ALTERNATIVE FUEL SYSTEMS

Prins

installation manual
Engine Kit
part 2/2

MANUFACTURER	Ford
TYPE	Mondeo
ENGINE DISPLACEMENT	1596 cc
NUMBER OF VALVES	16
ENGINE CODE / NUMBER - OUTPUT	JTBB - 118kW
VEHICLE CATEGORIES	M1
TRANSMISSION	MT
AFC VERSION / SYSTEM	**AFC-2.1 / DLM Gen3**
PETROL ECU MANUFACTURER / CODE	Bosch MED
HIGH PRESSURE PETROL PUMP	Bosch HDP-5-PE BM5G 0261.520.140 (Type 7)
HIGH PRESSURE PETROL INJECTOR	Bosch HDEV-5-1
MODEL YEAR:	2011
SYSTEM APPROVAL NUMBER (R115)	X
LOCATION R115 SYSTEM STICKER	right side, centre door post
ENGINE SET NUMBER	347/070616001/A
MANUAL NUMBER	076/0707100
DATE	24-4-2017
	347/070616002/A
	Version 30-6-2016 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 Gen3 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.
- When working on the car, beware of moving and rotating parts in the engine compartment (even when the engine is not running !!).
- 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 debris has been removed (especially when mounting an exterior filler into body work).
- After having completed the installation, check the whole system for LPG leakage; use a gas 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’s 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 the system (with warranty card) on the Prins warranty portal within 14 days after installation.

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 no. 099/99928)
- Exhaust gas analyzer
- Multimeter
- Oscilloscope
- Prins diagnostic software
- Prins Diagnostic Tool
- Torque wrench (5-50Nm)
- Torque wrench (200-250Nm)
- Portable light
- Assortment drill bits Ø4 to 12 mm
- Assortment cutters (Ø20, 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

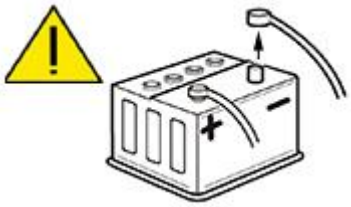
- Check the vehicle drivability on petrol
- Check the fuel system for error codes (scan tool)
- Check if the catalytic converter is in good condition (exhaust gas analyzer)
- Check the condition of the ignition system (spark plugs, cables, coil)

Tightening moments

		Nm	Spanner mm
M 5 x 0,8		6.5	8
M 6 x 1,0		11.3	10
M 8 x 1,25		27.3	13
M 10 x 1,5		54	15-16-17
Banjo bolt		10	14
Supply line connection tank		15	13
Fuel module Allen bolts tank		20	7
Filler hose connection tank		50	22
Boost pump M6 mounting bolts		10	10
FMU M6 mounting bolts		10	10
High pressure petrol fuel line		24-35	17
Quick release		20	19

EXPLANATION OF SYMBOLS:

= IMPORTANT, CAUTION

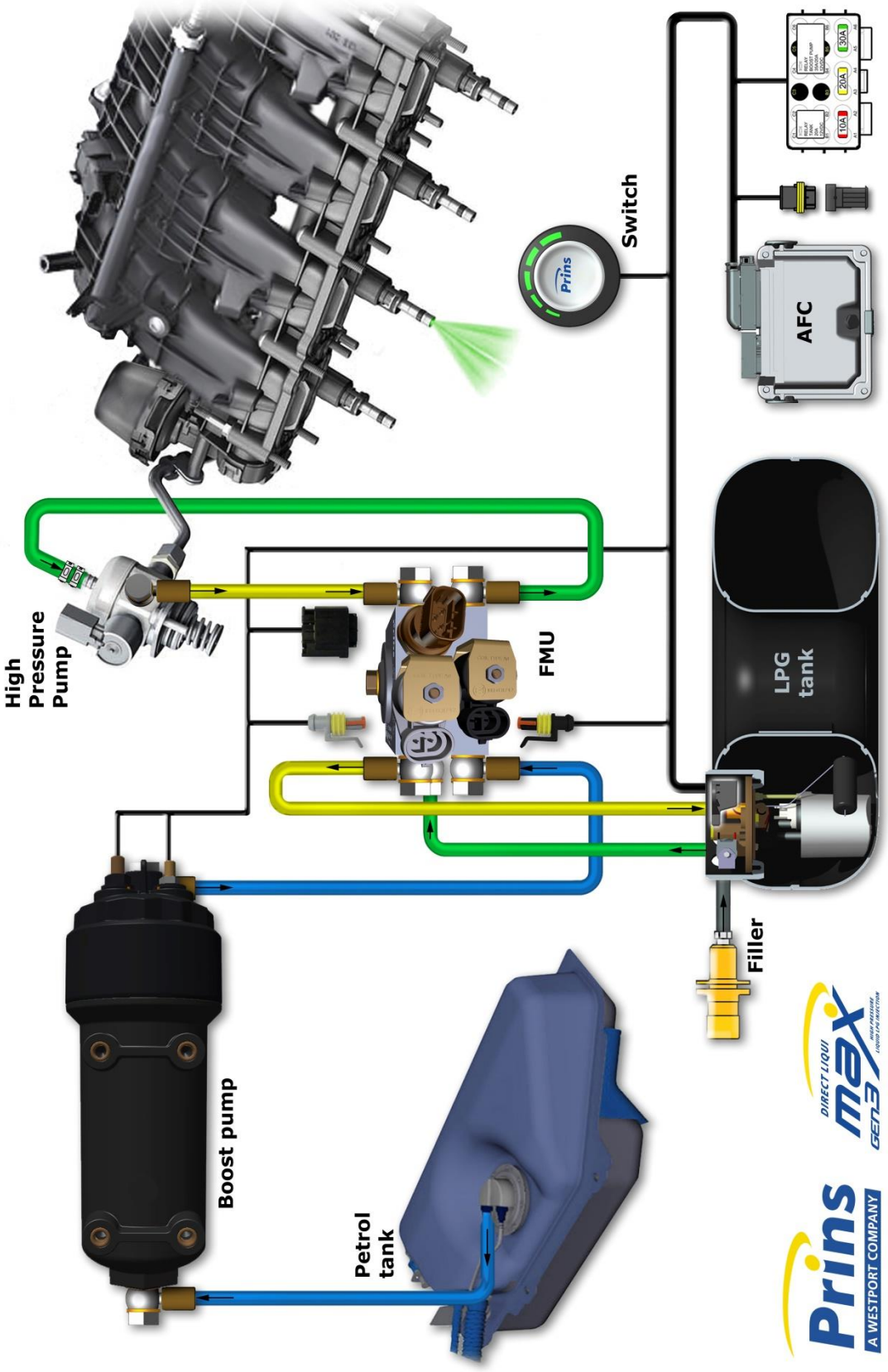


= WEAR SAFETY GOGGLES

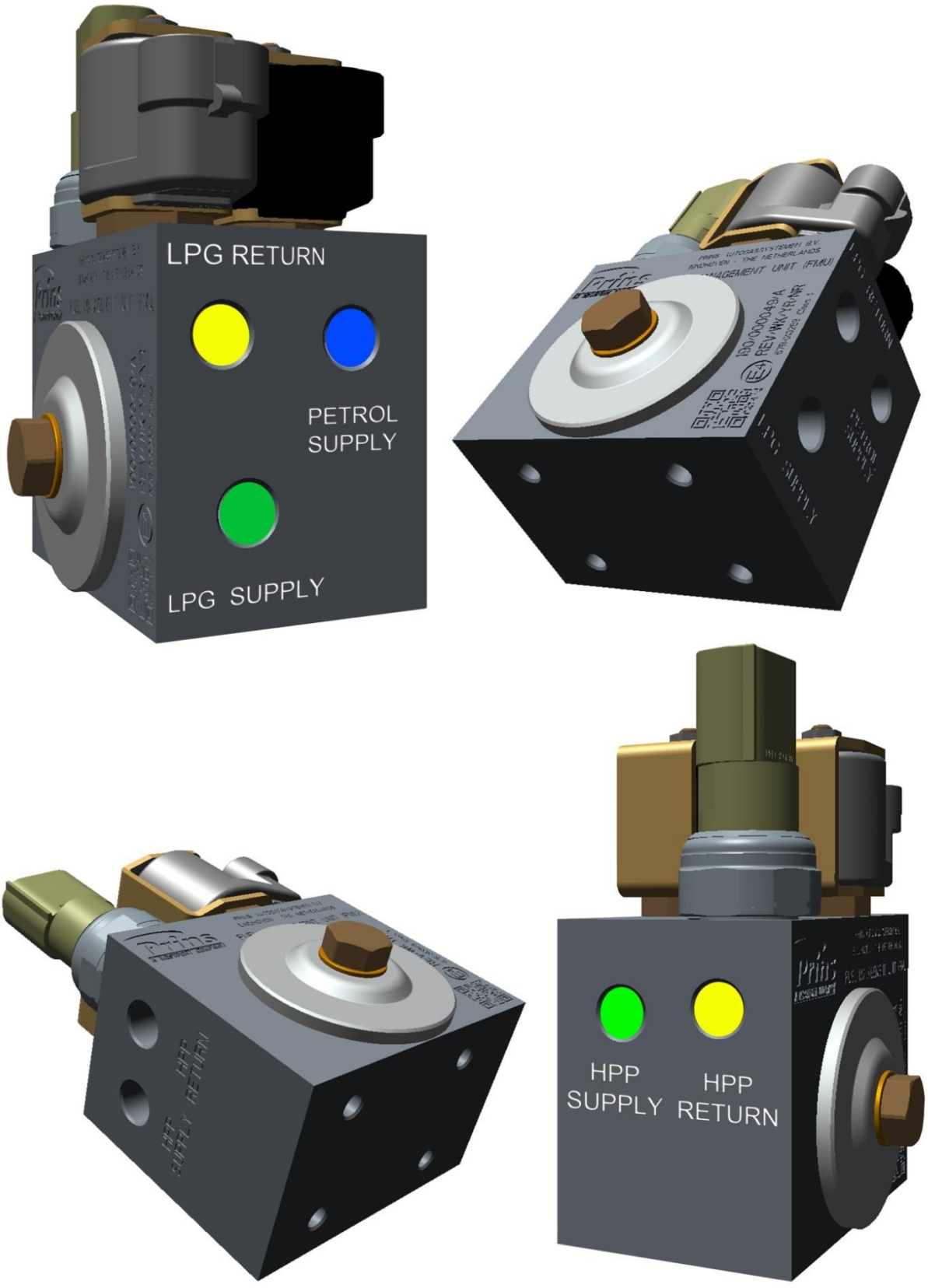
Direct LiquiMax parts / approval numbers

	
Fuel Management Unit : E4-67R-010269	Boost pump
	
Prins AFC: E4-67R-010098 E4-10R-030507	High Pressure Pump : E4-67R-010266 High Pressure Rail : E4-67R-010267 High Pressure Injectors : E4-67R-010309
	
	Fuel lines XD-series : E4-67R-010247

Overview DLM Direct Injection



Fuel Management Unit connections



Fuel Management Unit

Boost pump

DLM component location overview

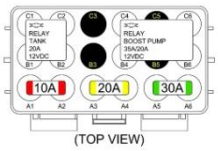
HPP pump

FMU

Boost pump

AFC

Fuse / relay box



i.a. R115 approval sticker :
Right side centre door post

Removal of the High Pressure Petrol Pump

-REMOVAL-

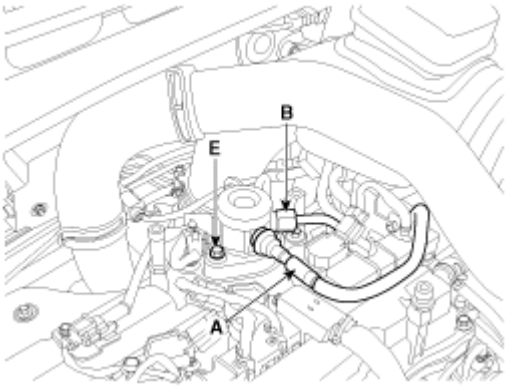
-WARNING-

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.



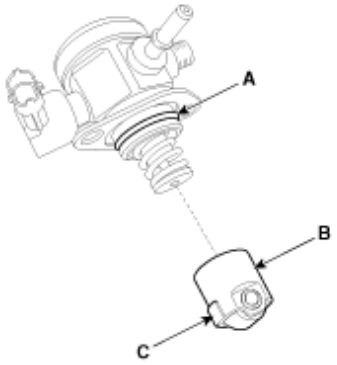
CAREFULLY store the removed petrol pump. Make sure no pollution can come into the pump.

Installation of the 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 Nm.

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 Nm.

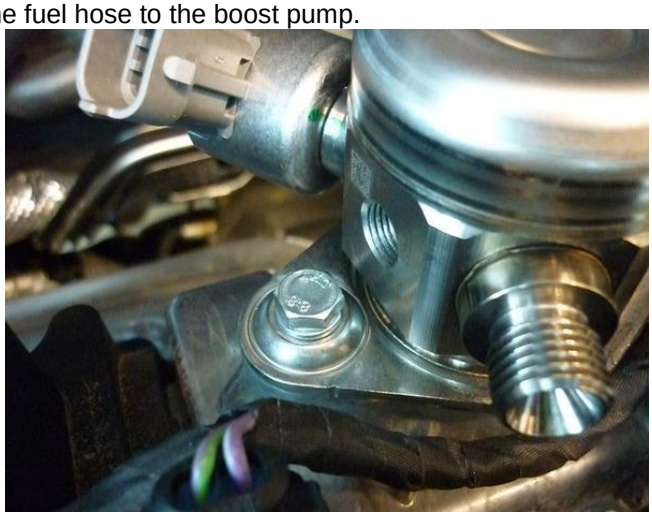
Installation is reverse of removal.

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)

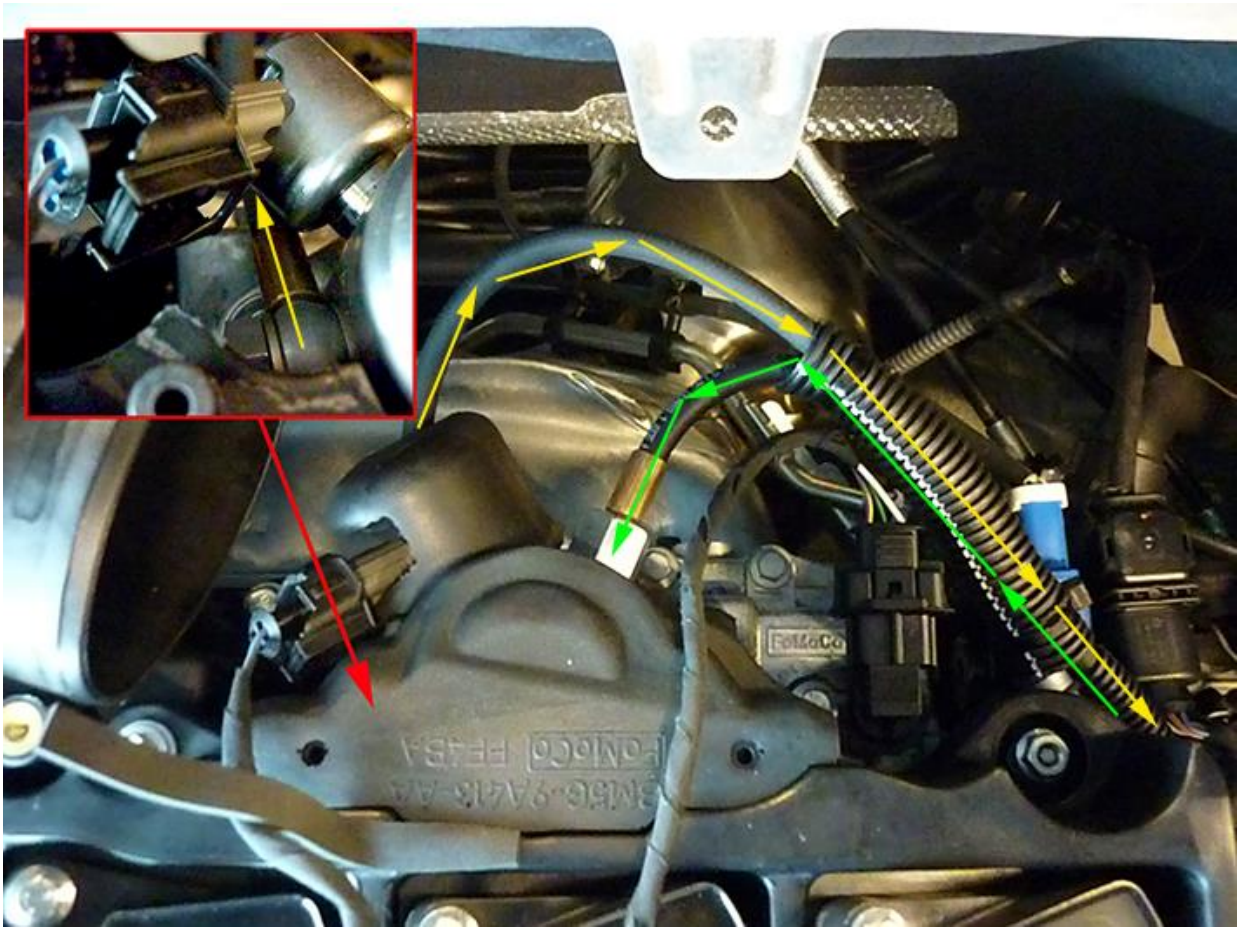
Remove low pressure petrol line (not used anymore)

See chapter : Connection of the fuel hose to the boost pump.



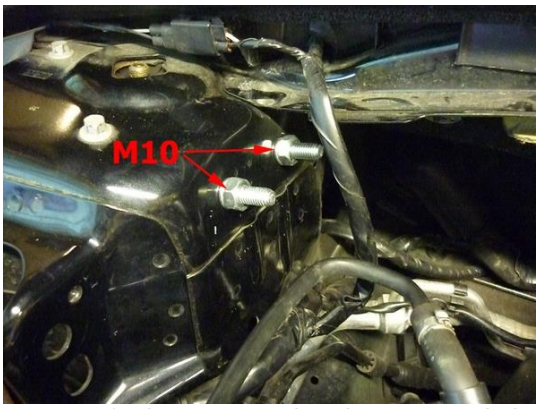
Install a new (shorter) M6x25 bolt.

High pressure petrol pump LPG supply / return



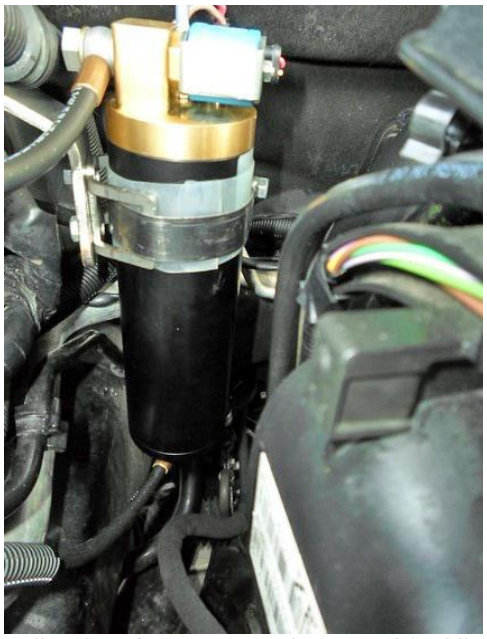
Adapt cover. Remove bolt (cut away)

Boost pump



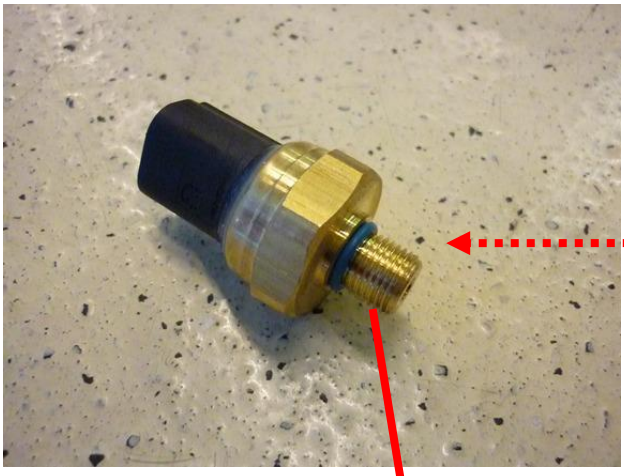
2 bolts M6x13 for boost pump bracket onto main bracket

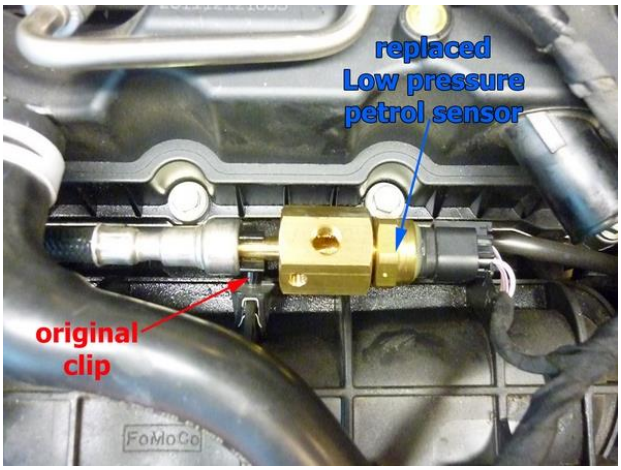
Pictures show the old version boost pump. Install new Type 5 boost pump.

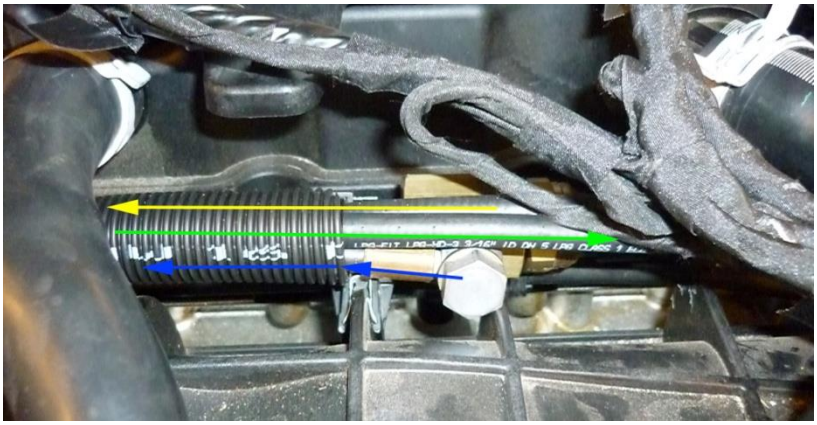


Split-tube Ø9mm protection petrol fuel line

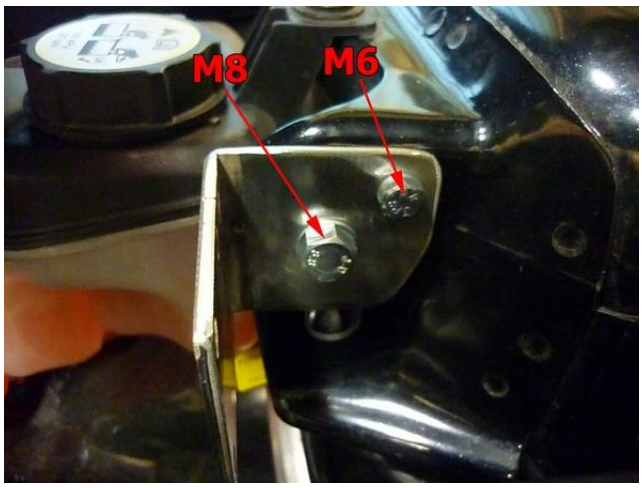
Connection of the petrol fuel hose to the boost pump.





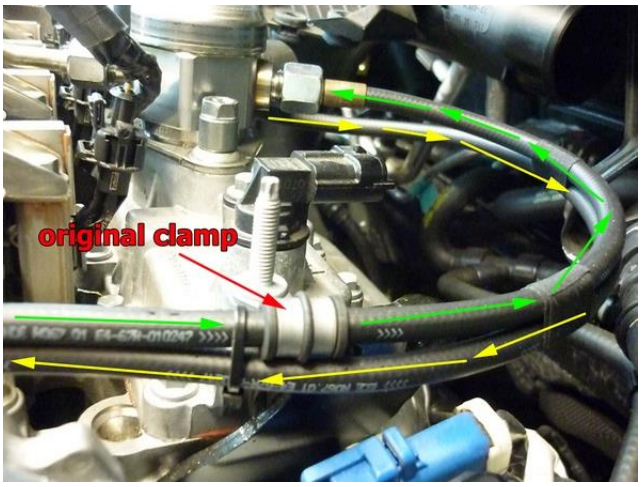


Mounting the Fuel Unit



Connection of the fuel hose to the boost pump.

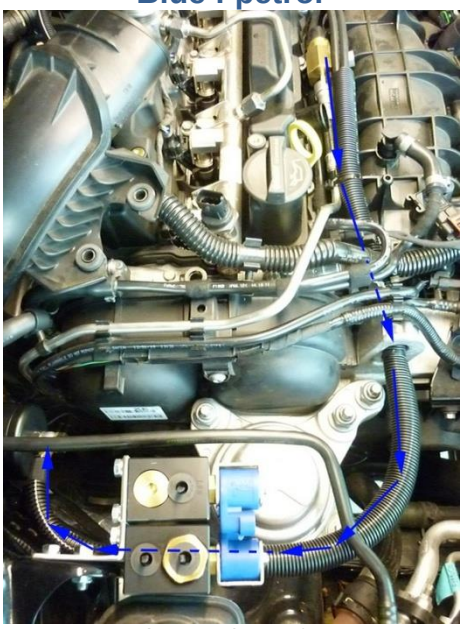
Connect the fuel hoses to the boost pump.



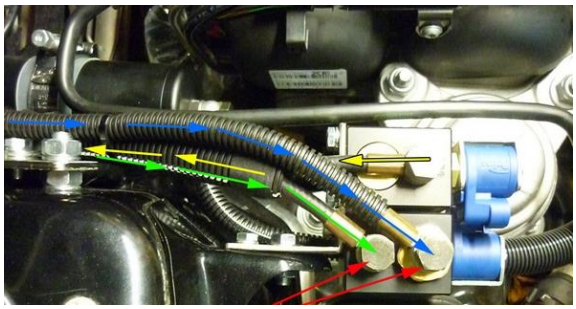
Upgrade FSU/FRU for FMU

Connection of the petrol fuel hose to the boost pump.

Blue : petrol

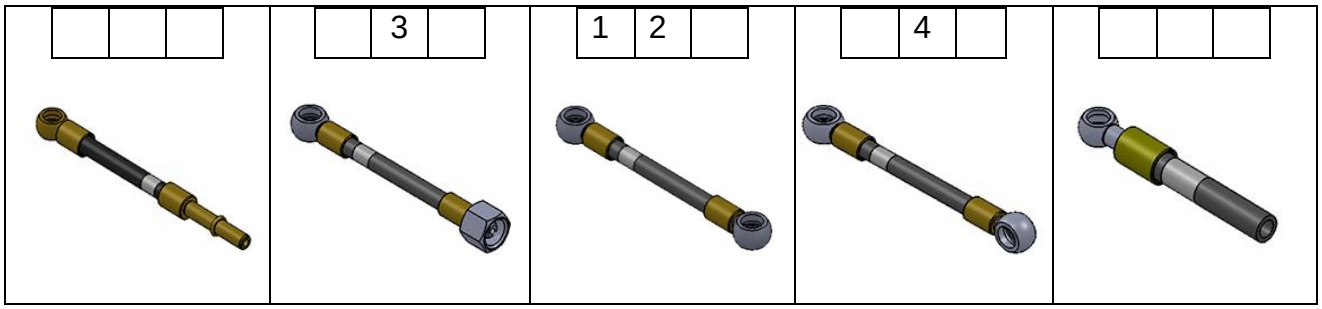


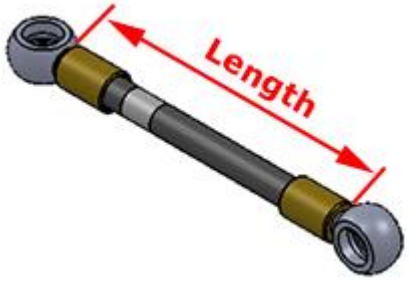
Upgrade FSU/FRU for FMU



LPG / petrol fuel lines

Hose		from	to	Length (cm)
1	XD-3	Adapter original petrol hose	Boost pump in	90
2	XD-3	Boost pump out	FMU petrol supply	25
3	XD-3	FMU HPP supply	High pressure pump	115
4	XD-3	High pressure pump	FMU HPP return	125
5	XD fuel supply line	FMU LPG supply	Tank	550
6	XD fuel return line	FMU LPG return	Tank	550

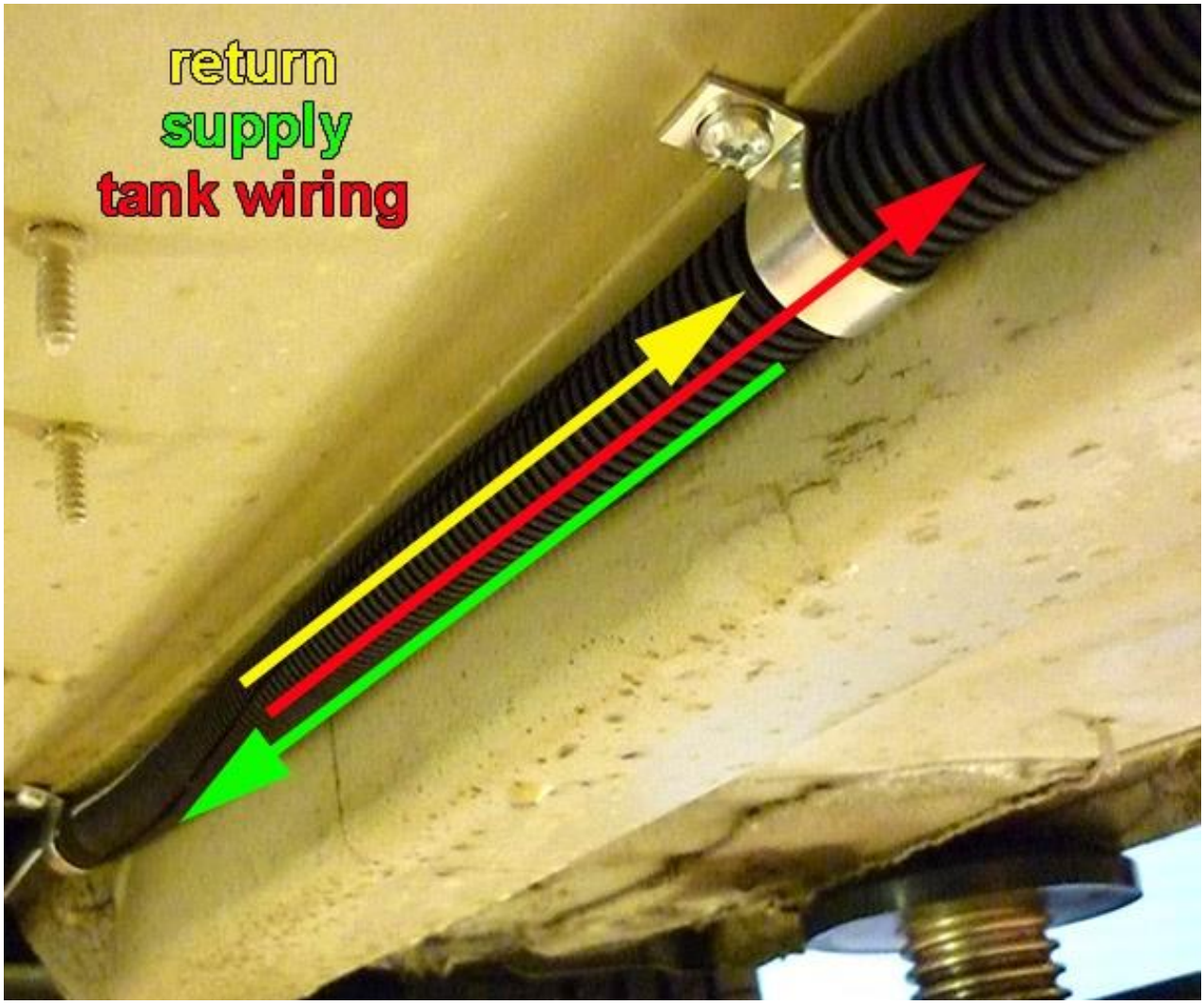




Install the fuel line using two bonded seal washers and banjo bolt :

Supply hose – Return hose – Tank wiring

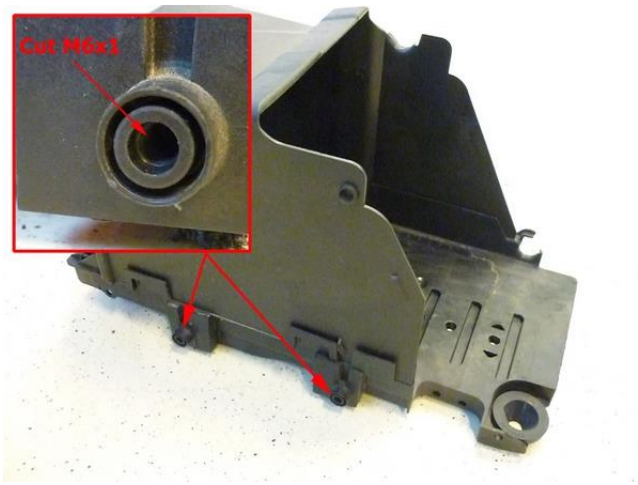
Protect the supply- and return hose together with tank-wiring using the Ø16mm split tube.
Mount the “hose assembly“ with clamps, with a maximum distance of 40cm.



Demo photo

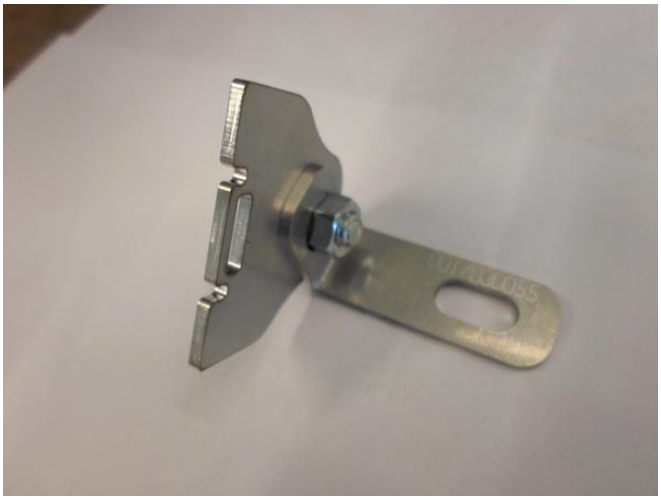
Mounting the AFC-2.1

Remove battery box

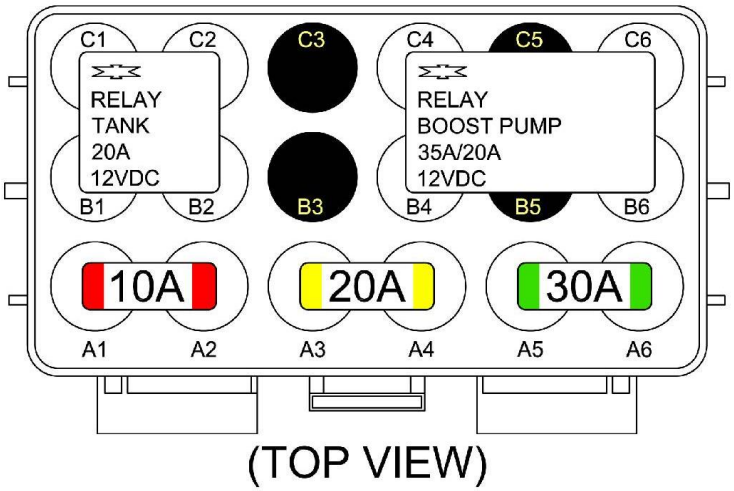


Bolt on the bracket with M6x20 and spring washers

Mounting the fuse / relay box

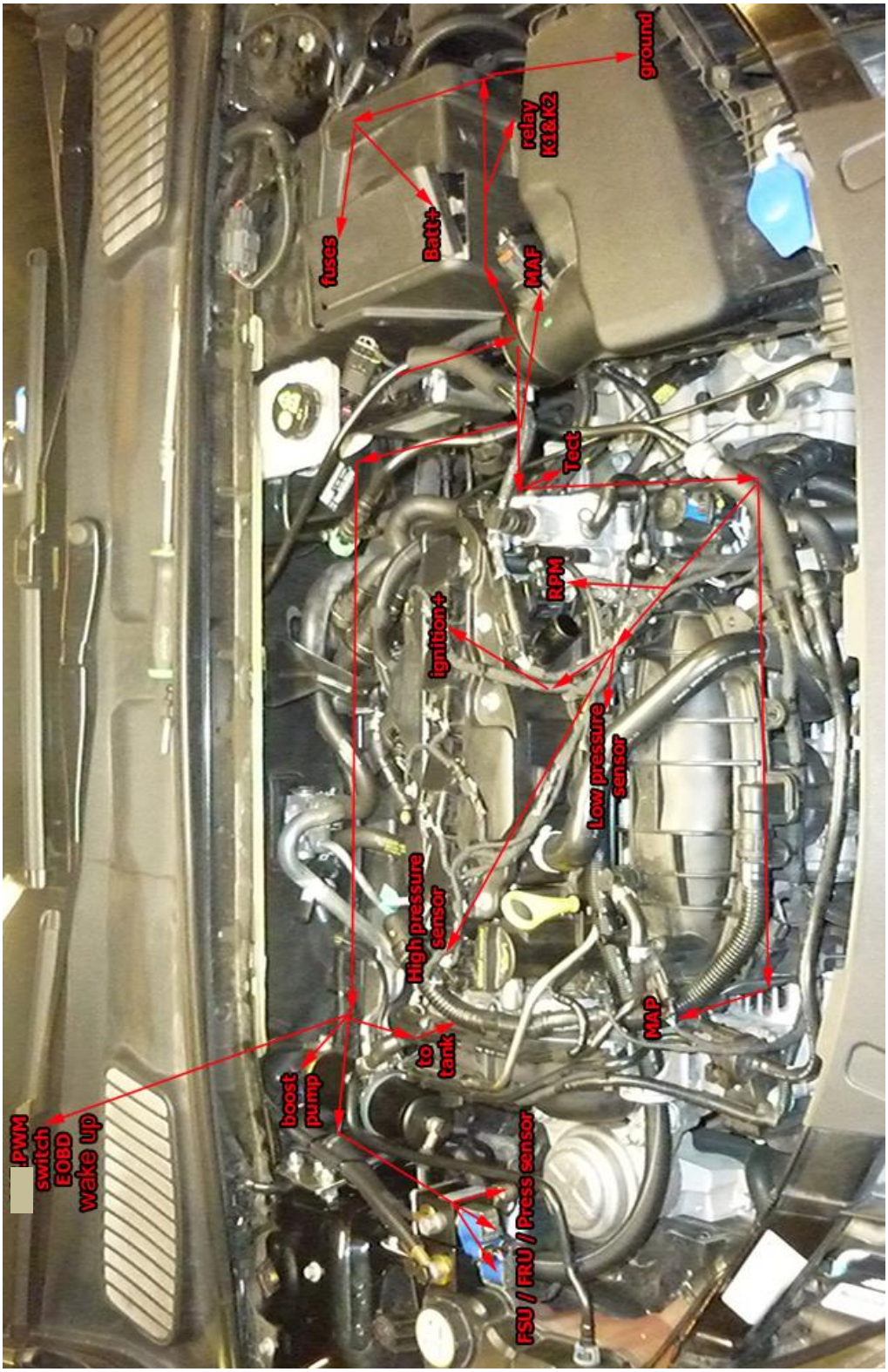


Install fuse box near the battery with brackets



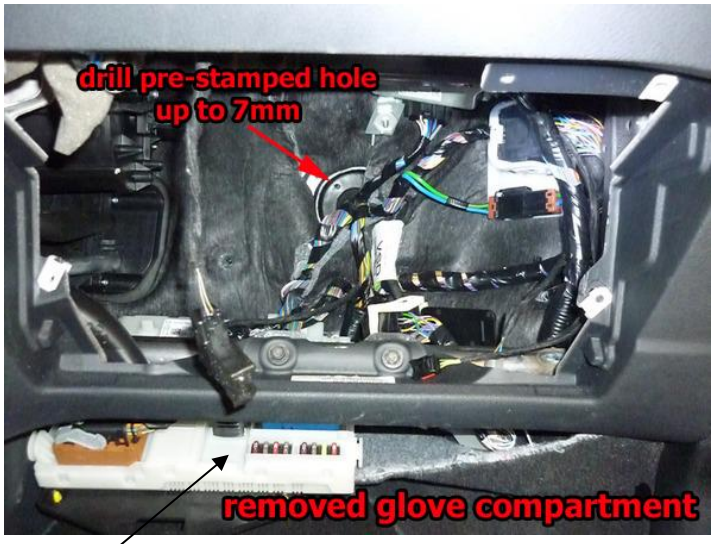
(TOP VIEW)

Wiring AFC



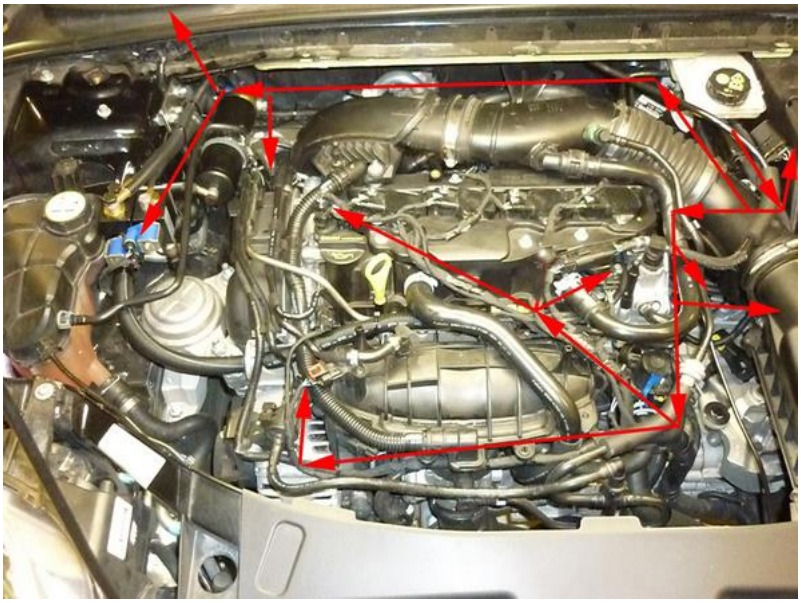
Wiring inside

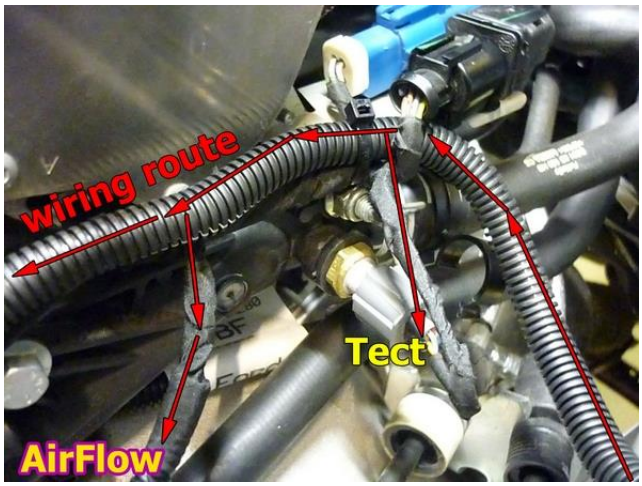
Switch / CAN / 56 Digital input 2 PWM **/ 40** wake-up

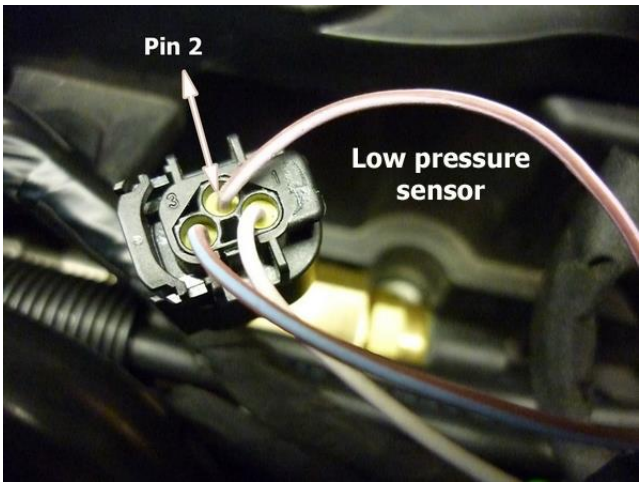


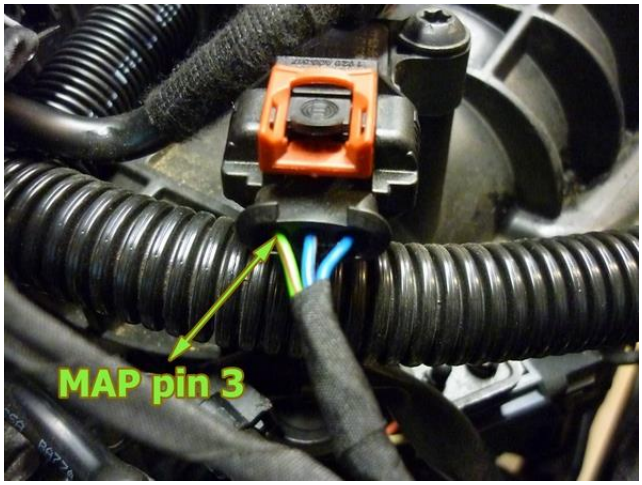
BCM

Wiring routing

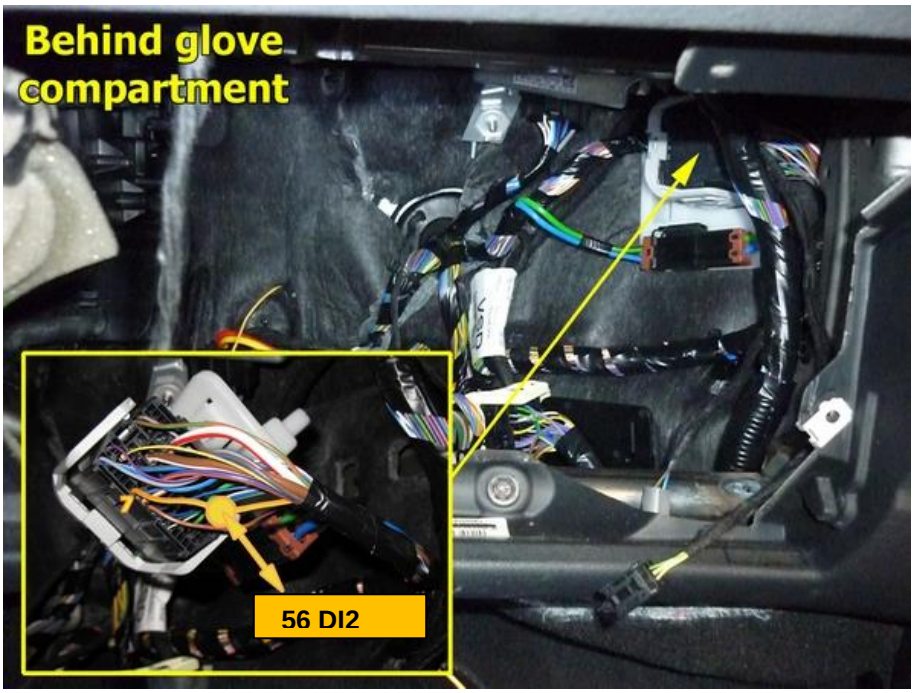




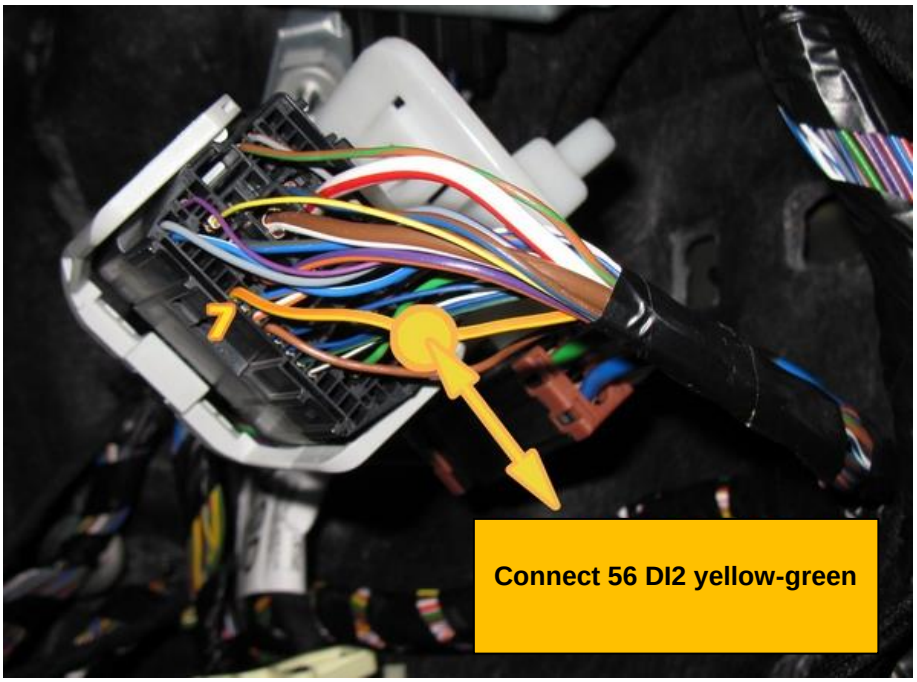




PWM petrol tank connection



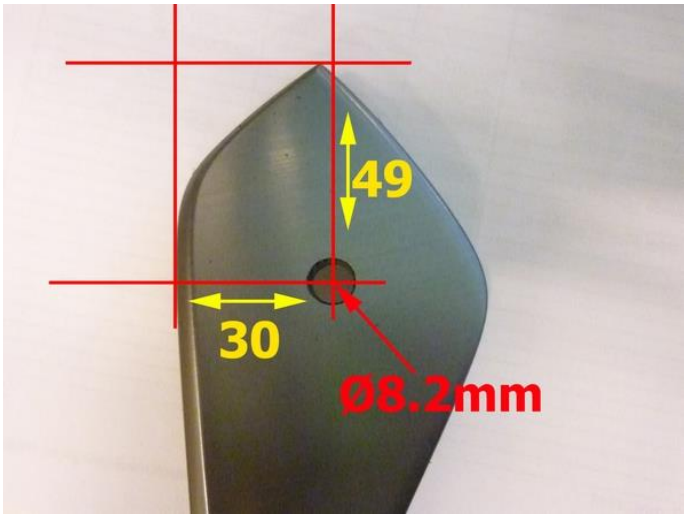
Pin 7, PWM wire



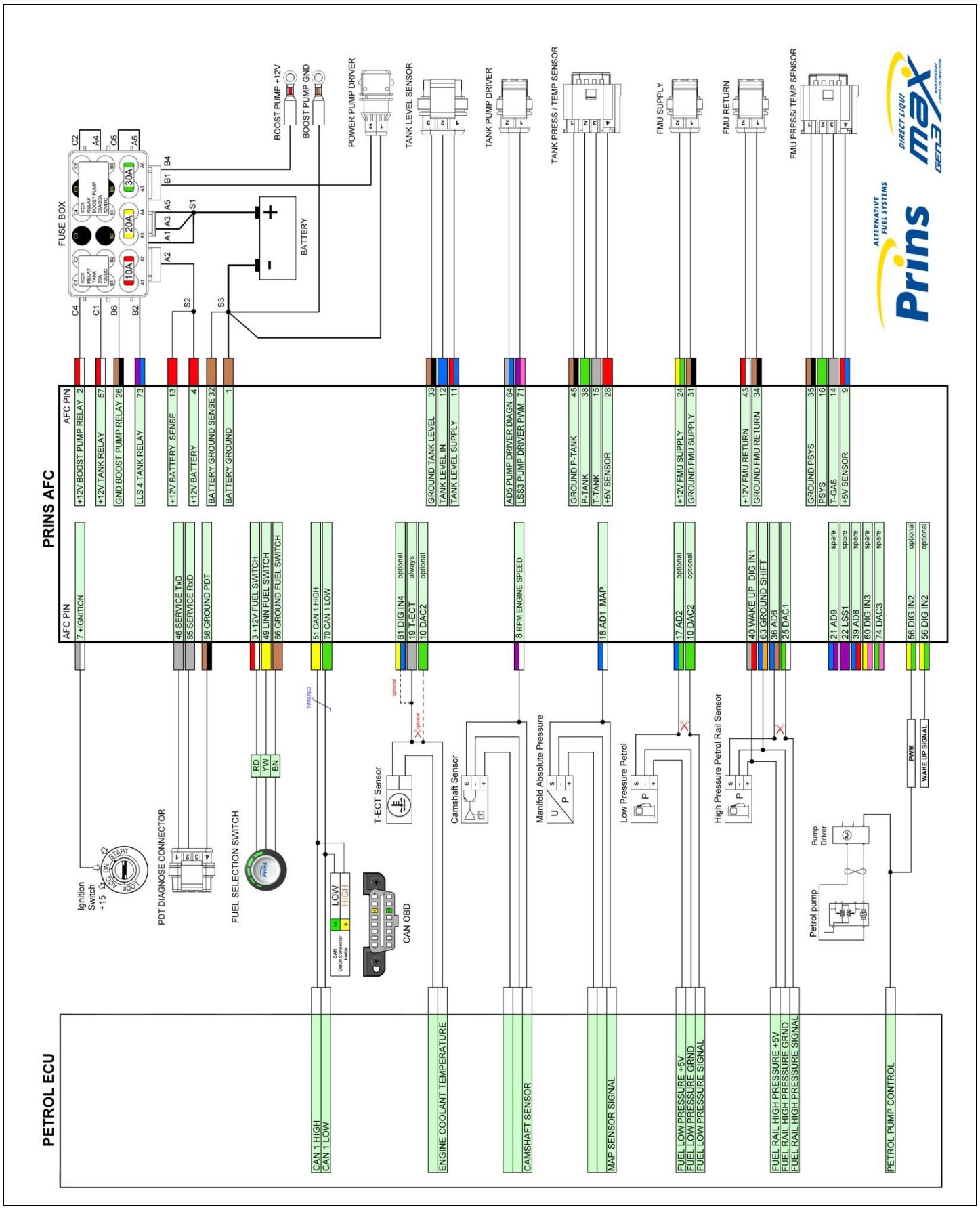
Extend wiring if necessary

Mounting the fuel selection switch

Mount the switch, drill Ø8,2mm.



Basic DLM Gen3 wiring diagram

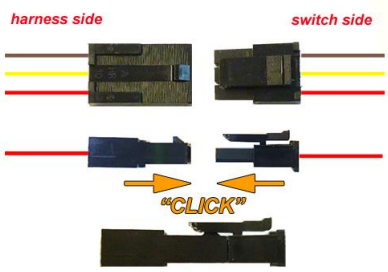


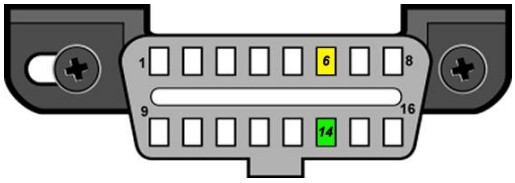
Main Connector

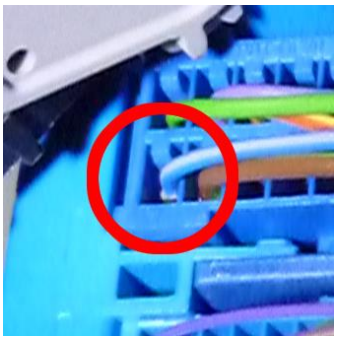
Electrical connections

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

Driver / Passenger 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.
		

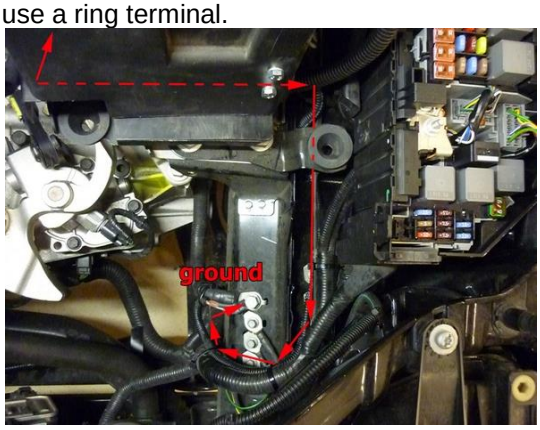
51 CAN-High		Yellow	EOBD connector pin 6
70 CAN-Low		Green	EOBD connector pin 14
			

40 Wake-up		Grey-red	*High pressure petrol sensor 5Volt supply / car wake-up*
			Wire colour :blue-grey Wire location : under glove compartment, blue connector.  

			Digital Input 2, OEM petrol pump driver, PWM IN. Wire colour : yellow-orange, pin 7 Wire location :see chapter: PWM petrol tank connection page 27
56 DIG IN2		Yellow-green	

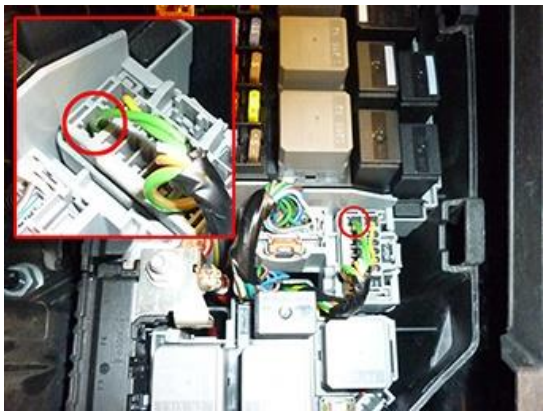
Electrical connections

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

Wire text	*clr*	*Wire colour*	*Connection*
1			*Connect to the '–' of the battery (-31);* use a ring terminal. 
1 BATTERY GROUND		Brown	

4			*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. 
4 +12V BATTERY		Red	

7			*Connect to +ignition / contact+ (+15).* **Do not place the fuses in the holder before having completed the installation of the LPG system**. Wire colour : double green wires Wire location : fuse box
7 +IGNITION		Grey-white	



Electrical connections

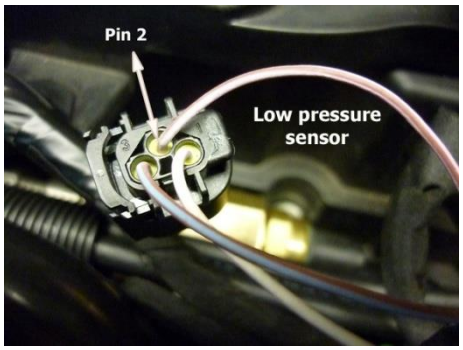
Check and measure the wiring in case of changes in the cars wiring colours.
Insulate not used wires.

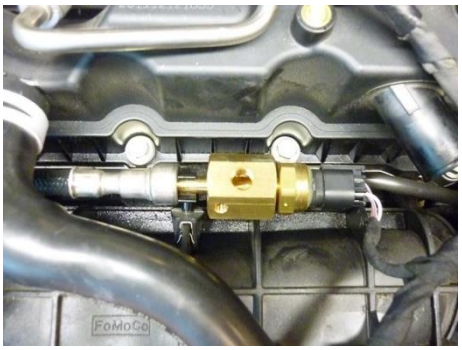
Wire text	*clr*	*Wire colour*	*Connection*
36 & 25			*High pressure petrol sensor signal interruption.* Wire colour :blue-brown, pin **2** Wire location : 3-pole connector, petrol pressure sensor. right side rail
36 AD 6		Blue-brown	Sensor side
25 DAC 1		Green-white	Petrol ecu side
			High pressure petrol sensor ground. Wire colour :green-purple, pin **1** Wire location : 3-pole connector, petrol pressure sensor. right side rail
63 Ground Shift		Blue-orange	
			High pressure petrol sensor supply Wire colour : grey, pin **3** Wire location : 3-pole connector, petrol pressure sensor. right side rail
61 DIG IN4		Yellow-blue	

Electrical connections

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

Wire text	*clr*	*Wire colour*	*Connection*
17 & 10			*Low pressure petrol sensor signal interruption.* Wire colour :Pink-brown, pin 2 Wire location : Low petrol pressure sensor in Prins adaptor.
17 AD 2		Blue-green	Sensor side
10 DAC 2		Green	Petrol ecu side



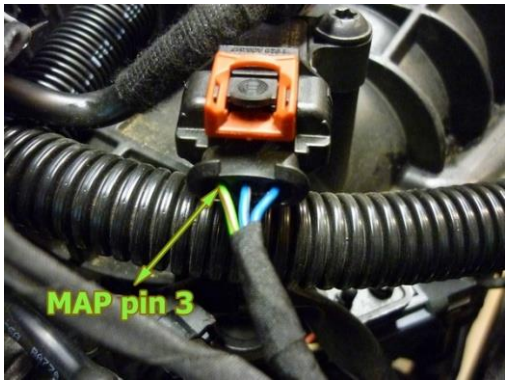


			For measuring the engine speed signal. Wire colour :brown-blue Wire location : cam sensor, left side engine, pin 2
8 RPM		Purple-white	

Electrical connections

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

Wire text	*clr*	*Wire colour*	*Connection*
			Analog in (sensor side) MAP sensor in. Wire colour : yellow, pin 3 Wire location : intake manifold, MAP sensor
18 AD 1		Blue-white	



			For measuring the engine coolant temperature. Wire colour : yellow Wire location : coolant sensor, left side cylinder head.
19 T-ect		Grey	

Electrical connections

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

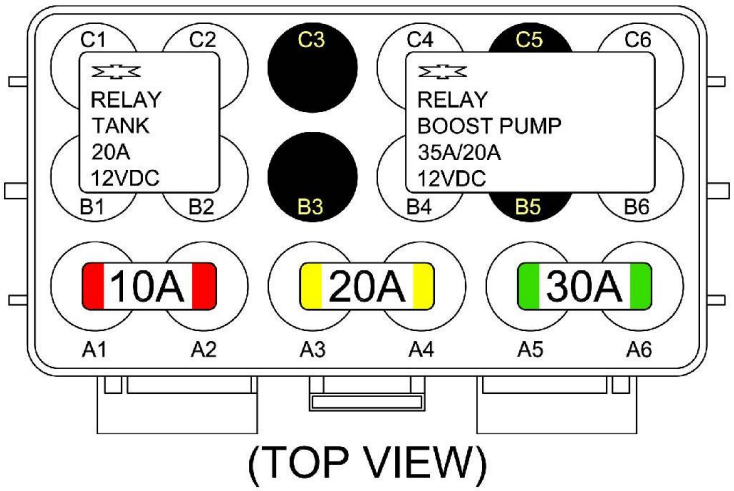
Wire text	*clr*	*Wire colour*	*Connection*
			Analog in 9 (sensor side, WB in / MAF in). Wire colour : Wire location :
21 AD 9		Blue-purple	
			Low Switched Side, spare. Wire colour : Wire location :
22 LSS 1		Purple	
			Analog Input 8. Wire colour : Wire location :
39 AD 8		Blue-red	
			Digital Input 3. Wire colour : Wire location :
60 DIG IN3		Yellow-pink	
			Simulation 3, Analog out (ecu side, WB out / MAF out). Wire colour : Wire location :
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***
4-pole FMU P/T sensor 1. 35 Ground P-Sys 2. 16 P-Sys 3. 14 T-Sys 4. 9 +5V sensor	 Brown-black Green Grey Red-blue	Connect the 4-pole connector to the P/T sensor.
2-pole black connector FMU 24 +12V FMU supply 31 Ground FMU supply	 Yellow-green Brown-black	Connect the 2-pole connector to the black lock-off valve of the Fuel Management Unit
2-pole grey connector FMU 43 +12V FMU return 34 Ground FMU return	 Red-white Brown-black	Connect the 2-pole connector to the grey lock-off valve of the Fuel Management Unit
4-pole diagnose connector 46 Service TxD 65 Service RxD 68 Ground PDT	 Grey Grey Brown-black	*Diagnose connector for service / diagnosis.* Connector pin 1 Connector pin 2 Connector pin 4
Boost pump relay 2 +12V boost pump relay 26 Ground BP relay +12V fused BATT +12V Boost pump	 Red-white Brown-black Red Red	 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 +12V tank relay 73 LSS 4 tank relay +12V BATT fused +12V driver	 Red-white Purple-blue Red Red	 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



(TOP VIEW)

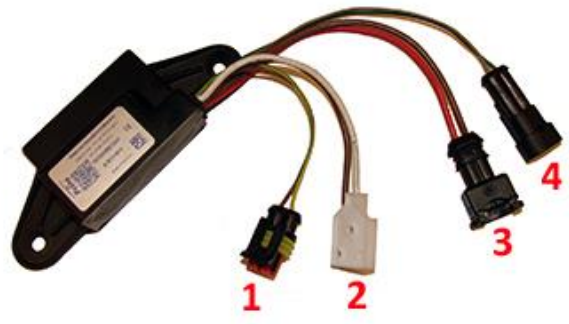
Electrical connections

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 1. 33 Ground tank level 2. 12 Tank level in 3. 11 + tank level supply	Brown-white Blue Red-blue	Connect the 3-pole connector to the tank level sensor.
4-pole Tank P/T sensor 1. 45 Ground P-Tank 2. 38 P-Tank 3. 15 T-Tank 4. 28 +5V sensor	Brown-black Green Grey Red	Connect the 4-pole connector to the P/T sensor.
2-pole Steering Diagnose connector 1. Ground pump driver 2. +12V pump driver	Brown Red	Connect the 2-pole connector to the driver, connector 3.
2-pole Steering Diagnose connector 1. 71 LSS3 Pump driver PWM 2. 64 Pump driver diagnose	Purple-pink Blue-grey	Connect the 2-pole connector to the driver, connector 4.

Pump Driver			
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 Brown	From tank pump driver From tank pump driver	
3. *2-pole connector driver*	Brown Red	From main ground From tank pump relay	Ground pump driver +12V pump driver
4. *2-pole connector driver*	Green Grey	From AFC pin 71 From AFC pin 64	LSS3 Pump driver PWM Pump driver diagnose



Prins safety stickers

Apply the sticker on an eye catching location.

Checklist after installation

1. Install the system fuses.
   Turn on ignition.
   Connect the Prins Diagnostic Tool and run the Prins Diagnostic 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 gas leak detector device or a fluid detection like soap. Also check for petrol leakage.
   Check all made connections and XD-hose crimps for petrol / LPG 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 ECU 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.

ALTERNATIVE FUEL SYSTEMS
Prins