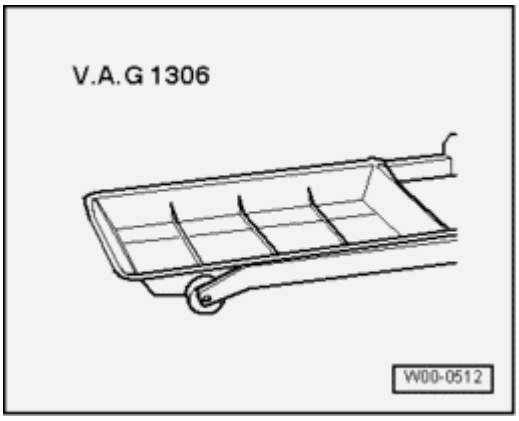


Fig. 457: Identifying Drip Tray V.A.G 1306
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1306 Drip tray for VAG1202A

Removing

- Remove front bumper:

Refer to

- **63 BUMPER**
- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

NOTE: Drained coolant must be stored in a clean container for disposal or reuse.

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e. hot coolant may escape when opening.

- Open cap of coolant expansion tank.

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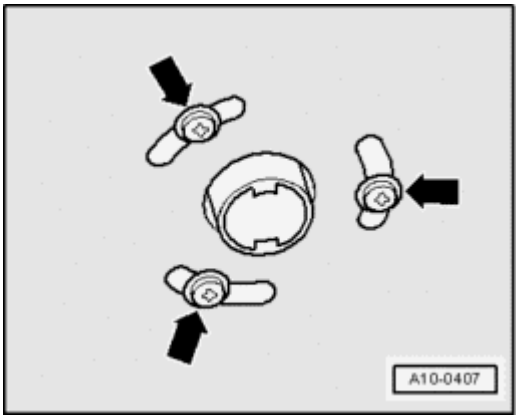


Fig. 458: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

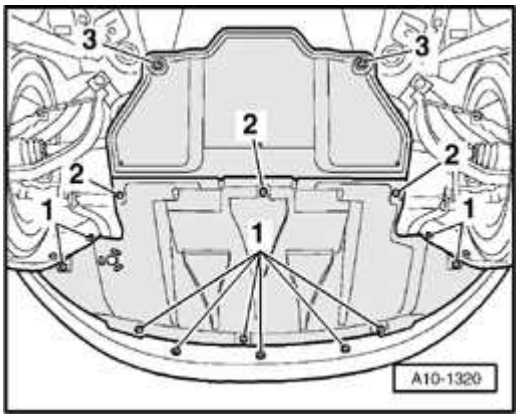


Fig. 459: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or quick-release screws -1- and -2- and remove front sound insulation.
- Place VAG1306 drip tray beneath engine.

Vehicles with drain plug

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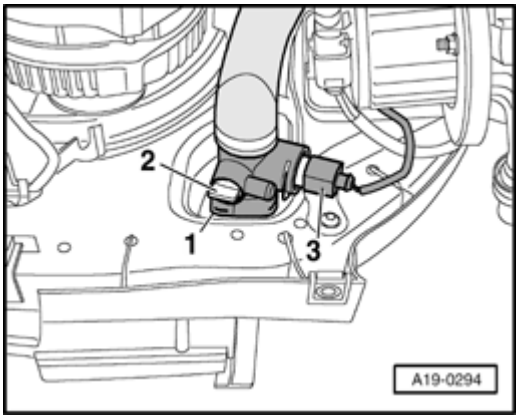


Fig. 460: Identifying Drain Plug
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Turn radiator drain plug -2- counterclockwise. If needed, attach accessory hose to connection flange and drain coolant.

Vehicles without drain plug

- Remove retaining clamp for Engine Coolant Temperature (ECT) sensor (on radiator) -G83-.
- Remove Engine Coolant Temperature (ECT) sensor from outlet and drain coolant.

All

- Pull off retaining clip -1- for lower coolant hose and disconnect coolant hose from radiator.

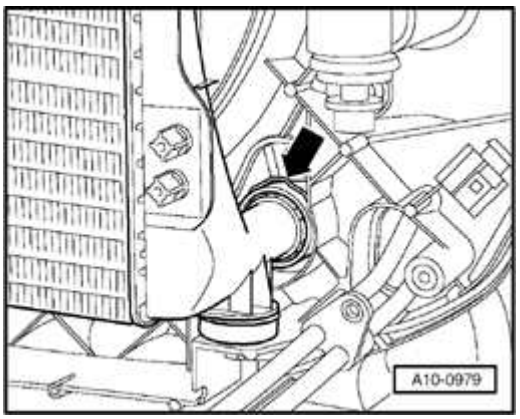


Fig. 461: Disconnecting Lower Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect left coolant hose from radiator (arrow).

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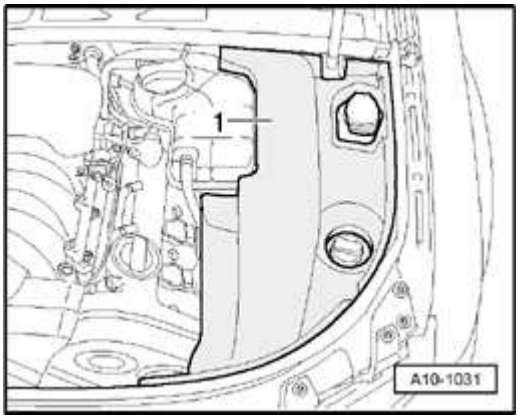


Fig. 462: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

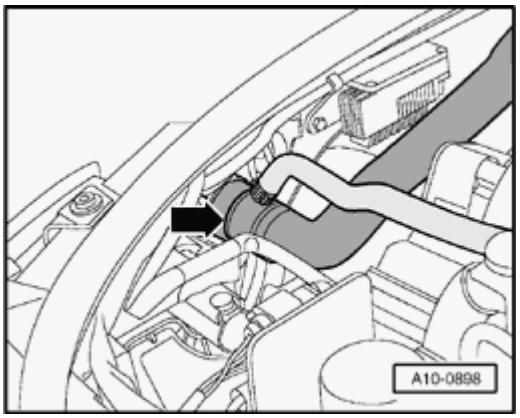
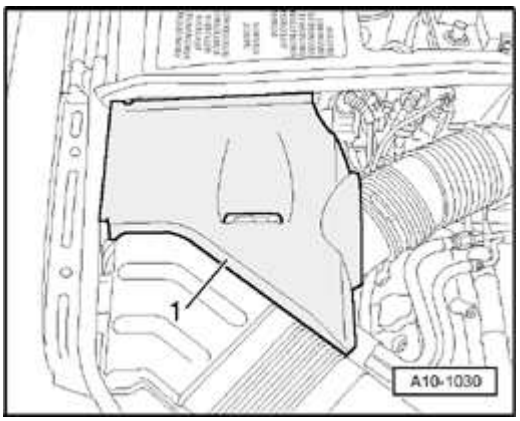


Fig. 463: Disconnecting Top Coolant Hose From Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect top coolant hose (arrow) from radiator.

Vehicles with automatic transmission



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Fig. 464: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

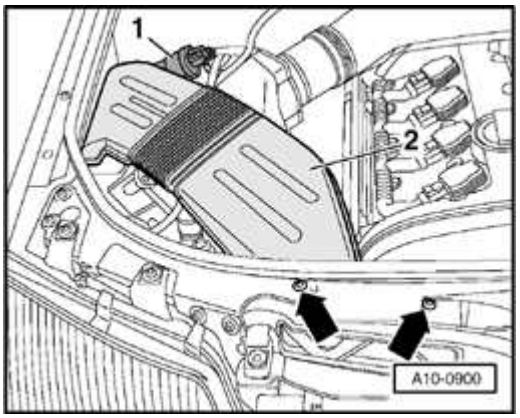


Fig. 465: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

NOTE: Observe the rules of cleanliness for working on automatic transmissions:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

- Place an oil receptacle underneath.

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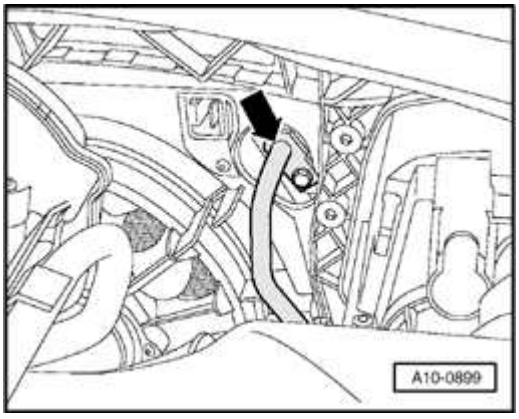


Fig. 466: Disconnecting ATF-Lines At Top And Bottom Of Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect top (arrow) and bottom ATF lines from radiator:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

- Tie up ATF lines to top of longmember to prevent fluid from escaping.

All

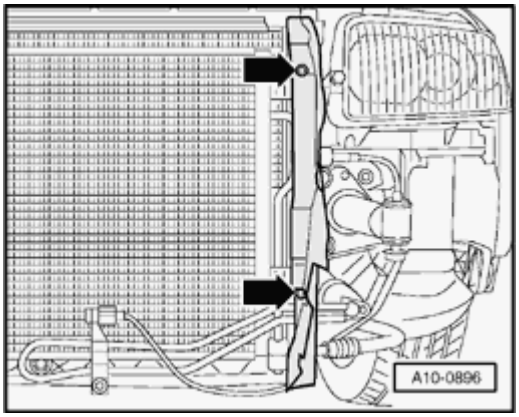


Fig. 467: Removing Air Ducts On Left/Right Of Radiator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air guides from left and right of radiator (arrows).

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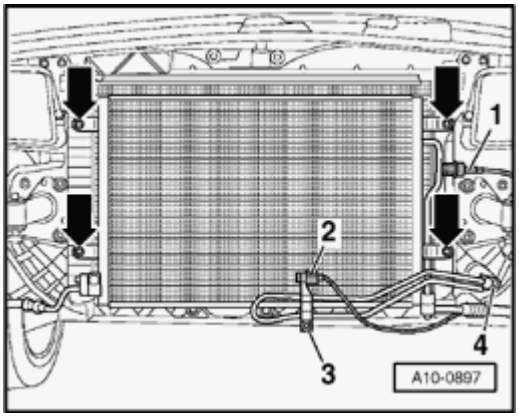


Fig. 468: Identifying Outside Air Temperature Sensor G17, Bolts & High Pressure Sensor G65 Electrical Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unclip temperature sensor -2- for outside temperature display from bracket.
- Remove bolts -3- and -4- and remove power steering cooling coil. Hoses remain connected.
- Disconnect harness connector -1- at High pressure sensor -G65-.

CAUTION: Do not open refrigerant circuit for A/C system.

- Remove condenser mounting bolts (arrows).

NOTE: Do not bend or stretch lines or hoses as condenser and/or refrigerant lines/hoses may be damaged.

- Carefully swing condenser downward and move aside.

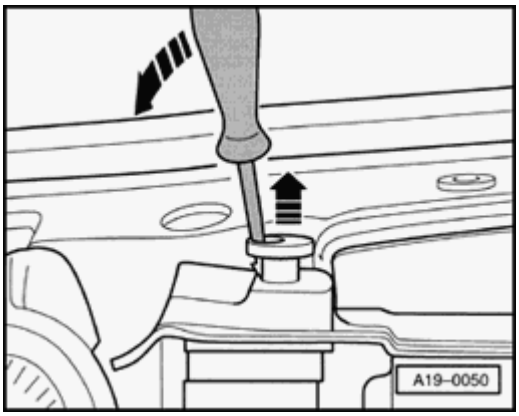


Fig. 469: Loosening Both Radiator Retaining Bolts, Pulling Up And Removing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen both radiator retaining bolts, pull up and remove (arrows).

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- Tilt radiator forward, pull up and remove.

Installing

Installation is reverse of removal, noting the following:

- Install front bumper:

Refer to

- **63 BUMPER**
- **63 - BUMPERS** for BODY EXTERIOR - CABRIOLET

- Top up coolant. Refer to **Filling**.

NOTE: Complete quantity of coolant must be replaced if the radiator was replaced.

Vehicles with automatic transmission

- Secure ATF lines:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Check ATF level:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Refer to **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING**

Tightening torque

Component	Nm
Condenser to radiator	10

Coolant fan motor, replacing

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Special tools and equipment

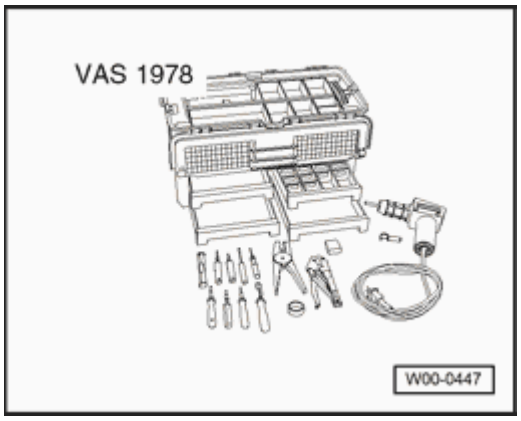


Fig. 470: Wiring Harness Repair Kit V.A.S 1978
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS1978 Wiring harness repair kit

NOTE:

- **Coolant FC (Fan Control) Control Module and coolant fan motor are supplied as a replacement part without the harness connector.**
- **Repairs to wiring harnesses and connectors must only be performed using the VAS1978 wiring harness repair kit.**

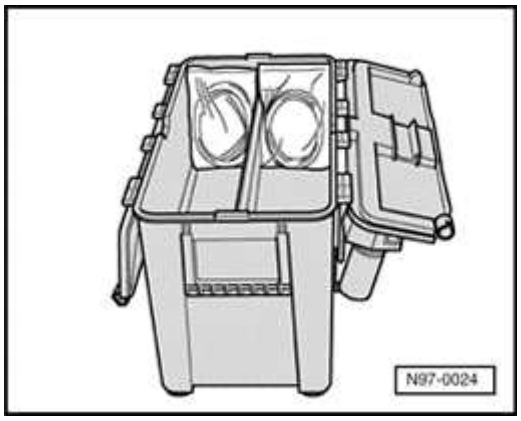


Fig. 471: Opened Wiring Harness Repair Kit VAS 1978
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Detailed instructions on how to use VAS1978 are supplied with the repair kit.

The manual also explains how to repair open circuits and faulty connectors.

Cooling system, checking for leaks

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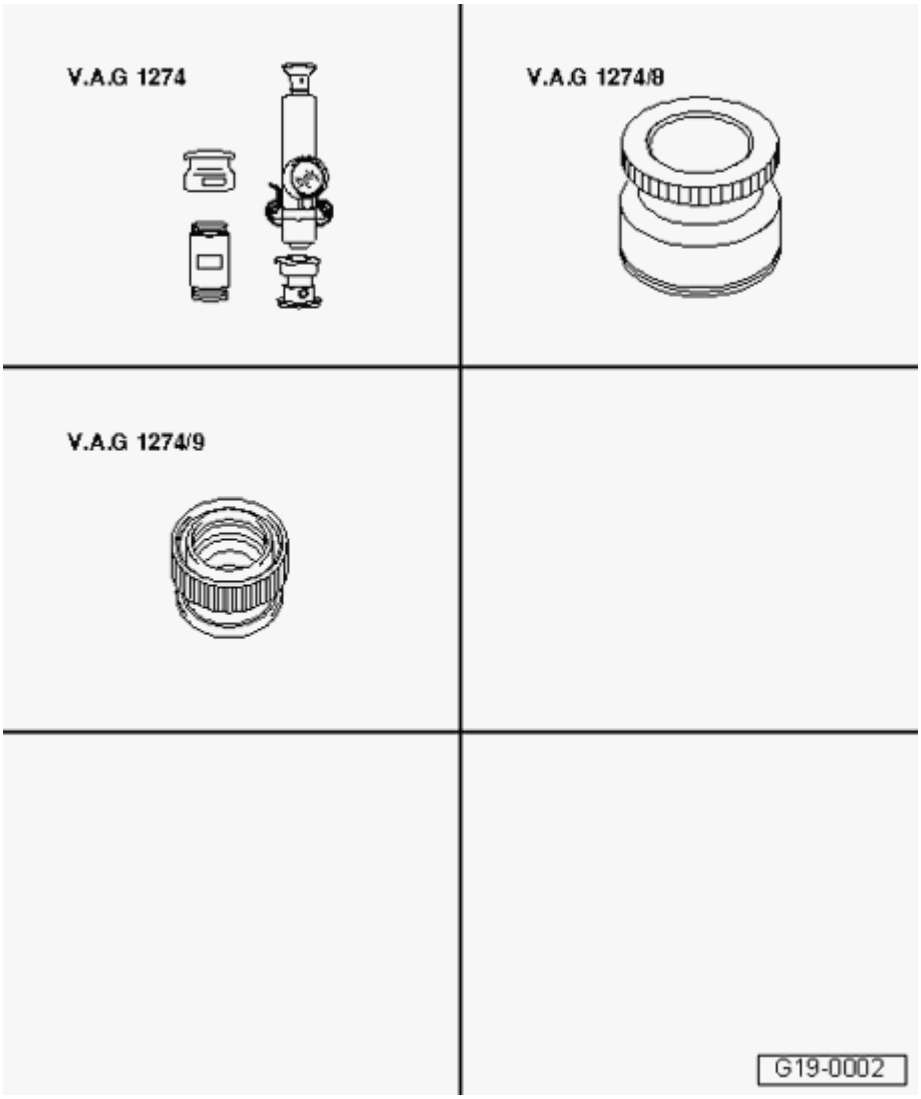


Fig. 472: Identifying Special Tools - Cooling System, Checking For Leaks
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1274 Cooling system tester
- VAG1274/8 Adapter
- VAG1274/9 Adapter

Requirement

- Engine at operating temperature.

Work sequence

WARNING: Cover cap of expansion tank with rag and open carefully, as hot steam i.e.

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hot coolant may escape when opening.

- Open cap of coolant expansion tank.

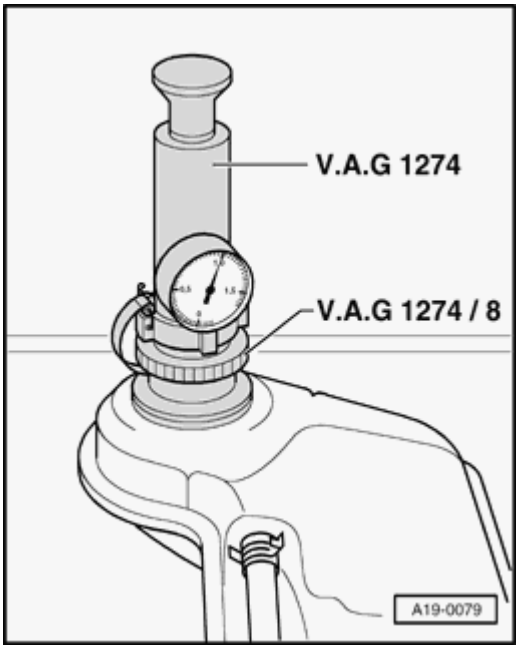


Fig. 473: Attaching VAG1274 Cooling System Tester Together With VAG1274/8 Adapter To Coolant Expansion Tank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach VAG1274 cooling system tester together with VAG1274/8 adapter to coolant expansion tank.
- Use tester hand pump to create a pressure of approx. 1.0 bar.
- If pressure drops, detect leak and repair malfunction.

Pressure relief valve in cap, checking

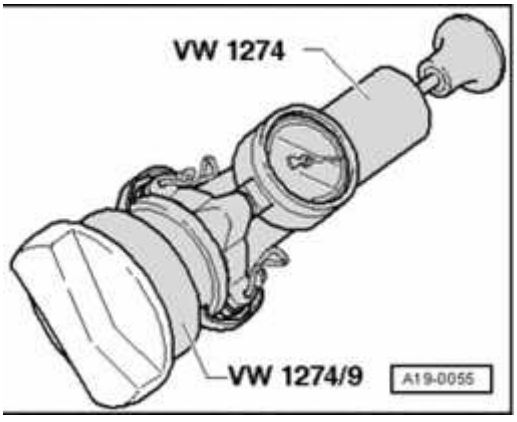


Fig. 474: Checking Pressure Relief Valve In Filler Cap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Using VAG1274/9 adapter attach VAG1274 cooling system tester to coolant reservoir tank cap.
- Pump using hand pump.

- Pressure release valve must open at a positive pressure of 1.4 to 1.6 bar

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26 EXHAUST SYSTEM, EMISSION CONTROLS

EXHAUST SYSTEM, SERVICING

Exhaust system, servicing

NOTE:

- **Always replace gaskets and self-locking nuts.**
- **After exhaust system repairs, make sure the exhaust system is not under stress and is far enough from the body. If necessary, loosen clamps and align mufflers and exhaust pipes so that there is adequate distance to the vehicle body, and weight is evenly distributed among the exhaust hangers.**
- **The flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.**

Exhaust system components, overview (vehicles with front wheel drive)

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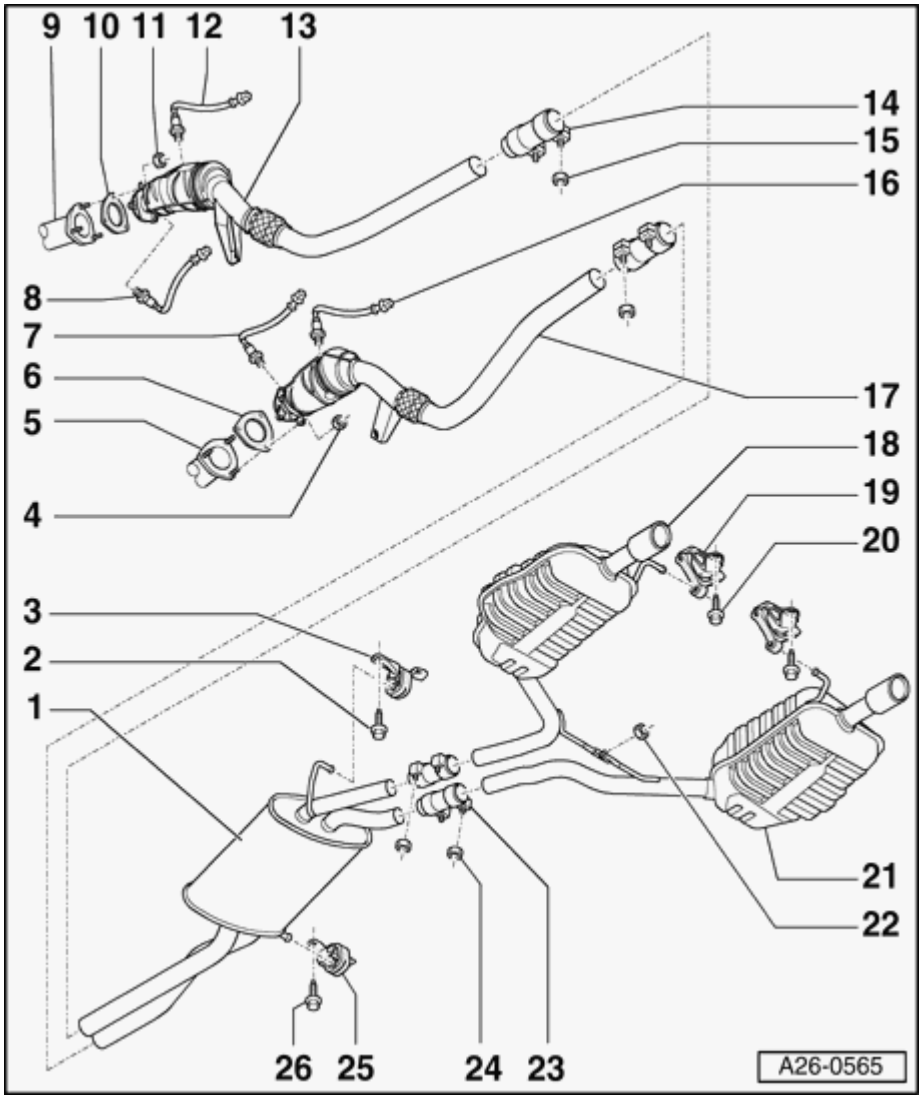


Fig. 475: Exhaust System Components, Overview (Vehicles With Front Wheel Drive)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Center muffler

- Factory installed with rear muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**

2 - 23 Nm

3 - Support ring

- Replace if damaged

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4 - 27 Nm

- Always replace

5 - Exhaust manifold

- For cylinder bank 1 (right)
- Removing and installing. Refer to **Right exhaust manifold, removing and installing**

6 - Gasket

- Always replace

7 - Oxygen sensor, 55 Nm

- Before catalytic converter
- For cylinder bank 1 (right)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

8 - Oxygen sensor, 55 Nm

- Before catalytic converter
- For cylinder bank 2 (left)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

9 - Exhaust manifold

- For cylinder bank 2 (left)
- Removing and installing. Refer to **Left exhaust manifold, removing and installing**

10 - Gasket

- Always replace

11 - 27 Nm

- Always replace

12 - Oxygen sensor, 55 Nm

- Behind catalytic converter
- For cylinder bank 2 (left)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

13 - Front exhaust pipe with catalytic converter

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- For cylinder bank 2 (left)
- With decoupling element
- Decoupling element must not be bent more than 10°, otherwise it may be damaged
- Protect from hit and impact stress

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**
- Individual mounting components for vehicles with manual transmission. See **Fig. 479**
- Individual mounting components for vehicles with automatic transmission 01J. See **Fig. 483**
- Vehicles with manual transmission, removing and installing. Refer to **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)**

- Vehicles with automatic transmission 01J, removing and installing. Refer to **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)**

14 - Front clamping sleeve

- Before tightening ensure exhaust system is free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**
- Installed position. See **Fig. 477**
- Tighten bolts evenly

15 - 40 Nm

16 - Oxygen sensor, 55 Nm

- Behind catalytic converter
- For cylinder bank 1 (right)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

17 - Front exhaust pipe with catalytic converter

- For cylinder bank 1 (right)
- With decoupling element
- Decoupling element must not be bent more than 10°, otherwise it may be damaged
- Protect from hit and impact stress

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**
- Individual mounting components for vehicles with manual transmission. See **Fig. 480**
- Individual mounting components for vehicles with automatic transmission 01J. See **Fig. 484**
- Vehicles with manual transmission, removing and installing. Refer to **Right front exhaust pipe with**

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catalytic converter, removing and installing (vehicles with manual transmission)

- Vehicles with automatic transmission 01J, removing and installing. Refer to **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)**

18 - Rear muffler

- For left side of vehicle
- Factory-installed with center muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Replacing end pipes. See **Fig. 485**

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**

19 - Support ring

- Replace if damaged

20 - 23 Nm

21 - Rear muffler

- For right side of vehicle
- Factory-installed with center muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Replacing end pipes. See **Fig. 485**

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**

22 - 23 Nm

23 - Rear clamping sleeve

- Used when center or rear muffler is replaced separately.
- Before tightening ensure exhaust system is free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)**
- Installed position. See **Fig. 478**
- Tighten bolts evenly

24 - 40 Nm

25 - Support ring

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- Replace if damaged

26 - 23 Nm

Exhaust system components, overview, (vehicles with all wheel drive)

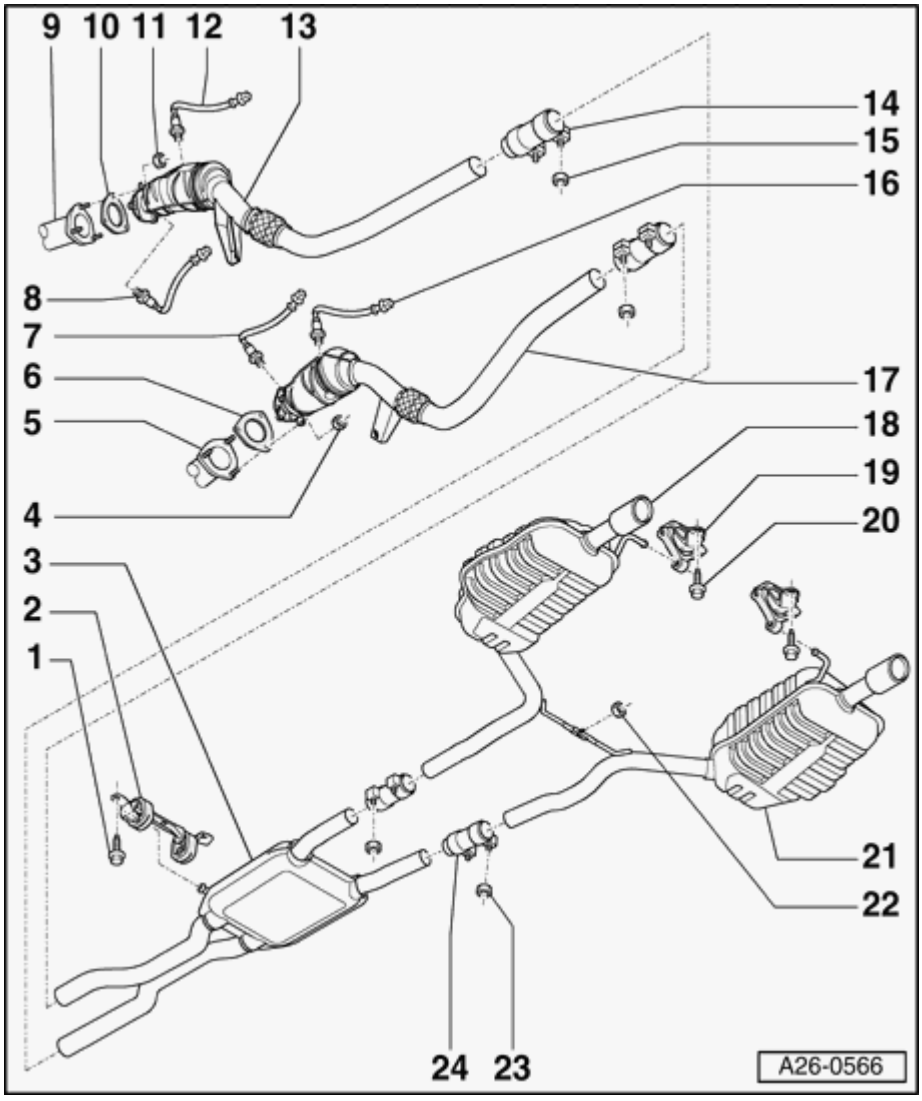


Fig. 476: Exhaust System Components, Overview, (Vehicles With All Wheel Drive)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 23 Nm

2 - Support ring

- Replace if damaged

3 - Center muffler

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- Factory-installed with rear muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**

4 - 27 Nm

- Always replace

5 - Exhaust manifold

- For cylinder bank 1 (right)
- Removing and installing. Refer to **Right exhaust manifold, removing and installing**

6 - Gasket

- Always replace

7 - Oxygen sensor, 55 Nm

- Before catalytic converter
- For cylinder bank 1 (right)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

8 - Oxygen sensor, 55 Nm

- Before catalytic converter
- For cylinder bank 2 (left)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

9 - Exhaust manifold

- Cylinder bank 2 (left)
- Removing and installing. Refer to **Left exhaust manifold, removing and installing**

10 - Gasket

- Always replace

11 - 27 Nm

- Always replace

12 - Oxygen sensor, 55 Nm

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- Behind catalytic converter
- For cylinder bank 2 (left)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

13 - Front exhaust pipe with catalytic converter

- For cylinder bank 2 (left)
- With decoupling element
- Decoupling element must not be bent more than 10°, otherwise it may be damaged
- Protect from hit and impact stress

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**
- Individual mounting components for vehicles with manual transmission. See **Fig. 480**
- Individual mounting components for vehicles with automatic transmission 01V. See **Fig. 482**
- Vehicles with manual transmission, removing and installing. Refer to **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)**

- Vehicles with automatic transmission 01V, removing and installing. Refer to **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)**

14 - Front clamping sleeve

- Before tightening ensure exhaust system is free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**
- Installed position. See **Fig. 477**
- Tighten bolts evenly

15 - 40 Nm

16 - Oxygen sensor, 55 Nm

- Behind catalytic converter
- For cylinder bank 1 (right)
- Only grease threads with G 052 112 A3. Do NOT allow grease to get into slots on sensor body

17 - Front exhaust pipe with catalytic converter

- For cylinder bank 1 (right)
- With decoupling element
- Decoupling element must not be bent more than 10°, otherwise it may be damaged
- Protect from hit- and impact stress

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- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**
- Individual mounting components for vehicles with manual transmission. See **Fig. 479**
- Individual mounting components for vehicles with automatic transmission 01V. See **Fig. 481**
- Vehicles with manual transmission, removing and installing. Refer to **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)**
- Vehicles with automatic transmission 01V, removing and installing. Refer to **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)**

18 - Rear muffler

- For left side of vehicle
- Factory-installed with center muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Replacing end pipes. See **Fig. 485**
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**

19 - Support ring

- Replace if damaged

20 - 23 Nm

21 - Rear muffler

- For right side of vehicle
- Factory-installed with center muffler as one unit. If repair is necessary, replace separately
- Cutting point. Refer to **Center and rear muffler, separating**
- Replacing end pipes. See **Fig. 485**
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with all wheel drive)**

22 - 23 Nm

23 - 40 Nm

24 - Rear clamping sleeve

- Used when center or rear muffler is replaced separately.
- Before tightening ensure exhaust system is free of stress. Refer to **Exhaust system, aligning free of**

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stress (vehicles with all wheel drive)

- Installed position. See **Fig. 478**
- Tighten bolts evenly

Installed position of front clamping sleeves

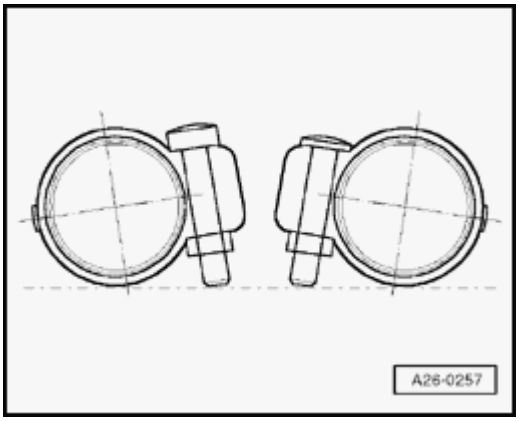


Fig. 477: Identifying Installed Position Of Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install double clamps so that bolt ends do not project over lower edge of double clamp.
- Threaded connections face each other

Installed position of rear clamping sleeves

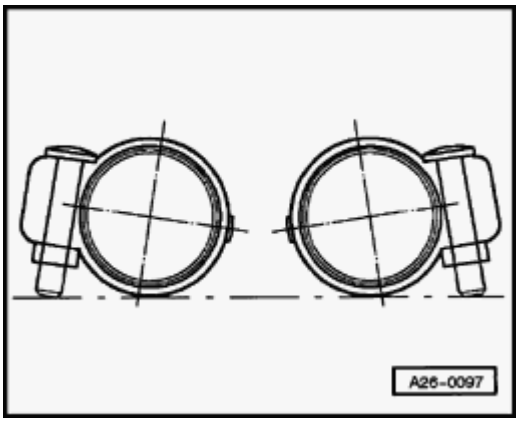


Fig. 478: Installation Position Of Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install double clamps so that bolt ends do not project over lower edge of double clamp.
- Threaded connections face outward

Individual left mounting components for vehicles with manual transmission

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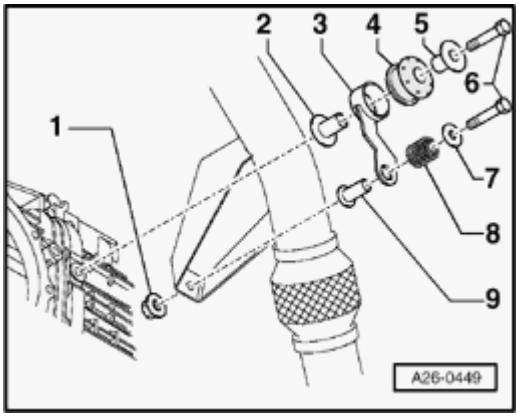


Fig. 479: Individual Left Mounting Components For Vehicles With Manual Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Self-locking nut (25Nm)

2 - Spacer sleeve

3 - Strap

4 - Buffer

5 - Spacer sleeve

6 - Bolt (25Nm)

7 - Washer

8 - Compression spring

9 - Spacer sleeve

Individual right mounting components for vehicles with manual transmission

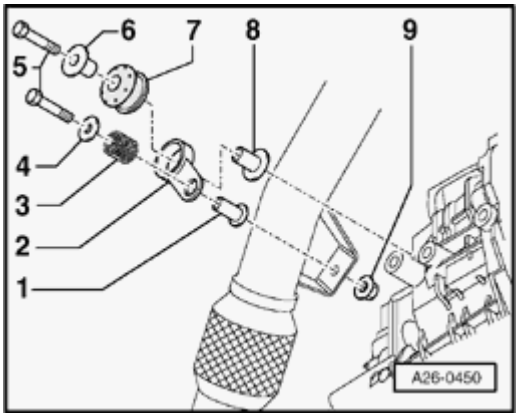


Fig. 480: Individual Right Mounting Components For Vehicles With Manual Transmission

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Spacer sleeve

2 - Strap

3 - Compression spring

4 - Washer

5 - Bolt (25Nm)

6 - Spacer sleeve

7 - Buffer

8 - Spacer sleeve

9 - Self-locking nut (25Nm)

Individual left mounting components for vehicles with automatic transmission 01V

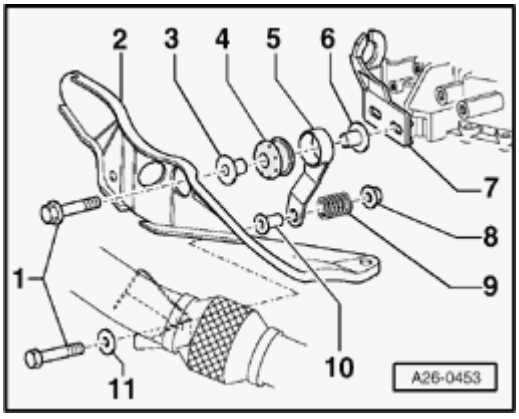


Fig. 481: Individual Left Mounting Components For Vehicles With Automatic Transmission 01V
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt (25Nm)

2 - Heat shield for selector lever cable

3 - Spacer sleeve

4 - Buffer

5 - Strap

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6 - Spacer sleeve

7 - Pivot

8 - Self-locking nut (25Nm)

9 - Compression spring

10 - Spacer sleeve

11 - Washer

Individual right mounting components for vehicles with automatic transmission 01V

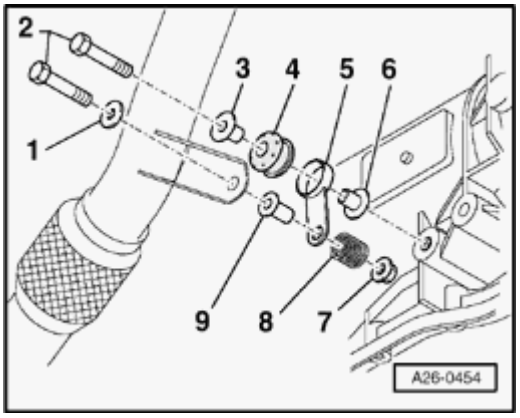


Fig. 482: Individual Right Mounting Components For Vehicles With Automatic Transmission 01V
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Washer

2 - Bolt (25Nm)

3 - Spacer sleeve

4 - Buffer

5 - Strap

6 - Spacer sleeve

7 - Self-locking nut (25Nm)

8 - Compression spring

9 - Spacer sleeve

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Individual left mounting components for vehicles with automatic transmission 01J

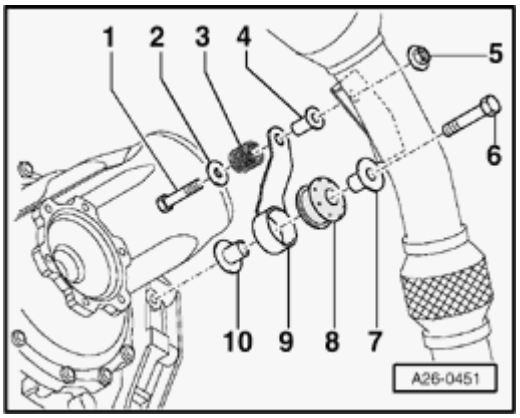


Fig. 483: Individual Left Mounting Components For Vehicles With Automatic Transmission 01J
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Bolt (25Nm)

2 - Washer

3 - Compression spring

4 - Spacer sleeve

5 - Self-locking nut (25Nm)

6 - Bolt (25Nm)

7 - Spacer sleeve

8 - Buffer

9 - Strap

10 - Spacer sleeve

Individual right mounting components for vehicles with automatic transmission 01J

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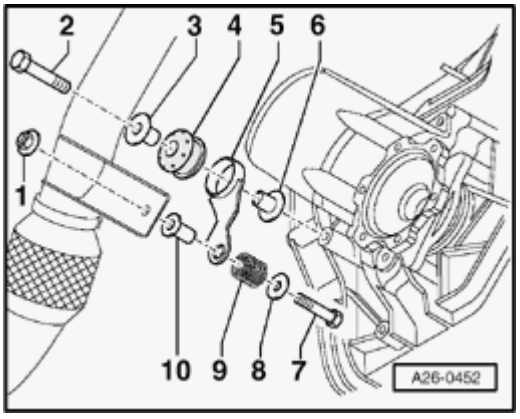


Fig. 484: Individual Right Mounting Components For Vehicles With Automatic Transmission 01J
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Self-locking nut (25Nm)

2 - Bolt (25Nm)

3 - Spacer sleeve

4 - Buffer

5 - Strap

6 - Spacer sleeve

7 - Bolt (25Nm)

8 - Washer

9 - Compression spring

10 - Spacer sleeve

Replacing end pipe

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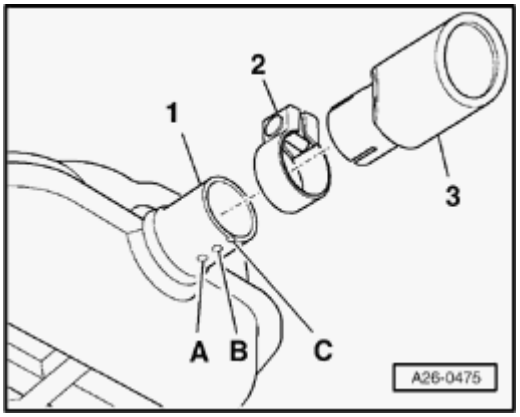


Fig. 485: Replacing End Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

WARNING: Wear protective glasses.

- Using VAG1523 saw, cut end pipe -1- at cutting point -C- at right angle.
- Connect end pipe -3- up to marking -A-, so that slot on end pipe lines up with marking -B- on cover.
- Tighten mounting bolt of clamp -2- to 25 Nm.

Center and rear muffler, separating

- A separating point has been provided in the connecting pipe for individual replacement of the center or rear muffler.
- Separating point is marked by a depression around the circumference of the exhaust pipe.

Special tools and equipment

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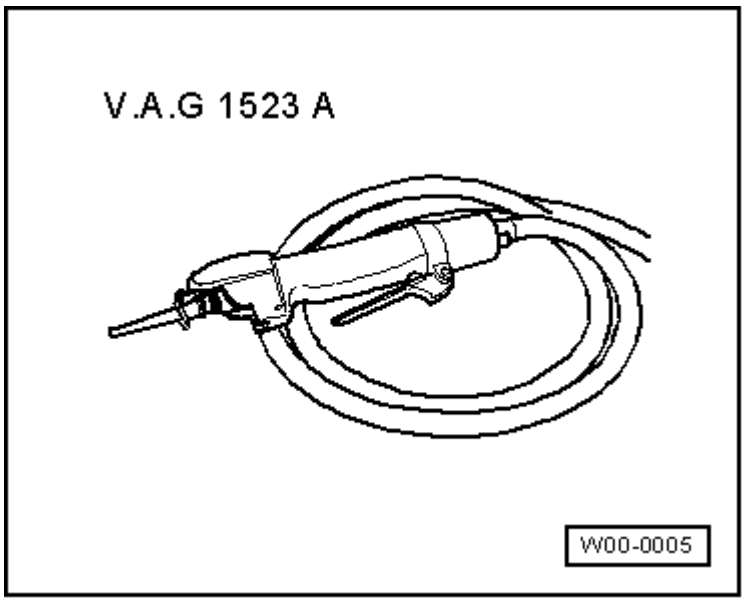


Fig. 486: Identifying Body Repair Saw V.A.G 1523 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1523A Body repair saw
- Protective glasses

NOTE:

- **An All Wheel Drive (AWD) vehicle is shown in the illustrations.**
- **For vehicles with Front Wheel Drive (FWD), the work steps are the same as for vehicles with All Wheel Drive (AWD).**

Work sequence

WARNING: Wear protective glasses.

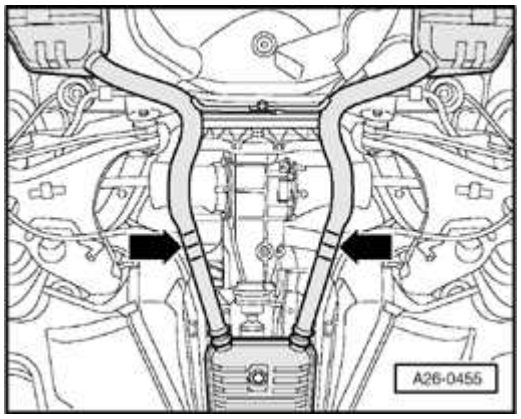


Fig. 487: Using VAG1523 A Saw To Cut Exhaust Pipes At Separating Point At Right Angle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Using VAG1523 A saw, cut exhaust pipes at separating point (arrow) at a right angle.

NOTE: Separating point is the middle one of the 3 depressions on the exhaust pipe.

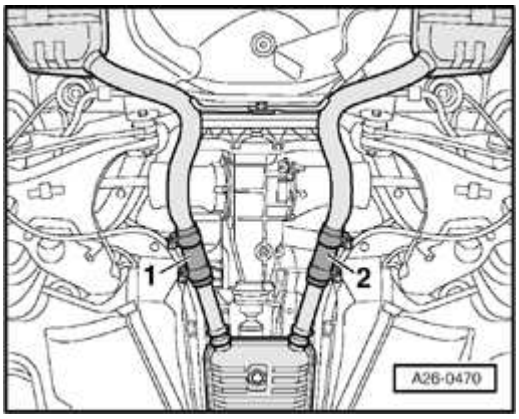


Fig. 488: Positioning Clamping Sleeves At Center On Separating Cut
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- When installing, center double clamps -1- and -2- on separation cut.

- Installed position of double clamps. See **Fig. 478**

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.
- Align rear muffler horizontally.
- Tighten double clamp bolts uniformly to 40 Nm.

Left front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)

Removing

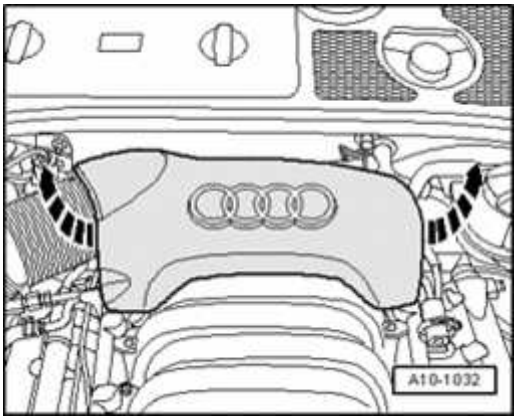


Fig. 489: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove rear engine cover (arrows).

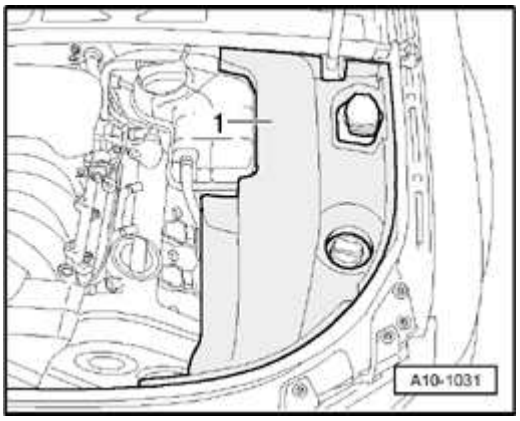


Fig. 490: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

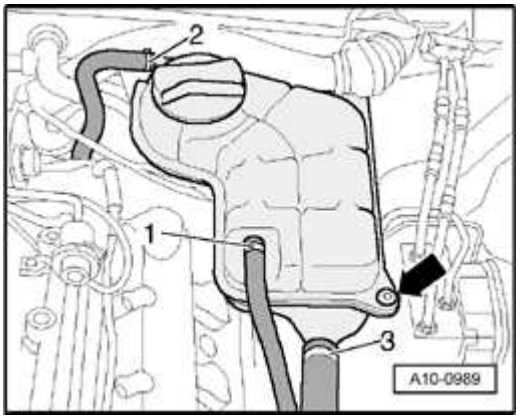


Fig. 491: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of coolant reservoir.
- Tie coolant reservoir with connected coolant hoses -1 to 3- to side.
- Remove heat shield for harness connectors at left of bulkhead, if installed.

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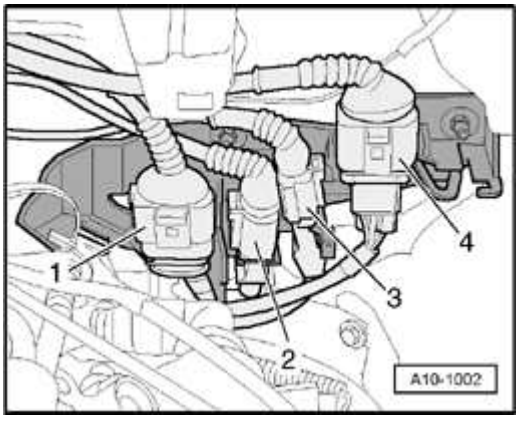


Fig. 492: Removing Harness Connectors From Bracket At Left Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at left of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Guide wires to oxygen sensors downward.

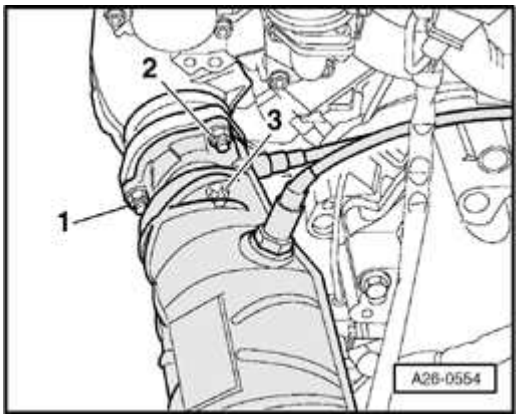


Fig. 493: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove left front wheel.

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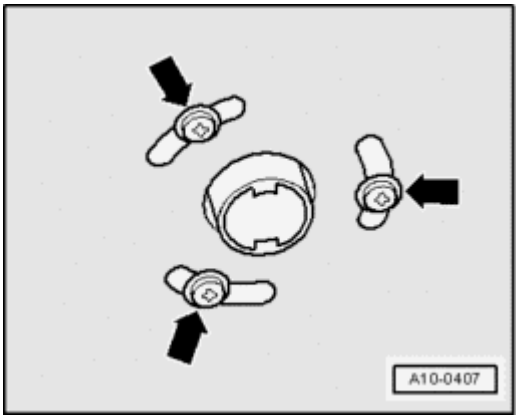


Fig. 494: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

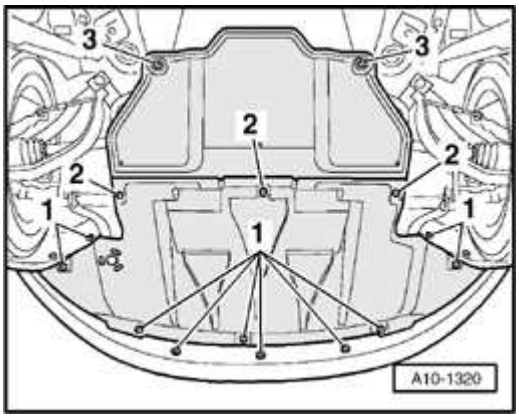
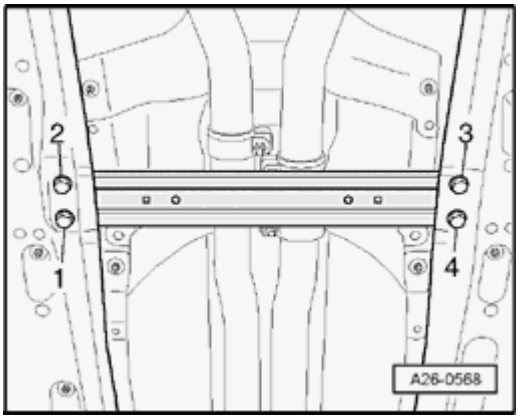


Fig. 495: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Release quick-release screws -3- and remove rear sound insulation, if present.



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Fig. 496: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

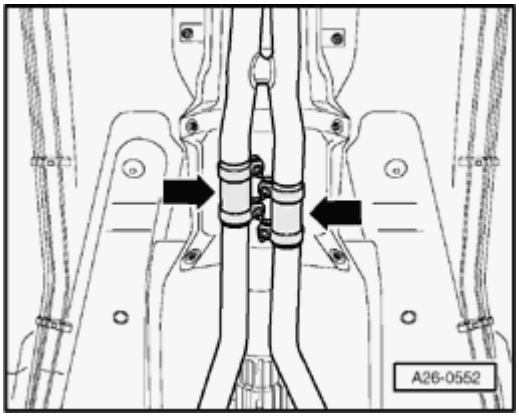


Fig. 497: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at left double clamp (left arrow).

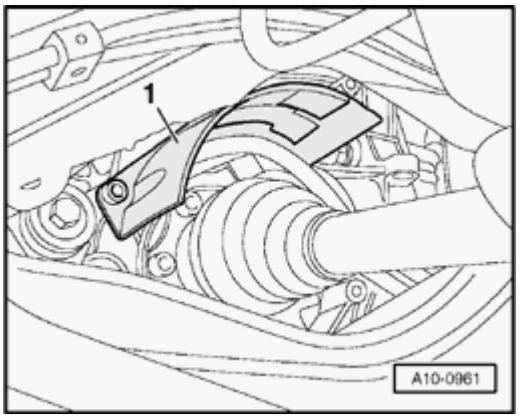


Fig. 498: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for left drive axle.

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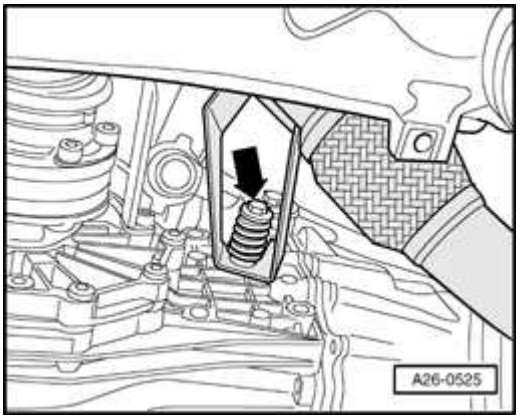


Fig. 499: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrow).
- Expose oxygen sensor wires.

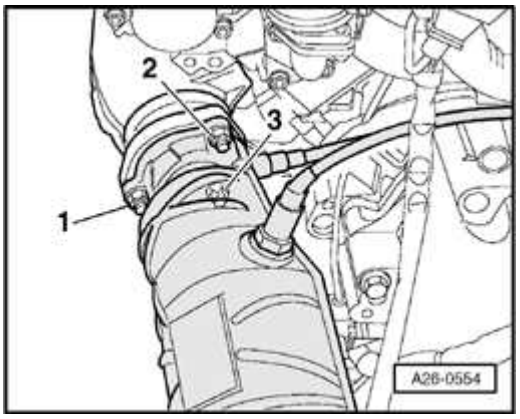


Fig. 500: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor wiring must always be secured in the same position when**

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installing so that contact with the exhaust pipe is avoided.

- **Replace gaskets and self-locking nuts.**

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

NOTE: Individual mounting components for exhaust system to transmission on vehicles with manual transmission. See Fig. 479.

Tightening torques

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Drive axle protection to transmission	23

Right front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)

Removing

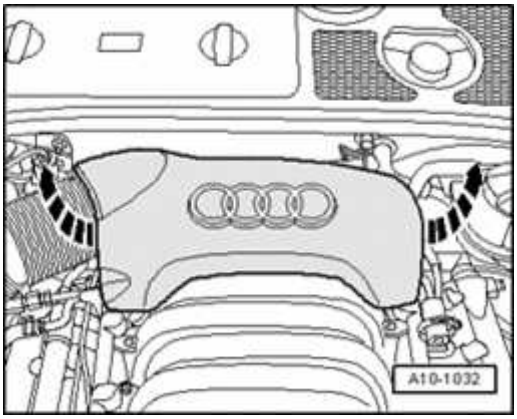


Fig. 501: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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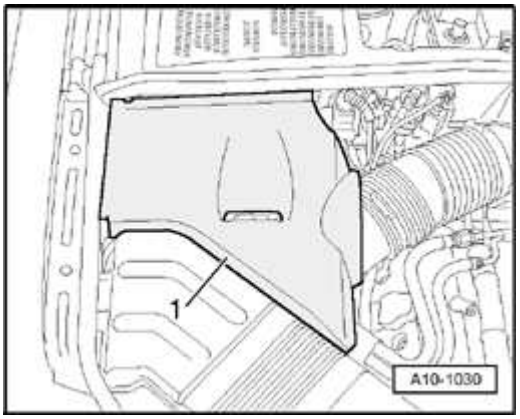


Fig. 502: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

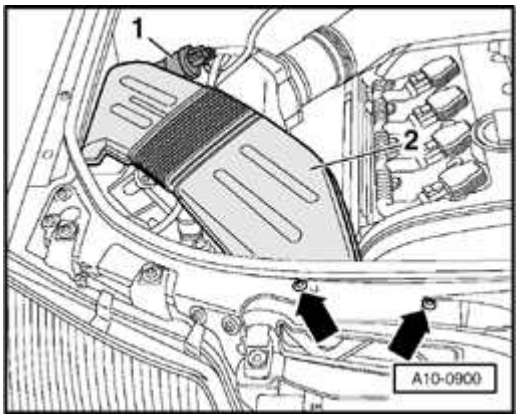
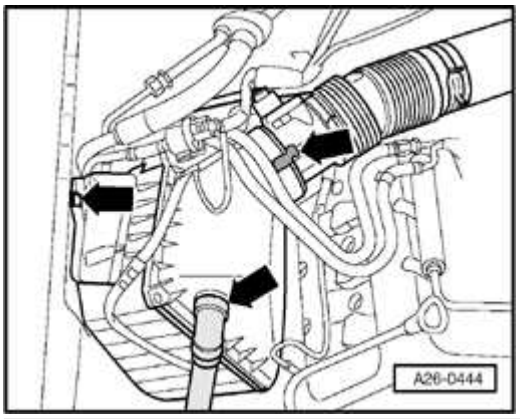


Fig. 503: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.



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Fig. 504: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).

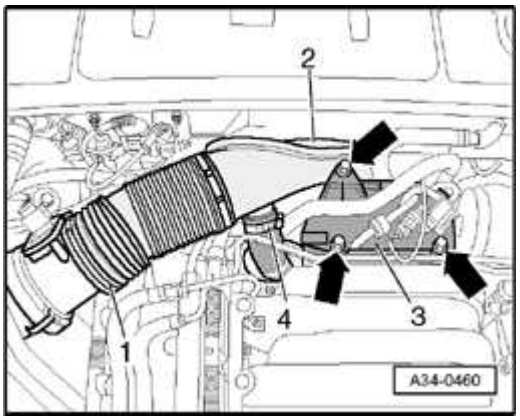


Fig. 505: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect electrical harness connector at Mass Air Flow (MAF) sensor.
- Remove hose -4- from air duct -2-.

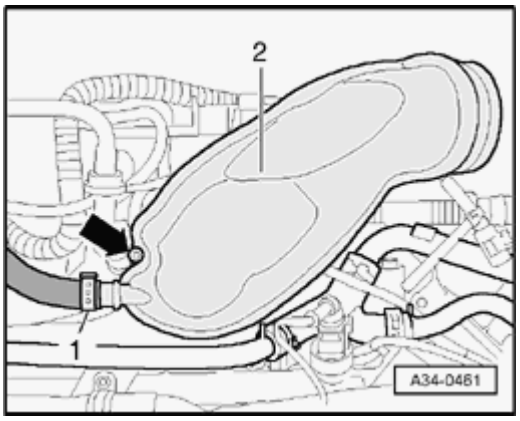


Fig. 506: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

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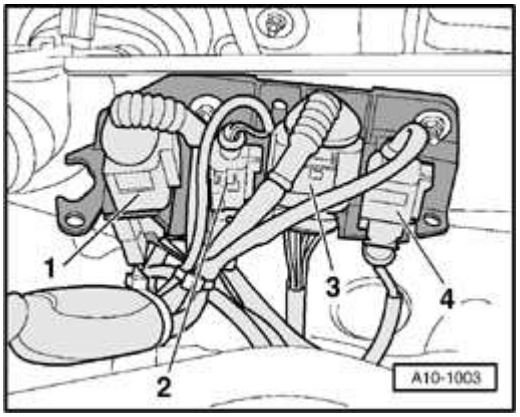


Fig. 507: Removing Harness Connectors From Bracket At Right Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at right of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Guide wires to oxygen sensors downward.

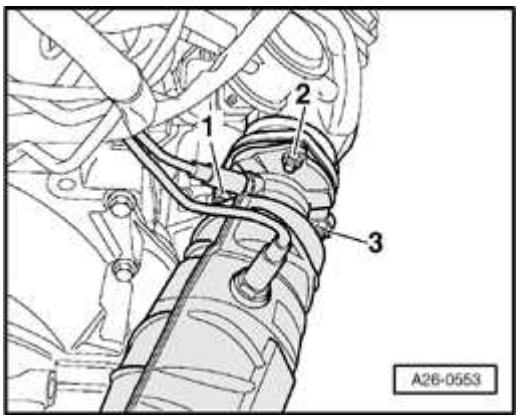


Fig. 508: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove right front wheel

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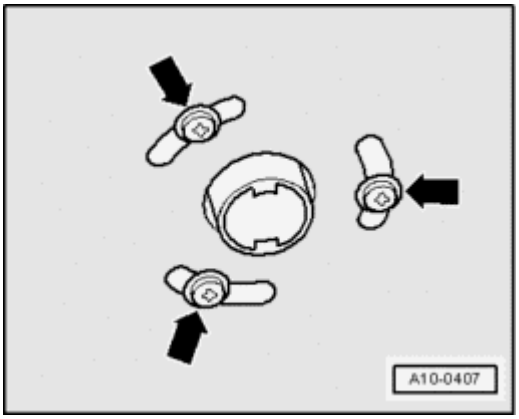


Fig. 509: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

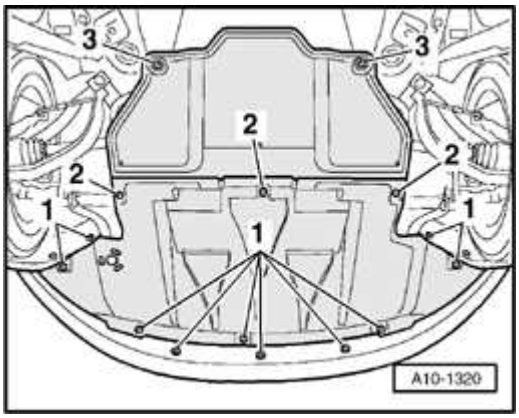
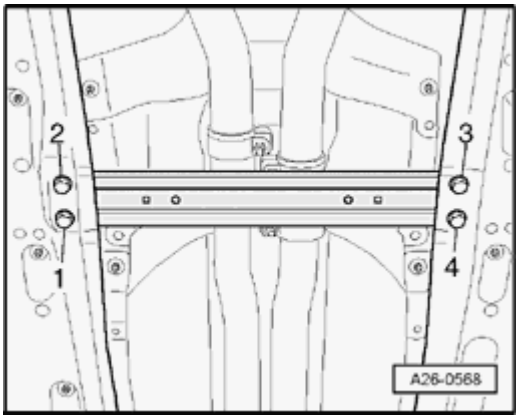


Fig. 510: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.



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Fig. 511: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged..

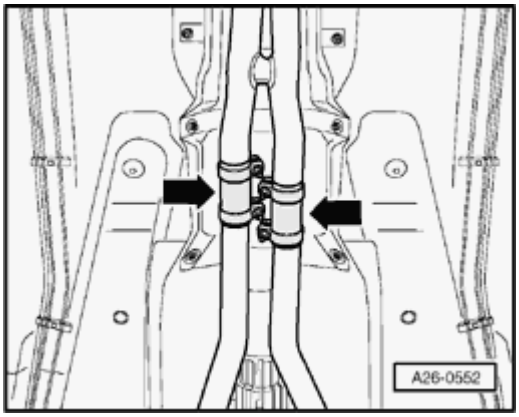


Fig. 512: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at right double clamp (right arrow).

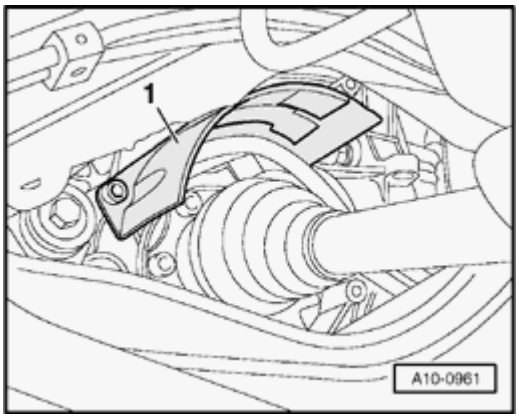


Fig. 513: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for right drive axle.

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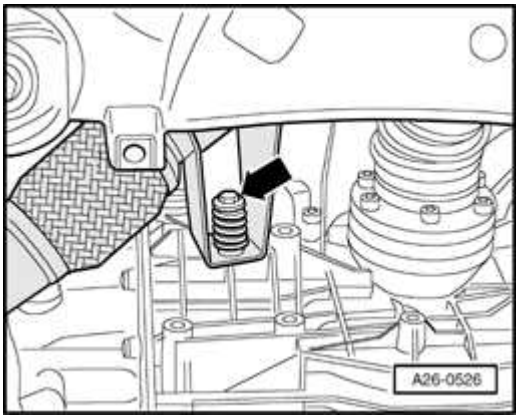


Fig. 514: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrow).
- Expose oxygen sensor wires.

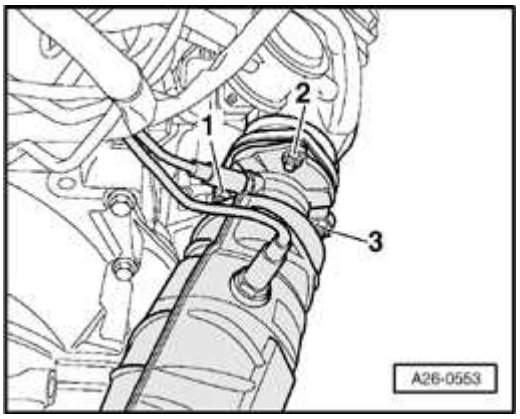


Fig. 515: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor wiring must always be secured in the same position when**

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installing so that contact with the exhaust pipe is avoided.

- **Replace gaskets and self-locking nuts.**

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

NOTE: Individual mounting components for exhaust system to transmission on vehicles with manual transmission. See Fig. 480.

Tightening torques

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Drive axle protection to transmission	23

Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)

Special tools and equipment

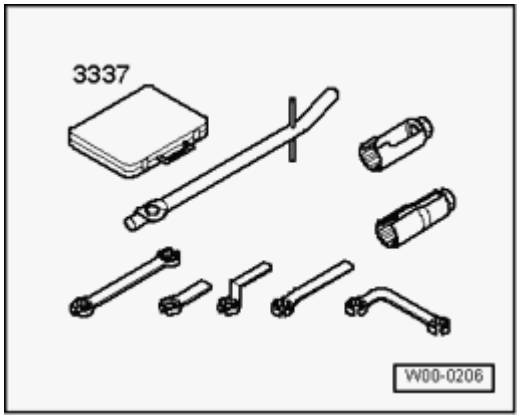


Fig. 516: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3337 Wrench, 7-piece set

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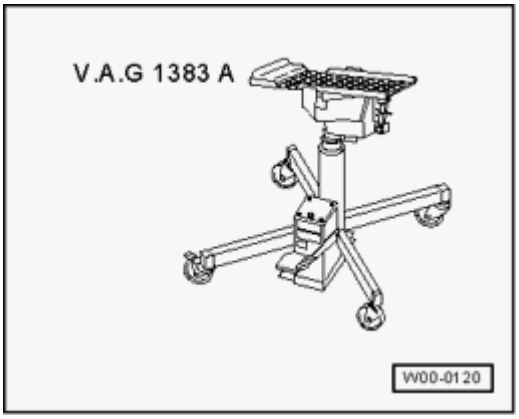


Fig. 517: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engine/transmission hoist
- Locking compound G 052 112 A3

Removing

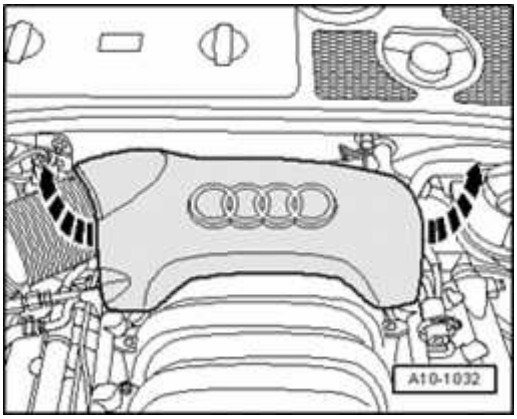


Fig. 518: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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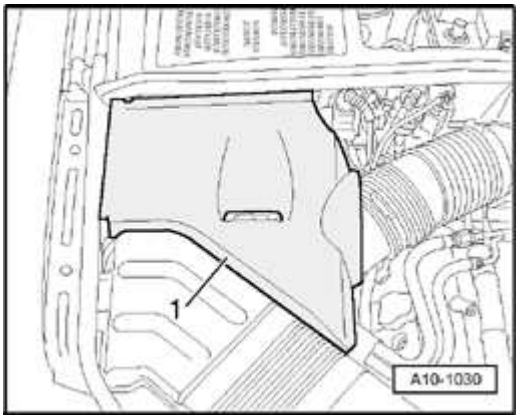


Fig. 519: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

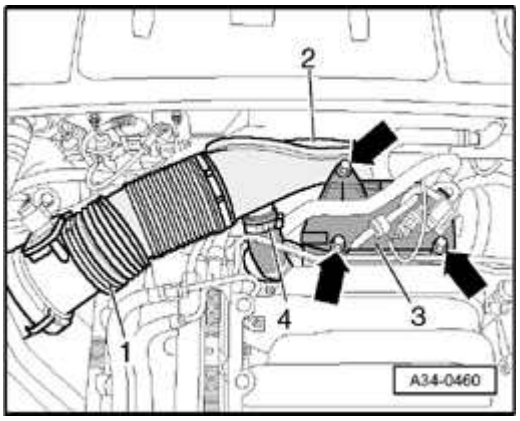
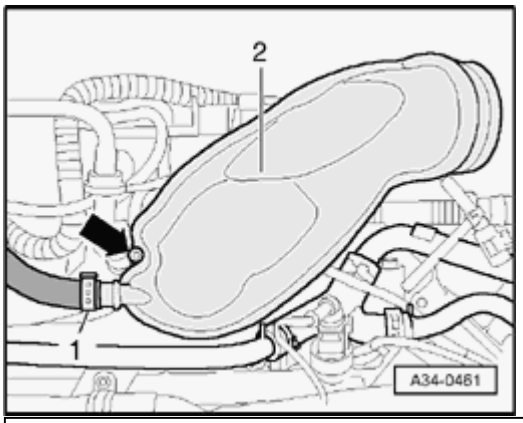


Fig. 520: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air hose -1- at Mass Air Flow (MAF) sensor.
- Remove hose -4- from air duct -2-.



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Fig. 521: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

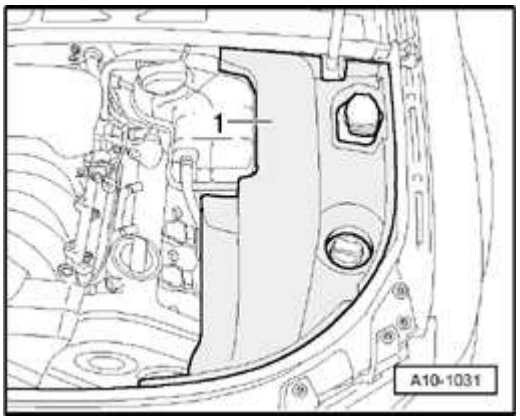


Fig. 522: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

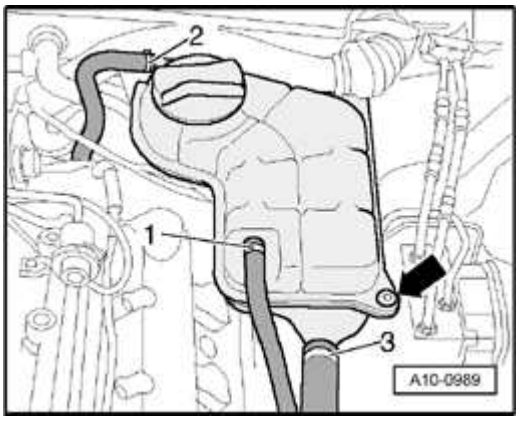


Fig. 523: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of coolant reservoir.
- Tie coolant reservoir with connected coolant hoses -1 to 3- to side.

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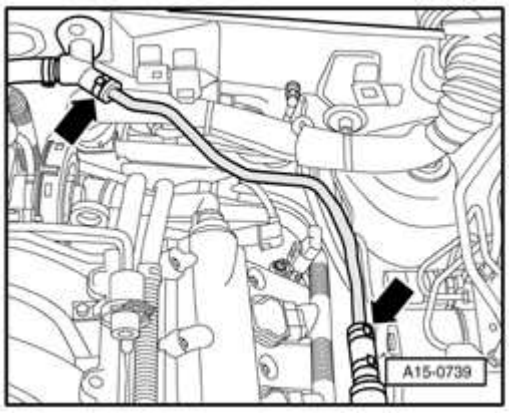


Fig. 524: Disconnecting Vacuum Hose To Brake Booster
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose to brake booster (arrows).
- Remove heat shield for harness connectors at left of bulkhead, if installed.

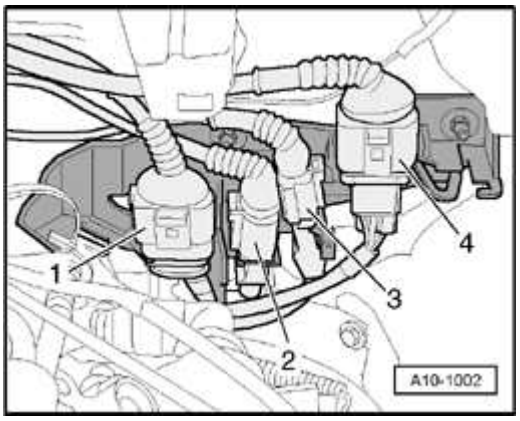


Fig. 525: Removing Harness Connectors From Bracket At Left Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at left of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

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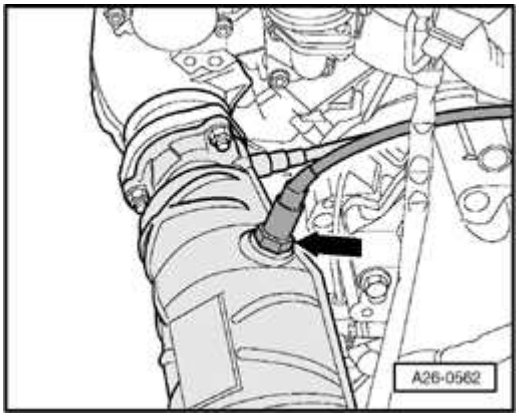


Fig. 526: Unscrewing Oxygen Sensor Behind Catalytic Converter Using Special Tool 3337/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: Illustration is shown with engine removed.

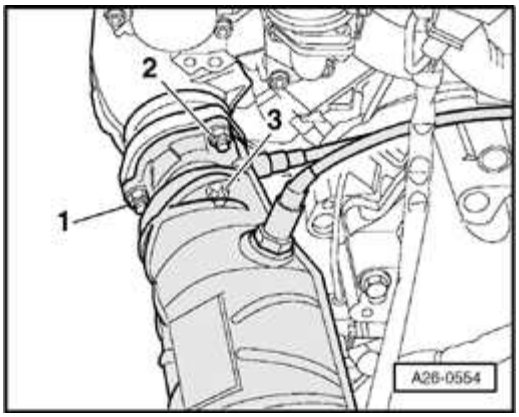


Fig. 527: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove left front wheel.

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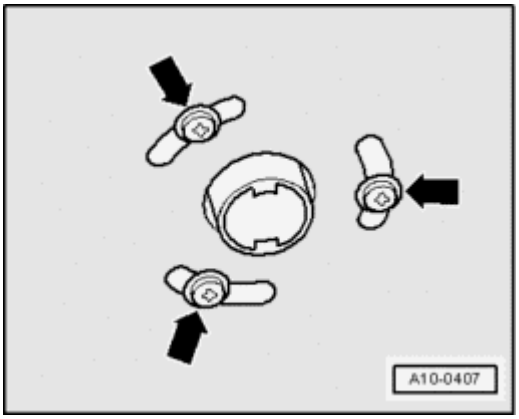


Fig. 528: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

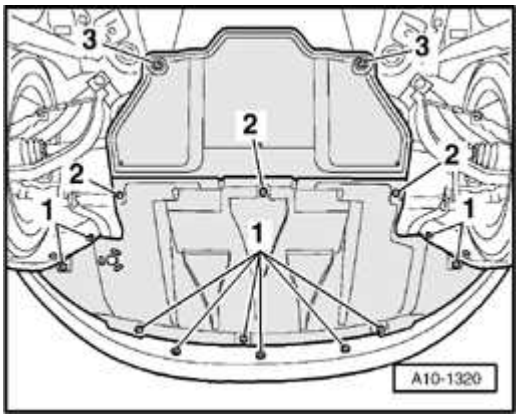
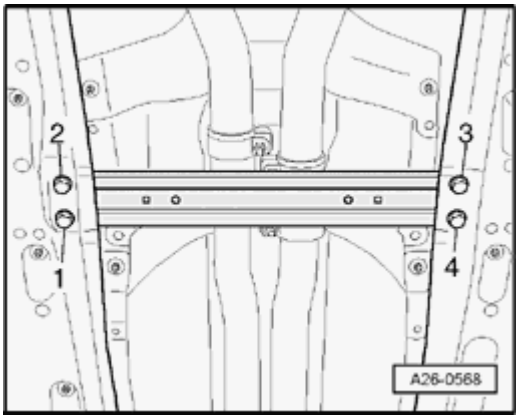


Fig. 529: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.



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Fig. 530: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged..

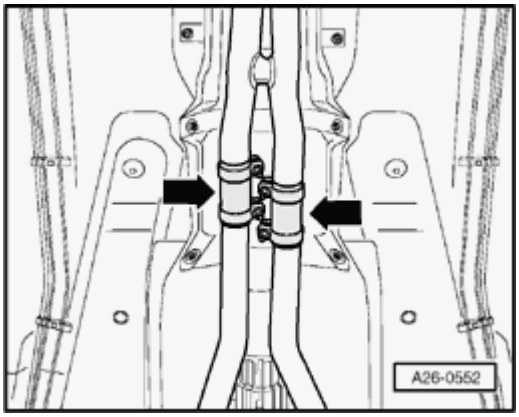


Fig. 531: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at both double clamps (arrows).

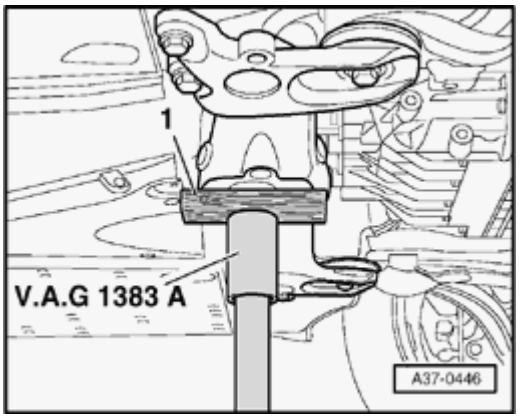


Fig. 532: Removing VAG1359/2 Universal Mount From VAG1383A Engine/Transmission Jack And Inserting Piece Of Wood Instead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove VAG1359/2 universal mount from VAG1383A engine/transmission jack and insert a piece of wood -1- instead.
- Support rear crossmember using VAG1383A engine/transmission jack.

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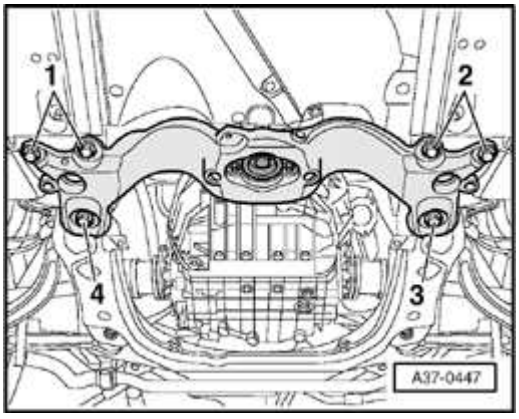


Fig. 533: Removing Bolts & Slowly Release Rear Crossmember Using VAG1383A Engine/Transmission Jack
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-, then bolts -3- and -4-.
- Slowly release rear crossmember using VAG1383A engine/transmission jack.
- Set aside VAG1383A engine/transmission jack.

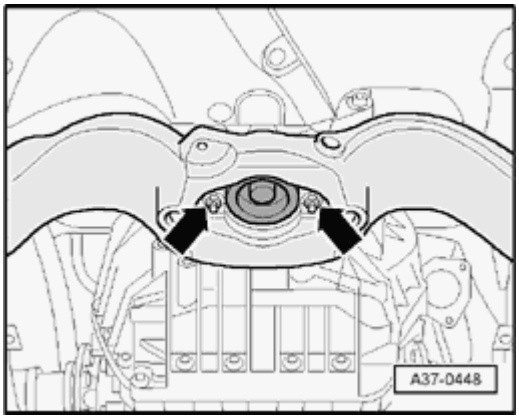


Fig. 534: Removing Nuts And Rear Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts (arrows) and rear crossmember.

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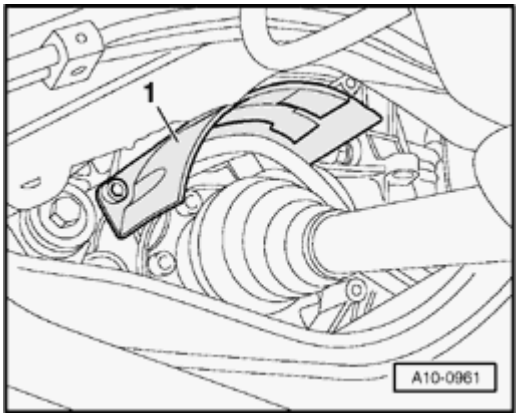


Fig. 535: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for left drive axle.

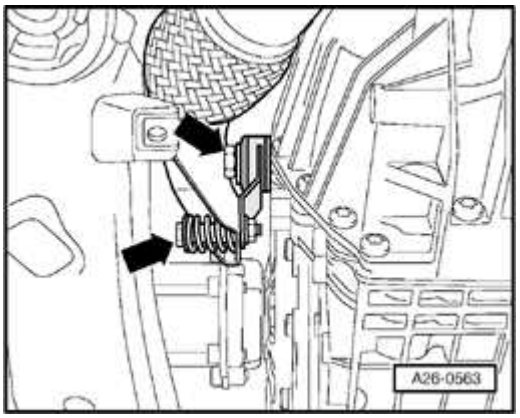


Fig. 536: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrows).
- Expose oxygen sensor wire.

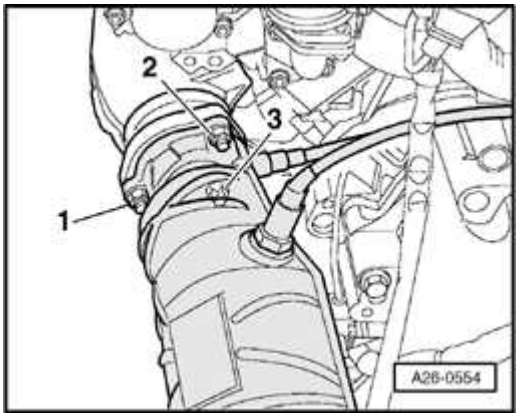


Fig. 537: Removing Nut For Left Exhaust Pipe/Exhaust Manifold

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Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

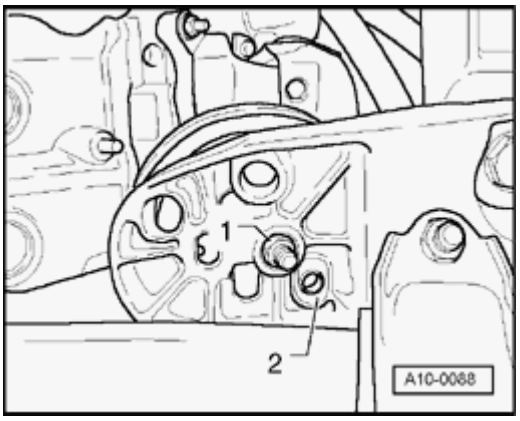


Fig. 538: Threaded Connections And Positioning Sleeves On Lower Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen lower nuts -1- several turns on left and right of engine mount.
- Press transmission to right.
- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**
- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Install subframe:

Refer to **40 - FRONT SUSPENSION**

- Install engine free of stress.
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

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NOTE: Individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01J. See Fig. 483 .

Tightening torques

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55
Engine mount to console	23

Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)

Special tools and equipment

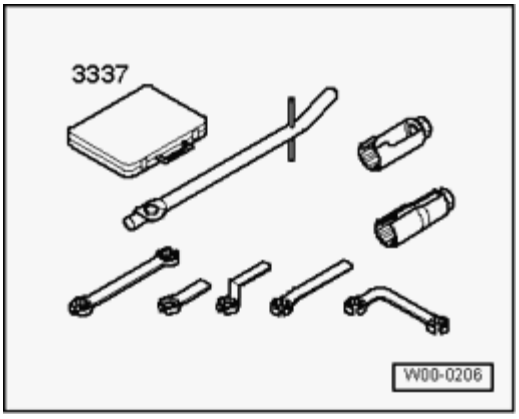


Fig. 539: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3337 Wrench, 7-piece set

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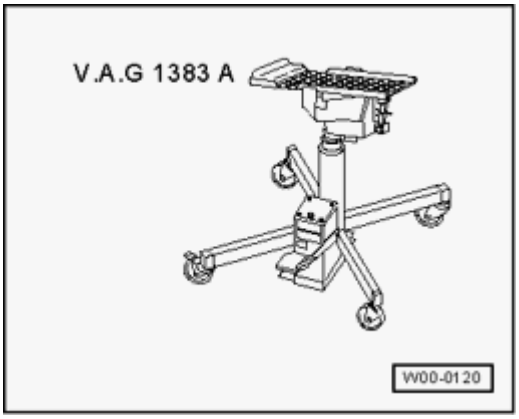


Fig. 540: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Engine/transmission hoist
- Locking compound G 052 112 A3

Removing

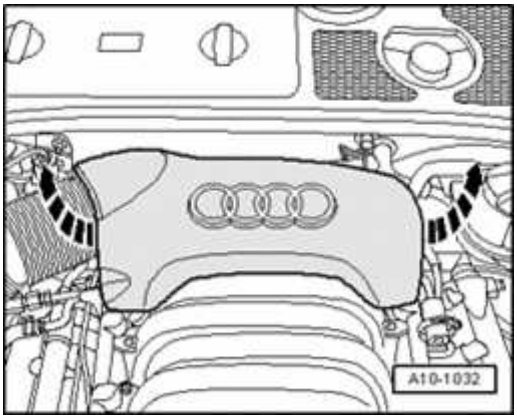


Fig. 541: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

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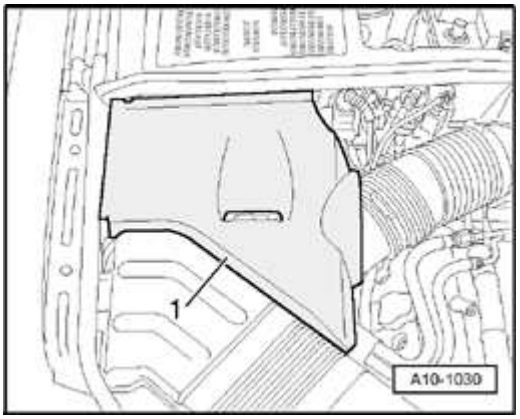


Fig. 542: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

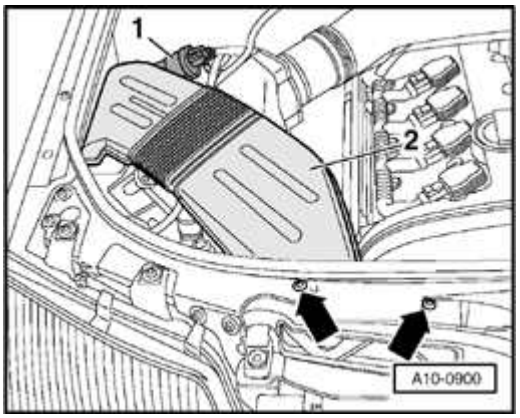
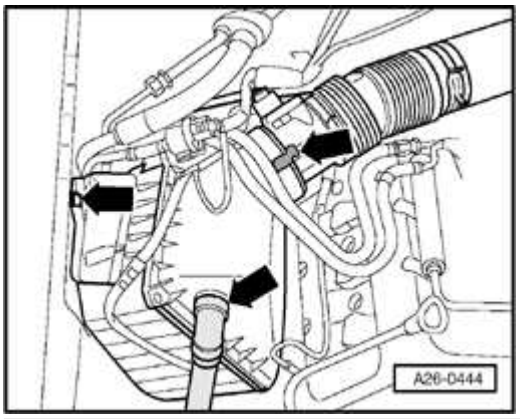


Fig. 543: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.



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Fig. 544: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).

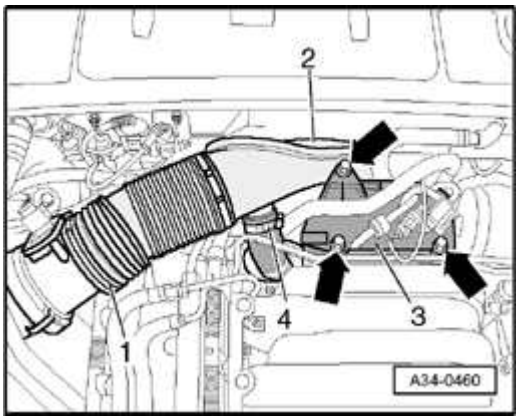


Fig. 545: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect electrical harness connector at Mass Air Flow (MAF) sensor.
- Remove hose -4- from air duct -2-.

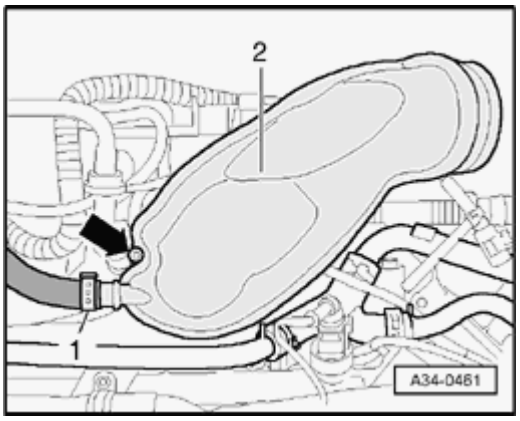


Fig. 546: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

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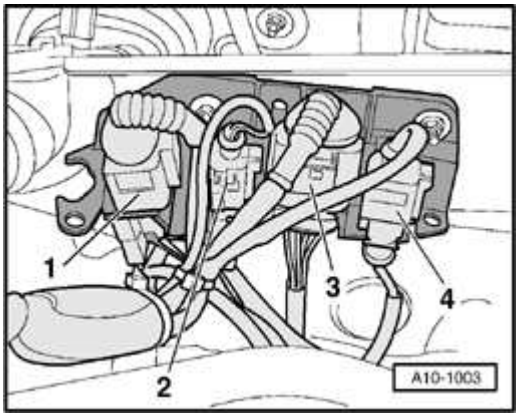


Fig. 547: Removing Harness Connectors From Bracket At Right Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at right of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

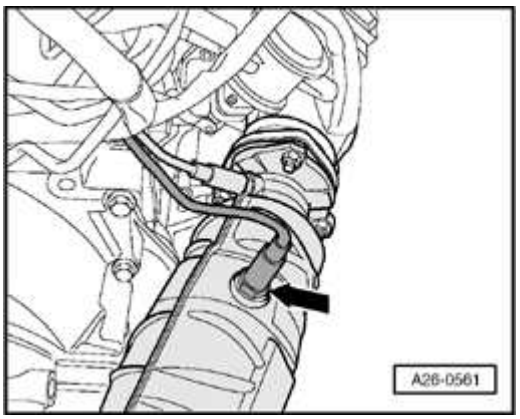


Fig. 548: Unscrewing Oxygen Sensor Behind Catalytic Converter Using Special Tool 3337/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: Illustration is shown with engine removed.

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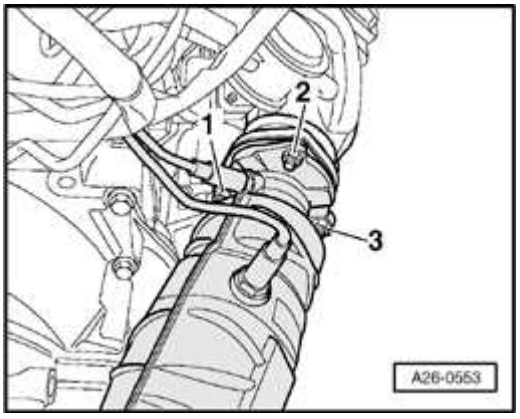


Fig. 549: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove right front wheel

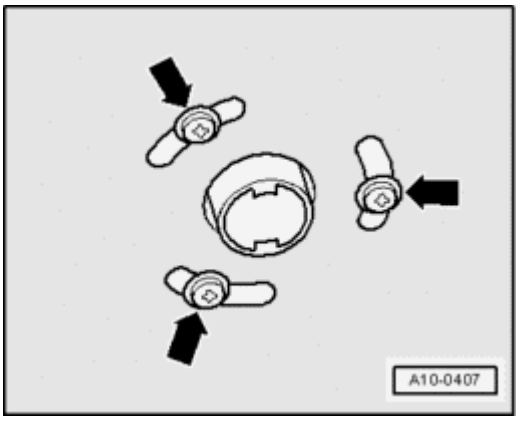


Fig. 550: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

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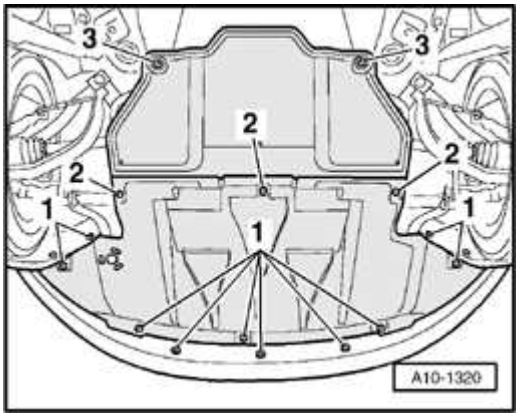


Fig. 551: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.

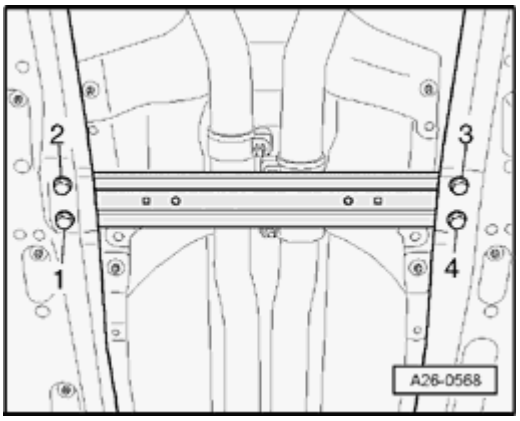


Fig. 552: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

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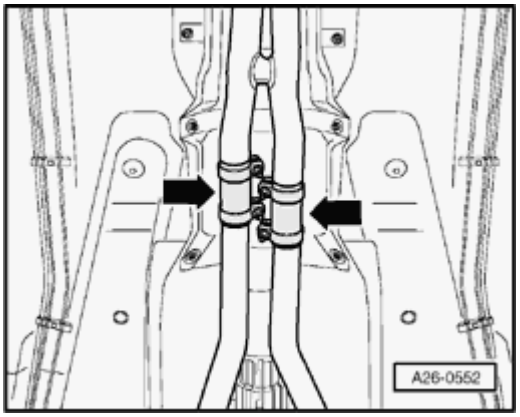


Fig. 553: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at both double clamps (arrows).

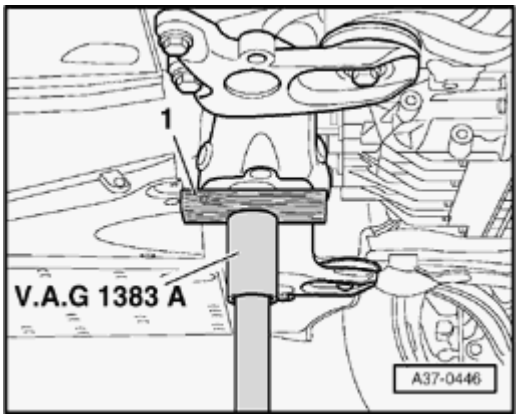


Fig. 554: Removing VAG1359/2 Universal Mount From VAG1383A Engine/Transmission Jack And Inserting Piece Of Wood Instead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove VAG1359/2 universal mount from VAG1383A engine/transmission jack and insert a piece of wood -1- instead.
- Support rear crossmember using VAG1383A engine/transmission jack.

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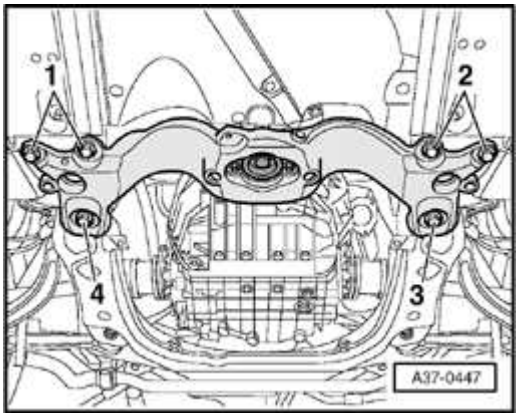


Fig. 555: Removing Bolts & Slowly Release Rear Crossmember Using VAG1383A Engine/Transmission Jack
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2-, then bolts -3- and -4-.
- Slowly release rear crossmember using VAG1383A engine/transmission jack.
- Set aside VAG1383A engine/transmission jack.

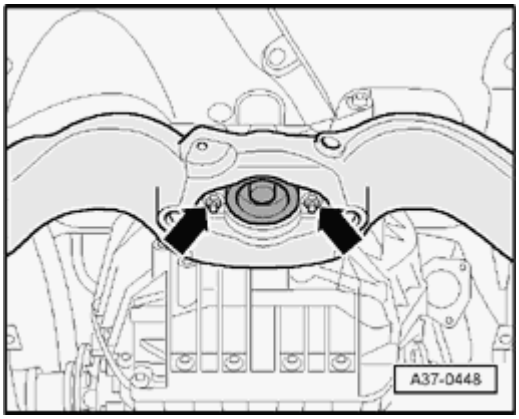


Fig. 556: Removing Nuts And Rear Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts (arrows) and rear crossmember.

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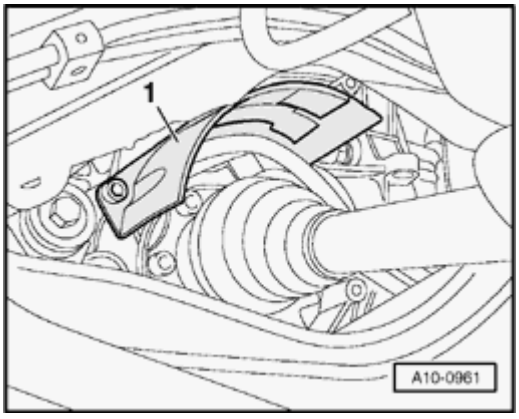


Fig. 557: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for right drive axle.
- Remove right drive axle.

Refer to **40 - FRONT SUSPENSION**

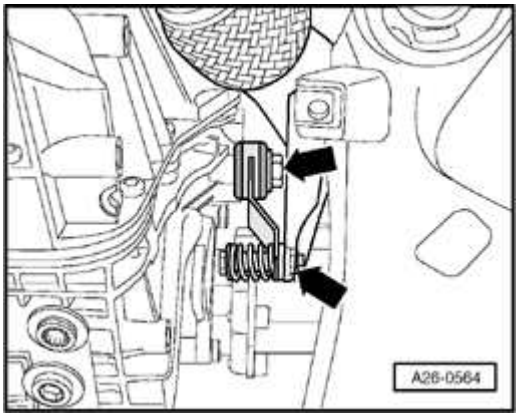


Fig. 558: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrows).

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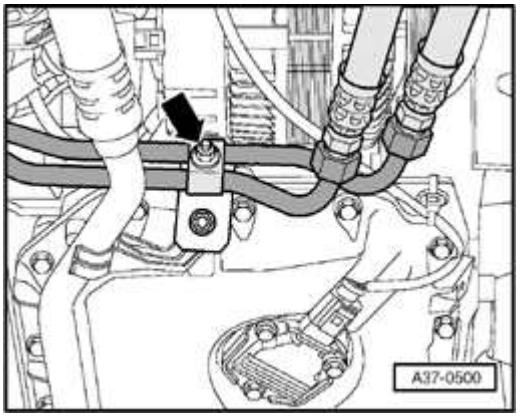


Fig. 559: Unbolting Bracket For ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for ATF lines (arrow).

NOTE: Observe the rules of cleanliness for working on automatic transmissions:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Place oil pan underneath.

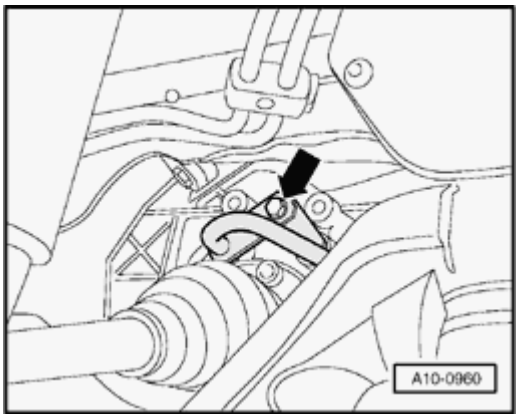


Fig. 560: Removing Bolt And Disconnecting ATF Lines From Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect ATF lines from transmission.
- Tie up ATF lines off to side.
- Expose oxygen sensor wire.

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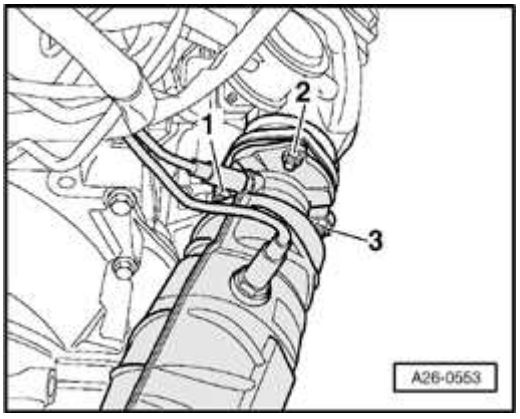


Fig. 561: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

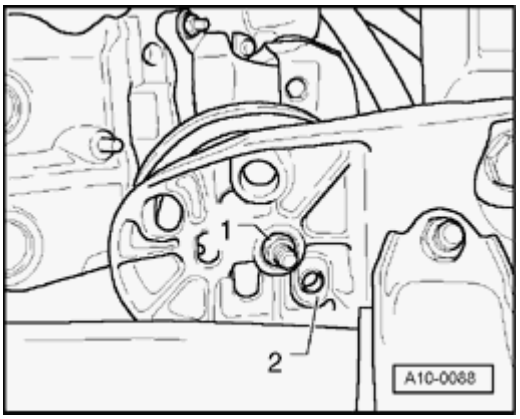


Fig. 562: Threaded Connections And Positioning Sleeves On Lower Engine Mounts
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen lower nuts -1- (on left and right engine mounts) several turns.
- Press transmission to left.
- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**

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- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Secure ATF lines:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Install subframe:

Refer to **40 - FRONT SUSPENSION**

- Install drive axle.

Refer to **40 - FRONT SUSPENSION**

- Install engine free of stress.
- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

NOTE: Individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01J. See Fig. 484.

- Check ATF level:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Tightening torques

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25

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Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55
Engine mount to console	23

Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)

Special tools and equipment

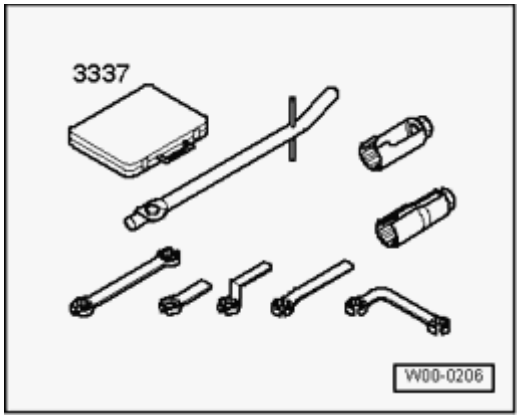


Fig. 563: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3337 Wrench, 7-piece set

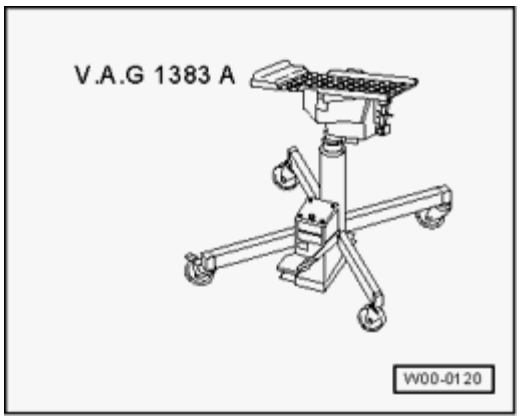


Fig. 564: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1383A Engine/transmission hoist
- Locking compound G 052 112 A3

Removing

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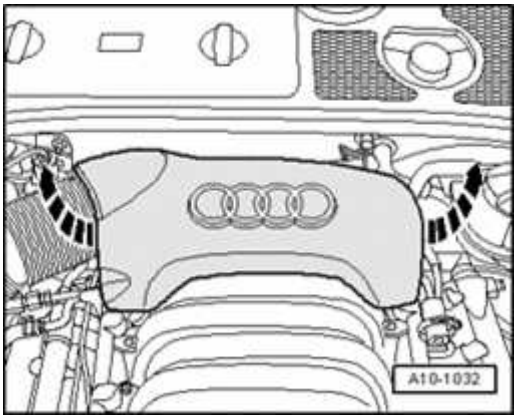


Fig. 565: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

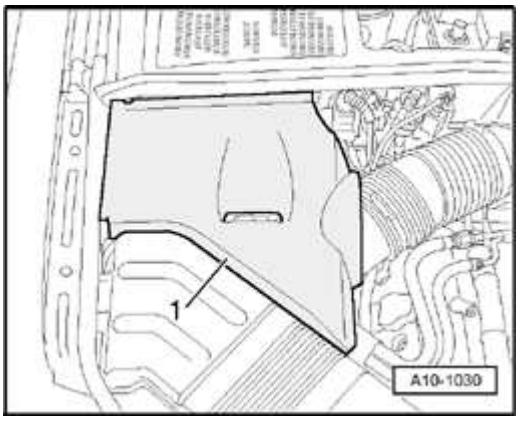


Fig. 566: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

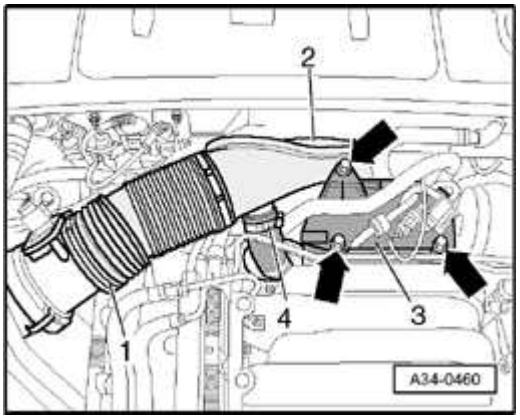


Fig. 567: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air duct -1- at Mass Air Flow (MAF) sensor.
- Remove hose -4- for crankcase ventilation from air duct -2-.

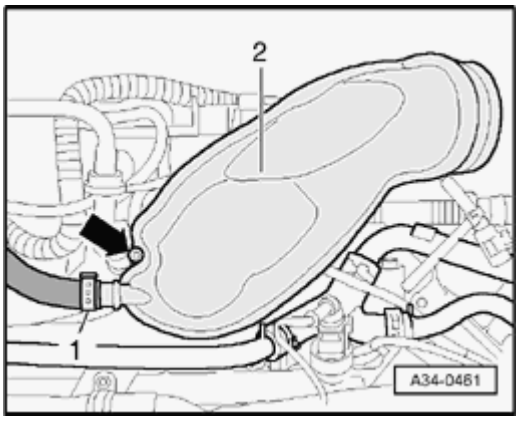


Fig. 568: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

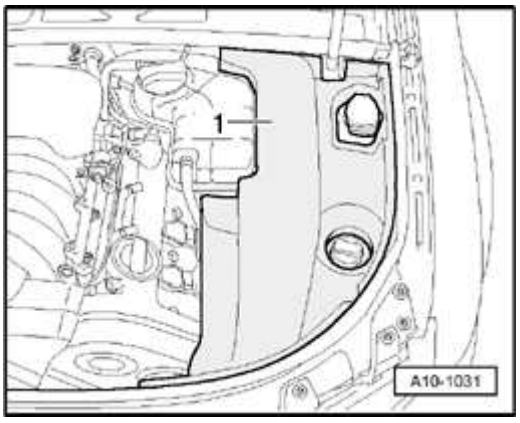


Fig. 569: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

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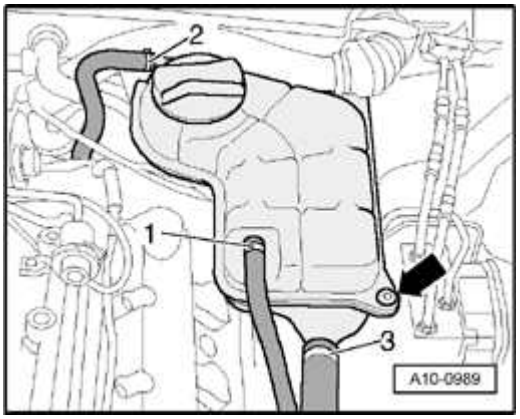


Fig. 570: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of coolant reservoir.
- Tie coolant reservoir with connected coolant hoses -1 to 3- to side.

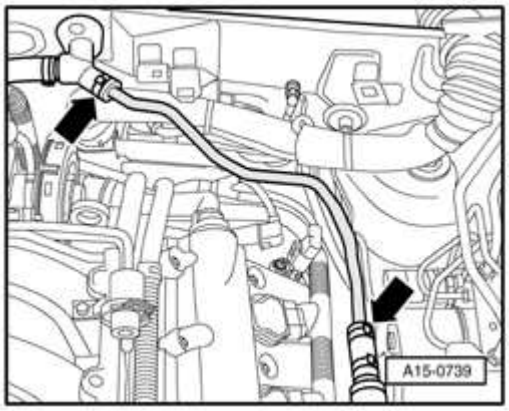


Fig. 571: Disconnecting Vacuum Hose To Brake Booster
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose to brake booster (arrows).
- Remove heat shield for harness connectors at left of bulkhead, if installed.

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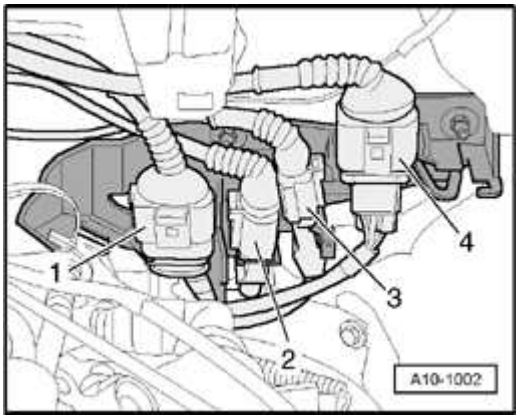


Fig. 572: Removing Harness Connectors From Bracket At Left Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at left of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

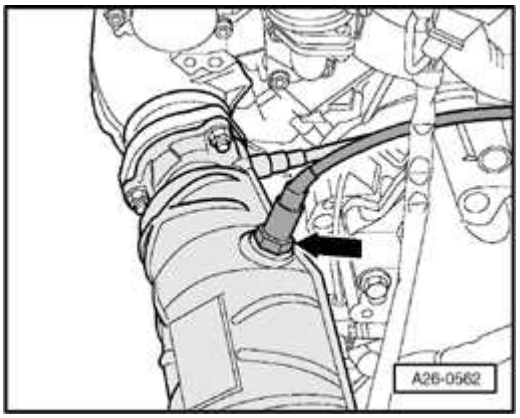


Fig. 573: Unscrewing Oxygen Sensor Behind Catalytic Converter Using Special Tool 3337/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: Illustration is shown with engine removed.

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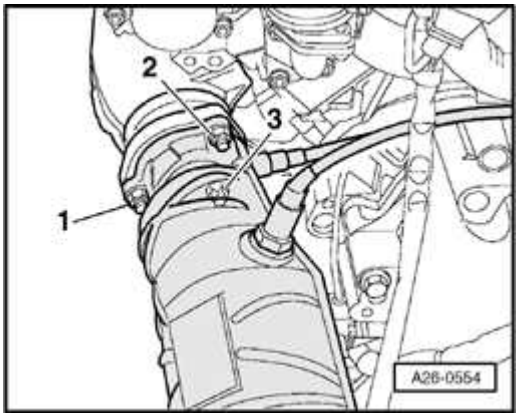


Fig. 574: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove left front wheel.

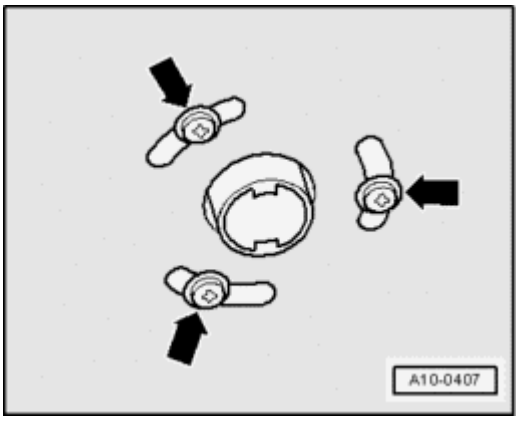


Fig. 575: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

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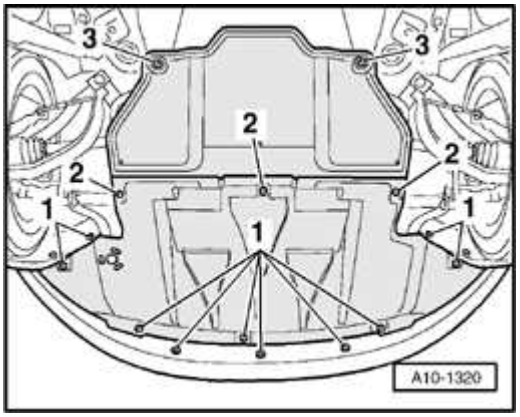


Fig. 576: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.

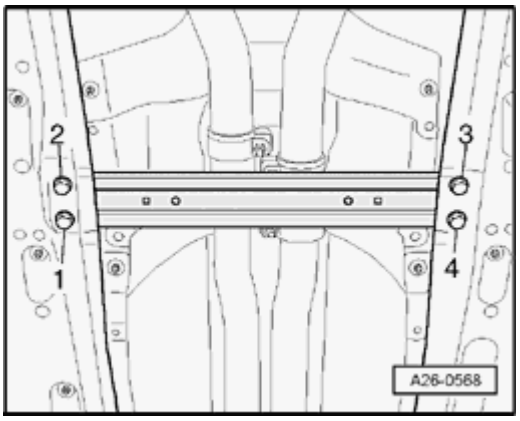


Fig. 577: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged..

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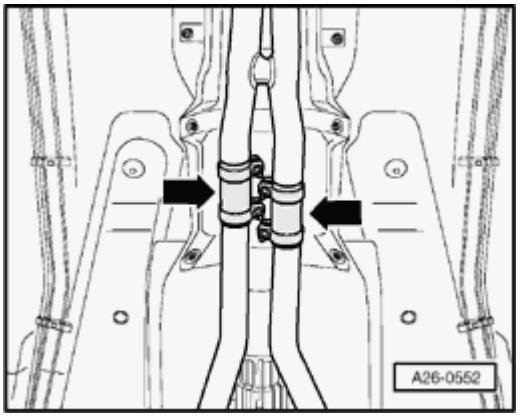


Fig. 578: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at both double clamps (arrows).
- Remove heat shield above exhaust system.

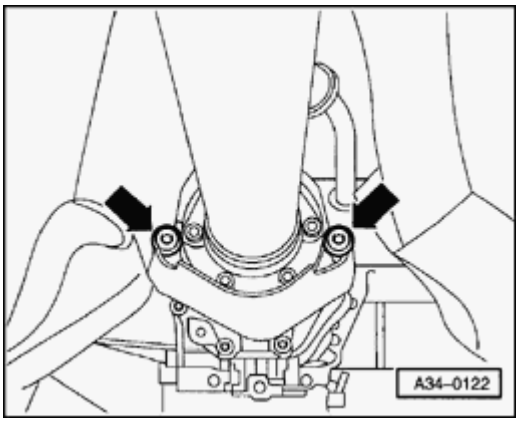


Fig. 579: Identifying Heat Shield Fasteners For Torsen Differential
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield for driveshaft from cover for Torsen differential (arrows).
- Remove bolts at flange of transmission/driveshaft.
- Push driveshaft to rear final drive together. Constant velocity joints can be adjusted axially.
- Rest driveshaft on exhaust system.

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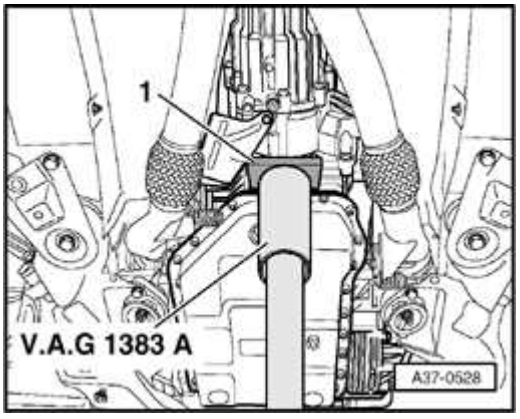


Fig. 580: Positioning Engine/Transmission Jack VAG1383A Directly Behind ATF Drip Tray
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position engine/transmission jack VAG1383A directly behind ATF drip tray. Insert a wood block -1- to protect transmission housing.

WARNING: The lock carrier must be installed.

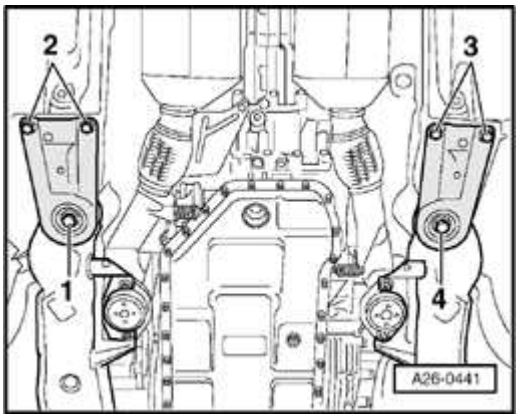


Fig. 581: Removing Bolts And Mounting Bolts Of Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -2- and -3- and then mounting bolts -1- and -4- of subframe.
- Lower transmission and subframe slightly using VAG1383A engine/transmission jack.

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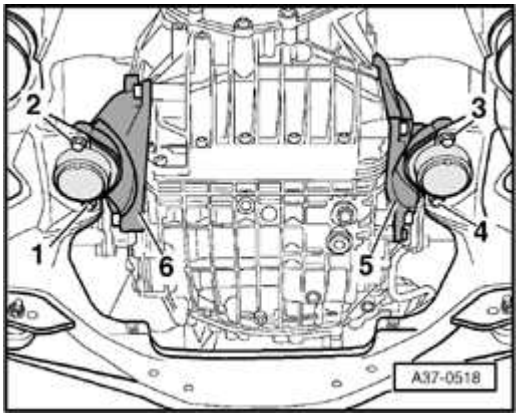


Fig. 582: Removing Bolts 1 To 4 For Transmission Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts 1 to 4 for transmission mount.
- Unbolt both transmission mounts -5- and -6- at transmission housing and remove transmission supports with transmission mounts.
- Lower transmission slowly.

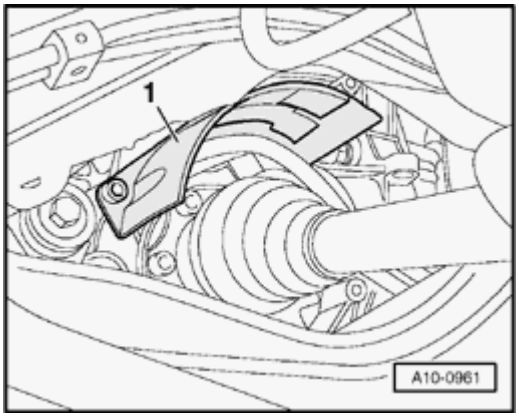


Fig. 583: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for left drive axle.

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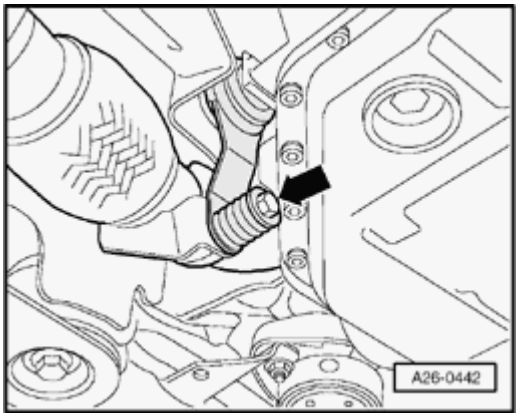


Fig. 584: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrow).

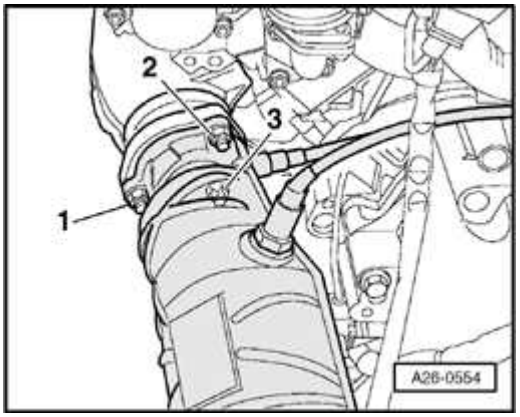


Fig. 585: Removing Nut For Left Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**

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- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Install transmission supports:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Install subframe:

Refer to **40 - FRONT SUSPENSION**

- Installing driveshaft:

Refer to

- **39 FINAL DRIVE, DIFFERENTIAL** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **39F - FRONT FINAL DRIVE, DIFFERENTIAL** for 6 SPD. MANUAL TRANSMISSION 0A3 ALL WHEEL DRIVE, INTERNAL COMPONENT SERVICING
- **39 FINAL DRIVE - DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **39 FINAL DRIVE - FRONT DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

NOTE: Individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01V. See Fig. 481.

Tightening torques

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Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55

Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)

Special tools and equipment

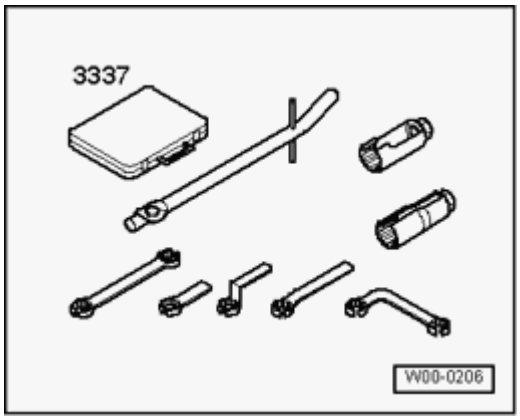


Fig. 586: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3337 Wrench, 7-piece set

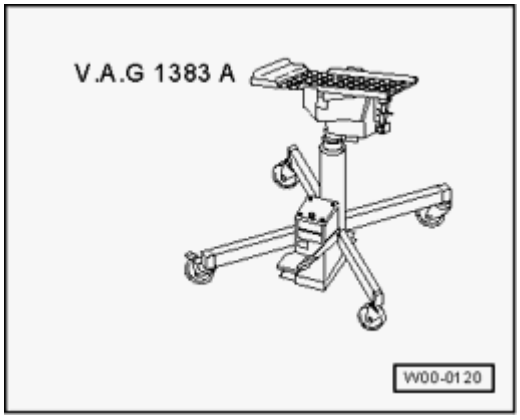


Fig. 587: Identifying Engine/Transmission Jack V.A.G. 1383 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1383A Engine/transmission hoist

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- Locking compound G 052 112 A3

Removing

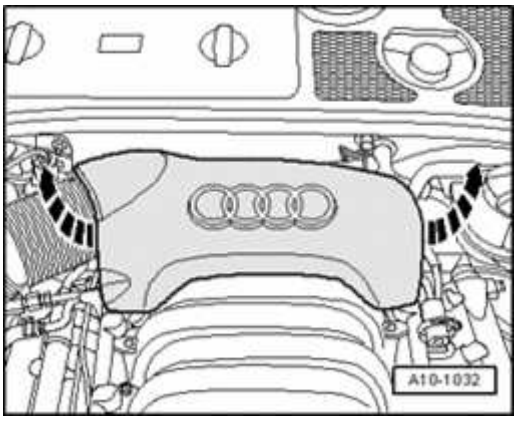


Fig. 588: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

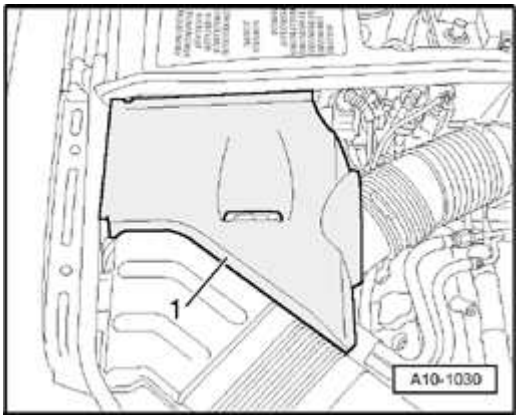


Fig. 589: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

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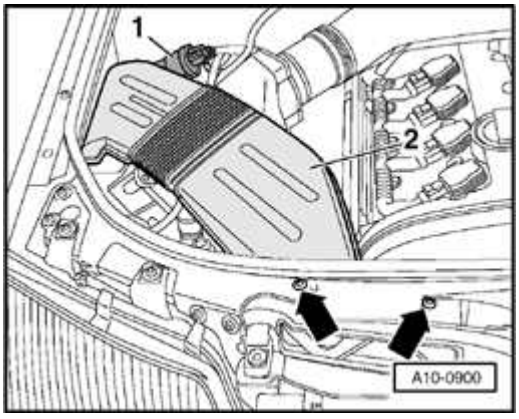


Fig. 590: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

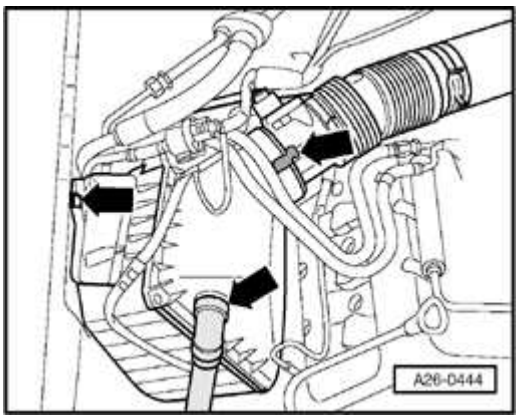
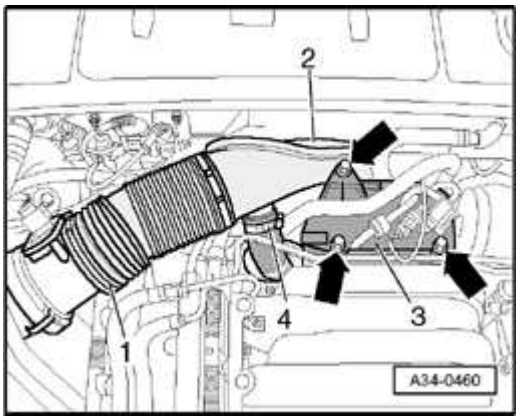


Fig. 591: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).



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Fig. 592: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect electrical harness connector at Mass Air Flow (MAF) sensor.
- Remove hose -4- of crankcase ventilation from air duct -2-.

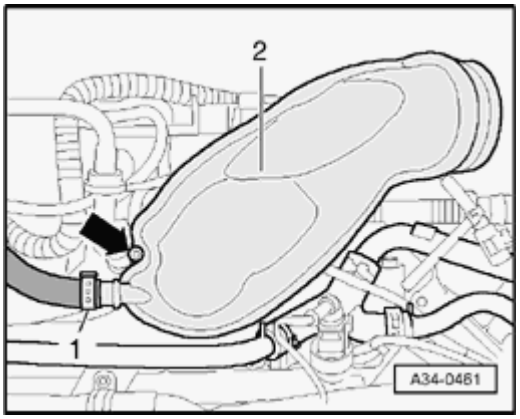


Fig. 593: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

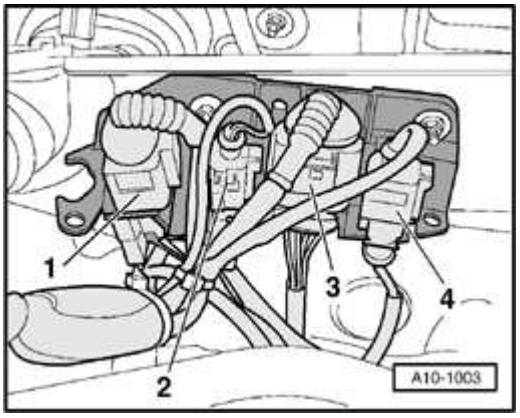


Fig. 594: Removing Harness Connectors From Bracket At Right Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1 to 4- from bracket at right of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

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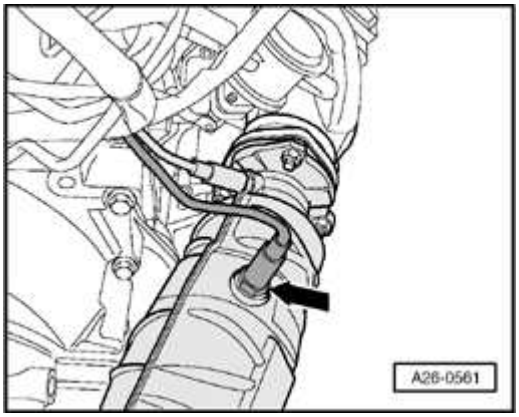


Fig. 595: Unscrewing Oxygen Sensor Behind Catalytic Converter Using Special Tool 3337/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: The illustration is shown with the engine removed.

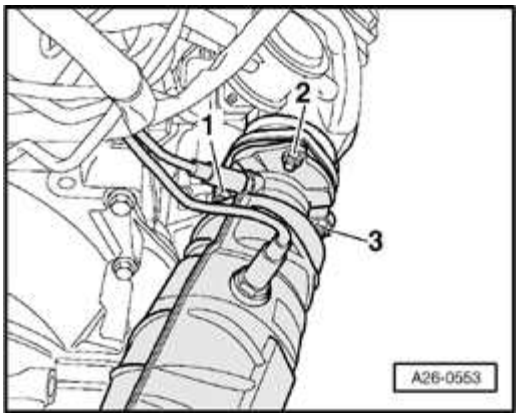


Fig. 596: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

- Remove right front wheel

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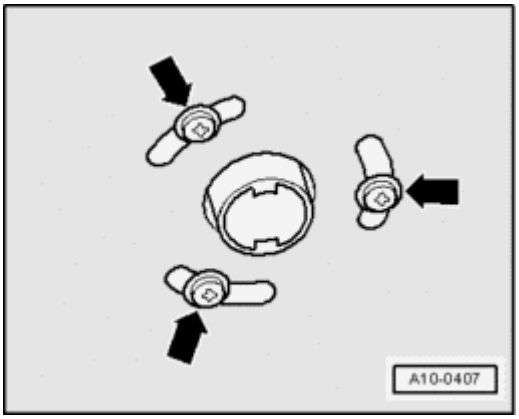


Fig. 597: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater on sound insulation.

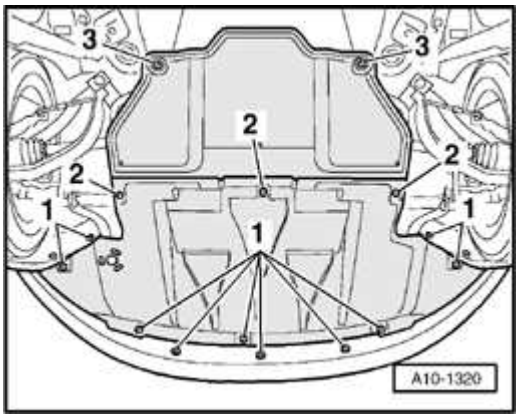
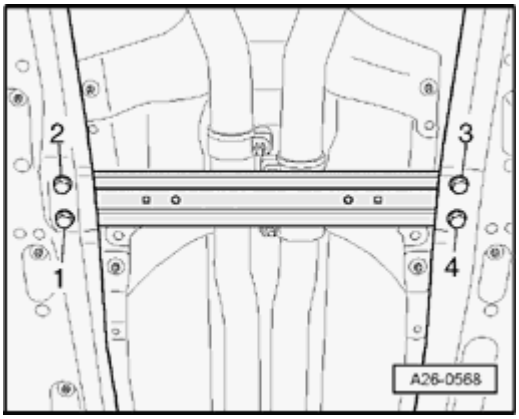


Fig. 598: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.
- Remove quick-release screws -3- and remove rear sound insulation, if present.



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Fig. 599: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be cant more than 10°, otherwise it may be damaged.

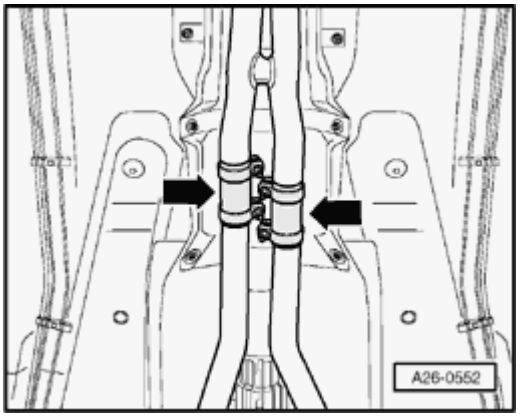


Fig. 600: Disconnecting Exhaust System At Double Clamps
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect exhaust system at both double clamps -arrows-.
- Remove heat shield above exhaust system.

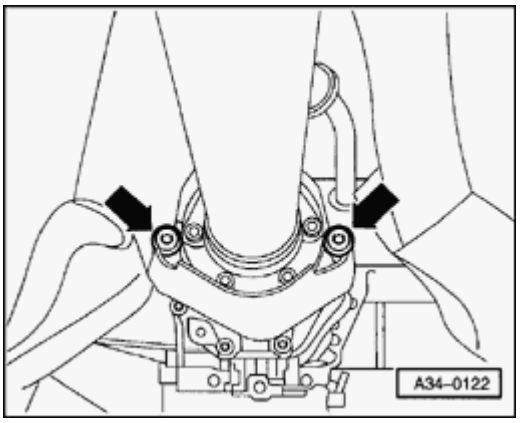


Fig. 601: Identifying Heat Shield Fasteners For Torsen Differential
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield for driveshaft from cover for Torsen differential (arrows).
- Remove bolts at flange of transmission/driveshaft.
- Push driveshaft to rear final drive together. Constant velocity joints can be adjusted axially.
- Rest driveshaft on exhaust system.

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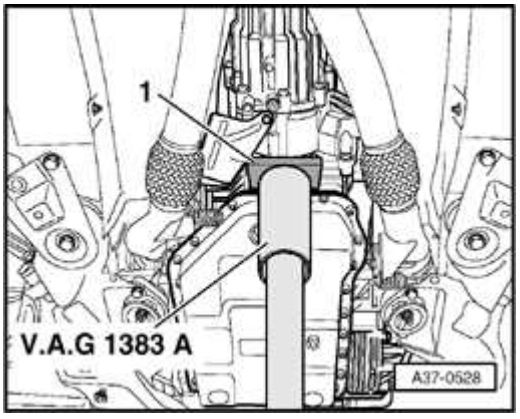


Fig. 602: Positioning Engine/Transmission Jack VAG1383A Directly Behind ATF Drip Tray
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Position engine/transmission jack VAG1383A directly behind ATF drip tray. Insert a wood block -1- to protect transmission housing.

WARNING: The lock carrier must be installed.

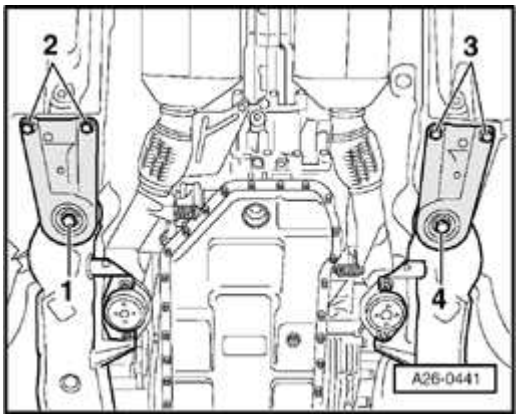


Fig. 603: Removing Bolts And Mounting Bolts Of Subframe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -2- and -3- and then mounting bolts -1- and -4- of subframe.
- Lower transmission and subframe slightly using VAG1383A engine/transmission jack.

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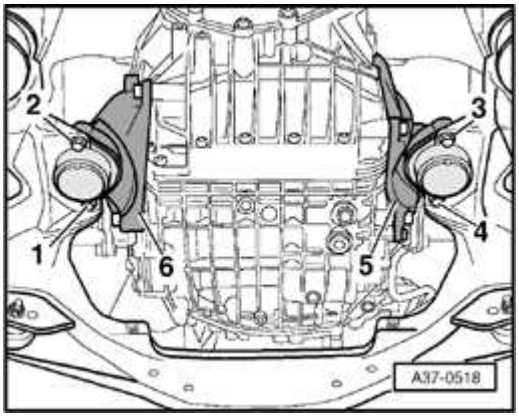


Fig. 604: Removing Bolts 1 To 4 For Transmission Mount
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- to -4- for transmission mount.
- Unbolt both transmission mounts -5- and -6- at transmission housing and remove transmission supports with transmission mounts.
- Lower transmission slowly.

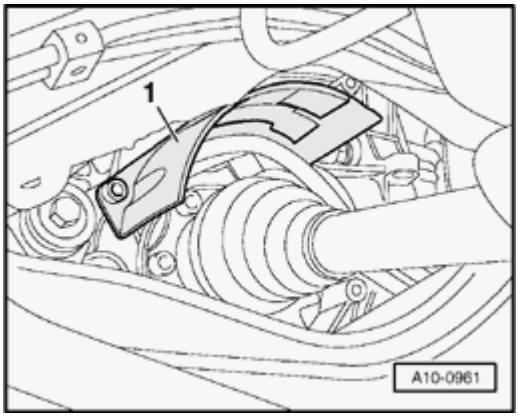


Fig. 605: Removing Left/Right Heat Shields For Drive Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove heat shield -1- for right drive axle.
- Remove right drive axle.

Refer to **40 - FRONT SUSPENSION**

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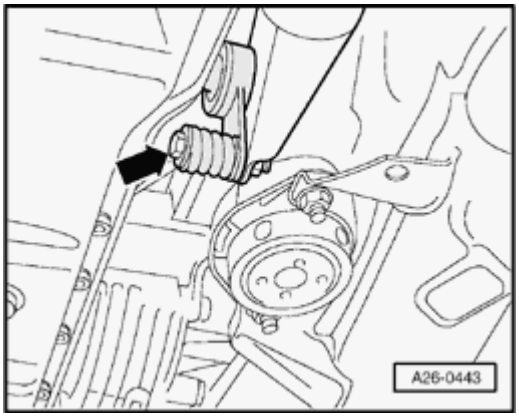


Fig. 606: Removing Bracket For Front Exhaust Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bracket for front exhaust pipe (arrow).

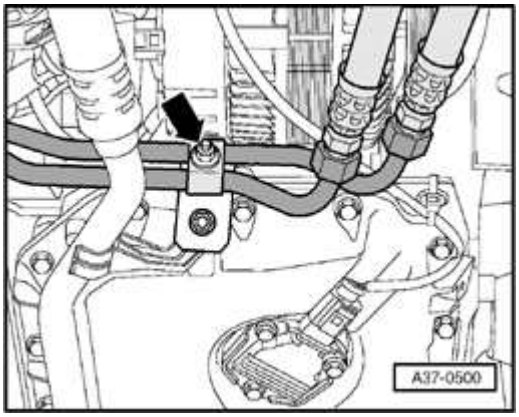


Fig. 607: Unbolting Bracket For ATF Lines
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt bracket for ATF lines (arrow).

NOTE: Observe the rules of cleanliness for working on automatic transmissions:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Place oil pan underneath.

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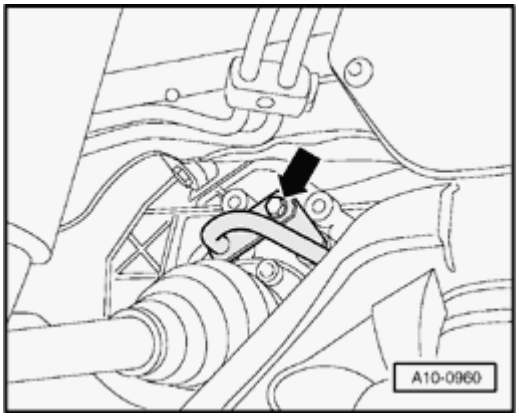


Fig. 608: Removing Bolt And Disconnecting ATF Lines From Transmission
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect ATF lines from transmission.
- Tie up ATF lines off to side.
- Expose oxygen sensor wire.

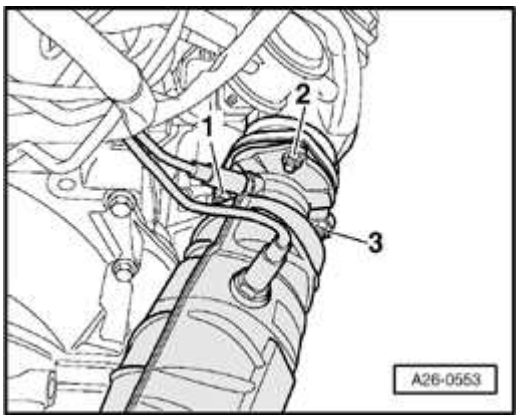


Fig. 609: Removing Nut For Right Exhaust Pipe/Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: The illustration is shown with the engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**

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- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**
- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Install transmission supports:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Install subframe:

Refer to **40 - FRONT SUSPENSION**

- Install drive axle.

Refer to **40 - FRONT SUSPENSION**

- Installing driveshaft:

Refer to

- **39 FINAL DRIVE, DIFFERENTIAL** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **39F - FRONT FINAL DRIVE, DIFFERENTIAL** for 6 SPD. MANUAL TRANSMISSION 0A3 ALL WHEEL DRIVE, INTERNAL COMPONENT SERVICING
- **39 FINAL DRIVE - DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **39 FINAL DRIVE - FRONT DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE
- **39 FINAL DRIVE, DIFFERENTIAL** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

- Secure ATF lines:

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Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

NOTE: Individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01V. See Fig. 478.

- Check ATF level:

Refer to

- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J
- **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING

Tightening torques

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55

Left exhaust manifold, removing and installing

Removing

- Remove left front exhaust pipe with catalytic converter. Refer to **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)**, **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)** and **Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)**.

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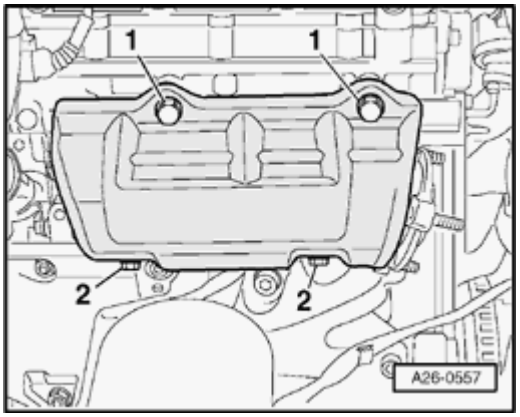


Fig. 610: Removing Threaded Connection At Heat Shield Which Is Accessible From Bottom
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove threaded connection -2- at heat shield which is accessible from bottom.
- Unscrew threaded connection -1- which is accessible from top and remove heat shield.

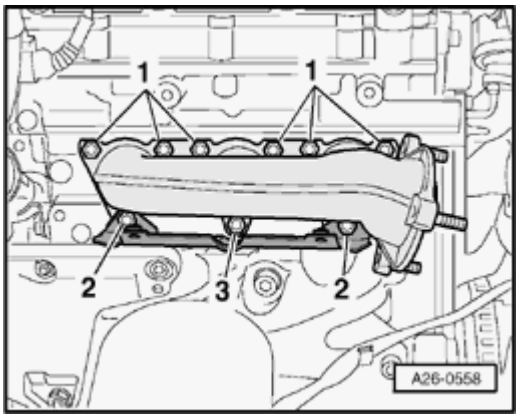


Fig. 611: Identifying Threaded Connections, Nuts, Heat Shield Bracket & Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew threaded connections -1- of exhaust manifold which is accessible from top.
- Remove nuts -2- from bottom and remove heat shield bracket.
- Remove nut -3- and remove exhaust manifold.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and self-locking nuts.

- Install left front exhaust pipe with catalytic converter. Refer to **Installing** for vehicles with manual transmission, **Installing** for vehicles with automatic transmission 01J and **Installing** for vehicles with automatic transmission 01V.

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- Install exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** and **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

Tightening torques

Component		Nm
Exhaust manifold to cylinder head		25
Heat shield	M6	10
for exhaust manifold	M8	25

Right exhaust manifold, removing and installing

Removing

- Remove right front exhaust pipe with catalytic converter. Refer to **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)**, **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)** and **Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)**.

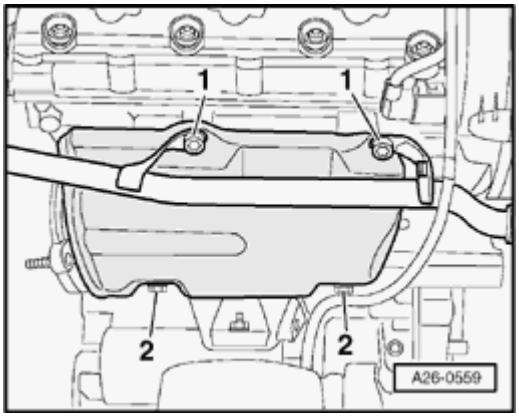


Fig. 612: Removing Threaded Connection At Heat Shield & Unscrewing Threaded Connection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove threaded connection -2- at heat shield which is accessible from bottom.
- Unscrew threaded connection -1- which is accessible from top.

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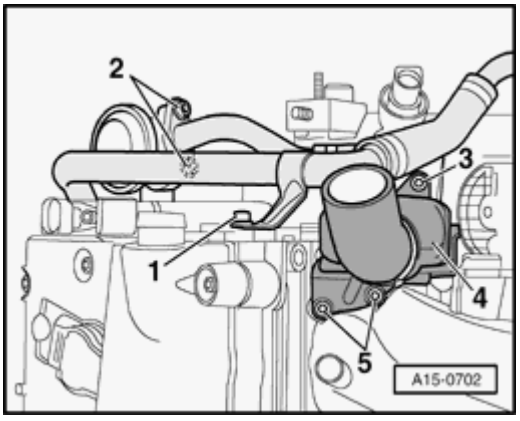


Fig. 613: Removing Bolts At Lines Of Secondary Air Injection & Resonator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -2- at secondary air injection lines.

NOTE: Resonator -4- remains installed with bolts -3- and -5-.

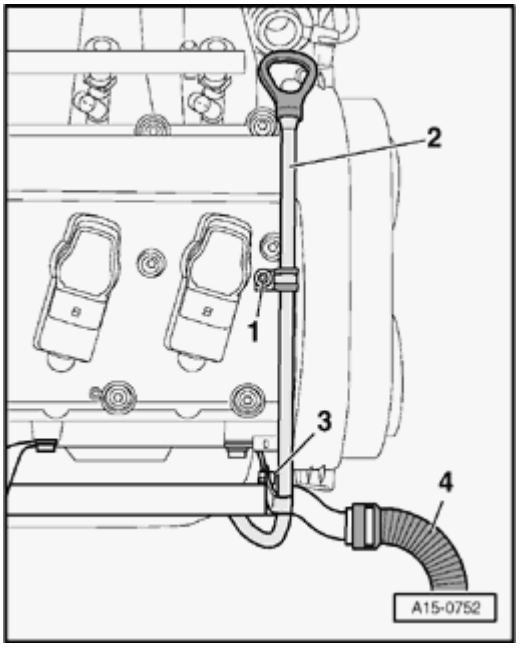


Fig. 614: Identifying Bolts, Hose From Line Of Secondary Air Injection
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- and -3-.
- Disconnect hose -4- from secondary air injection line.
- Pull out guide tube for oil dipstick -2- toward top from oil pan (upper part) and swing it forward.
- Remove heat shield.

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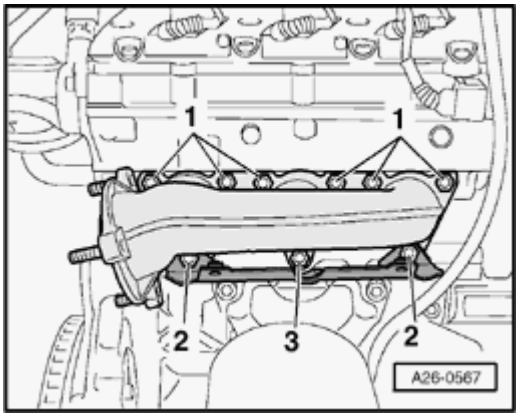


Fig. 615: Unscrewing Threaded Connection On Exhaust Manifold & Removing Nuts, Heat Shield Bracket & Exhaust Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew threaded connection -1- on exhaust manifold which is accessible from top.
- Remove nuts -2- from bottom and remove heat shield bracket.
- Remove nut -3- and remove exhaust manifold.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and self-locking nuts.

- Replace O-ring at guide tube for oil dipstick and insert guide tube into hole in oil pan (upper part).
- Install right front exhaust pipe with catalytic converter. Refer to **Installing** for vehicles with automatic transmission 01J or **Installing** for vehicles with automatic transmission 01V.
- Align exhaust system free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** or **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

Tightening torque

Component		Nm
Exhaust manifold to cylinder head		25
Heat shield to heat shield bracket		10
Tube for	M6	10
Secondary Air Injection	M8	25
Guide tube for oil dipstick to line for secondary air injection		10

Exhaust system, aligning free of stress (vehicles with front wheel drive)

NOTE: Align exhaust system when cold.

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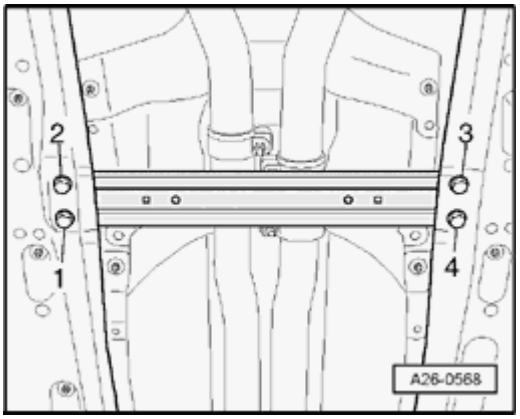


Fig. 616: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember (55 Nm).

- Vehicles without clamping sleeve between center and rear muffler

- Loosen double clamp bolts, item - 14.

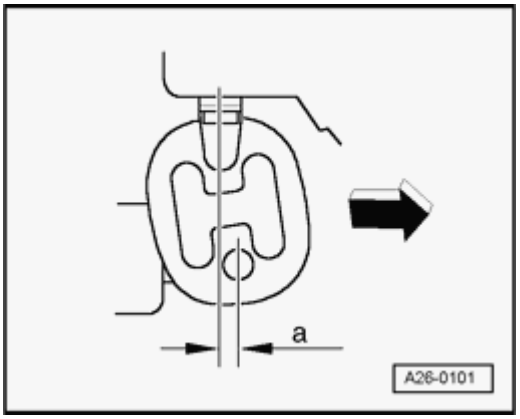


Fig. 617: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push exhaust system far enough forward (arrow) so that pre-tension at retaining loop at center muffler -a- = 5 to 9 mm.
- Tighten double clamp bolts uniformly to 40 Nm.
- Align end pipes. Refer to **Tailpipes, aligning** .

- Vehicles with clamping sleeve between center and rear muffler

NOTE: Only for vehicles with double clamp between center and rear mufflers, the rear muffler must also be aligned.

- Loosen double clamp bolts at front, item - 14 and rear, item - 23

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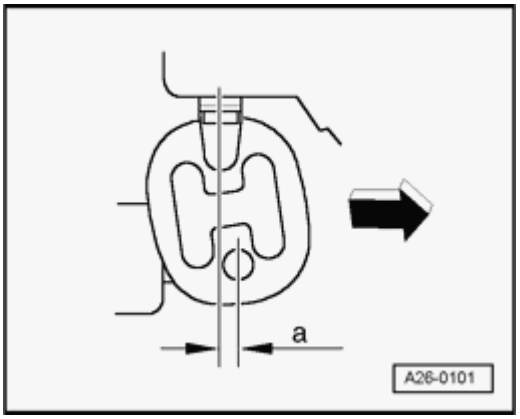


Fig. 618: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push front part of exhaust system far enough forward (arrow) so that pre-tension at retaining loop at center muffler -a- = 5 to 9 mm.
- Tighten front double clamp bolts, item - 14 evenly to 40 Nm.

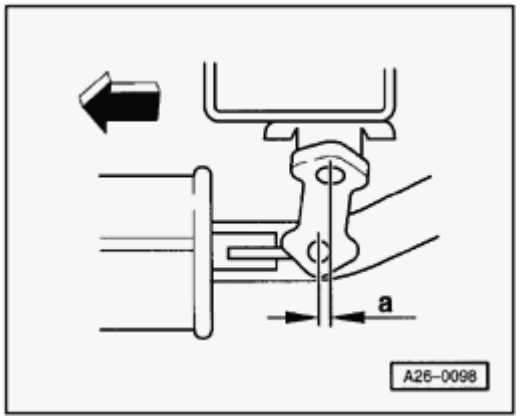


Fig. 619: Pushing Rear Section Of Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push rear part of exhaust system far enough forward (arrow) so that pre-tension at rear retaining loops at rear muffler -a- = 7 to 11 mm.
- Align rear muffler horizontally.
- Tighten rear double clamp bolts, item - 23 evenly to 40 Nm.
- Align end pipes. Refer to **Tailpipes, aligning** .

Exhaust system, aligning free of stress (vehicles with all wheel drive)

NOTE: Align exhaust system when cold.

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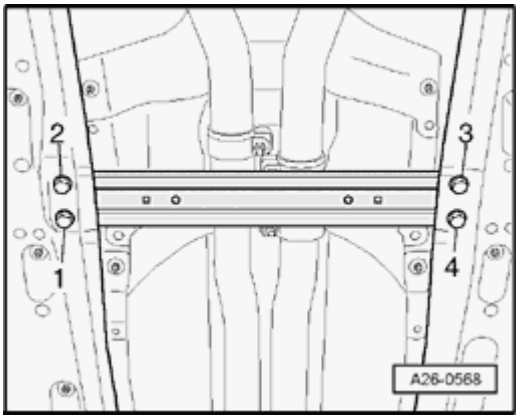


Fig. 620: Removing Bolts For Front Vehicle Floor Crossmember
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- through -4- and remove crossmember (55 Nm).

- Vehicles without clamping sleeve between center and rear muffler

- Loosen double clamp bolts, item - 14.

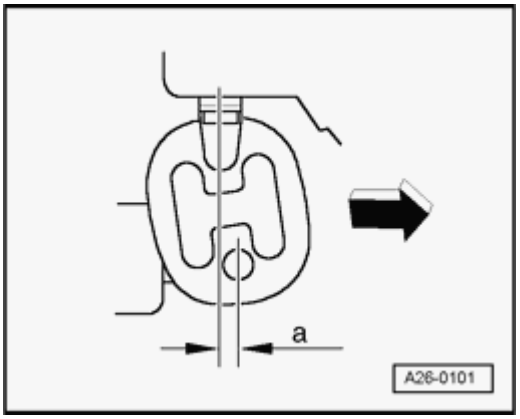


Fig. 621: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push exhaust system far enough forward (arrow) so that pre-tension at right retaining loop at center muffler -a- = 5 to 9 mm.
- Tighten double clamp bolts uniformly to 40 Nm.
- Align end pipes. Refer to **Tailpipes, aligning** .

- Vehicles with clamping sleeve between center and rear muffler

NOTE: Only for vehicles with double clamp between center and rear mufflers, the center muffler must also be aligned.

- Loosen double clamp bolts, item - 14, and item - 24.

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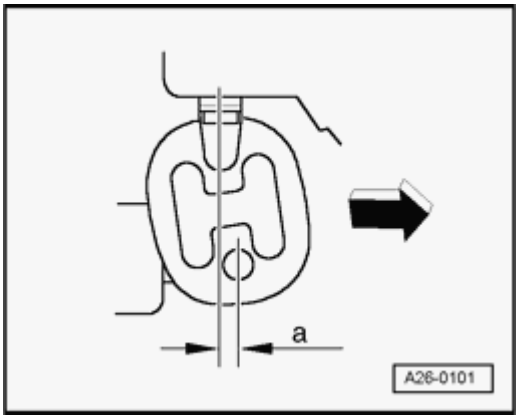


Fig. 622: Pushing Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push front part of exhaust system far enough forward (arrow) so that pre-tension at retaining loop at center muffler -a- = 5 to 9 mm.
- Tighten front double clamp bolts, item - 14 evenly to 40 Nm.

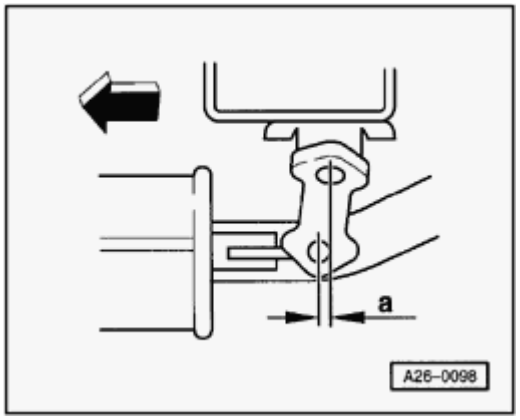


Fig. 623: Pushing Rear Section Of Exhaust System Toward Front Of Vehicle
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Push rear part of exhaust system far enough forward (arrow) so that pre-tension at rear retaining loops at rear muffler -a- = 7 to 11 mm.
- Align rear muffler horizontally.
- Tighten rear double clamp bolts, item - 24 evenly to 40 Nm.
- Align end pipes. Refer to **Tailpipes, aligning** .

Tailpipes, aligning

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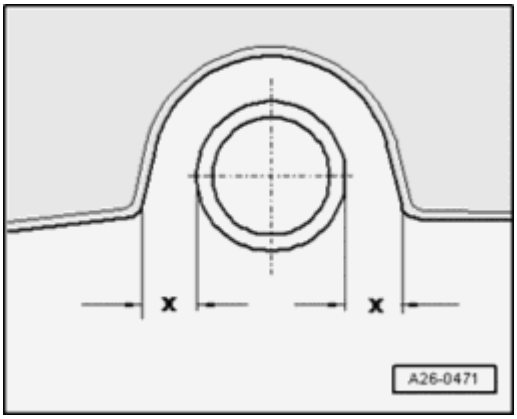


Fig. 624: Checking Distance Of End Pipes At Left/Right To Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check distance of end pipes at left and right to bumper:

- Dimension -x- left = dimension -x- right

If necessary, correct dimension -x- as follows:

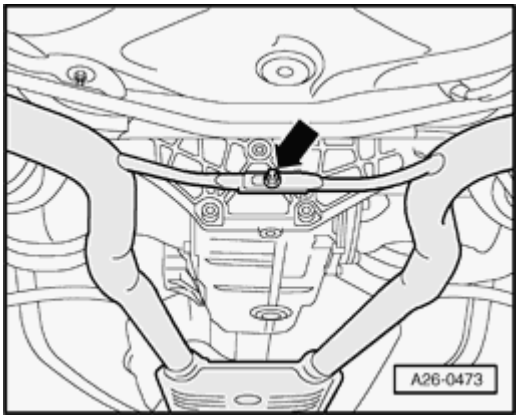


Fig. 625: Loosening Nut Of Brace Between Exhaust Pipes
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen nuts (arrows) of brace between exhaust pipes.
- Change distance of rear mufflers to each other.
- Tighten nut to 23 Nm.

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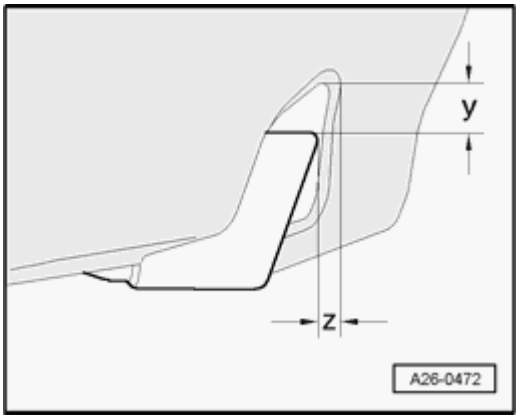


Fig. 626: Checking Distances Of End Pipes To Bumper
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check distances -y- and -z- of end pipes to bumper:

- Dimension -y- = greater than 20 mm
- Dimension -z- = 9 to 14 mm

- If necessary, check whether exhaust system is installed free of stress. Refer to **Exhaust system, aligning free of stress (vehicles with front wheel drive)** or **Exhaust system, aligning free of stress (vehicles with all wheel drive)**.

Exhaust system, checking for proper seal

- Start engine and let run at idle.
- Seal tailpipes with cloths or plug for duration of leak test.
- Check for leaks by listening at cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe etc.
- Repair leaks.

SECONDARY AIR SYSTEM

Secondary air system

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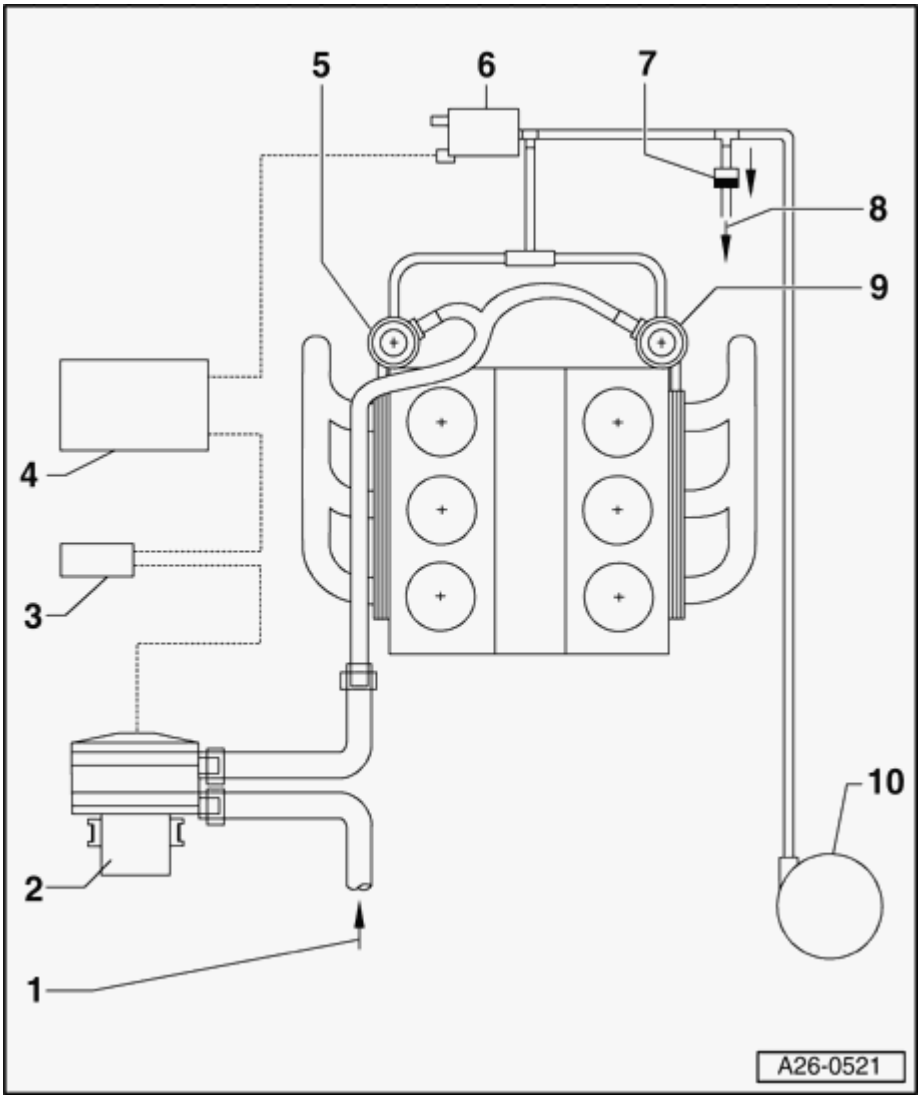


Fig. 627: Identifying Secondary Air System
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The Secondary Air Injection (AIR) system causes the catalytic converter to heat up more quickly, resulting in earlier operating readiness following cold start.

Principle

Due to over-enrichment of the mixture during the cold start phase, there is an increased amount of uncombusted carbon monoxide in the exhaust. Secondary Air Injection (AIR) improves secondary oxidation in the catalytic converter and therefore reduces emissions. The heat produced by secondary oxidation greatly reduces start-up time for the catalytic converter, therefore improving exhaust quality during the cold start phase significantly.

Function

- In the cold start phase, the ECM -4- activates the secondary air pump -2- via the relay for secondary air

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injection -3-. Air reaches the combination valves for secondary air injection -5- and -9-.

- The Secondary Air Injection (AIR) valve -6- is activated in parallel, which allows the vacuum to reach the combination valves for secondary air injection -5- and -9-. The appropriate combination valve for secondary air injection thereby opens the path for secondary air to the exhaust channels of the cylinder head.

1 - From air filter housing

2 - Secondary Air Injection (AIR) pump motor -V101-

- Component location. See **Fig. 629**
- Removing and installing. Refer to **Secondary Air Injection (AIR) pump motor -V101-, removing and installing**

3 - Secondary Air Injection (AIR) pump relay -J299-

- Component location. See **Fig. 630**

4 - Motronic Engine Control Module (ECM) -J220-

5 - Combination valve for secondary air injection (right)

- Component location. See **Fig. 631**
- Checking. Refer to **Combination valve for Secondary Air Injection (AIR), checking function and proper seal**
- Removing and installing. Refer to **Right combination valve for secondary air injection, removing and installing**

6 - Secondary Air Injection (AIR) solenoid valve -N112-

- Component location. See **Fig. 628**

7 - Check-valve

- Installed position (light/dark side): Arrow points in direction of flow, as shown in .

8 - To Intake manifold

9 - Combination valve for secondary air injection (left)

- Component location. See **Fig. 631**
- Checking. Refer to **Combination valve for Secondary Air Injection (AIR), checking function and proper seal**
- Removing and installing. Refer to **Left combination valve for secondary air injection, removing and installing**

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10 - Vacuum reservoir

- Installed location: Under wheelhousing liner in left front wheelhousing

Component location Secondary Air Injection (AIR) solenoid valve -N112-

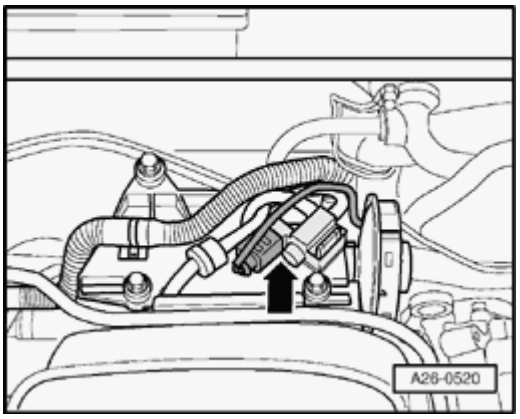


Fig. 628: Disconnecting Hoses From Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bolted to holding plate for solenoid valves at rear of engine (arrow).

Secondary Air Injection (AIR) pump motor -V101-

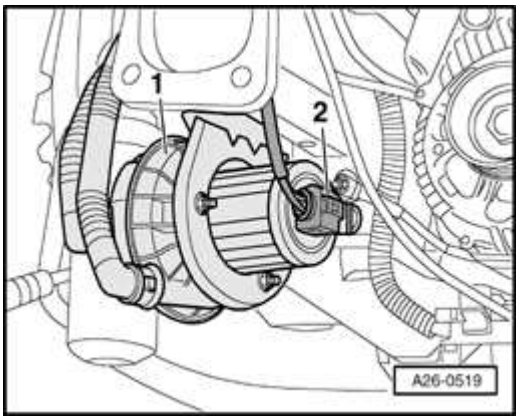


Fig. 629: Secondary Air Injection (AIR) Pump Motor -V101-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- At front right in engine compartment below air filter housing

1 - Secondary Air Injection (AIR) pump motor -V101-

2 - Electrical harness connector for Secondary Air Injection (AIR) pump motor -V101-

Secondary Air Injection (AIR) pump relay -J299-

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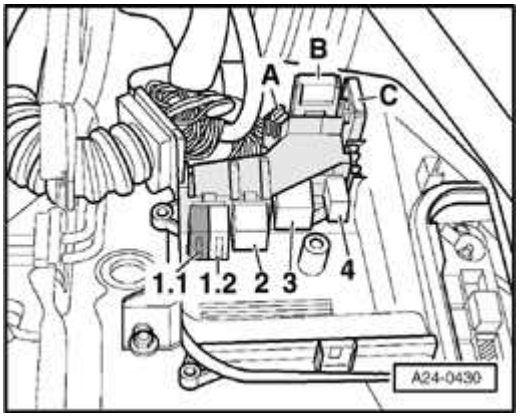


Fig. 630: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- In E-box, plenum chamber

3 - Secondary Air Injection (AIR) pump relay -J299-

B - Fuse for secondary air pump -S130-

Combination valve for Secondary Air Injection (AIR)

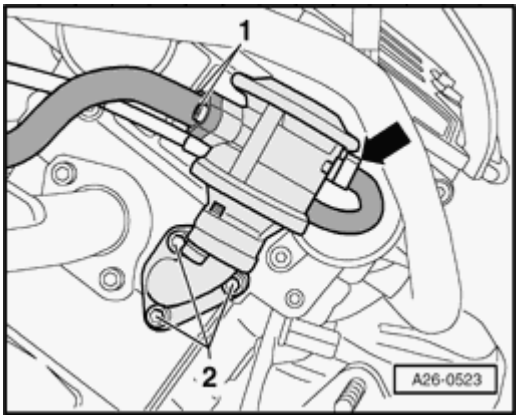


Fig. 631: Combination Valve For Secondary Air Injection (AIR)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- At rear of cylinder heads

NOTE: Right valve is shown in illustration.

Secondary Air Injection (AIR) solenoid valve -N112-, checking

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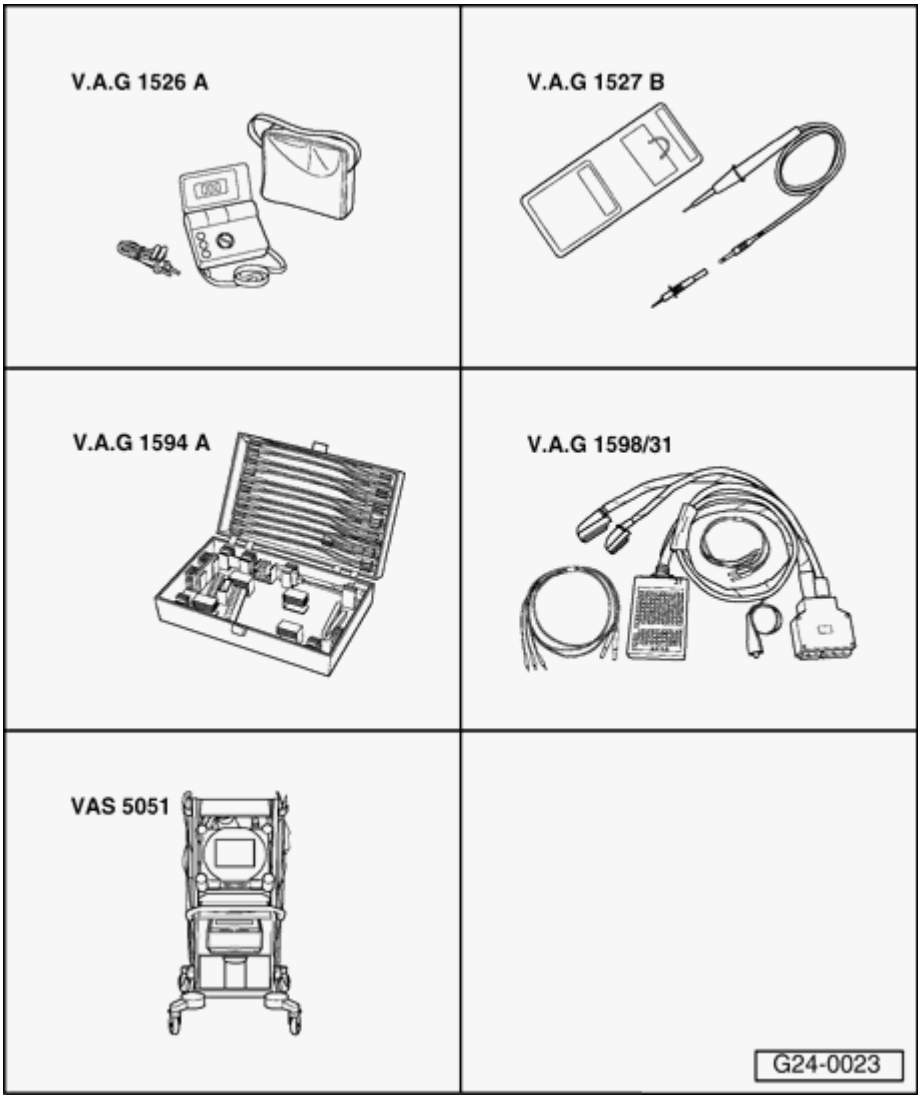


Fig. 632: Identifying Special Tools - Secondary Air Injection (AIR) Solenoid Valve -N112-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526A Multimeter
- VAG1527B Voltage tester
- VAG1594A Connector test kit
- VAG1598/31 Test box
- VAS5051 Vehicle diagnosis, testing and information system with VAG5051/1 Adapter

Requirement

- VAS5051 tester connected and vehicle On Board Diagnostic (OBD) function 01 "Engine electronics" selected.

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Work sequence

NOTE: The Secondary Air Injection (AIR) solenoid valve -N112- and wire connections are monitored by the Engine Control Module (ECM).

- Check DTC memory of Engine Control Module (ECM).

If a malfunction regarding Secondary Air Injection (AIR) solenoid valve -N112- is displayed:

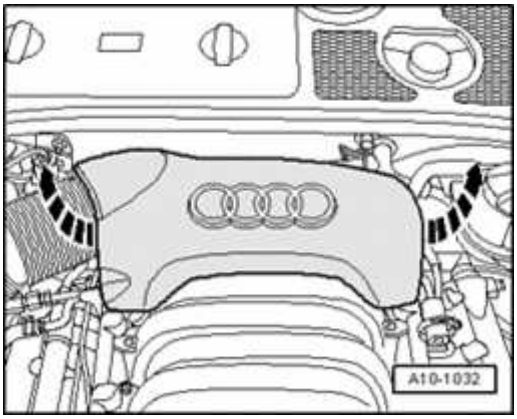


Fig. 633: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

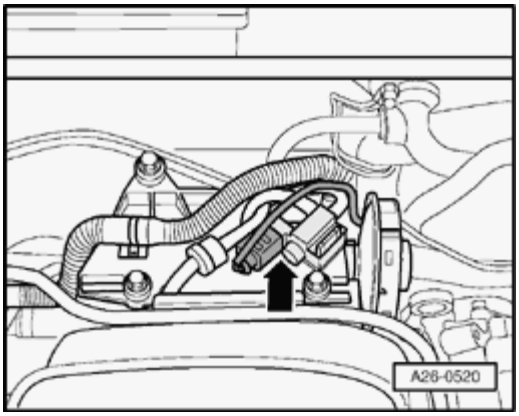


Fig. 634: Disconnecting Hoses From Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect hoses from Secondary Air Injection (AIR) solenoid valve -N112- (arrow); electrical harness connector remains connected.

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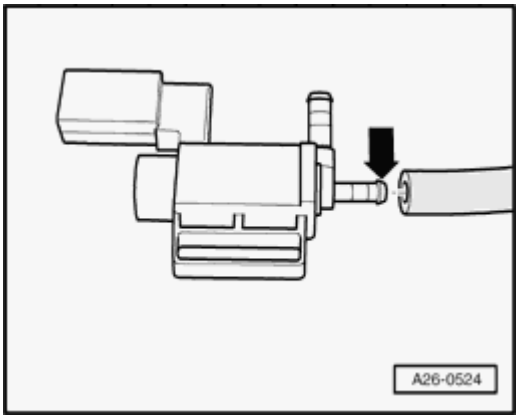


Fig. 635: Attaching Assisting Hose To Connection Of Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Attach assisting hose to connection of valve (indicated by an arrow).
- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) Solenoid Valve -N112-:

- Valve must click...
- ..and must open and close (can be tested by blowing into assisting hose).

If valve does not open or close properly:

- Replace Secondary Air Injection (AIR) solenoid valve -N112-.

If valve does not click during output Diagnostic Test Mode (DTM):

Checking internal resistance

- Switch ignition off.

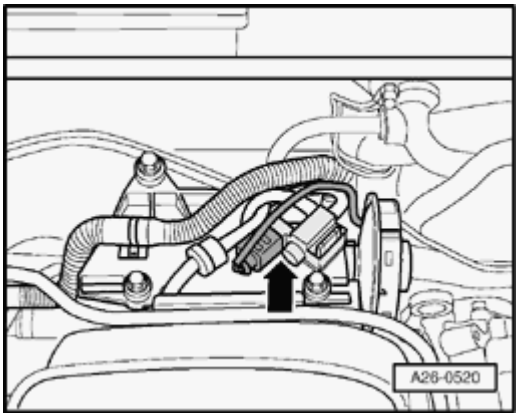


Fig. 636: Disconnecting Hoses From Secondary Air Injection (AIR) Solenoid Valve -N112-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Disconnect harness connector from Secondary Air Injection (AIR) solenoid valve -N112- (arrow).

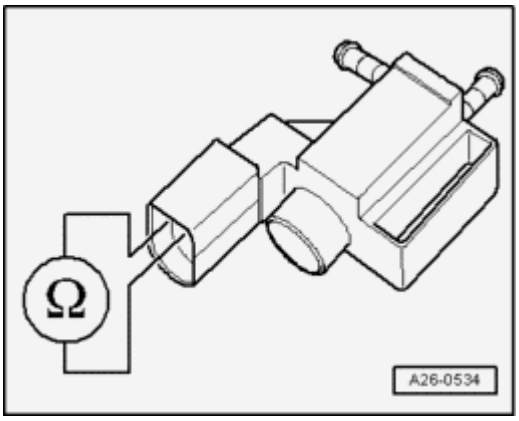


Fig. 637: Measuring Valve Resistance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter at valve for resistance measurement.
- Specification: 25 to 35 ohms

If specified value is not obtained:

- Replace Secondary Air Injection (AIR) solenoid valve -N112-.

If specified value is obtained:

Checking voltage supply

Requirements

- Fuse for Secondary Air Injection (AIR) OK

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Fuel Pump (FP) relay OK

NOTE: Voltage is supplied to Secondary Air Injection (AIR) solenoid valve -N112- via the Fuel Pump (FP) relay.

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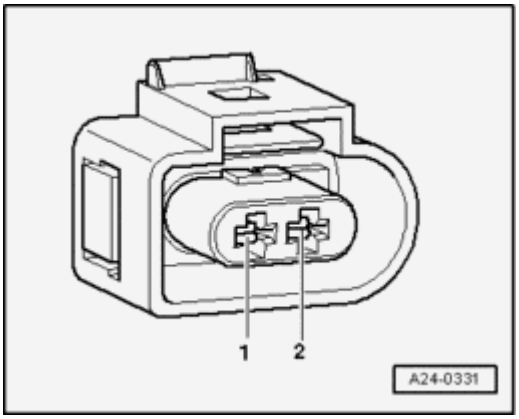


Fig. 638: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
1	Engine Ground (GND)

- Operate starter briefly.
- LED must light up

If LED does not light up:

- Check wire connection from terminal 1 of connector to Fuel Pump (FP) relay via fuse for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Repair open circuit if necessary.

If LED lights up:

Checking activation

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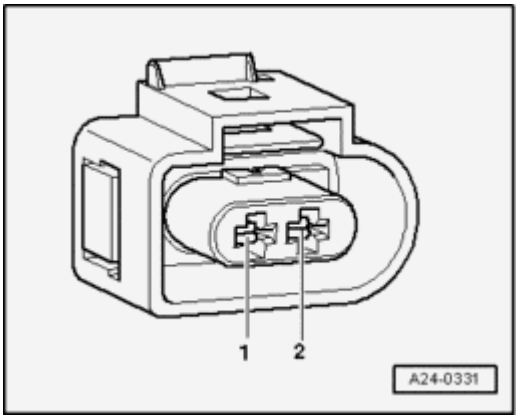


Fig. 639: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester to connector terminals 1 (B+) and 2.
- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) solenoid valve - N112-:

- LED must blink

If LED does not blink or if it remains constantly lit:

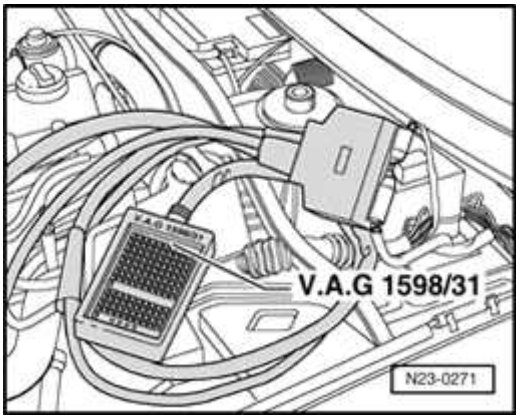


Fig. 640: VAG1598/31 Test Box Connected To Control Module Wiring Harness
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1598/31 test box to harness connectors of wiring harness (do not connect ECM). Connect Ground (GND) clip at test box (not visible in illustration) to Ground (GND).

Refer to **24 MULTIPORT FUEL INJECTION (MFI)**

- Check following wire connection for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket

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2	44

- Repair open circuit or short circuit if necessary.

Secondary Air Injection (AIR) pump relay -J299- and activation, checking

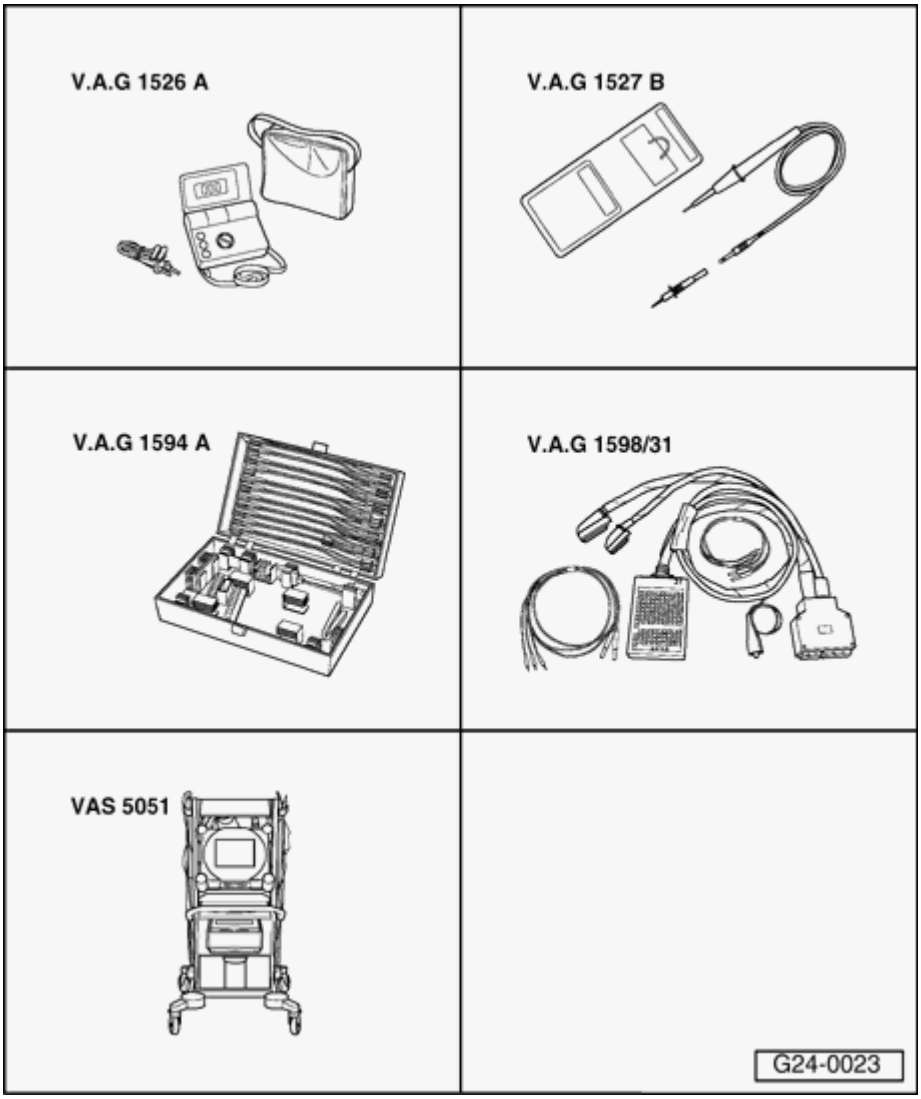


Fig. 641: Identifying Special Tools - Secondary Air Injection (AIR) Pump Relay -J299- And Activation, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526A Multimeter
- VAG1527B Voltage tester
- VAG1594A Connector test kit

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- VAG1598/31 Test box
- VAS5051 Vehicle diagnosis, testing and information system with VAG5051/1 Adapter

Requirement

- VAS5051 tester connected and vehicle On Board Diagnostic (OBD) function 01 "Engine electronics" selected.

Work sequence

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) pump relay -J299-.

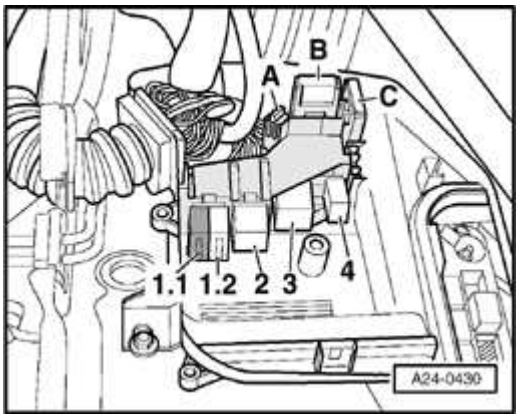


Fig. 642: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secondary Air Injection (AIR) pump relay -3- (in E-box, plenum chamber) must engage and Secondary Air Injection (AIR) pump relay -J299- must run in intervals

A - Does not engage relay:

- Check voltage supply of Secondary Air Injection (AIR) pump relay. Refer to **Checking voltage supply of Secondary Air Injection (AIR) pump relay**.
- Check activation of Secondary Air Injection (AIR) pump relay. Refer to **Check activation of the Secondary Air Injection (AIR) pump relay**.

B - If relay triggers, but Secondary Air Injection (AIR) pump motor does not run:

- Check voltage supply of Secondary Air Injection (AIR) pump motor. Refer to **Check voltage supply of the Secondary Air Injection (AIR) pump motor**.

Checking voltage supply of Secondary Air Injection (AIR) pump relay

- Switch ignition off.

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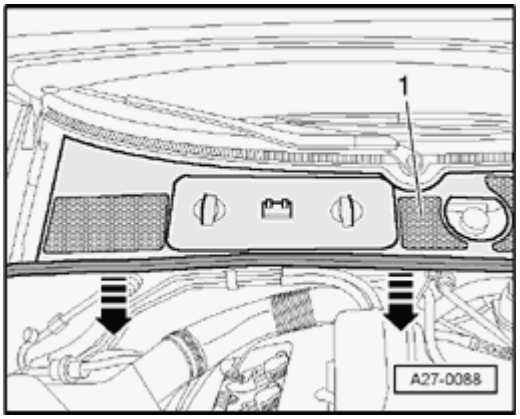


Fig. 643: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull rubber seal off of plenum chamber cover in direction of arrow.
- Remove plenum chamber cover -1- toward front.

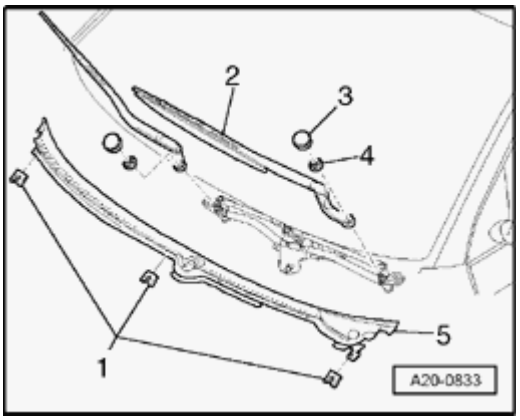


Fig. 644: Removing Securing Clips And Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off both covers -3- using a screwdriver.
- Loosen hex-nuts -4- by several turns.
- Loosen wiper arm -2- by lightly tilting from wiper axle.
- Remove hex nuts completely and remove wiper arms.

- Disconnect securing clips -1- and remove cowl grille -5-.

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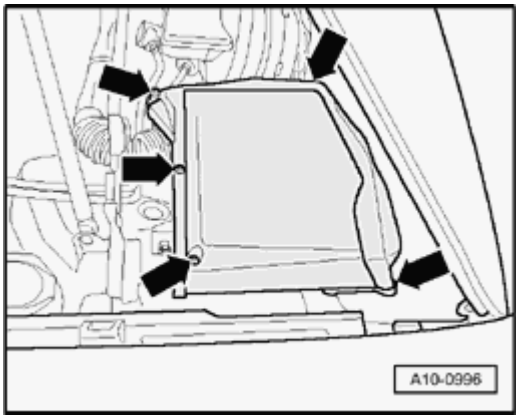


Fig. 645: Removing Screws And Cover From E-Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove E-box cover in plenum chamber (arrows).

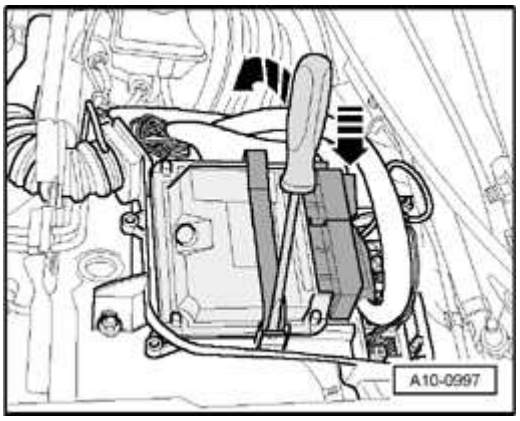
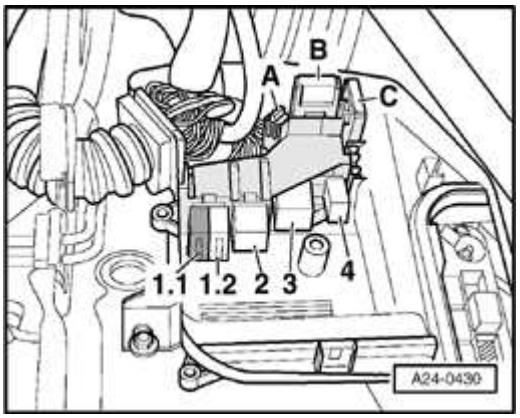


Fig. 646: Using Screwdriver To Remove Retainer Bar And Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off Engine Control Module (ECM) retaining bracket (arrows) using a screwdriver and set control module aside.
- If installed, unclip Transmission Control Module (TCM) retaining bracket and set control module aside.



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Fig. 647: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Secondary Air Injection (AIR) pump relay -3-.

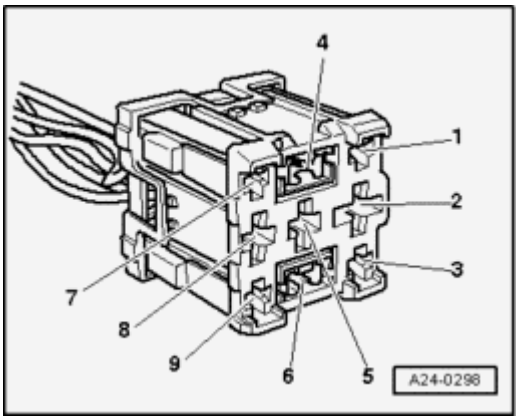


Fig. 648: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter for voltage measurement as follows.

Relay carrier in E-box, plenum chamber, Position 3 Terminal	Measure to
8	Engine Ground (GND)

- Specification: approx. battery voltage

If specified value is not obtained:

- Perform following tests marked with dots:

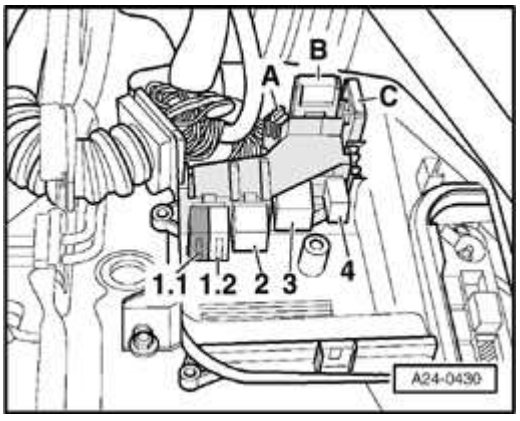


Fig. 649: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Check Fuse for secondary air pump -S130- (40 A) in E-Box, plenum chamber, position B.
- Check wire connection from battery + (terminal 30) via Fuse for secondary air pump -S130- to Secondary Air Injection (AIR) pump relay -J299- (in relay and fuse carrier in E-Box, plenum chamber, position 3) for open circuit.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

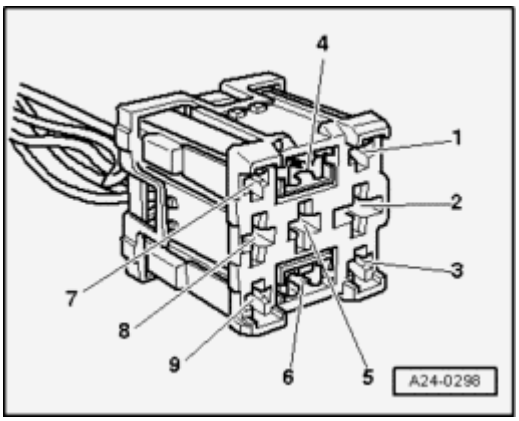


Fig. 650: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter for voltage measurement as follows.

Relay carrier in E-box, plenum chamber, Position 3 Terminal	Measure to
4	Engine Ground (GND)

- Operate starter briefly.

- Specification: approx. battery voltage

If specified value is not obtained:

- Perform following tests marked with dots:

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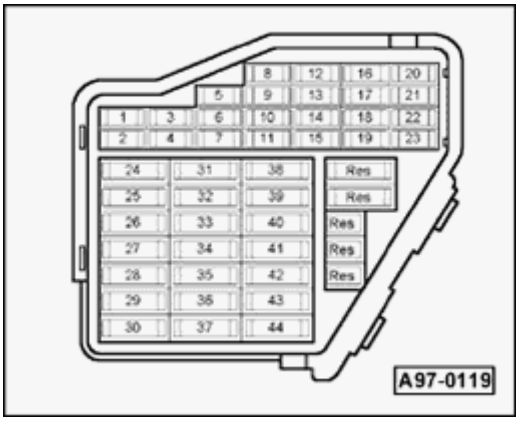


Fig. 651: Main Fuse Case
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check fuse -S234- in fuse holder (position 34).
- Check wire connection from Secondary Air Injection (AIR) pump relay -J299- (in 3-socket relay carrier in E-box, plenum chamber) via Fuse in fuse holder -S234- (position 34) to Fuel Pump (FP) relay for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

Check activation of the Secondary Air Injection (AIR) pump relay

- Switch ignition off.
- Remove Secondary Air Injection (AIR) pump relay

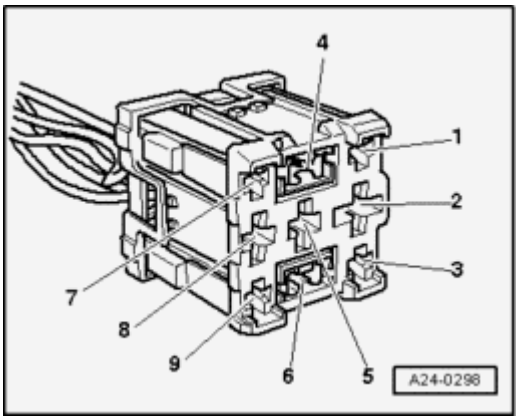


Fig. 652: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester as follows:

Relay carrier in E-box, plenum chamber, Position 3 Terminal	Measure to

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6	Engine Ground (GND)

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) rump relay - J299-.

- LED must blink

If LED does not blink:

- Switch ignition off.

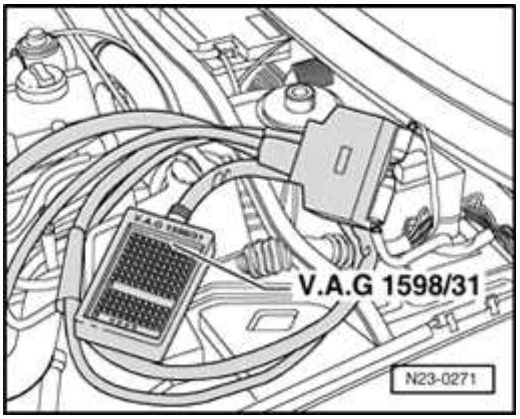


Fig. 653: VAG1598/31 Test Box Connected To Control Module Wiring Harness
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1598/31 test box to harness connectors of wiring harness (do not connect ECM). Connect Ground (GND) clip at test box (not visible in illustration) to Ground (GND).

Refer to **24 MULTIPORT FUEL INJECTION (MFI)**

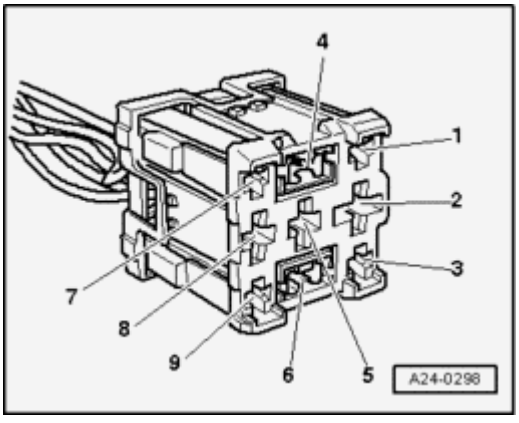


Fig. 654: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check following wire connection for open circuit and short circuit to Ground (GND) and B+:

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Relay carrier in E-box, Plenum chamber, Position 3 Terminal	VAG1598/31 test box Socket
6	46

- Repair open circuit or short circuit if necessary.

If no malfunctions are detected:

- Replace Secondary Air Injection (AIR) pump relay -J299-.

Check voltage supply of the Secondary Air Injection (AIR) pump motor

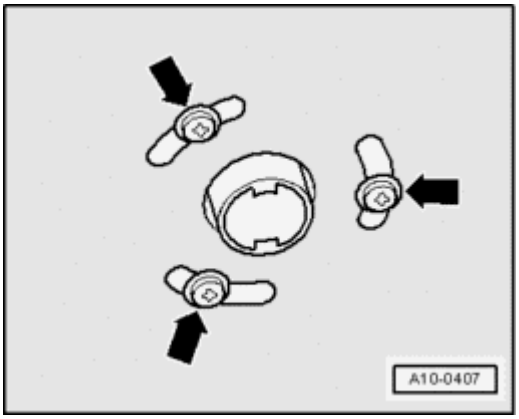


Fig. 655: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater at sound insulation.

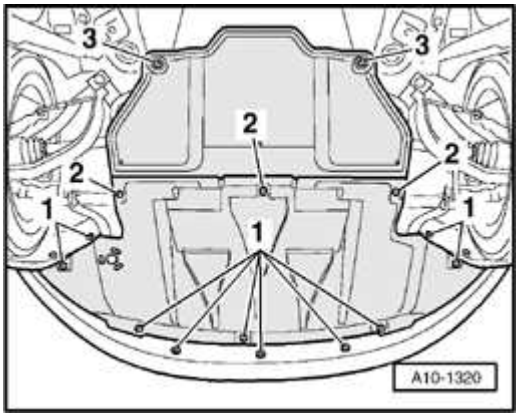


Fig. 656: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.

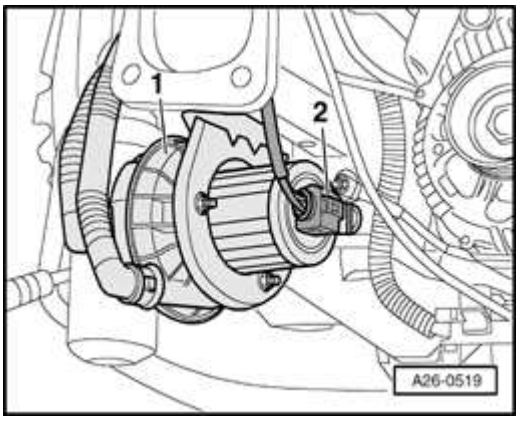


Fig. 657: Disconnecting Electrical Harness Connector At Secondary Air Injection (AIR) Pump Motor -V101-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector -2- at Secondary Air Injection (AIR) pump motor -V101-, -1-.

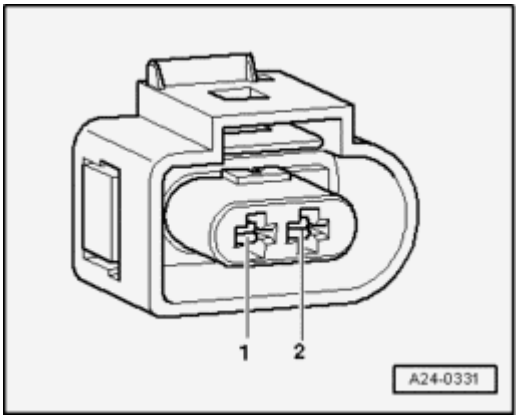


Fig. 658: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1527B voltage tester between terminals 1 and 2
- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) pump relay -J299-.

- LED must blink

If LED does not blink:

- Perform following tests marked with dots:

- Check wire connection from terminal 2 of connector to Secondary Air Injection (AIR) pump relay -J299- (in relay carrier in E-Box, plenum chamber, position 3) for open circuit.

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Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Check wire connection from terminal 1 of connector to Ground (GND) for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

If no malfunctions are detected:

- Replace Secondary Air Injection (AIR) pump motor -V101-.

Secondary Air Injection (AIR) pump motor -V101-, removing and installing

Removing

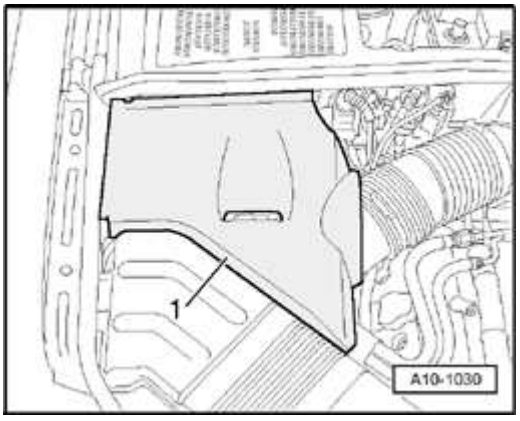


Fig. 659: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

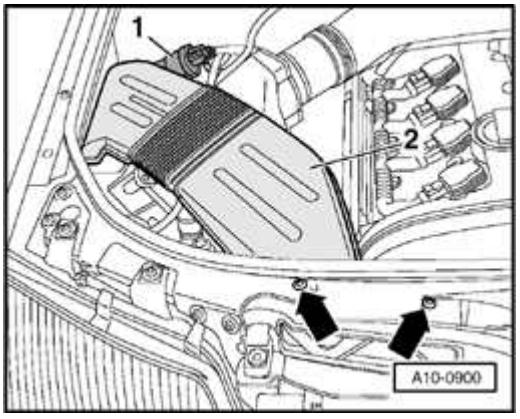


Fig. 660: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).

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- Detach Evaporative Emission (EVAP) canister purge regulator valve -N80- -1- at air guide.
- Remove air guide -2-.

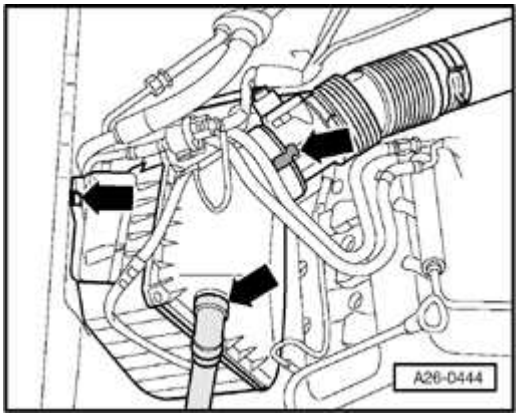


Fig. 661: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).
- Remove both bolts on Secondary Air Injection (AIR) pump bracket, which are accessible from top.

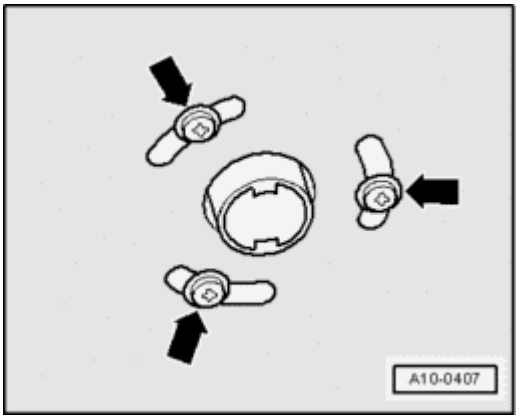


Fig. 662: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater at sound insulation.

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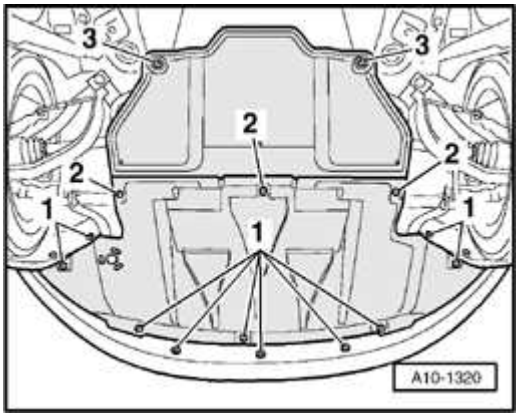


Fig. 663: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.

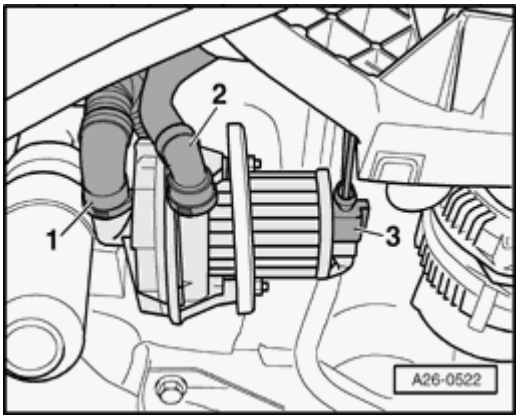


Fig. 664: Disconnecting Electrical Harness Connector & Air Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connector -3-.
- Disconnect air hoses -1- and -2-.
- Remove bolts for Secondary Air Injection (AIR) pump bracket, which are accessible from bottom.
- Remove Secondary Air Injection (AIR) pump motor -V101- with bracket.

- If necessary, separate Secondary Air Injection (AIR) pump motor -V101- from bracket.

Installing

Installation is the reverse of removal.

Tightening torques

Component	Nm

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Secondary Air Injection (AIR) pump motor to bracket	10
Bracket for Secondary Air Injection (AIR) pump motor to chassis	10

Combination valve for Secondary Air Injection (AIR), checking function and proper seal

Special tools and equipment

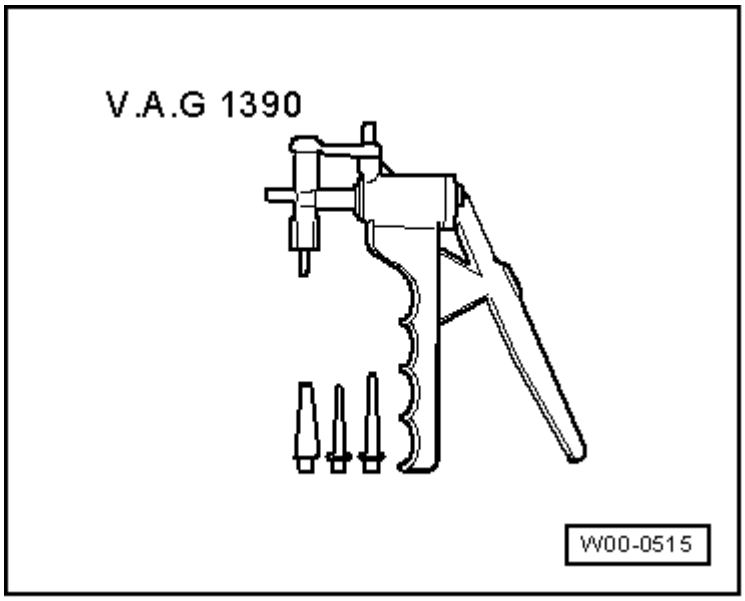


Fig. 665: Identifying Hand Vacuum Pump V.A.G. 1390
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1390 Hand vacuum pump

Requirements

- Vacuum lines and hose connections leak-free.
- Vacuum lines not clogged.

Work sequence

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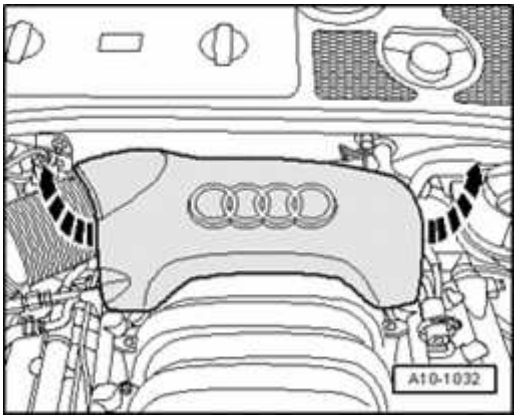


Fig. 666: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

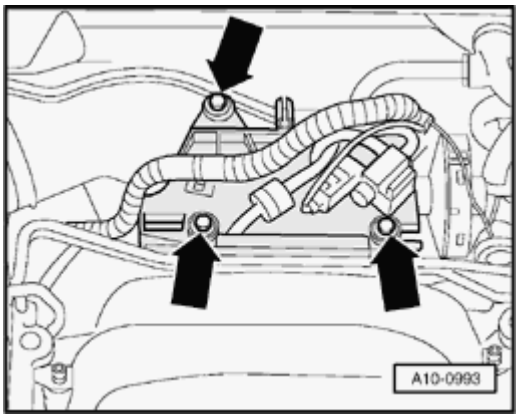
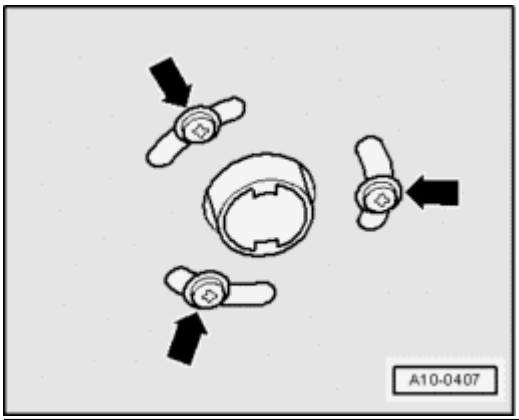


Fig. 667: Removing Bolts For Holding Plate For Solenoid Valves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate for solenoid valves (arrows).
- Lift up holding plate and disconnect vacuum hose from Y-piece of combination valve to be checked.
- Connect VAG1390 hand vacuum pump to vacuum hose of combination valve to be checked.



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Fig. 668: Identifying Exhaust Pipe Fasteners
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of auxiliary heater at sound insulation.

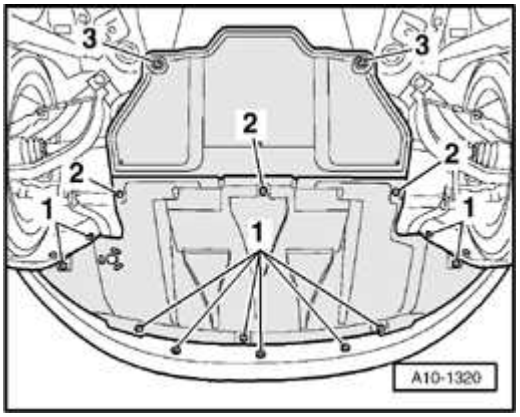


Fig. 669: Identifying Quick-Release Fasteners And Noise Insulation
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front sound insulation.

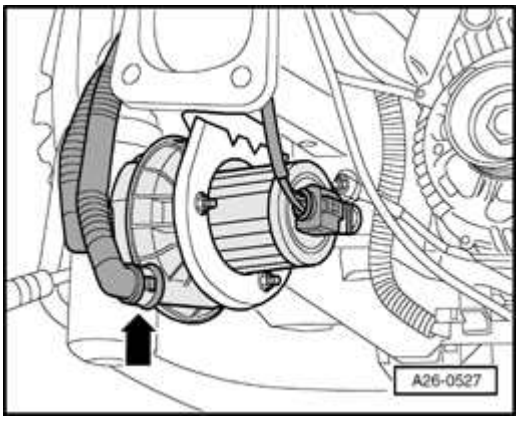


Fig. 670: Disconnecting Pressure Hose At Secondary Air Injection (AIR) Pump Motor And Blow Into It With Light Pressure
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect pressure hose (arrow) at Secondary Air Injection (AIR) pump motor and blow into it with light pressure (do not use pressurized air).

- Both combination valves must be closed, it must not be possible to blow through hose

- Operate hand vacuum pump.

- Relevant combination valve must open, it must be possible to blow through

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If the relevant combination valve does not open:

- Replace combination valve. Refer to **Left combination valve for secondary air injection, removing and installing** or **Right combination valve for secondary air injection, removing and installing**.

Left combination valve for secondary air injection, removing and installing

Removing

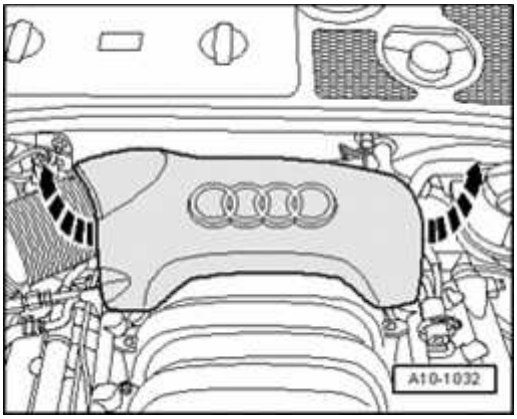


Fig. 671: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

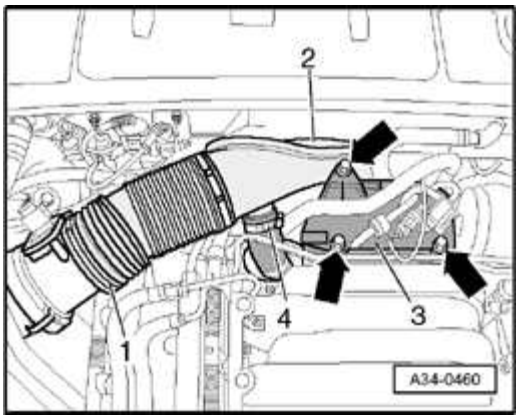


Fig. 672: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air hose -1- at Mass Air Flow (MAF) sensor.
- Disconnect hose -4- for crankcase ventilation from air guide -2-.

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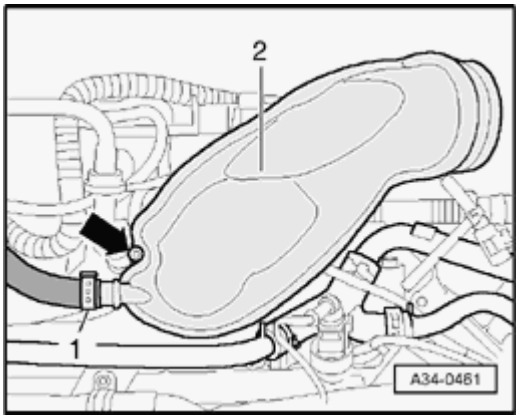


Fig. 673: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air guide -2- at throttle valve control module.
- Disconnect hose -1- from air guide.

NOTE: The illustration shows the air guide from the rear with the engine removed.

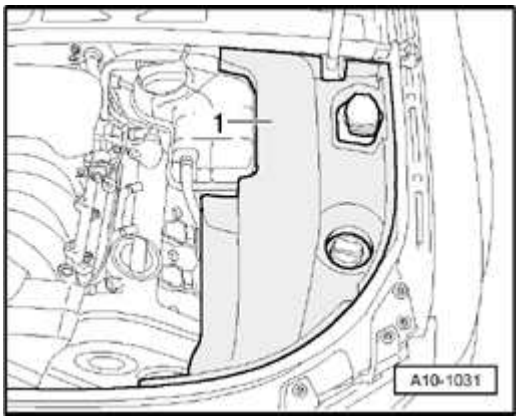


Fig. 674: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

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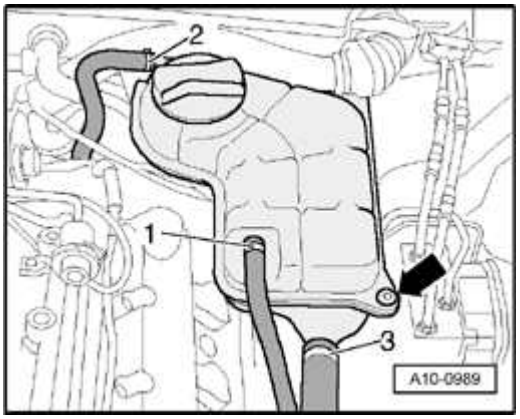


Fig. 675: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clamp coolant hose -2- using 3094 hose clamps and disconnect coolant hose from coolant reservoir.
- Unbolt coolant reservoir (arrow).
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- at bottom of coolant reservoir.
- Lay coolant reservoir with connected coolant hoses -1- and -3- to side.

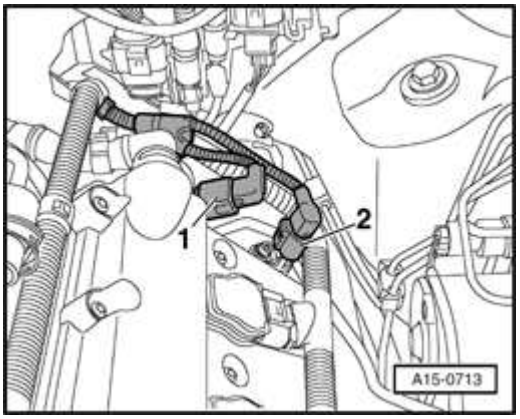


Fig. 676: Disconnecting Electrical Harness Connectors And At Camshaft Position (CMP) Sensor 2 -G163- And Camshaft Position (CMP) Sensor 4 -G301-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect electrical harness connectors -1- and -2- at Camshaft Position (CMP) sensor 2 -G163- and Camshaft Position (CMP) sensor 4 -G301-.
- Disconnect hose -3- from crankcase ventilation at cylinder head cover.

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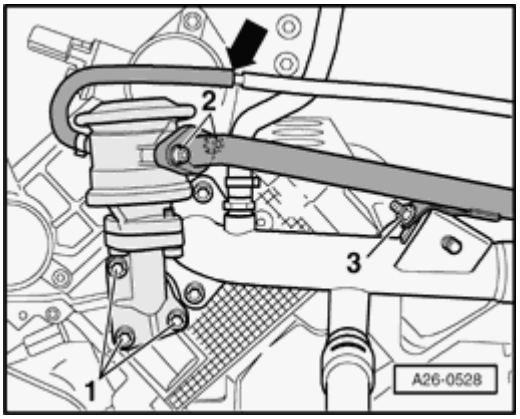


Fig. 677: Identifying Bolts At Flange Of Combination Valve For Secondary Air Injection, Nut, Combination Valve & Vacuum Hose
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts -1- at flange of combination valve for secondary air injection.
- Loosen nut -3- several turns.
- Remove bolts -2- and and disconnect vacuum hose (arrow).
- Remove combination valve.

NOTE: Illustration is shown with engine removed.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and O-rings.

- Top up coolant. Refer to **Filling**.

Tightening torques

Component		Nm
Combination valve to cylinder head		10
Connector tube to	Combination valve	10
	Coolant line	10

Right combination valve for secondary air injection, removing and installing

Removing

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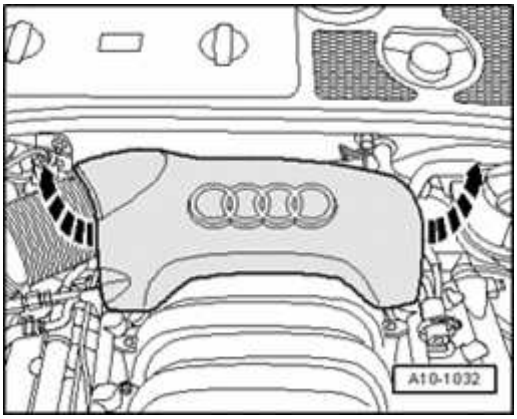


Fig. 678: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

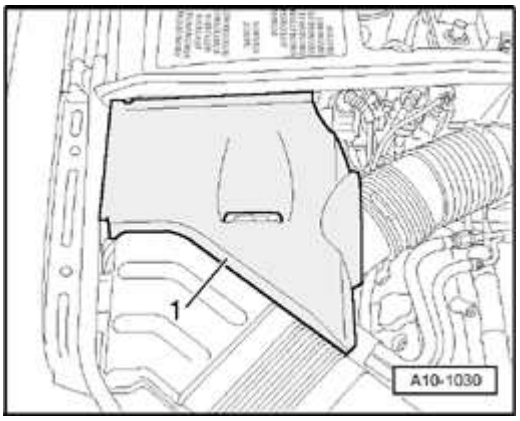


Fig. 679: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

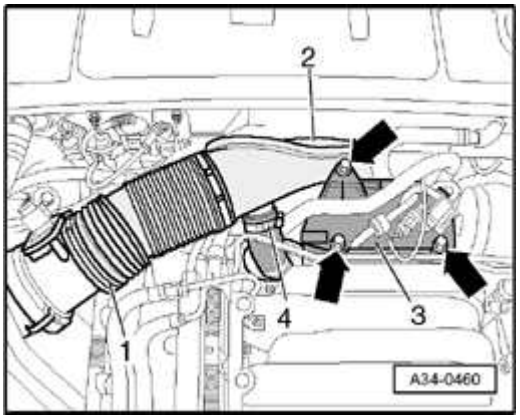


Fig. 680: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air hose -1- at Mass Air Flow (MAF) sensor.
- Disconnect hose -4- for crankcase ventilation from air guide -2-.

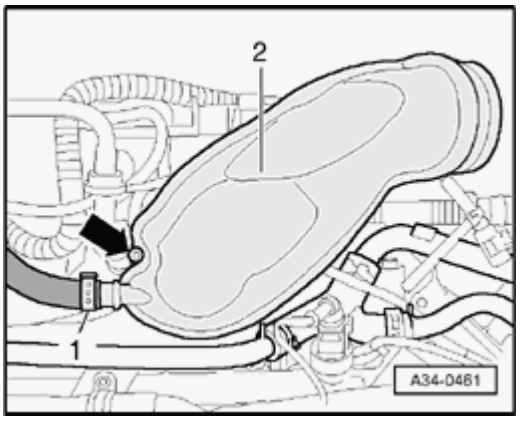


Fig. 681: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air guide -2- at throttle valve control module.
- Disconnect hose -1- from air guide.

NOTE: The illustration shows the air guide from the rear with the engine removed.

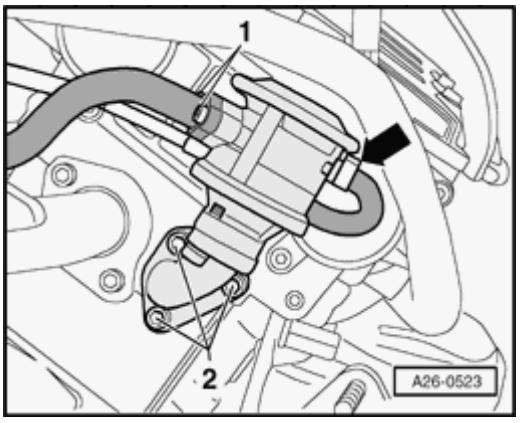


Fig. 682: Unscrewing Bolts And Removing Combination Valve
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew bolts -1- and -2- and remove combination valve.
- Disconnect vacuum hose (arrow).

Installing

Installation is reverse of removal, noting the following:

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NOTE: Replace gaskets and O-rings.

Tightening torques

Component	Nm
Combination valve to cylinder head	10
Connecting tube to combination valve	10

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2002-2004 ENGINE

Exhaust System, Emission Controls, 3.0L AVK - A4

EXHAUST SYSTEM, EMISSION CONTROLS

EXHAUST SYSTEM, SERVICING

NOTE:

- **Always replace gaskets and self-locking nuts.**
- **After exhaust system repairs, make sure exhaust system is not under stress and is far enough from the body. If necessary, loosen clamps and align mufflers and exhaust pipes so that there is adequate distance to vehicle body, and weight is evenly distributed among the exhaust hangers.**
- **Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.**

Exhaust system components, overview (Front Wheel Drive vehicles)

The following list pertains to **Fig. 1** .

1. **Center muffler**
   - Factory installed with rear muffler as one unit. If repair is necessary, replace separately
   - Cutting point, see **Procedure**
   - Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)**
2. **23 Nm**
3. **Support ring**
   - Replace if damaged
4. **27 Nm**
   - Always replace
5. **Exhaust manifold**
   - For cylinder bank 1 (right)
   - Removing and installing. See **RIGHT EXHAUST MANIFOLD, REMOVING AND INSTALLING**
6. **Gasket**
   - Always replace
7. **Oxygen sensor - 55 Nm**
   - Before catalytic converter
   - For cylinder bank 1 (right)
   - Only grease threads with "G 052 112 A3", do NOT allow grease to get into slots on sensor body
8. **Oxygen sensor - 55 Nm**

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- Before catalytic converter
- For cylinder bank 2 (left)
- Only grease threads with "G 052 112 A3", do NOT allow grease to get into slots on sensor body

9. **Exhaust manifold**
   - For cylinder bank 2 (left)
   - Removing and installing. See **LEFT EXHAUST MANIFOLD, REMOVING AND INSTALLING**
10. **Gasket**
    - Always replace
11. **27 Nm**
    - Always replace
12. **Oxygen sensor - 55 Nm**
    - Behind catalytic converter
    - For cylinder bank 2 (left)
    - Only grease threads with "G 052 112 A3", do NOT allow grease to get into slots on sensor body
13. **Front exhaust pipe with catalytic converter**
    - For cylinder bank 2 (left)
    - With decoupling element
    - Decoupling element must not be bent more than 10°, otherwise it may be damaged
    - Protect from hit- and impact stress
    - Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
    - Individual mounting components for vehicles with manual transmission. See **INDIVIDUAL LEFT MOUNTING COMPONENTS FOR VEHICLES WITH MANUAL TRANSMISSION** .
    - Individual mounting components for vehicles with automatic transmission 01J. See **INDIVIDUAL LEFT MOUNTING COMPONENTS FOR VEHICLES WITH AUTOMATIC TRANSMISSION 01J** .
    - Vehicles with manual transmission, removing and installing. See **LEFT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH MANUAL TRANSMISSION)** .
    - Vehicles with automatic transmission 01 J, removing and installing. See **LEFT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH AUTOMATIC TRANSMISSION 01J)** .
14. **Front clamping sleeve**
    - Before tightening ensure exhaust system is free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
    - Installation position. See **INSTALLED POSITION OF FRONT CLAMPING SLEEVES** .
    - Tighten bolts evenly
15. **40 Nm**

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16. **Oxygen sensor - 55 Nm**
    - Behind catalytic converter
    - For cylinder bank 1 (right)
    - Only grease threads with "G 052 112 A3", do NOT allow grease to get into slots on sensor body
17. **Front exhaust pipe with catalytic converter**
    - For cylinder bank 1 (right)
    - With decoupling element
    - Decoupling element must not be bent more than 10°, otherwise it may be damaged
    - Protect from hit- and impact stress
    - Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
    - Individual mounting components for vehicles with manual transmission. See **INDIVIDUAL RIGHT MOUNTING COMPONENTS FOR VEHICLES WITH MANUAL TRANSMISSION** .
    - Individual mounting components for vehicles with automatic transmission 01J. See **INDIVIDUAL RIGHT MOUNTING COMPONENTS FOR VEHICLES WITH AUTOMATIC TRANSMISSION 01J**
    - Vehicles with manual transmission, removing and installing. See **RIGHT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH MANUAL TRANSMISSION)**
    - Vehicles with automatic transmission 01 J, removing and installing. See **RIGHT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH AUTOMATIC TRANSMISSION 01J)** .
18. **Rear muffler**
    - For left side of vehicle
    - Factory-installed with center muffler as one unit. If repair is necessary, replace separately
    - Cutting point, see **PROCEDURE**
    - Replacing end pipes, see **REPLACING END PIPE**
    - Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
19. **Support ring**
    - Replace if damaged
20. **23 Nm**
21. **Rear muffler**
    - For right side of vehicle
    - Factory-installed with center muffler as one unit. If repair is necessary, replace separately
    - Cutting point, see **PROCEDURE**
    - Replacing end pipes, see **REPLACING END PIPE**
    - Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .

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22. **23 Nm**
23. **Rear clamping sleeve**
    - Used when center or rear muffler is replaced separately.
    - Before tightening ensure exhaust system is free of stress, see **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
    - Installation position, see **INSTALLED POSITION OF REAR CLAMPING SLEEVES**
    - Tighten bolts evenly
24. **40 Nm**
25. **Support ring**
    - Replace if damaged
26. **23 Nm**

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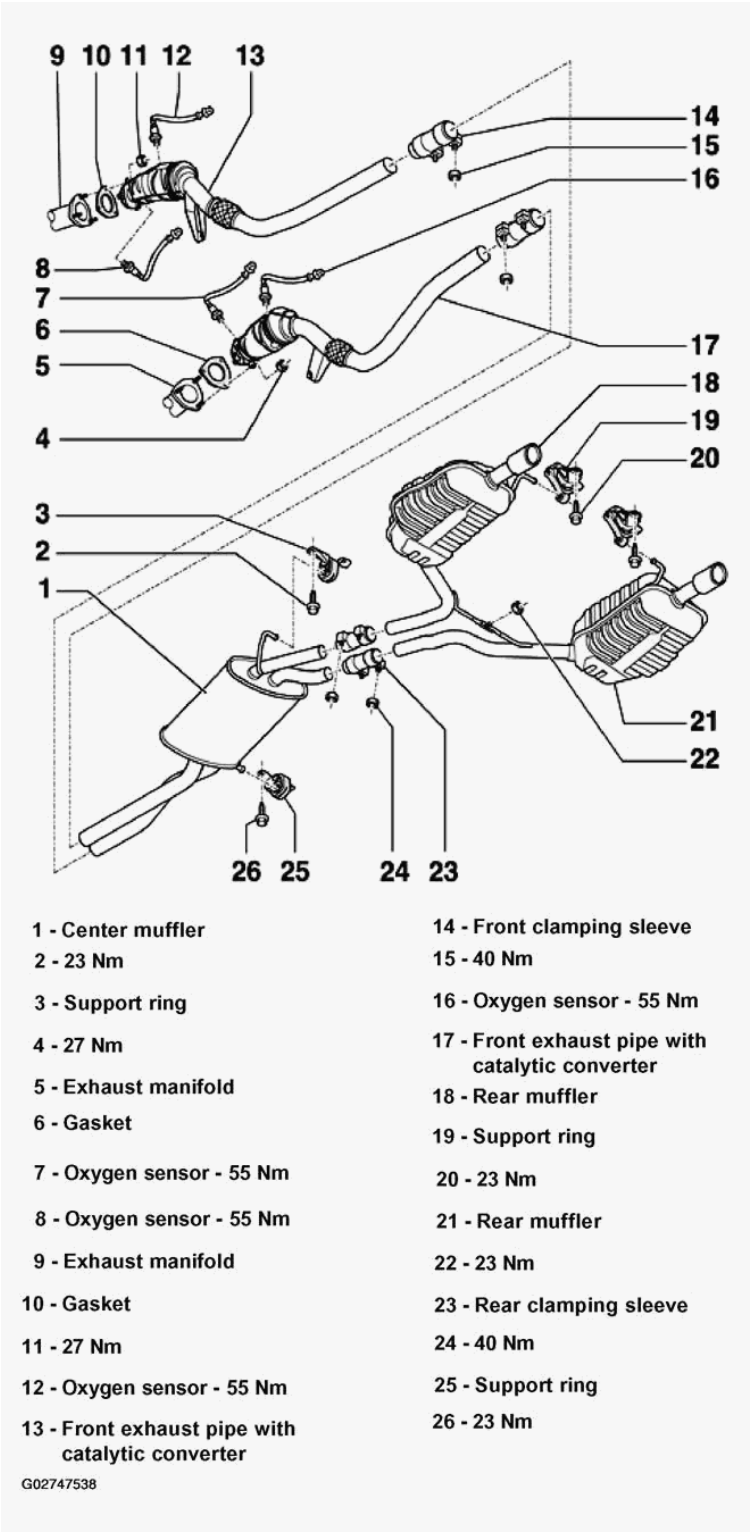


Fig. 1: Overview Of Exhaust System Components - Front Wheel Drive Vehicles
Courtesy of AUDI OF AMERICA, INC.

Exhaust system components, overview, (All Wheel Drive vehicles)

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The following list pertains to **Fig. 2** .

1. **23 Nm**
2. **Support ring**
   - Replace if damaged
3. **Center muffler**
   - Factory-installed with rear muffler as one unit. If repair is necessary, replace separately
   - Cutting point, see **PROCEDURE**
   - Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)**
4. **27 Nm**
   - Always replace
5. **Exhaust manifold**
   - For cylinder bank 1 (right)
   - Removing and installing, see **RIGHT EXHAUST MANIFOLD, REMOVING AND INSTALLING**
6. **Gasket**
   - Always replace
7. **Oxygen sensor - 55 Nm**
   - Before catalytic converter
   - For cylinder bank 1 (right)
   - Only grease threads with "G 052 112 A3", do NOT allow grease to get into slots on sensor body
8. **Oxygen sensor - 55 Nm**
   - Before catalytic converter
   - For cylinder bank 2 (left)
   - Only grease threads with "G 052 112 A3", do NOT allow grease to get into slots on sensor body
9. **Exhaust manifold**
   - Cylinder bank 2 (left)
   - Removing and installing, see **LEFT EXHAUST MANIFOLD, REMOVING AND INSTALLING**
10. **Gasket**
    - Always replace
11. **27 Nm**
    - Always replace
12. **Oxygen sensor - 55 Nm**
    - Behind catalytic converter
    - For cylinder bank 2 (left)
    - Only grease threads with "G 052 112 A3", do NOT allow grease to get into slots on sensor body

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13. **Front exhaust pipe with catalytic converter**
    - For cylinder bank 2 (left)
    - With decoupling element
    - Decoupling element must not be bent more than 10°, otherwise it may be damaged
    - Protect from hit- and impact stress
    - Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
    - Individual mounting components for vehicles with manual transmission, see **INDIVIDUAL RIGHT MOUNTING COMPONENTS FOR VEHICLES WITH MANUAL TRANSMISSION**
    - Individual mounting components for vehicles with automatic transmission 01V, see **INDIVIDUAL RIGHT MOUNTING COMPONENTS FOR VEHICLES WITH AUTOMATIC TRANSMISSION 01V**
    - Vehicles with manual transmission, removing and installing, see **RIGHT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH MANUAL TRANSMISSION)**
    - Vehicles with automatic transmission 01V, removing and installing, see **RIGHT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH AUTOMATIC TRANSMISSION 01V)**
14. **Front clamping sleeve**
    - Before tightening ensure exhaust system is free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
    - Installation position, see **INSTALLED POSITION OF FRONT CLAMPING SLEEVES**
    - Tighten bolts evenly
15. **40 Nm**
16. **Oxygen sensor - 55 Nm**
    - Behind catalytic converter
    - For cylinder bank 1 (right)
    - Only grease threads with "G 052 112 A3", do NOT allow grease to get into slots on sensor body
17. **Front exhaust pipe with catalytic converter**
    - For cylinder bank 1 (right)
    - With decoupling element
    - Decoupling element must not be bent more than 10°, otherwise it may be damaged
    - Protect from hit- and impact stress
    - Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
    - Individual mounting components for vehicles with manual transmission, see **INDIVIDUAL LEFT MOUNTING COMPONENTS FOR VEHICLES WITH MANUAL TRANSMISSION**
    - Individual mounting components for vehicles with automatic transmission 01V, see **INDIVIDUAL LEFT MOUNTING COMPONENTS FOR VEHICLES WITH AUTOMATIC**

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TRANSMISSION 01V

- Vehicles with manual transmission, removing and installing, see **LEFT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH MANUAL TRANSMISSION)**
- Vehicles with automatic transmission 01V, removing and installing, see **LEFT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH AUTOMATIC TRANSMISSION 01V)**

18. **Rear muffler**
    - For left side of vehicle
    - Factory-installed with center muffler as one unit. If repair is necessary, replace separately
    - Cutting point, see **PROCEDURE**
    - Replacing end pipes, see **REPLACING END PIPE**
    - Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
19. **Support ring**
    - Replace if damaged
20. **23 Nm**
21. **Rear muffler**
    - For right side of vehicle
    - Factory-installed with center muffler as one unit. If repair is necessary, replace separately
    - Cutting point, see **PROCEDURE**
    - Replacing end pipes, see **REPLACING END PIPE**
    - Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
22. **23 Nm**
23. **40 Nm**
24. **Rear clamping sleeve**
    - Used when center or rear muffler is replaced separately.
    - Before tightening ensure exhaust system is free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
    - Installation position, see **INSTALLED POSITION OF REAR CLAMPING SLEEVES**
    - Tighten bolts evenly

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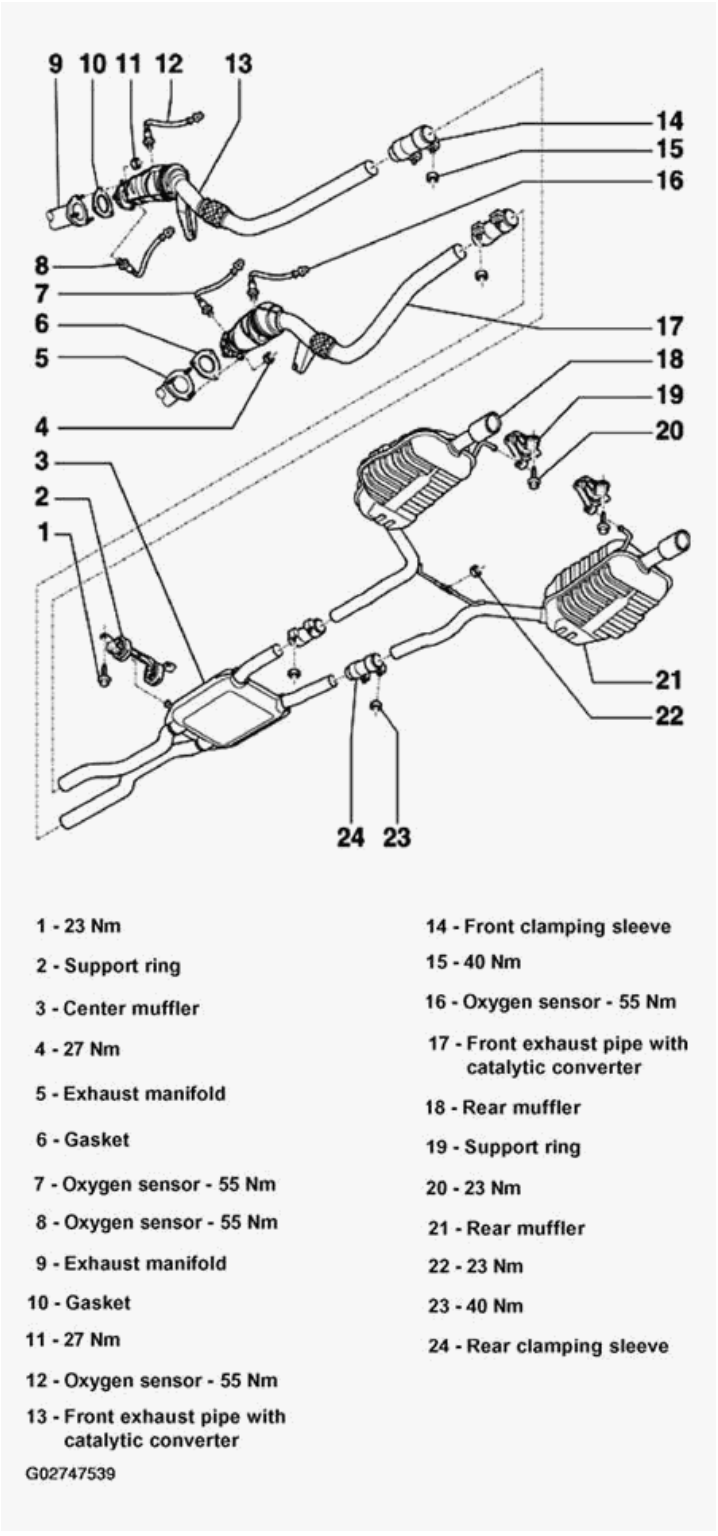


Fig. 2: Overview Of Exhaust System Components - All Wheel Drive vehicles
Courtesy of AUDI OF AMERICA, INC.

Installed position of front clamping sleeves

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- Install double clamps so that the bolt ends do not project over lower edge of double clamp.
  - Threaded connections face each other

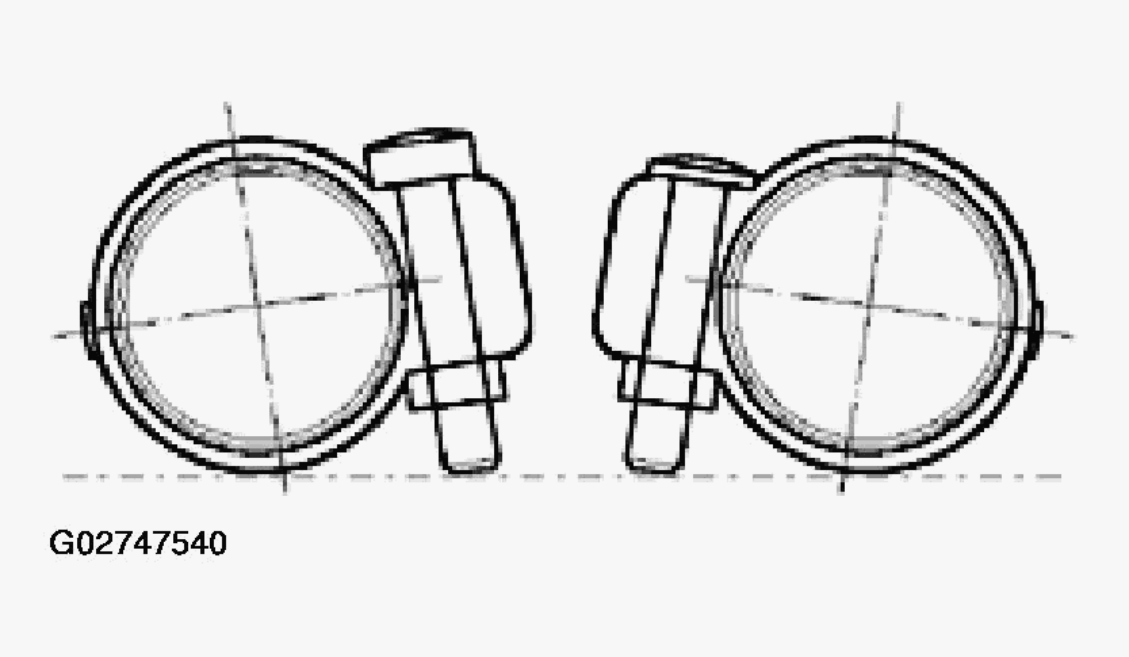


Fig. 3: Identifying Installed Position Of Front Clamping Sleeves
Courtesy of AUDI OF AMERICA, INC.

Installed position of rear clamping sleeves

- Install double clamps so that the bolt ends do not project over lower edge of double clamp.
  - Threaded connections face outward

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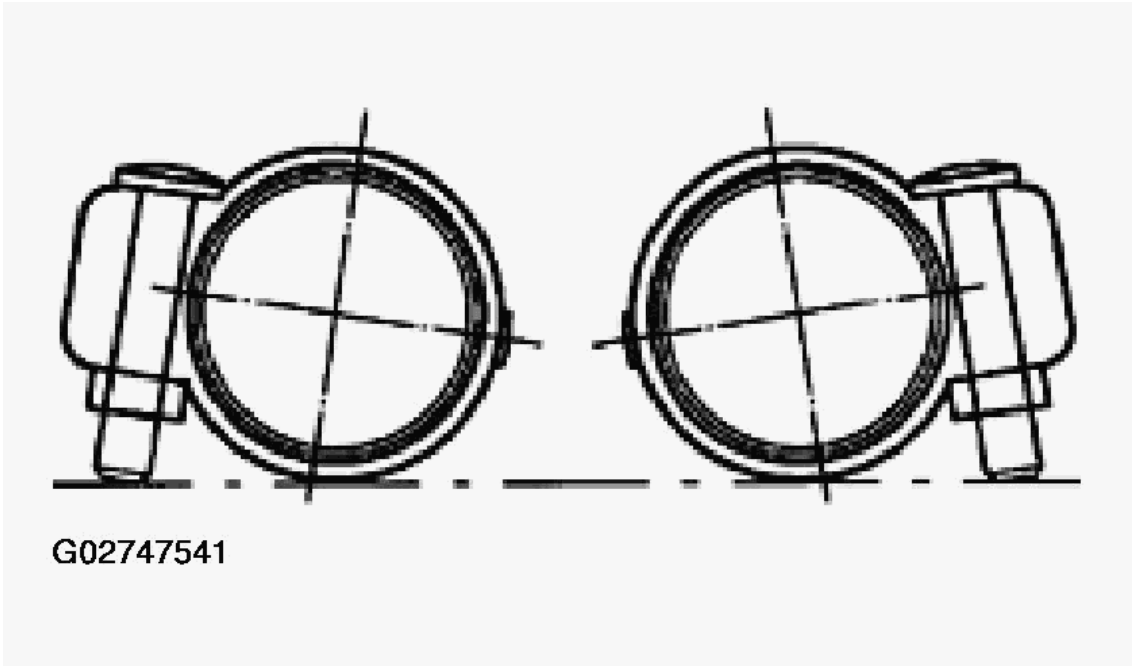


Fig. 4: Identifying Installed Position Of Rear Clamping Sleeves
Courtesy of AUDI OF AMERICA, INC.

Individual left mounting components for vehicles with manual transmission

1. Self-locking nut (25Nm)
2. Spacer sleeve
3. Strap
4. Buffer
5. Spacer sleeve
6. Bolt (25Nm)
7. Washer
8. Compression spring
9. Spacer sleeve

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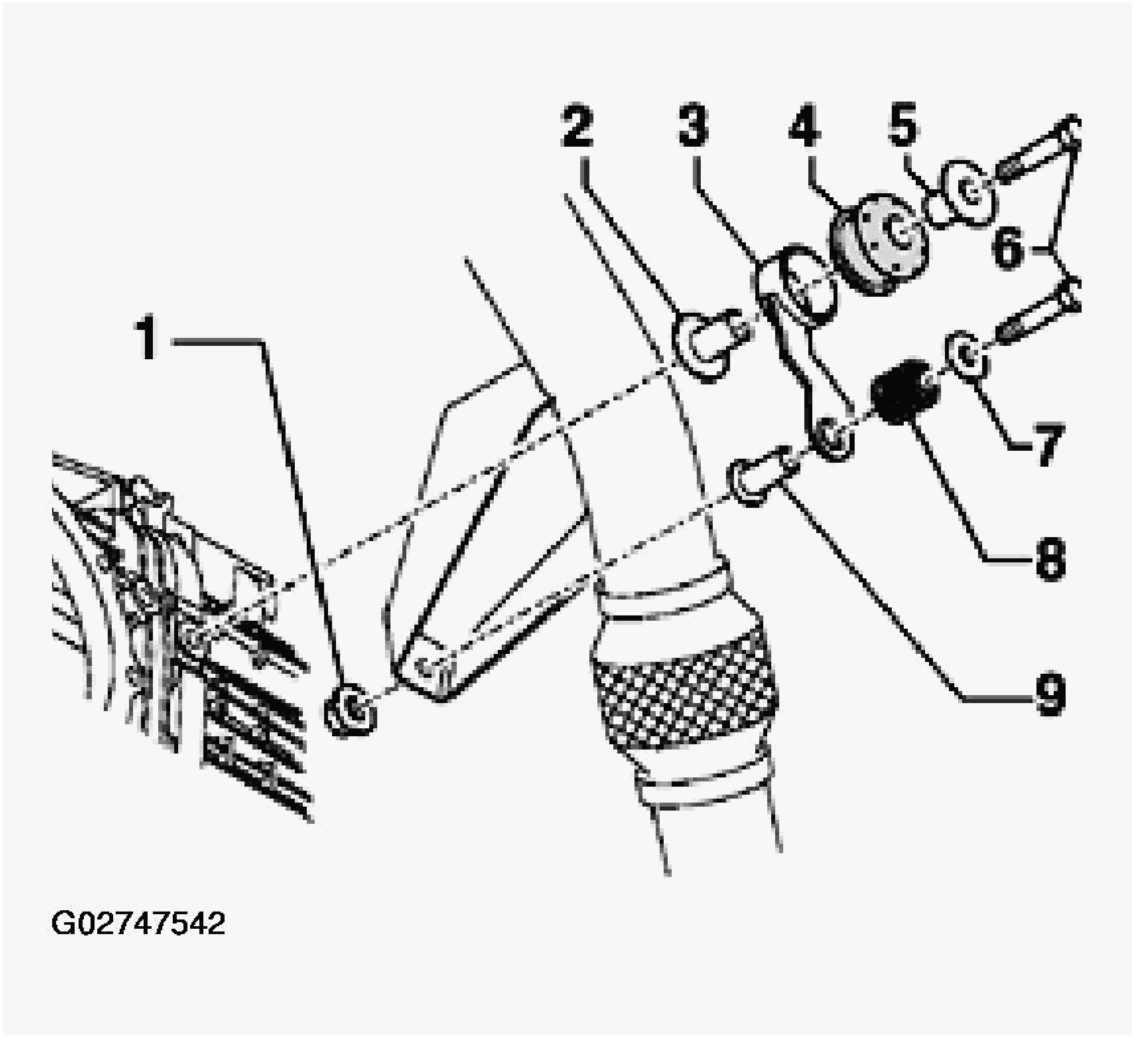


Fig. 5: Identifying Left Mounting Components - Vehicles With M\T
Courtesy of AUDI OF AMERICA, INC.

Individual right mounting components for vehicles with manual transmission

NOTE: The following list refers to items in Fig. 6 .

1. Spacer sleeve
2. Strap
3. Compression spring
4. Washer
5. Bolt (25 Nm)
6. Spacer sleeve
7. Buffer
8. Spacer sleeve
9. Self-locking nut (25 Nm)

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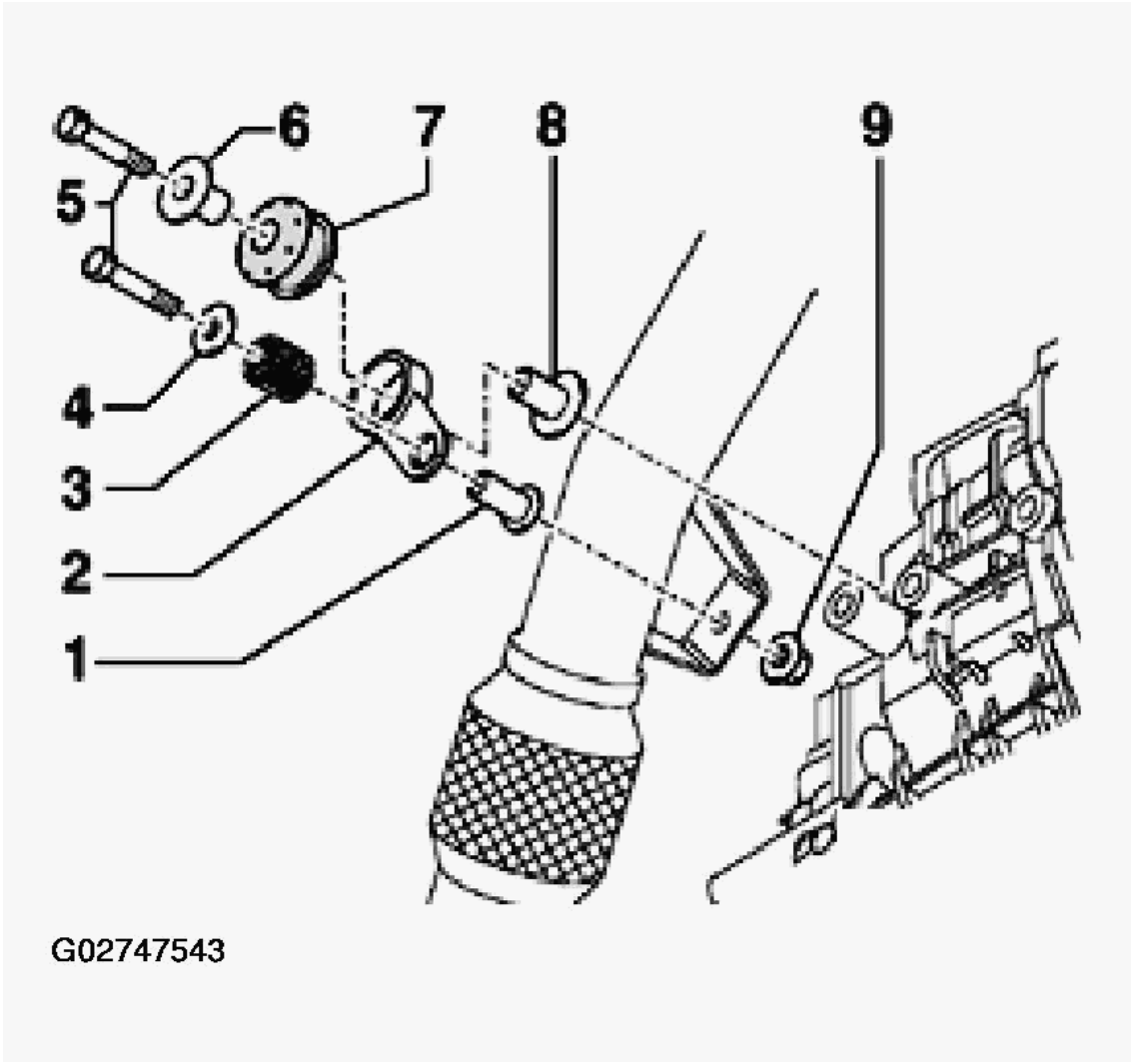


Fig. 6: Identifying Right Mounting Components - Vehicles With M\T
Courtesy of AUDI OF AMERICA, INC.

Individual left mounting components for vehicles with automatic transmission 01V

NOTE: The following list refers to items in Fig. 7 .

1. Bolt (25 Nm)
2. Heat shield for selector lever cable
3. Spacer sleeve
4. Buffer
5. Strap
6. Spacer sleeve
7. Pivot
8. Self-locking nut (25 Nm)

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9. Compression spring
10. Spacer sleeve
11. Washer

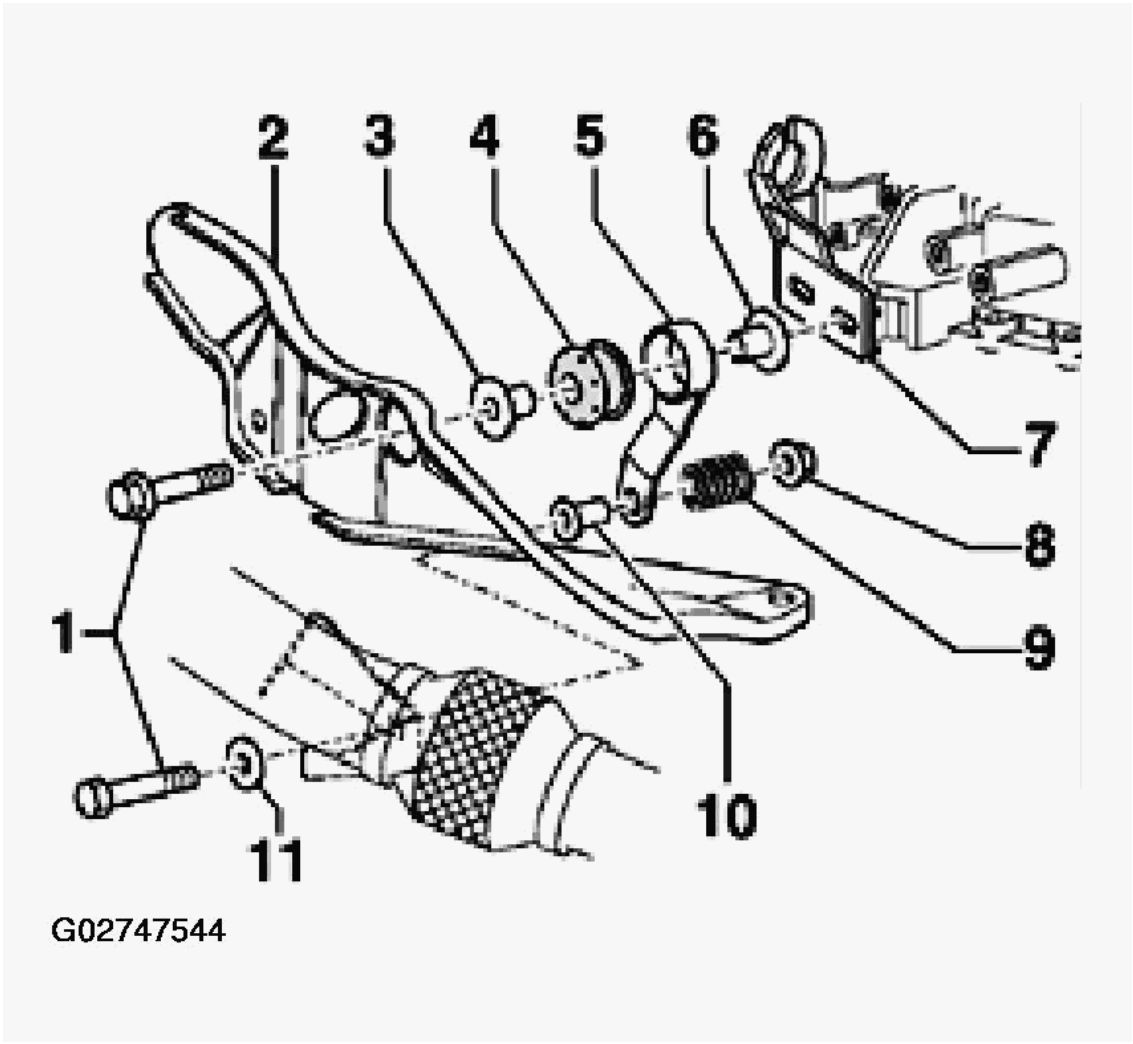


Fig. 7: Identifying Left Mounting Components - Vehicles With A\T 01V
Courtesy of AUDI OF AMERICA, INC.

Individual right mounting components for vehicles with automatic transmission 01V

NOTE: The following list refers to items in Fig. 8 .

1. Washer
2. Bolt (25 Nm)
3. Spacer sleeve
4. Buffer
5. Strap

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6. Spacer sleeve
7. Self-locking nut (25 Nm)
8. Compression spring
9. Spacer sleeve

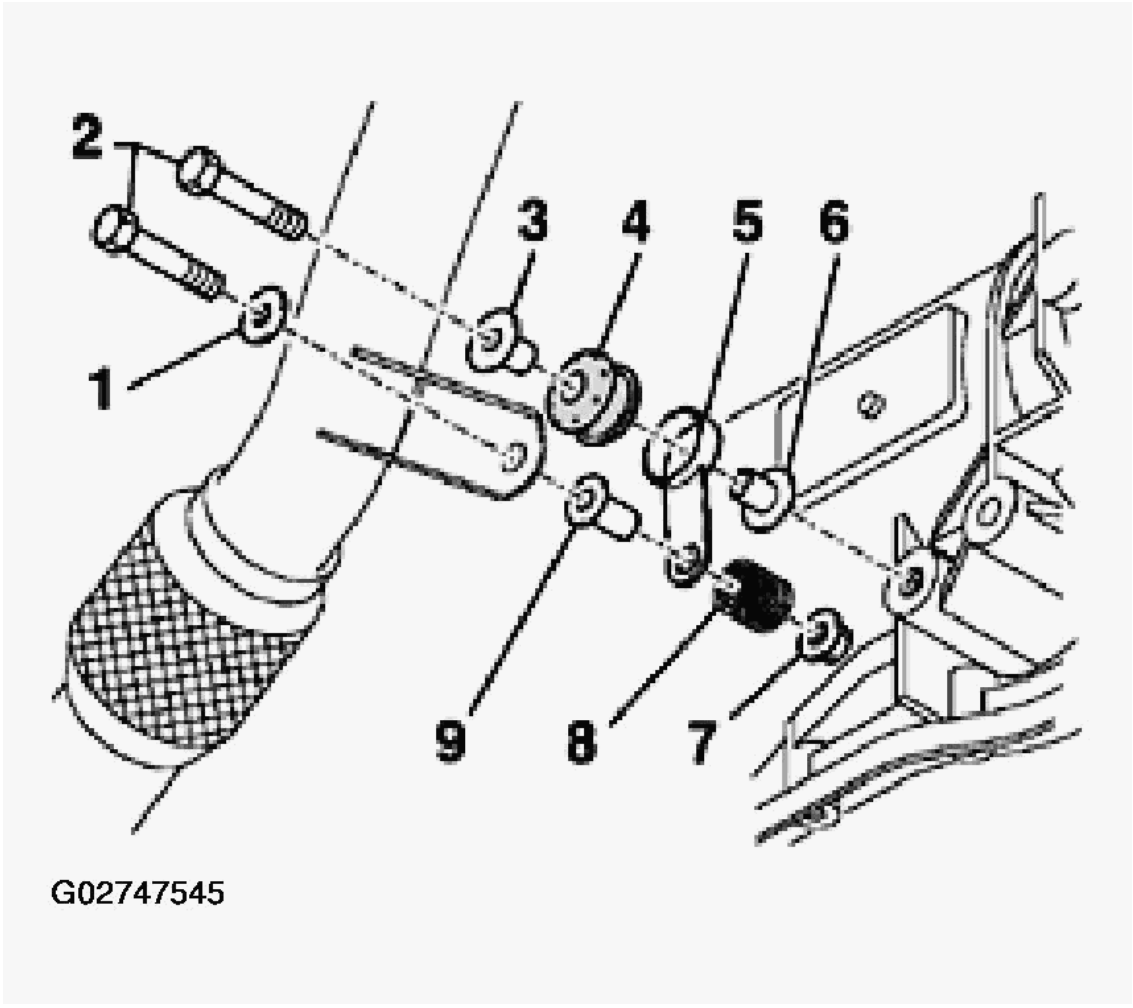


Fig. 8: Identifying Right Mounting Components - Vehicles With A\T 01V
Courtesy of AUDI OF AMERICA, INC.

Individual left mounting components for vehicles with automatic transmission 01J

NOTE: The following list refers to items in Fig. 9 .

1. Bolt (25 Nm)
2. Washer
3. Compression spring
4. Spacer sleeve
5. Self-locking nut (25 Nm)

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6. Bolt (25 Nm)
7. Spacer sleeve
8. Buffer
9. Strap
10. Spacer sleeve

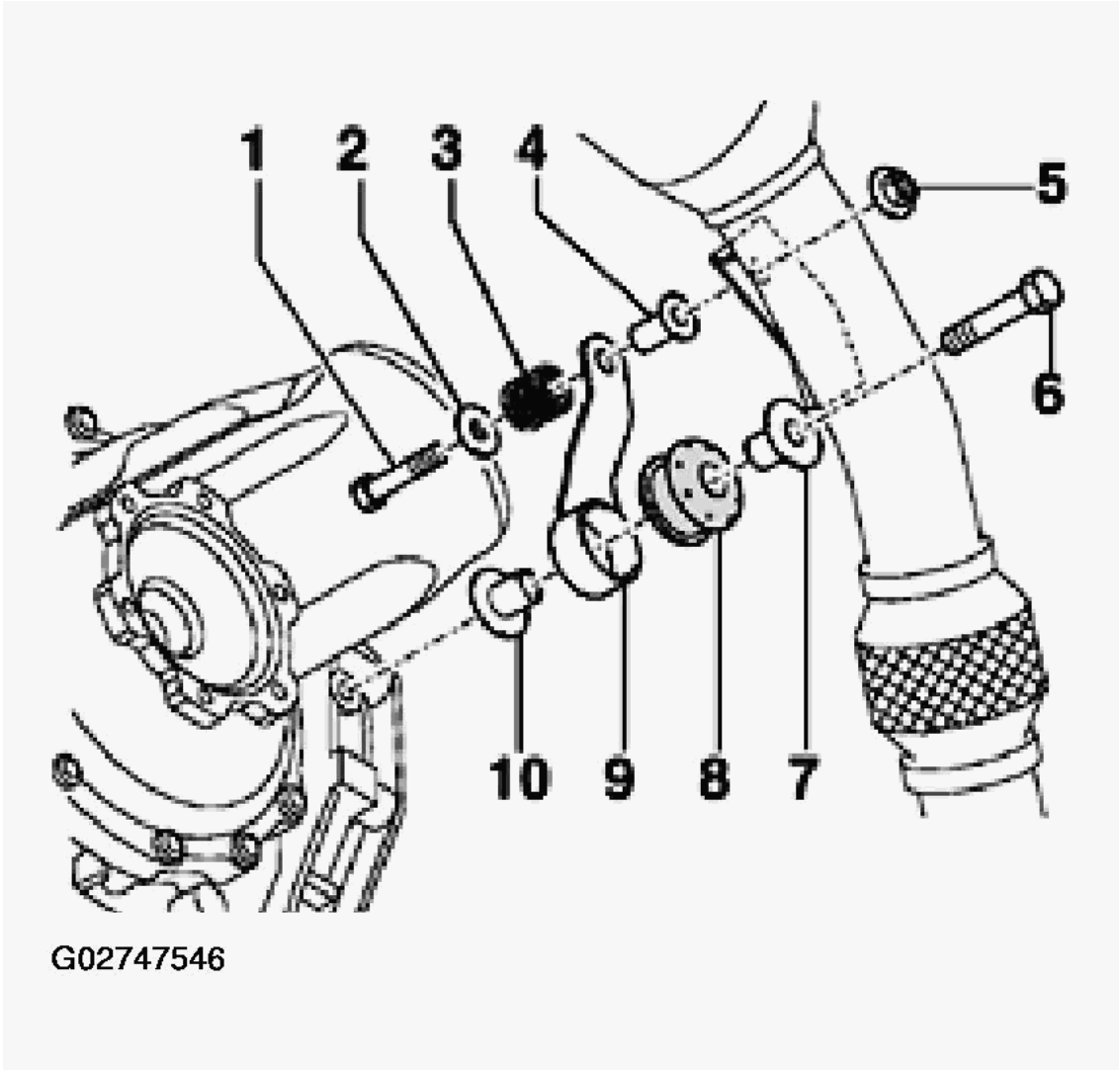


Fig. 9: Identifying Left Mounting Components - Vehicles With A\T 01J
Courtesy of AUDI OF AMERICA, INC.

Individual right mounting components for vehicles with automatic transmission 01J

NOTE: The following list refers to items in Fig. 10 .

1. Self-locking nut (25 Nm)
2. Bolt (25 Nm)

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3. Spacer sleeve
4. Buffer
5. Strap
6. Spacer sleeve
7. Bolt (25 Nm)
8. Washer
9. Compression spring
10. Spacer sleeve

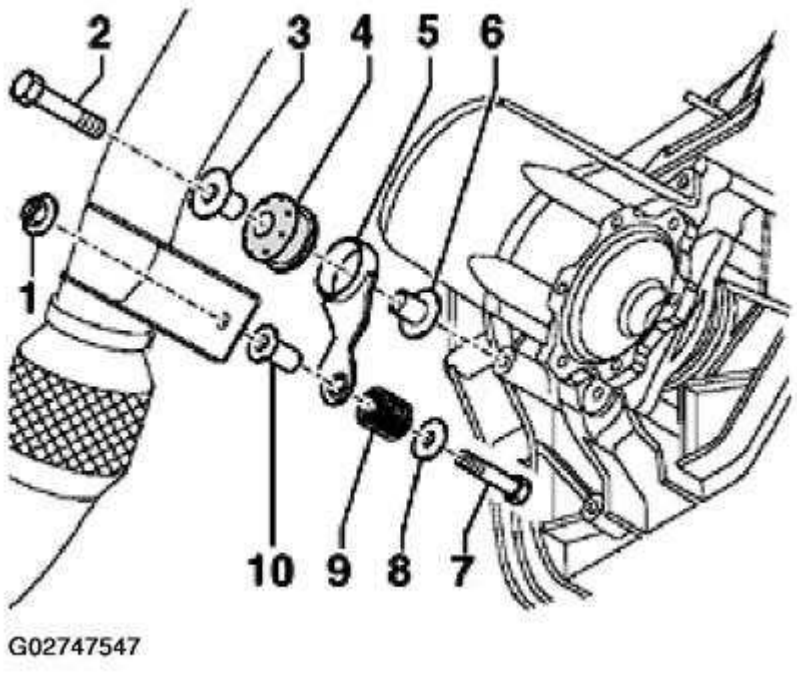


Fig. 10: Identifying Right Mounting Components - Vehicles With A\T 01J
Courtesy of AUDI OF AMERICA, INC.

Replacing end pipe

WARNING: Wear protective glasses.

- Using VAG1523 saw, cut end pipe - 1 - at cutting point -C- at right angle.
- Connect end pipe -3- up to marking -A-, so that the slot on end pipe lines up with marking -B- on cover.
- Tighten mounting bolt of clamp -2- to 25 Nm.

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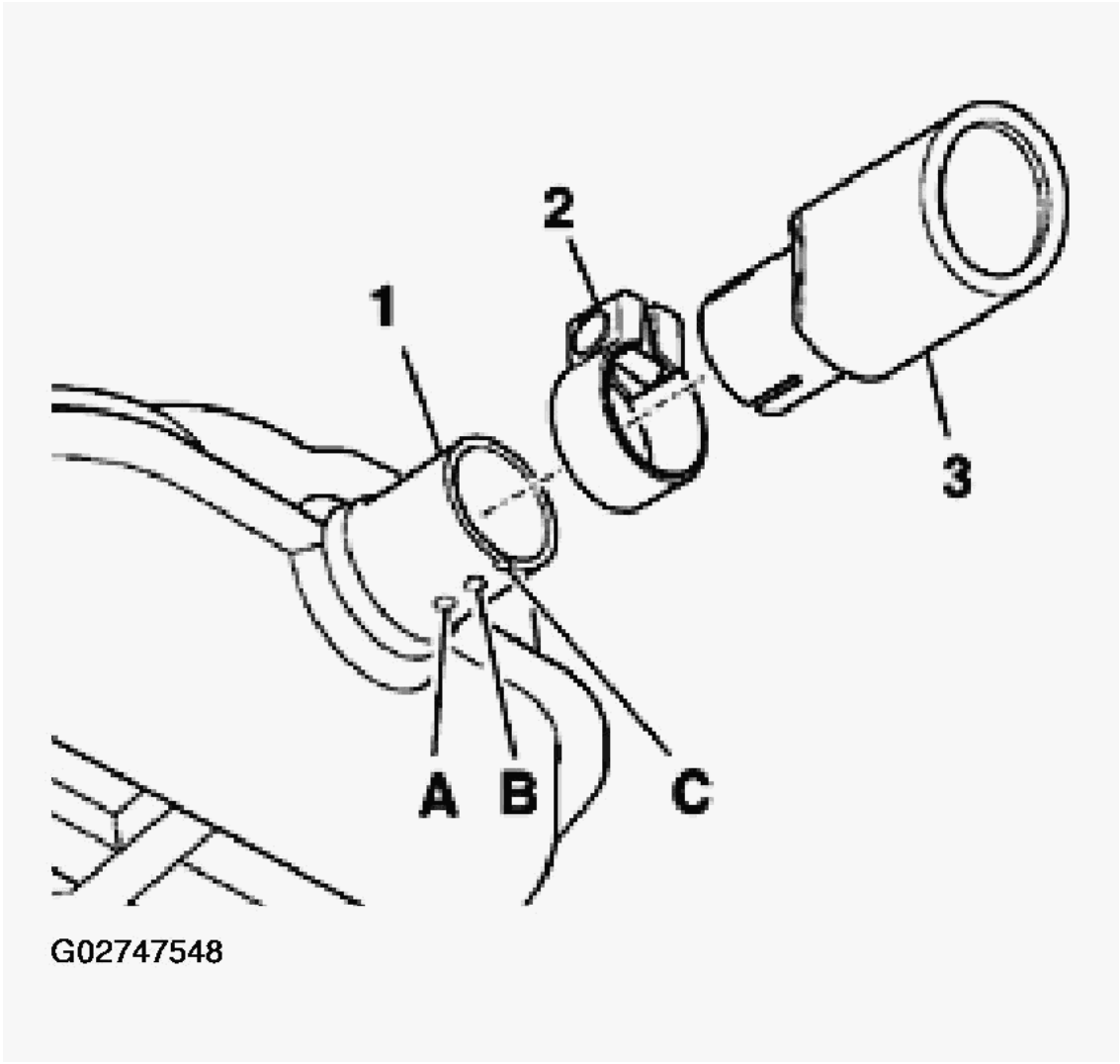


Fig. 11: Replacing End Pipe
Courtesy of AUDI OF AMERICA, INC.

Center and rear muffler, separating

- A separating point has been provided in the connecting pipe for individual replacement of the center or rear muffler.
- Separating point is marked by a depression around the circumference of the exhaust pipe.

Special tools and equipment

- VAG1523A body repair saw

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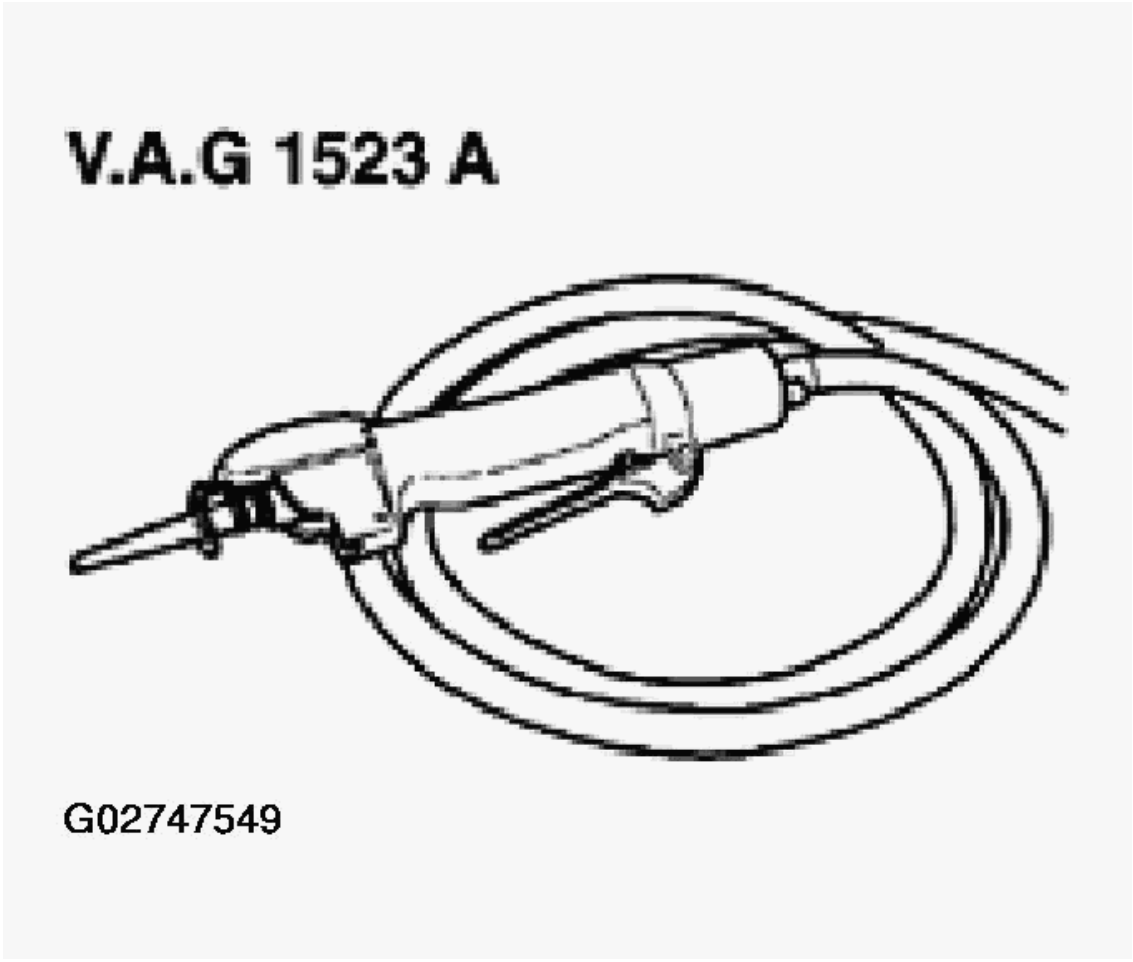


Fig. 12: Identifying Special Tools And Equipment - VAG1523A Body Repair Saw
Courtesy of AUDI OF AMERICA, INC.

- Protective glasses

NOTE:

- **An All Wheel Drive (AWD) vehicle is shown in the illustrations.**
- **For vehicles with Front Wheel Drive (FWD), the work steps are the same as for vehicles with All Wheel Drive (AWD).**

Procedure

WARNING: Wear protective glasses.

- Using VAG1523 A saw, cut exhaust pipes at separating point (arrow) at a right angle.

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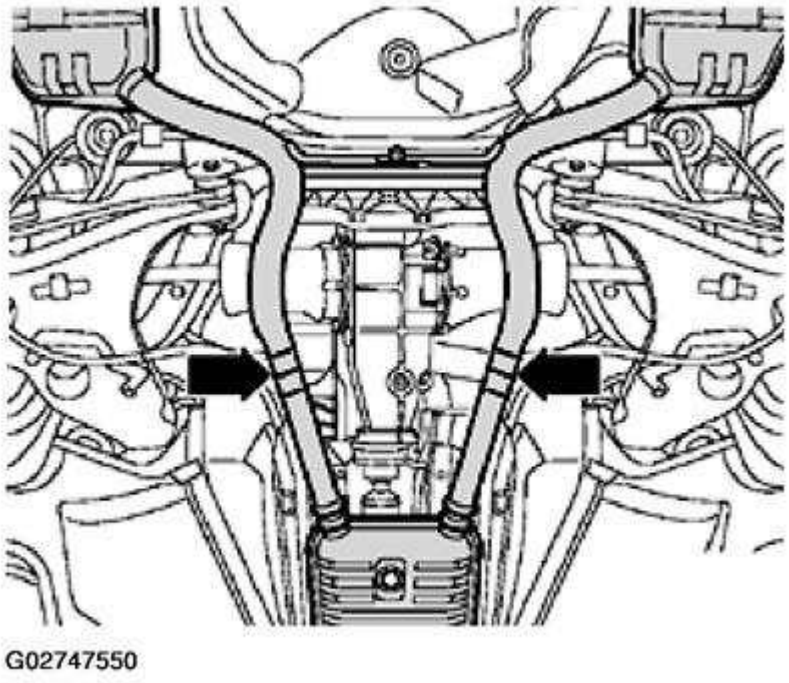


Fig. 13: Cutting Exhaust Pipes At Separating Point
Courtesy of AUDI OF AMERICA, INC.

NOTE: Separating point is the middle one of the 3 depressions on the exhaust pipe.

- When installing, center double clamps -1- and -2- on separation cut.

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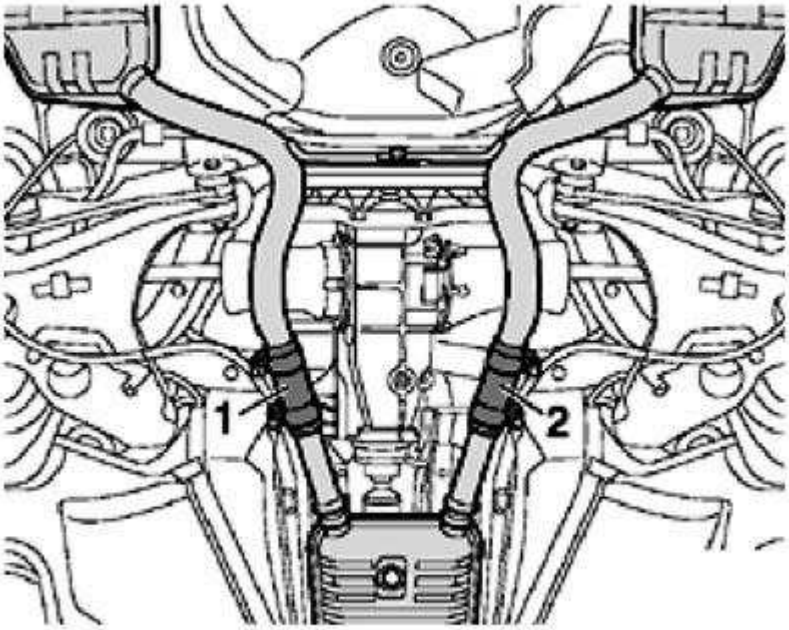


Fig. 14: Centering Double Clamps And On Separation Cut
Courtesy of AUDI OF AMERICA, INC.

- Installation position of double clamps, see **INSTALLED POSITION OF REAR CLAMPING SLEEVES**

- Install exhaust system free of stress, se **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** and **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .
- Align rear muffler horizontally.
- Tighten double clamp bolts uniformly to 40 Nm.

Left front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)

Removing

- Remove rear engine cover (arrows).

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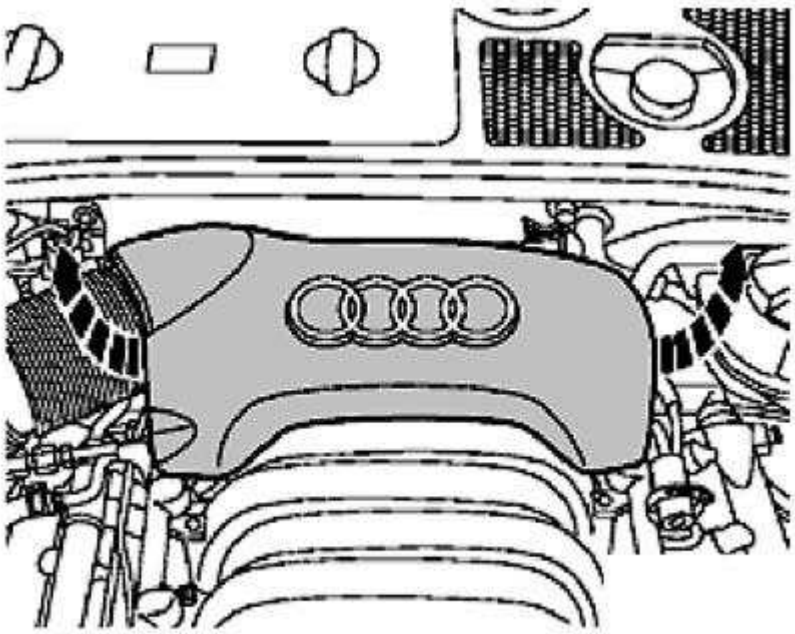


Fig. 15: Removing Rear Engine Cover
Courtesy of AUDI OF AMERICA, INC.

- Remove cover -1- in engine compartment (left side).

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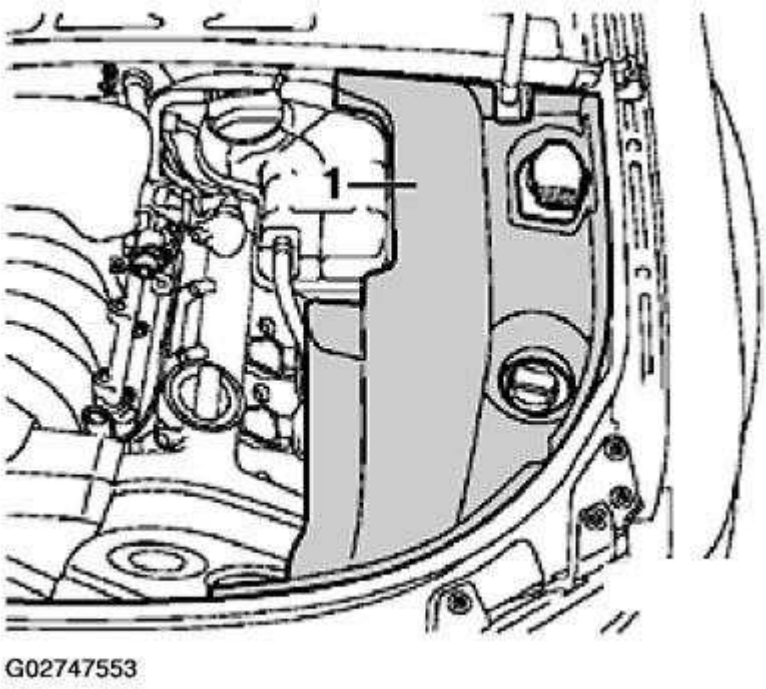


Fig. 16: Removing Engine Compartment Left Side Cover
Courtesy of AUDI OF AMERICA, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) Warning Switch -F66- at bottom of coolant reservoir.
- Tie coolant reservoir with connected coolant hoses -1 to 3- to side.
- Remove heat shield for harness connectors at left of bulkhead, if installed.

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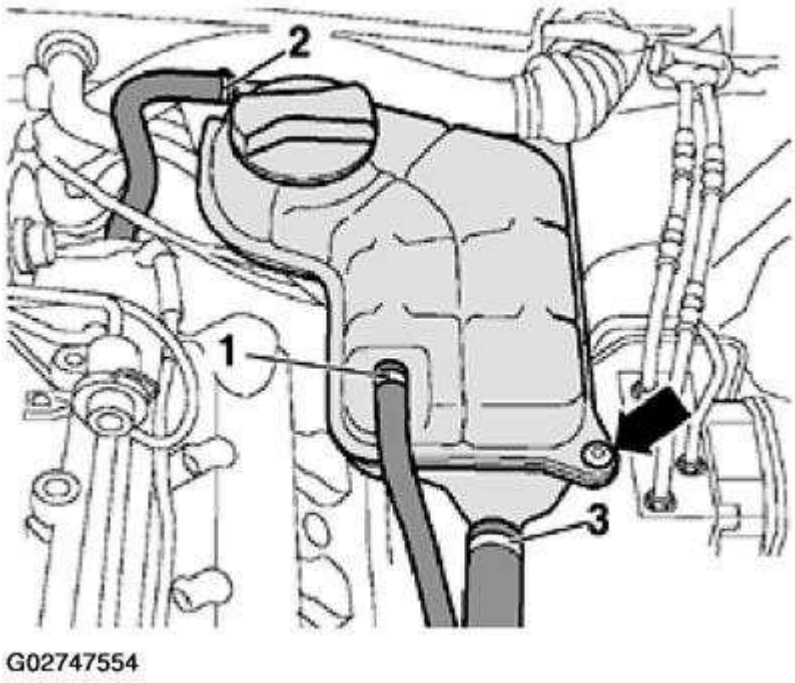


Fig. 17: Removing Coolant Reservoir - M\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove harness connectors -1 to 4- from bracket at left of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Guide wires to the oxygen sensors downward.

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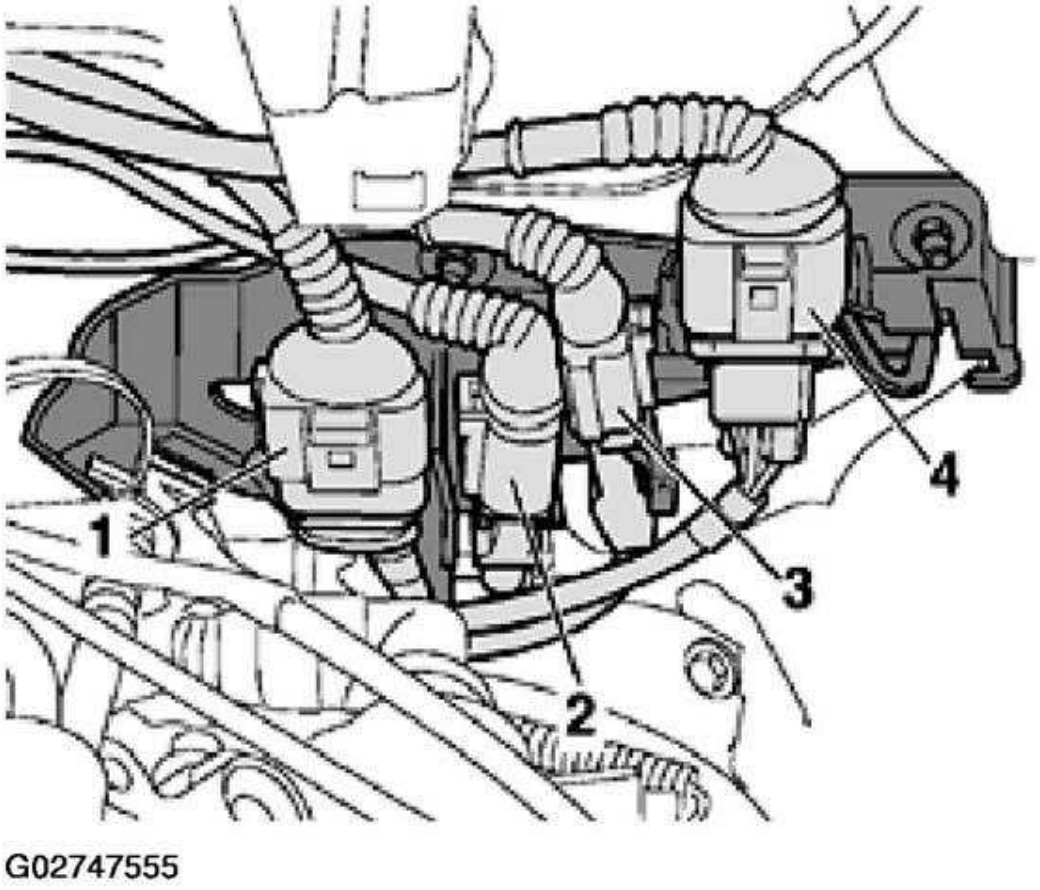


Fig. 18: Removing Harness Connectors From Bracket At Left Of Bulkhead - M\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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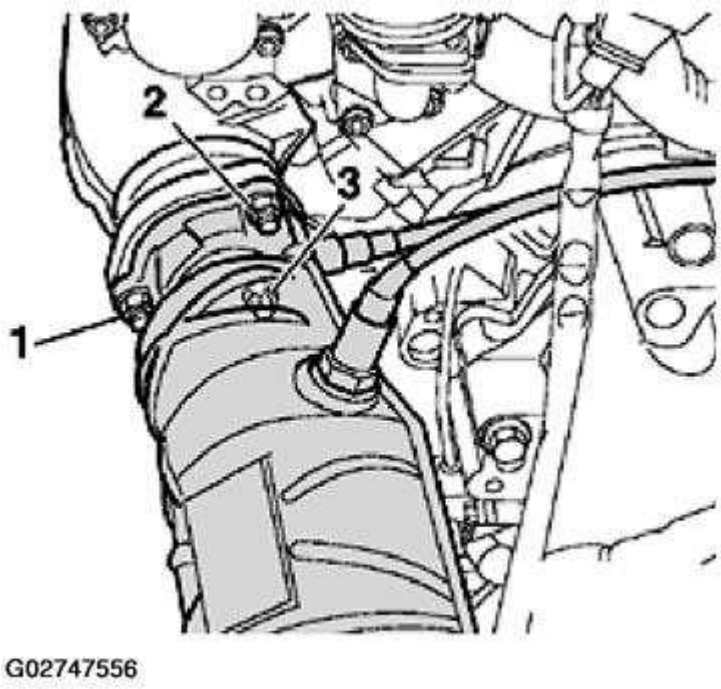


Fig. 19: Removing Exhaust Pipe/Exhaust Manifold Nut - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove left front wheel.
- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of parking heater/auxiliary heater on noise insulation.

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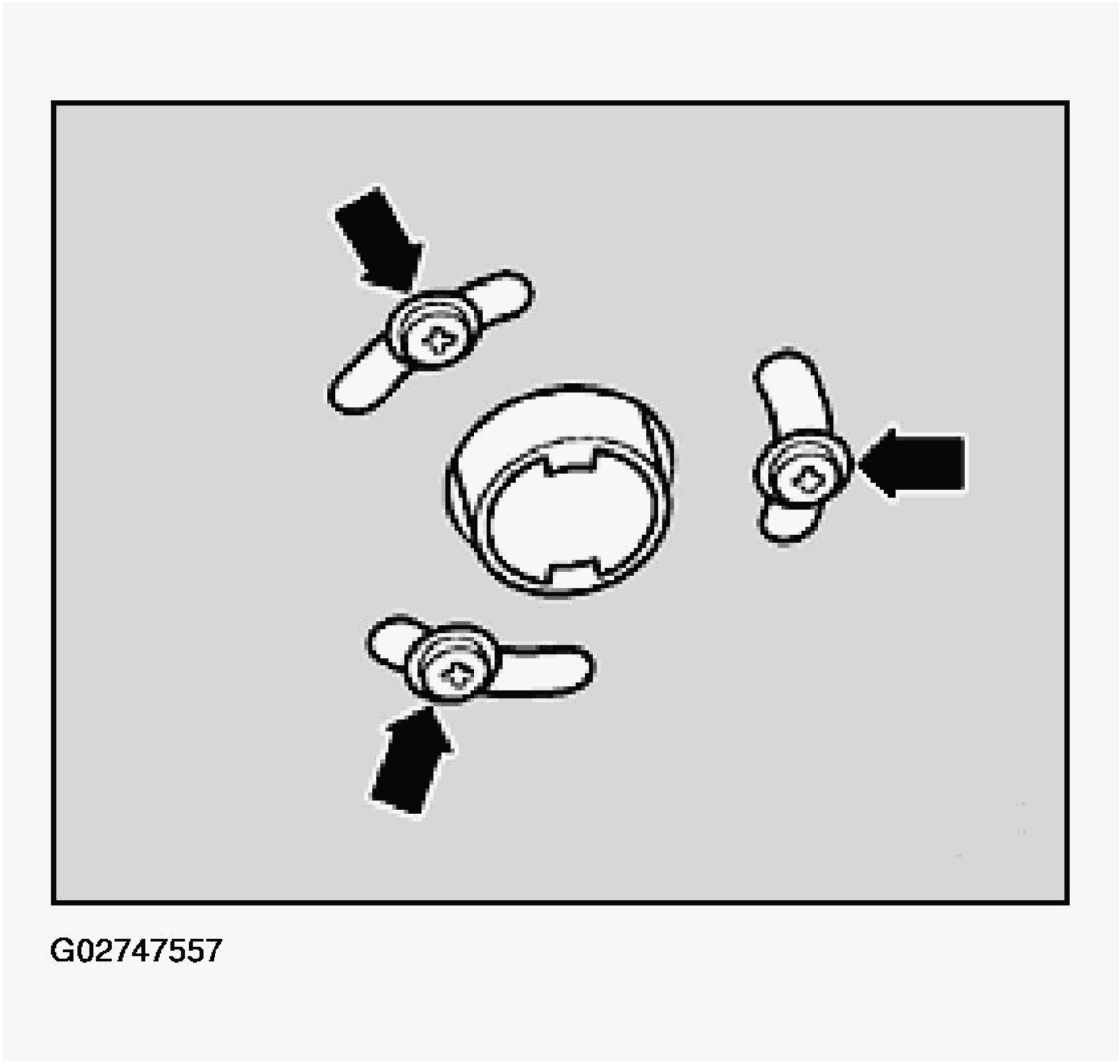


Fig. 20: Removing Parking Heater/Auxiliary Heater Exhaust Pipe Bolts - M\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front noise insulation.
- Release quick-release screws -3- and remove rear noise insulation, if present.

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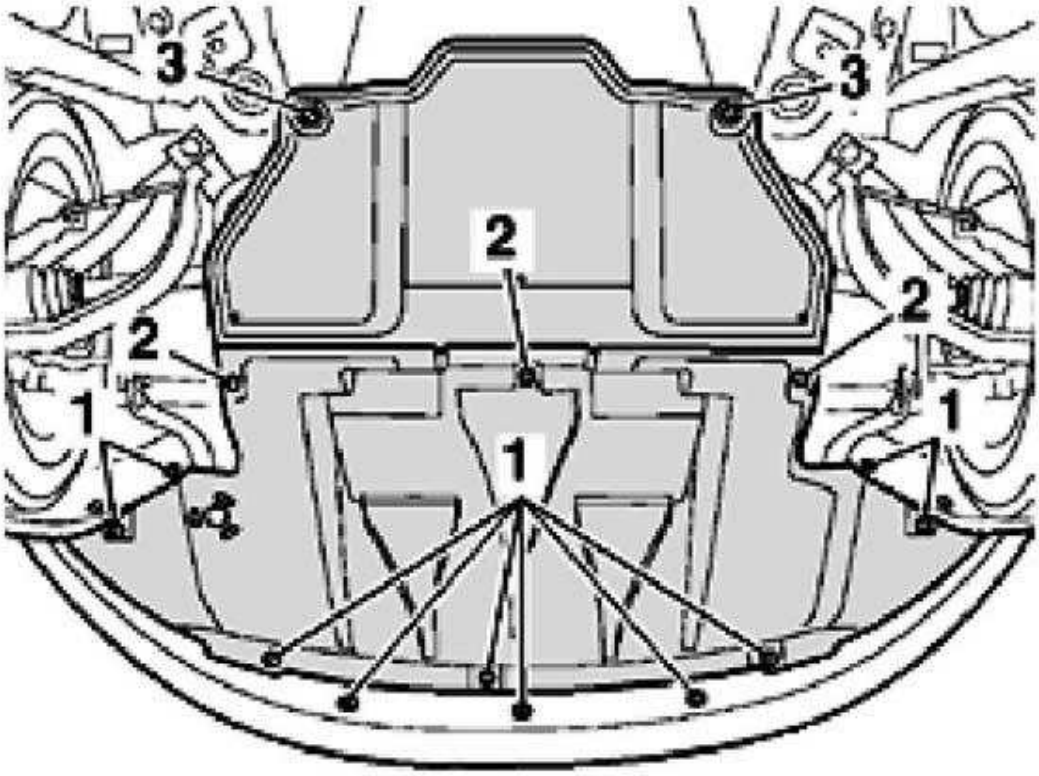


Fig. 21: Removing Front And Rear Noise Insulation - M\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts -1- through -4- and remove crossmember.

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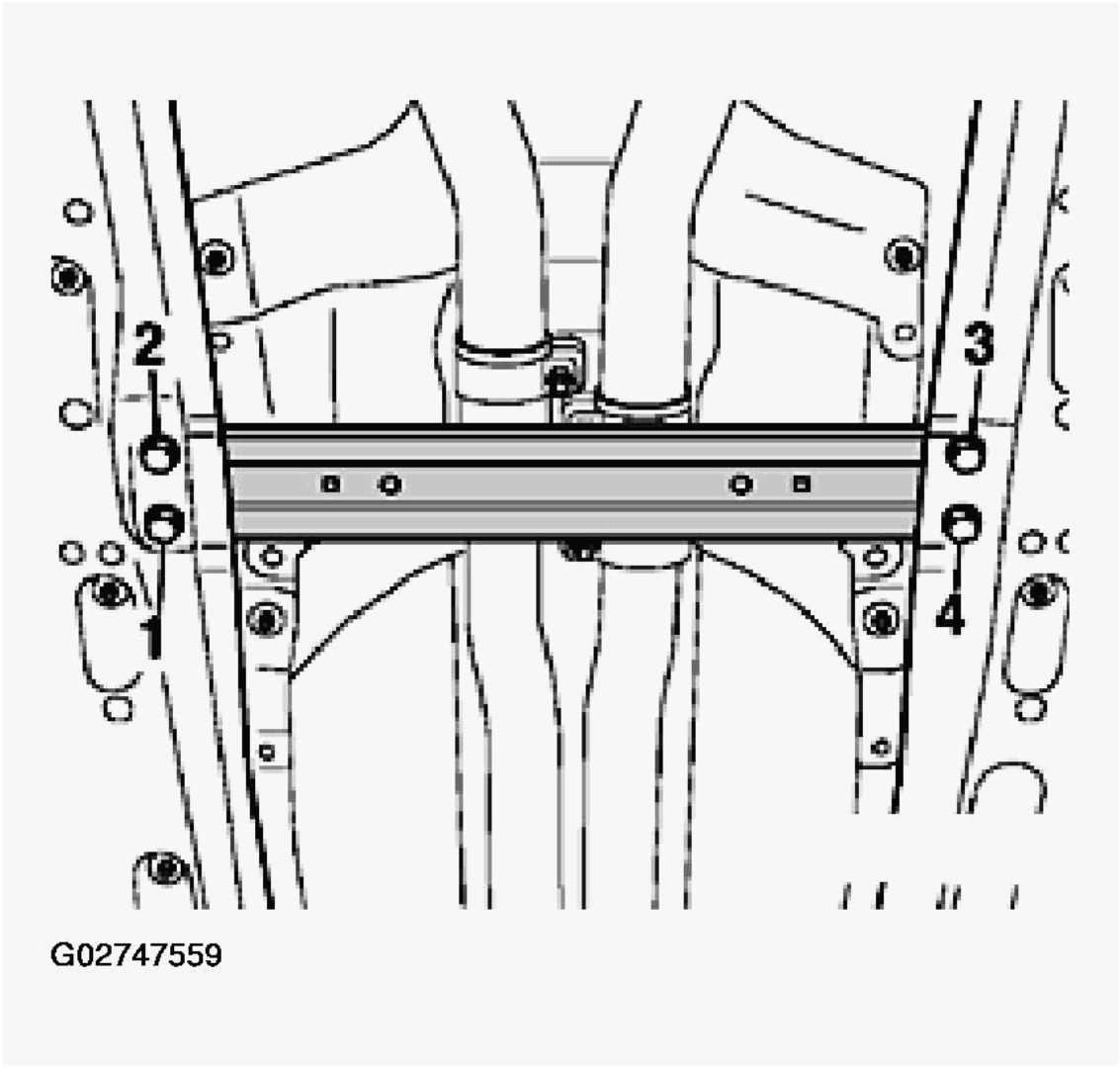


Fig. 22: Removing Crossmember - M\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

- Disconnect exhaust system at left double clamp (left arrow).

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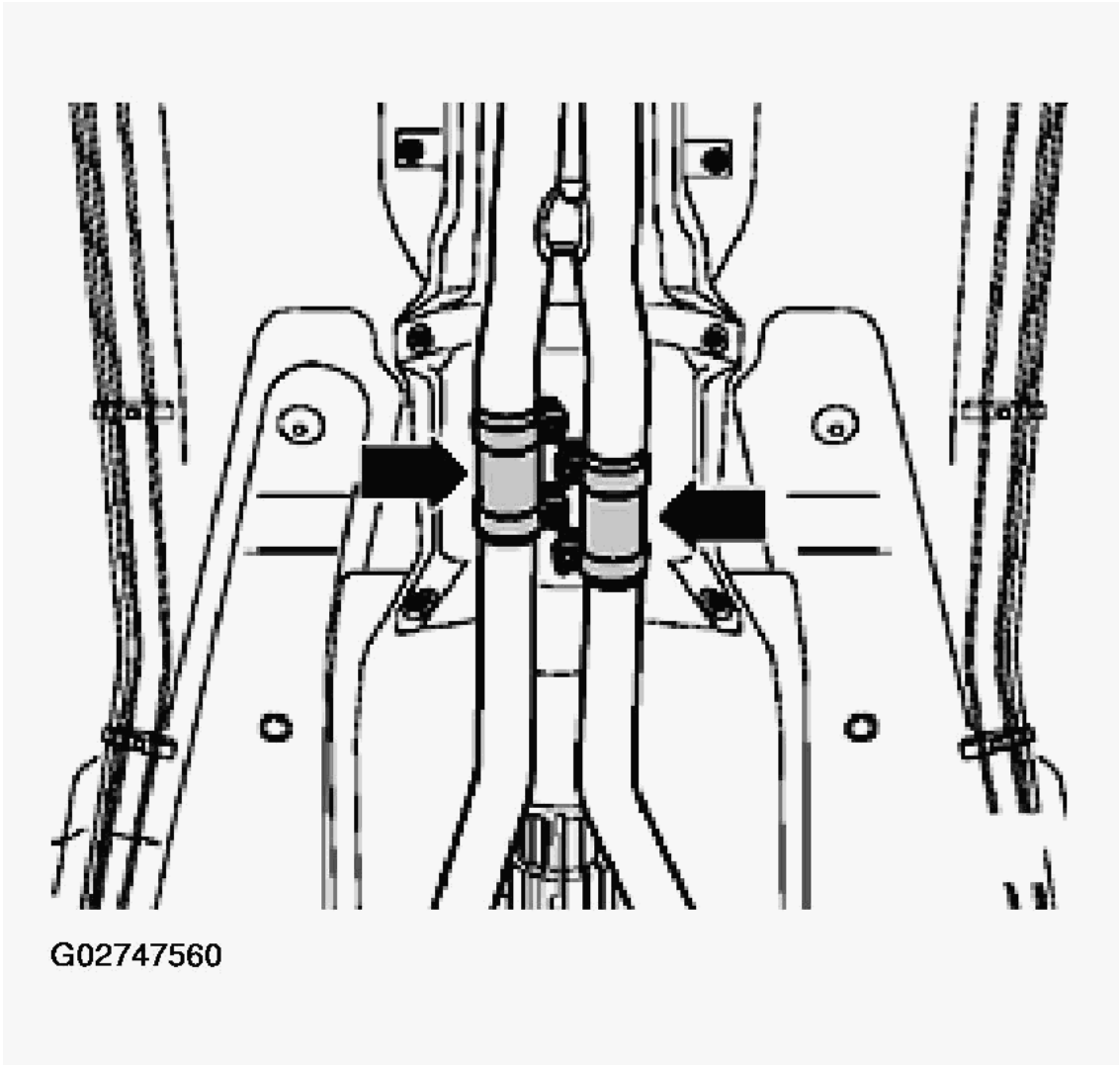


Fig. 23: Disconnecting Exhaust System At Left Double Clamp - M\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove heat shield -1- for left drive axle.

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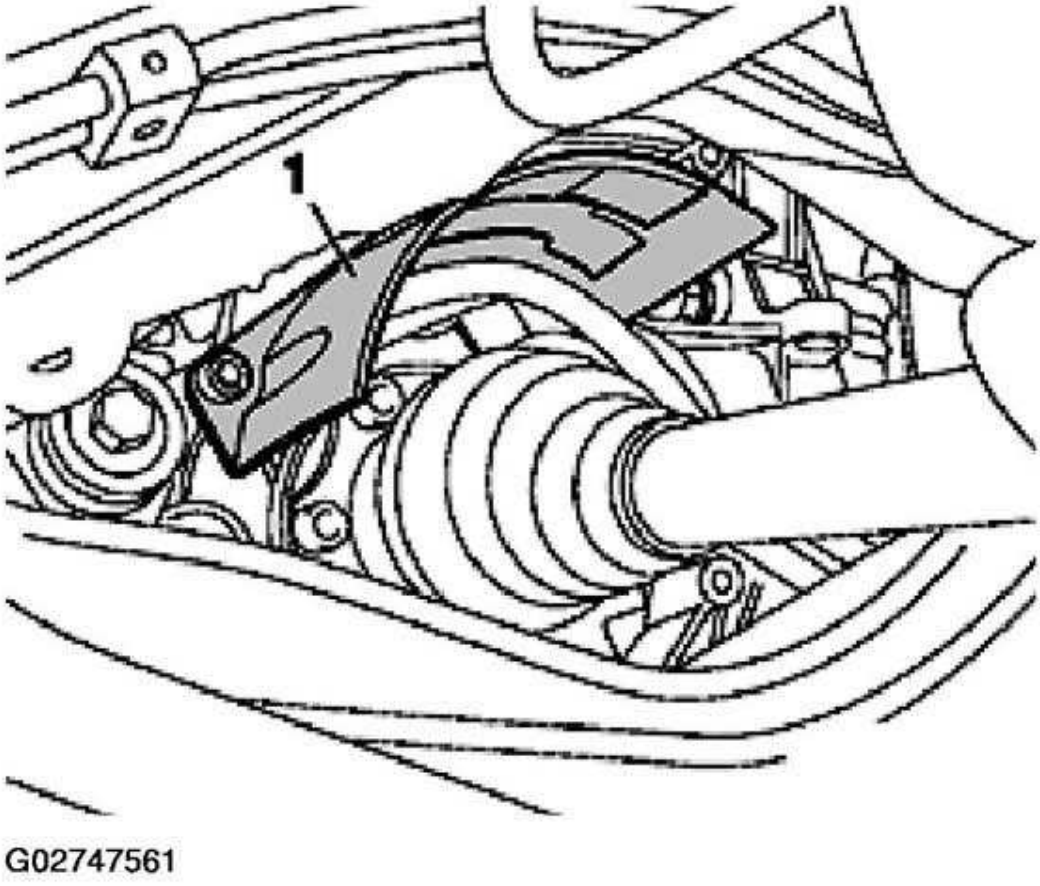


Fig. 24: Removing Heat Shield For Left Drive Axle - M\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bracket for front exhaust pipe (arrow).

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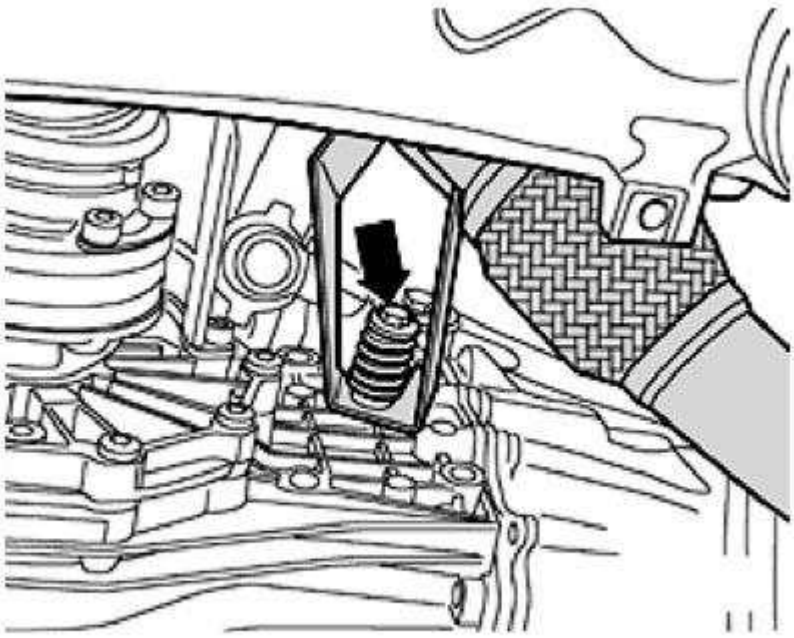


Fig. 25: Removing Front Exhaust Pipe Bracket - M\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Expose oxygen sensor wires.
- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

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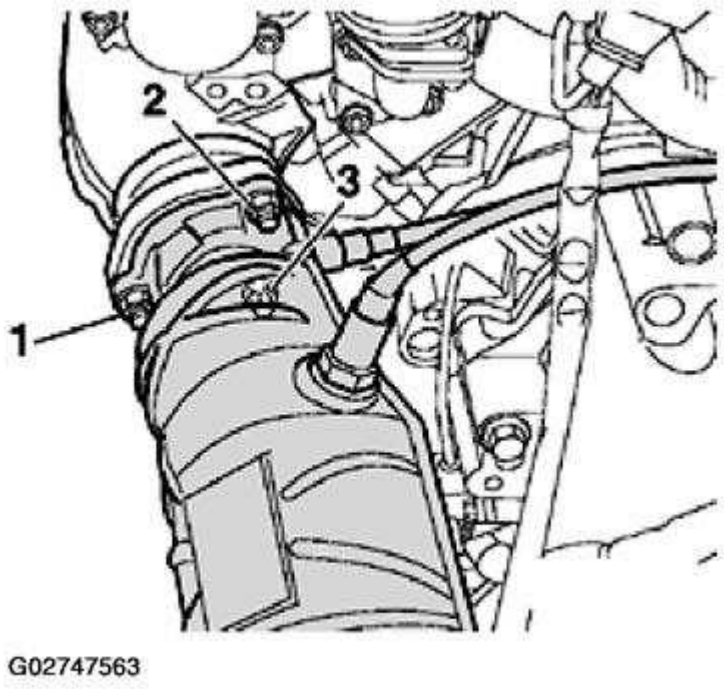


Fig. 26: Removing Front Exhaust Pipe/Exhaust Manifold Nuts - M\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

NOTE: Illustration is shown with engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** and **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .

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NOTE: For individual mounting components for exhaust system to transmission on vehicles with manual transmission, see INDIVIDUAL LEFT MOUNTING COMPONENTS FOR VEHICLES WITH MANUAL TRANSMISSION .

Tightening torques

TIGHTENING TORQUES: LH EXHAUST SYSTEM (M\T)

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Drive axle protection to transmission	23

Right front exhaust pipe with catalytic converter, removing and installing (vehicles with manual transmission)

Removing

- Remove rear engine cover (arrows).

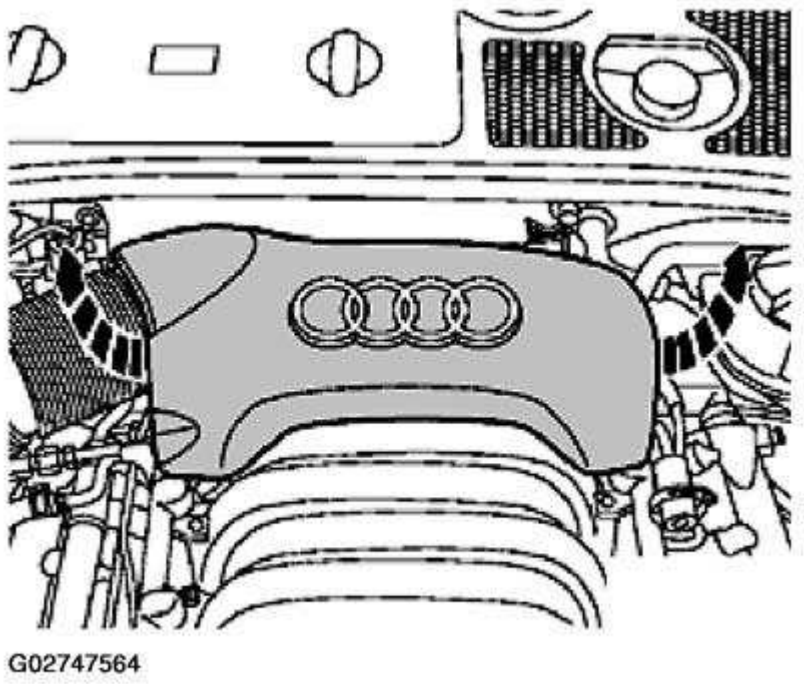


Fig. 27: Removing Rear Engine Cover - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove cover -1- in engine compartment (right side).

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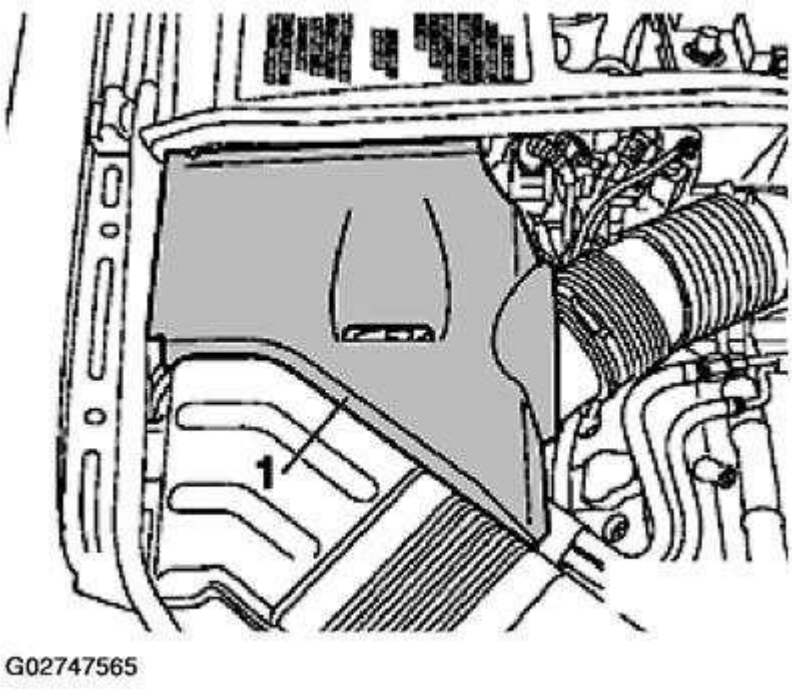


Fig. 28: Removing Right Side Engine Compartment Cover - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- -1- at air guide.
- Remove air guide -2-.

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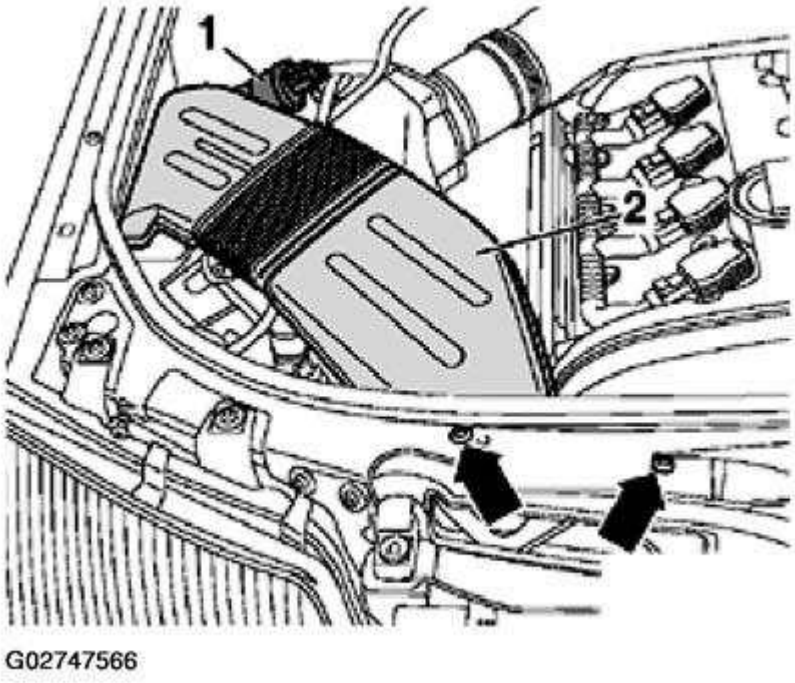


Fig. 29: Detaching Evaporative Emission (EVAP) Canister Purge Regulator Valve And Air Guide - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove air filter housing (arrows).

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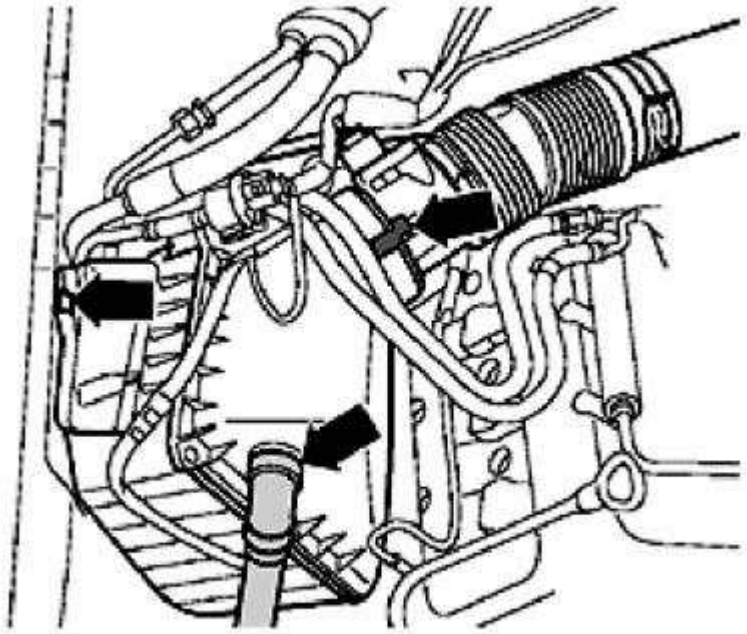


Fig. 30: Removing Air Filter Housing - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect electrical harness connector at Mass Air Flow (MAF) sensor.
- Remove hose -4- from air duct -2-.

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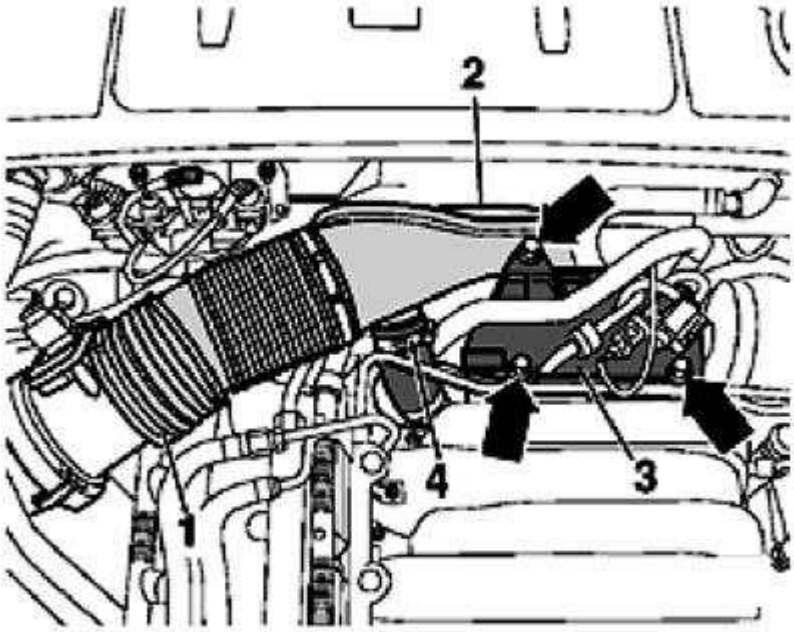


Fig. 31: Removing Solenoid Valves Holding Plate Bolts And Air Duct Hose - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

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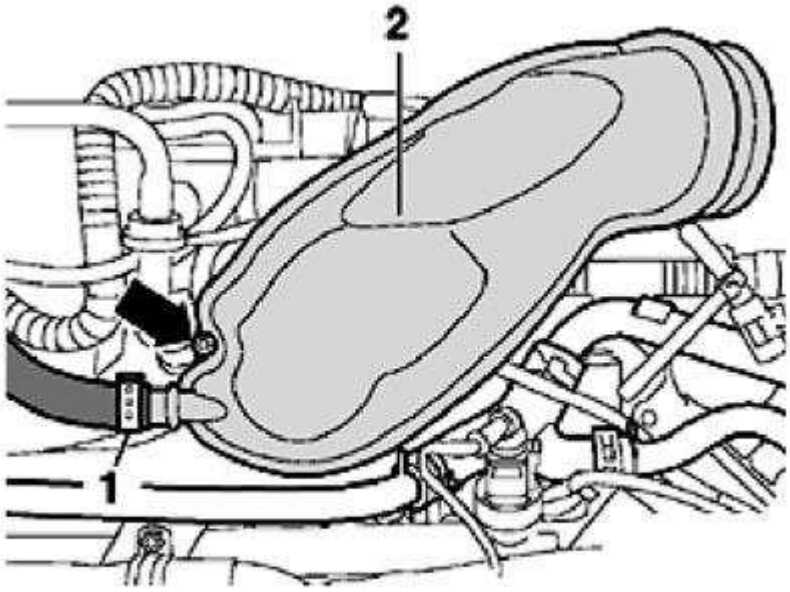


Fig. 32: Disconnecting Air Duct At Throttle Valve Control Module And Hose From Air Duct - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

NOTE: Illustration shows the air guide from rear with the engine removed.

- Remove harness connectors -1 to 4- from bracket at right of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Guide wires to the oxygen sensors downward.

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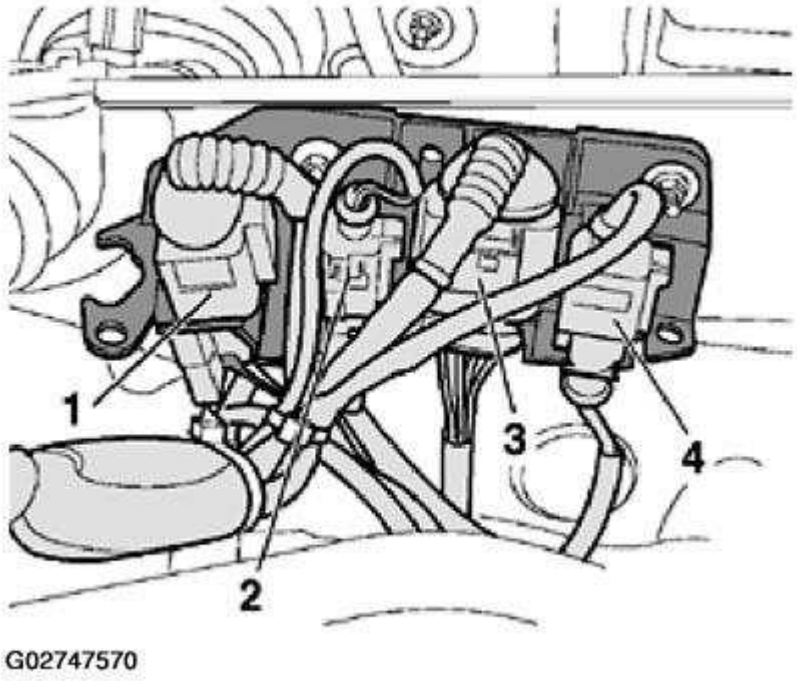


Fig. 33: Removing Harness Connectors To From Bracket At Right Of Bulkhead - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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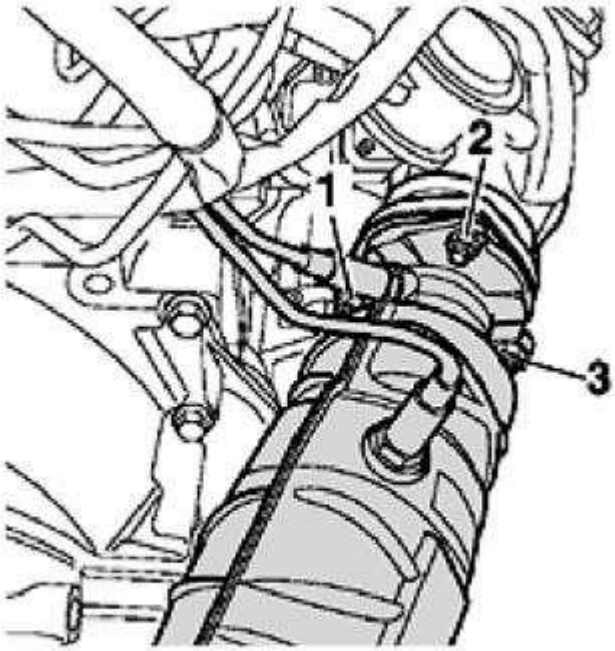


Fig. 34: Removing Exhaust Pipe/Exhaust Manifold Nut - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove right front wheel
- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of parking heater/auxiliary heater on noise insulation.

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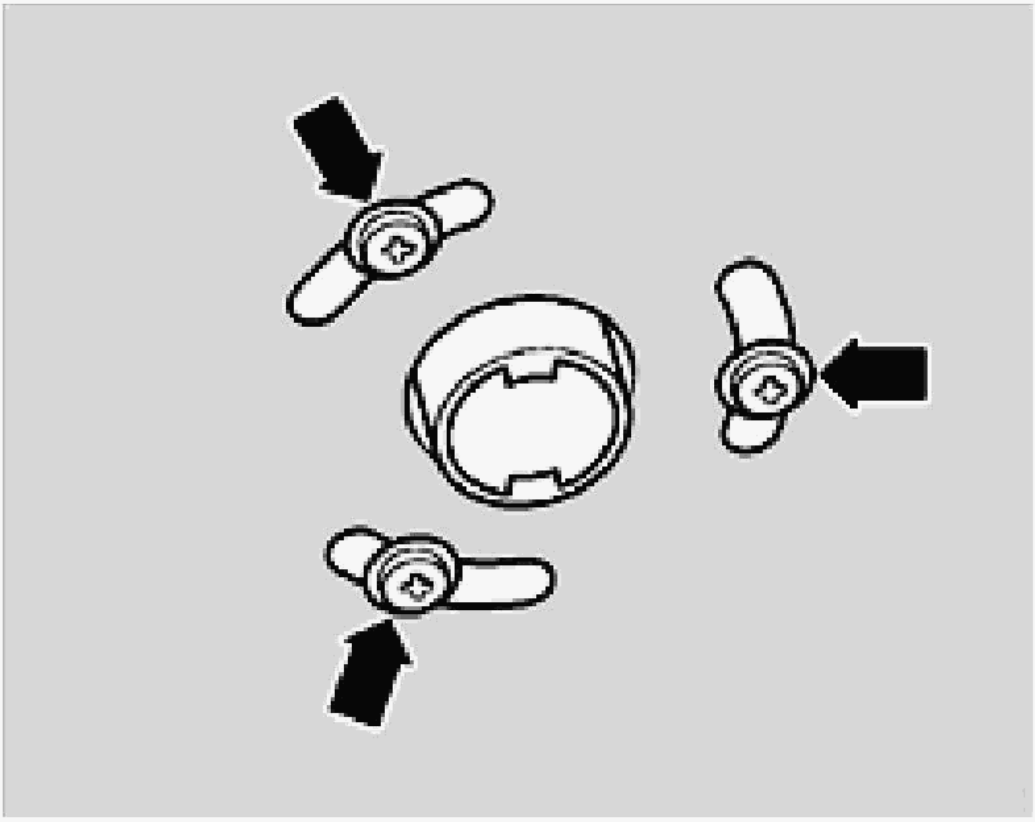


Fig. 35: Removing Parking Heater/Auxiliary Heater Exhaust Pipe Bolts - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front noise insulation.
- Remove quick-release screws -3- and remove rear noise insulation, if present.

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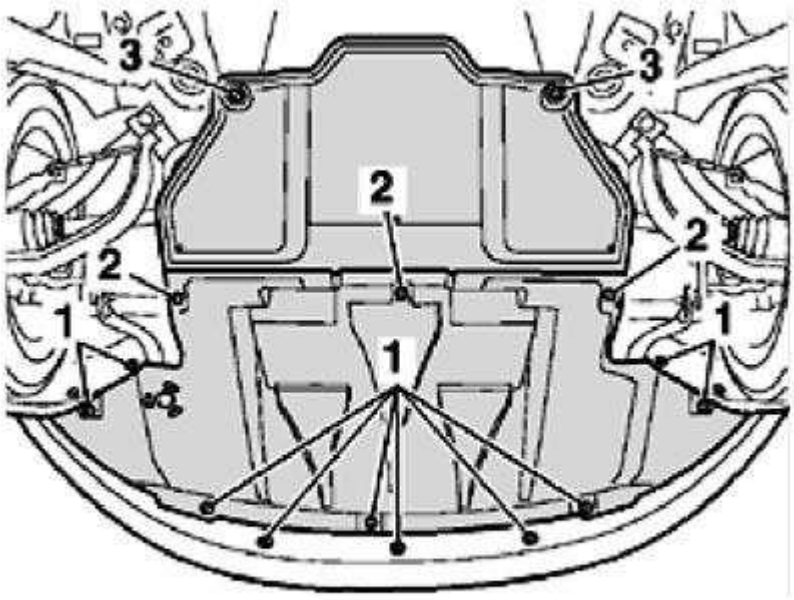


Fig. 36: Removing Front And Rear Noise Insulation - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged..

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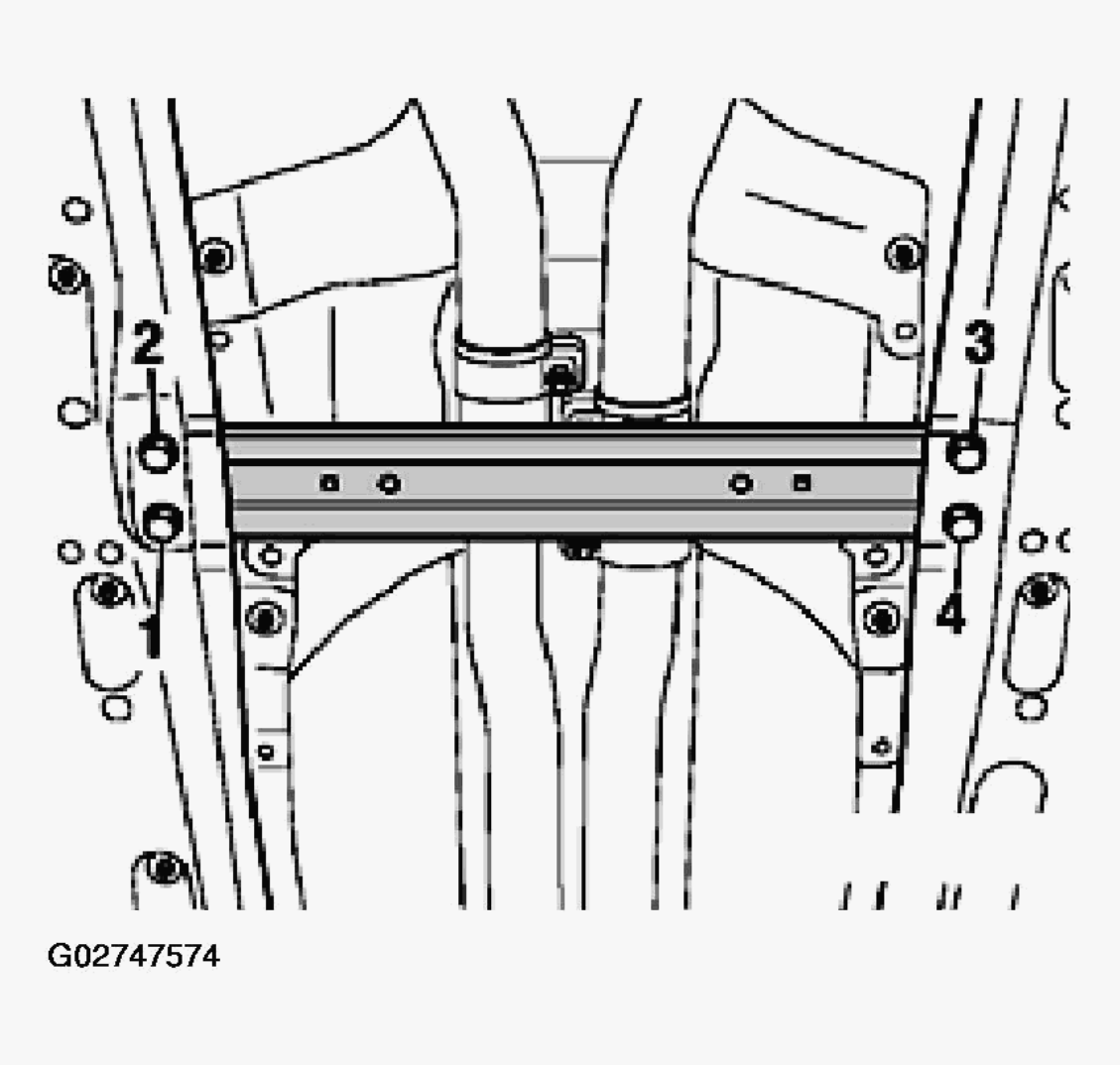


Fig. 37: Removing Crossmember - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Disconnect exhaust system at right double clamp (right arrow).

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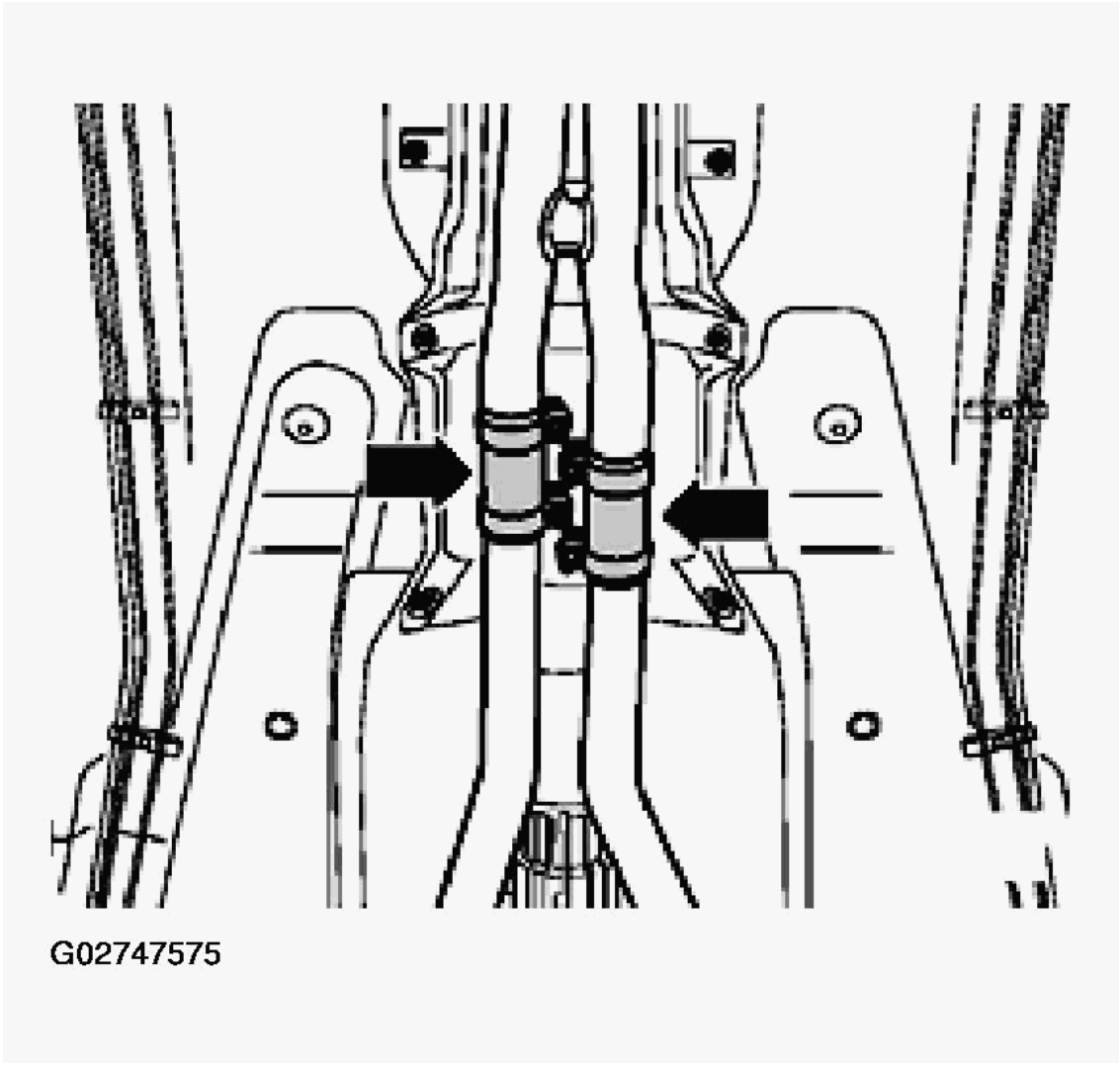


Fig. 38: Disconnecting Exhaust System At Right Double Clamp - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove heat shield -1- for right drive axle.

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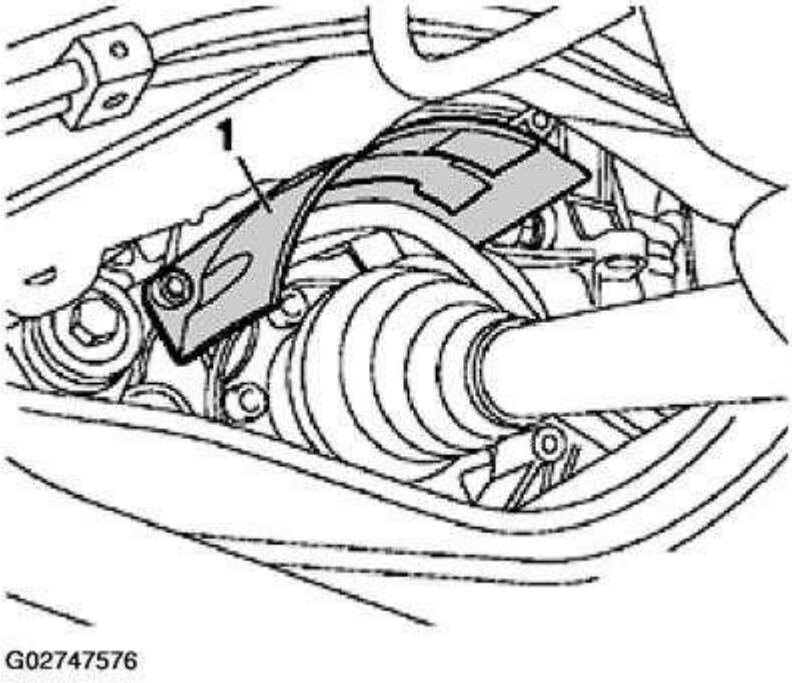


Fig. 39: Removing Right Drive Axle Heat Shield - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bracket for front exhaust pipe (arrow).

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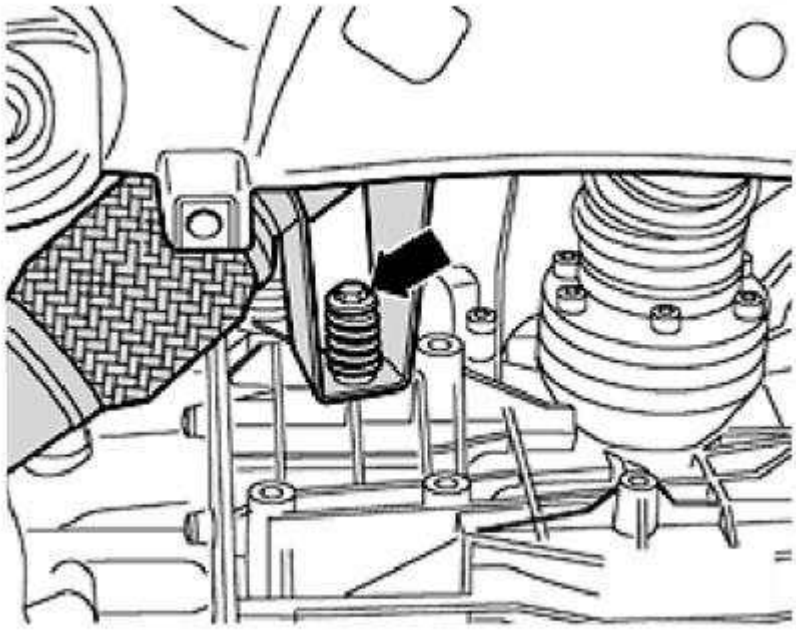


Fig. 40: Removing Front Exhaust Pipe Bracket - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Expose oxygen sensor wires.
- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

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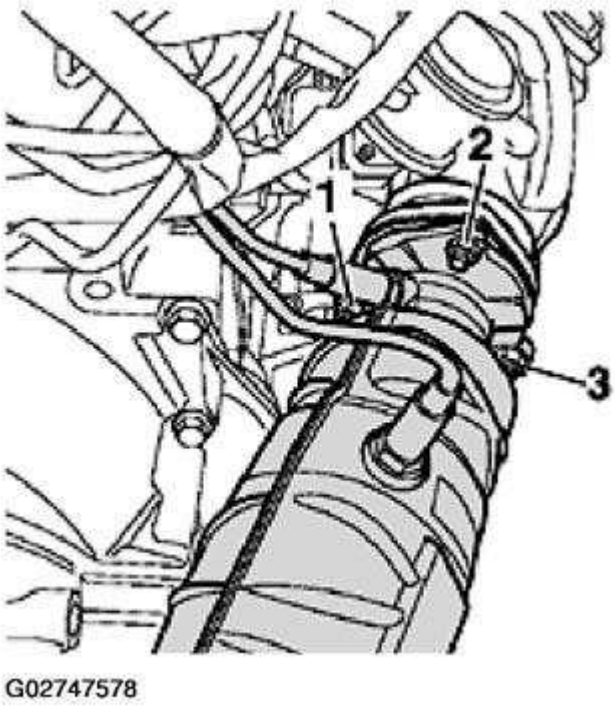


Fig. 41: Removing Front Exhaust Pipe/Exhaust Manifold Nuts - M\T Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** and **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .

NOTE: **For individual mounting components for exhaust system to transmission on vehicles with manual transmission, see INDIVIDUAL RIGHT MOUNTING**

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COMPONENTS FOR VEHICLES WITH MANUAL TRANSMISSION .

Tightening torques

TIGHTENING TORQUES: RH EXHAUST SYSTEM (M\T)

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Drive axle protection to transmission	23

Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)

Special tools and equipment

- 3337 wrench, 7-piece set

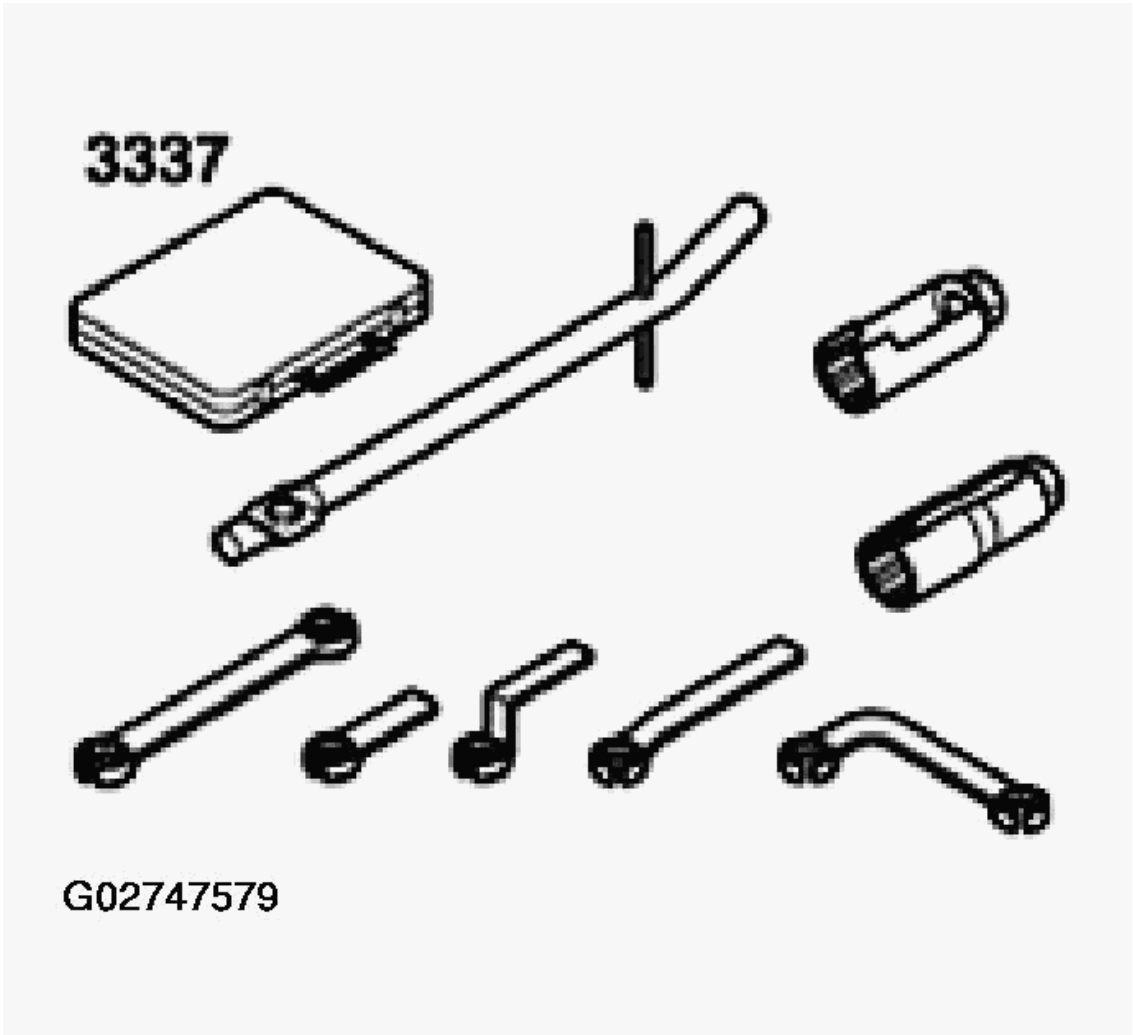


Fig. 42: Identifying Special Tool And Equipment - 3337 Wrench, 7-Piece Set (A\T 01J LH)

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Courtesy of AUDI OF AMERICA, INC.

- Engine/transmission hoist

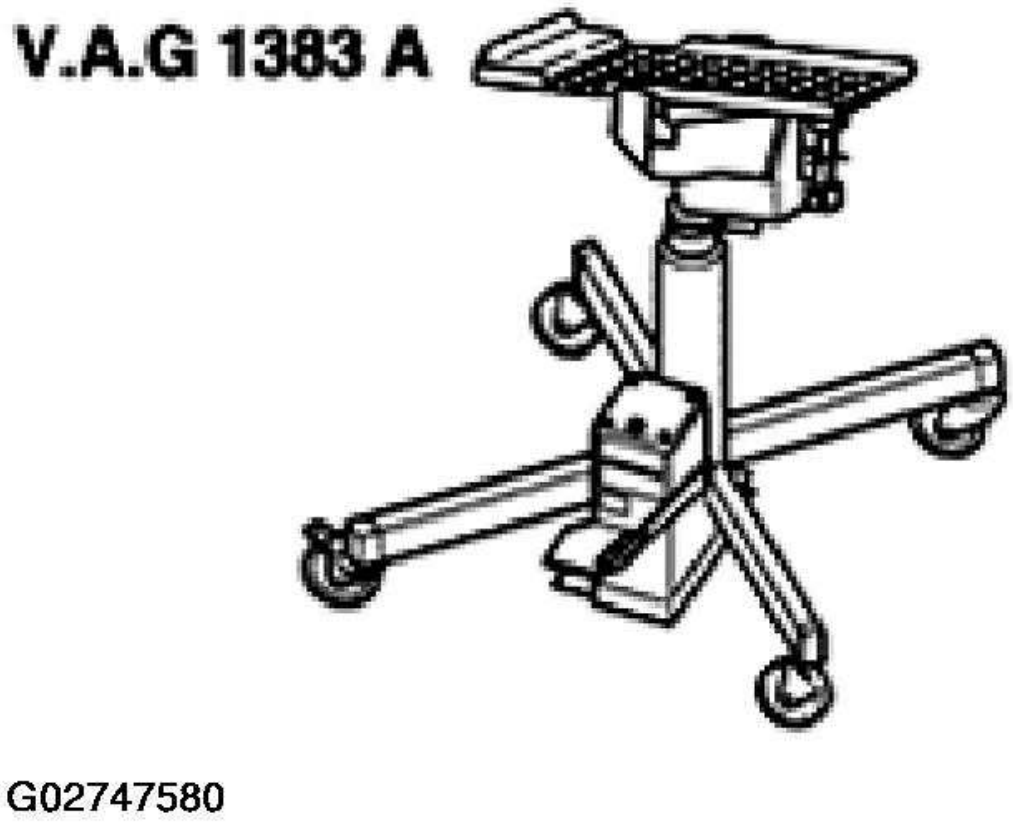


Fig. 43: Identifying Special Tool And Equipment - Engine/Transmission Hoist (A\T 01J LH)
Courtesy of AUDI OF AMERICA, INC.

- Locking compound G 052 112 A3

Removing

- Remove rear engine cover (arrows).

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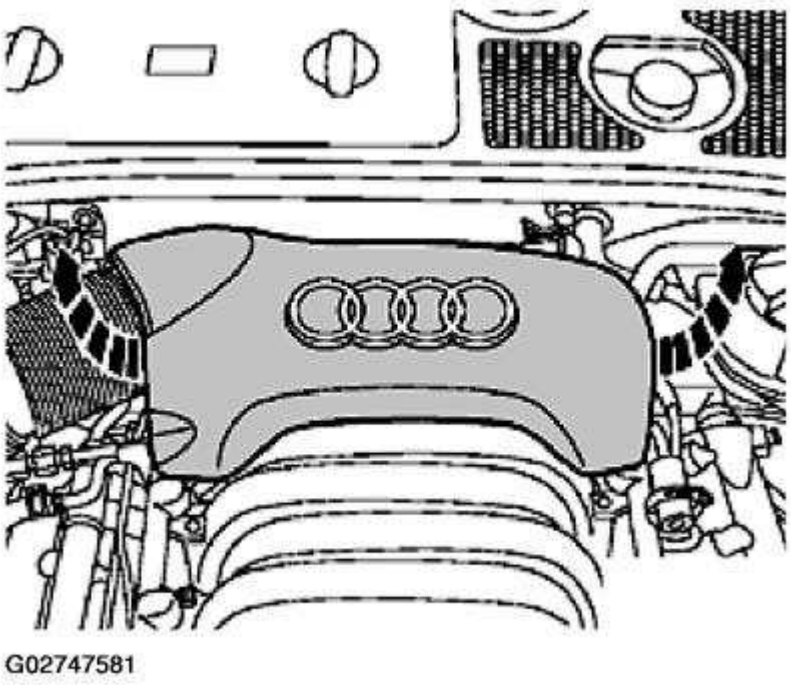


Fig. 44: Removing Rear Engine Cover - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove cover -1- in engine compartment (right side).

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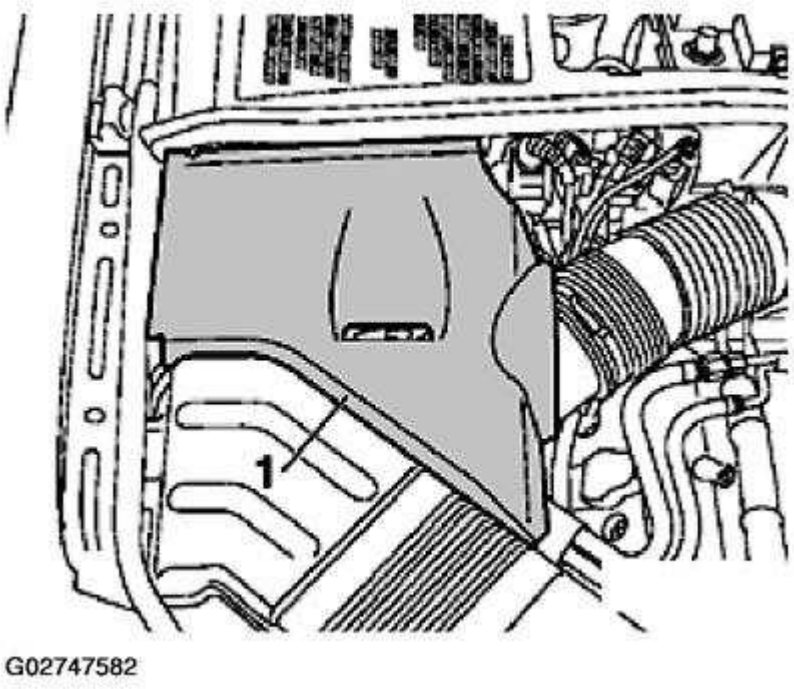


Fig. 45: Removing Right Side Engine Compartment Cover - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air hose -1- at Mass Air Flow (MAF) sensor.
- Remove hose -4- from air duct -2-.

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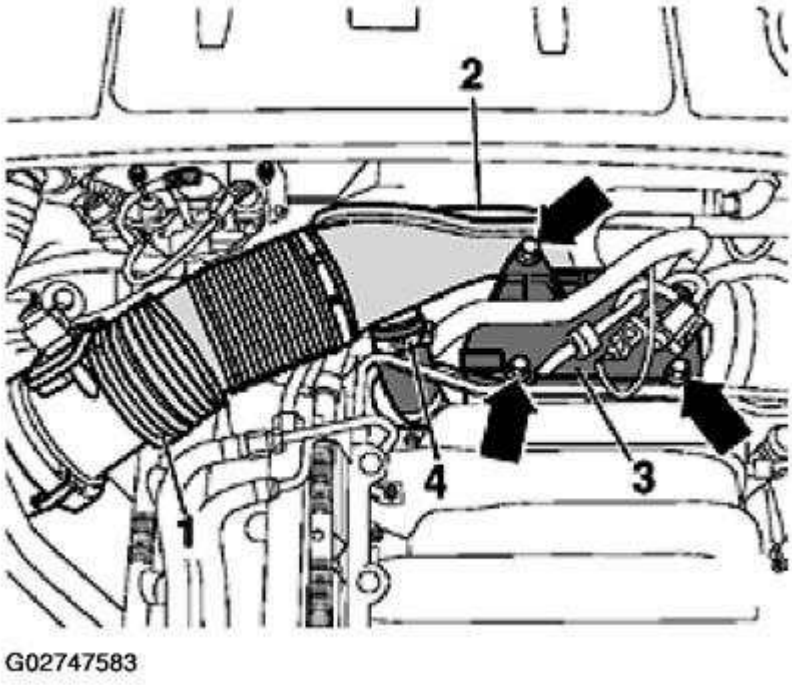


Fig. 46: Removing Solenoid Valves Holding Plate, And Intake Air Hose - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

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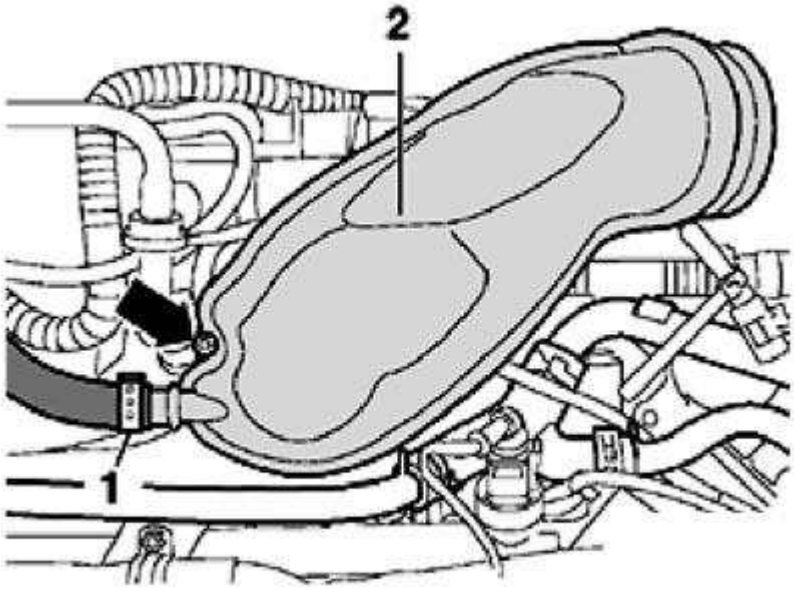


Fig. 47: Disconnecting Air Duct - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove cover -1- in engine compartment (left side).

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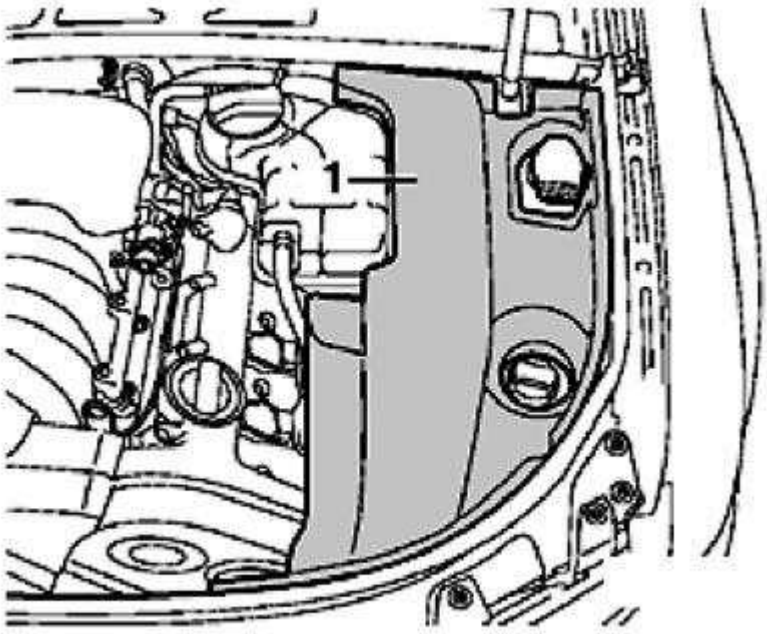


Fig. 48: Removing Left Side Engine Compartment Cover - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) Warning Switch -F66- at bottom of coolant reservoir.
- Tie coolant reservoir with connected coolant hoses -1 to 3- to side.

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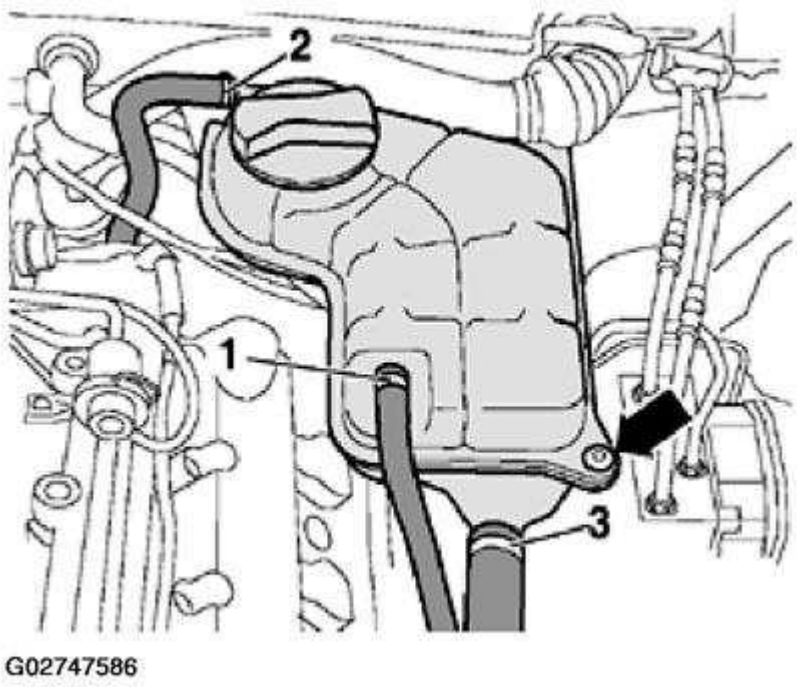


Fig. 49: Removing Coolant Reservoir - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Disconnect vacuum hose to brake booster (arrows).
- Remove heat shield for harness connectors at left of bulkhead, if installed.

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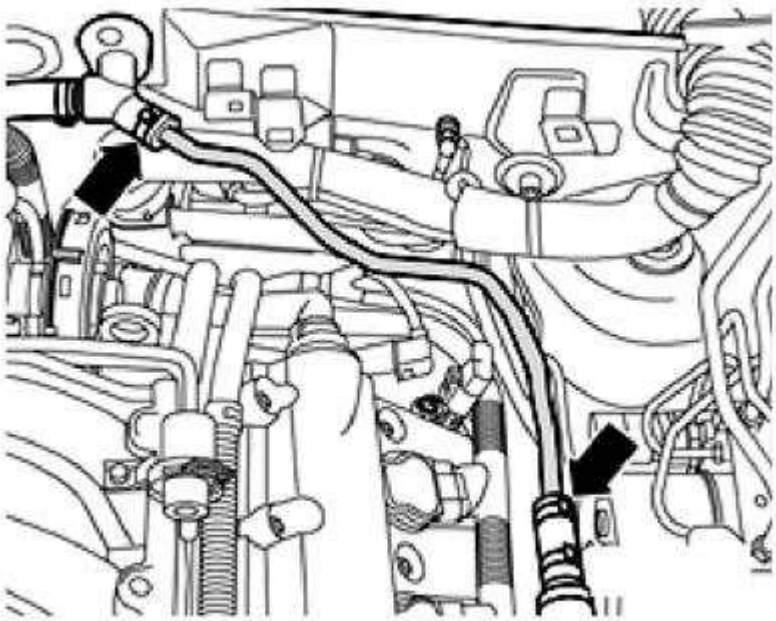


Fig. 50: Disconnecting Vacuum Hose To Brake Booster - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove harness connectors -1 to 4- from bracket at left of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

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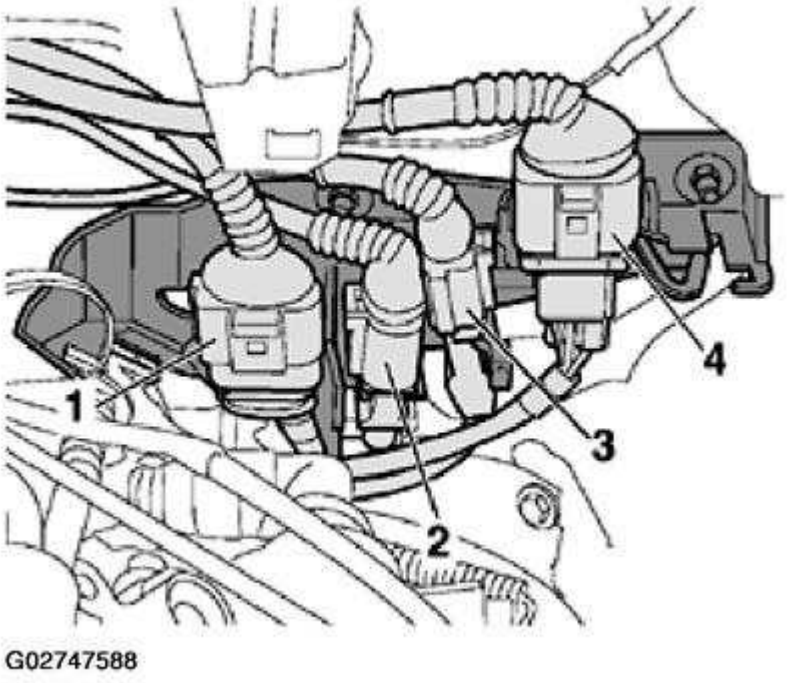


Fig. 51: Removing Harness Connectors From Bracket At Left Of Bulkhead - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: Illustration is shown with engine removed.

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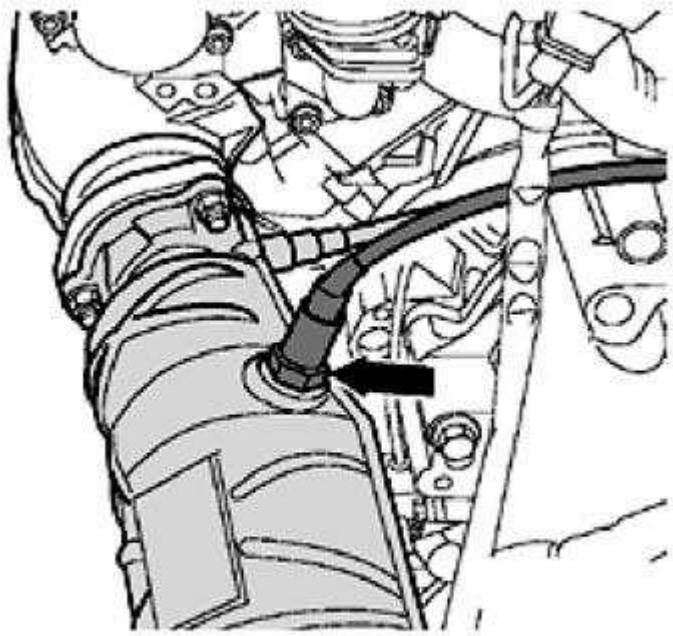


Fig. 52: Unscrewing Oxygen Sensor Behind Catalytic Converter - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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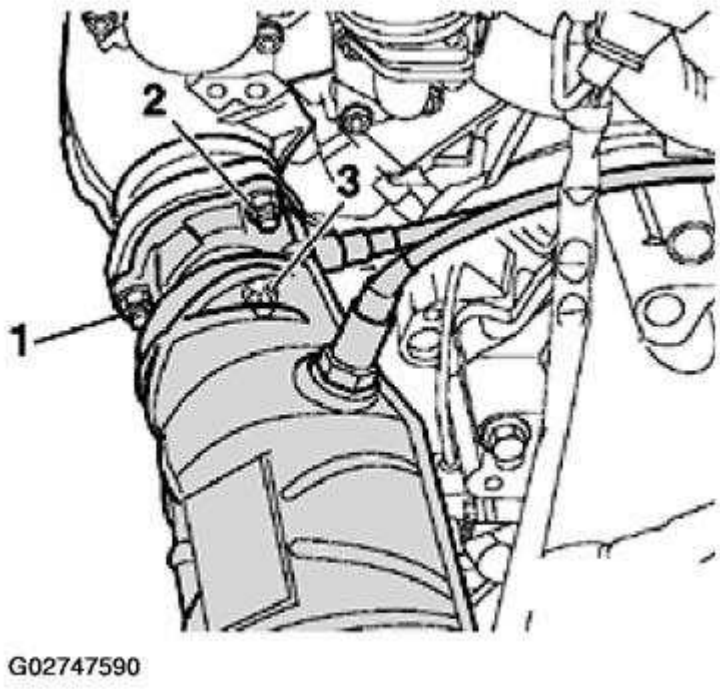


Fig. 53: Removing Exhaust Pipe/Exhaust Manifold Nut - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove left front wheel.
- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of parking heater/auxiliary heater on noise insulation.

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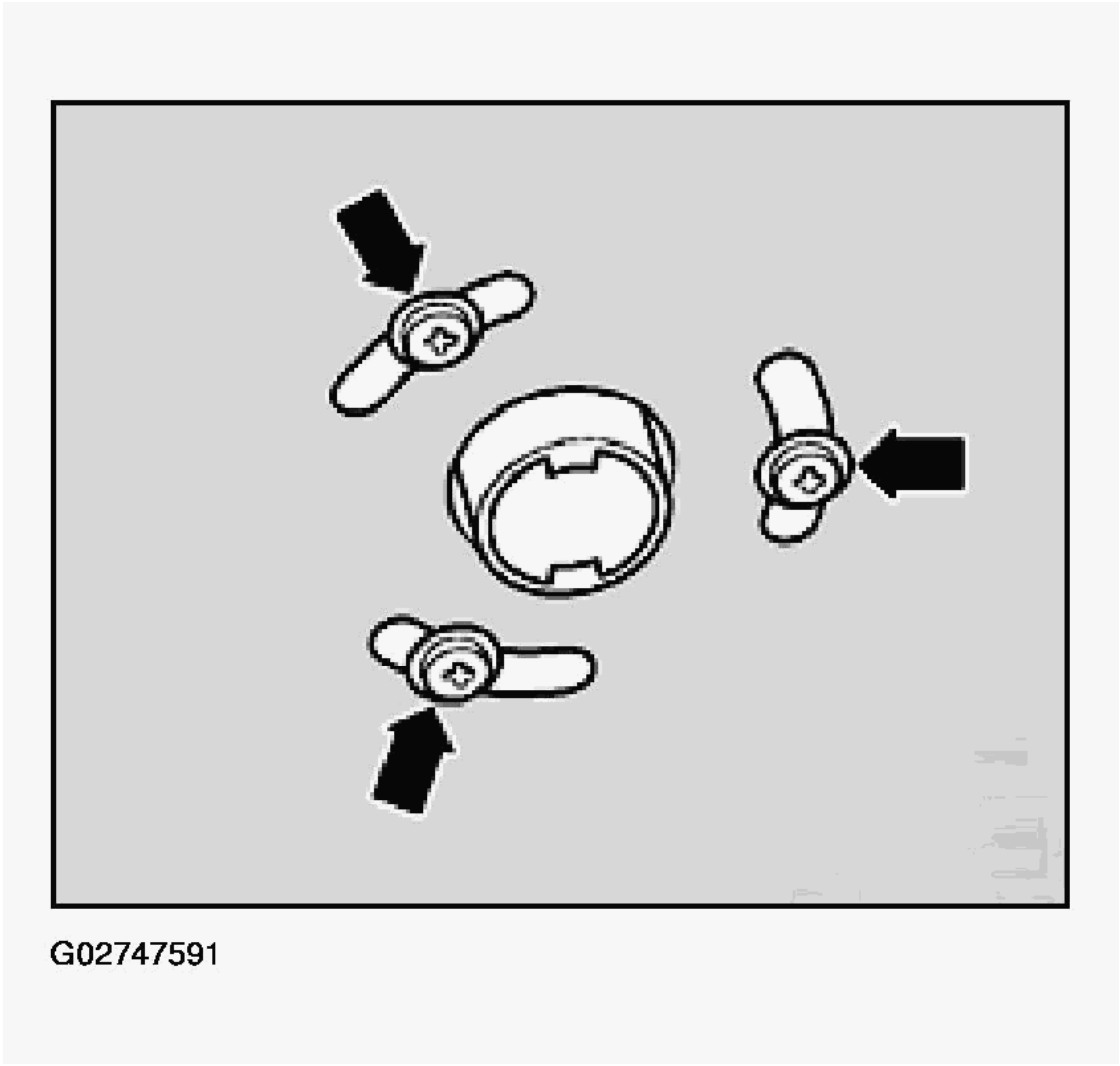
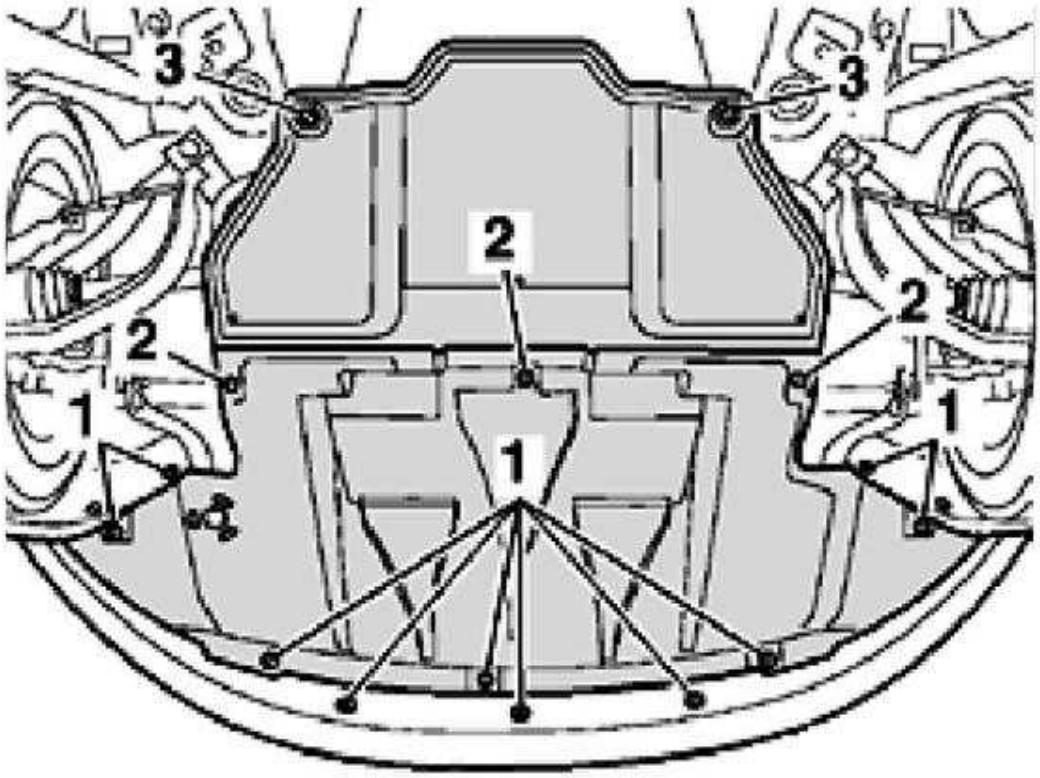


Fig. 54: Removing Parking Heater/Auxiliary Heater Exhaust Pipe Bolts - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front noise insulation.
- Remove quick-release screws -3- and remove rear noise insulation, if present.

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Fig. 55: Removing Front And Rear Noise Insulation - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged..

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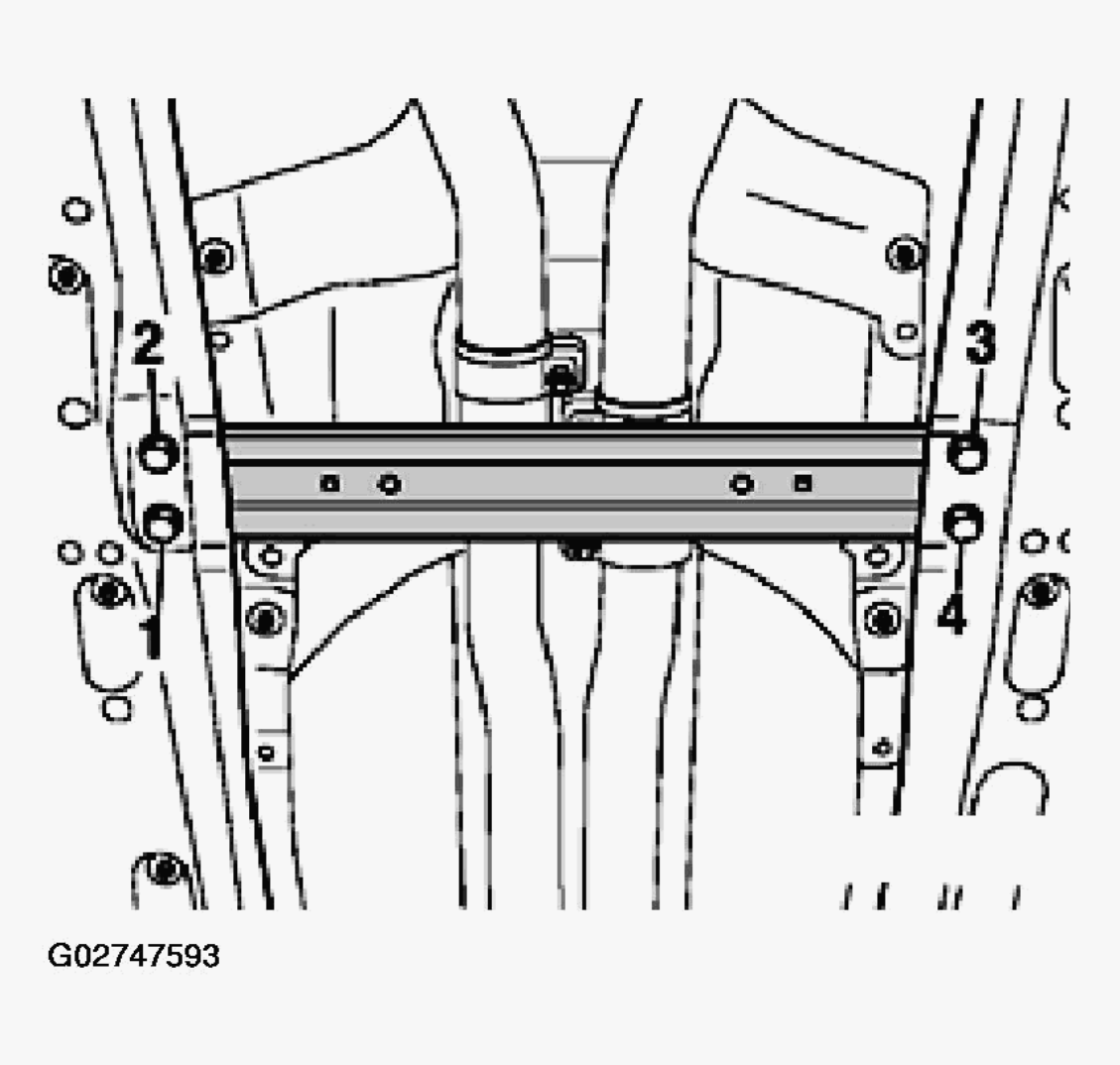


Fig. 56: Removing Crossmember - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Disconnect exhaust system at both double clamps -arrows-.

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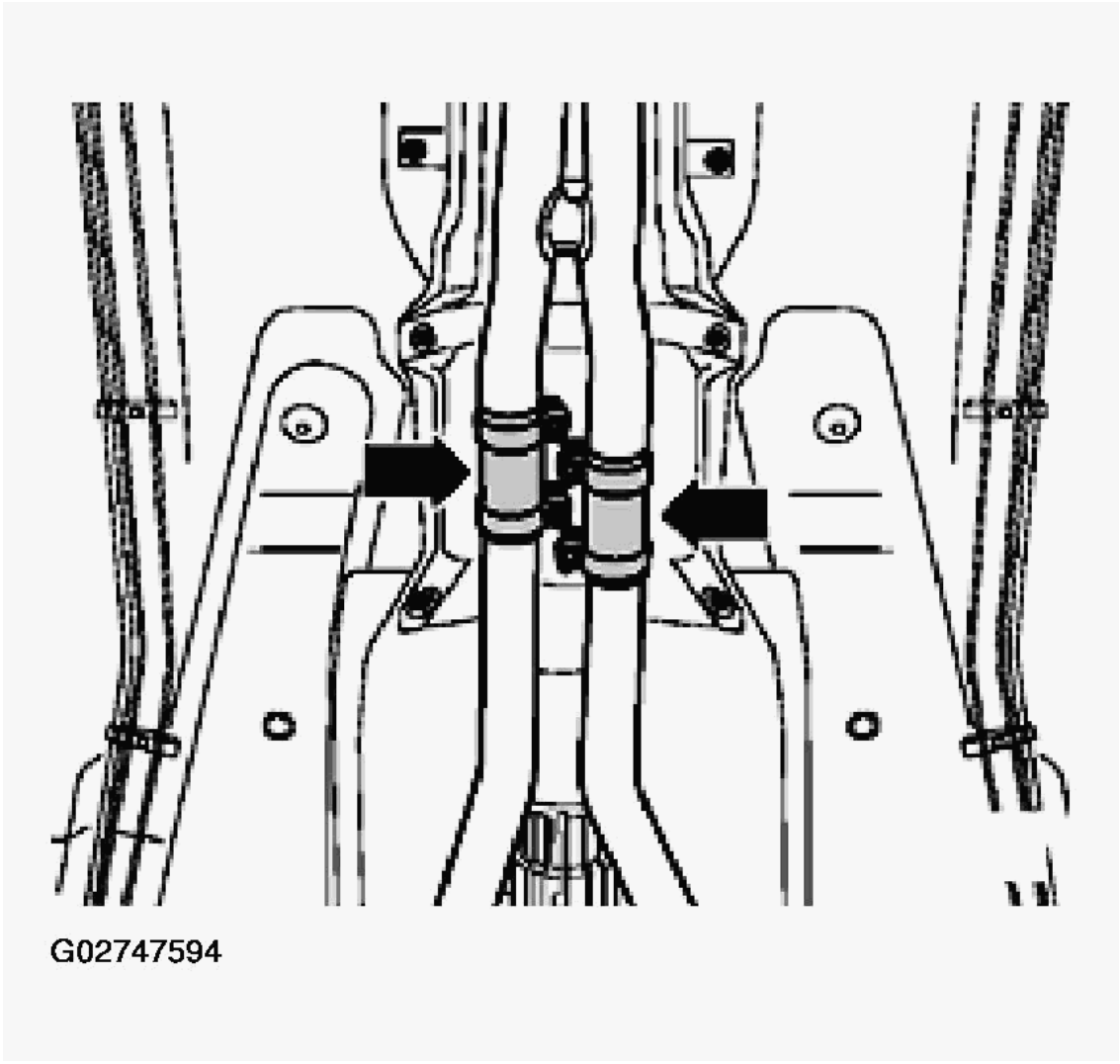


Fig. 57: Disconnecting Exhaust System At Both Double Clamps - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove VAG1359/2 universal mount from VAG1383A engine/gearbox jack and insert a piece of wood -1- instead.
- Support rear cross member using VAG1383A engine/transmission jack.

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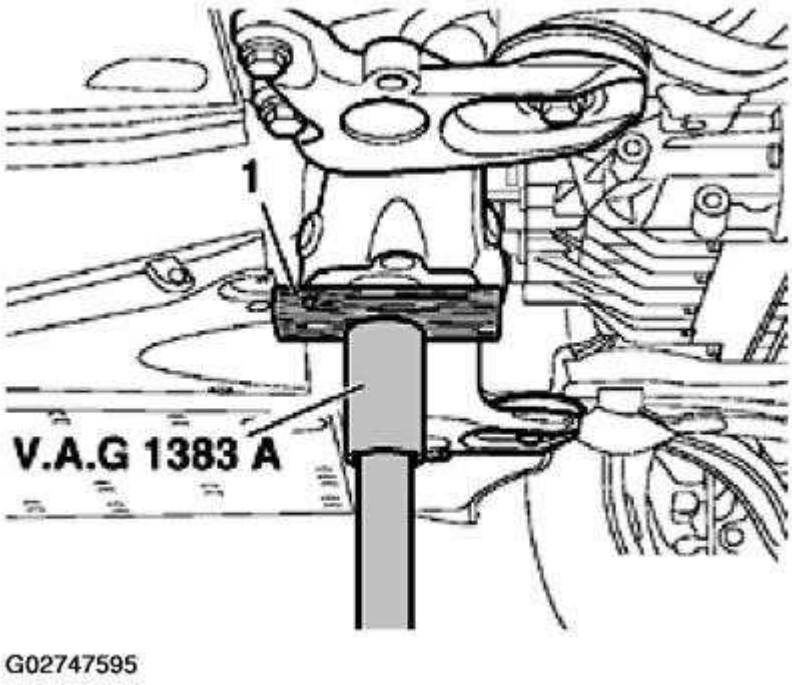


Fig. 58: Removing Universal Mount From Engine/Gearbox Jack - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- First remove bolts -1- and -2-, then bolts -3- and -4-.

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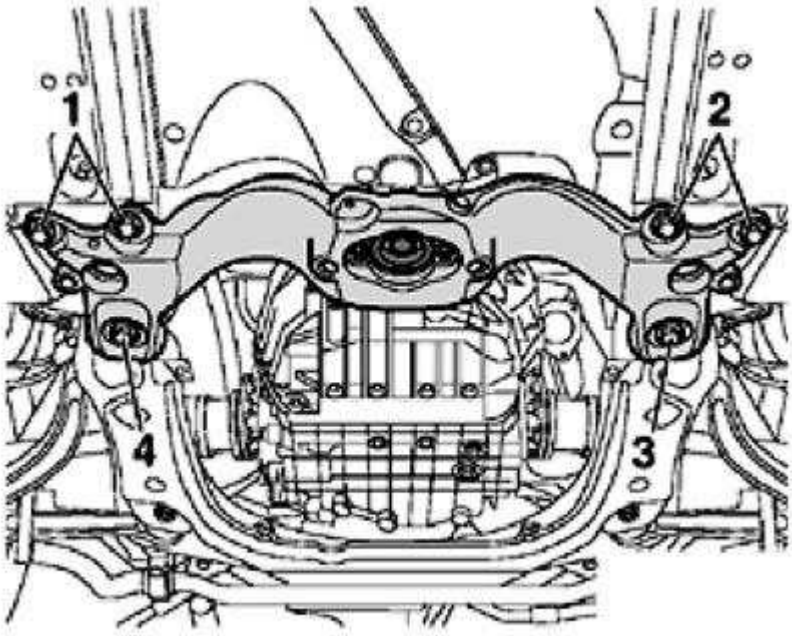


Fig. 59: Releasing Rear Cross Member - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Release slowly the rear cross member using VAG1383A engine/transmission jack.
- Set aside VAG1383A engine/transmission jack.
- Remove nuts (arrows) and rear cross member.

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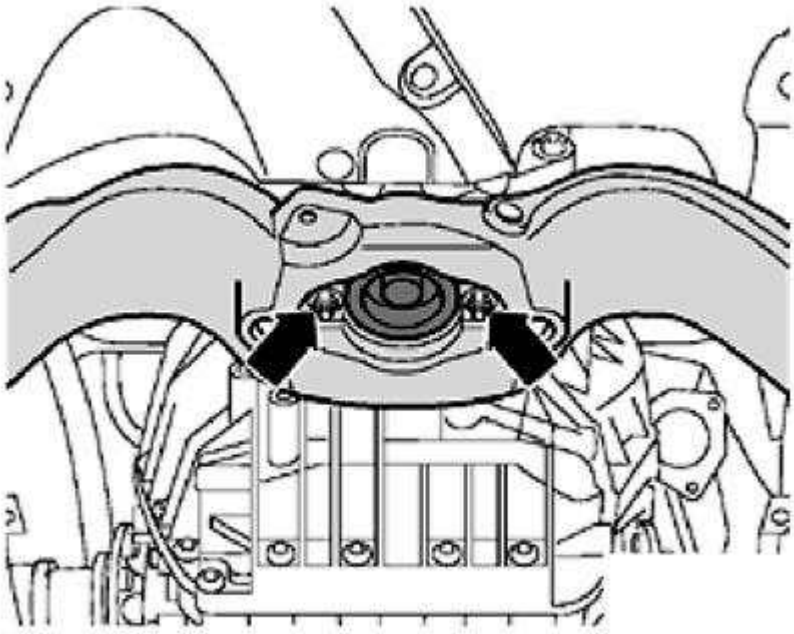


Fig. 60: Removing Rear Cross Member - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove heat shield -1- for left drive axle.

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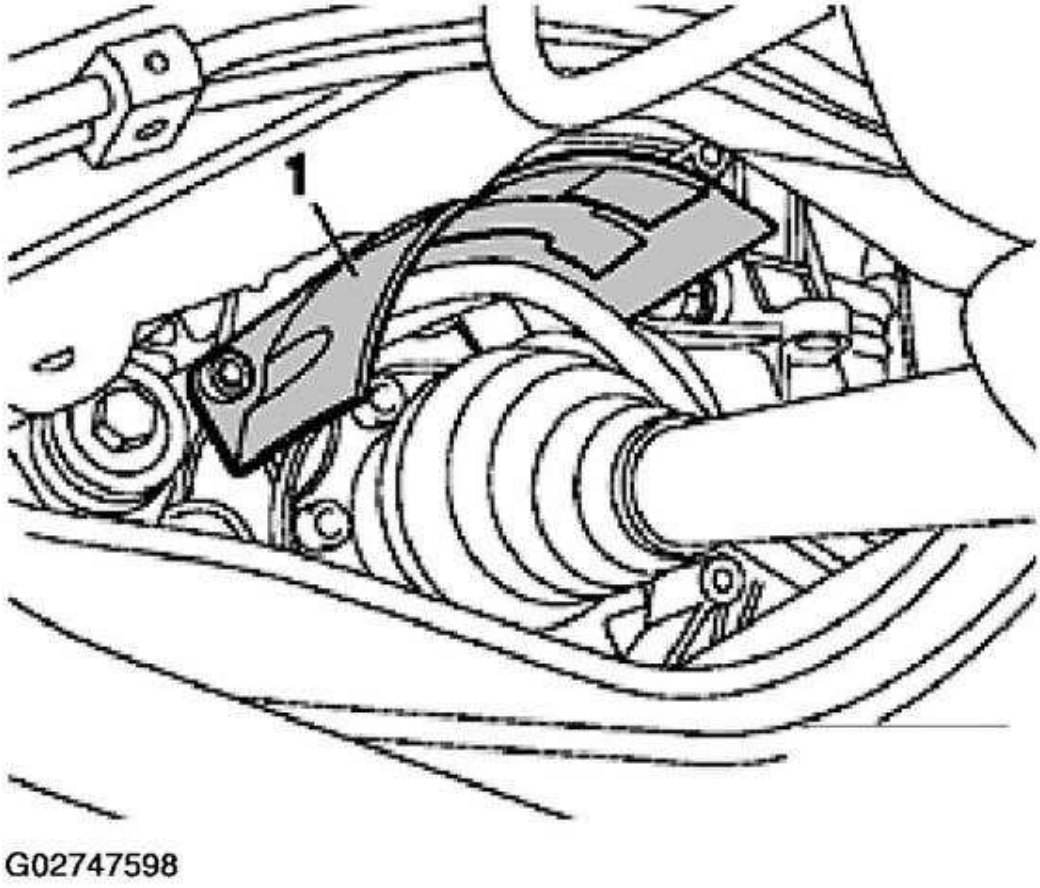


Fig. 61: Removing Heat Shield For Left Drive Axle - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bracket for front exhaust pipe (arrows).

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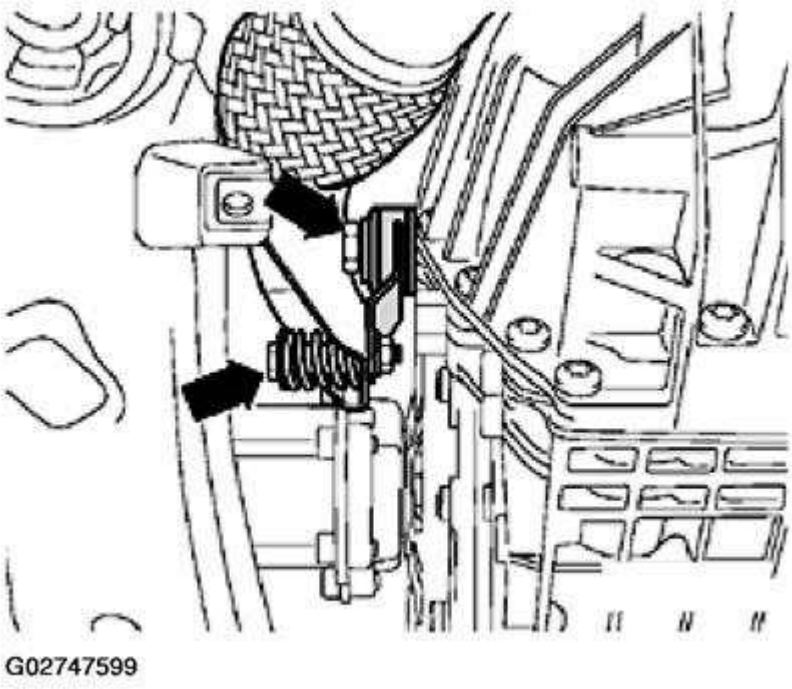


Fig. 62: Removing Front Exhaust Pipe Bracket - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Expose oxygen sensor wire.
- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

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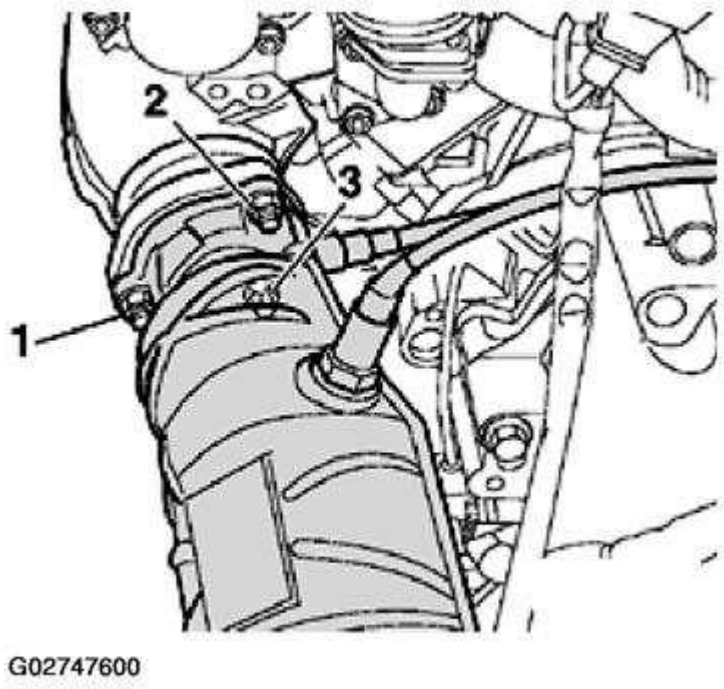


Fig. 63: Removing LH Front Exhaust Pipe/Exhaust Manifold Nuts
Courtesy of AUDI OF AMERICA, INC.

- Loosen lower nuts -1- several turns on left and right of engine mount.

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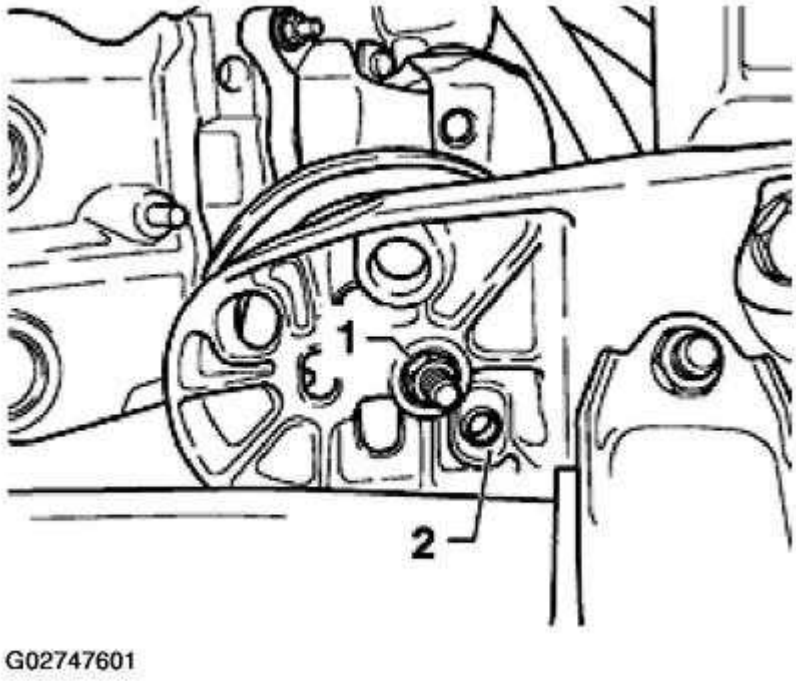


Fig. 64: Removing Engine Mount Nuts - A\T Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Press transmission to the right.
- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**
- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Install subframe:

  See **SUBFRAME & BUSHINGS**

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- Install engine free of stress.
- Install exhaust system free of stress, see **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** and **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .

NOTE: For individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01J, see INDIVIDUAL LEFT MOUNTING COMPONENTS FOR VEHICLES WITH AUTOMATIC TRANSMISSION 01J .

Tightening torques

TIGHTENING TORQUES: LH EXHAUST SYSTEM (A\T 01J)

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55
Engine mount to console	23

Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01J)

Special tools and equipment

- 3337 wrench, 7-piece set

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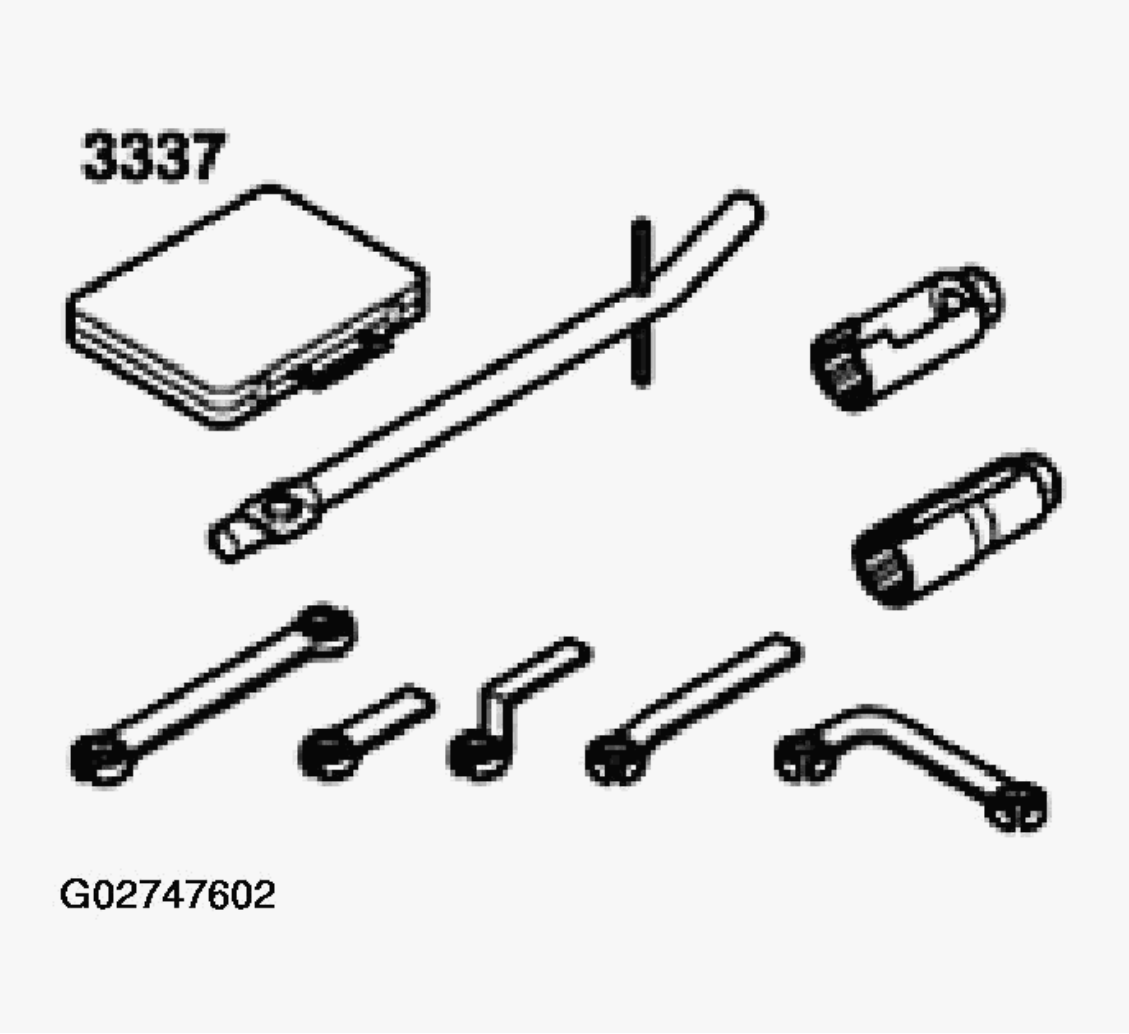


Fig. 65: Identifying Special Tool And Equipment - 3337 Wrench (A\T 01J RH)
Courtesy of AUDI OF AMERICA, INC.

- Engine/transmission hoist

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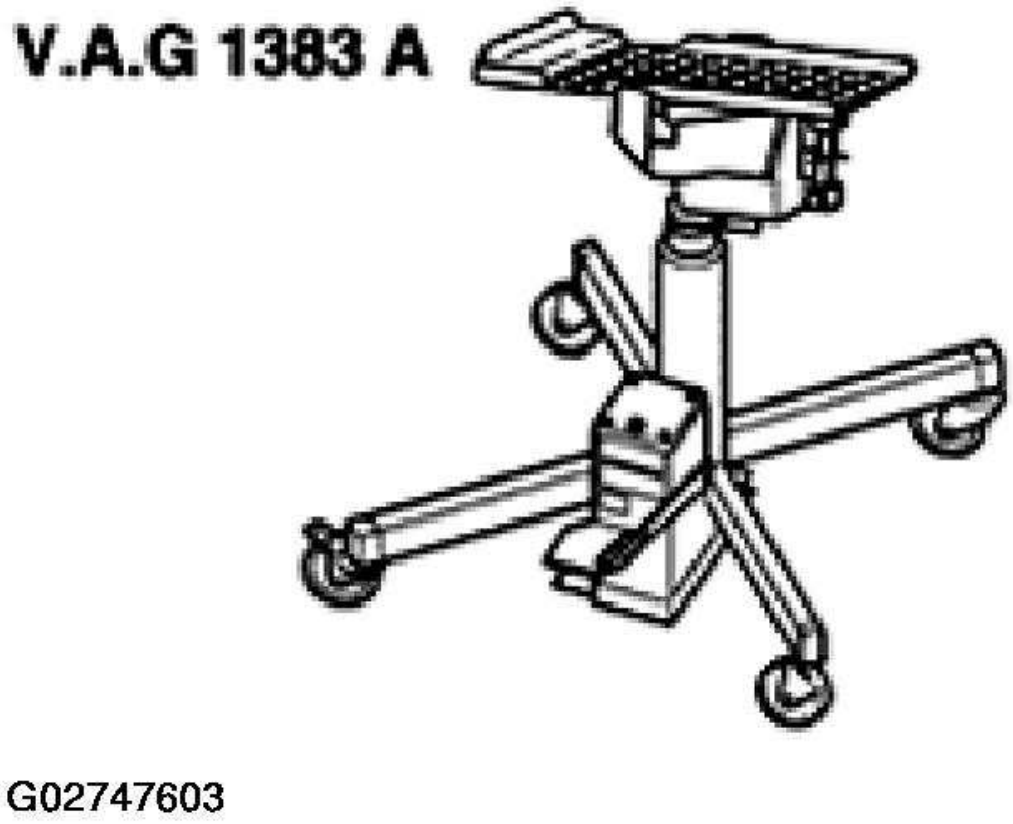


Fig. 66: Identifying Special Tool And Equipment - Engine/Transmission Hoist (A\T 01J RH)
Courtesy of AUDI OF AMERICA, INC.

- Locking compound G 052 112 A3

Removing

- Remove rear engine cover (arrows).

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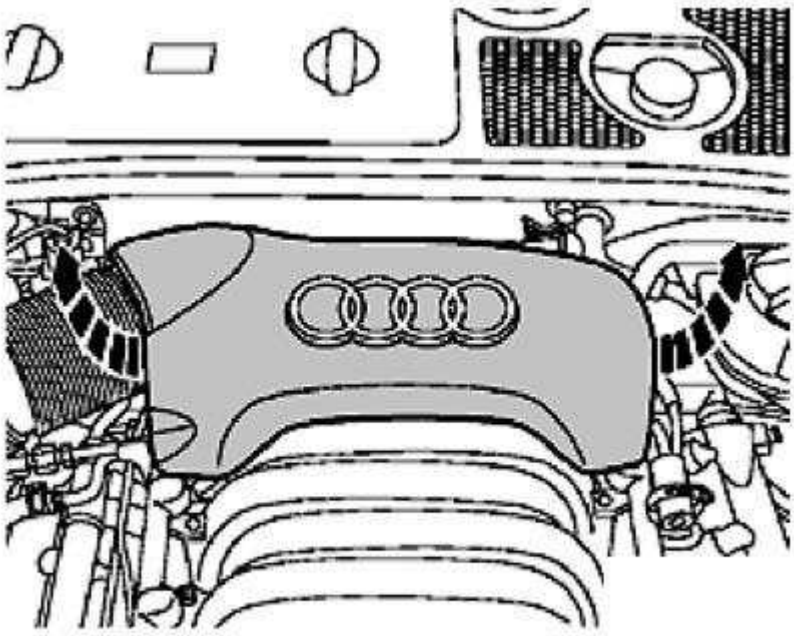


Fig. 67: Removing Rear Engine Cover - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove cover -1- in engine compartment (right side).

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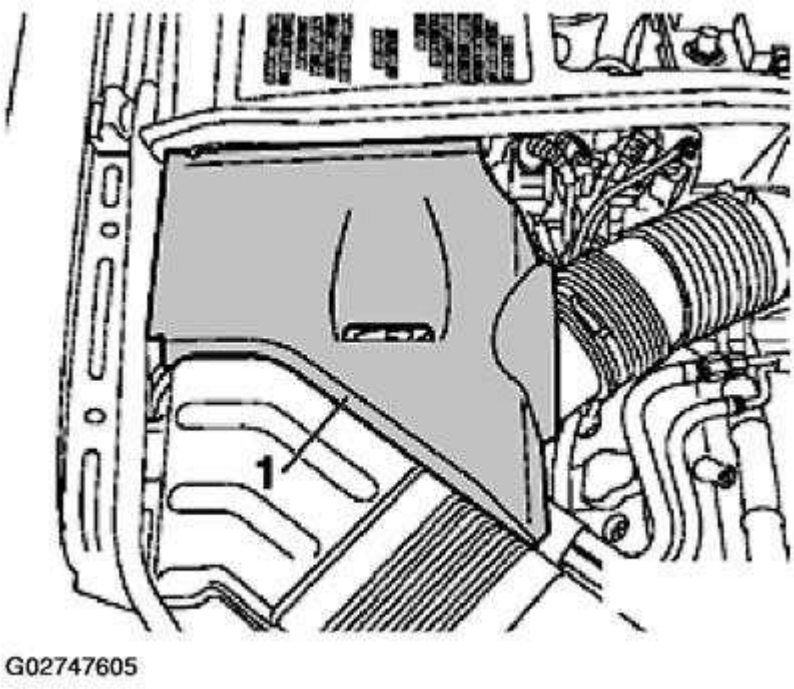


Fig. 68: Removing Right Side Engine Compartment Cover - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts (arrows).

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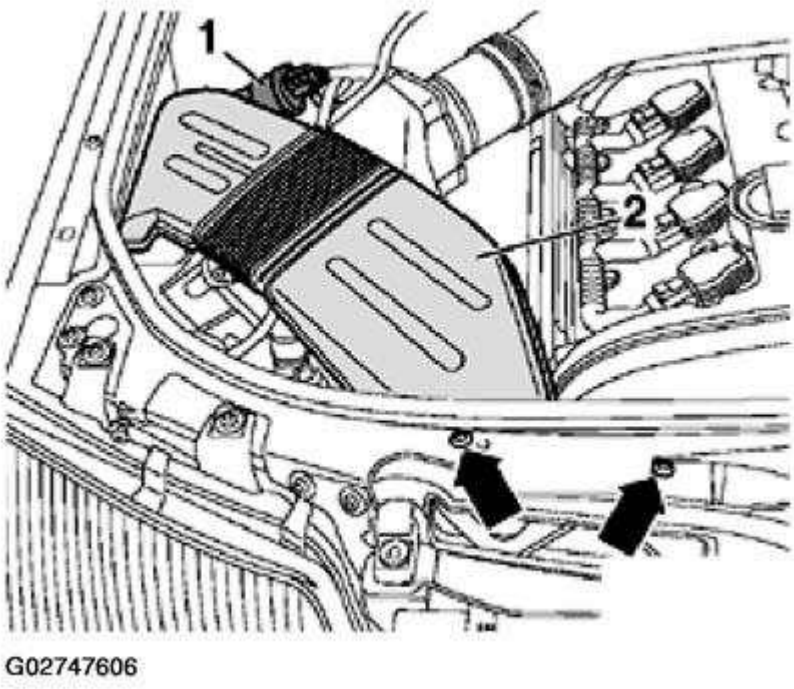


Fig. 69: Detaching Evaporative Emission (EVAP) Canister Purge Regulator Valve - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Detach Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- -1- at air guide.
- Remove air guide -2-.
- Remove air filter housing (arrows).

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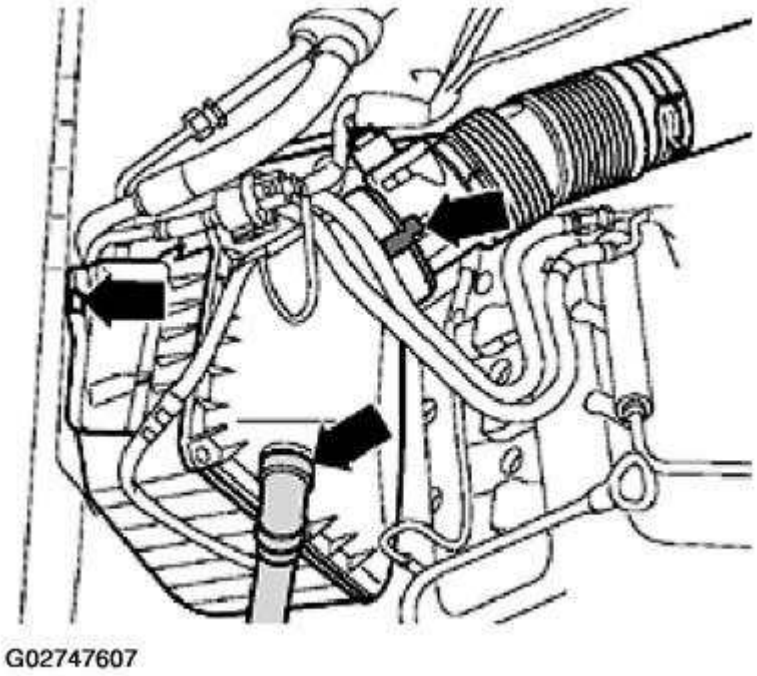


Fig. 70: Removing Air Filter Housing - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect electrical harness connector at Mass Air Flow (MAF) sensor.
- Remove hose -4- from air duct -2-.

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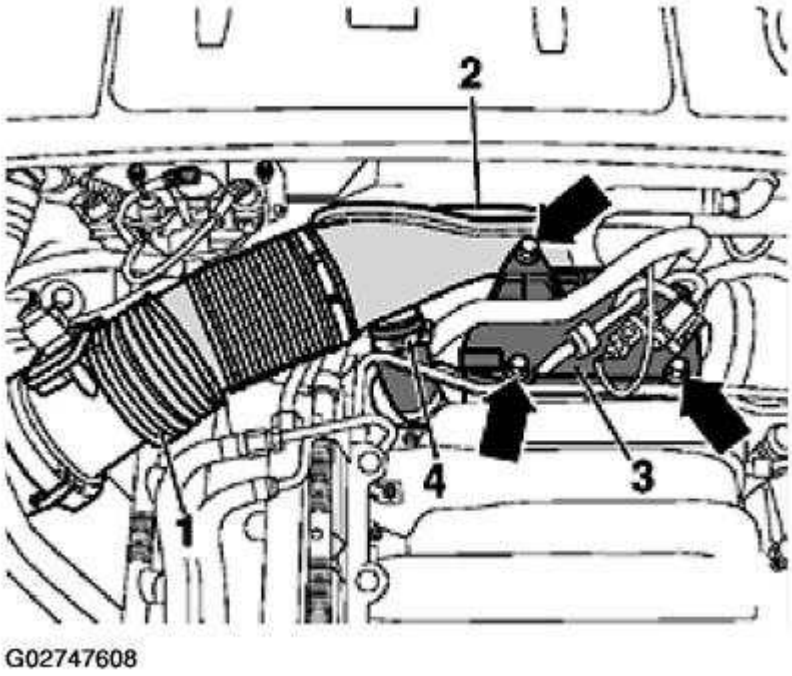


Fig. 71: Removing Solenoid Valves Holding Plate And MAF Sensor Electrical Harness Connector - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

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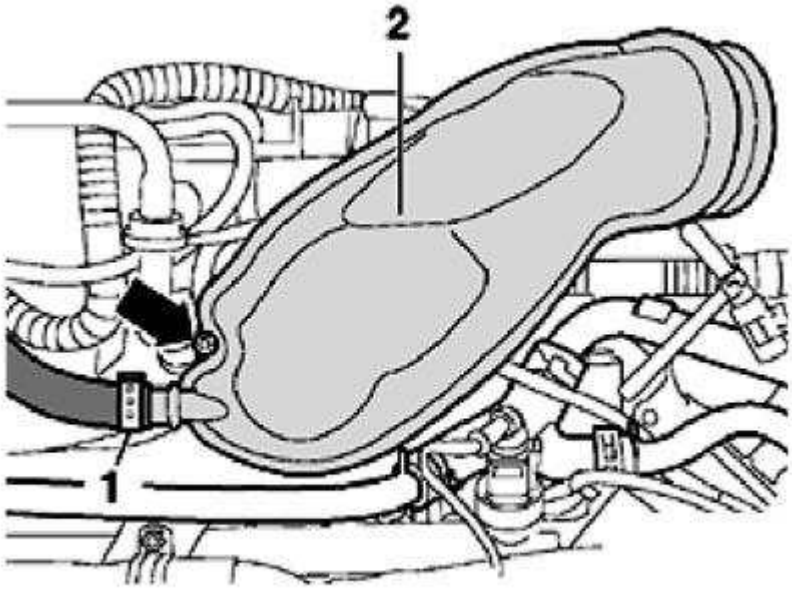


Fig. 72: Disconnecting Air Duct At Throttle Valve Control Module - A\T 01J Vehicle (Front RH Exhaust Pipe)
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- Remove harness connectors -1 to 4- from bracket at right of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

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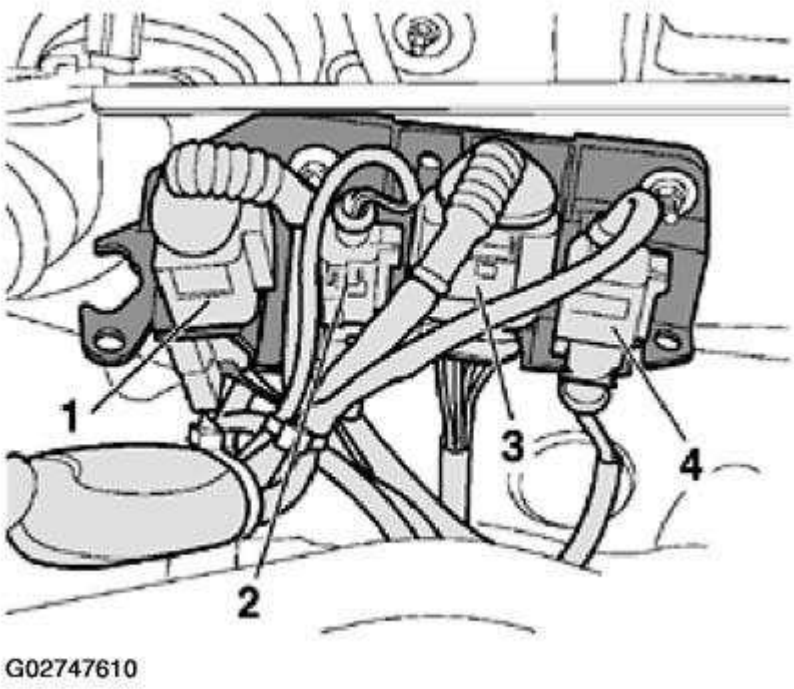


Fig. 73: Removing Harness Connectors From Bracket At Right Of Bulkhead - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: Illustration is shown with engine removed.

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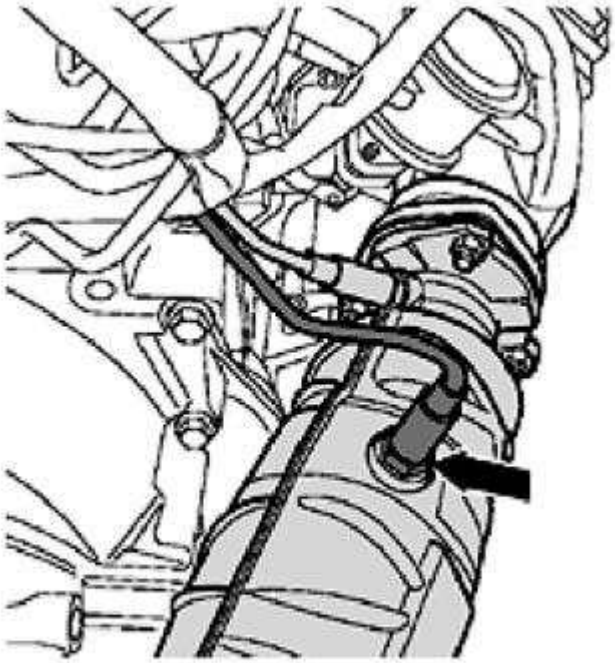


Fig. 74: Unscrewing Oxygen Sensor Behind Catalytic Converter - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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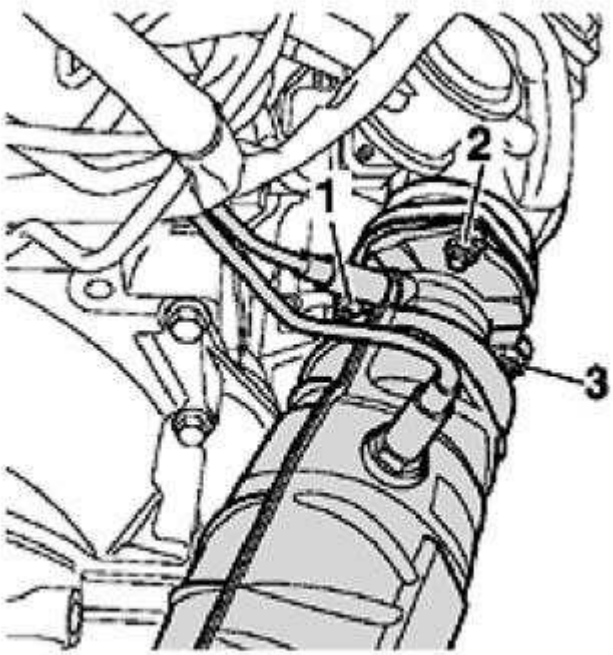


Fig. 75: Removing Exhaust Pipe/Exhaust Manifold Nut - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove right front wheel
- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of parking heater/auxiliary heater on noise insulation.

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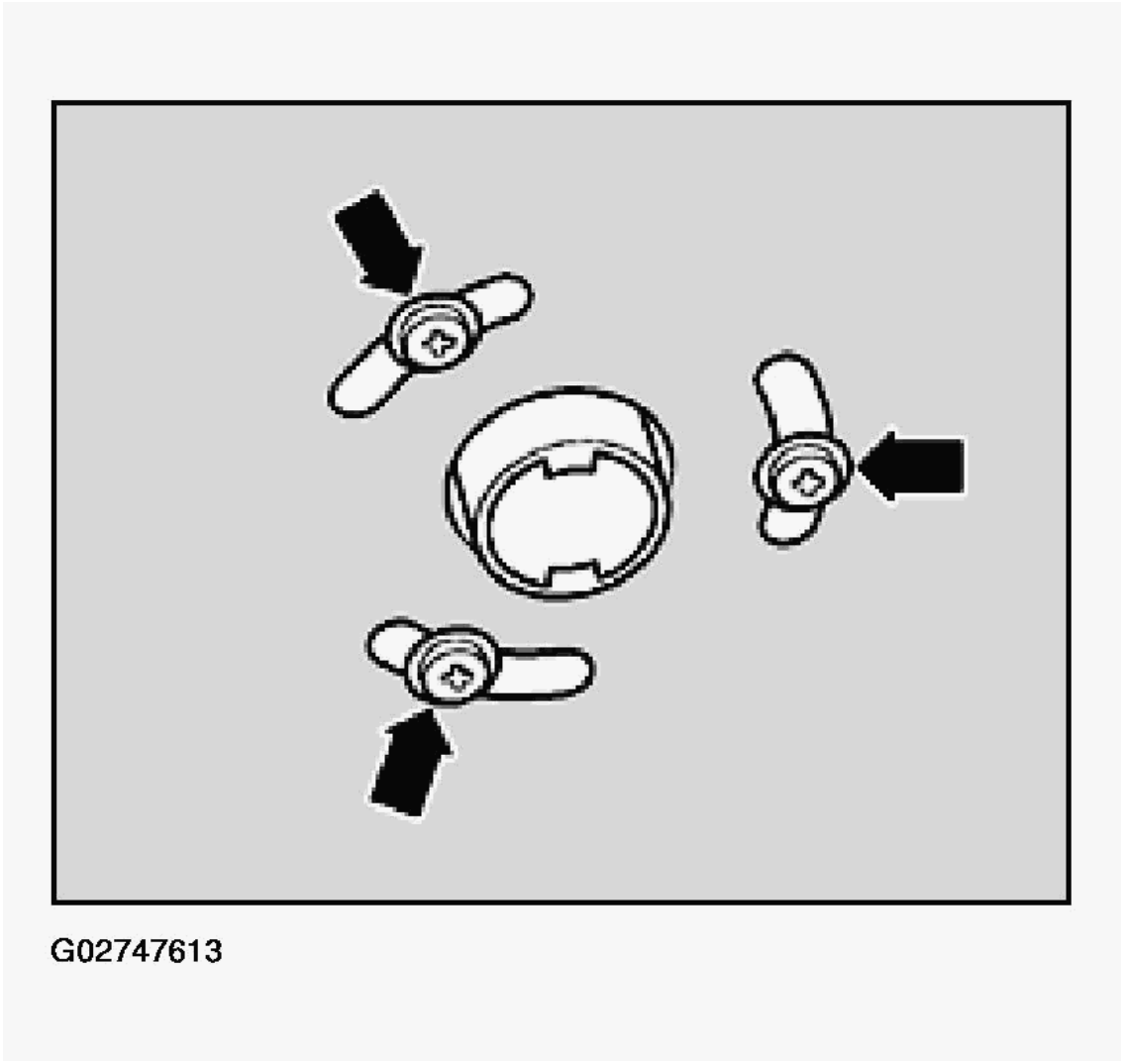


Fig. 76: Removing Parking Heater/Auxiliary Heater Exhaust Pipe Bolts - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front noise insulation.
- Remove quick-release screws -3- and remove rear noise insulation, if present.

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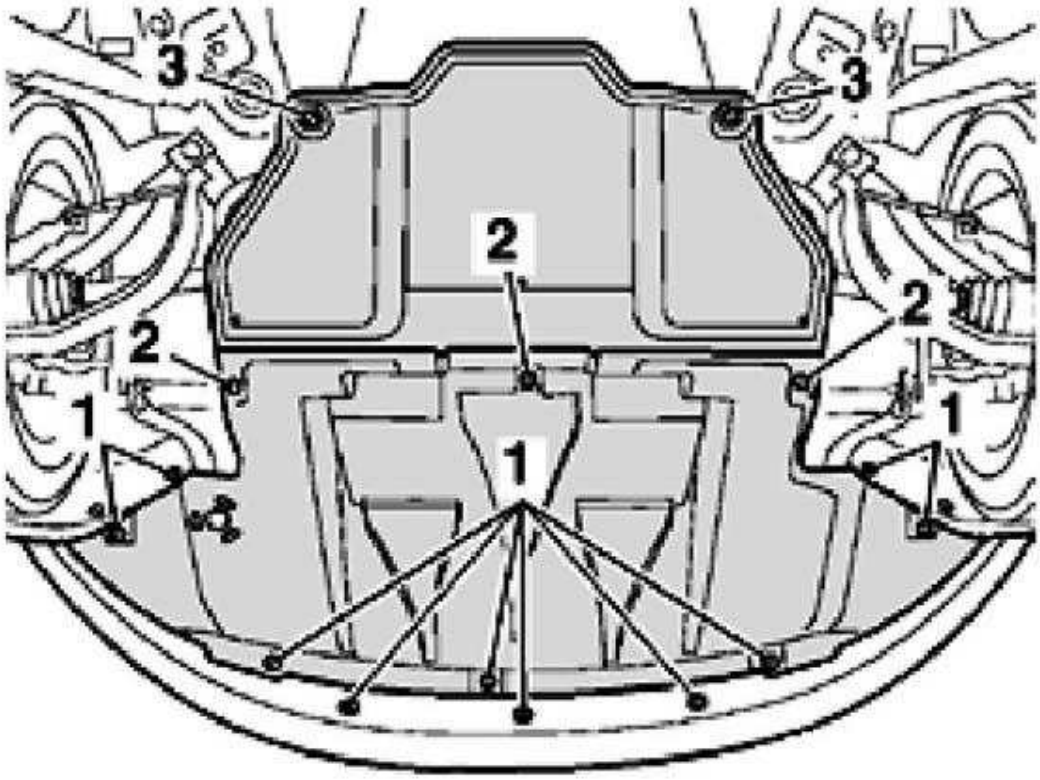


Fig. 77: Removing Front And Rear Noise Insulation - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts -1- through -4- and remove crossmember.

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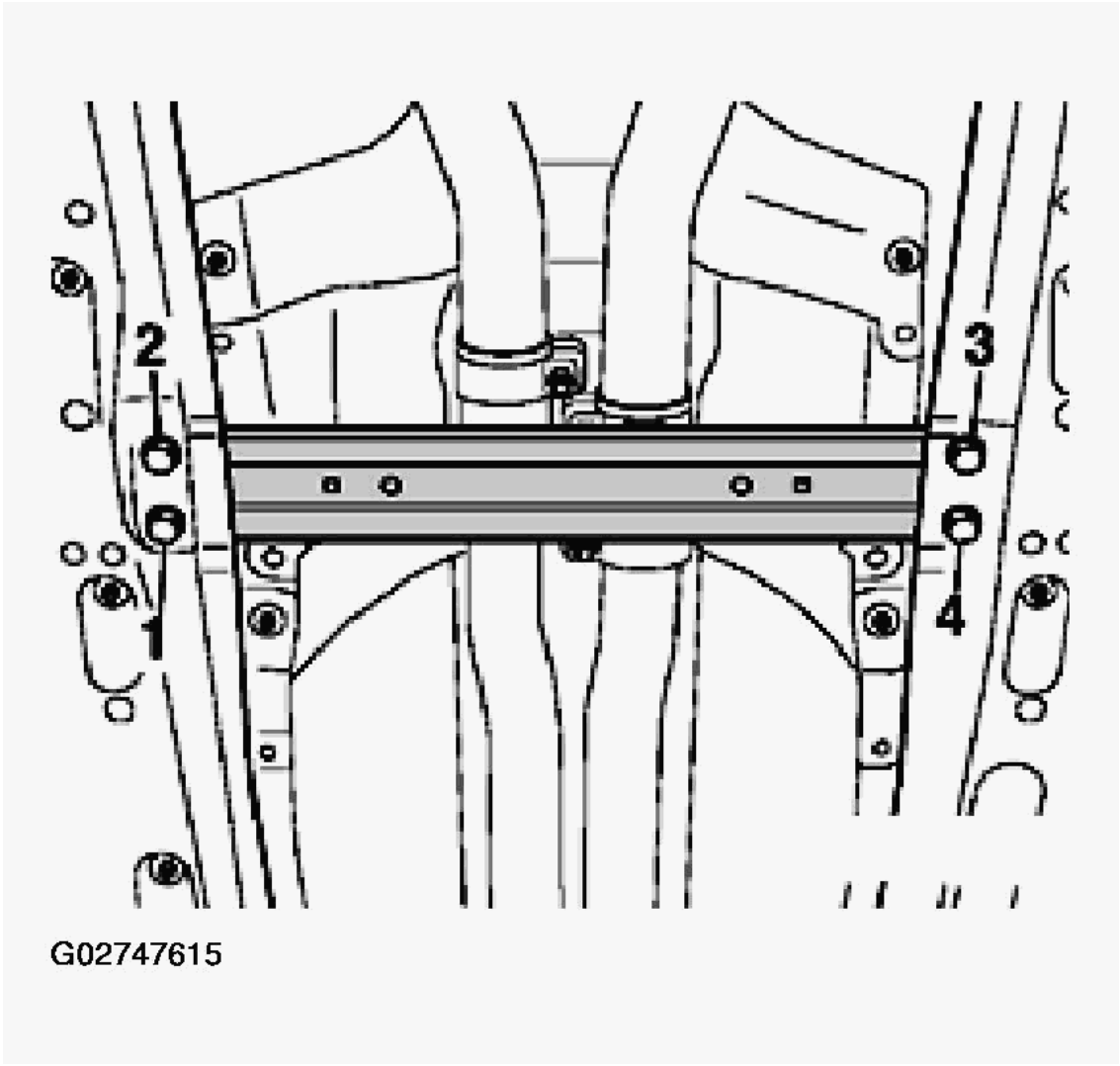


Fig. 78: Removing Crossmember - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged.

- Disconnect exhaust system at both double clamps -arrows-.

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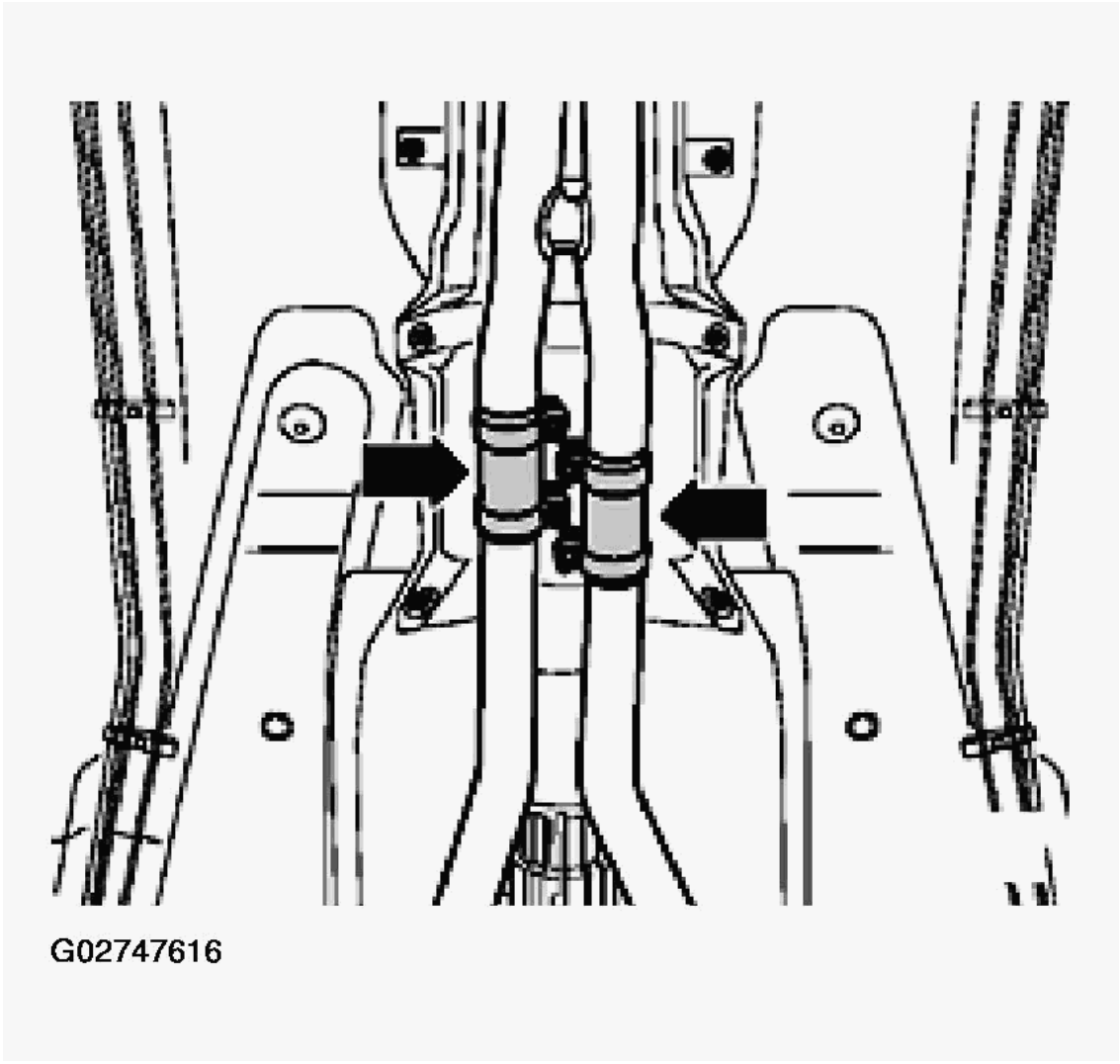


Fig. 79: Disconnecting Exhaust System At Both Double Clamps - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove VAG1359/2 universal mount from VAG1383A engine/gearbox jack and insert a piece of wood -1- instead.

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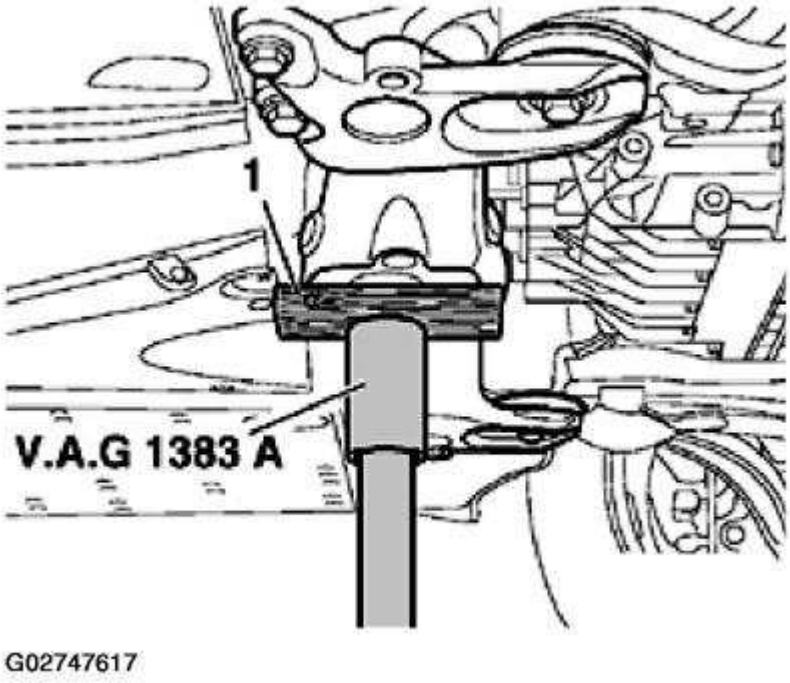


Fig. 80: Removing Universal Mount From Engine/Gearbox Jack - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Support rear cross member using VAG1383A engine/transmission jack.
- First remove bolts -1- and -2-, then bolts -3- and -4-.

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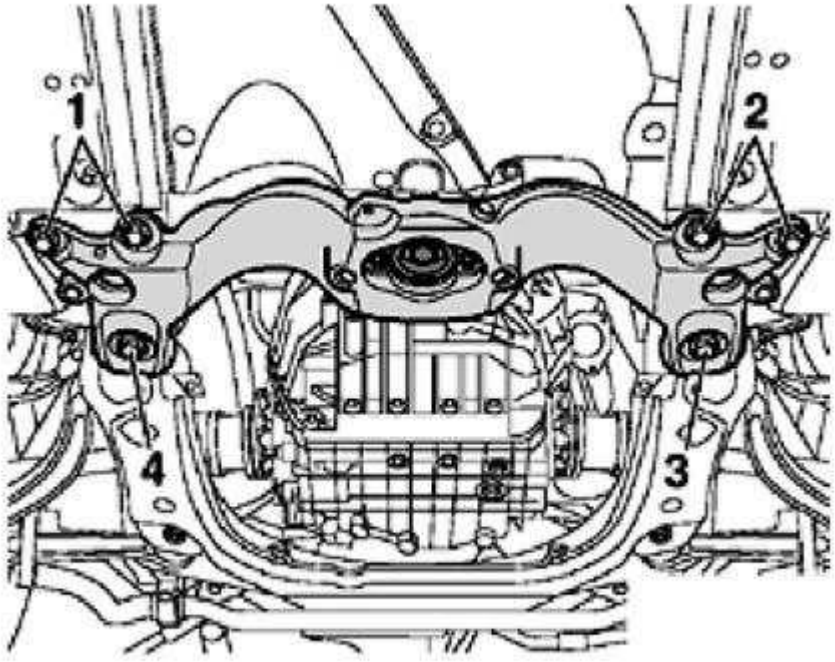


Fig. 81: Releasing Rear Cross Member - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Release slowly the rear cross member using VAG1383A engine/transmission jack.
- Set aside VAG1383A engine/transmission jack.
- Remove nuts (arrows) and rear cross member.

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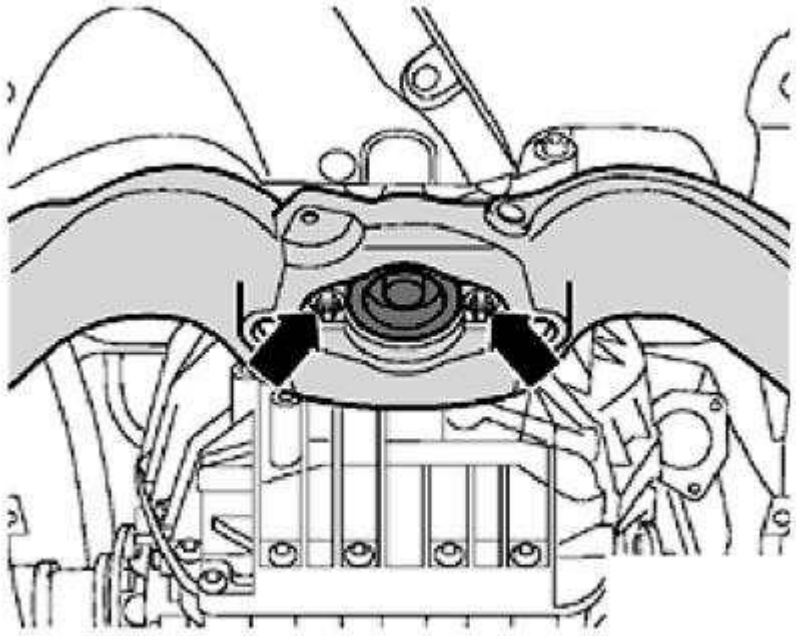


Fig. 82: Removing Rear Cross Member - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove heat shield -1- for right drive axle.

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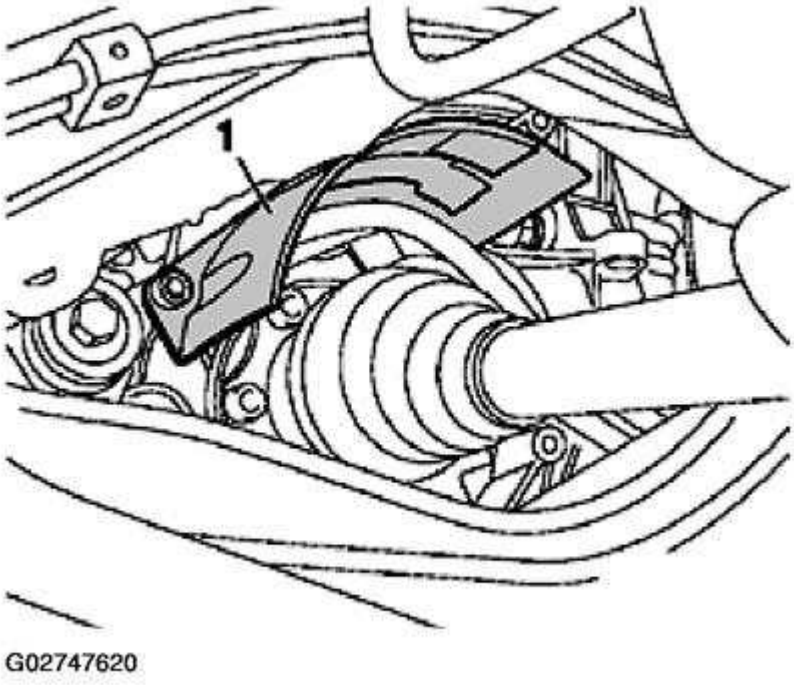


Fig. 83: Removing Heat Shield From Right Drive Axle - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove right drive axle.

  See **FRONT AXLE SHAFT** .

- Remove bracket for front exhaust pipe (arrows).

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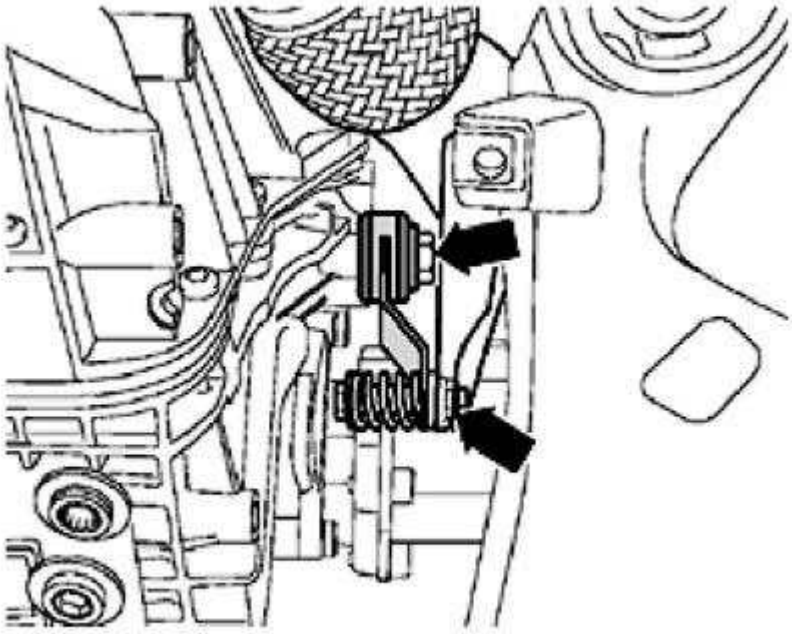


Fig. 84: Removing Front Exhaust Pipe Bracket - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Unbolt bracket for ATF-lines (arrow).

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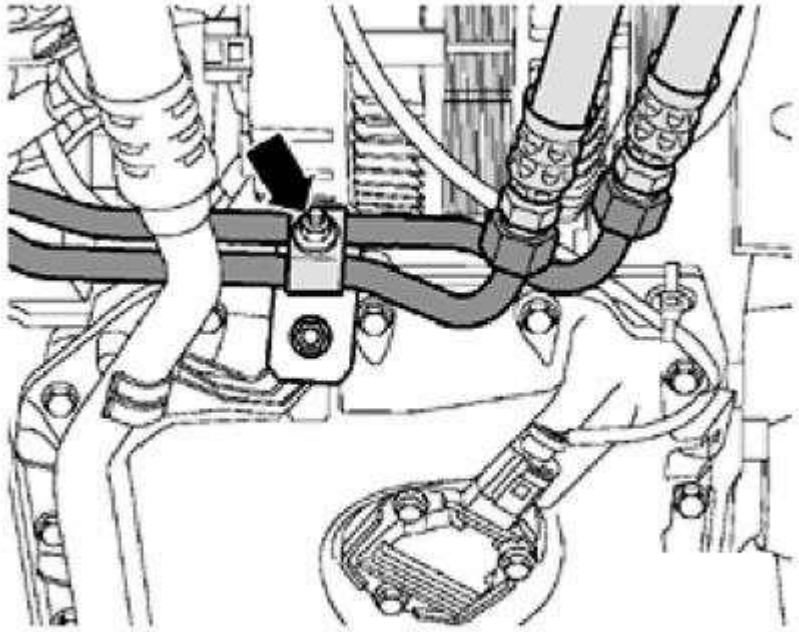


Fig. 85: Removing ATF-Lines Bracket Bolt - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

NOTE: Observe the rules of cleanliness for working on automatic transmissions:

See **RULES FOR CLEANLINESS** .

- Place oil pan underneath.
- Remove bolt (arrow) and disconnect ATF lines from transmission.

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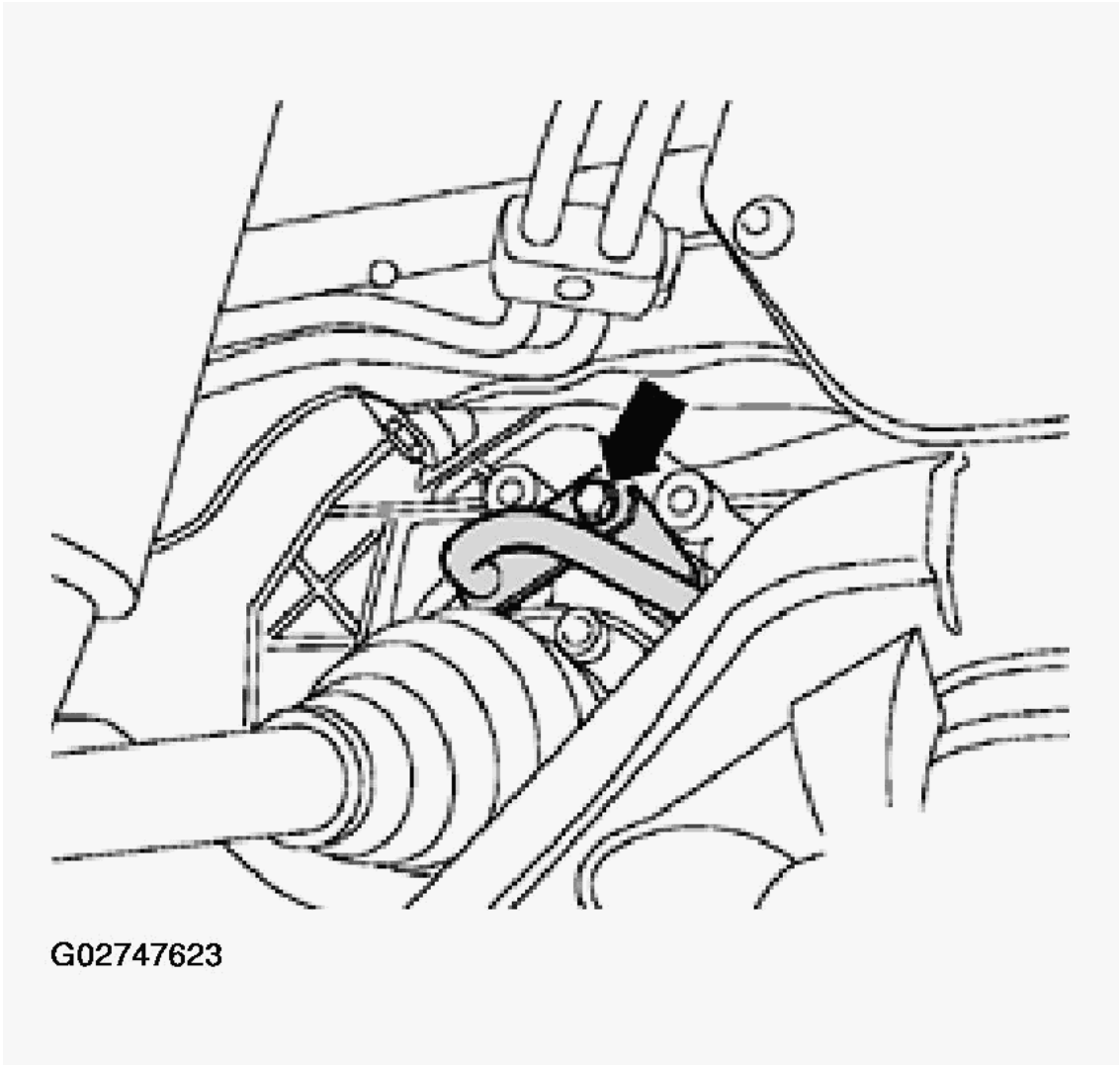


Fig. 86: Disconnecting ATF Lines From Transmission - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Tie up ATF lines off to side.
- Expose oxygen sensor wire.
- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

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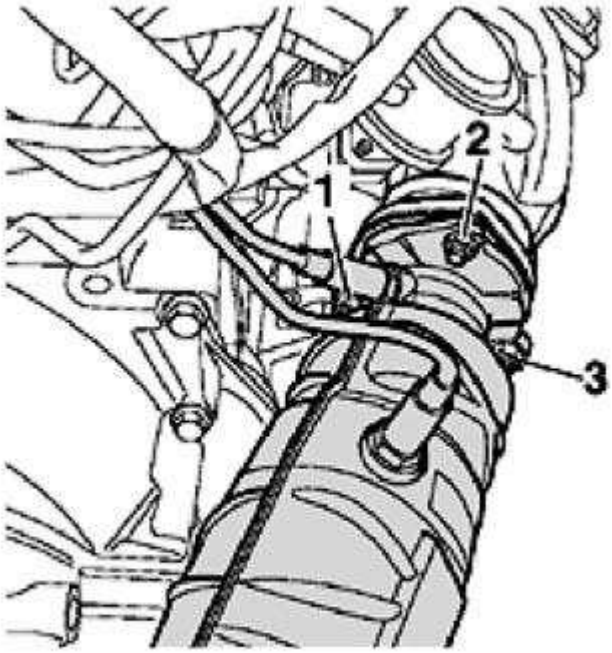


Fig. 87: Removing Front Exhaust Pipe/Exhaust Manifold Nuts - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Loosen lower nuts -1- (on left and right engine mounts) several turns.

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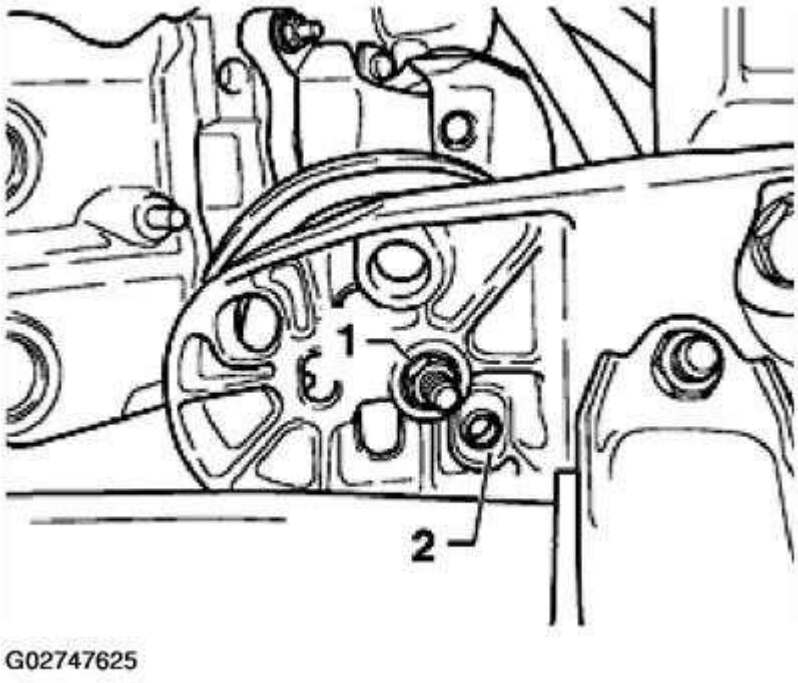


Fig. 88: Removing Engine Mounts Nuts - A\T 01J Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Press transmission to the left.
- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**
- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Secure ATF lines:
- Install subframe:

See **SUBFRAME & BUSHINGS** .

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- Install drive axle.

  See **FRONT AXLE SHAFT** .

- Install engine free of stress.
- Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** and **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .

NOTE: **For individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01J, see INDIVIDUAL RIGHT MOUNTING COMPONENTS FOR VEHICLES WITH AUTOMATIC TRANSMISSION 01J .**

- Check ATF level.

  See **SERVICING - A/T (01J)**

Tightening torques

TIGHTENING TORQUES: RH EXHAUST SYSTEM (A\T 01J)

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55
Engine mount to console	23

Left front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)

Special tools and equipment

- 3337 wrench, 7-piece set

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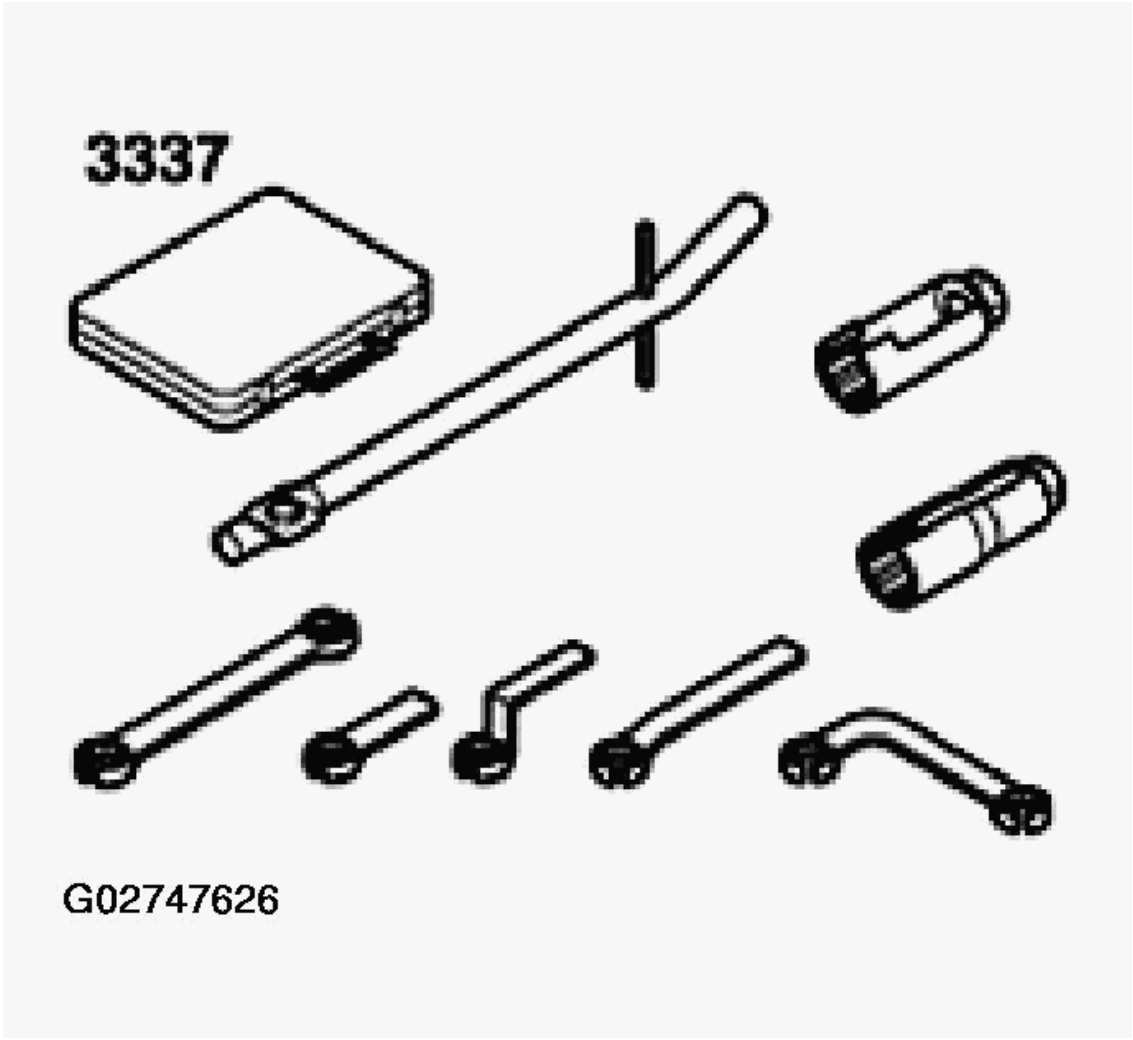


Fig. 89: Identifying Special Tool And Equipment - 3337 Wrench (A\T 01V)
Courtesy of AUDI OF AMERICA, INC.

- Engine/transmission hoist

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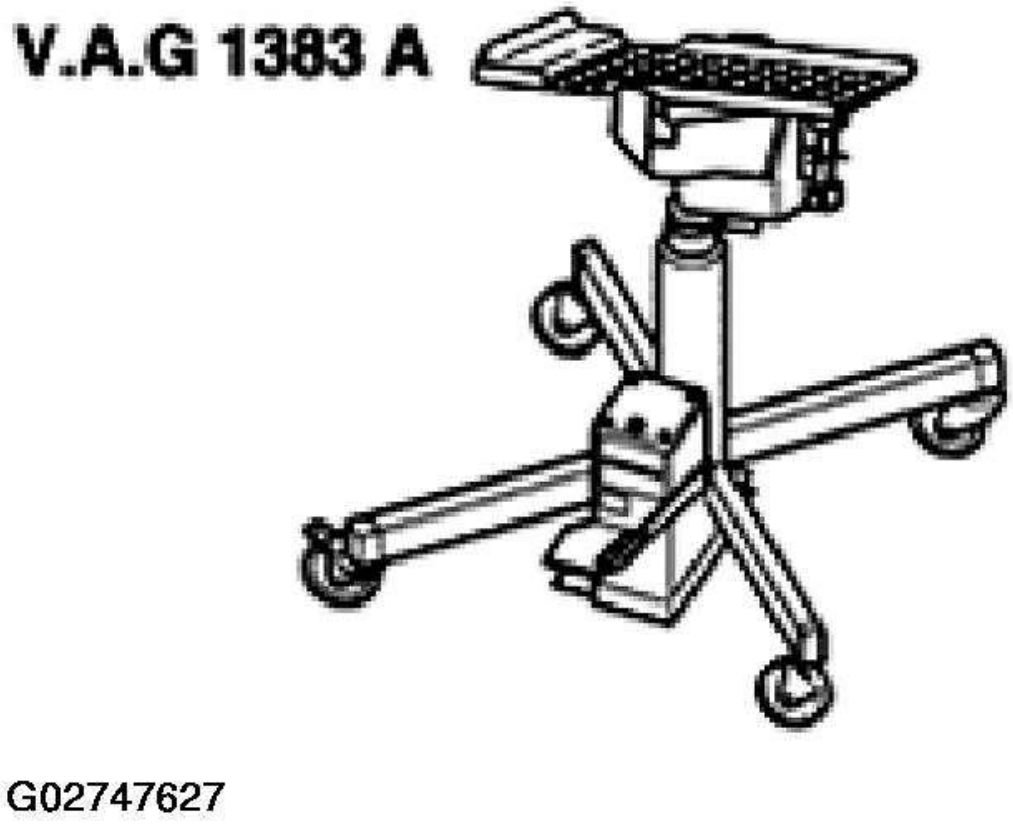


Fig. 90: Identifying Special Tool And Equipment - Engine/Transmission Hoist (A\T 01V)
Courtesy of AUDI OF AMERICA, INC.

- Locking compound G 052 112 A3

Removing

- Remove rear engine cover (arrows).

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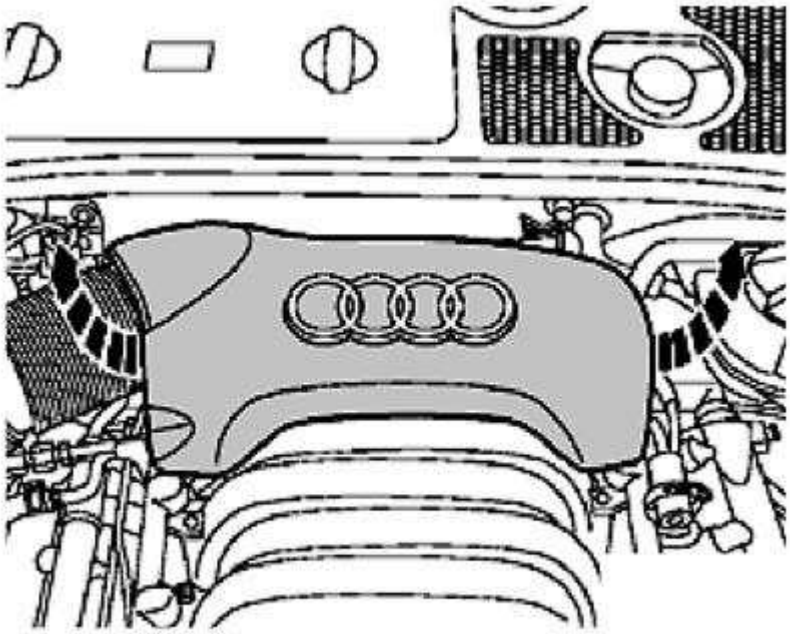


Fig. 91: Removing Rear Engine Cover - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove cover -1- in engine compartment (right side).

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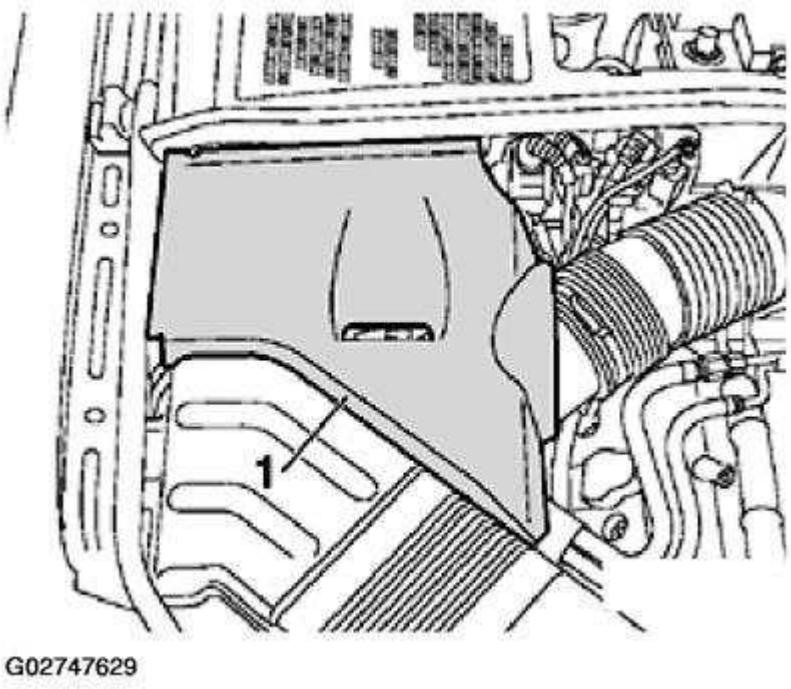


Fig. 92: Removing Right Side Engine Compartment Cover - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air duct -1- at Mass Air Flow (MAF) sensor.
- Remove hose -4- for crankcase ventilation from air duct -2-.

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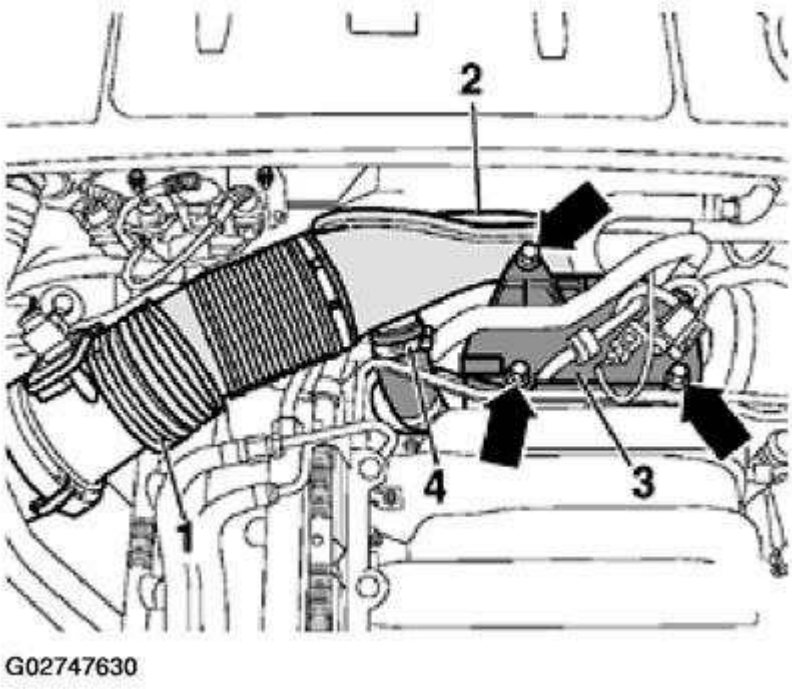


Fig. 93: Removing Solenoid Valves Holding Plate - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

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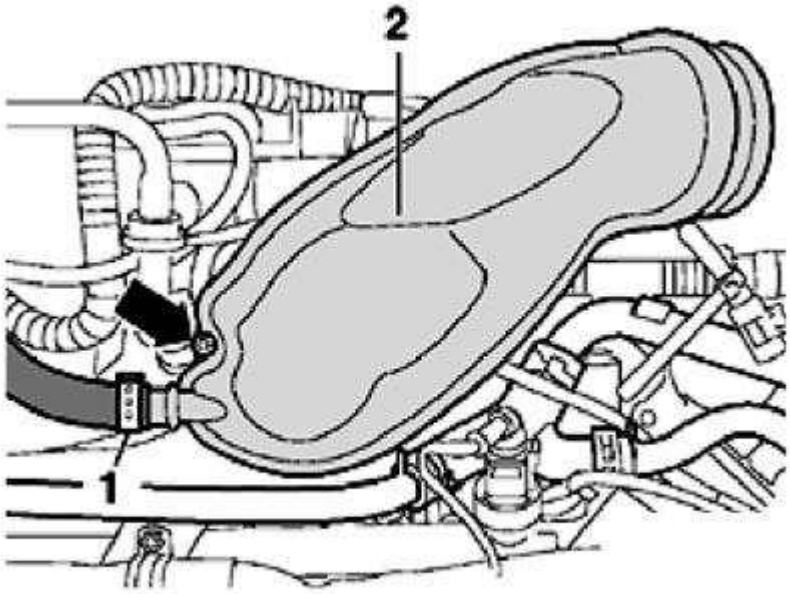


Fig. 94: Disconnecting Air Duct At Throttle Valve Control Module - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove cover -1- in engine compartment (left side).

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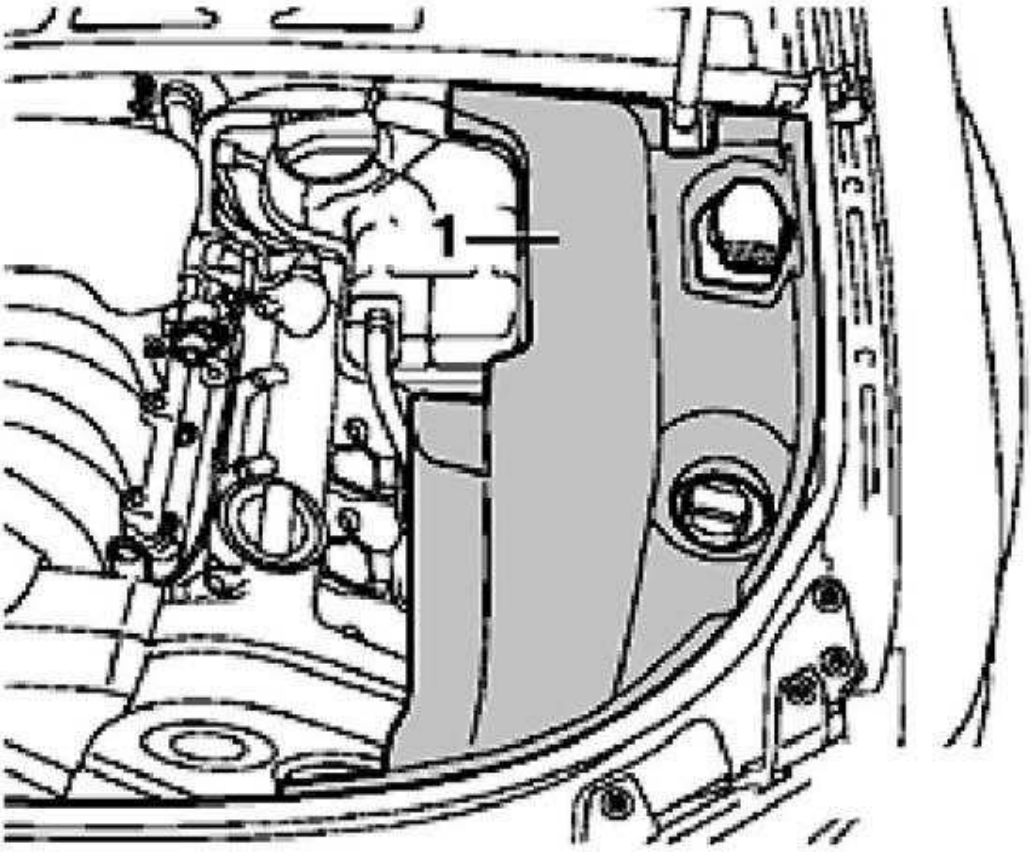


Fig. 95: Removing Left Side Engine Compartment Cover - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) Warning Switch -F66- at bottom of coolant reservoir.
- Tie coolant reservoir with connected coolant hoses -1 to 3- to side.

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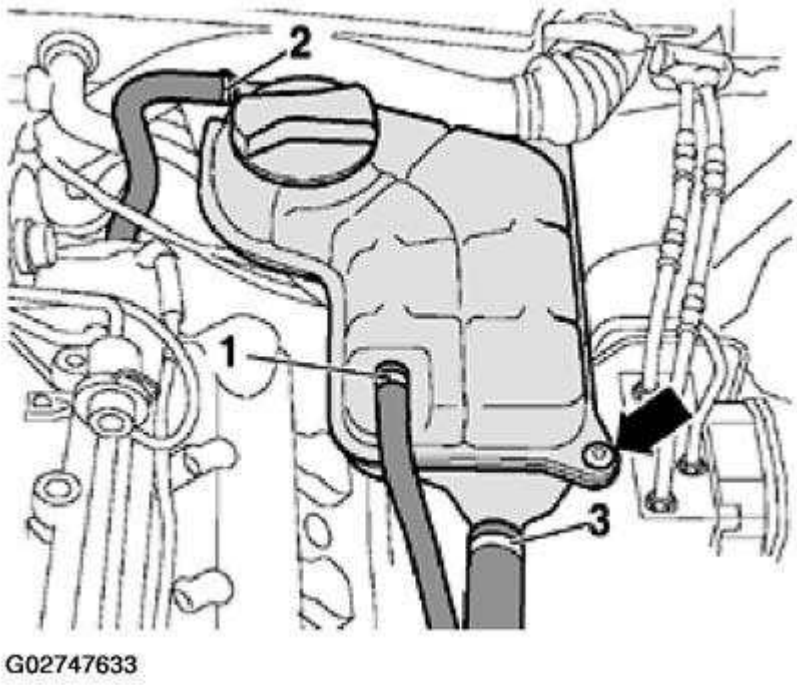


Fig. 96: Removing Coolant Reservoir - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Disconnect vacuum hose to brake booster (arrows).

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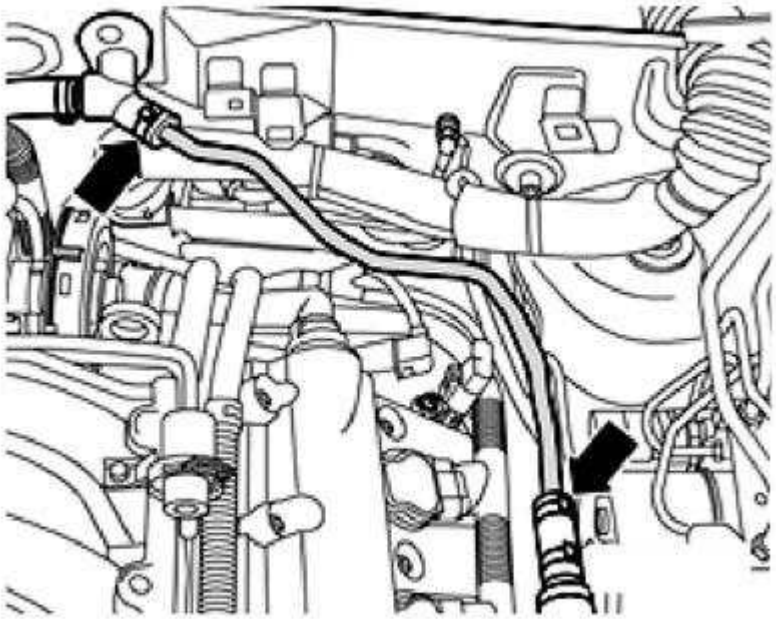


Fig. 97: Disconnecting Vacuum Hose To Brake Booster - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove heat shield for harness connectors at left of bulkhead, if installed.
- Remove harness connectors -1 to 4- from bracket at left of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

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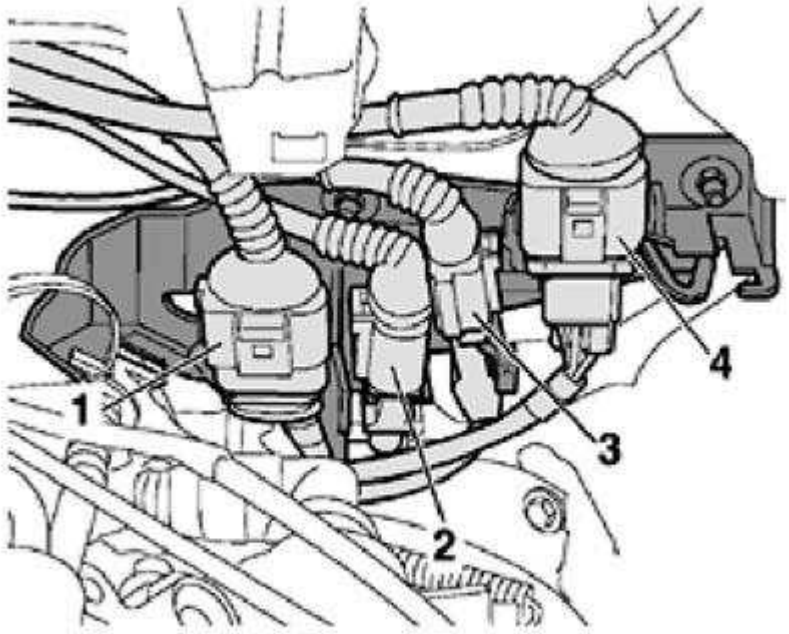


Fig. 98: Removing Harness Connectors From Bracket At Left Of Bulkhead - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: Illustration is shown with engine removed.

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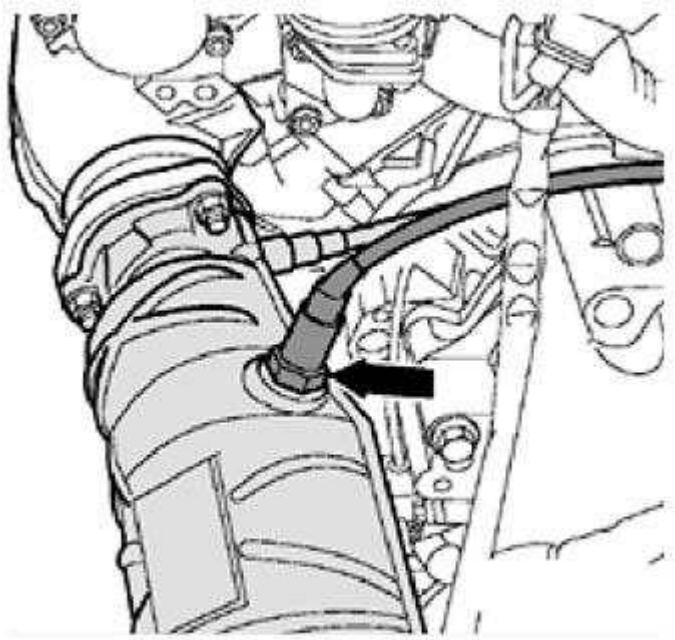


Fig. 99: Unscrewing Oxygen Sensor Behind Catalytic Converter - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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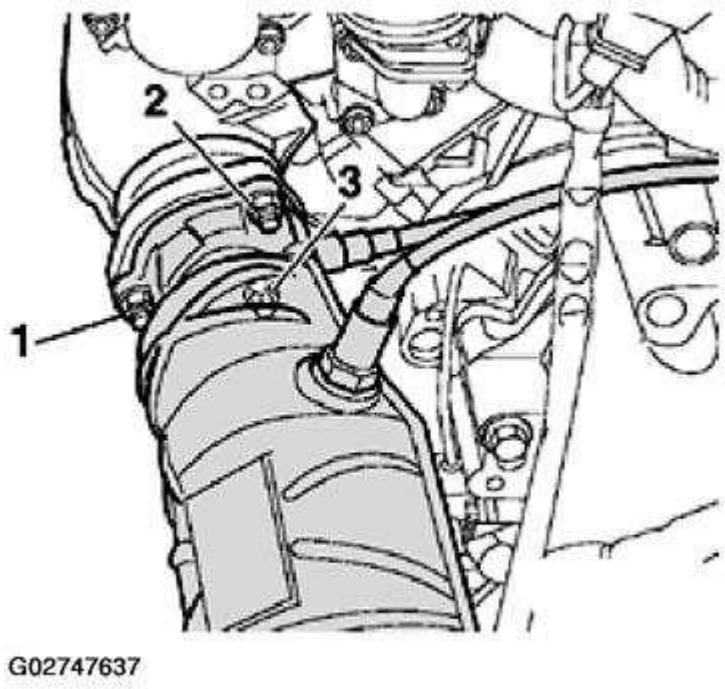


Fig. 100: Removing Exhaust Pipe/Exhaust Manifold Nut - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove left front wheel.
- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of parking heater/auxiliary heater on noise insulation.

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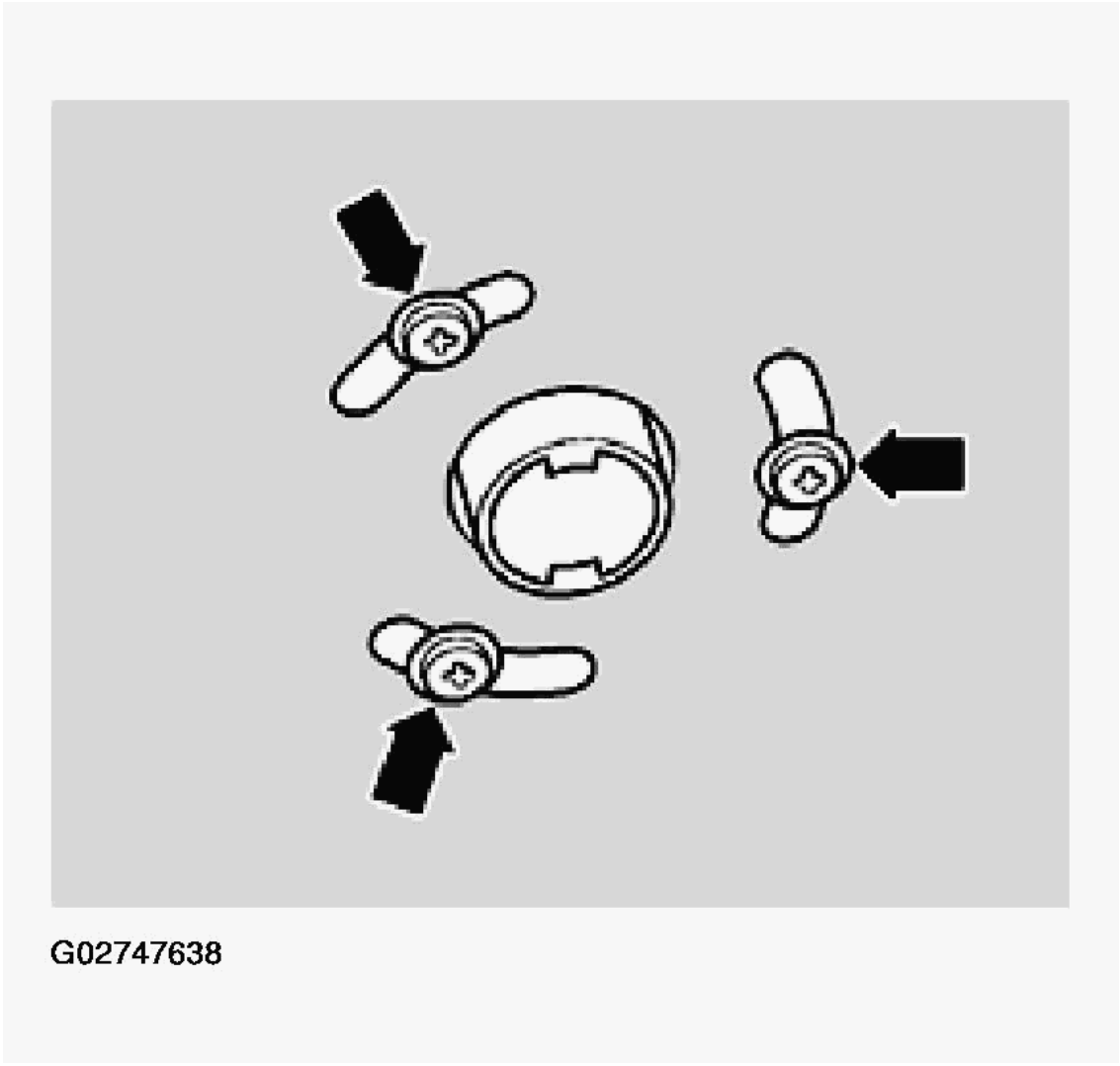


Fig. 101: Removing Parking Heater/Auxiliary Heater Exhaust Pipe - A\T 01V Vehicle (Front LH Exhaust Pipe)
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- Remove bolts or release quick-release screws -1- and -2- and remove front noise insulation.
- Remove quick-release screws -3- and remove rear noise insulation, if present.

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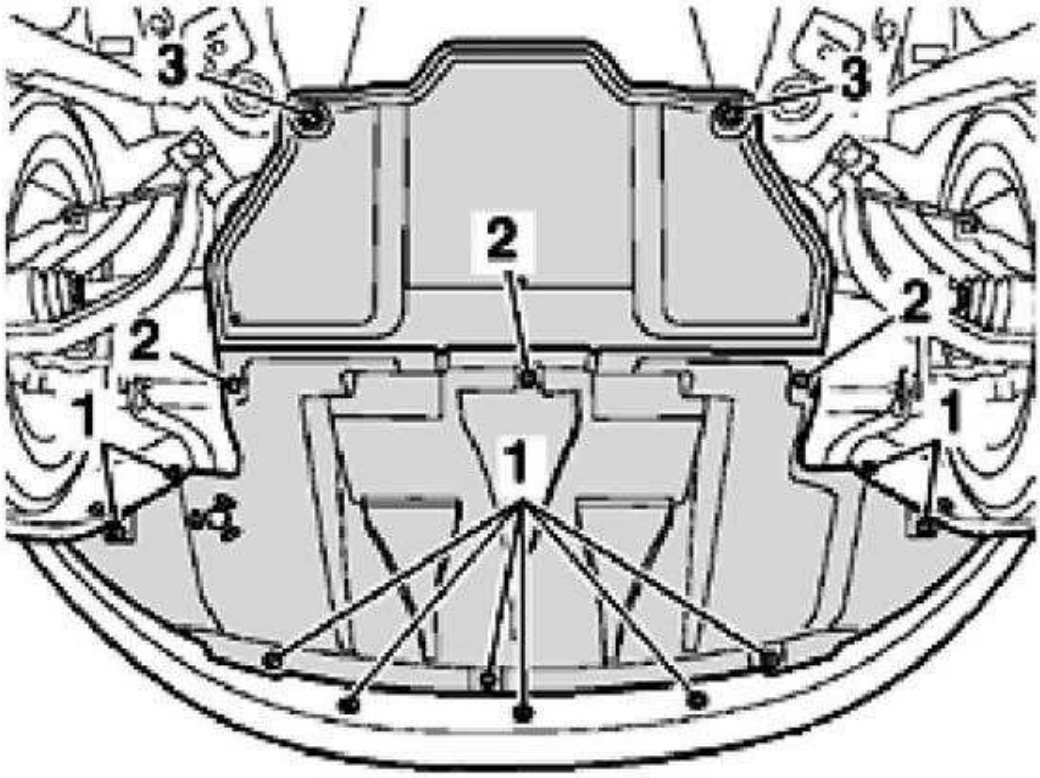


Fig. 102: Removing Front And Rear Noise Insulation - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts -1- through -4- and remove crossmember.

NOTE: Flex joint in front exhaust pipe must not be bent more than 10°, otherwise it may be damaged..

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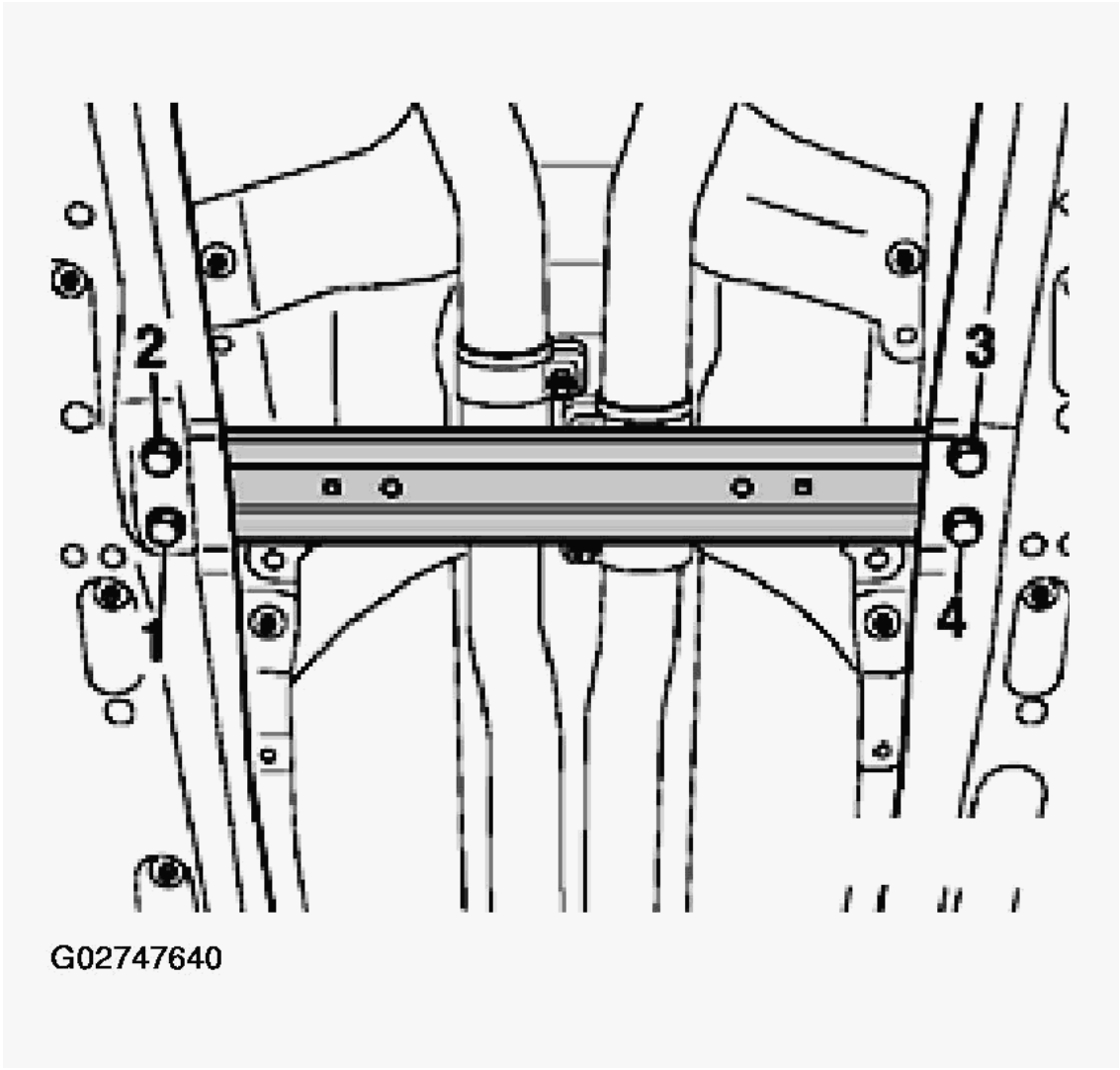


Fig. 103: Removing Crossmember - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Disconnect exhaust system at both double clamps -arrows-.
- Remove heat shield above exhaust system.

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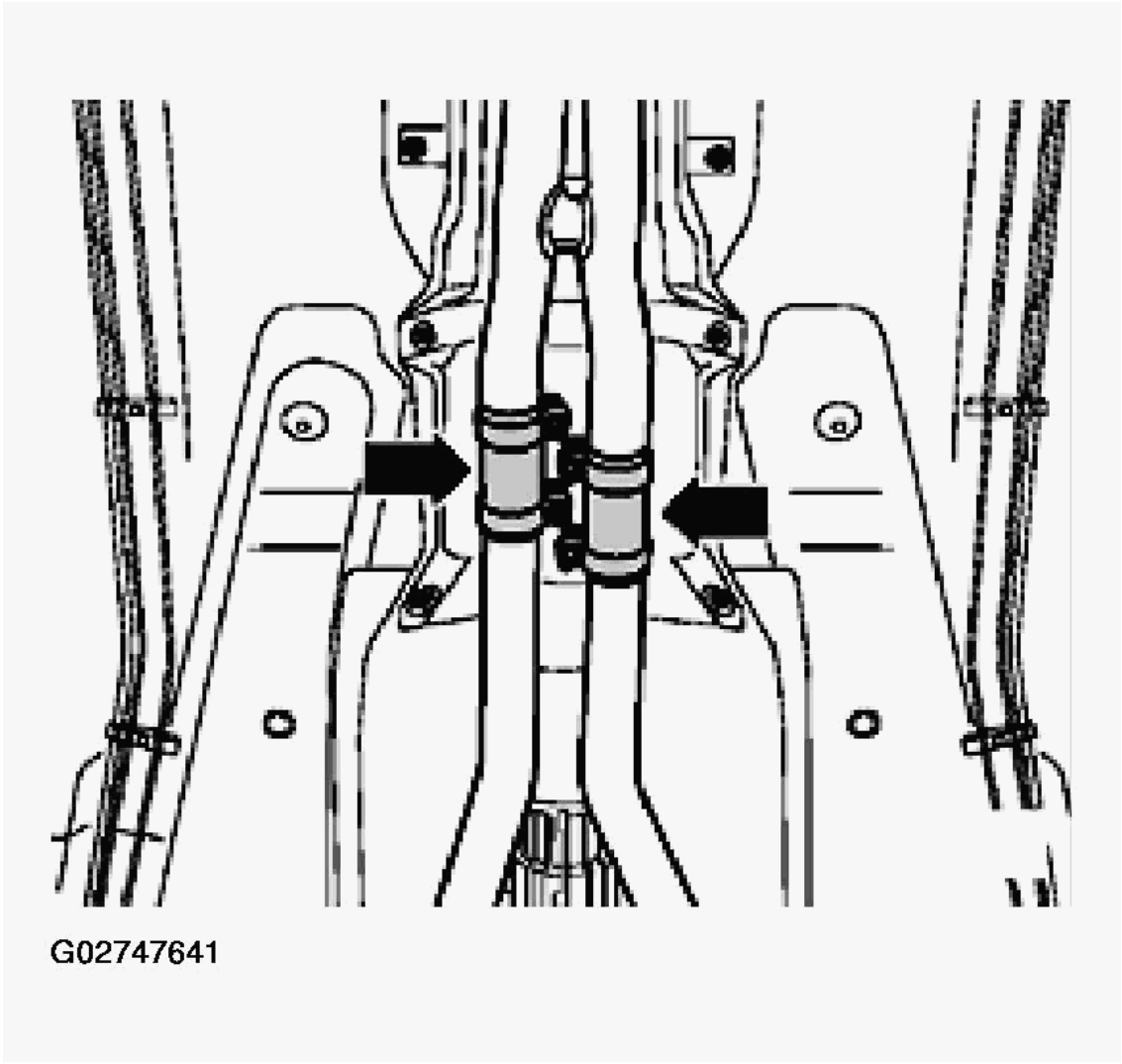


Fig. 104: Disconnecting Exhaust System At Both Double Clamps - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove heat shield for driveshaft from cover for Torsen differential (arrows).

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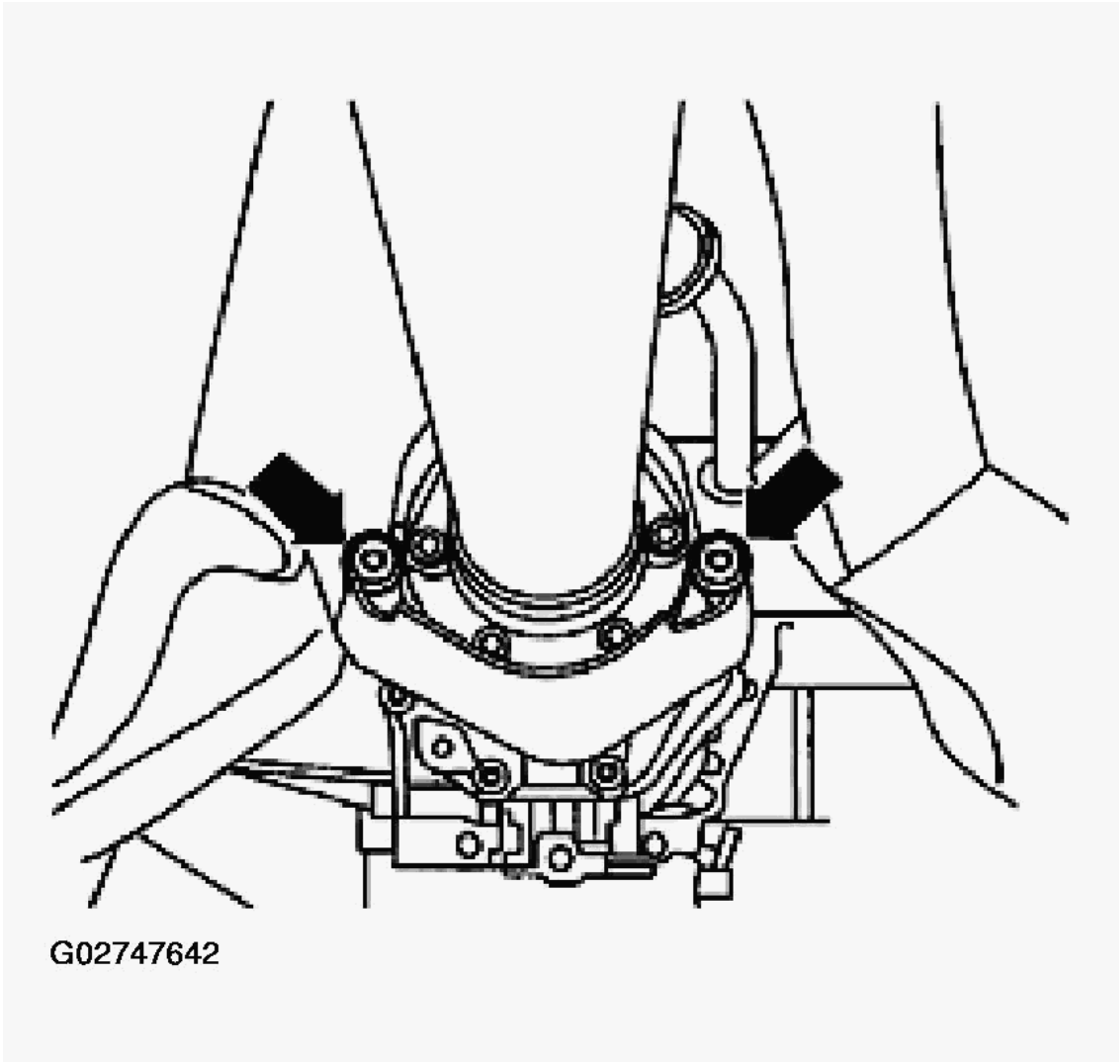


Fig. 105: Removing Heat Shield For Driveshaft From Cover For Torsen Differential - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts at flange of transmission/drive shaft.
- Push driveshaft to rear final drive together. The constant velocity joints can be adjusted axially.
- Rest driveshaft on exhaust system.
- Position engine/transmission jack VAG 1383 A directly behind ATF drip tray. Insert a wood block -1- to protect the transmission housing.

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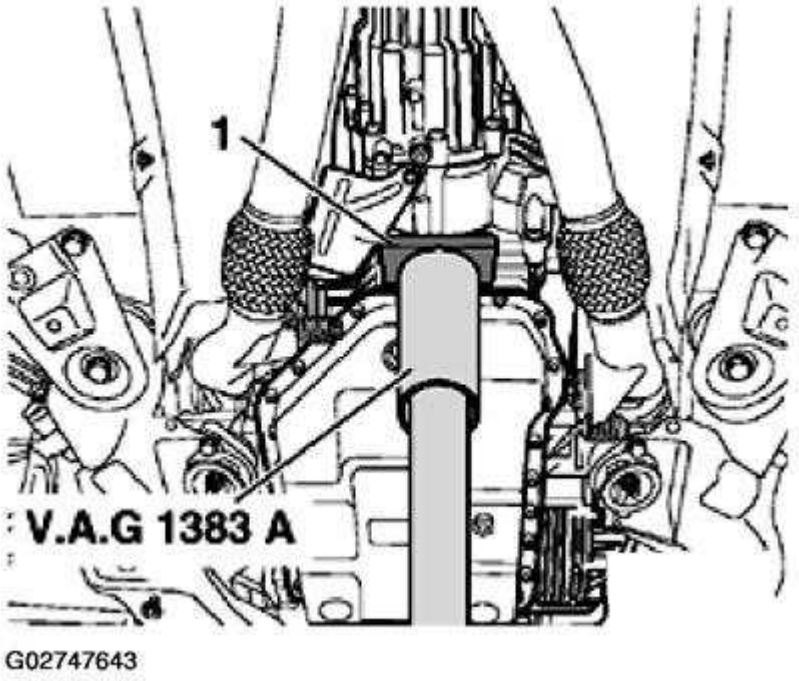


Fig. 106: Positioning Engine/Transmission Jack Behind ATF Drip Tray - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

WARNING: The lock carrier must be installed.

- First remove bolts -2- and -3- and then mounting bolts -1- and -4- of subframe.
- Slightly lower the transmission and subframe using VAG1383A engine/gearbox jack.

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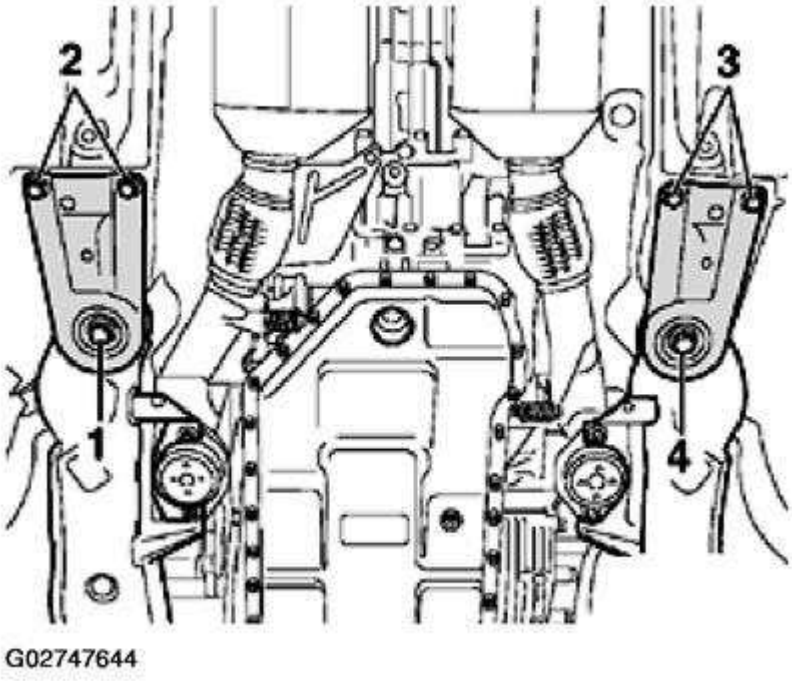


Fig. 107: Removing Subframe Bolts - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts 1 to 4 for transmission mount.
- Unbolt both transmission mounts -5- and -6- at transmission housing and remove transmission supports with transmission mounts.

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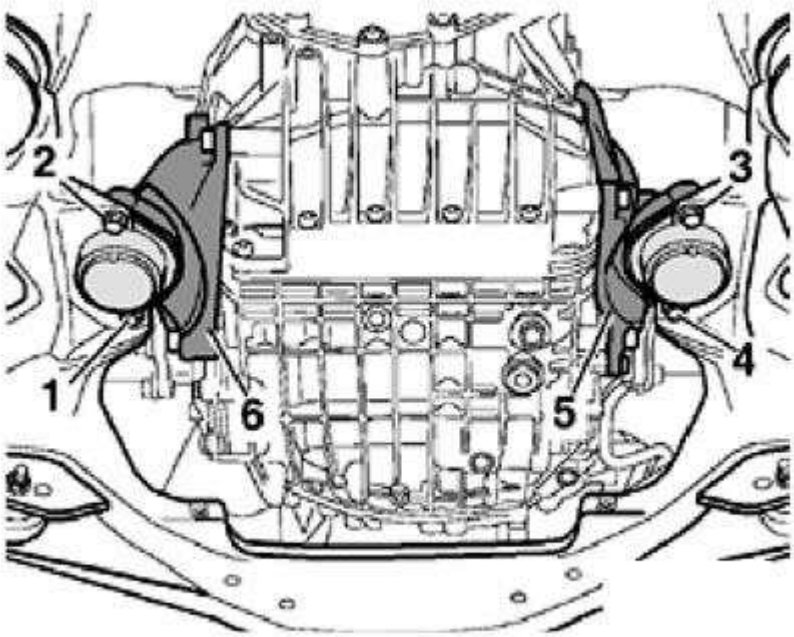


Fig. 108: Removing Transmission Mount Bolts - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Lower transmission slowly.
- Remove heat shield -1- for left drive axle.

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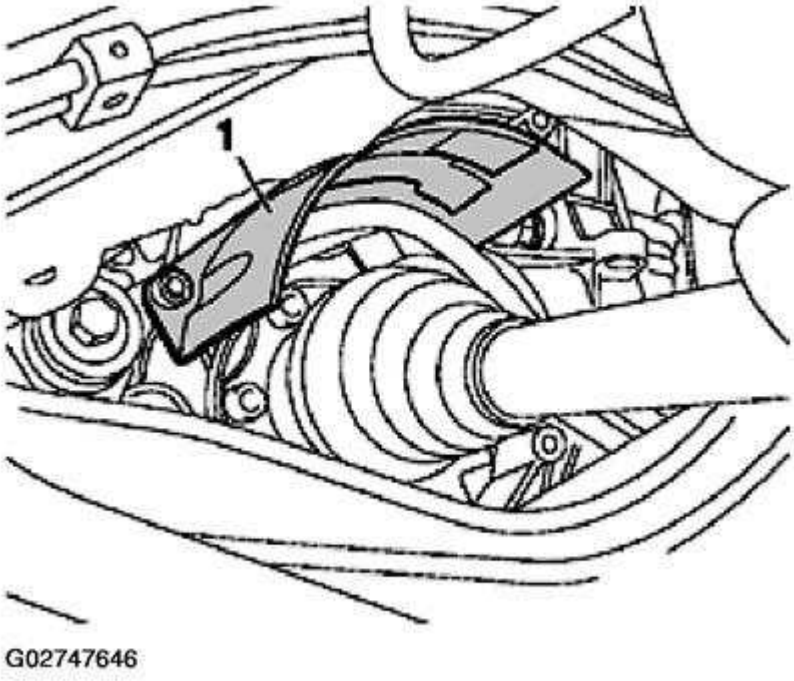


Fig. 109: Removing Heat Shield For Left Drive Axle - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bracket for front exhaust pipe (arrow).

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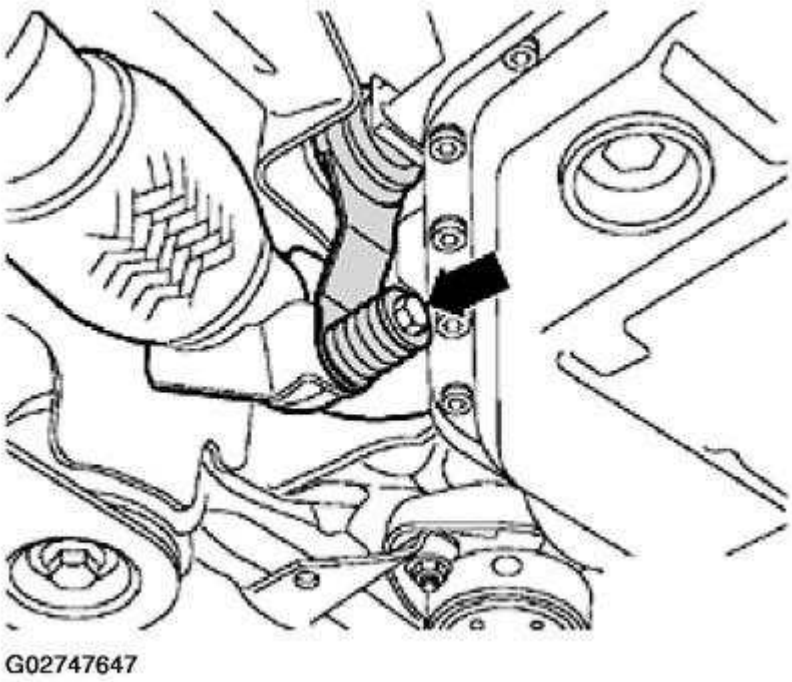


Fig. 110: Removing Front Exhaust Pipe Bracket - A\T 01V Vehicle (Front LH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

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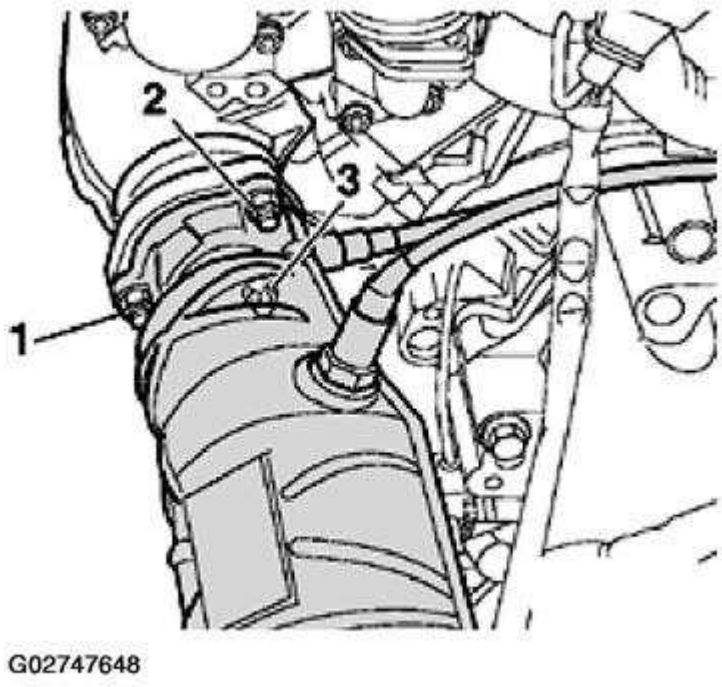


Fig. 111: Removing LH Front Exhaust Pipe/Exhaust Manifold - A\T 01V Vehicle
Courtesy of AUDI OF AMERICA, INC.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**
- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Install transmission supports.

See **Fig. 112** and **Fig. 113** . Tighten M10 bolts to 40 Nm. Tighten M6 bolts to 10 Nm.

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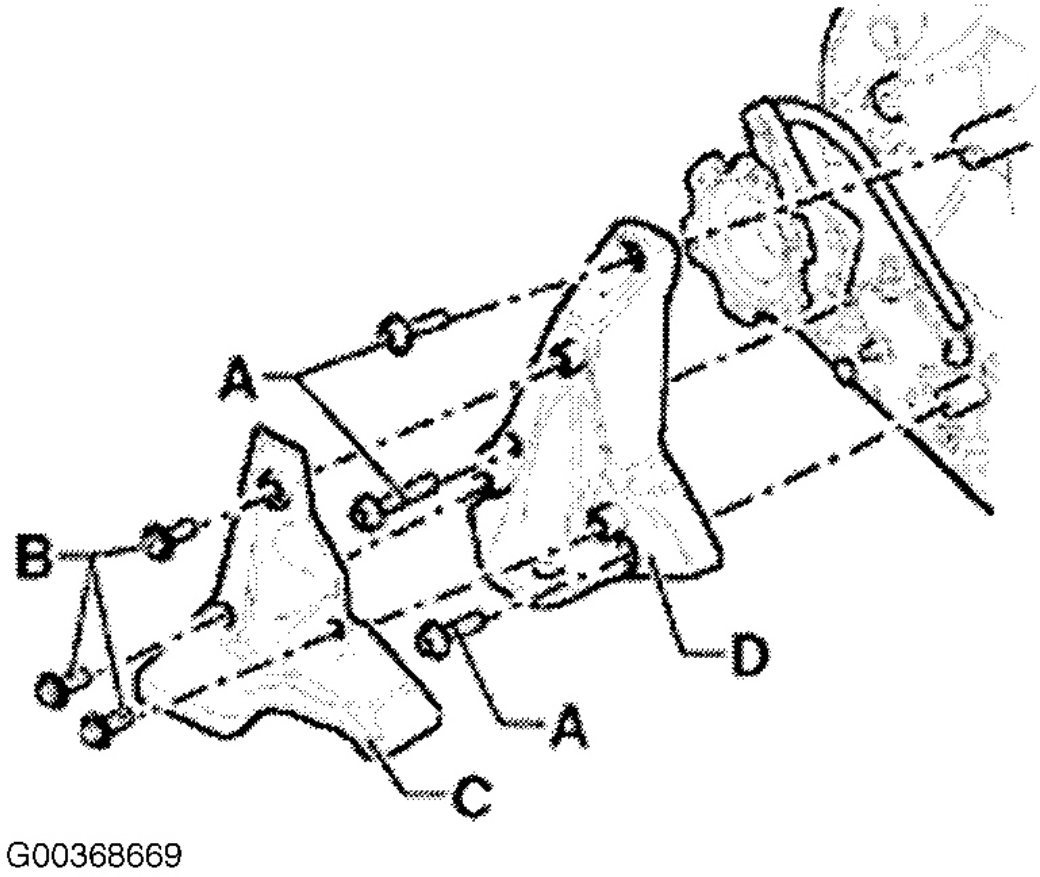


Fig. 112: Locating Left Transaxle Support Heat Shields
Courtesy of AUDI OF AMERICA, INC.

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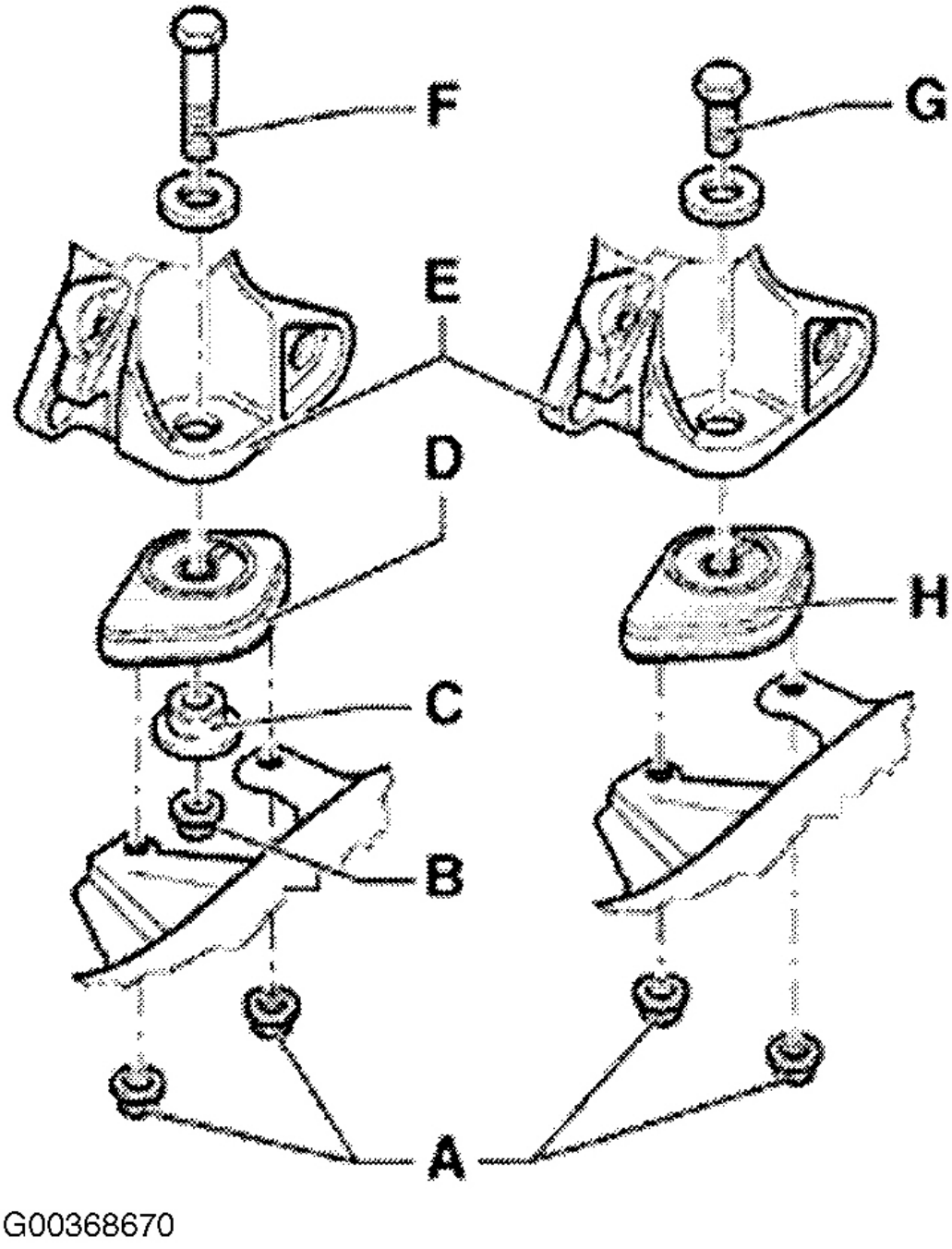


Fig. 113: Locating Left & Right Transaxle Supports
Courtesy of AUDI OF AMERICA, INC.

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NOTE: Items (C) and (B) are not installed on vehicles with hydraulic transmission bearing (H), because bolt (G) is threaded directly into the transmission bearing. See Fig. 113 .

- Install subframe:

  See **SUBFRAME & BUSHINGS** .

- Install drive axle shaft:

  See **FRONT AXLE SHAFT** .

- Installing driveshaft:

  See **DRIVESHAFT** .

- Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** and **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .

NOTE: For individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01V, see INDIVIDUAL LEFT MOUNTING COMPONENTS FOR VEHICLES WITH AUTOMATIC TRANSMISSION 01V .

Tightening torques

TIGHTENING TORQUES: LH EXHAUST SYSTEM (A\T 01V)

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55

Right front exhaust pipe with catalytic converter, removing and installing (vehicles with automatic transmission 01V)

Special tools and equipment

- 3337 wrench, 7-piece set

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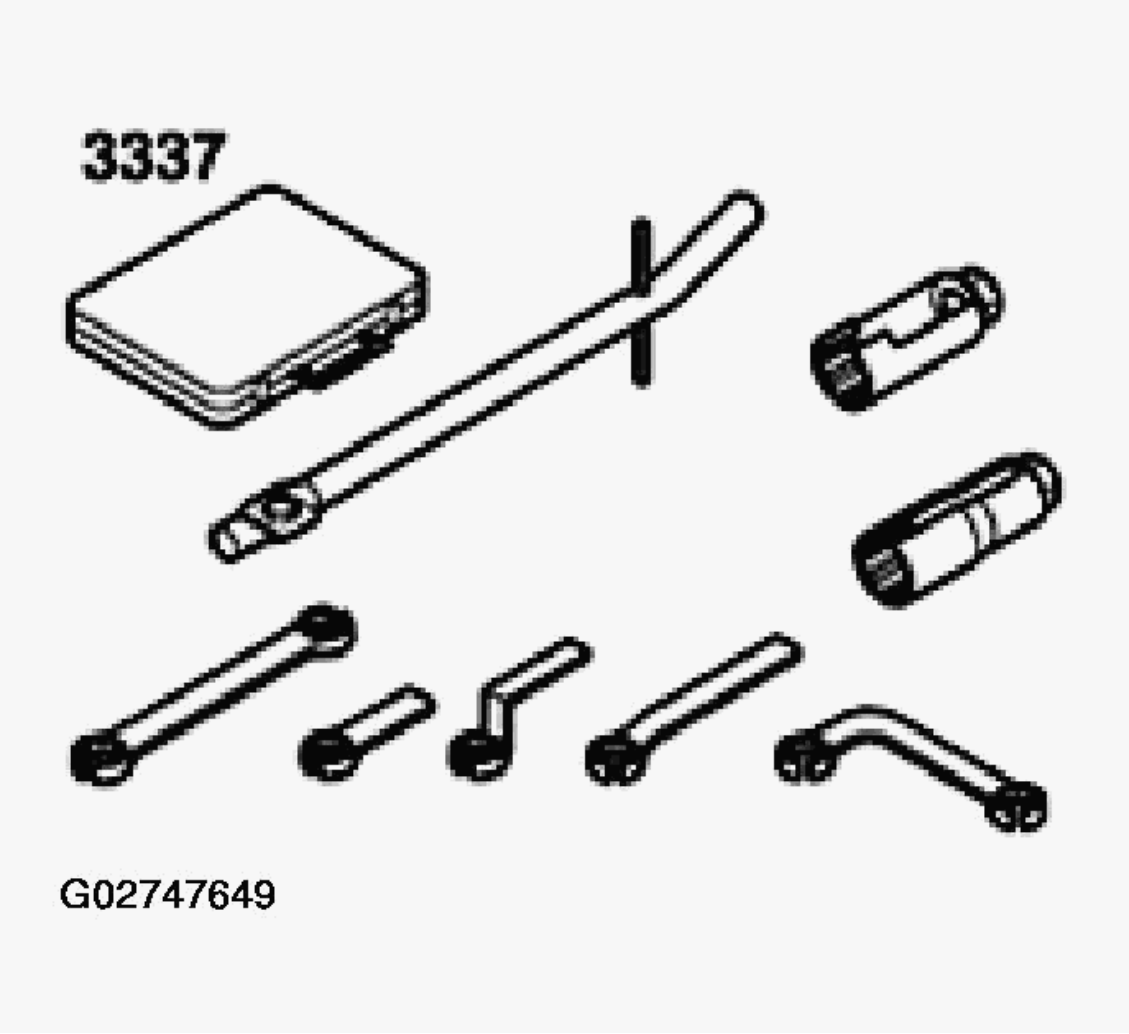


Fig. 114: Identifying Special Tool And Equipment - 3337 wrench, 7-piece set (A\T 01V RH)
Courtesy of AUDI OF AMERICA, INC.

- Engine/transmission hoist
- Locking compound G 052 112 A3

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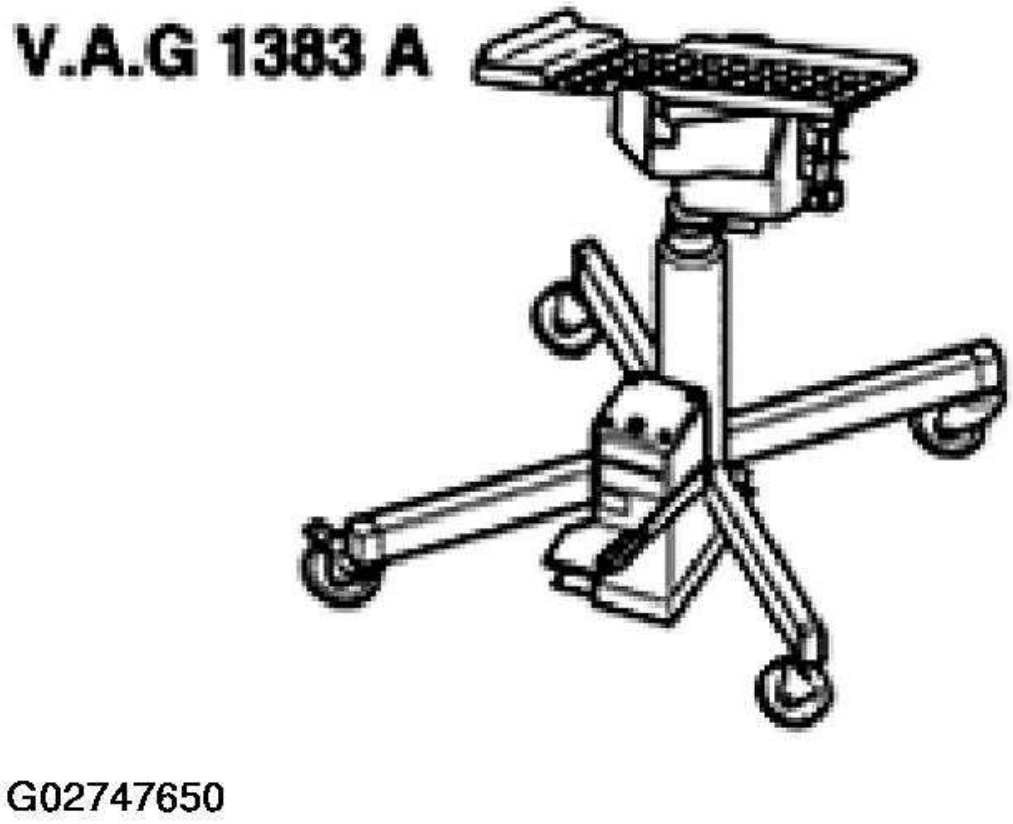


Fig. 115: Identifying Special Tool And Equipment - Engine/Transmission Hoist (A\T 01V RH)
Courtesy of AUDI OF AMERICA, INC.

Removing

- Remove rear engine cover (arrows).

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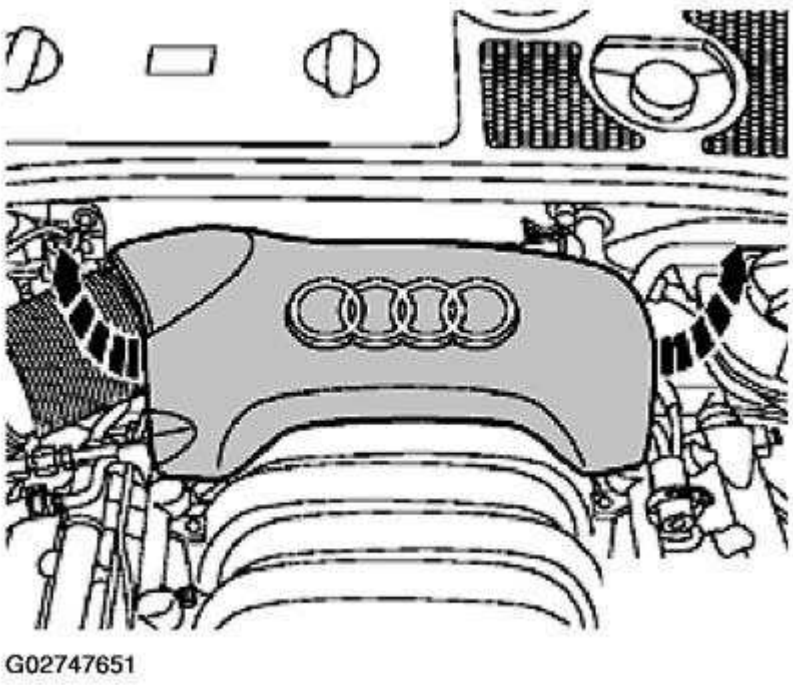


Fig. 116: Removing Rear Engine Cover - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove cover -1- in engine compartment (right side).

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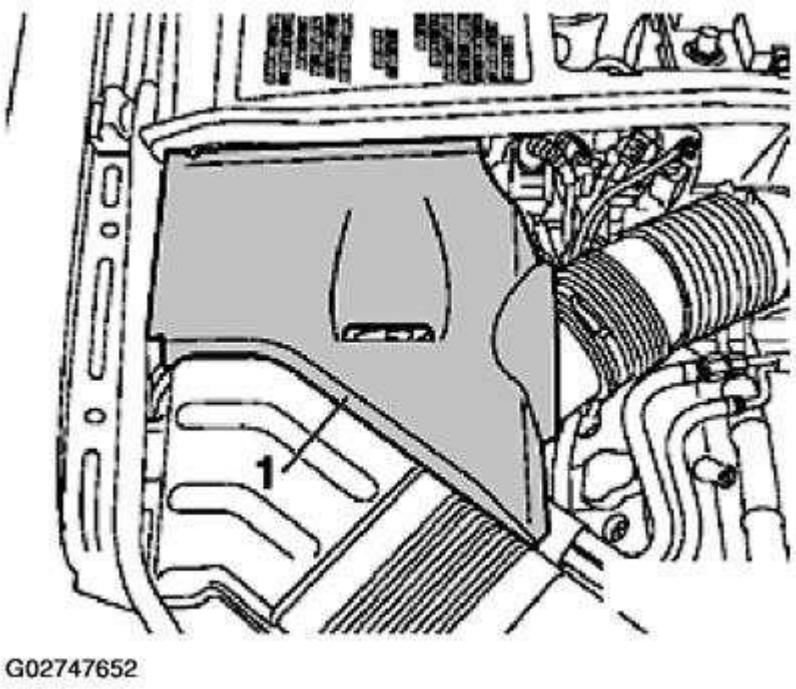


Fig. 117: Removing Right Side Engine Compartment Cover - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- -1- at air guide.
- Remove air guide -2-.

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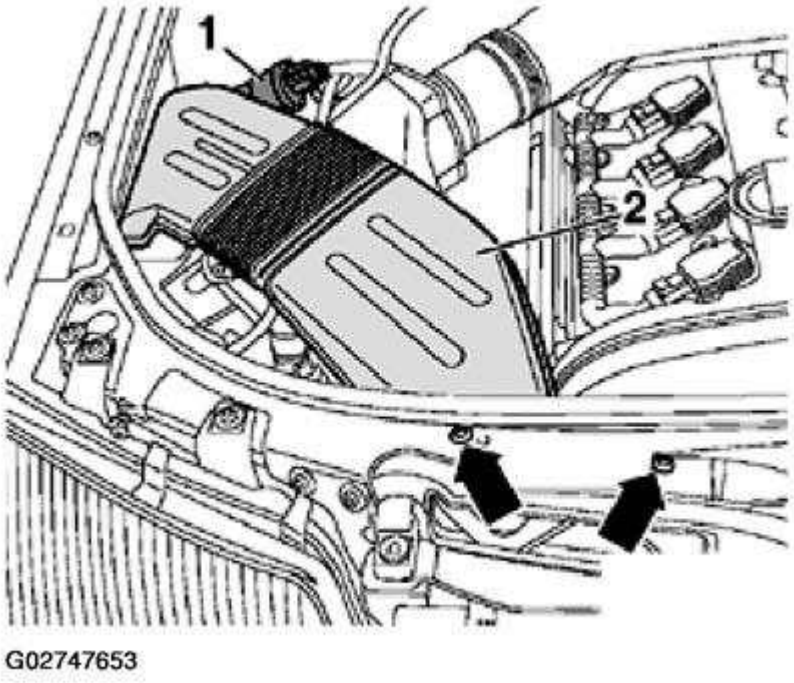


Fig. 118: Detaching Evaporative Emission (EVAP) Canister Purge Regulator Valve - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove air filter housing (arrows).

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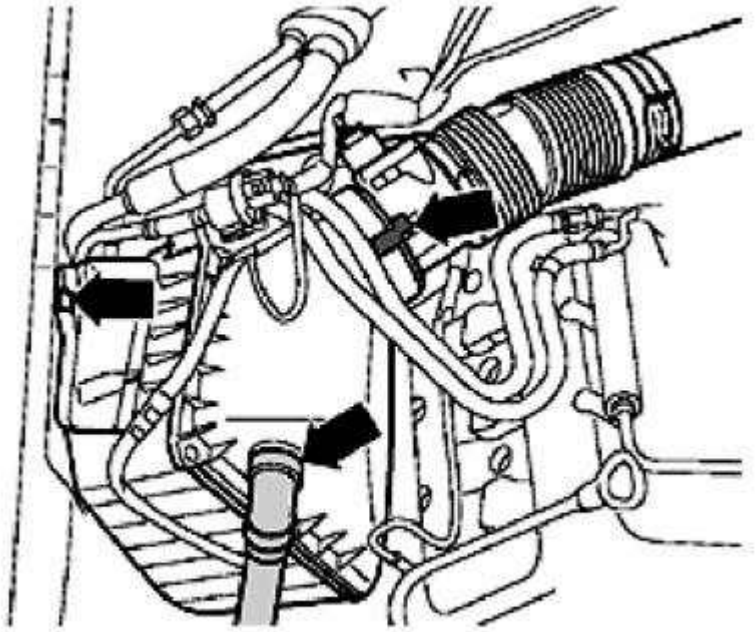


Fig. 119: Removing Air Filter Housing - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect electrical harness connector at Mass Air Flow (MAF) sensor.
- Remove hose -4- of crankcase ventilation from air duct -2-.

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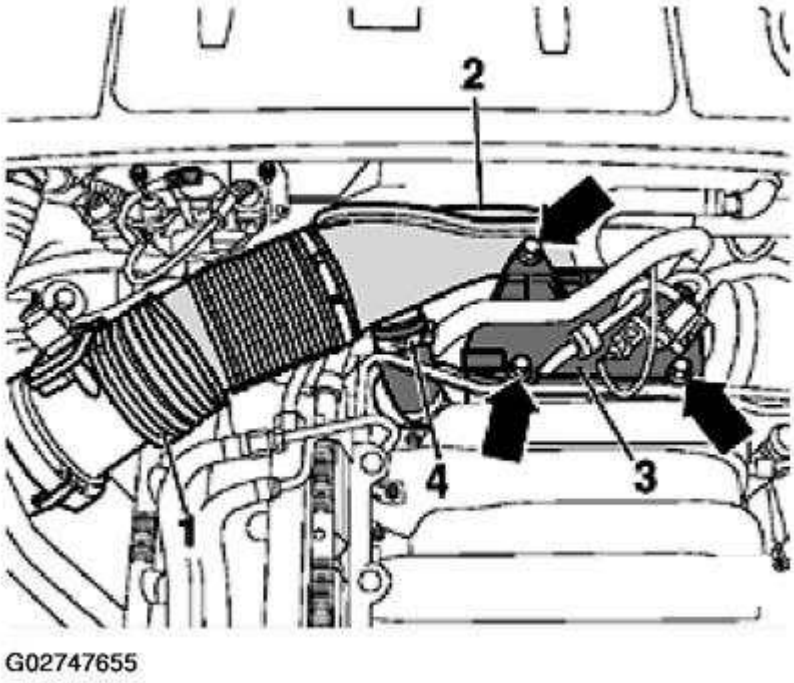


Fig. 120: Removing Solenoid Valves Holding Plate - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolt (arrow) and disconnect air duct -2- at throttle valve control module.
- Disconnect hose -1- from air duct.

NOTE: Illustration shows the air guide from rear with the engine removed.

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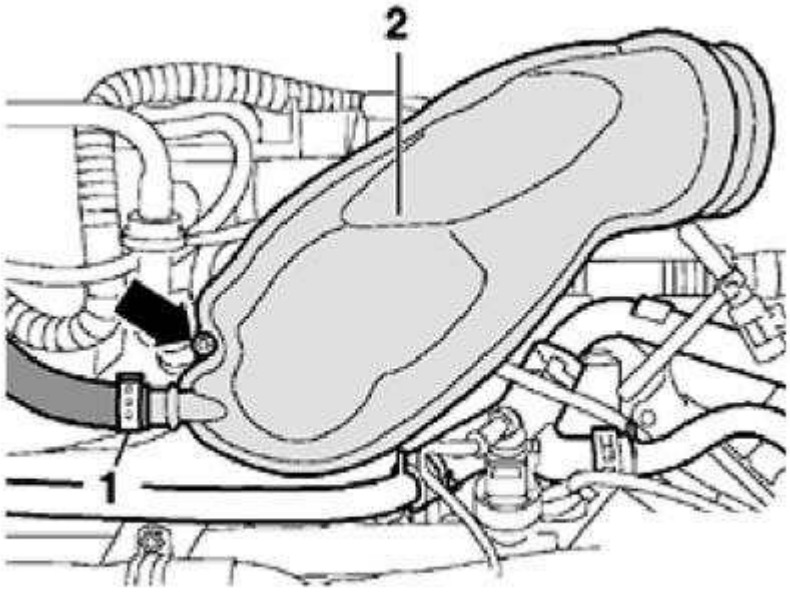


Fig. 121: Disconnecting Air Duct At Throttle Valve Control Module - A\T 01V Vehicle (Front RH Exhaust Pipe)
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- Remove harness connectors -1 to 4- from bracket at right of bulkhead.
- Disconnect electrical harness connectors -1- and -4-.
- Move wires to oxygen sensors clear.

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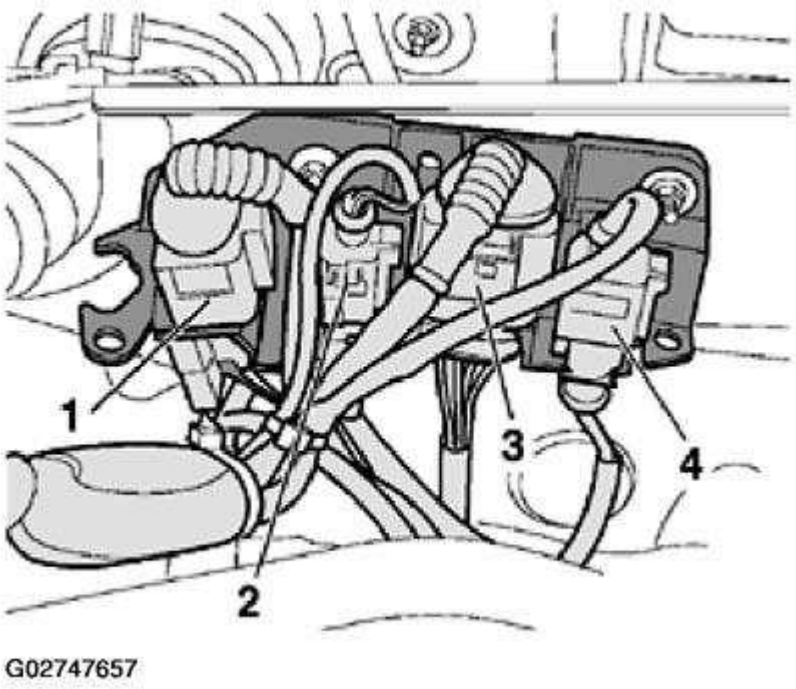


Fig. 122: Removing Harness Connectors From Bracket At Right Of Bulkhead - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Unscrew oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: Illustration is shown with engine removed.

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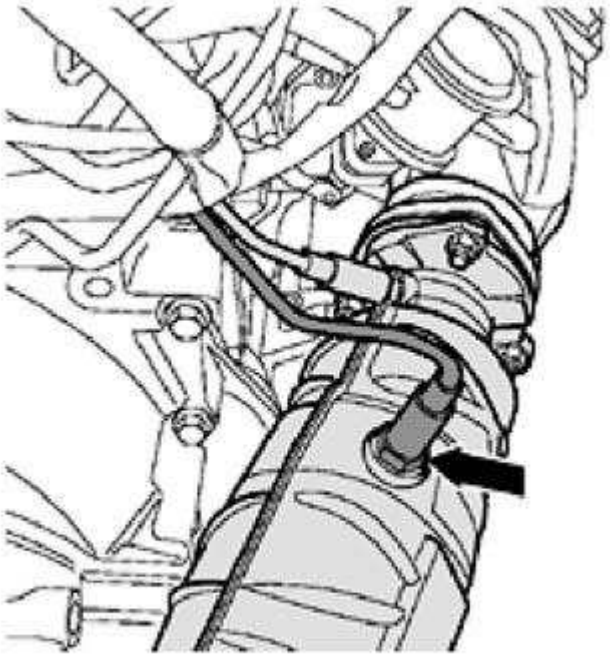


Fig. 123: Unscrewing Oxygen Sensor Behind Catalytic Converter - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove nut -2- for exhaust pipe/exhaust manifold which is accessible from top.

NOTE: Illustration is shown with engine removed.

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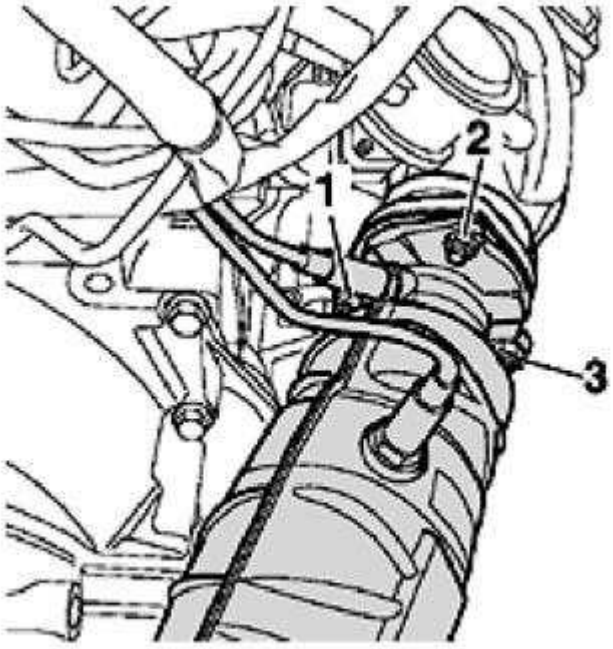


Fig. 124: Removing Exhaust Pipe/Exhaust Manifold Nut - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove right front wheel
- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of parking heater/auxiliary heater on noise insulation.

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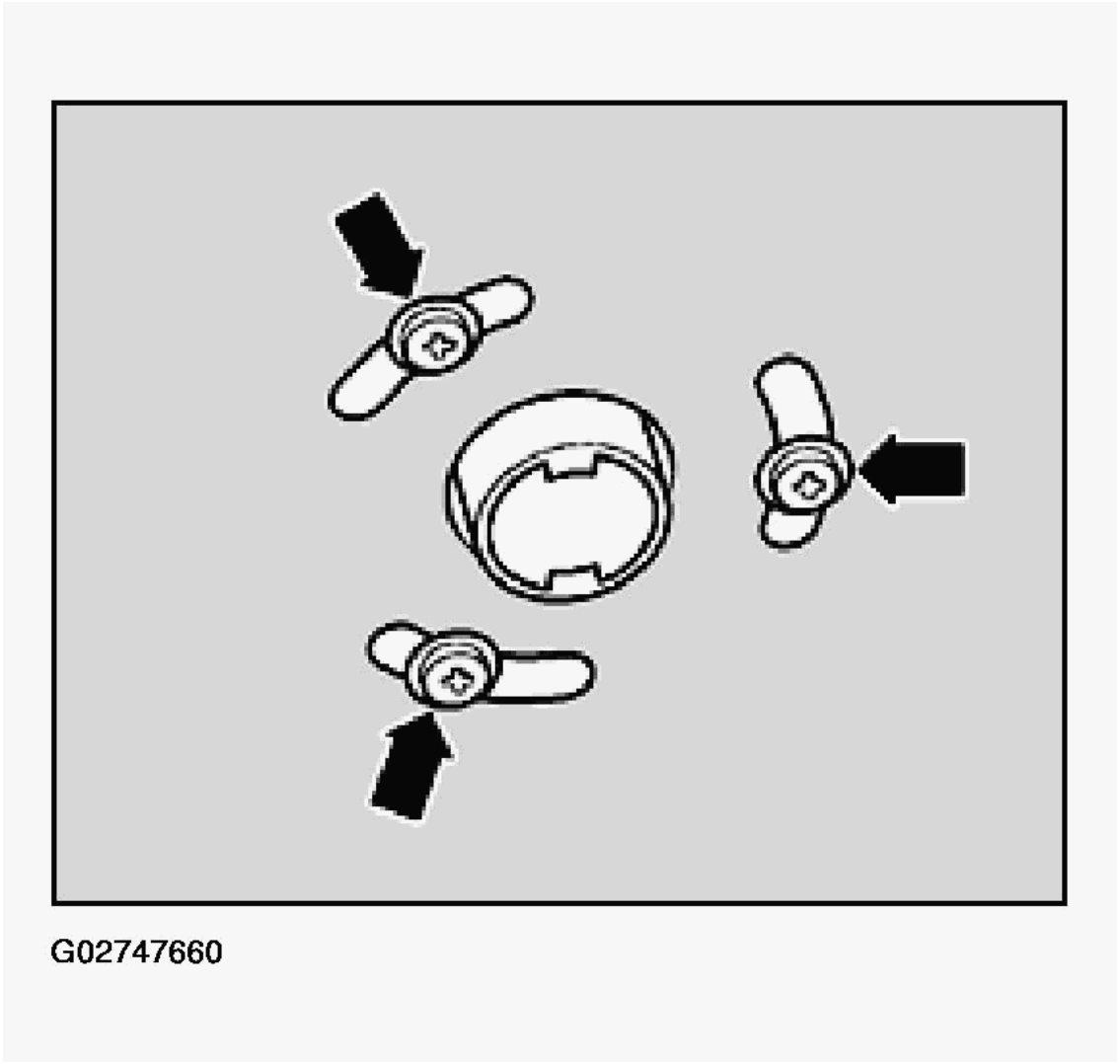


Fig. 125: Removing Parking Heater/Auxiliary Heater Exhaust Pipe Bolts - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front noise insulation.
- Remove quick-release screws -3- and remove rear noise insulation, if present.

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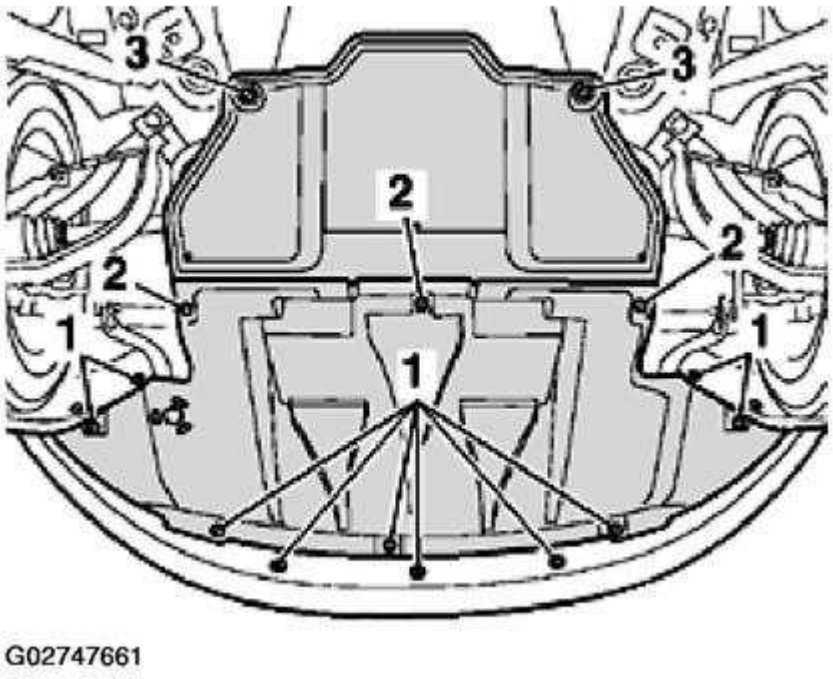


Fig. 126: Removing Front And Rear Noise Insulation - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts -1- through -4- and remove crossmember.

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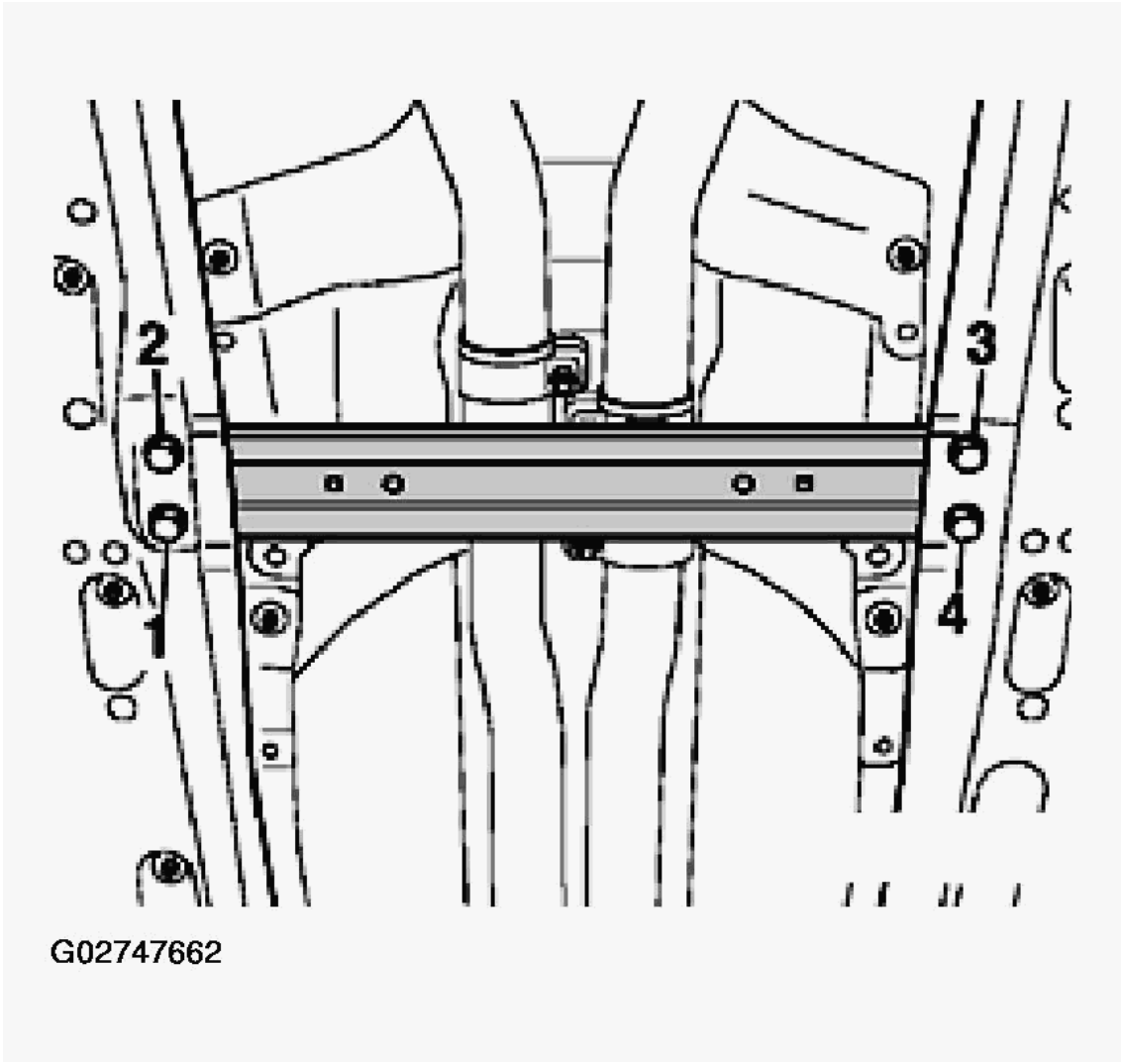


Fig. 127: Removing Crossmember - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

NOTE: Flex joint in front exhaust pipe must not be cant more than 10°, otherwise it may be damaged.

- Disconnect exhaust system at both double clamps - arrows-.

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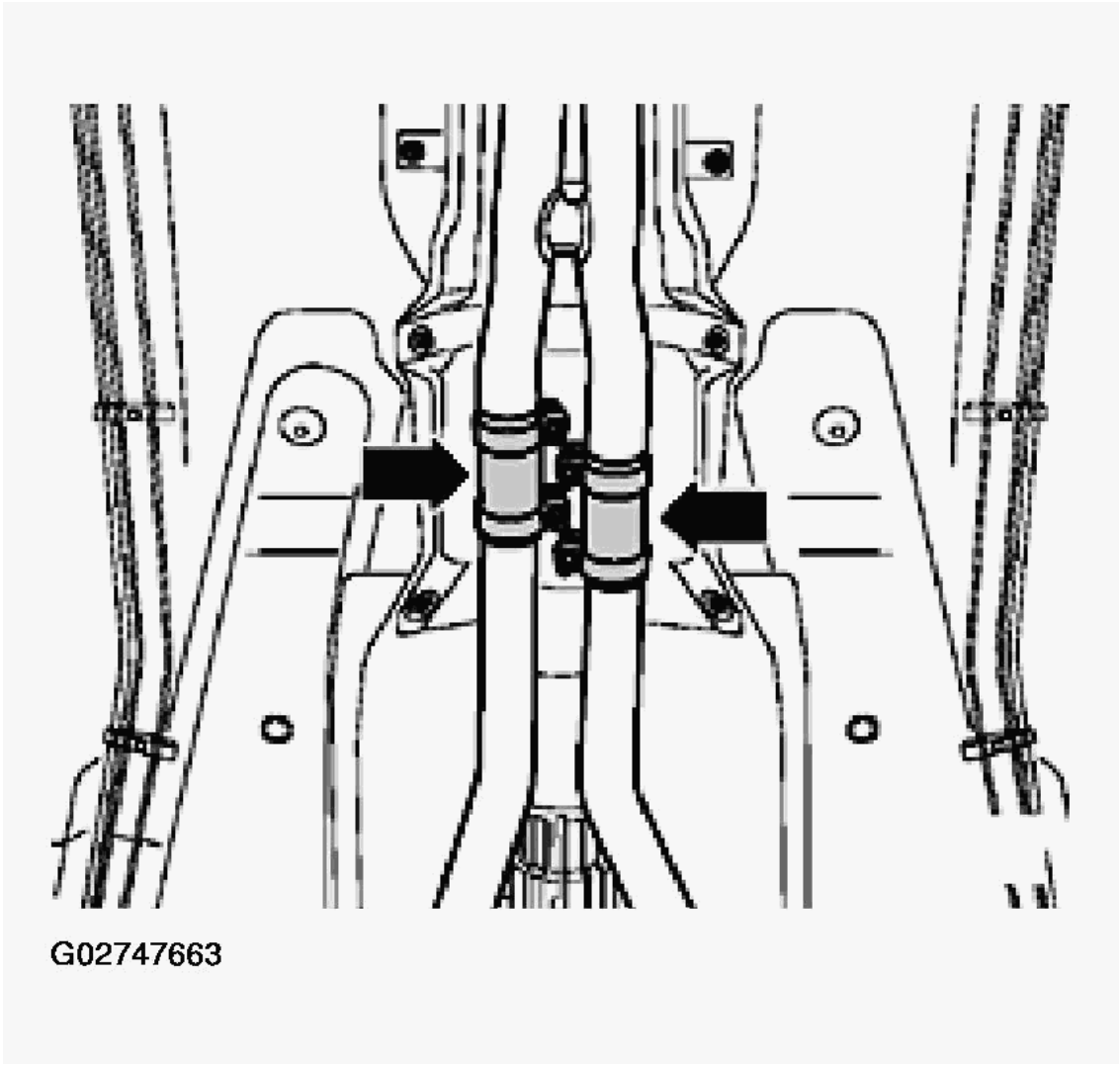


Fig. 128: Disconnecting Exhaust System At Both Double Clamps - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove heat shield above exhaust system.
- Remove heat shield for driveshaft from cover for Torsen differential (arrows).

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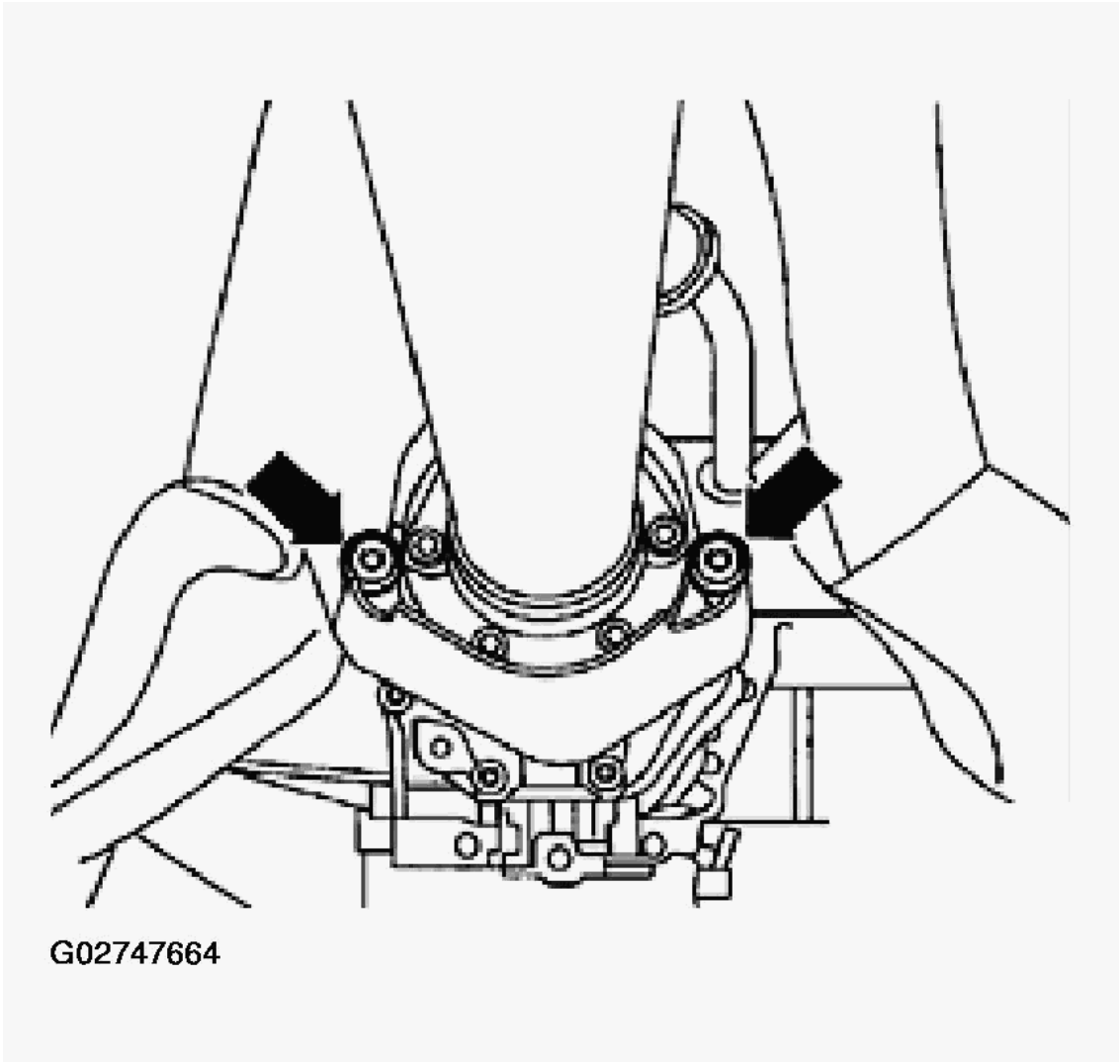


Fig. 129: Removing Heat Shield For Driveshaft From Torsen Differential Cover - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts at flange of transmission/drive shaft.
- Push driveshaft to rear final drive together. The constant velocity joints can be adjusted axially.
- Rest driveshaft on exhaust system.
- Position engine/transmission jack V.A.G 1383 A directly behind ATF drip tray. Insert a wood block -1- to protect the transmission housing.

WARNING: The lock carrier must be installed.

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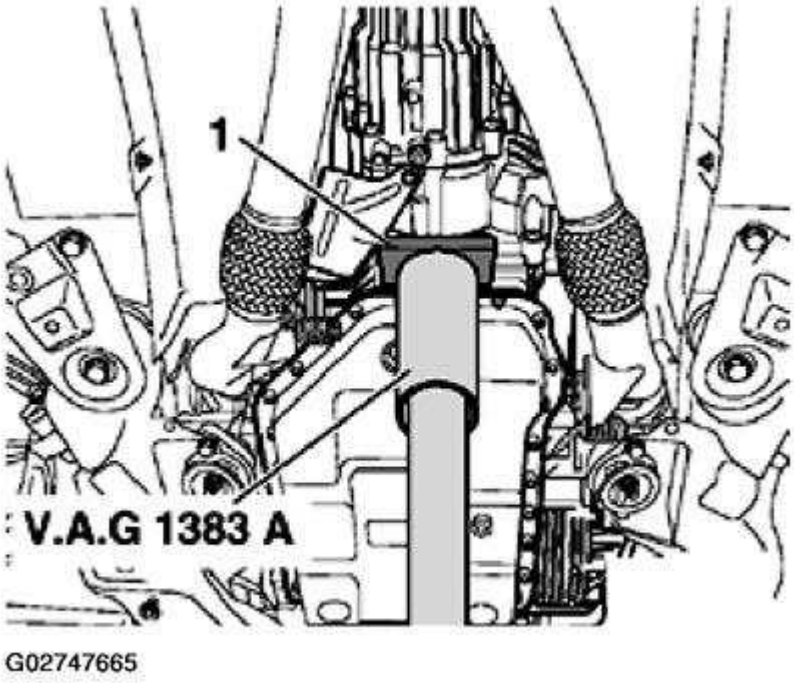


Fig. 130: Positioning Engine/Transmission Jack Behind ATF Drip Tray - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- First remove bolts -2- and -3- and then mounting bolts -1- and -4- of subframe.
- Slightly lower the transmission and subframe using VAG 1383A engine/gearbox jack.

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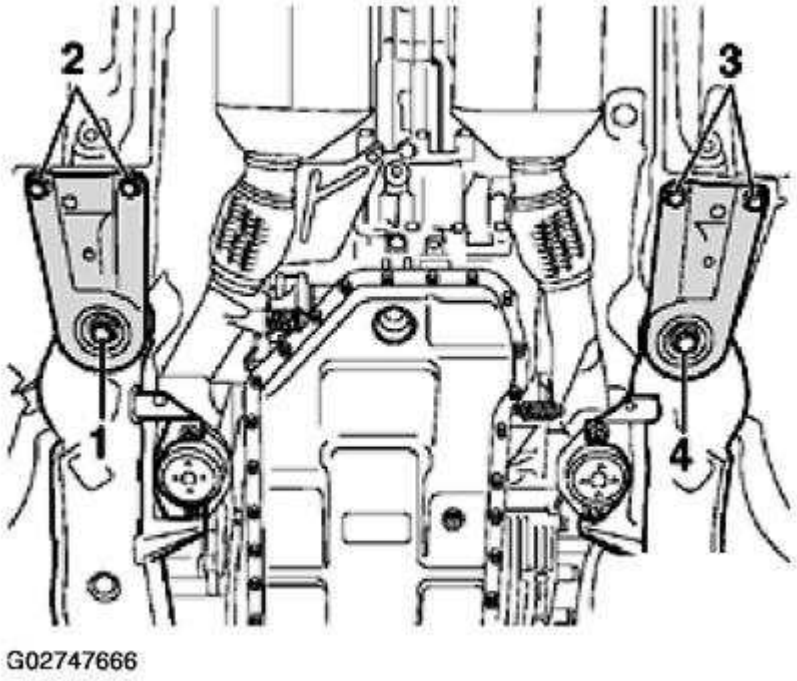


Fig. 131: Removing Subframe Mounting Bolts - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts -1- to -4- for transmission mount.
- Unbolt both transmission mounts -5- and -6- at transmission housing and remove transmission supports with transmission mounts.

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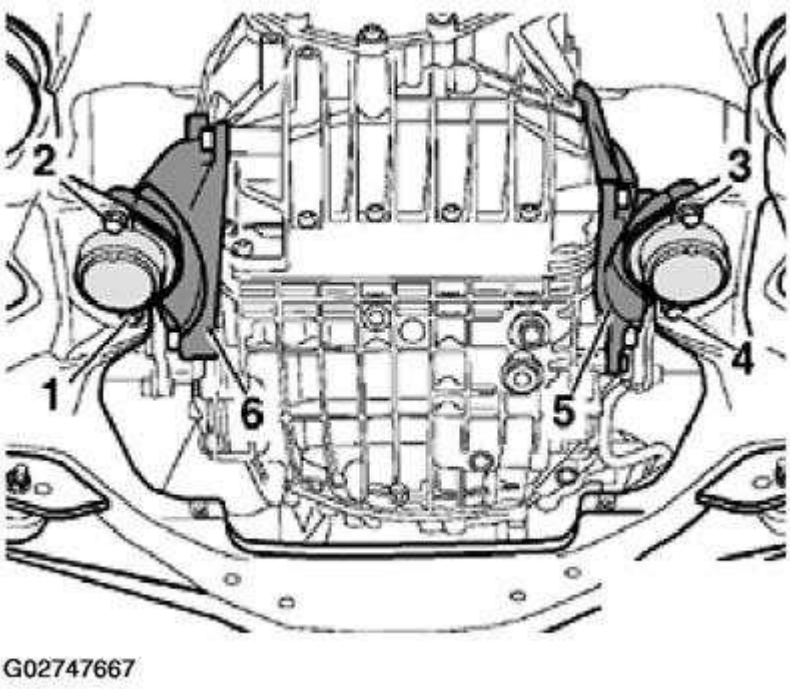


Fig. 132: Removing Transmission Mount Bolts - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Lower transmission slowly.
- Remove heat shield -1- for right drive axle.
- Remove right drive axle.

See **FRONT AXLE SHAFT** .

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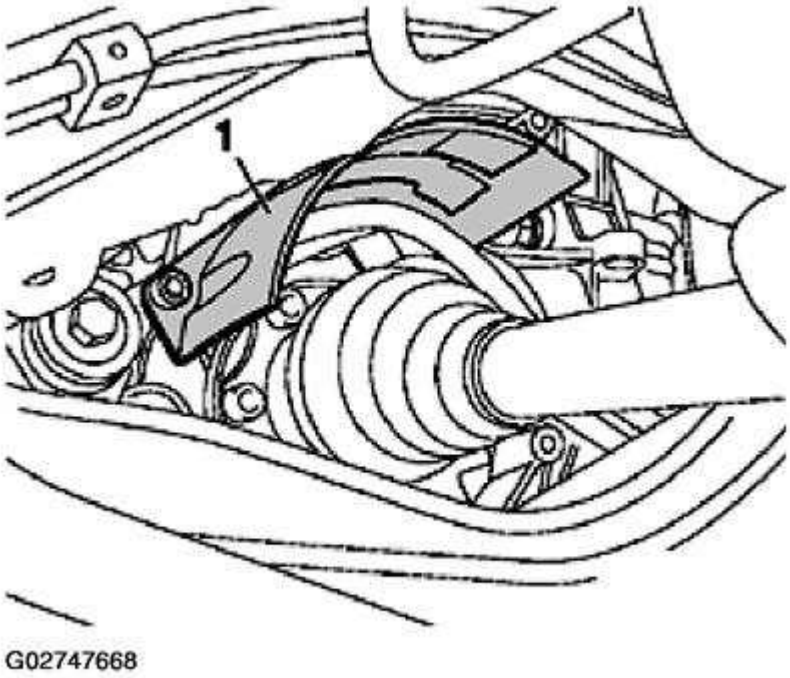


Fig. 133: Removing Right Drive Axle Heat Shield - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Remove bracket for front exhaust pipe (arrow).

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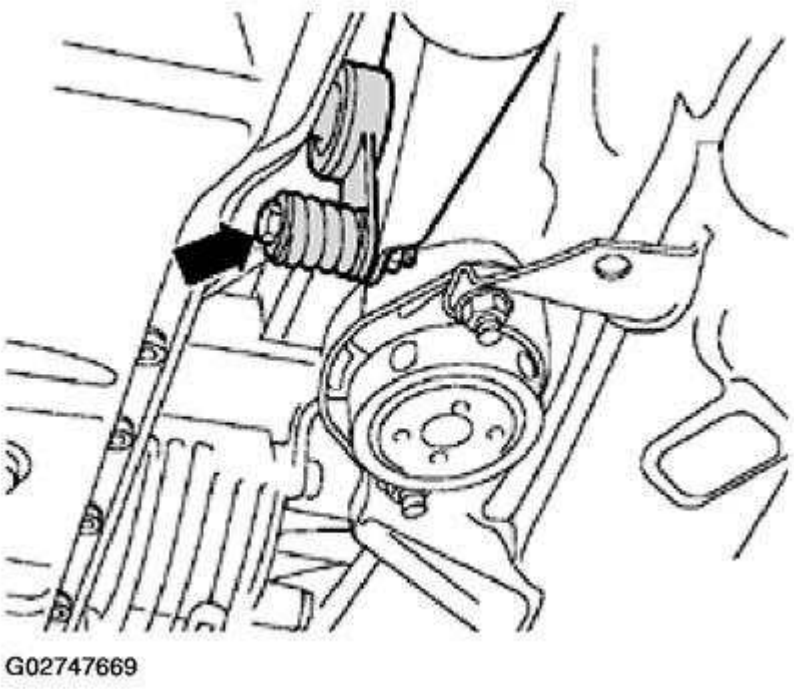


Fig. 134: Removing RH Front Exhaust Pipe Bracket - A\T 01V Vehicle
Courtesy of AUDI OF AMERICA, INC.

- Unbolt bracket for ATF-lines (arrow).

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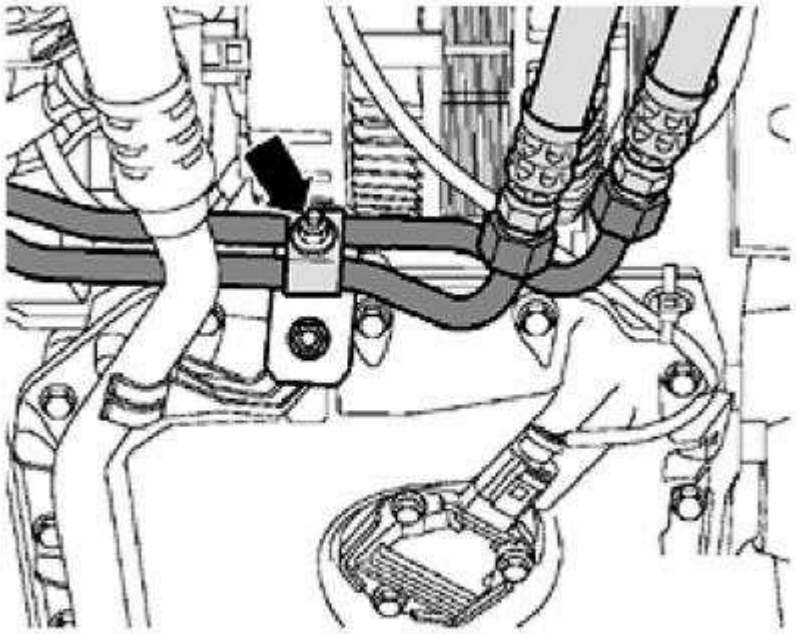


Fig. 135: Removing ATF-Lines Bracket Bolt - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

NOTE: Observe the rules of cleanliness for working on automatic transmissions:

- Place oil pan underneath.
- Remove bolt (arrow) and disconnect ATF-lines from transmission.

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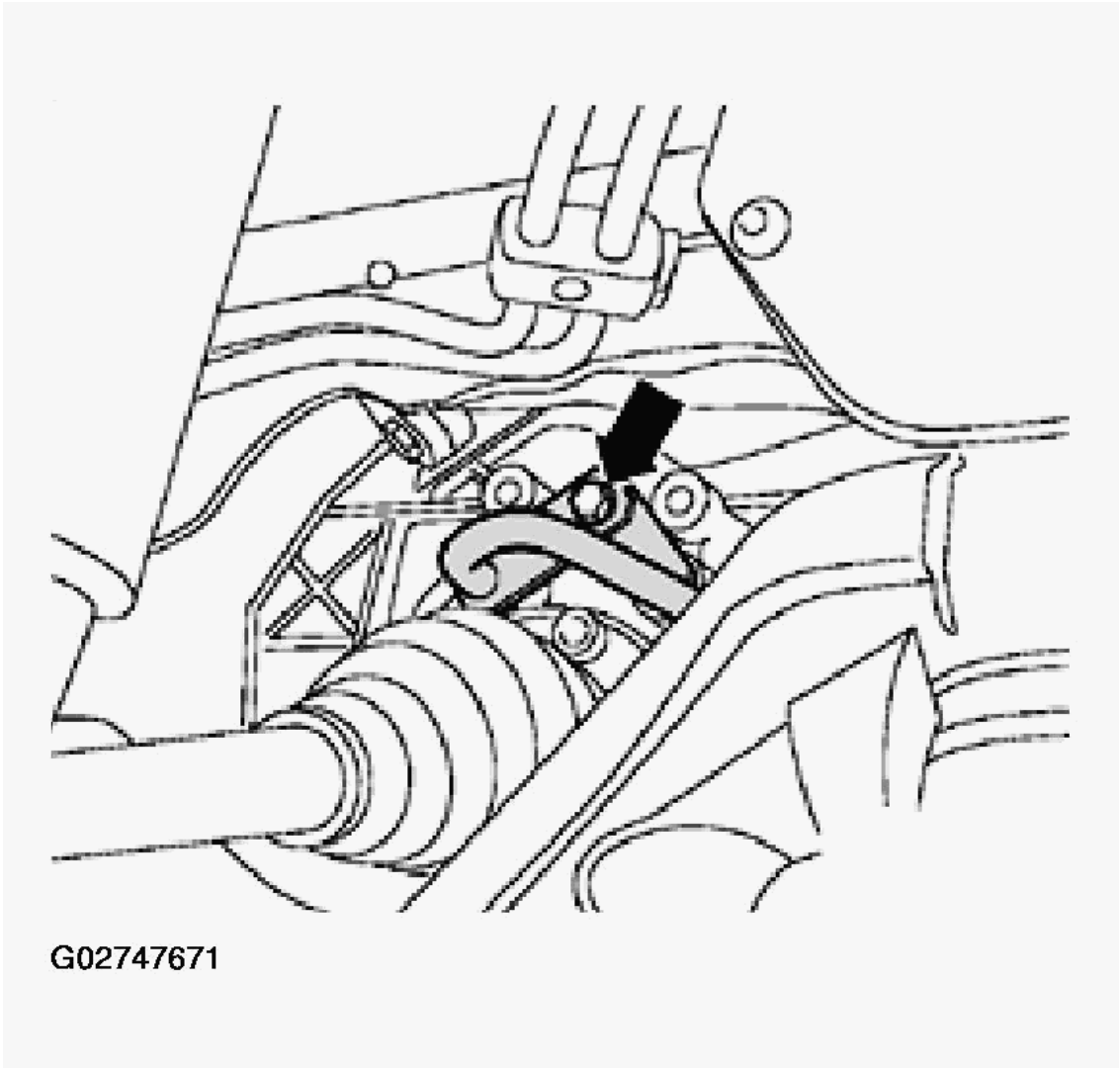


Fig. 136: Disconnecting ATF-Lines From Transmission - A\T 01V Vehicle (Front RH Exhaust Pipe)
Courtesy of AUDI OF AMERICA, INC.

- Tie up ATF lines off to side.
- Expose oxygen sensor wire.
- Remove nuts -1- and -3- for front exhaust pipe/exhaust manifold which are accessible from bottom.

NOTE: Illustration is shown with engine removed.

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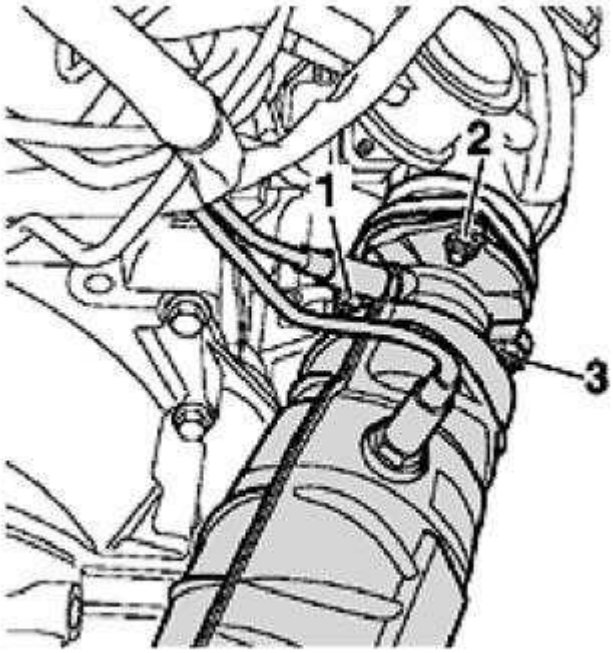


Fig. 137: Removing RH Front Exhaust Pipe/Exhaust Manifold Nuts - A\T 01V Vehicle
Courtesy of AUDI OF AMERICA, INC.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **All cable ties opened or cut during engine removal must be reinstalled at the same locations during installation.**
- **Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.**
- **Oxygen sensor wiring must always be secured in the same position when installing so that contact with the exhaust pipe is avoided.**
- **Replace gaskets and self-locking nuts.**

- Install transmission supports.

See **Fig. 138** and .**Fig. 139** . Tighten M10 bolts to 40 Nm. Tighten M6 bolts to 10 Nm.

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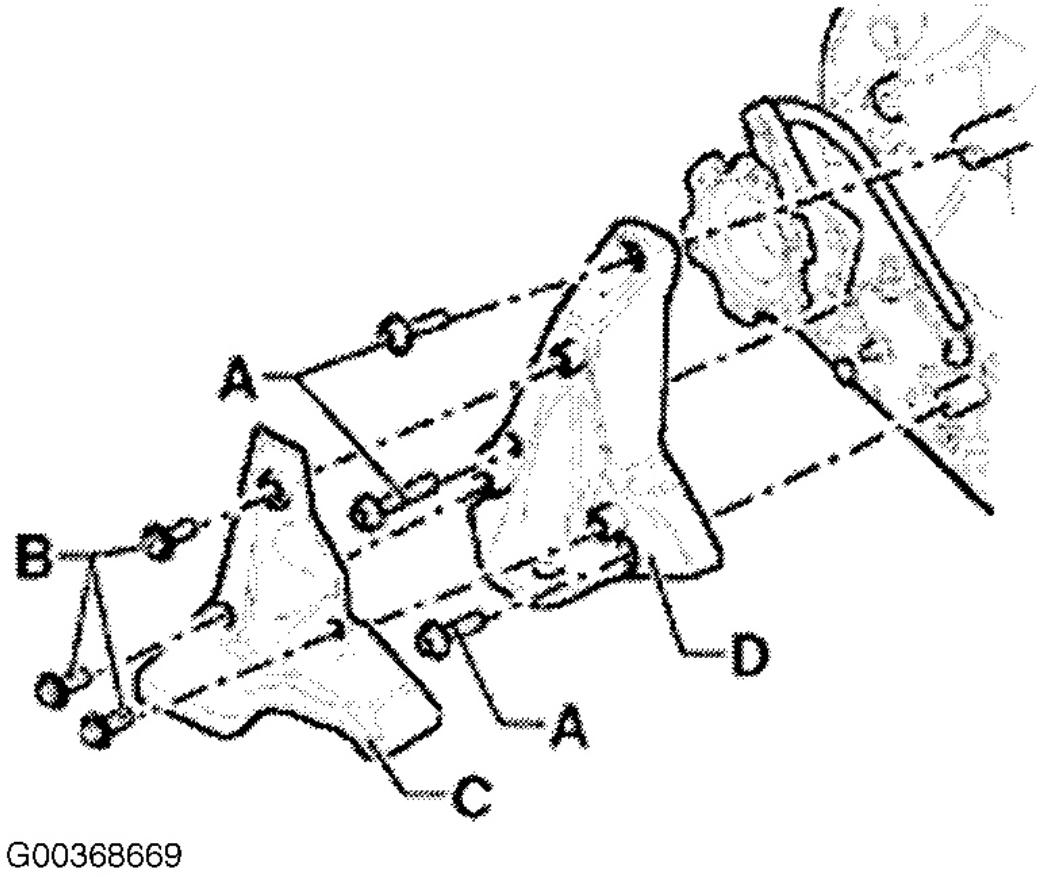


Fig. 138: Locating Left Transaxle Support Heat Shields
Courtesy of AUDI OF AMERICA, INC.

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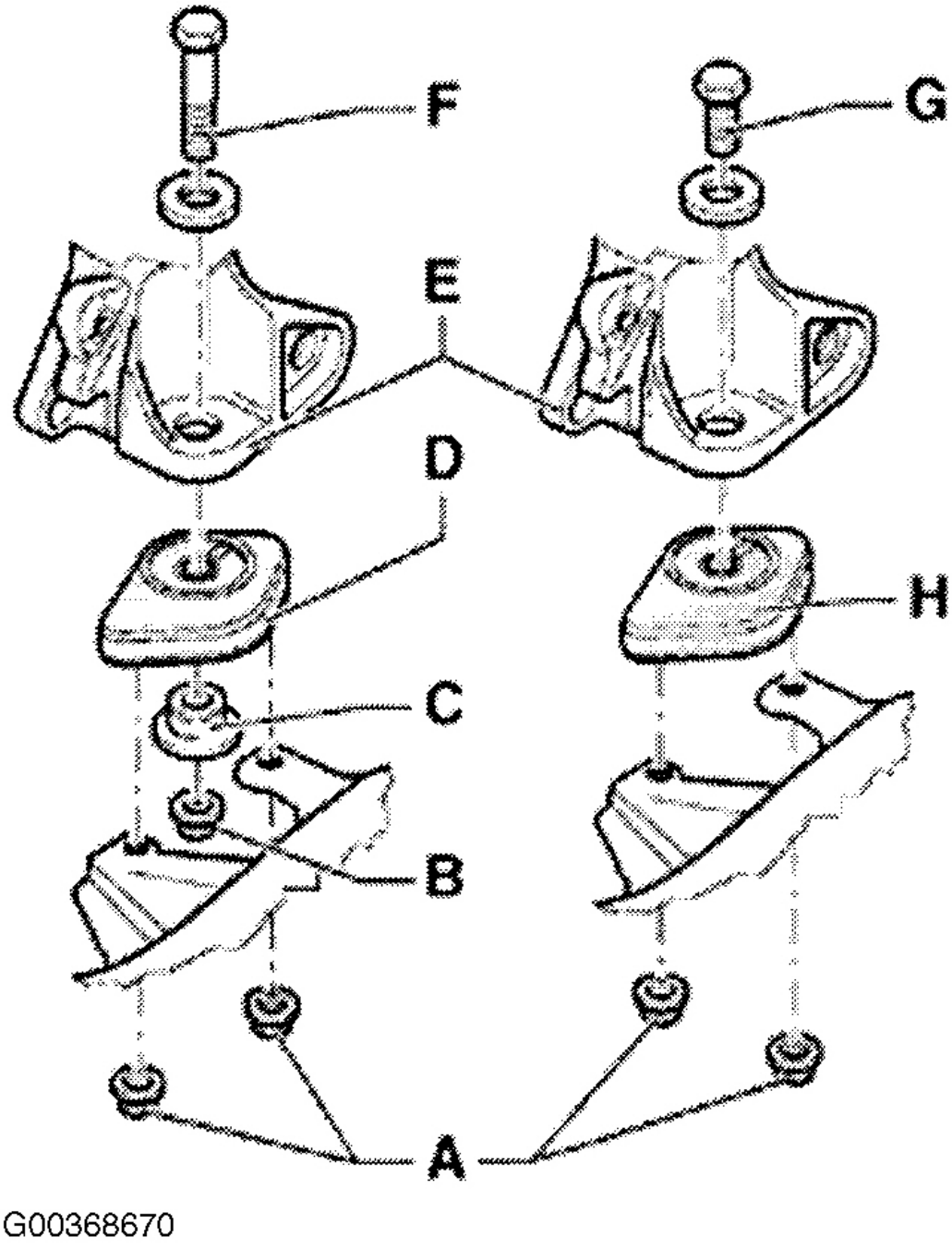


Fig. 139: Locating Left & Right Transaxle Supports
Courtesy of AUDI OF AMERICA, INC.

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NOTE: Items (C) and (B) are not installed on vehicles with hydraulic transmission bearing (H), because bolt (G) is threaded directly into the transmission bearing. See Fig. 139 .

- Install subframe:

  See **SUBFRAME & BUSHINGS** ,

- Install drive axle.

  See **FRONT AXLE SHAFT**

- Installing driveshaft:

  See **DRIVESHAFT**

- Secure ATF lines:
- Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** and **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .

NOTE: For individual mounting components for exhaust system to transmission on vehicles with automatic transmission 01V, see INDIVIDUAL RIGHT MOUNTING COMPONENTS FOR VEHICLES WITH AUTOMATIC TRANSMISSION 01V .

- Check ATF level.

  See **CHECKING FLUID LEVELS** .

Tightening torques

TIGHTENING TORQUES: RH EXHAUST SYSTEM (A\T 01V)

Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27
Front exhaust pipe with catalytic converter to hanging strap	25
Mounting straps to transmission	25
Drive axle protection to transmission	23
Oxygen sensor to catalytic converter	55

Left exhaust manifold, removing and installing

Removing

- Remove left front exhaust pipe with catalytic converter. See **LEFT FRONT EXHAUST PIPE WITH**

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CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH MANUAL TRANSMISSION) , **LEFT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH AUTOMATIC TRANSMISSION 01J)** and **LEFT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH AUTOMATIC TRANSMISSION 01V)** .

- Remove threaded connection -2- at heat shield which is accessible from bottom.
- Unscrew threaded connection -1- which is accessible from top and remove heat shield.

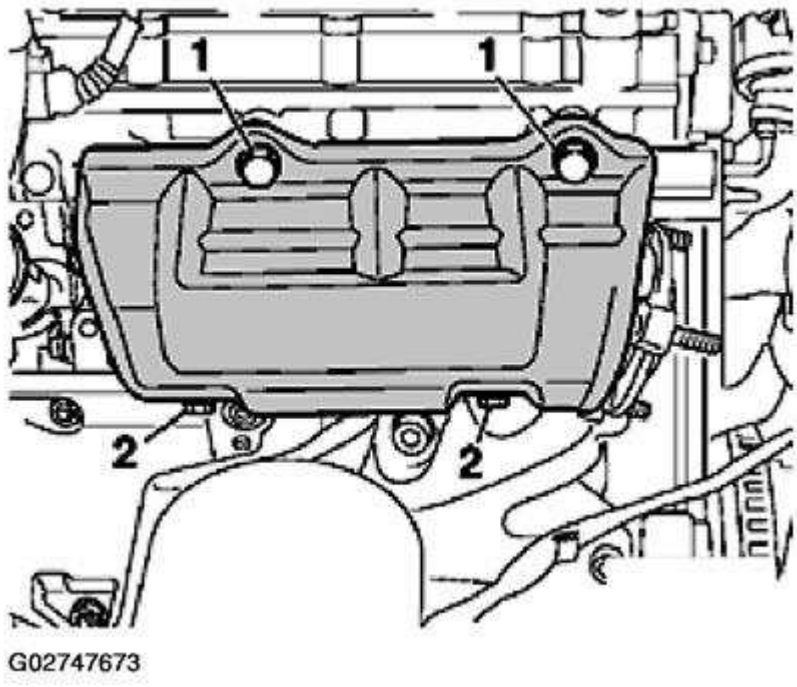


Fig. 140: Removing Heat Shield - LH Exhaust Manifold
Courtesy of AUDI OF AMERICA, INC.

- Unscrew threaded connections -1- of exhaust manifold which is accessible from top.
- Remove nuts -2- from bottom and remove heat shield bracket.
- Remove nut -3- and remove exhaust manifold.

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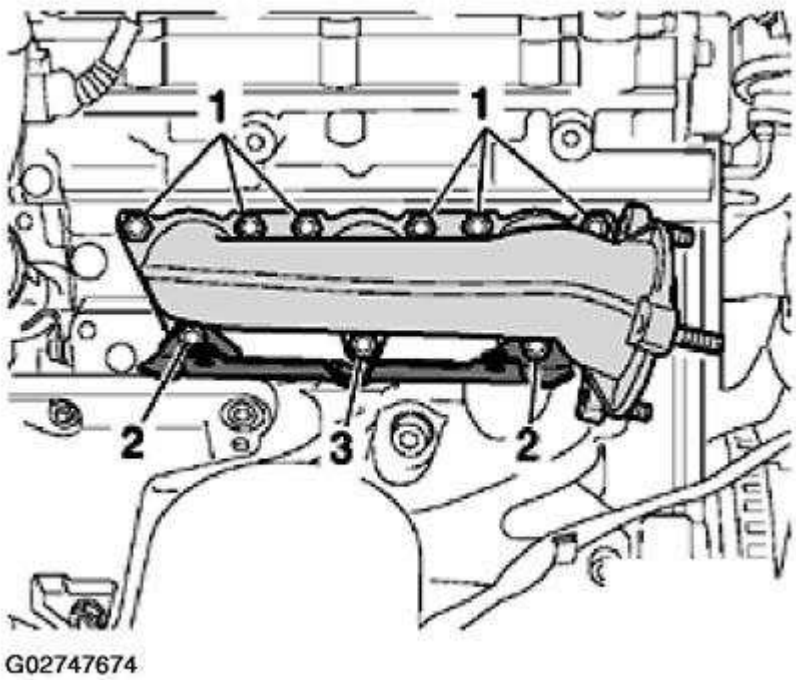


Fig. 141: Removing LH Exhaust Manifold
Courtesy of AUDI OF AMERICA, INC.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and self-locking nuts.

- Install left front exhaust pipe with catalytic converter. See **INSTALLING** , **INSTALLING** and **INSTALLING** .
- Install exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** and **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .

Tightening torques

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Component		Nm
Exhaust manifold to cylinder head		25
Heat shield	M6	10
for exhaust manifold	M8	25

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Fig. 142: Left Hand Exhaust Manifold Components Tightening Torques Chart
Courtesy of AUDI OF AMERICA, INC.

Right exhaust manifold, removing and installing

Removing

- Remove right front exhaust pipe with catalytic converter. See **RIGHT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH MANUAL TRANSMISSION)** , **RIGHT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH AUTOMATIC TRANSMISSION 01J)** and **RIGHT FRONT EXHAUST PIPE WITH CATALYTIC CONVERTER, REMOVING AND INSTALLING (VEHICLES WITH AUTOMATIC TRANSMISSION 01V)** .
- Remove threaded connection -2- at heat shield which is accessible from bottom.
- Unscrew threaded connection -1- which is accessible from top.

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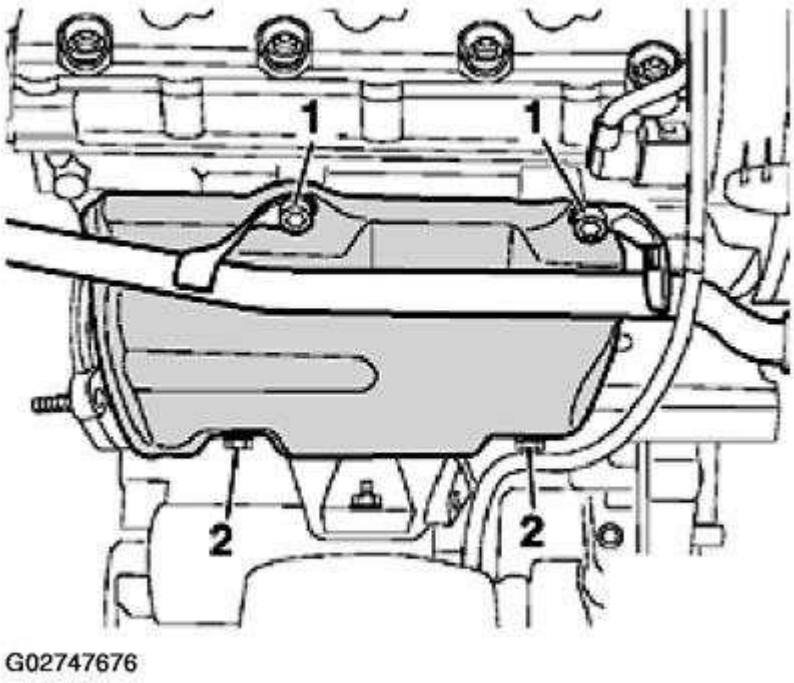


Fig. 143: Removing Threaded Connection At Heat Shield - RH Exhaust Manifold
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts -1- and -2- at secondary air injection lines.

NOTE: Resonator -4- remains installed with bolts -3- and -5-.

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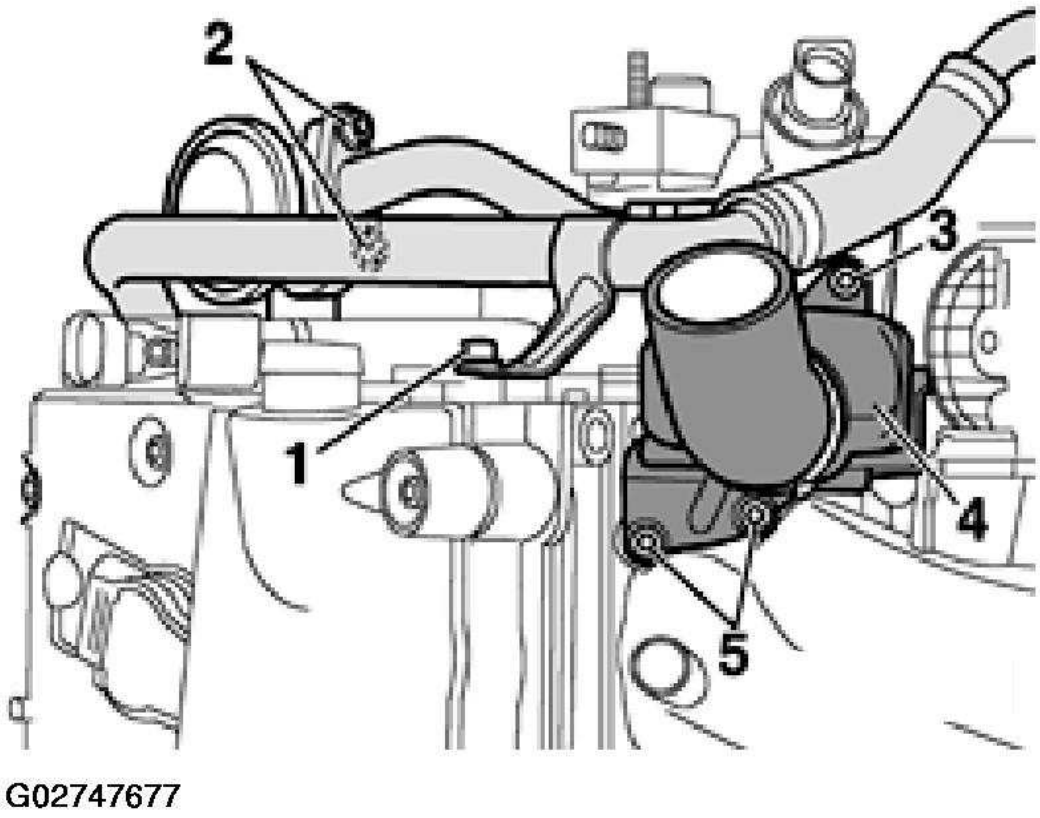


Fig. 144: Removing Secondary Air Injection Lines Bolts - RH Exhaust Manifold
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts -1- and -3-.
- Disconnect hose -4- from secondary air injection line.
- Pull out guide tube for oil dipstick -2- toward top from the oil pan (upper part) and swing it forward.

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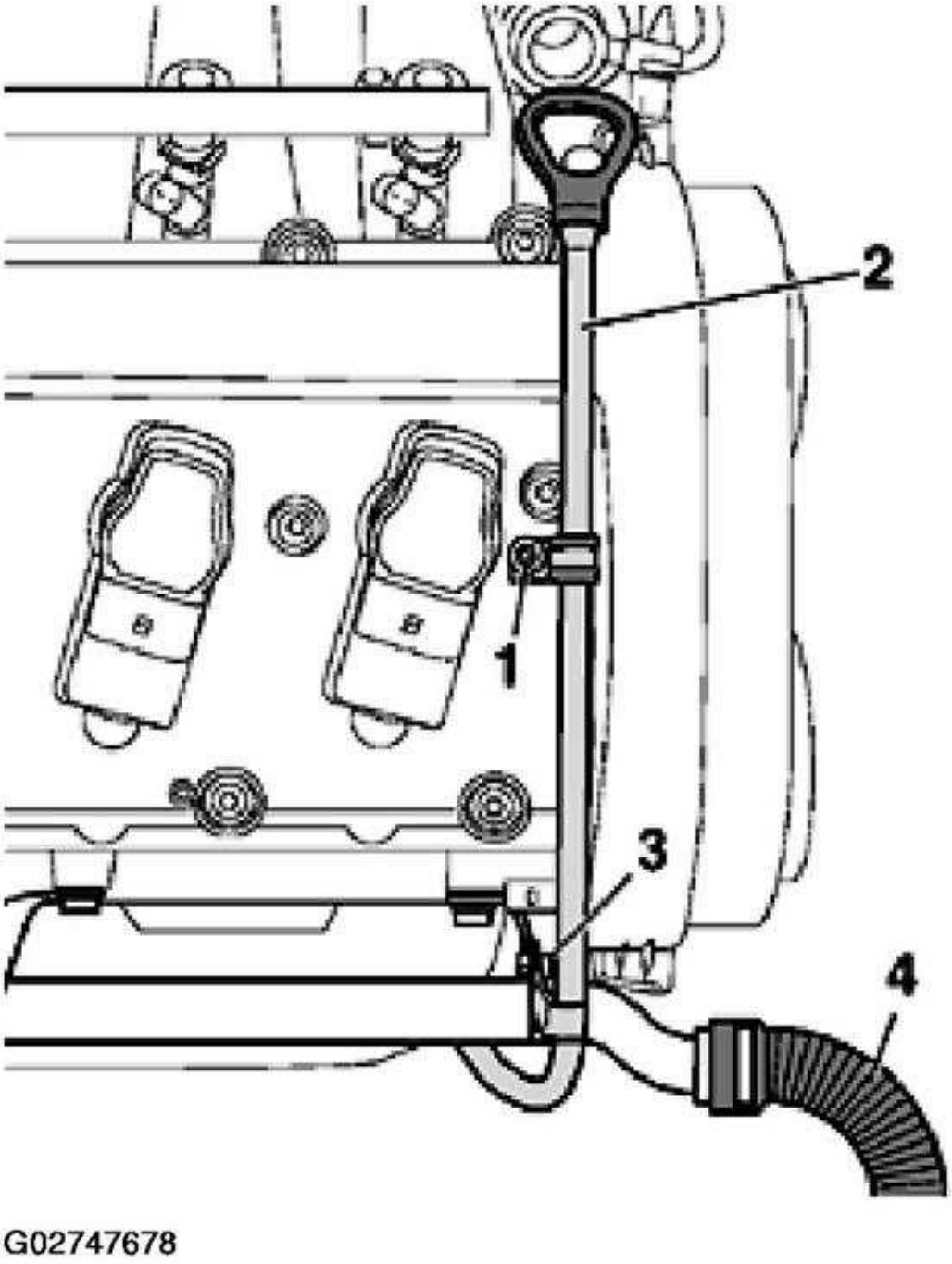


Fig. 145: Guide Tube For Oil Dipstick -2-
Courtesy of AUDI OF AMERICA, INC.

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- Remove heat shield.
- Unscrew threaded connection -1- on exhaust manifold which is accessible from top.
- Remove nuts -2- from bottom and remove heat shield bracket.
- Remove nut -3- and remove exhaust manifold.

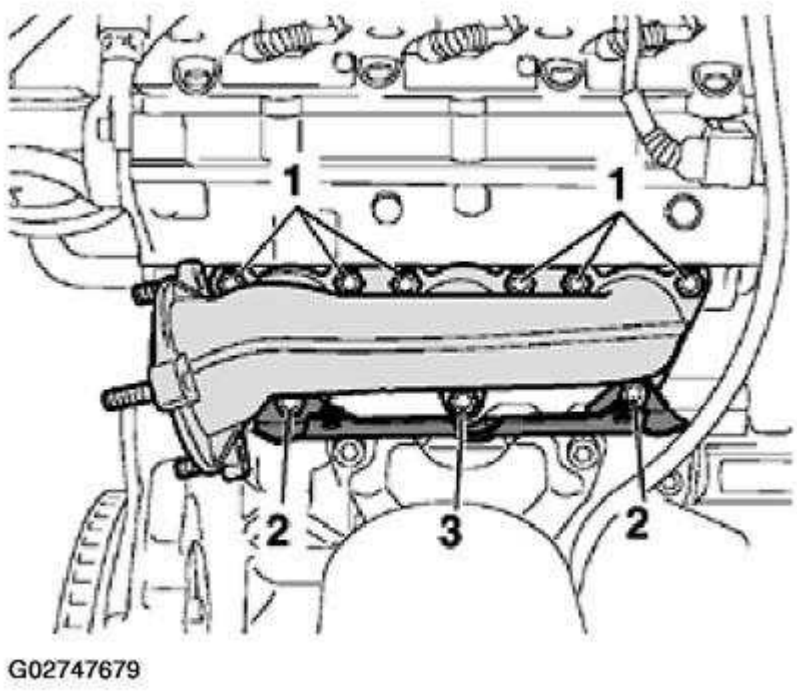


Fig. 146: Removing RH Exhaust Manifold
Courtesy of AUDI OF AMERICA, INC.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and self-locking nuts.

- Replace O-ring at guide tube for oil dipstick and insert guide tube into hole in oil pan (upper part).
- Install right front exhaust pipe with catalytic converter. See **INSTALLING** , **INSTALLING** or **INSTALLING** .
- Align exhaust system free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** or **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .

Tightening torque

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TIGHTENING TORQUES: RH EXHAUST MANIFOLD

Component	Nm
Exhaust manifold to cylinder head	25
Heat shield to heat shield bracket	10
Tube for Secondary Air Injection	
M6	10
M8	25
Guide tube for oil dipstick to line for secondary air injection	10

Exhaust system, aligning free of stress (front wheel drive vehicles)

NOTE: Align exhaust system when cold.

- Remove bolts -1- through -4- and remove crossmember (55 Nm).
  - Vehicles without clamping sleeve between center and rear muffler

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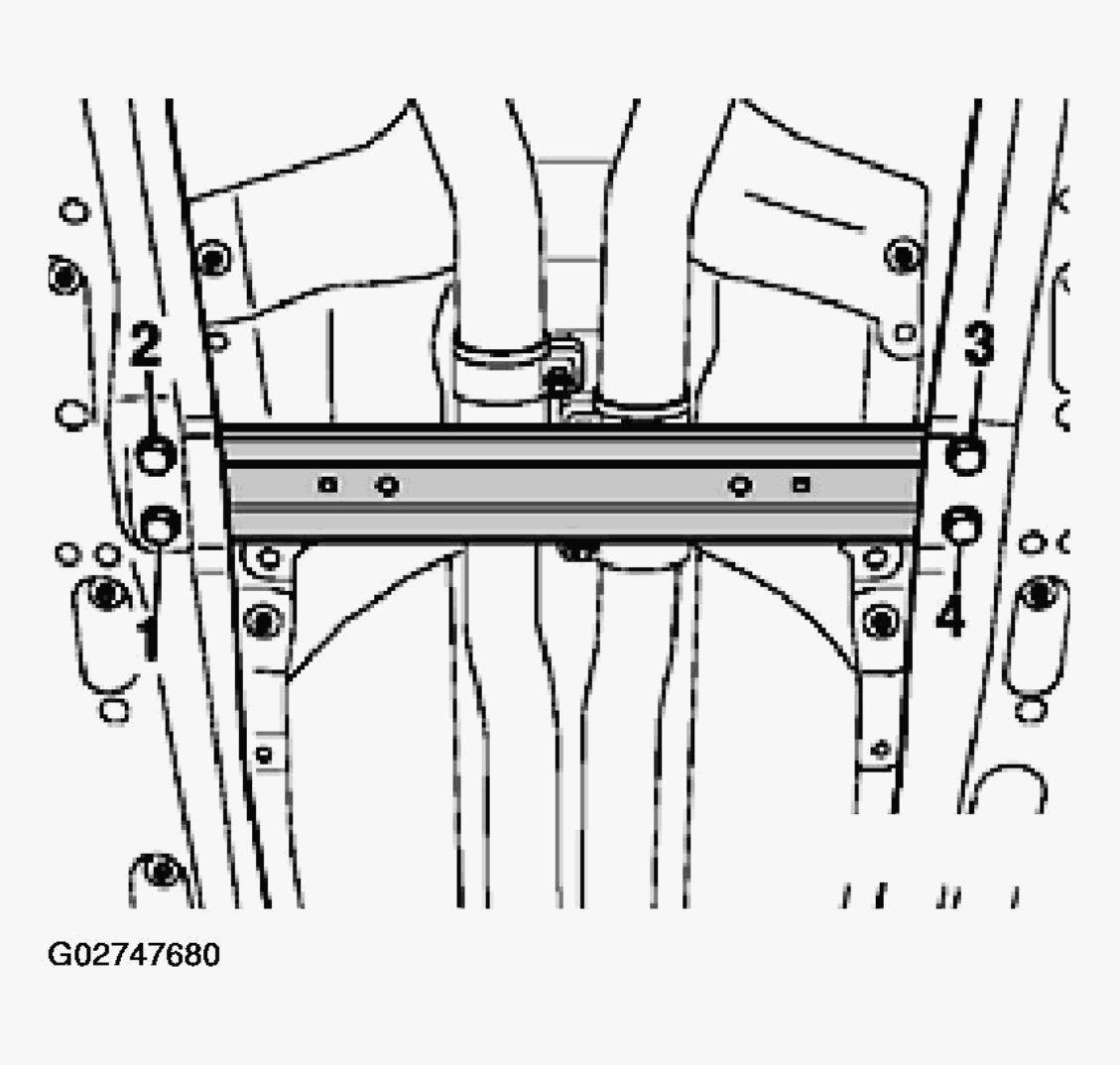


Fig. 147: Removing Crossmember - Exhaust System Aligning (Front Wheel Drive Vehicles)
Courtesy of AUDI OF AMERICA, INC.

- Loosen double clamp bolts. See **EXHAUST SYSTEM COMPONENTS, OVERVIEW (FRONT WHEEL DRIVE VEHICLES)** , Item -14-.
- Push exhaust system far enough forward (arrow) so that the pre-tension at the retaining loop at center muffler a = 5 to 9 mm.
- Tighten double clamp bolts uniformly to 40 Nm.
- Align end pipes. See **TAILPIPES, ALIGNING** .

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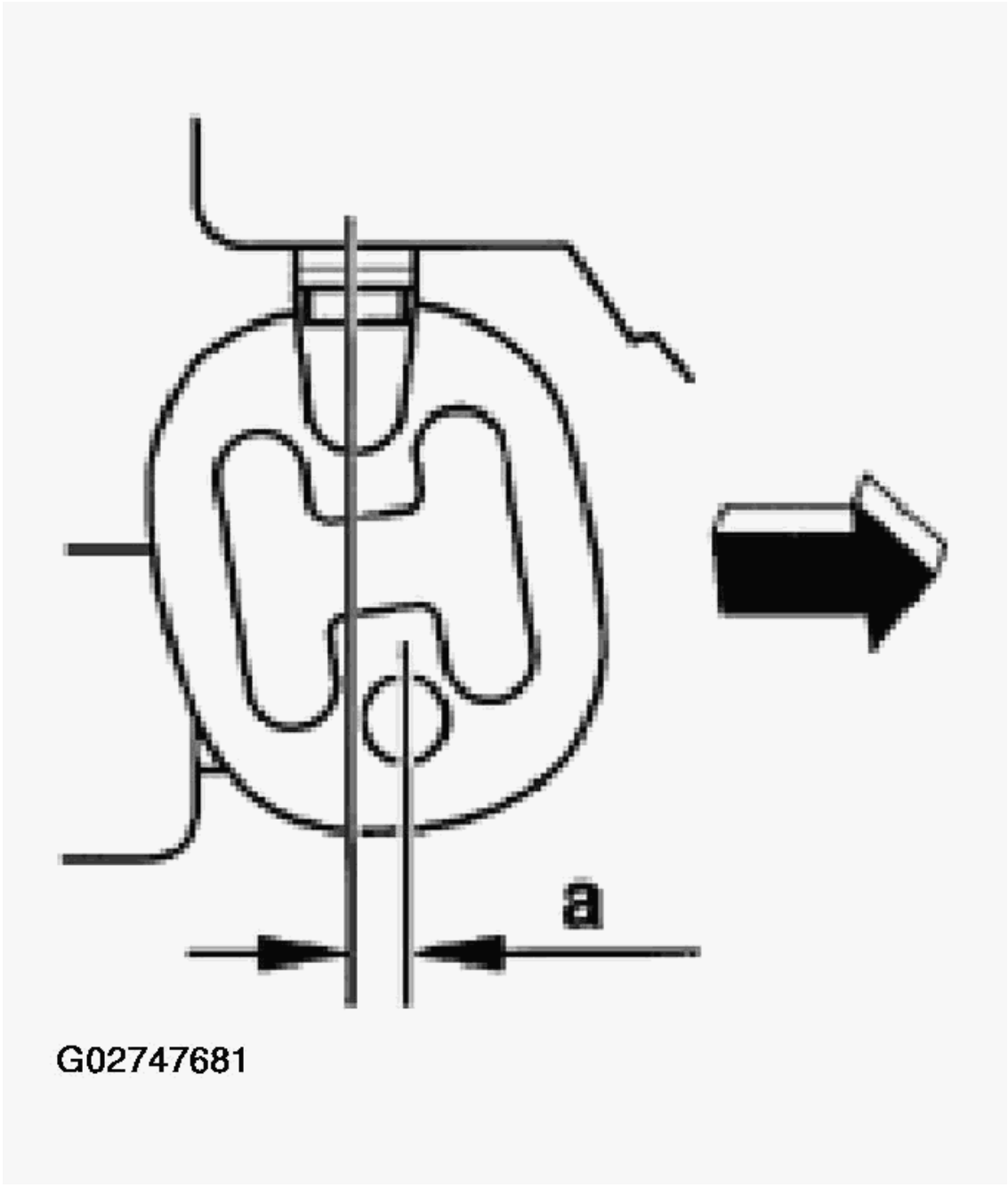


Fig. 148: Identifying Exhaust System Pushing Distance - Exhaust System Aligning (Front Wheel Drive Vehicles)
Courtesy of AUDI OF AMERICA, INC.

- Vehicles with clamping sleeve between center and rear muffler

NOTE: Only for vehicles with double clamp between center and rear mufflers, the rear muffler must also be aligned.

- Loosen double clamp bolts. See **EXHAUST SYSTEM COMPONENTS, OVERVIEW (FRONT**

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WHEEL DRIVE VEHICLES) , Items -14- and -23-.

- Push front part of exhaust system far enough forward (arrow) so that the pre-tension at the retaining loop at center muffler a = 5 to 9 mm.
- Tighten front double clamp bolts (see **EXHAUST SYSTEM COMPONENTS, OVERVIEW, (ALL WHEEL DRIVE VEHICLES)** , Item -14-) evenly to 40 Nm.

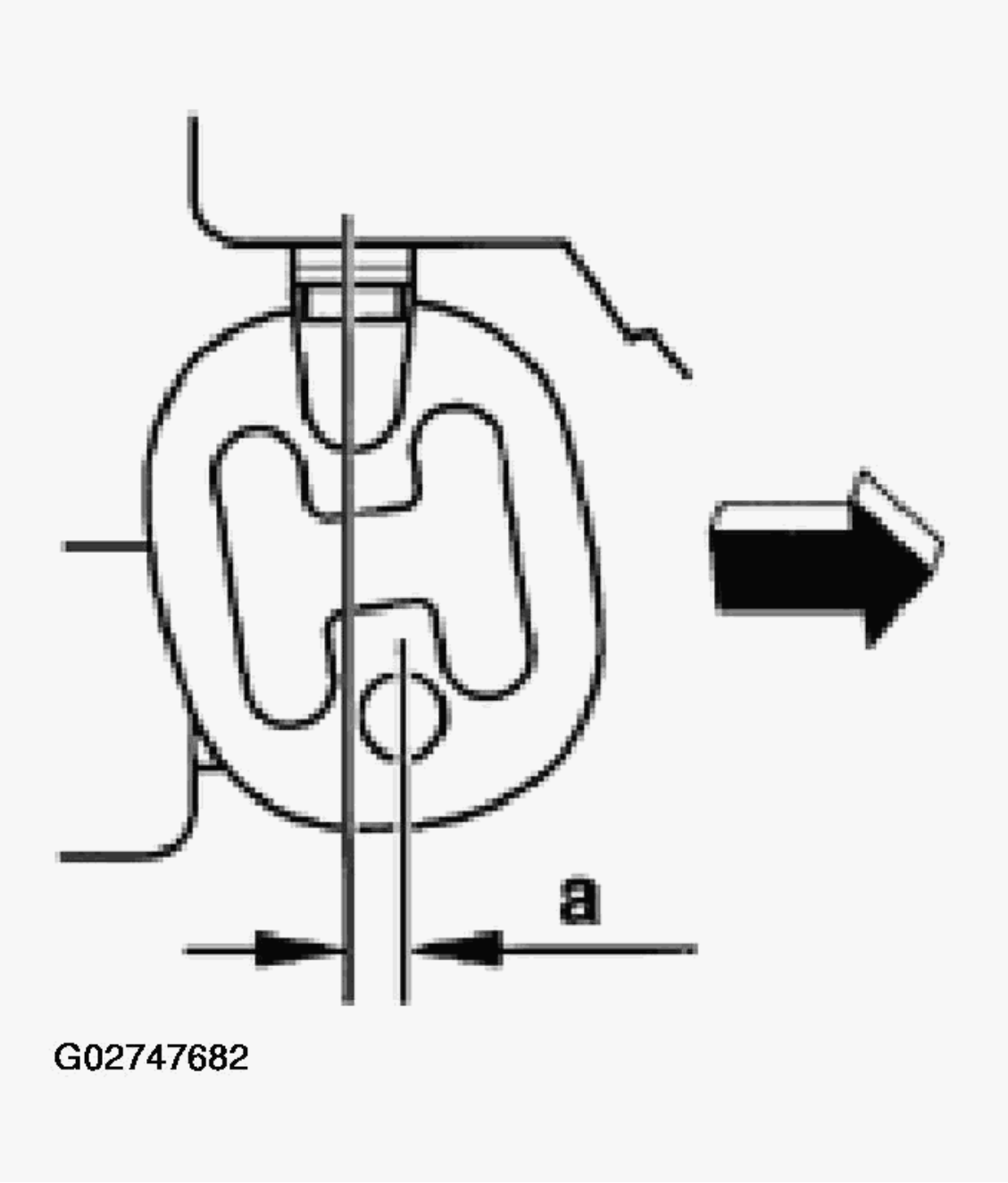


Fig. 149: Identifying Exhaust System (Front Part) Pushing Distance - Exhaust System Aligning (Front Wheel Drive Vehicles)
Courtesy of AUDI OF AMERICA, INC.

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- Push rear part of exhaust system far enough forward (arrow) so that the pre-tension at rear retaining loops at rear muffler a = 7 to 11 mm.
- Align rear muffler horizontally.
- Tighten rear double clamp bolts (see **EXHAUST SYSTEM COMPONENTS, OVERVIEW (FRONT WHEEL DRIVE VEHICLES)** , Item -23-) evenly to 40 Nm.
- Align end pipes, see **Tailpipes, aligning** .

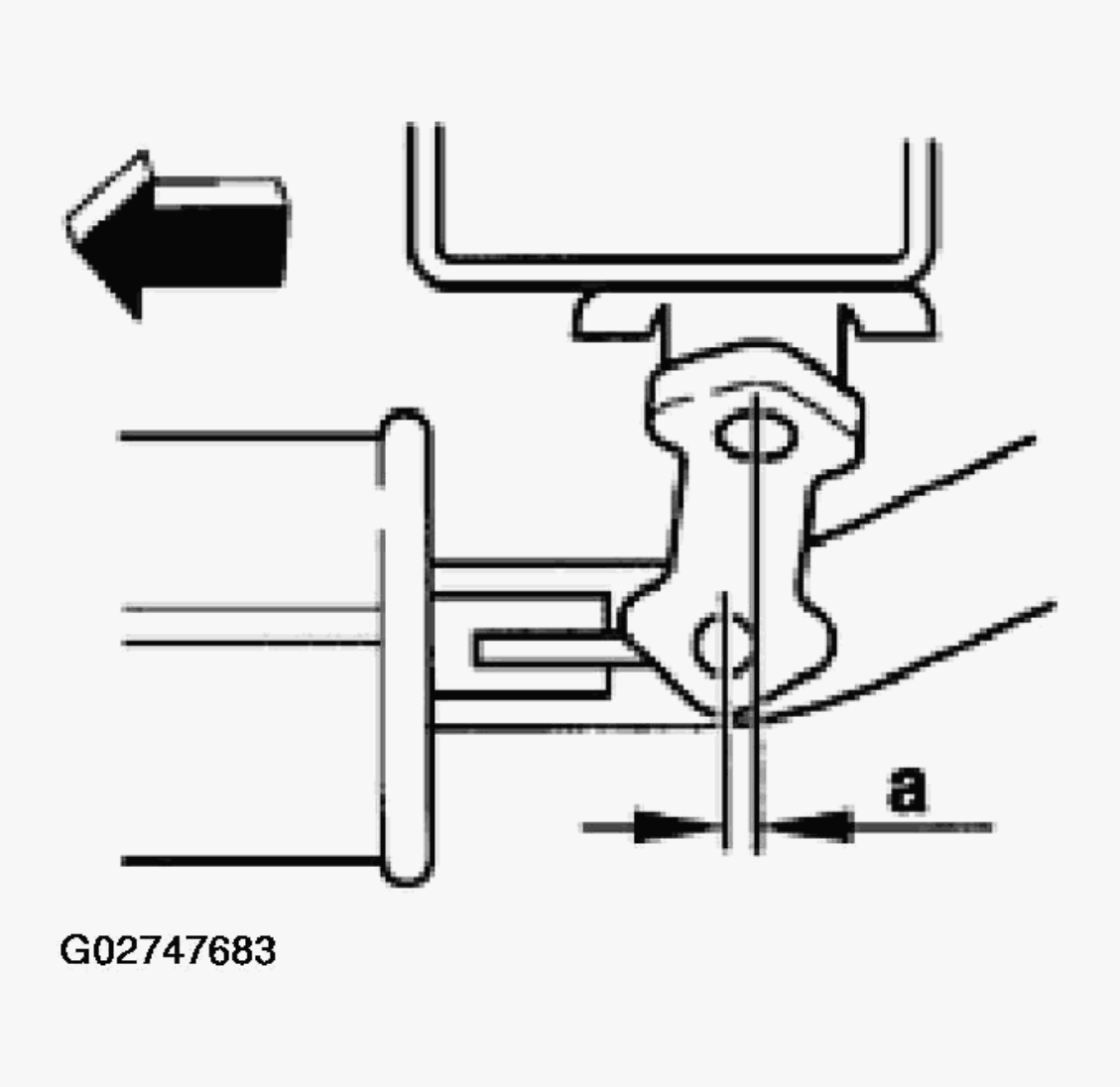


Fig. 150: Identifying Exhaust System (Rear Part) Pushing Distance - Exhaust System Aligning (Front Wheel Drive Vehicles)
Courtesy of AUDI OF AMERICA, INC.

Exhaust system, aligning free of stress (all wheel drive vehicles)

NOTE: Align exhaust system when cold.

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- Remove bolts -1- through -4- and remove crossmember (55 Nm).
  - Vehicles without clamping sleeve between center and rear muffler

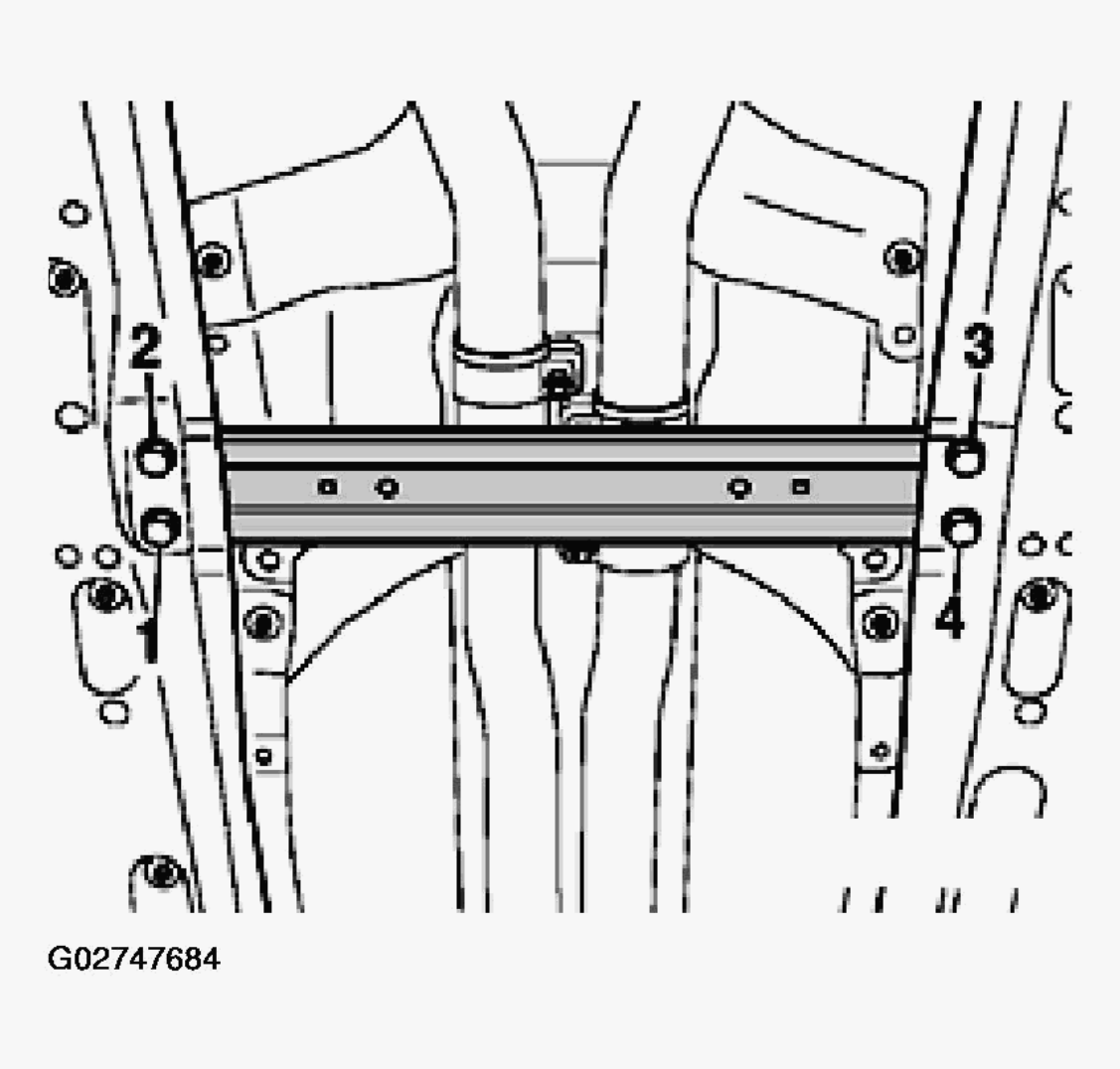


Fig. 151: Removing Crossmember - Exhaust System Aligning
Courtesy of AUDI OF AMERICA, INC.

- Loosen double clamp bolts. See **EXHAUST SYSTEM COMPONENTS, OVERVIEW, (ALL WHEEL DRIVE VEHICLES)** , Item -14-.
- Push exhaust system far enough forward (arrow) so that the pre-tension at the right retaining loop at center muffler a = 5 to 9 mm.
- Tighten double clamp bolts uniformly to 40 Nm.
- Align end pipes, see **TAILPIPES, ALIGNING** .

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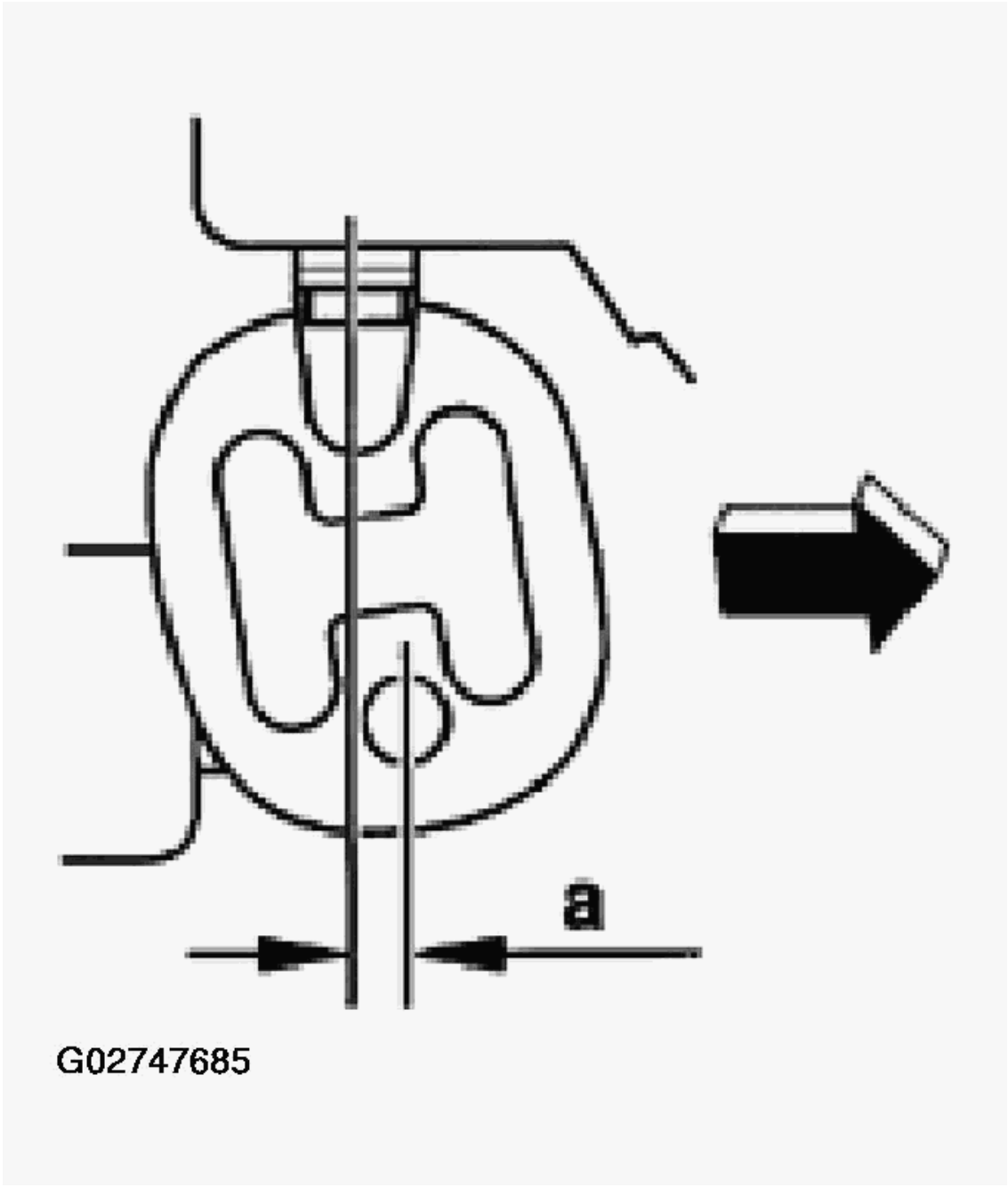


Fig. 152: Identifying Exhaust System Pushing Distance - Exhaust System Aligning
Courtesy of AUDI OF AMERICA, INC.

- Vehicles with clamping sleeve between center and rear muffler

NOTE: Only for vehicles with double clamp between center and rear mufflers, the center muffler must also be aligned.

- Loosen double clamp bolts. See **EXHAUST SYSTEM COMPONENTS, OVERVIEW, (ALL**

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WHEEL DRIVE VEHICLES) , Items -14- and -24-.

- Push front part of exhaust system far enough forward (arrow) so that the pre-tension at the retaining loop at center muffler a = 5 to 9 mm.

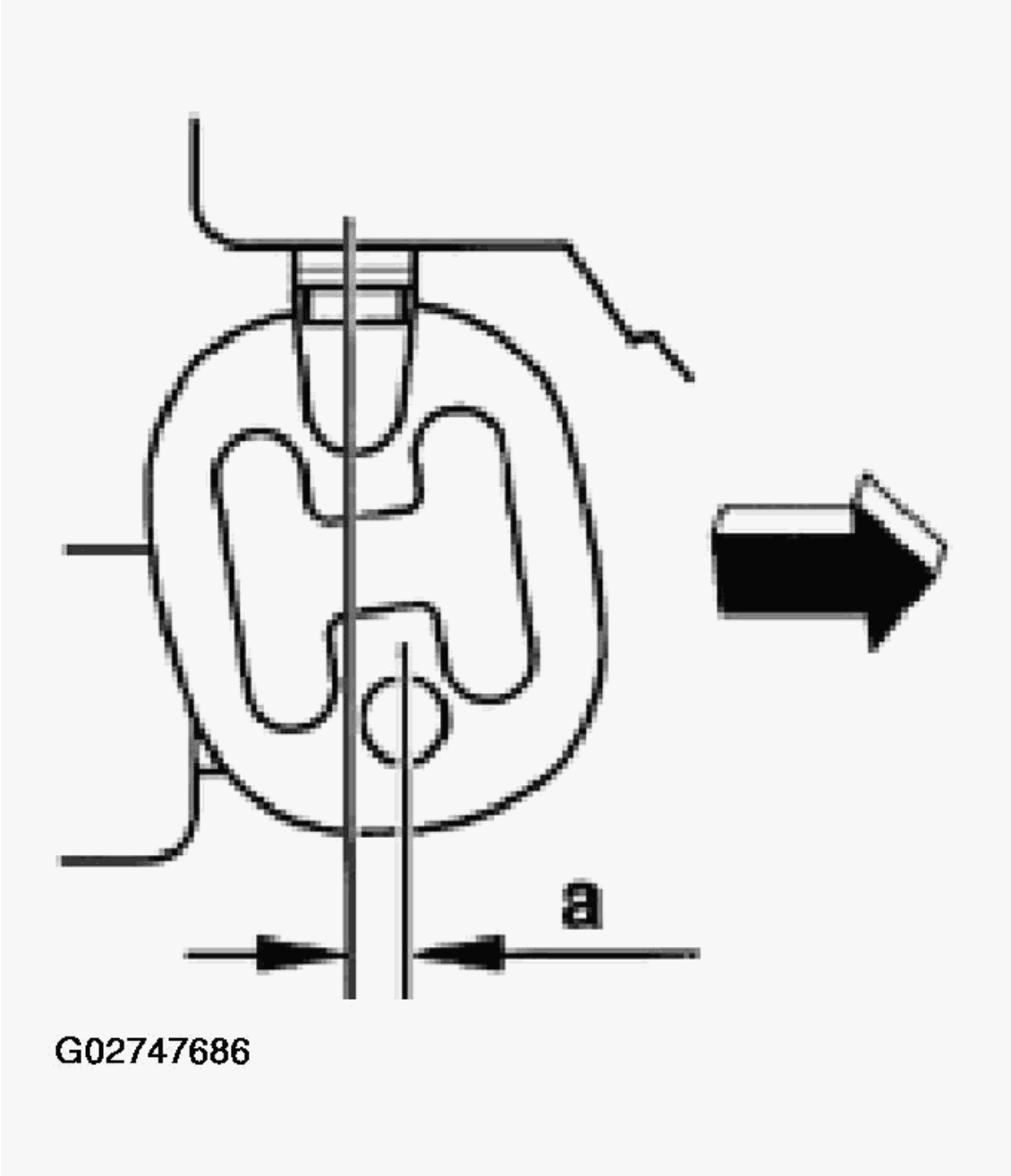


Fig. 153: Identifying Exhaust System (Front Part) Pushing Distance - Exhaust System Aligning
Courtesy of AUDI OF AMERICA, INC.

- Tighten front double clamp bolts (see **EXHAUST SYSTEM COMPONENTS, OVERVIEW, (ALL WHEEL DRIVE VEHICLES)** , Item -14-) evenly to 40 Nm.
- Push rear part of exhaust system far enough forward (arrow) so that the pre-tension at rear retaining loops

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at rear muffler a = 7 to 11 mm.

- Align rear muffler horizontally.
- Tighten rear double clamp bolts (see **EXHAUST SYSTEM COMPONENTS, OVERVIEW, (ALL WHEEL DRIVE VEHICLES)** , Item -24-) evenly to 40 Nm.
- Align end pipes, see **TAILPIPES, ALIGNING** .

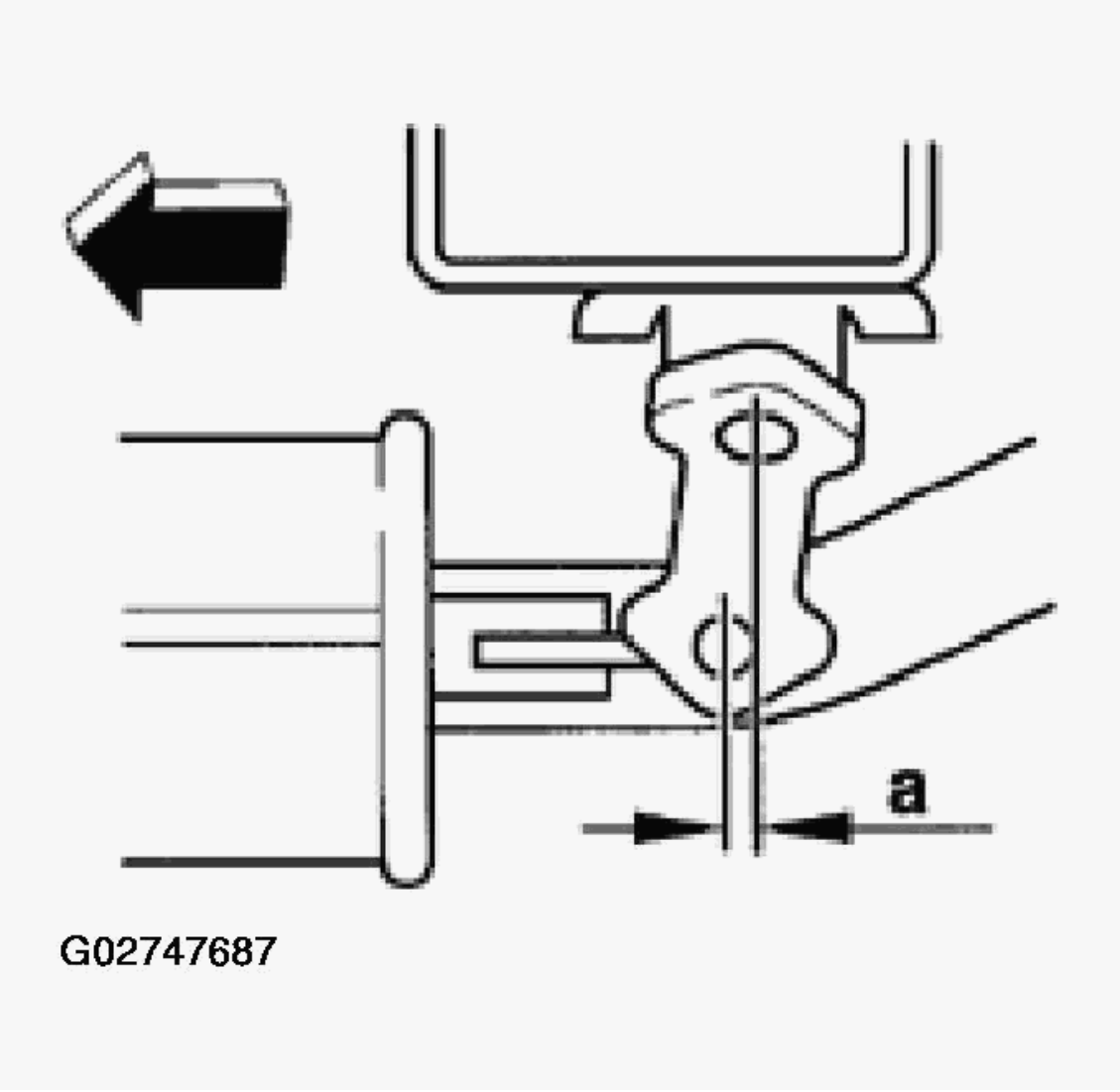


Fig. 154: Identifying Exhaust System (Rear Part) Pushing Distance - Exhaust System Aligning
Courtesy of AUDI OF AMERICA, INC.

Tailpipes, aligning

- Check distance of end pipes at left and right to bumper:
  - Dimension x left = dimension x right

If necessary, correct dimension x as follows:

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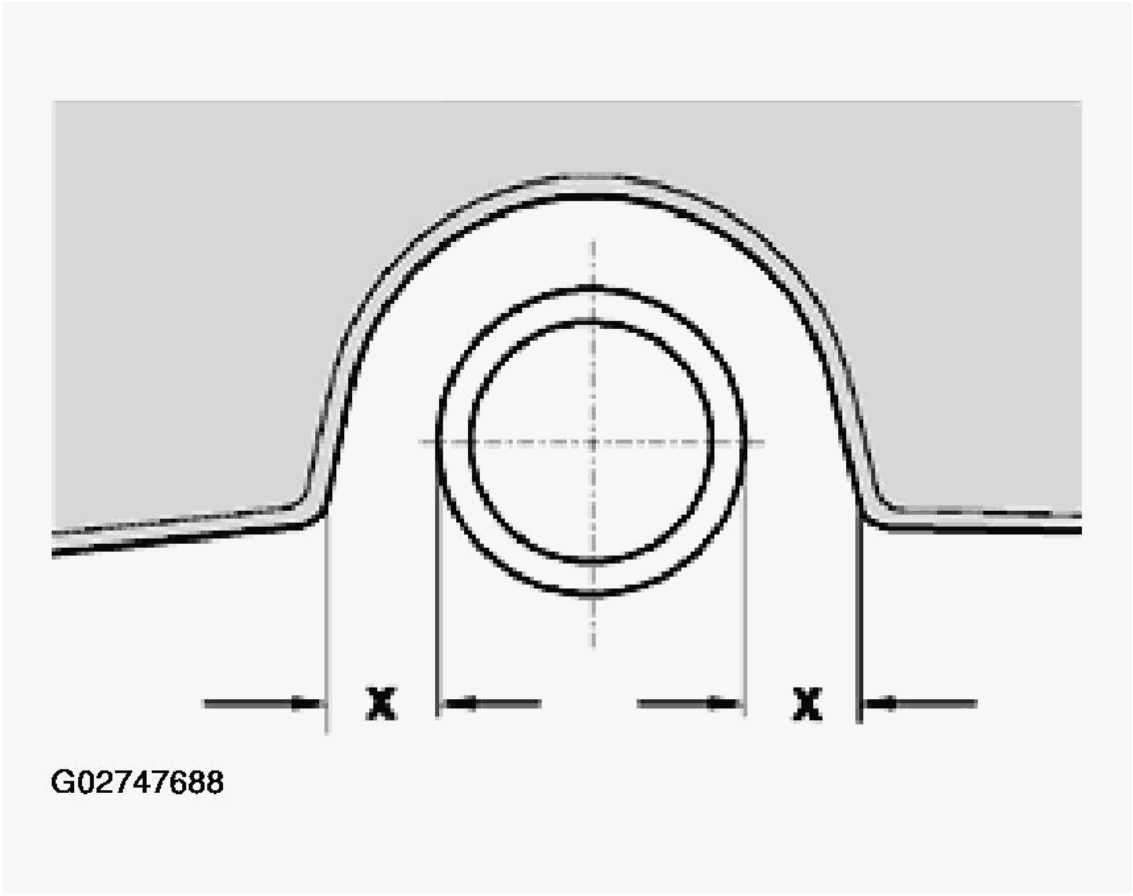


Fig. 155: Checking Distance Of End Pipes At Left And Right To Bumper
Courtesy of AUDI OF AMERICA, INC.

- Loosen nuts (arrows) of brace between exhaust pipes.
- Change the distance of the rear mufflers to each other.
- Tighten nut to 23 Nm.

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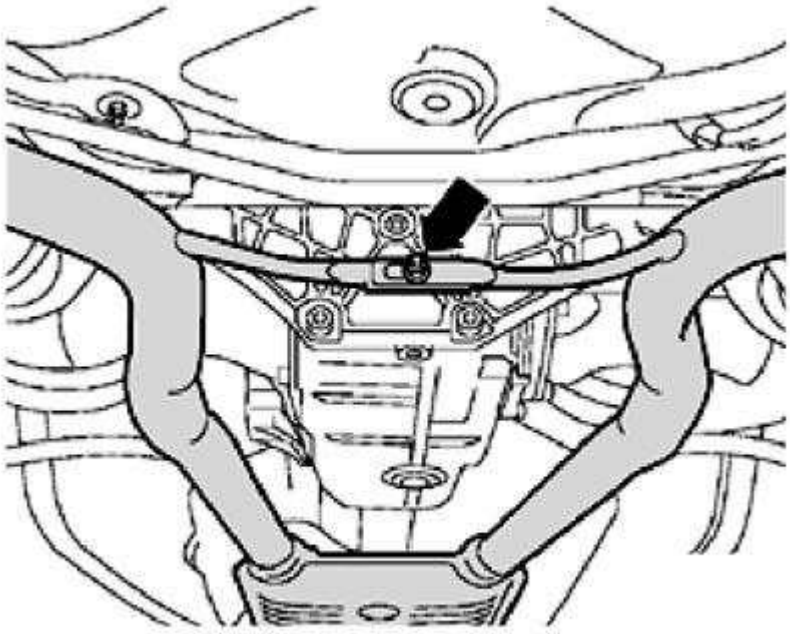


Fig. 156: Loosening Brace Nuts Between Exhaust Pipes
Courtesy of AUDI OF AMERICA, INC.

- Check distances -y- and -z- of end pipes to bumper:
  - Dimension y = greater than 20 mm
  - Dimension z = 9 to 14 mm
- If necessary, check whether the exhaust system is installed free of stress. See **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** or **EXHAUST SYSTEM, ALIGNING FREE OF STRESS (ALL WHEEL DRIVE VEHICLES)** .

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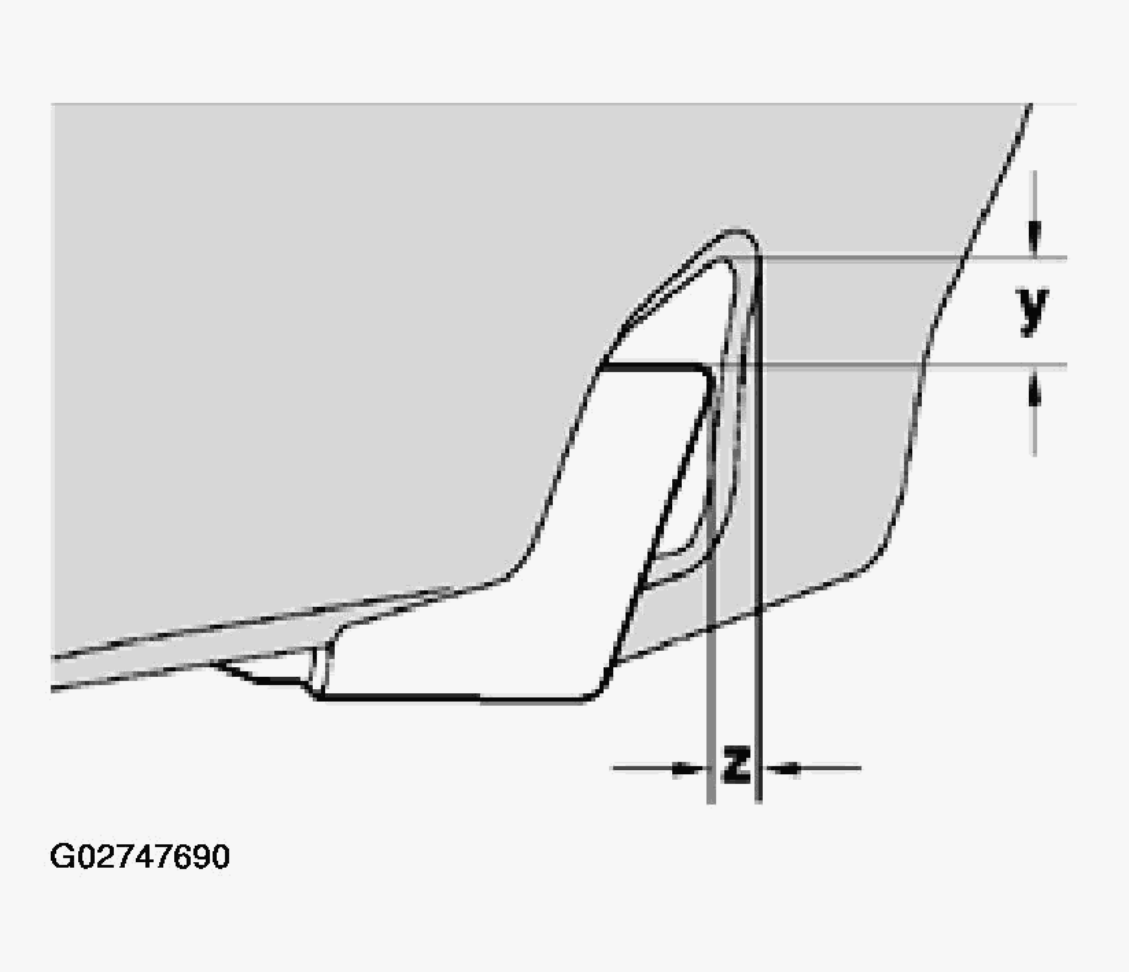


Fig. 157: Checking Distances y And z Of End Pipes To Bumper
Courtesy of AUDI OF AMERICA, INC.

Exhaust system, checking for proper seal

- Start engine and let run at idle.
- Seal tailpipes with cloths or plug for the duration of the leak test.
- Check for leaks by listening at cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe etc.
- Repair leaks.

SECONDARY AIR SYSTEM

The Secondary Air Injection (AIR) system causes the catalytic converter to heat up more quickly, resulting in earlier operating readiness following cold start.

Principle

Due to over-enrichment of the mixture during the cold start phase, there is an increased amount of uncombusted carbon monoxide in the exhaust. Secondary Air Injection (AIR) improves secondary oxidation in the catalytic

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converter and therefore reduces emissions. The heat produced by secondary oxidation greatly reduces start-up time for the catalytic converter, therefore improving exhaust quality during the cold start phase significantly.

Function

- In the cold start phase, the ECM -4- activates the secondary air pump -2- via the relay for secondary air injection -3-. Air reaches the combination valves for Secondary Air Injection (AIR) -5- and -9-.
- The Secondary Air Injection (AIR) valve -6- is activated in parallel, which allows the vacuum to reach the combination valves for Secondary Air Injection (AIR) -5- and -9-. The appropriate combination valve for Secondary Air Injection (AIR) thereby opens the path for secondary air to the exhaust channels of the cylinder head.

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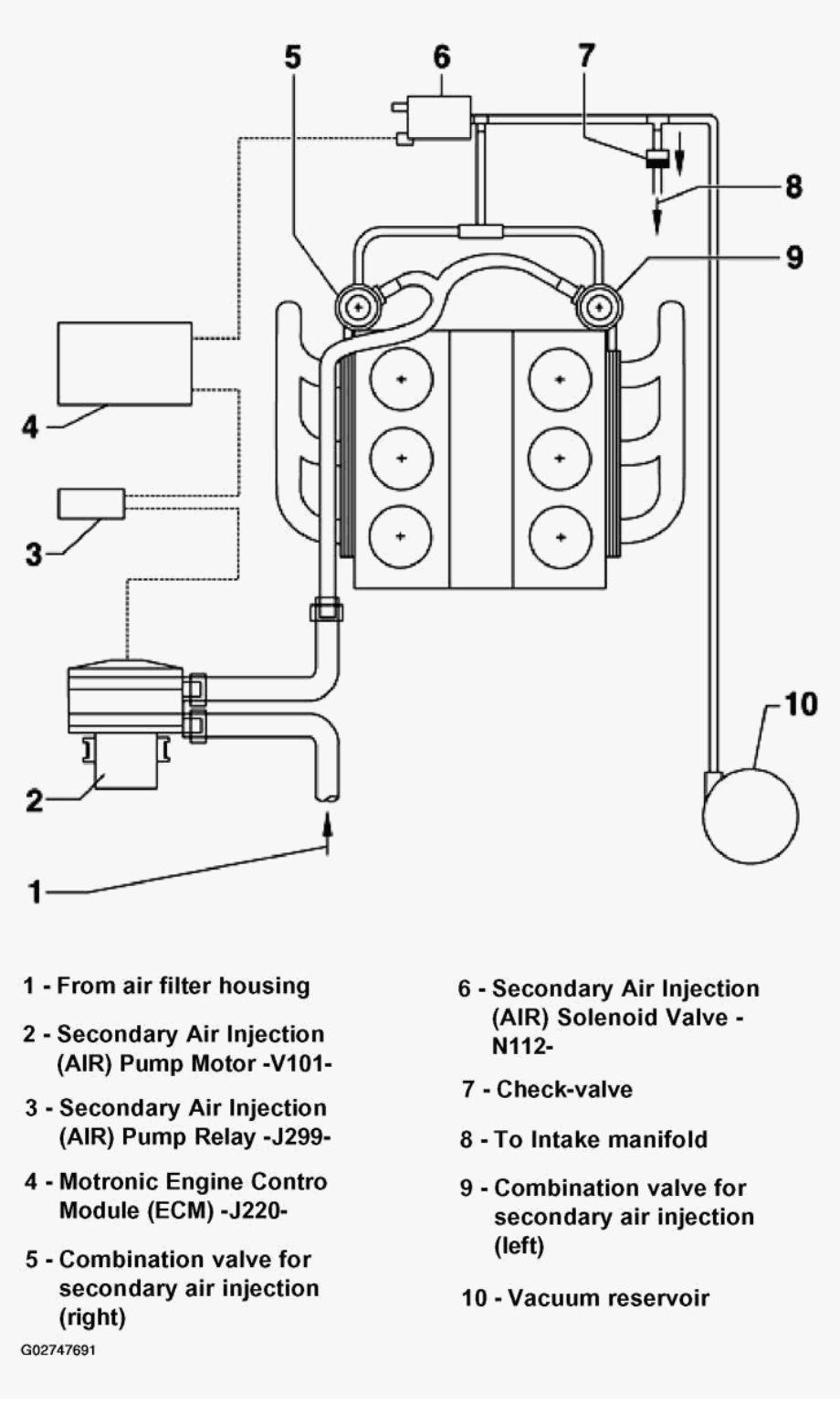


Fig. 158: View Of Secondary Air System
Courtesy of AUDI OF AMERICA, INC.

The following list pertains to **Fig. 158** .

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1. **From air filter housing**
2. **Secondary Air Injection (AIR) Pump Motor -V101-**
   - Component location, see **SECONDARY AIR INJECTION (AIR) PUMP MOTOR -V101-**
   - Removing and installing, see **SECONDARY AIR INJECTION (AIR) PUMP MOTOR - V101-, REMOVING AND INSTALLING**
3. **Secondary Air Injection (AIR) Pump Relay -J299-**
   - Component location, see **SECONDARY AIR INJECTION (AIR) PUMP RELAY -J299-**
4. **Motronic Engine Control Module (ECM) -J220-**
5. **Combination valve for secondary air injection (right)**
   - Component location, see **COMBINATION VALVE FOR SECONDARY AIR INJECTION (AIR)**
   - Checking, see **COMBINATION VALVE FOR SECONDARY AIR INJECTION (AIR), CHECKING FUNCTION AND PROPER SEAL**
   - Removing and installing, see **RIGHT COMBINATION VALVE FOR SECONDARY AIR INJECTION, REMOVING AND INSTALLING**
6. **Secondary Air Injection (AIR) Solenoid Valve -N112-**
   - Component location, see **COMPONENT LOCATION SECONDARY AIR INJECTION (AIR) SOLENOID VALVE -N112-**
7. **Check-valve**
   - Installed position (light/dark side): Arrow points in direction of flow, as shown in figure.
8. **To Intake manifold**
9. **Combination valve for secondary air injection (left)**
   - Component location, see **COMBINATION VALVE FOR SECONDARY AIR INJECTION (AIR)**
   - Checking, see **COMBINATION VALVE FOR SECONDARY AIR INJECTION (AIR), CHECKING FUNCTION AND PROPER SEAL**
   - Removing and installing, see **LEFT COMBINATION VALVE FOR SECONDARY AIR INJECTION, REMOVING AND INSTALLING**
10. **Vacuum reservoir**
    - Installation location: Under wheel housing liner in front left wheel housing

Component location Secondary Air Injection (AIR) Solenoid Valve -N112-

Component location Secondary Air Injection (AIR) Solenoid Valve -N112-

- Bolted to holding plate for solenoid valves at rear of engine (arrow).

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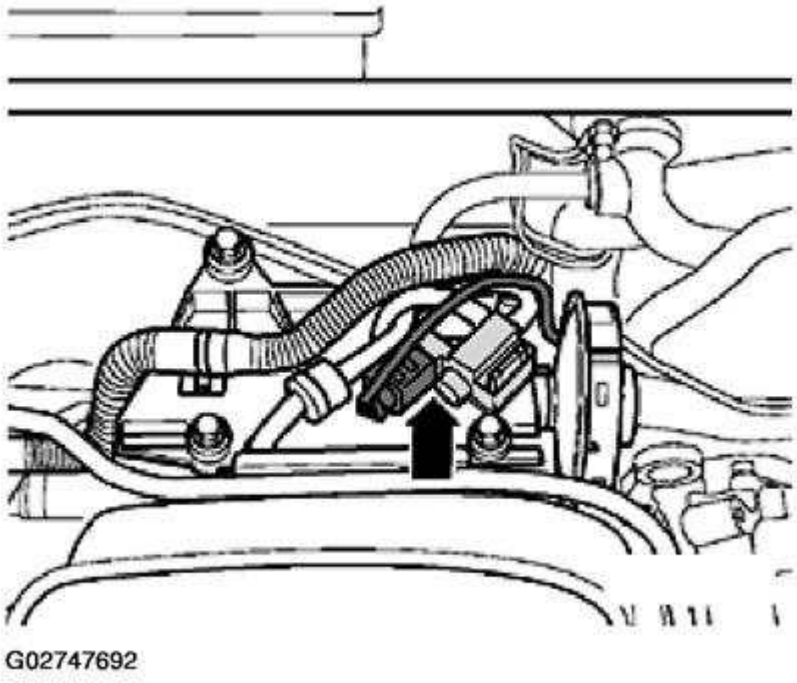


Fig. 159: Identifying Secondary Air Injection (AIR) Solenoid Valve Location
Courtesy of AUDI OF AMERICA, INC.

Secondary Air Injection (AIR) Pump Motor -V101-

- At front right in engine compartment below air filter housing

1. Secondary Air Injection (AIR) Pump Motor -V101-
2. Electrical harness connector for Secondary Air Injection (AIR) Pump Motor -V101-

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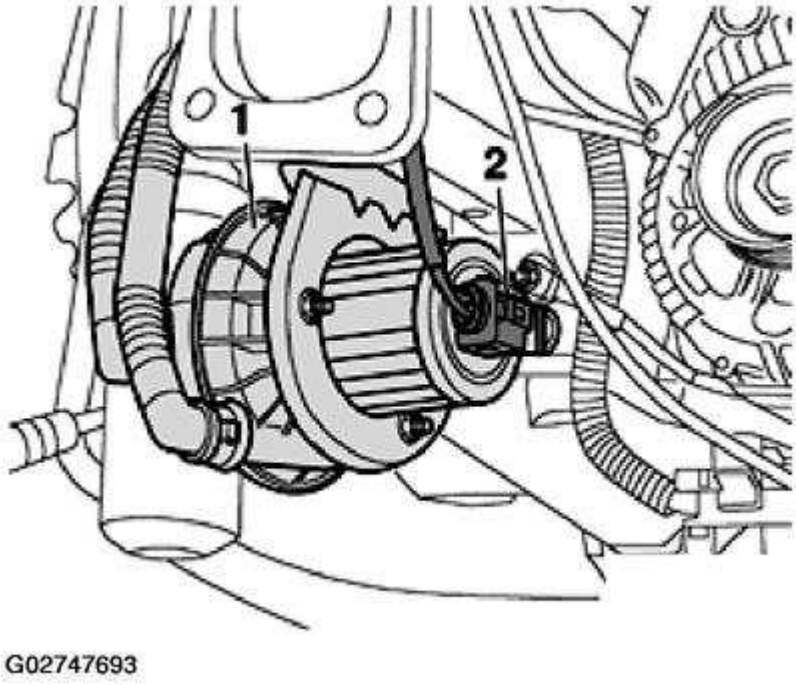


Fig. 160: Identifying Secondary Air Injection (AIR) Pump Motor Location
Courtesy of AUDI OF AMERICA, INC.

Secondary Air Injection (AIR) Pump Relay -J299-

- In E-box, plenum chamber

  3 - Secondary Air Injection (AIR) Pump Relay -J299-

  B - Fuse for secondary air pump -S130-

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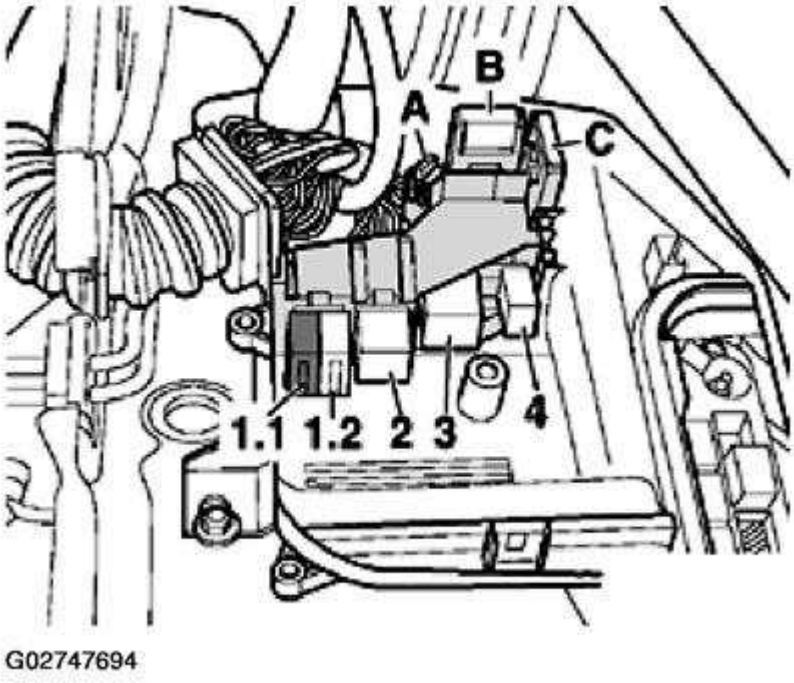


Fig. 161: Identifying Secondary Air Injection (AIR) Pump Relay Location
Courtesy of AUDI OF AMERICA, INC.

Combination valve for secondary air injection (AIR)

- At rear of cylinder heads

NOTE: Right valve is shown in illustration.

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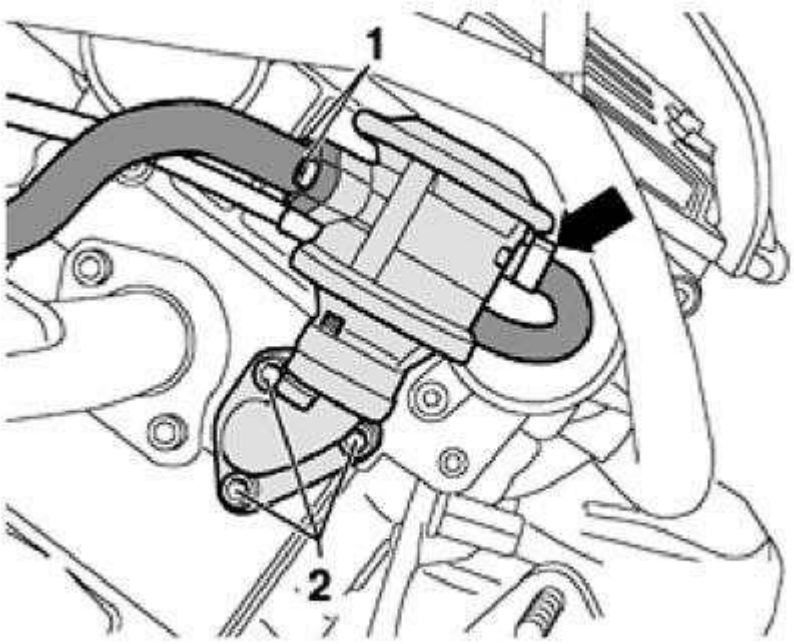


Fig. 162: Identifying Combination Valve For Secondary Air Injection (AIR) Location
Courtesy of AUDI OF AMERICA, INC.

Secondary Air Injection (AIR) solenoid valve -N112-, checking

Special tools and equipment

- VAG1526A
- VAG1527B
- Vag1594A
- Vag1598/31
- Vas5051 With Vag5051/1

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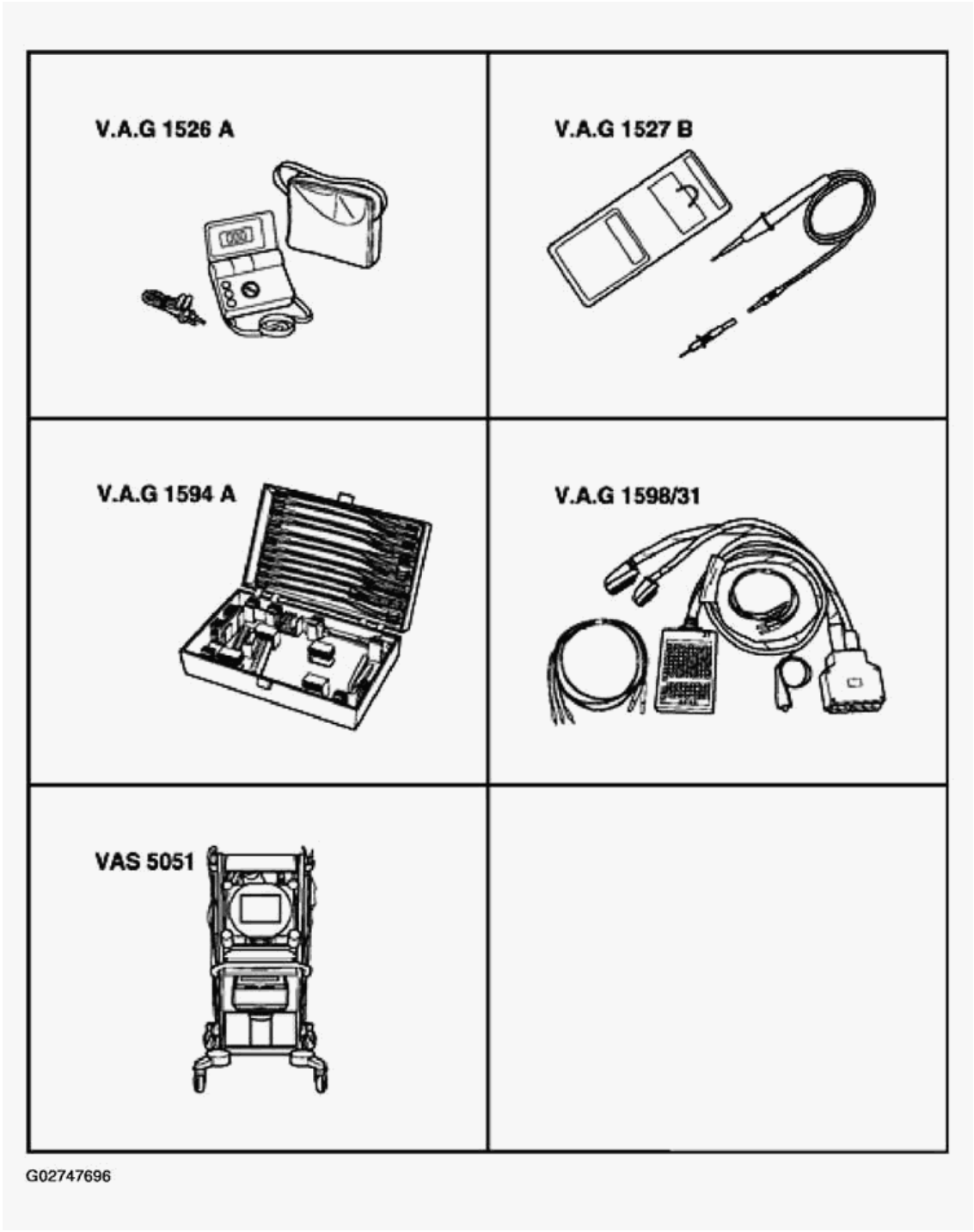


Fig. 163: Identifying Special Tools And Equipment - Secondary Air Injection (Air) Solenoid Valve
Courtesy of AUDI OF AMERICA, INC.

Test Requirement:

- Vas5051 Tester Connected And Vehicle On Board Diagnostic (Obd) Function 01 "Engine Electronics" Selected.

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Test Sequence

NOTE: Secondary Air Injection (Air) Solenoid Valve -N112- And Wire Connections Are Monitored By The Engine Control Module (Ecm).

- Check Dtc Memory Of Engine Control Module (ECM).

  If A Malfunction Regarding Secondary Air Injection (Air) Solenoid Valve -N112- Is Displayed:

- Remove Rear Engine Cover (Arrows).

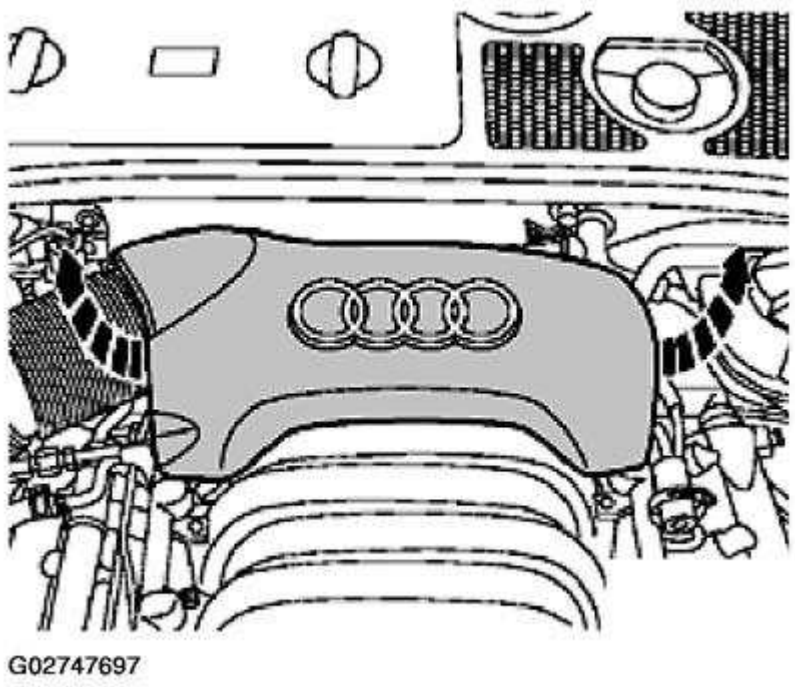


Fig. 164: Removing Rear Engine Cover
Courtesy of AUDI OF AMERICA, INC.

- Disconnect Hoses From Secondary Air Injection (Air) Solenoid Valve -N112- (Arrow); The Electrical Harness Connector Remains Connected.

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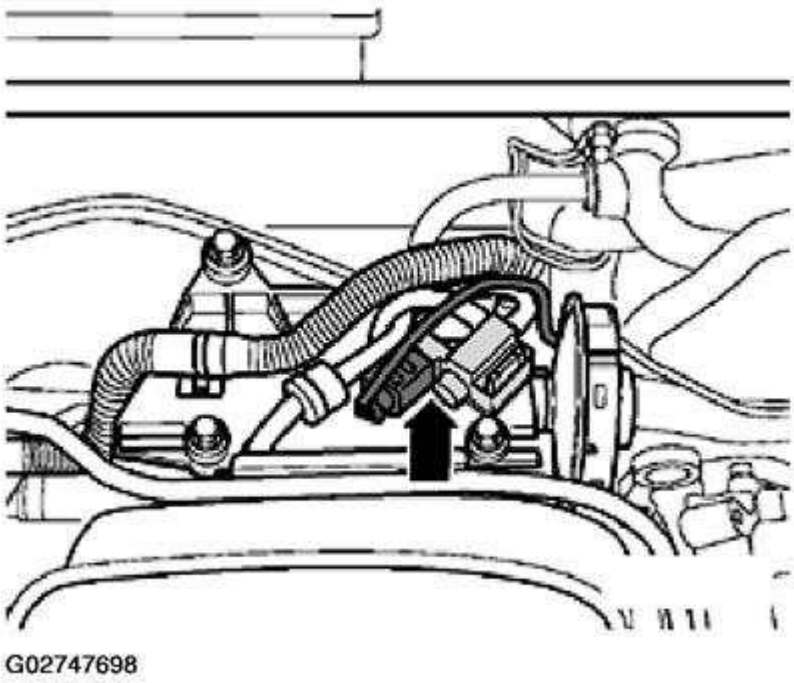


Fig. 165: Disconnecting Hoses From Secondary Air Injection (AIR) Solenoid Valve
Courtesy of AUDI OF AMERICA, INC.

- Attach assisting hose to the connection of valve (indicated by an arrow).

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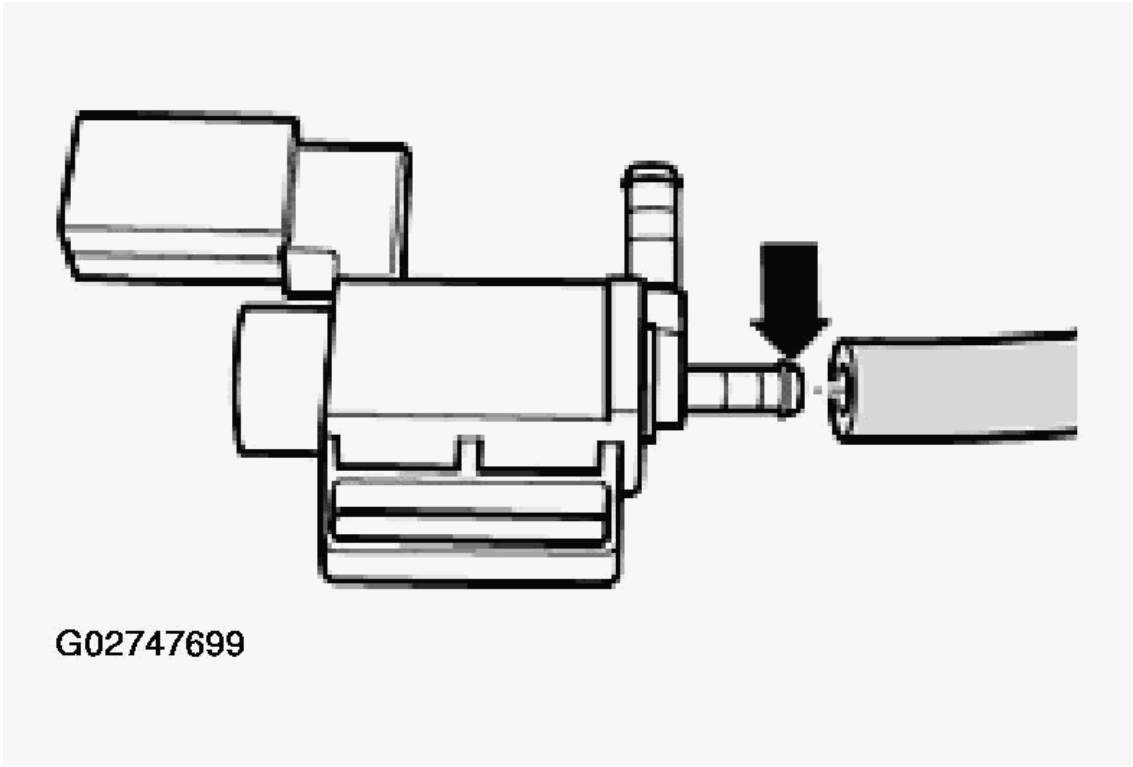


Fig. 166: Attaching Assisting Hose To Connection Of Valve
Courtesy of AUDI OF AMERICA, INC.

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) Solenoid Valve -N112-:
  - Valve must click.
  - ...and must open and close (can be tested by blowing into assisting hose).

  If valve does not open or close properly:

- Replace Secondary Air Injection (AIR) Solenoid Valve -N112-.

  If valve does not click during output Diagnostic Test Mode (DTM):

Checking internal resistance

- Switch ignition off.
- Disconnect harness connector from Secondary Air Injection (AIR) Solenoid Valve -N112- (arrow).

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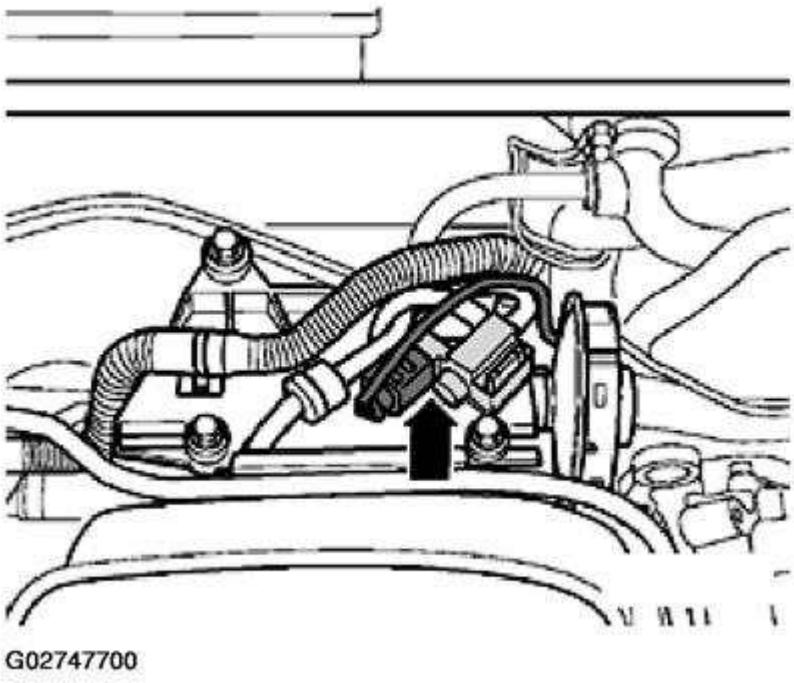


Fig. 167: Disconnecting Harness Connector From Secondary Air Injection (AIR) Solenoid Valve
Courtesy of AUDI OF AMERICA, INC.

- Connect multimeter at valve for resistance measurement.
  - Specification: 25 to 35 ohm

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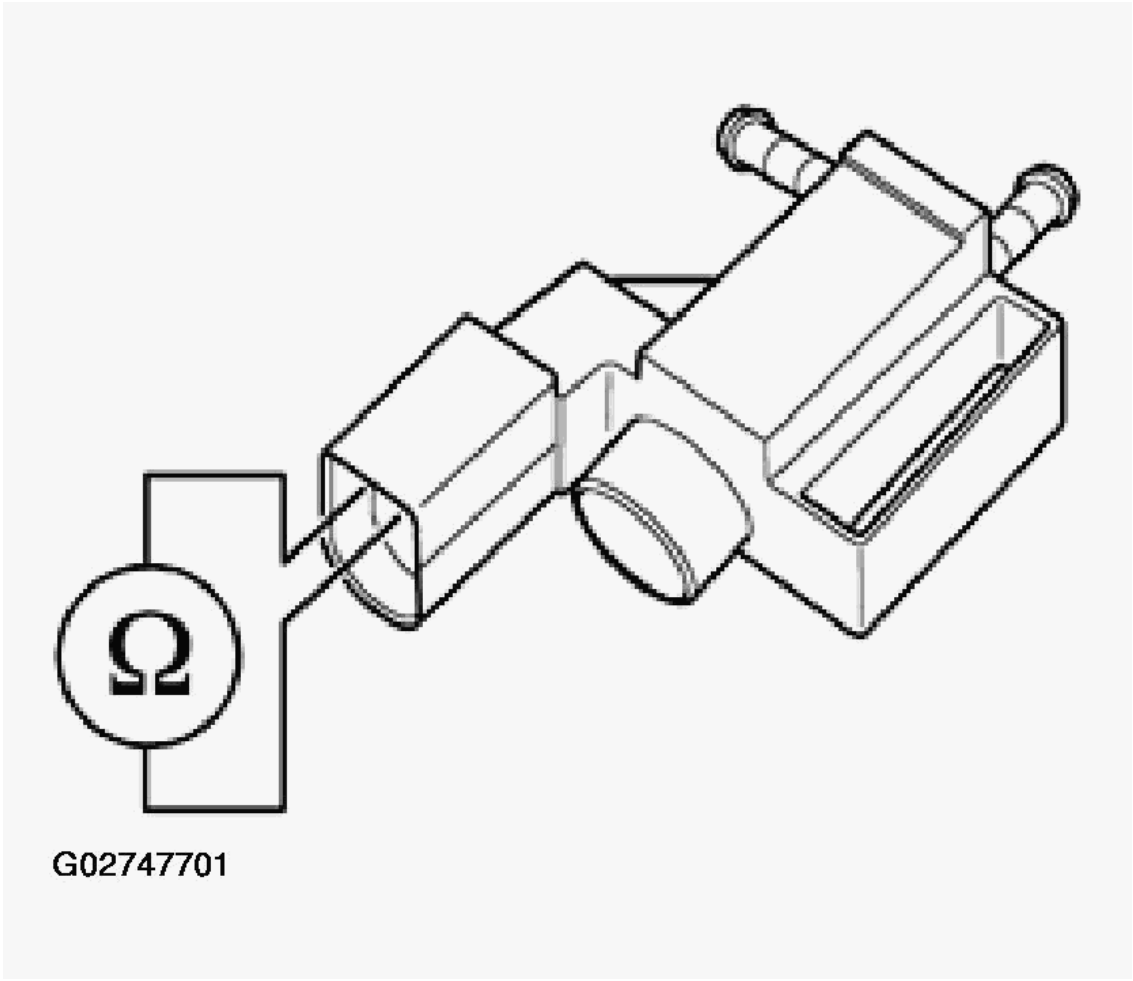


Fig. 168: Measuring Secondary Air Injection (AIR) Solenoid Valve Resistance
Courtesy of AUDI OF AMERICA, INC.

If specified value is not obtained:

- Replace Secondary Air Injection (AIR) Solenoid Valve -N112-.

If specified value is obtained:

Checking voltage supply

Test requirements:

- Fuse for Secondary Air Injection (AIR) OK

  See appropriate System Wiring Diagram article

- Fuel Pump (FP) relay OK

Voltage supply check

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NOTE: Voltage is supplied to Secondary Air Injection (AIR) Solenoid Valve -N112- via the Fuel Pump (FP) relay.

- Connect VAG1527B voltage tester as follows:

CHECKING VOLTAGE SUPPLY CIRCUIT TO SECONDARY AIR INJECTION (AIR) SOLENOID VALVE

Harness Connector Terminal	Measure to
1	Engine Ground (GND)

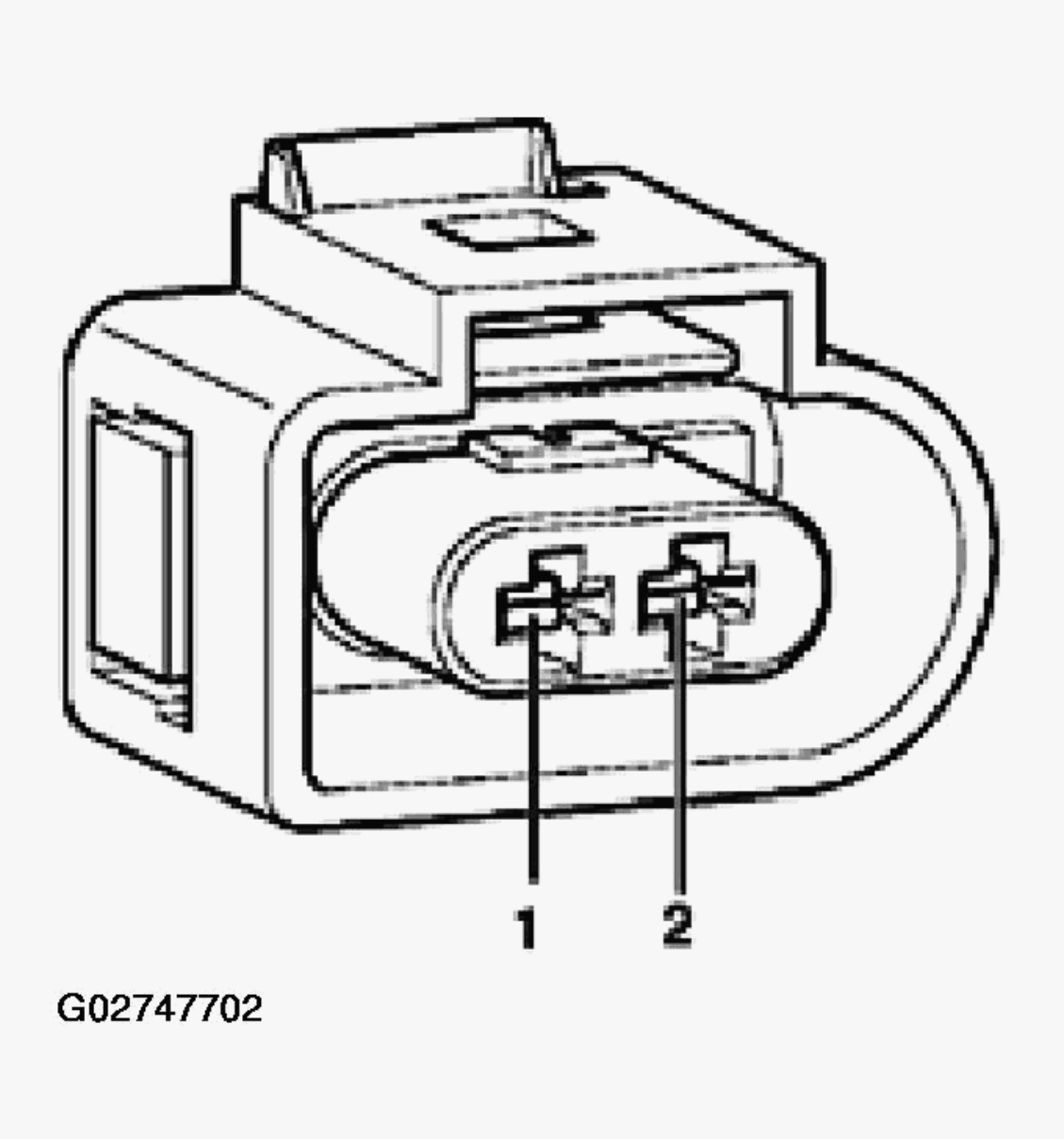


Fig. 169: Identifying Secondary Air Injection (AIR) Solenoid Valve Harness Connector Terminals
Courtesy of AUDI OF AMERICA, INC.

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- Operate starter briefly.
  - LED must light up.

  If LED does not light up:

- Check wire connection from terminal 1 of connector to Fuel Pump (FP) relay via fuse for open circuit:

  See appropriate System Wiring Diagram

- Repair open circuit if necessary.

  If LED lights up:

Checking activation

- Connect VAG1527B voltage tester to connector terminals 1 (B+) and 2.

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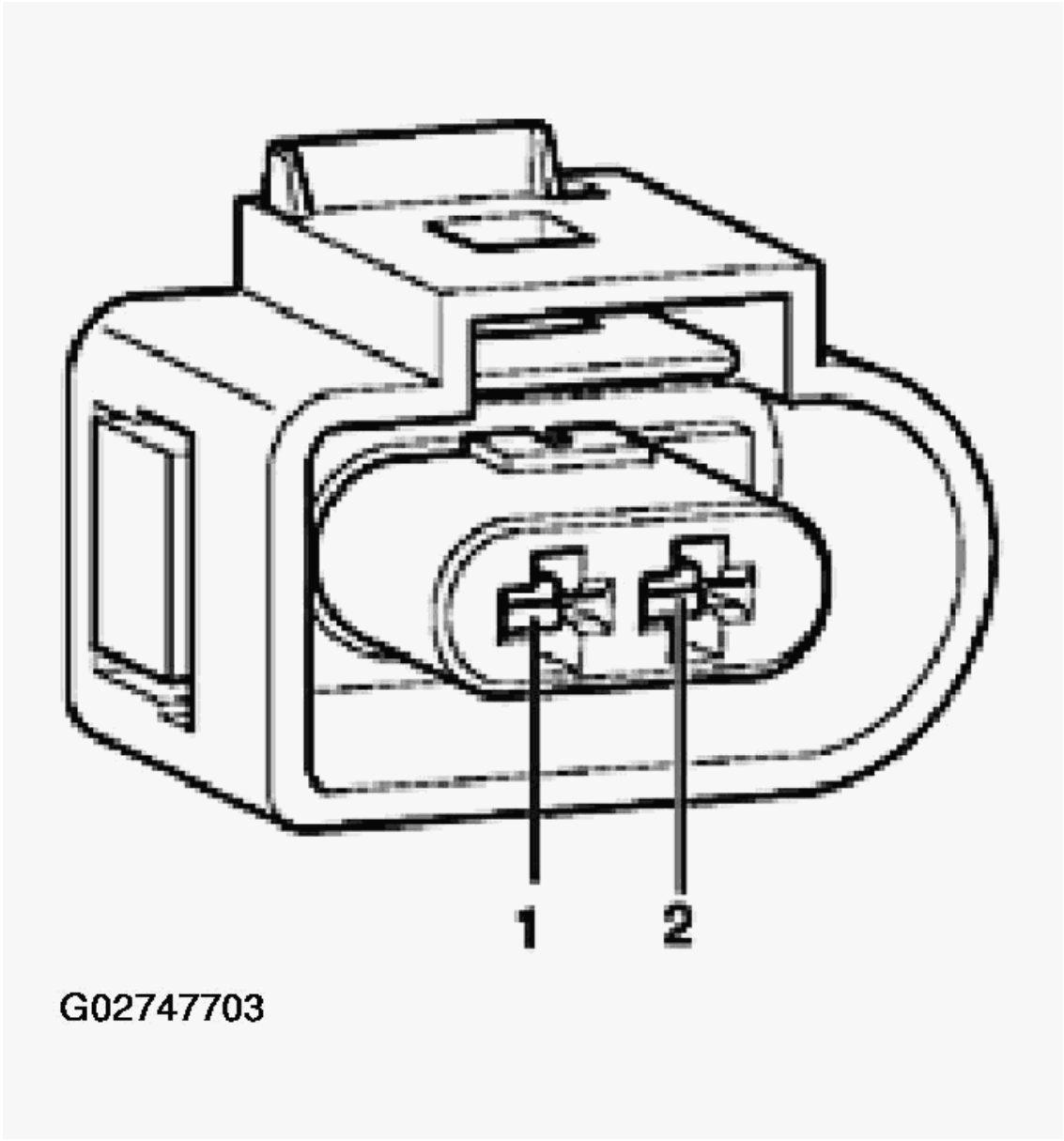


Fig. 170: Identifying Secondary Air Injection (AIR) Solenoid Valve Harness Connector Terminals
Courtesy of AUDI OF AMERICA, INC.

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) Solenoid Valve - N112-:
  - LED must blink.

If LED does not blink or if it remains constantly lit:

- Connect VAG 1598/31 test box to harness connectors of wiring harness (do not connect ECM). Connect Ground (GND) clip at test box (not visible in **Fig. 171**) to Ground (GND).

See **WIRING AND COMPONENT CHECK WITH TEST BOX VAG** .

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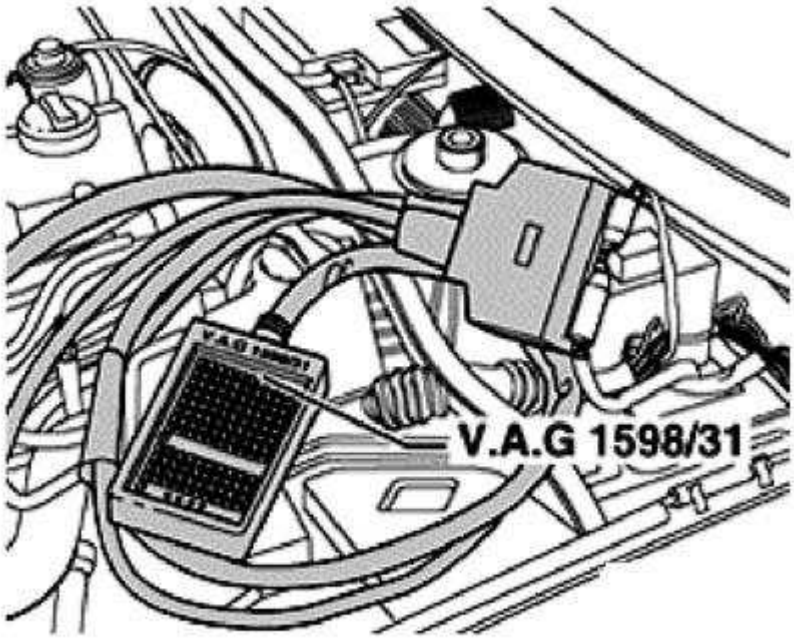


Fig. 171: Connecting VAG 1598/31 Test Box To Harness Connectors Of Wiring Harness
Courtesy of AUDI OF AMERICA, INC.

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

CHECKING ACTIVATION CIRCUIT FOR SECONDARY AIR INJECTION (AIR) SOLENOID VALVE

Harness connector terminal	VAG1598/31 test box socket
2	44

- Repair open circuit or short circuit if necessary.

Secondary Air Injection (AIR) pump relay -J299- and activation, checking

Special tools and equipment

- VAG1526A
- VAG1527B
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

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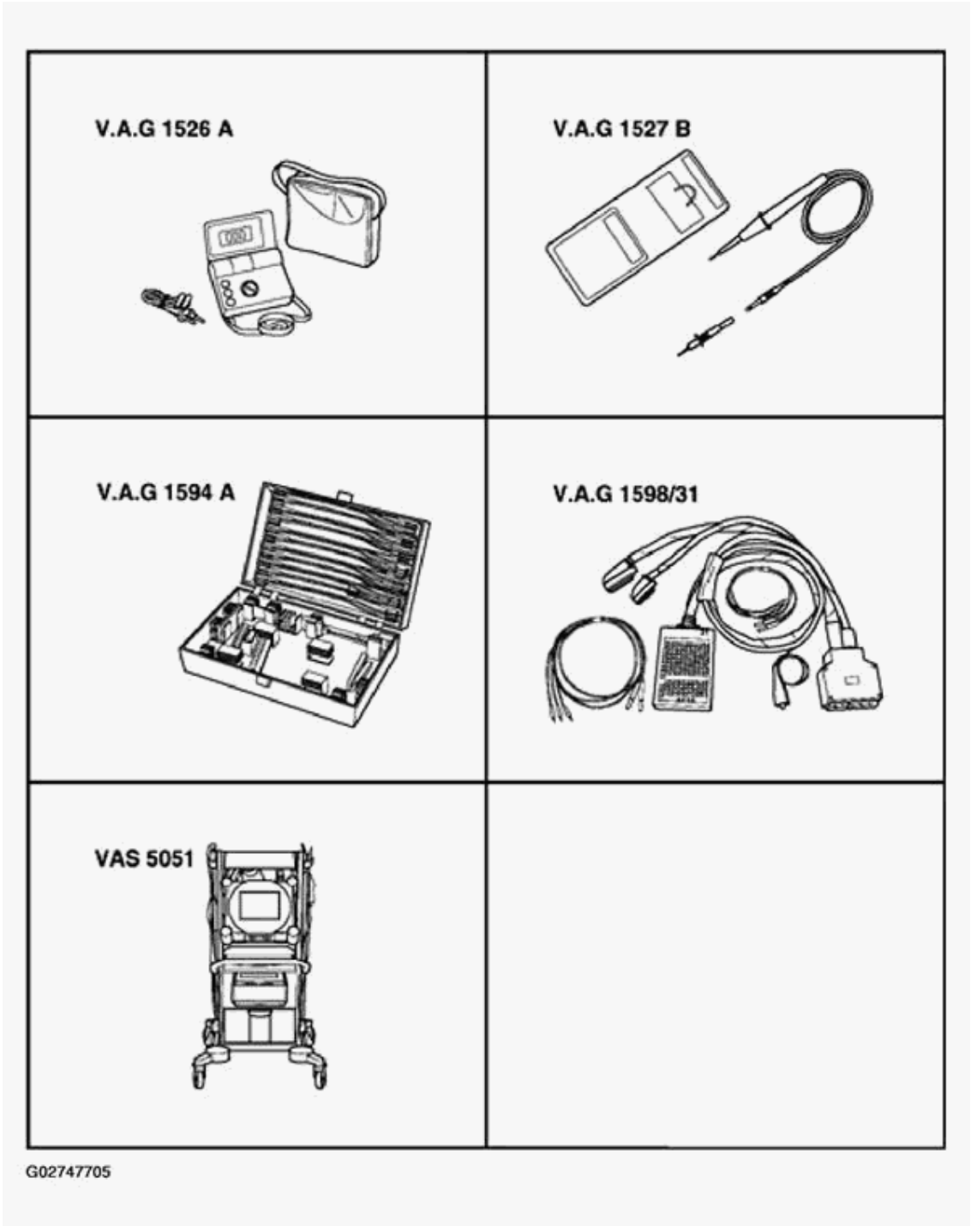


Fig. 172: Identifying Special Tools And Equipment - Secondary Air Injection (AIR) Pump Relay
Courtesy of AUDI OF AMERICA, INC.

Test requirement:

- VAS5051 tester connected and vehicle On Board Diagnostic (OBD) function 01 "Engine electronics" selected.

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Test sequence

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) Pump Relay -J299-.
  - Secondary Air Injection (AIR) Pump Relay -3- (in E-box, plenum chamber) must engage and Secondary Air Injection (AIR) Pump Relay -J299- must run in intervals

A - does not engage the relay:

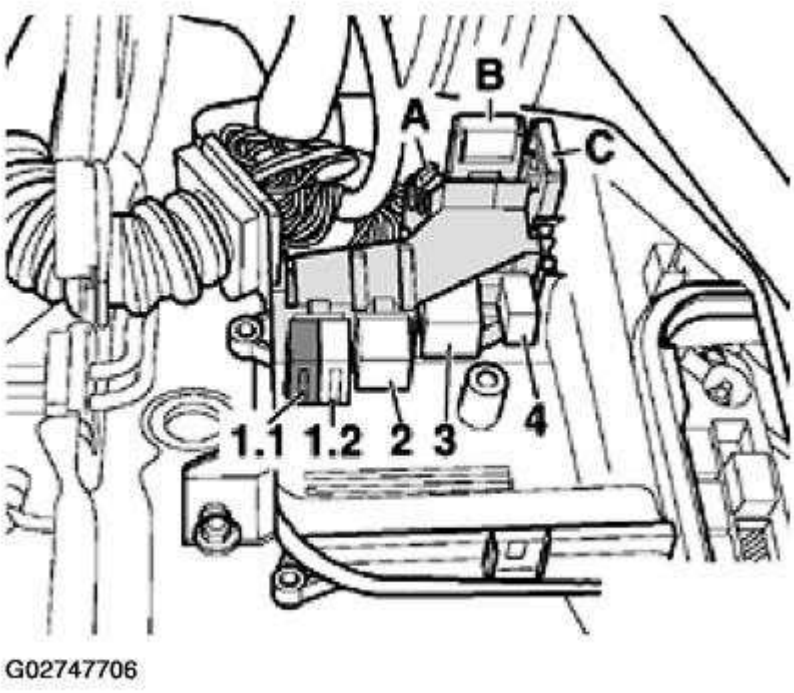


Fig. 173: Identifying Secondary Air Injection (AIR) Pump Relay Location
Courtesy of AUDI OF AMERICA, INC.

- See **CHECKING VOLTAGE SUPPLY OF SECONDARY AIR INJECTION (AIR) PUMP RELAY**
- Checking activation of Secondary Air Injection (AIR) Pump Relay, see **CHECK ACTIVATION OF THE SECONDARY AIR INJECTION (AIR) PUMP RELAY** .

B - If relay triggers, but Secondary Air Injection (AIR) Pump Motor does not run:

- Checking voltage supply of Secondary Air Injection (AIR) Pump Motor, see **CHECK VOLTAGE SUPPLY OF THE SECONDARY AIR INJECTION (AIR) PUMP MOTOR** .

Checking voltage supply of Secondary Air Injection (AIR) Pump Relay

- Switch ignition off.

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- Pull off rubber seal from plenum chamber cover in direction of arrow.
- Remove plenum chamber cover -1- toward front.

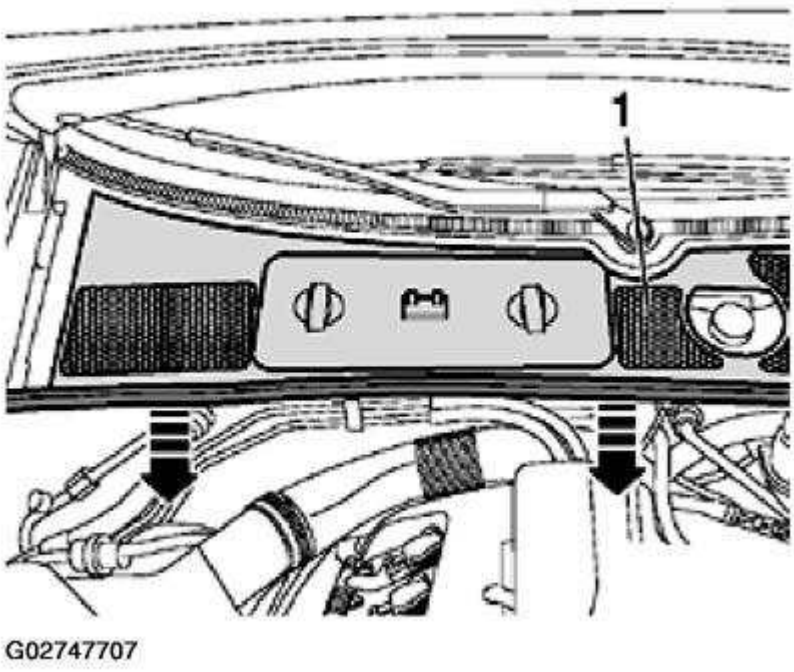


Fig. 174: Pulling Off Rubber Seal From Plenum Chamber Cover
Courtesy of AUDI OF AMERICA, INC.

- Pry off both covers -3- using a screwdriver.
- Loosen hex-nuts -4- by several turns.
- Loosen wiper arm -2- by lightly tilting from wiper axle.
- Remove hex nuts completely and remove wiper arms.
- Disconnect securing clips -1- and remove cowl grill -5-.

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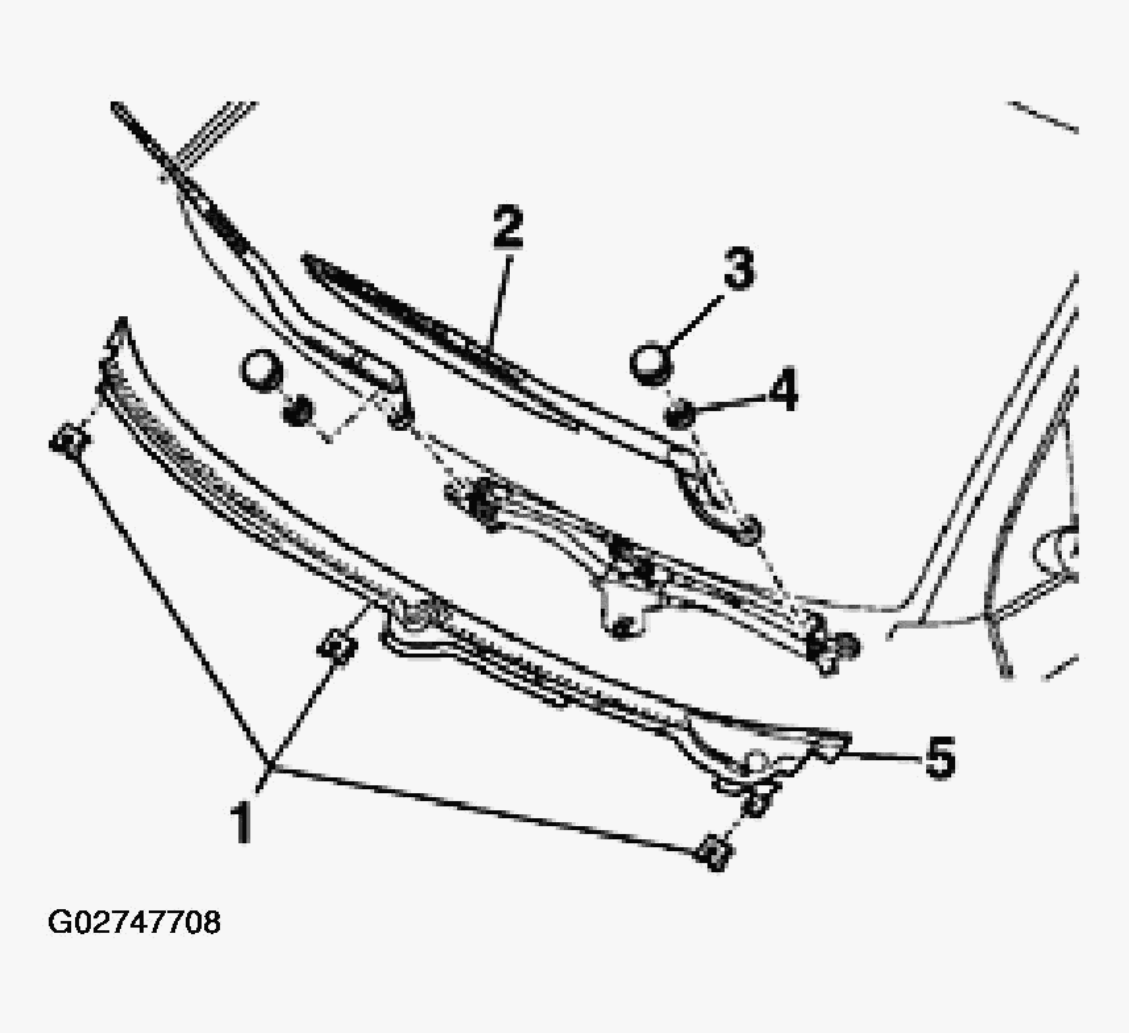


Fig. 175: Removing Wiper Arms And Cowl Grill
Courtesy of AUDI OF AMERICA, INC.

- Remove E-box cover in plenum chamber -arrows-.

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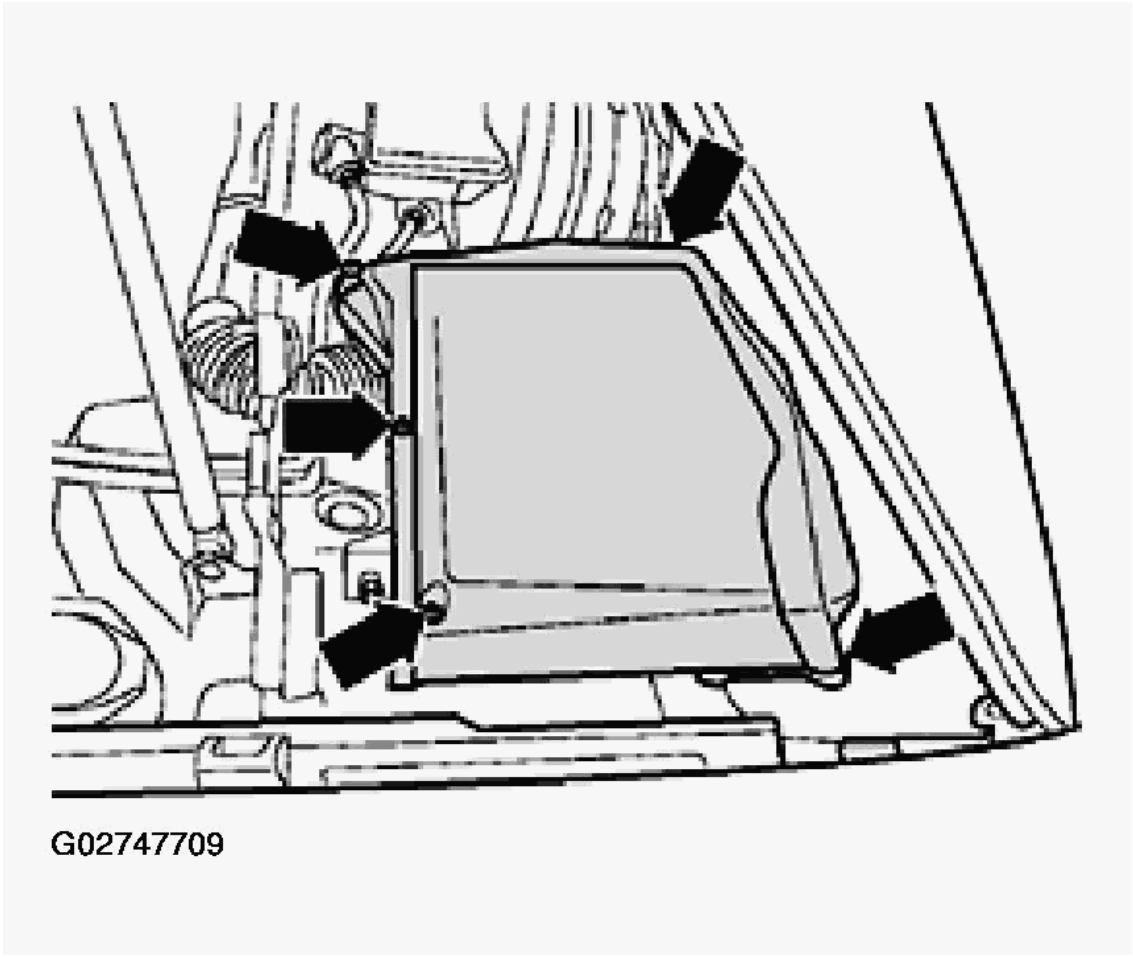


Fig. 176: Removing E-Box Cover In Plenum Chamber
Courtesy of AUDI OF AMERICA, INC.

- Pry off Engine Control Module (ECM) retaining bracket (arrows) using a screwdriver and set control module aside.
- If installed, unclip Transmission Control Module (TCM) retaining bracket and set control module aside.

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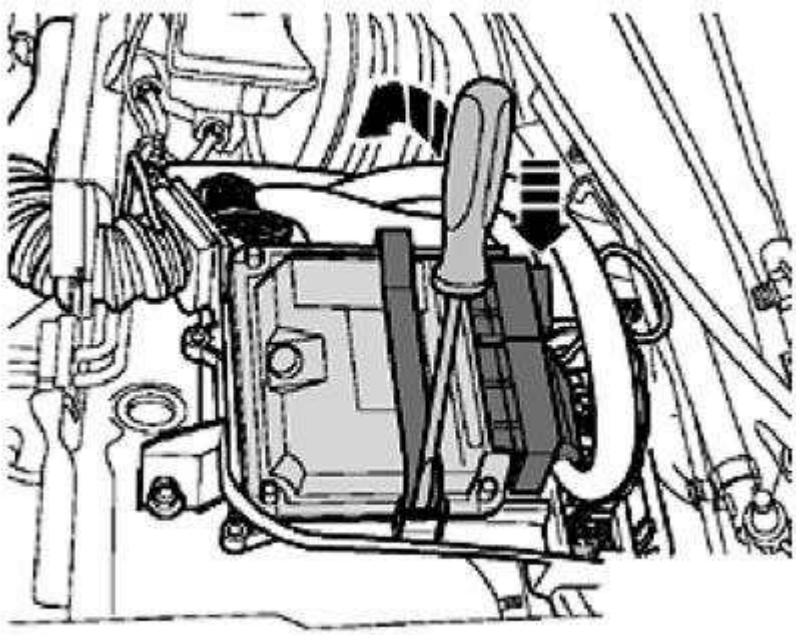


Fig. 177: Prying Off Engine Control Module Retaining Bracket
Courtesy of AUDI OF AMERICA, INC.

- Remove Secondary Air Injection (AIR) pump relay -3-.

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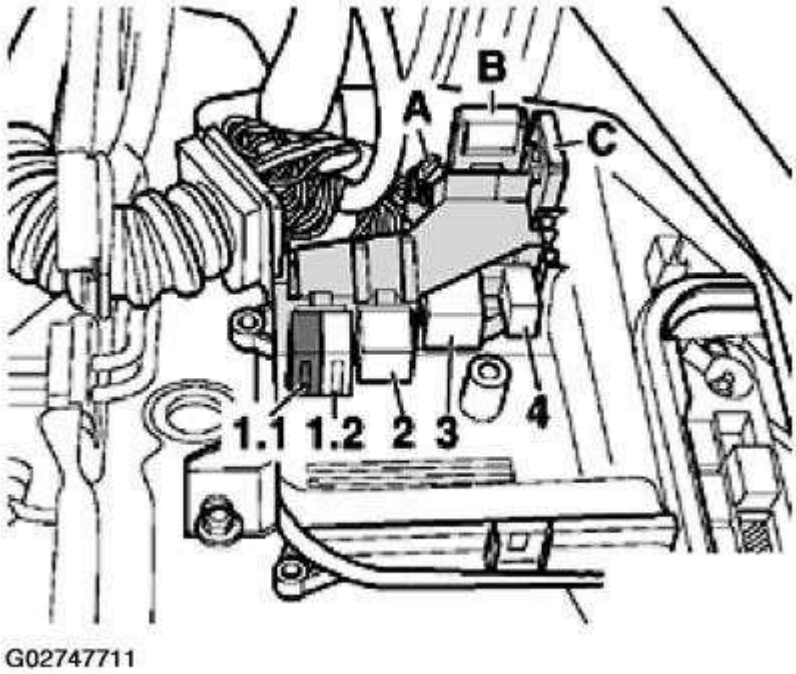


Fig. 178: Removing Secondary Air Injection (AIR) Pump Relay
Courtesy of AUDI OF AMERICA, INC.

- Connect multimeter for voltage measurement as follows

SECONDARY AIR INJECTION (AIR) PUMP RELAY VOLTAGE REFERENCE

Relay carrier in E-box, plenum chamber, position 3 Terminal	Measure to
8	Engine Ground (GND)

- Specification: approx. battery voltage

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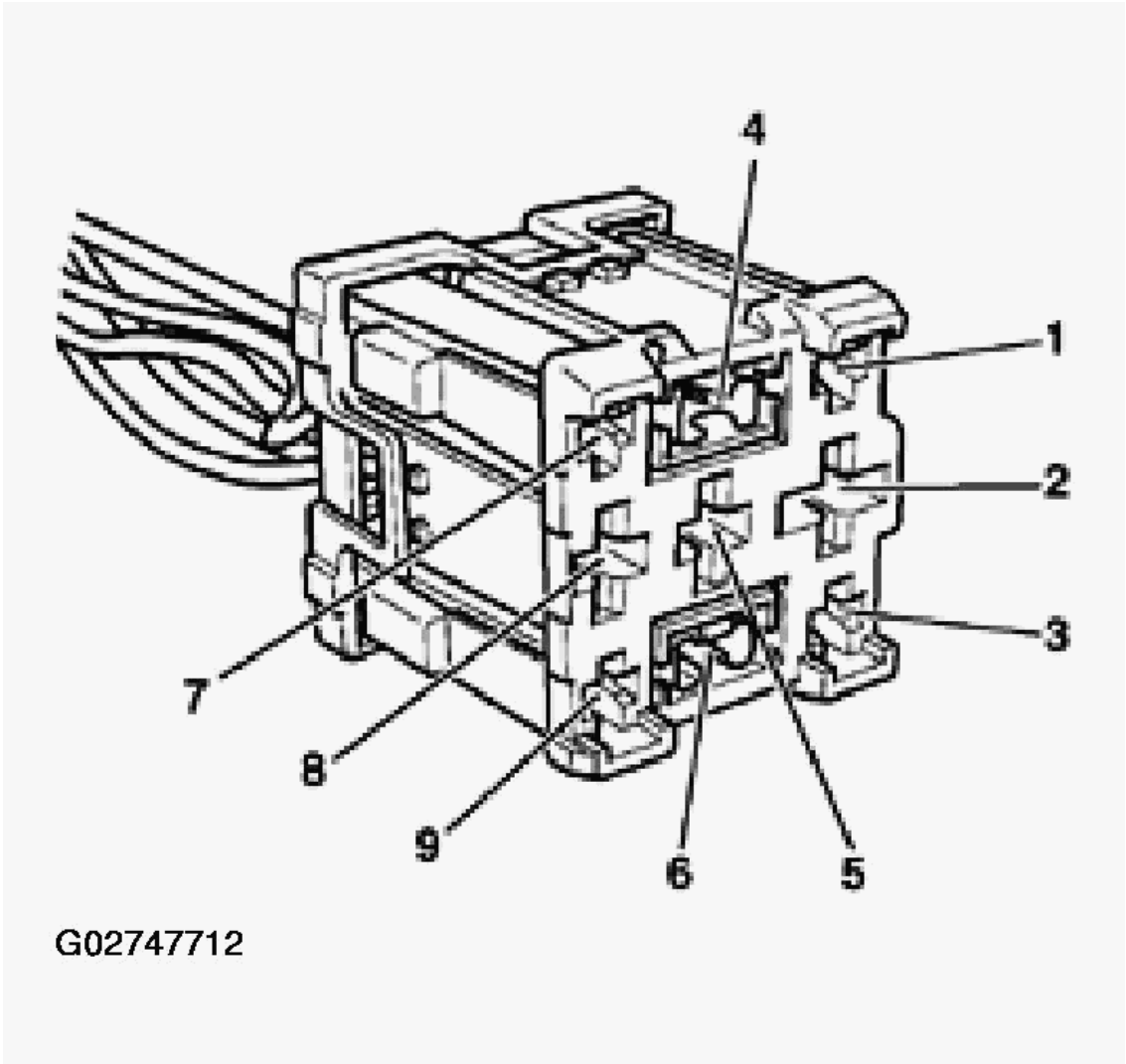


Fig. 179: Identifying Secondary Air Injection (AIR) Pump Relay Harness Connector Terminals
Courtesy of AUDI OF AMERICA, INC.

If specified value is not obtained:

- Perform the following tests marked with dots:
  - Check Fuse for secondary air pump -S130- (40 A) in E-Box, plenum chamber, position B.
  - Check wire connection from battery + (terminal 30) via Fuse for secondary air pump -S130- to Secondary Air Injection (AIR) Pump Relay -J299- (in relay and fuse carrier in E-Box, plenum chamber, position 3) for open circuit.

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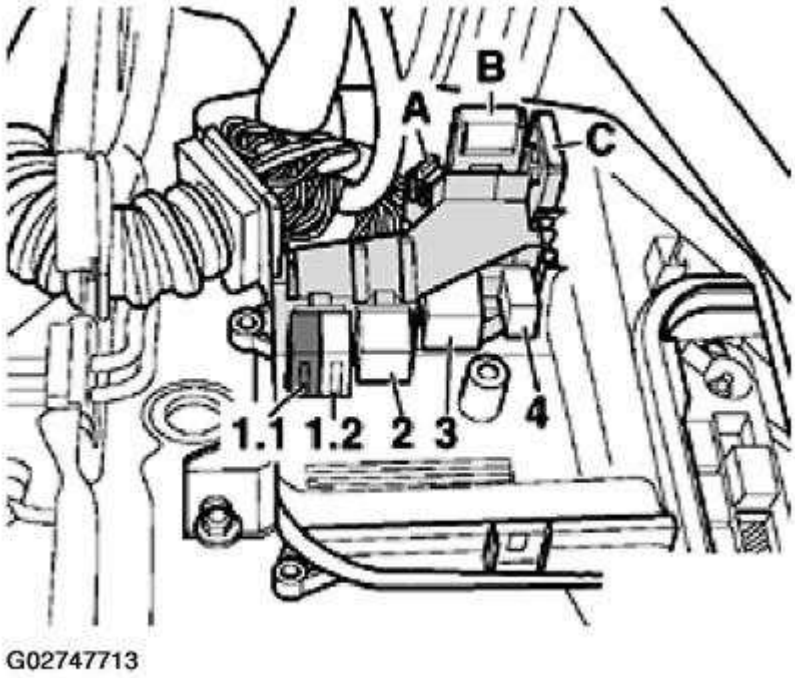


Fig. 180: Identifying Secondary Air Pump Fuses Location
Courtesy of AUDI OF AMERICA, INC.

- Connect multimeter for voltage measurement as follows.

SECONDARY AIR INJECTION (AIR) PUMP RELAY VOLTAGE REFERENCE

Relay carrier in E-box, plenum chamber, position 3 Terminal	Measure to
4	Engine Ground (GND)

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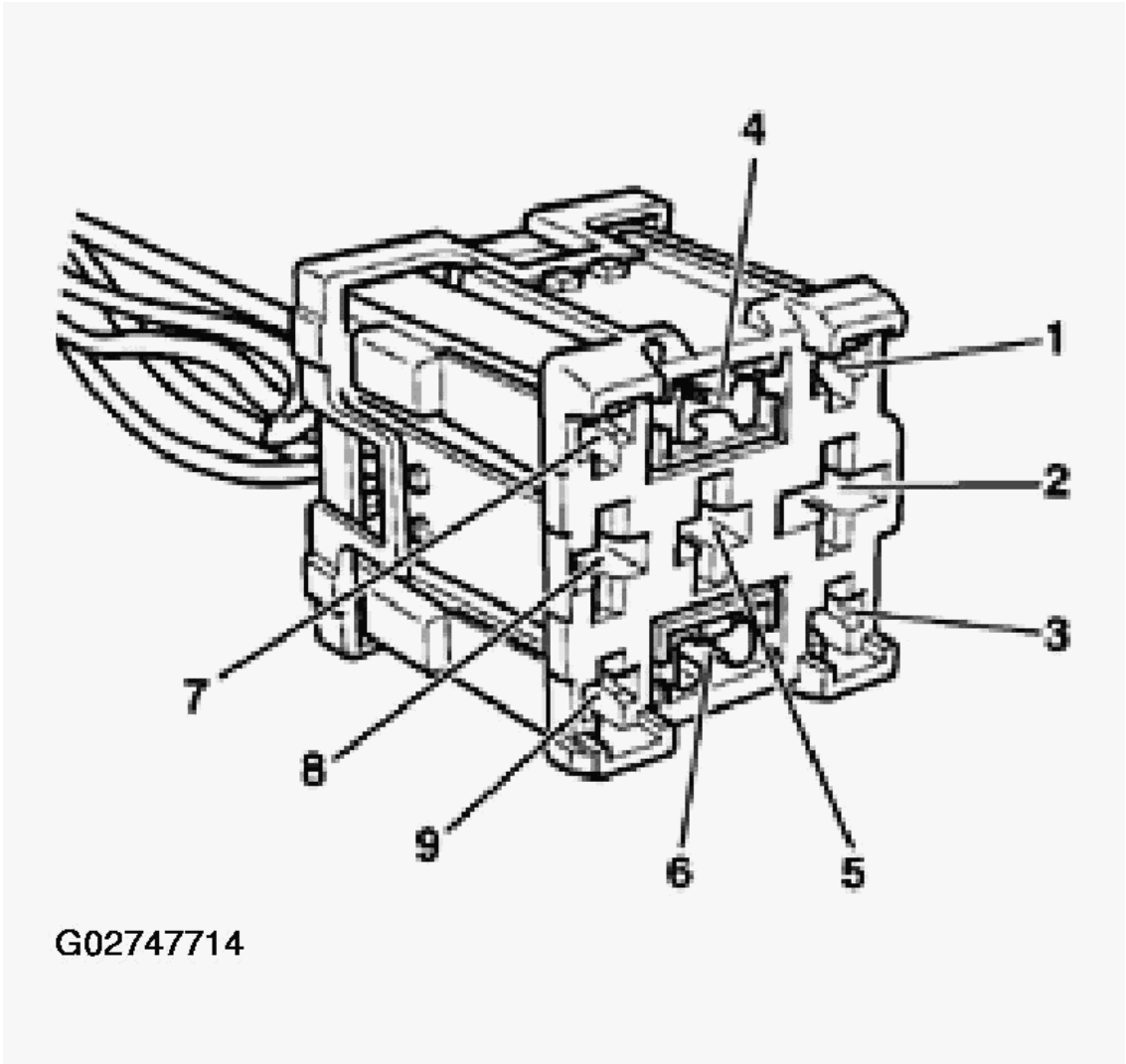


Fig. 181: Identifying Secondary Air Injection (AIR) Pump Relay Harness Connector Terminals
Courtesy of AUDI OF AMERICA, INC.

- Operate starter briefly.
  - Specification: approx. battery voltage

If specified value is not obtained:

- Perform the following tests marked with dots:
  - Check fuse -S234- in fuse holder (position 34).
  - Check wire connection from Secondary Air Injection (AIR) Pump Relay -J299- (in 3-socket relay carrier in E-box, plenum chamber) via Fuse in fuse holder -S234- (position 34) to Fuel Pump (FP) relay for open circuit.

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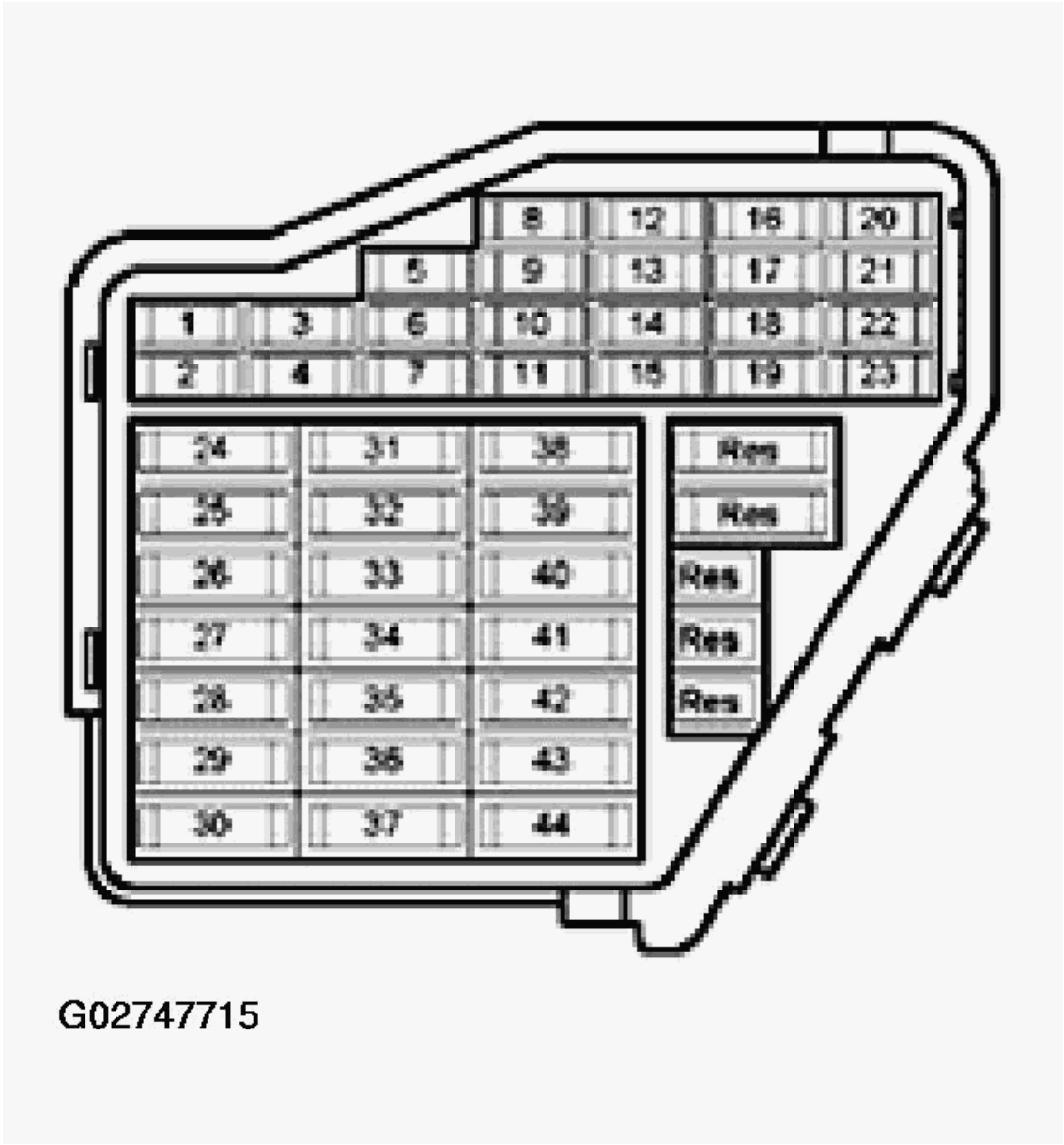


Fig. 182: Identifying Fuse S234 (34)In Fuse Holder
Courtesy of AUDI OF AMERICA, INC.

Check activation of the Secondary Air Injection (AIR) pump relay

- Switch ignition off.
- Remove Secondary Air Injection (AIR) pump relay
- Connect VAG1527B voltage tester as follows:

SECONDARY AIR INJECTION (AIR) PUMP RELAY ACTIVATION REFERENCE

Relay carrier in E-box, plenum chamber	Measure to
position 3	

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Terminal	
6	Engine Ground (GND)

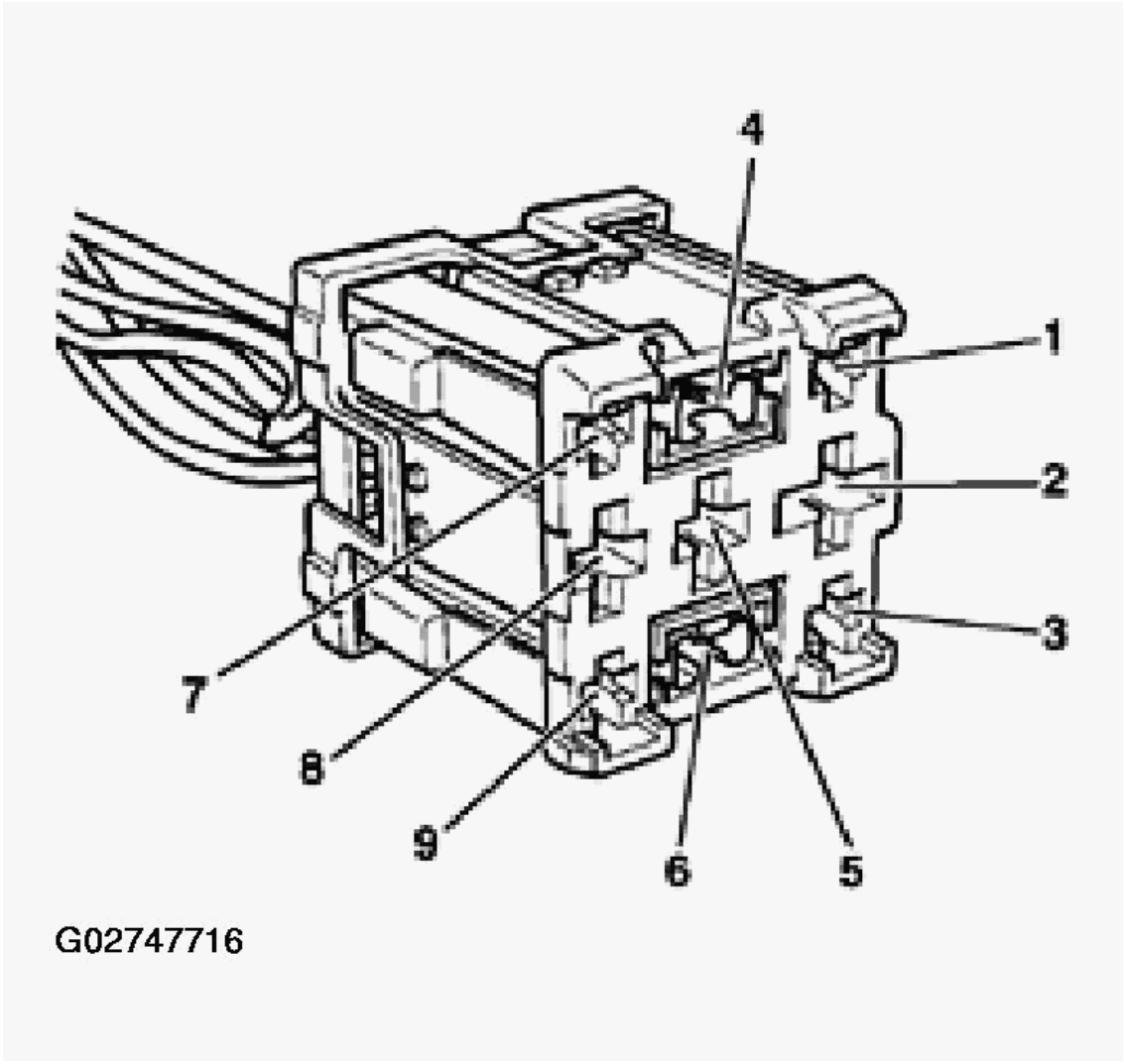


Fig. 183: Identifying Secondary Air Injection (AIR) Pump Relay Harness Connector Terminals - Activation Checking
Courtesy of AUDI OF AMERICA, INC.

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) Pump Relay - J299-.
  - LED must blink.

If LED does not blink:

- Switch ignition off.
- Connect VAG1598/31 test box to harness connectors of wiring harness (do not connect ECM). Connect Ground (GND) clip at test box (not visible in illustration) to Ground (GND).

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See **WIRING AND COMPONENT CHECK WITH TEST BOX VAG** ,

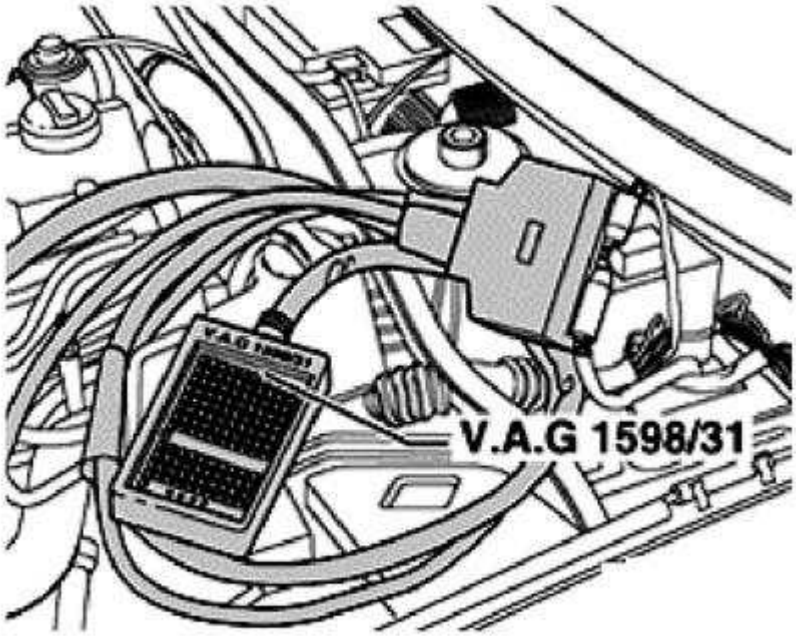


Fig. 184: Connecting VAG1598/31 Test Box To Harness Connectors Of Wiring Harness
Courtesy of AUDI OF AMERICA, INC.

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

SECONDARY AIR INJECTION (AIR) PUMP RELAY OPEN AND SHORT CIRCUIT REFERENCE

Relay carrier in E-box plenum chamber, position 3 Terminal	VAG1598/31 test box Socket
6	46

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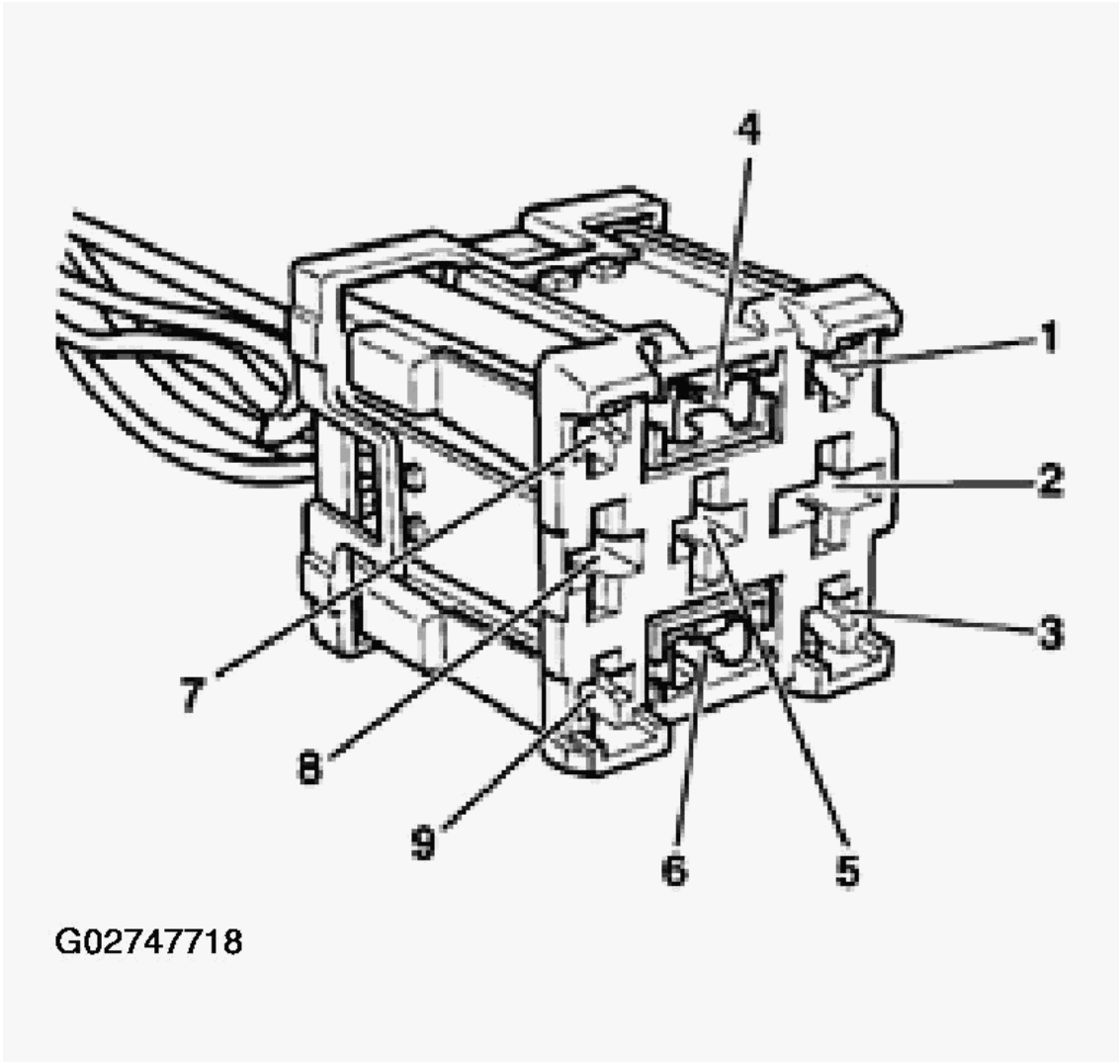


Fig. 185: Identifying Secondary Air Injection (AIR) Pump Relay Harness Connector Terminals - Open And Short Circuit Checking
Courtesy of AUDI OF AMERICA, INC.

- Repair open circuit or short circuit if necessary.

If no malfunctions are detected:

- Replace Secondary Air Injection (AIR) Pump Relay -J299-.

Check voltage supply of the Secondary Air Injection (AIR) pump motor

- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of parking heater/auxiliary heater at noise insulation.

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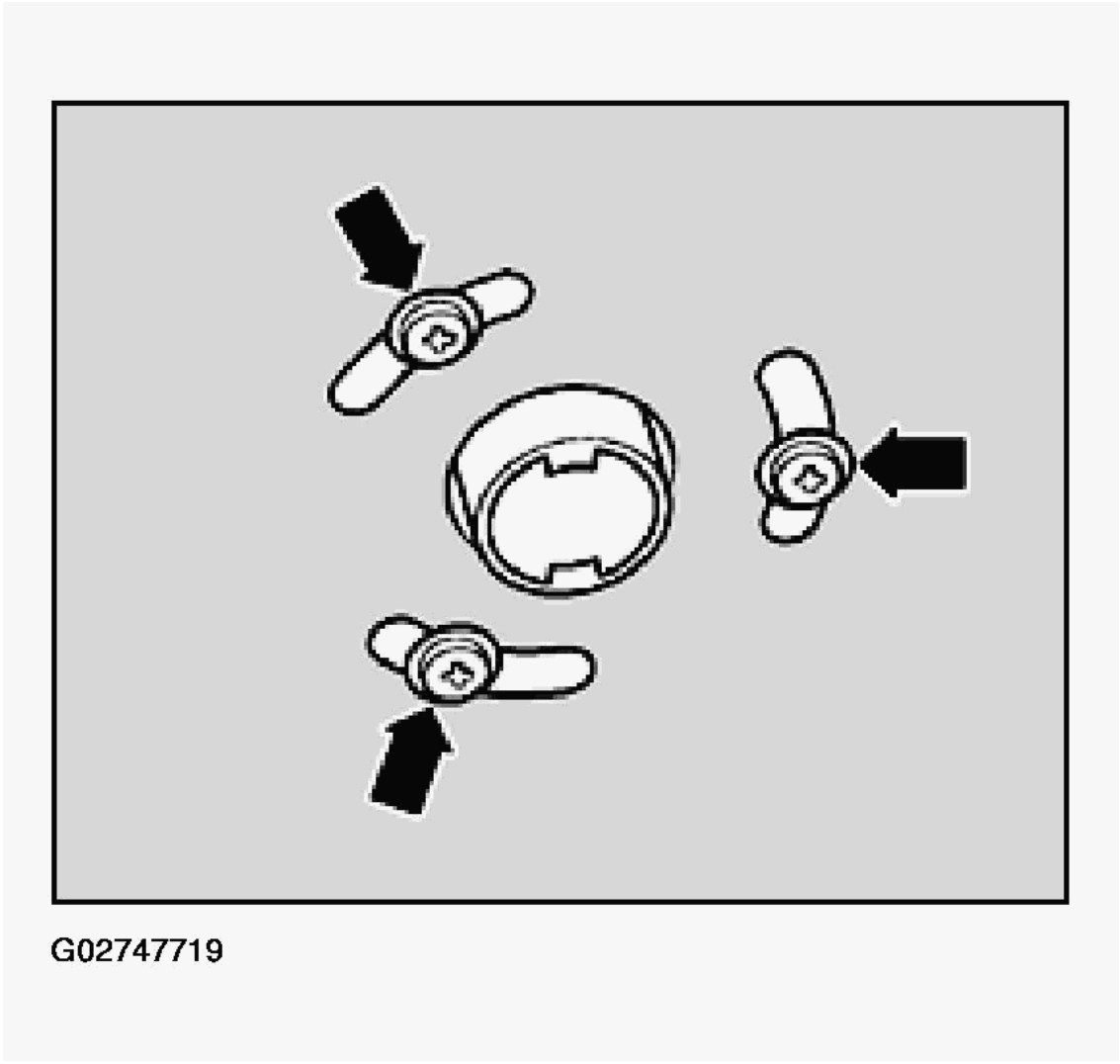


Fig. 186: Removing Parking Heater/Auxiliary Heater Exhaust Pipe Bolts
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front noise insulation.

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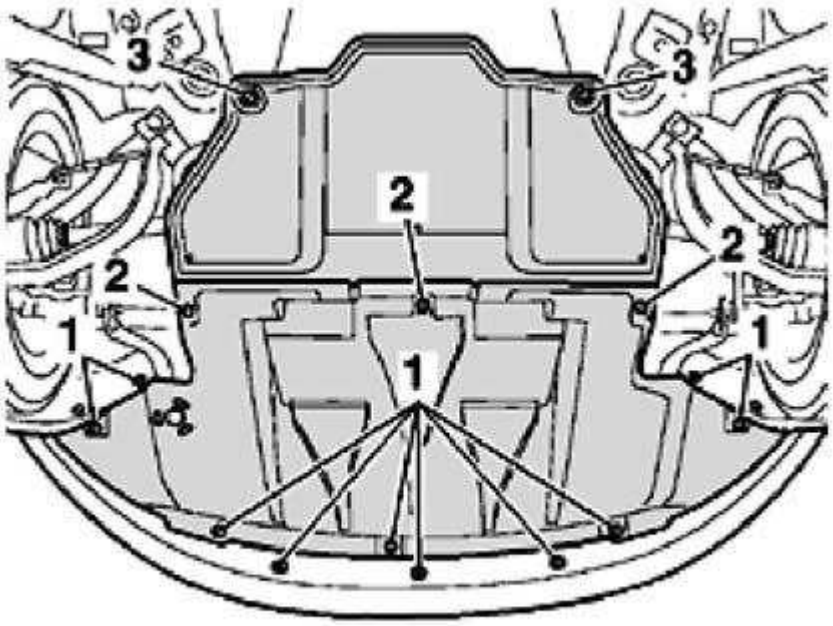


Fig. 187: Removing Front Noise Insulation
Courtesy of AUDI OF AMERICA, INC.

- Disconnect electrical harness connector -2- at Secondary Air Injection (AIR) Pump Motor -V101- -Item 1-.

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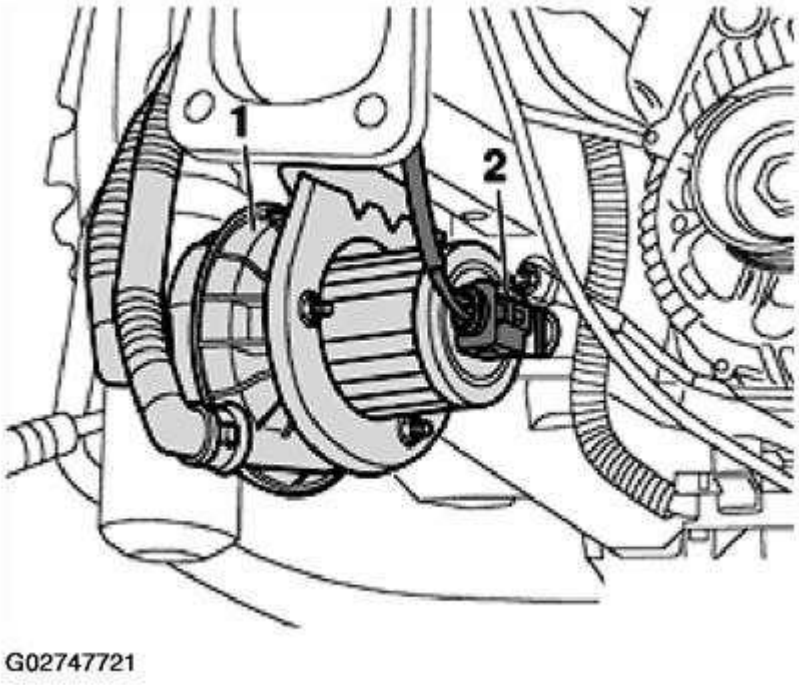


Fig. 188: Disconnecting Secondary Air Injection (AIR) Pump Motor Electrical Harness Connector
Courtesy of AUDI OF AMERICA, INC.

- Connect VAG1527B voltage tester between terminals 1 and 2
- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) Pump Relay - J299-.
  - LED must blink.

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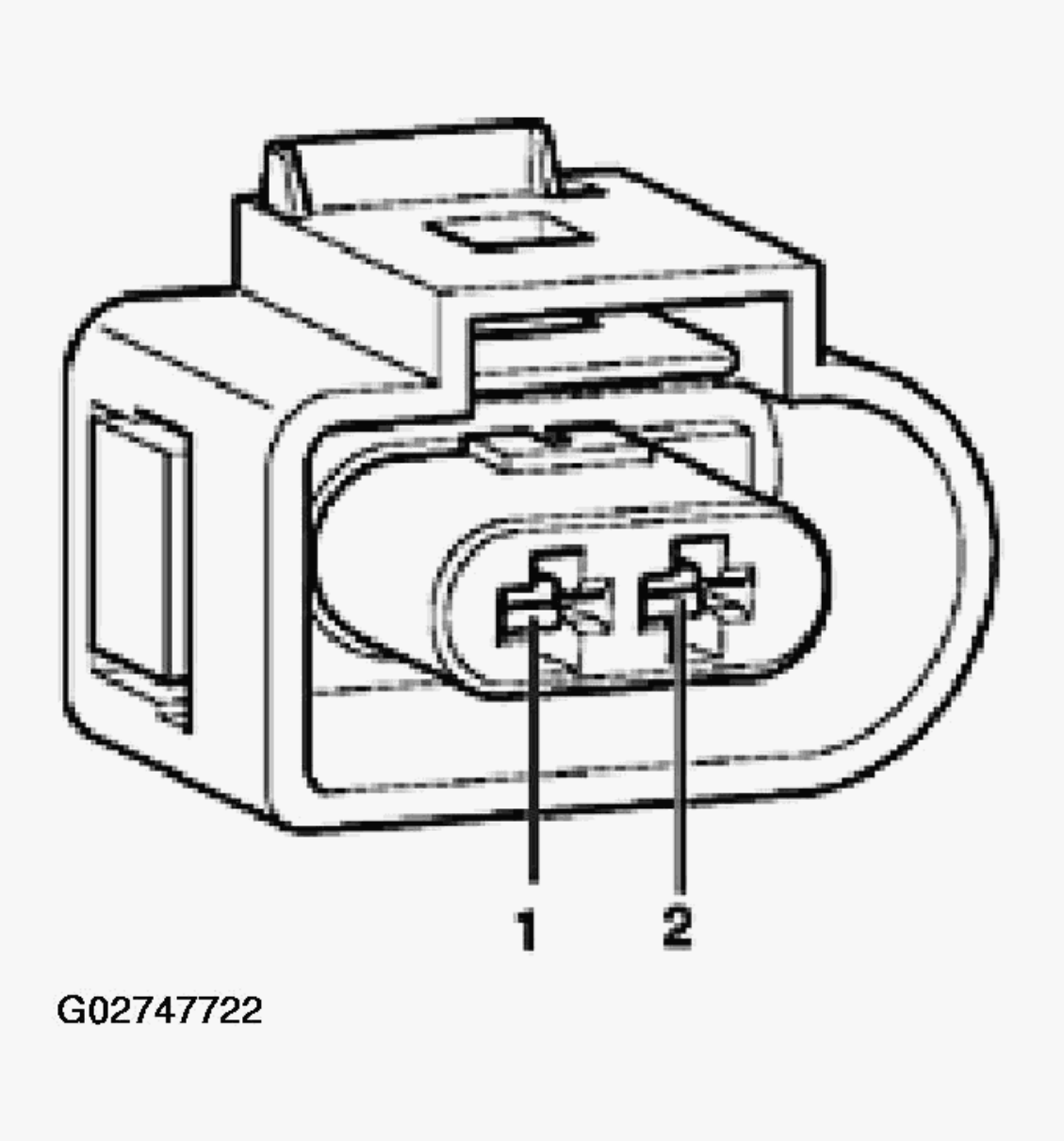


Fig. 189: Identifying Secondary Air Injection (AIR) Pump Motor Harness Connector Terminals 1 And 2
Courtesy of AUDI OF AMERICA, INC.

If LED does not blink:

- Perform the following tests marked with dots:
  - Check wire connection from terminal 2 of connector to Secondary Air Injection (AIR) Pump Relay -J299- (in relay carrier in E-Box, plenum chamber, position 3) for open circuit.

    See appropriate System Wiring Diagrams article

  - Check wire connection from terminal 1 of connector to Ground (GND) for open circuit:

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See appropriate System Wiring Diagrams article

If no malfunctions are detected:

- Replace Secondary Air Injection (AIR) Pump Motor - V101-.

Secondary Air Injection (AIR) pump motor - V101-, removing and installing

Removing

- Remove cover -1- in engine compartment (right side).

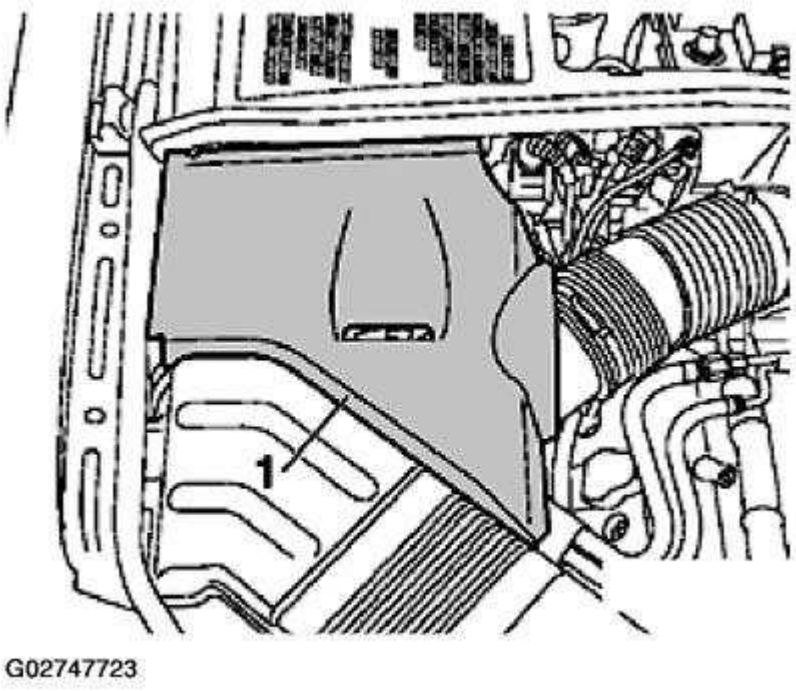


Fig. 190: Removing Right Side Engine Compartment Cover
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts (arrows).
- Detach Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- -1- at air guide.
- Remove air guide -2-.

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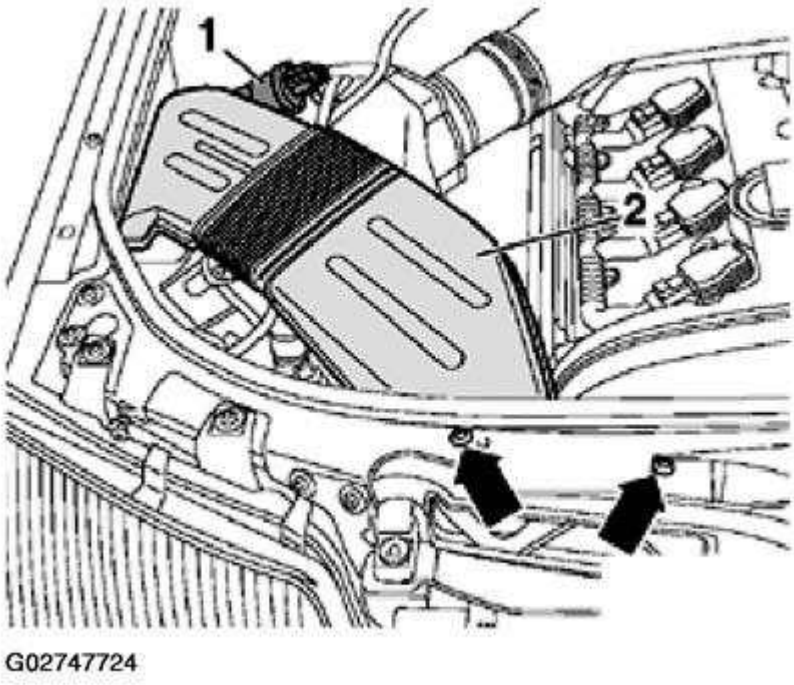


Fig. 191: Detaching Evaporative Emission (EVAP) Canister Purge Regulator Valve
Courtesy of AUDI OF AMERICA, INC.

- Remove air filter housing (arrows).

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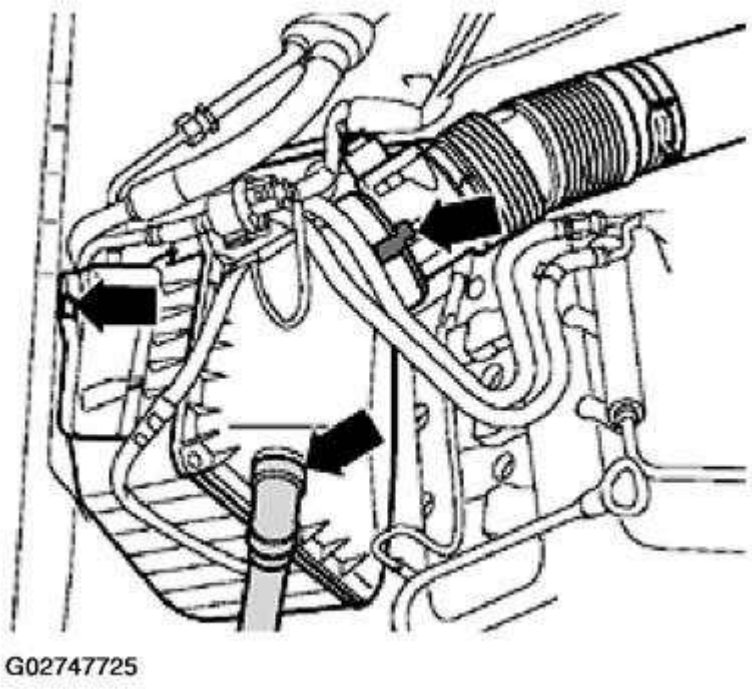


Fig. 192: Removing Air Filter Housing
Courtesy of AUDI OF AMERICA, INC.

- Remove both bolts on secondary Air Injection (AIR) pump bracket, which are accessible from top.
- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of parking heater/auxiliary heater at noise insulation.

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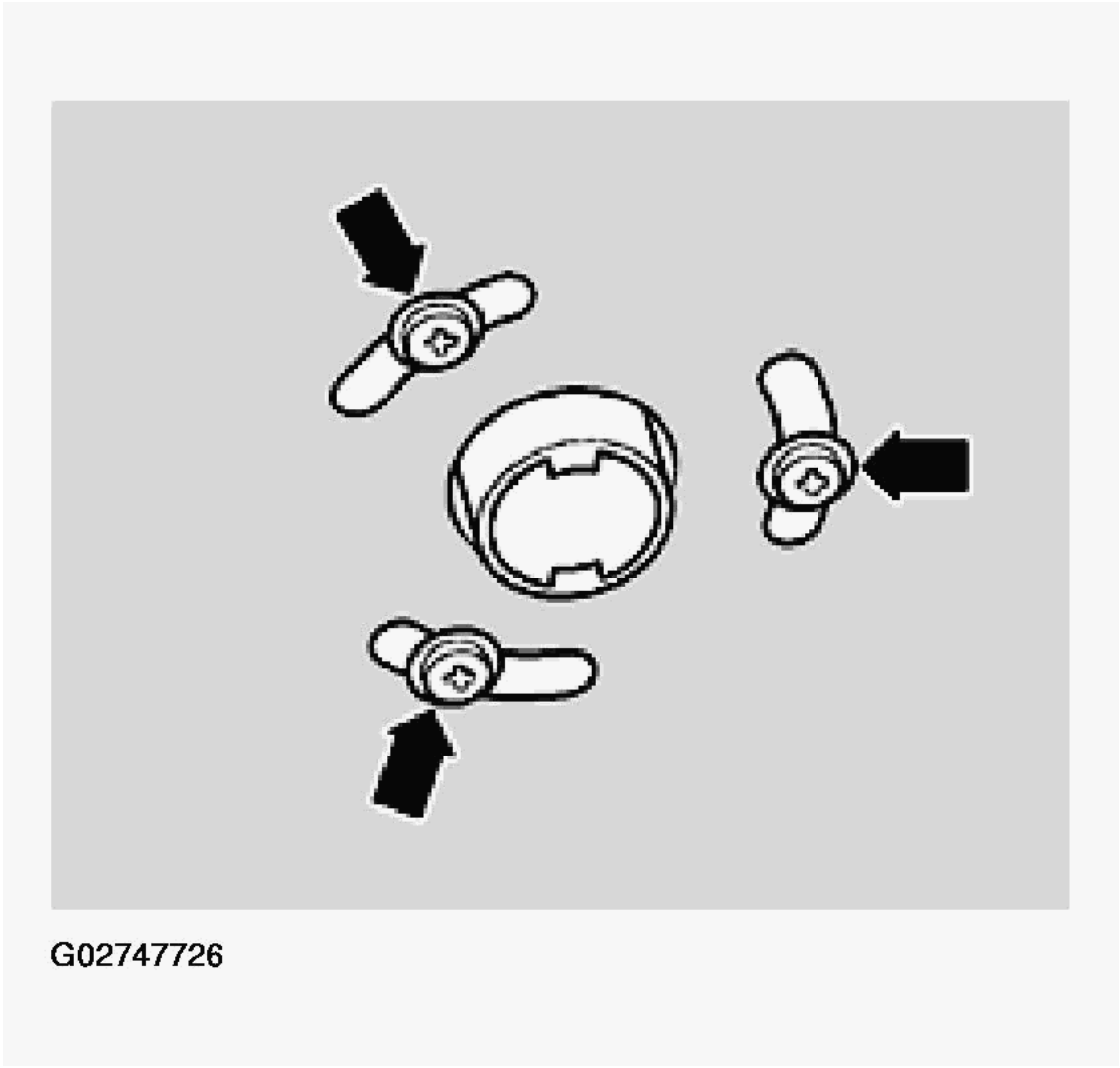


Fig. 193: Removing Parking Heater/Auxiliary Heater Exhaust Pipe Bolts
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front noise insulation.

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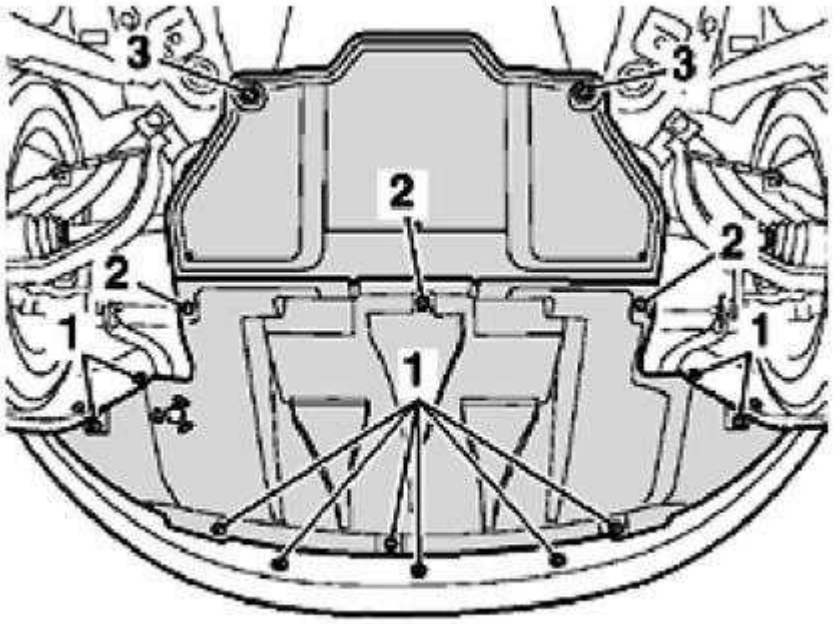


Fig. 194: Removing Front Noise Insulation
Courtesy of AUDI OF AMERICA, INC.

- Disconnect electrical harness connector -3-.
- Disconnect air hoses -1- and -2-.

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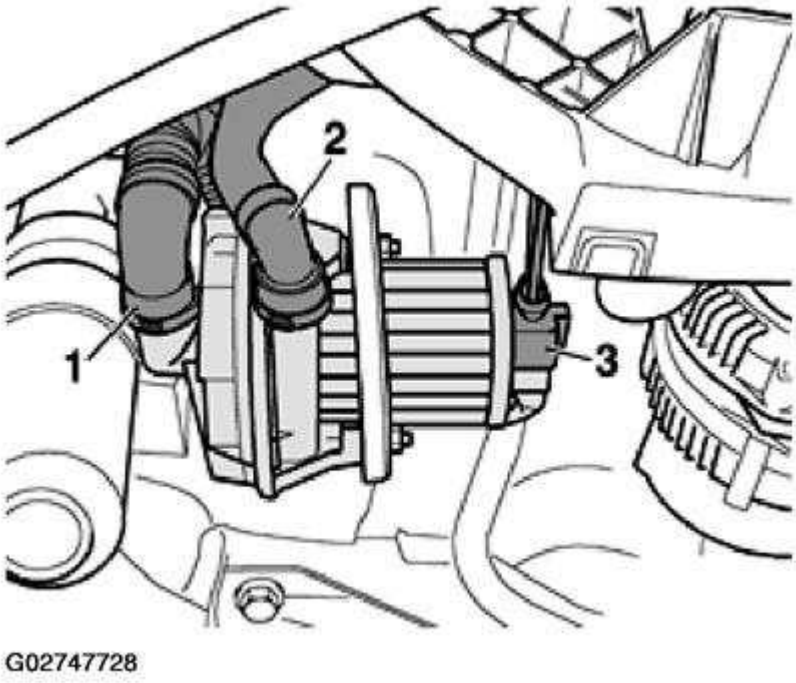


Fig. 195: Disconnecting Electrical Harness Connector And Air Hoses
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts for secondary Air Injection (AIR) pump bracket, which are accessible from bottom.
- Remove Secondary Air Injection (AIR) Pump Motor -V101- with bracket.
- If necessary, separate Secondary Air Injection (AIR) Pump Motor -V101- from bracket.

Installing

Installation is the reverse of removal.

Tightening torques

TIGHTENING TORQUES: SECONDARY AIR INJECTION (AIR) PUMP MOTOR

Component	Nm
Motor for Secondary Air Injection (AIR) to bracket	10
Bracket for motor for Secondary Air Injection (AIR) to chassis	10

Combination valve for Secondary Air Injection (AIR), checking function and proper seal

Special tools and equipment

- VAG1390 hand vacuum pump

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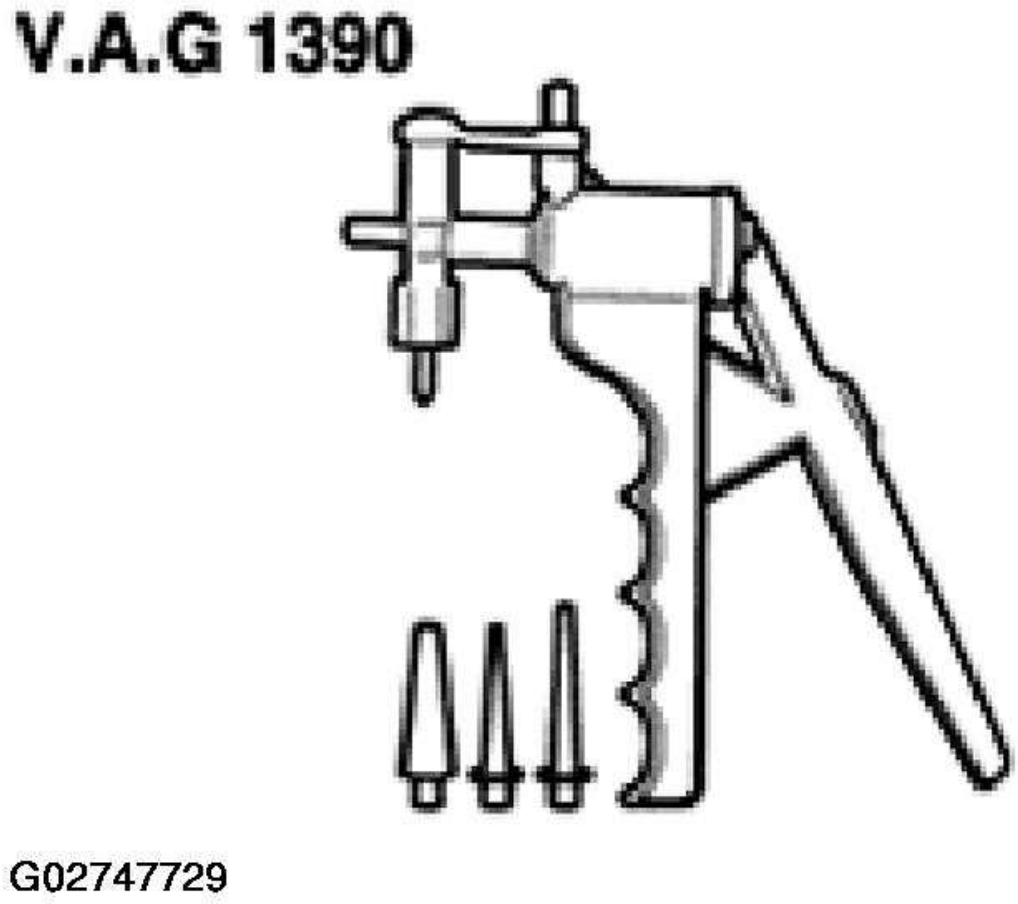


Fig. 196: Identifying Special Tool And Equipment - VAG1390 Hand Vacuum Pump
Courtesy of AUDI OF AMERICA, INC.

Test requirements:

- Vacuum lines and hose connections leak-free.
- Vacuum lines not clogged.

Test sequence

- Remove rear engine cover (arrows).

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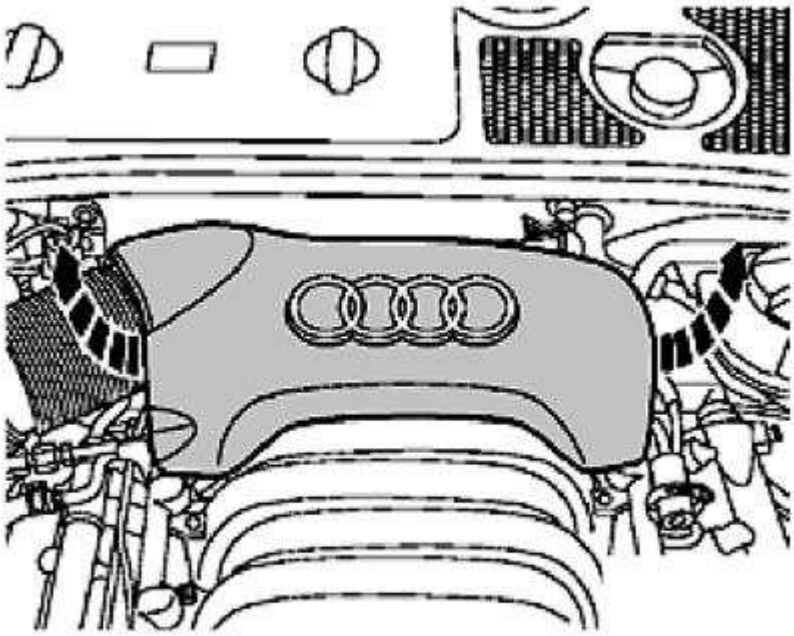


Fig. 197: Removing Rear Engine Cover
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts for holding plate for solenoid valves (arrows).

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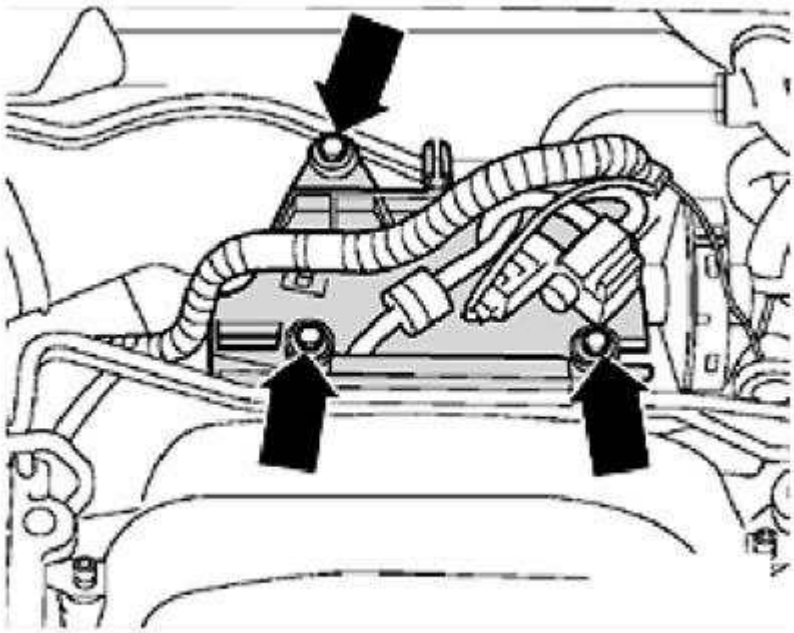


Fig. 198: Removing Solenoid Valves Holding Plate Bolts
Courtesy of AUDI OF AMERICA, INC.

- Lift up holding plate and disconnect vacuum hose from Y-piece of combination valve to be checked.
- Connect VAG1390 hand vacuum pump to vacuum hose of combination valve to be checked.
- For vehicles with auxiliary heater, remove bolts (arrows) for exhaust pipe of parking heater/auxiliary heater at noise insulation.

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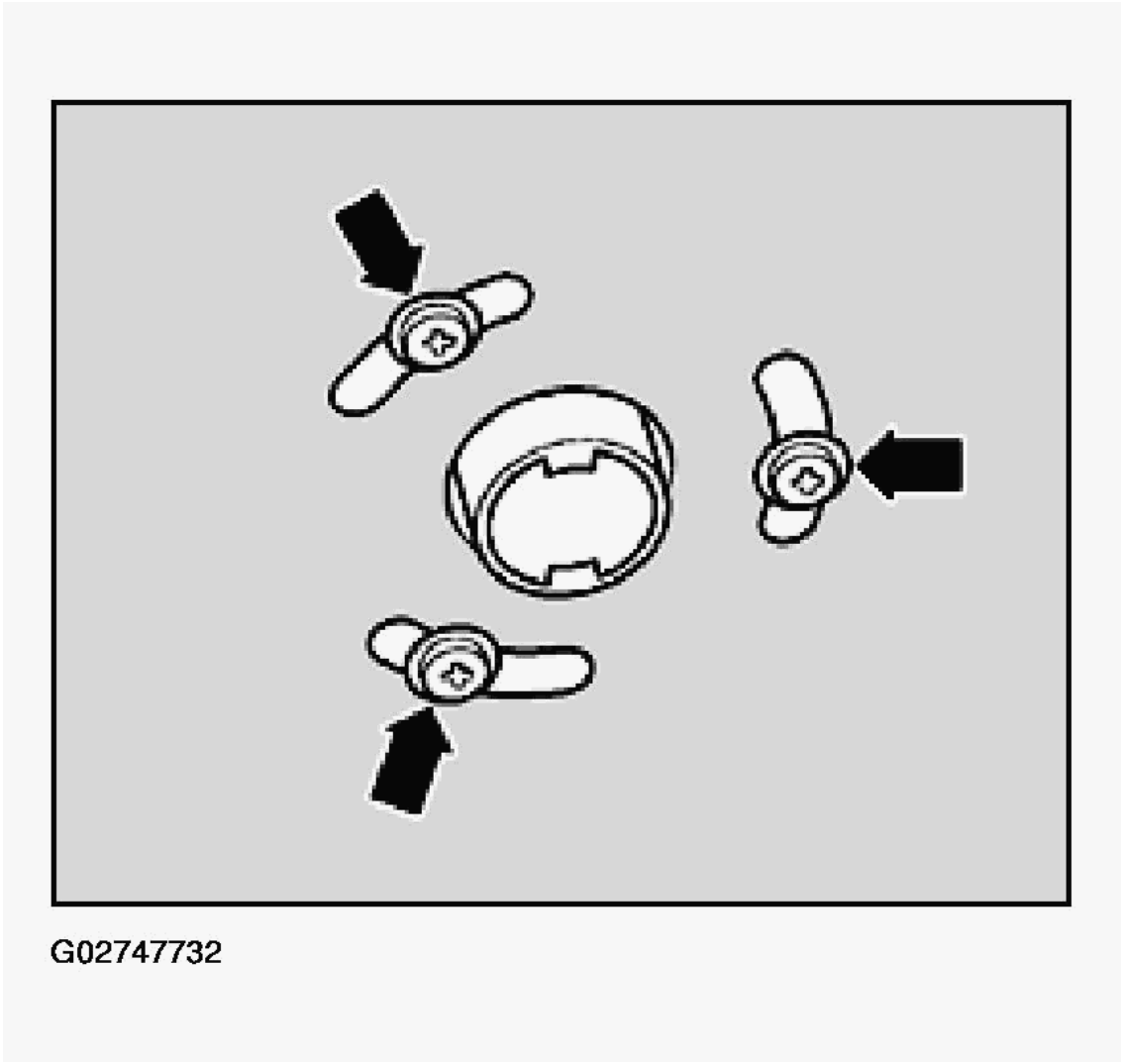


Fig. 199: Removing Parking Heater/Auxiliary Heater Exhaust Pipe Bolts
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts or release quick-release screws -1- and -2- and remove front noise insulation.

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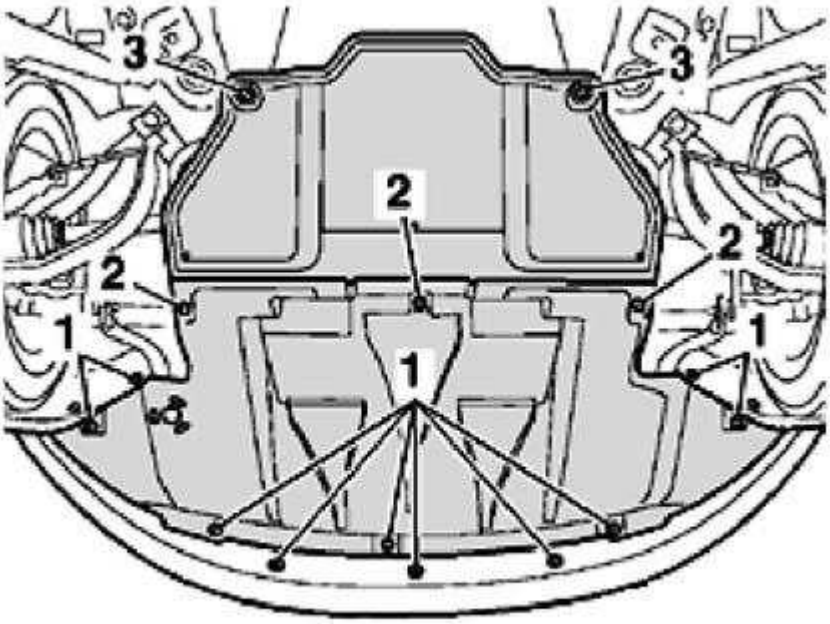


Fig. 200: Removing Front Noise Insulation
Courtesy of AUDI OF AMERICA, INC.

- Disconnect pressure hose (arrow) at Secondary Air Injection (AIR) Pump Motor and blow into it with light pressure (do not use pressurized air).
  - Both combination valves must be closed, it must not be possible to blow through hose

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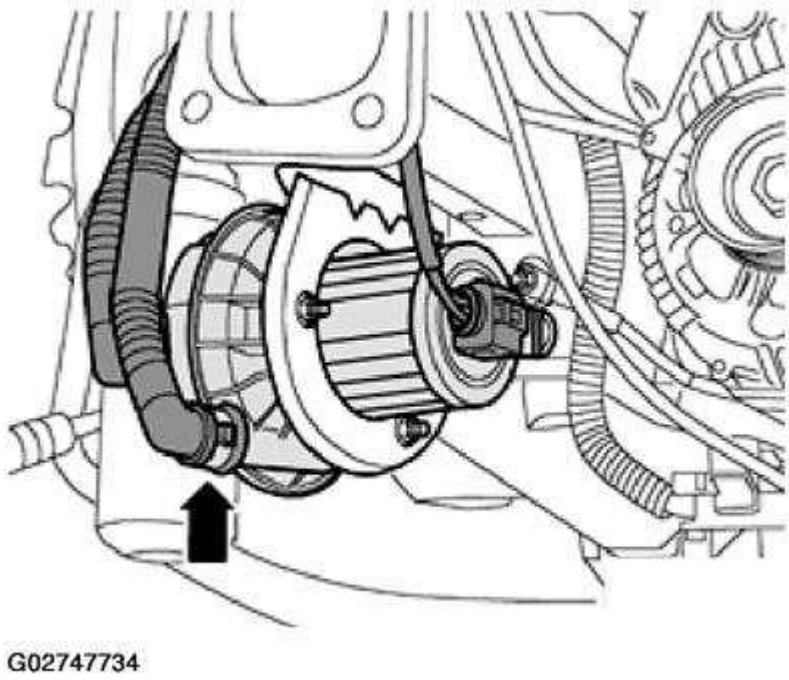


Fig. 201: Disconnecting Pressure Hose At Secondary Air Injection (AIR) Pump Motor
Courtesy of AUDI OF AMERICA, INC.

- Operate hand vacuum pump.
  - The relevant combination valve must open, it must be possible to blow through

If the relevant combination valve does not open:

- Replace combination valve. See **LEFT COMBINATION VALVE FOR SECONDARY AIR INJECTION, REMOVING AND INSTALLING** or **RIGHT COMBINATION VALVE FOR SECONDARY AIR INJECTION, REMOVING AND INSTALLING** .

Left combination valve for secondary air injection, removing and installing

Removing

- Remove rear engine cover (arrows).

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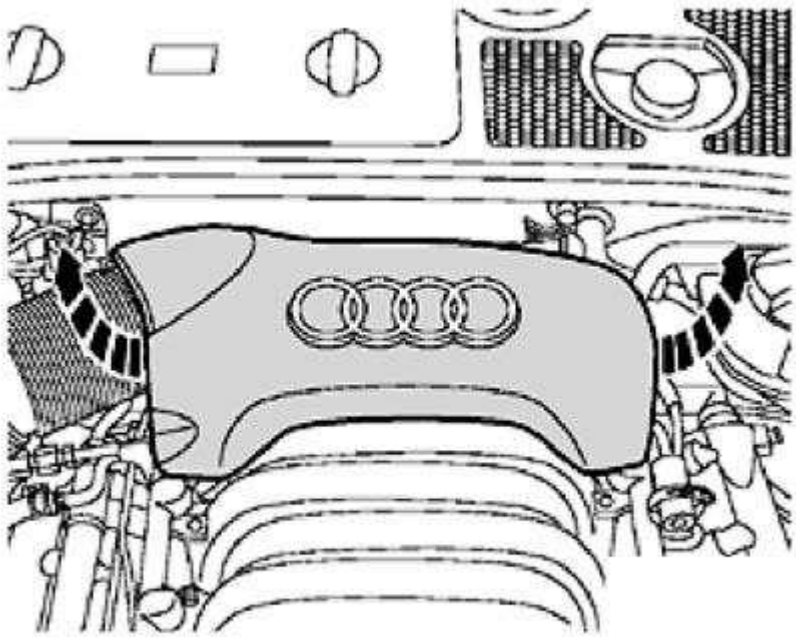


Fig. 202: Removing Rear Engine Cover - LH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air hose -1- at Mass Air Flow (MAF) sensor.
- Disconnect hose -4- for crankcase ventilation from air guide -2-.

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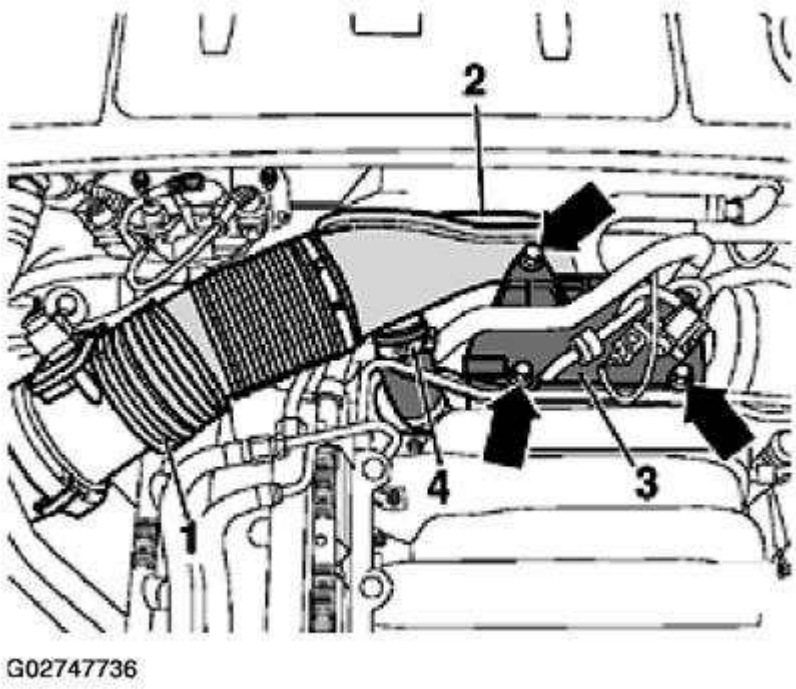


Fig. 203: Removing Solenoid Valves Holding Plate Bolts - LH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

- Remove bolt (arrow) and disconnect air guide -2- at throttle valve control module.
- Disconnect hose -1- from air guide.

NOTE: Illustration shows the air guide from rear with the engine removed.

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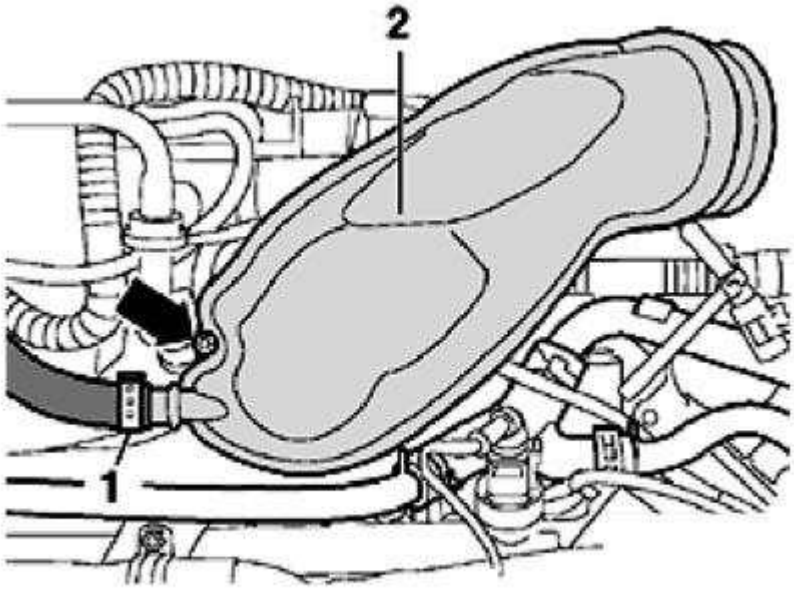


Fig. 204: Disconnecting Air Guide At Throttle Valve Control Module - LH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

- Remove cover -1- in engine compartment (left side).

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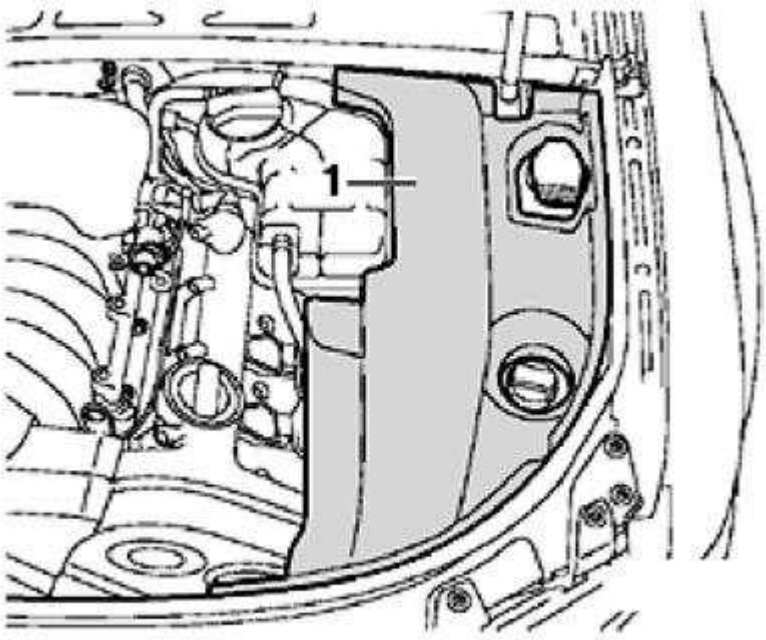


Fig. 205: Removing Left Side Engine Compartment Cover - LH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

- Clamp coolant hose -2- using 3094 hose clamps and disconnect coolant hose from coolant reservoir.
- Unbolt coolant reservoir (arrow).
- Disconnect electrical wiring to Engine Coolant Level (ECL) Warning Switch -F66- at bottom of coolant reservoir.
- Lay coolant reservoir with connected coolant hoses -1- and -3- to side.

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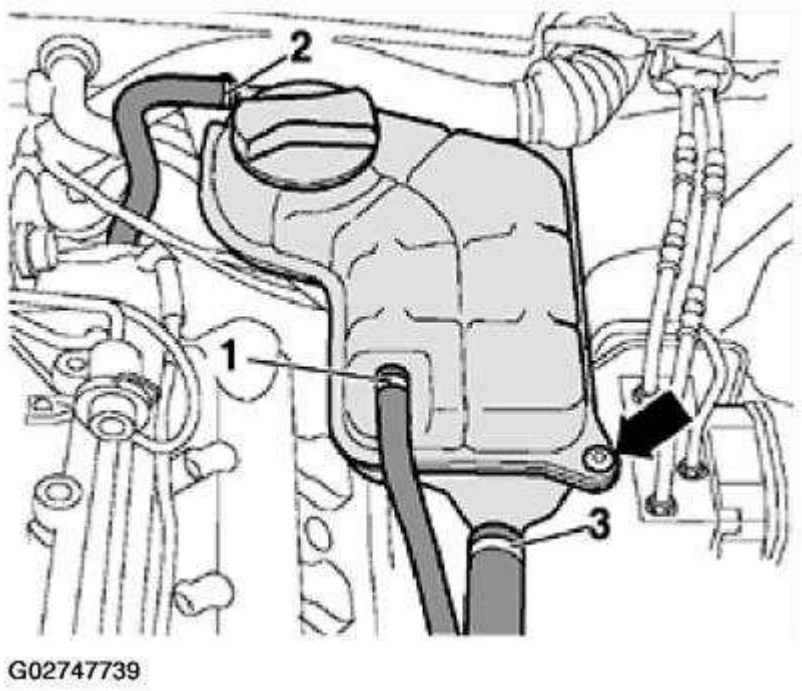


Fig. 206: Laying Coolant Reservoir With Connected Coolant Hoses - LH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

- Disconnect electrical harness connectors -1- and -2- at Camshaft Position (CMP) Sensor 2 -G163- and Camshaft Position (CMP) Sensor 4 -G301-.
- Disconnect hose -3- from crankcase ventilation at cylinder head cover.

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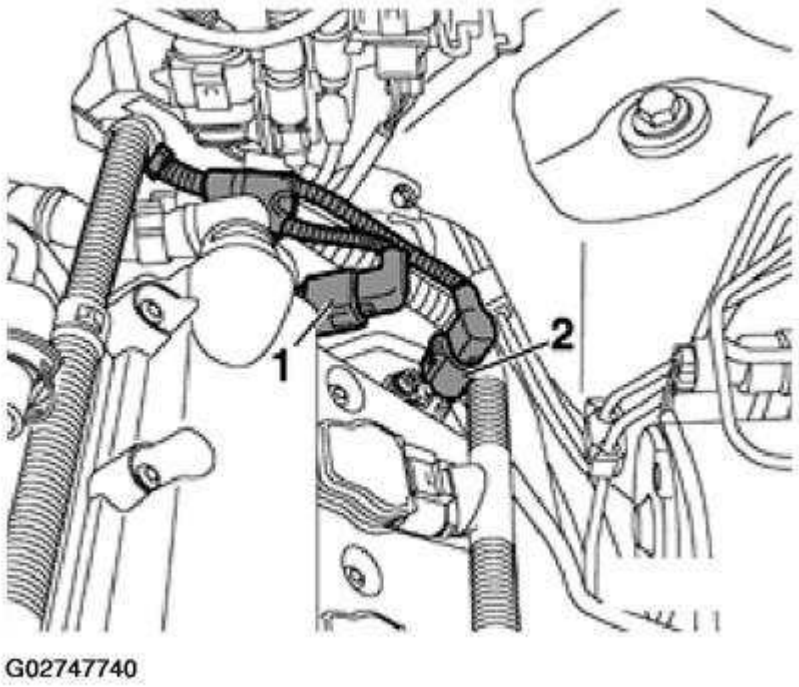


Fig. 207: Disconnecting CMP Sensor 2 And CMP 4 Electrical Harness Connectors - LH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts -1- at flange of combination valve for secondary air injection.
- Loosen nut -3- several turns.
- Remove bolts -2- and disconnect vacuum hose (arrow).

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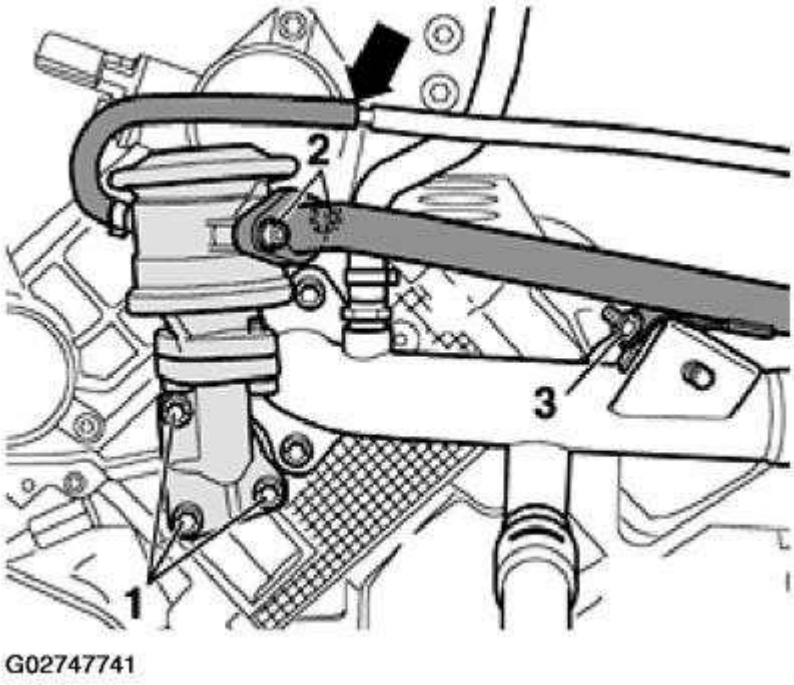


Fig. 208: Removing LH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

- Remove combination valve.

NOTE: Illustration is shown with engine removed.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and O-rings.

- Top off coolant. See **COOLANT, DRAINING AND REFILLING** .

Tightening torques

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Component		Nm
Combination valve to cylinder head		10
Connector tube to	Combination valve	10
	Coolant pipe	10

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Fig. 209: Left Hand Combination Valve Components Tightening Torques Chart
Courtesy of AUDI OF AMERICA, INC.

Right combination valve for secondary air injection, removing and installing

Removing

- Remove rear engine cover (arrows).

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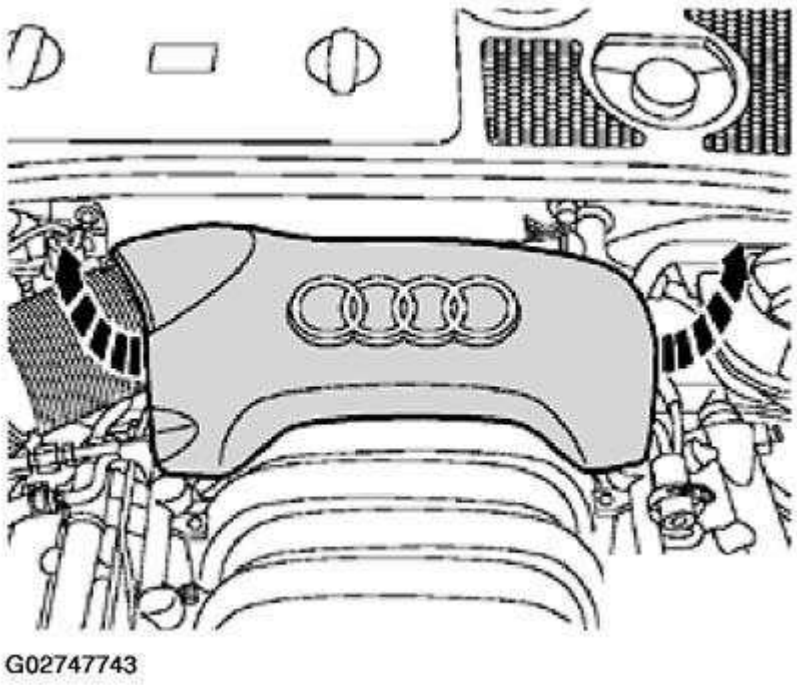


Fig. 210: Removing Rear Engine Cover - RH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

- Remove cover -1- in engine compartment (right side).

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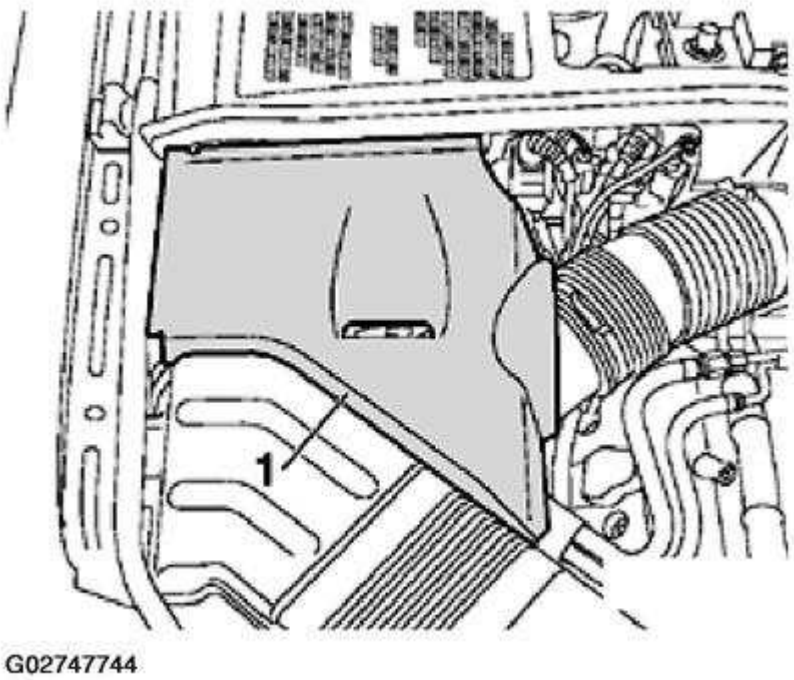


Fig. 211: Removing Right Side Engine Compartment - RH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect intake air hose -1- at Mass Air Flow (MAF) sensor.
- Disconnect hose -4- for crankcase ventilation from air guide -2-.

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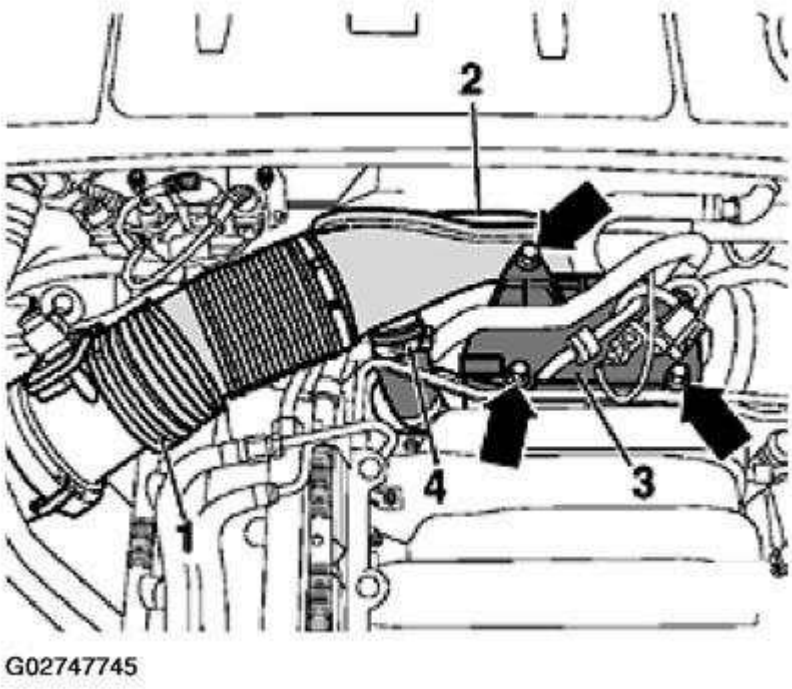


Fig. 212: Removing Solenoid Valves Holding Plate - RH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

- Remove bolt (arrow) and disconnect air guide -2- at throttle valve control module.
- Disconnect hose -1- from air guide.

NOTE: Illustration shows the air guide from rear with the engine removed.

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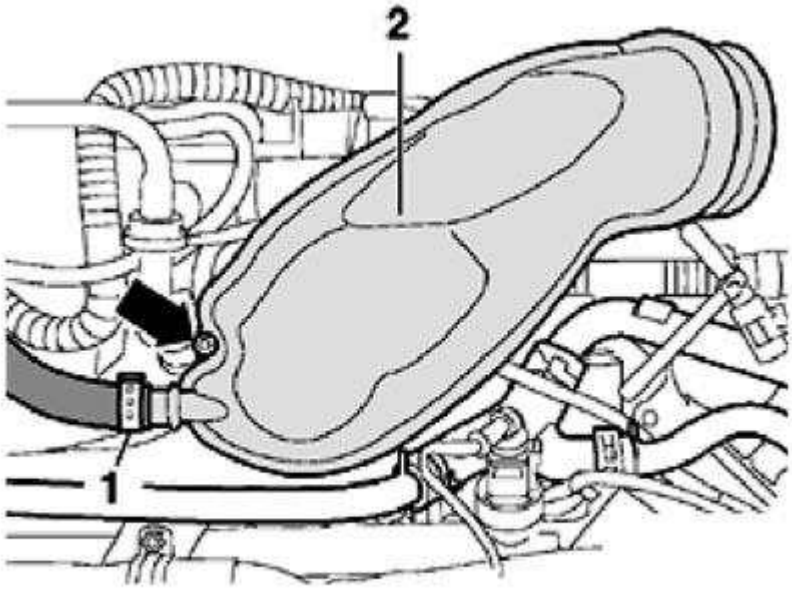


Fig. 213: Disconnecting Air Guide At Throttle Valve Control Module - RH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

- Unscrew bolts -1- and -2- and remove combination valve.
- Disconnect vacuum hose (arrow).

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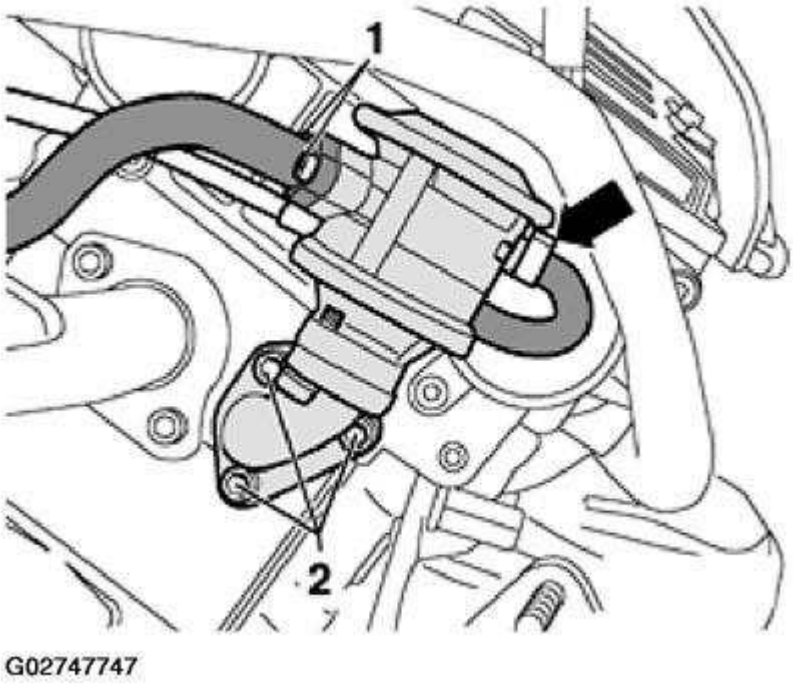


Fig. 214: Removing RH Combination Valve
Courtesy of AUDI OF AMERICA, INC.

Installing

Installation is reverse of removal, noting the following:

NOTE: Replace gaskets and O-rings.

Tightening torques

TIGHTENING TORQUES: SECONDARY AIR INJECTION COMBINATION VALVE

Component	Nm
Combination valve to cylinder head	10
Connecting tube to combination valve	10

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