ALTERNATIVE FUEL SYSTEMS

Prins

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

Installation manual Dedicated PART 2/2

DIRECT LIQUI max-2.0 HIGH PRESSURE LIQUID LPG INJECTION

MANUFACTURER	FORD
TYPE	FOCUS
ENGINE DISPLACEMENT	1.0
NUMBER OF VALVES	12V
ENGINE CODE / NUMBER	M1DA / M2DA
VEHICLE CATEGORIES	M
TRANSMISSION	MT
VERSION	**ACF-2.1**
PETROL ECU MANUFACTURER / CODE	FoMoCo
HIGH PRESSURE PETROL POMP	Bosch 0261520094 / 0261520095
HIGH PRESSURE PETROL INJECTOR	FoMoCo
MODEL YEAR:	2013
SYSTEM APPROVAL NUMBER (R115)	E4-115R-000009 / DLM-LPG 02
LOCATION R115 SYSTEM STICKER	right side, centre door post
ENGINE SET NUMBER	347/070045/A / 347/070024/A
MANUAL NUMBER	076/0704800
DATE	19-4-2016

Version 2013-09-28 D

TABLE OF CONTENTS

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-2.0 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 / servicing** 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 the 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 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
- 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 (5-50Nm)
- 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)
- 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

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)

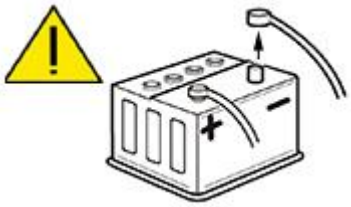
Tightening moments

		Nm	Spanner mm
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		24.5	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
Boost pump clamp		7	10
High pressure petrol fuel line		24-35	17

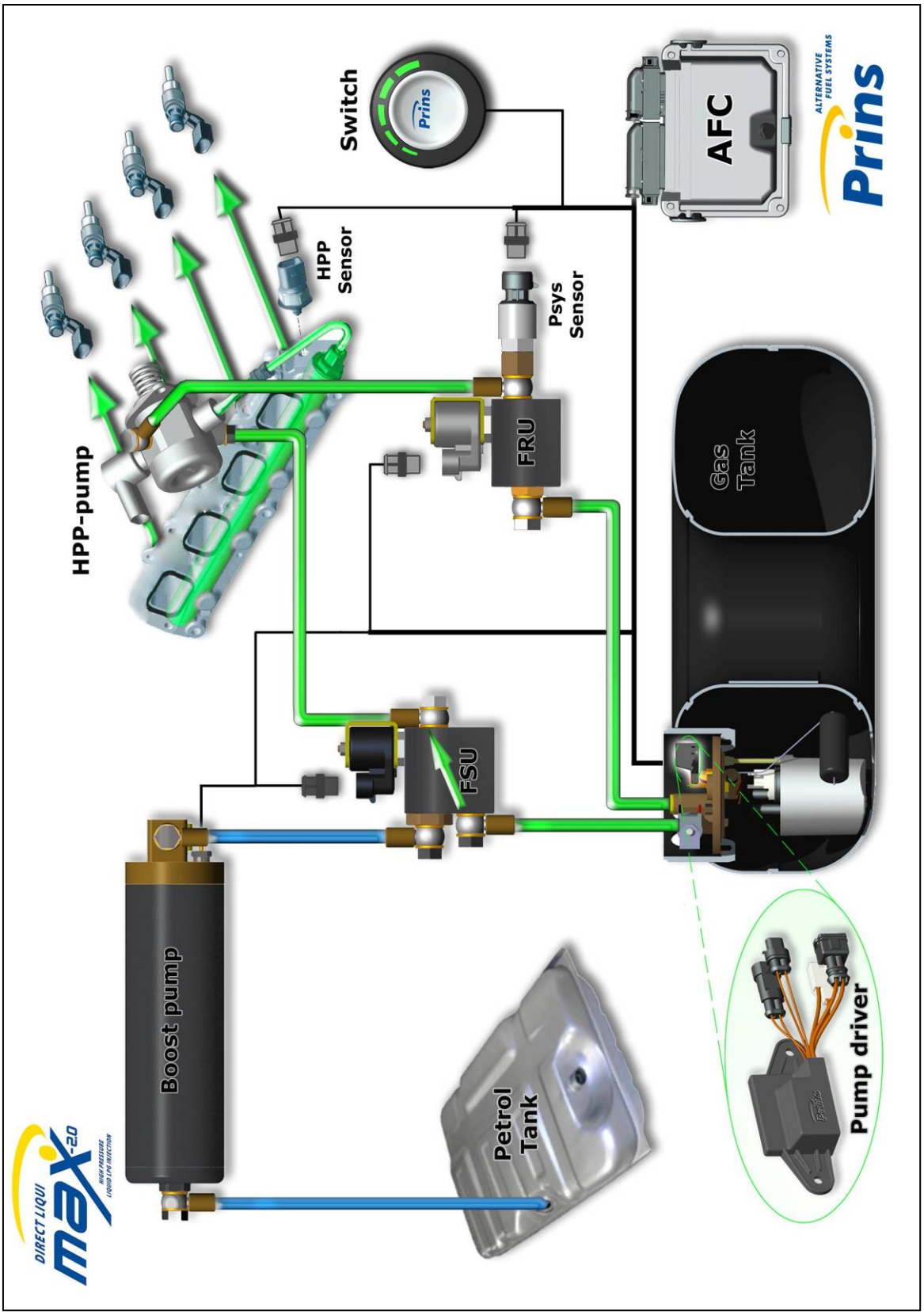
EXPLANATION OF SYMBOLS :

= IMPORTANT, CAUTION

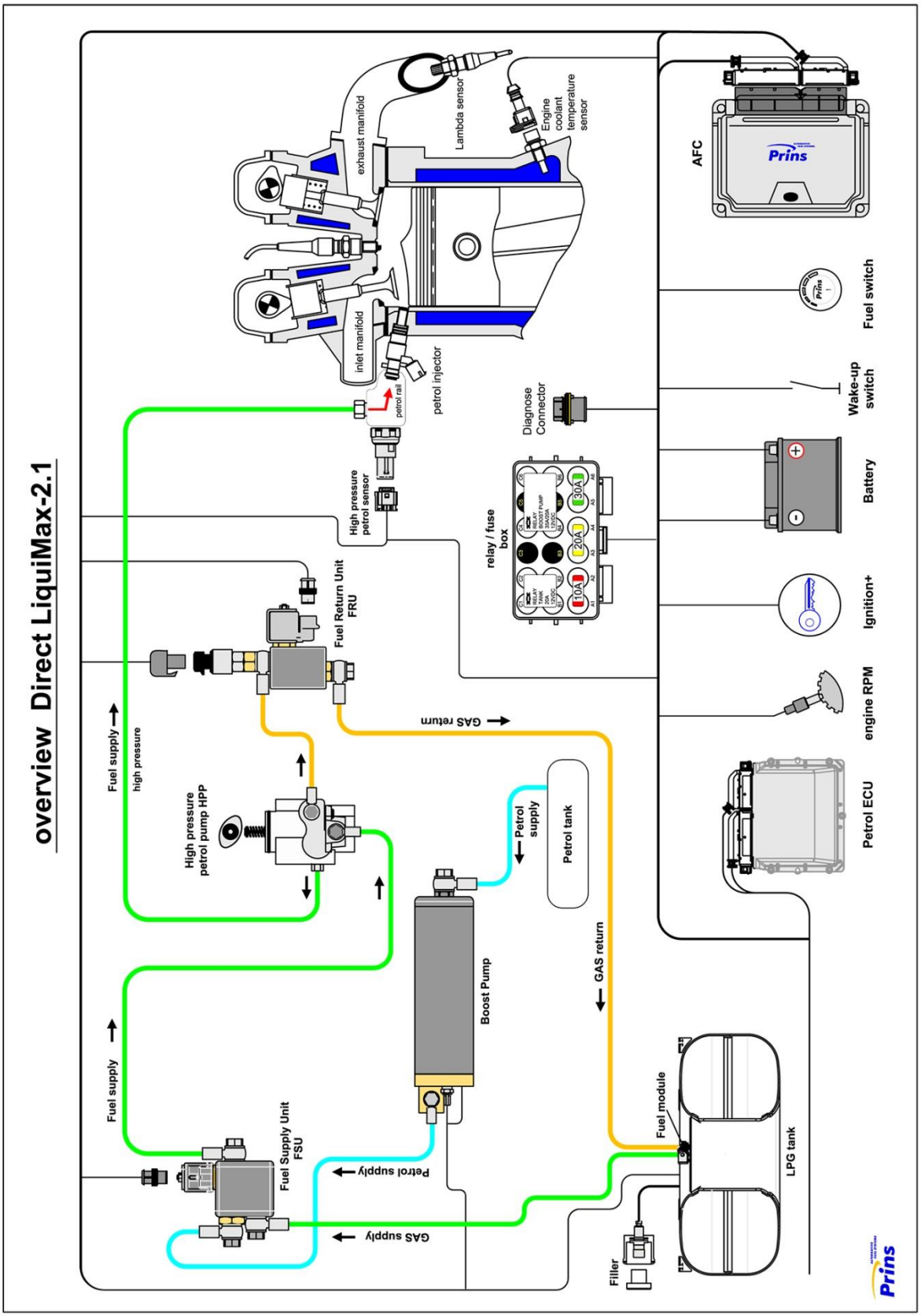
= WEAR SAFETY GOGGLES



Direct LiquiMax-2.0, AFC-2.1



Direct LiquiMax-2.0 diagram, AFC-2.1



Direct LiquiMax parts / approval numbers

1st generation

2nd generation

Fuel Supply Unit : E4-67R-010269

1st generation

2nd generation

Fuel Return Unit : E4-67R-010270
Pressure Sensor : E4-67R-010051

Boost pump

High Pressure Pump : E4-67R-010266
High Pressure Rail : E4-67R-010267
High Pressure Injectors : E4-67R-010309

Prins AFC: E4-67R-010098
E4-10R-030507

Fuel lines series XD : E4-67R-010247 XD3
E4-67R-010247 XD4

DLM component location overview

HPP pump

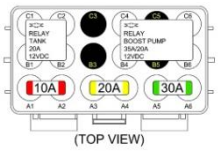
Petrol ECU

FSU

AFC

FRU

Fuse / relay box



Boost pump

R115 approval sticker :
Right side centre door post

Removal of the Bosch High Pressure Petrol Pump

-REMOVAL-

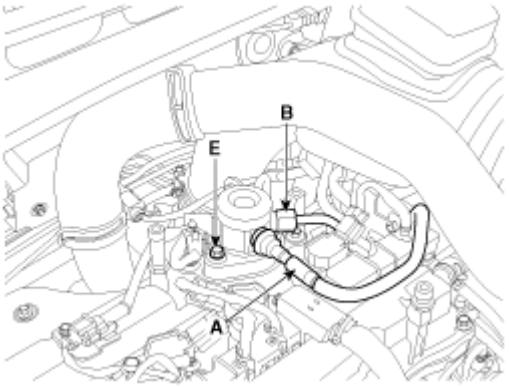
-WARNING-

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.



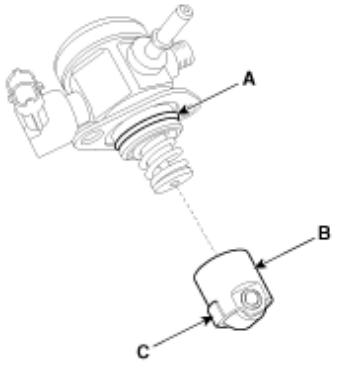
CAREFULLY store the removed petrol pump. Make sure no pollution can come into the pump.

Installation of the Bosch High Pressure Petrol 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.



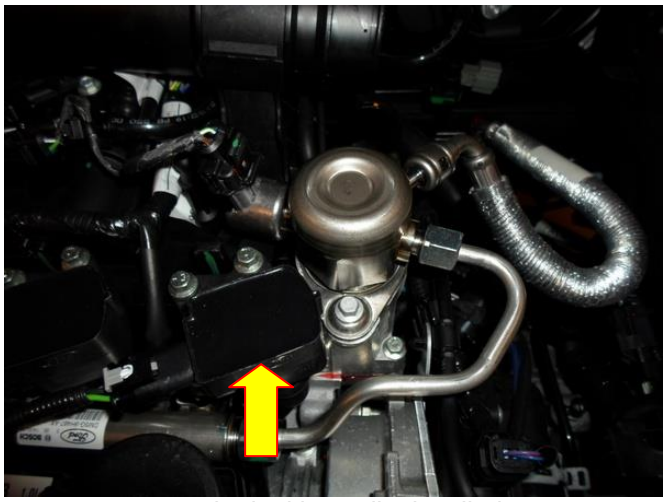
Installation bolts:
When tightening the installation bolts of the high pressure fuel pump, tighten and turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.
High pressure petrol pump installation bolt: 12.8 ~ 14.7 N.m

Petrol 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 petrol pipe installation nut: 26.5 ~ 32.4 N.m

Installation is reverse of removal.

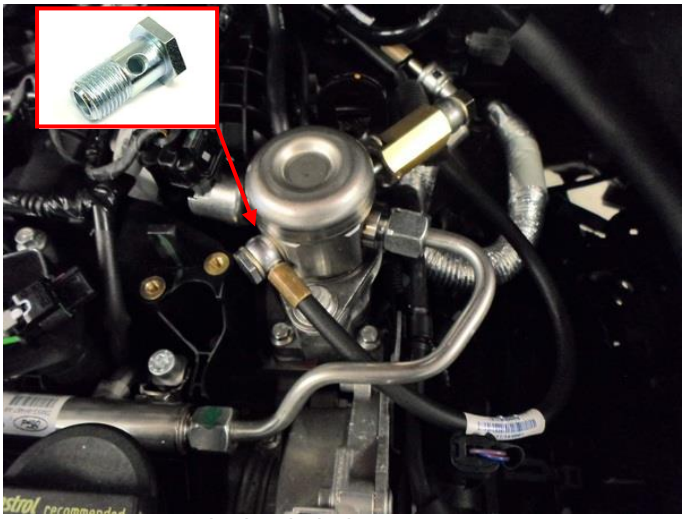
High pressure pump installation

Remove air-filter, ignition coil cil.3,
Replace the high pressure pump for the adapted high pressure pump.
(Follow the workshop manual of the car)



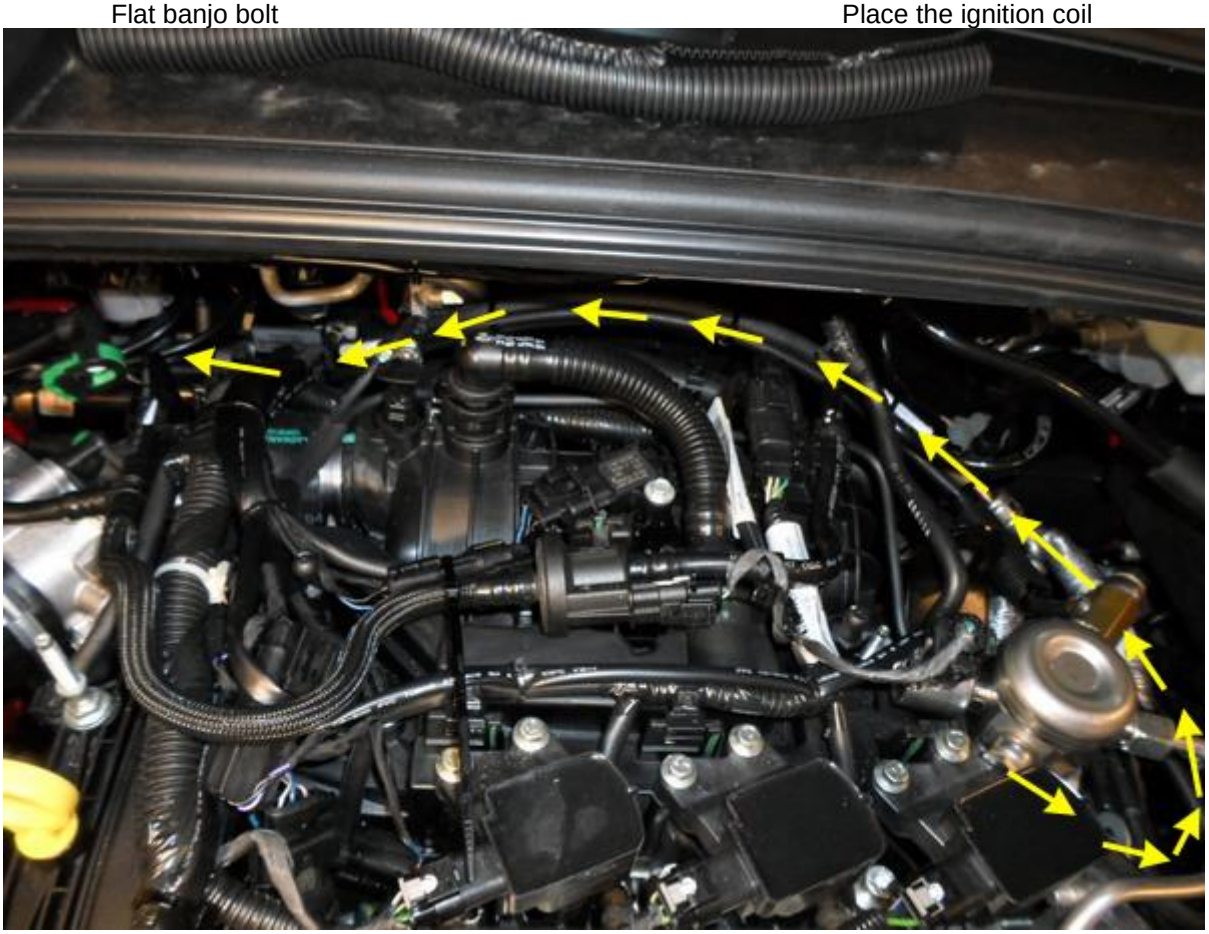
Remove the ignition coil 3th cylinder.

High pressure petrol pump LPG return

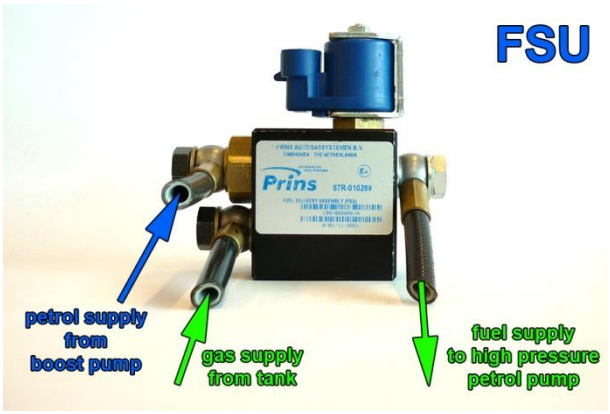


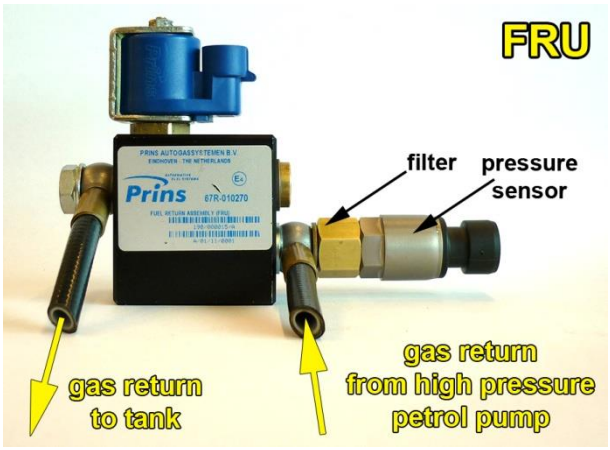
Flat banjo bolt

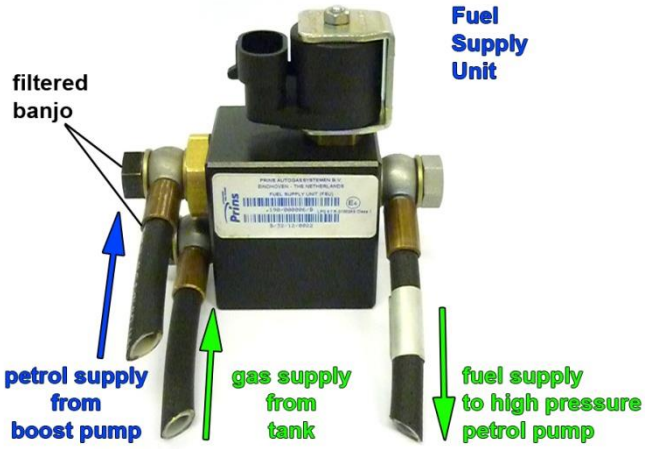
Place the ignition coil

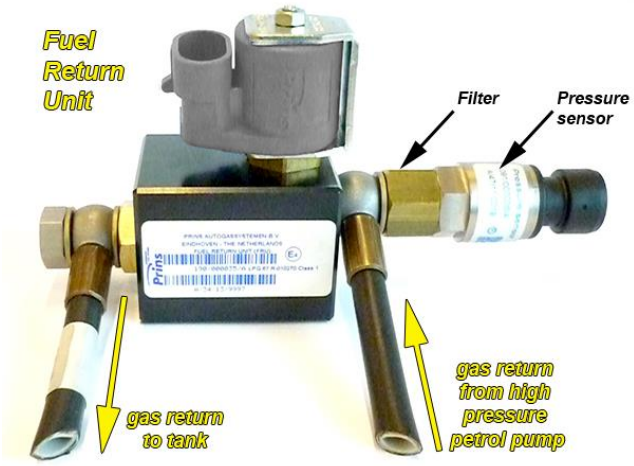


Fuel Supply Unit / Fuel Return Unit





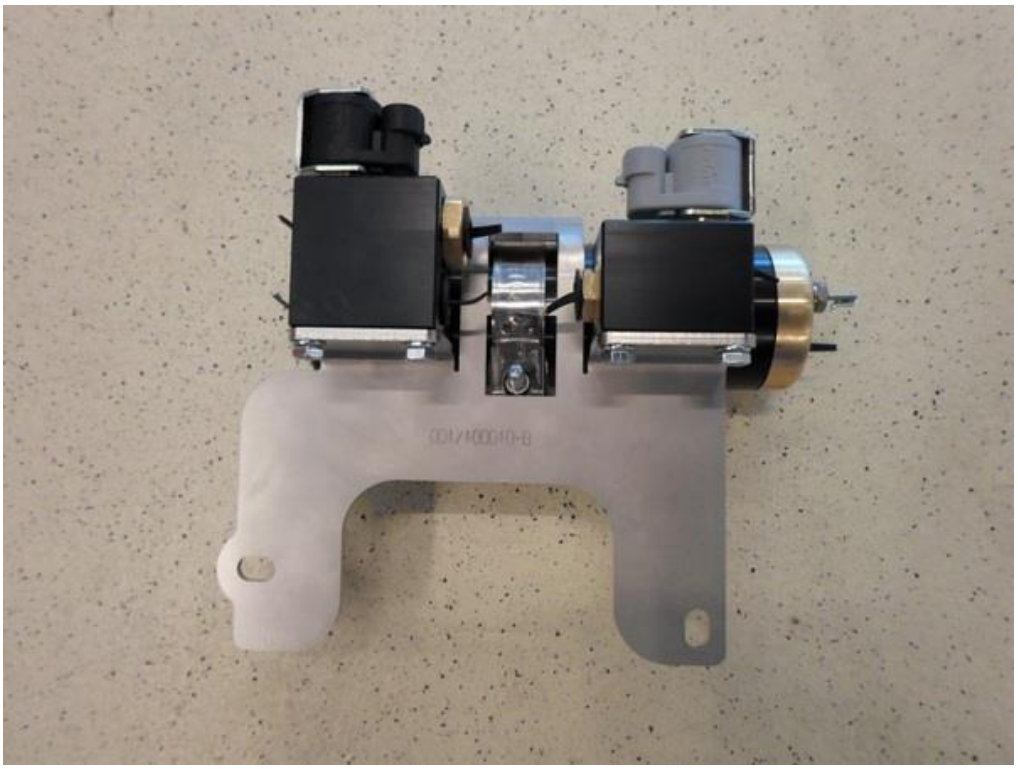


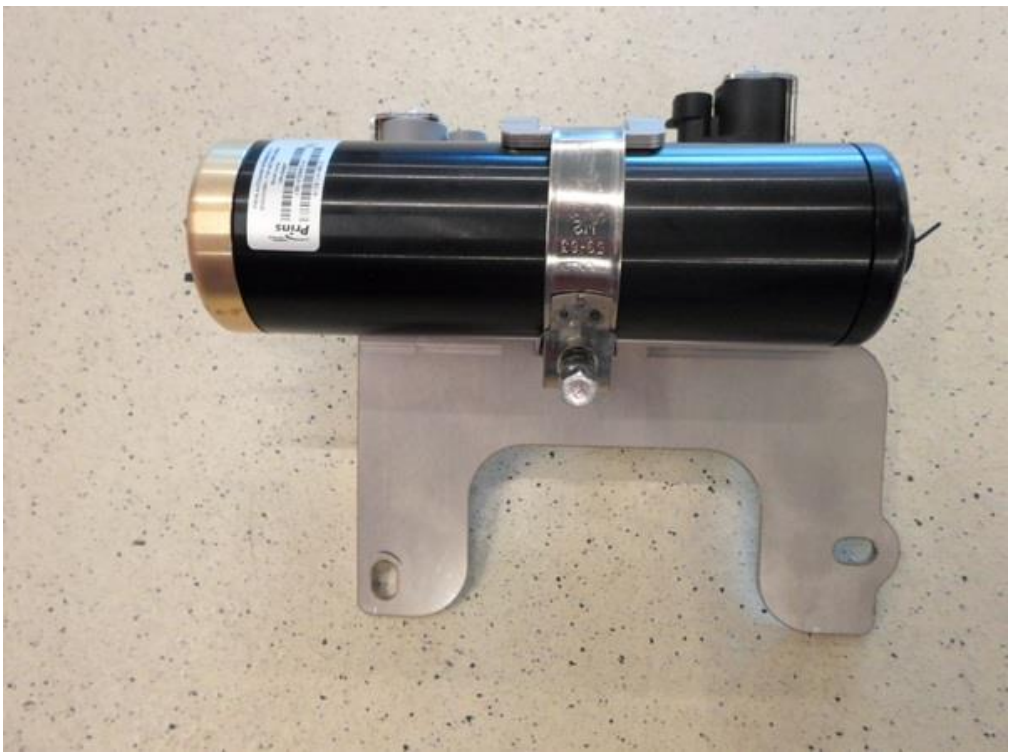


Black filtered banjo will only be used on inlet connections !

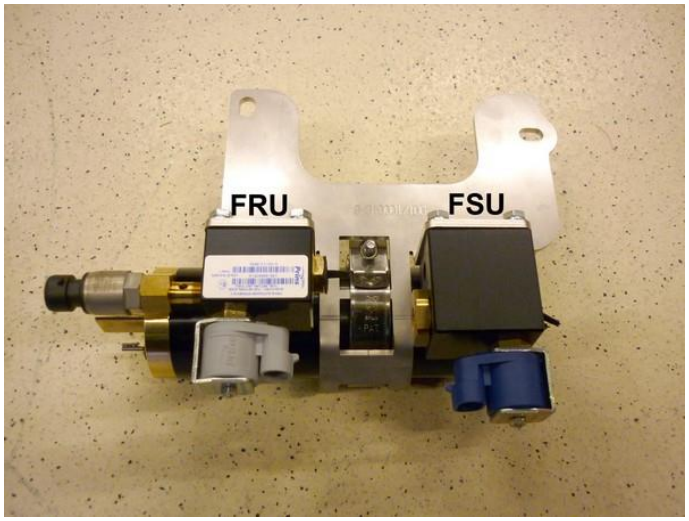
Filter inside sensor banjo

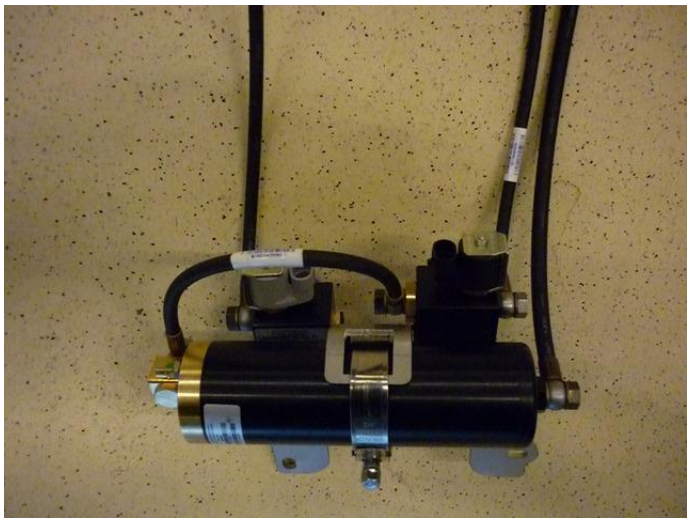
Mounting the Fuel Units

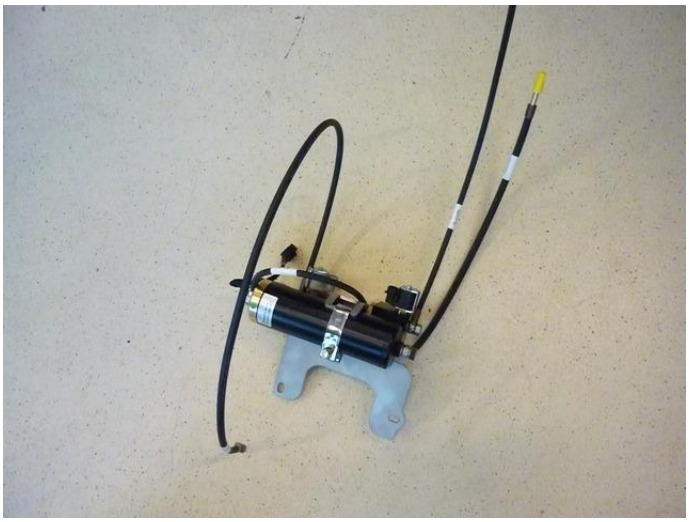


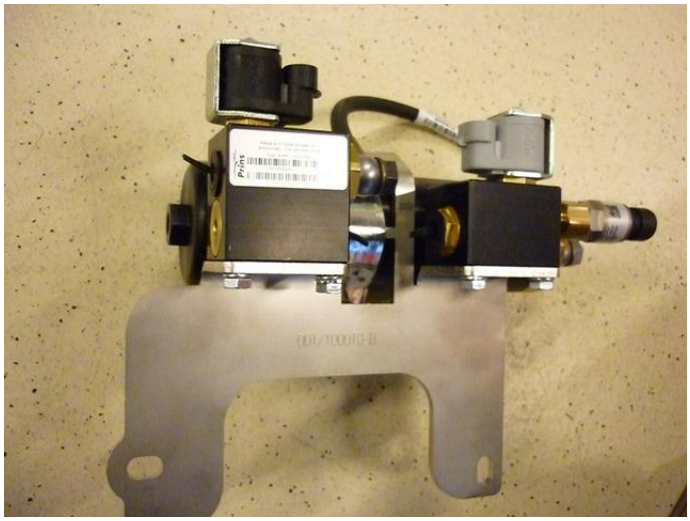


Boost pump / FRU / FSU bracket



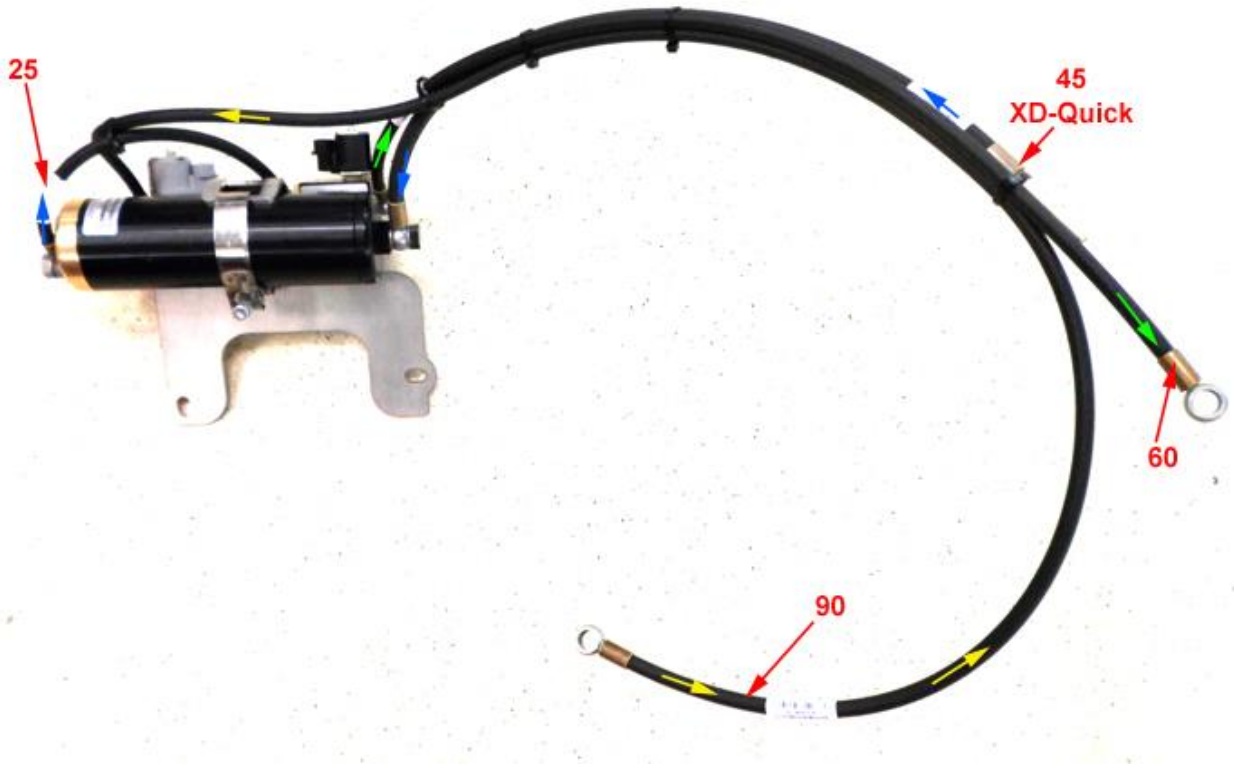


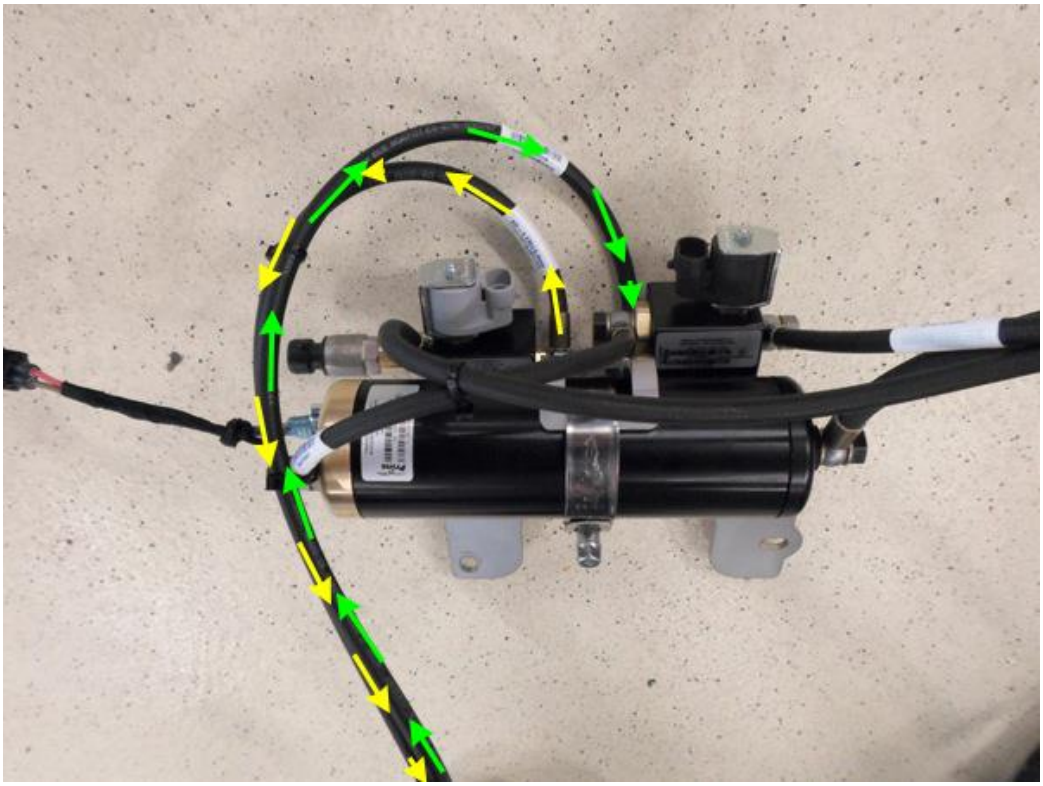




Connection of the fuel hose to the boost pump.

Connect the fuel hoses to the boost pump.





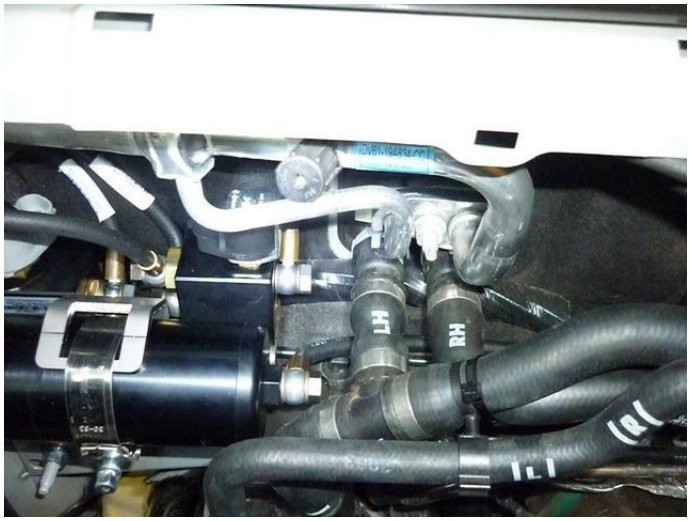
Fuel line and return line **to LPG tank.**

Boost pump / FRU / FSU bracket

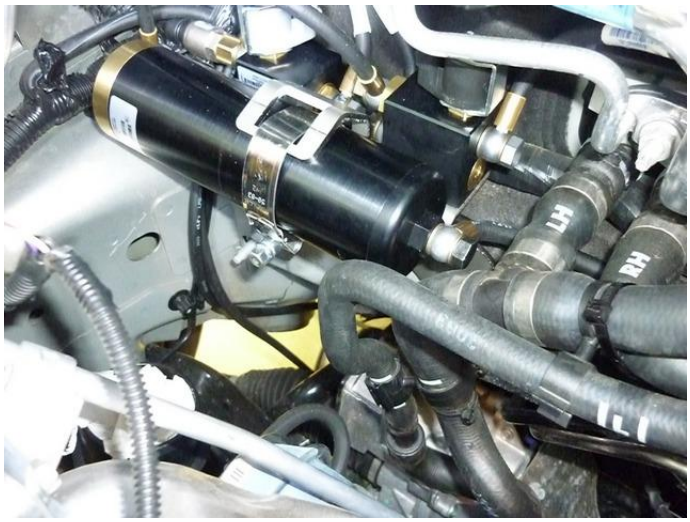
Remove battery, engine cover, air-filter, ignition coils, cover, wiper box, left wiper motor (driver side)

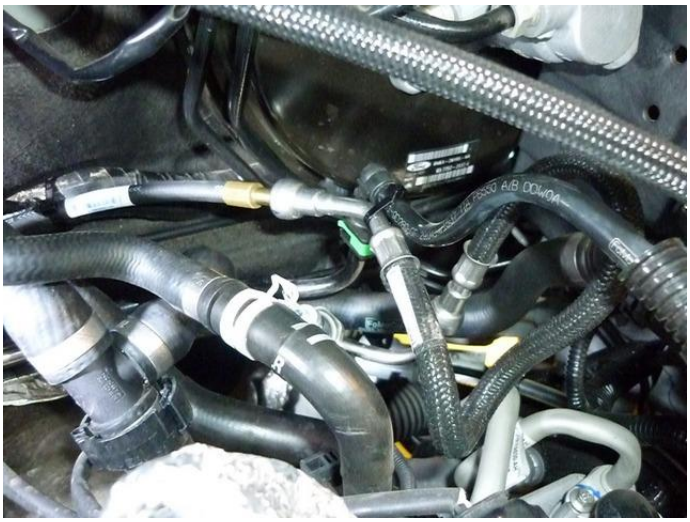
Remove fabric. One side M8 washer plate

Boost pump / FRU / FSU bracket



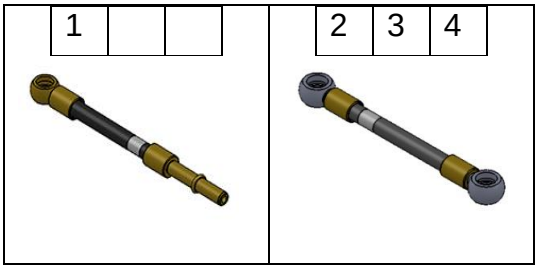
Connect tank supply and return.





LPG / petrol fuel lines

Hose		from	to	Length (cm)
1	XD- quick	Adapter original petrol hose	Petrol boost pump	45cm
2	XD-3	Fuel supply unit	High pressure petrol pump	60cm
3	XD-3	Petrol boost pump	Fuel supply unit	25cm
4	XD-3	Fuel return unit	High pressure petrol pump	90cm



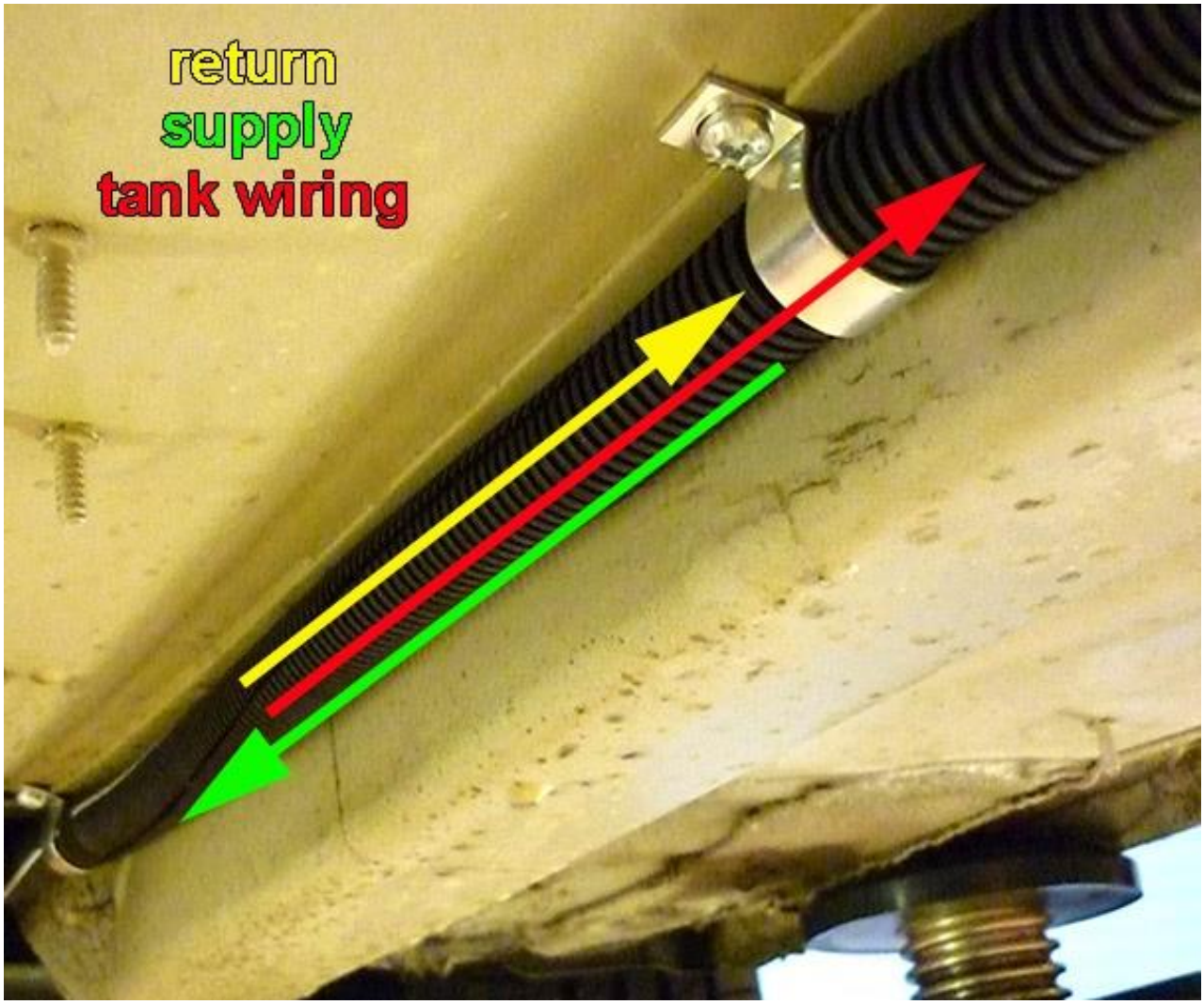
Install the fuel line using two bonded seal washers and banjo bolt :

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

181/300009/A

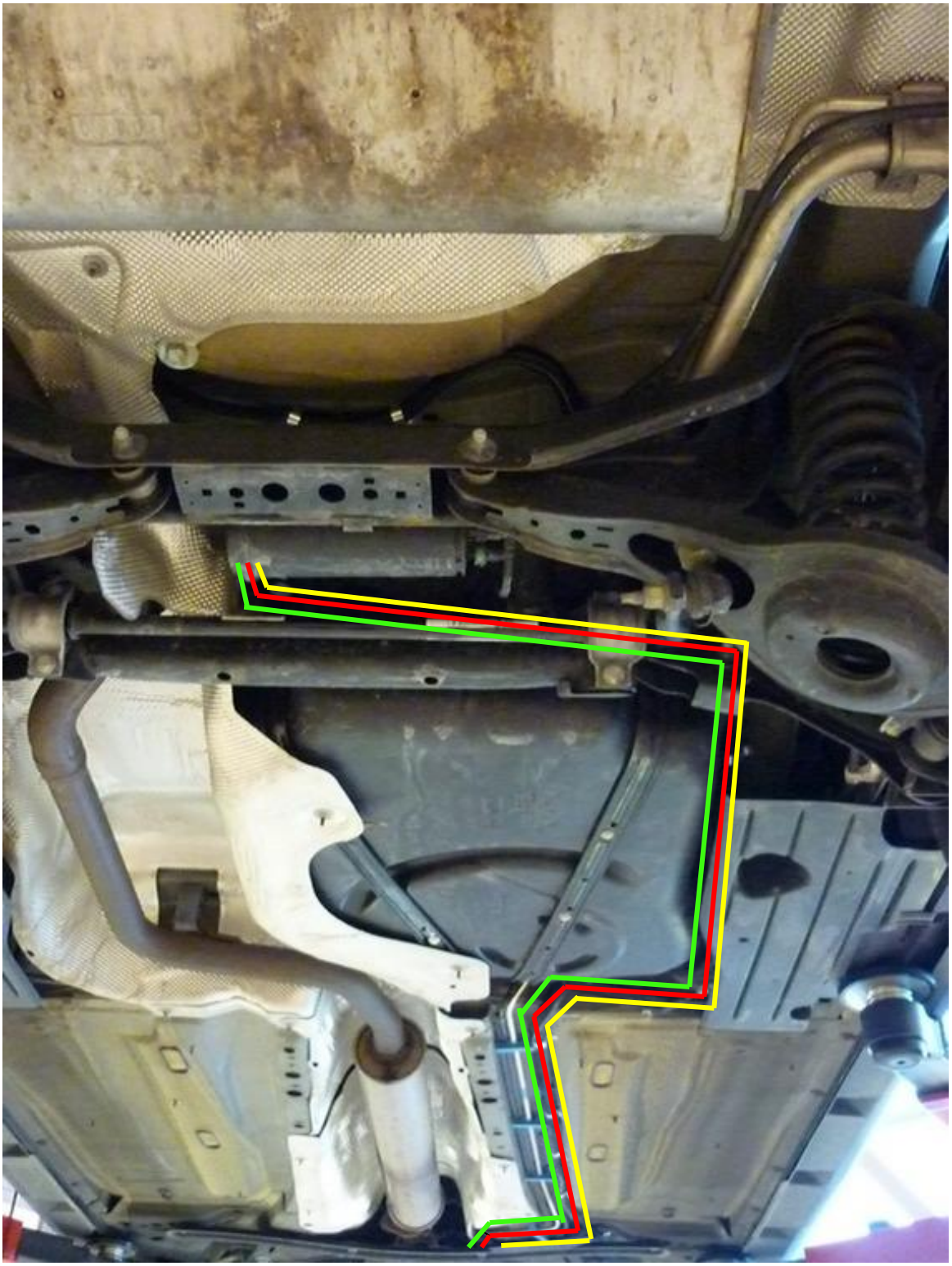
Supply hose – Return hose – Tank wiring

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.

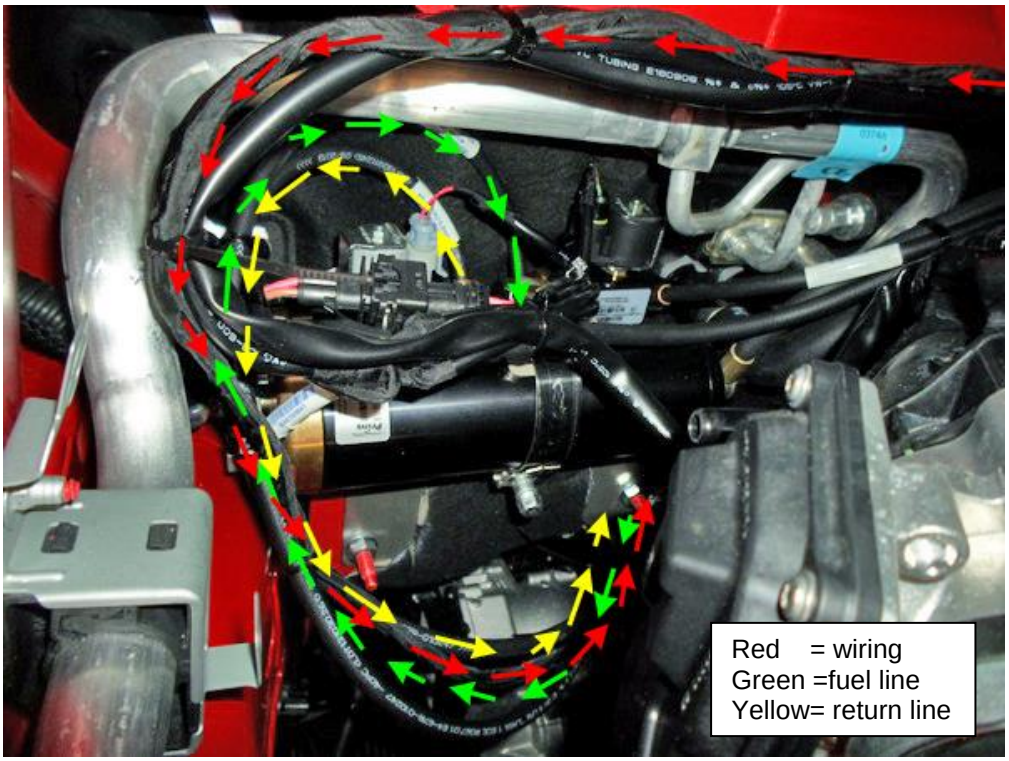


Demo photo

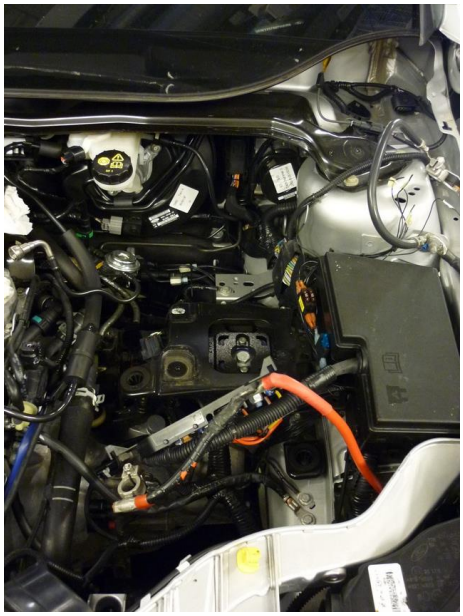
Hose routing 1



Hose routing 2

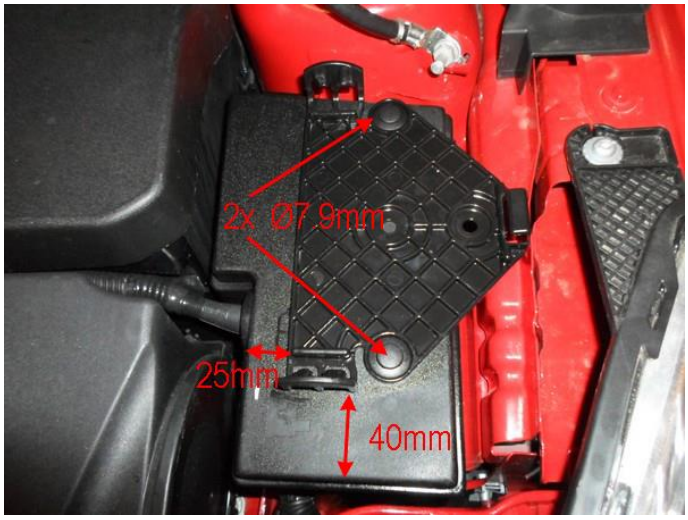


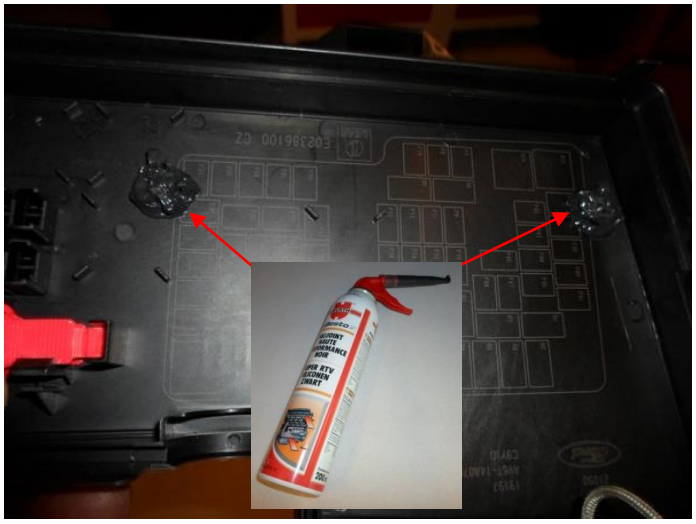
Mounting the AFC-2.1 Small battery



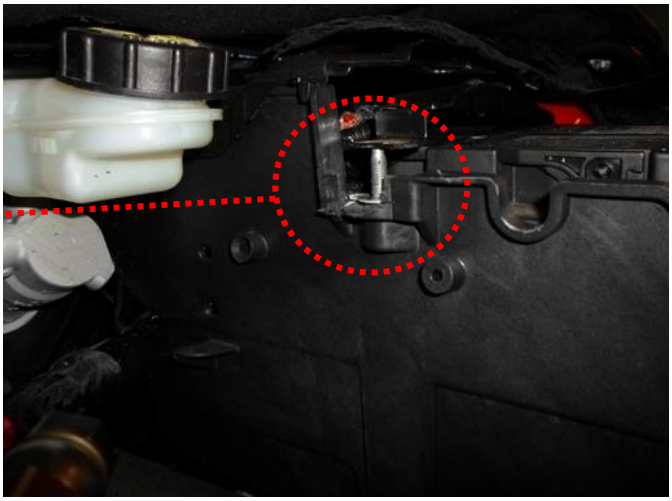
Remove corner for AFC

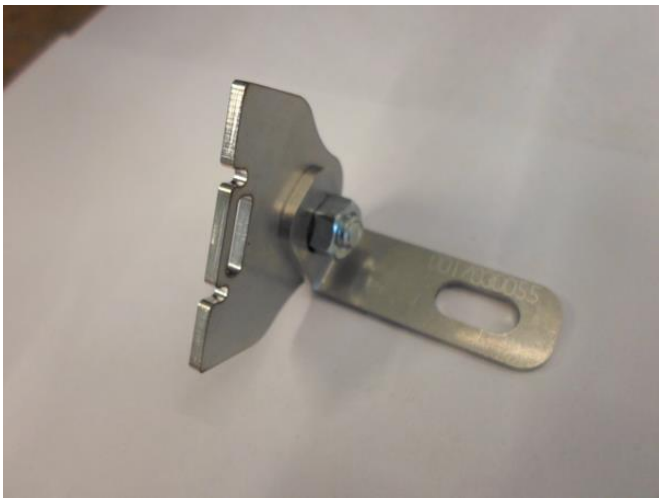
Mounting the AFC-2.1 Large battery

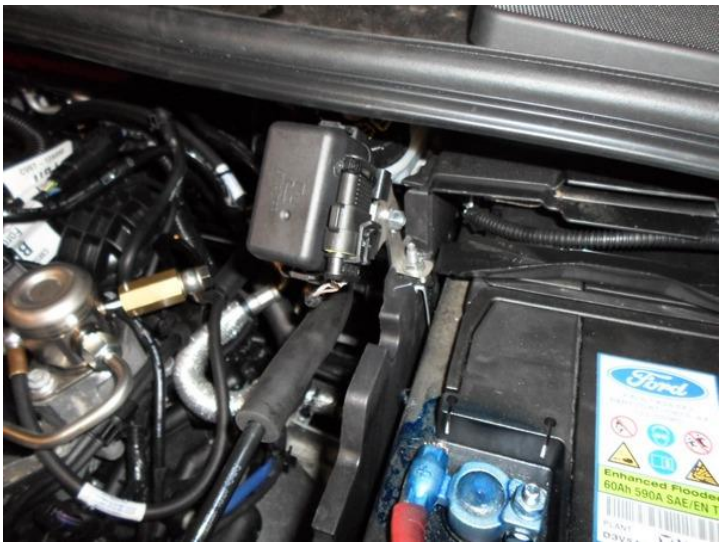




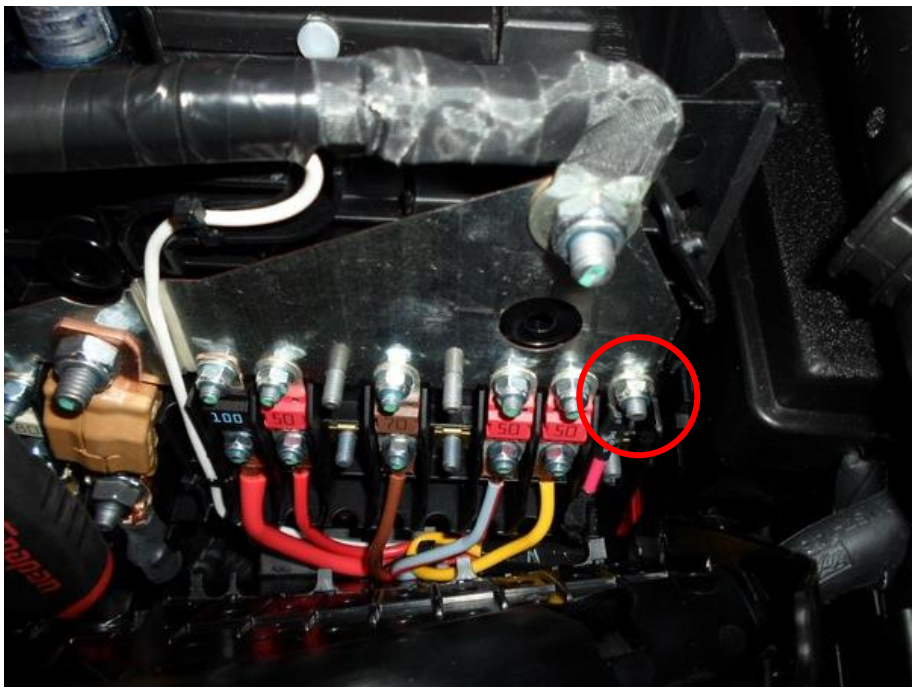
Mounting the fuse / relay box







Wiring



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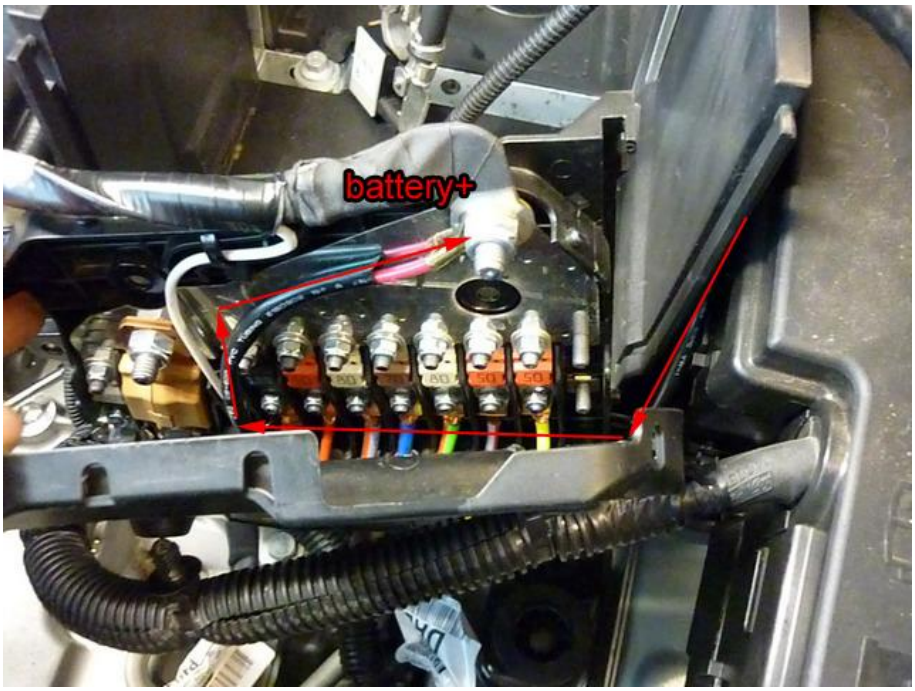
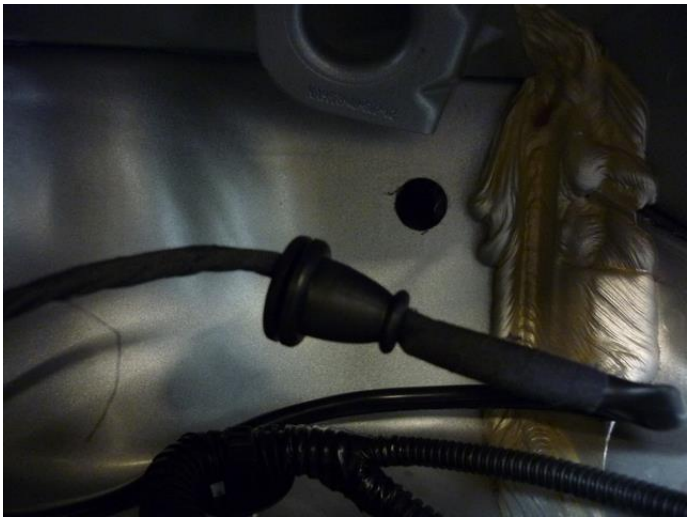
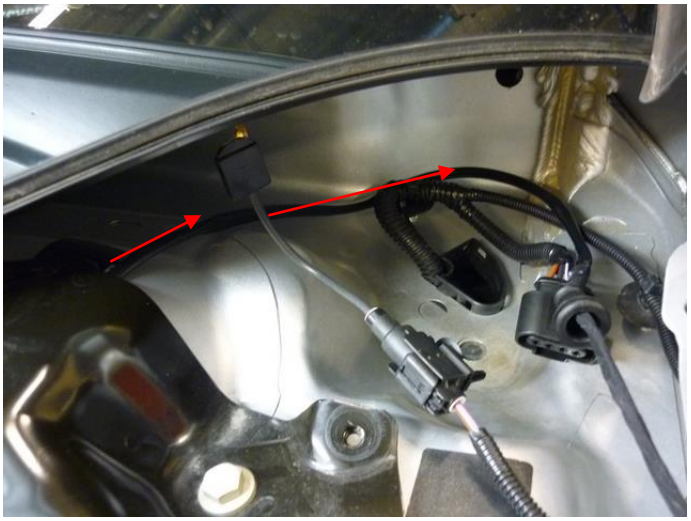
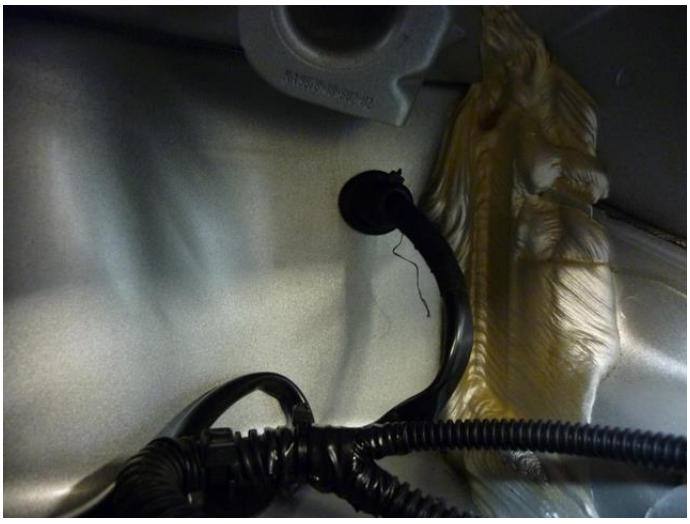


Wiring / Grummet

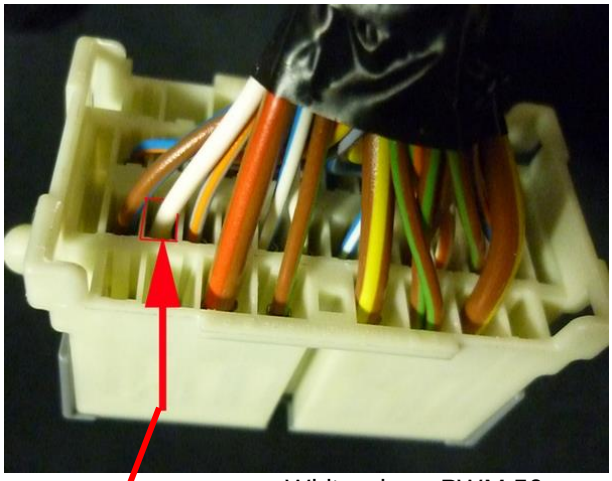




Drill a hole Ø16mm (conical)

Wiring inside : * switch / *CAN wiring / * pwm DI2 wire 56 yellow-green

PWM signal



White wire = PWM 56

If needed, extend wire.

56	DI 2	Yellow-green	PWM petrol pump, white wire

Mounting the fuel selection switch

Mount the switch, drill Ø8,2mm.

Drill Ø8.2mm

Electrical connections

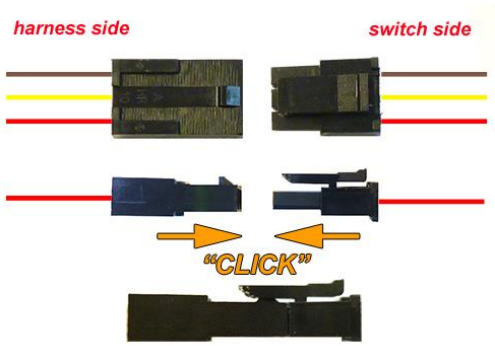
Insulate not used wires.

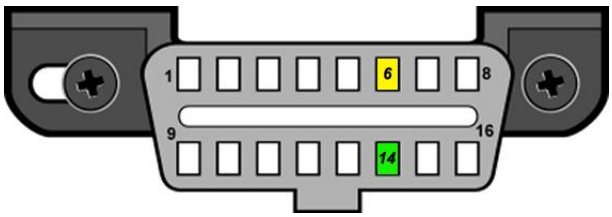
Wire number / code		Wire colour	Connection
22	LSS 1	Purple-white	Not used, insulate.
23	LSS 2	Purple-green	Not used, insulate.
42	Digital out pull up 2	Red-purple	Not used, insulate.
58	+12V switched	Red-white	Not used, insulate.
60	DI 3	Yellow-pink	Not used, insulate.
61	DI 4	Yellow-blue	Not used, insulate.
20	AD 3	Blue-pink	Not used, insulate.
19	AD 4	Blue	Not used, insulate.
74	DAC 3	Green-pink	Not used, insulate.
40	Wake-up	Grey-red	Not used, insulate.
21	AD 9	Blue-purple	Not used, insulate.

Electrical connections

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

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-black Red-white Yellow	Connect the 3-pole connector to the Prins fuel selection switch.
		

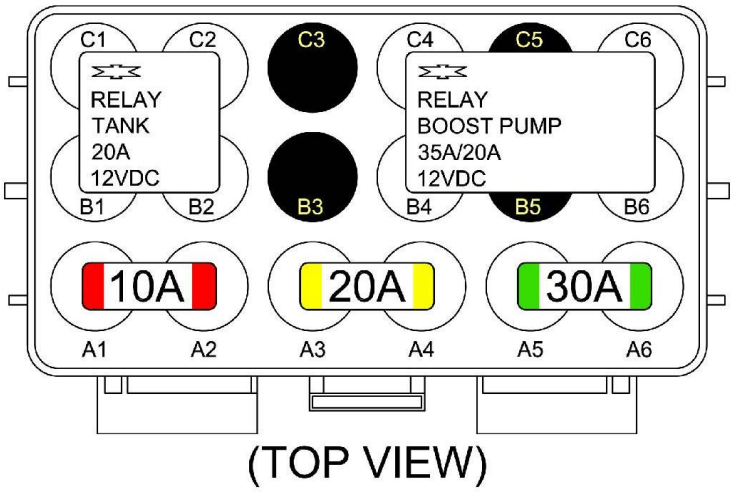
51	CAN-High	Yellow	EOBD connector pin 6
70	CAN-Low	Green	EOBD connector pin 14
			

Electrical connections

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

1-32 MAIN GND ecu MAIN GROUND SENSE	Brown	Connect to the '–' of the battery (-31) ; use a ring terminal. Wire colour : Original ground point, left suspension strut

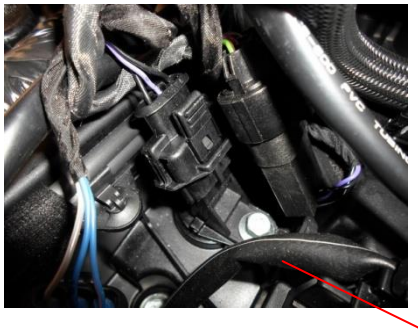
4 – 13 +12V BATT sense +12V BATT fused +12V BATT boost pump +12V BATT pump driver	Red	Connect to the '+' of the battery (+30); use a ring terminal. **Do not place the fuses** before having completed the installation of the lpg system.



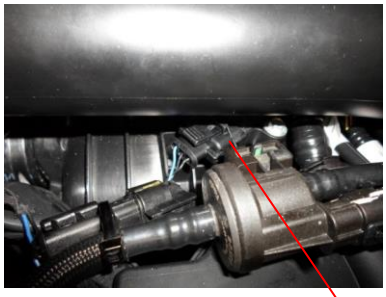
(TOP VIEW)

Electrical location connectors

Camshaft

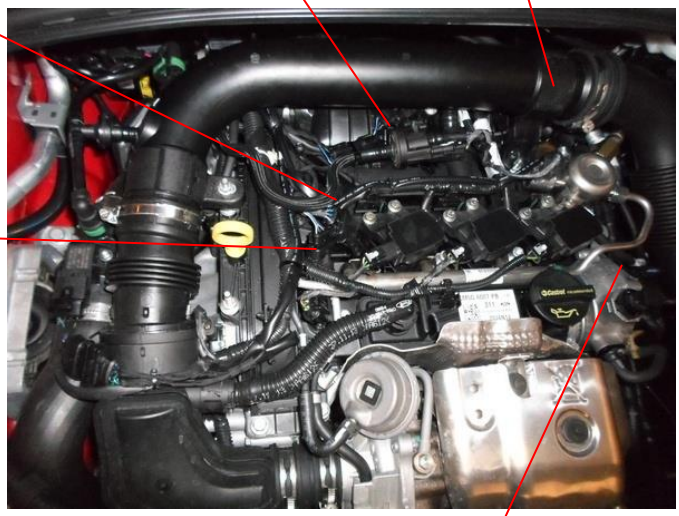


MAP sensor



LOW pressure sensor

HPP petrol sensor



T-ect sensor

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*
36&25		High pressure petrol sensor signal interruption Wire colour :Blue /brown Wire location : Connector High pressure petrol sensor, Pin 2
36 AD 6	Blue-brown	Sensor side
25 DAC 1	Green-white	Petrol ecu side

63 Ground Shift	Blue-orange	High pressure petrol sensor ground Wire colour :Blue/green Wire location : Connector High pressure petrol sensor, Pin 1

7 +12V IGNITION	Grey - white	Make a connection to +ignition / contact+ (+15). Do not place the fuses in the holder before having completed the installation of the lpg system. Wire colour : Grey Wire location :Connector High pressure petrol sensor, Pin 3

18 AD 1	Blue-white	Analog in (sensor side) MAP sensor in Wire colour :Yellow Wire location : 3pole connector MAP sensor, Pin 3

8 RPM engine speed	Purple-white	For measuring the engine speed signal. Wire colour : Purple Wire location : 3pole connector Camshaft sensor Pin 2

15 T-ect	Grey	For measuring the engine coolant temperature. Wire colour : Yellow Wire location :T-ect sensor 2pole connector Pin 1

17&10		**Low** pressure petrol sensor signal interruption
17 AD2	Blue-green	Sensor side
10 DAC 2	Green	ECU side. Wire colour :Blue-brown. Wire location : Low petrol pressure line, left side in petrol line, Pin 2

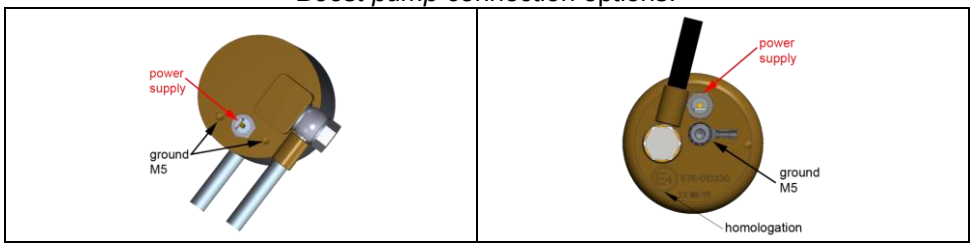
Electrical connections

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
4-pole black connector MAP @Plug&Play wiring only ! 18 AD1	 Pin 1 Black (not used) Pin 2 Black (not used) Pin 3 Black (not used) Pin 4 Blue - white	*For measuring the inlet manifold pressure (MAP).* *Cut off connector and insulate not used wires.* Isolate the wiring (plug&play wiring only) Wire colour :**Yellow** Wire location : 3pole connector MAP sensor **Pin 3**
3-pole connector 35 Ground Psys pin A 9 +5V sensor pin B 16 Psys pin C	 Brown Red-blue 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
2-pole connector FSU, black 24 + Lock-off FSU 31 C Ground	 Yellow-green Brown-black	Connect the 2-pole connector to the lock-off valve of the Fuel Supply Unit
2-pole connector FRU, grey 43 + Lock-off FRU 34 C Ground	 Red-white Brown-black	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-black	Diagnose connector for service / diagnosis Connector pin 1 Connector pin 2 Connector pin 4
Boost pump relay 2 + relay boost pump 26 Ground BP relay +12V fused BATT +12V Boost pump	 Red-white Purple-blue Red 2.5mm2 Red 2.5mm2	 Pin 86 of the boost pump relay C4 Pin 85 of the boost pump relay B6 Pin 30 of the boost pump relay C6-A5 Pin 87 of the boost pump relay B4
Wiring tank pump driver relay 57 + driver relay 73 LSS 4 tank relay +12V BATT fused +12V driver	 Red-white Purple-blue Red 2.5mm2 Red 2.5mm2	 Pin 86 of the driver relay C1 Pin 85 of the driver relay B2 Pin 30 of the driver relay C2-A4 Pin 87 of the driver relay B1

Boost pump connection options:



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 33 Ground tank gauge 12 Tank level in 11 + tank level supply	 Brown-black Blue Red-blue	Connect the 3-pole connector to the tank level sensor.
2-pole driver connector 71 LSS 3 PWM driver 64 AD 5 driver diagnose	 Purple-pink Blue-grey	Connect the 2-pole connector to the pump driver (4).
1. *2-pole connector tank lock-off*	Green-yellow Brown	From tank pump driver From tank pump driver
2. *3-pole connector tank pump*	Red 2.5mm^2 Brown 2.5mm^2	From tank pump driver From tank pump driver
3. *2-pole connector power driver*	Red 2.5mm^2 Brown 2.5mm^2	From tank pump relay 87 From main ground
4. *2-pole connector driver*	Green Grey	From AFC pin 71 pwm From AFC pin 64 diagnose

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.