ALTERNATIVE FUEL SYSTEMS

Prins

Quality, innovation and customer care, it's in our nature

Installation manual
Dedicated
PART 2/2

MANUFACTURER	Volvo
TYPE	XC60
ENGINE DISPLACEMENT	1999CC
NUMBER OF VALVES	16V
ENGINE CODE / NUMBER	B4204T7
VEHICLE CATEGORIES	M
TRANSMISSION	AT
VERSION	Direct LiquiMax-2.1
PETROL ECU MANUFACTURER / CODE	Bosch MED 17.0
HIGH PRESSURE PETROL POMP	Bosch HDP-5-PE
HIGH PRESSURE PETROL INJECTOR	Bosch HDEV-5-1
MODEL YEAR:	2013
SYSTEM APPROVAL NUMBER (R115)	E4-115R-000009 / DLM-LPG 02
LOCATION SYSTEM STICKER	right side, centre door post
ENGINE SET NUMBER	367/070011/A
MANUAL NUMBER	076/2706000
DATE	2014-04-24

Version 2013-02-20 D

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FOR EXPLANATION AND CIRCUIT DIAGRAMS SEE : INSTALLATION MANUAL GENERAL PART 1 / 2

General instructions

- The installation of the system shall be done in accordance with the installation manual provided by Prins Autogassystemen.
- This manual is based on Dutch regulations, always install the system in accordance to the local regulations.
- For an optimal functioning of the Direct LiquiMax system, maintain a clean and organized work environment during installation and maintenance to prevent pollution of the LPG components.
- Always download the “general manual 1/2 “ from our website for basic instructions and diagrams.
- Always disconnect the battery when installing the LPG system. Make sure the ignition key is outside the car. Be aware of central door locking, radio / telephone memory code, alarm system.
- Wear safety goggles when working on petrol filled system / connections (pressurized petrol)
- Do not place the main fuse into the fuse holder before having completed the installation of the system.
- The AFC has to be activated by means of the Prins diagnosis software.
- Never disconnect the AFC connector, unless you have removed the main fuse.
- When installing the wiring harness, ensure that it does not run near any of the ignition components.

  Solder and insulate all electrical connections.
  The wires in the loom are provided with numbers and text. The text on the wire explains the function of the wire. The wire harness is not model specific, therefore is it may be necessary to adjust the length of the wires. Ensure maximum care is taken when connecting wiring.
  Make professional joints using solder and shrink sleeve. Do not stretch the wiring harness.
- No component of the LPG-system shall be located within 100 mm of the exhaust or similar heat source, unless such components are adequately shielded against heat.
- If holes have to be drilled (wear safety glasses) for installing brackets, etc., the drilled holes must always be treated with an anti-corrosion agent, after the chips have been removed (especially when mounting a exterior filler into body work).
- After having completed the installation, check the whole system for LPG leakage; use a LPG leak detection device. Also check for leak of engine coolant, petrol and air.
- Fitting and maintenance is only allowed by Prins Autogassystemen selected LPG engineers.
- Failure to follow the instructions in this manual can result in a poor or non-working LPG installation or a dangerous situation.
- For maintenance instructions and filter registration see owner manual.
- Prins Autogassystemen is not responsible for any damages to people or objects as a result of changes to Prins products.
- Check our website regularly for diagrams, certificates, updates, info-bulletins and product information.

Register (warranty card) the system on the Prins warranty portal .

Required equipment / tools / materials for installing a complete system

- Complete workshop toolbox (wrenches, screwdrivers, cutters, pliers, ratchet, sockets)
- Car lift
- Portable computer : operating on Windows 98,W2000 or XP.
  Internal memory : 16 Mb or more
  Memory HD space : 5MB
  Screen : 256 colours, advise colours 16 bits or more
  Com port : 1 free COM port 1 or COM port 2 with a 9 or 25 pins connector
- Vehicle fuel system scan tool or OBD scan tool Prins (part nr. 099/99928)
- Exhaust gas analyser
- Multimeter
- Oscilloscope
- Prins diagnostic software
- Prins serial interface
- Torque wrench (10Nm)
- Torque wrench (200-250Nm)
- Portable light
- Assortment drill bits 4 to 12 mm
- Assortment cutters (ø 20, 30, 50, 70 mm)
- Portable drill or pneumatic drill
- Thread cutting device (male M6x1, M8x1, M10x1)
- Socket 46mm
- Air gun
- Vacuum cleaner
- Safety goggles
- Hot air gun
- Soldering iron, soldering tin
- Wire-stripping pliers
- Adhesive tape
- Adhesive sealant
- Thread locking compound
- Anti-corrosion agent / black body coating
- Gas leak detection device or foam leak spray
- Shrink sleeves
- Engine coolant

Vehicle check

- Check the vehicle drivability on petrol
- Check the fuel system for error codes (scan tool)
- Check if the catalytic converter is in good condition (exhaust gas analyzer)
- Check the condition of the ignition system (spark plugs, cables, coil)

Tightening moments

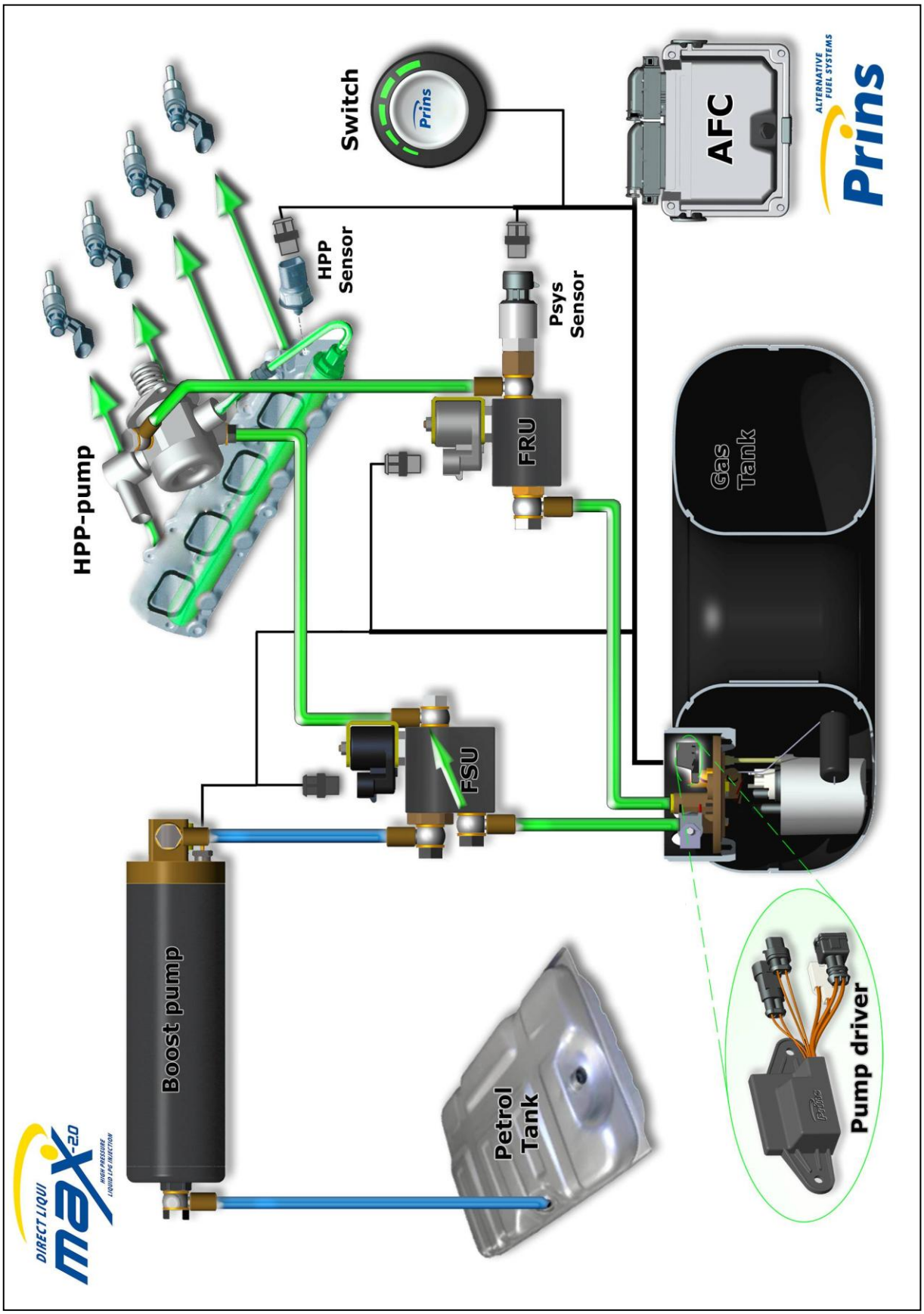
		Nm	SW
M 4 x 0,7		3,3	7
M 5 x 0,8		6,5	8
M 6 x 1,0		11,3	10
M 7 x 1,0		14,5	11
M 8 x 1		45,5,1	13
M 8 x 1,25		27,3	13
M 10 x 1		52	15-16-17
M 10 x 1,5		54	15-16-17
(filtered)Banjo bolt		10	14
Supply line connection		15	13
Fuel module Allen bolts		20	7
Filler hose connection		50	22

EXPLANATION OF SYMBOLS :

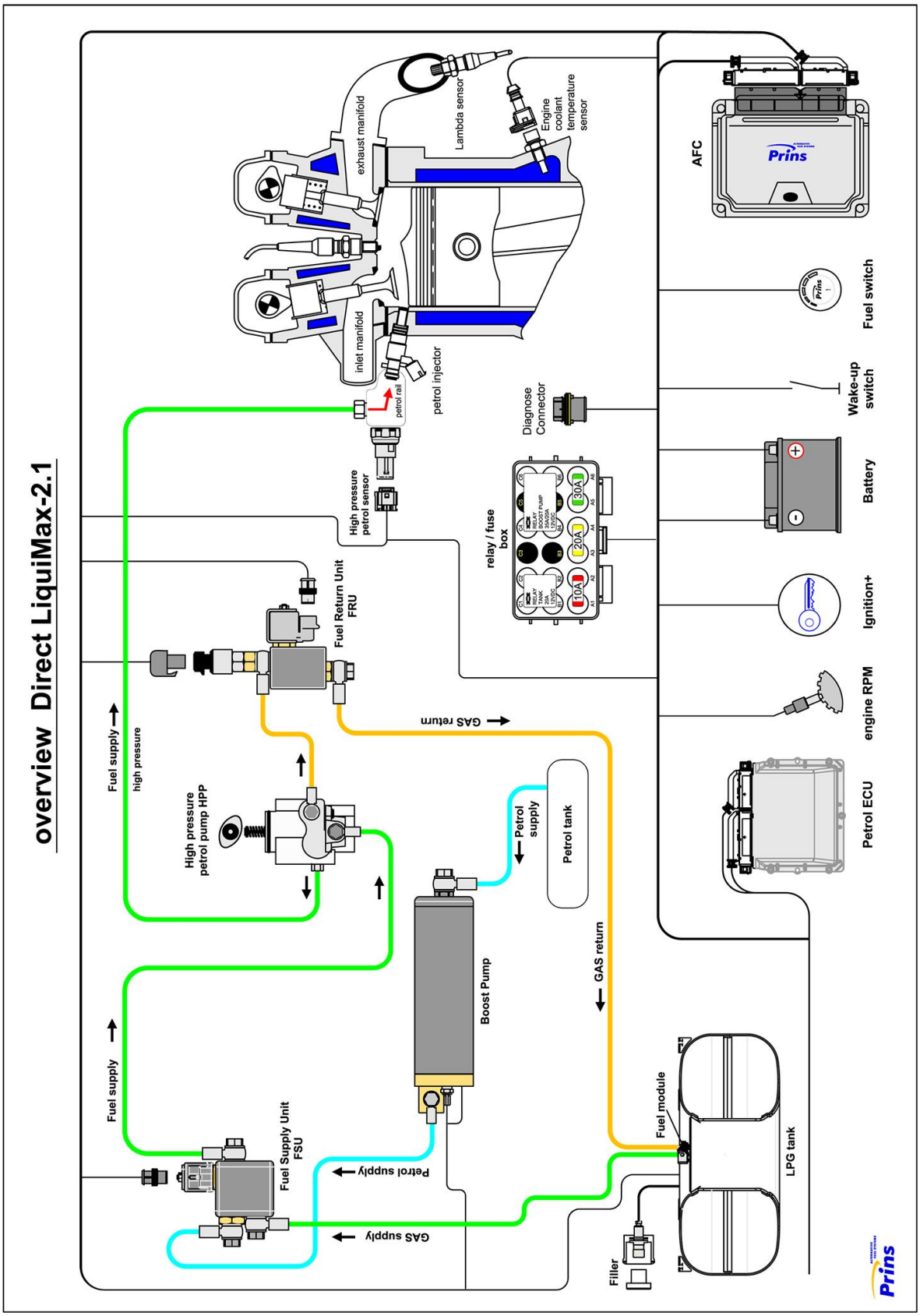
= IMPORTANT, CAUTION

= WEAR SAFETY GOGGLES

Direct LiquiMax



Overview Direct LiquiMax



Direct LiquiMax parts / approval numbers

<table>
<tr>
<td> 

1st generation
 

2nd generation</td>
<td> 

1st generation
 
2nd generation</td>
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<tr>
<td>Fuel Supply Unit : E4-67R-010269</td>
<td>Fuel Return Unit : E4-67R-010270
Pressure Sensor : E4-67R-010051</td>
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<td> 
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<td>  </td>
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<tr>
<td>Boost pump</td>
<td>High Pressure Pump : E4-67R-010266
High Pressure Rail : E4-67R-010267
High Pressure Injectors : E4-67R-010309</td>
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<td>Prins ECU : E4-67R-010098
E4-10R-030507</td>
<td>Fuel lines series XD : E4-67R-010247 XD3
E4-67R-010247 XD4</td>
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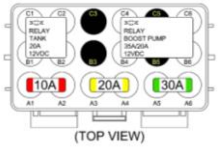
DLM-2.1 component location overview

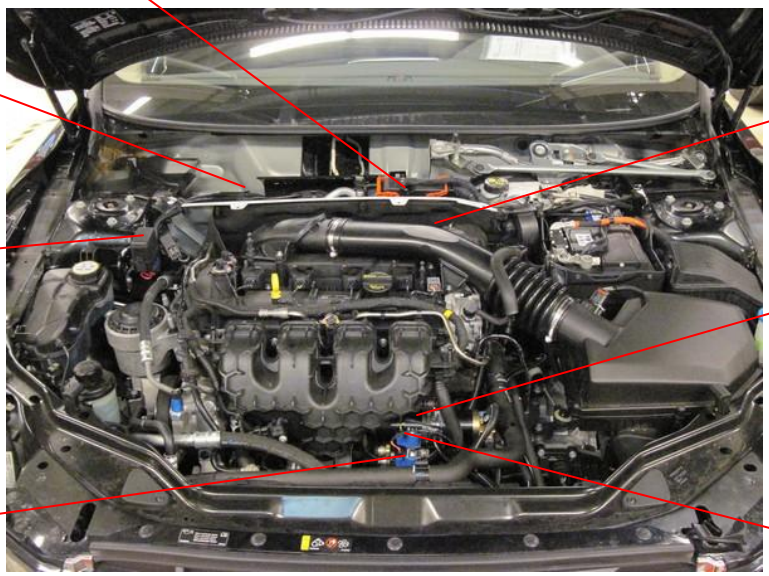
Petrol ECU

AFC

Fuse / relay box



FRU



HPP pump

Boost pump

FSU

L: R115 approval sticker
Right side centre door post

Removal of the Bosch High Pressure Pump

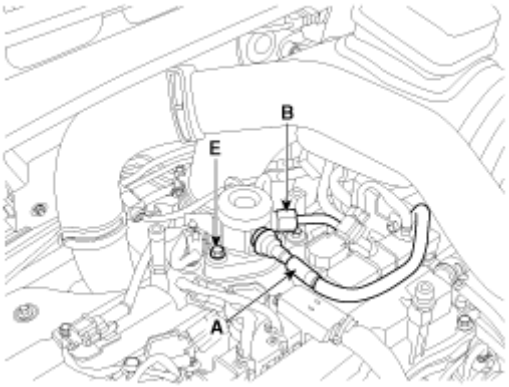
-REMOVAL-

-WARNING-

In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, there may be injury caused by leakage of the high pressure fuel.
Don't do any repair work right after engine stops (HOT engine).

- Turn the ignition switch OFF and disconnect the battery negative (-) cable.
- Ware safety goggles.
- Disconnect the fuel pressure regulator valve connector
- Disconnect the High Pressure fuel feed pipe (B)
- Remove the Low Pressure fuel pipe / hose (A).
- Remove the installation bolts (E), and then remove the high pressure fuel pump from the cylinder head assembly.

  CAUTION:
  Unscrew in turn the two bolts in small steps (0.5 turns). In case of fully unscrewing one of the two bolts with the other bolt installed, the housing surface of the cylinder head may break because of tension of the pump spring.



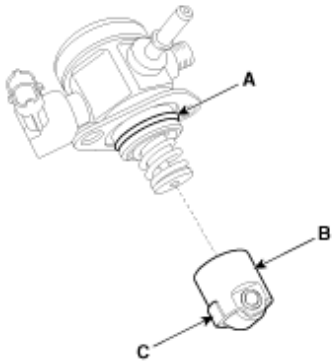
CAREFULLY store the removed petrol pump. Make sure no pollution can come into the pump.

Installation of the Bosch High Pressure Pump

-INSTALLATION-

Before installing the high pressure fuel pump, position the roller tappet (**B**&**C**) in the lowest position by rotating the crankshaft. Otherwise the installation bolts may be broken because of tension of the pump spring.

Apply engine oil to the O-ring (**A**) of the high pressure fuel pump, the roller tappet (**B**), and the protrusion (**C**). (roller tappet, only if removed from cylinder head)
Also apply engine oil to the groove on the location where the protrusion (**C**) is installed.



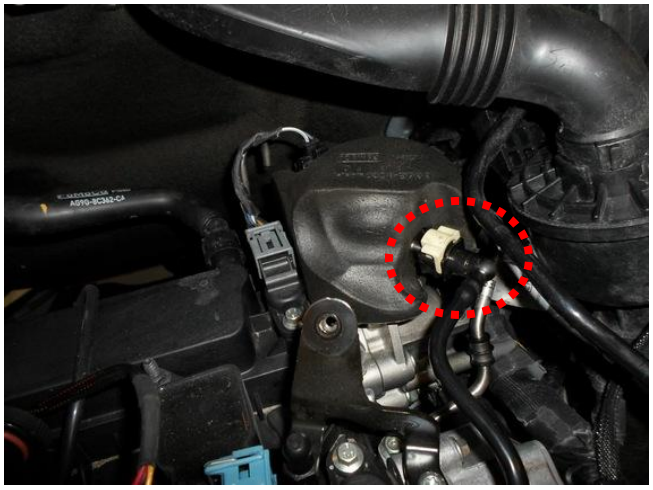
Installation bolts:
When tightening the installation bolts of the high pressure fuel pump, tighten and turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.
High pressure fuel pump installation bolt: 12.8 ~ 14.7 N.m

Fuel pipe:
First hand-tighten the nut(s) fully until they are not fastened any more in order to have them inserted in place and then completely tighten to the specified torque using a torque wrench.
If not tightening the bolts or nuts in a straight line with the mating bolt holes or fittings, it may cause a fuel leak due to broken threads.
High pressure fuel pipe installation nut: 26.5 ~ 32.4 N.m

Installation is reverse of removal.

High pressure pump installation

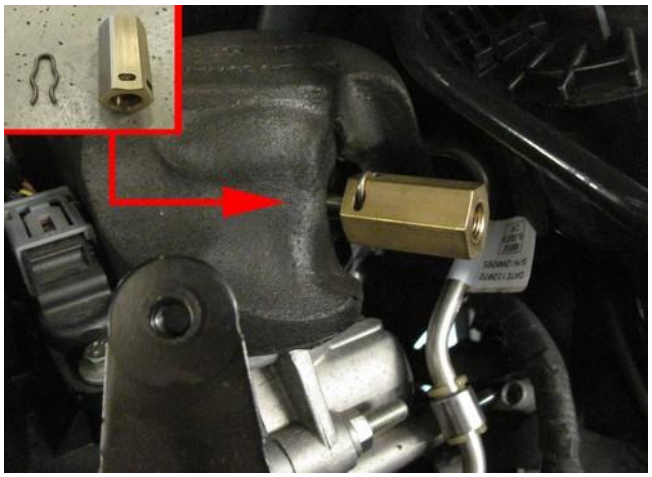
Replace the high pressure pump for the adapted high pressure pump.
(Follow the workshop manual of the car) ***Remove original petrol supply hose (quick releases)***




Remove the quick release of the fuel supply line to the high pressure pump and turn the fuel supply line 180 degrees with the quick release to the front.

“Old” high pressure pump.

“New” high pressure pump with return.

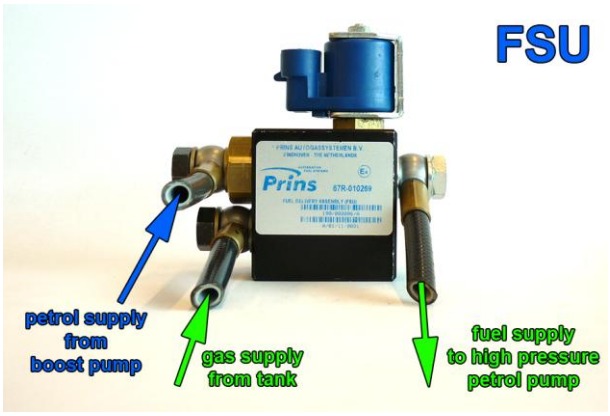



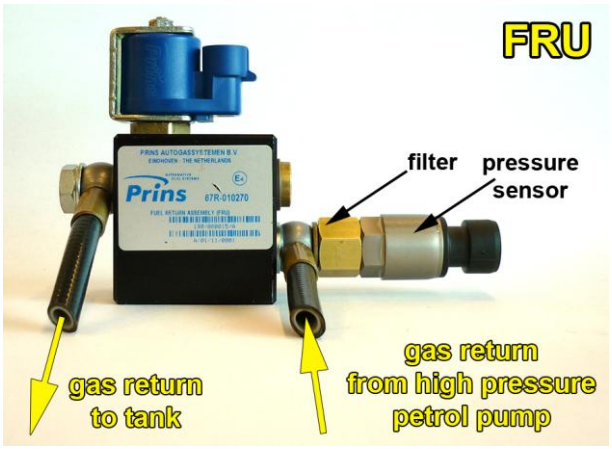
Mount “new” high pressure pump. Mount quick release to high pressure pump inlet.

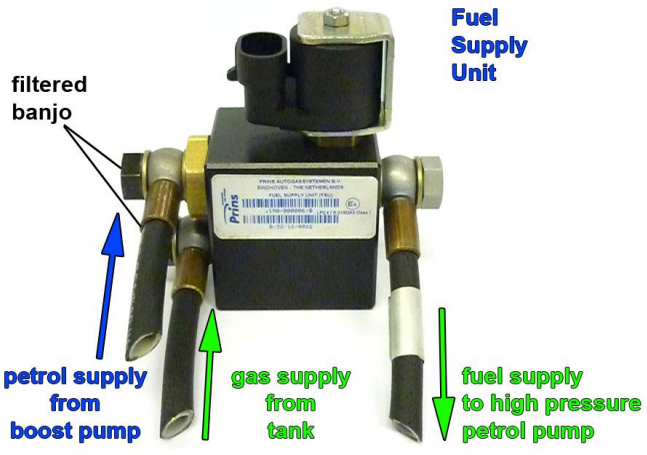
High pressure pump with return

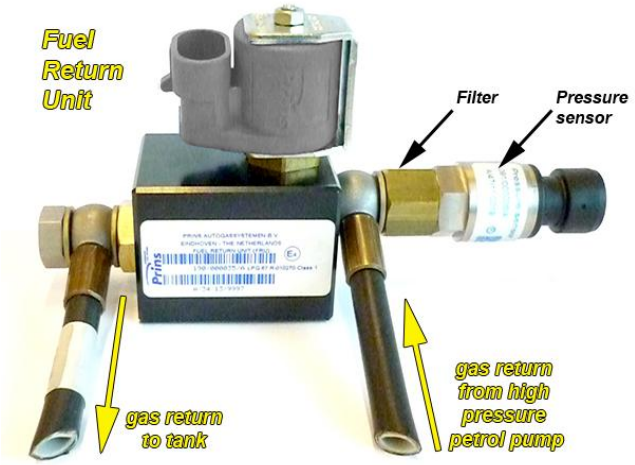
Replace the high pressure pump for the adapted high pressure pump.
(Follow the workshop manual of the car)

Fuel Supply Unit / Fuel Return Unit









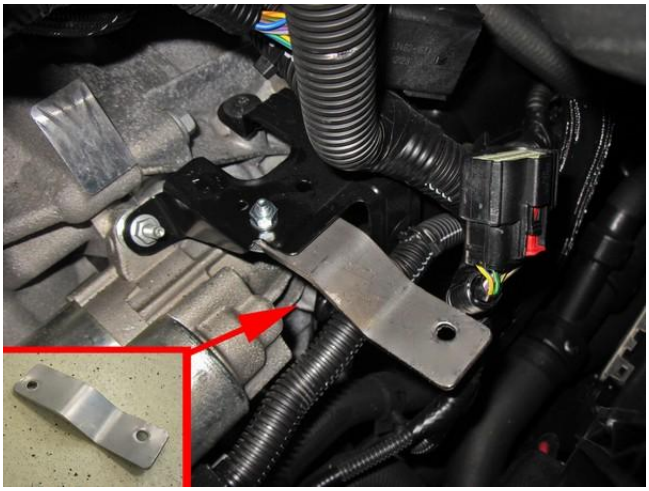
Black filtered banjo will only be used on inlet connections !

Filter inside sensor banjo

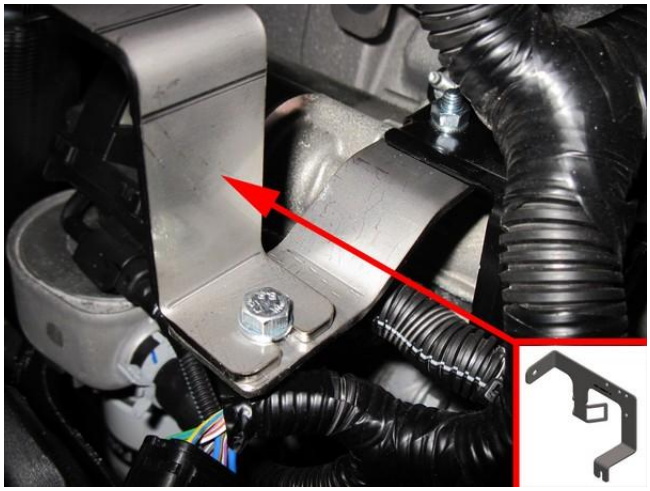
Manifold preparation

Carefully remove from inlet manifold

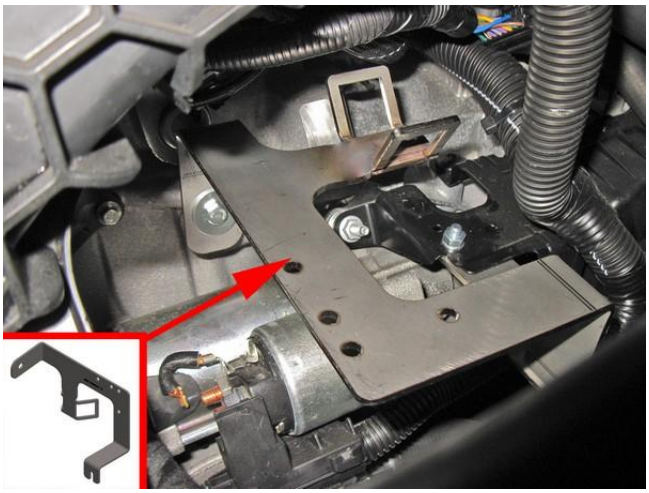
FSU / FRU / Boost pump installation 1



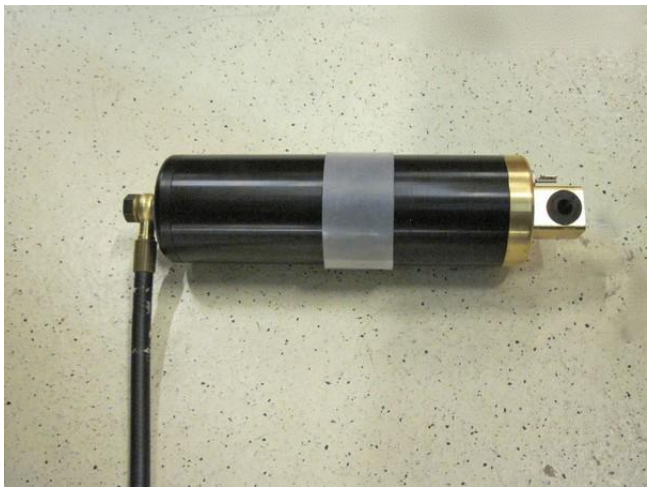
Mount support bracket just above starter.



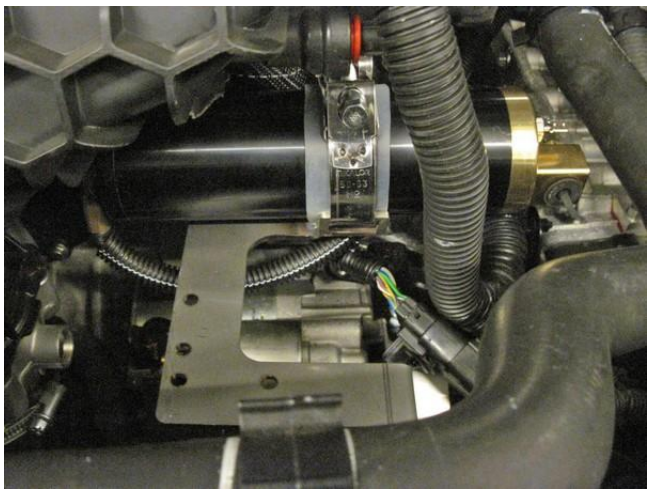
Mount FSU / FRU / Boost pump bracket.



Mount FSU / FRU / Boost pump bracket.

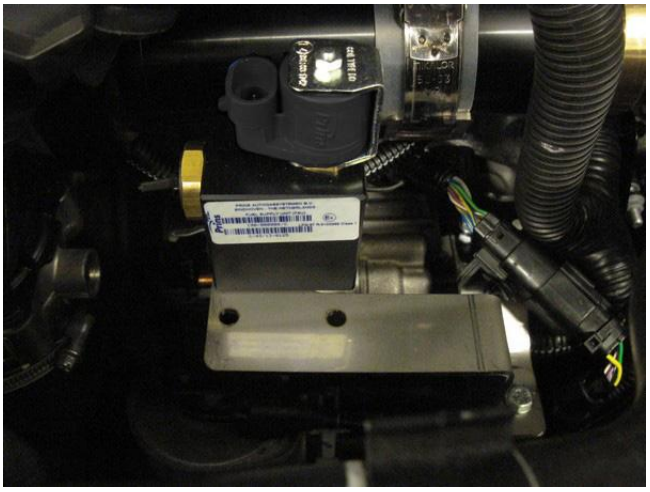


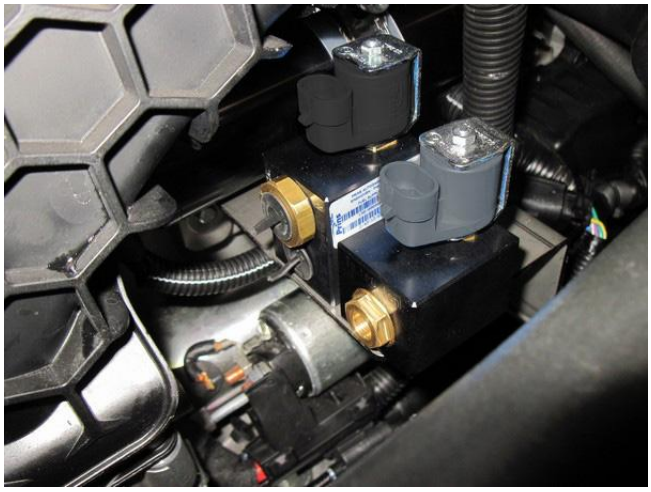
Mount boost pump with hose to bracket with clamp & rubber sleeve.



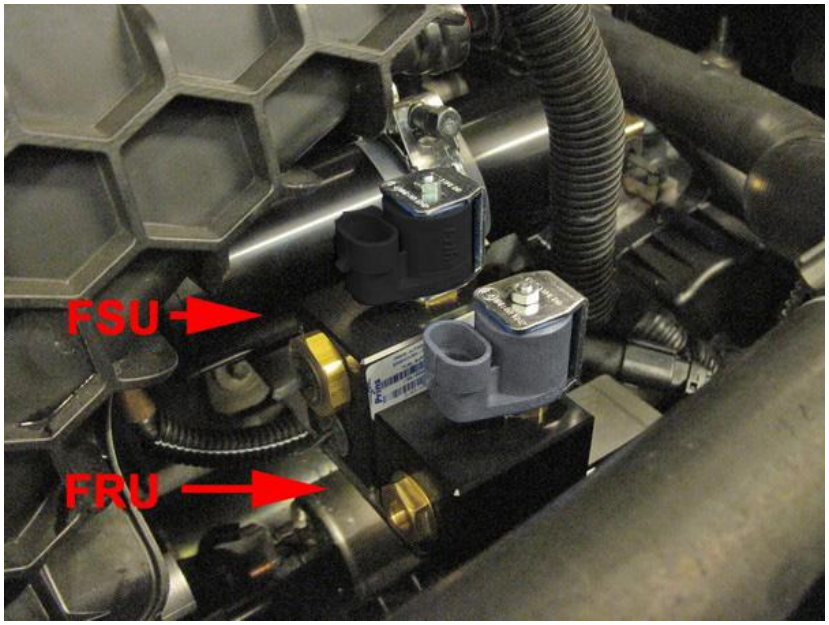
Mount boost pump with hose to bracket with clamp & rubber sleeve.

FSU / FRU / Boost pump installation 2

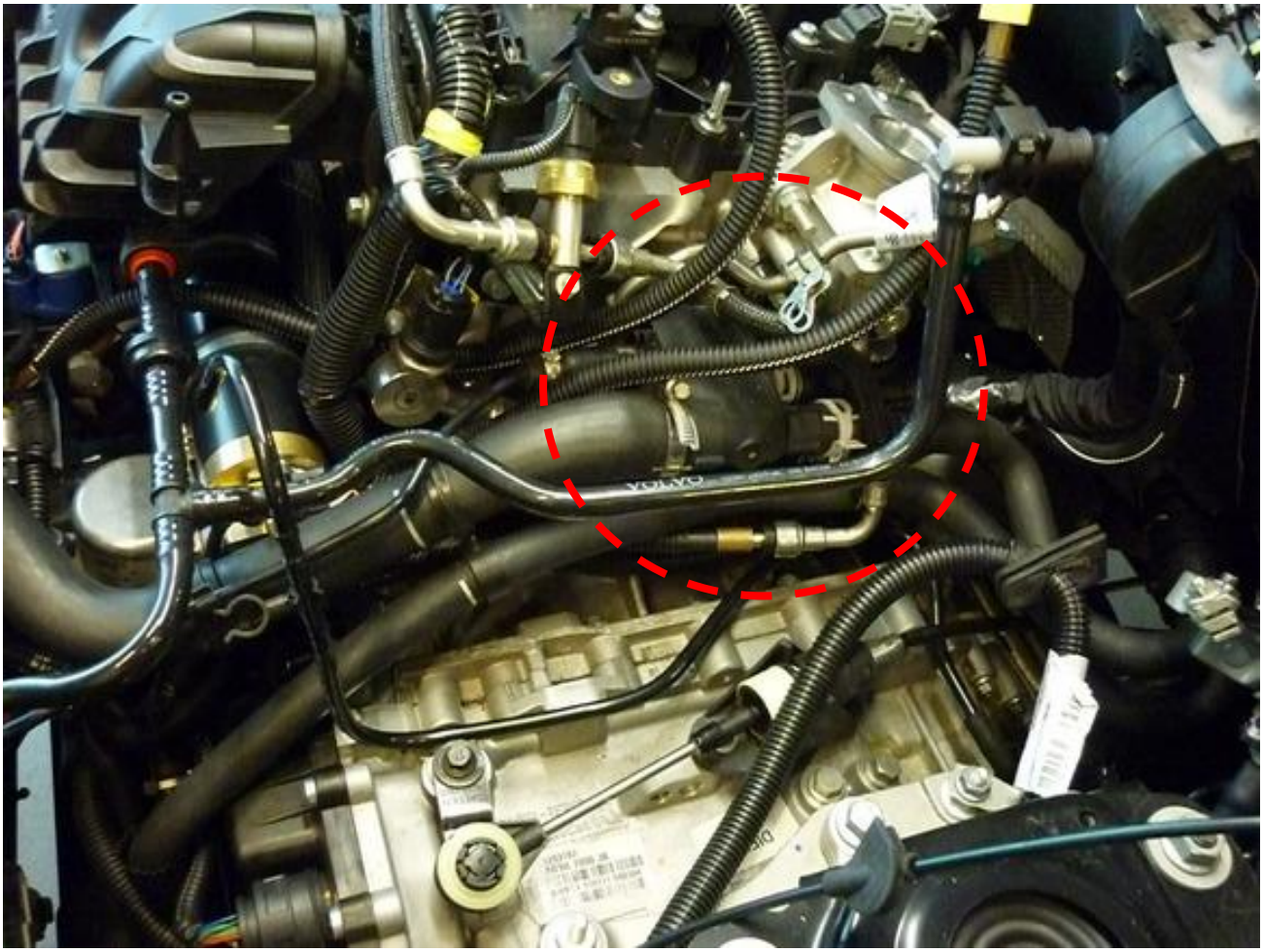




Mount FSU & FRU.



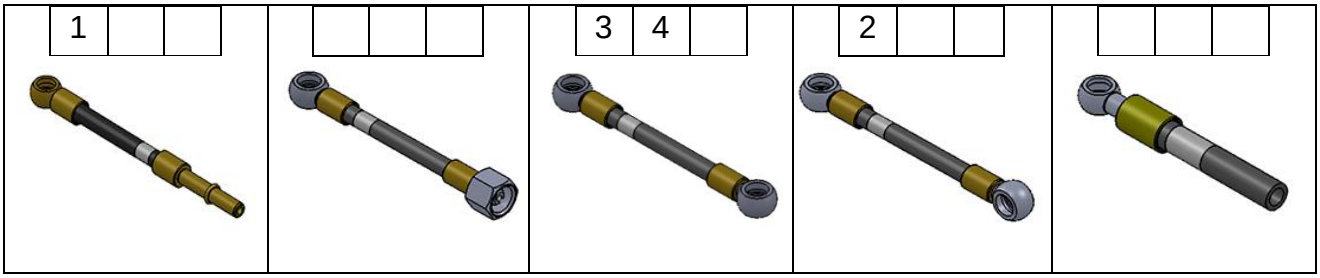
Connection of the fuel hose to the boost pump



Connect the hose from the original petrol fuel hose (quick connection) to the boost pump hose.

Lpg / petrol fuel lines

Hose		from	to	Length (cm)
1	XD-4	Adapter original petrol hose	Petrol boost pump	45
2	XD-3	Petrol boost pump	Fuel supply unit	45
3	XD-3	Fuel supply unit	High pressure petrol pump	55
4	XD-3	pressure petrol pump	Fuel return unit High	55

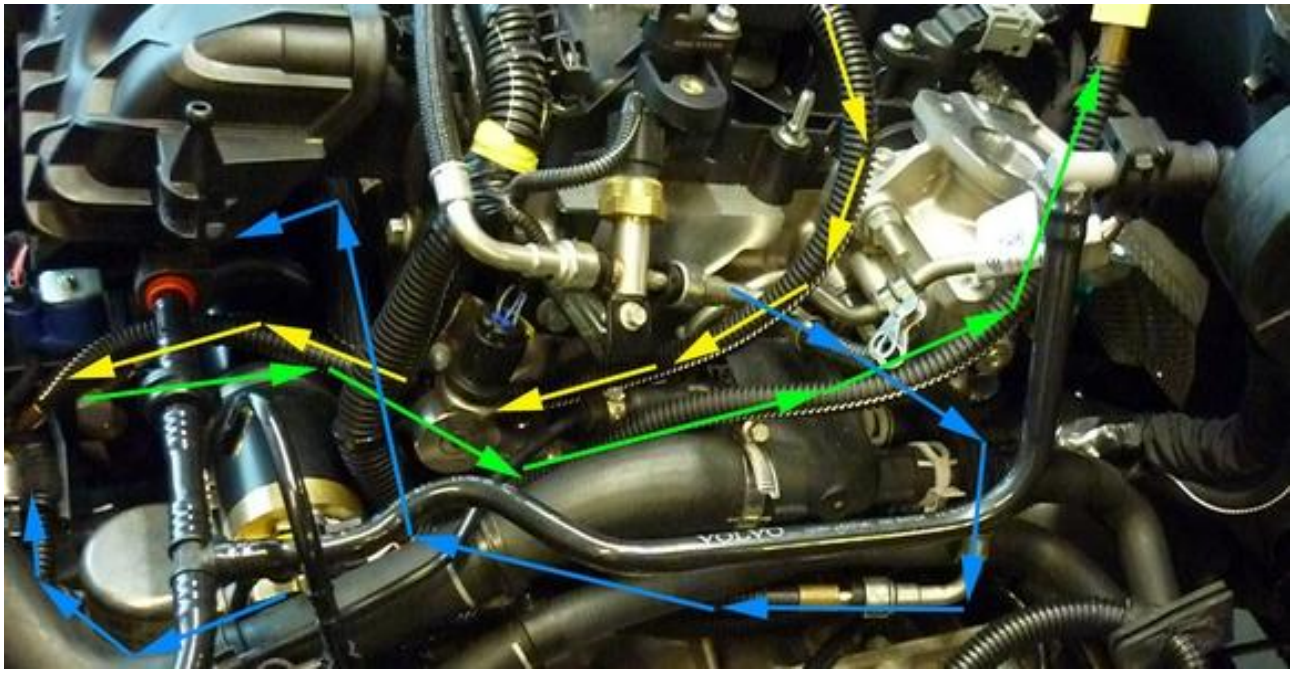


Install the fuel line using two bonded seal washers and banjo bolt :

<u>Filtered banjo:</u> (FSU supply inlets / boost pump inlet / HPP pump inlet : black filtered banjo) :

181/300009/A

Hose routing

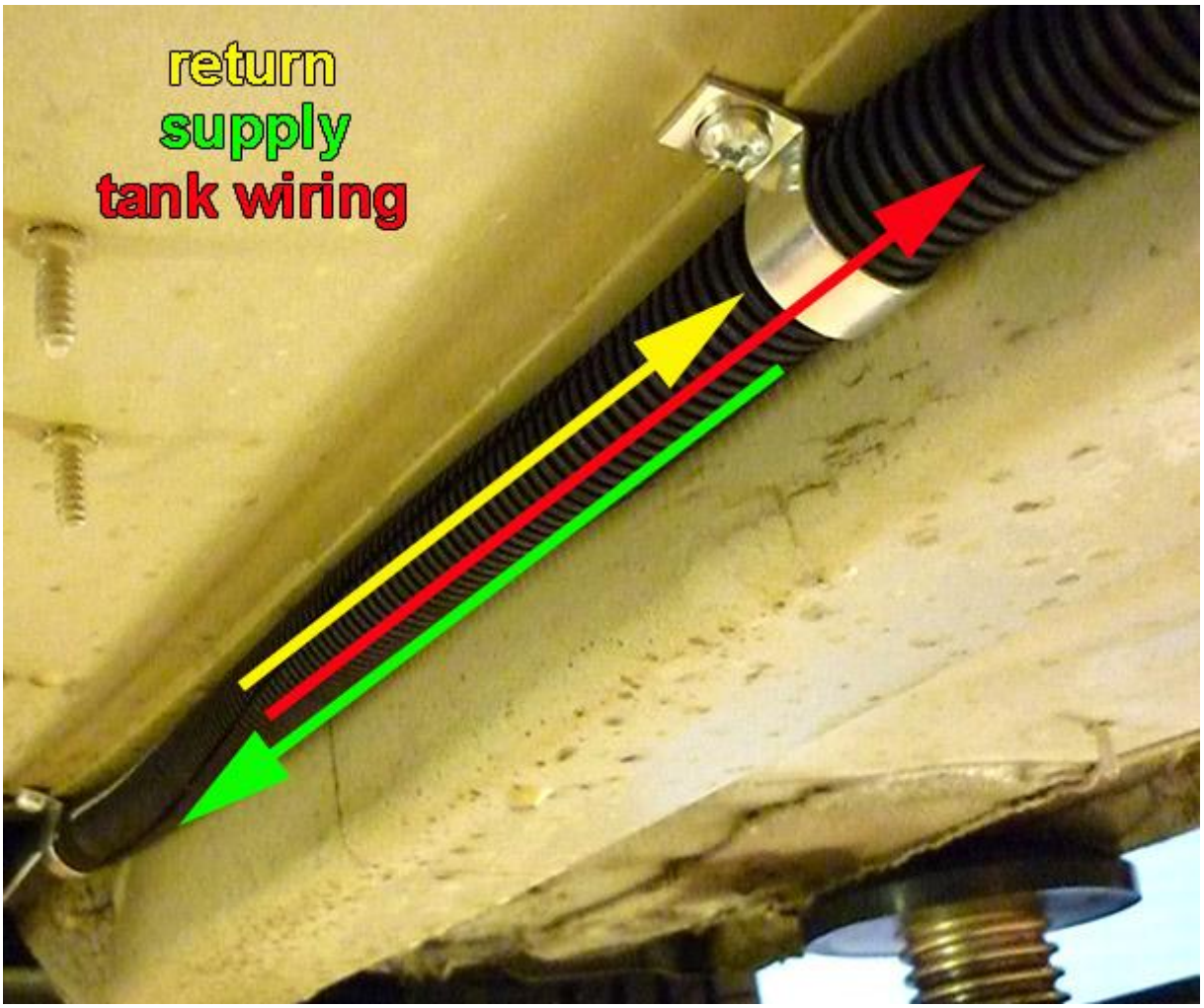


Mount the hoses from:
1) Original petrol hose to boost pump (blue arrows)
2) Boost pump to FSU (blue arrows)
3) FSU to high pressure petrol pump (green arrows)
4) High pressure petrol pump to FRU (yellow arrows)

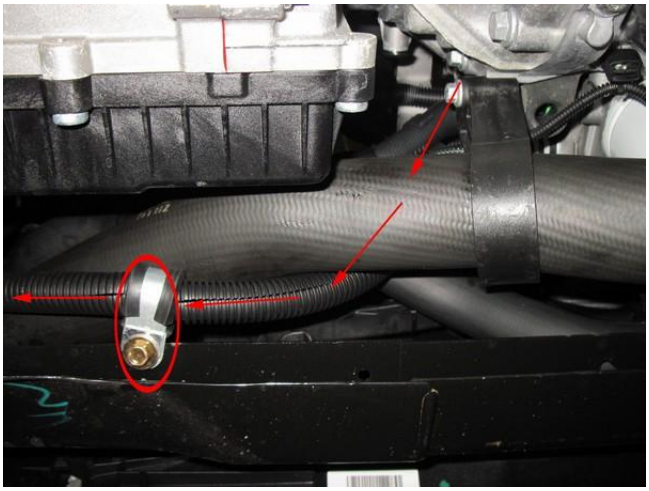
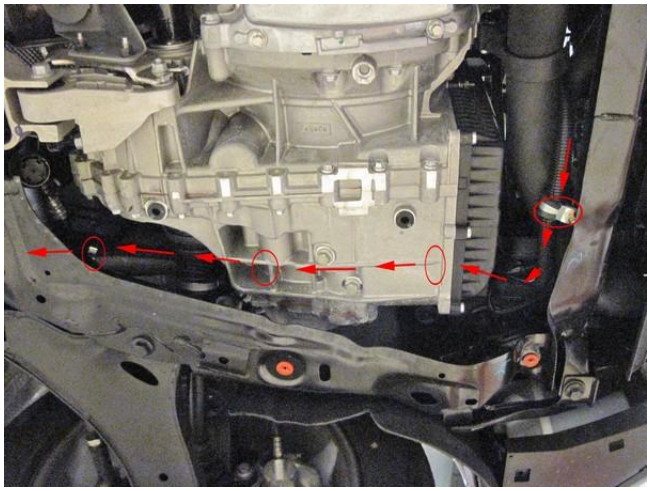
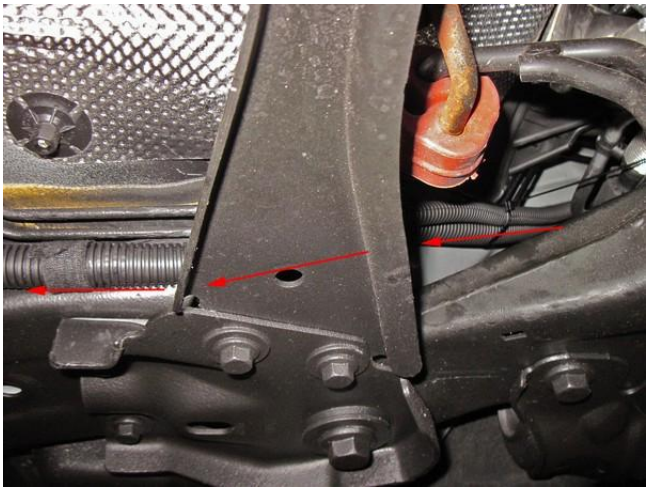
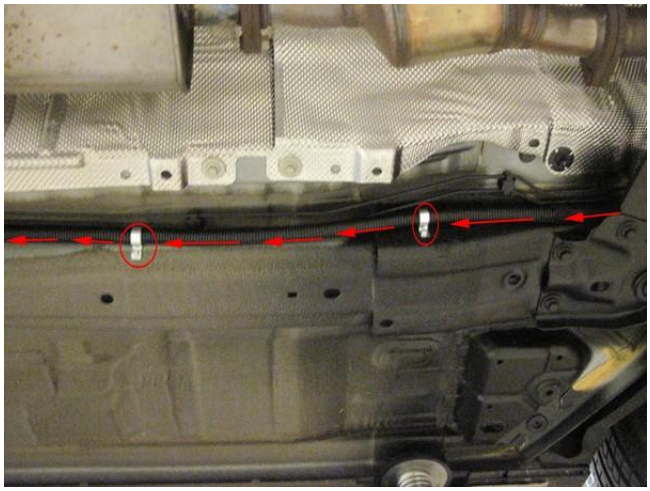
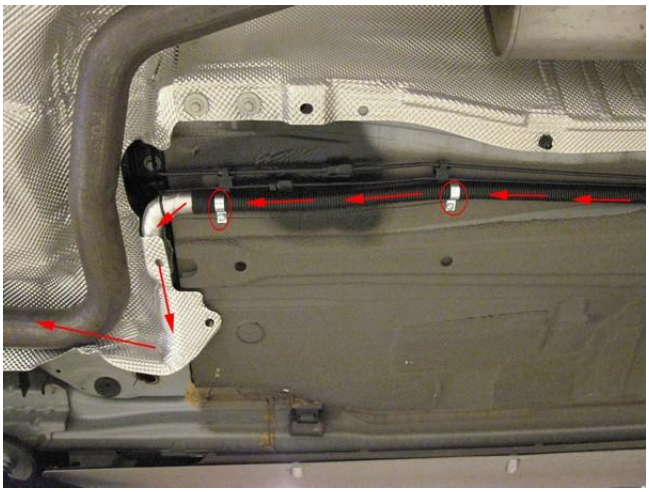
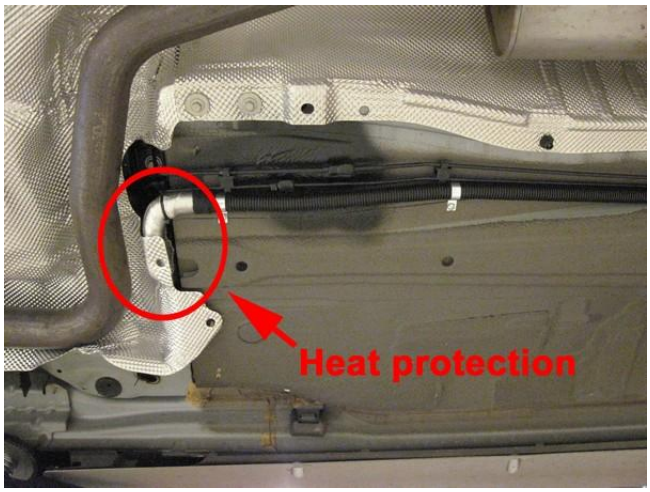
Overview at the high pressure pump

Supply hose – Return hose – Tank wiring

Protect the supply- and return hose together with tank-wiring using the Ø16 split tube.
Mount the “hose assembly “ with clamps, with a maximum distance of 40cm.

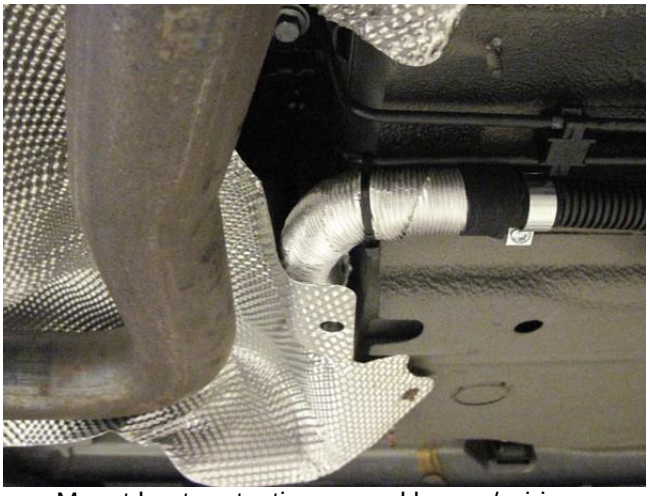


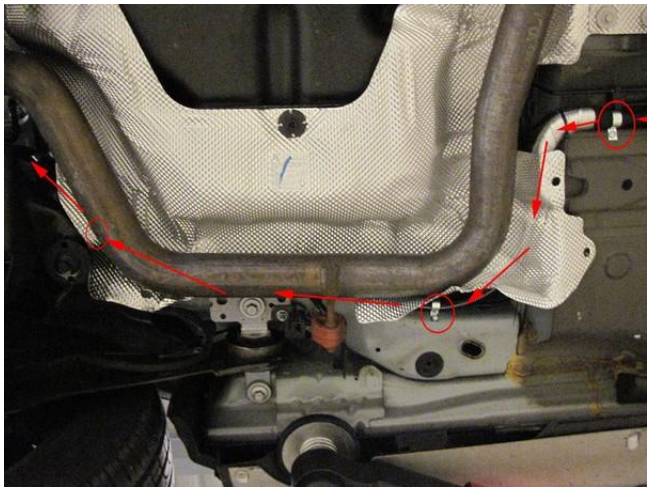
Supply hose – Return hose – Tank wiring 2

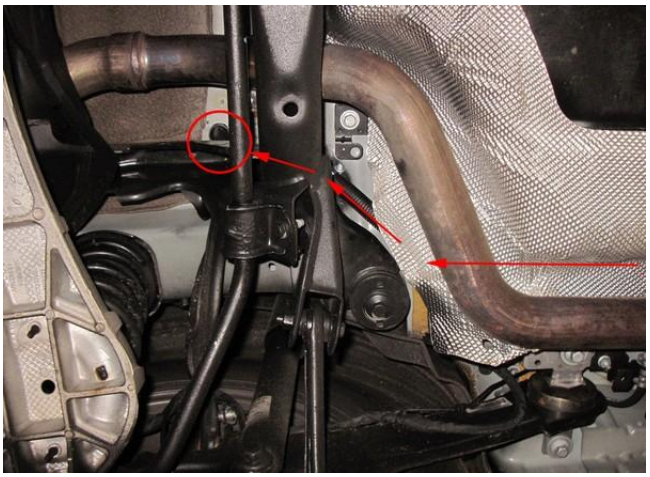
Mount heat protection around hoses / wiring.

Supply hose – Return hose – Tank wiring 3

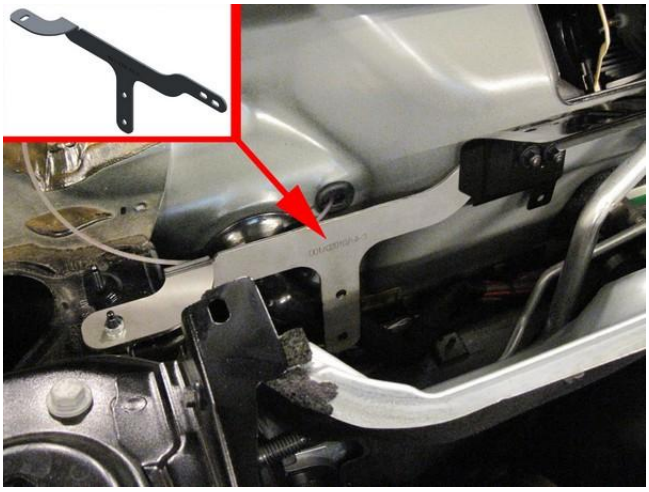


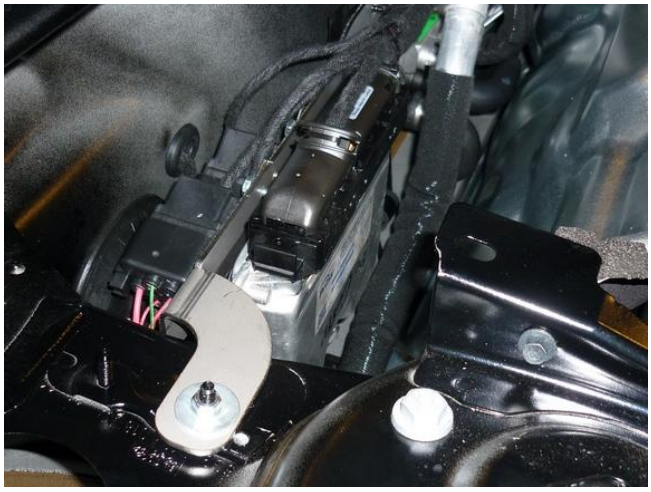


Mount heat protection around hoses / wiring.

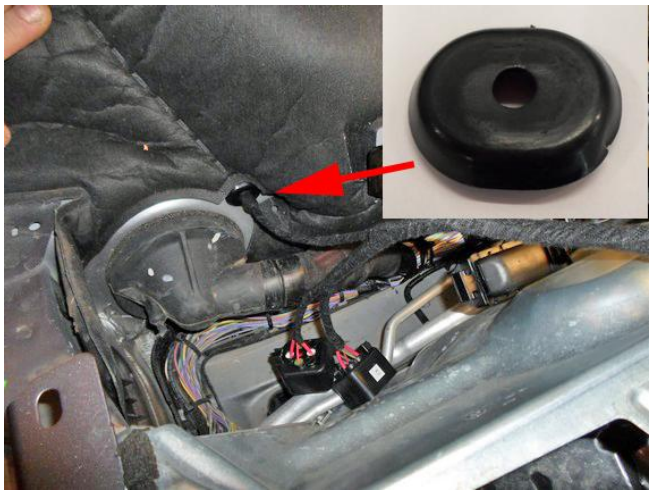


Mounting the AFC



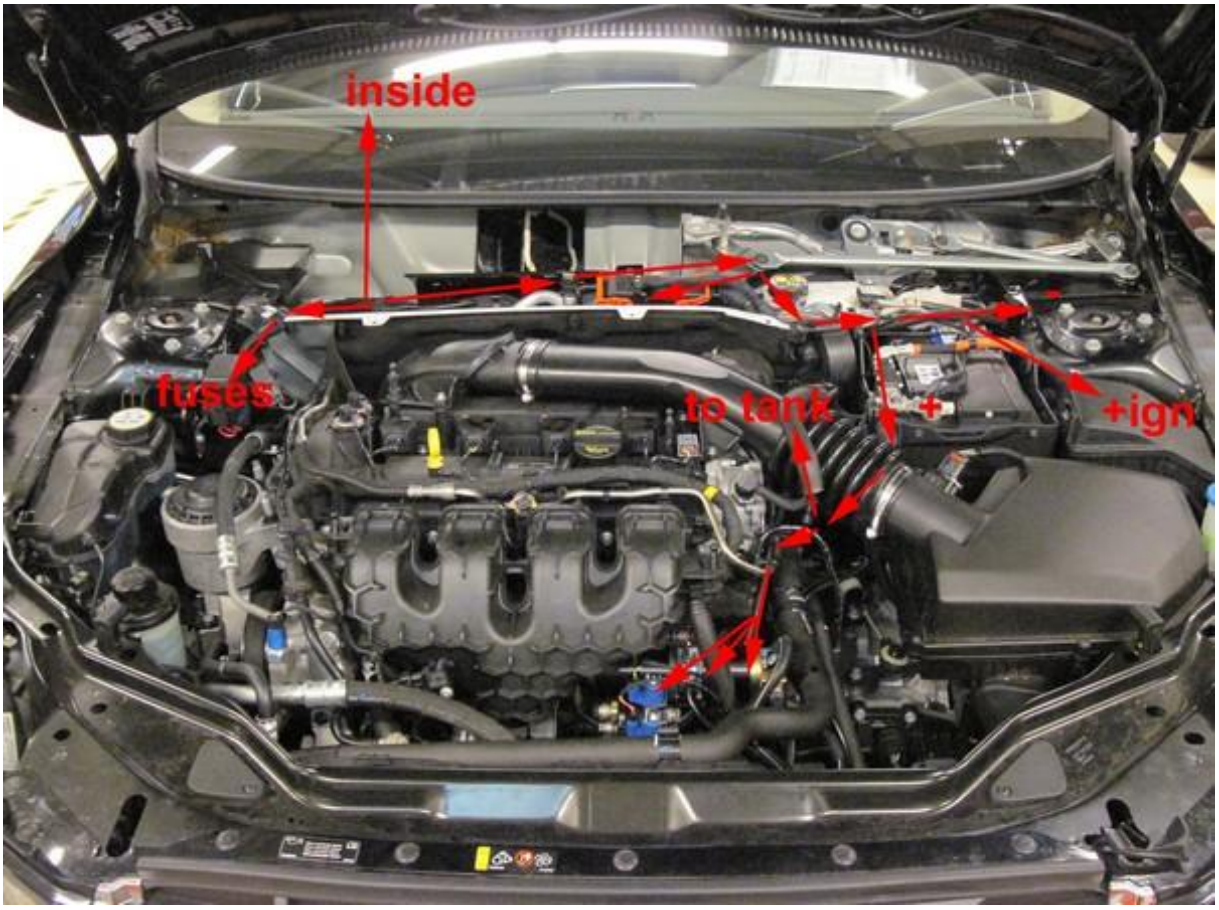


Mount the AFC bracket. Use original threaded ends with plastic nuts behind the black shield.
Mount the plastic AFC clip with the quick clips & mount the AFC in the plastic AFC clip.

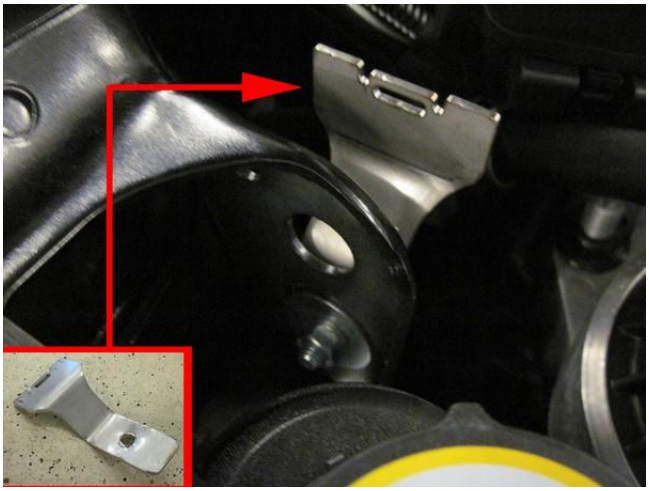
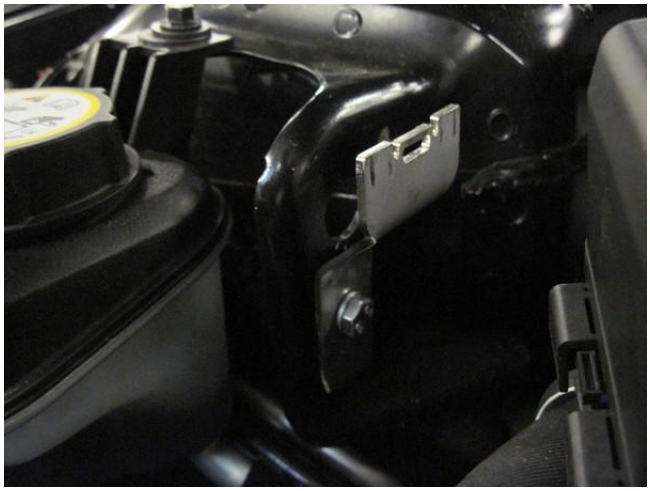


Wiring grommet to the passenger room behind AFC bracket

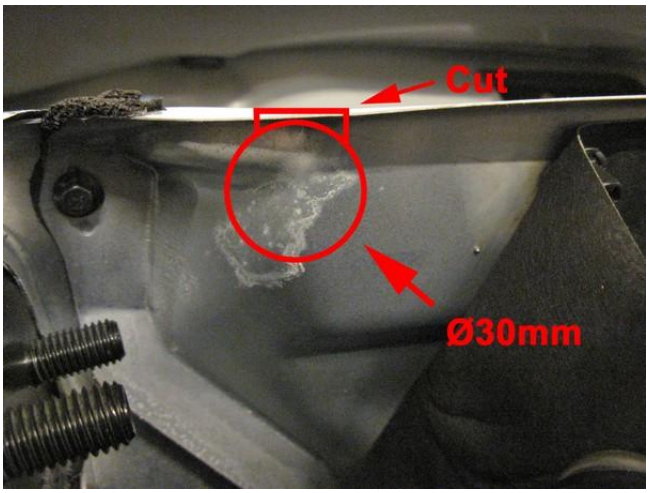
Wiring routing AFC

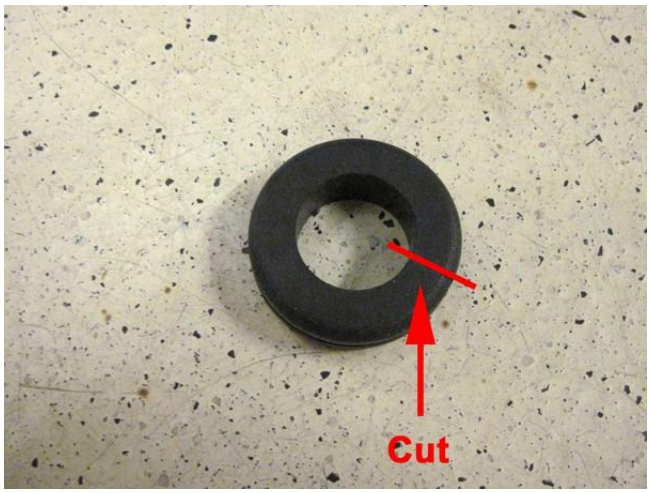


Fuse / relay box & Wiring transits

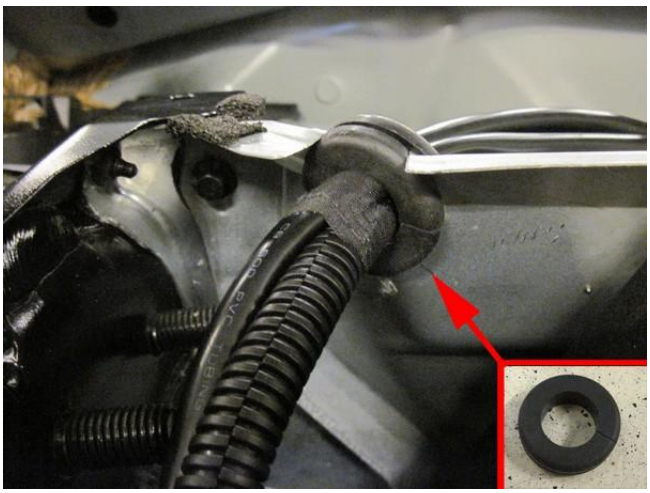
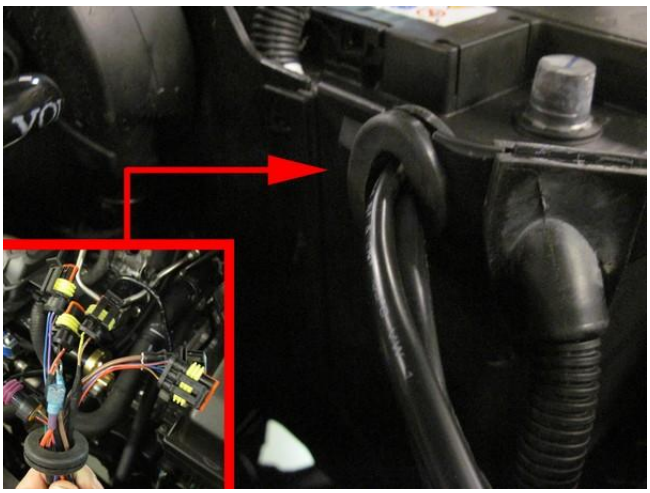



Mount fuse / relay bracket





Drill hole & cut out top for wiring transit. Cut grommet for wiring transit.

Mount wiring with grommet to vehicle. The same for the wiring transit at the battery box.

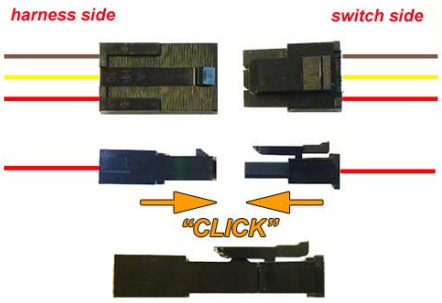
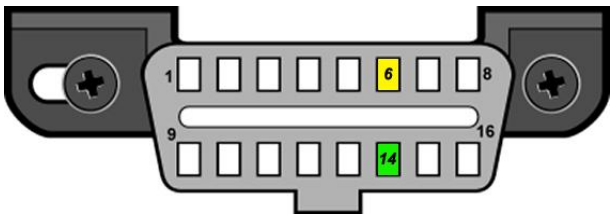
Mounting the fuel selection switch

⚠ Mount the switch.

or

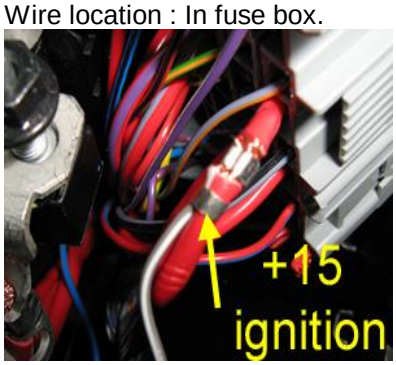
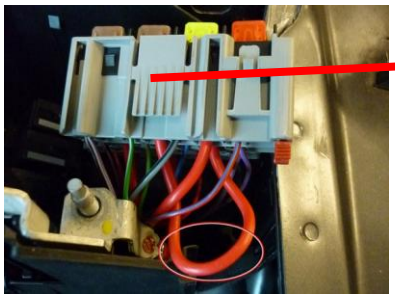
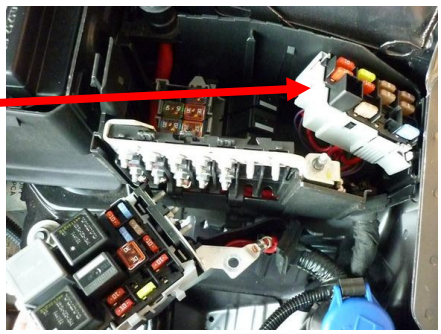
Electrical connections

Driver room

Wire number / code	**Wire colour**	**Connection**
3-pole micro connector 66 Ground fuel switch 3 +12V fuel switch 49 LIN fuel switch	 Brown Red Yellow	Connect the 3-pole connector to the Prins fuel selection switch.
		
51 CAN-High	Yellow	EOBD connector pin 6
70 CAN-Low	Green	EOBD connector pin 14
		

Electrical connections

Check and measure the wiring in case of changes in the cars wiring colours.
Insulate not used wires.

Wire number / code	*Wire colour*	*Connection*
1-32 MAIN GND ecu MAIN GROUND SENSE MAIN GND pump driver MAIN GND boost pump	brown	Connect to the '–' of the battery (-31) ; use a ring terminal. Wire colour : **Brown** Wire location : Under the black panel, under the windshield wiper 
4 – 13 – 44 +12V BATT sense +12V BATT fused +12V BATT boost pump +12V BATT pump driver	red	Connect to the '+' of the battery use a ring terminal. Do not place the fuse in the holder before having completed the installation of the LPG system. Wire colour : **Red** Wire location : + Battery 
7 +12V IGNITION	grey - white	Make a connection to ignition + / contact + (+15). Do not place the fuse in the holder before having completed the installation of the LPG system. Wire colour : **Red (wire loop)** Wire location : In fuse box.    

Electrical connections

Check and measure the wiring in case of changes in the cars wiring colours.
Insulate not used wires.

Petrol ecu → A = big ecu connector & B = smallest ecu connector

Wire number / code	*Wire colour*	*Connection*
36 AD6 25 DAC1	Blue-brown Green-white	*High pressure petrol sensor signal interruption* Sensor side. ECU side. *Wire colour :* **Blue - Brown** *Wire location :* Petrol ecu Pin **A9**
63 Ground Shift	Blue-green	*High pressure petrol sensor ground* *Wire colour:* **Blue - grey** *Wire location :* Petrol ecu Pin **A31**
17 AD2 10 DAC2	Blue-green Green	*Low pressure petrol sensor interruption* *Sensor side* *ECU side* *Wire colour :* **Purple - brown** *Wire location :* Petrol ecu Pin **A7**
40 Wake-up	Grey-red	*High pressure petrol sensor 5Volt supply* *Wire colour :* **Grey** *Wire location :* Petrol ecu Pin **A23**
60 DI3	Yellow-grey	*Airflow* *Wire colour :* **Yellow - purple** *Wire location :* Petrol ecu Pin **A55**
18 AD1	Blue-white	*For measuring the inlet manifold pressure from the engine MAP sensor.* *Wire colour :* **Green - Brown** *Wire location :*Petrol ecu pin **A83**
8 RPM	Purple-white	*For measuring the engine speed signal.* *Wire colour :* **Brown - Blue** *Wire location :* Petrol ecu pin **A80**
15 T-ect	Grey	*For measuring the engine coolant temperature.* *Wire colour :* **Yellow** *Wire location :* Petrol ecu pin **A12**
56 DI2	Yellow-green	*Petrol fuel pump driver (PWM in)* *Wire colour :* **Yellow - Orange** *Wire location :* Petrol ecu Pin **B45 (!! B-connector)**

Electrical connections

Insulate not used wires.

Wire number / code	*Wire colour*	
19 AD 4	Blue	insulate
20 AD 3	Blue-pink	insulate
21 AD 9	Blue-purple	insulate
22 LSS 1	Purple-white	insulate
23 LSS 2	Purple-green	insulate
42 Digital out pull up 2	Red-purple	insulate
58 +12V switched	Red-white	insulate
61 DI4	Yellow-blue	insulate
74 DAC 3	Green-pink	insulate

Electrical connections

Check and measure the wiring in case of changes in the cars wiring colours.
Insulate not used wires.

Engine room

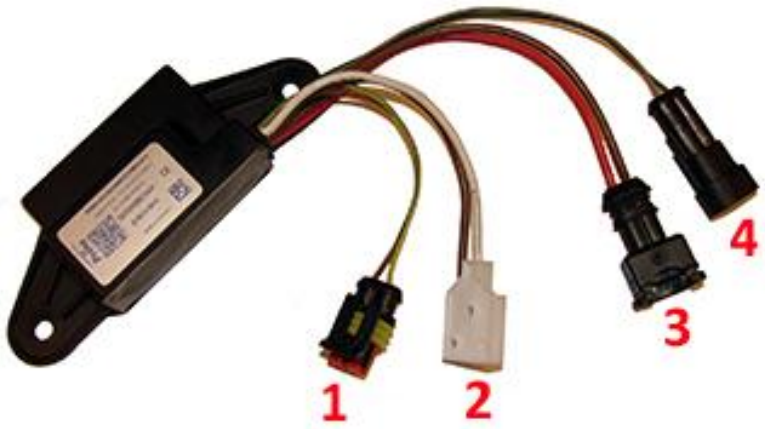
Wire number / code	**Wire colour**	**Connection**
3-pole connector 35 C Ground pin A 9 +5V sensor pin B 16 Psys pin C	 Brown Red Green	Connect the 3-pole connector to the Psys sensor positioned into the Fuel Return Unit. Sensor wire pin A Sensor wire pin B Sensor wire pin C
14 T-LPG	Grey	Not used, insulate.
2-pole connector Boost Pump 106 + Lock-off Boost Pump 98 Ground lock-off	Red White-yellow	Connect the 2-pole connector to the lock-off valve of the Boost Pump.
2-pole connector FSU 108 + Lock-off FSU 100 Ground lock off	Red Pink-yellow	Connect the 2-pole connector to the lock-off valve of the Fuel Supply Unit
2-pole connector FRU 90 + Lock-off FRU 82 Ground lock off	Red Blue-yellow	Connect the 2-pole connector to the lock-off valve of the Fuel Return Unit
4-pole diagnose connector 46 Service TxD 65 Service RxD 68 C ground	 Grey Grey Brown	Diagnose connector for service / diagnosis Connector pin 1 Connector pin 2 Connector pin 4
Boost pump relay 107 + relay boost pump 99 GND relay boost pump +12V fused BATT +12V Boost pump	Red Green-yellow Red Red	Pin 86 of the boost pump relay Pin 85 of the boost pump relay Pin 30 of the boost pump relay Pin 87 of the boost pump relay

Electrical connections

Check and measure the wiring in case of changes in the cars wiring colours.
Insulate not used wires.

LPG tank housing

Wire number / code	***Wire colour***	***Connection***
3-pole tank level connector *40 Ground tank gauge* *12 Tank level in* *11 + tank level supply*	 Brown Blue Red	Connect the 3-pole connector to the tank level sensor. Connector pin 1 Connector pin 2 Connector pin 3
1. *2-pole connector tank lock-off*	Green-yellow Brown	Pump driver to lock-off power Pump driver to lock-off ground
2. *3-pole fusite*	Red Brown -	1. Pump power 2. Pump ground 3. not used
3. *2-pole connector tank pump*	Red 2.5mm^2 Brown 2.5mm^2	Pump driver power Pump driver ground
4. *2-pole connector*	Grey Green	Pump driver diagnose Pump driver control



Wiring tank relay 2 + tank relay 26 Ground tank relay +12V BATT fused +12V pump driver	 Red Green-yellow Red 2.5mm^2 Red 2.5mm^2	 Pin 86 of the tank relay Pin 85 of the tank relay Pin 30 of the tank relay Pin 87 of the tank relay

Checklist after installation

1. Install the system fuses.
   Turn on ignition.
   Connect the Prins interface wire and run the Prins diagnosis program.
   When working on the car, beware of moving and rotating parts in the engine compartment
   (even when the engine is not running !!).

2. When commissioning the LPG system, you must activate the AFC with the diagnosis software.

3. Check whether the program in the AFC matches with the car (dedicated engine set):
   See “Identification” in the diagnosis program.

4. Check all components and connections for any LPG leakage, use a LPG leak detector device or
   a fluid detection like soap. Also check for petrol leakage. Make sure the solenoid valves are in open position.
   No evidence of leakage is permitted.
   Caution for moving and rotating parts in the engine compartment !

5. Use the diagnosis software to check again all input and output signals.

6. Check the system for error codes and solve these, if required.
   Check the petrol MMS for EOBD error codes.
   Place the protection connector back on the diagnose connector.

7. Make a test drive and check the cars drivability on LPG and petrol.