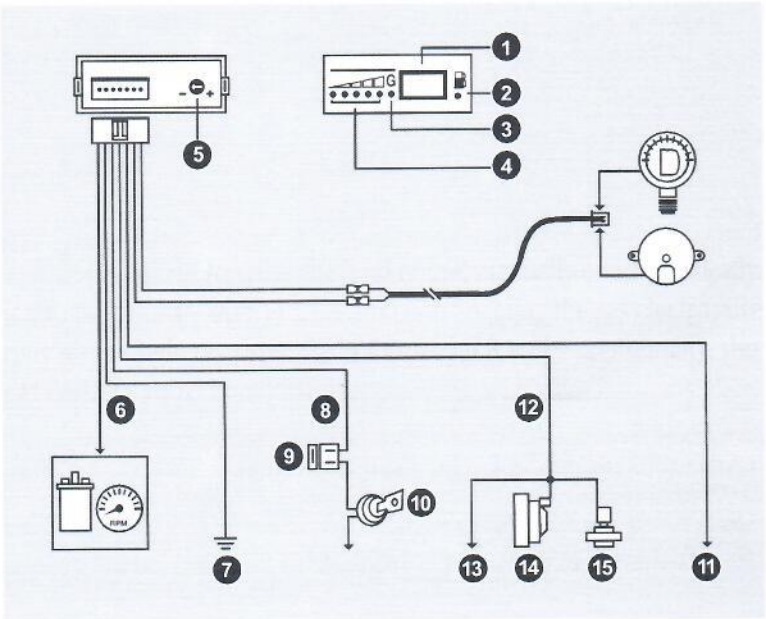
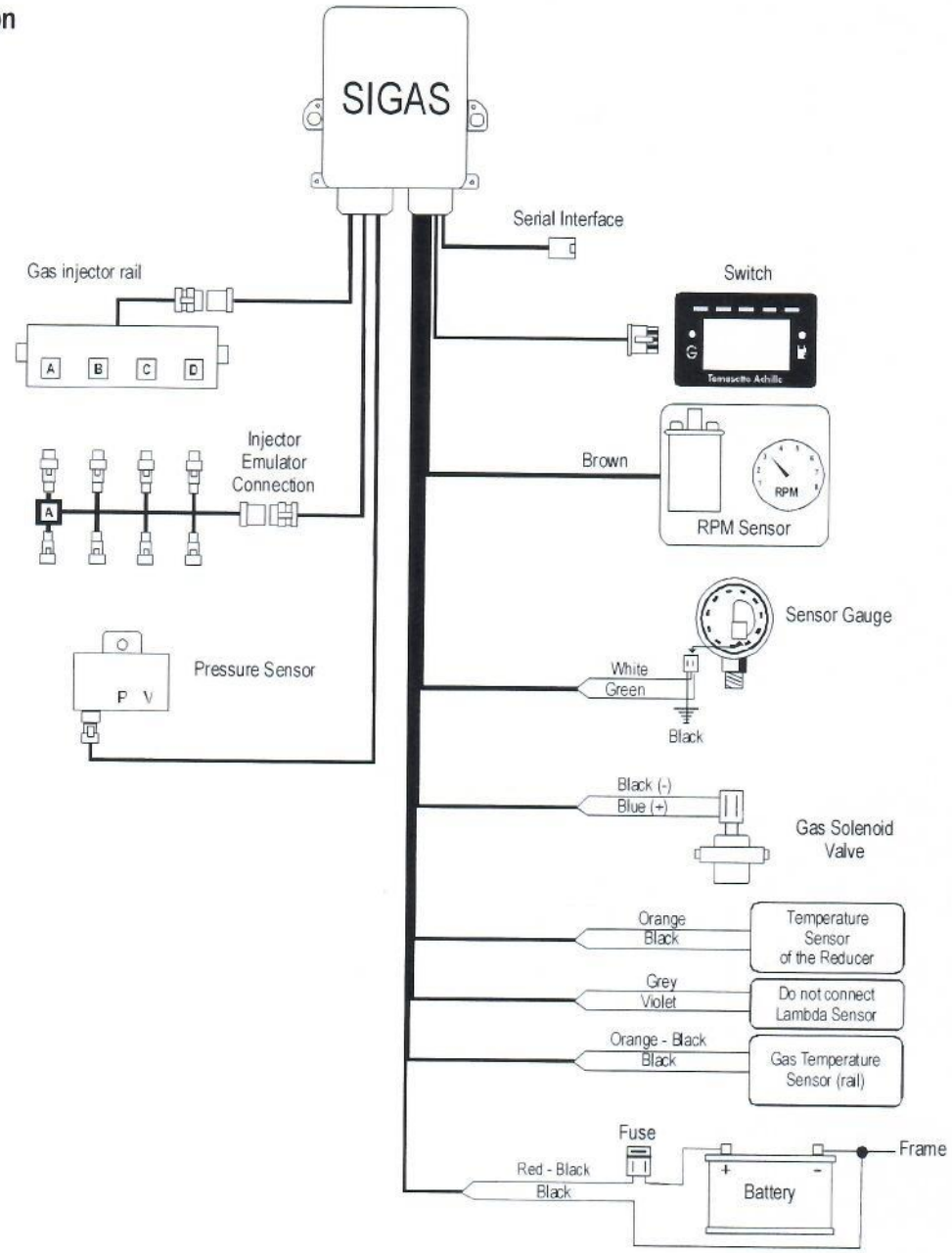
## Fuel switch key

This device allows to select the kind of fuel manually or automatically. It also includes a " SAFETY CAR" function enabling the gas electrovalve only if the engine is running, in this way if it stops accidentally, the gas delivery stops immediately.




1. Fuel selecting key.
2. Gasoline running Indicator.
3. Gas running Indicator.
4. Indicators of fuel level and reserve.
5. Choking timing (carburetor) or engine's rotation rate for the commutation (injection).
6. RPM Connecting cable (coil's negative, tachometer or winding on coil's outlet).
7. Grounding
8. Positive after the keyswitch (10) with protection fuse (9).
9. Protection fuse.
10. Keyswitch.
11. Connection to the gasoline electrovalve, only carbureted vehicles.
12. "BLUE" cable +12V when the vehicle runs with CNG.
13. Connection for CNG fittings (Timing processor, emulators, etc.).
14. Electrovalve on pressure reducer.
15. Gas electrovalve.

## Electrical installation




## Installation Check

**Initial Pneumatic Test (Previous to CNG filling)**

- Pressure: 200bar
- Time: 10 minutes.
- Element to be tested: high pressure piping and threaded connections
- Fluid used: Inert gas (nitrogen)

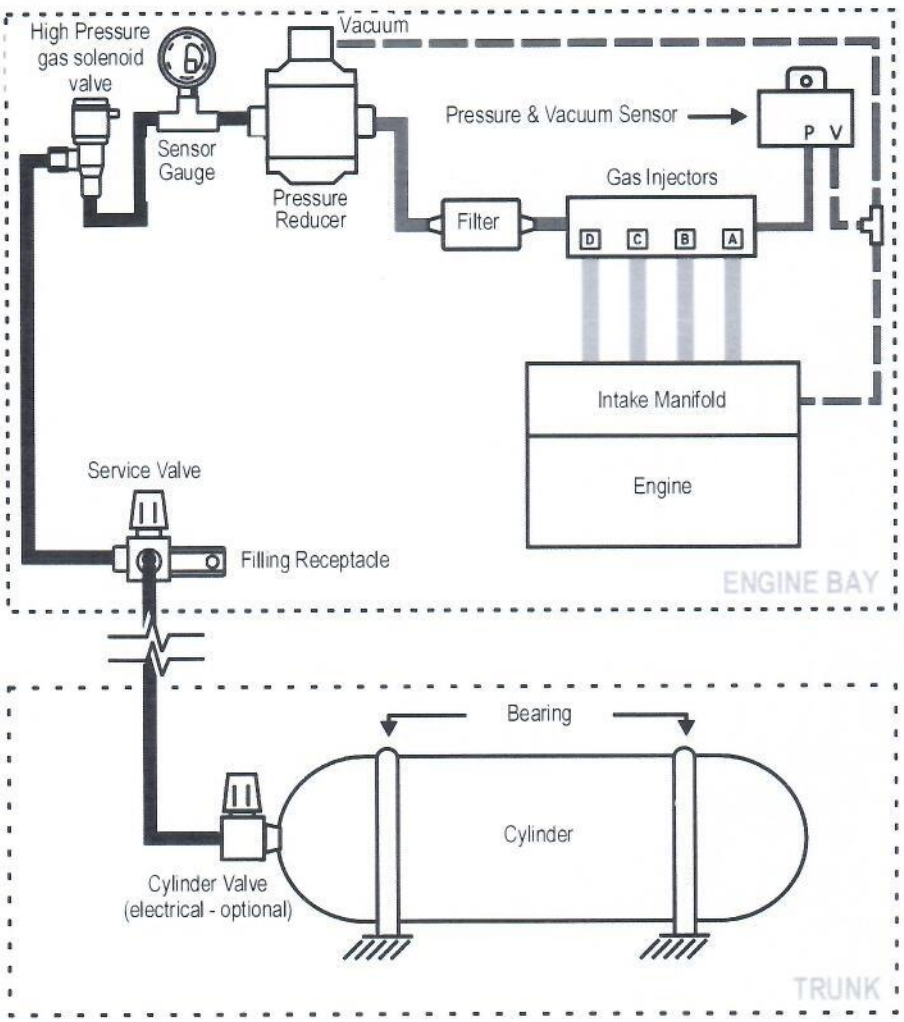
**TEST AND METHOD:**

- Close the service valves installed in the cylinders.
- Open the filling valve.
- Connect the filling valve test line, using an adapter in the connection hole.
- The whole circuit must be subjected to testing time and pressure, checking the imperviousness in all the connection points with neutral soap foam.
- Once the test is finished, vent the system and open the cylinder valves.

**Pneumatic Test (First CNG Filling)**

- Approximate pressure: 200 bar.
- Check with soapy water the connections of all those parts that accumulate gas, from the cylinder neck to the controller outlet.
- Once the checking is finished, clean with water and connect again the venting system.

## Pneumatic Diagram




## Cylinder installation for CNG Storage

The CNG containers must be placed following the line or profile of the vehicle and taking care that such line or profile protect the containers, even in case of overturn. The cylinders must be mounted with different types of bearings according to the model and type of vehicle to be converted. The place chosen for the fixing of the mounting screws must guarantee the necessary rigidity to achieve a firm attachment of the containers to the chassis.

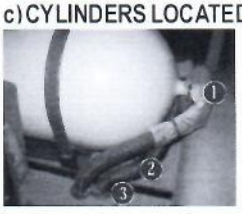
**a) CYLINDER VALVE INSTALLATION**

- Fix the cylinder on an appropriate bearing for cylinder valve mounting and adjustment.
- Check that the screw thread is clean and without strains.
- Wrap the screw thread 6 times with teflon tape clockwise, apply a thin layer of high-torque thread sealant (Loctite 680).
- Thread the valve to the cylinder and adjust with torquemeter with a 19kg-m to 21kg-m torque with a special wrench for the type of valve used.

**b) INSTALLATION UNDER THE VEHICLE FLOOR :**

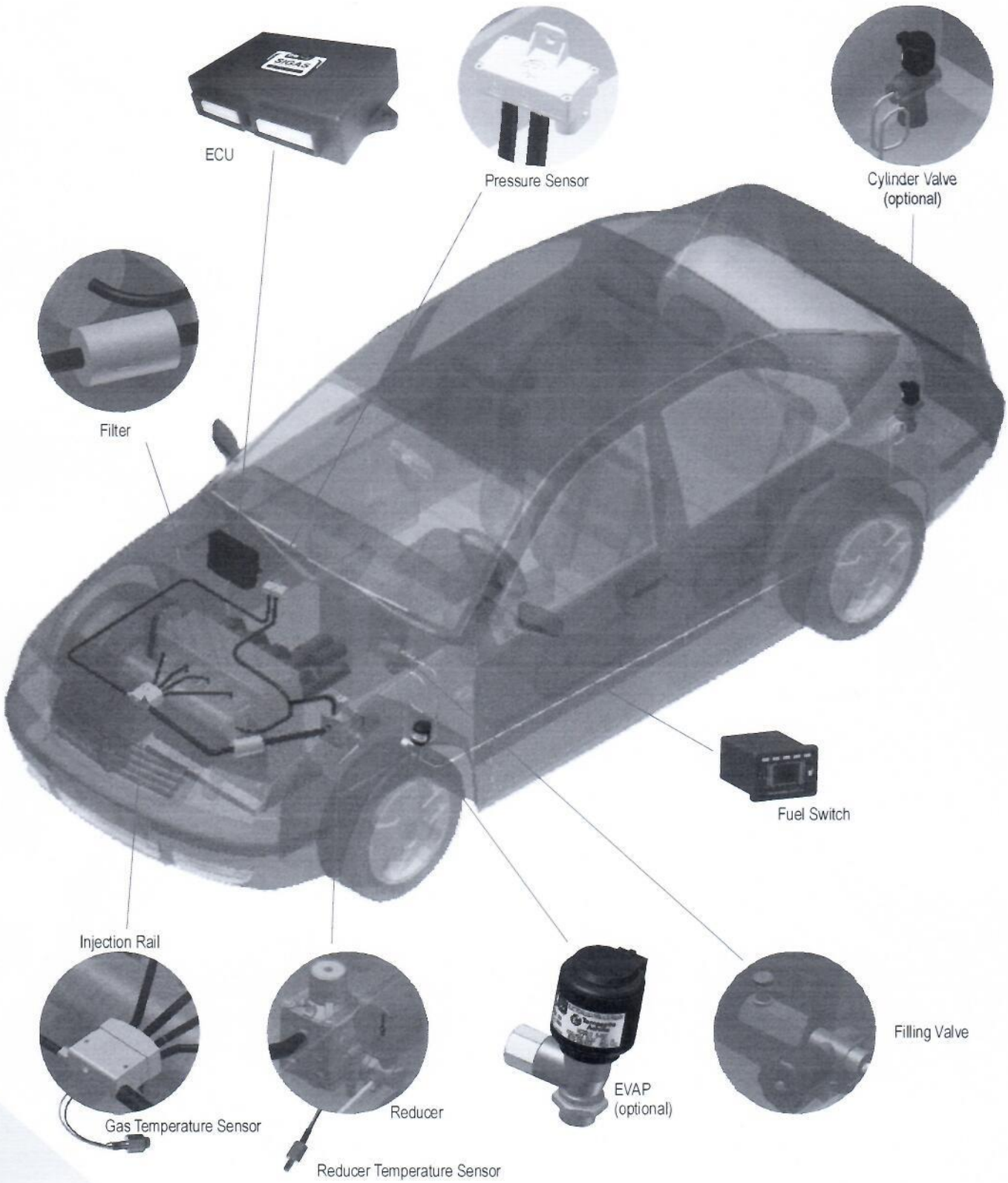
Keep a 250mm minimum distance between the floor and the vehicle with maximum load. The installation must be performed using all the material provided in the kit, e.g. bearings, belts, bolts, covers, protectors, etc. according to the vehicle type or model.

**c) CYLINDERS LOCATED IN THE CLOSED COMPARTMENT:**




Venting tubes leading to the outside must be installed in the car vehicle or trunk to lead possible leaks in the cylinder valve. Use a venting bag **(1) (in the case of using an electrical cylinder valve, the use of a venting bag is not necessary), venting tubes (2), venting pipes and accessories (3).**

## Location of Components
## Mechanical Installation

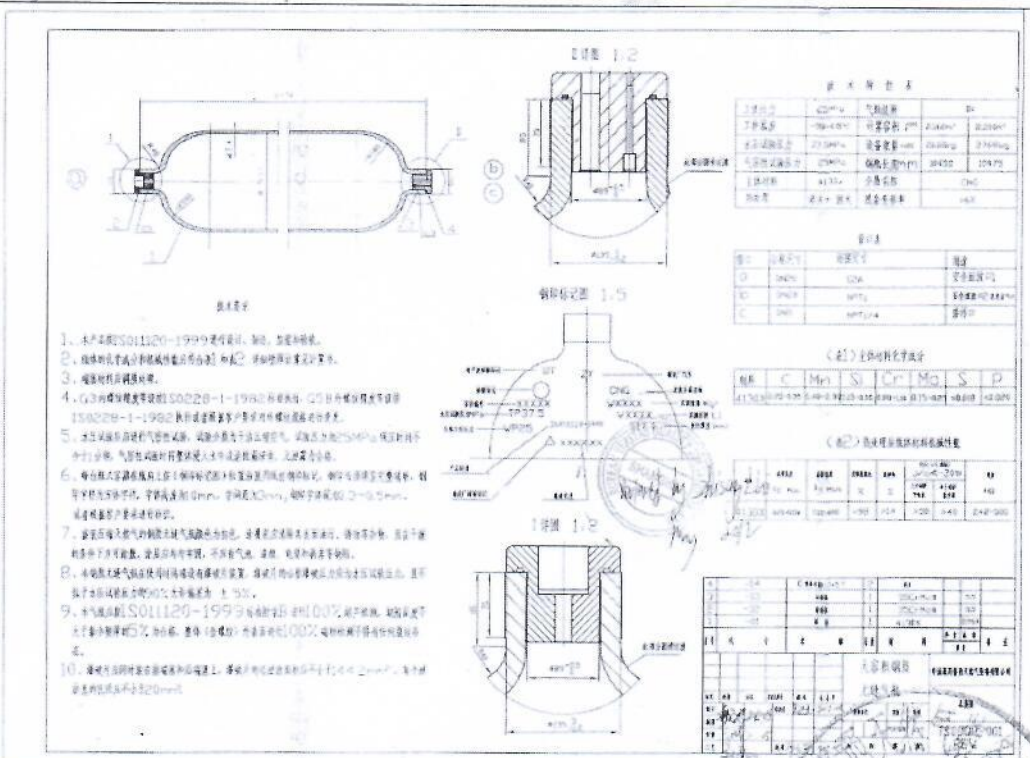


SGS

| | | |
|---|---|---|
| 1212N12013-30 | Actual value | 255-269 |

Remark: Required values were according to specification of design drawing.
No activities were performed after the SGS inspector indicated QC manager the problem.
The original hardness test record and drawing provided by manufactory as below:

Origin Hardness Test Report



Design Drawing

NIPCO PLC

**Issued from: Ibafo CNG Station**

# TECHNICAL CLEARANCE REPORT

Customer no.:GGL/WS/2016/_____ Date: ___/___/2016

Certified that the vehicle bearing registration no. _____ owned by Mr/Mrs/M/s. _____, residing at_____

_____

(Phone nos._____&_____) is technically fit for CNG conversion. The customer has agreed to pay N_____(_____Naira only) as down payment towards installation of the CNG conversion kit and has also agreed to sign the CNG kit sale agreement before conversion. Please accept the payment and advise us for proceeding with the kit fitment.

**Details of the vehicle to be converted:**

Make: Model: Type:( )Taxi; ( )Pvt

Category: ( )Car; ( )Mini Bus; ( )Pick-up VIN:

Engine No.: Chassis No.:

**Bank account details of customer:**

In which bank:_____Whether holds ATM card: ( )YES; ( )NO

**Recommendations:**

Kit type: ( ) Open loop; ( ) Closed loop; ( ) Sequential type (4/6/8 cyl)

Make of Kit: ( ) TA; ( ) SALUSTRI; ( ) VANAZ

Cylinder water capacity: 65 ltrs (indicate 30/50/60/65/75/80)

No. of cylinders:_____ no.

Make of Cylinder: ( ) EKCL; ( ) CMBIHCL; ( ) KIOSHI

Prepared & recommended by:
(Workshop Supervisor)

Authorised by:
(Workshop Manager)

Distribution: 1.Original copy: Mr.Peter, F&A; Copy: Workshop customer file

**NOTE: PLEASE ATTACH COPY OF OWNERSHIP DOCUMENT (VEH. LICENSE)**

***PROMOTE CNG- AN ECONOMICAL, CLEAN & SAFE VEHICULAR FUEL***

Marketer: ( ) Suleiman; ( ) Others

# NIPCO PLC, IBAFO CNG STATION

## PRE-CONVERSION INSPECTION REPORT

| | |
|---|---|
| Format No.: | CNG/WS/001 |
| Rev. No: 0 / Date | 01/01/2015 |

**REMARKS IF ANY:**

| | | | |
|---|---|---|---|
| Date of Inspection | | Whether converted before (Yes/No). **If Yes, do not convert** | |
| Kit Fitment Workshop | | | |
| Vehicle Make | | Model: | |
| Vehicle Registration No. | | Type (Pvt/Taxi) | |
| Owner's Name | | Phone No.: | |

| A. | VEHICLE CONDITION/ STRUCTURAL INTEGRITY | Status Ok | Status Not Ok |
|---|---|---|---|
| 1 | Exterior (Body) | | |
| 2 | Trunk Space (surface) | | |
| 3 | Trunk Space for mounting Cylinder | | |
| 4 | Engine Bay/ compartment space for mounting Regulator and other Kit components | | |
| 5 | Chassis | | |
| 6 | Suspension | | |
| 7 | Exhaust Pipe/ Silencer | | |
| **C** | **ELECTRICAL SYSTEMS** | | |
| 1 | Battery Condition | | |
| 2 | Battery Voltage (to be measured) | V | |
| 3 | Battery Terminals & Wires | | |
| 4 | Spark plug Condition(remove all plugs & check) | | |
| 5 | HT Lead Condition | | |
| 6 | Ignition Coil Condition | | |
| 7 | Overall wiring Condition | | |
| 8 | Ignition Switch Condition | | |

| B. | ENGINE CONDITION | Status Ok | Status Not Ok |
|---|---|---|---|
| 1 | Engine Mounting | | |
| 2 | Overall Condition | | |
| 3 | Inlet Manifold | | |
| 4 | Exhaust Manifold | | |
| 5 | Engine Vibration | | |
| 6 | Idling Speed (RPM) | | |
| 7 | High Speed (RPM) | | |
| 8 | Engine Sound | | |
| 9 | Air Cleaner and its mounting bolt | | |
| 10 | Fuel Injectors | | |
| 11 | Carburetor | | |
| 12 | Carburetor Dimensions (Outer Dia X Collar height in mm) | | |
| **D.** | **DOCUMENTATION VALIDITY** | | |
| 1 | Vehicle License(Valid/Not valid) | | |
| 2 | Vehicle License carries Owner's name (Yes/No) | | |
| 3 | Insurance (Valid/Not Valid) | | |

| E. | ENGINE VARIABLES | |
|---|---|---|
| 1 | No. of Cylinders | |
| 2 | Engine CC | |
| 3 | Fuel Injection System (Carburetor/ MPFI) | |
| 4 | Ignition system-Full Distributor/Half Distributor/Coil (If Coil, indicate Nos.) | |
| 5 | Throttle System (Electronic/Manual) | |
| 6 | TPS Sensor (Yes/No) | |
| 7 | Sensor (MAP/MAF) | |
| 8 | Oxygen Sensor (Yes/No) | |
| 9 | CKP sensor(Yes/No) | |
| 10 | Air Pump/valve (Yes/No) | |
| **G.** | **COMPATIBILITY** | |
| 1 | Intake Manifold- (Steel/Aluminium/Plastic) | |
| 2 | Mixer Availability (Yes/No) | |

OBSERVATIONS:

| | | | |
|---|---|---|---|
| Vehicle is fit for conversion (Yes/No) | | Type of kit Recommended (Open Loop/Closed Loop/Sequential 4cyl/6cyl/8cyl) | |

Repairs to be done by Vehicle owner before submitting the vehicle for conversion(use separate sheet if the list is long):

| | | | | | |
|---|---|---|---|---|---|
| 1 | | 3 | | 5 | |
| 2 | | 4 | | 6 | |

| Inspected by (Workshop Supervisor): | | Verified by (Workshop Manager): | | Accepted by (Vehicle Owner): | |
|---|---|---|---|---|---|
| Name: | | Name: | | Name: | |
| Sign: | | Sign | | Sign | |
| Date: | | Date: | | Date: | |

# GREEN GAS LIMITED

## POST – CONVERSION CHECKLIST

This checklist shall be carried out by the installer before handing over the vehicle to the customer

| Format No.: | CNG/WS/003 |
|---|---|
| Rev. No.: 0 Date | 01/01/2015 |

| | | | | |
|---|---|---|---|---|
| A | **Details of Converted Vehicle** | | | |
| | a) Name and Address of Kit Installer | | | Green Gas Limited, Ibafo CNG Station, Ibafo, Ogun State |
| | b) Make | | | |
| | c) Model | | | |
| | d) Year of Manufacture | | | |
| | e) Registration Number | | | |
| | f) Vehicle Identification Number | | | |
| | g) Engine Number | | | |
| | h) Chassis Number | | | |
| | i) Date of Conversion | | | |
| | j) Mileage on Date of Conversion | | | |
| | k) Name of the Owner/ Contact Number | | | |
| | l) Type of Operation | | | Bi-fuel |
| B | **Details of CNG System** | | | |
| | 1 | **CNG Cylinder** | | |
| | | 1.1 | Validity of hydro test certificate | |
| | | 1.2 | Check for any corrosion on cylinder | |
| | | 1.3 | Check mounting points free from corrosion and fractures | |
| | | 1.4 | Ensure cylinder is securely mounted within the vehicle and check tightness of nuts and bolts | |
| | | 1.5 | Ensure round washer/ square plate of thickness not less than 2.5mm and of area not less than 3600 sqmm is used for reinforcing the vehicle steel sheet metal where the cylinder / cylinder bracket is anchored | |
| | | 1.6 | Ensure anchorage bolt or studs shall be not less than 10mm diameter and shall have strength grade class 8.8 as per ISO 4014 | |
| | | 1.7 | Ensure clamping bands are of minimum 30mm wide and thickness of 3mm minimum (applicable for cylinder up to 100 ltrs. water capacity) | |
| | | 1.8 | Ensure non-moisture retaining hard rubber or equivalent material is provided on the inner side of the clamping bands to prevent possibility of external corrosion of cylinder | |
| | | 1.9 | Ensure minimum 5mm clearance is kept between cylinder and vehicle body structure | |
| | | 1.10 | Ensure distance between cylinder valve and vehicle body extremities shall not be less than 200mm | |
| | 2 | **Cylinder Valve** | | |
| | | 2.1 | Check for any physical damage to valve | |
| | | 2.2 | Check for correct operation of valve | |
| | | 2.3 | Ensure burst disc is fitted | |
| | | 2.4 | Check leakage using non corrosive foaming agent or methane leak detector | |
| | 3 | **Ventilation Bag** | | |
| | | 3.1 | Ensure installation of ventilation bag is gas tight | |
| | | 3.2 | Ensure ease of operation of cylinder valve | |
| | 4 | **Refilling Valve** | | |
| | | 4.1 | Ensure refilling valve is securely mounted | |
| | | 4.2 | Check for dust protection cap | |
| | | 4.3 | Check leakage using non corrosive foaming agent or methane leak detector | |

# GREEN GAS LIMITED

## POST – CONVERSION CHECKLIST

| | | | | |
|---|---|---|---|---|
| | **5** | **Fuel line** | | |
| | | 5.1 | Check for any damage and corrosion on CNG fuel line | |
| | | 5.2 | Ensure fuel line is securely mounted | |
| | | 5.3 | Ensure fuel line is clamped by clips spaced not more than 600mm apart | |
| | | 5.4 | Ensure distance between fuel line and exhaust heat source shall not be less than 75mm | |
| | | 5.5 | Check for deformation of 'U' and Pigtail bends provided in high pressure piping for flexibility | |
| | | 5.6 | Ensure fuel line is protected and shielded where necessary | |
| | | 5.7 | Check leakage using non corrosive foaming agent or methane leak detector | |
| | **6** | **Shut off valve (Solenoid Valve) wherever separately provided** | | |
| | | 6.1 | Ensure shut off valve is securely mounted | |
| | | 6.2 | Check operation for "Close & Open" as required | |
| | | 6.3 | Check leakage using non corrosive foaming agent or methane leak detector | |
| | **7** | **Pressure Gauge with Sensor** | | |
| | | 7.1 | Ensure CNG pressure gauge is securely mounted | |
| | | 7.2 | Check leakage using non-corrosive foaming agent or methane leak detector | |
| | **8** | **Petrol Solenoid Valve with By-pass Device** | | |
| | | 8.1 | Ensure petrol solenoid valve is securely mounted | |
| | | 8.2 | Check for correct operation | |
| | | 8.3 | Check petrol hose for any cracks | |
| | | 8.4 | Ensure sufficient flexibility for engine movement | |
| | | 8.5 | Ensure hose joints are leak free | |
| | **9** | **Gas-Air Mixer** | | |
| | | 9.1 | Ensure gas-air mixer is securely mounted | |
| | | 9.2 | Ensure back-fire deflector where applicable | |
| | **10** | **Regulator** | | |
| | | 10.1 | Ensure regulator is securely mounted | |
| | | 10.2 | Ensure mounting is as close to the engine carburetor position as convenient | |
| | | 10.3 | Ensure minimum distance of 150mm from exhaust system. Where this distance is less than 150mm, ensure shield is provided for protection from radiant heat and any impingement from exhaust gases due to exhaust system failure | |
| | | 10.4 | Ensure no gas by-pass after engine has stopped | |
| | | 10.5 | Check leakage using non-corrosive foaming agent or methane leak detector | |
| | **11** | **Fuel Selector Switch** | | |
| | | 11.1 | Ensure fuel selection switch is securely mounted on the dashboard | |
| | | 11.2 | Ensure the location is convenient for the driver to operate with ease | |
| | | 11.3 | Ensure connections are properly done as per recommended connection diagram | |
| | | 11.4 | Ensure fuel gauge (LED lights) is calibrated for various levels / pressure of CNG in the cylinder | |

# GREEN GAS LIMITED

## POST – CONVERSION CHECKLIST

| | | | |
|---|---|---|---|
| **12** | **Electronic Control Unit (for Fuel Injection Vehicles)** | | |
| | 12.1 | Ensure the Electronic Control module is securely mounted | |
| | 12.2 | Ensure the mounting is in vertical position with cable facing down to avoid entry of water | |
| | 12.3 | Ensure the cables and module is away from heat source (radiation, exhaust manifold e.t.c) and high voltage cables, ignition coil, spark plugs, distributor e.t.c. | |
| | 12.4 | Ensure connections are properly done as per recommended connection diagram | |
| | 12.5 | Ensure the pin connectors of wiring harnesses (signal harness & Injector harness) are connected to respective devices/sensors as per recommended connection diagram. | |
| | 12.6 | Ensure the gas injectors are located away from heat source | |
| | 12.7 | Ensure correct gas flow direction of filter | |
| | 12.8 | Ensure the length of hoses between gas injectors and the manifold is not more than 250mm | |
| **13** | **Timing Advance Processor** | | |
| | 13.1 | Ensure Timing Advance Processor (TAP) is securely mounted | |
| | 13.2 | Ensure the mounting is in vertical position with cables facing down to avoid entry of water | |
| | 13.3 | Ensure TAP is away from heat source (radiation, exhaust manifold e.t.c) | |
| | 13.4 | Ensure cables and module of TAP is away from high voltage cables, ignition coil, spark plugs, distributor e.t.c. | |
| | 13.5 | Ensure connections (positive & negative) are properly done as per recommended connection diagram | |
| **14** | **XLP Control unit(for vehicles fitted with closed loop system )** | | |
| | 14.1 | Ensure XLP control unit is securely mounted | |
| | 14.2 | Ensure the mounting is in vertical position with cables facing down to avoid entry of water | |
| | 14.3 | Ensure XLP control unit is away from heat sources (radiation, exhaust manifold e.t.c.) and high voltage cables, ignition coils, spark plugs, distributor e.t.c. | |
| | 14.4 | Ensure connections are properly done as per recommended connection diagram | |
| | 14.5 | Ensure the pin connectors of wiring harness are connected to respective devices/ sensors as per recommended connection diagram | |
| **15** | **Electrical Wiring** | | |
| | 15.1 | Ensure current limiting device (fuse) is fitted | |
| | 15.2 | Ensure all electrical connections are secure | |
| | 15.3 | Ensure terminals are insulated to prevent shorting | |
| | 15.4 | Ensure wiring is properly installed, taped, clipped and contained in a loom along its length | |
| **16** | **Compliance Plate** | | |
| | 16.1 | Ensure compliance plate is securely installed near the refilling valve and carries correct markings of the following parameters: | |
| | 16.2 | Date of conversion | |
| | 16.3 | Name of CNG workshop | |
| | 16.4 | Vehicle number | |
| | 16.5 | Kit serial number and make | |
| | 16.6 | Cylinder serial number and make | |
| | 16.7 | Water capacity (Ltr) | |
| | 16.8 | Maximum filling pressure (200kg/cm$^2$) | |
| | 16.9 | Date of last test | |
| | 16.10 | Next test date | |

# GREEN GAS LIMITED

## POST – CONVERSION CHECKLIST

| | | | |
|---|---|---|---|
| | **17** | **Identification Label in Front and Rear as per Approved Design** | |
| | | 17.1 Ensure identification label is pasted on the front and rear of the vehicle for proper visibility from front & rear sides | |
| | **18** | **Performance Test** | |
| | | 18.1 Ensure engine idle RPM is correct | |
| | | 18.2 Ensure vehicle pick-up is correct and not sluggish | |
| | | 18.3 Ensure engine power is good at high RPM | |
| | | 18.4 Ensure exhaust emission parameters are within acceptable limits in idling condition (CO, HC and NOx) | |
| | **19** | **Documentation** | |
| | | 19.1 Ensure installation certificate is duly signed by vehicle owner and by witnessee | |
| | | 19.2 Ensure the following set of documents are given to vehicle owner after successful CNG conversion | |
| | | - Installation certificate | |
| | | - Cylinder hydrotest certificate | |
| | | - CNG owner's manual | |
| | | 19.3 Ensure photocopy of the following vehicle / owner documents are kept in record: | |
| | | - Vehicle Licence | |
| | | - Insurance Certificate | |
| | | - Vehicle Owner's driving licence | |
| | | - Vehicle Owner's National I.D card (if available) | |
| | **20** | **Counseling/Operation Assistance** | |
| | | 20.1 Ensure vehicle owner/driver is well informed on safe operating procedures of vehicle in CNG/petrol mode; maintenance instructions; safety awareness and precautions to be taken while servicing/repairing the vehicle | |

Checked by:

Name:_____

Date:_____

Sign:_____

Verified by:

Name:_____

Date:_____

Sign:_____