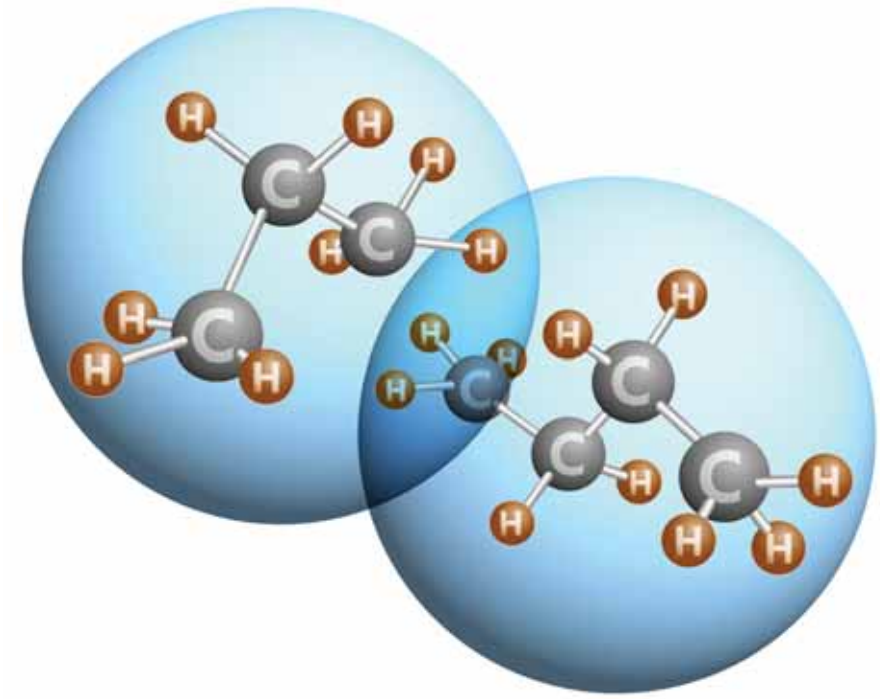
LPG system in Škoda vehicles

Self-study programme

For the first time in the history of the Škoda vehicles, the customer is offered a liquefied petroleum gas powered vehicle directly from the factory. Liquefied petroleum gas is also known as liquid gas or LPG (Liquefied Petroleum Gas).

LPG has already been used for decades and is currently the world's most widely used alternative fuel. It is a clean-burning fuel, therefore making it one of the most modern energy carriers. In many big cities more and more vehicles run on LPG, which is largely due to the rising popularity of this fuel.



LPG consists of a mixture of propane, butane and additives. Compared to other fuels, the use of LPG results in significantly lower exhaust emissions. Overall, the emissions produced by liquefied LPG vehicles are among the lowest emissions achieved at present by internal combustion engines. The LPG fuel is virtually sulphur-free and the combustion takes place with almost no soot emissions. Pollutants such as carbon monoxide (CO), hydrocarbon (HC), nitrogen oxides (NOx) and other exhaust gas components, which pose adverse health and environmental risks, are significantly reduced.

Contents

You will find the instructions for the installation, removal, repair, diagnosis and detailed user information in the repair manual, the diagnosis unit VAS 505x and in the onboard literature.

The time for going to press was on the 07/2009. This brochure is not subject to update.

Brief presentation of the LPG system

The main components of the LPG system

All the component parts which are required for the gas operation are already installed during the production.
The normal petrol operation remains unchanged.

The LPG system consists of:

- the gas control unit
- the gas fuel tank filler neck
- the LPG tank with integrated multi-function valve
- the conversion button with the gas supply indicator and the switch for the fuel selection
- the evaporator with the electromagnetic high-pressure valve for the gas operation
- the gas filter
- the gas distributor strip with the gas injection valves and the sensor of the gas distributor strip.

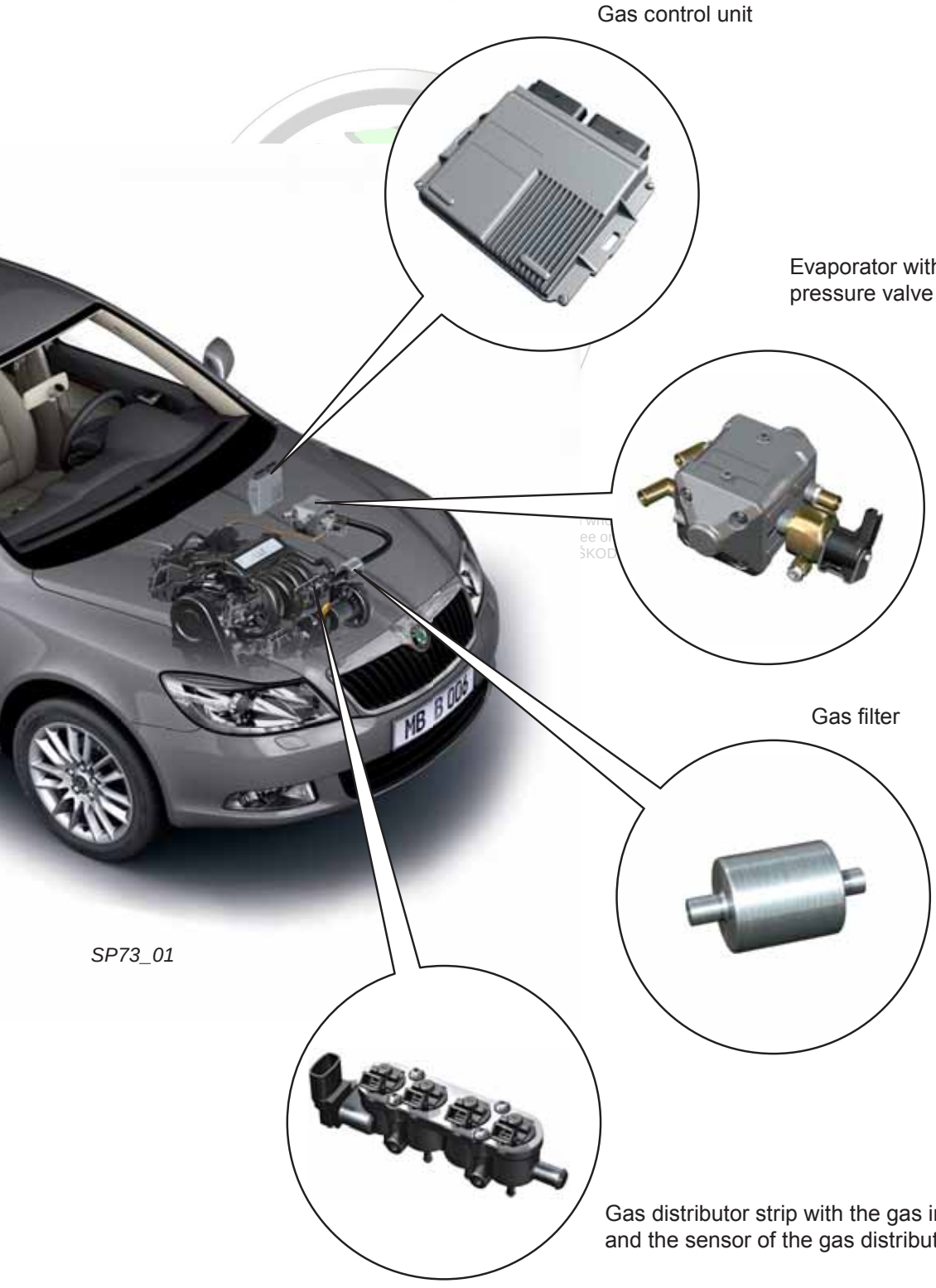
Gas fuel tank filler neck

LPG tank with integrated multi-function valve

Conversion button with the gas supply indicator and the switch for the fuel selection

Consequences of failure

If one or more components or component parts in the LPG system fail, the system switches back to petrol operation. If a fault is indicated when restarting the engine, the system does not switch back to LPG operation instead it only operates in petrol mode. It is necessary to visit an authorised service workshop.



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Brief presentation of the LPG system

The 1.6 ltr./75kW Engine with 2-valve technology

The 1.6 ltr. engine powered by LPG is based on the 1.6 ltr. Flex Fuel (E85) engine with the identification characters CCSA, which in turn is based on the technology of the 1.6 ltr. 75kW MPI engine with the identification characters BSE and is known from the Škoda Octavia II model range.
There are no mechanical adaptations of the petrol engine CCSA necessary to enable LPG operation. The normal petrol operation remains unchanged and a switchover to LPG operation is possible using the conversion button in the centre console. In gas operation, the engine produces a power output of 72kW.

Technical highlights

- 2-valve technology with roller rocker arm
- aluminium engine block with ribbed oil pan
- secondary air system
- plastic variable intake manifold
- modified applications of the engine control unit, adapted to the long-term gas operation
- the valve drive, the cylinder head and the pistons with the piston rings were taken over from the Flex Fuel engine CCSA

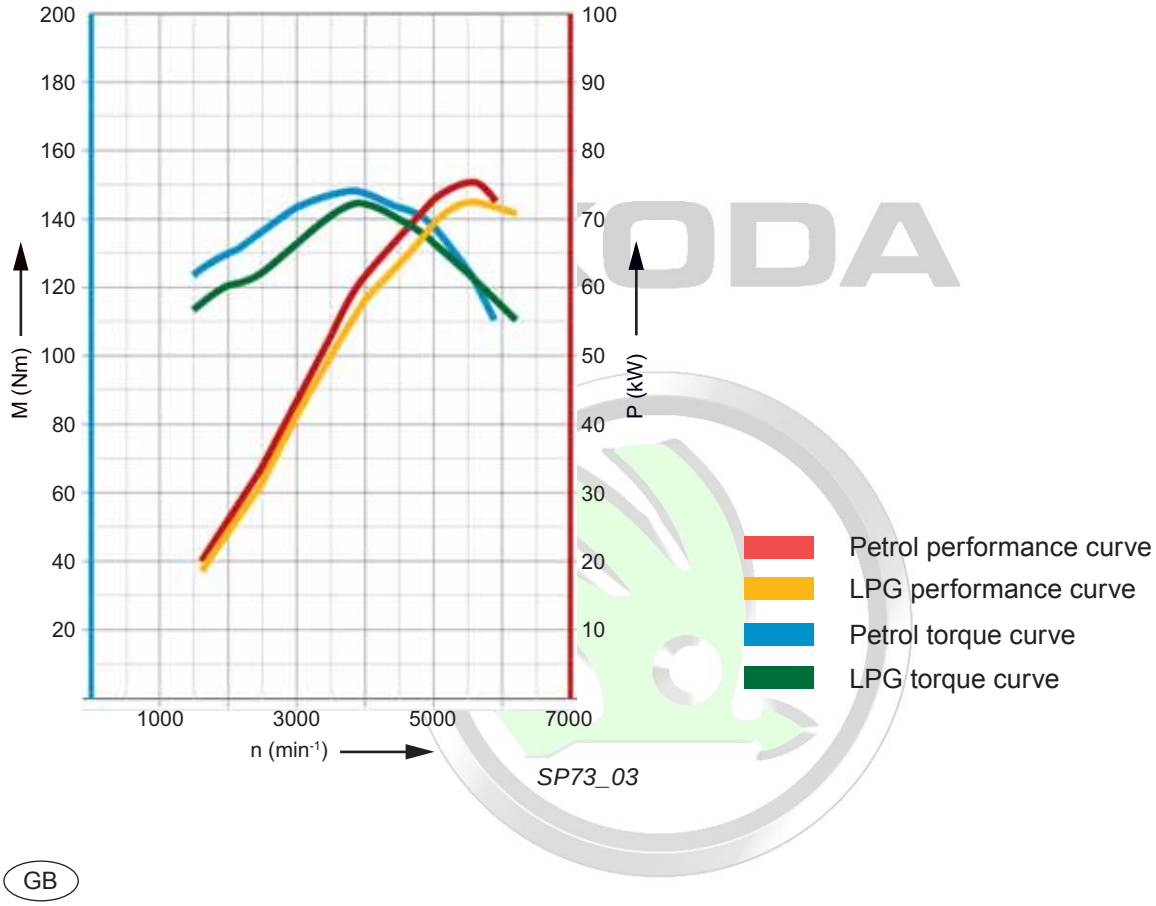
SP73_02

The gas-powered 1.6 ltr. engine must not be operated with ethanol (E85).

Technical data

Engine identification character	CHGA
Design	Inline engine
Number of cylinders	4
Valves per cylinder	2
Displacement	1595cm^3
Bore	81mm
Stroke	77.4mm
Compression ratio	10.3 : 1
max. power output	75kW at 5600 rpm - petrol
	72kW at 5600 rpm - LPG
max. torque	148Nm at 3800 rpm - petrol
	144Nm at 3800 rpm - LPG
Engine management	Simos 7PP
Fuel	Super Unleaded RON 95 (Normal Unleaded RON 91 with low reduction in performance)
	LPG (liquefied petroleum gas)
Exhaust after treatment	Main catalytic converter with lambda control
Emission standard	EU4

Torque and power output diagram



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The gas fuel tank filler neck

The gas fuel tank filler neck is located right next to the petrol tank filler neck under the petrol cap and is connected to the LPG tank via an LPG line.

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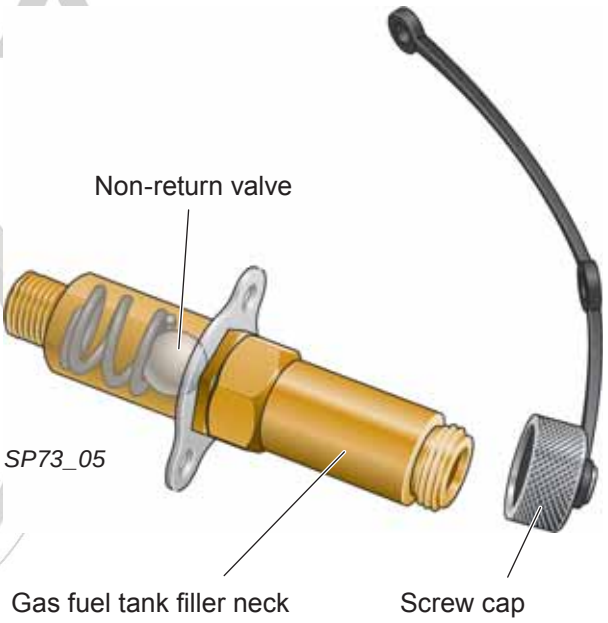
The gas fuel tank filler neck is provided with a non-return valve. This allows the liquid LPG to flow in one direction and prevents the liquid LPG to flow in the opposite direction.

The non-return valve opens under the fluid pressure when filling up.



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The tank nozzle adapter

In various countries the liquefied gas pumps are fitted with different fuel nozzles, therefore keep in mind that so-called tank nozzle adapters must be used in order to connect the fuel nozzle to the gas fuel tank filler neck when refuelling the vehicle. Currently there are two connection systems which are the most common all over Europe. The **ACME** tank nozzle adapter and the **Dish connector**.

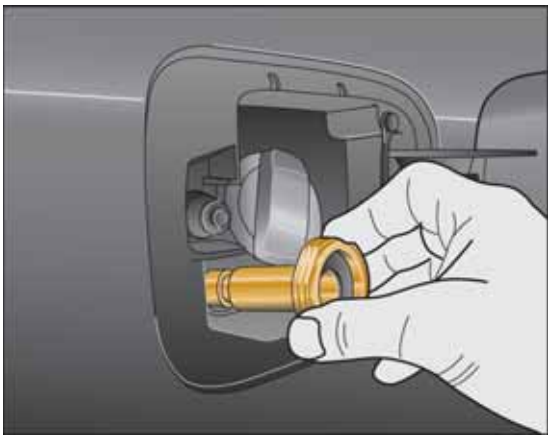
ACME connector	**Dish connector**
 *SP73_06*	 *SP73_07*
Belgium Germany England Ireland Luxembourg Poland Scotland Switzerland	Czech Republic Denmark France Greece Hungary Italy Austria Portugal

Both tank nozzle adapters are components of the vehicle equipment.

The fuelling process

When refuelling, the fuel flows through a closed system (the fuel nozzle and the gas fuel tank filler neck). Refuelling with LPG is as easy and takes just as long as with petrol. The filled quantity of LPG is indicated in litres and shown on the pump display in the same way as for petrol.
The maximum filling capacity of the LPG tank is approx. 80%, this ensures there is sufficent room for the LPG to expand mainly at higher ambient temperatures.

After opening the fuel flap, the screw cap is unscrewed from the gas fuel tank filler neck and the adapter is screwed in.



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Remove the fuel nozzle from the pump.

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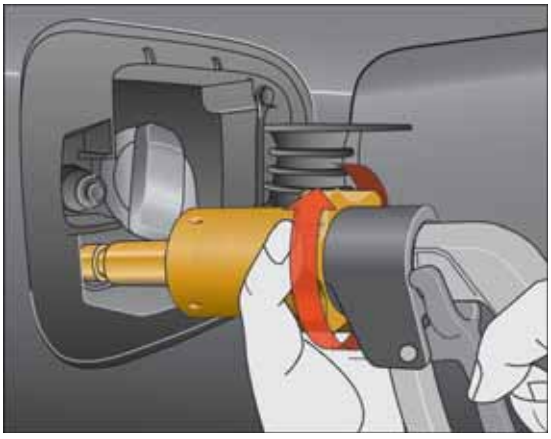
Screw the rotary head of the fuel nozzle onto the adapter. Squeeze the trigger of the fuel nozzle and engage the trigger lock.



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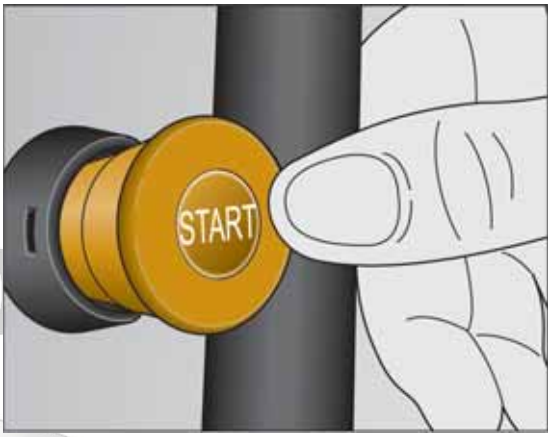
Press the start button on the petrol pump and hold it pressed until the tank is filled up.



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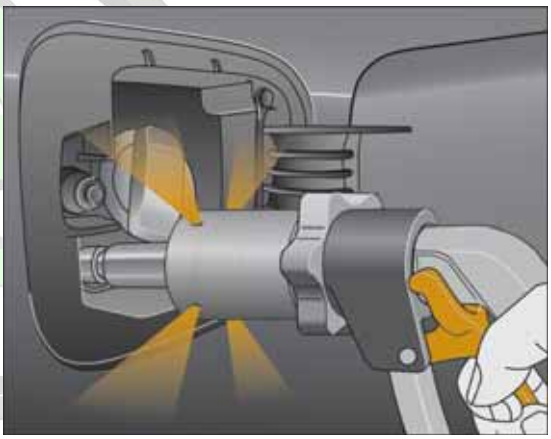
When releasing the fuel nozzle, a small quantity of LPG escapes into the surrounding area from the outlet holes in the rotary head. The LPG which escapes has a very low temperature and frostbite may occur on contact with the skin. Therefore the outlet holes must not be touched when refuelling.



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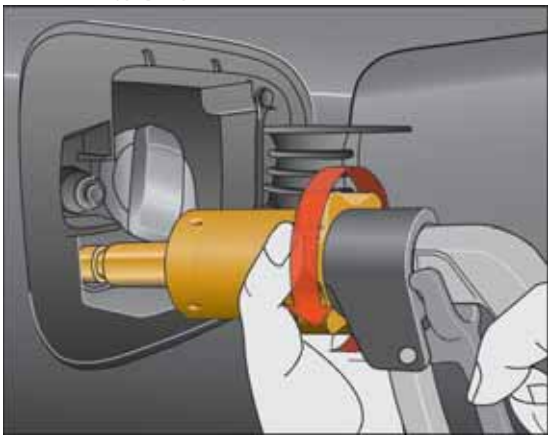
Remove the rotary head of the fuel nozzle and the adapter from the gas fuel tank filler neck. Screw the screw cap onto the gas fuel tank filler neck.



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The procedure described for connecting the fuel nozzle is valid for the ACME connector.

The LPG lines

The fuel enters the fuel tank via the LPG lines and from there it flows to the engine.
The LPG system is divided into a high-pressure area and a low-pressure area. The LPG lines consist of copper tubing with a PVC hose jacket in the high-pressure area and they consist of hoses made of special rubber in the low-pressure area.

The following LPG lines are installed:

1. from the gas fuel tank filler neck to the tank (high-pressure area)	- copper tubing (ø 8mm) + PVC hose jacket - pressure of 8-10bar - LPG in the liquid state
2. from the tank to the evaporator (high-pressure area)	- copper tubing (ø 6mm) + PVC hose jacket - pressure of 8-10bar - LPG in the liquid state
3. from the evaporator to the gas distributor strip with the gas injection valves (low-pressure area)	- hoses made of special rubber - pressure of 0.1-2bar - LPG in the gaseous state
4. from the gas distributor strip with the gas injection valves to the intake manifold (low-pressure area)	- hoses made of special rubber - pressure of 0.1-2bar - LPG in the gaseous state

LPG lines which are damaged (e.g. after an accident) must be completely replaced.

The LPG tank

The toroidal LPG tank is installed in the spare wheel well.

It is made from sheet steel with a thickness of 3.5mm.

The LPG tank has a capacity of 55 litres. The LPG tank cannot be filled past 80% of its total volume, because the LPG expands with the increase of temperature. The filling level is temperature-dependent and can fluctuate. The LPG tank holds approx. 44 litres when the outside temperature is 15°C.

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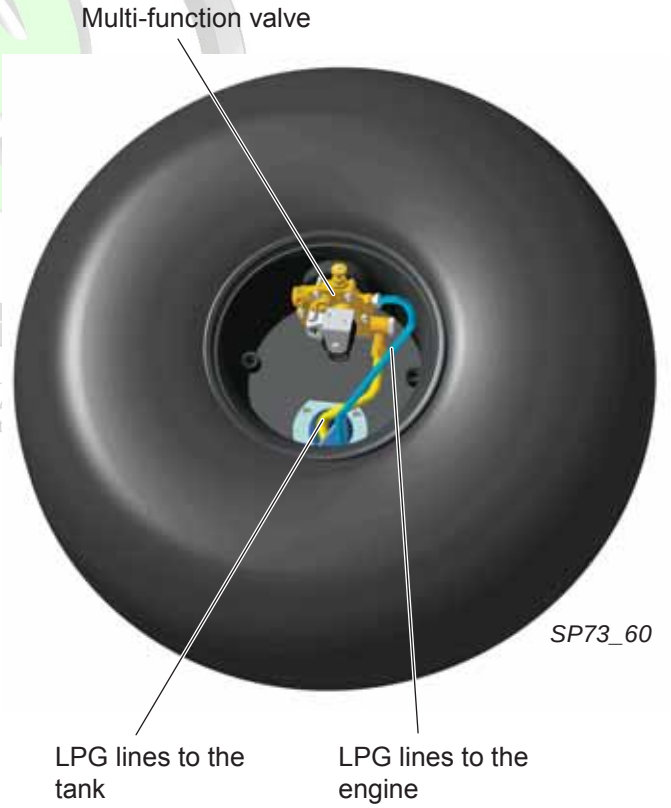
A multi-function valve is integrated in the LPG tank. It is located in the hollow space in the middle of the LPG tank. The hollow space is closed by a cover with a rubber seal, whereby a gas-tight box is created.



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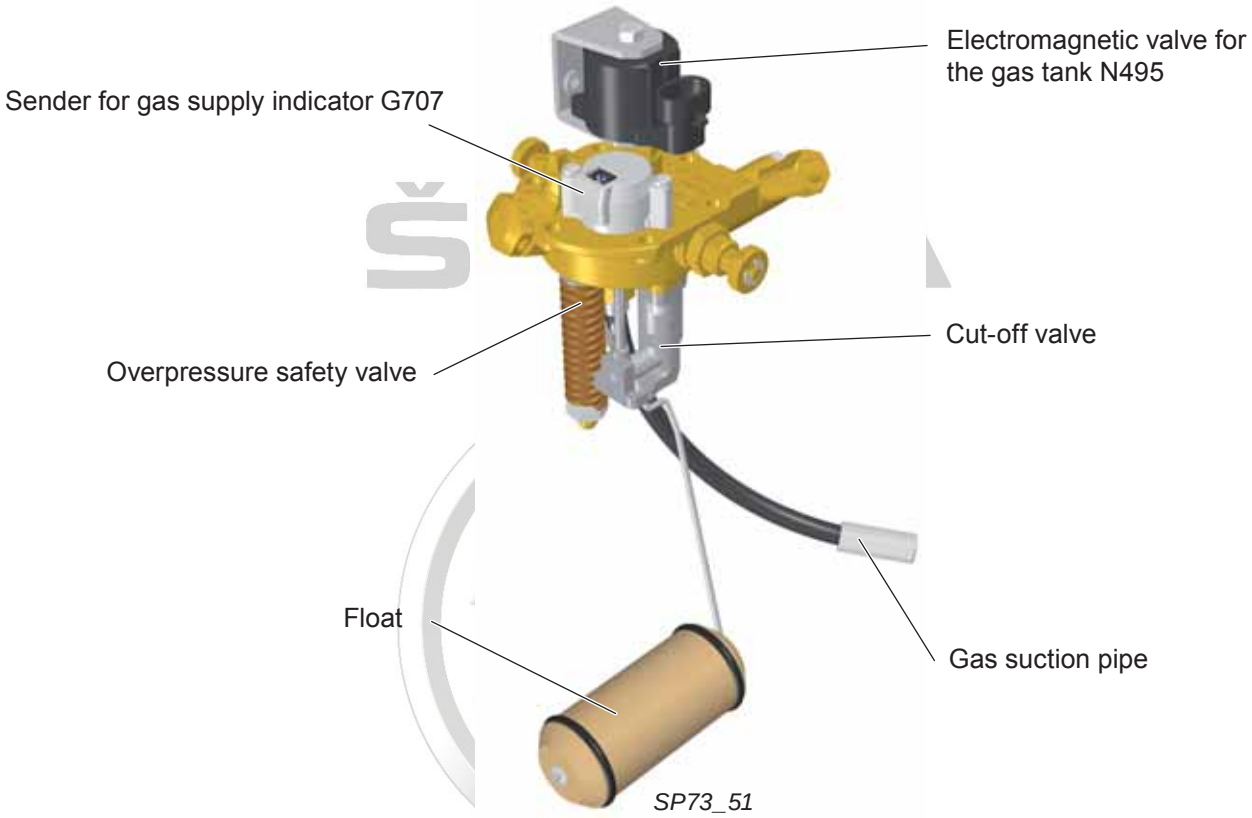
The multi-function valve in the LPG tank

The multi-function valve combines the following functions in a single body:
- the electromagnetic valve for the gas tank N495
- the cut-off valve
- the overpressure safety valve
- the sender for the gas supply indicator G707



Position of the multi-function valve in the gas tank

The electromagnetic valve for the gas tank N495

The electromagnetic valve for the gas tank N495 is a component of the multi-function valve.

The valve for the gas tank regulates the LPG flow from the gas tank to the evaporator in the engine compartment. The opening and closing functions of the valve are actuated by the gas control unit.

When switching over to petrol operation or switching off the engine, in the event of a high severity accident (crash detection) or a loss of voltage supply, the valve closes automatically.

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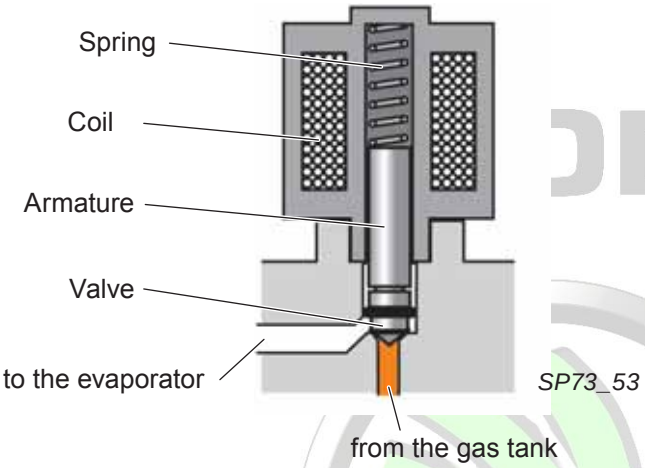
Function

Valve closed



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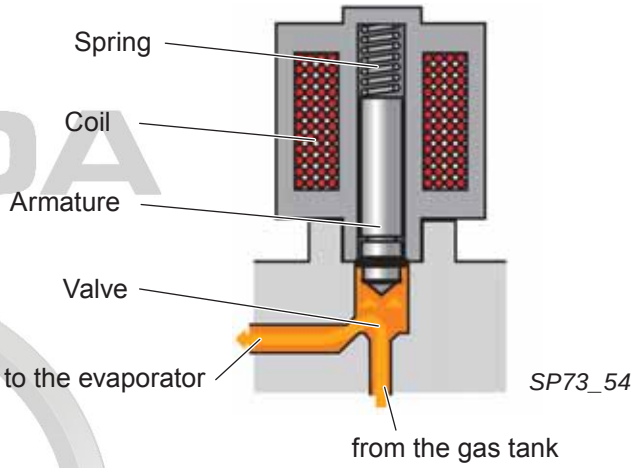
In the de-energised condition, the valve armature is pushed into the valve seat by the spring force and thereby shuts off the gas inflow from the gas tank to the evaporator.

Valve opened



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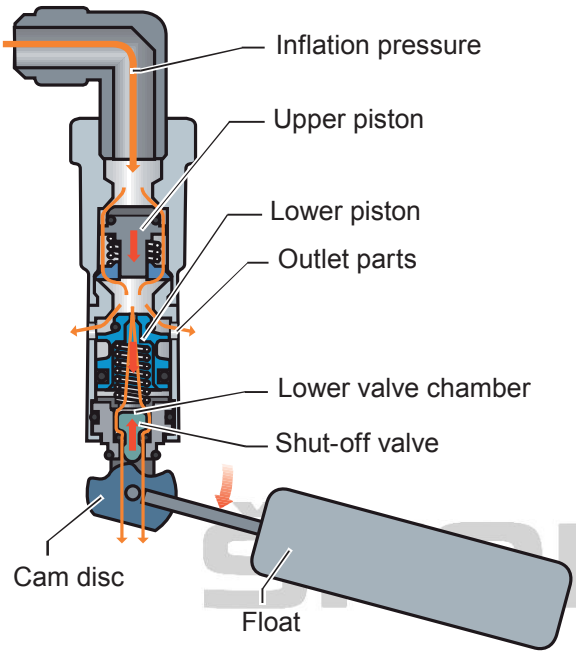
If all the system requirements for the gas operation are fulfilled, the gas control unit energises the electromagnetic valve for the gas tank N495. The magnetic field of the coil, which is energised by the voltage, pulls up the armature against the spring force and the access to the evaporator is opened. If the LPG operation is terminated, the gas control unit cuts off the voltage supply to the valve for the gas tank. The valve is closed by the spring force.

The cut-off valve

The cut-off valve is located on the valve pot of the LPG tank. It serves to interrupt the fuelling process. The filling process is interrupted once the tank has reached a filling level of 80%.



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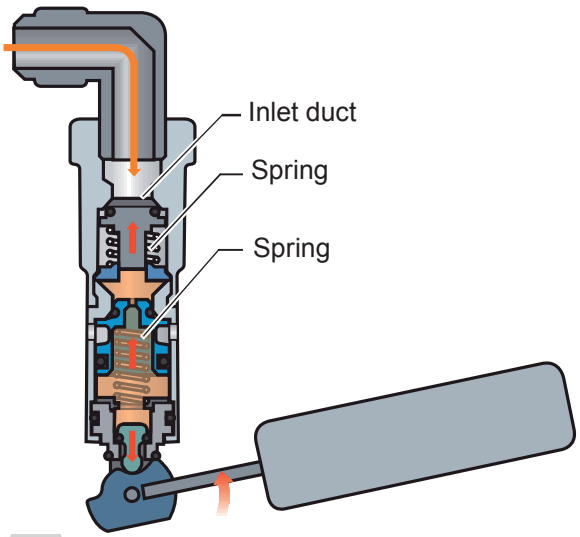

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The upper and the lower pistons are forced down by the inflation pressure. The upper piston has the function of a non-return valve. The lower piston opens to the outlet ports through which the liquid LPG flows into the tank. In addition, there is a small bore in the centre of the lower piston through which the liquid LPG enters the tank via the open shut-off valve. If the shut-off valve is open, no pressure can build up in the lower valve chamber.
Depending on the filling level, the cam disc is rotated by means of a float during the filling process. The cam disc operates the shut-off valve.

When the position of the float corresponds to a filling level of 80%, the shut-off valve slips down into the recess of the cam disc and thereby the shut-off valve closes.
Now the liquid gas creates a pressure build-up inside the lower valve chamber. This pressure together with the spring force enable the lower piston to move up. At the same time the lateral outlet ports are closed. The back pressure builds up and becomes the filling pressure, the dispenser switches off and the upper piston closes the inlet duct by means of the spring force.

The overpressure safety valve

The overpressure safety valve as well as the valve for the gas tank N495 and the cut-off valve are components of the multi-function valve.

The valve prevents the rupture of the LPG tank caused by the build-up of excessive pressure in the tank, for example as a result of high temperatures.

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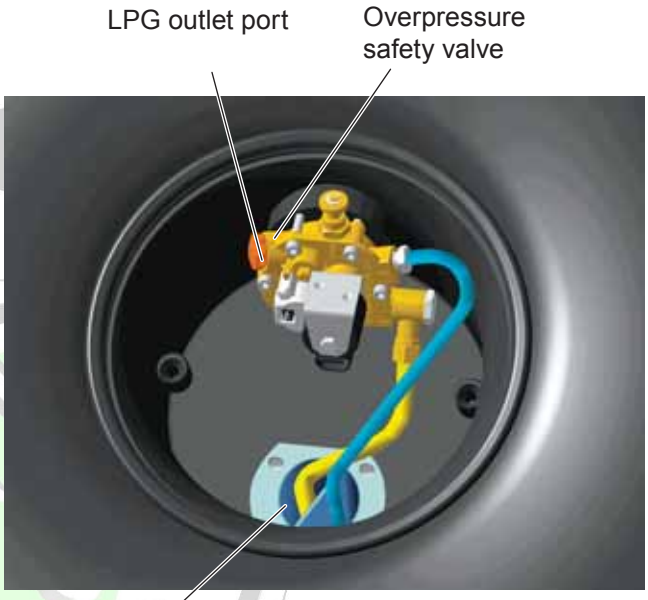
It functions as follows

When the pressure in the LPG tank exceeds the value of 27.5 bar, the pressure relief valve is mechanically opened by the gas pressure and the LPG escapes into the area of the multi-function valve. The gas is lead from here to underneath the rear-end of the vehicle through plastic vent hoses.



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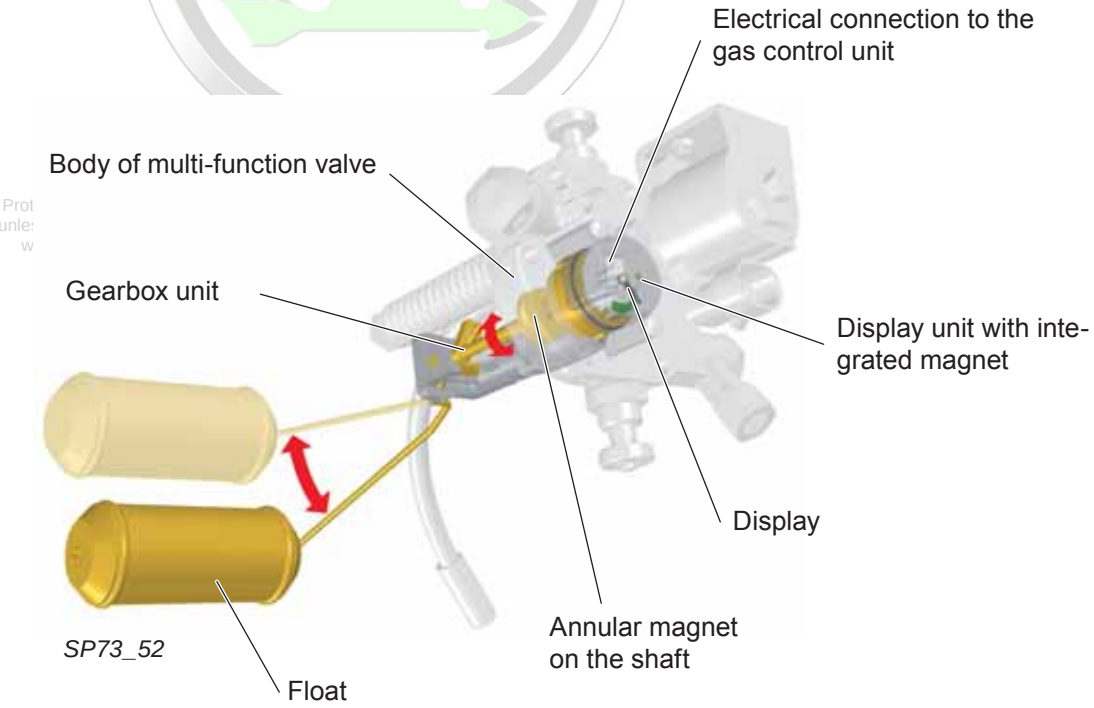
The sender for the gas supply indicator G707

The sender for the gas supply indicator G707 is a component of the multi-function valve. The sensor measuring device is integrated in the area for LPG.
The fluid level contained in the gas tank is displayed at two points:

- above the display unit on the body of the multi-function valve and
- on the fuel level display integrated in the conversion button (gas supply indicator G706) in the centre console.

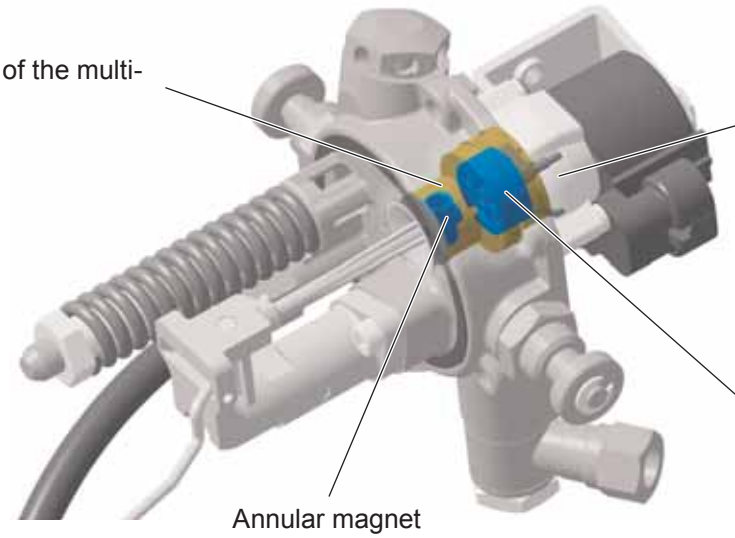
Display unit on the body of the multi-function valve



Function

The float moves inside the gas tank depending on the filling level (as in the petrol tank). This thrust movement is converted to the rotational movement by means of a lever system in the gearbox unit when the filling level changes. The annular magnet located at the end of the shaft, which protrudes from the gearbox unit, rotates as a result of this. The shaft end with the annular magnet is integrated in a housing within the valve body. Another magnet can also be found in the display unit. Depending on the filling level, the two annular magnets have a certain position to each other. The two magnets are separated by an insulation gap within the valve body and thus form a contactless magnetic connection. This magnetic connection influences the position of the needle in the display unit, where the filling level of the gas tank can be read off. This movement transfer between the float and the needle, which is created by the magnetic field, does not exclude the risk of gas escape.
The display of the filling level on the body of the multi-function valve only serves as a safety feature.

Contactless magnetic connection



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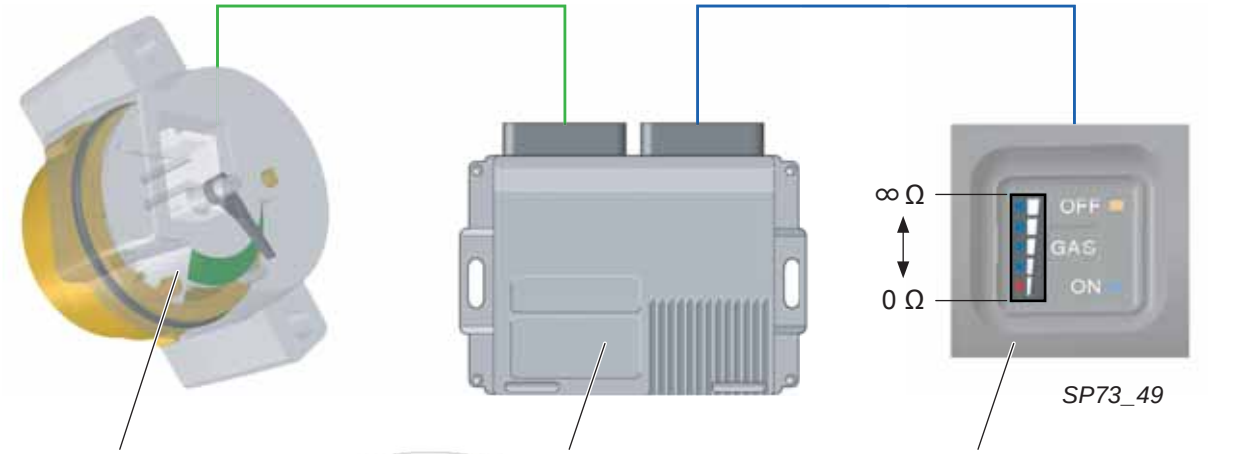
Gas supply indicator G706 in the centre console



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Function

The driver is informed about the filling level by means of the gas supply indicator G706 integrated in the conversion button, which is located in the centre console in the passenger compartment.
The sender for the gas supply indicator G707 (switchable resistor matrix according to the position of the magnets or the gas tank float) is energised by the gas control unit.
Depending on the filling level in the gas tank, various 0 - ∞ ohm resistors can be used.

The evaporator (pressure regulator)

The LPG is converted in the evaporator from the liquid to the gaseous aggregate state.
In addition, the evaporator has the task to reduce the pressure of the LPG from approx. 10bar to 1bar above the pressure prevailing in the intake manifold.
The pressure of the LPG is reduced in two stages in the evaporator. The pressure fluctuations can be better compensated for because of the two-stage pressure reduction.

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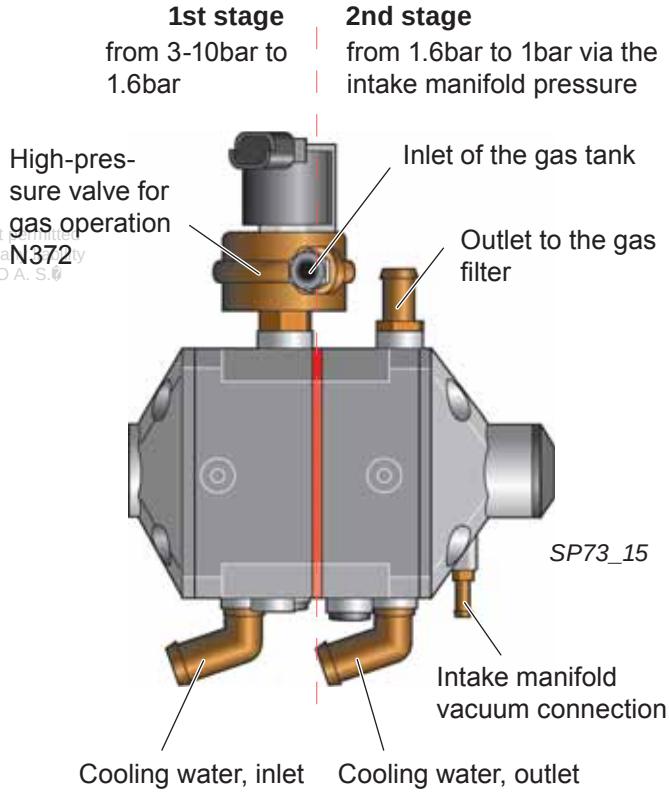
Technical highlights

- two-stage pressure reduction
- electromagnetic high-pressure valve for gas operation N372 with external connector and integrated filter element
- internal cooling circuit to prevent moisture and ice formation in the evaporator



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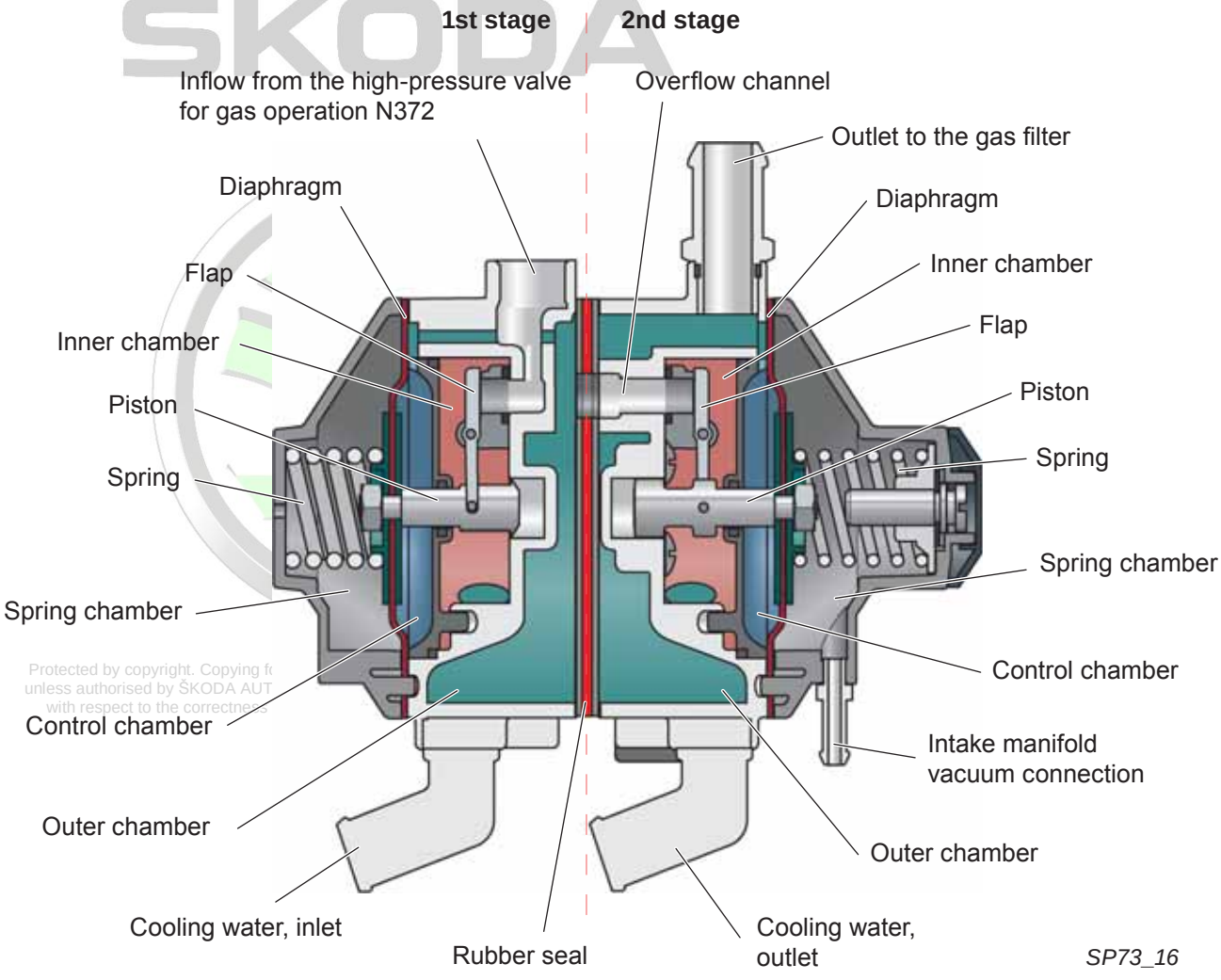
Technical data

Type	Two-stage evaporator with diaphragm
Working pressure	0.95bar up to 1.1bar
Max. working pressure	3.5bar
Weight	1450g
Operating volume flow	40 kg/h
Operating temperature	from -20°C up to +120°C

Every 90.000km, the evaporator must be checked for contamination. This inspection of the evaporator is carried out using the control screw. In case of contamination, the filter in the electromagnetic high-pressure valve N372 must be changed. Please observe the entries in ELSA for this purpose.

Structure

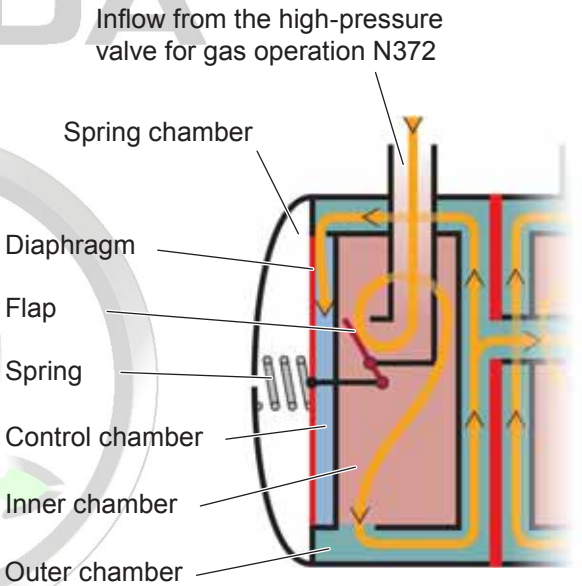
The evaporator has two stages. Each stage contains an inner chamber, an outer chamber and a control chamber in which there is LPG. The LPG flows between the 1st stage and the 2nd stage via an overflow channel which connects both stages. In addition, each stage has a valve with a flap and a piston. The piston is screwed to the diaphragm. Each side of the evaporator has a spring chamber. A spring is located in each spring chamber. Atmospheric pressure prevails in the spring chamber of the 1st stage and intake manifold pressure prevails in the spring chamber of the 2nd Stage.
Between the 1st and 2nd stage is a rubber seal that separates the cooling circuit from the LPG.



Function

1st stage

The liquid LPG flows through the electromagnetic high-pressure valve for gas operation N372 with a maximum pressure of 10bar and then enters the inner chamber of the 1st stage. At the same time the valve flap of the inner chamber is opened. Then the liquid LPG passes through the outer chamber and enters the control chamber of the 1st stage. On its way, the liquid LPG expands and thus converts to the gaseous state. The diaphragm of the 1st stage is influenced by the preset spring on the side of the spring chamber and the atmospheric pressure prevailing in the spring chamber.



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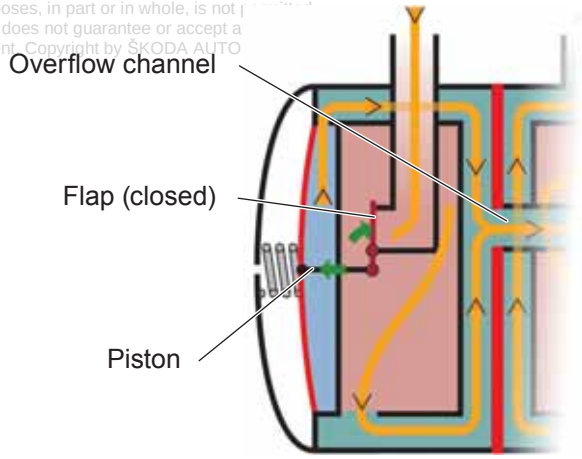
When the gas pressure in the control chamber exceeds 1.6bar, the spring is pressed together by means of the diaphragm. The piston screwed to the diaphragm operates the valve flap which shuts off the inflow from the electromagnetic high-pressure valve for gas operation N372. The LPG can continue to expand and flows through the overflow channel into the inner chamber of the 2nd stage.



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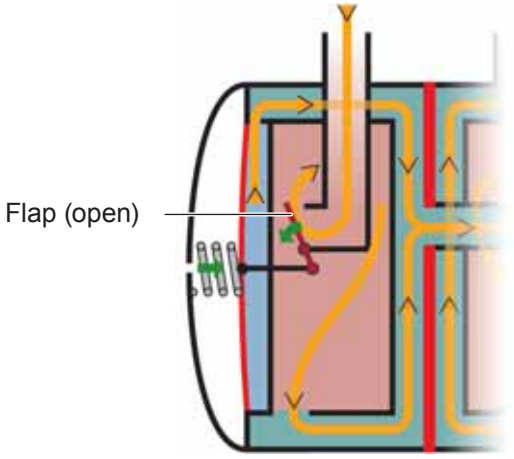
Through this, the pressure which acts on the diaphragm in the control chamber drops again below 1.6bar. The spring presses on the valve flap by means of the piston. The valve opens and allows the inflow of the LPG from the electromagnetic high-pressure valve N372. In this way, the pressure of the LPG is reduced from maximum 10bar to 1.6bar.



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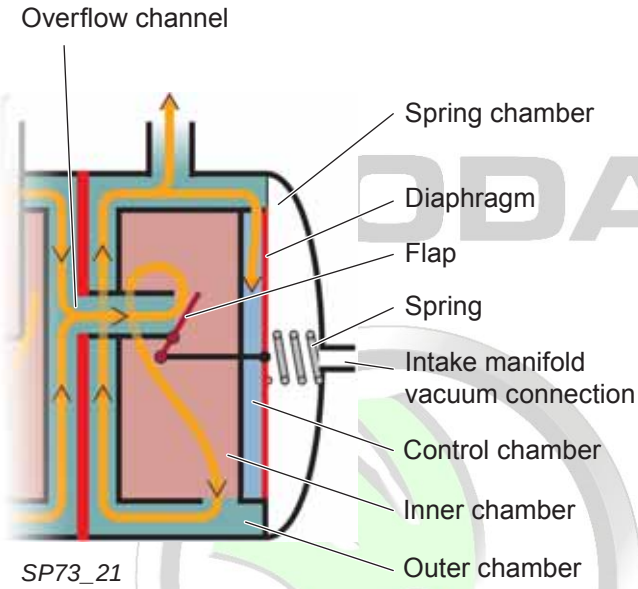

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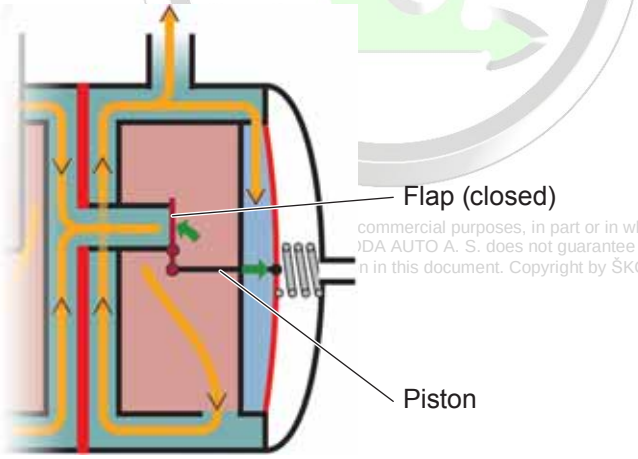
2nd stage

In the 2nd stage, the liquid LPG continues to expand and is reduced to an overpressure of 1bar above the intake manifold pressure. The LPG passes through the overflow channel from the outer chamber of the 1st stage and enters the inner chamber of the 2nd stage. At the same time the valve flap of the overflow channel is opened. As the gas expands, it flows through the outer chamber and enters the control chamber of the 2nd stage. The diaphragm of the 2nd stage is influenced by the preset spring on the side of the spring chamber and the intake manifold pressure prevailing in the spring chamber.



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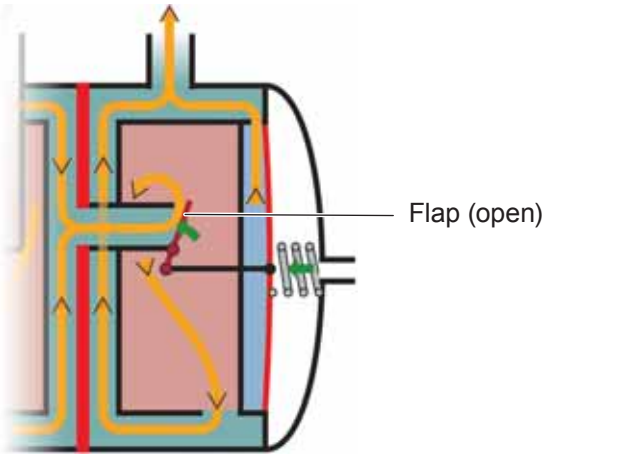
When the gas pressure in the control chamber exceeds 1bar above the intake manifold over-pressure, the spring is pressed together by means of the diaphragm. The piston screwed to the diaphragm operates the valve flap which shuts off the inflow of the LPG from the overflow channel.
The LPG can continue to expand and reaches the filter and the gas injection valves via the outlet.



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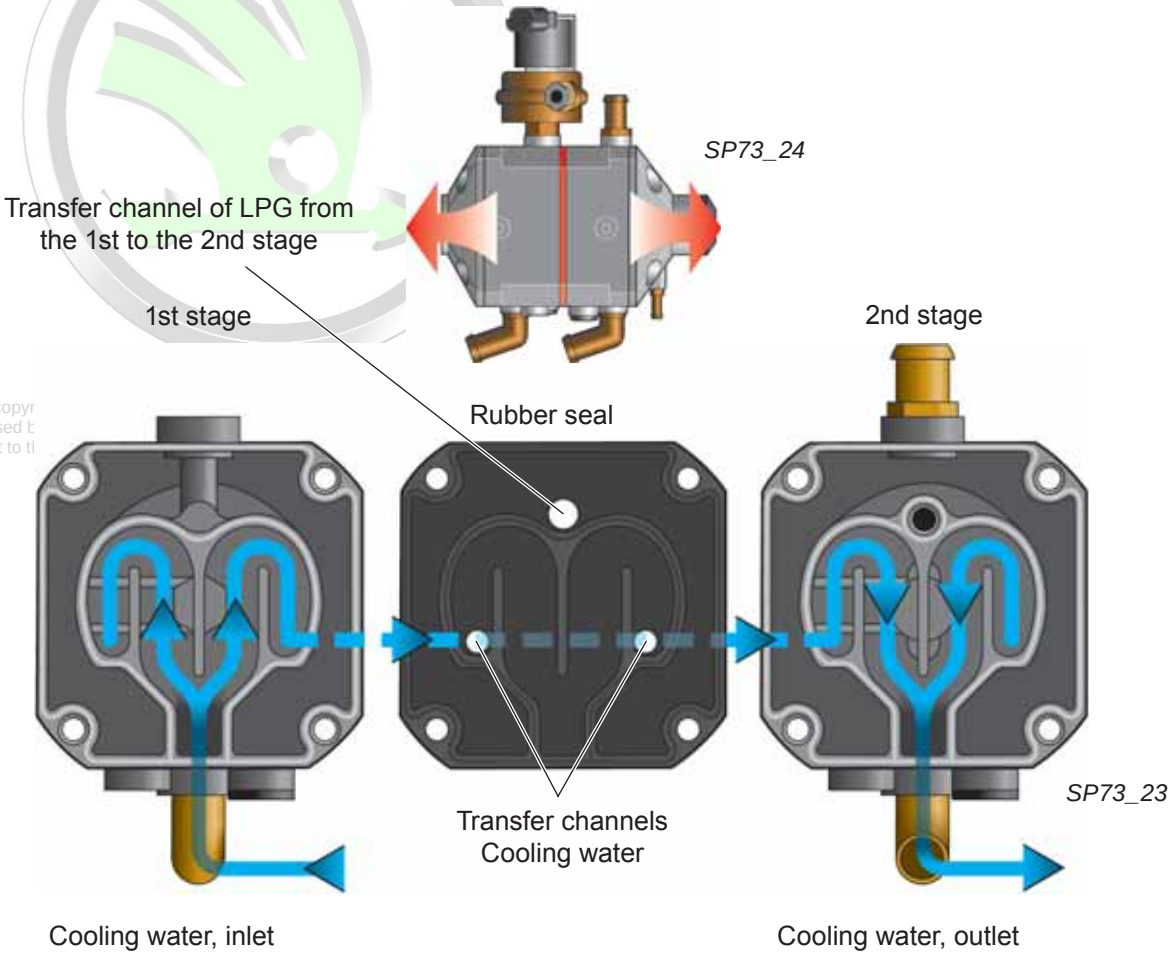
Through this, the pressure which acts on the diaphragm in the control chamber drops again below 1bar above the intake manifold pressure. The spring presses on the valve flap by means of the piston. The valve opens and allows the inflow of the LPG from the overflow channel.

The cooling circuit

Structure

The cooling circuit is located inside the evaporator. It is connected to the cooling circuit of the engine via both cooling water connections. The rubber seal in the evaporator divides the cooling circuit into the 1st and 2nd stage. The cooling water flows from the 1st to the 2nd stage via both transfer channels.



Function

When the LPG is down-regulated from 10bar to 1bar above the intake manifold pressure, the liquid LPG expands and thereby changes the aggregate state from liquid to gas. At the same time the gas and its surroundings cool down creating the so-called "cold expansion" effect, which could lead to the evaporator icing up. Therefore, the cooling circuit of the evaporator is connected to the cooling circuit of the engine before it is connected to the heat exchanger. In this way, the heated cooling water contained in the evaporator prevents ice formation.

The electromagnetic high-pressure valve for gas operation N372

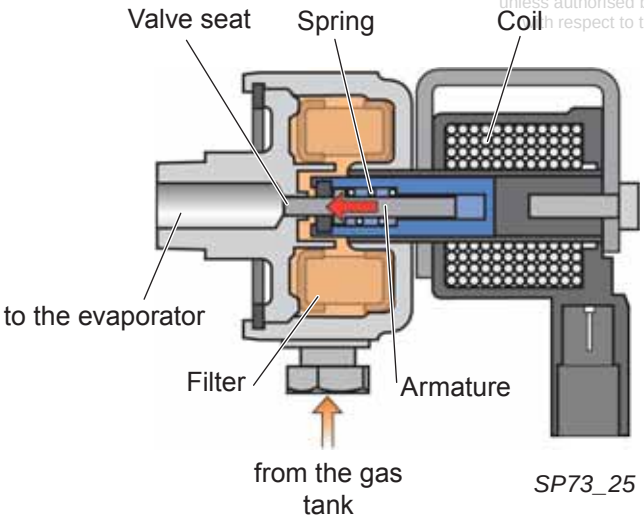
The electromagnetic high-pressure valve for gas operation N372 is mounted on the evaporator housing and serves to interrupt the gas supply from the gas tank to the evaporator.
A filter is integrated in the high-pressure valve. It is used to filter out the impurities in the liquid LPG in order to protect the sensitive component parts of the evaporator.

The electromagnetic high-pressure valve for gas operation N372 operates in the same way as the valve for the gas tank N495.

The electromagnetic high-pressure valve for gas operation N372 is only operated by the gas control unit J659 during the LPG operation. When switching over to petrol operation or switching off the engine, in the event of an accident (crash detection) or a loss of voltage supply, the valve closes automatically and no LPG enters the evaporator.

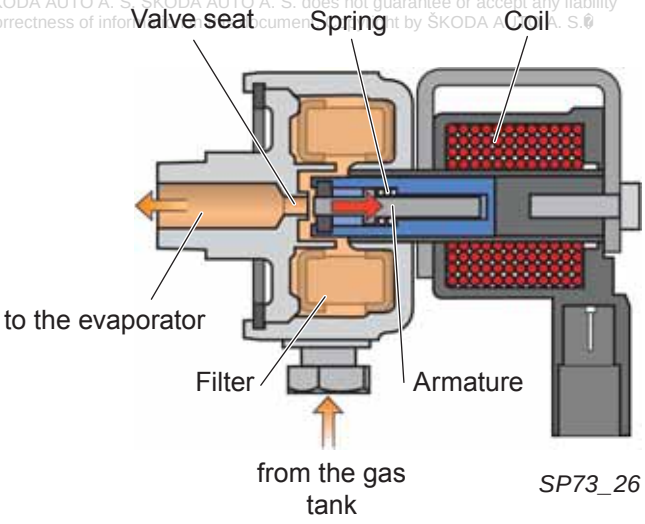
Function

Valve closed



SP73_25

Valve opened



SP73_26

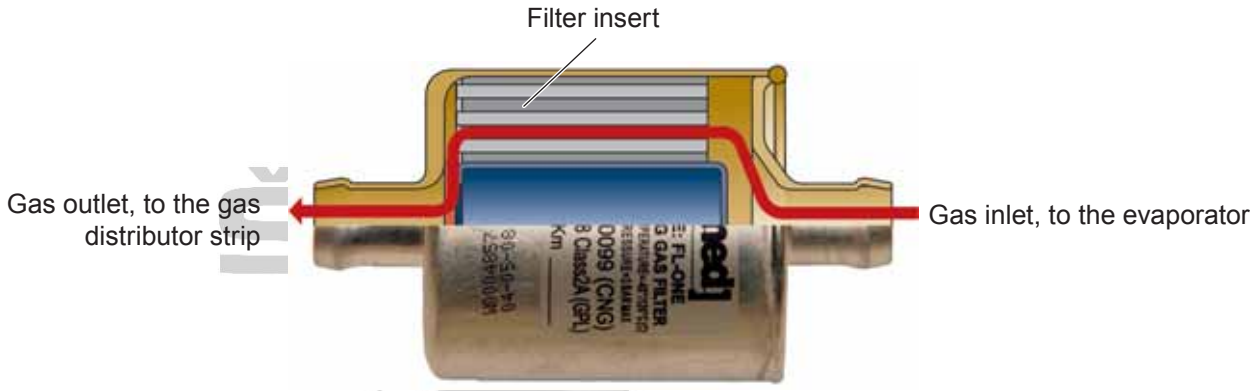
In the de-energised condition, the valve armature is pushed into the valve seat by the spring force and thereby shuts off the access to the evaporator.

If all the system requirements for the gas operation are fulfilled, the gas control unit energises the electromagnetic high-pressure valve N372. The magnetic field of the coil, which is energised by the voltage, pulls up the armature against the spring force and the access to the evaporator is opened. If the LPG operation is terminated, the gas control unit immediately turns off the valve.

The gas filter

The gas filter is located between the evaporator and the gas distributor strip with the gas injection valves. It serves to protect the gas injection valves and filters micro-particles out of the gas.

SP73_27



SP73_28

The gas filter must be changed every 30.000km.
When installing the gas filter, ensure that the marking of the flow direction on the filter corresponds to the flow direction of the gas.

The gas distributor strip with the gas injection valves

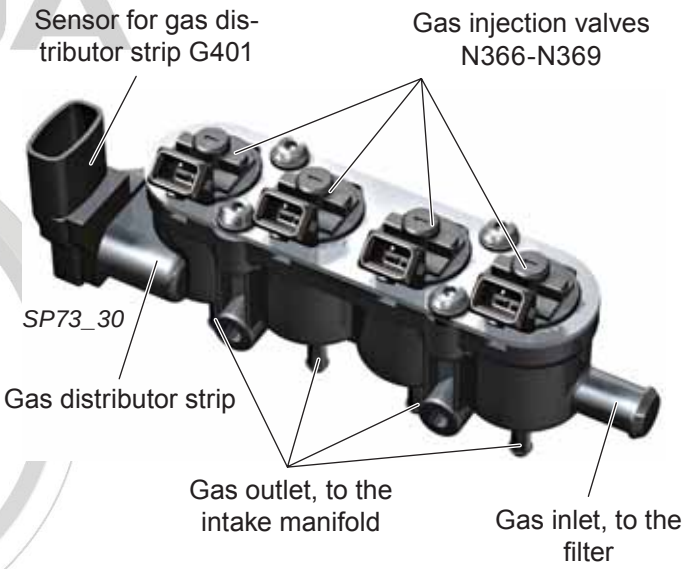
The gas distributor strip is fitted on the intake manifold of the engine. Four electrically actuated gas injection valves as well as a sensor for the gas distributor strip G401, which measures the pressure and the temperature of the LPG, are integrated in the gas distributor strip.

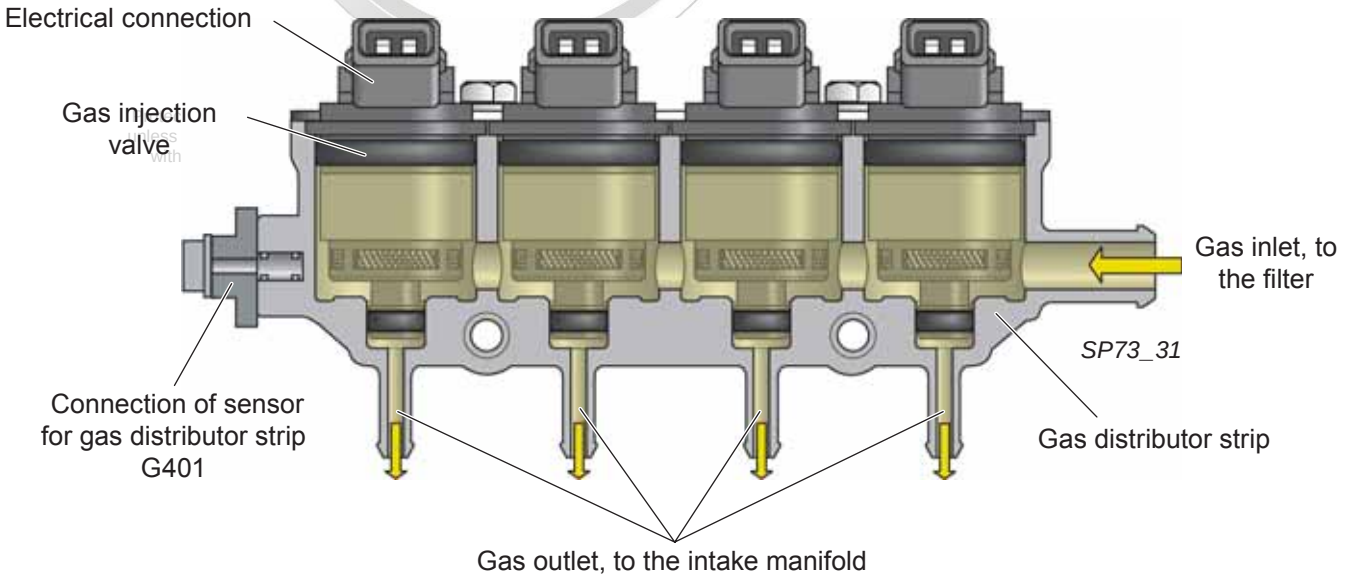
From the evaporator the LPG flows through the gas filter and enters the gas distributor strip.
A precisely dosed quantity of gas flows out of the gas injection valves and passes through the rubber hoses to the intake manifold and then into the combustion chamber of each cylinder.

The gas injection valves are actuated by the gas control unit.

SP73_29

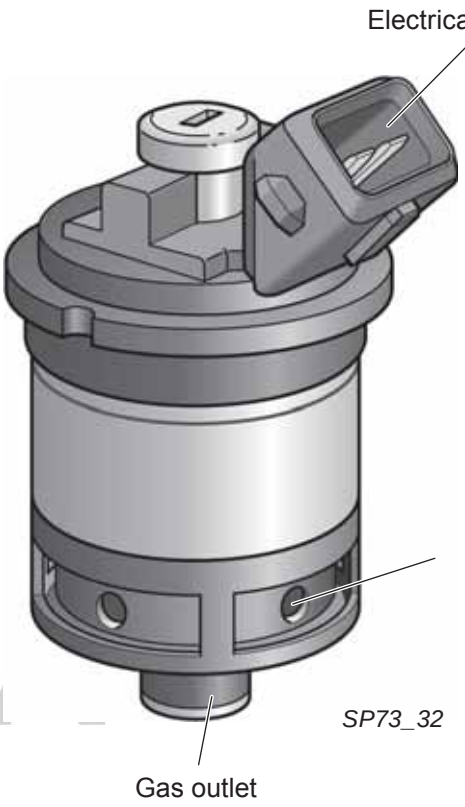
If the gas injection valves are operating in the gas mode, this can be heard through rather loud clacking noises. In order to counter the increased noise level in the gas operation, a blanket insulator is fitted under the engine hood.





Gas injection valves N366-N369

The gas injection valves N366-N369 are installed in the gas distributor strip.



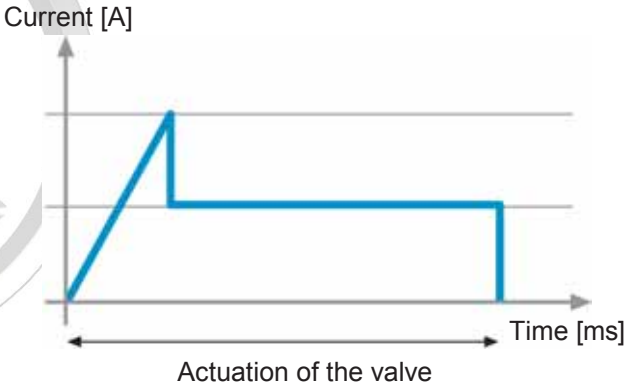
Technical highlights

- simple, stable structure of the magnetic valve
- designed with relatively large coils to prevent the bonding of LPG
- easy installation
- long life (about 290 million cycles)

Technical data

Response time	1.7 ms ± 0.2
Operating temperature	-40°C up to +120°C
Max. working pressure	3bar

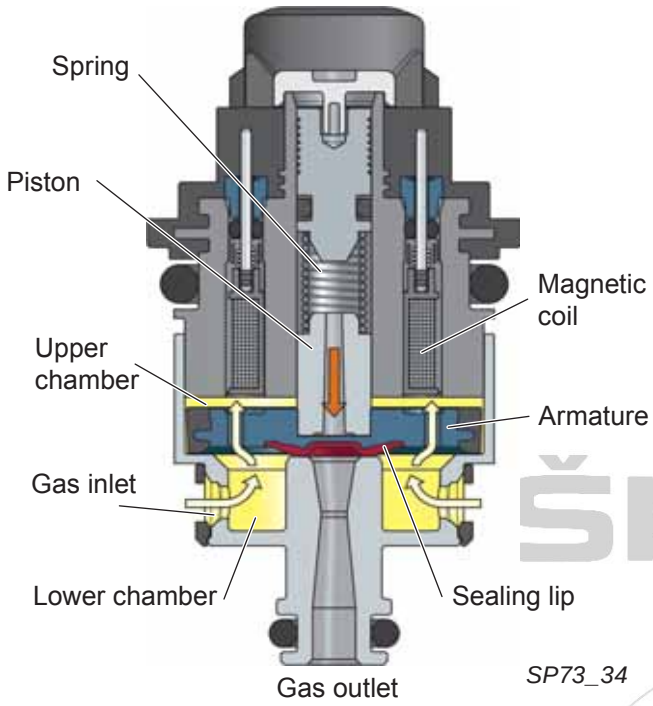
The gas injection valves are actuated by the gas control unit J659 using a pulse width modulation signal (PWM).



Before operating in LPG mode, carry out a function test on the injection valves once per engine start. This means that the injection valves are actuated by the gas control unit and are briefly raised shortly before switching over from petrol to LPG mode. This is a safety measure against residues penetrating into the gas injection valve and it also prevents bonding.

Function

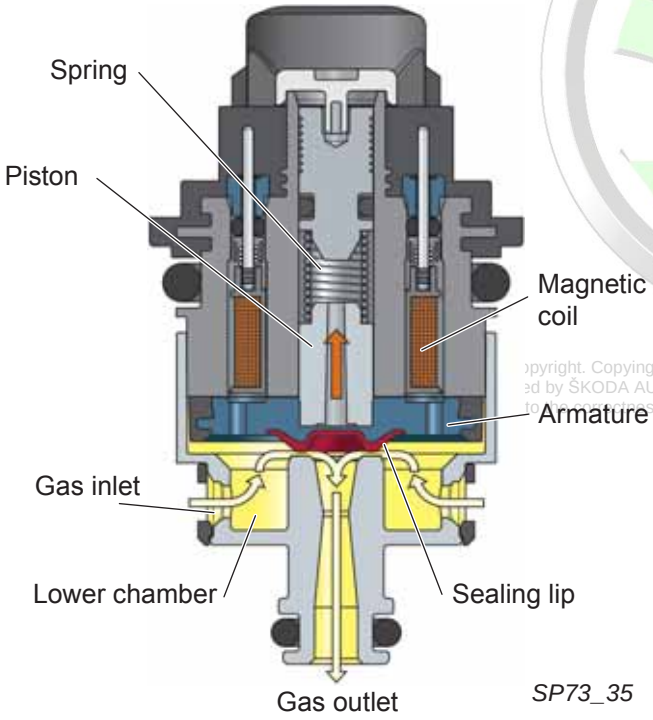
During the LPG operation, the gas injection valves blow the LPG which is in the gaseous state into the intake manifold of each cylinder.



SP73_34

Not actuated

The gas injection valve is de-energized. The pressure spring pushes the piston with the armature and the sealing lip downwards and thus closes the gas outlet to the intake manifold. LPG flows through the gas inlet into the lower chamber and passes through the bores in the armature into the upper chamber of the gas injection valve. Through this, the same gas pressure acts on the armature in the upper and lower chamber. The pressure prevailing in the lower chamber prevents the armature with the sealing lip being pushed up counter to the spring force and the gas injection valve from opening the gas outlet.



SP73_35

Actuated

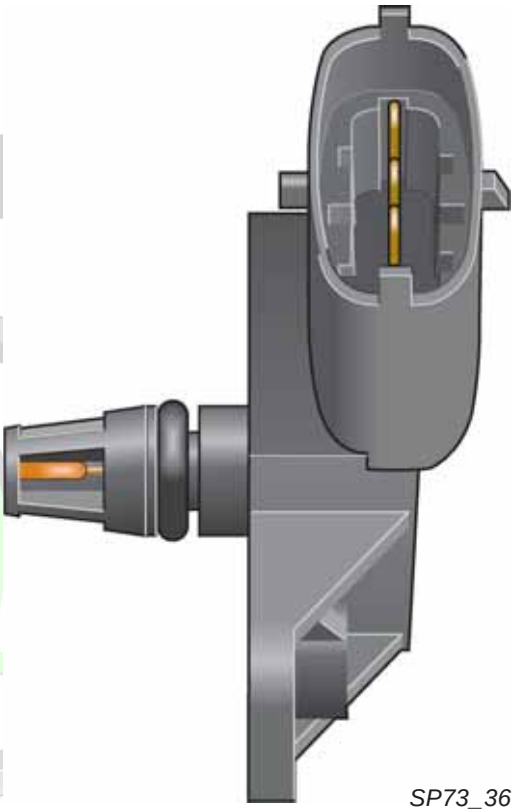
The gas injection valves are actuated by the gas control unit using the PWM signal. The electrical connection and the magnetic coil are located in the valve housing. When the magnetic coil is energised, this generates a magnetic field. In the magnetic field the armature together with the sealing lip are raised counter to the spring force of the pressure spring and the gas outlet opens. The LPG flows from the upper chamber into the lower chamber through the bores in the armature and then enters the intake manifold via the gas outlet.

The sensor for the gas distributor strip G401

The sensor for the gas distributor strip G401 is installed in the gas distributor strip. It serves to measure the pressure and the temperature of the LPG. The gas temperature and the gas pressure are used to calculate and control the opening times of the gas injection valves.

The gas pressure signal also determines when it is required to switch back to petrol operation:

- inadequate LPG in the gas tank
- a pressure drop in the gas system
- clogged gas filter



SP73_36

The switch for the fuel selection E395 and the gas supply indicator G706

The gas supply indicator G706 and the switch for the fuel selection (petrol, gas) E395 are integrated in a conversion button. This button is located in the centre console.
The conversion button displays the following functions:

- fuel selection petrol/gas
- gas level in the gas tank (filling level)
- signalling of fault functions

SP73_44

The switch for the fuel selection E395

The switch for the fuel selection E395 is used to switch over from petrol to gas (or vice versa).
It is also possible to switch between petrol and gas operation while the engine is running, even when the vehicle is in motion.
The choice of fuel is indicated by the steady lighting up of the blue LED "ON" when in gas mode or the orange LED "OFF" when in petrol mode.

Switching over from the petrol to the LPG operation is performed if the following conditions are met:

- adequate LPG in the gas tank
- engine coolant temperature higher than 30°C
- engine speed in driving mode higher than 1200 rpm

Switching over from the LPG to the petrol operation is performed automatically in one of the following situations:

- inadequate LPG in the gas tank
- fault function

The gas supply indicator G706

The row of blue LEDs indicates the filling level of gas held in the tank. If the level of the liquid gas in the gas tank is very low, the red reserve LED comes on.

Engine start

The engine start-up is always performed in petrol mode.

If the vehicle is parked when in gas mode, the blue LED "ON" flashes quickly when restarting – this means that the system automatically switches over to gas mode once all the operating conditions are met.

LPG tank empty

If the LPG tank is empty, a slow intermittent beep sound is heard. Additionally, the orange LED "OFF" lights up and the blue LED "ON" flashes slowly. The system automatically switches over to petrol.
To turn off the beep sound, the driver must press the conversion button. Thereafter, only the orange LED "OFF" for petrol operation remains lit.

Fault functions in the LPG system

The fault functions can be divided into two categories:

1. A temporary malfunction

During a brief period of full-throttle acceleration (for example when overtaking) the gas pressure is no longer adequate if the filling level in the gas tank is low.
If the conditions for the gas operation are met during a "temporary malfunction" (in our example: the engine runs in the partial load range or the gas tank was refilled), the system switches over again to gas mode after operating the conversion button.

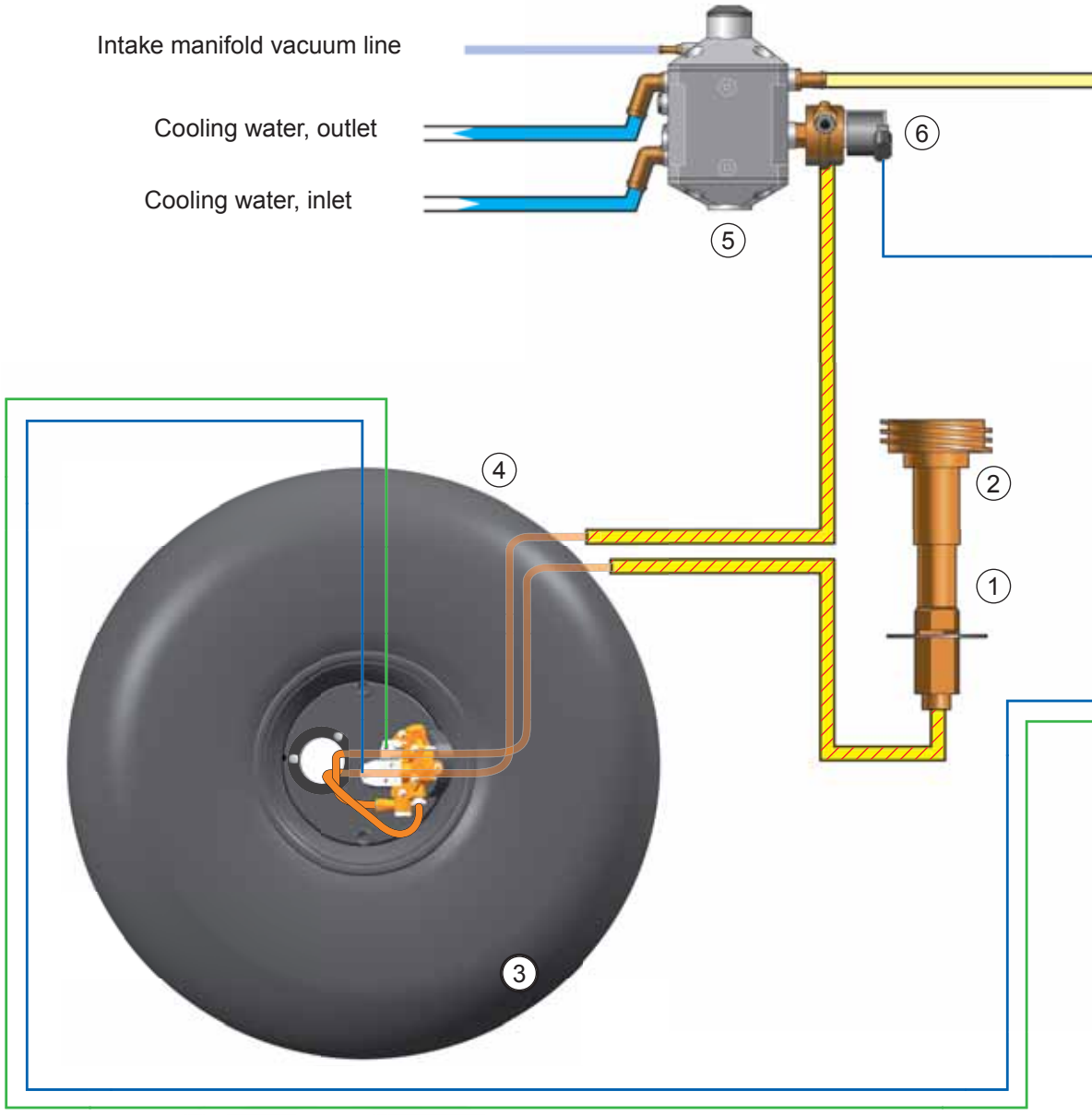
2. A fault in the LPG system

(e.g. if a disconnection of the gas injection valve is detected)
If a "fault in the LPG system" is present, in our example if a disconnection of the gas injection valve is detected, it is not possible to switch over to LPG operation.

Both categories of faults are detected by the system and an entry is made in the fault memory of the gas control unit J659. Thereby, the orange LED "OFF" lights up and the blue LED "ON" flashes quickly. In addition, a quick intermittent beep sound is heard. The system automatically switches over to petrol.
To turn off the beep sound, the driver must press the conversion button. Thereafter, only the orange LED "OFF" for petrol operation remains lit.

You will find a detailed description of the operation and switch signalling for the fuel selection in the supplement – Vehicles with gas operation, provided in the user manual of the vehicle.

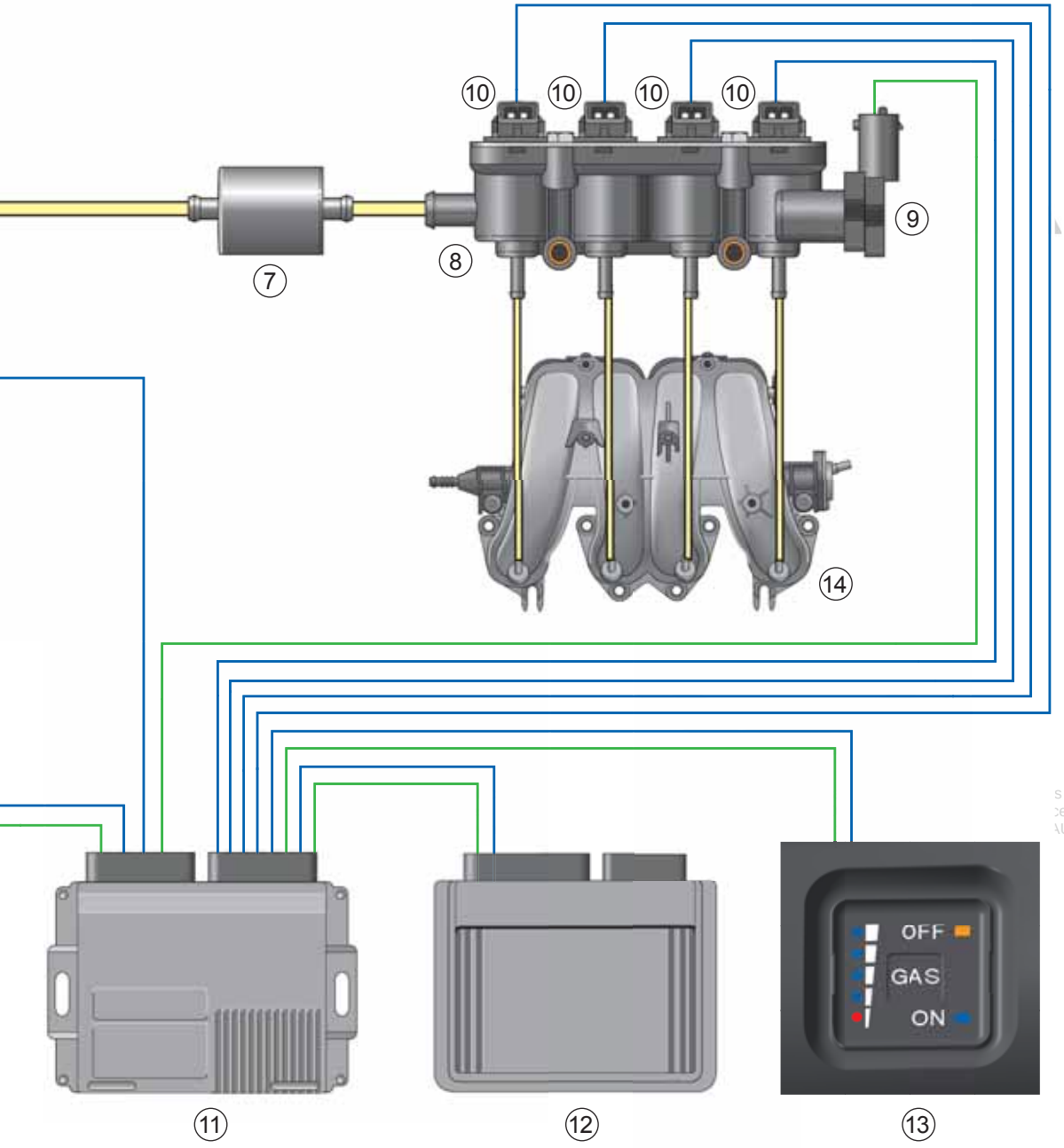
The supply scheme



Legend

1 Gas fuel tank filler neck
2 Connection adapter
3 Gas tank
4 Multi-function valve of the gas tank
- electromagnetic valve for the gas tank N495
- overpressure safety valve
- cut-off valve
- sender for gas supply indicator G707

5 Evaporator
6 Electromagnetic high-pressure valve for gas operation N372
7 Gas filter
8 Gas distributor strip
9 Sensor for gas distributor strip G401
10 Gas injection valves N366-N369
11 Gas control unit J659



SP73_37

12 Engine control unit J623
13 Switch for fuel selection E395 and conversion button with gas supply indicator G706
14 Intake manifold

LPG high-pressure line, approx. 10bar
LPG low-pressure line, approx. 1bar above intake manifold pressure
Vacuum line
Cooling water line
Sensor signal line
Actuator signal line

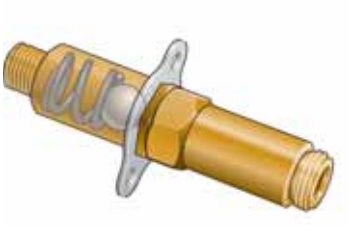
Safety concept of the LPG system

The concept of the LPG system and all the components, the structure and the materials used ensure the highest possible reliability and protection against damage.
The high standard of safety has been confirmed by a series of crash tests.

Safety components of the LPG system:

The gas fuel tank filler neck with the non-return valve

The non-return valve prevents the gas flowing back after refueling.



SP73_05

The LPG tank

The LPG gas tank is located in the spare wheel well and is therefore protected as best as possible against mechanical damage and weathering. It consists of 3.5 mm thick sheet steel, is heat resistant and meets the highest safety requirements.
Each fuel tank is subjected six times to a safety test during the production and is provided with a serial number and a test certificate.

SP73_43

To support the high reliability of LPG vehicles, the LPG is mixed with odourants. This allows even the smallest leaks of the LPG system to be perceived by sense of smell.

The cut-off valve

The cut-off valve automatically shuts off the inflow of LPG when refuelling once the gas tank has reached a filling level of 80%. This ensures that there is enough room in the gas tank for expansion during an increase of temperature. The valve also prevents the gas from flowing back after refuelling.

SP73_39

The overpressure safety valve

The overpressure safety valve prevents the rupture of the LPG tank from the build-up of excessive pressure in the tank, for example as a result of high temperatures. As soon as the pressure in the tank exceeds 27.5bar, the valve opens mechanically and remains open until the pressure in the tank has returned to normal.

SP73_40

The electromagnetic valve for the gas tank N495

The electromagnetic valve for the gas tank N495 automatically interrupts the gas supply when the engine is standing in still motion, when switching over to petrol operation as well as after detecting a high severity accident (crash detection).

SP73_38

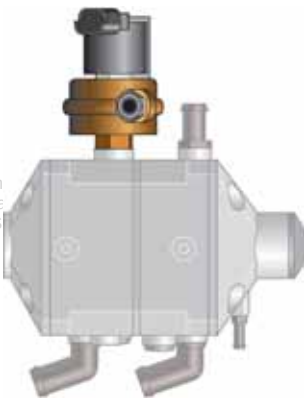
High-pressure lines

All the high-pressure lines and connecting elements are made of copper and run mainly outside the passenger compartment.

SP73_41

The electromagnetic high-pressure valve for gas operation N372

The electromagnetic high-pressure valve for gas operation N372 automatically interrupts the gas supply to the evaporator when the engine is standing in still motion, when switching over to petrol operation as well as after detecting a high severity accident (crash detection).



SP73_45

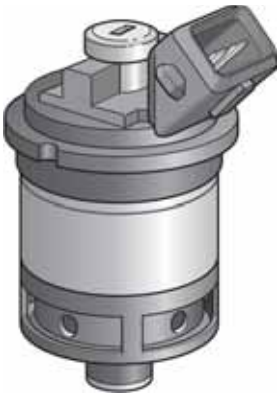
Low-pressure lines

In the low-pressure area, the LPG is transported through special rubber hoses which prevent that the low pressure lines are damaged through oscillations.

SP73_42

Gas injection valves N366-N369

The gas injection valves only open once they are actuated by the gas control unit J659 using the PWM signal.



SP73_32

System overview

Sensors

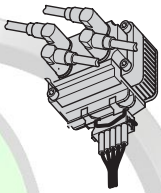
Sender for gas supply indicator G707

Switch for fuel selection (petrol, gas) E395

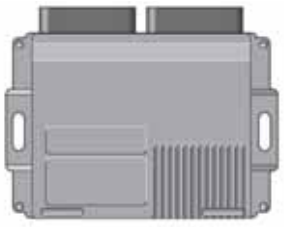
Sensor for gas distributor strip G401

Coolant temperature sender G62

Output stage N122



Intake manifold pressure sender G71

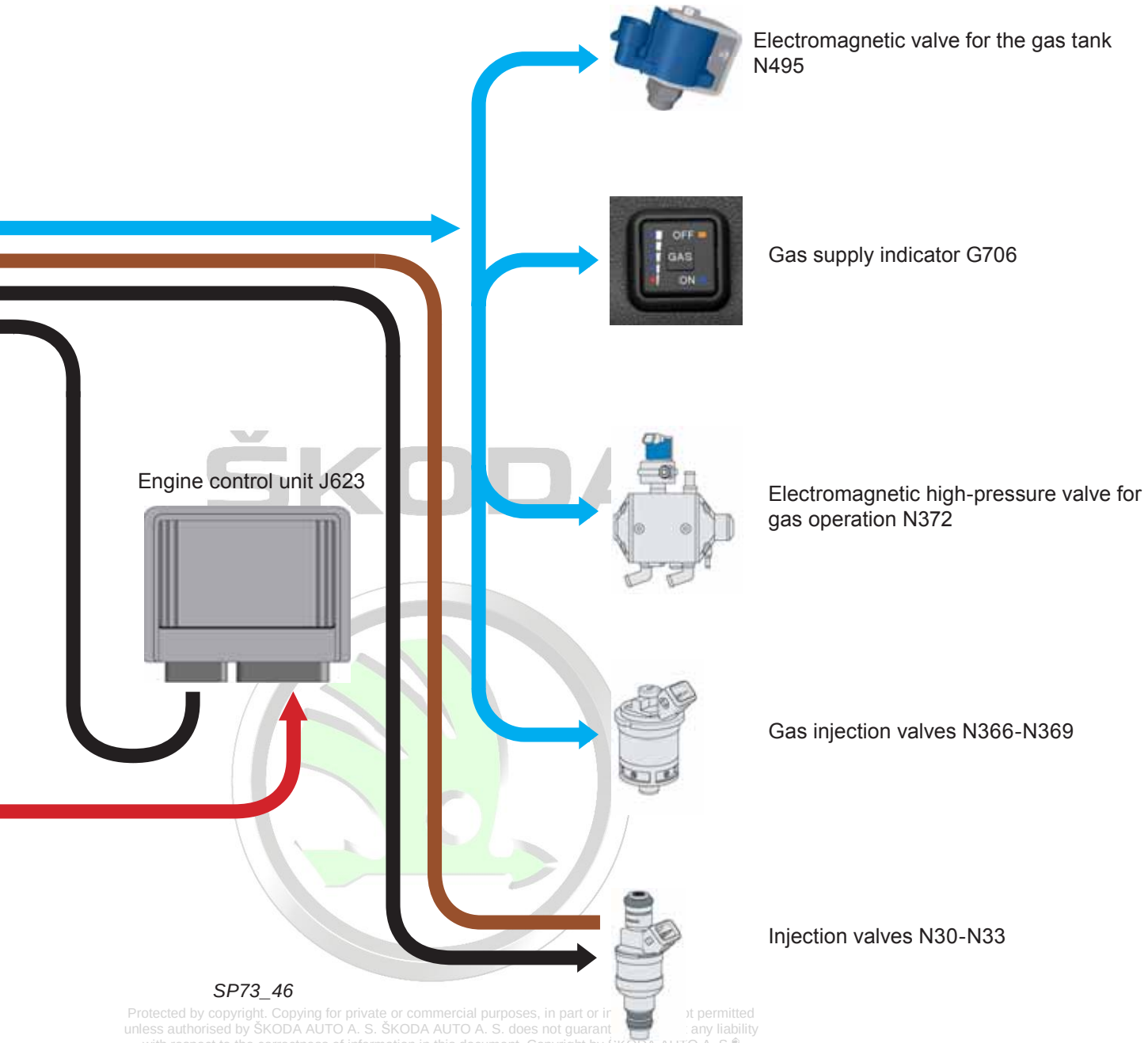


Gas control unit J659

Legend

- Sensors for gas operation
- Sensors for gas operation
- Sensors for gas operation
- Sensors for petrol operation
- Actuators for gas operation
- Actuators for petrol operation

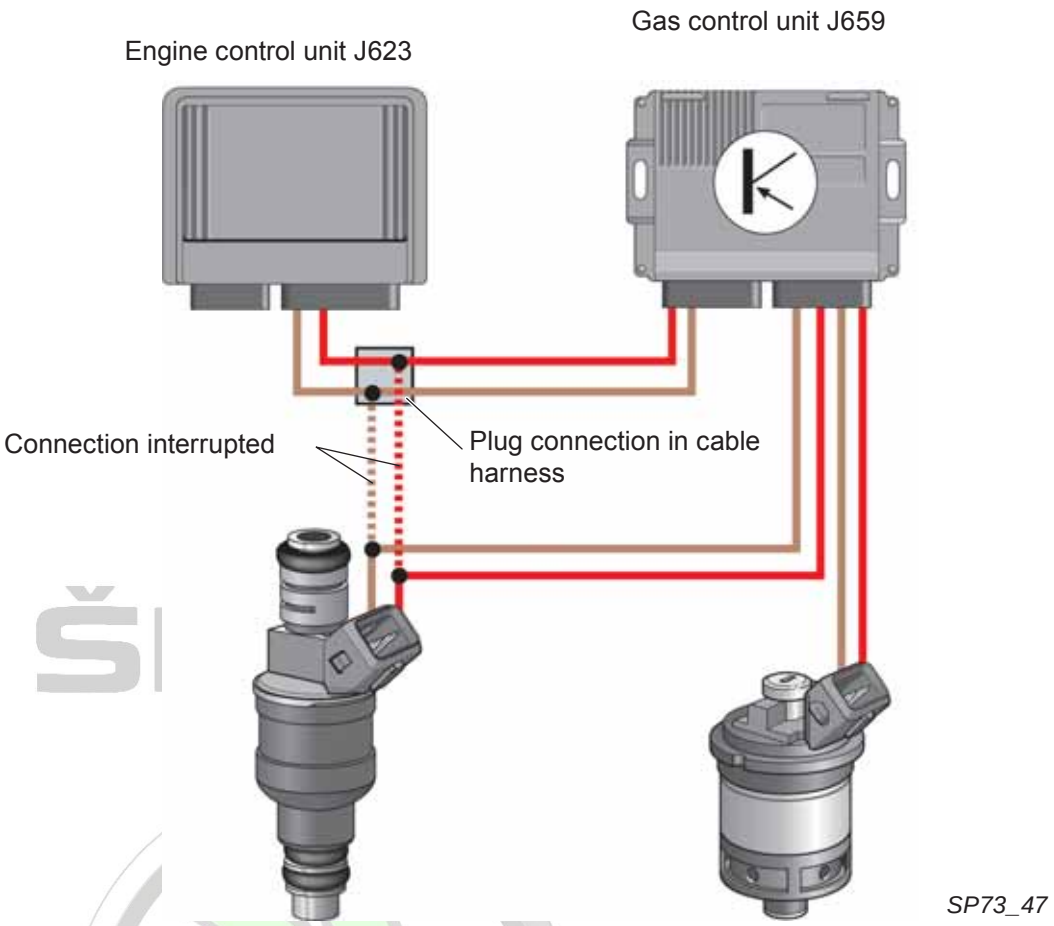
Actuators



SP73_46

The control units

In addition to the engine control unit J623, a gas control unit J659 which is installed in the battery box is required for actuating the LPG operation.
The original wiring from the engine control unit to the petrol injection valves is interrupted and is provided with an electrical plug. The petrol injection signals are transmitted from this plug to the gas control unit, where they are used for the calculation of the gas injection times.
To avoid a fault message in the engine control unit, due to an interruption in the wiring, the engine control unit receives the expected signals of the petrol injection valves by means of resistors in the gas control unit.

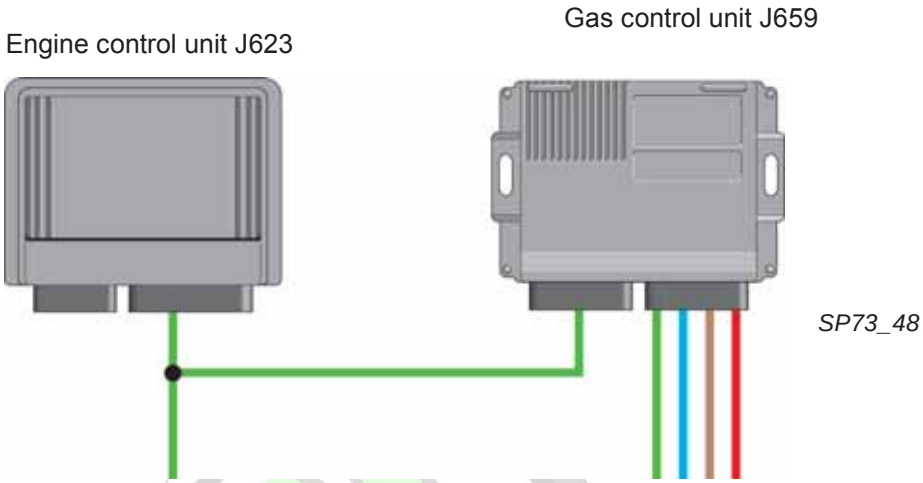


Legend

Earth
Positive

The gas control unit J659

The gas control unit J659 controls the gas injection based on the signals of the sensors and the actuators. In this way, the engine operation meets the requirements for optimal efficiency and low emission.



Sensors and actuators of the engine control unit J623:
- coolant temperature sender G62
- output stage N122
- intake manifold pressure sender G71
- gas injection valves N30-N33

Sensors and actuators of the gas control unit J659:
- sender for gas supply indicator G707
- gas supply indicator G706
- switch for fuel selection E395
- sensor for gas distributor strip G401
- electromagnetic valve for the gas tank N495
- electromagnetic high-pressure valve for gas operation N372
- gas injection valves N366-N369

Legend

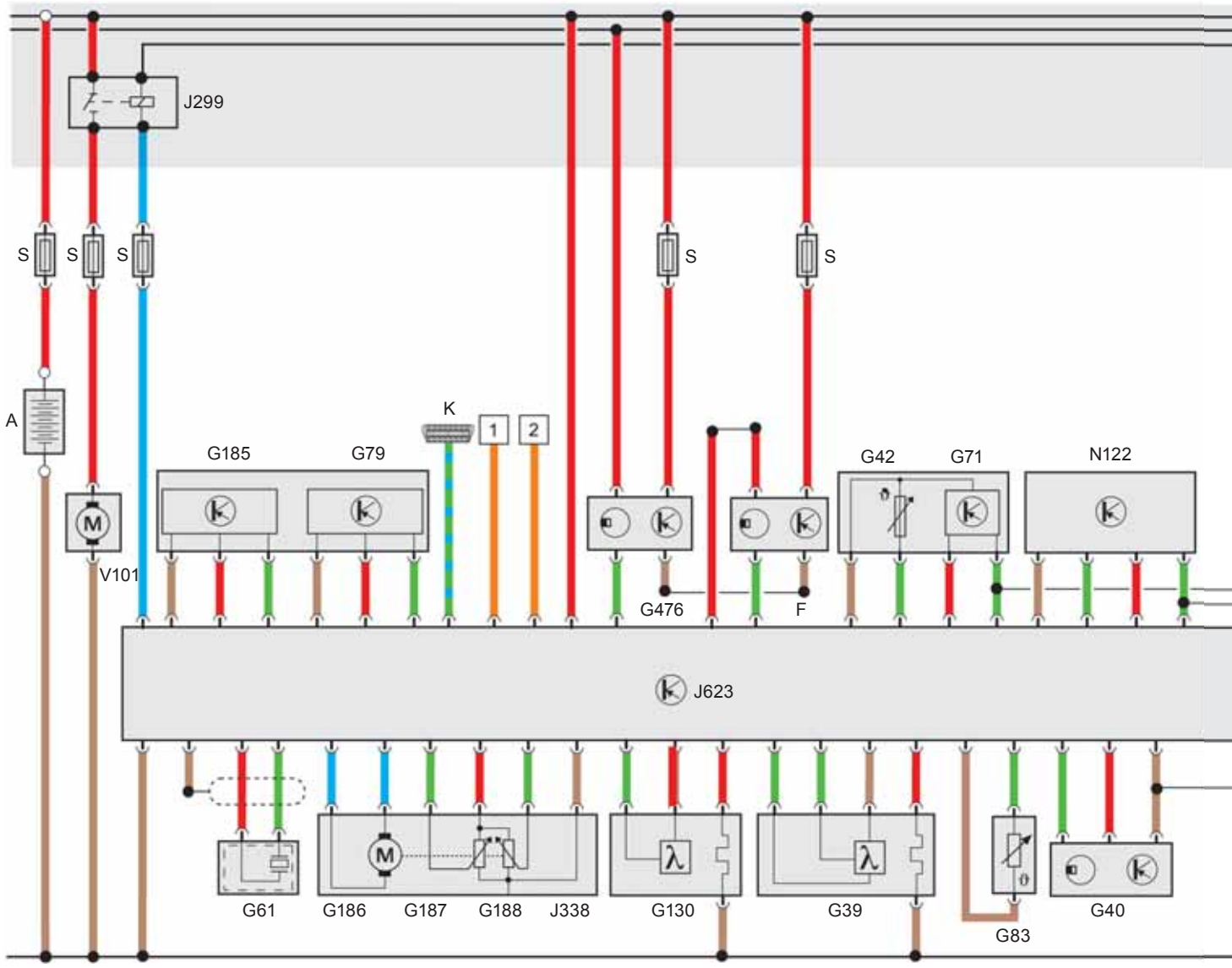
- Input signal
- Output signal
- Earth
- Positive

The engine control unit J623

To ensure a safe vehicle start-up even after parking the vehicle in the LPG operation, the performance map data in the engine control unit J623 was adapted.

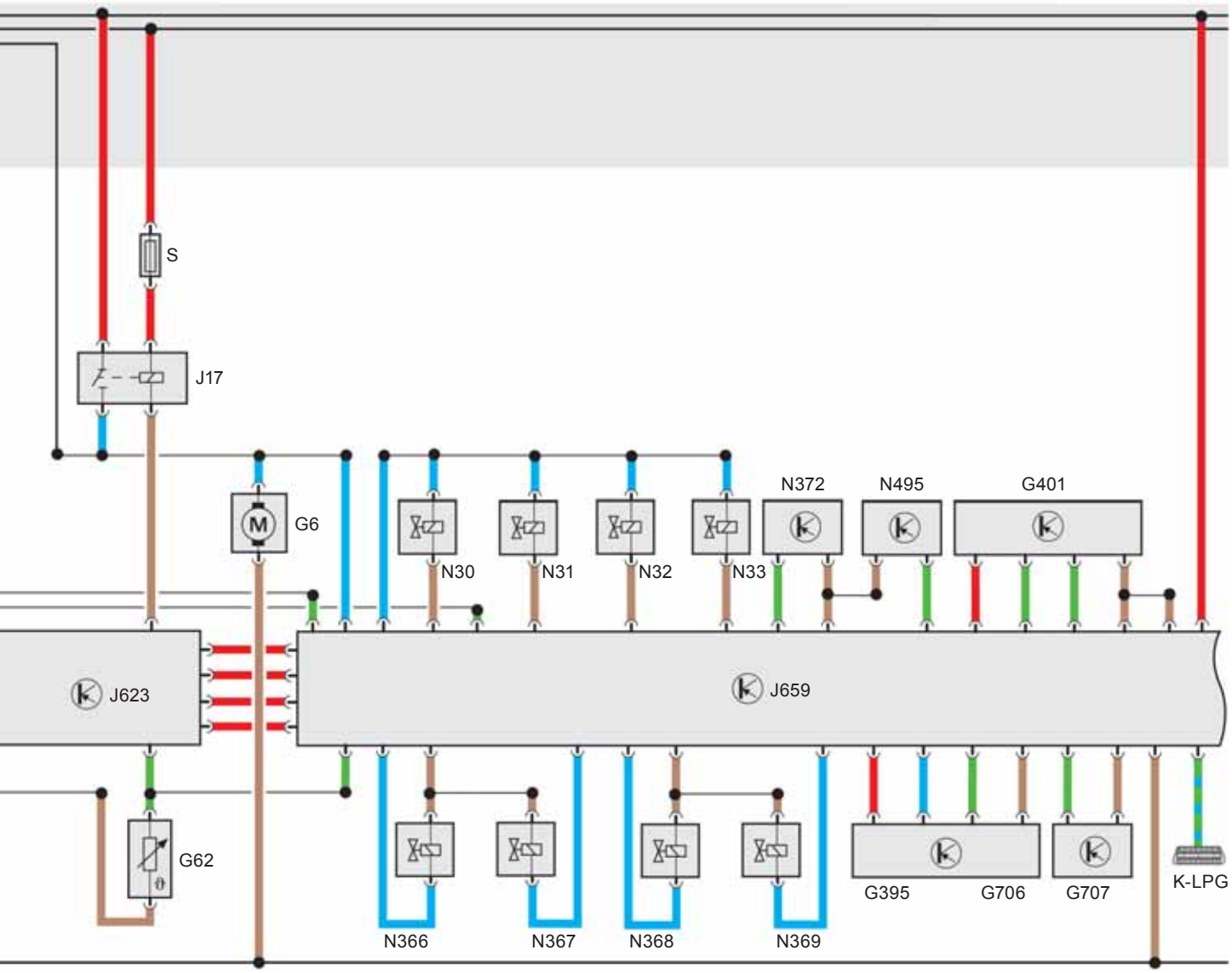
Function diagram of the LPG system

Wiring diagram



Legend

A	Battery
E395	Switch for fuel selection (petrol, gas) E395
F	Brake light switch
G6	Fuel pump for predelivery
G39	Lambda probe before catalytic converter
G40	Hall sender
G42	Intake air temperature sender
G61	Knock sensor 1
G62	Coolant temperature sender
G71	Intake manifold pressure sender
G79	Accelerator pedal sender
G83	Coolant temperature sender at radiator outlet
G130	Lambda probe after catalytic converter
G185	Accelerator pedal position sender 2
G186	Throttle valve drive
G187	Throttle valve drive angle sender 1
G188	Throttle valve drive angle sender 2
G401	Sensor for gas distributor strip
G476	Clutch position sender
G706	Gas supply indicator
G707	Sender for gas supply indicator
J17	Fuel pumpe relay
J299	Secondary air pump relay
J338	Throttle valve module
J623	Engine control unit
J659	Gas control unit
N30	Injection valve for cylinder 1
N31	Injection valve for cylinder 2
N32	Injection valve for cylinder 3



SP73_50

N33	Injection valve for cylinder 4
N122	Output stage
N366	Gas injection valve 1
N367	Gas injection valve 2
N368	Gas injection valve 3
N369	Gas injection valve 4
N372	Electromagnetic high-pressure valve for gas operation
N495	Electromagnetic valve for the gas tank
V101	Secondary air pump
K	Diagnostic connection
K-LPG	Diagnostic connection for the LPG operation
S	Fuse
1	CAN data bus
2	CAN data bus

- Positive
- Earth
- Input signal
- Output signal
- CAN data bus

Remarks

List of Self-Study Programmes so far

No.	Title
1	Mono-Motronic
2	Central locking
3	Vehicle alarm
4	Working with electrical plans
5	ŠKODA FELICIA
6	Safety of the ŠKODA vehicles
7	Principles of ABS - not published
8	ABS - FELICIA
9	Protection against starting with transponder
10	Air conditioning in the vehicle
11	Air conditioning FELICIA
12	1.6 engine - MPI 1AV
13	Four-stroke diesel engine
14	Power-assisted steering
15	ŠKODA OCTAVIA
16	1.9 ltr. TDI diesel engine
17	ŠKODA OCTAVIA Convenience electronic system
18	ŠKODA OCTAVIA mech. gearbox 02K, 02J
19	1.6 ltr. and 1.8 ltr. petrol engines
20	Automatic gearbox - fundamentals
21	Automatic gearbox 01M
22	1.9 ltr./50 kW SDI diesel engines, 1.9 ltr./81 kW TDI
23	1.8 ltr./110 kW and 1.8 ltr./92 kW petrol engines
24	OCTAVIA, CAN BUS data logger
25	OCTAVIA - CLIMATRONIC
26	OCTAVIA - Vehicle safety
27	OCTAVIA - 1.4-ltr./44 kW engine and gearbox 002
28	OCTAVIA - ESP - fundamentals, design, functions
29	OCTAVIA 4 x 4 - all-wheel drive
30	2.0 ltr. 85 kW and 88 kW petrol engines
31	Radio navigation system - design and function
32	ŠKODA FABIA - technical information
33	ŠKODA FABIA - electrical units
34	ŠKODA FABIA - electro-hydraulic power-assisted steering
35	1.4-ltr. - 16 V 55/74 kW petrol engines
36	ŠKODA FABIA - 1.9 ltr. TDI Unit injection
37	Mechanical gearbox 02T and 002
38	ŠkodaOctavia; model 2001
39	Euro-On-Board-Diagnosis
40	Automatic gearbox 001
41	Six-speed gearbox 02M
42	**Škoda**Fabia - ESP
43	Emissions in the exhaust gases
44	Extended service intervals
45	Three-cylinder petrol engines 1.2 ltr.
46	**Škoda**Superb; Vehicle presentation; part I
47	**Škoda**Superb; Vehicle presentation; part II
48	**Škoda**Superb; 2.8-ltr./142 kW V6 petrol engine
49	**Škoda**Superb; 2.5 ltr./114 kW TDI V6 diesel engine
50	**Škoda**Superb; automatic gearbox 01V
51	2.0 ltr./85 kW petrol engine with balancing shaft and two-stage suction line
52	ŠkodaFabia; 1.4 ltr. TDI engine with unit injection system
53	**Škoda**Octavia; Vehicle presentation
54	**Škoda**Octavia; Electrical Components
55	FSI petrol engines; 2.0 ltr./110 kW and 1.6 ltr./85 kW
56	Automatic gearbox DSG-02E
57	Diesel engine; 2.0 ltr./103 kW TDI with pump-nozzle unit, 2.0 ltr./100 kW TDI with pump-nozzle unit
58	**Škoda**Octavia, Chassis and electromechanical power-assisted steering
59	**Škoda**Octavia RS, 2.0 ltr./147 kW FSI turbo engine
60	2.0 ltr./103 kW 2V TDI diesel engine; solid particle filter with additive
61	Radio navigation systems in the **Škoda**
62	**Škoda**Roomster; Vehicle presentation – part I
63	**Škoda**Roomster; Vehicle presentation part II
64	**Škoda**Fabia II; Vehicle presentation
65	**Škoda**Superb II; Vehicle presentation part I
66	**Škoda**Superb II; Vehicle presentation part II
67	2.0 ltr./125 kW TDI diesel engine with Common Rail injection system
68	1.4 ltr./92 kW TSI petrol engine with turbo drive
69	3.6 ltr./191 kW FSI petrol engine
70	All-wheel drive with Haldex coupling of the IV generation
71	**Škoda**Yeti; Vehicle presentation part I
72	**Škoda**Yeti; Vehicle presentation, part II
73	LPG system in Škoda vehicles

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