

January 2008

*Fuelling a greener future*

Prepared by



**Indian  
Auto LPG  
COALITION**  
*Fuelling a greener future*

*Booklet  
On  
Safe Practices / Check List  
for LPG Operated Vehicles*

in co-ordination with

**ARAI**  
Progress through Research

# India's No.1 Gas Conversion Kit - ACE Lpg CAR KITS



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- All India " Sales & Service " network.



## ACE Lpg CAR KITS PVT. Ltd.

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...they have a right for it  
and it is our responsibility



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Warming up to all the action with more than 400 stations in the country now and Auto LPG being available in more than 150 cities already, more and more vehicle owners are converting to this Economical and Environment Friendly Fuel, paving way for India to become one of the largest Auto LPG markets in the world in the next few years.

Low costs of infrastructure and conversion, easy availability, versatility of use and of course, an impeccable safety record make Auto LPG the only viable, un-adulterable and environment friendly alternative auto fuel in India.



# Indian Auto LPG COALITION

*Fuelling a greener future*

IAC, a member of "Central Motor Vehicle Rules - Technical Standing Committee" (CMVR-TSC) & "Standing Committee on Emission Legislation" (SCOE), Government of India, is widely recognized as the nodal body for the Auto LPG Industry in India with practically all major stakeholders on board. IAC membership base is expanding rapidly and we now have the Oil Sector PSUs, Private LPG Marketers, Kit Suppliers, Equipment Manufacturers and Turnkey Installers as members, in addition to a very proactive support of World LPG Gas Association, USAID, ARAI and SIAM.

We have been actively organizing Seminars, Workshops and various activities for state RTO's like that for Maharashtra, Karnataka, participating at various International forums like World LPG association activities in France, USA, China & South Africa and initiating very meaningful interactions with the leading OEs.

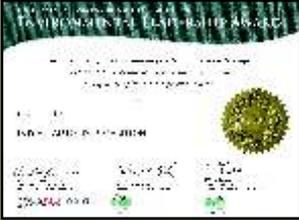
Please visit our comprehensive website at [www.iac.org.in](http://www.iac.org.in) for more details.

## Mission

*Promote LPG in an integrated manner, as an alternate, gaseous, environment friendly fuel by involving all stakeholders to bring a cost effective & safe auto fuel to Indian consumers, using the best global practices*

**Economy** of a diesel vehicle, **Emissions** of a CNG engine and **Performance** of a petrol engine

# EVENTS



ENVIRONMENTAL LEADERSHIP AWARD



IAC organized Seminar on Inspection and Safety in Mumbai on Sep 12, 2006



IAC organized Workshop at ARAI Pune in 2006



(Standing left to right, Mr. Curtis Donatson (President, CleanFUEL USA), Mr. David Garman (Assistant Secretary, US Department of Energy), Mr. John Joseph (President, IAC and VP Reliance Industries) and Mr. Suyash Gupta (General Secretary, IAC and Director, CleanFUEL India)



IAC President, Mr. John Joseph and Vice President, Mr. Sunil Mathur attended the WLPG's GAIN Council meeting in Nice, France in May 2007. Mr. John addressed the gathering. The car in the photograph was driven down Nice from Paris, 800 kms away, all the way on ALPG, in 9 hours.



IOC Chairman Mr Sarthak Behuria (third from left) at IAC's booth in World LPG Forum at Shanghai. Standing to his left is Mr Minal Roy (GM-LPG) IOC.



Front row, left to right, Mr Shinde (Transport Commissioner Maharashtra), Mr J Joseph (IAC), Mr Desai (Reliance), Mr K Bala Krishnan (USAID), Mr KK Gandhi (CSAM), Mr M K Chaudhari ( ARAI). Standing left to right: Suyash Gupta (CleanFUEL), Ms Maria Reidpath (NETL) and Emobility International rep



Complete Indian delegation with US Department of Energy team at Clean Cities International conference in Palm Springs, California, in May 2005



BPLC Director Marketing Mr S Radhakrishnan (third from left) at IAC's booth in World LPG Forum at Shanghai. Standing to his right is Mr R K Singh (ED-LPG) BPLC.



IAC organized LPG Kit Safety Check up camp at IOC LPG Station in New Delhi on Sep. 10, 2006.



Mr Pramod Nairga, Director, Ministry of Petroleum and Natural Gas (second from left), with Mr S V Saini (ED-LPG), Hindustan Petroleum Corporation Ltd at IAC booth in Shanghai.



IAC Organized Seminar on Inspection & Safety in Aurangabad on July 28, 2007



IAC Delegation with General Motors India VP Mr. Ankush Arora



**IAC**  
**Indian**  
**Auto LPG**  
**COALITION**  
*Fuelling a greener future*



IAC Runners with Reliance President P. Raghavendran Participating in Mumbai Marathon 2007

# EVENTS



Fourth All Stakeholder meet at Mumbai in September 2006



IAC Delegation with Ford India President Mr. Arvind Matthew (4<sup>th</sup> from left)



Shri S. K. Dash - Joint Secretary, Ministry of Road Transport & Highways, Inaugurating the seminar by lighting a lamp



Shri S.K. Dash releasing IAC's Inaugural Newsletter



Shri P.C. Katania (J. CCOE) addressing the delegates



Shri P. Raghvenderan - President - Reliance Ind Ltd. (Refinery Business) delivering the key note address



Shri S.K. Hazra - Managing Director AEGIS Logistics Limited chairing the session on Infrastructure



Shri Balraj Bhanot - (Former Chairman CMVR Technical Committee) chairing the session on Retrofits



More than 75 Delegates participated in the Conference



Ms Anumita Roy Chowdhury with Mr S R Marathe (Director-ARAI) and Mr M K Chaudhri (Sr Dy Director-ARAI)



IAC Delegation at Auto Expo 2008



IAC Contingent at Mumbai Marathon 2008



**Indian  
Auto LPG  
COALITION**  
*Facilitating a greener future*



Dear Users of Auto LPG:

AutoLPG (ALPG) is a fuel that has become very popular amongst the three and four wheeler users in the country. The attraction to use ALPG is not only its cost savings but also because it is a safe, clean, easily-available and environmentally friendly alternate fuel.

Indian Auto LPG Coalition (IAC) had been formed to take the Auto LPG regime forward in our country by observing international practices in the safe handling and usage of the product. IAC was formed out of various stake holders such as Oil Cos., Retro-fitters, LPG marketers/importers, Govt. bodies such as Transport Depts., ARAI, and others.

This popular ALPG fuel is now available across the country in over 400 dispensing stations and more and more stations are rapidly being put up by public sector oil companies such as IOC, BPCL & HPCL and also private players like Reliance, Vanaz, AEGIS, ELF, Gas Energy and so on. Simultaneously, Auto manufacturers (OEMs) are working on adding more ALPG variants of vehicles. Also, leading authorized retro-fitters are setting up conversion facilities in the various cities and towns of the country.

As most of the cars today on the roads running on ALPG are retrofitted, it is most important that ALPG consumers and also Transport Dept. officials know the various aspects with regard to safe fitment and usage of this new alternate fuel in the vehicles. This booklet, therefore, has been produced to serve as a ready reckoner, detailing all the fitment and usage aspects connected with ALPG. I trust that you would find the same useful.

If you have any suggestions, please feel free to log in to our website <http://www.iac.org.in> and give the same.

Wishing you happy motoring with ALPG.

John Joseph  
President (IAC)



S. D. SHINDE, I.A.S.  
TRANSPORT COMMISSIONER



**TRANSPORT COMMISSIONER'S OFFICE**

Administrative Building, 3rd & 4h Floor,  
Near Dr. Ambedkar Udyan,  
Government Colony, Bandra (East),  
Mumbai 400 051  
Tel. : 6516336

**PREFACE**

Today we live in modern Era of Civil Society where individual Rights particularly the Right to Life are of immense importance. The present civilization is facing many Problems as threatening of life of flora and fauna. The reason is pollution: particularly vehicular pollution is one of them .The awareness about this problem and an action regarding controlling pollution on global level started after the Earth Summit in 1992. Search for alternate fuels which emit less amount of Green House Gases, was one of the controllable measure adopted. In India and particularly Maharashtra, it started with Hon`ble Mumbai High Court's Order under Writ Petition No. 1762/99.The High Court gave order for phasing out old vehicles and conversion of vehicles to environment friendly fuels like Compressed Natural Gas and Liquefied Petroleum Gas.

Maintaining a high safety standard during conversion to alternate green fuel is difficult Task on the part of Auto Industries and Motor Vehicles Department, as it requires adoption of new technology. While registering the LPG operated motor vehicle, precautions are to be taken as the LPG is inflammable and is heavier than air.

The Transport Commissioner's Office has taken a leading step in 2001 by formulating the guidelines for Retrofitment Centers and started conducting Training Programs for the officers of the department and retrofitthers.I appreciate the timely response given by Indian Auto LPG Coalition for bringing out such informative handbook for field officers working in Motor Vehicles Department in Maharashtra.

“Ready Reckoner Booklet for Safe Practices” is to be followed by Motor Vehicles Department officers before registration of LPG operated vehicles. This publication is a good endeavor by the Automotive Research Association of India which will help the Registration authorities in applying checks while registering LPG operated vehicles ensuring safety of the society as a whole.

At the end I express my gratitude to Shri John Joseph, President of Indian auto LPG Coalition for bringing about this Booklet for the use of Motor Vehicles Department.

(S. D. SHINDE)  
Transport Commissioner,  
Maharashtra State, Mumbai.

ಎಂ.ಸಿ. ನಾರಾಯಣ ಗೌಡ, ಭಾ.ಪೋ.ವೆ  
ಪಾರಿಗ ಅಯುಕ್ತರು  
M.C. NARAYANA GOWDA, I.P.S  
Commissioner for Transport



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5ನೇ ಮಹಡಿ, ಬಹು ಮಹಡಿಗಳ ಕಟ್ಟಡ  
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**Date: 13-04-2007**

### **FOREWORD**

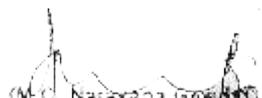
I am glad to understand that IAC is doing a commendable work by means of proactively working with the transport authorities in promoting safety and inspection in the field of auto LPG.

The training programmes for RTOs conducted in Bangalore and Mumbai is a good beginning.

The booklet being published on auto LPG will be useful for everyone involved in the field.

I wish all the best IAC in its noble endeavor to help the country to reduce pollution.



  
(M.C. Narayana Gowda)  
Commissioner for Transport

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- 1.4.0 General instructions for motorists

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- 2.0.0 Auto LPG conversion kit
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- 2.2.0 LPG delivery system
- 2.3.0 LPG control system

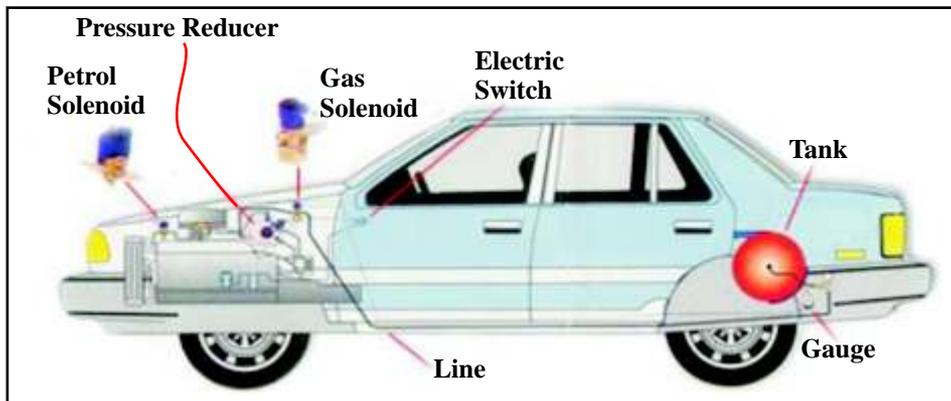
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- 2. Form of Submission
- 3. Slip of endorsement in RC Book.

## SECTION – 1: USE OF LPG IN AUTOMOBILES



### 1.1.0 LPG: GENERAL CHARACTERISTICS

- 1.1.1 LPG is termed as Liquefied Petroleum Gas and is mixture of commercial Propane and Butane . At ambient temperature and atmospheric pressure it is a gaseous substance and can be condensed to liquid state by application of moderate pressure. It is normally stored as liquid under pressure in specially constructed tanks or cylinders. In the liquid state, it is a colourless watery fluid.
- 1.1.2 Density – Vapour LPG is 1.8 to 2 times heavier than air. In case of leakages, it settles down at ground level and does not get easily dissipated in air. In contrast, liquid LPG is lighter than water and floats on the surface of water. Liquid density is approximately 0.54 to 0.56 at 15 deg. C.
- 1.1.3 Vapour Pressure – The pressure inside the tank or cylinder is called the vapour pressure at the observed temperature. As per BIS specification of auto LPG, it may vary from 5.2 to 10.50 kg / sq. cm. at 40 deg.C. Hence the tanks are specially designed under SMPV ( U ) Rules to withstand the internal pressure.

- 1.1.4 Flammability and Explosive Limit – LPG has an explosive limit of 1.8% to 9.5% by volume in air. This means LPG will form an explosive mixture in this range in air and will burn with explosion if ignited. However, auto ignition temperature of LPG is higher than that of petrol or diesel ( about 500 deg.C compared to 325 °C & 350 °C respectively ) and hence it will not ignite on its own at normal temperature.
- 1.1.5 Calorific Value- LPG has heating value of 10,900 Kcal / kg which is almost comparable to Petrol.
- 1.1.6 Volatility – Liquid LPG is highly volatile and expands about 250 times its volume in air. Therefore leakage of LPG should be prevented before it creates a great risk.
- 1.1.7 Cubical expansion – Liquid LPG expands with temperature rise at a higher proportion than petrol. This is why the LPG tanks should never be filled more than 80% of its volume.
- 1.1.8 Odour - LPG does not have any smell of its own. But it is artificially odourised for safety reasons by adding a small amount of ethyl mercaptan so as to detect any leakage of escaping gas.
- 1.1.9 Colour – LPG is colourless both in liquid and gaseous form . In case of leakage, the vaporization of liquid cools the atmosphere and condenses surrounding water vapour to form a whitish fog and make it possible to see an escaping gas.
- 1.1.10 Viscosity- LPG has low viscosity of around 0.3 CS @45 deg C and can leak when other petroleum products normally do not, thus demanding a very high integrity in the pressurized system to avoid leakage.
- 1.1.11 LPG melts substances such as grease, oils and paints. It causes swellings in natural rubber. This is why synthetic rubber is used for the hose manufacturing.
- 1.1.12 Owing to its rapid vaporization and consequent lowering of temperature, liquid LPG can cause severe frost burns if brought in contact with the skin. Protective clothing such as gloves and goggles should be worn if exposure to this hazard is likely to occur.
- 1.1.13 Like most light hydrocarbon vapours, LPG vapour is also slightly anaesthetic and also cause suffocation if present in sufficiently high concentrations.

## 1.2.0 WHY AUTO LPG?

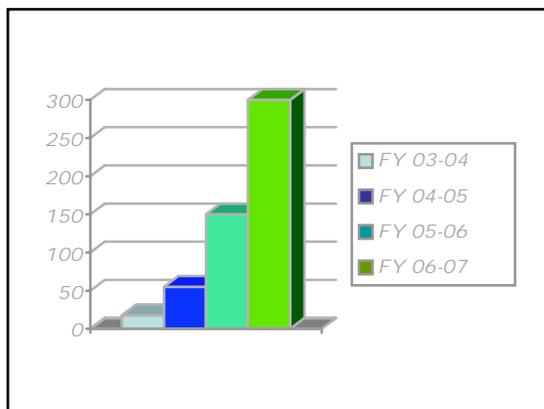
Use of LPG as automotive fuel is an age-old practice in various countries. Over 10 million MT/ year of LPG is used as auto fuel in the world to-day. The technology of conversion kit is proven and has been constantly upgraded with the improvement in vehicle design in terms of fuel efficiency and emission standards. In India, LPG has been officially recognized as an auto fuel in 2002 after amendment of all relevant Acts / Rules at Central and State levels. Since then it has picked up great momentum and with the enthusiasm by some of the State Governments in reducing pollution in cities and industrial towns, motorists have chosen ALPG as a friendly fuel. Auto LPG conversion in the existing vehicles is not only being done by the retro-fitters, the OEMs have also come up with factory-fitted vehicles. This has become possible due its inherent advantage in abetting environmental pollution, fuel economy and customers' preference.

### 1.2.1 ADVANTAGES:

- ALPG is most economical fuel for petrol vehicles. At today's price, the running cost is almost half of petrol.
- Auto LPG meets BIS standard IS : 14861 which has Octane Number of 88 (minimum).
- ALPG fitment in vehicles is safer than petrol system.
- Smooth running and easy drivability.
- Less pollution.
- Easy availability in major cities and towns.

To sum up, ALPG is equivalent to CNG in emission characteristics and offers petrol comfort with greater economy. ALPG is set to become the future fuel of the country.

### Industry ALPG volumes (000'KL)



### 1.3.0 WHY SHOULD WE NOT USE REMOVABLE LPG CYLINDERS IN VEHICLES

- As per CMVR 115 C only fixed Auto LPG Tank with its safety gadgets approved by CCOE are allowed in motor vehicles.
- Use of cylinders other than approved ALPG fixed tank is highly unsafe and prohibited under law.
- Auto LPG tank shall neither be replaced by domestic / commercial / industrial LPG cylinder nor cylinders containing any other gases.

### 1.4.0 GENERAL INSTRUCTIONS FOR MOTORISTS

- 1.4.1 LPG being highly inflammable, any hot work (welding / gas cutting / brazing etc.) on the body or other parts of LPG driven vehicle should be done by trained staff at authorized work shop.
- 1.4.2 Repair of LPG tank is not permitted under any circumstances. However repair / maintenance of Auto LPG system and its components should be carried out at authorized workshops. Ideally, repairs should be done by the same Retrofitter who has originally fitted ALPG system to the vehicle.
- 1.4.3 Auto LPG tank and the piping system should be checked regularly for any leakage.
- 1.4.4 In case of serious leakage of LPG system, cut off LPG supply and park the car in open area away from ignition sources. Move all the people from the vehicle to a safe distance in an upward wind direction and seek assistance of nearest authorized Installer / workshop.
- 1.4.5 Do not use domestic or any other moveable LPG cylinder as auto fuel as it is prohibited under law and is highly unsafe.
- 1.4.6 Auto LPG re-fuelling to the vehicle tank should be done only at the authorized ALPG Stations through the dispensing nozzle. Do not fill domestic LPG or any other gas in ALPG tank.
- 1.4.7 After refueling LPG, please ensure that the dust plug is inserted back on the filler valve.
- 1.4.8 It is recommended to run the vehicle 5-7 kilo meters in petrol mode after every 100-150 kms run in LPG mode, to keep the petrol system in good condition.
- 1.4.9 For carburetor engine, it is a good practice to put the selector switch in neutral position for a while before switching over to LPG. Switching over directly from petrol mode to LPG may lead to engine stalling or backfire due to mixing of both fuels.
- 1.4.10 Never tamper with any of the components in the LPG system.
- 1.4.11 Any other safety recommendation by vehicle / kit manufacturer may be followed.

## SECTION – 2

### ALPG CONVERSION KIT , ITS COMPONENTS AND FUNCTIONS

#### 2.0.0 ALPG CONVERSION KIT

ALPG conversion kit is a complete system assembly for converting a vehicle to run on LPG on bi- fuel mode. It has mainly three parts –

- ( A ) ALPG tank with its accessories fixed in the boot of the car. For 3- wheeler vehicles, the auto LPG tank is installed under the driver's seat.
- ( B ) LPG delivery System through Vapouriser–Regulator and Venturi Mixer.
- ( C ) LPG Control mechanism – Closed loop system (ECU, Stepper motor/ Injector(s), Emulator & oxygen sensor etc) or open loop system (manual power screw without any feed back mechanism)

#### 2.1.0 AUTO LPG TANK (ALT) AND ACCESSORIES :



Auto LPG tank is a metallic cylinder or a container of suitable capacity for filling LPG to be used as fuel for Spark Ignition ( S.I ) motor vehicles. The tank may be of cylindrical or donut shape to fit in the vehicle space and fixed rigidly to form an integral part of the vehicle. The tank

shall be approved by Chief Controller of Explosives under Gas Cylinders Rules 1981 and meet the requirements as per I S: 14899 (as amended from time to time).

Unlike normal LPG cylinder, each auto LPG tank is fitted with a Multi- Function Valve for protection of the vehicle system and safety of the passenger and surroundings. It is an assembly for mounting on auto LPG tank for filling and withdrawal of LPG along with safety devices including:

- i. Automatic fill limiter
- ii. Service valve
- iii. Excess flow check valve

- iv. Pressure Relief Valve
- v. Fusible Plug
- vi. Content Gauge
- vii. Non-Return Valve on fill connector

Multi Function Valve Assembly shall conform to latest Indian Standard (amended from time to time) and approved by Chief Controller of Explosives (CCOE).

- 2.1.1 **AUTOMATIC FILL LIMITER:** a provision in the filling system of the Auto LPG Tank, which automatically terminates filling when the liquid level in the Auto LPG Tank has reached 80% of its volumetric capacity.
- 2.1.2 **SERVICE VALVE:** a manually operated or remotely controlled shut-off valve fitted on the Auto LPG Tank which can open or shut off the LPG supply.
- 2.1.3 **EXCESS FLOW CHECK VALVE:** a valve fitted on LPG outlet line which closes automatically when a predetermined flow limit is exceeded by the pressure drop. This is to safeguard against accidental rupture of LPG line from the tank to the engine.
- 2.1.4 **PRESSURE RELIEF VALVE:** an automatic pressure relieving device, communicating directly with the vapour space of the tank and pops off if the tank pressure exceeds 22 kg / sq.cm. This is a safety valve to maintain internal fluid pressure in the tank.
- 2.1.5 **FUSIBLE PLUG:** a device which melts at 110 - 120 deg C and allows the product to vent out. It prevents the auto LPG tank from over – pressurization in the event of fire.
- 2.1.6 **CONTENT GAUGE:** gives visual indication of the level or quantity of the LPG contained in Auto LPG Tank.
- 2.1.7 **NON-RETURN VALVE:** fitted on the LPG filling line which permits fuel to flow in one direction only.

Multi Valve Assembly on the ALPG tank is fitted in a gas-tight chamber. It is connected with a vent pipe which is led to the outside of the vehicle and away from the vehicle exhaust. In case of any leakage of gas from valve or popping off of safety relief valve, LPG cannot enter the passenger space. It will be safely vented out.

## 2.2.0 LPG DELIVERY SYSTEM :

### 2.2.1 VAPOURISER – REGULATOR



Vaporizer / Regulator is connected to the radiator water circulating system. Liquid LPG from the tank is vaporized by the hot water from radiator and the regulator maintains the output pressure and flow as required by the engine.

### 2.2.2 VENTURI MIXER

The function of Venturi Mixer is to mix LPG vapour with incoming air in correct proportion and supply to the engine cylinder.



### 2.2.3 AUTOMATIC FUEL SHUT-OFF VALVE:



A solenoid valve for shutting off the supply of LPG from the tank when ignition switch is put off.

### 2.2.4 SELECTOR SWITCH :

For switching over from petrol to LPG mode or vice versa. It is located on the dash board.



### 2.3.0 LPG CONTROL SYSTEM:

LPG control systems are of 2 types,- Open-Loop System and Closed-Loop System.

Open-loop is the simplest form of conversion and does not need accurate control. In this system LPG-air mixture is drawn by the vacuum signal before it enters the cylinders.



#### 2.3.1 EMULATOR :

is a buffer to absorb the signals of petrol injection when the car is running on LPG mode in a MFI engine. It works as a dummy between petrol and LPG.



#### 2.3.2 STEPPER MOTOR :

It regulates the flow of LPG in the injection system in MPFI engines based on signals from ECU or Lambda Control. It has 216 steps and regulates the fuel flow accurately.

#### 2.3.3 ECU or LAMBDA CONTROL :

It measures the oxygen content in the exhaust stream and send signals to Stepper Motor to control LPG flow.

ECU and Stepper Motor are essential components of closed - loop system. The LPG conversion kit needs to be duly tested and approved by one of Testing Agencies mentioned in Central Motor Vehicles Rules 126 in a bi-fuel mode of LPG / petrol or dedicated mode of LPG.



## SECTION – 3

### **CHECKLIST FOR INSPECTION OF LPG VEHICLES (NEW AND IN-USE) (OTHER THAN LPG BUSES) BEFORE REGISTRATION BY REGISTERING AUTHORITY**

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This checklist is for inspection of LPG vehicles (other than LPG Buses) i.e. three and four wheeler etc before registration by RTOs. Reference to relevant clauses of Safety Code of Practice, e.g. A IS 026/AIS 027 as the case may be, and guidelines issued by Central Government from time to time should be made wherever appropriate.

#### **3.1.0 Details of LPG Vehicle**

##### **3.1.1 OE Vehicle manufacturer / Supplier.**

- a. Name and address
- b. Name and address of Retrofitter.

##### **3.1.2 Name of type approval agency**

ARAI / IIP / VRDE/ test agency  
approved by Central Govt.from  
time to time

##### **3.1.3 Type approval**

- a. Reference number of type approval certificate
- b. Validity of certificate

##### **3.1.4 Chassis and engine No.**

- a. Original as per RCTC  
or
- b. New in case replacement of engine

##### **3.1.5 Vehicle details**

- a. Registration No:(if applicable)
- b. Vehicle type , make & model
- c. Year of manufacture of Vehicle
- d. Month & year of conversion

### 3.2.0 Detail of LPG System

Checking Auto LPG Tank (s)(ALT) as per CCOE / Vehicle Testing Agency approvals ( ARAI / IIP / VRDE )

- a. Make of ALPG tank
- b. Capacity, lit
- c. Type approval certificate
- d. Hydro-test of tank

### 3.2.1 Tank Installation

#### Safety checks

- a. Check for corrosion on any LPG components / mountings of gas circuit
- b. Check whether ALT is securely mounted within the vehicle and check tightness of nuts and bolts
- c. Check whether minimum 5 mm clearance is kept between ALT and vehicle body structure.
- d. Distance between ALT valve and vehicle body extremities shall not be less than 200 mm unless valves are protected  
(as per the details provided by the kit/vehicle manufacturer/kit supplier and duly vetted and approved by test agencies ) to minimize the possibility of damage due to collision, overturning/ other accident.
- e. Check whether ALT is correctly oriented ( using angle finder if required) as specified in type approval certificate for base model (i.e. 0° / 30° / 90° etc w.r.t. horizontal plane)
- f. In case the model being inspected is other than the base model for which the type approval has been given and is covered by the flexibility clause of +/- 25%, check if it has got the layout approval or change of orientation, if any.



- g. Check for reinforcement if ALT is mounted on floor of the vehicle (minimum dimension of reinforcement thickness & surface area shall not be less than 2.5 mm & 3600 mm<sup>2</sup> respectively).
- h. Check for packing (as approved by test agency) provided for inner side of the ALT mounting band(s).

Notes:

*Rubber packing if found damaged during inspection it should be replaced by the new material having revised specification*



### 3.2.2 Multi –function Valve

- a. Check specific type & model approved by Vehicle Testing Agency for the vehicle under inspection.
- b. Check for operation of solenoid valve
- c. Check for physical damage / distortion to valves (visual inspection)
- d. Check for the vent pipe outlet routing away from exhaust in case of ALT fitting in the enclosed compartment.



### 3.2.3 Refilling Valve

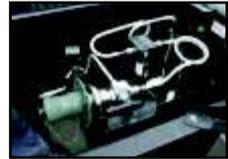
**Safety checks –**

- a. Check the position as per layout.
- b. Check for dust cap to be present



### 3.2.4 Fuel Line Safety checks-

- a. Check for corrosion, deformation and damage on LPG fuel line .
- b. In case of PVC sleeved fuel line , corrosion shall be inspected at the ends, wherever it is exposed. Also inspect for any damage to the sleeving. Sleeve should be firmly gripped to the LPG fuel line.
- c. Check whether fuel line is securely mounted.
- d. Check for U and Pigtail bends provided in high pressure piping for flexibility as per approved layout.
- e. Check whether effective protection is provided ,as per approved lay-out, to prevent the possibility of damage due to loose objects from road.
- f. Distance between fuel line and exhaust pipe / shield shall not be less than 75 mm and the fuel line should also be properly clamped and routed so as not to touch the engine block.
- g. Check the distance between any two clips which shall not be more than 600mm (500mm incase of 3 wheeler respectively).



### 3.2.5 Shut Off Valve (Solenoid Valve(s)) wherever separately provided Safety checks

Check operation for "Close & Open(electrical activation)" as required



### 3.2.6 Regulator

#### Safety checks

- a. Verify the following as per type approval specification
  - Make
  - Type(if applicable)
  - Identification No
- b. Check whether regulator is securely mounted
- c. Distance between regulator & exhaust should be more than 100mm.



### 3.2.7 Gas-Air Mixer

#### Safety checks

- a. Verify the following as per type approval specification
  - Make
  - Type(if applicable)
  - Identification No
- b. Check whether gas-air mixer is securely mounted



### 3.2.8 Electrical Wiring

#### Safety checks for OE & in-use vehicles -

- a. Check whether that current limiting device (fuse) is fitted as per manufacturer specifications and make .
- b. Terminals are insulated to prevent shorting.
- c. Wiring are taped and clipped with loom & mounted securely.
- d. Battery shall be securely mounted and battery terminal shall be locked properly by means of suitable nut & bolt with washers.
- e. Check installation of battery cut-off switch as per vehicle / chassis manufacturer's recommendations (if applicable). Location of Battery cut-off switch should be within the reach of driver in seating posture in driving seat.
- f. Check routing of high tension cable to avoid accidental earthing and to be placed away from any heat source – as per Vehicle / chassis manufacturer's recommendations / layout or as approved by Test Agency.
- g. Check for proper make of high tension cable connected to Spark Plug as per Vehicle/chassis manufacturer's recommendation. Check for tight fitment of its terminal to the spark-plug.



**3.2.9 Automatic fill limiter(AFL):**

- a. Check operation of AFL for maximum 80% filling of LPG( if required)

Note: This test is to be performed randomly on vehicle to inspect at dispensing station. This will ensure effectiveness of safety



**3.2.10 LPG Filter: (wherever separately provided)**

- a. Check whether LPG filter is securely mounted

**3.2.11 Compliance Plate:**

Installation Check

Check for following

- a. ALT identification No.
- b. Date of last testing and the name of certifying agency
- c. Water capacity (ltr)
- d. Next due date of testing
- e. Water capacity (ltr) of total installation
- f. Vehicle registration/ identification No. (to be furnished after registration)
- g. Check whether compliance plate is installed near filling connection & be clearly visible to the filling agency

Details for no. of ALTs		
1	2	Remark

**3.2.12 Identification label in front and rear:**

- a. Located on left side of the front and rear safety glass and shall Check whether visibility from front and rear sides

**3.2.13 Compartment/Sub-compartment/Gas tight housing(for internally mounted ALT/s)**

- a. Check whether Compartment / Sub-compartment Gas tight housing is in good condition i.e. shall not show any crack/damage.



- b. Check whether it is firmly clamped to the conduit/vent hose/ducting

**3.2.14 Conduits/ducting (for internally mounted ALT/s)**

Check whether Conduits/ducting is in good condition i.e. shall not show any crack/damage

**3.2.15 Petrol Shut Off Valve (Solenoid) (if applicable i.e. Gasoline injection vehicle does not require such solenoid valve)**

- a. Check operation
- b. Check whether service shut off valve (petrol) is securely mounted
- c. Leak test (visual inspection)
- d. Verify the make & type as per the Type Approval specification.



**3.2.16 Fuel selection switch (for bi-fuel mode) & indicator for LPG content.**

Check operation



**3.2.17 Low pressure hose**

Check for kinks, damage or abrasion to the cover

**3.2.18 High Pressure pipe**

Check for any damage / crack at the bends.

**3.2.19 Catalytic Converter**

Specification of catalytic Converter fitted on vehicle shall be verified as per type approval specification.

**3.2.20 ECU ( Lambda Control with Emulator )**

Specification, make, model & ID No. of ECU shall be verified as per type approval specification.

**FORM B.T.I.**

Maharashtra Motor Vehicle Rules, 1959  
{See Rules 65 (1) }  
Notice in regard to an alteration in a Motor Vehicle

To,  
The Registering Authority  
Dy./ RTO .....

I am Owner of the Vehicle having following description.

M.V. No. .... Make..... Model.....  
Type..... Fuel..... U.W.....Kg. RLY.....Kg. ....

Document of the Vehicles are as below:

Tax is paid up to.....Insurance valid upto.....

Permit No.....Valid upto.....

C.F. Valid upto.....

The vehicle is converted with HPA / HPY of .....

I have enclosed N.O.C. to do the necessary changes for financier (If covered with HPA / HPY) or Not covered with HPA / HPY.

I intends to retorfit LPG Kit make.....approved by (VRDE /ARAI)vide letter  
No.....dt.....as per Transport Commissioner's office letter No. ....  
..... dt.....Workshop ..... (Name of workshop)

Approved as per Transport Commissioner's office letter No. ....  
.....dt / /

I will produce the vehicles within 14 days for inspection before you, after conversion.  
The above information is true.

Date: **Signature of the Owner**  
.....

**Approved kit for the said model is available**

**Signature of Retrofitter**  
.....

*(for use of the Regional Transport Office only)*

Approval is here by Accorded / Refused for making the requested alteration with reasons given below.

.....  
.....

## Submitted

M.V. No. .... Class: ..... Date.....

Produced duly retrofitted with L.P.G. Conversion System of following description.

Date of retrofitment.....

- A) Name & address of the Retrofitter
- B) Name of the Conversion System
- C) L.P.G. Kit make & model:..... Kit Sr. No.....  
Approval order No. & date :.....  
Approving Agency:.....
- D) Gas cylinder make:..... Cylinder Sr. No.....  
Water capacity of the Cylinder :.....  
Chief Controller of Explosive's Certificate testing for cylinder testing  
Outward No. :..... Dated.....
- E) Fee Rs. 50/-..... Dated.....
- F) Unladen Weight..... Kg. :.....

## Enclosed

- 1) Installation Certificate
- 2) CCOE Certificate for Cylinder
- 3) PUC Certificate
- 4) Unladen Weight slip
- 5) Chassis No. of Vehicle & Cylinder Sr. No. Kit No., Pencil Prints attached.

It approved office record may be fitment of L.P.G. Kit

**Signature of Inspector of Motors Vehicles**

Note : A,B,C,D,E,F, in RC and Record.

**Signature of Registering Authority**

Note taken

**Signature of Jr. Clerk**

**Signature of Head Clerk**

### Endorsement Slip for Noting in RC

Regional Transport Office.....  
 M.V. No.....LMV/Auto Rickshaw.....  
 Is converted to run on LPG fuel by M/S.....  
 Fitted with LPG Kit No. ....Make.....  
 .....& following cylinders make.....

NO	Sr. No. of the Cylinder	Water capacity	Hydro Test Certificate Valid upto
1			
2			

CCOE Certificate No. .... dt.....  
 UW.....Kgs.....  
 The M. V. is inspected by IMV..... dt.....  
 BTI fees Rs. 50/- paid valid R. No..... dt.....

Note : Please renew the hydro test certificate before expire and Produce for endorsement in RC and records.

Regional Transport Office:.....

### Endorsement Slip for Noting in RC

Regional Transport Office.....  
 M.V. No.....LMV/Auto Rickshaw.....  
 Is converted to run on LPG fuel by M/S.....  
 Fitted with LPG Kit No. ....Make.....  
 .....& following cylinders make.....

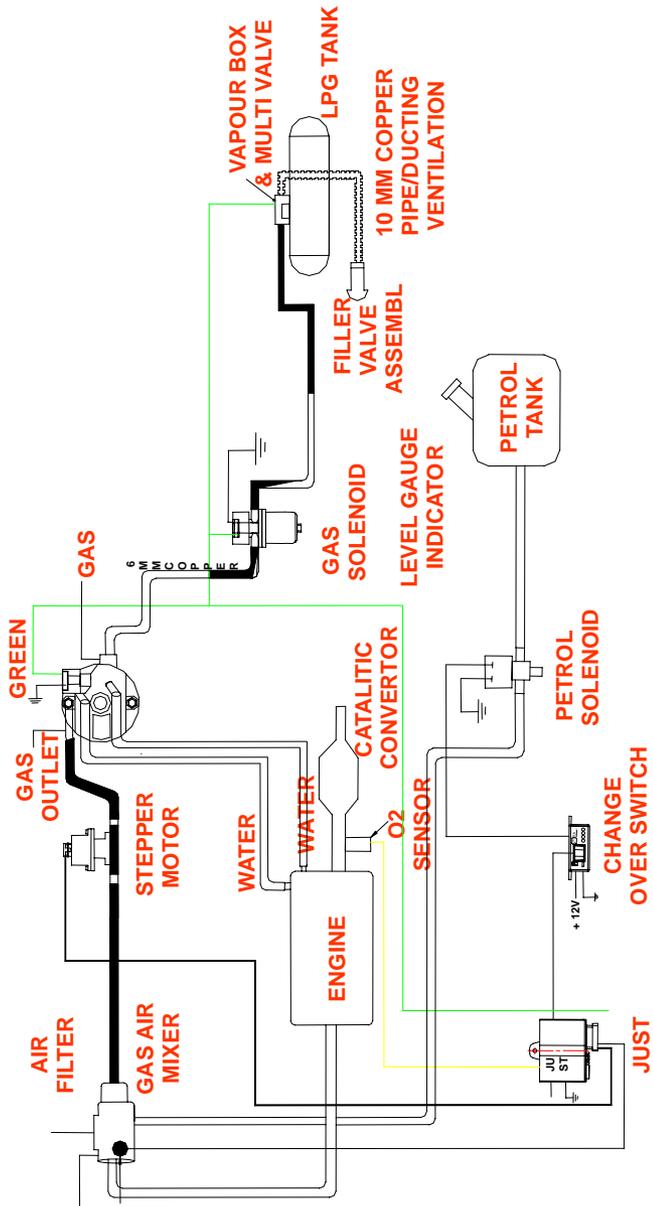
NO	Sr. No. of the Cylinder	Water capacity	Hydro Test Certificate Valid upto
1			
2			

CCOE Certificate No. .... dt.....  
 UW.....Kgs.....  
 The M. V. is inspected by IMV..... dt.....  
 BTI fees Rs. 50/- paid valid R. No..... dt.....

Note : Please renew the hydro test certificate before expire and Produce for endorsement in RC and records.

Regional Transport Office:.....

LPG INSTALLATION - SCHEMATIC DIAGRAM



## Members & Associates



## Members & Associates



Switches . Horns . Lighting . LPG / CNG kits



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Director- Technical  
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  - Up to 15% less greenhouse gas
  - Up to 50% less particulates
  - Up to 60% less CO
  - Up to 33% less NO

Virtually Zero Evaporative emissions of hydrocarbons  
Up to 80% less air toxics like benzene and 1,3 butadiene

A brief comparison of vehicular emissions of Auto LPG vis-à-vis Petrol and Diesel is:

Auto LPG Emissions\*

Compared to Petrol	Compared to Diesel
75% less Carbon Monoxide	90% less Particulates
85% less Hydrocarbons	90% less Oxides of Nitrogen
40% less Oxides of Nitrogen	70% less Ozone forming potential
87% less Ozone forming potential	60% less Carbon Monoxide
10% less Carbon Dioxide	

\* Based on tests undertaken at the independent Millbrook Vehicle Emissions Laboratories (UK) in 1998 and 1999.

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