PAN LEARNING CENTRE

SNG RETROFITTING

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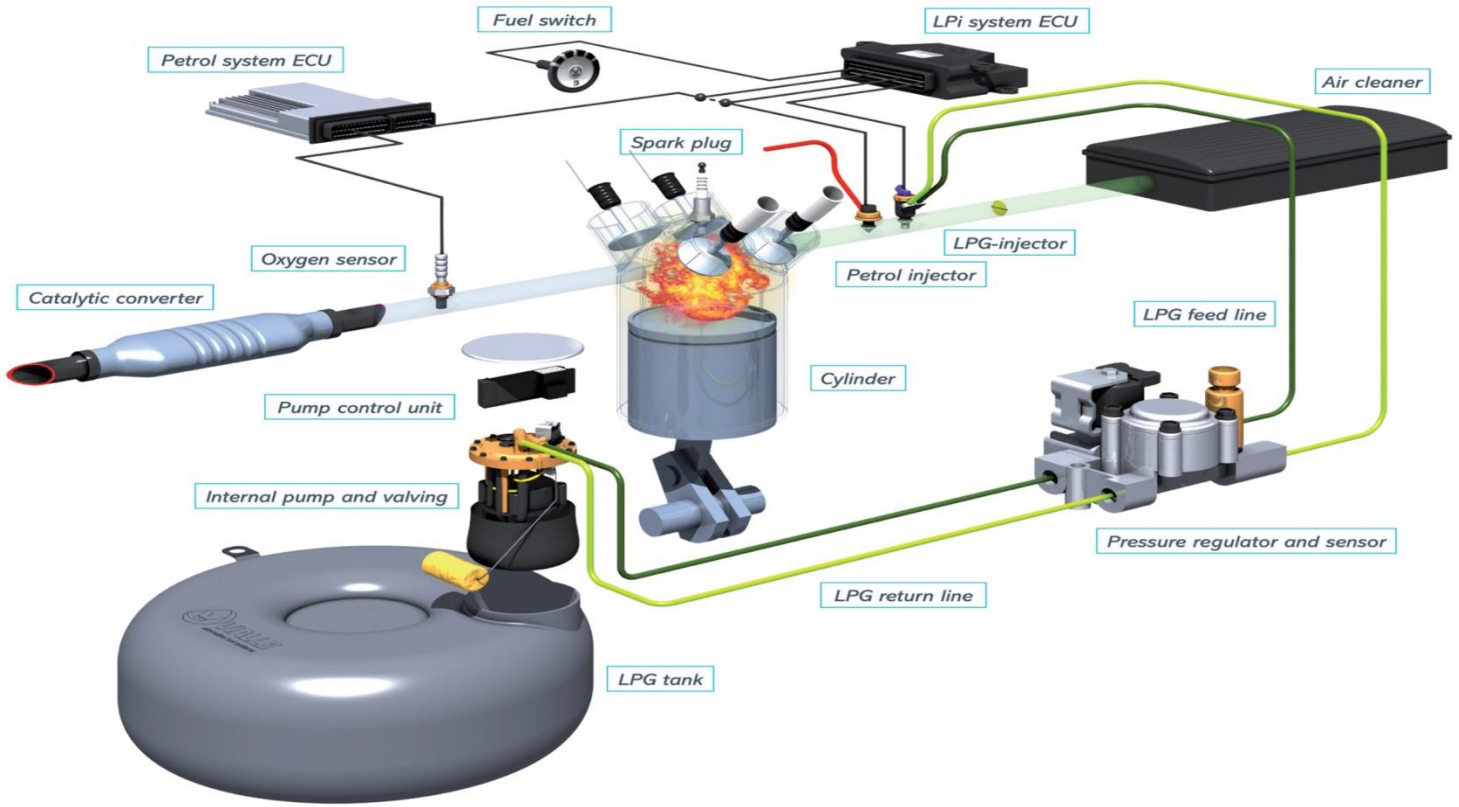
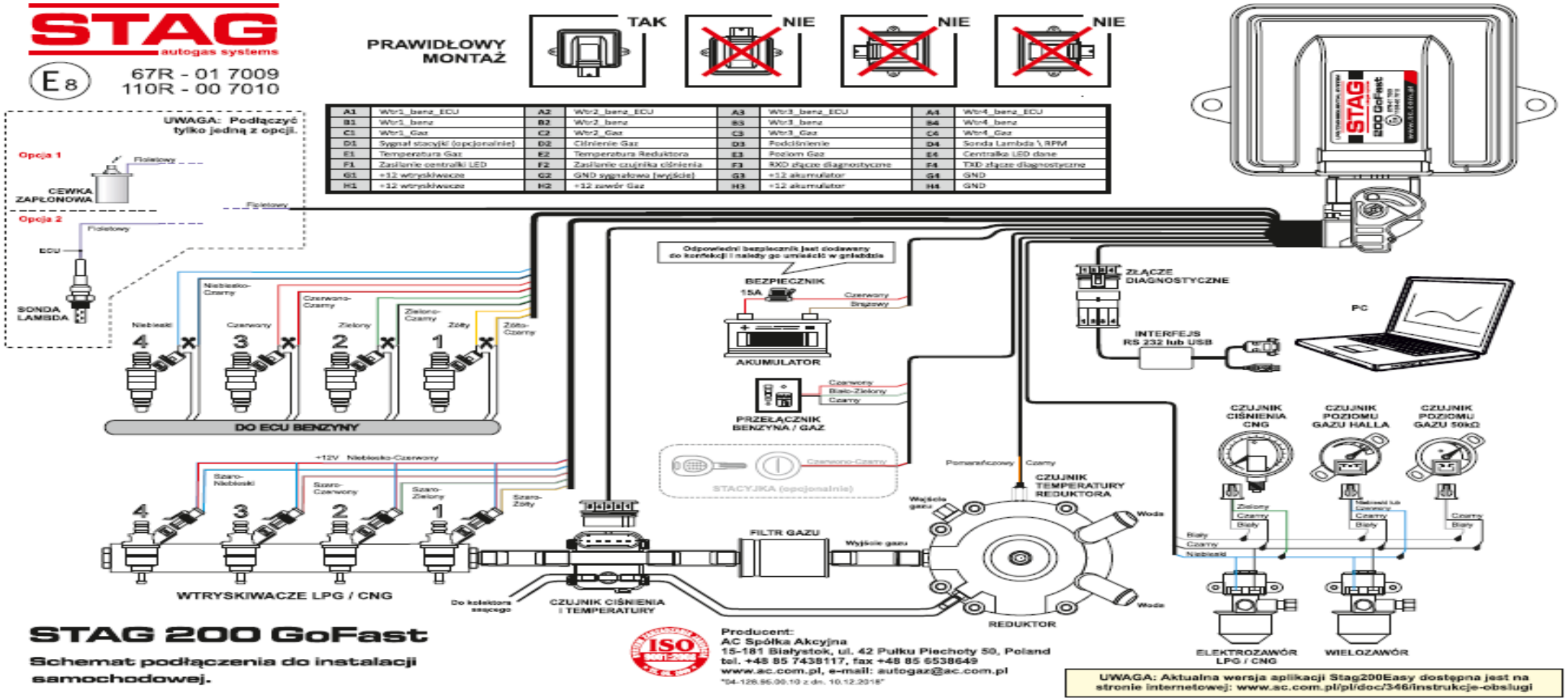
General System description of the retrofitting.

General description of the autogas system (LPG/CNG)



General System description of the retrofitting.

System wiring



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Pictorial presentation and general arrangement drawings showing all the technical aspects

1. Gas controller
2. Reducer
3. Gas injectors
4. Temp & Pressure sensor
5. Gas filter
6. Change over switch
7. Filling valve
8. Gas tank with multivalve embedded

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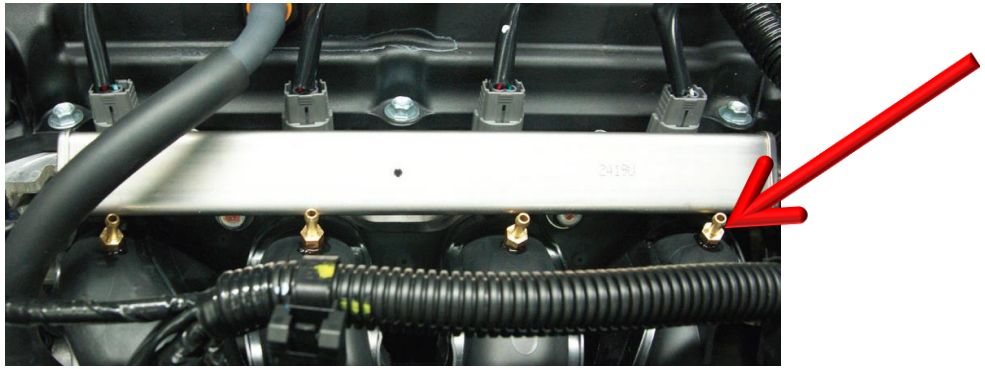
Pictorial presentation of components

Change over switch mounted on dashboard

Gas injectors and nozzles connection



Gas nozzles mounted on drilled intake manifold

LPG/CNG injectors

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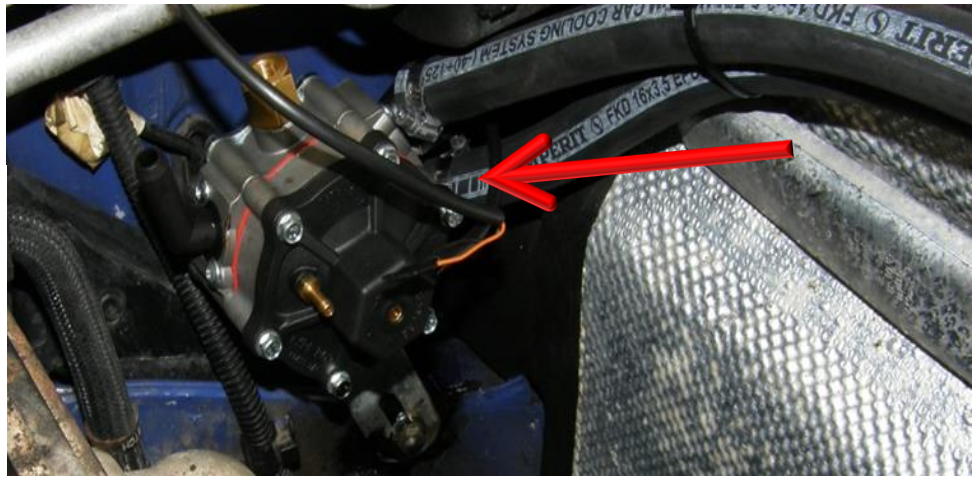
Pictorial presentation of components

Reducer and its connection to the vehicle heating system



One position for the Filling valve

Tank types and multivalve assembly

Multivalve assembly

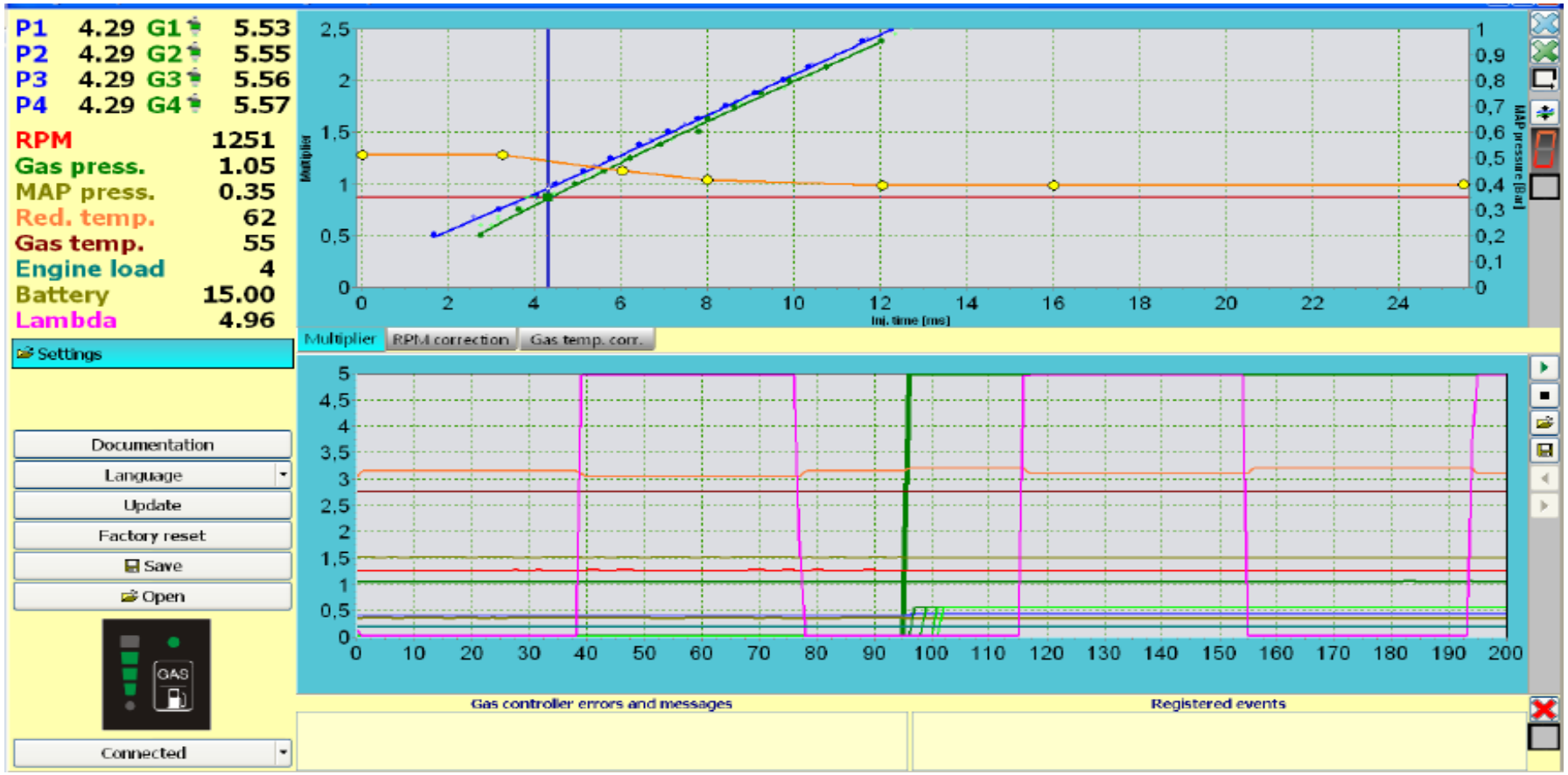
Cylindrical and toriodal (internal and external) have variations and capacities

Calculations of how the conversion system work with vehicle engine System

The gas dosing is adjusted to ensure that the injection pulses for the petrol/diesel and gas systems are similar at different drive conditions for a particular engine characteristics

The multiplier factor is a function of engine behavior when driven on petrol/diesel

Maps are used for correct setting of the gas injection. Oscilloscope settings are stored for future reference.



Multiplier and oscilloscope window

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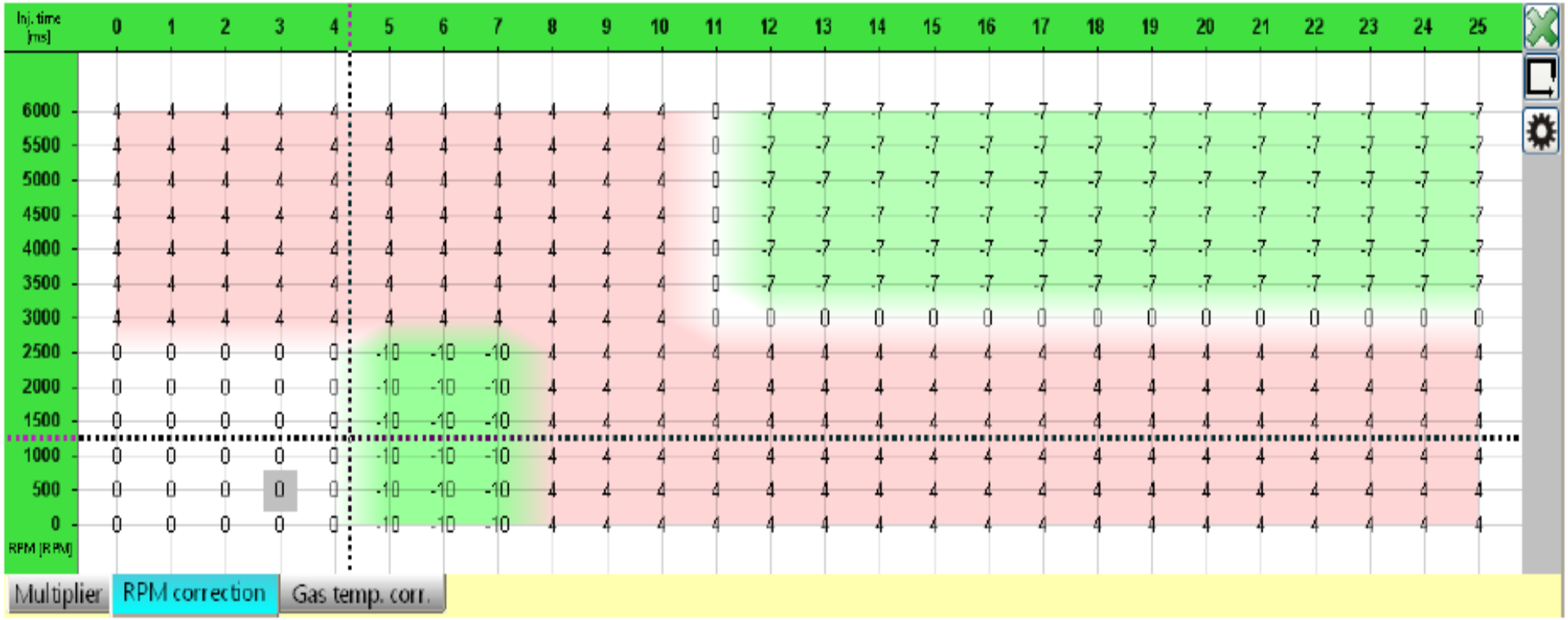
➢ System Calculations Con't



Gas controller program enables the required correction depending on Engine RPM and Gas temperature

Integrity assurance of the Tank (Gas Cylinder) including any design code, material, test/quality certifications.

1. LPG TANKS

All STEP Gas Tanks (Toroidal and Cylindrical) are tested and certified according to the latest European safety and quality standards (ECE 67R-01) and TSEN ISO 9001 quality management system.

Tanks are made from heat treated high resistance electro welded steels and subjected to the following tests which conforms to test specifications in annex 10 of the ECE 67R-01 standards:

1. **Tensile Test** (Tensile strength, yield strength, elasticity modulus, spectro structure) as specified in Euronorm 10120
2. **Bending Test:** to determine mechanical compatibility of metal sheets used for tank bodies, welded joint and weld seams as specified in Euronorm 10120
3. **Explosion Test:** To ensure that the burst pressure of the tank is above 67 bar. Explosion must not be recorded on a weld seam and without fragmentation effect.
4. **Radiographic test:** To detect weld defects such as cracks, gaps and penetration effect on the weld seam. The test is done in accordance with ISO R 1106.
5. **Macroscopic test** for weld seam in accordance with ISO R1106

- Integrity assurance Con’t

1. **Life (Fatigue) Test:** To determine tank life accepted as 10 years. (hydraulic pressure of 30 bar is exerted to the tank body for 10,000 times in 4 seconds period.

2. **Bonfire Test:** Burning in fire to 590oC at 80% occupancy to test tank and multivalve integrity at specified fire conditions.

TANK DESIGN PARAMETERS

Design Pressure :	30 bar
Working Pressure :	20 bar
Regulation:	ECE 67.01 Regulation
Working Temperature:	-20 +65oC

- Integrity assurance Con’t

2. CNG TANKS

These cylinders are tested and qualified in accordance with ANSI/NGV2 (2007) and are FMVSS 304 compliant.

Design approvals and certifications are attached

Key Features:

- 1-1/8” UNF neck thread configuration
- Solenoid and manual valves available
- External PRD available
- ANSI/NGV2(2007) and FMVSS 304 compliant
- Canadian approvals
- Pressure rating 3,600 psi
- Stainless Steel serviceable boss or one-piece aluminum boss available
- Corrosion free seamless liner reduces maintenance and permeation
- Added drop protection with PU caps
- Lighter than steel by nearly 80%
- Service life of 20 years

Manual closure of the gas cylinder /mitigation in case the auto switch/shut off valve fails

The manual valve (4) installed on the multivalve at the upstream circuit of the solenoid shut off valve ensures manual closure of outlet pipe. Outlet gas flow can thus be intercepted in the event of auto shut off valve failure.

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Calculation reports and charts associated with the change.

1. The rated horsepower of the engine to be retrofitted must be determined.
2. Gas conversion kits (LPG/CNG) must be selected to suite the maximum horsepower of the engine.
3. The gas injectors should be adapted to the sectional horsepower of the engine using charts that comes with the selected conversion kits.

4. Following minimum distance must be maintained during installation of gas components:

i. Components to the exhaust system = 100mm
ii. Line fixing points = 400 mm
iii. Cylindrical tanks and back seat = 300mm

Safety features in the event of failure or leakage from the tank (gas cylinder).

- The gas tank must be properly maintained to prevent leakages from tank wall.
- It is highly recommended that all tanks should be inspected by Certified CNG and LPG fuel system inspectors.
- This inspection should be conducted every 36 months or 36,000 miles which ever comes first.
- Attention must be given to labels on the tank defining **inspection and expiration dates.**
- **It is the responsibility of vehicle owners and fleet managers to ensure that the tanks are inspected as at when due.**

FUEL CONSUMPTION AND SAVINGS ANALYSIS FOR DIESEL - CNG DUAL FUEL SYSTEM
– *Supplied by Prins Autogas Systems*

Calculation is based on:

CNG N90/scm (118N kg)
LPG N98/Liter
Petrol N162
Diesel N189
High Gas (high caloric) CNG
LPG with 70% propane / 30% butane

Peugeot car, Petrol, consumption 10l/100km
Yearly mileage 40.000km

Yearly fuel costs petrol only: N648.000

Yearly fuel costs LPG: N461.176 --> You save N186.824 (29%)

Yearly fuel costs CNG: N302.564 --> You save N 345.436 (53%)

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FUEL CONSUMPTION

Same Peugeot car, 4C Diesel engine, Diesel consumption 6l/100km

Yearly mileage 40.000km

Yearly fuel costs Diesel only mode: N453.600

Yearly fuel costs Diesel-LPG with 22% estimate substitution
Fuel cost diesel: N353.808
Fuel cost LPG: N76.074
Total fuel cost per year: N429.882
Fuel savings compared to 100% Diesel: N23.718 (not feasible)

Yearly fuel costs Diesel-CNG with 40% estimate substitution
Fuel cost diesel: N272.160
Fuel cost CNG: N92.232
Total fuel cost per year: N364.392
Fuel savings compared to 100% Diesel: N89.208 (not feasible)

Best regards