ALTERNATIVE FUEL SYSTEMS

Prins

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

Installation manual
Dedicated
PART 2/2

MANUFACTURER	CADILLAC
TYPE	CTS
ENGINE DISPLACEMENT	3600 / 3000
NUMBER OF VALVES	24V
ENGINE CODE / NUMBER	**LFX** / LF1
VEHICLE CATEGORIES	M
TRANSMISSION	AT
VERSION	Direct LiquiMax-2.0
PETROL ECU MANUFACTURER / CODE	AC Delco
HIGH PRESSURE PETROL POMP	AC Delco 12641740
HIGH PRESSURE PETROL INJECTOR	AC Delco
MODEL YEAR:	2012
SYSTEM APPROVAL NUMBER (R115)	E4-115R-000012 / DLM-LPG 05
LOCATION SYSTEM STICKER	right side, centre door post
ENGINE SET NUMBER	**335/070004/A** / 335/070012/A
MANUAL NUMBER	076/3500500
DATE	2013-12-19

Version 2012-05-21 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 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.

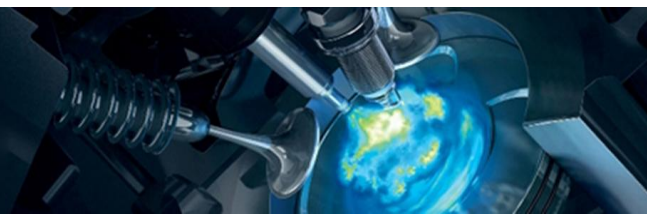
Register (warranty card) the system on the Prins warranty portal .

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

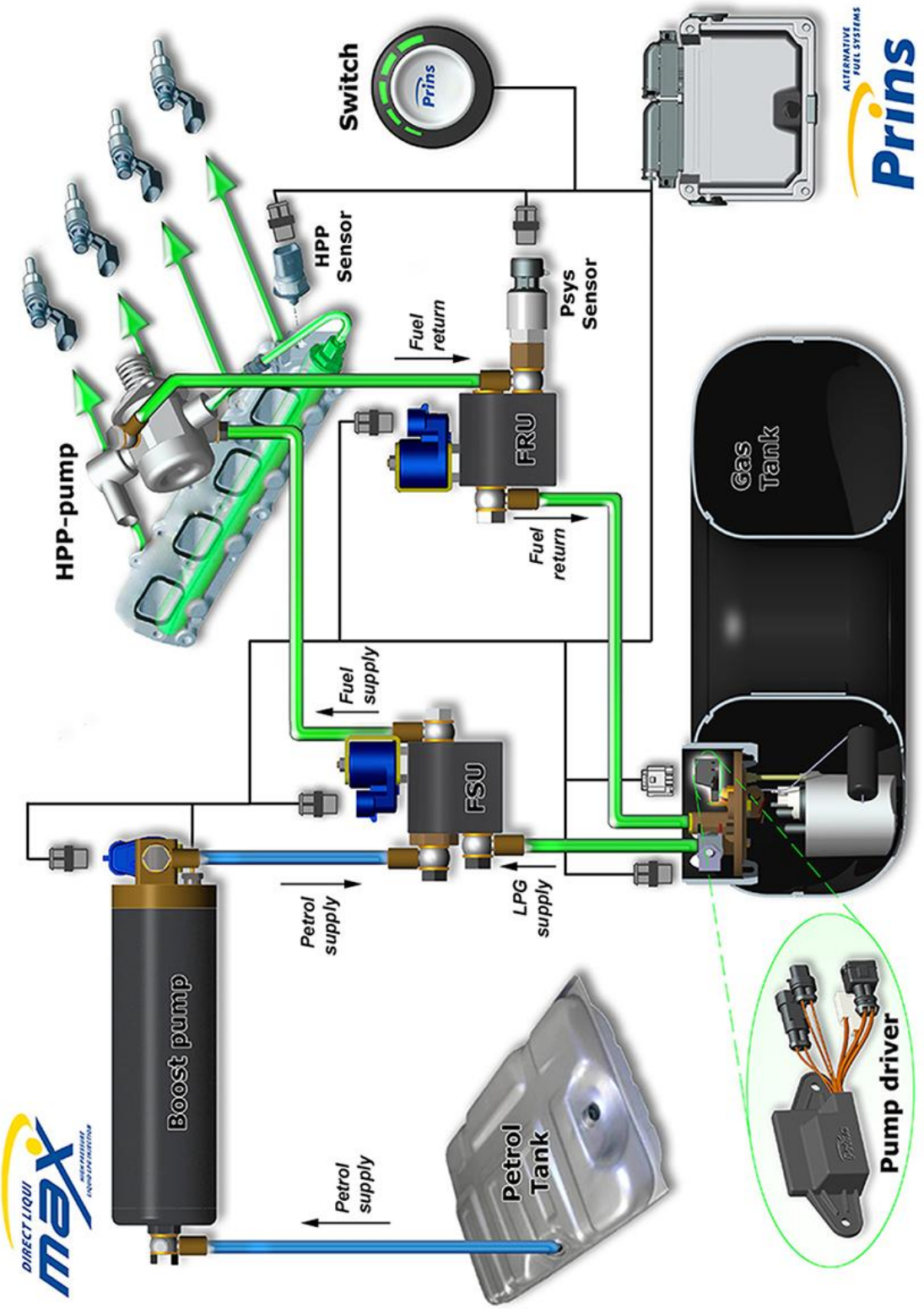
		Nm	SW
M 4 x 0,7		3,3	7
M 5 x 0,8		6,5	8
M 6 x 1,0		11,3	10
M 7 x 1,0		14,5	11
M 8 x 1		24,5	13
M 8 x 1,25		27,3	13
M 10 x 1		52	15-16-17
M 10 x 1,5		54	15-16-17
(filtered)Banjo bolt		10	14
Supply line connection		15	13
Fuel module Allen bolts		20	7
Filler hose connection		50	22

EXPLANATION OF SYMBOLS :

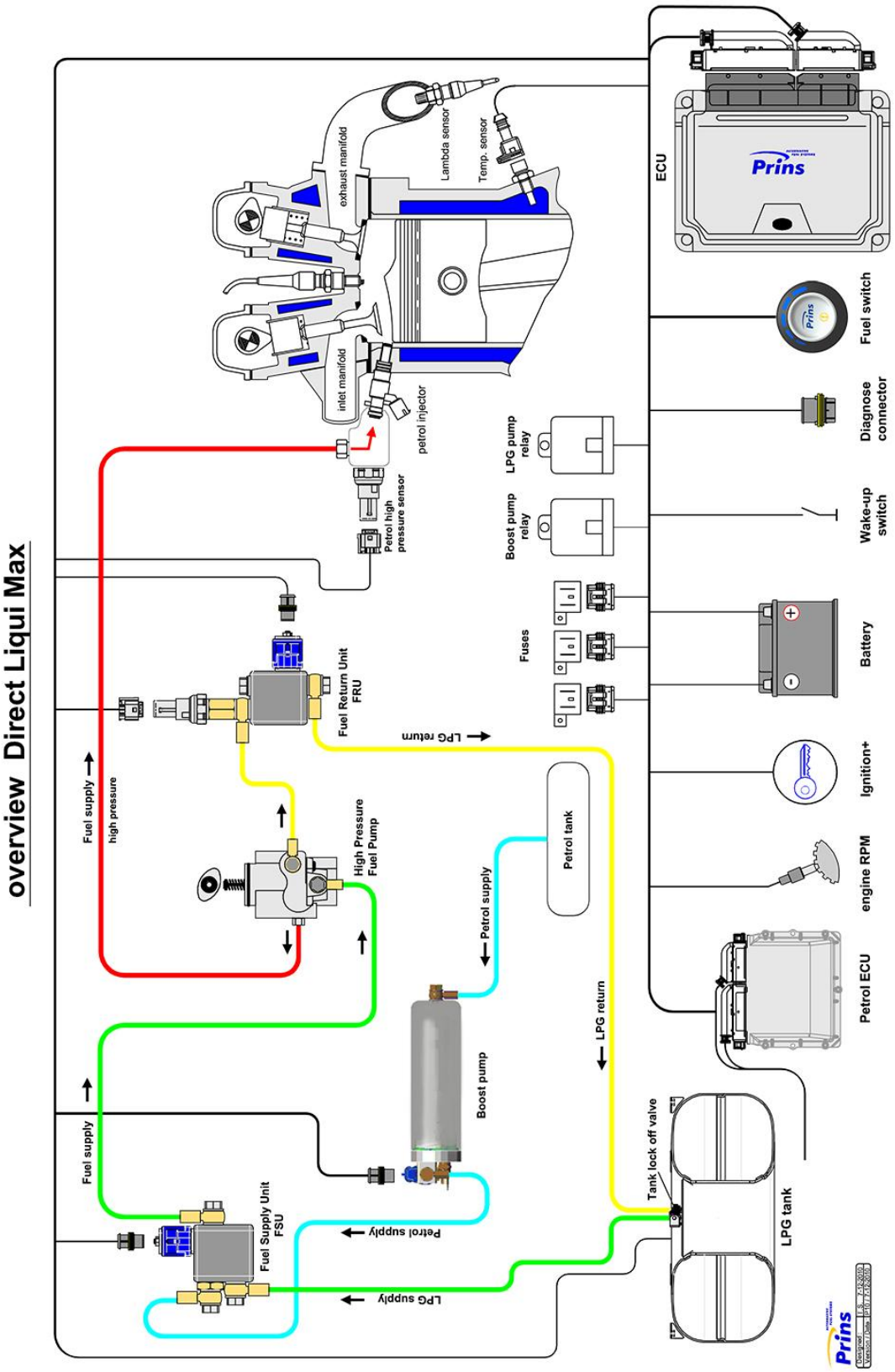
= IMPORTANT, CAUTION

= 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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<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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<tr>
<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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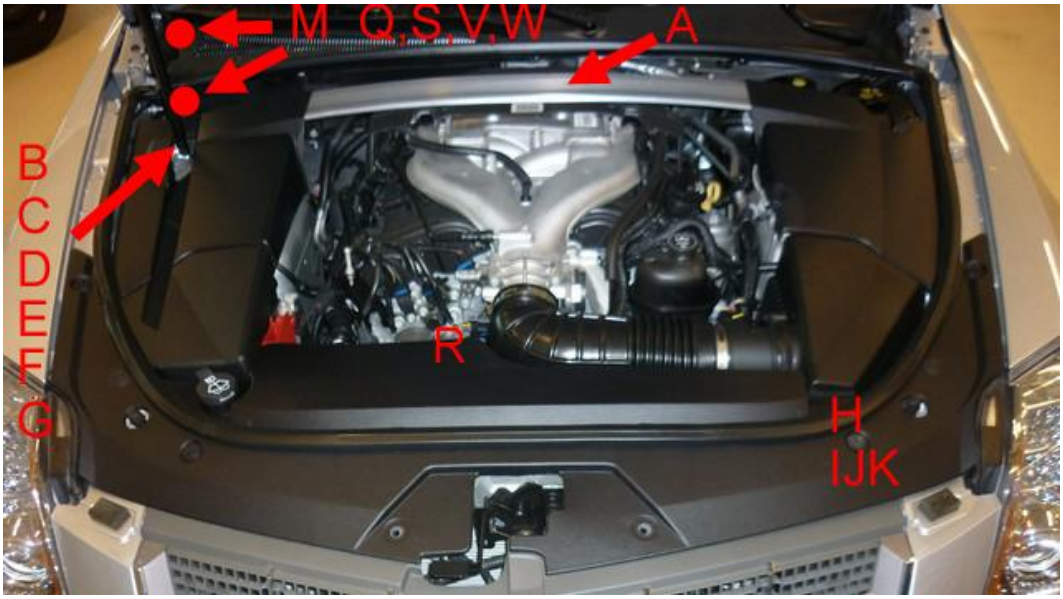
Mounting and connection points



A : High pressure petrol pump	L : R115 Approval sticker
B : Fuel Supply Unit : FSU	M : Grommet
C : Fuel Return Unit : FRU	N : Gas system fuses
D : Boost pump	P : T-ect
E : AFC	Q : Low pressure petrol sensor signal
F : Boost pump relay	R : MAP, Analog 3
G : Tank relay	S : Digital input 3 pwm
H : Petrol ECU	T : Analog 4
I : Engine speed signal RPM	V : Analog 2
J : “+” ignition	W : Wake-Up
K : High pressure petrol sensor signal	X : Digital input

L:
R115 approval sticker :
Right side centre door post

Removal of the AC Delco High Pressure Pump

-REMOVAL-

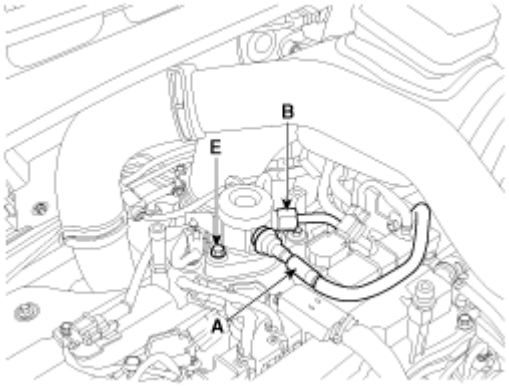
-WARNING-

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.



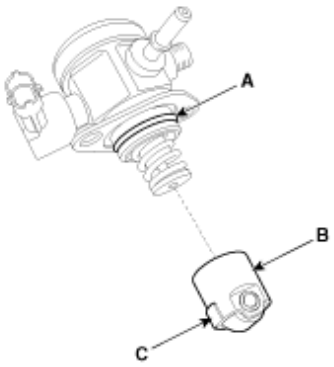
CAREFULLY store the removed petrol pump. Make sure no pollution can come into the pump.

Installation of the Delco 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

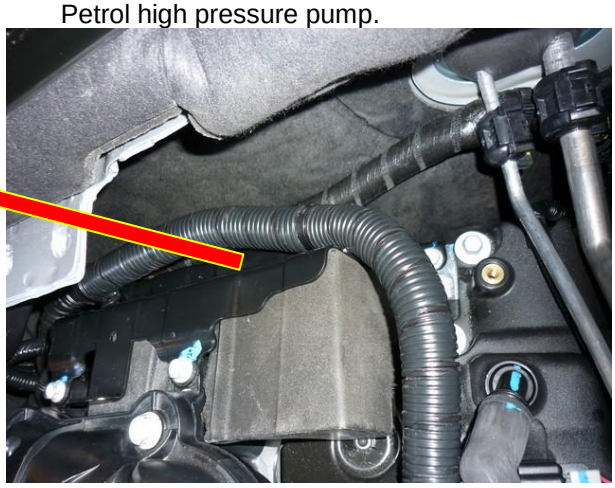
Fuel pipe:
First hand-tighten the nut(s) fully until they are not fastened any more in order to have them inserted in place and then completely tighten to the specified torque using a torque wrench.
If not tightening the bolts or nuts in a straight line with the mating bolt holes or fittings, it may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

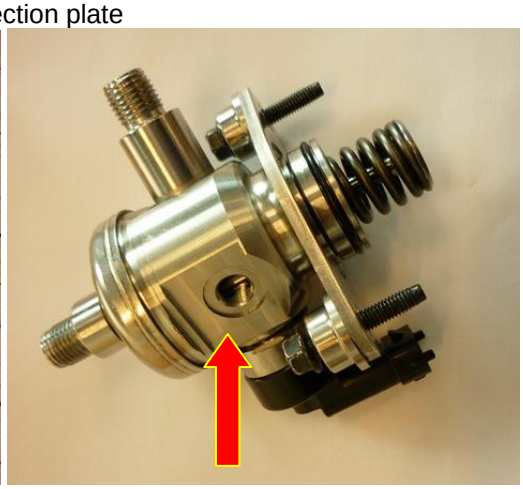
High petrol pressure pump installation

Replace the high pressure pump for the adapted high pressure pump.
(Follow the workshop manual of the car)
Remove wiper arm, cover, wiper motor.
Remove the upper inlet part with throttle body. ***Make sure nothing can fall into the intake ducts***.

Petrol high pressure pump.

Remove the protection plate

Replace the high pressure pump for the adapted version.

Roller tappet :

Careful : roller tappet can fall out the pump housing !
See chapter : Installation of the Bosch High Pressure Pump !

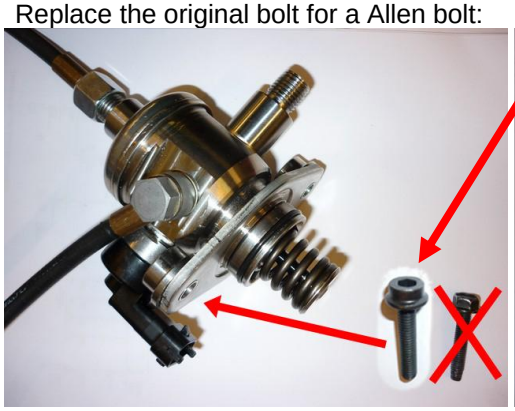
High petrol pressure pump return

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

Not used again

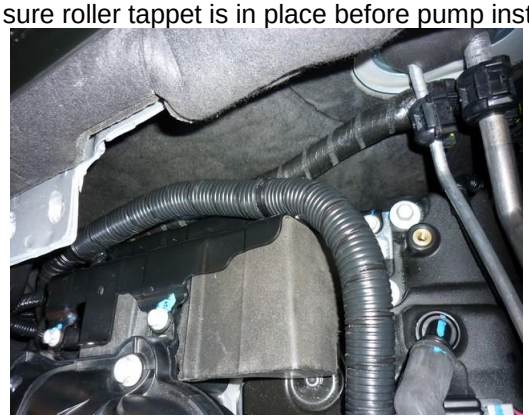
Allen bolt ***Short head banjo bolt***

Replace the original bolt for a Allen bolt:



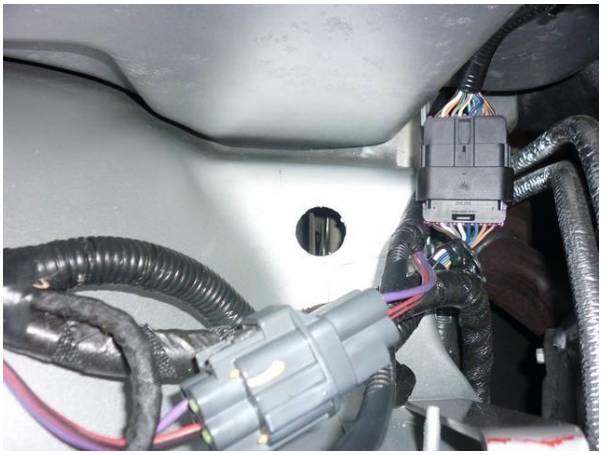
Install / tighten the hoses (see page 4) as shown. After installation, tightening is no longer possible !!!

be sure roller tappet is in place before pump installation !



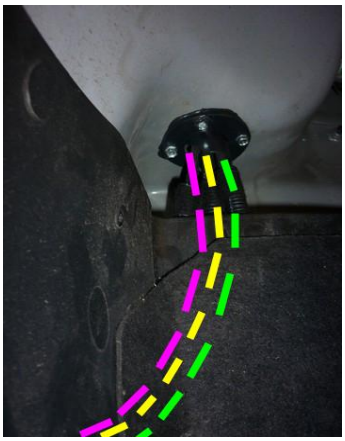
Install protection shield back on the engine.

Mounting the LPG supply and return hoses



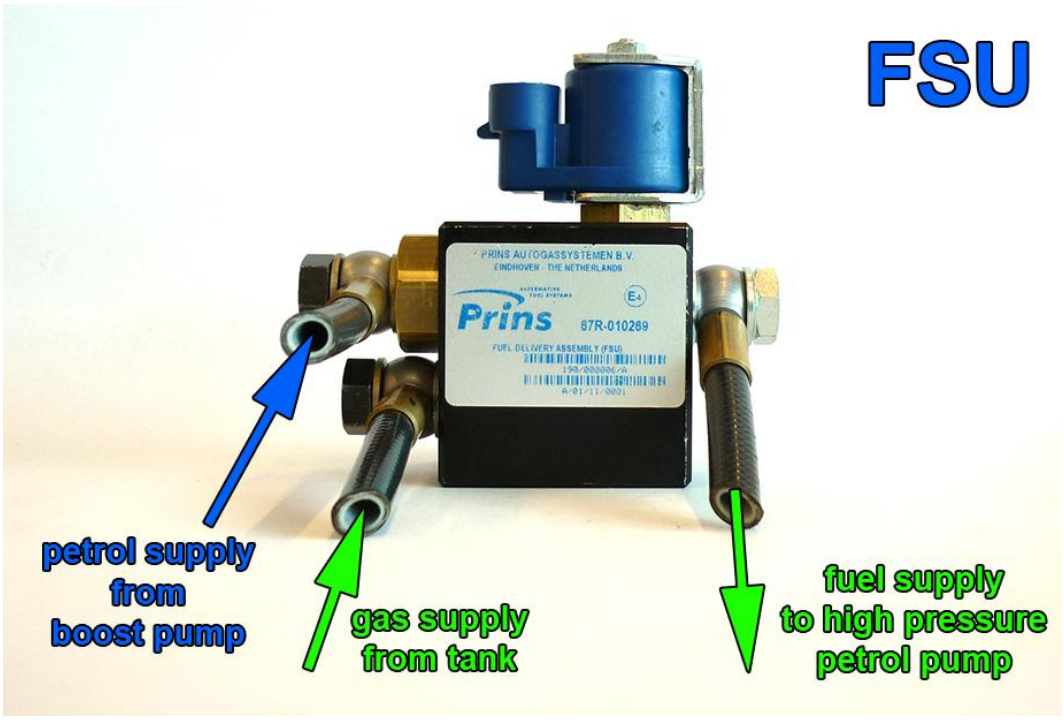

Drill a ø30mm hole in the right front wheel fender (see photo).
protect against corrosion.


Adapt bleeder and fix with four screws and kit.



- -Wiring harness to the LPG tank
- -Return hose
- -Supply hose

Fuel Supply Unit



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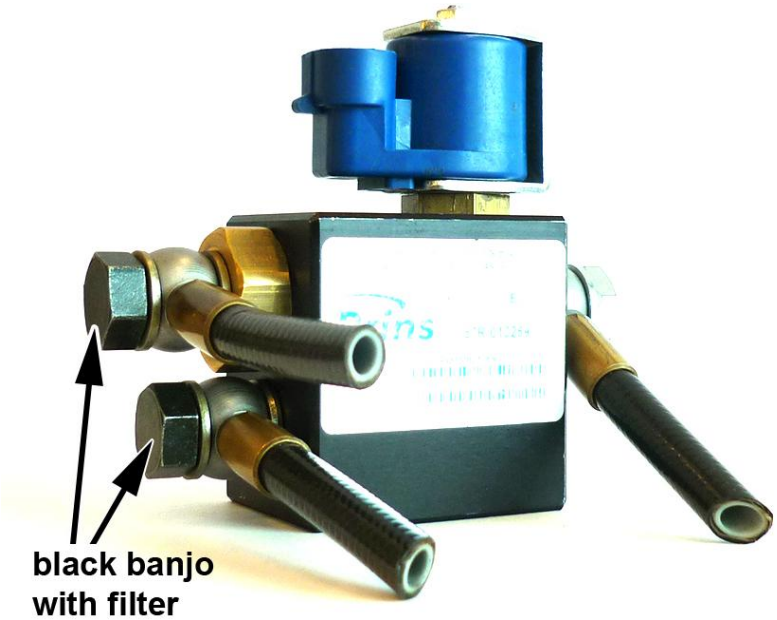
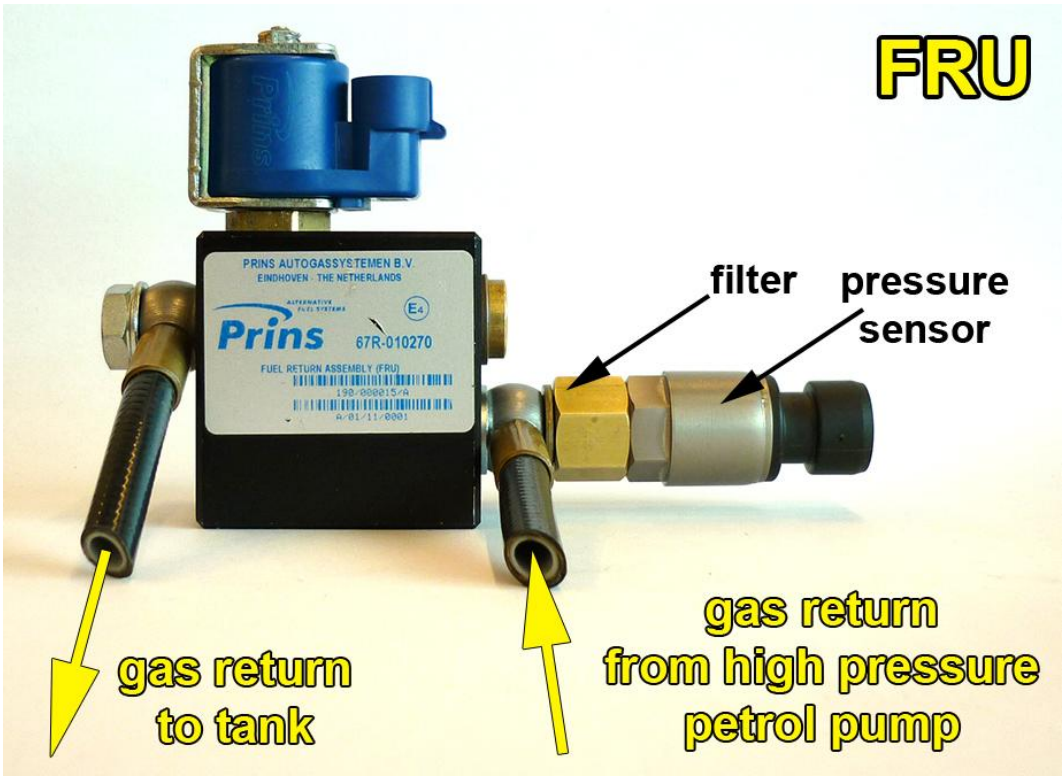


Black filtered banjo will only be used on inlet connections !

Fuel Return Unit

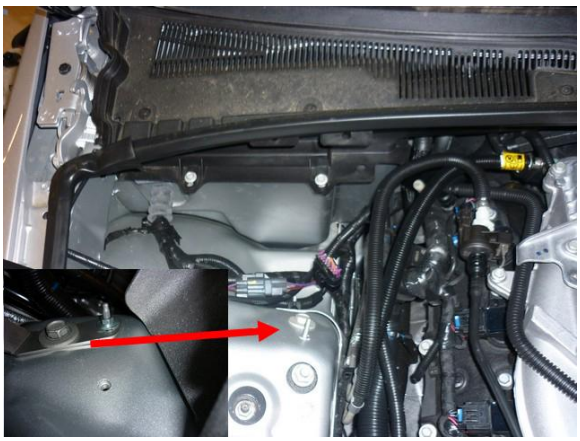


Filter inside sensor banjo

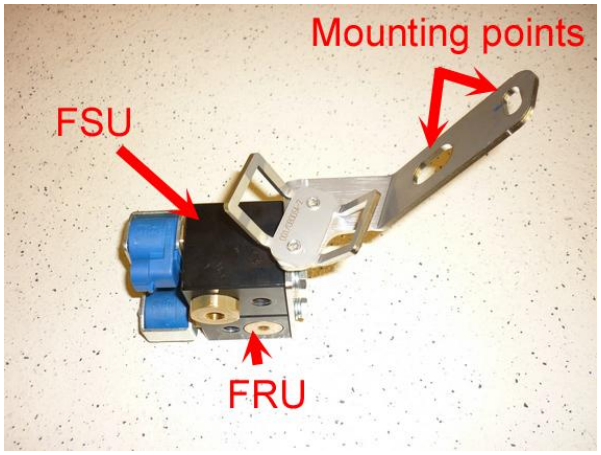
Mounting the Fuel Supply and Fuel Return Unit

001/110008/A

001/080054/2



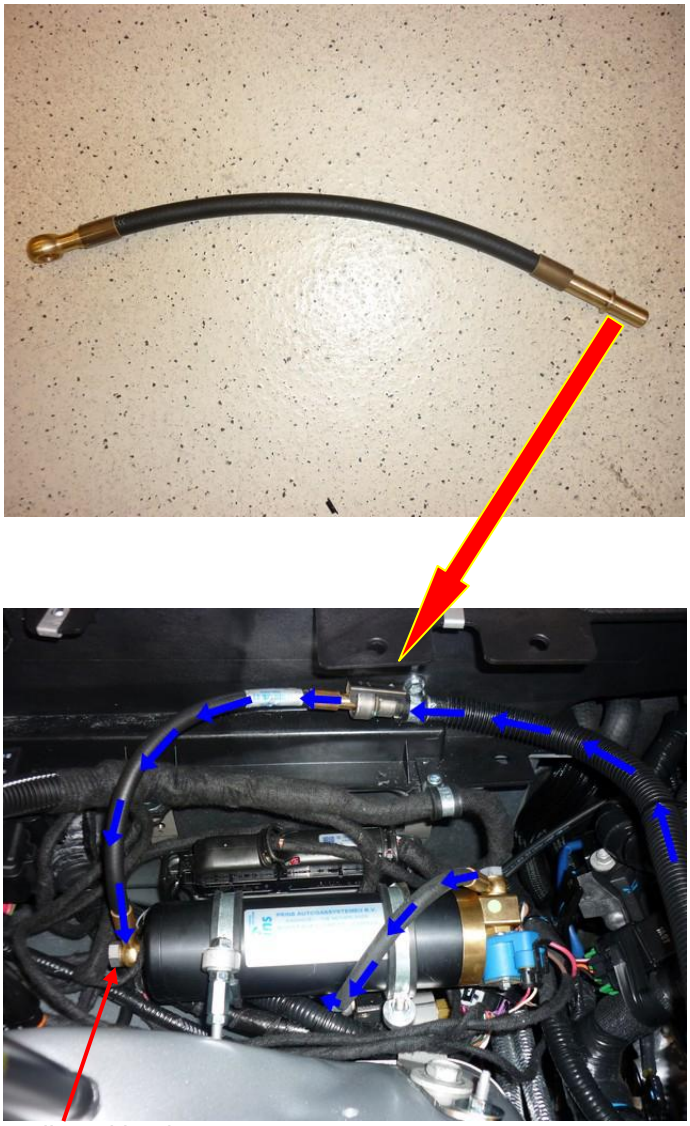
Install FSU and FRU onto the bracket and mount the bracket on the right suspension strut



Original mounting point on the right suspension strut.

Boost pump

Connection of the fuel hose to the boost pump.



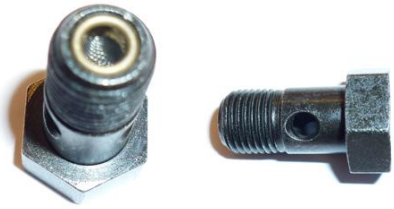
Filtered banjo

LPG / petrol fuel lines

Hose Ø mm	from	to	Length (cm)
XD 4	Adapter original petrol hose	Petrol boost pump	25 cm
XD 3	Fuel supply unit	High pressure petrol pump	65 cm
XD 4	Petrol boost pump	Fuel supply unit	20 cm
XD 3	Fuel return unit	High pressure petrol pump	75 cm

Install the fuel line using two bonded seal washers and (filtered) banjo bolt for each banjo side:

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



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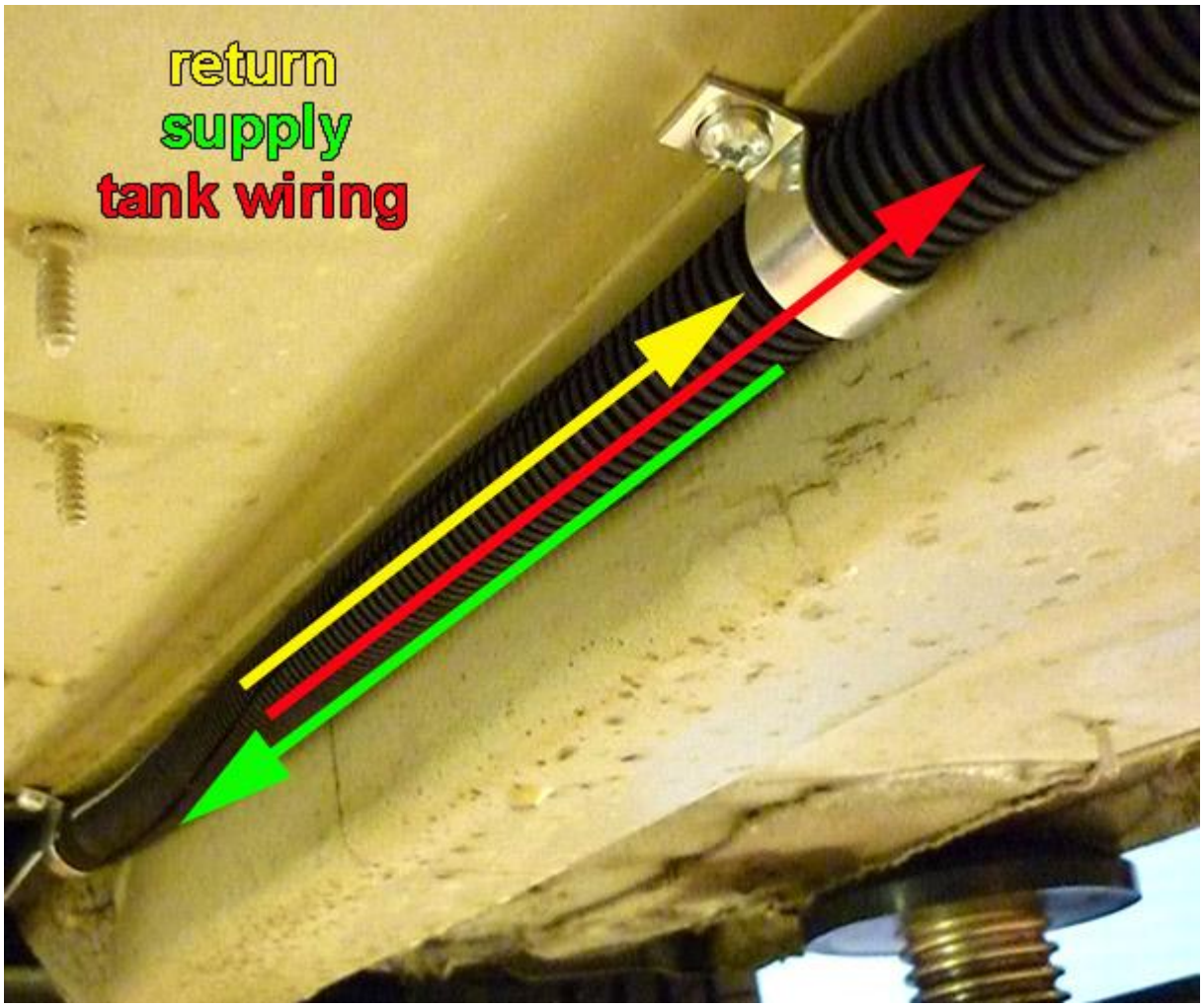
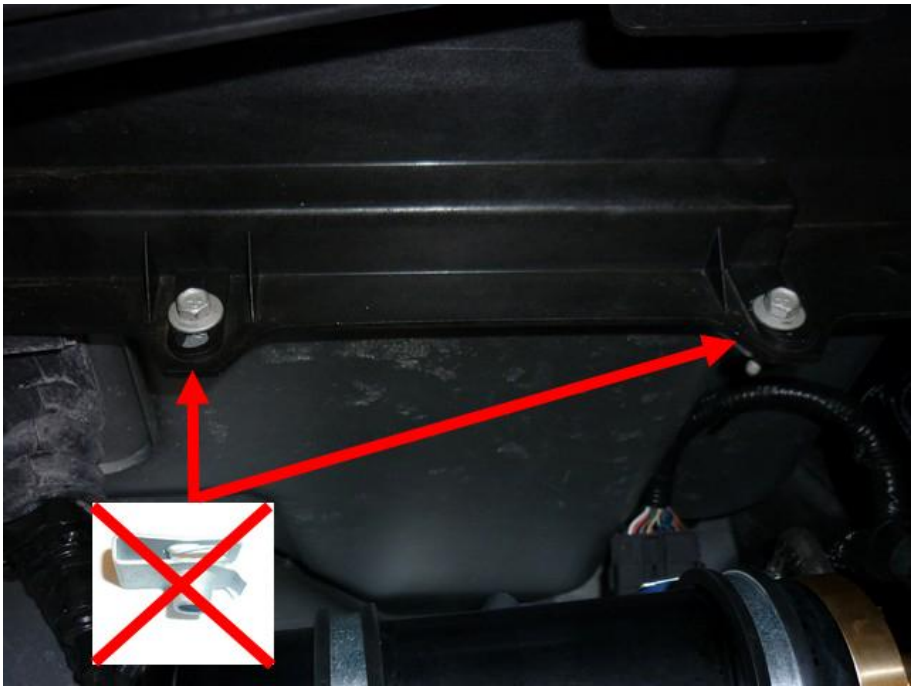
Supply hose – Return hose – Tank wiring

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.



Mounting the AFC

All models

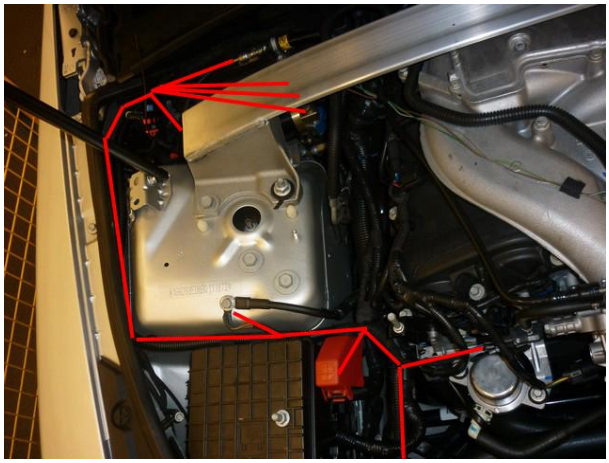
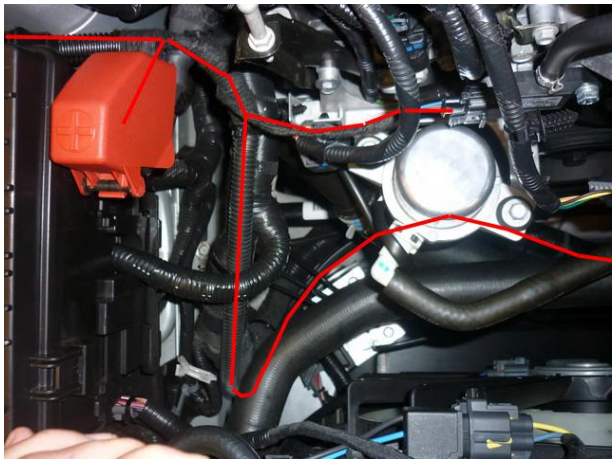


Remove the bolts and remove the clips.
Re-use bolts for the AFC bracket.

Mount the AFC bracket, with mounted AFC speed clip, with the original bolts.

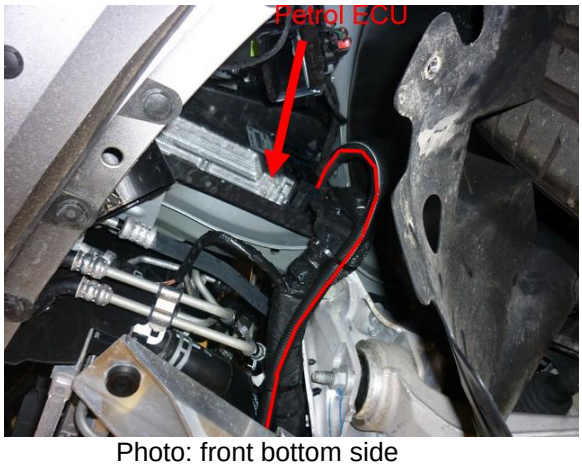
Wiring AFC / Routing wiring

Routing model 2012 petrol ecu left side underneath head light.

Route the AFC harness, together with the original thick wiring harness
(Original harness runs over the sub frame) to the petrol ECU.

*Extend the wiring harness to the petrol ECU for **125cm.***



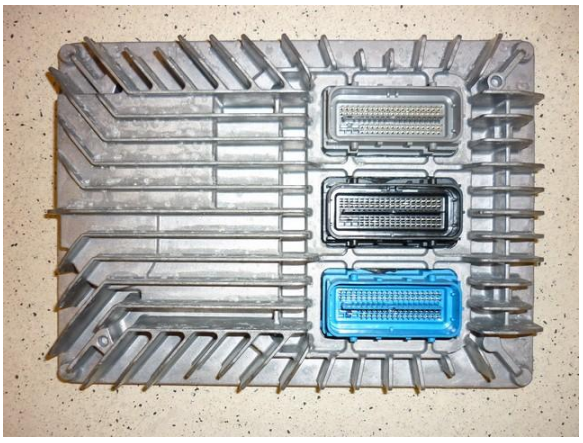


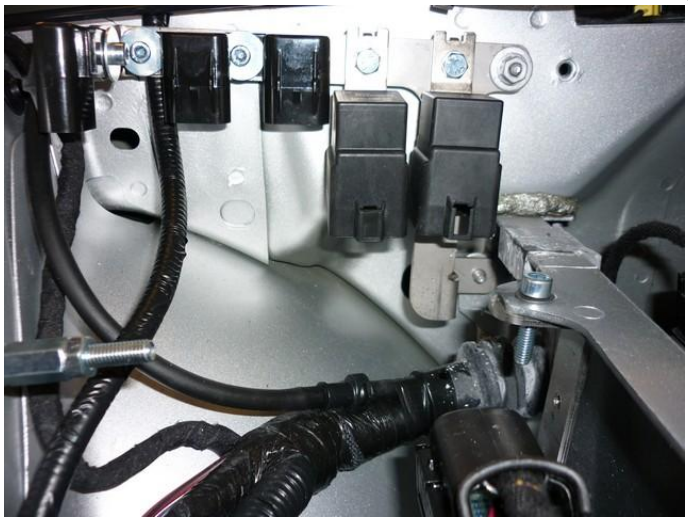
Photo: front bottom side

Fuse installation

Model 2008

Remove the bracket (if present)

All models:

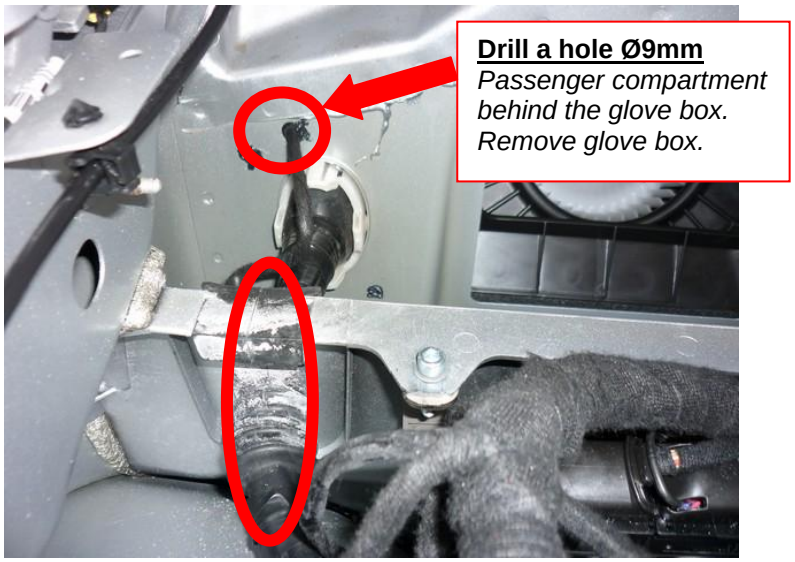


Install the fuses and relays onto the bracket

Mounting the fuel selection switch

Wiring inside : Switch, EOBD, CAN, Pump driver petrol wiring.

Grommet cable harness

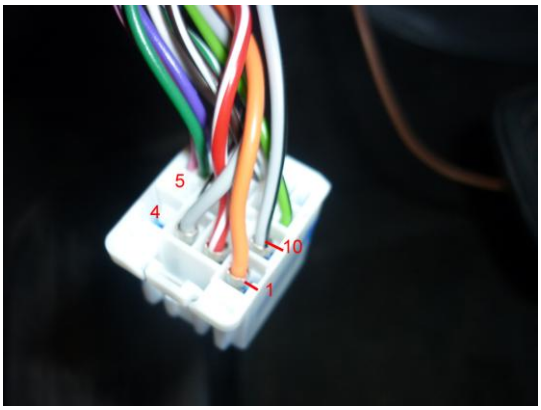


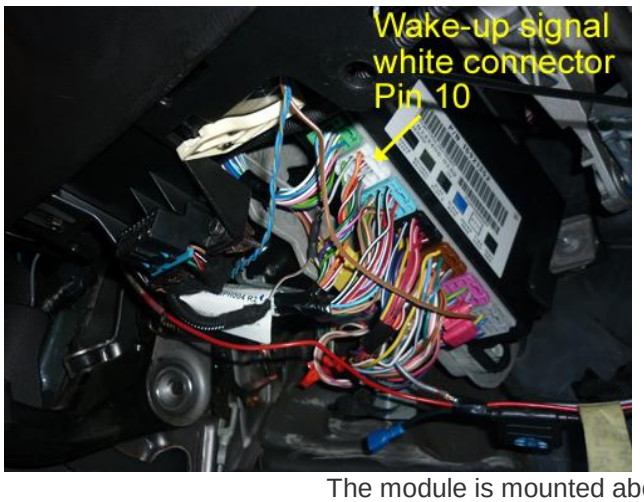
Transit to passenger compartment : Switch, EOBD, CAN, Pump driver petrol wiring.

Electrical connections

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

Driver room inside

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	Blue-yellow	EOBD connector pin 6
70 CAN-Low	Blue	EOBD connector pin 14
121 Wake-up	Red-grey	Wire colour : Grey-black Wire location : left-side dashboard Body Control Module locking right of the steering column above the accelerator pedal (see picture) with connector **pin 10** 



The module is mounted above the accelerator pedal.

Electrical connections

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

Trunk inside

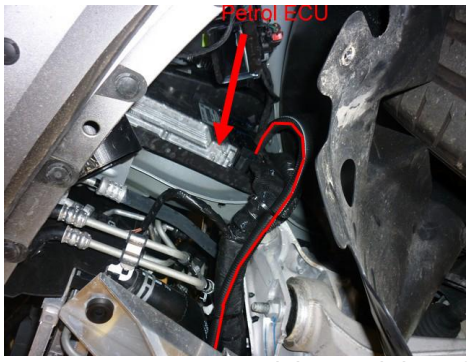
17 Analog 2 10 Simulation 2 **Extend wires (see picture)**	Blue-black Green-black	Low pressure sensor petrol interruption Sensor side. ECU side. Wire colour :Purple Wire location : on left wheel arch in the trunk. Module **Pin 10** 
115 Digital input 4 **Extend wires (see picture)**	Yellow-red	Petrol fuel pump driver (PWM in) Fuel pump flow control module. Wire colour :Grey Wire location : on left wheel arch in the trunk. Module **Pin 47** 

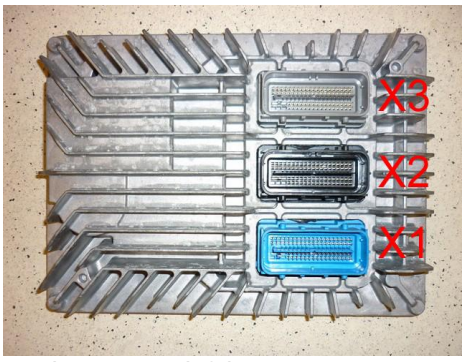
Extend the wires

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 : Right suspension strut 
4 – 13 – 44 +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 fuse in the holder before having completed the installation of the LPG system. Wire location :Fuse box 





Model 2012,(Photo front bottom car left.)

Electrical connections

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

Engine room

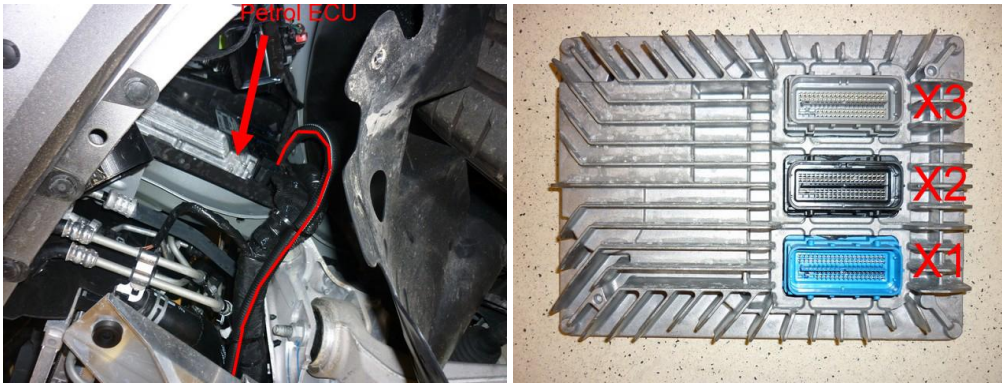
Wire number / code	*Wire colour*	*Connection*
18 Analog 1 25 Simulation 1	Blue-red Green-grey	*High pressure petrol sensor signal interruption* Sensor side. ECU side. Wire colour :Yellow Wire location : Petrol ECU under the left headlight insert ECU connector **X2, black connector, pin 19**
19 Analog 4	Blue-white	*High pressure petrol sensor ground* Wire colour :Tan Wire location : Petrol **X2, black connector, pin 3**
117 Digital input 3	Yellow-black	*High pressure petrol sensor 5Volt supply* Wire colour :**Grey** Wire location : **petrol ecu X2, black connector, Pin 18**
119 Digital input 2 23 Digital Simulation	Yellow-grey Green-red	Digital Airflow signal sensor interruption Wire colour :Yellow sensor side Wire colour :Yellow ecu side Wire location : Petrol ecu **X2, black connector, pin 52**
97 Digital input 5	Yellow-orange	High pressure sensor Fuel pump actuator Wire colour :Purple Wire location : petrol ecu **X3, grey connector, Pin 32**
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 : Pink Wire location :Petrol ECU under the left headlight insert ECU connector **X1, blue connector, pin 51**
113 Digital input 6	Yellow-purple	insulate
6 Lambda1 WB	Orange	insulate
42 Lambda2 WB 10KΩ	Orange-white	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
27 +5V sensor 37 C ground 20 Analog 3 MAP* * cut off connector: Only use blue signal wire 20	Red:insulate Brown:insulate Blue	Wire colour : light- green Wire location : Petrol ecu **X2, black connector, pin 43**
8 RPM Extend wires (see picture)	Purple-white	For measuring the engine speed signal. Wire colour :Yellow Wire location :Petrol ecu **X3, grey connector, pin 26**
15 T-ect Extend wires (see picture)	Grey	For measuring the engine coolant temperature. Wire colour : Yellow Wire location : Petrol ECU under the left headlight insert ECU connector **X3, grey connector, pin 8**



Model 2012,(Photo front bottom car left.)


Extend the wires

Electrical connections

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

Engine room

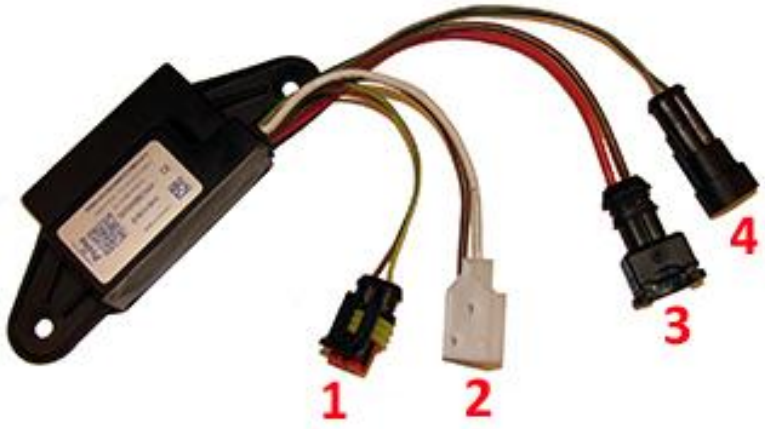
Wire number / code	Wire colour	Connection
3-pole connector		Connect the 3-pole connector to the Psys sensor positioned into the Fuel Return Unit.
35 C Ground pin A	Brown	Sensor wire pin A
9 +5V sensor pin B	Red	Sensor wire pin B
16 Psys pin C	Green	Sensor wire pin C
14 T-LPG	Grey	Not used, insulate.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