

R89/E



CNG REDUCER

Use and Maintenance Instructions

First Edition June '05

Second Edition 10

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1. Introduction

- The scope of this manual is to:
 - 1 Facilitate the Use and Maintenance of the CNG reducer;
- The informations here detailed don't substitute standards and/or regulations, valid where the installation is performed at that time.

2. Safety conditions

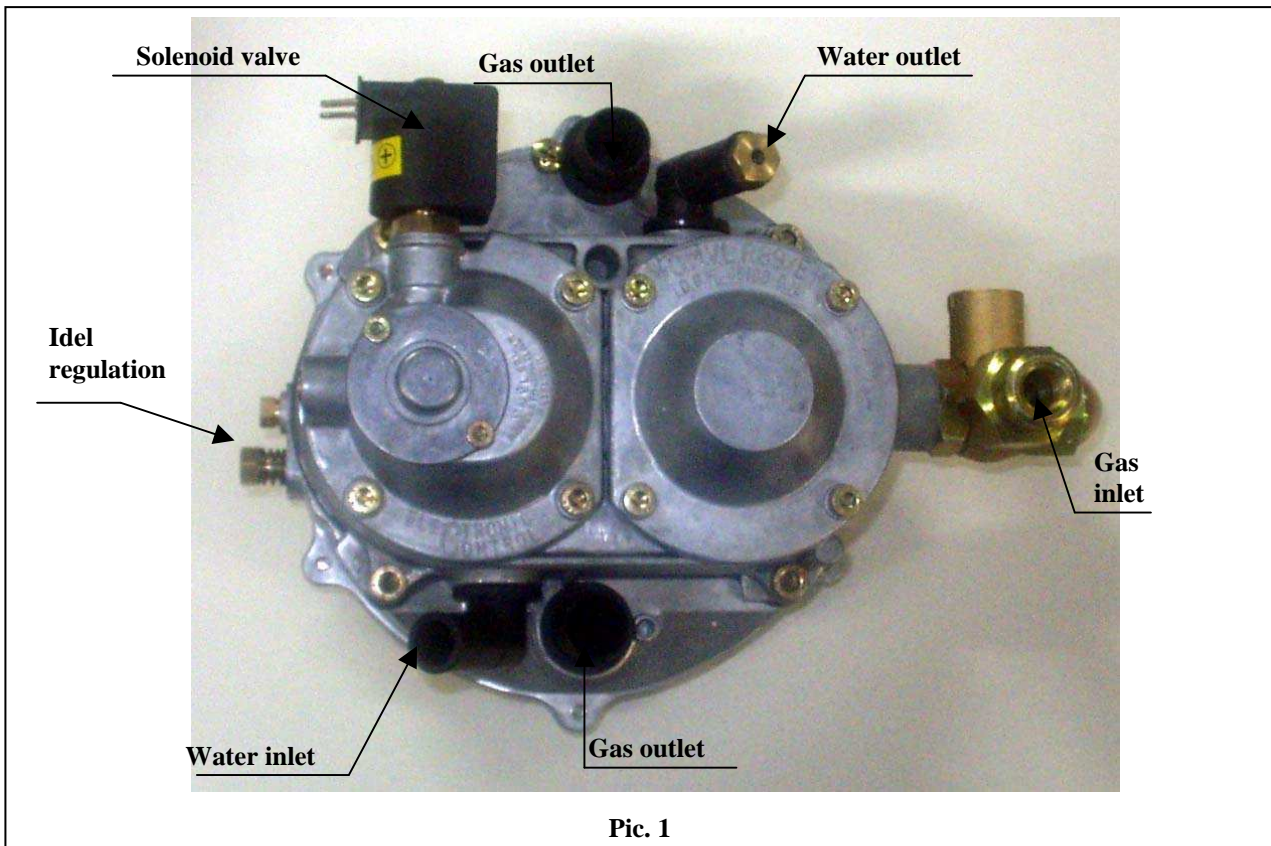
- The **R89/E CNG reduced**, if not installed in the right way, can give wrong working or damaging to the vehicle and/or to the people.
- Also engine emissions and performances may be influenced by a wrong installation.
- This Manual is a guide for Qualified Technician in the automotive field. The reducer, must be installed only by suitably instructed and qualified people, in agreement with the instructions of this manual.
- OMVL declines every responsibility directly or indirectly due and/or caused by a wrong interpretation or execution of any part of this manual.
- This manual must be deeply studied and understood before converting the vehicle.
- To prevent gas leakages, that can cause fire or explosion, don't smoke, avoid sparks, free flame and operations with electrical devices, near engine vane and during refueling.
- The user of the vehicle and any other person unauthorized, have not to do any type of regulation and/or modification of the installed system. Every operation on the system is allowed only on authorized workshops and by suitably instructed technicians. A wrong Use and Maintenance of the system will jeopardize the vehicle safety.

3. Mechanical components installation procedure

3.1. R89/E pressure reducer installation

Technical Features:

- Type: Double stage, with stabilizer
- Pressure reduction system: By spring/membrane
- Heating system: By engine cooling liquid (water)
- Activation device: Solenoid valve
- Maximum Flow rate: 50 m³/h (two outlets Φ 19 mm)



Pic. 1

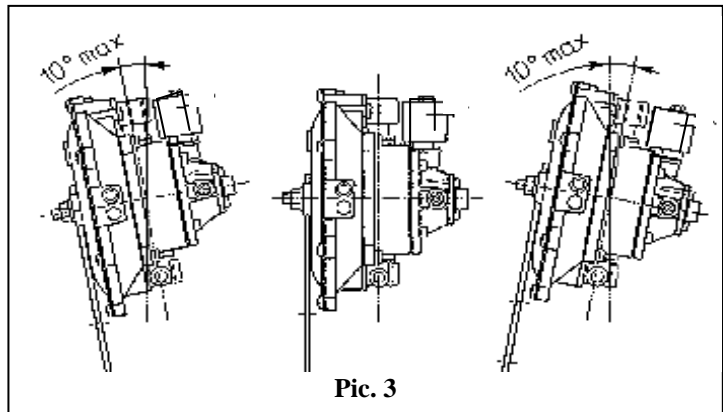
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3.1.1. R 89/E reducer advantages

- It's the only one on the market with “**Self Controlled pneumatic Pilot**” (patented). This device has the scope to maintain a constant pressure in the chamber where the engine is fed, at every gas flow rate with every rpm values.
- The only one that can be successfully used at every cylinders volume, **from 0,5 to 6,0 lt.**
- **Double gas outlet** to make easier the installation and connections (the outlet not used is closed by a special cap in equipment).
- **Safety valve** to avoid reducer fails and eventual damages to people and things, in case of overpressure inside reducer chamber.
- **Stabilizer**: device that maintain a constant outlet pressure independently from reducer inlet pressure (tank pressure). This allows a stable idle.
- **Supplementary idle device**, studied to avoid sudden engine switch off in case of strong braking or fast bend.

3.1.2. Reducer installation instructions

- Reducer must be installed, in the engine vane, in vertical position, as much protected as possible to avoid damaging in case of car crash. It must be firmly fixed to the vehicle body (the bracket in equipment is a good support), to allow a good “grounding” of the component.
- Reducer angle on the vertical axis, must not exceed $\pm 10^\circ$, as shown in fig. beside.
- Pressure reducer must be fixed, closed to engine cooling liquid pipes and closed to the mixer.
- Install the reducer far from exhaust manifold, to avoid gas uncontrolled overheating at reducer outlet.
- Fix the reducer at a lower level than the top of the cooling circuit into the heater. If this is not possible, carefully vent from air the engine cooling circuit before sealing it again. Air bubbles in the circuit can reduce efficiency in heat exchange between the two fluids.
- Don't fix the reducer to the engine. High heat and vibration could seriously damage it.
- Pipes connecting reducer to the engine cooling circuit, have to be a bit longer than the minimum required length. This to avoid pipes obstruction during engine running and to permit an easy reducer disassembly from its bracket, in case of small repairs, without disconnecting the pipes.
- Protect the venting hole on the steel cover from air flow coming from the engine cooling fan. A strong air flow on low pressure membrane, can cause wrong engine operation due to incorrect gas flow rate.



Pic. 3

3.1.3. Reducer working principles

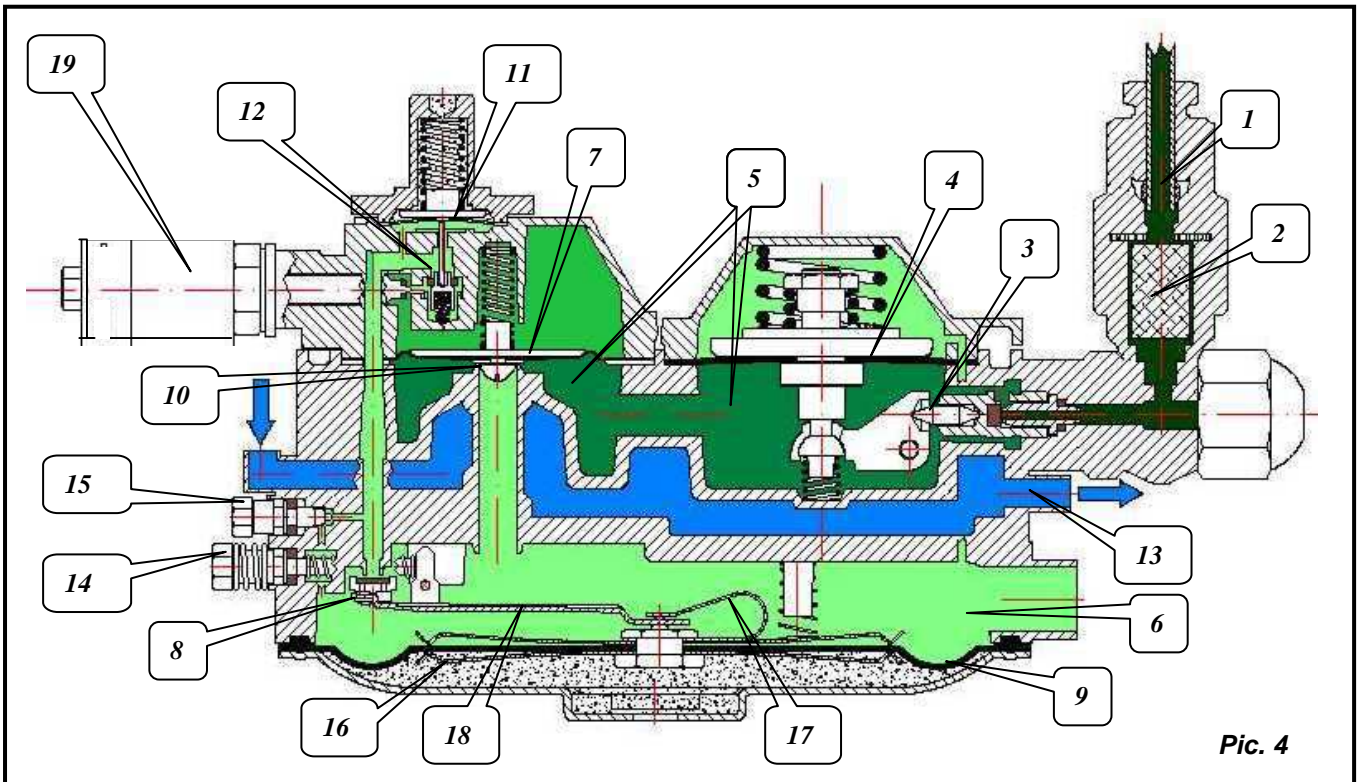
Compressed Natural Gas flows from the tank to reducer through a **special inlet nipple (1)**. A **filter (2)** avoid solid particles to get into the reducer.

1° Reduction stage. The High Pressure Valve (3), is controlled by High Pressure Membrane (4). This regulates gas flow in the double Chamber of heating and expansion (5), where pressure is reduced till 180 kPa. From here gas flows to the 2° reduction stage.

2° Reduction stage. It is constituted by a Chamber (6), in communication with the mixer, placed upstream the throttle valve. The Membrane Unit (7), through the Valve (8) actuated by the Membrane (9), feel the suction generated by engine pistons. The Valve (10), controlled by the just mentioned unit, regulates gas flow from 1° stage Chambers (5) to 2° stage Chamber (6), where pressure is furtherly reduced till atmospheric (0 ± 20 Pa). From here, gas flows into intake manifold

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where it mixes with air coming from engine air filter, before flowing inside cylinders ignition chambers.



Pic. 4

“Stabilizer” device. The Stabilizing Valve (12) is controlled by the Membrane (11). This valve permit to optimise the gas flow to the engine independently from engine rpm values and from gas tank pressure.

Shut off valve. A solenoid valve (19), controlled by gas/petrol switcher, cuts gas flow from 1° to 2° stage, at the same time the engine is switched off. This happens both in case of intentional and casual switching off (in case of damaging, accident, fuel completely consumed, etc).

Heating system: CNG expansion due to pressure reduction, has the effect of a temperature reduction. To avoid icing inside the reducer, and to get the best efficiency from the fuel, the chambers where gas is expanding, are heated up by engine cooling liquid (13).

Carburetion adjustment screws. Beside reducer there are 2 adjusting screws. The hexagonal M10 screw is the Offset adjusting screw (14) and allow to modify the delivered gas quantity. The hexagonal M8 screw is the Idle adjusting screw (15) and it's usually closed. It must be unscrewed only in the case the engine is switching off, in case of strong braking or fast bend.

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4. MAINTENANCE AND REPAIR

ATTENTION

All extraordinary and preventive maintenance has to be performed with standstill car and with electrical supply and gas circuit cut.

4.1. Extraordinary Maintenance

High and low pressure gas line leakage check

Water line leakage check

Residuals draining from reducer low pressure chamber

Reducer gasket and membrane substitution

Low pressure rubber hose substitution

Regulator textile filter substitution

Repairs due to accidental ruptures

4.2. Preventive and Corrective maintenance Activities

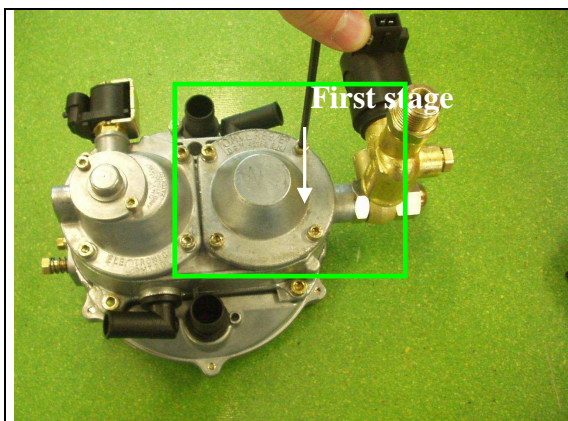
Periodical maintenance and correct use are necessary factors to guarantee the good and safe working and duration of the system. Extraordinary maintenance interventions, at the prescribed intervals, have to be made by the mechanical technician under respect of safety prescription reported in this manual. Check on the vehicle dashboard the distance the car has run (in km), time intervals have to be controlled reporting on a suitable handbook the maintenance interventions dates.

Maintenance Preventive Plan

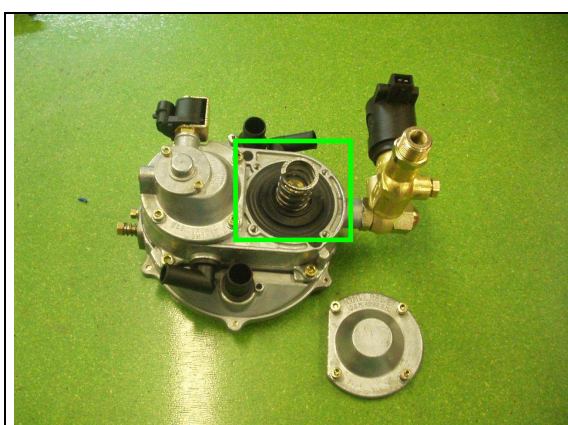
Distance				Operations	Period of time			
15.000 [km]	30.000 [km]	50.000 [km]	100.000 [km]		6 months	1 year	2 years	5 years
				Gas system seal check (components, connections)	•			
			•	Reducer gasket and membrane substitution			•	
			•	Reducer textile filter substitution			•	
		•		Draining of residuals eventually collected inside reducer		•		

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4.3. 2° stage membrane substitution



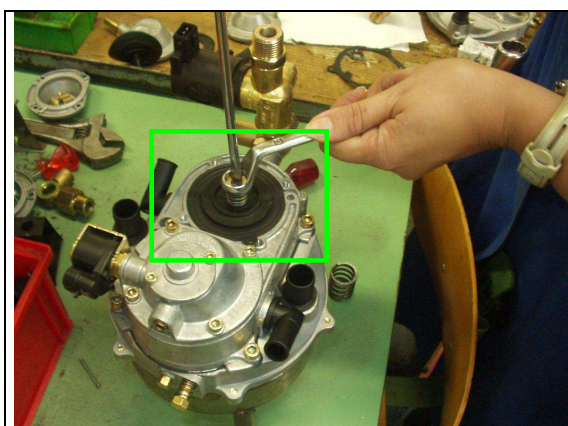
- Remove the I stage cover screwing out the four screws



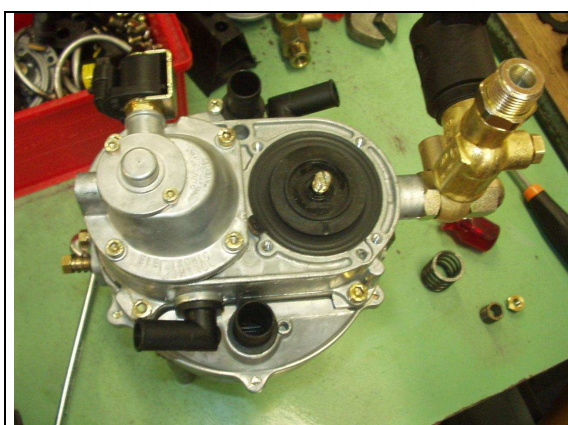
- Remove carefully the I stage cover paying attention to the internal spring compression.



- Remove the spring.

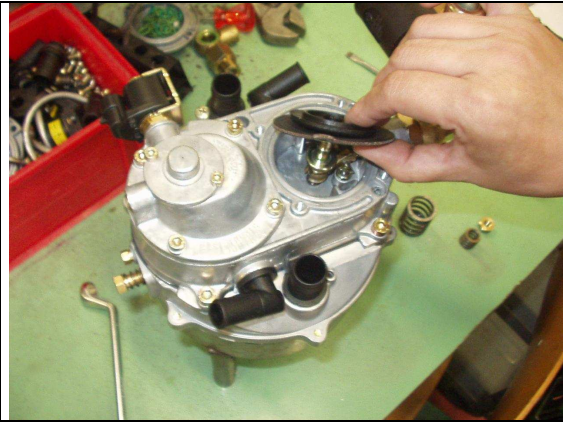


- Unscrew the regulation spring nut turning anticlockwise the wrench

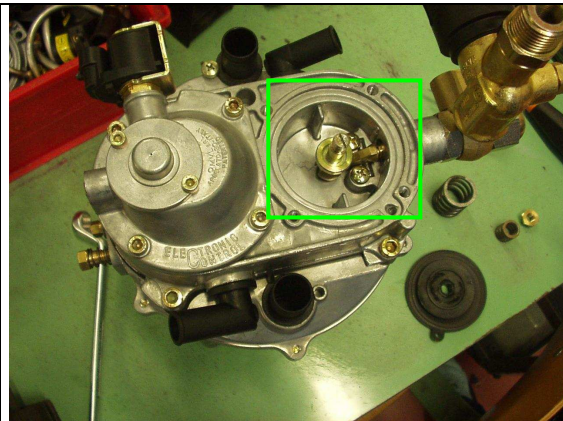


- Remove the spring

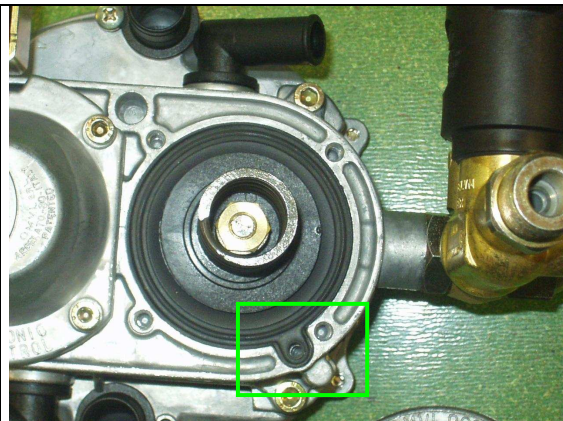
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- Remove carefully the plate and the membrane group



- Verify the status of I stage internal camber



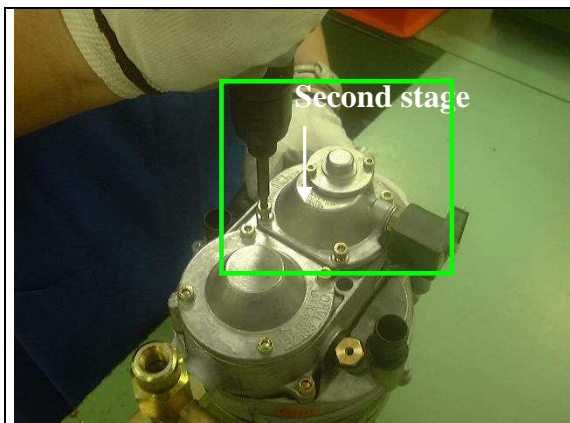
- Substitute the membrane group



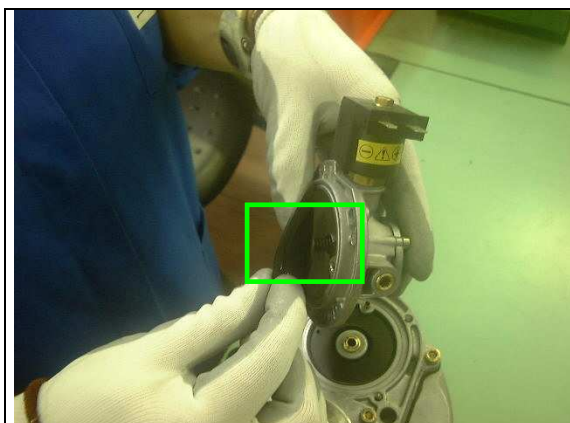
- After placing the 2 regulation spring verify that the membrane appendix is inside the hole.

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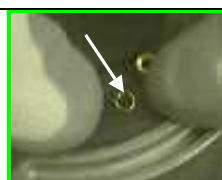
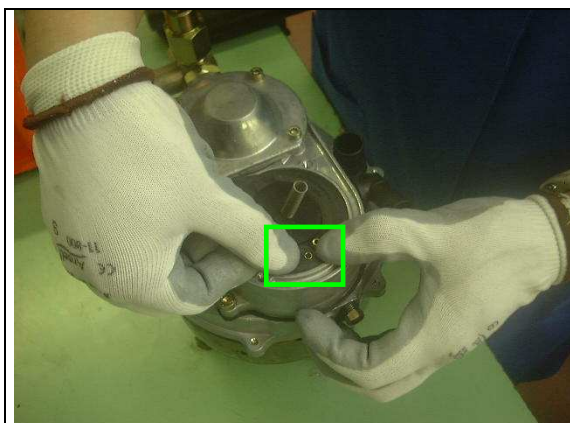
4.4. 2° stage membrane substitution



- Remove the II° stage cover screwing out the four screws



- Gently rise the membrane extracting carefully the connected spring from its cover side, avoiding to stretch it.



- Position the new membrane connecting the membrane hole with the relevant body ferrule

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- Insert the membrane spring in its cover side

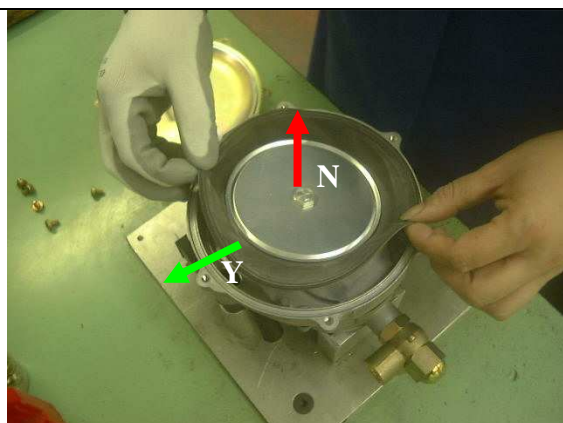


- Fix the II° stage cover, screwing the four screws following a cross scheme 1-2, 3-4

4.5. Low pressure membrane substitution



- Remove the back cover screwing out the six screws

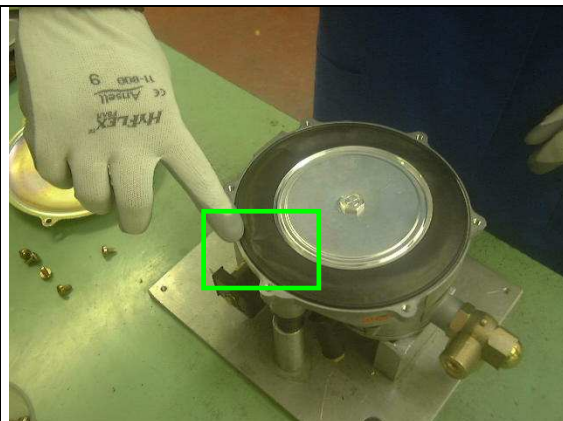


- Remove the membrane from its seat maintaining it horizontal, as shown by the green arrow.
- Do not force the membrane vertically (red arrow)

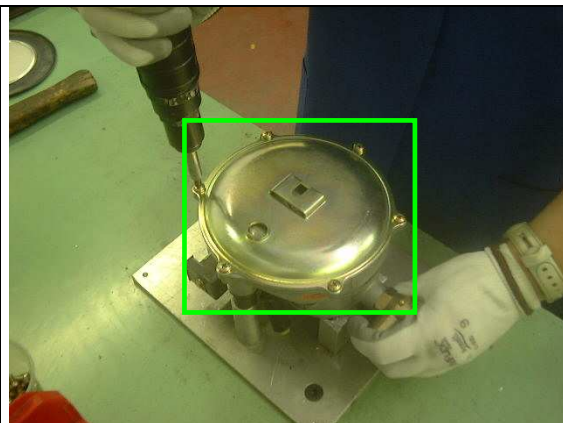
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- Position the new membrane connecting the back hook to the black metal lever



- Insert carefully the membrane O-ring gasket to the channel around the aluminium body



- Fix the back cover screwing the six screws following a cross scheme 1-2, 3-4, 5-6



- **OPTIONAL**
If the substitution have been made to reduce a possible membrane vibration noise, fix with an appropriate glue a plastic connector in the back cover hole. This operation should decrease any residual membrane noise.

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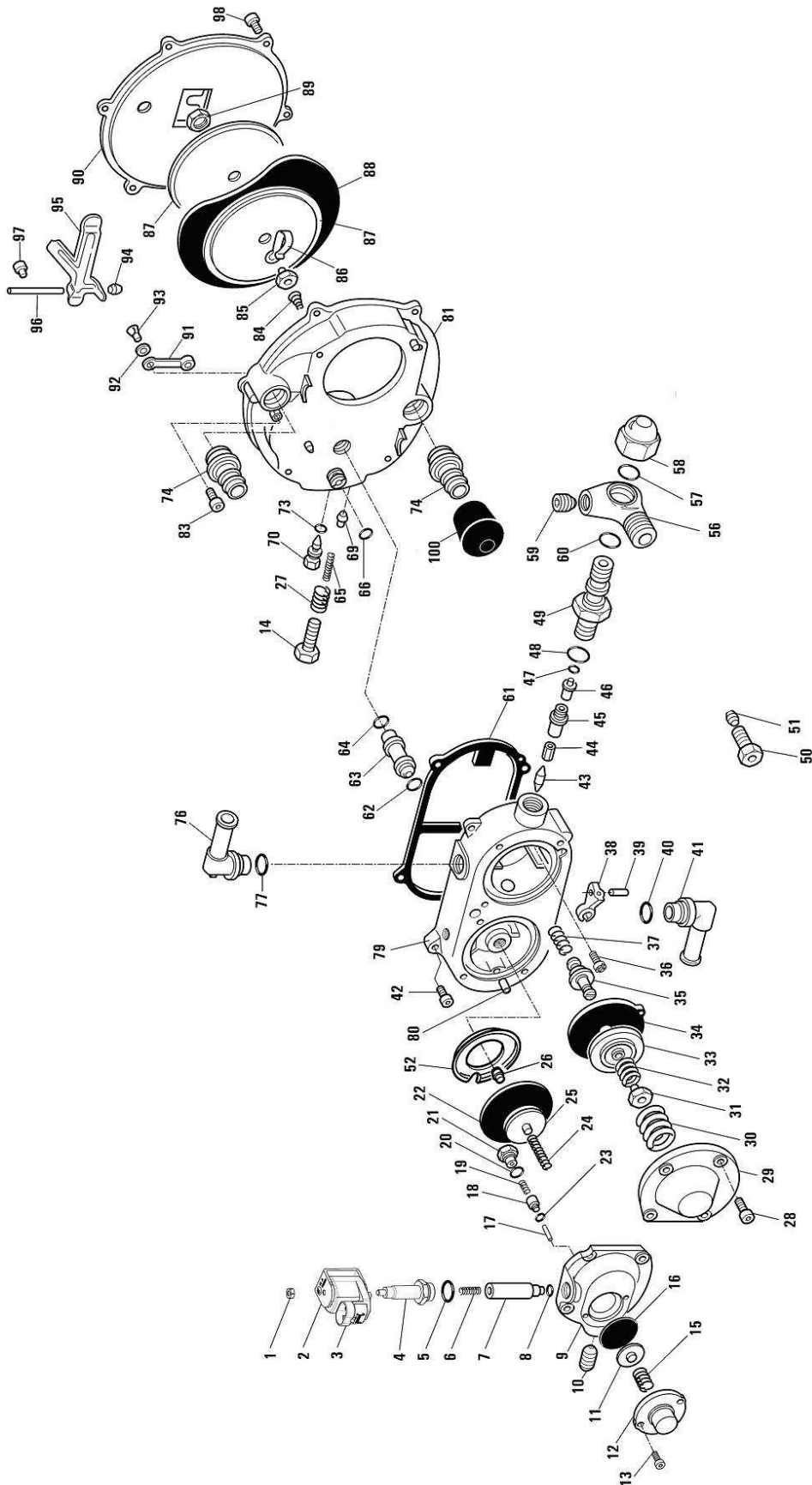
4.6. Troubleshooting: causes and remedies

The following table shows the main troubles that can happen during normal working of the vehicle. The causes of wrong working and the remedies to adopt are indicated as well.

n°	TROUBLE	CAUSE	REMEDY
1	Low power	Low gas flow rate due to L.P.membrane lever setted in wrong way	Check the position with the suitable caliper
2	Internal leakage in the high pressure camber	High pressure shutter damaged	Replace the shutter
3	Engine off in case of strong turns.	Wrong adjustment of screw n° 15 (fig. 4 – page 7).	Adjust the screw, unscrewing it slightly.
4	Engine is switching off at the idle.	Wrong adjustment of the idle screw in the regulator (screw n° 14 in Fig. 4 – page 7).	Slightly unscrew the screw till having a good carburation.
5	Metallic noise coming from pressure reducer in case of strong acceleration.	Low pressure membrane diaphragm (n° 16 in fig. 4 – page 7) touches on external cover of the reducer.	Replace the low pressure membrane group.

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Table 5.1 – R 89/E PRESSURE REGULATOR



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