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 | Opel |
| TYPE | Astra J |
| ENGINE DISPLACEMENT | 1600 |
| NUMBER OF VALVES | 16 |
| ENGINE CODE / NUMBER | A/16XHT |
| VEHICLE CATEGORIES | M |
| TRANSMISSION | MT |
| VERSION | **AFC-2.1** |
| PETROL ECU MANUFACTURER / CODE | AC Delco |
| HIGH PRESSURE PETROL POMP | Bosch 0261520 110/111 |
| HIGH PRESSURE PETROL INJECTOR | Bosch |
| MODEL YEAR: | 2013- |
| SYSTEM APPROVAL NUMBER ( R115 ) | E4-115R-000012 DLM-LPG 05 |
| LOCATION R115 SYSTEM STICKER | right side, centre door post |
| ENGINE SET NUMBER | 357/070007/A |
| MANUAL NUMBER | 076/1708600 |
| DATE | 2014-06-16 |



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 : 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 ( 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 )

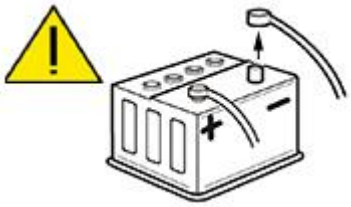
## Tightening moments

| | | 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 |

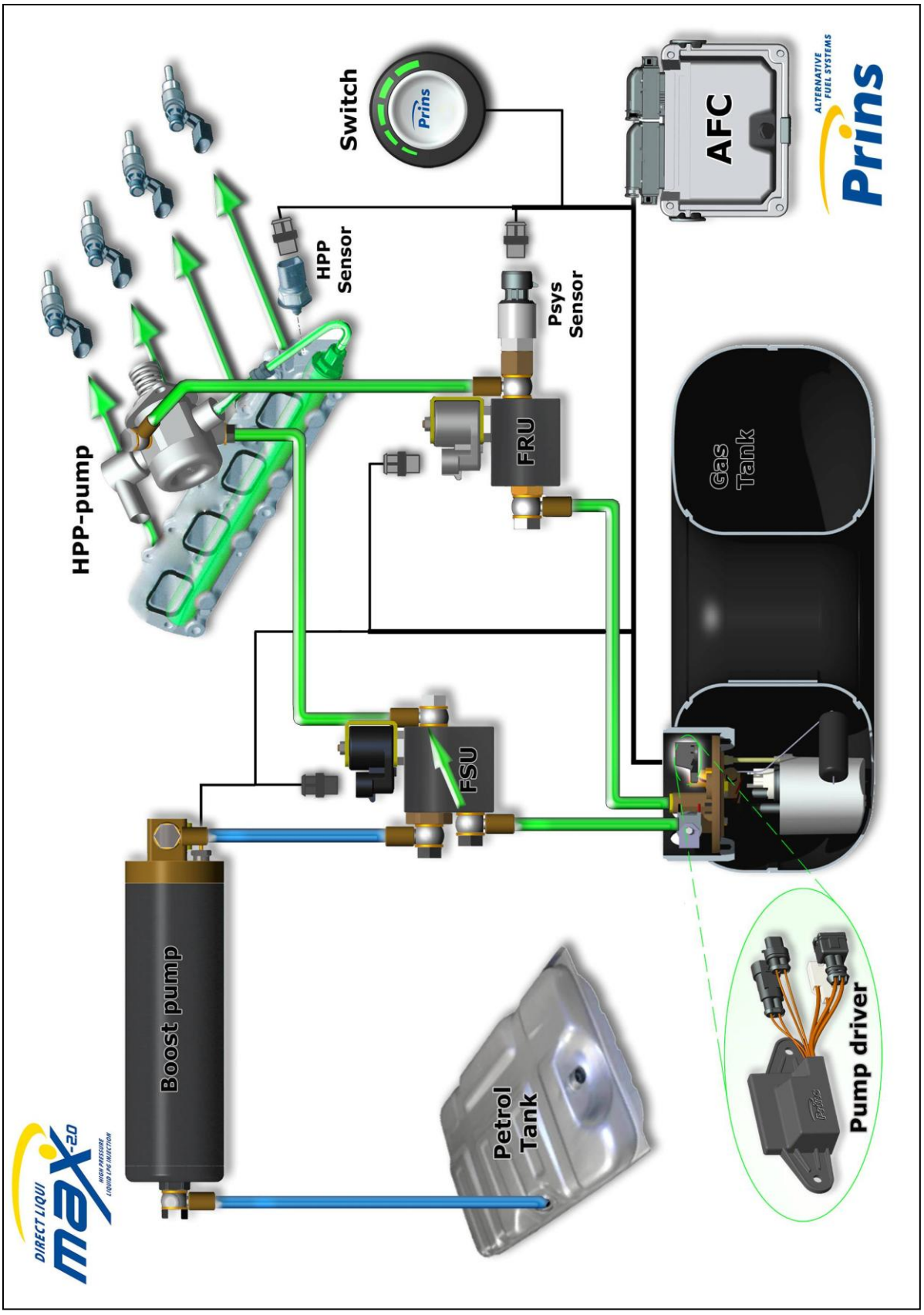
EXPLANATION OF SYMBOLS :

= IMPORTANT, CAUTION

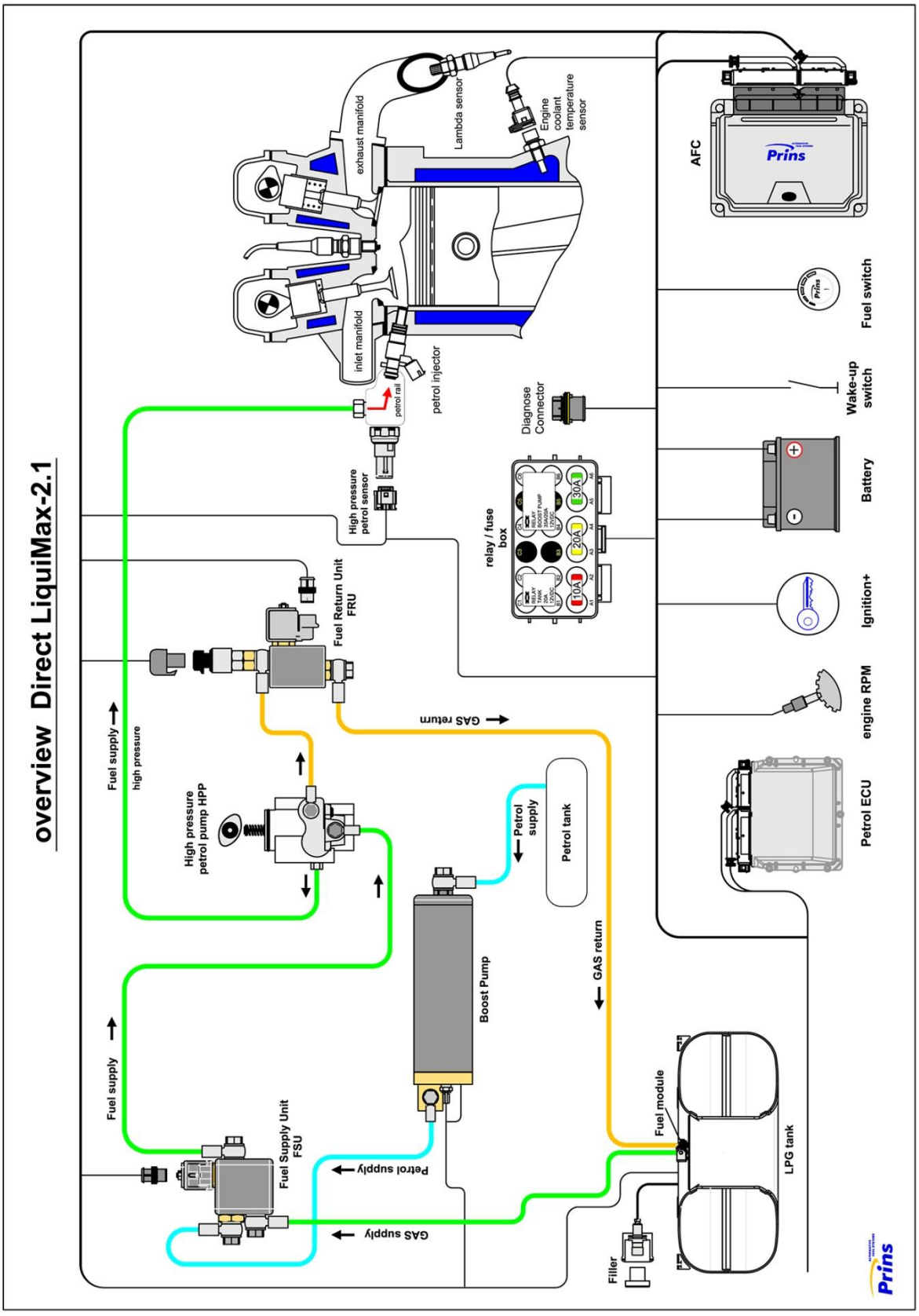
= WEAR SAFETY GOGGLES



# 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**

**FSU**

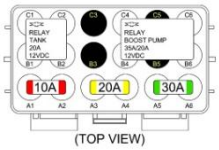

**FRU**

**Boost pump**

**Petrol ECU**

**AFC**

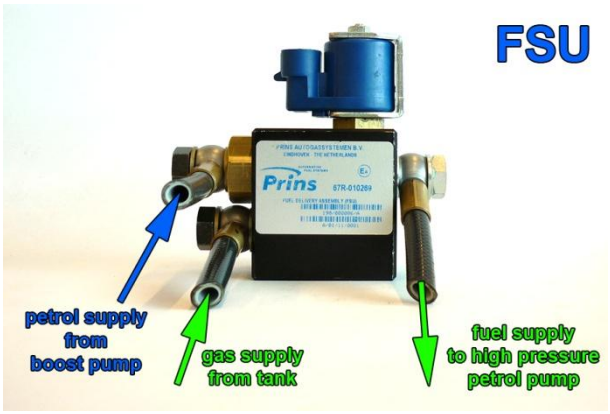
**Fuse / relay box**

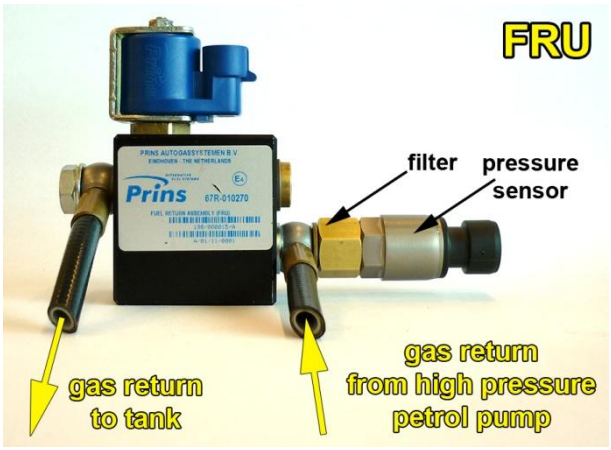


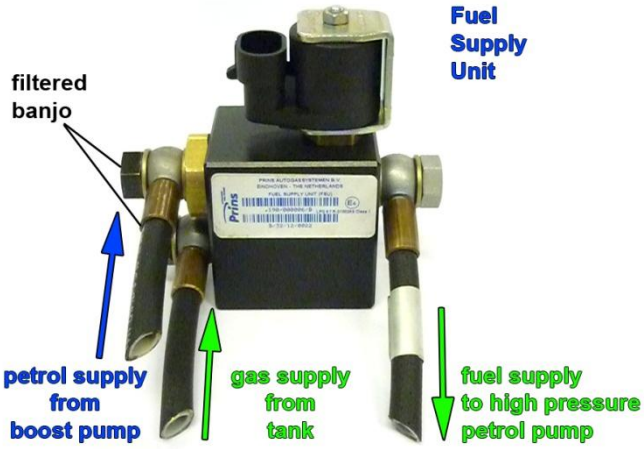


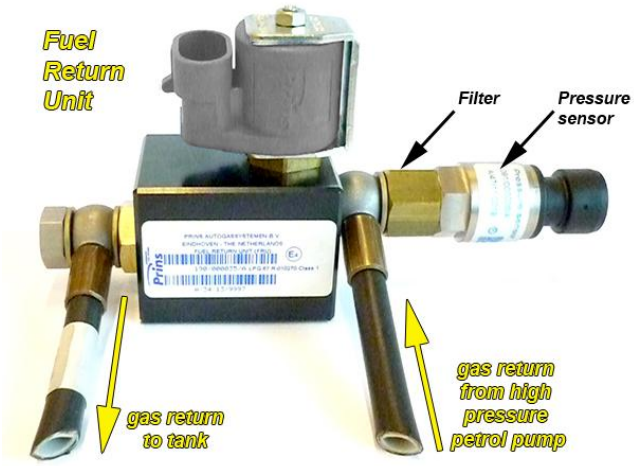
R115 approval sticker :
Right side centre door post

# Fuel Supply Unit / Fuel Return Unit



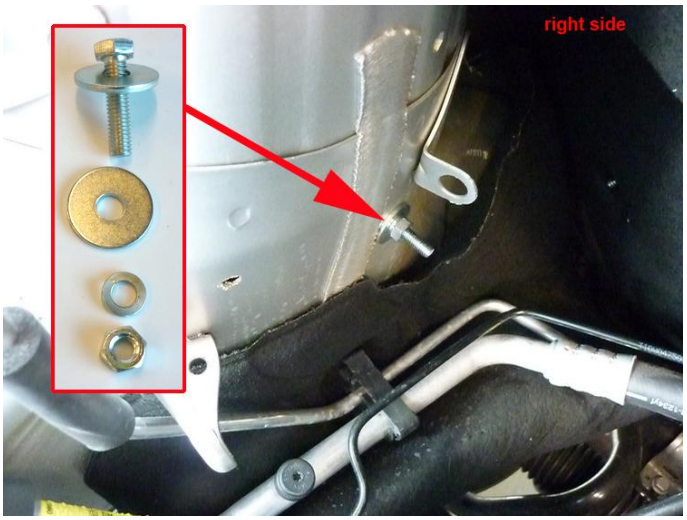



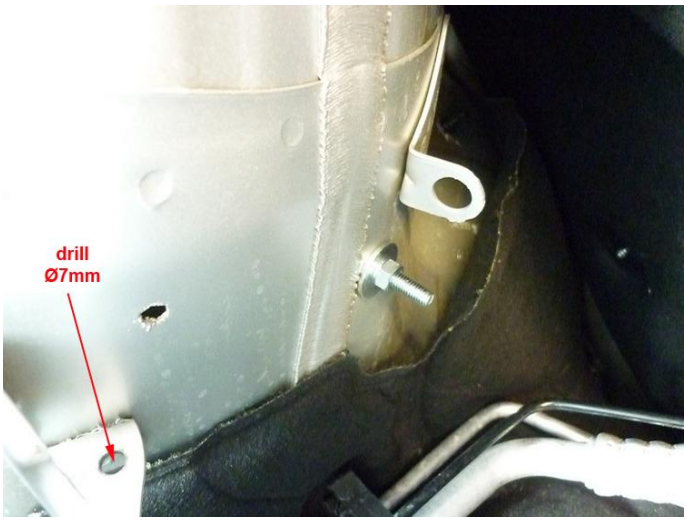



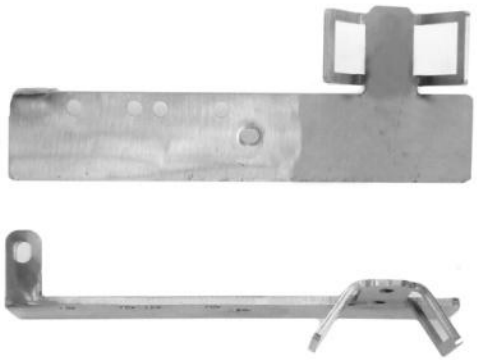

**Black filtered banjo will only be used on inlet connections !**

**Filter inside sensor banjo**

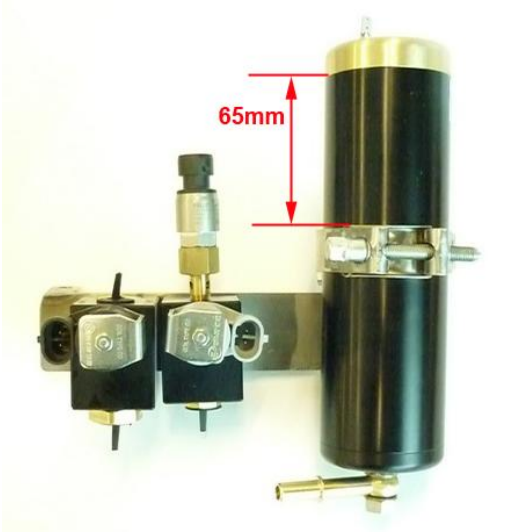
# System bracket installation preparation

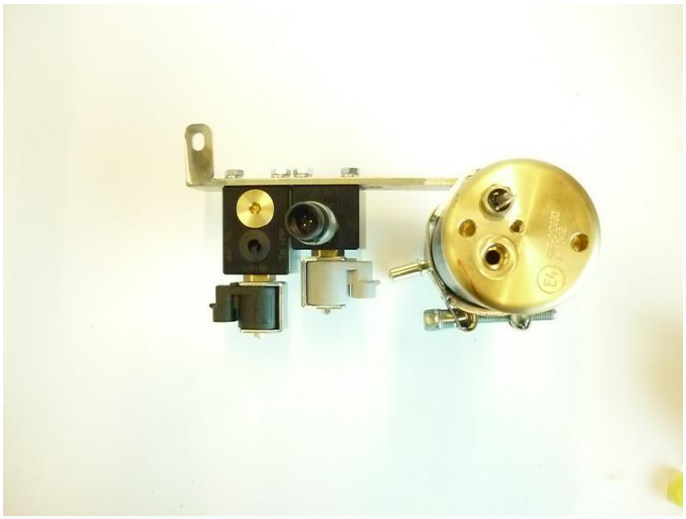


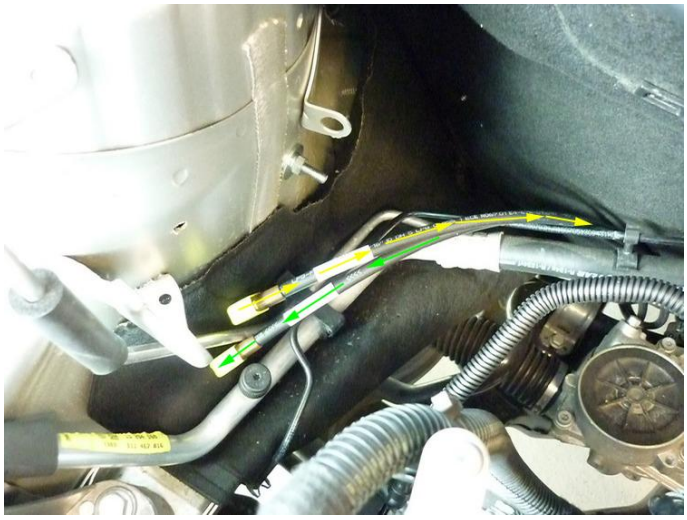
# System bracket

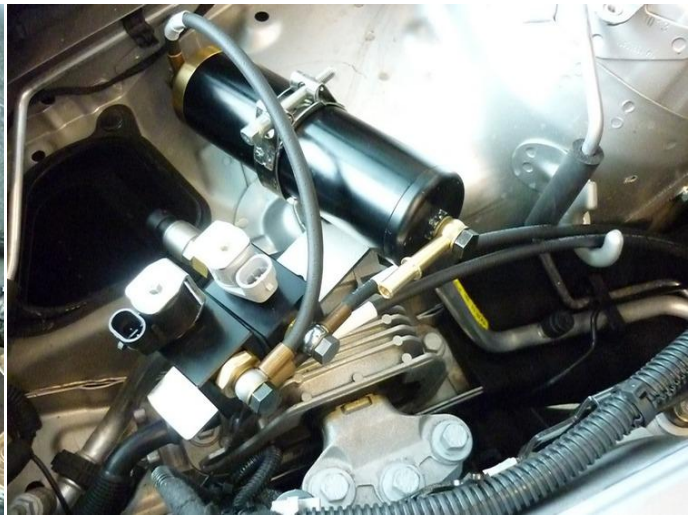


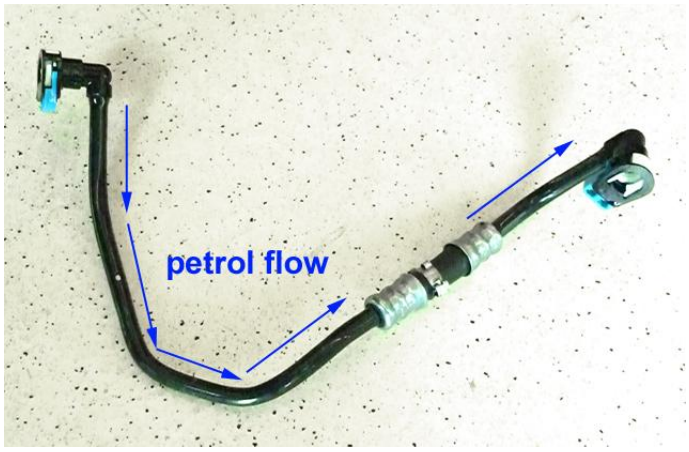



## Connection of the fuel hose to the boost pump.

Connect the original fuel hose to the boost pump.








Boost pump side

# Removal of the Bosch High Pressure Petrol Pump

**-REMOVAL-**

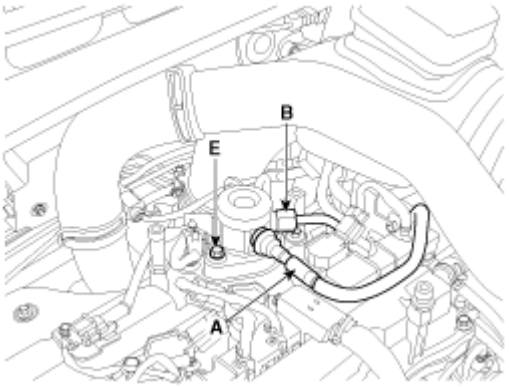
-WARNING-

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.



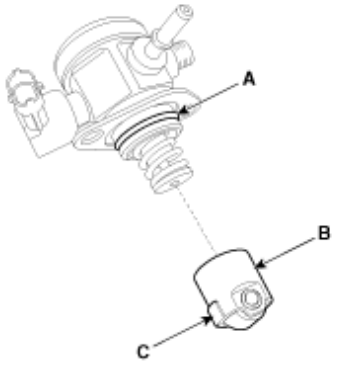

**CAREFULLY** store the removed petrol pump. Make sure no pollution can come into the pump.

# 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

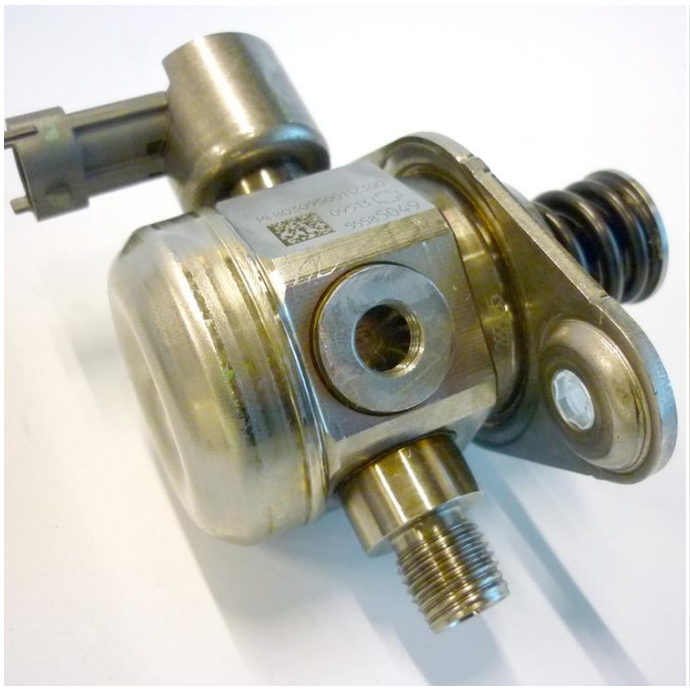
Petrol pipe:
First hand-tighten the nut(s) fully until they are not fastened any more in order to have them inserted in place and then completely tighten to the specified torque using a torque wrench.
If not tightening the bolts or nuts in a straight line with the mating bolt holes or fittings, it may 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 petrol pump installation

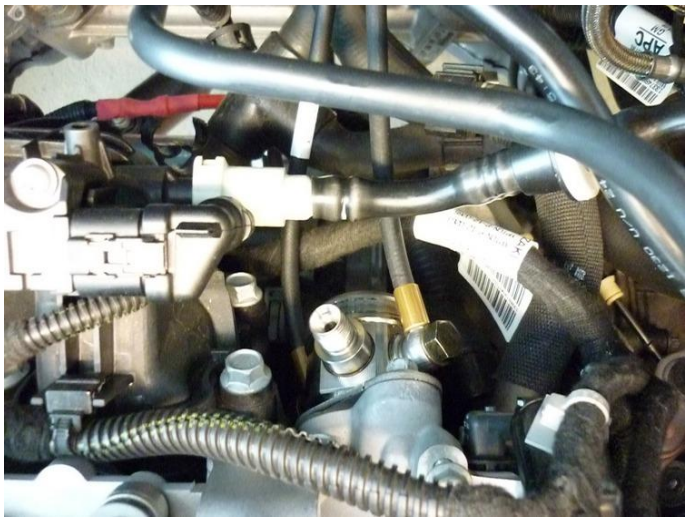
Replace the original high pressure petrol pump for the adapted high pressure petrol pump.
( Follow the workshop manual of the car )

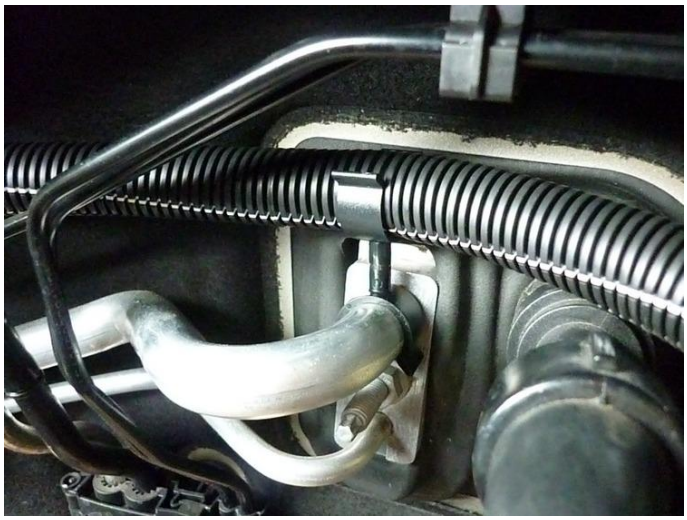
Original pump



Adapted pump / pump with return and supply hoses; inlet: filtered banjo

# Pump hose routing

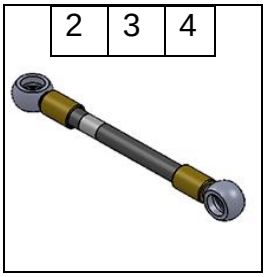




Hose with split tube and spacer clip on AC pipe

## LPG / petrol fuel lines

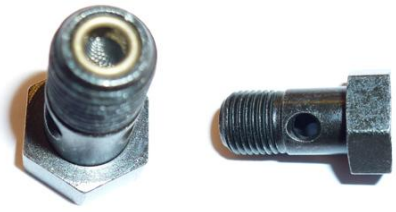
| Hose | | from | to | Length ( cm ) |
|---|---|---|---|---|
| 1 | original | Adapter original petrol hose | Petrol boost pump | |
| 2 | XD | Fuel supply unit | High pressure petrol pump | 90 |
| 3 | XD | Petrol boost pump | Fuel supply unit | 30 |
| 4 | XD | Fuel return unit | High pressure petrol pump | 90 |





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

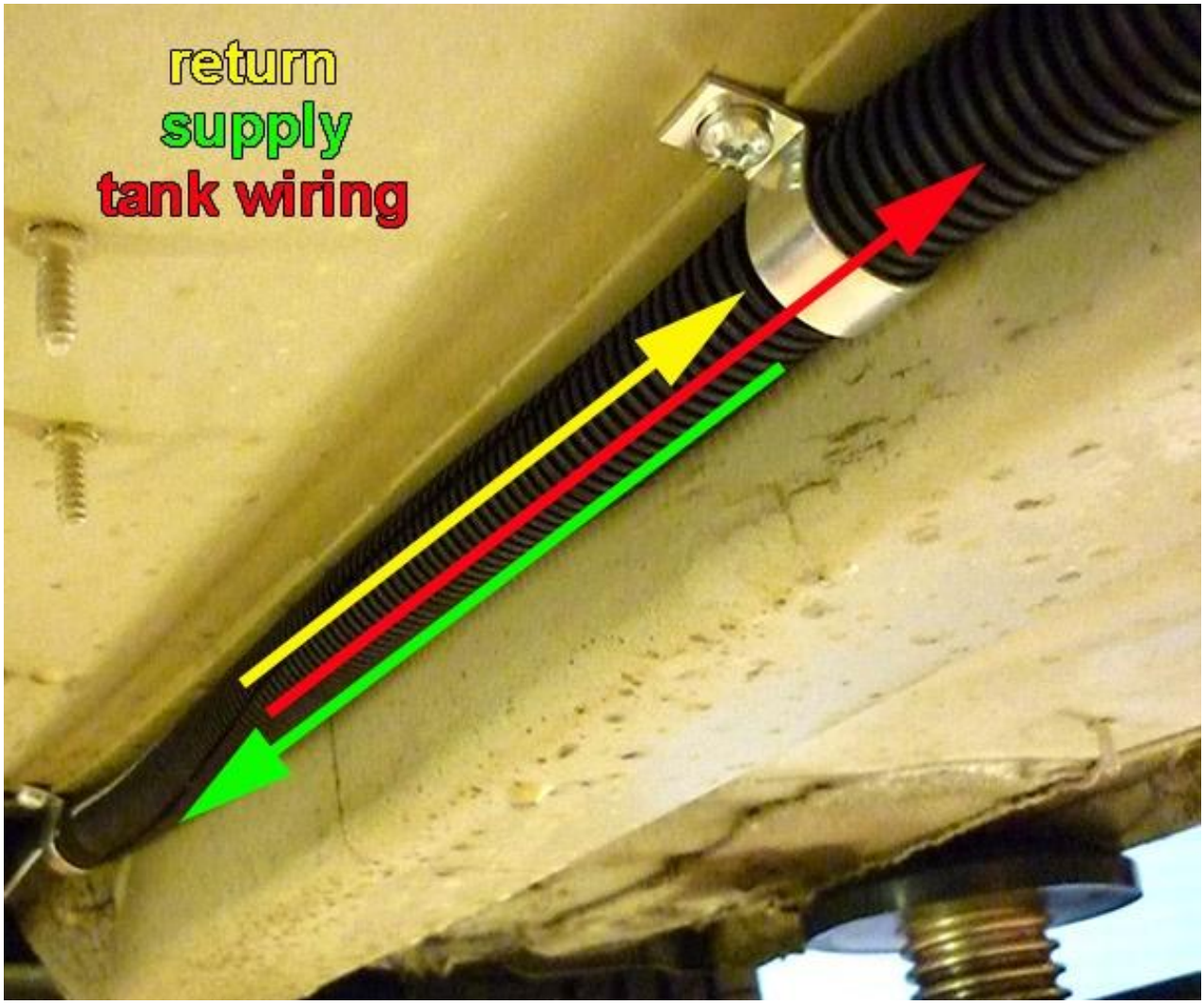

**<u>Filtered banjo:</u> ( FSU supply inlets / boost pump inlet / HPP pump inlet : black filtered banjo ) :**



181/300009/A

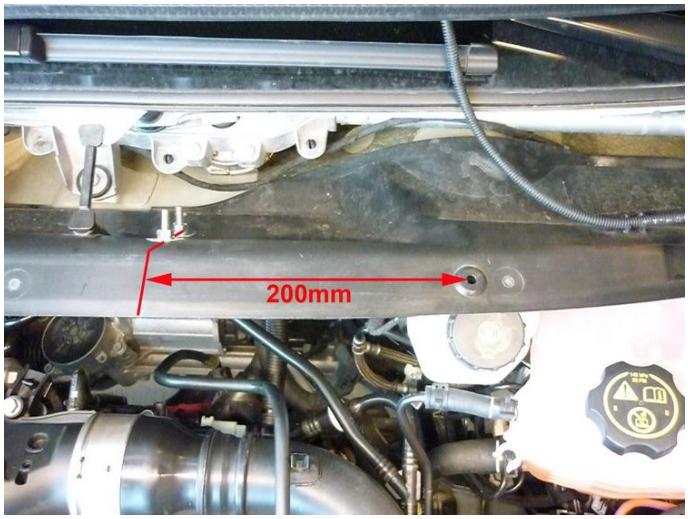
## Supply hose – Return hose – Tank wiring

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.



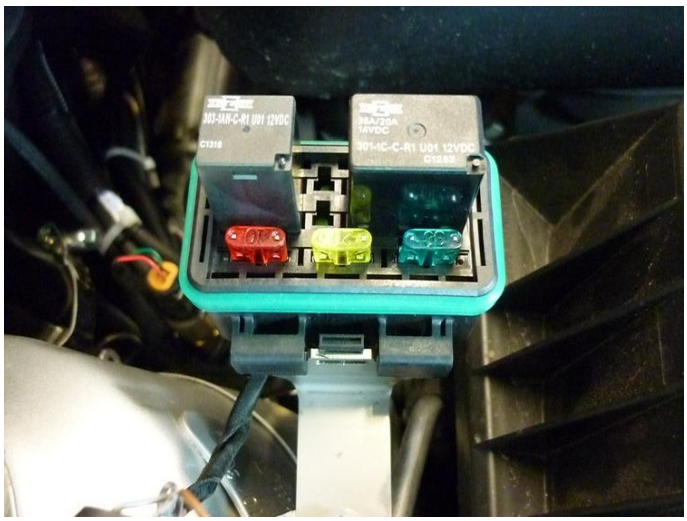

Demo photo

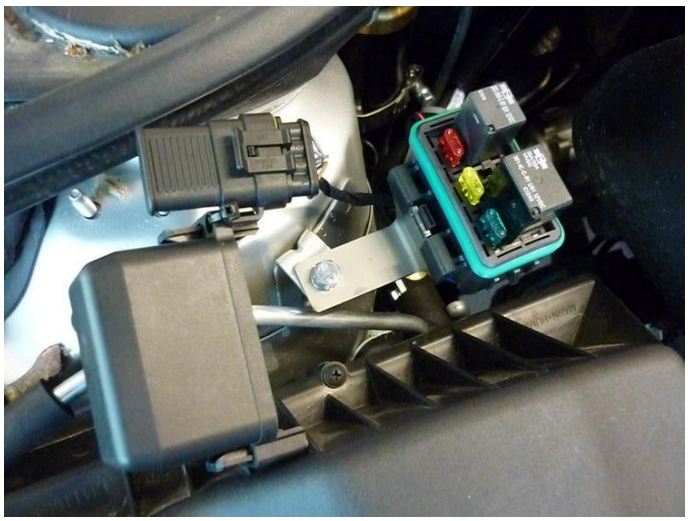
# Mounting the AFC-2.1




Mark, remove foam, mark holes, drill Ø7mm

# Mounting the fuse / relay box

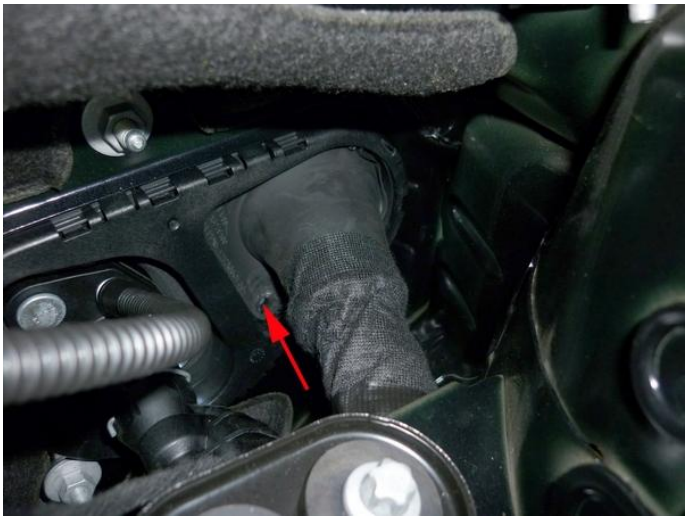


# Wiring

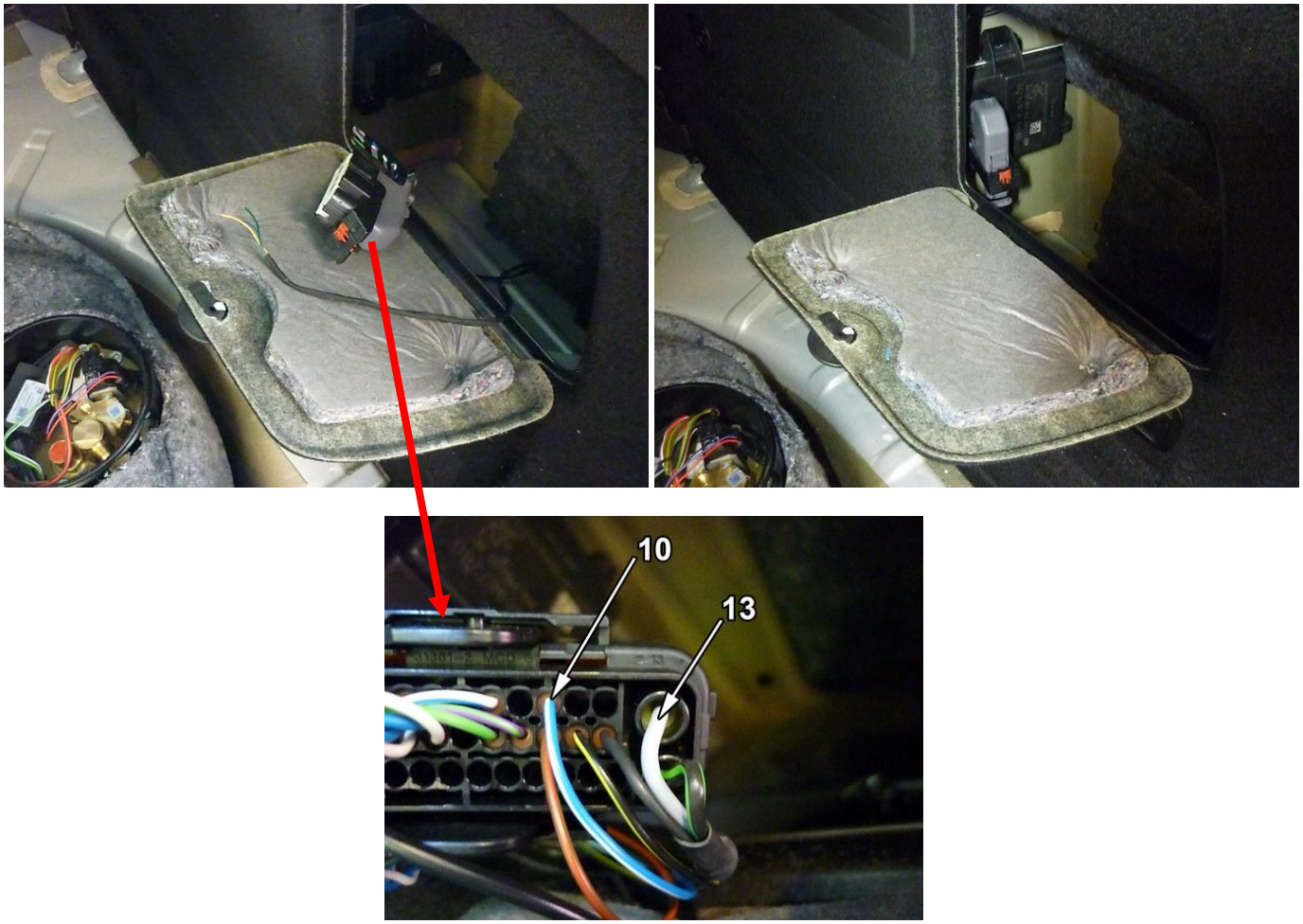
**Inside wiring :**
**Switch Wiring / CAN / pump driver wiring loom ( 3 wires, 6 meter )**

Remove battery and coolant reservoir.
Beware of the coolant reservoir level sensor in front of the reservoir.




See table next page how to connect the 3-wire loom to the AFC connector wiring/pinning

# Petrol pressure simulation




**10** : Fuel line pressure sensor signal
**13** : Fuel pump supply voltage

**10** : Cut the blue-white wire pin 10.
Connect wire 17, sensor in, to the sensor side
Connect wire 10, sensor out, to the connector side
**13** :Connect wire 56 to wire 13 (grey), power supply

| | | |
|---|---|---|
| 17&10 | **AFC wiring connect to Driver loom** | *Low pressure petrol sensor signal interruption*<br>Wire colour :<br>Wire location : |
| 17 AD 2 Blue-green | Blue-green connect to **Blue-black** | *Analog in ( sensor side, LOW pressure in / Boost in )*<br><br>Pin 10: blue-white, sensor side |
| 10 DAC 2 Green | Green connect to **Green-black** | *Simulation, analog out ( ecu side, LOW pressure out / Boost out )*<br><br>Pin 10: blue-white, connector side |
| | | |
| 56 DI 2 Yellow-green | Yellow-green connect to **Yellow-red** | *Digital Input 2, OEM petrol pump driver, PWM IN*<br><br>Pin 13: grey |

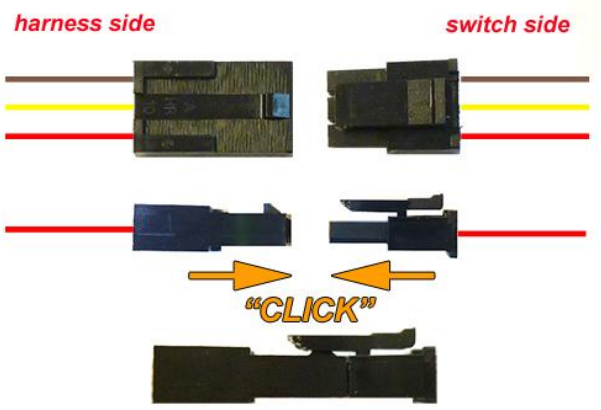
## Mounting the fuel selection switch

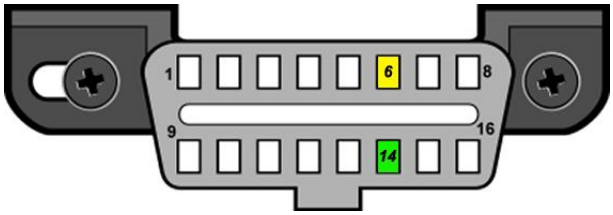
Mount the switch, drill Ø8,2mm.

# Electrical connections

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

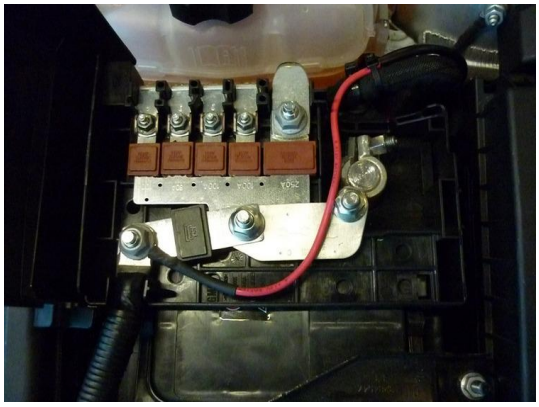
**Driver room**

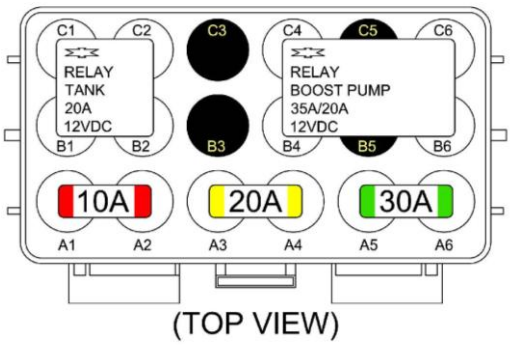
| ***Wire number / code*** | **Wire colour** | **Connection** |
|---|---|---|
| *3-pole micro connector*<br>66 Ground fuel switch<br>3 +12V fuel switch<br>49 LIN fuel switch | <br>Brown-black<br>Red-white<br>Yellow | Connect the 3-pole connector to the Prins fuel selection switch. |
| | |  |

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

# Electrical connections

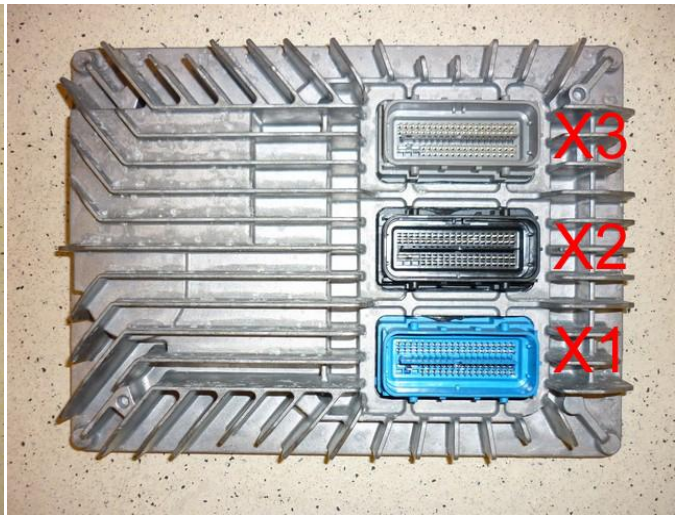
**Check and measure the wiring in case of changes in the cars wiring colours.**
**Insulate not used wires.**

| | | |
|---|---|---|
| 1-32<br>MAIN GND ecu<br>MAIN GROUND SENSE | Brown | Connect to the '–' of the battery ( -31 ) ;<br>use a ring terminal.<br>Wire colour : ground points Ø6mm ring terminal.<br>Wire location : in front of battery<br>  |
| 4 – 13<br>+12V BATT sense<br>+12V BATT fused<br>+12V BATT boost pump<br>+12V BATT pump driver | Red | Connect to the '+' of the battery ( +30 );<br>use a ring terminal Ø8mm.<br>**Do not place the fuses** before having completed the installation of the lpg system.<br>  |



(TOP VIEW)

# Petrol ECU




# 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* |
|---|---|---|
| 63 Ground Shift | Blue-orange | *High pressure petrol sensor ground*<br>Wire colour : black-green<br>Wire location : **X2, black connector, pin 3** |
| 7 +12V IGNITION | Grey - white | Wake up<br>Wire colour : blue-white<br>Wire location : **X2, black connector, pin 18** |
| 36&25 | | *High pressure petrol sensor signal interruption*<br>Wire colour : blue-white<br>Wire location : **X2, black connector, pin 19** |
| 36 AD 6 | Blue-brown | Sensor side |
| 25 DAC 1 | Green-white | Petrol ecu side |
| 18 AD 1 | Blue-white | *Analog in ( sensor side ) MAP sensor in*<br>Wire colour : green-white<br>Wire location : **X2, black connector, pin 43** |
| 15 T-ect | Grey | For measuring the engine coolant temperature.<br>Wire colour : blue<br>Wire location : **X3, grey connector, pin 8** |
| 8 RPM engine speed | Purple-white | For measuring the engine speed signal.<br>Wire colour :green<br>Wire location : **X3, grey connector, pin 26** |

Inside trunk:

| | | |
|---|---|---|
| 17&10 | AFC wiring connect to Driver loom | *Driver Low pressure petrol sensor signal interruption*<br>Wire location :trunk, right rear side, behind panel. |
| 17 AD 2 | Blue-green connect to **Blue-black** | *Analog in ( sensor side, LOW pressure in / Boost in )*<br>Pin 10: blue-white, sensor side |
| 10 DAC 2 | Green connect to **Green-black** | *Simulation, analog out ( ecu side, LOW pressure out / Boost out )*<br>Pin 10: blue-white, connector side |
| | | |
| 56 DI 2 | Yellow-green connect to **Yellow-red** | *Digital Input 2, OEM petrol pump driver, PWM IN*<br>Pin 13: grey |

# 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 |
|---|---|---|
| 22 LSS 1 | Purple-white | |
| 23 LSS 2 | Purple-green | |
| 40 Wake-up | Grey-red | |
| 42 Digital out pull up 2 | Red-purple | |
| 58 +12V switched | Red-white | |
| 60 DI 3 | Yellow-grey | |
| 61 DI 4 | Yellow-blue | |
| 20 AD 3 | Blue-pink | |
| 19 AD 4 | Blue | |
| 21 AD 9 | Blue-purple | |
| 74 DAC 3 | Green-pink | |

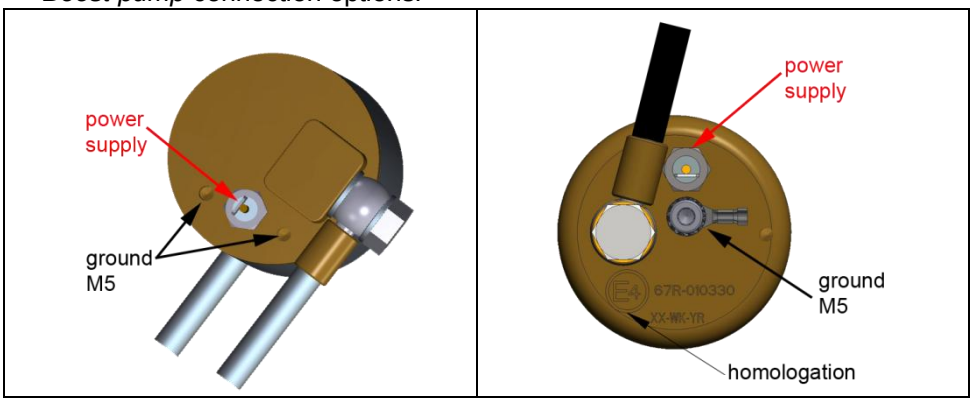
# Electrical connections

**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* | | Connect the 3-pole connector to the Psys sensor positioned into the Fuel Return Unit. |
| 35 Ground Psys pin A | Brown | Sensor wire pin A |
| 9 +5V sensor pin B | Red-blue | Sensor wire pin B |
| 16 Psys pin C | Green | Sensor wire pin C |
| | | |
| *2-pole connector FSU, black* | | |
| 24 + Lock-off FSU | Yellow-green | Connect the 2-pole connector to the lock-off valve |
| 31 C Ground | Brown-black | of the Fuel Supply Unit |
| *2-pole connector FRU, grey* | | |
| 43 + Lock-off FRU | Red-white | Connect the 2-pole connector to the lock-off valve |
| 34 C Ground | Brown-black | of the Fuel Return Unit |
| *4-pole diagnose connector* | | Diagnose connector for service / diagnosis |
| 46 Service TxD | Grey | Connector pin 1 |
| 65 Service RxD | Grey | Connector pin 2 |
| 68 C Ground | Brown-black | Connector pin 4 |
| *Boost pump relay* | | |
| 2 + relay boost pump | Red-white | Pin 86 of the boost pump relay C4 |
| 26 Ground BP relay | Purple-blue | Pin 85 of the boost pump relay B6 |
| +12V fused BATT | Red 2.5mm2 | Pin 30 of the boost pump relay C6-A5 |
| +12V Boost pump | Red 2.5mm2 | Pin 87 of the boost pump relay B4 |
| *Wiring tank pump driver relay* | | |
| 57 + driver relay | Red-white | Pin 86 of the driver relay C1 |
| 73 LSS 4 tank relay | Purple-blue | Pin 85 of the driver relay B2 |
| +12V BATT fused | Red 2.5mm2 | Pin 30 of the driver relay C2-A4 |
| +12V driver | Red 2.5mm2 | Pin 87 of the driver relay B1 |

*Boost pump* connection options:

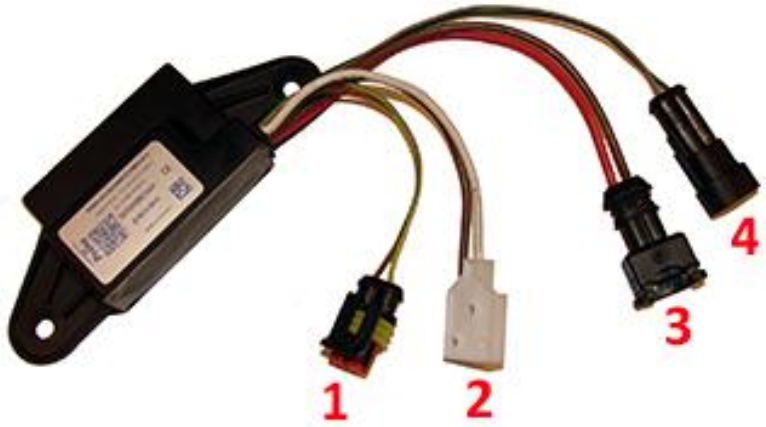


# Electrical connections

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