

**VOLVO**

**Service Bulletin  
Buses**

D13H Engine  
October 2011

**SERVICE BULLETINS RELATED TO D13 ENGINE**

**GENERAL INFORMATION**

**SPECIFICATIONS**

**COMPONENT REPLACEMENT OR ADJUSTMENT**

## Engine Service Bulletins

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Low Power Output  
Symptom Fault Tracing

## **Low Power Output**

## Low Power Output, Fault Tracing

### Symptom fault tracing

Depending on vehicle configuration, conditions related to low power output symptoms may be caused or influenced by specific faults or malfunctions in other vehicle components such as axles, engine rating, etc. In such cases, refer to the specific service information for those components. Also, fuel saving features may be enabled on the vehicle, which could result in low power in certain circumstances.

**Note:** You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing any suggested

procedures. If you are not properly trained and certified in a procedure, ask your supervisor for training before you perform it.

"General Information", page 2

For specific symptoms, see:

- "Sudden Loss of Power", page 5
- "Gradual Loss of Power", page 5
- "Engine Does Not Reach Rated Speed", page 6
- "Low Power After Vehicle Repair", page 6

## General Information

**Note:** Always use Tech Tool for fault tracing.



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**Note:** During fault tracing, the engine should be run at the operating temperature as well as at the temperature where the symptom occurs.

- Low power in combination with normal fuel consumption may have several causes. If no external symptoms are displayed, check the fuel, air, exhaust system, compression, the mechanical parts of the engine and the engine control system.



## **Basic Conditions for Achieving the Correct Tractive Power**

The following conditions should be met in order for the engine to yield the right tractive power:

- Access to the right amount of fuel
- Access to the right amount of air
- The engine should emit exhaust gases without any hindrance
- The engine should be in a mechanically fault-free condition
- The ignition temperature is sufficiently high in the cylinders
- The engine control system, including sensors, should be free from faults

### **Fuel**

If the engine is supplied with too little fuel or poor quality fuel, this will have a negative effect on the tractive power.

Environmental diesel fuels also have a negative effect on tractive power.

The following can negatively affect fuel injection:

- Restricted or dirty fuel filter(s) or fuel/water separator filter
- Faulty overflow valve
- Worn or faulty fuel supply pump
- Air leakage into the fuel supply pump supply line
- Kinks or blockage in any of the fuel lines
- Restricted vent line or valve at the fuel tank
- Impurities in the fuel
- Poor fuel quality

### **Air Supplied to the Engine**

A reduced amount of air supplied to the engine means that the fuel delivery is also reduced, and this results in lower power output.

The supply of air to the engine may be affected by:

- A damaged or restricted air inlet
- A restricted or dirty air cleaner (ACL)
- A leaking charge air pipe (joints)
- A leaking or damaged charge air cooler (CAC)
- A clogged CAC
- Damaged turbine wheels in the turbocharger or turbocharger housings
- A restricted exhaust gas recirculation (EGR) cooler (exhaust gases not adequately cooled)
- Defective EGR control valves
- Altitude

It is important that both the engine's air inlet and the turbocharger are free from faults.

Never replace a turbocharger because of poor power output without first determining that the turbocharger has damaged components.

### **Exhaust System, Back Pressure**

Restrictions on the exhaust side means that it is difficult to emit exhaust gases, therefore causing the exhaust back pressure to increase. This, in return, results in difficulty getting a sufficient amount of fresh air into the cylinders to efficiently burn the fuel being injected into the cylinders.

The direct result of this is a lower intake manifold pressure, inferior response, and higher fuel consumption.

An incorrectly rebuilt exhaust system with a lot of bends may mean that the engine cannot emit its exhaust gases freely. The same problem will arise if the exhaust system is damaged (flattened), or if the shutter in the exhaust pressure governor (if equipped) seizes or is damaged.

### **Compression**

The compression is a good measure of the mechanical condition of the engine. If there is sufficient compression, the temperature in the cylinder is probably also sufficient.

Generally speaking, low compression is noticeable when you have starting problems that worsen as the engine gets hot or when there is blue oil smoke or abnormal amounts of crankcase gases. A problem may be indicated when one cylinder's compression is significantly lower than the others.

Minor deviations between cylinders are normal.

### **Engine Control System**

The engine control system, including sensors, should be free from faults.

**Note:** When there are faults on some components, such as the intake manifold pressure sensor, the result is a natural reduction of the tractive power.

### **Evaluation**

If none of these areas shows abnormal values, yet the customer still maintains that the vehicle still has low power, a reliable dynamometer test should be carried out.

If this test does not show that the vehicle has low power, no further technical measures should be taken. **Go through the results together with the customer.**

The customer's complaints could be related to the vehicle's specification, or that the customer's references are not comparable with the actual vehicle. If faults can not be found on the vehicle, there could be other circumstances that make the customer dissatisfied, i.e. his experience of noise from the vehicle may have changed. Also, fuel saving features may be enabled on the vehicle, which could result in low power in certain circumstances.

If the dynamometer test shows that the vehicle clearly has low power, fault tracing should continue in order to determine in which system the fault may be.

## **Fault Tracing**

Temporary faults can be difficult to trace since the fault may not occur when the vehicle is brought in to be checked.

Fault tracing should be performed based on what the driver has experienced. The information that the driver has provided in conjunction with the gathering of factual data should form the basis of how the problem should be resolved.

Whenever possible, try to recreate the problem in an environment and situation similar to the one described by the driver.

Begin by determining if anything has recently happened to the vehicle that could point to the electrical system, but which does not have anything to do with the engine control system.

For specific symptoms, see:

- “Sudden Loss of Power”, page 5
- “Gradual Loss of Power”, page 5
- “Engine Does Not Reach Rated Speed”, page 6
- “Low Power After Vehicle Repair”, page 6

## **Sudden Loss of Power**

Sudden power loss may be caused by:

- Failure in a component or system causing a lack of fuel or air, or intake/exhaust restrictions.
- Poor fuel quality.
- Mechanical problems in internal engine components.
- Factors monitored by the engine control system, including sensor faults, high coolant temperature or high engine load.
- Exhaust gas recirculation (EGR) valve faults.
- Turbocharger malfunction.

## **Gradual Loss of Power**

Gradual power loss may be caused by:

- Gradual failure in a component or system causing irregular combustion.
- Air intake restrictions.
- Exhaust restrictions.
- Exhaust gas recirculation (EGR) valve faults.

## Engine Does Not Reach Rated Speed

Difficulty reaching rated engine speed may be caused by:

- Problems in the fuel or intake system.
- Specific diagnostic trouble fault codes (DTC) generating a response by the engine control system.

## Low Power After Vehicle Repair

In case of sudden low power after a vehicle is repaired or rebuilt, it should be determined whether the cause is related to an engine component or a fault in another vehicle component. Low power can also be caused by:

- Incorrect (unauthorized) or improperly installed engine components.
- Engine control module (ECM) limiting engine speed or torque because of a diagnostic trouble code (DTC) generated by faulty or improperly installed electrical components.

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High Fuel Consumption

Symptom Fault Tracing

## **High Fuel Consumption**

## High Fuel Consumption, Fault Tracing

### Symptom fault tracing

It is often hard to determine the causes of high fuel consumption. A vehicle consumes the amount of fuel which is demanded for a specific work load. If the work load increases, the fuel consumption will also increase. If the way of driving changes, the fuel consumption will also change.

The cause of abnormal fuel consumption might not be an engine or vehicle related problem. The most likely reason is changed work load. It is important to look at the details of the high fuel consumption complaint. If fuel consumption is compared to a previously owned vehicle or another vehicle, the complaint is not relevant — fuel consumption differs between vehicles, emission levels and vehicle types.

**Note:** No complaints regarding high fuel consumption will be considered if the vehicle has been driven less than 50 000 km (32,000 mi) or before the first oil change — which ever comes first. The engine and fuel system have not been broken in until after that mileage/period of time.

When receiving a complaint regarding high fuel consumption, please consider the following:

- Fuel consumption is most affected by the driving conditions including driving habits. The driver has the most influence on fuel economy. An uneven or erratic driving style with continuous acceleration and braking, or driving at high speed, will increase fuel consumption. A smoother driving style saves fuel and wear on the vehicle.
- Certain countries have stricter environmental and legal demands for diesel fuel. These fuel types will emit less exhaust fumes compared to other fuel, which will make the engine perform less and consume more fuel. Fuel type and quality must be taken into consideration when comparing engine fuel consumption and performance. For more information about fuel quality, see Function Group 170. This information describes what fuel types provide the best combination of economy and performance for VOLVO engines. For other fuels used

there are no tests or specification values that can be used for fault tracing.

**Note:** Poor fuel quality and the use of fuel additives will result in poor engine performance. **Warranty claims regarding damaged components due to usage of fuel which does not meet VOLVO standards, may not be taken into consideration.** For more information about biodiesel fuels, see Function Group 175.

- Check the vehicle repair history.
- If a high fuel consumption complaint is in combination with a low power complaint, prioritize the low power complaint. If the low power complaint is resolved, most likely the fuel consumption complaint will be also be solved.
- Other conditions affect fuel consumption — for instance; the type of terrain where the vehicle is primarily driven, weather conditions such as wind, snow, and extreme hot and cold temperatures.
- Check other vehicle components:
  - Axle alignment; the entire vehicle combination must be correct.
  - Pinion angles and ride height must be correct.
  - Brakes must NOT be dragging.
  - The wheel alignment must be correct.
  - The air pressure in the tires must be correct.
  - Tires that show a high level of tread wear can be an indication of problems with the vehicle that could cause high fuel consumption.
  - Tire type
  - The compressor charge time must be within the specification. There must be no leakage in the air system.
  - The air conditioning compressor must not be constantly engaged.

This Service Bulletin replaces bulletin 200-128 dated 7.2009.

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Abbreviations, Emission Control System

PREVH, PREVX, 9700

## **Abbreviations, Emission Control System**

This bulletin lists the abbreviations used to describe US07 and US2010 emissions compliant components, systems and operation.

# Abbreviations, Emission Control System

US07	US2010	DESCRIPTION
	AAT	Ambient Air Temperature
	ABS	Anti-Lock Braking System
	AC	Air Conditioning
	ACL	Air Cleaner
	ACM	Aftertreatment Control Module
AFI		Aftertreatment Fuel Injector
	AFR	Air Fuel Ratio
	AP	Accelerator Pedal
	APCS	Actively-Pressurized Cooling System
	APP	Accelerator Pedal Position
AR		Active Regeneration
	A/T	Automatic Transmission
ATS		Aftertreatment System
	AWL	Amber Warning Lamp
	BARO	Barometric Pressure
	BBM	Body Builder Module
	BPP	Brake Pedal Position
CAC	CAC	Charge Air Cooler
	CAL	Calibration
	CAL ID	Calibration Identification
	CAN	Controller Area Network
	CAT	Catalyst
	CC	Cruise Control
	CCB	Crankcase Breather
	CCM	Comprehensive Component Monitor
	CCP	Crankcase Pressure
	CCS	Coast Clutch Solenoid
CCV		Crankcase Ventilation
CEGR		Cooled Exhaust Gas Recirculation
	CFI	Continuous Fuel Injection
	CKP	Crankshaft Position
	CL	Closed Loop
	CM	Cold Mode
	CMP	Camshaft Position
CO		Carbon Monoxide



	CP	Coolant Pressure
	CPP	Clutch Pedal Position
	CR	Compression Ratio
	CTP	Closed Throttle Position
	CVN	Calibration Verification Number
D11F		Volvo 11 Liter Diesel Engine with US07 Compliant Emissions
	D11H	Volvo 11 Liter Diesel Engine with US2010 Compliant Emissions
D13F		Volvo 13 Liter Diesel Engine with US07 Compliant Emissions
	D13H	Volvo 13 Liter Diesel Engine with US2010 Compliant Emissions
D16F		Volvo 16 Liter Diesel Engine with US07 Compliant Emissions
	D16H	Volvo 16 Liter Diesel Engine with US2010 Compliant Emissions
	DCC	Diagnostic Connector, Cab
	DCU	Diagnostic Connector, Under-hood
	DEF	Diesel Exhaust Fluid
	DF	Deterioration Factor
	DFI	Direct Fuel Injection
	DLC	Data Link Connector
DOC	DOC	Diesel Oxidation Catalyst
DPF	DPF	Diesel Particulate Filter
	DRL	Daytime Running Lights
DRV		Discharge Recirculation Valve
	DST	Detonation Sensitive Timing
	DTC	Diagnostic Trouble Code
	DTM	Diagnostic Test Mode
	DVOM	Digital Volt Ohm Meter
EATS		Exhaust Aftertreatment System
	EBP	Exhaust Back Pressure
	EC	Engine Control
	ECC	Electronic Climate Control
	ECL	Engine Coolant Level
	ECM	Engine Control Module
	ECP	Engine Certification Plate
	ECP	Engine Coolant Pressure
	ECT	Engine Coolant Temperature
	ECS	Electronically-Controlled Suspension
	ECU	Electronic Control Unit
	EEC	Electronic Engine Control
EECU		Engine Electronic Control Unit
	EEPROM	Electronically Erasable Programmable Read Only Memory
	EFC	Electronic Fuel Control
	EFT	Engine Fuel Temperature

EGR	EGR	Exhaust Gas Recirculation
	EGT	Exhaust Gas Temperature
	EHT	Electronic Hand Throttle
	EM	Engine Modification
	EO	Engine Overspeed
	EOL	Engine Oil Level
	EOP	Engine Oil Pressure
	EOT	Engine Oil Temperature
	EPG	Exhaust Pressure Governor
	EPROM	Erasable Programmable Read Only Memory
	ESC	Engine Speed Control
	ESP	Electronic Stability Program
	EST	Exhaust System Temperature
	ETA	Engine Timing Actuator
EUI		Electronic Unit Injector
	FC	Fan Control
	FCC	Fan Control Circuit
	FI	Fuel Injection
	FL	Fuel Lift
	FMI	Failure Mode Indicator
	FP	Fuel Pump
	FRA	Fuel Rack Actuator
	FS	Fuel Shutoff
	FT	Fuel Trim
	GD	Guided Diagnostics
	GMF	Gas Mass Flow
	GND	Ground
	GPS	Global Positioning System
	GSECU	Gear Selector Electronic Control Unit
HC		Hydrocarbons
HEST		High Exhaust System Temperature
	HI	High Idle
	HIG	High Idle Governor
	IA	Intake Air
	IAH	Intake Air Heater
	IAP	Injection Actuation Pressure
	IAT	Intake Air Temperature
	ICP	Injection Control Pressure
	ID	Identification Data
	IFI	Indirect Fuel Injection
	IFP	Injection Fuel Pressure

	I/M	Inspection and Maintenance
	IMP	Intake Manifold Pressure
	IMS	Idle Management System
	INJ	Injector
	ISC	Idle Speed Control
	IV	Idle Validation
	IVS	Idle Validation Switch
	LCM	Light Control Module
	LOAD	Calculated Load Value
	LOV	Life of Vehicle
	LVD	Logged Vehicle Data
	MAF	Mass Air Flow
	MAP	Manifold Absolute Pressure
	MDP	Manifold Differential Pressure
	MID	Message Identification
	MIL	Malfunction Indicator Lamp
MP7 US07		Mack 11 Liter Diesel Engine with US07 Compliant Emissions
	MP7 US2010	Mack 11 Liter Diesel Engine with US2010 Compliant Emissions
MP8 US07		Mack 13 Liter Diesel Engine with US07 Compliant Emissions
	MP8 US2010	Mack 13 Liter Diesel Engine with US2010 Compliant Emissions
MP10 US07		Mack 16 Liter Diesel Engine with US07 Compliant Emissions
	MP10 US2010	Mack 16 Liter Diesel Engine with US2010 Compliant Emissions
NCV		Needle Control Valve
NOP		Needle Opening Pressure
NOx	NOx	Nitrogen Oxide
	OBD	On Board Diagnostic
	OC	Oxidation Catalyst
	OL	Open Loop
	OSS	Output Shaft Speed
	PC	Pressure Control
	PID	Parameter Identification
	PL	Protect Lamp
PM		Particulate Matter
	PNP	Park/Neutral Position
	PPID	Proprietary Parameter Identification
PR		Passive Regeneration
	PROM	Programmable Read Only Memory
	PSID	Proprietary Subsystem Identification
PTO	PTO	Power Takeoff
PTT	PTT	Premium Tech Tool
	PW	Pulse Width

	PWM	Pulse Width Modulation
	RAM	Random Access Memory
	RFP	Rail Fuel Pressure
	ROM	Read Only Memory
	RPM	Revolutions Per Minute
	RSL	Red Stop Lamp
	RSL	Road Speed Limit
	SCR	Selective Catalytic Reduction
	SFP	Supply Fuel Pressure
	SFT	Supply Fuel Temperature
	SID	Subsystem Identification
SOV		Shut-Off Valve
SP		Spill Valve
	SPL	Smoke Puff Limiter
SRA		Smart Remote Actuator
	SRI	Service Reminder Indicator
	SPN	Suspect Parameter Number
	SRS	Supplemental Restraint System
	SRT	System Readiness Test
	SS	Shift Solenoid
	ST	Scan Tool
	TACH	Tachometer
	TC	Turbocharger
	TCM	Transmission Control Module
TDC		Top Dead Center
	TGW	Telematics Gateway
	TPM	Tire Pressure Monitoring
	TP	Throttle Position
	TPM	Tire Pressure Monitoring
	TR	Transmission Range
	TSS	Turbine Shaft Speed
	TWC	Three Way Catalyst
	UDS	Urea Dosing System
UHFP		Ultra High Fuel injection Pressure
ULSD		Ultra Low Sulfur Diesel
VBOC		Vertical Back of Cab
VCADS	VCADS	Vehicle Computer-Aided Diagnostic System
	VDA	Vehicle Data Administration
VECU	VECU	Vehicle Electronic Control Unit
VGT	VGT	Variable Geometry Turbocharger
	VIN	Vehicle Identification Number

	VLS	Vehicle Limiting Speed
	VREF	Voltage Reference
	VSG	Variable Speed Governor
	VSS	Vehicle Speed Sensor
	WCC	Wastegate Control Circuit
	WSL	Wait to Start Lamp

This Service Bulletin replaces bulletins 200-02 dated 12.2008 and 200-241 dated 3.2008.

Date	Group	No.	Release	Page
8.2010	<b>200</b>	<b>242</b>	<b>02</b>	1(7)

**General Safety Practices**

**Engine**

**PREVH, PREVX, B13R**

## **General Safety Practices**

Before servicing the engine or engine components, please review the following safety information:

### **Contents**

- “General Work Practices”, page 3
- “General Service Information”, page 7

# General

## Engine Safety Practices

There is no substitute for common sense and careful practices in the workplace. Improper practices or carelessness can cause burns, cuts, mutilation, asphyxiation, or other bodily injury or death.

This information contains general safety precautions and guidelines that must be followed to reduce risk to personal safety. Special safety precautions are listed in specific procedures when they apply.

Read and understand all of the safety precautions and guidelines before performing any repair.

## General Work Practices

### DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

### DANGER

Do not service any part of the fuel system while smoking or in the presence of flames, sparks, or hot surfaces. Failure to follow these precautions can result in fire, which can cause serious injury or death.

### DANGER

When operating the vehicle on streets and highways while testing is performed, it is mandatory to have one person drive while another performs the test. Failure to do so may cause a collision, which can result in serious injury or death.

### DANGER

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

### DANGER

Exhaust gases contain carbon monoxide. Always run the engine outdoors or use a properly vented exhaust hose. Prolonged or excessive exposure may cause serious illness or death.

### DANGER

Never operate the engine in an area where hydrocarbon vapors (gasoline, for example) are present or are suspected to be present. Hydrocarbon vapors can enter the air intake and over speed the engine, causing severe engine damage and/or an explosion and fire. Serious personal injury or death could occur.

### DANGER

Always use a piece of paper or cardboard when checking for a leak. Escaping fluid under high pressure, even a pin-hole sized leak, can penetrate body tissue, causing serious injury or death. If fluid is injected into your skin, immediate treatment must be administered by a doctor familiar with this type of injury.

### DANGER

Compressed air can cause serious personal injury. When using compressed air for cleaning, wear a protective face shield, protective clothing and protective shoes. Pressurized water could cause particles and/or hot water to be sprayed in your direction and cause personal injury. The maximum air pressure must be below 200 kPa (30 psi) for cleaning purposes.

### DANGER

The diesel engine will operate on any fuel which enters the cylinder, whether it is from the injectors or from the air intake system. Therefore, if any solvent is used to flush out the air cleaner element, the engine may over speed during start-up. Engine damage and severe injury and/or death from burns or explosion can occur.

### DANGER

Excessive heat may cause the pressurized components of the air conditioning system to explode. Some mixtures of R134a refrigerant can become combustible at elevated pressures. Never weld, solder, steam clean or use a gas torch near any part of the air conditioning system. Severe injury or death may occur from an explosion.

### DANGER

DO NOT use ether or other combustible starting aids on any engine equipped with an intake air heater (IAH). If the engine is equipped with an IAH, introduction of ether or similar starting aids could cause a fire or explosion resulting in severe property damage, serious personal injury or death.



 **DANGER**

Exhaust gases and components can be at extremely high temperatures during aftertreatment diesel particulate filter (DPF) regeneration. When parking the vehicle, keep away from any flammable materials, vapors, or structures.

 **DANGER**

The temperature of the exhaust system components during the aftertreatment DPF regeneration process can exceed 350 °C (660 °F). The exhaust gas leaving the system can reach 505 °C (940 °F). Various factors (including ambient temperature and duration of the aftertreatment (DPF regeneration process) determine when these components will return to normal operating temperature after aftertreatment DPF regeneration has completed. Be extremely careful around these hot components. Contact with these components can result in serious personal injury.

 **DANGER**

The engines use high voltage to the electronic injectors. Do not come in contact with the injector terminals while the engine is running as there could be as much as 90V going to the electronic injectors. Contact may result in electrical shock. Personal injury or death can occur.

 **WARNING**

Use a hoist or get assistance when lifting components that weigh 23 kg (50 lb) or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. Always use a spreader bar when necessary. The lifting hooks **MUST NOT** be side loaded. Failure to follow these warnings may result in personal injury.

 **WARNING**

Always wear appropriate eye protection to prevent the risk of eye injury due to contact with debris or fluids.

 **WARNING**

Use caution when installing test equipment, and keep yourself away from hot engine components and/or fluids. A hot engine and/or fluids can permanently damage test equipment or can cause personal injury due to burns.

 **WARNING**

Clean up fuel spills immediately. Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire.

 **WARNING**

Do not work near the fan with the engine running or the ignition in the ON position. The engine fan can engage at any time without warning. Anyone near the fan when it turns on could be seriously injured. Before turning on the ignition, be sure that no one is near the fan.

 **WARNING**

Use **ONLY** the correct engine barring techniques for manually rotating the crankshaft. **DO NOT** attempt to rotate the engine by pulling or prying on the fan. This practice can cause serious personal injury.

 **WARNING**

Do not remove the coolant fill cap (or cap on the expansion tank) if the engine coolant is hot; wait until engine coolant temperature (ECT) is less than 50 °C (120 °F). Otherwise, scalding steam or fluid may escape under pressure, which can cause serious injury.

 **WARNING**

Do not remove coolant hoses when the engine cooling system is hot and under pressure. Doing so can cause scalding and burns on exposed parts of the body.

 **WARNING**

Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects and other reproductive harm.

 **WARNING**

Always replace fuses and circuit breakers with the same current/amperage. Increasing fuse or circuit breaker rating may result in electrical circuit overheating and possible fire.

 **WARNING**

DO NOT access the engine compartment if you see or hear steam or coolant escaping. Wait until steam or coolant can no longer be seen or heard before opening the engine compartment.

 **WARNING**

Coolant may be combustible. Coolant leaked or spilled onto hot surfaces or electrical components can cause a fire. Clean up coolant spills immediately.

 **WARNING**

Always wear eye protection when working around batteries to prevent the risk of injury due to contact with sulfuric acid or an explosion.

 **WARNING**

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

 **WARNING**

DO NOT store fuel containers in the vehicle. They may leak, explode and cause or feed a fire. Empty or full, they present a hazard that may lead to burns in the event of a fire.

 **WARNING**

DO NOT remove, attach, or tighten turbocharger air intake ducting while the engine is operating, or operate the engine while the ducting is removed. Working around the turbocharger with the ducting removed may cause severe personal injury.

 **WARNING**

Exhaust system components can be hot. Contact with hot components can cause severe personal injury. Allow the exhaust system to cool before working with exhaust system components.

 **WARNING**

Aftertreatment diesel exhaust fluid (DEF) is an irritant. Contact with aftertreatment DEF can irritate the skin and eyes. Inhaling aftertreatment DEF mist can cause lung irritation. Avoid aftertreatment DEF contact with skin and eyes. Avoid breathing mist created by aftertreatment DEF spray.

 **WARNING**

DEF can irritate skin. If DEF gets on your skin, remove contaminated clothing and wash skin thoroughly with soap and water. Get medical help if skin becomes irritated. Wash clothes before you wear them again.

 **WARNING**

DEF can irritate eyes. If DEF gets in your eyes, flush your eyes immediately with water for at least 15 minutes, lifting the upper and lower eyelids occasionally. Get medical help if eye irritation persists.

 **WARNING**

DEF can irritate your lungs and respiratory system. If you inhale DEF vapor, move to a location where you can breathe fresh air. Get medical help if breathing becomes difficult.

 **WARNING**

If DEF is spilled on hot components turn your face away immediately. DEF vaporizes quickly and the vapor can burn your face and eyes.

 **CAUTION**

Do not spill DEF onto exposed connectors when you disconnect hoses and remove parts. If you spill DEF on an exposed connector, you must replace the connector immediately. DEF is highly corrosive to metal, particularly copper and aluminum. It will not help if you try to clean DEF off of the connectors with water or compressed air, because DEF quickly oxidizes metal and "creeps" into the wiring.

 **CAUTION**

Make sure to thoroughly clean DEF off of tools and clothes, so fluid or crystals doesn't get on parts that could be damaged.

 **CAUTION**

Observe the greatest possible cleanliness when working on the cylinder head. Dirt particles in the fuel and oil channels can cause the injectors to malfunction, and can cause the engine brake (if equipped) to fail.

 **CAUTION**

Never add coolant to a hot or overheated engine. Engine damage can result. Allow engine to cool sufficiently before servicing.

 **CAUTION**

Handling and disposal of used engine oils may be subject to federal, state, and local law and regulation. Use authorized waste disposal facilities, including civic amenity sites and garages providing authorized facilities for receipt of used oil. If in doubt, contact your state and local environmental authorities or the Environmental Protection Agency (EPA) for guidance as to proper handling and disposal of used engine oil.

 **CAUTION**

Failure to properly set the camshaft timing to the crankshaft may result in loss of performance, poor fuel economy or, in extreme cases, damage to engine and components.

 **CAUTION**

Do not weld on the engine or engine components. Welding on the engine or components mounted on the engine can cause serious damage to the engine control module (ECM).

 **CAUTION**

Always dispose of all lubricants (motor oil, coolant, gear box oils, etc) and filters according to Federal or local regulations. Used oil disposed of in nature or waterways contaminates our drinking water and kills wildlife.

 **CAUTION**

When using a pressure washer to clean the vehicle, do not direct the spray at electrical components in the engine compartment such as the alternator, starter and compressors. Water spray from pressure washers can damage electrical components.

 **CAUTION**

If there are other ground cables connected to the battery [such as ECM, transmission electronic control unit (ECU), etc.], disconnect those wires first, then remove the main battery ground cable. Electronic modules may be damaged when their ground(s) are connected/disconnected with the main battery ground disconnected. Therefore, disconnect the main battery ground last or when installing, connect the main ground first.

 **CAUTION**

Shutting off an engine immediately after high speed or full load operation can damage the turbocharger and cause heat stress in the engine. Always let the engine idle for 3 to 5 minutes before shutting it off.

 **CAUTION**

Continuously restarting the engine once the shutdown system is active may result in severe engine damage.

 **CAUTION**

Diesel engines for 2010 and later model year vehicles are designed to operate only with Ultra Low Sulfur Diesel (ULSD) fuel. Use of fuel other than ULSD will reduce the efficiency and durability of the engine, permanently damaging the advanced emission control systems, reducing fuel economy, and possibly preventing the engine from running at all. Manufacturer's warranties are likely to be rendered void by usage of improper or incorrect fuel, and usage of fuels other than ULSD fuel in diesel-powered vehicles is illegal and punishable with civil penalties. Use of fuel additives to compensate for the lower sulfur content is not recommended by Volvo Bus Corporation. Blends of No. 1D and No. 2D grades of ULSD are recommended and allowable for cold weather operations.

 **CAUTION**

Do not put diesel fuel in the aftertreatment DEF tank. Diesel fuel, if sprayed into the hot exhaust along with the aftertreatment DEF, could ignite explosively causing a fire resulting in personal injury or damage to the exhaust system.

 **CAUTION**

Aftertreatment DEF is corrosive to certain metals. Spilled aftertreatment DEF can damage metal surfaces or components. Handle aftertreatment DEF properly to avoid aftertreatment DEF contact with metal objects.

 **CAUTION**

If the vehicle is in a location that may be hazardous when aftertreatment DPF regeneration required begins (i.e., in close proximity to flammable materials or gases, inside tunnels, parked under flammable objects, etc.), the aftertreatment DPF regeneration required should be stopped. If aftertreatment DPF regeneration required is stopped by the vehicle operator, it must be initiated at a later time when the vehicle is in a safer location. Aftertreatment DPF regeneration required that are stopped and never restarted at a later time, however, will require that the vehicle be taken to an authorized Volvo Bus Corporation dealer the have the aftertreatment regeneration manually started with special service tools.

 **CAUTION**

Do not fill the aftertreatment DEF tank with diesel fuel, water, other liquids, or other aftertreatment DEF because they will damage the aftertreatment DEF system. Use only VOLVO specified aftertreatment DEF (ISO 222241-1) in the aftertreatment DEF tank. Never start the engine if you have filled the tank with anything other than pure aftertreatment DEF.

 **CAUTION**

Using an aftertreatment DEF not approved by VOLVO will damage the aftertreatment system permanently. Engine output will be negatively affected and other engine components also risk being damaged.

 **CAUTION**

Welding on buses can damage the vehicle electrical system/components due to the voltage and current spikes that normally occur when welding. It is preferable to avoid welding on an assembled bus. However, if any structure on or in contact with the vehicle must be welded, follow the recommendations below:

- 1 Before welding on the vehicle, disconnect power to the component being welded.
- 2 Disconnect both the positive (+) and negative (-) battery cables. Disconnect the negative cable first. Reconnect the positive cable first. Vehicles equipped with battery "quick disconnect" must still have the cables removed directly at the battery.
- 3 Disconnect engine/starter ground from the chassis. Disconnect the power harness and vehicle interface harness at the ECM.
- 4 If vehicles are equipped with systems that have their own ECUs, such as ABS brakes, vehicle ECU, or instrument cluster, disconnect each control unit at each electrical connection. This "opens" the circuit and will prevent transient voltage from reaching from one ECU to another.

**Note:** Before disconnecting the connectors, the ignition switch must be turned to the **OFF** position.

- 5 Attach the welder ground cable as close to the weld as possible (no more than 610 mm (24 in) from the part being welded).
- 6 Do not connect the welder ground cable to the ECM or the ECM cooling plate.
- 7 Welding cables should not be allowed to lay on, near or cross over any electrical wiring or electronic component during the welding procedure.
- 8 After the welding process has been completed and the welded parts have cooled, inspect wiring and components for possible shorts or damage which would allow the possibility of drawing excessive currents or cause short circuits when the batteries are reconnected.

## General Service Information

- Never remove the ECM connectors or any other electrical wires from the sensors while the engine is running. The ignition key must be in the **OFF** position and the engine stopped.
- Never turn the battery master switch **OFF** or disconnect the battery cables while the engine is running.
- When oven-drying spray-paint work, any ECUs must be removed from the bus. The maximum allowable drying temperature, with the control units in the vehicle, is 80 °C (176 °F).
- Use only batteries for auxiliary starting. Using a starting unit can induce peak voltages that can damage the electronic components.
- When charging batteries with a rapid charger, battery cables must be disconnected. (Normal trickle charging does not require this procedure.)
- If a connector is removed, make sure it is reinstalled correctly and is not covered with oil or other fluids which can result in a poor connection.

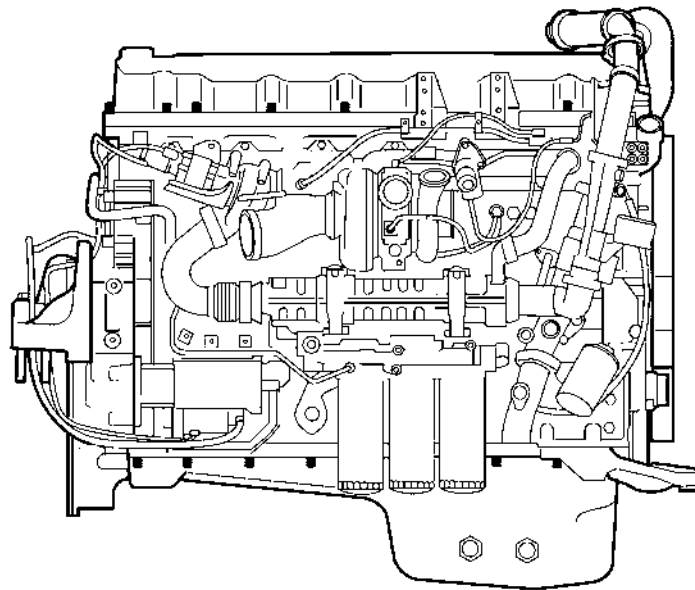
This service bulletin replaces bulletin 200-321 dated 4.2011.

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9.2011	<b>200</b>	<b>321</b>	<b>03</b>	1(46)

Specifications

D13

## Specifications



W2005779

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**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Specifications

## General

### Weights and Dimensions

Engine type	In-line direct injection diesel
Number of cylinders	6
Displacement	13 L
Swept volume	12.78 L
Cylinder bore and stroke	131 x 158 mm (5.16 x 6.22 inches)
Emissions level	US07: 2.5g NOx; 0.1g Pt maximum US2010: 0.2 g/hp-hr NOx maximum
Fuel system	Electronic injector
Valve actuation	Single overhead camshaft, four valves per cylinder
Aspiration	Variable geometry turbocharger with sliding nozzle ring
Cylinder and piston type	Wet Sleeve; one-piece steel piston
Electronic control	Volvo Vectro electronic management system
Emission controls	US07: Cooled EGR; Diesel Particulate Filter (DPF) US2010: Cooled EGR; Diesel Particulate Filter (DPF); Selective Catalytic Reduction (SCR)
Peak power ratings	375–500 hp
Peak torque ratings	1965–2373 Nm (1450–1750 ft-lb)
Adjustable low idle	550–700 rpm, default 600 rpm
Top speed	2100 rpm
Maximum full load revolutions	High Idle – 2200 rpm, Peak Power – 2100 rpm
Weight	Approximately 1,130 kg (2500 lb)
Firing order	1-5-3-6-2-4
Compression ratio	16:1
Fasteners and threads	Metric
Flywheel housing (standard)	Aluminum
Total length	1366 mm (54 inches)
Total width	971 mm (38 inches)
Total height	1281 mm (50 inches)

**Component Features and Materials**

Item	Description
Air compressor	Flange mounted, oil lubricated, water cooled
Camshaft	Induction hardened, gear driven
Coolant conditioner	Spin-on type, disposable
Connecting rods	Forged steel, cracked cap design
Crankshaft	Drop forged steel, induction hardened, seven main bearings
Cylinder block	In-line six cylinder, nodular iron, machined with bearing caps, stiffener plate, timing gear mounting plate, guide dowels for cylinder head; wet replaceable cylinder sleeves
Cylinder head	One-piece cast iron alloy; overhead camshaft, four valves per cylinder, injectors; cast iron valve guides and oil seals; steel valve seats; copper or stainless steel injector sleeves; integral fuel passages and thermostat housing; guide slots for installation on block
Valve cover	Plastic, 20 spring tension screws
Cylinder liner	Wet Sleeve; replaceable; with EDPM rubber and Viton seals
Cylinder head — Valve springs	Double springs on each exhaust valve
Cylinder head — Valve guides	Cast iron, replaceable; with oil seals
Cylinder head gasket	One-piece steel stamping; elastomer seals added; one-time bosses to aid in head installation
Cylinder head bolts	M16 (38)
Timing gear cover (rear of cylinder head)	Die-cast aluminum, elastomer seals
Flywheel housing	Die-cast aluminum
Fuel filters	One 30-micron primary, one 5-micron secondary
Fuel injection	Six individually programmed unit injectors: ECM controlled; common fuel gallery in head; constant supply pressure; over-pressure return
Fuel supply pump	Gear type pump integral with power steering pump; idler gear driven
Lubrication system	Crankshaft gear driven oil pump; system integrated with block and head; serves camshaft, rocker arm shaft, pistons, crankshaft, air compressor, turbocharger, EGR valve; three oil filters; oil level and temperature sensor in oil pan; pump pressure tube, strainer and pressure relief valve
Main bearing caps	Nodular iron; machined with block; No. 7 mounts oil pump; numbered for reassembly; sleeve guides for screws; thrust washers at No. 4 main bearing journal
Exhaust manifold	Three-piece, six port
Pistons	One-piece steel; three ring grooves
Piston rings — Compression	Two: one trapezoidal cross section, one rectangular cross section
Piston rings — Oil	One: garter spring type; scraping
Oil filters	Two 40-micron full flow, one 5-micron bypass; Filter capacity, two full flow: <ul style="list-style-type: none"> <li>• 4.0–4.5 liters (4.2–4.8 quarts)</li> </ul>



Item	Description
Oil pan	Plastic, steel; 22 spring tension screws Sump capacity: • 36 liters (38 quarts)
Thermostat	Sleeve type: 82°C (180°F)
Thermostat housing	Integrated in cylinder head
Turbocharger	Variable geometry type: Holset; exhaust driven; fixed vanes; sliding ring nozzle; infinitely variable volume; oil and water cooled
Valve lifters	Roller followers
Valve seat inserts	Pressed in head; replaceable
Vibration damper	Internal fluid-filled ring
Coolant pump	Centrifugal rotor impeller; belt driven

## Engine

### Cylinder Head

Maximum unevenness (bottom face) .....	0.1 mm (0.004 inch)
--	---------------------

### Cylinder Head Bolts

Quantity .....	38
Thread size .....	M16
Length.....	200 mm (7.87 inches)

### Cylinder Block

Length.....	1052 mm (41.42 inches)
Height, upper block face — crankshaft center.....	422 mm (16.61 inches)
Height, lower block face — crankshaft center .....	120 mm (4.72 inches)

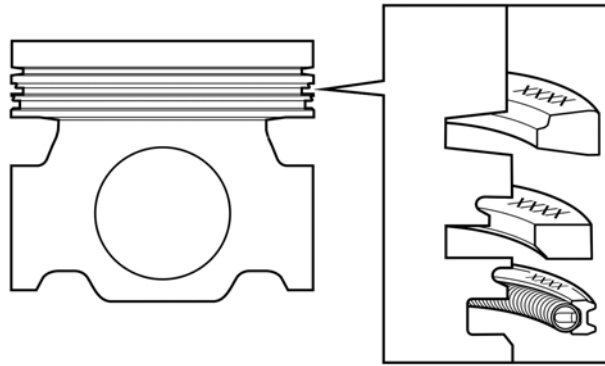
### Cylinder Liner

Type .....	Wet, replaceable
Height of sealing surface above block face .....	0.15–0.21 mm (0.006–0.008 inch)
Number of sealing rings per cylinder liner .....	1 + 3

### Piston

Number of ring grooves .....	3
Front marking .....	Arrow pointing forwards

## Piston Rings

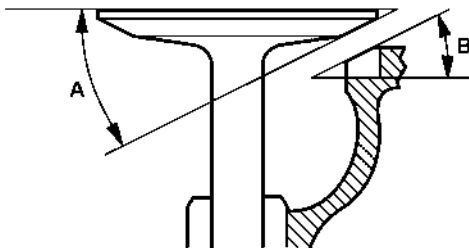


T2022726

<b>Compression Rings</b>	
Quantity .....	2
Labelling .....	Up (color marking to left of gap)
Piston ring clearance in groove:	
Upper compression ring .....	Trapezium profile
Lower compression ring .....	0.09–0.14 mm (0.0035–0.0055 inch)
<b>Oil Scraper Ring</b>	
Quantity .....	1
Labelling .....	Up (color marking to left of gap)
Piston ring clearance in groove .....	0.05–0.10 mm (0.0019–0.0039 inch)

# Valve Mechanism

## Valves



T2019432

Valve disc diameter:

Inlet..... 42 mm (1.654 inches)  
Exhaust..... 40 mm (1.575 inches)

Valve stem diameter:

Inlet/Exhaust..... 8 mm (0.315 inch)

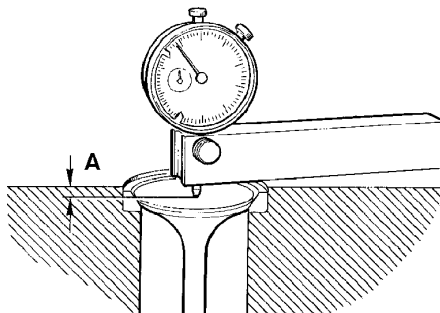
Valve face angle (A):

Inlet..... 24.5 degrees  
Exhaust..... 39.5 degrees

Valve seat angle in cylinder head (B):

Inlet..... 25 degrees  
Exhaust..... 40 degrees

**Note:** When replacing valve seats, also replace the valves.



T2023980

Measurement (A) between valve head and cylinder head face:

Inlet..... 1.0 mm (0.039 inch) minimum  
Exhaust..... 1.35 mm (0.053 inch) minimum

Maximum wear value:

Inlet..... 1.7 mm (0.067 inch)  
Exhaust..... 1.5 mm (0.059 inch)

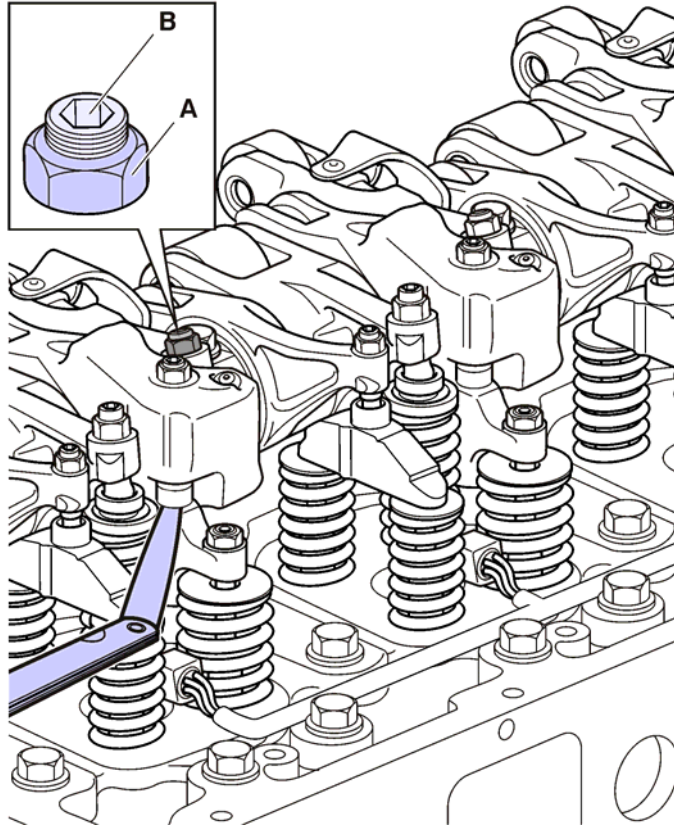
Valve lash (clearance) cold engine, adjustment value:

Inlet.....	0.2 mm (0.008 inch)
Exhaust.....	0.8 mm (0.031 inch)
Exhaust, engine brake.....	1.0 mm (0.394 inch)

Valve lash (clearance) cold engine, check value:

Inlet.....	0.15–0.25 mm (0.006–0.009 inch)
Exhaust.....	0.75–0.85 mm (0.029–0.033 inch)
Exhaust, engine brake.....	0.95–1.05 mm (0.037–0.041 inch)

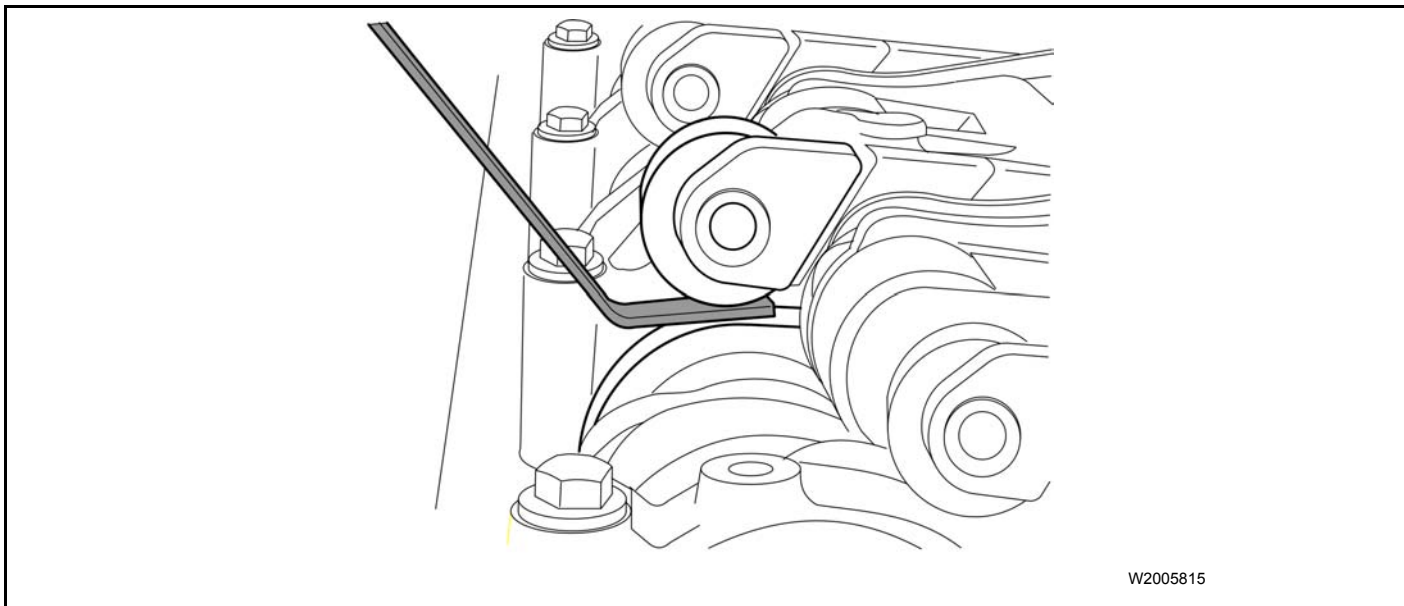
## Engine Brake Rocker Arm, Engine Brake



T2027091

Engine brake rocker arm, adjustment:

Valve caliper pressed down by adjusting screw (B)..... tighten the adjuster screw until it makes contact and then a further 1/2 turn until the valve yoke clearly moves down and the exhaust valve opens slightly



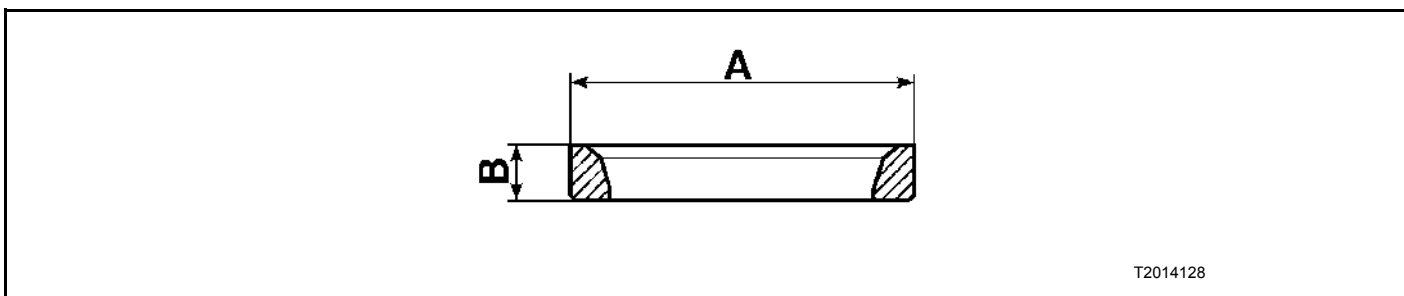
Engine brake rocker arm clearance ..... 2.5 mm (0.098 inch)

**Rocker Arms**

Rocker arm bearing clearance ..... 0.08 mm (0.003 inch) maximum

Rocker arm roller clearance ..... 0.1 mm (0.004 inch) maximum

**Valve Seats**

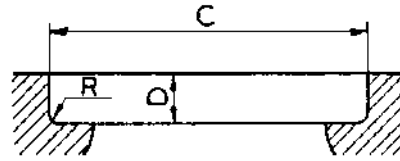


Standard outside diameter (A):  
 Inlet ..... 45.1 mm (1.776 inches)  
 Exhaust ..... 43.1 mm (1.697 inches)

Oversize outside diameter (A):  
 Inlet ..... 45.3 mm (1.783 inches)  
 Exhaust ..... 43.3 mm (1.705 inches)

Height (B):  
 Inlet ..... 7.55 mm (0.297 inch)  
 Exhaust ..... 7.5 mm (0.295 inch)

## Valve Seat Location

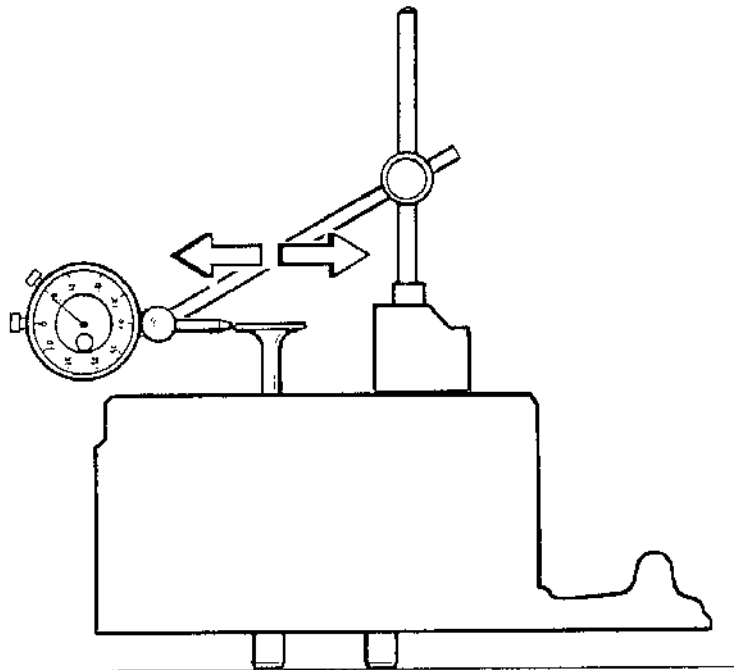


T2012872

Standard diameter (C):	
Inlet.....	45.0 mm (1.772 inches)
Exhaust.....	43.0 mm (1.693 inches)
Oversize diameter (C):	
Inlet.....	45.2 mm (1.78 inches)
Exhaust.....	43.2 mm (1.701 inches)
Depth (D):	
Inlet.....	11.8 ± 0.13 mm (0.465 ± 0.005 inch)
Exhaust.....	11.2 ± 0.13 mm (0.441 ± 0.005 inch)
Seat bottom radius (R):	
Inlet/Exhaust.....	0.8 mm (0.032 inch) maximum

## Valve Guides

Length:	
Inlet/Exhaust.....	83.5 mm (3.287 inches)
Inner diameter:	
Inlet/Exhaust.....	8 mm (0.315 inch)
Height above cylinder head spring surface:	
Inlet/Exhaust.....	24.5 ± 0.2 mm (0.965 ± 0.008 inch)



C2000483

Valve stem-to-guide wear clearance:<sup>1</sup>

Inlet.....	0.7 mm (0.027 inch) maximum
Exhaust.....	0.7 mm (0.027 inch) maximum

<sup>1</sup> The measurements are calculated for the measurement method described in the service literature, see Function Group 214.

## Valve Springs

Inlet valve spring:

Length unloaded..... 73.8 mm (2.91 inches)

Exhaust outer valve spring:

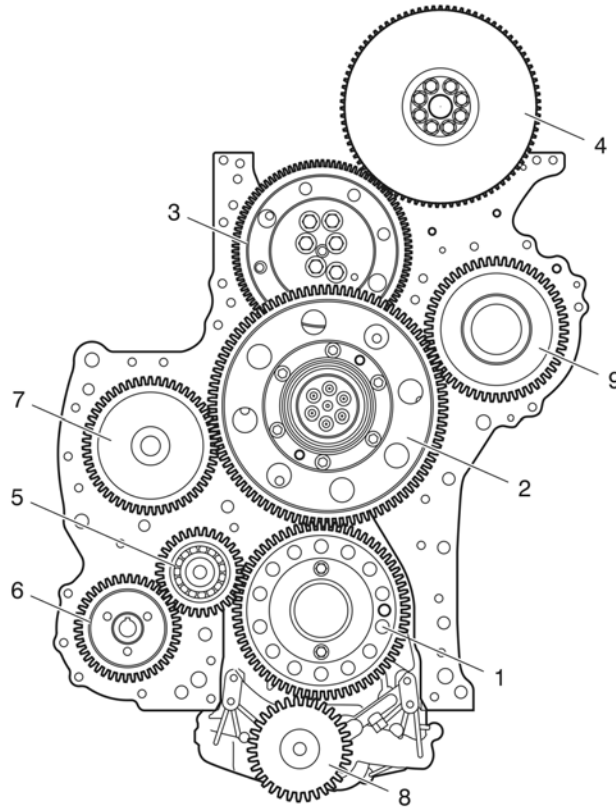
Length unloaded..... 73.8 mm (2.91 inches)

Exhaust inner valve spring:

Length unloaded..... 70.5 mm (2.78 inches)

# Engine Timing Gears

## Timing Gears



T2022797

Component.....	Number of Teeth
1. Drive gear, crankshaft .....	63
2. Idler gear, outer and inner drive .....	Outer: 84, Inner: 56
3. Idler gear, adjustable .....	73
4. Drive gear, camshaft .....	84
5. Idler gear, power steering pump .....	29
6. Drive gear, power steering pump .....	36
7. Drive gear, air compressor .....	48
8. Drive gear, lubricating oil pump .....	31
9. Engine power take-off (optional) .....	50
Idler gear to camshaft gear backlash (adjustable).....	0.05–0.15 mm (0.002–0.006 inch)
Oil pump backlash .....	0.05–0.40 mm (0.002–0.016 inch)
Idler gear axle-to-bushing clearance .....	0.05 mm (0.002 inch) maximum
All other drive and idler gear, backlash.....	0.05–0.17 mm (0.002–0.007 inch)



## Camshaft

**Control of camshaft settings, cold engine and valve clearance for cylinder 1 inlet valve equals zero.**

Inlet valve for cylinder 1 should be open  $1.6 \pm 0.3$  mm ( $0.063 \pm 0.012$  inch) at a flywheel position of 6 degrees after TDC. When checking, the timing gears must be rotated in the correct direction (counterclockwise) in order to take up all gear tooth clearance.

Axle arrangements ..... Gear

Number of bearings ..... 7

Standard bearing journal diameter ..... 69.97–70.00 mm (2.754–2.760 inch)

**Undersize bearing journal diameters:**

0.25 mm (0.010 inch)..... 69.72–69.78 mm (2.746–2.747 inches)

0.50 mm (0.020 inch)..... 69.47–69.53 mm (2.735–2.737 inches)

0.75 mm (0.030 inch)..... 69.22–69.28 mm (2.725–2.728 inches)

**Valve lift at zero play:**

Inlet..... 13.1 mm (0.520 inch)

Exhaust VEB ..... 12.5 mm (0.490 inch)

Permitted wear, entire camshaft profile ..... 0.1 mm (0.0039 inch) maximum

Unit injector, stroke ..... 18 mm (0.710 inch)

**Wear value**

Max end float ..... 0.24 mm (0.0094 inch)

Bearing, permitted diametrical wear ..... 0.1 mm (0.0039 inch) maximum

## Camshaft Bearings

Camshaft bearing thickness, standard ..... 1.92 mm (0.075 inch)

**Oversize:**

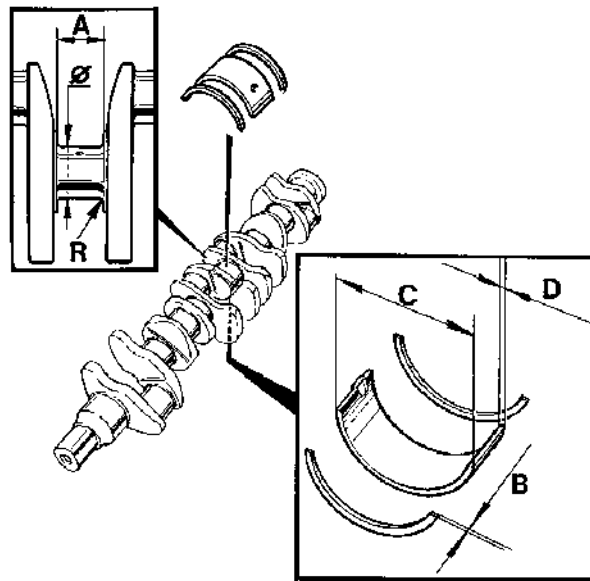
0.25 mm (0.010 inch)..... 2.04 mm (0.080 inch)

0.50 mm (0.020 inch)..... 2.17 mm (0.085 inch)

0.75 mm (0.030 inch)..... 2.29 mm (0.090 inch)

# Crank Mechanism

## Crankshaft



T2012873

**Wear value:**

Crankshaft axial clearance<sup>1</sup> ..... 0.4 mm (0.016 inch) maximum

**Machining value:**

Main bearing and connecting rod bearing journal out-of-round ..... 0.006 mm (0.0002 inch) maximum

Main bearing and connecting rod bearing journal taper ..... 0.02 mm (0.0008 inch) maximum

Runout of middle bearing ..... 0.15 mm (0.006 inch) maximum

<sup>1</sup> The measurements refer to lubricated components.

## Main Bearing Journals

Standard diameter (Ø).....	108.0 mm (4.25 inches)
<b>Undersize diameter:</b>	
0.25 mm (0.010 inch).....	107.75 mm (4.2421 inches)
0.50 mm (0.020 inch).....	107.50 mm (4.2323 inches)
0.75 mm (0.030 inch).....	107.25 mm (4.2224 inches)
1.00 mm (0.040 inch).....	107.00 mm (4.2126 inches)
1.25 mm (0.050 inch).....	106.75 mm (4.2027 inches)
Surface finish, main bearing journal .....	Ra 0.25
Surface finish, radius .....	Ra 0.4
Width, axial bearing pin (A), standard .....	47.0 mm (1.850 inches)
<b>Oversize:</b>	
0.2 mm (0.008 inch), axial bearing 0.1 mm (0.004 inch) .....	47.2 mm (1.858 inches)
0.4 mm (0.016 inch), axial bearing 0.2 mm (0.008 inch) .....	47.4 mm (1.866 inches)
0.6 mm (0.241 inch), axial bearing 0.3 mm (0.012 inch) .....	47.6 mm (1.874 inches)
Recess radius (R).....	4.0 mm (0.157 inch)

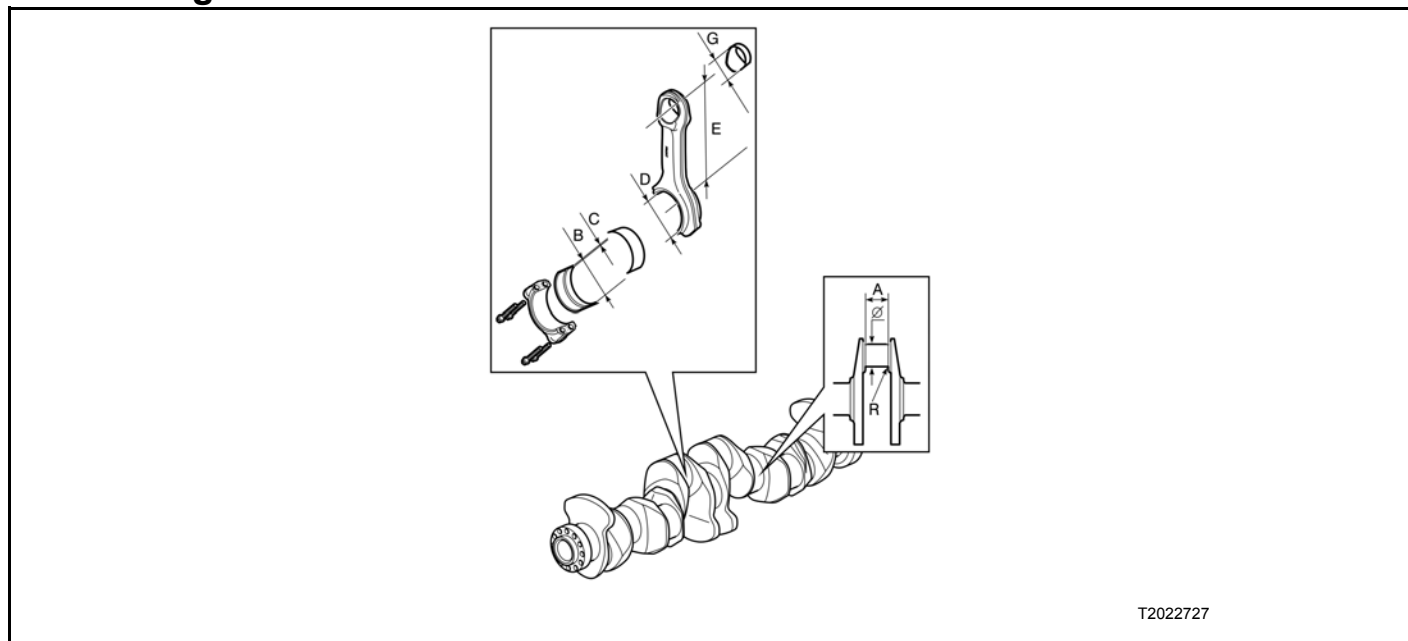
## Thrust Washers (Axial Bearing)

Standard width (B).....	3.18 mm (0.125 inch)
Oversize:	
0.1 mm (0.004 inch).....	3.28 mm (0.129 inch)
0.2 mm (0.008 inch).....	3.38 mm (0.133 inch)
0.3 mm (0.012 inch).....	3.48 mm (0.137 inch)
0.4 mm (0.016 inch).....	3.58 mm (0.141 inch)

## Main Bearings

Standard thickness (D).....	2.48 mm (0.098 inch)
Oversize:	
0.25 mm (0.010 inch).....	2.61 mm (0.103 inch)
0.50 mm (0.020 inch).....	2.74 mm (0.108 inch)
0.75 mm (0.030 inch).....	2.86 mm (0.112 inch)
1.00 mm (0.040 inch).....	2.98 mm (0.117 inch)
1.25 mm (0.050 inch).....	3.11 mm (0.122 inch)
Main bearing maximum permitted diametrical wear value .....	0.05–0.12 mm (0.002–0.005 inch) max.

## Connecting Rod Journals



T2022727

Diameter (Ø).....	99.0 mm (3.898 inches)
Undersize:	
0.25 mm (0.010 inch).....	98.75 mm (3.888 inches)
0.50 mm (0.020 inch).....	98.50 mm (3.878 inches)
0.75 mm (0.030 inch).....	98.25 mm (3.868 inches)
1.00 mm (0.040 inch).....	98.00 mm (3.858 inches)
1.25 mm (0.050 inch).....	97.75 mm (3.848 inches)
Surface finish, bearing journal .....	Ra 0.25
Surface finish, radius .....	Ra 0.4
Width (A).....	57.0 mm (2.244 inches)
Recess radius (R).....	4.0 mm (0.157 inch)

## Connecting Rod Bearings

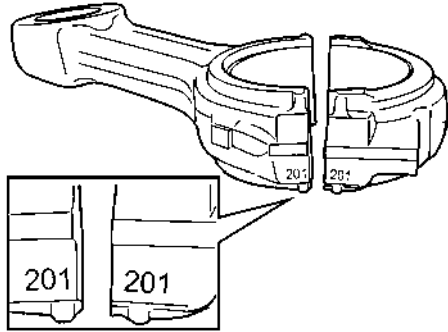
Standard thickness (C).....	2.39 mm (0.094 inch)
Oversize:	
0.25 mm (0.010 inch).....	2.64 mm (0.104 inch)
0.50 mm (0.020 inch).....	2.89 mm (0.114 inch)
0.75 mm (0.030 inch).....	3.14 mm (0.124 inch)
1.00 mm (0.040 inch).....	3.39 mm (0.134 inch)
1.25 mm (0.050 inch).....	3.64 mm (0.143 inch)

## Connecting Rod

<b>Wear Value</b>	
End play, connecting rod at crankshaft journal <sup>1</sup> .....	0.35 mm (0.0138 inch) maximum
Big-end bearing, diametrical play <sup>1</sup> .....	0.1 mm (0.004 inch)

<sup>1</sup> The measurements refer to lubricated components.

Marking:  
 The FRONT marking on the connecting rod faces forward



The diagram shows a perspective view of a connecting rod and its cap. The rod has a '201' marking on its side. The cap has a '20' marking on its side. An inset shows two views of the end of the rod, both with '201' markings.

T2019085

The connecting rod and cap are marked as a pair with a three-digit serial number.

## Flywheel, mounted

Axial runout (manual transmission) measurement radius 150 mm (5.91 inches).....	Less than 0.21 mm (0.008 inch)
---	--------------------------------

## Flywheel Housing, mounted

Axial runout of contact surface against clutch housing.....	0.2 mm (0.008 inch) maximum
Radial runout of guide against clutch housing.....	0.26 mm (0.010 inch) maximum

## Lubricating and Oil System

### Oil

For oil change volume, specification and maintenance intervals, refer to Service Information, Function Group 175.

### Oil Pressure

Operating speed (over 1,100 rpm) .....	300–550 kPa (45–80 psi)
Cold engine (above 1,100 rpm) .....	650 kPa (95 psi)
Low idle .....	250 kPa (35 psi) minimum
Piston cooling pressure, hot engine (above 1,100 rpm) .....	200–300 kPa (30–45 psi)

### Oil Pressure, Rocker Arm Shaft

Engine brake non-activated .....	80–120 kPa (12–17 psi)
Engine brake activated (900–2300 rpm) .....	220 kPa (32 psi) minimum

### Oil Temperature

Hot engine, engine running (coolant temperature 75–95°C (167–203°F) .....	90–110°C (194–230°F) <sup>1</sup>
---	-----------------------------------

<sup>1</sup> Up to 125°C (257°F) with heavy load

### Lubricating Oil Pump

Type .....	Gear driven
Number of teeth, drive gear .....	31
Backlash .....	0.05–0.40 mm (0.0019–0.0157 inch)

### Oil Filter Housing Valves

Item	Spring Free Length	Spring Length Under Load
Safety valve, oil pump	74 mm (2.914 inches)	Load: 35 N (7.87 lbf) Length: 41 mm (1.61 inches)
Reduction valve marking — yellow	61 mm (2.402 inches)	Load: 66 N (14.84 lbf) Length: 39 mm (1.54 inches)
Overflow valve, full flow filter	69 mm (2.717 inches)	Load: 13–15 N (2.92–3.37 lbf) Length: 40 mm (1.575 inches)

Piston cooling jet control solenoid valve: 9.5 - 11.5 ohms at 20°C (68°F)
Oil cooler thermostat solenoid valve: 6.8 - 11.2 ohms at 20°C (68°F)

## Fuel System

### Fuel Pump Pressure

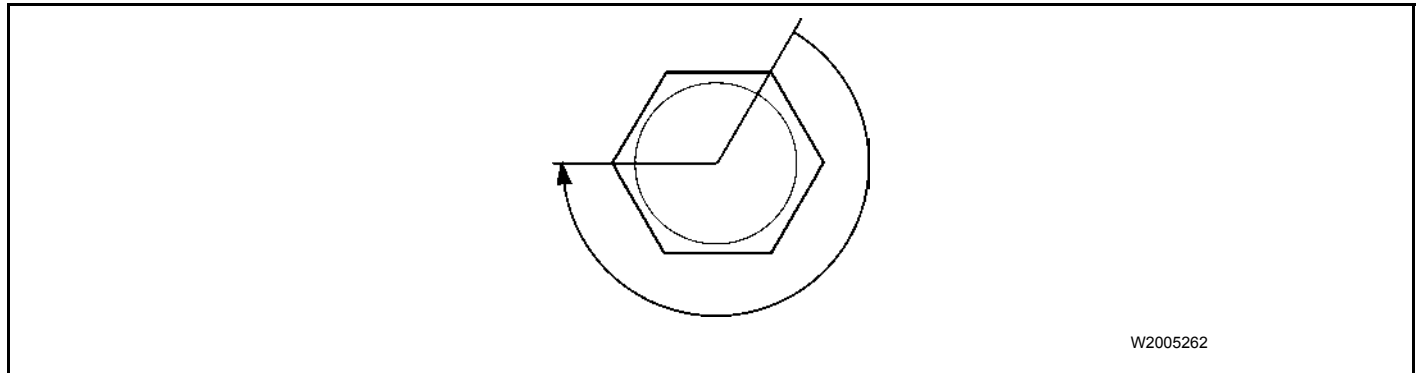
600 rpm .....	100 kPa (15 psi) minimum
1200 rpm .....	300 kPa (44 psi) minimum
Full load .....	300 kPa (44 psi) minimum

### Overflow Valve

Opening pressure .....	300–550 kPa (44–80 psi)
------------------------	-------------------------

### Injectors

To adjust the rocker arm pretension for injectors:



W2005262

Tighten the rocker arm adjusting screw .....	Obtain zero clearance
Tighten the rocker arm adjusting screw .....	Additional 4 flats (2/3 turn) clockwise

## Inlet and Exhaust System

### Variable Geometry Turbocharger

Turbine rotor shaft axial clearance .....	0.040–0.090 mm (0.002–0.004 inch) maximum
Turbine rotor shaft radial clearance .....	0.330–0.500 mm (0.013–0.020 inch) maximum

### Heat Retention Function

Heat retention activated:	
Coolant temperature .....	Less than 60°C (140°F)
Engine load .....	Less than approximately half load
Heat retention deactivated:	
Coolant temperature .....	Greater than 70°C (158°F)
Engine load .....	Greater than approximately half load
Ambient temperature .....	Greater than 13°C (55°F)

### Inlet Manifold Air Temperature Sensor

Cold engine, engine off .....	Ambient temperature
Warm engine, engine running with coolant temperature at 75–95°C (167–203°F) .....	40°C (104°F) above ambient temperature

## Engine Brake Activation

Braking Force (%)	Engine Brake (On/Off)
40%	Off
50% <sup>1</sup>	On
70%	On
100%	On
Cruise mode	On/Off

<sup>1</sup> 50% braking power can only be obtained in automatic position or with a 3-position switch.

Activated:	
Engine speed.....	Greater than approximately 700–800 rpm
Vehicle speed .....	Greater than approximately 5 km/h (3 mph)
Engine oil temperature .....	Greater than 20°C (68°F)
Boost pressure .....	Less than 150 kPa (22 psi)
Deactivated:	
Engine speed.....	Less than approximately 800–900 rpm
Vehicle speed .....	Less than approximately 5 km/h (3 mph)
Engine oil temperature .....	Less than 15°C (59°F)
Boost pressure .....	Greater than 170 kPa (24 psi)

## Compression Brake Switch

2-way switch can give 0% or 100% braking power.
3-way switch can give 0%, 50% or 100% braking power.
4-way switch can give 0%, 40%, 70% or 100% braking power.
5/6-way switch can give 0%, 40%, 70% or 100% braking power, and also 50% in A-position.

## Exhaust Back Pressure

Exhaust back pressure .....	30 kPa (4.35 psi) maximum
-----------------------------	---------------------------

## Cooling System

### General

Pressure valve opens .....	90 kPa (13 psi)
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### Thermostat

Quantity .....	1
Opening temperature.....	82°C (180°F)

## Coolant

For additional cooling system volumes, coolant requirements and maintenance intervals, refer to Service Information Function Group 18.

Type 1.....	Regular Coolant
Color.....	Purple/fuchsia
Contains.....	Glycol and anti-corrosion additives
Mixed with.....	Water (STD 1285,1)
Type 2.....	Extended Life Coolant (ELC)
Color.....	Red
Contains.....	Glycol and anti-corrosion additives
Mixed with.....	Water (STD 1285,1)
Type 3.....	Extended Service Coolant (ESC)
Color.....	Blue
Contains.....	Glycol and anti-corrosion additives
Mixed with.....	Water (STD 1285,1)

## Fan On/Off

Activated System	Conditions	Fan Engagement
Coolant temperature	100°C (212°F)	Activated
Coolant temperature	96°C (205°F)	Deactivated
Inlet manifold temperature	85°C (185°F)	Activated
Inlet manifold temperature	80°C (176°F)	Deactivated
Engine (ECM) temperature	Greater than 100°C (212°F)	Activated
Engine (ECM) temperature	Less than 95°C (203°F)	Deactivated
AC system	Greater than 20 bar (290 psi)	Activated



## Electronically Controlled Viscous Fan

Activated System	Conditions	Fan Engagement
Coolant temperature	96°C (205°F)	Variable fan speed activation
Engine (ECM) temperature	Greater than 100°C (212°F) Less than 95°C (203°F)	1200 rpm Deactivated
Inlet manifold air temperature	Greater than 70°C (150°F) Greater than half of maximum engine torque	1200 rpm 7 second delay after engine brake activated
AC compressor clutch activated	Engine speed greater than 1500 rpm Ambient temperature greater than 40°C (104°F) Vehicle speed less than 45 km/h (28 mph)	1200 rpm
AC compressor clutch activated	Engine speed greater than 1200 rpm Ambient temperature greater than 30°C (86°F) Vehicle speed less than 45 km/h (28 mph)	1000 rpm
AC compressor clutch activated	Ambient temperature greater than 35°C (95°F) Vehicle speed less than 10 km/h (6 mph)	1200 rpm
AC compressor clutch activated	Ambient temperature greater than 20°C (68°F) Vehicle speed less than 20 km/h (12 mph)	600 rpm
AC compressor clutch activated	Refrigerant pressure greater than 20 bar (300 psi)	Full engagement

## **Engine Control System**

### **Engine ECM**

Number of pins .....	2 x 62
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### **Sensors**

**Note:** Use the diagnostic tool for component function and sensor values checks.

#### **Camshaft Sensor**

Distance to toothed gear .....	1.1 ± 0.4 mm (0.04 ± 0.02 inch)
--------------------------------	---------------------------------

#### **Flywheel Sensor**

Distance to flywheel.....	1.5 ± 0.5 mm (0.06 ± 0.02 inch)
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## Tightening Torques and Patterns

### Engine Component Torque Specifications (Critical Fasteners)

**Note:** All components are to be clean and free from foreign material or corrosion. Assemblies are to be made using suitable tools and procedures so that no permanent damage occurs as a result of the assembly.

Threads, washers under the head of the screw and the washer face of the nuts should be lubricated with clean engine oil unless otherwise specified.

The following listed fasteners require the use of a calibrated manual torque wrench. If an adaptor is required in combination with a torque wrench, a correction factor must be applied to the torque wrench settings (readings) in order to obtain accurate fastener torque values.



#### CAUTION

Repeated tightening of fasteners and threaded components reduces their capacity to function adequately. The following table describes the various items and the limits of their reusability. Failure to conform to these limits can result in severe component damage.

Fasteners	Examples	Reusable Limit	Reuse Recommendations
Highly loaded screws (phosphating plus oil)	Cylinder head Cylinder block Injector clamp Camshaft bearing housing Transmission Flywheel	5 times	Apply engine oil on threads and under screw head. Mark bolt head with an indentation. Dry mounting for new screws (delivered with oil pre-applied and anti-rust treatment for spare parts). If a part is replaced, e.g., cylinder head, also replace the screws.
Highly loaded screws (phosphating plus oil)	Connecting rods	5 times	
Special screws (specific shape)	Oil pan and valve cover	No limit	No limit if no cracks, corrosion or damage to the flat surfaces.
Stainless steel/bronze studs and flange locknuts (Spiralock)	Turbocharger Exhaust manifold EGR valve	Not reusable	If turbocharger, exhaust manifold or EGR valve studs or nuts are loosened, they must be replaced.
Prevailing torque feature screws (Dri-lock Plastic or Tuflock)	Piston cooling nozzles Timing gear plate	Not reusable	
Standard screws	Property class 8.8	Do not reuse	Torque and angle tightened or yield limit tightened bolts.
Standard screws	Property class 10.9 Property class 12.9	No limit	No limit if no cracks, corrosion or damage to the flat surfaces.
V-nipple with taper threads	With locking fluid pre-applied	Not reusable	Before fitting the new nipple, clean the hole with a nipple tap and apply sealant on the nipple thread, or use a new coated nipple.

Fasteners	Examples	Reusable Limit	Reuse Recommendations
Taper plugs or nipples	With sealer fluid pre-applied	Not reusable	Before fitting the new nipple, clean the hole with a nipple tap and apply sealant on the nipple thread, or use a new coated nipple.

## Tightening Torques Group 20

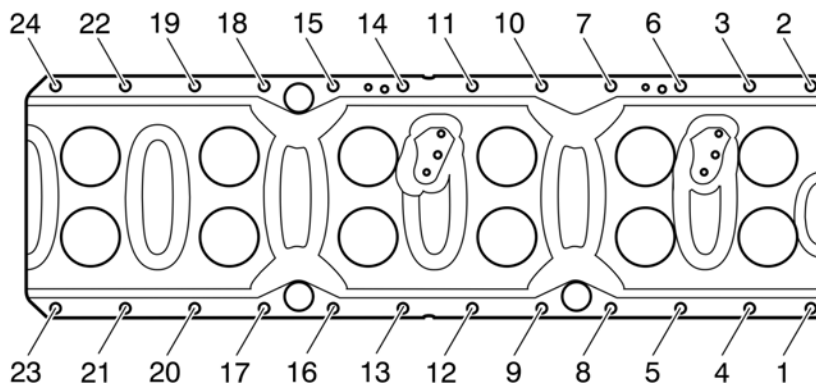
General Tightening Torques	
M6 standard bolt 8.8.....	10 ± 1.5 Nm (7.4 ± 1 ft-lb) (89 ± 13 in-lb)
M8 standard bolt 8.8.....	24 ± 4 Nm (18 ± 3 ft-lb)
M10 standard bolt 8.8.....	48 ± 8 Nm (35 ± 6 ft-lb)
M12 standard bolt 8.8.....	85 ± 15 Nm (63 ± 11 ft-lb)
M14 standard bolt 8.8.....	140 ± 25 Nm (103 ± 18 ft-lb)
M16 standard bolt 8.8.....	190 ± 35 Nm (140 ± 26 ft-lb)

Bolts that have been torque-tightened only, can be reused.	
Torque-tightened, angle-tightened, yield-limit-tightened bolts:	
8.8.....	Should not be reused
10.9.....	Can be reused
12.9.....	Can be reused

**Note:** Check bolts before reusing. Bolts showing damage, for example cut marks on the underside or distortion of the flats, should be discarded.

## Tightening Torques Group 21

Intermediate front engine mounting brackets (accessories brackets):	
Step 1 .....	105 ± 15 Nm (77.5 ± 11 ft-lb)
Step 2 (angle tightening) .....	60 ± 5 degrees
Front engine mounting:	
Bracket to engine block .....	275 ± 45 Nm (203 ± 33 ft-lb)
Bracket to engine cushion .....	140 ± 25 Nm (103 ± 18 ft-lb)
Cushion to cross member .....	85 ± 15 Nm (63 ± 11 ft-lb)
Rear engine mounting:	
Bracket to flywheel housing .....	300 ± 45 Nm (221 ± 33 ft-lb)
Bracket to engine cushion .....	540 ± 90 Nm (398 ± 66 ft-lb)
Cushion to frame .....	200 ± 30 Nm (148 ± 24 ft-lb)
Crankshaft main bearing cap:	
Step 1 .....	150 ± 20 Nm (111 ± 15 ft-lb)
Step 2 (angle tightening) .....	120 ± 5 degrees
Connecting rod cap:	
Step 1 .....	20 ± 3 Nm (15 ± 2 ft-lb)
Step 2 .....	60 ± 3 Nm (44 ± 2 ft-lb)
Step 3 (angle tightening) .....	90 ± 5 degrees
Piston cooling nozzle .....	24 ± 4 Nm (18 ± 3 ft-lb)
Engine block plugs .....	50 ± 5 Nm (37 ± 7 ft-lb)

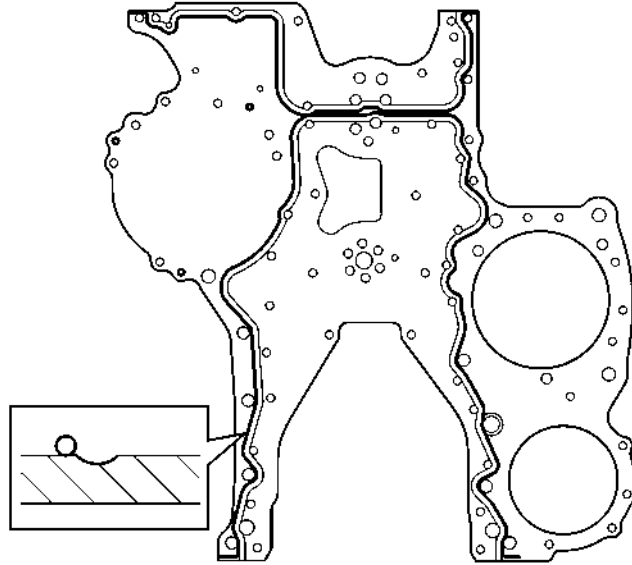


T2022728

### Engine stiffening frame:

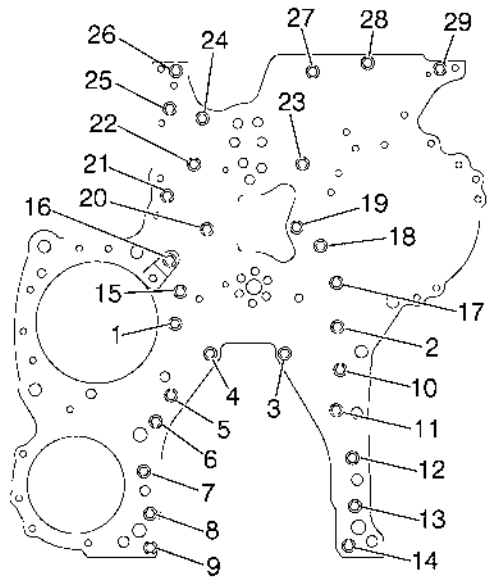
Step 1: Tighten the bolts 1-24 in numerical order .....	40 ± 5 Nm (30 ± 4 ft-lb)
Step 2: Tighten the bolts 1-24 in numerical order (angle tightening) .....	90 ± 5 degrees

**Note:** These bolts should not be reused.



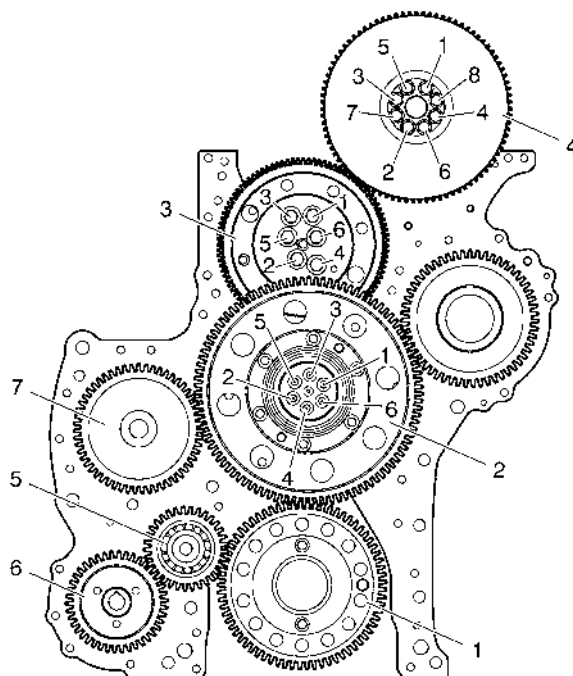
T2022337

**Note:** Apply sealant outside the groove as illustrated, maximum 20 minutes before mounting.  
Thickness of sealant bead: 2 mm (0.079 inch)



W2005945

Timing gear plate, tighten in sequence shown .....  $28 \pm 4 \text{ Nm}$  ( $21 \pm 3 \text{ ft-lb}$ )



W2006478

Timing gears:

1. Drive gear, crankshaft ..... 24 ± 4 Nm (18 ± 3 ft-lb)

2. Double idler gear:

Step 1 ..... 25 ± 3 Nm (19 ± 2 ft-lb)

Step 2 (angle tightening) ..... 110 ± 5 degrees

**Note:** Tighten following the order shown in the illustration.

3. Idler gear, adjustable:

Step 1 ..... 35 ± 4 Nm (26 ± 3 ft-lb)

Step 2 (angle tightening) ..... 120 ± 5 degrees

**Note:** Tighten following the order shown in the illustration.

4. Drive gear, camshaft (includes vibration damper):

Step 1 ..... 45 ± 5 Nm (33 ± 4 ft-lb)

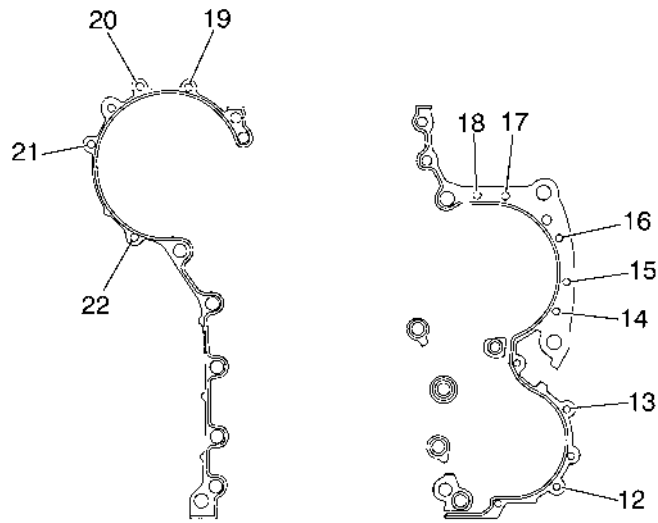
Step 2 (angle tightening) ..... 90 ± 5 degrees

**Note:** Tighten following the order shown in the illustration.

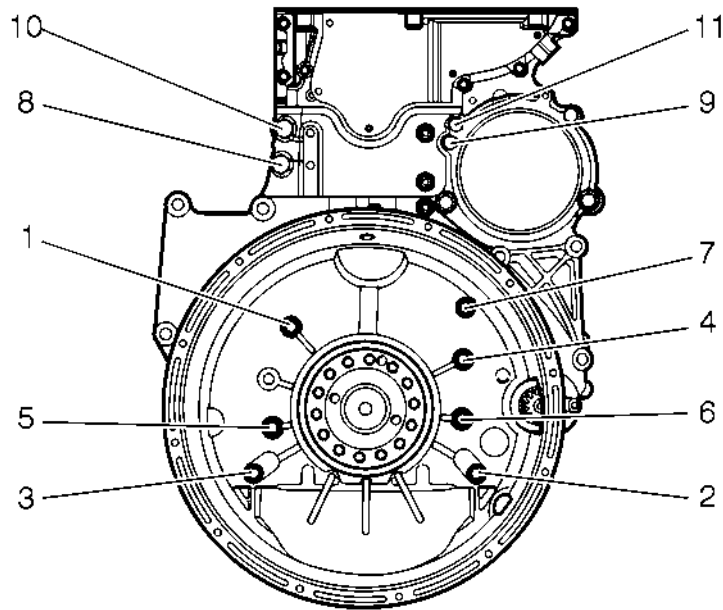
5. Idler gear: 140 ± 10 Nm (103 ± 7 ft-lb)

6. Drive gear, power steering pump: 100 ± 10 Nm (74 ± 7 ft-lb)

7. Drive gear, air compressor: 200 +50 -0 Nm (147 +37 -0 ft-lb)



W2006480



T2025683

**Flywheel housing:**

Step 1: Tighten all M14, M10, M8 bolts ..... 24 ± 4 Nm (18 ± 3 ft-lb)

Step 2: Tighten all bolts in numerical order to the following torque:

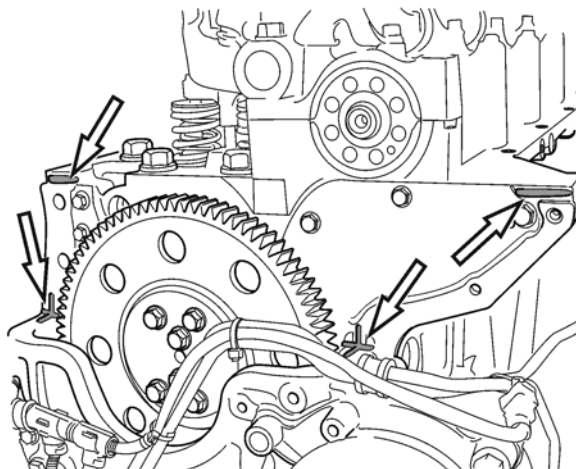
M14 bolts (1–7)..... 140 ± 20 Nm (103 ± 15 ft-lb)

M10 bolts (8–11)..... 48 ± 8 Nm (36 ± 6 ft-lb)

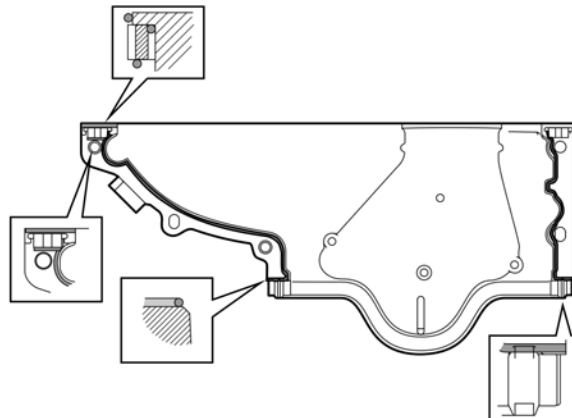
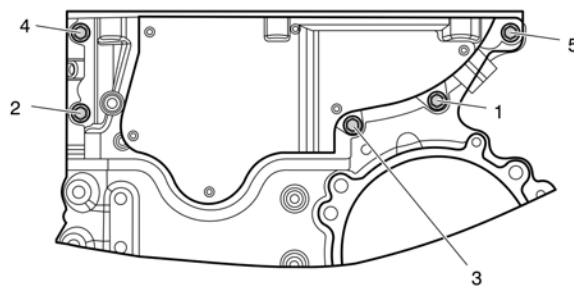
M8 bolts (12–22)..... 24 ± 4 Nm (18 ± 3 ft-lb)

**Note:** Apply sealant in a 2 mm (0.079 inch) thick bead as illustrated.





T2023649



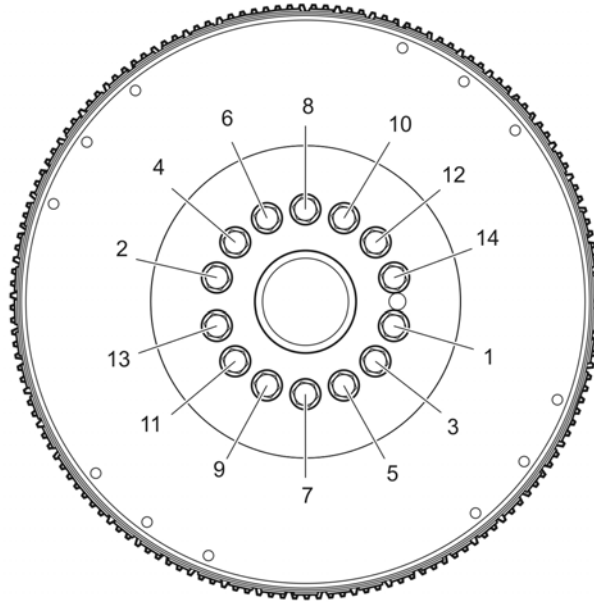
T2022983

Timing gear cover:

Step 1: Position the cover in place with bolts 1 and 2 and install alignment tool.

Step 2: Tighten the bolts in the numerical order shown. ....  $24 \pm 4 \text{ Nm}$  ( $18 \pm 3 \text{ ft-lb}$ )

**Note:** Apply sealant in a 2 mm (0.079 inch) thick bead, maximum 20 minutes before mounting, and carefully tighten the contact surfaces shown in the enlarged parts of the illustration.

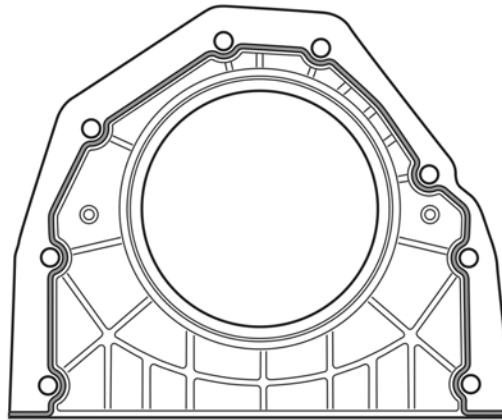
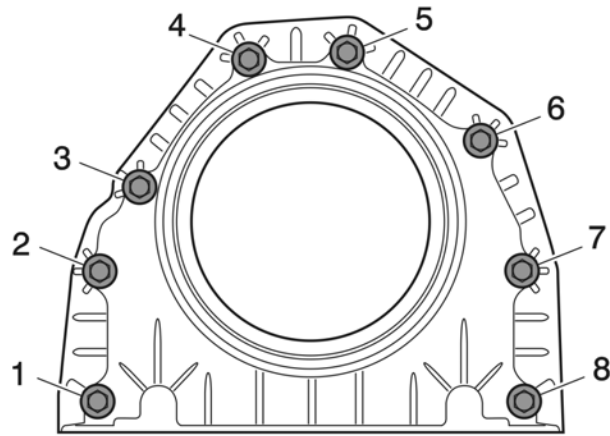


T2022729

Flywheel:

- Step 1 .....  $60 \pm 5 \text{ Nm}$  ( $44 \pm 4 \text{ ft-lb}$ )
- Step 2 (angle tightening) .....  $120 \pm 10 \text{ degrees}$

**Note:** Make sure the flange is dry and clean. Tighten the bolts in the numerical order as shown.



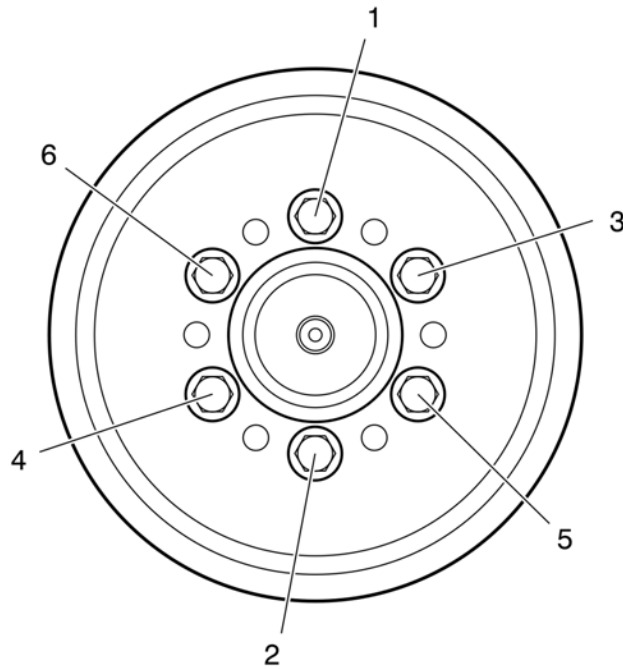
T2022739

Cover, crankshaft seal:

Step 1. Position the cover with bolts 2 and 7 and tighten to contact

Step 2: Tighten the bolts in numerical order 1–8 as shown .....  $24 \pm 4$  Nm ( $18 \pm 3$  ft-lb)

**Note:** Apply sealant in a 2 mm (0.079 inch) thick bead as illustrated and tighten bolts in numerical order.

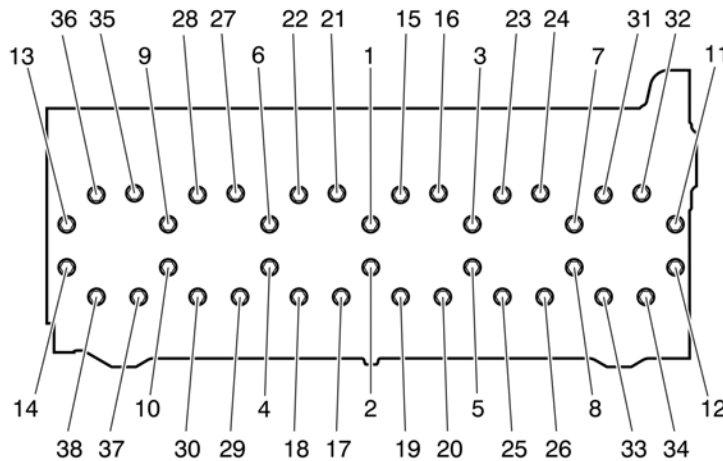


T2022730

**Crankshaft vibration damper:**

- Step 1 .....  $35 \pm 5 \text{ Nm}$  ( $26 \pm 4 \text{ ft-lb}$ )  
 Step 2 .....  $90 \pm 10 \text{ Nm}$  ( $66 \pm 7 \text{ ft-lb}$ )

**Note:** Tighten the bolts in the numerical order 1, 2, 3, 4, 5, 6, 1. The vibration damper 8.8 bolts should not be reused.

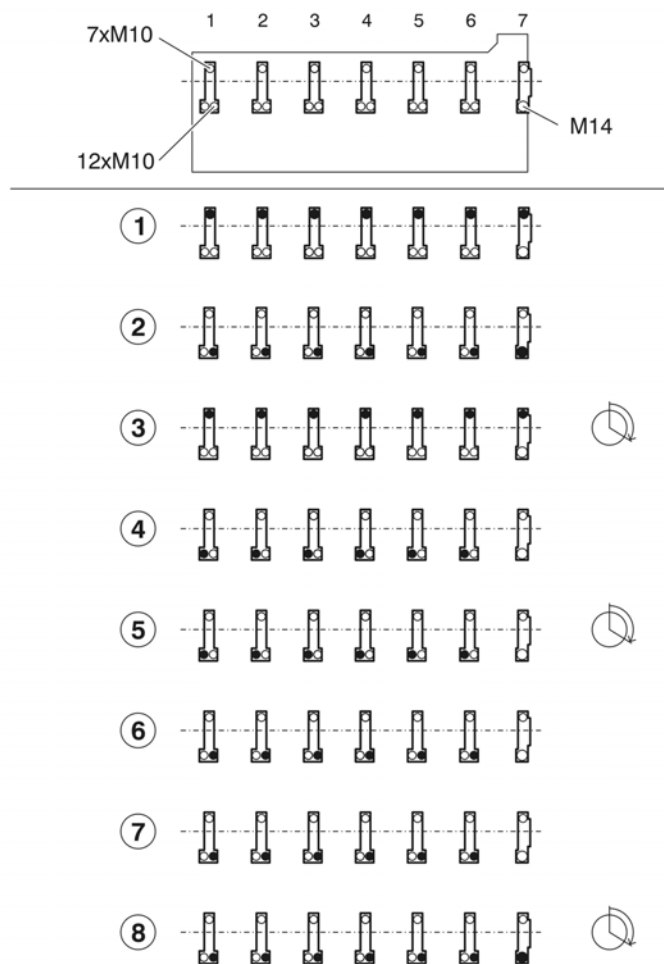


T2022734

**Cylinder head:**

- Step 1 .....  $100 \pm 5 \text{ Nm}$  ( $74 \pm 4 \text{ ft-lb}$ )  
 Step 2 (angle tightening) .....  $120 \pm 5 \text{ degrees}$   
 Step 3 (angle tightening) .....  $90 \pm 5 \text{ degrees}$

**Note:** The cylinder head must be mounted according to instructions, see Cylinder Head, Replacement Function Group 21.



T2022796

**Bearing cap, camshaft/rocker arm shaft:**

Bearing caps 1 to 6 are attached with one bolt on the engine right side and two bolts on the engine left side, while bearing cap 7 is attached with only one bolt per side. Tighten the bolts in the following steps as illustrated:

**Note:** Tighten the bolts in numerical order from bearing cap 1 to 7 or 7 to 1, except in step 2.

Step 1: With camshaft and bearing caps in place, tighten the marked bolts of bearing caps 1 to 7 ..... 25 ± 3 Nm (19 ± 2 ft-lb)

Step 2: With rocker shaft in place, tighten the marked bolts (in stages) in the order 4, 3, 5, 2, 6, 1, 7 ..... 60 ± 5 Nm (44 ± 4 ft-lb)

**Note:** The bolts must be tightened in stages to ensure that the rocker arm shaft is seated without bending.

Step 3: Angle tighten marked bolts of bearing caps 1 to 7 ..... 90 ± 5 degrees

Step 4: Tighten the marked bolts of bearing caps 1 to 6 ..... 25 ± 3 Nm (19 ± 2 ft-lb)

Step 5: Angle tighten the bolts of bearing caps 1 to 6 ..... 120 ± 5 degrees

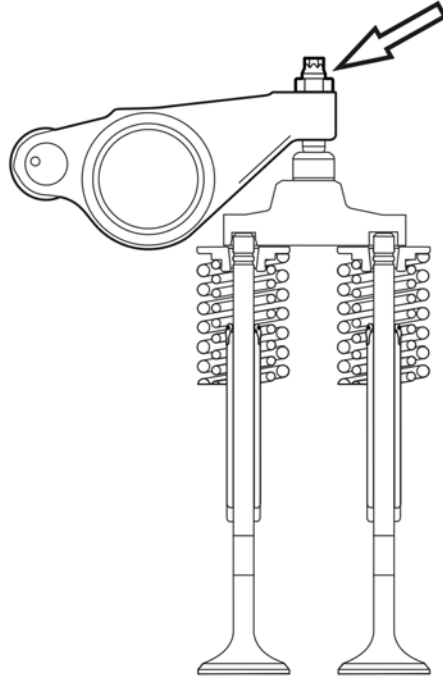
Step 6: Loosen the marked bolts of bearing caps 1 to 6.

Step 7: Tighten the marked bolts of bearing caps 1 to 6 ..... 25 ± 3 Nm (19 ± 2 ft-lb)

Step 8: Angle tighten the bolts of bearing caps 1 to 6 and the bolt of bearing cap 7 ..... 120 ± 5 degrees

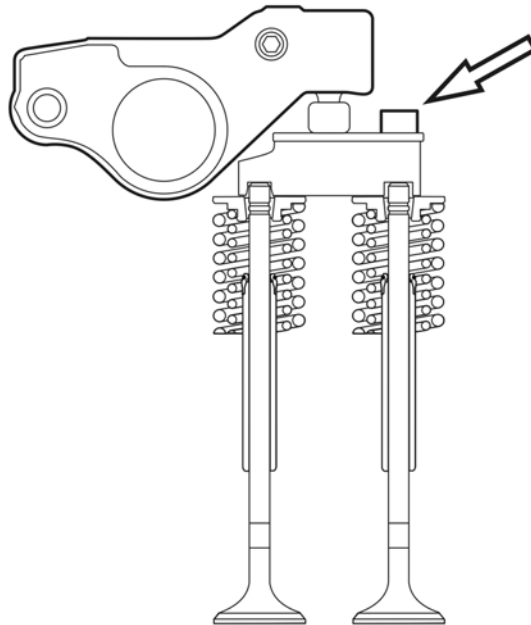
**Note:** When only the rocker arm has been loosened, step 1 and step 3 are not required.

Engine brake control valve ..... 24 ± 4 Nm (18 ± 3 ft-lb)



T2022965

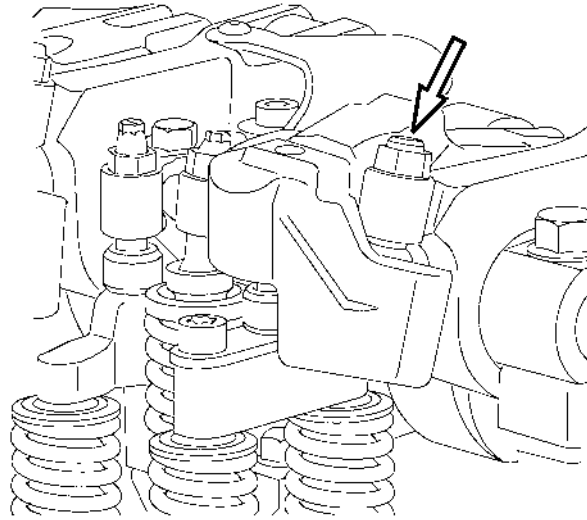
Locknut, valve adjustment screw (inlet/exhaust) .....  $38 \pm 4$  Nm ( $28 \pm 3$  ft-lb)  
 or, angle tighten after contact .....  $60 \pm 5$  degrees



T2022966

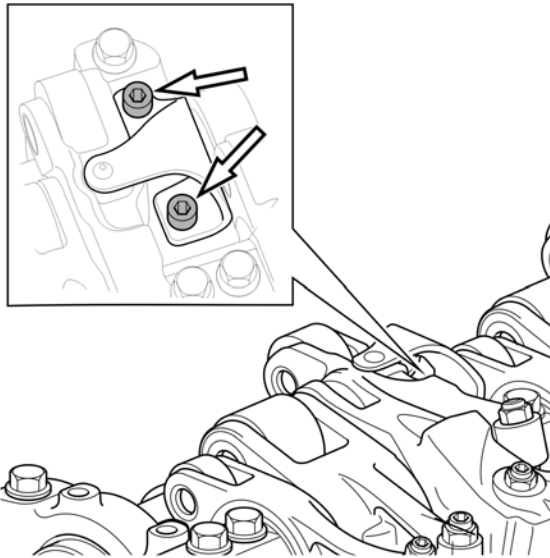
Locknut, valve adjustment screw (exhaust, engine brake) .....  $38 \pm 4$  Nm ( $28 \pm 3$  ft-lb)  
 or, angle tighten after contact .....  $30 +1.5 -0$  degrees

**Note:** Hold the valve bridge while tightening.



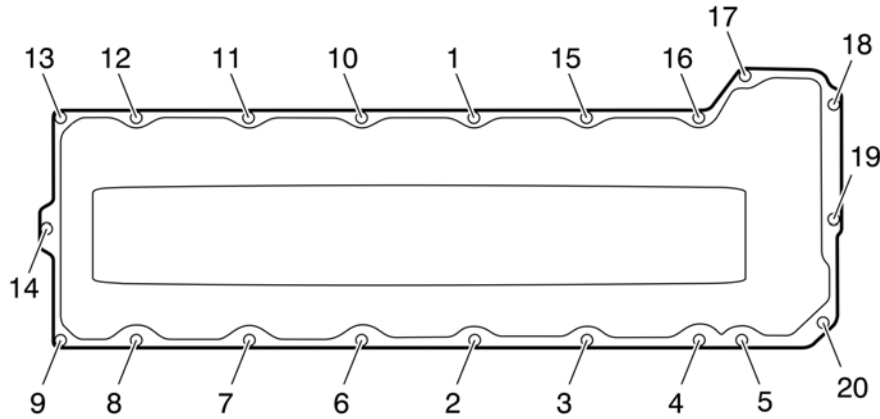
W2005946

Locknut, engine brake rocker arm .....	52 ± 4 Nm (38 ± 3 ft-lb)
or, angle tighten after contact .....	45 ± 5 degrees



T2022951

Camshaft bearing cap spring tab (engine brake only) .....	25 ± 3 Nm (18 ± 2 ft-lb)
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T2022732

Valve cover ..... 24 ±4 Nm (18 ±3 ft-lb)

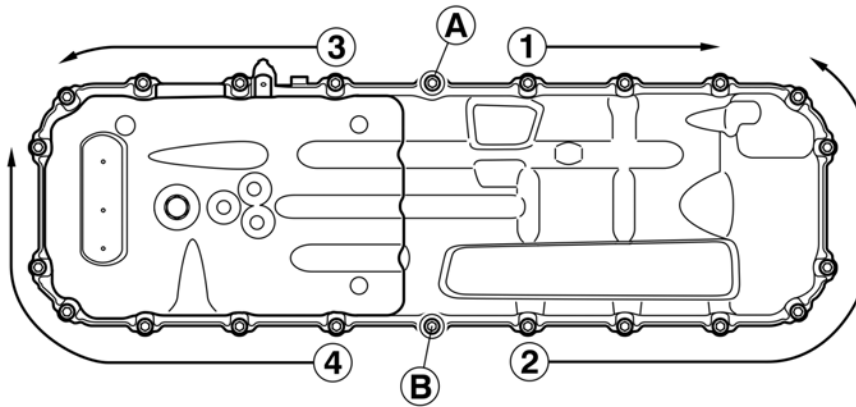
**Note:** Tighten the bolts in the numerical order shown.

### Tightening Torques Group 22

Oil pump, pickup tube ..... 24 ±4 Nm (18 ±3 ft-lb)

Oil filter housing ..... 24 ±4 Nm (18 ±3 ft-lb)

Oil filter ..... 25 +5/-0 Nm (18.5 +3.5/-0 ft-lb)



T2023838

Oil pan (steel and plastic) ..... 24 ±4 Nm (18 ±3 ft-lb)

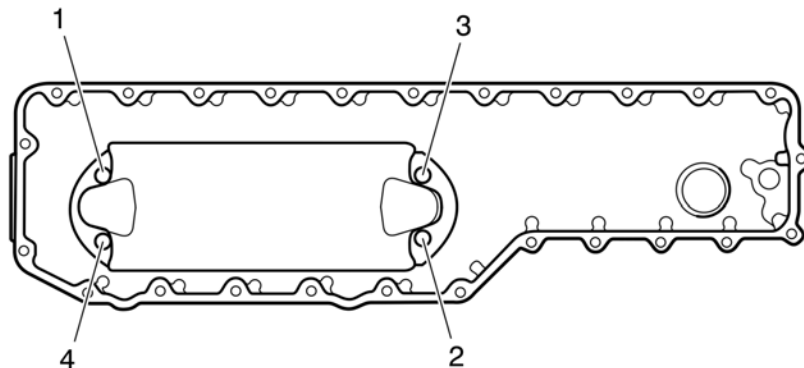
Install the oil pan bolts A and B, and tighten ..... 24 ±4 Nm (18 ±3 ft-lb)

Tighten the bolts from the middle and outwards in order 1-4 as shown ..... 24 ±4 Nm (18 ±3 ft-lb)

Finish by checking the torque for bolts A and B ..... 24 ±4 Nm (18 ±3 ft-lb)

Drain plug, oil pan (steel and plastic) ..... 60 ± 10 Nm (44 ± 7 ft-lb)



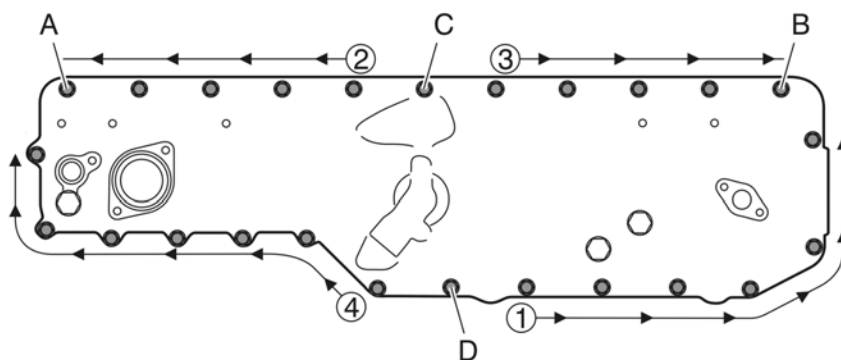


T2022733

Oil cooler, retaining bolts:

Step 1 .....	5 ± 1 Nm (44 ± 9 in-lb)
Step 2 .....	27 ± 4 Nm (20 ± 3 ft-lb)

**Note:** Tighten the bolts diagonally and finish by tightening the first bolt again.



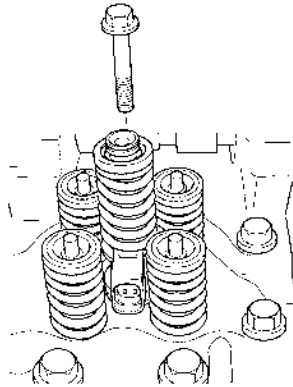
T2023837

Oil cooler cover:

Position the cover to the engine block and install bolt (A) into the oval hole. Press the cover against the water pump housing using an assembly tool and install bolt (B). Check that the cover is positioned correctly.

Install bolts C and D and tighten.....	24 ± 4 Nm (18 ± 3 ft-lb)
Tighten the cover bolts from the middle and outwards in order 1–4 as shown.....	24 ± 4 Nm (18 ± 3 ft-lb)
Finish by checking the torque for bolts C and D.....	24 ± 4 Nm (18 ± 3 ft-lb)

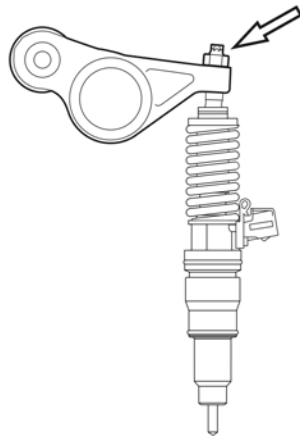
## Tightening Torques Group 23



T2022208

Retainer, injector:

Step 1 .....	20 +5/-0 Nm (15 +4/-0 ft-lb)
Step 2 Angle tightening .....	180 ±5 degrees
Step 3 Loosen until the torque is 10–15 Nm (7–11 ft-lb).	
Step 4 .....	20 +5/-0 Nm (15 +4/-0 ft-lb)
Step 5 Angle tightening .....	90 ±5 degrees



T2022967

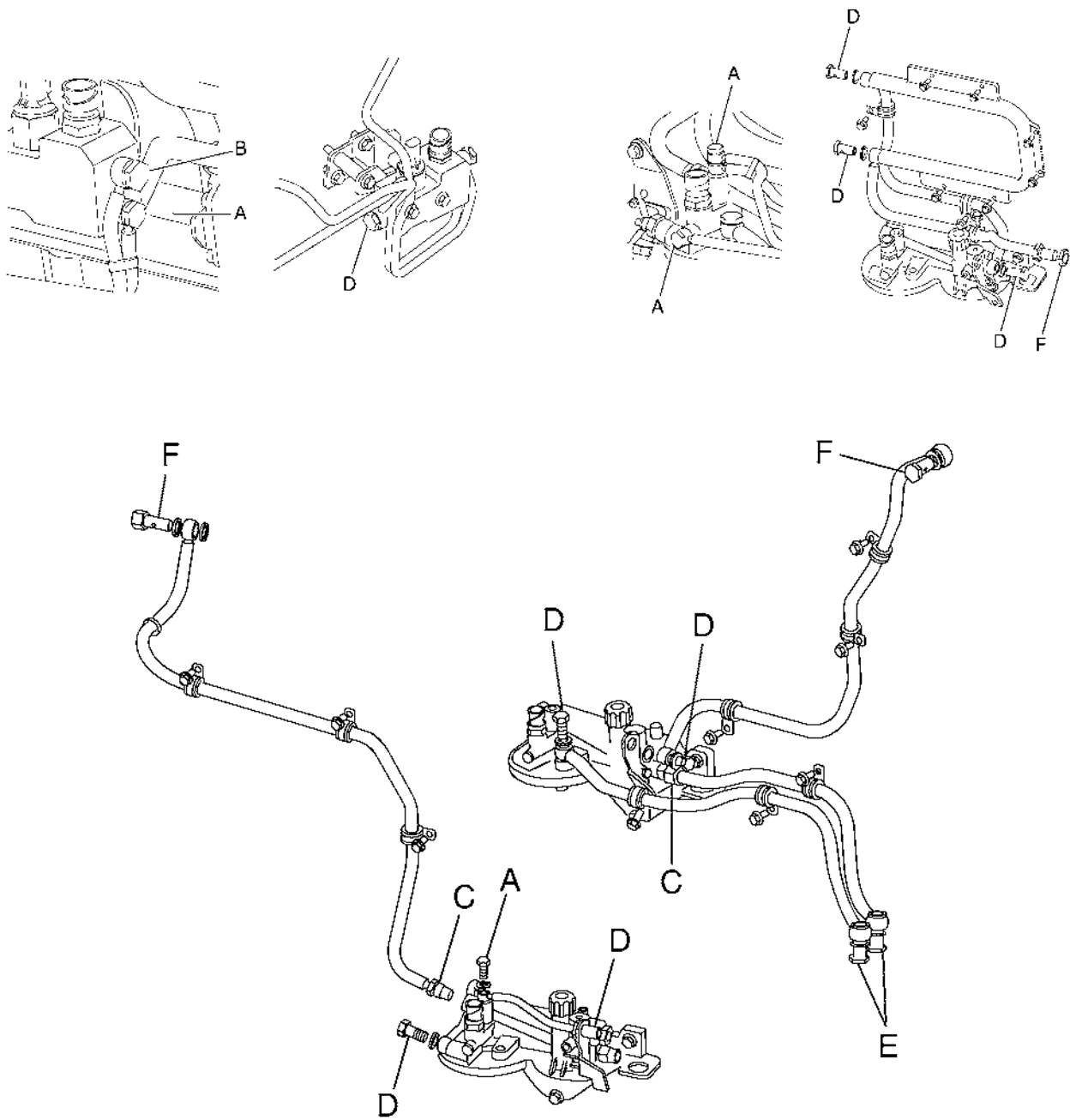
Locknut, injector adjusting screw.....	52 ± 4 Nm (38 ± 3 ft-lb)
or, angle tighten after contact .....	45 ± 5 degrees

Tandem pump mounting bolts .....	24 ± 4 Nm (18 ± 3 ft-lb)
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Fuel pump (mounted on power steering pump).....	8 +2/-0 Nm (6 +1/-0 ft-lb)
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Fuel filter housing .....	24 ± 4 Nm (18 ± 3 ft-lb)
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Fuel filter (primary, secondary) .....	18 ± 3 Nm (13 ± 2 ft-lb)
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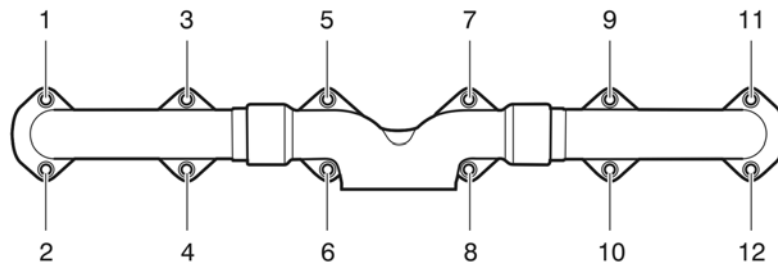


Fuel line fittings:

A .....	18 ± 3 Nm (13 ± 2 ft-lb)
B .....	28 ± 4 Nm (20.5 ± 3 ft-lb)
C .....	30 ± 4 Nm (22 ± 3 ft-lb)
D .....	35 ± 5 Nm (26 ± 4 ft-lb)
E .....	40 ± 5 Nm (29.5 ± 4 ft-lb)
F .....	48 ± 5 Nm (35 ± 4 ft-lb)

## Tightening Torques Group 25

Intake manifold .....	24 ± 4 Nm (18 ± 3 ft-lb)
<b>Note:</b> Tighten the bolts diagonally from the center outward.	
Housing, preheater:	
Step 1 .....	10 ± 2 Nm (8 ± 1 ft-lb)
Step 2 .....	24 ± 3 Nm (18 ± 2 ft-lb)
<b>Note:</b> Tighten the bolts diagonally.	
Preheater terminal connections .....	10 ± 1.5 Nm (8 ± 1 ft-lb)
Plug, M10 .....	20 ± 3 Nm (15 ± 2 ft-lb)
Pressure/temperature sensor, boost air .....	10 ± 1 Nm (88 ± 9 in-lb)



T2022740

Exhaust manifold:	
Step 1: Tighten bolts 1 through 12 .....	5 - 10 Nm (4 - 7 ft-lb)
Step 2: Tighten bolts 1 through 12 .....	40 ± 4 Nm (30 ± 3 ft-lb)
Step 3: Tighten bolts 1 through 12 .....	52 ± 4 Nm (38 ± 3 ft-lb)
<b>Note:</b> Tighten the exhaust manifold bolts following the numbered sequence.	
<b>Note:</b> Exhaust manifold bolts are not reusable. Replace the bolts if removed or loosened.	

Exhaust gas recirculation (EGR):	
EGR valve mounting bolts:	
Step 1 .....	20 ± 4 Nm (15 ± 3 ft-lb)
Step 2 .....	61 ± 3 Nm (45 ± 4 ft-lb)
<b>Note:</b> Tighten the bolts diagonally.	
EGR hot pipe clamps.....	6 Nm (50 in-lb)
EGR cooler mounting screws and locknuts.....	12 ± 2 Nm (9 ± 1.5 ft-lb)
EGR cooler draincock mounting.....	15 ± 3 Nm (11 ± 2 ft-lb)
EGR cooler draincock valve .....	3 ± 0.5 Nm (27 ± 4 in-lb)
EGR cold pipe hose clamps .....	7 ± 1 Nm (62 ± 9 in-lb)
EGR cold pipe V-clamps .....	10 ± 2 Nm (7 ± 1 ft-lb)
Mixing chamber inlet tube.....	24 ± 4 Nm (18 ± 3 ft-lb)

Turbocharger:	
Turbocharger mounting screws and nuts:	
Step 1 .....	20 ± 4 Nm (15 ± 3 ft-lb)
Step 2 .....	48 ± 8 Nm (35 ± 6 ft-lb)

**Note:** Tighten diagonally.

Charge air cooler V-clamp .....	7 ± 1 Nm (62 ± 9 in-lb)
Diffuser V-clamp .....	12 ± 2 Nm (9 ± 1.5 ft-lb)
Turbocharger oil supply and return .....	24 ± 4 Nm (18 ± 3 ft-lb)
Turbocharger coolant supply .....	48 ± 5 Nm (35 ± 4 ft-lb)
Turbocharger coolant return:	
Hollow screw .....	48 ± 5 Nm (35 ± 4 ft-lb)
Fitting nut .....	60 ± 6 Nm (44 ± 5 ft-lb)
Actuator coolant supply and return:	
At turbocharger .....	12 ± 3 Nm (9 ± 2 ft-lb)
At block .....	48 ± 5 Nm (35 ± 4 ft-lb)

Closed crankcase ventilation (CCV):	
Mounting bolts .....	24 ± 4 Nm (18 ± 3 ft-lb)
Hose clamps .....	4 ± 0.6 Nm (35 ± 5 in-lb)

Diesel Particulate Filter (DPF):	
Lower mounting bracket .....	48 ± 8 Nm (35 ± 6 ft-lb)
Mounting strap fastener .....	27 ± 4 Nm (20 ± 3 ft-lb)
DPF V-band clamp .....	20 ± 3 Nm (15 ± 2 ft-lb)
Aftertreatment diesel exhaust fluid dosing valve fasteners .....	6 ± 2 Nm (53 ± 18 in-lb)

Selective Catalytic Reduction (SCR), vertical:	
Mounting nuts .....	271 Nm (200 ft-lb)
Cage fasteners .....	68 Nm (50 ft-lb)
Heat shield fasteners .....	24 ± 4 Nm (18 ± 3 ft-lb)
Exhaust V-band clamp .....	7 ± 2 Nm (62 ± 18 in-lb)
V-band clamps (DPF to SCR pipe) .....	7 ± 0.5 Nm (60 ± 5 in-lb)

Selective Catalytic Reduction (SCR), horizontal:	
Mounting strap nuts .....	45 ± 5 Nm (400 ± 45 in-lb)
Frame rail mounting bracket nuts .....	140 ± 25 Nm (103 ± 18 ft-lb)
Heat shield screws .....	24 ± 4 Nm (18 ± 3 ft-lb)
Exhaust V-band clamp .....	7 ± 2 Nm (62 ± 18 in-lb)
V-band clamps (DPF to SCR pipe) .....	7 ± 0.5 Nm (60 ± 5 in-lb)

Diesel Exhaust Fluid (DEF) tank:	
DEF pump screws .....	24 ± 4 Nm (18 ± 3 ft-lb)
ACM bracket screws .....	24 ± 4 Nm (18 ± 3 ft-lb)
ACM mounting nuts .....	24 ± 4 Nm (18 ± 3 ft-lb)
Solenoid valve mounting bracket screws .....	3 ± 0.5 Nm (27 ± 4 in-lb)
Tank cover screws .....	24 ± 4 Nm (18 ± 3 ft-lb)
Tank bracket to bracket screws .....	24 ± 4 Nm (18 ± 3 ft-lb)
Tank bracket to tank screws .....	48 ± 8 Nm (35 ± 6 ft-lb)
Frame rail mounting bracket to tank bracket fasteners .....	85 ± 15 Nm (63 ± 11 ft-lb)
Frame rail mounting bracket to frame fasteners .....	140 ± 25 Nm (103 ± 18 ft-lb)

Aftertreatment hydrocarbon doser (previous version):

Doser:

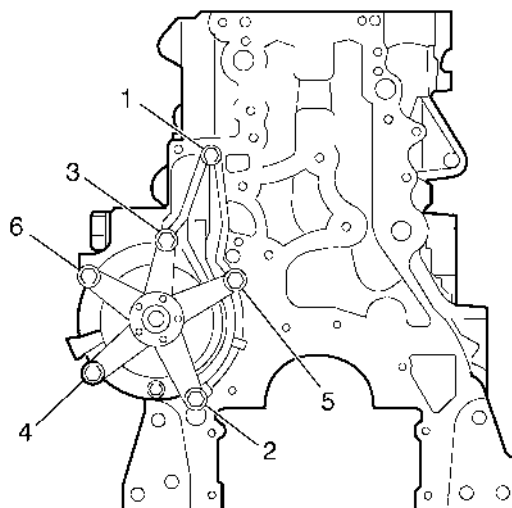
Mounting bolts .....	14 ± 0.5 Nm (125 ± 4.5 in-lb)
Fuel line fitting .....	15 ± 0.5 Nm (135 ± 5 in-lb)
Cooling lines .....	48 ± 5 Nm (35 ± 4 ft-lb)
Two-way check valve.....	24 Nm (18 ft-lb)
Air line.....	27 Nm (20 ft-lb)
Shut-off Valve:	
Mounting.....	13.5 ± 3 Nm (120 ± 24 in-lb)
Fuel line fittings.....	see Group 23

Aftertreatment hydrocarbon doser (new version)

Doser:

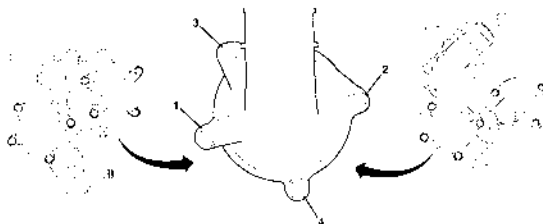
Mounting bolts .....	14 ± 0.5 Nm (125 ± 4.5 in-lb)
Air/Fuel line fitting .....	15 ± 2 Nm (135 ± 18 in-lb)
M10 P-clamp flange screw .....	28 ± 4 Nm (21 ± 3 ft-lb)
Connection joint between left and right fuel pipes .....	15 ± 2 Nm (135 ± 18 in-lb)
Aftertreatment hydrocarbon dosing module:	
Air/Fuel line fitting .....	15 ± 2 Nm (135 ± 18 in-lb)
Fuel line from housing to module fittings .....	Maximum 18 Nm (13 ft-lb)

## Tightening Torques Group 26



W2005979

Coolant pump (Note: Tighten in sequence twice) .....	24 ± 4 Nm (18 ± 3 ft-lb)
Coolant pump pulley .....	24 ± 4 Nm (18 ± 3 ft-lb)
Coolant pump housing.....	48 ± 8 Nm (35 ± 6 ft-lb)



W2031416

Front and side cover, thermostat housing .....	28 Nm (21 ft-lb)
Tensioner .....	48 ± 8 Nm (35 ± 6 ft-lb)
Drive belt idler.....	24 ± 4 Nm (18 ± 3 ft-lb)
Fan hub:	
15mm hex (wrench size) nut .....	48 ± 8 Nm (35 ± 6 ft-lb)
VHD with 13L engine, 45mm stud length and 16mm hex (wrench size) nut.....	70 ± 12 Nm (52 ± 9 ft-lb)
Viscous fan drive:	
Drive-to-hub.....	24 ± 4 Nm (18 ± 3 ft-lb)

## Tightening Torques Group 28

Sensor and Location.....	Specification
Flywheel position/speed, top of flywheel housing.....	8 ± 2 Nm (6 ± 1 ft-lb)
Camshaft position, timing gear cover .....	8 ± 2 Nm (6 ± 1 ft-lb)
Turbocharger speed, top middle of turbocharger .....	8.5 ± 2 Nm (75 ± 18 in-lb)
Turbocharger discharge temperature .....	45 ± 4.5 Nm (33 ± 3 ft-lb)
Oil level/temperature, inside sump .....	10 ± 1 Nm (89 ± 9 in-lb)
Oil pressure, block, front of air compressor .....	30 ± 5 Nm (22 ± 4 ft-lb)
Coolant level, surge tank .....	Plug-in
Coolant temperature, front right side cylinder head.....	22 ± 3 Nm (16 ± 2 ft-lb)
Fuel pressure, fuel filter housing .....	25 ± 3 Nm (18.5 ± 2 ft-lb)
Aftertreatment fuel injector fuel pressure, behind fuel filter housing.....	25 ± 3 Nm (18.5 ± 2 ft-lb)
Crankcase pressure, block, front of air compressor .....	25 ± 3 Nm (18.5 ± 2 ft-lb)
Charge air temperature and pressure, intake manifold .....	10 ± 1 Nm (89 ± 9 in-lb)
EGR temperature, EGR venturi.....	45 ± 4.5 Nm (33 ± 3 ft-lb)
EGR differential pressure, EGR venturi.....	20 ± 3 Nm (15 ± 2 ft-lb)
Piston cooling jet pressure sensor.....	25 ± 3 Nm (18.5 ± 2 ft-lb)
DPF temperature, DPF inlet, catalyst, outlet modules.....	45 ± 4.5 Nm (33 ± 3 ft-lb)
DPF differential pressure, DPF inlet, catalyst, outlet modules:	
Box .....	6 ± 1 Nm (53 ± 9 in-lb)
Fitting nuts .....	16.3 ± 2.7 Nm (12 ± 2 ft-lb)
NOx sensor, exhaust pipe after DPF .....	50 ± 10 Nm (37 ± 7 ft-lb)
NOx sensor, exhaust pipe after SCR.....	50 ± 10 Nm (37 ± 7 ft-lb)
NOx module, frame bracket.....	24 ± 4 Nm (18 ± 3 ft-lb)



### Tightening Torques Group 3

Starter motor mounting nuts:	
Delco .....	85 ± 15 Nm (63 ± 11 ft-lb)
Melco .....	60 ± 6 Nm (44 ± 5 ft-lb)
Starter cables (Bat+, E-):	
Delco .....	26 ± 1.5 Nm (19 ± 1 ft-lb)
Melco .....	25 ± 5 Nm (18.5 ± 3.5 ft-lb)
Starter control wire:	
Delco .....	2.2 ± 0.2 Nm (19.5 ± 2 in-lb)
Melco .....	4 ± 1 Nm (35 ± 9 in-lb)
Alternator:	
Mounting bracket .....	48 ± 8 Nm (35 ± 6 ft-lb)
Pad mounts .....	65.5 ± 7.5 Nm (48 ± 5.5 ft-lb)
Pulley nut .....	101.5 ± 6.5 Nm (75 ± 5 ft-lb)
Battery terminal .....	6.5 ± 0.25 Nm (57.5 ± 2.5 in-lb)
Ground terminal .....	6.2 ± 0.5 Nm (55 ± 5 in-lb)
I, R terminals .....	2.3 ± 0.5 Nm (20 ± 5 in-lb)
AC refrigerant compressor mounting bolts .....	24 ± 4 Nm (18 ± 3 ft-lb)
Wiring harness conduit to block .....	24 ± 3 Nm (18 ± 2 ft-lb)
Wiring harness conduit cover .....	3.5 ± 0.5 Nm (31 ± 4.4 in-lb)
Cable channel cover .....	3.5 ± 0.5 Nm (31 ± 4.4 in-lb)

### Tightening Torques Group 5

Air compressor mounting bolts .....	85 ± 15 Nm (63 ± 11 ft-lb)
Air compressor out connection .....	130 ± 20 Nm (96 ± 15 ft-lb)
Air compressor gear .....	270 ± 20 Nm (200 ± 15 ft-lb)

## Engine Lubricants and Sealants

Use only the following recommended sealing compounds and lubricants.

installing new gaskets, clean and degrease gasket sealing surfaces to avoid leaks.

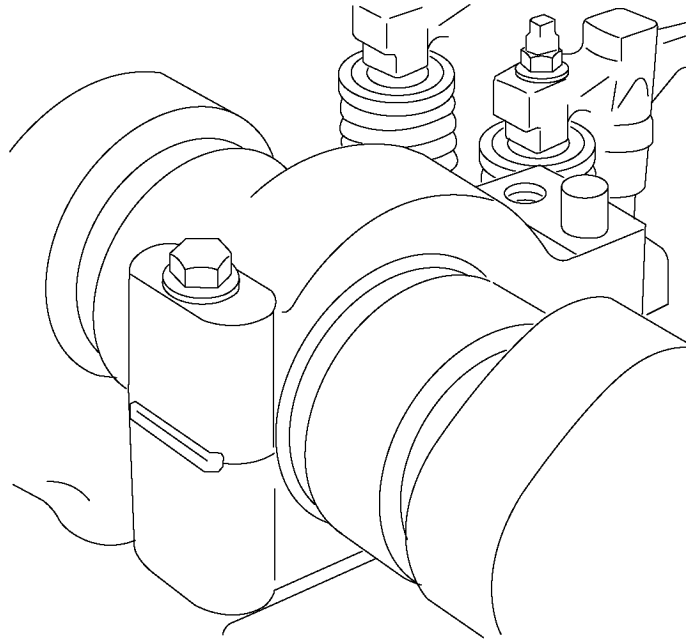
**Note:** All genuine cylinder head gaskets are pre-coated and do not require any type of sealing compound. When

Location	Sealant or Lubricant
Cup plugs/threaded plugs	Loctite® 277 or equivalent/Teflon® thread sealer
Cylinder liner seat	1161231 sealant
Oil filter seal	Clean engine oil
Holding metal parts in place	Petroleum jelly
Valve stems and guides	Clean engine oil
Engine front cover/flywheel housing/timing gear cover	3092340 sealant
Engine parts, fasteners and washers	Clean engine oil
Exhaust manifold studs and NOx sensors	High temperature 1161929 anti-seize
Oil cooler assembly O-ring	Clean engine oil
Oil cooler cover	Permatex 85409 or equivalent gasket dressing
O-rings, coolant, EPDM	Clean coolant, or Dow Corning® 55
O-rings (except as noted)	Dow Corning® 55 O-ring lubricant
Threaded sensors	Sealing compound on threads
Turbocharger mounting nuts	1161929 anti-seize

Date	Group	No.	Page
8.2008	211	323	1(5)

## Camshaft Bearing Housing Assembly, Replacement D13

### Camshaft Bearing Housing Assembly, Replacement



W2005852

This information contains the proper procedure to replace factory or aftermarket camshaft housing assemblies on Volvo 13L engines.

#### Contents

- “Camshaft Bearing Housing Assembly, Replacement” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

2119-03-03-02

## Camshaft Bearing Housing Assembly, Replacement

Camshaft removed

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing any procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### When Replacing Factory-Installed Assemblies

**DO NOT MIX** a replacement assembly with the original factory-installed assemblies. The original assemblies were machined together with the cylinder head when the engine was manufactured and can not be replaced individually or installed on another cylinder head. **All 7 bearing housing assemblies must be replaced by using the appropriate camshaft bearing housing assembly spare part kit and following the instructions in this service bulletin.**

**Note:** When installing a new cylinder head, do not mix the new assemblies with original assemblies from the old cylinder head. Use only new assemblies on a new cylinder head.

### When Replacing Aftermarket Assemblies

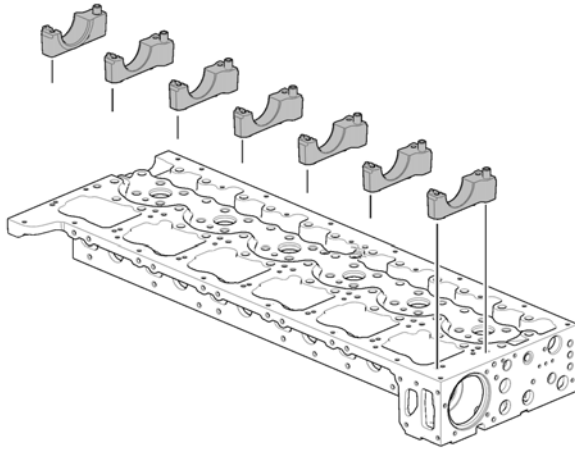
If there are already replacement assemblies on the cylinder head, and one or more assemblies are damaged, all 7 bearing housing assemblies must be replaced by using the appropriate camshaft bearing housing assembly spare part kit and following the instructions in this service bulletin. Replacement assemblies can be identified by the oval-shaped holes for the locating pins. For assemblies in the 2 through 6 positions, both locating pin holes are oval in the side-to-side direction. For assemblies in the 1 and 7 positions, one locating pin hole is oval in the front-to-rear direction; the other pin hole is round and has a locating pin pre-assembled in it.

## Replacement

### 1

Remove the lower bearing saddles using a pry bar. Remove the No. 7 rearmost saddle using a soft-faced mallet by tapping side to side.

**Note:** Pins should come off the cylinder head with the saddles. If they do not, remove them.



T2026160

### 2

Clean the contact surfaces.

### 3



## CAUTION

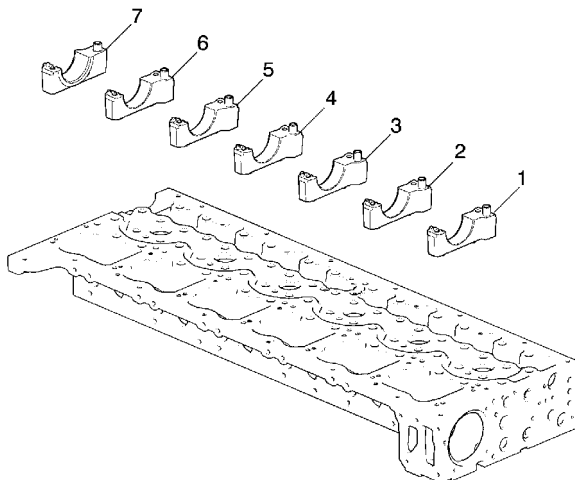
Do not use excessive force to punch the assemblies when marking their position on the cylinder head. Damage to components can result.

Use a metal stamp or electric etching to mark the position, 1 through 7, at which the assembly will be installed on the cylinder head. Mark both the lower saddle and cap of each new replacement assembly. Location markings will indicate the correct installation position of the assemblies if they are ever removed from the cylinder head.

Assemblies 1 and 7 have a pre-installed locating pin on the bottom surface.

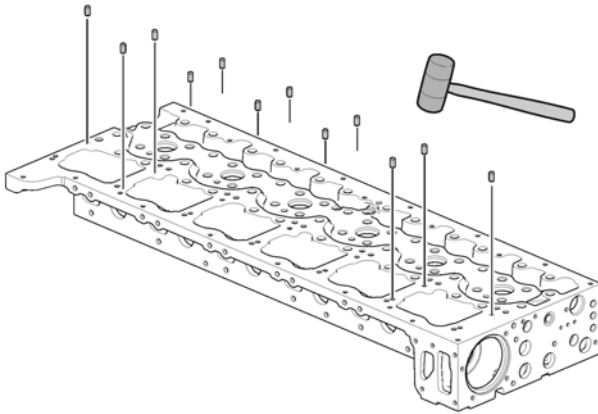
The number 7 assembly has a special counterbore machining around the camshaft bore to accommodate the special thrust bearing used only in the number 7 assembly.

Assemblies 2 through 6 are common and do not have pre-installed locating pins on the bottom surface.



W2006619

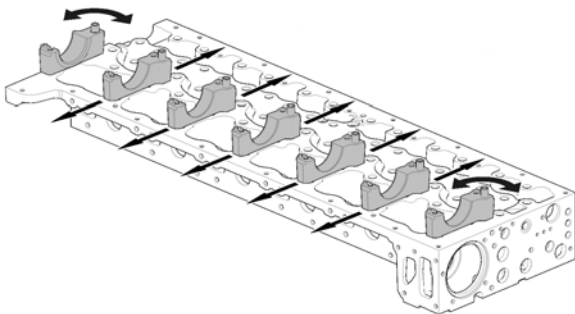
- 4**  
Install the 12 locating pins from the parts kit at the cylinder head locations shown. Use a plastic mallet so as not to damage the locating pins.



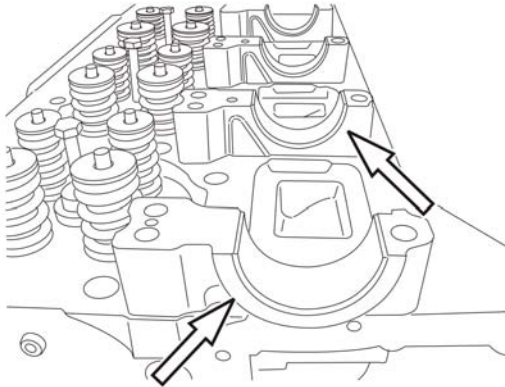
T2026333

- 5**  
Install the new lower bearing saddles into the correct positions on the cylinder head.

- 6**  
Check that the lower bearing saddles can move slightly on the locating pins. The lower saddles position adjusts to allow for proper alignment during camshaft installation. Lower saddles 1 and 7 should turn slightly forward and back at one locating pin location. Lower saddles 2 through 6 should move slightly side to side.



T2026334



W2005237

**7**

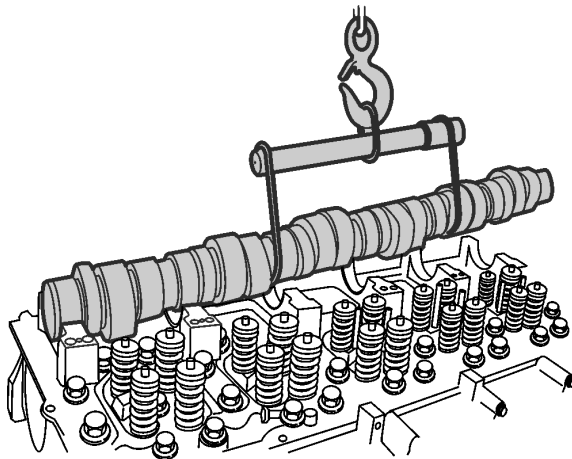
Insert the camshaft lower bearings into the lower saddles and lubricate them with clean engine oil.

**8**

Thoroughly inspect the camshaft before installing it on the cylinder head. Refer to the service information in Group 21.

**9**

Lower the camshaft carefully into place and remove the lifting tool. Rotate the camshaft by hand to ensure that the camshaft is not binding in the lower bearing saddles.



W2005134



**CAUTION**

The camshaft is heavy. Do not attempt to install the camshaft without the help of an assistant or the use of a suitable lifting device. Failure to heed this caution may result in severe personal injury and component damage.

85109034

**10**

Install the camshaft upper bearings into the new bearing caps and lubricate them with clean engine oil.

**11**

Install the new bearing caps on the correct bearing saddles. Final tightening is done later when the rocker arm shaft is installed. Use a soft-faced mallet to seat the bearing caps over the dowel pins.

**Note:** Verify that the camshaft has free rotation after the fastener tightening has been completed.

**12**

Complete the camshaft installation using the service information in Group 21.

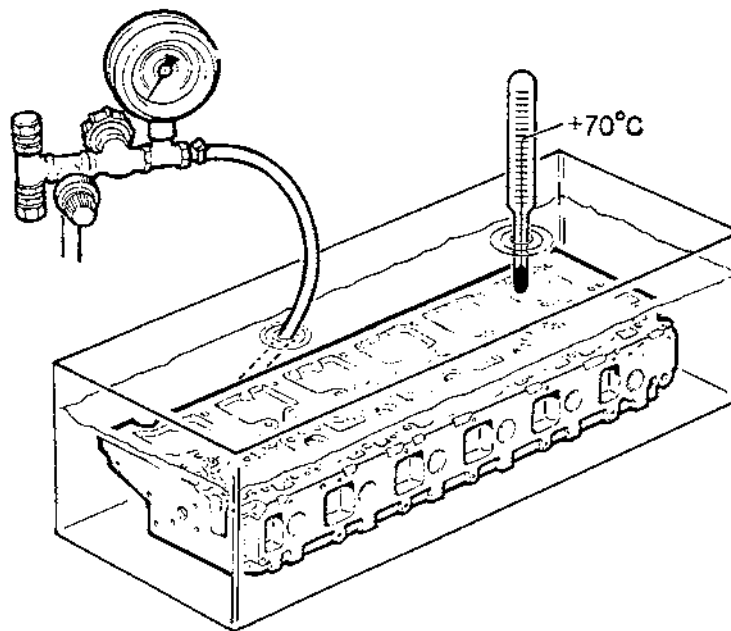
This service bulletin replaces bulletin 211-66 dated 2.2008.

Date	Group	No.	Release	Page
7.2011	<b>211</b>	<b>66</b>	<b>02</b>	1(4)

Cylinder Head, Pressure Test

D13

## Cylinder Head, Pressure Test



T2008809

## Contents

- "Cylinder Head, Pressure Test (First)", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



## 2111-06-04-01 Cylinder Head, Pressure Test (First) Cylinder head removed

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9809696, 9990106, 9990107, 9996662, 9998266*

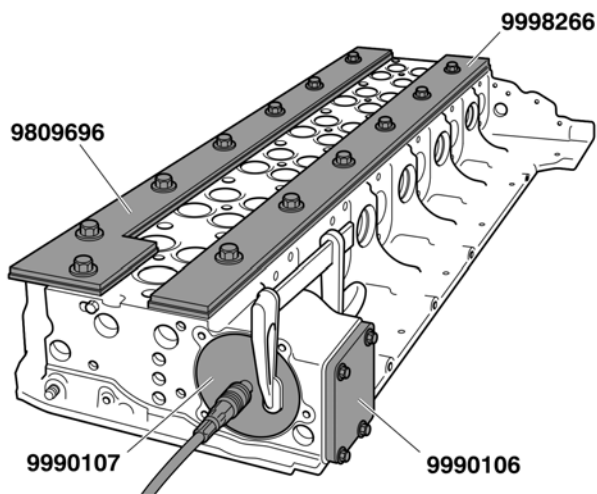
**1**

Clean the contact surfaces on the cylinder head.

**2**

Install the following on the cylinder head:

- Sealing plates 9809696 and 9998266 onto the cylinder head using cylinder head bolts and M16 nuts
- Connection disc 9990107 in the position of the thermostat housing cover
- Plug M12x1.5 in the temperature sensor hole
- Sealing plate 9990106 on the side of the cylinder head
- Lifting chain



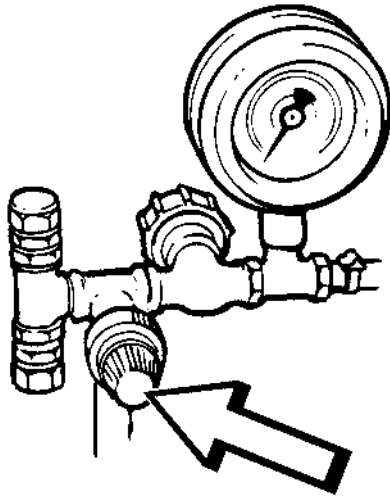
T2022359

9809696, 9990106, 9990107, 9998266

**3**

Connect pressure gauge 9996662. Connect the pressure gauge hose to the connection disc. Adjust the pressure to 100 kPa (14.5 psi) using the control valve. Close the stop valve for 2 minutes. The pressure should not fall.

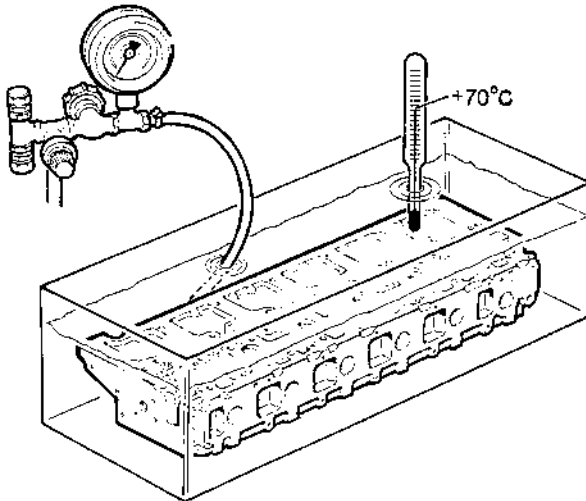
9996662



T2007039

**4**

Lower the pressure in the cylinder head by adjusting the knob on the pressure gauge control valve.



T2008809

**5**

Lower the cylinder head into a water bath at 70°C (158°F).

**6**

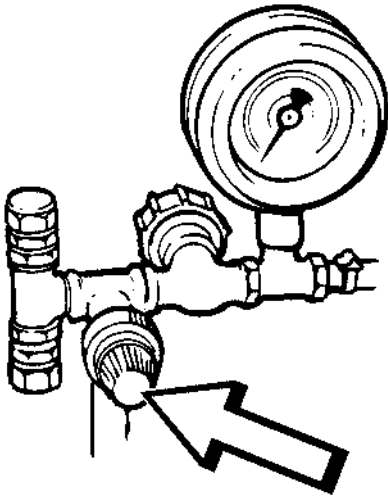
Connect an air supply to the pressure gauge. Carefully open the control valve.

**7**

Set the pressure to **50 kPa (7.25 psi)** and hold the pressure for **1 minute**.

**8**

Raise the pressure to **150 kPa (21.8 psi)**. Close the stop valve and check after **2 minutes** whether the pressure has fallen or if any air bubbles are visible.



T2007039

**9**

Lower the pressure in the cylinder head by adjusting the knob on the pressure gauge control valve.

**10**

Lift the cylinder head out of the water bath.

**11**

Remove all the sealing washers. Using compressed air, blow the water off the cylinder head.

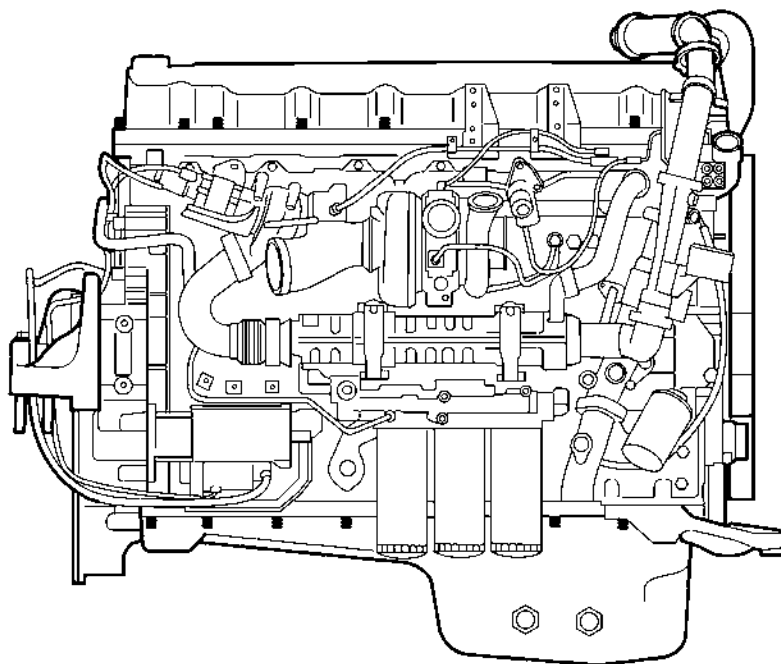
**Note:** Take extra care with the fuel passages. Make sure that no dirt enters the fuel channels, as this can cause the injectors to be damaged.

Date	Group	No.	Release	Page
7.2008	<b>211</b>	<b>67</b>		1(10)

## Valve Cover Gaskets, Replacement (All)

D13F

### Valve Cover Gaskets, Replacement (All)



W2005779

This information covers the proper replacement procedure for the valve cover gasket on a Volvo D13F engine in a Prevost vehicle.

### Contents

- "Valve Cover Gaskets, Replacement (All)", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2116-03-02-01**

## Valve Cover Gaskets, Replacement (All)

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

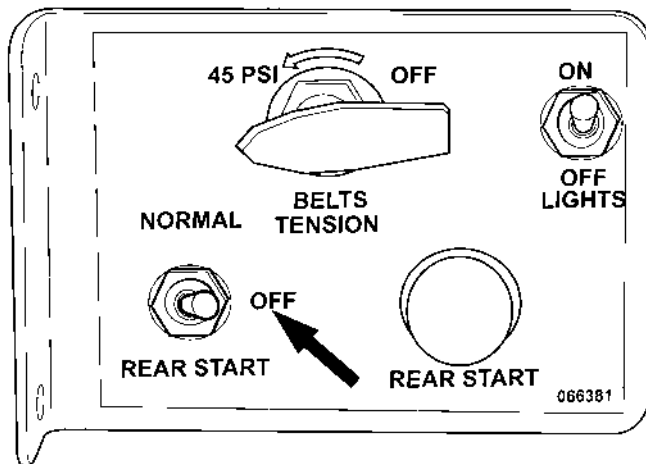
### Removal

**1**

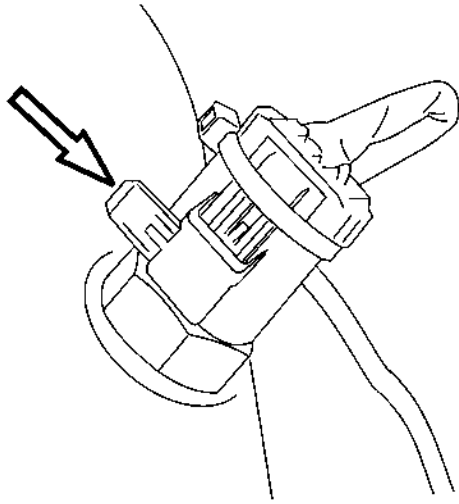
Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.

**2**

Open the engine compartment door. Set the starter selector switch to the OFF position.



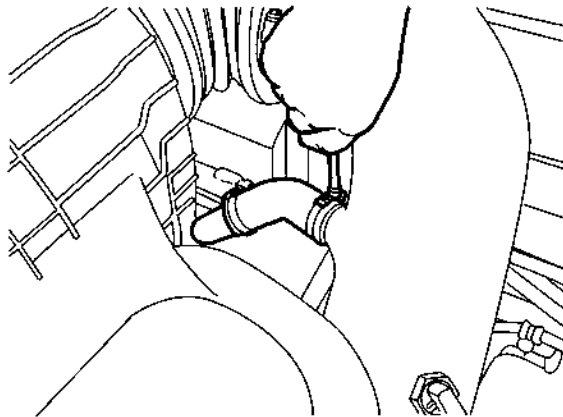
W2006494



W2004720

**3**

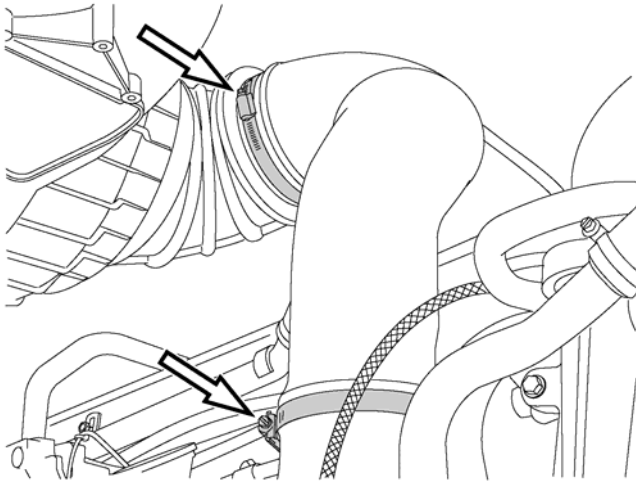
Unplug the air temperature sensor wiring harness connector. Remove the lock tab and separate the connector from the sensor. Remove the sensor harness clamp from the main fresh air pipe.



W2004719

**4**

Loosen the air compressor fresh air hose clamp.



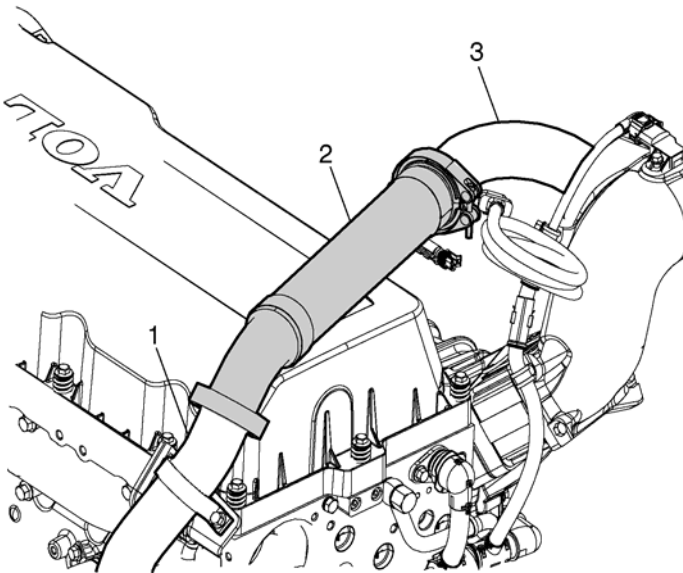
W2006005

**5**

Loosen the clamps and remove the main fresh air pipe from the air compressor fresh air hose, the air filter housing and the turbocharger air inlet elbow.

**6**

Loosen the V-clamps and remove the EGR crossover pipe. Discard the V-clamps.



W2005960

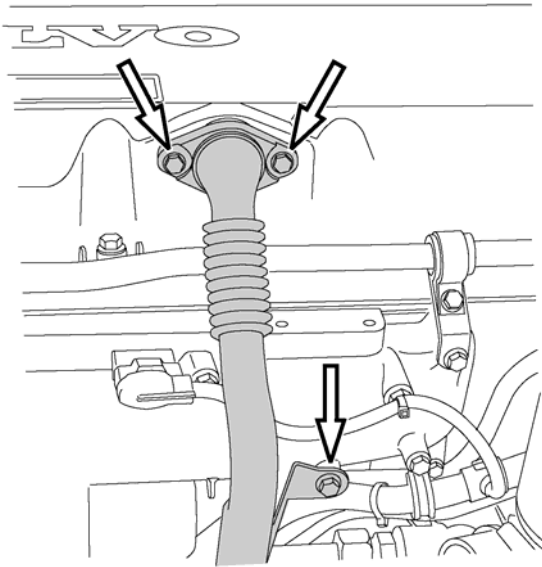
- 1 Venturi Outlet Pipe
- 2 Crossover Pipe
- 3 Mixer Inlet Pipe

**7**

Loosen the clamp and mounting brackets to allow air compressor fresh air pipe to be removed.

**8**

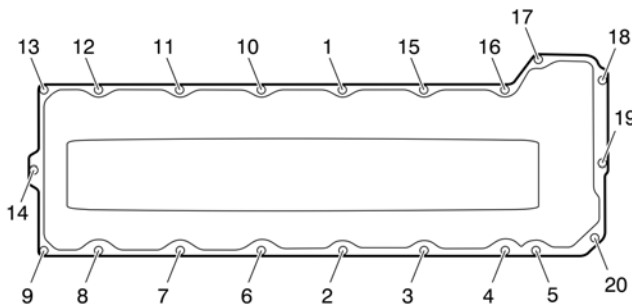
Remove the aftertreatment fuel injector harness clips at the valve cover.



W2006122

**9**

Remove the fasteners which secure crankcase ventilation tube and bracket to valve cover and intake manifold. Relocate the tube away from the manifold.



T2022732

**10**

Disconnect the discharge line and mounting brackets from the air compressor. Move the discharge air line out of the way and strap in place.

**11**

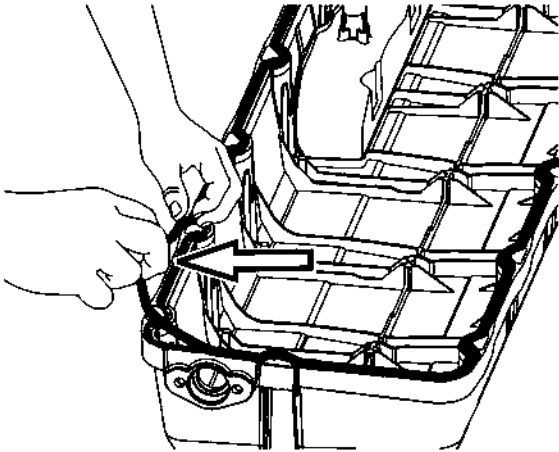
Remove the spring-loaded bolts from the valve cover.

**12**

Lift and remove the valve cover.

**Note:** Rotate the valve cover as needed, to clear the camshaft gear and damper.





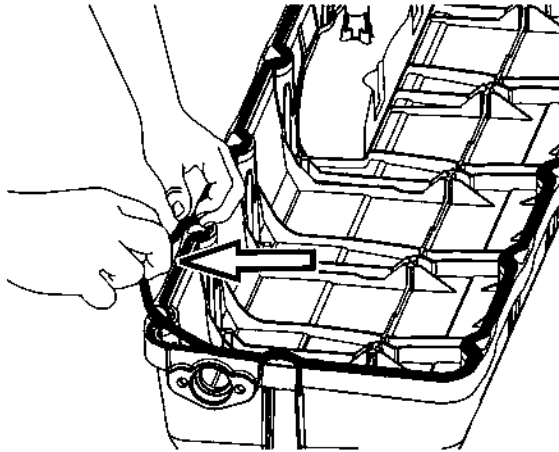
W2005162

- 13**  
Remove the rubber gasket from the channel in the valve cover.

## Installation

1

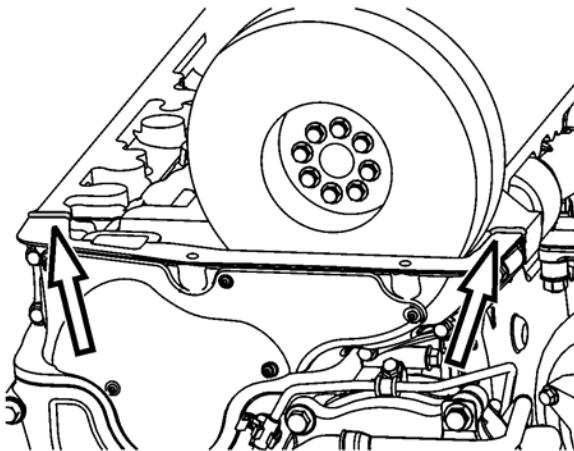
Clean the gasket sealing surface of the valve cover and the cylinder head. The surfaces should be clear of any dirt or debris and free of any oil.



W2005162

2

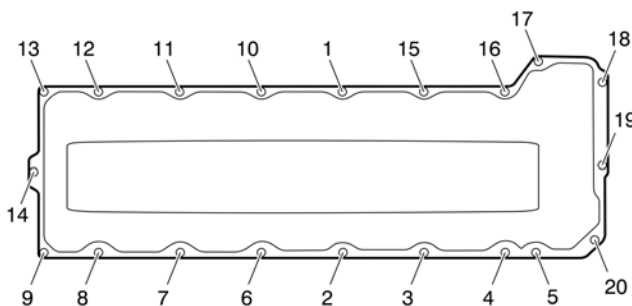
Carefully place a new gasket into the channel, making sure that it is properly seated and follows the contour of the channel.



W2005157

3

Apply a 2 mm (0.079 inch) bead of Volvo sealant to the area where the timing cover and the cylinder head meet. This parting line is on both sides of the cylinder head. Carefully position the valve cover on the cylinder head and make sure that the seal remains properly seated.



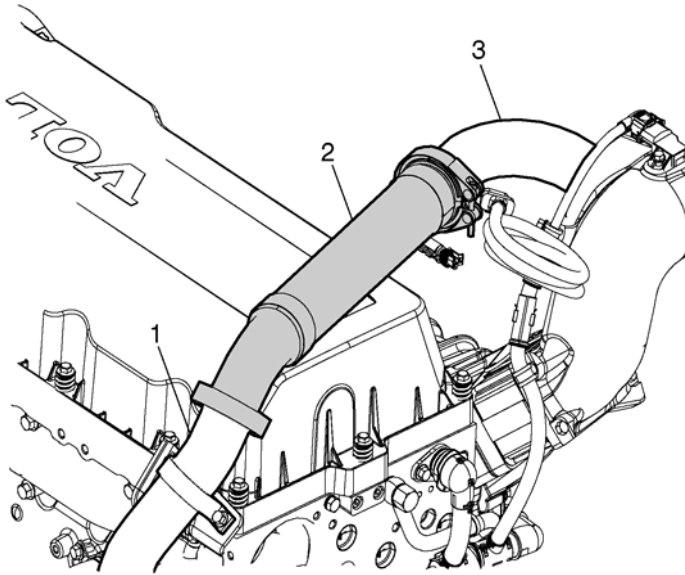
T2022732

4

Install the spring-loaded bolts in the valve cover. Tighten the valve cover bolts to specification.

**Note:** For correct torque specifications, refer to the Specifications bulletin in Group 20.

**Note:** The bolt springs provide even tension on the valve cover gasket.

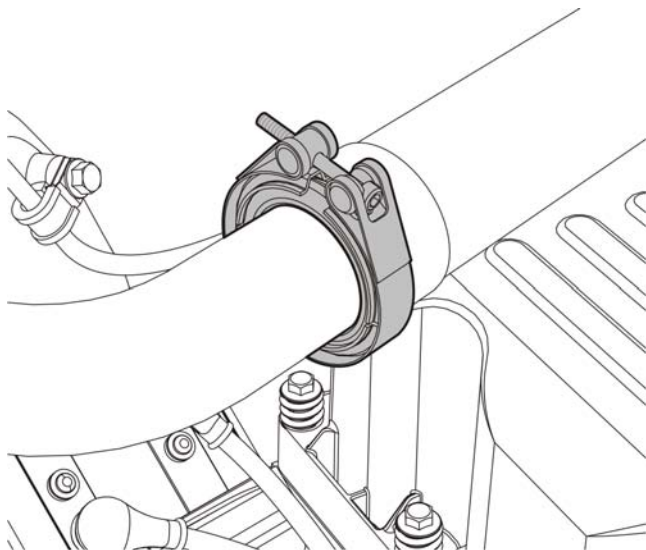


W2005960

**5**

Position the crossover pipe (with new O-rings) between the venturi outlet pipe and the mixer inlet pipe.

- 1 Venturi Outlet Pipe
- 2 Crossover Pipe
- 3 Mixer Inlet Pipe



W2005804

**6**

Make sure the O-rings are in place and install new V-clamps at both ends of the crossover pipe. Tighten the clamps to specification.

**7**

Remove the strap used to temporarily hold the air compressor discharge line. Connect the discharge line to the air compressor and secure the pipe mounting brackets to the cylinder head.

**8**

Install the air compressor fresh air pipe to the air compressor. Secure the mounting brackets to the cylinder head.

**9**

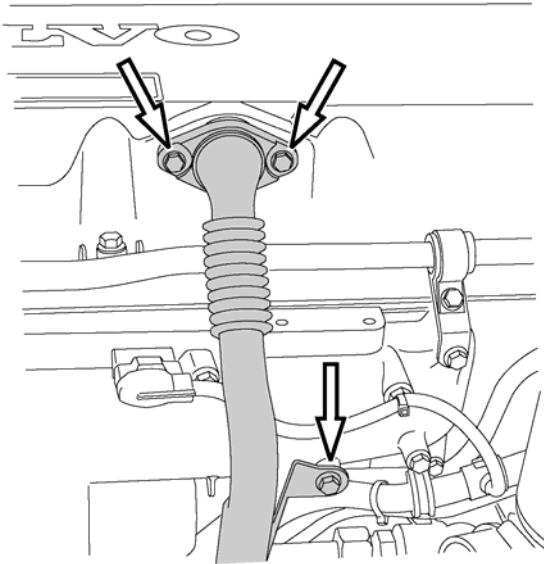
Install the aftertreatment fuel injector harness clips on the valve cover.

**10**

Install the fasteners securing crankcase ventilation tube and bracket to valve cover and intake manifold. Tighten the fasteners to specification.

**Note:** Inspect the crankcase ventilation tube O-ring and replace if necessary.

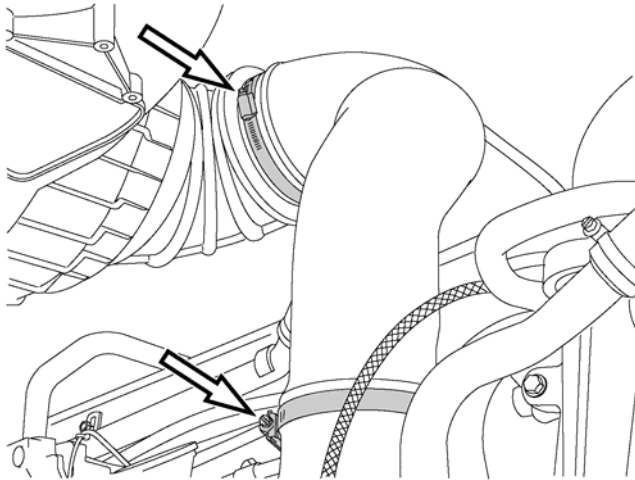
**Note:** Ensure that the same bolts that were removed at disassembly are reinstalled in the same location. Damage to the valve cover will result if the bolts installed are too long.



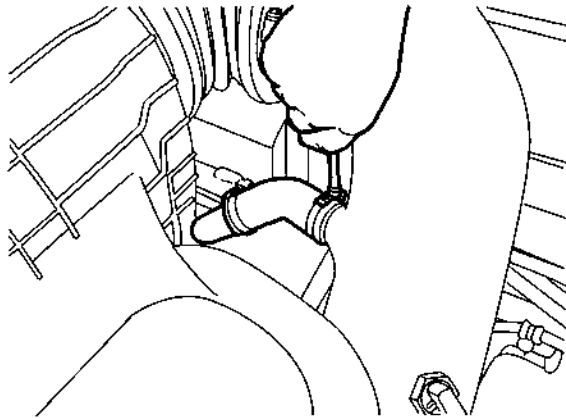
W2006122

**11**

Install the main fresh air pipe between the air filter housing and the turbocharger air inlet elbow. Position the clamps and tighten to secure.



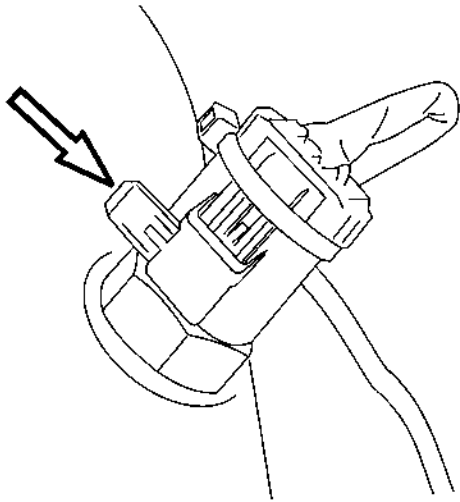
W2006005



W2004719

**12**

Install the air compressor fresh air hose to the main fresh air pipe, position the clamp and tighten to secure.



W2004720

**13**

Install the air temperature sensor connector to the sensor. Insert and secure the connector lock tab. Install the sensor harness clamp to the main fresh air pipe.

**14**

Turn the ignition key to the ON position. Set the starter selector switch to the rear start position.

**15**

Press the starter push-button switch. Release push-button after the engine starts. Check for leaks and proper operation.

**16**

If a new valve cover is installed, print a new Engine Certification Label and attach it to the cover.

**17**

Set the starter selector switch to the NORMAL position. Close the engine compartment door.

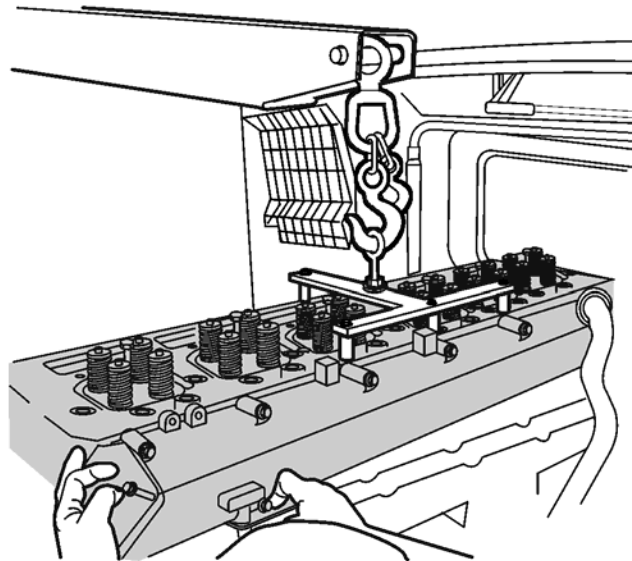
This Service Bulletin replaces service bulletins 211-00 and 211-01 dated 8.2009.

Date	Group	No.	Release	Page
8.2010	<b>211</b>	<b>87</b>	<b>02</b>	1(26)

## Cylinder Head, Replacement

D13

### Cylinder Head, Replacement



W2005117

This information covers the service procedures for replacing the cylinder head on the VOLVO PREVH, PREVX, and 9700 Model buses equipped with the D13 engines.

### Contents

- "Removal", page 2
- "Installation", page 14

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2111-03-02-01 Cylinder Head, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9990006, 85111422 A & B, 88800188, 85109250, 85109034, 9996400, 9996966, 9998249, 9998251, 88800014, 9990262*

### Removal

**Note:** Intake and exhaust manifold removed.

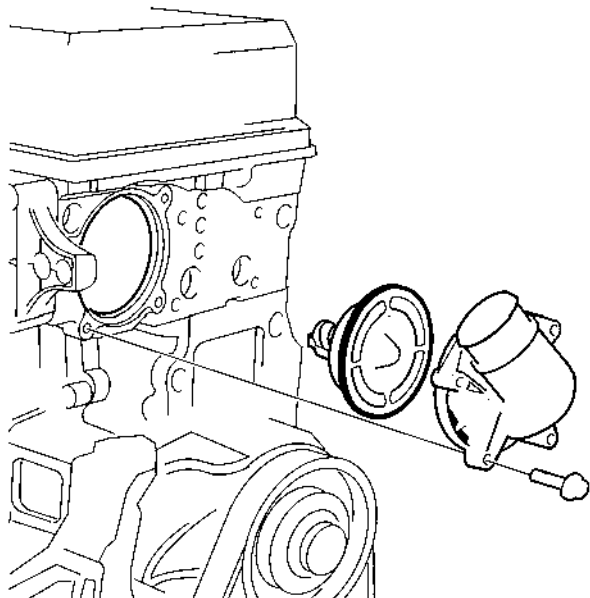
**1**

Remove the thermostat housing and the thermostat.



#### **WARNING**

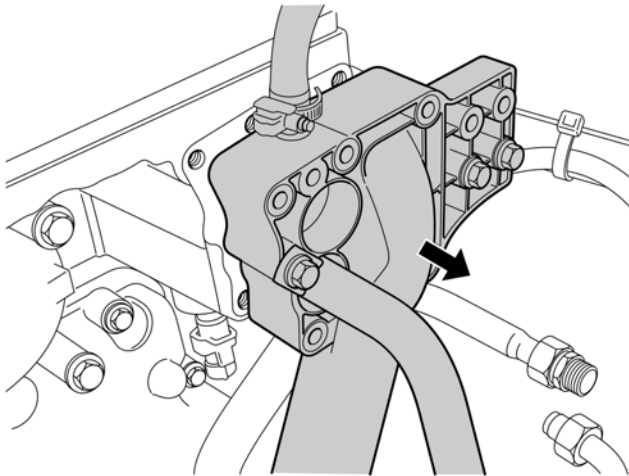
The coolant is hot. Use caution or personal injury could occur.



T2022128

**2**

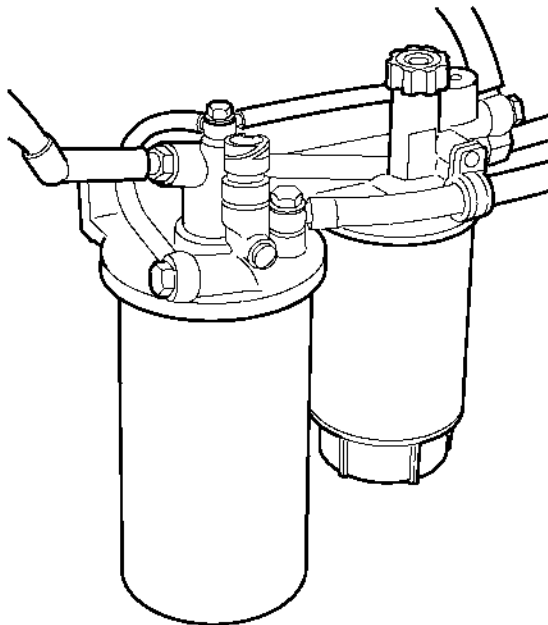
Remove the fan ring bracket.



T2022605

**3**

Remove the bypass pipe bolts. Remove the coolant pipe fixture bolts. Pull the bypass pipe out a little so that it clears the cylinder head. Remove the engine coolant temperature sensor connector from below the thermostat housing.



W2005849

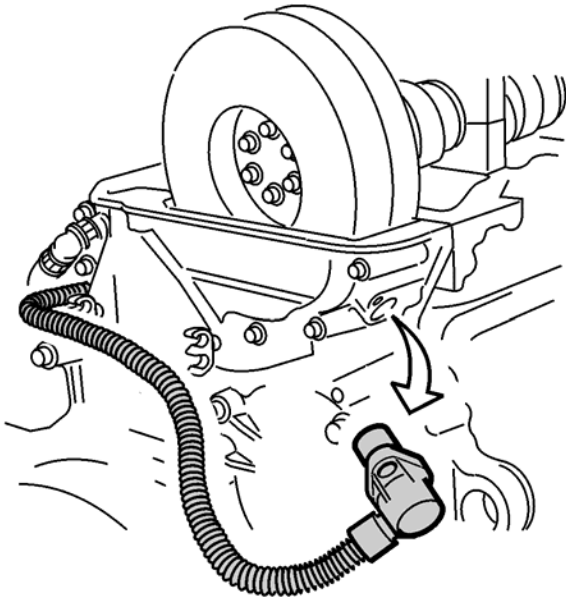
**4**

Clean around the fuel supply line on the fuel filter housing. Loosen the fuel supply line at the filter housing to allow fuel to drain from the cylinder head. Drain the fuel into a suitable container.

**5**

Remove the valve cover. Refer to Group 21 for procedure.





T2021625

**6**

Remove the camshaft position sensor.

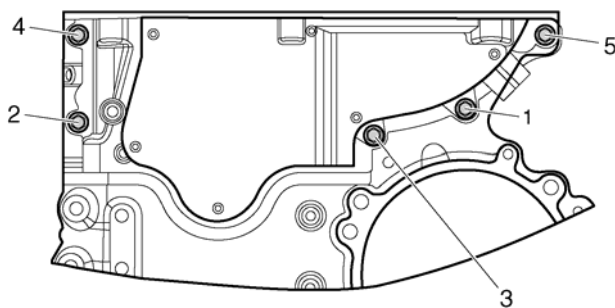
**Note:** Retain any shims.

**7**

Disconnect the intake air temperature sensor wiring harness connector, if equipped. First, remove the lock tab, then cut the tie strap and separate the connector from the intake air temperature sensor. Also, remove the sensor harness bolt and P-clamp securing the sensor harness to the fresh air pipe.

**8**

Remove the screws attaching the timing gear cover to the timing gear plate and cylinder head.



W2006133

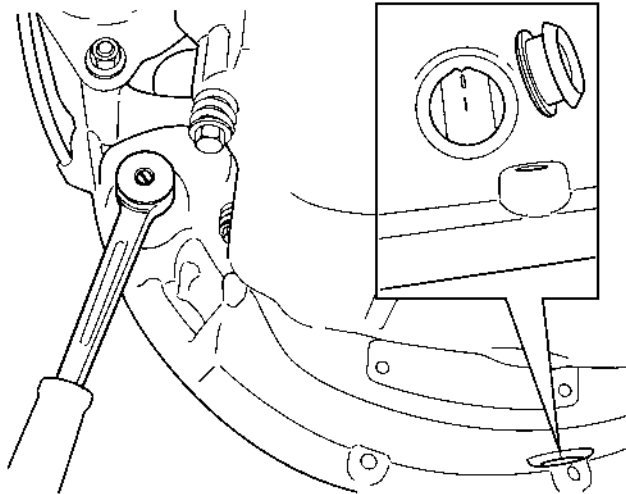
**9**

Loosen the nuts on the air compressor discharge pipe. Remove the discharge pipe clamps.

**10**

Clean carefully around the fuel line connection on the cylinder head. Remove the banjo bolts from the fuel line.

**Note:** Protect openings in pipes and the cylinder head from dirt.

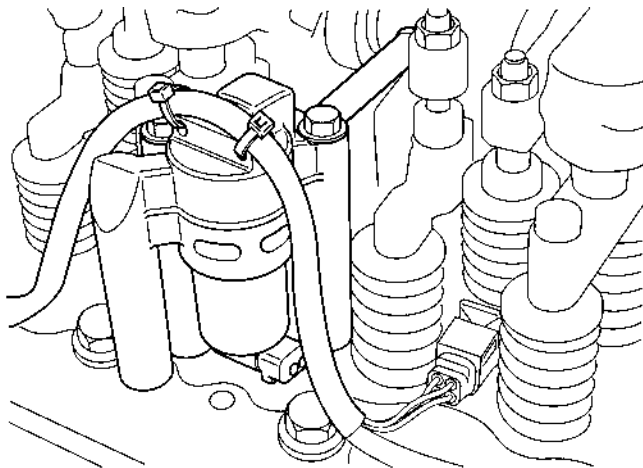


T2022114

**11**

Remove the plugs from the flywheel casing. Install the crankshaft rotation tool. Crank the flywheel until the piston in cylinder 1 is at TDC, 0° on the flywheel.

88800014



T2022123

**12**

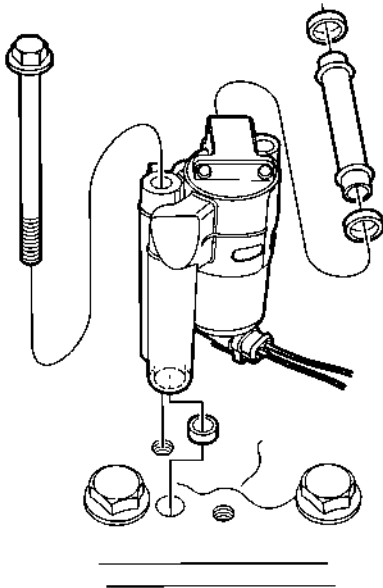
Clean and dry around the control valve. Cut the nylon tie straps securing the injector electrical wiring harness to the engine brake control valve.

**Note:** On engines not equipped with an engine brake, an oil flow adapter is used in place of the engine brake control valve. It is mounted in the same location on the cylinder head and provides oil to the rocker shaft.



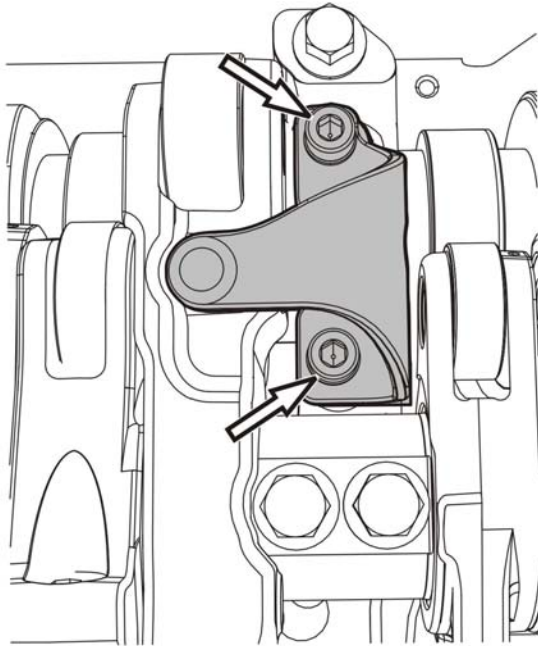
W2004837

- 13**  
Remove the control valve electrical connector.



W2004869

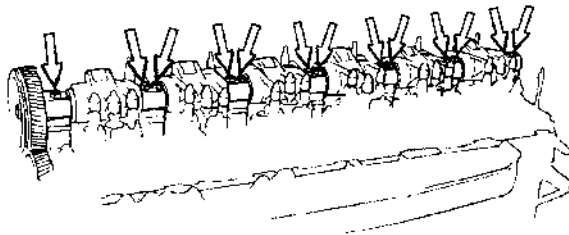
- 14**  
Remove the engine brake control valve bolts. Remove the control valve and the oil pipe between the valve and the rocker arm shaft.



W2005845

**15**

Remove the leaf springs from the camshaft bearing caps (applies to engines equipped with engine brake).



W2006220

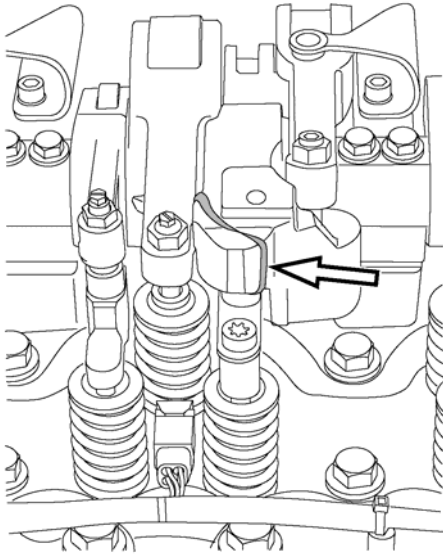
**16**

Beginning at the center camshaft bearing cap and working in sequence alternately forward and back from the center, evenly loosen the rocker arm shaft bolts along the entire length of the shaft until there is no valve or injector spring pressure exerted on the assembly. Install rocker arm assembly lifting tool 85109250. Always use the proper tool for the particular series engine.

**CAUTION**

The bolts must be loosened evenly, in stages and in sequence, to prevent bending or damaging the shaft.

85109250



W2006172

**17**

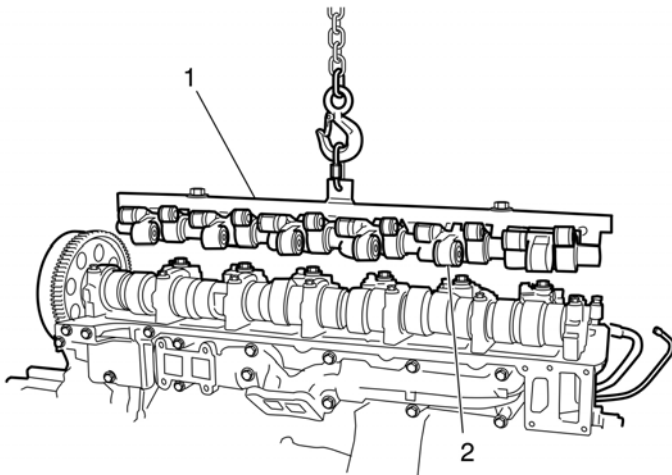
On engine brake equipped engines, secure the pistons in the exhaust rocker arms with elastic bands or similar, to prevent the pistons from falling out when the rocker arm assembly is removed.

**18**

Carefully lift off the rocker arm assembly.

**Note:** The pistons and rocker arms are matched. One, two or three punch marks should match between the rocker arm and piston.

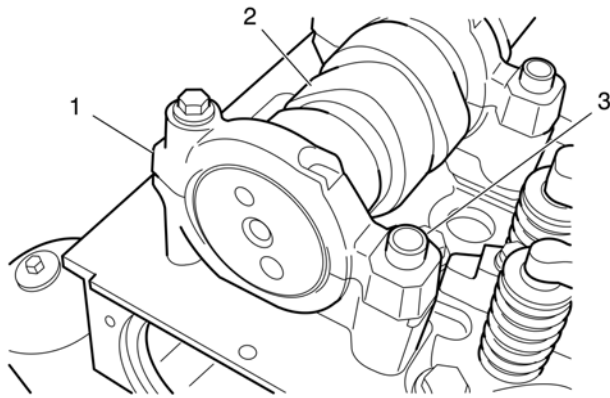
85109250



W2005513

1 Lifting Tool 85109250

2 Rocker Shaft Assembly



W2005514

- 1 Camshaft Bearing Cap
- 2 Camshaft
- 3 Alignment Sleeve

**19**

Make sure that the alignment sleeves remain in position on each bearing cap.

**20**

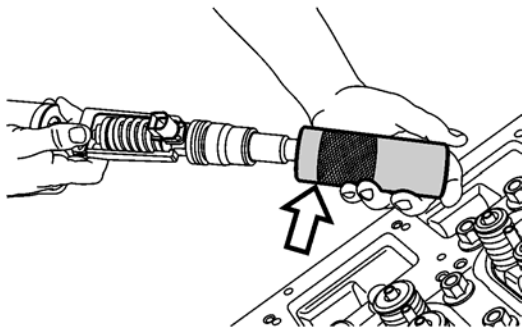
Mark the valve bridges so they can be installed in the same location during reassembly. Remove the valve bridges.

**21**

Mark the location of the injectors for reinstallation. Injectors must be installed in the same cylinder as they were removed. Remove the unit injectors. Refer to Group 21 for procedure.

**22**

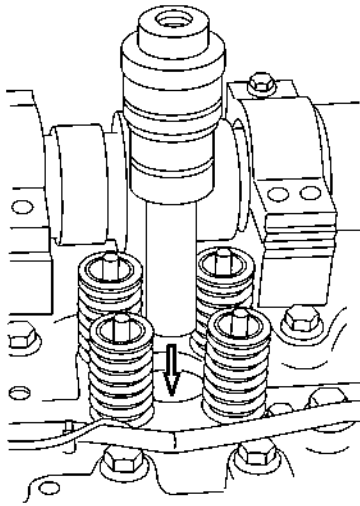
Using compressed air, clean out the injector hold down bolt holes. Install the protective sheath to the removed unit injector.



W2005112

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9998249

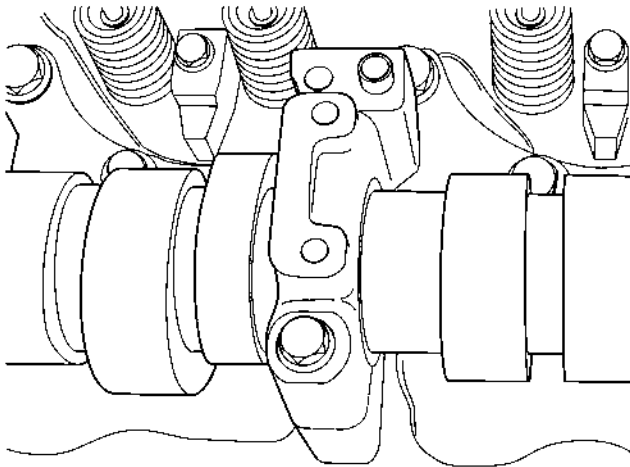


W2005172

**23**

Insert a protective plug in the hole in the cylinder head left by the unit injector.

9998251



T2022284

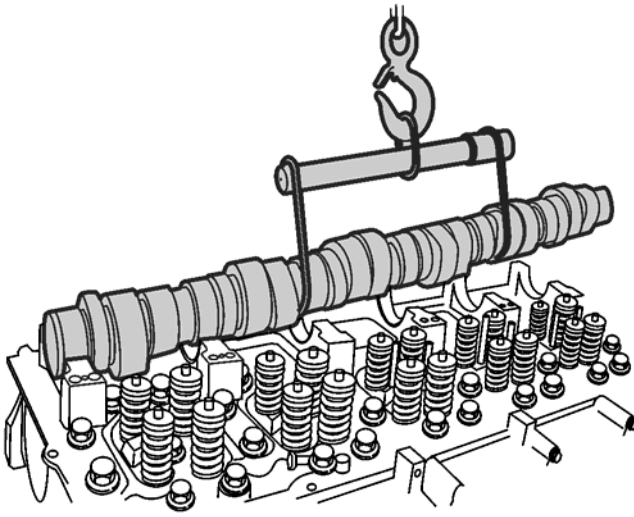
**24**

Remove the camshaft bearing caps.

**25**

Carefully lift away the camshaft with lifting tool.

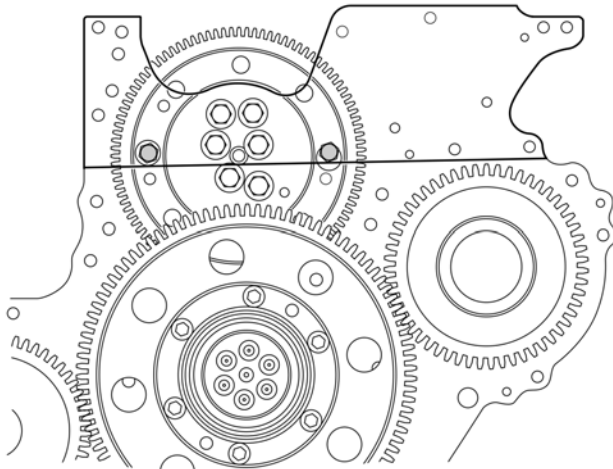
85109034



W2005134

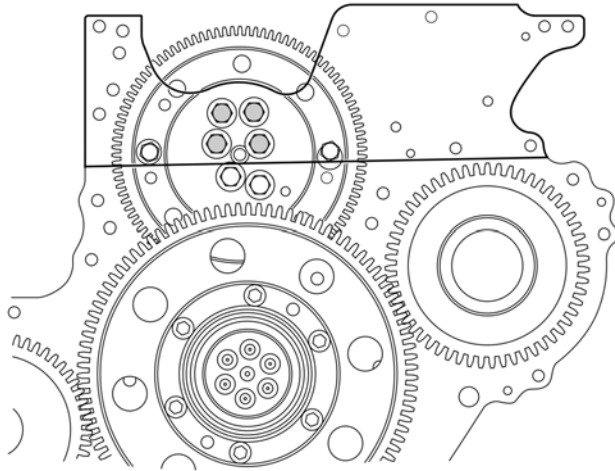
**26**

Turn the crankshaft so that a bolt in the timing gear plate is accessible, and remove bolt. Turn the crankshaft a little and remove the other bolt.



T2022362

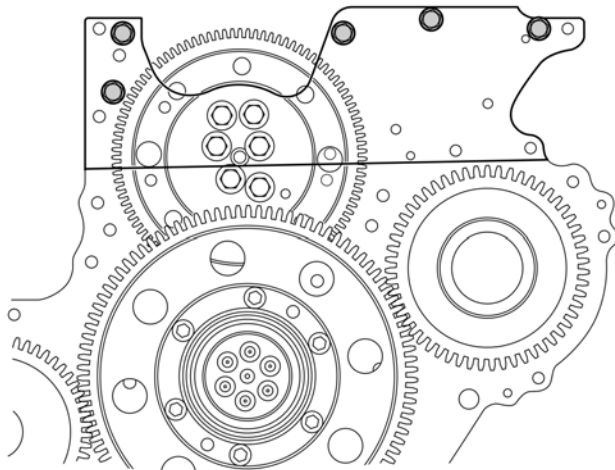




T2022363

**27**

Remove the upper screws from the idler gear hub.



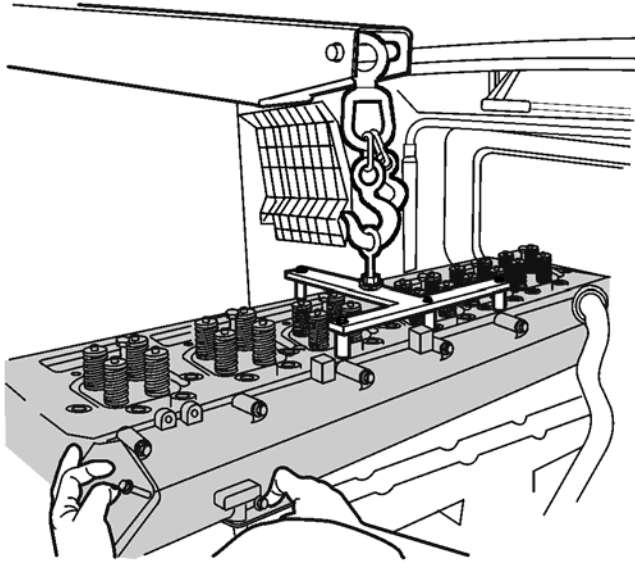
T2022364

**28**

Remove the bolts securing the timing gear plate to the cylinder head.

**29**

Remove engine oil from the "hollows" beneath the camshaft to prevent oil from running into the coolant channels.

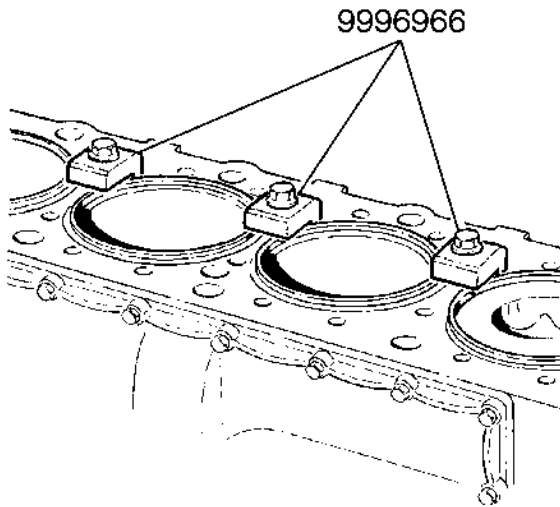


W2005117

**30**

Attach lifting tool and carefully lift off the cylinder head.

88800188



T2019374

**31**

Remove the cylinder head gasket. Secure the cylinder liners with clamping tool.

9996966

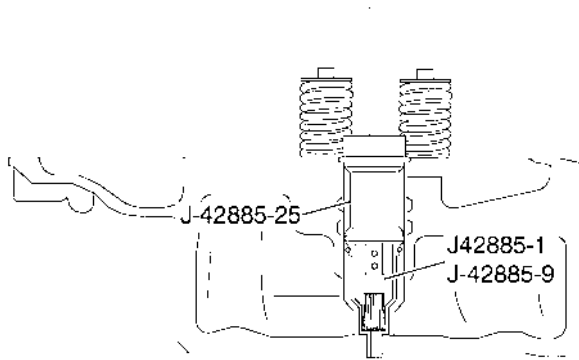
**32**

Remove the crankshaft rotation tool.

## Installation

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 85109250, 85109208, 9996966, 9999683, 9999696, 88800014, 88800031, J-42885, 9998251, 88800188, 85109034, J44514-B*



W2006256

### 1

Clean the unit injector sleeves with brush and extension installed to protect the fuel passages. After cleaning the sleeve, carefully inspect the inside surface of the sleeve, especially the bottom surface where the injector seal is located. Any remaining contamination is unacceptable and must be removed. Also, if there is any indication of a discrepancy that raises concern about suitability of the sleeve for reuse, replace it with a new sleeve.

---

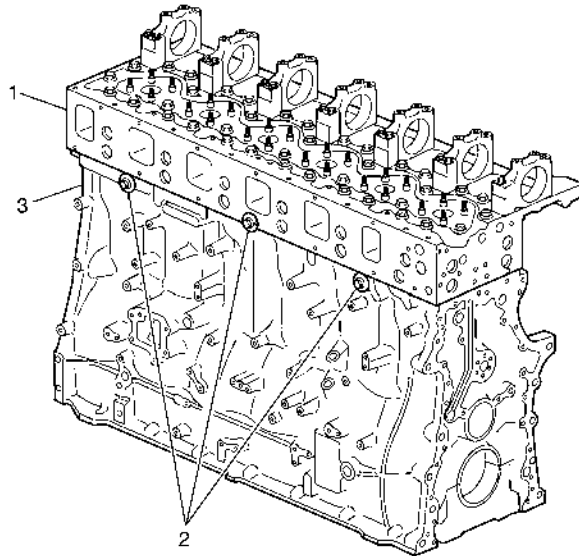
J-42885

### 2

Install fuel injector bore plugs.

---

9998251



W2006306

- 1 Cylinder Head
- 2 Guide Washers
- 3 Cylinder Block

**3**  
Clean the engine block.

**4**  
Install the head lifting tool. Clean the cylinder head carefully. Check that the guide washers on the engine block and cylinder head are clean and free of rust.

---

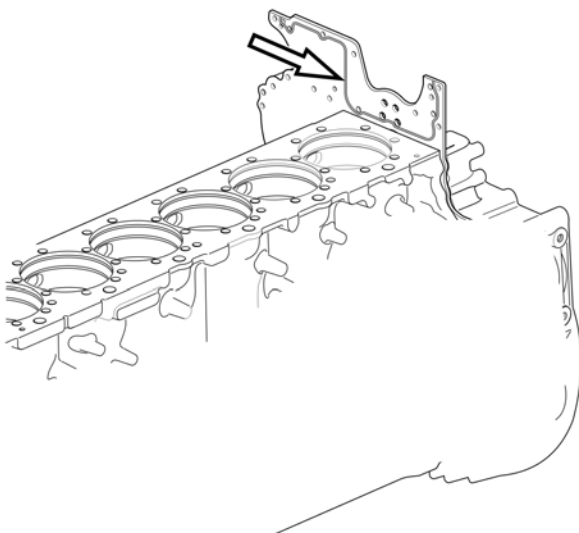
88800188

**5**  
Remove the press tools and install the cylinder head gasket.

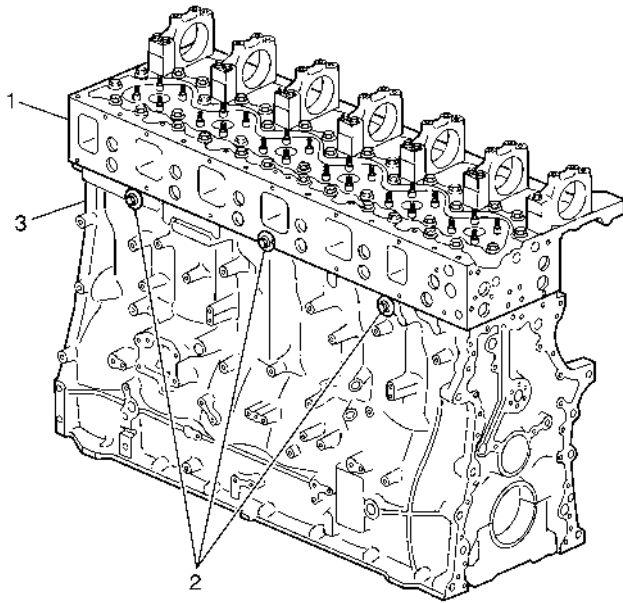
**Note:** Check that the seals are correctly positioned with their holes all centered.

**6**  
Apply a 2 mm (0.07 in.) thick bead of approved sealant to the surface at the side of the "track" on the timing gear plate (as shown in the illustration).

**Note:** The cylinder head must be installed and tightened within 20 minutes after the sealant has been applied.



T2022794



W2006306

- 1 Cylinder Head
- 2 Guide Washers
- 3 Cylinder Block

**7**

Carefully lower the cylinder head until it makes contact with the cylinder head gasket. Press the cylinder head against the timing gear cover and the guide washers at the left side.

Insert the bolts through the timing gear plate and the adjustable idler gear hub. Tighten the bolts to specification. Refer to Group 20.

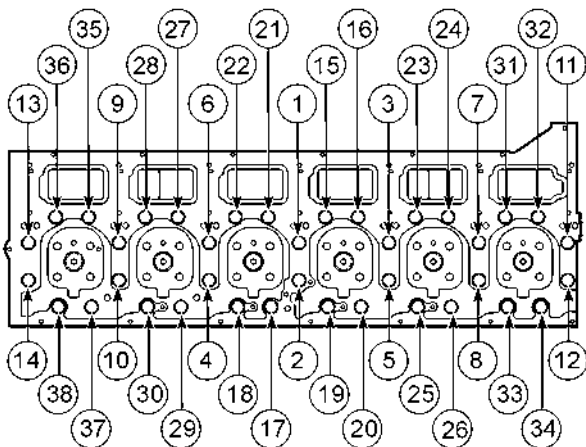
88800188

**8**

Apply a small amount of engine oil on bolt threads.

**9**

Insert 4 cylinder head bolts into locations 24, 26, 28 and 30. Tighten the bolts to specification.



T2020160

**10**

Remove the head lifting bracket.

**11**

Apply a small amount of engine oil on bolt threads. Insert the remaining cylinder head bolts. Clean the cylinder head bolts before reuse.

**Note:** The cylinder head bolts must **not** be reused more than 5 times. Mark the cylinder head bolts by punching them.

**12**

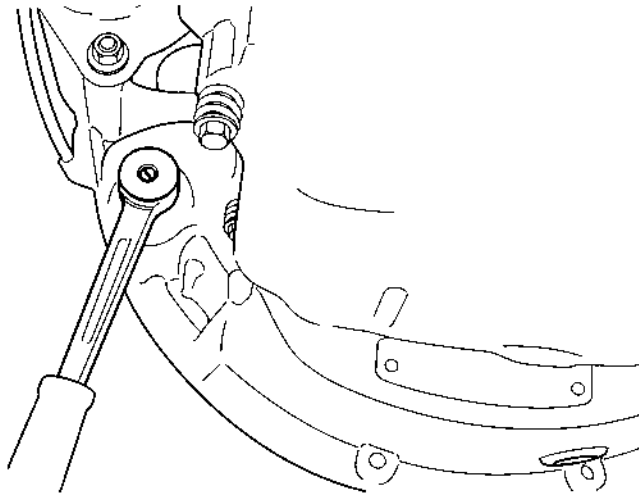
Torque tighten and angle tighten cylinder head bolts in accordance with the tightening diagram in specifications.

**13**

Remove the plug from the flywheel casing and install cranking tool

---

88800014



T2022378

**14**

Insert new coated screws into the timing gear plate. Tighten to specification. Use the flywheel turning tool to rotate engine so that the screw holes in the timing plate becomes accessible through the idler gear hole. Using a clean shop towel, cover the opening in the flywheel housing to prevent screws from falling into the engine. Insert the screws and tighten to specification. Remove the shop towel.

Insert new coated screws into the timing gear plate. Tighten to specification. Use the flywheel turning tool to rotate engine so that the screw holes in the timing plate becomes accessible through the idler gear hole. Using a clean shop towel, cover the opening in the flywheel housing to prevent screws from falling into the engine. Insert the screws and tighten to specification. Remove the shop towel.

**Note:** Never turn the engine while the shop towel is inserted.

**15**

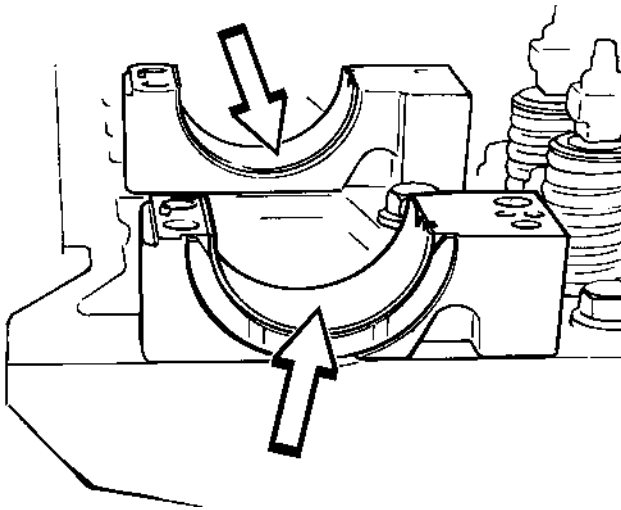
Insert the idler gear screws into the hub. Tighten to specification.

**16**

Clean and inspect the camshaft using solvent and compressed air.

**17**

Install the camshaft lower bearing shells and lubricate them with engine oil.

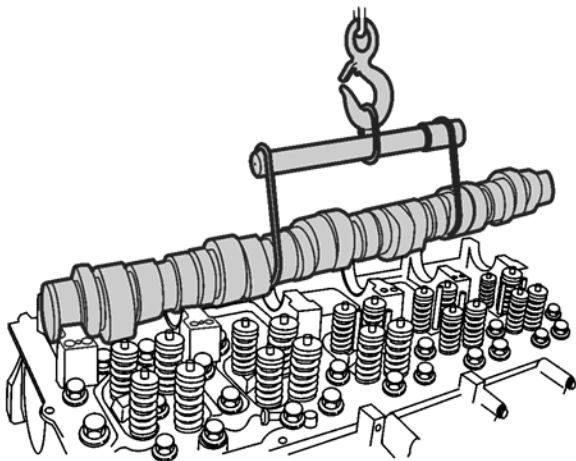


T2008859

**18**

Lower the camshaft carefully into place and remove the camshaft lifting tool. Rotate the camshaft by hand to ensure the camshaft is not binding in the lower bearing saddles.

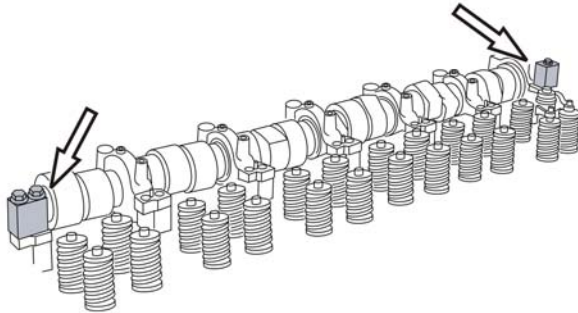
85109034



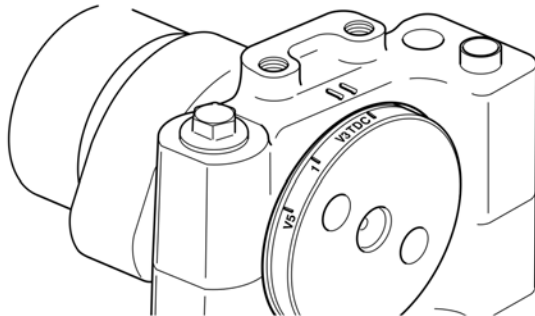
W2005134

**19**

Install the camshaft upper bearings into the camshaft bearing caps, lubricate the bearings and install the bearing caps to the respective bearing saddles. Use a soft faced mallet to seat the bearing caps over the dowel pins.



W0002297



T2022609

**20**

Install the exhaust side bearing cap bolts and tighten to specification.

**21**

Install the bearing cap press tool (2 required) at the number 7 and number 1 bearing caps as shown in the illustration.

**Note:** The tool is used when adjusting the timing gear backlash when the rocker shaft assembly is not installed.

---

85109208

**22**

Install the unit injectors. See Group 21 for procedure.

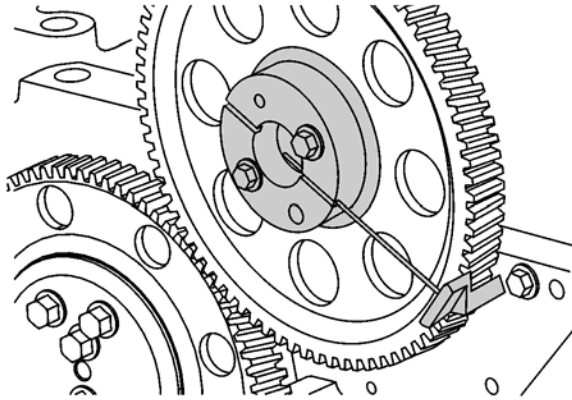
**23**

Ensure that the camshaft mark (**TDC**) lies between the markings on the bearing cap. Check that the flywheel is at **0°**.

**24**

Install the camshaft gear, noting the marking on the timing gear plate.





W2005135

**25**

Install the camshaft timing gear without the damper using the camshaft alignment spacer block with two bolts.

**26**

Position the camshaft gear so that the reference hole in the timing gear plate is between the marks on the gear. Insert the alignment tool into the hole in the cylinder head to engage the camshaft gear teeth with the rod of the tool in the slot of the clamp tool. Rotate the camshaft until this occurs.

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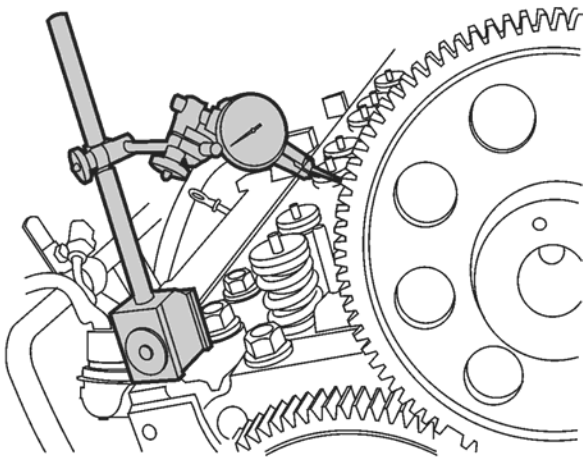
J44514B

**27**

Check the gear backlash between the timing gear and the adjustable intermediate idle gear. Install the magnetic base and the dial gauge against a tooth on the adjustable intermediate idler gear and turn the gear back and forth. Read off the value on the rocker indicator and compare with the value in specifications.

---

9999683, 9999696



W2005136

**28**

Check and adjust the backlash between the camshaft timing gear and the adjustable idler gear. Position the dial indicator against a tooth of the camshaft timing gear and rock the gear back and forth while holding the adjustable gear with the clamp from the kit. Note the value on the dial indicator and compare with the specification.

---

9989683, 9999696, J44514B

**29**

When the gear backlash is correct, replace all adjustable idler gear bolts, one at a time and tighten to specification.

**Note:** Mark the bolts to aid in tightening the bolts to the degrees rotation specification.

**30**

Remove the camshaft alignment spacer block from the camshaft timing gear and install the vibration damper and clamp plate using new bolts. Tighten the bolts to specification.

**Note:** Mark the bolts to aid in tightening the bolts to the degrees rotation specification.

**31**

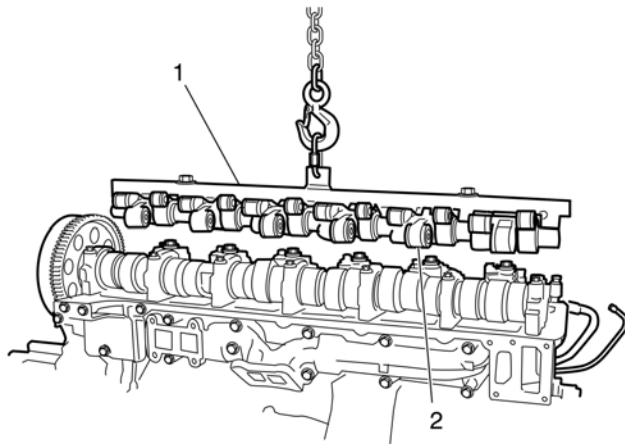
Oil the valve bridges and cam with engine oil. Position the rocker arm assembly and remove the rocker arm assembly lifting tool. Install the rocker arm bridge. Tighten the screws a little at a time evenly across the entire rocker arm bridge, so that the rocker arm shaft is not bent. Tighten rocker arm mounting bolts to specification.

**Note:** Make sure that the rocker arm shaft sits correctly in the guide sleeves in the camshaft bearing brackets.

**Note:** For engine brake equipped engines, remove the restraints for the exhaust rocker arm pistons.

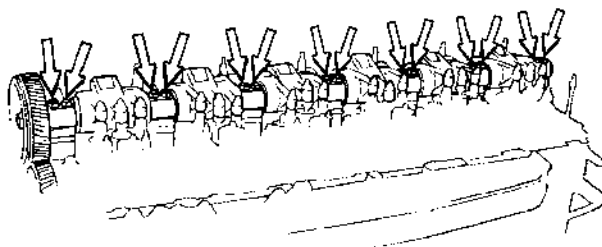
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85109250



W2005513

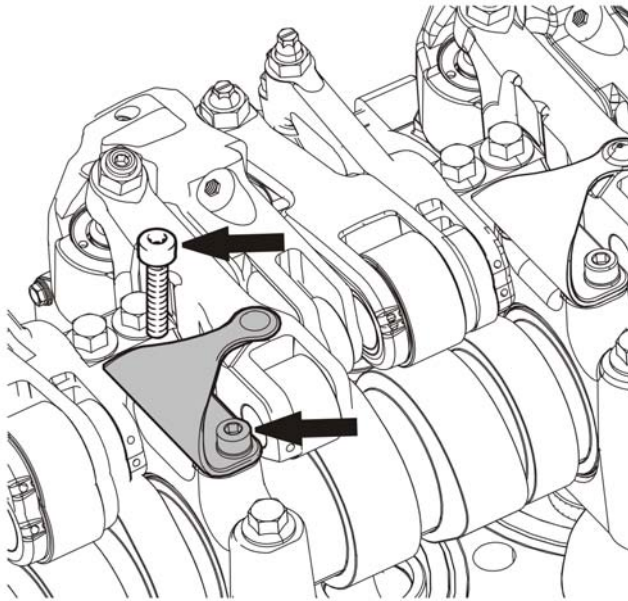
- 1 Rocker Arm Assembly Lifting Tool
- 2 Rocker Arm Assembly



C2001720

**32**

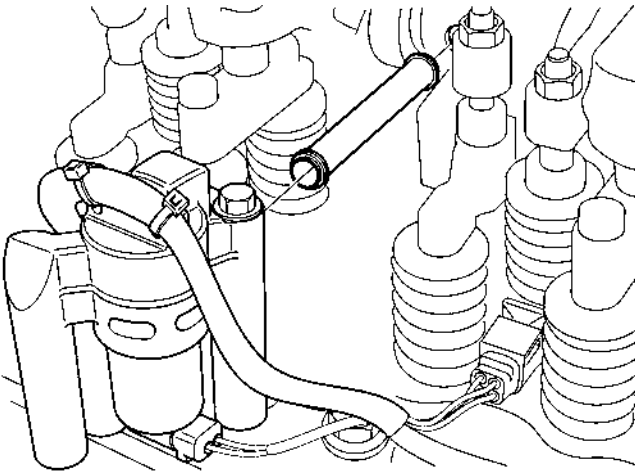
Tighten the rocker arm bridge to specification.



W2005753

**33**

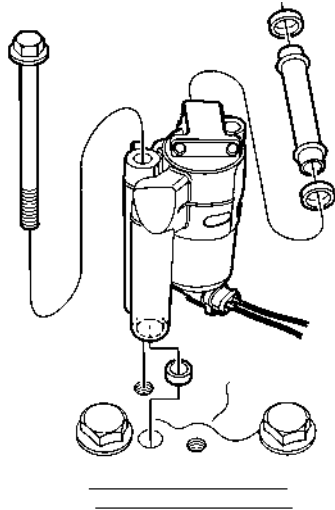
Install the leaf springs onto the camshaft bearing caps (applies to engines equipped with engine brake).



T2022124

**34**

Clean and dry around the control valve pipe. Lubricate the hole in the rocker arm shaft and the hole in the control valve. Install new O-rings on the pipe and carefully push the pipe into the control valve. Make sure the seals are not damaged. Carefully press the pipe into the oil hole of the engine brake control valve. Make sure the O-ring is seated fully in the valve.



W2004869

**35**

Clean the mating surfaces on the cylinder head and the control valve. Replace the O-ring at the bottom of the engine brake control valve. Position the valve on the cylinder head. Align the engine brake oil pipe and O-ring with the hole in the rocker shaft. Make sure the engine brake oil pipe O-ring is fully seated. Tighten the screws to specification. Plug in the engine brake control valve harness connector.

**36**

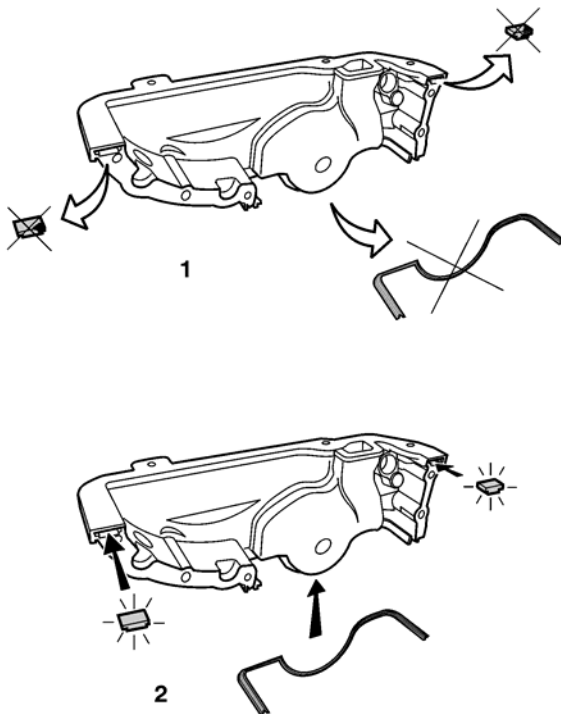
Install the connector for the electrical connections to the unit injectors. Push in the connector until you hear a distinct "click".

**37**

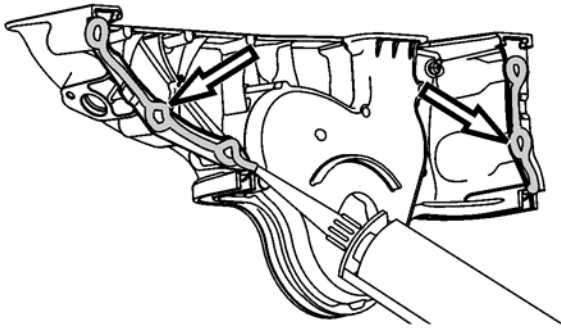
Clean the contact surfaces of the upper timing gear cover, timing gear plate and cylinder head.

**38**

Change the seals in the upper timing gear cover. Discard used seals.



T2021628

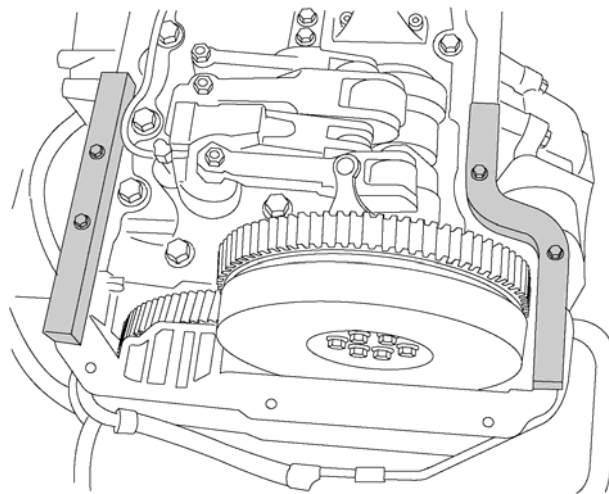


W2005137

**39**

Apply a 2 mm (0.08 in) thick bead of sealing compound according to illustration.

**Note:** The timing gear cover must be installed within 20 minutes of the sealant being applied.



W2006191

**40**

Install the upper timing gear cover. Install the screws in the oval holes. Do not over tighten. Install clamp tool. Press down the cover so that it is flush. Install the other screws. Tighten to specification.

---

85111422

**41**

Remove the clamp tools.

**42**

Install the flywheel turning tool.

---

88800014

**43**


Check for proper camshaft position sensor clearance using the sensor depth gauge to determine if shims are required for sensor depth. The camshaft position sensor clearance specification is 0.7-1.5 mm (0.02-0.06 inch).

- 1 Rotate the engine until a tooth of the camshaft toothed wheel is aligned with the sensor bore.
- 2 Insert the depth gauge into the sensor bore until the outer part of the gauge is fully seated against the timing gear cover.
- 3 Loosen the thumb screw of the gauge and push the inner part of the gauge in until it contacts a tooth of the toothed wheel.
- 4 Tighten the thumb screw to secure the inner part of the gauge.
- 5 Carefully remove the gauge from the camshaft sensor bore.
- 6 Use a depth micrometer to measure the gauge from the bottom of the gauge collar to the end of the gauge shaft. Record your measurement.
- 7 Determine the number of shims required using the table below.

Measurement	Shims Required
Greater than 35.2 mm (1.39 inch)	0
35.2 — 34.6 mm (1.39 — 1.36 inch)	1
Less than 34.6 mm (1.36 inch)	2

88800031

**44**

 <b>CAUTION</b>
Use clean motor oil to lubricate the sensor O-ring before installation. If the O-ring is not lubricated before installation, the O-ring may be damaged and an oil leak will result.

Use clean motor oil to lubricate the sensor O-ring before installation. Install the camshaft position sensor with appropriate shim(s) and new lubricated O-ring. Secure with bolt and plug in harness connector.

**45**

Adjust the inlet, exhaust and unit injectors to specification. Refer to Valves and Unit Injectors, Adjustment in Group 21.

**46**

Remove the cranking tool and reinstall the plug in the flywheel housing.

**47**

Install the fuel line banjo bolts with new seals at the front of the engine.

**48**

Install the fan shroud bracket, left side.

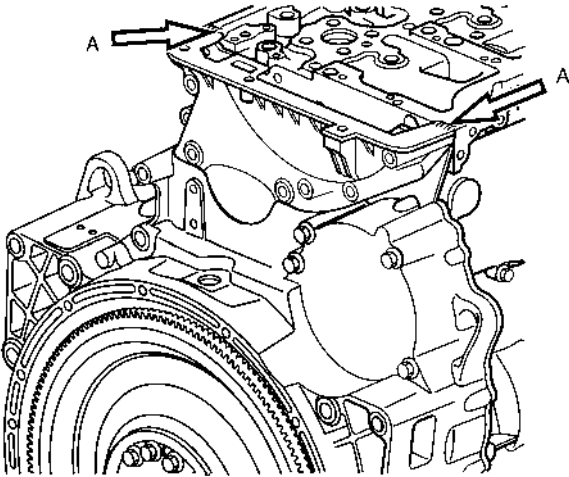
**49**

Install the temperature sensor into the cylinder head. Connect the connector.

**50**

Clean the mating surfaces for the valve cover. Apply a 2 mm (0.08 in) thick bead of approved sealant to the surface between the upper timing gear cover and the cylinder head.

**Note:** The timing gear cover must be installed within 20 minutes after the sealant has been applied.



T2022117

**51**

Install the valve cover. Tighten fasteners to specification.

**52**

Install the thermostat and thermostat housing. Tighten fasteners to specification.

**Note:** Ensure that the rubber seal is correctly seated on the thermostat.

**53**

Install the coolant pipe on the thermostat housing.

**54**

Bleed the fuel system.

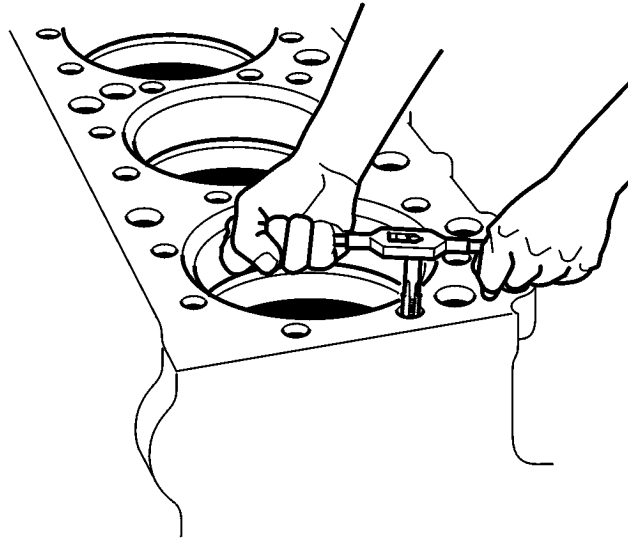
**55**

Clean up any spillage.

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2.2008	<b>212</b>	<b>20</b>	1(3)

## Threads in Engine Block, Cleaning D13F

### Threads in Engine Block, Cleaning



C2002611

### Contents

- “Threads in Engine Block, Cleaning (One Cylinder Head)” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



## 2121-11-05-01 Threads in Engine Block, Cleaning (One Cylinder Head)

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

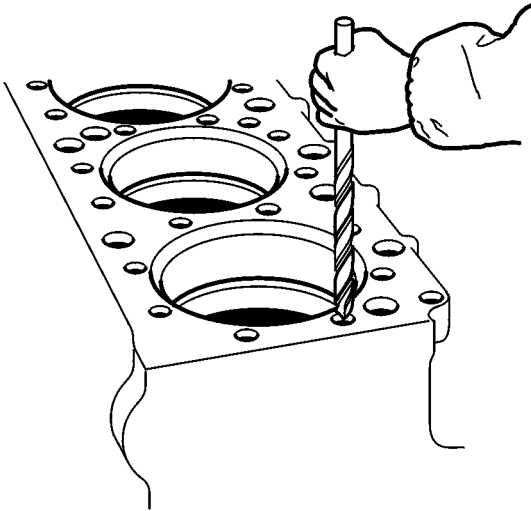
**1**

If needed, use a drill bit of the correct size. Clean out any debris from threaded holes. **Turn by hand ONLY.**

 **CAUTION**

Do not use power tools. Doing so could cause damage to the engine block.

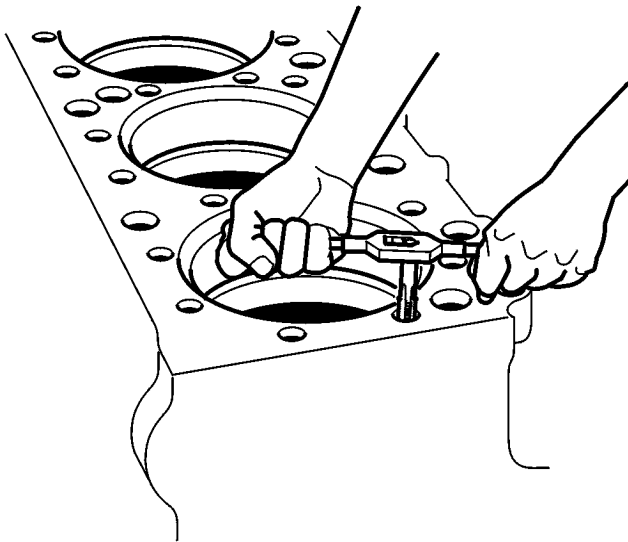
**Note:** Make sure the bit will fit inside threads without causing damage.



C2001734

**2**

Thread the tap into the cylinder head mounting holes. Use short in and out motions to clean out threads. Continue until threads are clean, top to bottom.



C2002611

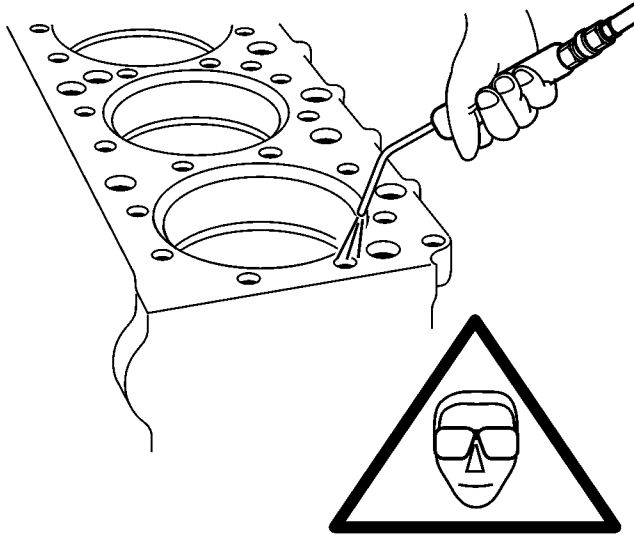
3



**WARNING**

Whenever compressed air is used, use eye protection to prevent eye injury.

Use compressed air to clean out threaded hole.

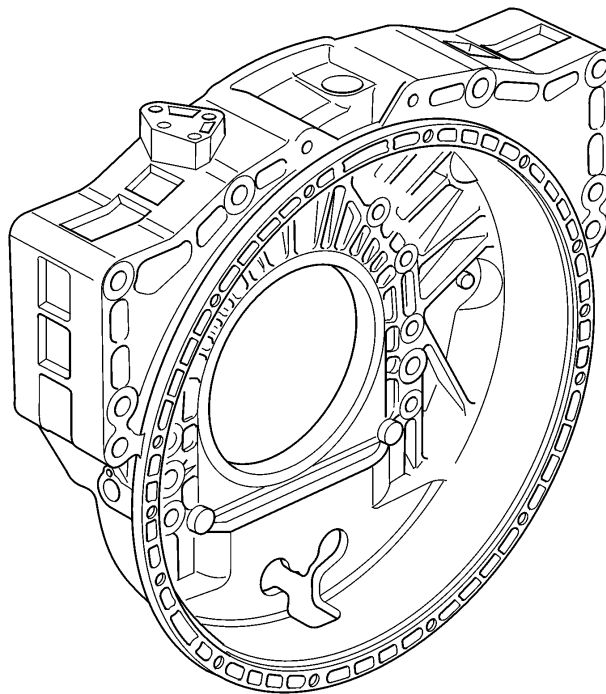


T2020602

Date	Group	No.	Page
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## Flywheel Housing Run-Out, Checking D13

### Flywheel Housing Run-Out, Checking



C2002636

### Contents

- “Flywheel Housing Run-out, Checking” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2125-06-03-02

# Flywheel Housing Run-out, Checking

Clutch removed

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 88800014*

*Other special equipment: 9999683, 9999696, 9989876*

**1**

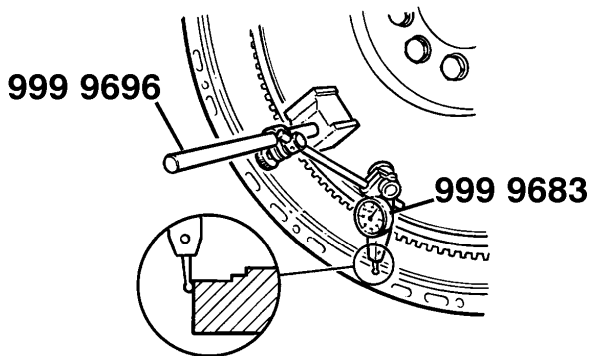
Clean the engine flywheel and the flywheel housing.

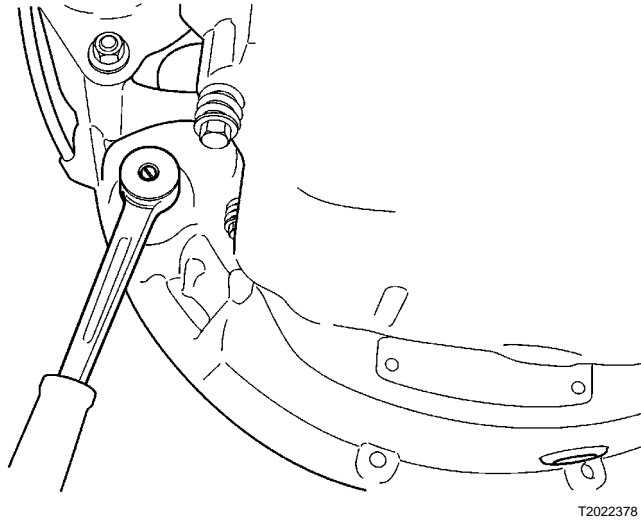
**Note:** Make sure that the dial indicator and the magnetic stand adjustable rods are secure to ensure that the gauge will not move from the previous position.

**2**

Attach the rocker indicator using the magnetic holder to the engine flywheel and place the dial gauge tip on the flywheel housing outer flange (axial runout). Read off the value measured. Position the magnetic holder with the rocker indicator on the opposite side of the flywheel. Compare the values given in "Specifications", group 20. Repeat the measurement in at least four places.

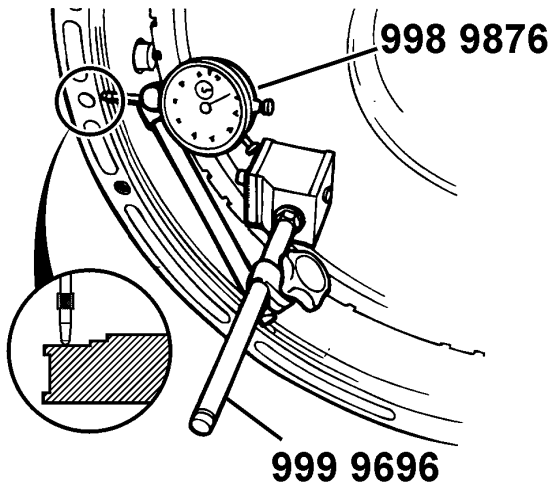
9999683, 9999696





**3**  
Remove the plug from the flywheel casing and install cranking tool 88800014.

88800014



**4**  
Attach the magnetic holder to the engine flywheel housing and place the dial gauge tip on the flywheel housing inner flange (radial runout). Turn the flywheel and read off the value. Compare with the values given in "Specifications", group 20.

9989876, 9999696

C2002610

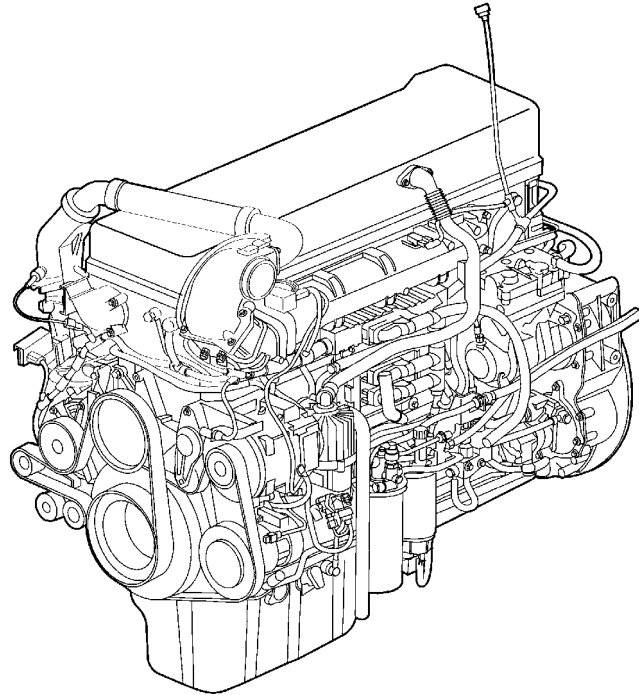
**5**  
Check the mating surface of the flywheel casing with the block and the flywheel mating surface with the crankshaft if any of the values are exceeded. Do this before replacing the flywheel casing.

**6**  
Remove the cranking tool and reinstall the plug in the flywheel cover.

Date	Group	No.	Page
9.2008	212	35	1(5)

## Engine Stiffening Frame, Replacement D13

### Engine Stiffening Frame, Replacement



W2005941

This information covers the replacement procedure for the engine stiffening frame on the Volvo D13 engines on a Prevost coach.

### Contents

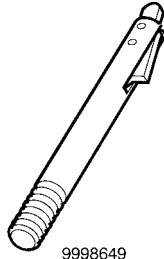
- “Special Tools” page 2
- “Stiffening Frame, Replacement” page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

## Special Tools

For Special Tools ordering instructions, refer to Tool Information, group 08.



9998649

W2006137

**9998649**

Stiffening Frame Tool

# Service Procedures

## 2129-03-02-01

### Stiffening Frame, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9998649*

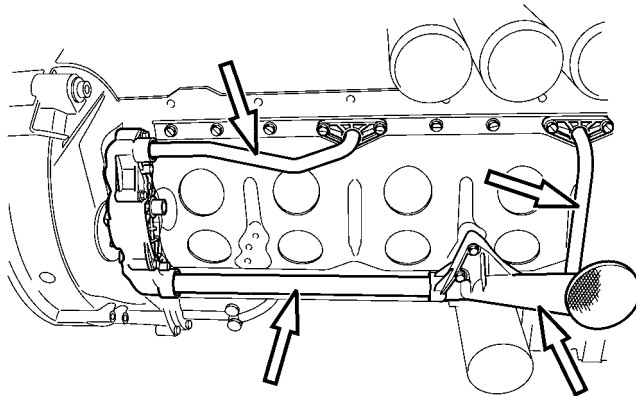
## Removal

**1**

Remove the oil pan. Refer to the service procedures in Group 21.

**2**

Loosen and remove the bolts securing the oil strainer to the engine stiffening frame. Remove the oil strainer and pickup (suction) tube. Slide the tube out of the oil pump.



W2006100

**3**

Remove the fasteners securing the oil pressure crossover pipe to the skirt of the cylinder block. Remove the pipe.

**4**

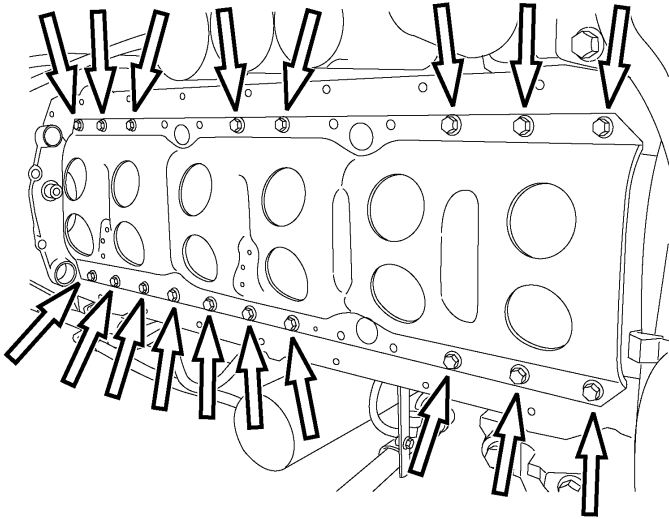
Remove the fasteners securing the oil pressure pipe to the skirt of the cylinder block. Slide the pipe out of the oil pump.



- 5**  
Remove a fastener from each side at the center of the engine stiffening frame and install the stiffening frame tools. These tools support the stiffening frame during removal and installation.

9998649

- 6**  
Remove the engine stiffening frame fasteners and remove the frame.



W2006101

**WARNING**

The engine stiffening frame has sharp edges which can cause injury. Wear protective gloves when handling.

## Installation

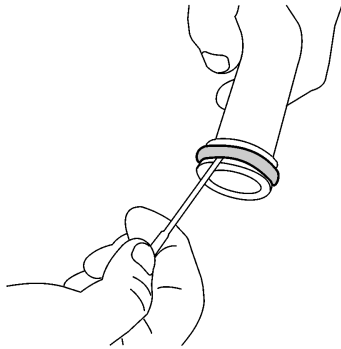
- 1**  
Place the engine stiffening frame in position on the cylinder block. Use the stiffening frame tools to support the frame while installing the new fasteners. Remove the stiffening frame tools and install the remaining two fasteners. Tighten the fasteners to specification.

**Note:** The engine stiffening frame fasteners are a one time use only. New fasteners must be installed.

**Note:** For correct torque specifications, refer to the Specifications bulletin in Group 20.

9998649

- 2**  
Clean and inspect the oil strainer, suction pipe, crossover pipe and pressure pipe for cracks. Replace if necessary.

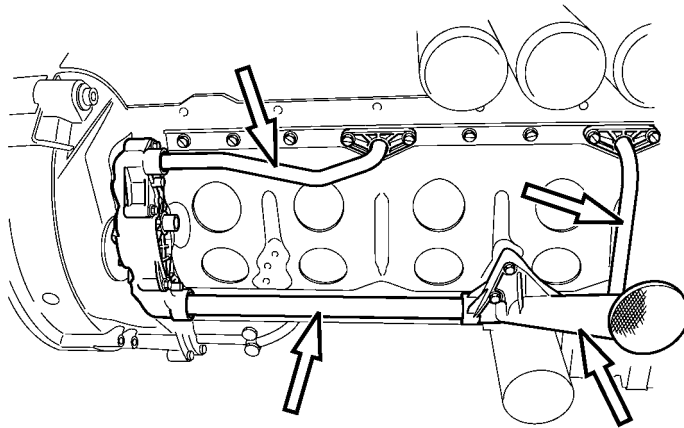


W2004956

**3**

Lubricate and install new O-rings on the oil pressure pipe, oil suction pipe and oil crossover pipe.

**Note:** Separate the oil suction pipe from the oil strainer as needed to replace that O-ring.



W2006100

**4**

Slide the oil pressure pipe into the oil pump and position the pipe flange to the cylinder block. Install the fasteners and tighten to specification.

**5**

Position the oil pressure crossover pipe to the skirts of the cylinder block. Install the fasteners and tighten to specification.

**6**

Assemble the oil strainer and oil pickup pipe. Slide the oil pickup pipe into the oil pump and position the oil strainer to the engine stiffening frame. Install the fasteners and tighten to specification.

**7**

Install the oil pan. Refer to the service procedures in Group 21.

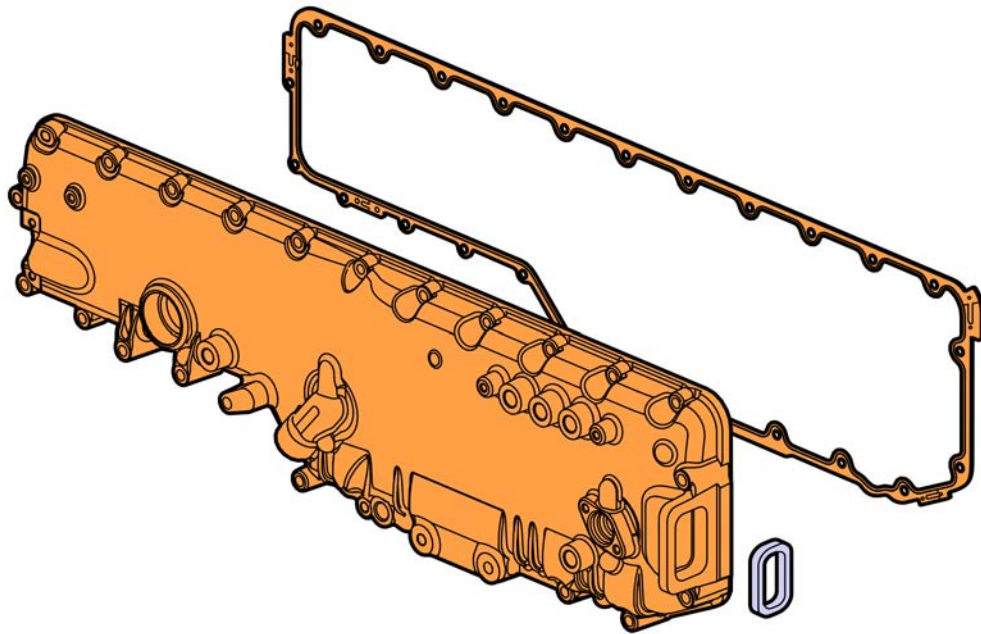
Date	Group	No.	Release	Page
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Gasket, Coolant Cover Oil Cooler,  
Replacement

D13H

B13R, PREVH, PREVX

## Gasket, Coolant Cover Oil, Replacement



W2064683

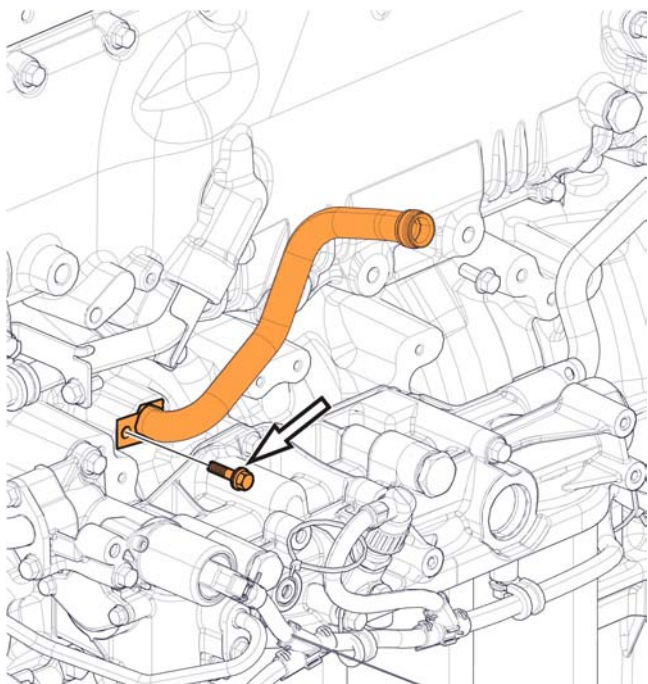
## 21201-2 Gasket, coolant cover oil cooler, replace

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

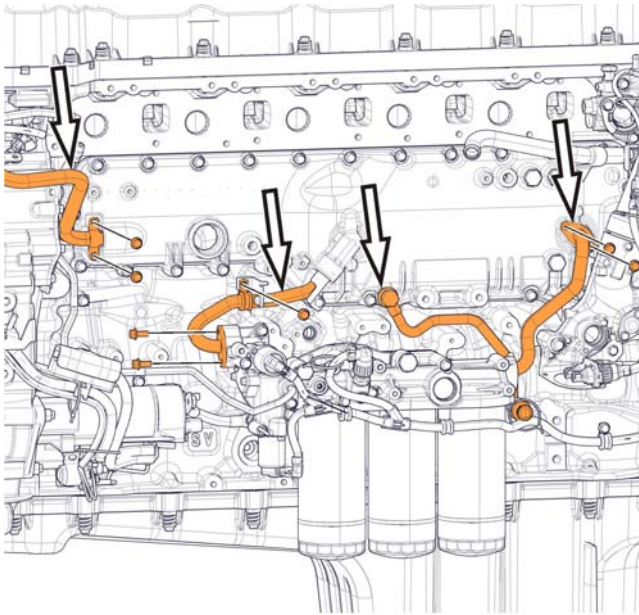
*Special tools: 88800022*

### Removal

- 1**  
Remove the turbocharger according to,Function Group 2551, Information type Repair Turbocharger, replace.
- 2**  
Remove the EGR valve according to,Function Group 2931, Information type Repair EGR valve, replace.
- 3**  
Remove the EGR cooler according to,Function Group 2932, Information type Repair EGR cooler, replace.  
Remove the EGR cooler brackets.
- 4**  
Remove the turbocharger oil return pipe.



T2031915



T2031916

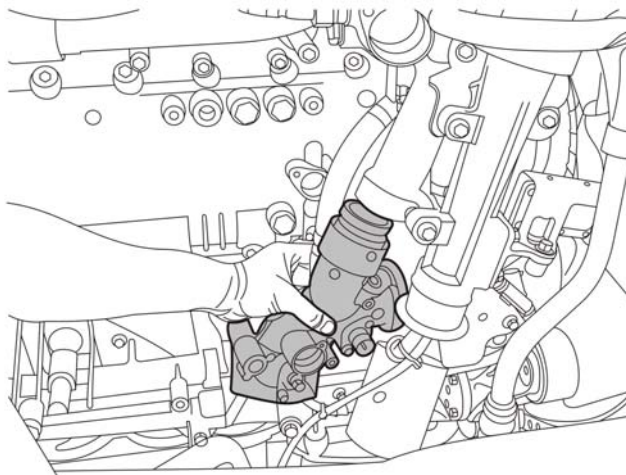
**5**

Remove the coolant pipe from the oil cooler cover.

Remove the rear pipe between the oil filter housing and the oil cooler cover.

Remove the water drain pipe from the oil cooler cover.

Remove the front pipe between the oil filter housing and the oil cooler cover.



W2006069

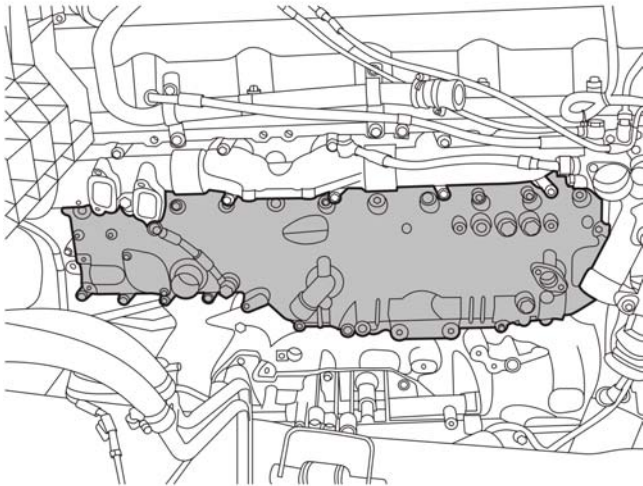
**6**

Remove the water pump inlet housing with the coolant hose connected.

7

Remove the oil cooler cover fasteners and remove the oil cooler and cover assembly from the engine.

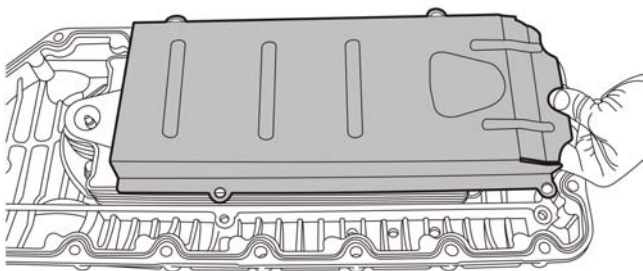
**Note:** Remember all fastener locations. Some fasteners are of different lengths.



W2006070

8

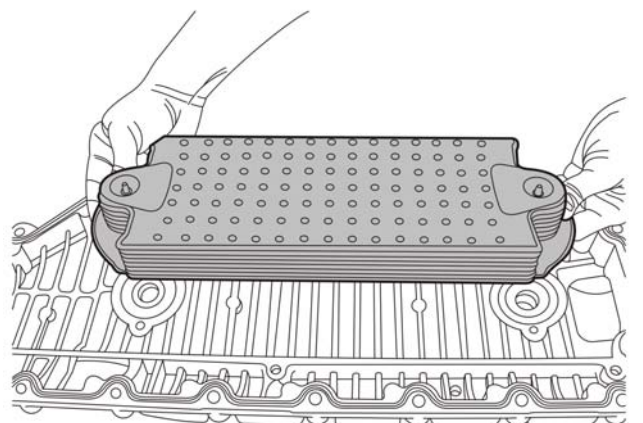
Place the oil cooler and cover assembly on a clean work surface and remove the flow plate.



W2006071

9

Remove the oil cooler fasteners and remove the cooler from the cover.



W2006072

**10**

Clean all gasket sealing surfaces on the engine block.

## Installation

**1**

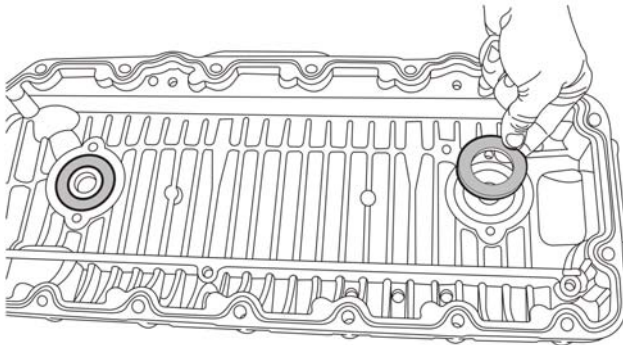
**Note:** The new Coolant Duct Cover Kit 21508089 must be used when replacing the coolant cover or gasket. The new kit includes the coolant cover and gasket.

**Note:** Old covers cannot be used with new gaskets and new covers cannot be used with old gaskets.

Clean the cooler mounting surfaces on the inside of the cover to prevent contamination of the engine block from debris.

**2**

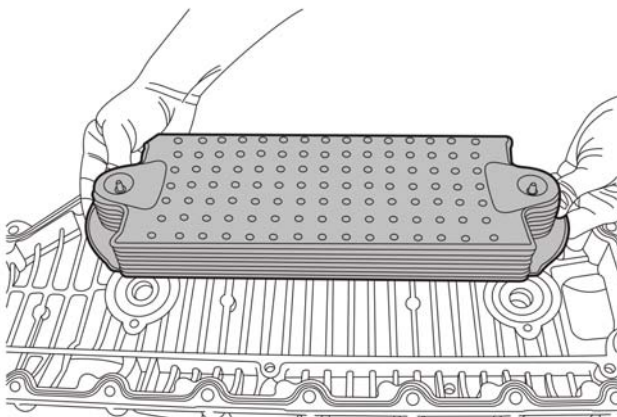
Install new oil cooler sealing O-rings into the cover grooves between the oil cooler and cover.



W2006073

**3**

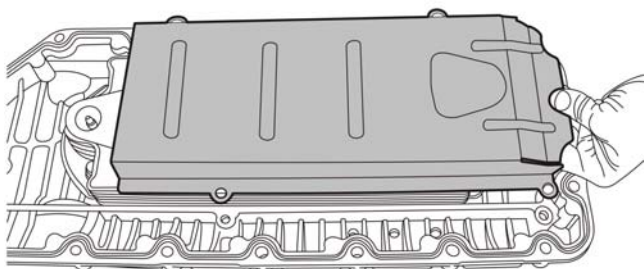
Install the oil cooler in the oil cooler cover. Tighten fasteners to specification, see Function Group 20.



W2006072

**4**

Install the oil cooler flow plate over the oil cooler. Tighten fasteners to specification, see Function Group 20.

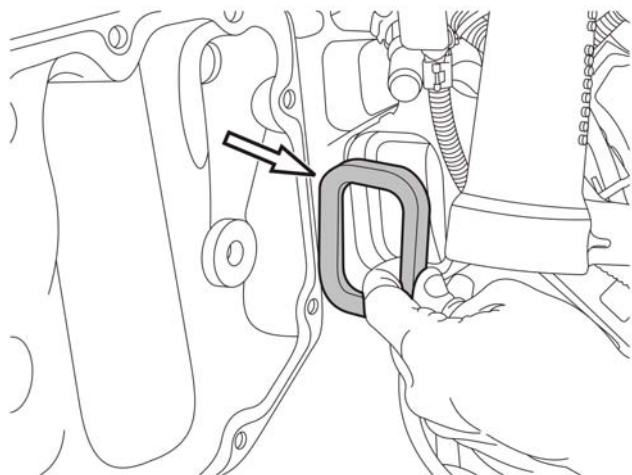


W2006071

**5**

Replace the water pump inlet housing formed rubber gasket with a new gasket. Lubricate new gasket upon installation.

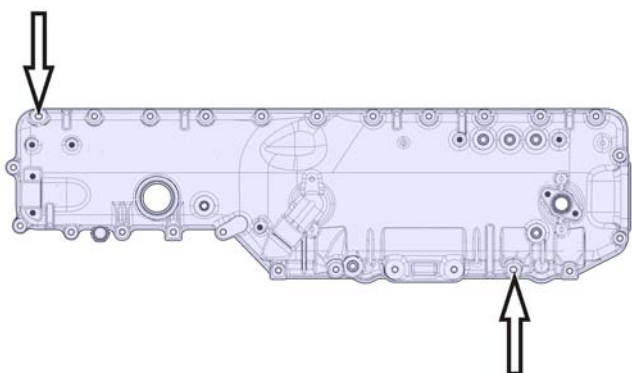
**Note:** The new water pump inlet housing gasket is ordered separately from the Coolant Duct Cover kit. Order part number 20430678 for replacement pump inlet housing gasket.



W2006075

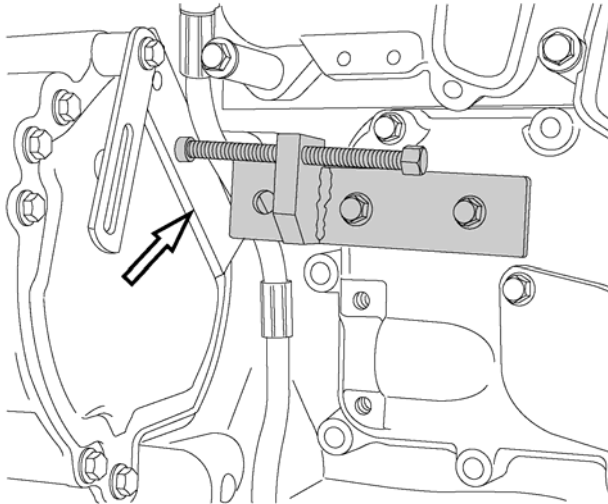
**6**

Install dowel pins in the two slotted holes in the duct cover, one at the upper rear and the other at the bottom front. Install new oil cooler cover gasket from kit 21508089 onto the dowel pins.



T2057105





W2006076

**7**

Using the assembly tool (88800022), push the cover forward to compress the formed rubber gasket at the water pump inlet. Install upper right corner fastener.

**Note:** A small piece of metal stock should be used to prevent deformation of the stamped cover that is in contact with the tool.

88800022

**8**

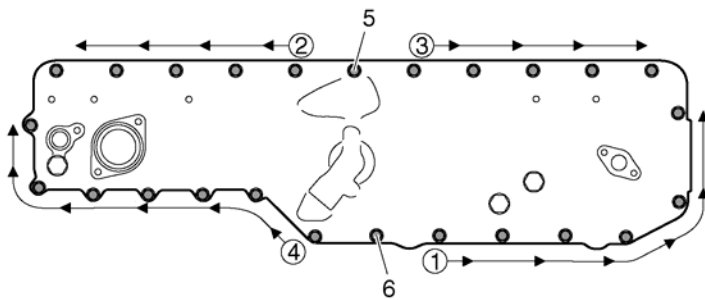
Adjust cover as required to allow upper and lower center fasteners to be installed. Using a feeler gauge to check clearance, maintain a constant gap between cover and the lip of the cylinder head. Adjust cover as necessary to match the above criteria and tighten center fasteners to hold cover in place.

**Note:** The upper center mounting location has a tighter tolerance than other mounting locations.

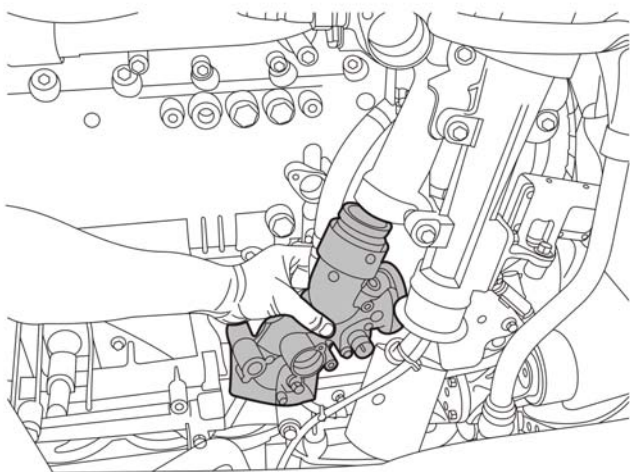
**9**

Start all remaining cover fasteners and tighten fasteners to specification in the order shown in diagram.

See Function Group 20, Information type Specifications Specifications



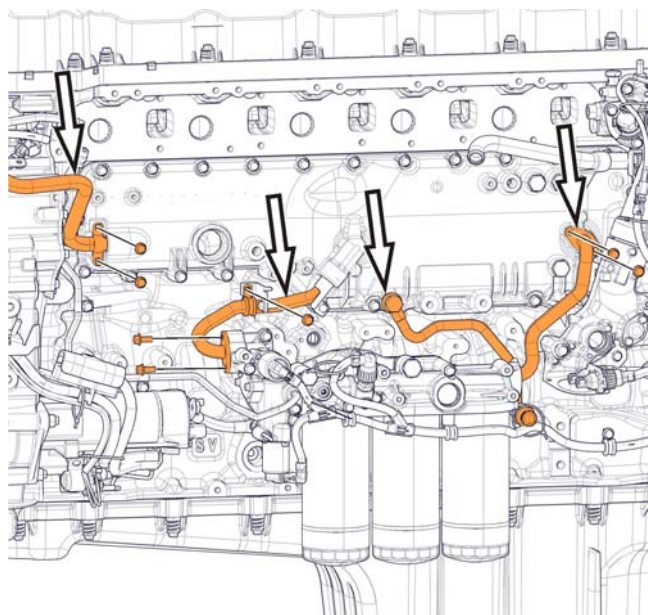
W2006216



W2006069

**10**

Install the water pump inlet housing with the hose attached. Replace and lubricate all sealing O-rings.



T2031916

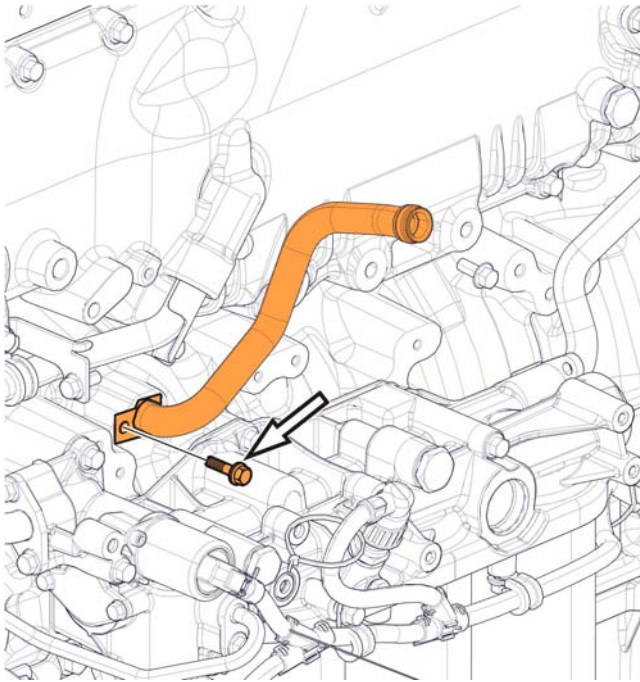
**11**

Install the front pipe between the oil filter housing and the oil cooler cover with a new gasket.

Fit the water drain pipe to the oil cooler cover using new sealing rings.

Fit the pipe between the oil filter housing and the oil cooler cover with new gaskets.

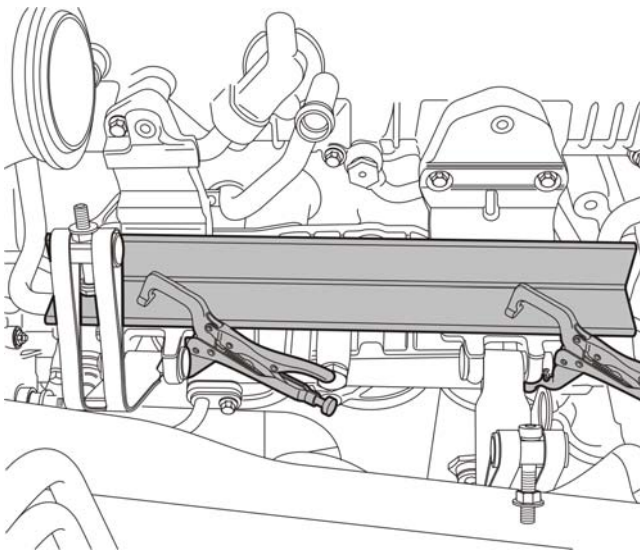
Fit the coolant pipe to the oil cooler cover with a new gasket.



T2031915

**12**

Fit the turbocharger oil return pipe with a new gasket.



W2005974

**13**

Fit the EGR cooler brackets.

**Note:** Use a straight angle iron or similar to keep the brackets in line.

**14**

Fit the EGR cooler according to,Function Group 2932, Information type Repair EGR cooler, replace.

**15**

Fit the EGR valve according to,Function Group 2931, Information type Repair EGR valve, replace.

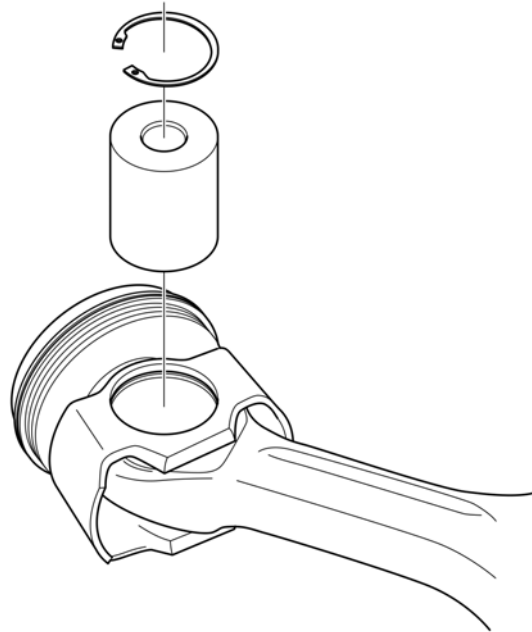
**16**

Fit the turbocharger according to,Function Group 2551, Information type Repair Turbocharger, replace.

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8.2008	<b>213</b>	<b>67</b>	1(12)

## Cylinder Liners and Pistons, Replacement D13

### Cylinder Liners and Pistons, Replacement



T2022501

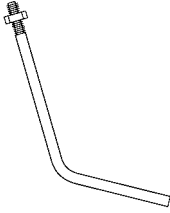
### Contents

- “Special Tools” page 2
- “Cylinder Liners and Pistons, Replacement (All)” page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## Special Tools

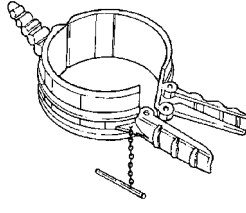
For special tools ordering instructions, refer to Tools Information, Group 08.



W0002414

**9989876**

Dial Indicator Extension Tool



T001180

**9990158**

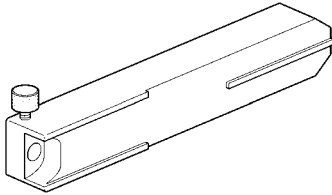
Piston Ring Compressor Tool



W0001802

**9998511**

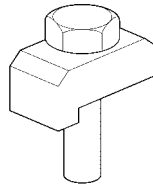
Lever Tool



W2006579

**9992479**

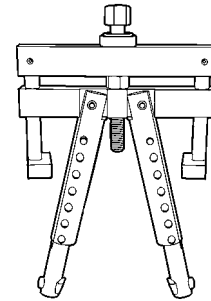
Retainer Tool



W2006577

**85109123**

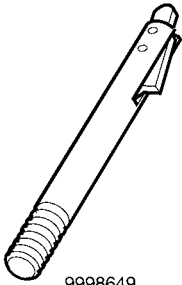
Press Tool



W0002114

**PT-6400?C**

Cylinder Liner Puller

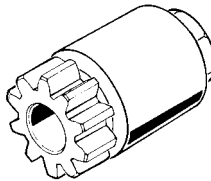


9998649

W2006137

**9998649**

Retainer



T0012612

**88800014**

Engine Turning Tool

## 2131-03-03-01

# Cylinder Liners and Pistons, Replacement (All)

### Cylinder heads and oil pan removed

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

The cylinder liner O-rings are made of fluorocarbon rubber. When fluorine-rubber is exposed to high temperatures (above 300 °C/ 572 °F) **hydrofluoric acid** can be generated. **Hydrofluoric acid is extremely corrosive!**

- Contact with skin can result in serious corrosion injuries.
- Splash in the eyes can result in corrosion sores.
- Inhalation of vapors can damage the respiratory tract.



#### **WARNING**

Take great care when working on engines which can have been exposed to high temperatures, resulting for example from overheating, cutting or fire. Under no circumstances are cylinder liner O-rings to be burnt off when dismantling or destroyed by burning under uncontrolled conditions.

- Always use neoprene gloves (gloves approved for handling chemicals) and protective goggles.
- Handle removed O-rings in the same way as corrosive acids.
- Never blow clean using compressed air.  
All remnants, including ashes, can be highly corrosive.
- Place all remnants in plastic containers, to which warning text is attached.
- Before taking the gloves off, they must be washed under running water.

*Special tools: 9989876, 9990158, 85109123,  
PT-6400-C, 9998511, 9992479, 8880014,  
9998649*

## Remove

1

### **WARNING**

The stiffening frame has sharp edges. To prevent personal injury, use protective gloves.

- 1 Remove the pipe and strainer from the stiffening frame.
- 2 Remove the oil pickup tube.
- 3 Remove the pressure pipe from the pump.
- 4 Remove the reinforcement frame.

### **WARNING**

Use extreme caution when coming in contact with used engine oil. Used engine oil could cause cancer.

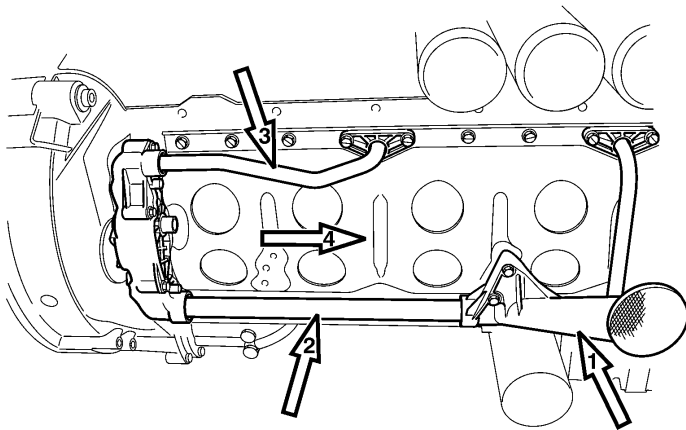
**Note:** Special tool 9998649 can be used to support the stiffening frame during removal and installation. Remove a fastener from each side at the center of the engine stiffening frame and install the stiffening frame tools.

9998649

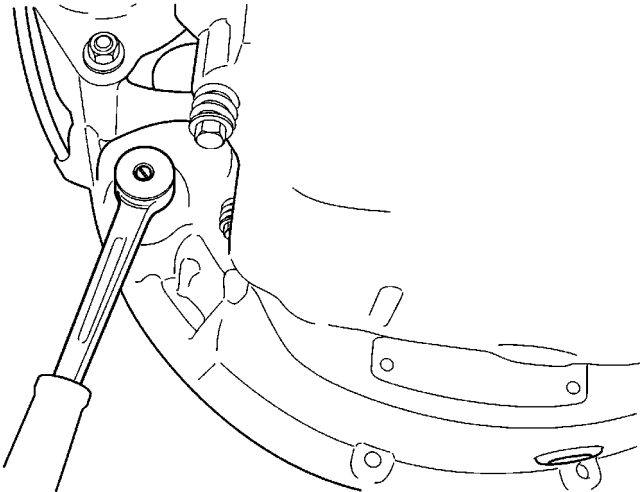
2

Remove the plug from the flywheel housing and install tool 88800014. Turn the crankshaft until it is possible to get at the screws on the connecting rod which is to be removed.

88800014

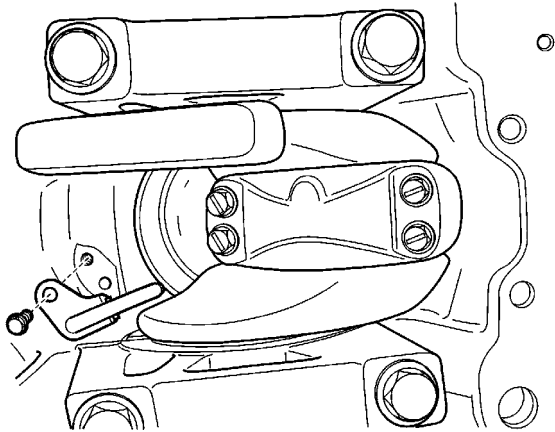


W2006029



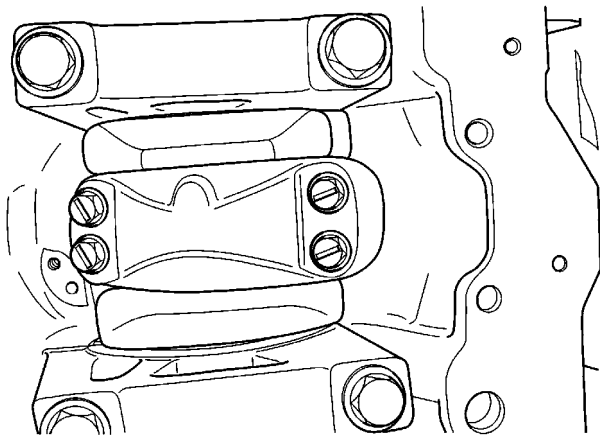
T2022378

- 3**  
Remove the piston cooling jet.



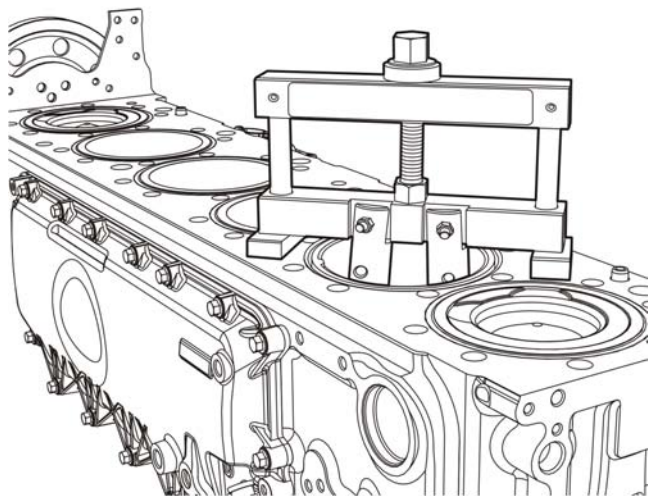
T2022286

- 4**  
Remove connecting rod bearing cap and bearing shells.



T2022287

- 5**  
Remove the piston with the connecting rod.



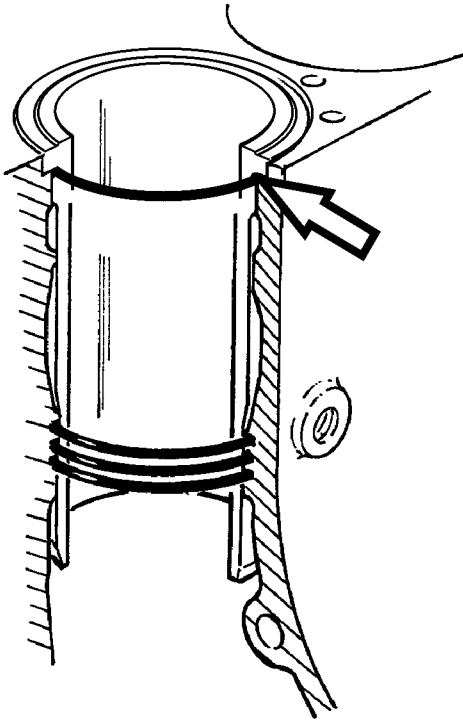
W2005255

- 6**  
Pull the cylinder liner out of the block.

PT-6400-C

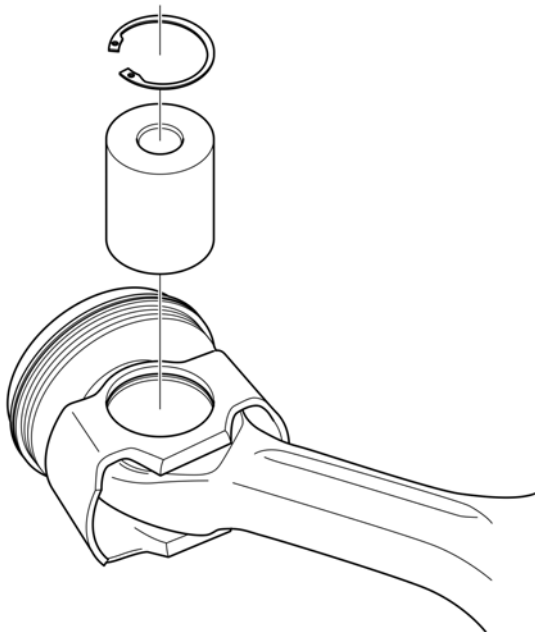


- 7**  
Remove the cylinder liner's sealing rings.



T2019854

- 8**  
Remove the snap ring from the piston and push out the piston pin. Remove the piston from the connecting rod.



T2022501

- 9**  
Clean the sealing surfaces on the cylinder block and the groove for the sealing rings. Do not use scrapers or other tools which can damage the sealing surfaces.

### Installation

#### 10

Check the cylinder block's liner seat for damage. If it is necessary to mill the liner shelf, see service information in Group 21.

Install the cylinder liner, **without** the sealing ring. Fix the cylinder liner with **two** clamping tools.

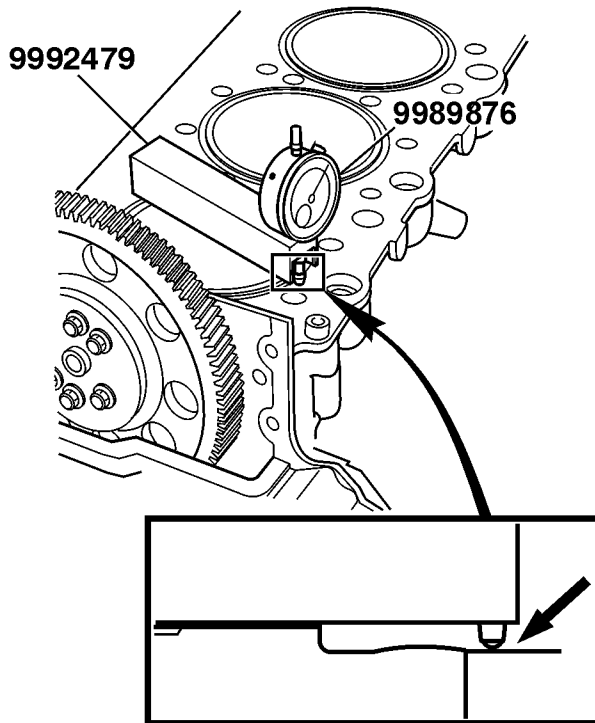
85109123

#### 11

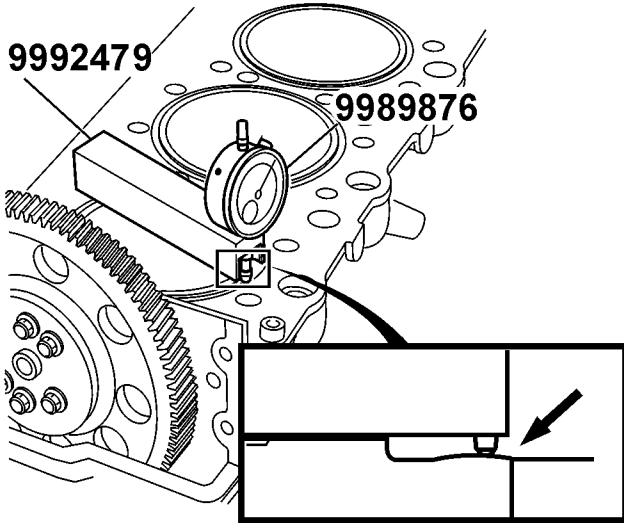
Mount dial gauge 9989876 in dial indicator holder 9992479. Place the holder with the dial gauge across the cylinder liner.

Zero the dial gauge with a couple of millimeters' preload against the cylinder block's surface.

9989876, 9992479



T2019670



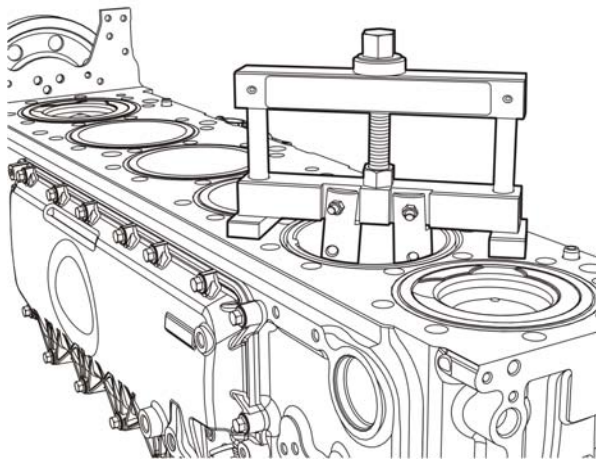
T2019761

**12**

Measure the height between the cylinder liner and the cylinder block surface.  
Measure the liner's height at two different diagonally opposite positions.  
Calculate the average of both the measurements.  
For correct liner height above the block surface see specifications, group 20.  
If the height of the liner above the surface of the block is outside the specified tolerance, the liner seat on the cylinder block should be milled. See service information in Group 21.

**Note:** Always measure at the highest point on the sealing surface.

Mark the liner's position on the cylinder block with a felt tip pen, so that it will be put back in the same position on assembly.  
Repeat the procedure for the remaining cylinder liners.



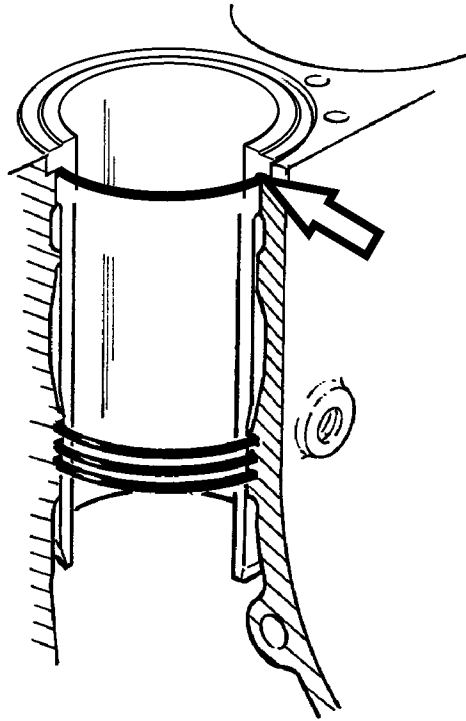
W2005255

**13**

Remove the press tool.

Pull the cylinder liner out of the block.  
Place cylinder liners in the same sequence that they are installed, together with their adjustment spacers.

PT-6400-C

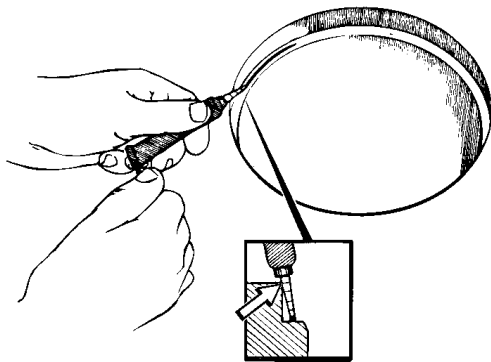


T2019854

**14**

Lubricate the O-rings. Install the liner sealing rings to the engine block.

**Note:** The purple sealing ring is installed furthest down.



T2009013

**15**

If the liner is installed **with** a shim, a bead of sealing compound should be put on the engine block liner seat.

**Note:** No sealant is to be used between the adjustment spacer and the cylinder liner's collar.

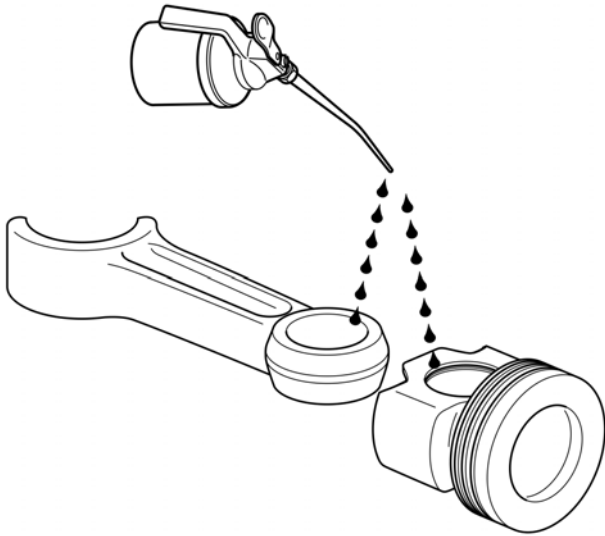
**Note:** Once the sealing compound has been applied, the liner must be installed **within 20 minutes**.

If the cylinder head **cannot** be installed and torque tightened within 20 minutes, the liner must be fixed in the engine block with two press tools.

85109123

**16**

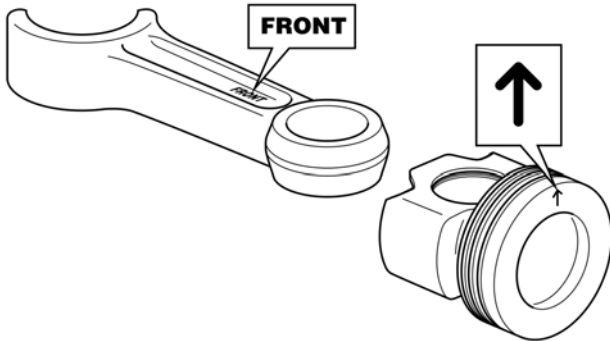
Install the cylinder liner by pressing the liner down into the cylinder.



T2022502

**17**

Lubricate the piston pin and the piston bushing with engine oil.



T2022504

**18**

Install the connecting rod in the piston with the marking "FRONT" on the connecting rod and the arrow on the piston facing the same direction. Push the piston pin in.

**Note:** The piston pin should go in when pushed without any great force. If the resistance is too great, the piston needs to be heated. The connecting rod should rotate freely on the piston pin.

Install the snap ring.

**19**

Using piston ring pliers, install the piston rings. Regarding the oil ring, the gap in the spring should be situated diametrically opposite the ring gap.

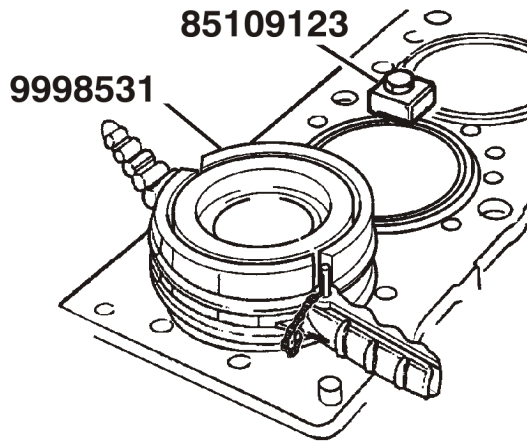
**Note:** All the piston rings (even the oil scraper) are marked with letters or punch marks. These marks should face **upwards**.

**20**

Lubricate the piston and the piston rings with engine oil. Check that the piston rings gaps are radically displaced. The piston ring gaps should be situated with the equal spacing in relation to one another 60°.

**21**

Use a piston ring compressor, insert the piston with its connecting rod.



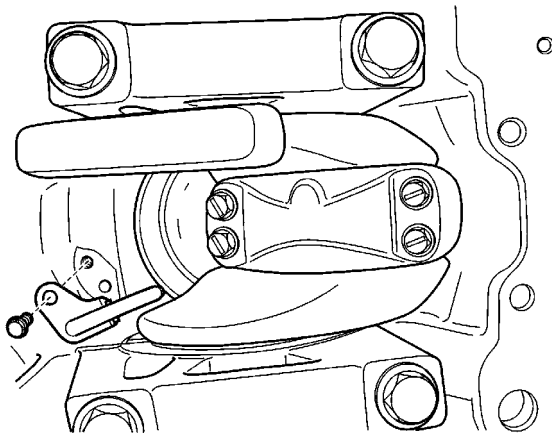
Temporarily remove the press tool when the piston is installed. Reinstall the press tools when the piston is in position.

9998531, 85109123

W2006211

**22**

Lubricate the crankshaft bearing shells and crankshaft pin with engine oil. Install the connecting rod caps. Check that they sit correctly in the connecting rod and caps. Install the connecting rod cap according to the markings and torque tighten according to specifications, see group 20.



T2022286

**23**

Clean the piston cooling jet and check that it is not damaged. Install the piston cooling jet with **new** bolts and O-ring. Tighten as specified in "Specifications", see Group 20.

**Note:** Use only **new** bolts, pretreated with locking material.

**24**

Remove cranking tool 88800014 and replace the plug.

88800014

25

 **WARNING**

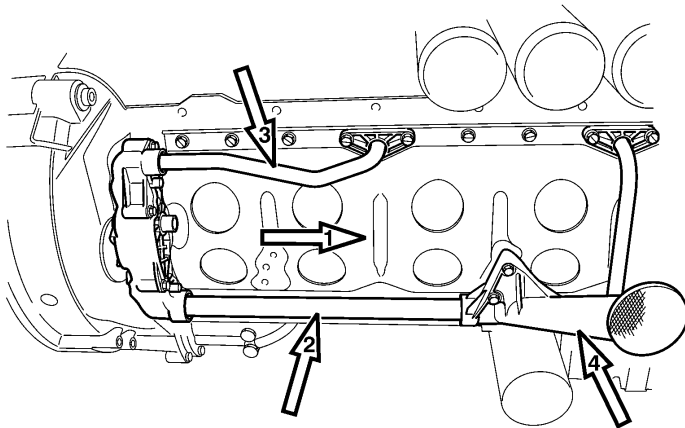
The stiffening frame has sharp edges. To prevent personal injury, use protective gloves.

Install the stiffening frame using new fasteners.

- 1 Tighten stiffening frame fasteners in sequence according to Specifications, Group 20.
- 2 Install the oil pickup tube with new fasteners and gaskets.
- 3 Install the pressure pipe to the pump with new fasteners and gaskets. Tighten all fasteners according to Specifications, Group 20.
- 4 Install the pipe and strainer on the stiffening frame with new gaskets. Secure the bolts with thread lock and tighten according to Specifications, Group 20.

**Note:** Special tool 9998649 can be used to support the stiffening frame during removal and installation. Use the stiffening frame tools to support the frame while installing the new fasteners.

9998649

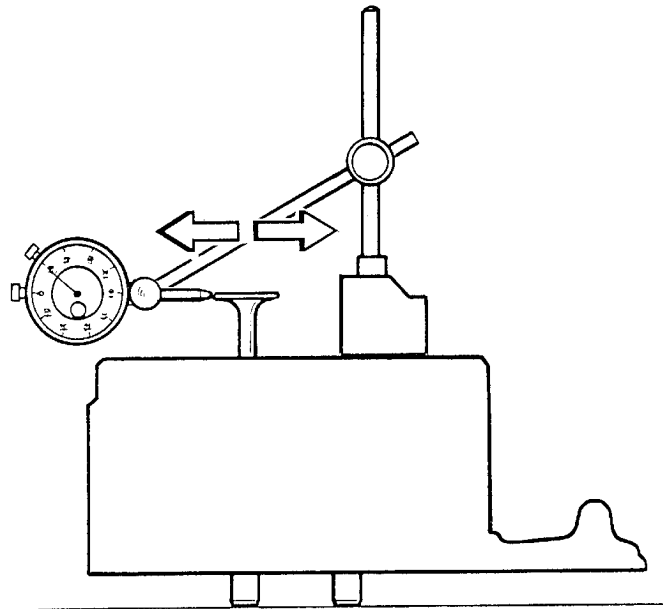


W2006030

Date	Group	No.	Page
2.2008	<b>214</b>	<b>100</b>	1(4)

## Valve Guide Wear, Checking D13

### Valve Guide Wear, Checking



C2000483

### Contents

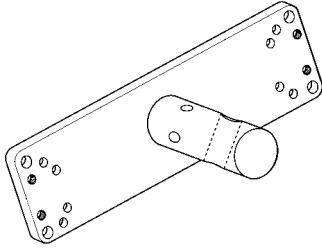
- “Valve Guide Wear, Checking” page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



For information on ordering special tools and other special equipment, see tool information Group 08.

## Special tools

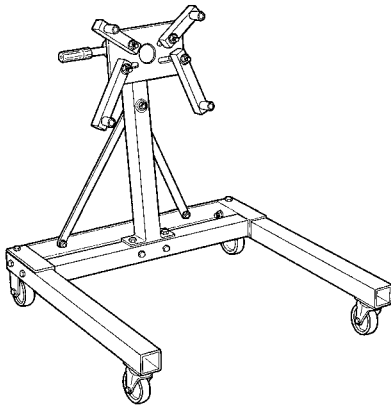


W0002293

**J47364**

Cylinder head adapter plate

## Other special equipment



W0002294

**2012**

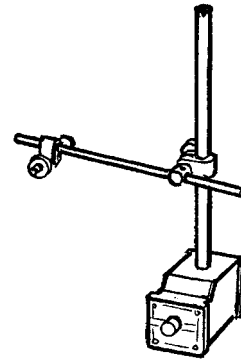
Stand



C0000786

**9989876**

Dial indicator



C0000823

**9999696**

Magnetic holder

## 2143-06-05-01 Valve Guide Wear, Checking

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 2012*

*Other special equipment: J47364, 9989876, 9999696*

**1**

Remove the oil seals from the valve guides.

**2**

Mount the cylinder head in the engine stand 2012 using fixture J47364.

Turn the cylinder head so that valves are facing upwards.

2012, J47364

**3**

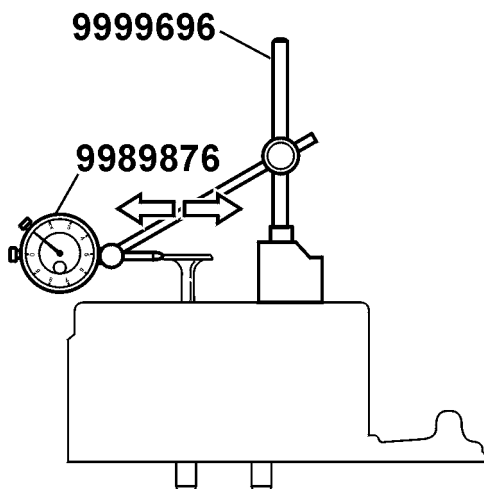
Install a new valve in the guide so that the end of the valve stem is even with the valve guide edge.

**4**

Use dial indicator 9989876 with magnetic holder 9999696. Place the tip of the dial indicator against the edge of the valve disc.

Slide the valve to and fro in the direction of the intake port. Read off the measured value and compare with the value that is given in the specification.

9989876, 9999696



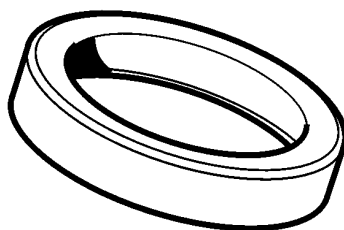
**5**

Use the same procedure to check all valve guides.  
Replace the valve guides if the measured values exceed  
the values given in the specification.

Date	Group	No.	Page
2.2008	<b>214</b>	<b>101</b>	1(6)

Valve Seat, Replacement (One)  
D13F

## Valve Seat, Replacement (One)



- “Valve Seat, Replacement (One)” page 2

T2020015

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

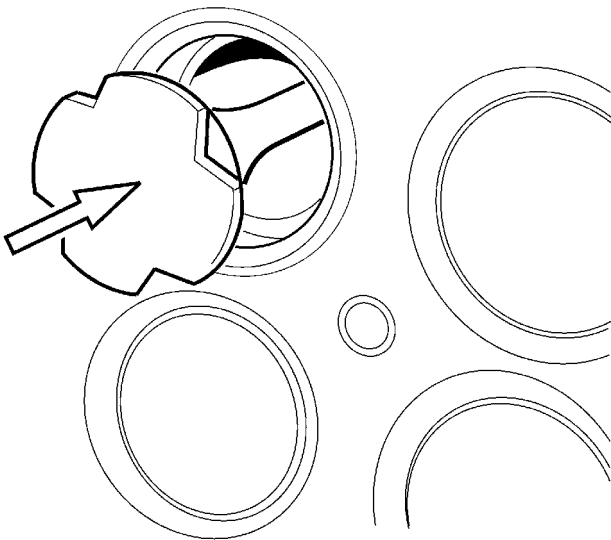
## 2149-03-05-01 Valve Seat, Replacement (One)

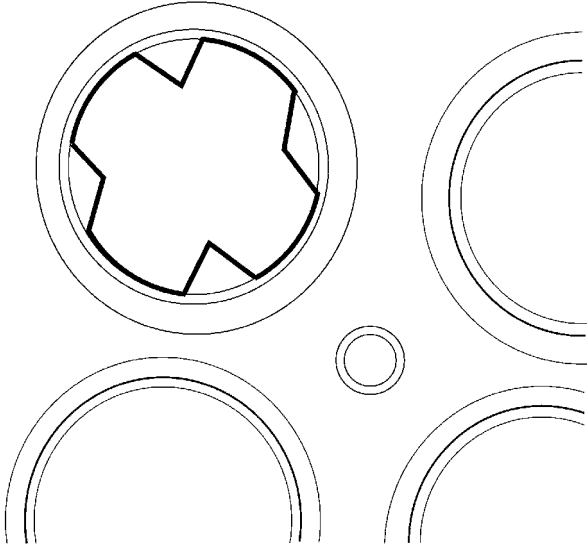
You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

**Note:** There are different variants of valves and valve seats. These variants cannot be combined. Later inlet valve variants are most easily identified by the fact that they are magnetic, and by checking the part number. Exchange cylinder heads are of the later variant with non-magnetic inlet valves.

**1**  
Grind four (4) "V" slots into the old valve to allow for the seat and valve to be welded together.

**2**  
Insert the valve into the seat to be removed.

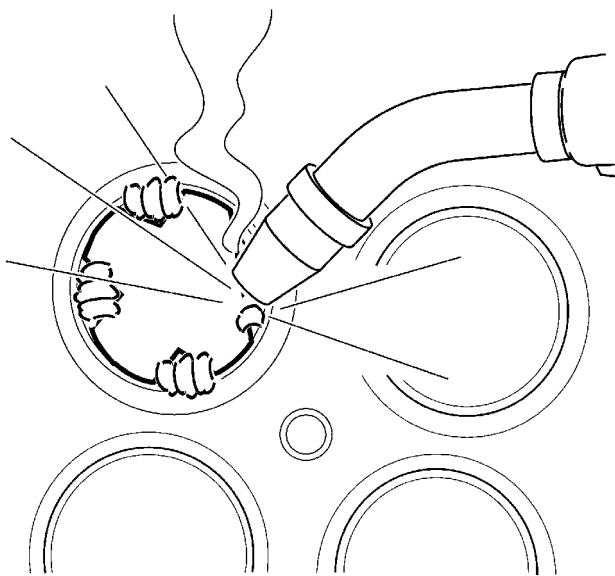




W2006311

**3**

**Note:** Only experienced welders should attempt this procedure. Use caution to cover the cylinder head to prevent damage while welding.

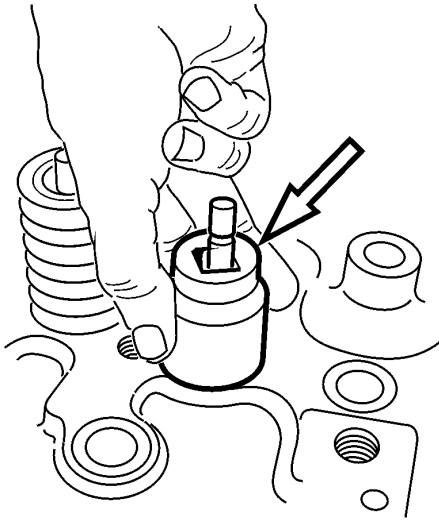


W2006312

**4**

Weld a small bead on all four (4) "V" slots on the valve to secure valve and seat together.

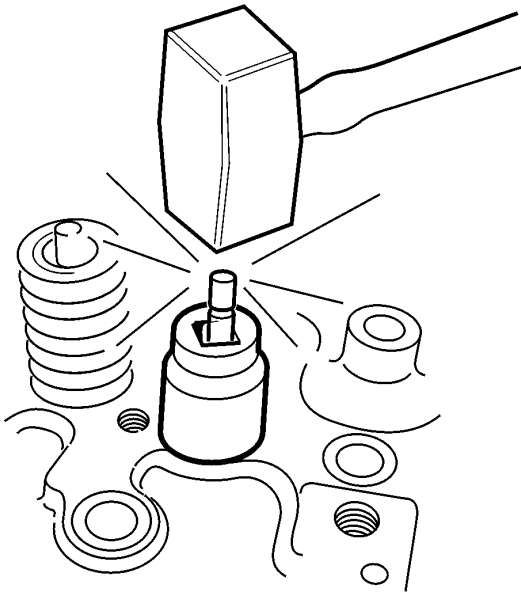
- 5**  
Cover the valve stem guide with the proper size and length socket to protect guide from damage.



T2020012

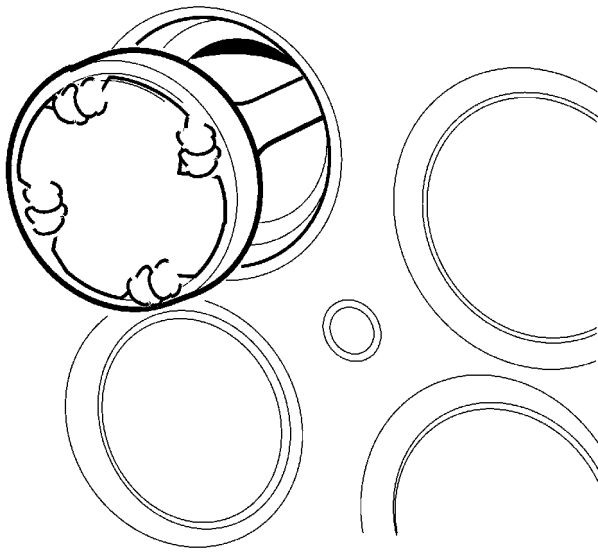
- 6**  
Carefully tap out the old seat.

**Note:** Use caution when tapping on the valve stem. Do not damage the stem. The stem must be clean and free of burrs to prevent damage to the valve guide. If necessary, repair and clean the stem.



T2020013

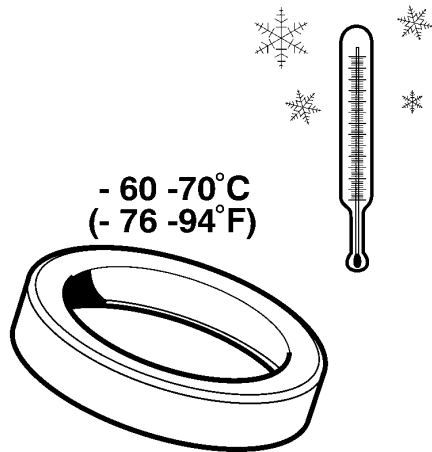
7



W2006313

8

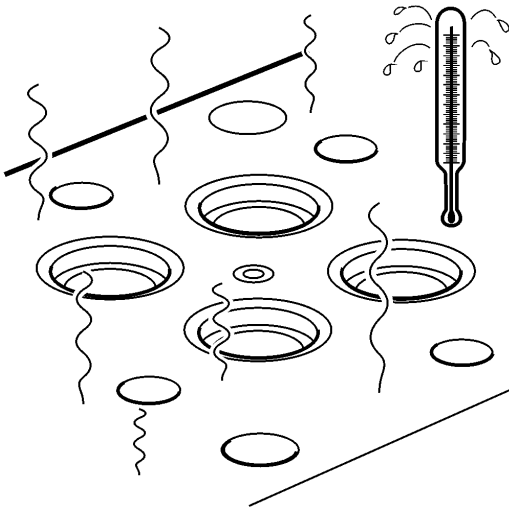
Using caution, position the new seat on a block of dry ice. Allow seat to remain on ice for several minutes to obtain the proper temperature to allow the seat to shrink.



W2006316

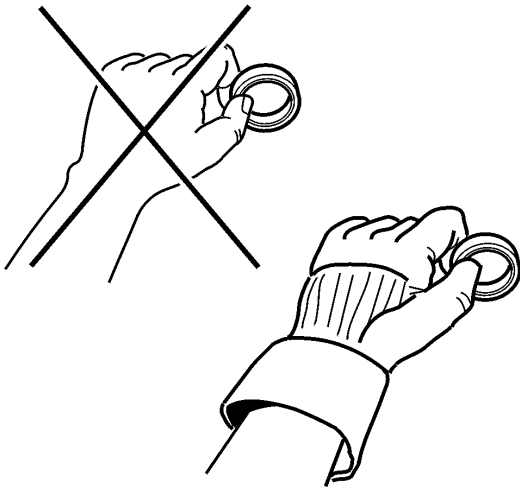


**9**  
Using a heat gun, apply heat to cylinder head around area where seat will be installed.



T2020034

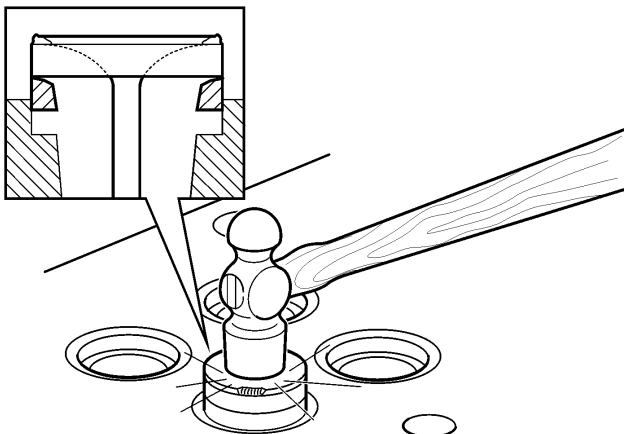
**10**  
Using protective gloves, carefully position the new seat into place.



T2020033

**11**  
Use the old valve and seat to tap the new seat into the head until the seat bottoms.

**Note:** The valve and valve seat cannot be machined.



T2022228

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Date	Group	No.	Page
2.2008	<b>214</b>	<b>102</b>	1(4)

## Valve Stem Seals, Replacement D13

### Valve Stem Seals, Replacement

#### Contents

- “Valve Stem Seals, Replacement” page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2149-03-02-01 Valve Stem Seals, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9990210, 88800151*

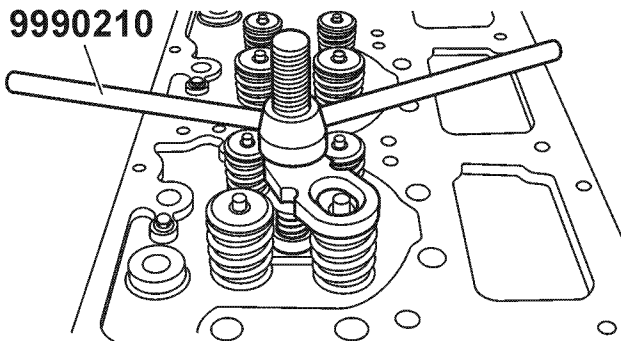
1

### **WARNING**

Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock.

Remove the unit injectors (See "Unit Injectors, Replacement" Group 23). Insert and screw tight tool 9990210 in the unit injector location.

9990210



T2021211

2

Turn the engine crankshaft to top dead center (TDC) for the appropriate pair of cylinders.

**Note:** Pistons must be at TDC when the valves are released. This is so that the valves do not drop into the cylinder.

3

### **WARNING**

Use protective goggles or eye injury could occur.

Press down the valve springs for the appropriate cylinder. Use tool 9990210.

9990210

4

Remove the valve retainers and the valve springs.

**5**  
Remove the old valve stem seals.

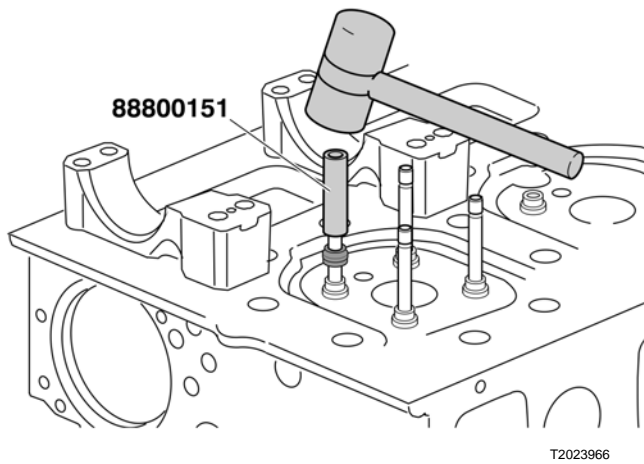
**6**  
Using a clean cloth, thoroughly clean all engine oil off the valve stem and valve guide.

**7**  
Position the new valve stem seal onto the valve stem.

**Note:** The valve stem seal must be dry when installed.


**8**  
Use tool 888800151 to install the valve stem seal into the valve guide.

**Note:** Ensure that the valve stem seal is pushed all the way down, so that the bottom of the seal is in contact with the surrounding valve guide.



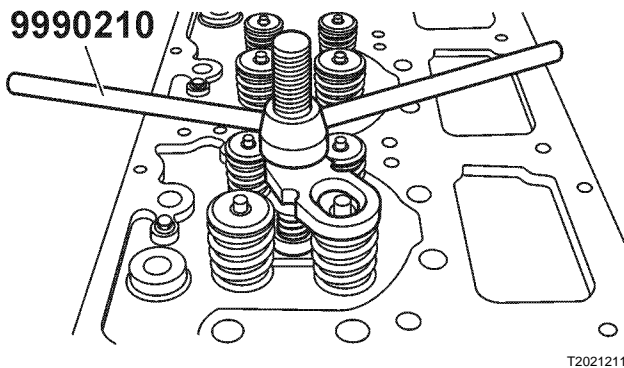
88800151

**9**

 <b>WARNING</b>
Use protective goggles or eye injury could occur.

Install the valve spring and valve keepers. Using a plastic or rubber hammer, carefully tap in the valve keepers to their correct positions.

9990210



T2021211

**10**



**WARNING**

Fingers can be trapped in the camshaft gear and cause personal injury.

Move the valve spring compressor to the next cylinder for the appropriate cylinder pair and repeat the above procedure. Turn the engine so that the next cylinder pair is at TDC. Repeat the procedure. Continue with the final cylinder pair.

**Note:** Each piston must be at TDC when the valves are released. This is to prevent the valves from falling into the cylinder.

**11**

Install the unit injectors (See "Unit Injectors, Replacement" Group 23).

**12**

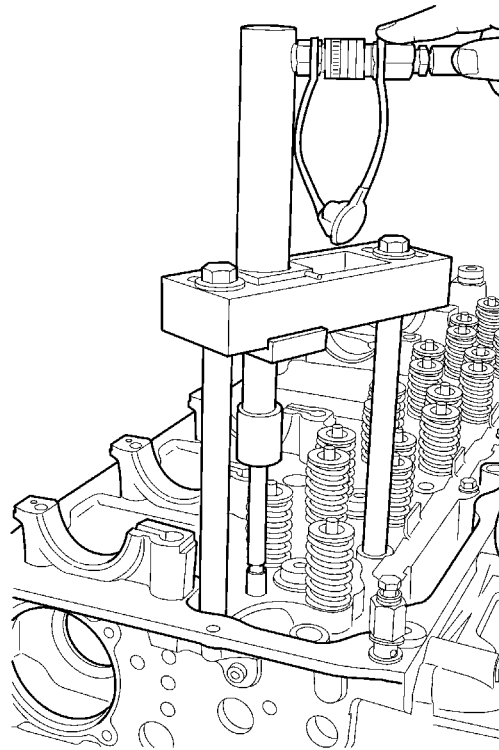
Install all previously removed cables to the ground (negative) battery terminals.

**13**

Perform a functional check and check for leakage.

## Valve Guides, Replacement D13F

### Valve Guides, Replacement



W2006124

### Contents

- “Valve Guides, Replacement (One Cylinder Head)” page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2143-03-05-03 Valve Guides, Replacement (One Cylinder Head)

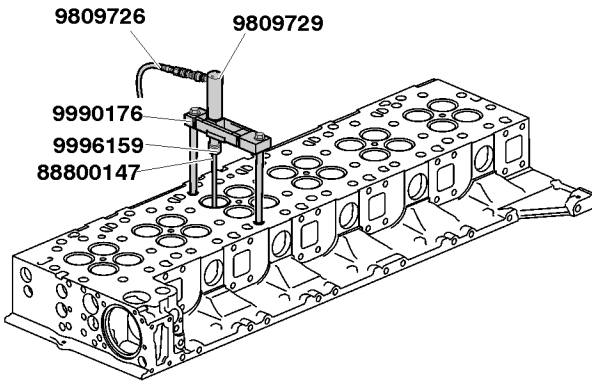
*Special tools: 9809726, 9809729, 9990176, 9996159, 88800062, 88800147, J47364, 2012-A*

### Removal

1

Use tools according to the table below and mount them on the cylinder head.


Press tool	9990176
Hydraulic pump	9809726
Hydraulic cylinder	9809729
Pin	9996159
Drift	88800147
Cylinder head mounting fixture	J47364
Cylinder head stand	2012-A



9809726, 9809729, 9990176, 9996159, 88800147, J47364, 2012-A

2

Press out the valve guides.

 <b>WARNING</b>
Use protective goggles or eye injury could occur.

### Installation

**3**

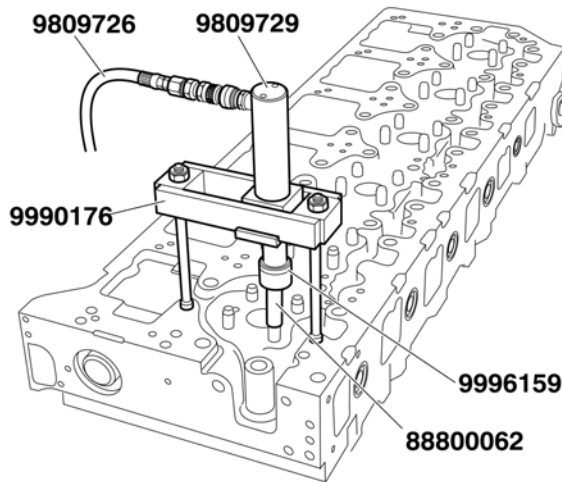
Heat the cylinder head with hot water while also cooling the valve guides with, e.g. dry ice.

**4**

Using engine oil, lubricate the valve guide hole in the cylinder head.

**5**

Use tools according to the table below and mount them on the cylinder head.



T2024221

Press tool	9990176
Hydraulic pump	9809726
Hydraulic cylinder	9809729
Pin	9996159
Drift	88800147
Cylinder head mounting fixture	J47364
Cylinder head stand	2012-A

9809726, 9809729, 9990176, 9996159, 88800147, J47364, 2012-A

**6**

Press the valve guides in until the tool bottoms against the cylinder head surface. This will give the correct height. See Function Group 20, Information type Specifications, Specifications.



### WARNING

Use protective goggles or eye injury could occur.

**7**

Repeat for the remaining valve guides.

**8**

Remove the tools from the cylinder head.

**9**

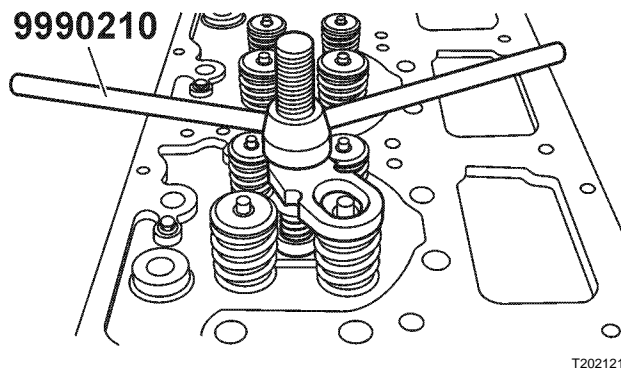
Blow the cylinder head oil and fuel channels clean.



Date	Group	No.	Page
2.2008	<b>214</b>	<b>104</b>	1(3)

## Valves, Remove and Install D13

### Valves, Remove and Install



T2021211

### Contents

- “Valves, Remove and Install (One Cylinder)” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2140-19-05-01 Valves, Remove and Install (One Cylinder)

Cylinder head removed

*Special tools: 88800151, 9990210*

### Removal

1

#### CAUTION

Valves and valve seats cannot be machined. They should be replaced if either are found to be defective.

Clean the cylinder head.  
Mark the valves if they are to be re-used.

2

Insert the valve spring compressor into the unit injector location.

9990210

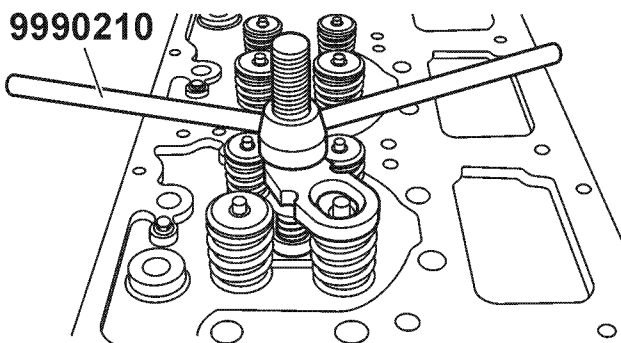
3

#### WARNING

Use protective goggles or injury to the eyes can occur.

Press down the valve spring. Gently tap the spring plate with a plastic or rubber hammer.

Remove the valve stem keepers and the valve spring.



T2021211

4

Remove the valve stem seals and the valve.

### Installation

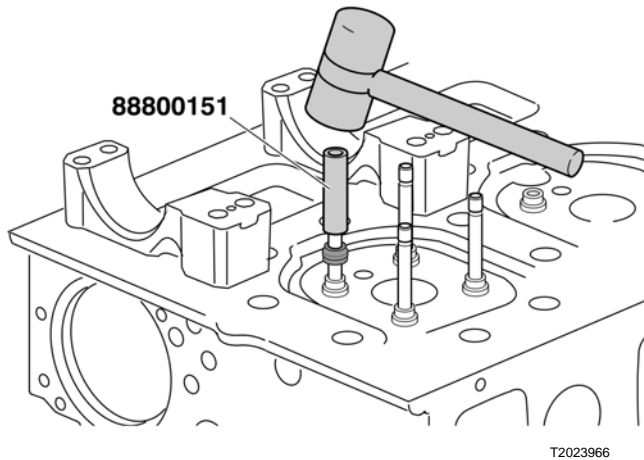
5

Install new valve.

**Note:** Oil the valve stem.

6

Using a clean cloth, thoroughly clean all engine oil off the valve stem and valve guide.



T2023966

**7**

Position the new valve stem seal onto the valve stem.

**Note:** The valve stem seals must be dry when fitted.

**8**

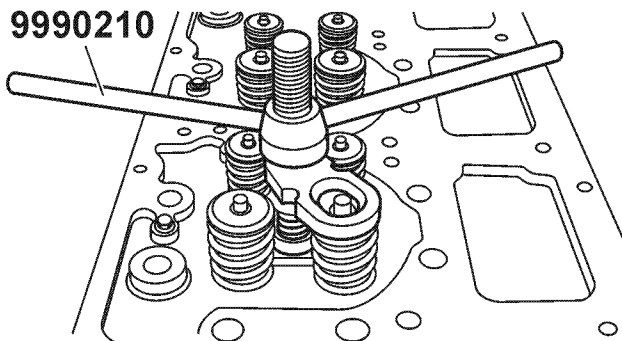
Use tool 88800151 to install the valve stem seal onto the valve guide.

**Note:** The tool is designed to fit different engines and can therefore be turned round.

Use a plastic or rubber hammer so that the tool will not be damaged.

**Note:** Ensure that the valve stem seal is pushed all the way down, so that the bottom of the seal is in contact with the surrounding valve guide.

88800151



T2021211

**9**



**WARNING**

Use protective goggles or injury to the eyes can occur.

Using a plastic or rubber hammer, install the valve spring and keepers. Carefully position the valve keepers in their correct positions.

9990210

**10**

Visually inspect the keepers to ensure that they are properly installed.

**11**

Repeat the procedure with the next valve.

Date	Group	No.	Release	Page
9.2011	<b>214</b>	<b>69</b>	<b>01</b>	1(3)

## Rocker Arm Shaft Oil Pressure, Checking

D13

### Rocker Arm Shaft Oil Pressure, Checking

This information covers procedures for checking the rocker arm shaft oil pressure on VOLVO engines.

#### Contents

- "Rocker Arm Shaft Oil Pressure, Checking", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2146-06-02-02**

## Rocker Arm Shaft Oil Pressure, Checking

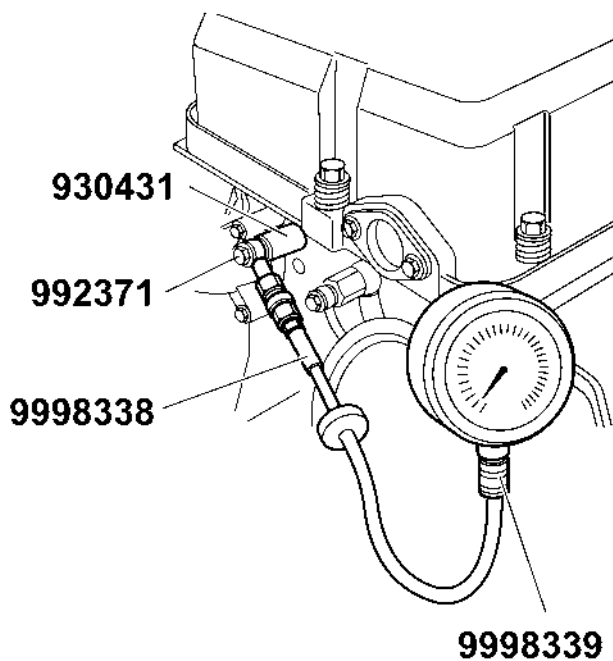
You must read and understand the precautions and guidelines in Service Information, Function Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 930431, 992371, 9998338, 9998339*

### Checking Oil Pressure

- 1**  
Apply the parking brake and place the shift lever in neutral.
- 2**  
Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.
- 3**  
Remove test port plug from cylinder head.
- 4**  
Connect test equipment to cylinder head.

930431, 992371, 9998338, 9998339



**5**

Install all previously removed cables to the ground (negative) battery terminals.

**6**

Start the engine and check the pressure reading on the gauge. Activate the engine brake and check the reading on the gauge.

**Note:** The oil pressure in the rocker shaft is regulated to approximately 100 kPa (14 psi). Oil pressure should rise to minimum 200 kPa (30 psi ) in less than a second. When brake is deactivated, pressure should drop to regulated pressure in less than 1 second.

**7**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**8**

Remove test equipment.

**9**

Install test port plug and tighten plug to specification.

**10**

Install all previously removed cables to the ground (negative) battery terminals.

**11**

Start the engine, check for leaks and proper operation. After shutdown, replenish fluids as necessary.

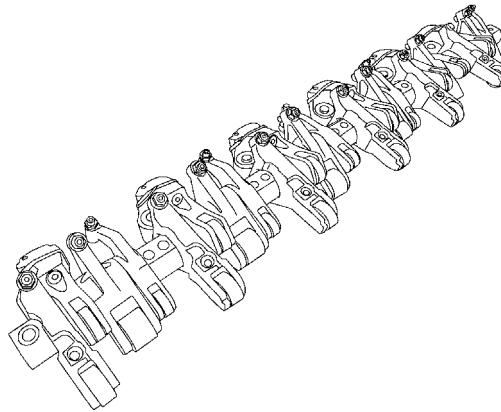
**12**

Use Tech Tool to check and clear any diagnostic trouble codes (DTC).

Date	Group	No.	Page
9.2008	<b>214</b>	<b>84</b>	1(13)

## Rocker Arms, Replacement (All) D13

### Rocker Arms, Replacement (All)



W2006240

This information covers procedures for replacing the rocker arm and shaft on Volvo D13 engines.

### Contents

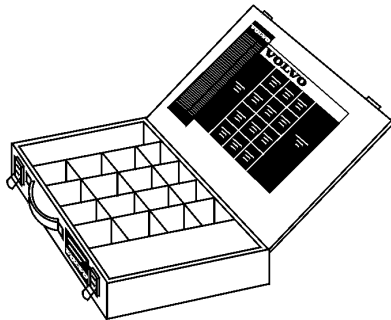
- "Special Tools" page 2
- "Rocker Arms, Replacement (All)" page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

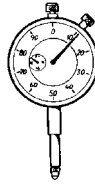
# Tools

## Special Tools

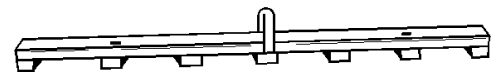
The following special tools are used to replace or repair components. The tools can be ordered from Volvo; please refer to the specified part number when ordering.



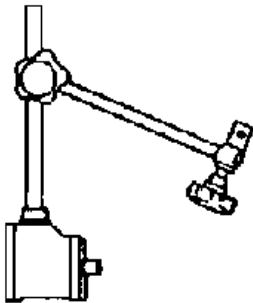
**85111158**  
VEB Shim Kit



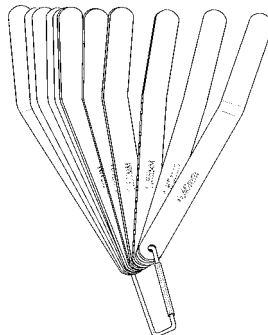
T0010127  
**9989876**  
Dial Indicator



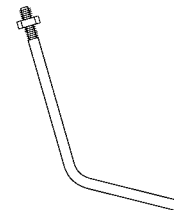
**85109250**  
Rocker Assembly Lifting Tool



**9999696**  
Magnetic Stand



**85111377**  
Feeler Gauge Set



**85111493**  
Dial Indicator Angled Extension (or  
Equivalent)



# Service Procedures

## 2145-03-04-01

### Rocker Arms, Replacement (All)

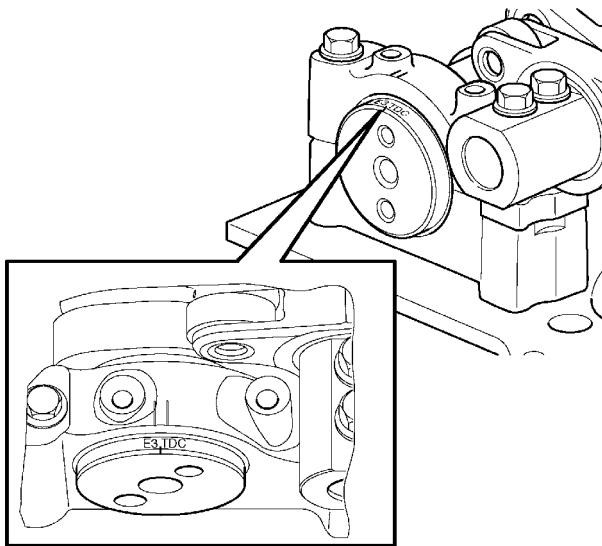
You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing any procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9989876, 9999696, 85109250, 85111158, 85111377, 85111493*

## Removal

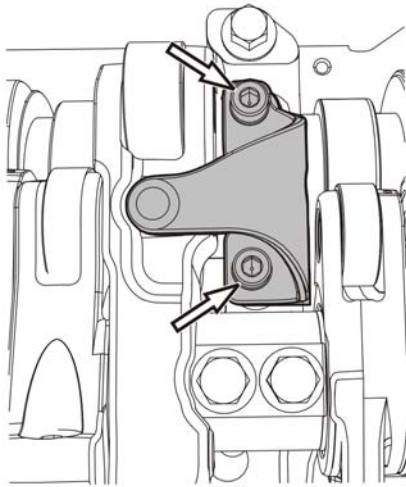
**1**  
Remove the valve cover. Refer to service procedures in Group 21.

**2**  
Rotate the engine so that the camshaft is positioned at top dead center (TDC) by aligning the TDC mark on the camshaft with the timing marks on the No. 1 camshaft bearing cap.



**3**

Loosen all mounting fasteners for the leaf spring on the brake rockers and remove the leaf springs.

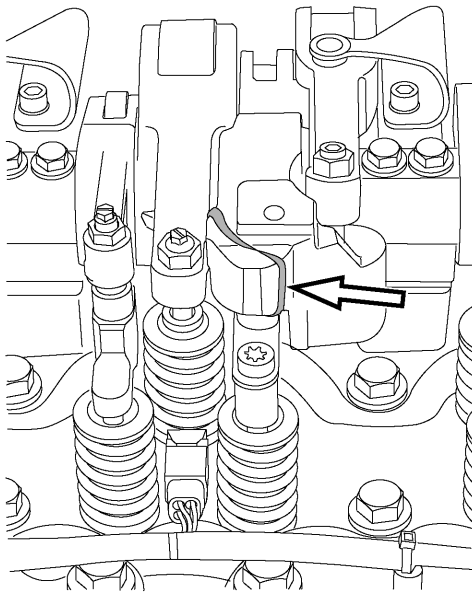


W2005845

**4**

Secure the pistons in the exhaust rocker arms using rubber bands (or tie straps) to prevent piston damage.

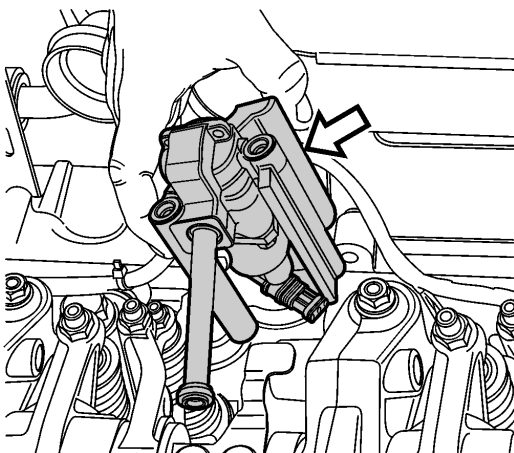
**Note:** Pistons and rocker arms are matched together and should not be mixed.



W2006172

**5**

Remove the Volvo Engine Brake (VEB) control valve along with the pipe between the valve and rocker arm shaft.



W2004839

- 6**  
Remove the fasteners attaching the rocker arm shaft to the camshaft bearings caps.

 **CAUTION**

The order of the rocker arm assembly must be maintained. Make certain the sets of four are kept together. Make certain the rocker arms are identified so they can be returned to their original positions on the shaft. Failure to heed this caution may result in severe engine damage.

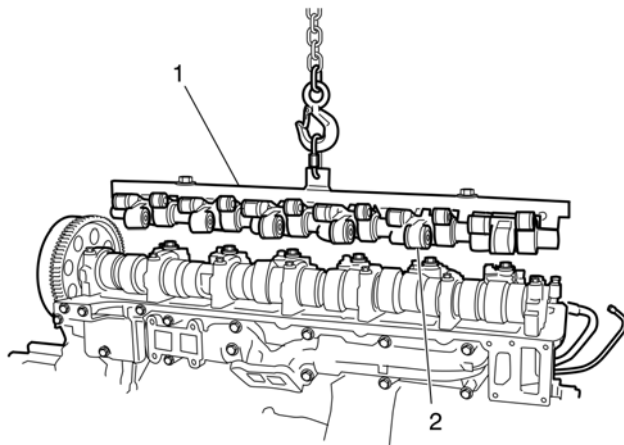
- 7**  
Attach the lifting tool to the rocker arm shaft.

85109250

- 8**  
Loosen the rocker arm shaft mounting fasteners evenly in stages to avoid bending the shaft. With the aid of an assistant, remove the fasteners and carefully lift off the shaft assembly using the lifting tool. Place the rocker shaft in secure location.

**Note:** Ensure the pistons are secured in the exhaust rocker arms with elastic bands so that the pistons do not fall out as the shaft is removed.

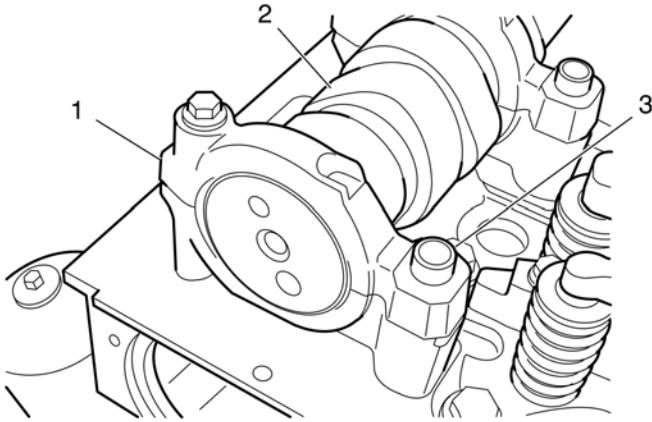
85109250



W2005513

- 1 Lifting Tool 85109250  
2 Rocker Shaft Assembly

**9**  
With the rocker shaft assembly removed, check to ensure that the alignment sleeves remain in position on each bearing cap.



W2005514

- 1 Camshaft Bearing Cap
- 2 Camshaft
- 3 Alignment Sleeve

## Disassembly, Inspection and Assembly

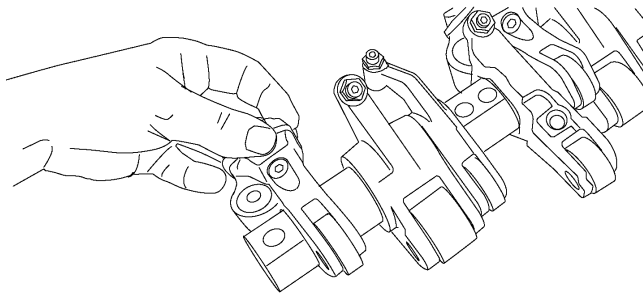
The following components can be replaced: rocker arm shaft, expansion plugs, complete rocker arms and adjusting screws.

### 1

Place the rocker shaft assembly on a workbench and remove the lifting tool.

### 2

Remove the rocker arms from the rocker arm shaft.



W2006231

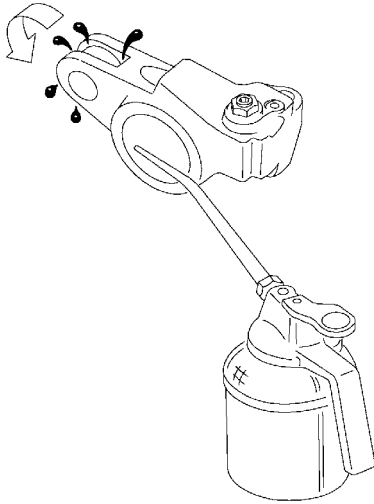
### 3

Clean the parts, paying special attention to the oil channels in the bearing housing and the oil holes for the rocker arm shaft and rocker arms.

### 4

Check the wear on the rocker arm shaft and ball screws. The threads should be undamaged on ball screws and locknuts.

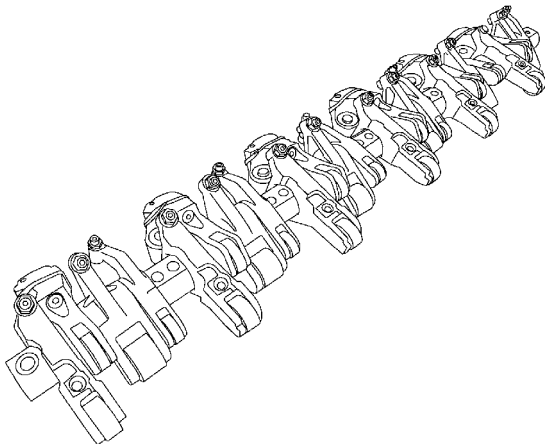
**Note:** If a rocker arm has an overly worn bushing, replace the complete rocker arm.



W2005940

**5**  
Lubricate the rocker arm shaft with engine oil and replace the rocker arms.

**Note:** It is extremely important that the rocker arms and rocker arm shaft are carefully cleaned and oiled with engine oil before rocker arms and shafts are installed together.



W2006240

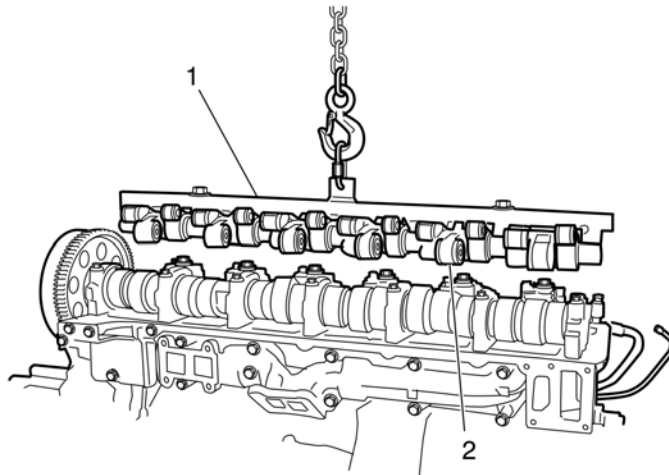
**6**  
Install all the rocker arms on the rocker shaft. Check that they move freely.

**7**  
With the rocker arms in place on the shaft, carefully attach the lifting tool to the rocker shaft assembly.

## Installation

**1**  
Oil the valve bridges and the camshaft lobes with engine oil.

**2**  
Using the lifting tool and an assistant, place the rocker shaft assembly in position on the inboard side of the camshaft bearing caps.



W2005513

- 1 Lifting Tool 85109250
- 2 Rocker Shaft Assembly

**3**  
Remove the lifting tool. Starting at the middle of the shaft, install and tighten the rocker arm shaft bolts a little at a time, evenly across the entire shaft so that the shaft does not become distorted, bent or fractured.

**Note:** Make sure that the rocker arm shaft is seated properly in the guide dowels of the camshaft bearing caps. Remove the restraints (rubber bands or tie straps) securing the exhaust rocker arm pistons.

---

85109250

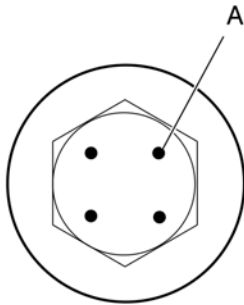
**4**  
Lubricate the rocker arm rollers.

**5**

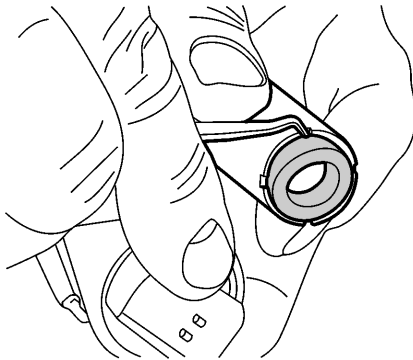
Tighten all camshaft bearing cap and rocker arm shaft bolts in sequence to specification.

**Note:** Refer to Group 20 for the correct torque specifications.

**Note:** The bolts have limited reusability and must be marked (A) with a punch each time they are installed in service. Bolts with four punch marks when removed have been tightened five times and must be discarded.



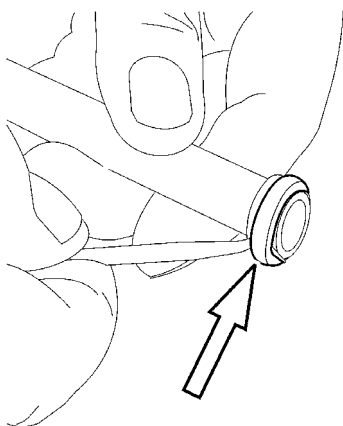
W2005481



W2004855

**6**

Replace the O-ring at the bottom of the VEB control valve.

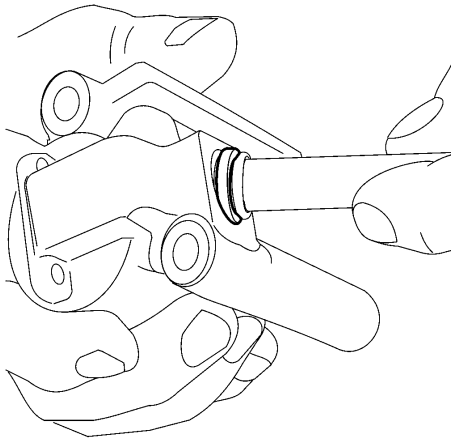


W2004853

**7**

Clean the VEB control valve oil pipe and replace the O-rings. Lubricate the pipe hole in the rocker arm shaft and the O-rings on the pipe.

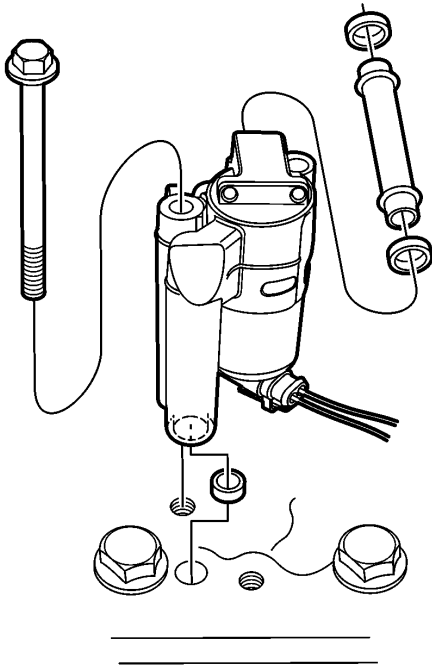




W2004854

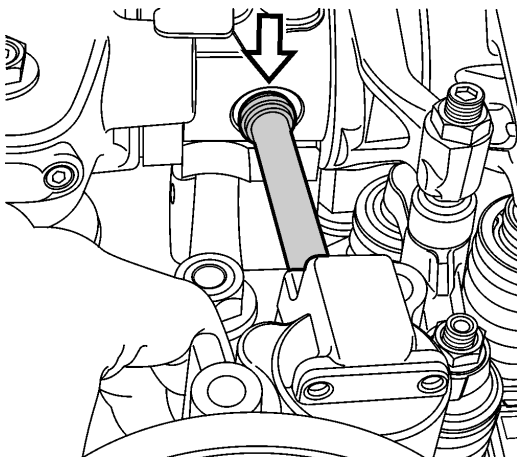
**8**  
Insert the oil pipe into the oil hole of the VEB control valve.

**Note:** Make sure that the O-ring is seated fully in the valve.



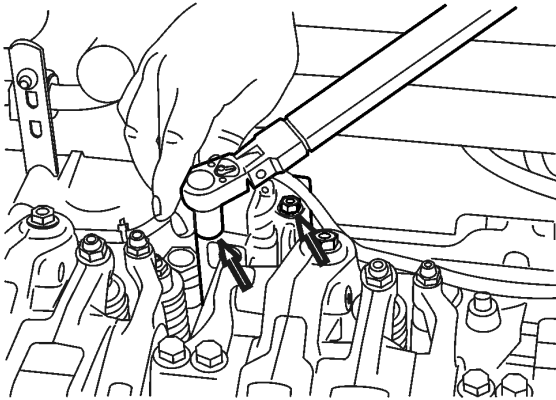
W2004869

**9**  
Position the VEB control valve on the cylinder head.



W2004857

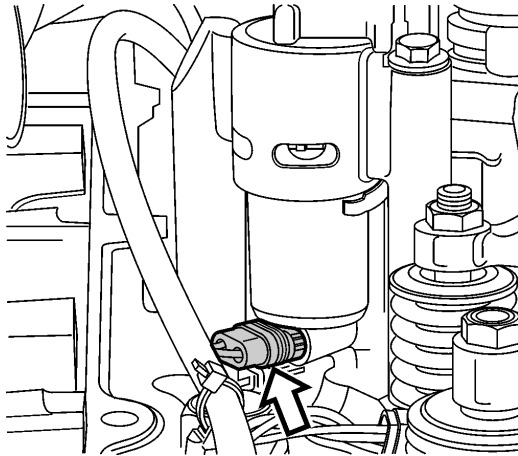
**10**  
Align the VEB oil pipe and O-ring with the hole in the rocker shaft.



W2004858

**11**  
Install the VEB control valve bolts and tighten to specification.

**Note:** Make sure the VEB oil pipe O-ring is fully seated.

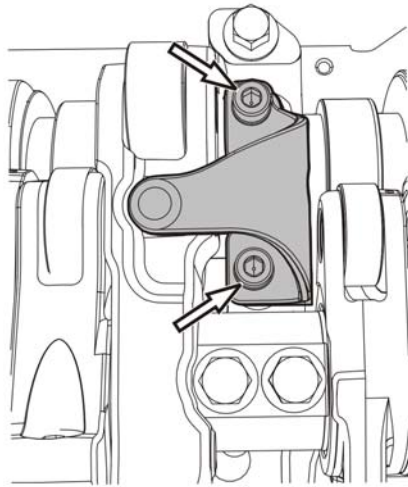


W2004837

**12**  
Plug-in the VEB control valve harness connector.

**13**  
Reposition the fuel injector harness over the VEB control valve and secure with tie straps.

**14**  
Adjust the inlet vales, exhaust vales and unit injectors.  
Refer to the service procedures in Group 21.



W2005845

**15**

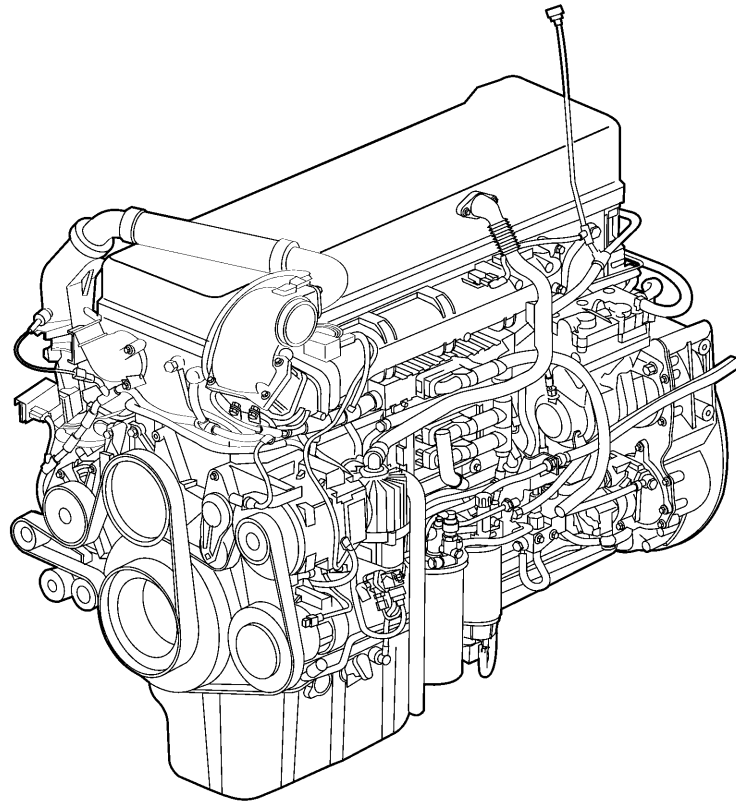
Place the leaf springs in position on the camshaft bearing caps. Install the fasteners and tighten to specification.

**16**

Install the valve cover. Refer to the service procedures in Group 21.

## Valves and Unit injectors, Adjustment D13

### Valves and Unit Injectors, Adjustment



W2005941

This information covers the correct procedure for adjusting the valves and unit injectors on the Volvo D13 engine.

#### Contents

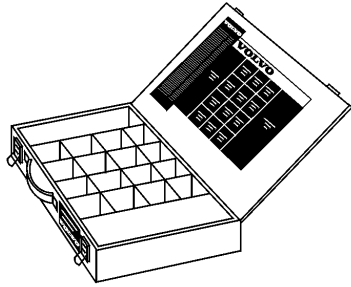
- "Special Tools" page 2
- "Valves and Unit Injectors, Adjustment" page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

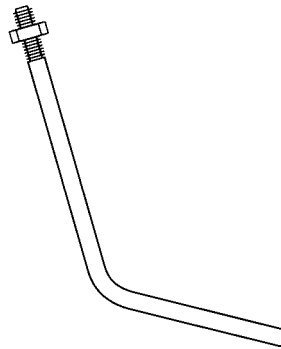
# Tools

## Special Tools

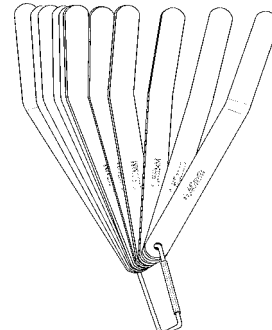
For special tools ordering instructions, refer to Tool Information, group 08.



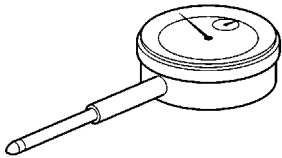
W0001924  
**3949521**  
VEB Shim Kit



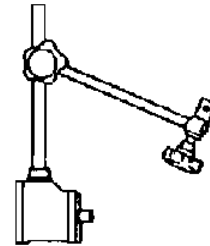
W0002414  
**85111493**  
Dial Indicator Angled Extension  
(or Equivalent)



W0000416  
**85111377**  
Feeler Gauge Set



T0010788  
**9989876**  
Dial Indicator (or Equivalent)



W0001790  
**9999696**  
Magnetic Stand (or Equivalent)

# Service Procedures

## Valves and Unit Injectors, Adjustment

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

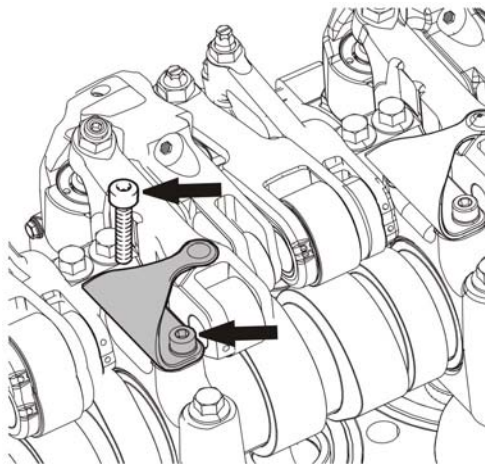
*Special tools: 3949521, 9989876, 9999696, 85111493, 85111377*

### 1

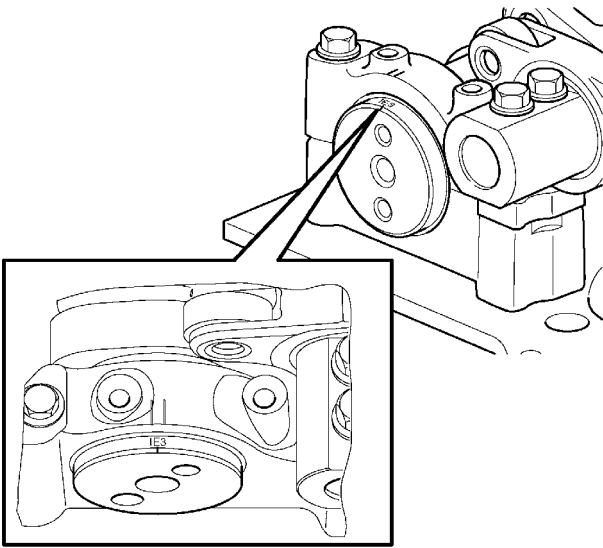
Remove the valve cover. Refer to service procedures in Group 21.

### 2

Loosen the fasteners retaining the leaf springs to release spring tension on the Volvo Engine Brake (VEB) rocker arms.



W2005753



W2006171

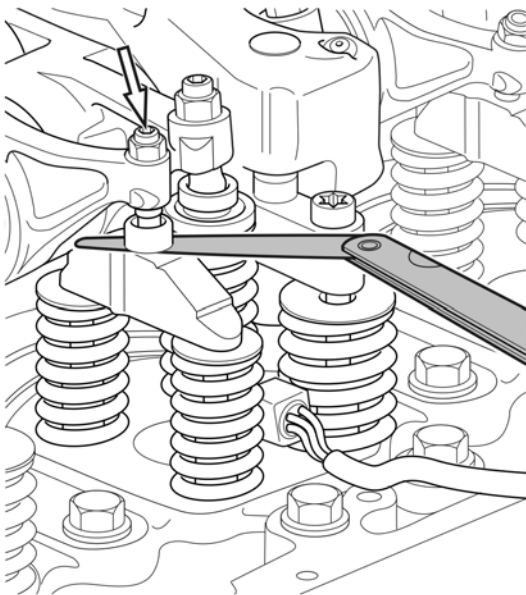
**3**  
Camshaft markings 1–6 apply to adjustment of inlet valves and unit injector. Camshaft markings E1–E6 apply to adjustment of exhaust valves.

Cam Position	Injector	Intake	Exhaust	VEB Rocker
5	X	X		
E6			X	X
3	X	X		
E2			X	X
6	X	X		
E4			X	X
2	X	X		
E1			X	X
4	X	X		
E5			X	X
1	X	X		
E3			X	X

### Intake Valves, Adjustment

**4**  
Rotate the engine to the next camshaft marking for adjustment of the intake valve. Rotate the engine until the valve and injector mark on the front end of the camshaft aligns with the stamped mark on the camshaft front bearing cap.

**5**  
With the engine cold (140°F or less), check the intake valve clearance. Push down on the back of the rocker and insert a feeler gauge of the proper specification,  $0.20 \pm 0.05$  mm ( $0.008 \pm 0.002$  inch), between the bridge and the adjustment screw. If the inlet rocker requires adjustment, loosen the locknut on the rocker and adjust the plunger.



T2023322

**6**

Tighten the locknut on the plunger by holding the adjusting screw in place and tighten the locknut to  $38 \pm 4$  Nm ( $28 \pm 3$  ft-lb).

---

$38 \pm 4$  Nm  
( $28 \pm 3$  ft-lb)

**7**

Recheck the valve clearance after the nut is tightened.

**Note:** Mark the rocker arm when the valve has been adjusted.

### Unit Injector, Adjustment

**8**

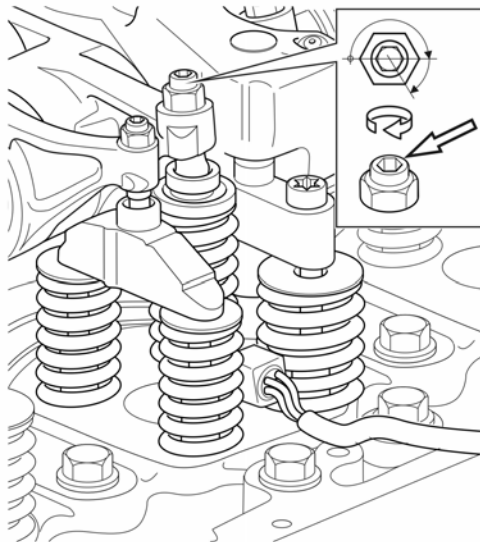
To adjust the injector on the same cylinder location, loosen the locknut and back off the adjusting screw until it no longer makes contact.

**9**

Adjust the unit injector's rocker arm to zero clearance.

**10**

Tighten the adjusting screw four flats or 240 degrees of clockwise rotation.



T2023323

**11**

Torque-tighten the adjusting screw locknut to  $52 \pm 4$  Nm ( $38 \pm 3$  ft-lb).

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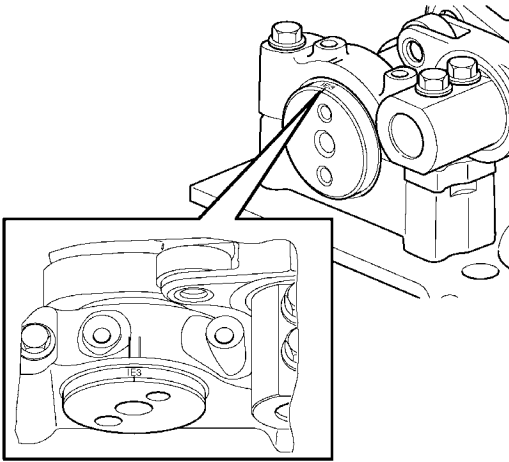
$52 \pm 4$  Nm  
( $38 \pm 3$  ft-lb)



## Exhaust Valves, Adjustment

### 12

Rotate the engine to the next camshaft marking (number plus "E") for the adjustment of the exhaust valves.

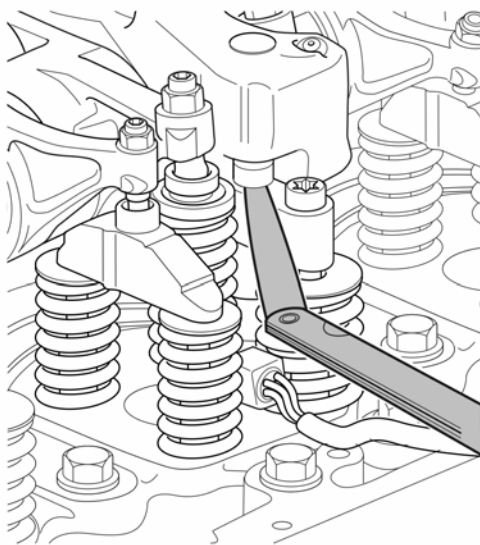


W2006171

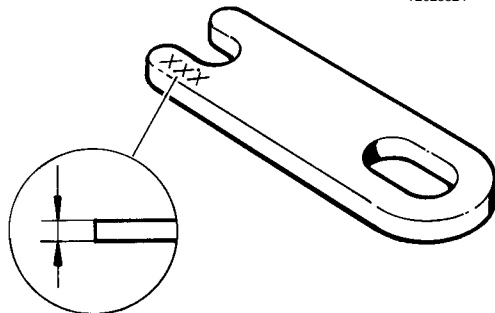
### 13

#### Exhaust Bridge Shim Check

- Push down on the back of the exhaust rocker and insert a feeler gauge of the proper specification of  $1.00 \pm 0.05$  mm ( $0.039 \pm 0.002$  inch) between the bridge and the brake plunger.
- If clearance is not within specification, adjust the clearance as required, using shims placed on top of the valve bridge.
  - Remove the shim retaining screw and remove the shim.
  - Make sure that the valve bridge and shim(s) are clean.



T2023324

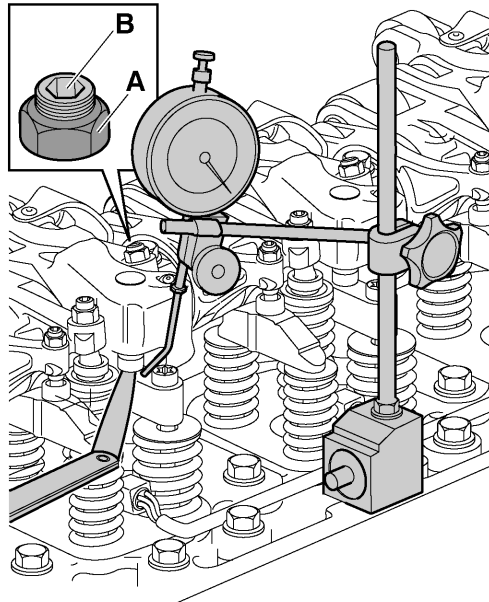


T2009008

- Determine the thickness of the shim(s) required to match the measured clearance
- Place the shim(s) in position on the valve yoke, install the retaining screw and tighten to  $38 \pm 4$  Nm ( $28 \pm 3$  ft-lb).  
DO NOT use more than two shims. Shims are available (shim kit No. 3949521) in 0.05 mm (0.002 inch) increments with the thickness marked on the surface. If two shims are required to take up the clearance, the shims should be of nearly equal thickness.

Allow feeler gauge to remain in place between the rocker arm and the valve bridge during the following brake rocker check.

3949521  
 $38 \pm 4$  Nm  
( $28 \pm 3$  ft-lb)



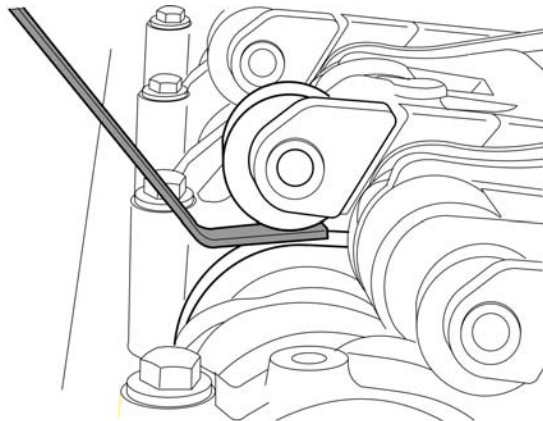
W2006212

#### 14 Engine Brake Rocker Adjust

- Loosen the locknut on the brake rocker arm "A".
- Assemble the dial indicator angled extension onto the dial indicator and tighten the extension locknut.
- Position a magnetic stand and dial indicator with angled extension to allow the shaft of indicator extension to set onto the valve bridge as close to the brake rocker plunger as possible.
- Tighten the adjusting screw "B" clockwise until the dial indicator shows that the valve bridge has been pressed down by  $0.60 \pm 0.05$  mm ( $0.024 \pm 0.002$  inch).
- Loosen the adjusting screw "B" counterclockwise 720 degrees (two revolutions).
- Tighten retention locknut "A" to  $52 \pm 4$  Nm ( $38 \pm 3$  ft-lb).
- Remove the dial indicator, magnetic stand and feeler gauge.

9989876, 85111493, 9999696

$52 \pm 4$  Nm  
( $38 \pm 3$  ft-lb)



W2005815

#### 15 VEB Engine Brake Check

Check the engine brake rocker arm clearance between the rocker arm roller and the camshaft with the 3.6 mm feeler gauge 85111377.

- With the dial indicator, magnetic stand and feeler gauge removed, insert a shim and feeler gauge between the camshaft lobe and the rocker arm roller.
- Clearance between the camshaft and rocker roller should meet a specification of  $3.60 \pm 0.10$  mm ( $0.142 \pm 0.004$  inch).
- If the clearance is not within the specification, the adjustment must be repeated per the previous adjustment.

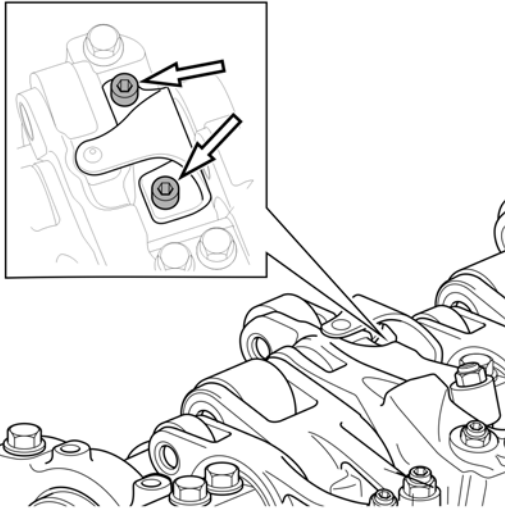
85111377

16  
Recheck valve clearance after the locknut is tightened.

**Note:** Mark the rocker arm when the valve has been adjusted.

17  
Repeat the above procedure to adjust all other unit injectors and valve locations by rotating the engine to the next nearest camshaft mark.

18  
After all unit injectors and valves have been checked and adjusted if necessary, clean the valve cover contact surface on the cylinder head.



T2022951

**19**

Tighten the leaf spring retaining screws on the exhaust rocker arms to  $25 \pm 3$  Nm ( $18 \pm 2$  ft-lb).

---

$25 \pm 3$  Nm  
( $18 \pm 2$  ft-lb)

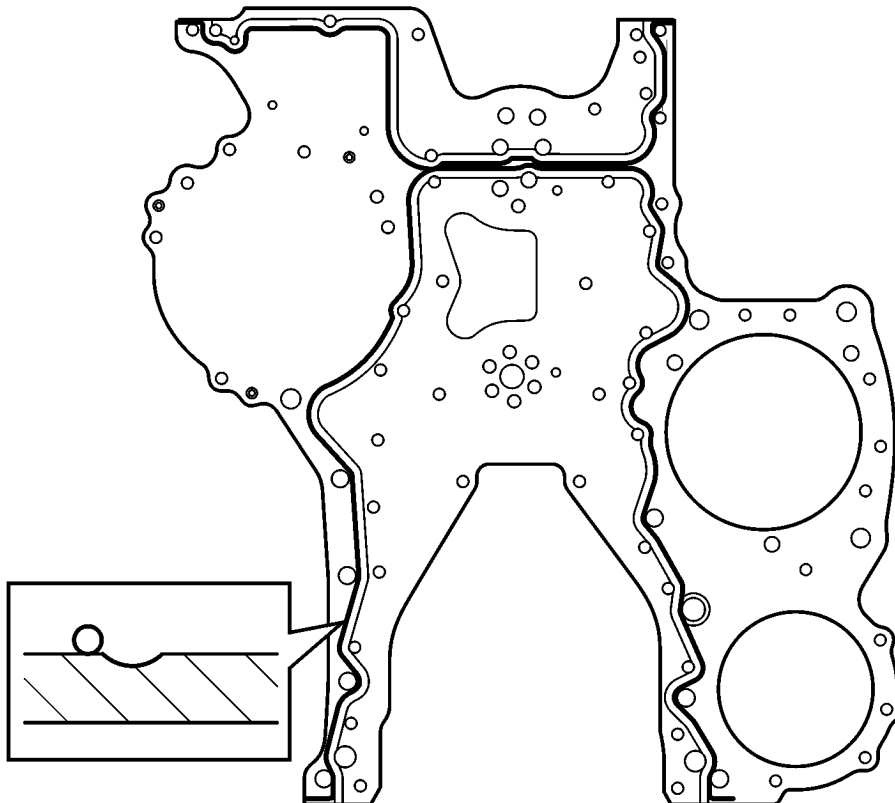
**20**

Install the valve cover. Refer to service procedures in Group 21.

Date	Group	No.	Page
2.2008	<b>215</b>	<b>100</b>	1(4)

## Sealant, Timing Gear Plate, Replacement D13

### Sealant, Timing Gear Plate, Replacement



T2022337

### Contents

“Sealant, Timing Gear Plate, Replacement” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2152-03-03-04 Sealant, Timing Gear Plate, Replacement

Timing gears removed

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

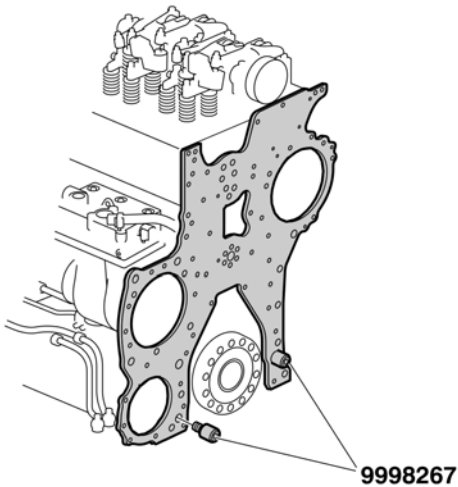
*Special tools: 9998267*

**1**

Install two guides 9998267 in the timing gear plate guide holes before loosening the timing gear plate.

**Note:** The guides should not be loosened or moved from their positions before the timing gear plate has been reinstalled.

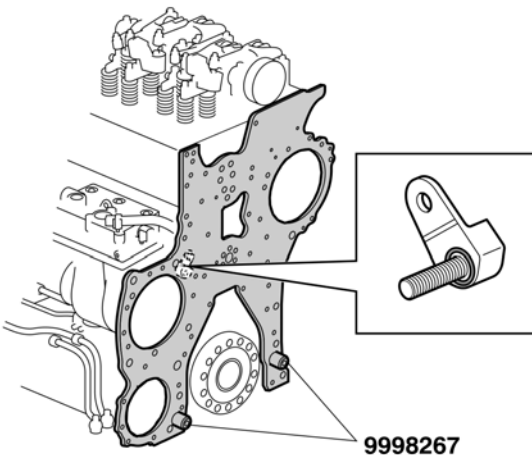
9998267



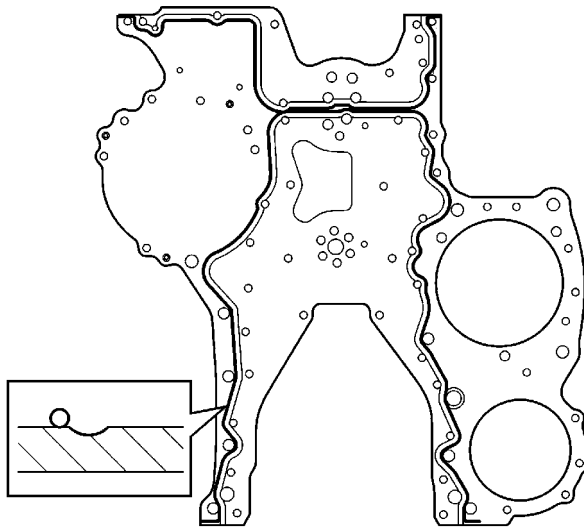
T2022376

**2**

Remove the compressor stud.



T2022377



T2022337

**3**

Remove the timing gear plate.

**4**

Clean the timing gear plate on both sides.

**5**

Clean the contact surfaces on the engine block and cylinder head. Remove sealing compound from the groove on the engine block side.

**6**

Apply a 2 mm thick bead of sealing compound onto the timing gear plate according to the figure in the "Specifications", see group 20.

**Note:** Sealing compound must be applied **outside** the groove in the timing gear plate. This causes the excess compound to be forced down into the groove, giving better sealing.

The timing gear plate must be installed within 20 minutes of the sealant being applied.

**7**

Install the timing gear plate.

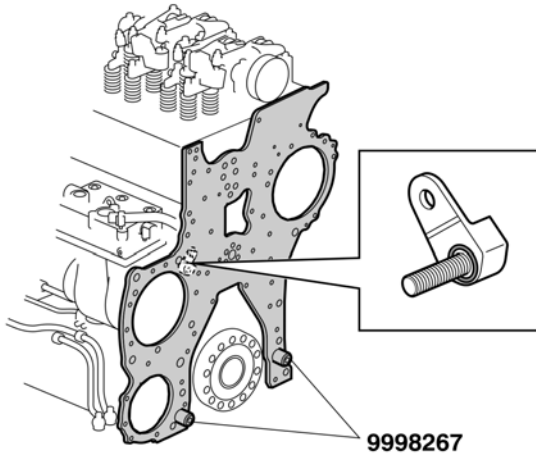
**Note:** Use only **new** bolts, pre-treated with locking compound.

Torque-tighten the bolts according to the tightening sequence, see "Specifications" group 20.

Clean away excessive sealing compound before it dries.

---

9998267



- 8**  
Install the compressor stud, with a new sealing ring and new bolt.

T2022377

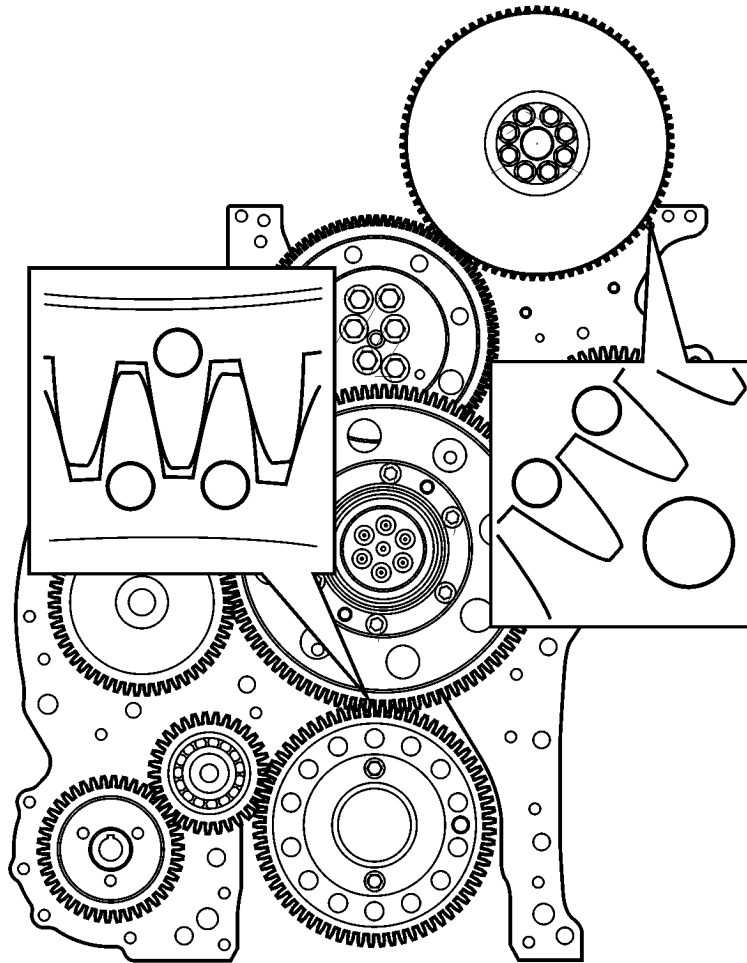
- 9**  
Remove the guides for the timing gear plate.

Date	Group	No.	Page
8.2008	215	106	1(7)

## Timing Gears Replacement (All)

D13

## Timing Gears, Replacement (All)



T2022369

### Contents

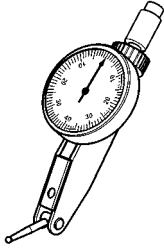
- “Special Tools” page 2
- “Timing Gears, Replacement (All)” page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



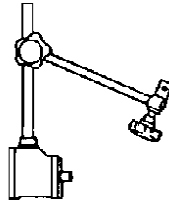
## Special Tools

For information on ordering special tools, please refer to the special tools information, group 08.



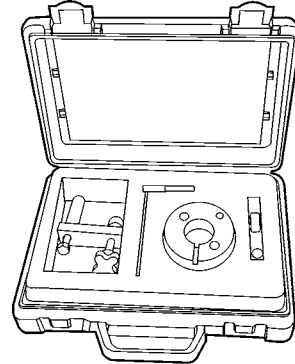
C0001436

**9999683**  
Sweep Dial Indicator



W0001790

**9999696**  
Magnetic Stand



W0001814

**J44514-B**  
Camshaft Alignment Tool Kit

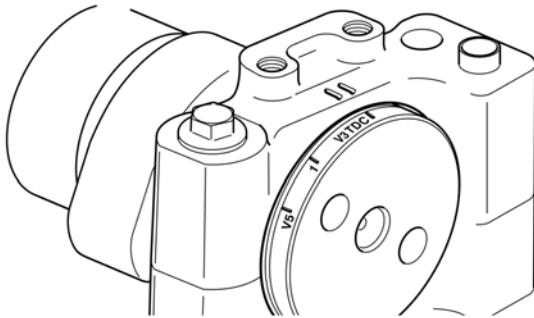
## 2153-03-03-01

### Timing Gears, Replacement (All)

Casing and oil pan removed

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9999683, 9999696, J44514-B*



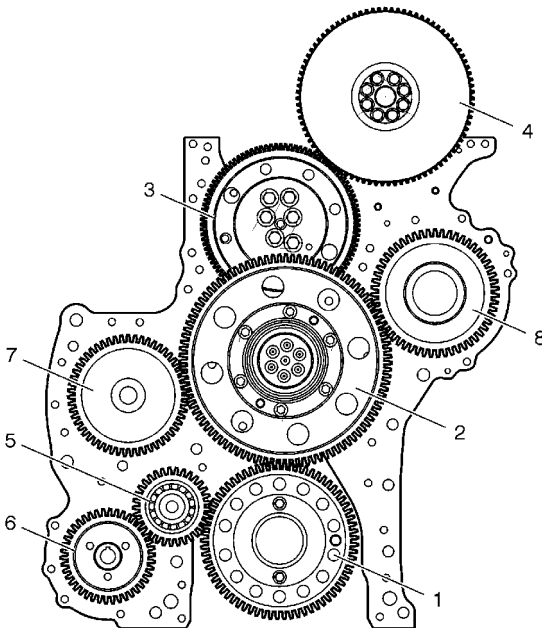
T2022609

**1**

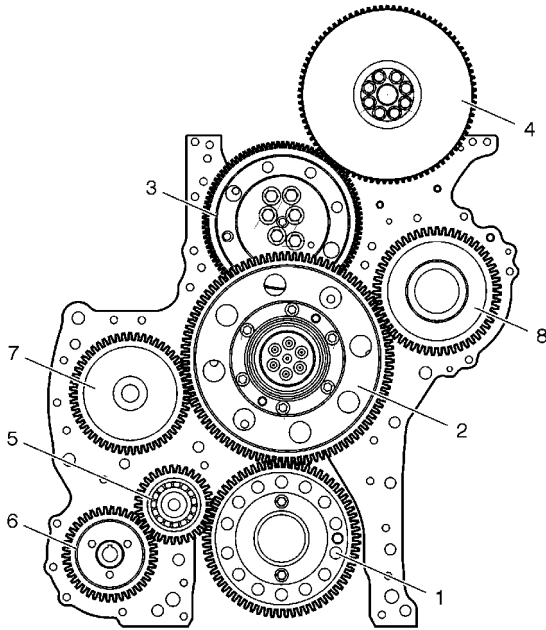
Check that the crankshaft and camshaft are positioned at TDC (Top Dead Center).

**2**

Remove the idling gear (5).  
Remove the seal ring from the bearing journal.



T2022341



T2022341

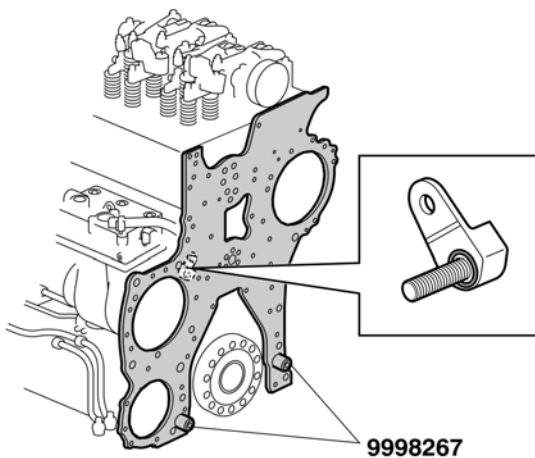
**3**  
Using a gear puller, remove the crankshaft gear (1).  
Remove the seal ring from the groove in the crankshaft journal.

**4**  
Remove the idling gears (2) and (3).

**Note:** The double idler gear (2) must **not** be taken apart.

**5**  
Remove the vibration damper and the camshaft gear (4).

**6**  
Remove the compressor studs from the timing gear plate. Change the sealing ring and install the studs with new locking bolts.



T2022377

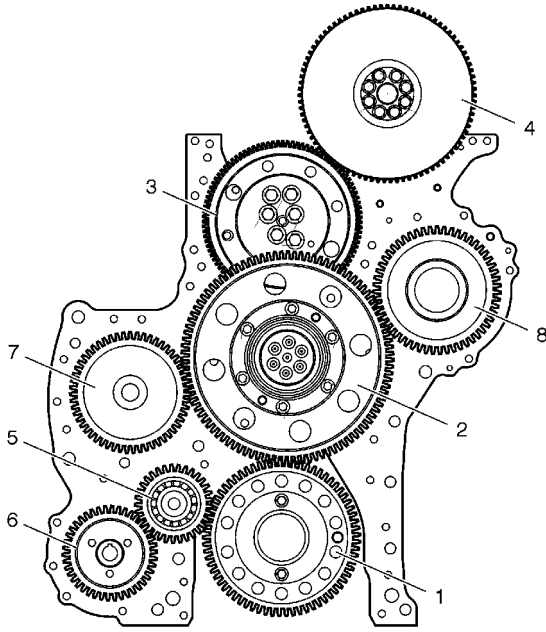
**7**  
Apply a new sealing ring to the crankshaft.

**8**

Apply a film of oil onto the O-ring that will meet with the crankshaft gear surface.  
Install the crankshaft gear (1).

**9**

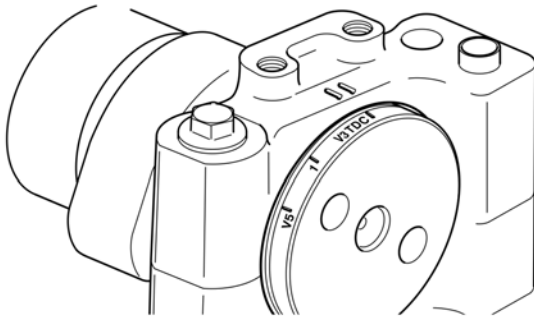
Install the upper idler gear (3) with its thrust washer.  
Tighten the bolts by hand only.



T2022341

**10**

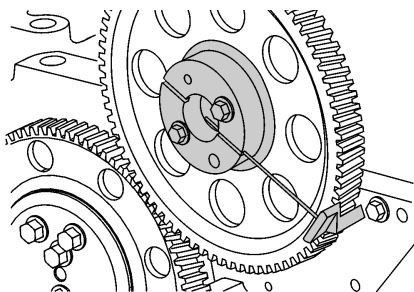
Check that the crankshaft and camshaft are positioned at TDC (Top Dead Center).



T2022609

**11**

Install the camshaft gear (4).  
Position the camshaft gear so that the reference hole in the timing gear plate is between the marks on the gear.  
Insert the alignment tool into the hole in the timing gear plate to engage the camshaft gear teeth with the rod of the tool in the slot of the clamp tool. Rotate the camshaft until this occurs, then remove the alignment rod.



W2005135

J44514-B

**12**

Install the vibration damper onto the camshaft gear with new bolts. Torque-tighten the bolts to the specification of  $45 \pm 5$  Nm ( $33 \pm 4$  ft-lb) then,  $90 \pm 5$  degrees of angle tightening.

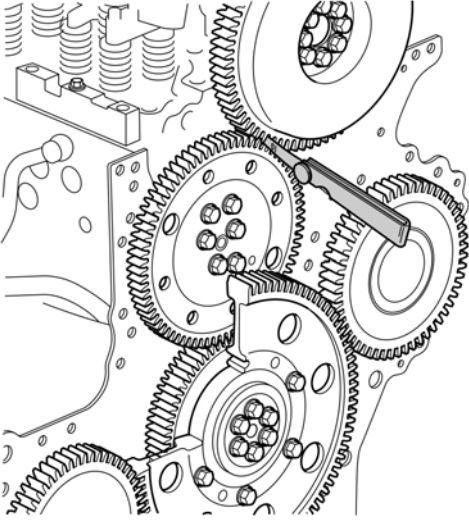
---

$45 \pm 5$  Nm ( $33 \pm 4$  ft-lb)  
Angle tighten  $90 \pm 5$  degrees

**13**

Insert a 0.1 mm (0.004 in.) feeler gauge. Adjust the idler gear so that there is slight pressure on the feeler gauge.

Tighten the bolts by hand only.



T2022371

**14**

Remove the feeler gauge.

**Note:** There should be a slight resistance on the feeler gauge when removed.

**15**

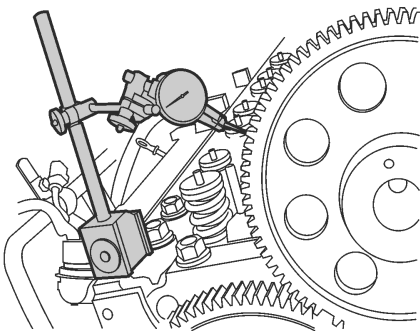
Install the magnetic stand 9999696 and dial indicator 9999683 so that the tip of the dial indicator rests on a tooth of the camshaft gear.

Check the gear backlash by turning the camshaft gear in both directions. Read the clearance on the dial indicator. For the correct value of 0.05–0.15 mm (0.002–0.006 inch).

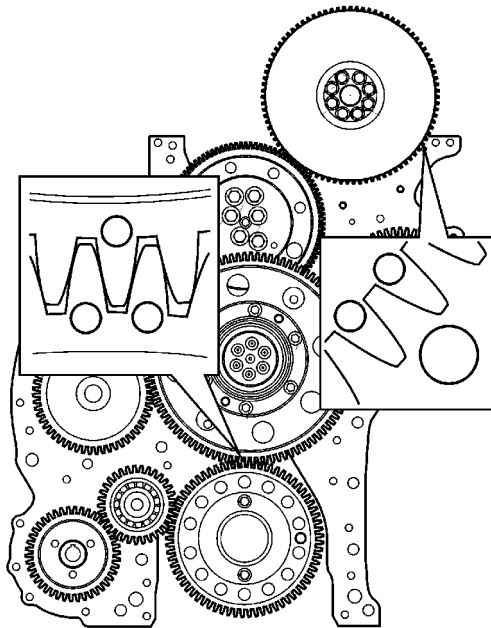
Tighten the upper idler gear bolts to the specification of  $35 \pm 4$  Nm ( $26 \pm 3$  ft-lb) then,  $120 \pm 5$  degrees of angle tightening.

---

$35 \pm 4$  Nm ( $26 \pm 3$  ft-lb)  
Angle tighten  $120 \pm 5$  degrees  
9999683, 9999696



W2005136



T2022369

**16**

Install the double idler gear (2) to the timing gear plate, using new bolts. Check that the idler gear marking lies between the markings on the crankshaft gear teeth.

Tighten the bolts to the specification of  $25 \pm 3$  Nm ( $19 \pm 2$  ft-lb) then,  $110 \pm 5$  degrees of angle tightening.

$25 \pm 3$  Nm ( $19 \pm 2$  ft-lb)  
Angle tighten  $110 \pm 5$  degrees

**17**

To reduce the possibility of gear noise, install only the latest configuration auxiliary idler gear 21049784 with matching bolt 21050240 onto the timing gear plate. Tighten the idler gear bolt to specification of  $140 \pm 10$  Nm ( $103 \pm 7$  ft-lb).

**Note:** Only install the latest configuration auxiliary idler gear and bolt configurations. This latest configuration gear no longer utilizes an O-ring on the end of the shaft.

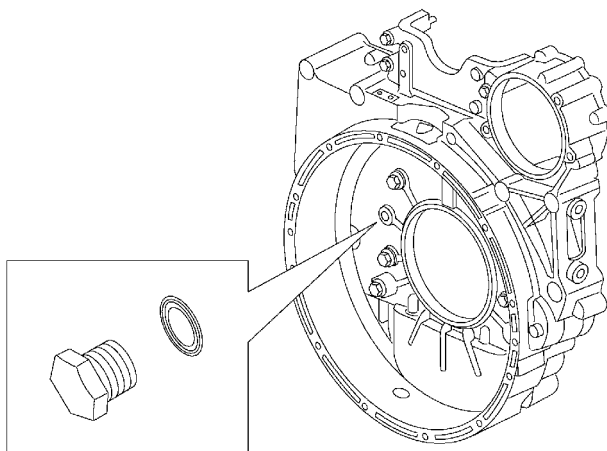
$140 \pm 10$  Nm  
( $103 \pm 7$  ft-lb)

**18**

If the engine was originally built with the longer idler gear bolts, the flywheel housing may need to be updated to block the idler gear bolt hole with a plug and washer from plug kit 21090322. Use the following procedure to thread the hole and install the plug:

- 1 Using a 3/4 -16 UNF  $\times 11.5$  tap, thread the hole indicated in the illustration.
- 2 Apply thread locking compound (Loctite® 277 or equivalent) to the threads of the plug.
- 3 Insert the plug with washer and tighten to specification,  $40 \pm 4$  Nm ( $30 \pm 3$  ft-lb)

$40 \pm 4$  Nm  
( $30 \pm 3$  ft-lb)

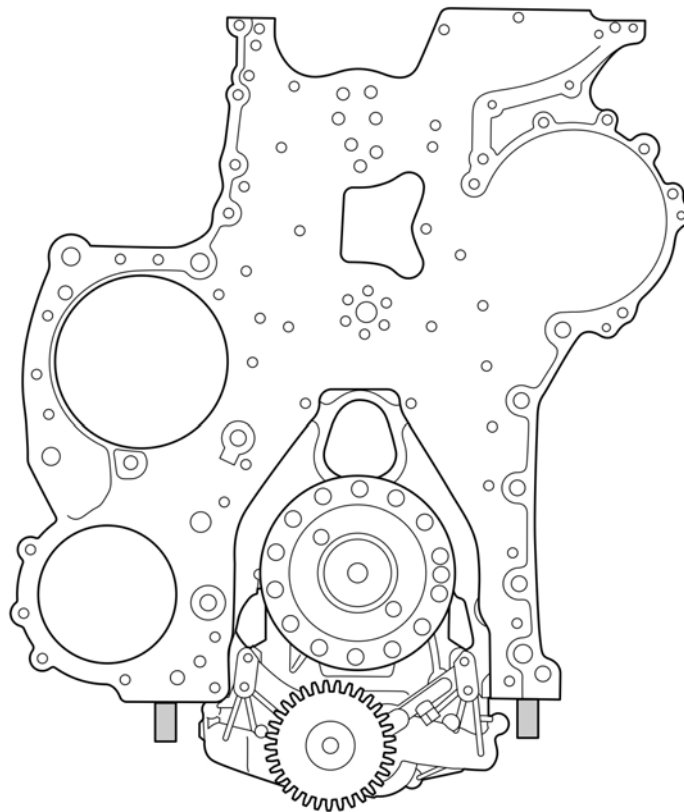


W2006428

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9.2008	<b>215</b>	<b>107</b>	1(6)

## Timing Gear Plate, Adjustment D13

### Timing Gear Plate, Adjustment



W2006237

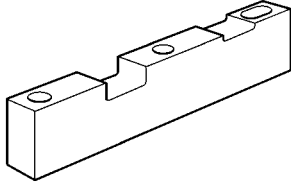
### Contents

- "Special Tools" page 2
- "Timing Gear Plate, Adjustment" page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

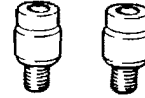
## Special Tools

For special tools ordering instructions, refer to Tools Information, Group 08.



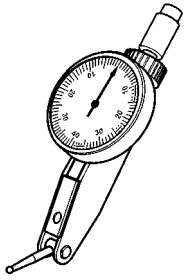
W0002018  
**9998601**

Cylinder Head Front Alignment Block



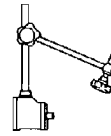
C0000238

**9998267**  
Guide Tool



C0001436  
**9999683**

Sweep Dial Indicator



W0001790

**9999696**  
Magnetic Stand



## 2151-05-03-01

# Timing Gear Plate, Adjustment

Timing gear cover removed

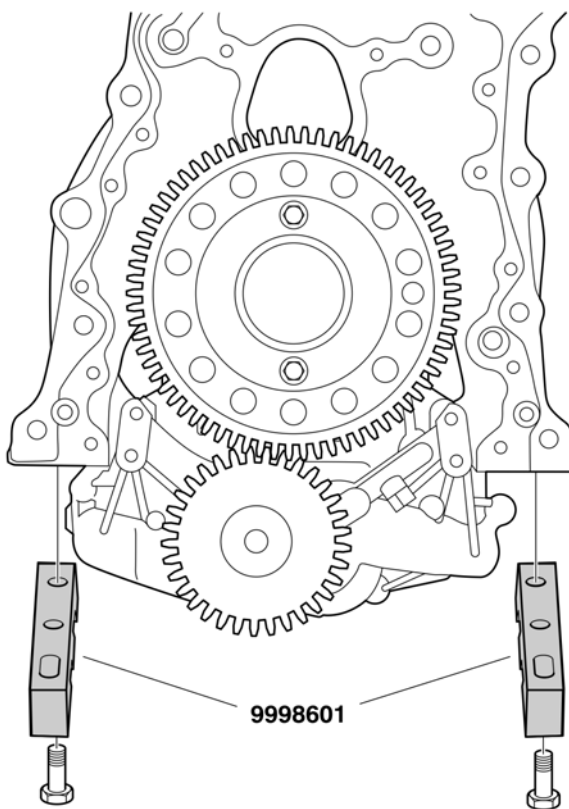
You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9998601, 9998267, 9999683, 9999696*

**1**  
Install the alignment guides 9998601 to the base of the engine block.

**Note:** Make sure that the guides are flat and free from burrs and other damage, since this could damage the mating surface of the engine block.

9998601



W2006245

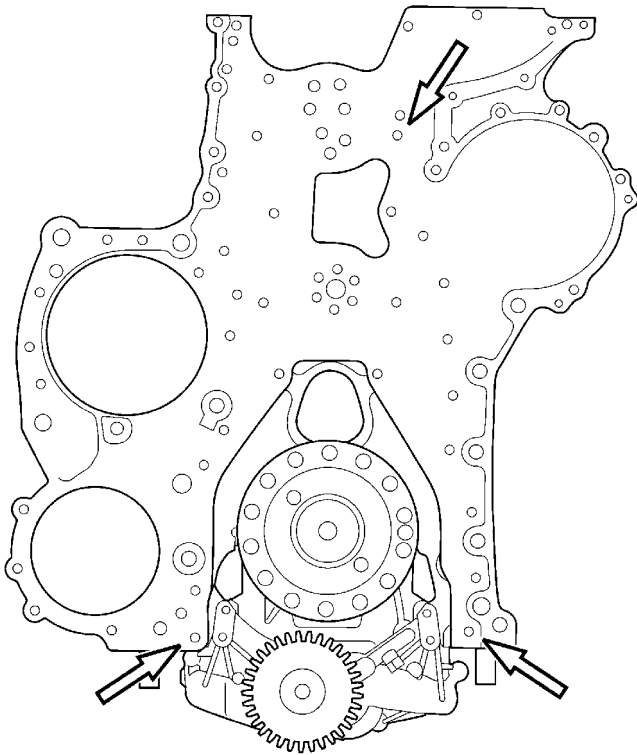
**2**

Install the timing gear plate, so that it rests on the 9998601 guides.

**Note:** Carefully clean all silicone sealer residue from both the timing gear plate and the engine block surface. Also clean all silicone sealer residue and dirt off the timing gear plate guide holes.

Install three of the timing gear plate bolts: two at the bottom and one at the top (see illustration). Tighten the bolts until they pull the plate flush against the engine block, but not so tight that the position of the timing gear plate cannot be adjusted.

9998601

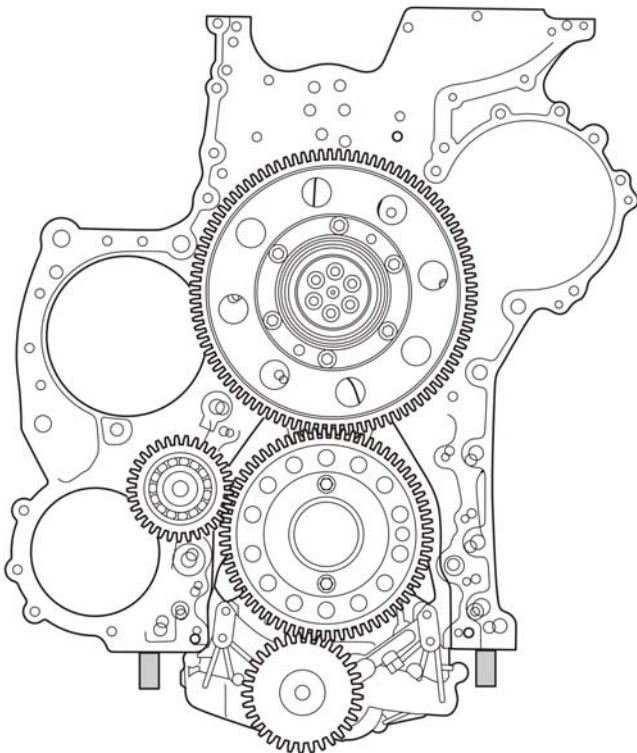


W2006255

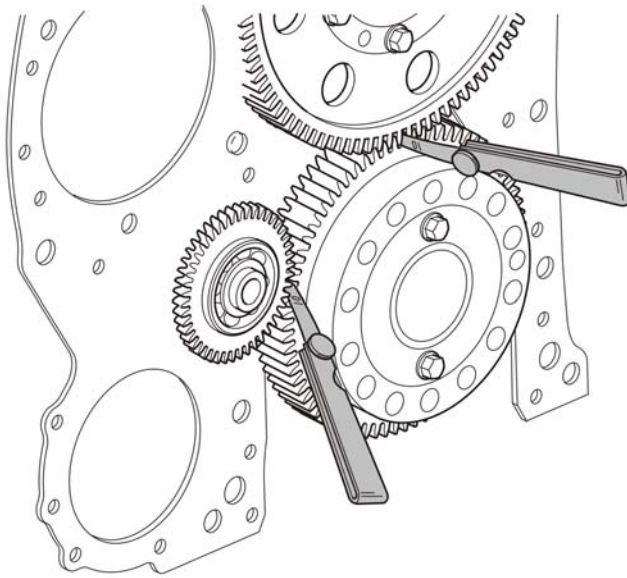
**3**

Install the idler gear.  
Install two diagonally placed bolts in the double idler gear.  
Install a bolt into the lower idler gear with a covering washer to protect the end of the shaft.

Tighten the bolts until the gears are secure, then check that the timing gear plate position can still be adjusted.



W2006637



W2006638

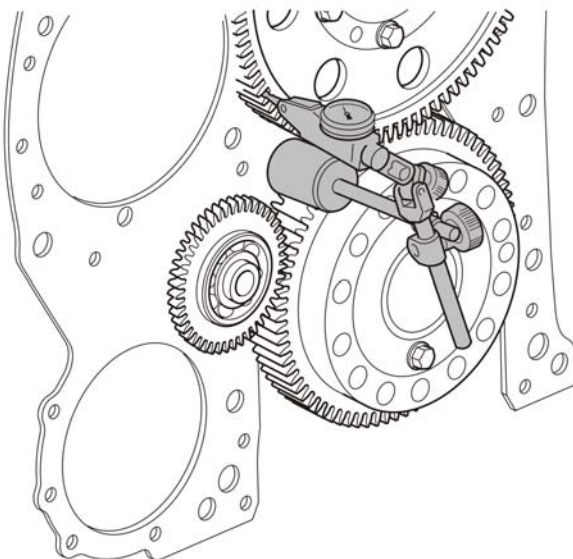
**4**  
Place two 0.10 mm (0.004 in.) feeler gauges between the central two gear teeth on each gear wheel. Adjust the position of the transmission gear plate using a soft faced hammer, until both feeler gauges have a consistent amount of pressure between the gear teeth. There must be equal resistance on both feeler gauges.

**5**  
Tighten the three bolts in the timing gear plate and the bolts in the idler gear.

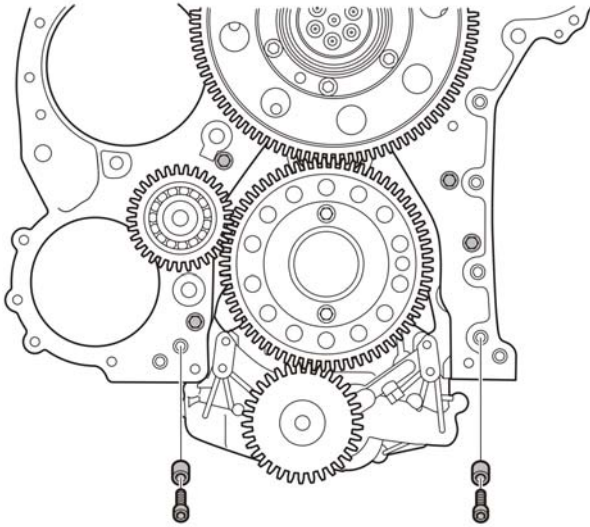
**Note:** Tighten the screws so that the timing gear plate can not be moved.

**6**  
Remove the feeler gauges. Install the dial gauge 9999683 with magnetic stand 9999696 and measure the gear backlash between the idler gears. Compare the measured values with those in "Specifications", see group 20. Check the timing gear plate position in relation to the base of the block. This dimension should be  $0 \pm 0.25$  mm ( $0 \pm 0.010$  in.).

9999683, 9999696,  $0 \pm 0.25$  mm ( $0 \pm 0.010$  in.)



W2006639



W2006640

**7**

When the gear flank backlash is within the specified values, install the guides 9998267 and torque tighten them to 60 Nm (44.25 ft-lb). Then, remove the alignment guides from the base of the engine block.

9998267, 60 Nm (44.25 ft-lb)

**8**

Remove the two idler gears. Remove the timing gear plate.

**Note:** When the timing gear plate is being removed, it must be drawn straight out to avoid moving or damaging the guides 9998267.

9998267

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## Camshaft Wear, Check D13F

### Camshaft Wear, Check

This information contains the proper procedure to check the camshaft for wear and damage on Volvo D13F engines.

#### Contents

- “Camshaft Wear, Checking” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2154-06-02-01 Camshaft Wear, Checking

**1**

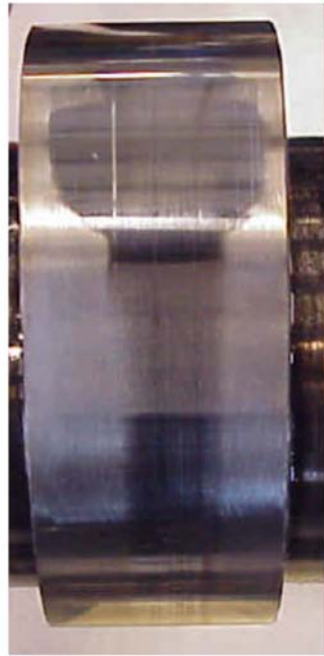
Remove the valve cover from the engine. Refer to Group 21 for service procedures.

**2**

Turn the camshaft. Check the camshaft with regard to wear on the camshaft lobes and damage to the surfaces.

**Note:** Unevenness can develop on cam lobe surfaces during normal operation. This does **not** mean the camshaft must be changed.

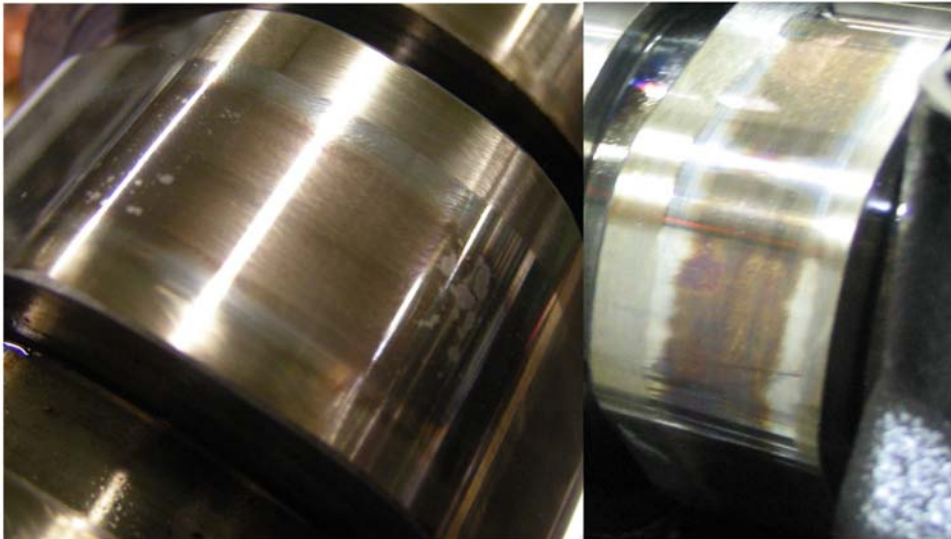
3



W2006614

Acceptable Injection Lobe Wear  
(only change of coloration)

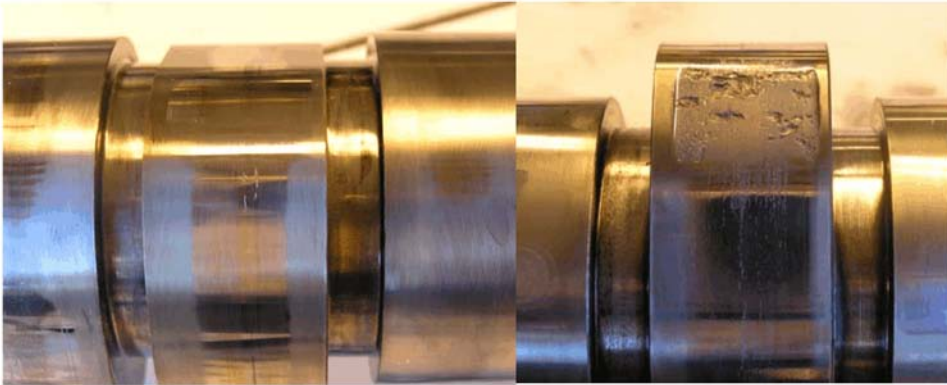
These figures shows examples of scoring that will **not** affect the running of the engine. Camshafts with this type of scoring do **not** need to be changed.



W2006616

Acceptable Inlet/Exhaust/Brake Lobe Wear  
(only change of coloration)

**4**



W2006615

Unacceptable Injection Lobe Wear  
(several millimeters of damage which can be  
felt with fingernail)

These figures show examples of a camshaft with material damage. The camshaft should **not** be reused. Replace the rocker arms that roll on the damaged cam lobes when the camshaft is replaced.



W2006617

Unacceptable Inlet/Exhaust/Brake Lobe Wear  
(several millimeters of damage which can be  
felt with fingernail)

**5**  
Install the valve cover. Refer to Group 21 for service  
procedures.

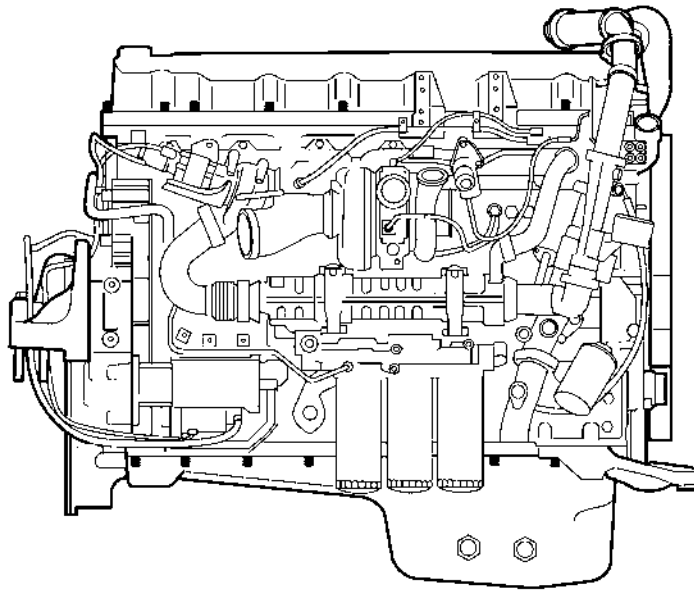


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## Timing Gear Cover (Upper), Replacement

D13

### Timing Gear Cover (Upper), Replacement



W2005779

This information covers replacement of the upper timing gear cover on a Volvo D13 engine.

#### Contents

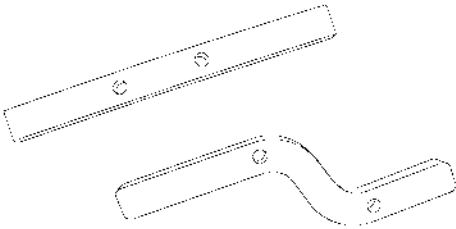
- "Special Tools", page 2
- "Timing Gear Cover (Upper), Replacement", page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

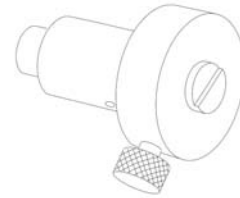
## Special Tools

For special tool ordering instructions, see tool information in group 08.



W2006190

**85111422A/B**  
Timing Cover Clamp Tools



W0002268

**88800031**  
Sensor Depth Gauge

# Service Procedures

2151-03-02-01

## Timing Gear Cover (Upper), Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform the procedure.

*Special tools: 85111422A, 85111422B, 88800031*

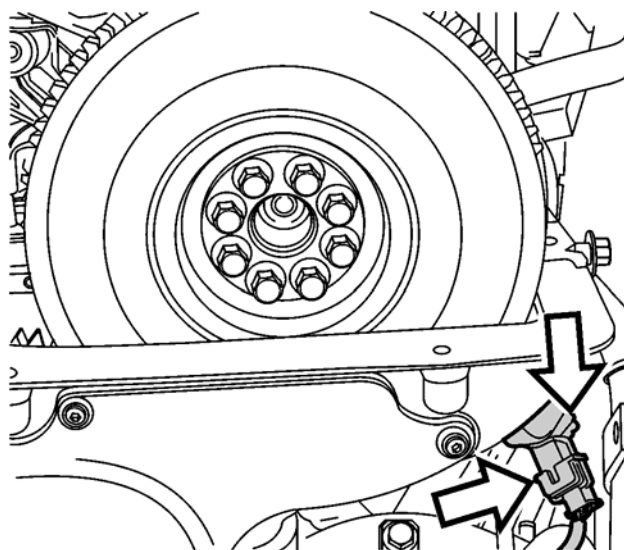
### Removal

- 1 Remove cooling system and engine components as necessary to pull engine back gently approximately 13 to 20 cm (5 to 8 inches). Refer to the service procedures in Group 21.

**Note:**

- 2 Remove the valve cover. Refer to the service procedures in Group 21.

- 3 Disconnect the camshaft position sensor harness connector, remove the bolt and pull out the sensor.

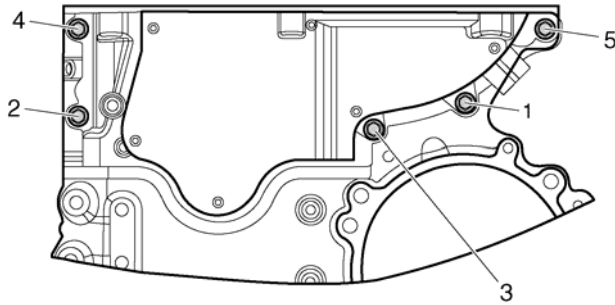


W2005104

- 4 Remove all straps, P-clamps and other retainers used to restrain harnesses, oil lines and coolant tubes to the rear of the engine.

**5**

Remove the timing gear cover fasteners and remove the cover.



W2006133

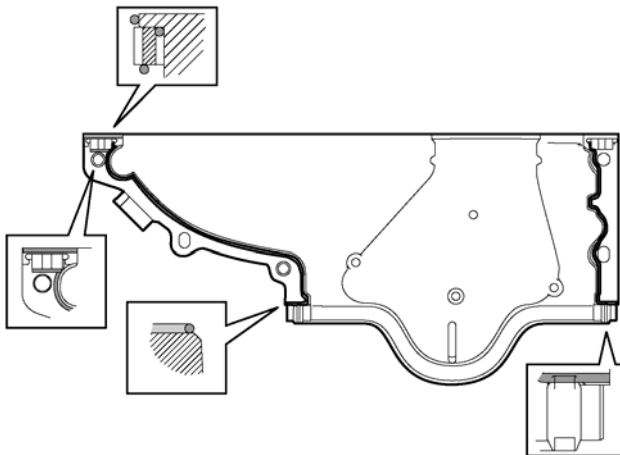
**6**

Clean all gasket sealing surfaces. All surfaces must be completely free of any grease or oil.

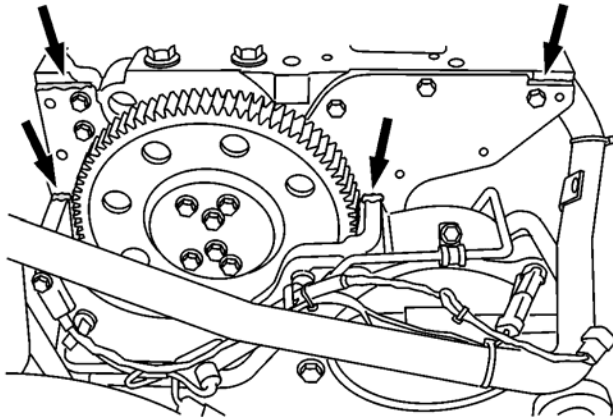
## Installation

**1**

Install the timing gear cover seals and gaskets.



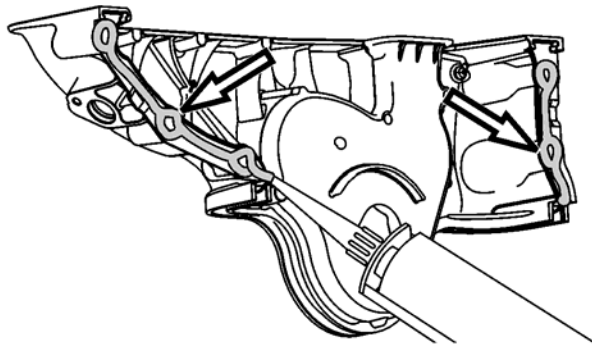
W2006134



W2005102

**2**

Apply sealant in the bottom corners where the timing gear plate and the flywheel housing meet. Also apply sealant to the top of the timing gear plate (in the corner) next to the cylinder head.



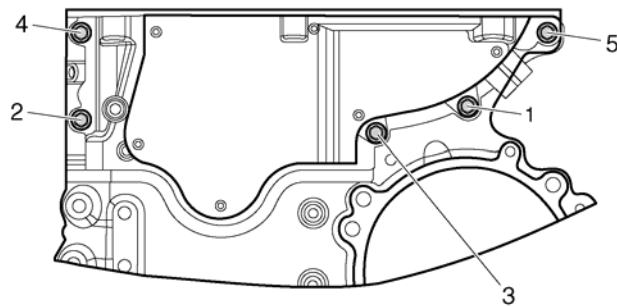
W2005137

**3**

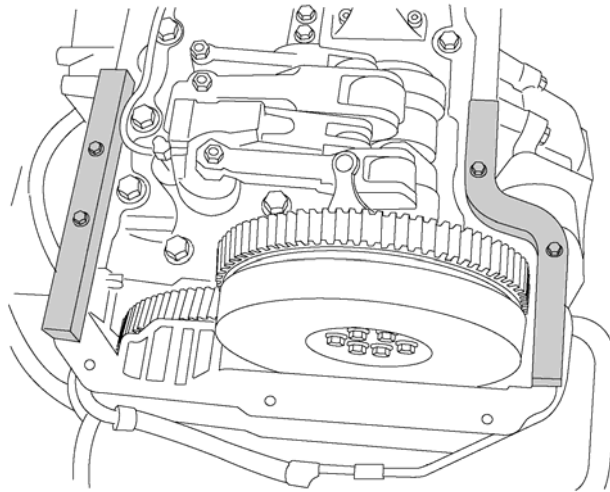
Apply sealant to the mating surfaces of the timing gear cover.

**4**

Position the timing gear cover, install the fasteners marked 1 and 2.



W2006133

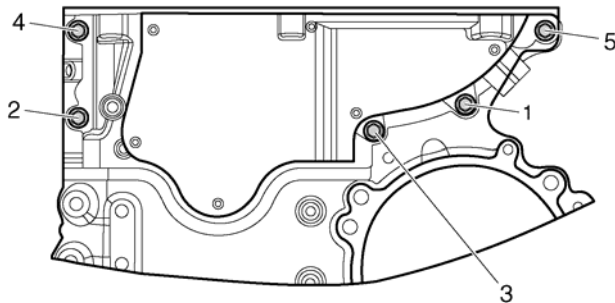


W2006191

**5**

Install the timing cover clamp tools so that the timing gear cover surface is flush with the seal surface on the cylinder head.

85111422A, 85111422B



W2006133

**6**

Torque the timing gear cover fasteners to specification.

**Note:** For correct torque specifications, refer to Specifications in Group 20.

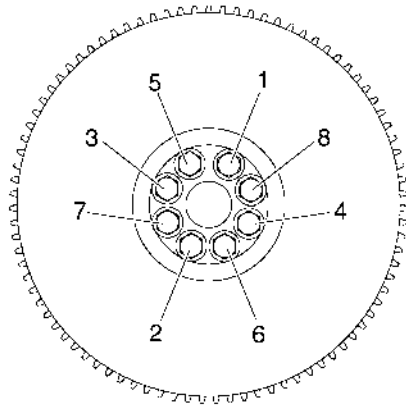
**7**

Remove the timing cover clamp tools.

**8**

Install vibration damper and gear clamp plate with new fasteners if the reusability limit has been exceeded. Refer to Specifications in Group 20. Tighten damper mounting screws in two steps in the proper sequence.

**Note:** Bolts and screws that have limited reusability must be marked with a punch each time they are installed in service. Bolts and screws with four punch marks when removed have been tightened five times and must be discarded and replaced with new.



W2006135

**CAUTION**

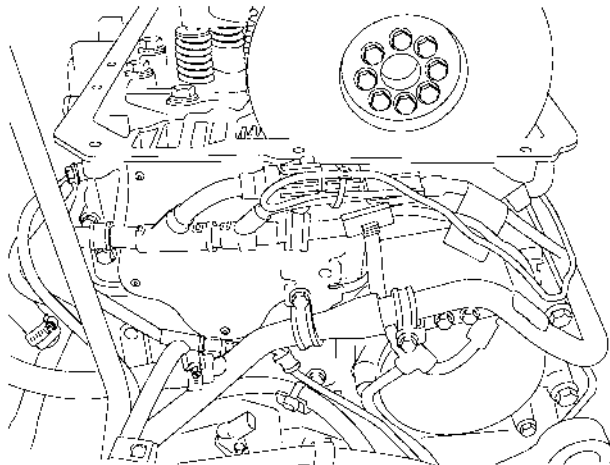
Do not reuse timing gear mounting plate bolts.

**9**

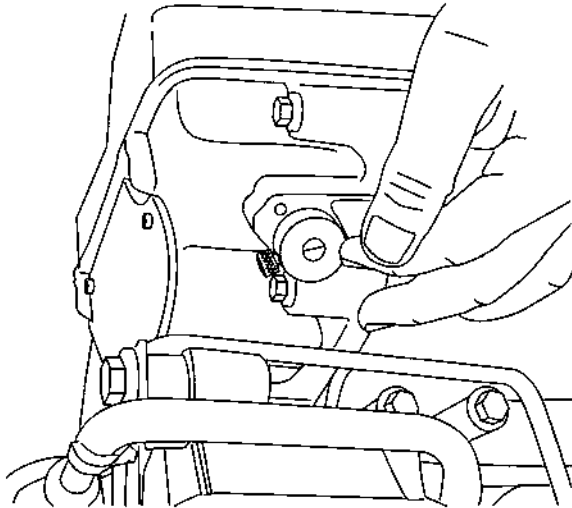
Position the rear support bracket onto the rear of engine and install support bracket fasteners to secure.

**10**

Install all tie straps, P-clamps and other retainers used to restrain harnesses, oil lines and coolant tubes to the rear of the engine.



W2006132



W2005068

**11**

Check for proper camshaft position sensor clearance using the sensor depth gauge to determine if shims are required for sensor depth. Refer to Specifications in Group 20 for the camshaft position sensor clearance specification.

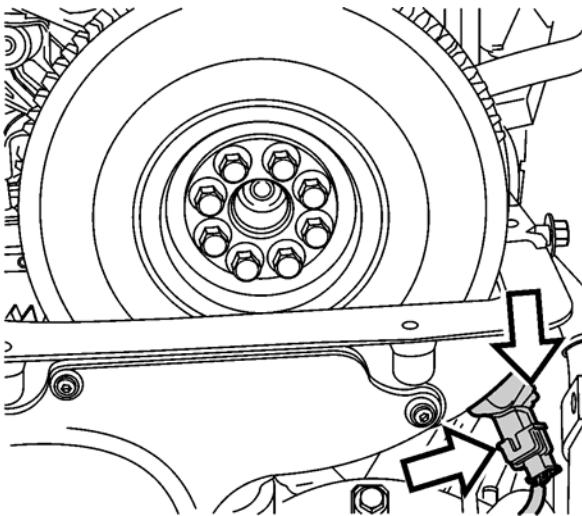
- 1 Rotate the engine until a tooth of the camshaft toothed wheel is aligned with the sensor bore.
- 2 Insert the depth gauge into the sensor bore until the outer part of the gauge is fully seated against the timing gear cover.
- 3 Loosen the thumb screw of the gauge and push the inner part of the gauge in until it contacts a tooth of the toothed wheel.
- 4 Tighten the thumb screw to secure the inner part of the gauge.
- 5 Carefully remove the gauge from the camshaft sensor bore and observe the location of steps between the inner and outer portions of the gauge:
  - Both steps below the surface of the gauge = no shims required.
  - One step below the surface of the gauge = one shim required.
  - Both steps above the surface of the gauge = two shims required.

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88800031

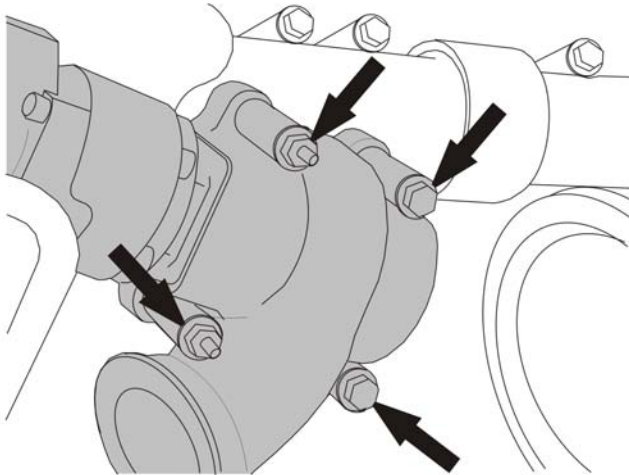
**12**

Install the camshaft position sensor with appropriate shim(s), new O-ring, secure with bolt and plug in harness connector.



W2005104

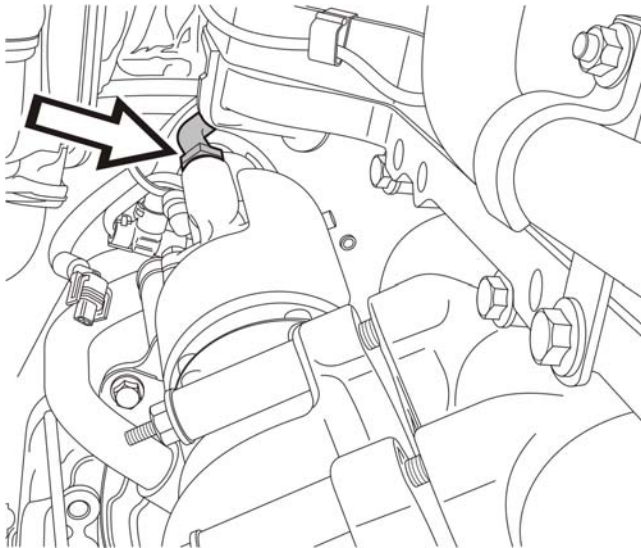




W2005693

**13**

With the EGR valve near the exhaust manifold ports, remove mounting bolts then slip a new metal gasket between the valve and the exhaust manifold. Start new bolts to hold the EGR valve and gasket in place.



W2005955

**14**

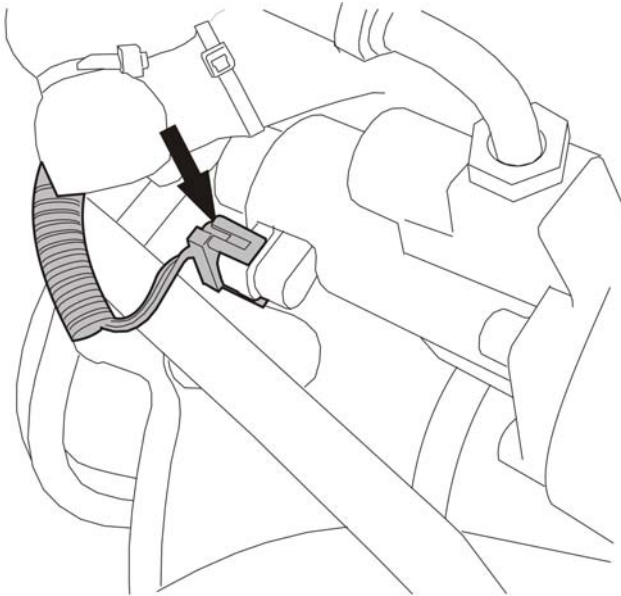
Install EGR valve oil line and tighten to specification.

**15**

Tighten the EGR valve mounting bolts to specification.

**16**

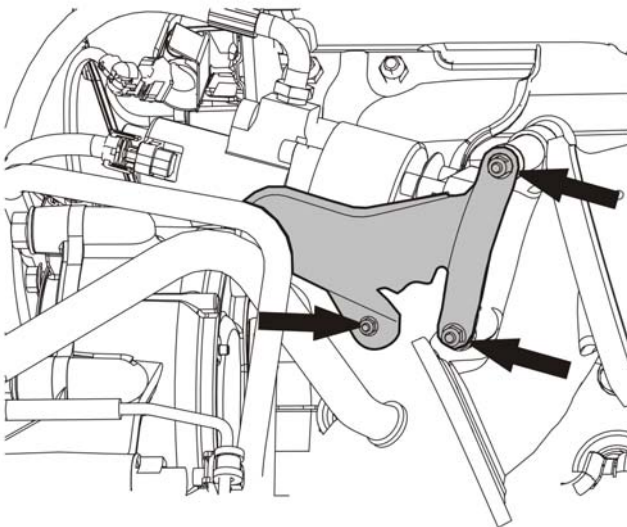
Connect the wiring harness connector to the EGR valve.



W2005689

**17**

Place the EGR heat shield in position over the EGR valve. Install the fasteners to secure the shield to the cylinder block and to the studs on the valve mounting bolt heads. Tighten the fasteners to specification.



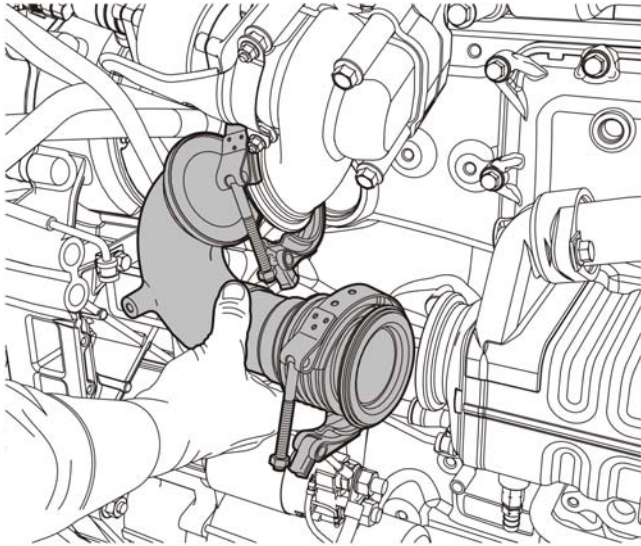
W2005685

**18**

Install new high temperature gaskets into the EGR valve end of the hot pipe and the inlet of the EGR cooler. Ensure the gaskets lay flat against the flange surfaces.

**19**

Inspect the V-clamps and T-bolt threads for wear or damage. If they are OK, apply anti-sieze compound to the T-bolt threads. Lubricate the V-inserts of the clamps with oil.



W2005641

**20**

Hook the upper V-clamp over the EGR valve flange. Place the remaining V-clamp over the bellows on the hot pipe.

**21**

Lubricate the flange on the EGR cooler inlet and the flange on the EGR hot pipe with fresh engine oil. Lubrication aids in proper V-clamp installation.

**22**

Position the EGR hot pipe between the EGR valve and the EGR cooler. Make sure the flanges engage properly. Slide the upper V-clamp over the flange and tighten until snug. Slide the lower V-clamp over the flange and tighten the clamp until snug.

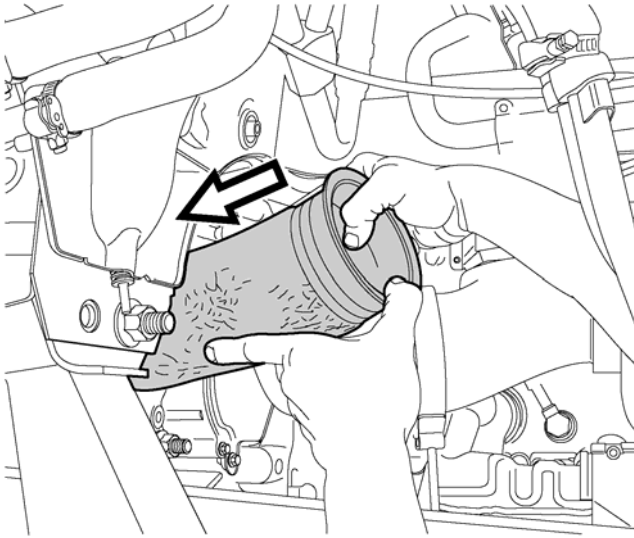
**23**

Make sure the hot pipe flange is seated properly in the EGR cooler. The hot pipe flange must be concentric with the cooler flange.

**24**

Position the V-clamps so that the T-bolts clear both heat shields. Tighten the clamps to specification.

**Note:** After reaching the specified torque, inspect the V-clamps to make sure that no portion of the clamp has "bottomed out."



W2006038

**25**

Position the exhaust pipe between the diffuser pipe and the DPF muffler inlet pipe and loosely install the V-clamps.

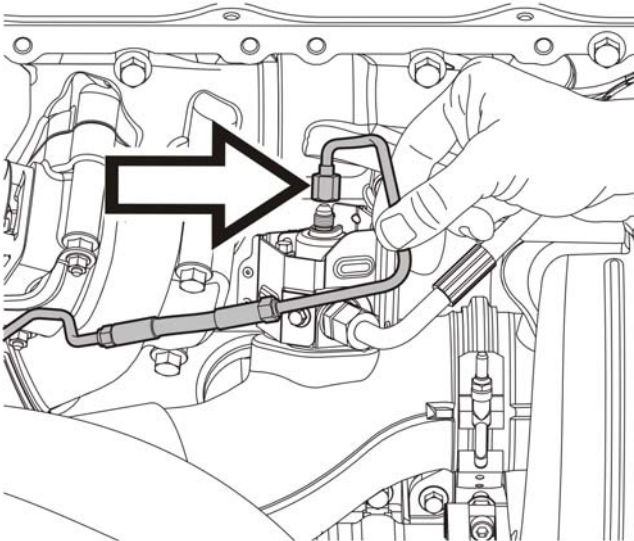
**26**

Adjust the exhaust pipe and diffuser pipe as needed and then, tighten the V-clamps to specification.

**27**

Install the fuel line to the AFI.

**Note:** For vehicles equipped with the AFI air purge system, install the two-way check valve on the AFI.



W2005951

**28**

Install the AFI fuel line clamp to the EGR valve heat shield.

**29**

Install the valve cover. Refer to the service procedures in Group 21.

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2.2008	<b>216</b>	<b>100</b>	1(6)

**Crankshaft Seal, Replacement (Rear)****D13F****Crankshaft Seal, Replacement (Rear)**

This information covers service procedures for replacing the rear crankshaft seal on the Volvo D13F engine, in vehicle with transmission and clutch removed.

**Contents**

- "Special Tools" page 2
- "Crankshaft Seal, Replacement (Rear)" page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

## Special Tools

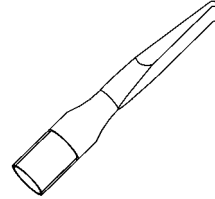
For special tools ordering information, refer to Tool Information, group 08.



W0001798

**9998238**

Seal Installer (Drift)  
Used with Handle 9992000



T0011294

**9990192**

Crankshaft Seal Puller



W2005717

**9996400**

Slide Hammer



W0001793

**9992000**

Handle

# Service Procedures

## 2167-03-03-01

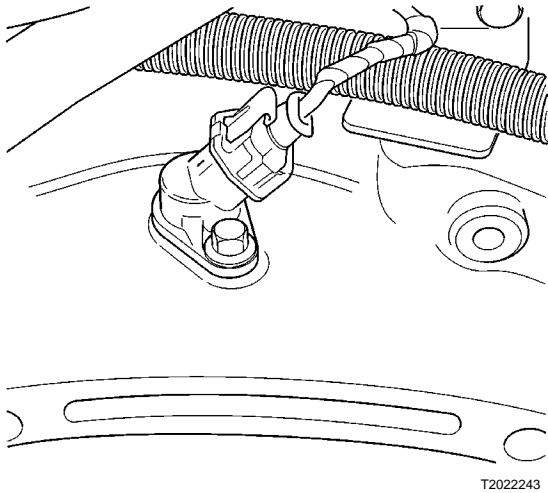
### Crankshaft Seal, Replacement (Rear)

Transmission removed

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9990192, 9996400, 9992000, 9998238*

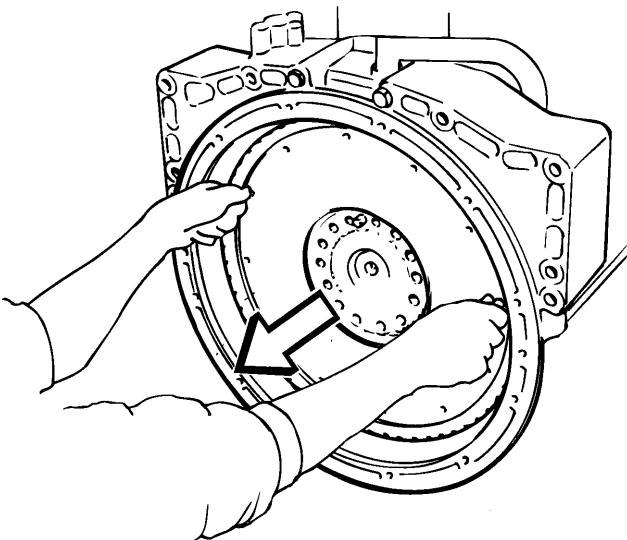
- 1  
Unplug the connector, remove the bolt and carefully pull the flywheel sensor out of the flywheel housing.

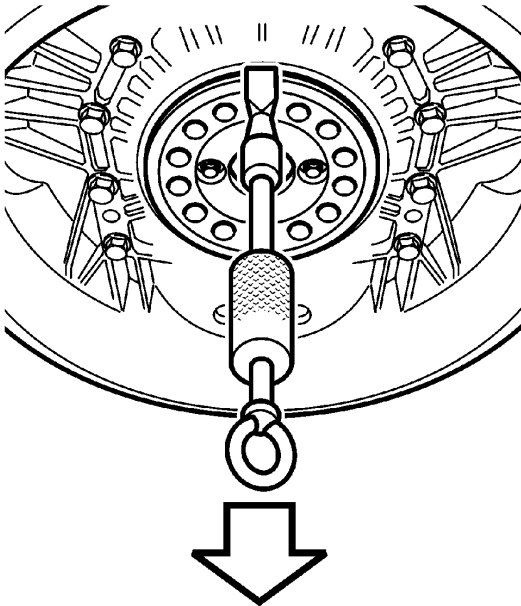


- 2  
Install two screws (M10x100) into the flywheel as handles to aid in removal. Remove the flywheel mounting screws and remove the flywheel from the crankshaft.

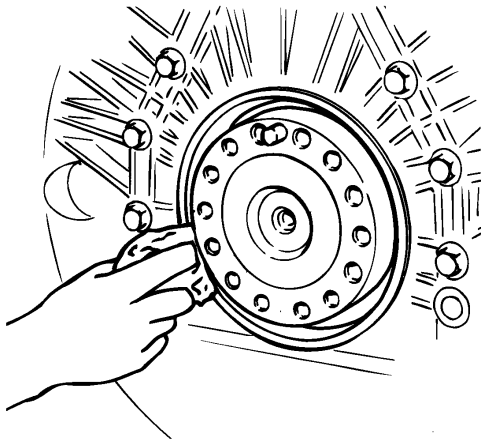
### DANGER

The flywheel is heavy. Do not attempt to remove the flywheel without the help of an assistant or the use of a suitable lifting device. Failure to heed this caution can result in severe personal injury and component damage.

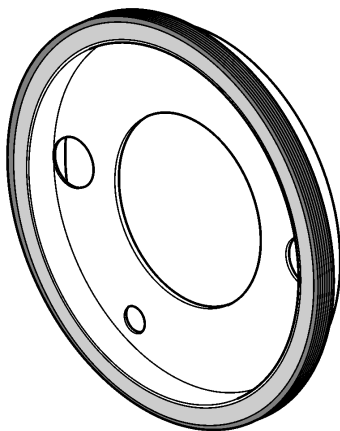




T2021760



T2006662



T2022255

**3**

Attach the puller to the slide hammer. Check that the tools are free from burrs and dirt. Insert the end of the puller between the seal and crankshaft and tap out the seal.

**Note:** Make sure not to damage the crankshaft. Slant the puller inwards to get a good grip on the seal.

9990192, 9996400

**4**

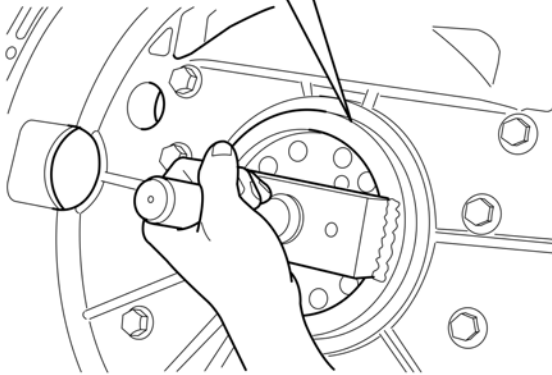
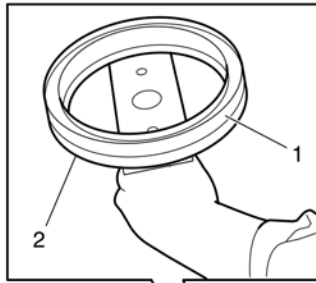
Thoroughly clean the sealing surfaces of the flywheel housing and of the crankshaft.

**5**

**Note:** Standard size Teflon seals are shipped on a plastic installation sleeve. Do not remove the seal from the sleeve before installation. The installation sleeve provides a smooth surface for the seal as it moves from the tool to the crankshaft flange.

Thoroughly clean the surface of the crankshaft flange.





W2005548

- 1 Rear Crankshaft Seal
- 2 Rear Crankshaft Seal Installer

**6**

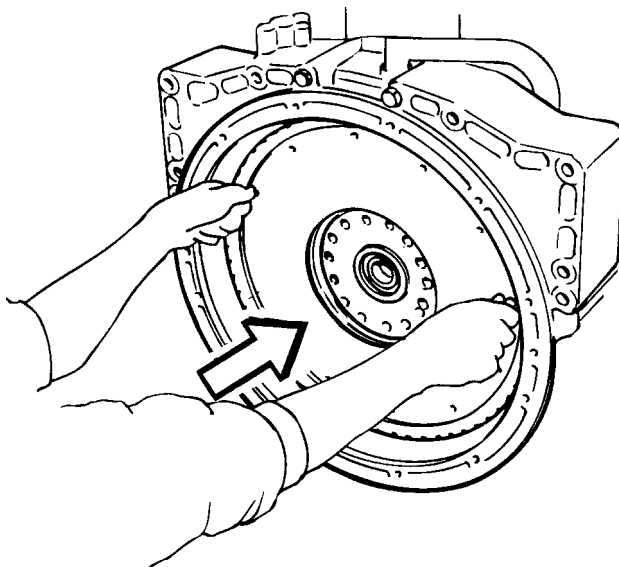
Install the new seal on the drift, making sure that the seal is turned in the proper direction. Carefully tap the seal into the flywheel housing using the handle and drift until the drift evenly contacts the crankshaft.

**Note:** Position the drift so that it does not interfere with the alignment dowel during installation. The rear crankshaft seal depth of  $8.0 \pm 0.5$  mm ( $0.315 \pm 0.002$  inch) is set by the drift tool when fully seated.

9992000, 9998238

**7**

**Note:** When installing the flywheel, insert two alignment studs in the crankshaft flange to aid in the installation. Position the flywheel over the dowel pin and alignment studs on the flywheel mounting surface at the rear of the crankshaft.



T2009043

**8**

Install the flywheel mounting screws and tighten the screws finger-tight.

**9**

Remove the two alignment studs and insert the remaining mounting screws.

**10**



**CAUTION**

Do not tighten adjacent screws sequentially. Doing so can result in uneven flywheel alignment. Failure to heed this caution can result in severe engine damage.

Tighten the screws in a crisscross pattern to  $60 \pm 5$  Nm ( $44 \pm 4$  ft-lb) plus  $135 \pm 10$  degrees rotation.

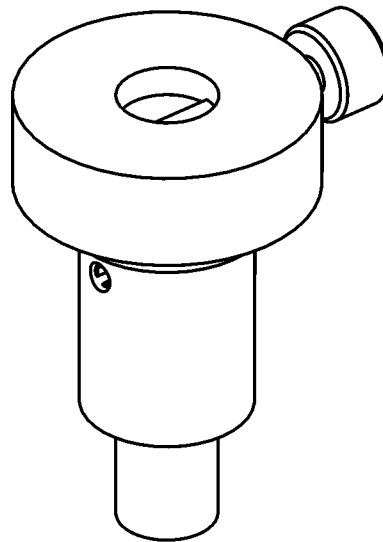
**11**

Carefully install the flywheel sensor along with any shims, install the bolt and tighten to specification. Plug the harness connector onto the flywheel sensor.

## Flywheel Sensor Distance, Checking D13F

### Flywheel Sensor Distance, Checking

This information covers the procedure to check for proper flywheel position sensor clearance, using the sensor depth gauge to determine if shims are required for sensor depth.



T0013033

### Contents

- “Flywheel Sensor Distance, Checking” page 2.

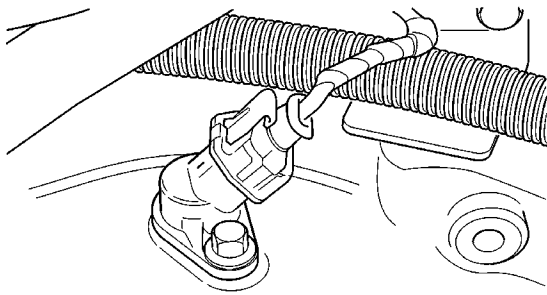
**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2169-06-02-01 Flywheel Sensor Distance, Checking

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 88800031*

**1**  
Remove the flywheel sensor.



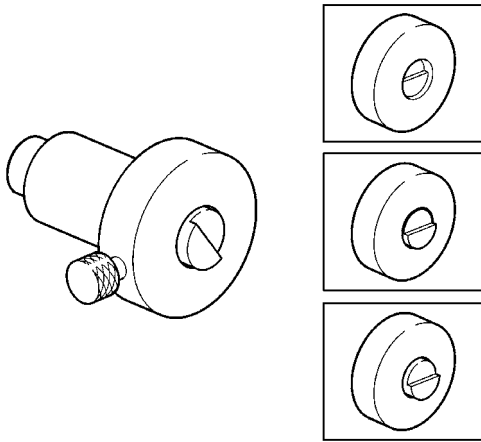
**2**  
Rotate the engine until one of the teeth on the flywheel is aligned with the sensor bore.

**3**  
Insert the tool into the sensor bore until the outer part of the tool is fully seated against the flywheel housing.

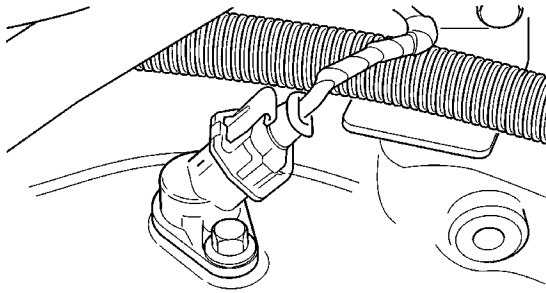
88800031

**4**  
Loosen the thumb screw of the tool and push the inner part of the tool until it contacts the flywheel.

**5**  
Tighten the thumb screw to secure the inner part of the tool.



T2022368



T2022243

**6**

Carefully remove the tool from the flywheel sensor bore and observe the location of the steps:

- Both steps below the surface = no shim required
- One step below the surface = one shim required
- Both steps above the surface = two shims required

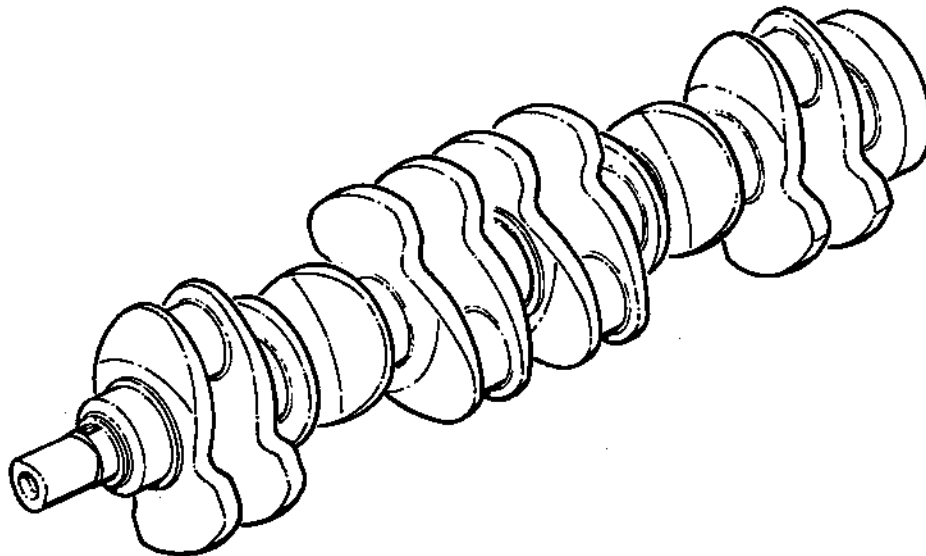
**7**

Install the flywheel sensor with the proper shim(s).

Date	Group	No.	Release	Page
3.2009	<b>216</b>	<b>102</b>		1(18)

## Crankshaft, Replacement Engine Removed D13F

### Crankshaft, Replacement



T2006853

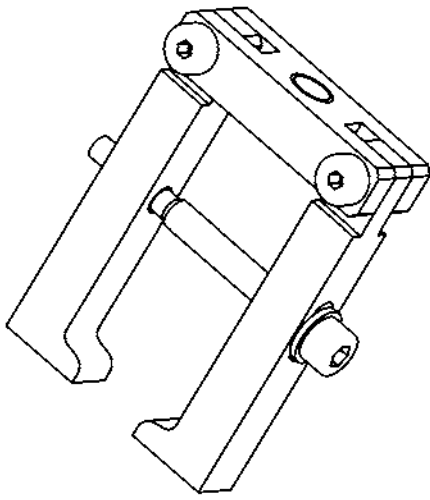
### Contents

- "Special Tools", page 2
- "Crankshaft, Replacement", page 4

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## Special Tools

For special tools ordering instructions, refer to Tool information, group 08.



T0010584

**9990114**  
Puller



C0001802

**9996400**  
Slide Hammer



W0001790

**9999696**  
Magnetic Base



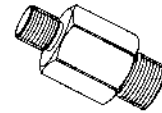
C0000225

**9998238**  
Rear Seal Installer



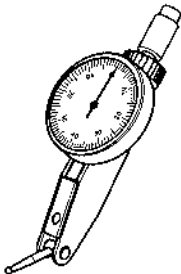
T0010682

**9992000**  
Handle



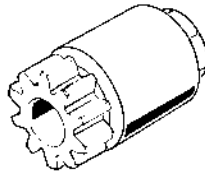
T0011428

**9990262**  
Adapter



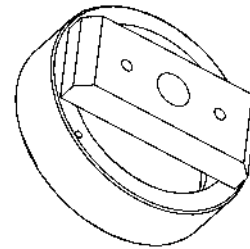
C0001436

**9989876**  
Dial Indicator



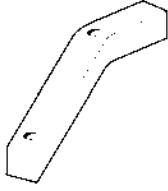
T0012612

**88800014**  
Flywheel Turning Tool



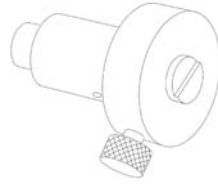
T0012654

**88800021**  
Front Main Seal Remover/Installer



W2005151

**85109033B**  
Timing Cover Clamp Tool



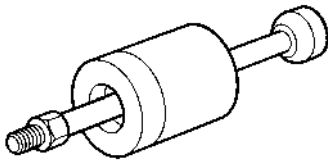
W0002268

**88800031**  
Sensor Depth Gauge



W0002279

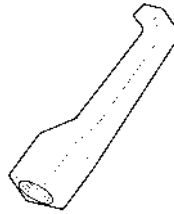
**85109208**  
Bearing Cap Press Tool



9990013

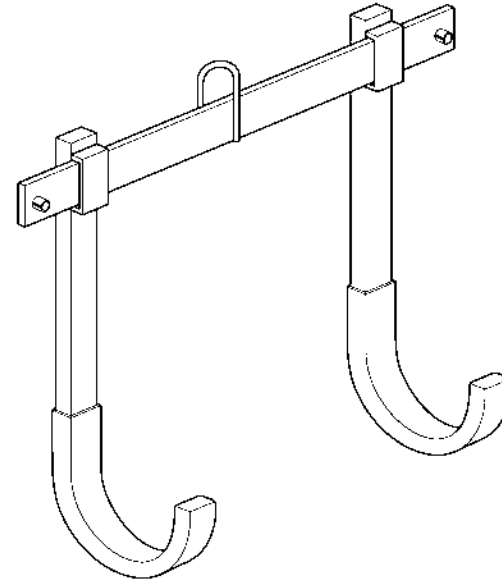
T0010011

**9990012**  
Drift Tool



W0002313

**88800228**  
Spacer Ring



W2006452

**J49002**  
Camshaft Lifting Tool



## 2161-03-04-01

# Crankshaft, Replacement

### Engine removed

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9990114, 88800228, 9996400, 9998238, 9992000, 9989876, 9998318, 9998601, 9999683, 9999696, 88800014, 88800021, 85109033B, J49002*

### Remove

**1**

Mount the engine in overhaul stand.

J-48662, J-29109A

**2**

Remove the valve cover and upper timing gear cover.

**3**

Remove the oil pan.

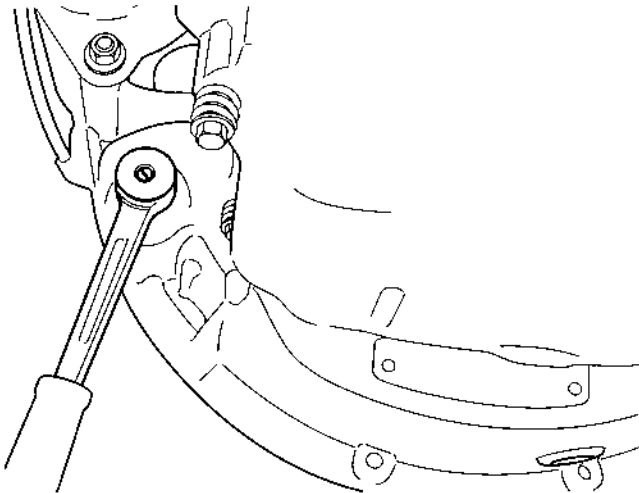
**4**

Rotate the engine in the overhaul stand.  
Remove the oil pump pipe and strainer.

**5**

Remove the plug from the flywheel housing and install cranking tool 88800014.

88800014



T2022378

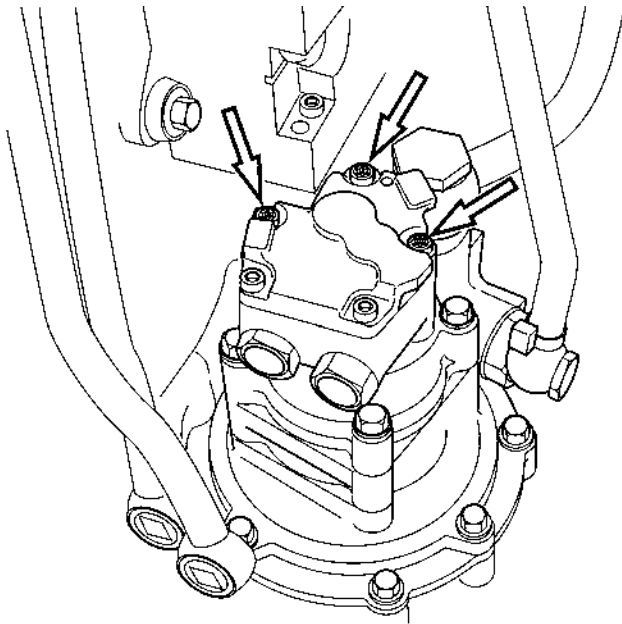
**6**

Remove the reinforcement frame.

**7**  
Remove the oil pump.

**8**  
Remove the compressor.

**9**  
Remove the power steering pump bolts.



T2022147

**10**  
Remove the starter motor.

**11**  
Remove the vibration damper and the drive belt.

**12**

Remove the cover for the front crankshaft seal.

**13**

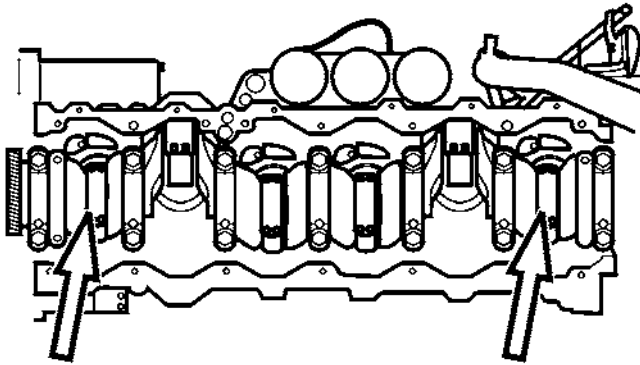
Turn the engine so that the 1st and 6th pistons are at top dead center (TDC).

Remove the 1st and 6th connecting rod caps.  
Remove the connecting rod shells.

**Note:** Check for markings on the connecting rods and caps. If there are no factory markings, mark them before removing caps (This will be important when re-installing).

**CAUTION**

Caps and connecting rods are match sets. Take care not to damage the connecting rods or caps.

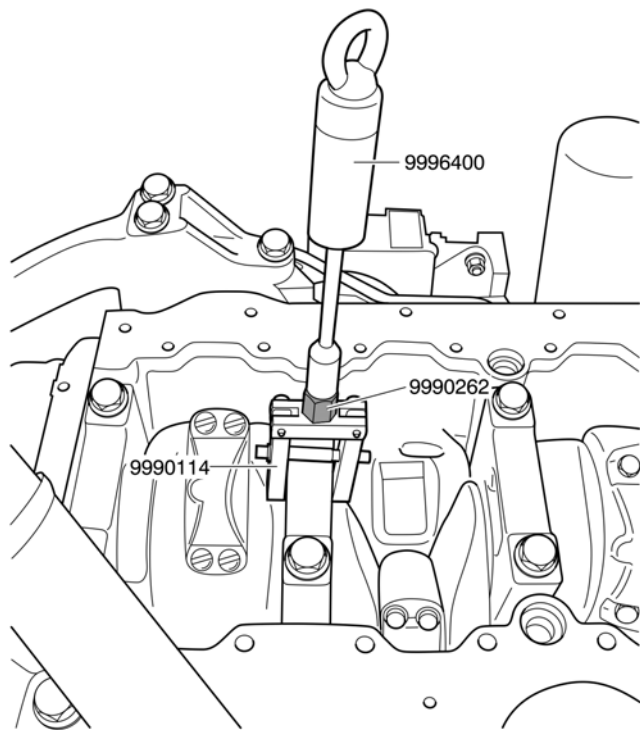


T2020991

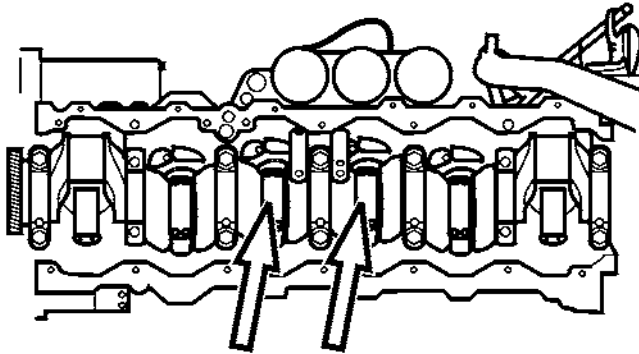
**14**

Remove main bearing caps 2 and 6. Use puller 9990114, adapter 9990262 and slide hammer 9996400.

9990114, 9990262, 9996400



T2022549



T2020993

**15**

Rotate the crankshaft clockwise (seen from the flywheel housing)  $\frac{1}{2}$  of a revolution so that the 3rd and 4th pistons are at top dead center (**TDC**).

Remove the 3rd and 4th connecting rod caps.  
Remove the connecting rod shells.

**Note:** Check for markings on the connecting rods and caps. If there are no factory markings, mark them before removing caps (This will be important when re-installing).

**! CAUTION**

Caps and connecting rods are match sets. Take care not to damage the connecting rods or caps.

88800014

**16**

Remove main bearing caps 1, 4 and 7. Use puller 9990114, adapter 9990262 and slide hammer 9996400.

9990114, 9990262, 9996400

**17**

Turn the engine so that the 2nd and 5th pistons are at top dead center (**TDC**).

Remove the 2nd and 5th connecting rod caps.  
Remove the connecting rod shells.

**Note:** Check for markings on the connecting rods and caps. If there are no factory markings, mark them before removing caps (This will be important when re-installing).

**! CAUTION**

Caps and connecting rods are match sets. Take care not to damage the connecting rods or caps.

**18**

Remove main bearing caps 3 and 5. Use puller 9990114, adapter 9990262 and slide hammer 9996400.

9990114, 9990262, 9996400

**19**

Remove the flywheel and the flywheel housing.

**20**

Tap the crankshaft seal out of the flywheel housing.

**21**

Using lifting tool J49002, remove the crankshaft.

\_\_\_\_\_   
J49002

**22**

Using a gear puller, remove the gear from the crankshaft.

**23**

Remove all main bearing shells.

**Installation**

**1**

Clean the main bearing seats in the cylinder block and install new bearing shells. Lubricate the bearing shell surfaces with engine oil.

**Note:** The bearing shells should **not** be lubricated on the outside!

**2**

Using lifting tool J49002, carefully, install the new crankshaft.

\_\_\_\_\_   
J49002

**3**

Install all main bearing caps with new bearing shells.

**Note:** Lubricate the bearing shells surfaces with engine oil.

**4**

Install an axial bearing to the middle main bearing. Tighten the fasteners to specification.

With your hand, make sure the crankshaft can be rotated.

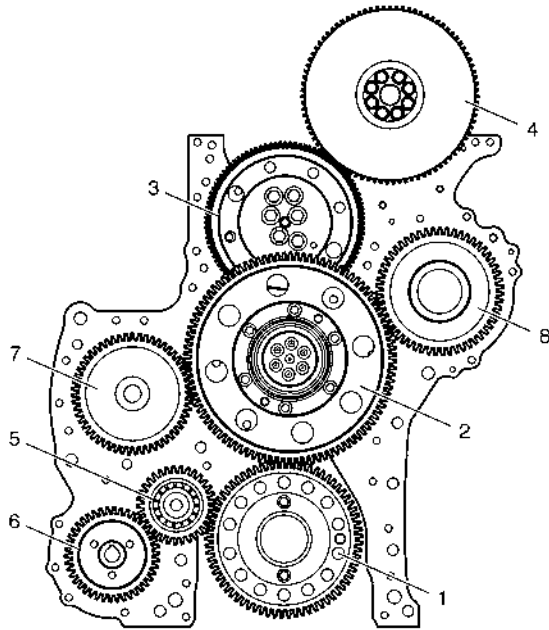
**Note:** For correct torque specifications, refer to the Specifications bulletin in Group 20.

**5**

Install the gear with the sealing ring onto the crankshaft. Tighten the fasteners to specification.

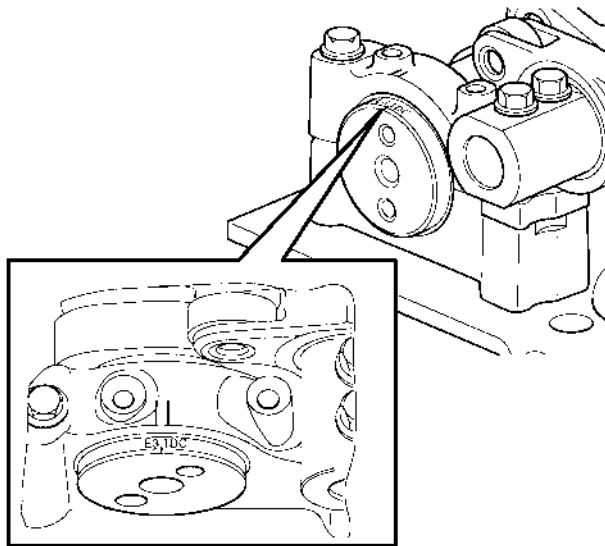
**6**

Apply a film of oil to the crankshaft gear surface that will meet the crankshaft journal. Install the crankshaft gear (1).



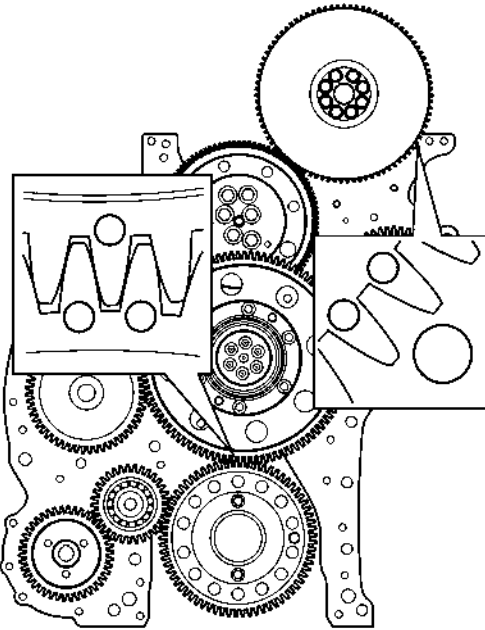
T2022341

**7**  
Install the upper idler gear (3) with its thrust washer.  
Tighten the bolts by hand only.



W2006173

**8**  
Check that the camshaft is positioned at TDC (Top Dead Center).



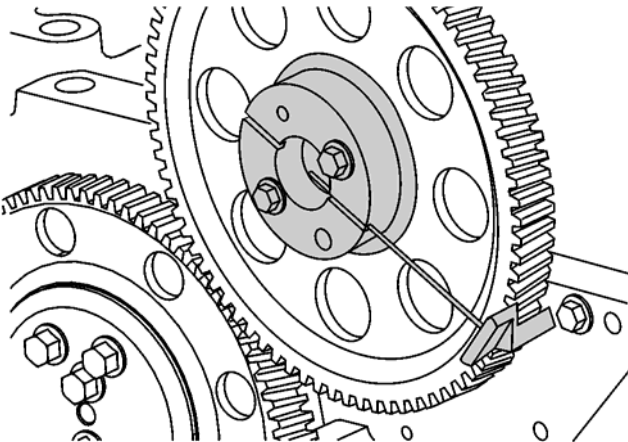
T2022369

**9**

Install the camshaft gear without the damper using the camshaft alignment spacer block J44514B with two bolts. Tighten the bolts to  $45 \pm 5$  Nm ( $33 \pm 4$  ft-lb),  $90 \pm 5$  degree rotation.

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J44514B



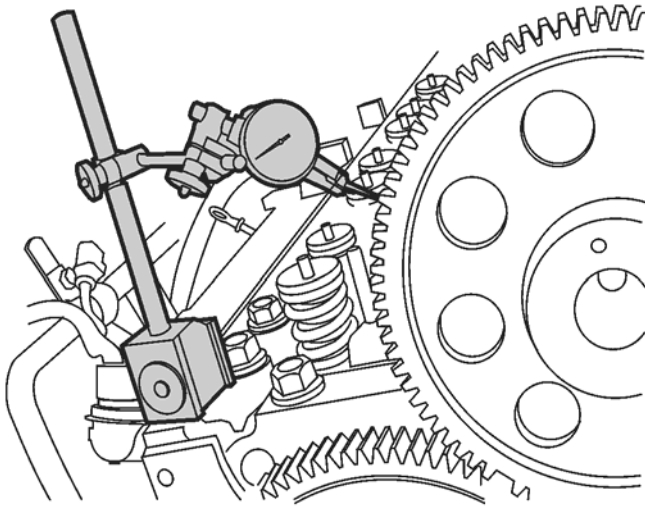
W2005135

**10**

Position the camshaft gear so that the reference hole in the timing gear plate is between the marks on the gear. Insert the alignment tool into the hole in the cylinder head to engage the camshaft gear teeth with the rod of the tool in the slot of the clamp tool. Rotate the camshaft until this occurs, then remove alignment rod.

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J44514B

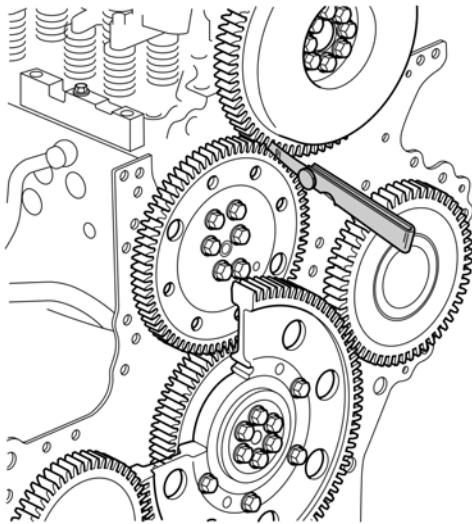


W2005136

**11**

Check the backlash between the camshaft gear and the adjustable idler gear. Position the dial indicator against a tooth of the camshaft gear and rock the gear back and forth while holding the adjustable gear with the clamp from the kit. Note the value on the dial indicator and compare with the specification of  $0.10 \pm 0.05$  mm ( $0.004 \pm 0.002$  inch).

9989876, 9999696, J44514B



T2022371

**12**

**13**

Insert a 0.1 mm (0.004 in.) feeler gauge. Adjust the idler gear so that there is slight pressure on the feeler gauge.

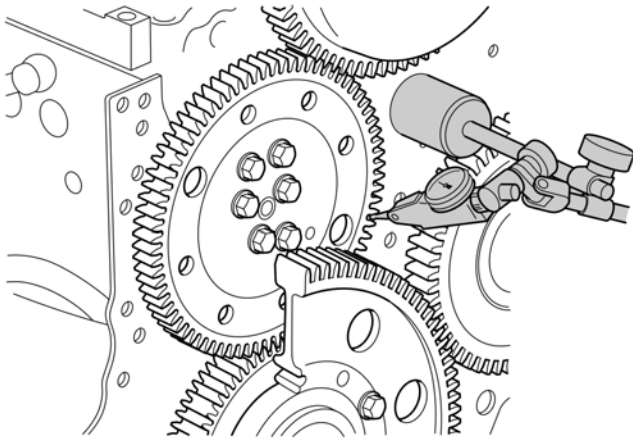
Tighten the bolts by hand only.

**14**

Remove the feeler gauge.

**Note:** There should be a slight resistance on the feeler gauge when removed.





T2022366

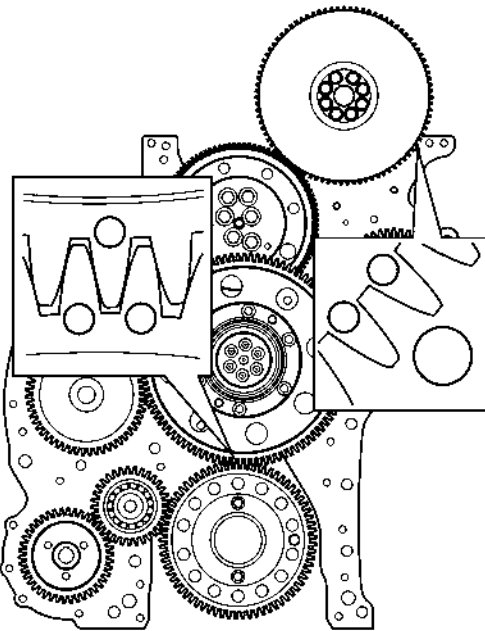
**15**

Install the magnetic stand 9999696 and dial indicator 9989876 so that the tip of the dial indicator rests on a tooth of the upper idler gear.

Check the gear backlash by turning the camshaft gear in both directions. Read the clearance on the dial indicator. For the correct value, see "Specifications", group 20.

Torque-tighten the upper idler gear bolts to specification.

9989876, 9999696

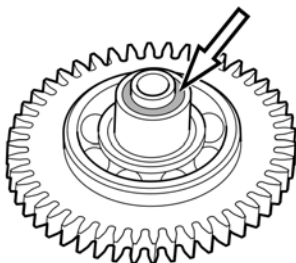


T2022369

**16**

Install the double idler gear (2) to the timing gear plate, using new bolts. Check that the idler gear marking lies between the markings on the crankshaft gear teeth.

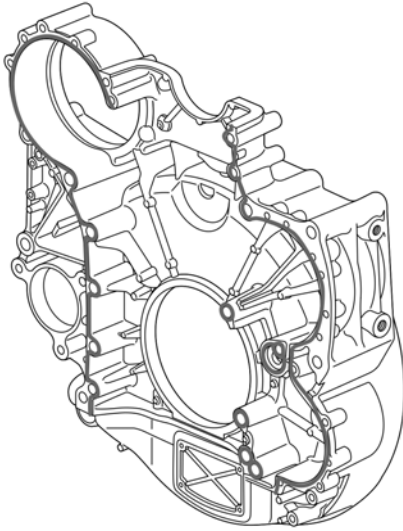
Torque tighten the bolts in accordance with the "Specifications"; refer to Group 20.



T2022373

**17**

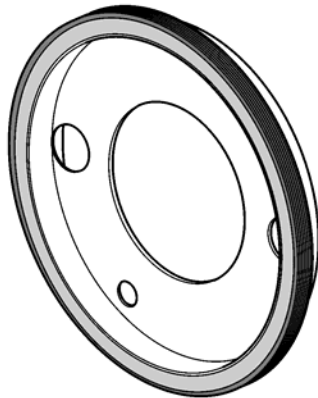
Apply a new sealing ring to the idler gear bearing journal. Install the idler gear on to the timing gear plate.



T2022591

**18**

Apply sealing agent to the timing gear plate. Install the flywheel housing and align using the guide pins. Torque tighten according to "Specifications", see Group 20.



T2022255

**19**

Using drifts 9998238 and 9992000, install a new rear crankshaft seal.

**Note:** Thoroughly clean the sealing area in the flywheel housing and the sealing surface against the crankshaft.

**Note:** The seal comes with a protective sleeve installed in the seal.

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9998238, 9992000

**20**

Install the flywheel. Torque-tighten to specification. Use 88800014 and a pull handle or wrench to lock the flywheel.

---

88800014

**21**

Lubricate and install new bearing shells on the 2nd and 5th connecting rods. Replace the bearing caps and torque-tighten to specification.

**Note:** Make sure that all contact surfaces are thoroughly cleaned!

**22**

Rotate the crankshaft so that it aligns the 3rd and 4th connecting rods. Lubricate and install new bearing shells. Replace the bearing caps and torque-tighten to specification.

**Note:** Make sure that all contact surfaces are thoroughly cleaned!

---

88800014

**23**

Rotate the crankshaft so that it aligns the 1st and 6th connecting rods. Lubricate and install new bearing shells. Replace the bearing caps and torque-tighten to specification.

**Note:** Make sure that all contact surfaces are thoroughly cleaned!

---

88800014

**24**

Install the oil pump. Torque-tighten to specification.

**25**

Replace the reinforcing frame, oil pipes, and strainer for the oil pump. Torque-tighten to specification.

**26**

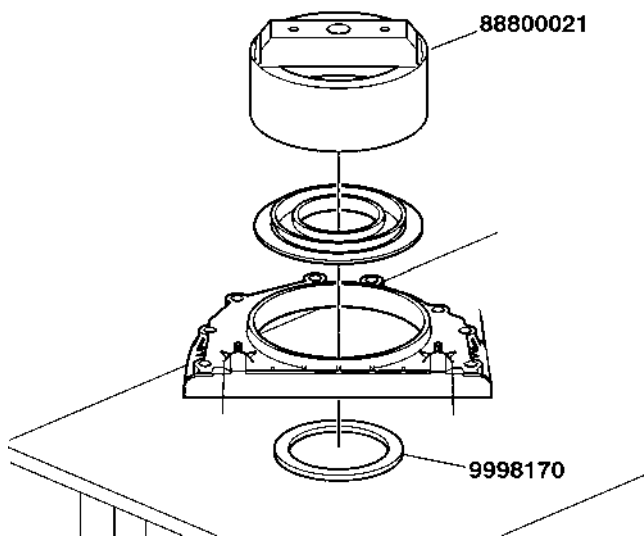
Tap the old front crankshaft seal out of the cover.

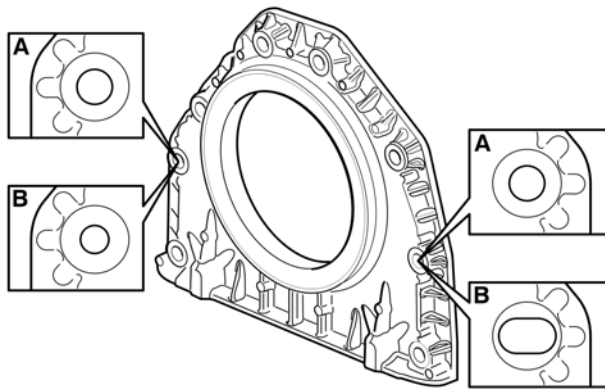
**27**

Place the crankshaft housing with the spacer 9998170 in the center on a flat surface. Install a new crankshaft seal with plastic ring in the crankshaft housing. The spacer ring prevents the plastic ring from sliding off. Carefully tap the crankshaft seal into the crankshaft housing with drift 88800021 and handle 9992000 until the crankshaft seal is level with the crankshaft housing.

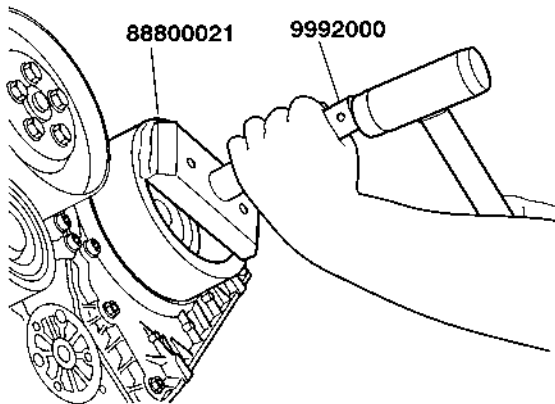
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9992000, 9998170, 88800021





T2022786



T2022240

## 28

Apply sealant to the crankshaft housing sealing surfaces. Centralize the crankshaft housing against the crankshaft with the plastic ring.

Install the crankshaft housing. Note that there are two different types of housing. In the later type (B in figure), the LH hole is smaller than earlier type and the RH hole is oval. The holes permit a later type of housing to be correctly aligned.

**For the earlier type (A) the following applies:**

Install the bolts without tightening them. Using a straight edged ruler, make sure the cover is flush with the bottom edge of the engine block.

**For the later type (B) the following applies:**

Install screws in both screw holes which align the cover to the correct position. Tighten by hand so that the cover is fixed. Install the remaining screws.

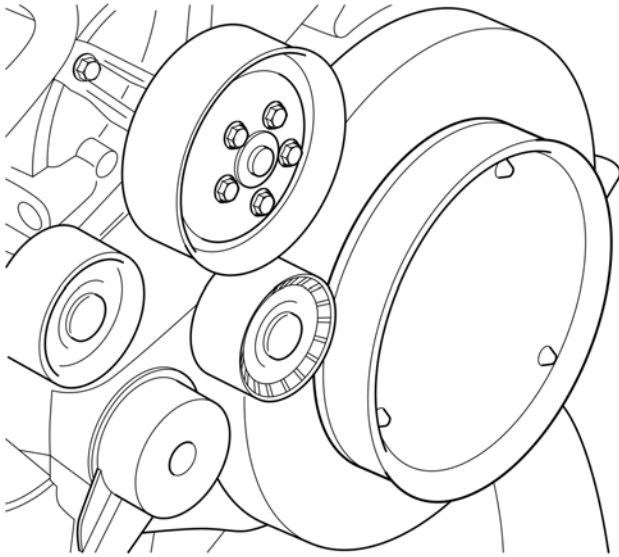
Torque tighten the screws according to "Specifications", see group 20.

Remove excess sealant.

## 29

Remove the plastic ring from the crankshaft. Drive in the crankshaft seal with drift 88800021 and handle 9992000 until the drift bottoms against the crankshaft.

9992000, 88800021



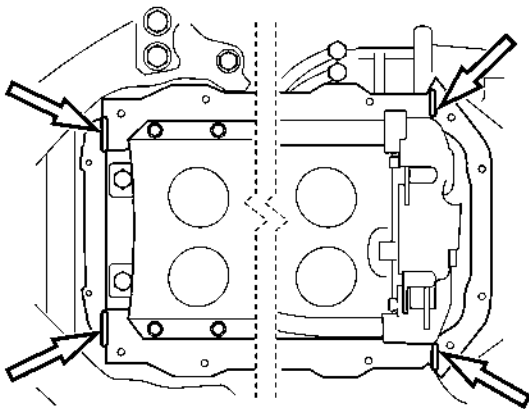
T2022497

**30**

Attach the oscillation damper and cover. Torque-tighten to specification.

**Note:** Use caution not to damage the vibration damper.

Install the drive belt.



T2022383

**31**

Install the oil pan gasket.

Apply 4 beads of sealing compound, 2 mm (0.08 in), on both ends of the engine block mating surface.

**Note:** The oil pan must be installed within 20 minutes after the sealant has been applied.

**32**

Install the oil pan. Torque-tighten fasteners to specification.

**33**

Install the starter motor.

**34**

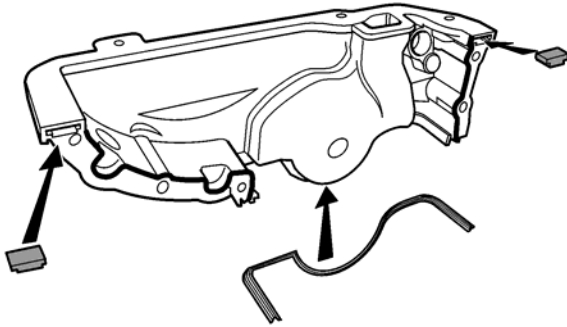
Install the power steering pump.

**35**

Install the compressor.

**36**

Install new seals on the upper timing gear cover.

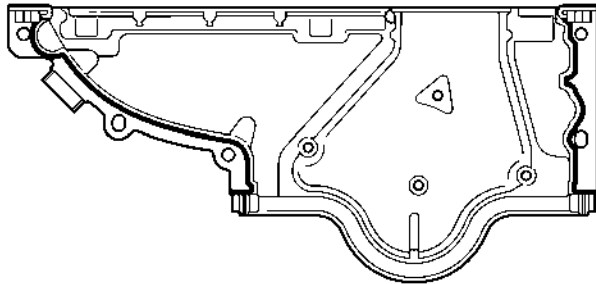


T2022148

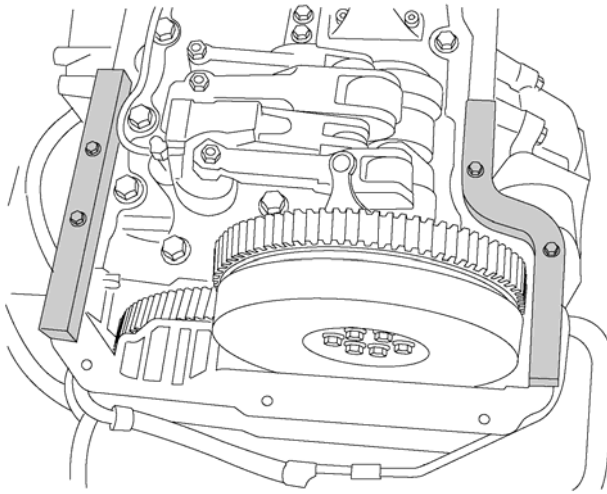
**37**

Apply sealant to the timing gear cover; see "Specifications" group 20.

**Note:** The transmission cover must be installed within 20 minutes after the sealant has been applied.



T2022339

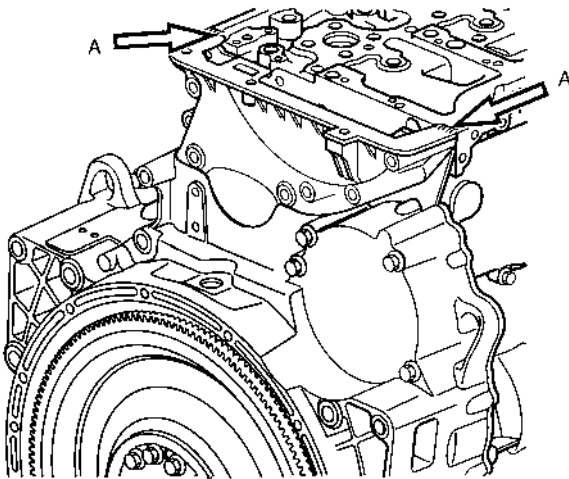


W2006191

**38**

Position the upper timing gear cover. Install the screws and tighten the cover into place. Install press tool 9998601 and 9998318 and screw down the tool so that the sealing surface of the timing gear cover is aligned with the sealing surface of the cylinder head. Torque-tighten the timing gear cover screws to specification.

85111422 A, 85111422 B



T2022117

**39**

Apply two 2 mm (0.08 in.) thick beads of sealant to the surface (A) between the upper timing gear cover and the valve cover.

**Note:** The valve cover must be installed within 20 minutes of the sealant being applied.

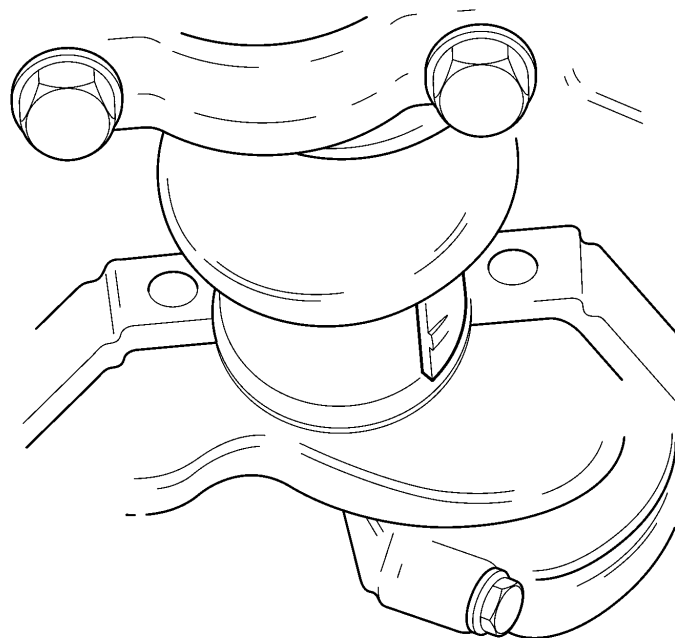
**40**

Install the valve cover. Torque-tighten to specification.

Date	Group	No.	Page
8.2008	<b>216</b>	<b>104</b>	1(7)

## Main Bearings, Replacement (All) D13F

### Main Bearings, Replacement (All)



W2006096

### Contents

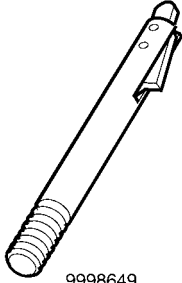
- "Special Tools" page 2
- "Main Bearings, Replacement (All)" page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



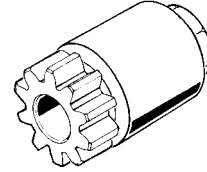
## Special Tools

For special tools ordering instructions, refer to Tool information, group 08.



9998649

W2006137  
**9998649**  
Retainer



T0012612

**88800014**  
Flywheel Turning Tool

## 2162-03-03-01 Main Bearings, Replacement (All)

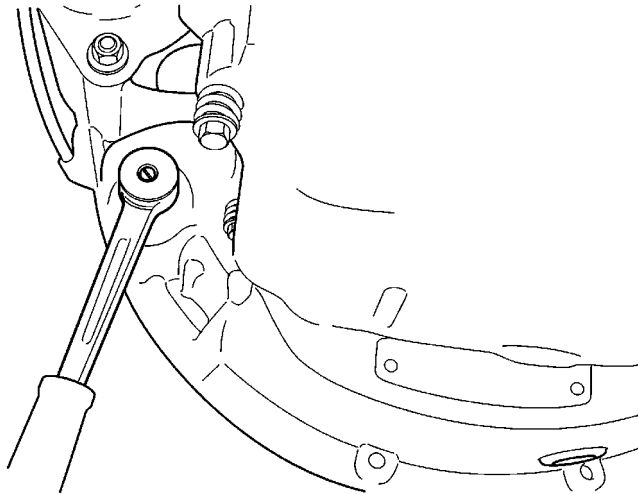
Oil pan removed

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

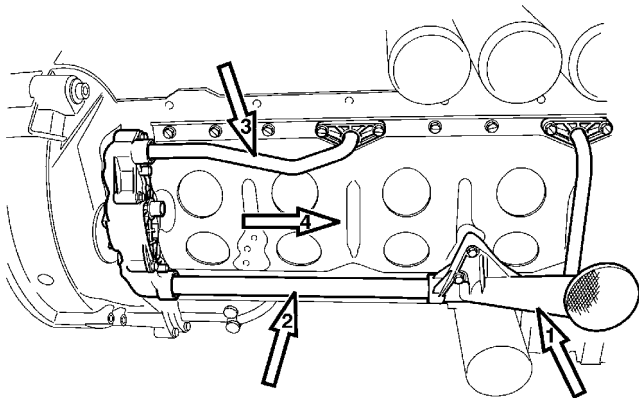
*Special tools: 9998649, 88800014*

**1**  
Remove the plug from the flywheel housing and install cranking tool 88800014.

88800014



T2022378



W2006029

- 2
- 1 Remove the pipe and strainer from the reinforcing frame.
- 2 Remove the oil pick-up tube.
- 3 Remove the pressure pipe from the pump.
- 4 Remove the stiffening frame.

**WARNING**

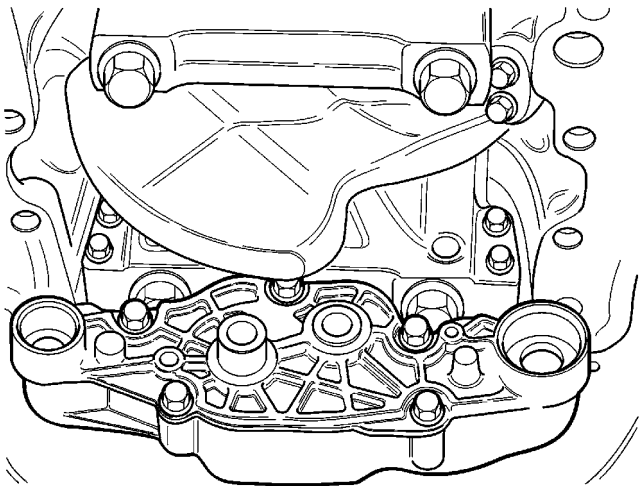
The stiffening frame has sharp edges. To prevent personal injury, use protective gloves.

**WARNING**

Use extreme caution when coming into contact with used engine oil. Used engine oil could cause cancer.

**Note:** Special tool 9998649 can be used to support the stiffening frame during removal and installation. Remove a fastener from each side at the center of the engine stiffening frame and install the stiffening frame tools.

9998649

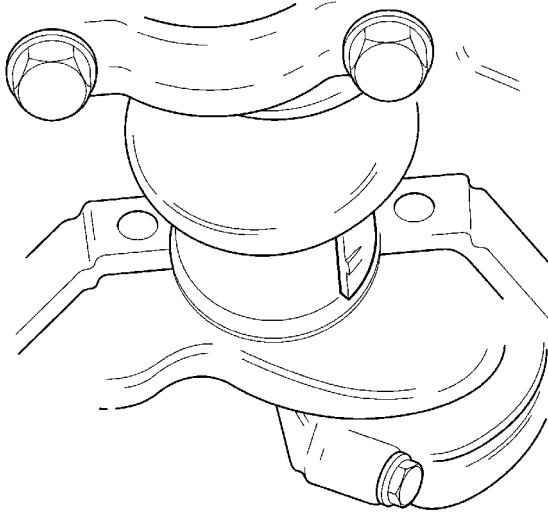


T2022249

- 3
- Rotate the crankshaft so that the oil pump fasteners can be accessed.
- Remove the oil pump from the main bearing cap.

88800014

- 4
- Note:** Before removing bearing caps, make sure the caps are properly marked. They should be marked on the center of the cap. The part number on the cap should face the front of the engine. Remove one main bearing cap at a time.
- Remove the main bearing caps.



W2006096

**5**

Remove the upper bearings by inserting a flexible putty knife between the crankshaft and the block.

**Note:** Turn the crankshaft with the hand turning tool. Turn the crankshaft in the proper direction. Be careful not to damage the crankshaft, block, or bearing. The crankshaft thrust bearing is mounted in the center main bearing, number 4. Thrust bearing washers are available in several oversize dimensions.

**6**

Perform a visual inspection of the crankshaft journals, block and bearing caps for signs of wear and/or damage. Check the back of the bearing for the bearing size. Bearings can be stamped "STD" for standard, or, with a number indicating the oversize of the bearing shell.

**7**

Install the upper bearing shell by turning the crankshaft in the direction of the rotation with cranking tool 88800014.

**Note:** Due to tight tolerances, the crankshaft should be aligned with the engine block before installing.

**Note:** Check that the locating tab on the bearing shell fits correctly into the recess in the bearing seat (use Special tool 88800014).

---

88800014

**8**

Install the main bearing cap together with the lower bearing shell.

**9**

Replace the other main bearings, one at a time and in the same manner as the first one. After replacing each bearing, check that the crankshaft rotates freely by turning it around with cranking tool 88800014.

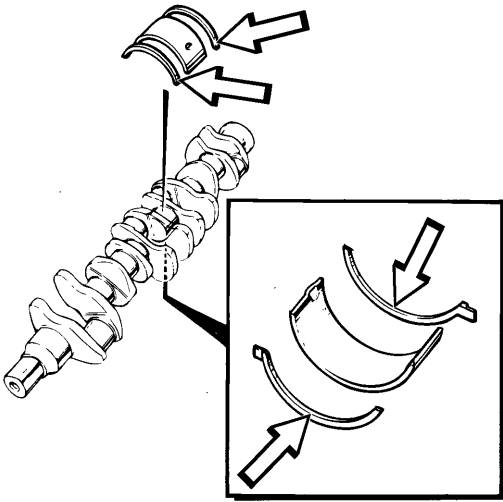
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88800014

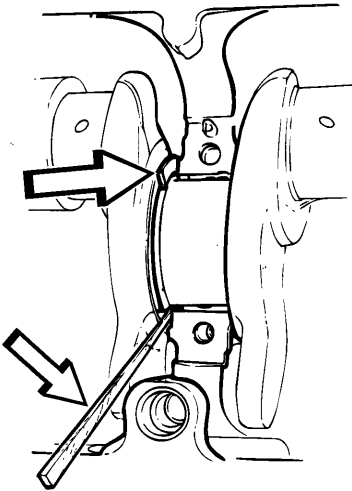
**10**

Check the crankshaft axial play and replace the thrust bearings if there is too much play or if the bearings are damaged. Use a dial indicator to measure axial play.

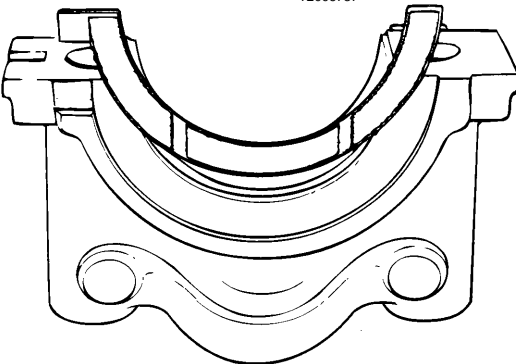
11



T2006736



T2006737



T2006738

Lubricate the crankshaft side of the new bearing shells and thrust bearings. Install the bearing caps. Using the hand cranking tool, rotate the engine several rotations to verify that the bearings have been properly installed.

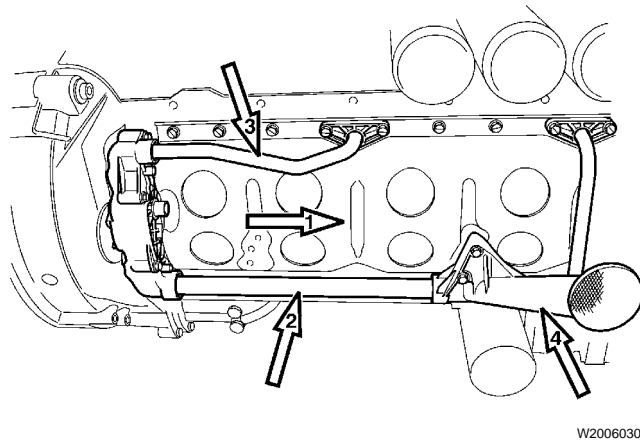
**Note:** Make sure the bearing caps are correctly fitted (see markings on the cap).

12

Check crankshaft end play with a dial indicator. See Specifications.

13

Install the oil pump on the main bearing cap. Torque tighten the bolts in accordance with the "Specifications" (see Group 20).



**14**

Install the stiffening frame. Use new fasteners.

**! WARNING**

The stiffening frame has sharp edges. To prevent personal injury, use protective gloves!

- 1 Tighten the stiffening frame bolts according to the diagram (See "Specifications" group 20).
- 2 Install the oil pick-up tube with new fasteners and gaskets.
- 3 Install the pressure pipe to the pump with new fasteners and gaskets.
- 4 Install the pipe and strainer to the reinforcement frame with new gaskets.

**Note:** Use thread lock on the fasteners.

**Note:** Special tool 9998649 can be used to support the stiffening frame during removal and installation. Use the stiffening frame tools to support the frame while installing the new fasteners.

9998649

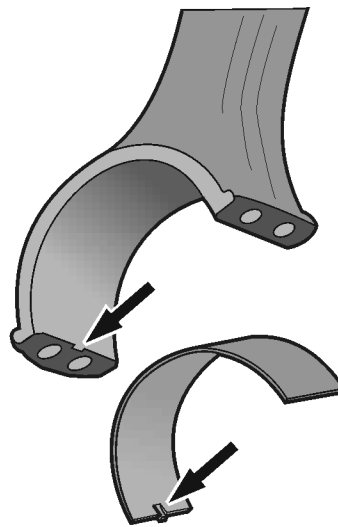
**15**

Remove the cranking tool and reinstall the plug in the flywheel housing.

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## Connecting Rod Bearings, Replacement (All) D13F

### Connecting Rod Bearings, Replacement (All)



T2019310

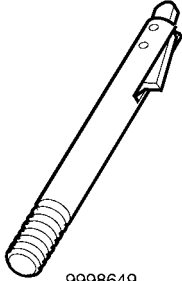
#### Content

- “Connecting Rod Bearings, Replacement (All)” page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

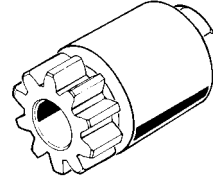
## Special Tools

For special tools ordering instructions, refer to Tools Information, Group 08.



9998649

W2006137  
**9998649**  
Retainer



T0012612

**88800014**  
Engine Turning Tool



## 2165-03-03-01 Connecting Rod Bearings, Replacement (All)

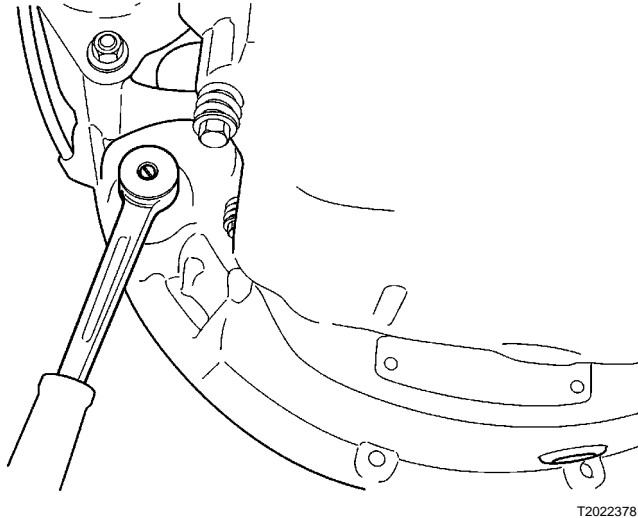
Oil pan removed

*Special tools: 9998649, 88800014*

**1**

Remove the plug from the flywheel casing and install cranking tool 88800014.

88800014



T2022378

**2**



### WARNING

The stiffening frame has sharp edges. To prevent personal injury, use protective gloves.

- 1 Remove the pipe and strainer from the stiffening frame.
- 2 Remove the oil pickup tube.
- 3 Remove the pressure pipe from the pump.
- 4 Remove the stiffening frame.

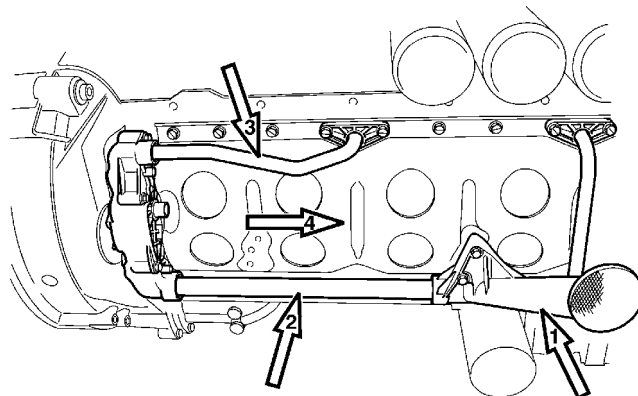


### WARNING

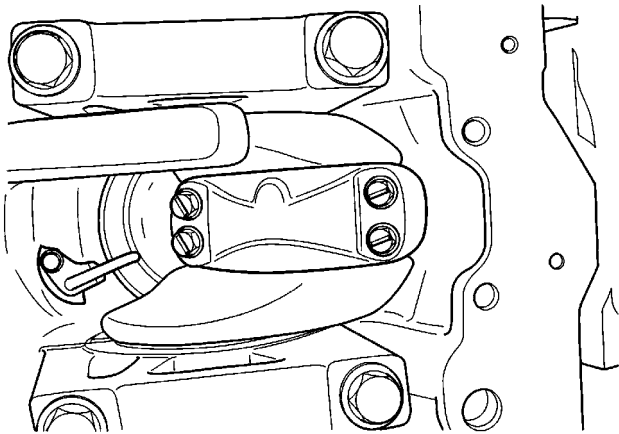
Use extreme caution when coming in contact with used engine oil. Used engine oil could cause cancer.

**Note:** Special tool 9998649 can be used to support the stiffening frame during removal and installation. Remove a fastener from each side at the center of the engine stiffening frame and install the stiffening frame tools.

9998649



W2006029



T2022285

- 3**  
Turn the flywheel until the bearing caps on connecting rods 1 and 6 are in position for removing the bolts.

88800014

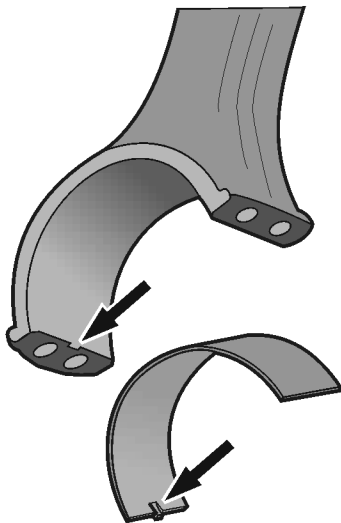
- 4**  
Remove the piston cooling nozzles to prevent them from being damaged.

- 5**  
Remove the caps. Push up the connecting rods as much as is needed to remove the big end shells.

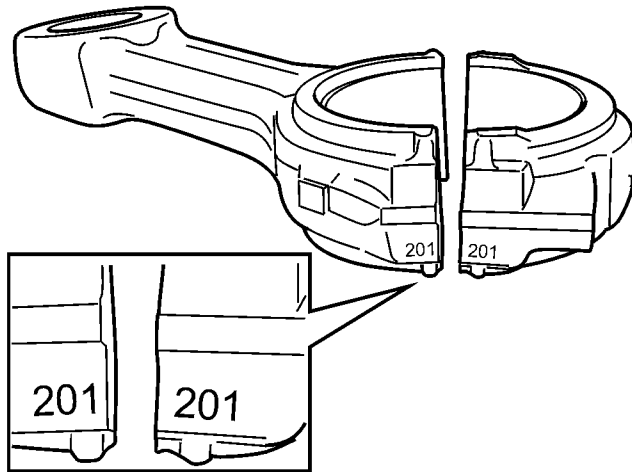
**Note:** Check the bearing surfaces for uneven wear or other damage. If there is abnormal wear, the cause must be found before reassembly.

- 6**  
**Note:** The bearing size is found on the back of the bearing shell.  
Carefully clean the bearing contact on the connecting rods and bearing caps.  
Clean the bearing seats and install new bearing shells.

- 7**  
Lubricate the new bearing shells with clean engine oil.



T2019310



T2019085

**8**

Carefully pull the connecting rod (with new bearing) onto the crankshaft. Use caution not to damage the crankshaft.

**9**

Install the bearing caps.

**Note:** Ensure that the correct cap is fitted to the correct connecting rod (refer to the marks).

Tighten, alternately, until the surfaces meet. Torque tighten according to "Specifications", see Group 20.

**10**

Install the piston cooling nozzle.

**11**

Turn the crankshaft until the next two connecting rods are in position for removing the bolts. Repeat the above procedure from step 4 through 10.

88800014

**12**

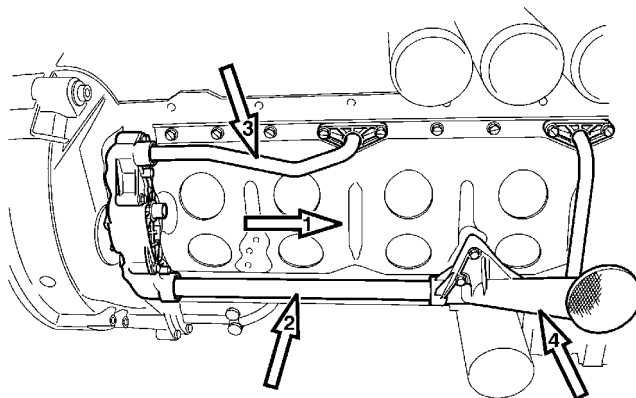
**WARNING**

The stiffening frame has sharp edges. To prevent personal injury, use protective gloves.

Install the stiffening frame using new fasteners.

- 1 Tighten stiffening frame fasteners in sequence according to Specifications, Group 20.
- 2 Install the oil pickup tube with new fasteners and gaskets.
- 3 Install the pressure pipe to the pump with new bolts and gaskets.
- 4 Install the pipe and strainer on the reinforcement frame with new gaskets. Secure the bolts with thread lock and tighten according to Specifications, Group 20.

**Note:** Special tool 9998649 can be used to support the stiffening frame during removal and installation. Use the stiffening frame tools to support the frame while installing the new fasteners.



W2006030

**13**

Remove the cranking tool and reinstall the plug in the flywheel cover.

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## Oil Pan, Replacement D13F

### Oil Pan, Replacement

This information covers the proper replacement procedure for the oil pan on the Volvo D13F engine in a Prevost coach.

### Contents

- "Oil Pan, Replacement" page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2171-03-02-01**

## Oil Pan, Replacement

### Removal

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

**1**

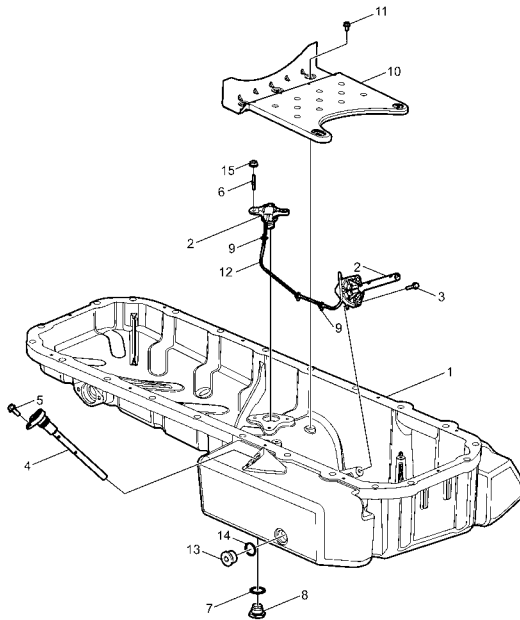
Apply the parking brake and shift the transmission to neutral.

**2**

Open the engine compartment. Move the engine switch to the off position to disable the engine.

**3**

Lift the vehicle to access the oil pan. Position jackstands of a suitable capacity under the axle to support the vehicle.



W2006339

- 1 Oil Pan
- 2 Oil Level/Temperature Sensor
- 3 Flange Screw
- 4 Pipe
- 5 Flange Screw
- 6 Stud
- 7 Gasket
- 8 Magnetic Plug
- 9 Clip
- 10 Baffle Plate
- 11 Flange Screw
- 12 Oil Level Sensor Pipe
- 13 Plug
- 14 O-Ring
- 15 Flange Nut

**4**

Place an approved container under the oil pan and remove the oil drain plug.

**Note:** Use only hand tools when removing and tightening the drain plug. Do not use air tools.

**5**

Remove the splash shield from around the filters.

**6**

Pull the dipstick partially out of the dipstick tube, then remove the dipstick tube fastener and tube from the oil pan. Remove and discard the O-ring.

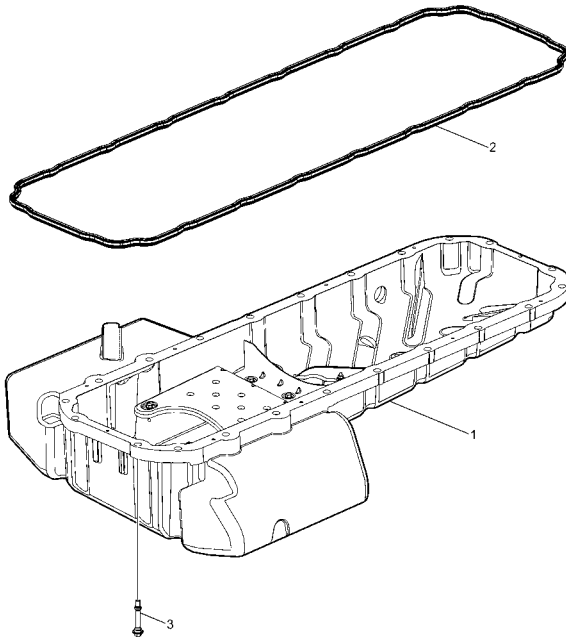
**7**

Remove the oil fill tube fasteners and tube from the oil pan. Remove and discard the tube O-ring.

- 8**  
Disconnect the oil level/temperature sensor external connector.
- 9**  
Remove the front engine mount crossover support bracket.
- 10**  
Remove the oil pan fasteners. To prevent the oil pan from falling, do not remove one fastener on each side of the oil pan.
- 11**  
With the aid of an assistant, support the oil pan and remove the two remaining fasteners. Carefully lower the pan to avoid contact with the oil pickup tube.
- 12**  
Remove the oil level/temperature sensor assembly.
- 13**  
If applicable, remove the oil heater element from the oil pan.
- 14**  
If applicable, replace the O-ring on the heater element and install the element in the replacement oil pan.
- 15**  
Transfer all sensors, plugs, and fittings to the replacement pan, as required.

## Installation

- 1**  
Install a new O-ring in the sensor connector.
- 2**  
Install the oil level/temperature sensor assembly.
- 3**  
Install a new oil pan seal on the replacement oil pan.

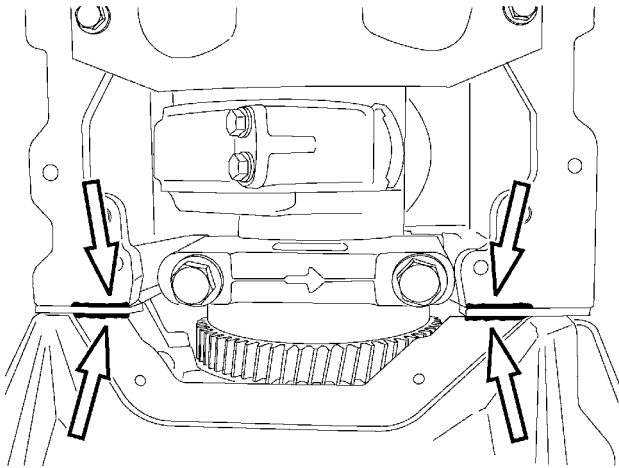


W2006340

- 1 Oil Pan
- 2 Oil Pan Seal
- 3 Flange Screw

- 4**  
Clean the oil pan mounting surfaces on the cylinder block, flywheel housing and front seal cover. All surfaces must be completely free of any grease or oil residue.





W2006078

**5**

Apply a 2 mm (0.079 inch) wide bead of Volvo approved sealant at the following locations:

- The seams between the flywheel housing and the timing gear mounting plate
- The seams between the timing gear mounting plate and the engine block
- The seams between the front seal cover and the engine block

**Note:** Make sure that the block flange is flush with the flywheel housing and the crankshaft front cover to prevent leaking. If not flush, the flywheel housing and/or the crankshaft front cover must be realigned.

**Note:** The oil pan must be installed within 20 minutes of applying the sealant. If the oil pan is not installed within 20 minutes, remove the sealant, clean the mounting surfaces and reapply sealant.

**6**

With assistance, position the oil pan to the engine block and install the fasteners.

**Note:** Use care to prevent damage to the oil pickup.

**7**

Torque-tighten the oil pan fasteners in the correct sequence. Refer to the specification manual for the sequence and torque specification.

**8**

Install the front engine mount crossover support bracket. Torque-tighten the fasteners to specification.

**9**

Connect the oil level/temperature sensor connector.

**10**

Install a new O-ring on the oil fill tube and install the tube to the oil pan. Install the oil fill tube fasteners and tighten to secure.

**11**

Install a new O-ring on the dipstick tube. Install the tube and secure with the fastener. Install the dipstick.

**12**

Install the splash shield around the filters.

**13**

Lift the vehicle, remove the jackstands and lower the vehicle.

**14**

Fill the engine with the specified amount of approved engine oil. Do not overfill.

**15**

Turn the ignition switch to the ON position. Move the engine switch to the rear start position. Start the engine, check for leaks and proper operation. After shutdown, replenish fluids as necessary.

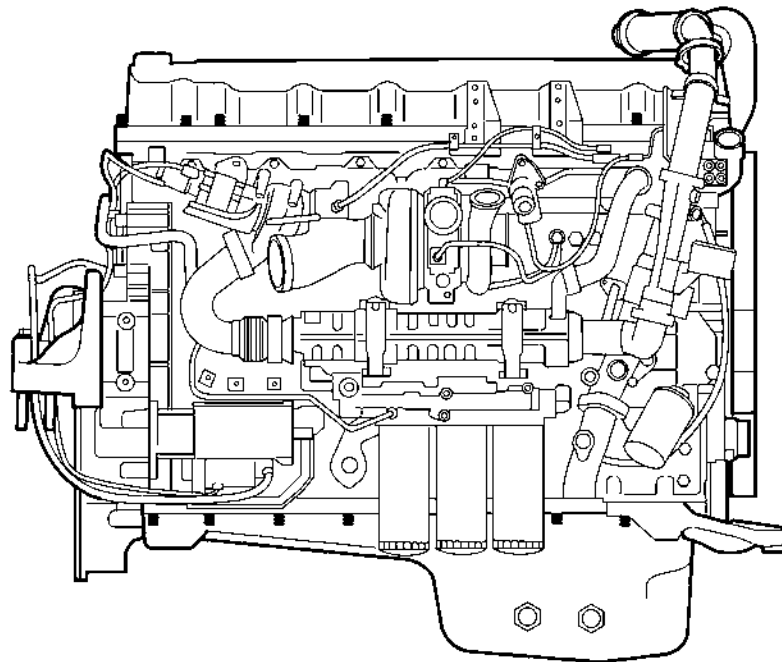
**16**

Close the engine compartment.

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Lubrication and Oil System  
Design and Function  
PREVH, PREVX, B13R

## Lubrication and Oil System, Design and Function



W2005779

This information covers the design and function of the lubrication and oil system used on VOLVO PREVH, PREVX, and B13R model buses with D13H engines.

### Contents

- "Lubrication and Oil System", page 2

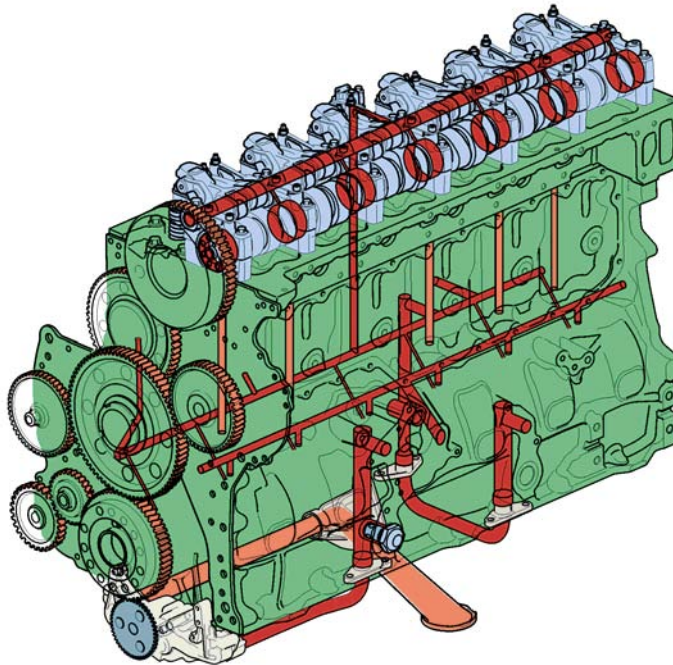
**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Design and Function

## Lubrication and Oil System

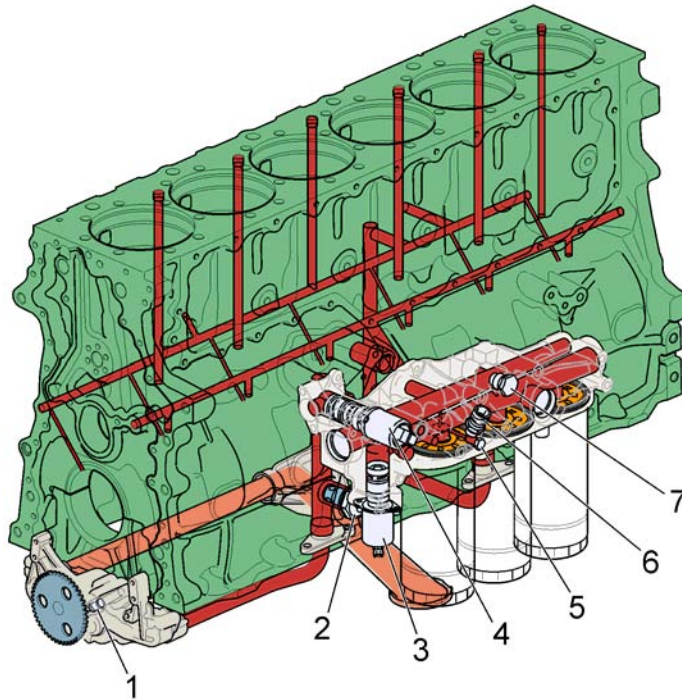
### General

The engine is pressure lubricated by a gear pump located at the rear of the engine and driven by the crankshaft. Two longitudinal oil channels are drilled through the cylinder block, the main lubrication channel (oil gallery) and the piston cooling oil channel. The main lubrication channel (on the right side of the engine) provides oil to the crankshaft journals. The piston cooling channel (on the left side of the engine) provides oil to the piston lubrication and cooling circuit. The main oil gallery runs into a cast channel which carries lubricating oil to the timing gears. A centrally located channel drilled through the cylinder block and cylinder head carries lubricating oil up to the engine brake valve/connection housing and the hollow rocker arm shaft, which via oil channels lubricates the camshaft bearings and rocker arm bearings. All the way through the adjustable idler gear is a channel which lubricates the mesh between the drive gear for the power takeoff (PTO) and the double idler gear.



T2026876

The oil filter housing is secured by fasteners to the right side of the engine and has two full flow filters and one bypass filter. Sensors in the oil pan monitor the engine oil level (EOL) and engine oil temperature (EOT). The oil cooler is located in the engine block cooling jacket on the right side of the engine.



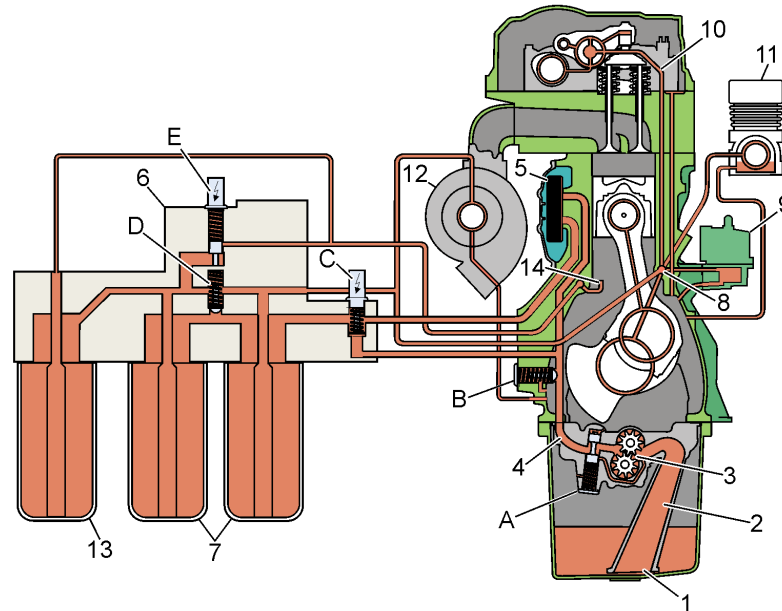
T2026819

The oil flow through the engine is regulated by valves and sensors located inside the cylinder block, pump, and oil filter housing as follows:

- 1 Reduction Valve
- 2 Safety Valve
- 3 Engine Piston Cooling Oil Supply Valve
- 4 Electrically Controlled Valve for Oil Cooler
- 5 Pressure Outlet for Piston Cooling
- 6 Engine Piston Oil Pressure Sensor
- 7 Overflow Valve for Full-Flow Filter.

The reduction valve (1) is integrated into the oil pump and cannot be replaced as a separate item.

## Lubrication System Operating Principles



T2026877

Oil is drawn up through the strainer (1) via plastic pipe (2) from the sump to the oil pump (3), which forces the oil via pressure pipe (4) to the channels in the cylinder block. The oil then passes through the oil cooler (5) to the filter housing (6). After being filtered through both full-flow filters (7), the oil passes through a connection pipe to the cylinder block's main lubrication gallery (8) for distribution to all lubrication points and to the engine crankcase breather (CCB) oil separator turbine (9). Lubrication of the valve mechanism takes place via a drilled channel up to the engine brake valve (10).

External piping is used to lubricate the air compressor (11) and turbocharger (12) with oil that has been filtered by the full flow filters (7).

The finely filtered oil from the bypass filter (13) is mixed with the piston cooling oil, which is pumped into the piston

cooling gallery. From there, the oil is sprayed from the piston cooling nozzles (14) against the undersides of the pistons.

A. Reduction Valve — Maintains the engine oil pressure (EOP) at the correct level.

B. Safety Valve — Protects the oil pump, filters, and oil cooler against excessive pressure when the oil viscosity is high.

C. Electrically Controlled Valve for Oil Cooler — Controls the EOT to its optimal value.

D. Overflow Valve for the Full Flow Filter — Opens and allows oil to pass through, bypassing the oil filter if it becomes blocked.

E. Engine Piston Cooling Oil Supply Valve — Controls the oil flow to the piston cooling channel.

### *Extreme Cold Start*

Extreme cold start is considered to be when starting the engine at temperatures below -20° C (-4° F). The safety valve (B) opens to protect the oil pump against the high pressure that occurs when the oil viscosity is too high. The reduction valve (A), oil cooler bypass valve (C) and piston cooling oil supply valve (E) open due to the high viscosity.

### *Driving at Low Engine Speed (RPM)*

When driving at low RPM at normal operating temperature, the reduction valve (A) partly opens to maintain the EOP within the correct values. The piston cooling oil supply valve (E) is open and has begun to control the flow to the piston cooling channel.

### *Driving at High RPM*

When driving at high RPM at normal operating temperature, valves (A) and (E) are open.

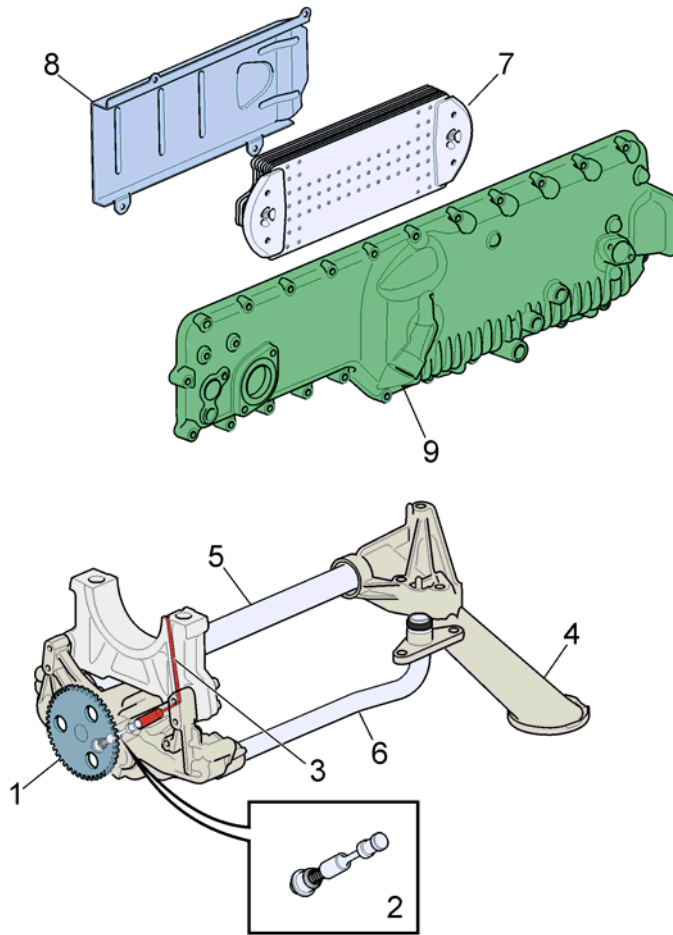
### *Blocked Oil Filters*

If a full-flow filter becomes blocked, the overflow valve (D) opens and unfiltered oil is pumped into the engine lubrication system.

### *Idling, Hot Engine*

At low RPM and with the engine at normal operating temperature, all valves are closed.

## Oil Pump and Cooler



T2026879

The oil pump is a gear wheel pump located at the rear of the engine and secured by four bolts to the rear main bearing cap. It is driven by a gear (1) directly from the crankshaft gear. The pump has helical gear wheels to reduce noise, and its shafts run in bearings directly in the pump housing, which is made of aluminium. A pressure reduction valve (2) is fitted in the oil pump and controls the pressure in the lubrication system via an oil channel (3) in the rear main bearing.

The suction system is in two parts and consists of a plastic pipe (4) and a strainer in the sump, and a pipe (5) of steel or aluminum. The plastic pipe is bolted to the stiffening frame. The metal pipe is sealed at each end by rubber seals and is available in two lengths, depending on the type of oil sump used and how it is installed. The pressure pipe (6) is made of steel and secured to the cylinder block and sealed with rubber seals.

A connection pipe from the oil filter housing carries the oil to the main lubricating oil gallery.

The oil cooler (7) is bolted directly to the oil cooler cover (9) and is completely surrounded by coolant. The flow plate (8) is bolted to the oil cooler cover to direct the flow of coolant over the oil cooler.



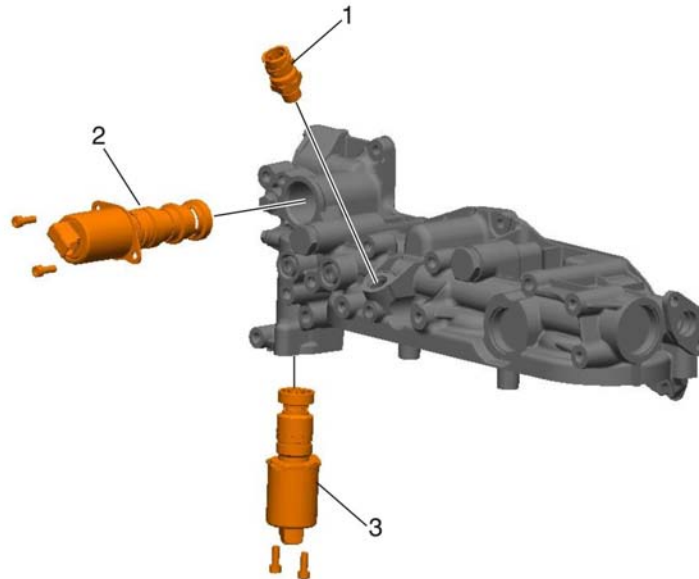
## Oil Filtration

One of the functions of the oil lubrication system is to trap impurities in the oil to prevent them from entering the engine lubrication points and bearing surfaces. As the engine operates, the oil accumulates dirt that needs to be cleaned up before it returns to the lubrication points. The oil is roughly filtered while passing through the oil manifold filter.

The engine lubrication system is equipped with three filters to get rid of the dirt particles. The oil filters are the replaceable spin-on type.

All oil coming through the pump passes through the filters before entering the engine.

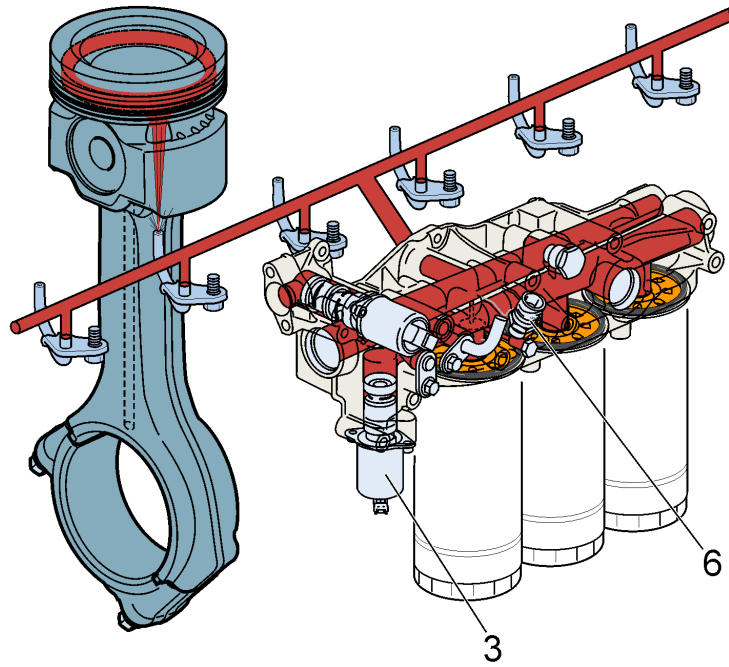
The oil filter housing assembly is mounted on the right side of the cylinder block. The three filters attach to the underside of the housing.



W2055588

- 1 Engine Piston Cooling Oil Pressure Sensor
- 2 Oil Cooler Thermostat Control Solenoid
- 3 Engine Piston Cooling Oil Supply Valve

## Piston Cooling System



T2026820

The illustration shows the oil flow for the piston cooling system where the oil supply valve (3) balances the oil flow to the piston cooling channel. The oil supply valve (3) is controlled by the engine control module (ECM) which gets its signals from the piston cooling oil pressure sensor (6). The piston cooling nozzle is aligned so that the oil jet hits the inlet hole to the piston cooling chamber.

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## Pickup Tube, Oil Pump, Replacement D13F

### Pickup Tube, Oil Pump, Replacement

This information covers the proper replacement procedure for the oil pump pickup tube on the Volvo D13F engine in a Prevost coach.

#### Contents

- "Pickup Tube, Oil Pump, Replacement" page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

## 2211-03-02-03

### Pickup Tube, Oil Pump, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## Removal

- 1**  
Apply the parking brake and shift the transmission to neutral.
- 2**  
Open the engine compartment. Move the engine switch to the off position to disable the engine.
- 3**  
Lift the vehicle to access the oil pan. Position jackstands of a suitable capacity under the axle to support the vehicle.
- 4**  
Place an approved container under the oil pan. Drain the oil by removing the drain plug.  
**Note:** Use only hand tools when removing and tightening the drain plug. Do not use air tools.
- 5**  
Remove the splash shield from around the filters.
- 6**  
Pull the dipstick partially out of the dipstick tube. Remove the dipstick tube fastener and tube from the oil pan. Remove and discard the O-ring.
- 7**  
Remove the oil fill tube fasteners and tube from the oil pan. Remove and discard the tube O-ring.
- 8**  
Disconnect the oil level/temperature sensor connector.

**9**

Remove the front engine mount crossover support bracket.

**10**

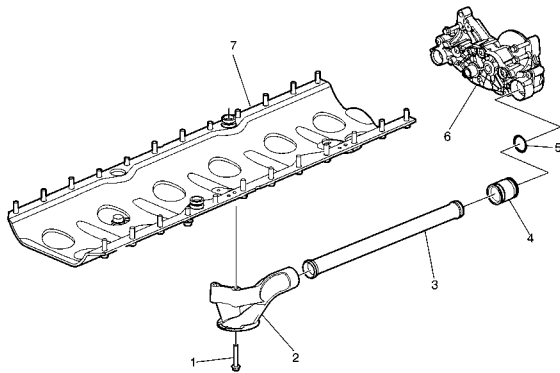
Remove the oil pan fasteners. To prevent the oil pan from falling, do not remove one fastener on each side of the oil pan.

**11**

With the aid of a assistant, support the oil pan and remove the two remaining fasteners. Carefully lower the pan to avoid contact with the oil pickup tube.

**12**

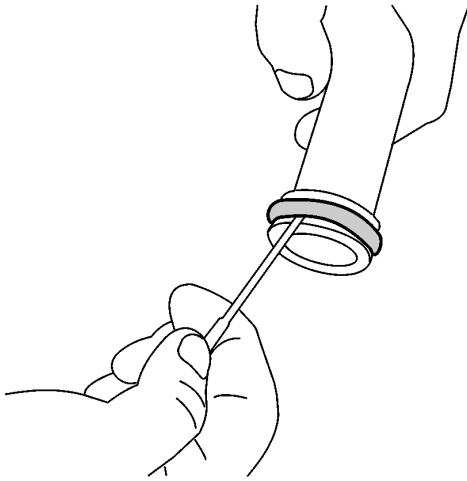
Loosen and remove the bolts securing the oil strainer to the engine stiffening frame. Remove the oil strainer and pickup (suction) tube. Slide the tube out of the oil pump.



W2006341

- 1 Flange Screw
- 2 Oil Strainer
- 3 Suction Tube
- 4 Connection Pipe
- 5 Sealing Ring
- 6 Oil Pump
- 7 Engine Stiffening Frame

## Installation



W2004956

### 1

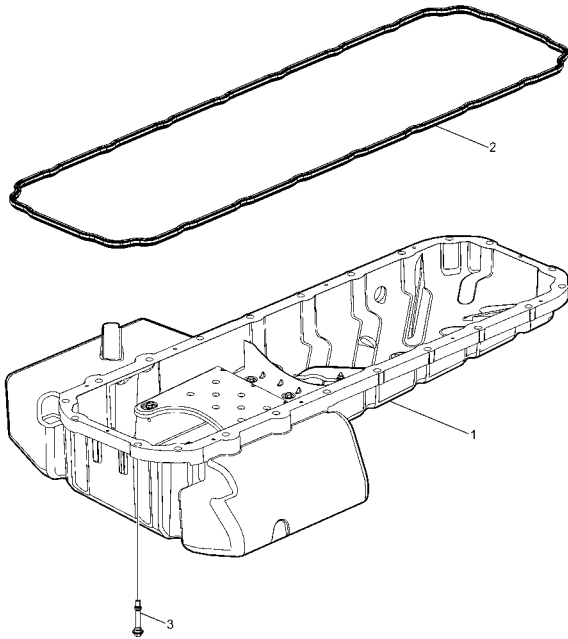
Replace the oil suction tube O-ring. Lubricate the O-ring with engine oil before installation.

**Note:** Separate the oil suction tube from the oil strainer as needed to replace the O-ring. Clean and inspect the oil strainer and suction tube for cracks. Replace if necessary.

### 2

Assemble the oil strainer and oil pickup tube. Slide the oil pickup (suction) pipe into the oil pump. Position the oil strainer to the engine stiffening frame and install the screws. Torque-tighten the screws to specification.

**Note:** Apply locking fluid to the screws.



- 1 Oil Pan
- 2 Oil Pan Seal
- 3 Flange Screw

W2006340

**3**

Clean the mounting surfaces on the oil pan, cylinder block, flywheel housing and front seal cover. All surfaces must be completely free of any grease or oil residue.

**4**

Inspect the oil pan seal and replace if necessary.

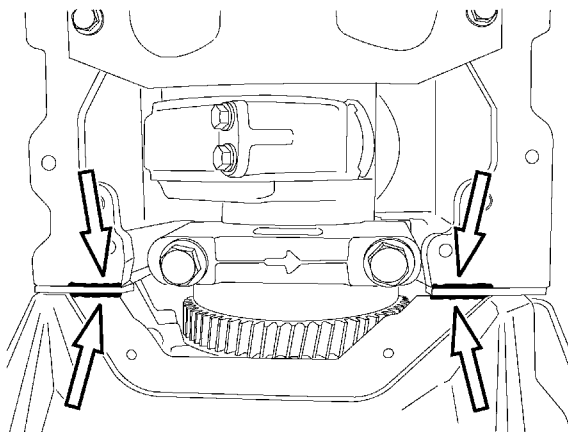
**5**

Apply a 2 mm (0.079 inch) wide bead of Volvo approved sealant at the following locations:

- The seams between the flywheel housing and the timing gear mounting plate
- The seams between the timing gear mounting plate and the cylinder block
- The seams between the front seal cover and the cylinder block

**Note:** Make sure the block flange is flush with the flywheel housing and the crankshaft front cover to prevent leaking. If not flush, the flywheel housing and/or the front cover must be realigned.

**Note:** The oil pan must be installed within 20 minutes of applying the sealant. If the oil pan is not installed within 20 minutes, remove the sealant, clean the mounting surfaces and reapply sealant.



W2006078

**6**

With assistance, position the oil pan to the cylinder block and install the fasteners.

**Note:** Use care to prevent damage to the oil pickup.

**7**

Torque-tighten the oil pan fasteners in the correct sequence. Refer to the specification manual for the sequence and torque specification.

**8**

Install the front engine mount crossover support bracket. Torque-tighten the fasteners to specification.

**9**

Connect the oil level/temperature sensor connector.

**10**

Install a new O-ring on the oil fill tube and install the tube to the oil pan. Install the oil fill tube fasteners and tighten to secure.

**11**

Install a new O-ring on the dipstick tube. Install the dipstick tube and secure with the fastener. Install the dipstick.

**12**

Install the splash shield around the filters.

**13**

Lift the vehicle, remove the jackstands and lower the vehicle.

**14**

Fill the engine with the specified amount of approved engine oil. Do not overfill.

**15**

Turn the ignition switch to the ON position. Move the engine switch to the rear start position. Start the engine, check for leaks and proper operation. After shutdown, replenish fluids as necessary.

**16**

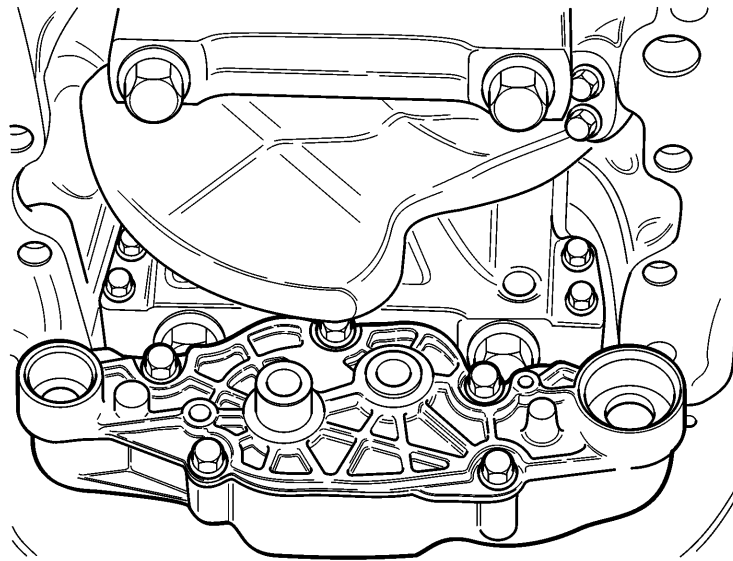
Close the engine compartment.



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## Oil Pump, Replacement D13F

### Oil Pump, Replacement



T2022249

### Contents

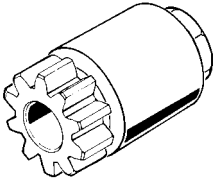
- "Special Tools" page 2
- "Oil Pump, Replacement" page 3

**Note:** Information is subject to change without notice.  
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# Tools

## Special Tools

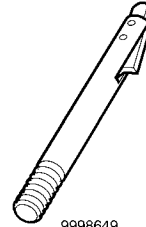
For special tools ordering instructions, refer to Tools Information, group 08.



T0012612

**88800014**

Flywheel Turning Tool



9998649

W2006137

**9998649**

Stiffening Frame Tool

# Service Procedures

## 2211-03-02-01

### Oil Pump, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 88800014, 9998649*

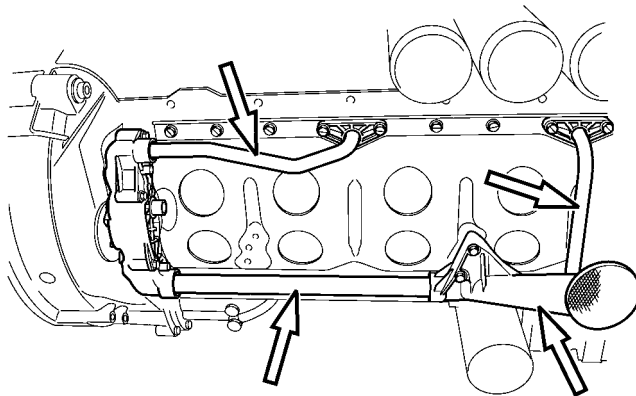
## Removal

**1**

Remove the oil pan. Refer to the service procedures in Group 22.

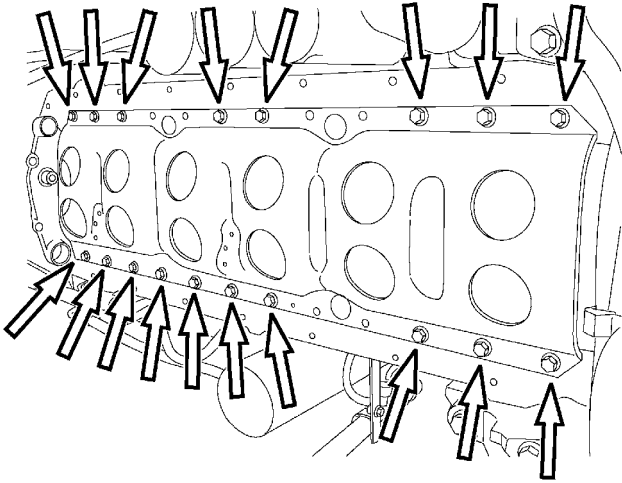
**2**

- Loosen and remove the bolts securing the oil strainer to the engine stiffening frame. Remove the oil strainer and pickup (suction) tube. Slide the tube out of the oil pump.
- Remove the fasteners securing the oil pressure crossover pipe to the skirt of the cylinder block. Remove the pipe.
- Remove the fasteners securing the oil pressure pipe to the skirt of the cylinder block. Slide the pipe out of the oil pump.




W2006100

**3**  
Remove the engine stiffening frame.



W2006101

 <b>CAUTION</b>
The engine stiffening frame has sharp edges which can cause injury. Wear protective gloves when handling.

**Note:** Special tool 9998649 can be used to support the stiffening frame during removal and installation. Remove a fastener from each side at the center of the engine stiffening frame and install the stiffening frame tools.

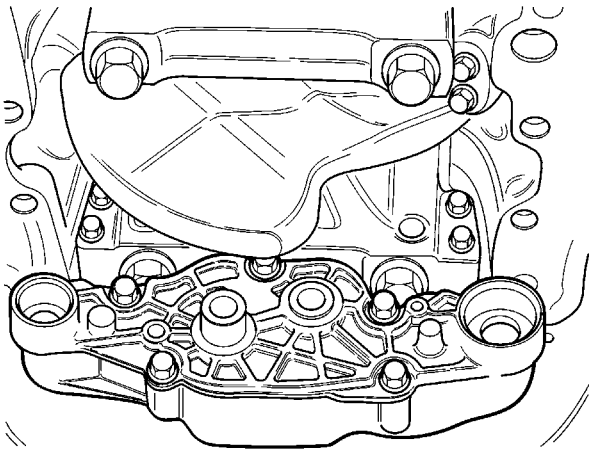
9998649

**4**  
If needed, remove the plug from the flywheel housing and install the flywheel turning tool.

88800014

**5**  
If needed, rotate the crankshaft using the flywheel turning tool to move the crankshaft out of the way.

88800014



T2022249

**6**  
Remove the bolts securing the oil pump to the crankshaft rear main bearing cap and remove the pump.

## Installation

**Note:** Clean the oil pump mounting surface of the rear main bearing cap before installing the new oil pump.

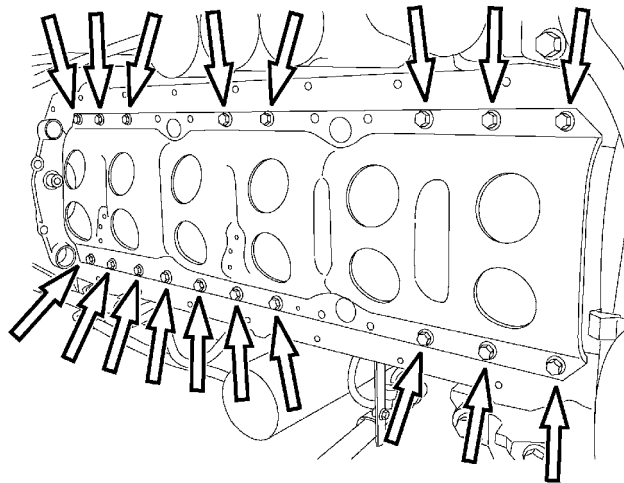
### 1

Position the oil pump to the rear main bearing cap, install the bolts and tighten to specification.

**Note:** Refer to Group 20 for the correct torque specifications.

### 2

Install the engine stiffening frame, new bolts and tighten to specification.



W2006101



### CAUTION

The engine stiffening frame has sharp edges which can cause injury. Wear protective gloves when handling.

**Note:** Special tool 9998649 can be used to support the stiffening frame during removal and installation. Use the stiffening frame tools to support the frame while installing the new fasteners.

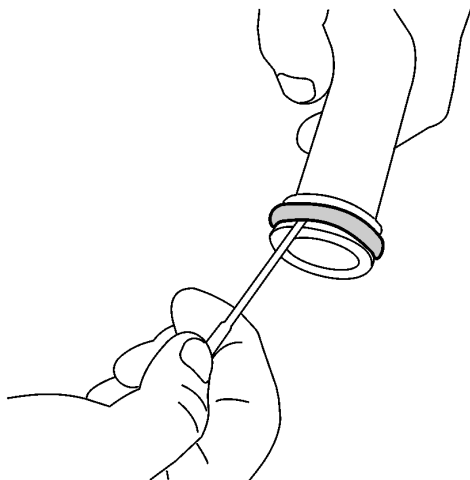
**Note:** The engine stiffening frame attaching bolts are a ONE TIME USE ONLY. New bolts must be installed.

9998649

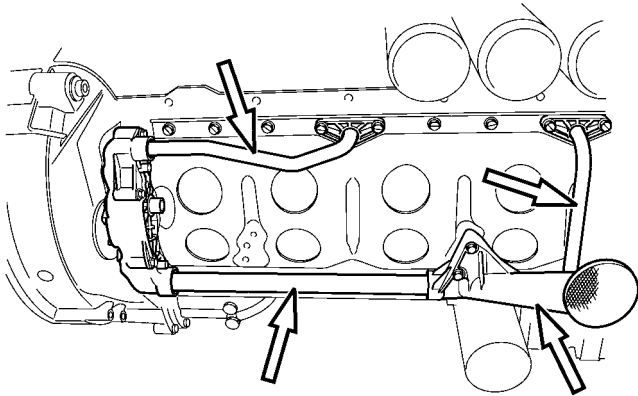
### 3

Replace the O-rings of the oil pressure pipe, oil suction pipe and oil crossover pipe. Lubricate the O-rings with engine oil before installation.

**Note:** Separate the oil suction pipe from the oil strainer as needed to replace that O-ring. Clean and inspect the oil strainer, suction pipe, crossover pipe and pressure pipe for cracks. Replace if necessary.



W2004956



W2006100

**4**

- Slide the oil pressure pipe into the oil pump and position the pipe flange to the cylinder block. Install the fasteners and tighten to specification.
- Position the oil pressure crossover pipe to the skirts of the cylinder block. Install the fasteners and tighten to specification.
- Assemble the oil strainer and oil pickup pipe. Slide the oil pickup pipe into the oil pump and position the oil strainer to the engine stiffening frame. Install the fasteners and tighten to specification.

**5**

Install the oil pan. Refer to service procedures in Group 22.

This Service Bulletin replaces bulletin 221-42 dated 9.2008.

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## Piston Cooling Nozzle, Replacement

B13R, PREVH, PREVX

### Piston Cooling Nozzle, Replacement

This information covers servicing the piston cooling nozzles on D13F and D13H engines.

**Note:** When the engine is running, there usually is a buildup of heat in the piston that, in some cases, requires extra cooling. The oil is then forced through the engine block drilled galleries into the piston cooling nozzles for piston cooling. There is one nozzle for each piston.

**Note:** To prevent the piston cooling nozzles from being damaged, always remove them before removing pistons and cylinder liners.

#### Contents

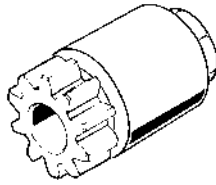
- "Special Tools", page 2
- "Piston Cooling Nozzle, Replacement", page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

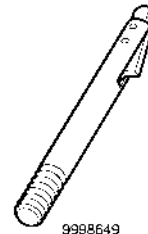
## Special Tools

For Special Tools ordering instructions, refer to Tool Information, group 08.



T0012612

**88800014**  
Flywheel Turning Tool



9998649

W2006137

**9998649**  
Stiffening Frame Tool



# Service Procedures

**2219-03-02-02**

## Piston Cooling Nozzle, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 88800014, 9998649*

### Removal

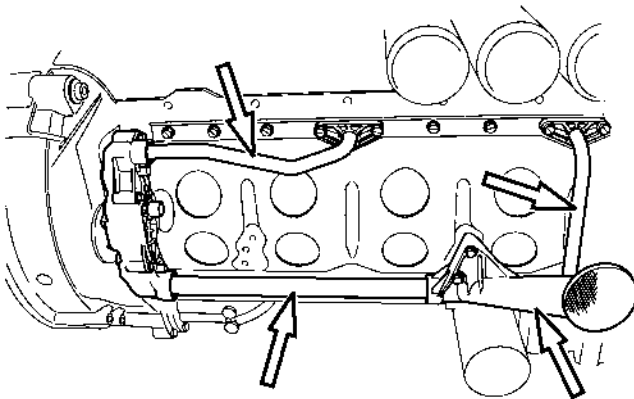
**1**

Remove the oil pan.

**Note:** Refer to Function Group 21 for removal of the oil pan.

**2**

Loosen and remove the fasteners securing the oil strainer to the engine stiffening frame. Remove the oil strainer and pickup (suction) tube. Slide the tube out of the oil pump.



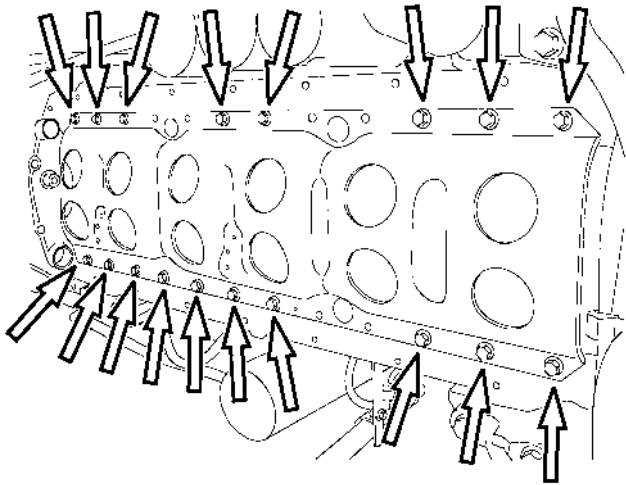
W2006100

**3**

Remove the fasteners securing the oil pressure crossover pipe to the skirt of the cylinder block. Remove the pipe.

**4**

Remove the fasteners securing the oil pressure pipe to the skirt of the cylinder block. Slide the pipe out of the oil pump.



W2006101

**5**

Remove the engine stiffening frame.

**! WARNING**

The engine stiffening frame has sharp edges which can cause injury. Wear protective gloves when handling.

**Note:** Special tool 9998649 can be used to support the stiffening frame during removal and installation. Remove a fastener from each side at the center of the engine stiffening frame and install the stiffening frame tools.

9998649

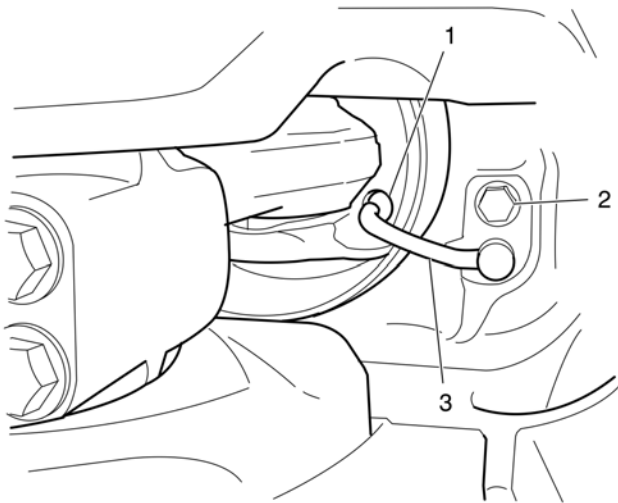
**6**

If needed, remove the plug from the flywheel housing and install the flywheel turning tool.

88800014

**7**

Turn the flywheel until the piston cooling nozzle is easily accessible.



W2005545

- 1 Piston Cooling Duct
- 2 Retaining Fastener
- 3 Spray Nozzle

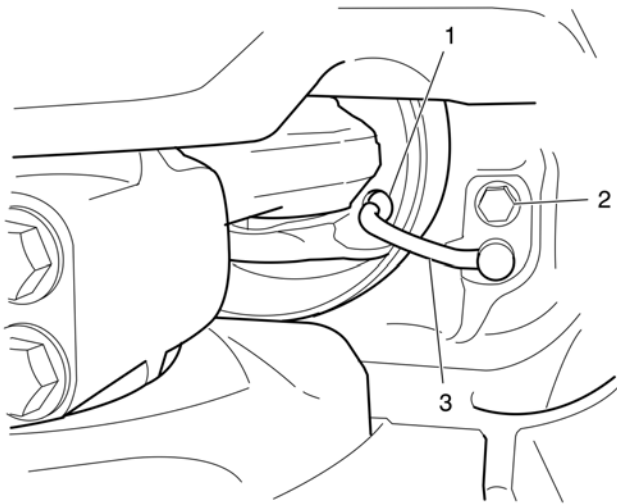
**8**

Remove the piston cooling nozzle retaining fastener.

**9**

Carefully pull the piston cooling nozzle from the cylinder block.

## Installation



W2005545

- 1 Piston Cooling Duct
- 2 Retaining Fastener
- 3 Spray Nozzle

**1**

Install the piston cooling nozzle, using a new retaining fastener. Tighten the fasteners to specification; refer to Function Group 200, Specifications.

**Note:** Any piston cooling nozzle suspected of damage must be replaced (this also applies to a new replacement nozzle). Always make sure the piston cooling nozzle fits correctly in its hole and the nozzle attachment plate is flush with the cylinder block.

**2**

Replace any other piston cooling nozzles as needed.

**3**

Install the engine stiffening frame, using new fasteners. Tighten the fasteners to specification; refer to Function Group 200, Specifications.

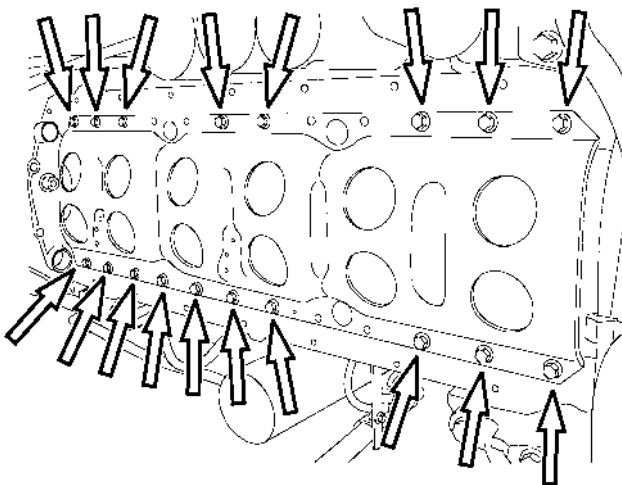
### **WARNING**

The engine stiffening frame has sharp edges which can cause injury. Wear protective gloves when handling.

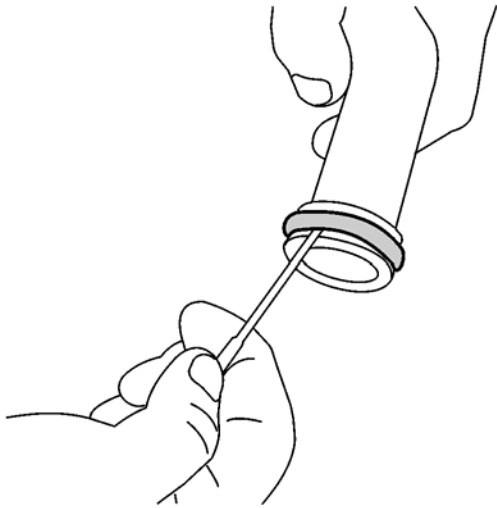
**Note:** Special tool 9998649 can be used to support the stiffening frame during removal and installation. Use the stiffening frame tools to support the frame while installing the new fasteners.

**Note:** The engine stiffening frame attaching bolts are ONE TIME USE ONLY. New bolts must be installed.

9998649



W2006101

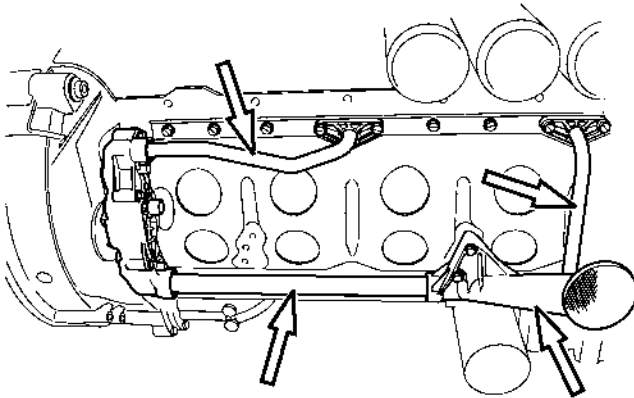


W2004956

**4**

Replace the oil pressure pipe, oil pickup pipe and oil crossover pipe O-rings. Lubricate the O-rings with engine oil before installation.

**Note:** Separate the oil suction pipe from the oil strainer as needed to replace that O-ring. Clean the oil strainer, suction pipe, crossover pipe and pressure pipe and inspect for cracks. Replace if necessary.



W2006100

**5**

Slide the oil pressure pipe into the oil pump and position the pipe flange to the cylinder block. Install the fasteners and tighten to specification; refer to Function Group 200, Specifications.

**6**

Position the oil pressure crossover pipe to the skirts of the cylinder block. Install the fasteners and tighten to specification; refer to Function Group 200, Specifications.

**7**

Assemble the oil strainer and oil pickup pipe. Slide the oil pickup pipe into the oil pump and position the oil strainer to the engine stiffening frame. Install the fasteners and tighten to specification; refer to Function Group 200, Specifications.

**8**

Install the oil pan.

**Note:** Refer to Function Group 21 for installation of the oil pan.

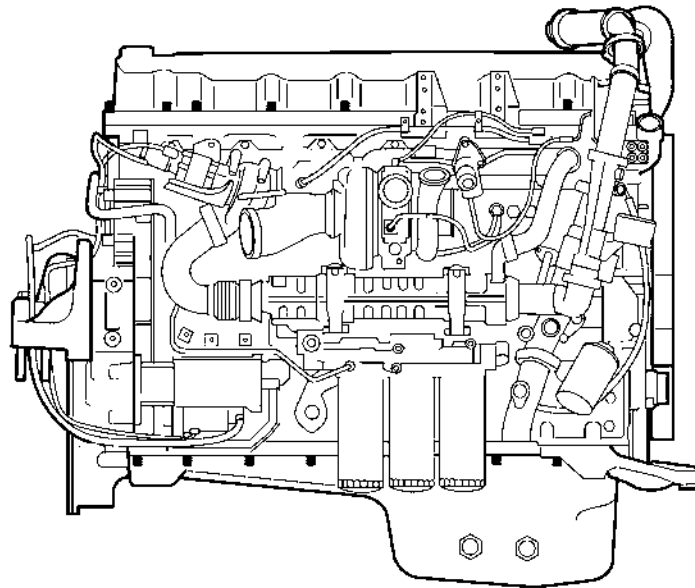
This Service Bulletin replaces SB 222-02,  
dated 4.2009, and SB 222-100, dated 2.2008.

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Oil Filter Housing, Replacement

D13F, D13H

## Oil Filter Housing, Replacement



W2005779

This information covers replacement of the oil filter housing on VOLVO buses equipped with the D13F and D13H engines.

### Contents

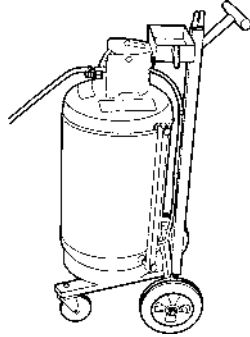
- “Special Tools”, page 2
- “Oil Filter Housing, Replacement”, page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

## Special Tools

For special tools ordering instructions, refer to Tool Information, Group 08.



W2004191

**85112740**  
Coolant Extractor



# Service Procedures

**2222-03-02-01**

## Oil Filter Housing, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 85112740*

### Removal

**1**

Apply the parking brake and place the shift lever in neutral.

**2**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**3**

Open the engine compartment door, connect the coolant extractor, and drain the coolant.

#### **DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

---

85112740

**4**

Unlatch and remove the left rear wheel skirt.

**5**

Remove the access panel behind the left rear wheel.

**6**

Open the side compartment door to access the coolant package.

**7**

Remove the coolant package, refer to Function Group 261.

**8**

Remove the upper radiator coolant pipe with the bracket attached.

**9**

Remove the exhaust pipe clamp at the diffuser and the one clamp before the aftertreatment diesel particulate filter (DPF). Remove the exhaust pipe as an assembly with the mounting clamps and brackets attached.

**10**

Remove the upper exhaust pipe mounting bracket.

**11**

Disconnect the intake air temperature (IAT) sensor wiring harness connector. Remove the clamp securing the sensor harness to the intake air pipe.

**12**

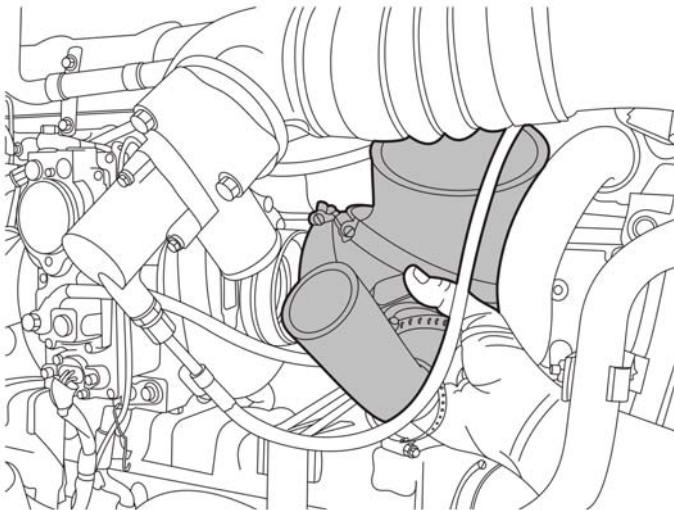
Remove the clamp and disconnect the air compressor intake air hose from the main intake air pipe.

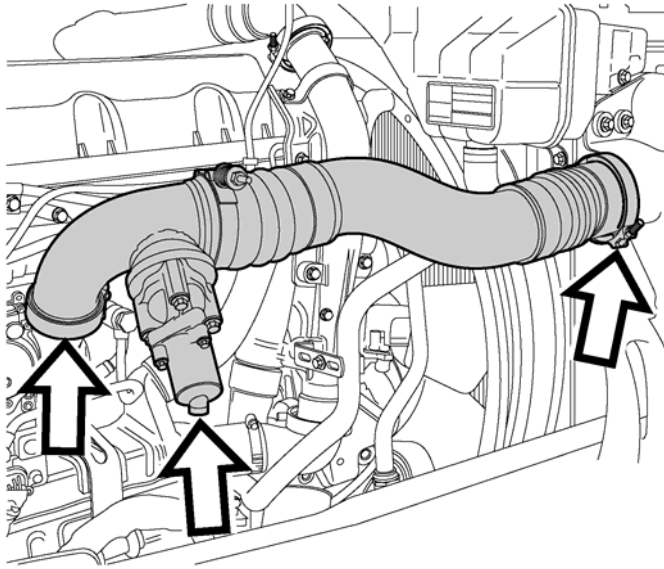
**13**

Remove the clamps securing the main intake air pipe to the air cleaner housing and to the turbocharger air inlet elbow. Remove the intake air pipe.

**14**

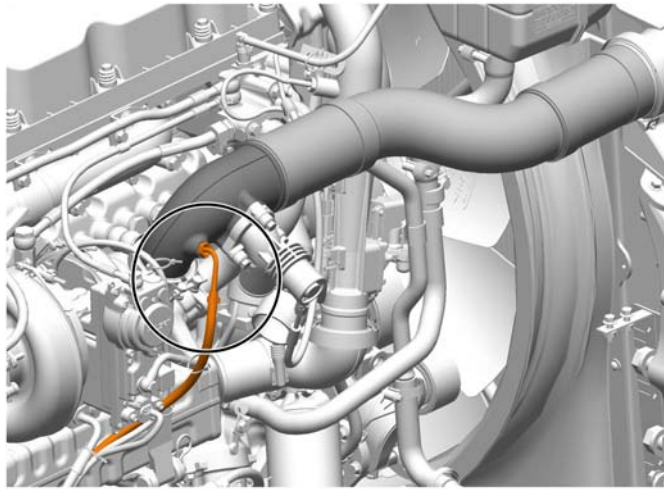
Loosen the clamp and disconnect the inlet elbow bypass hose from the engine turbocharger compressor bypass valve. Loosen the inlet elbow clamp at the turbocharger and remove the inlet elbow.





W2006107

D13F Engine Shown

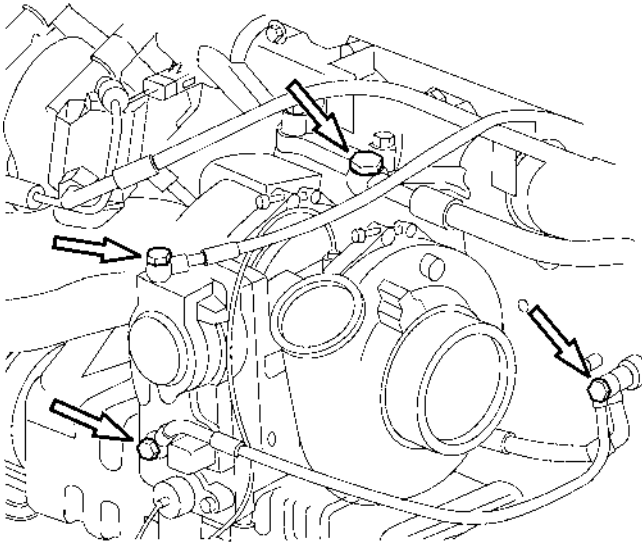


W2036541

D13H Engine Shown

**15**

Remove the air supply line from the bypass valve. On D13H engines, disconnect the engine turbocharger compressor outlet temperature sensor located in the elbow at the turbocharger end of the pipe. Loosen the hose clamps and remove the charge air cooler (CAC) inlet pipe (turbocharger-to-CAC).

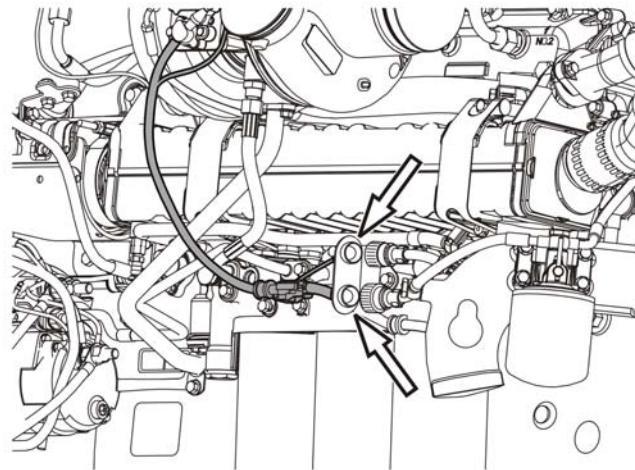


W2005965

**16**

Disconnect all coolant supply and coolant return lines from the turbocharger and turbocharger actuator.

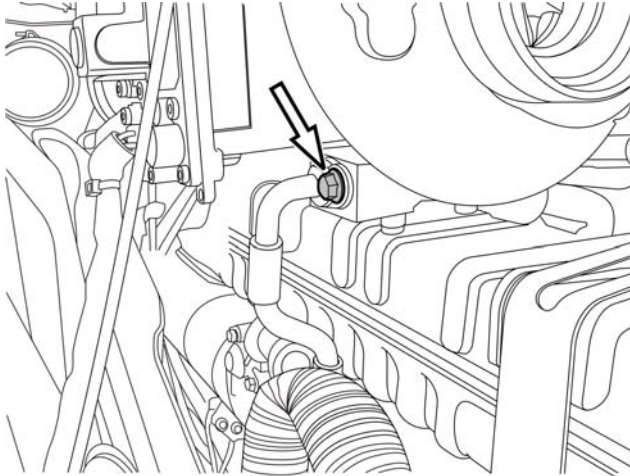
**Note:** Remove the lower return line from the cylinder block.



W2005620

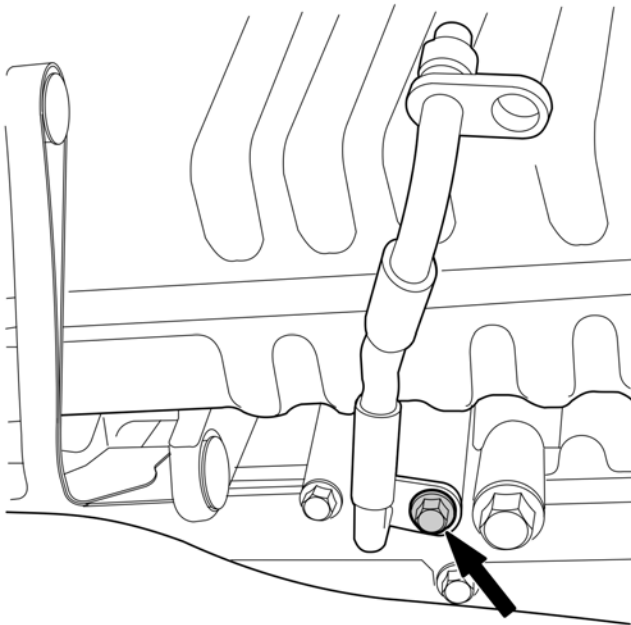
**17**

Disconnect the turbocharger actuator harness and wheel speed sensor leads at the engine harness connector bracket. Cut and remove all tie straps.



W2005966

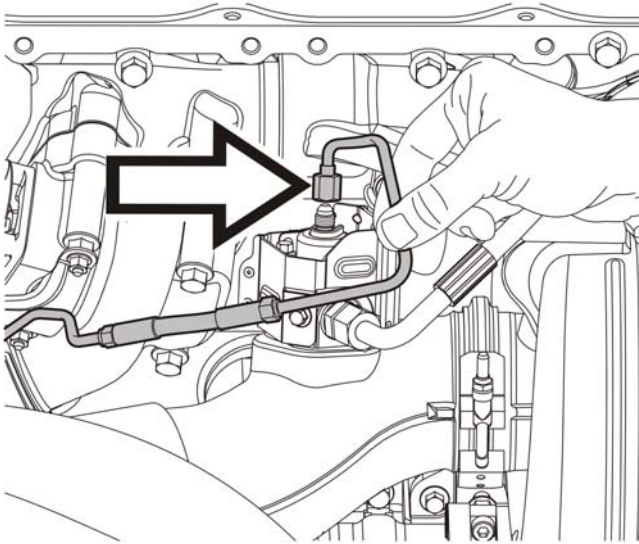
- 18**  
Disconnect the oil supply line at the turbocharger.



W2005969

- 19**  
Remove the turbocharger oil supply line from the oil filter housing.

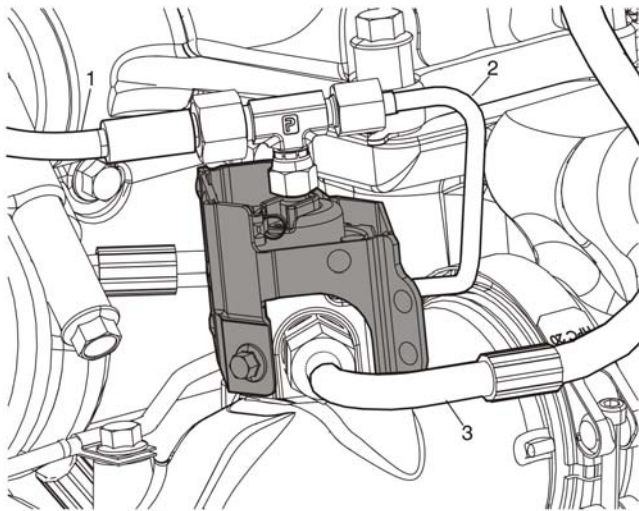
- 20**  
Disconnect the aftertreatment hydrocarbon doser connector from the engine wiring harness. Remove the harness clamp and tie straps. Allow the harness to hang free.



W2005951

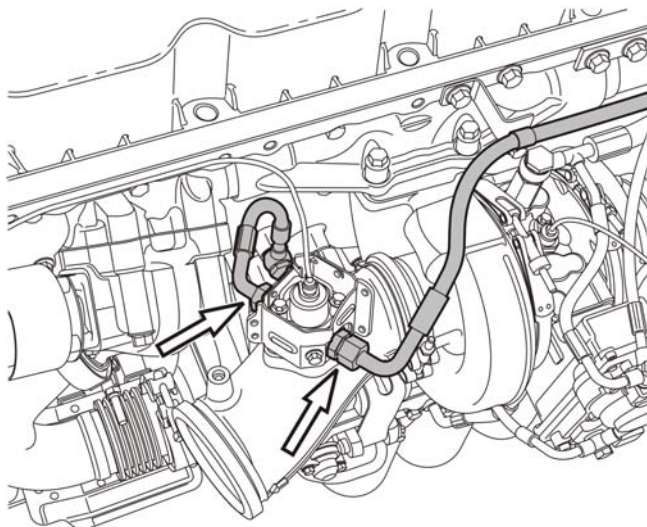
**21**

If the doser is not equipped with a two-way check valve, disconnect the fuel supply line from the aftertreatment hydrocarbon doser. Collect any residual fuel that may be in the fuel line in a suitable container. If the doser is equipped with a two-way check valve, disconnect the two-way check valve from the aftertreatment hydrocarbon doser.



W2006759

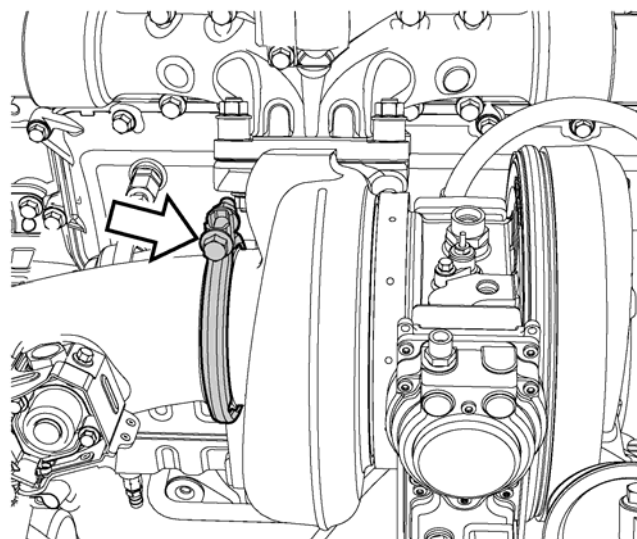
- 1 Air Line
- 2 Fuel Line
- 3 Coolant Line.



W2005925

**22**

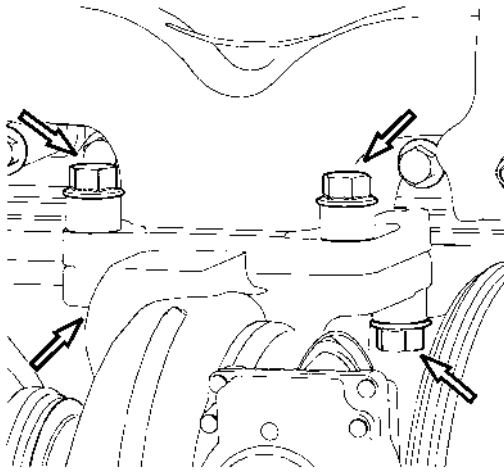
Disconnect the coolant lines from the aftertreatment hydrocarbon doser fittings.



W2006136

**23**

Note the diffuser alignment. Loosen the V-band clamp at the turbocharger and remove the diffuser pipe.



W2006064

**24**

Remove the turbocharger mounting fasteners and spacers.

**25**

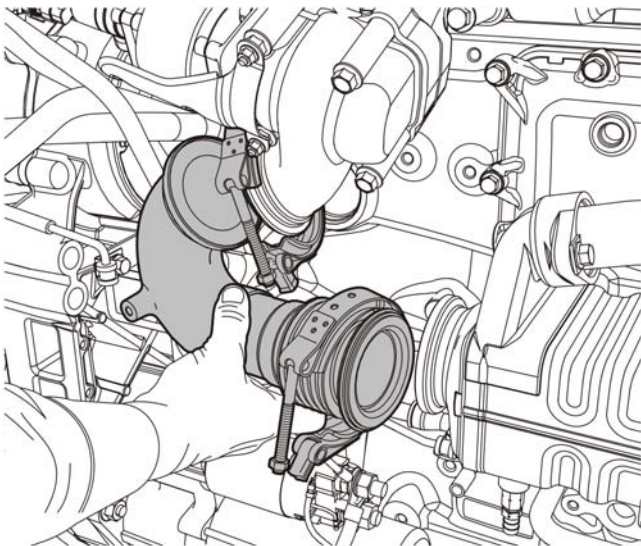
Remove the turbocharger from the exhaust manifold.

**26**

Remove the exhaust gas recirculation (EGR) hot pipe lower exhaust support bracket.

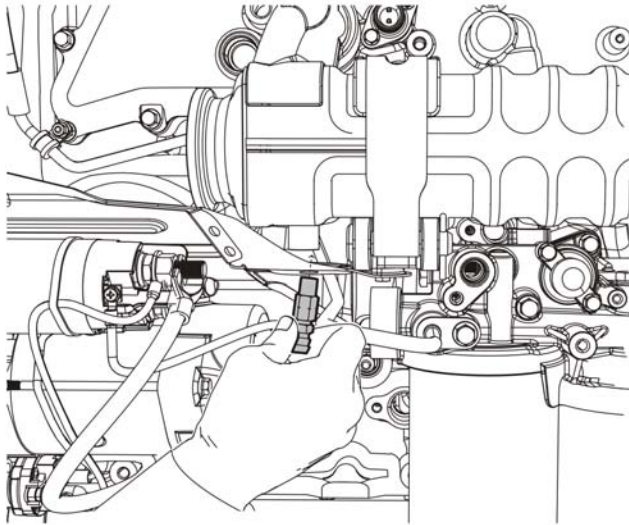
**27**

Remove the V-band clamps retaining the EGR hot pipe and remove the pipe.



W2005641





W2005716

**28**

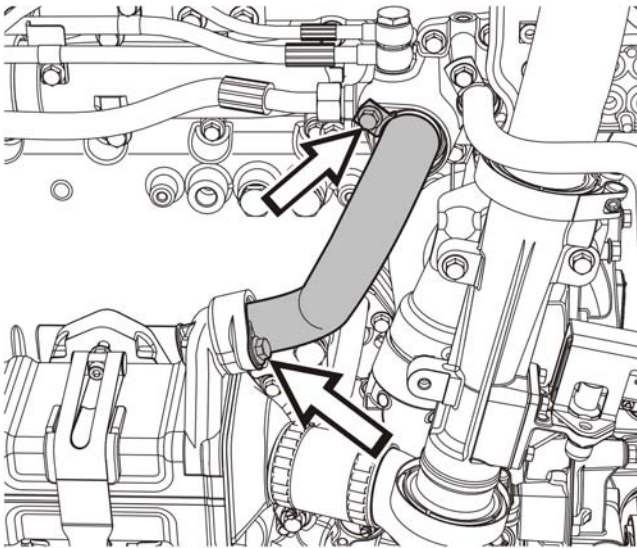
Place a suitable drain pan under the EGR cooler. Open the drain fitting and allow the coolant to drain from the cooler. Remove the EGR cooler drain fitting.

**29**

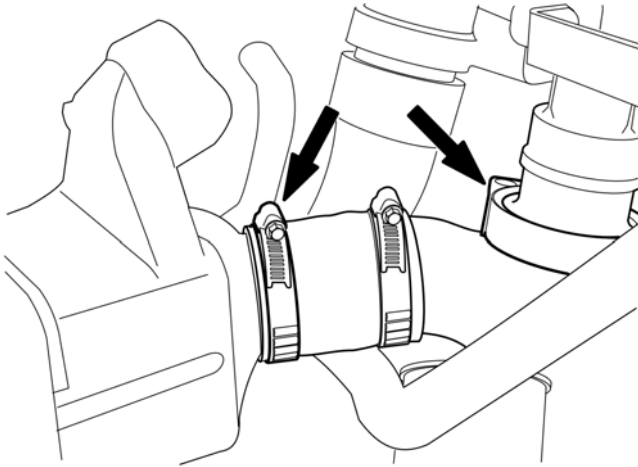
If necessary, remove the upper transmission coolant pipe.

**30**

Remove the fasteners and retainer clips securing the EGR cooler coolant pipe. Remove the coolant pipe.



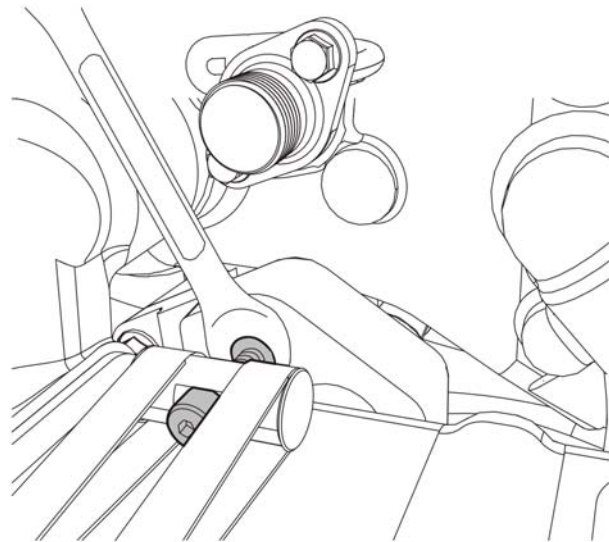
W2005967



W2005968

**31**

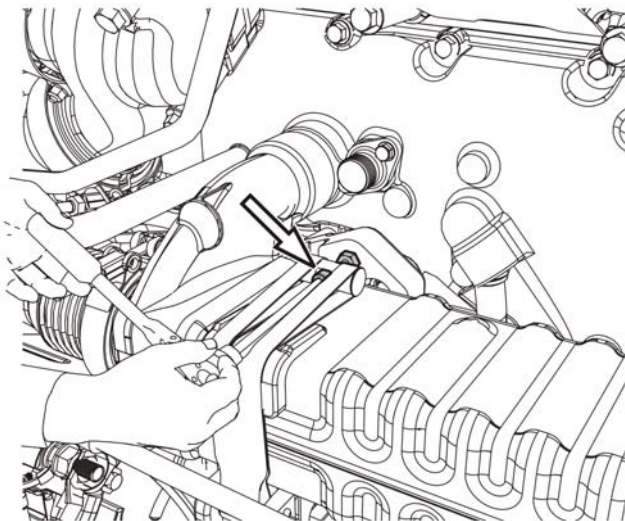
Remove the V-band clamp from the venturi inlet elbow. Loosen the clamp and remove the EGR hose and pipe located between the EGR cooler and the venturi.



W2005752

**32**

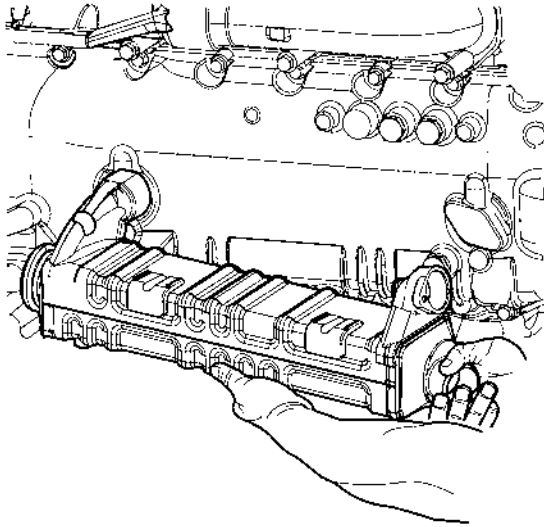
Loosen the nut and T-bolt on each EGR cooler clamp strap.



W2005751

**33**

Remove the fasteners securing the retaining straps to the EGR mounting brackets. Rotate the straps back out of the way.



W2005970

**34**

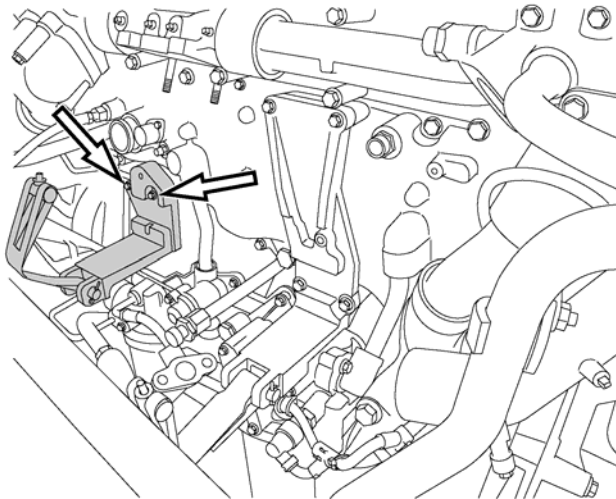
Remove the EGR cooler from the mounting brackets.

**35**

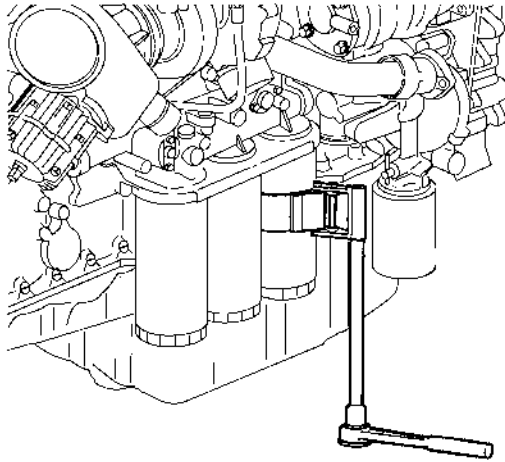
Remove the support bracket for the transmission coolant pipes that wraps around the oil filter housing.

**36**

Remove the fasteners securing the EGR cooler rear bracket to the engine oil cooler cover and the cylinder block. Remove the bracket from the engine.



W2006180

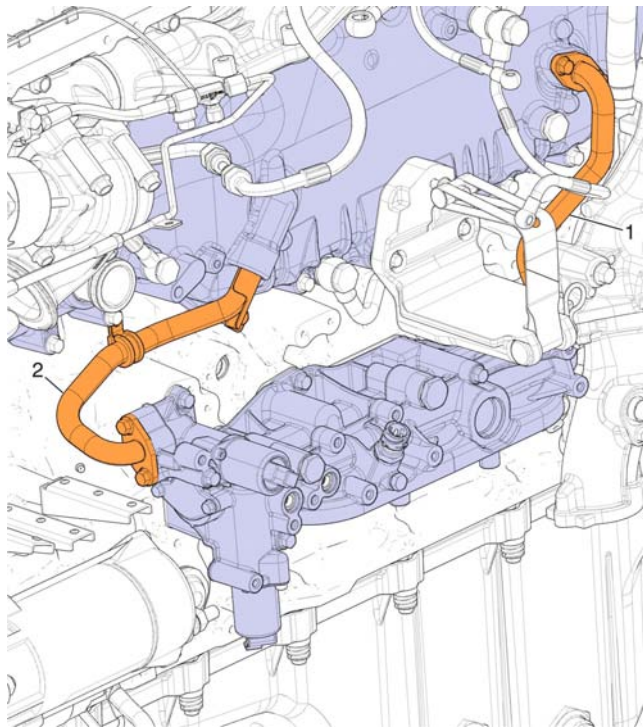


W2005876

**37**

Clean around the oil filter housing. Remove the oil filters using the oil filter wrench or oil filter socket.

**Note:** Place a suitable container below the filters to catch any oil.



W2059284

**38**

Mark the orientation of the inlet and outlet oil cooler tubes for reassembly.

D13H Engine Shown

- 1 Oil Cooler Outlet Tube
- 2 Oil Cooler Inlet Tube

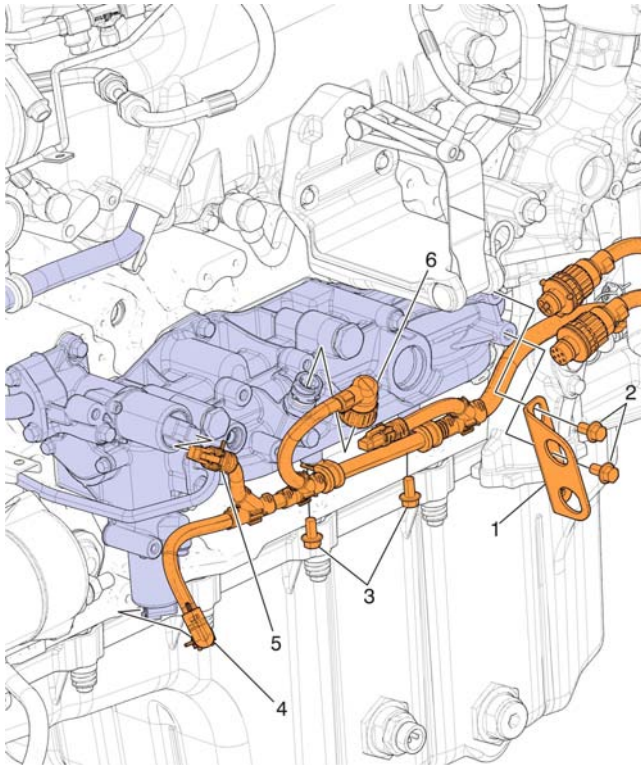


W2059286

D13H Engine Shown

- 1 Oil Cooler Inlet Tube
- 2 Bracket
- 3 Fastener
- 4 Fastener
- 5 Seal
- 6 Oil Cooler Outlet Tube
- 7 Seal
- 8 Fastener
- 9 Fastener

**39**  
Remove the inlet and outlet tubes from the engine oil cooler cover and the oil filter housing.



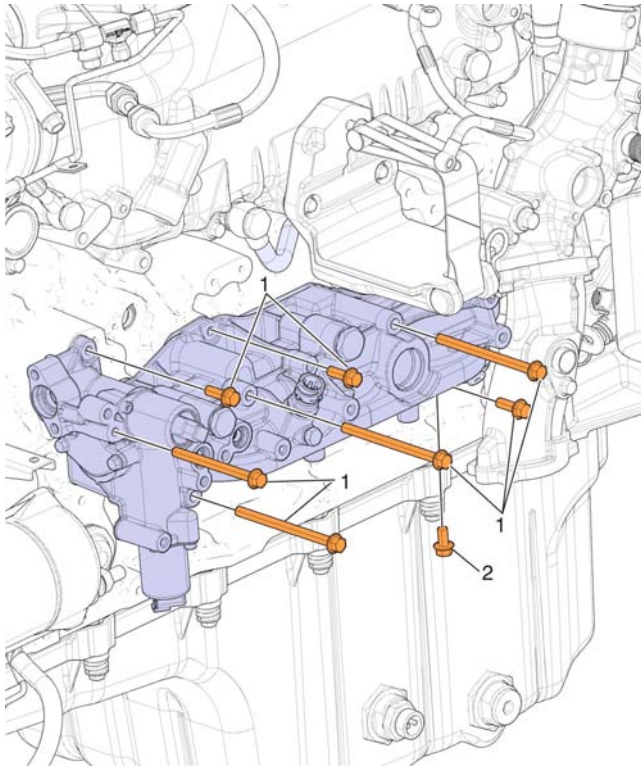
W2059282

**40**

On D13H engines, disconnect the wiring harness from the sensors and solenoids on the oil filter housing. Remove the fasteners securing the wiring harness P-clamps and engine harness connector bracket to the oil filter housing.

**D13H Engine Shown**

- 1 Engine Harness Connector Bracket
- 2 Fastener
- 3 Fastener
- 4 Engine Piston Cooling Oil Supply Valve Wiring Harness Connector
- 5 Oil Cooler Thermostat Control Solenoid Wiring Harness Connector
- 6 Engine Piston Cooling Oil Pressure Sensor Wiring Harness Connector.



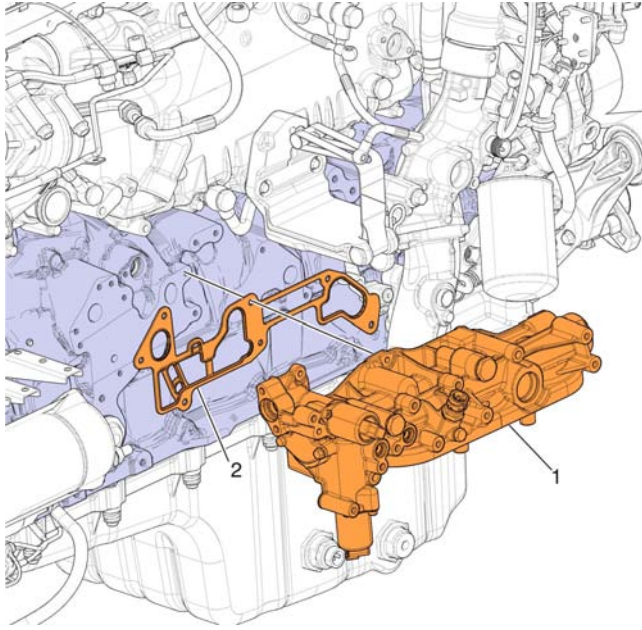
W2059283

D13H Engine Shown

- 1 Fastener
- 2 Fastener

**41**

Remove the oil filter housing mounting fasteners.



W2059285

D13H Engine Shown

- 1 Oil Filter Housing
- 2 Oil Filter Housing Gasket

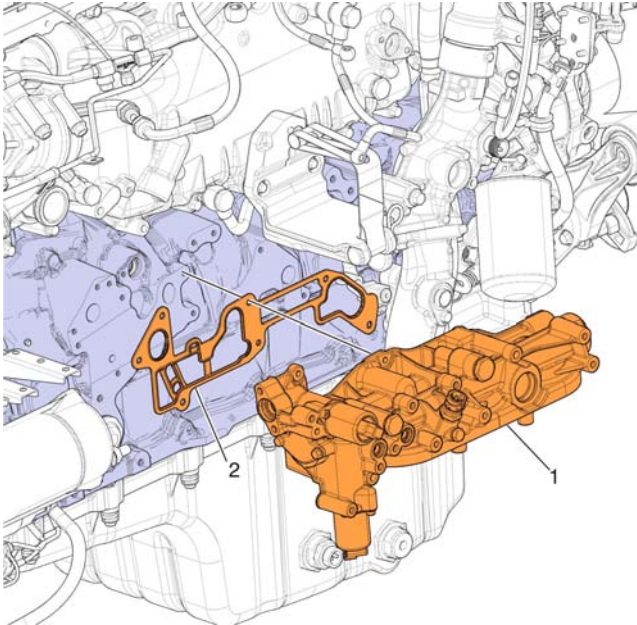
**42**

Remove the oil filter housing from the engine. Remove the filter housing gasket and discard.



## Installation

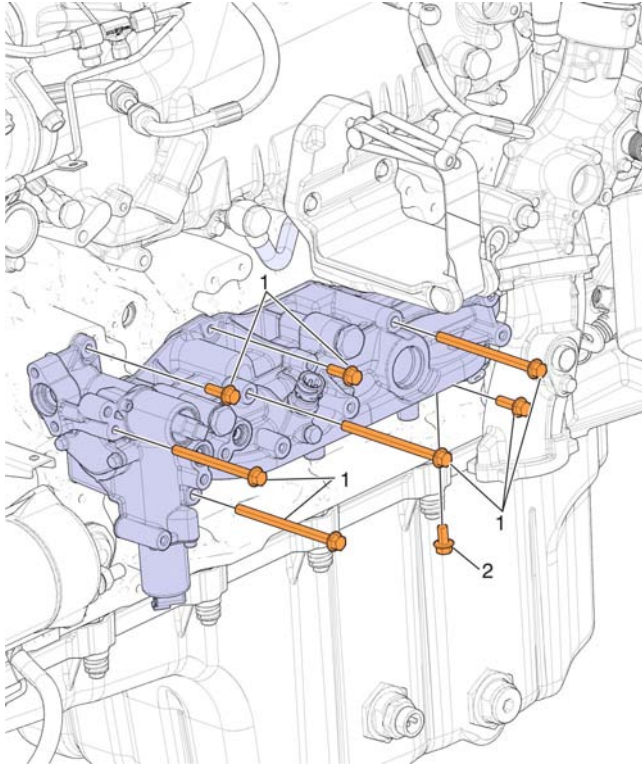
- 1**  
Clean the mounting surfaces of the oil filter housing and the cylinder block.
- 2**  
Install alignment pins to hold the oil filter housing gasket in place during installation.
- 3**  
Using a new gasket, position the oil filter housing on the cylinder block.



W2059285

D13H Engine Shown

- 1 Oil Filter Housing
- 2 Oil Filter Housing Gasket

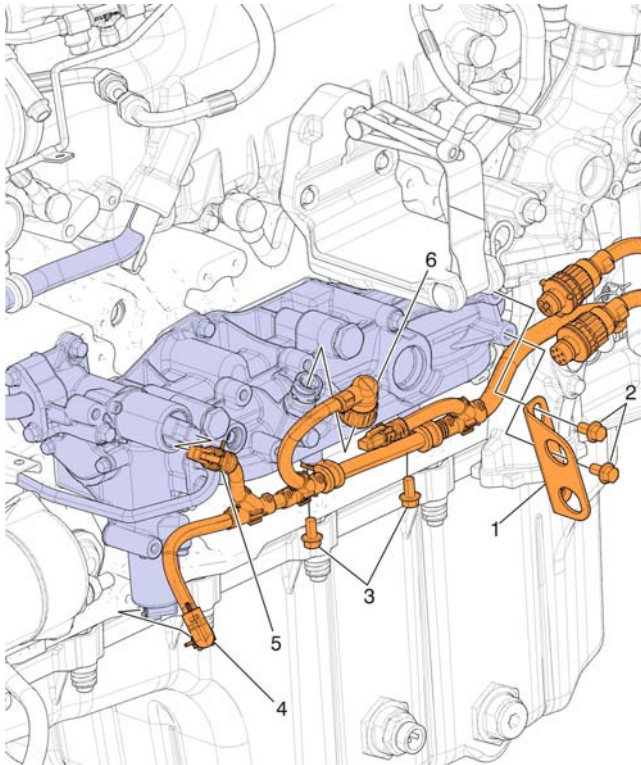


W2059283

D13H Engine Shown

- 1 Fastener
- 2 Fastener

**4**  
Install the oil filter housing mounting fasteners. Remove the alignment pins and install the remaining fasteners. Tighten the mounting fasteners to specification, refer to Function Group 20, Specifications.



W2059282

**5**

On D13H engines, reconnect the wiring harness to the sensors and solenoids on the oil filter housing. Install the fasteners securing the wiring harness P-clamps and engine harness connector bracket to the oil filter housing.

**D13H Engine Shown**

- 1 Engine Harness Connector Bracket
- 2 Fastener
- 3 Fastener
- 4 Engine Piston Cooling Oil Supply Valve Wiring Harness Connector
- 5 Oil Cooler Thermostat Control Solenoid Wiring Harness Connector
- 6 Engine Piston Cooling Oil Pressure Sensor Wiring Harness Connector.



W2059286

D13H Engine Shown

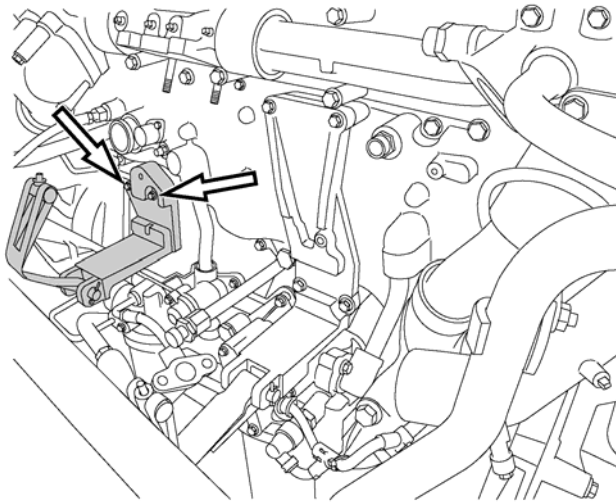
- 1 Oil Cooler Inlet Tube
- 2 Bracket
- 3 Fastener
- 4 Fastener
- 5 Seal
- 6 Oil Cooler Outlet Tube
- 7 Seal
- 8 Fastener
- 9 Fastener

**6**

Remove the old seals from the oil cooler inlet and outlet tubes. Lubricate and install new oil tube seals. Install the oil tubes to the ports on the oil cooler cover and to the oil filter housing. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**7**

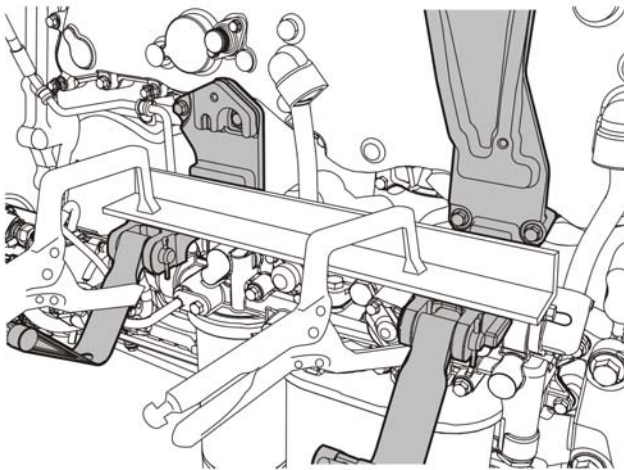
If necessary, install the support bracket for the transmission coolant pipes that wraps around the oil filter housing.



W2006180

**8**

Place the EGR cooler rear bracket in position over the engine oil cooler cover and the cylinder block. Loosely install the mounting bolts. Do not tighten at this time.



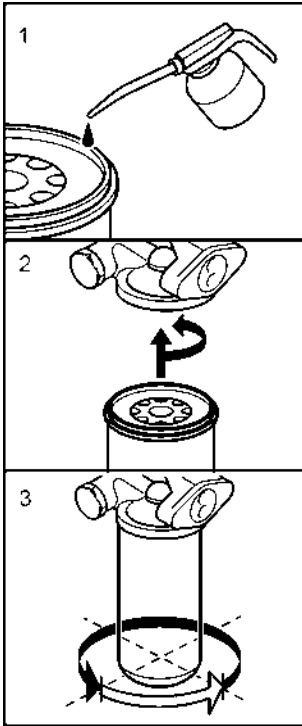
W2005715

**9**

Place a straightedge across the cooler mounting pads of the EGR cooler brackets and clamp the straightedge in place on the pads.

**10**

Tighten the bracket mounting bolts to specification, refer to Function Group 20, Specifications. Remove the clamps and straight edge.



C2002835

**11**

Fill new oil filters with clean engine oil. Lubricate the filter gaskets with oil (1). Hand-tighten the filters until they contact the face of the oil filter housing (2). Manually tighten the oil filter an additional 3/4 to 1 full turn (3).

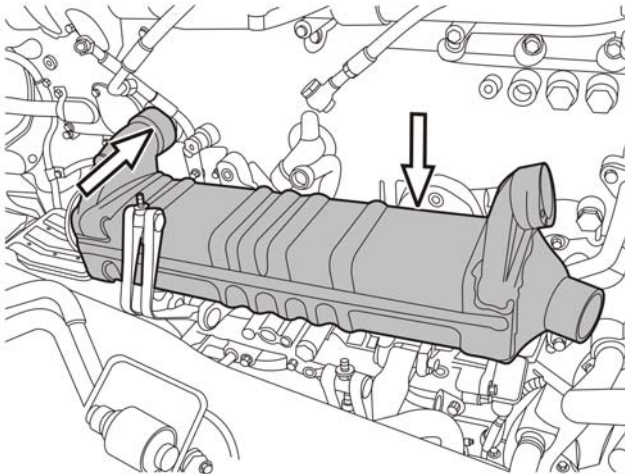
**12**

Lubricate and install new EGR cooler coolant O-rings.

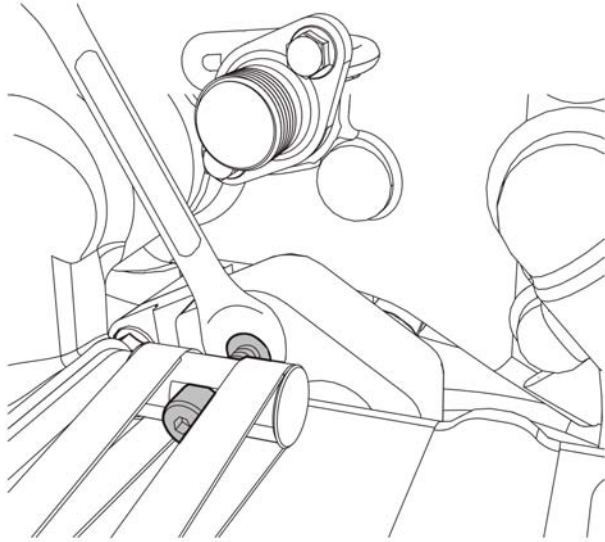
**13**

Place the EGR cooler in position on the mounting brackets. Align the EGR cooler with the cooler return port and engage the cooler.

**Note:** The alignment pin at the bottom of the cooler must fall into the groove on the front bracket.



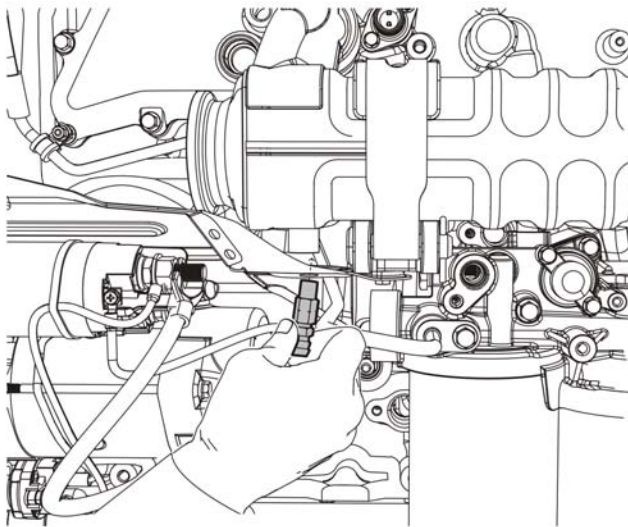
W2005971



W2005752

**14**

Rotate the retaining straps into position. Tighten the fasteners and jam nuts to specification, refer to Function Group 20, Specifications.



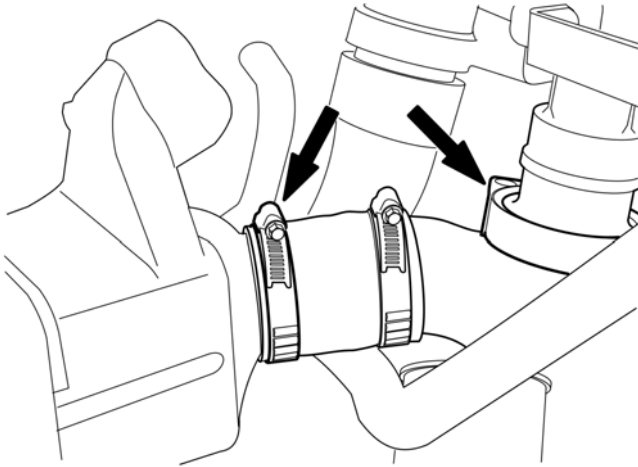
W2005716

**15**

Install the EGR cooler drain fitting. Tighten to specification, refer to Function Group 20, Specifications.

**16**

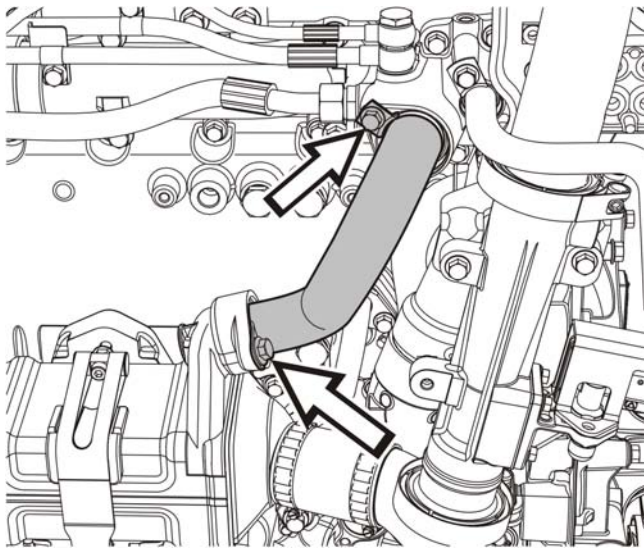
Replace the hose and O-ring on the pipe that connects the EGR cooler outlet to the venturi.



W2005968

**17**

Position the pipe with a new hose attached to the EGR cooler outlet. Tighten the V-band clamps at the venturi and hose clamps securely.



W2005967

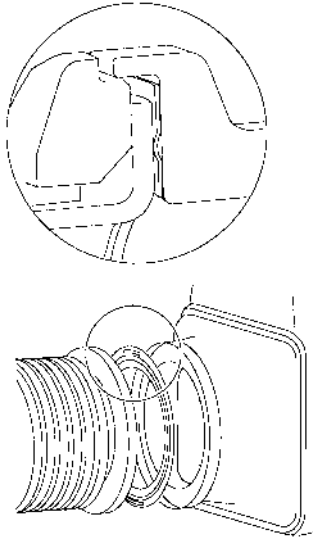
**18**

Lubricate and install new O-rings on the EGR cooler coolant pipe. Position pipe on the engine. Install the retainer clips with fasteners and tighten to specification, refer to Function Group 20, Specifications.

**19**

If necessary, install the upper transmission coolant pipe.





W2006187

**20**

Install new gaskets into the EGR valve end of the hot pipe and into the inlet of the EGR cooler. Make sure the gaskets lay flat against the flange surfaces with the bead of the gaskets facing toward the hot pipe.

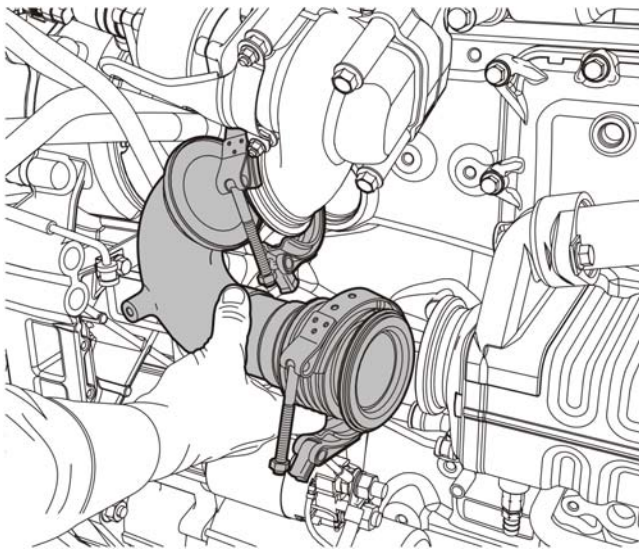
**Note:** These gaskets are one time use only. Do not reuse the gaskets.

**21**

Inspect the V-band clamps and T-bolt threads for wear or damage and replace if necessary. If they are OK, apply anti-seize compound to the T-bolt threads. Lubricate the V-inserts of the clamps.

**22**

Hook the upper V-band clamp over the EGR valve flange. Place the lower V-band clamp over the bellows on the hot pipe.



W2005641

**23**

Lubricate the flange on the EGR cooler inlet and the flange on the EGR hot pipe with engine oil. Lubrication aids in V-band clamp installation.

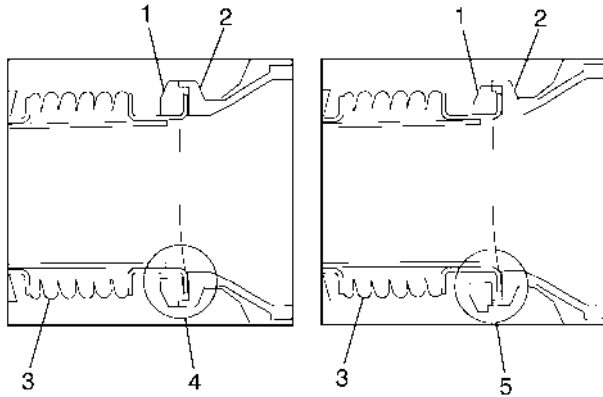
**24**

Position the EGR hot pipe between the EGR valve and the EGR cooler. Make sure the flanges engage properly. While holding the hot pipe in position, slide the upper V-band clamp over the flanges and tighten until snug. Slide the lower V-band clamp over the flange of the EGR cooler and tighten until snug.

**25**

Visually inspect the floating flange through the gap in the V-band clamp to make sure it is properly seated in the EGR cooler flange. The floating flange must be concentric with the EGR cooler flange.

**Note:** If the floating flange is not properly seated in the EGR cooler flange, the gasket will not be compressed and the seal will leak.



W2006163

- 1 EGR Pipe Floating Flange
- 2 EGR Cooler Flange
- 3 EGR Pipe
- 4 Flange Assembled Correctly
- 5 Flange Assembled Incorrectly

**26**

Position the V-band clamps so that the T-bolts clear the heat shield. Tighten the clamps to specification, refer to Function Group 20, Specifications.

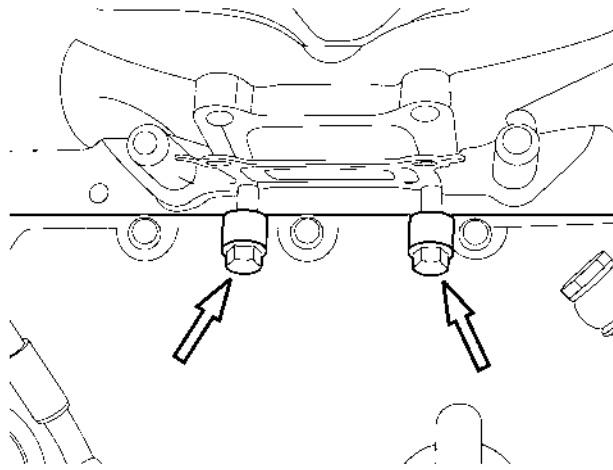
**Note:** After reaching the specified torque, inspect the V-band clamps to make sure that no portion of the clamps has bottomed out.

**27**

Install the EGR hot pipe lower exhaust support bracket.

**28**

Clean the mounting surfaces of the turbocharger and the exhaust manifold.



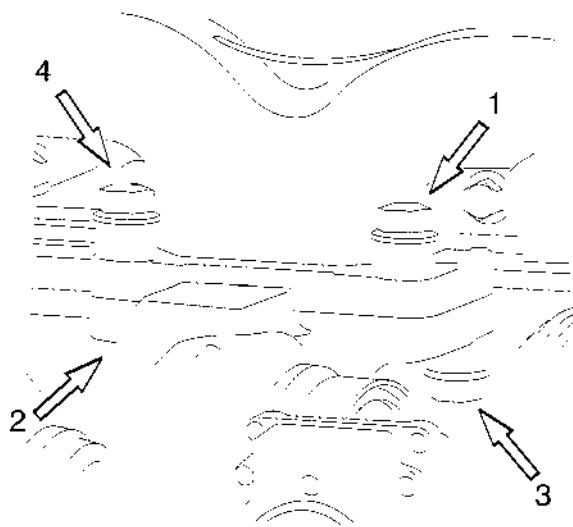
W2006720

**29**

Install a new turbocharger gasket and the rear mounting flange screws and spacers on the exhaust manifold.

**Note:** Apply anti-seize compound to the threads and under the heads or contact surfaces of the fasteners. Anti-seize helps prevent fastener oxidation corrosion and reduces friction to help achieve the intended clamp load on the component when tightening the fasteners to specification.

**Note:** Make sure to use the correct turbocharger gasket designated for the D13F and D13H engines only.

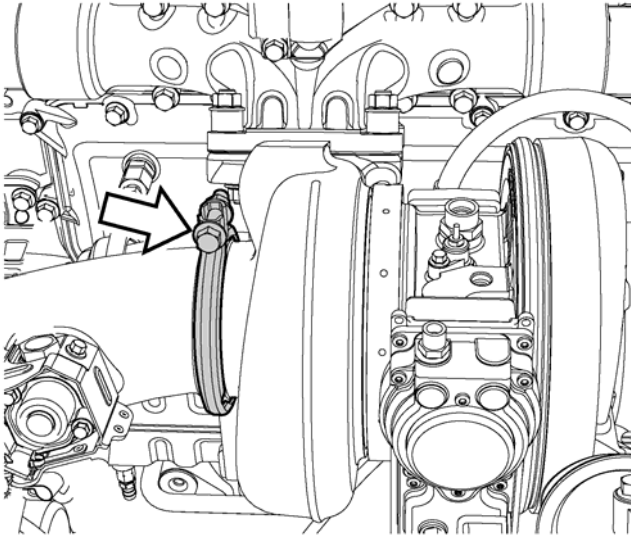


W2006721

**30**

Using new sealing rings, insert the turbocharger oil return line into the turbocharger. Position the turbocharger on the flange screws of the exhaust manifold. The turbocharger flange slots slide onto the manifold studs. Install the remaining turbocharger mounting flange screws and spacers. Tighten the fasteners to specification in the sequence shown, refer to Group 20, Specifications.

**Note:** Apply anti-seize compound to the threads and under the heads or contact surfaces of the fasteners. Anti-seize helps prevent fastener oxidation corrosion and reduces friction to help achieve the intended clamp load on the component when tightening the fasteners to specification.



W2006136

**31**

Position the diffuser against the turbocharger and loosely install a new V-band clamp.

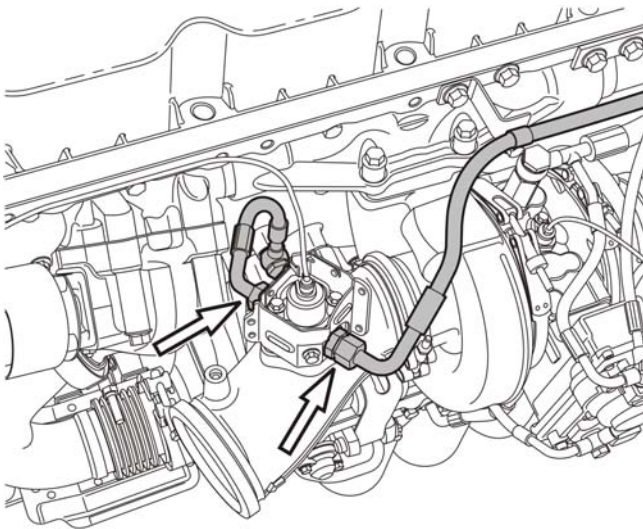
**Note:** The diffuser V-band clamp is a one-time-use clamp.

**32**

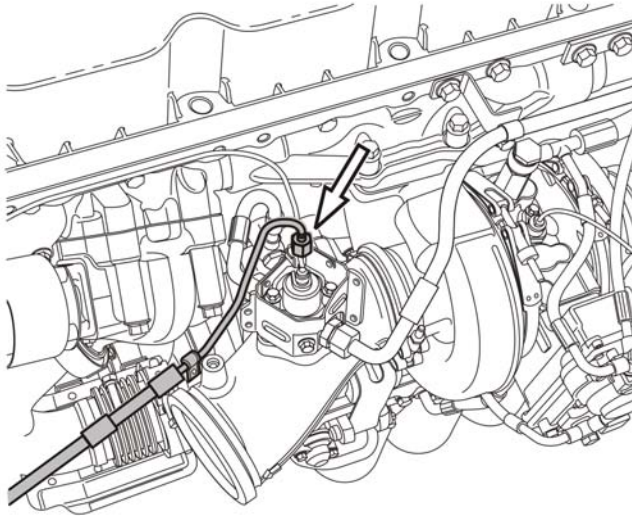
Connect the aftertreatment hydrocarbon doser wiring harness connector. Secure the harness with the clips and tie straps.

**33**

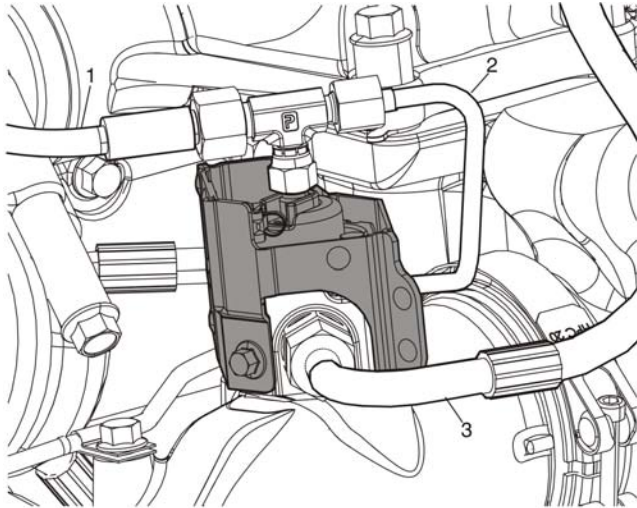
Connect the aftertreatment hydrocarbon doser coolant lines and tighten to specification, refer to Function Group 20, Specifications.



W2005925



W2005926

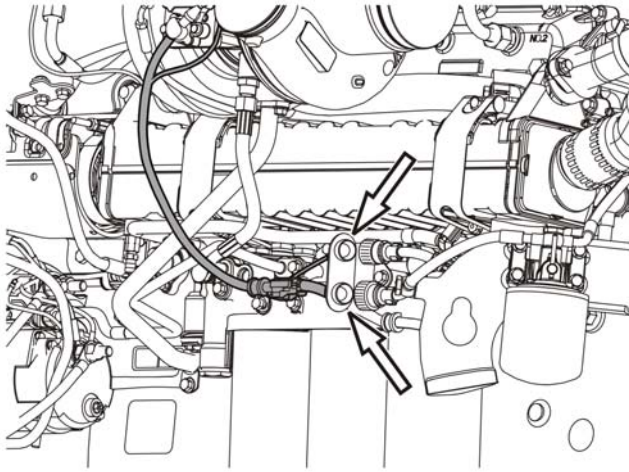


W2006759

- 1 Air Line
- 2 Fuel Line
- 3 Coolant Line.

**34**

If the aftertreatment hydrocarbon doser is not equipped with a two-way check valve, install the doser fuel line and tighten to specification, refer to Function Group 20, Specifications. Install the clamp bracket to secure the fuel line to the diffuser. If the doser is equipped with a two-way check valve, connect the two-way check valve to the doser.



W2005620

**35**

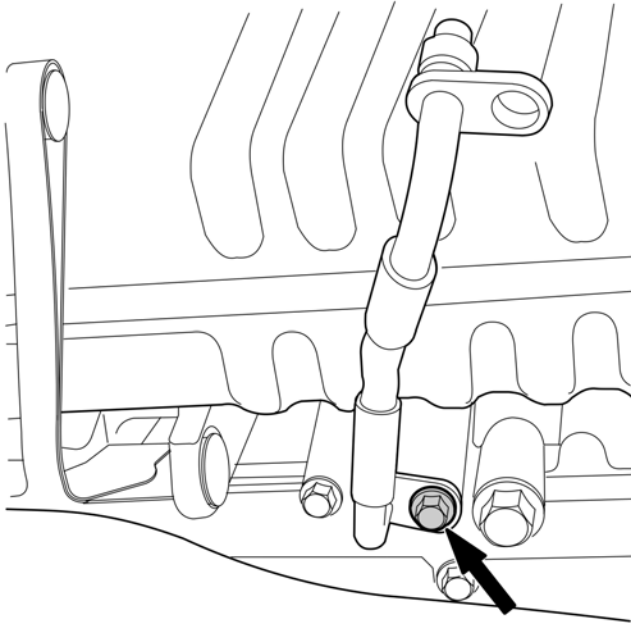
Connect the turbocharger actuator and wheel speed sensor wiring harness. Position the connector with the flat side toward the flat in the bracket. Secure the harness to the oil filter housing using a P-clamp.



W2056887

**36**

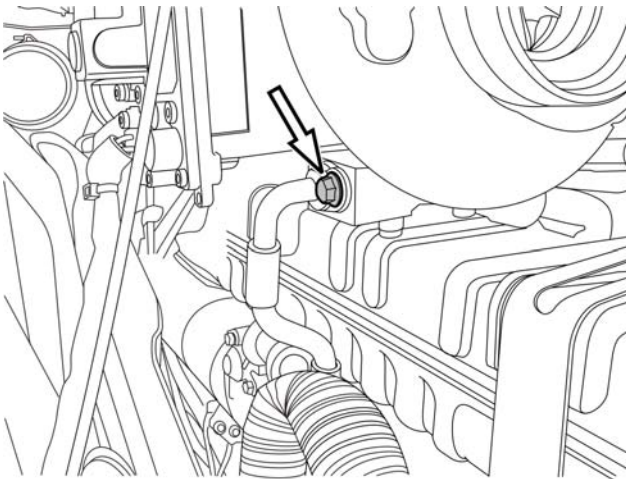
Install the tie straps as shown to secure the harness.



W2005969

**37**

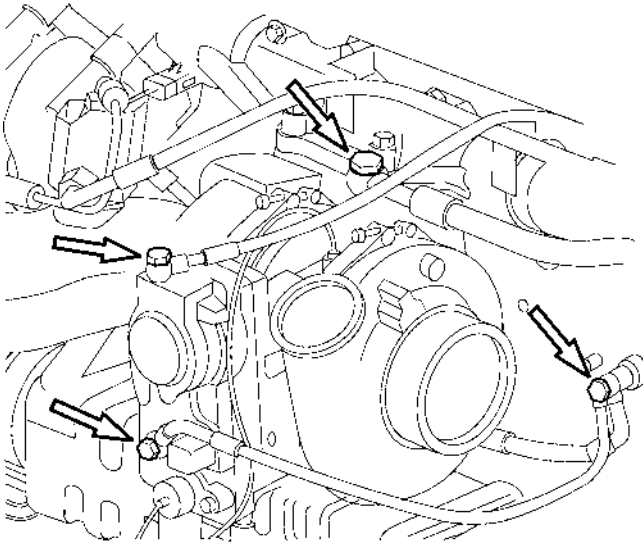
Replace and lubricate the turbocharger oil feed line O-rings. Connect the turbocharger oil feed line to the port on the oil filter housing.



W2005966

**38**

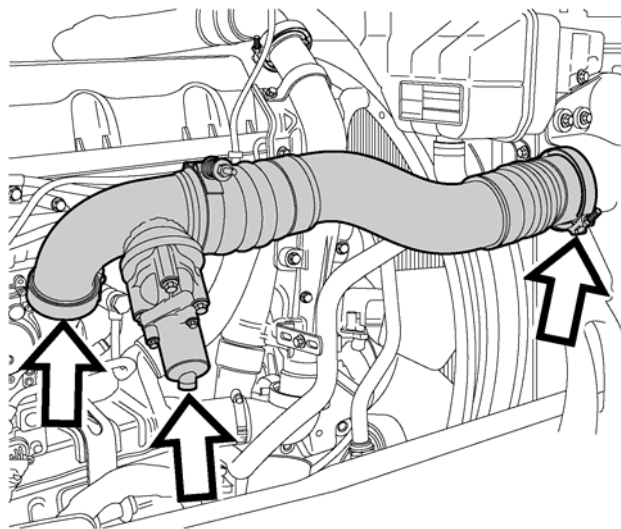
Install the fastener securing the turbocharger oil feed line to the turbocharger. Tighten the fastener to specification, refer to Group 20, Specifications.



W2005965

**39**

Replace all sealing washers used on the banjo fittings for the turbocharger and turbocharger actuator. Connect all coolant supply and return lines to the turbocharger and turbocharger actuator. Connect the turbocharger coolant line to the cylinder block.



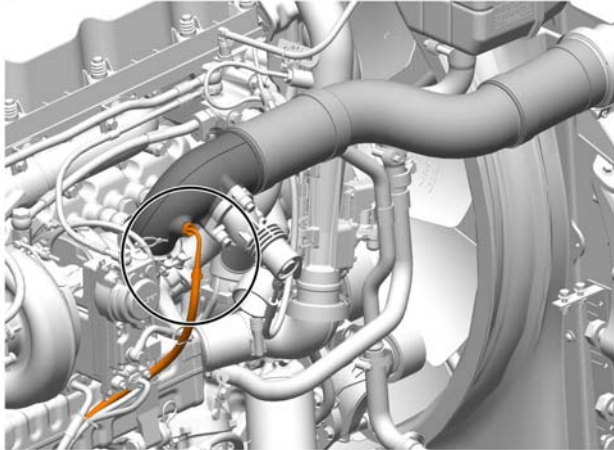
W2006107

**40**

Install new O-rings at the ends of the charge air cooler inlet pipe assembly. Inspect and lubricate the V-band clamps, lubricate the T-bolts and V-inserts, and install the pipe assembly. Tighten the clamps to specification, refer to Function Group 20, Specifications.

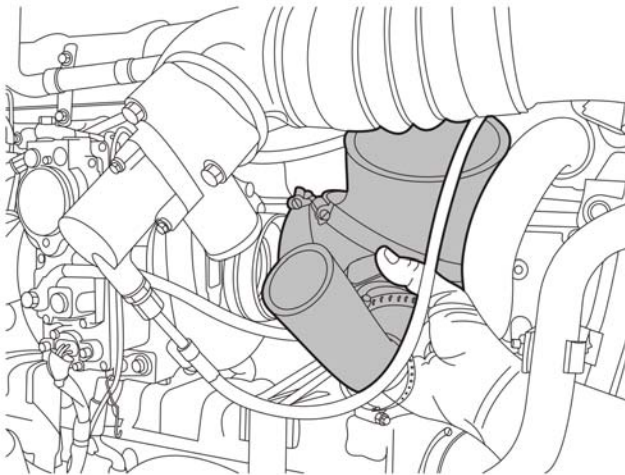
D13F Engine Shown





W2036541

D13H Engine Shown



W2005973

**41**

Connect the air line to the bypass valve. On D13H engines, reconnect the engine turbocharger outlet temperature sensor wiring harness (located in the elbow at the turbocharger end of the pipe).

**42**

Install the intake air inlet elbow on the turbocharger and bypass valve. Do not tighten the clamps at this time.

**43**

Install the intake air inlet elbow as an assembly. Install the inlet elbow bypass valve hose clamp at the valve. Install the inlet elbow clamp at the turbocharger. Connect the air supply line to the bypass valve and secure the support clamp to the pipe.

**44**

Install the intake air pipe. Install and tighten the clamps securing the main intake air pipe to the air cleaner housing, turbocharger air inlet elbow and at the bypass valve.

**45**

Install the air compressor intake air hose to the main intake air pipe, position the clamp and tighten to secure.

**46**

Install the IAT wiring harness connector to the sensor.  
Install the sensor harness clamp to the main intake air pipe to secure the harness.

**47**

Install the upper exhaust pipe mounting bracket.

**48**

Install the exhaust pipe as an assembly with the mounting clamps and brackets attached.

**49**

Install the upper radiator coolant pipe with the bracket attached.

**50**

Install the coolant package, refer to Function Group 261.

**51**

Install the access panel behind the left rear wheel.

**52**

Install the left rear wheel skirt.

**53**

Fill the cooling system with the recommended coolant using the coolant extractor.

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85112740

**54**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**55**

Start the engine, check for leaks and proper operation.  
After shutdown, replenish fluids as necessary.

Date	Group	No.	Page
2.2008	<b>222</b>	<b>101</b>	1(3)

## Oil Filter, Replacement D13F

### Oil Filter, Replacement

This information covers the proper procedure for replacing the oil filters on a Volvo D13F engine.

#### Contents

- “Oil Filter, Replacement” page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and might differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2223-03-02-02 Oil Filter, Replacement

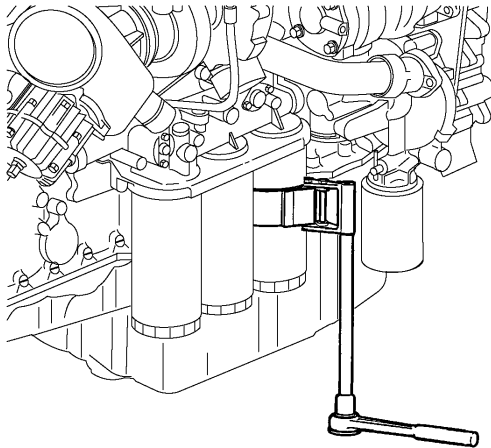
Incl. bypass filter

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **WARNING**

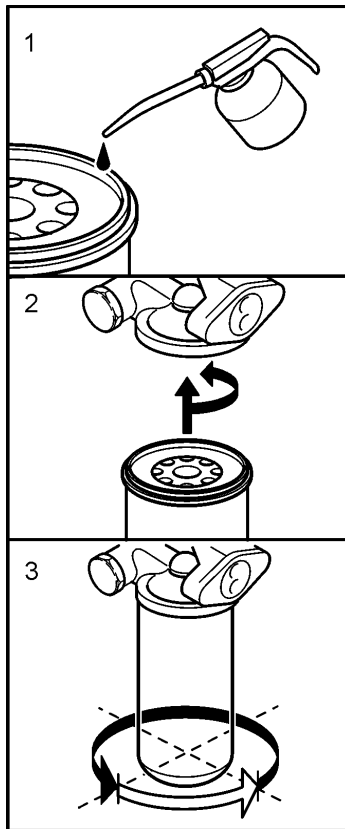
Hot oil may cause burns. To avoid being burned, take extra care when working around hot oil, and wear protective gloves and clothing as needed.

- 1**  
Clean around the oil filter housing and remove the filters using the oil filter wrench or the oil filter socket.



W2005876

- 2**  
Clean around the oil filter housing and remove the filters using the oil filter wrench or the oil filter socket.



C2002835

**3**

Prefill the new oil filters with approved engine oil. Also, lubricate the filter gaskets with engine oil (1). Hand tighten the oil filters until they contact the sealing surface of the oil filter housing (2). Manually tighten the oil filters an additional 3/4 to 1 turn (3).

**4**

Start the engine and check for leaks around the oil filter housing and filters.

**5**

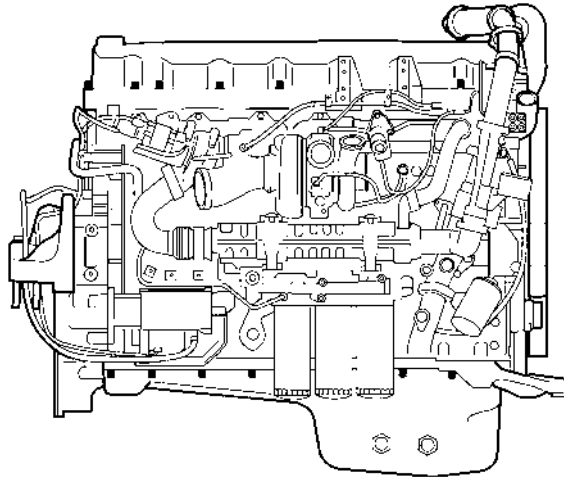
Check the oil level. Add approved engine oil to the recommended level, if necessary. Do not overfill.

Date	Group	No.	Release	Page
9.2010	<b>222</b>	<b>18</b>	<b>01</b>	1(5)

## Control Valve, Piston Cooling, Replacement

D13H

### Control Valve, Piston Cooling, Replacement



W2005779

This information covers the procedure for replacing the piston cooling control valve on buses equipped with the D13H engine.

### Contents

- "Control Valve, Piston Cooling, Replacement", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2229-03-02-11**

## Control Valve, Piston Cooling, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

**1**

Apply the parking brake and place the shift lever in neutral.

**2**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**3**

Place an approved container under the oil filter housing to catch any oil that drains.

**4**

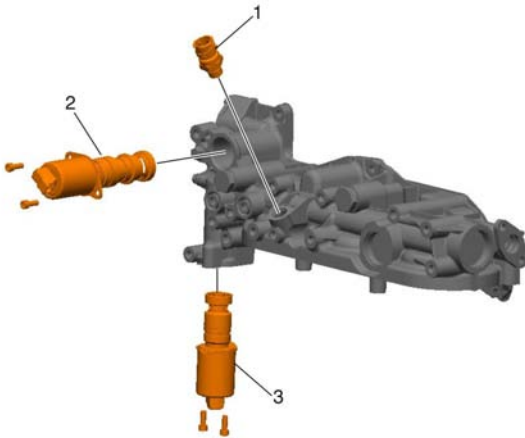
Remove the sound baffles.

**5**

Clean the area around the piston cooling control valve.

**6**

Remove the cable ties as needed and disconnect the wiring harness connector from the piston cooling control valve.



**7**  
Remove the piston cooling control valve fasteners and remove the control valve from the oil filter housing.

W2055588

- 1 Piston Cooling Jet Pressure Sensor
- 2 Oil Cooler Thermostat Control Solenoid
- 3 Piston Cooling Control Valve

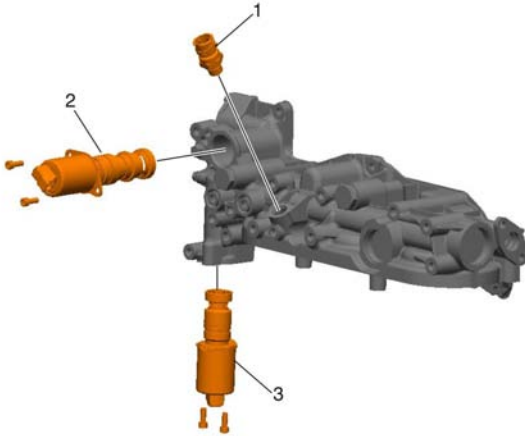


## Installation

**1**  
Clean the valve contact surface on the oil filter housing.

**2**  
Lubricate a new O-ring with clean engine oil and install onto the piston cooling control valve.

**3**  
Install the piston cooling control valve into the valve bore in the oil filter housing and install the fasteners. Tighten fasteners to specification, refer to Function Group 20, Specifications.



W2055588

- 1 Piston Cooling Jet Pressure Sensor
- 2 Oil Cooler Thermostat Control Solenoid
- 3 Piston Cooling Control Valve

**4**  
Reconnect the wiring harness connector to the piston cooling control valve. Install cable ties as required to secure the wiring harness.

**5**  
Reconnect all previously removed cables to the negative (ground) battery terminals.

**6**  
Start and run the engine and check for leaks and proper operation.

**7**  
Install the sound baffles.

**8**  
Check the engine oil level and add engine oil as needed.

**9**

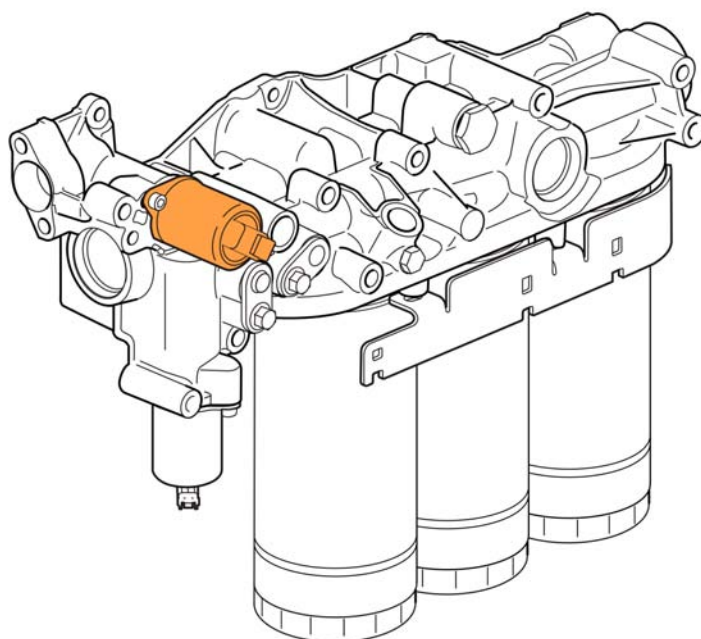
Connect Tech Tool to the vehicle. Use Guided Diagnostics to read and clear any diagnostic trouble codes (DTCs).

Date	Group	No.	Release	Page
9.2010	<b>222</b>	<b>20</b>	<b>01</b>	1(6)

Thermostat Valve Or Pressure Valve  
Oil Cooler, Replacement

B13R, PREVH, PREVX

## Thermostat Valve Or Pressure Valve Oil Cooler, Replacement



W2060464

This service bulletin covers the procedure for replacing the thermostat valve or pressure valve oil cooler on VOLVO buses.

### Content

- "Thermostat Valve Or Pressure Valve Oil Cooler, Replacement", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2229-03-02-07

# Thermostat Valve Or Pressure Valve Oil Cooler, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## Removal

**1**

Apply the parking brake and place transmission in neutral.

**2**

Open the battery compartment access doors.

**3**

Disconnect all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

Open the rear engine service doors.

**5**

Remove the bottom engine shields.

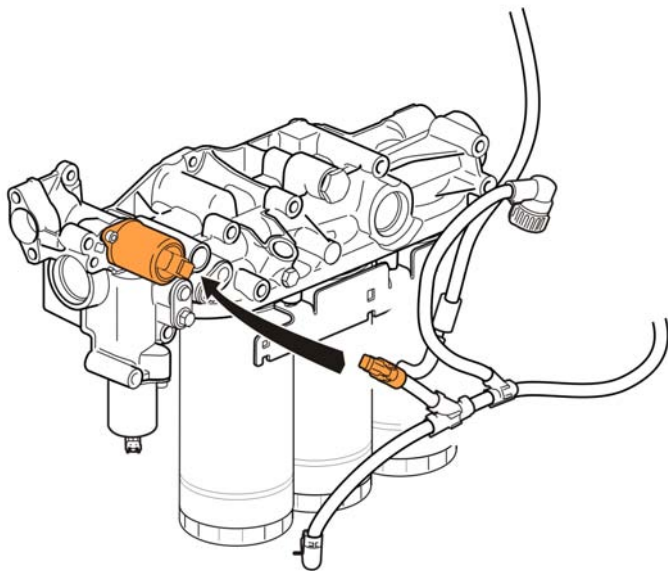
**Note:** If needed, raise the bus.

**6**

Thoroughly clean area around thermostat on oil filter housing.

**7**

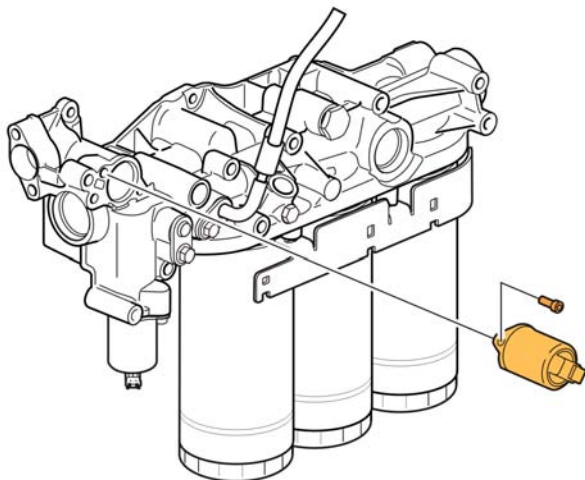
Remove cable tie and disconnect the wiring harness connector from the valve.



W2060465

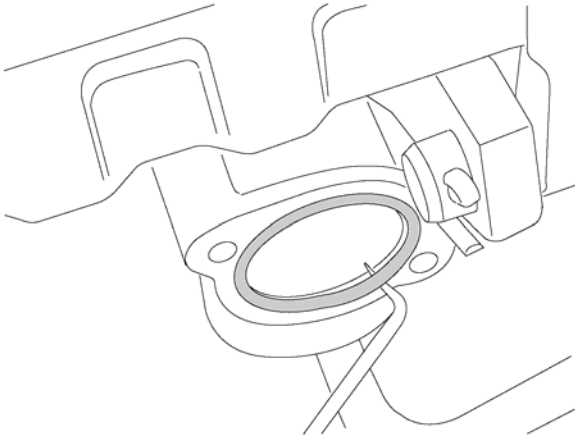
**8**

Remove the thermostat valve fasteners and remove the thermostat valve from the oil filter housing.



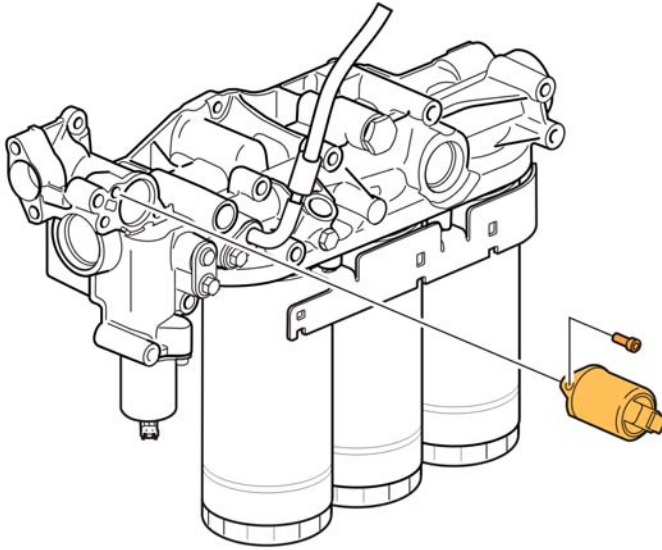
W2060466

- 9**  
Replace thermostat valve O-ring in the oil filter housing.



W2006105

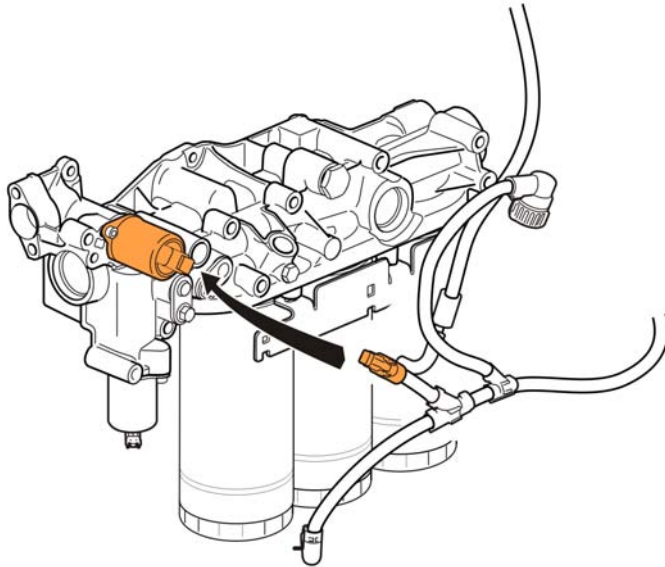
## Installation



W2060466

**1**

Install a new thermostat valve with a new gasket. Tighten to specification, refer to Function Group 20, Specifications.



W2060465

**2**

Reconnect the wiring harness connector to the valve and secure with cable tie.

**3**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**4**

Start the engine and check for leaks at the valve. Replenish fluids as required.

**5**

Close the battery compartment access doors.

**6**

Close the rear engine service doors.

**7**

Install the bottom engine shields.

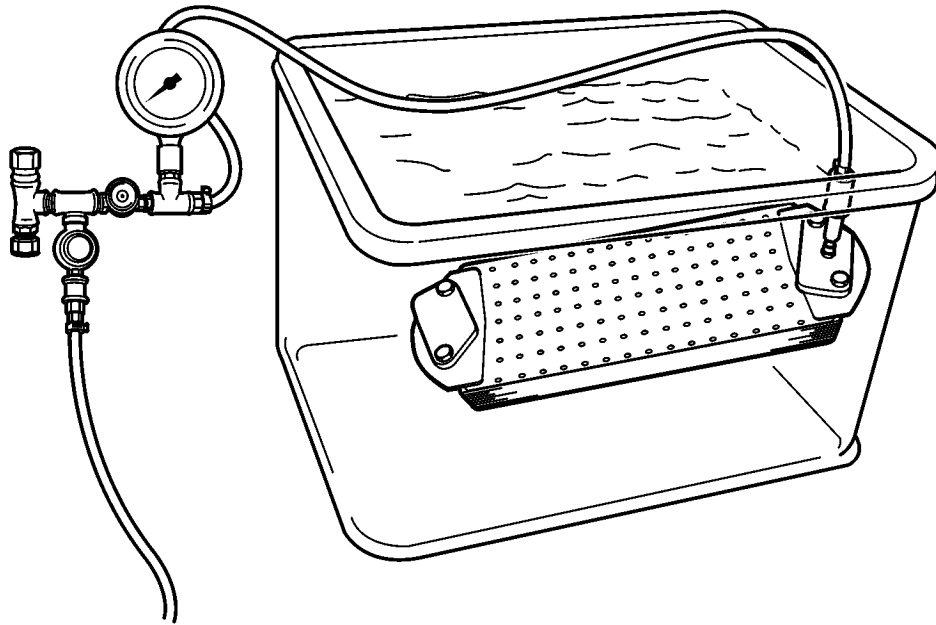
**Note:** If needed, lower the bus.



Date	Group	No.	Page
2.2008	<b>223</b>	<b>100</b>	1(2)

## Oil Cooler, Pressure Test D13F

### Oil Cooler, Pressure Test



T2022120

### Contents

- "Oil Cooler, Pressure Test" page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2231-06-05-01 Oil Cooler, Pressure Test

### Oil cooler removed

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9992663, 9996684*

*Other special equipment: 9996662*

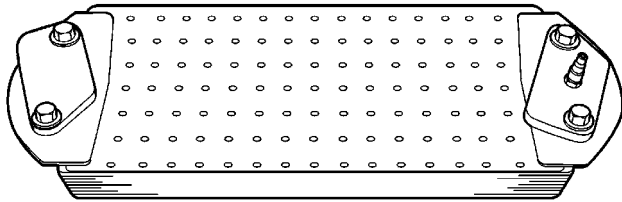
#### 1

In order to discover small leaks, the oil cooler must be at the temperature as the testing room. Rinse the oil cooler with water that is at room temperature until the oil cooler is at room temperature.

#### 2

Install the pressure testing equipment and ensure that the washers seal properly.

9992663, 9996684

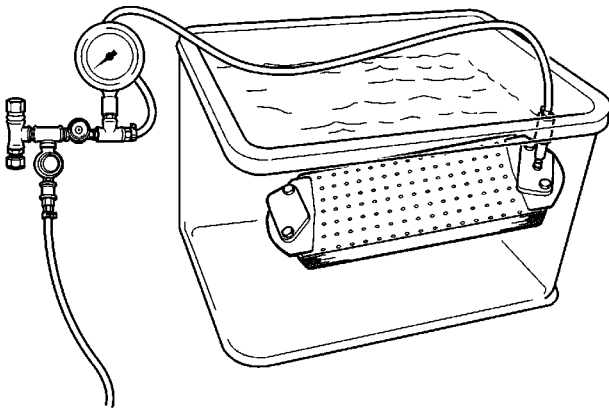


T2022119

#### 3

Connect pressure gauge.  
Lower the oil cooler into a container with water at room temperature. Increase the pressure gradually to 250 kPa (36 psi). Maintain the pressure for a minimum of one minute.

250 kPa (36 psi) 9996662



T2022120

#### 4

Lift out the oil cooler and remove the pressure testing equipment.

This service bulletin replaces bulletin 223-26 dated 5.09.

Date	Group	No.	Release	Page
1.2011	<b>223</b>	<b>26</b>		1(14)

Oil Cooler Insert, Replacement

D13

B13R, PrevH, PrevX

## **Oil Cooler Insert, Replacement**

# Service Procedures

## 22327-3

### Oil Cooler Insert, Replacement

*Special tools: 88800022*

**1**

Remove radiator, refer to Function Group 26.

**2**

Remove Turbocharger, remove according to Function Group 2551, Information type Repair Turbocharger, Removal.

**3**

Remove the heat shield for the EGR valve.

**4**

Remove the EGR valve electrical connection.

**5**

Note the position of the V clamp. Remove the V-clamp for the EGR valve.

**6**

Remove the oil lines for the EGR valve.

**7**

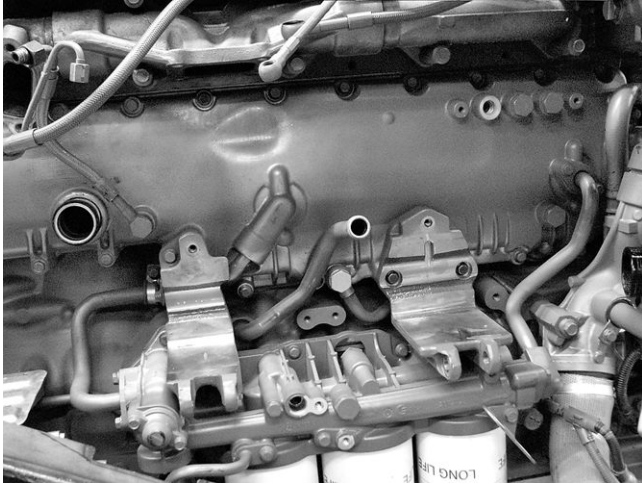
Note the location of the screws. Remove the EGR valve from the exhaust manifold.

**8**

Plug the EGR valve pipe and connections.

**9**

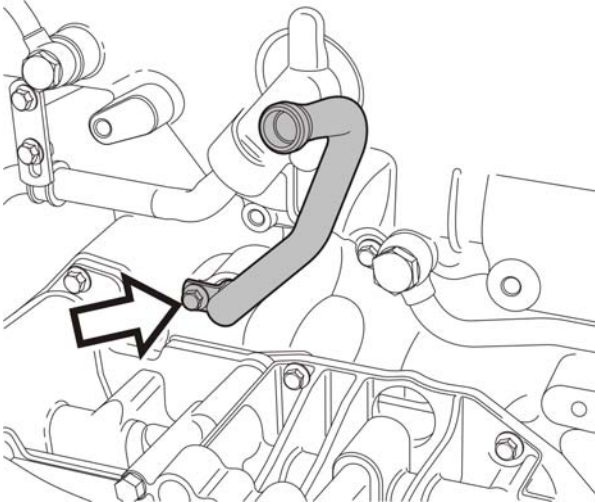
Remove EGR cooler, remove according to Function Group 2932, Information type Repair EGR Cooler, Removal.



T2026574

**10**

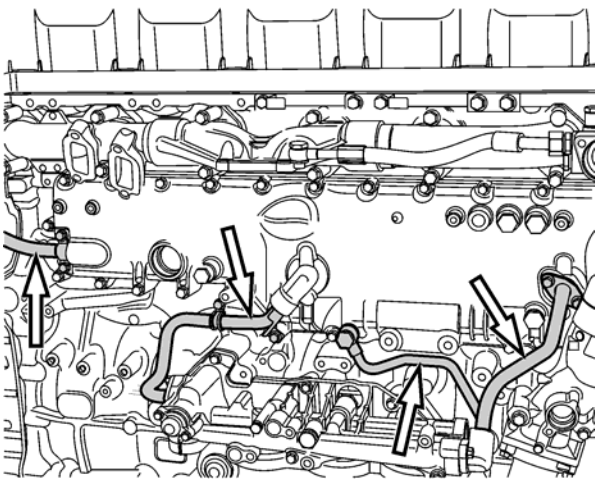
Remove the EGR heat exchanger's brackets.



W2006067

**11**

Remove the turbocharger return oil pipe from the cylinder block.



T2025653

**12**

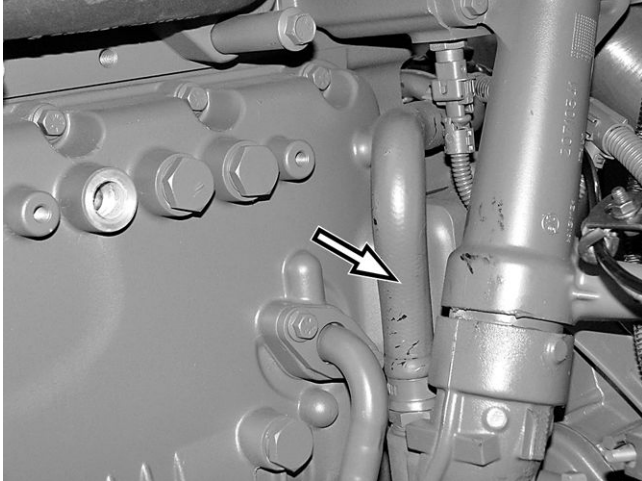
Remove the EGR cooler rear pipes from the coolant cover.

**13**

Remove the front oil pipe from the oil filter housing and the oil cooler cover. Remove the rear oil pipe cap from the oil filter housing. Remove the rear oil pipe.

**14**

Remove the coolant hose on the front of the coolant cover.



T2026575

**15**

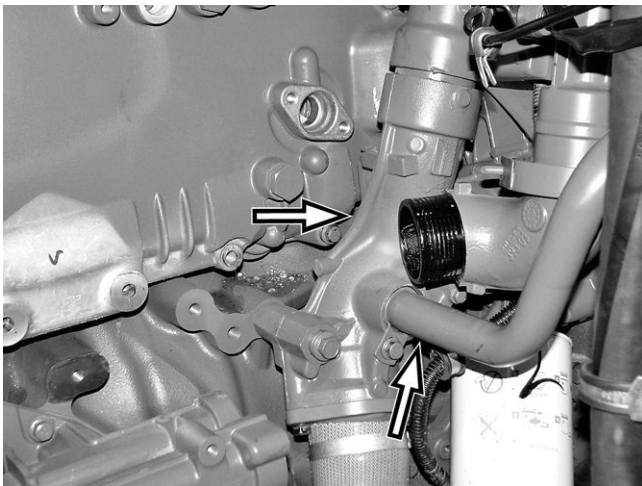
Remove the coolant cover clamps. Remove the rubber clamp from the bracket. Remove the rear coolant pipe.

**16**

Remove the screw for the coolant drain pipe from the oil filter bracket. Remove the coolant drain pipe from the oil cooler cover.

**17**

Remove the coolant pipe and hose from the coolant housing. Remove the screws and housing.

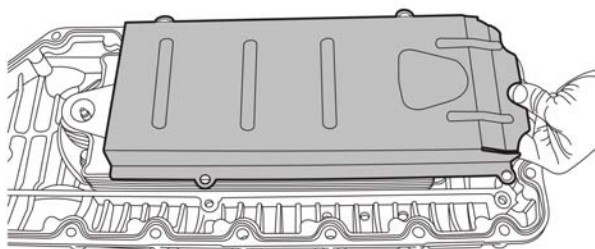


T2026576

**18**

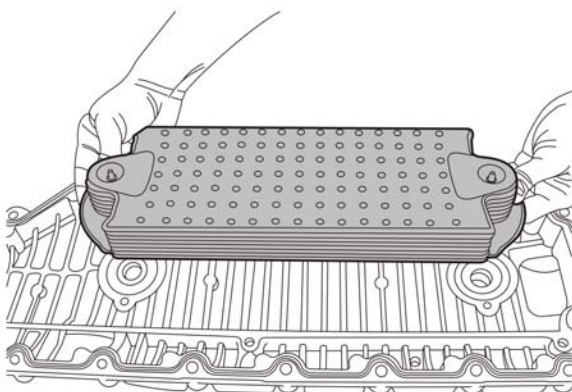
Remove the oil cooler cover. Place the cover on a work bench.

- 19**  
Remove the flow plate.

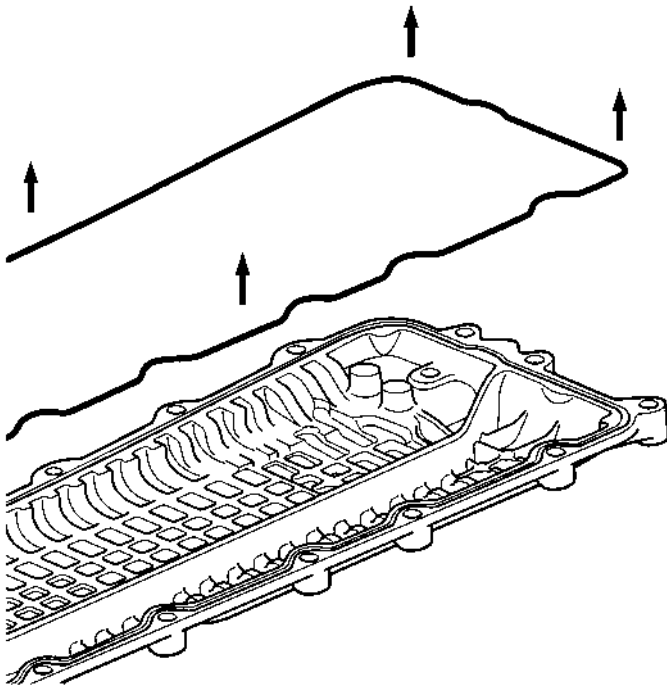


W2006071

- 20**  
Remove the oil cooler.



W2006072

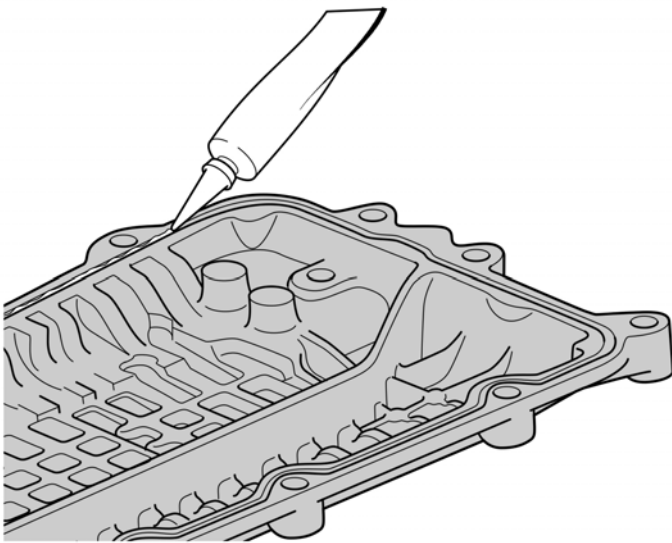


T2025483

**21**

Remove the gasket from the oil cooler cover. Clean the cover and gasket groove of all gasket remnants.

**Note:** Do not use sharp tools which could damage the cooler cover and gasket groove.



T2023635

**22**

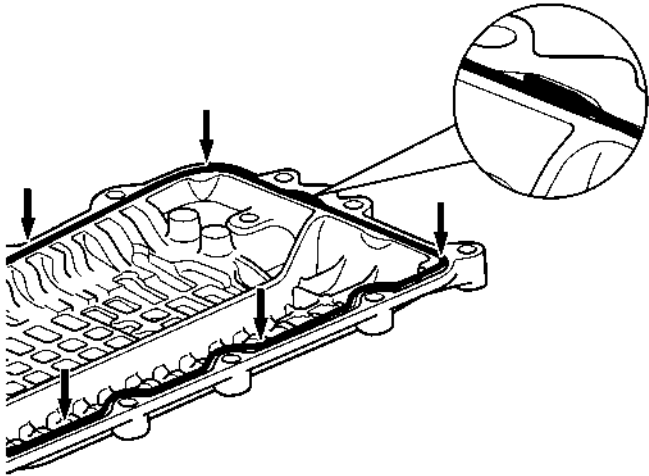
Apply a very thin layer of Volvo approved gasket dressing, such as Permatex 85409 or equivalent, in the oil cooler cover groove to help retain the gasket in place during cover installation. Allow the gasket dressing to air dry and become tacky before installing the gasket.



**23**

Install a new gasket on the cooler cover.

**Note:** Ensure that the gasket does not stretch too much and that it is correctly seated.



T2025484

**24**

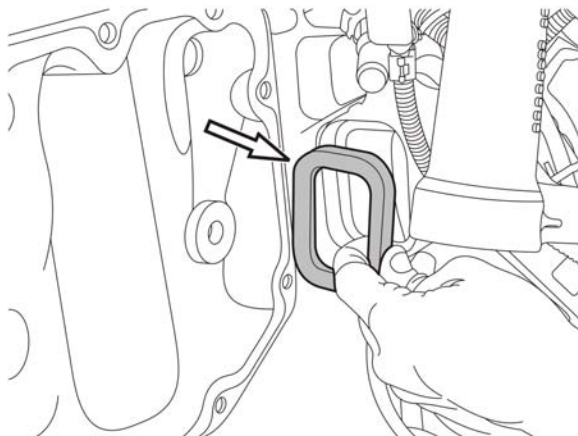
Install the oil cooler. Use new gaskets and tighten screws to torque according to Function Group 2, Information type Specifications Tightening Torques and Patterns.

**25**

Install the flow plate and tighten the screws in accordance with Function Group 2, Information type Specifications Tightening Torques and Patterns.

**26**

Install a new seal in the water pump housing. Apply soapy water to the seal.



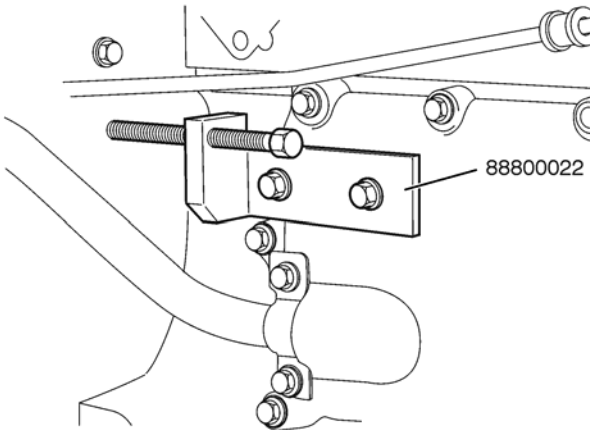
W2006075

**27**

Clean the cylinder head contact surface.

**28**

Install the cover to the cylinder block. Press the cover against the water pump housing using the assembly tool. Check using a feeler gauge or similar that the cover is correctly located with respect to the cylinder head. Torque tighten the screws in accordance with Function Group 2, Information type Specifications Tightening Torques and Patterns.



T2025853

**29**

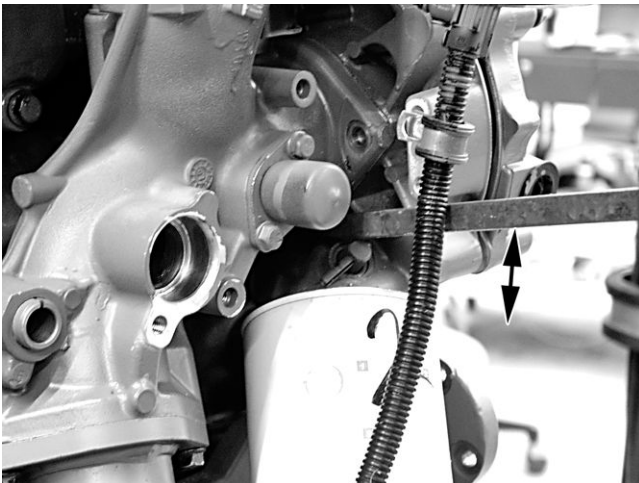
Install the inner screw and move down the tap for the coolant filter.



T2026577

**30**

Install the coolant housing. Use a new seal. Rotate in the coolant housing carefully using a lever and install the remaining screws. Tighten the screws and move up the tap again.



T2026578

**31**

Install the coolant hose on the front of the coolant cover. Tighten the hose clamps.

**32**

Install the rear coolant pipe. Install the clamp on the coolant cover. Install the rubber clamp on the bracket.

**33**

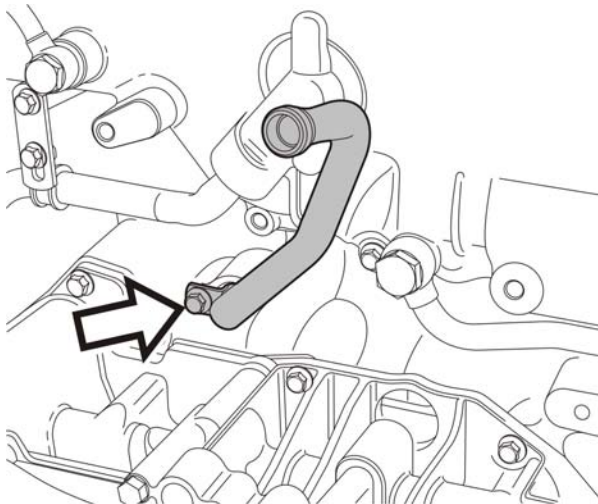
Install the coolant drain pipe on the oil cooler cover. Use new sealing washers. Install the coolant drain pipe screw for the oil filter bracket.

**34**

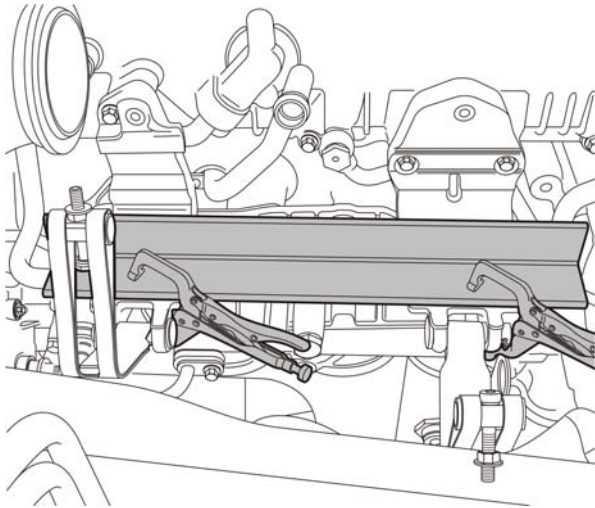
Apply soapy water to the new gaskets. Install the front oil pipe to the oil filter housing and the oil cooler cover. Install the rear oil pipe. Install the rear oil pipe cap on the oil filter housing.

**35**

Apply soapy water to the new gaskets. Install the turbocharger return oil pipe to the cylinder block.



W2006067



W2005974

**36**

Install the EGR heat exchanger brackets.

**Note:** Use a straight angle iron or similar to keep the brackets in line.

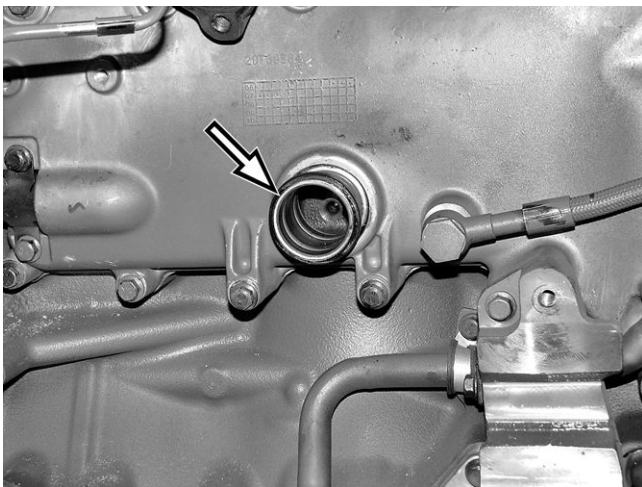
**37**

Apply soapy water to the new seals for the rear coolant pipe. Install the coolant pipe in the oil cooler cover.

**Note:** Check that the EGR cooler drain nipple is tightened.

**38**

Install a new o-ring and lubricate it with Vaseline.



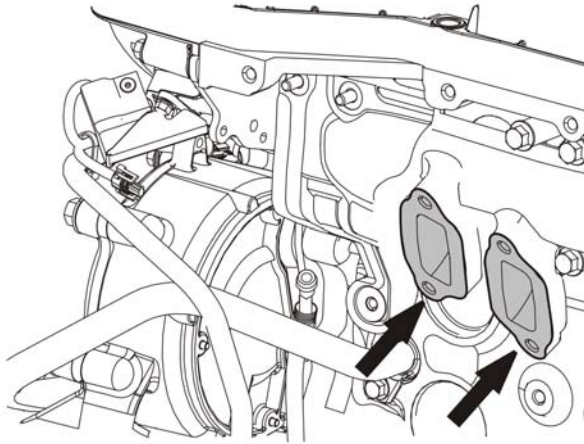
T2026564

**39**

Install the EGR cooler according to Function Group 2932, Information type Repair EGR Cooler, Replacement.

**40**

Install the turbocharger according to Function Group 2551, Information type Repair Turbocharger, Replacement.



W2005697

**41**

Remove the gaskets and clean the contact surfaces.

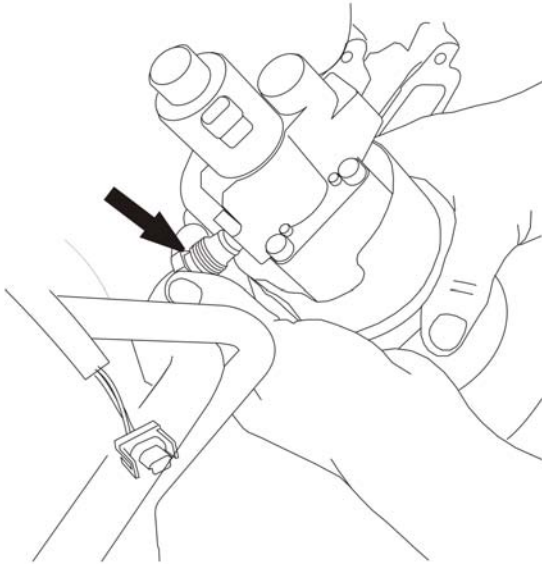
**Note:** Gaskets must not be reused.

**42**

Replace the o-ring in the pressure oil line connection.

**43**

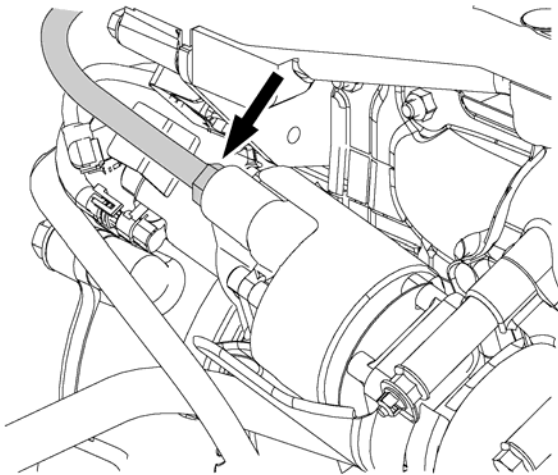
Check that the exhaust manifold heat shield is in place and undamaged.



W2005694

**44**

Position the EGR valve and install the pressure oil line and return oil line to the EGR valve. Do not tighten the cap nut.



W2006049

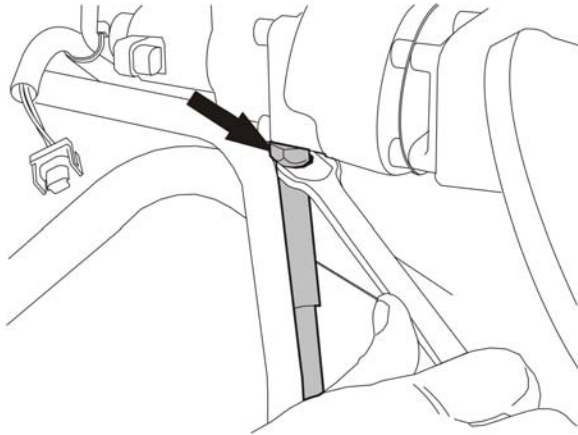
Return line

**45**

Install the EGR valve with a new gasket on the exhaust manifold. Do not tighten the screws in order to facilitate installing the return oil line.

**46**

Torque tighten the EGR valve screws according to Function Group 2, Information type Specifications Tightening Torques and Patterns.



W2005692

**47**

Tighten the oil line cap nuts.

**48**

Connect the EGR valve cabling.

**49**

Apply assembly compound to the V-clamp.

**50**

Install the gasket in the inlet pipe.

**Note:** Check that the gasket comes into the correct position.

**51**

Install the clamp on the EGR valve. Position the inlet pipe in the EGR valve flange.

**Note:** Check that the pipe is correctly positioned in the EGR valve flange.

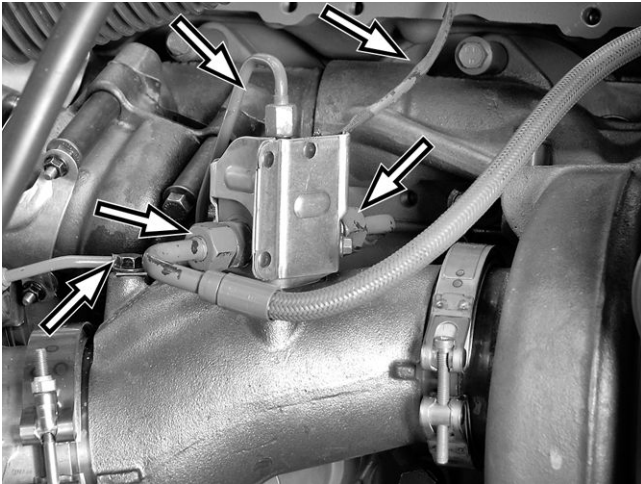
Install the clamp over the joint. Tighten the clamp to the torque specified in Function Group 2, Information type Specifications Tightening Torques and Patterns.

**52**

Check that the heat shield is not damaged. Install the heat shield on the EGR valve.

**53**

Install a new gasket. Install the diffusion pipe to the turbocharger. Turn the diffusion pipe to the correct position. Install and tighten the clamp.



T2026557

**54**

Install the fuel line and the clamp for the after-treatment system injector. Install the injector coolant connections. Secure the injector cables in their clamps and install the connector.

**55**

Install the exhaust pipe with flex hose. Use a new seal and tighten to the torque specified in Function Group 2, Information type Specifications Tightening Torques and Patterns.

**56**

Install Radiator, install according to Function Group 2611, Information type Repair Radiator, Installation.

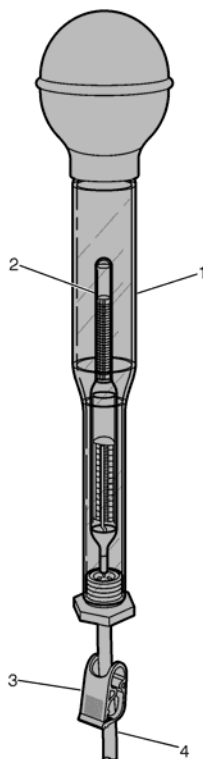


## Diesel Fuel Hydrometer, Instructions

D13F, D13H

### Diesel Fuel Hydrometer, Instructions

The diesel fuel hydrometer is used for troubleshooting engine performance problems and measuring diesel fuel quality. The hydrometer measurements are given as an American Petroleum Institute (API) gravity reading when testing diesel fuel composition and combustion characteristics.



W2059421

Diesel Fuel Hydrometer Assembly J38641-B	
Item	Description
1	Glass Tube
2	Bulb
3	Tube Clamp
4	Siphon Tube

### Contents

- "Diesel Fuel Hydrometer, Instructions", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2309-06-03-01 Diesel Fuel Hydrometer, Instructions

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

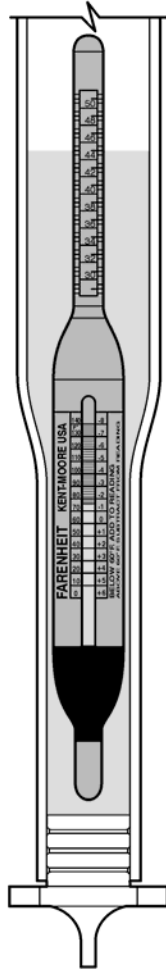


### **WARNING**

Individuals performing API gravity test must wear proper protective equipment (PPE) before drawing a sample of diesel fuel. Safety glasses must be worn to prevent eye contamination in case of a splash. Gloves must be worn to prevent contamination through skin contact. If contact is made, immediately flush eyes and/or skin with water and seek medical attention.

#### **1**

Assemble hydrometer part number J38641-B as shown in figure on page 1.



W2059422

**2**

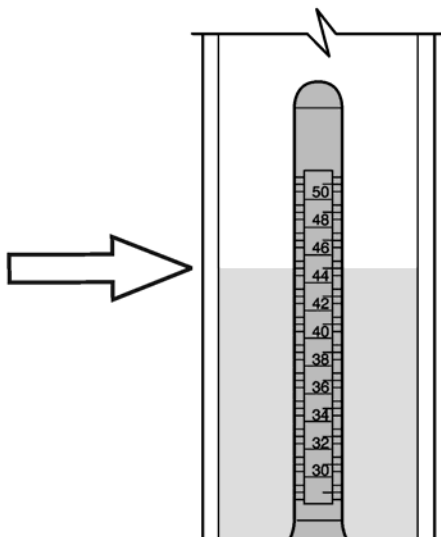
Draw sufficient fuel into the hydrometer to completely float the bulb inside the glass tube. See Figure.

**3**

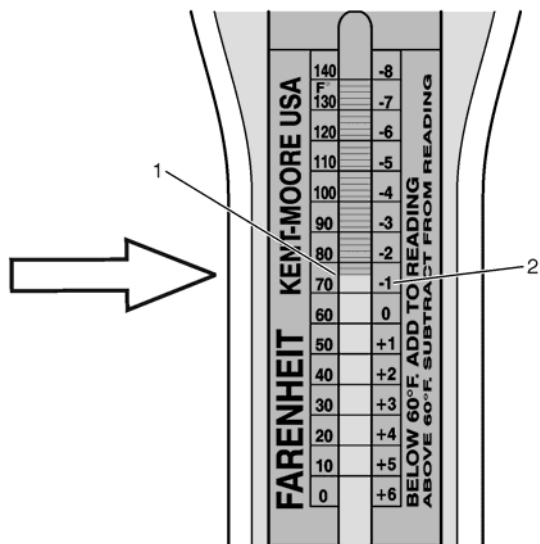
Close the siphon tube using tube clamp.

**4**

Take an API gravity reading from the top scale indicated by the fuel line on the floating bulb. See example of an API gravity reading of (45) as shown in figure.



W2059423



W2059424

<b>EXAMPLE</b>	
API Gravity Reading	45
Subtract Bottom Temperature/Variable Scale Reading From API Gravity Reading	-1
Corrected API Gravity Reading	44

W2059425

**5**

Take a reading from the bottom temperature scale indicated by the mercury level on the floating bulb. See Item (1) in figure for example of temperature reading (76° F). Temperature is measured in Fahrenheit and used to determine the variable factor shown on the right side of the temperature scale. See item (2) in figure for example of variable reading.

**Note:** The variable factor shown on the right of the temperature scale is displayed in whole numbers and is subtracted or added to the API gravity reading to determine corrected API gravity.

**6**

Add or subtract the variable factor (based on temperature) from the API gravity measurement. The result is the corrected API gravity for diesel fuel. See Figure.

**Note:** The example Figure is used only to illustrate the proper procedure for determining the corrected API gravity reading.

**7**

See the table below for Volvo's recommended API gravity ranges for Type 1-D and Type 2-D heavy vehicle diesel fuel.

<b>API Gravity Range for Heavy Vehicle Diesel Fuel</b>	
Diesel Fuel Type	API Gravity range
TYPE 1-D	40 — 44
TYPE 2-D	32 — 37

Date	Group	No.	Release	Page
5.2011	<b>230</b>	<b>252</b>	<b>01</b>	1(11)

## Fuel System, Design and Function

D13H

### Fuel System, Design and Function

This information covers the design and function of the fuel system on the VOLVO and PREVOST buses equipped with a D13H engine.

#### Contents

- "Fuel System", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Design and Function

## Fuel System

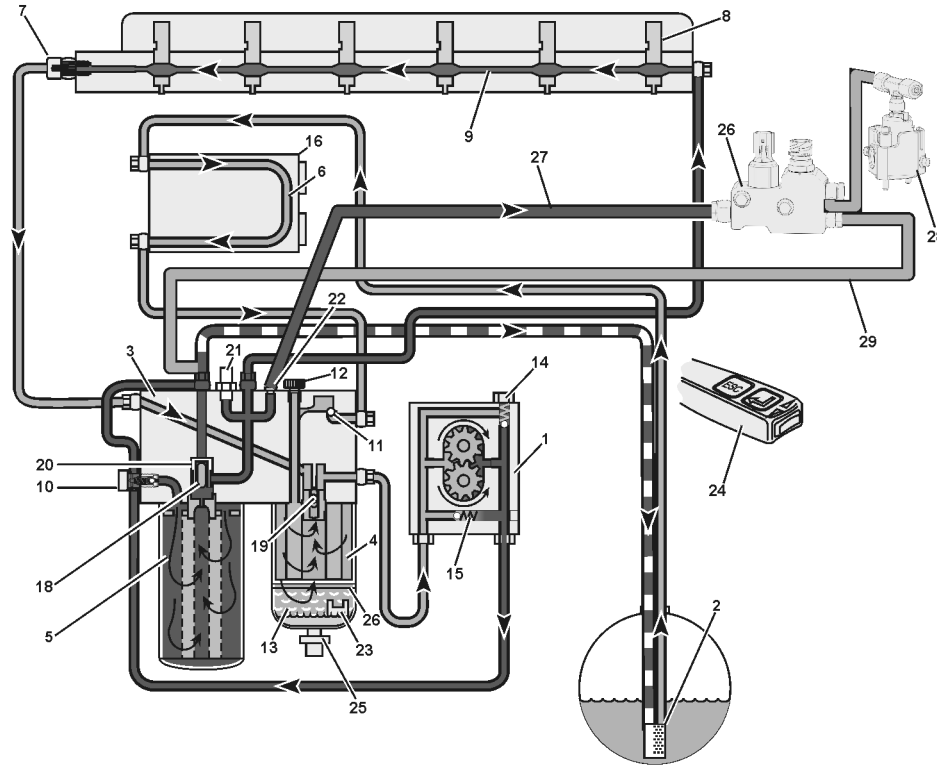
**When fault tracing, it is important to understand the function of the system in order to avoid replacing non-defective components.**

### Fuel System Overview

The fuel system is electronically controlled (EMS). Fuel injection is performed by injectors, one for each cylinder, at high pressure. The high pressure is created mechanically by the overhead camshaft and rocker arms. Regulation of the fuel amount and injection point are electronically controlled by the engine control module (ECM), which receives signals from a number of sensors.

The engine can be equipped with a hand pump, located on the fuel filter housing.

## Fuel System Operation



W2066119

The fuel is drawn by means of the fuel pump (1) through a strainer (2) in the combined tank unit, up through the cooling loop (6), which cools the engine control module (ECM) (16), and then down to the fuel filter housing (3). There the fuel passes through a non-return valve (11) and a prefilter (4) with a water separator (13). The task of the non-return valve is to prevent fuel from running back to the tank when the engine is switched off, or when pumping by hand.

The fuel pump (1) sends fuel to the fuel filter housing (3) and through the main filter (5) up to the longitudinal fuel rail (9) in the cylinder head. This rail supplies each injector (8) with fuel via a ring-shaped channel around each injector in the cylinder head. Overflow valve (7) controls the pressure of the fuel feed to the injectors.

When the aftertreatment hydrocarbon doser opens, fuel flows into the valve block (26) via the fuel line (27) and on to the doser (28). When the doser closes fuel flows back via the valve block and on through the return line (29) to the fuel tank.

Return fuel from the cylinder head fuel rail (9) goes through the overflow valve (7) back to the fuel filter housing (3). The through channel in the fuel filter housing mixes the return fuel with fuel from the tank and draws it on to the fuel pump inlet (suction side).

There are two valves in the fuel pump. The safety valve (14) allows the fuel to flow back to the suction side when the pressure becomes too high, for example when the fuel filter is blocked. The non-return valve (15) opens when the

manual fuel pump (12) is being used, so that the fuel can be pumped more easily by hand.

The fuel filter housing (3) also has a built-in bleed valve (10). The fuel system is vented automatically when the engine starts. Any air in the system flows, together with a small amount of fuel, back to the tank (2) via a pipe.

When changing filters close valves (18 and 19) to prevent fuel leaking out when the fuel filter is removed. Air bleeding of the filter when changing filters is controlled by valves (18 and 20) in the filter housing and the bleed valve (10).

There is a fuel pressure sensor (21) in the fuel filter housing which measures the fuel pressure after the fuel filter. A diagnostic trouble code (DTC) is shown on the instrument panel if the fuel pressure is less than the specification. The plugged outlet (22) in the fuel filter housing is used for fuel pressure measurements with an external pressure sensor or gauge.

There is a level sensor (23) inside the water separator (13) which sends a signal to the driver if there is water in the system. Draining is performed by means of a stalk (24) on the steering column. This opens an electrical drain valve (25) via a command from the ECM.

For the draining process to be activated, the following conditions must be met:

- Level sensor (3) in the water separator shows a high water level
- Engine switched off/starter key in the drive position
- The vehicle is stationary
- The parking brake is applied

If the engine is started during the draining process, the draining will be stopped. A warning on the instrument panel

remains as long as the “water in fuel” indicator is above the warning level.

As an extra accessory there is also a fuel heater (26) that is installed in the lower part of the water separator.

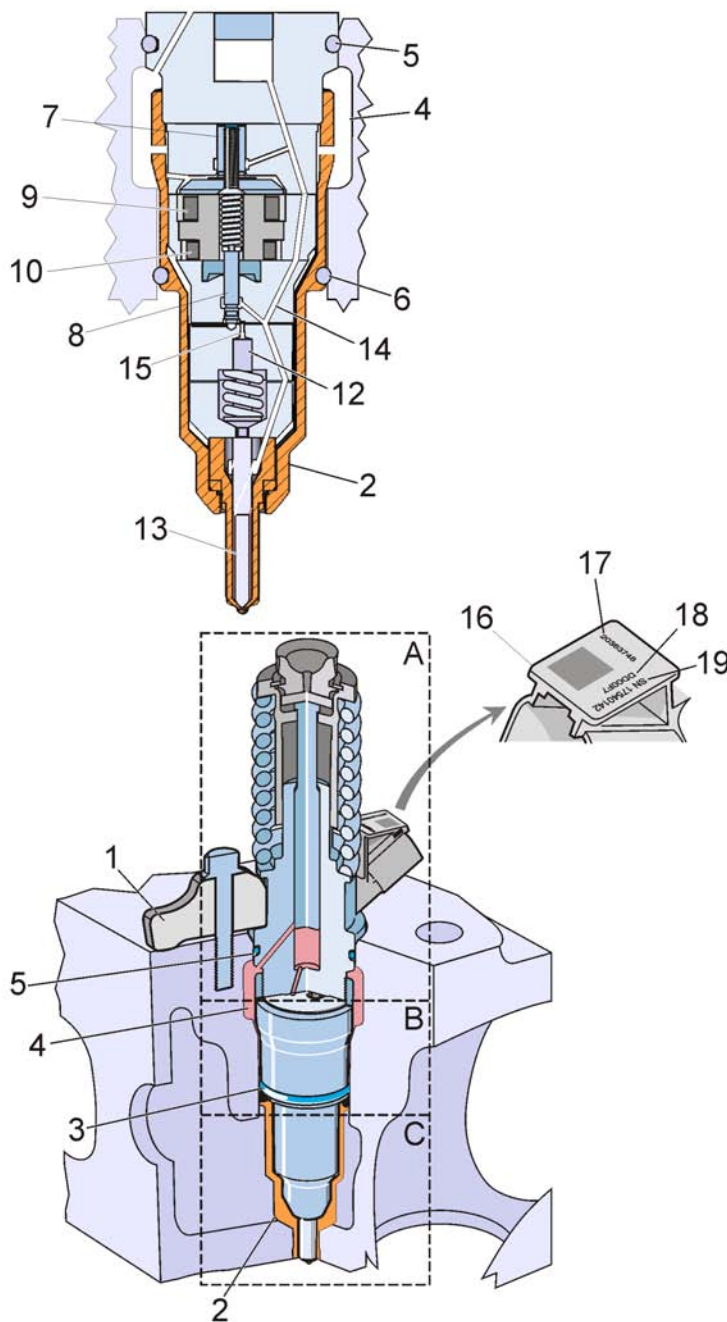
The hand pump (12), if equipped, is located on the fuel filter housing and is used to pump fuel forward (with the engine stopped) in case the fuel system has been emptied.

**Note:** The hand pump must not be used while the engine is running.



## Fuel System Components

### Injectors



T2054876

The unit injectors are of type E3 with two solenoid valves for more precise injection. This ensures better combustion and minimizes particle emission, producing cleaner exhaust gases.

The injectors are placed vertically at the centre of each cylinder, between the four valves, and are held in place by a yoke (1). The lower part of the injector is held against the coolant jacket in the injector sleeve (2) and with O-ring (3).

The ring shaped chamber for fuel supply (4) around each injector is sealed by two O-rings (5 and 6).

A unit injector principally consists of three parts:

- Pump section
- Valve section (actuator)
- Spray atomizer section

Within the valve section are two solenoid valves — the waste valve (7) and the needle valve (8) with solenoid coils (9 and 10 respectively) and return springs.

In the **filling phase** the pump piston moves upwards and fuel from the cylinder head fuel rail is forced into the unit injector.

In the **waste phase** the pump piston moves down and fuel is forced back out into the cylinder head fuel rail. During this time the solenoid valve coils have no current and the waste valve is open, so no pressure can build up in the fuel channel to the spray atomizer.

In the **pressure buildup phase**, the waste valve solenoid coil is energized and the waste valve closes. This allows a high pressure to be built up in the fuel channel (14). Pressure also increases in the chamber (15) behind the needle valve, which affects the needle valve piston (12) and prevents the needle valve (8) from opening the nozzle pin (13).

Once the desired fuel pressure has been achieved, the **injection phase** begins. The needle valve solenoid coil

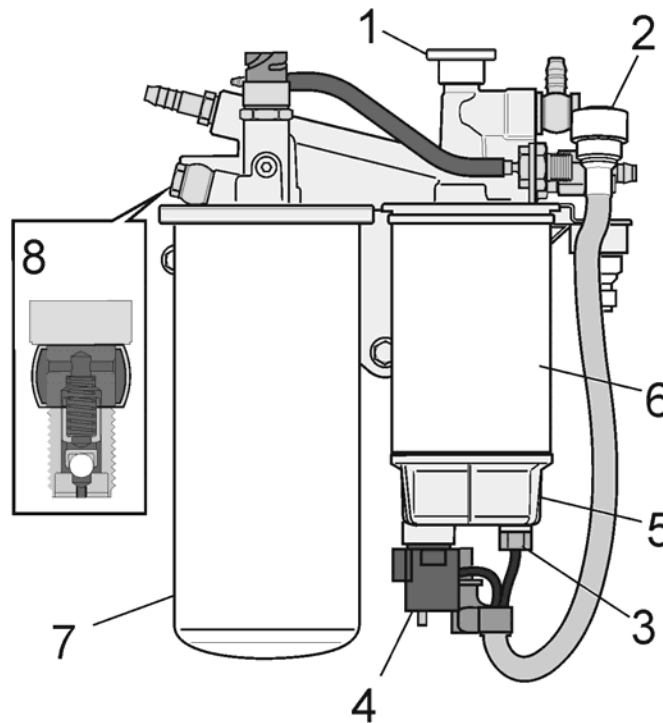
receives electric current and opens the needle valve (8). This releases the high pressure on to the needle valve piston and the nozzle pin (13) opens. Atomized fuel now sprays out at extremely high pressure into the engine combustion chamber.

Fuel injection is stopped by opening the waste valve again, which causes the pressure on the piston (12) to drop and the nozzle pin (13) closes.

The complete injection process is controlled by the engine management system (EMS).

There are three markings on the injector electrical connector (16) — part number (17), trim code (18) and manufacturing number (19). When replacing one or more injectors, the engine control module (ECM) must be programmed with the new injector trim code, since each injector is unique and the engine is trimmed for optimal fuel injection and as low emission as possible. The trim code is programmed in using the parameter programming section of Tech Tool. Programming only needs to be carried out for the replacement injector(s).

## Fuel Filter Housing

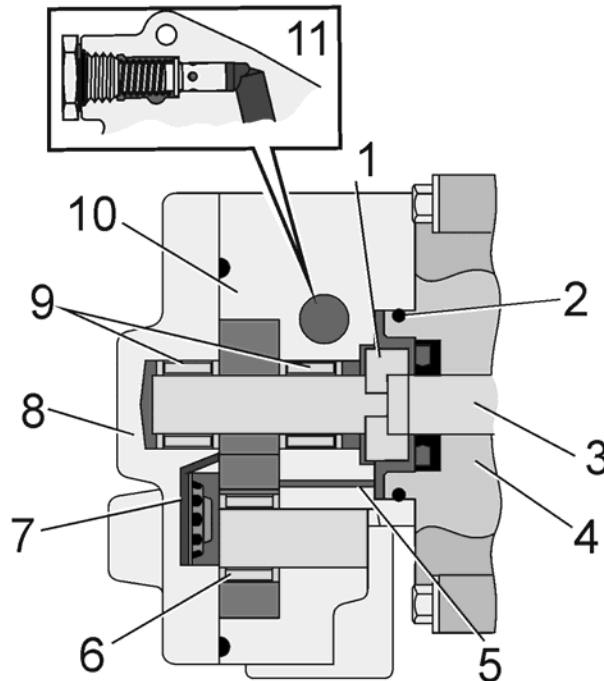


W2066130

Some engines are equipped with a hand pump (1) in the fuel filter housing, which is used to pump fuel forward if the system has been emptied, and a non-return valve to prevent fuel from running back to the tank when the engine is switched off. The electrical connections (2) are for the level sensor (3) and the drain valve (4) in the water separator (5). The prefilter (6) filters the fuel before it passes through the feed pump, it is on the suction side. The main filter (7) filters the fuel after it passes through the feed pump, it is on the pressure side.

The system is equipped with a large fuel filter located on the left-hand side of the engine. The filter insert consists of a corrugated filter paper with a high resistance to water and very good filtering properties. In addition, a fine-gauge net filter on the fuel suction line in the fuel tank separates any possible solid impurities before the fuel is pumped up into the system.

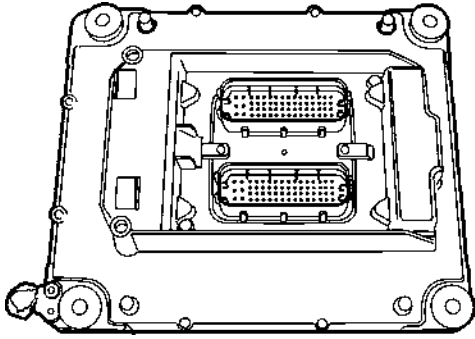
## Fuel Pump



W2066129

The fuel pump is of the gear type and mounted on the power steering pump (4). The fuel pump is driven by the shaft (3) passing through the power steering pump. Sealing between the two pumps uses an O-ring (2) positioned in a groove in the power steering pump flange. Power transmission between the pumps is via a floating follower (1). The pump housing (10) and the cover (8) are cast iron. The drive gear shaft and the pump wheel run in needle bearings (9 and 6 respectively). The pump safety valve (11) is located in the pump housing and the non-return valve (7) in the pump end cover. Fuel which leaks past the pump drive shaft is drawn back to the suction side in the pump via a channel (5). The capacity of the pump has been adapted to give the correct pressure and flow to the injectors. Filling the injectors requires relatively high pressure. The flow must be large enough to even out any fuel temperature differences in the cylinder head fuel gallery.

## Engine Control Module (ECM)



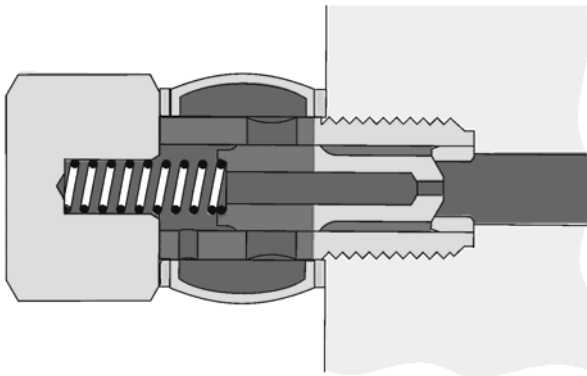
W2003778

The cooling loop on the left side of the engine cools the engine control module (ECM) using fuel from the suction side of the fuel pump.

The engine control module (ECM) is the central part of the injection system. It is located on the left-hand side of the engine. The ECM receives continuous information from the accelerator pedal and from several other sensors on the engine. It calculates the amount and the time to inject fuel into the cylinders. Electrical wiring to the injectors transmits control signals to the injectors from the ECM.

The ECM uses the flywheel sensor to monitor engine rotation and engine speed variations during a revolution. This allows the ECM to ensure that each injector receives exactly the correct amount of fuel. The ECM stores information when a fault occurs or if something in the system is abnormal. Intermittent faults are also stored and can be traced at a later time.

## Overflow Valve



W2066132

The overflow valve on the cylinder head controls the pressure in the low pressure system, which supplies fuel to the unit injectors and at the same time cools them. The overflow valve has a built-in bleed valve for the fuel system.

**Always replace the fuel line compression sealing washers when:**

- Troubleshooting for fuel aeration and/or
- Performing any service procedure that requires the removal of engine fuel lines.

## Aftertreatment Hydrocarbon Dosing System

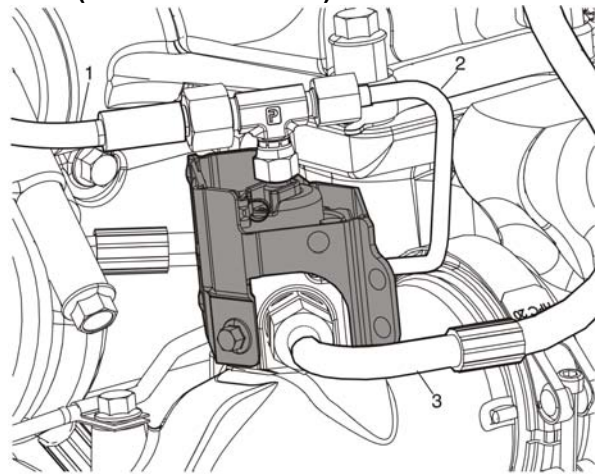
The aftertreatment hydrocarbon doser injects diesel fuel into the exhaust stream to increase the exhaust gas temperature (EGT) to the range needed for forced aftertreatment diesel particulate filter (DPF) stationary regeneration when passive DPF regeneration is insufficient to prevent a high soot level in the filter. The engine control module (ECM) notifies the driver that a forced stationary regeneration is needed so the driver can start it with a switch on the dashboard. A service technician can start it manually in a safe location. The aftertreatment hydrocarbon doser is also used when the vehicle is moving to heat up the system and quickly get the engine in compliance with US2010 emissions requirements. At idle this is done by adjusting the engine timing and fuel delivery to increase EGT.

### Aftertreatment Hydrocarbon Dosing System Components (Previous Version)

US2010 emissions compliant engines have a continuous air purge system which removes any fuel remaining in the doser after aftertreatment DPF regeneration. When the engine is operating, there is a constant flow of air through the doser. The secondary vehicle air system, which is off when the engine is off, supplies the air. The main components of the previous system are:

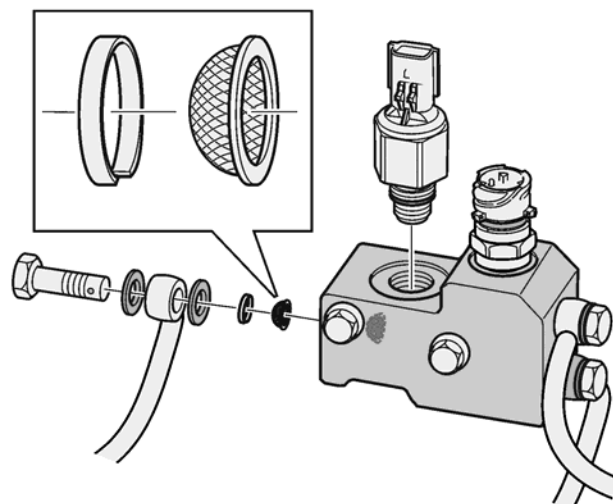
- Chassis-mounted pressure regulator with inlet filter
- Doser-mounted check valve assembly
- Air and fuel supply tubes and hoses
- Air dryer cartridge with coalescing element
- Air shut-off valve

The secondary air system sends air to the in-line filter mounted on the pressure regulator inlet. The pressure regulator lowers the air pressure from chassis pressure, 620-825 kPa (90-120 psi), to approximately 220 kPa (32 psi). Air from the regulator flows through a one-way check valve with a filter screen, which prevents back-flow to the regulator. Air then flows through the doser and into the engine exhaust stream. Fuel is also sent to the doser check valve through a one-way check valve. The ECM controls air and fuel flow to the doser. The shut-off valve prevents air leakage into the fuel system when the ignition switch is in the OFF position. A valve block mounted on the cold side of the engine contains an aftertreatment hydrocarbon fuel pressure sensor and shut-off valve.



W2006759

- 1 Air Line
- 2 Fuel Line
- 3 Coolant Line



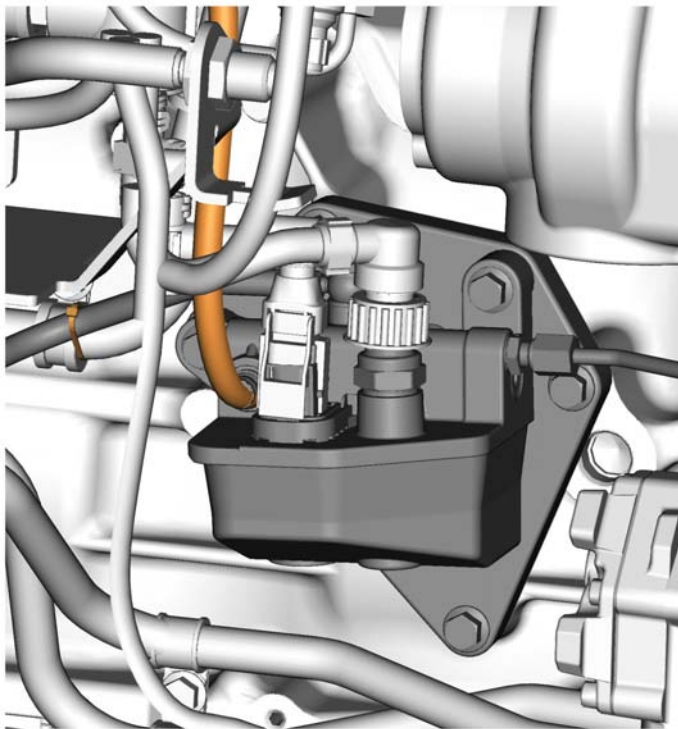
W2066122

## Aftertreatment Hydrocarbon Dosing System Components (New Version)

The main components of the new system are:

- Aftertreatment hydrocarbon dosing module
- Aftertreatment hydrocarbon doser
- Air and fuel supply tubes and hoses
- Chassis-mounted pressure regulator with inlet filter
- Air dryer cartridge with coalescing element

The aftertreatment hydrocarbon dosing module contains three non-serviceable valves, the aftertreatment fuel shutoff valve, aftertreatment purge air valve and aftertreatment hydrocarbon dosing control valve, and a serviceable aftertreatment fuel pressure sensor.

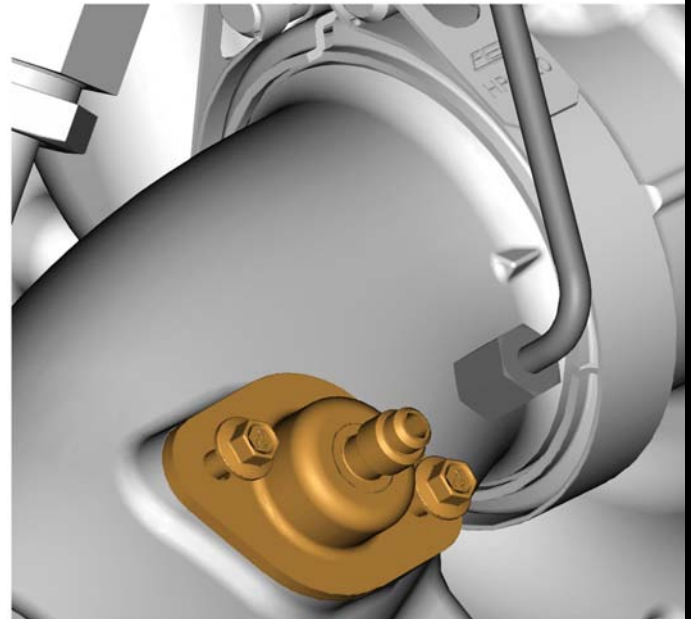


W2064628

Aftertreatment Hydrocarbon Dosing Module

The secondary air system sends air to the in-line filter mounted on the pressure regulator inlet. The pressure regulator lowers the air pressure from chassis pressure, 620-825 kPa (90-120 psi), to approximately 220 kPa (32 psi). During air purge operation, the engine control module (ECM) sends a voltage signal to open the aftertreatment purge air valve. This allows air pressure to flow into the aftertreatment hydrocarbon dosing module. The ECM then sends a signal to the aftertreatment hydrocarbon dosing control valve that allows purge air pressure to be monitored by a signal from the aftertreatment fuel pressure sensor to the ECM. The engine control module (ECM) uses this input to determine if the system is operating correctly.

During DPF regeneration, the ECM sends a voltage signal to open the aftertreatment fuel shutoff valve. This allows fuel to flow into the aftertreatment hydrocarbon dosing module. The aftertreatment fuel pressure sensor monitors the fuel pressure value and sends a reference signal to the ECM. The ECM then sends a signal to the aftertreatment hydrocarbon dosing control valve that regulates the amount of fuel delivered to the aftertreatment hydrocarbon doser through the air/fuel line.

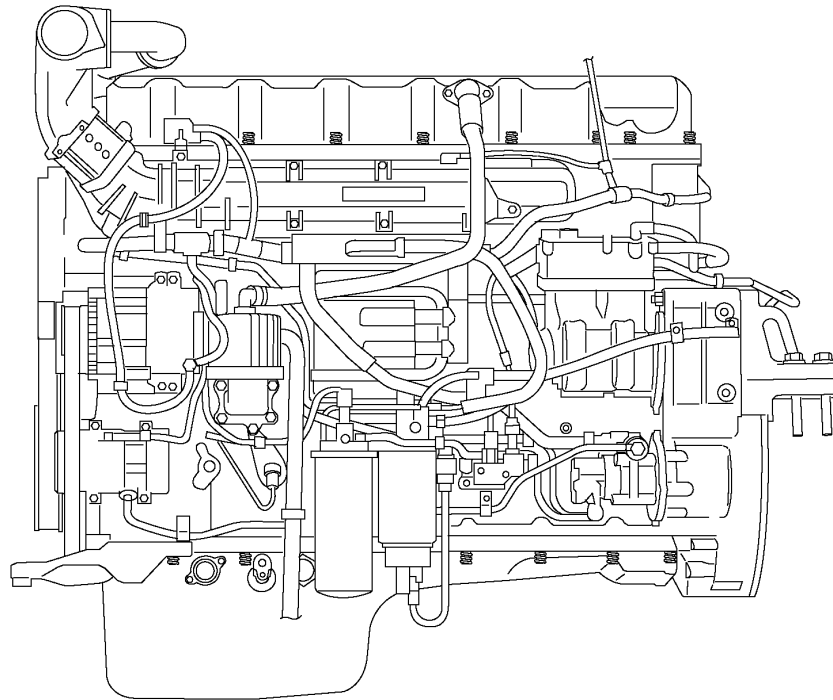


W2064631

Aftertreatment Hydrocarbon Doser

Fuel System  
Design and Function  
D13F

## Fuel System, Design and Function



W2005843

This information covers the design and function of the fuel system on the Volvo D13F engine.

### Contents

- “Fuel System” page 2

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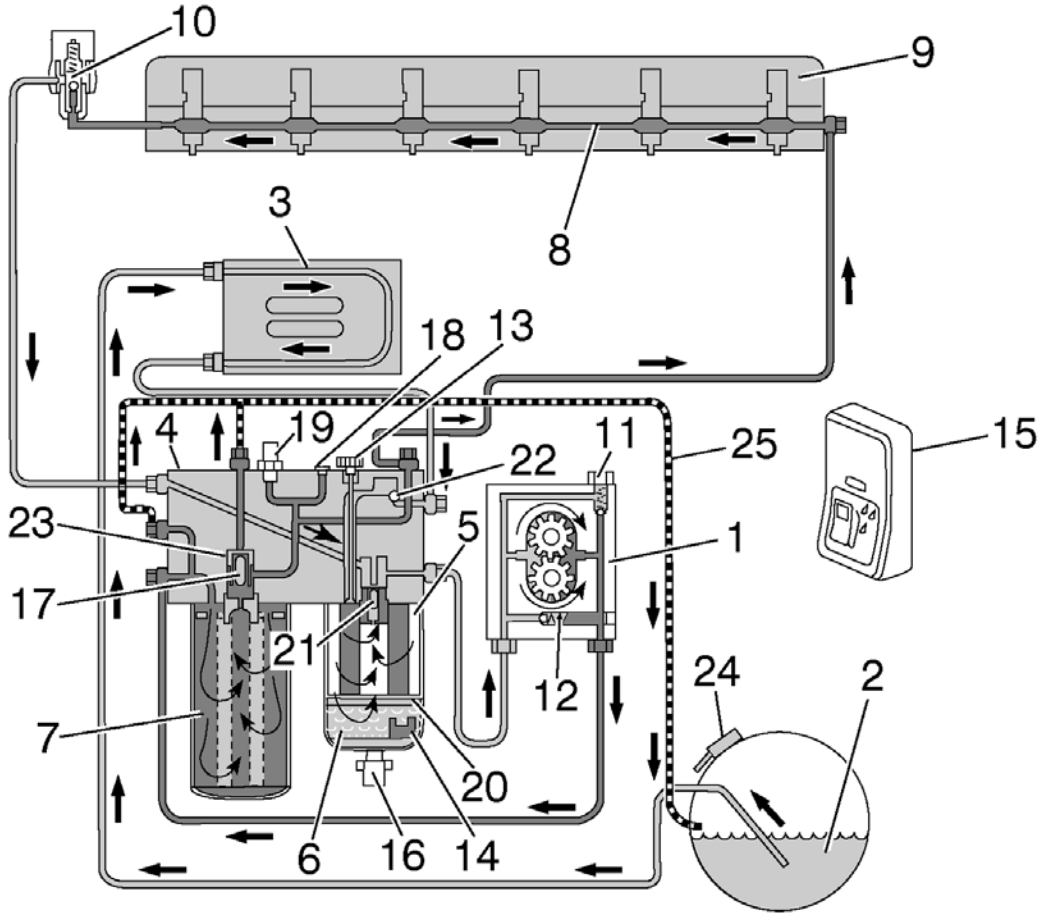


# Design and Function

## Fuel System

When fault tracing, it is important to understand the function of the system in order to avoid replacing non-defective components.

## System Function



Fuel is drawn up the fuel lines by the supply pump (1) through the pickup tube in the fuel tank (2) in through the Engine Electronic Control Unit (EECU) cooling coil (3), and into the fuel filter housing (4). The fuel filter housing is equipped with a pre-filter (5) and a water separator (6), where fuel is filtered through the primary filter that separates any water from the fuel.

The supply pump (1) forces the fuel into the fuel filter housing through the main filter (7) to a cylinder head longitudinal fuel gallery (8). This channel supplies each unit injector (9) with pressurized fuel by a circular groove around each unit injector in the cylinder head. The overflow valve (10) controls the fuel supply pressure to the unit injectors.

The return fuel from the overflow valve (10) is returned back to the fuel filter housing and is mixed with the fuel from the fuel tank in a channel within the fuel filter housing (4).

### *Supply Pump Valves*

Two valves are located in the supply pump (1).

The safety valve (11) allows fuel to flow back to the suction side when the pressure becomes too high, e.g., if the fuel filter is blocked or is too restricted. The non-return valve (12) opens when hand-priming is used.

### *Automatic Bleeding*

If air gets into the system, it is bled when the engine starts. During bleeding, the air is pressed out through the fuel filter housing over to the fuel tank through the return line (25). Bleeding for the filter replacement is controlled by valves (17) and (23).

### *Water Drainage*

Draining water from the water separator (5) requires the following:

- The sensor (14) in the water separator indicates water in the fuel bowl.
- The engine is not running.
- The ignition key is in the ON position.
- The parking brake is applied.

When the switch (15) is depressed (located in the cab instrument panel), the drain valve (16) opens for about 15 seconds and drains the water. If additional drainage is needed, wait 6 minutes before repeating because the function is on a timer.

### *Manual Hand Pump*

The manual hand pump (11) is located on the fuel filter housing and is used to pump fuel (when the engine is not running) after the fuel system has been drained for repair, etc. The non-return valve (22) for the hand-priming pump is also located in the fuel filter housing.

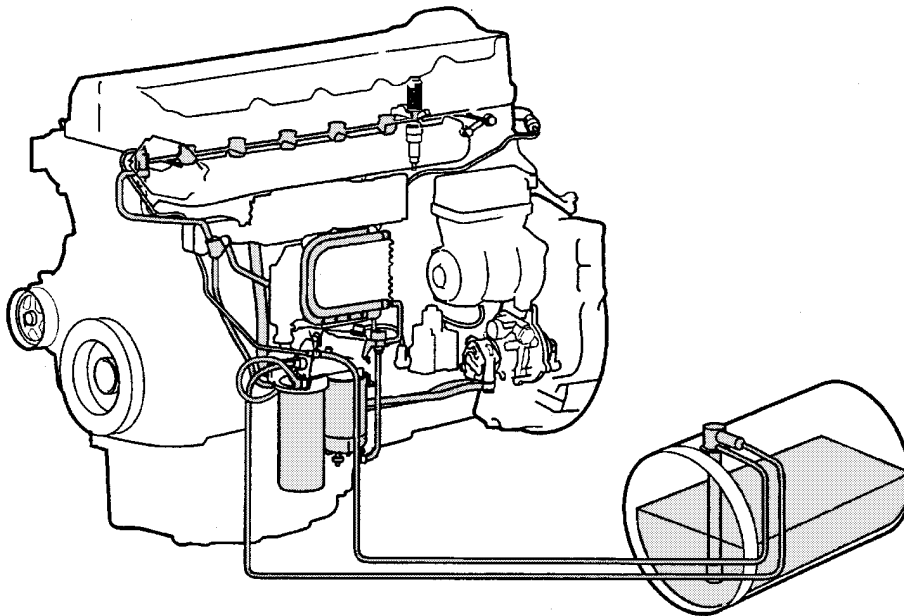
*Other*

The fuel filter housing eliminates the need to drain the fuel when replacing the filter. The valve pegs (17) and (21) close when the fuel filter is removed. It is not necessary to bleed the fuel system after replacing the filter, since this is performed automatically when the engine is started and runs for more than 2 minutes.

The plugged outlet (18) is fitted on the fuel filter housing. The outlet is used when measuring supply pressure after the fuel filter with an external pressure gauge. The pressure sensor (19) on the fuel filter housing monitors the supply pressure after the fuel filter. A fault code is displayed on the instrument cluster if the fuel supply pressure is less than the specified value.

A fuel heater (20) is available as an option. It is located in the lower part of the water separator. The fuel tank breather (24) prevents excessive vacuum in the fuel tank(s) which could possibly result in fuel starvation.

**Fuel System Components**



Current Volvo diesel engines are electronically controlled and designed to meet today's strict environmental standards. Meeting these standards requires optimum combustion. This demands, among other things, injecting the exact amount of fuel into the combustion chamber under very high pressure at precisely the correct time, depending on engine speed, load, temperature and other conditions.

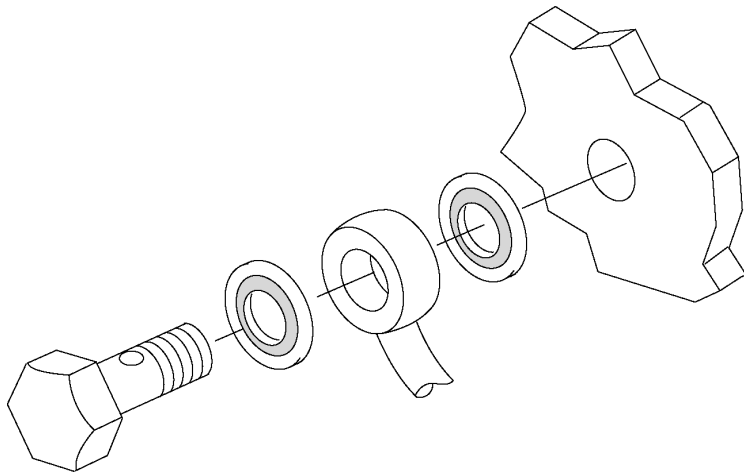
Totally mechanical injection systems cannot meet these demands and so requires that engines are equipped with an electronically controlled injection system. An Engine Electronic Control Unit (EECU) receives electrical signals from the accelerator pedal and a number of other sensors on the engine. These sensors provide speed, pressure and temperature signals, sent to the EECU, which in turn governs the fuel injection process. The EECU has a built-in diagnostic system which electronically detects and traces faults that might occur in the fuel system.

Each cylinder has four valves. Individual differences always occur between the cylinders in an internal combustion engine. The engine has a cylinder balancing system, the purpose of which is to even out the amounts of fuel between the cylinders. Cylinder balancing takes place with the engine running at idle speed, providing certain preconditions have been met.

*Fuel Line Compression Fitting*

**Always replace the fuel line compression sealing washers when:**

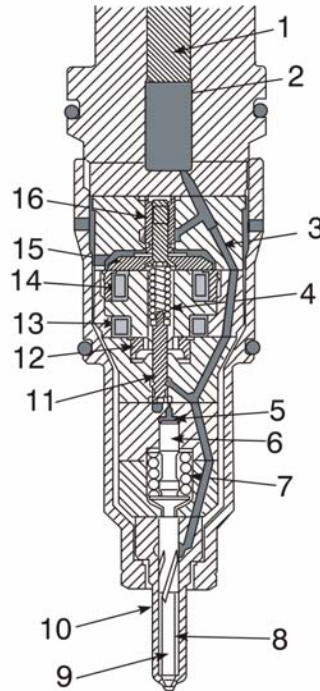
- Troubleshooting for fuel aeration and/or
- Performing any service procedure that requires the removal of engine fuel lines.



W2005829

Typical Compression Sealing Washers

## Unit Injectors



1. Pump Element	9. Needle
2. Pump Chamber	10. Nozzle
3. High Pressure Fuel Line	11. Needle Control Valve (NCV)
4. Return Spring	12. Needle Control Valve Armature
5. Needle Backing Chamber	13. Needle Control Valve Electrical Coil
6. Needle Control Piston	14. Spill Valve Electrical Coil
7. Needle Closing Spring	15. Spill Valve Armature
8. Needle Chamber	16. Spill Valve (SV)

W2005194

Unit injectors for diesel engines have both injector pump element and the nozzle assembly in the same body. The pump stroke is activated by a camshaft lobe which rotates at one half crankshaft speed in 4 stroke engines. The pump stroke is always constant, but the delivery through the injection nozzle is controlled by an electrically operated solenoid valve, usually named a Spill Valve (SV). The SV is located between the high pressure fuel line and the low pressure fuel line. When the SV is closed, all the fuel from the pump chamber is forced through the nozzle and into the engine combustion chamber. When the SV is open, the fuel is routed into the low pressure fuel feed line and so no fuel passes through the nozzle. The SV is operated by the Engine Electronic Control Unit (EECU) by software and certain power stages capable of driving the solenoids.

The injected fuel quantity per pump cycle is determined by how long the SV is closed during the pump stroke. The start of injection, i.e., injection timing, is determined by when the SV is closed.

The injection pressure achieved is balanced out by a number of factors:

- 1 The pumping capacity (pump element diameter, cam rate) versus the restriction in the nozzle (the nozzle hole area).
- 2 The engine speed, i.e., fuel/sec from the pump chamber versus the nozzle hole area.
- 3 The nozzle opening pressure.

For a given unit injector/cam/nozzle specification, the injection pressure is well defined over the speed/load range for a specific engine. Engine exhaust emissions are very dependent on the fuel spray characteristics and are, to a large extent, influenced by the nozzle spray hold design and the injection pressure. Therefore, it is of great benefit to be able to change these parameters and today it is possible to vary at least one of them, namely the injection pressure. The method is to let the pressure build up to a desired level before opening the nozzle needle.

To make the nozzle opening freely adjustable, a second valve is used, the Needle Control Valve (NCV). The NCV is a three port, two position valve, located between the high pressure fuel line, the low pressure fuel line and a needle backing chamber. The valve controls the pressure in the backing chamber by either connecting the chamber to the high pressure line or to the low pressure fuel line. Pressure in the chamber exerts force on the back of the nozzle by the control piston. The diameter of the control piston is the same as the needle guide diameter so that when the needle is off the needle seat, pressure balance is achieved. When the needle is on the needle seat, the effective area on the lift side is reduced and, with the same pressure acting on both sides, there is a net force keeping the needle on the needle seat.

The force equation is:

- Pressure x control piston area plus spring force acts to keep the needle closed.
- Pressure x lift area acts to open the needle.

With the same pressure acting on both areas, the acting force is spring force plus the pressure force due to the difference of the two effective areas. This keeps the needle closed.

When the desired pressure in the needle chamber is achieved, the NCV is activated, closing the high pressure line to the back of the needle control piston and at the same time, connecting the back of the piston to the low pressure line. The high pressure on the back of the needle control piston is removed and the pressure on the lift side now overcomes the closing force from the needle closing spring and the needle opens.

In this way, the Needle Opening Pressure (NOP) can be varied between the preset spring NOP and the maximum pumping pressure. Practically, the levels used are between 250–1800 bar, to be compared with a common nozzle, using 250–350 bar opening pressure.

The influence on spray formation is such that the soot (particulate matter) formation is lowered with increased needle opening pressure while at the same time, NOx formation is increased.

By using a variable NOP over the speed/load range of the engine, it is possible to balance with trade-off between the particulate matter and NOx formation to achieve the best combination for each speed/load point and thus decrease engine exhaust emissions.



## **Injector Operational Phases**

### *Fill Phase*

During the filling phase, the pump plunger is on its way up, the camshaft lobe is passing its highest point and the rocker arm is on its way toward the camshaft base circle.

The fuel valve is open, allowing fuel to flow into the unit injector from the lower fuel gallery. Fuel flows into the cylinder head and the unit injector pump cylinder. Filling continues until the pump plunger reaches its upper position.

### *Spill Phase*

The spill phase begins when the camshaft lobe forces the rocker arm to push the pump plunger down.

The fuel can now flow through the fuel valve, through the holes in the unit injector and out through the fuel gallery. The spill phase continues as long as the fuel valve is open.

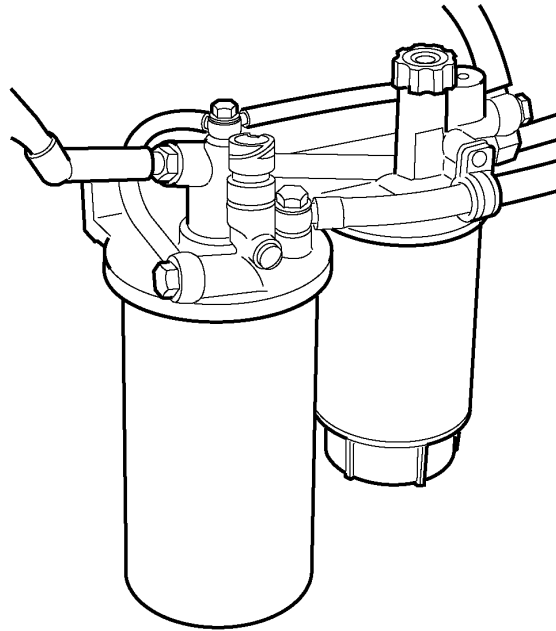
### *Injection Phase*

The injection phase begins when the fuel valve closes. The camshaft lobe and rocker arm continue to press down on the pump plunger and injection occurs as the path through the fuel valve closes. The injection phase continues as long as the fuel valve is closed.

### *Pressure Drop Phase*

The injection phase ends when the fuel valve opens and pressure in the unit injector drops below the nozzle opening pressure. The fuel flows through the open fuel valve, through the unit injector holes and out through the fuel gallery. Note that the fuel valve position (closed or open) determines when the injection phase begins and ends. The time during which the fuel valve is closed determines the amount of fuel injected at each pump stroke.

## Fuel Filter



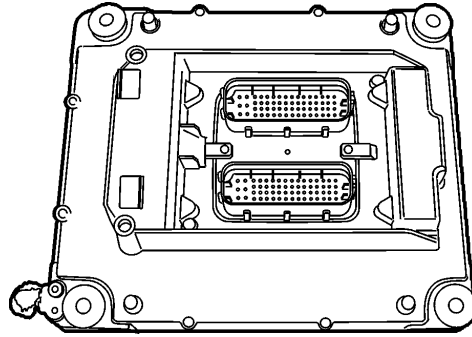
W2005849

The system is equipped with a large fuel filter located on the left-hand side of the engine. The filter insert consists of a corrugated filter paper with a high resistance to water and very good filtering properties. In addition, a fine-gauge net filter on the fuel suction line in the fuel tank separates any possible solid impurities before the fuel is pumped up into the system.

## Fuel Feed Pump

The capacity of the pump has been adapted to give the correct pressure and flow to the unit injectors. Filling the unit injectors requires relatively high pressure. The flow must be large enough to even out any fuel temperature differences in the cylinder head fuel gallery.

## Engine Electronic Control Unit (EECU)



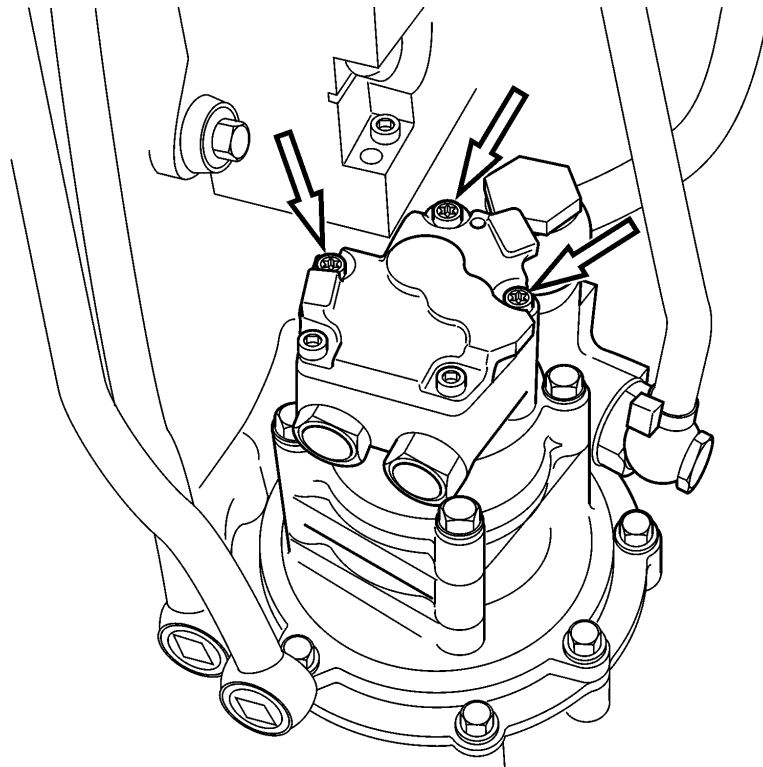
W2003778

The engine electronic control unit is the central part of the injection system. It is located on the left-hand side of the engine. The EECU receives continuous information from the accelerator pedal and from several other sensors on the engine. It calculates the amount and the time to inject fuel into the cylinders. Electrical wiring to the unit injectors transmits control signals to the injectors from the EECU.

The EECU uses the flywheel sensor to monitor engine rotation and engine speed variations during a revolution. This allows the EECU to ensure that each unit injector receives exactly the correct amount of fuel. The EECU stores information when a fault occurs or if something in the system is abnormal. Intermittent faults are also stored and can be traced at a later time.

## Fuel Pump, Replacement D13F

### Fuel Pump, Replacement



T2022147

### Contents

- "Fuel Feed Pump, Replacement" page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2331-03-02-01 Fuel Feed Pump, Replacement

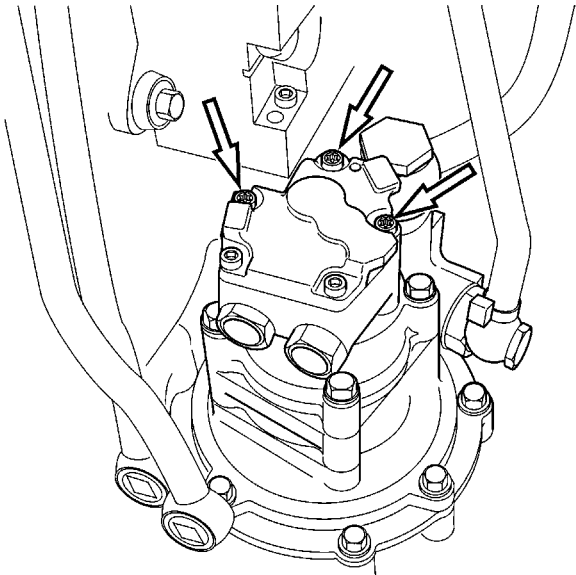
You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

**1**  
Clean around the feed pump and loosen the fuel lines at the feed pump. Position a container to catch any fuel that drains from the pump or lines.

**2**  
Remove the fuel pump.

**Note:** Only remove the screws marked with arrows.

**CAUTION**  
Be sure to clean any dirt that might be in the head of the fasteners. Debris will prevent the tool from fitting properly and cause damage to the fasteners.

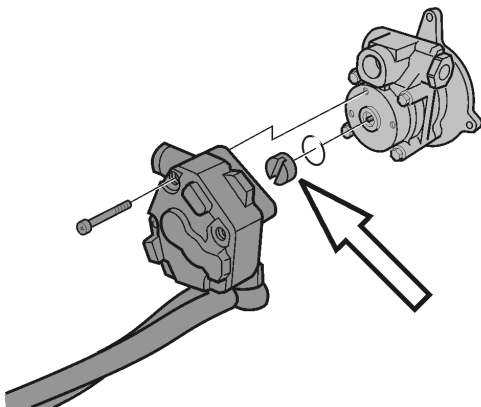


T2022147

**3**  
Check that the adapter and the fuel pump drive axle are not damaged.

**4**  
Install the new fuel pump. Torque-tighten fasteners to specification.

**Note:** Use a new sealing ring. Check that the fuel pump drive axle sits correctly in the power steering pump.



W2004886

**5**

Connect the fuel lines to the feed pump.

**6**

Using the hand primer on the fuel filter housing, prime the fuel system.

**7**

Start the engine and let it run for 5 minutes. Make sure there are no leaks.

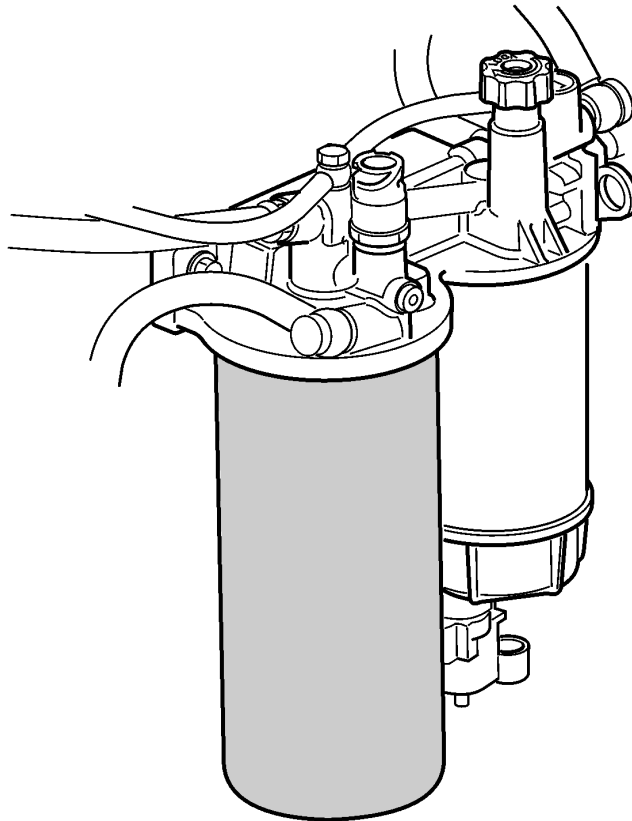
**8**

Check and clear any fault codes set due to the fuel pump being replaced.

Date	Group	No.	Page
2.2008	<b>233</b>	<b>101</b>	1(3)

## Fuel Filter, Replacement D13F

### Fuel Filter, Replacement



T2021435

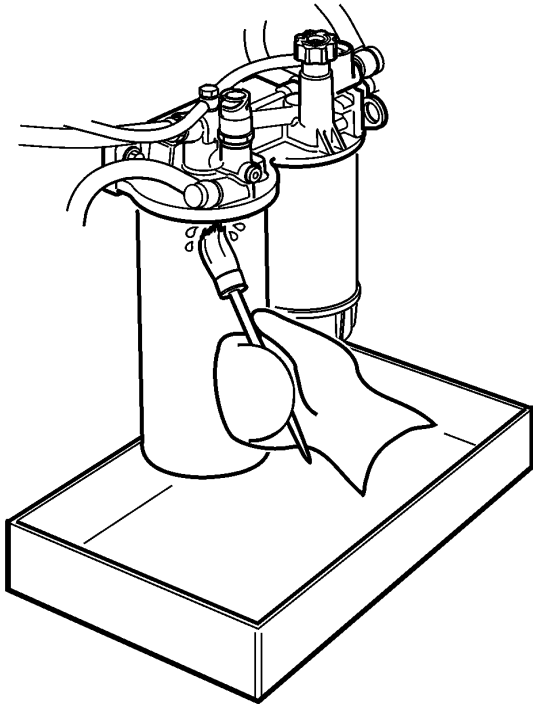
### Contents

- “Fuel Filter, Replacement (One)” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2335-03-03-02 Fuel Filter, Replacement (One)

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

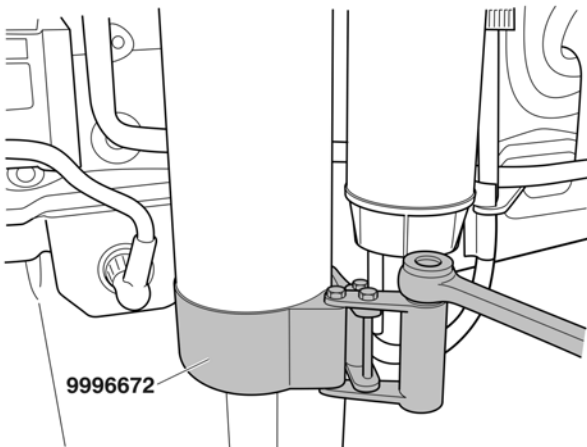


T2021436

**1**  
Clean around sealing area on fuel filter and housing.

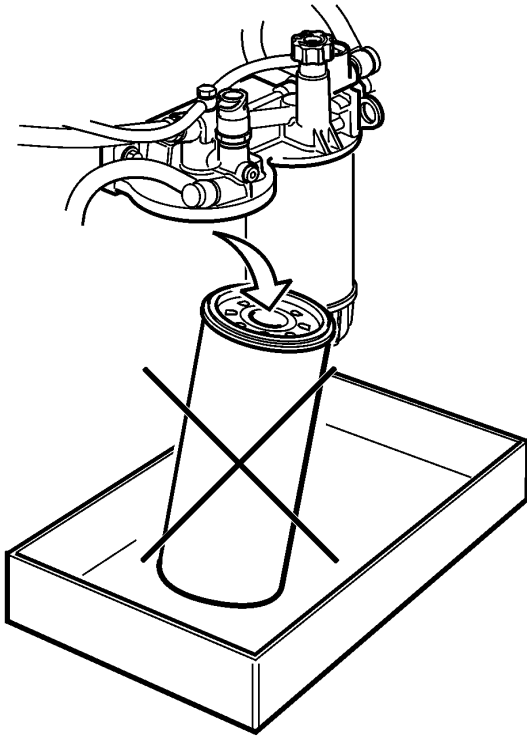
**2**  
Before removing the fuel filter, position a container under filter to catch any fuel that might spill.

9996672 or equivalent



T2023188





T2021437

**3**

Lubricate the seal and install the filter. Tighten according to the instructions on the filter.

 **CAUTION**

Fuel in the old filter **must absolutely not** be poured into the new filter. This kind of contaminated fuel can damage the unit injectors.

**4**

Prime the fuel system by pumping the hand priming pump on the fuel filter housing until resistance is felt indicating that the system is full of fuel.

**5**

Start the engine and carry out a fuel-tightness check.

**6**

Let the engine run for about 5 minutes to remove air pockets from the fuel system.

**Note:** The engine speed must **not** be increased, otherwise air can be pressed into the cylinder head, causing the engine to stop.

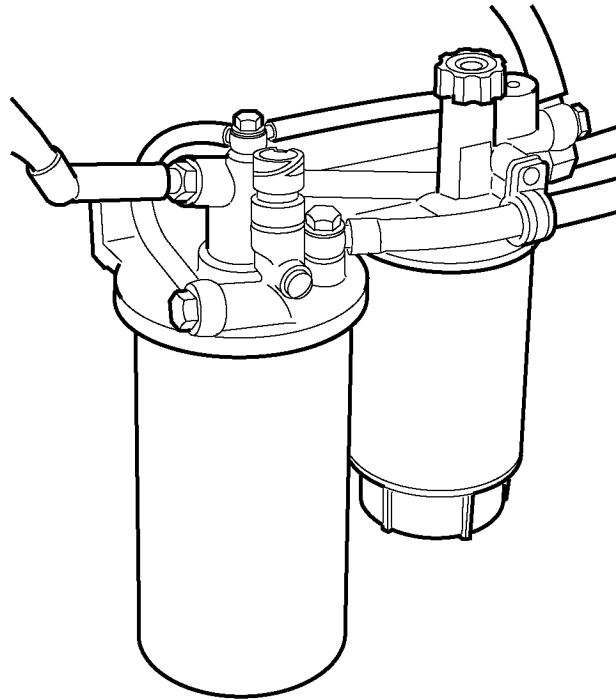
**7**

Check that no fault codes have been set.

Date	Group	No.	Page
2.2008	<b>233</b>	<b>102</b>	1(4)

## Filter, Water Separator, Replacement D13F

### Filter, Water Separator, Replacement



W2005849

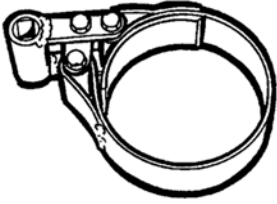
### Contents

- "Filter, Water Separator, Replacement" page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

For information about ordering special tools, see the tool information in group 08.

## **Special tools**

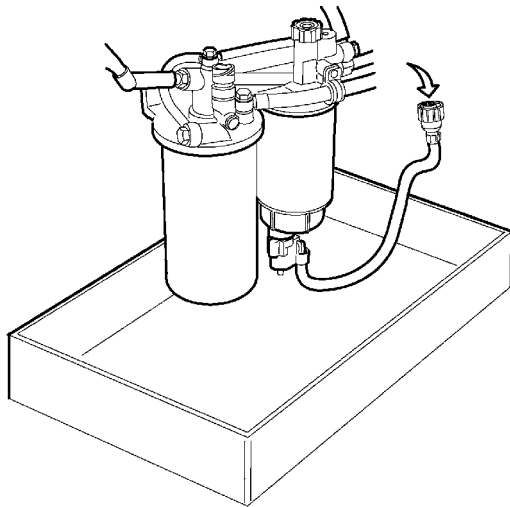


**9996671**

Oil filter wrench (or equivalent)

## 2339-03-03-01 Filter, Water Separator, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.



W2005858

**1**

Disconnect the wiring from the sensor for the water separator.

**2**

Remove the water separator filter from the filter housing. Use oil filter wrench 9996671 (or equivalent). Collect any spilled fuel in a container.

9996671 (or equivalent)

**3**

Remove the lower section of the water separator from the filter.

**4**

Wash the underside and blow clean using compressed air.

**5**

Check that the drain holes in the lower section are not blocked.

**6**

Install a new seal on the lower section. Lubricate the seal using engine oil. Install the lower section on the new filter.

**7**

Lubricate the filter seal. Install the filter on the filter housing. Rotate clockwise until the seal is tight against the housing. Then rotate clockwise another 1/2-3/4 turn.

**8**

Connect the wiring to the sensor for the water separator.

**9**

Prime the fuel system by pumping the hand priming pump on the fuel filter housing until resistance is felt indicating that the system is full of fuel.

**10**

Start the engine. Conduct a leak test.

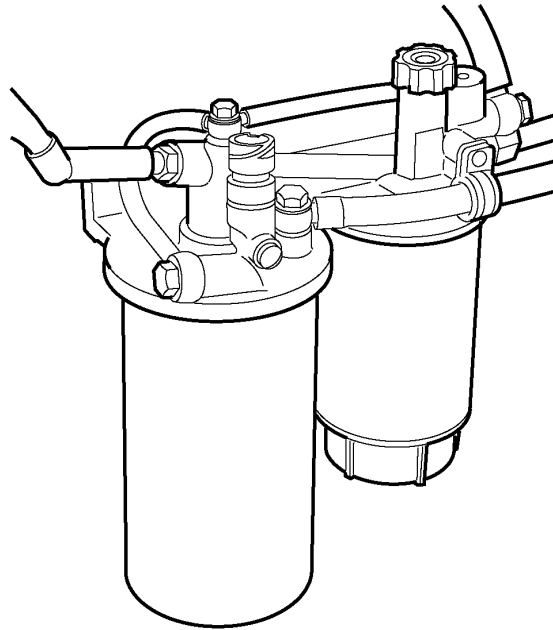
**11**

Check that no fault codes are stored.

Date	Group	No.	Page
2.2008	<b>233</b>	<b>103</b>	1(9)

## Fuel Filter Housing, Replacement D13F

### Fuel Filter Housing, Replacement



W2005849

This information covers the procedure for replacement of the fuel filter housing on the Volvo D13F engine.

### Contents

- “Fuel Filter Housing, Replacement” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

## 2334-03-02-03

### Fuel Filter Housing, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

#### Removal

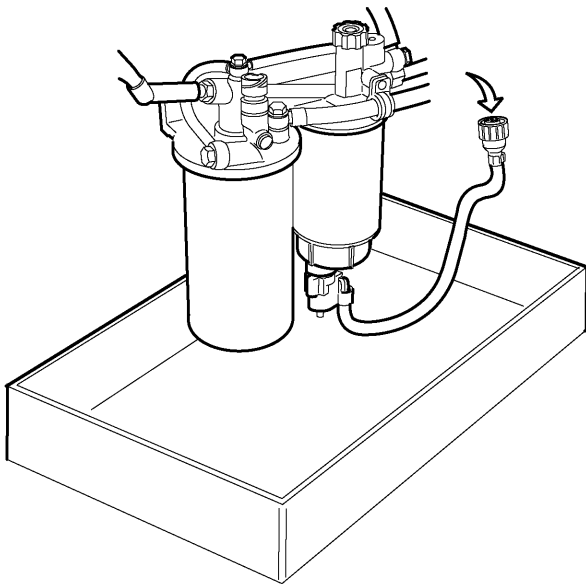
**Note:** Ignition key must be in the OFF position. Use an approved container to catch fuel from the fuel lines as they are disconnected and from the fuel filters as they are removed.

**1**

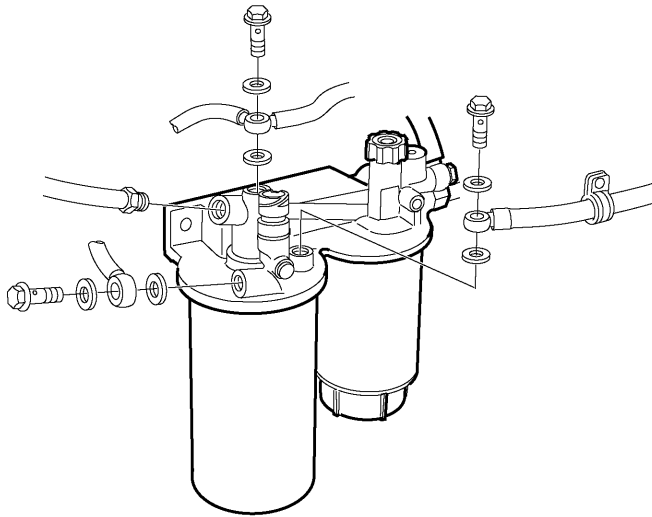
Apply the parking brake and place the shift lever in neutral.

**2**

Place an approved container under the fuel filter housing, then drain the water from the primary fuel filter. Disconnect the water/fuel separator indicator electrical connector.

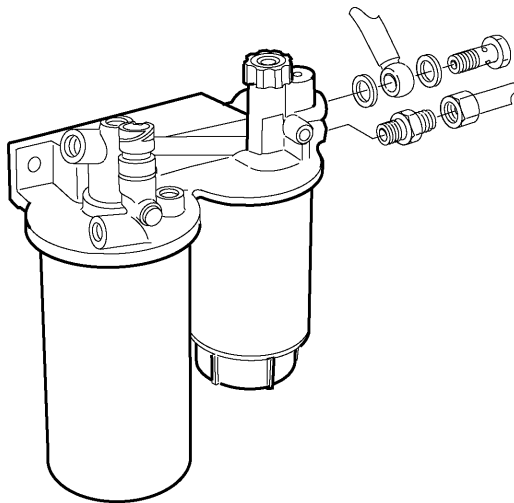


- 3**  
Remove the fuel lines above the secondary fuel filter from the fuel filter housing.



W2005859

- 4**  
Remove the remaining fuel lines from the fuel filter housing.



W2005860

- 5**  
Remove the fuel filters and water/fuel separator indicator cover from the fuel filter housing.

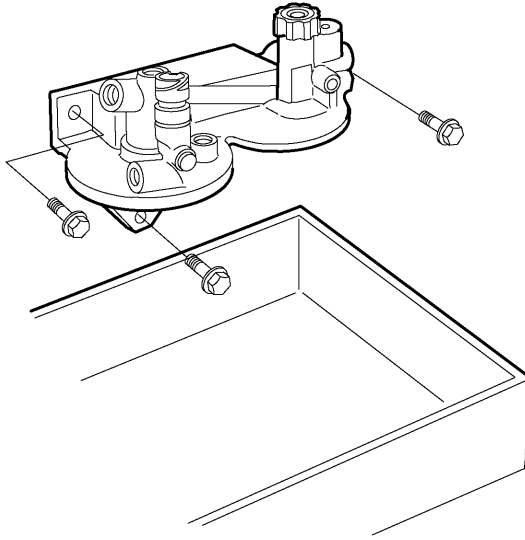
- 6**  
Remove the water/fuel separator indicator cover from the primary fuel filter.

- 7**  
Disconnect the electrical connector for the sensor.



- 8**  
Remove the bolts and the fuel filter housing.

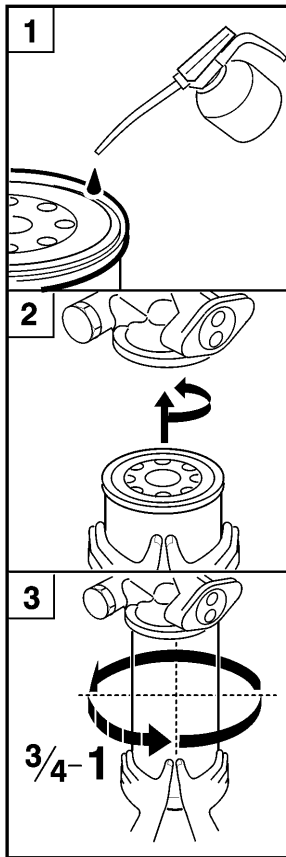
**Note:** Install new fuel filters when replacing the fuel filter housing.



W2005861

## Installation

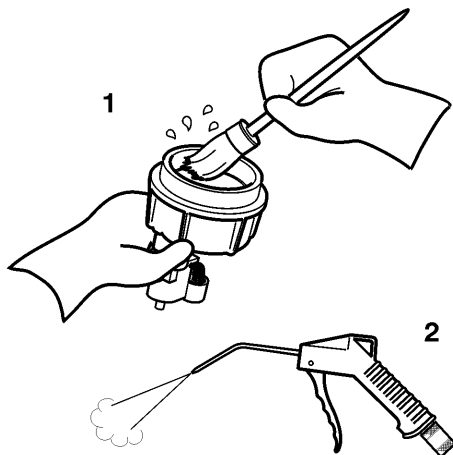
- 1**  
Install the bolts and the new filter housing to the side of the engine. Tighten the bolts to  $24 \pm 4$  Nm ( $18 \pm 3$  ft-lb).
- 2**  
Connect the electrical connector for the sensor.



T2021439

**3**

Apply a thin coating of clean engine oil to the gasket of the secondary fuel filter (1). Screw the fuel filter into position (2). Tighten the filter 3/4 to 1 full turn (3) after the gasket makes contact with the fuel filter housing.

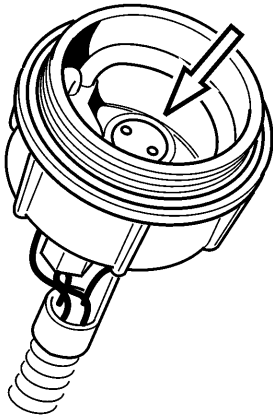


T2021429

**4**

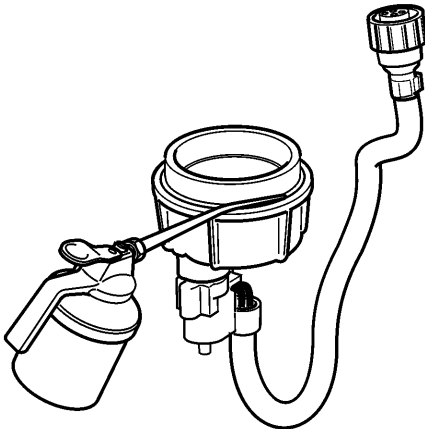
Remove and discard the old gasket from the water/fuel separator indicator cover. Clean the cover thoroughly (1) and then blow dry with filtered compressed air (2).

- 5**  
Check that the drainage hole in the water/fuel separator indicator cover is not blocked.



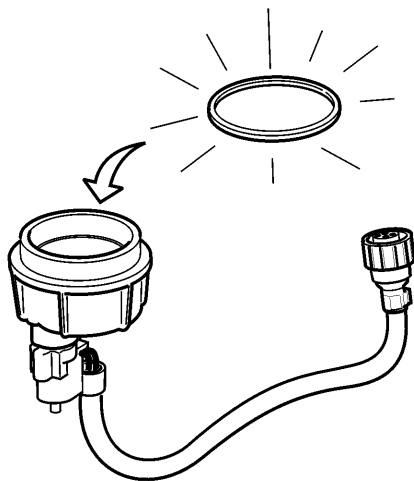
T2021430

- 6**  
Apply a thin coating of clean engine oil to the surface of the water/fuel separator indicator cover.

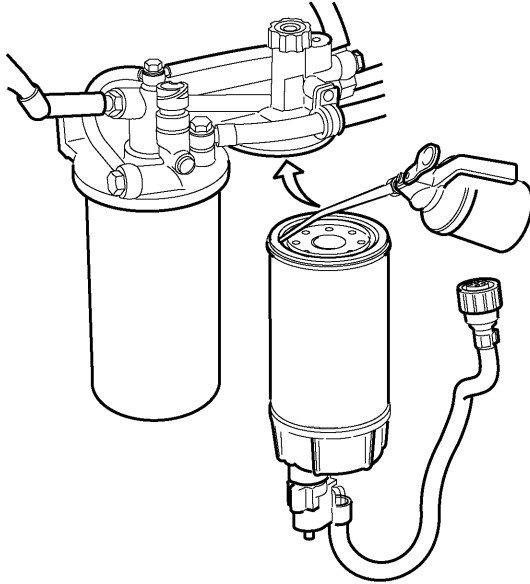


T2021432

- 7**  
Install a new gasket to the water/fuel separator indicator cover. Install the water/fuel separator indicator cover on the primary fuel filter.



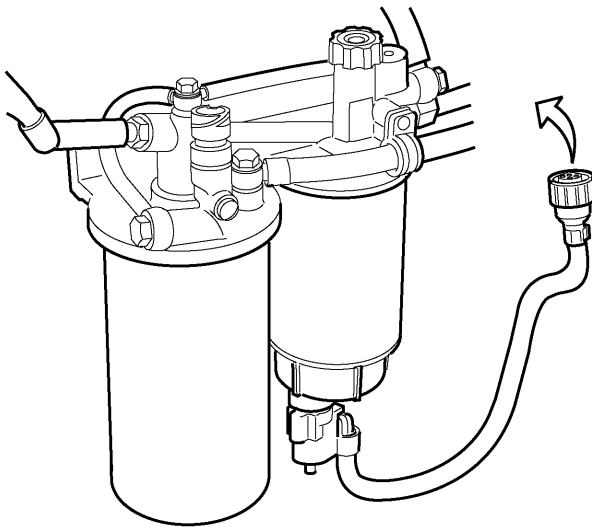
T2021431



W2005862

**8**

Apply a thin coating of clean engine oil to the surface of the primary fuel filter, install the primary fuel filter to the fuel filter housing, then tighten the primary fuel filter 1/2–3/4 turn.



W2005863

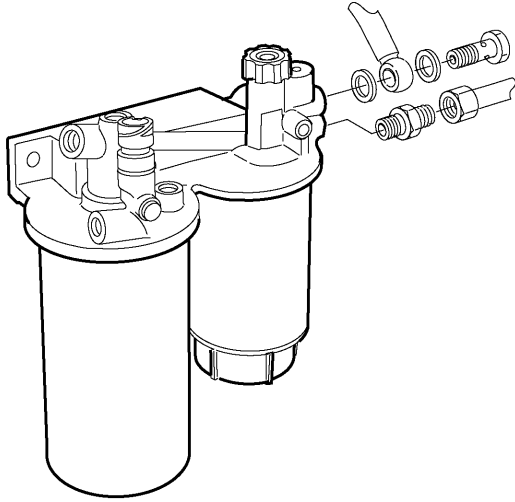
**9**

Connect the electrical connector for the water/fuel separator indicator cover.

**10**

Connect the fuel lines and new seals to the primary side of the fuel filter housing.

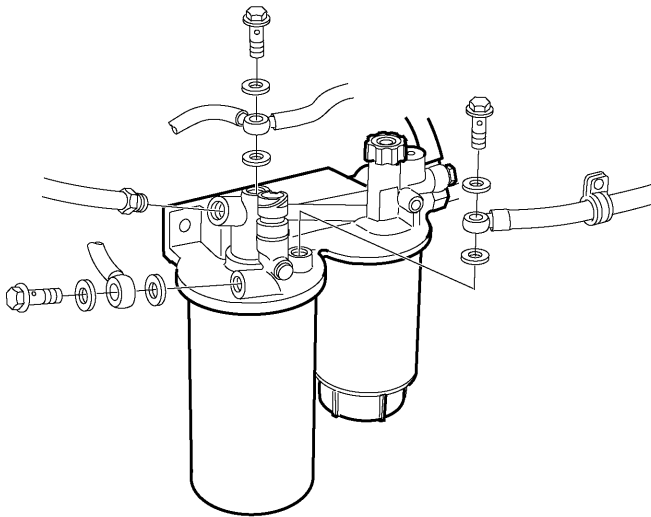
**Note:** To avoid leaking fuel lines, always replace with new seals.



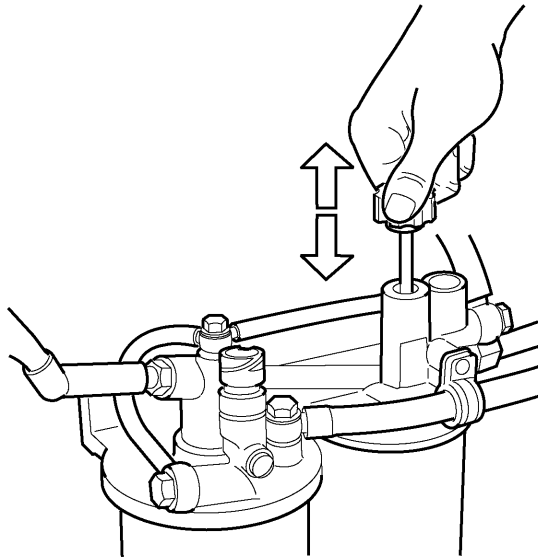
W2005860

**11**

Install the fuel lines and new seals above and in front of the secondary fuel filter to the fuel filter housing.



W2005859



W2005864

**12**

Prime the fuel system by pumping the hand priming pump on the fuel filter housing until resistance is felt, indicating that the system is full of fuel.

**13**

Start the engine. Let the engine run at low idle for about 5 minutes. Check for any fuel leaks and correct if necessary.

**Note:** The engine speed should not be increased above low idle because any air pockets can be forced into the cylinder head and result in the engine stopping.

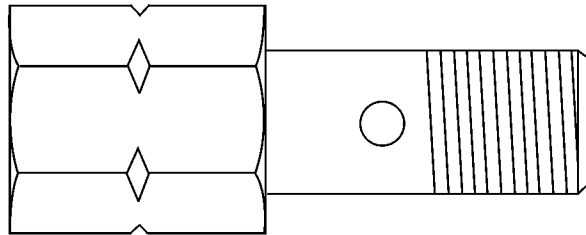
**14**

Make sure that there are no fault codes set.

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5.2008	<b>233</b>	<b>104</b>	1(4)

## Overflow Valve, Replacement D13F

### Overflow Valve, Replacement



W2005120

This information covers replacing the fuel overflow valve on the Volvo D13F engine in a Prevost vehicle.

### Contents

- “Overflow Valve, Replacement” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

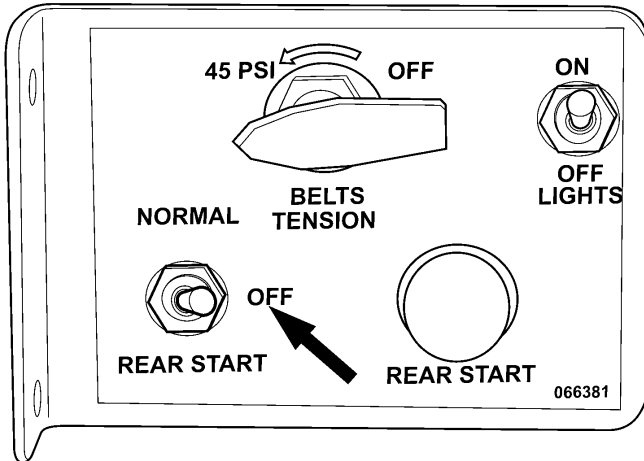
## 2339-03-02-02 Overflow Valve, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

**1**  
Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.

**2**  
Open the engine compartment door. Set the starter selector switch to the OFF position.

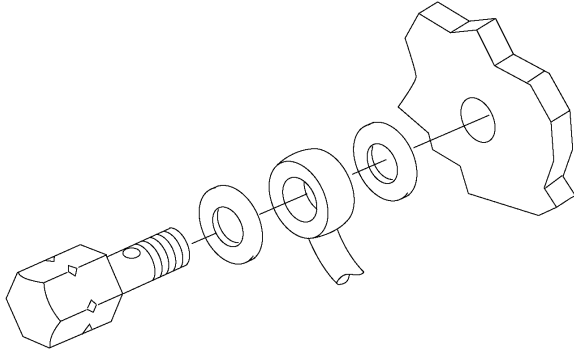


W2006494



**3**  
Remove the overflow valve, two gaskets and the fuel line. Use an approved container to catch fuel from the fuel lines as they are disconnected.

**Note:** The overflow valve is located on the front of the cylinder head on all Volvo engines.



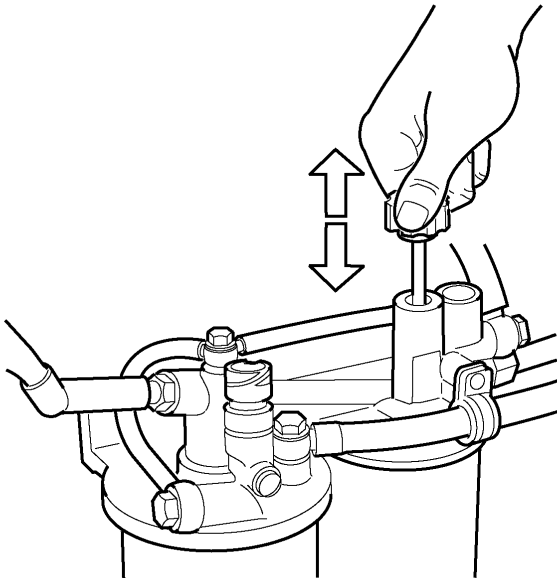
W2006147

## Installation

**1**  
Install the fuel line, new overflow valve and two new gaskets to the cylinder head. Tighten the overflow valve to specification.

**Note:** For correct torque specifications, refer to the Specifications bulletin in Group 20.

**2**  
Prime the fuel system by pumping with the hand pump until resistance is felt.



W2005864

**3**  
Turn the ignition key to the ON position. Set the starter selector switch to the rear start position.

**4**

Press the starter push-button switch. Release push-button after the engine starts. Check for leaks and proper operation.

**5**

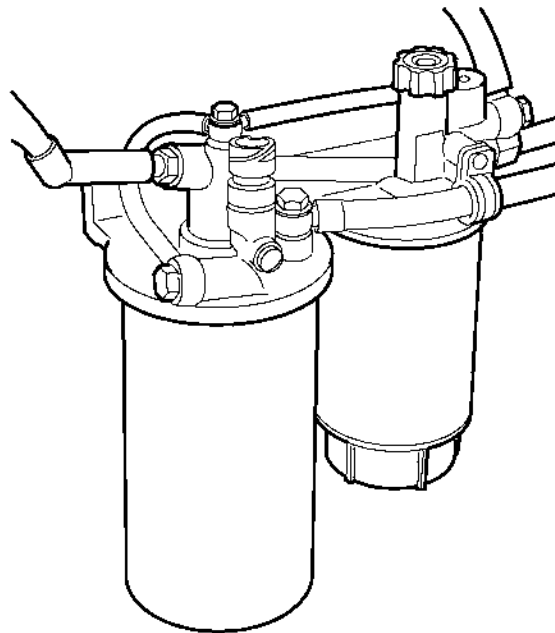
Set the starter selector switch to the NORMAL position. Close the engine compartment door.

Date	Group	No.	Release	Page
9.2010	<b>233</b>	<b>23</b>		1(6)

Filter, Water Separator, Replacement

PREVH, PREVX

## Filter, Water Separator, Replacement



W2005849

This information covers the procedures to replace the water Separator filter and the fuel filter on the Volvo D13H engine in the Prevost model PREVH or PREVX bus.

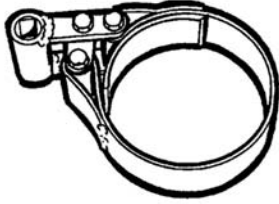
### Contents

- "Special Tools", page 2
- "Filter, Water Separator, Replacement", page 3
- "Fuel Filter Replacement", page 5

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

For information about ordering special tools, see the tool information in group 08.

## Special Tools



**9996671**

Oil filter wrench (or equivalent)

## **2339-03-03-01**

### **Filter, Water Separator, Replacement**

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

**1**

Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the off position.

**2**

Open the battery hatch located at the right side rear of the vehicle.

**3**

Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock.

**4**

Access the engine compartment by opening the rear doors or hatch.

**5**

Disconnect the wiring harness from the water separator filter bowl.

**6**

Make sure that the filter casing is clean. If not already clean, use an approved solvent to wash the area around the filter mounting. Blow dry with compressed air.

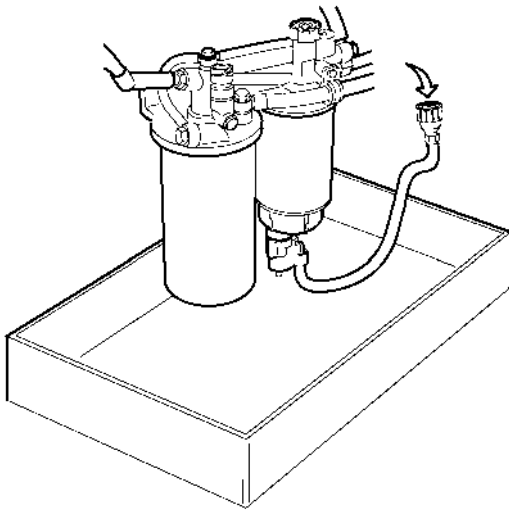
**7**

Place a suitable drip container under the engine to catch any spilled fuel or water.

#### **Water Separator Filter Replacement**

**8**

Unscrew and remove the water separator filter bowl.



W2005858

**9**

Remove the water separator filter from the filter housing. Use oil filter wrench 9996671 (or equivalent). Always dispose of fuel according to Federal or local regulations. Take the drained fuel and water to a recycle or waste management center.

9996671 (or equivalent)

**10**

Check that the drain holes in the lower section are not blocked.

**11**

Install a new seal on the lower bowl section. Lubricate the seal using clean engine oil. Install the lower section on the new filter.

**12**

Lubricate the inner and outer filter seals with clean engine oil. Install the filter on the filter housing. Rotate clockwise until the seal is tight against the housing. Then rotate clockwise another 1/2-3/4 turn.

 **CAUTION**

The new filter must be positioned properly on the filter housing during installation. If the filter is not positioned properly, the inner seal could be damaged. Inner seal damage may result in engine starting problems.

**13**

Screw the water bowl into the filter casing.

**14**

If the fuel filter is being replaced at this time, proceed to Step 15.

## Fuel Filter Replacement

### 15

Using oil filter wrench 9996671 (or equivalent), remove the fuel filter from the filter housing and place in drip container.

### 16

Apply a thin film of clean engine oil to the sealing gasket of the new fuel filter.

### 17

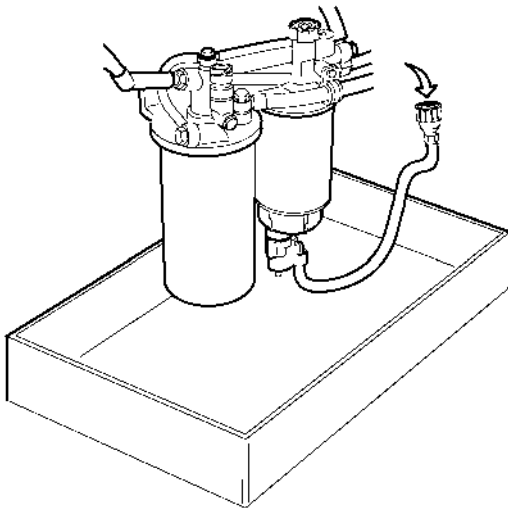
Screw the new dry fuel filter in place. Rotate clockwise until the seal contacts the base. Then rotate clockwise another 1/2-3/4 turn.

### 18

Prime the fuel system by pumping the hand priming pump on the fuel filter housing until resistance is felt indicating that the system is full of fuel.

### 19

Connect the wiring harness to the water separator filter bowl.



W2005858

### 20

Start the engine and let idle. Check for fuel leaks.

### 21

Remove the drip container from beneath the engine. Dispose of spilled fuel properly.

### 22

Reconnect all cables to ground (negative) battery terminals.

### 23

Close the battery hatch of the vehicle.

**24**

Check that no fault codes are stored.



Date	Group	No.	Release	Page
3.2011	<b>237</b>	<b>013</b>	<b>01</b>	1(9)

Yoke, Injector, Check

D13H

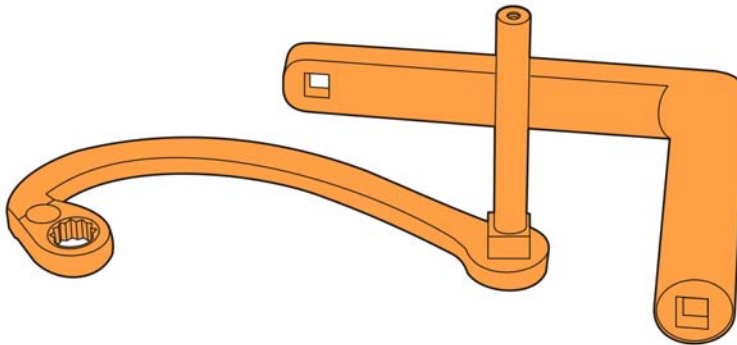
## Yoke, Injector, Check

A new tool, part number 88800341, has been released to make it possible to retorque the injector yoke without removing the rocker arm shaft.



### CAUTION

The procedure in this bulletin must be followed exactly. If the procedure in this bulletin is not followed exactly, damage to the engine may result.



T0064385

Special Tool 88800341

## Contents

- “Yoke, Injector, Check”, page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

## 2372-06-02-01 Yoke, Injector, Check

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

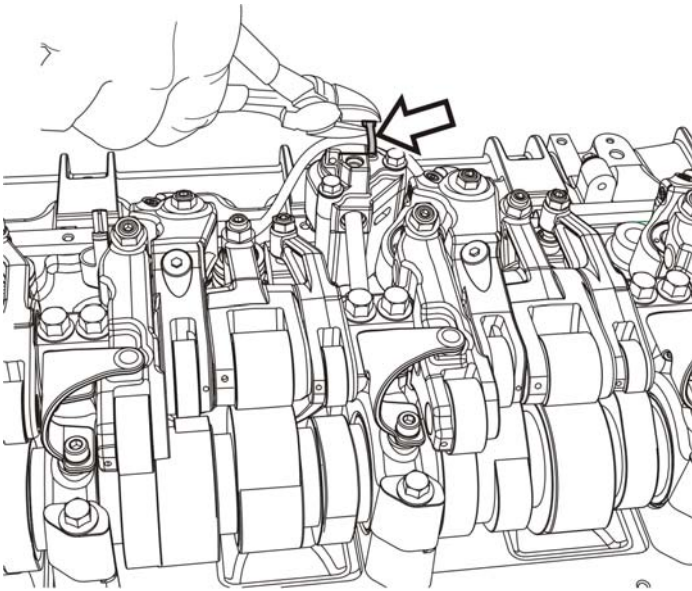
*Special tools: 88800341*

**1**

Remove the valve cover from the engine. Refer to Function Group 211 for service procedures.

**2**

Cut the nylon tie straps securing the injector electrical wiring harness to the engine compression brake control valve.



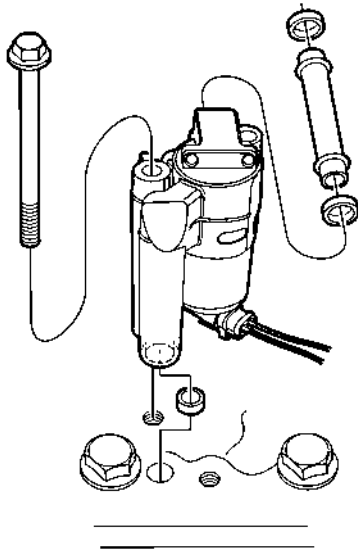
W2005846

**3**

Clean around the engine compression brake control valve and disconnect the valve electrical connector.



W2004837



W2004869

**4**

Remove the engine compression brake control valve bolts. Remove the valve and the oil pipe between the valve and the rocker arm shaft.



W2064627

**5**

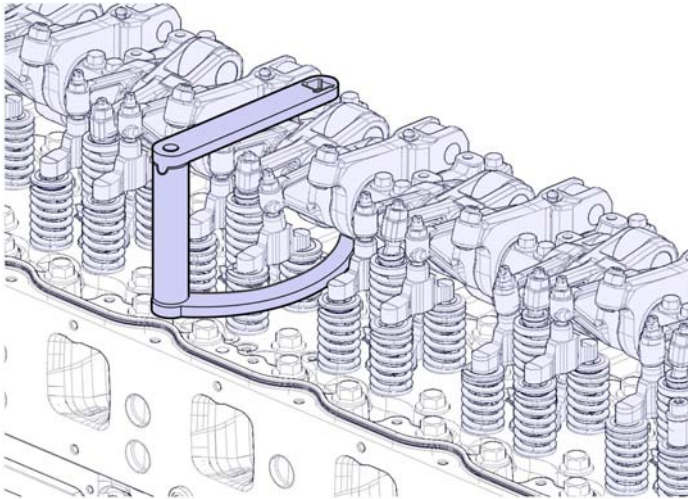
Set the ratchet mechanism on the tool to loosen the yoke fasteners. Install the retorquer tool segment with the reversible ratchet mechanism on the injector yoke fastener from the rear of the injector. Install the other tool segment over the vertical post and rotate it until it seats firmly against the square post section of the post.

**Note:** When the tool segment with the ratchet mechanism is properly in place on the yoke fastener, the round post will point straight-up from the cylinder head.

**Note:** There is only one position when the two segments are properly engaged. When the two segments are properly engaged, the square opening for the torque wrench is directly above the injector yoke fastener.

---

88800341



T2062879

**6**

Install a ratchet wrench in the square opening in the tool and loosen the injector yoke fasteners to 10-15 Nm (7-11 lb-ft) or four full ratcheting cycles.

**! CAUTION**

Do not completely loosen the fasteners (removing all clamp load). If all clamp load is removed from the fasteners, damage to the engine will result.

**7**

Remove the ratchet wrench and upper segment of the tool from the lower segment of the tool. Use the same procedure to loosen the remainder of the injector yoke fasteners.

**8**

Set the ratchet mechanism on the tool to tighten the yoke fasteners.

**9**

Position the tools on each injector yoke fastener as described previously. Use a torque wrench to tighten the yoke fasteners to 60 +5/-0 Nm (44 +4/-0 lb-ft). The horizontal tool segments and torque wrench must be parallel to the top of the cylinder head to apply the correct torque to the fasteners.

**Note:** This torque specification is only to be used for this specific tightening procedure with special tool 88800341.

 **WARNING**

When tightening fasteners, keep the torque wrench drive directly over the head of the fastener. If the drive is not directly over the head of the fastener, an incorrect amount of torque may be applied to the fasteners. Also, the tool may slip from the head of the fastener, causing personal injury, and damage to the fastener or tool.

 **CAUTION**

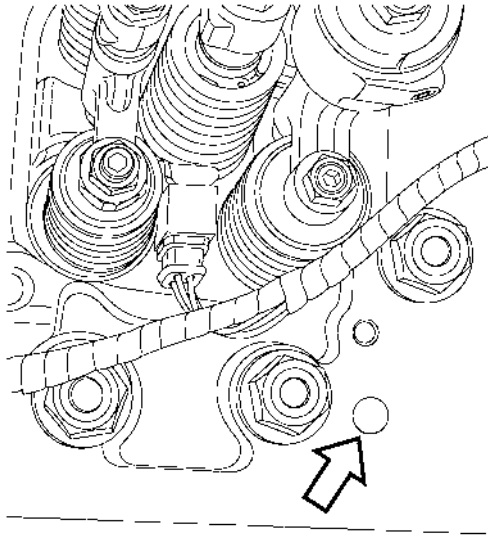
Use a properly calibrated torque wrench. Do not use a torque wrench that is damaged or if its calibration history is unknown. Damage to the engine will result.

 **CAUTION**

Do not support any part of the tool with your hand during torquing. Do not allow the tool to contact the valve spring or other parts of the engine during torquing. Failure to do so may result in incorrect torque applied to the fastener and damage to the engine may occur.

**10**

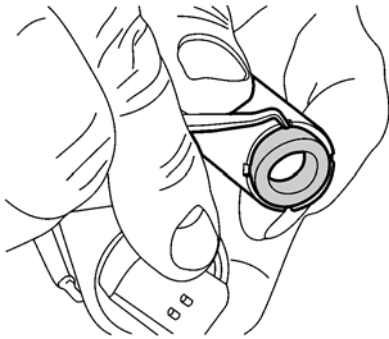
Remove the torque wrench and tool from the engine.



W2006227

**11**

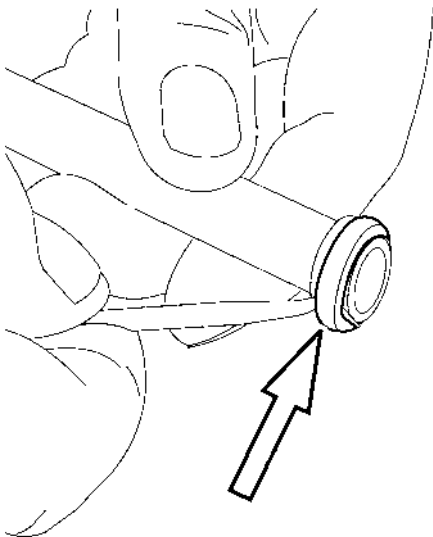
Clean the cylinder head sealing surface for the engine compression brake control valve. Check that there is no dirt in the cylinder head oil gallery.



W2004855

**12**

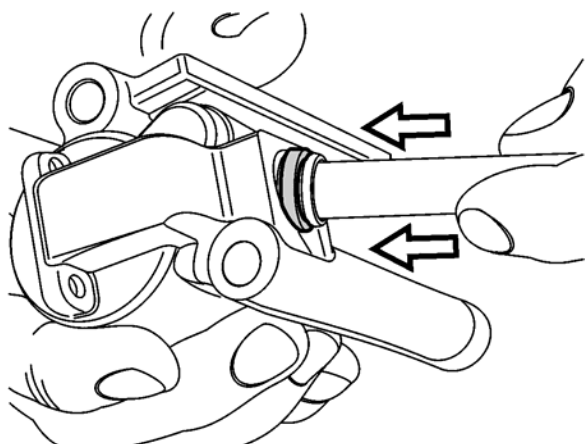
Replace the O-ring at the bottom of the engine compression valve.



W2004853

**13**

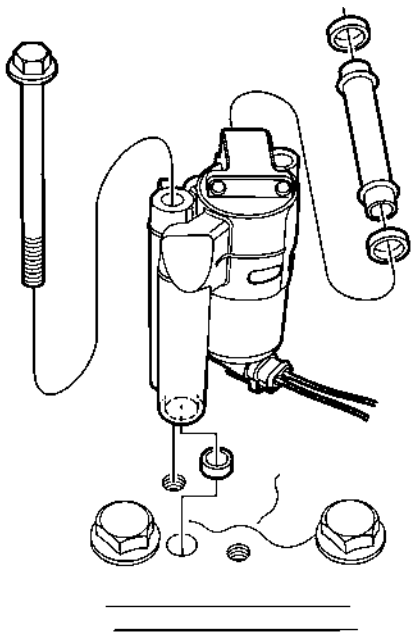
Clean the engine compression brake control valve oil pipe and replace the O-rings. Lubricate the pipe hole in the rocker arm shaft and the O-rings on the pipe.



W2004871

**14**

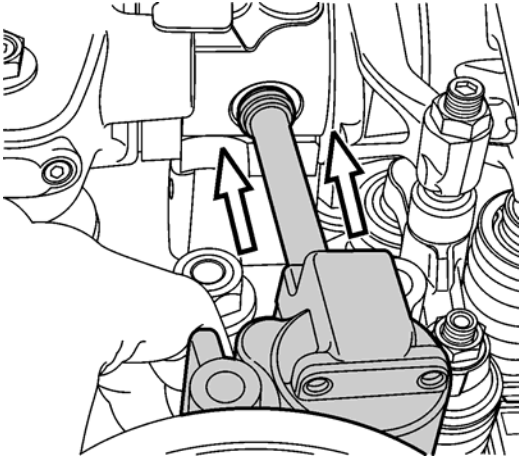
Insert the oil pipe into the oil hole of the engine compression brake control valve. Make sure the O-ring is seated fully in the valve.



W2004869

**15**

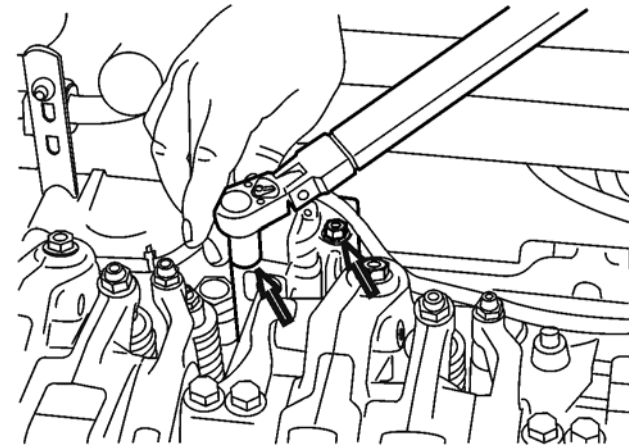
Position the engine compression brake control valve on the cylinder head.



W2004870

**16**

Position the engine compression brake valve and at the same time, press the oil pipe into the rocker arm shaft. Make sure the seal remains correctly located during oil pipe installation into the rocker arm.



W2004858

**17**

Install the engine compression brake control valve bolts and tighten to specification. Refer to Function Group 20, Specifications.

**Note:** Make sure the engine compression brake oil pipe O-ring is fully seated.



W2004837

**18**

Plug in the engine compression brake connector until fully engaged.



**19**

Reposition the fuel injector harness over the engine brake control valve and secure with high temperature cable ties.

**20**

Install the valve cover on the cylinder head. Refer to Function Group 211 for service procedures. Use a new O-ring when installing the crankcase ventilation tube.

This service bulletin replaces bulletins 237-57 dated 8.2009.

Date	Group	No.	Release	Page
3.2011	<b>237</b>	<b>57</b>	<b>02</b>	1(16)

Injector, Replacement

D13

9700, PrevH, PrevX

## Injector, Replacement

This information covers replacement procedures for the injectors on the VOLVO D13 engines.

### Contents

- “Special Tools”, page 2
- “Injector, Replacement (One)”, page 3

**Note:** Information is subject to change without notice.  
Illustrations are used as reference only and can differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

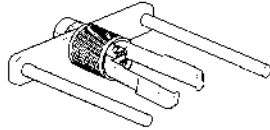
# Tools

## Special Tools

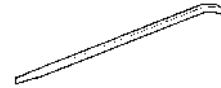
For information on ordering special tools, please refer to the special tools information, group 08.



T2018915



W2006395



W0001802

**9990013**  
Slide Hammer



C0000228

**J48922**  
Heavy-Duty Injector Puller



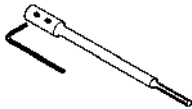
C0000229

**9998511**  
Lever



T0012612

**9998249**  
Protection Sleeve



C0001224

**9998251**  
Protective Plug



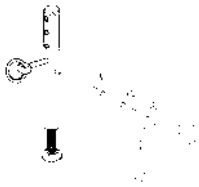
C0000249

**88800014**  
D13 Flywheel Turning Tool



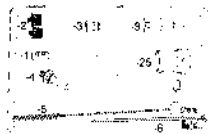
W0002215

**J42885-1**  
Handle



W0001935

**J42885-9**  
Flat Injector Tube Cleaning Brush



W0002416

**J42885-25**  
Fuel Bore Protector



T2018914

**J41989**  
Valve Spring Compressor

**J42885**  
Flat Injector Tube Bore Brush Set

**9990006**  
Puller

# Service Procedures

**2374-03-02-01**

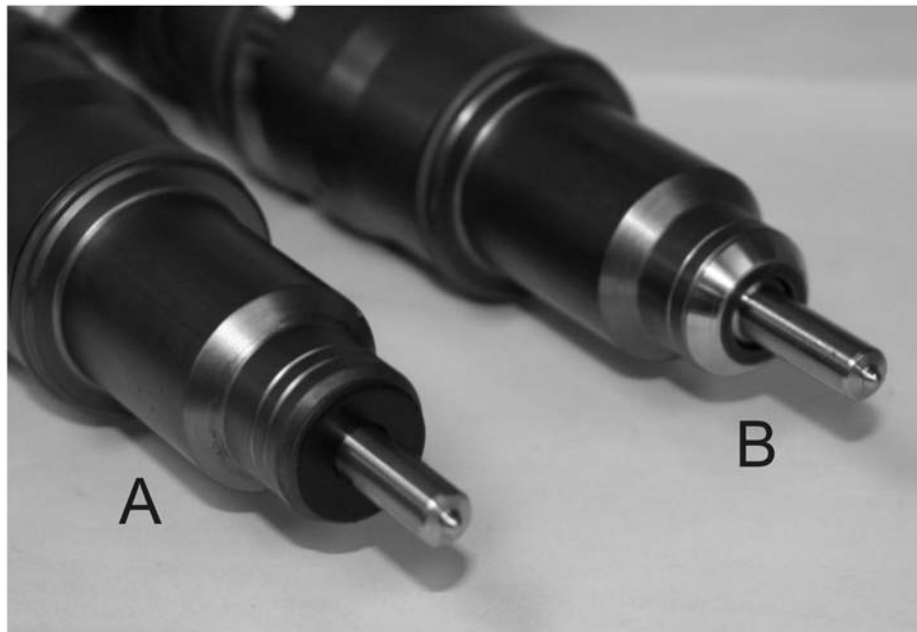
## Injector, Replacement (One)

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9998249, 9998511, 9998251, 9996956, J42885, J41989, J48922, 88800014, 9990006, 9990013, 88880056*

### Injector Identification

**Note:** There are two types of injectors used in Volvo engines, conical and flat. The conical injector sleeves are made of stainless steel. The flat injector sleeves are copper and a washer is installed between the injector and the sleeve. You must determine which type of injector is in the engine to know the proper tools to use for the replacement procedure.



W2056876

- A. Flat Injector
- B. Conical Injector



W2043908



**CAUTION**

Conical and copper injectors and sleeves should not be mixed in the same engine. The same type of injector and sleeve must be used in all six cylinders. Mixing sleeves can result in damage to the engine.

## Removal

**1**

Lift up the rear service cover and remove the inner service cover.

**2**

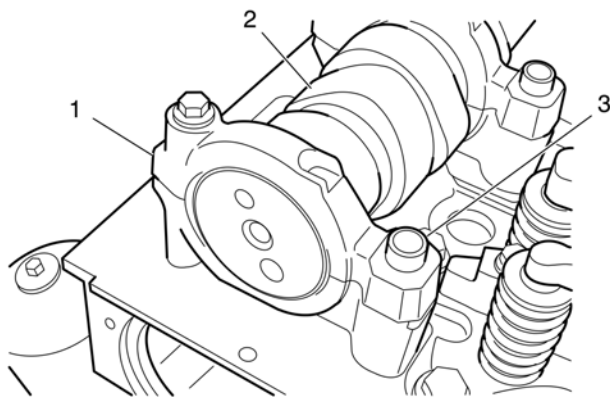
Remove the valve cover from the engine. Refer to Function Group 211 for service procedures.

**3**

Remove the rocker arm shaft. Refer to Function Group 214 for service procedures.

### CAUTION

The order of the rocker arm assembly must be maintained. Make certain the sets of four are kept together. Make certain the rocker arms are identified so they can be returned to their original positions on the shaft. Failure to heed this caution may result in severe engine damage.



W2005514

- 1 Camshaft Bearing Cap
- 2 Camshaft
- 3 Alignment Sleeve

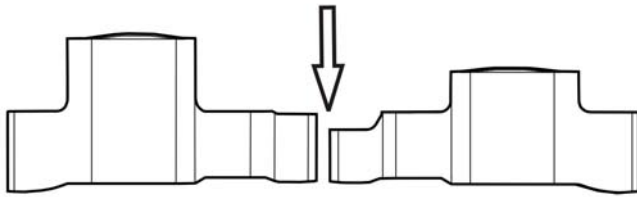
**4**

Make sure the alignment sleeves remain in position on each bearing cap.

**5**

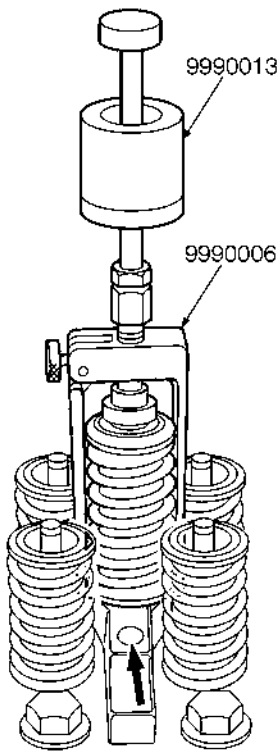
Mark the valve bridges so they can be installed in the same location during reassembly. Remove the valve bridges.

**Note:** Mark the location of the injectors for reinstallation. Injectors must be installed in the same cylinder as they were removed.



W2006625

Injector Hold Downs



W2005170

**6**

Thoroughly clean around the injectors that are to be removed. Remove the injector hold down bolt. If the hold down has a recess in the yoke, proceed to Removal Step 6. If the hold down does NOT have a recess in the yoke, proceed to Removal Step 7.

**7**

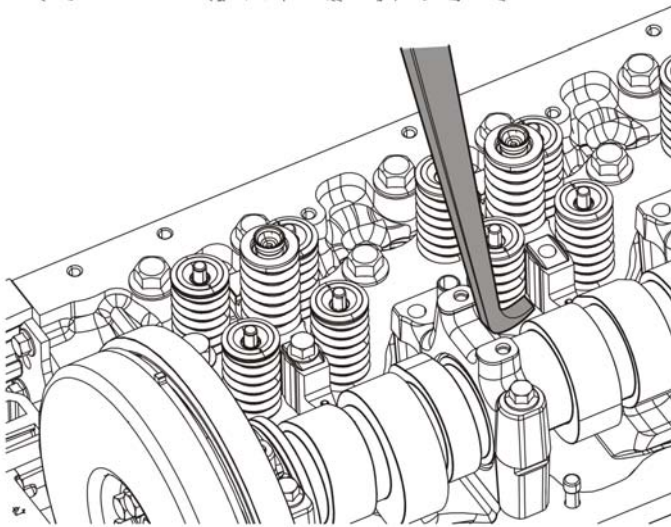
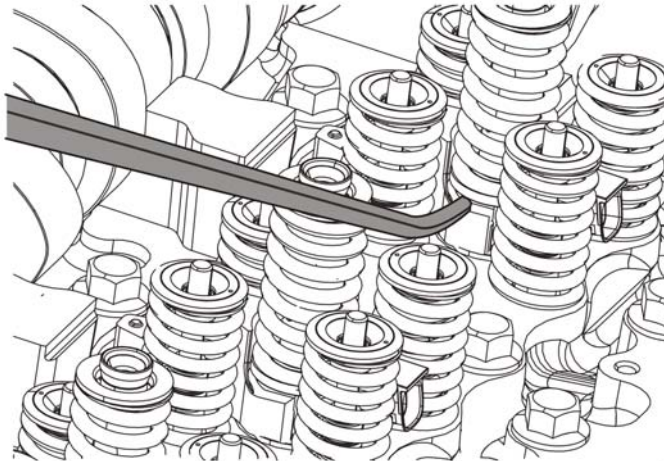
**CAUTION**

Do not use excessive force on the injector with the slide hammer. If the injector is stuck in the sleeve, the puller can be damaged by the slide hammer.

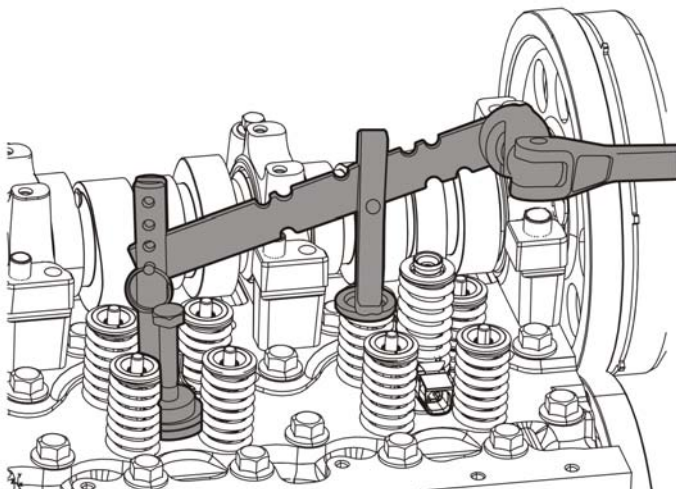
Install the puller onto the injector. Position the puller fork in the groove on the injector and lock the arm using the thumb screw on the side. Secure the puller by screwing down the screw toward the inner cup of the injector. Install the slide hammer. Use reasonable force with the slide hammer to pull the injector free from the cylinder head. If the injector can not be removed with the slide hammer and puller, proceed to Removal Step 12. If the injector can be removed with the slide hammer and puller, proceed to Removal Step 13.

**Note:** Use care when removing the injector because the injector hold down is not secure and could fall off if not held in place.

9990006, 9990013



W2006623



W2006622

8

**CAUTION**

Do not use excessive force on the injector with the pry bar. If the injector is stuck in the sleeve, the pry bar can cause damage to engine components.

Use reasonable force with a pry bar under the hold down or injector lip to remove the injector. If the injector can not be removed with the pry bar, proceed to Removal Step 8. If the injector can be removed with the pry bar, proceed to Removal Step 13.

**Note:** Use care when removing the injector because the injector hold down is not secure and could fall off if not held in place.

9998511

9

Install valve spring compressor in adjacent cylinder injector hold down bolt hole.

**Note:** Cover all oil passage holes in the cylinder head and gear train opening with shop towels.

J41989



**10**

Remove the shop towel from the gear train opening. Use special tool to turn the engine until the camshaft is at TDC. Depending on which injector is being removed, turn the engine from TDC to the appropriate camshaft mark, see table below. Confirm the piston is at the top of the cylinder by using a 40 cm (16 inch) piece of straight stiff wire in the injector hole of the companion cylinder.

**D13 Engines Camshaft Marks**

<b>Companion Cylinder</b>	<b>Camshaft Mark</b>
1 and 6	TDC
2 and 5	Between 5E6 and 3E2
3 and 4	Between 3E2 and 6E4

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88800014

**11**



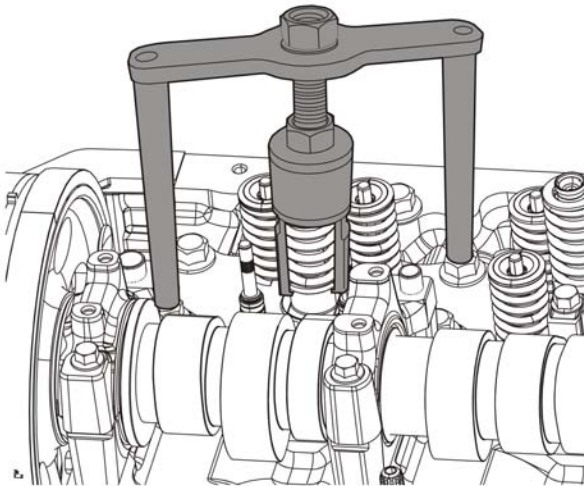
**WARNING**

Use protective goggles or injury to the eyes can occur.

Cover the gear train opening with a shop towel. Compress the intake valve spring and remove keepers and spring. Remove the injector hold down.

**12**

Position and compress intake valve spring and install keepers. Tap on the valve stem with a soft-faced mallet to make sure keepers are seated properly. Remove the compressor tool from the cylinder head.



W2006624

For clarity, the puller is shown on the cylinder head with the valve springs removed. If the valve springs were removed to remove the hold down, it is not necessary to install the springs before removing the injector. However, installing the springs protects the valve stems from damage during injector removal.

### 13

Install the puller onto the injector. Position the puller forks in the grooves on the injector. Secure the puller by sliding the lock collar down over the forks and secure with collar nut to hold the injector. Remove the injector, and hold down if not already removed, from the cylinder head using hand tools.

**Note:** Use care when removing the injector because the injector hold down is not secure and could fall off if not held in place.

### CAUTION

If excessive combustion leakage has resulted in the sleeve being stuck-fast to the injector by carbon, the injector must be replaced. The condition is found when the injector is removed and the sleeve comes out with the injector.

J48922

### 14

For flat injectors only, remove and discard the injector nozzle gasket (flat washer) from the injector tip or copper sleeve bore.

**Note:** If an injector nozzle gasket (flat washer) had been used for the seal joint between the injector copper sleeve and the injector, discard the used gasket immediately after the injector is removed. A used gasket must not be reused. When the injector is removed, this gasket may come out attached to the injector or it may remain in the bottom of the injector sleeve.

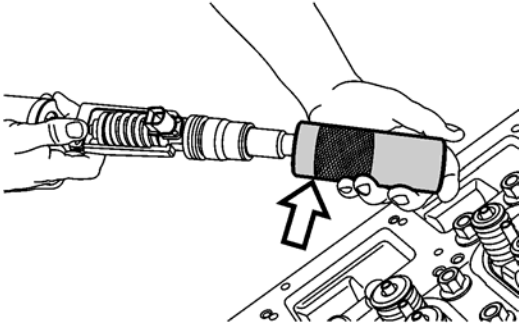
**Note:** If the nozzle gasket (flat washer) is attached to the injector, loosen it with gentle prying from a thin flat gasket scrapper blade. If the gasket is in the bottom of the injector sleeve, initially attempt to remove it with a magnet. If this is unsuccessful, use a standard flat blade screwdriver with a long thin shank and narrow width blade to loosen the gasket. Locate the blade in the recess between the outside of the gasket and the injector sleeve. Use the blade to apply force on the outside of the gasket at different locations around the gasket. Continue this until the gasket separates from the sleeve.

**15**

Using compressed air, clean out the injector hold down bolt holes. Install the protective sleeve over the injector to prevent damage.

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9998249



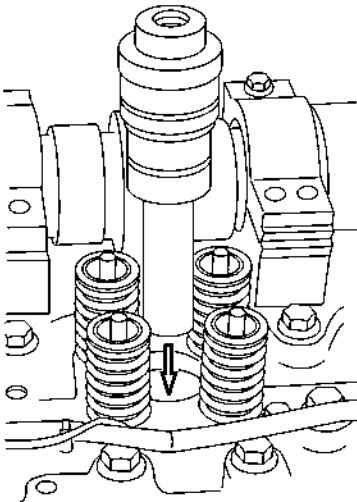
W2005112

**16**

If the injector is not being installed immediately, install the protective plug into the injector bore of the cylinder head to protect it from debris.

---

9998251



W2005172

## Installation

### 1

Install the protective sleeve, J42885-25, and clean the injector sleeve with the appropriate brush and extension. For copper sleeves, use bushes in kit J42885. For stainless steel sleeves, use brushes in kit 88880056.

**Note:** After cleaning the sleeve, carefully inspect the inside surface of the sleeve, especially the bottom surface. Any remaining contamination is unacceptable and must be removed. Also, if there is any indication of a discrepancy that raises concern about suitability of the sleeve for reuse, replace it with a new sleeve.

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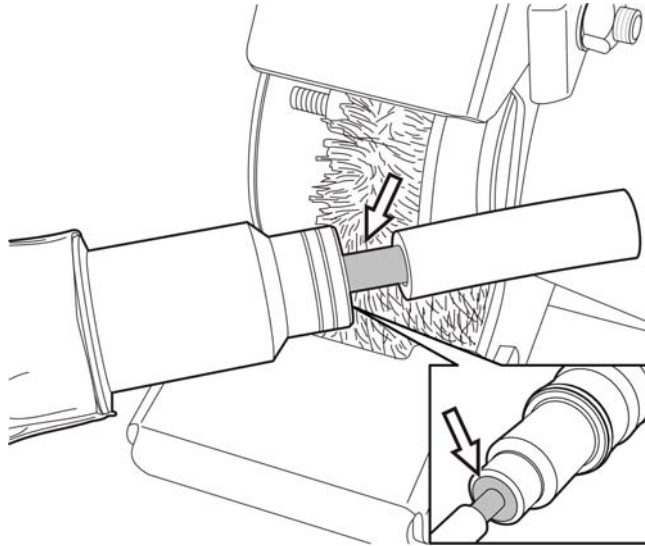
J42885, or 88880056

### 2

To determine if the injector is suitable for reuse, the injector must be cleaned. The cap nut seat surface is the only surface which requires a thorough cleaning. Remove the two O-rings from the injector. Cover the two O-ring grooves and the complete area between the grooves with tape or equivalent to prevent contamination from getting into the injector. Also, cover the electrical connection opening. Protect the nozzle spray holes from damage by covering approximately half of the nozzle tip length with a piece of 6 mm (0.25 inch) ID hose.

### CAUTION

Injectors operate at very high fuel injection pressures, which keep the nozzle tip spray holes clean and free of carbon. The outer surface of the tip spray holes does not need to be cleaned and to prevent spray hole damage **MUST NOT** be cleaned with a wire wheel.



Flat Injector Shown

**3**

With the injector surfaces protected as described above, clean the cap nut seat surface of hard carbon deposits by careful use of a wire wheel, confining the wire wheel contact to the cap nut seat surface only and completing the cleaning with hand tools. Carefully remove the carbon by applying slight nominal pressure with the wire wheel against the cap nut and nozzle for short periods of time. Clean any remaining carbon using hand tools such as a hand scraper or medium grit emery cloth.

**CAUTION**

The carbon will be very hard and difficult to remove. Variables such as size and condition of the wire wheel may result in a tendency to force the wheel harder against the cap nut. However, it is very important to not use excessive pressure against the wire wheel to clean the cap nut seat surface. The use of excessive force must be avoided and can damage the seat surface resulting in an injector that cannot be reused.

**Note:** Using the precautions described in this procedure, a steel wire wheel is allowed to be used to clean the nozzle cap nut seat surface as described, but must not touch the nozzle tip spray holes under any circumstances or hole damage will result.

**Note:** The spray hole damage described here cannot be seen with a magnifying glass or an eye loop. A microscope with a minimum 10x magnification is needed to see this damage.

**4**

After cleaning, inspect the injector nozzle cap nut seat surface for pitting or related damage. If there is pitting or other damage, the injector can not be reused. If there is no pitting on the seat surface, the injector can be reused.

**Note:** Pitting on surfaces other than the cap nut seat surface does not effect the function of the injector and is acceptable.

**5**

Install new O-rings on the injector as follows:

- Upper ring — large diameter, violet
- Lower ring — small diameter, violet

**6**

Lubricate both sealing O-rings with clean engine oil.

**7**

For flat injectors only, preassemble the new injection nozzle NBR washer to the injector. Three small projections (grippers) on the inside diameter of this NBR washer provide the means to retain the gasket to the injector on assembly. Using hand force, push the NBR washer over the injector tip until it becomes fully seated against the bottom of the injector.

**Note:** Before installing the gasket, inspect it to ensure that it is the correct part. The correct gasket is identified by three small projections on the inside diameter and a gray coating over the entire gasket to enhance the ability to seal.

**Note:** This gasket must be installed dry. Do not use grease or any other materials to secure this gasket to the injector for installation.

**8**

 **CAUTION**

Any oil which may have pooled in the bottom of the injector yoke screw hole must be cleaned from the hole to avoid hydraulic lock when the screw is installed and tightened. Hydraulic lock would result in a lack of clamp load and/or a cylinder head cracked at the screw hole.

 **CAUTION**

The new long screw must be used with the 38 mm high yoke. If the shorter screw for the 28 mm high yoke is used with the 38 mm yoke, insufficient thread engagement in the cylinder head will result and the cylinder head threads will fail during screw tightening.

 **CAUTION**

Do not mix tall (38mm) and short (28mm) hold downs in the same engine. Use either all tall or all short hold downs. Mixing tall and short hold downs in the same engine may result in engine damage.

When reusing a hold down screw, clean the screw before installation. Apply a light coat of oil to the threads on the screw and to the underside of the screw head. Slip the injector hold down and screw onto the injector.

**9**

For conical injectors only, use diesel fuel to lubricate the injector capnut cone.

**10**

Center the injector between the valve springs and then push down on the injector using hand pressure to seat the O-rings. Clamp the injector in position with the injector hold down by tightening the injector hold down bolt. Tighten the injector hold down bolt using the following five step procedure:

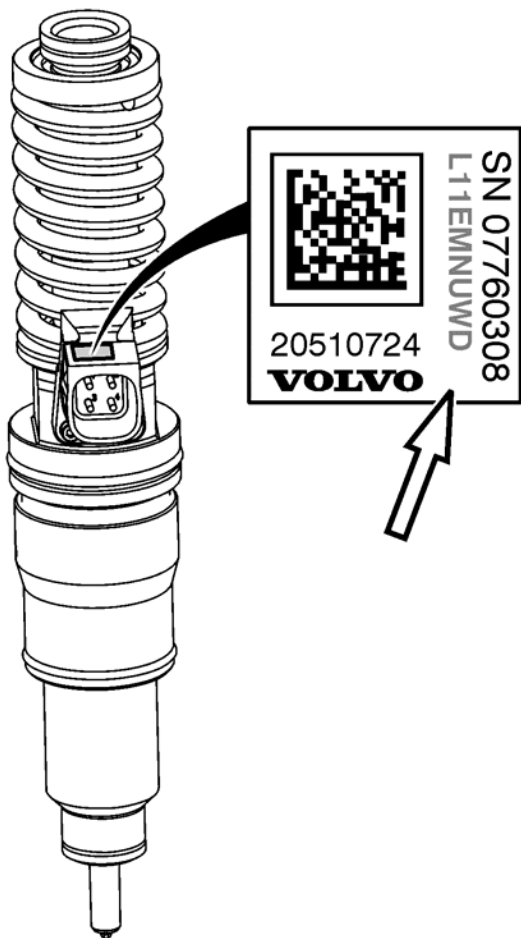
- 1 Tighten 20 +5-0 Nm (15 +4-0 ft-lb).
- 2 Tighten 180 ±5 degrees angle of tightening.
- 3 Loosen the hold down bolt until torque is 10 to 15 Nm (7.0 to 11.0 ft-lb), then:

**Note:** This should be achieved by loosening with an angle of 100-110 degrees. Do not completely loosen the bolt to prevent components from moving after the previous seating process.

- 4 Tighten 20 +5-0 Nm (15 +4-0 ft-lb).
- 5 Tighten 90 ±5 degrees angle of tightening.

**Note:**

- For flat injectors only, assembly with a new injection nozzle gasket always requires that the five (5) step injector hold down bolt tightening process be used.
- The injector hold down bolt can be reused only four (4) times. After the initial installation, every additional application of the five step injector hold down bolt tightening process requires that a punch mark be applied to the head of the bolt. After four (4) punch marks have been accumulated, the bolt cannot be reused again and must be replaced.



W2004684

**11**

When replacing injectors, the engine control module (ECM) must be programmed with the new injector's trim codes. The code is printed on top of the injector electrical connector. The programming is performed using VCADS and is necessary to ensure that engine timing and emission levels are correct.

**Note:** Due to the ECM self learning capability, it is necessary to reset learned ECM parameters after servicing some engine related components. This allows the ECMU to learn the new components behavior. After servicing is complete, perform the "Learned Data Reset" using the PC tool. This is located in the Function Group 1 menu.

**Note:** If reinstalling an injector into the same location, reprogramming is not required.

**12**

Install the valve bridges onto the same cylinders as marked at disassembly. Lubricate the valve bridges and camshaft lobes with engine oil.



**13**

Install the rocker arm shaft. Refer to Function Group 214 for service procedures.

**14**

Adjust the inlet and exhaust valves and injectors. Refer to Function Group 214 for service procedures.

**15**

Install the valve cover on the cylinder head. Refer to Function Group 211 for service procedures.

**16**

Start the engine and run until the engine clears and runs without stumbling. This procedure might need to be repeated to get the fuel system completely free of air.

**Note:** If the engine does not start on the first attempt, prime the fuel system again. Engine priming might need to occur several times in order to get the engine to start.

**17**

Allow the engine to run at low idle for about 5 minutes. Check for any fuel leaks and correct as necessary.

**Note:** The engine speed should **not** be increased because air pockets can be forced into the cylinder head which could result in the engine stopping.

**18**

Install the inner service cover and lower the rear service cover.

This service bulletin replaces bulletin 237-58 dated 9.2009.

Date	Group	No.	Release	Page
9.2011	<b>237</b>	<b>58</b>	<b>02</b>	1(28)

Sleeve, Injector, Replacement

D13

## Sleeve, Injector, Replacement



### CAUTION

This bulletin describes important new tools and procedure for injector sleeve replacement. These tools and procedure replace all existing tools and procedures for copper and conical sleeve replacement. If the procedure in this bulletin is not followed exactly, damage to the engine may result.

Failure to follow the procedure in this bulletin exactly may result in warranty claim denial.

Refer to service bulletin 237-57 for injector replacement procedures.

## Contents

- "Sleeve Identification", page 2
- "Copper Sleeve Replacement", page 4
- "Conical Sleeve Replacement", page 17

**Note:** Information is subject to change without notice.

Illustrations are used for reference only, and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

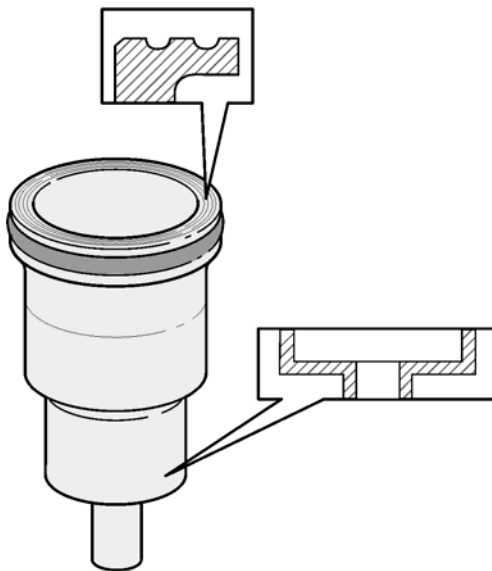
**2379-03-02-02**

## Sleeve, Injector, Replacement (One)

You must read and understand the precautions and guidelines in Service Information, Function Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

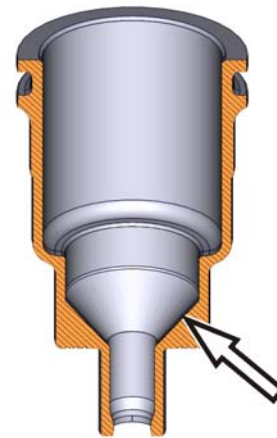
### Sleeve Identification

**Note:** There are two types of injector sleeves used in VOLVO engines, conical and flat copper. The conical sleeves are made of stainless steel. A washer is used with the flat copper sleeves. You must determine which type of sleeve is in the engine to know the proper tools to use for the replacement procedure.



T2025133

Flat Copper Sleeve with Washer (previous design)



T2050703

Conical Stainless Steel Sleeve (new design)

 **CAUTION**

Conical and copper sleeves should not be mixed in the same engine. The same type of sleeve must be used in all six cylinders. Mixing sleeves can result in damage to the engine.



W2043908

For information on how to replace a copper sleeve, see “Copper Sleeve Replacement”, page 4 . For information on how to replace a conical sleeve, see “Conical Sleeve Replacement”, page 17.

## Copper Sleeve Replacement

*Special tools: 9990649, 9998249, 9998250, 9998251, 9998252, 9998253, 85112740, 88800014, 88800196, 88800281, 88800282, 88800285, 88880010, J42885, PT2900*

### **1**

Apply the parking brake and place the shift lever in neutral.

### **2**

Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock.

### **3**

Drain the coolant from the radiator and engine using the coolant extractor.

**Note:** An alternate method is to connect the drain hose to the drain fitting and drain the coolant.

---

9990649, 85112740

### **4**

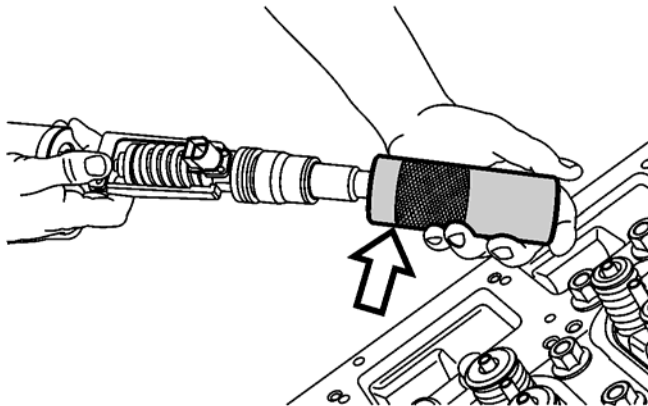
Clean around the fuel supply line fitting on the filter housing. Loosen the fuel line at the filter housing to allow fuel to drain from the cylinder head. Allow the fuel to drain into a suitable container.

### **5**

Remove the valve cover. Refer to Function Group 211 for procedure.

### **6**

Thoroughly clean around the injectors that are to be removed. Remove the injector(s). Refer to Function Group 237 for procedure.



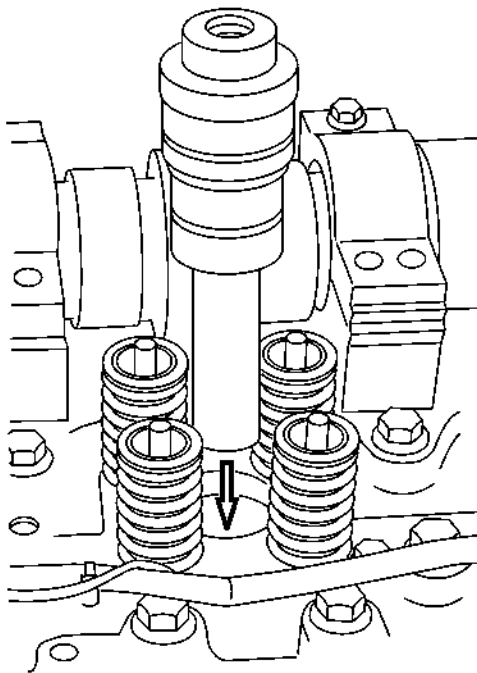
W2005112

**7**

Install the protective sleeve over the injector to prevent damage.

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9998249



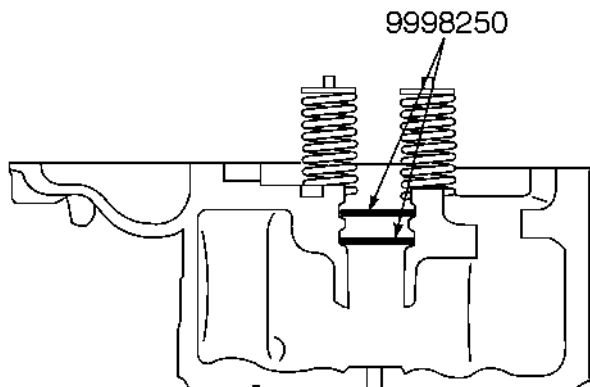
W2005172

**8**

If the injector sleeve is not being removed immediately, install the protective plug into the injector bore of the cylinder head to protect it from debris.

---

9998251



W2005171

**9**

Install two sealing rings to prevent dirt from entering the fuel gallery when the injector sleeve is removed.

**Note:** Two sealing rings are required to cover the fuel gallery.

---

9998250

**10**

Install the flywheel turning tool. Turn the flywheel until the piston is at its lowest position in the cylinder. Confirm the piston is at the lowest position in the cylinder by using a 40 cm (16 inch) piece of straight stiff wire in the injector hole of the cylinder.

**Note:** This is to ensure that the injector sleeve tapping tool does not damage the piston due to tool length.

**Note:** Ensure the turning tool is well greased before attempting to turn the flywheel.

**Note:** If it is necessary to replace other injector sleeves, continue the procedure on pairs of companion cylinders (1 and 6, 2 and 5, 3 and 4). It is necessary to rotate the crankshaft and place each pair of companion cylinders at the lowest position in the cylinder.

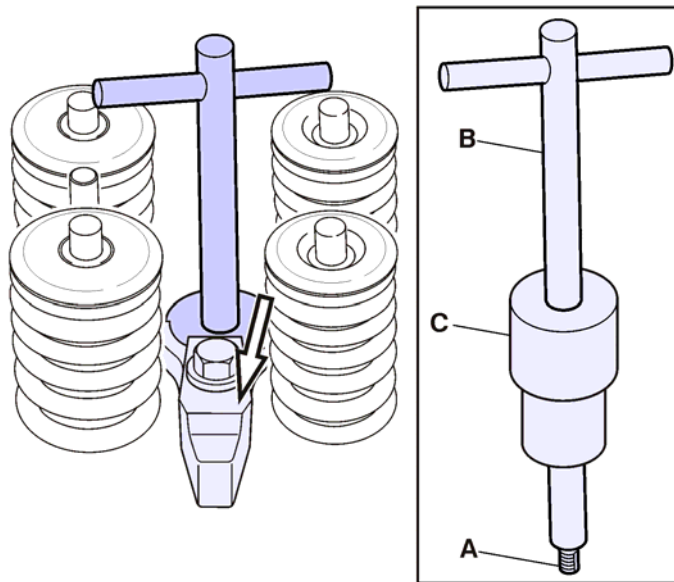
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88800014, or 9996956



W2038611

8.5 mm Forming Tap, 88800281



T2055473

A. 8.5 mm Forming Tap, 88800281

B. Tap Handle, 9998252

C. Sleeve Hold Down, 88800285

**11**

Insert the forming tap into the tap handle until it stops. Make sure a flat on the tap is aligned with the upper set screw. Tighten upper set screw first, then tighten lower set screw. Completely coat the forming tap with fresh, extreme pressure NLGI #2 grease or equivalent.

**Note:** Forming taps require extreme pressure grease due to the cold working process used to form threads.

**CAUTION**

If the injector sleeve is not completely tapped through to the opening of the tip, an end piece of the tip can break off and fall into the cylinder during removal. These types of failures are not covered by warranty.

88800281, 9998252

**12**

**Note:** Use a spare fastener to tighten the injector hold down on the sleeve hold down (special tool number 88800285). Do not use the hold down screw from the engine because it is a limited use screw.

Position tap holder and sleeve hold down in the injector bore. Position the injector hold down over the sleeve hold down and tighten a spare fastener to  $80 \pm 5$  Nm ( $60 \pm 4$  ft-lb). Apply moderate downward force to get the tap started while turning the tap handle clockwise. Continue turning in the same direction, **without reversing**, until the injector sleeve is tapped all the way through. The shoulder of the tap handle bottoms on the injector sleeve. Ensure that the tap is completely through the injector sleeve.

**CAUTION**

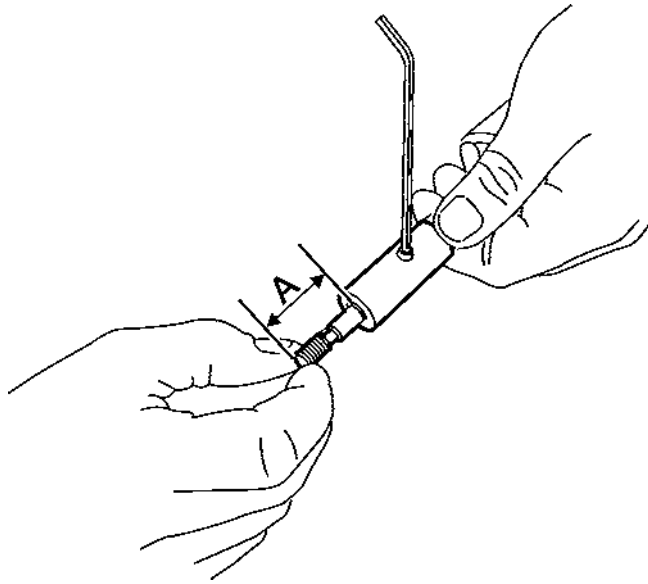
If threads are not cut completely through the tip of the injector sleeve, the tip can break off and fall into the cylinder. This can result in damage to the cylinder, piston, valves or turbocharger. These types of failures are not covered by warranty.

9998252, 88800281, 88800285

**13**

Remove screw from the injector hold down. Remove the injector hold down, sleeve hold down, tap and tapping tool.





W2003433

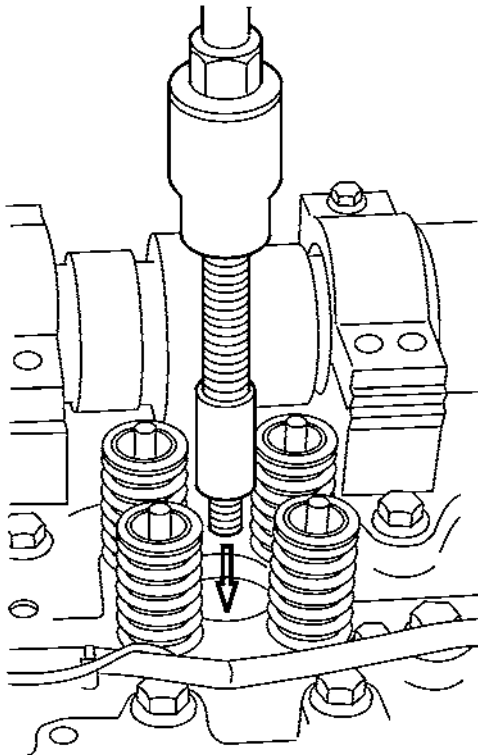
**14**

Install the 8.5 mm extractor bolt into the end of the extractor tool. Adjust the bolt until it extends approximately 25 mm (1 inch) beyond the end of the tool (dimension A).

88800282, 9998253

**15**

Tighten the set screw of the extractor tool to secure the bolt. Make sure that the set screw is seated against the flat part of the extractor bolt.



W2005079

**16**

**CAUTION**

Make sure the extractor bolt is threaded completely into the injector sleeve before attempting to remove it or the tip of the sleeve may break off as it is removed. This broken sleeve tip can seriously damage the piston, valves or turbocharger. These types of failures are not covered by warranty.

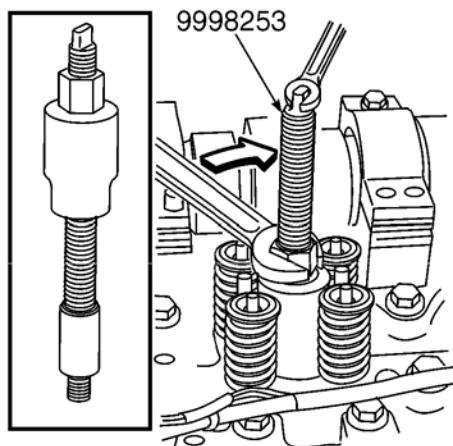
Lubricate the threads of the forcing screw on the puller. Lubricate under the face of the nut. Place the extractor tool with the bolt into the injector bore. Make sure the nut on the spindle is backed off so that the threaded end can be completely installed through the injector sleeve tip. Hand tighten until the bolt bottoms out in the sleeve.

**Note:** If it is necessary to replace other injector sleeves, continue the procedure on pairs of companion cylinders (1 and 6, 2 and 5, 3 and 4). It is necessary to rotate the crankshaft and place each pair of companion cylinders at the lowest position in the cylinder.

**17**

While holding the top of the tool stationary, turn the large nut clockwise to extract the injector sleeve.

**Note:** When the injector sleeve is removed, make sure that the extractor bolt is extended at least one thread beyond the injector sleeve. If not, make sure that no part of the injector sleeve has broken off and fallen into the cylinder.



**CAUTION**

Do not use air tools to remove injector sleeves, or damage to the injector bore can result.

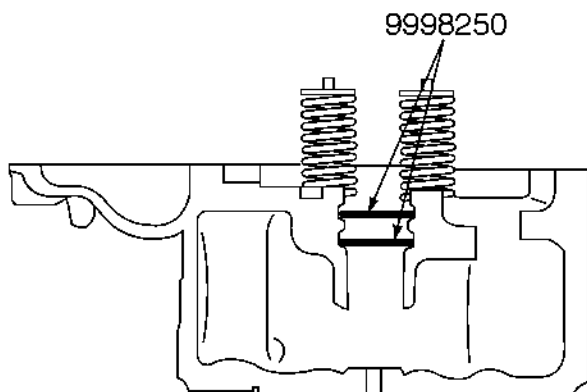
9998253

W2005442

**18**

Remove the two sealing rings from the fuel passage. Using the chip vacuum, remove any remaining debris from the injector bore.

9998250, PT2900

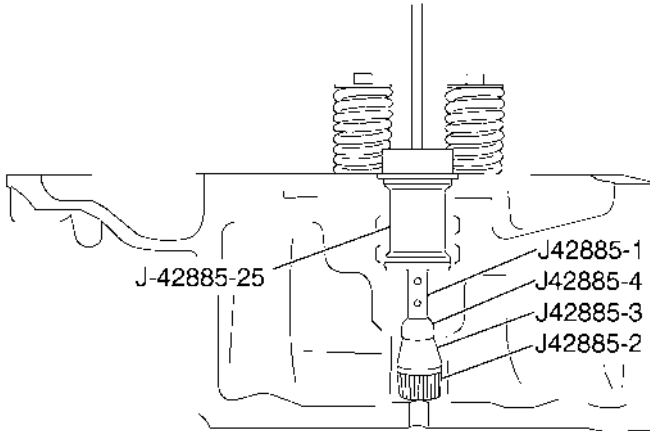


W2005171

**19**

Install the injector bore sealing tool to protect the fuel passage area and prevent debris from entering. Use a spare fastener to secure the tool in the cylinder head.

J-42885-25



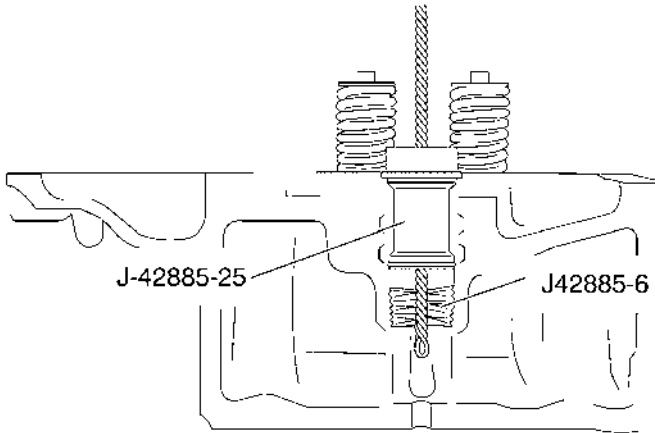
W2006260

**20**

Using the cleaning kit, clean the injector sleeve seat of the cylinder head.

**Note:** The injector bore sealing tool must be used to prevent dirt from entering the fuel passage.

J-42885-1, J-42885-2, J-42885-3, J-42885-4, J-42885-25



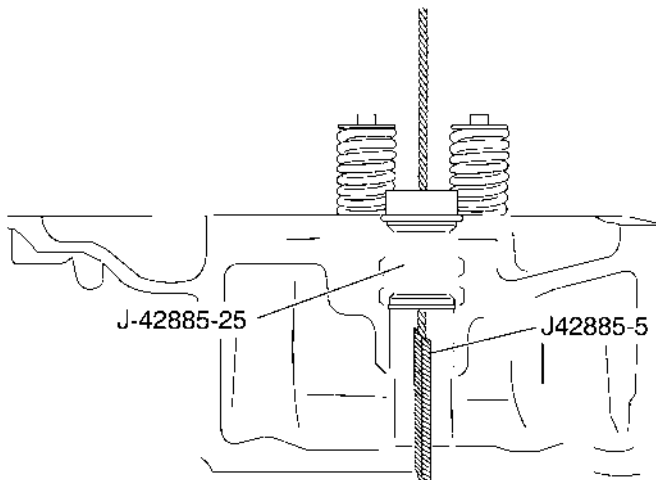
W2005616

**21**

Using the brush, clean the cylinder head injector bore walls for the injector sleeve.

**Note:** The injector bore sealing tool must be used to prevent debris from entering the fuel passage.

J42885-6, J42885-25



W2005617

**22**

Using the brush, clean the injector sleeve opening in the cylinder head.

**Note:** The injector bore sealing tool must be used to prevent debris from entering the fuel passage.

**Note:** When replacing the injector sleeves, it is important to check that the sleeve bore in the cylinder head is free from any carbon deposits or other residue (i.e., pieces of O-ring, etc.) before installing a new injector sleeve. Repeat cleaning if necessary.

J42885-5, J-42885-25

**23**

**! WARNING**

Do not attempt to blow away debris using compressed air. Doing so can result in eye injury.

Using the chip vacuum, remove all debris from the injector sleeve bore.

PT2900

**24**

Remove the injector bore sealing tool from the cylinder head. Using the chip vacuum, remove any remaining debris.

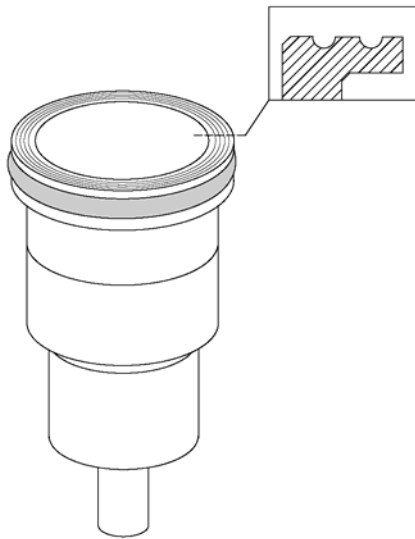
PT2900, J-42885-25

**25**

Ensure the piston is at the lowest position in the cylinder. If not, use the flywheel turning tool to place the piston at its lowest position.

**Note:** This is to ensure that the sleeve installation tool does not damage the piston due to tool length.

88800014, or 9996956



W2006261

Copper Injector Sleeve

**26**

Before installing a copper sleeve, inspect it to ensure that it is the correct part. The correct sleeve is identified by two concentric circular grooves machined into the top surface.

**27**

**Note:** Always use the new O-ring included in the sleeve kit.

Lubricate a new injector sleeve O-ring with clean coolant or soapy water. Install the O-ring on the injector sleeve and lubricate again with clean coolant or soapy water.

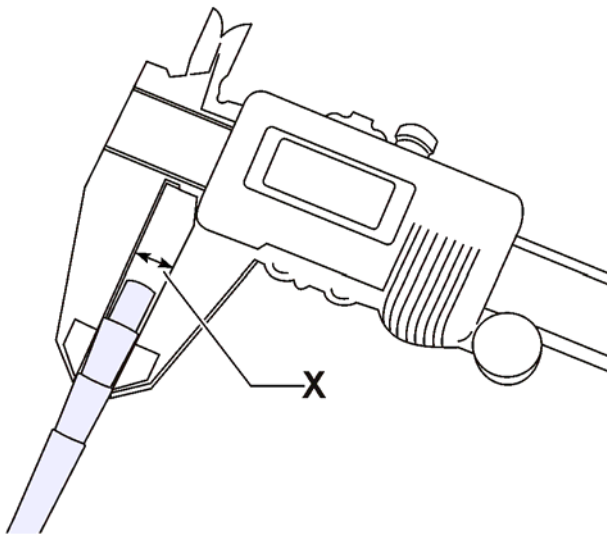
**28**

**CAUTION**

Failure to use the proper bit can result in the bit breaking off into the cylinder head. These types of failures are not covered by warranty.

Using calipers, measure the swedging bit to make sure that the proper swedging tool is used. Measurement should read  $7.8 \pm 0.1$  mm. Also, verify that the swedging bit has three stages and the length is 108 mm.

**Note:** Swedging bit can be ordered as a spare part if the bit is worn or broken.



T2048537

$X = 7.8 \pm 0.1$  mm

88880010



W2044095

Copper Sleeve Installation Tool, 88800196

29

 **CAUTION**

Before installing the sleeve on the installation tool, inspect the tool to ensure that it is the correct tool. For copper sleeves, the correct tool is identified by a bottom surface that is perfectly flat with no machined circular recess. Use of a tool with a machined circular recess on the bottom may result in damage to the copper sleeve.

Place the new injector sleeve on the installation tool. Thread the swedging bit completely into the flaring tool until it stops (finger tight), then loosen the swedging bit 180°. Lubricate the swedging bit and the threads on the tool with fresh, extreme pressure NLGI #2 grease or equivalent.

 **CAUTION**

Failure to loosen the swedging bit can result in the bit being twisted or broken.

**Note:** Do not place the injector nozzle gasket (flat coated washer) in the copper sleeve, as this will damage the swedging bit.

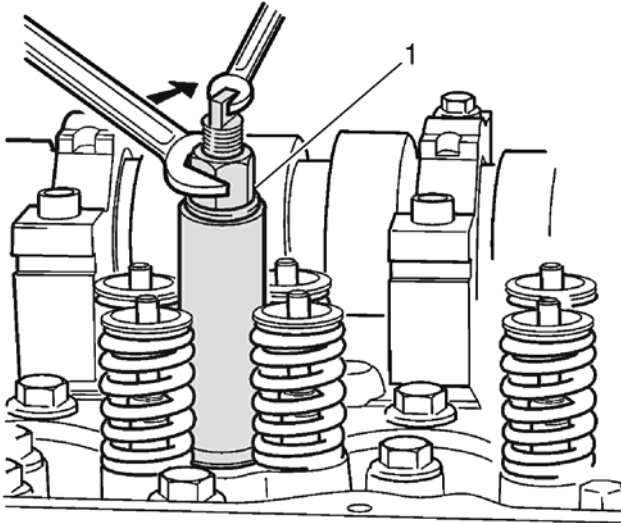
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88800196

30

Carefully place the sleeve installation tool and new injector sleeve into the injector bore of the cylinder head. Carefully move the injector sleeve downward into the injector bore so that the swedging bit is guided into the injector tip bore in the cylinder head. Push downward on the installation tool using hand force to move the injector sleeve downward until it bottoms out on the injector sleeve seat in the bottom of the injector bore. Use the injector hold down and a spare fastener to hold the tool in position. To ensure that the copper sleeve is bottomed in the cylinder head, tighten the injector hold down fastener to 80 ± 5 Nm (60 ± 4 ft-lb).

**Note:** Remove any oil from the injector hold down bolt holes to avoid hydraulic lock for this step and when the injector is installed.



W2006221

1 Installation Tool

**31**

Flare the injector sleeve by turning the nut clockwise while holding the spindle until the swedging bit has been pulled completely through the injector sleeve.



**CAUTION**

Failure to hold the spindle can result in a twisted or broken swedging bit.

**32**

Remove sleeve installation tool from the injector bore.

**Note:** If the injector is not being installed immediately, install the protective plug into the injector bore to protect it from debris.

---

9998251

**33**

Install the injector. Refer to Function Group 237 for procedure.

**34**

Install the rocker shaft. Refer to Function Group 214 for procedure.

**35**

Adjust the valves and injectors. Refer to Function Group 214 for procedure.

**36**

Install the valve cover. Refer to Function Group 211 for procedure.

**37**

Secure the fuel supply line fitting at the fuel filter housing (loosened earlier to drain fuel from the cylinder head). Clean any fuel that remains around the fitting.

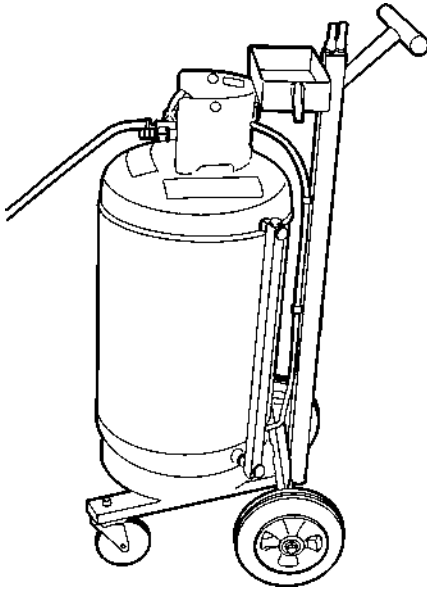
**38**

Install all previously removed cables to the ground (negative) battery terminals.

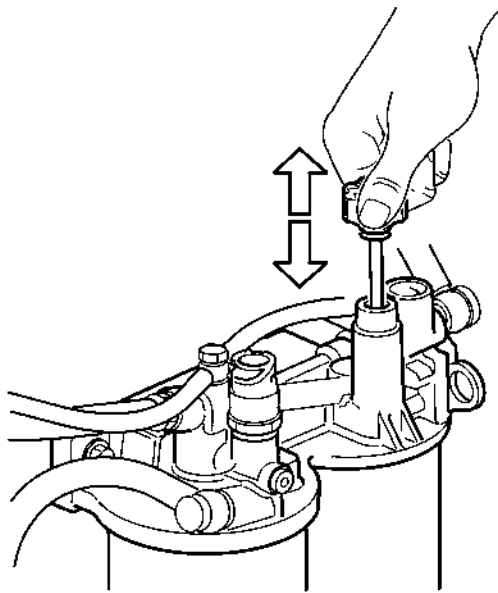
**39**

Use coolant extractor to fill the system with approved coolant per specifications.

85112740



W2004191



T2021565

**40**

Prime the fuel system.



**41**

Start the engine and run until the engine clears and runs without stumbling. This procedure may need to be repeated once or twice to get the fuel system completely free of air.

**Note:** If the engine does not start on the first attempt, prime the fuel system again, and refer to the previous step. Engine priming may need to occur several times in order to get the engine to start.

**42**

Allow the engine to run at low idle for about 5 minutes. Check for any fuel leaks and correct if necessary.

**Note:** The engine speed should **not** be increased as any air pockets can be forced into the cylinder head which can result in the engine stopping.

## Conical Sleeve Replacement

*Special tools: 9990649, 9998249, 9998250, 9998251, 9998252, 9998253, 85112740, 88800014, 88800283, 88800285, 88800288, 88800289, 88880054, J42885, PT2900*

### 1

Apply the parking brake and place the shift lever in neutral.

### 2

Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock.

### 3

Drain the coolant from the radiator and engine using the coolant extractor.

**Note:** An alternate method is to connect the drain hose to the drain fitting and drain the coolant.

---

9990649 , 85112740

### 4

Clean around the fuel supply line fitting on the filter housing. Loosen the fuel line at the filter housing to allow fuel to drain from the cylinder head. Allow the fuel to drain into a suitable container.

### 5

Remove the valve cover. Refer to Function Group 211 for procedure.

**Note:** Rotate the valve cover as needed, to clear the camshaft gear and damper.

**Note:** Dependent upon chassis, engine cover may need to be removed for clearance to remove valve cover.

### 6

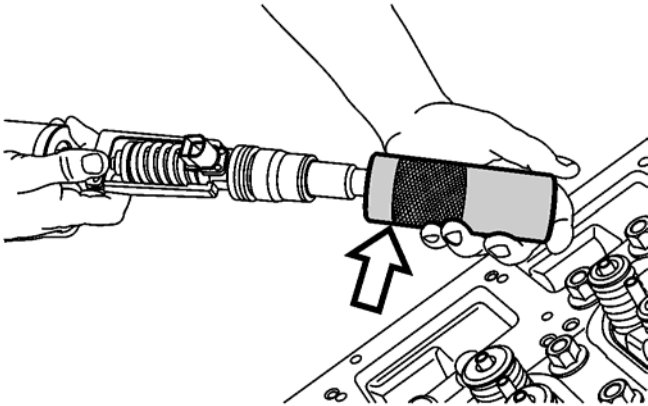
Thoroughly clean around the injectors that are to be removed. Remove the injector(s). Refer to Function Group 237 for procedure.

7

Install the protective sleeve over the injector to prevent damage.

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9998249



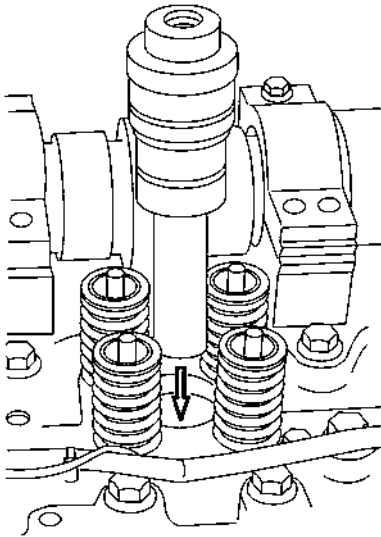
W2005112

8

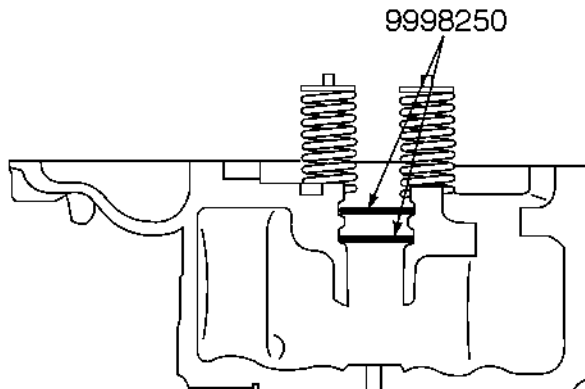
If the injector sleeve is not being removed immediately, install the protective plug into the injector bore of the cylinder head to protect it from debris.

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9998251



W2005172



W2005171

**9**

Install two sealing rings to prevent dirt from entering the fuel gallery when the injector sleeve is removed.

**Note:** Two sealing rings are required to cover the fuel gallery.

---

9998250

**10**

Install the flywheel turning tool. Turn the flywheel until the piston is at its lowest position in the cylinder. Confirm the piston is at the lowest position in the cylinder by using a 40 cm (16 inch) piece of straight stiff wire in the injector hole of the cylinder.

**Note:** This is to ensure that the injector sleeve tapping tool does not damage the piston due to tool length.

**Note:** Ensure the turning tool is well greased before attempting to turn the flywheel.

**Note:** If it is necessary to replace other injector sleeves, continue the procedure on pairs of companion cylinders (1 and 6, 2 and 5, 3 and 4). It is necessary to rotate the crankshaft and place each pair of companion cylinders at the lowest position in the cylinder.

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88800014, or 9996956



W2038611

**11**

Insert the 8.3 forming tap into the tap handle until it stops. Make sure a flat on the tap is aligned with the upper set screw. Tighten upper set screw first, then tighten lower set screw. Completely coat the forming tap with fresh, extreme pressure NLGI #2 grease or equivalent.

**Note:** Forming taps require extreme pressure grease due to the cold working process used to form threads.

**CAUTION**

If the injector sleeve is not completely tapped through to the opening of the tip, an end piece of the tip can break off and fall into the cylinder during removal. These types of failures are not covered by warranty.

88800289, 9998252

**12**

**Note:** Use a spare fastener to tighten the injector hold down on the sleeve hold down (special tool number 88800285). Do not use the hold down screw from the engine because it is a limited use screw.

Position tap holder and sleeve hold down in the injector bore. Position the injector hold down over the sleeve hold down and tighten a spare fastener to  $80 \pm 5$  Nm ( $60 \pm 4$  ft-lb). Apply moderate downward force to get the tap started while turning the tap handle clockwise. Continue turning in the same direction, without reversing, until the injector sleeve is tapped all the way through. The shoulder of the tap handle bottoms on the injector sleeve. Ensure that the tap is completely through the injector sleeve.

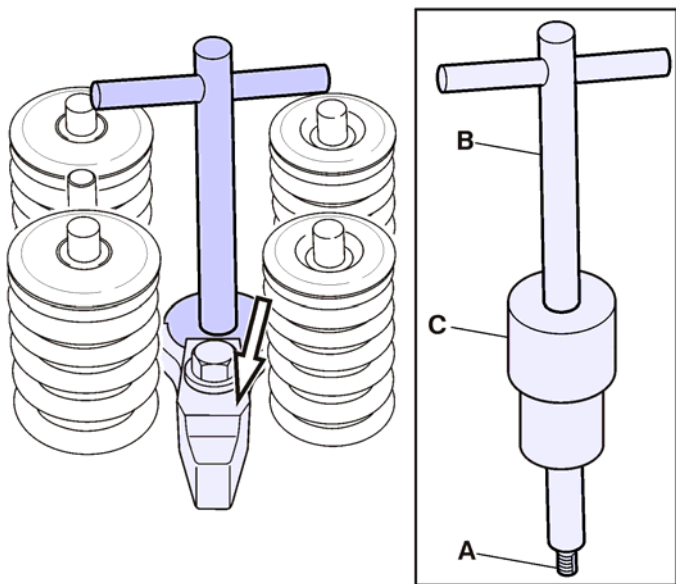
**CAUTION**

If threads are not cut completely through the tip of the injector sleeve, the tip can break off and fall into the cylinder. This can result in damage to the cylinder, piston, valves or turbocharger. These types of failures are not covered by warranty.

9998252, 88800285, 88800289

**13**

Remove screw from the injector hold down. Remove the injector hold down, sleeve hold down, tap and tapping tool.

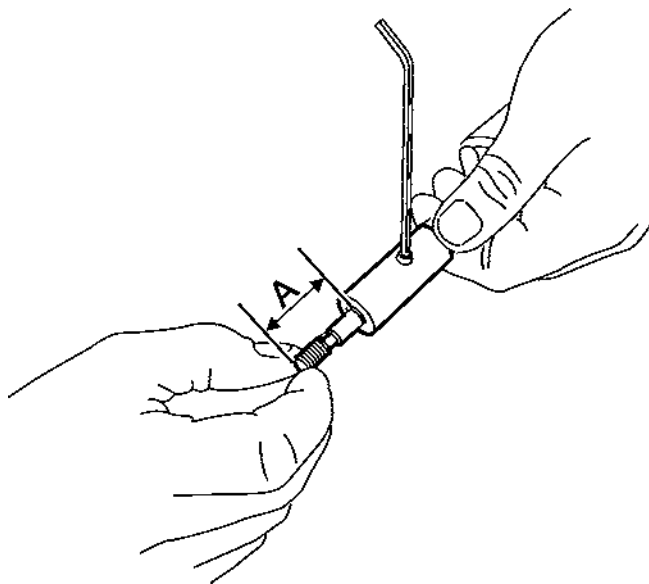


T2055473

A. 8.3 mm Forming Tap, 88800289

B. Tap Handle, 9998252

C. Sleeve Hold Down, 88800285



W2003433

**14**

Install the 8.3 mm extractor bolt into the end of the extractor tool. Adjust the bolt until it extends approximately 25 mm (1 inch) beyond the end of the tool (dimension A).

88800288, 9998253

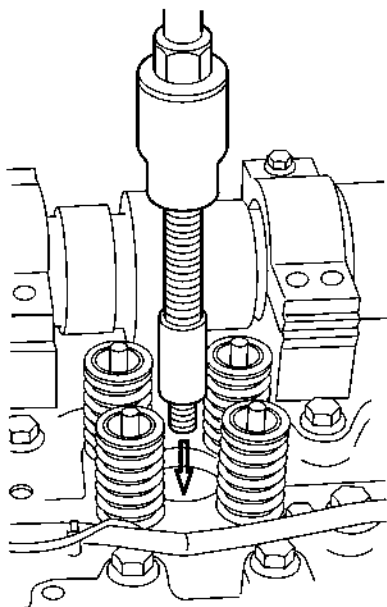
**15**

Tighten the set screw of the extractor tool to secure the bolt. Make sure that the set screw is seated against the flat part of the extractor bolt.

**16**

 **CAUTION**

Make sure the extractor bolt is threaded completely into the injector sleeve before attempting to remove it or the tip of the sleeve may break off as it is removed. This broken sleeve tip can seriously damage the piston, valves or turbocharger. These types of failures are not covered by warranty.



W2005079

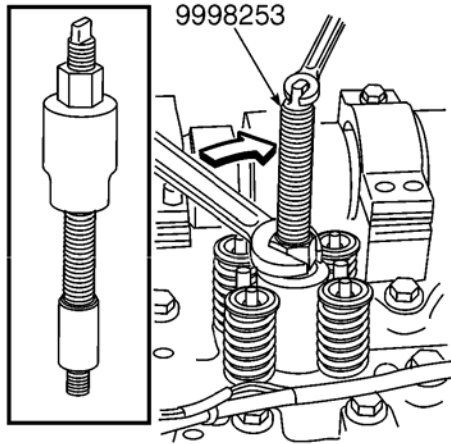
Lubricate the threads of the forcing screw on the puller. Lubricate under the face of the nut. Place the extractor tool with the bolt into the injector bore. Make sure the nut on the spindle is backed off so that the threaded end can be completely installed through the injector sleeve tip. Hand tighten until the bolt bottoms out in the sleeve.

**Note:** If it is necessary to replace other injector sleeves, continue the procedure on pairs of companion cylinders (1 and 6, 2 and 5, 3 and 4). It is necessary to rotate the crankshaft and place each pair of companion cylinders at the lowest position in the cylinder.

**17**

While holding the top of the tool stationary, turn the large nut clockwise to extract the injector sleeve.

**Note:** When the injector sleeve is removed, make sure that the extractor bolt is extended at least one thread beyond the injector sleeve. If not, make sure that no part of the injector sleeve has broken off and fallen into the cylinder.



**CAUTION**

Do not use air tools to remove injector sleeves, or damage to the injector bore can result.

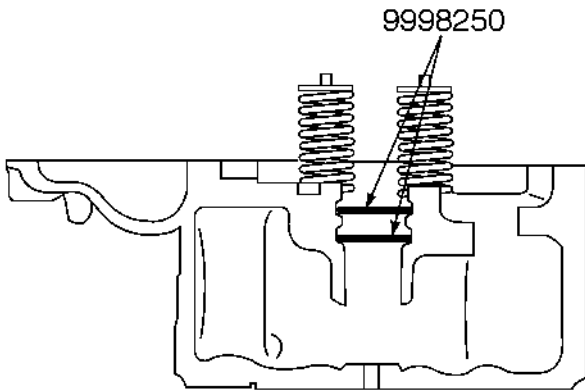
9998253

W2005442

**18**

Remove the two sealing rings from the fuel passage. Using the chip vacuum, remove any remaining debris from the injector bore.

9998250, PT2900

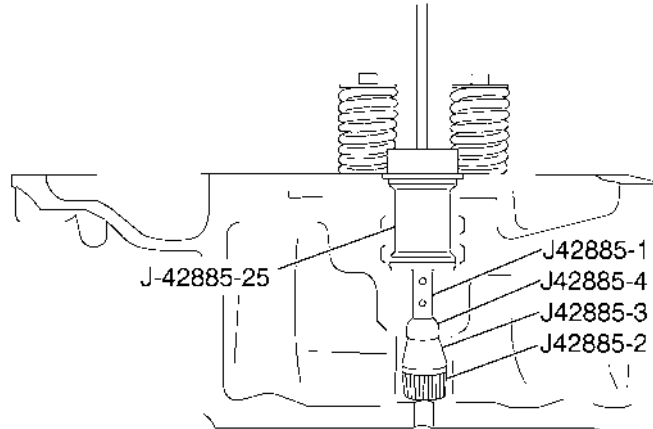


W2005171

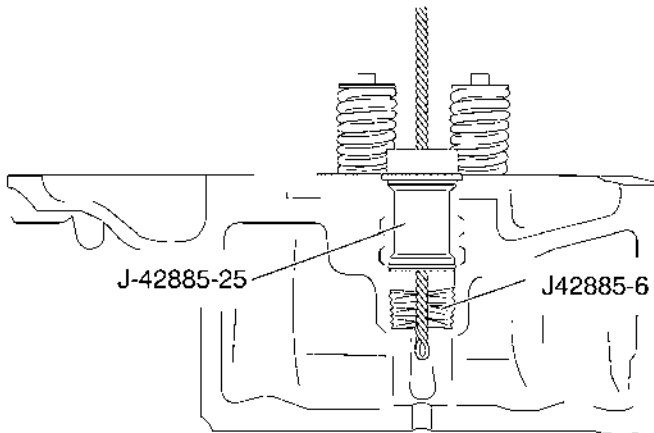
**19**

Install the injector bore sealing tool to protect the fuel passage area and prevent debris from entering. Use a spare fastener to secure the tool in the cylinder head.

J-42885-25



W2006260



W2005616

**20**

Using the cleaning kit, clean the injector sleeve seat of the cylinder head.

**Note:** The injector bore sealing tool must be used to prevent dirt from entering the fuel passage.

J42885-1, J42885-2, J42885-3, J42885-4, J-42885-25

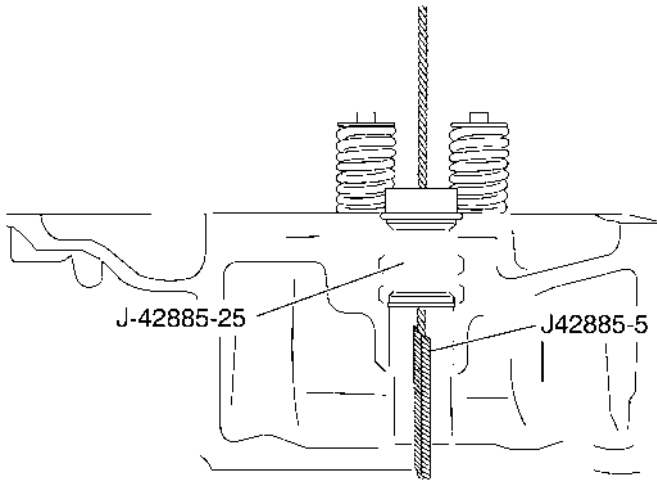
**21**

Using the brush, clean the cylinder head injector bore walls for the injector sleeve.

**Note:** The injector bore sealing tool must be used to prevent debris from entering the fuel passage.

J42885-6, J42885-25





W2005617

**22**

Using the brush, clean the injector sleeve opening in the cylinder head.

**Note:** The injector bore sealing tool must be used to prevent debris from entering the fuel passage.

**Note:** When replacing the injector sleeves, it is important to check that the sleeve bore in the cylinder head is free from any carbon deposits or other residue (i.e., pieces of O-ring, etc.) before installing a new injector sleeve. Repeat cleaning if necessary.

J42885-5, J-42885-25

**23**

**! WARNING**

Do not attempt to blow away debris using compressed air. Doing so can result in eye injury.

Using the chip vacuum, remove all debris from the injector sleeve bore.

PT2900

**24**

Remove the injector bore sealing tool from the cylinder head. Using the chip vacuum, remove any remaining debris.

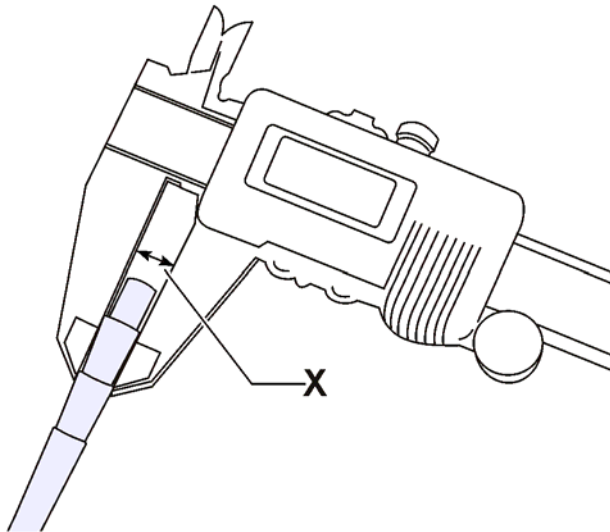
PT2900, J-42885-25

**25**

Ensure the piston is at the lowest position in the cylinder. If not, use the flywheel turning tool to place the piston at its lowest position.

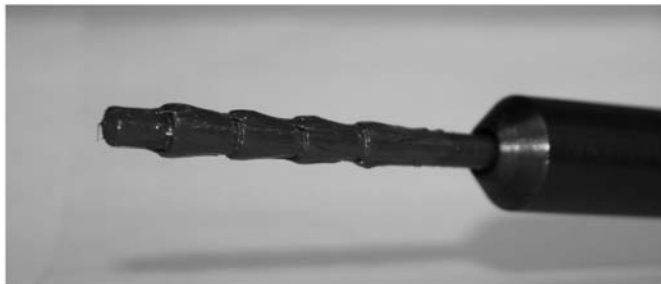
**Note:** This is to ensure that the sleeve installation tool does not damage the piston due to tool length.

88800014



T2048537

X = 7.9 ± 0.05 mm



W2038612

Conical Sleeve Installation Tool, 88800283

**26**

**Note:** Always use the new O-ring included in the sleeve kit.

Lubricate a new injector sleeve O-ring with clean coolant or soapy water. Install the O-ring on the injector sleeve and lubricate again with clean coolant or soapy water.

**27**

**CAUTION**

Failure to use the proper bit can result in the bit breaking off into the cylinder head. These types of failures are not covered by warranty.

Using calipers, measure the swedging bit to make sure that the proper swedging tool is used. Measurement should read 7.9 ± 0.05 mm. Also, verify that the swedging bit has four stages and the length is 120 mm.

**Note:** Swedging bit can be ordered as a spare part if the bit is worn or broken.

88880054

**28**

**CAUTION**

Before installing the sleeve on the installation tool, inspect the tool to ensure that it is the correct tool.

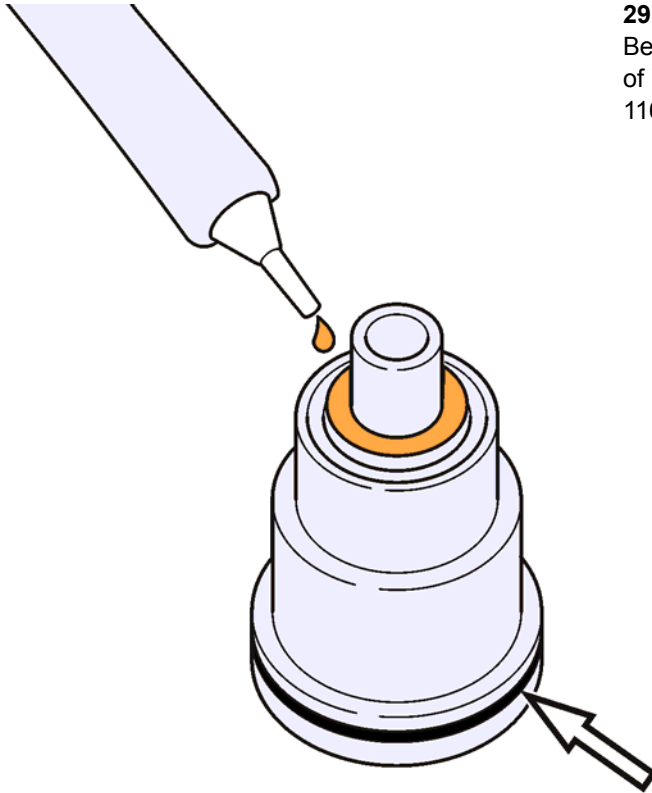
Place the new injector sleeve on the installation tool. Thread the swedging bit completely into the flaring tool until it stops (finger tight), then loosen the swedging bit 180°. Lubricate the swedging bit and the threads on the tool with fresh, extreme pressure NLGI #2 grease or equivalent.

**CAUTION**

Failure to loosen the swedging bit can result in the bit being twisted or broken.

**Note:** To ensure that the swedging bit is pulled completely through the sleeve, install at least 8 mm (0.3 in) of spacers under the nut on the flaring tool.

88800283



T2048540

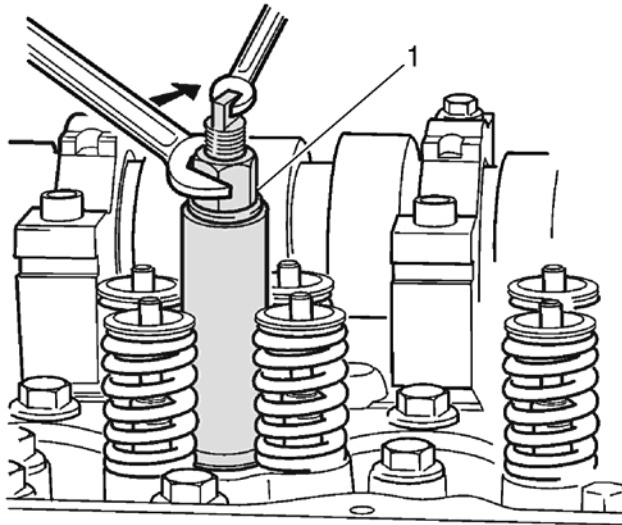
**29**

Before installing a conical sleeve, apply a 2-3 mm bead of VOLVO approved sealing compound (part number 1161059) to the bottom of the injector sleeve.

**30**

Carefully place the sleeve installation tool and new injector sleeve into the injector bore of the cylinder head. Carefully move the injector sleeve downward into the injector bore so that the swedging bit is guided into the injector tip bore in the cylinder head. Push downward on the installation tool using hand force to move the injector sleeve downward until it bottoms out on the injector sleeve seat in the bottom of the injector bore. Use the injector hold down and a spare fastener to hold the tool in position. To ensure that the sleeve is bottomed in the cylinder head, tighten the injector hold down fastener to  $80 \pm 5$  Nm ( $60 \pm 4$  ft-lb).

**Note:** Remove any oil from the injector hold down bolt holes to avoid hydraulic lock for this step and when the injector is installed.



W2006221

1 Installation Tool

**31**

Flare the injector sleeve by turning the nut clockwise while holding the spindle until the swedging bit has been pulled completely through the injector sleeve.

**CAUTION**

Failure to hold the spindle can result in a twisted or broken swedging bit.

**32**

Remove sleeve installation tool from the injector bore.

**Note:** If the injector is not being installed immediately, install the protective plug into the injector bore to protect it from debris.

9998251

**33**

Install the injector. Refer to Function Group 237 for procedure.

**34**

Install the rocker shaft. Refer to Function Group 214 for procedure.

**35**

Adjust the valves and injectors. Refer to Function Group 214 for procedure.

**36**

Install the valve cover. Refer to Function Group 211 for procedure.

**37**

Secure the fuel supply line fitting at the fuel filter housing (loosened earlier to drain fuel from the cylinder head). Clean any fuel that remains around the fitting.

**38**

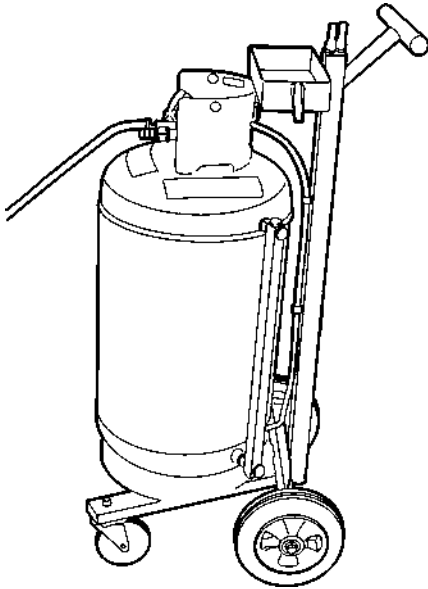
Install all previously removed cables to the ground (negative) battery terminals.

**39**

Use coolant extractor to fill the system with approved coolant per specifications.

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85112740



W2004191

**40**

Prime the fuel system.

**41**

Start the engine and run until the engine clears and runs without stumbling. This procedure may need to be repeated once or twice to get the fuel system completely free of air.

**Note:** If the engine does not start on the first attempt, prime the fuel system again, and refer to the previous step. Engine priming may need to occur several times in order to get the engine to start.

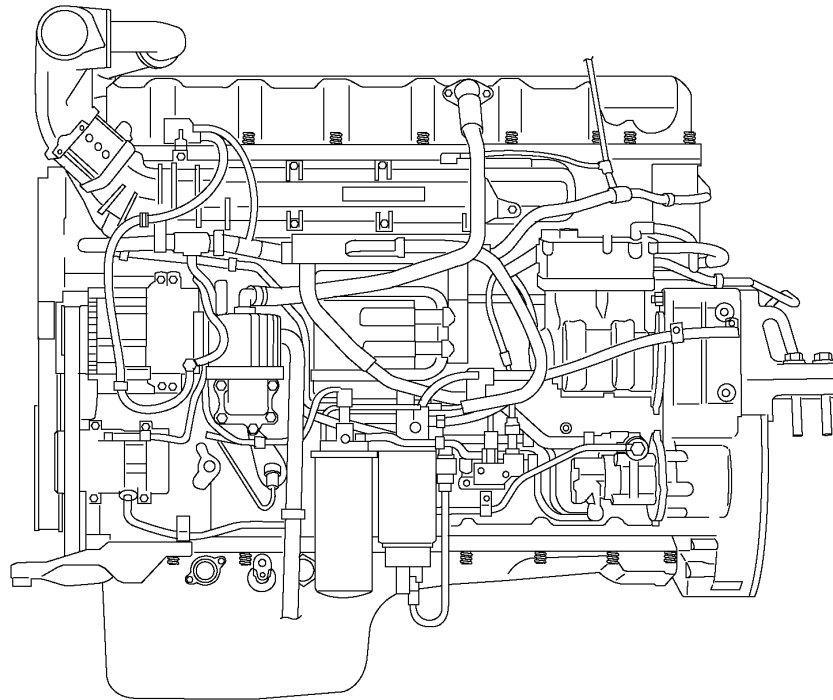
**42**

Allow the engine to run at low idle for about 5 minutes. Check for any fuel leaks and correct if necessary.

**Note:** The engine speed should **not** be increased as any air pockets can be forced into the cylinder head which can result in the engine stopping.

## Intake and Exhaust System Design and Function D13F

### Intake and Exhaust System, Design and Function



W2005843

This information covers the design and function of various intake and exhaust system components on the Volvo D13F engine.

#### Contents

- “Intake and Exhaust System” page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Design and Function

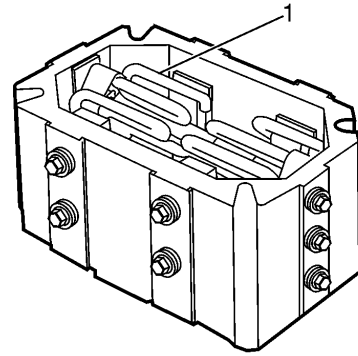
## Intake and Exhaust System

### Air Preheater

The D13F can be equipped with an inlet air preheater. The purpose of the inlet air preheater is to warm air in the inlet manifold when starting the engine. This heated air eases starting at very low temperatures and reduces engine smoking when starting a cold engine. The following conditions are required to engage the preheater:

- The parking brake must be applied.
- The power take-off must not be engaged.

The air preheater does not engage at coolant temperatures over 10°C (50°F). At a coolant temperature of 10°C (50°F), the preheating time is 25 seconds. At coolant temperatures below -15°C (5°F), the preheating time is 55 seconds. Preheating time increases linearly between 10°C (50°F) and -15°C (5°F). The post-heating time is always the same as the preheating time.



1 Air Preheater Element

W3005576

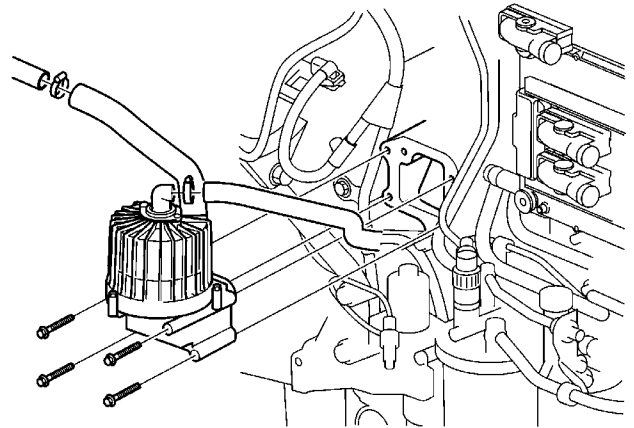
### Engines without Preheater

On engines not equipped with an air preheater, engine coolant temperature determines the point at which fuel injection begins while starting. The crankshaft rotates an extra number of turns to increase cylinder temperature before fuel injection begins. This provides more reliable starting and reduces exhaust emissions during cold starts at temperatures as low as -15°C (5°F). This means that the crankshaft might need to rotate approximately 3–4 rotations before fuel injection begins and the engine starts.

## Crankcase Ventilation

The D13F uses crankcase ventilation with its outlet at the valve cover, through the crankcase ventilation separator which is bolted to the left side of the engine block.

The crankcase ventilation separator is designed as an oil trap to prevent oil from escaping through the breather pipe. The separator is of the centrifugal type.



T2022153

## Air Restriction Indicator

There are several types of restriction indicators that can be mounted in different locations, such as on the air cleaner duct or on/above the instrument panel. The air restriction indicator mounted on the instrument panel permits continuous monitoring of the gauge.

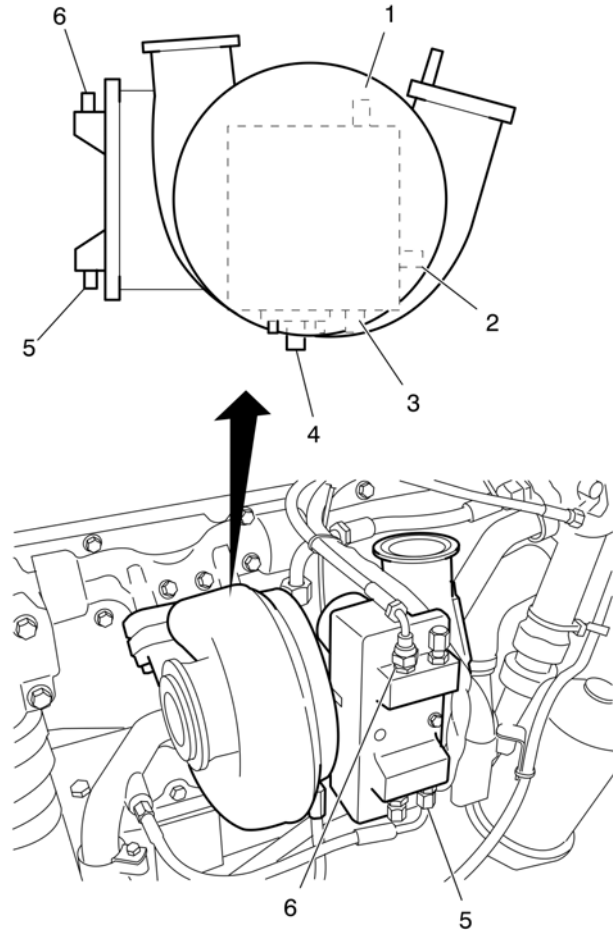
When either the flag or piston-type restriction gauge is mounted directly on the air cleaner, the piston is usually drawn downward into view as the element loads with dirt. It locks into full view only after the restriction (caused by a dirty element) reaches the rated value of the indicator.



## Turbocharger

In order to be able to quickly regulate the charge air pressure and drive the EGR, a new type of turbocharger unit with variable geometry has been introduced. This turbocharger contributes to lower emissions, provides optimal fuel consumption and increases power output. The extent of turbocharger function can be varied by the speed of the gases entering the turbine. This is controlled by an electrically-operated actuator. The turbocharger bearing housing and the actuator are both liquid cooled.

The variable geometry turbocharger (VGT) has a set of vanes and a sliding nozzle ring that maintains sufficient backpressure in the exhaust manifold for proper operation of the EGR system. A certain amount of backpressure is required to push the exhaust gases into the pressurized intake air at the EGR mixer.



- 1 Coolant Outlet Port (Center Housing)
- 2 Coolant Inlet Port (Center Housing)
- 3 Oil Supply Port
- 4 Oil Return Port
- 5 Coolant Return Line
- 6 Coolant Supply Line

W2005569

## Turbocharger Operation

The turbocharger is driven by the exhaust gases from the engine passing through the turbine housing and out into the exhaust system.

The flow of exhaust gases causes the turbine wheel inside the turbine housing to rotate. On the same shaft as the turbine wheel is a compressor wheel. The compressor wheel is mounted in a housing which is connected between the air cleaner and the inlet manifold through a charge air cooler and pipes, hoses and clamps for connection.

When the compressor wheel rotates, air is drawn in from the air cleaner, compressed and forced into the cylinders of the engine — but not before it has been cooled down after passing through the charge air cooler.

## Engine Brake

The Volvo Engine Brake (VEB) consists of a very effective engine compression brake.

### Compression Brake

During the engine compression stroke and combustion (operating) stroke, the controlled opening of the exhaust valves creates an overpressure in the combustion chamber. This, in turn, produces a braking effect on the crankshaft.

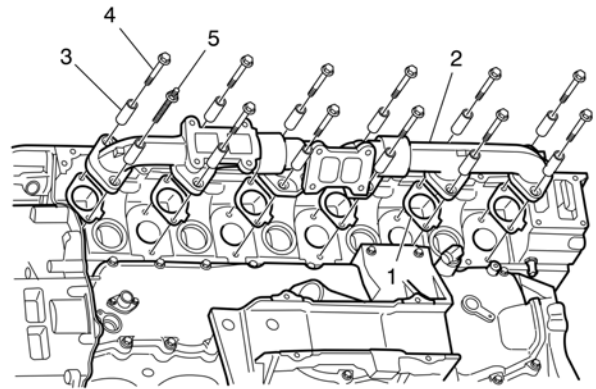
To better accomplish this task, the Volvo Engine Brake (VEB) is designed with an additional cam and rocker arm at each cylinder for operation of the VEB. To make sure the VEB cams open the exhaust valves, the VEB and exhaust rocker arms are arranged and valved in a manner that reduces valve clearance during the braking sequence.

Additionally, the sliding nozzle ring of the turbocharger controls exhaust backpressure not only for proper operation of the EGR system, but also for enhanced braking.

For more information about the design and function of the Volvo Engine Brake, refer to Service Information, group 25.

## Exhaust Manifold

The exhaust manifold has been modified to accommodate the EGR valve. The amount of exhaust gases being recirculated is controlled by an EGR valve mounted to the rear section of the three-piece exhaust manifold. For specific information on the design and function of the EGR system, refer to Service Information, group 29. For specifications, refer to Service Information, group 20.



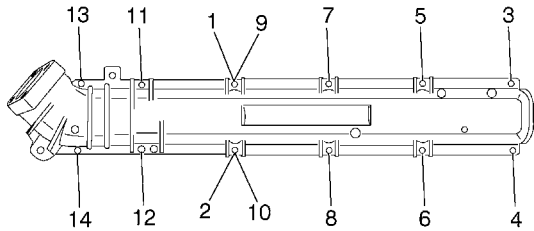
W2005573

- 1 Exhaust Manifold Gaskets
- 2 Exhaust Manifold
- 3 Spacers
- 4 Screws
- 5 Screw with Head Stud

## Intake Manifold

The intake manifold is mounted on the left side of the cylinder head and routes inlet air from the charge-air cooler to the cylinders. Mounted on the manifold inlet is the EGR mixer where recirculated exhaust gases from the EGR system are introduced into the inlet air stream to reduce combustion temperatures. For more specifications, refer to Service Information, group 20.

## Tightening Sequence

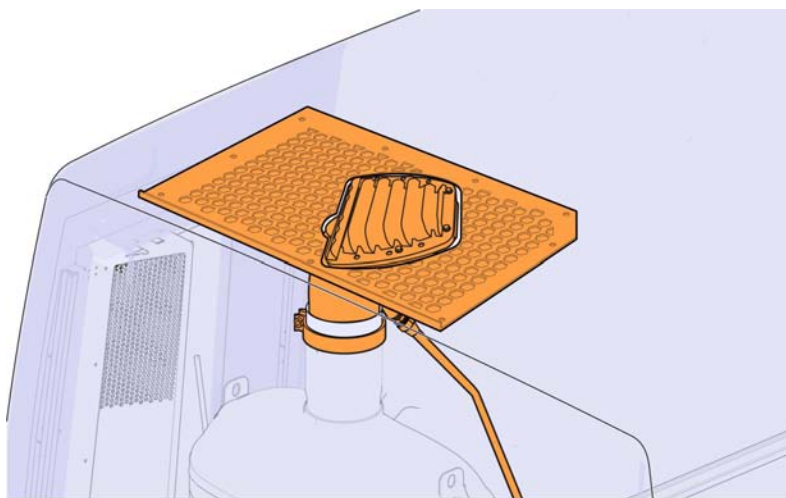


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## Stack Pipe Replacement PREVX

### Stack Pipe, Replacement



W2059734

This service bulletin covers the procedures for replacing the exhaust diffuser stack pipe on the VOLVO PREVX model bus.

### Contents

- "Stack Pipe, Replacement", page 2 .

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2521-03-02-05 Stack Pipe, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

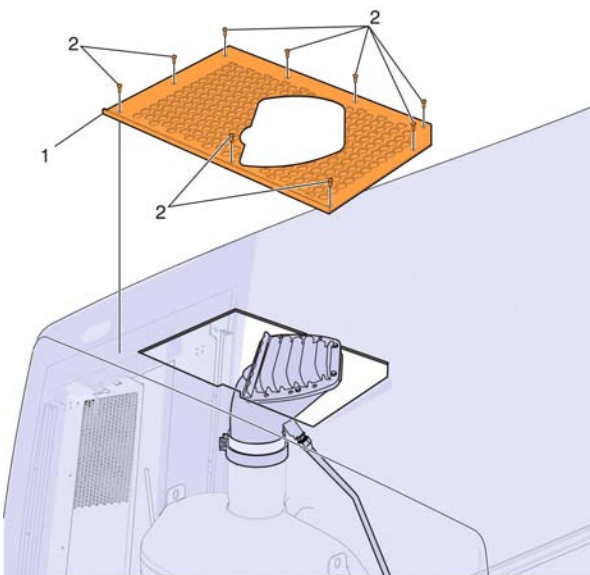
### **DANGER**

Before working on a vehicle, set the parking brake, place the mDRIVE transmission in Neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

## Removal

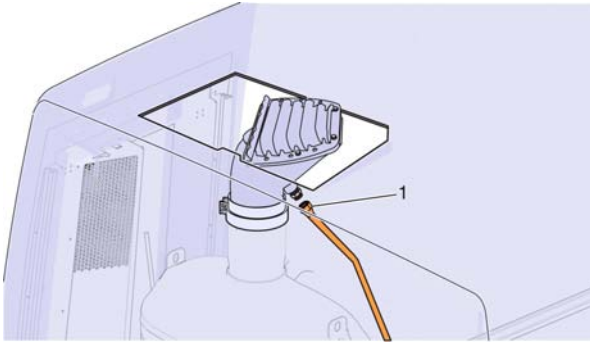
**1**  
Apply the parking brake and place the mDRIVE shifter in neutral.

**2**  
Remove the fasteners securing the shield surrounding the exhaust diffuser stack pipe and remove the shield from the top of the bus.



W2059735

- 1 Stack Pipe Shield
- 2 Fasteners

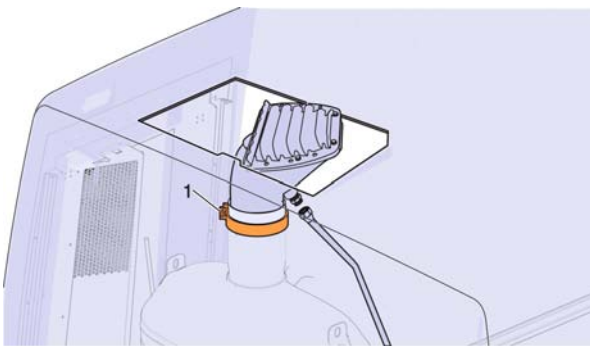


W2059736

1 Liquid Drain Line

**3**

Disconnect the liquid drain line from the exhaust diffuser stack pipe drain tube fitting. Retain the drain line for later use in Installation step 3.

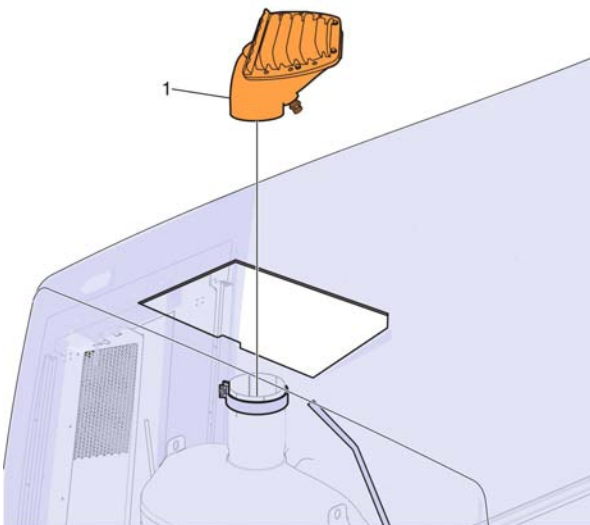


W2059737

1 Stack Pipe Clamp

**4**

Loosen the clamp securing the exhaust diffuser stack pipe to the selective catalytic reduction (SCR) outlet.



W2059738

1 Stack Pipe

**5**

Remove the defective diffuser exhaust stack pipe from the SCR outlet and discard the clamp.

**6**

Remove the liquid drain line fitting from the exhaust diffuser stack pipe. Retain the drain line fitting for later use in Installation step 1.

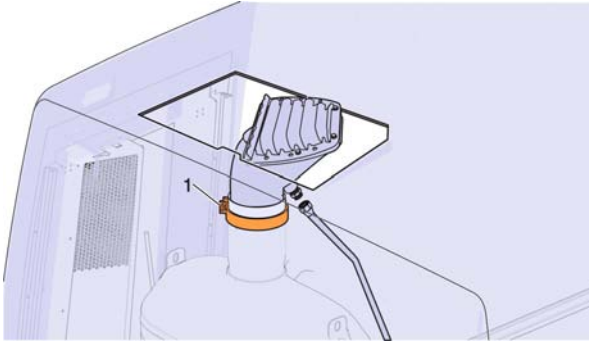
## Installation

**1**

Install the retained liquid drain line fitting onto the replacement exhaust diffuser stack pipe.

**2**

Position the replacement diffuser exhaust stack pipe onto the SCR outlet, and use a new clamp to loosely attach the replacement diffuser exhaust stack pipe to the SCR outlet. Do NOT tighten the clamp at this time.

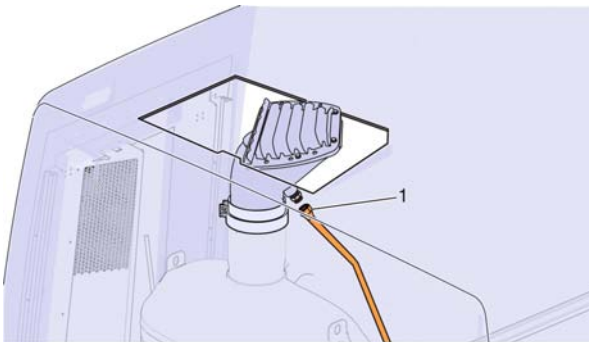


W2059737

1 Stack Pipe Clamp

**3**

Attach the retained liquid drain line to the fitting on the replacement exhaust diffuser stack pipe.



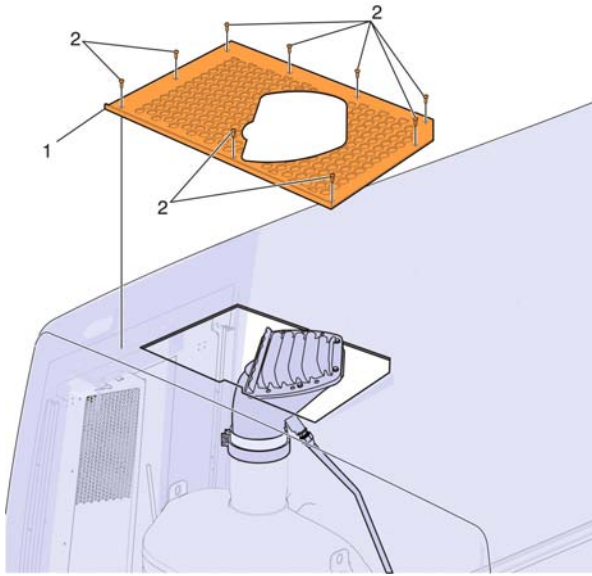
W2059736

1 Liquid Drain Line

**4**

Tighten the clamp securing the replacement diffuser exhaust stack pipe to the SCR outlet to specification; refer to Function Group 200 , "Specifications."





W2059735

**5**

Using the fasteners, install the shield surrounding the exhaust diffuser stack pipe to the top of the bus.

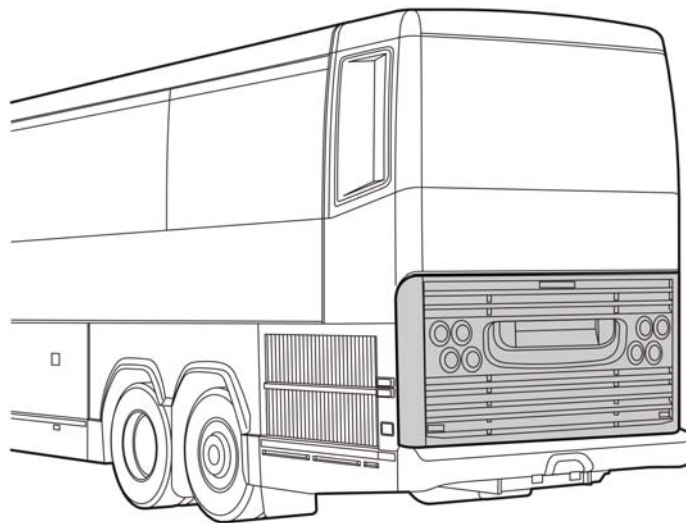
1 Stack Pipe Shield

2 Fasteners

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## Thermal Wrap, Diesel Particulate Filter Outlet Replacement PREVX

### Thermal Wrap, Replacement



W2006767

This information covers the service procedure for the replacement of the exhaust system thermal wrap at the Diesel Particulate Filter (DPF) outlet on a Prevost model PREVX bus.

### Contents

- "Thermal Wrap, Replacement", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

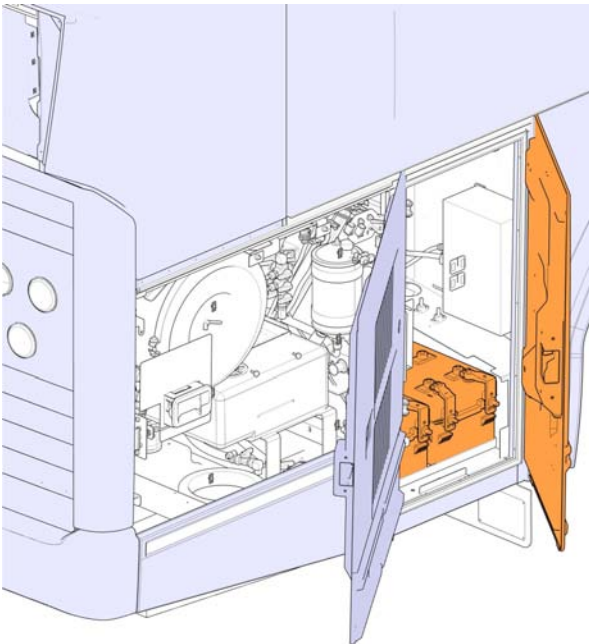
## 2529-03-02-02

### Thermal Wrap, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## Removal

- 1**  
Make sure that the exhaust system has had time to cool before beginning this procedure.
- 2**  
Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the off position.
- 3**  
Open the battery hatch located at the right side rear of the vehicle.



W8060022

- 4**  
Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock.

**5**

Open the rear doors to access the engine compartment.



W2060041

**6**

Cut the heat resistant tie straps securing the defective section of thermal wrap to be replaced with tin snips or equivalent tool and discard.

**7**

Remove and discard the defective section of thermal wrap.

## Installation

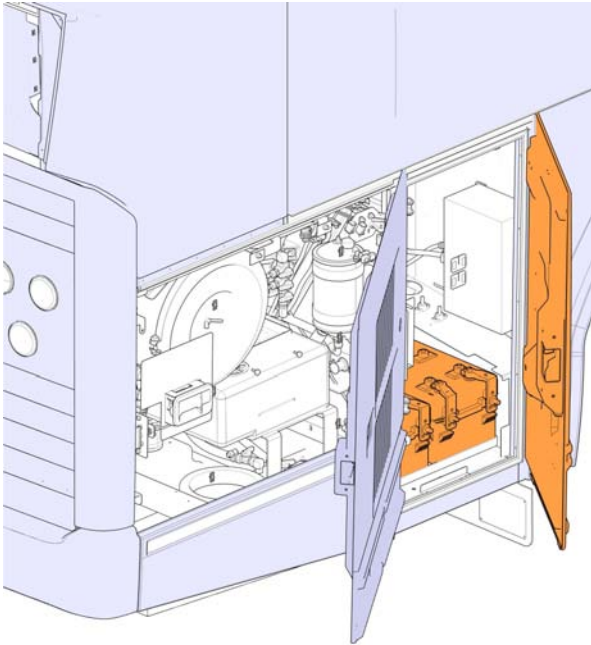
**1**

Install the new section of thermal wrap and secure with new heat resistant cable ties.

**Note:** Make sure that the flap is correctly positioned before securing ties.



W2060041



W8060022

**2**

Install the previously removed cables to the ground (negative) battery terminals.

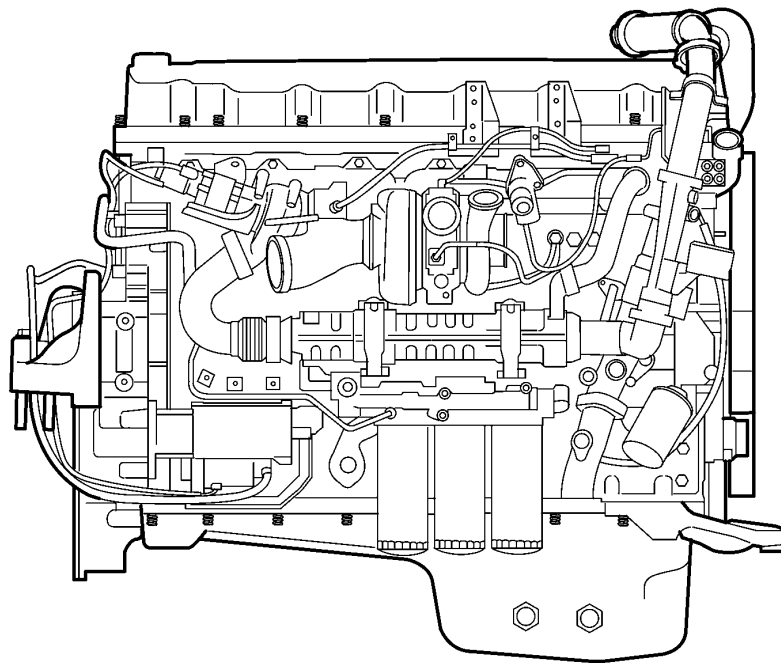
**3**

Close the battery hatch.

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Engine Brake  
Design and Function  
D13F

## Engine Brake, Design and Function



W2005779

This information covers the design and function of the Volvo Engine Compression Brake (VCB) on the Volvo D13F engine.

### Contents

- “Engine Brake” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Design and Function

## Engine Brake

During the engine compression stroke and combustion (operating) stroke, the controlled opening of the exhaust valves creates an overpressure in the combustion chamber. This, in turn, produces a braking effect on the crankshaft.

To better accomplish this task, the Volvo Engine Compression Brake (VCB) is designed with an additional camshaft lobe and rocker arm at each cylinder for operation of the VCB. To make sure the VCB camshaft lobes open the exhaust valves, the VCB and exhaust rocker arms are arranged and valved in a manner that reduces valve clearance during the braking sequence.

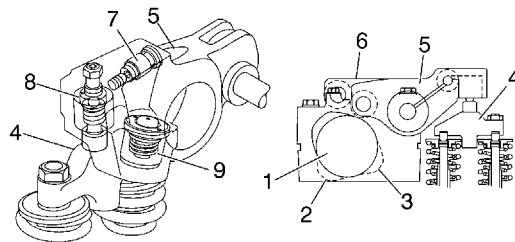
The engine brake control valve is located on the cylinder head between cylinders three and four. The inlet of the control valve is connected to a lubricating oil channel in the engine block, and the outlet of the valve is connected to the rocker arm shaft through a tube. If the engine is equipped with an engine brake, this is shown on the front engine identification label, on the left side of the rocker cover.

## System Components

### Camshaft and Rocker Arms

On engines with a compression brake, the camshaft (1) is designed with an additional lobe at each cylinder for operation of the VCB. There are four camshaft lobes, which operate the intake valves, the unit injectors, the exhaust valves and the VCB. The lift height of the VCB lobes on the camshaft are very low compared to normal exhaust camshaft lobes. The brake camshaft has two lobes for operation of the VCB, the charging lobe (3) and the decompression lobe (2) which lift the exhaust valves at the appropriate time to eliminate the power stroke driving power and fully utilize the braking power.

Inside the exhaust rocker arm (5) are two pistons, the pump piston (9) and the power piston (8), along with a non-return valve, another piston (7) and a spring. The power piston is located directly above the exhaust valve bridge (4). The power piston presses down on the exhaust valve bridge to open the exhaust valves. The pump piston is located directly underneath the engine brake rocker arm (6). The brake rocker arm pushes against the pump piston. The exhaust rocker arm is shaped so that the brake rocker arm is positioned above the exhaust rocker arm.

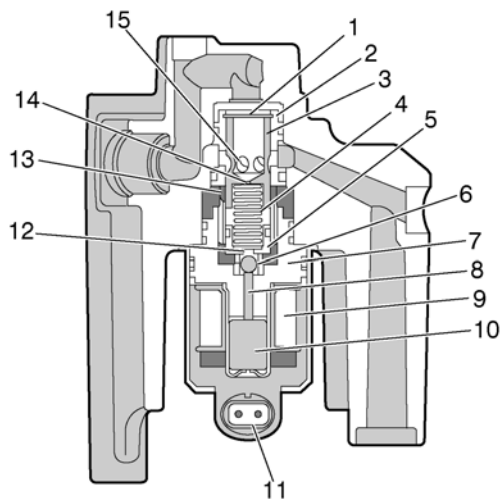


- 1 Camshaft
- 2 Decompression Lobe
- 3 Charging Lobe
- 4 Exhaust Valve Bridge
- 5 Exhaust Rocker Arm
- 6 Engine Brake Rocker Arm
- 7 Piston
- 8 Power Piston
- 9 Pump Piston

W2006764

## Control Valve

The control valve is mounted on the cylinder head under the valve cover and is connected to the oil system ahead of the rocker arm shaft. Its purpose is to reduce oil pressure to the rocker arms while the engine is operating. There is always full system oil pressure to the control valve inlet. A seal connects the inlet to the lube oil gallery in the cylinder head. Oil pressure to the rocker arm shaft can be increased by the solenoid valve which is a part of the control valve, from about 100 kPa (14.5 psi) while the engine is operating to over 200 kPa (29 psi) during compression braking. The control valve regulates the oil pressure to the rocker arm shaft assembly and is controlled by the Engine Electronic Control Unit (EECU).



W2005933

- 1 Locking Ring
- 2 Sleeve
- 3 Valve Slider
- 4 Balance Spring
- 5 Spring Seat with Ball Holder
- 6 Valve Ball
- 7 Cylinder
- 8 Rod
- 9 Solenoid Coil
- 10 Piston
- 11 Electrical Connection
- 12 Pressure Regulation Hole for Flow Control
- 13 Return Hole
- 14 Calibration Hole
- 15 Hole for Oil Flow to Rocker Arm



### *Neutral*

The VCB valve is shown in its neutral position, which means that the engine is stationary. The solenoid coil (9) is not energized and the valve slider (3) is up against the locking ring (1).

### *Normal Driving*

During normal engine running, the solenoid coil (9) is not energized. The solenoid valve is in regulation mode and forces oil through the hole (15) to the rocker arms while allowing oil to flow through the calibration hole (14) and onwards to the return hole (13). This reduces the oil pressure to 100 kPa (14.5 psi), which is enough to lubricate the camshaft bearings and valve rocker arms.

### *Engine Brake Activated*

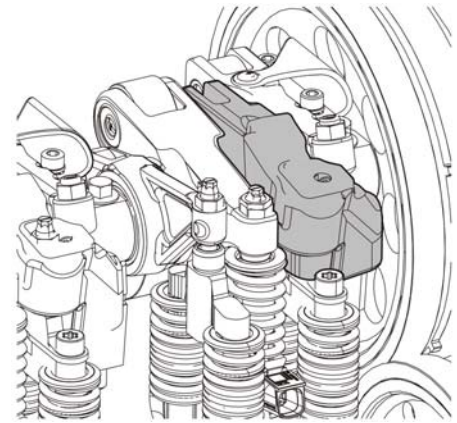
When the engine is running and the engine brake is activated, the solenoid coil (9) is energized and the valve slider (3) is forced to its end position which is fully open. The trapped oil acts as a hydraulic lock. Full oil pressure is now delivered to the rocker arm shaft and the compression brake comes into action.

### *Engine Brake Deactivated*

When the engine is running and the engine brake is released, the solenoid coil (9) is de-energized. The high pressure oil inside the rocker arm shaft causes the valve slider (3) to quickly move and open the oil return connection (13) so that the oil can drain out. When the oil pressure has fallen to approximately 100 kPa (14.5 psi), the valve slider returns to its regulation position.

## Exhaust Rocker Arms

The exhaust rocker arms on an engine with a compression brake are larger than those of a conventional engine. The rocker arm is equipped with a non-return valve and a piston with a pressure-limiting valve. Its purpose is to regulate oil flow during compression braking.



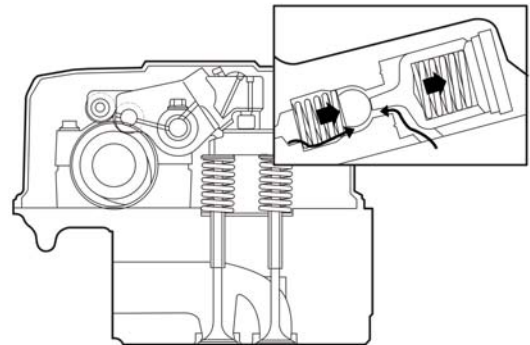
W2005872

## Non-Return Valve

The non-return valve, consisting of a piston, spring and ball is located in the exhaust rocker arm. When oil from the rocker arm shaft is forced into the valve, the spring force and the oil pressure determine movement of the piston.

When the oil pressure is low, about 100 kPa (14.5 psi), the control valve is in its engine operating position. During this time, the piston will not move out of its rest position because the oil pressure cannot overcome the spring force. The piston pin prevents the ball from seating and the oil can flow freely through the valve in both directions.

When the control valve begins compression braking, oil pressure to the non-return valve increases. The spring force in the non-return valve is such that when the oil pressure exceeds about 200 kPa (29 psi), it overcomes the spring force and moves the piston to where it no longer controls the ball. The spring forces the ball against its seat and the oil contained above the piston cannot flow past the ball. As a result, high oil pressure is formed above the piston.

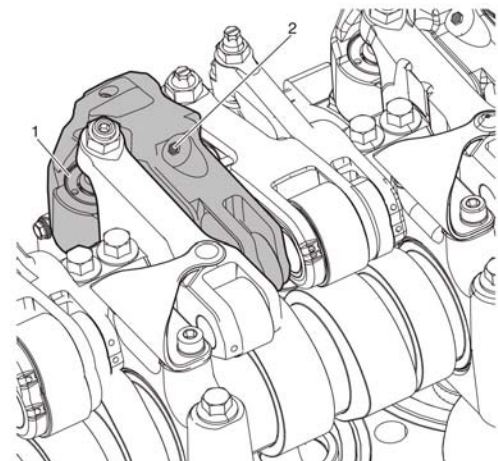


W2005888

## Rocker Arm Piston

The rocker arm (pump) piston is located in the arm offset, facing upward and aligned with the VCB rocker arm adjustment screw. The purpose of the piston is to eliminate all valve clearance during compression braking which it does by closing the gap between the exhaust rocker arm and the engine brake rocker arm.

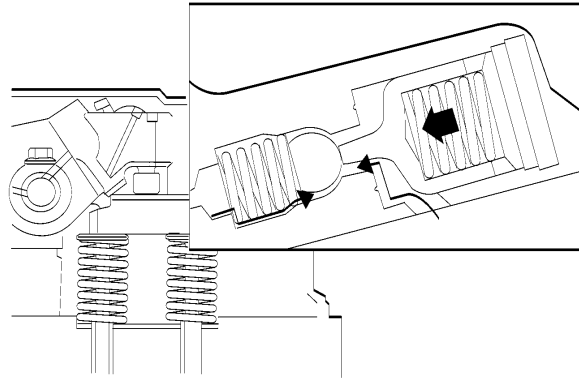
1. Rocker Arm (Pump) Piston
2. Non-Return Valve Location



W2005873

### *Normal Engine Operation — No Compression Braking*

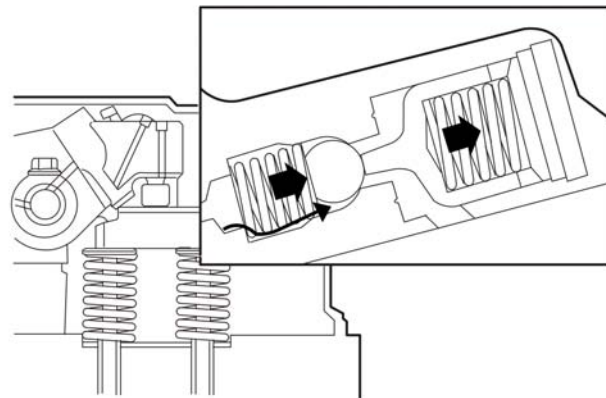
While the engine is running, the control valve reduces the oil pressure in the rocker arm shaft to approximately 100 kPa (14.5 psi). The non-return valve is kept open by the piston being pushed forward. The oil channels fill, but the low pressure is not able to push the pump piston to its upper position. The brake rocker arm does not contact the exhaust valve rocker arm (5). In this situation, the exhaust valves are not affected by the cam lobes on the engine brake cam.



W2005889

### *Compression Braking*

During compression braking, the control valve raises the oil pressure to system oil pressure in the rocker arm shaft. The piston is moved back, but the non-return valve is held open by the oil flow. The higher pressure is able to push the pump piston to its upper position. When the pump piston is pushed to its upper position, the clearance between the engine brake rocker arm and the exhaust valve rocker arm is taken up.



Oil pressure pushes the pump piston to its upper position and fills the volume beneath the piston. Once the oil has filled the system and no longer flows, the non-return valve closes. When the brake rocker arm travels over one of the two lobes, the pump piston is pushed down and the oil volume beneath the piston applies pressure to the power piston. The piston is pushed down and the exhaust valves open. The non-return valve is kept closed by the high oil pressure while the exhaust valves are open.

W2005900

After the exhaust valves close and the brake rocker arm is no longer exerting pressure on the pump piston, the oil that was pushing the power piston down runs back to the pump piston. The system then refills because the non-return valve opens to allow the amount of oil that leaked out during the previous cycle to come through.

Deactivation takes place when the oil pressure in the rocker shaft falls to approximately 100 kPa (14.5 psi). The non-return valve piston opens the non-return valve so that oil can flow back to the rocker arm shaft. The pump piston spring forces the pump piston back to its lower position and the brake rocker arm cannot come into contact with the pump piston.

## Control System

The engine brake is associated with accelerator pedal movement and is activated when the pedal is completely released based on the selection made with the Engine Brake buttons on the steering wheel.

The following conditions must be met for engine brake function:

- Engine Brake button LOW or HIGH depressed
- Engine Brake/Transmission Retarder selector switch is set to Engine Brake position (selector switch can be found on the dashboard only if the vehicle is equipped with both systems)
- Vehicle speed over 12 km/h (7.5 mph)
- Engine temperature over 43<sup>o</sup>C (110<sup>o</sup>F)
- Accelerator pedal is released
- Engine speed exceeds 1150 rpm

## Switch

The compression brake is controlled by Engine Brake buttons located on the steering wheel.

A typical switch can have the following selections:

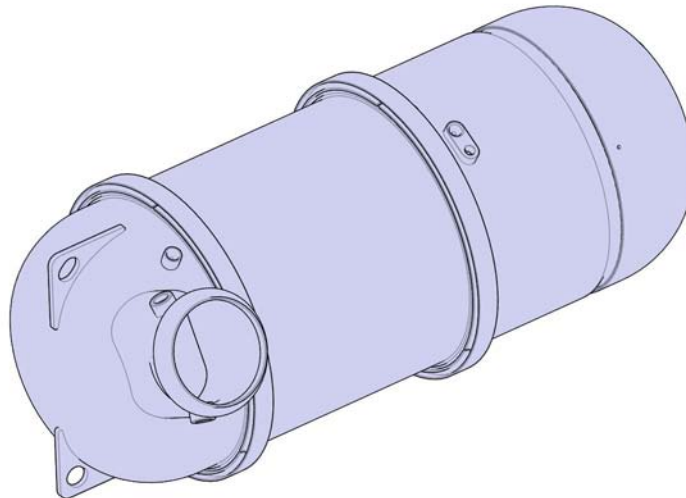
- OFF — Exhaust brake and compression brake not engaged
- LO — Exhaust brake engaged
- HI — Exhaust brake and compression brake engaged

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## Aftertreatment Diesel Particulate Filter (DPF) Insert Replacement

9700, PREVH, PREVX

### Aftertreatment Diesel Particulate Filter (DPF) Insert, Replacement



W2060468

This service bulletin provides the procedures for replacing the aftertreatment DPF insert on VOLVO 9700, PREVH and PREVX model buses.

### Contents

- “Aftertreatment Diesel Particulate Filter (DPF) Insert, Replacement”, page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2545-03-02-05**

## Aftertreatment Diesel Particulate Filter (DPF) Insert, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

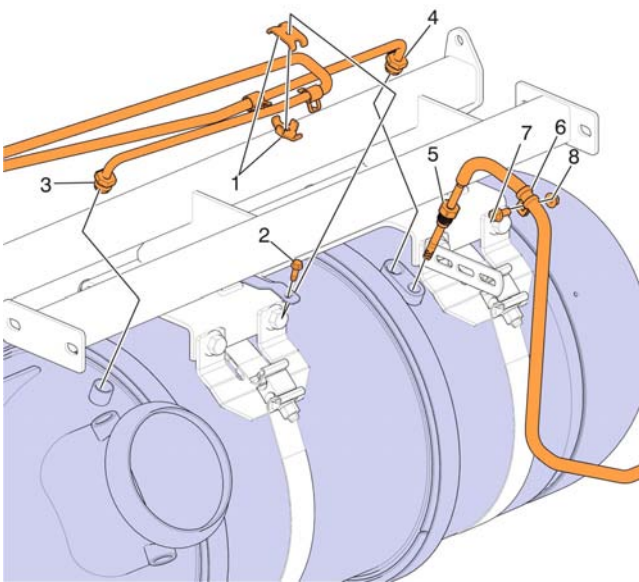
### Removal

**1**

Remove the DPF from the vehicle. Refer to function group 254.

**2**

Remove the fastener securing the clamps that mount the differential pressure tubes to the upper mounting bracket.



W2060469

- 1 Differential Pressure Tube Clamps
- 2 Differential Pressure Tube Clamp Fastener
- 3 Differential Pressure Tube (Inlet Side)
- 4 Differential Pressure Tube (Outlet Side)
- 5 NOx Sensor
- 6 Sensor P-Clamp
- 7 Sensor Clamp Screw
- 8 Sensor Clamp Nut

**3**

Remove the ends of the differential pressure tubes from the two fittings on the aftertreatment DPF.

**4**

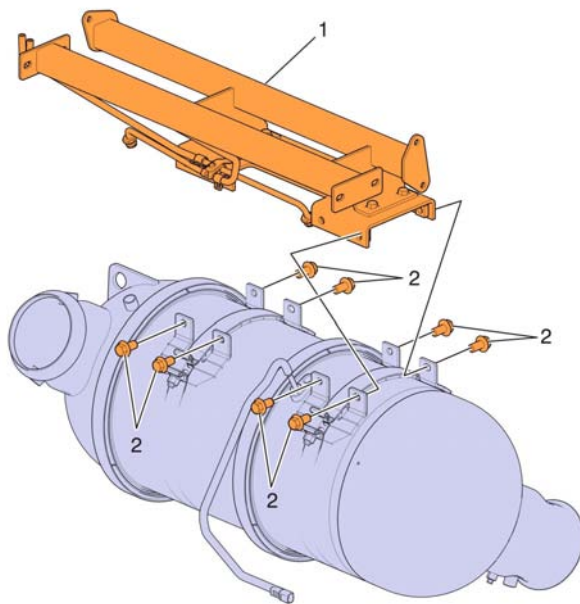
Remove the screw and nut securing the NOx sensor lead P-clamp to the bracket, then remove the NOx sensor from the port on the DPF.

**5**

Separate the DPF thermal wrap at the hook and loop fastener and remove the wrap from the DPF.

**6**

Remove the fasteners securing the aftertreatment DPF upper mounting bracket to the DPF mounting band clamps. Remove the upper mounting bracket, frame mounting brackets and sensor module bracket as an assembly off the DPF.



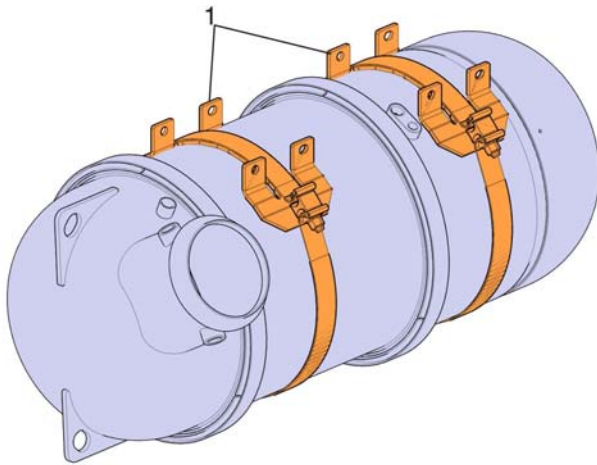
W2060458

1 Upper Mounting Bracket Assembly

2 Fasteners

**CAUTION**

Carefully lay the removed assembly aside, using caution to avoid damaging the NOx sensor harness. Secure the assembly to prevent it from falling over and possibly getting damaged.



W2060471

1 DPF Mounting Band Clamps

**7**

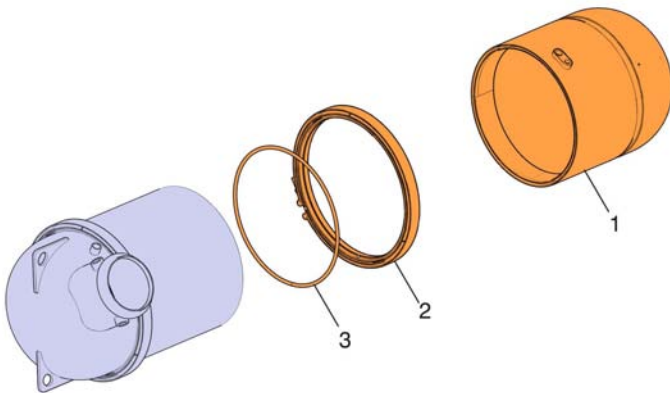
Mark the position and alignment of the DPF mounting band clamps in relation to the inlet housing, outlet elbow and sensor port, then remove the band clamps from the DPF.

**8**

With the aid of an assistant, attach a lifting chain to the DPF assembly, then lift the DPF assembly and set it on the floor supported on wooden blocks. Remove the lifting chain from the DPF.

**9**

Using a suitable support stand, carefully stand the DPF assembly on end with the filter insert down. Then, remove the V-band clamp securing the catalyst to the defective filter insert and set the catalyst/inlet housing assembly aside in a safe place.



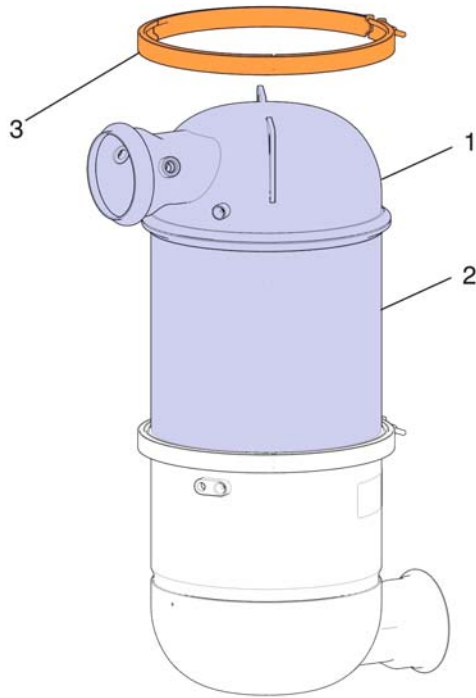
W2060473

1 Catalyst and Inlet Housing

2 V-Band Clamp

3 Gasket





W2060472

- 1 DPF Outlet Housing
- 2 Filter Insert
- 3 V-Band Clamp

**10**

Remove the V-band clamp and separate the filter insert from the aftertreatment DPF outlet housing. Discard the filter gasket.

## Installation

**1**

Inspect and clean all mating surfaces on the catalyst and outlet housing.

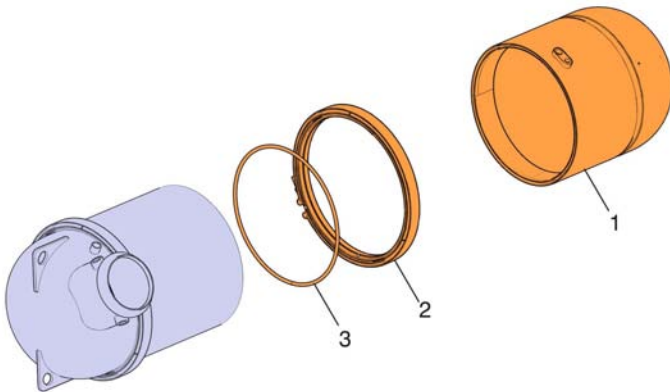
**2**

Remove a replacement DPF filter insert from the package and stand it on end.

**3**

Place a new gasket on the catalyst removed from the DPF in the Removal procedure, position the catalyst/inlet housing assembly on the replacement filter insert, and loosely secure them together with the V-band clamp.

**Note:** Do NOT tighten the V-band clamp at this time.

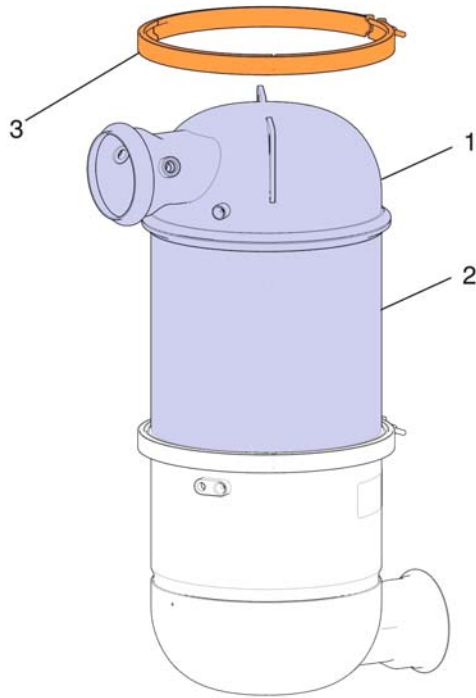


W2060473

1 Catalyst and Inlet Housing

2 V-Band Clamp

3 Gasket



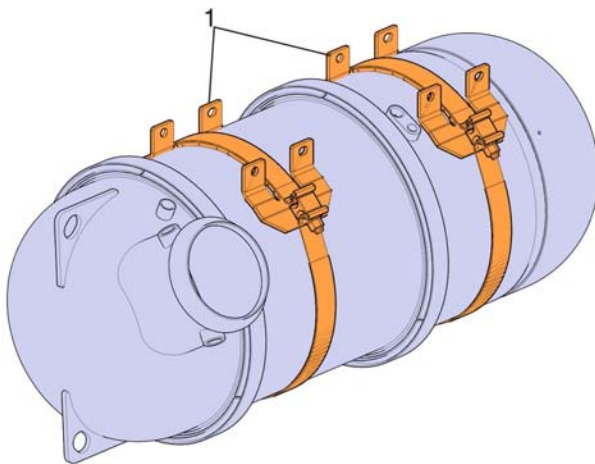
W2060472

- 1 DPF Outlet Housing
- 2 Filter Insert
- 3 V-Band Clamp

**4**

Using the V-band clamp and a new gasket, loosely attach the DPF outlet housing to the replacement filter insert.

**Note:** Do NOT tighten the V-band clamp at this time.

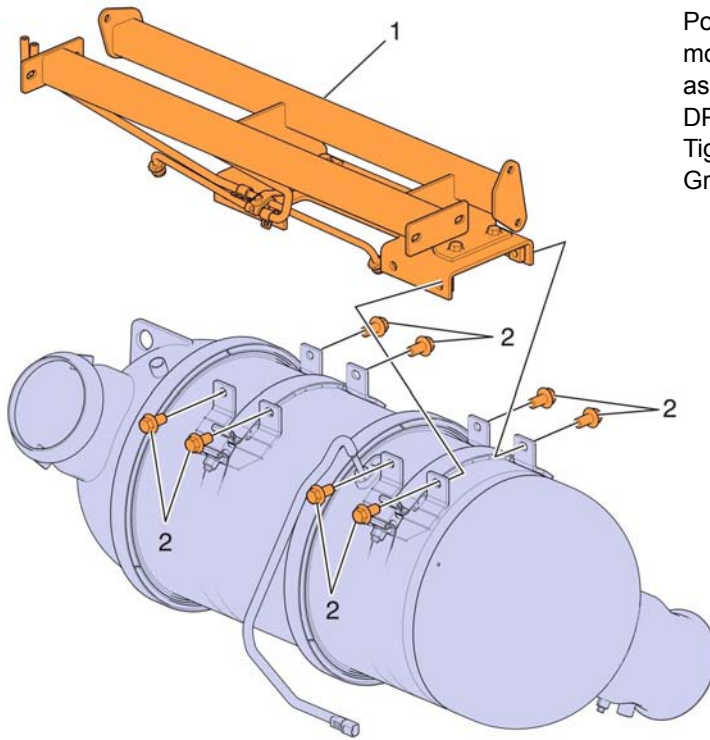


W2060471

- 1 DPF Mounting Band Clamps

**5**

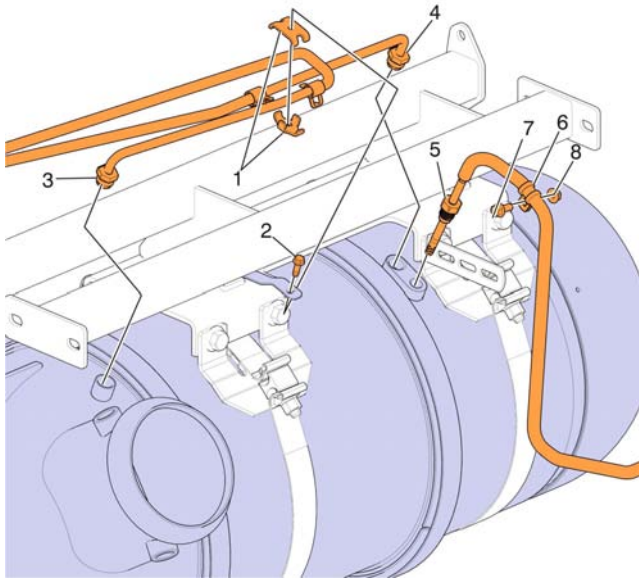
Loosely position the two DPF mounting band clamps onto the DPF and turn the catalyst as needed to align all the parts per the marks made during the Removal procedure. When the parts are properly aligned, tighten the two V-band clamps followed by the two DPF mounting band clamps. Tighten all the clamps to specification; refer to Function Group 200, Specifications.



**6**  
Position the aftertreatment mounting bracket, frame mounting brackets and sensor module bracket as an assembly on the DPF. Using the fasteners, attach the DPF upper mounting bracket to the DPF band clamps. Tighten the fasteners to specification; refer to Function Group 200, Specifications.

W2060458

- 1 Upper Mounting Bracket Assembly
- 2 Fasteners



W2060469

- 1 Differential Pressure Tube Clamps
- 2 Differential Pressure Tube Clamp Fastener
- 3 Differential Pressure Tube (Inlet Side)
- 4 Differential Pressure Tube (Outlet Side)
- 5 NOx Sensor
- 6 Sensor Clamp
- 7 Sensor Clamp Screw
- 8 Sensor Clamp Nut

**7**

Position the DPF thermal wrap onto the DPF and secure it in place using the hook & loop fastener.

**8**

Install the NOx sensor into the port on the DPF, then use the P-clamp, screw and nut to secure the NOx sensor lead to the bracket.

**9**

Install the ends of the pressure tubes into the two fittings on the aftertreatment DPF.

**10**

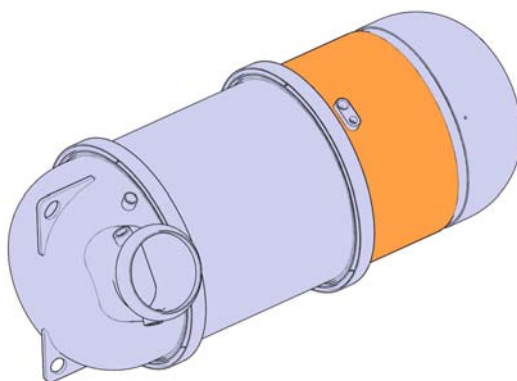
Use the fastener to attach the clamps that secure the differential pressure tubes to the upper mounting bracket.

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## Aftertreatment Diesel Oxidation Catalyst (DOC), Replacement

D13H

### Aftertreatment Diesel Oxidation Catalyst (DOC), Replacement



W2060457

This information provides the service procedure for replacing the Aftertreatment Diesel Oxidation Catalyst (DOC) on VOLVO PREVH, PREVX, and 9700 model buses equipped with the D13H engine.

### Contents

- "Aftertreatment Diesel Oxidation Catalyst (DOC), Replacement", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2541-03-02-01**

## Aftertreatment Diesel Oxidation Catalyst (DOC), Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

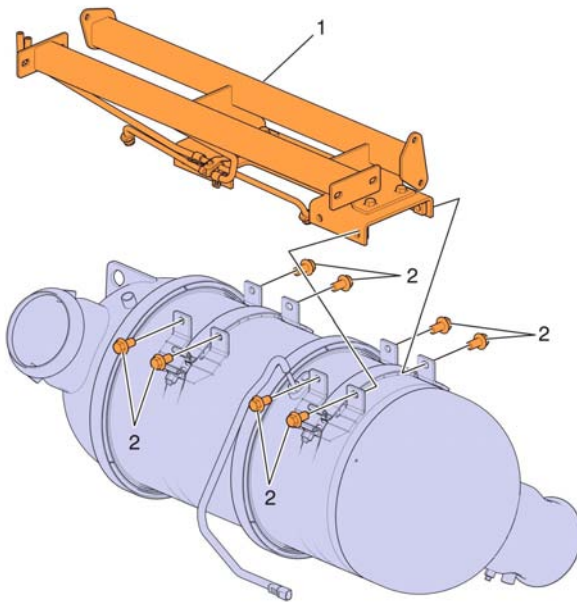
### Removal

**1**

Remove the Aftertreatment Diesel Particulate Filter (DPF). Refer to Function Group 254.

**2**

Remove the fasteners securing the aftertreatment DPF upper mounting bracket to the aftertreatment DPF band clamps. Remove the aftertreatment DPF upper mounting bracket, the frame mount brackets, and sensor module bracket as an assembly. Carefully set the assembly to the side. Secure the assembly from damage.



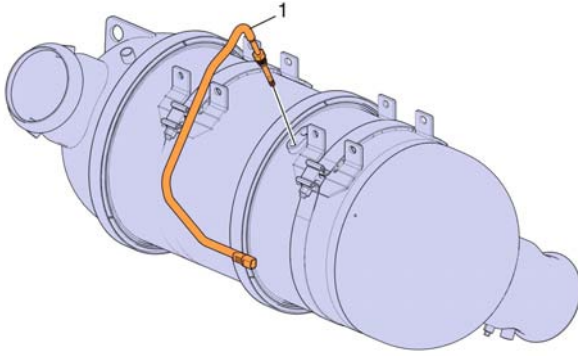
W2060458

### CAUTION

Use care when handling the NOx sensor wiring harness.

1 Aftertreatment DPF Upper Mounting Bracket

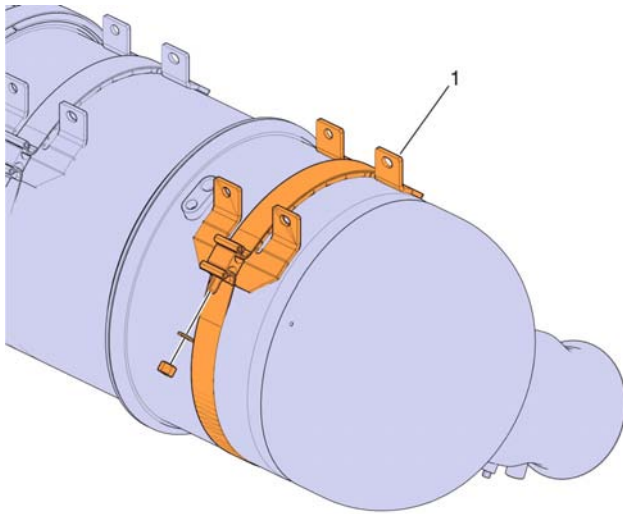
2 Fasteners



W2060459

1 Temperature Sensor

**3**  
Remove the temperature sensor and harness clamp from the aftertreatment DOC section.



W2060461

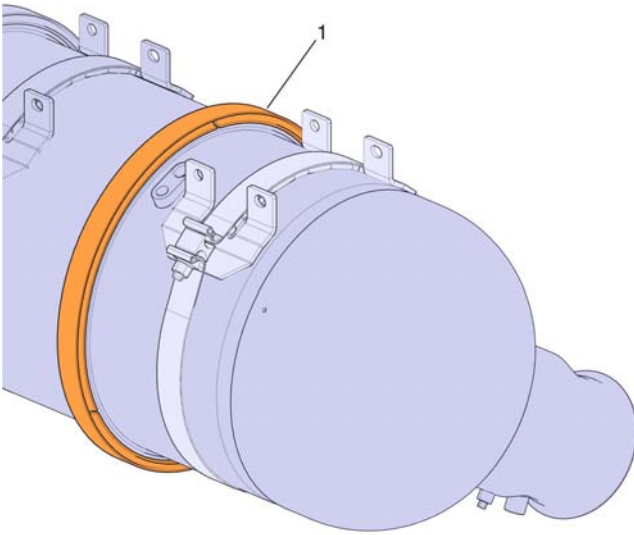
1 Mounting Strap

**4**  
Remove the aftertreatment DPF mounting strap from the aftertreatment DOC section.



**5**

Make alignment marks on the aftertreatment DPF to aid in reassembly. Remove the V-band clamp.

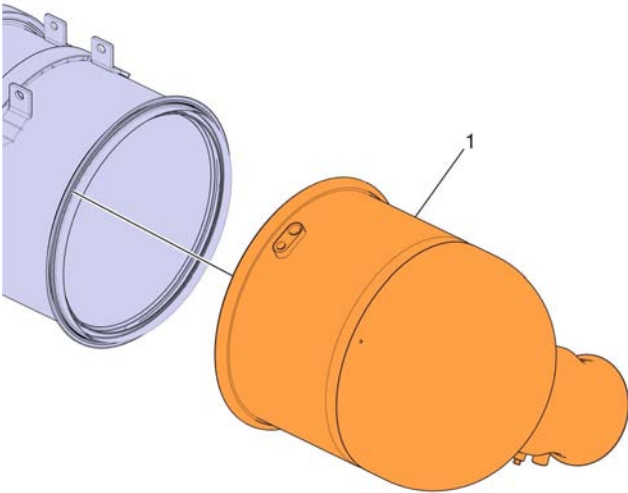


W2060460

1 V-Band Clamp

**6**

With assistance, lift the aftertreatment DOC section away from the aftertreatment DPF. Discard the gasket.



W2060462

1 Aftertreatment DOC

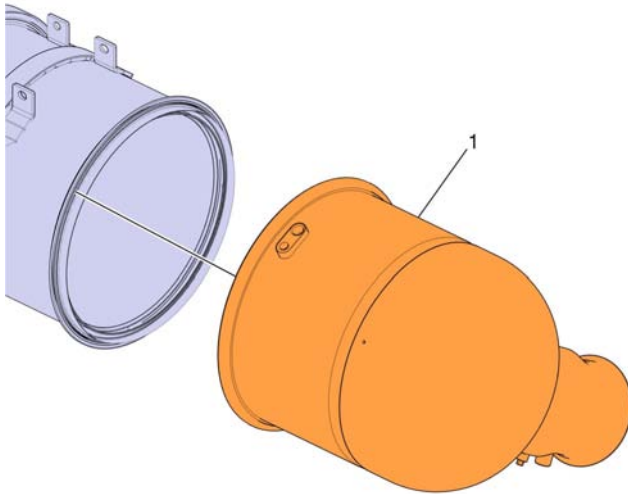
## Installation

**1**

Clean the gasket sealing surfaces on the aftertreatment DOC and the aftertreatment DPF.

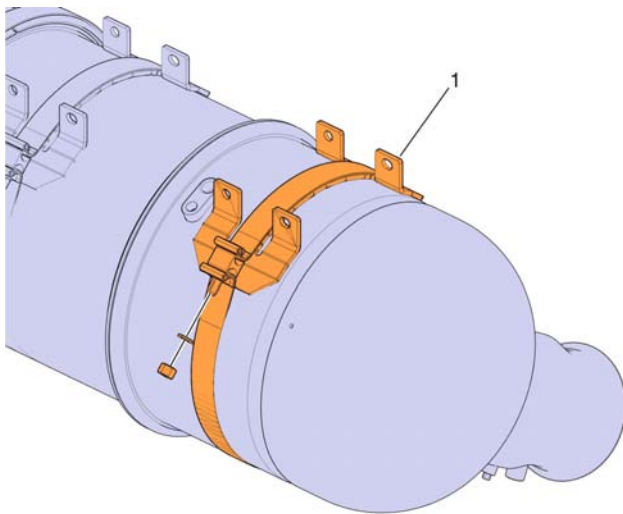
**2**

Install the aftertreatment DOC onto the aftertreatment DPF using a new gasket. Install the V-band clamp and tighten to specification. Refer to Function Group 20, Specifications.



W2060462

1 Aftertreatment DOC

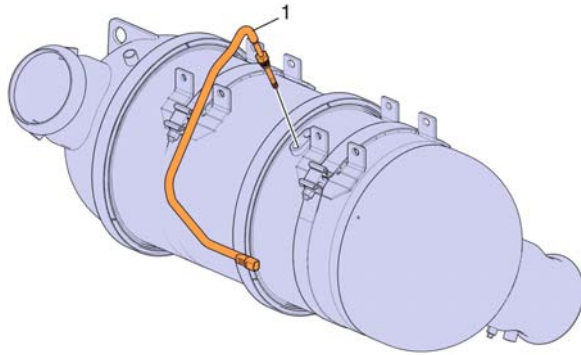


W2060461

1 Mounting Strap

**3**

Position the mounting strap around the aftertreatment DOC and tighten to specification, refer to Function Group 20, Specifications.

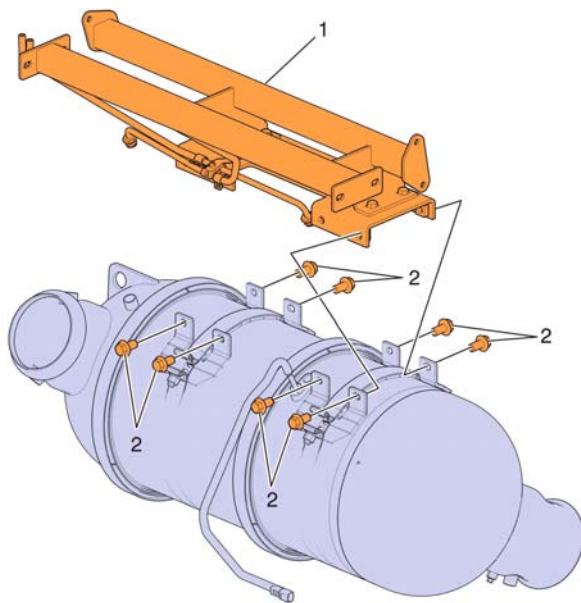


W2060459

**4**

Install the temperature sensor into the aftertreatment DOC section and secure the wiring harness with the clamp. Tighten the temperature sensor to specification, refer to Function Group 20, Specifications.

**1** Temperature Sensor



W2060458

**5**

Install the aftertreatment DPF upper mounting bracket, the frame mount brackets, and sensor module bracket assembly. Tighten all fasteners to specification, refer to Function Group 20, Specifications.

**1** Aftertreatment DPF Upper Mounting Bracket

**2** Fasteners

**6**

Install the DPF. Refer to Function Group 254.

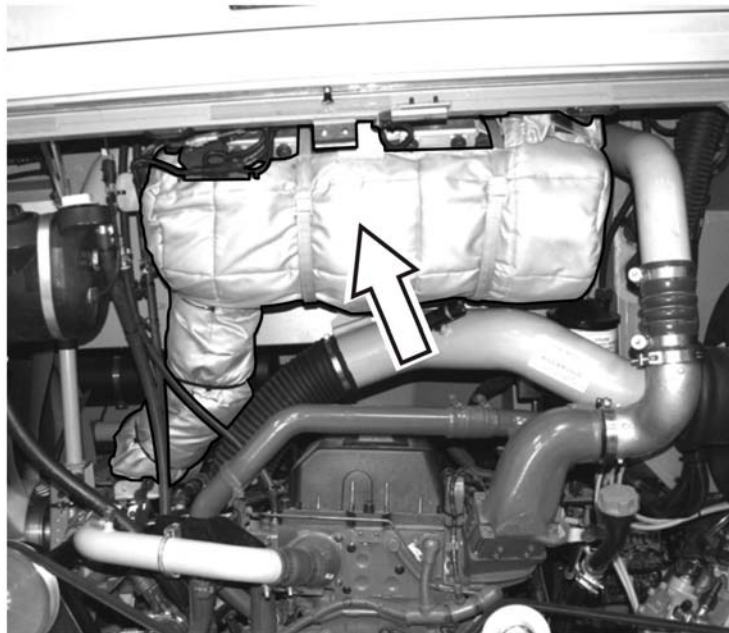
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## Aftertreatment Diesel Particulate Filter (DPF), Complete, Replacement (One)

D13H

PREVX

## Aftertreatment Diesel Particulate Filter (DPF), Complete, Replacement (One)



W2060307

This information provides the service procedures for replacing the Aftertreatment Diesel Particulate Filter (DPF) assembly on the VOLVO PREVX model bus equipped with the D13H engine.

### Contents

- "Aftertreatment Diesel Particulate Filter (DPF), Complete, Replacement (One)", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

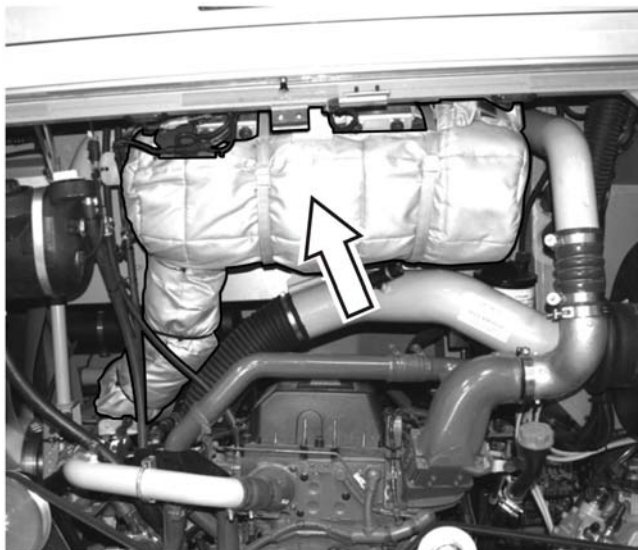
**2545-03-02-02**

## Aftertreatment Diesel Particulate Filter (DPF), Complete, Replacement (One)

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

- 1**  
Apply the parking brake and place the shift lever in neutral.
- 2**  
Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.
- 3**  
Open the rear engine service doors to access the aftertreatment DPF.
- 4**  
Remove the heat wrap from the aftertreatment DPF outlet pipe elbow and the aftertreatment DPF inlet pipe.



W2060307

- 5**  
Remove and discard the V-band clamps from the aftertreatment DPF inlet and outlet.

**6**

Remove the aftertreatment DPF inlet exhaust pipe support bracket mounting fastener and position the inlet exhaust pipe away from the aftertreatment DPF.

**7**

Remove the clamp and disconnect the air compressor intake air hose from the main intake air pipe.

**8**

Remove the clamps at both ends of the main intake air hard crossover pipe. Remove the fastener securing the main intake air pipe to the engine compartment wall. Remove the intake air pipe from the vehicle.

**9**

Disconnect the aftertreatment DPF wiring harness (37-pin connector) and cut the tie straps as required to release the harness.

**10**

Remove the aftertreatment DPF outlet temperature sensor from the aftertreatment DPF outlet elbow.

**11**

Remove the back side aftertreatment DPF mounting bracket from the support rubber and the aftertreatment DPF assembly. Loosen the lower vertical aftertreatment DPF support bracket fasteners at the rubber separator. Remove the upper vertical aftertreatment DPF support bracket fasteners at the rubber separator.

**12**

With assistance, place a lifting device (e.g., the forks of a forklift) under the aftertreatment DPF assembly. Lift up on the aftertreatment DPF and remove the fasteners from the vertical rubber mounts. Carefully remove the aftertreatment DPF assembly from the vehicle.

## Installation

**1**

Transfer the aftertreatment DPF mounting brackets and heat wrap to the replacement aftertreatment DPF.

**2**

With assistance, position the replacement aftertreatment DPF into the vehicle and hang it on the rear mounts.

**3**

Install the back side aftertreatment DPF bracket onto the aftertreatment DPF housing. Install the fasteners and tighten to specification, refer to Function Group 20, Specifications. Tighten the lower vertical support bracket fasteners at the rubber separator, then install and tighten the upper vertical aftertreatment DPF support bracket fasteners at the rubber separator. Tighten the upper vertical mounting bracket fasteners at the chassis. Tighten all fasteners to specification, refer to Function Group 20, Specifications.

**4**

Apply anti-seize compound to the threads of the temperature sensor. Install the aftertreatment DPF outlet temperature sensor to the aftertreatment DPF outlet elbow. Tighten the sensor to specification, refer to Function Group 20, Specifications.

**5**

Connect the aftertreatment DPF wiring harness (37-pin connector) to the aftertreatment DPF. Secure the wiring harness with tie straps as required.

**6**

Install the main intake air pipe into the vehicle. Install the fastener securing the main intake air hard pipe to the engine compartment wall. Tighten the fastener to specification, refer to Function Group 20, Specifications.

**7**

Connect the air compressor intake air hose to the main intake air pipe and secure with a hose clamp.

**8**

Install hose clamps at both ends of the main intake air hard pipe and tighten to specification, refer to Function Group 20, Specifications.

**9**

Clean the sealing surfaces on the aftertreatment DPF inlet and the exhaust pipe. Position the exhaust pipe to the aftertreatment DPF inlet using a new gasket. Install a new V-Band clamp and tighten to specification, refer to Function Group 20, Specifications.

**10**

Install the fastener securing the aftertreatment DPF inlet pipe to the mounting bracket and tighten to specification, refer to Function Group 20, Specifications.

**11**

Clean the sealing surfaces on the aftertreatment DPF outlet and the outlet pipe. Position the aftertreatment DPF outlet pipe to the aftertreatment DPF outlet using a new gasket. Install a new V-Band clamp and tighten to specification, refer to Function Group 20, Specifications.

**12**

Position the heat wrap over the aftertreatment DPF inlet and outlet pipes and secure as required with fasteners and tie straps.

**13**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**14**

Start the engine, check for leaks and proper operation.

**15**

Close the rear engine service doors.



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## Turbocharger and Exhaust Aftertreatment Systems

B13R, PREVH, PREVX

### Turbocharger and Exhaust Aftertreatment Systems

The purpose of this document is to provide information for successful turbocharger and aftertreatment component replacement in the event of a system failure. Thorough and careful work during installation and repair will lead to root cause identification, prevent a premature failure of replacement components, and preserve cores for remanufacturing. Turbocharger replacements due to incorrect or careless work procedures are not warrantable.

#### Contents

- “Aftertreatment Diesel Particulate Filter (DPF) Assembly Inspection and Service”, page 2
- “Selective Catalytic Reduction (SCR) Service (US2010 engines only)”, page 12
- “Turbocharger Failure”, page 12
- “Precautions for Installation of Replacement Turbochargers”, page 20

**Note:** Information is subject to change without notice.

Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## General

### Aftertreatment Diesel Particulate Filter (DPF) Assembly Inspection and Service

#### CAUTION

Before installing replacement DPF components, all exhaust piping must be clean of all debris and oil and fuel residue. The root cause of the contamination must be corrected before installing replacement components to prevent component damage.

**Note:** The DPF element recommended service interval for cleaning or exchange is 400 000 km (250,000 mi) or 4,500 hours whichever comes first. Exceeding this recommendation can cause the following problems:

- Increased DPF regeneration frequency
- Higher exhaust gas temperatures (EGT)
- Incorrect reporting of aftertreatment DPF soot level
- Filter core damage

**Note:** If soot level displayed in the Exhaust Aftertreatment Diagnostics screen in VCADS exceeds the limits given under "soot ratio check", the DPF filter element must be replaced and the root cause of the high soot must be diagnosed. Do not reset soot level to allow a service DPF regeneration to occur.

### DPF System Functional Tests (vehicle operable)

The following tests, also described in Guided Diagnostics fault tracing for specific diagnostic trouble codes (DTCs), will help in diagnosing DPF regeneration complaints on vehicles.

#### Soot Ratio Check

The soot ratio can be checked using the Exhaust Aftertreatment Diagnostics operation in VCADS. The value displayed is a calculated amount of soot in the DPF. As the soot level exceeds certain thresholds, diagnostic trouble codes (DTCs) will be triggered and the engine will undergo a derate. After a DPF regeneration, the soot level is recalculated and reset. Depending on the trigger that initiated the regeneration, the soot level will be reset to some value greater than zero. This is normal.

- The DPF element must be replaced if the soot ratio as displayed in VCADS, exceeds the limits given in this section.
- The soot level should never be reset unless the DPF element has been replaced.

#### CAUTION

Failure to replace DPF elements with excessive soot buildup can cause filters to melt or crack due to uncontrolled soot oxidation and high temperatures which renders the DPF core useless.

#### Soot Level Requiring DPF Element Change

US07 VOLVO Engines, Catalyzed DPF 200%

US2010 VOLVO Engines, Catalyzed DPF 160%

**Note:** Soot ratio and learned data must be reset when changing DPF element.

## DPF Delta Pressure Check (before service DPF regeneration)

The purpose of this test is to check that the DPF is not overloaded with soot to a level that will damage the DPF if a service regeneration is performed.



### CAUTION

Before a service DPF regeneration is performed on any vehicle, the DPF delta pressure test **MUST** be performed to measure back-pressure through the DPF. If the back-pressure is too high, a DPF regeneration **MUST NOT** be performed because the filter is filled over capacity with soot or ash. The filter must be replaced. If a regeneration is performed, the filter is at risk of cracking which ruins core value.

- 1 Operate engine until engine coolant temperature (ECT) reaches at least 82°C (180°F).
- 2 Enter the Exhaust Aftertreatment Diagnostics operation in VCADS.
- 3 Start the operation and monitor the DPF differential pressure for maximum value while operating the engine (vehicle stationary) at maximum RPM (greater than 1,800) for 30 seconds.
- 4 Interpret the results using the table.

### DPF Delta Pressure Check (before service DPF regeneration)

Differential/Delta Pressure Value	Actions
Greater than 15.2 kPa (2.2 psi)	<ol style="list-style-type: none"> <li>1 Remove DPF element</li> <li>2 Investigate and correct root cause using symptom and DTC guided diagnostics</li> <li>3 Install new DPF element</li> <li>4 Reset soot ratio</li> <li>5 Perform service DPF regeneration with new element</li> </ol>
15.2 kPa (2.2 psi) or less	<ol style="list-style-type: none"> <li>1 Perform service DPF regeneration (only If soot level is below the level for DPF element replacement)</li> <li>2 Allow the exhaust system to cool by idling the engine approximately 5 minutes</li> <li>3 Repeat the DPF Delta Pressure test (after service DPF regeneration)</li> </ol>

## **DPF Delta Pressure Check (after service DPF regeneration)**

It is necessary to repeat the DPF Delta Pressure test after the service DPF regeneration has completed and after the EGT has stabilized at normal levels. This test will reveal a filter that is clogged with ash, or otherwise damaged with a restriction level that is too high.

- 1 Idle engine until EGT is below 300°C (572°F).
- 2 Enter the Exhaust Aftertreatment Diagnostics operation in VCADS.
- 3 Start the operation and monitor the DPF differential pressure value while operating the engine (vehicle stationary, engine no load) at maximum RPM (greater than 1,800) for 30 seconds.
- 4 Interpret the results using the table.

### **DPF Delta Pressure Check (after service DPF regeneration)**

<b>Differential/Delta Pressure Value</b>	<b>Actions</b>
Greater than 9 kPa (1.3 psi)	<ol style="list-style-type: none"><li>1 Remove DPF element</li><li>2 Install new DPF element</li><li>3 Reset soot ratio</li></ol>
9 kPa (1.3 psi) or less	<ol style="list-style-type: none"><li>1 No further action required</li></ol>

## Exhaust Aftertreatment System Logged Data

Data from prior DPF regenerations is stored in the engine control module (ECM) and can be viewed with the Exhaust Aftertreatment System Logged Data operations in VCADS. This information can be useful in troubleshooting DPF regeneration problems.

- Regeneration Start Triggers
- Regeneration Duration
- Success Results
- Soot Level Information

## Vehicle Configuration

Many different vehicle configuration options exist with regard to DPF regeneration. The vehicle must be configured properly for the application. The Exhaust Aftertreatment Diagnostics operation allows the vehicle configuration options for DPF regeneration to be viewed. Vehicles not set up properly for the application or driving pattern can suffer failed DPF regenerations that are not due to individual component failure. Contact Technical Support Services for advice on the correct configuration for individual vehicles, applications, or duty cycles.

## Filter Element and Catalyst Inspection

### Overview

- 1 Check for fluid contamination
- 2 Check for filter media pushed out of metal canister
- 3 Inspect filter element outlet face
- 4 Inspect filter element inlet face

**Note:** Reference the pictures contained in the following sections.



### **CAUTION**

The DPF and diesel oxidation catalyst (DOC) must be handled carefully. They must not be dropped or the media will crack. The flange surfaces must be protected when the filter is disassembled to avoid damage such as scratches or dents which will prevent the flanges from sealing.

## Fluid Contamination - Oil and Fuel

### CAUTION

Oil and fuel in the DPF can cause uncontrolled temperature in the DPF which can melt and crack the media in the DPF element. This will prevent the DPF from trapping particulate matter and prevent it from being remanufactured for further use. The root cause of the contamination must be corrected before DPF element replacement. When the exhaust system is contaminated with oil or fuel from a component failure, the DPF must be disassembled and examined for contamination of the DPF.

### *System Contamination with Oil or Fuel Service Steps*

The root cause of the contamination must be corrected before DPF element replacement.

- 1 Disassemble the DPF assembly and separate the particulate filter from the DOC.
- 2 Examine the DOC for oil or fuel saturation. A DOC that is saturated or dripping with oil or fuel contamination must be replaced. A saturated DOC can pass contamination through to the particulate filter and cause uncontrolled temperatures and melting or cracking of the particulate filter. The DOC can be reused under the following conditions:
  - The DOC is not saturated or dripping
  - The area of contamination on the DOC inlet surface does not exceed 10 cm (4 in) in diameter.
- 3 Inlet and outlet DPF housings and all exhaust piping must be thoroughly drained and cleaned of any oil and fuel residue prior to installation of replacement components.
- 4 If the DPF element is found to be contaminated with oil or fuel it must be replaced.



W2058094

Oil on DPF Filter Inlet or Outlet Surface

## Fluid Contamination — Coolant, Water or Condensation

Coolant or water entry into the DPF system may pose a problem for the DOC or particulate filter material. Excess fluid must be drained from the piping to prevent damage to sensors mounted in the DPF or freezing and media cracking in cold weather.

- Rain water entry through the exhaust stack must be minimized for parked vehicles, or vehicles in transit.
- For coolant contamination in the exhaust system, the root cause of the contamination must be corrected.
- The presence of coolant or water in the DPF does NOT require replacement of the filter or DOC.

## Filter Media Pushed Out

**Note:** Applicable to DPF element only.

Check to see if the DPF element has been pushed from the metal housing. This indicates very high back pressure was created due to rapid and excessive soot buildup.

This condition can be caused by excessive oil or fuel introduced into the exhaust system.



W2058095

### **1. Identify and correct the root cause of excessive soot.**

Suspect components affecting soot production:

- Engine Sensors (incorrect reading)
- Injector/Nozzle (cracked or leaking)
- Exhaust Gas Recirculation (EGR) cooler (clogged)
- EGR Valve
- Charge Air Cooler (CAC) and Intake Piping

Tips for investigating causes of high soot:

- 1 Monitor key-on sensor values using PTT to determine whether they are within acceptable range.
- 2 Check Exhaust Aftertreatment Logged Data using VCADS for historic regeneration information indicating high soot production.

Vehicle operating characteristics affecting soot production:

- Excessive Idling
- High Oil Consumption
- Poor Quality Fuel



### **CAUTION**

US07 and later emissions level engines must be operated on ultra low sulfur diesel (ULSD) fuel only! Damage to the emissions control system and frequent regenerations will result from using fuel out of specification.

### **2. Replace DPF filter insert, reset soot ratio, and perform learned data reset.**

## Outlet Face Inspection (DPF filter only)

- Inspect filter outlet face for evidence of soot which indicates the closed cells in the filter have cracked or melted.
- Check for cells melted together or rounded.
- Inspect for large breaks in ceramic media exposing open cells.

If any of the above conditions are present, the DPF element must be replaced.

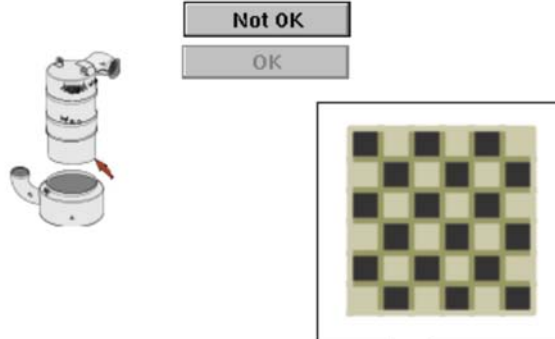
**Note:** This inspection is not applicable to DOC due to straight through cell design.



W2058115

Melted Filter

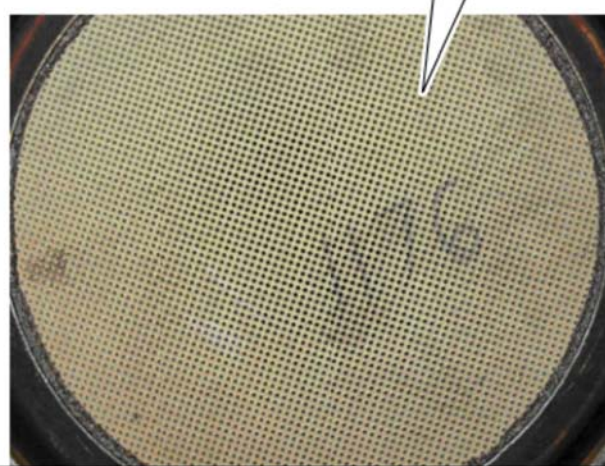




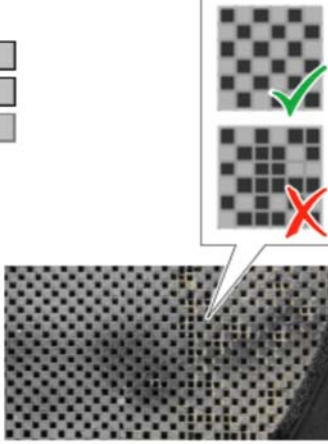
Not OK

OK

Particulate filter outlet, OK



W2058113




DK

Overhead DPP

Not DK

Missing plugs or cracked particulate filter, Not DK



W2058114

## **Inlet Face Cleaning and Inspection (applicable to DPF element and certain serviceable DOC)**

Check for thick soot buildup on the inlet faces of filter element and DOC (if applicable) and clean. Use a plastic scraper with a rounded edge to clean the surface or a vacuum. Do not use metal tools. If the delta pressure through the filter exceeds the limits given for before service DPF regeneration, the filter must be replaced.



W2058118

Soot on filter inlet can be cleaned, unless filter exceeds the delta pressure limits given in the DPF delta pressure test 15.2 kPa (2.2 psi), see the "Function Tests"

**IMPORTANT:** Visible soot buildup must not be used as an indication of filter plugging that requires replacement. Filter replacement due to soot loading should only be determined through parameters and tests results from Premium Tech Tool (PTT).

### *DPF Element Only*

- Check for cells melted together or rounded
- Inspect for large breaks in ceramic media exposing open cells

The above conditions require DPF element replacement.



W2058119

Melted Channels



W2058117

Rounded Channels

### *DOC Only*

- Check inlet face of DOC for foreign debris and clean as necessary. Check the DPF inlet module for foreign debris and clean as necessary.

**Note:** The presence of debris such as metal fragments from a turbocharger failure does not require DOC replacement unless there are large breaks in the ceramic media.

**IMPORTANT:** When there is a turbine side failure of the turbocharger, such as a broken blade, remove exhaust piping as necessary and clean debris from the piping and inlet module of the DPF.

## **Selective Catalytic Reduction (SCR) Service (US2010 engines only)**

The SCR catalyst is a self contained unit and cannot be disassembled to inspect component condition.

Determination of SCR catalyst condition should be made using tests in Guided Diagnostics based off relevant diagnostic trouble codes (DTCs) and symptoms.

In the event the aftertreatment diesel particulate filter (DPF) is saturated with fuel or oil due to a component failure, the following operations should be performed in VCADS, to clean the SCR catalyst after DPF replacement:  
2585-11-03-03 SCR, Diesel Exhaust Fluid, Crystal Sublimation

Always contact Technical Support Services for approval before SCR replacement

### **Turbocharger Failure**

**IMPORTANT:** Never disassemble compressor or turbine housing covers. They are secured with tamper evident fasteners. Disassembly will void the manufacturer's warranty.

### **Turbocharger Failure due to Stuck Variable Geometry Turbocharger (VGT) Mechanism (applies to VGT units only)**

Damage to the VGT mechanism that operates the sliding vanes in the turbocharger can result in a sector shaft that is hard to move (binding) or one that cannot reach the extents of normal travel. This requires replacement of the turbocharger and root cause correction.

**Note:** Refer to appropriate service literature for checking VGT mechanism travel. The procedure varies depending on engine series and turbocharger model.

**This type of damage can be caused by the following conditions:**

- Foreign Object Damage
- Excessive Soot
- Varnished Nozzle

## Foreign Object Damage

Foreign object damage is caused by material passing through the turbocharger in the exhaust stream which damages the turbine wheel, or more commonly, the VGT mechanism. It can come from many sources including:

- Debris from a previous service repair.
- Abnormal metallic debris from the engine including pieces of valve or valve guide.
- Debris passing through the engine and out the exhaust such as pieces of exhaust gas recirculation (EGR) tubing, metal gasket material or a failed intake air heater (IAH) element.
- Debris dislodged from the charge air cooler (CAC) or EGR cooler such as solder residue or gasket fragments.
- Contamination from intake air or EGR piping left opened or uncovered.
- Broken tips from engine sensors such as EGR temperature, intake manifold pressure (IMP), or intake manifold air temperature.



W2058120

VGT vane ring damage due to foreign objects in exhaust stream

## Excessive Soot

The VGT mechanism can bind or have restricted movement due to engines producing excessive soot. This would be accompanied by frequent aftertreatment diesel particulate filter (DPF) regenerations. A sooted nozzle is usually manifested by a VGT mechanism that is hard to turn, sticks, or binds. It will be accompanied by mechanical faults (DTCs) for the variable geometry turbocharger.

**How to correct:** Investigate and eliminate the cause of excessive soot.

### Suspect components affecting soot production:

- Engine sensors (incorrect reading)
- Injector/nozzle (cracked or leaking)

Foreign object damage is usually manifested by a VGT mechanism that has a restricted range of travel and will not reach the end stop in the closing direction.

**Note:** Foreign object damage is a common failure mode on US07 turbochargers. Warranty review of such failures shows that debris from previous repairs are a major contributor. Cleanliness in the repair of EGR and intake air (IA) systems is very important!

**How to correct: Identify the source of debris and clean.** Check vehicle repair history. If there have been recent internal engine, intake or exhaust repairs, or recent turbocharger replacements, contamination is likely the problem. This condition must be corrected before further repairs are performed. Contact tech support for advice on how to proceed before repairing.

**Note:** US07 Engines: a common source of foreign object damage is steel gasket material including exhaust manifold gaskets, and EGR pipe gaskets. Misalignment on EGR pipe installation can cause the steel gasket to burn out and break into pieces. The pieces will be sent through the EGR cooler and recirculated through the engine, causing damage. Any broken gasket pieces must be removed from the EGR and exhaust circuits!

**Note:** D13F Engines: a common source of foreign object damage was an early version EGR mixer pipe end breaking off. Reference FSB293-001.

- EGR cooler (clogged)
- EGR valve
- Charge air cooler (CAC) and intake piping

Vehicle operating characteristics affecting soot production:

- Excessive idling
- High oil consumption
- Poor quality fuel

It may be helpful to monitor key-on values for engine sensors using VCADS, and check exhaust aftertreatment logged data for DPF regeneration information indicating high soot production.

## Varnished Nozzle

A varnished nozzle condition can occur in very cold ambient air temperature (AAT) regions when the engine is idled for extended periods. Hydrocarbon deposits form on the VGT mechanism that have a hard lacquer appearance. The engine operating strategy contains a heat mode function which is designed to burn off the varnish.



W2058161

A varnished nozzle is usually manifested by a VGT mechanism that is hard to turn, sticks, or binds. It will be accompanied by mechanical faults (DTCs) for the variable geometry turbocharger.

### **How to Correct:**

- 1 Verify the engine control module (ECM) software is current, and update as necessary. For US07 emissions vehicles, software changes were made in November 2009 that improve the heat mode strategy to prevent varnish accumulation.
- 2 Instruct driver on proper vehicle operation. For the heat mode function to work properly, the ECM must receive a parking brake control signal to indicate the vehicle is parked. The vehicle main parking control brake must be activated. Vehicles parked using a trailer brake only will not enter heat mode.
- 3 Verify the vehicle electronic control unit (VECU) is getting the required parking brake signal input and correct as necessary.

## Oil Passing into Turbine (exhaust side)

The symptom of oil contamination in the turbine housing can be the result of bad sealing devices in the turbocharger or it can be caused by other engine problems. Correction of the root cause and proper system cleaning must be performed before turbocharger replacement.

Remove intake boot from the compressor housing and check for oil contamination in the compressor side. Is there oil leakage on both the compressor and turbine side?

### Yes — Oil is present in both compressor and turbine housing

- 1 Spin the shaft with thumb and finger. Check turbine and compressor wheel to housing clearance. If wheels are rubbing housings, replace the turbocharger. Check for problems with engine oil supply pressure.
- 2 Inspect for causes of high crankcase pressure. Since oil drain from the turbocharger back to the sump is gravity feed, it can be slowed due to high pressure or restriction in the drain tube. Identify and correct the root cause. Suspect components include:
  - Turbocharger oil drain line
  - Restricted breather tube
  - Faulty crankcase ventilation separator
  - Power cylinder components

If all of the above checks turn out OK, the likely cause is a defective mechanical oil seal in the turbocharger,

in which case the turbo should be replaced. Proceed to Step 5. If the root cause was found to be an engine problem, and the turbocharger is determined to be OK, proceed to Step 3.

- 3 Drain excess oil from turbine housing
- 4 Clean oil residue from compressor wheel using solvent and compressed air so that this condition will not be misdiagnosed in a future repair.

**Note:** DO NOT remove compressor or turbine housings.

- 5 On DPF equipped vehicles, the exhaust system must be cleaned of oil contamination see "Aftertreatment Diesel Particulate Filter (DPF) Assembly Inspection and Service", page 2 for advice on cleaning and inspection.
- 6 Inspect and clean oil from charge air piping and CAC if necessary. Refer to appropriate service information.

### No — Oil is leaking from exhaust side of turbocharger only

Determine if oil is coming from the engine. Are the exhaust manifold and cylinder head wet with oil?

- **Yes** — Drain excess oil from turbine housing and correct the problem with base engine. Do not replace turbocharger. On DPF equipped vehicles, the exhaust system must be cleaned of oil contamination see "Aftertreatment Diesel Particulate Filter (DPF) Assembly Inspection and Service", page 2 for advice on cleaning and inspection.

- **No** — Replace turbocharger, refer to service information.

#### CAUTION

On DPF equipped vehicles, the exhaust system must be cleaned of oil contamination see "Aftertreatment Diesel Particulate Filter (DPF) Assembly Inspection and Service", page 2 for advice on cleaning and inspection.

## Oil Passing into Compressor Side

This condition can be caused by bad mechanical sealing devices in the turbocharger or it can be caused by external factors. The following checks must be performed:

Remove the diffuser pipe on turbine outlet. Inspect for oil contamination in turbine housing. Is there oil leakage in turbine housing as well as compressor housing?

### Yes — Oil is present in both compressor and turbine housing

Follow steps contained in the previous section.

### No — Oil is leaking from the compressor side of turbocharger only

- 1 Inspect air filter element(s) for restriction and replace as necessary.
- 2 Inspect air filter restriction indicator for proper function and replace as necessary.

 **CAUTION**

Continued operation of an engine with a restricted air filter can cause oil to be drawn past the mechanical shaft seal on the turbocharger. It is NOT necessary to replace the turbocharger due to this condition once the restriction is corrected.

- 3 Inspect the intake piping for the air compressor for presence of oil – correct this condition by servicing or replacing the air compressor as necessary.

**Note:** A worn or failing brake air compressor can pass oil into the engine intake piping due to a shared fresh air intake. This condition can often coat the compressor wheel with oil. It has often been misdiagnosed as a failed turbocharger. When engine oil is entering the turbocharger from the brake air compressor it there will be small traces in the upstream air piping, and burned oil in the compressor discharge.

- 4 If the above conditions pass inspection, the likely cause is a defective mechanical oil seal in the turbocharger, in which case the turbocharger should be replaced.
- 5 Clean oil residue from compressor wheel using solvent and compressed air so that this condition will not be misdiagnosed in a future repair.

**Note:** Do not remove the compressor housing.

- 6 Clean the oil residue from intake air piping.
- 7 Clean the oil residue from CAC and piping. Refer to appropriate service information.



## Broken Turbocharger Shaft/Compressor or Turbine Wheel Separated

A failure where compressor or turbine wheels become unbalanced and causes destruction of the shaft will ruin the bearing system in the turbocharger. This debris will contaminate the engine oil.

The following steps must be performed every time a turbocharger failure of this nature is encountered.

- 1 Completely remove the turbocharger oil drain tube from the engine and thoroughly clean.
- 2 Change engine oil and oil filters.
- 3 After the turbocharger is removed from the engine, look into the turbine side. Examine the wheel for damage to blades, a missing blade or blade tip. Check for oil

contamination in the exhaust piping and clean. See "Aftertreatment Diesel Particulate Filter (DPF) Assembly Inspection and Service", page 2 .

### CAUTION

On DPF equipped vehicles, debris and oil must be cleaned from exhaust piping and DPF inlet section. Debris left in the exhaust pipes can cause progressive damage to the catalyst.

- 4 Inspect compressor wheel for damage to blades, a missing blade or blade pieces.

## Compressor Wheel Is Damaged and Missing Pieces — Service Steps

- 1 Remove air filter housing and complete air intake piping assembly, inspect, and clean all debris from piping.

**Note:** High velocity metal fragments from a failure can embed into the air cleaner element and piping.



W2058121

Air Compressor Intake Hose with Embedded Debris

- 2 Replace air cleaner element.
- 3 Inspect brake air compressor intake pipe for debris. Repeat turbocharger failures have been caused by debris lodged in air compressor intake piping. Replace any rubber hoses with embedded debris.
- 4 Remove charge air piping between turbocharger and CAC. Clean all debris and oil contamination as necessary.
- 5 Pressure test CAC and replace if necessary. High velocity debris can damage the CAC.
- 6 If CAC tests OK, remove CAC and clean. Refer to appropriate service information.

## **Damaged Blades on Compressor Wheel (turbine wheel OK)**

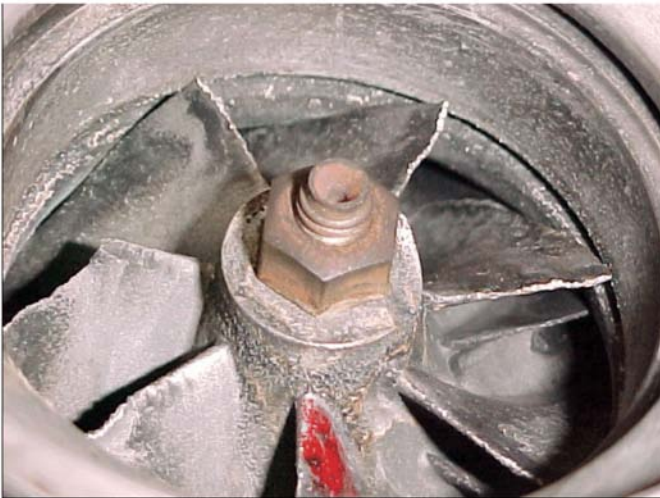
Damage to the blades on the compressor wheel accompanied by complaints of unusual turbo noise and or low boost is usually caused by debris going through compressor wheel (FOD).

- 1 Check vehicle repair history for recent repairs to the intake system in the event of damaged blades. Make sure the source of damage is corrected.
- 2 Remove fresh air connection for the brake air compressor from the intake air piping. Remove connection at the air compressor. Carefully inspect for debris originating from air compressor indicating a mechanical failure.
- 3 If any debris is found, thoroughly clean air compressor intake piping and service air compressor as necessary.
- 4 Refer to "Compressor Wheel Is Damaged and Missing Pieces — Service Steps", page 17 for repair guidelines.



W2058124

Compressor Wheel Damage From Foreign Objects



W2058123

Compressor Wheel Damage Due To Foreign Objects

## Turbocharger Compressor Wheel is Cracked or Burst

A compressor wheel that is cracked or has burst apart is caused by a material failure. This is a primary failure that will result in other secondary damage to the shaft and turbine wheel. It is not necessary to investigate root cause in these failures.

Before installing a replacement turbocharger, perform all of the service steps listed under “Compressor Wheel Is Damaged and Missing Pieces — Service Steps”, page 17.

In addition, the exhaust system must be cleaned of debris and contamination. See “Aftertreatment Diesel Particulate Filter (DPF) Assembly Inspection and Service”, page 2 .



W2058605

Cracked Compressor Wheel



W2058604

Burst Compressor Wheel

## Damage to Turbine Wheel Blades

### Foreign Object Damage

Damage to the turbine wheel blades can occur due to foreign object damage (FOD). The symptoms of this include abnormal turbocharger noise and low boost. It can be difficult to identify this failure because the damage occurs on the inlet side of the turbine wheel and may not be visible on the turbine outlet.

**Note:** This failure mode resulting from FOD is more common on non-VGT turbochargers. On VGT models,

FOD usually causes a stuck VGT mechanism or one that will not fully close.

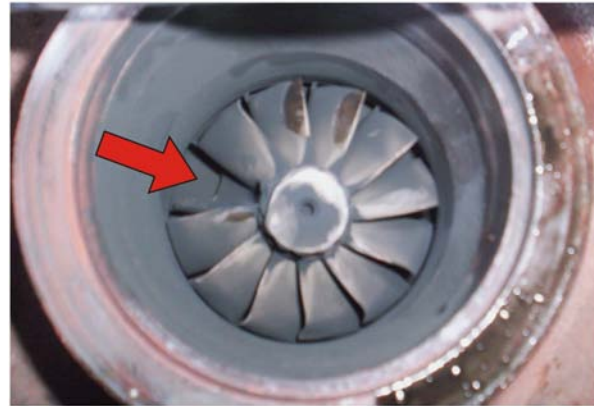
To identify and correct the root cause, investigate according to the recommendations under "Foreign Object Damage", page 13. The entire system must be cleaned as specified in this document

### Material Failure

A turbine wheel material failure will result in other secondary damage to the shaft, compressor wheel, and total turbo failure. The signs of this failure will be a complete blade missing from the turbine wheel. It is NOT necessary to investigate root cause in these failures. The system must be cleaned before turbo replacement as specified in this document.

Before installing a replacement turbocharger, perform all of the system cleaning operations described in this document, as applicable.

In addition, the exhaust system must be cleaned of debris and contamination. See "Aftertreatment Diesel Particulate Filter (DPF) Assembly Inspection and Service", page 2



W2058606

Turbine Wheel Material Failure (missing blade)

## Precautions for Installation of Replacement Turbochargers

Careful and thorough work must be performed to insure all replacement or reinstalled turbochargers last their full service life. The following steps must always be performed.

- 1 Protective caps to prevent contamination should always be used to cover exhaust, air, coolant and lube inlets and outlets. Do not remove covers from an opening until that opening is ready to be connected.
- 2 Turbocharger must be pre-lubricated with clean engine oil at the time of installation. An oil film on the bearing

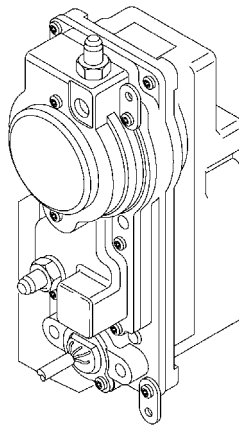
surfaces will prevent dry start damage. Pour clean engine oil in the oil feed hole in the bearing housing. Spin the shaft several revolutions and repeat once again.

- 3 Compressor housings and turbine housings must not be disassembled on a turbocharger.
- 4 Intake and exhaust system cleanliness is very important. Any size debris can cause damage or failure to a turbocharger.

Date	Group	No.	Page
10.2008	<b>255</b>	<b>54</b>	1(11)

Actuator, Variable Geometry  
Turbocharger, Replacement  
D13F

## Actuator, Variable Geometry Turbocharger, Replacement



W2006206

This information covers the proper replacement procedure for the variable geometry turbocharger actuator on the Volvo D13F engine.

### Contents

- "Special Tools" page 2
- "Actuator, Variable Geometry Turbocharger, Replacement" page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

## Special Tools

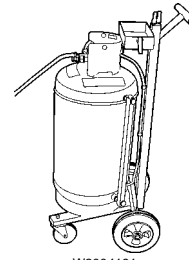
For special tools ordering information, refer to Tool Information, group 08.



W0001795

**9996049**

Coolant Drain Hose



W2004191

**85112740**

Coolant Extractor

## 2559-03-02-14 Actuator, Variable Geometry Turbocharger, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9996049, 85112740*

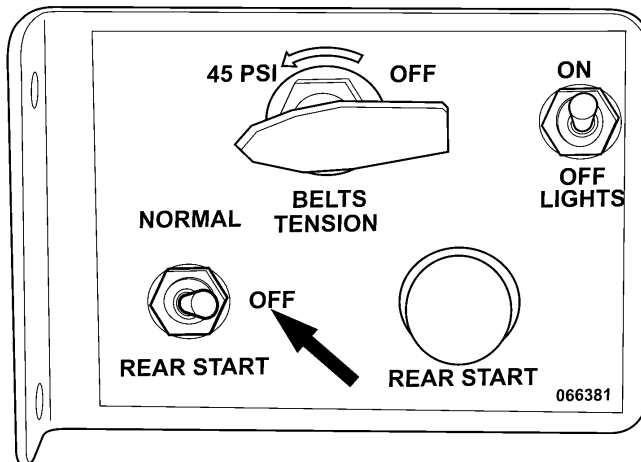
### Removal

**1**

Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.

**2**

Open the engine compartment door. Set the starter selector switch to the OFF position.

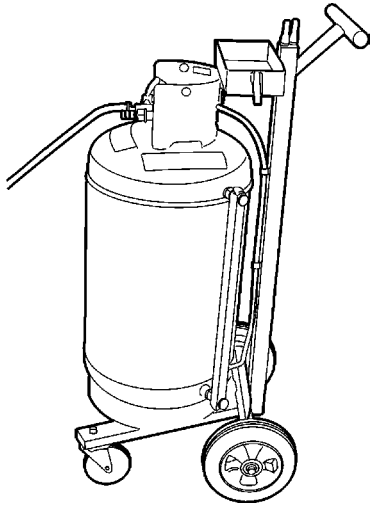


W2006494

**3**

Using pressure wash equipment, clean the turbocharger actuator while it is still mounted.

**Note:** Make sure all electrical connections and coolant pipes in the area of the turbocharger actuator are securely fastened.



W2004191

**4**

Use the coolant extractor to drain the coolant from the engine. An alternate method is to drain the coolant into a suitable container using the drain hose.

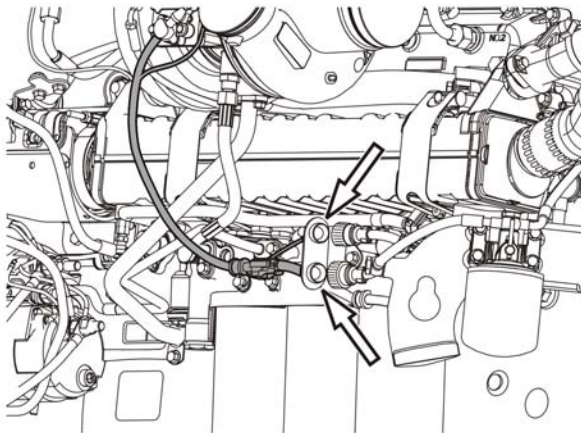
**! DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740, 9996049

**5**

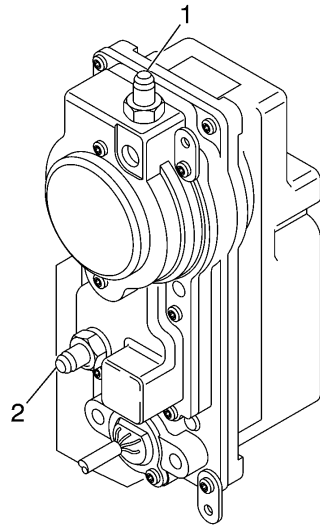
Disconnect the actuator assembly electrical connector at the wiring harness. Cut any tie straps as needed.



W2005620



**6**  
Disconnect the coolant lines from the actuator.



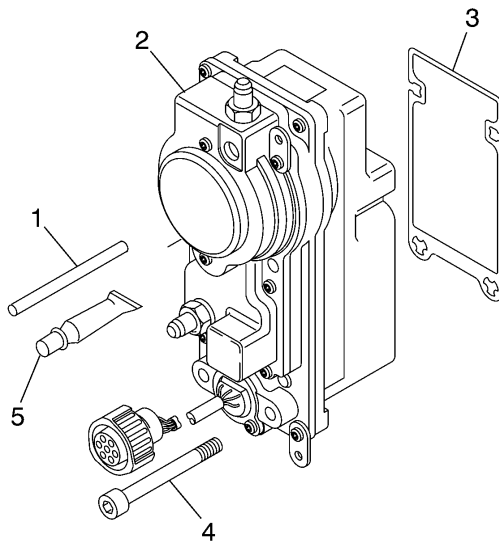
- 1 Coolant Return Port
- 2 Coolant Inlet Port

W2005699

**CAUTION**

Protect the insides of the actuator assembly and the exposed parts from contamination when removed. Failure to do so can result in component malfunction or failure.

**7**  
Remove the actuator from the turbocharger. Remove and discard the gasket.



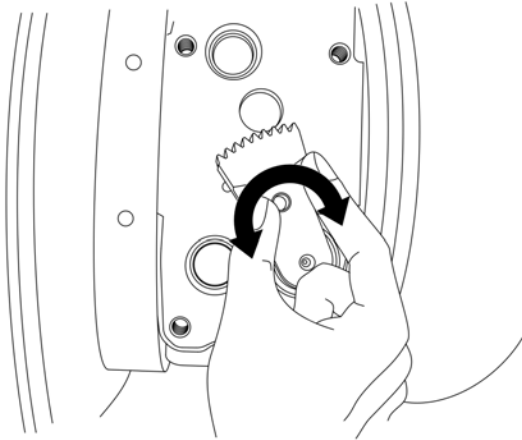
- 1 Alignment Pin
- 2 Actuator Housing
- 3 Gasket
- 4 Screw (4 Required)
- 5 Grease Applicator Tube

W2005698

## Installation

**1**

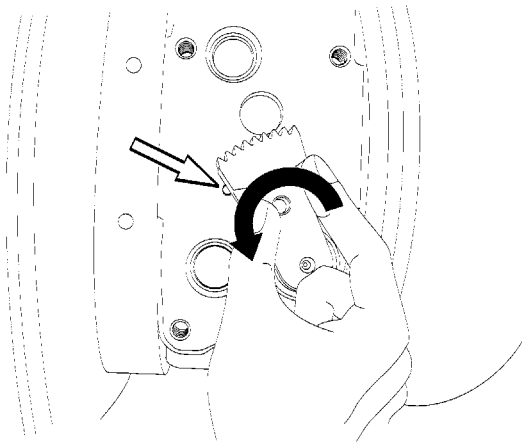
Using gloves, manually rotate the turbocharger sector gear back and forth (counterclockwise and clockwise). It should be noted that when the sector gear is at the end of travel, or at an end stop, it can require significant force to overcome friction then, start it's motion in the opposite direction. This is normal and not cause for concern. Apply more force to move the sector gear. Once in motion, the sector gear movement should be smooth, without binding or sticking until it reaches it's end of travel (end stop).



W2005277

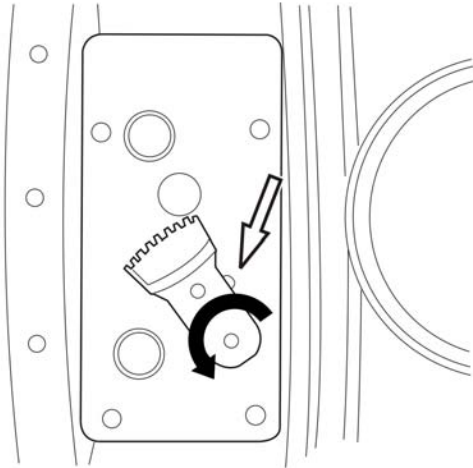
**2**

Rotate the sector gear fully counterclockwise until contact is made with the end stop of the variable geometry internal mechanism. 1/4 to 3/4 of the 3mm (0.118 inch) reference hole should be visible at the edge of the sector gear nearest the turbine housing.



W2006758

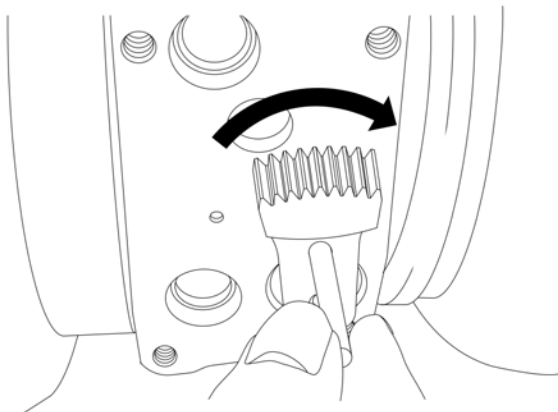
Alignment Hole Inspection, 3mm (0.118 inch) Hole



W2005276

Alignment Hole Inspection, 5mm (0.197 inch) Hole

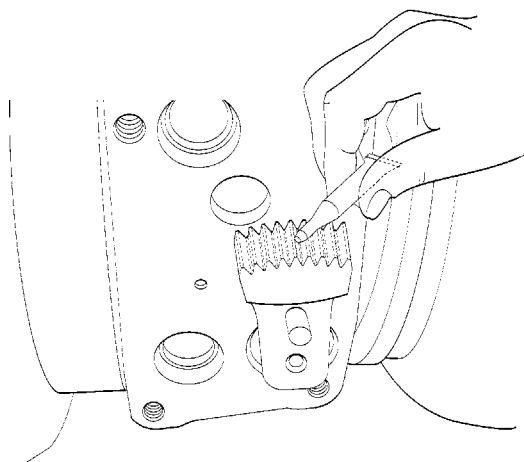
**3**  
For turbochargers manufactured without the small 3mm (0.118 inch) alignment hole, a portion (half) of the 5mm (0.197 inch) alignment hole should be exposed at the compressor housing side of the sector gear when the sector gear is fully rotated toward the turbine housing.



W2005275

**4**  
Rotate the sector gear fully clockwise. Make sure that the alignment pin fits through the sector gear into the alignment hole in the housing. The diameter of the alignment hole is 5mm (0.197 inch).

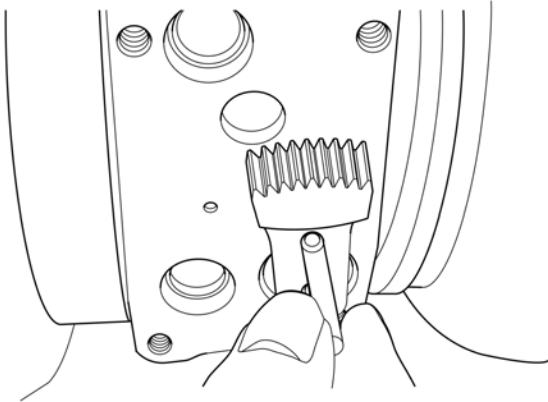
**Note:** If the sector gear does not align properly with the alignment hole or does not rotate properly in either direction, replace the turbocharger.



W2006760

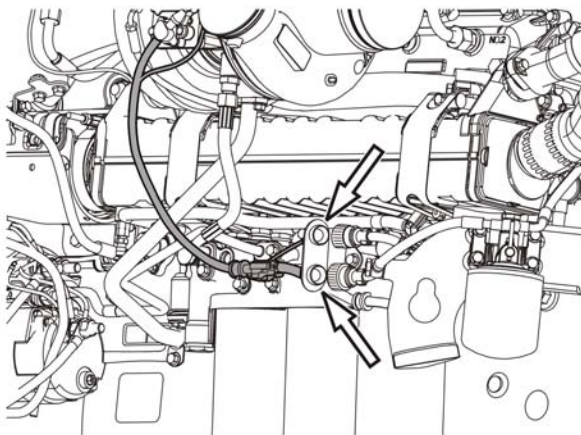
**5**  
Lubricate the sector gear teeth using the grease applicator tube that comes in the installation kit.

- 6**  
Remove the alignment pin without disturbing the position of the sector gear. The gear must not be moved from this position.



W2005209

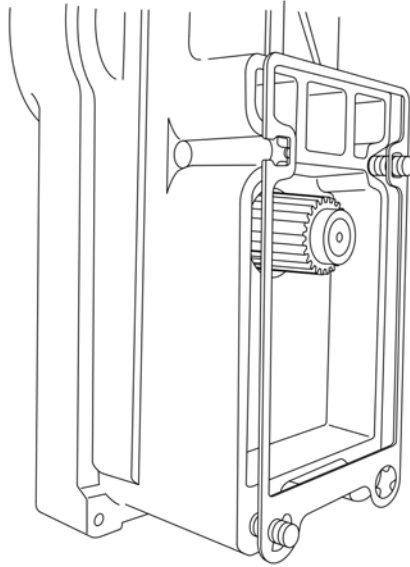
- 7**  
Connect the actuator electrical wiring harness connector to the engine wiring harness connector. Install tie straps as needed to secure the harness.



W2005620

- 8**  
Connect the VCADS Pro PC to the vehicle diagnostic data connector and turn the ignition switch ON. Using the directions in VCADS Pro, command the actuator to the install position. Turn OFF the ignition switch when done.

**Note:** Do not disturb the actuator drive gear after the gear is in the install position. Proper calibration of the actuator drive gear to the turbocharger sector gear must be maintained for proper operation.

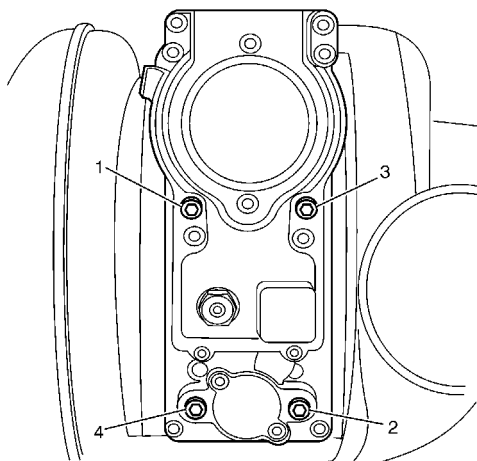


W2005211

**9**

Install two new mounting screws diagonally across the actuator. Place a new gasket over the protruding screws at the back of the actuator.

**Note:** Always use the new screws and gasket provided in the actuator installation kit.



W2005242

**10**

Carefully align the actuator with the turbocharger and install it into position. Hold the actuator in place and hand tighten the two screws. Install the two remaining new screws and hand tighten. Use the following steps to tighten the screws.

- 1 Tighten the screws in the pattern shown to 3 Nm (27 in-lb).
- 2 Tighten the screws in the pattern shown to 11 Nm (97 in-lb).

**11**

Connect the VCADS Pro PC to the diagnostic data connector and turn ON the ignition switch. Using the on screen directions in VCADS Pro, perform the VGT calibration procedure. If the actuator is installed correctly, the procedure indicates a successful VGT calibration. If the calibration fails, either the pre-positioning of the actuator drive gear is incorrect, the sector gear positioning is incorrect, the actuator is faulty or the turbocharger sector gear and nozzle ring mechanism is damaged. Turn OFF the ignition switch when done.

**12**

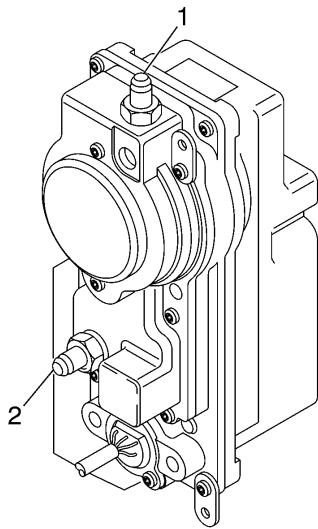
If the actuator is suspected of being faulty and requires replacement, follow the preceding installation steps with the new actuator.

**Note:** There are two actuator installation kits available:

- A kit that includes the gasket, screws, alignment pin and gear lubrication grease for an existing actuator installation.
- A kit that includes the actuator, gasket, screws, alignment pin and gear lubrication grease for a new actuator installation.

**13**

Connect the coolant lines to the actuator and tighten the fittings.



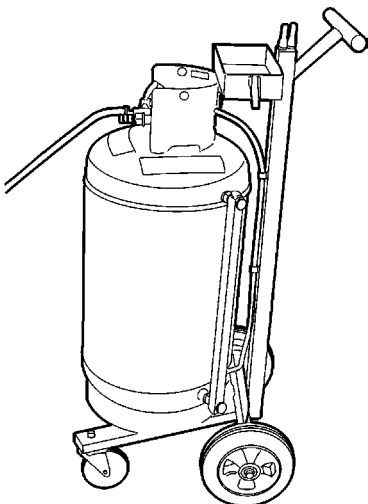
- 1 Coolant Return Port
- 2 Coolant Inlet Port

W2005699

**14**

Use the coolant extractor to fill the cooling system with the approved coolant.

85112740



W2004191

**15**

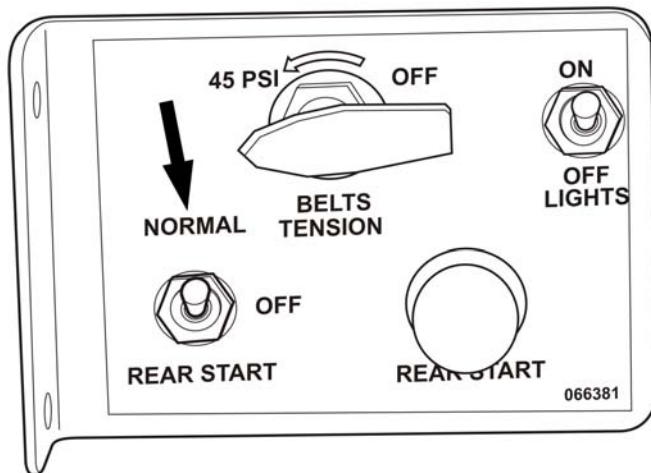
Turn the ignition key to the On position. Set the starter selector switch to the rear start position.

**16**

Press the starter push-button switch. Release push-button after the engine starts. Check for leaks and proper operation. After shutdown, replenish fluids as necessary.

**17**

Set the starter selector switch to the NORMAL position. Close the engine compartment door.



Date	Group	No.	Page
2.2008	<b>257</b>	<b>100</b>	1(3)

## Separator, Crankcase Ventilation, Replacement D13F

### Separator, Crankcase Ventilation, Replacement

This information covers the proper replacement procedure for the crankcase ventilation separator on the Volvo D13F engine.

#### Contents

- “Separator, Crankcase Ventilation, Replacement” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



# Service Procedures

## 2571-03-02-03

### Separator, Crankcase Ventilation, Replacement

1

 **WARNING**

Apply the parking brake and shift the transmission to neutral.

2

Open the engine compartment. Move the engine switch to the off position to disable the engine.

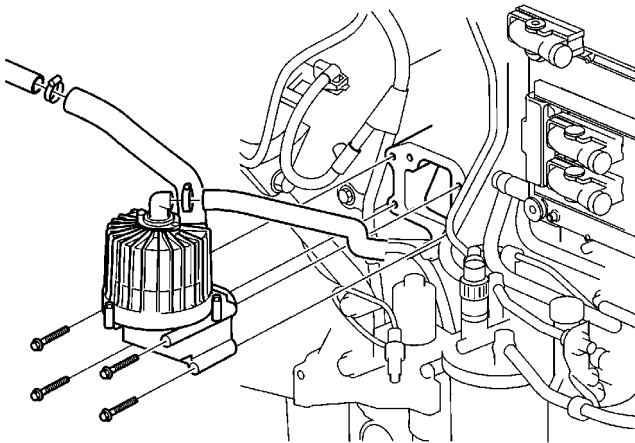
3

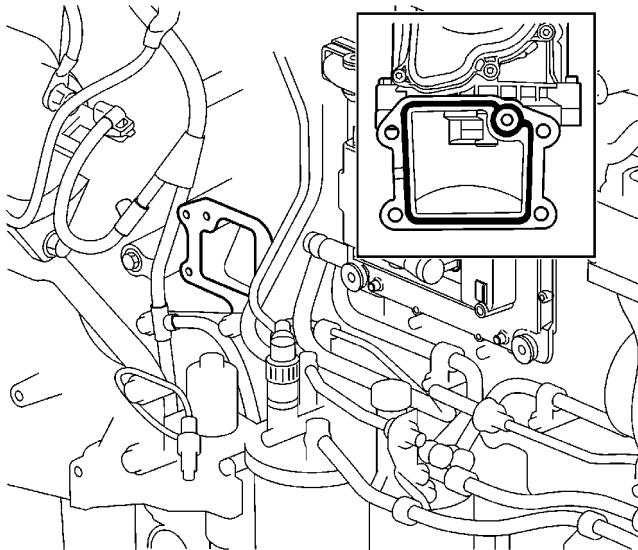
Clean the engine block thoroughly around the crankcase ventilation separator.

4

Detach the hoses from the crankcase ventilation separator. Remove the crankcase ventilation separator from the engine block.

**Note:** Tie straps may need to be removed for additional space during removal.





T2022154

**5**  
Clean the crankcase ventilation separator mating surface on the engine block. Install the crankcase ventilation separator with a new gasket. Tighten the bolts to specification.

**6**  
Attach the hoses to the crankcase ventilation separator.

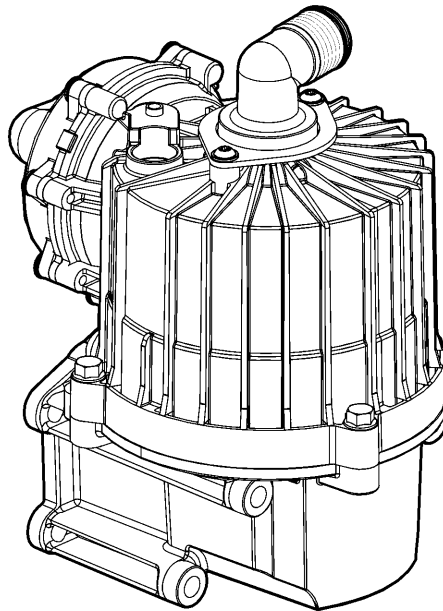
**7**  
Turn the ignition switch to the ON position. Move the engine switch to the rear start position. Start the engine, check for leaks and proper operation. After shutdown, replenish fluids as necessary.

**8**  
Close the engine compartment.

Date	Group	No.	Page
1.2009	<b>257</b>	<b>20</b>	1(3)

## Crankcase Ventilation Check D13F

### Crankcase Ventilation, Check



W2006836

This procedure provides information on troubleshooting (checking) of the Volvo D13F crankcase ventilation system.

### Contents

- “Crankcase Ventilation, Check” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2571-06-02-01 Crankcase Ventilation, Check

### Inlet Pipe Check

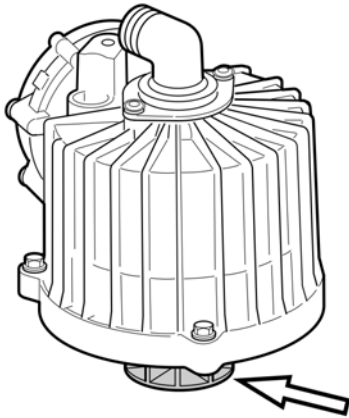
1

Check the inlet pipe for oil film, oil residue and particles. Remove any deposits from the pipe. Any deposits in the inlet pipe can cause clogging and thereby damage the separator.

### Separator Hand Check

1

Remove the crankcase ventilation separator and attempt to rotate the turbine by hand. It should rotate easily. If the turbine is faulty, replace the separator.



T2022597

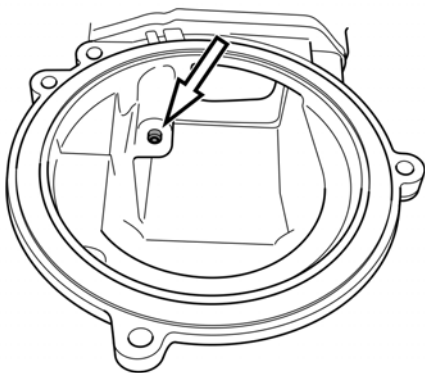
2

If a problem is not found, refer to the next section.

### Separator Oil Nozzle Check

1

Remove the crankcase ventilation separator and check the oil nozzle that operates the separator. If the oil nozzle becomes clogged, the oil pressure is reduced and the turbine does not rotate as it should.



T2022599

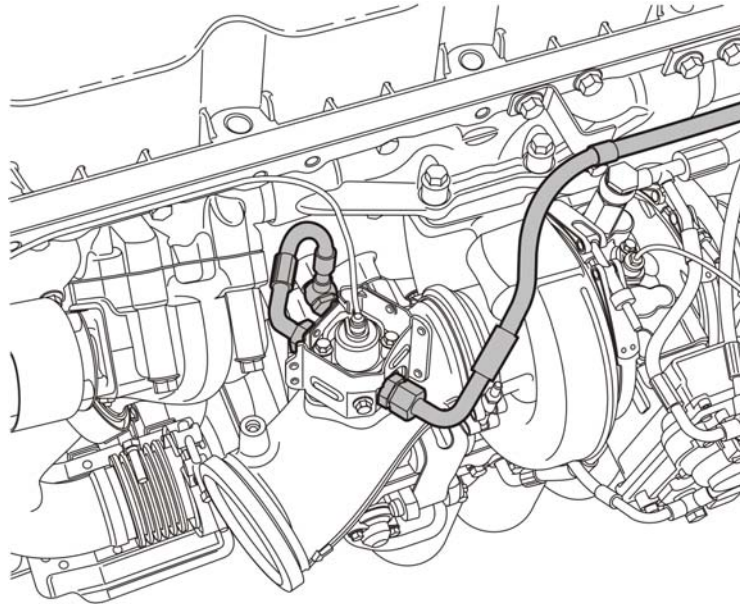
**2**

Check for deposits and dirt. Clean if necessary. If cleaning doesn't help, replace the crankcase ventilation separator.

Date	Group	No.	Page
4.2008	<b>258</b>	<b>01</b>	1(7)

## Injector, Aftertreatment, Replacement D13F

### Injector, Aftertreatment, Replacement



W2005917

This information covers replacement of the aftertreatment fuel injector used for the exhaust aftertreatment system on a Volvo D13F engine in a Prevost vehicle.

### Contents

- "Special Tools" page 2
- "Injector, Aftertreatment, Replacement" page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

# Tools

## Special Tools

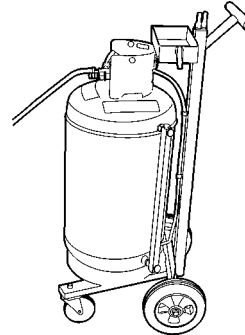
For special tools ordering instructions, refer to Tools Information, group 08.



W0001795

**9996049**

Coolant Drain Hose



W2004191

**85112740**

Coolant Extractor

# Service Procedures

## 2589-03-02-13

### Injector, Aftertreatment, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9996049, 85112740*

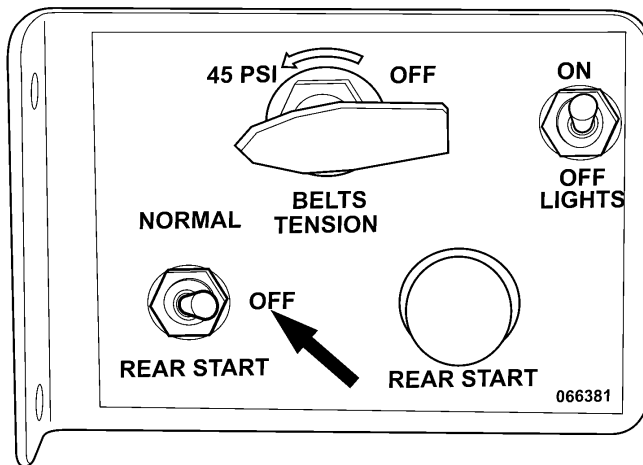
## Removal

**1**

Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.

**2**

Open the engine compartment door. Set the starter selector switch to the OFF position.



W2006494

**3**

Connect the coolant extraction tool 85112740. Drain the coolant.

**Note:** An alternative method is to use drain hose 9996049 to drain the coolant into an approved container.

85112740, 9996049

**4**

Remove exhaust pipes, clamps and brackets as needed to access the aftertreatment fuel injector.



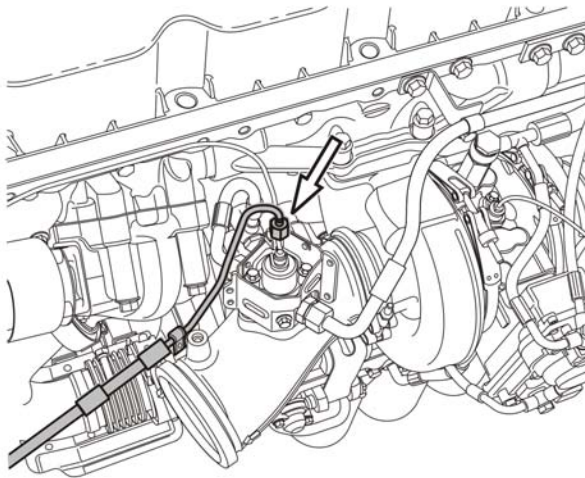
**5**  
Remove coolant pipe, hose, clamps and bracket between the thermostat housing and the upper radiator coolant pipe.

**6**  
Lift the vehicle. Position jackstands of a suitable capacity under the axle to support the vehicle. Remove the left rear wheel.

**7**  
Remove the access panel located behind the left rear wheel so the injector harness can be accessed on the back side of the engine.

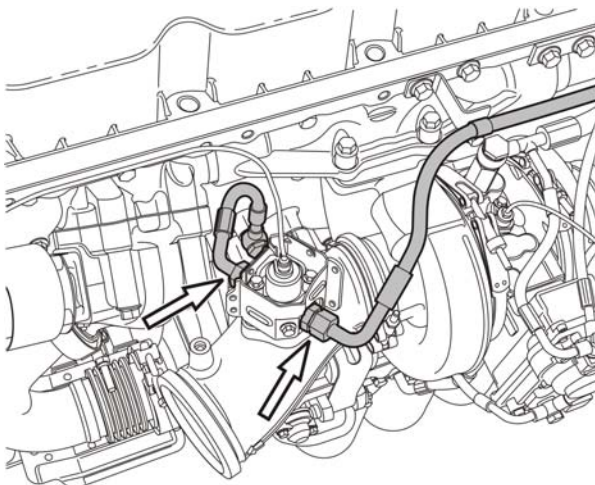
**8**  
Disconnect the aftertreatment fuel injector from the engine wiring harness. Remove all clamps and tie straps to release the injector.

**9**  
Remove the injector fuel supply line. Collect any residual fuel that might be in the fuel line in a suitable container.

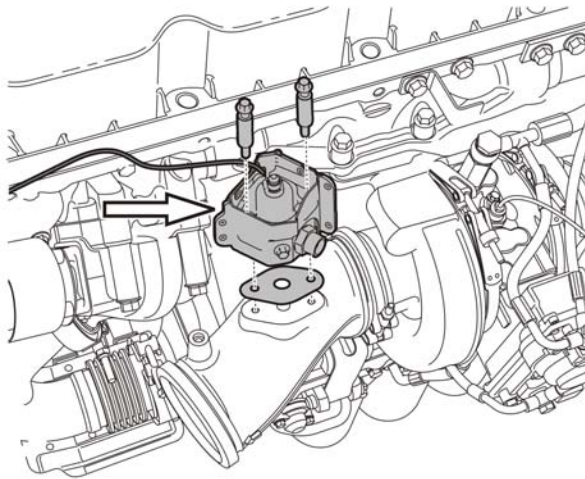


W2005926

**10**  
Remove the inlet and outlet coolant lines from the injector fittings.



W2005925



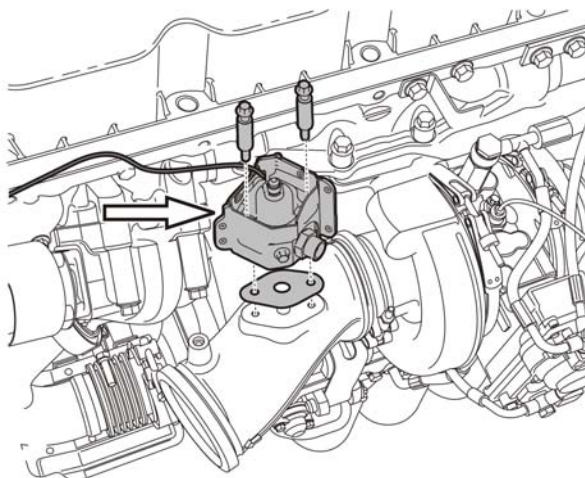
W2005928

- 11**  
Remove and discard the injector mounting bolts and spacers. Remove the injector from the turbocharger diffuser pipe.

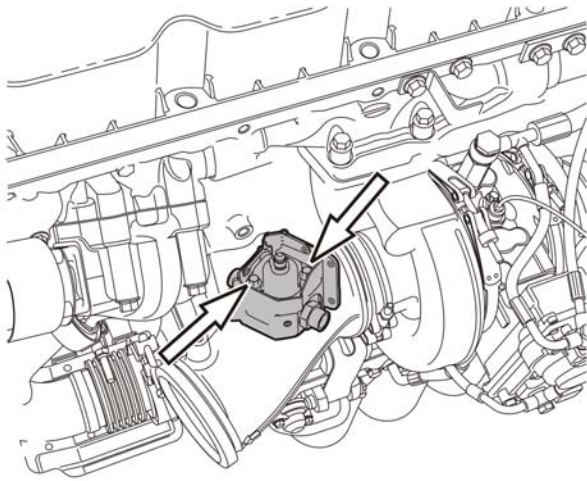
- 12**  
Remove and discard the high-temperature gasket and steel plate gasket from the bottom of the injector.

## Installation

- 1**  
Transfer the coolant fittings from the original aftertreatment fuel injector to the replacement injector.
- 2**  
Clean the injector mounting surface on the diffuser pipe.
- 3**  
Install a new high-temperature gasket and steel plate gasket to the bottom of the aftertreatment fuel injector.
- 4**  
Apply high-temperature nickel-graphite anti-seize compound to the new injector mounting bolt threads and insert the bolts into the spacers. Position the injector on the turbocharger diffuser pipe and hand start the bolts with spacers.



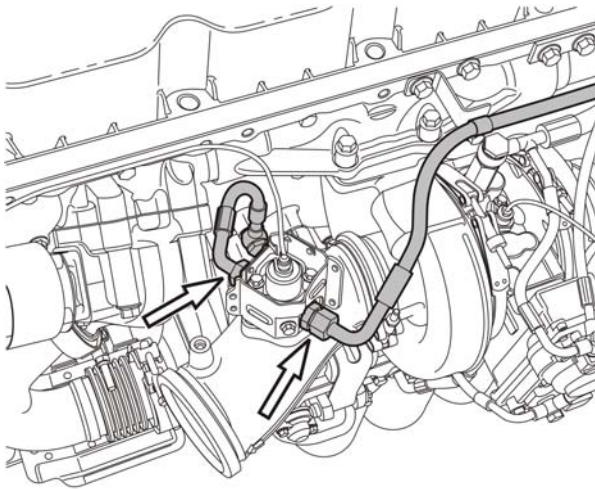
W2005928



W2005929

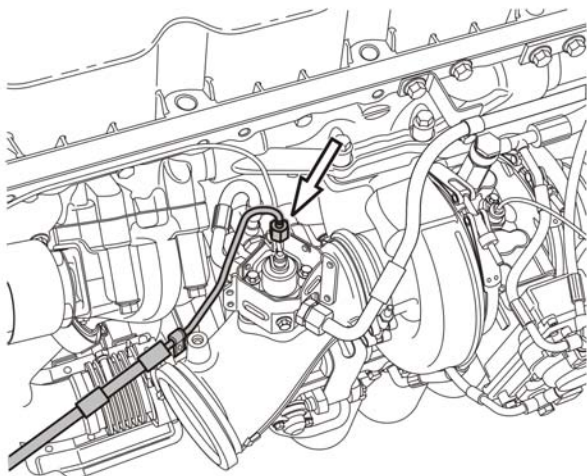
- 5**  
Secure the injector mounting bolts. Tighten the bolts to specification.

**Note:** For correct torque specifications, refer to the Specifications bulletin in Group 20.



W2005925

- 6**  
Install the coolant lines to the aftertreatment fuel injector fittings and tighten to secure.



W2005926

- 7**  
Install the aftertreatment injector fuel supply line. Tighten the fuel line to specification.

**8**

Connect the aftertreatment fuel injector to the engine wiring harness. Secure with clamps and tie straps.

**9**

Install the access panel behind the left rear wheel.

**10**

Install the left rear wheel. Lift the vehicle, remove the jackstands and lower the vehicle.

**11**

Install the coolant pipe, hose, clamps and bracket.

**12**

Install the exhaust pipes, clamps and brackets.

**13**

Fill the engine cooling system with the recommended coolant using the coolant extractor.

---

85112740

**14**

Turn the ignition key to the ON position. Set the starter selector switch to the rear start position.

**15**

Press the starter push-button switch. Release push-button after the engine starts. Check for leaks and proper operation.

**16**

With VCADS/PTT, reset AFI adaptive factor, clear inactive codes and perform a complete service regeneration.

**17**

After shutdown, replenish fluids as necessary.

**18**

Set the starter selector switch to the NORMAL position. Close the engine compartment door.

Date	Group	No.	Page
5.2008	<b>258</b>	<b>04</b>	1(5)

## Shut-off Valve, Aftertreatment, Replacement D13F

### Shut-off Valve, Aftertreatment, Replacement

This information covers replacement of the shut-off valve used with the exhaust aftertreatment system on a Volvo D13F engine in a Prevost vehicle.

#### Contents

- “Shut-off Valve, Aftertreatment, Replacement” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

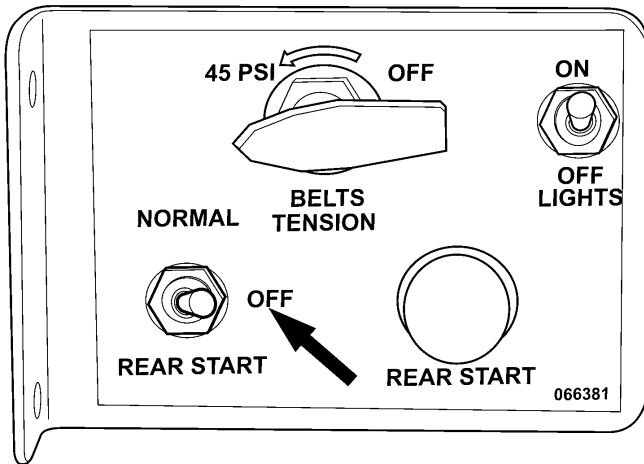
## 2589-03-02-15

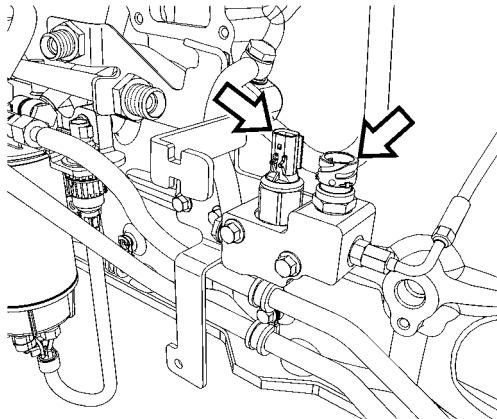
### Shut-off Valve, Aftertreatment, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

- 1 Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.
- 2 Open the engine compartment door. Set the starter selector switch to the OFF position.



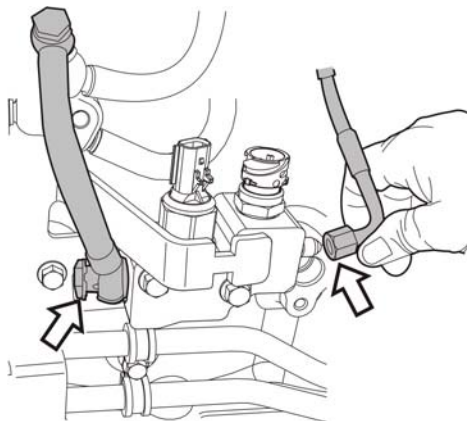


W2005770

**3**  
Disconnect both electrical connectors from the top of the aftertreatment shut-off valve, located on the left side of the engine to the rear of the fuel filters.

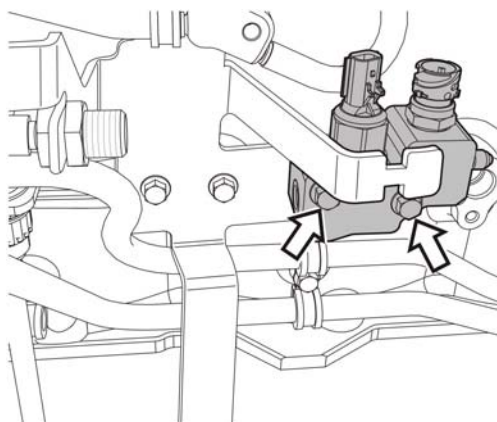
**4**  
Remove the clamp bracket screw from the fuel pump lines and reposition lines out of the way.

**5**  
Disconnect both inlet and outlet fuel hose connection from the aftertreatment shut-off valve. Collect any residual fuel that may flow from the fuel lines in a suitable container.



W2005769

**6**  
Remove the bolts securing the shut-off valve to the left side of the engine block and remove the valve.



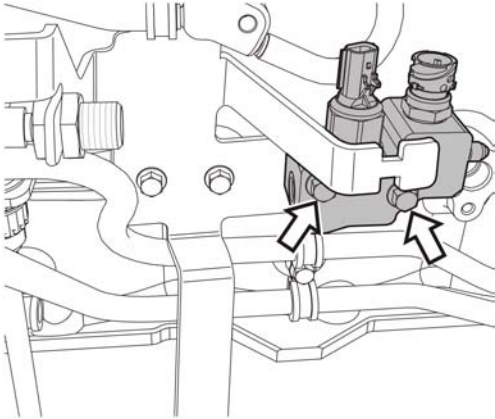
W2005768

## Installation

**1**

Position the shut-off valve assembly on the block pads and install the bolts. Tighten the bolts to specification.

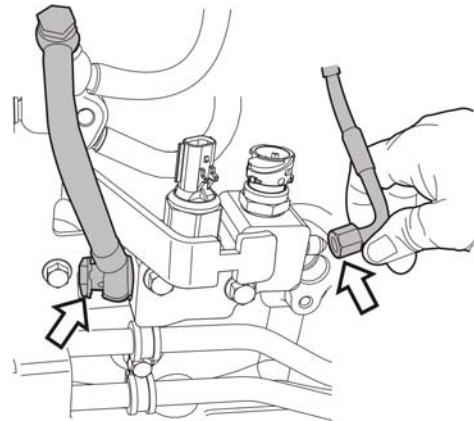
**Note:** For correct torque specifications, refer to the Specifications bulletin in Group 20.



W2005768

**2**

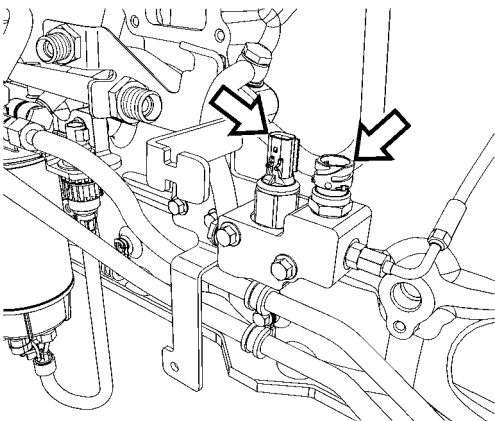
Connect the inlet fuel hose connection to the aftertreatment shut-off valve and install with two new sealing washers. Also, connect the outlet hose to the fitting on the valve. Tighten all fittings securely.



W2005769

**3**

Connect the fuel pressure sensor and electrical connectors to the top of the aftertreatment shut-off valve.



W2005770

**4**

Place the previously moved fuel lines in position against the cylinder block and install the clamp bracket and screw.

**5**

Turn the ignition key to the ON position. Set the starter selector switch to the rear start position.



**6**

Press the starter push-button switch. Release push-button after the engine starts. Check for leaks and proper operation.

**7**

Set the starter selector switch to the NORMAL position. Close the engine compartment door.

Date	Group	No.	Release	Page
9.2010	<b>258</b>	<b>10</b>	<b>01</b>	1(5)

Wiring Harness, Diesel Particulate Filter (DPF), Replacement

PREVH, PREVX

## Wiring Harness, Diesel Particulate Filter (DPF), Replacement

This information covers the proper replacement procedure for the diesel particulate filter (DPF) wiring harness on the Prevost model buses.

### Contents

- "Wiring Harness, Particulate Filter, Replacement", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2589-03-02-16**

## Wiring Harness, Particulate Filter, Replacement

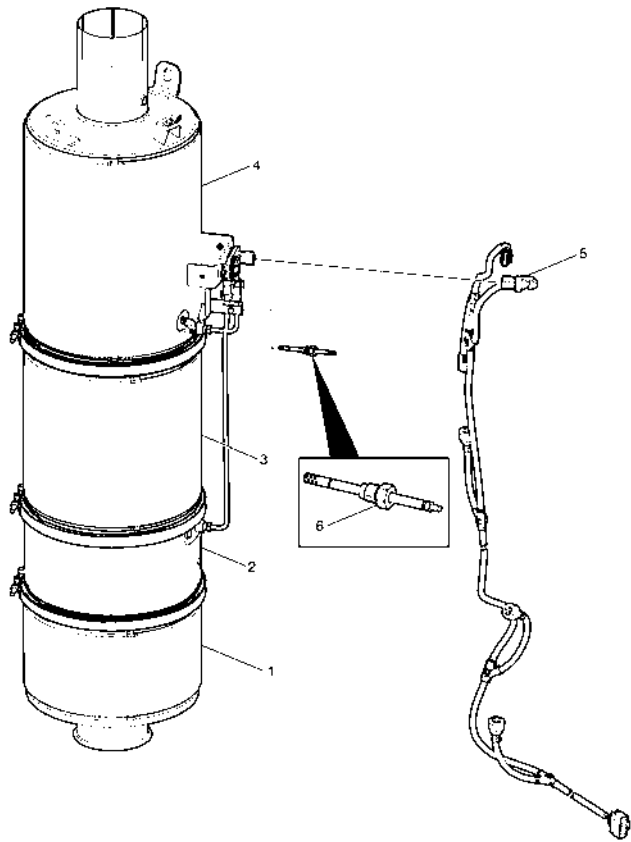
### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

You must read and understand the precautions and guidelines in Service Information, Groups 20 and 30, "General Safety Practices" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## Removal

- 1**  
Open the lower, then the upper rear hatches to get access to the diesel particulate filter (DPF).
- 2**  
Set the engine disable switch to "OFF".



W2006342

- 1 Inlet Section
- 2 Catalyst Section
- 3 Particulate Filter
- 4 Outlet Section
- 5 Wiring Harness
- 6 Temperature Sensor

**3**  
Disconnect the DPF harness from the sensors. The temperature sensor is shown as an example.

**Note:** Do not remove the sensors from the DPF.

**4**  
Remove the cable ties that attach the DPF harness.

**5**  
Disconnect the main DPF harness connector and remove the DPF harness from the chassis.

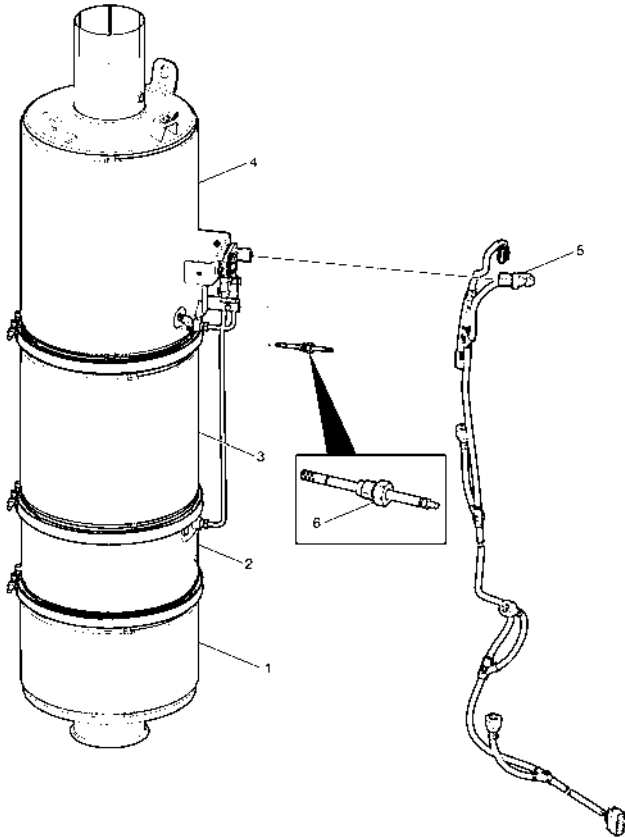
## Installation

**1**

Put the replacement diesel particulate filter (DPF) harness in the chassis. Connect the main DPF harness connector.

**2**

Connect the DPF harness to the sensors. The temperature sensor is shown as an example.



W2006342

- 1 Inlet Section
- 2 Catalyst Section
- 3 Particulate Filter
- 4 Outlet Section
- 5 Wiring Harness
- 6 Temperature Sensor

**3**

Attach the DPF harness with cable ties.

**4**

Set the engine disable switch to "ON".

**5**

Close the upper rear hatches, then the lower rear hatches.

Date	Group	No.	Release	Page
5.2011	<b>258</b>	<b>100</b>	<b>01</b>	1(5)

Air Supply Line, Replacement  
9700, PrevH, PrevX

## Air Supply Line, Replacement

This information provides the service procedure for replacing the air supply line on PrevH, PrevX and 9700 vehicles equipped with an aftertreatment hydrocarbon dosing module.

### Contents

- "Air Supply Line, Replacement", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2585-03-02-06**

## Air Supply Line, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: J-44773*

### Removal

**1**

Apply the parking brake and place the shift lever in neutral.

**2**

Open engine service doors.

**Note:** On some models it maybe necessary to remove the splash shield underneath the engine to allow access to the fuel supply line, from underneath the vehicle.

**Note:** If the splash shield requires removal to access the fuel supply line, raise and support the vehicle to provide safe access to the undercarriage of the vehicle.

**3**

#### **DANGER**

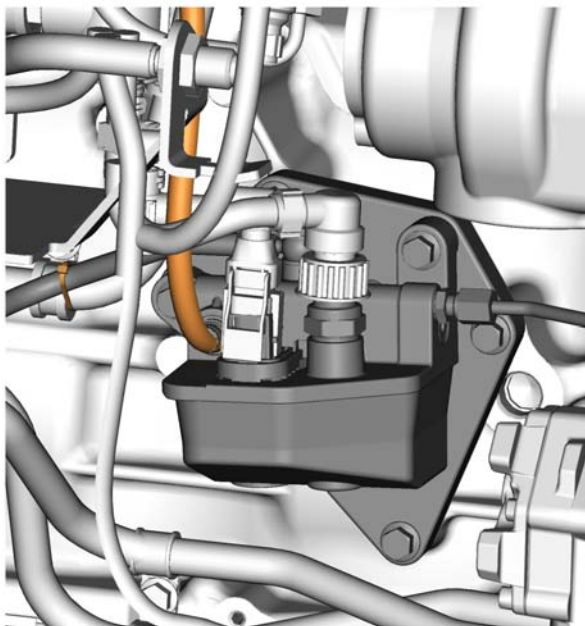
Before beginning any work on any part of the air system, be certain that the air pressure has been released. Failure to do so may cause a component to violently separate, which can result in serious personal injury.

Drain the air system.

**4**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.





W2064628

**5**

Disconnect the air supply line from the aftertreatment hydrocarbon dosing module and the pressure regulator.

**Note:** The pressure regulator can be located anywhere on the vehicle chassis. This will require you to trace the line from the aftertreatment hydrocarbon dosing module to the pressure regulator.

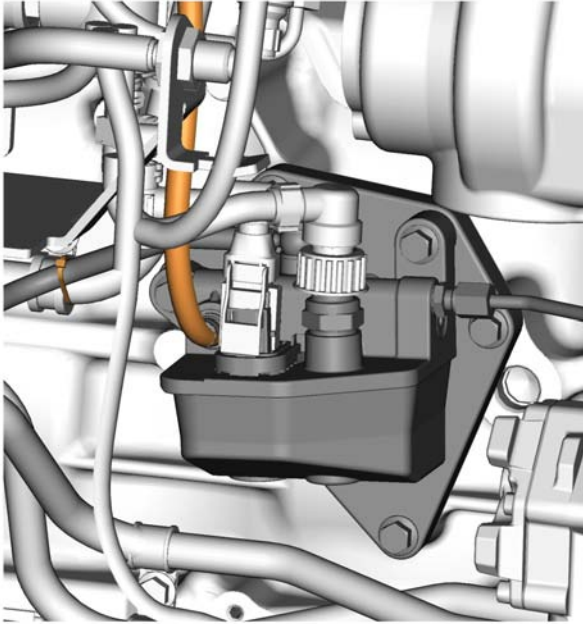
---

J-44773

**6**

Cut the tie straps securing the air supply line and remove it from the vehicle.

## Installation



W2064628

**1**

Position the air supply line on the vehicle. Connect it to the aftertreatment hydrocarbon dosing module and the pressure regulator.

**Note:** Follow the path of the previously removed line.

---

J-44773

**2**

Secure the air supply line with tie straps.

**3**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**4**

Start the engine, build air to operating pressure, check for leaks and proper operation.

**Note:** If fault tracing was performed using Guided Diagnostics, return to Guided Diagnostics for repair verification.

**5**

Close engine service doors.

**Note:** If the engine splash shield was previously removed to allow access to the fuel supply line, install the splash shield. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**Note:** If the splash shield was installed, raise the vehicle and remove supports and lower the vehicle to the floor.

Date	Group	No.	Release	Page
5.2011	<b>258</b>	<b>101</b>	<b>01</b>	1(7)

## Aftertreatment Hydrocarbon Dosing Module, Replacement

9700, PrevH, PrevX

## Aftertreatment Hydrocarbon Dosing Module, Replacement

This information covers replacement of the aftertreatment hydrocarbon dosing module on PREVOST and VOLVO buses.

### Contents

- “Aftertreatment Hydrocarbon Dosing Module, Replacement”, page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only, and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2585-03-02-10**

## Aftertreatment Hydrocarbon Dosing Module, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: J-44773*

### Removal

**1**

Apply the parking brake and place the shift lever in neutral.

**2**

Open engine service doors.

**Note:** On some models it may be necessary to remove the splash shield underneath the engine to allow access to the aftertreatment hydrocarbon dosing module, from underneath the vehicle.

**Note:** If the splash shield requires removal to access to the aftertreatment hydrocarbon dosing module, raise and support the vehicle to provide safe access to the undercarriage of the vehicle.

**3**

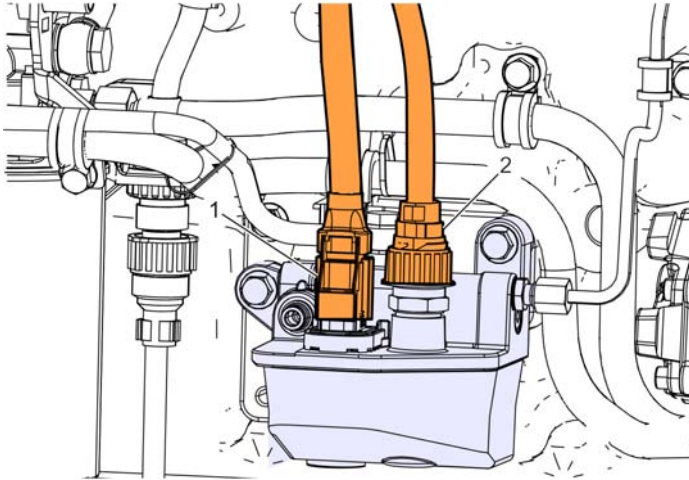
#### **DANGER**

Before beginning any work on any part of the air system, be certain that the air pressure has been released. Failure to do so may cause a component to violently separate, which can result in serious personal injury.

Drain the air system.

**4**

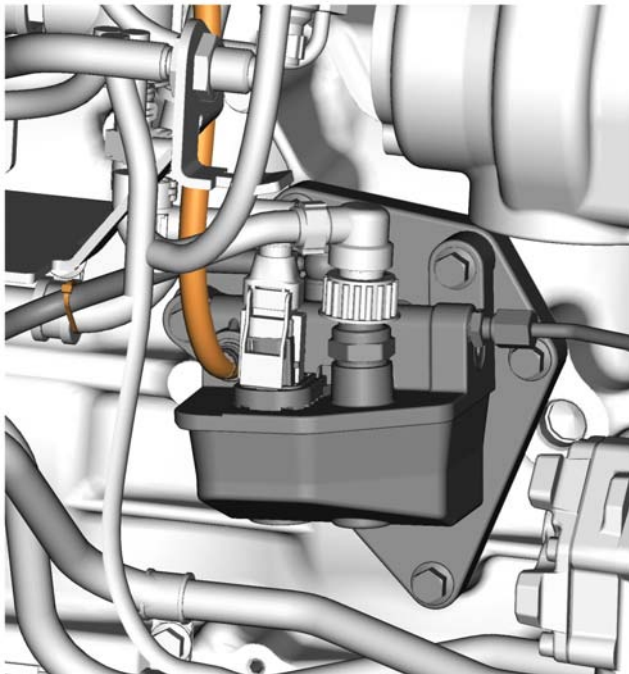
Disconnect all cables from negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.



W2065575

- 1 Aftertreatment Hydrocarbon Dosing Module Connector
- 2 Fuel Pressure Sensor Connector

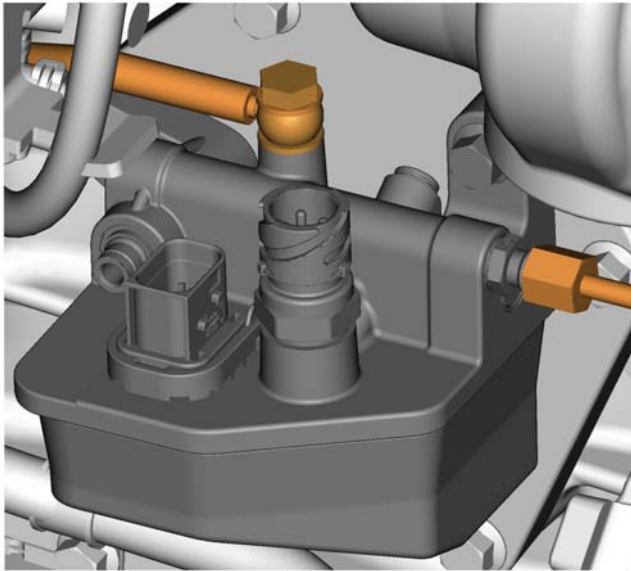
**5**  
Disconnect the wiring harness from the aftertreatment hydrocarbon dosing module and the fuel pressure sensor.



W2064628

**6**  
Disconnect the air supply line from the aftertreatment hydrocarbon dosing module.

J-44773



W2064634

7

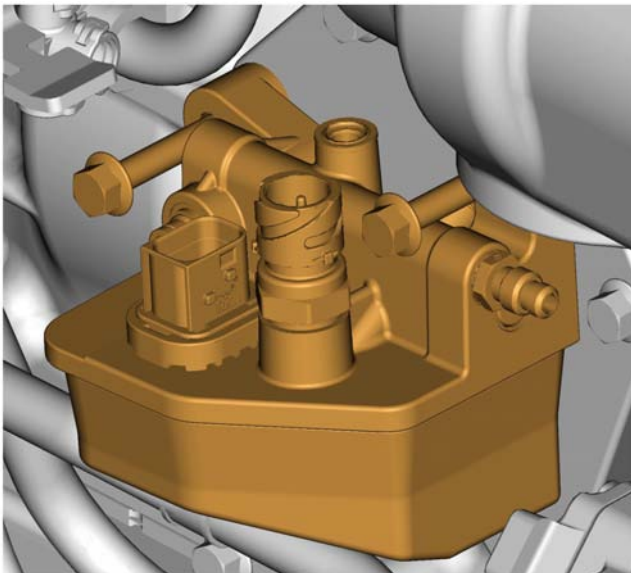
**! WARNING**

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire and result in component damage and serious personal injury.

Disconnect the inlet and outlet fuel lines from the aftertreatment hydrocarbon dosing module. Collect any residual fuel that might be in the fuel lines in a suitable container.

**! CAUTION**

Do not kink the lines. Kinking the lines may result in leakage.

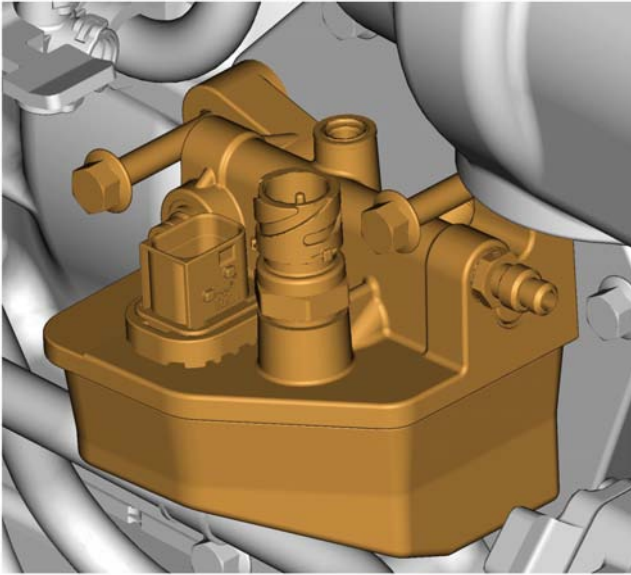


W2064635

8

Remove the mounting fasteners and aftertreatment hydrocarbon dosing module from the mounting bracket.

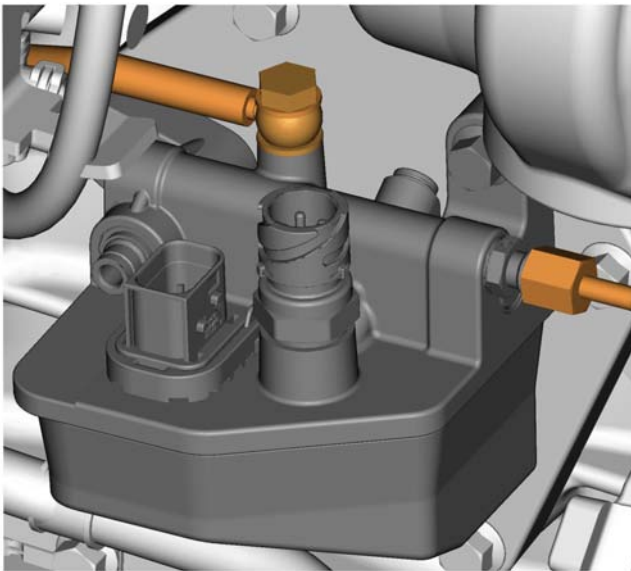
## Installation



W2064635

**1**

Install the aftertreatment hydrocarbon dosing module onto the mounting bracket. Tighten the fasteners to specification, refer to Function Group 20; "Specifications".



W2064634

**2**

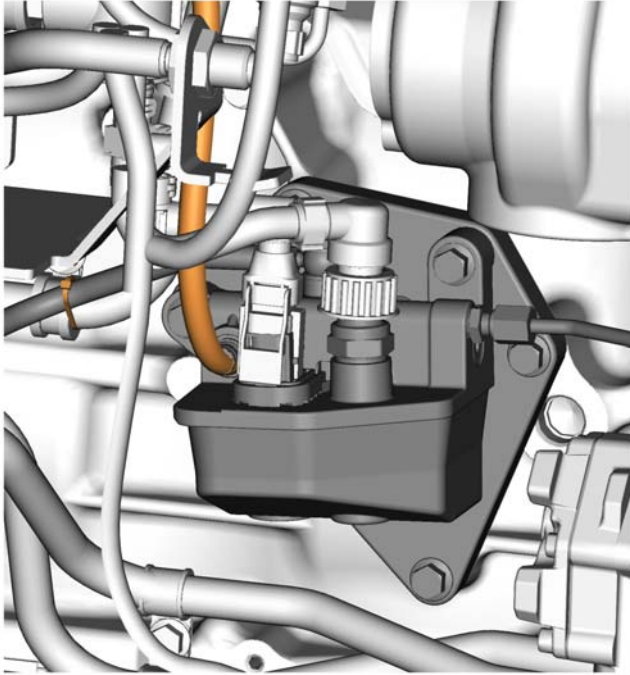


### **WARNING**

Fuel lines must be tightened to the stated specification. Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire and result in component damage and serious personal injury.

Connect the inlet and outlet fuel lines to the aftertreatment hydrocarbon dosing module. Tighten the fuel line fittings to specification, refer to Function Group 20; "Specifications".





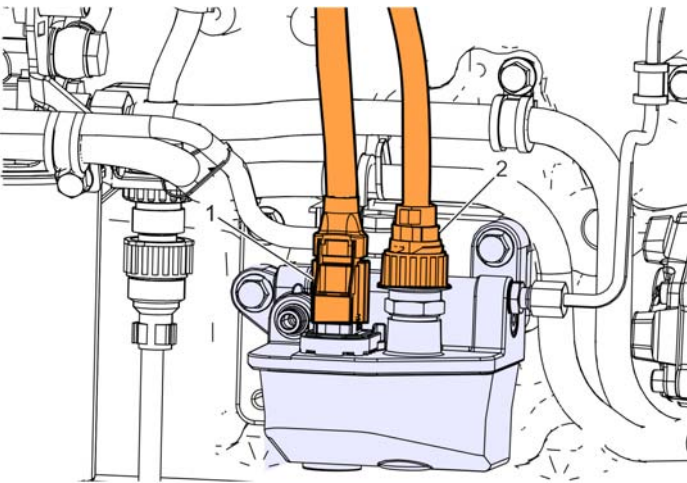
W2064628

**3**

Connect the air supply line to the aftertreatment hydrocarbon dosing module.

---

J-44773



W2065575

**4**

Connect the wiring harnesses to the aftertreatment hydrocarbon dosing module and the fuel pressure sensor.

1 Aftertreatment Hydrocarbon Dosing Module Connector

2 Fuel Pressure Sensor Connector

**5**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**6**



**WARNING**

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire and result in component damage and serious personal injury.

Start the engine, build air to operating pressure. Start the service regeneration process. When fuel dosing starts, check for leaks starting on the hot side of the engine. Clear any diagnostic trouble codes, if needed.

**Note:** If fault tracing was performed using Guided Diagnostics, return to Guided Diagnostics for repair verification.

**7**

Close engine service doors.

**Note:** If the engine splash shield was previously removed to allow access to the fuel supply line, install the splash shield. Tighten the fasteners to specification, refer to Function Group 20; "Specifications".

**Note:** If the splash shield was installed, raise the vehicle and remove supports and lower the vehicle to the floor.

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## Aftertreatment Hydrocarbon Doser, Replacement

9700, PrevH, PrevX

## Aftertreatment Hydrocarbon Doser, Replacement

This information covers replacement of the aftertreatment hydrocarbon doser on PREVOST and VOLVO buses.

### Contents

- "Aftertreatment Hydrocarbon Doser, Replacement", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only, and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2584-03-02-03**

## Aftertreatment Hydrocarbon Doser, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

**1**

Apply the parking brake and place the shift lever in neutral.

**2**

Open the rear engine service doors.

**3**

Disconnect all cables from negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

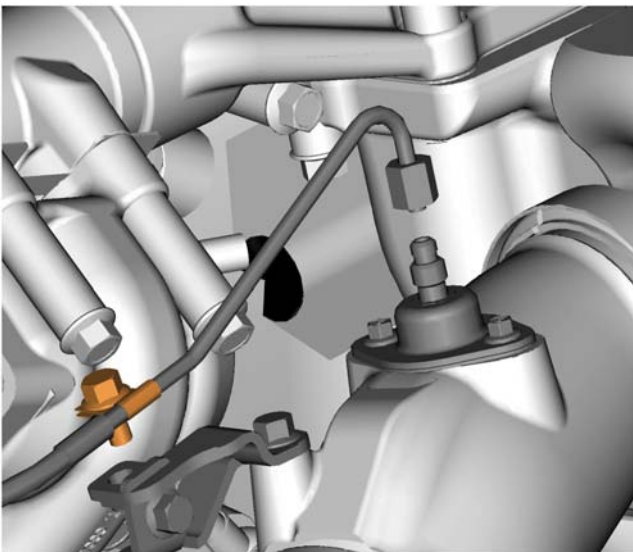
For 9700 and PrevX buses, remove the fasteners and the floor panel. Store floor panel and fasteners in a secure location.

**5**

For PrevH buses, remove the coolant package. Refer to Function Group 26 for service procedures.

**6**

Remove the fastener and P-clamp securing the line to the mounting bracket on the diffuser pipe.



7



**WARNING**

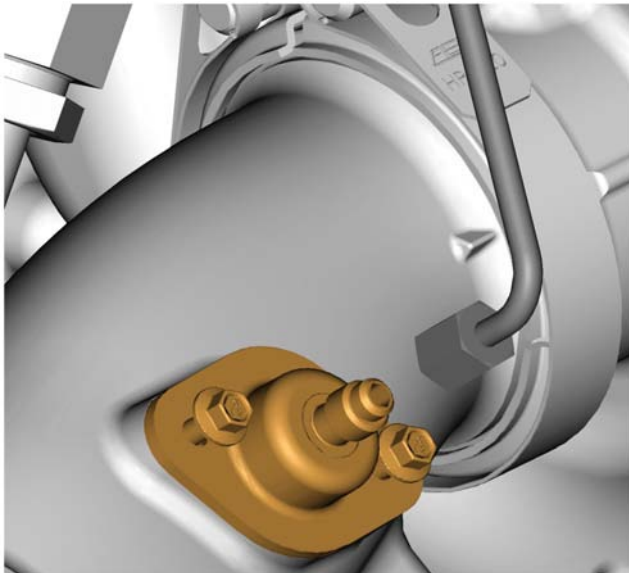
Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire and result in component damage and serious personal injury.

Disconnect the line from the aftertreatment hydrocarbon doser fitting. Collect any residual fuel that might be in the line in a suitable container.



**CAUTION**

Do not kink the line. Kinking the line may result in leakage.



W2064631

8

Loosen the aftertreatment hydrocarbon doser mounting fasteners. Remove the aftertreatment hydrocarbon doser from the diffuser pipe (which attaches to the turbocharger outlet).

## Installation

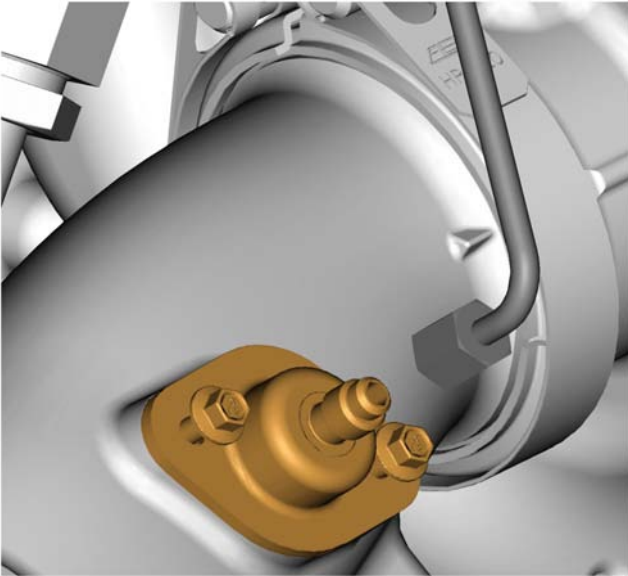
1

Clean the sealing surface on the diffuser pipe before mounting the aftertreatment hydrocarbon doser.

2

Install a new gasket and aftertreatment hydrocarbon doser onto the diffuser pipe. Tighten the fasteners to specification, refer to Function Group 20; "Specifications".

**Note:** The fasteners include pre-applied high-temperature anti-seize compound.



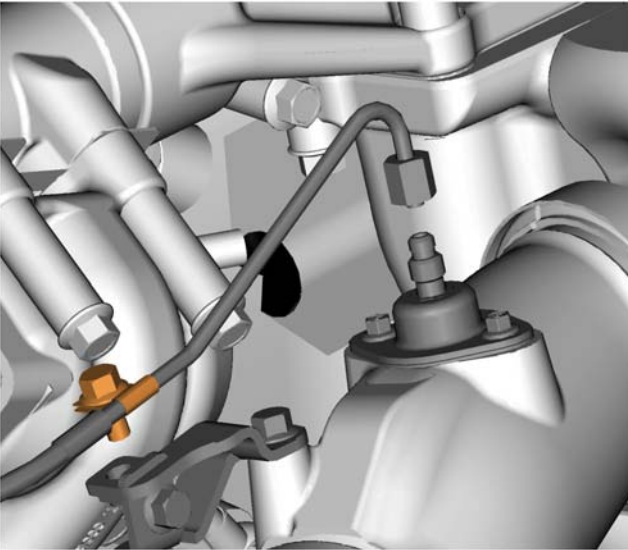
W2064631

3

### **WARNING**

Fuel lines must be tightened to the stated specification. Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire and result in component damage and serious personal injury.

Connect the line to the aftertreatment hydrocarbon doser. Tighten the line fitting to specification, refer to Function Group 20; "Specifications".



W2064630

4

Install the P-clamp and fastener to secure the line to the mounting bracket on the diffuser pipe.

5

Reconnect all previously removed cables to the negative (ground) battery terminals.

**6**

Start the engine, build air to operating pressure. Start the service regeneration process. When fuel dosing starts, check for leaks starting on the hot side of the engine. Clear any diagnostic trouble codes, if needed.

**Note:** If fault tracing was performed using Guided Diagnostics, return to Guided Diagnostics for repair verification.

**7**

For PrevH buses, install the coolant package. Refer to Function Group 26 for service procedures.

**8**

For 9700 and PrevX buses, install the floor panel and fasteners.

**9**

Close the rear engine service doors.

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## Hard Fuel Line, Aftertreatment Hydrocarbon Doser, Replacement

9700, PrevH, PrevX

## Hard Fuel Line, Aftertreatment Hydrocarbon Doser, Replacement

This information provides the service procedures for replacing the hard line connected to the aftertreatment hydrocarbon doser on VOLVO and PREVOST buses.

### Contents

- "Hard Fuel Line, Aftertreatment Hydrocarbon Doser, Replacement", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



# Service Procedures

**2585-03-02-12**

## Hard Fuel Line, Aftertreatment Hydrocarbon Doser, Replacement To Doser

You must read and understand the precautions and guidelines in Service Information, Groups 20, 70 and 80 "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

**1**

Apply the parking brake and place the shift lever in neutral.

**2**

Open the rear engine service door(s).

**3**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

Remove the coolant package. Refer to Function Group 26 for service procedures.

**5**

Remove the floor panel over the engine compartment.

**6**

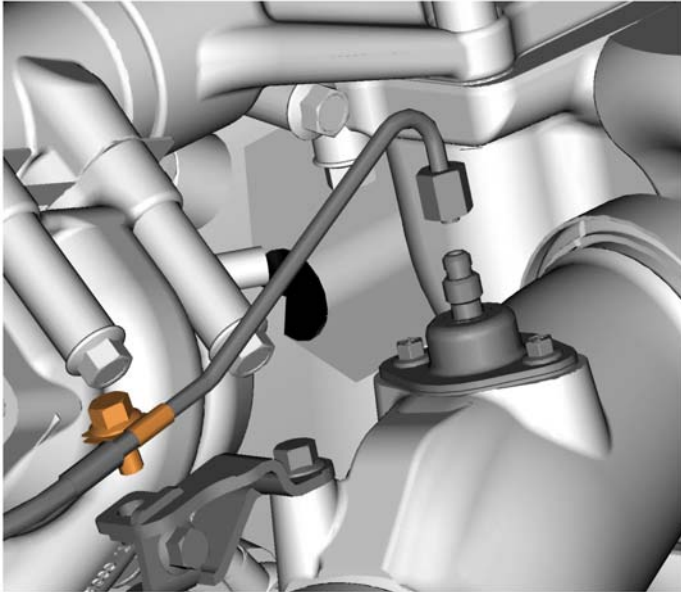


#### **WARNING**

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire and result in component damage and serious personal injury.

Disconnect the aftertreatment hydrocarbon doser hard line from the hard line connected to the aftertreatment hydrocarbon dosing module.

**Note:** Provide protection to keep debris from entering the hard line to the aftertreatment hydrocarbon dosing module.



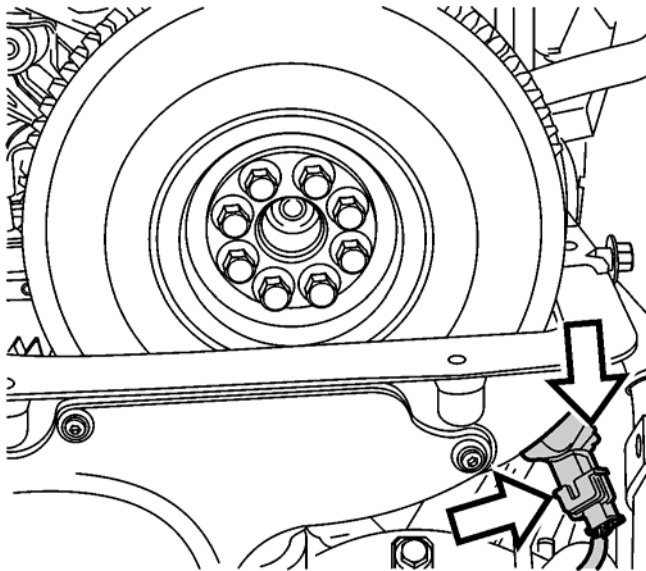
W2064630

**7**

Disconnect the hard line from the aftertreatment hydrocarbon doser. Collect any residual fuel that might be in the line into a suitable container.

 **CAUTION**

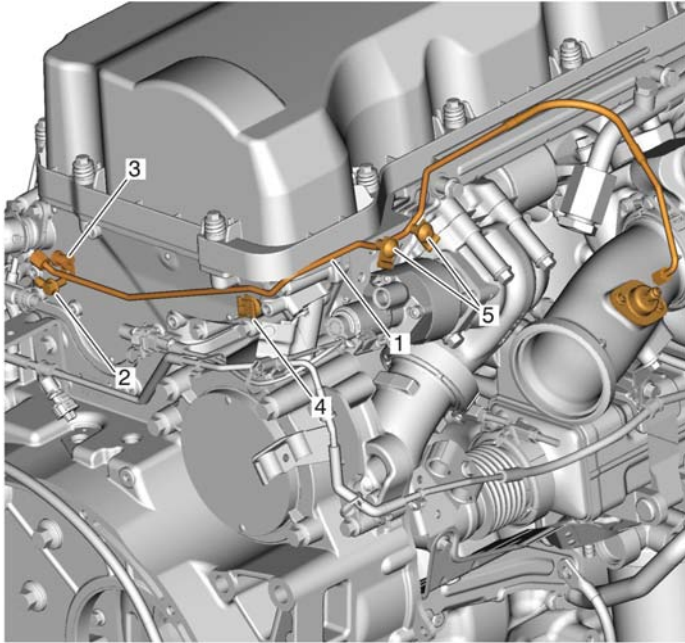
Do not kink the line. Kinking the line may result in leakage.



W2005104

**8**

Disconnect and remove the camshaft sensor.



W2064759

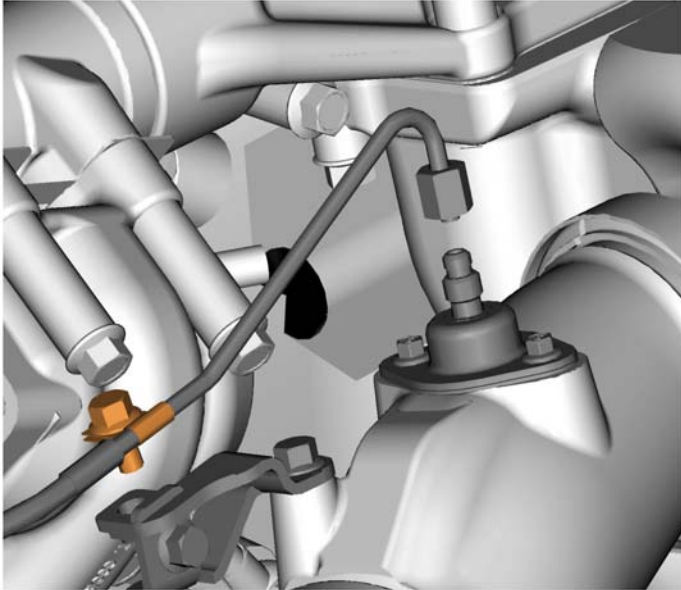
**9**

Remove the fasteners and P-clamps securing the line.  
Remove the line from the engine.

- 1 Aftertreatment Hydrocarbon Doser Line
- 2 Fasteners
- 3 P-Clamps
- 4 Tie Straps
- 5 Fasteners and Clamps

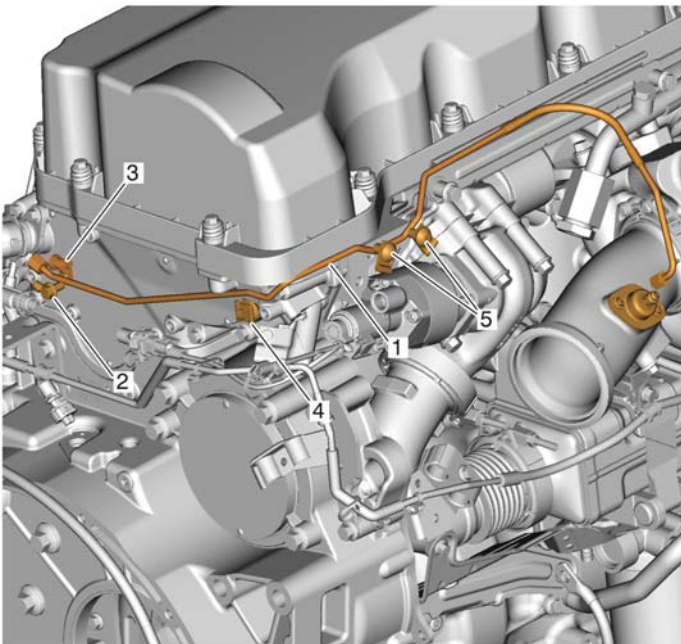
## Installation

**1**  
Position the line on the engine.



W2064630

**2**  
Connect the line to the aftertreatment hydrocarbon doser (do not tighten at this time).



W2064759

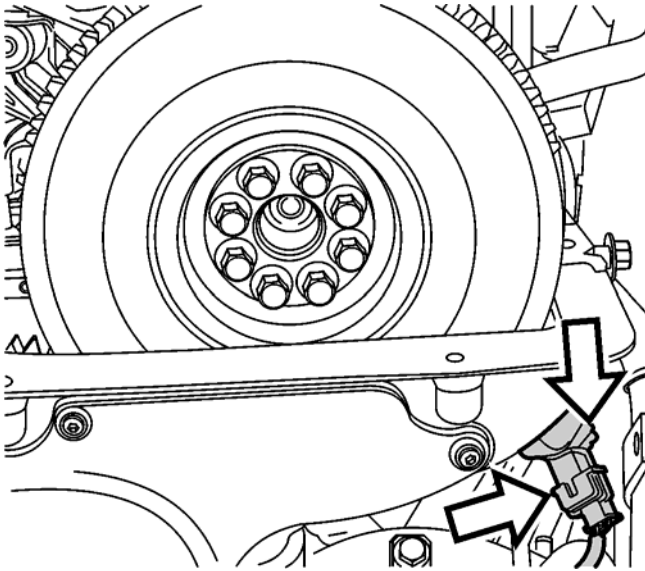
- 1 Aftertreatment Hydrocarbon Doser Line
- 2 Fasteners
- 3 P-Clamps
- 4 Tie Straps
- 5 Fasteners & Clamps

**3**

### **WARNING**

Fuel lines must be tightened to the stated specification. Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire and result in component damage and serious personal injury.

Connect the aftertreatment hydrocarbon doser line to the line connected to the aftertreatment hydrocarbon dosing module. Install the fasteners and P-clamps to secure the line. Tighten the line fittings and fasteners to specification, refer to Function Group 20; "Specifications".



W2005104

**4**  
Install and connect the camshaft sensor.

**5**  
Install the coolant package. Refer to Function Group 26 for service procedures.

**6**  
Reconnect all previously removed cables to the negative (ground) battery terminals.

**7**  
Start the engine, build air to operating pressure. Start the service regeneration process. When fuel dosing starts, check for leaks starting on the hot side of the engine. Clear any diagnostic trouble codes, if needed.

**Note:** If fault tracing was performed using Guided Diagnostics, return to Guided Diagnostics for repair verification.

**8**  
Install the access panel onto the floor.

**9**  
Close the rear engine service door(s).

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## Fuel Supply Line, Replacement

9700, PrevH, PrevX

## Fuel Supply Line, Replacement

This information provides the service procedures for replacing the fuel supply line on PREVOST and 9700 buses equipped with an aftertreatment hydrocarbon dosing module.

### Contents

- "Fuel Supply Line, Replacement", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2585-03-02-09**

## Fuel Supply Line, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

**1**

Apply the parking brake and place the shift lever in neutral.

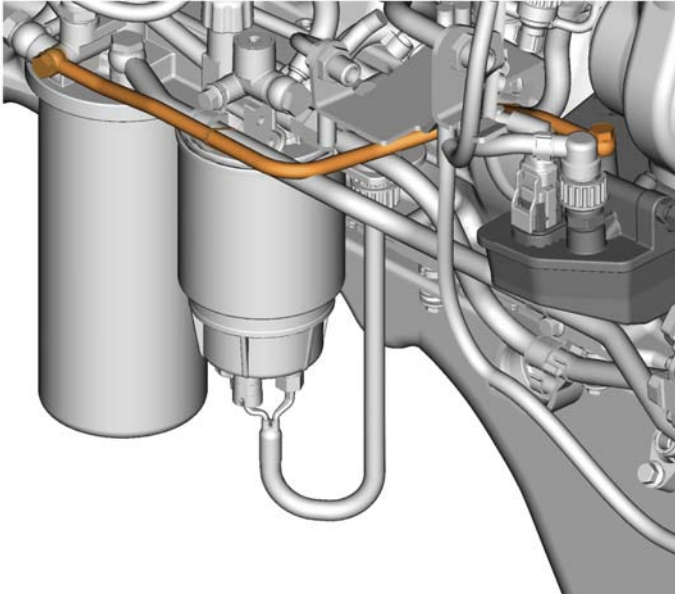
**2**

Open engine service doors. If necessary, raise and support the vehicle to provide safe access to the undercarriage of the vehicle.

**Note:** On some models it may be necessary to remove the splash shield underneath the engine to allow access to the fuel supply line.

**3**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.



W2064629

**4**

**! WARNING**

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire and result in component damage and serious personal injury.

Disconnect the fuel supply line from the aftertreatment hydrocarbon dosing module and the fuel filter housing. Collect any residual fuel that might be in the fuel line in a suitable container.

**! CAUTION**

Do not allow fuel to leak onto the aftertreatment hydrocarbon dosing module wiring harness connectors. This will cause damage to the connectors rubber parts.

**! CAUTION**

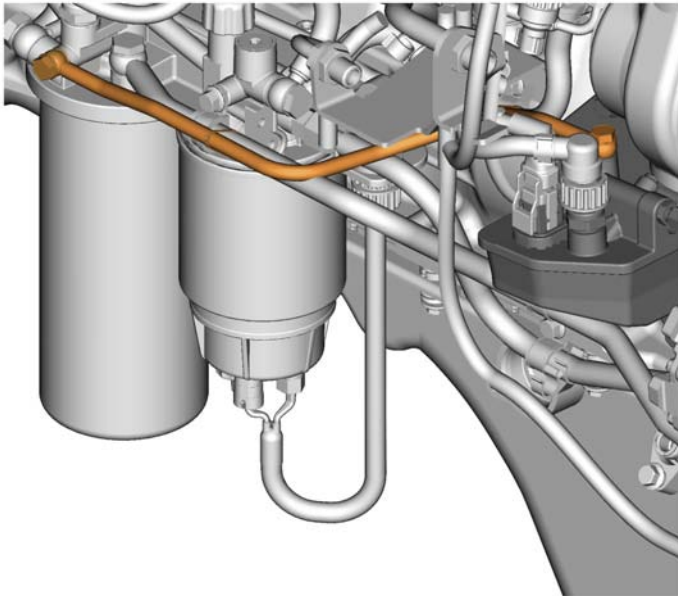
Do not kink the fuel line. Kinking the fuel line may result in leakage.

**5**

Cut the tie straps securing the fuel supply line and remove it from the vehicle.



## Installation



W2064629

1

### **WARNING**

Fuel lines must be tightened to the stated specification. Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire and result in component damage and serious personal injury.

Position the fuel supply line on the vehicle. Attach the end of the fuel supply line with the plastic retainer to the aftertreatment hydrocarbon dosing module. Attach the other end of the fuel supply line to the fuel filter housing. Remove the plastic retainer from the hollow screw. Tighten the fuel supply line fittings to specification, refer to Function Group 20, Specifications.

2

Secure the fuel supply line with tie straps.

3

Connect all previously removed cables to the negative (ground) battery terminals.

4

Start the engine, build air to operating pressure. Start the service regeneration process. When fuel dosing starts, check for leaks starting on the hot side of the engine. Clear any diagnostic trouble codes, if needed.

**Note:** If fault tracing was performed using Guided Diagnostics, return to Guided Diagnostics for repair verification.

5

Close engine service doors. If necessary, install the splash shield, raise the vehicle, remove supports and lower the vehicle to the floor.

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Hard Fuel Line, Aftertreatment Hydrocarbon  
Doser, Replacement

9700, PrevH, PrefvX

## Hard Fuel Line, Aftertreatment Hydrocarbon Doser, Replacement

This information provides the service procedures for replacing the hard line connected to the aftertreatment hydrocarbon dosing module on PREVOST and VOLVO buses.

### Contents

- “Hard Fuel Line, Aftertreatment Hydrocarbon Doser, Replacement”, page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2585-03-02-05**

## Hard Fuel Line, Aftertreatment Hydrocarbon Doser, Replacement

From Module

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

**1**

Apply the parking brake and place the shift lever in neutral.

**2**

Disconnect all cables from negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**3**

If necessary, raise and support the vehicle to provide safe access to the undercarriage.

**4**

If necessary, remove the splash shield underneath the engine to allow access to the hard line connected to the aftertreatment hydrocarbon dosing module.

**5**

If necessary, remove the fasteners and seat cushions from the seat frame attached to the floor panel over the engine compartment. Store the seat cushions in a secure location.

**6**

If necessary, remove the fasteners and seat frame from the floor panel. Store the seat frame in a secure location.

**7**

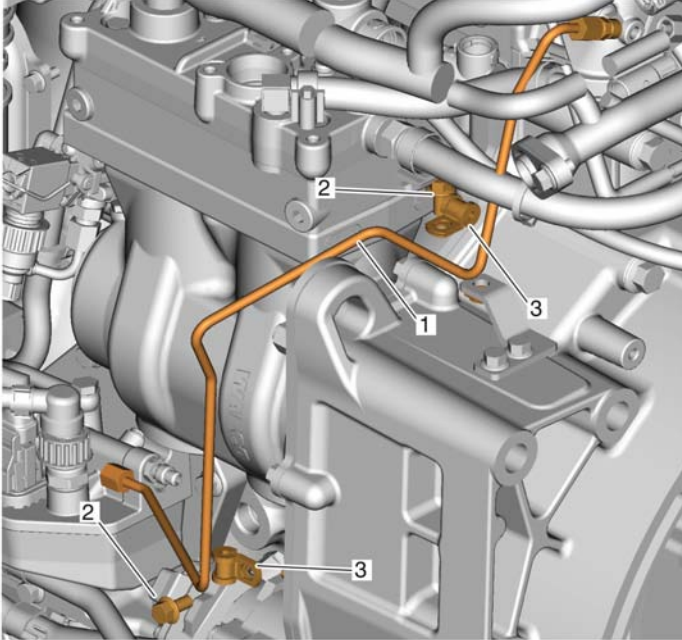
To gain access to the aftertreatment hydrocarbon dosing module, remove the fasteners and the floor panel. Store floor panel and fasteners in a secure location.

**8**

Remove the clamps and tie straps securing the engine harness to provide access to the hard line to the aftertreatment hydrocarbon doser.

**9**

Remove the fasteners and P-clamps securing the hard line to the aftertreatment hydrocarbon dosing module.



W2064758

- 1 Line
- 2 Fasteners
- 3 P-Clamps

**10**

 **WARNING**

Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire and result in component damage and serious personal injury.

Disconnect the hard line from the aftertreatment hydrocarbon dosing module. Collect any residual fuel that might be in the line in a suitable container.

 **CAUTION**

Do not allow fuel to leak onto the aftertreatment hydrocarbon dosing module wiring harness connectors. This will cause damage to the connectors rubber parts.

 **CAUTION**

Do not kink the line. Kinking the line may result in leakage.

**11**

Disconnect the aftertreatment hydrocarbon dosing module line from the line to the aftertreatment hydrocarbon doser. Remove the hard line from the engine.

**Note:** Provide protection to keep debris from entering the hard line to the aftertreatment hydrocarbon doser.

## Installation

**1**

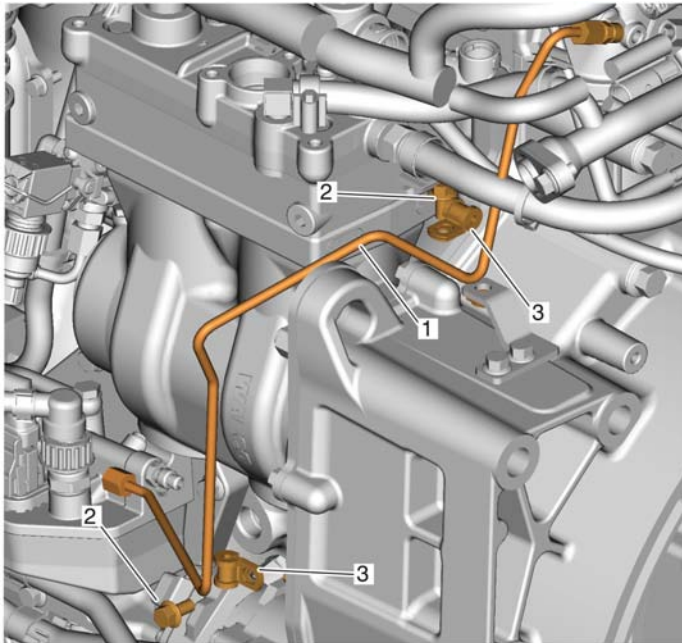
Position the hard line to the aftertreatment hydrocarbon dosing module on the engine.

**2**

Connect the hard line to aftertreatment hydrocarbon dosing module and to the hard line to the aftertreatment hydrocarbon doser (do not tighten at this time).

**3**

Install P-clamps and fasteners to secure the hard line. Tighten the hard line fittings and fasteners to specification, refer to Function Group 20; "Specifications".



W2064758

1 Line

2 Fasteners

3 P-Clamps

**4**

Install the clamps and tie straps securing the engine harness.

**5**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**6**

Start the engine, build air to operating pressure. Start the service regeneration process. When fuel dosing starts, check for leaks starting on the hot side of the engine. Clear any diagnostic trouble codes, if needed.

**Note:** If fault tracing was performed using Guided Diagnostics, return to Guided Diagnostics for repair verification.

**7**

Install the access panel onto the floor and tighten fasteners.

**8**

If removed previously, position the seat frame onto the floor panel. Install and tighten fasteners.

**9**

If removed previously, install the seat cushions and tighten fasteners.

**10**

If removed previously, install the splash shield and tighten the fasteners.

**11**

If the vehicle was previously raised, remove supports and lower the vehicle to the floor.

This service bulletin replaces bulletin 258-27 dated 9.2010.

Date	Group	No.	Release	Page
5.2011	<b>258</b>	<b>27</b>	<b>02</b>	1(18)

## Aftertreatment System Design and Function

9700, PrevH, PrevX

### Aftertreatment System, Design and Function

This service bulletin describes the design and function of the aftertreatment systems used on US2010 emissions Volvo vehicles. These systems include the exhaust gas recirculation (EGR) system, the aftertreatment diesel particulate filter (DPF) system, and the aftertreatment selective catalytic reduction (SCR) system.

#### Contents

- "Emissions Aftertreatment System (EATS)", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



# Design and Function

## Emissions Aftertreatment System (EATS)

The aftertreatment system consists of engine and exhaust components and sensors that work together to lower emissions to meet the US2010 emission requirements for the heavy truck industry. This bulletin describes the main Aftertreatment systems and components, such as the aftertreatment diesel particulate filter (DPF) system, the exhaust gas recirculation (EGR) system and the aftertreatment selective catalytic reduction (SCR) system, and how they work together to lower emissions and improve fuel economy.

## System Components and Operations

### Exhaust Gas Recirculation (EGR) System

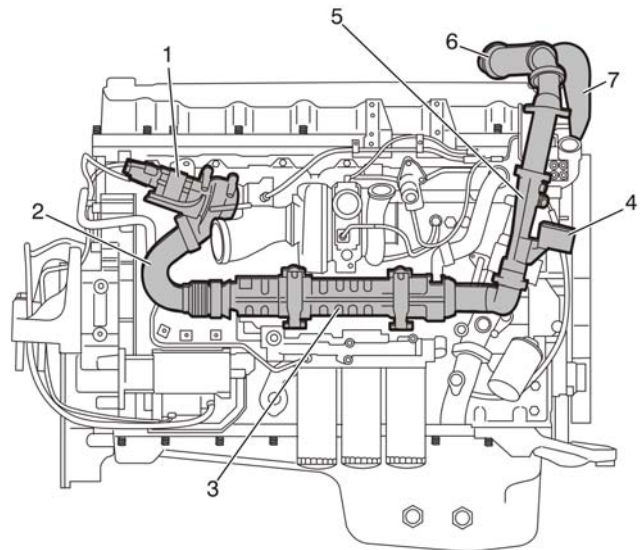
The EGR system is designed to recirculate exhaust gases into the combustion chambers to reduce the nitrogen oxide (NOx) emissions.

The NOx content increases with higher combustion temperatures. Recirculating cooled exhaust gases reduces the temperature in the combustion chamber and lowers the level of NOx emissions. To do this, the pressure must be higher in the exhaust side than in the inlet side and is controlled by the variable geometry turbocharger (VGT).

An EGR valve is mounted on the exhaust manifold. This valve is controlled by the oil pressure and regulates the recirculation of exhaust gases.

A portion of the exhaust gas is redirected from the exhaust manifold into the EGR cooler, through the Venturi tube, which measures the gas flow, and into the EGR mixing chamber. There, the exhaust gas is mixed with intake air cooled by the charge air cooler before it goes into the intake manifold.

The amount of recirculated exhaust gases is controlled by the engine control module (ECM) and depends on engine load, engine coolant temperature (ECT) and other various factors.



W2005851

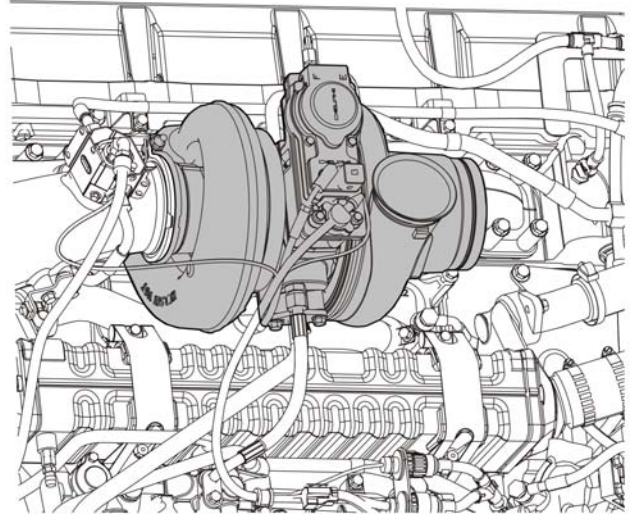
- 1 EGR Valve
- 2 EGR Valve Exhaust Pipe
- 3 EGR Cooler
- 4 EGR Differential Pressure Sensor
- 5 Venturi Tube
- 6 Crossover Pipe
- 7 EGR Mixing Chamber

## **Variable Geometry Turbocharger (VGT)**

The VGT regulates the charge air pressure and drives the exhaust gas recirculation (EGR) system. The turbocharger lowers emissions, provides optimum fuel consumption and increases power output. The speed of the gases entering the turbine controls the turbocharger function. The gas speed is controlled by an electronic actuator. Engine coolant cools the turbocharger bearing housing and the actuator.

The VGT has a set of vanes and a sliding nozzle ring that maintain sufficient back pressure in the exhaust manifold to properly operate the EGR system. Back pressure is required to push the exhaust gases into the pressurized intake air at the EGR mixer.

The turbocharger sliding nozzle ring controls the exhaust back pressure for proper operation of the EGR system and for enhanced braking. When the variable geometry nozzle mechanism is fully closed, the turbocharger performs as an exhaust brake.



W2005653

## **Aftertreatment Diesel Particulate Filter (DPF) System**

### *Simplified Concept*

US2010 emissions engines utilize an aftertreatment diesel particulate filter (DPF) system to meet US2010 emissions particulate matter regulations. The engine exhaust contains particulate matter, most of which gets trapped in the aftertreatment DPF. Eventually, the particulate matter has to be oxidized (burned). The aftertreatment DPF system design uses the following two methods to oxidize accumulated particulate matter.

- Aftertreatment DPF Passive Regeneration
- Aftertreatment DPF Forced Stationary Regeneration using the aftertreatment hydrocarbon doser when passive regeneration is insufficient

The system maximizes aftertreatment operating conditions for passive regeneration while maintaining the system's ability to begin forced stationary regeneration when it is required. Forced stationary regeneration is a backup when passive regeneration is insufficient. The intention is to minimize the number of forced stationary regenerations.

## *Strategy*

Passive regeneration occurs when the exhaust gas temperature (EGT) at the DPF inlet and the NOx to particulate matter ratio are high enough to oxidize the particulate matter. Passive regeneration is a slow reaction. Once it starts it can be a continuous process.

Forced stationary regeneration is a faster reaction that takes approximately 25 minutes to completely oxidize accumulated particulate matter. The engine control module (ECM) controls forced stationary regeneration with input from the aftertreatment control module (ACM). The ECM determines when to begin a forced stationary regeneration, controls the correct fuel quantity from the aftertreatment hydrocarbon doser based on temperature limits, and determines when to end a forced stationary regeneration. A heat mode is activated that allows the EGT to rise to the minimum temperature needed for a forced stationary regeneration.

## *Activation*

When passive regeneration occurs the driver is not aware of it. Passive regeneration does not change engine operation.

Forced stationary regeneration has to be started by the driver with a dashboard switch when a warning light flashes and there is "regeneration needed" message. The driver can not start the forced stationary regeneration without notification from the engine.

## *Deactivation*

- Passive regeneration: ignition key in the OFF position
- Forced stationary regeneration: ignition key in the OFF position or parking break OFF, vehicle speed greater than 2 km/hr (1 mph), gear engaged/pedal

## *After-Market Service*

### **WARNING**

The service technician must make sure that the vehicle is in a safe location. The high temperatures created during the aftertreatment DPF regeneration process can cause a fire if flammable materials are too close to the exhaust pipe or muffler. Serious personal injury can result and the vehicle or equipment can be damaged.

### **CAUTION**

The following precautions should be considered before handling the diesel particulate filter (DPF) components:

- A. Wear suitable eye protection.
- B. Wear suitable overalls or apron and heavy-duty gloves to avoid skin contact.
- C. Wear suitable respirator to avoid inhalation.
- D. Ensure adequate ventilation.

Ash is the residue from the noncombustible part of the particulate matter and accumulates in the filter. Lubrication oil consumed by the engine is usually the source of ash. Filters must be cleaned to avoid excessive back pressure. The DPF has been sized to meet or exceed the EPA service interval regulations of 240 000 km (150,000 miles) or 4,500 hours. The normal DPF filter insert replacement interval is 400 000 km (250,000 miles).

A trained service technician at a service center will determine if the aftertreatment DPF ash load is excessive and if the filter should be removed from the aftertreatment DPF and replaced. If the aftertreatment DPF ash load is below the removal level, the service technician can run a manual stationary aftertreatment DPF regeneration using Tech Tool.

The aftertreatment diesel oxidation catalyst (DOC) is not serviceable.

## Aftertreatment Diesel Particulate Filter (DPF)

The aftertreatment DPF with diesel oxidation catalyst (DOC) and particulate trap reduces the emission of particulates (soot), hydrocarbons (HC) and carbon monoxide (CO).

Only Ultra Low Sulphur Diesel with a sulphur limit of 15 parts per million may be used to prevent clogging the aftertreatment DPF. **The maximum allowable blend of biodiesel is 5%.**

In the aftertreatment DPF system, soot is trapped in a catalyzed ceramic monolith particulate filter with noble metal coating. The aftertreatment DPF is regenerated passively or actively by an aftertreatment hydrocarbon doser that injects diesel fuel to burn the exhaust gases by catalytic reaction. This reduces the amount of soot and extends the life of the aftertreatment DPF.

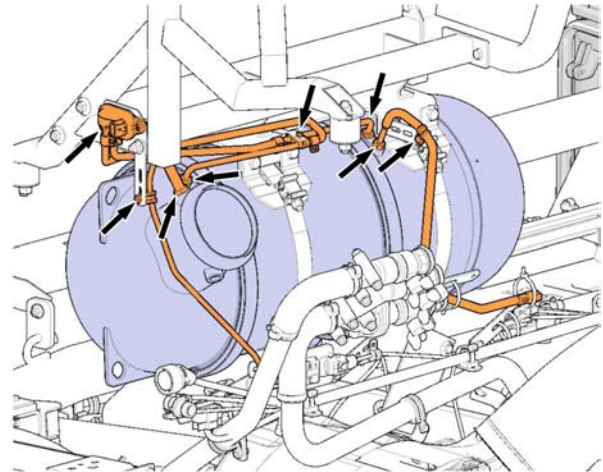
The aftertreatment DPF system is designed to primarily use passive aftertreatment DPF regeneration, which removes soot from the monolith by a catalytic reaction process that does not use additional fuel.

If the duty cycle is more “stop-and-go”, passive aftertreatment DPF regeneration might be insufficient to remove soot. Then a forced stationary regeneration will be necessary.

To increase the exhaust gas temperature (EGT) and maintain it during the heat mode required by forced stationary regeneration, an engine turbocharger compressor bypass valve is connected to the compressor side of the turbocharger. It recirculates part of the warm charge air from the outlet to the inlet of the turbocharger. A solenoid valve turns the bypass valve on or off.

The DPF is mounted above the engine at the back of the bus. There are two NOx sensors used with US2010 emissions engines. One is mounted on the DPF outlet pipe and the other is mounted on the pipe after the selective catalytic reduction (SCR) unit. Refer to the aftertreatment SCR system section of this bulletin for more details about SCR.

The aftertreatment DPF continuously oxidizes particles trapped in it. Some of the particles trapped in the aftertreatment DPF are inorganic material (ash) that can't be oxidized. The aftertreatment DPF must be serviced, because the ash will eventually build up, block the filter, and create exhaust gas back pressure. This increases fuel consumption and can cause derate, excessive engine wear or damage, and aftertreatment DPF damage.



W2060213

## Engine Turbocharger Compressor Bypass Valve

Lower torque levels require more heat for efficient aftertreatment diesel particulate filter (DPF) regeneration. The engine turbocharger compressor bypass valve can create higher exhaust gas temperatures (EGTs) by reducing turbocharger effectiveness. The bypass valve recirculates boosted air back into the turbocharger compressor inlet. This raises the EGT and maintains the aftertreatment diesel oxidation catalyst (DOC) temperature at a level that allows DPF regeneration.



W2005903

## Aftertreatment Hydrocarbon Dosing System

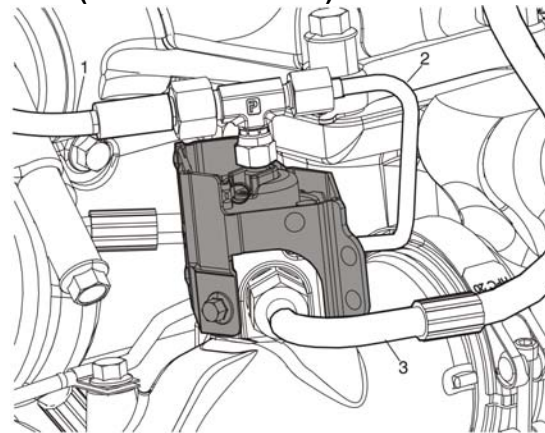
The aftertreatment hydrocarbon doser injects diesel fuel into the exhaust stream to increase the exhaust gas temperature (EGT) to the range needed for forced aftertreatment diesel particulate filter (DPF) regeneration when passive DPF regeneration is insufficient to prevent a high soot level in the filter. The engine control module (ECM) notifies the driver that a forced stationary regeneration is needed so the driver can start it with a switch on the dashboard. A service technician can start it manually in a safe location. The aftertreatment hydrocarbon doser is also used when the vehicle is moving to heat up the system and quickly get the engine in compliance with US2010 emissions requirements. At idle this is done by adjusting the engine timing and fuel delivery to increase EGT.

### Aftertreatment Hydrocarbon Dosing System Components (Previous Version)

US2010 emissions compliant engines have a continuous air purge system which removes any fuel remaining in the doser after aftertreatment DPF regeneration. When the engine is operating, there is a constant flow of air through the doser. The secondary vehicle air system, which is off when the engine is off, supplies the air. The main components of the previous system are:

- Chassis-mounted pressure regulator with inlet filter
- Doser-mounted check valve assembly
- Air and fuel supply tubes and hoses
- Air dryer cartridge with coalescing element
- Air shut-off valve

The secondary air system sends air to the in-line filter mounted on the pressure regulator inlet. The pressure regulator lowers the air pressure from chassis pressure, 620-825 kPa (90-120 psi), to approximately 220 kPa (32 psi). Air from the regulator flows through a one-way check valve with a filter screen, which prevents back-flow to the regulator. Air then flows through the doser and into the engine exhaust stream. Fuel is also sent to the doser check valve through a one-way check valve. The ECM controls air and fuel flow to the doser. The shut-off valve prevents air leakage into the fuel system when the ignition switch is in the OFF position.



W2006759

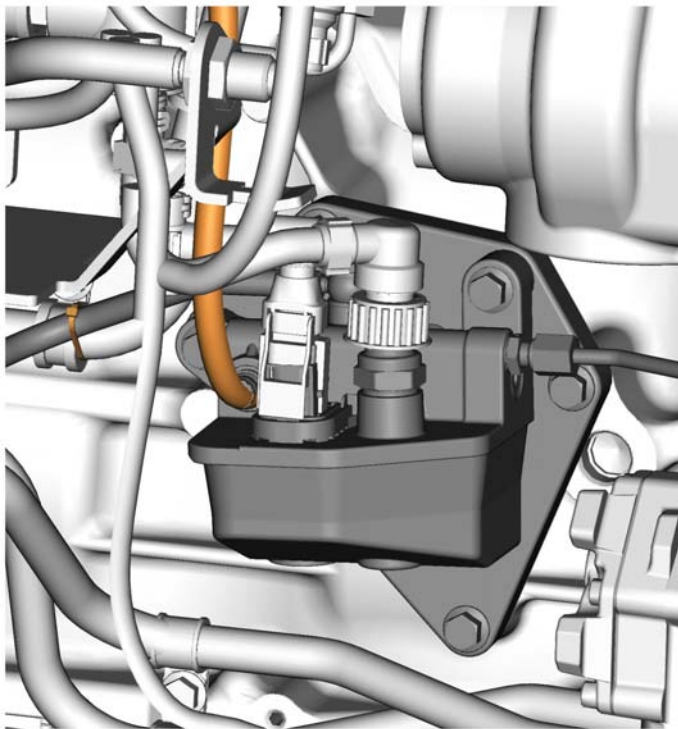
- 1 Air Line
- 2 Fuel Line
- 3 Coolant Line

## Aftertreatment Hydrocarbon Dosing System Components (New Version)

The main components of the new system are:

- Aftertreatment hydrocarbon dosing module
- Aftertreatment hydrocarbon doser
- Air and fuel supply tubes and hoses
- Chassis-mounted pressure regulator with inlet filter
- Air dryer cartridge with coalescing element

The aftertreatment hydrocarbon dosing module contains three non-serviceable valves, the aftertreatment fuel shutoff valve, aftertreatment purge air valve and aftertreatment hydrocarbon dosing control valve, and a serviceable aftertreatment fuel pressure sensor.

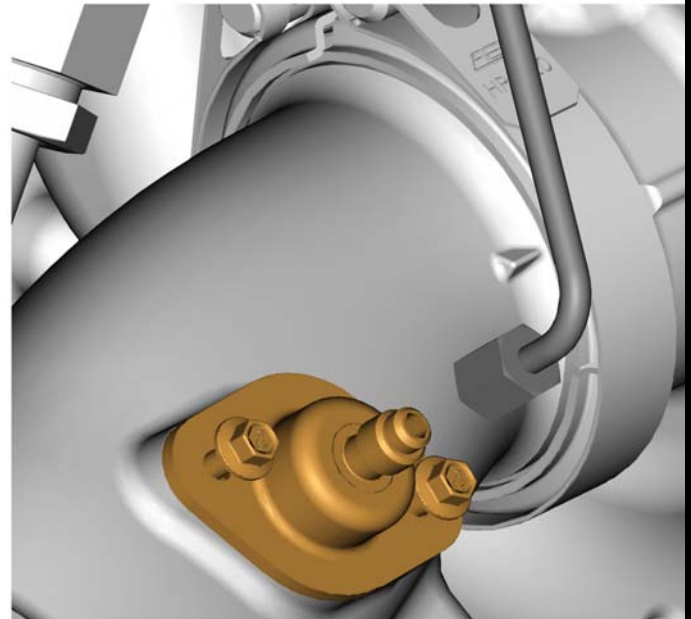


W2064628

Aftertreatment Hydrocarbon Dosing Module

The secondary air system sends air to the in-line filter mounted on the pressure regulator inlet. The pressure regulator lowers the air pressure from chassis pressure, 620-825 kPa (90–120 psi), to approximately 220 kPa (32 psi). During air purge operation, the engine control module (ECM) sends a voltage signal to open the aftertreatment purge air valve. This allows air pressure to flow into the aftertreatment hydrocarbon dosing module. The ECM then sends a signal to the aftertreatment hydrocarbon dosing control valve that allows purge air pressure to be monitored by a signal from the aftertreatment fuel pressure sensor to the ECM. The ECM uses this input to determine if the system is operating correctly.

During aftertreatment DPF regeneration, the ECM sends a voltage signal to open the aftertreatment fuel shutoff valve. This allows fuel to flow into the aftertreatment hydrocarbon dosing module. The aftertreatment fuel pressure sensor monitors the fuel pressure value and sends a reference signal to the ECM. The ECM then sends a signal to the aftertreatment hydrocarbon dosing control valve that regulates the amount of fuel delivered to the aftertreatment hydrocarbon doser through the air/fuel line.



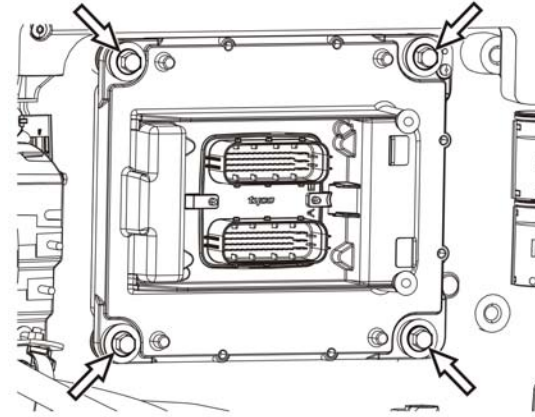
W2064631

Aftertreatment Hydrocarbon Doser

## Engine Control Module (ECM)

The engine control module (ECM) controls the aftertreatment systems. The ECM monitors elapsed time, distance travelled, fuel consumption, diesel particulate filter (DPF) soot accumulation, and other sensor signals to determine when conditions are right to start an aftertreatment DPF regeneration.

The ECM also monitors all the valves and components that are required to make sure that aftertreatment DPF regeneration is controlled and successful. These include, but are not limited to, control of the engine turbocharger compressor bypass valve, the turbocharger actuator and the exhaust gas recirculation (EGR) valve position. Control of these and other components is essential for a successful aftertreatment DPF regeneration.



W2005598

Engine Control Module

## Emission Control Sensors

The engine control module (ECM), in combination with the aftertreatment control module (ACM), controls the aftertreatment systems by analyzing the data it receives from sensors located throughout the systems. Included are sensors that monitor the variable geometry turbocharger (VGT), exhaust gas recirculation (EGR) system, engine coolant, engine position, aftertreatment diesel particulate filter (DPF) and aftertreatment selective catalytic reduction (SCR). Chassis-mounted sensors are also required, including those that monitor the ambient air temperature (AAT). Examples of some of the main sensors are listed below. Sensors may vary depending on the system used.

### 1 Turbocharger

- VGT Wheel Speed Sensor
- VGT Position Sensor
- Intake Manifold Pressure (IMP) Sensor
- Intake Manifold Air Temperature Sensor

### 2 Engine Position

- Camshaft Position (CMP) Sensor
- Crankshaft Position (CKP) Sensor

### 3 Engine Coolant

- Engine Coolant Temperature (ECT) Sensor

### 4 Aftertreatment Diesel Particulate Filter (DPF)

- Engine Exhaust Gas Temperature (EGT) Sensor
- Aftertreatment DPF Intake Temperature Sensor
- Aftertreatment DPF Outlet Temperature Sensor
- Aftertreatment DPF Differential Pressure Sensor
- Aftertreatment Outlet NOx Sensor
- Aftertreatment Fuel Pressure Sensor

### 5 EGR System

- EGR Temperature Sensor
- EGR Differential Pressure Sensor

### 6 Intake Air Sensors

- Intake Air Temperature (IAT) Sensor
- Ambient Air Temperature (AAT) Sensor
- Barometric Pressure (BARO) Sensor

### 7 Aftertreatment Selective Catalytic Reduction (SCR) System

- Aftertreatment Diesel Exhaust Fluid (DEF) Dosing Pressure Sensor
- Aftertreatment DEF Tank Temperature Sensor
- Aftertreatment DEF Tank Level Sensor
- Aftertreatment Outlet NOx Sensor

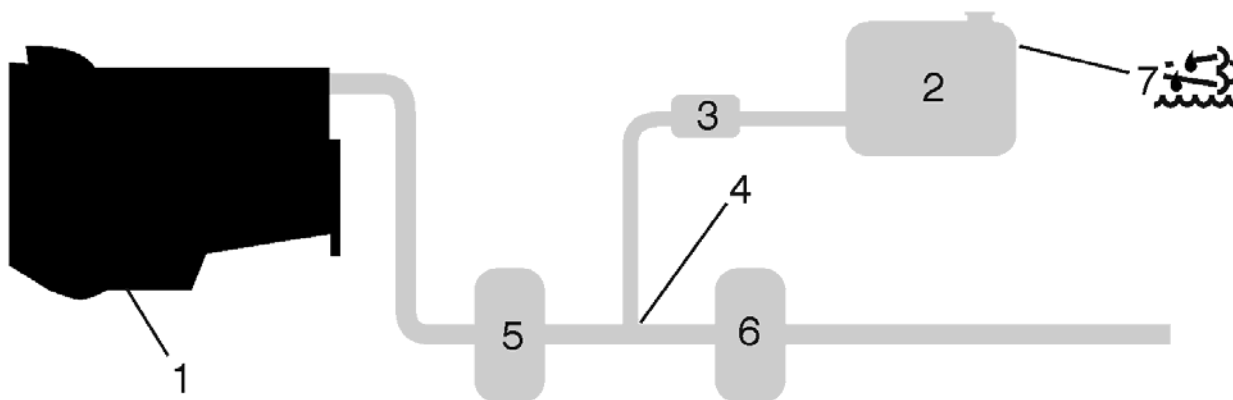
## Aftertreatment Selective Catalytic Reduction (SCR) System

US2010 engines use a selective catalytic reduction (SCR) system with diesel exhaust fluid (DEF) dosing to meet US2010 NOx emission regulations, which apply to all heavy duty diesel engines built after January 1, 2010. The new US2010 standards require 83% reduction in nitrogen oxide (NOx) emissions compared to US07 standards. The aftertreatment SCR system reduces NOx emissions.

The SCR system adds DEF to the exhaust stream. The DEF pump (3) pulls DEF from the DEF tank (2) and sends it to the aftertreatment DEF dosing valve (4). The dosing valve injects DEF into the exhaust gases between the aftertreatment diesel particulate filter (DPF) (5) and the aftertreatment SCR catalyst (6). The treated exhaust then enters the SCR Catalyst where the heat in the exhaust

system converts the DEF into ammonia and carbon dioxide. Ammonia is the active substance in the chemical reaction in the SCR catalyst. This chemical reaction occurs at temperatures above 200° C (390° F) and converts nitrogen oxides (NOx) into harmless nitrogen gas and water vapor, which occur naturally in the environment.

The engine control module (ECM) calculates how much and when DEF should be added to the exhaust gases based on the current engine load. The ECM then signals the aftertreatment control module (ACM), which controls the aftertreatment DEF pump and DEF dosing valve. This process maximizes the reduction of emissions during all engine operating conditions.

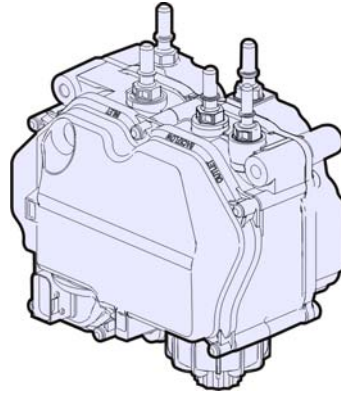


W2031651

- 1 Diesel Engine
- 2 Aftertreatment DEF Tank
- 3 Aftertreatment DEF Pump
- 4 Aftertreatment DEF Dosing Valve
- 5 Aftertreatment DPF
- 6 Aftertreatment SCR Catalyst
- 7 Aftertreatment DEF Tank Gauge

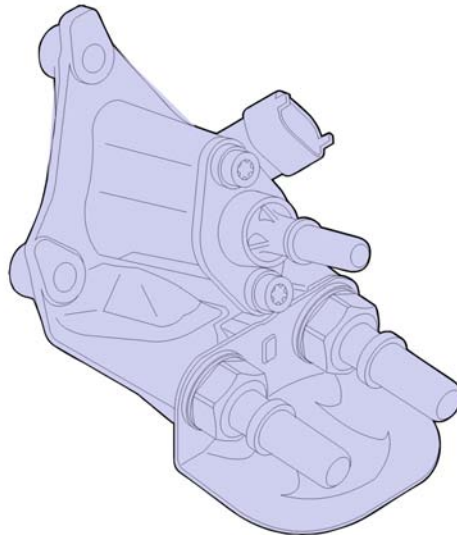


## Aftertreatment Selective Catalytic Reduction (SCR) System Components and Function



W2054664

Aftertreatment DEF Pump



W2038622

Aftertreatment DEF Dosing Valve



W2055491

Aftertreatment SCR Catalyst

The aftertreatment DEF tank level sensor sends a signal to the ACM that tells the ACM that the DEF is above the required minimum level in the DEF tank. The ACM starts the DEF pump, which builds up the system pressure to 900 kPa (130 PSI).

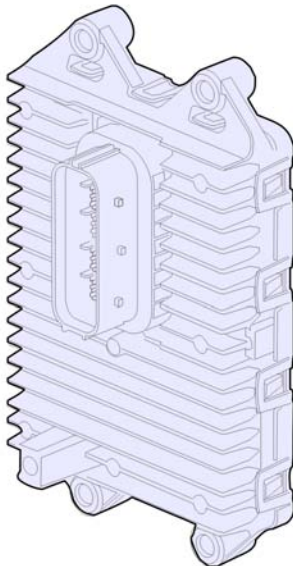
When the SCR system meets certain conditions, the engine control module (ECM) sends a signal to the ACM. The ACM opens the DEF dosing valve, which injects the DEF into the exhaust pipe before the SCR catalyst. The DEF system target pressure of 900 kPa (130 PSI) is maintained by pump motor speed adjustments. A constant overflow of DEF circulates through the backflow orifice to keep the pressure stable.

The high exhaust gas temperature (EGT) converts the DEF into ammonia and carbon dioxide. The ammonia causes a chemical reaction in the SCR catalyst that converts the exhaust gases into nitrogen gas and water vapor.

The nitrogen oxide (NOx) sensor measures the NOx level in the exhaust gases. If the system does not maintain the required emissions level, a warning light appears on the instrument panel in the cab and a diagnostic trouble code (DTC) is stored in the ECM.

The DPF outlet temperature sensor measures the EGT of exhaust gas entering the SCR catalyst. The ACM monitors both DPF outlet temperature and NOx sensor signals, calculates the required DEF dosing amount and activates the DEF dosing valve. After the dosing valve is activated, the correct amount of DEF will be injected into the exhaust stream.

## Aftertreatment Control Module (ACM)



W2038621

The DEF is temperature sensitive. A heating loop in the DEF tank contains hot engine coolant and heats the DEF to thaw it if it is frozen and to prevent it from freezing during engine operation. The tank coolant heating loop also heats the DEF pump. The lines to and from the DEF tank are electrically heated and insulated.

A temperature sensor in the DEF tank continuously monitors the temperature in the tank. If the temperature falls below 10° C (50° F), the ACM opens a DEF tank heating valve which allows hot engine coolant to pass through the DEF tank heating loop and the DEF pump. When the DEF reaches a temperature of 15° C (60° F), the DEF tank temperature sensor signals the ACM which closes the valve and stops the heating. If the ambient air temperature (AAT) drops to 4° C (40° F) or less, the DEF line heaters turn on periodically to keep the lines from freezing.

If the system detects a fault that affects the DEF injection process, a malfunction indicator light (MIL) appears on the instrument panel in the cab and a DTC is stored in the ECM.

A gauge on the instrument panel in the cab shows the level of DEF in the tank. When the DEF level in the DEF tank gets low, an aftertreatment DEF tank low level indicator appears. See "Aftertreatment DEF Tank Level — Driver Warning and Inducement", page 15 for more information about low DEF level.

When the engine is shut down, DEF is partly purged from the DEF system. The purging is started by the activation of the aftertreatment DEF return valve and DEF dosing valve and is active for one minute after the engine stops.

The ACM controls the following components in the aftertreatment selective catalytic reduction (SCR) system.

- Aftertreatment Diesel Exhaust Fluid (DEF) Dosing Valve
- Aftertreatment DEF Tank Heater Valve
- Aftertreatment DEF Line Heaters
- Aftertreatment DEF Pump
- Aftertreatment DEF Return Valve
- Aftertreatment DEF Tank Level Sensor

The ACM also monitors the following in the SCR system.

- Aftertreatment DEF Dosing Pressure
- Aftertreatment DEF Tank Temperature
- Aftertreatment DEF Tank Level
- Aftertreatment DPF Intake/Outlet Temperature
- Aftertreatment DPF Differential Pressure
- NOx Sensors

## Aftertreatment Diesel Exhaust Fluid (DEF)

### **WARNING**

Do not put diesel fuel in the aftertreatment DEF tank. If diesel fuel is injected into the hot exhaust gases along with the DEF, it could ignite explosively and start a fire, which could cause serious personal injury and damage the exhaust system. The DEF tank filler cap and diesel tank filler cap are labeled and the filler caps, necks and nozzles are different sizes to help prevent the tanks from being filled with the wrong fuel.

### **WARNING**

Aftertreatment DEF is an irritant. Contact with aftertreatment DEF can irritate the skin and eyes. Inhaling aftertreatment DEF mist can cause lung irritation. Avoid aftertreatment DEF contact with skin and eyes. Avoid breathing mist created by aftertreatment DEF spray.

### **CAUTION**

Only use VOLVO approved aftertreatment DEF in the aftertreatment selective catalytic reduction (SCR) system. Do not use DEF that is not approved by VOLVO, because it will damage the aftertreatment system permanently, decrease engine output, possibly damage other engine components and may impact your product warranties.

Aftertreatment DEF is a solution of urea crystals and deionized water. Urea is a nitrogen compound that turns into ammonia and carbon dioxide when it is heated. It is colorless, not flammable and freezes at -11° C (12° F). DEF is not dangerous when handled correctly. However, it is highly corrosive to metal, particularly copper and aluminum. See "Aftertreatment DEF Quality — Driver Warning and Inducement", page 16 for more information about DEF quality.

## Handling Aftertreatment DEF

### **CAUTION**

When disconnecting lines and components, do not spill aftertreatment DEF onto separated connectors. If this occurs, replace the connectors immediately. Cleaning with water or compressed air will not help as the aftertreatment DEF quickly oxidizes metal and due to capillary action "creeps" along cabling at a speed of about 600 mm/hr (24 in/hr).

When you handle DEF make sure the electrical connectors are either connected or well wrapped in a protective cover if they are disconnected.



W2035724



T2025985

Wrap Exposed Connectors

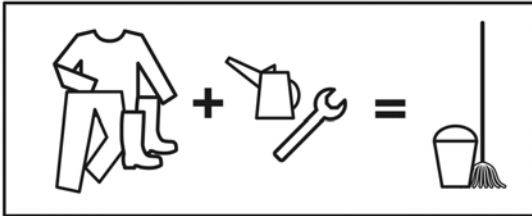
### When You Replace A DEF Pump Or DEF Dosing Valve:

- Make sure the system is depressurized.
- Always detach the aftertreatment DEF lines **before** you disconnect the electrical connectors to prevent DEF spillage from entering the connectors.
- Make sure you wrap exposed connectors in a protective cover.
- Make sure you seal the system so the DEF will not crystallize if the system has to be disconnected for several hours. Part number 21376772 is a set of six cap plugs that can be used to plug the fittings on the DEF pump.

## Cleaning Tools And Clothing

### CAUTION

Make sure to thoroughly clean aftertreatment DEF off of tools and clothes, so that fluid or crystals do not transfer to other components that could be damaged.



T2023003

## DEF Spills

### WARNING

Aftertreatment DEF spilled onto hot components will quickly vaporize. Turn your face away to avoid serious personal injury. If you **inhale** DEF vapor, move to a location where you can breathe fresh air. Get medical help, if necessary.

Do not flush DEF spillages into a regular drainage system. Dispose of DEF properly according to local regulations.

If DEF **contacts skin**, remove contaminated clothing and rinse skin with plenty of water.

If DEF **contacts eyes**, rinse eyes for several minutes. Get medical help, if necessary.

Do not allow DEF to come into contact with other chemicals.

DEF is not flammable. If it is exposed to high temperatures, it breaks down into ammonia and carbon dioxide.

DEF is highly corrosive to certain metals, including copper and aluminum.

If DEF spills on the vehicle, wipe it off and rinse with water. Spilled DEF can form white crystals on the vehicle. Rinse them off with water.






## Aftertreatment DEF Tank Level — Driver Warning and Inducement

**Note:** See the vehicle operator’s manual for additional information about driver warnings and inducements.

DEF tanks are sized to have no less than twice the diesel fuel tank mileage or hour range.

The vehicle instrument cluster has a permanent Aftertreatment DEF tank level gauge.






**Note:** Repeated acts of tampering, or a fault that is not repaired correctly, may cause the inducement level to return to the highest level of inducement previously achieved.

Triggers	Diagnostic Trouble Codes	Aftertreatment DEF Tank Low Level Indicator	Inducement
100% to 12% Aftertreatment DEF Tank Level Gauge	None	OFF	None
<=12% Aftertreatment DEF Tank Level Gauge	SPN 5246 FMI 15 SPN 1761 FMI 11	DEF Solid  W2029416	None
0% Aftertreatment DEF Tank Level Gauge (approximately 1% DEF Remaining)	SPN 5246 FMI 16 SPN 1761 FMI 18	DEF Flashing  W2029415	25% Torque Reduction
0% Aftertreatment DEF Tank Gauge Insufficient DEF Pump Pressure Diesel Fuel Refueling >15% Vehicle stationary or shut off for more than 20 minutes	SPN 5246 FMI 0 SPN 4095 FMI 7 SPN 1761 FMI 18	DEF Flashing  W2029415	8 km/h (5 mph) Road Speed Limit (RSL) <sup>1</sup>
DEF tank empty and refueling event with parking brake applied  <b>Note:</b> To avoid the Back Stop feature, the DEF tank must be filled to more than 18% of capacity.	SPN 5246 FMI 0 SPN 1761 FMI 18	DEF Flashing  W2029415	8 km/h (5 mph) Road Speed Limit (RSL) <sup>1</sup>
Back Stop Feature	SPN 5246 FMI 0 SPN 1761 FMI 18	DEF Flashing  W2029415	8 km/h (5 mph) Road Speed Limit (RSL) <sup>1</sup>

<sup>1</sup> Vehicle has to be stationary before 8 km/h (5 mph) Road Speed Limit (RSL) becomes Active.

## Aftertreatment DEF Quality — Driver Warning and Inducement

**Note:** See the vehicle operator's manual for additional information about driver warnings and inducements.

Triggers	Diagnostic Trouble Codes	Aftertreatment DEF Quality Indicator	Inducement
Good DEF Quality	None	OFF	None
Poor DEF Quality DTC Initial Detected <sup>1 2</sup>	SPN 4094 FMI 18 SPN 5246 FMI 15	 W2029417	None
Poor DEF Quality DTC Initial Detected + 1 hour	SPN 4094 FMI 18 SPN 5246 FMI 16	 W2029417	25% Torque Reduction
Poor DEF Quality DTC Initial Detected + 4 hours	SPN 4094 FMI 18 SPN 5246 FMI 16	 W2029417	25% Torque Reduction
Diesel Fuel Refueling Event with Parking Brake ON (>15% fuel level increase) Vehicle stopped or engine shut down for >20 minutes (Back Stop Feature)	SPN 4094 FMI 18 SPN 5246 FMI 0	 W2029417	8 km/h (5 mph) Road Speed Limit (RSL) <sup>3</sup>
Key Cycle Before Evaluation Completed/Confirmed DEF Dilution Temporary Exit from 8 km/h (5 mph) Inducement	SPN 4094 FMI 1 SPN 4094 FMI 18	 W2029417	25% Torque Reduction

<sup>1</sup> Based on a confirmed NOx sensor evaluation of measured versus predicted SCR NOx conversion.

<sup>2</sup> Poor DEF Quality defined as DEF diluted with water in 50/50 proportions.

<sup>3</sup> Vehicle has to be stationary before 8 km/h (5 mph) Road Speed Limit (RSL) becomes active.

### Exit conditions for DEF Quality "8 km/h (5 mph) road speed limit" Inducement:





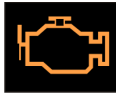

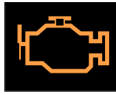
**First Restart:** Return to 25% torque reduction until proper DEF quality evaluation. If poor DEF quality is detected during the next monitoring cycle, then 8 km/h (5 mph) resumed after vehicle is stationary for 20 minutes<sup>1</sup>. After one engine restart, Tech Tool is required to exit the 8 km/h (5 mph) RSL.

**With Tech Tool Diagnostic Trouble Code (DTC) Clearing:** Invoke 25% torque reduction until proper DEF quality evaluation. If poor DEF quality is detected during the next monitoring cycle then 8 km/h (5 mph) resumed after vehicle is stationary for 20 minutes.<sup>1</sup>

<sup>1</sup> Chronological time, not engine run time.

## Aftertreatment Tampering — Driver Warning and Inducement

**Note:** See the vehicle operator’s manual for additional information about driver warnings and inducements.

Triggers	Diagnostic Trouble Codes	Aftertreatment DEF Quality Indicator	Inducement
No Fault	None	OFF	None
Tampering Fault Detected	Refer to “SCR System Tampering Types”, page 18 for SCR Tampering DTC	 W2029417	None
Second Drive Cycle with Active DTC	Tampering DTC SPN 5246 FMI 15	 W2029417  W2036007	None
One Hour of Driving with Confirmed Active DTC	Tampering DTC SPN 5246 FMI 16	 W2029417  W2036007	25% Torque Reduction
Four Hours of Driving with Confirmed Active DTC	Tampering DTC SPN 5246 FMI 16	 W2029417  W2036007	25% Torque Reduction
Diesel Fuel Refueling Event with Parking Brake ON (>15% fuel level increase) Vehicle stopped or engine shut down for >20 minutes (Back Stop Feature)	Tampering DTC SPN 5246 FMI 0	 W2029417  W2036007	8 km/h (5 mph) Road Speed Limit (RSL) <sup>1</sup>

<sup>1</sup> Vehicle has to be stationary before 8 km/h (5 mph) Road Speed Limit (RSL) becomes active.



### *SCR System Tampering Types*

<b>SCR System Tampering Type</b>	<b>Diagnostic Trouble Code</b>
Aftertreatment Control Module Disconnected	SPN 1231 FMI 9
Pre-SCR NOx Sensor Disconnected	SPN 3216 FMI 9
Post-SCR NOx Sensor Disconnected	SPN 3226 FMI 9
DEF Pump Disconnected	SPN 4334 FMI 5
DEF Dosing Valve Disconnected	SPN 5394 FMI 5
DEF Level Sensor Disconnected	SPN 1761 FMI 5
DEF Supply Line to DEF Pump Disconnected	SPN 5392 FMI 31
DEF Return Line Blocked or Plugged	SPN 5485 FMI 11
DEF Dosing Line Blocked or Plugged	SPN 5394 FMI 14

### **Misfilling Diesel or Aftertreatment DEF Tanks**

Although diesel fuel and Aftertreatment DEF caps are clearly labeled and filler necks and nozzles are different accidents can happen.

Contamination of fluids by- misfilling of diesel or DEF in the wrong tank may result in vehicle malfunction.

#### **Results of Misfilling DEF in Diesel Tank**

- Engine may run poorly or not at all
- Injectors may be damaged
- Exhaust system corrosion may occur between turbocharger and Aftertreatment DPF
- On Board Diagnostic (OBD) Diagnostic Trouble Codes (DTC)

- Costly repairs

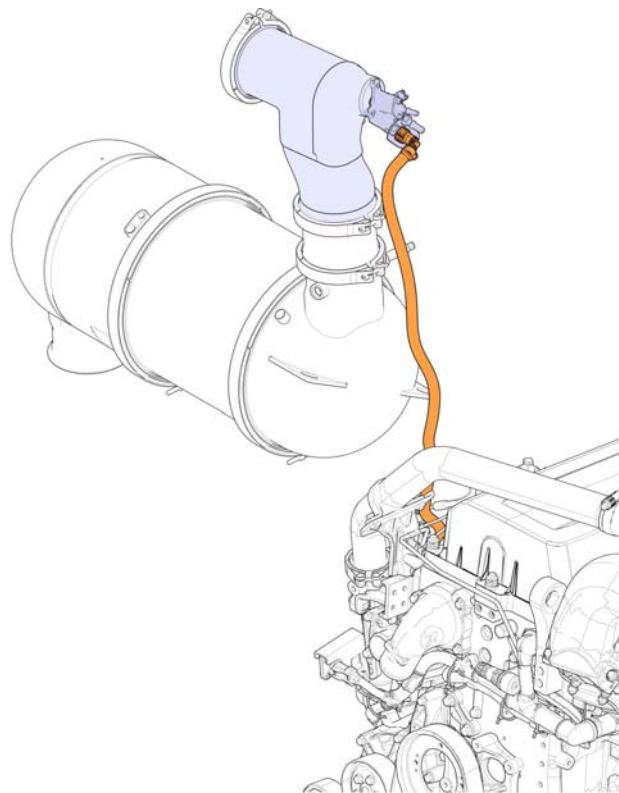
#### **Results of Misfilling Diesel in Aftertreatment DEF Tank**

- Aftertreatment SCR system may be damaged by diesel
- SCR Catalyst may be damaged by diesel (chemical damage)
- Emissions may be non-compliant
- On Board Diagnostic (OBD) Diagnostic Trouble Codes (DTC)
- Costly repairs

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Aftertreatment Diesel Exhaust Fluid (DEF) Coolant Hose Replacement  
PREVX

## Aftertreatment Diesel Exhaust Fluid (DEF) Coolant Hose, Replacement



W2060366

This service bulletin covers the procedures for replacing the DEF coolant hose used on VOLVO PREVX model buses.

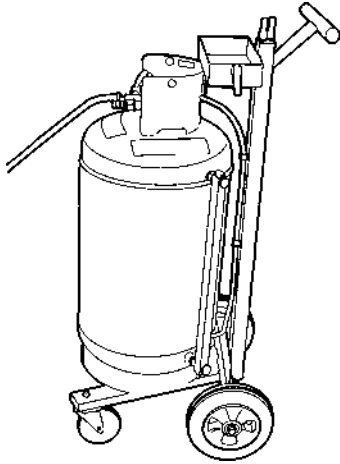
### Contents

- "Special Tools", page 2 .
- "Aftertreatment Diesel Exhaust Fluid (DEF) Coolant Hose, Replacement", page 3 .

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## Special Tools

For special tools ordering information, refer to Tool Information, group 08.



W2004191

**85112740**  
Coolant Extractor

## 2589-03-02-33

# Aftertreatment Diesel Exhaust Fluid (DEF) Coolant Hose, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

### **DANGER**

Before working on a vehicle, set the parking brake, place the I-Shift transmission in Neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

*Special tools: 85112740*

## Removal

**1**

Apply the parking brake and place the I-Shift selector in Neutral.

**2**

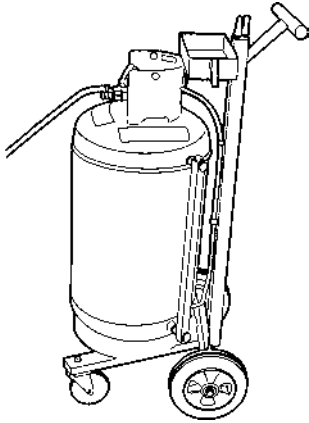
Open the battery compartment access doors.

**3**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

Open both right-rear engine service access doors to access the aftertreatment DEF tank, DEF lines and DEF pump.



W2004191

**5**

Connect the coolant extractor and drain the engine coolant.

**⚠ DANGER**

Engine coolant is toxic and can pose a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

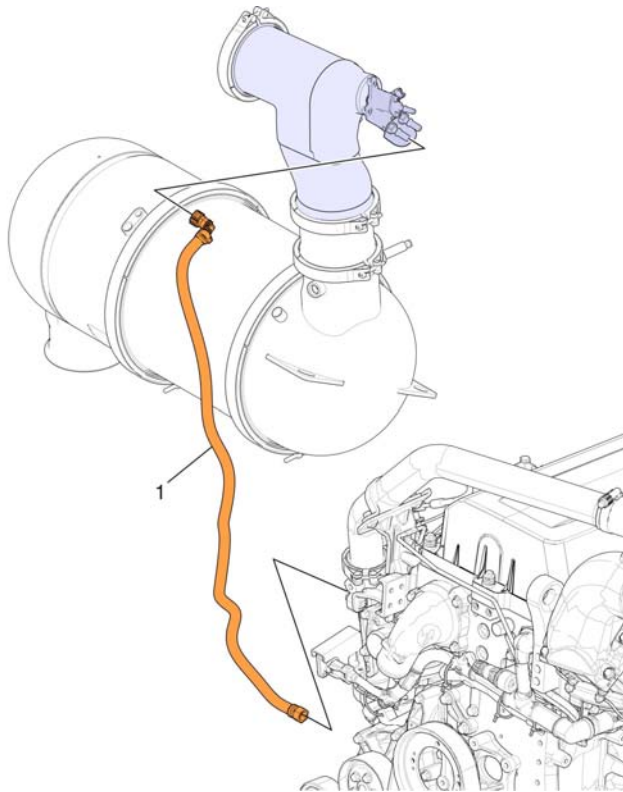
85112740

**6**

Place a suitable container under the DEF coolant hose to catch any spilled coolant during the removal procedure.

**7**

Disconnect the ends of the defective DEF coolant hose, remove it from the vehicle and discard it.



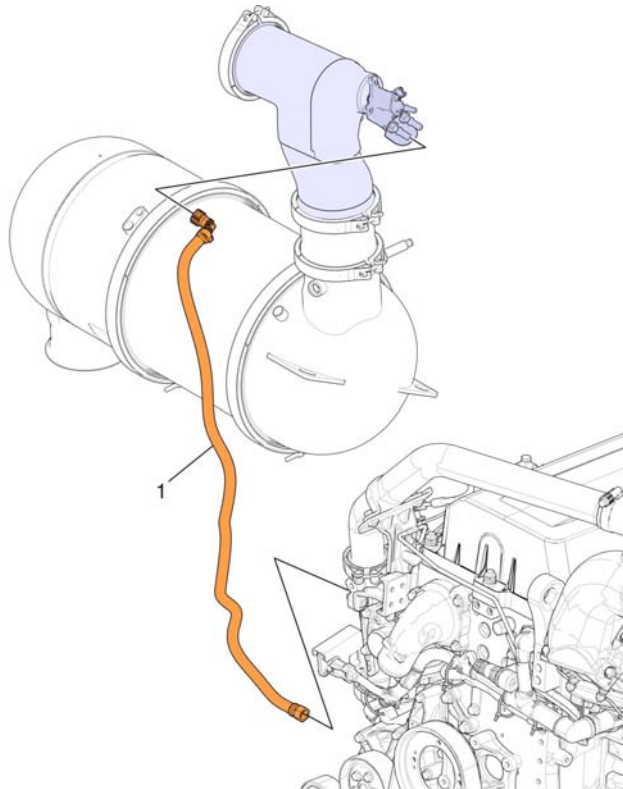
W2060367

1 DEF Coolant Hose

## Installation

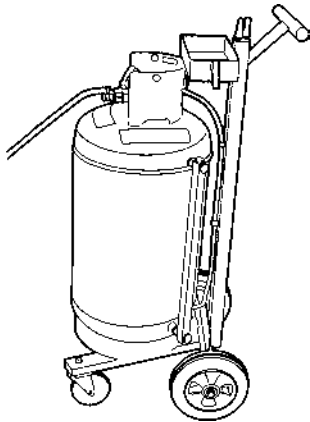
**1**

Install the replacement DEF coolant hose in the vehicle.



W2060367

1 DEF Coolant Hose



W2004191

**2**

Fill the engine cooling system with the recommended coolant using the coolant extractor.

### **⚠ DANGER**

Engine coolant is toxic and can pose a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740

**3**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**4**

Close the battery compartment access doors.

**5**

Start the engine and check for leaks and proper operation. Replenish fluids as needed.

**6**

Close both right-rear service access doors.

Date	Group	No.	Release	Page
9.2010	<b>258</b>	<b>34</b>	<b>01</b>	1(9)

## Aftertreatment Selective Catalytic Reduction (SCR) Catalyst Mounting Bracket, Replacement

PREVX

### Aftertreatment Selective Catalytic Reduction (SCR) Catalyst Mounting Bracket, Replacement



W2060060

This information provides the service procedures for replacing the Aftertreatment Selective Catalytic Reduction (SCR) Catalyst mounting bracket on the PREVOST PREVX model bus.

#### Contents

- “Special Tools”, page 2
- “Aftertreatment Selective Catalytic Reduction (SCR) Mounting Bracket, Replacement”, page 3

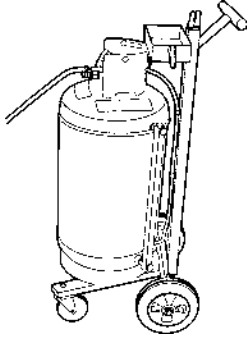
**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



# Tools

## Special Tools

For special tools ordering instructions, refer to Tool Information, Group 08.



W2004191

**85112740**  
Coolant Extractor

# Service Procedures

**2589-03-02-35**

## Aftertreatment Selective Catalytic Reduction (SCR) Mounting Bracket, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 85112740*

### Removal

**1**

Apply the parking brake and place the shift lever in neutral.

**2**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**3**

Open the rear engine service doors.

**4**

Connect the coolant extractor and drain the coolant.

#### **DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

---

85112740

**5**

Use a complete vehicle lift or jack to raise the rear axle and remove the left rear wheel. Lift the wheel skirt and remove the side panel to access the heater ball valve. Close the heater ball valve.

**6**

Open the rear side compartment to access the coolant package. Remove the grill stop.

**7**

Remove the condenser with brackets from the cooling package leaving the hoses connected.

**Note:** This step is only for vehicles with a secondary driver A/C unit.

**8**

Remove the air deflector seals around the cooling package.

**9**

Remove the upper coolant package support bracket.

**10**

Remove all coolant hoses and pipes from the coolant package. Remove the charge air cooler (CAC) pipe.

**11**

Remove the lower air deflector shield support bracket from the lower section below the coolant package.

**12**

Cut the tie straps and disconnect the electrical connector from the fan clutch. Remove the fan drive shaft fasteners at the gear box.

**13**

Remove all lower coolant package mounting fasteners.

**14**

Position the forks of a forklift under the coolant package.

**15**

With assistance, slide the coolant package out and onto the forklift. Transfer the coolant package to a secure location.

**16**

Remove the coolant expansion tank and mounting bracket as an assembly.

**17**

Relocate the A/C dryer and lines.

**18**

Remove the aftertreatment diesel particulate filter (DPF) inlet exhaust pipe.

**19**

Remove the CAC pipe from the cooler to the mixer.

**20**

Remove the heat wrap from the aftertreatment SCR catalyst as required to access the exhaust temperature sensor and clamps. Remove the temperature sensor at the aftertreatment DPF outlet. Remove the aftertreatment SCR catalyst exhaust inlet clamp and the aftertreatment DPF exhaust outlet clamp and pull the pipe away from the aftertreatment SCR catalyst.

**21**

Remove the aftertreatment SCR catalyst access door.



W2060060

**22**

Remove the fasteners and remove the roof mounted aftertreatment SCR catalyst guard.

**23**

Loosen the clamp and remove the diffuser from the aftertreatment SCR catalyst with the drain tube attached.

**24**

Disconnect the NOx sensor harness and remove the module.

**25**

Remove the aftertreatment SCR catalyst water drain pipe.

**26**

Connect a lifting chain to the lifting eyelets on the aftertreatment SCR catalyst. Position a lifting device and support the weight of the aftertreatment SCR catalyst.

**27**

Remove the aftertreatment SCR catalyst mounting fasteners (aftertreatment SCR catalyst to rubber mounts), then remove the lower U-shaped mount.

**28**

With assistance, remove the aftertreatment SCR catalyst through the lower side door where the coolant package mounts.

**29**

Remove the defective mounting bracket from the aftertreatment SCR catalyst.

## Installation

**1**

Install the replacement mounting bracket onto the replacement aftertreatment SCR catalyst. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**2**

Install a lifting chain to the lifting eyelets on the replacement aftertreatment SCR catalyst.

**3**

Using a lifting device, with assistance, install the aftertreatment SCR catalyst into the chassis through the lower side door.

**4**

Install the lower U-shaped mount, then install the aftertreatment SCR catalyst mounting fasteners (aftertreatment SCR catalyst to rubber mounts). Tighten all fasteners to specification, Refer to Function Group 20, Specifications.

**5**

Remove the lifting chain and the lifting device.

**6**

Install the aftertreatment SCR catalyst water drain pipe. Tighten to specification, refer to Function Group 20, Specifications.

**7**

Connect and install the NOx sensor wiring harness and module. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**8**

Install the diffuser to the aftertreatment SCR catalyst (with the upper drain tube attached) and install the clamp. Tighten the clamp to specification, refer to Function Group 20, Specifications.

**9**

Install the roof mounted aftertreatment SCR catalyst guard. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**10**

Install the aftertreatment SCR catalyst access door.

**11**

Clean the sealing surfaces on the aftertreatment SCR catalyst inlet, the aftertreatment DPF outlet, and the exhaust pipe between the aftertreatment DPF and the aftertreatment SCR catalyst. Using new gaskets, position the pipe between the aftertreatment SCR catalyst and the aftertreatment DPF and install new V-band clamps. Tighten the V-band clamps to specification, refer to Function Group 20, Specifications.

**12**

Install the aftertreatment DPF outlet temperature sensor. Tighten to specification, refer to Function Group 20, Specifications. Secure the heat wrap on the pipe.

**13**

With assistance, use a forklift to position the coolant package into the chassis. Install the upper mounting bracket and fasteners. Install the lower mounting fasteners (align the fan drive shaft to the gear box).

**14**

Tighten all upper and lower coolant package fasteners to specification, refer to Function Group 20, Specifications.

**15**

Install the fan drive shaft fasteners at the gear box and connect the electrical connector. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**16**

Install the fitting that was removed from the top of the radiator. Connect all coolant hoses and pipes to the coolant package. Install the CAC pipe. Tighten the coolant and CAC hose clamps to specification, refer to Function Group 20, Specifications.

**17**

Install the air deflector lower mounting cross bar and seals around the coolant package.

**18**

Install the condenser with brackets to the cooling package. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**Note:** This step is only for vehicles with a secondary driver A/C unit.

**19**

Install the coolant package access door grill stop. Tighten the fasteners to specification. Refer to Function Group 20, Specifications.

**20**

Close the side compartment door.

**21**

Position and secure the A/C dryer and lines.

**22**

Clean the sealing surfaces on the flex pipe and the aftertreatment DPF inlet pipe. Using a new gasket, position the pipe and install a new V-band clamp. Tighten the V-band clamp to specification, refer to Function Group 20, Specifications. Pull the heat wrap over the V-band clamp and secure.

**23**

Secure the aftertreatment diesel exhaust fluid (DEF) dosing valve coolant lines to the bracket on the left side of the aftertreatment DPF.

**24**

Install the coolant expansion tank and mounting bracket as an assembly. Reconnect all hoses to the expansion tank. Connect the coolant level sensor wiring harness connector and secure the wiring harness with tie straps.

**25**

Fill the cooling system with the recommended coolant using the coolant extractor.

---

85112740

**26**

Open the heater ball valve.

**27**

Install the access panel behind the left rear wheel. Install the left rear wheel and lower the vehicle.

**28**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**29**

Start the engine, check for leaks and proper operation.

**30**

Close the rear engine service doors.



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## Air Regulator, Aftertreatment Doser, Replacement

B13R, PREVH, PREVX

## Air Regulator, Aftertreatment Doser, Replacement

This information covers replacement of the aftertreatment doser air regulator on VOLVO model B13R, PREVH and PREVX buses.

### Contents

- "Air Regulator, Aftertreatment Doser, Replacement", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only, and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2585-03-02-08**

## Air Regulator, Aftertreatment Doser, Replacement

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## Replacement

**1**

Open the rear engine service doors.

**2**

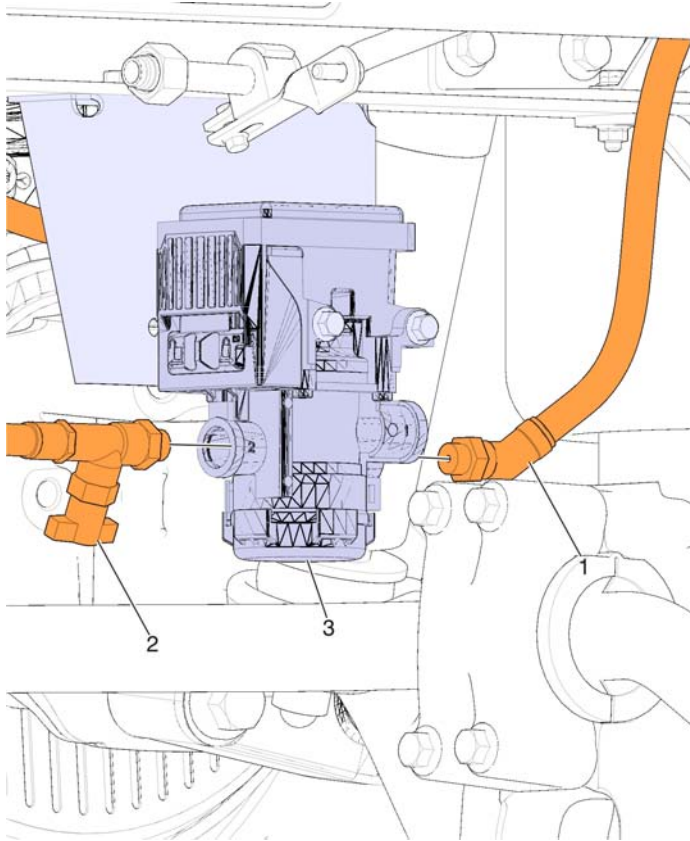
Set the engine disable switch to "OFF".

**3**

### **DANGER**

Before beginning any work on any part of the air system, be certain that the air pressure has been released. Failure to do so may cause a component to violently separate, which can result in serious personal injury.

Drain the air system.



W2060869

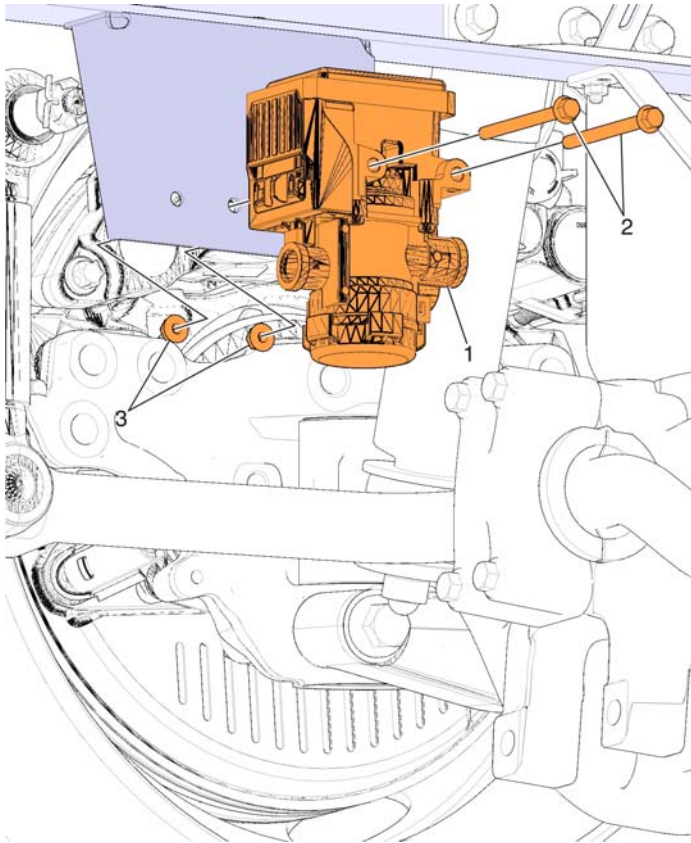
- 1 Harness
- 2 Air Line
- 3 Air Regulator

**4**

Remove cable ties as necessary from the harness (1) and air line (2) in the area around the aftertreatment doser air regulator (3). Then disconnect the harness (1) and the air line (2) from the air regulator (3).

**Note:** On B13R model buses the air regulator location is behind the left rear wheel inside the frame.

**Note:** On PREVH and PREVX model buses the air regulator location is on the cold side of the engine inside the engine cradle frame.

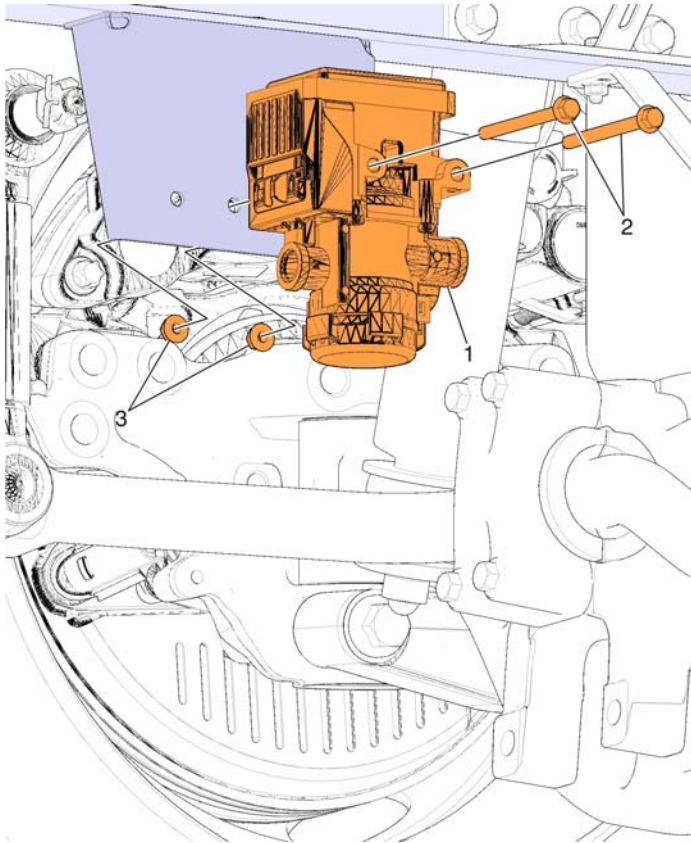


W2060870

- 1 Air Regulator
- 2 Fastener Bolts
- 3 Fastener Nuts

**5**  
Remove the air regulator fasteners (2, 3) and air regulator (1).

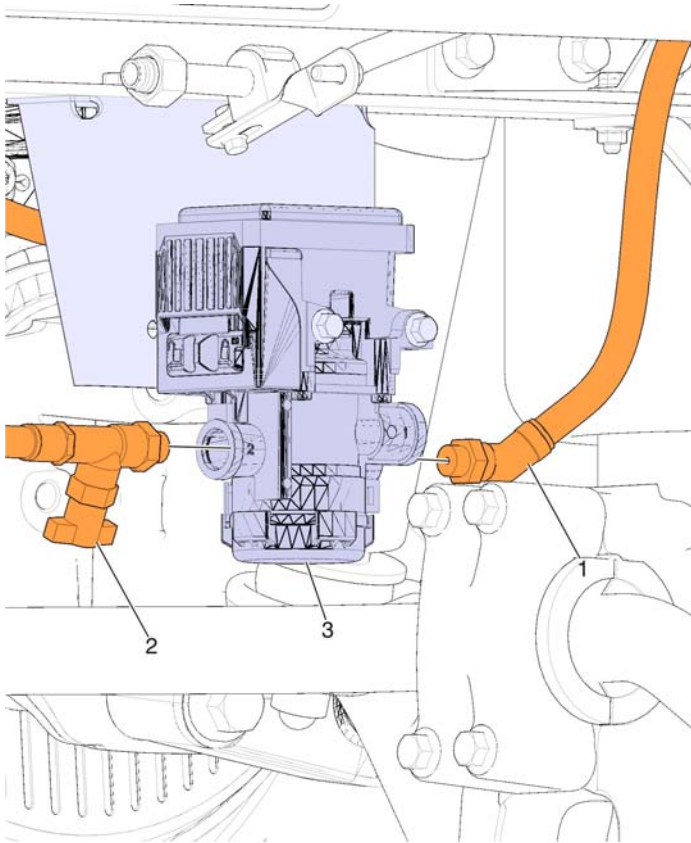
**6**  
Transfer the air regulator fittings.



**7**  
Install the replacement air regulator (1) with the fasteners (2, 3).

W2060870

- 1 Air Regulator
- 2 Fastener Bolts
- 3 Fastener Nuts



W2060869

- 1 Harness
- 2 Air Line
- 3 Air Regulator

**8**  
Connect the harness (1) and the air line (2) to the air regulator (3). Install cable ties as necessary.

**9**  
Set the engine disable switch to "ON".

**10**  
Pressurize the air system and check for leaks.

**11**  
Close the rear engine service doors.

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Aftertreatment Doser, Clean

PREVX

## Doser, Aftertreatment, Clean

This information covers cleaning of the aftertreatment doser used for the aftertreatment system on Prevost PREVX model buses. Do not drain the coolant or remove the coolant lines to the aftertreatment doser to clean the doser.

### Contents

- “Aftertreatment Doser, Clean”, page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2584-11-02-01**

## Aftertreatment Doser, Clean

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

You must read and understand the precautions and guidelines in Service Information, Groups 20 and 30, "General Safety Practices", before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## Cleaning

**1**

Apply the parking brake and place the shift lever in neutral.

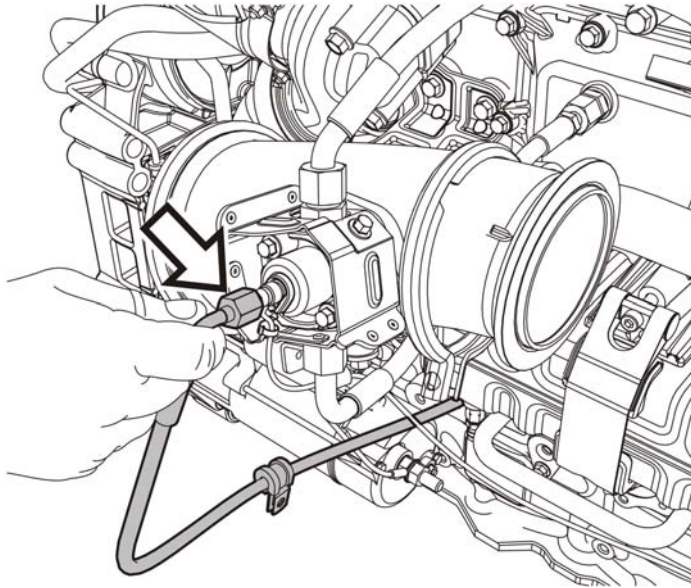
**2**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**3**

Remove P-clamp bolts securing the aftertreatment doser harness and fuel line.





W2005656

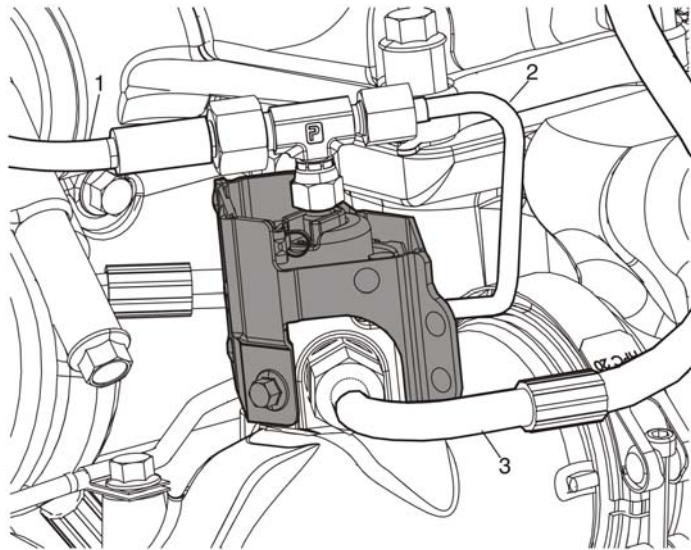
4

**CAUTION**

Do not kink the fuel and coolant lines. Kinking the lines may result in leakage.

If the doser is not equipped with a two-way check valve, disconnect the aftertreatment doser fuel supply line. Collect any residual fuel that might be in the fuel line in a suitable container. If equipped, remove the fuel line clamp at turbocharger diffuser and discard the clamp and screw.

**Note:** The coolant lines and coolant do not need to be removed for aftertreatment doser cleaning.



W2006759

- 1 Air Line
- 2 Fuel Line
- 3 Coolant Line

5

**CAUTION**

Do not kink the fuel and coolant lines. Kinking the lines may result in leakage.

If the doser is equipped with a two-way check valve, remove the two-way check valve.

**Note:** The coolant lines and coolant do not need to be removed for aftertreatment doser cleaning.



W2053647

Aftertreatment Doser Inlet Screen

**6**

 **CAUTION**

Always use a fine nylon or brass brush to scrub the aftertreatment doser inlet screen. Do not use a steel bristle brush to clean the doser inlet screen. A steel bristle brush will damage the injector and could lead to leakage.

Inspect the inlet screen to the aftertreatment doser. If it is filled with carbon, spray carburetor cleaner on the doser screen and use a fine nylon or brass brush to scrub the screen repeatedly. Repeat as necessary to clean all carbon off of the screen.

**7**

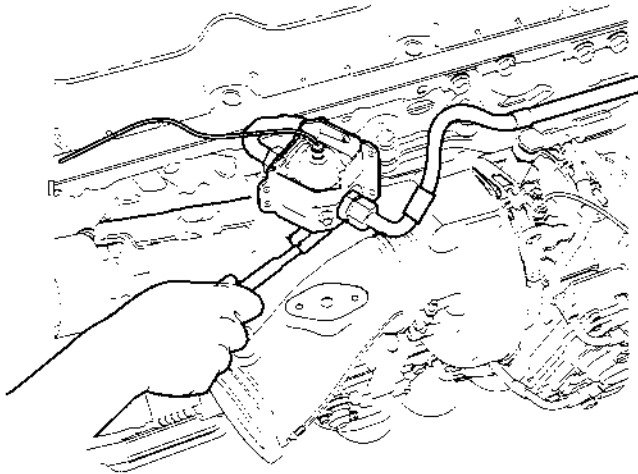
Remove and discard the aftertreatment doser mounting bolts and spacers. Remove the doser from the diffuser pipe (which attaches to the turbocharger outlet).

**8**

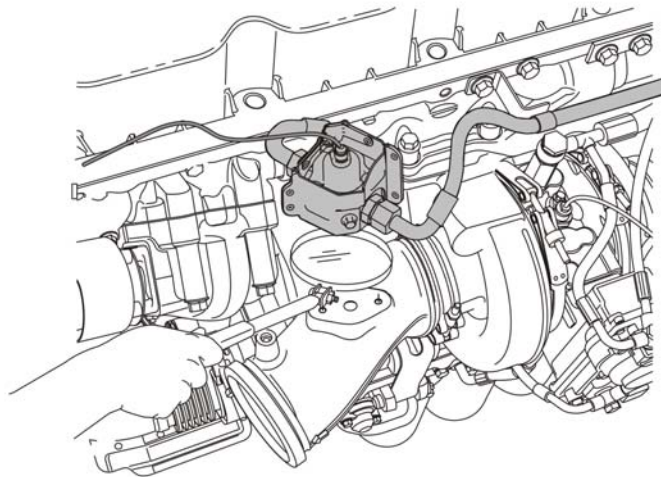
Cover the hole in the diffuser pipe to prevent dirt and cleaning solution from entering the exhaust system.

**9**

Remove and discard the high-temperature gasket and steel plate gasket from the bottom of the doser.



W2006496



W2006436

10

**CAUTION**

Only high quality carburetor cleaner should be used to clean the doser. Other cleaners, such as brake cleaner products, do not work and may contain chlorine, which could damage the catalyst if they enter the exhaust system.

**CAUTION**

Only use a nylon brush to clean the doser tip. Do not use a brass or steel brush. Damage to the doser tip may result.

Turn the aftertreatment doser body to allow the doser tip to be sprayed with carburetor cleaning solution. Brush the doser tip with a stiff bristled nylon "tooth" brush. Repeat two or three times.

11

Inspect the doser tip. Use a mirror if a clear view of the tip is not possible.

12

Install a new high-temperature gasket and steel plate gasket onto the bottom of the aftertreatment doser.

13

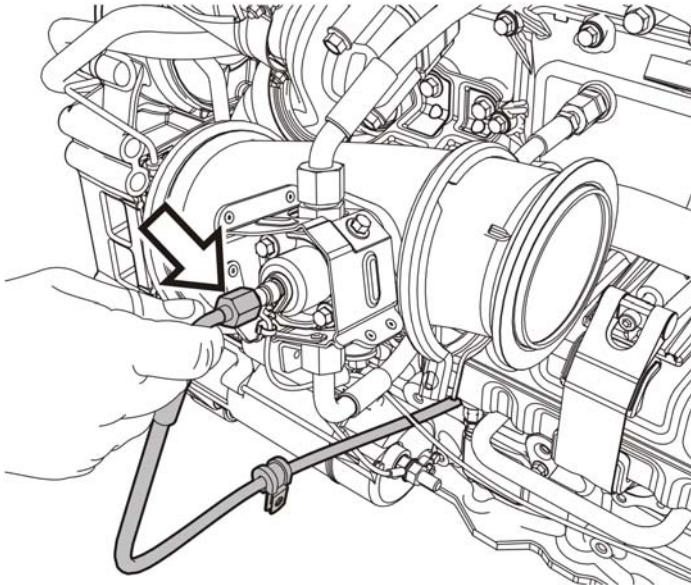
Apply high-temperature nickel-graphite anti-seize compound (part number 1161929 or equivalent) to the new doser mounting bolt threads and insert the bolts into the spacers.

**14**

Secure the doser mounting bolts. Tighten the bolts to specification, refer to Function Group 200, Specifications.

**15**

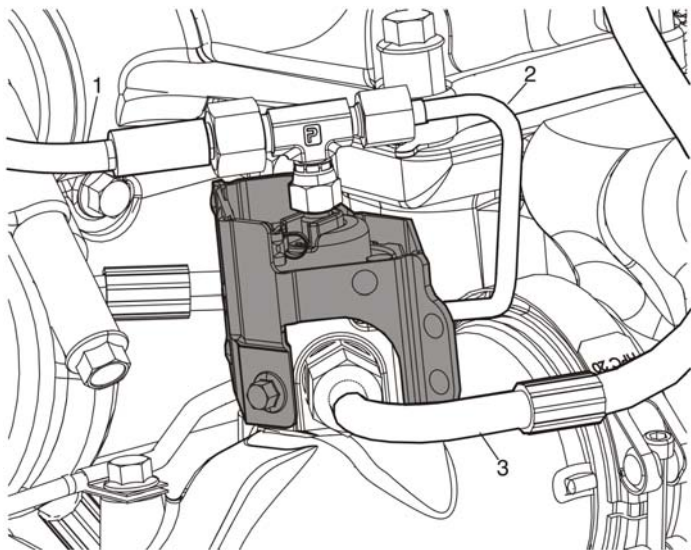
If the doser is not equipped with a two-way check valve, connect the aftertreatment doser fuel supply line. Tighten the fuel line fitting to specification, refer to Function Group 200, Specifications.



W2005656

**16**

If the doser is equipped with a two-way check valve, use carburetor cleaner and shop air to clean the aftertreatment doser and two-way check valve threads.



W2006759

- 1 Air Line
- 2 Fuel Line
- 3 Coolant Line

**17**

 **CAUTION**

Only apply Loctite to the top threads of the aftertreatment doser. Loctite on the flare or injector tip will damage the aftertreatment doser.

Apply two drops of Loctite 271 180 degrees apart on the top threads of the doser. While securing the check valve with a wrench, tighten the check valve swivel nut to specification, refer to Function Group 200, Specifications.

**18**

Install P-clamp bolts securing the aftertreatment doser harness and fuel line. If equipped, install new silicone, clamp, and screw securing fuel line to turbocharger diffuser.

**19**

If removed, install the inner splash guard assembly.

**20**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**21**

Connect the Tech Tool to the vehicle and perform the aftertreatment diagnostics function test in VCADS. Activate the fuel shut-off solenoid and check for leaks.

**22**

Use the scan tool to reset the aftertreatment doser adaptive factor. Use Guided Diagnostics to read and clear all diagnostic trouble codes (DTCs).

**23**

Perform a complete service regeneration. Check for leaks and proper operation during the regeneration.

**24**

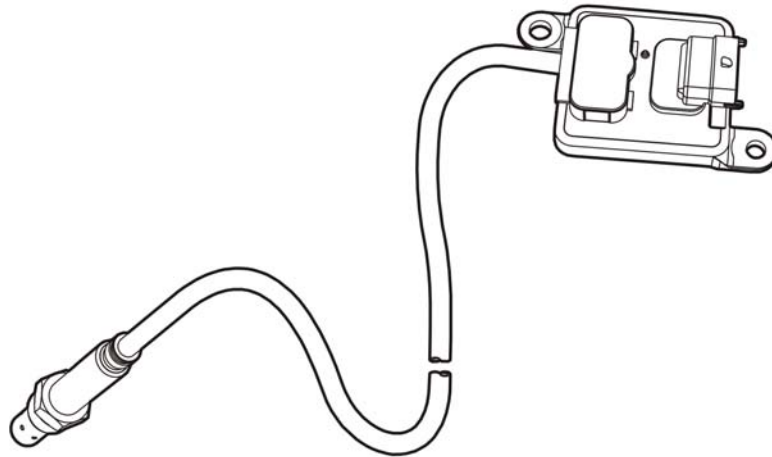
After shutdown, replenish fluids as necessary. Re-check the doser fuel line fitting and make sure it is tightened to specification.

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NOx Sensor and Control Module,  
Replacement, Exhaust Outlet Pipe

PREVH, PREVX, B13R

## NOx Sensor and Control Module, Replacement, Exhaust Outlet Pipe



W2006481

This information covers replacement of the outlet NOx sensor and control module used in the exhaust aftertreatment system on VOLVO model PREVH, PREVX, B13R buses.

### Contents

- "NOX Sensor, Replacement", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

## 2589-03-02-10 NOX Sensor, Replacement

### Exhaust Outlet Pipe

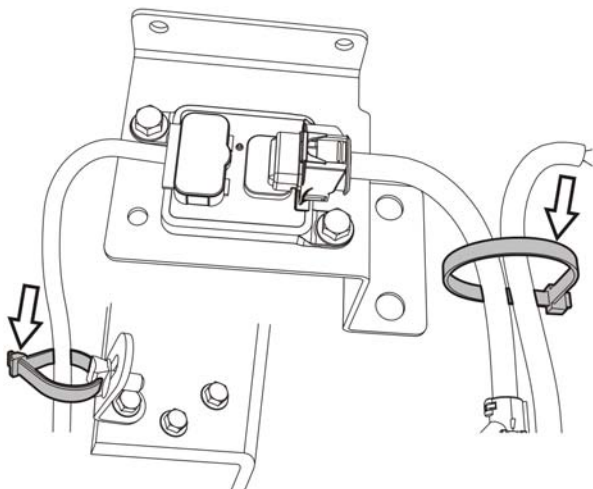
#### **DANGER**

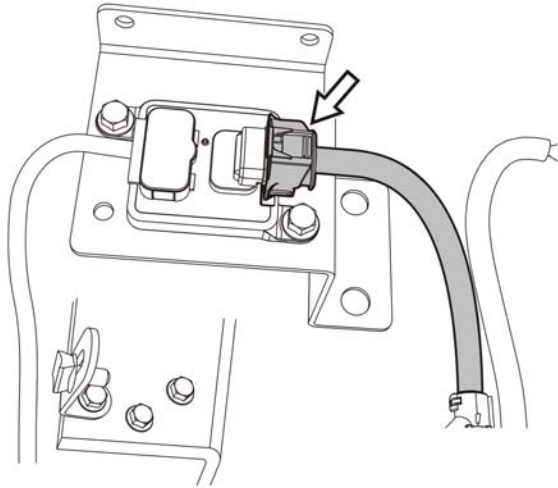
Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## Removal

- 1**  
Open the rear engine service doors.
- 2**  
Set the engine disable switch to "OFF".
- 3**  
Open the left rear selective catalytic reduction (SCR) access door.
- 4**  
Remove all tie straps that attach the harness connector and the sensor lead.

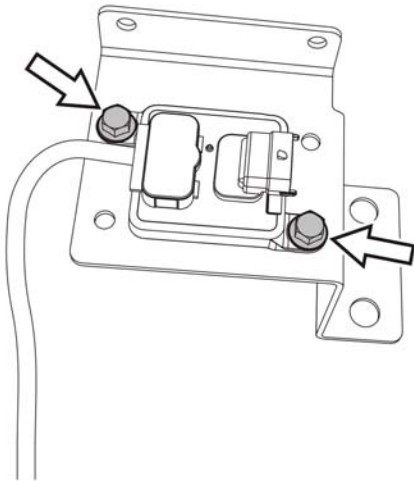




W2006483

**5**

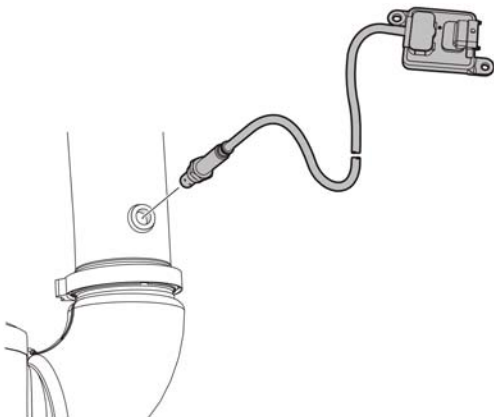
Disconnect the harness from the NOx control module.



W2006484

**6**

Remove the control module mounting fasteners.



W2006486

**7**

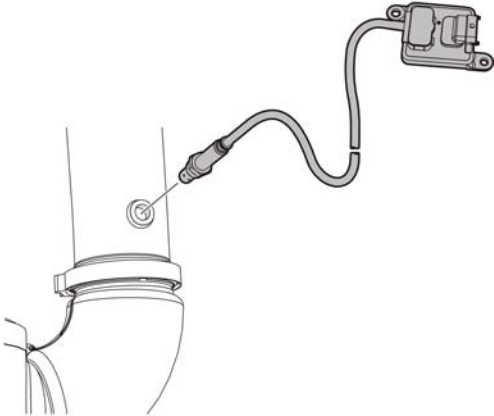
Remove the NOx sensor from the exhaust outlet pipe.



## Installation

**1**

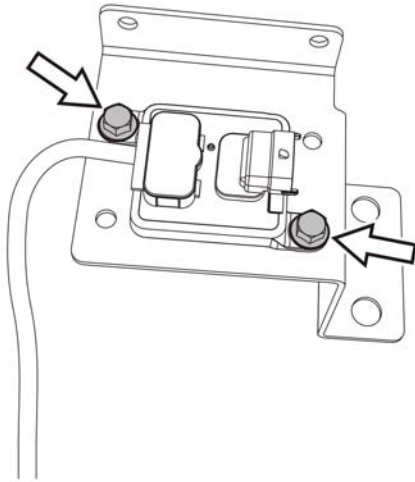
Install the replacement NOx sensor in the exhaust outlet pipe.



W2006486

**2**

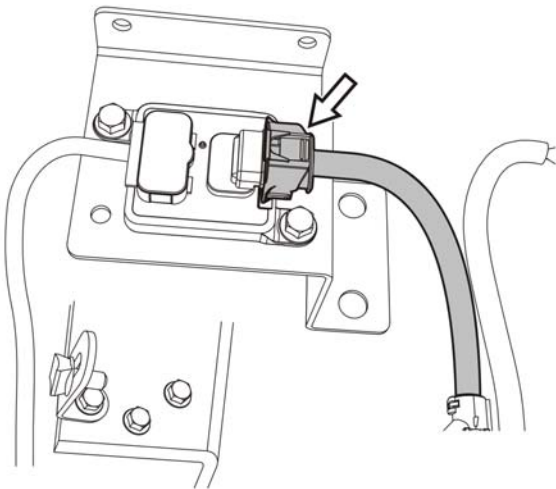
Install the control module mounting fasteners.



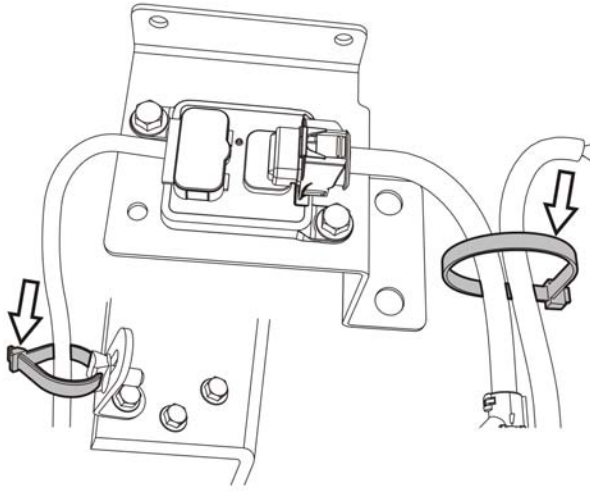
W2006484

**3**

Connect the harness to the control module.



W2006483



W2006482

**4**

Attach the harness and the sensor lead with tie straps.

**5**

Set the engine disable switch to "ON".

**6**

Connect the Tech Tool, clear diagnostic trouble codes (DTCs) and check operation.

**7**

Close the left rear selective catalytic reduction (SCR) access door.

**8**

Close the rear engine service doors.

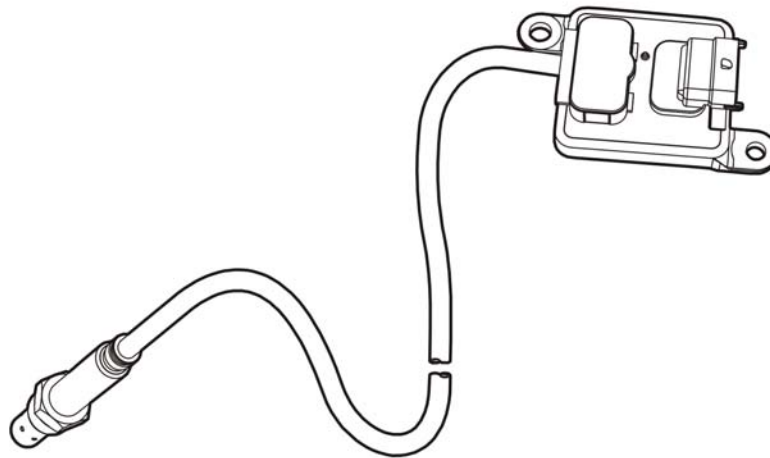
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## NOx Sensor and Control Module, Replacement

Selective Catalytic Reduction (SCR) Inlet

PREVH, PREVX, B13R

## NOx Sensor and Control Module, Replacement, Selective Catalytic Reduction (SCR) Inlet



W2006481

This information covers replacement of the NOx sensor and control module used in the exhaust aftertreatment system on VOLVO model PREVH, PREVX, B13R buses.

### Contents

- “NOx Sensor and Control Module, Replacement”, page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2589-03-02-11**

## NOX Sensor and Control Module, Replacement

### SCR Inlet

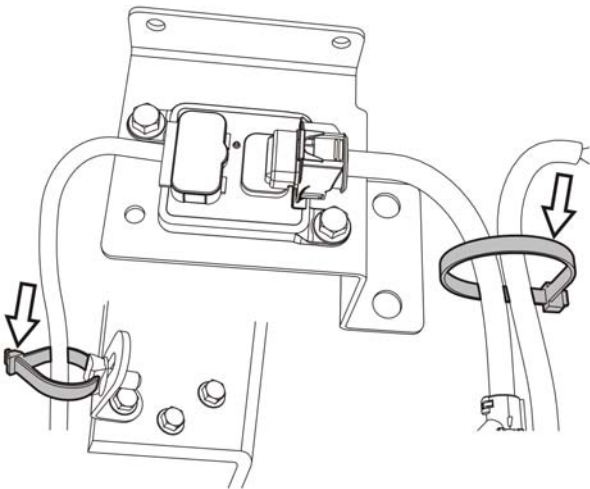
#### **DANGER**

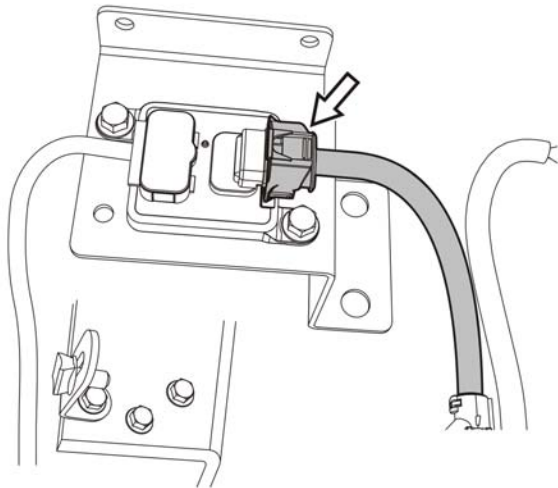
Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

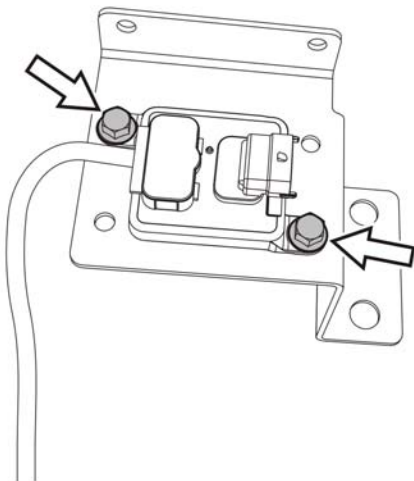
- 1**  
Open the rear engine service doors.
- 2**  
Set the engine disable switch to "OFF".
- 3**  
Remove the insulation from around the diesel particulate filter (DPF) outlet pipe and doser.
- 4**  
Remove all tie straps that attach the harness connector and the sensor lead.





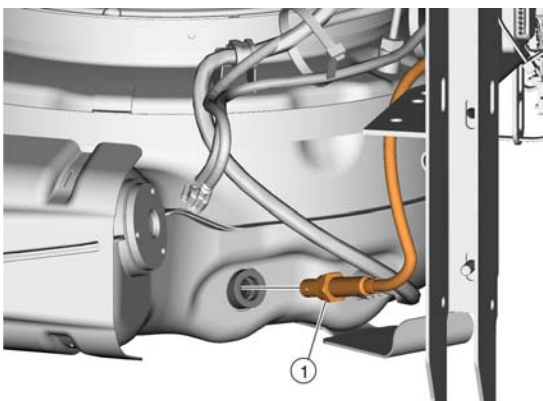
W2006483

**5**  
Disconnect the harness from the NOx control module.



W2006484

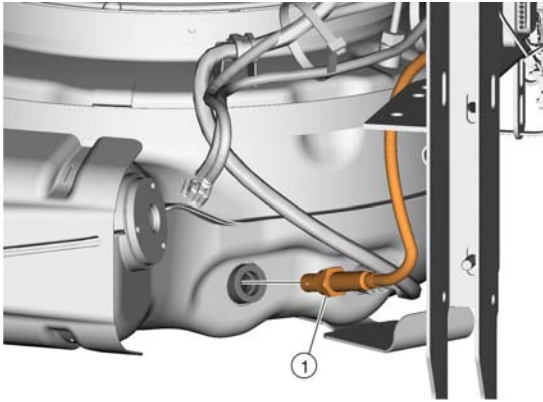
**6**  
Remove the control module mounting fasteners.



W2055427

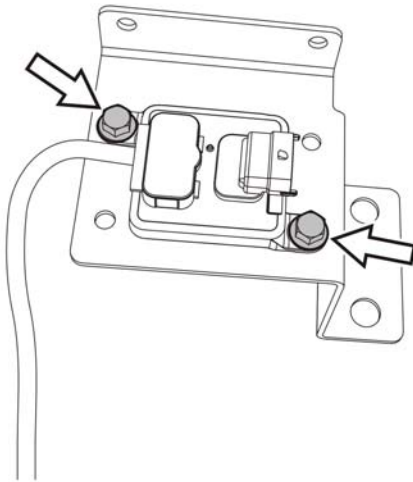
**7**  
Remove the NOx sensor (1).

## Installation



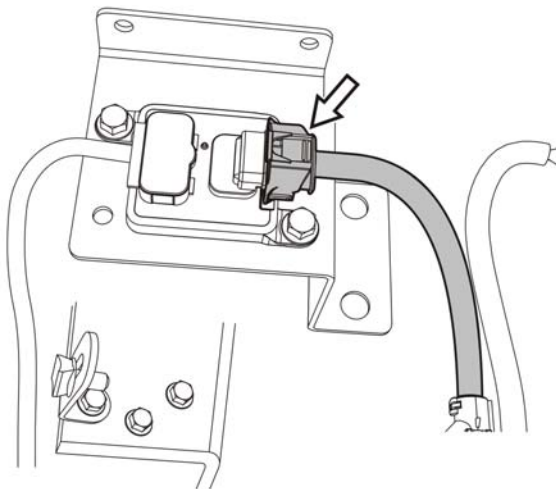
W2055427

- 1**  
Install the NOx sensor (1).



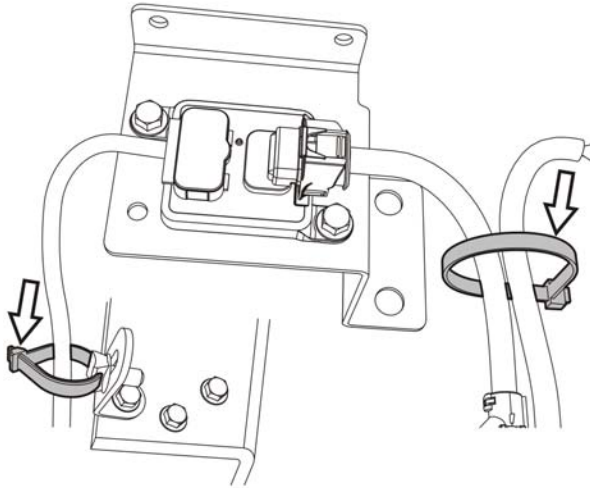
W2006484

- 2**  
Install the control module mounting fasteners.



W2006483

- 3**  
Connect the harness to the control module.



W2006482

**4**

Attach the harness and the sensor lead with tie straps.

**5**

Install insulation around the DPF outlet pipe and doser.

**6**

Set the engine disable switch to "ON".

**7**

Connect the Tech Tool, use guided diagnostics to read and clear any diagnostic trouble codes (DTCs) and check operation.

**8**

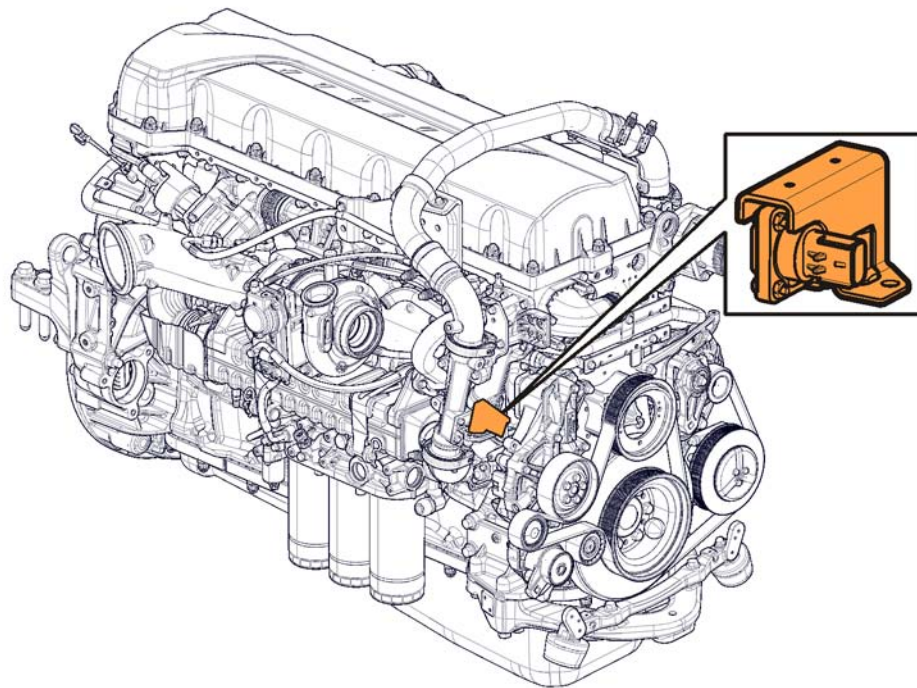
Close the rear engine service doors.

Date	Group	No.	Release	Page
9.2010	<b>258</b>	<b>55</b>	<b>01</b>	1(4)

### Aftertreatment Diesel Particulate Filter (DPF) Differential Pressure Sensor, Replacement

B13R, PREVH, PREVX

## Aftertreatment Diesel Particulate Filter (DPF) Differential Pressure Sensor, Replacement



T2058786

This information covers replacement of the aftertreatment diesel particulate filter (DPF) differential pressure sensor used in the exhaust aftertreatment system on VOLVO buses.

### Contents

- “Aftertreatment DPF Differential Pressure Sensor, Replacement”, page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.



# Service Procedures

**2589-03-02-12**

## Aftertreatment DPF Differential Pressure Sensor, Replacement

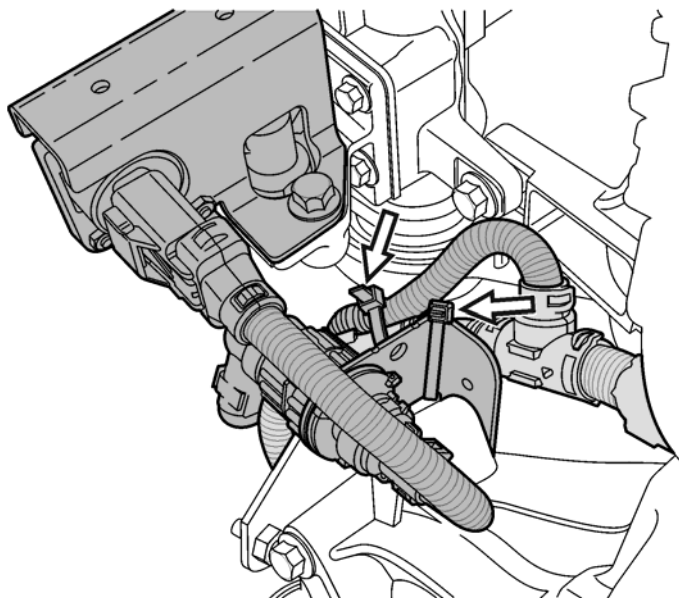
 **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

- 1**  
Open the rear engine service doors.
  
- 2**  
Set the engine disable switch to "OFF".



W2057041

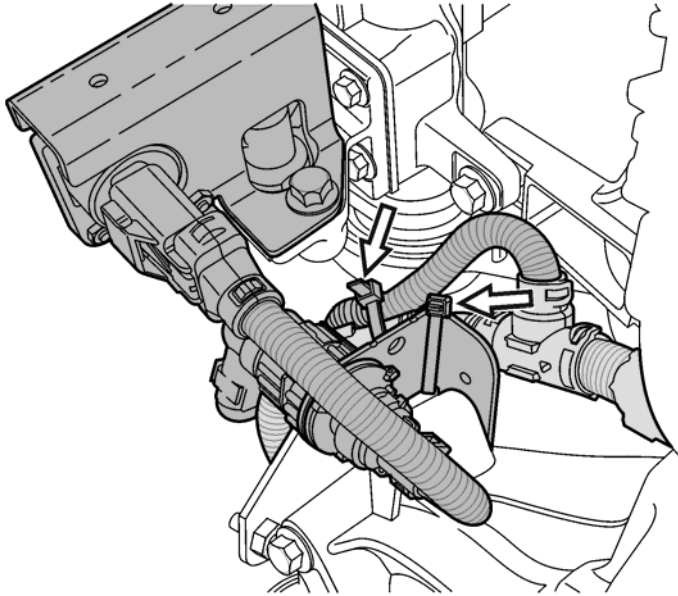
**3**

Remove the tie straps that attach the harness connector, the diesel particulate filter (DPF) differential pressure sensor lead, and harness in the area around the sensor. Disconnect the harness from the sensor.

**4**

Remove the DPF differential pressure sensor mounting fasteners. Remove the sensor from the hose connections.

## Installation



W2057041

**1**

Install the replacement diesel particulate filter (DPF) differential pressure sensor to the hose connections. Install the sensor mounting fasteners.

**2**

Connect the harness to the DPF differential pressure sensor. Install tie straps where necessary to attach the harness connector, sensor lead, and harness in the area around the sensor.

**3**

Set the engine disable switch to "ON".

**4**

Connect the Tech Tool, use Guided Diagnostics to read and clear any diagnostic trouble codes (DTCs) and check operation.

**5**

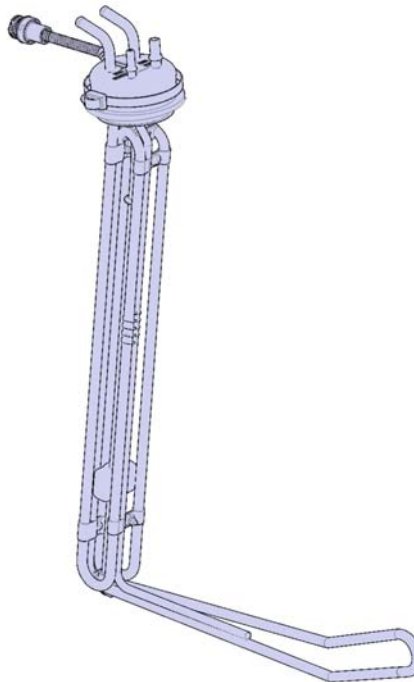
Close the rear engine service doors.

Date	Group	No.	Release	Page
9.2010	<b>258</b>	<b>56</b>		1(4)

## Aftertreatment Diesel Exhaust Fluid Tank (DEF) Level Sensor Replacement

B13R, PREVH, PREVX

### Aftertreatment Diesel Exhaust Fluid Tank (DEF) Level Sensor, Replacement



W2060194

This service bulletin provides the procedure for replacing the fluid level sensor in the aftertreatment diesel exhaust fluid (DEF) tank on VOLVO buses.

#### Contents

- "Aftertreatment Diesel Exhaust Fluid Tank (DEF) Level Sensor, Replacement", page 2 .

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2589-03-02-05 Aftertreatment Diesel Exhaust Fluid Tank (DEF) Level Sensor, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

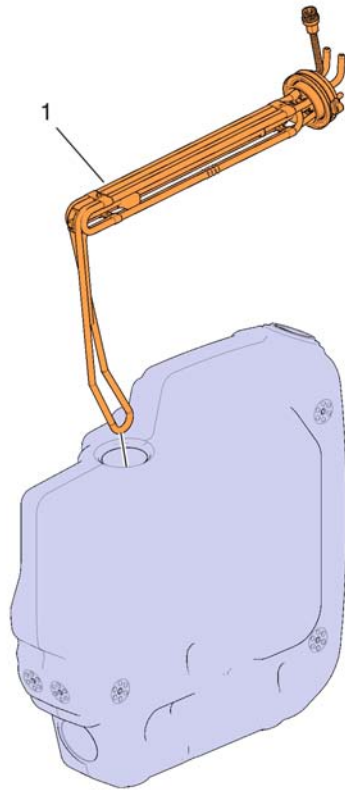
### **DANGER**

Before working on a vehicle, set the parking brake, place the I-Shift transmission in Neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

## Removal

1

Remove the DEF tank. Refer to Function Group 258 for procedure.



- 2**  
Loosen the clamp securing the DEF level sensor in the DEF tank and remove the level sensor from the DEF tank.

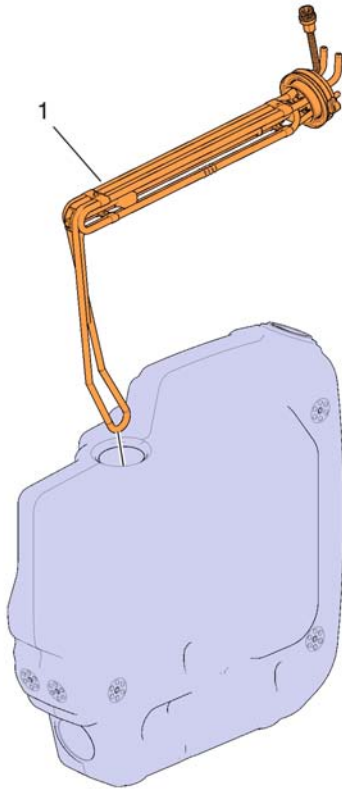
W2060200

1 DEF Level Sensor

## Installation

**1**

Position the replacement level sensor in the DEF tank and tighten the clamp to secure it in place.



W2060200

1 DEF Level Sensor

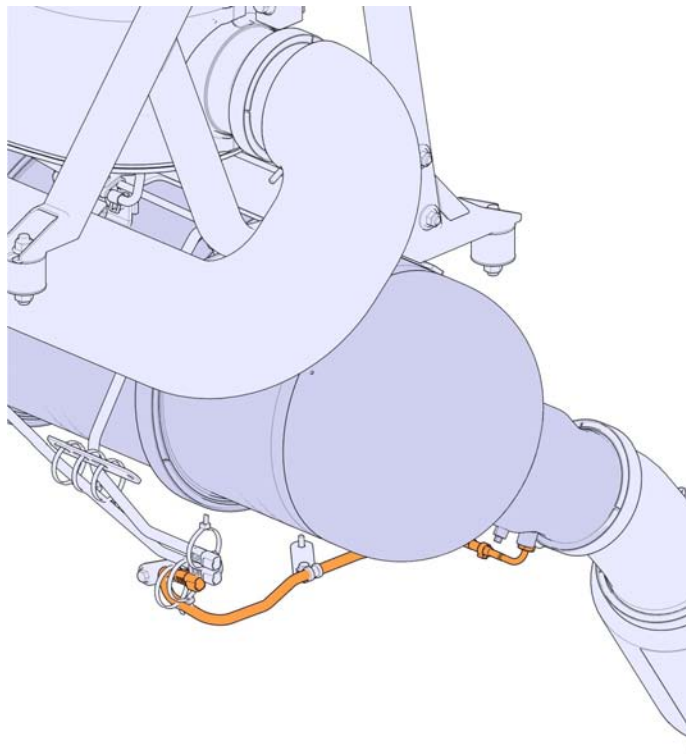
**2**

Install the DEF tank. Refer to Function Group 258 for service procedure.

Date	Group	No.	Release	Page
9.2010	<b>258</b>	<b>65</b>	<b>01</b>	1(5)

## Exhaust Temperature Sensor, Replacement

### Exhaust Temperature Sensor, Replacement



W2060426

This service bulletin covers the procedure for replacing the exhaust temperature sensor on the VOLVO bus.

### Content

- “Exhaust Temperature Sensor, Replacement”, page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



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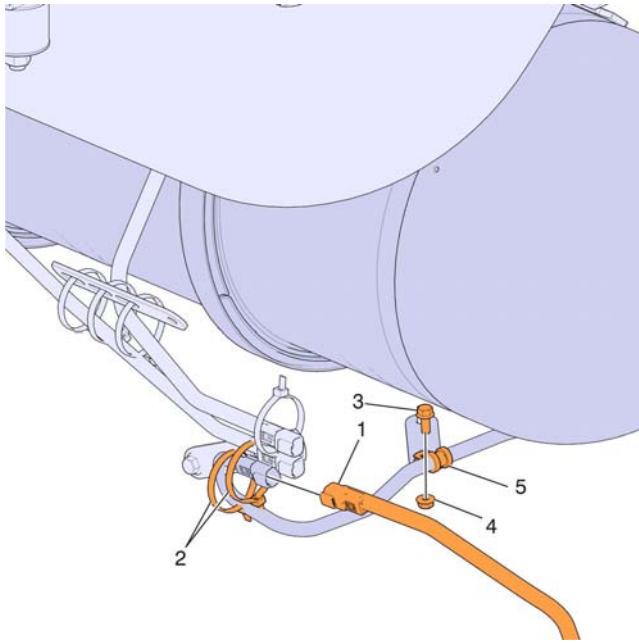
## **2589-03-02-03**

# **Exhaust Temperature Sensor, Replacement**

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## **Removal**

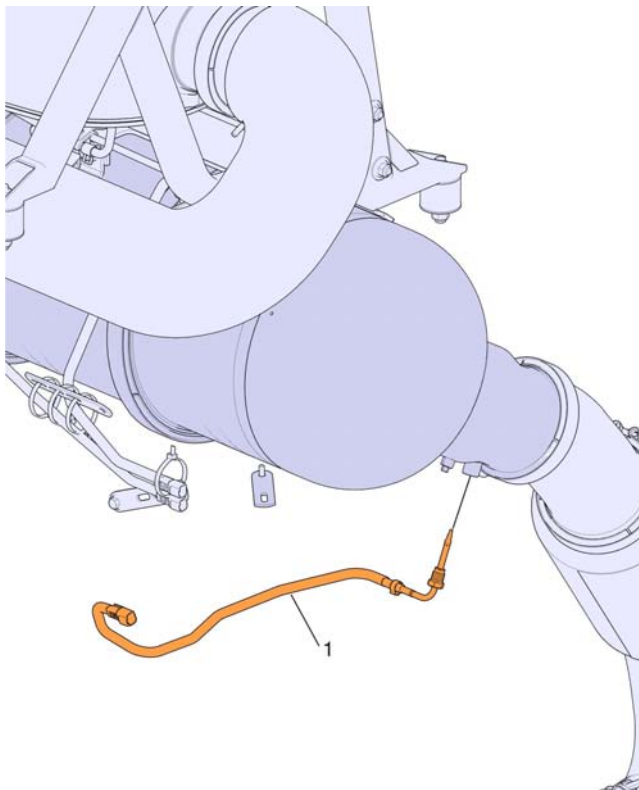
- 1**  
Apply the parking brake and place I-Shift shifter in neutral.
- 2**  
Open the battery compartment access doors.
- 3**  
Disconnect all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.
- 4**  
Open the rear engine service doors.
- 5**  
Remove or pull back insulation to access exhaust temperature sensor.
- 6**  
Cut cable ties.



W2060427

- 1 Electrical Harness
- 2 Cable Tie
- 3 Screw
- 4 Nut
- 5 Clamp

**7**  
Remove clamps and disconnect the wiring harness connector from the exhaust temperature sensor.



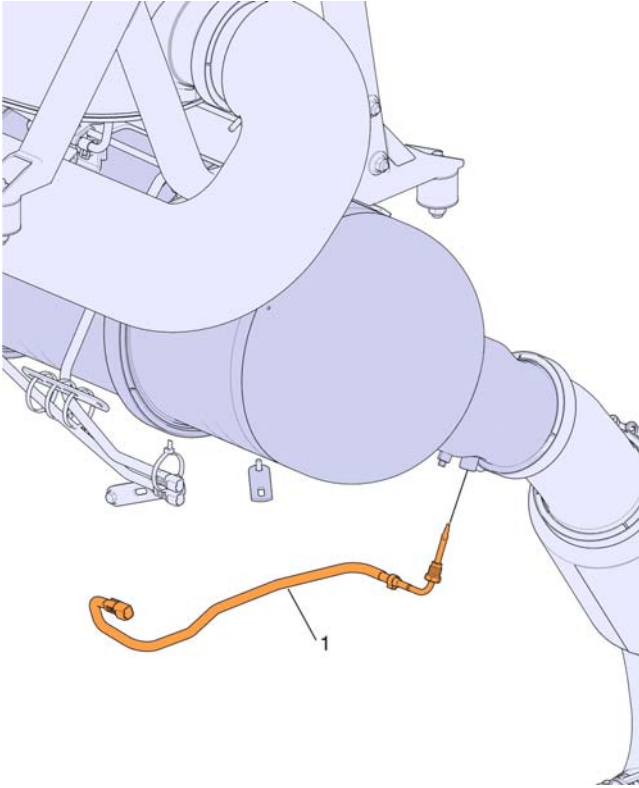
W2060428

- 1 Sensor

**8**  
Remove the defective temperature sensor.

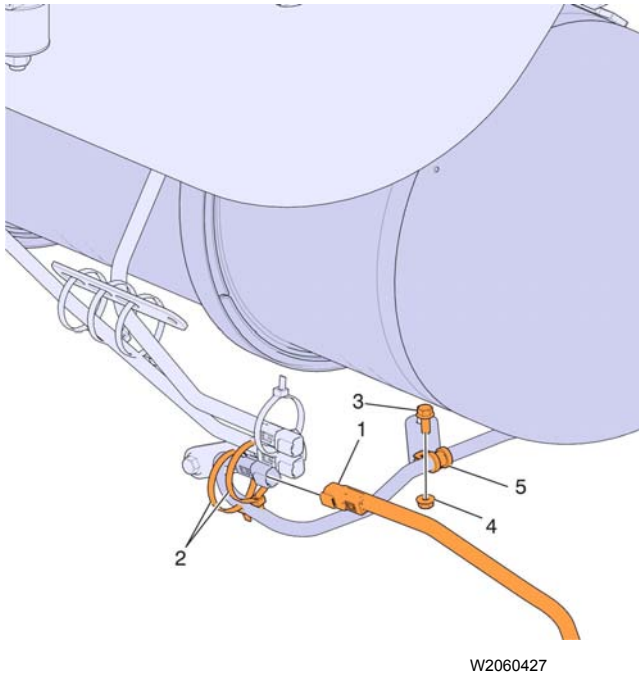
## Installation

- 1**  
Clean the exhaust temperature sensor contact surface.
- 2**  
Install the replacement exhaust temperature sensor.



W2060428

1 Sensor



- 1 Electrical Harness
- 2 Cable Tie
- 3 Screw
- 4 Nut
- 5 Clamp

**3**  
Reconnect the wiring harness connector to the exhaust temperature sensor and install clamps.

**4**  
Secure the wiring harness with cable ties.

**5**  
Reconnect all previously removed cables to the negative (ground) battery terminals.

**6**  
Start the engine and check for function and leaks.

**7**  
Connect Tech Tool to the vehicle. Use Guided Diagnostics to read and clear any diagnostic trouble codes (DTCs).

**8**  
Install insulation, if removed.

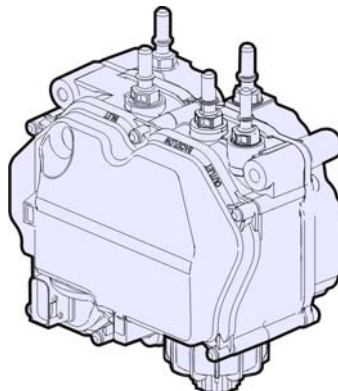
**9**  
Close the battery compartment access doors.

**10**  
Close the rear engine service doors.

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8.2010	<b>258</b>	<b>75</b>	<b>01</b>	1(5)

## Filter, Diesel Exhaust Fluid (DEF), Replacement

### Filter, Diesel Exhaust Fluid (DEF), Replacement



W2054664

This information provides the correct procedure for replacing the Diesel Exhaust Fluid (DEF) filter in the DEF pump on Volvo US2010 emissions compliant vehicles.

#### Content

- "Filter, Diesel Exhaust Fluid (DEF), Replacement", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2583-03-02-01 Filter, Diesel Exhaust Fluid (DEF), Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

**1**

Apply parking brake and place shift lever in neutral.

**2**

Open rear engine service doors.

**3**

Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

For Prevost vehicles, open the right service door at the air conditioner evaporator. For B13R vehicles, open the right rear service door.

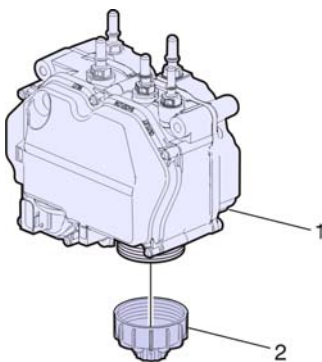
**5**

**Note:** For information on the handling of DEF fluid, refer to "General Safety Practices", Group 20.

**Note:** Before you loosen the filter cover, place a suitable container under the DEF tank to catch fluid that may drain from the pump.

Clean the area around filter cover. Loosen and remove filter cover.

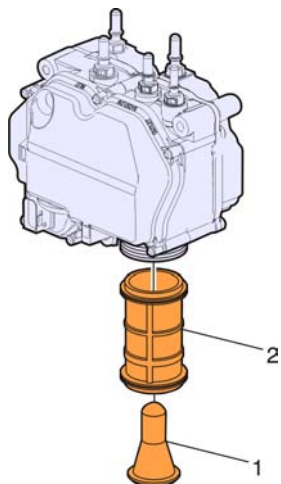
**Note:** Protect the filter area and housing from contamination.



W2055441

1 Pump

2 Filter Cover



**6**  
Use needle nose pliers to carefully remove the equalizer and filter element. Do not damage the sealing surface on the housing.

W2054663

- 1 Equalizer
- 2 Filter Element



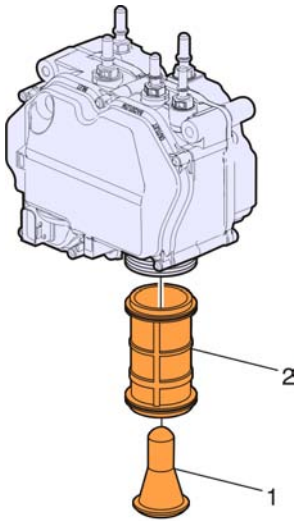
W2057577

## Installation

1

**Note:** Insure that the sealing surface of the housing is clean.

Install new filter element and equalizer.



W2054663

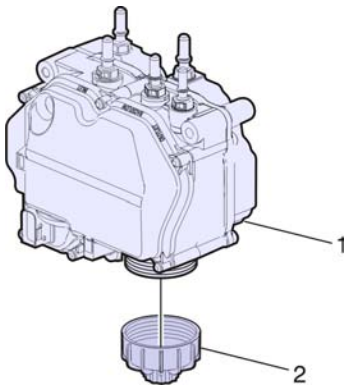
1 Equalizer

2 Filter Element

2

**Note:** Check the filter cover and housing for damage. If either the filter cover or housing are damaged the damaged part must be replaced.

Install filter cover and tighten to specification, refer to Specifications in Group 20.



W2055441

1 Pump

2 Filter Cover

3

Install all previously removed cables to the ground (negative) battery terminals.

4

Properly dispose of any DEF drained from the filter opening. Do not reuse.

5

Clean any DEF residue from the pump assembly. Start the engine and verify no leaks at the filter cover.



**6**

For Prevost vehicles, close the right service door at the air conditioner evaporator. For B13R vehicles, close the right rear service door.

**7**

Close rear engine service doors.

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Aftertreatment Diesel Exhaust Fluid (DEF)  
Line, Electrically Heated  
Replacement (At Tank)

PREVX

## Aftertreatment Diesel Exhaust Fluid (DEF) Line, Electrically Heated, Replacement (At Tank)

This service bulletin covers the procedure for replacing an electrically-heated aftertreatment DEF line that connects the DEF pump to the DEF tank level sensor and is used on VOLVO PREVX model buses.

### Contents

- “Aftertreatment Diesel Exhaust Fluid (DEF) Line, Electrically Heated, Replacement (At Tank)”, page 2 .

**Note:** Information is subject to change without notice.

Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2589-03-02-09

# Aftertreatment Diesel Exhaust Fluid (DEF) Line, Electrically Heated, Replacement (At Tank)

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

### **DANGER**

Before working on a vehicle, set the parking brake, place the I-Shift transmission in Neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

## Removal

**1**

Apply the parking brake and place the I-Shift selector in Neutral.

**2**

Open both right-rear engine access service doors to access the aftertreatment DEF tank, DEF pump and DEF lines.

**3**

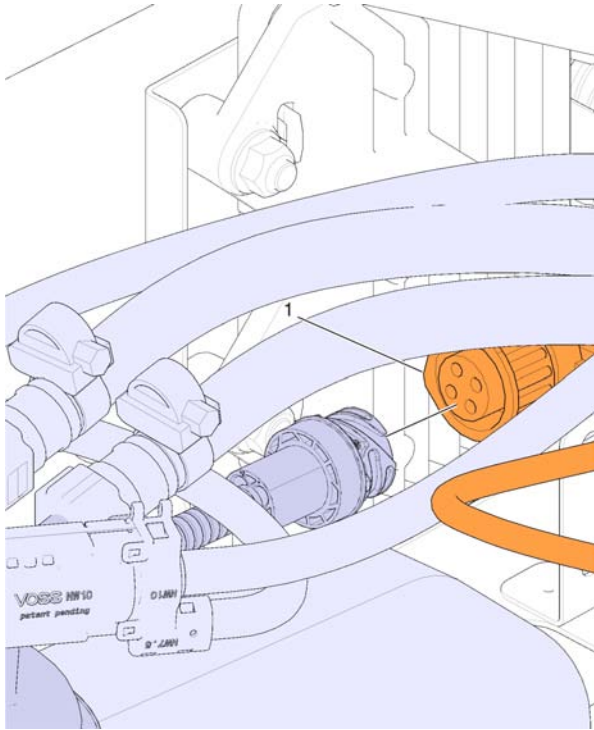
Open the battery compartment access doors.

**4**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**5**

Open the right-hand service door located at the A/C evaporator.



W2060191

**1** Level Sensor Wiring Harness Lead

**6**

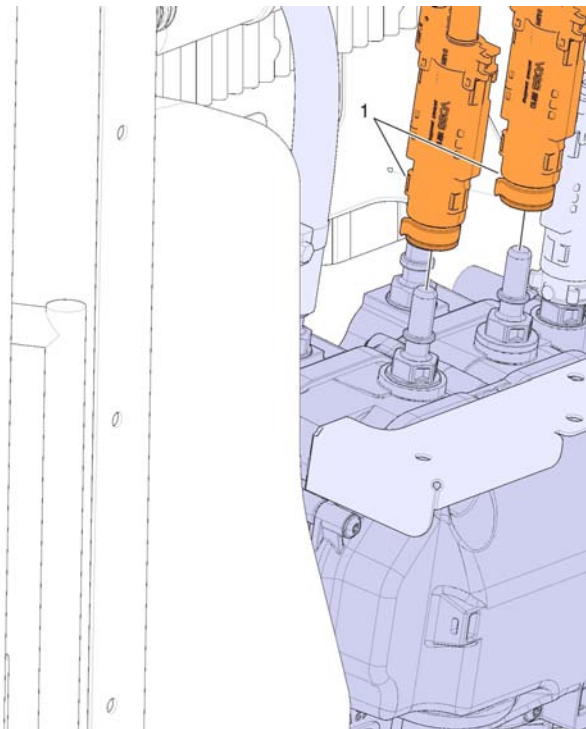
Disconnect the wiring harness lead from the DEF tank level sensor connector and cut any plastic tie straps as needed.

**7**

Position an appropriate container under the DEF pump to catch drained DEF fluid.

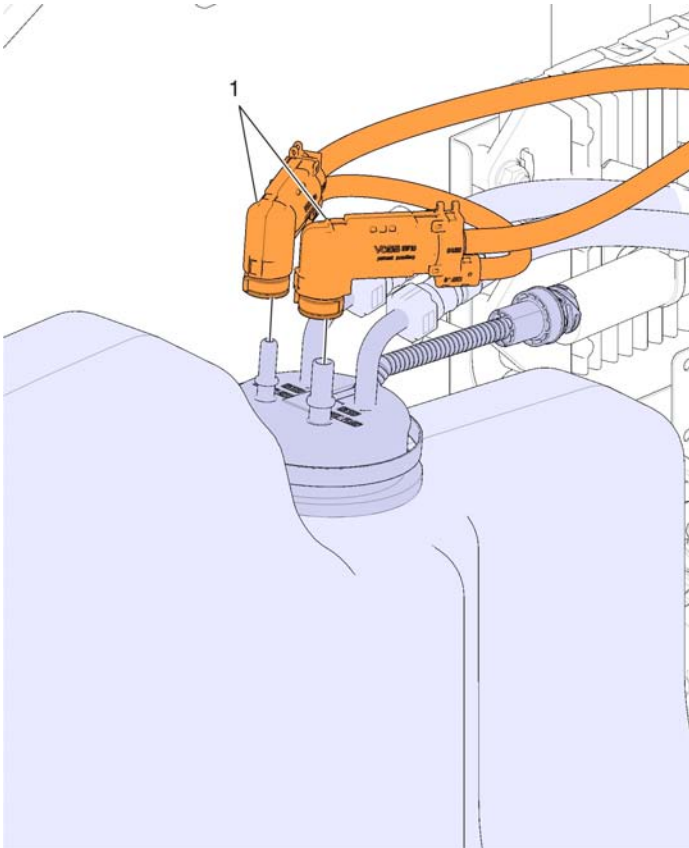
**8**

Disconnect the DEF lines from the fittings on the DEF pump.



W2060192

1 DEF Lines at DEF Pump



W2060193

**9**  
Disconnect the DEF lines from the fittings on the DEF tank level sensor unit and cut any plastic tie straps as needed.

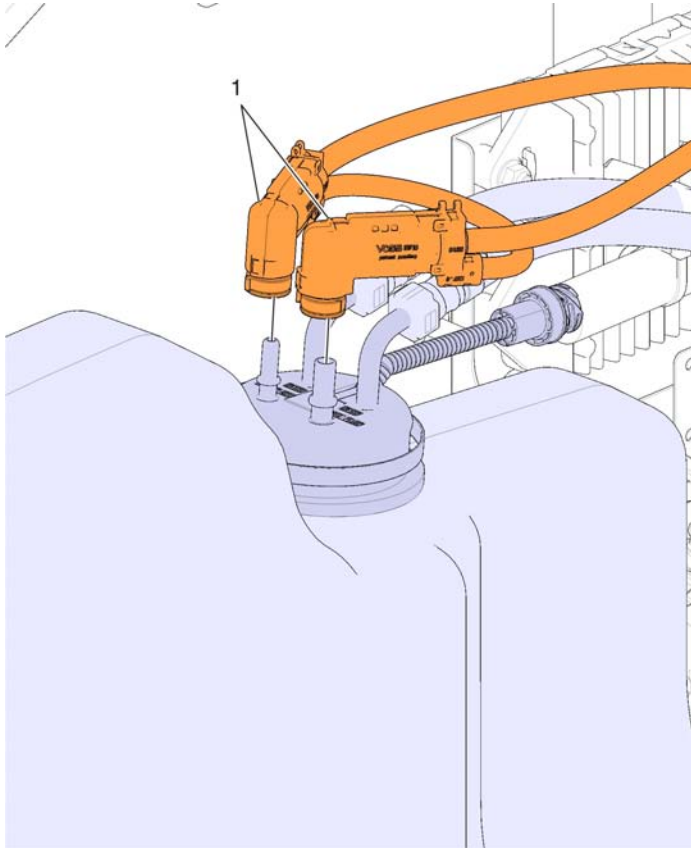
1 DEF Lines at DEF Level Sensor

**10**  
Remove the defective DEF line assembly from the vehicle.

## Installation

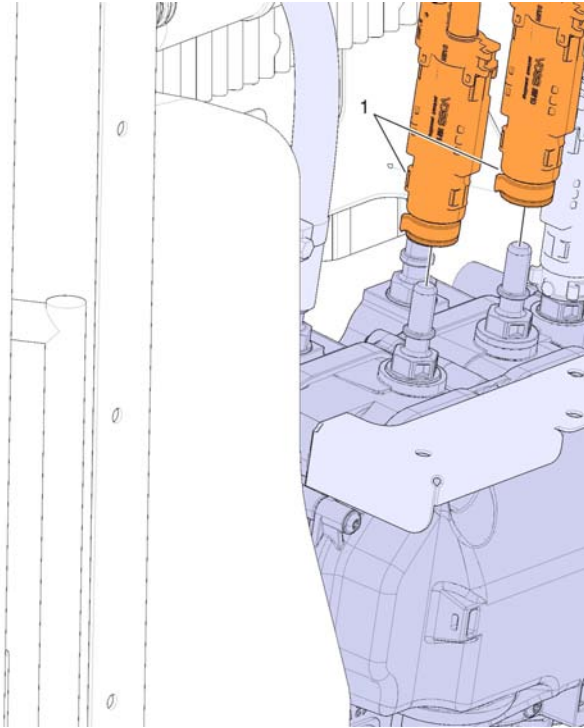
**1**  
Loosely route the replacement DEF line assembly between the DEF tank level sensor and the DEF pump.

**2**  
Connect both DEF lines to the fittings on the DEF tank level sensor.



W2060193

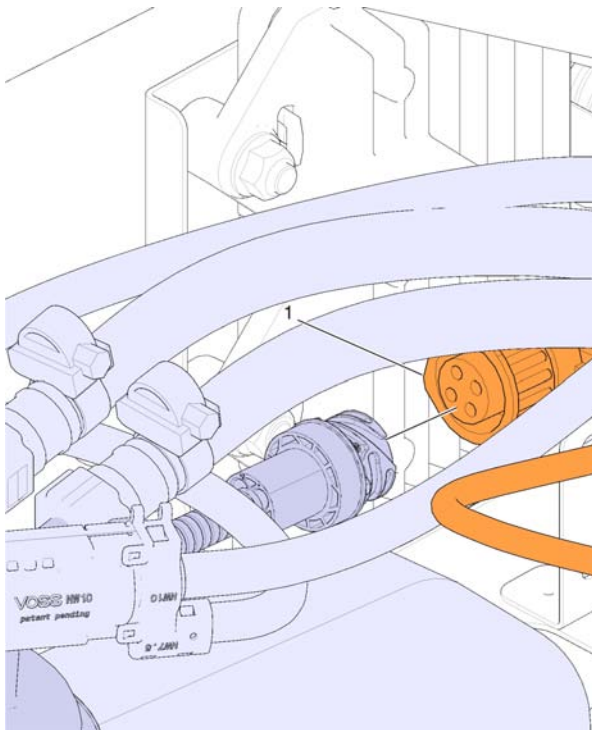
1 DEF Lines at DEF Level Sensor



W2060192

1 DEF Lines at DEF Pump

**3**  
Connect both DEF lines to the fittings on the DEF pump.



W2060191

1 Level Sensor Wiring Harness Lead

**4**  
Connect the wiring harness lead to the DEF tank level sensor connector.

**5**

Use plastic tie straps as needed to secure the DEF lines and the level sensor wiring harness.

**6**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**7**

Close the battery compartment access doors.

**8**

Start the engine and check for leaks and proper operation.

**9**

Close the right-hand service door located at the A/C evaporator.

**10**

Close both right-rear engine access service doors.

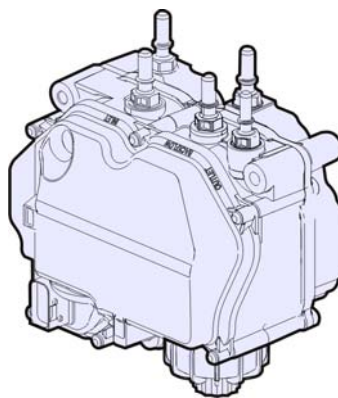


Date	Group	No.	Release	Page
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## Aftertreatment Diesel Exhaust Fluid (DEF) Pump, Replacement

PREVX

### Aftertreatment Diesel Exhaust Fluid (DEF) Pump, Replacement



W2054664

This information covers a procedure for replacing the Aftertreatment Diesel Exhaust Fluid (DEF) pump unit on a PREVX model bus.

#### Content

- “Special Tools”, page 2
- “Aftertreatment Diesel Exhaust Fluid (DEF) Pump, Replacement”, page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## Special Tools

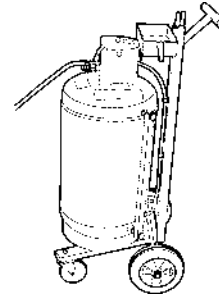
For special tools ordering information, refer to Tool Information, group 08.



W0001795

**9996049**

Coolant Drain Hose



W2004191

**85112740**

Coolant Extractor

## 2589-03-02-36

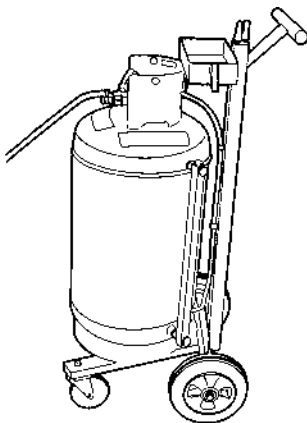
# Aftertreatment Diesel Exhaust Fluid (DEF) Pump, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## Removal

- 1**  
Apply parking brake and place shift lever in neutral.
- 2**  
Open rear engine service doors.
- 3**  
Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.
- 4**  
Open right service door at the air conditioner evaporator.
- 5**  
Connect the coolant extractor to the drain fitting at the bottom of the radiator and drain the coolant.

**Note:** An alternate method is to connect the coolant drain hose to the drain fitting and drain the coolant into a suitable container.



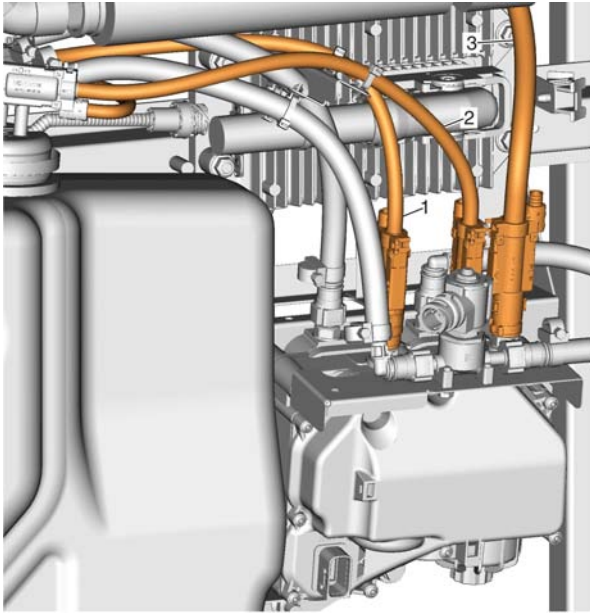
W2004191

### **DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740, 9996049

- 6**  
Place an approved suitable container under the DEF tank to catch fluid that may drain from the pump. Dispose of DEF according to local regulations.



W2060062

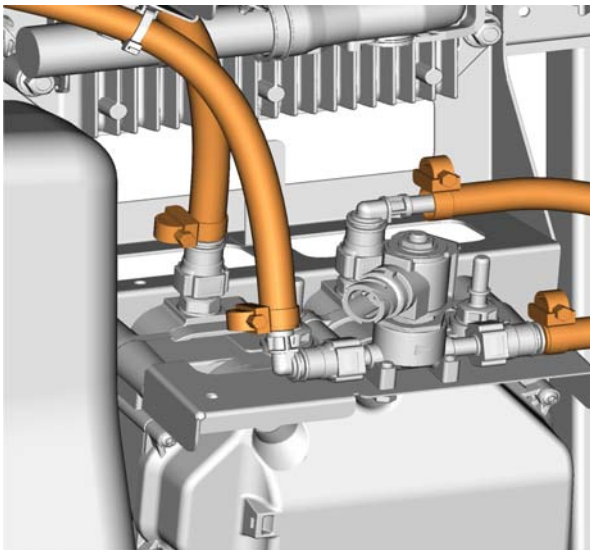
- 1 DEF Inlet Line
- 2 DEF Backflow Line
- 3 DEF Outlet Line

7

**Note:** For information on the handling of DEF, refer to General Safety Practices, Function Group 20.

**Note:** If inlet and backflow lines are switched, the system will not start.

Mark the DEF lines before removal. Remove the DEF inlet, backflow and outlet lines from the pump. Place protective caps on the DEF connectors.

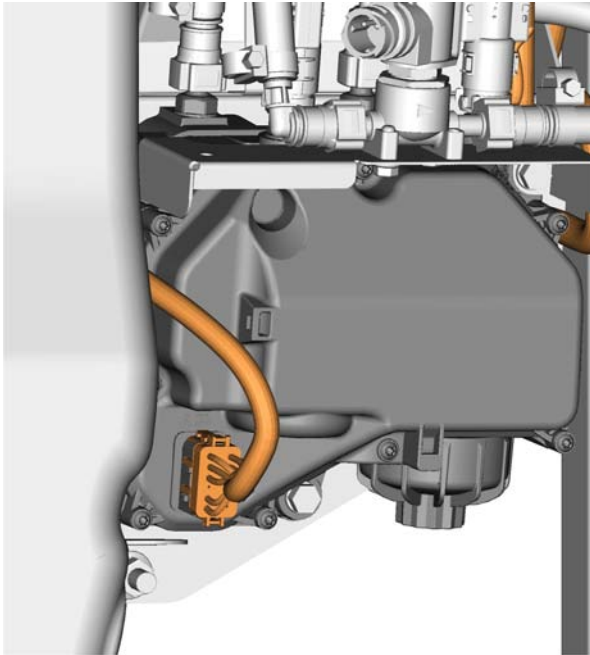


W2060065

- 1 Coolant Lines

8

Remove the inlet and outlet coolant lines from the pump. Place protective caps on the coolant connectors.

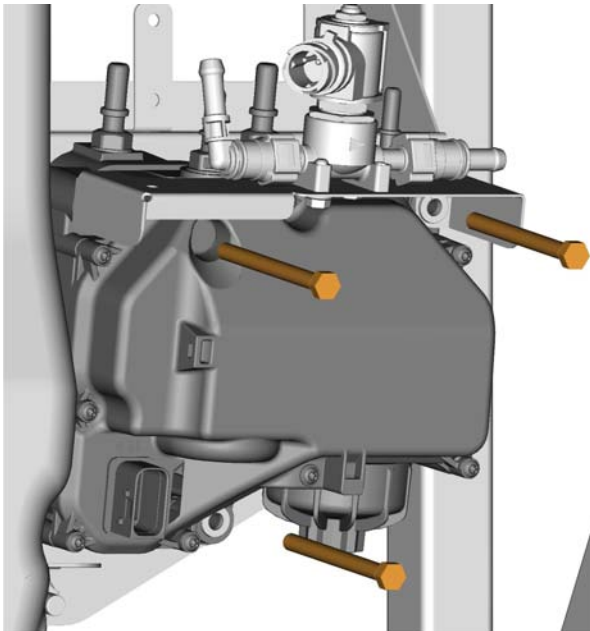


W2060061

**1** Wiring Harness Connector

**9**

Remove cable tie and disconnect the wiring harness connector from the DEF pump. Cover the wiring harness connector with a plastic bag to protect from possible damage from DEF.



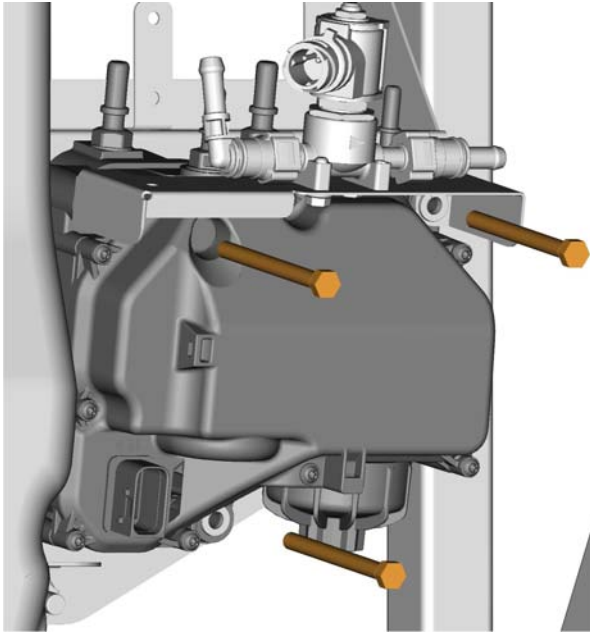
W2060066

**1** Fasteners

**10**

Remove the fasteners and DEF pump from the mounting bracket.

## Installation

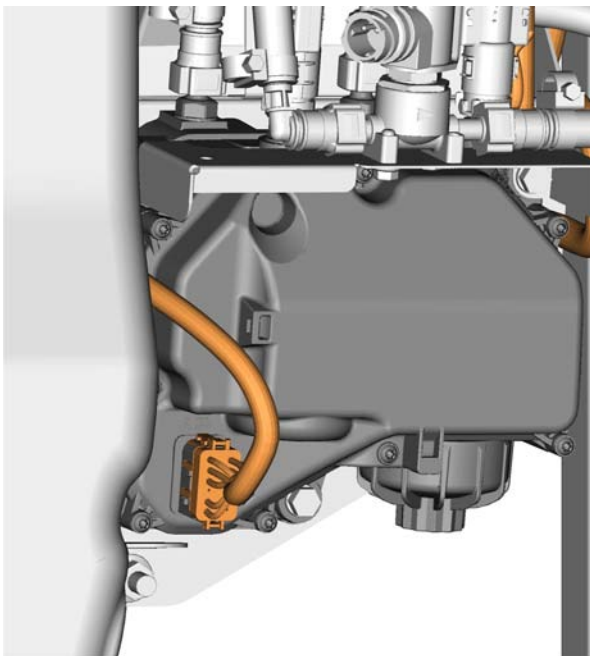


W2060066

**1**

Position the DEF pump onto the mounting bracket. Install the fasteners and tighten to specification, refer to Function Group 20, Specifications.

1 Fasteners

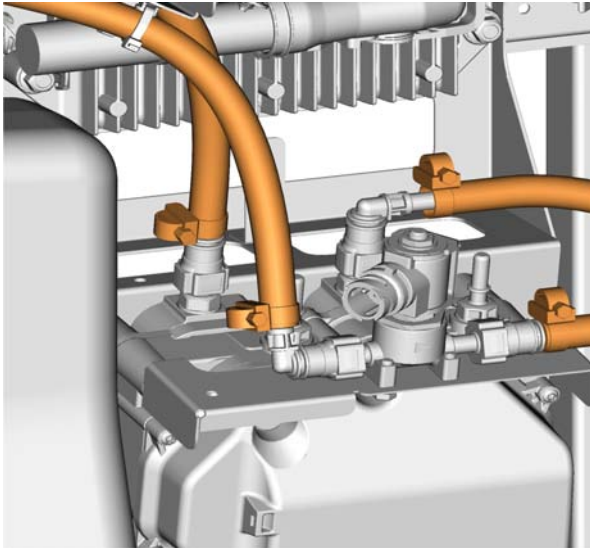


W2060061

**2**

Remove plastic bag from the wiring harness connector. Attach the wiring harness connector to the DEF pump and secure using a cable tie.

1 Wiring Harness Connector

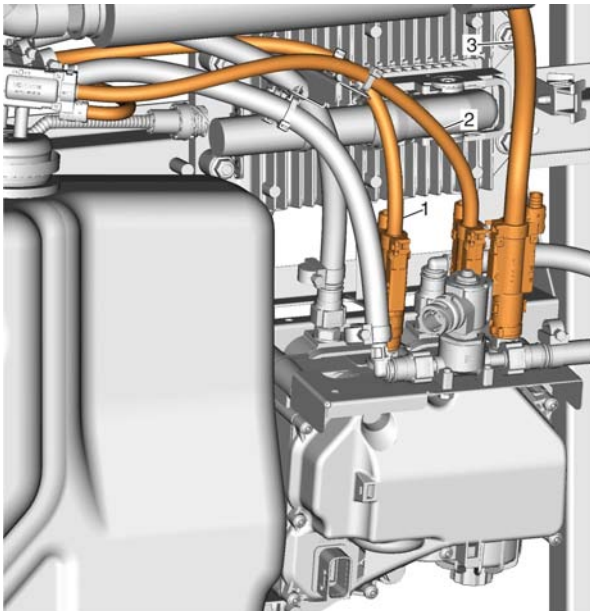


W2060065

1 Coolant Lines

**3**

Install the inlet and outlet coolant lines onto the DEF pump.



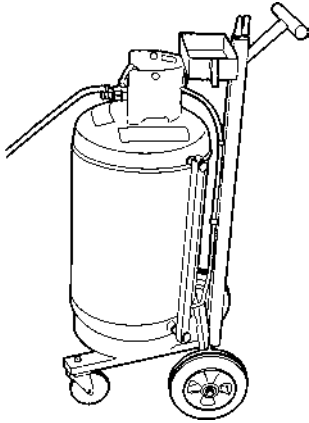
W2060062

- 1 DEF Inlet Line
- 2 DEF Backflow Line
- 3 DEF Outlet Line

**4**

Install DEF inlet, backflow and outlet lines onto the pump.

**Note:** If inlet and backflow lines are switched, the system will not start.



W2004191

**5**

Fill the cooling system with the recommended coolant using the coolant extractor. Ensure the coolant system is full.

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85112740

**6**

Install all previously removed cables to the ground (negative) battery terminals.

**7**

Connect Tech Tool to the vehicle. Use Guided Diagnostics to read and clear any diagnostic trouble codes (DTCs). Check for proper operation and for leaks.

**8**

Close right service door at the air conditioner evaporator.

**9**

Close rear engine service doors.

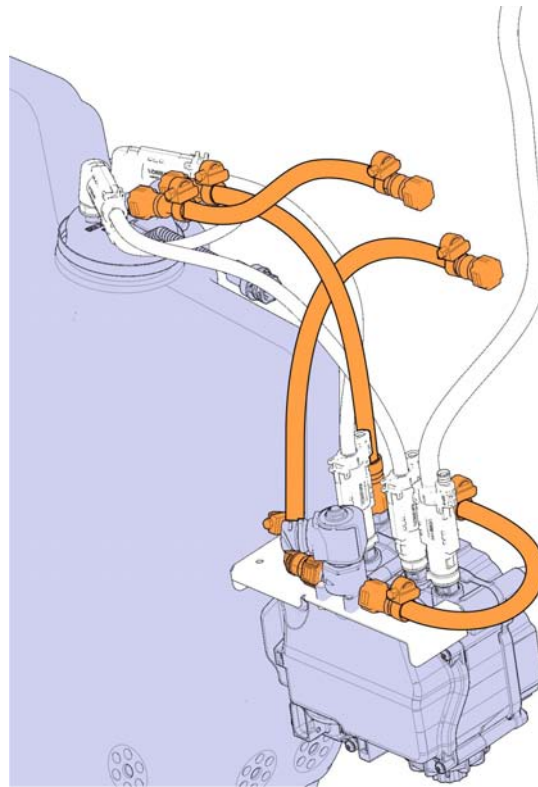


Date	Group	No.	Release	Page
9.2010	<b>258</b>	<b>76</b>	<b>01</b>	1(6)

## Aftertreatment Diesel Exhaust Fluid (DEF) Coolant Hose, Replacement

PREVH, PREVX

### Aftertreatment Diesel Exhaust Fluid (DEF) Coolant Hose, Replacement



W2060883

This information provides the correct procedure for replacing the aftertreatment diesel exhaust fluid (DEF) coolant hose on PREVH and PREVX model buses.

#### Content

- “Special Tools”, page 2
- “Aftertreatment Diesel Exhaust Fluid (DEF) Coolant Hose, Replacement”, page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## Special Tools

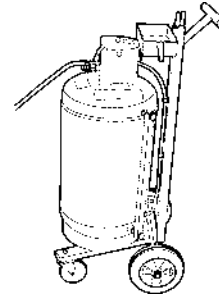
For special tools ordering information, refer to Tool Information, group 08.



W0001795

**9996049**

Coolant Drain Hose



W2004191

**85112740**

Coolant Extractor

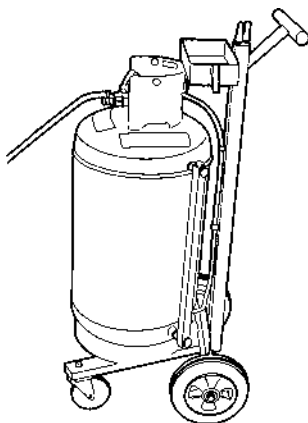
## 2589-03-02-33 Aftertreatment Diesel Exhaust Fluid (DEF) Coolant Hose, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

- 1**  
Apply parking brake and place shift lever in neutral.
- 2**  
Open rear engine service doors.
- 3**  
Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.
- 4**  
Open right service door at the air conditioner evaporator.
- 5**  
Connect the coolant extractor to the drain fitting at the bottom of the radiator and drain the coolant.

**Note:** An alternate method is to connect the coolant drain hose to the drain fitting and drain the coolant into a suitable container.



W2004191

#### **DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740, 9996049

- 6**  
Place an approved suitable container under the diesel exhaust fluid (DEF) tank to catch fluid that may drain from the pump. Dispose of DEF according to local regulations.

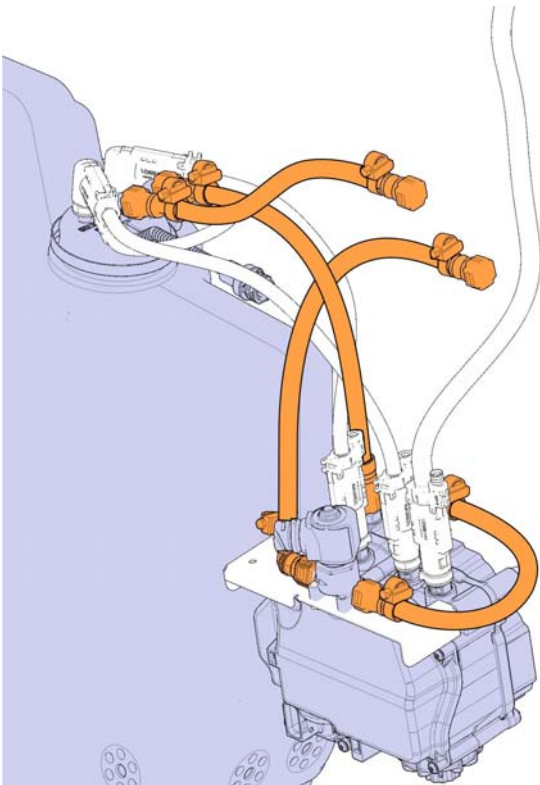
**7**

Each DEF coolant hose is an assembly that includes four replaceable segments. The Removal steps in this Service Bulletin may be used to replace any one of the four hose segments. The four replaceable coolant hose segments include the following:

- Coolant hose to the doser valve
- Coolant hose from the DEF pump to the solenoid
- Coolant hose from the solenoid to the DEF tank fluid level sensor sending unit
- Coolant hose from the DEF pump to the DEF tank fluid level sensor sending unit.

**8**

Disconnect each end of the coolant hose segment to be replaced.



W2060883

**9**

Remove and discard the defective DEF coolant hose segment.

## Installation

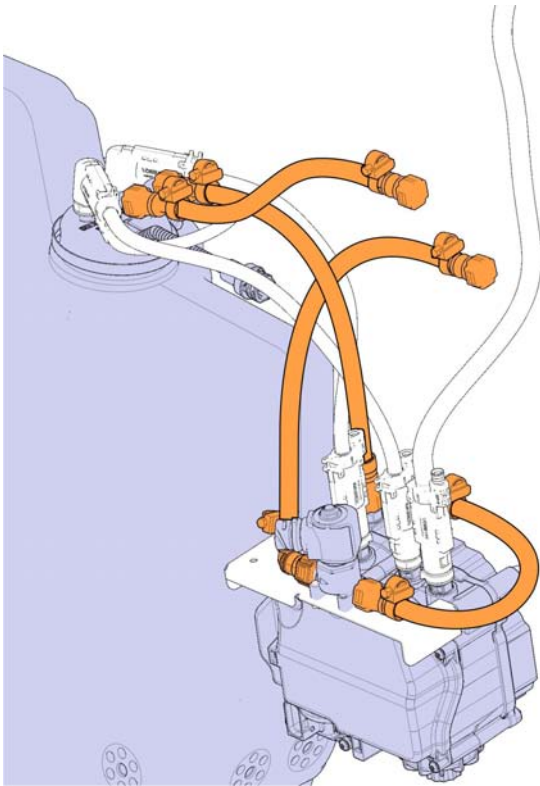
### 1

Each DEF coolant hose is an assembly that includes four replaceable segments. The Installation steps in this Service Bulletin may be used to install any one of the four hose segments. The four replaceable coolant hose segments include the following:

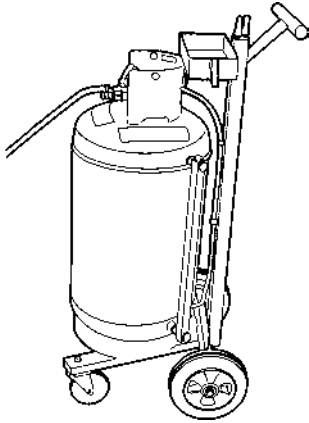
- Coolant hose to the doser valve
- Coolant hose from the DEF pump to the solenoid
- Coolant hose from the solenoid to the DEF tank fluid level sensor sending unit
- Coolant hose from the DEF pump to the DEF tank fluid level sensor sending unit.

### 2

Connect the ends of the replacement DEF coolant hose segment to the fittings from which the defective hose segment was removed.



W2060883



W2004191

**3**

Fill the cooling system with the recommended coolant using the coolant extractor. Ensure the coolant system is full.

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85112740

**4**

Install all previously removed cables to the ground (negative) battery terminals.

**5**

Connect Tech Tool to the vehicle. Use Guided Diagnostics to read and clear any diagnostic trouble codes (DTCs). Check for proper operation and for leaks.

**6**

Close right service door at the air conditioner evaporator.

**7**

Close rear engine service doors.

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Aftertreatment Diesel Exhaust Fluid  
(DEF) Line, Electrically Heated (Tank  
to Dosing Valve)

Replacement

PREVX

## Aftertreatment Diesel Exhaust Fluid (DEF) Line, Electrically Heated (Tank to Dosing Valve), Replacement

This service bulletin covers the procedures for replacing the electrically-heated aftertreatment diesel exhaust fluid (DEF) line that connects the DEF pump to the dosing valve and used on VOLVO PREVX model buses.

### Contents

- “Aftertreatment Diesel Exhaust Fluid (DEF) Line, Electrically Heated, Replacement (Tank to Dosing Valve)”, page 2 .

**Note:** Information is subject to change without notice.

Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2589-03-02-27

# Aftertreatment Diesel Exhaust Fluid (DEF) Line, Electrically Heated, Replacement (Tank to Dosing Valve)

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

### **DANGER**

Before working on a vehicle, set the parking brake, place the I-Shift transmission in Neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

## Removal

**1**

Apply the parking brake and place the I-Shift selector in Neutral.

**2**

Open both right-rear engine access service doors to access the aftertreatment DEF tank, dosing valve, DEF pump and DEF lines.

**3**

Open the battery compartment access doors.

**4**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

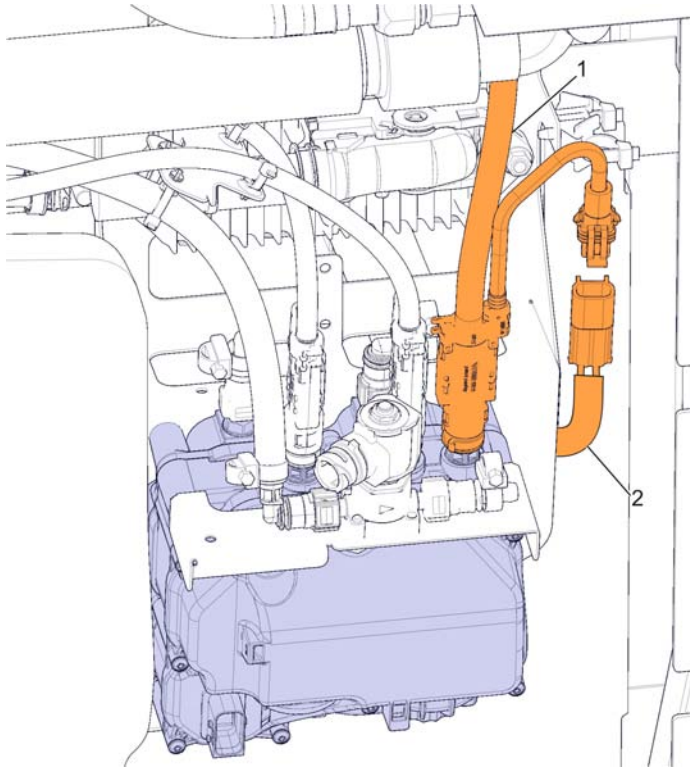
**5**

Open the right-hand service door located at the A/C evaporator.

**6**

Position a suitable container under the DEF pump to catch any spilled DEF during the removal procedure.





W2060314

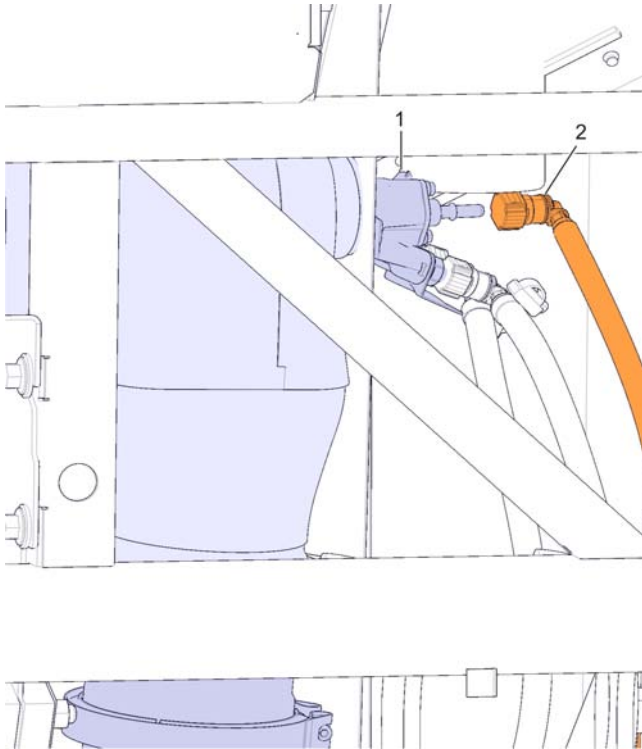
- 1 Tank-to-Dosing Valve DEF Line
- 2 Wiring Harness Electrical Connector

**7**  
Disconnect the wiring harness lead from the connector on the DEF pump.

**8**  
Disconnect the defective pump-to-dosing valve DEF line from the DEF pump fitting.

**9**  
At the DEF pump end, cut any plastic tie straps securing the pump-to-dosing valve DEF line to the vehicle.

**10**  
As much as possible, straighten the DEF pump end of the disconnected pump-to-dosing valve DEF line (up to the point where it enters the plastic pipe).



**11**

At the dosing valve, disconnect the defective DEF line from the DEF dosing valve fitting.

1 Dosing Valve

2 Tank-to-Dosing Valve DEF Line

**12**

As much as possible, straighten the dosing valve end of the disconnected pump-to-dosing valve DEF line (up to the point where it enters the plastic pipe).

**13**

At the dosing valve end of the DEF line, cut plastic tie straps securing the DEF line to the vehicle.

**Note:** The actual removal of the defective DEF line and the positioning of the replacement DEF line is best accomplished simultaneously during Installation Steps 1–3.

## Installation

**1**

At the DEF pump end of the DEF line, cut the line where the electrical leads pigtail off the line.

**2**

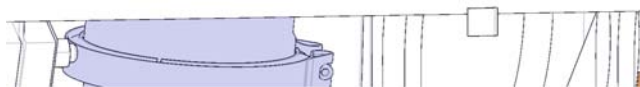
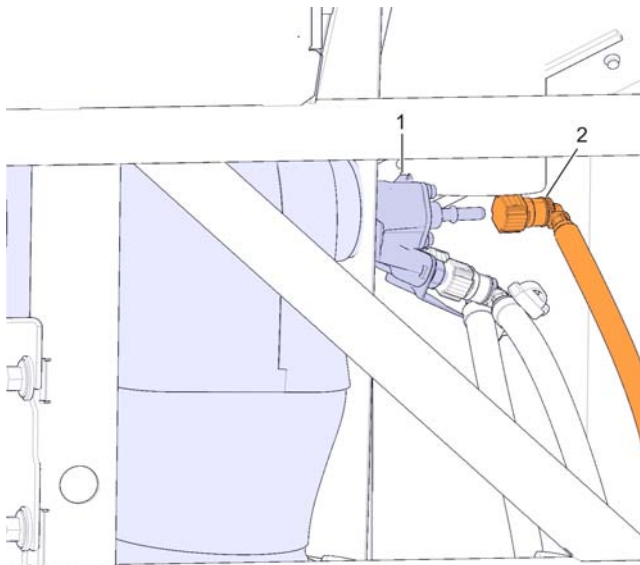
Temporarily secure the cut end of the defective line to the “dosing valve” end of the replacement DEF line.

**3**

Two people should then “fish” the replacement DEF line through the plastic pipe and into position. To do this, one person slowly pulls on the defective line at the dosing valve end while another person pushes the joined defective/replacement DEF line into the plastic pipe at the DEF pump end. Pull the lines through the pipe until the replacement line reaches the dosing valve.

**4**

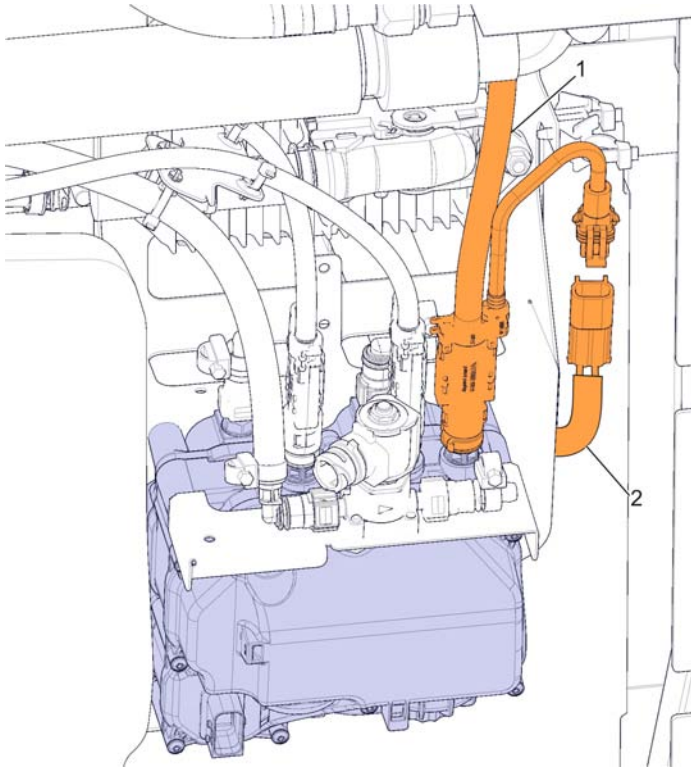
At the dosing valve, separate the two connected lines (defective and replacement) and connect the end of the replacement DEF line to the dosing valve fitting.



W2060316

1 Tank-to-Dosing Valve DEF Line

2 Dosing Valve



W2060314

**5**  
Connect the other end of the replacement DEF line to the DEF pump fitting.

- 1 Tank-to-Dosing Valve DEF Line
- 2 Wiring Harness Electrical Connector

**6**  
At the DEF pump, reconnect the wiring harness lead to the DEF pump connector.

**7**  
Use new plastic tie straps to secure the replacement DEF line in the engine compartment, from the dosing valve to the plastic pipe and from the DEF pump to the plastic pipe.

**8**  
Reconnect all previously removed cables to the negative (ground) battery terminals.

**9**  
Close the battery compartment access doors.

**10**  
Start the engine and check for leaks and proper operation.

**11**  
Close the right-hand service door located at the A/C evaporator.

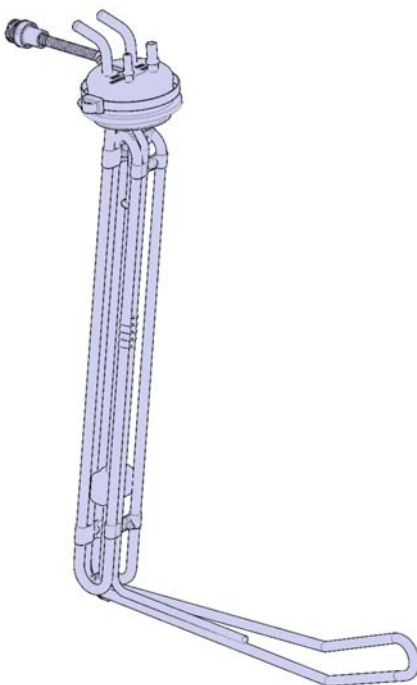
**12**

Close both right-rear engine access service doors.

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Aftertreatment Diesel Exhaust Fluid  
Tank (DEF) Level Sensor  
Replacement  
PREVX

## Aftertreatment Diesel Exhaust Fluid Tank (DEF) Level Sensor, Replacement



W2060194

This service bulletin covers the procedures for replacing the fluid level sensor in the aftertreatment diesel exhaust fluid (DEF) tank on VOLVO PREVX model buses.

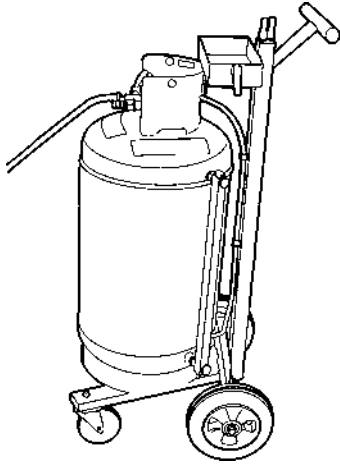
### Contents

- “Special Tools”, page 2 .
- “Aftertreatment Diesel Exhaust Fluid Tank (DEF) Level Sensor, Replacement”, page 3 .

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## Special Tools

For special tools ordering information, refer to Tool Information, group 08.



W2004191

**85112740**  
Coolant Extractor

## 2589-03-02-05

# Aftertreatment Diesel Exhaust Fluid Tank (DEF) Level Sensor, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

### **DANGER**

Before working on a vehicle, set the parking brake, place the I-Shift transmission in Neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

*Special tools: 85112740*

## Removal

**1**

Apply the parking brake and place the I-Shift gear selector in neutral.

**2**

Open the battery compartment access doors.

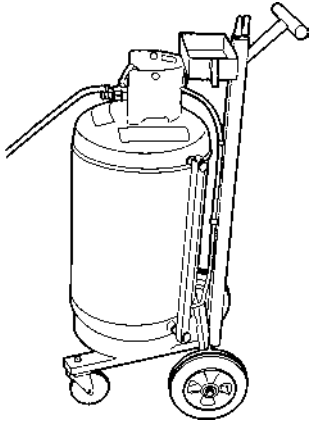
**3**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

Open the right engine service access door at the A/C evaporator to access the aftertreatment DEF tank.





W2004191

**5**

Connect the coolant extractor and drain the engine coolant.

**⚠ DANGER**

Engine coolant is toxic and can pose a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

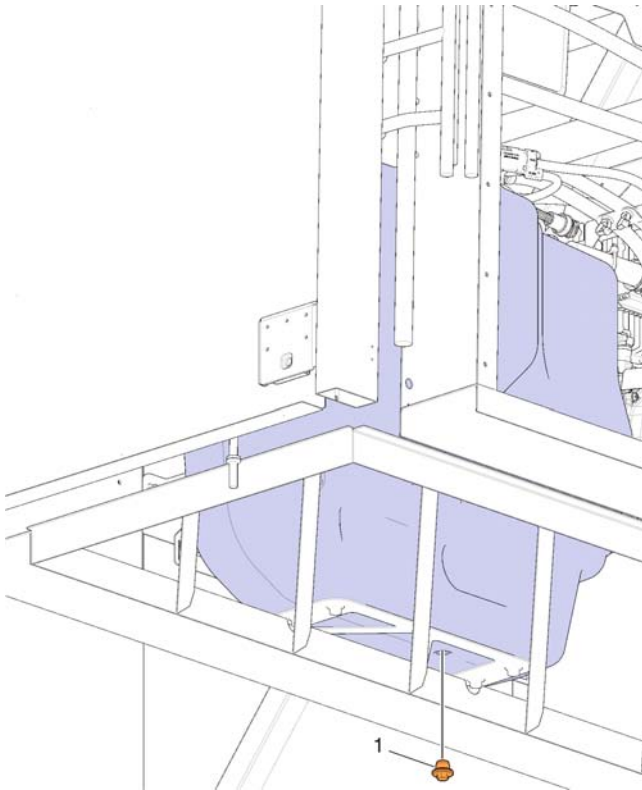
85112740

**6**

Place a suitable container under the DEF tank to catch any spilled DEF and coolant during the removal procedure.

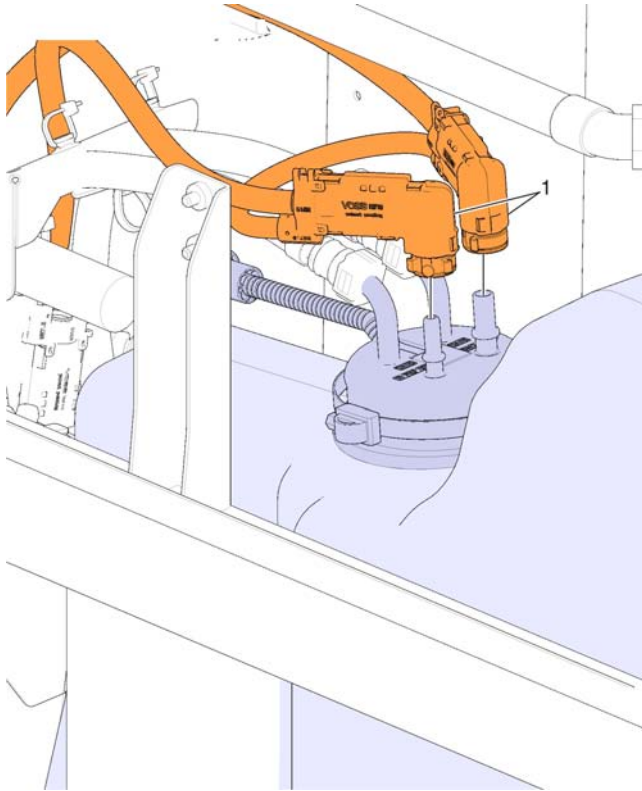
**7**

Remove the drain plug from the DEF tank and, using the container positioned in step 6, catch any drained fluid remaining in the DEF tank. When all the fluid has drained from the DEF tank, replace the drain plug and tighten.



W2060195

1 DEF Tank Drain Plug



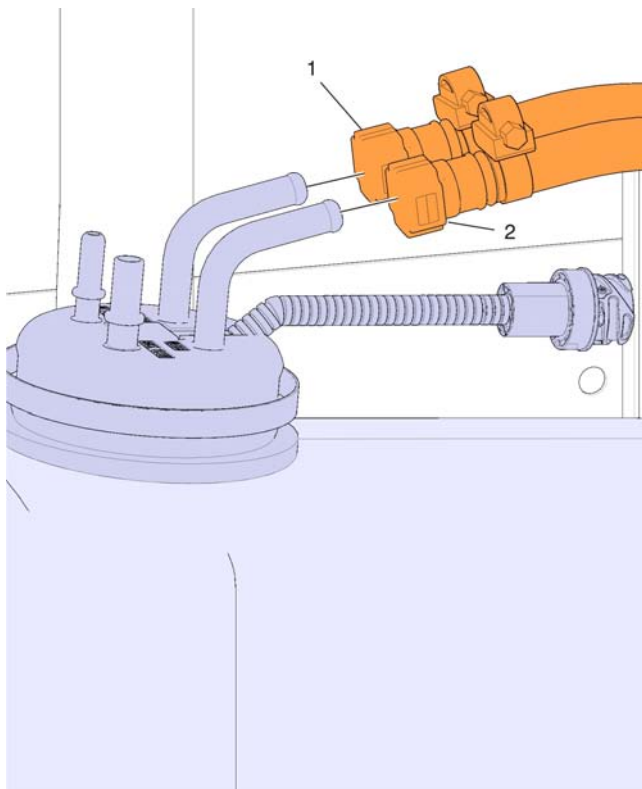
W2060196

1 DEF Lines

**8**

Disconnect the DEF lines from the DEF tank level sensor fittings.

**Note:** Before detaching the DEF lines, note their position since they differ in size.



W2060197

1 Coolant Line

**9**

Disconnect the two coolant lines from the fittings on the DEF tank level sensor.

2 Coolant Line

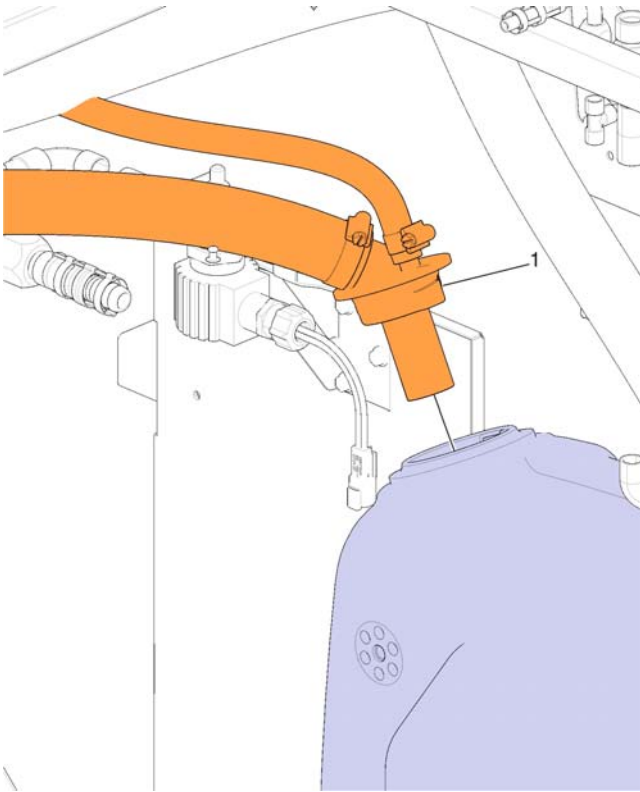
**10**

Disconnect the wiring harness lead from the DEF tank level sensor connector.

**Note:** Cover the wiring harness connectors with a plastic bag to protect them from any spilled DEF, which is highly corrosive to electrical contacts.

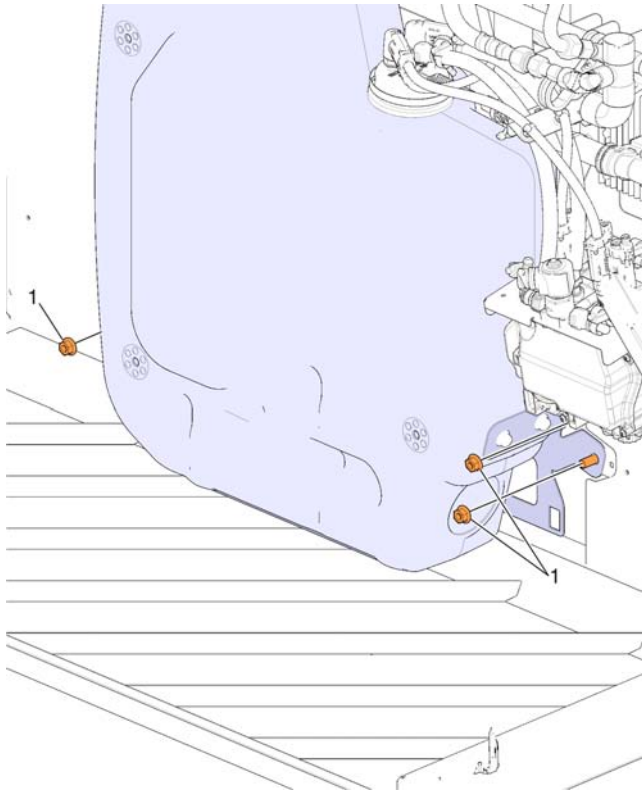
**11**

Remove the filler fitting (with the DEF inlet and breather hoses attached) from the DEF tank.



W2060118

1 DEF Tank Inlet & Breather Hose Fitting

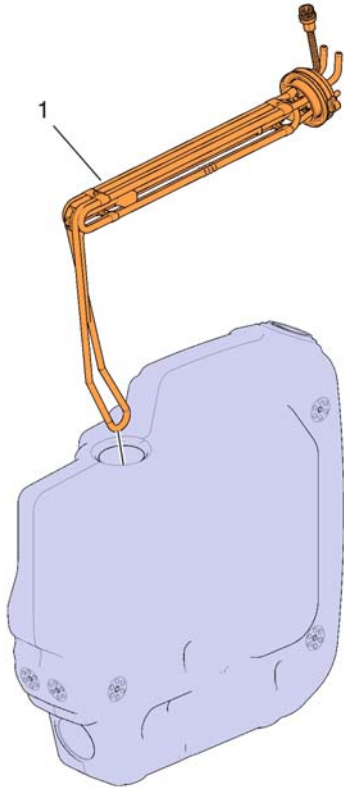


W2060119

1 Mounting Fasteners

**12**

Remove the fasteners securing the DEF tank to the vehicle chassis and carefully remove the tank from the vehicle compartment.



**13**

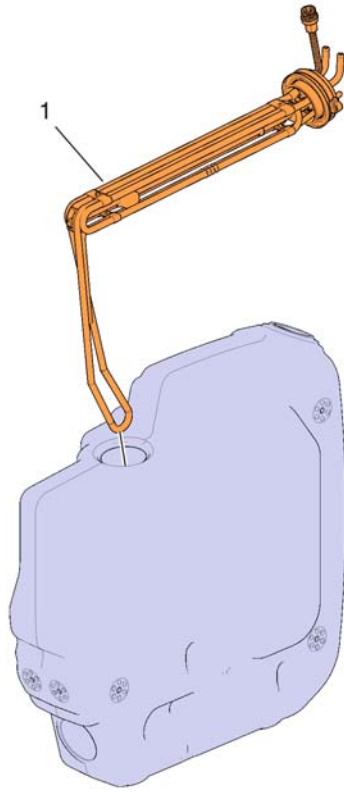
Loosen the clamp securing the DEF level sensor in the DEF tank and remove the defective level sensor from the DEF tank.

W2060200

1 DEF Level Sensor

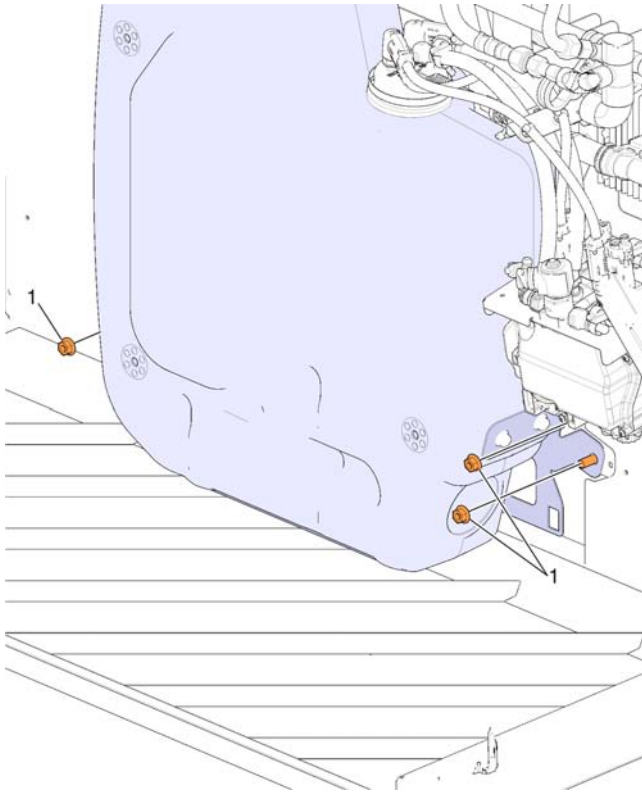
## Installation

- 1**  
Position the replacement level sensor in the DEF tank and tighten the clamp to secure it in place.



W2060200

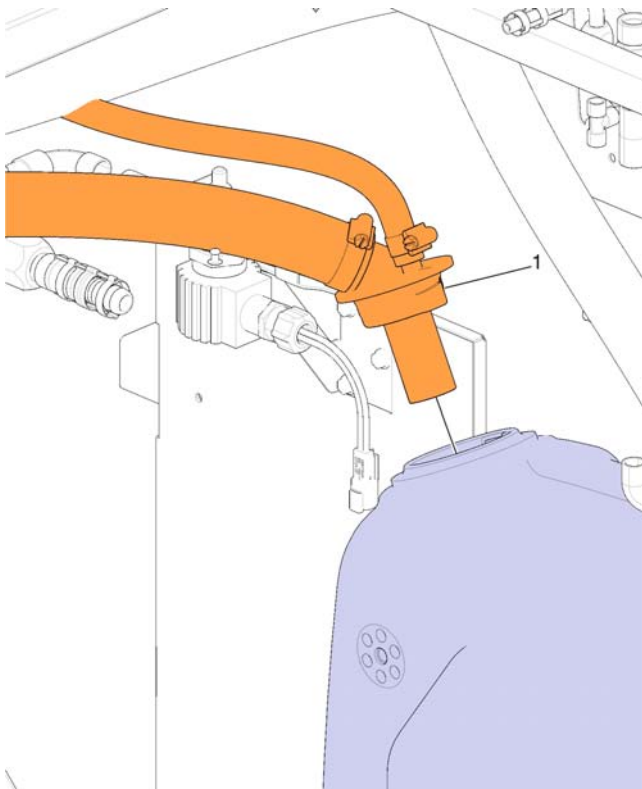
1 DEF Level Sensor



W2060119

- 2**  
Position the DEF tank in the vehicle compartment and use the fasteners to secure it in place on the chassis. Tighten the fasteners to specification; refer to Function Group 200, "Specifications."

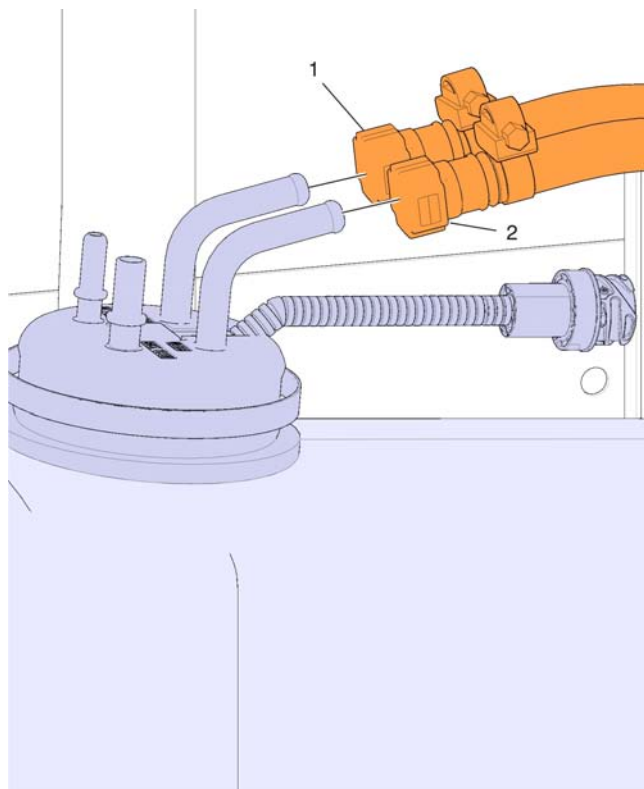
**1** Mounting Fasteners



W2060118

- 3**  
Install the DEF tank inlet and breather hose fitting onto the DEF tank.

1 DEF Tank Inlet & Breather Hose Fitting



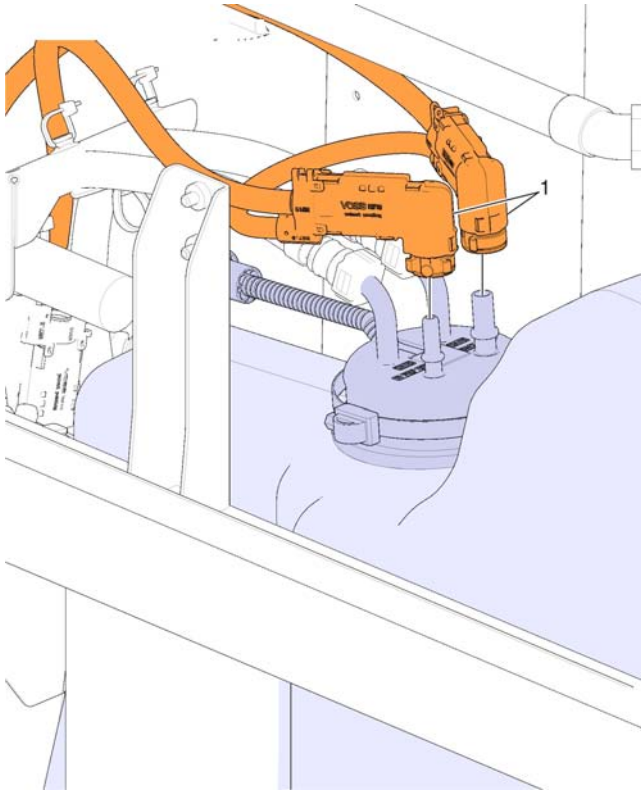
W2060197

- 1 Coolant Line
- 2 Coolant Line

**4**  
Remove the protective plastic bag from the wiring harness connector and connect the wiring harness lead to the level sensor connector.

**5**  
Attach the two DEF coolant lines to the fittings on the DEF tank level sensor.



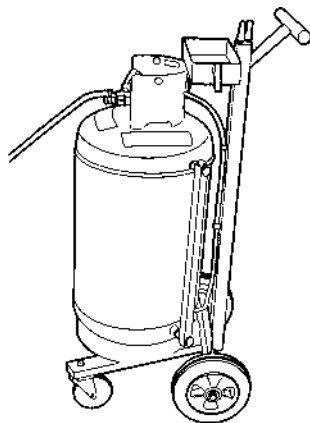


W2060196

**6**

Attach the two DEF lines to the fittings on the DEF tank level sensor. Since the lines are different sizes, be sure to attach them to the correct fittings.

1 DEF Lines



W2004191

**7**

Fill the DEF tank with DEF fluid.

**8**

Fill the engine cooling system with the recommended coolant using the coolant extractor.

**⚠ DANGER**

Engine coolant is toxic and can pose a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740

**9**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**10**

Close the battery compartment access doors.

**11**

Start the engine and check for leaks and proper operation. Replenish fluids as needed.

**12**

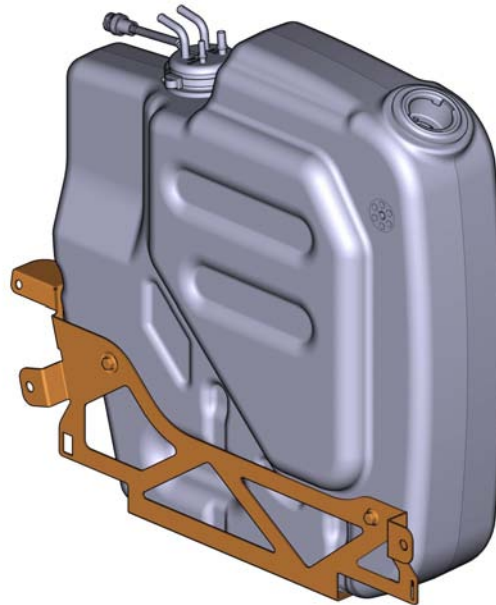
Close the right engine service access doors.

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Aftertreatment Diesel Exhaust Fluid  
(DEF) Tank Bracket  
Replacement (MAIN)

PREVX

## Aftertreatment Diesel Exhaust Fluid (DEF) Tank Bracket, Replacement (MAIN)



W2060362

This service bulletin covers the procedures for replacing the main mounting bracket on the aftertreatment DEF tank used on VOLVO PREVX model buses.

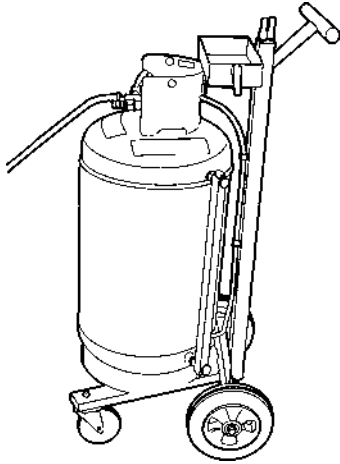
### Contents

- “Special Tools”, page 2 .
- “Aftertreatment Diesel Exhaust Fluid (DEF) Tank Bracket, Replacement (MAIN)”, page 3 .

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## Special Tools

For special tools ordering information, refer to Tool Information, group 08.



W2004191

**85112740**  
Coolant Extractor

## 2589-03-02-32

# Aftertreatment Diesel Exhaust Fluid (DEF) Tank Bracket, Replacement (MAIN)

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

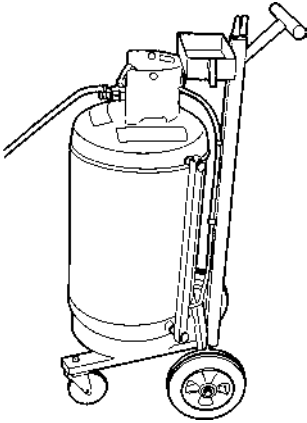
### **DANGER**

Before working on a vehicle, set the parking brake, place the I-Shift transmission in Neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

*Special tools: 85112740*

## Removal

- 1**  
Apply the parking brake and place the I-Shift selector in Neutral.
- 2**  
Open the battery compartment access doors.
- 3**  
Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.
- 4**  
Open both right-rear engine service access doors to access the aftertreatment DEF tank, DEF lines and DEF pump.



W2004191

**5**

Connect the coolant extractor and drain the engine coolant.

**⚠ DANGER**

Engine coolant is toxic and can pose a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740

**6**

Place a suitable container under the DEF tank to catch any spilled DEF and coolant during the removal procedure.

**7**

Remove the drain plug from the DEF tank and, using the container positioned in step 6, catch any drained fluid remaining in the DEF tank. When all the fluid has drained from the DEF tank, replace the drain plug and tighten.

**8**

Disconnect the DEF lines attached to the DEF tank level sensor.

**Note:** Before detaching the DEF lines, note their position since they differ in size.

**9**

Disconnect the two coolant lines attached to the fittings on the DEF tank level sensor.

**10**

Disconnect the wiring harness lead from the DEF tank level sensor electrical connector.

**Note:** Cover the wiring harness connectors with a plastic bag to protect them from any spilled DEF, which is highly corrosive to electrical contacts.

**11**

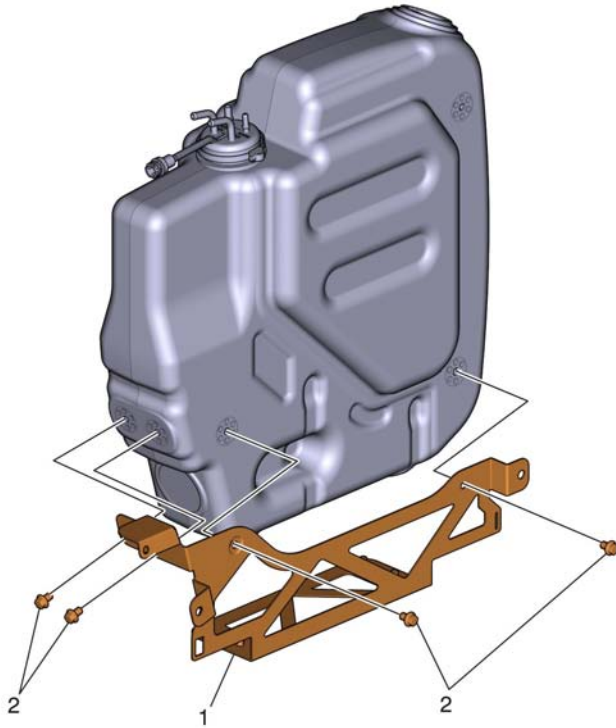
Remove the DEF inlet and breather hose from the DEF tank.

**12**

Remove the fasteners securing the DEF tank to the vehicle and carefully remove the tank from the vehicle compartment.

**13**

Remove the fasteners securing the defective main DEF tank bracket to the DEF tank and remove the bracket.

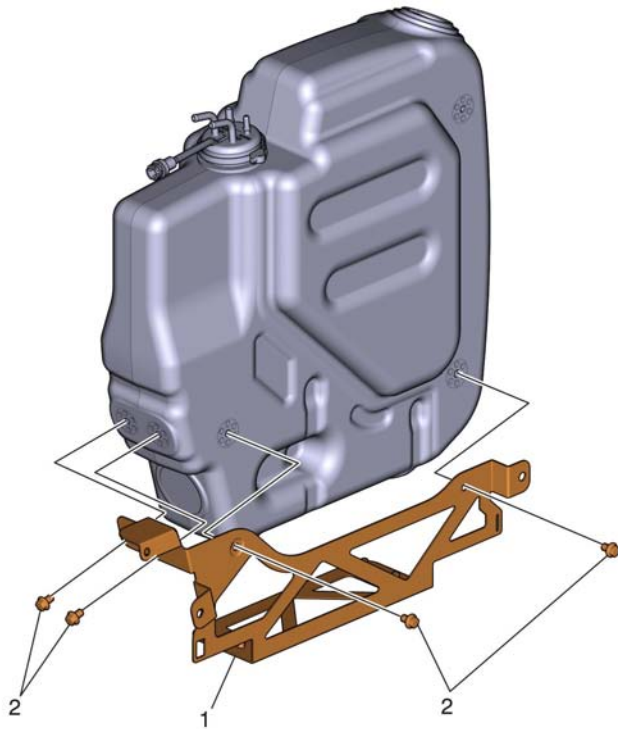


W2060363

1 Mounting Bracket

2 Fasteners

## Installation



W2060363

1 Mounting Bracket

2 Fasteners

### 1

Position the replacement main DEF tank bracket onto the DEF tank and secure with the fasteners. Tighten the fasteners to specification; refer to Function Group 200, "Specifications."

### 2

Position the DEF tank in the vehicle compartment and use the fasteners to secure it in place. Tighten the fasteners to specification; refer to Function Group 200, "Specifications."

### 3

Install the DEF inlet and breather hose onto the DEF tank.

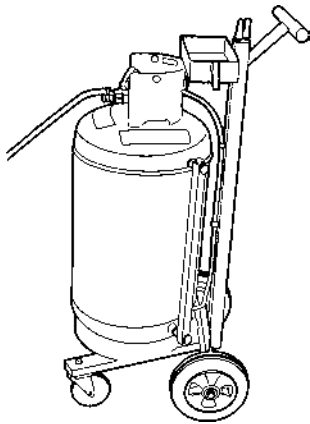
### 4

Remove the protective plastic bag from the wiring harness connector and connect the wiring harness lead to the level sensor electrical connector.

### 5

Attach the two coolant lines to the fittings on the DEF tank level sensor.





W2004191

**6**

Attach the two DEF lines to the fittings on the DEF tank level sensor. Since the lines are different sizes, be sure to attach them to the correct fittings.

**7**

Fill the DEF tank with DEF fluid.

**8**

Fill the engine cooling system with the recommended coolant using the coolant extractor.

**⚠ DANGER**

Engine coolant is toxic and can pose a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740

**9**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**10**

Close the battery compartment access doors.

**11**

Start the engine and check for leaks and proper operation. Replenish fluids as needed.

**12**

Close both right-rear service access doors.

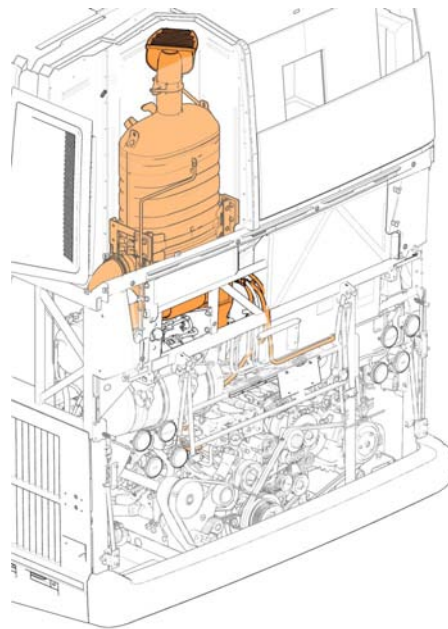
Date	Group	No.	Release	Page
9.2010	<b>258</b>	<b>80</b>	<b>01</b>	1(9)

## Aftertreatment Selective Catalytic Reduction (SCR) Catalyst, Replacement

D13H

PREVX

### Aftertreatment Selective Catalytic Reduction (SCR) Catalyst, Replacement



W2059829

This information provides the service procedure for replacing the Aftertreatment Selective Catalytic Reduction (SCR) Catalyst assembly on the VOLVO PREVX model bus equipped with the D13H engine.

### Contents

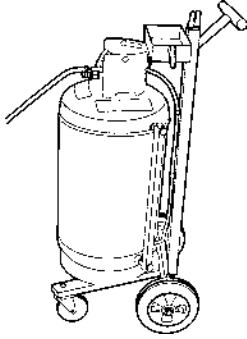
- "Special Tools", page 2
- "Aftertreatment Selective Catalytic Reduction (SCR) Catalyst, Replacement", page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

## Special Tools

For special tools ordering instructions, refer to Tool Information, Group 08.



W2004191

**85112740**  
Coolant Extractor

# Service Procedures

**2586-03-02-01**

## Aftertreatment Selective Catalytic Reduction (SCR) Catalyst, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 85112740*

### Removal

**1**

Apply the parking brake and place the shift lever in neutral.

**2**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**3**

Open the rear engine service doors.

**4**

Connect the coolant extractor and drain the coolant.

#### **DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

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85112740

**5**

Use a complete vehicle lift or jack to raise the rear axle and remove the left rear wheel. Lift the wheel skirt and remove the side panel to access the heater ball valve. Close the heater ball valve.

**6**

Open the rear side compartment to access the coolant package. Remove the grill stop.

**7**

Remove the condenser with brackets from the cooling package leaving the hoses connected.

**Note:** This step is only for vehicles with a secondary driver A/C unit.

**8**

Remove the air deflector seals around the cooling package.

**9**

Remove the upper coolant package support bracket.

**10**

Remove all coolant hoses and pipes from the coolant package. Remove the charge air cooler (CAC) pipe.

**11**

Remove the lower air deflector shield support bracket from the lower section below the coolant package.

**12**

Cut the tie straps and disconnect the electrical connector from the fan clutch. Remove the fan drive shaft fasteners at the gear box.

**13**

Remove all lower coolant package mounting fasteners.

**14**

Position the forks of a forklift under the coolant package.

**15**

With assistance, slide the coolant package out and onto the forklift. Transfer the coolant package to a secure location.

**16**

Remove the coolant expansion tank and mounting bracket as an assembly.

**17**

Relocate the A/C dryer and lines.

**18**

Remove the aftertreatment diesel particulate filter (DPF) inlet exhaust pipe.

**19**

Remove the CAC pipe from the cooler to the mixer.

**20**

Remove the heat wrap from the aftertreatment SCR catalyst as required to access the exhaust temperature sensor and clamps. Remove the temperature sensor at the aftertreatment DPF outlet. Remove the aftertreatment SCR catalyst exhaust inlet clamp and the aftertreatment DPF exhaust outlet clamp and pull the pipe away from the aftertreatment SCR catalyst.

**21**

Remove the aftertreatment SCR catalyst access door.



W2060060

**22**

Remove the fasteners and remove the roof mounted aftertreatment SCR catalyst guard.

**23**

Loosen the clamp and remove the diffuser from the aftertreatment SCR catalyst with the drain tube attached.

**24**

Disconnect the NOx sensor harness and remove the module.

**25**

Remove the aftertreatment SCR catalyst water drain pipe.

**26**

Connect a lifting chain to the lifting eyelets on the aftertreatment SCR catalyst. Position a lifting device and support the weight of the aftertreatment SCR catalyst.

**27**

Remove the aftertreatment SCR catalyst mounting fasteners (aftertreatment SCR catalyst to rubber mounts), then remove the lower U-shaped mount.

**28**

With assistance, remove the aftertreatment SCR catalyst through the lower side door where the coolant package mounts.

**29**

Remove the mounting brackets from the aftertreatment SCR catalyst.

## Installation

**1**

Install the mounting brackets onto the replacement aftertreatment SCR catalyst. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**2**

Install a lifting chain to the lifting eyelets on the replacement aftertreatment SCR catalyst.

**3**

Using a lifting device, with assistance, install the aftertreatment SCR catalyst into the chassis through the lower side door.

**4**

Install the lower U-shaped mount, then install the aftertreatment SCR catalyst mounting fasteners (aftertreatment SCR catalyst to rubber mounts). Tighten all fasteners to specification, refer to Function Group 20, Specifications.

**5**

Remove the lifting chain and the lifting device.

**6**

Install the aftertreatment SCR catalyst water drain pipe. Tighten to specification, refer to Function Group 20, Specifications.

**7**

Connect and install the NOx sensor wiring harness and module. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**8**

Install the diffuser to the aftertreatment SCR catalyst (with the upper drain tube attached) and install the clamp. Tighten the clamp to specification, refer to Function Group 20, Specifications.

**9**

Install the roof mounted aftertreatment SCR catalyst guard. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**10**

Install the aftertreatment SCR catalyst access door.



**11**

Clean the sealing surfaces on the aftertreatment SCR catalyst inlet, the aftertreatment DPF outlet, and the exhaust pipe between the aftertreatment DPF and the aftertreatment SCR catalyst. Using new gaskets, position the pipe between the aftertreatment SCR catalyst and the aftertreatment DPF and install new V-band clamps. Tighten the V-band clamps to specification, refer to Function Group 20, Specifications.

**12**

Install the aftertreatment DPF outlet temperature sensor. Tighten to specification, refer to Function Group 20, Specifications. Secure the heat wrap on the pipe.

**13**

With assistance, use a forklift to position the coolant package into the chassis. Install the upper mounting bracket and fasteners. Install the lower mounting fasteners (align the fan drive shaft to the gear box).

**14**

Tighten all upper and lower coolant package fasteners to specification, refer to Function Group 20, Specifications.

**15**

Install the fan drive shaft fasteners at the gear box and connect the electrical connector. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**16**

Install the fitting that was removed from the top of the radiator. Connect all coolant hoses and pipes to the coolant package. Install the CAC pipe. Tighten the coolant and CAC hose clamps to specification, refer to Function Group 20, Specifications.

**17**

Install the air deflector lower mounting cross bar and seals around the coolant package.

**18**

Install the condenser with brackets to the cooling package. Tighten the fasteners to specification, refer to Function Group 20, Specifications.

**Note:** This step is only for vehicles with a secondary driver A/C unit.

**19**

Install the coolant package access door grill stop. Tighten the fasteners to specification. Refer to Function Group 20, Specifications.

**20**

Close the side compartment door.

**21**

Position and secure the A/C dryer and lines.

**22**

Clean the sealing surfaces on the flex pipe and the aftertreatment DPF inlet pipe. Using a new gasket, position the pipe and install a new V-band clamp. Tighten the V-band clamp to specification, refer to Function Group 20, Specifications. Pull the heat wrap over the V-band clamp and secure.

**23**

Secure the aftertreatment diesel exhaust fluid (DEF) dosing valve coolant lines to the bracket on the left side of the aftertreatment DPF.

**24**

Install the coolant expansion tank and mounting bracket as an assembly. Reconnect all hoses to the expansion tank. Connect the coolant level sensor wiring harness connector and secure the wiring harness with tie straps.

**25**

Fill the cooling system with the recommended coolant using the coolant extractor.

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85112740

**26**

Open the heater ball valve.

**27**

Install the access panel behind the left rear wheel. Install the left rear wheel and lower the vehicle.

**28**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**29**

Start the engine, check for leaks and proper operation.

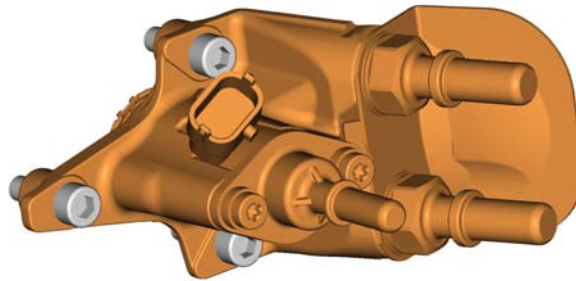
**30**

Close the rear engine service doors.

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9.2010	<b>258</b>	<b>81</b>	<b>01</b>	1(9)

Aftertreatment Diesel Exhaust Fluid  
(DEF) Dosing Valve  
Replacement  
PREVH, PREVX

## Aftertreatment Diesel Exhaust Fluid (DEF) Dosing Valve, Replacement



W2054160

This document provides the service procedures for the replacement of the Aftertreatment Diesel Exhaust Fluid (DEF) Dosing Valve on Prevost buses.

### Contents

- “Special Tools”, page 2
- “Aftertreatment Diesel Exhaust Fluid (DEF) Dosing Valve, Replacement”, page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

## Special Tools

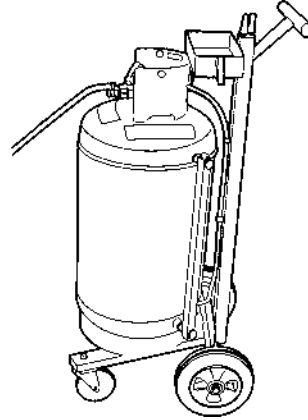
For special tools ordering information, refer to Tool Information, Group 08.



W0001795

**9996049**

Coolant Drain Hose



W2004191

**85112740**

Coolant Extractor

# Service Procedures

**2589-03-02-19**

## Aftertreatment Diesel Exhaust Fluid (DEF) Dosing Valve, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 85112740, 9996049*

### Removal

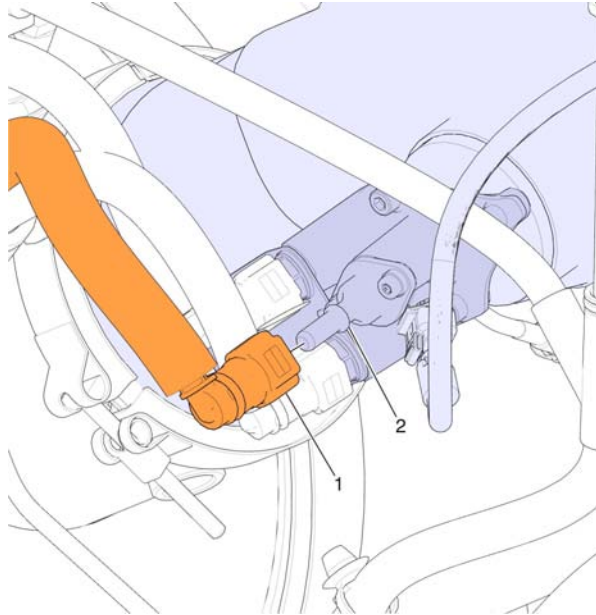
- 1**  
Apply the parking brake and transmission in neutral.
- 2**  
Open rear engine service doors.
- 3**  
Remove all cables from the ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.
- 4**  
Connect the coolant extractor to the drain fitting at the bottom of the radiator and drain the coolant.  
**Note:** An alternate method is to connect a coolant drain hose to the radiator drain fitting and drain the coolant into a suitable container.

#### **DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause seriously illness or death.

85112740, 9996049

- 5**  
Remove insulation from around the diesel particulate filter (DPF) outlet pipe and doser.
- 6**  
Label coolant lines to aid in reassembly.



W2060410

- 1 DEF Supply Line
- 2 Dosing Valve

7

Push the quick connect fitting coupling in the ON direction, squeeze the holding clip lugs on either side of the connector and pull to disconnect the DEF supply line from the dosing valve. Cover the DEF line with a plastic bag and secure the bag with a tie wrap to prevent spillage on nearby components.

**! WARNING**

Aftertreatment DEF is an irritant. Contact with DEF can irritate the skin and eyes. Inhaling DEF mist can cause lung irritation. Avoid DEF contact with skin and eyes. Avoid breathing mist created by DEF spray.

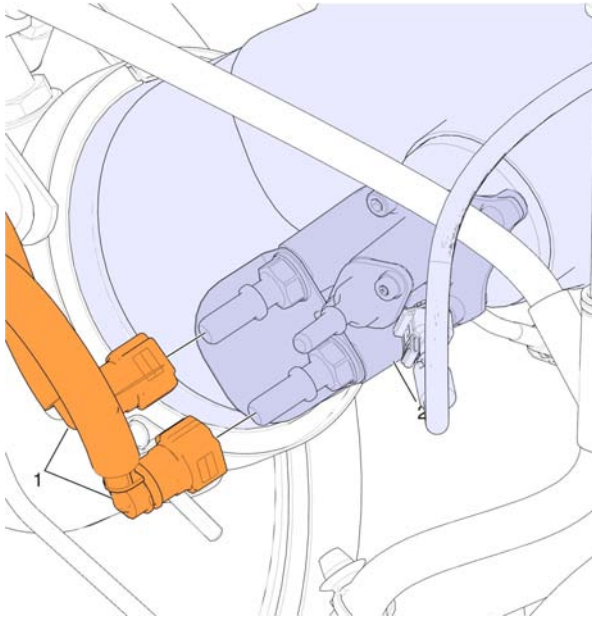
**! WARNING**

When disconnecting hoses and components, do not spill DEF onto separated connectors. If this occurs, replace the connectors **immediately**. Cleaning with water or compressed air will not help as the DEF quickly oxidizes metal and, due to capillary action, "creeps" along cabling at a speed of about 0.6 meters/hour.

**Note:** If the DEF line will remain open for an extended period of time, seal the opening to prevent crystallization of fluid in the line.

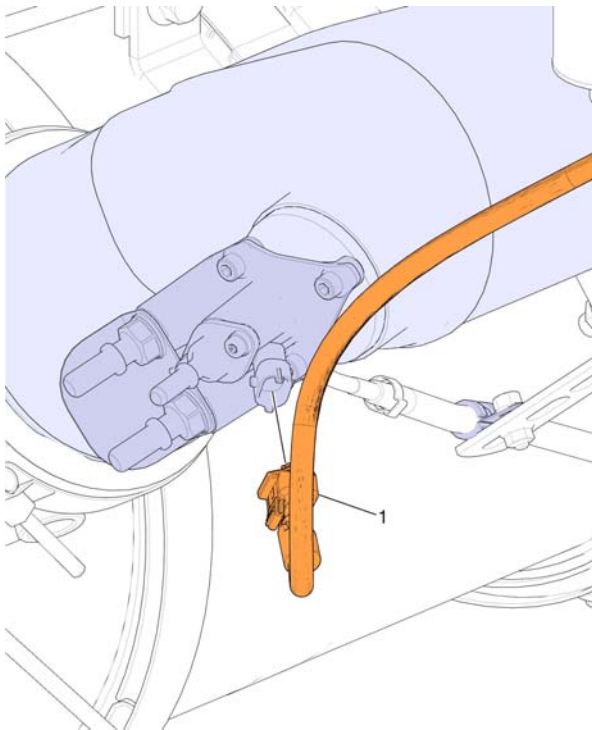
**! CAUTION**

Do not use pliers or other tools to release the connector. Tools can damage the retention mechanism and prevent proper sealing when reinstalled. Connectors and lines damaged by improper removal will not be covered under warranty.



W2060411

**1 Coolant Lines**



W2060412

**1 Electrical Connector**

**8**

Push the quick connect fitting coupling in the ON direction, squeeze the holding clip lugs on either side of the connector and pull to disconnect the coolant lines from the dosing valve.

**CAUTION**

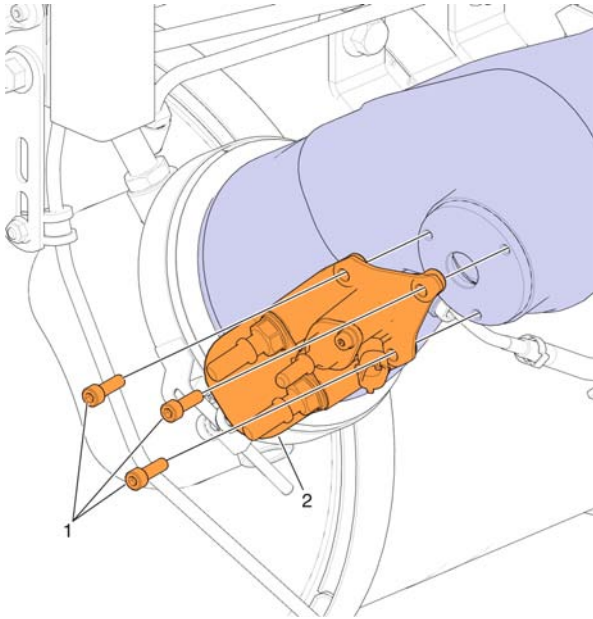
Do not use pliers or other tools to release the connector. Tools can damage the retention mechanism and prevent proper sealing when reinstalled. Connectors and lines damaged by improper removal will not be covered under warranty.

**CAUTION**

Do not clamp nylon coolant lines. Clamps will damage nylon lines.

**9**

Disconnect the electrical connector and position away from the aftertreatment DEF dosing valve. Cover the connector with a plastic bag and secure the bag with a tie wrap to protect it from the aftertreatment DEF.



W2060413

1 Fasteners

2 Dosing Valve

**10**

Remove and discard the aftertreatment DEF dosing valve fasteners. Remove the aftertreatment DEF dosing valve from the aftertreatment DPF.

**Note:** If the dosing valve will be reused, use plug kit 21376772 to cap the coolant and DEF valve fittings to prevent contamination and crystallization of DEF in the valve.

**11**

Remove and discard the aftertreatment DEF dosing valve gasket.



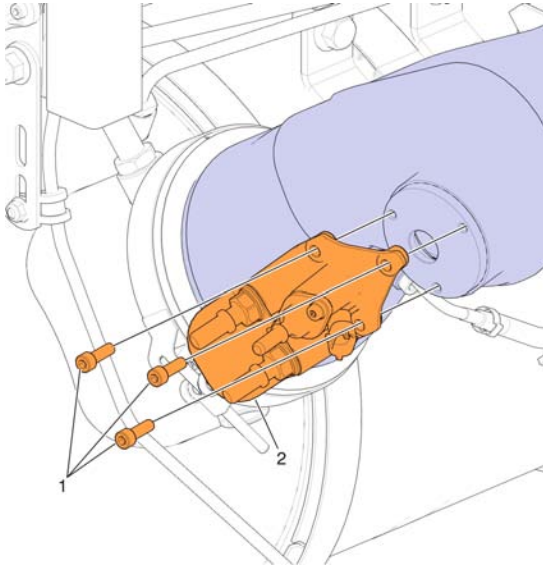
## Installation

**1**

Make sure that the mounting surface on the DPF outlet pipe is clean.

**2**

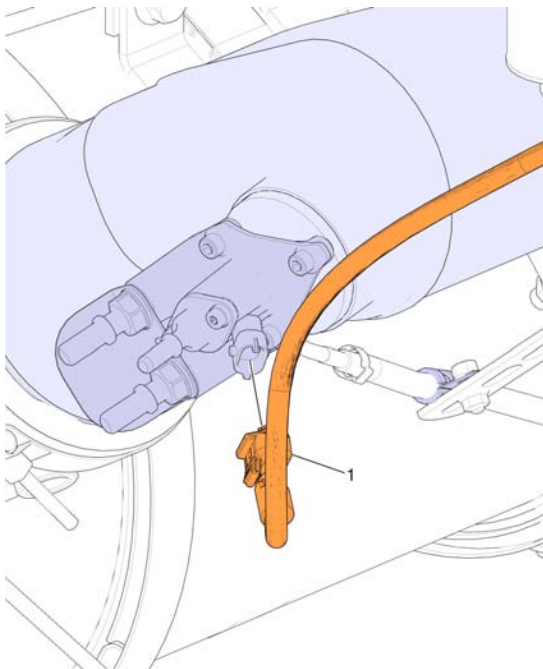
Position a new gasket on the aftertreatment DEF dosing valve and install the valve on the aftertreatment DPF using new fasteners. Tighten the fasteners to specification, refer to Function Group 20, Specifications.



W2060413

1 Fasteners

2 Dosing Valve

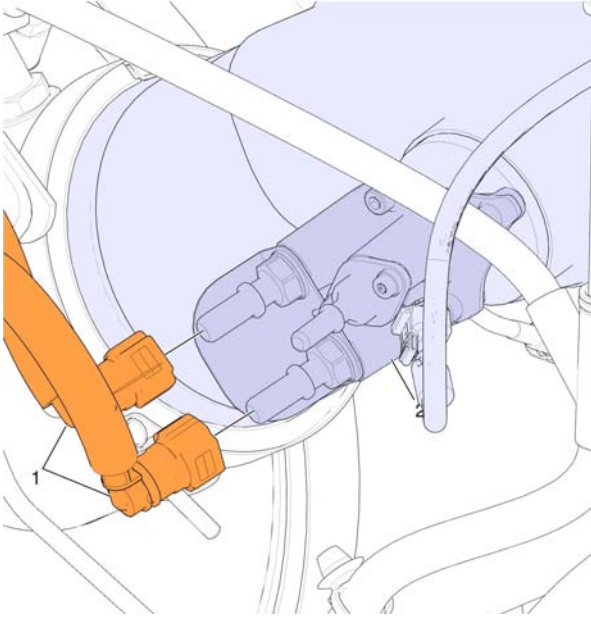


W2060412

1 Electrical Connector

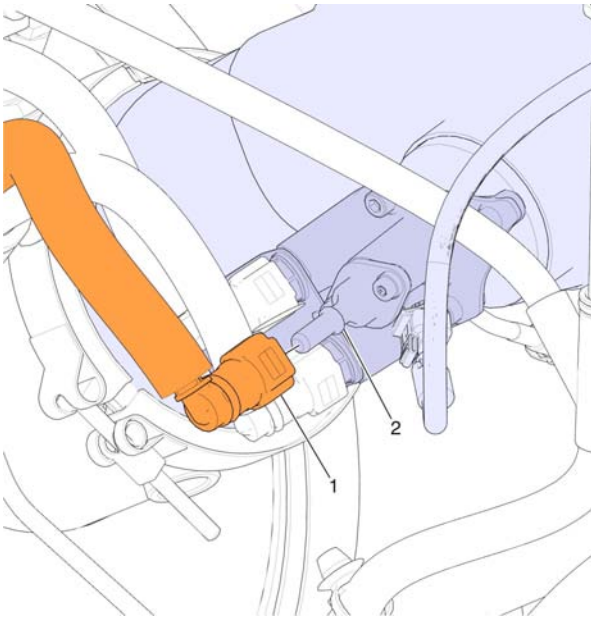
**3**

Remove the protective covering and reconnect the electrical connector to the aftertreatment DEF dosing valve.



W2060411

**1 Coolant Lines**



W2060410

**1 DEF Supply Line**

**2 Dosing Valve**

**4**

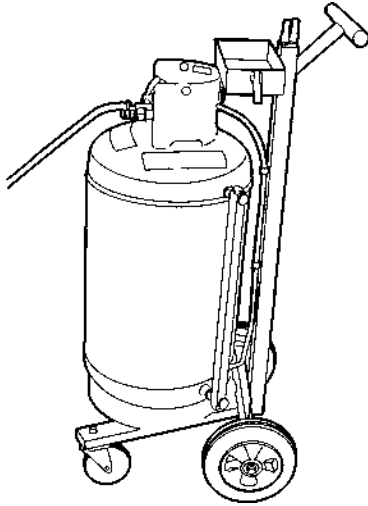
Verify the connector is clean and shows no signs of damage. Push the fitting onto the valve until it stops to reconnect the coolant lines to the aftertreatment DEF dosing valve. Pull the fitting in the OFF direction to ensure the connector is locked in place.

**5**

Remove the protective covering and verify the connector is clean and shows no signs of damage. Push the fitting onto the valve until it stops to reconnect the DEF supply line to the aftertreatment DEF dosing valve. Pull the fitting in the OFF direction to ensure the connector is locked in place.

**6**

Install insulation around DPF outlet pipe and dosing valve.



W2004191

**7**

Fill the cooling system with the recommended coolant using the coolant extractor.

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85112740

**8**

Install all previously removed cables to the ground (negative) battery terminals.

**9**

Connect Tech Tool and use Guided Diagnostics to read and clear any diagnostic trouble codes (DTCs). Run SCR Dosing Test 1 in VCADS to fill the line and dosing valve with DEF. Check for any DEF leaks at the connection.

**10**

Clean any residual fluids from the dosing valve and lines. Start the engine and check for coolant leaks at the dosing valve. Run the DEF Tank Heating Valve Activation Test in VCADS to purge air from the coolant lines. Ensure coolant is at the correct level after test. Clear any codes as required. Replenish the engine coolant level as required.

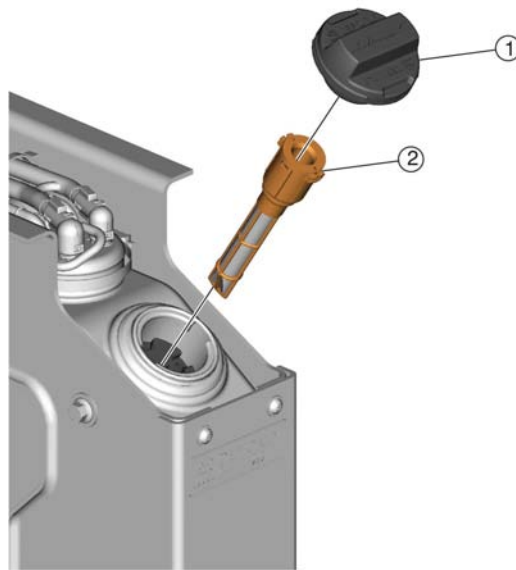
**11**

Close rear engine service doors.

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## Aftertreatment Diesel Exhaust Fluid (DEF) Tank, Filler Neck Insert, Replacement PREVH, PREVX

### Aftertreatment Diesel Exhaust Fluid (DEF) Tank, Filler Neck Insert, Replacement



W2056081

This information covers the procedure for replacing the filler neck insert in the aftertreatment diesel exhaust fluid (DEF) tank on PREVH and PREVX model buses.

#### Contents

- "Aftertreatment Diesel Exhaust Fluid (DEF) Tank, Filler Neck Insert, Replacement", page 2.

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

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## **2589-03-02-42**

# **Aftertreatment Diesel Exhaust Fluid (DEF) Tank, Filler Neck Insert, Replacement**

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## Removal

**1**

Apply the parking brake and place the shift lever in neutral.

**2**

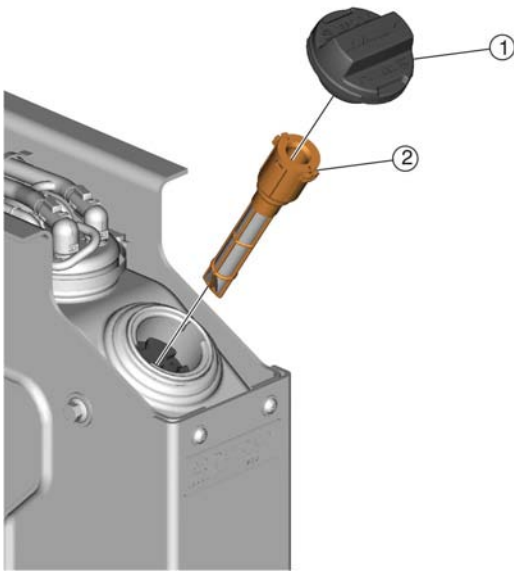
Open rear engine service doors.

**3**

Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

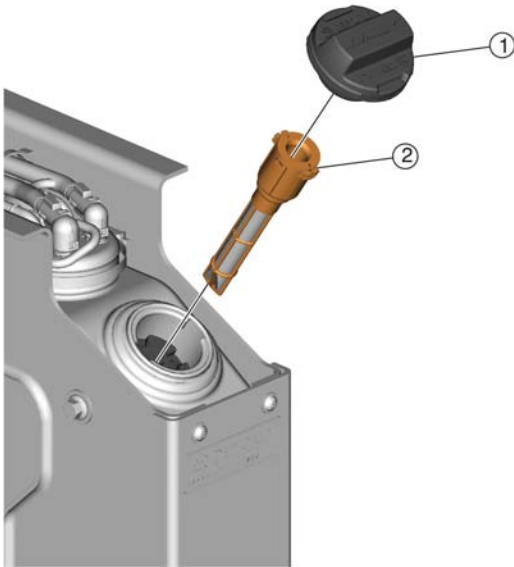
Open right service door at the air-conditioner evaporator.



W2056081

1 – Filler Cap

**5**  
Remove filler cap from the DEF tank.



W2056081

1 – Filler Cap  
2 – Filler Neck Insert

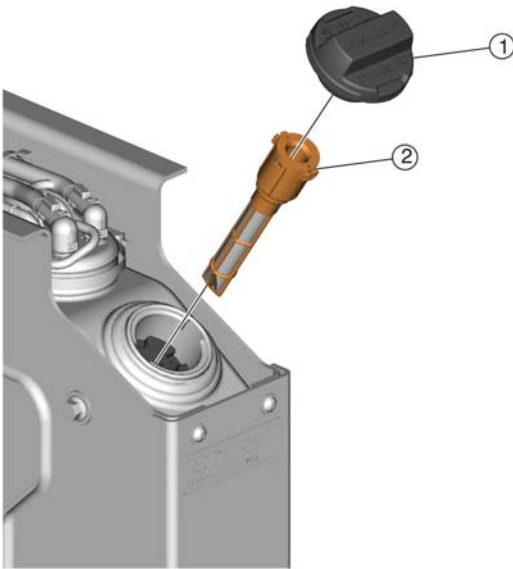
**6**  
Release the retaining tabs and remove defective filler neck insert from the DEF tank filler neck. Discard the old seal.

## Installation

### 1

Install replacement insert into DEF tank filler neck with new seal.

**Note:** Insert until the retaining tabs snap into the filler neck.



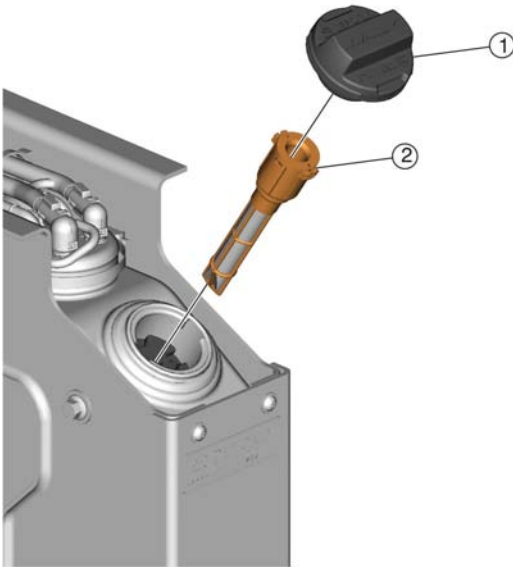
W2056081

1 – Filler Cap

2 – Filler Neck Insert

### 2

Install filler cap onto the DEF tank.



W2056081

1 – Filler Cap

**3**

Install all previously removed cables to the ground (negative) battery terminals.

**4**

Close right service door at the air-conditioner evaporator.

**5**

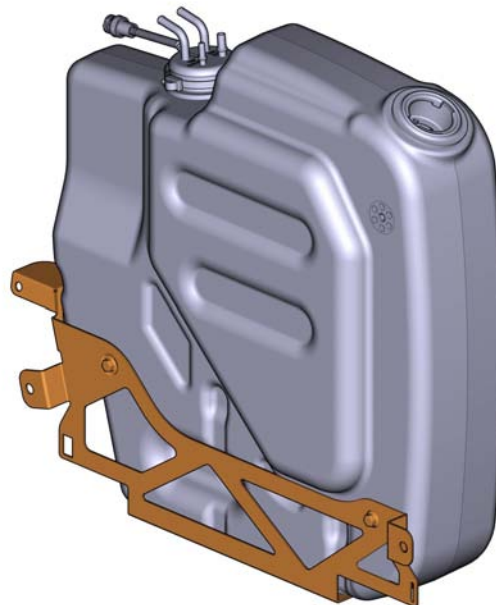
Close rear engine service doors.



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Aftertreatment Diesel Exhaust Fluid (DEF) Tank,  
Replacement  
PREVH, PREVX

## Aftertreatment Diesel Exhaust Fluid (DEF) Tank, Replacement



W2060362

This information covers the service procedure for the replacement of the Aftertreatment Diesel Exhaust Fluid (DEF) Tank on the Prevost model PREVH or PREVX bus.

### Contents

- "Aftertreatment Diesel Exhaust Fluid (DEF) Tank, Replacement", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2589-03-02-01**

## Aftertreatment Diesel Exhaust Fluid (DEF) Tank, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal and Replacement

#### **DANGER**

Coolant is toxic and can irritate the skin and poses a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

#### **WARNING**

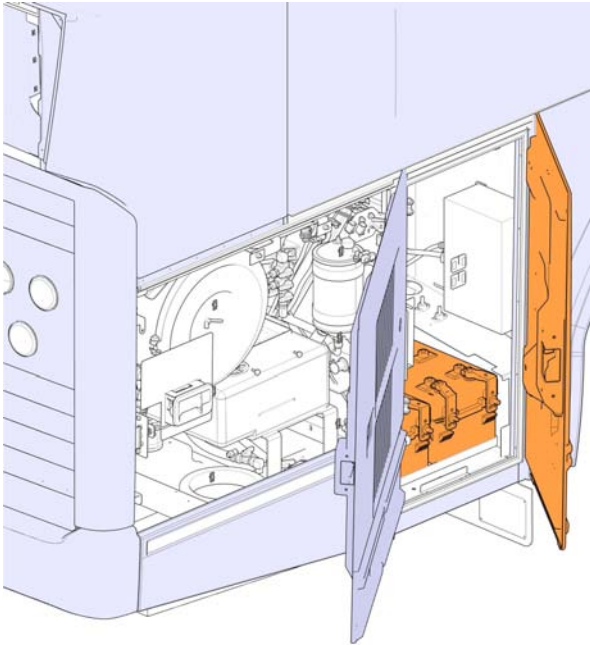
You must use approved Aftertreatment DEF in the Aftertreatment SCR system. Do not use DEF that is not approved, because it could damage the aftertreatment system permanently, decrease engine output and possibly damage other engine components

#### **CAUTION**

Do not spill Aftertreatment DEF onto exposed connectors when you disconnect hoses and components. If you spill DEF on an unprotected connector, you must replace the connector **immediately**. DEF is highly corrosive to metal, particularly copper and aluminum. Do not try to clean DEF off of the connectors with water or compressed air. They are ineffective because DEF quickly oxidizes metal and "creeps" into the wiring.

**1**

Apply the parking brake and place the shift lever in neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.



W8060022

**2**  
Open the right side electrical service door.

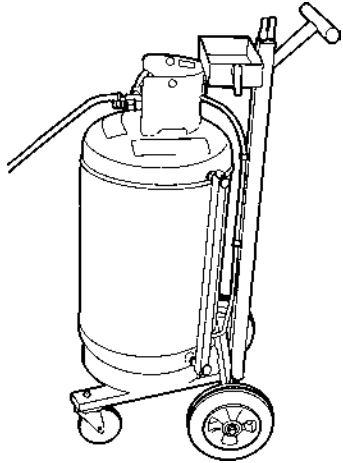
**3**  
Remove all cables from the ground (negative) battery terminals to prevent personal injury from electrical shock.

**4**  
Access the engine compartment via the rear doors or hatch.

**5**  
Open the right service door at the A/C evaporator.



W2060419



W2004191

Coolant Extractor 85112740

**6**

Drain the engine coolant from the vehicle using the coolant extractor P/N 85112740

**Removal**

**7**

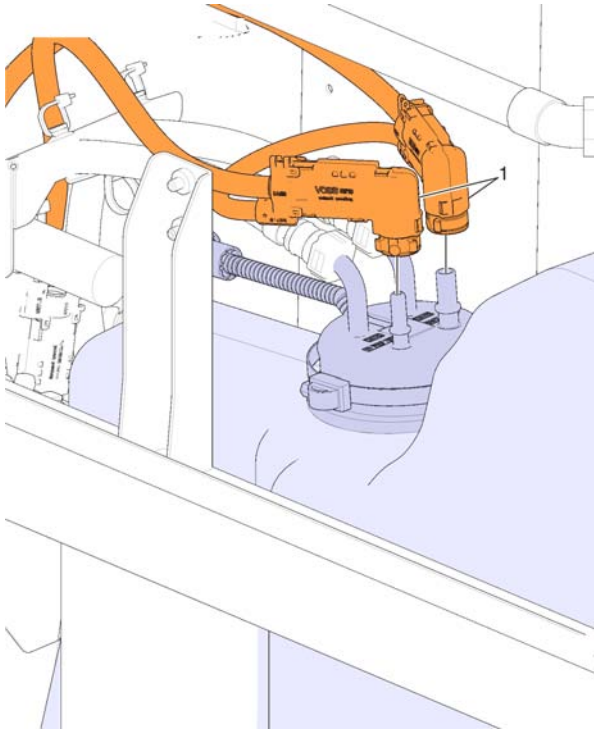
Clean the DEF tank and its mounting area.

**8**

Remove the plug and drain the DEF into an approved container of appropriate size.

**9**

Place a drip container under the DEF tank to catch any DEF or coolant.

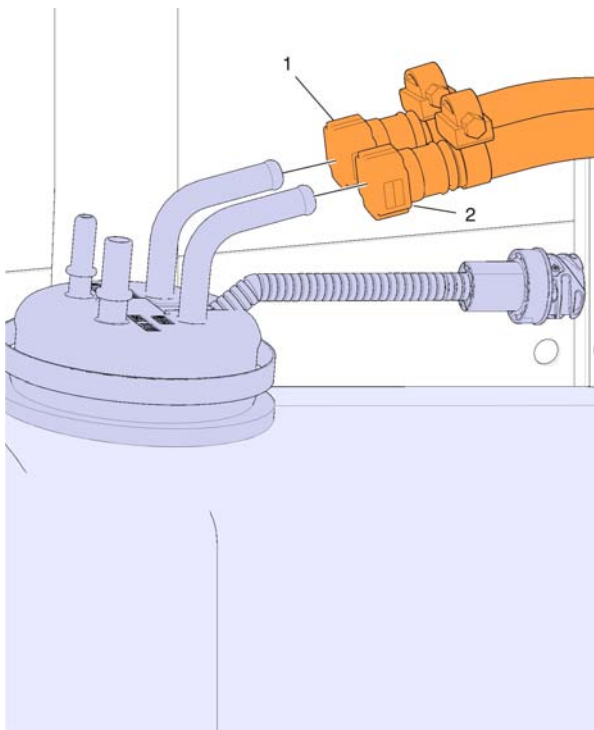


W2060196

**10**

Remove the DEF lines from the level sensor.

**Note:** Note for future reference the position of the lines before removing them.



W2060197

**11**

Remove the coolant lines from the level sensor.

**12**

Disconnect the level sensor from the wiring harness. Cover the exposed wiring harness connector with a plastic bag to protect it from DEF contamination.

**13**

Remove the drain pan from the vehicle. Also remove the drip container at this time. Dispose of the DEF and other fluids properly

**14**

Remove the DEF Inlet and breather hoses from the DEF tank.

**15**

Remove the DEF tank mounting fasteners.

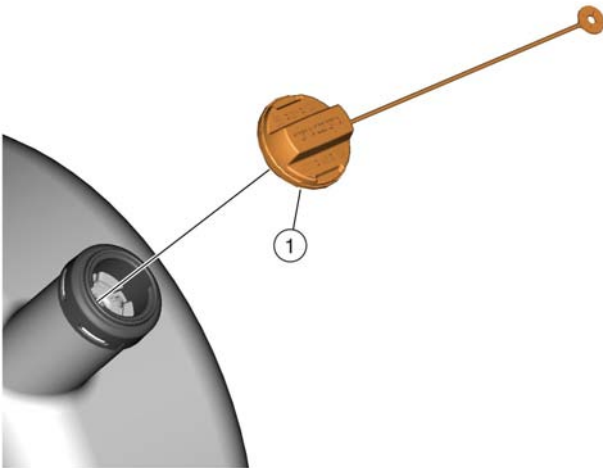
**16**

Remove the DEF tank from the vehicle.

**Transfer Usable Hardware**

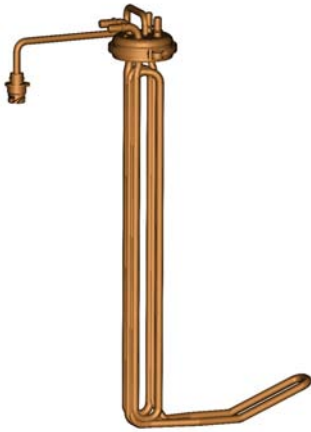
**17**

Transfer the filler neck insert to the replacement DEF tank.



W2056361

1 DEF Tank Cap and Splash Shield



W2055830

**18**

Transfer the level sensor to the replacement tank.

**19**

Transfer the mounting bracket with its fasteners to the replacement tank.

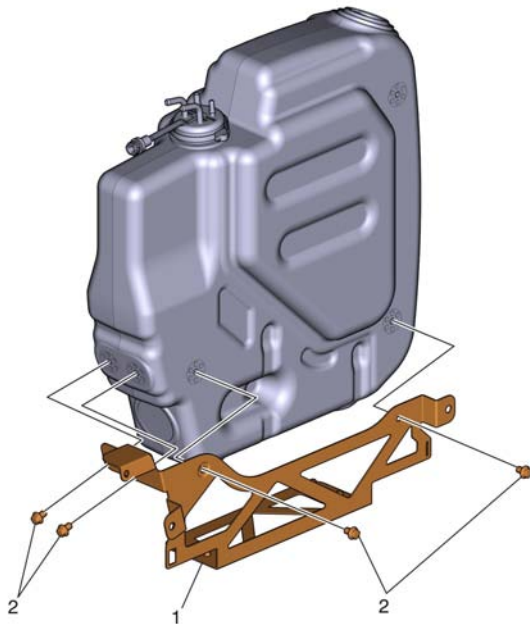
**20**

Transfer the drain plug to the replacement DEF tank.

**Install Replacement Tank**

**21**

Install and secure the DEF tank using its existing fasteners.



W2060363

**22**

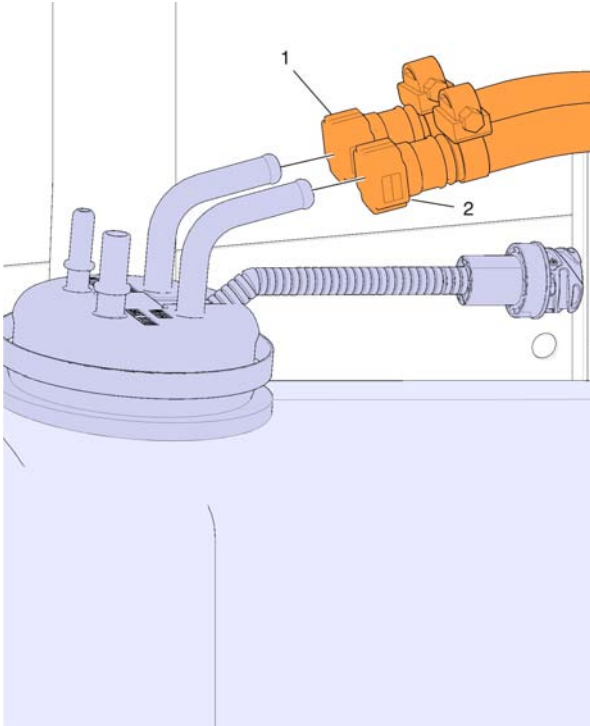
Install the DEF Inlet and breather hoses to the DEF tank.

**23**

Remove the plastic bag from the wiring harness connector. Reconnect the level sensor to the wiring harness and secure with cable ties.

**24**

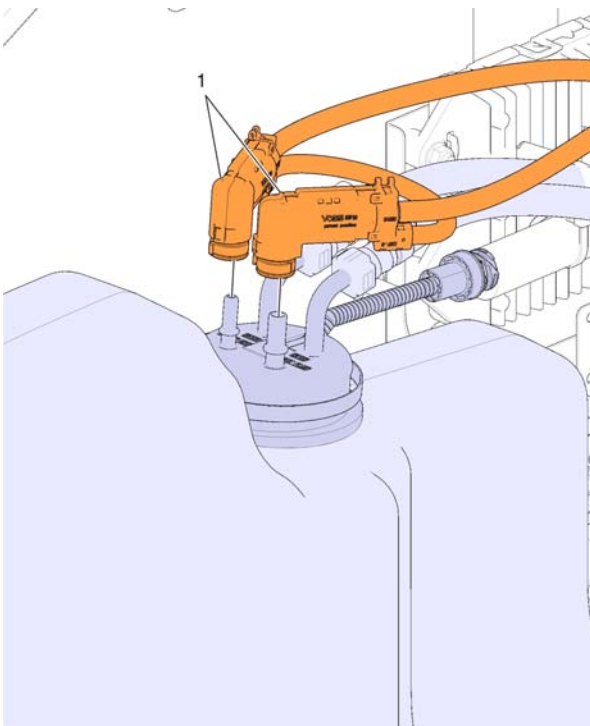
Install the coolant lines to the level sensor



W2060197

**25**

Install the DEF lines to the level sensor using information noted during removal.



W2060193

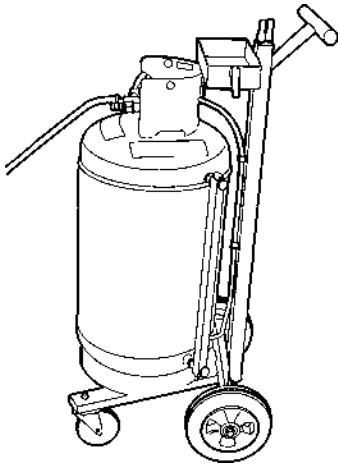


**26**

Fill the DEF tank with approved DEF fluid.

**27**

Fill the cooling system with recommended coolant using the coolant extractor/filler P/N 85112740



W2004191

Coolant Extractor 85112740

**28**

Install all previously removed cables to the ground (negative) battery terminals.

**29**

Check the vehicle for proper operation and the aftertreatment system for leaks.

**30**

Close the right service door at the A/C evaporator.

**31**

Close the previously opened engine compartment rear doors or hatch.

Date	Group	No.	Release	Page
8.2010	<b>258</b>	<b>85</b>	<b>01</b>	1(5)

Aftertreatment Diesel Exhaust Fluid  
(DEF) Tank, Flush

B13R, PREVH, PREVX

## Aftertreatment Diesel Exhaust Fluid (DEF) Tank, Flush

This information covers the service procedures for flushing the Aftertreatment Diesel Exhaust Fluid (DEF) Tank on VOLVO buses.

### Contents

- "Aftertreatment Diesel Exhaust Fluid (DEF) Tank, Flush", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2589-11-03-02**

## Aftertreatment Diesel Exhaust Fluid (DEF) Tank, Flush

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

#### **DANGER**

Coolant is toxic and can irritate the skin and poses a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

#### **WARNING**

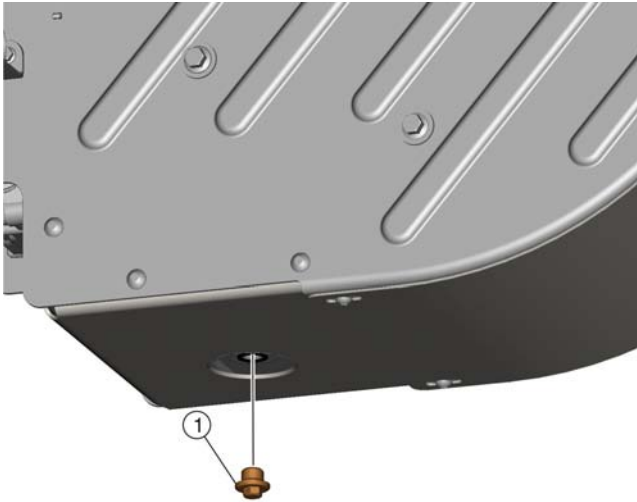
You must use approved Aftertreatment DEF in the Aftertreatment SCR system. Do not use DEF that is not approved, because it could damage the aftertreatment system permanently, decrease engine output and possibly damage other engine components

#### **CAUTION**

Do not spill Aftertreatment DEF onto exposed connectors when you disconnect hoses and components. If you spill DEF on an unprotected connector, you must replace the connector **immediately**. DEF is highly corrosive to metal, particularly copper and aluminum. Do not try to clean DEF off of the connectors with water or compressed air. They are ineffective because DEF quickly oxidizes metal and "creeps" into the wiring.

**1**

Put a suitable container under the diesel exhaust fluid (DEF) tank.



W2055831

1 DEF Tank Drain Plug

**2**  
Remove the DEF tank drain plug (1).

**3**

 **CAUTION**

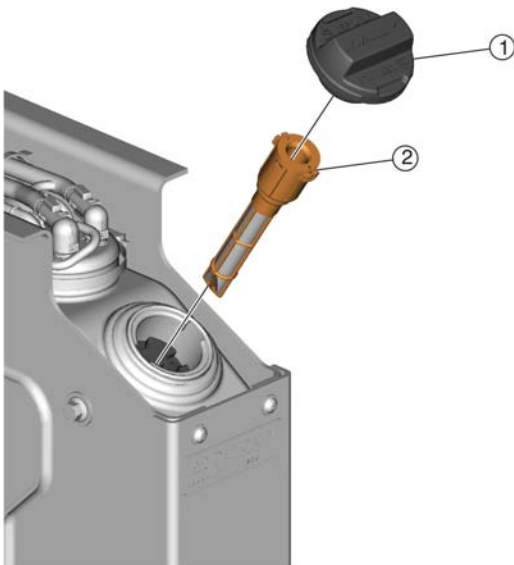
Do not use used DEF again. It will damage the aftertreatment system.

Let all of the DEF drain from the tank. Discard the used DEF according to local regulations.

**4**

Remove the DEF tank filler neck and screen (2).

**Note:** The DEF tank cap (1) is shown for reference.



W2056081

1 DEF Tank Cap

2 DEF Tank Filler Neck and Screen

**5**

Flush the tank with hot water. Let all of the water drain from the tank.

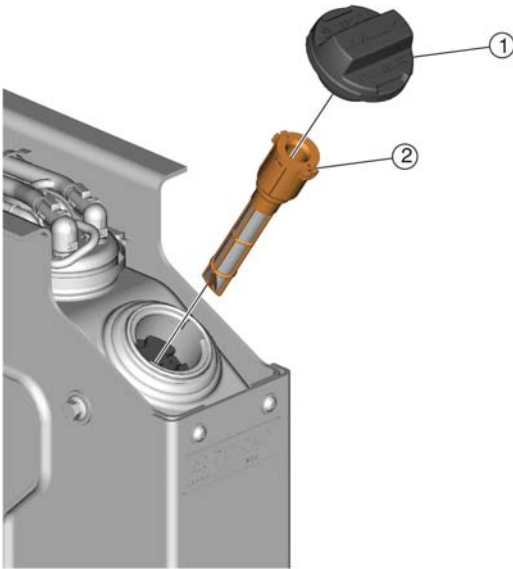
**6**

Clean the filler neck screen.

**7**

Install the DEF tank filler neck and screen (2).

**Note:** The DEF tank cap (1) is shown for reference.



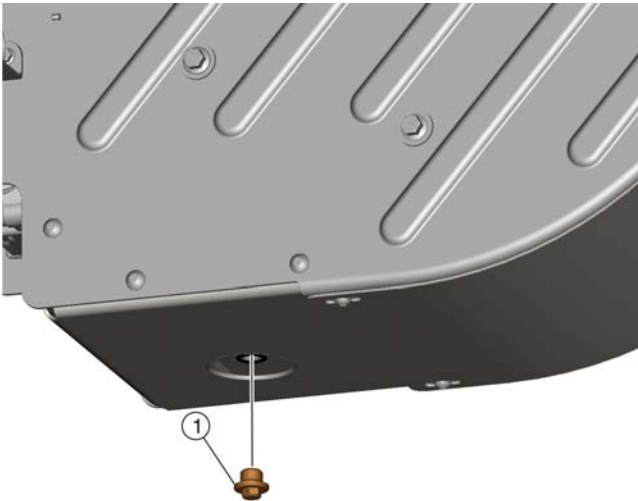
W2056081

1 DEF Tank Cap

2 DEF Tank Filler Neck and Screen

**8**

Install the DEF tank drain plug (1).



W2055831

1 DEF Tank Drain Plug

9

 **CAUTION**

You must use VOLVO approved DEF in the aftertreatment SCR system. Do not use DEF that is not approved by VOLVO, because it could damage the aftertreatment system permanently, decrease engine output and possibly damage other engine components.

 **CAUTION**

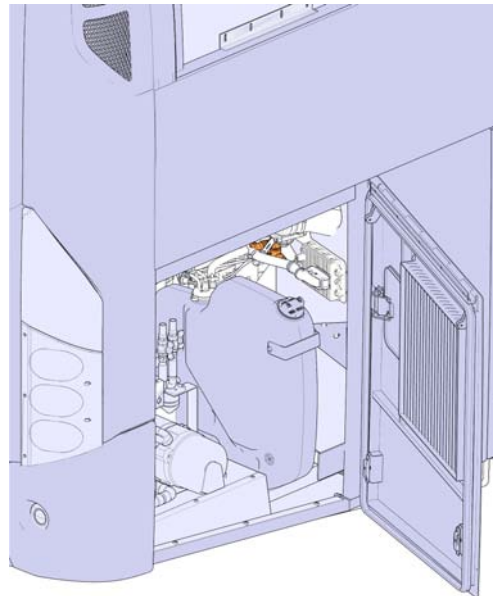
Do not use used DEF again. It will damage the aftertreatment system.

Fill the tank with new VOLVO approved DEF.

Date	Group	No.	Release	Page
9.2010	<b>258</b>	<b>90</b>	<b>01</b>	1(8)

## Aftertreatment Diesel Exhaust Fluid (DEF) Tank Heater Valve, Replacement

### Aftertreatment Diesel Exhaust Fluid (DEF) Tank Heater Valve, Replacement



W2060453

This service bulletin Provides the procedure for replacing the DEF tank heater valve on VOLVO buses.

#### Content

- “Special Tools”, page 2
- “Aftertreatment Diesel Exhaust Fluid (DEF) Tank Heater Valve, Replacement”, page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## Special Tools

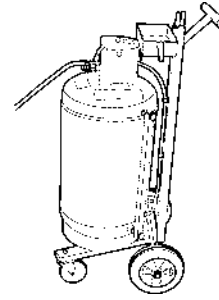
For special tools ordering information, refer to Tool Information, group 08.



W0001795

**9996049**

Coolant Drain Hose



W2004191

**DBT2V700 or 85112740**

Coolant Extractor



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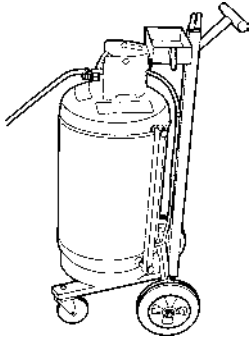
## **2589-03-02-07**

# **Aftertreatment Diesel Exhaust Fluid (DEF) Tank Heater Valve, Replacement**

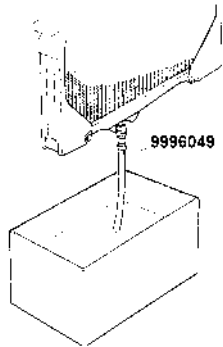
You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## **Removal**

- 1**  
Apply the parking brake and place I-Shift shifter in neutral.
  
- 2**  
Open the battery compartment access doors.
  
- 3**  
Disconnect all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.
  
- 4**  
Open the rear engine service doors.



W2004191



C2000268

**5**

Use the coolant extractor to remove the coolant from the engine. An alternate method is to drain the coolant into a suitable container using the drain hose.

**⚠ DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740, 9996049

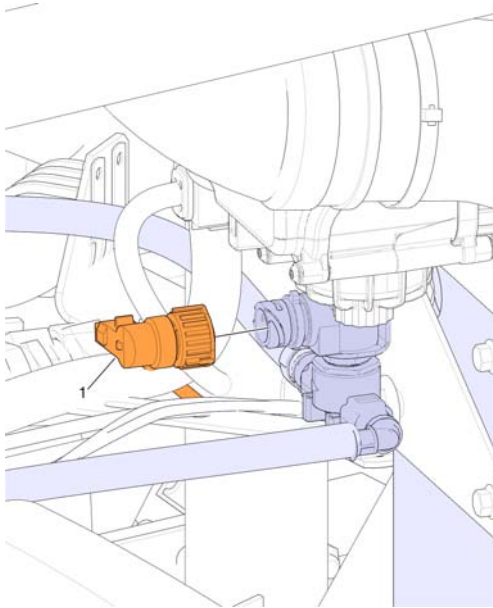
**6**

Open the right service door at the A/C evaporator.

**7**

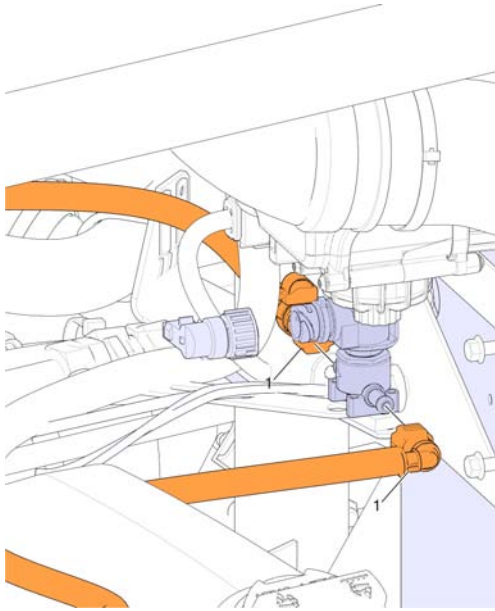
Remove cable tie and disconnect the wiring harness connector from the valve.

**Note:** Protect the wiring harness with a plastic bag and put out of the way.



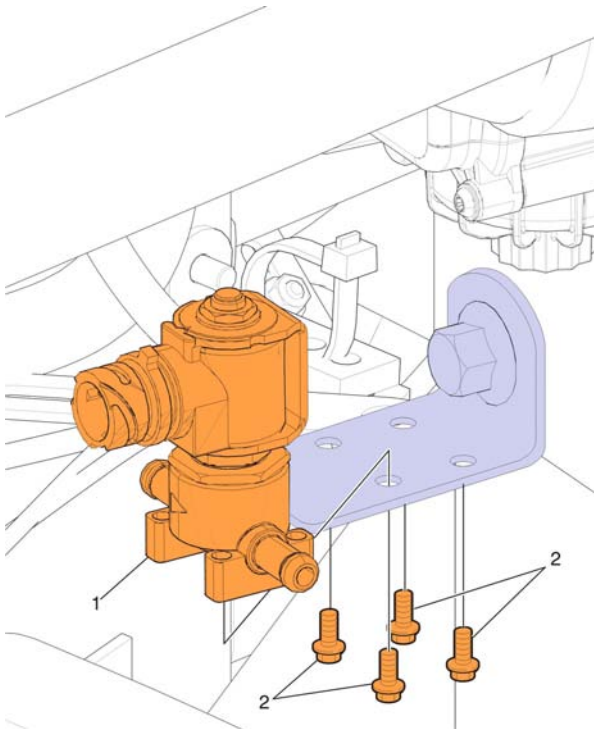
W2060454

1 Electrical Harness



W2060455

1 Valve Coolant Lines



W2060456

1 Valve

2 Fasteners

**8**

Push the quick connect fitting coupling in the ON direction, squeeze the holding clip lugs on either side of the connector and pull to disconnect the coolant lines from the valve.

**CAUTION**

Do not use pliers or other tools to release the connector. Tools can damage the retention mechanism and prevent proper sealing when reinstalled. Connectors and lines damaged by improper removal will not be covered under warranty.

**CAUTION**

Do not clamp nylon coolant lines. Clamps will damage nylon lines.

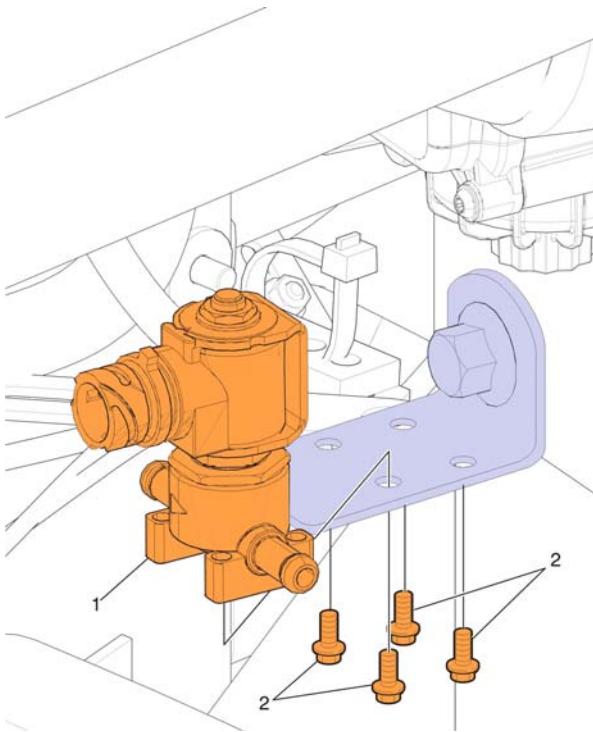
**9**

Remove fasteners and valve from the mounting bracket.

## Installation

### 1

Install the fasteners and replacement valve on the mounting bracket. Tighten fasteners to specification, refer to Function Group 20, Specifications.

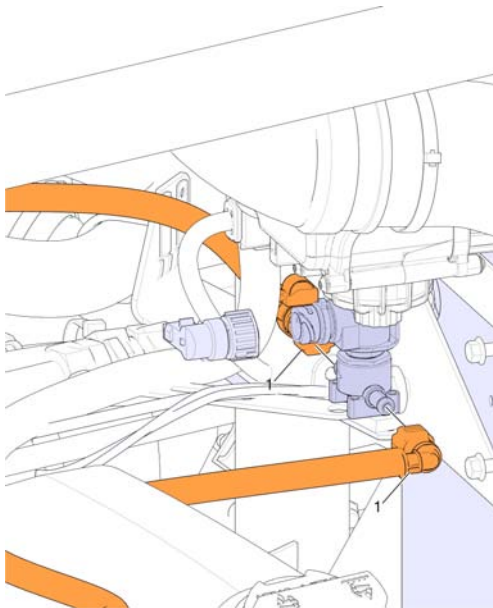


W2060456

- 1 Valve
- 2 Fasteners

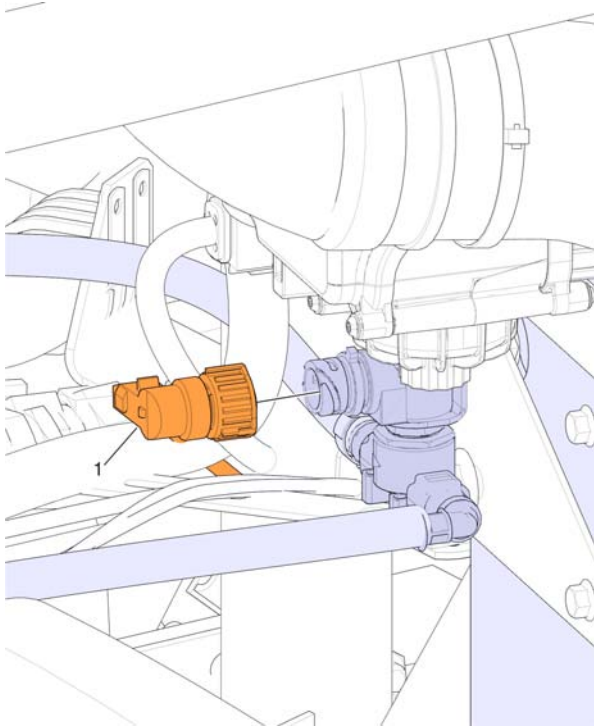
### 2

Verify the connector is clean and shows no signs of damage. Push the fitting onto the valve until it stops to reconnect the coolant lines to the valve. Pull the fitting in the OFF direction to ensure the connector is locked in place.



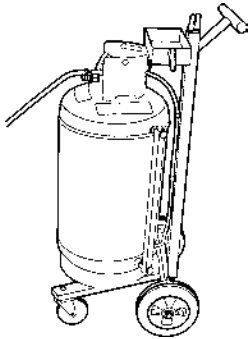
W2060455

- 1 Coolant Lines



W2060454

1 Wiring Harness



W2004191

**3**

Connect the wiring harness to the valve and secure with cable ties.

**4**

Fill the cooling system with the proper amount of recommended coolant using the coolant extractor.

---

85112740

**5**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**6**

Start the engine and check for coolant leaks at the valve. Connect Tech Tool to the vehicle. Run the DEF Tank Heating Valve Activation Test in VCADS to purge air from the coolant lines. Ensure coolant is at the correct level after test. Use Guided Diagnostics to rear and clear any diagnostic fault codes (DTCs). Replenish the engine coolant level as required.

**7**

Close the battery compartment access doors.

**8**

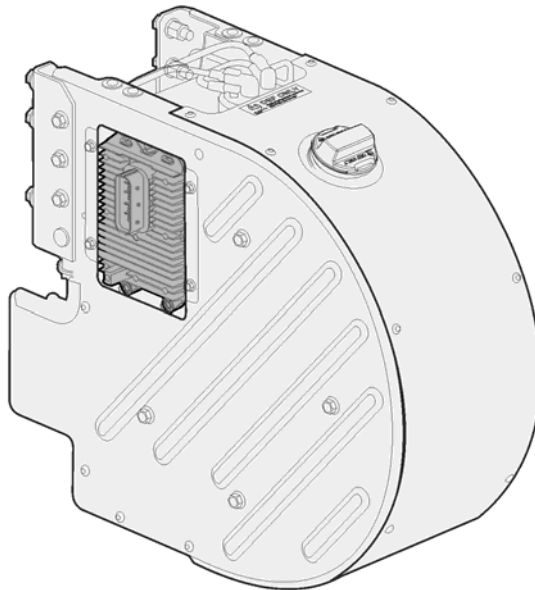
Close the rear engine service doors.

Date	Group	No.	Release	Page
9.2010	<b>258</b>	<b>93</b>	<b>01</b>	1(4)

## Aftertreatment Control Module (ACM), Replacement

PREVX

### Aftertreatment Control Module (ACM), Replacement



W2029917

This information provides a procedure for replacing the aftertreatment control module (ACM) on Prevost model PREVX buses.

#### Content

- "Aftertreatment Control Module, Replacement", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2589-03-02-20 Aftertreatment Control Module, Replacement

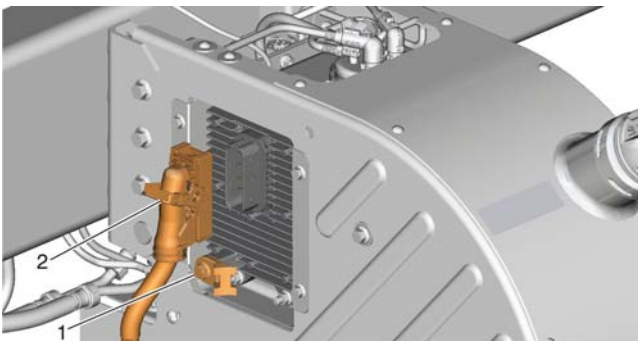
### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## Removal

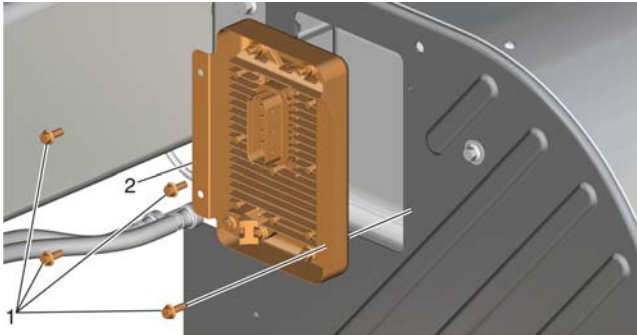
- 1**  
Apply the parking brake and put the shift lever in neutral.
- 2**  
Open the rear engine service doors.
- 3**  
Set the engine disable switch to "OFF".
- 4**  
Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.
- 5**  
Open the right service door at the A/C evaporator.
- 6**  
Remove cable ties (1) and disconnect the electrical harness (2) from the aftertreatment control module (ACM).



W2054110



2 Electrical Harness



W2054111

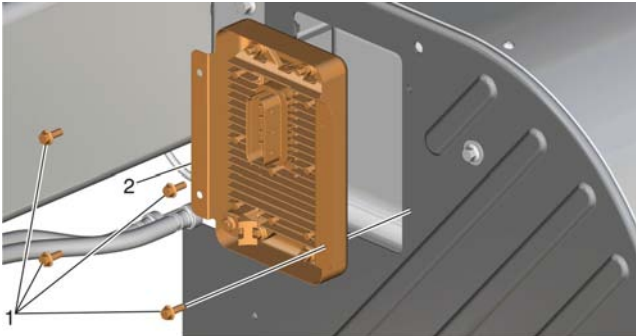
1 ACM Fasteners

2 ACM

**7**

Remove the ACM mounting fasteners (1) and the ACM (2).

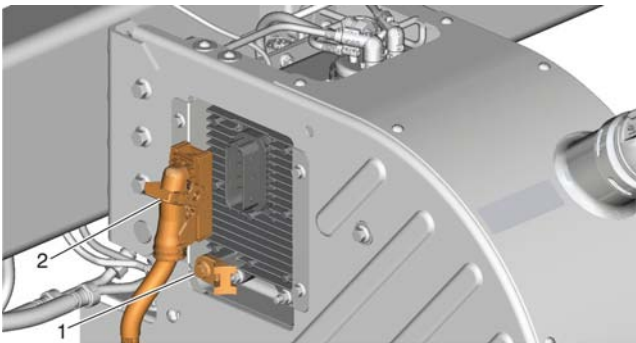
## Installation



W2054111

1 ACM Fasteners

2 ACM



W2054110

1 Cable Tie

2 Electrical Harness

**1**

Install the aftertreatment control module ACM (2) and the ACM mounting fasteners (1).

**2**

Connect the electrical harness (2) to the ACM and attach the harness with cable ties (1).

**3**

Install all previously removed cables to the ground (negative) battery terminals.

**4**

Close the right service door at the A/C evaporator.

**5**

Set the engine disable switch to "ON".

**6**

Connect Tech Tool and use Guided Diagnostics to read and clear any diagnostic trouble codes (DTCs). Reset engine data.

**7**

Close the rear engine service doors.

Date	Group	No.	Release	Page
4.2011	<b>258</b>	<b>96</b>		1(4)

Aftertreatment Selective Catalytic  
Reduction (SCR)

Harness Special Tool, Alteration

B13R, PREVH, PREVX

## Aftertreatment Selective Catalytic Reduction (SCR) Harness Special Tool, Alteration



T0030465

This information covers the alteration procedure for the aftertreatment selective catalytic reduction (SCR) harness special tool **88890120**.

### Contents

- "Aftertreatment Selective Catalytic Reduction (SCR) Harness Special Tool, Alteration", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2589-03-02-49**

## Aftertreatment Selective Catalytic Reduction (SCR) Harness Special Tool, Alteration

You must read and understand the precautions and guidelines in Service Information, group 2, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

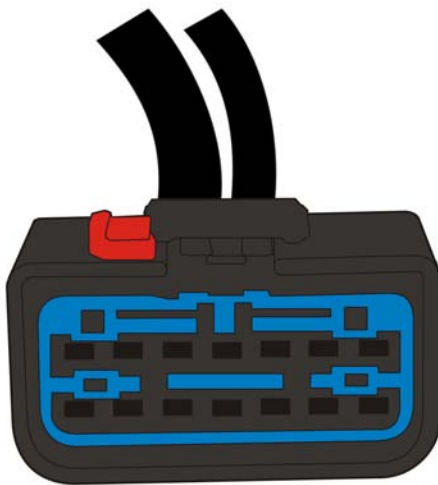
You must read and understand the precautions and guidelines in Service Information, group 3, "General Safety Practices, Electrical" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

1

### CAUTION

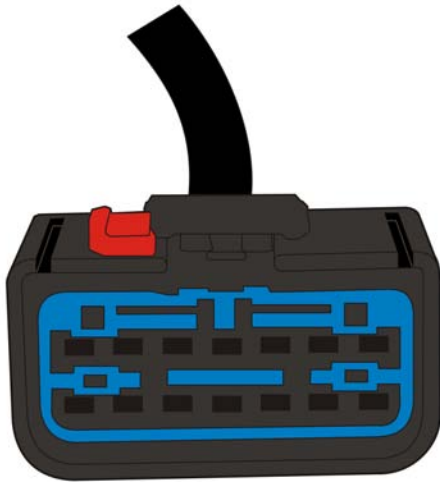
Use caution when altering the pin housing. Failure to do so can result in component damage.

Locate the female pin housing (top side), with red locking tab. Make a 3 mm (0.11 in) wide slot on each side 35 mm (1.37 in) apart. Each slot will be approximately 27 mm (1.06 in) in length.



W0064811

**Unaltered Female Pin Housing**

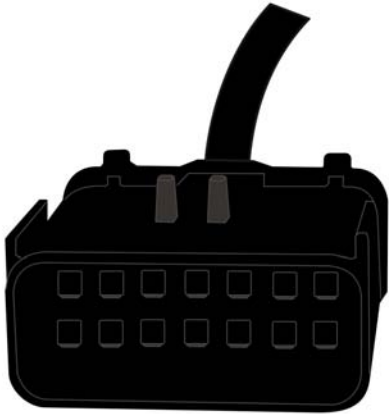


W0064813

**Altered Female Pin Housing**

**2**

Locate the male pin housing (top side), with locking tab.  
Using a small grinder remove the outer tabs on upper  
outside corners.



W0064812

**Unaltered Male Pin Housing**



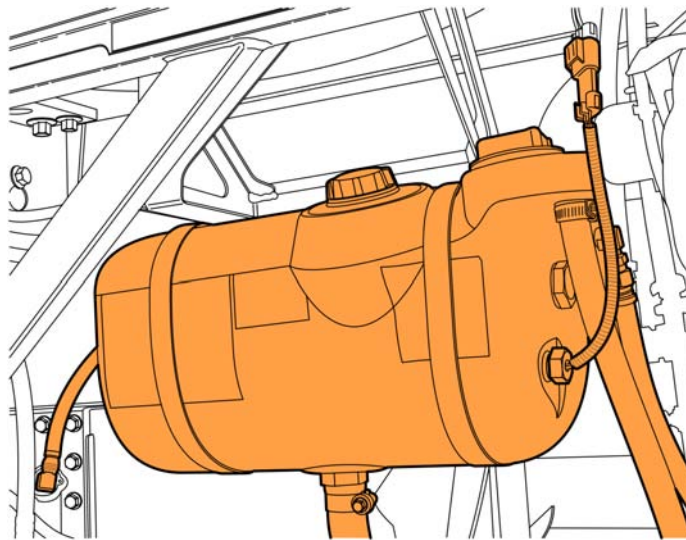
W0064814

**Altered Male Pin Housing**

Date	Group	No.	Release	Page
8.2010	<b>261</b>	<b>01</b>		1(7)

## Expansion Tank Replacement PREVX

### Expansion Tank, Replacement



W2060298

This service bulletin covers the procedures for replacing the engine coolant expansion tank on VOLVO PREVX model buses.

### Contents

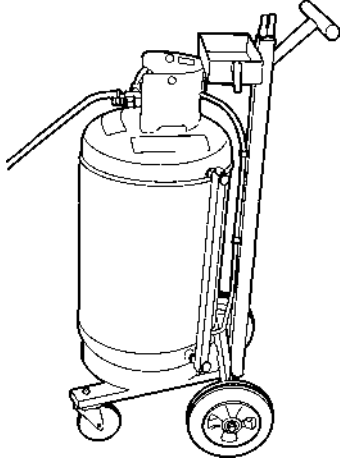
- "Special Tools", page 2 .
- "Expansion Tank, Replacement", page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

## Special Tools

For special tools ordering information, refer to Tool Information, group 08.



W2004191

**85112740**  
Coolant Extractor



# Service Procedures

**2612-03-02-01**

## Expansion Tank, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

### **DANGER**

Before working on a vehicle, set the parking brake, place the I-Shift transmission in Neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

## Removal

**1**

Apply the parking brake and place the I-Shift selector in Neutral.

**2**

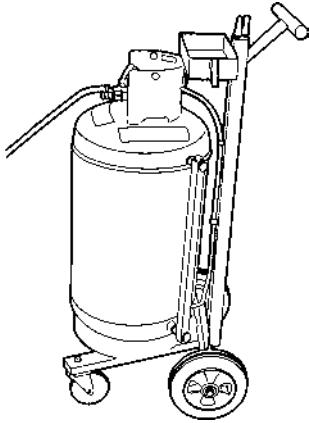
Open the battery compartment access doors.

**3**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

Open the rear engine service doors and the right-side access door to access the coolant expansion tank components.



W2004191

**5**

Connect the coolant extractor and drain the engine coolant.

**⚠ DANGER**

Engine coolant is toxic and can pose a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

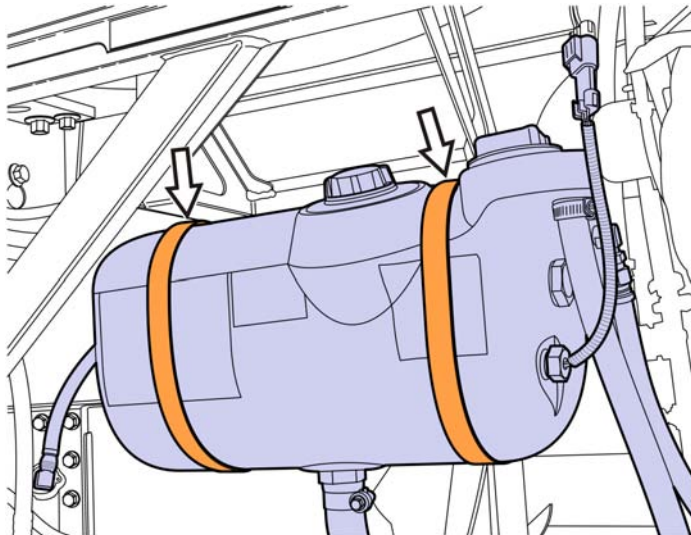
85112740

**6**

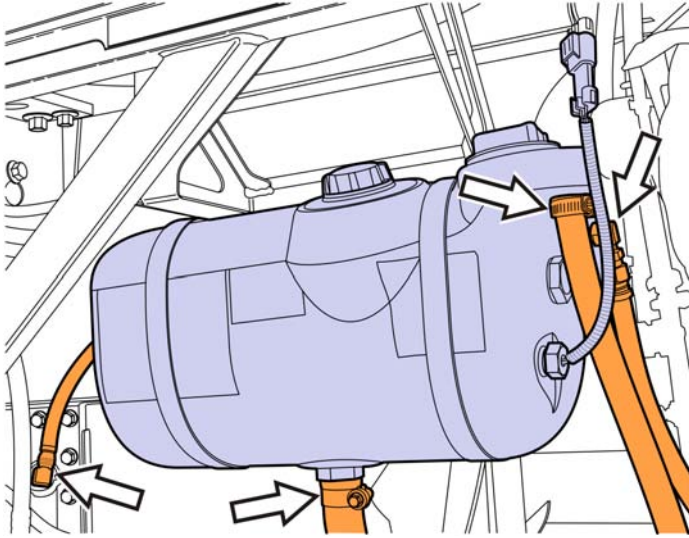
Remove the engine compartment light.

**7**

Remove the fasteners securing the retainer bands/expansion tank to the vehicle chassis.

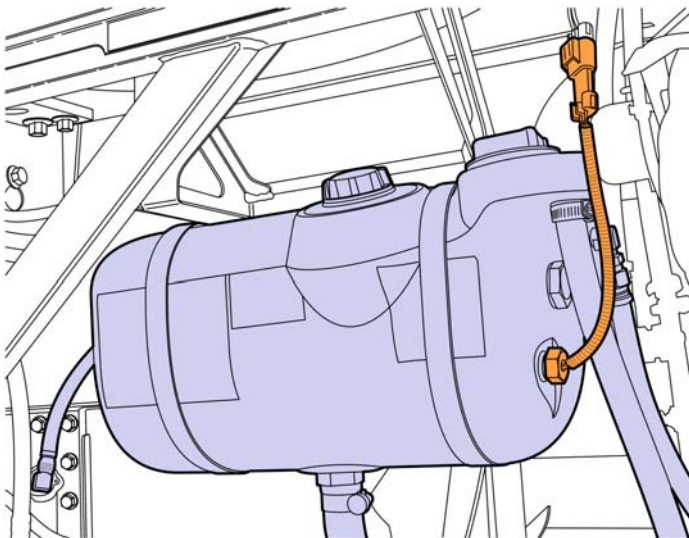


W2060301



W2060302

**8**  
Remove the coolant lines from the fittings on the expansion tank.



W2060303

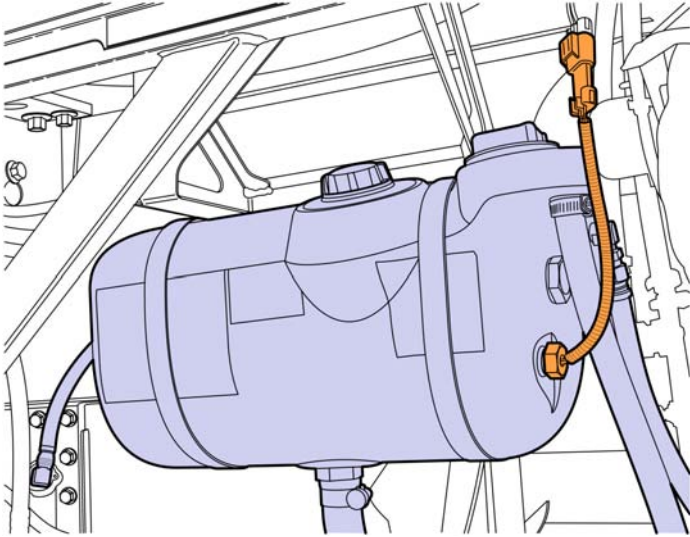
**9**  
Remove the wiring harness lead from the connector.

**10**  
Remove the defective expansion tank from the vehicle.

## Installation

**1**

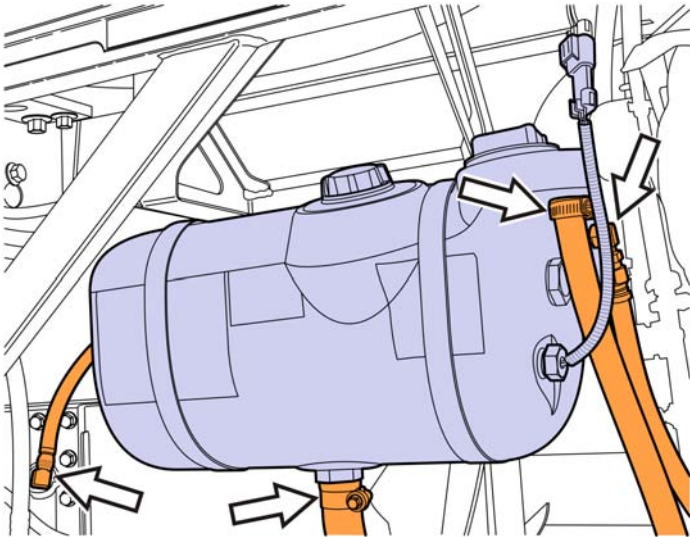
Position the replacement expansion tank in the vehicle and connect the wiring harness lead to the connector on the expansion tank.



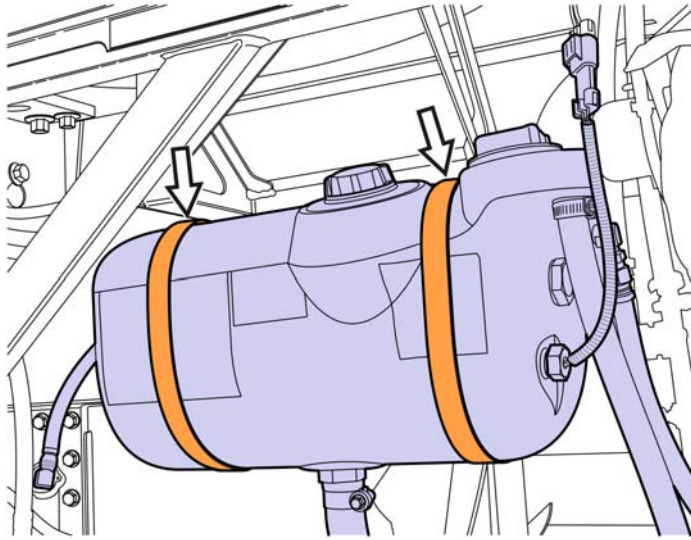
W2060303

**2**

Connect the coolant lines to the fittings on the replacement expansion tank.

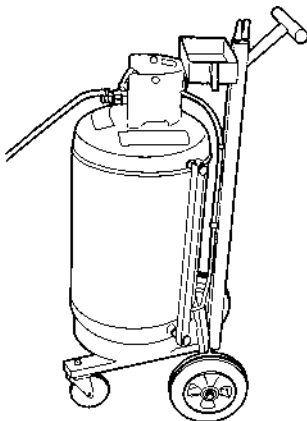


W2060302



W2060301

- 3**  
Using the fasteners, secure the retainer bands holding the expansion tank in position.



W2004191

- 4**  
Install the engine compartment light.

- 5**  
Connect the coolant extractor and install the engine coolant.

**⚠ DANGER**

Engine coolant is toxic and can pose a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740

- 6**  
Reconnect all previously removed cables to the negative (ground) battery terminals.

- 7**  
Close the battery compartment access doors.

- 8**  
Start the engine and check for leaks and proper operation. Replenish fluids as needed.

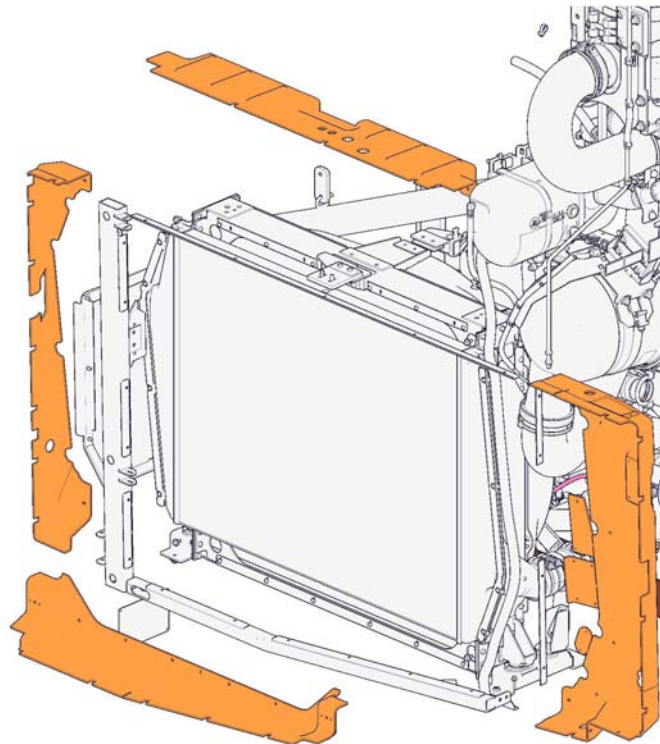
- 9**  
Close right-rear and rear engine compartment doors.

Date	Group	No.	Release	Page
9.2010	<b>261</b>	<b>02</b>	<b>01</b>	1(4)

## Radiator Recirculation Shield, Replacement

PREVX

### Radiator Recirculation Shield, Replacement



W2060474

This service bulletin covers the procedure for replacing the radiator recirculation shield on the PREVOST PREVX bus.

### Content

- “Radiator Recirculation Shield, Replacement”, page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

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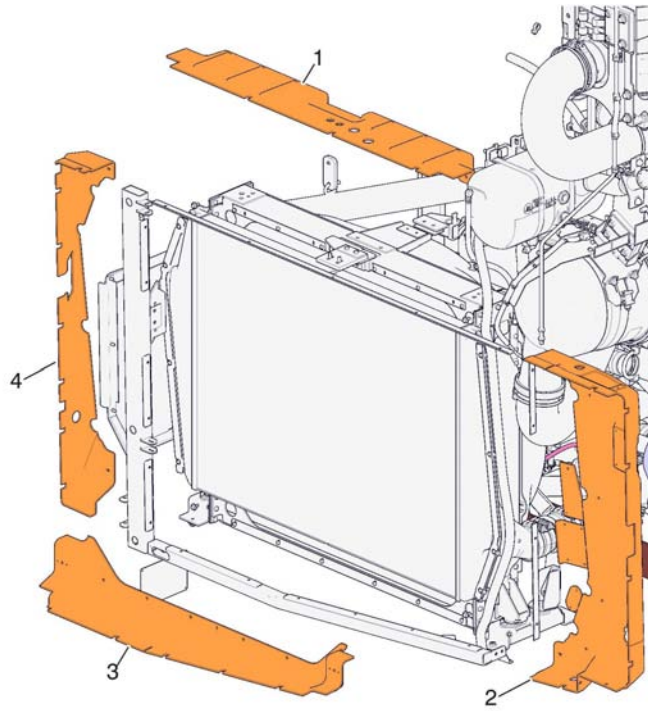
## **2619-03-02-02**

# **Radiator Recirculation Shield, Replacement**

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## Removal

- 1**  
Apply the parking brake and place I-Shift shifter in neutral.
  
- 2**  
Open the battery compartment access doors.
  
- 3**  
Disconnect all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.
  
- 4**  
Open the side service door to access the coolant package.
  
- 5**  
Remove the grille stop.



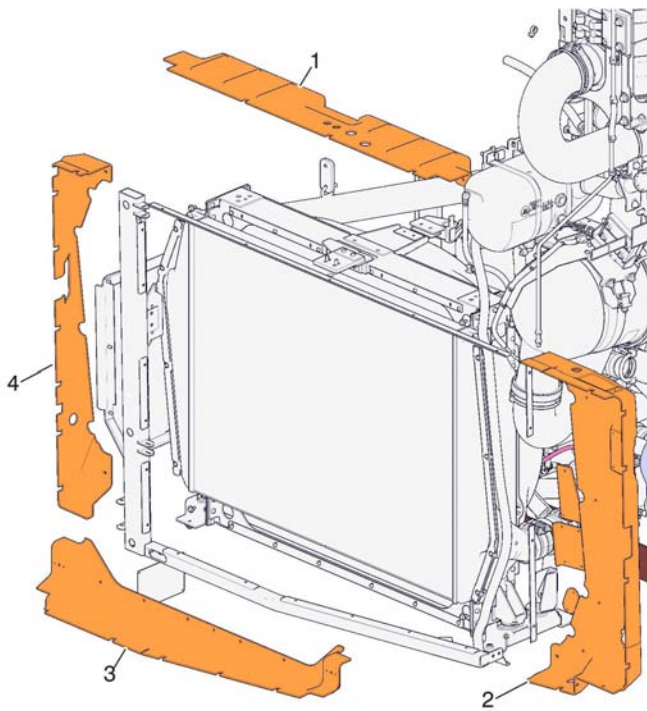
W2060475

- 1 Top Shield
- 2 Side Shield
- 3 Bottom Shield
- 4 Side Shield

**6**  
Remove fasteners and remove the air circulation shields around the coolant package.



## Installation



W2060475

**1**  
Install the air circulation shields around the coolant package.

- 1 Top Shield
- 2 Side Shield
- 3 Bottom Shield
- 4 Side Shield

**2**  
Install the grille stop.

**3**  
Reconnect all previously removed cables to the negative (ground) battery terminals.

**4**  
Start the engine and check for function.

**5**  
Close the battery compartment access doors.

**6**  
Close the side service doors.

Date	Group	No.	Release	Page
8.2010	<b>261</b>	<b>07</b>		1(6)

## Coolant Pipe Replacement (Expansion Tank to Coolant Pump)

PREVX

### Coolant Pipe, Replacement (Expansion Tank to Coolant Pump)



W2060493

This service bulletin covers the procedures for replacing the coolant pipe connecting the expansion tank to the coolant pump on VOLVO PREVX model buses.

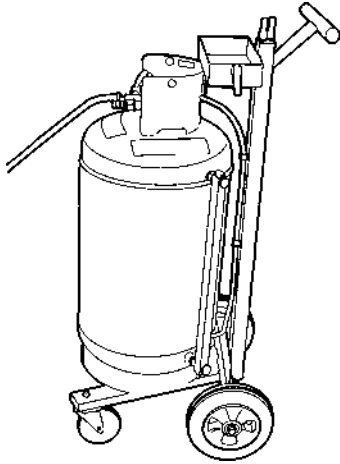
### Contents

- “Special Tools”, page 2 .
- “Coolant Pipe, Replacement (Expansion Tank to Coolant Pump)”, page 3 .

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## Special Tools

For special tools ordering information, refer to Tool Information, group 08.



W2004191

**85112740**  
Coolant Extractor

## 2616-03-02-07

# Coolant Pipe, Replacement (Expansion Tank to Coolant Pump)

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

### **DANGER**

Before working on a vehicle, set the parking brake, place the I-Shift transmission in Neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

*Special tools: 85112740*

## Removal

**1**

Apply the parking brake and place the I-Shift gear selector in Neutral.

**2**

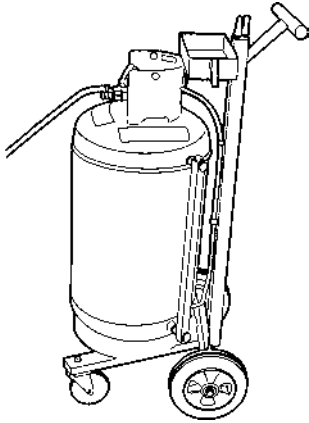
Open the battery compartment access doors.

**3**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

Open the right-side door and rear engine compartment service doors to access the coolant pipe, expansion tank and coolant pump.



W2004191

**5**

Connect the coolant extractor and drain the engine coolant.

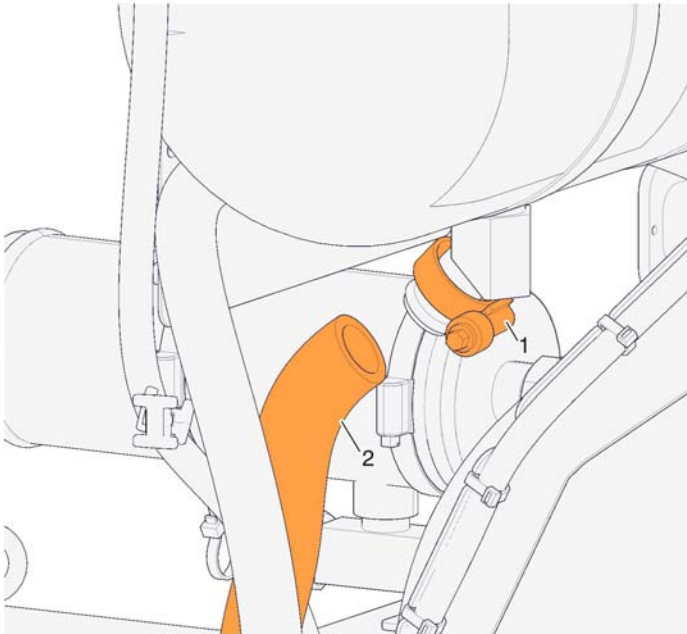
**⚠ DANGER**

Engine coolant is toxic and can pose a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740

**6**

Remove the clamps securing the coolant pipe to the expansion tank and to the coolant pump and remove the defective coolant pipe from the vehicle.



W2060494

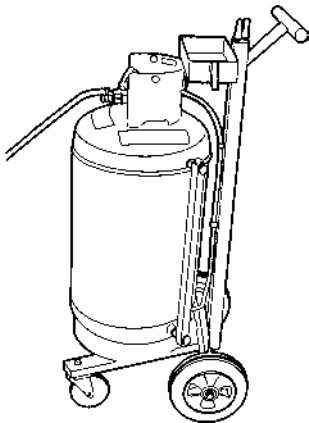
- 1 Hose Clamp
- 2 Coolant Pipe

## Installation



W2060494

- 1 Hose Clamp
- 2 Coolant Pipe



W2004191

- 1**  
Position the ends of the replacement coolant pipe onto the expansion tank fitting and the coolant pump fitting. Secure the pipe in place using the clamps.

- 2**  
Fill the engine cooling system with the recommended coolant using the coolant extractor.

### **DANGER**

Engine coolant is toxic and can pose a risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740

- 3**  
Reconnect all previously removed cables to the negative (ground) battery terminals.

- 4**  
Close the battery compartment access doors.

- 5**  
Start the engine and check for leaks and proper operation. Replenish fluids as needed.

**6**

Close the right-side door and the rear engine compartment doors.

Date	Group	No.	Release	Page
9.2010	<b>261</b>	<b>20</b>	<b>01</b>	1(8)

## Radiator Hose, Replacement (Upper)

PREVH, PREVX

## Radiator Hose, Replacement (Upper)

This service bulletin covers the procedure for replacing the upper radiator hose on the PREVOST PREVH and PREVX model bus.

### Content

- "Special Tools", page 2
- "Radiator Hose, Replacement (Upper)", page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



## Special Tools

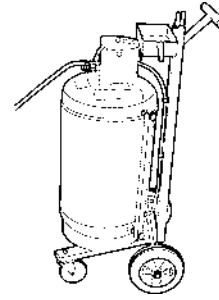
For special tools ordering information, refer to Tool Information, group 08.



W0001795

**9996049**

Coolant Drain Hose



W2004191

**DBT2V700 or 85112740**

Coolant Extractor

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## **2615-03-02-01**

### **Radiator Hose, Replacement (Upper)**

**incl. drain coolant**

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## **Removal**

**1**

Apply the parking brake and place I-Shift shifter in neutral.

**2**

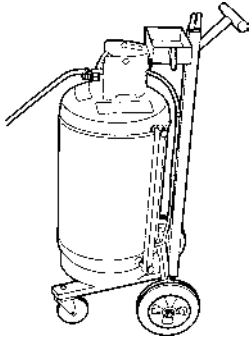
Open the battery compartment access doors.

**3**

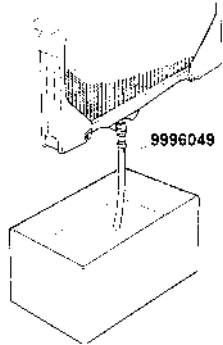
Disconnect all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

Open the rear engine service doors.



W2004191



C2000268

**5**

Use the coolant extractor to remove the coolant from the engine. An alternate method is to drain the coolant into a suitable container using the drain hose.

**⚠ DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

DBT2V700, 85112740, 9996049

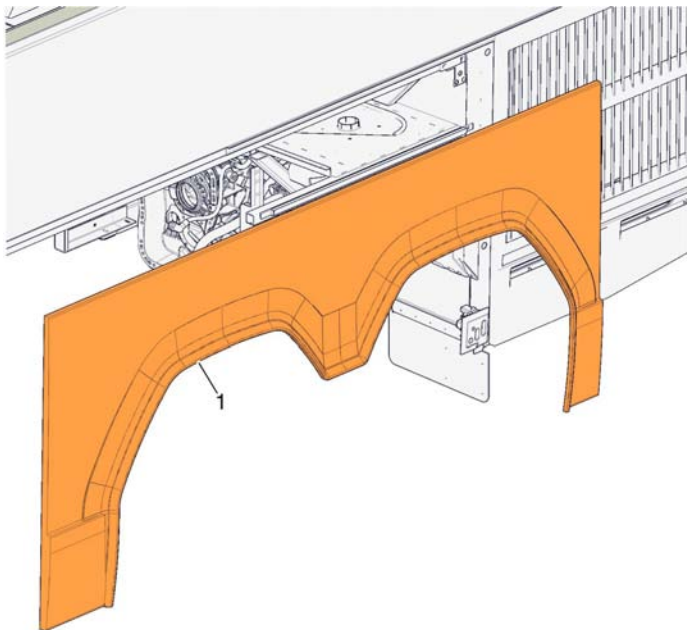
**At the Radiator**

**6**

Unlatch and remove left wheel skirt.

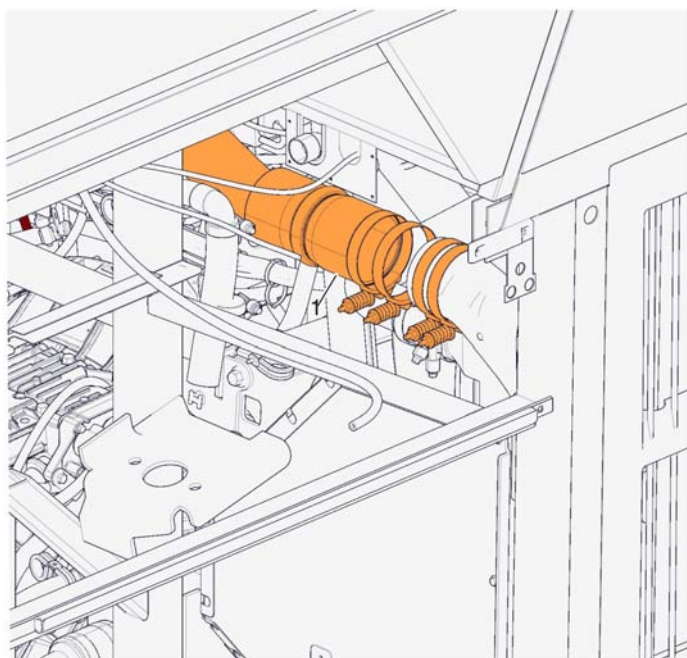
**7**

Using a complete vehicle lift or jack, raise the rear axle and remove the left rear wheel.



W2060503

- 8**  
Remove the access panel behind left rear tire.

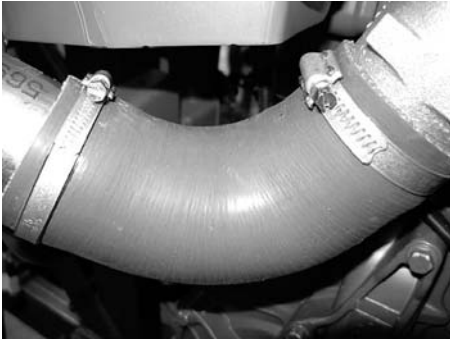


W2060504

- 9**  
Remove defective coolant hose.

## At the Engine

- 10**  
Remove defective coolant hose.

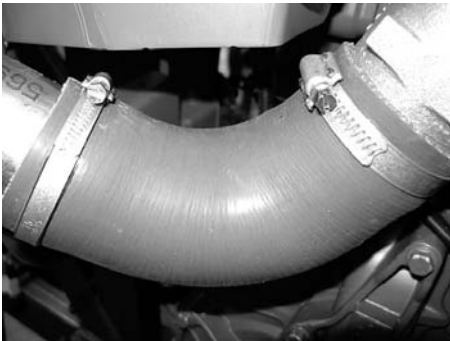


T2026297

## Installation

### At the Engine

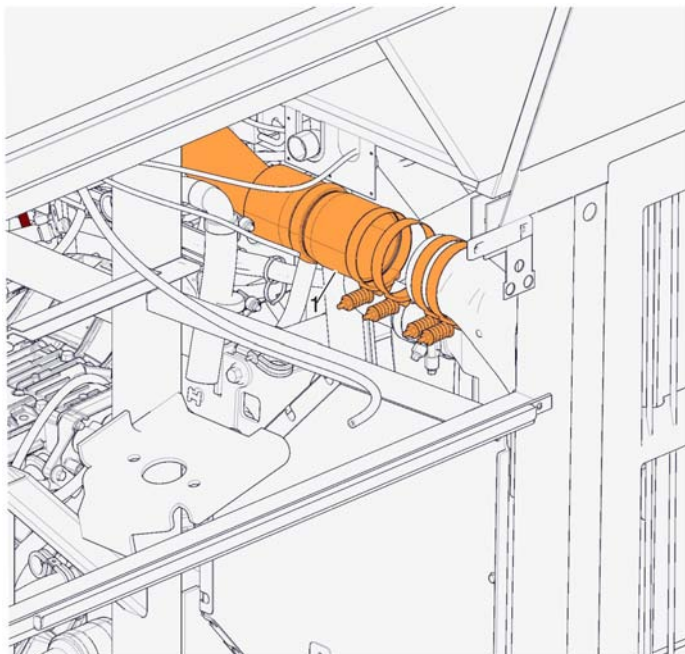
- 1**  
Install the replacement coolant hose.



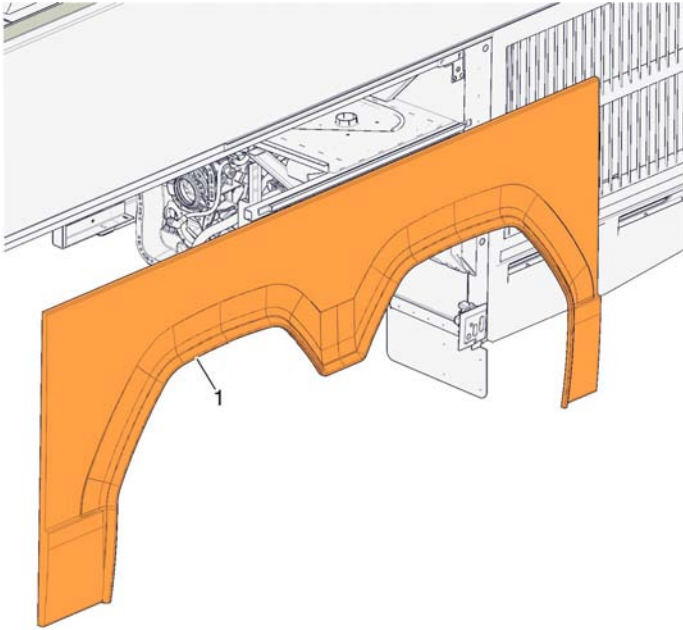
T2026297

### At the Radiator

- 2**  
Install replacement coolant hose.

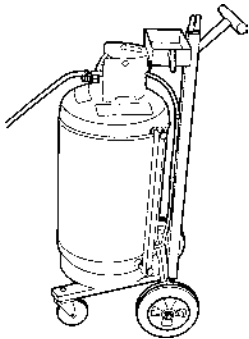


W2060504



W2060503

- 3**  
Install the access panel behind the left rear tire.



W2004191

- 4**  
Install the left rear tire and lower the bus and remove the vehicle lift.

- 5**  
Install and latch the left rear skirt.

- 6**  
Fill the cooling system with the proper amount of recommended coolant using the coolant extractor.

- 7**  
Reconnect all previously removed cables to the negative (ground) battery terminals.

- 8**  
Start the engine and check for coolant leaks at the valve. Replenish the engine coolant level as required.

- 9**  
Close the battery compartment access doors.

**10**

Close the rear engine service doors.

Date	Group	No.	Release	Page
9.2010	<b>261</b>	<b>24</b>	<b>01</b>	1(5)

## Radiator Hose, Replacement (Lower)

PREVX

### Radiator Hose, Replacement (Lower)

This service bulletin covers the procedure for replacing the lower radiator hose on the PREVOST PREVX bus.

#### Content

- "Special Tools", page 2
- "Radiator Hose, Replacement (Lower)", page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



## Special Tools

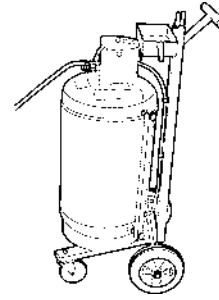
For special tools ordering information, refer to Tool Information, group 08.



W0001795

**9996049**

Coolant Drain Hose



W2004191

**DBT2V700 or 85112740**

Coolant Extractor

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## **2615-03-02-02**

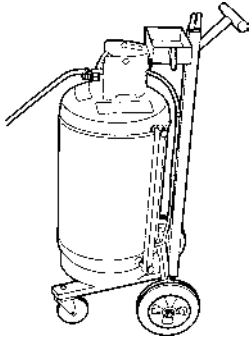
### **Radiator Hose, Replacement (Lower)**

**(incl. drain coolant)**

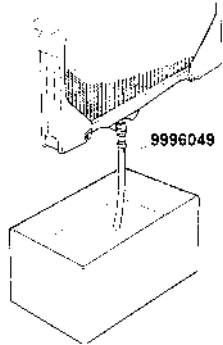
You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

## **Removal**

- 1**  
Apply the parking brake and place I-Shift shifter in neutral.
- 2**  
Open the battery compartment access doors.
- 3**  
Disconnect all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.
- 4**  
Open the rear engine service doors.



W2004191



C2000268

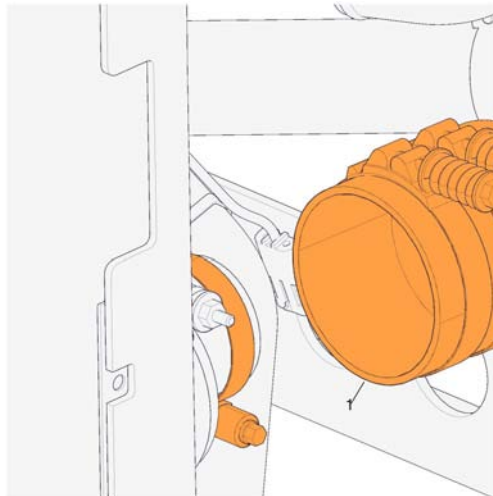
**5**

Use the coolant extractor to remove the coolant from the engine. An alternate method is to drain the coolant into a suitable container using the drain hose.

**⚠ DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

DBT2V700, 85112740, 9996049

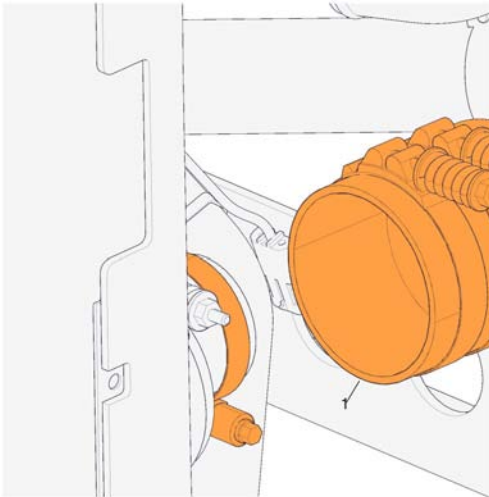


W2060500

**6**

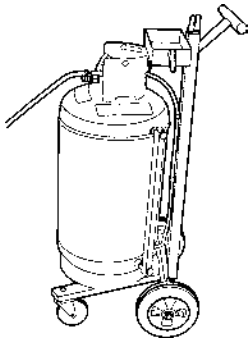
Remove defective coolant hose.

## Installation



W2060500

- 1**  
Install replacement coolant hose.



W2004191

- 2**  
Fill the cooling system with the proper amount of recommended coolant using the coolant extractor.

- 3**  
Reconnect all previously removed cables to the negative (ground) battery terminals.

- 4**  
Start the engine and check for coolant leaks at the valve. Replenish the engine coolant level as required.

- 5**  
Close the battery compartment access doors.

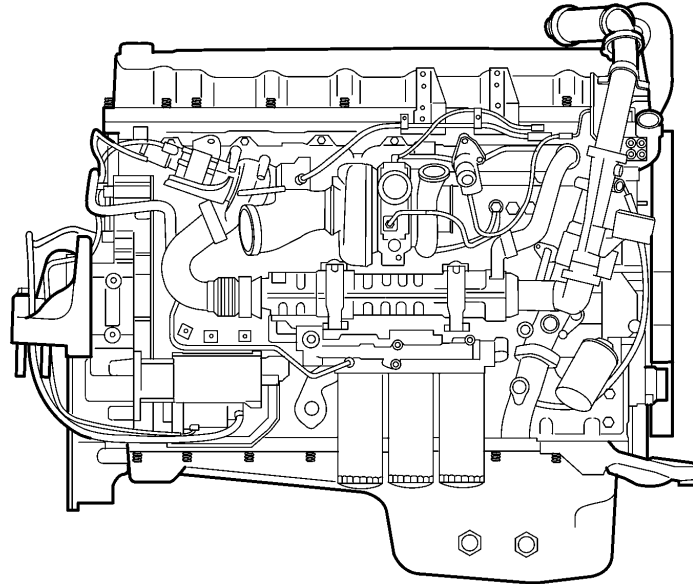
- 6**  
Close the rear engine service doors.

This service bulletin replaces bulletin 262-26 dated 10/2008.

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4.2009	<b>262</b>	<b>26</b>	1(4)

## Thermostat, Replacement D13F

### Thermostat, Replacement



W2005779

This information covers the service procedures for the replacement of the thermostat on a chassis with Volvo D13F engine. Other information provided is cooling system pressure testing.

### Contents

- "Special Tools" page 2
- "Thermostat, Replacement" page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

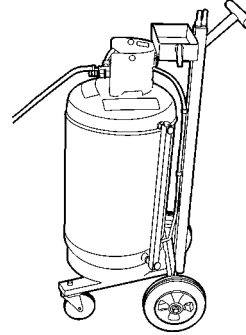
## Special Tools

For special tool ordering instructions, see tool information in group 08.



W0001795

**9996049**  
Coolant Drain Hose



W2004191

**85112740**  
Coolant Extractor

# Service Procedures

## 2627-03-02-02

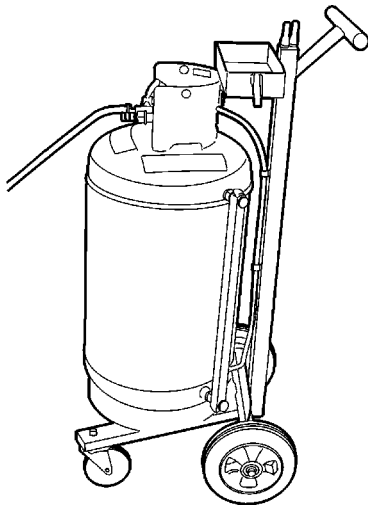
### Thermostat, Replacement

Excluded: Test

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing these procedures. If you are not properly trained and certified in these procedures, ask your supervisor for training before you perform the procedures.

*Special tools: 85112740, 9996049*

## Removal



W2004191

**1**

Use the coolant extractor to remove the coolant from the engine. An alternate method is to drain the coolant into a suitable container using the drain hose.

### **DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

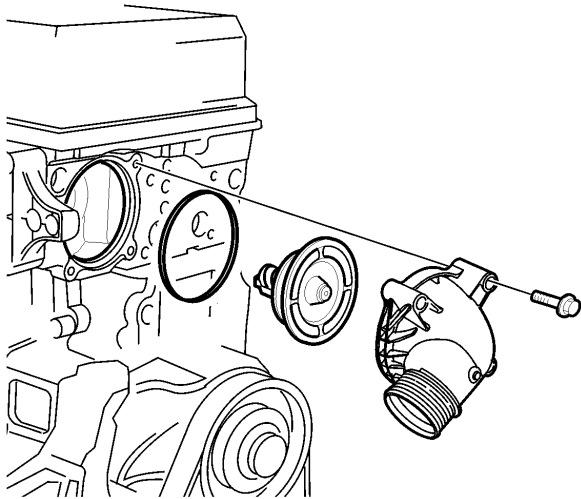
85112740, 9996049

**2**

Loosen the clamp and remove the upper radiator hose from the radiator and suction out any remaining coolant.

**3**

Loosen the clamp and remove the upper radiator hose from the thermostat housing.



- 4 Remove the bolts, the thermostat housing and the thermostat. Carefully clean the thermostat seat and all cylinder head-to-thermostat housing mating surfaces.

W2006899

## Installation

- 1 Install the new thermostat.  
**Note:** Make sure that the rubber seal remains properly seated.
- 2 Position the thermostat housing to the cylinder head, install the bolts and torque-tighten to  $24 \pm 4$  Nm ( $18 \pm 3$  ft-lb).  

---

 $24 \pm 4$  Nm  
( $18 \pm 3$  ft-lb)
- 3 Install the upper radiator hose to the thermostat housing and to the radiator. Position the clamps and tighten to secure.
- 4 Using the coolant extractor, fill the cooling system with the recommended coolant.  

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85112740
- 5 Start the engine, check for leaks and proper operation. After shutdown, replenish fluids as necessary.



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## Thermostat, Checking D13F

### Thermostat, Checking

This information covers the procedures for checking the thermostat on the Volvo D13F engine.

#### Contents

- “Thermostat, Checking” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

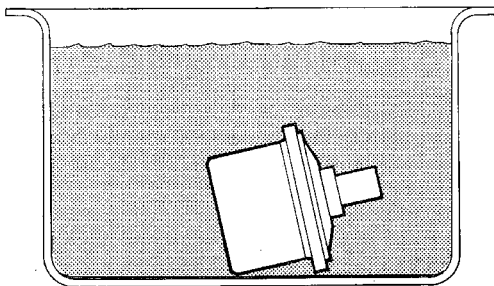
## 2627-06-05-01 Thermostat, Checking

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

**A function check must be carried out before installing a new thermostat.**

**Note:** Check to be sure that the thermostat closes fully. This can be done by holding it up to the light to check that there is no visible gap at the opening point. If the thermostat does not close properly, replace it.

**1**  
Warm up water in a receptacle to 75°C (167°F) and immerse the thermostat in the water as illustrated. Use a piece of wire attached to the thermostat.

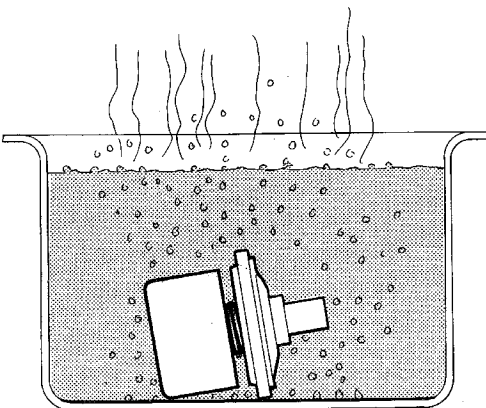


T2007256

Checking the Thermostat

**2**  
After at least 30 seconds, check that the thermostat is still closed.

**3**  
Now warm the water to 100°C (212°F). After at least 30 seconds at boiling point, check that the thermostat has opened at least 7 mm (9/32 in). If the thermostat has not opened, it must be replaced. A good thermostat starts to close at 95°C (203°F) and is fully closed at approximately 85°C (185°F).



T2007255

Checking the Thermostat

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## Coolant Pump, Replacement D13F

### Coolant Pump, Replacement

This information covers the replacement procedures for the coolant pump on a Prevost vehicle with the Volvo D13F engine.

#### Contents

- "Special Tools" page 2
- "Coolant Pump, Replacement" page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

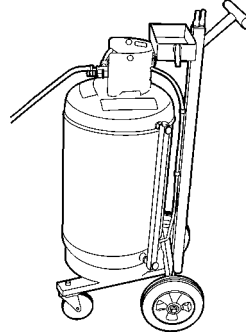
## Special Tools

For special tool ordering instructions, see tool information in group 08.



W0001795

**9996049**  
Coolant Drain Hose



W2004191

**85112740**  
Coolant Extractor

# Service Procedures

## 2621-03-02-01

### Coolant Pump, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing these procedures. If you are not properly trained and certified in these procedures, ask your supervisor for training before you perform the procedures.

*Special tools: 9996049, 85112740*

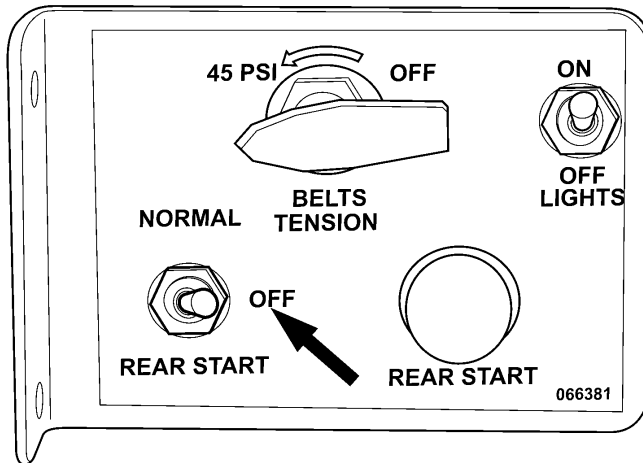
### Removal

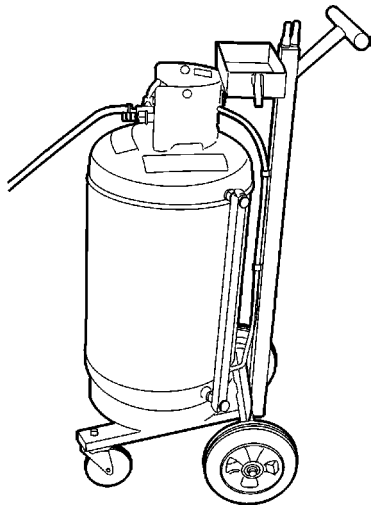
**1**

Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.

**2**

Open the engine compartment door. Set the starter selector switch to the OFF position.





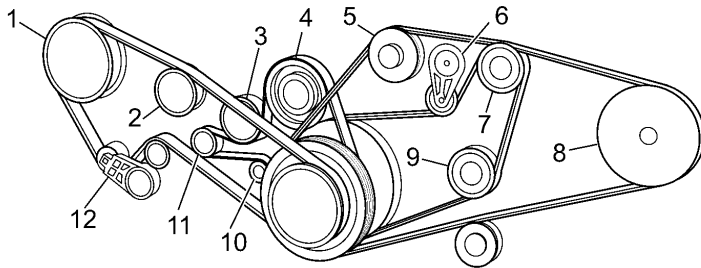
W2004191

- 3** Use the coolant extractor to drain the coolant from the engine. An alternate method is to drain the coolant into a suitable container using the drain hose.

**! DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

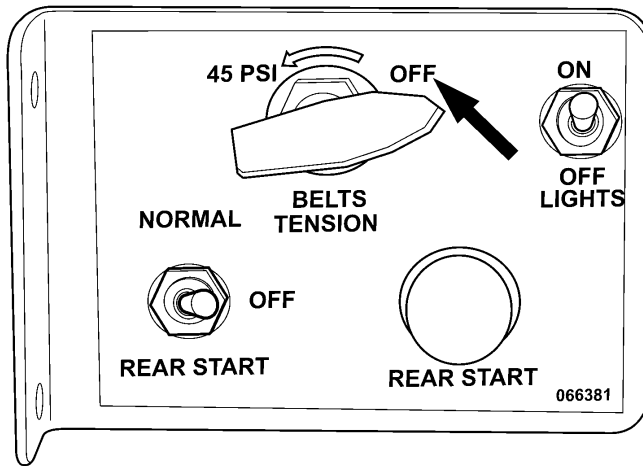
85112740, 9996049



W2006753

- 1 Engine Cooling Fan Drive Pulley
- 2 Engine Cooling Fan Drive Belt Idler
- 3 Coolant Pump Drive Pulley
- 4 Upper Coolant Pump Belt Idler
- 5 A/C Compressor Belt Idler
- 6 Alternator Belt Tensioner
- 7 Alternator Drive Pulley
- 8 A/C Compressor Drive Pulley
- 9 Alternator Drive Pulley
- 10 Coolant Pump Belt Tensioner
- 11 Lower Coolant Pump Belt Idler
- 12 Engine Cooling Fan Drive Belt Tensioner

- 4** Remove the engine cooling fan drive belt.



W2006754

**5**

Using the A/C compressor air pressure release valve, loosen the drive belts to the compressor.

**6**

Loosen the coolant pump drive pulley fasteners and the upper coolant pump belt idler fasteners.

**Note:** The fasteners are easier to loosen with tension on the belt.

**7**

Remove the coolant pump drive belt and the belt tensioner.

**8**

Remove the pulley from the upper coolant pump drive belt idler.

**9**

Remove the coolant pump bolts and remove the coolant pump from the engine.

**10**

Clean the coolant pump sealing surface on the cylinder block.

**11**

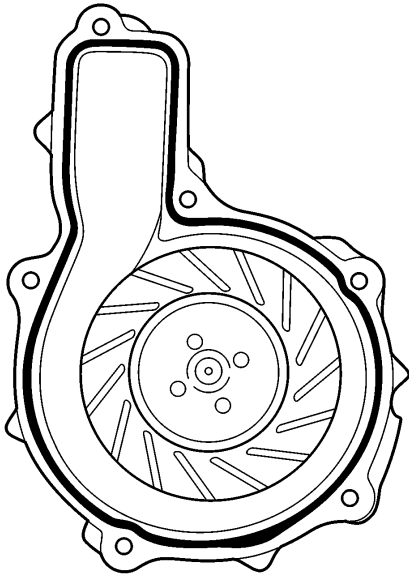
Transfer coolant pump pulley to the replacement pump.

**Note:** Torque fasteners after belt is installed.

**12**

Inspect the coolant pump for internal damage. If the pump has internal damage, install a new coolant filter onto the coolant filter housing.

## Installation



T2022247

- 1**  
Press a new sealing ring into the groove of the replacement coolant pump.

- 2**  
Position the replacement coolant pump on the engine and align the bolt holes.

**Note:** Make sure the sealing ring remains seated in the groove of the pump.

- 3**  
Install the coolant pump bolts and tighten to specification.

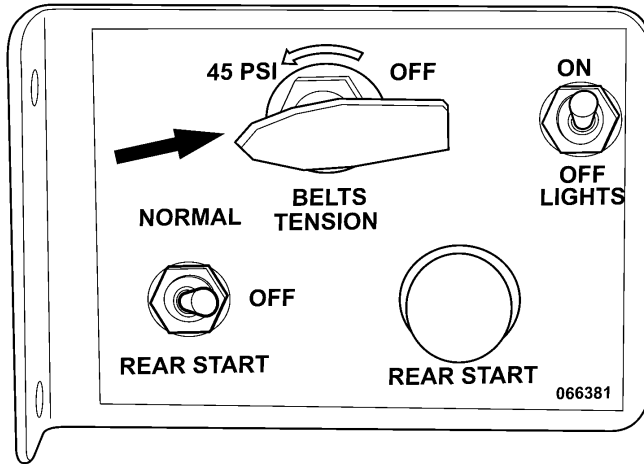
- 4**  
Install the upper coolant pump drive belt idler pulley.

**Note:** Torque fasteners after belt is installed.

- 5**  
Install the coolant pump drive belt tensioner and belt. Tighten the tensioner fasteners to specification.

- 6**  
Tighten the coolant pump drive pulley and belt idler pulley fasteners to specification.





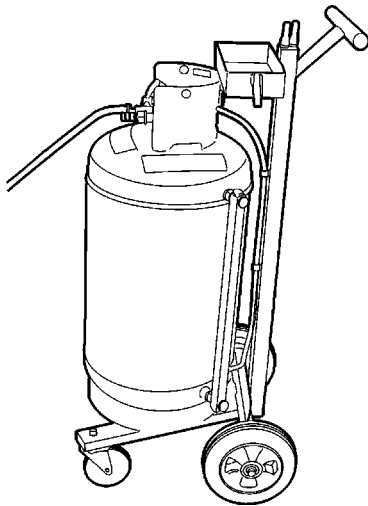
W2006756

**7**  
Using the A/C compressor air pressure release valve, tighten the drive belts to the compressor.

**8**  
Install the engine cooling fan drive belt.

**9**  
Fill the cooling system with the recommended coolant using the coolant extractor.

85112740

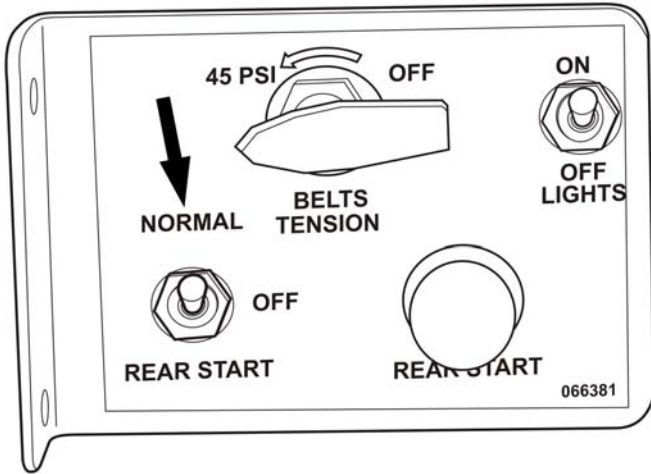


W2004191

**10**  
Turn the ignition key to the ON position. Set the starter selector switch to the rear start position.

**11**  
Press the starter push-button switch. Release push-button after the engine starts. Check for leaks and proper operation. After shutdown, replenish fluids as necessary.

- 12**  
Set the starter selector switch to the NORMAL position.  
Close the engine compartment door.



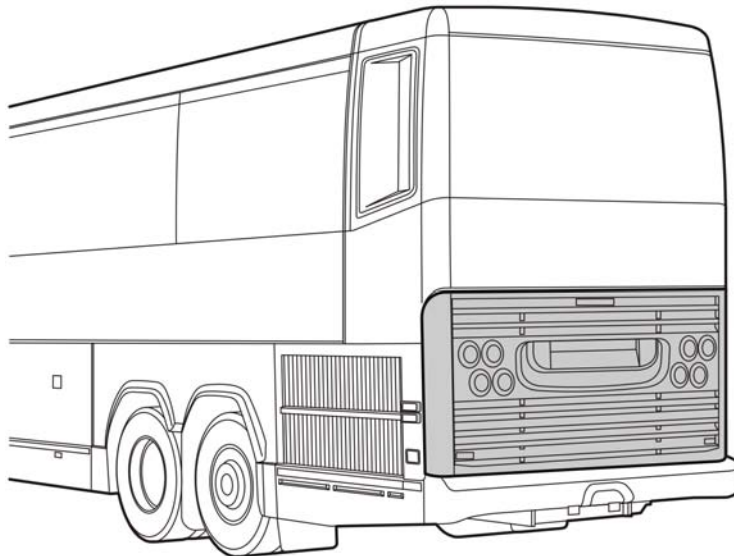
W2006505

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## Fan Shroud, Replacement

PREVX

## Fan Shroud, Replacement



W2006767

This information covers the service procedure for replacing the fan shroud on a Prevost model PREVX bus.

### Contents

- "Special Tools", page 2
- "Fan Shroud, Replacement", page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

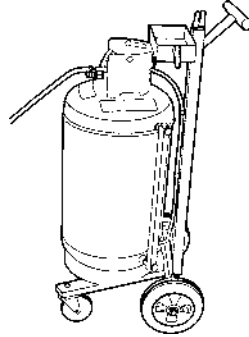
## Special Tools

For special tool ordering instructions, see tool information in group 08.



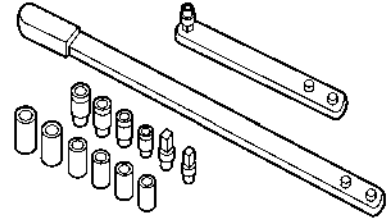
W0001795

**9996049**  
Coolant Drain Hose



W2004191

**85112740**  
Coolant Extractor/Filler



W0001817

**J-44392**  
Drive Belt Tensioner Tool

# Service Procedures

## 2632-03-02-01

### Fan Shroud, Replacement

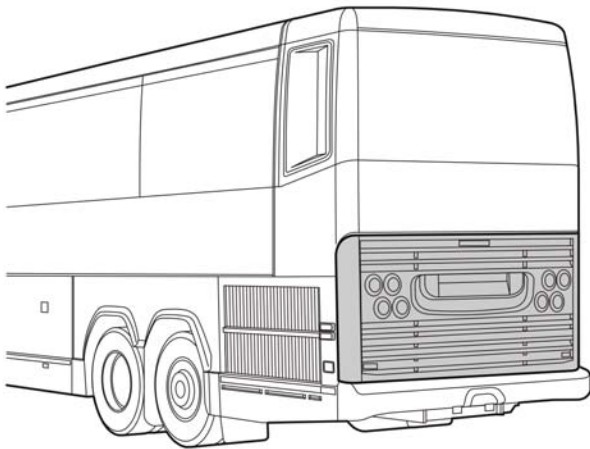
You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing these procedures. If you are not properly trained and certified in these procedures, ask your supervisor for training before you perform the procedures.

*Special tools: 85112740, 9996049, J-44392*

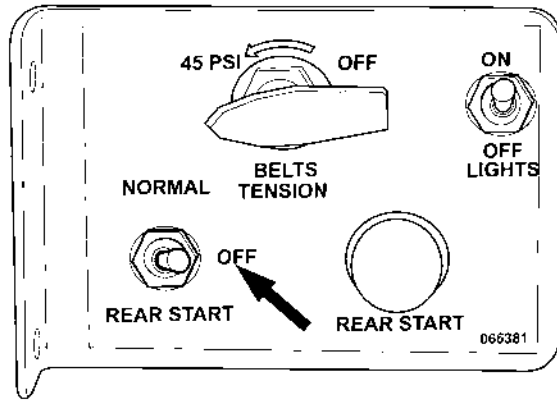
#### Removal

**1**  
Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.

**2**  
Open the engine compartment service doors.



W2006767



W2006494

**3**

Set the starter switch to the OFF position.

**4**

Using complete vehicle lifts or jack, raise the rear axle and remove the left rear wheel.

**5**

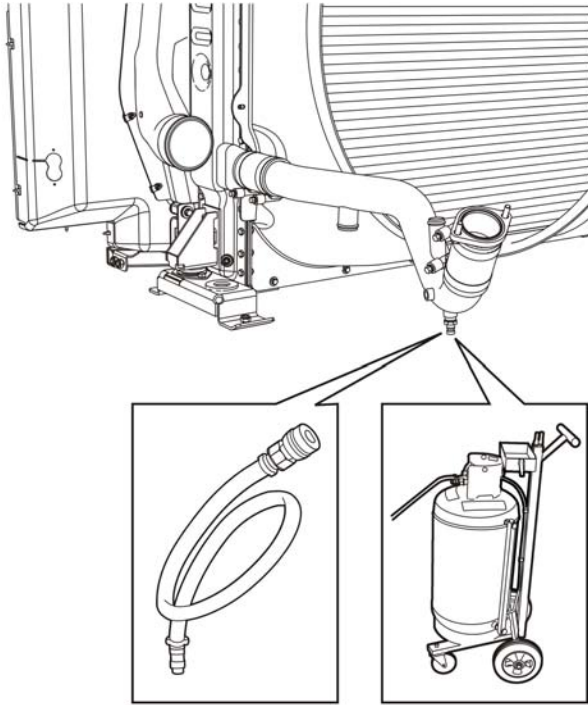
If vehicle is equipped with a belly pan, remove it and set aside at this time.

**6**

Lift up the left wheel skirt and remove the slide panel to access the heater ball valve.

**7**

Turn the heater ball valve off in the compartment behind the left rear wheel.



W2006765

**8**

Connect coolant extractor P/N 85112740 to the cooling system.

**⚠ DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

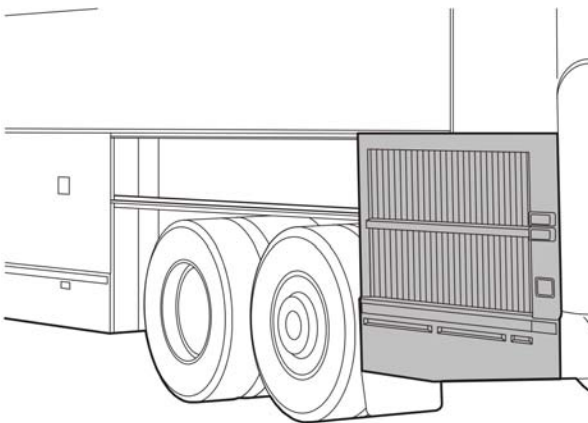
**9**

Drain the engine coolant.

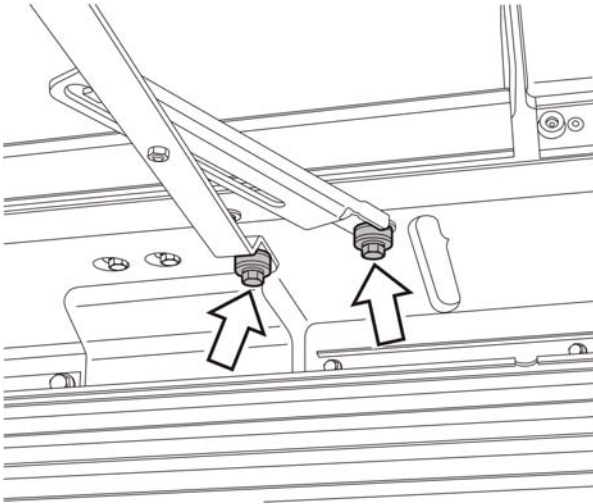
**10**

Open the side compartment to access the coolant package.

**Note:** Make sure there is enough room at the side of the vehicle to accommodate a fork lift truck perpendicular to it.

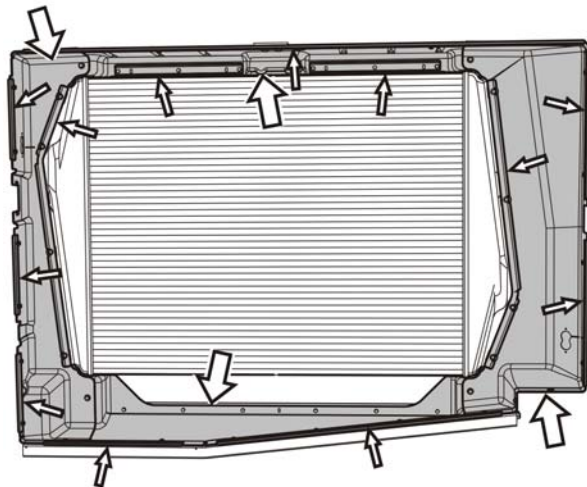


W2006768



W2006769

- 11**  
Remove the grille stop from the vehicle.



W2006770

- 12**  
If vehicle is equipped with a secondary drivers A/C unit, remove the condenser with brackets from the coolant package at this time. Leave the hoses attached.

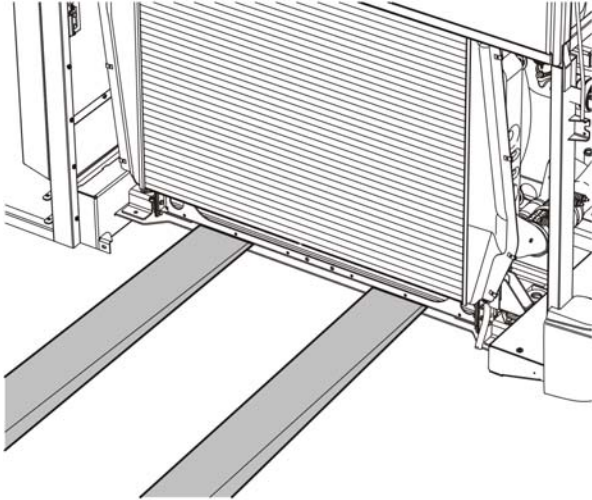
- 13**  
Remove the air deflector seals from around the coolant package.

- 14**  
Disconnect the tube from the surge tank to the radiator.

- 15**  
Remove the coolant package. Refer to Function Group 261.

- 16**  
Position the forks of a fork lift truck under the coolant package. It must be capable of safely lifting the coolant package.

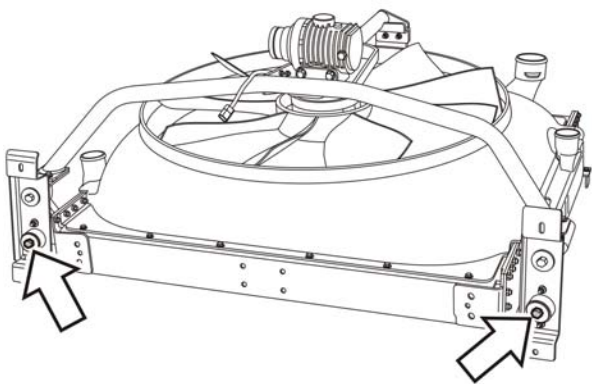




W2006777

**17**

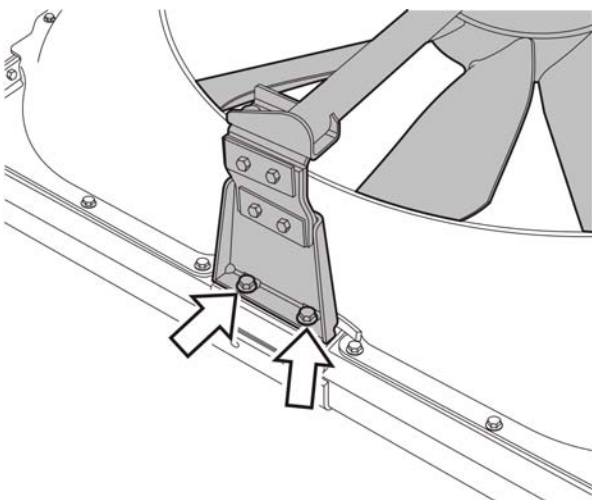
With the help of an assistant, slide the coolant package out of the vehicle and onto the forks of the lift truck. Carefully move the coolant package to a secure location.



W2006779

**18**

Lay the radiator face down on a flat surface with the fan blade facing up. Remove the fasteners that connect the lower radiator mounts to the radiator.



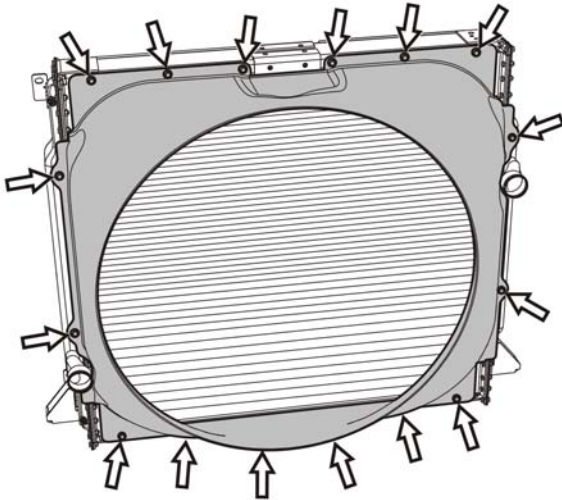
W2006780

**19**

Remove the upper fan drive support bracket from the upper section of the radiator.

**20**

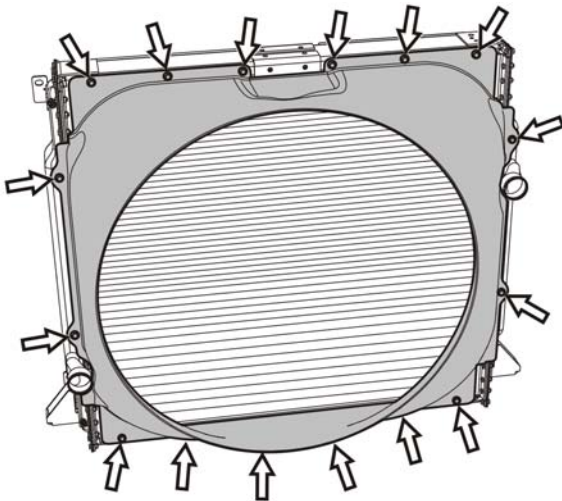
With the help of an assistant, remove the fan drive and fan drive frame from the radiator.



W2006781

**21**

Remove the fasteners and the defective fan shroud from the radiator.



W2006781

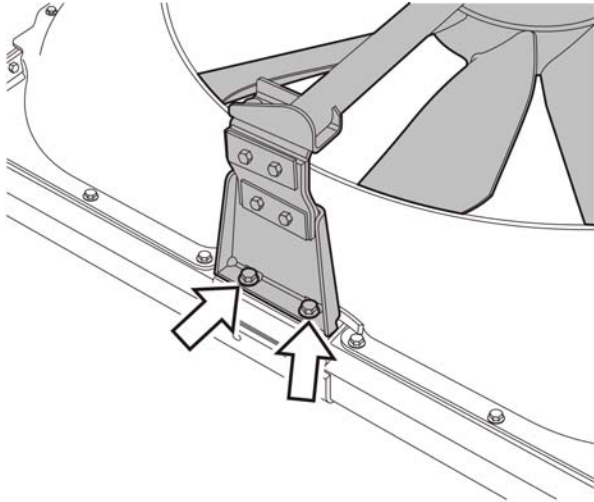
**Installation**

**22**

Install the replacement fan shroud to the radiator and tighten the fasteners to specification. Refer to Function Group 26, Cooling System.

**23**

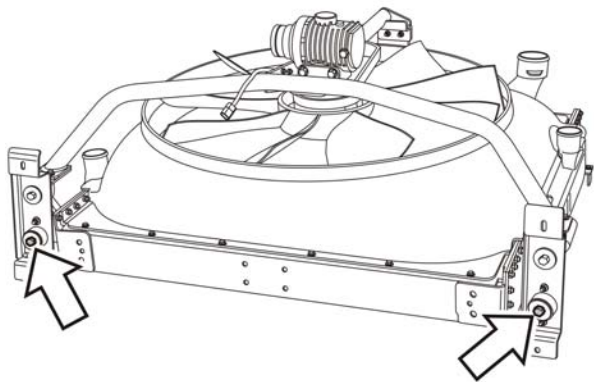
With the help of an assistant, install the fan drive and fan drive frame to the radiator.



W2006780

**24**

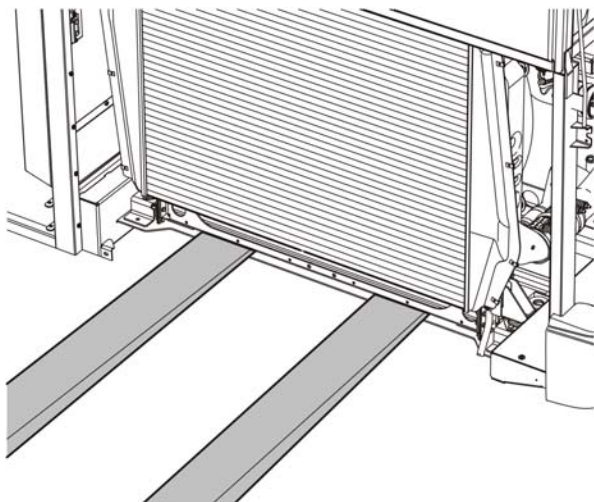
Install the upper fan drive bracket to the upper section of the radiator.



W2006779

**25**

Install fasteners that connect the lower radiator mounts to the radiator.



W2006777

**26**

With the help of an assistant, use a fork lift truck to move the reassembled coolant package into position on the vehicle. Slide coolant package off of forks and onto vehicle mounting bracket.

**Note:** Be sure to align the drive shaft to the gear box.

**27**

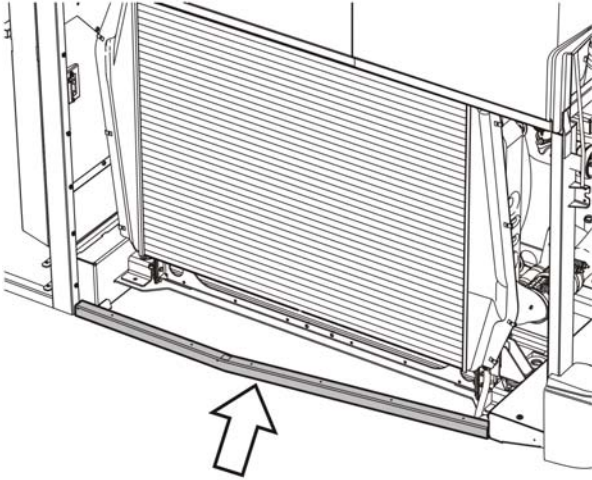
Install the coolant package. Refer to Function Group 261.

**28**

Reconnect the tube from the surge tank to the radiator.

**29**

Install air deflector shield lower support bracket. and seals around the coolant package.



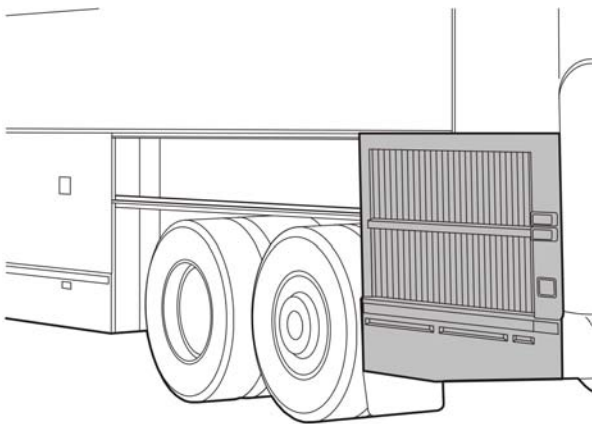
W2006774

**30**

If vehicle is equipped with a secondary drivers A/C unit, install the condenser with brackets to the coolant package at this time.

**31**

Close the side compartment door.



W2006768

**32**

Install door stop.

**33**

Check transmission cooler plug. Fill engine with recommended coolant using the coolant extractor/filler P/N 85112740 through the drain nipple on the lower radiator pipe.

**34**

Install the left rear wheel.

**35**

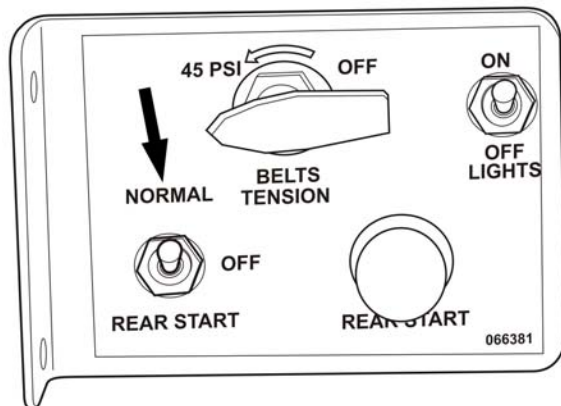
If vehicle is equipped with a previously removed belly pan, install it at this time.

**36**

Lower the vehicle and remove jacks.

**37**

Set the starter selector switch to the NORMAL position.



W2006505

**38**

Start the engine and run at idle.

**Note:** The hand brake must be applied and the bus must be on the floor.

Check for coolant leaks. After shutdown, replenish fluids as necessary.

**39**

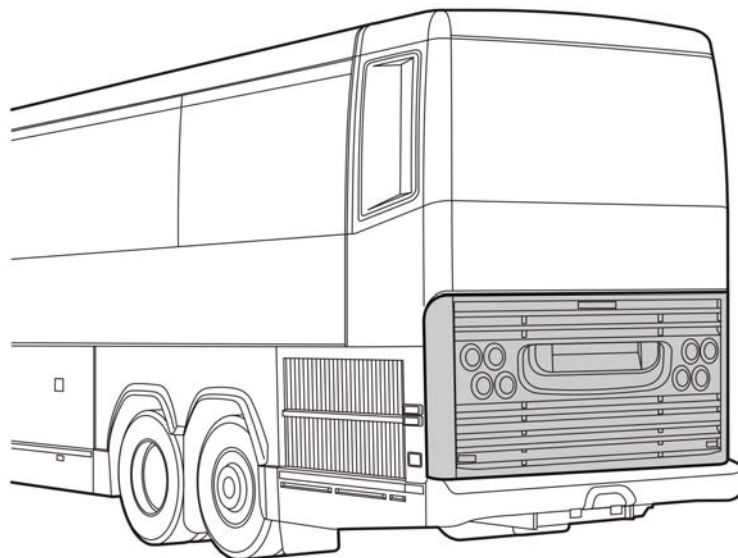
Close the rear engine compartment service doors.

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## Fan Blade, Replacement

PREVX

## Fan Blade, Replacement



W2006767

This information covers the service procedure for replacing the fan blade on a Prevost model PREVX bus.

### Contents

- "Special Tools", page 2
- "Fan Blade, Replacement", page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

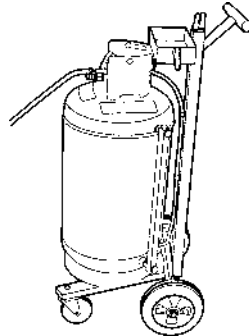
## Special Tools

For special tool ordering instructions, see tool information in group 08.



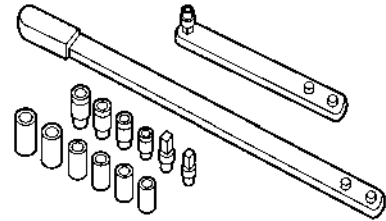
W0001795

**9996049**  
Coolant Drain Hose



W2004191

**85112740**  
Coolant Extractor/Filler



W0001817

**J-44392**  
Drive Belt Tensioner Tool

# Service Procedures

**2631-03-02-02**

## Fan Blade, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing these procedures. If you are not properly trained and certified in these procedures, ask your supervisor for training before you perform the procedures.

*Special tools: 85112740, 9996049, J-44392*

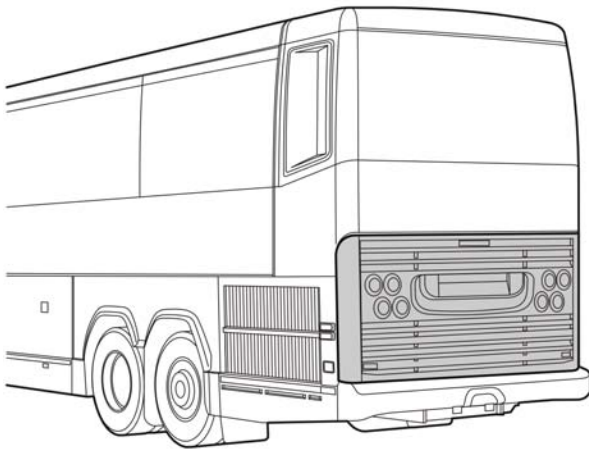
### Removal

**1**

Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.

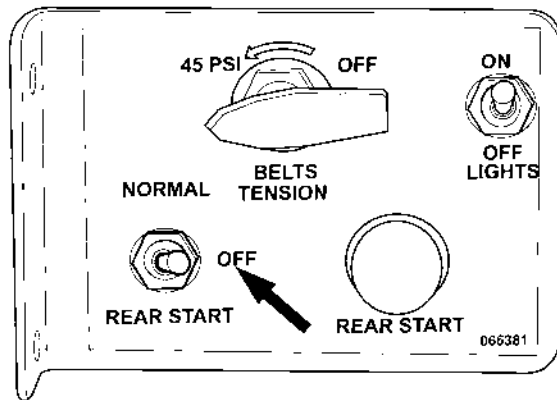
**2**

Open the engine compartment service doors.



W2006767





W2006494

**3**

Set the starter switch to the OFF position.

**4**

Using complete vehicle lifts or jack, raise the rear axle and remove the left rear wheel.

**5**

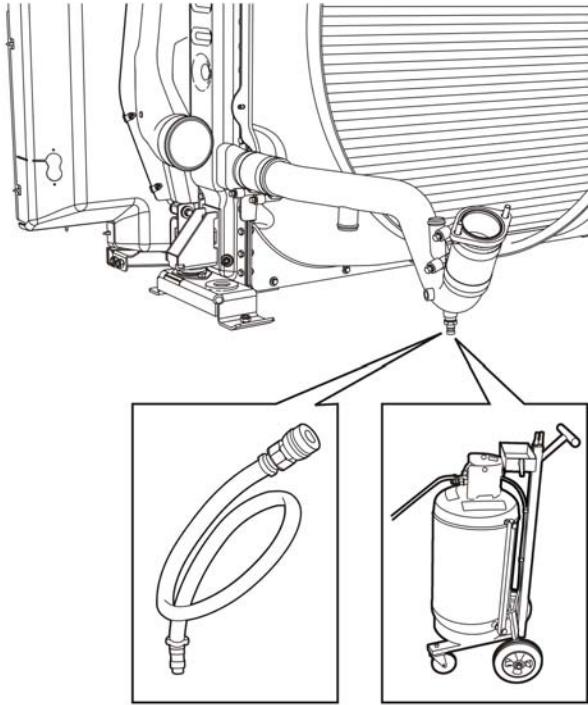
If vehicle is equipped with a belly pan, remove it and set aside at this time.

**6**

Lift up the left wheel skirt and remove the slide panel to access the heater ball valve.

**7**

Turn the heater ball valve off in the compartment behind the left rear wheel.



W2006765

**8**

Connect coolant extractor P/N 85112740 to the cooling system.

**⚠ DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

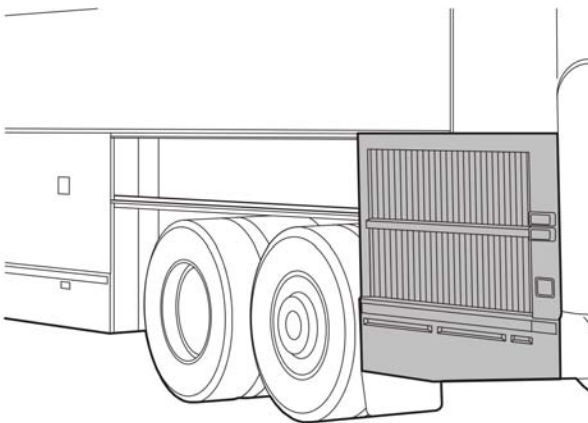
**9**

Drain the engine coolant.

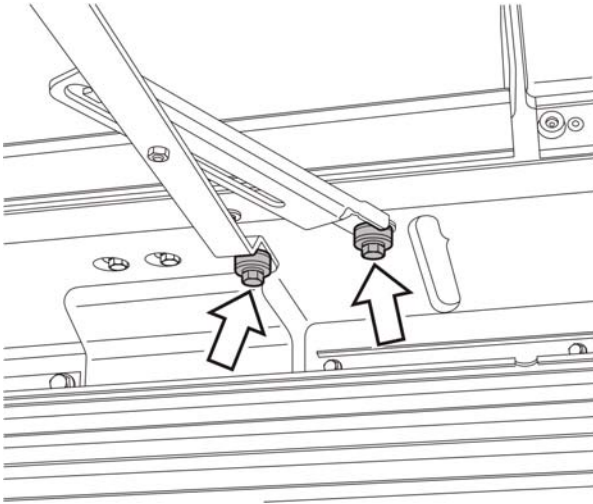
**10**

Open the side compartment to access the coolant package.

**Note:** Make sure there is enough room at the side of the vehicle to accommodate a fork lift truck perpendicular to it.

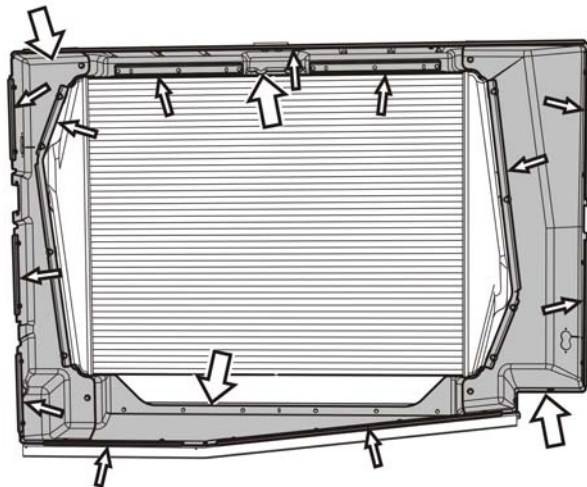


W2006768



W2006769

- 11**  
Remove the grille stop from the vehicle.



W2006770

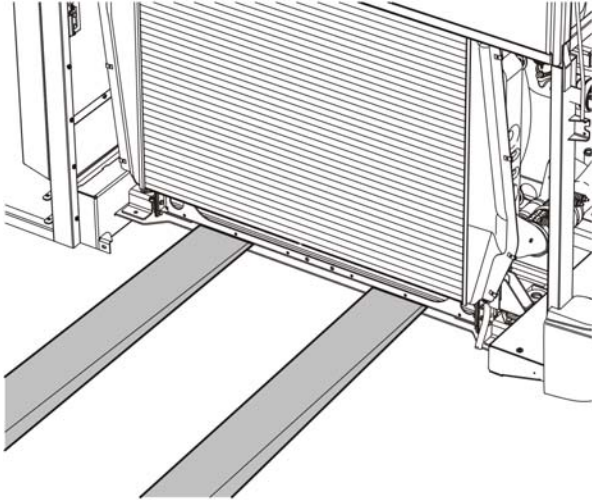
- 12**  
If vehicle is equipped with a secondary drivers A/C unit, remove the condenser with brackets from the coolant package at this time. Leave the hoses attached.

- 13**  
Remove the air deflector seals from around the coolant package.

- 14**  
Disconnect the tube from the surge tank to the radiator.

- 15**  
Remove the coolant package. Refer to Function Group 261.

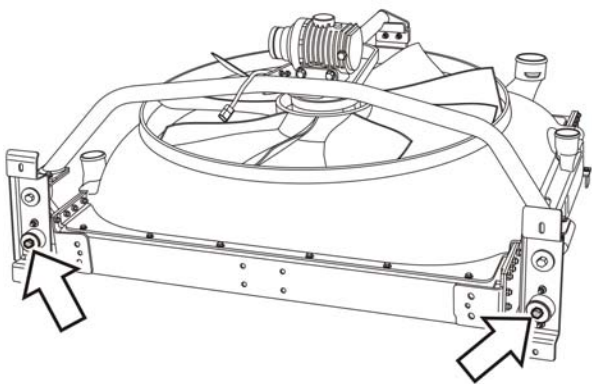
- 16**  
Position the forks of a fork lift truck under the coolant package. It must be capable of safely lifting the coolant package.



W2006777

**17**

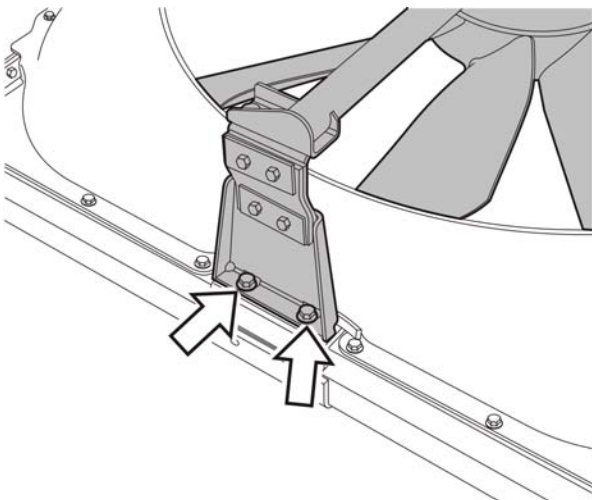
With the help of an assistant, slide the coolant package out of the vehicle and onto the forks of the lift truck. Carefully move the coolant package to a secure location.



W2006779

**18**

Lay the radiator face down on a flat surface with the fan blade facing up. Remove the fasteners that connect the lower radiator mounts to the radiator.



W2006780

**19**

Remove the upper fan drive support bracket from the upper section of the radiator.

**20**

With the help of an assistant, remove the fan drive and fan drive frame from the radiator.

**21**

Remove the fasteners and the defective engine cooling fan blade from the fan drive hub.

**Installation**

**22**

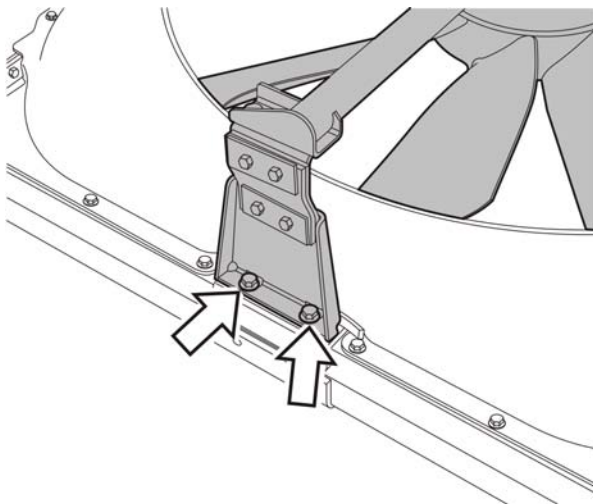
Install the replacement fan blade and tighten the fasteners to specification. Refer to Function Group 26, Cooling System.

**23**

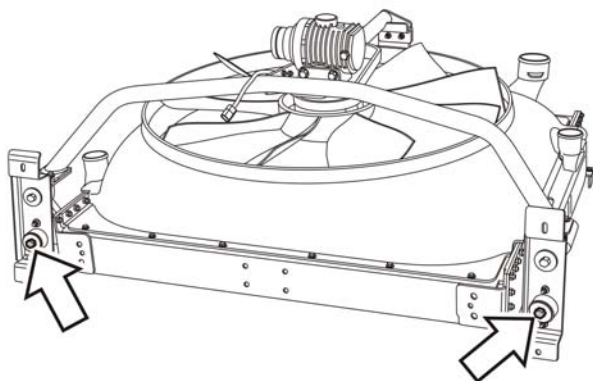
With the help of an assistant, install the fan drive and fan drive frame to the radiator.

**24**

Install the upper fan drive bracket to the upper section of the radiator.



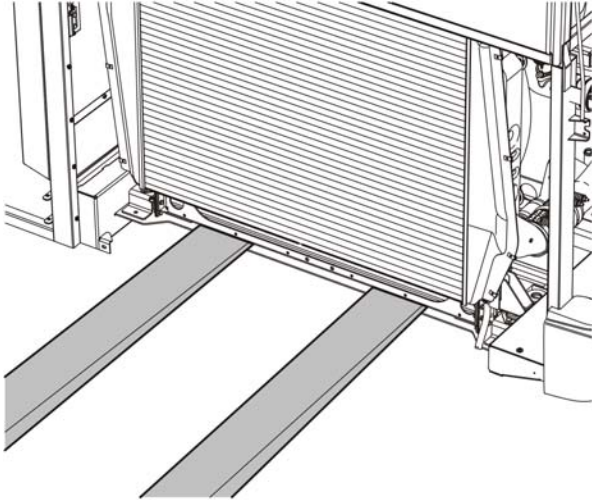
W2006780



W2006779

**25**

Install fasteners that connect the lower radiator mounts to the radiator.



W2006777

**26**

With the help of an assistant, use a fork lift truck to move the reassembled coolant package into position on the vehicle. Slide coolant package off of forks and onto vehicle mounting bracket.

**Note:** Be sure to align the drive shaft to the gear box.

**27**

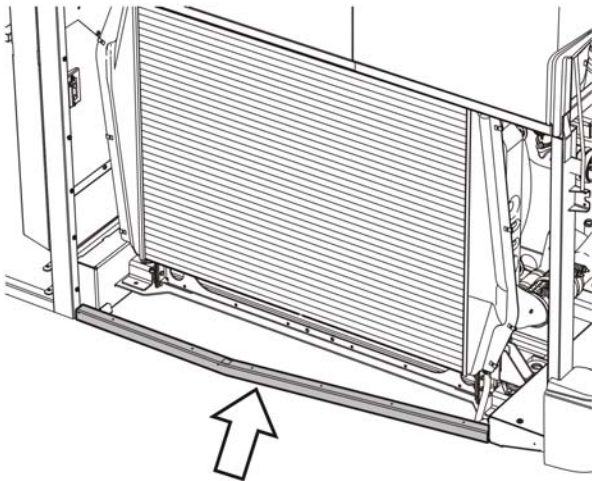
Install the coolant package. Refer to Function Group 261.

**28**

Reconnect the tube from the surge tank to the radiator.

**29**

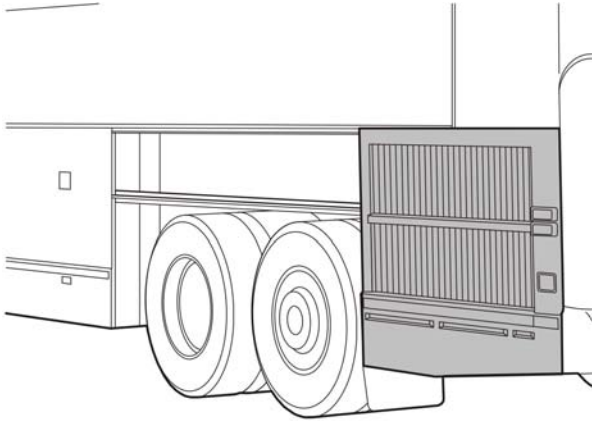
Install air deflector shield lower support bracket. and seals around the coolant package.



W2006774

**30**

If vehicle is equipped with a secondary drivers A/C unit, install the condenser with brackets to the coolant package at this time.



W2006768

**31**  
Close the side compartment door.

**32**  
Install door stop.

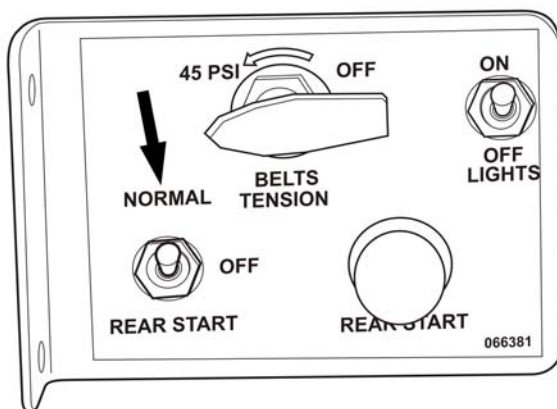
**33**  
Check transmission cooler plug. Fill with recommended coolant using the coolant extractor/filler P/N 85112740 through the drain nipple on the lower radiator pipe.

**34**  
Install the left rear wheel.

**35**  
If vehicle is equipped with a previously removed belly pan, install it at this time.

**36**  
Lower the vehicle and remove jacks.

**37**  
Set the starter selector switch to the NORMAL position.



W2006505

**38**

Start the engine and run at idle.

**Note:** The hand brake must be applied and the bus must be on the floor.

Check for coolant leaks. After shutdown, replenish fluids as necessary.

**39**

Close the rear engine compartment service doors.

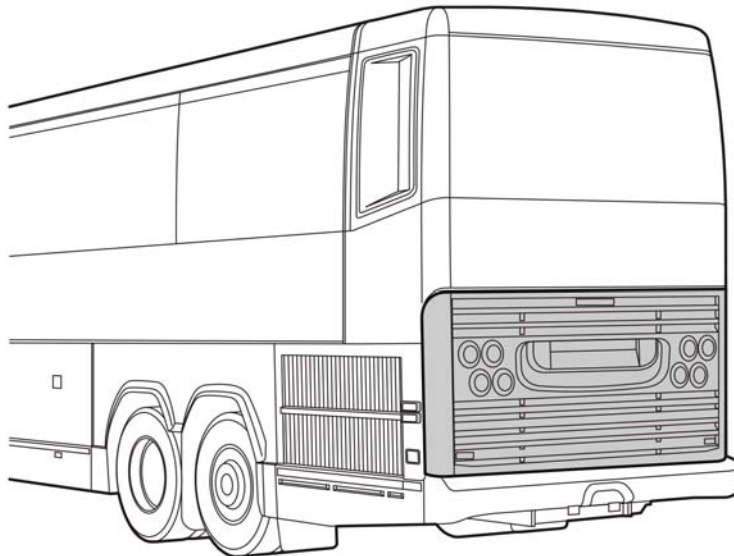


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9.2010	<b>263</b>	<b>05</b>		1(11)

## Fan Hub Assembly, Replacement

PREVX

### Fan Hub Assembly, Replacement



W2006767

This information covers the service procedure for replacing the fan hub assembly on a Prevost model PREVX bus.

### Contents

- "Special Tools", page 2
- "Fan Hub Assembly, Replacement", page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

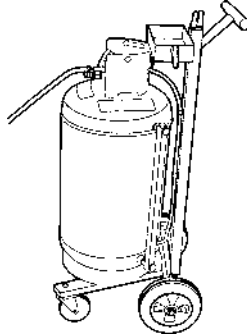
## Special Tools

For special tool ordering instructions, see tool information in group 08.



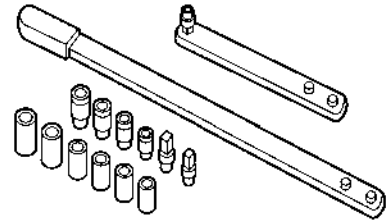
W0001795

**9996049**  
Coolant Drain Hose



W2004191

**85112740**  
Coolant Extractor/Filler



W0001817

**J-44392**  
Drive Belt Tensioner Tool

# Service Procedures

**2633-03-02-05**

## Fan Hub Assembly, Replacement

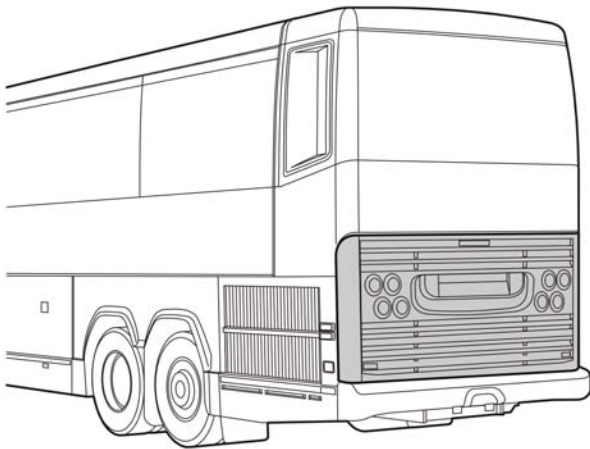
You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing these procedures. If you are not properly trained and certified in these procedures, ask your supervisor for training before you perform the procedures.

*Special tools: 85112740, 9996049, J-44392*

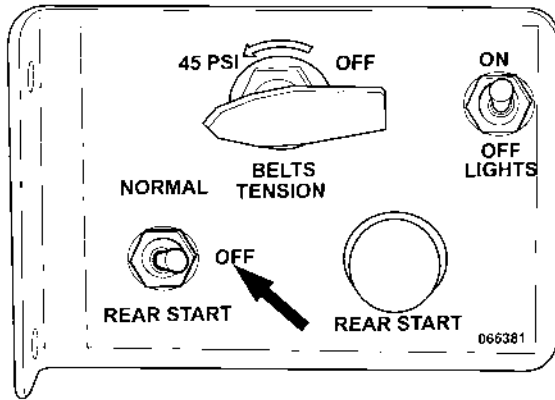
### Removal

**1**  
Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.

**2**  
Open the engine compartment service doors.



W2006767



W2006494

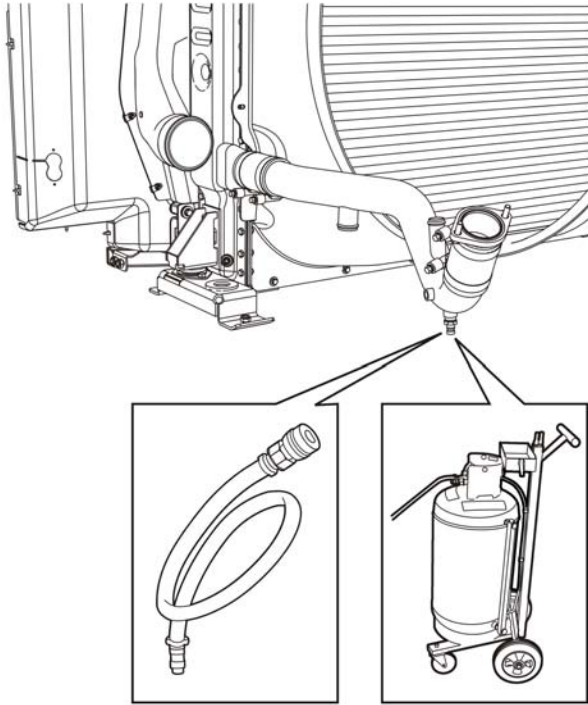
**3**  
Set the starter switch to the OFF position.

**4**  
Using complete vehicle lifts or jack, raise the rear axle and remove the left rear wheel.

**5**  
If vehicle is equipped with a belly pan, remove it and set aside at this time.

**6**  
Lift up the left wheel skirt and remove the slide panel to access the heater ball valve.

**7**  
Turn the heater ball valve off in the compartment behind the left rear wheel.



W2006765

**8**

Connect coolant extractor P/N 85112740 to the cooling system.

**⚠ DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

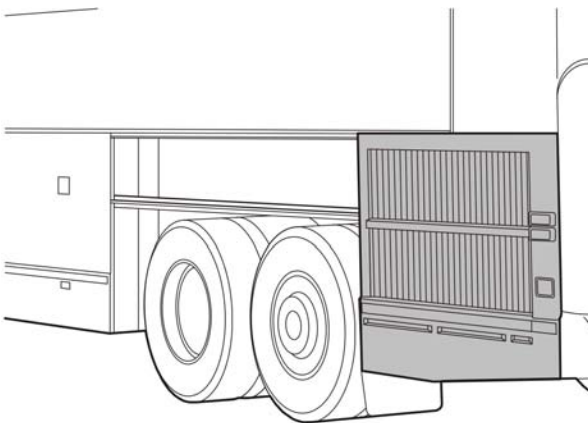
**9**

Drain the engine coolant.

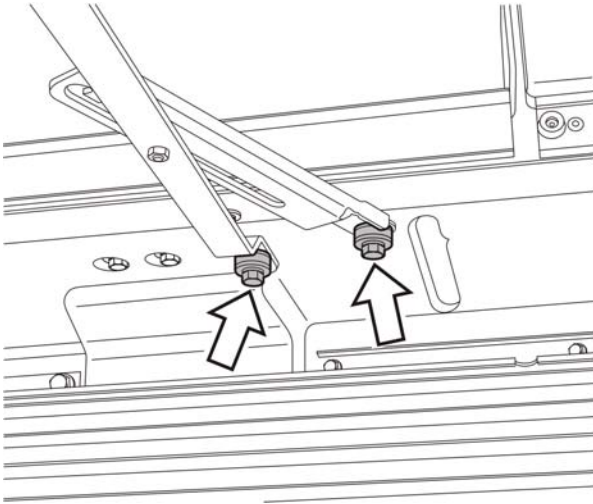
**10**

Open the side compartment to access the coolant package.

**Note:** Make sure there is enough room at the side of the vehicle to accommodate a fork lift truck perpendicular to it.

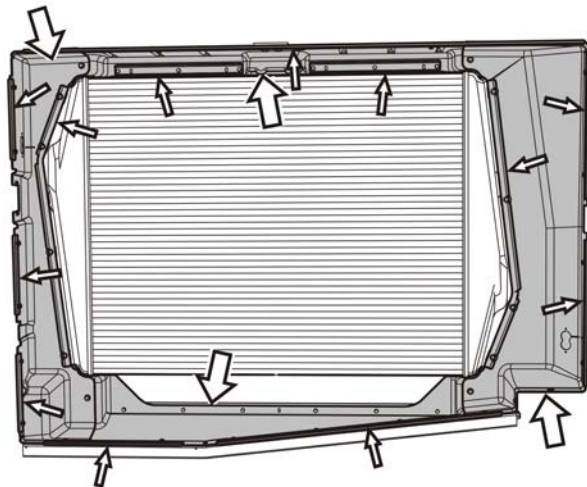


W2006768



W2006769

- 11**  
Remove the grille stop from the vehicle.



W2006770

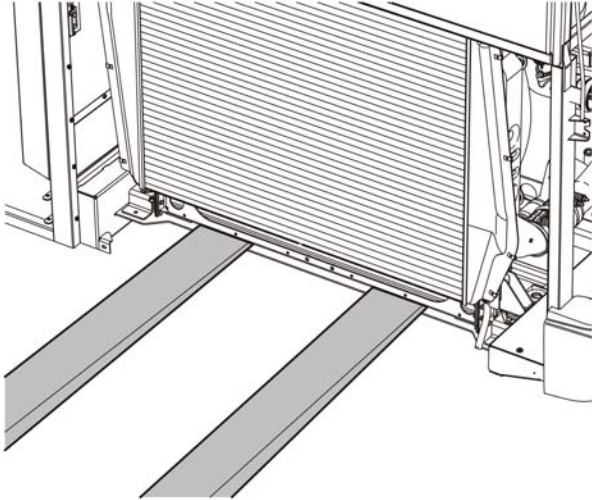
- 12**  
If vehicle is equipped with a secondary drivers A/C unit, remove the condenser with brackets from the coolant package at this time. Leave the hoses attached.

- 13**  
Remove the air deflector seals from around the coolant package.

- 14**  
Disconnect the tube from the surge tank to the radiator.

- 15**  
Remove the coolant package. Refer to Function Group 261.

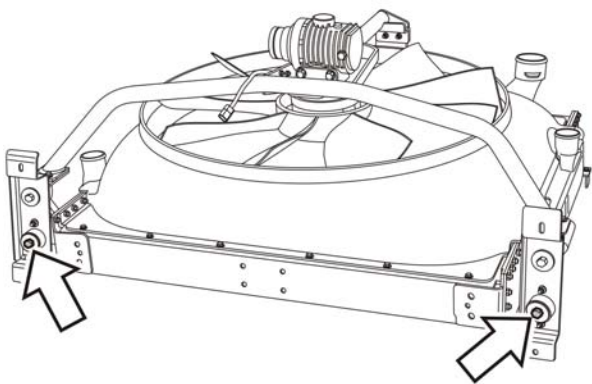
- 16**  
Position the forks of a fork lift truck under the coolant package. It must be capable of safely lifting the coolant package.



W2006777

**17**

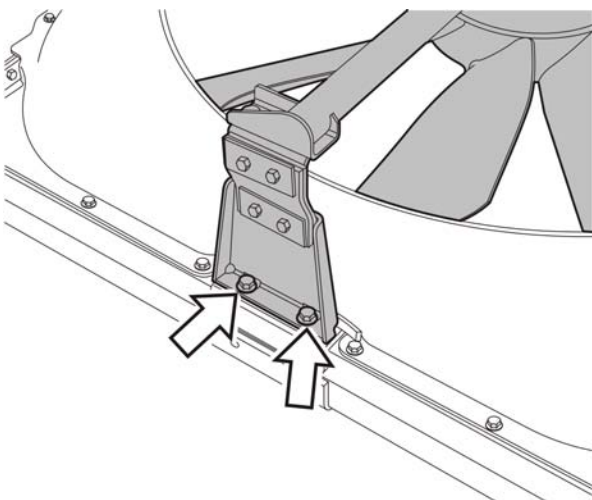
With the help of an assistant, slide the coolant package out of the vehicle and onto the forks of the lift truck. Carefully move the coolant package to a secure location.



W2006779

**18**

Lay the radiator face down on a flat surface with the fan blade facing up. Remove the fasteners that connect the lower radiator mounts to the radiator.



W2006780

**19**

Remove the upper fan drive support bracket from the upper section of the radiator.

**20**

With the help of an assistant, remove the fan drive and fan drive frame from the radiator.

**21**

Remove the engine cooling fan blade from the fan hub assembly.

**22**

Remove the defective fan hub assembly from the mounting frame.

**Installation**

**23**

Install the replacement fan hub assembly to the mounting frame and tighten the fasteners to specification. Refer to Function Group 26, Cooling System.

**24**

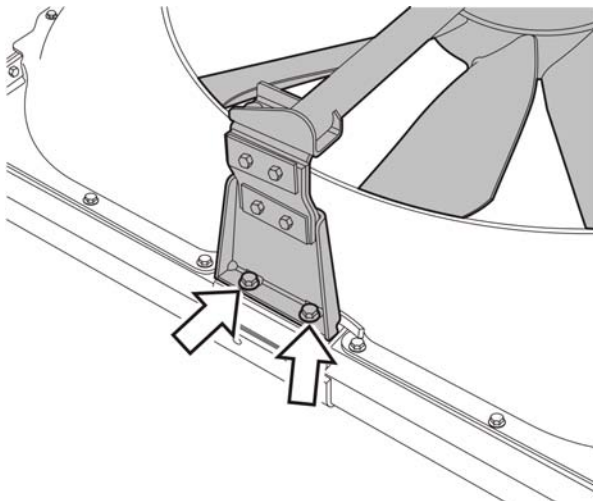
Install the engine cooling fan blade to the fan hub assembly.

**25**

With the help of an assistant, install the fan drive and fan drive frame to the radiator.

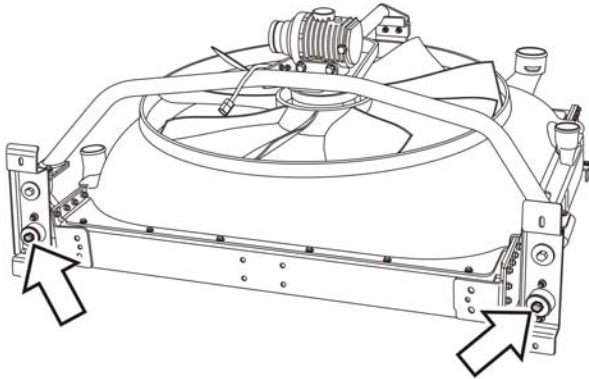
**26**

Install the upper fan drive bracket to the upper section of the radiator.



W2006780

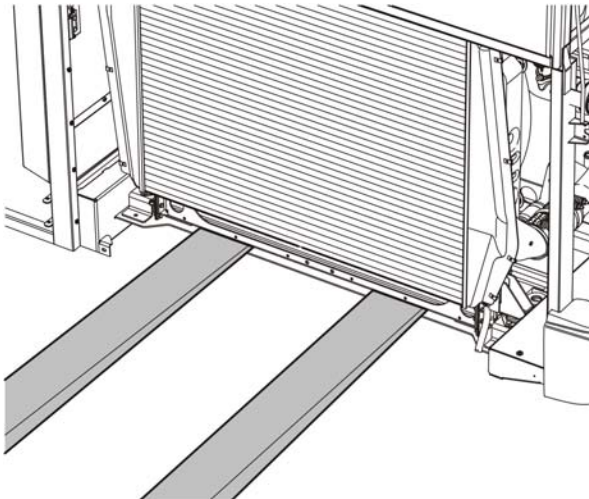




W2006779

**27**

Install fasteners that connect the lower radiator mounts to the radiator.



W2006777

**28**

With the help of an assistant, use a fork lift truck to move the reassembled coolant package into position on the vehicle. Slide coolant package off of forks and onto vehicle mounting bracket.

**Note:** Be sure to align the drive shaft to the gear box.

**29**

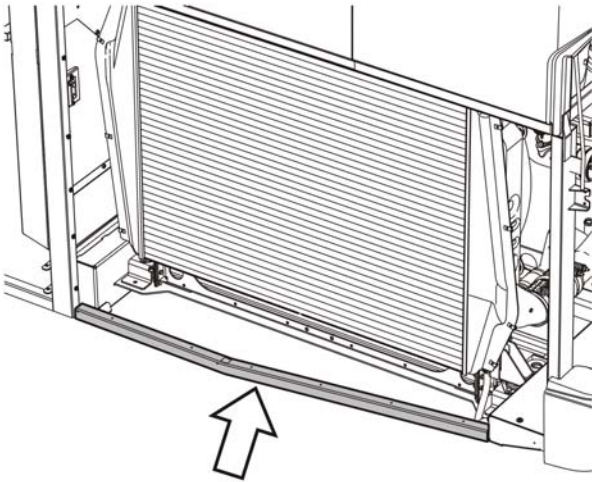
Install the coolant package. Refer to Function Group 261.

**30**

Reconnect the tube from the surge tank to the radiator.

**31**

Install air deflector shield lower support bracket, and seals around the coolant package.



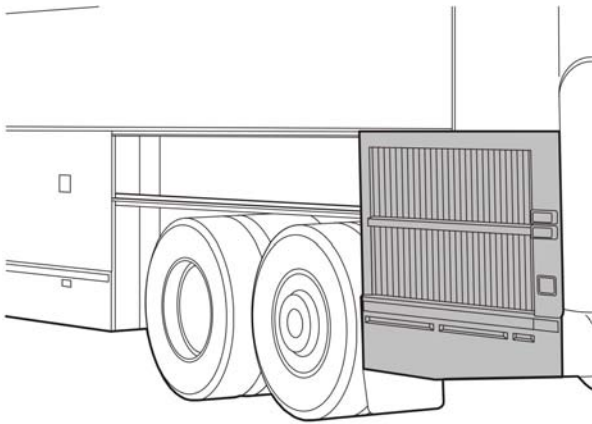
W2006774

**32**

If vehicle is equipped with a secondary drivers A/C unit, install the condenser with brackets to the coolant package at this time.

**33**

Close the side compartment door.



W2006768

**34**

Install door stop.

**35**

Check transmission cooler plug. Fill with recommended coolant using the coolant extractor/filler P/N 85112740 through the drain nipple on the lower radiator pipe.

**36**

Install the left rear wheel.

**37**

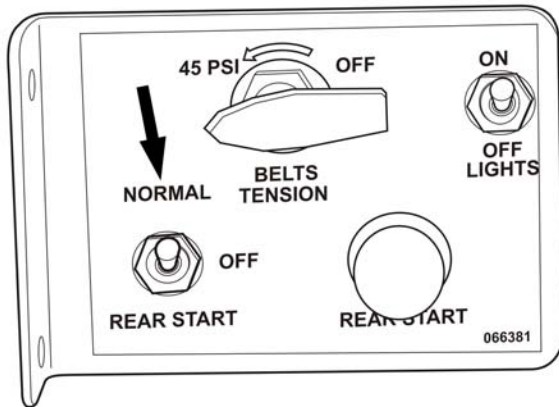
If vehicle is equipped with a previously removed belly pan, install it at this time.

**38**

Lower the vehicle and remove jacks.

**39**

Set the starter selector switch to the NORMAL position.



W2006505

**40**

Start the engine and run at idle.

**Note:** The hand brake must be applied and the bus must be on the floor.

Check for coolant leaks. After shutdown, replenish fluids as necessary.

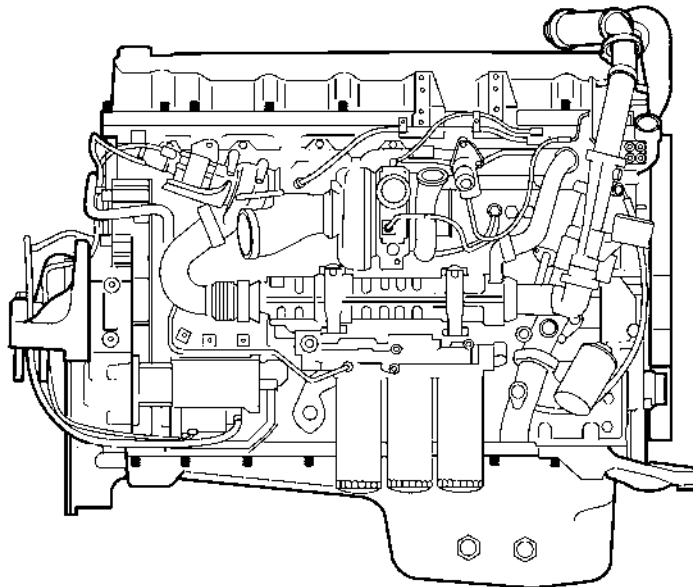
**41**

Close the rear engine compartment service doors.

Date	Group	No.	Release	Page
9.2010	<b>263</b>	<b>30</b>		1(8)

## Fan Belt Idler Pulley Replacement PREVX

### Fan Belt Idler Pulley, Replacement



W2005779

This information covers the service procedures for replacing the fan belt idler pulley and tensioner on a PREVX bus equipped with D13F or D13H engines.

#### Contents

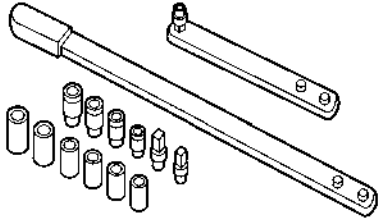
- "Special Tools", page 2
- "Fan Belt Idler Pulley, Replacement", page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

## Special Tools

For special tool ordering instructions, see tool information in group 08.



W0001817

### **J-44392**

Drive Belt Tensioner Tool



W2060222

### **J-44392-2**

Drive Belt Tensioner Tool Adapter

# Service Procedures

**2639-03-02-03**

## Fan Belt Idler Pulley, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing these procedures. If you are not properly trained and certified in these procedures, ask your supervisor for training before you perform the procedures.

*Special tools: J-44392, J-44392-2*

### Fan Belt Upper Idler

**1**

Apply parking brake and transmission in neutral.

**2**

Open rear engine service doors.

**3**

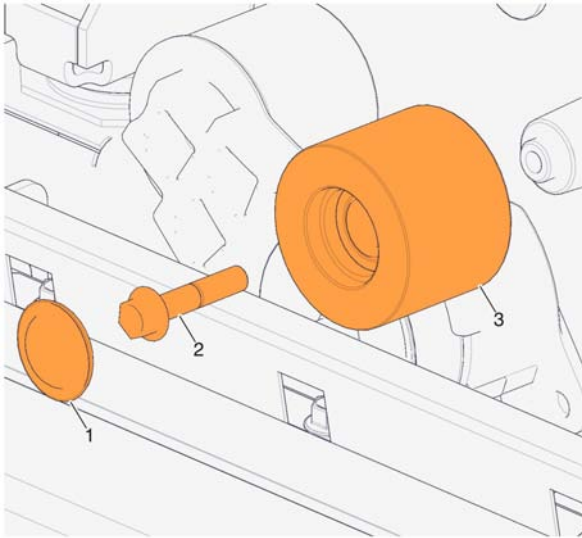
Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

Using tool J-44392 and adapter J-44392-2, pry the belt tensioner away from the fan drive belt and remove the belt.

---

J-44392, J-44392-2

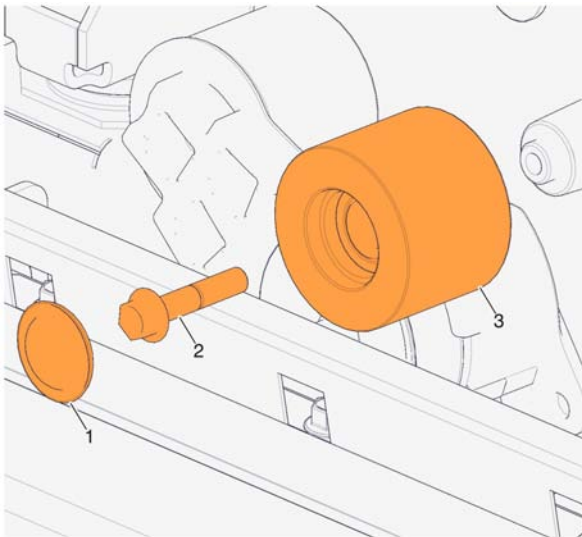


W2060364

**5**

Remove engine cooling fan drive support upper idler.  
Remove the cover, fastener and upper idler.

- 1 Cover
- 2 Fastener
- 3 Upper Idler

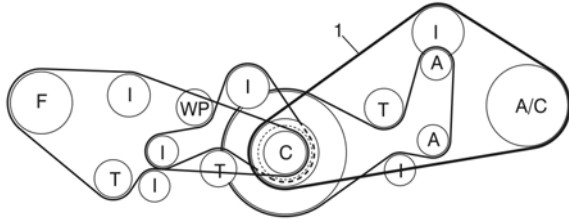


W2060364

**6**

Install engine cooling fan drive support upper idler.  
Tighten the fastener to specification, refer to Function  
Group 20, Specifications.

- 1 Cover
- 2 Fastener
- 3 Upper Idler



W1059479

A — Alternator

A/C — Air Conditioner

C — Crank

F — Fan

I — Idler

T — Tensioner

WP — Water Pump

1 – The belt for the A/C requires a pair

**7**

Install the replacement fan drive belt over the pulleys and then around the auto-adjuster.

**Note:** Make sure that the drive belt is properly routed and aligned correctly in the pulley grooves. Refer to the figure shown for proper routing of the belt.

**8**

Install all previously removed cables to the ground (negative) battery terminals.

**9**

Start the engine and check for proper operation.

**10**

Close rear engine service doors.



## Fan Belt Lower Tensioner

**1**

Apply parking brake and transmission in neutral.

**2**

Open rear engine service doors.

**3**

Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

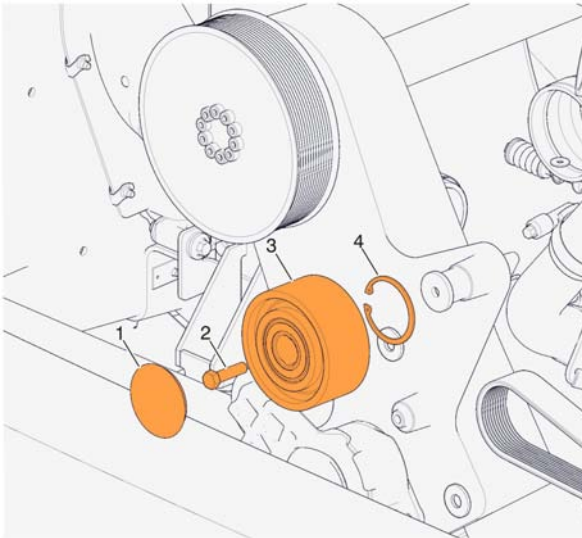
**4**

Using tool J-44392 and adapter J-44392-2, pry the belt tensioner away from the fan drive belt and remove the belt.

J-44392, J-44392-2

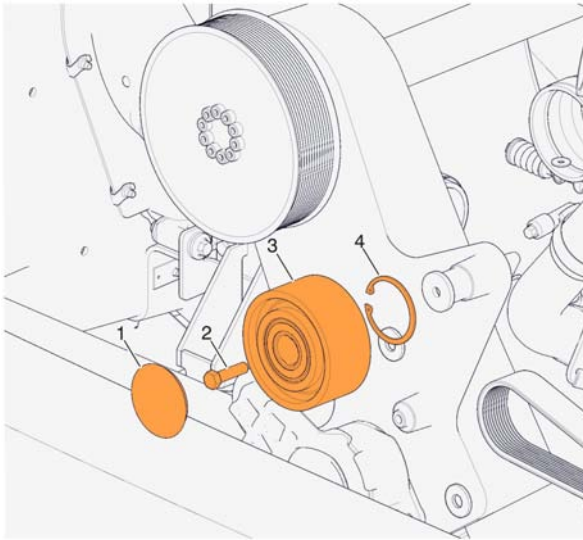
**5**

Remove engine cooling fan drive support lower tensioner. Remove cover, fastener, lower tensioner and snap ring.



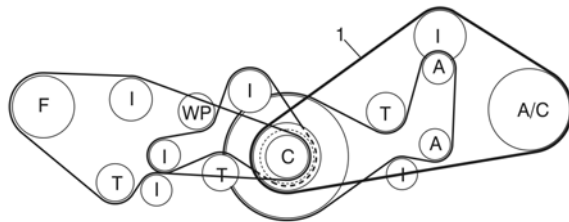
W2060365

- 1 Cover
- 2 Fastener
- 3 Lower Tensioner
- 4 Snap Ring



W2060365

- 1 Cover
- 2 Fastener
- 3 Lower Tensioner
- 4 Snap Ring



W1059479

- A — Alternator
- A/C — Air Conditioner
- C — Crank
- F — Fan
- I — Idler
- T — Tensioner
- WP — Water Pump
- 1 — The belt for the A/C requires a pair

**6**

Install engine cooling fan drive support lower tensioner. Tighten the fastener to specification, refer to Function Group 20, Specifications.

**7**

Install the replacement fan drive belt over the pulleys and then around the auto-adjuster.

**Note:** Make sure that the drive belt is properly routed and aligned correctly in the pulley grooves. Refer to the figure shown for proper routing of the belt.

**8**

Install all previously removed cables to the ground (negative) battery terminals.

**9**

Start the engine and check for proper operation.

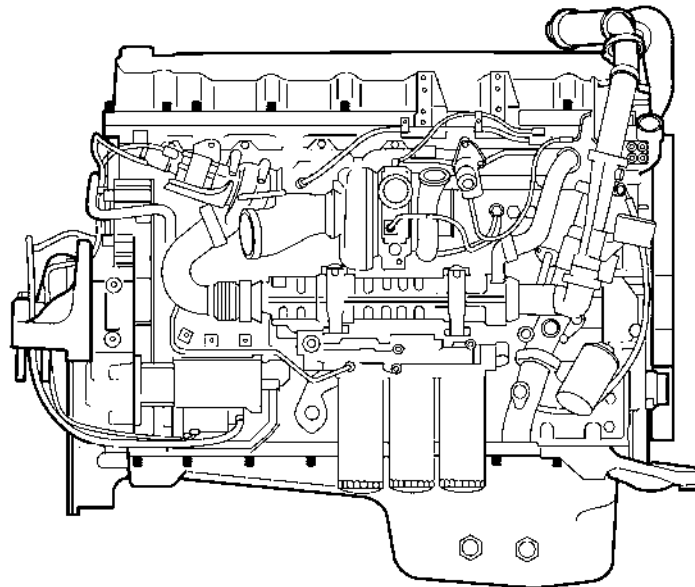
**10**

Close rear engine service doors.

Date	Group	No.	Release	Page
9.2010	<b>263</b>	<b>48</b>		1(9)

## Drive Belt Replacement PREVX

### Drive Belt, Replacement



W2005779

This information covers the service procedures for replacing the drive belts on a PREVX bus equipped with D13F or D13H engines.

#### Contents

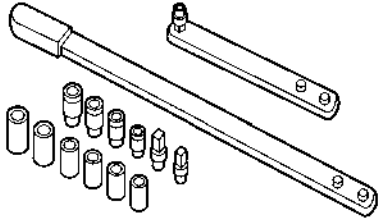
- "Special Tools", page 2
- "Drive Belt, Replacement", page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

## Special Tools

For special tool ordering instructions, see tool information in group 08.



W0001817

### **J-44392**

Drive Belt Tensioner Tool



W2060222

### **J-44392-2**

Drive Belt Tensioner Tool Adapter

# Service Procedures

**2634-03-02-04**

## Drive Belt, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing these procedures. If you are not properly trained and certified in these procedures, ask your supervisor for training before you perform the procedures.

*Special tools: J-44392, J-44392-2*

### Fan Drive Belt

**1**

Apply parking brake and transmission in neutral.

**2**

Open rear engine service doors.

**3**

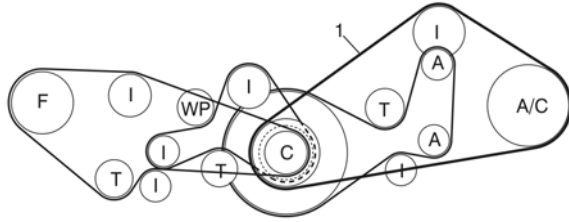
Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

Using tool J-44392 and adapter J-44392-2, pry the belt tensioner away from the fan drive belt and remove the belt.

---

J-44392, J-44392-2



W1059479

A — Alternator

A-C — Air Conditioner

C — Crank

F — Fan

I — Idler

T — Tensioner

WP — Water Pump

1 — The belt for the A/C requires a pair

**5**

Install the replacement fan drive belt over the pulleys and then around the auto-adjuster.

**Note:** Make sure that the drive belt is properly routed and aligned correctly in the pulley grooves. Refer to the figure shown for proper routing of the belt.

**6**

If there are no other drive belts in need of replacement, install all previously removed cables to the ground (negative) battery terminals.

**7**

Start the engine and check for proper operation.

**8**

Close rear engine service doors.

## A/C Drive Belt

**1**

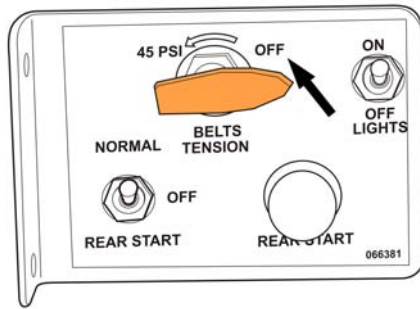
Apply parking brake and transmission in neutral.

**2**

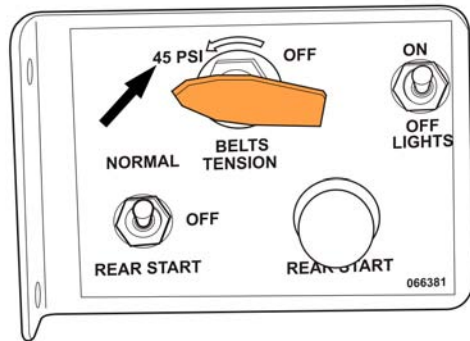
Open rear engine service doors.

**3**

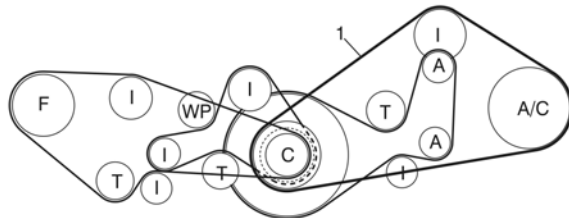
Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.



W2060009



W2060010



W1059479

A — Alternator

A-C — Air Conditioner

C — Crank

F — Fan

I — Idler

T — Tensioner

WP — Water Pump

1 — The belt for the A/C requires a pair

**4**

**Note:** To access the A/C drive belt for replacement, first the fan drive belt must be removed.

There is an air bag that supplies tension to the A/C drive belt. Release the pressure on the air bag by moving the belts tension switch to the off position.

**5**

With the pressure released on the air bag, install the replacement A/C drive belt over the pulleys. To reapply tension to the drive belt, pressurize the air bag by moving the belts tension switch to the 45 psi position. The air bag will automatically inflate to supply the proper pressure required for tension to A/C drive belt.

**Note:** Make sure that the drive belt is properly routed and aligned correctly in the pulley grooves. Refer to the figure shown for proper routing of the belts. The belt for the A/C requires a pair of belts, be sure to replace them both at the same time.



**6**

If there are no other drive belts in need of replacement, install all previously removed cables to the ground (negative) battery terminals.

**7**

Start the engine and check for proper operation.

**8**

Close rear engine service doors.

## Water Pump Drive Belt

**1**

Apply parking brake and transmission in neutral.

**2**

Open rear engine service doors.

**3**

Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

**Note:** To access the water pump drive belt for replacement, first the fan drive belt and A/C drive belt must be removed.

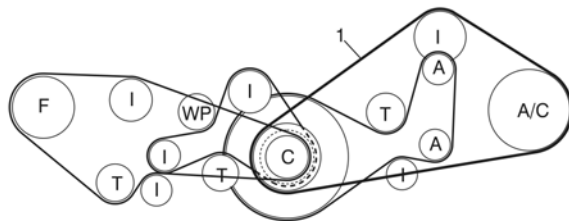
Using tool J-44392, pry the belt tensioner away from the water pump drive belt and remove the belt.

J-44392

**5**

With the belt tensioner compressed, install the replacement water pump drive belt over the pulleys. Relax the tensioner against the drive belt.

**Note:** Make sure that the drive belt is properly routed and aligned correctly in the pulley grooves. Refer to the figure shown for proper routing of the belt.



W1059479

A — Alternator

A-C — Air Conditioner

C — Crank

F — Fan

I — Idler

T — Tensioner

WP — Water Pump

1 — The belt for the A/C requires a pair

**6**

If there are no other drive belts in need of replacement, install all previously removed cables to the ground (negative) battery terminals.

**7**

Start the engine and check for proper operation.

**8**  
Close rear engine service doors.

## Alternator Drive Belt

**1**  
Apply parking brake and transmission in neutral.

**2**  
Open rear engine service doors.

**3**  
Remove all cables from ground (negative) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

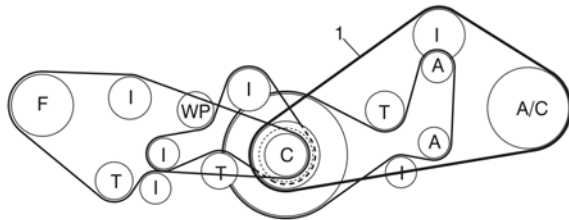
**4**  
**Note:** To access the alternator drive belt for replacement, first the fan drive belt, A/C drive belt, and water pump drive belt must be removed.

Using tool J-44392, pry the belt tensioner away from the alternator drive belt and remove the belt.

J-44392

**5**  
With the belt tensioner compressed, install the replacement alternator drive belt over the pulleys. Relax the tensioner against the drive belt.

**Note:** Make sure that the drive belt is properly routed and aligned correctly in the pulley grooves. Refer to the figure shown for proper routing of the belt.



W1059479

A — Alternator

A-C — Air Conditioner

C — Crank

F — Fan

I — Idler

T — Tensioner

WP — Water Pump

1 — The belt for the A/C requires a pair

**6**  
Install all previously removed cables to the ground (negative) battery terminals.

**7**

Start the engine and check for proper operation.

**8**

Close rear engine service doors.

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8.2010	<b>265</b>	<b>01</b>		1(4)

## Charge Air Cooler Replacement PREVX

### Charge Air Cooler, Replacement

This service bulletin covers the procedures for replacing the charge air cooler on VOLVO PREVX model buses.

#### Contents

- "Charge Air Cooler, Replacement", page 2 .

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2651-03-02-01 Charge Air Cooler, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

### **DANGER**

Before working on a vehicle, set the parking brake, place the I-Shift transmission in Neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

## Removal

**1**

Apply the parking brake and place the I-Shift selector in neutral.

**2**

Open the battery compartment access doors.

**3**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

Unlatch and remove the left-rear wheel skirt from the vehicle.

**5**

Remove the access panel behind the left-rear tire.

**6**

Open the side compartment to access the coolant package.

**7**

Remove the grill stop from the left-rear access grill.

**8**

Remove the air deflector shields around the coolant package.

**9**

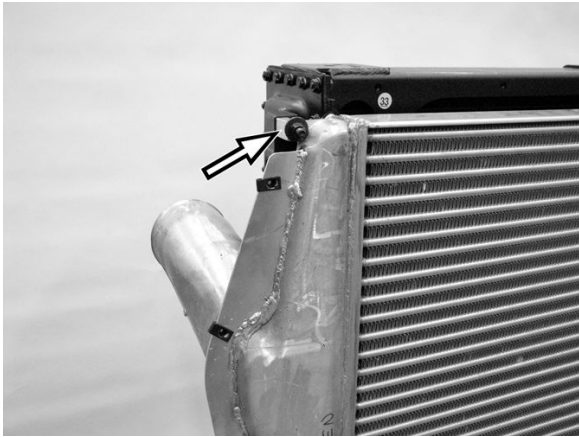
Remove the front charge air pipe clamp and break the hoses loose.

**10**

Remove the rear charge air hose clamp and break the hoses loose.

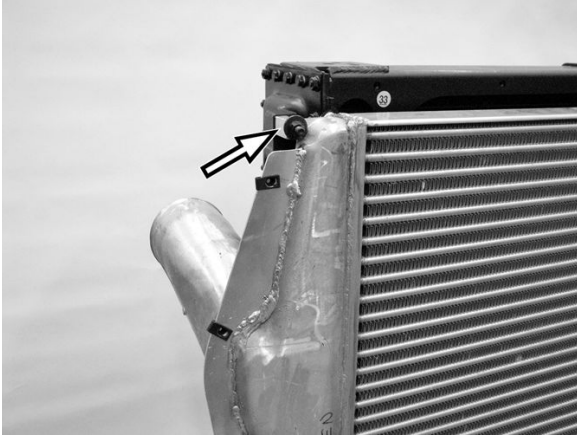
**11**

Remove the four fasteners securing the charge air cooler and carefully remove the defective charge air cooler from the radiator.



T2026529

## Installation



T2026529

**1**

Position the replacement charge air cooler on the radiator and install the mounting fasteners and tighten to specification; refer to Function Group 200, "Specifications."

**2**

Position the rear charge air hose and secure it in place with the clamp.

**3**

Position the front charge air hose and secure it in place with the clamp.

**4**

Install the air deflector shields around the coolant package.

**5**

Install the grill stop to the left-rear access grill.

**6**

Close the side compartment door.

**7**

Install the access panel behind the left-rear tire.

**8**

Position the left-rear wheel skirt onto the vehicle and latch to secure it in place.

**9**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**10**

Close the battery compartment access doors.



Date	Group	No.	Release	Page
8.2010	<b>265</b>	<b>01</b>		1(4)

## Charge Air Hose Replacement PREVX

### Charge Air Hose, Replacement

This service bulletin covers the procedures for replacing the charge air hose on VOLVO PREVX model buses.

#### Contents

- "Charge Air Hose, Replacement", page 2 .

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## 2652-03-02-01 Charge Air Hose, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### **DANGER**

Do not attempt to repair or service this vehicle without having sufficient training, the correct service literature and the proper tools. Failure to follow this could make the vehicle unsafe and lead to serious personal injury or death.

### **DANGER**

Before working on a vehicle, set the parking brake, place the I-Shift transmission in Neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

## Removal

**1**

Apply the parking brake and place the I-Shift selector in Neutral.

**2**

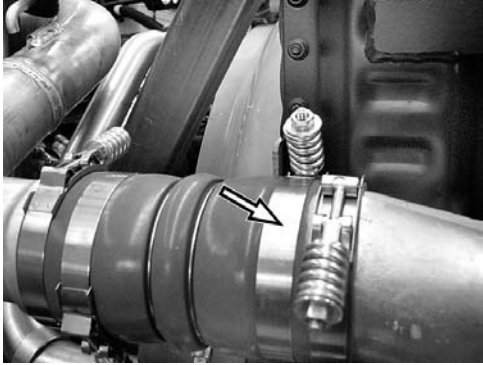
Open the battery compartment access doors.

**3**

Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

**4**

Open both rear engine service doors to access the charge air cooler and the charge air cooler hoses.

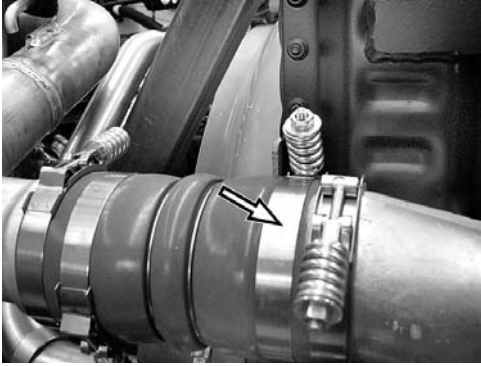


T2026553

**5**

Loosen the T-clamps securing the defective charge air cooler hose and remove the hose from the vehicle.

## Installation



T2026553

**1**

Position the replacement charge air hose in place on the vehicle and secure it using the T-clamps.

**2**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**3**

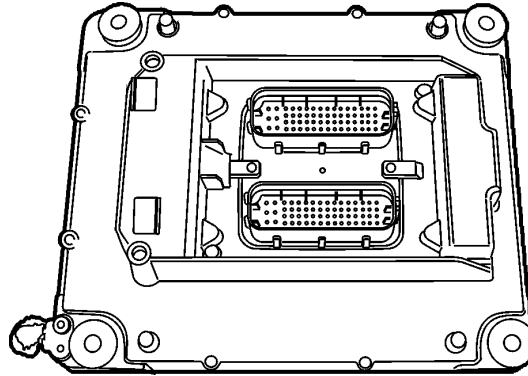
Close the battery compartment access doors.

**4**

Close both rear engine service doors.

## Engine Control Unit, Replacement D13F

### Engine Control Unit, Replacement



W2003778

This information covers the proper procedure for replacement of the Engine Electronic Control Unit (EECU) on the Volvo D13F engine.

### Contents

- "Special Tools" page 2
- "Engine Control Unit, Replacement" page 3

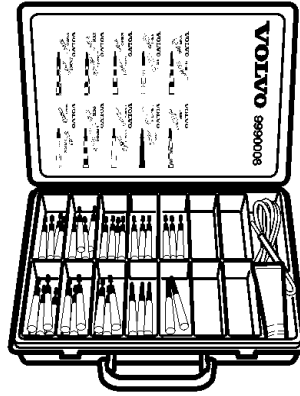
**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

**Note:** You should not replace an EECU without prior authorization from Tech Support.

# Tools

## Special Tools

The following special tools are used with VCADS Pro to diagnose engine faults. For special tools ordering instructions, refer to tool information in group 08.



W0002043

**9990008**

Test Pins

# Service Procedures

## 2841-03-02-01

### Engine Control Unit, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

**Note:** You should not replace an EECU without prior authorization from Tech Support.

## Removal

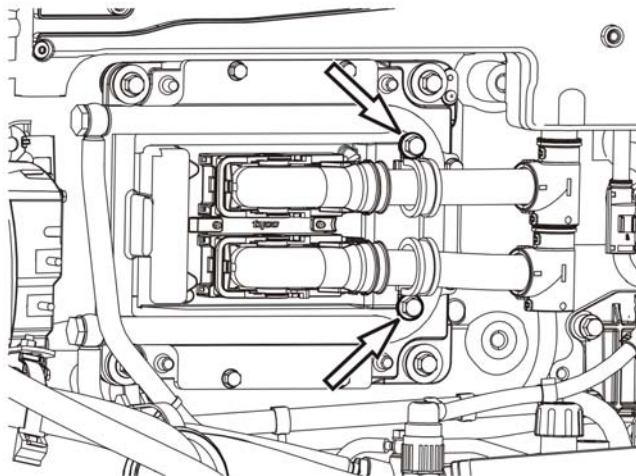
1

Remove all cables from the ground (negative) battery terminals to prevent personal injury from electrical shock.

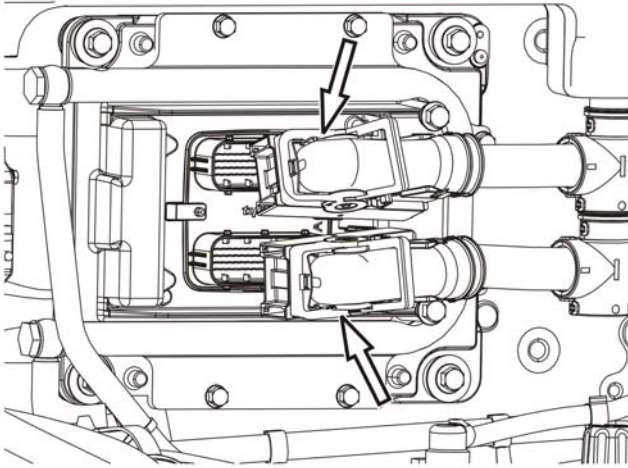
**Note:** Disconnect any ground wiring from electrical equipment connected to the batteries such as ECUs, satellite systems, etc.

2

Remove the bolts mounting the upper and lower wiring harness clamps to the EECU housing.

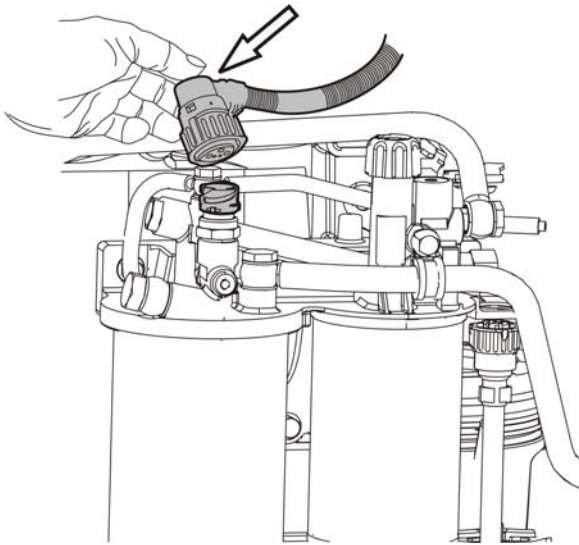


- 3**  
Push the connector locks inward and rotate outward to disconnect both wiring harnesses from the EECU.



W2005595

- 4**  
Disengage the fuel sensor harness connector from the fuel filter housing.

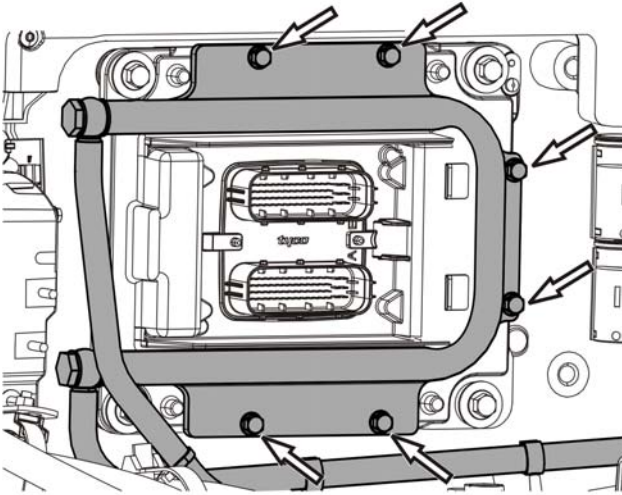


W2005596

- 5**  
Position the EECU harness out of the way to gain access to the EECU.

- 6**  
Remove the P-clamp securing the EECU cooler fuel line to the cylinder block.

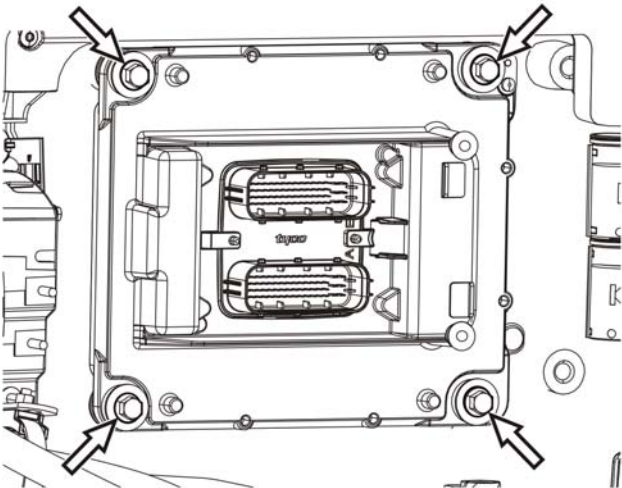




W2005597

- 7**  
Remove the bolts securing the EECU cooler to the EECU housing. Position the EECU cooler away from the EECU and allow the cooler to hang by the fuel lines.

**Note:** Keep the EECU cooler fuel lines attached and position the cooler out of the way.



W2005598

- 8**  
Remove the mounting bolts securing the EECU to the engine block and remove the EECU.

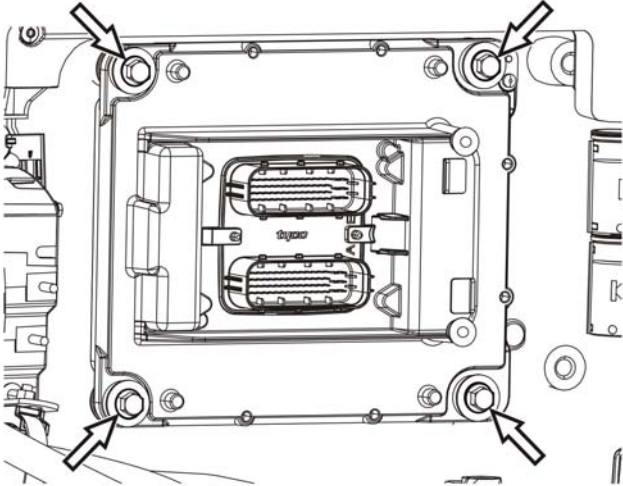
## Installation

**Note:** Make sure that the EECU contact surface on the engine block is free of dirt.

### 1

Mount the EECU to the engine block. Install and tighten the mounting bolts to specification.

**Note:** Make sure that rubber isolators are correctly installed and that the ground strap is grounded to the engine block.

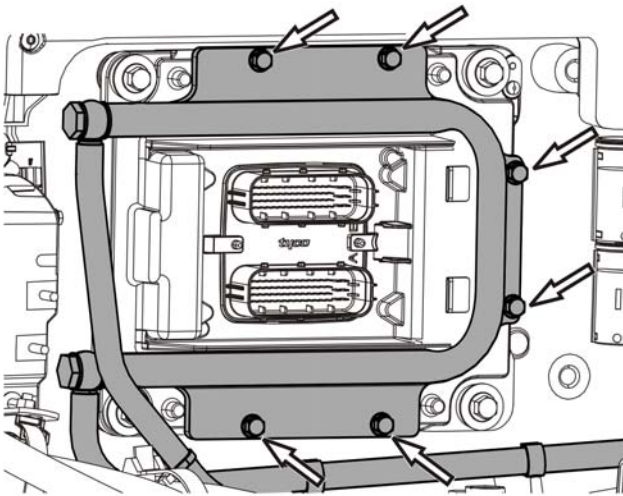


W2005598

### 2

Position the EECU cooling plate to the EECU, install the bolts and tighten to specification.

**Note:** If the EECU is painted in the region contacting the cooler, remove the paint to provide for the most efficient cooling.



W2005597

### 3

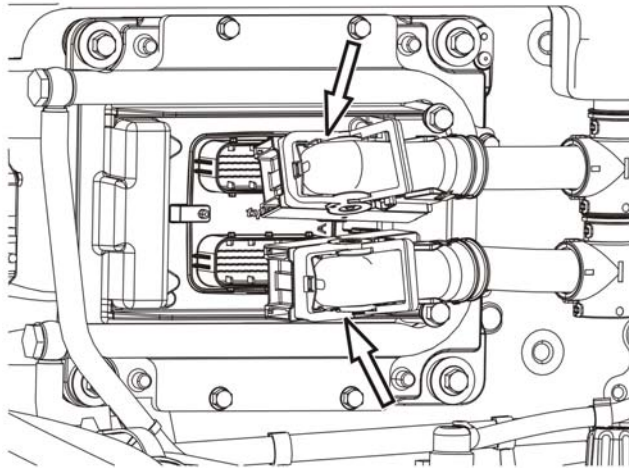
Install the P-clamp to secure the EECU cooler fuel line to the cylinder block.

### 4

Check the tension of the terminal connector pins using the test pins tool kit.

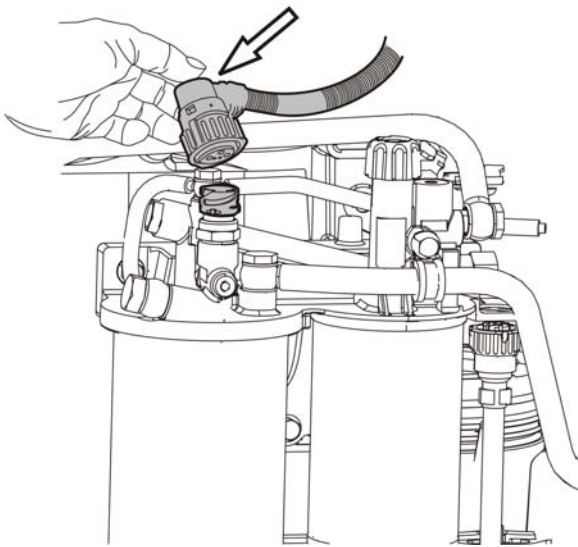
**Note:** If terminal pins are damaged or corroded, replace as necessary.

9990008



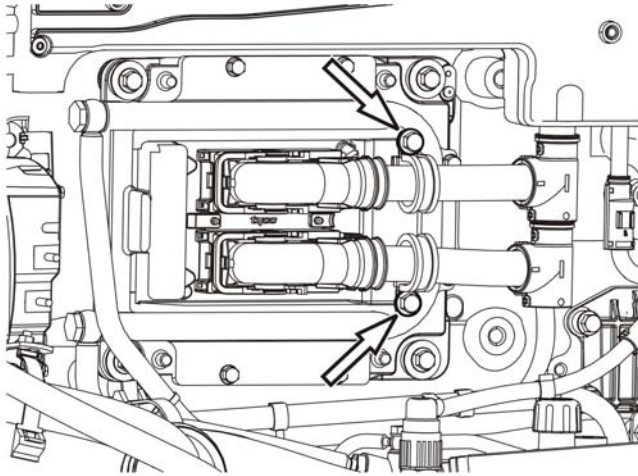
W2005595

**5**  
Carefully engage the upper and lower wiring harness connectors to the EECU. Verify that the connectors are latched and properly locked in position.



W2005596

**6**  
Install the fuel sensor harness connector to the fuel filter housing.



W2005594

**7**  
Install the bolts to secure the wiring harness clamps to the EECU.

**8**  
Install all previously removed cables to the ground (negative) battery terminals.

**Note:** Reconnect any ground wiring for electrical equipment connected to the batteries such as ECUs, satellite systems, etc.

**9**  
Connect VCADS Pro to the diagnostic connector and program the EECU (if not yet programmed).

**10**  
Start the engine and check that there are no fault codes.

Date	Group	No.	Release	Page
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**Fuel Pressure Sensor, Aftertreatment,  
Replacement**

9700, PrevH, PrevX

**Fuel Pressure Sensor, Aftertreatment, Replacement**

This information provides the service procedures for replacing the fuel pressure sensor on Prevost and 9700 vehicles equipped with an aftertreatment hydrocarbon dosing module.

**Contents**

- "Fuel Pressure Sensor, Aftertreatment, Replacement", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

**2846-03-03-05**

## Fuel Pressure Sensor, Aftertreatment, Replacement

You must read and understand the precautions and guidelines in Service Information, Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

**1**

Apply the parking brake and place the shift lever in neutral.

**2**

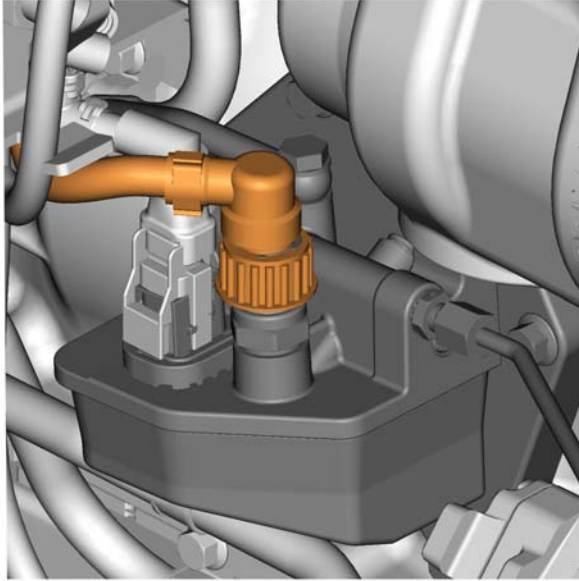
Open engine service doors.

**Note:** On some models it maybe necessary to remove the floor panel to allow access to the fuel pressure sensor, from underneath the vehicle.

**Note:** If the floor panel requires removal to access the fuel pressure sensor, raise and support the vehicle to provide safe access to the undercarriage of the vehicle.

**3**

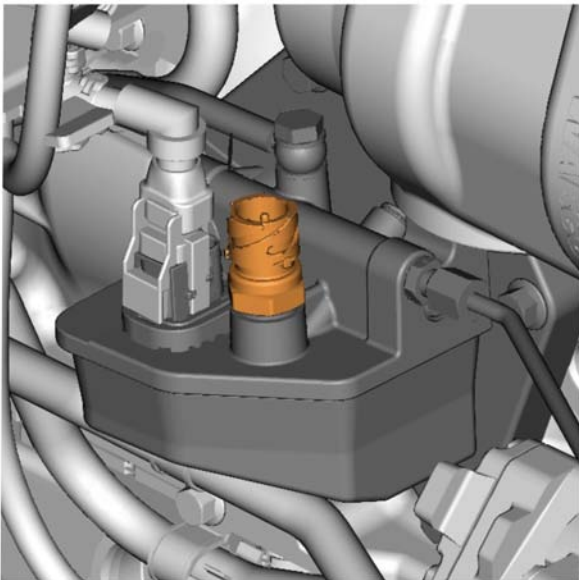
Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.



W2064648

**4**

Disconnect the wiring harness from the fuel pressure sensor.



W2064649

**5**

Remove the fuel pressure sensor from the aftertreatment hydrocarbon dosing module.

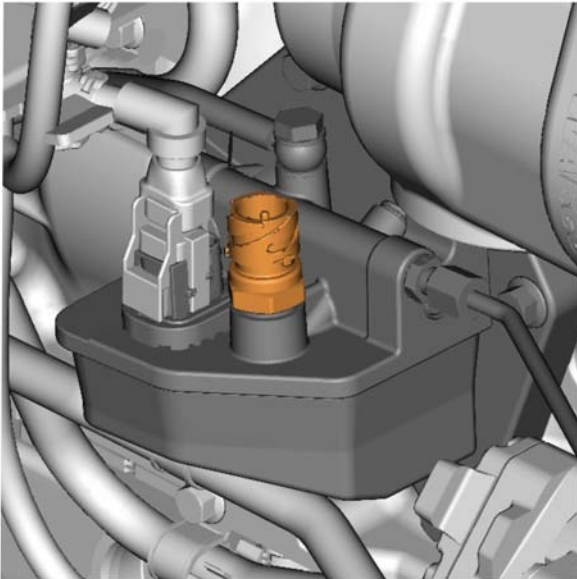
 **CAUTION**

Do not allow fuel to leak onto the aftertreatment hydrocarbon dosing module wiring harness connectors. This will cause damage to the connectors rubber parts.

## Installation

**1**

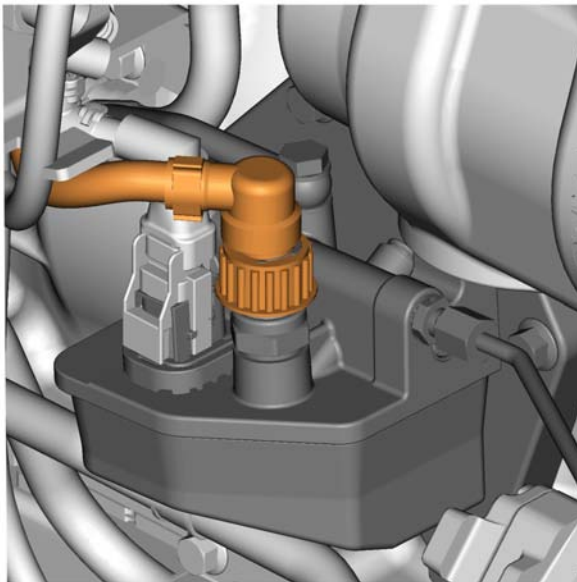
Install the fuel pressure sensor to the aftertreatment hydrocarbon dosing module. Tighten the fuel pressure sensor to specification, refer to Function Group 20, Specifications.



W2064649

**2**

Reconnect the wiring harness to the fuel pressure sensor.



W2064648



**3**

Reconnect all previously removed cables to the negative (ground) battery terminals.

**4**

Start the engine and check for leaks and proper operation. Clear fault codes, if needed.

**Note:** If fault tracing was performed using Guided Diagnostics, return to Guided Diagnostics for repair verification.

**5**

Close engine service doors.

**Note:** If the floor panel was previously removed to allow access to the fuel pressure sensor, install the bottom panel. Tighten the floor panel fasteners to specification, refer to Function Group 20, Specifications.

**Note:** If the floor panel was installed, raise the vehicle and remove supports and lower the vehicle to the floor.

Date	Group	No.	Release	Page
9.2010	<b>284</b>	<b>23</b>	<b>01</b>	1(2)

## Engine Sensor Locations

B13R, PREVH, PREVX

## Engine Sensor Locations

The information in this document shows the main engine sensor locations on the D13H engine used in VOLVO model B13R, PREVH, PREVX buses. Sensor locations may vary depending on application.

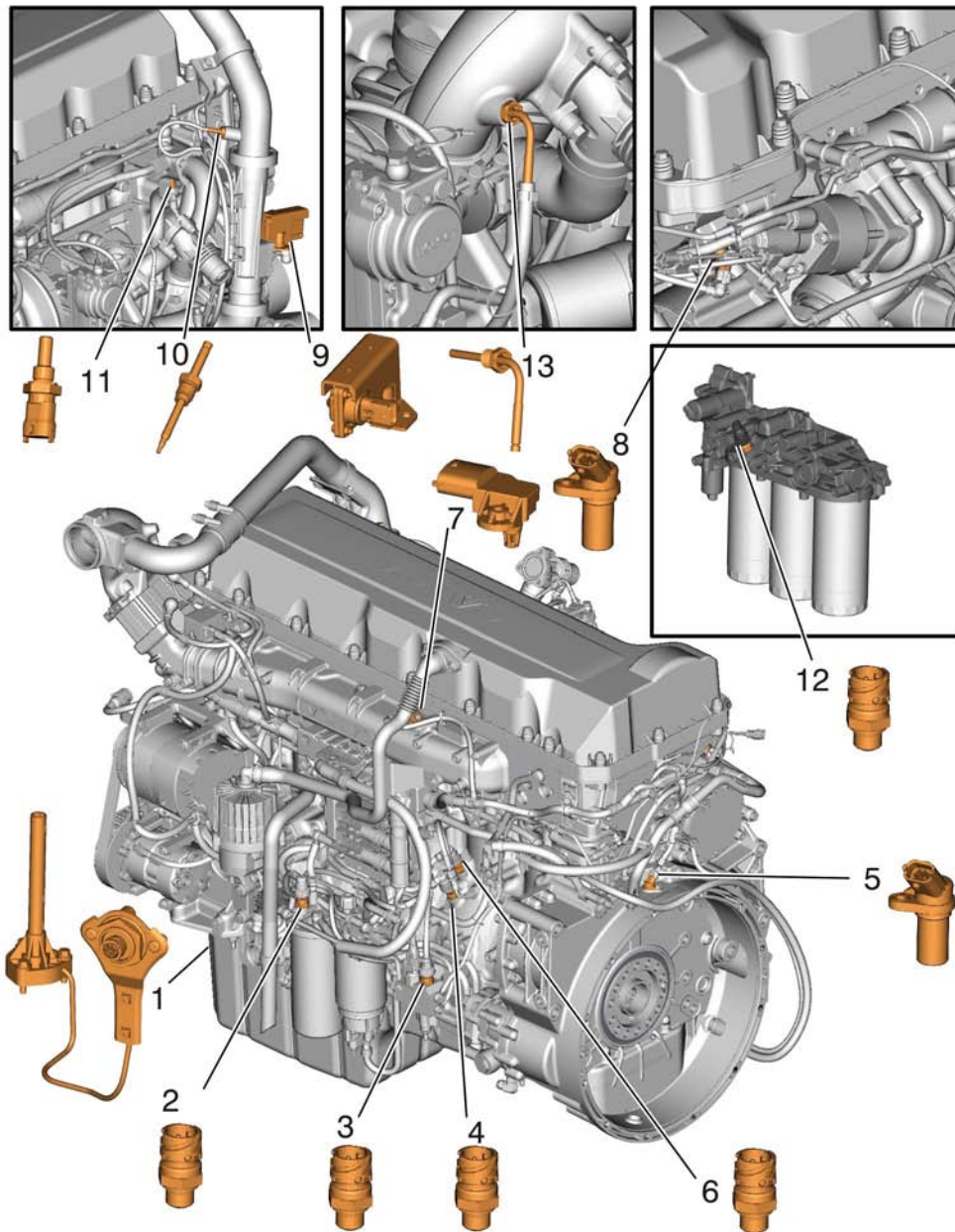
### Contents

- "Engine Sensor Locations", page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Design and Function

## Engine Sensor Locations



- |   |                                 |    |   |
|---|---------------------------------|----|---|
| 1 | Engine Oil Level/Temperature    | 8  | Camshaft Speed  |
| 2 | Fuel Pressure                   | 9  | Exhaust Gas Recirculation (EGR) Differential Pressure |
| 3 | Aftertreatment Fuel Pressure    | 10 | EGR Temperature                                       |
| 4 | Engine Oil Pressure (EOP)       | 11 | Engine Coolant Temperature (ECT)                      |
| 5 | Crankshaft Speed                | 12 | Piston Cooling Jet Oil Pressure Sensor                |
| 6 | Crankcase Pressure (CCP)        | 13 | Compressor Discharge Temperature Sensor               |
| 7 | Intake Air Temperature/Pressure |    |   |

This Service Bulletin replaces bulletins 293-77 dated 1.2009 and 293-25 dated 9.2010.

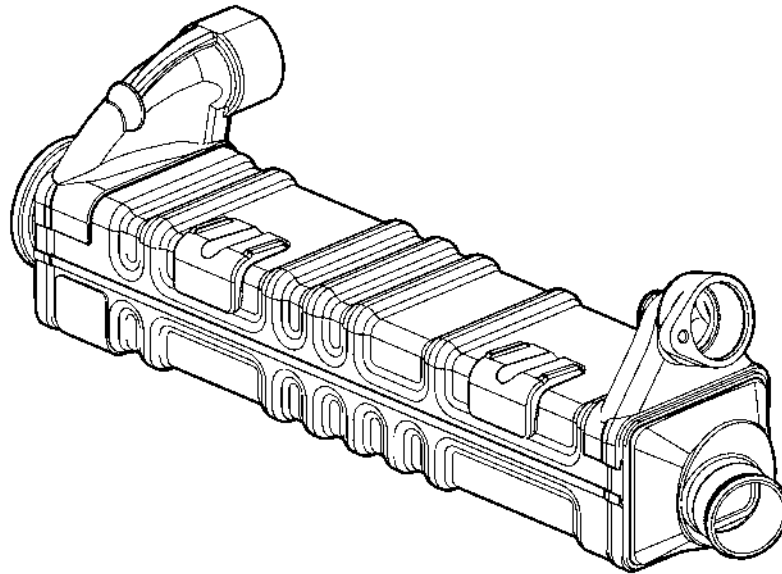
Date	Group	No.	Release	Page
3.2011	<b>293</b>	<b>25</b>	<b>03</b>	1(27)

EGR Cooler, Replacement

9700, PrevH, PrevX

D13

## EGR Cooler, Replacement



W2006747

This information covers replacement of the EGR cooler on the VOLVO D13 engine.

### Contents

- “Special Tools”, page 2
- “EGR Cooler, Replacement”, page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

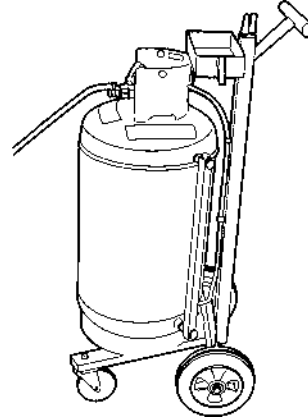
## Special Tools

For special tools ordering information, refer to Tool Information, group 08.



W0001795

**9996049**  
Coolant Drain Hose



W2004191

**85112740**  
Coolant Extractor

# Service Procedures

## 2932-03-02-01

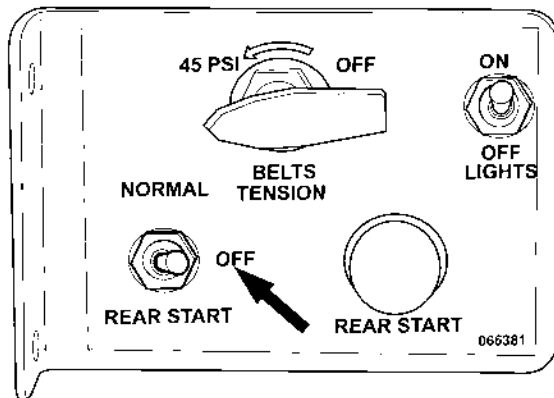
### EGR Cooler, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

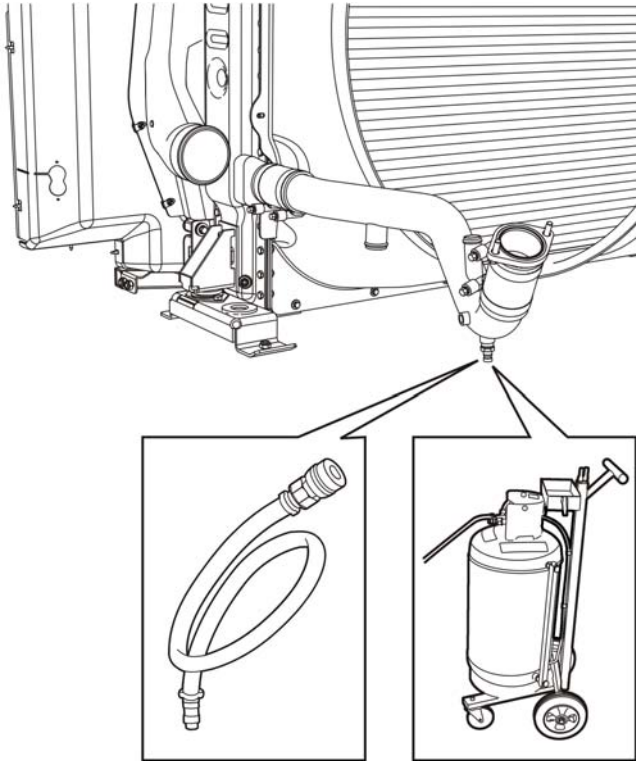
*Special tools: 85112740, 9996049*

## Removal

- 1  
Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.
- 2  
Access the engine compartment via the rear hatch.
- 3  
Set the starter selector switch to the off position.



W2006494



W2006765

**4**

Connect coolant extractor.

**Note:** If equipped, the bottom chassis skid plate must be removed for access.

**5**

Use the coolant extractor to drain the coolant from the engine. An alternate method is to drain the coolant into a suitable container using the drain hose.

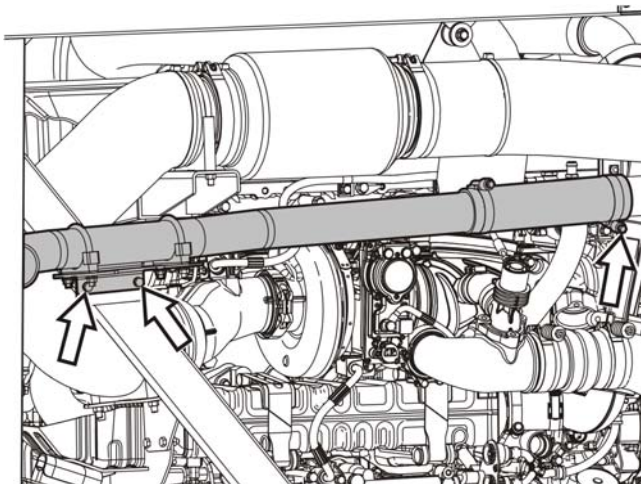
**⚠ DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

85112740, 9996049

**6**

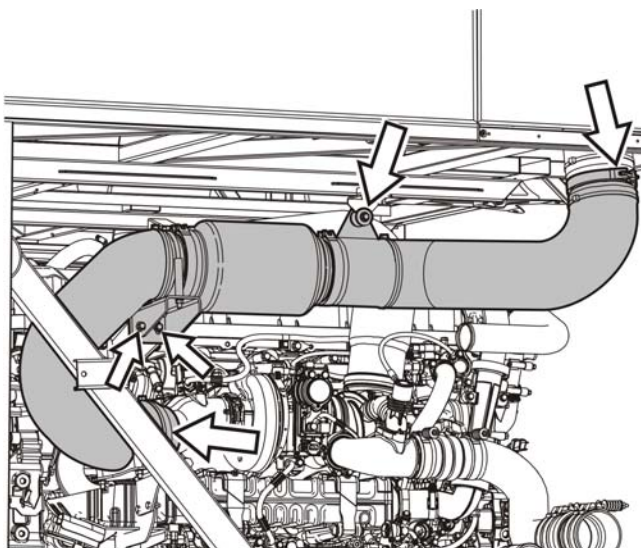
Remove coolant package. See Function Group 26.



W2006807

**7**

Remove upper radiator coolant pipe with bracket attached.



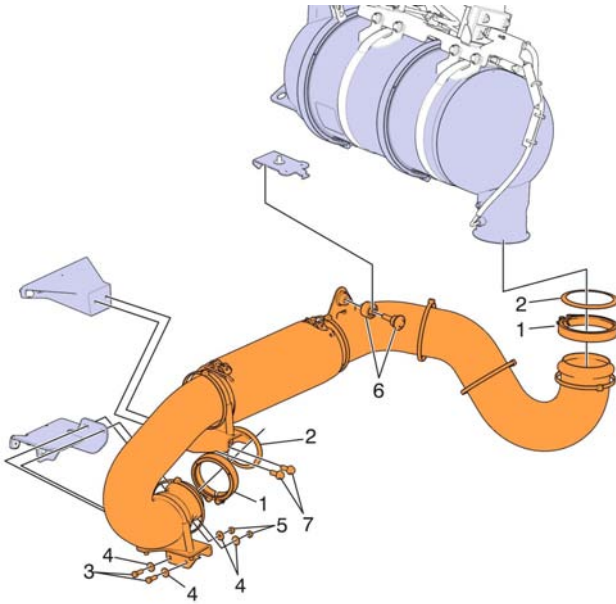
W2006808

**8**

Remove exhaust pipe clamp at diffuser and the clamp before the diesel particulate filter (DPF). Remove the exhaust pipe as an assembly.

D13F



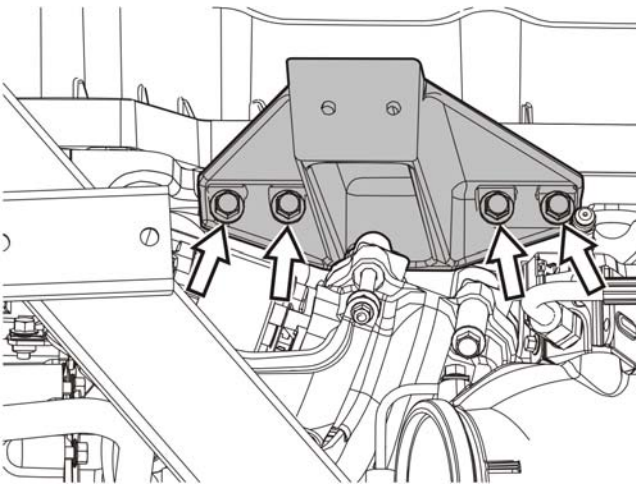


W2060830

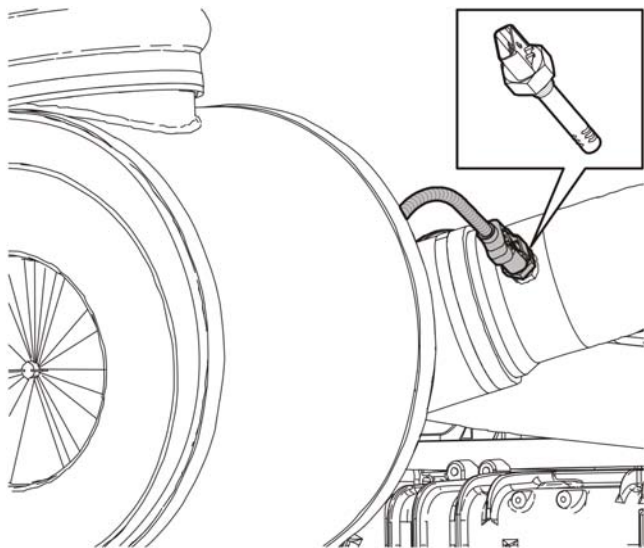
D13H

- 1 V-band Clamp
- 2 Gasket
- 3 Bolts
- 4 Washers
- 5 Nuts
- 6 Fastener and Bushing
- 7 Capscrews

- 9** Remove the upper exhaust pipe mounting bracket.



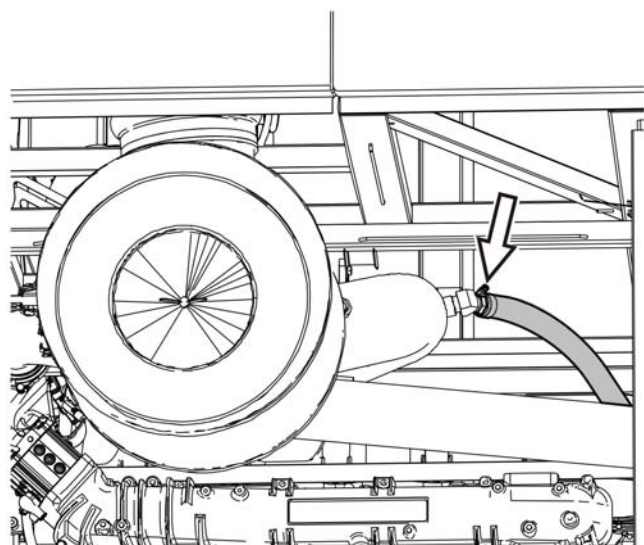
W2006809



W2006810

**10**

If equipped, disconnect the humidity/air intake temperature sensor and remove sensor from intake pipe.



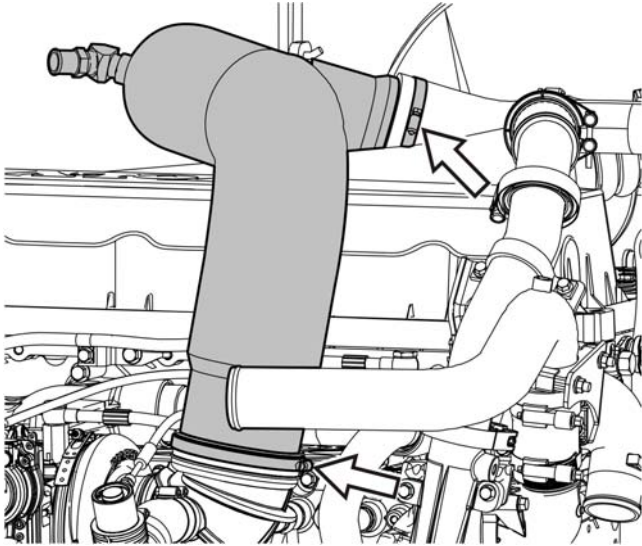
W2006811

**11**

Remove clamp and remove air compressor air inlet hose.

**12**

Remove hose clamps at air filter housing boot and turbocharger inlet boot.



W2006812

D13F

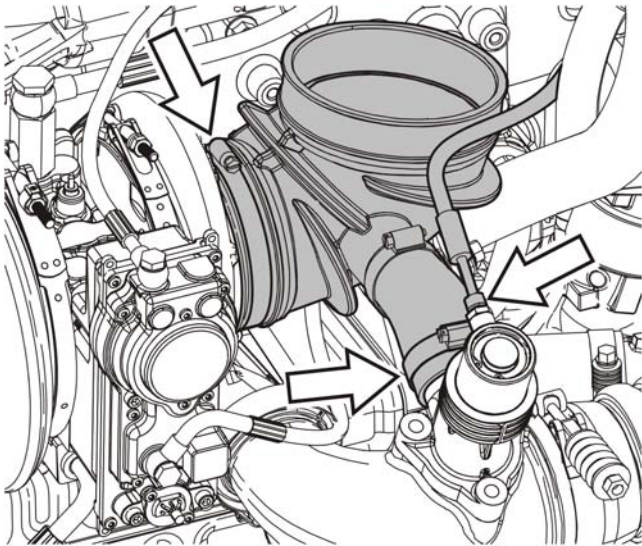
- 13**  
Remove fresh air intake pipe.

- 14**  
Remove engine turbocharger compressor bypass valve hose clamp at the valve.

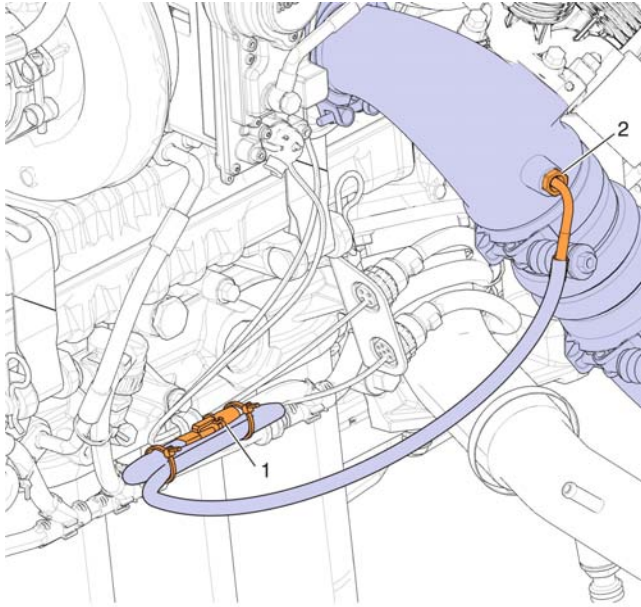
- 15**  
Remove turbo air intake hose clamp securing boot.

- 16**  
Remove bypass valve control line from valve.

- 17**  
Remove turbocharger air intake boot and fresh air intake pipe as an assembly.



W2006813



W2059588

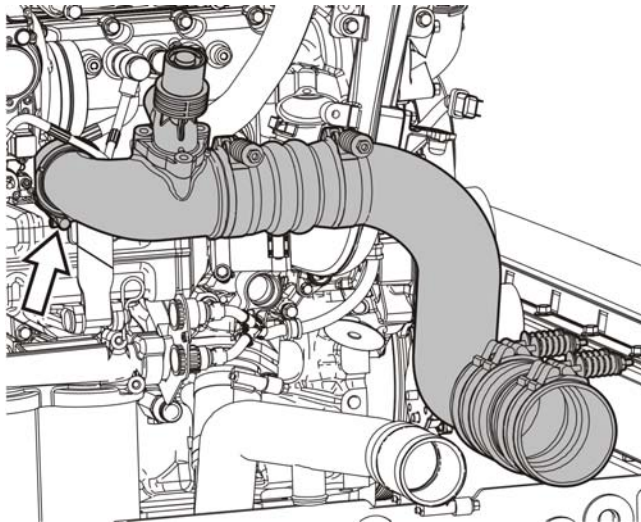
1 Connector

2 Sensor

**18**

If equipped, unplug the discharge air temperature sensor wiring harness connector in the wire bundle next to the engine block. Remove the sensor from the charge air pipe.

**Note:** Cut the cable ties securing the wiring harness connector to the wiring bundle.

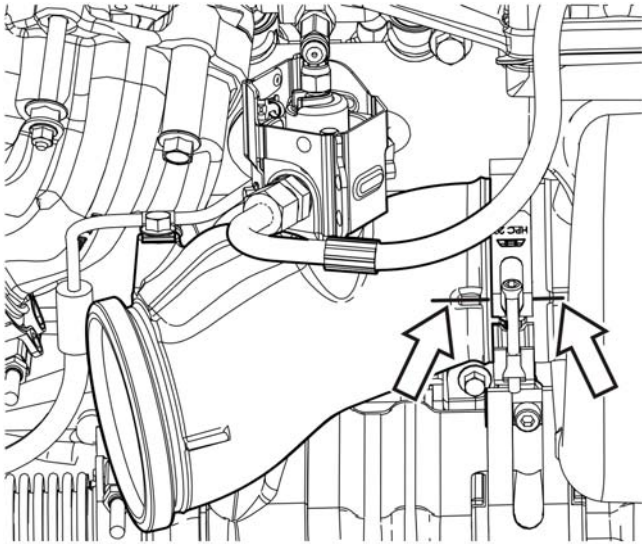


W2006814

**19**

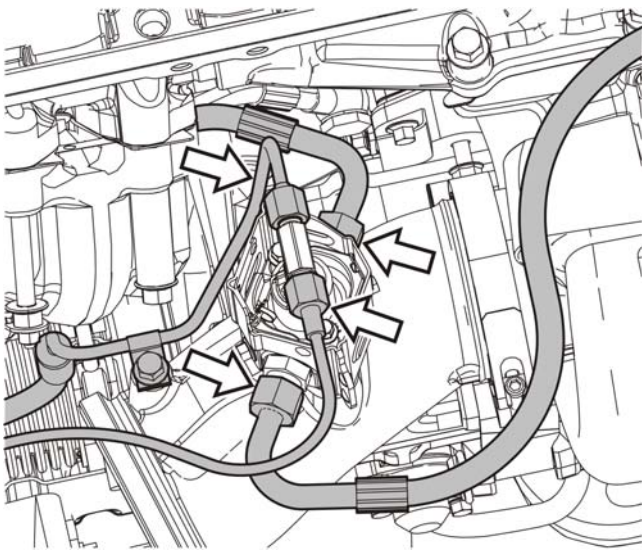
Remove charge air pipe from turbocharger.

**Note:** Remove all parts as an assembly and ensure that the wiring harness does not catch on anything when removing the assembly.



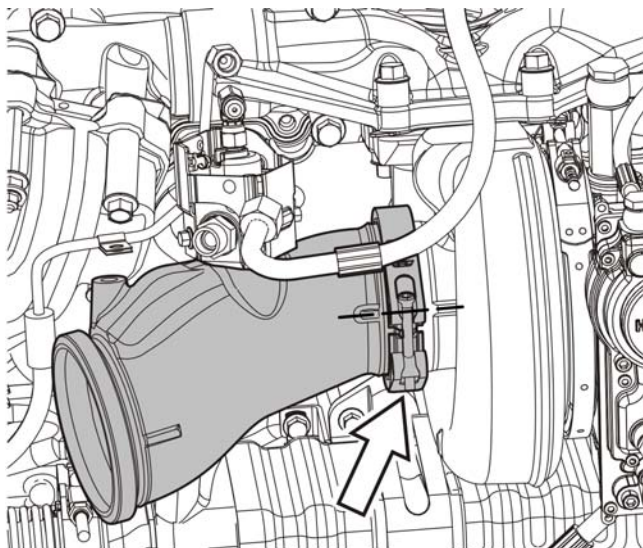
W2006816

**20**  
Check and mark diffuser alignment.



W2006817

**21**  
If the aftertreatment hydrocarbon doser is not equipped with two-way check valve, disconnect fuel line and coolant lines from doser. If the doser is equipped with two-way check valve, remove the check valve and coolant lines.

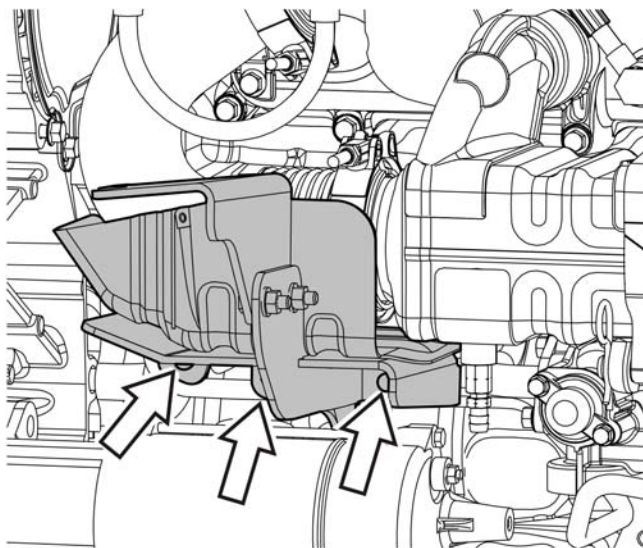


W2006818

**22**

Remove clamp securing diffuser to turbocharger.  
Remove diffuser.

**Note:** The diffuser can be moved to the top of the valve cover without disconnecting the electrical connector.



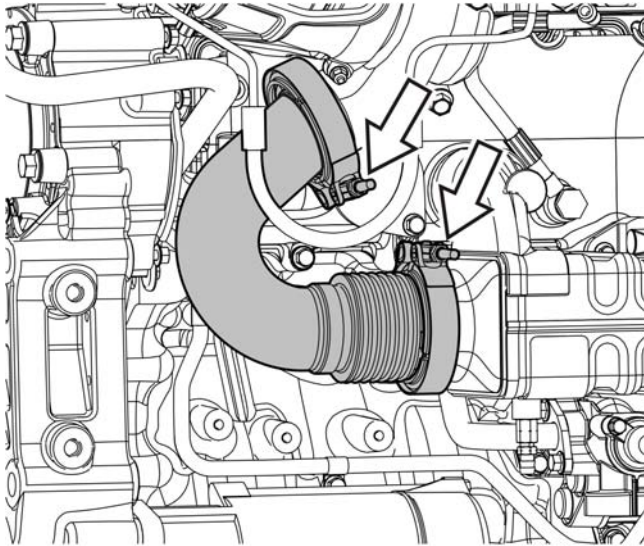
W2006819

**23**

Remove turbocharger. See Function Group 25.

**24**

Remove lower exhaust support bracket.

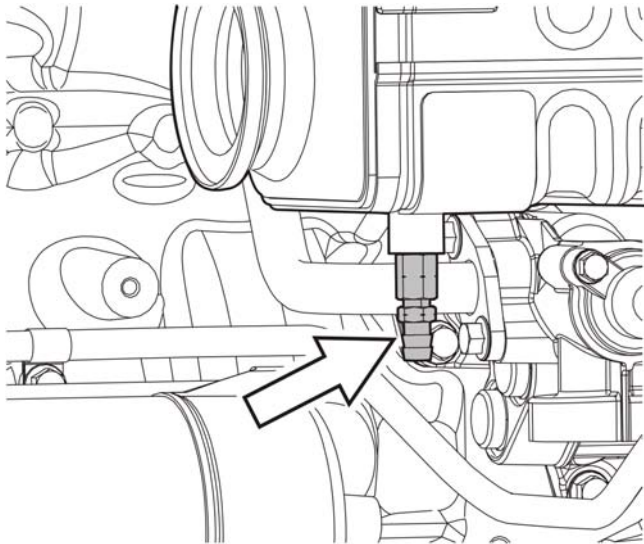


**25**

Remove and discard the gaskets and V-band clamps retaining the EGR hot pipe. Remove the pipe.

**Note:** Discard the gaskets and V-band clamps used to retain the EGR hot pipe. The gaskets and clamps are one time use only. Replace old gaskets and V-band clamps with new ones.

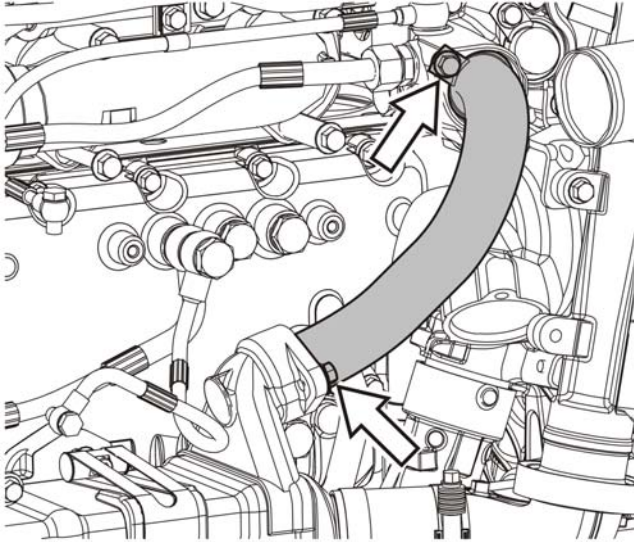
W2006821



**26**

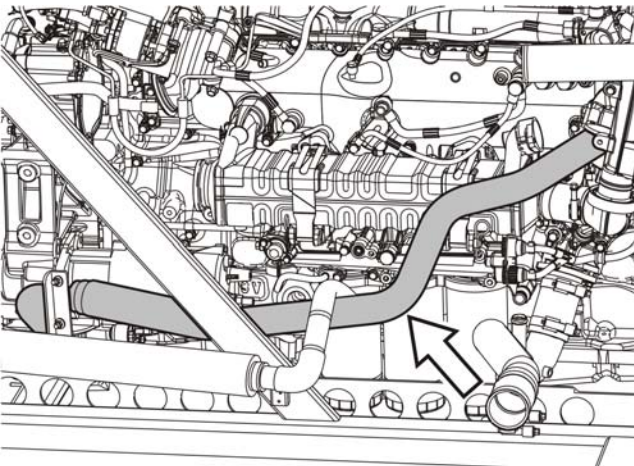
Loosen and remove the drain fitting from the EGR cooler. Drain coolant into a suitable container.

W2006822



W2006823

**27**  
Remove EGR cooler coolant pipe.

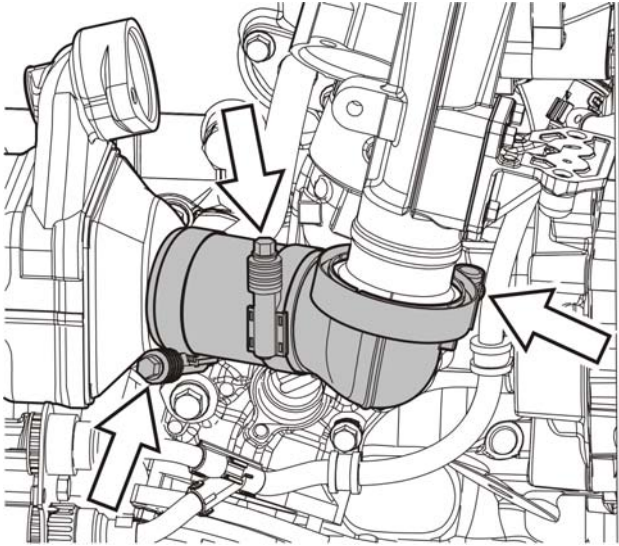


W2006824

**28**  
If necessary, remove upper transmission coolant pipe.

**29**  
If there are coolant fill and overflow lines tie strapped to bracket on diffuser at front of EGR cooler, tie straps may need to be snipped and hoses relocated.



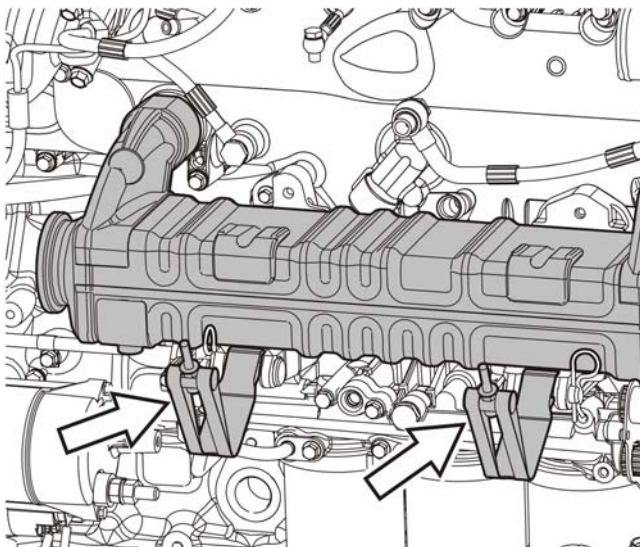


W2006825

**30**

Remove the V-band clamp from the venturi inlet elbow. Loosen the clamp and remove the EGR hose and pipe located between the EGR cooler and the venturi.

**Note:** Discard the V-band clamp used to retain the venturi inlet elbow and the EGR hose clamps. The clamps are one time use only. Replace old V-band clamps and hose clamps with new clamps.



W2006826

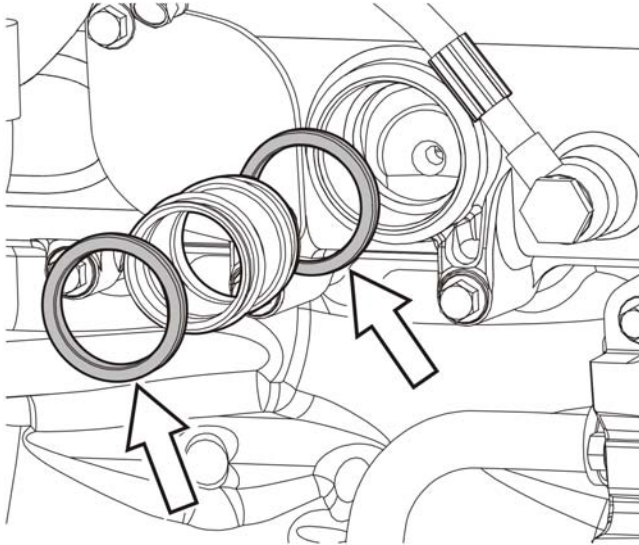
**31**

Remove both EGR clamps securing cooler to mounting brackets. Remove EGR cooler from mounting brackets.

## Installation

**1**

Replace and lubricate the O-rings that seals the EGR cooler to the oil cooler housing with approved lubricant.

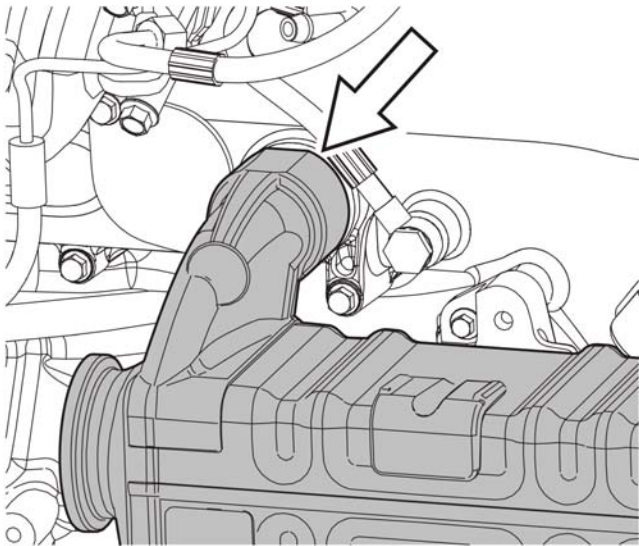


W2006827

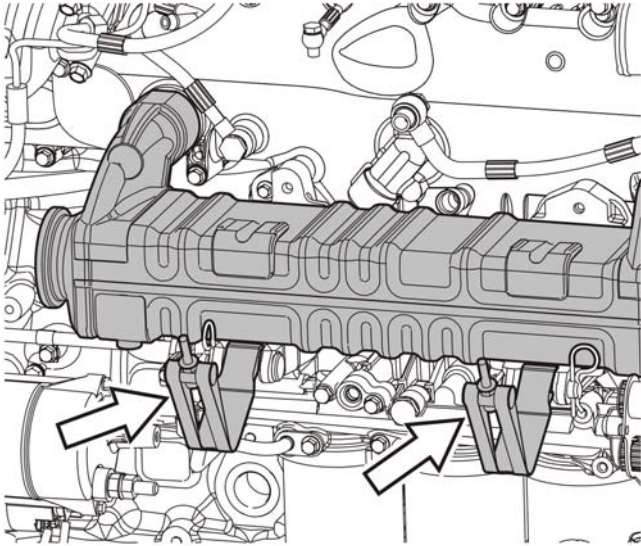
**2**

Place the EGR cooler in position on the mounting brackets. Align the EGR cooler with the coolant return port and press until EGR cooler seats against return port.

**Note:** The alignment pin at the bottom of the cooler must fall into the groove on the front bracket.



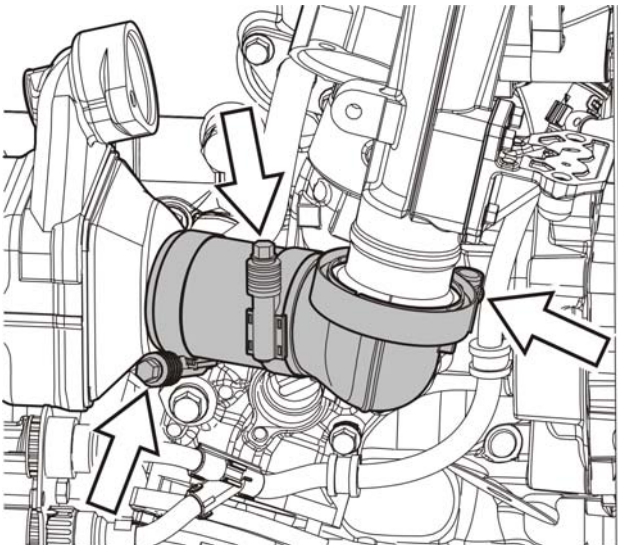
W2006828



W2006826

**3**

Rotate the retaining straps into position and tighten the fasteners on each strap to specification. Refer to Function Group 20, Specifications. Tighten the jam nut to secure each fastener.



W2006825

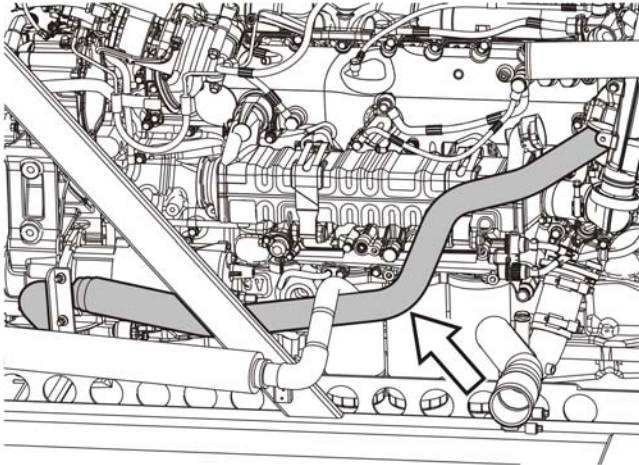
**4**

Install venturi inlet pipe with a new hose. Tighten the V-band clamps to specification.

**Note:** All EGR hoses are one time use only. Discard old hoses and replace with new ones.

**5**

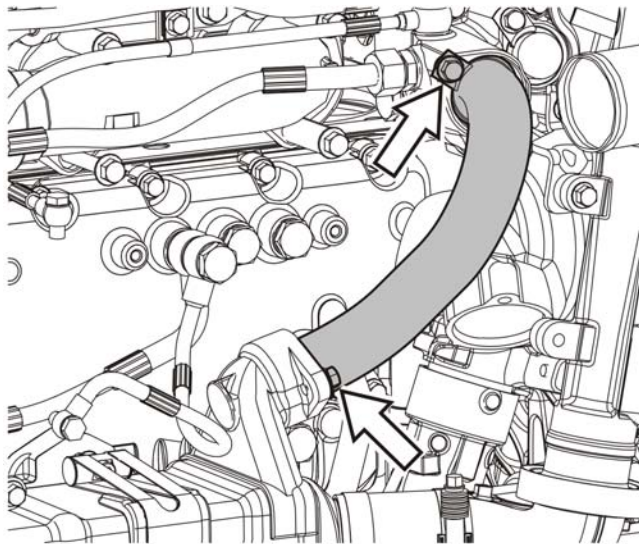
If necessary, reposition and use cable ties to retain coolant hoses to the diffuser bracket.



W2006824

**6**

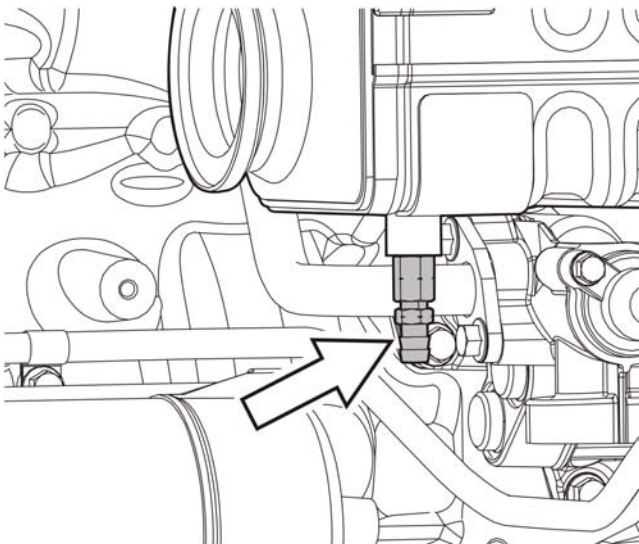
If necessary, install upper transmission coolant pipe.



W2006823

**7**

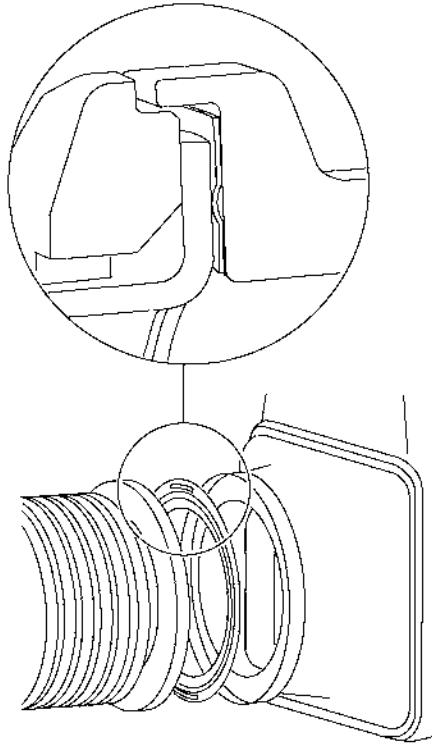
Install EGR cooler coolant pipe. Tighten fasteners to specification.



W2006822

**8**

Apply approved sealant to the threads of the drain valve. Install the drain valve in the cooler and tighten to specification.



W2006187

**9**

Install new high temperature gaskets into the EGR valve end of the hot pipe and the inlet of the EGR cooler. Ensure the gaskets lay flat against the flange surfaces with the bead of the gaskets facing toward the hot pipe.

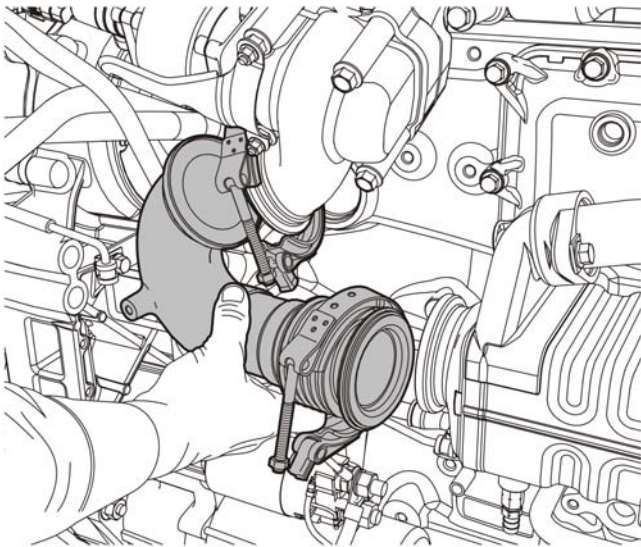
**Note:** These gaskets are one time use only. Do not reuse the gaskets.

**10**

Apply anti-seize compound to the T-bolt threads. Lubricate the V-inserts of the clamps with clean engine oil.

**11**

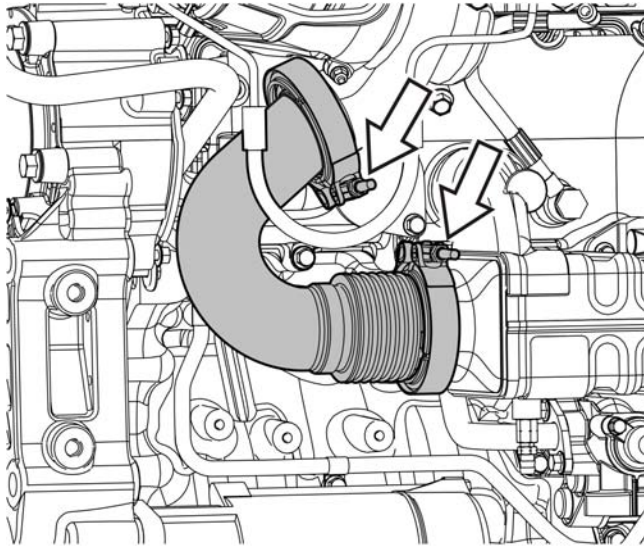
Hook the upper V-clamp over the EGR valve flange. Place the remaining V-clamp over the bellows on the hot pipe.



W2005641

**12**

Lubricate the flange on the EGR cooler inlet and the flange on the EGR hot pipe with clean engine oil. Lubrication aids in proper V-clamp installation.



**13**

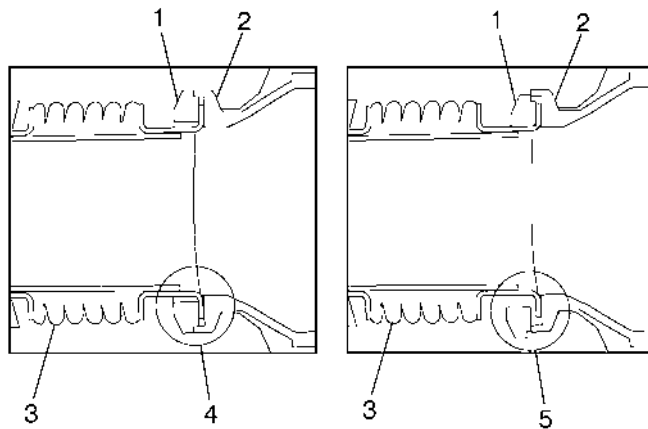
Position the EGR hot pipe between the EGR valve and the EGR cooler. Make sure the flanges engage properly. Slide the upper V-clamp over the flange and tighten until snug. Slide the lower V-clamp over the flange and tighten the clamp until snug.

W2006821

**14**

Visually inspect the floating flange through the gap in the V-clamp to make sure it is properly seated in the EGR cooler. The floating flange must be concentric with the cooler flange.

**Note:** If the floating flange is not properly seated in the EGR cooler flange, the gasket will not be compressed and the seal will leak.



W2006163

- 1 EGR Pipe Floating Flange
- 2 EGR Cooler Flange
- 3 EGR Pipe
- 4 Flange Assembled Correctly
- 5 Flange Assembled Incorrectly

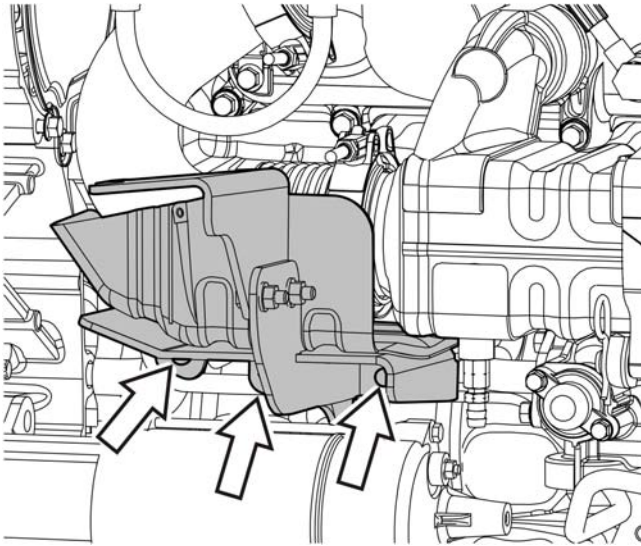
**15**

Position the V-clamps so that the T-bolts clear both heat shields. Tighten the clamps to specification.

**Note:** After reaching the specified torque, inspect the V-clamps to make sure that no portion of the clamp has "bottomed out."

**16**

Install lower exhaust support bracket.



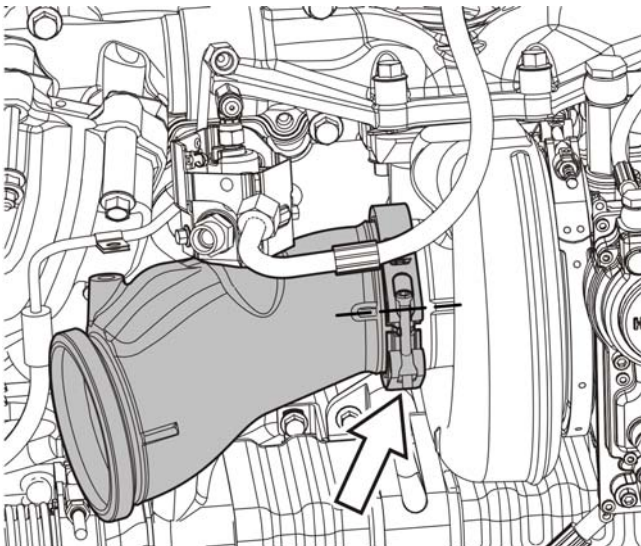
W2006819

**17**

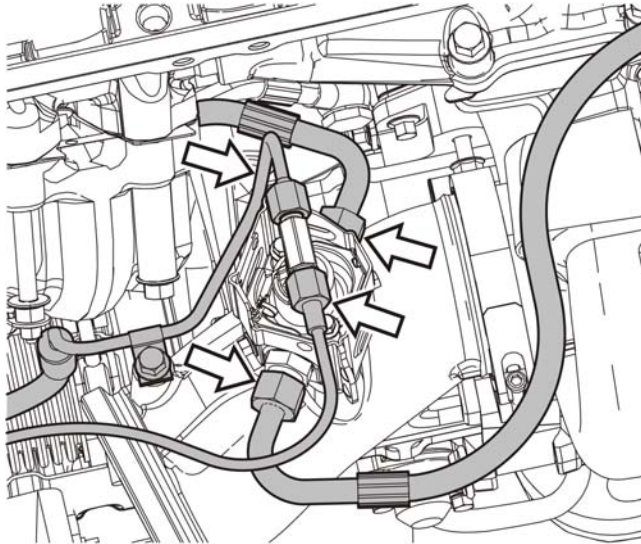
Install turbocharger. See Function Group 25.

**18**

Align diffuser and install clamp securing diffuser to turbocharger.



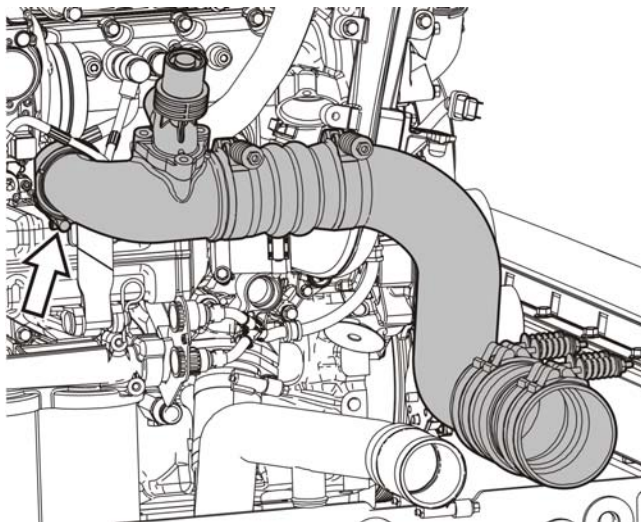
W2006818



W2006817

**19**

If aftertreatment hydrocarbon doser is not equipped with two-way check valve, connect fuel and coolant lines to doser. If doser is equipped with two-way check valve, connect two-way check valve and coolant lines to doser. Tighten all fittings to specification.



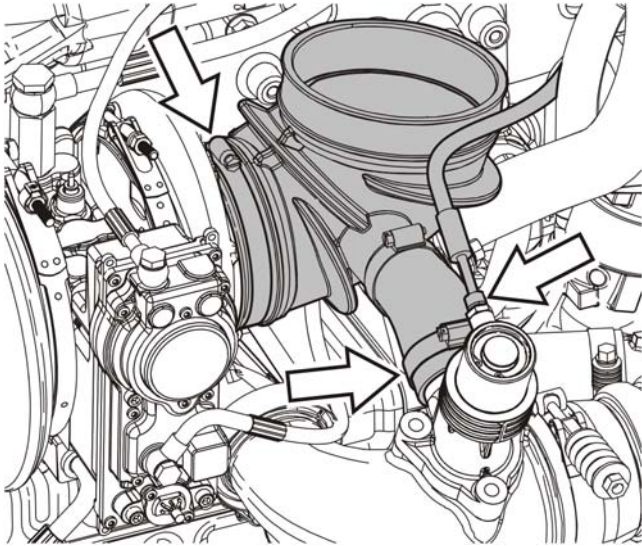
W2006814

**20**

Loosely install charge air pipe and boot to turbocharger. The charge air pipe will be secured after coolant package is installed.

**Note:** Install all parts as an assembly.

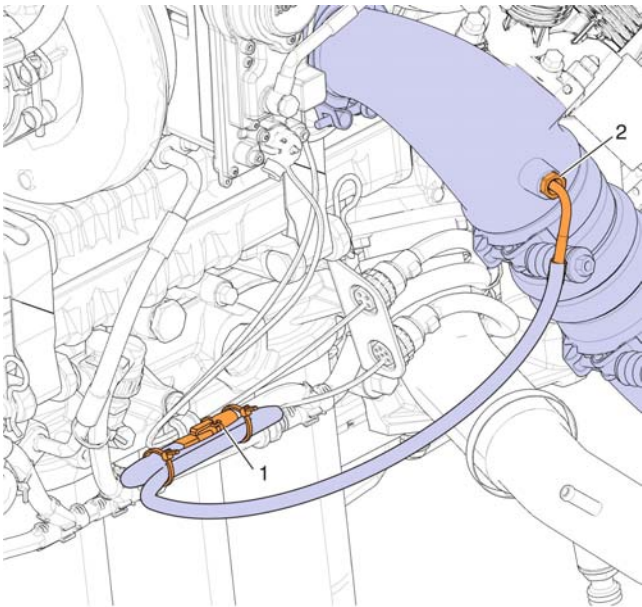




W2006813

**21**

Install turbo air intake hose clamp securing boot. Install bypass valve hose clamp at valve. Install bypass valve control line from valve and support clamp from pipe. Tighten all fasteners to specification.



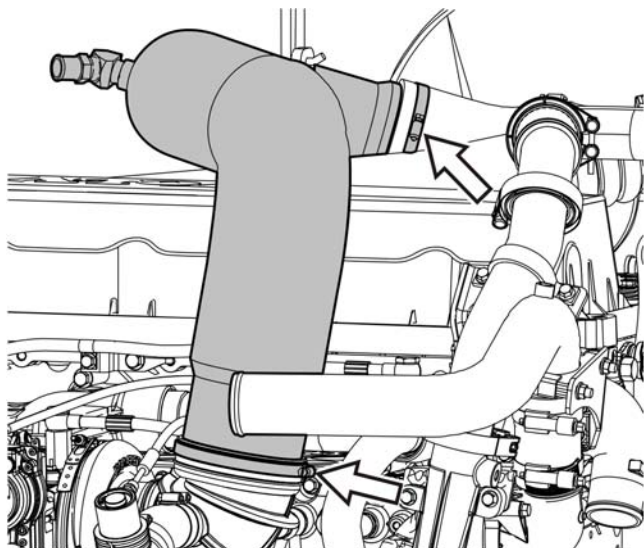
W2059588

**22**

If equipped, install the discharge air temperature sensor and connect the sensor wiring harness connector at the wire bundle next to the engine block. Secure with cable ties.

1 Connector

2 Sensor

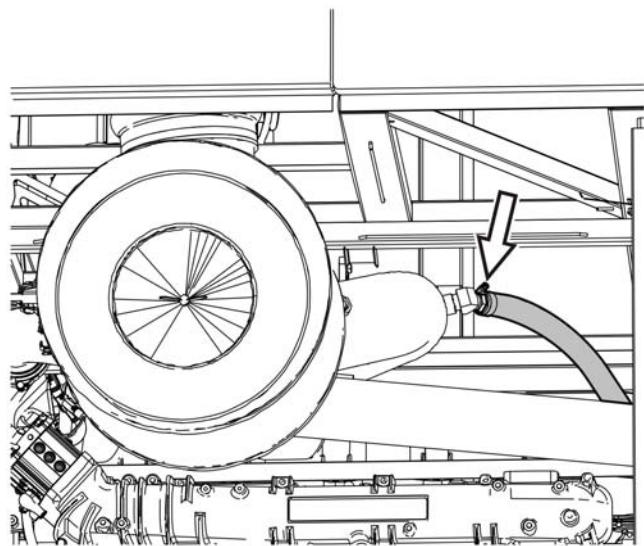


W2006812

D13F

**23**

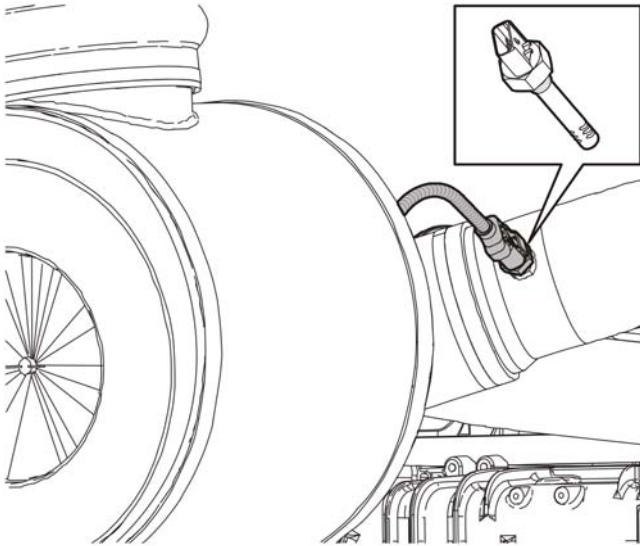
Install fresh air intake pipe. Install hose clamps at air filter housing boot and turbocharger inlet boot.



W2006811

**24**

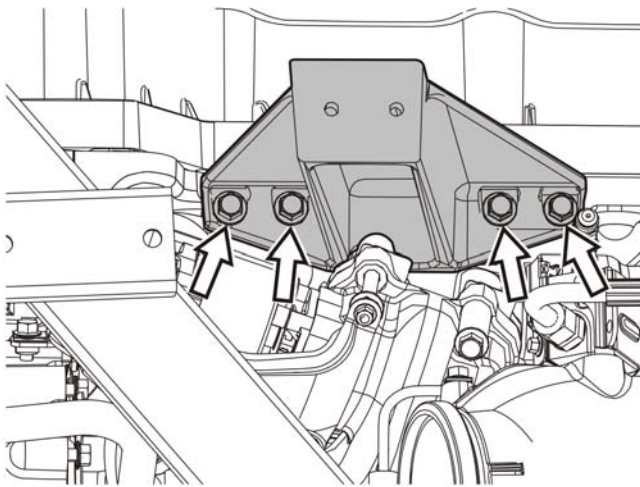
Install air compressor air inlet hose and install clamp.



W2006810

**25**

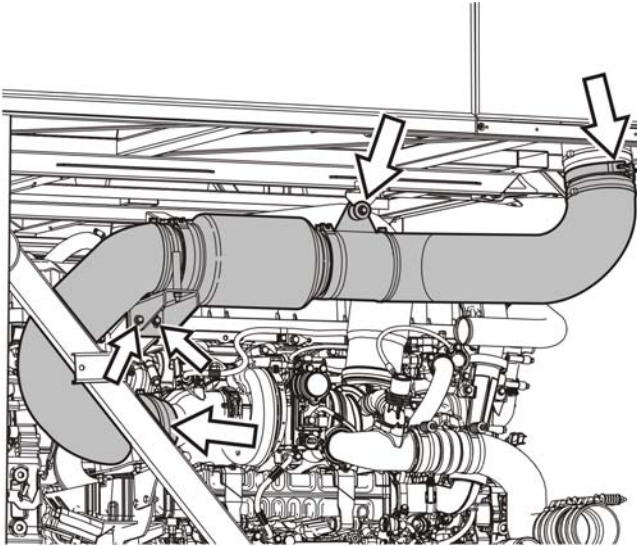
If equipped, install humidity/air intake temperature sensor and connect harness.



W2006809

**26**

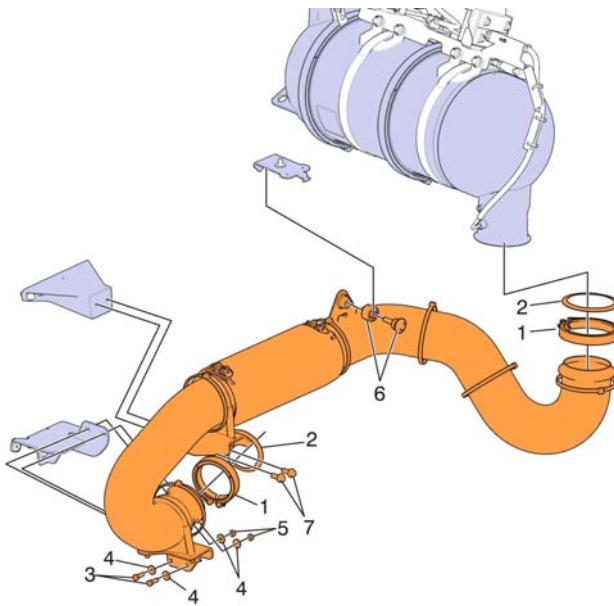
Install upper exhaust pipe mounting bracket. Tighten fasteners to specification.



W2006808

**27**  
Install exhaust pipe as an assembly with mounting  
clamps and brackets attached.

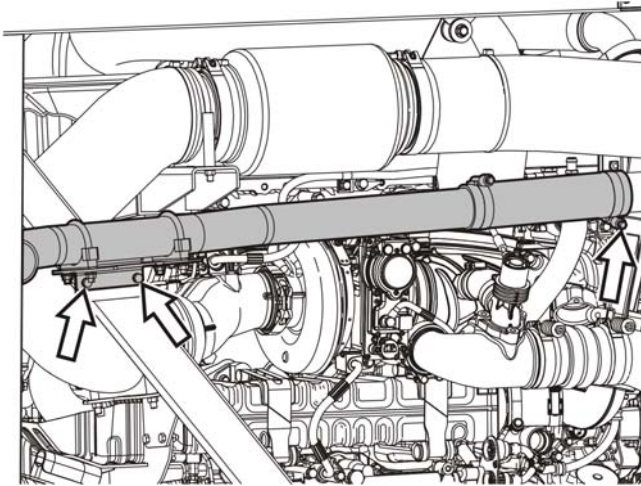
D13F



W2060830

D13H

- 1 V-band Clamp
- 2 Gasket
- 3 Bolts
- 4 Washers
- 5 Nuts
- 6 Fastener and Bushing
- 7 Capscrews



W2006807

**28**

Install upper radiator coolant pipe with bracket attached.

**29**

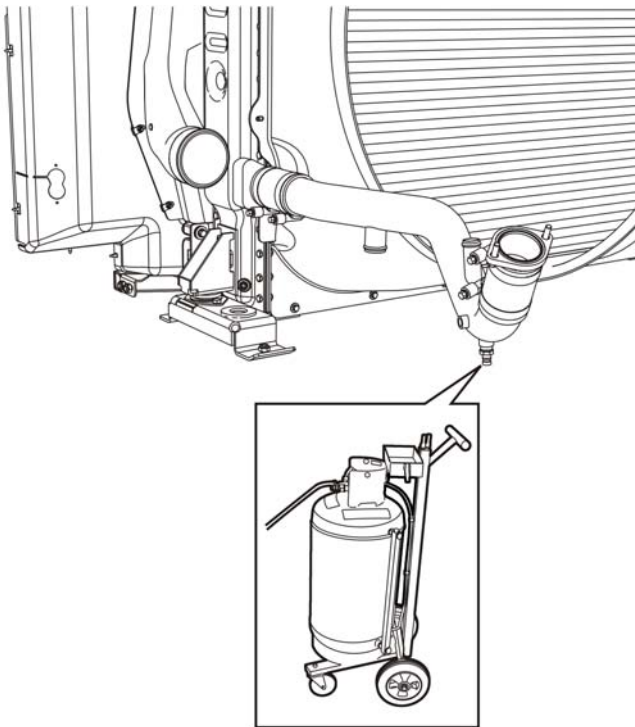
Install coolant package. See Function Group 26.

**30**

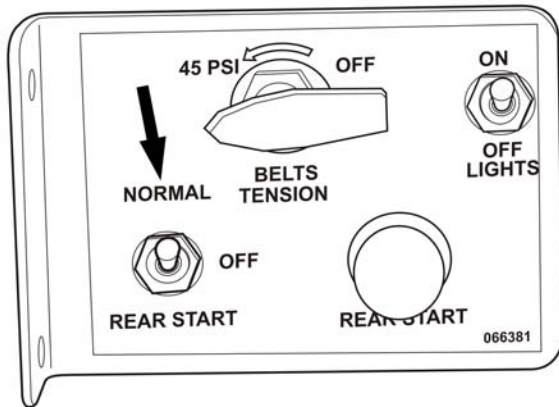
Fill the cooling system with the recommended coolant using the coolant extractor.

---

85112740



W2006782



W2006505

**31**

Set the starter selector switch to NORMAL position.

**32**

Start the engine, check for leaks and proper operation. After shutdown, replenish fluids as necessary.

**33**

If previously removed, install the bottom chassis skid plate.

**34**

Close the engine compartment.

**35**

Due to the engine control module (ECM) self learning capability, it is necessary to reset learned ECM parameters after servicing some engine related components. This allows the ECM to learn the new components behavior. After servicing is complete, perform the "Learned Data Reset" using the Tech Tool. This is located in the Function Group 1 menu. Use Guided Diagnostics to read and clear any diagnostic trouble codes (DTCs).

This service bulletin replaces bulletins 293-27,  
dated 4.2009 and 293-75 dated 1.2009.

Date	Group	No.	Release	Page
10.2011	<b>293</b>	<b>27</b>	<b>02</b>	1(5)

## EGR Cooler, Pressure Test

### EGR Cooler, Pressure Test

This service bulletin provides the procedure for pressure testing the EGR cooler removed from the engine.

#### Contents

- "EGR Cooler, Pressure Test", page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

## EGR Cooler, Pressure Test

You must read and understand the precautions and guidelines in Service Information, Function Group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: J42397-A, 88800216, 9990123, 9996662, 9998333, Spray Bottle, Liquid Dish Soap, Heat Gun*

## Pressure Test, EGR Cooler Removed

1

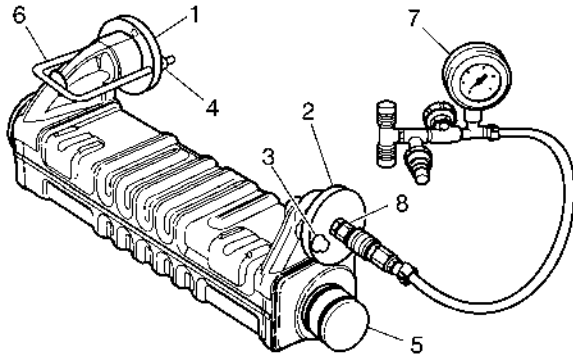
**Note:** This procedure should only be used if Guided Diagnostics or Technical Support has led you to removing the EGR cooler for testing due to coolant loss or the cooler is off for some other reason and the cooler needs to be verified as good before reinstalling.

**Note:** Liquid in the EGR cooler is not evidence of a leak. Depending on the situation, the liquid may be condensation. The EGR cooler should always be tested for leaks before replacement.

**Note:** Buildup can seal cracks in the EGR cooler preventing leak detection.

Perform the EGR cooler cleaning procedure before checking for leaks. Refer to Function Group 293.





W2006454

- 1 88800216-1
- 2 88800216-2
- 3 Flange Cap Screw
- 4 Flange Nut
- 5 88800216-5
- 6 U-Bolt
- 7 9996662
- 8 9998333

**2**

Lubricate the O-rings on plates. Install the coupler on the adapter plate and connect the gauge to the coupler. Install the adapter plate and pressure hose to the hot pipe end of the EGR cooler. Install plate on venturi end coolant port.

**CAUTION**

Do not overtighten the fasteners on the plates.

88800216, 9998333, 9996662

**3**

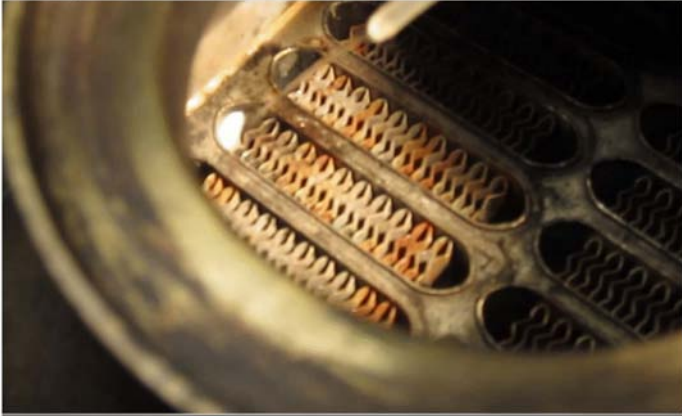
**WARNING**

Verify that all connections are secure before pressurizing cooler. If the connections are not secure, the plug could come loose. Serious personal injury can occur.

Apply soapy water to check the gauge, lines and fittings for leaks. Pressurize coolant side of cooler to 550 kPa (80 psi). Leave the shut off valve open to allow constant air pressure to the cooler.

**4**

Using a heat gun, heat the hot side of EGR cooler for 2-3 minutes to check for internal leaks. Heat the outside of EGR cooler for 2-3 minutes to check for external leaks.



W2068618

Internal Leak

**5**

Spray soapy water on the inlet and outlet of the EGR cooler to check for internal leaks. Inspect inlet and outlet for foam indicating leak location.



W2068939

External Leak at Weld Start/Stop

**6**

Spray soapy water on outside of EGR cooler to check for external leaks. Inspect outside of EGR cooler for foam indicating leak location.

**7**

Allow the EGR cooler to cool to ambient temperature to prevent false readings in the next steps.

**8**

Install the adapter plate, fitting and clear hose to the hot pipe end of the EGR cooler. Install hose and plug to seal the venturi end of the EGR cooler.



**CAUTION**

Do not overtighten the fasteners on the plate and plug.

**9**

Position a clear container with water enough to submerge the end of the hose connected to the EGR cooler. Tube connected to the exhaust outlet should be below water surface, but no greater than approximately 10 mm (0.5 in).

**10**

Place the tube into the water with no pressure in the cooling system and no pressure applied to the EGR cooler. If coolant is drawn into the tube or bubbles escape with no pressure applied the system temperatures are not stable. Test must not be performed until the system temperatures stabilize. When system temperatures are stable, remove the tube from the water and proceed to the next step.

**11**

 **WARNING**

Verify that all connections are secure before pressurizing cooler. If the connections are not secure, the plug could come loose. Serious personal injury can occur.

**Note:** The EGR cooler must be tested at ambient temperature to eliminate the possibility of a false reading.

Apply air pressure (550 kPa [80 psi]) to the EGR cooler. Leave the shut off valve open to allow constant air pressure to the cooler. Wait two minutes and then place the tube in the water. If bubbles are observed replace cooler. It may take several minutes for a leak to pressurize the cooler enough to allow air to escape the tube.

**12**

Remove the test equipment from the EGR cooler.

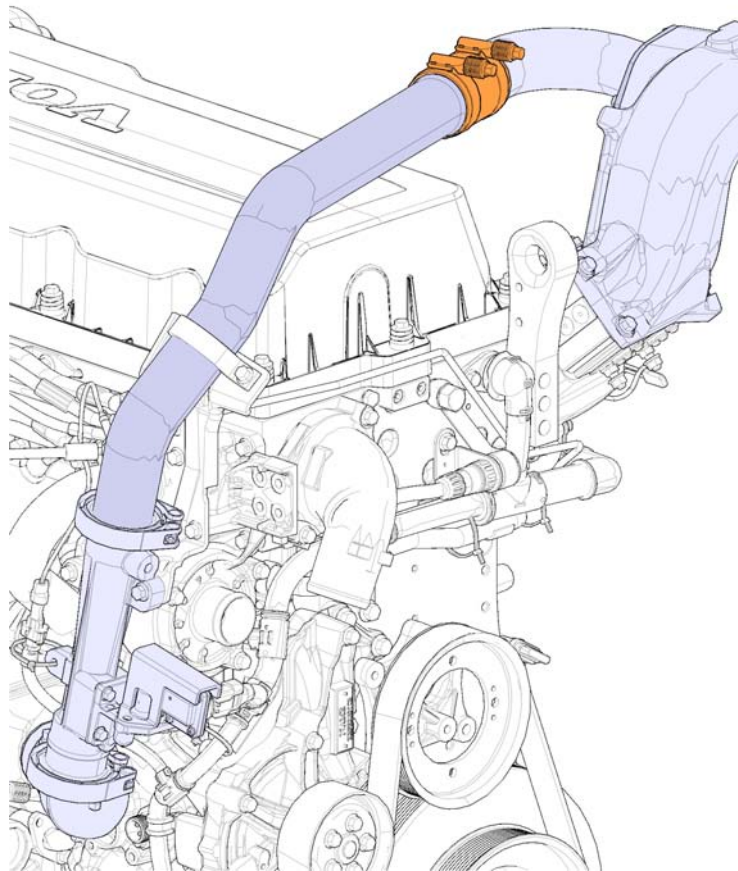
**13**

If no leaks are found the EGR cooler can be dried and reused.

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9.2010	<b>293</b>	<b>69</b>	<b>01</b>	1(9)

## EGR Pipes, Replacement PREVH, PREVX D13H

### EGR Pipes, Replacement



W2060708

This information covers the procedures for replacing the EGR mixer inlet pipe and EGR venturi outlet pipe on a Volvo D13H engine in a Prevost model PREVH or PREVX bus.

### Contents

- “Mixer Inlet Pipe”, page 2
- “Venturi Outlet Pipe”, page 6

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

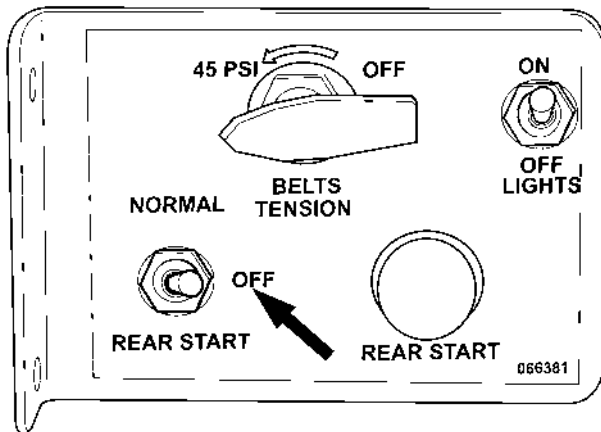
## 2934-03-02-02 EGR Pipe, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Mixer Inlet Pipe

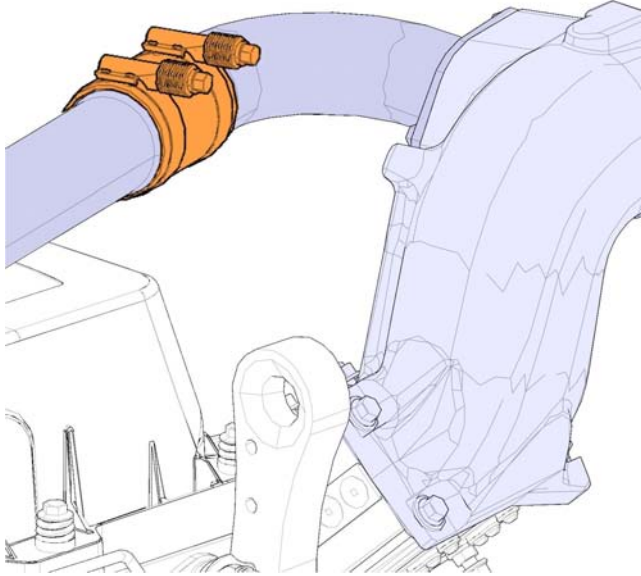
#### Removal

- 1  
Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.
- 2  
Open engine compartment doors or hatch.
- 3  
Set the starter selector switch to the OFF position.



**4**

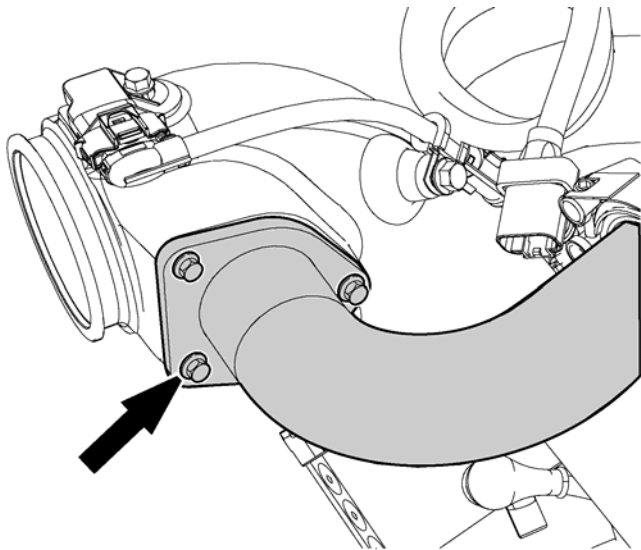
Loosen the flat band clamp at the mixer inlet pipe.



W2060709

**5**

Remove the bolts attaching the EGR inlet pipe to the mixer and remove the pipe. Discard the O-rings.

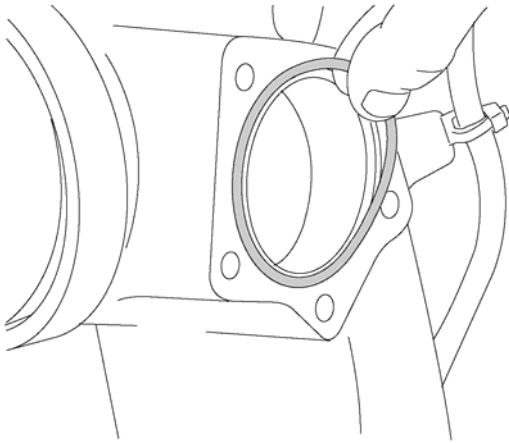


W2005962

## Installation

1

Install a new O-ring at the EGR mixer inlet.



W2005957

2

Place the EGR inlet pipe in position on the mixer inlet mounting pad and install the mounting bolts. Tighten the bolts to specification.

3

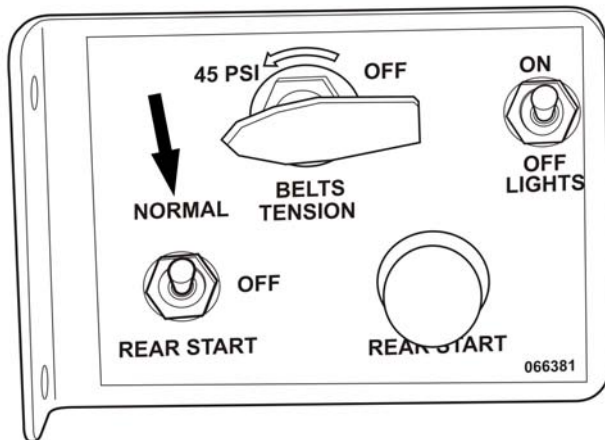
Place a flat band clamp onto the connector hose but do not secure at this time.

4

Position the mixer inlet pipe into the connector hose. Tighten the clamp to specification.

5

Set starter selector switch to NORMAL position.



W2006505

**6**

Start the engine, check for leaks and proper operation.

**7**

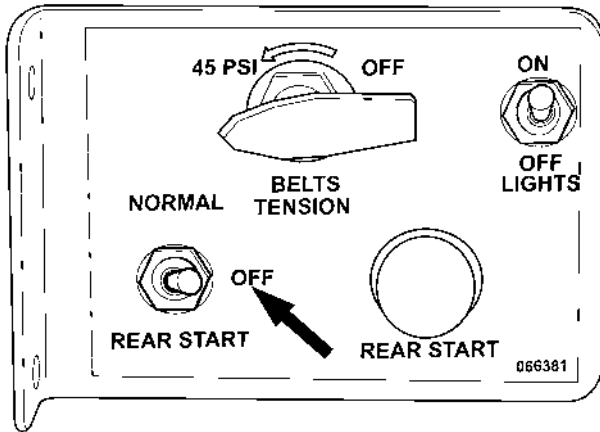
Close the engine compartment.



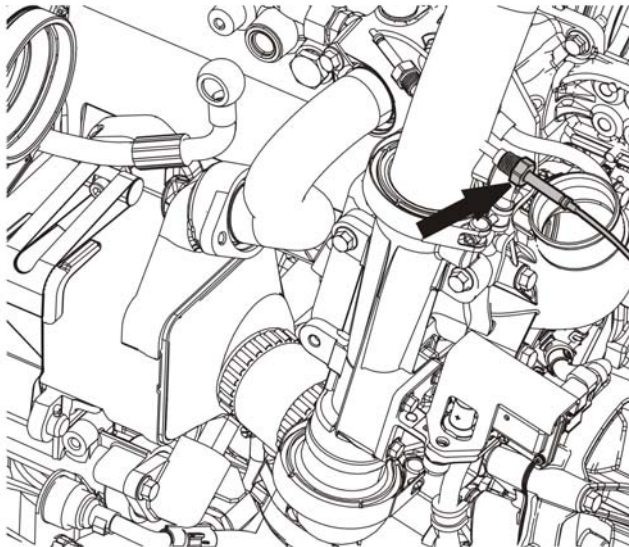
## Venturi Outlet Pipe

### Removal

- 1**  
Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.
- 2**  
Open engine compartment doors or hatch.
- 3**  
Set the starter selector switch to the OFF position.

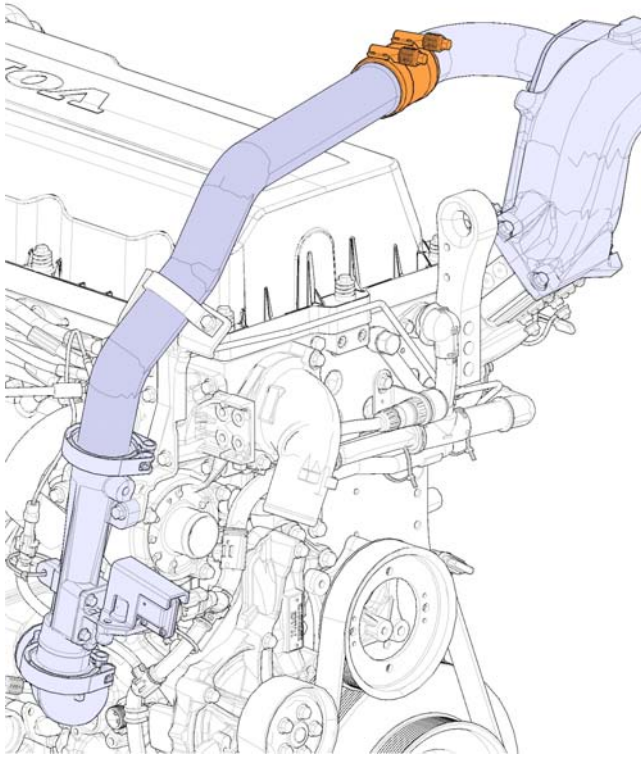


W2006494



W2005807

- 4**  
Loosen the collar nut and remove the EGR temperature sensor from the venturi tube outlet pipe.



W2060708

**5**

Loosen the flat band clamp connecting the outlet pipe at the top end of the venturi tube.

**6**

Loosen the flat band clamp connecting the venturi outlet pipe to the crossover pipe.

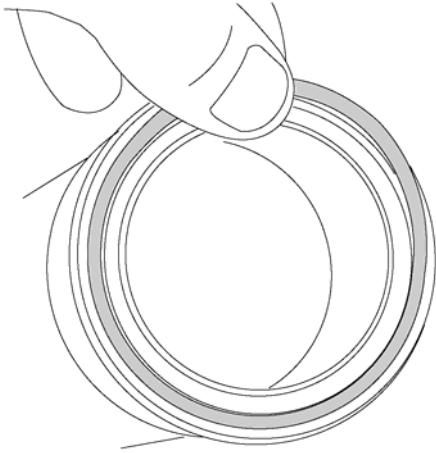
**7**

Remove all fasteners at the retainer strap securing the venturi outlet pipe to the venturi tube mounting bracket and remove the pipe from the engine.

## Installation

**1**

Place new O-rings in position on the venturi tube outlet flange and the inlet flange of the crossover pipe. Place flat band clamps onto connector hose before placing onto the pipes.



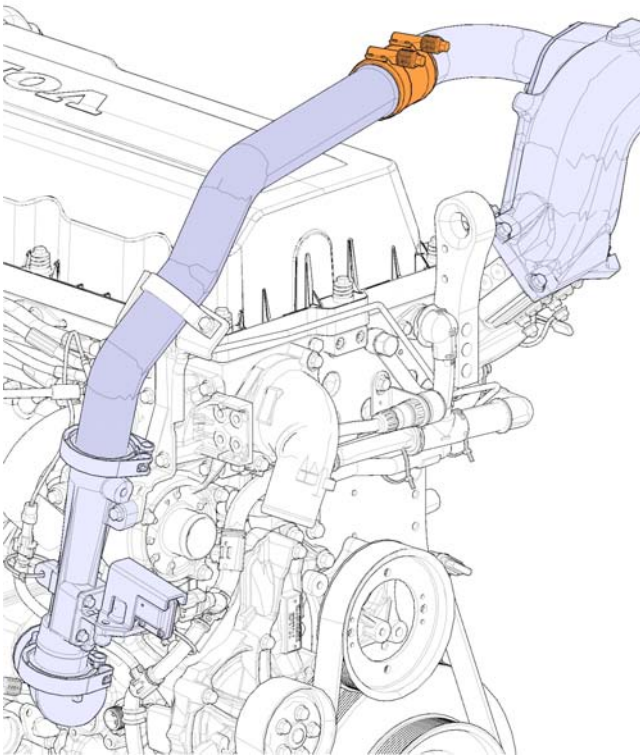
W2005959

**2**

Place the venturi outlet pipe in position between the venturi tube and the crossover connector hose.

**3**

Check to ensure that the O-rings are properly positioned in the pipe flanges and tighten clamps to specification.



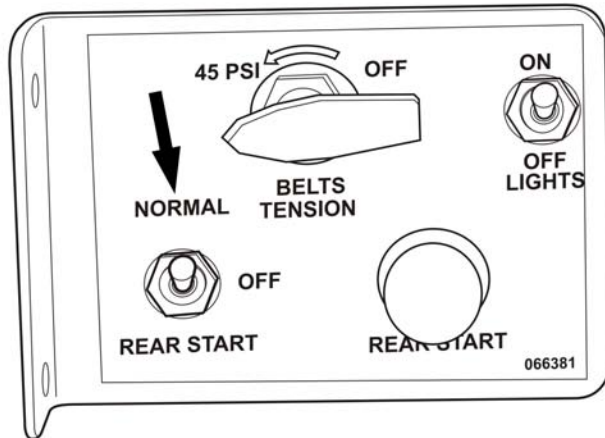
W2060708

**4**

Install the retainer strap to secure the venturi outlet pipe to the venturi mounting bracket. Tighten the clamp fasteners to specification.

**5**

Set starter selector switch to NORMAL position.



W2006505

**6**

Start the engine and check for exhaust leaks and proper operation.

**7**

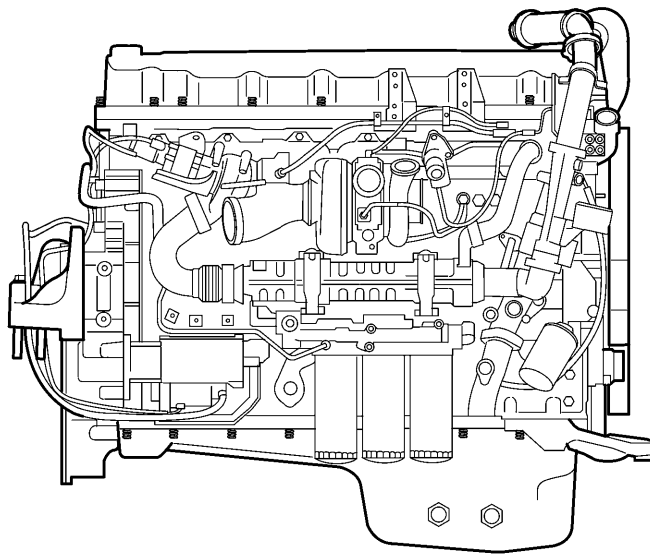
Close the previously opened engine compartment doors or hatch.

This Service Bulletin replaces service bulletin 293-72  
“Exhaust Gas Recirculation System, Design and Function”  
dated 10.08, publication number PV776-20182542.

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11.2008	<b>293</b>	<b>72</b>	1(5)

EGR System  
Design and Function  
D13F

## Exhaust Gas Recirculation (EGR) System, Design and Function



W2005779

This information covers design and function of the Exhaust Gas Recirculation (EGR) System on the Volvo D13F engine.

### Contents

- “Exhaust Gas Recirculation System” page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.

# Design and Function

## Exhaust Gas Recirculation System

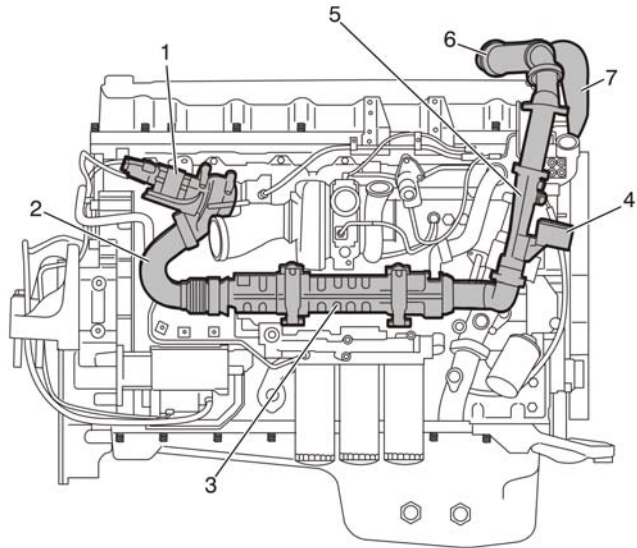
### Overview

Nitrous oxide (NOx) emission levels increase with combustion temperature. The primary function of the Exhaust Gas Recirculation (EGR) system is to cool exhaust gas and send it back to the combustion chamber to lower the combustion temperature, thereby reducing NOx.

A portion of the exhaust gas is redirected by an EGR valve (1) from the exhaust manifold into the EGR cooler (2).

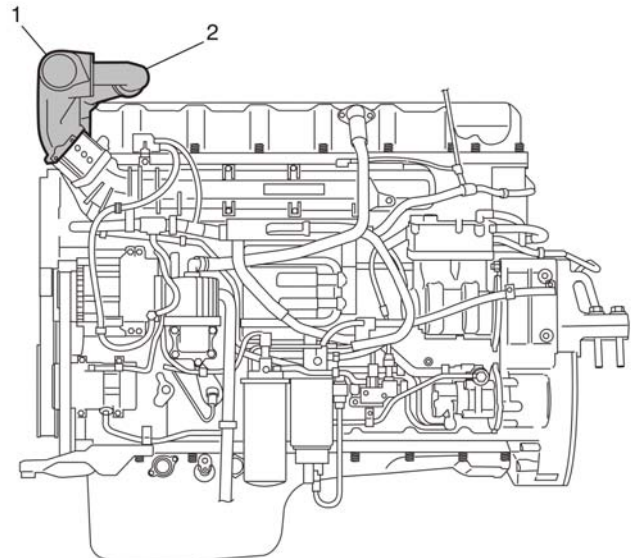
Cooled EGR gases flow into the mixing chamber (7), where they mix with intake air that has been cooled through the charge air cooler. From the mixing chamber, the combined EGR gases and intake air flow into the intake manifold.

The amount of recirculated EGR gases is controlled by the EGR valve and depends on differential pressure measured at the EGR venturi tube, engine RPM, engine load and coolant temperature. Maximum EGR flow is used under high engine speed and load conditions.



W2005851

- 1 EGR Valve
- 2 Hot Pipe
- 3 EGR Cooler
- 4 Differential Pressure Sensor
- 5 Venturi Tube
- 6 Crossover Pipe
- 7 EGR Mixer



W2005854

- 1 EGR Mixer
- 2 Crossover Pipe

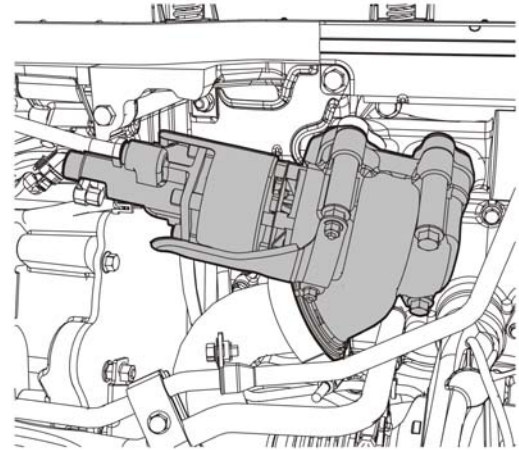
## System Components

### EGR Valve

The engine uses one EGR valve to control the amount of gases being recirculated. This valve is a poppet-type valve, operated by hydraulic pressure from the engine oil system which meters exhaust gas from the exhaust manifold into the EGR circuit. The hydraulic pressure is controlled by a solenoid within the valve assembly reacting to signals from the engine EECU. An internal spool valve diverts hydraulic fluid, applying pressure to precisely position the EGR poppet valve for control of the exhaust gas circulated through the engine. The poppet valve has two sealing surfaces on a common shaft to draw gases from the exhaust manifold EGR port simultaneously. The EGR valve is cooled by the engine oil lubrication system.

The EGR valve is located on the rear section of the exhaust manifold for reliable response. This location also protects the EGR cooler from exhaust pulses at high pressure, e.g., during engine braking.

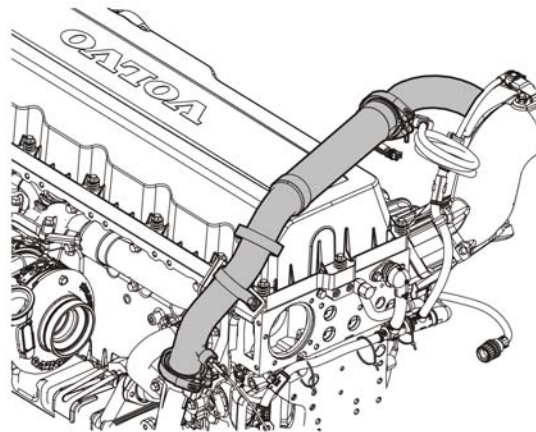
Corrosion occurs in the inlet manifold if exhaust gases are allowed to condense in the manifold. This condensation can produce both internal and external damage. To eliminate this corrosion, the EECU compares engine RPM, torque load, ambient temperature, inlet manifold temperature and EGR demand to calculate the dew point in the inlet manifold. It then adjusts the EGR opening to stay above the dew point. Additionally, surfaces within the inlet manifold and the mixing chamber are treated to resist corrosion.



W2005788

## EGR Crossover Tube

The EGR crossover tube along with the venturi outlet and mixer inlet pipes, routes the exhaust gas from the right side of the engine to the EGR mixer on the left side near the inlet manifold. The EGR crossover tube is connected to the outlet end of the EGR cooler by a hose and clamp.



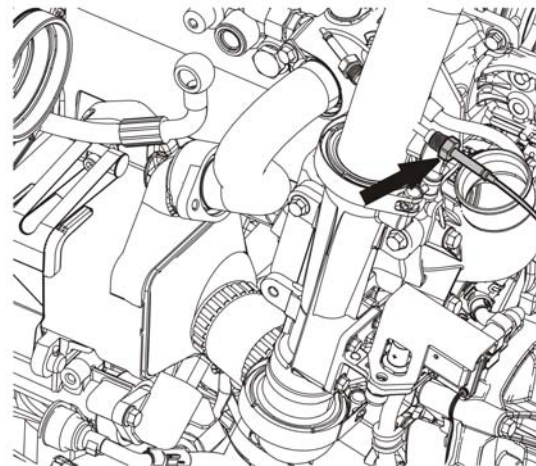
W2005802

## EGR Cooler

The EGR cooler is cooled by engine coolant and contains a series of internal pipes with vanes that allow the EGR gases to cool before they reach the mixing chamber. These vanes cause the gases to swirl, creating a higher cooling efficiency while reducing deposits. The swirling action also reduces the formation of undesirable solids in the exhaust gas.

## Temperature Sensor

The EGR temperature sensor is mounted in the venturi tube. The temperature sensor provides exhaust gas temperature information to the EECU. The EECU actuates the EGR valve to prevent cooler exhaust gas condensation which can be corrosive in the inlet manifold or mixing chamber.



W2005807

## EGR Mixer

The EGR mixer is the meeting point for cooled, recirculating exhaust gas and outside air from the charge air cooler. At this point, the combined gases pass into the inlet manifold and on to the combustion chambers.

## EGR Diagnostics

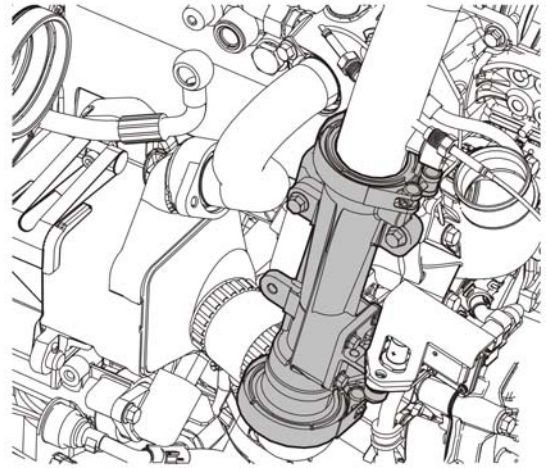
The EECU commands the EGR valve position and monitors electric current consumed by the EGR valve. An abnormally high reading indicates a jammed EGR valve. The EECU verifies that its command was sent and that the valve position reflects the command. If the valve is jammed, or its position doesn't change when commanded, the EECU sets fault codes.



## **EGR Venturi Tube**

The EGR venturi tube conducts cooled exhaust gas to the EGR mixer where it combines with fresh air coming from the charge air cooler. The flow sensors mount here.

The venturi tube acts along with the differential pressure sensor to determine the amount and temperature of the exhaust gas. The differential pressure sensor provides a signal to the EECU which actuates the EGR valve to increase or reduce flow.

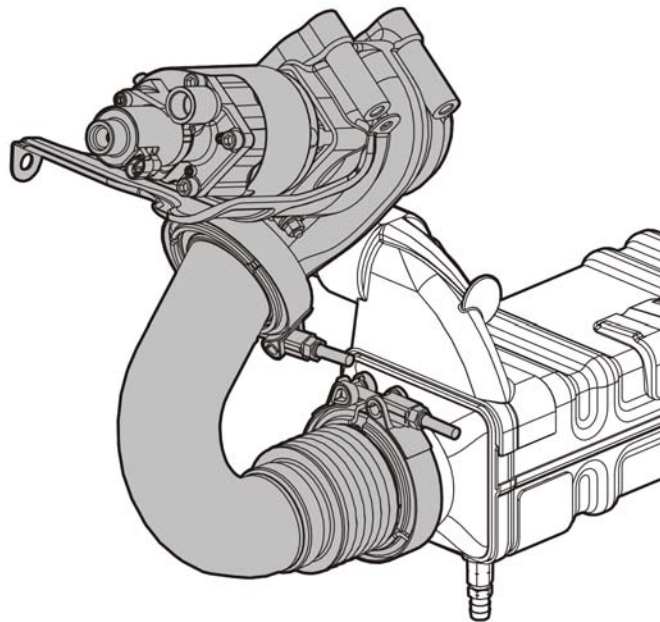


W2005806

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1.2009	<b>293</b>	<b>73</b>	1(18)

## EGR Valve Replacement D13F

### EGR Valve, Replacement



W2006845

This information covers the proper replacement procedure for the EGR valve on the Volvo D13F engine.

### Contents

- “Special Tools” page 2
- “EGR Valve, Replacement” page 3

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Tools

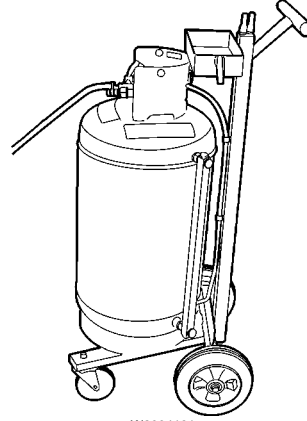
## Special Tools

For special tool ordering instructions, see tool information in group 08.



W0001795

**9996049**  
Coolant Drain Hose



W2004191

**85112740**  
Coolant Extractor

# Service Procedures

## 2931-03-02-01

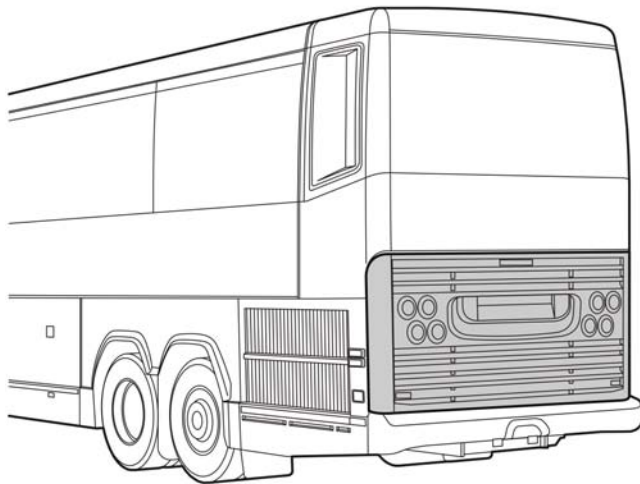
### EGR Valve, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 9996049, 85112740*

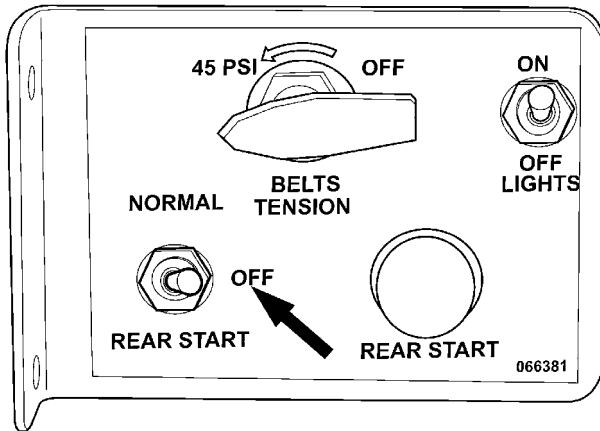
## Removal

- 1**  
Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.
- 2**  
Open engine compartment door.



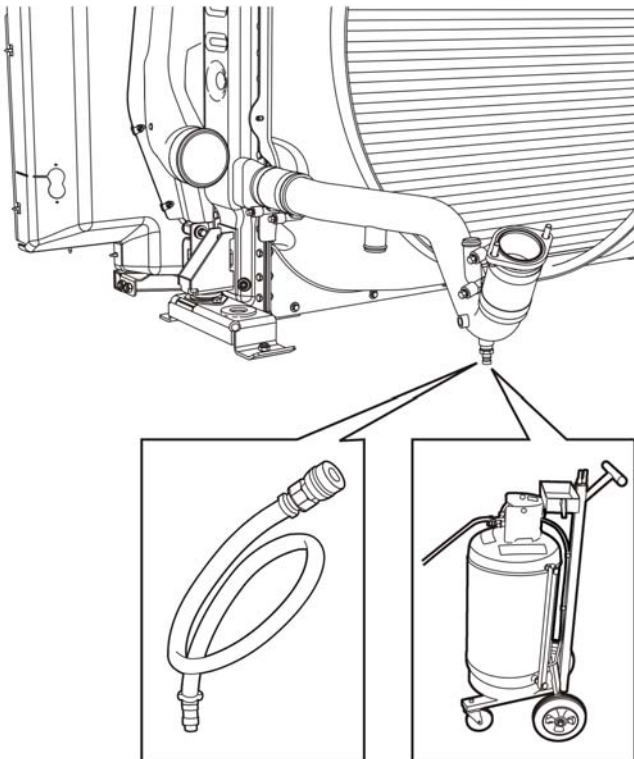
W2006767

- 3**  
Set starter selector switch to the OFF position.



W2006494

- 4**  
Connect coolant extractor.



W2006765

**5**

Use the coolant extractor to drain the coolant from the engine. An alternate method is to drain the coolant into a suitable container using the drain hose.

**! DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

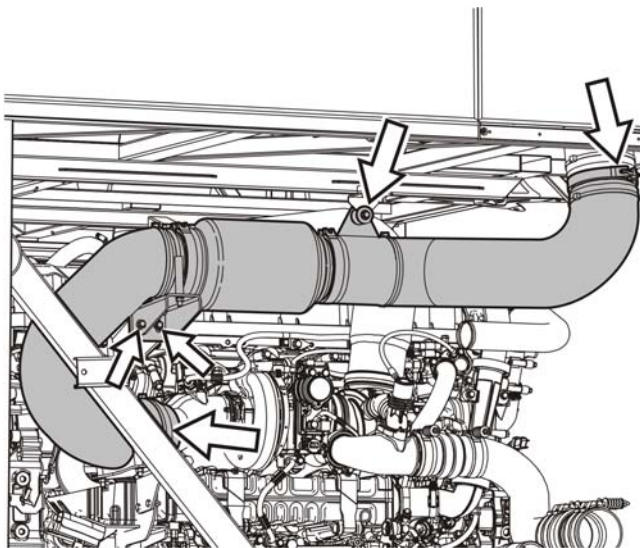
85112740, 9996049

**6**

Remove coolant package. See group 26.

**7**

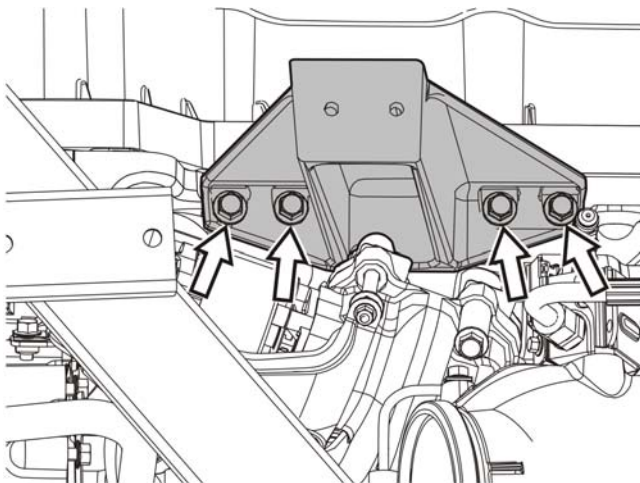
Remove exhaust pipe clamp at diffuser and the clamp before the DPF. Remove the exhaust pipe as an assembly.



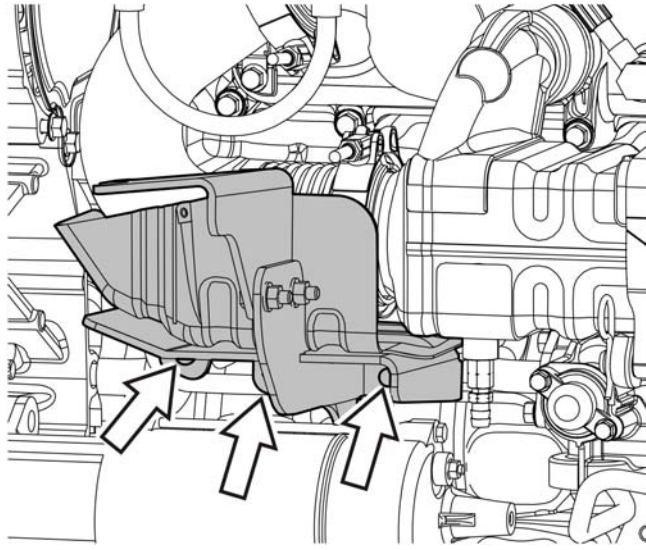
W2006808

**8**

Remove the upper exhaust pipe mounting bracket.

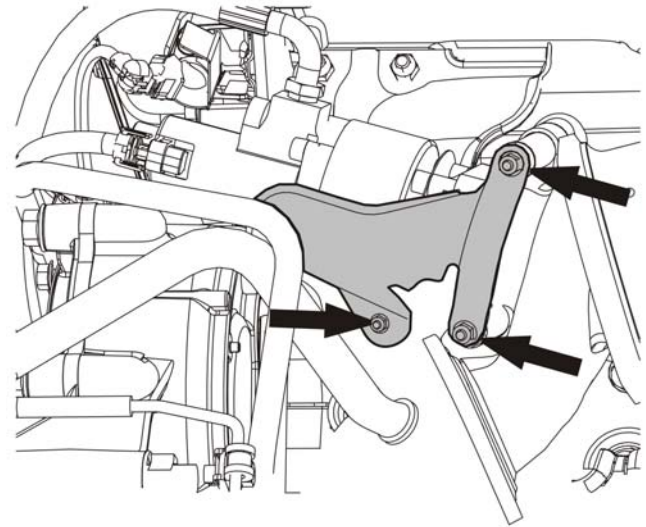


W2006809



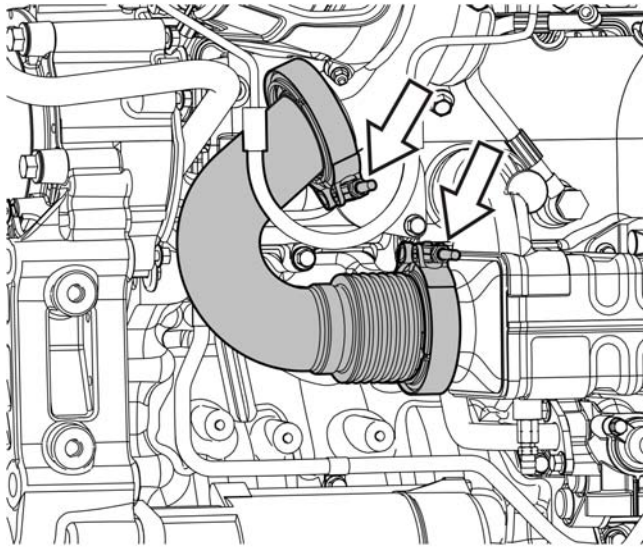
W2006819

- 9**  
Remove the EGR hot pipe lower exhaust support bracket.



W2005685

- 10**  
Remove the fasteners securing the EGR valve heat shield and remove the shield.

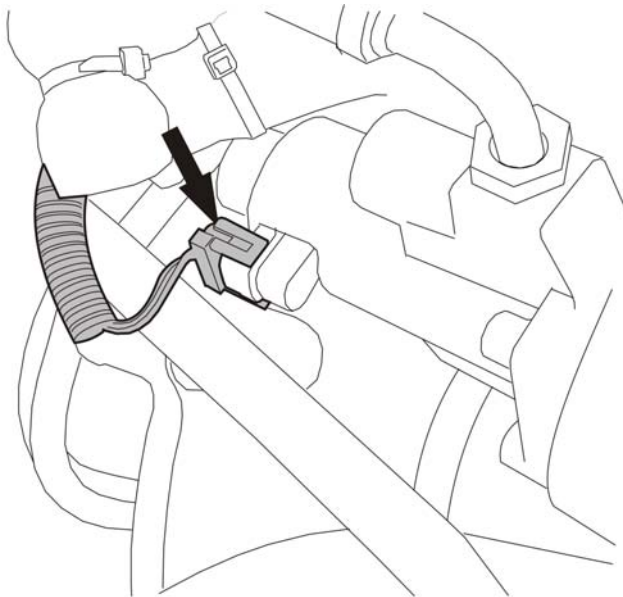


W2006821

**11**

Remove and discard the gaskets and V-band clamps retaining the EGR hot pipe. Remove the pipe.

**Note:** Discard the gaskets and V-band clamps used to retain the EGR hot pipe. The gaskets and clamps are one-time use only. Replace old gaskets and V-band clamps with new ones during installation.



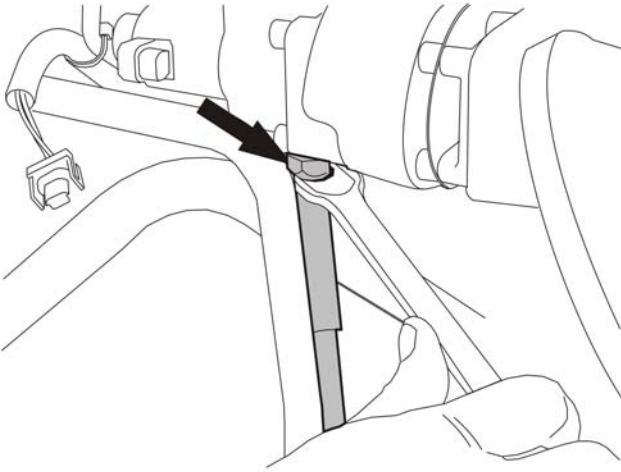
W2005689

**12**

Disconnect the wiring harness connector from the EGR valve.



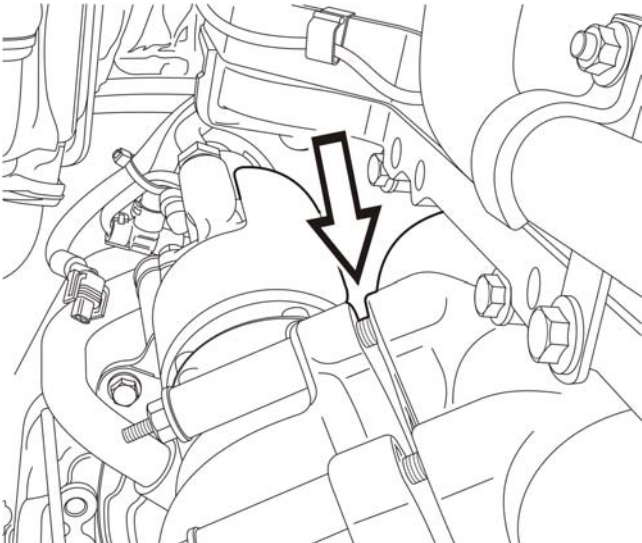
- 13**  
Loosen the oil supply line from the EGR valve.



W2005692

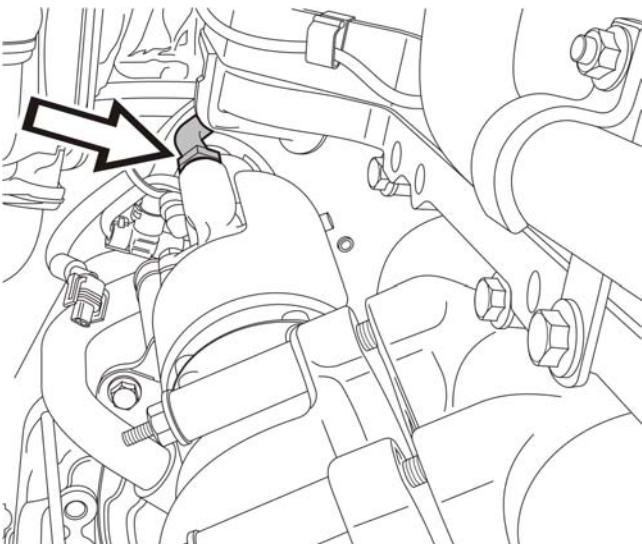
- 14**  
Loosen, but do not remove, the EGR valve mounting bolts.

**Note:** Loosening the EGR valve provides clearance for loosening the oil return line.

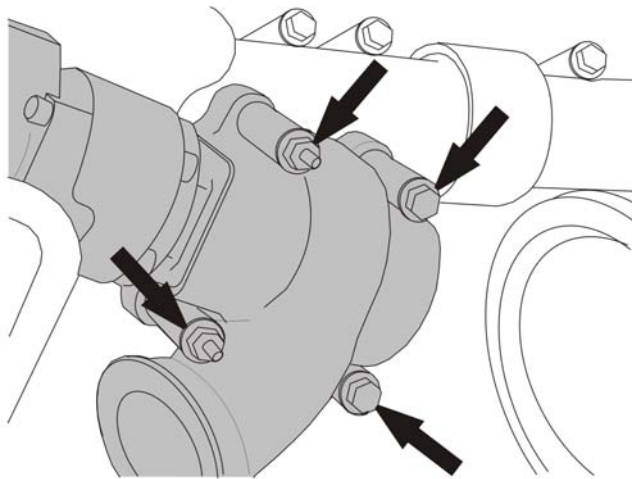


W2005954

- 15**  
Loosen the EGR valve oil return line.

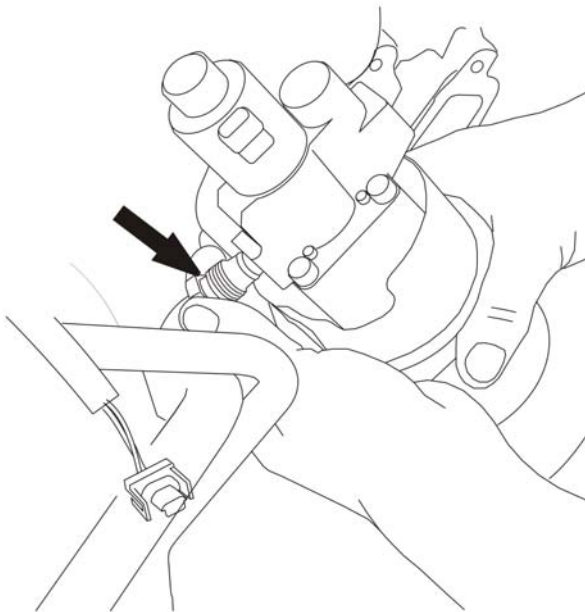


W2005955



W2005693

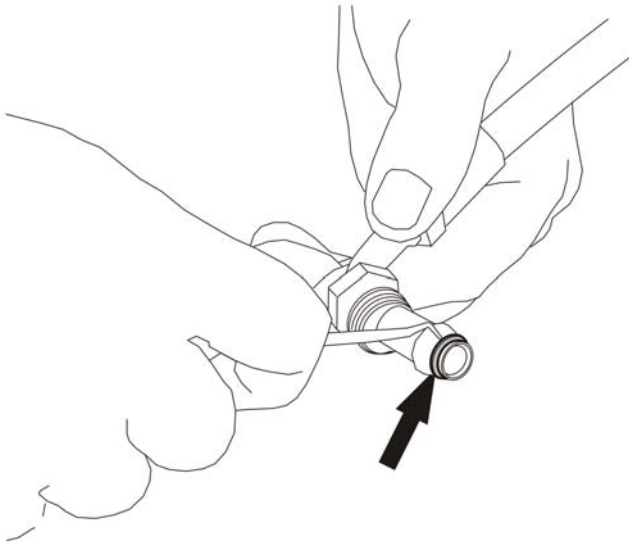
**16**  
Remove the EGR valve mounting bolts. Pull the valve away from the exhaust manifold.



W2005694

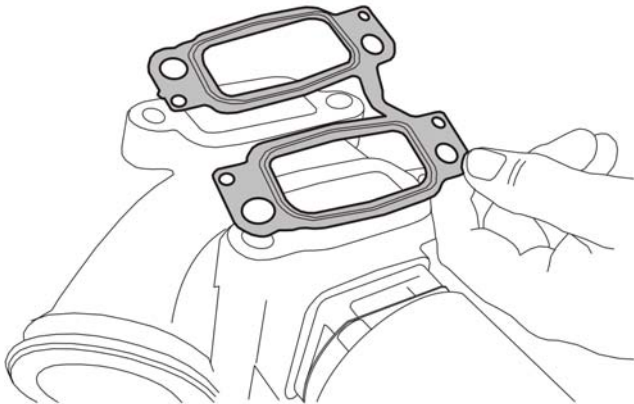
**17**  
Remove the oil lines from the EGR valve and remove the valve.

- 18**  
Replace the O-rings of the EGR valve oil supply and oil return lines. Lubricate the new O-rings with engine oil.



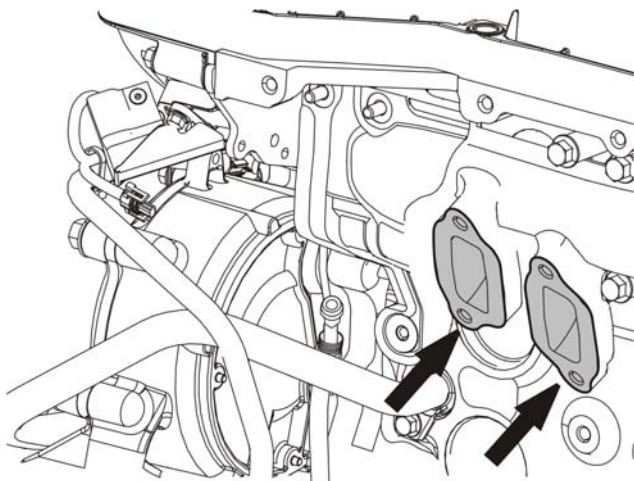
W2005691

- 19**  
Remove the metal gasket from the EGR valve.



W2005696

- 20**  
Clean any carbon deposits from the sealing surface of the EGR ports of the exhaust manifold.

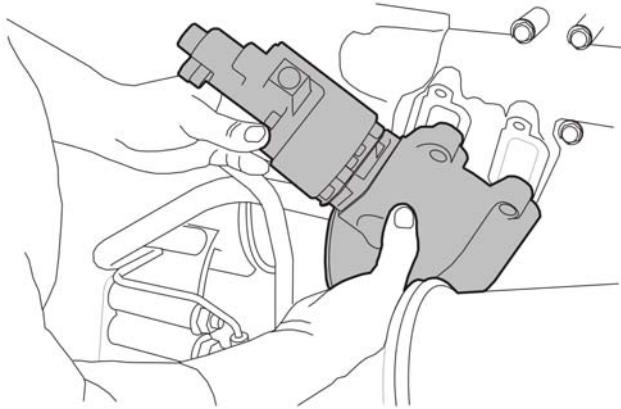


W2005697

## Installation

**1**

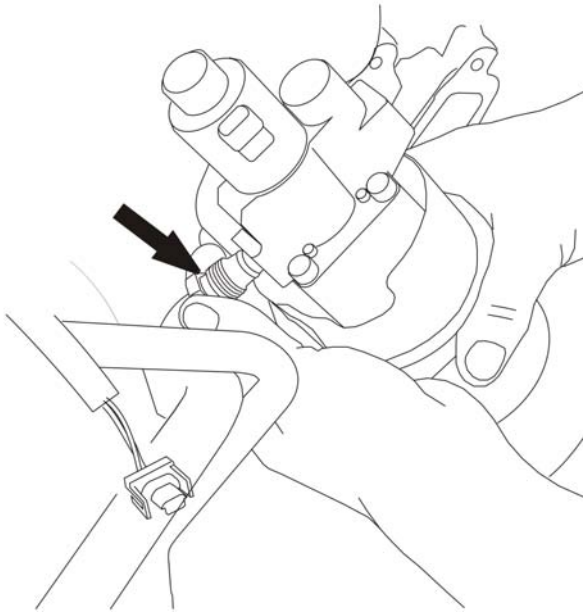
Position the EGR valve near the exhaust manifold EGR ports.



W2005695

**2**

Install the oil supply and oil return lines to the EGR valve. Finger tighten the fittings.

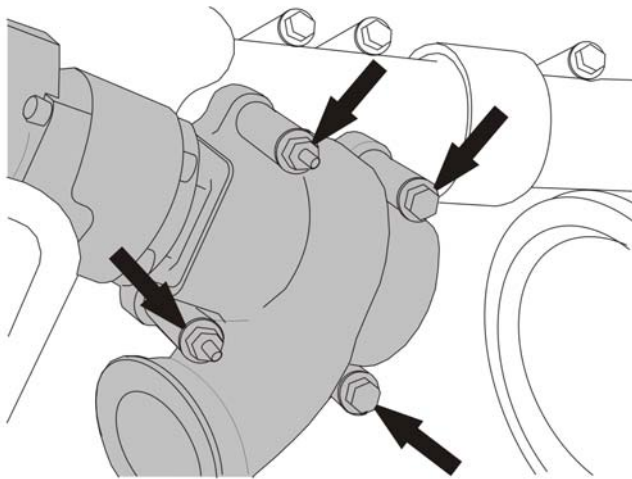


W2005694

**3**

With the EGR valve near the exhaust manifold ports, slip a new metal gasket between the valve and the manifold. Start two new bolts at the top of the EGR valve to hold the gasket.

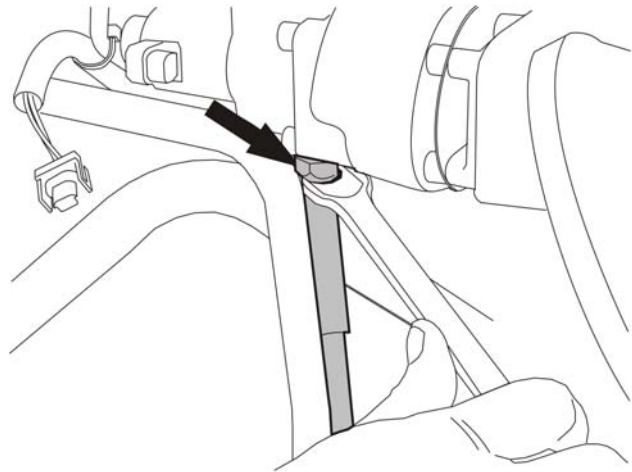
**Note:** Apply anti-seize compound to the threads and under the heads or contact surfaces of the fasteners. Anti-seize helps prevent fastener corrosion and reduces friction to help achieve the intended clamp load on the component with tightening the fasteners to specification.



W2005693

**4**  
Start the two remaining new EGR valve bolts.

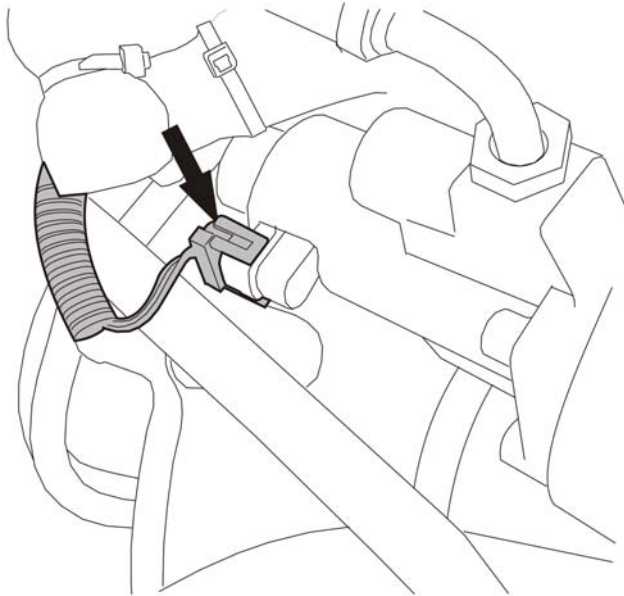
**Note:** Apply anti-seize compound to the threads and under the heads or contact surfaces of the fasteners.



W2005692

**5**  
Tighten both oil lines.

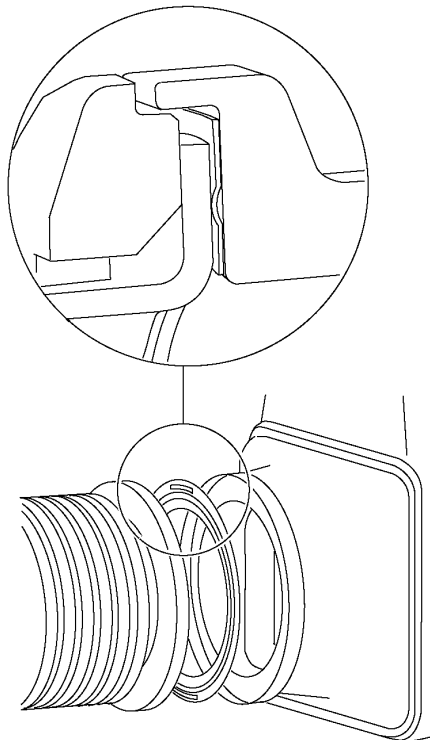
**6**  
Tighten the EGR valve mounting bolts to specification.



W2005689

**7**

Connect the wiring harness connector to the EGR valve.



W2006187

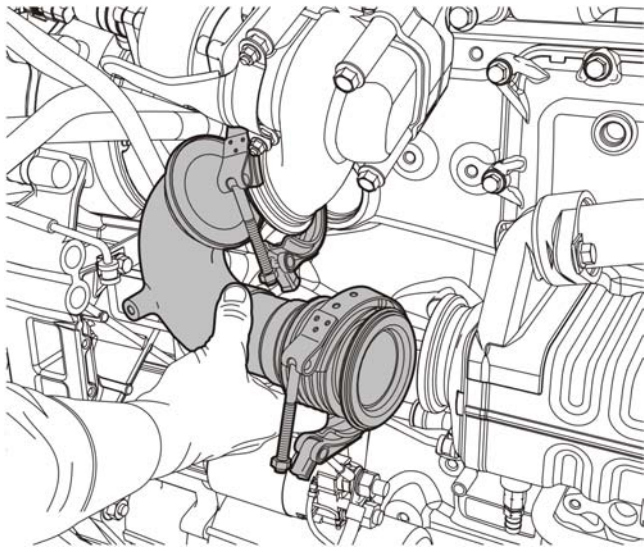
**8**

Install new high temperature gaskets into the EGR valve end of the hot pipe and the inlet of the EGR cooler. Ensure the gaskets lay flat against the flange surfaces with the bead of the gaskets facing toward the hot pipe.

**Note:** These gaskets are one-time use only. Do not reuse the gaskets.

**9**

Apply anti-seize compound to the T-bolt threads. Lubricate the V-inserts of the clamps with oil.

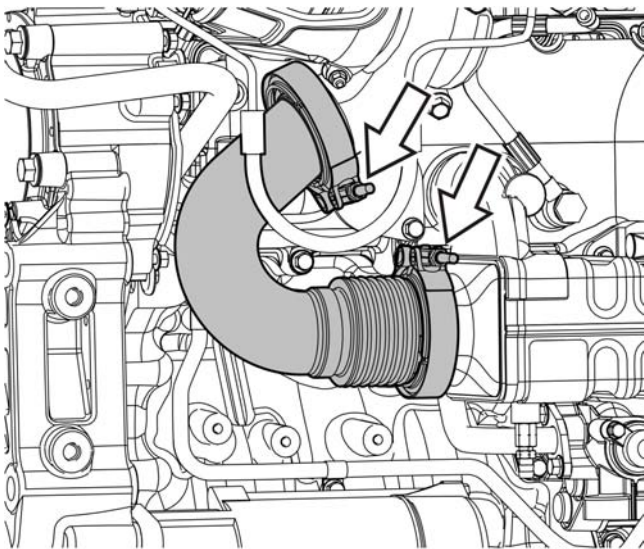


W2005641

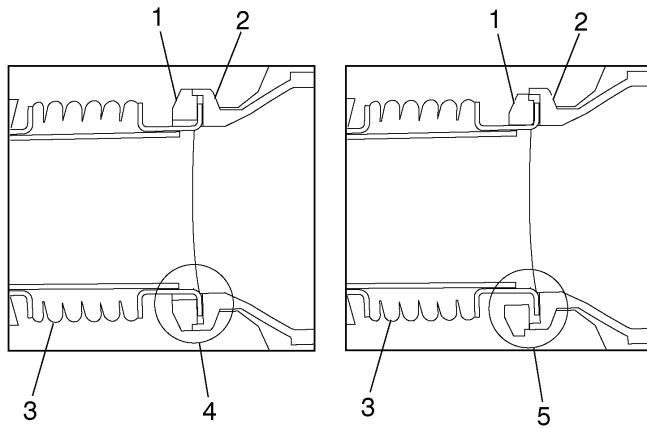
- 10**  
Hook the upper V-clamp over the EGR valve flange. Place the remaining V-clamp over the bellows on the hot pipe.

- 11**  
Lubricate the flange on the EGR cooler inlet and the flange on the EGR hot pipe with fresh engine oil. Lubrication aids in proper V-clamp installation.

- 12**  
Position the EGR hot pipe between the EGR valve and the EGR cooler. Make sure the flanges engage properly. Slide the upper V-clamp over the flange and tighten until snug. Slide the lower V-clamp over the flange and tighten the clamp until snug.



W2006821



- 1 EGR Pipe Floating Flange
- 2 EGR Cooler Flange
- 3 EGR Pipe
- 4 Flange Assembled Correctly
- 5 Flange Assembled Incorrectly

W2006163

**13**

Visually inspect the floating flange through the gap in the V-clamp to make sure it is properly seated in the EGR cooler. The floating flange must be concentric with the cooler flange.

**Note:** If the floating flange is not properly seated in the EGR cooler flange, the gasket will not be compressed and the seal will leak.

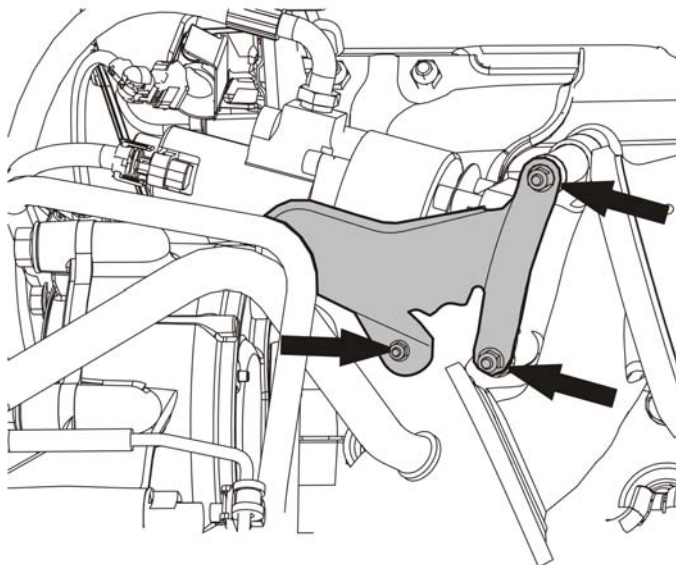
**14**

Position the V-clamps so that the T-bolts clear both heat shields. Tighten the clamps to specification.

**Note:** After reaching the specified torque, inspect the V-clamps to make sure that no portion of the clamp has "bottomed out."

**15**

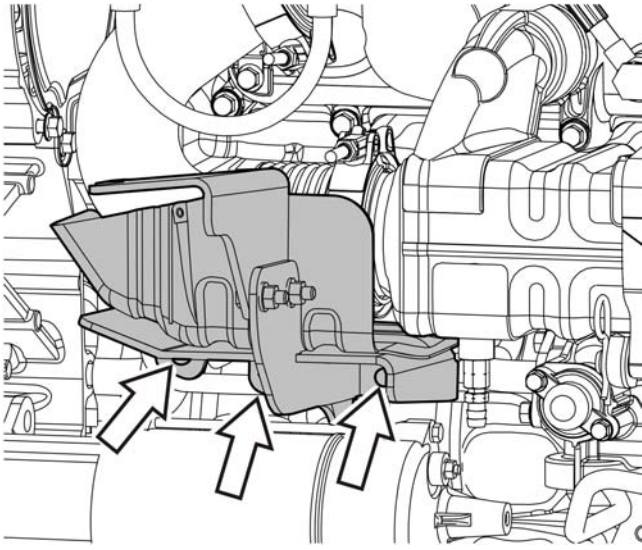
Place the EGR heat shield in position over the EGR valve. Install the fasteners to secure the shield to the cylinder block and to the studs on the valve mounting bolt heads. Tighten the fasteners to specification.



W2005685

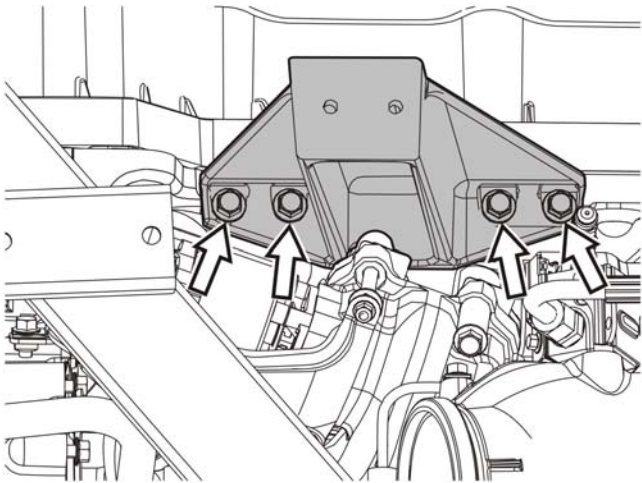


**16**  
Install EGR hot pipe lower exhaust bracket.



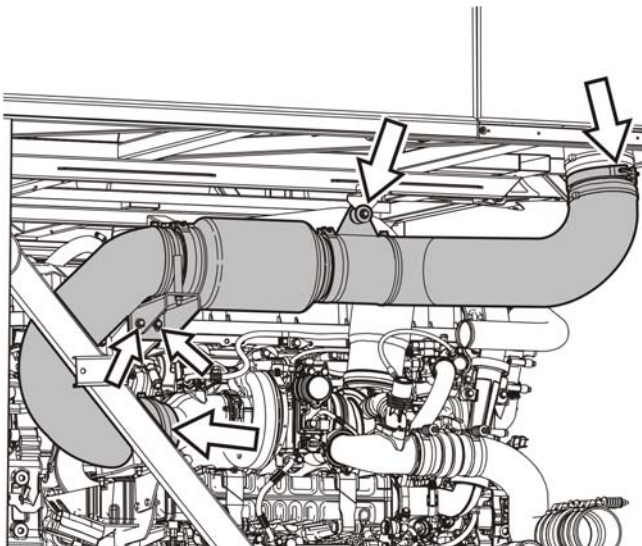
W2006819

**17**  
Install upper exhaust pipe mounting bracket.



W2006809

**18**  
Install the exhaust pipe as an assembly with mounting  
clamps and brackets attached.

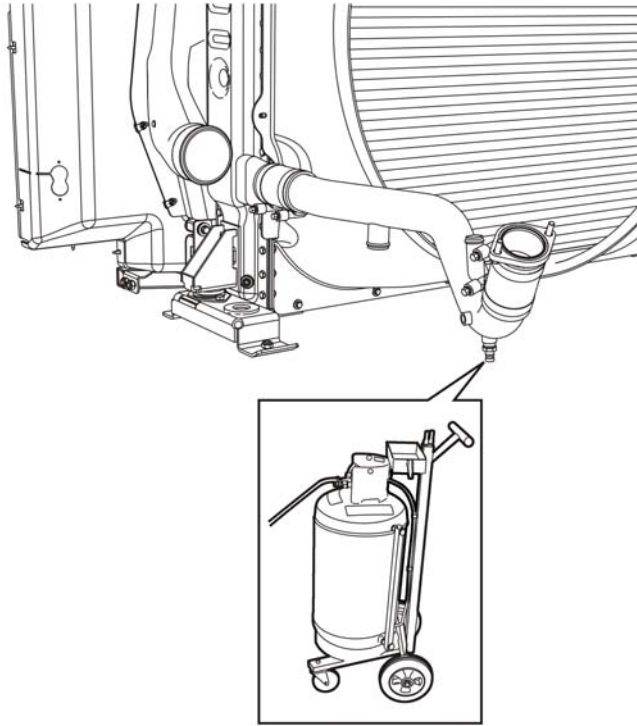


W2006808

**19**  
Install coolant package. See group 26.

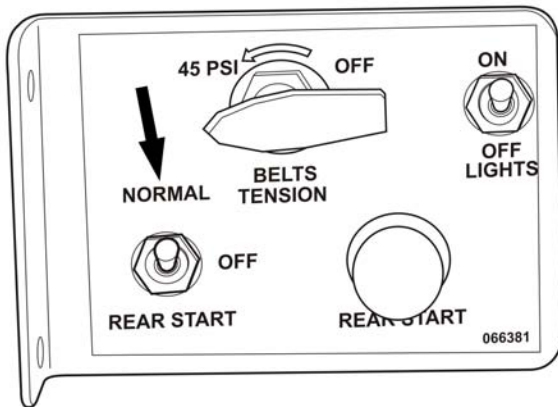
**20**  
Fill the cooling system with the recommended coolant using the coolant extractor.

85112740



W2006782

**21**  
Set starter selector switch to Normal position.

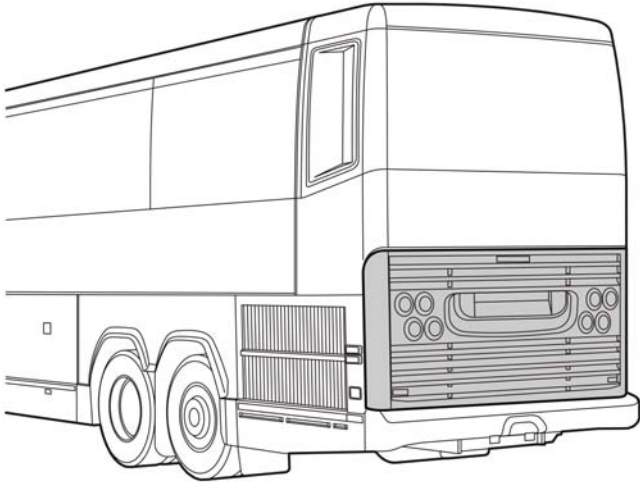


W2006505

**22**  
Start the engine, check for leaks and proper operation. After shutdown, replenish fluids as necessary.

**23**

Close the engine compartment.



W2006767

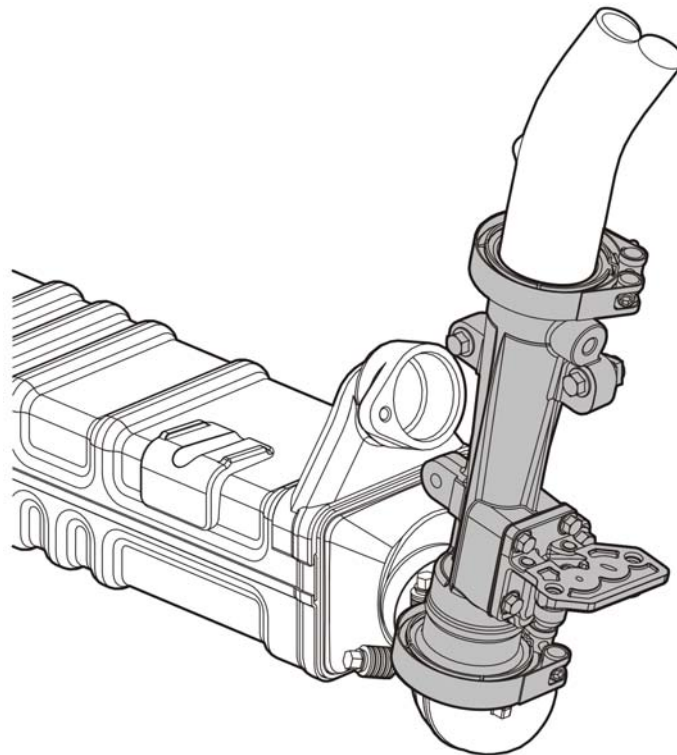
**24**

Due to the Engine Electronic Control Unit (EECU) self learning capability, it is necessary to reset learned EECU parameters after servicing some engine related components. This allows the EECU to learn the new components behavior. After servicing is complete, perform the "Learned Data Reset" using the PC tool. This is located in the Function Group 1 menu.

Date	Group	No.	Page
1.2009	<b>293</b>	<b>74</b>	1(8)

## Tube Venturi Replacement D13F

### EGR Venturi Tube, Replacement



W2006829

This information covers replacement of the EGR venturi tube on a Volvo D13F engine.

#### Contents

- “Tube Venturi, Replacement” page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

## 2411-03-02-01

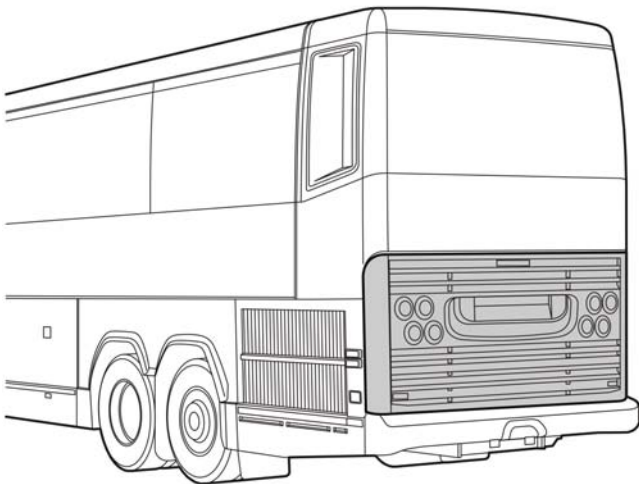
### Tube Venturi, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

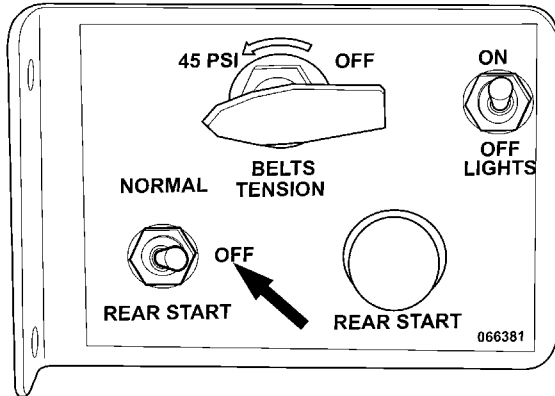
## Pressure Differential Sensor

### Removal

- 1**  
Apply the parking brake and place the shift lever in neutral.
- 2**  
Open engine compartment door.

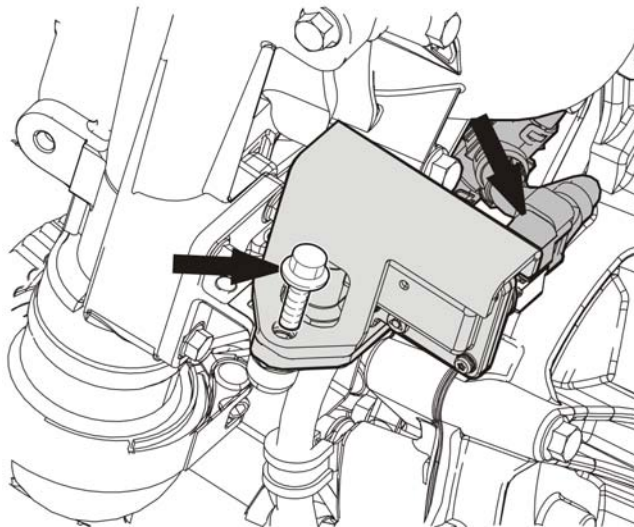


- 3**  
Set the starter selector switch to the OFF position.



W2006494

- 4**  
Disconnect the wiring harness lead from the connector terminal on the pressure differential sensor.



W2005805

- 5**  
Loosen and remove the mounting bolts.

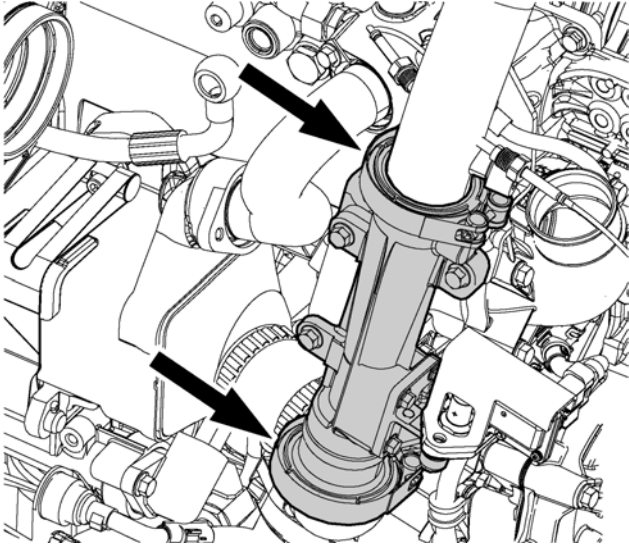
## Venturi Tube

### Removal

1

Loosen and remove the V-clamps at the top and bottom ends of the venturi tube.

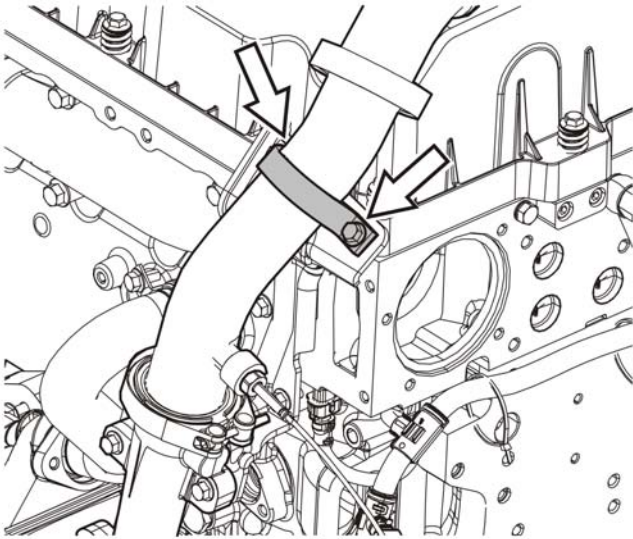
**Note:** Discard the old V-band clamps used to secure the venturi tube at the top and bottom. The clamps are one-time use only. Replace old V-band clamps with new clamps.



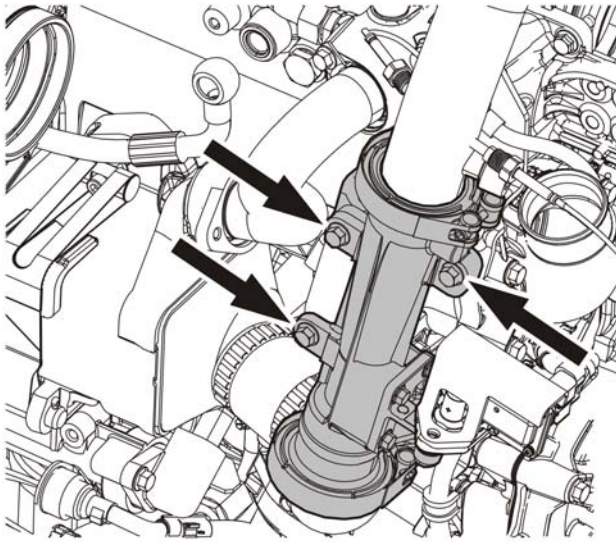
W2005958

2

Remove fasteners at the retainer strap that secures the venturi outlet pipe to the venturi tube mounting bracket.



W2006832



W2006847

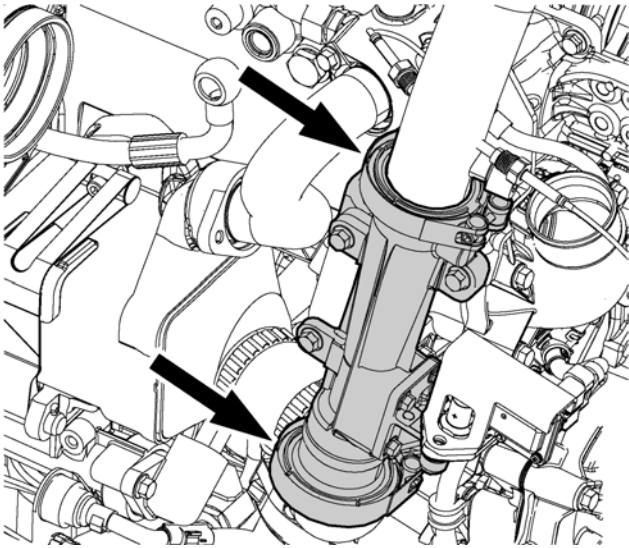
**3**  
Remove all fasteners securing the venturi tube to the mounting bracket.

**4**  
Remove the venturi tube from the engine.



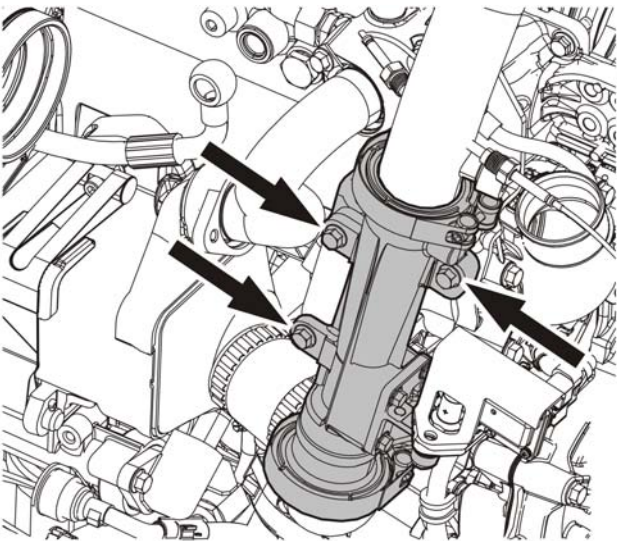
## Installation

- 1**  
Place a new O-ring on the 90-degree elbow.
- 2**  
Place a new O-ring on the venturi tube outlet flange.
- 3**  
Place the venturi tube in position on the mounting bracket.



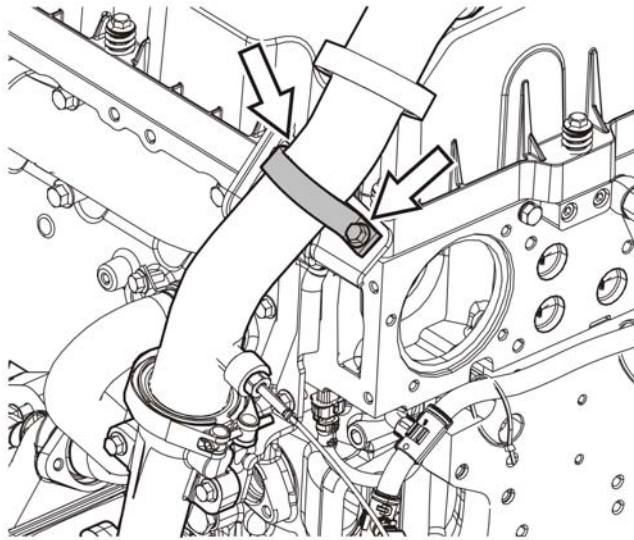
W2005958

- 4**  
Check that the O-ring is properly positioned on the venturi tube and install new V-clamps connecting the venturi tube to the crossover piping and 90-degree elbow. Tighten the clamps to specification.



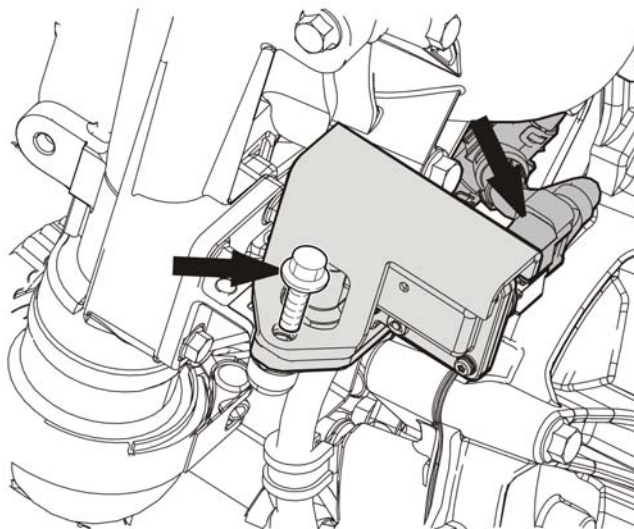
W2006847

- 5**  
Install all fasteners securing the venturi tube to the mounting bracket.



W2006832

**6**  
Install the retainer strap and fasteners to secure the venturi outlet pipe to the venturi tube mounting bracket.



W2005805

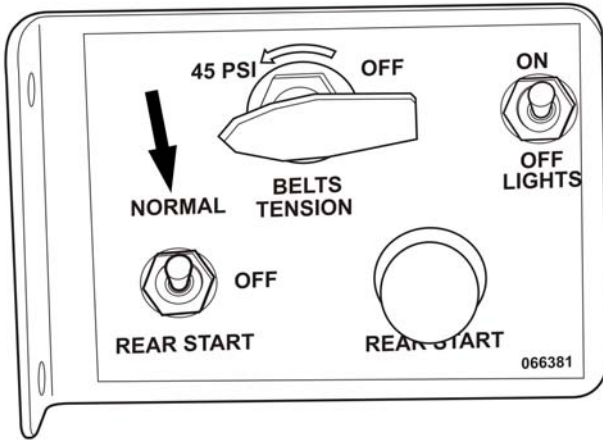
**7**  
Ensure new seals are in position on the pressure differential sensor mounting flange.

**8**  
Place the pressure differential sensor in position on the venturi tube and install the mounting bolts. Tighten the mounting bolts to specification.

**9**  
Connect the wiring harness lead to the pressure differential sensor terminal.

**10**  
Due to the Engine Electronic Control Unit (EECU) self learning capability, it is necessary to reset learned EECU parameters after servicing some engine related components. This allows the EECU to learn the new components behavior. After servicing is complete, perform the "Learned Data Reset" using the PC tool. This is located in the Function Group 1 menu.

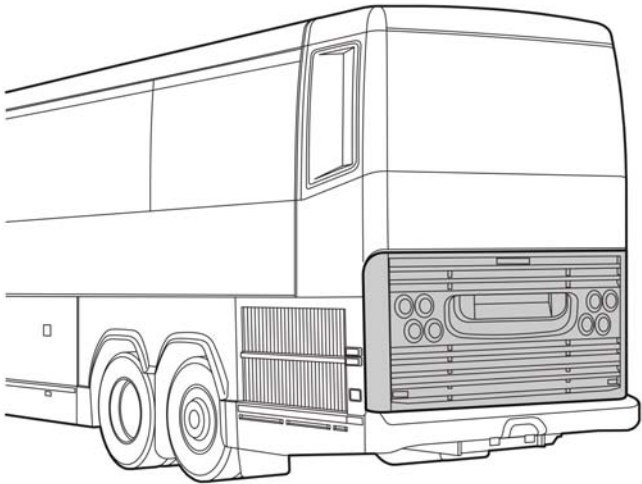
- 11**  
Set the starter selector switch to NORMAL position.



W2006505

- 12**  
Start the engine. Check for leaks and proper operation.

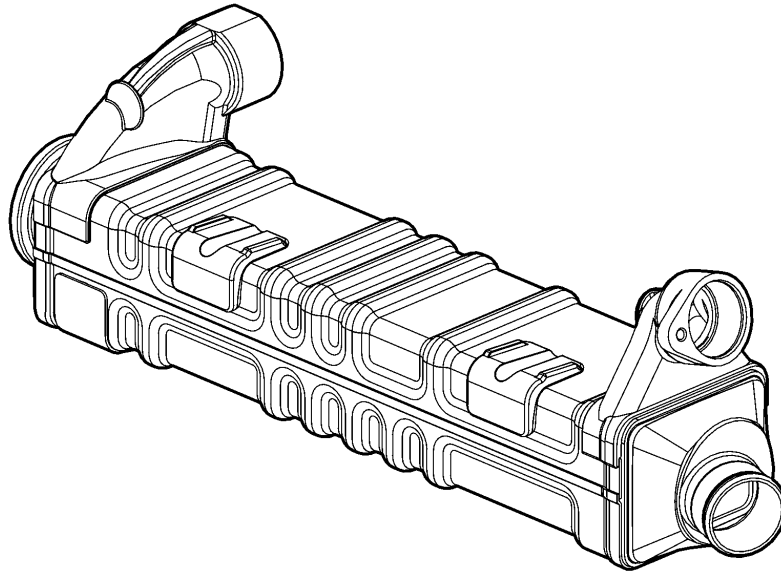
- 13**  
Close the engine compartment door.



W2006767

EGR Cooler  
Clean  
D13F

## EGR Cooler, Clean



W2006747

This information covers cleaning of the EGR cooler on the Volvo D13F engine.

### Contents

- "EGR Cooler, Clean" page 2

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

## 2932-11-02-01 EGR Cooler, Clean

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

Exhaust soot can be cleaned from the EGR cooler using the following procedure.

**Note:** The following procedure covers EGR coolers that have been removed from the engine.

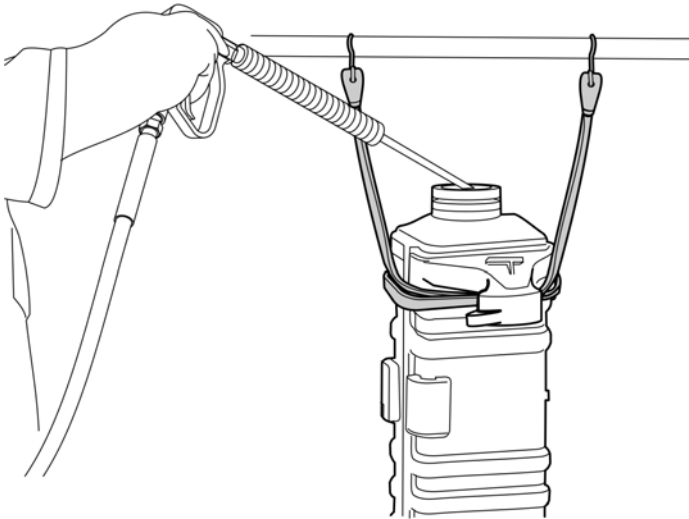
1

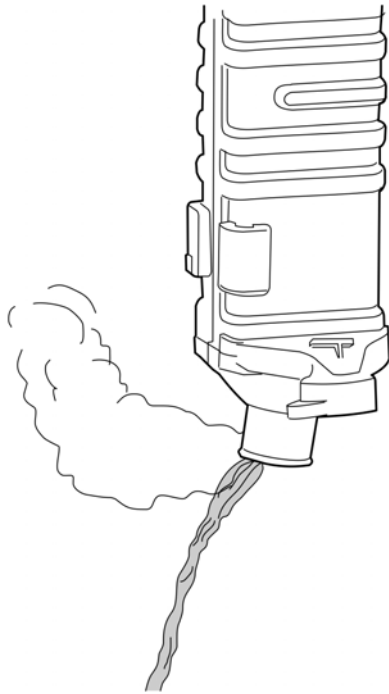
Hang the cooler from a support (inlet end up) and steam clean it through the inlet end first.



### CAUTION

Do not let the steam and air nozzles touch the EGR fins during cleaning. Failure to heed this caution can result in severe component damage.



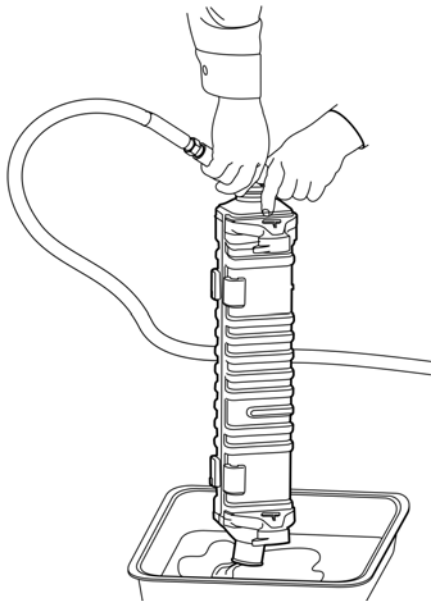


W2005761

**2**  
Steam and soot should flow out of the lower end of the cooler.

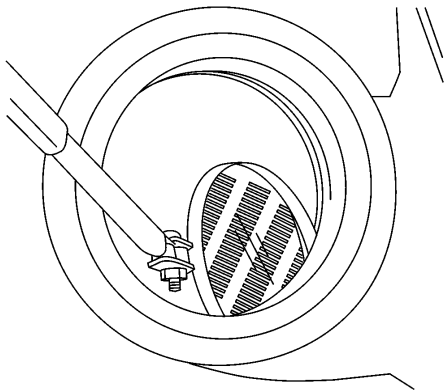
**3**  
Turn the cooler so that it hangs with the outlet end up. Steam clean through the outlet end until clean water flows.

**4**  
While the cooler hangs so that the water flows out, blow clean shop air into the outlet end until the cooler is dry.



W2005762

**5**  
Turn the cooler so that it hangs with the inlet end up and blow clean shop air into the inlet end until the cooler is dry.



W2005070

**6**  
Visually inspect the exhaust passages. If any soot or carbon remains in the cooler, reclean as needed.

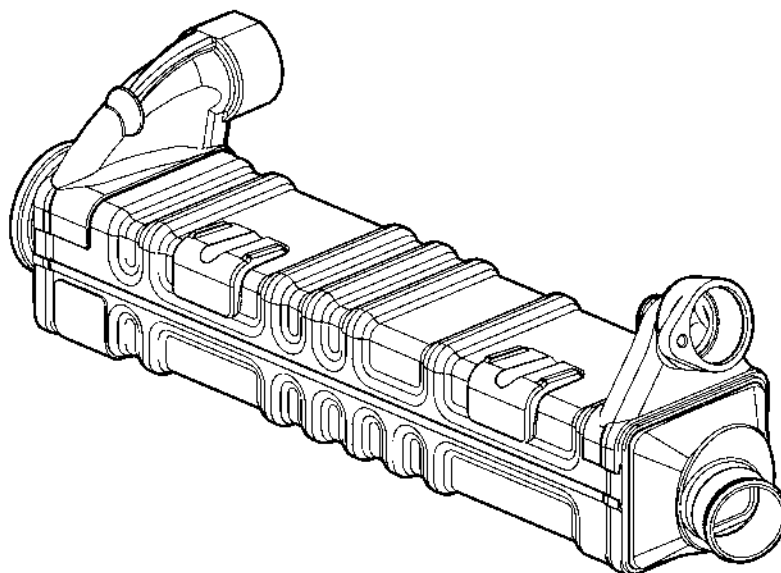
**7**  
Ensure that cooler is thoroughly dry before installation.

**8**  
Install EGR cooler. See group 29.

Date	Group	No.	Release	Page
9.2010	<b>293</b>	<b>77</b>		1(27)

EGR Cooler  
Replacement  
PREVH, PREVX  
D13F, D13H

## EGR Cooler, Replacement



W2006747

This information covers replacement of the EGR cooler on the Volvo D13F or D13H engine.

### Contents

- "Special Tools", page 2
- "EGR Cooler, Replacement", page 3

**Note:** Information is subject to change without notice.  
Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.



# Tools

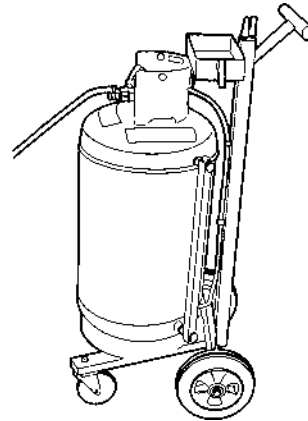
## Special Tools

For special tools ordering information, refer to Tool Information, group 08.



W0001795

**9996049**  
Coolant Drain Hose



W2004191

**85112740**  
Coolant Extractor

# Service Procedures

## 2932-03-02-01

### EGR Cooler, Replacement

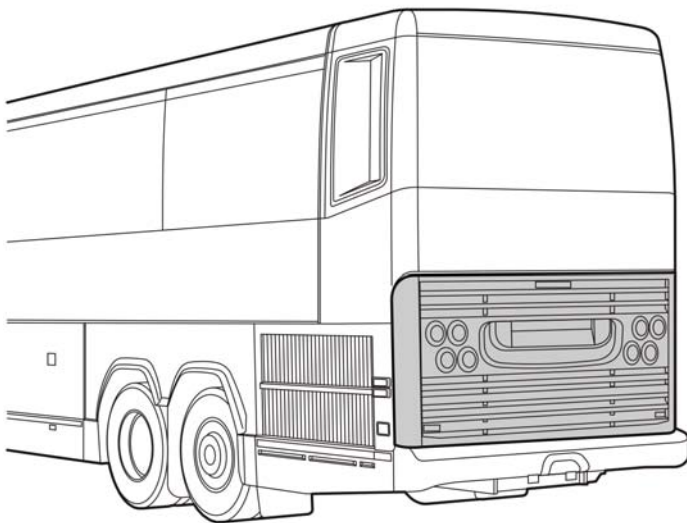
You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

*Special tools: 85112740, 9996049*

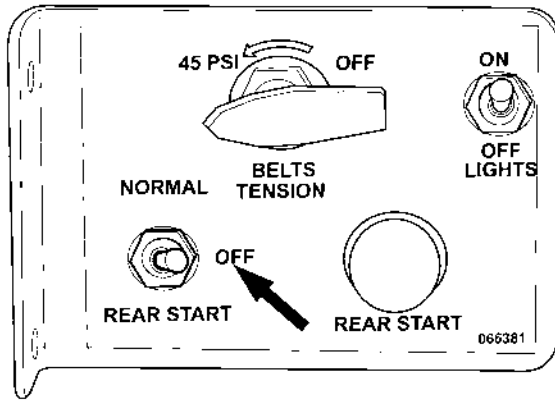
## Removal

**1**  
Apply the parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.

**2**  
Access the engine compartment via the rear doors or hatch.



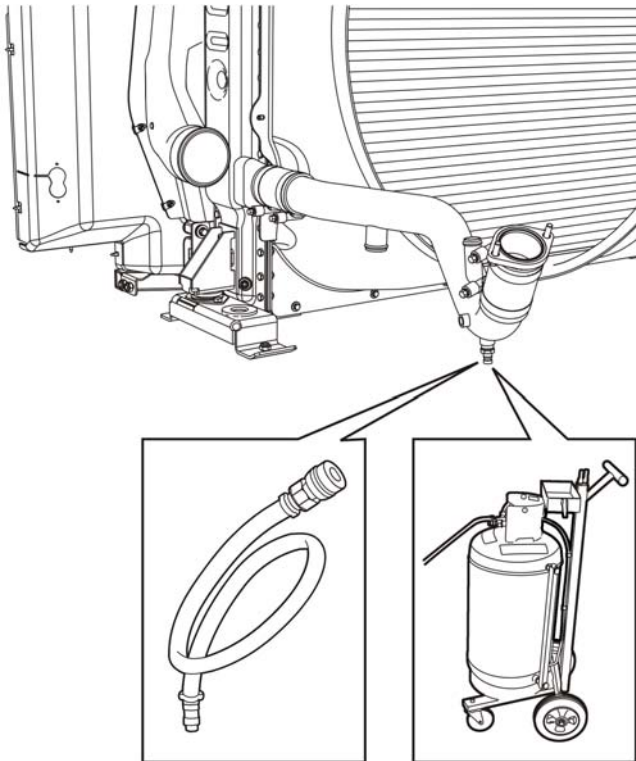
W2006767



W2006494

**3**

Set the starter selector switch to the off position.



W2006765

**4**

Connect coolant extractor.

**Note:** If equipped, the bottom chassis skid plate must be removed for access.

**5**

Use the coolant extractor to drain the coolant from the engine. An alternate method is to drain the coolant into a suitable container using the drain hose.

**⚠ DANGER**

Coolant is toxic; risk of poisoning. Do not drink coolant. Use proper hand protection when handling. Keep coolant out of reach of children and animals. Failure to follow these precautions can cause serious illness or death.

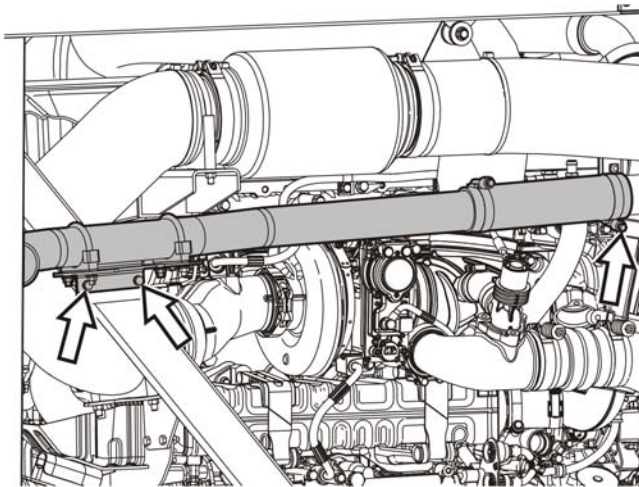
85112740, 9996049

**6**

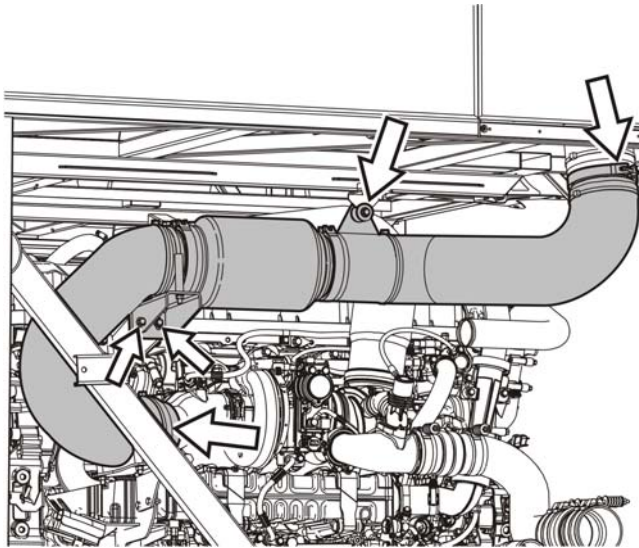
Remove coolant package. See Group 26.

**7**

Remove upper radiator coolant pipe with bracket attached.



W2006807

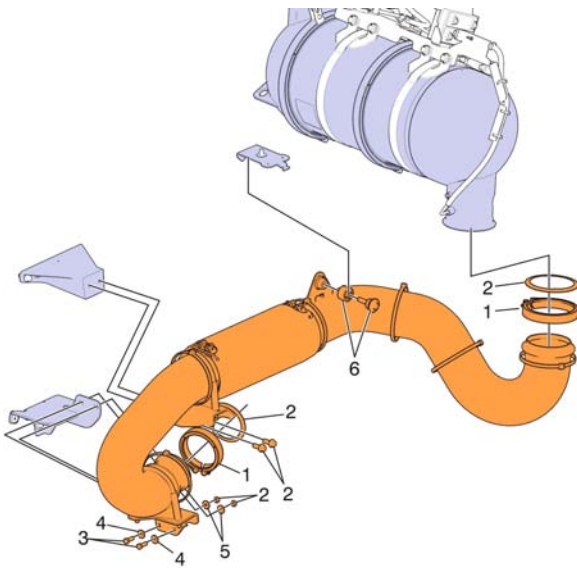


W2006808

**8**

Remove exhaust pipe clamp at diffuser and the clamp before the Diesel Particulate Filter (DPF). Remove the exhaust pipe as an assembly.

D13F Engine



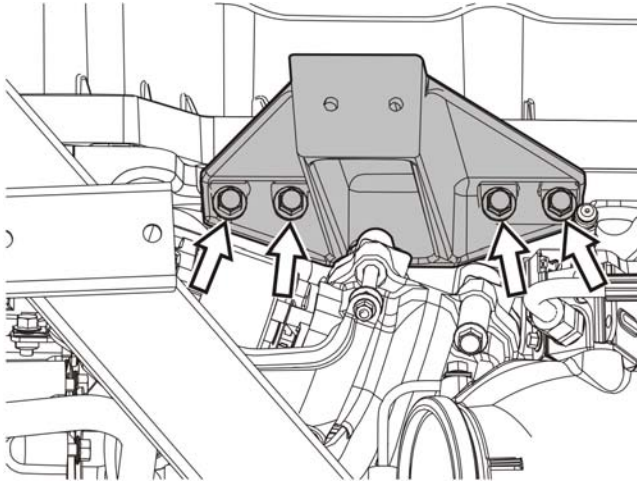
W2059819

D13H Engine

1 — V-band Clamp

2 — Gasket

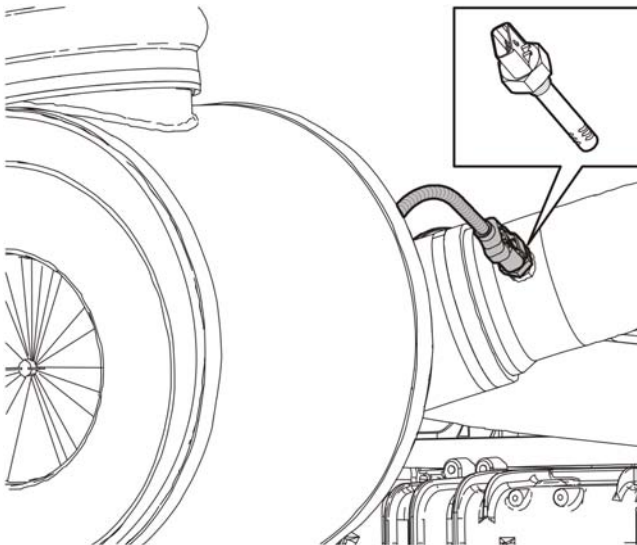
3, 4, 5, 6 — Fasteners



W2006809

**9**

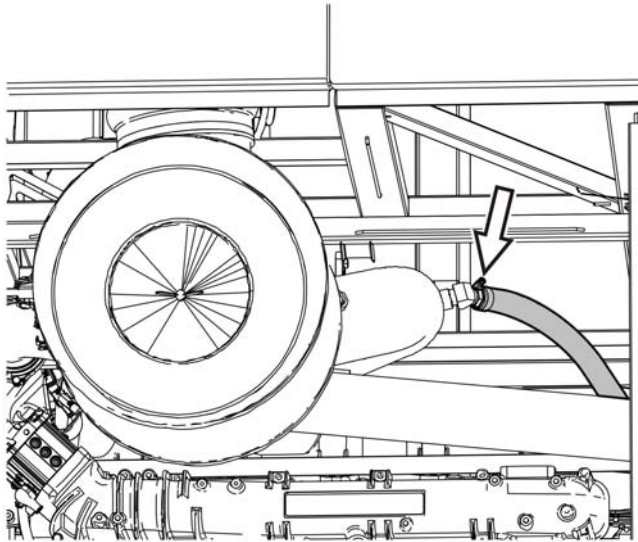
Remove the upper exhaust pipe mounting bracket.



W2006810

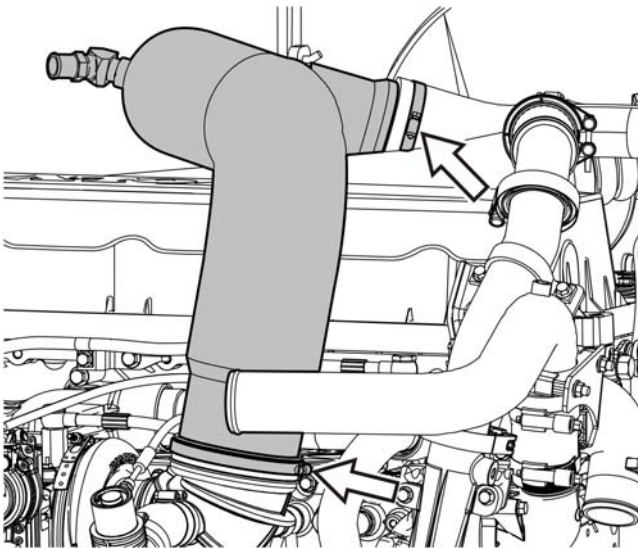
**10**

On D13F only, disconnect the humidity/air intake temp sensor and remove sensor from intake pipe.



W2006811

- 11**  
Remove clamp and remove air compressor air inlet hose.



W2006812

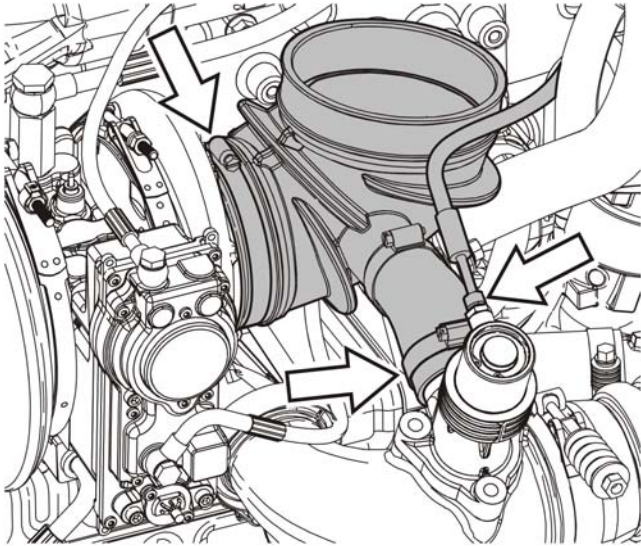
- 12**  
Remove hose clamps at air filter housing boot and turbo inlet boot.

- 13**  
Remove fresh air intake pipe.

- 14**  
Remove Engine Turbocharger Compressor By-Pass Valve (ETCBV) hose clamp at the valve.

- 15**  
Remove turbo air intake hose clamp securing boot.

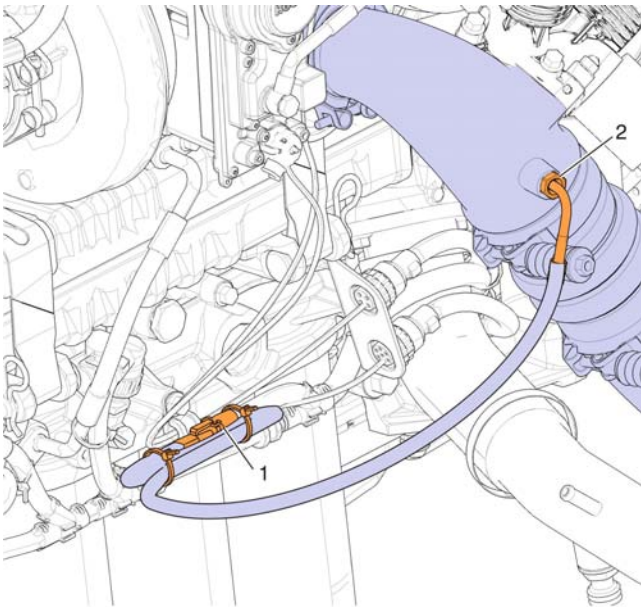
- 16**  
Remove ETCBV control line from valve.



W2006813

**17**

Remove turbo air intake boot and fresh air intake pipe as an assembly.



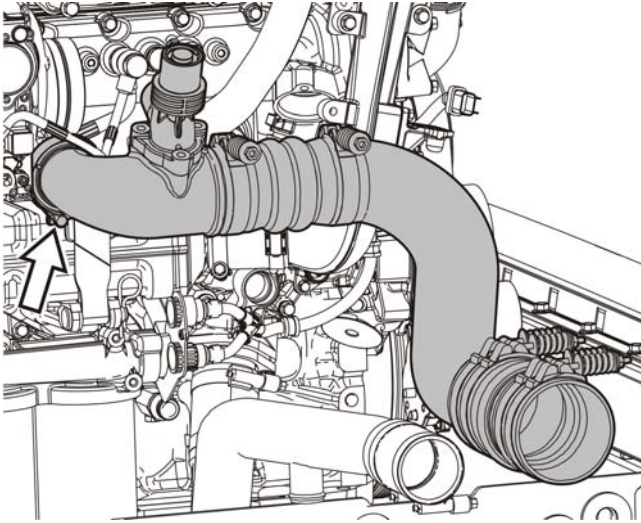
W2059588

**18**

On the D13H only, unplug the discharge air temperature sensor wiring harness from the sensor at the connector in the wire bundle next to the engine block.

**Note:** Cut the cable ties securing the wiring harness connector to the wiring bundle.



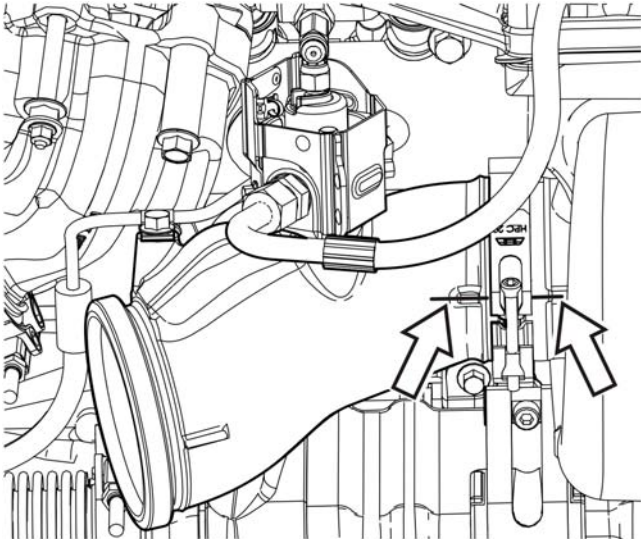


W2006814

**19**

Remove charge air pipe from turbocharger.

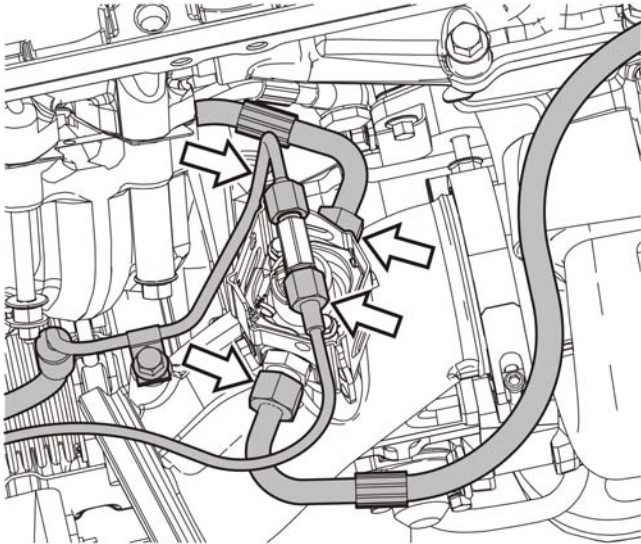
**Note:** Remove all parts as an assembly and ensure that the wiring harness cable does not catch on anything when removing the assembly.



W2006816

**20**

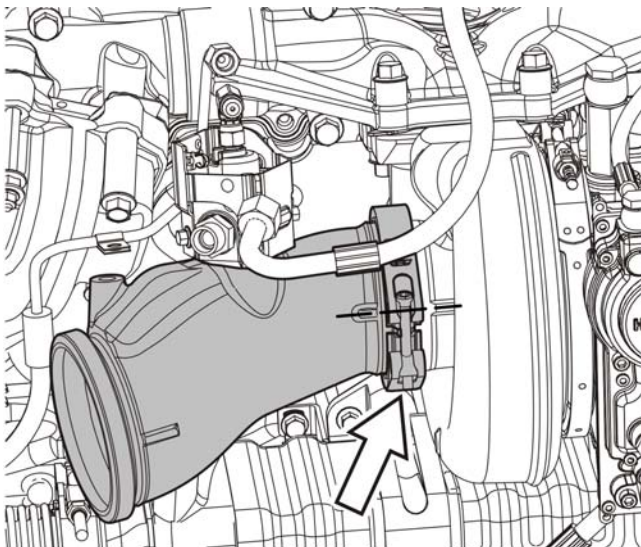
Check and mark diffuser alignment.



W2006817

**21**

Remove fuel line, water lines and air line from aftertreatment fuel injector.



W2006818

**22**

Remove clamp securing diffuser to turbocharger.  
Remove diffuser.

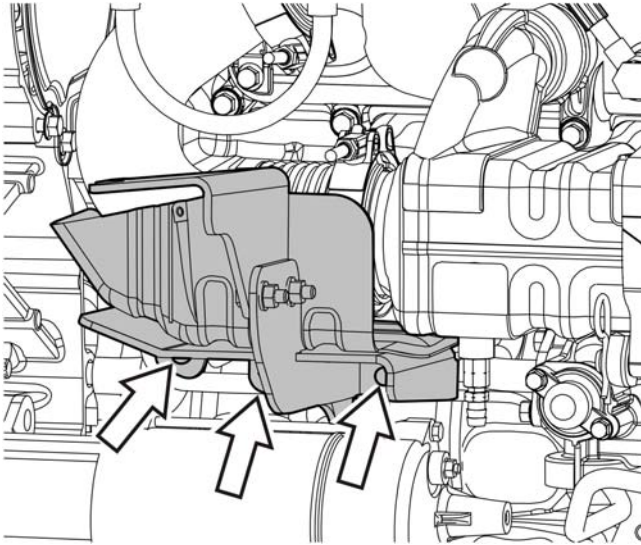
**Note:** The diffuser can be moved to the top of the valve cover without disconnecting the electrical connector.

**23**

Remove turbocharger. See Group 25.

**24**

Remove lower exhaust support bracket.

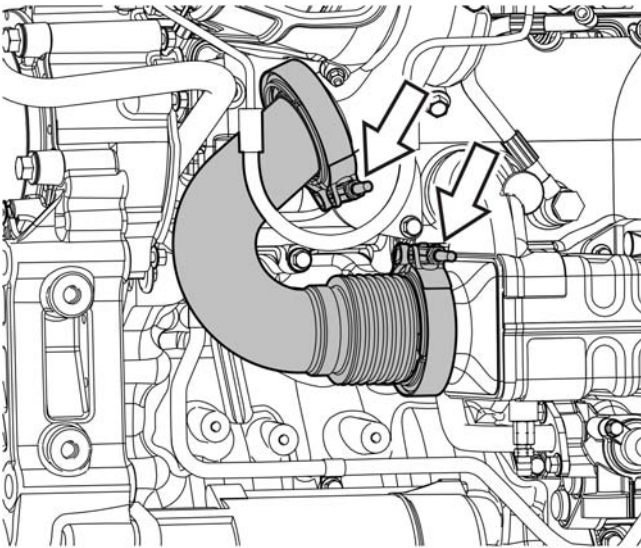


W2006819

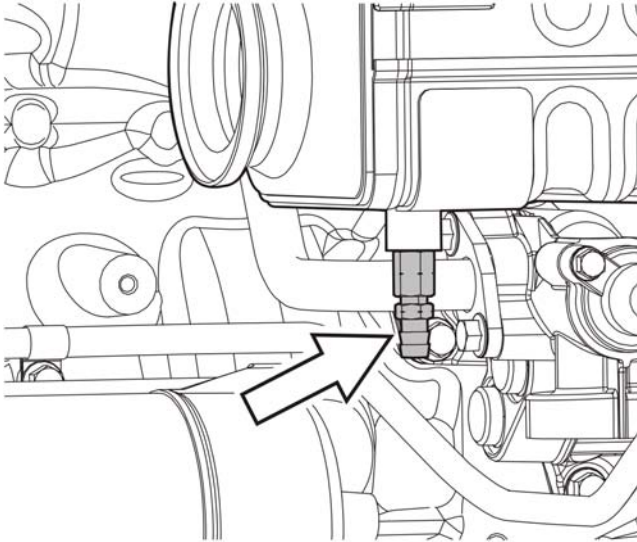
**25**

Remove and discard the gaskets and V-band clamps retaining the EGR hot pipe. Remove the pipe.

**Note:** Discard the gaskets and V-band clamps used to retain the EGR hot pipe. The gaskets and clamps are one time use only. Replace old gaskets and V-band clamps with new ones.



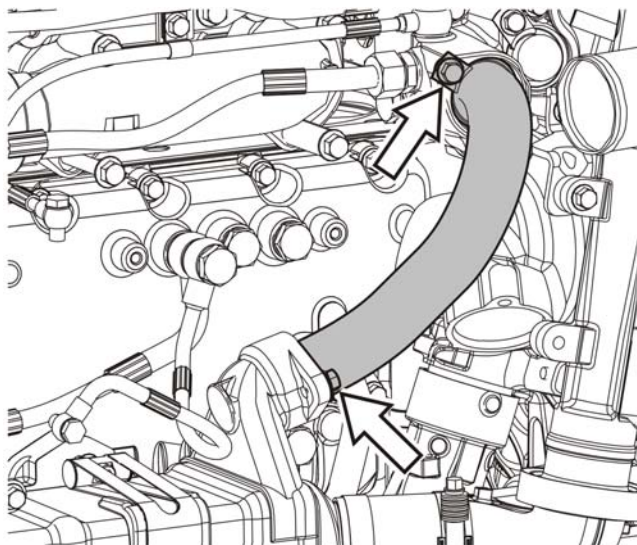
W2006821



W2006822

**26**

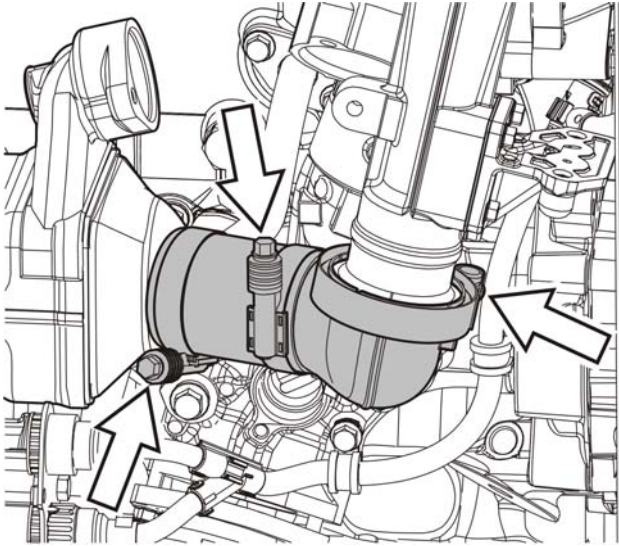
Loosen and remove the drain fitting from the EGR cooler.  
Drain coolant into a suitable container.



W2006823

**27**

Remove EGR Cooler coolant pipe.

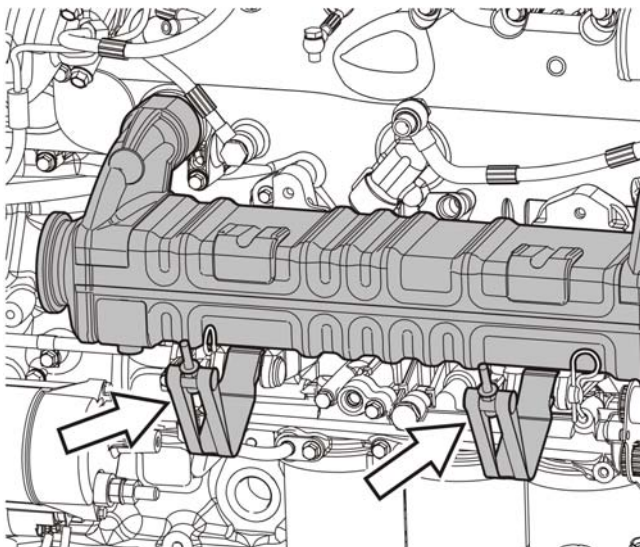


W2006825

**28**

Remove the V-band clamp from the venturi inlet elbow. Loosen the clamp and remove the EGR hose and pipe located between the EGR cooler and the venturi.

**Note:** Discard the V-band clamp used to retain the venturi inlet elbow and the EGR hose clamps. The clamps are one time use only. Replace old V-band clamps and hose clamps with new clamps.



W2006826

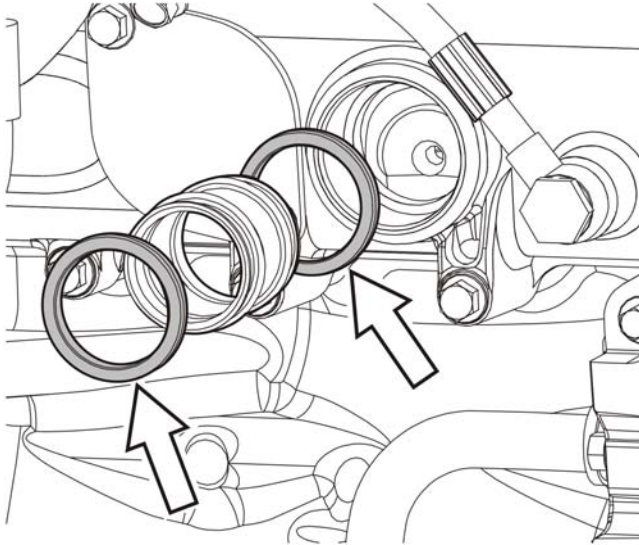
**29**

Remove both EGR clamps securing cooler to mounting brackets. Remove EGR Cooler from mounting brackets.

## Installation

**1**

Replace and lubricate the O-rings that seals the EGR cooler to the oil cooler housing with approved lubricant.

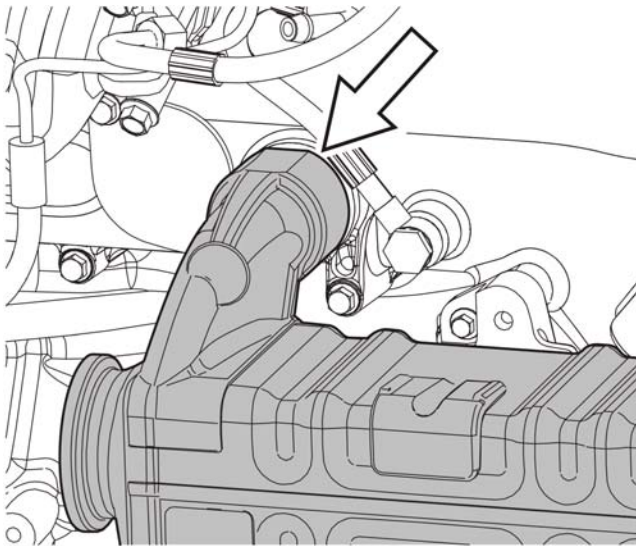


W2006827

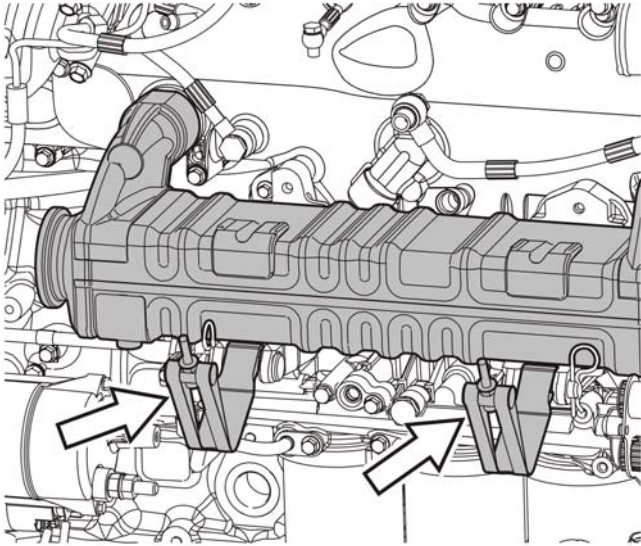
**2**

Place the EGR cooler in position on the mounting brackets. Align the EGR cooler with the coolant return port and press until EGR cooler seats against return port.

**Note:** The alignment pin at the bottom of the cooler must fall into the groove on the front bracket.



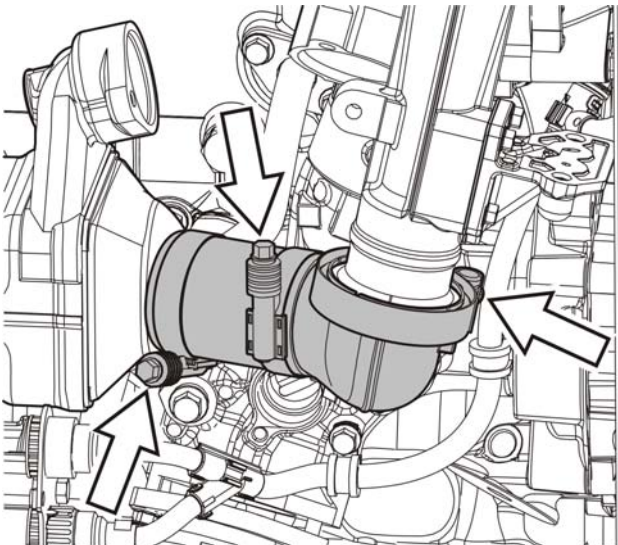
W2006828



W2006826

**3**

Rotate the retaining straps into position and tighten the fasteners on each strap to specification. Tighten the jam nut to secure each fastener.



W2006825

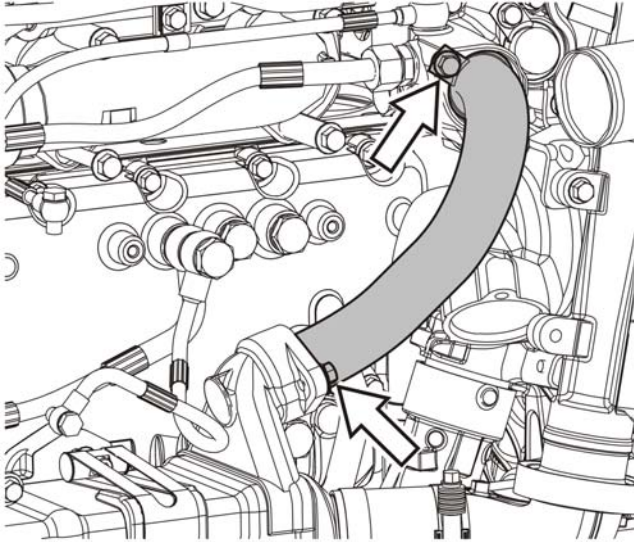
**4**

Install venturi inlet pipe with a new hose.

**Note:** All EGR hoses are one time use only. Discard old hoses and replace with new ones.

**5**

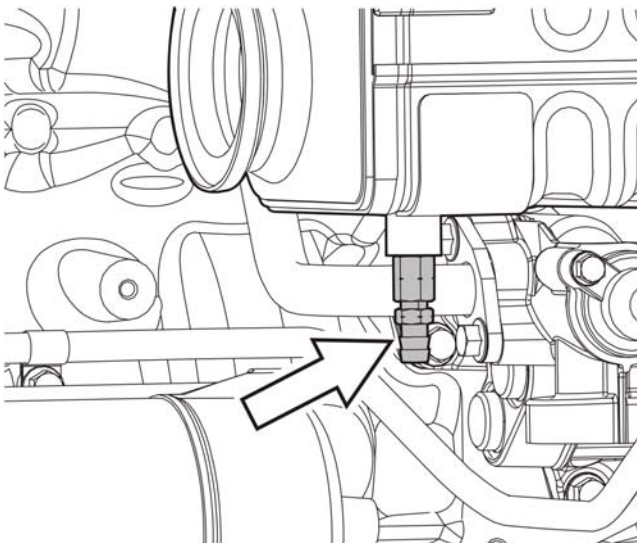
Reposition and connect coolant hoses to diffuser bracket.



W2006823

**6**

Install EGR cooler coolant pipe. Tighten fasteners to specification.

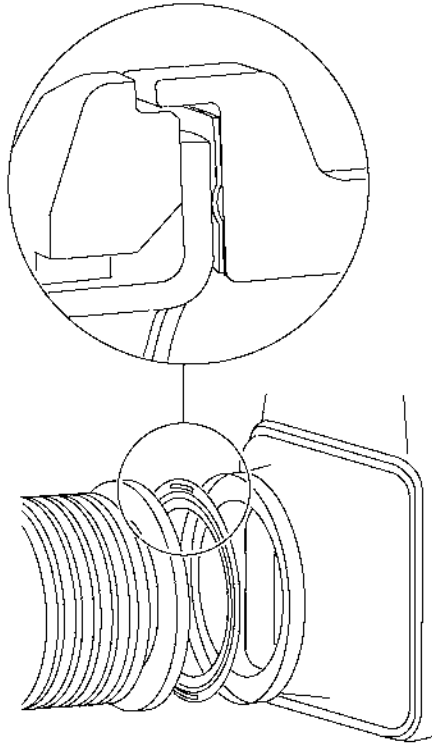


W2006822

**7**

Apply approved sealant to the threads of the drain valve. Install the drain valve in the cooler and tighten to specification.





W2006187

**8**

Install new high temperature gaskets into the EGR valve end of the hot pipe and the inlet of the EGR cooler. Ensure the gaskets lay flat against the flange surfaces with the bead of the gaskets facing toward the hot pipe.

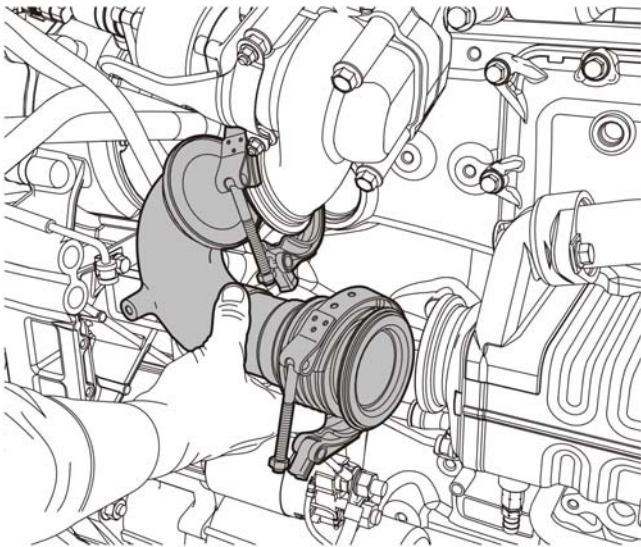
**Note:** These gaskets are one time use only. Do not reuse the gaskets.

**9**

Apply anti-seize compound to the T-bolt threads. Lubricate the V-inserts of the clamps with clean engine oil.

**10**

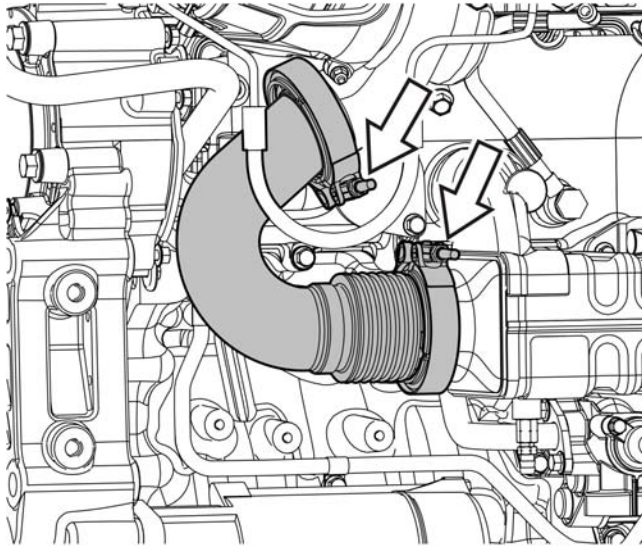
Hook the upper V-clamp over the EGR valve flange. Place the remaining V-clamp over the bellows on the hot pipe.



W2005641

**11**

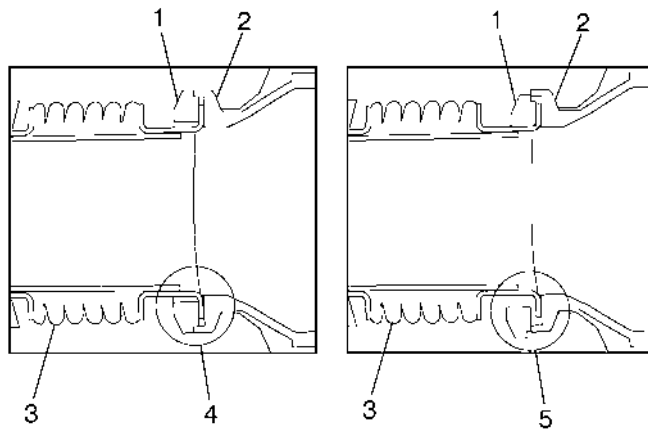
Lubricate the flange on the EGR cooler inlet and the flange on the EGR hot pipe with clean engine oil. Lubrication aids in proper V-clamp installation.



**12**

Position the EGR hot pipe between the EGR valve and the EGR cooler. Make sure the flanges engage properly. Slide the upper V-clamp over the flange and tighten until snug. Slide the lower V-clamp over the flange and tighten the clamp until snug.

W2006821



**13**

Visually inspect the floating flange through the gap in the V-clamp to make sure it is properly seated in the EGR cooler. The floating flange must be concentric with the cooler flange.

**Note:** If the floating flange is not properly seated in the EGR cooler flange, the gasket will not be compressed and the seal will leak.

W2006163

- 1 EGR Pipe Floating Flange
- 2 EGR Cooler Flange
- 3 EGR Pipe
- 4 Flange Assembled Correctly
- 5 Flange Assembled Incorrectly

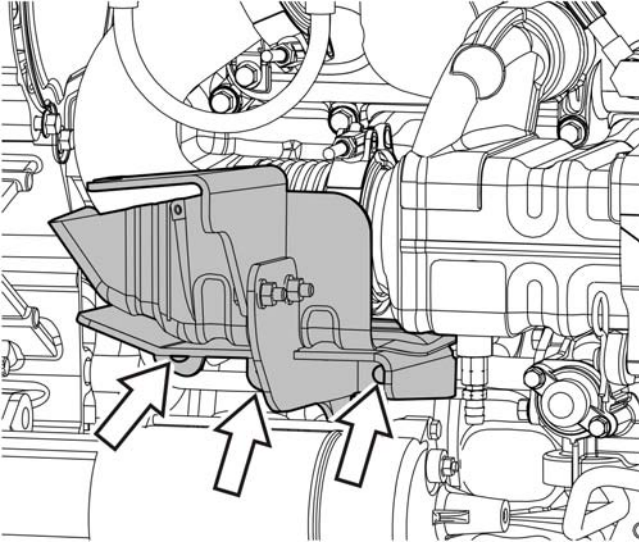
**14**

Position the V-clamps so that the T-bolts clear both heat shields. Tighten the clamps to specification.

**Note:** After reaching the specified torque, inspect the V-clamps to make sure that no portion of the clamp has "bottomed out."

**15**

Install lower exhaust support bracket.



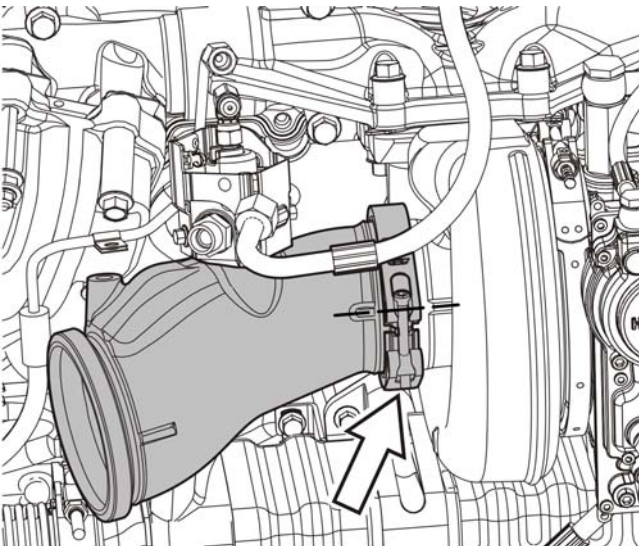
W2006819

**16**

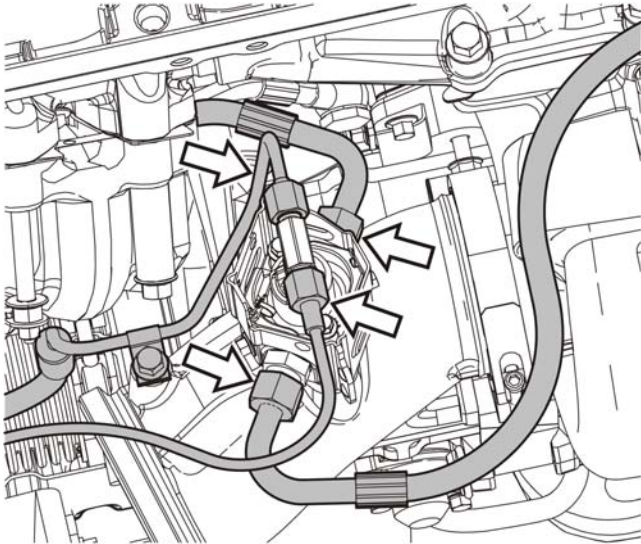
Install turbocharger. See group 25.

**17**

Align diffuser and install clamp securing diffuser to turbo.



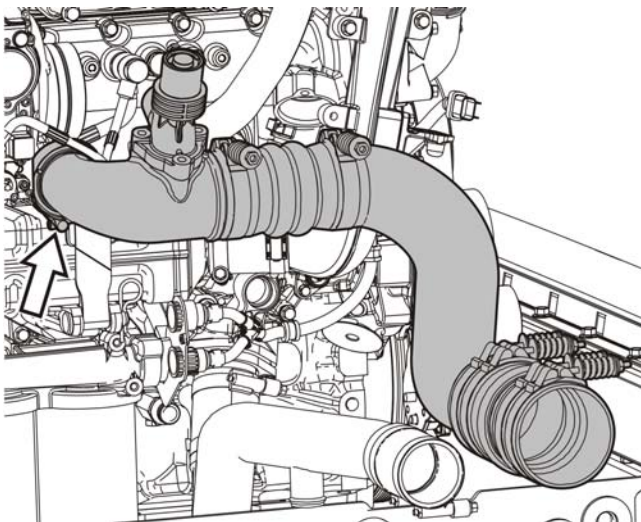
W2006818



W2006817

**18**

Connect fuel, air and water lines to aftertreatment fuel injector.

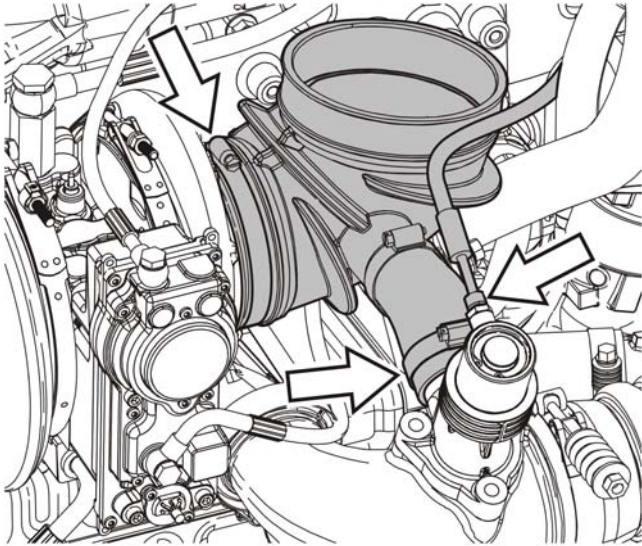


W2006814

**19**

Loosely install charge air pipe and boot to turbocharger. The charge air pipe will be secured after coolant package is installed.

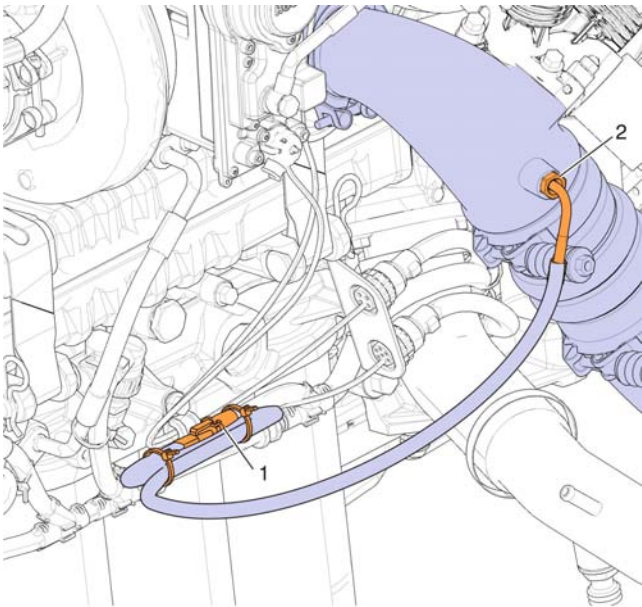
**Note:** Install all parts as an assembly.



W2006813

**20**

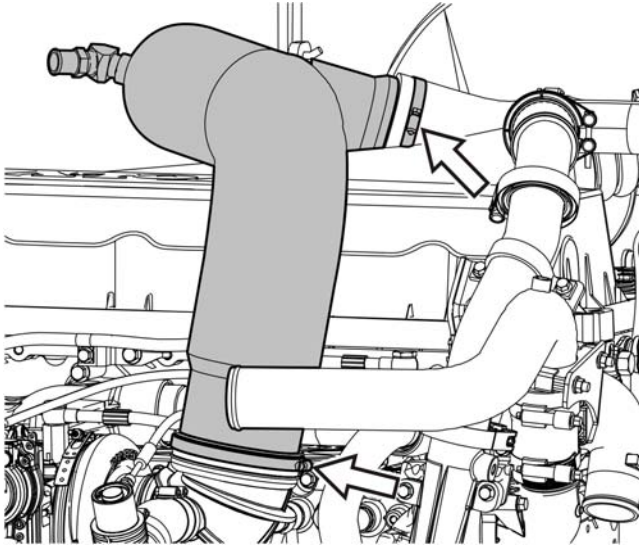
Install turbo air intake hose clamp securing boot. Install ETCBV hose clamp at valve. Install ETCBV control line from valve and support clamp from pipe. Tighten all fasteners to specification.



W2059588

**21**

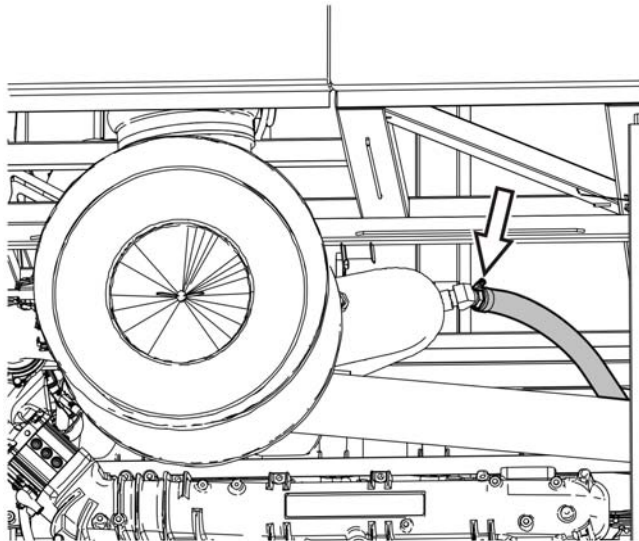
On the D13H only, reconnect the discharge air temperature sensor wiring harness connector at the wire bundle next to the engine block. Secure with cable ties.



W2006812

**22**

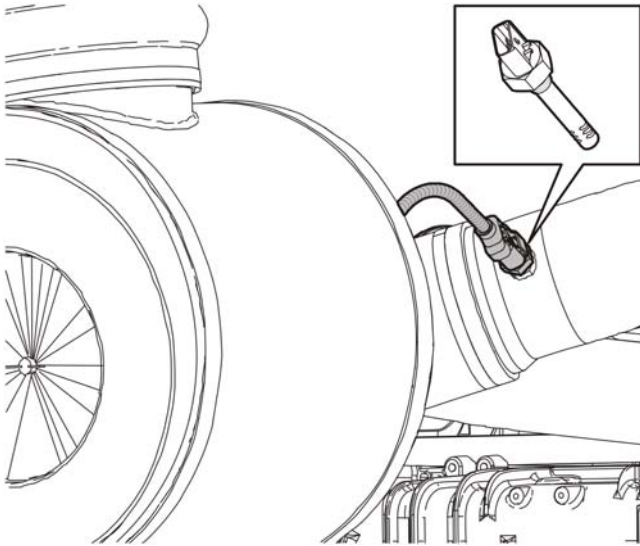
Install fresh air intake pipe. Install hose clamps at air filter housing boot and turbocharger inlet boot.



W2006811

**23**

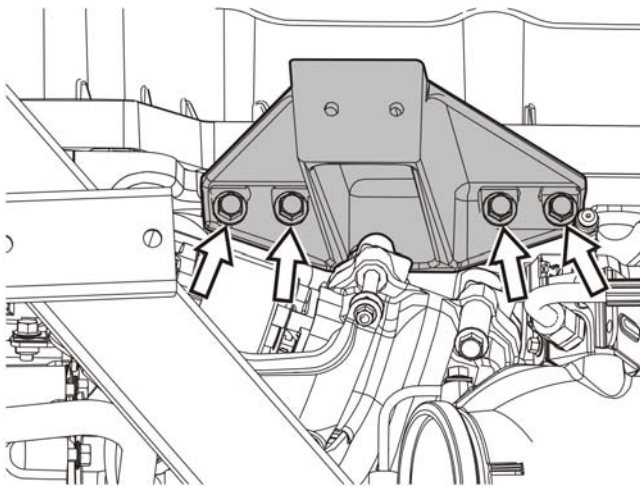
Install air compressor air inlet hose and install clamp.



W2006810

**24**

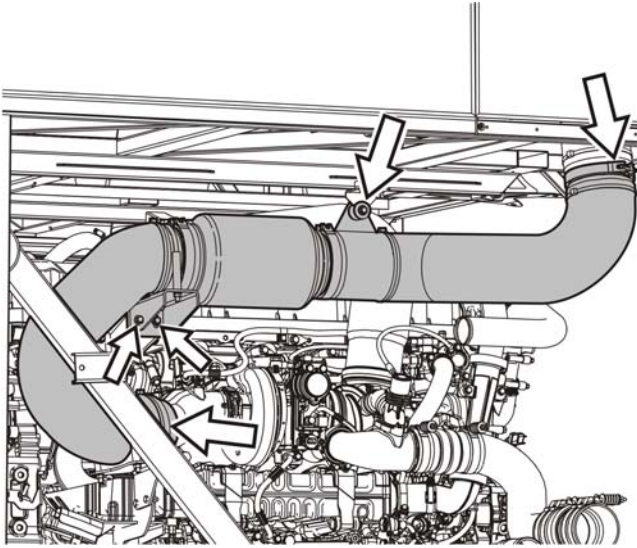
On D13F only, install humidity/air intake temp sensor and connect harness.



W2006809

**25**

Install upper exhaust pipe mounting bracket. Tighten fasteners to specification

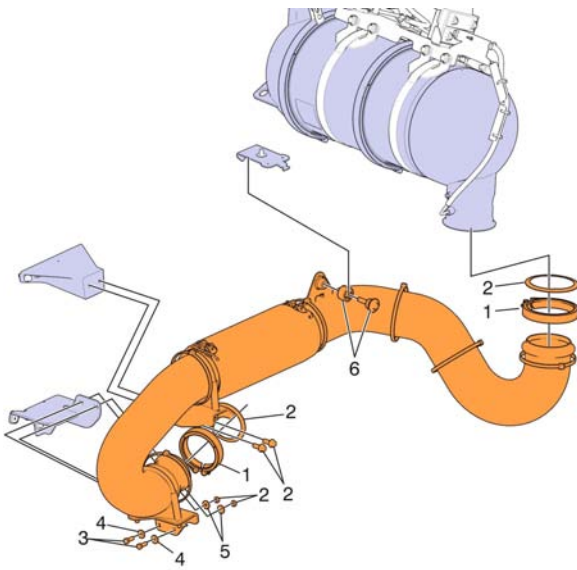


W2006808

D13F Engine

**26**

Install exhaust pipe as an assembly with mounting  
clamps and brackets attached.

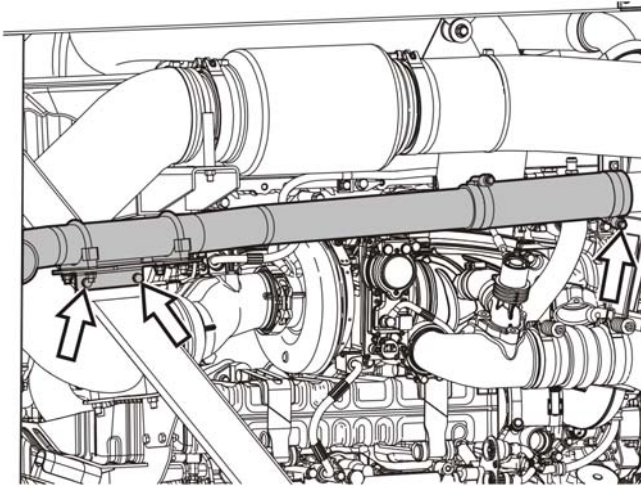


W2059819

D13H Engine

- 1 — V-band Clamp
- 2 — Gasket
- 3, 4, 5, 6 — Fasteners





W2006807

**27**

Install upper radiator coolant pipe with bracket attached.

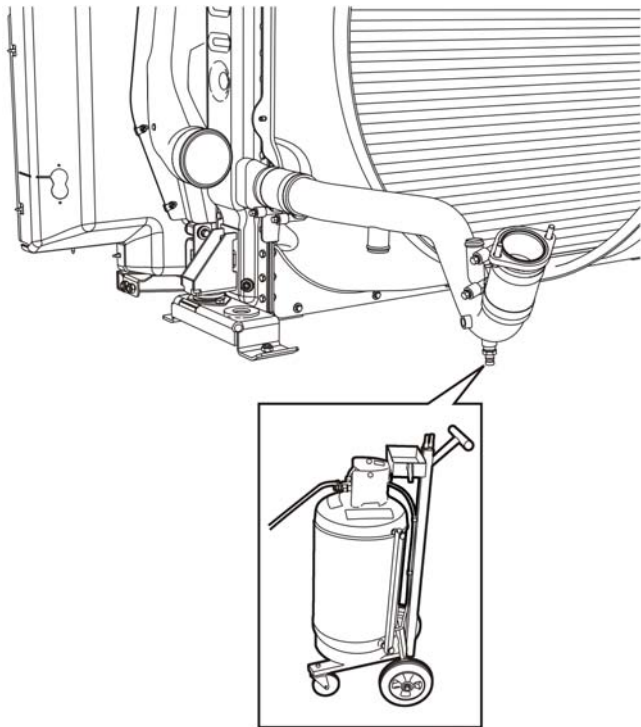
**28**

Install coolant package. See Group 26.

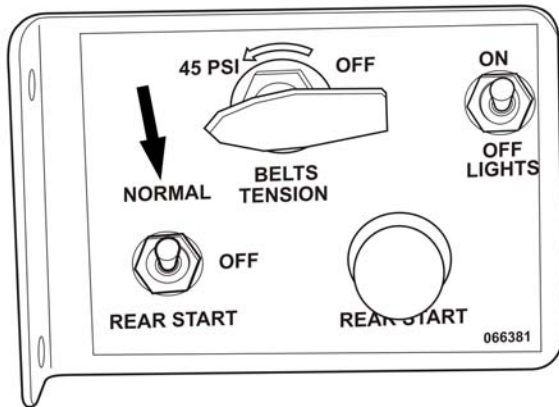
**29**

Fill the cooling system with the recommended coolant using the coolant extractor.

85112740



W2006782



W2006505

**30**

Set the starter selector switch to NORMAL position.

**31**

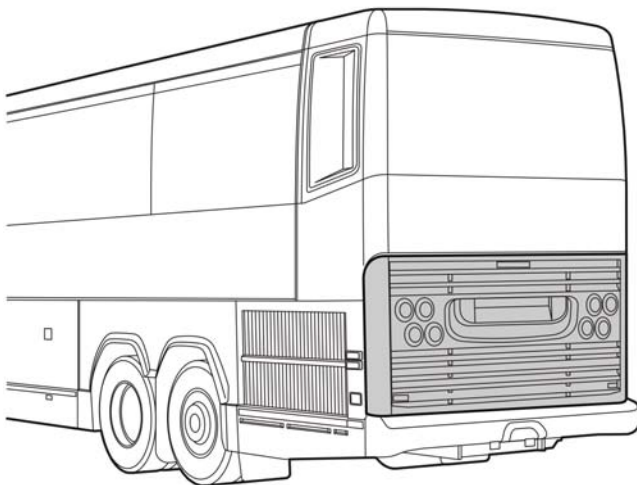
Start the engine, check for leaks and proper operation. After shutdown, replenish fluids as necessary.

**32**

If previously removed, install the bottom chassis skid plate.

**33**

Close the engine compartment.



W2006767

**34**

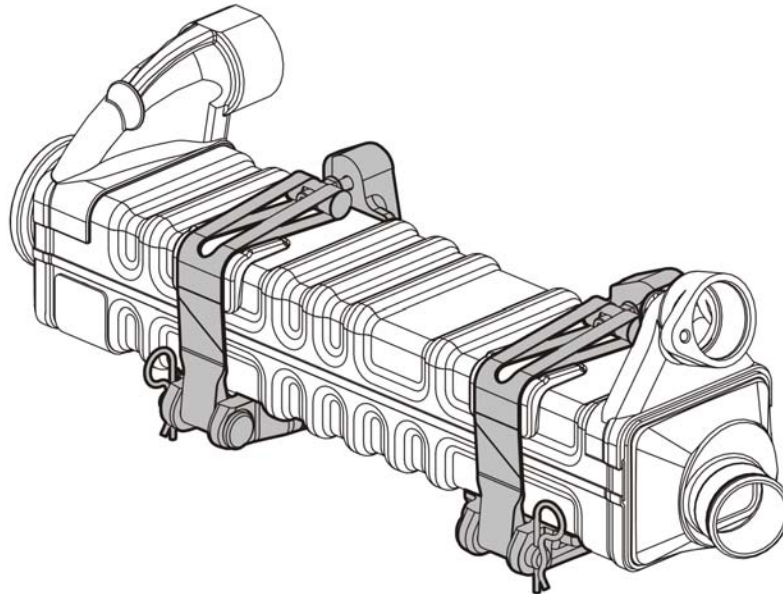
Due to the Engine Electronic Control Unit (EECU) self learning capability, it is necessary to reset learned EECU parameters after servicing some engine related components. This allows the EECU to learn the new components behavior. After servicing is complete, perform the "Learned Data Reset" using the Tech Tool. This is located in the Function Group 1 menu.

This Service Bulletin replaces service bulletin 293-78 "EGR Cooler Brackets, Replacement" dated 11.08, publication number PV776-20186894.

Date	Group	No.	Page
1.2009	<b>293</b>	<b>79</b>	1(5)

## EGR Cooler Brackets Replacement D13F

### EGR Cooler Brackets, Replacement



W2006748

This information covers replacement of the EGR cooler brackets on the Volvo D13F engine.

#### Contents

- "Brackets EGR Cooler, Replacement" page 2

**Note:** Information is subject to change without notice. Illustrations are used for reference only and can differ slightly from the actual vehicle being serviced. However, key components addressed in this information are represented as accurately as possible.

# Service Procedures

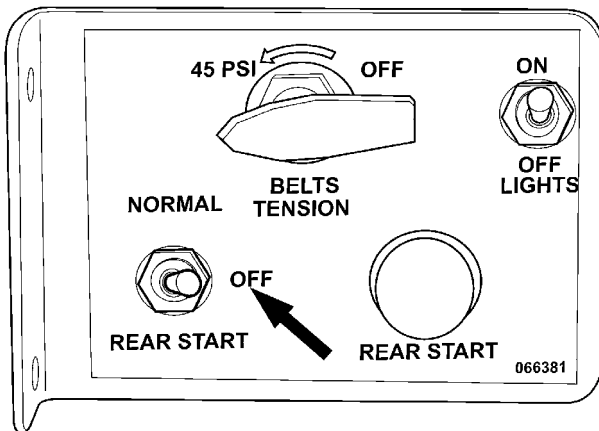
## 2935-03-02-01

### Brackets EGR Cooler, Replacement

You must read and understand the precautions and guidelines in Service Information, group 20, "General Safety Practices, Engine" before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

### Removal

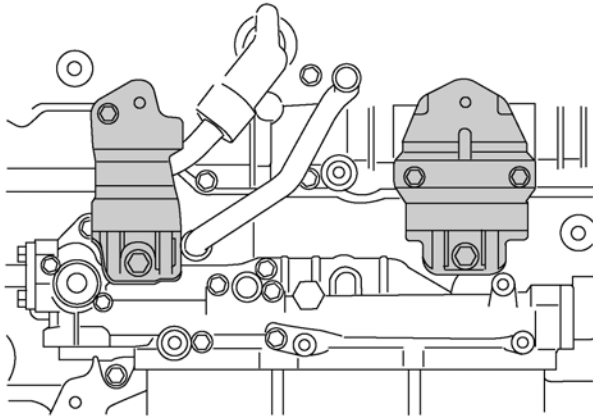
- 1  
Apply parking brake and shift the transmission to neutral. Shut off all electrical loads. Turn the ignition key to the OFF position.
- 2  
Open the engine compartment door.
- 3  
Set the starter selector switch to the OFF position.



W2006494

- 4  
Remove coolant package. See Group 26.
- 5  
Remove turbocharger. See Group 25.
- 6  
Remove EGR Cooler inlet pipe. See Group 29.
- 7  
Remove EGR Cooler. See Group 29

- 8**  
Remove the bolts securing the EGR cooler rear bracket to the oil cooler cover and the cylinder block. Remove the bracket from the engine.

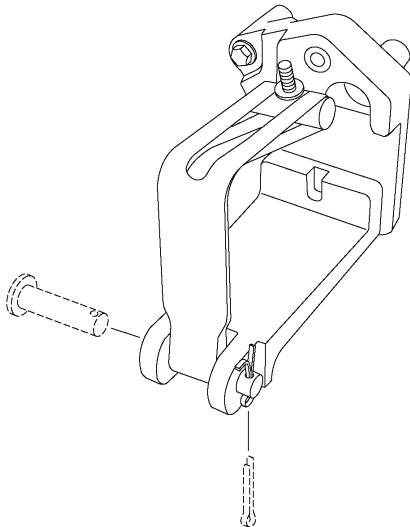


W2005901

- 9**  
Remove the bolts securing the EGR cooler front bracket to the oil cooler cover and the cylinder block. Remove the bracket from the engine.

## Installation

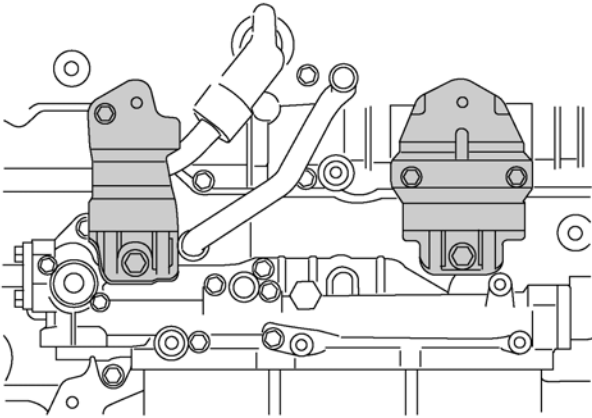
- 1**  
Transfer or replace retaining straps on the cooler brackets.



W2005913

**2**

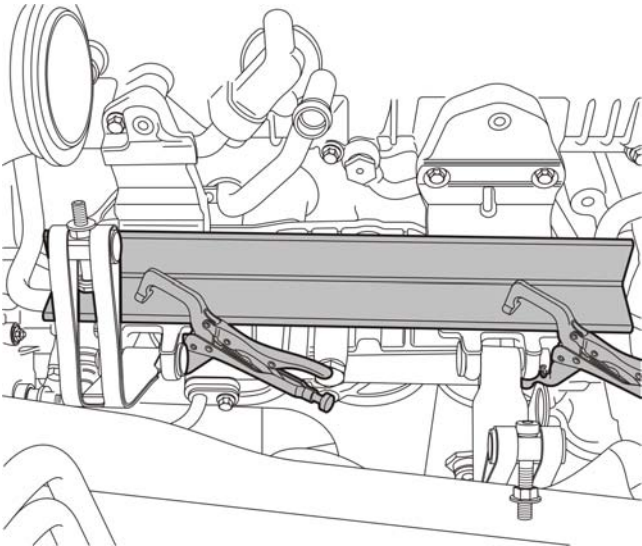
Position the EGR cooler front and rear brackets over the oil cooler cover and loosely install the mounting bolts. Do not tighten at this time.



W2005901

**3**

Place a straightedge across the mounting pads of the EGR cooler brackets and clamp the straightedge to the pads.



W2005974

**4**

Tighten the upper mounting bolts on both brackets to specification. Remove the clamps and straightedge.

**5**

Tighten the remaining mounting bolts on both brackets to specification.

**6**

Install EGR Cooler. See Group 29.

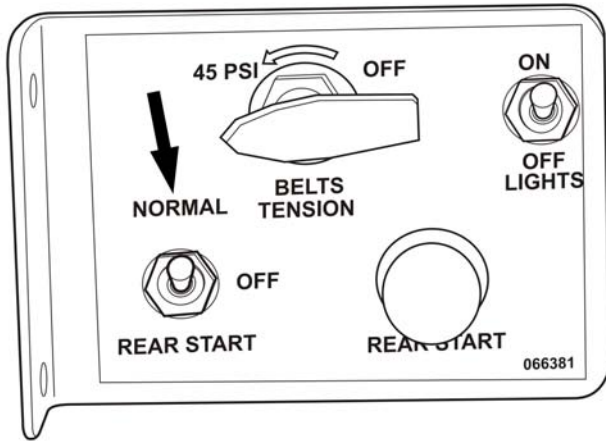
**7**

Install EGR Cooler inlet pipe. See Group 29.

**8**  
Install turbocharger. See Group 25.

**9**  
Install coolant package. See Group 26.

**10**  
Set the starter selector switch to NORMAL position.



W2006505

**11**  
Start the engine, check for leaks and proper operation.  
After shutdown, replenish fluids as necessary.

**12**  
Close the engine compartment door.