

# **Vehicle Standards Bulletin 14**

**NATIONAL CODE OF PRACTICE  
for  
LIGHT VEHICLE CONSTRUCTION  
and  
MODIFICATION**

**SECTION LM  
FUEL SYSTEMS**

**1<sup>st</sup> February 2006**

## National Code of Practice for Light Vehicle Construction and Modification (NCOP)

### **Warning to Users**

*Users of the NCOP need to be aware that this document needs to be used in conjunction with the appropriate administrative requirements of the jurisdiction in which they wish to either register a vehicle or to obtain approval for a modification for an already registered vehicle. "Administrative requirements" include, amongst other things, processes for:- vehicle registration, obtaining exemptions, obtaining modification approvals, vehicle inspections, preparation and submission of reports and the payment of appropriate fees and charges.*

*If unsure of any of these requirements, or if more information is needed for any other issues or processes, users should contact their relevant registration authority **prior** to commencing any work.*

*Whilst the NCOP provides assistance with respect to the construction of ICVs and the execution of modifications, it is not to be taken to be a design manual. Determination of component strength, performance, suitability and functionality must be either calculated or determined on a case by case basis by suitably qualified personnel experienced in each matter under consideration.*

*Users of the NCOP also need to ensure that they refer to the most recent version of the relevant Section/s when working on a job or project. The version is identified by the date on the face page of each Section. On the website, each Section has the version date contained in the Section file name for easy identification.*

*It is prudent to check for new versions if a job or project is taking a long time to complete.*

*If they have not already done so, users must also download the Preface and Introduction.*

*These two Sections provide the necessary background information to assist users in understanding how the NCOP is administered by registration authorities across Australia, on how it is structured, and the meaning of the types of modification codes specified in the NCOP.*

*Understanding these requirements is important to ensure that the correct processes are followed thereby reducing the likelihood of having work rejected by authorities.*

*Many of the Sections refer to other Sections for further information or additional requirements. Users **must** download all relevant Sections. Lack of information due to insufficient downloads will not be accepted as an excuse by authorities.*

*If in doubt about any issue concerning or contained in the NCOP, users should seek clarification from the appropriate state or territory registration authority.*

**Please do not contact the Department of Transport and Regional Services (DOTARS) about the NCOP. DOTARS provides the central NCOP website as a service only.**

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## **1 SCOPE**

This Section outlines the minimum design, installation and fabrication requirements for the following light vehicle modifications involving fuel systems.

### **1.1 NON-CERTIFIED MODIFICATIONS**

- Fitting replacement fuel lines.
- Fitting additional fuel filters.
- Fitting alternative fuel pumps.
- Fitting a manufacturer's optional fuel system

### **1.2 CERTIFIED MODIFICATIONS**

- Fitting an additional or replacement fuel tank.
- Fitting a surge tank.
- Fitting an Liquefied Petroleum Gas (LP Gas) conversion
- Fitting a Natural Gas (CNG) conversion

**NOTE:** The design installation and fabrication requirements for all of the above modifications are contained in sub-section 2 *General Requirements* and also in the relevant sub-sections 4 and 5.

## **2 GENERAL REQUIREMENTS**

This Section applies to all light vehicles and should be read in conjunction with the other Sections of the LM Code and the specific Approval Code for the modification or conversion

Where a replacement engine was originally designed to operate exclusively on unleaded fuel, the fuel filler neck must be modified so it will only accept the small nozzle used on unleaded fuel bowsers. An "Unleaded Fuel Only" sticker must be fitted adjacent to the fuel filler.

### **2.1 FUEL LINES**

The material used for fuel lines must be suitable for use with automotive fuels.

Fuel lines must be securely fastened. Push-on type hose connections must be fitted with hose clamps or clips to reduce the possibility of fire due to fuel hoses coming adrift and spraying fuel over electrical components or hot exhaust components.

Fuel lines must be well clear of the exhaust system and any turbocharger (if fitted). Fuel lines must be adequately supported and where under a vehicle, must be protected from road debris and damage either by chassis/body members or shielding.

Fuel lines must be adequately protected from chafing or damage where they pass through panels, bulkheads or chassis members.

## **2.2 FUEL TANKS (Other than LPG/CNG Containers)**

Fuel system modifications, replacement fuel tanks and “drop tanks” must meet the following requirements:

The vehicle must meet the minimum ground clearance requirements as defined in the ADR 41:

- No part of any fuel tank or fuel system component must lie below a plane created as a component of that vehicle’s Departure Angle<sup>1</sup>;
- Any fuel tank or fuel system component must be at least 100 mm inboard of the OEM permanent body work;
- Any fuel tank or fuel system component with a ground clearance of 200 mm or less must be adequately protected by shields or adjacent vehicle components;
- In the event of any tyre being deflated, no parts of the fuel tank or fuel system must contact the road surface;
- If a replacement tank of a larger capacity than the original uses the original mountings, their strength must be checked and shown to be adequate;
- No replacement fuel tank must adversely affect the controllability of the vehicle;
- The fuel filler inlet and cap should be located outside of the vehicle. Where an inlet is located inside a vehicle, it must never be inside the passenger compartment and the inlet must be separately sealed from the rest of the vehicle to ensure fumes do not enter the passenger cabin and that provisions are made to ensure any fuel spills are localized and drain outside the vehicle.
- The fuel tank and filler shall be so arranged that any overflow or leakage of fuel cannot accumulate nor contact the exhaust or electrical systems.
- Any apertures created to allow for the installation of the fuel tanks must be suitably sealed to prevent the entry of exhaust, road or petrol fumes into the cabin of the vehicle.

### **Additional Requirements for Vehicles fitted with Emission Control Systems\***

- All of the fuel tank evaporative controls for ventilation of the tank must be installed and operational to prevent hydrocarbon emissions entering the atmosphere.
- If the replacement fuel tank has a greater capacity than the largest optional fuel tank available for the vehicle, then an additional or larger canister of sufficient capacity must be fitted to vehicles equipped with evaporative emission control systems.
- Vehicles originally fitted with fuel tanks with expansion/vapour spaces must continue to provide these facilities. (E.g. modified fuel tanks must have vapour spaces proportional to their new capacity). Vehicles originally equipped with independent liquid/vapour separators must have either an additional separator or that provision built into the new tank.

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<sup>1</sup> Departure Angle is the greatest angle between the horizontal plane and the plane from the static loaded rear tyres to the lowest, rearmost extremity of the Original Equipment Manufacturer’s (OEM) permanent body work.

## 2.3 FABRICATION

All work must be performed in accordance with recognised engineering standards. Cutting, heating, welding or bending of components should be avoided by choosing unmodified production components wherever possible.

### WELDING

Welding of components, except where expressly specified to a higher standard, must be performed in accordance with recognised general engineering practices taking into account the function of the welded joint. This typically involves, for each task in question:

- choosing the appropriate welding method together with the most suitable welding materials
- ensuring appropriate job preparation is performed
- ensuring all subject joints and heat affected areas are effectively prepared and sealed in accordance with current trade techniques to minimise the onset of corrosion.

In addition, welds, particularly on structural members, should not be ground back to such an extent that the strength of the joint would be affected.

Where a higher or alternative weld standard is specified, the requirements of that standard must be satisfied.

Guidance on good welding techniques can be found in AS/NZS 1554.1:2004 *Structural steel welding - Welding of steel structures*.

### FASTENERS

Unless supported by specific engineering design, all fasteners on transmission mountings or in highly stressed locations must be high tensile ISO Grade 8.8 (mm sizes), SAE Grade 5 (inch sizes) or equivalent, as a minimum specification. All other fasteners are to be at least of similar strength and number to those in the original installation. Self-locking nuts should be used in preference to spring washers.

### **3 AUSTRALIAN DESIGN RULES**

The ADRs that may be affected by modifications covered in this section are as follows:

<b>ADR</b>	<b>Title &amp; Comments</b>
ADR 27	Vehicle Engine Emission Control
ADR 37	Vehicle Emission Control
ADR 40	Light Duty Vehicle Emissions Control
ADR 41	Mandatory Operation on Unleaded Petrol, Evaporative emission controls, Fuel tank filler necks designed only for unleaded fuel pump nozzles for vehicles required to operate on unleaded fuel only.
ADR 42	General Safety Requirements, The requirements for positioning of exhaust outlets.
ADR 43	Vehicle Configuration & Dimensions (Includes provisions for ground clearance).
ADR 44	Specific Purpose Vehicle Requirements (Includes provisions for LP Gas installation).

**NOTE:** To determine the ADRs that apply to the vehicle in question, refer to the Applicability Tables in Section LO. Vehicles manufactured after 1 January 1969 and prior to 1 July 1988 need to comply with the Second Edition ADRs whilst vehicles manufactured after this date need to comply with the Third Edition ADRs. Section LO has separate applicability tables for each edition.

The ADRs apply according to the vehicle's category and date of manufacture. It is the responsibility of the signatory to refer to the appropriate ADR applicable to the vehicle.

## 4 NON-CERTIFIED MODIFICATIONS

The following modifications may be carried out provided they do not affect compliance with Australian Design Rules and provided they meet the following general safety requirements.

### 4.1 FUEL LINES

The fitting of alternative or replacement fuel lines is allowed, provided that:

- the installation is in accordance with the manufacturer’s specifications; and
- all components used are unmodified.

### 4.2 FUEL FILTERS AND PUMPS

The fitting of additional fuel filters and/or alternative or replacement fuel pumps is allowed, provided that:

- the installation is in accordance with the manufacturer’s specifications;
- all components used are unmodified.

## 5 CERTIFIED MODIFICATIONS (LM CODES)

This section specifies particular requirements and covers limitations on approvals carried out under individual LM Approval Codes.

Each Code is supplemented with a checklist.

	<b>LM Approval Code Directory</b>	<b>Page</b>
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## FUEL TANK ALTERATION

### CODE LM1

#### SCOPE

The following is a summary of the modifications that may be approved under Code LM1 – Fuel Tank Alteration.

Approvals are **allowed** under Code LM1 for:

- Fitting an alternative fuel tank.
- Fitting a surge tank.

Approvals are **not allowed** under Code LM1 for:

Fitting an alternative fuel system (this is covered by Code LM2 or LM3).

This section does not apply to L-group vehicles (eg motorcycles).

#### ADR'S, ACTS AND REGULATIONS

The modified vehicle must continue to comply with all applicable ADR's, Acts and Regulations.

Outlined below are areas of the vehicle that may be affected by the modifications and that may require re-certification, testing and/or data to show compliance for the modified vehicle.

ADR	Title & Comments
ADR 27	Vehicle Engine Emission Control
ADR 37	Vehicle Emission Control
ADR 40	Light Duty Vehicle Emissions Control
ADR 41	Mandatory Operation on Unleaded Petrol, Evaporative emission controls, Fuel tank filler necks designed only for unleaded fuel pump nozzles for vehicles required to operate on unleaded fuel only.
ADR 42	General Safety Requirements, The requirements for positioning of exhaust outlets.
ADR 43	Vehicle Configuration & Dimensions (Includes provisions for ground clearance).
ADR 44	Specific Purpose Vehicle Requirements (Includes provisions for LP Gas installation).

**Note:** Any modifications to the vehicle that involve structural changes may affect compliance with seat belt and child restraint anchor points.

**CHECKLIST**  
**FUEL TANK ALTERATION**  
**APPROVAL CODE LM1**

(N/A= Not Applicable, Y=Yes, N=No)

1.	GENERAL			
1.1	Are all fuel lines used suitable for automotive fuels?		Y	N
1.2	Are all fuel lines securely fastened with clamps or clips?		Y	N
1.3	Are all visible leaks repaired?		Y	N
1.4	Are fuel lines well clear of the exhaust and any other dangerous ignition sources?		Y	N
1.5	Are fuel lines well protected from possible road damage?		Y	N
1.6	Lines are adequately protected from chafing?		Y	N
1.7	Location of tank meets the vehicle's "departure angle" requirements?		Y	N
1.8	All fuel lines are within 100mm inboard of OEM permanent bodywork?		Y	N
1.9	Adequate shielding provided for fuel tanks if ground clearance less than 200mm?		Y	N
1.10	Has the fuel tank installation been checked to ensure that no part of the fuel tank contacts the road should a tyre become deflated?		Y	N
1.11	If a replacement tank is of a larger capacity than the original and uses the original mountings, their strength has been checked and shown to be adequate?		Y	N
1.12	The replacement fuel tank does not adversely affect the controllability of the vehicle?		Y	N
1.13	The fuel filler inlet and cap are located outside of the vehicle?	N/A	Y	N
1.14	Where the inlet is located inside the vehicle, it is not inside the passenger compartment and the inlet is separately sealed from the rest of the vehicle	N/A	Y	N
1.15	The fuel tank and filler is so arranged that any overflow or leakage of fuel cannot accumulate nor contact the exhaust or electrical systems?		Y	N

[Continued overleaf]

(N/A= Not Applicable, Y=Yes, N=No)

1.16	All apertures created to allow for the installation of the fuel tanks are suitably sealed to prevent the entry of exhaust, road or petrol fumes into the cabin of the vehicle?		Y	N
<b>2.</b>	<b>ADDITIONAL REQUIREMENTS FOR VEHICLES FITTED WITH EMISSION CONTROL SYSTEMS.</b>			
2.1	All of the fuel tank evaporative controls for ventilation of the tank are installed and operational?		Y	N
2.2	If the replacement fuel tank has a greater capacity than the largest optional fuel tank available for the vehicle, an additional or larger canister of sufficient capacity has been fitted to vehicles equipped with evaporative emission control systems?		Y	N
2.3	Vehicles originally equipped with independent liquid/vapour separators have either an additional separator fitted or that provision built into the new tank?		Y	N
2.4	Vehicles designed to run on unleaded fuel have fitted to the tank, a fuel filler inlet that is designed to accept only unleaded fuel pump nozzles?		Y	N
<b>3.</b>	<b>WORKMANSHIP</b>			
3.1	Is all work performed in accordance with recognised engineering standards and to the satisfaction of the Inspector?		Y	N
<b>4.</b>	<b>WELDING</b>			
4.1	Has all welding been carried out by qualified tradesperson?		Y	N
4.2	Does all welding comply with relevant Australian Standards?		Y	N
<b>5.</b>	<b>ADR COMPLIANCE</b>			
5.1	Does converted vehicle continue to comply with applicable ADRs?		Y	N
<b>6.</b>	<b>INSPECTION</b>			
6.1	Has an inspection been carried out on the installation and all modified components and found to be satisfactory?		Y	N
<b>7.</b>	<b>RECORDS</b>			
7.1	Have complete records of vehicle conversion/modifications details been retained in a manner suitable for auditing?		Y	N

NOTE: If the answer to any question is **N (No)**, the modification cannot be approved under Approval Code LM1.

[Continued overleaf]

**Section LM Fuel Systems**

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FORM No: LM1

Make ..... Model ..... Year of Manufacture .....

Chassis No. or VIN .....

Vehicle Modified by .....

Description of Modification .....

Date of Inspection .....

Examined and Approved by .....

Company (if applicable) .....

Signed .....Date .....

## LIQUEFIED PETROLEUM GAS (LP GAS) CONVERSION

### CODE LM2

#### SCOPE

The following is a summary of the modifications that may be approved under Code LM2 – Liquefied Petroleum Gas Conversion.

Approvals are **allowed** under Code LM2 for:

- Fitting a liquefied petroleum gas fuel system to a petrol engine vehicle

Approvals are **not allowed** under Code LM2 for:

- Fitting a natural gas (CNG) fuel system (this is covered by Code LM3).
- Fitting replacement or modified fuel tanks (these are covered by Code LM1).

This section does not apply to L-group vehicles (e.g. motorcycles).

#### ADRs, ACTS AND REGULATIONS

The modified vehicle must continue to comply with all applicable ADR's, Acts and Regulations.

Outlined below are areas of the vehicle that may be affected by the modifications and that may require re-certification, testing and/or data to show compliance for the modified vehicle.

DETAIL	REQUIREMENTS
Brakes	ADR7, 31, 35
Speedometer accuracy	ADR 18
Tyre speed rating	ADR 24
Emissions	ADR 79/00

**NOTE:** To determine the ADRs that apply to the vehicle in question, refer to the Applicability Tables in Section LO. Vehicles manufactured after 1 January 1969 and prior to 1 July 1988 need to comply with the Second Edition ADRs whilst vehicles manufactured after this date need to comply with the Third Edition ADRs. Section LO has separate applicability tables for each edition.

The ADRs apply according to the vehicle's category and date of manufacture. It is the responsibility of the signatory to refer to the appropriate ADR applicable to the vehicle.

## **SPECIFIC REQUIREMENTS**

The safe use of Liquefied Petroleum Gas (LP Gas) requires strict safety standards to be followed for system design and installation.

The regulations allow the continued use of vehicles that were modified to comply with previous versions of AS/NZS 1425.

### **1. NEW LP GAS INSTALLATION REQUIREMENTS**

LP Gas installations must comply with *Australian Standard AS/NZS 1425 LP Gas Fuel Systems for Vehicle Engines*. This Standard provides the technical requirements for the installation of LP Gas fuel systems for motor vehicles in Australia.

Only a licensed technician or installer is allowed to carry out the installation or repair of automotive LP Gas equipment. The installer must fit an identification plate to certify that the LP Gas system meets the requirements of the current version of AS/NZS 1425 when it was installed.

*Note: At the date of issue of this Bulletin the latest version of the standard is AS/NZS 1425:2003 – it is expected that there will be a new edition issued in 2006.*

In all States and Territories in Australia the Administration of regulations relating to LP Gas installations is usually the responsibility of more than one department. As a result, certain technical requirements may vary and installation plates may vary in appearance. Please check with your local jurisdiction if you need additional information. In the majority of cases the licensed technician or installer will be able to offer advice.

As stated above, the installation requirements are specified in AS/NZS 1425 and as a consequence these requirements will not be repeated in this document. However a number of issues which affect the consumer directly are specified below for information purposes.

### **2. LP GAS COMPLIANCE or IDENTIFICATION PLATES**

#### **Vehicles with LP Gas systems installed by a licensed LP Gas installer**

Only a licensed LP Gas equipment installer is permitted to install automotive LP Gas equipment. Each installation must carry an LP Gas *Compliance Plate* to verify that the installation has been performed in accordance with AS/NZ1425. . The plate must be attached or fitted in the engine bay in a clearly visible location and include information such as installation date, state of origin, licence number of installer, Vehicle Identification Number (VIN), container serial number and test date.

### **3. LP GAS IDENTIFICATION LABELS**

The AVSR requires vehicles converted to run on LP Gas to have red retroreflective labels fixed to the front and rear registration plates. The labels must be at least 25mm square with a font size of at least 6mm high. This provision exists to allow vehicle installations performed under previous versions of the Australian Standard to continue to display labels that were appropriate at that time.

However the current standard, AS/NZS 1425:2003 specifies that the label:

- (a) shall be not less than 1mm thick and made of metal plate,
- (b) size shall not be less than 25mm square mounted as a diamond,

(c) colour shall be retroreflective red complying with AS/NZS 1906.1 Class2,

(d) shall have only the letters "LPG" in white and at least 10mm in height.

These labels are available from all licensed LP Gas installers and should be used on all new installations. These labels may also be used to replace existing labels.



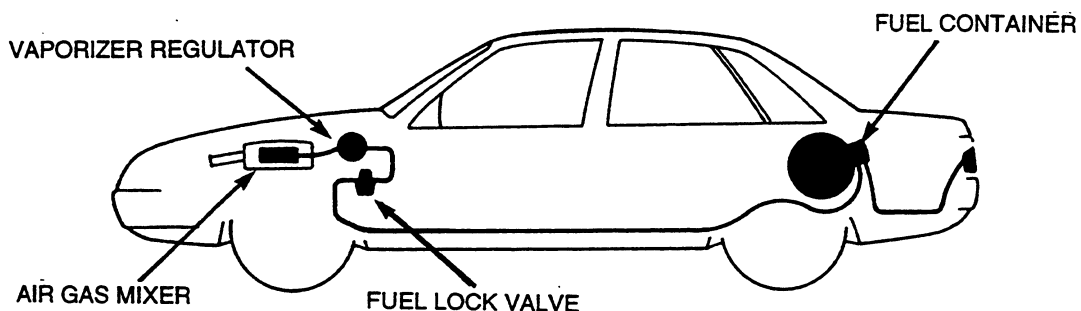
Figure LM1 LP Gas Operating Label

#### 4. LP GAS FUEL SYSTEMS

Petrol vehicles that are converted to operate on LP Gas can be equipped to run alternatively on LP Gas or petrol (bifueled vehicles), or on LP Gas only. There are also diesel gas vehicles converted to run on a mixture of diesel and up to approx 25% LP GAS concurrently (dual fuel vehicles).

The four main component parts fitted to the vehicle are:

- fuel container for storing the liquefied LP Gas.
- fuel lock valve (or filter lock) which prevents the flow of fuel when the engine stops.
- vaporiser regulator (or converter) which vaporizes LP Gas liquid (Liquid injection systems do not have a traditional style vaporiser/regulator but instead rely on fuel pump, rail, injectors and pressure regulator, similar to petrol system)
- an air/gas mixer that blends air and LP Gas for delivery to the engine or a vapor injection system interfacing with the original petrol injection system – or liquid injectors



LV007-NSW-EQUIP1.BMP

Figure LM2 Equipment for LP Gas vehicles

### 5. LP GAS FUEL CONTAINERS

The LP Gas fuel container is a tested pressure vessel that is designed and constructed in accordance with strict Australian Standards. During manufacture it is subjected to controlled heat treatment and stress relief to the weld affected areas. Therefore it is imperative that no welding, soldering, brazing or extreme heating of the cylinder takes place after the manufacture of the vessel.

Internally mounted containers must be encapsulated and vented to outside atmosphere so that any leaking gas [may not pass into any other enclosed space such as the boot or passenger compartment](#).

#### Periodic inspections of LP Gas Containers

All pressure vessels (including LP Gas containers) must bear a stamp that indicates the date on which the containers were last inspected. LP Gas containers must be removed from the vehicle and inspected by an authorised test station at least every ten years.

When the inspection of an LP Gas container is required, the owner should enlist the services of a certified gas cylinder testing station. Details regarding the location of certified testing stations may be obtained from any State or Territory Registration Authority or may be obtained directly from the miscellaneous SAI Global publication, *MP 48 Certified gas cylinder test stations*.

### 6. POLLUTION CONTROL EQUIPMENT

#### Vehicles converted to run on LP Gas only

A vehicle can be converted to operate on LP Gas only (single fuel) providing the following conditions are met:

For vehicles built between 1 July 1976 and 1 February 1986 and originally operating on leaded petrol, there are no emission requirements other than the maximum carbon monoxide exhaust concentration at engine idle speed must not exceed 4.5% and any engines that were originally fitted with exhaust gas re-circulation valves (EGR) and associated equipment must continue to be fitted with this equipment and the equipment must be operational.

Catalytic converters and associated engine emission control systems fitted to any vehicle originally operating on unleaded petrol and those fitted to vehicles manufactured after 1 February 1986, must remain operational.

Vehicles converted to operate on LP Gas only are not required to retain the evaporative emission control system (carbon canister etc).



### Vehicles converted to run on both petrol and LP Gas

An engine can be converted to operate on either petrol or LP Gas (bi-fuel) provided that when the vehicle is operated on petrol it complies with the petrol related regulations. All emission control systems, fuel emission systems and devices and engine control and management systems, including catalytic converters and oxygen sensors, if originally fitted, must remain operational on all such vehicles. On vehicles dated after 2003 LP Gas systems fitted must also comply with the emission test requirements of Appendix D of AS/NZS 1425:2003. A list of such emission compliant vehicle kits can be obtained from the LP GAS industry body LP GAS Australia on < [www.lpgautogas.com.au](http://www.lpgautogas.com.au) >.

Allowances are made for minor air cleaner and carburetion/injection modifications required for the conversion. The heated air intake system can be removed and replaced by a new unit if it is compatible with and recommended by the system manufacturer.

All passenger vehicles manufactured to comply with an emission ADR, must meet the exhaust emission limits applicable to the vehicle when the vehicle is operating on petrol. Where a vehicle was originally designated to operate with a closed loop engine management system, an LP GAS closed loop management system shall be installed that results in exhaust emission levels for LP Gas that meet the ADR requirement applicable to the vehicle.

### 7. STRUCTURAL ALTERATIONS

Where the installation of LP Gas equipment involves major structural alterations such as the removal of portions of a subframe, floorpan or roof support pillar, it is possible that the vehicle structural strength may have been reduced. In such cases, the modifications must comply with the requirements of Code LH *Body Modifications*. Reduction in structural strength may have an adverse affect on the strength of seat, seat belt and/or child restraint anchor points.

**CHECKLIST**  
**LIQUEFIED PETROLEUM GAS (LP GAS) CONVERSION**  
**APPROVAL CODE LM2**

(N/A= Not Applicable, Y=Yes, N=No)

<b>1.</b>	<b>LICENSED INSTALLER</b>		
1.1	Has the installation been performed by a licensed installer?		Y N
<b>2.</b>	<b>LP GAS COMPLIANCE PLATE</b>		
2.1	Has the licensed installer fitted an LP Gas Compliance plate that complies with the provisions of AS/NZS 1425 that confirms that all LP Gas work has been carried out according to the provisions of AS/NZS 1425.?		Y N
<b>3.</b>	<b>LP GAS IDENTIFICATION LABEL</b>		
3.1	Do the front and rear registration plates have an LP Gas Identification label attached as required by the AVSR?		Y N
<b>4.</b>	<b>EMISSION CONTROL EQUIPMENT</b>		
4.1	Where a vehicle has been converted to bi-fuel, are all the original emission control systems still connected as per the original installation?		Y N
<b>5.</b>	<b>WORKMANSHIP</b>		
5.1	Is all work performed in accordance with recognised engineering standards and to the satisfaction of the Inspector?		Y N
<b>6.</b>	<b>WELDING</b>		
6.1	Has all welding been carried out by qualified tradesperson?		Y N
6.2	Does all welding comply with relevant Australian Standards?		Y N
<b>7.</b>	<b>FASTENERS</b>		
7.1	Are high tensile bolts used on all new critical joints and mountings except container mounting requirements defined by AS/NZS1425?	N/A	Y N
7.2	Are self-locking nuts used on all new critical joints and mountings?	N/A	Y N
7.3	Are all replacement fasteners equivalent to or better than original?	N/A	Y N

[Continued overleaf]

**Section LM Fuel Systems**

FORM No: LM2

(N/A= Not Applicable, Y=Yes, N=No)

<b>8.</b>	<b>ADR COMPLIANCE</b>		
8.1	Does converted vehicle comply with applicable ADRs?		Y N
<b>9</b>	<b>BODY MODIFICATIONS</b>		
9.1	Have all body modifications been performed in accordance with Section LH?	N/A	Y N
9.2	Have all the checklists required under Section LH been signed and submitted?	N/A	Y N
<b>10.</b>	<b>INSPECTION</b>		
10.1	Has an inspection been carried out on the installation and all modified components and found to be satisfactory?		Y N

NOTE: If the answer to any question is **N (No)**, the modification cannot be approved under Approval Code LM2.

Make ..... Model ..... Year of Manufacture .....

Chassis No. or VIN .....

Vehicle Modified by .....

Description of Modification .....

Date of Inspection .....

Examined and Approved by .....

Company (if applicable) .....

Signed ..... Date .....

## NATURAL GAS (CNG) CONVERSION

### APPROVAL CODE LM3

#### SCOPE

The following is a summary of the modifications that may be approved under Code LM3 – Natural Gas Conversion (CNG).

Approvals are **allowed** under Code LM3 for:

- Fitting a CNG fuel system to a petrol engine vehicle

Approvals are **not allowed** under Code LM3 for:

- Fitting a liquefied petroleum gas fuel system (this is covered by Code LM2).
- Fitting replacement or modified fuel tanks (these are covered by Code LM1).

This section does not apply to L-group vehicles (e.g. motorcycles).

#### ADR'S, ACTS AND REGULATIONS

The modified vehicle must continue to comply with all applicable ADR's, Acts and Regulations.

Outlined below are areas of the vehicle that may be affected by the modifications and that may require re-certification, testing and/or data to show compliance for the modified vehicle.

DETAIL	REQUIREMENTS
Brakes	ADR7, 31, 35
Speedometer accuracy	ADR 18
Tyre speed rating	ADR 24

NOTE: To determine the ADRs that apply to the vehicle in question, refer to the Applicability Tables in Section LO. Vehicles manufactured after 1 January 1969 and prior to 1 July 1988 need to comply with the Second Edition ADRs whilst vehicles manufactured after this date need to comply with the Third Edition ADRs. Section LO has separate applicability tables for each edition.

The ADRs apply according to the vehicle's category and date of manufacture. It is the responsibility of the signatory to refer to the appropriate ADR applicable to the vehicle.

#### SPECIFIC REQUIREMENTS

The following are the requirements applying to vehicles that are converted to run on CNG:

## 1. INSTALLATION REQUIREMENTS

A licensed gas fitter can only carry out work on a CNG installation. The work for which a licence is needed includes installing a CNG system to a motor vehicle or repairing or adjusting any CNG equipment that has already been fitted to a vehicle. All CNG related work must comply with the provisions of AS/NZS 2739: *Natural gas (CNG) fuel systems for vehicle engines*.

After a CNG installation is fitted to a vehicle the installer must: provide the owner of the vehicle a Certificate of Compliance confirming that the installation is in accordance with AS/NZS 2739.

### CNG COMPLIANCE PLATE

A compliance plate must be securely attached to the body of the vehicle in a conspicuous position in the engine bay.

### CNG IDENTIFICATION LABELS

The installer must attach labels to the outside of the vehicle, in conspicuous places at both the front and back. Usually, the labels are fitted to the vehicle's registration plates.

The labels must be at least 25 mm square, be red in colour and have white lettering at least 10 mm high showing the letters "CNG".

However the current standard, AS/NZS 2739:2003 specifies that the label:

- (a) shall be not less than 1mm thick and made of metal plate,
- (b) size shall not be less than a 35mm diameter circle,
- (c) colour shall be retroreflective red complying with AS/NZS 1906.1 Class2,
- (d) shall have only the letters "CNG" in white and at least 10mm in height.

These labels are available from all licensed CNG installers and should be used on all new installations. These labels may also be used to replace existing labels.



Figure LM6 CNG Vehicle Identification

## **2. EMISSION REQUIREMENTS FOR CNG FUELLED VEHICLES**

### **Vehicles converted to run on CNG only**

A vehicle can be converted to operate on CNG only (single fuel) providing the following conditions are met:

- For vehicles built between 1 July 1976 and 1 February 1986 and originally operating on leaded petrol, there are no emission requirements other than that the maximum carbon monoxide concentration at engine idle speed must not exceed 4.5% and any engines that were originally fitted with exhaust gas re-circulation valves (EGR) and associated equipment must continue to be fitted with this equipment and the equipment must be operational.
- Catalytic converters and associated engine emission control systems of any vehicle originally operating on unleaded petrol and those manufactured after 1 February 1986 must remain operational.
- Vehicles converted to operate on CNG only are not required to retain the evaporative emission control system (carbon canister etc).

### **Vehicles Converted to Run on Both Diesel (or Petrol) and CNG**

An engine can be converted to operate on both diesel (or petrol) and CNG (dual-fuel) provided that when the vehicle is operated solely on diesel (or petrol) it complies with the diesel (or petrol) related regulations. All emission control systems, fuel emission systems and devices and engine control and management systems, including catalytic converters and oxygen sensors, if originally fitted, must remain operational on all such vehicles.

Allowances are made for minor air cleaner and carburetion/injection modifications required to fit the conversion. The heated air intake system can be removed and replaced by a new unit if it is compatible with and recommended by the system manufacturer.

All spark ignition powered passenger vehicles manufactured after 1 February 1986 must meet the exhaust emission limits applicable to the vehicle regardless of whether the vehicle is operating on CNG or petrol. CNG equipment fitted to the vehicle must be installed in accordance with the Manufacturer's instructions, so that the emission performance of the converted vehicle meets the requirements of the vehicle's applicable ADR.

**CHECKLIST**  
**NATURAL GAS (CNG) CONVERSION**  
**APPROVAL CODE LM3**

(N/A= Not Applicable, Y=Yes, N=No)

<b>1.</b>	<b>LICENSED INSTALLER</b>		
1.1	Has the installation been performed by a licensed installer?		Y N
<b>2.</b>	<b>CNG COMPLIANCE PLATE</b>		
2.1	Has the licensed installer fitted a CNG compliance plate that complies with the provisions of AS/NZS 2739 that confirms that all CNG work has been carried out according to the provisions of AS/NZS 2739?		Y N
<b>3.</b>	<b>CNG IDENTIFICATION LABEL</b>		
3.1	Do the front and rear registration plates have a CNG identification label attached?		Y N
<b>4.</b>	<b>EMISSION CONTROL EQUIPMENT</b>		
4.1	Where a vehicle has been converted to dual fuel, are all the original emission control systems still connected as per the original installation?		Y N
<b>5.</b>	<b>WORKMANSHIP</b>		
5.1	Is all work performed in accordance with recognised engineering standards and to the satisfaction of the Inspector?		Y N
<b>6.</b>	<b>WELDING</b>		
6.1	Has all welding been carried out by qualified tradesperson?		Y N
6.2	Does all welding comply with relevant Australian Standards?		Y N
<b>7.</b>	<b>FASTENERS</b>		
7.1	Are high tensile bolts and self-locking nuts used on all new critical joints and mountings?	N/A	Y N
7.2	Are all replacement fasteners equivalent to or better than original in strength and quality?	N/A	Y N

[Continued overleaf]

**Section LM Fuel Systems**

FORM No: LM3

(N/A= Not Applicable, Y=Yes, N=No)

<b>8.</b>	<b>ADR COMPLIANCE</b>			
8.1	Does converted vehicle comply with applicable ADRs?		Y	N
<b>9.</b>	<b>INSPECTION</b>			
9.1	Has an inspection been carried out on the installation and all modified components and found to be satisfactory?		Y	N
<b>10</b>	<b>BODY MODIFICATIONS</b>			
10.1	Have all body modifications been performed in accordance with Section LH?	N/A	Y	N
10.2	Have all the checklists required under Section LH been signed and submitted?	N/A	Y	N

NOTE: If the answer to any question is **N (No)**, the modification cannot be approved under Approval Code LM3.

Make ..... Model ..... Year of Manufacture .....

Chassis No. or VIN .....

Vehicle Modified by .....

Description of Modification .....

Date of Inspection .....

Examined and Approved by .....

Company (if applicable) .....

Signed ..... Date .....