INSTRUCTION MANUAL
for the retrofit installation
EMER BAT LPG FIAT

115R-000000

Content

Part I

1. National and international regulations

1.1 ECE regulations on gas-powered vehicles
1.2 National regulations

2. Retrofit system description

2.1 General description
2.2 Technical description
2.3 Description of the components
2.4 List of alternative components
2.5 Proper assembly check
2.6 Start-up procedures
2.7 Service instructions
2.8 System malfunction
2.9 Diagnosis

Part II

3. Installation instructions Fiat Punto

3.1 Technical Data
3.2 Installation
3.2.1 -14 Description, fotos or drawings of the installation
3.2.15 Position of type approval plate
3.2.16 Wiring diagram of the electrical system
(containing the mechanical components to which the wires shall be connected)
3.2.17 Scheme of the layout of the electrical components
(showing the detailed arrangement of the wiring)

Part I

1. National and international regulations

1.1 ECE regulations on gas-powered vehicles

ECE R 110 (CNG) and ECE R 67-01 (LPG)

Unified conditions for an approval of:

1. certain parts of vehicles which use compressed natural gas (CNG) or liquid petroleum gas (LPG) for propulsion,

2. vehicles concerning the installation of certain already approved parts required for using compressed natural gas (CNG) or liquid petroleum gas (LPG) as propulsion system.

Serves as a base for type approval of manufacturers´ CNG/LPG vehicles (new cars), as well as for the approval of the single parts used in these cars.

ECE R 115

Unified conditions for an approval of:

1. specific liquid petroleum gas (LPG) retrofit systems for installation in vehicles in order to use LPG as their propulsion system.

2. specific compressed natural gas (CNG) retrofit systems for installation in vehicles in order to use CNG as their propulsion system.

Serves as a base for system approval of retrofit systems.

1.2 National regulations

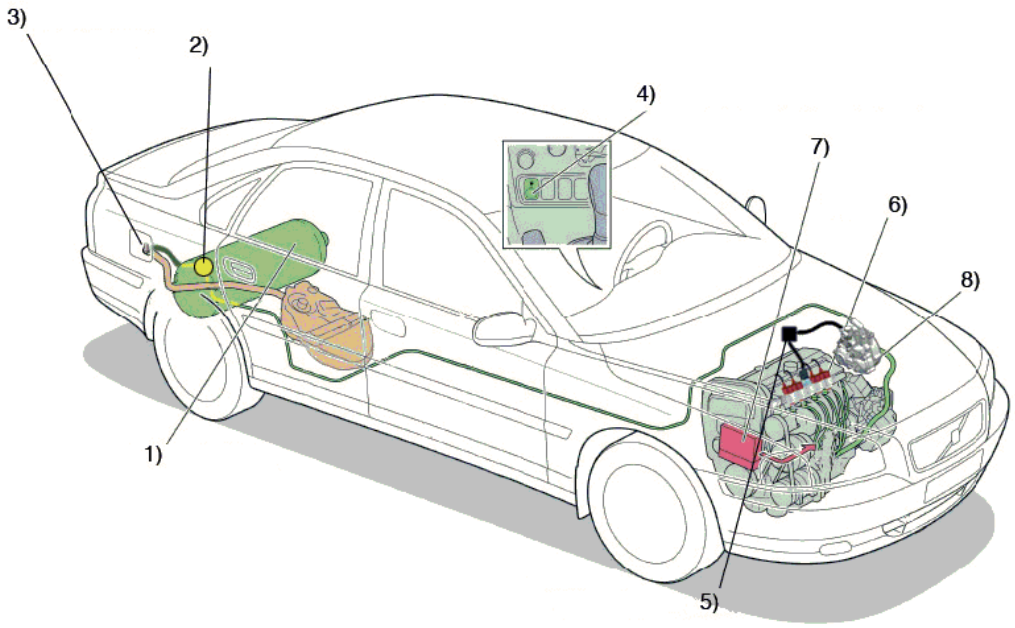
Germany:
§ 41 a StVZO regarding safety and installation of the system:

GAP: Gas System Test (identification of safety concerns regarding the gas system)

GSP: Gas System Installation Test (inspection and approval of the installation of a gas system according to ECE R 115)

2. Retrofit system description

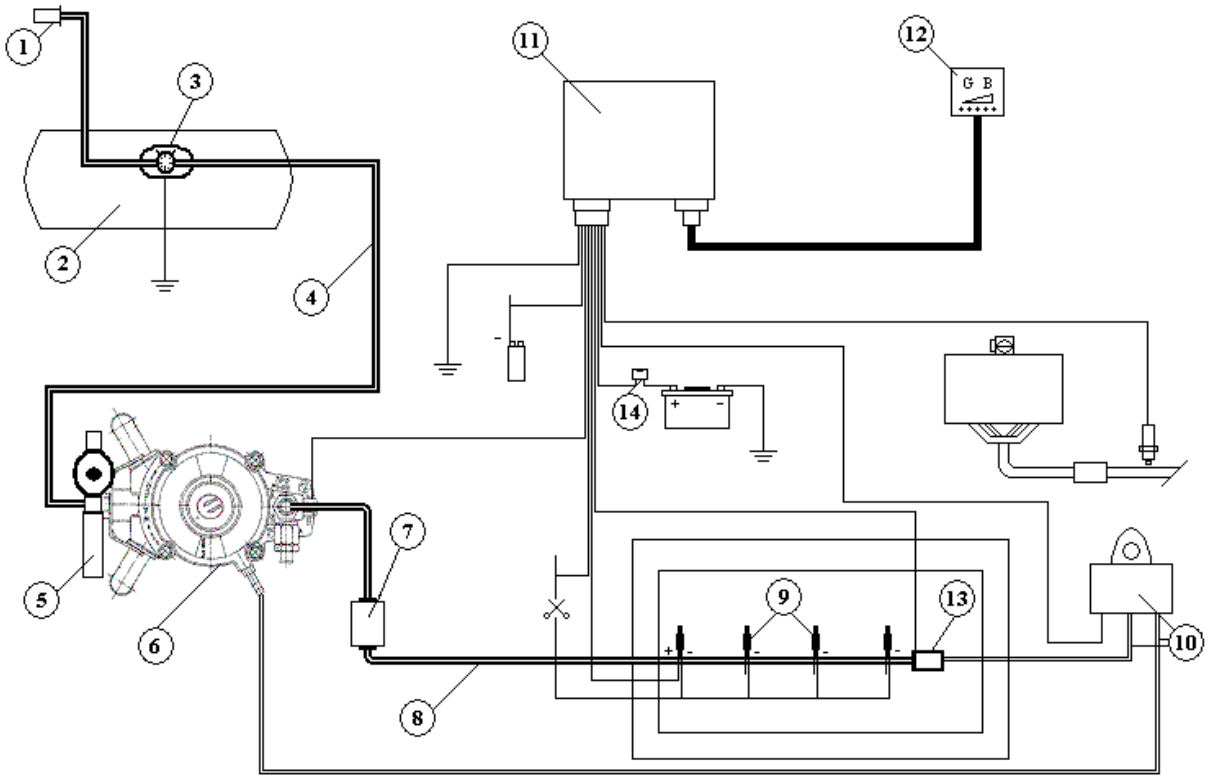
2.1 General description



1. Tank
2. Multivalve
3. Filling valve
4. Switch
5. MAP sensor
6. Injectors
7. ECU
8. Pressure regulator

Fuse fixed at the top of the battery.

2.2 Technical description



1. Filling valve
2. LPG tank
3. Multivalve
4. Rigid fuel line
5. Solenoid valve
6. Vaporizer/Pressure regulator
7. Filter
8. Flexible fuel line
9. Rail and injectors
10. Manifold Absolute Pressure (MAP) sensor
11. Electronic Control Unit (ECU)
12. Switch
13. Temperature Sensor
14. Fuse

2.3 Description of the components

General function:

Emer BAT LPG system is composed by specific components. Following description of each one specifying particular function and rule in complete system.

The tank is made in accordance with the European directive, ECE 6701, and manufactured with special steel plates. Its task is to contain LPG both at the liquid and gaseous state.

The multivalve includes: an 80% valve that automatically blocks refuelling of LPG when the maximum permitted level is reached; an excess flow valve that prevents the complete and rapid leaking of the LPG if a pipe bursts; an overpressure valve that, if the pressure or temperature rises inside the tank, drains the LPG to the outside with a controlled flow which stops pressure rising inside the tank; a solenoid valve that closes all LPG flows when the engine is off or when it is running on petrol; a device that measures the level of LPG in the liquid phase connected to the indicator instrument.
The filling valve is the device by which you fill the tank with LPG; it has a check valve that stops the Gas from flowing back.
The switch in an ergonomic position for the driver is used to switch the gas from running on gas to petrol and vice versa and to see approximately how much gas you have in the tank.

MAP (Manifold Absolute Pressure) sensor informs the gas control unit of the difference in pressure between the gas injectors and the suction manifolds.
This is a device for distributing the right quantity of fuel to each cylinder.

The ECU, receiving the necessary signals, is able to correct the quantity of gas, maintaining it at the perfect stoichiometric ratio to optimise consumption and performance.

The reducer vaporiser is a device that reduces LPG pressure from the pressure in the tank to working pressure; it is also able to vaporise the LPG from the liquid to the gaseous state; it has a solenoid valve that closes all flows of gas when the engine is off or running on petrol.

2.3.1 Filling valve

Type LPG filling valve is a valve for refuelling vehicles powered by LPG fuel. It is fitted on the vehicle near petrol filling valve either in the same compartment or in another position with its proper plastic box.

The valve is composed by a shaped body. At one side of it a fastened nipple is assembled with is corresponding seal 0-ring.
At the refuelling process the refuelling nozzle of the dispenser at the refuelling station is fitted inside the top of the glass. It is obtained from the shaped body in a way that his 0-ring steal being pressed on toroidal side inside the same glass. In this way tank can be refuelled by filling valve without any leakages.
Shaped body and anchor nipple enclose a VNR (Non Return Valve).

2.3.2 LPG tank

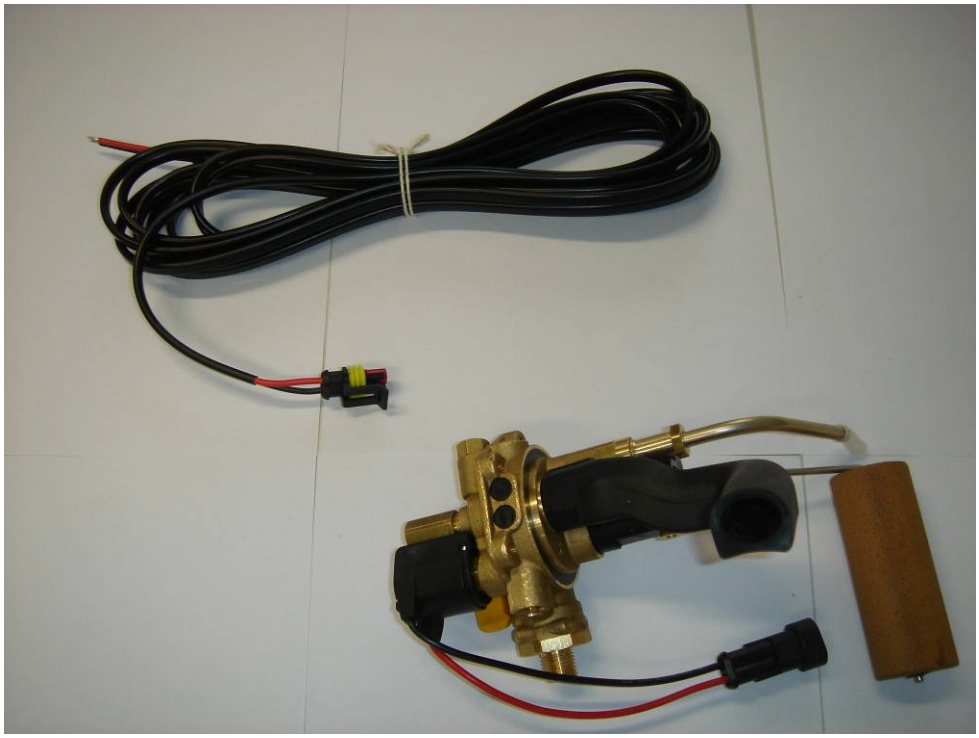
Toroidal LPG tanks for multivalve joined with internal fitting nozzle.

Cylinder intended for LPG mixture storage in gas installations in motor vehicles.

Technical data:

- manufactured - class 1
- test pressure 3,00 MPa
- bursting pressure min. 6,75 MPa
- manufactured according to UN ECE 67R-01

2.3.3 Multivalve



The multivalve is a multiple functional valve fitted on LPG tank.
This valve is a set of many devices with different function.
Two VNRs, an excess flow valve with a remote control automatic closing valve, a closing 80% valve with level indicator, a manual closing valve, an overpressure valve, and a fusible plug.
VNRs are positioned one at the input of charging pipe (to prevent back-flow of LPG) and one near the withdrawal pipe (to prevent flow of LPG inside the tank from the withdrawal pipe). VNR is composed by a flowing stopper, a contrast spring, and an 0-ring mounted on the stopper to guarantee retaining when it's closed. When the flow of LPG is at the granted way spring contrast is won by the flow itself and stopper is moved to opening position letting LPG to flow. In case of reverse way stopper is pressed by spring's effort in its closing position stopping LPG transfer.
Excess flow valve is positioned on main pipe near the withdrawal pipe and his function is to prevent emptying of the tank in case of accidental functioning pipe breaking. It's composed by a piston kept at opening position by a spring. Reaching prefixed pressure difference the piston is moved to closing position thanks to 0-ring fitted on the head of piston itself. A small passing hole throught the piston body guarantees a small leakage needed in case of valve rearm.
Automatic remote control closing valve is a normally closed type and forbid LPG to flow outside the tank when not electrically powered (generically it's connected to vehicle control board). It is composed by a stopper with head levelled steal that is pressed by LPG pressure allowing the seal.
80% closing valve is required to prevent that the tank is filled more than 80% of its volume. When the floating part reached 80% of the LPG volume inside the tank its movement block the LPG flow.
Connected to the 80% closing valve is positioned level indicator: movement of floating part is converted in turning movement through a small bar supporting magnet that drags a position indicator that shows LPG level inside the tank.

Manual closing valve in closing position prevent exit of LPG in the environment. It is enabled by a tap.
Overpressure valve start to work (opening and leaving LPG flow goes outside the tank) when LPG inside pressure exceeded a prefixed level. It is closed when LPG inside pressure go down the same level.
Fusible plug starts to work (leaving LPG flow goes outside the tank) when fusible alloy reached 120℃ ± 10℃ temperature. Onetime this valve is opened it can not be closed.

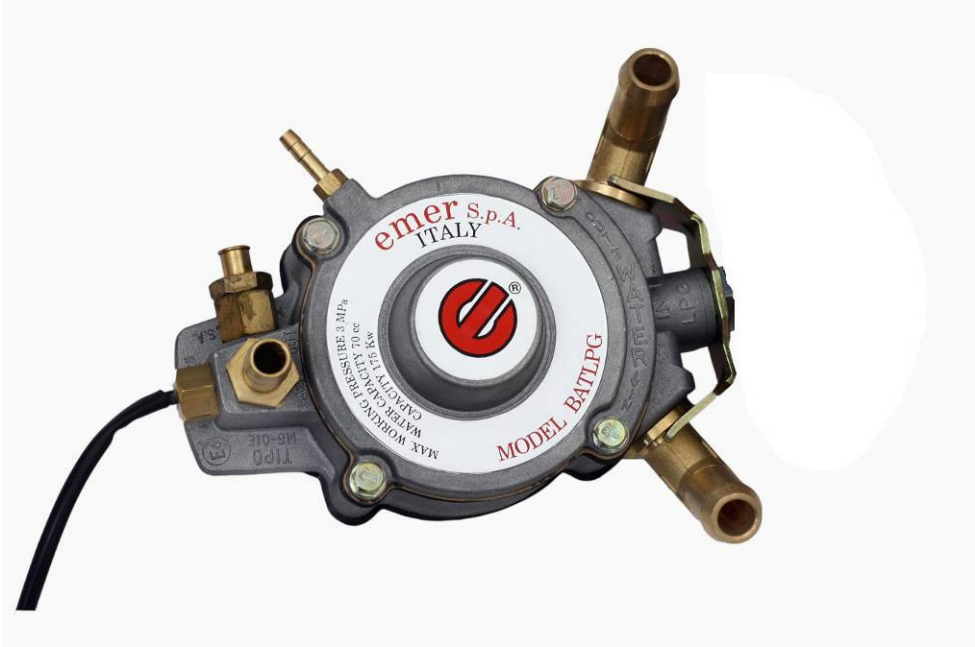
2.3.4 Tube

Copper hard pipe is used to connect multivalve to pressure regulator. Following R67-01 regulation homologation of this component is not required.
Copper and metal pipes are covered by a rubber or plastic sleeve.

2.3.5 Solenoid valve

1	VOLTAGE OF COIL	12 D.C.	
2	POWER OF COIL	11 W	
3	ELECTRICAL CONNECTION	Coil with integrated waterproof connector two ways Amp/Delphi superseal 1,5 mm compatible	
4	RESISTANCE	12,3 Ohm	
5	FUNCTION	Shut-off valve	Use for LPG only
6	NORMALLY	Closed	
7	MAX WORKING PRESSURE	3 MPa	At 12V D.C. +20°C
8	BURST PRESSURE	≥ 10 MPa	
9	FLOW CAPACITY	160 l/h with Δp 0,05 MPa 220 l/h with Δp 0,10 MPa	Test carried out with water
10	WORKING TIME	100%	
11	MAX AMBIENT WORKING TEMPERATURE	-25°C to +120°C	Continuous service
		+180°C	For 10 minutes
12	MEDIUM TEMPERATURE	-30°C / +65°C	
13	INLET / OUTLET	M12x1 female IN	
		M12x1 female OUT	
14	FILTER PAPER ELEMENT SURFACE	~7000 mmq, 7 micron rating	
15	COLOR COIL	Blue	
16	MAX OPENING PRESSURE	3,2 MPa with 12V	At +20°C
17	MAX OPENING PRESSURE UNDER REDUCED VOLTAGE	with 9V --1,2 MPa with 10V---1,7 MPa	At +15°C / +25°C
18	MIN CLOSING VOLTAGE	1,8 V	Without pressure At +15°C / +25°C
19	VALVE SEAT DIAMETER	5,0 mm	
20	LIFETIME	Car life / 10 years	In normal work conditions

2.3.6 Pressure regulator



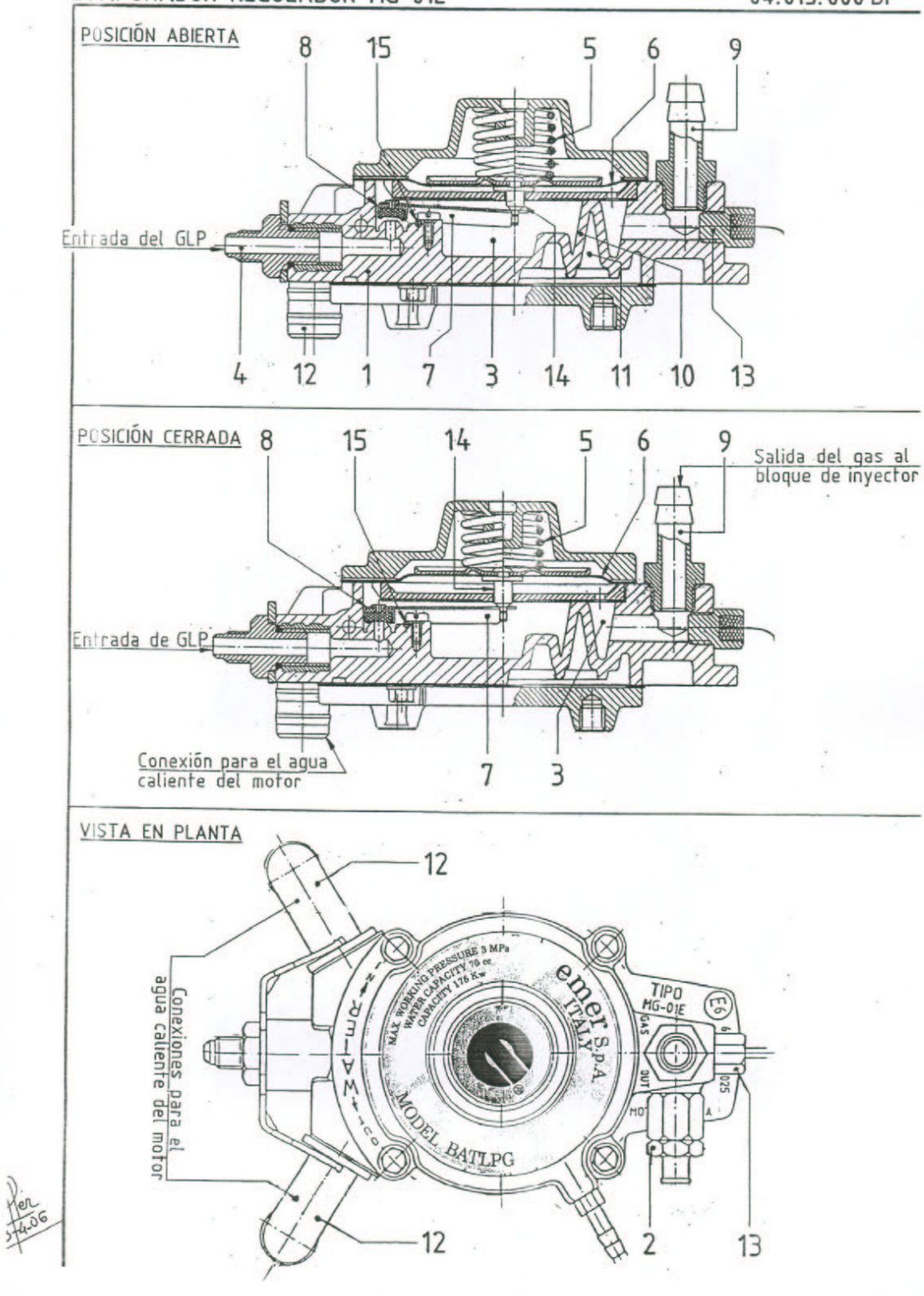
2.3.6.1 GENERALITIES

The vaporizer, as its name indicates, is a device which has two principal functions: regulate the feed pressure of LPG tank, to the service pressure; and convert the LPG from liquid state to gaseous state.

This device has two independents contiguous chambers. In first chamber the pressure is regulated and LPG is gasified (entering in liquid state). Second chamber makes the interchanger of heat function.

The maximum LPG feeding pressure, in liquid state, to reducer is 3.000 Kpa (30 bar).

EVAPORADOR-REGULADOR MG-01E 04.015.000 DF



2.3.6.2 DESCRIPTION OF THE DEVICE

The description of the most important parts of this device must to be read together with plane shown in the previous page where components are represented.

Regulation Chamber

In this chamber, pointed out in plane number 3, and which has labyrinth form, is where LPG is gasified from liquid phase, which comes from the tank and with pressure between 300 and 1.200 Kpa (3 and 12 bar, respectively). Inlet liquid gas is realised through connection (4).

In regulation chamber (3), pressure is reduced to 90 Kpa (0,9 bar) by a regulation device formed by a spring (5) and the diaphragm (6), that is hooked to the closing valve lever (8). Also, when is gasified, the gas which is in the chamber is, approximately, 50% liquid state and 50% gaseous state, that is which comes out through the hose (9) toward the injectors rail.

Heat Interchanger

Contiguous to the regulation chamber and separated by an aluminium partition (10), in labyrinth form, is situated a heat interchanger, formed by chamber (11), connected to circuit refrigeration of radiator of engine vehicle.

This installation disposition allows complete circulation of liquid refrigeration, hot, through chamber (11), and it guarantees a continuous vaporization of liquid LPG.

Other Devices

Aluminium body device (1) incorporates series of threaded drills that diverse elements are connected which are necessary for correct system LPG operation.

In his back part and to both sides, this body has two holes in those 2 connections (12) are connected for circuit connection of hot water coming from engine refrigeration system.

In his front part has three threaded drills. The frontal is to install a temperature sensor (13), connecting electrically with the electronic switchboard that incorporates LPG system.

Lateral is to connect a safe-deposit valve, with object of preventing an eventual increase of pressure in regulation chamber. And in superior drills, incorporates the connection of gas exit to injector blocks.

2.3.6.3 DESCRIPTION OF FUNCTIONING

Later we are going to describe the different situations that originate inside the reducer MG-01E, according to different phases that can take place.

Initial Gasification

Initially, when there is not still LPG in regulation chamber (see drawing "POSICION ABIERTA"), valve (8) remains opened up by the push that offspring diaphragm (6) makes on boards valve (8). The origin of this push is spring force (5) that presses the diaphragm (6).

Once LPG solenoid valve is opened, situated in evaporator entrance, the LPG arrives, in liquid state, to the interior joint connection (4), through which enters in regulation chamber (3).

As soon as liquid state LPG enters in labyrinth of regulation chamber (3) besides it begins to vaporize, by difference of pressure. It also begins to make a pressure on diaphragm (6), which at the same time begins to compress the spring (5).

When diaphragm pressure reaches pressure of 90 Kpa, it has compressed the spring (5) enough as the offspring (14), in the diaphragm (6). It has thrown of the lever up, which, rotating on the axis, makes press the valve on the hole entrance to regulation chamber, cutting gas step (see drawing "POSICION CERRADA").

In this moment, in regulation chamber, LPG is, approximately, 50% in liquid state and 50% in gas state. This LPG in gas state, is the one that comes out through the connection (9) toward the injectors block, which is feeding device from LPG to the engine.

Motor Starts up

When motor pulls up again, it begins to work in gasoline. And when refrigeration liquid motors warms and circulates through interchanger heat chamber (11) it facilitates the gasification of LPG.

And when inside the evaporator the temperature comes to approximately 20 ºC the engine automatically change to work in LPG.

When is taking place consumption of gas for the hole/connection (9), the pressure regulation chamber (3) lows. In consequence, spring displaces the diaphragm (6) lightly down ("POSICION ABIERTA") and offspring pushes the end of the lever (7) that tilts on the axis (15) and it opens the valve (8) allowing the step of liquid state LPG.

Gas entrance produces, again, the increase of pressure on diaphragm (6), which through offspring (4) comes back to throws of the lever (7) that tilts and force the valve (8) to close the step of gas.

Functioning to slow

While engine is working to slow, constantly repeats the previously process, it means; LPG little consumption, slight descent of pressure in regulation chamber, minimum opening of valve, entrance of some gas, pressure increasing and make more closing valve.

Functioning to full load

When the engine works to full load, it demands the maximum quantity of gas and, as consequence, a slight reduction of the pressure takes place in the regulation chamber (3), an the spring (5) displaces the diaphragm (6) that at the same time pushes with the offspring (14) the lever (7) which opens the valve (8) and reaches its maximum opening position. (POSICION ABIERTA)

But this position of the valve allows the entrance of a great quantity of LPG in regulation chamber (3), what causes the stabilization of the pressure in this chamber and the immediate valve closing. And as needing of gas continues being high, immediately takes place another slight reduction of pressure which again opens the valve.

And while vehicle motor works to full march, this alternation of opening-closing of valve (8) is constant. And with an approximate beat of 3 or 5 cycles per second.

STOP OF THE ENGINE

When deceleration takes place previous to the stop of engine vehicle, the device “cut of” which incorporates the electronic switchboard, that is the one that regulates the operation of LPG system, closes the step from the gas to the evaporator-regulator, until motor works to idle, before stops.

As soon as the motor stops, automatically, the LPG solenoid valve is disconnected, which closes step from the LPG to the evaporator-regulator, at the same time the injectors block is not connected that closes the step from the gas to cylinders of the engine.

From this moment, the valve (8) stays in the position it was when solenoid valve LPG was not connected and injectors block. In next works/ignition of the engine the whole process will be repeat again.

2.3.7 Filter

Exchangeable in-line LPG filter for gaseous phase

Valve body:
Anodized machined aluminium.

Filter paper:
Large filtering surface, low pressure drop, filter element in pleated paper 7 micron; spare filtering cartridge.

Text:
Polyester adhesive sticker on valve body.

Inlet / outlet connections for rubber hose:
Diameters 10 and 16 mm.

Rubbers:
Internal O-rings on valve bodies.
Internal O-ring between valve body and filter.

Technical specifications:

Pressure drop ΔP	Flow rate Q
0.5 bar	425 nl/h
1 bar	625 nl/h

N.B. Test carried out with water.

Max working pressure:
- 0,45 Mpa.

2.3.8 Rubber Pipe

Internal linen gas pipe type Autogas is a rubber pipe fol automotive LPG. It can be used with pressure till 450kPa (Class 2) and temperature between -25℃ and +125℃.

This pipe is composed by two different layers with an additional support between them.

It has different sizes defined by internal (ϕi) and external (ϕe) diameters.

- ϕi 10 x ϕe 17.5;
- ϕi 12 x ϕe 19.5;
- ϕi 14 x ϕe 21.5;
- ϕi 16 x ϕe 24;
- ϕi 17 x ϕe 25;
- ϕi 19 x ϕe 27.

It is used after LPG pressure regulator.

End joints are made by metallic wrappers.

2.3.9 Rail and injectors

1	PILOTING VOLTAGE OF COIL	12 D.C.	From E.C.U.
2	POWER OF COIL	48 W – 144W	
3	PILOTING TYPE	PEAK and HOLD 4 - 1	
4	TIME FOR PEAK CURRENT	4.5 ms	
5	ELECTRICAL CONNECTION	Integrated waterproof connector two ways Amp/Delphi compatible 1,5 mm	
6	RESISTANCE	3 Ohm ±4% - 1 Ohm ±4%	
7	FUNCTION	Injector Rail for sequential injection system	Use for LPG and CNG
8	NORMALLY	Closed	
9	MAX WORKING PRESSURE	0,45 MPa	At 12V D.C. +20°C
10	BURST PRESSURE	Over 10 MPa	
11	NUMBER VALVE SEAT AVAILABLE	4, 3, 2 and single	
12	OPENING TIME	3,3 ms	
13	CLOSING TIME	2,2 ms	
14	WORKING TIME	100%	
15	MAX AMBIENT WORKING TEMPERATURE	-25°C to +120°C	Continuous service
16	MEDIUM TEMPERATURE	-30°C / +65°C	
17	INLET / OUTLET	Connection for rubber hose D.10 mm IN and D.5 mm OUT	
18	ANGLE IN - OUT	At 90°	
19	VALVE SEAT DIAMETER	4,0 mm	
20	MOUNTING MATERIAL	Antivibration support, nozzles and fitting sensor	

2.3.10 MAP sensor

This components is used in bifuel LPG vehicles. It measures pressure after pressure regulator and vacuum at manifold. Pressure signals are changed in electrical signals in the way that they can be analyzed by ECU.
Power supply comes from ECU (+5Vdc). Maximum nominal pressure is 450 kPa (Class2).

2.3.11 ECU

In order to exploit the car original engine-management system, the main CNG unit input signal ('slave' type) is the petrol injector activation signal.
In this way, the CNG unit does not have to calculate injection time but receives it from petrol injectors.
Once the control unit has acquired injection time, it 'cleans' the time from petrol-related parameters (petrol injectors features, battery voltage, etc.) and adjusts it to LPG injectors, battery voltage, fuel pressure, and lambda-probe signals.
Petrol injectors parameters are derived by means of complex calculations and contain all the engine operating strategies: injection, warming-up, idling, full power, acceleration, deceleration, emission control, recovery strategies, self-adaptation. Therefore, if LPG injectors features are similar to those of petrol injectors, it is easier to control emissions, drivability, performance, RPM limitation. Moreover, no power losses and no engine knocking take place. The feeding system is constantly monitored to guarantee constant ideal performance, safeguarding catalyst efficiency and durability.
In addition to representing the control interface between petrol control unit and LPG injectors, the LPG control unit also controls other system components.

Technical details:

- Bi-fuel with automatic switch to gas programmable switch back to gasoline enrichment controls and extra-injected sensitiveness management.
- Feeding: 7-18 V DC.
- Processor: 16 bit/50 MHz.
- Input signals: Gas pressure – temperature pressure – RPM – petrol time injection – up to two oxygen sensors (optional) – range 3/8 petrol cylinders injectors.
- Output signals: range 3/8 gas cylinders injectors - up to two oxygen sensors emulators – solenoid valve to pressure regulator and to cylinder.
- Water resistance: waterproof box IP54 Aluminium.

2.3.12 Switch

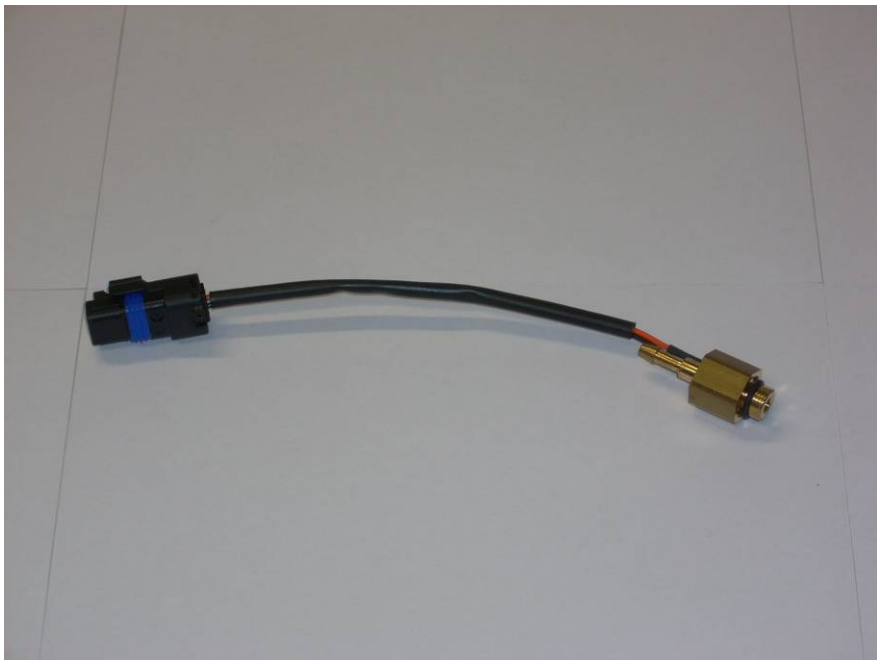
This component is used in bifuel vehicles to select functioning either with petrol or gas. Both functions can be selected by user pushing white button. By green led display gas level at the tank is shown.
Switch signal is sent by ECU that reads gas level present in the tank.

Principal function of the switch are:

- Show gas level in the LPG tank by 4 green led + 1 for reserve.
- Send to ECU the signal to switch from petrol to gas or viceversa.

Buzzer is used to inform user of dysfunctional behaviour, as malfunctions read by self diagnosis system or switch to petrol in case of empty LPG-tank.

2.3.13 Temperature Sensor



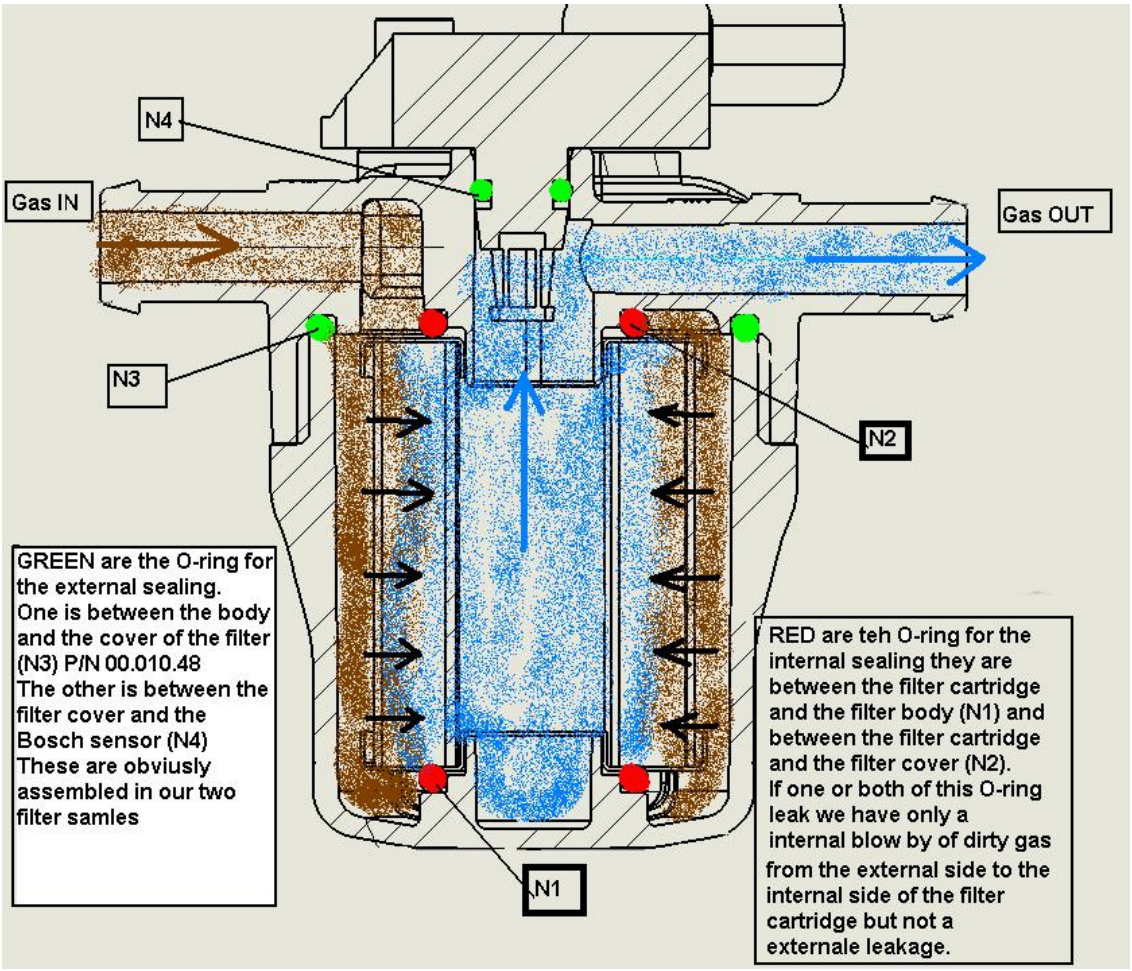
This sensor is used to detect gas temperature at the injector rail. In order to measure gas pressure a nozzle is used to connect it by a rubber pipe to manifold absolute pressure sensor.

2.3.14 Fuse

Fuse is used to protect the system from oversized current. It has to be fitted near the car battery in order to be detected easily. The maximum acceptable current is 15 A.

2.4 List of alternative components

2.4.1 Filter



Checking through separate CNG filter for gaseous phase.

Filter body:
Reinforced body inject pressed glass fiber.
Text:
Polyester adhesive sticker on valve body.

Inlet / outlet connections for rubber hose:
Diameters 11 , 14, and 16 mm.
Rubbers:
NBR 70 O-Ring.
Filter paper:
Spare filtering cartridge. Large filtering surface, low pressure drop, filter element in pleated paper 4 micron.

2.4.2.1 Rail and injector

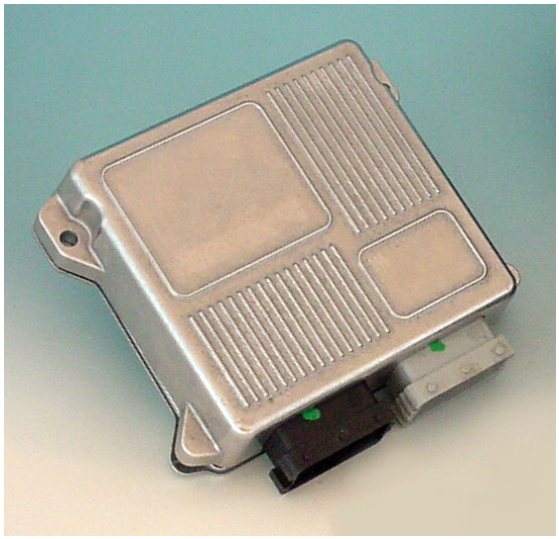
COMPONENTS	SPECIFICATIONS
Rail material	CW617 H080 UNIEN 12165:99
Solenoid coil	Voltage= 12 VDC Nominal Power= 57,6 W Resistance ±5% 20°C= 2.5 Ω
Pressure	2 bar
Flow	Each single injector with nozzle Ø2,8= 5,5 Nm^3/h

2.4.2.2 Rail and injector

1	PILOTING VOLTAGE OF COIL	12 D.C.	From E.C.U.
2	POWER OF COIL	48 W – 144W	
3	PILOTING TYPE	PEAK and HOLD 4 - 1	
4	TIME FOR PEAK CURRENT	4.5 ms	
5	ELECTRICAL CONNECTION	Integrated waterproof connector two ways Amp/Delphi compatible 1,5 mm	
6	RESISTANCE	3 Ohm ±4% - 1 Ohm ±4%	
7	FUNCTION	Injector Rail for sequential injection	Use for LPG and CNG

		system	
8	NORMALLY	Closed	
9	MAX WORKING PRESSURE	0,45 MPa	At 12V D.C. +20°C
10	BURST PRESSURE	Over 10 MPa	
11	NUMBER VALVE SEAT AVAILABLE	4, 3, 2 and single	
12	OPENING TIME	3,3 ms	
13	CLOSING TIME	2,2 ms	
14	WORKING TIME	100%	
15	MAX AMBIENT WORKING TEMPERATURE	-25°C to +120°C	Continuous service
16	MEDIUM TEMPERATURE	-30°C / +65°C	
17	APPROVALS	ECE 67R 01	Certificate no. 000104 for ECE 67 R issued by RDW Holland
		ECE 110 R	Certificate no. 000040 for ECE 110 R issued by RDW Holland
18	VALVES SEAT THREAD	M12x1	
19	INLET / OUTLET	Connection for rubber hose D.10 mm IN and D.5 mm OUT	
20	ANGLE IN - OUT	At 90°	
21	CORROSION RESISTANCE	144 h ISO 9227	
		48 h ASTM B 117	Ferrous parts yellow zinc plated 12 micron
22	COLOR COIL	Red	
23	TEXT	VALTEK on the coil and on the body	
24	VALVE SEAT DIAMETER	4,0 mm	
25	DURABILITY TEST	20.000 cycles	With Δp of 0,45 MPa
26	ENDURANCE TEST	150 million of cycles	
27	VIBRATION RESISTANCE TEST	2 hours at 17 Hz with amplitude of 1,5 mm	
28	EXTERNAL LEAKAGE	Nothing	
	SEAT LEAKAGE	Nothing	
29	MOUNTING MATERIAL	Antivibration support, nozzles and fitting sensor	

2.4.3 ECU



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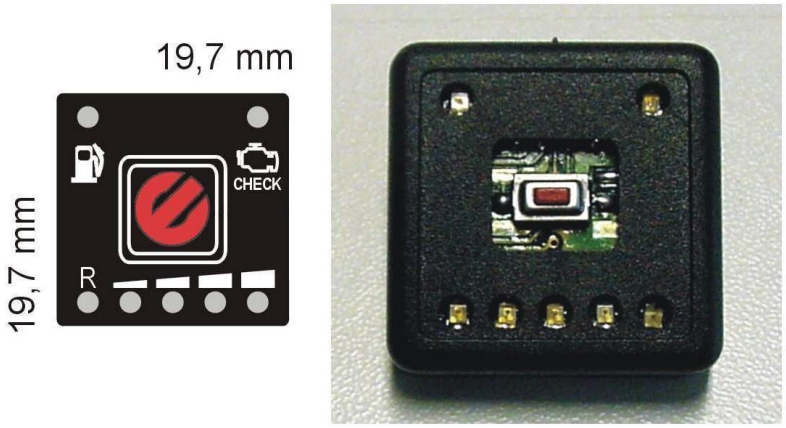
- Water resistance: waterproof box IP54 Aluminium.

2.4.4 Switch



This component is used in bifuel vehicles to select functoning either with petrol or gas. Both functions can be selected by user pushing white button. By green led dispay gas level at the tank is shown.
Switch signal is sent by ECU that reads gas level present in the tank.

Principal function of the switch are:

- Show gas level in the LPG tank by 4 green led + 1 for reserve.
- Send to ECU the signal to switch from petrol to gas or viceversa.

Buzzer is used to inform user of dysfunctional behaviour, as malfunctions read by self diagnosis system or switch to petrol in case of empty LPG-tank.

2.4.5 LPG tank with associated multivalve

LPG tank		**Multivalve**	
Manufacturer	**Type**	**Manufacturer**	**Type**
Tugra Makina	TE600200	Emer S.p.A.	MTV E67-01
Tugra Makina	TE600225	Emer S.p.A.	MTV E67
Tugra Makina	TE630200	Emer S.p.A.	MTV E67
Tugra Makina	TE630225	Emer S.p.A.	MTV E67
GZWM S.A.	ZTW 600/200	Emer S.p.A.	MTV E67
GZWM S.A.	ZTW 600/220	Emer S.p.A.	MTV E67
GZWM S.A.	ZTW 630/200	Emer S.p.A.	MTV E67
GZWM S.A.	ZTW 630/220	Emer S.p.A.	MTV E67

2.5 Proper assembly check

Components identification and check:

	Clear visible ECE Homologation number	**Check whether the components are:** • **not bent** • **not damaged** • **not corroded** • **not loose** • **not rubbing and** • **don´t have metal-to-metal contact**
Tank	□	□
Multivalve	□	□
Pressure regulator	□	□
Check valve	□	□
Filling valve	□	□
Filter	□	□
Threaded connection for pipe	□	□
Manifold pipe	□	□
Injector	□	□
Rubber pipe	□	□
ECU	□	□
Wiring		□
Temperature sensor		□
Switch		□
Diagnostic system		□

2.6 Start-up procedures

	Proper functioning
First refuelling	□
Leakage test	□
First starting of engine	□
Check of assembled components	□

Before starting the engine, check that all wrappers are well fastened and that no component of the gas system (including cables, hoses…etc.) will interfere with any moving part of the engine (such as belts, fan, etc.).
Check for any gas leakage in engine compartment and in tank compartment, both before and after starting the engine while using gasoline and also while using GAS.

At the first refuelling is required to put filling valve to the proper connection.
Refuel LPG into the tank.
Check that LPG litres refuelled correspond to 80% of the tank volume.
Check that switch indicates full charge with all green lights on.
Check any leakage from the components and connections of the complete system.
Checking leakage can be done by electrical detector.

2.7 Service instructions

First Service - 15,000 Km	
Km …… Date …….	Workshop stamp
Replaced the LPG Filter YES NO Checked the pressure of the gas reducer and fittings Checked the tightness of the tank fixing straps Visually inspected water/gas pipe conditions GAS time reset from the last service control	
Description of the repair/replacement carried out ……... ……..	

Second Service – 30,000 Km	
Km …… Date …….	Workshop stamp
Replaced the LPG Filter YES NO Replaced the injector filters Replaced the LPG solenoid valve filter Checked the pressure of the gas reducer and fittings Checked the tightness of the tank fixing straps Visually inspected water/gas pipe conditions GAS time reset from the last service control	
Description of the repair/replacement carried out ……... ……..	

Third Service – 45,000 Km	
Km …… Date …….	Workshop stamp
Replaced the LPG Filter YES NO Checked the pressure of the gas reducer and fittings Checked the tightness of the tank fixing straps Visually inspected water/gas pipe conditions GAS time reset from the last service control	
Description of the repair/replacement carried out ……... ……...	

Fourth Service – 60,000 Km	
Km …… Date …….	Workshop stamp
Replaced the LPG Filter YES NO Replaced the injector filters Replaced the LPG solenoid valve filter Checked the pressure of the gas reducer and fittings Checked the tightness of the tank fixing straps Visually inspected water/gas pipe conditions	
Description of the repair/replacement carried out ……... …….	

Fifth Service – 75,000 Km	
Km …… Date ……	Workshop stamp
Seq. Reducer overhauled YES NO Changed the LPG injectors Replaced the LPG Filter Checked the pressure of the gas reducer and fittings Checked the tightness of the tank fixing straps Visually inspected water/gas pipe conditions GAS time reset from the last service control	
Description of the repair/replacement carried out ……... ……	

Sixth Service – 90,000 Km	
Km …… Date ……	Workshop stamp
Replaced the LPG Filter YES NO Checked the pressure of the gas reducer and fittings Checked the tightness of the tank fixing straps Visually inspected water/gas pipe conditions GAS time reset from the last service control	
Description of the repair/replacement carried out ……... ……	

Seventh Service – 105,000 Km	
Km …… Date ……	Workshop stamp
Replaced the LPG Filter YES NO Replaced the injector filters Replaced the LPG solenoid valve filter Checked the pressure of the gas reducer and fittings Checked the tightness of the tank fixing straps Visually inspected water/gas pipe conditions GAS time reset from the last service control	
Description of the repair/replacement carried out ……... ……	

Eighth Service – 120,000 Km	
Km …… Date ……	Workshop stamp
Replaced the LPG Filter YES NO Checked the pressure of the gas reducer and fittings Checked the tightness of the tank fixing straps Visually inspected water/gas pipe conditions GAS time reset from the last service control	
Description of the repair/replacement carried out ……... ……	

Ninth Service – 135,000 Km	
Km …… Date ……	Workshop stamp

Replaced the LPG Filter	YES NO
Replaced the injector filters	
Replaced the LPG solenoid valve filter	
Checked the pressure of the gas reducer and fittings	
Checked the tightness of the tank fixing straps	
Visually inspected water/gas pipe conditions	
GAS time reset from the last service control	
Description of the repair/replacement carried out ……... …….	

Tenth Service – 150,000 Km	
Km ……	Workshop stamp
Date …….	
Seq. Reducer overhauled	YES NO
Changed the LPG injectors	
Replaced the LPG Filter	
Checked the pressure of the gas reducer and fittings	
Checked the tightness of the tank fixing straps	
Visually inspected water/gas pipe conditions	
GAS time reset from the last service control	
Description of the repair/replacement carried out ……... …….	

2.8 System malfunction

After about 10 seconds from ignition the switch turns off:
There is no rev signal.

The engine is running on three cylinders:
The injector cutter wiring harness is not installed correctly; check that letter “A” of the injector unit matches the blue and blue/black wires of the injector cutter wiring harness.
Once you’ve found the cylinder that’s not working, check:
1) the gas hose is not clogged/throttled or leaking,
2) that the fitting on the intake manifold is not clogged.
3) that the calibrated fitting on the injector unit does not have the same diameter as the others,
4) that the Gas ECU is sending a correct signal to that particular injector,
5) that the Gas injector control wires are not interrupted, have not come away from the gas control unit connector or from the injector unit connector.

As soon as you switch over to gas it goes back to petrol automatically:
If the switch stays in the position for switching over to gas it means:
1) gas injection times are too long,
2) the pressure of the natural gas reducer is too low.

If the error “injectors not compatible” appears check:
The PC has been disconnected from the serial cable with the programme open. Exit the programme, reconnect the serial cable and then reconnect up.

The number of revs displayed on the PC does not correspond to the number of revs of the car:
1) check the setting of the ignition type (monocoil/bicoil/tachometer)
2) check the setting of the rev signal type (standard/weak).

If, when switching to gas, the engine stops check:
1) there is fuel in the cylinder
2) the fuel is reaching the injector unit
3) there is 12 volt with the key in the ignition and turned once to make contact

The engine check pilot light turns on:
1) check the error in the petrol ECU
2) with the OBD socket check that the fast/slow petrol correctors are not creeping but if they are:
- correct while running on gas until the petrol correctors remain close to zero or are similar to running with petrol.
3) check that the lambda probe is working,
4) if there is a gas timing advancer try disconnecting it.

The control unit is not connecting:
Turn the panel on, connect anyway via the serial interface, re-programme the control unit with the new FW version and when you have finished, disconnect and the reconnect once more.

2.9 Diagnosis

Communication errors

Error code	Description	Action
C01	The control unit is not responding.	Check the connection, control unit power supply, efficiency of the communication interface.
C02/C03	The control unit is not compatible.	Replace the control unit.

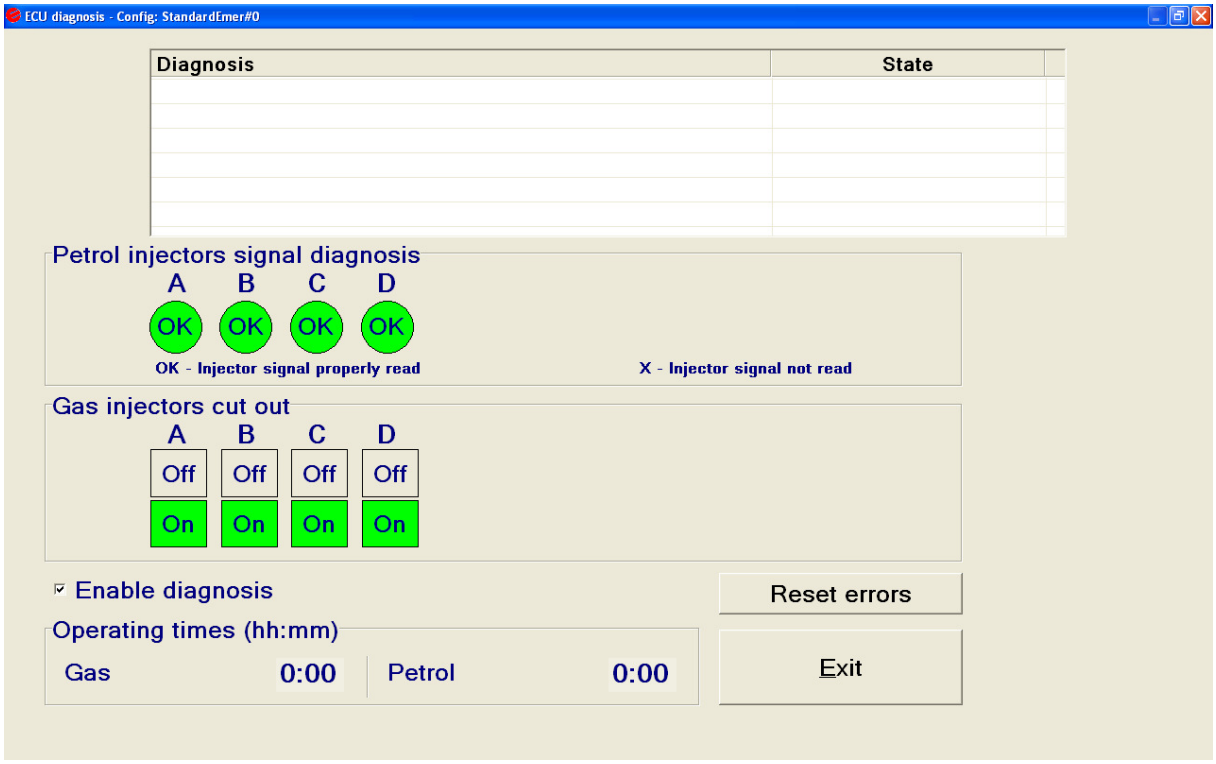
Hardware Key Errors

Error code	Description	Action
H01	Hardware key damaged or missing.	Check correct insertion of the hardware key or replace it.
H02	The hardware key is not responding.	Check correct insertion of the hardware key or replace it..
H03/H04	Hardware key expired or with erroneously programmed expiry date.	Ask Emer for the hardware key update.

Reprogramming Errors

Error code	Description	Action
P01	The control unit is not responding.	Check the connection, control unit power supply, efficiency of the communication interface.
P02	The control unit is not compatible.	Replace it.
P03	Problem in reading the programming file.	Check the right to access the folder that contains this file, check presence and/or integrity.
P04	Obsolete Internet Explorer version.	Update Internet Explorer to version 6.0 (or higher).
P05/P06/ P07/P08/ P09	Generic error when initialising reprogramming.	Turn power off and try reprogramming again within 4 seconds.
P10/P11	Programming file not right/damaged.	Ask Emer for the original programming file.
P12/P13/ P14	System error.	Contact Emer giving a detailed description of the problem and the system used (PC type, operating system, type of communication interface (serial/USB), etc…)
P15	Not the right control unit model.	You are trying to programme, for example, a control unit for 4 cylinders with a file for a 5-6-8-cylinder or Turbo control unit. Load the programming file that is compatible with the control unit model installed.
P1000 …	Generic programming error when downloading the file.	Turn power off and try reprogramming again within 4 seconds.

WARNING:
Never reprogram or reset from base parameters the ECU while engine is running on GAS.
After reprogramming the ECU or resetting from base parameters, it is necessary to set the proper vehicle configuration options before proceeding with autocalibration.



Part II

3. Installation instructions Fiat Punto

3.1 Fiat Punto: Technical data

Vehicle manufacturer	Fiat	Fiat
Type	Punto	Grande Punto
Category	M1	M1
Motor	199A400	
Displacement:	1242 ccm	1368 ccm
Injection	sequential injection	sequential injection
Drive unit	mechanical, 5 gears + reverse gear	mechanical, 5 gears + reverse gear
Retrofit type	sequential injection Emer	sequential injection Emer
Mod.	Emer Simple BAT LPG	Emer Simple BAT LPG
Fuel consumption		
Urban		
Gasoline	7.6 l/100km	8.7 l/100km
LPG	9.4 l/100km	9.4 l/100km
Extraurban		
Gasoline	5.0 l/100km	5.4 l/100km
LPG	6.3 l/100km	6.3 l/100km
Total		
Gasoline	6.1 l/100km	6.6 l/100km
LPG	7.8 l/100km	7.8 l/100km
Emissions CO2:		
Gasoline	145 g/km	155g/km
LPG	130 g/km	139 g/km
Power		
Gasoline	54.5 kW at 5500/min	88.0 kW at 5000/min
LPG	52.4 kW at 5300/min	84.6 kW at 4800/min
Weight	1030 kg	1025 kg

3.2 Installation

When installing the LPG Installation, compliance is required with the following guidelines:

- It's the installer's responsibility to check the national and/or local regulations and make all necessary adapts.
- Before starting the installation of the LPG system, remove the negative terminal from the battery.
- If necessary, consult the workshop manual of the car manufacturer before the parts are dissembled.
- All directions in the instruction manual are given from the direction of the traffic.
- Unless indicated otherwise, all measurements are in mm.
- When drilling be careful for the underlying parts.
- Deburr holes in the plating and treat them for rust.
- First check the measurements given and the wire colours and positions.
- The holes for the injectors must be drilled in accordance with the instructions. Use the correct drilling fig, if indicated.
- When fitting the injector nipples, vacuum nipples, water nipples, gas nipples, and LPG valve, use sealing locking agent on the screwthread.
- Mount the injector in line with the injector rail.
- Always oil the O-ring of the injector rail.
- Use the right hose clips when fitting all hoses.
- After installing the system, ensure a watertight seal on the cable and pipe lead-through.
- Use the connectors supplied for electrical connections and then insulate them completely. Do not solder.
- Prevent the risk of damage from wiring harnesses and hoses. Fasten them with the cable ties supplied.

3.2.1 Filling valve installation

Filling valve has to be fixed into de petrol refuel hollow.
The correct position is found when the LPG filling valve adapter can be screw in completely and don't have any interference with the petrol filling valve.

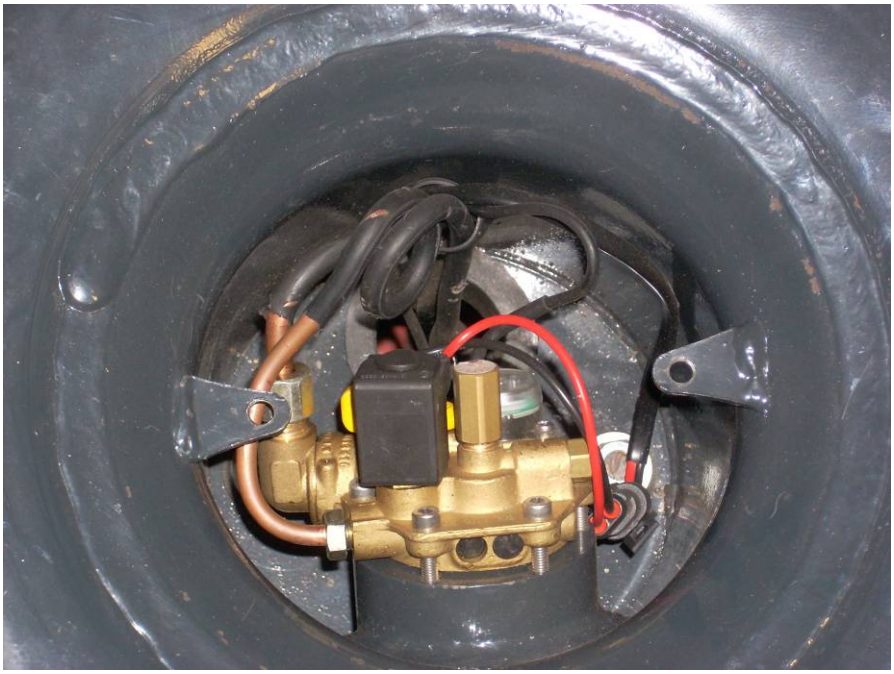
Filling valve

Filling valve adapter

Emer S.p.A.	EMER	E3-67R-0158464

3.2.2 Multivalve installation

Install the MTV on the tank before putting it into the boot, and upset the tank testing the exact working of the level gauge.
Check the tank lock ring has the axis of the two diametrically opposed holes perpendicular to the axis of the toroidal tank.
Check that the lock ring is inclined with respect to the vehicle-tank fixing plane.
In order, insert the following through the tank lock ring: float, draught pipe and vent pipe keeping them together and paying attention not to deform the float rod and the draught pipe. The vent pipe is fitted solely to the multivalve for toroidal tanks at 0°: the rubber pipe with a 90° bend returns to its original shape after straightening to be able to be inserted into the tank.
Insert the screws into the 6 holes of the multivalve lock ring.
The maximum permitted tightening torque for the 6 screws coupling the multivalve to the tank is 5 Nm.
Connect the 6 copper output pipe (the writing “out” with an arrow towards the outside of the body) using the small warhead and the threaded coupling with a 13 mm hexagon. Connect the 8 copper input pipe using the large warhead and the 17 mm hexagon nut.
Insert the solenoid valve pin.



Multivalve

3.2.3 LPG tank installation

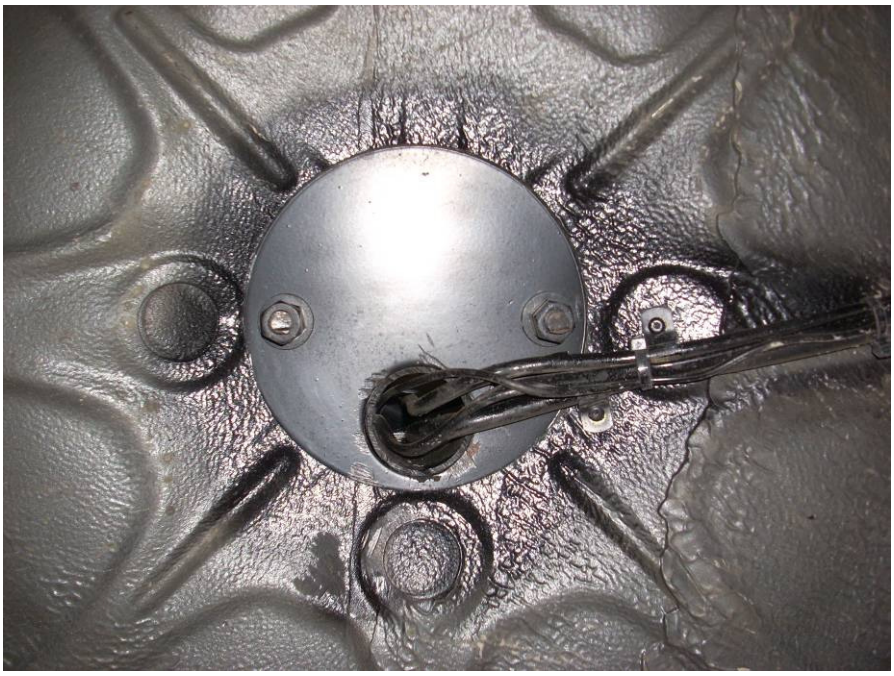
Use the hard support to fix the tank and place the plastic hall tube.
Place the plastic cover between the tank and the vehicle body.
Place the ventilating hoses with the environmental protections.

LPG tank

Tugra Makina	TE600200	E37-67R-010050

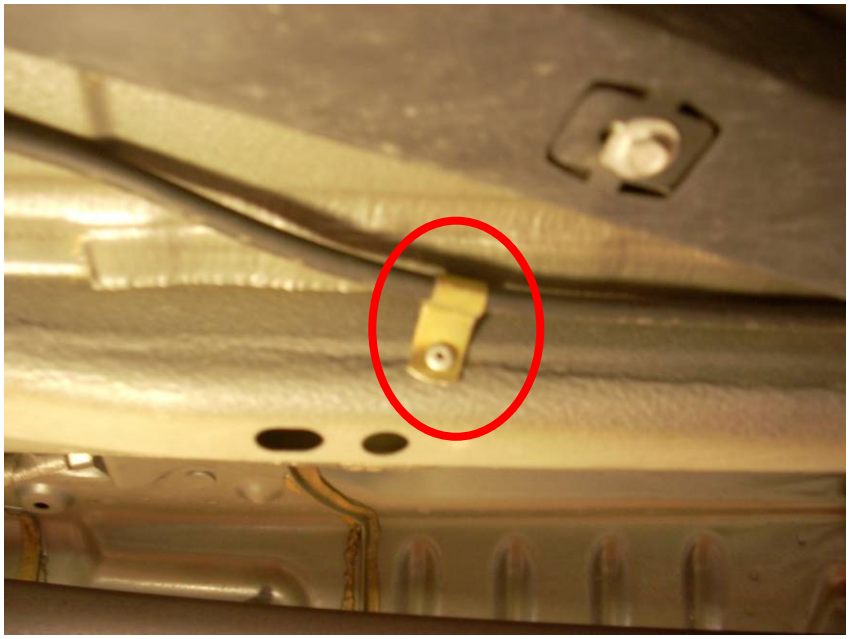
3.2.4 Tube installation

Use the tank hard support and the hall tube to connect the tube to the multivalve and the outside of the vehicle.



Tank hard support and hall tube

In order to fix copper pipe to the car use body strips.



Hard support of tube

3.2.5 Solenoid valve installation

Solenoid valve is fix to the pressure regulator.
The copper pipe to the engine compartment has to be connected to the inlet of solenoid valve.

Tube connection to inlet of solenoid valve

3.2.6 Pressure regulator installation

Install the regulator always in a position that is lower than the coolant expansion tank. It will facilitate circulation of water into the pressure regulator for its proper heating.
Don't secure the pressure regulator to the insulating panel between the engine compartment and the driver's cabin. Vibrations could turn into a noise for the driver.

Pressure reducer with solenoid valve

Emer S.p.A.	**MG-01 E**	**E6-67R-010025**

3.2.7 Filter installation

To connect filter is required to cut LPG pipe. With two strips pipe's strict connect to filter.

Filter

Valtek S.p.A.	Type 93	E4-67R-010105

3.2.8 Rail and injectors installation

Don't ever secure the gas injector rail to the vehicle's body. The gas injector rail must follow the exact vibrations and movements of the engine.

Injector rail

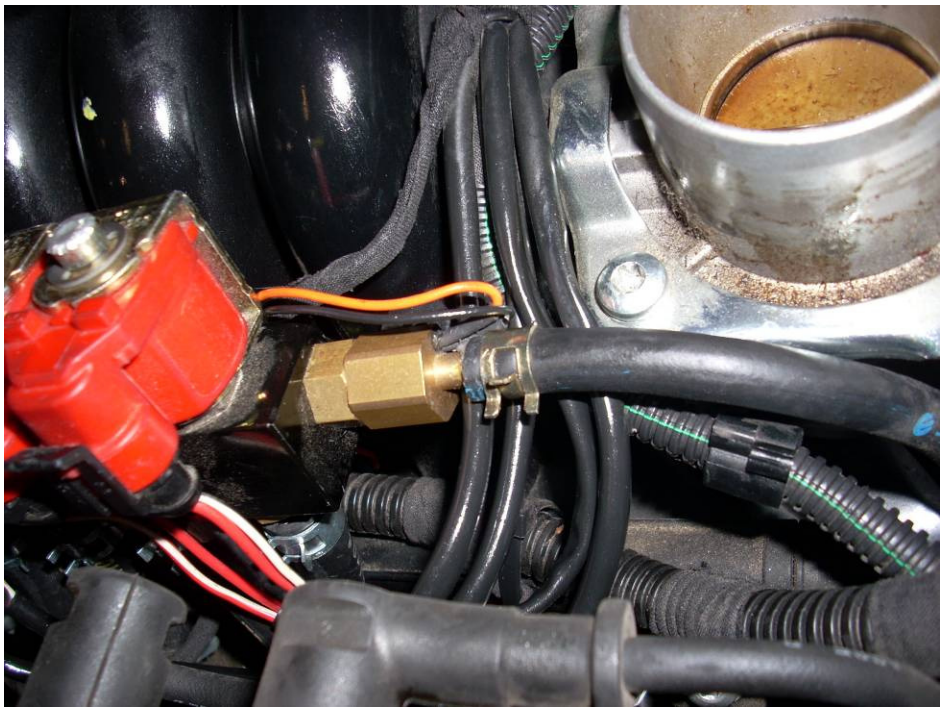
Valtek S.p.A.	Type 30	E4-67R-010104

To hardly connect injectors a fixed support to the manifold has to be used.

Injector rail hard support

3.2.9 Temperature sensor installation

Temperature sensor has to be connected to injector rail.



Temperature sensor connection

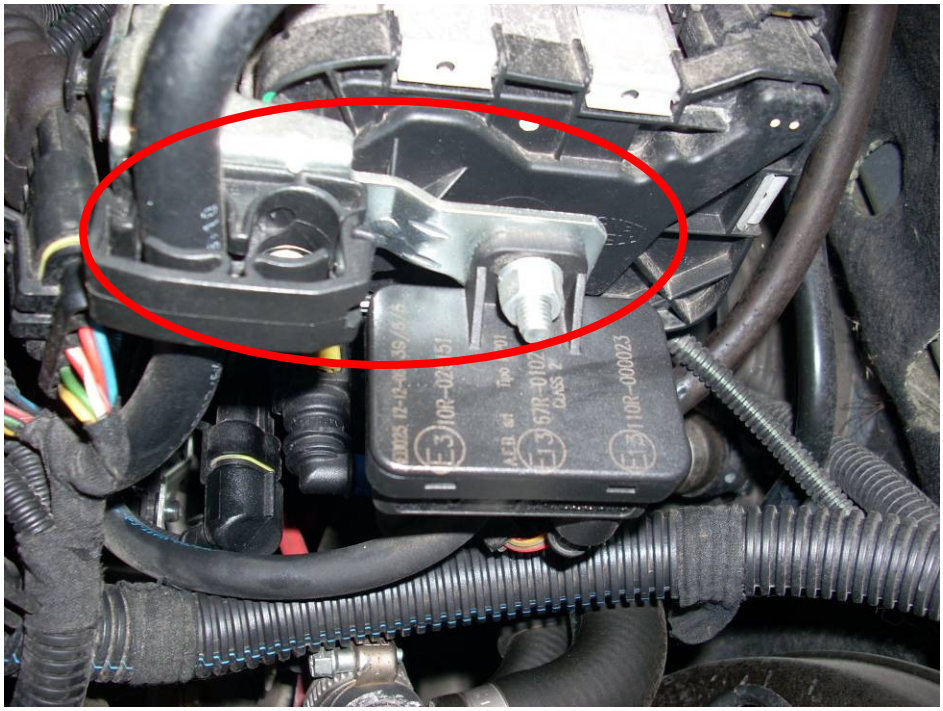
3.2.10 Rubber pipe installation

Fix the water pipe with strips from pressure regulator to original heating using T connections.
Fix the rubber pipe with strips from pressure regulator to filter.
Fix the rubber pipe with strips from filter to injector rail.
Fix the rubber pipe with strips from injector nozzles to manifold nozzles.

Overview of complete system

3.2.11 MAP sensor installation

Don’t install the manifold absolute pressure (MAP) sensor close to the exhaust, since the high temperature can damage it.
Use the hard support to fix the MAP sensor.



Hard support of MAP sensor

AEB S.r.l.	AEB025	E13-67R-010216

3.2.12 ECU installation

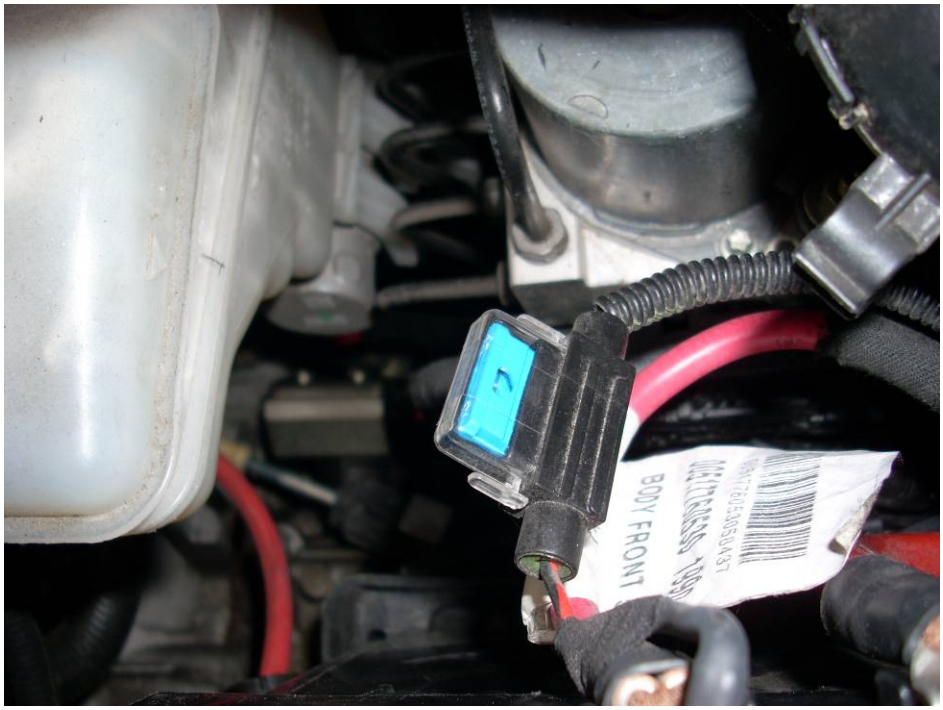
Don’t ever secure the gas electronic control unit (ECU) to the engine, engine vibrations could create malfunctions.
Use the supports to fix it near the battery.

Hard support of ECU

AEB S.r.l.	AEB2001	E13-67R-010157

3.2.13 Fuse installation

Place the system fuse Near the battery such that it will be easy to reach by the end user.



Fuse

3.2.14 Switch installation

The switch has to be fitted in a position that can be easily reachable and seeing by the driver.

Switch

3.2.15 Position of type approval plate

Place the plate under the engine cover.

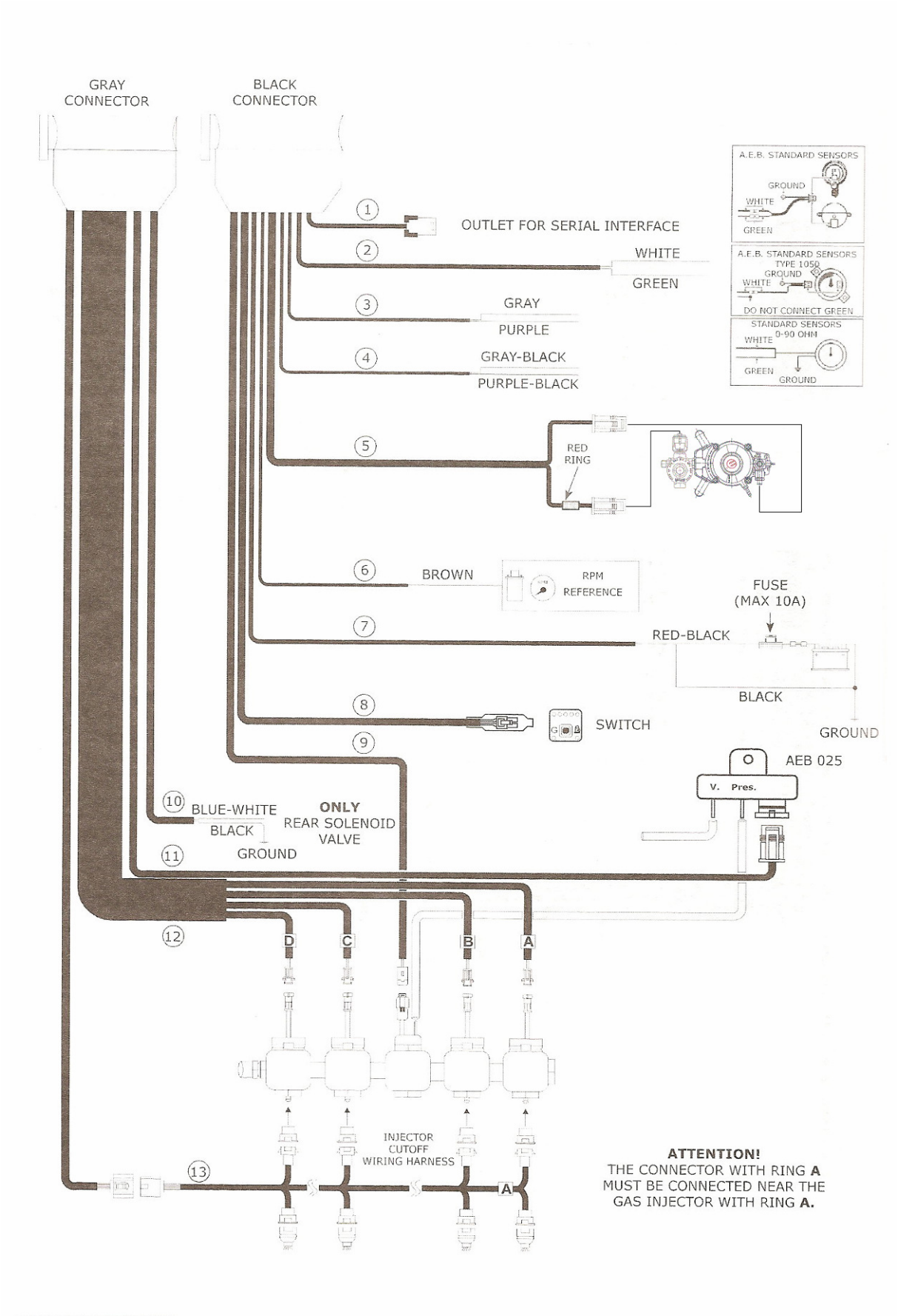
E1 115R-000000

Emer S.p.A. - Simple BAT LPG system

LPG

Component	Manufacturer	Type	ECE number
Filling valve	Emer S.p.A.	EMER	E3-67R-0158464
LPG tank	Tugra makina	Toroidal 600 x 200	E37-67R-010050
Multivalve	Emer S.p.A.	MTV E67-01	E3-67R-0158416
Solenoid valve	Valtek S.p.A.	07	E4-67R-010041
Pressure regulator	Motor G.L.P. SA	MG-01E	E6-67R-010025
Filter	Valtek S.p.A.	93	E4-67R-010105
Rubber pipe	Emer S.p.A.	Autogas	E3-67R-0158452
Rail and injectors	Valtek S.p.A.	30	E4-67R-010104
MAP sensor	AEB	AEB025	E13-67R-010216
ECU	AEB	AEB2001	E13-67R-010157

3.2.16 Wiring diagram of the electrical system



3.2.16.1 Plug in with 4-contact connector.
Diagnosis outlet for connection to the computer via serial interface.

3.2.16.2 Plug in with wires.
Green and White: For connecting the level sensors used to read the amount of fuel in the tank.

3.2.16.3 Plug in with wires.
Purple: Input solely for displaying oxygen sensor's values on the computer **(this connection is not needed by the control unit to calculate the system's operation parameters).**
Gray: Not used. Do not connect.

3.2.16.4 Plug in with wires.
Purple-Black: Input solely for displaying oxygen sensor's values on the computer **(this connection is not needed by the control unit to calculate the system's operation parameters).**
Gray-Black: Not used. Do not connect.

3.2.16.5 Plug in with two 2-contact connectors.
2-contact connector with red ring, to be connected to the gas solenoid valve on the reduction gear.
2-contact connector, to be connected to the temperature sensor on the reduction gear.

3.2.16.6 Plug in with brown wire.
Necessary for reading the rpm; can be connected to the rev counter wire or directly onto the negative terminal of a single or double coil.
The control unit's software will need to be properly programmed based on the type of connection.

3.2.16.7 Plug in with two wires.
Red-Black: Connect to battery's positive terminal.
Black: Connect to battery ground.
They are the control unit's power supply and ground, respectively. Connect them directly to the battery.
Connect the provided fuse on to the Red-Black wire, positioning it as close as possible to the battery.
Never replace the fuse with another having bigger amperage. This could cause irreparable damage.

3.2.16.8 Plug in with 4-contact connector.
For connection to the switch/indicator.

3.2.16.9 2-contact connector.
Connect to the gas temperature gauge on the injection rail.
The temperature gauge supplies the gas control unit with the temperature of the gas in the gas injection rail.

3.2.16.10 Plug in with wires.
Blue-White: output +12V gas operation (MAX absorption allowed: 10A).
Black: ground.
To be used **only** for powering the rear solenoid valve; **do not** use on the front solenoid valve or for gas users.

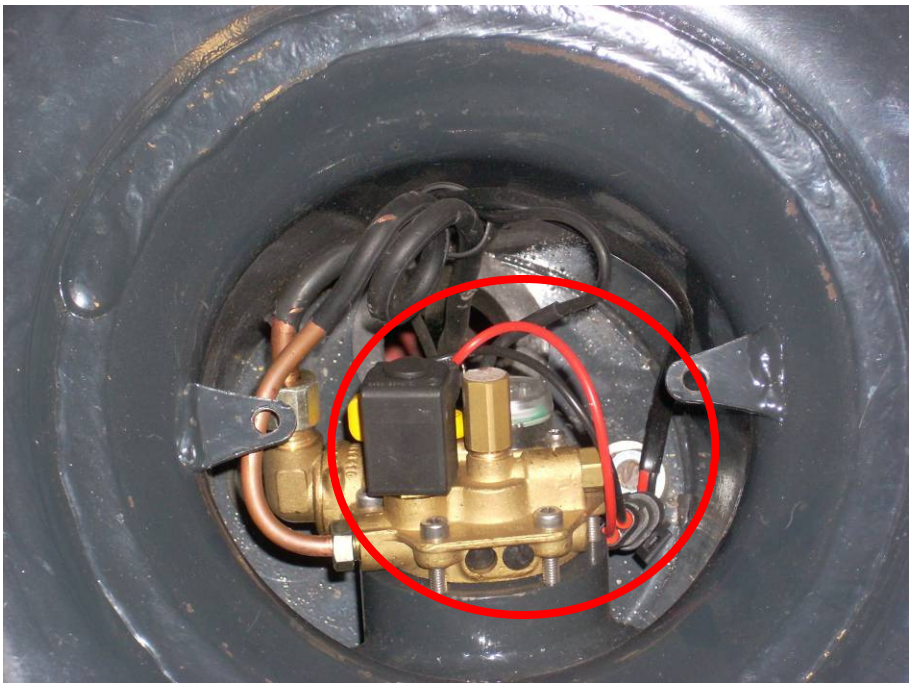
3.2.16.11 Wiring harness with 4-contact connector.
Connect to the pressure gauge supplied with the kit (AEB 025).
The pressure gauge supplies the gas control unit with the difference in pressure between gas injectors and the intake manifolds.
The lower part of the pressure gauge has 2 nozzles marked as **Pres.** And **V.**;

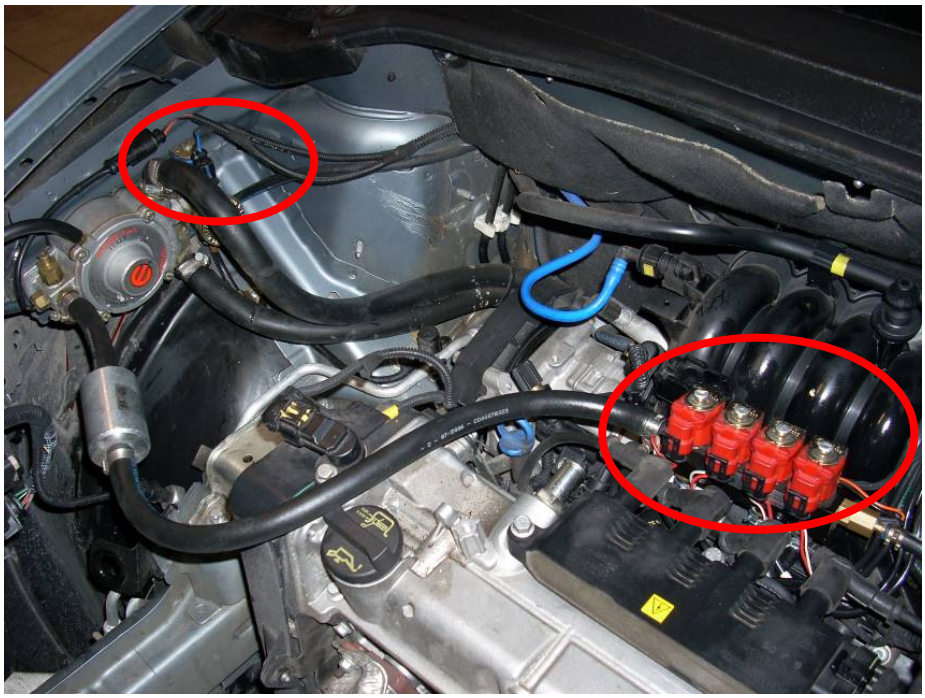
- Connect the pressure pipe coming from the gas injection rail to the **Pres.** Nozzle;
- Connect the vacuum pipe coming from the intake manifolds to the **V.** nozzle.

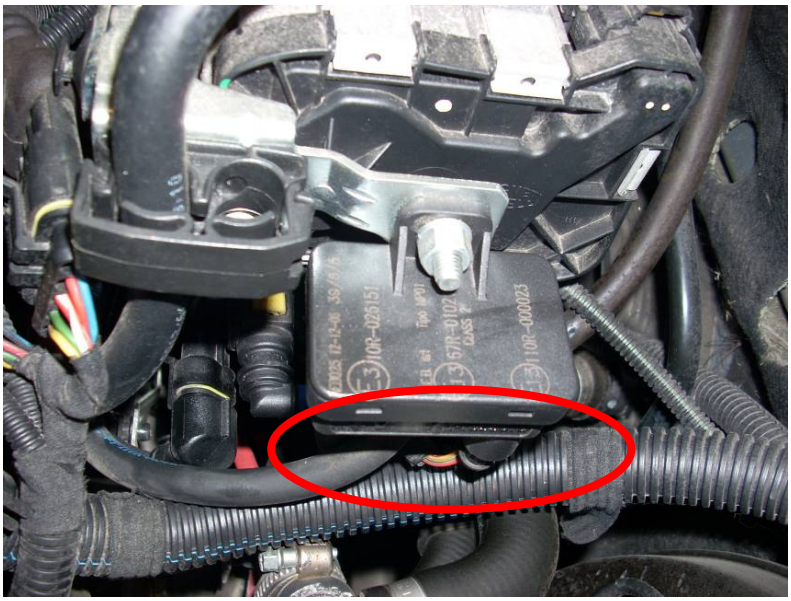
3.2.17Scheme of the layout of the electrical components

Don’t lay any wire close to alternator, high voltage cables, coils, belts, pulleys, high temperature parts like exhaust…. etc. All these disturb can interfere with the correct functioning of the system.

Connect the wiring socket to the appropriate component socket as indicated in the wiring diagram.








BODY FRONT