Vehicle Standards Bulletin 14

NATIONAL CODE OF PRACTICE
for
LIGHT VEHICLE CONSTRUCTION
and
MODIFICATION

SECTION LM
FUEL SYSTEMS

VERSION 2.0 JANUARY 2011

Vehicle Standards Bulletin 14

National Code of Practice for Light Vehicle Construction and Modification (VSB 14)

Important Information for Users

Users of VSB 14 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 the requirements specified in VSB 14, or if more information is needed for any other issues concerning the administrative requirements, users should contact their relevant Registration Authority **prior** to commencing any work.

While VSB 14 provides advice on the construction of Individually Constructed Vehicles (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 VSB 14 also need to ensure that they refer to the most recent version of the relevant Section/s when working on a project. The version is identified by the version number and date on the face page of each Section. The version and date is also located in the footer of each page in each Section. On the website the version number is specified in the Section file name for easy identification.

If a project is taking a long time to complete, check the currency of the version you are using.

Users must be familiar with the provisions stated in the Preface and Introduction. These two Sections provide the necessary background information to assist users in understanding how VSB 14 is administered by Registration Authorities across Australia, on how it is structured, and the meaning of the types of modification codes specified in VSB 14. If not already done so, users should download them for study and reference.

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

Many of the Sections refer to other Sections within VSB 14 for further information or additional requirements. Users must read and apply all relevant Sections.

If in doubt about any issue concerning or contained in VSB 14, users should seek clarification from the appropriate State or Territory Registration Authority.

Please do not contact Vehicle Safety Standards (VSS) of the Australian Government Department of Infrastructure and Transport in Canberra about VSB 14. VSS provides the website as a service only.

Document Amendments by Version

Version	Amendments
Version 2.0 **Published 1 January 2011**	Reference to ***CNG*** has now been replaced with the more generic ***NG*** except where reference to ***CNG*** is specifically required. This document has also a number of editorial amendments that have had no affect on its technical content.

CONTENTS

1 SCOPE

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

Section LM does not apply to ADR category L-group vehicles and motor cycles.

The term ***modify/modification*** used in this Section also means ***install/installation*** and ***convert/conversion*** as appropriate.

1.1 BASIC MODIFICATIONS NOT REQUIRING CERTIFICATION

The following modifications may be performed without certification:

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

1.2 MODIFICATIONS THAT MAY BE CERTIFIED

The following modifications may be performed under the Section LM Codes:

- Fitting an additional or replacement fuel tank and associated componentry;
- Fitting a surge tank;
- Installing a Liquefied Petroleum Gas (LP Gas) fuel system; and
- Installing a Natural Gas (NG) fuel system.

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.

Note: Codes LM2 and LM3 are not utilised in Queensland

2 GENERAL REQUIREMENTS

This sub-section applies to all light vehicles and must be read and applied in conjunction with all the LM Codes applicable to the proposed modifications.

Modified vehicles must continue to comply with the ADRs to which they were originally constructed, except as allowed for in the Australian Vehicle Standards Rules (AVSR). These modified vehicles must also comply with the applicable in-service requirements of the AVSR.

Modified pre-ADR vehicles must continue to comply with the AVSR.

Compliance with the AVSR also means compliance with the equivalent regulations of a State or Territory of Australia.

2.1 FUEL LINES

This clause refers to any fuel hose, pipe or tubing used in a vehicle's fuel system, irrespective of the fuel type used.

The material for fuel lines must be compatible for both the type of fuel and fuel system to be used and must comply with all applicable standards.

Fuel lines must be securely fastened. Push-on type hose connections must be fitted with a positive means of retention to reduce the possibility of fire due to leakage or fuel hoses coming adrift and spraying fuel over electrical components or hot exhaust components. Where hose clamps or clips are used the end of the mating pipe must have provision to aid the retention of the hose.

Fuel lines must be well clear of extremely hot components such as the exhaust system or 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 LP Gas/NG Containers)

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

- The vehicle must have a minimum ground clearance of 100mm and meet the minimum ground clearance requirements as defined in ADR 43;
- 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[1];
- Any fuel tank or fuel system component must be at least 100mm inboard of the OEM permanent body work (excluding the filler neck and assembly);
- Any fuel tank or fuel system component with a ground clearance of 200mm 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 125% or larger capacity than the original uses the original mountings, their strength must be checked and shown to be adequate by a Signatory;
- Replacement fuel tanks must not adversely affect the suspension travel, controllability, handling or road holding 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 not 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; and
- 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 Evaporative 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, an additional or larger canister of sufficient capacity must be fitted to vehicles equipped with evaporative emission control systems; and
- 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

[1] 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.

separators must have either an additional separator or that provision built into the new tank.

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.

2.3.1 Welding, Fasteners and Electroplating

Mandatory requirements and guidance on the above items are contained in Section LZ ***Appendices.***

- For the use of fasteners refer to Appendix A ***Fasteners***;
- For welding techniques and procedures refer to Appendix C ***Heating and Welding of Steering Components***; and
- For electroplating refer to Appendix D ***Electroplating***.

3 AUSTRALIAN DESIGN RULES

A modified vehicle must continue to comply with the ADRs to which it was originally constructed, except as allowed for in the AVSR.

Outlined in Table LM1 below are requirements and/or components of the vehicle that may be affected by the modifications and that may require re-certification, testing and/or data to show continuing compliance for the modified vehicle. This is not an exhaustive list and other modifications may also affect ADR compliance.

Table LM1 Summary of items that if modified, may detrimentally affect compliance with applicable ADRs

ADRs	DETAIL
ADR 26, 27x	Vehicle Engine Emission Control
ADR 37, 37/...	Vehicle Emission Control
ADR 40	Light Duty Vehicle Emissions Control
ADR 41, 41/...	Mandatory Operation on Unleaded Petrol, Evaporative emission controls..
ADR 42/...	General Safety Requirements, The requirements for positioning of exhaust outlets.
ADR 43/...	Vehicle Configuration and Dimensions (Includes provisions for ground clearance).
ADR 44/...	Specific Purpose Vehicle Requirements (Includes provisions for LP Gas installation).

ADR 79/...	Vehicle Emission Control. This vehicle standard is applicable to all M and N category vehicles with a Gross Vehicle Mass (GVM) less than or equal to 3.5 tonnes and with an engine that operates on petrol, diesel, liquefied petroleum gas or natural gas.
ADR 80/...	Emission Control for Heavy Vehicles. (This ADR applies to vehicles of the M and N ADR categories, with a GVM greater than 3.5 tonnes).

To determine the ADRs that apply to the vehicle in question, refer to the applicability tables in Section LO. Vehicles manufactured on or 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.

Alternatively, ADR applicability tables for individual vehicle categories may be referenced on the Department of Infrastructure and Transport ***RVCS*** website at the following address and under the section titled ***ADR Applicability Tables***:

http://rvcs.dotars.gov.au/

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 BASIC MODIFICATIONS NOT REQUIRING CERTIFICATION

The following modifications may be carried out provided they do not affect compliance with the ADRs, compliance with regulations including applicable vehicle standards and provided they meet the following general safety requirements.

4.1 FUEL LINES

The fitting of alternative or replacement fuel lines may be performed without certification, provided that:

- the installation is in accordance with good engineering practice;
- all components used are unmodified;
- the fuel lines are secured, properly supported and shielded against heat, abrasion and impact damage; and
- the fuel lines do not leak.

4.2 FUEL FILTERS AND PUMPS

The fitting of additional fuel filters and/or alternative or replacement fuel pumps may be performed without certification, provided that:

- the installation is in accordance with good engineering practice;
- all components used are unmodified;
- the alternative/replacement fuel filter and/ or fuel pump are secured, properly supported and shielded against heat, abrasion and impact damage; and
- the alternative/replacement fuel filter and/ or fuel pump do not leak.

5 MODIFICATIONS THAT MAY BE CERTIFIED UNDER THE LM CODES

This section specifies particular requirements and covers limitations on work that may be carried out under individual LM Codes.

Each Code is supplemented with a checklist (refer to Table LM2)

Table LM2 LM Code Directory

FUEL TANK ALTERATION

CODE LM1

SCOPE

Code LM1 covers the installation of alternative fuel tanks and the installation of surge tanks in light motor vehicles other than ADR category L-group vehicles and pre-ADR motor cycles and motor tricycles.

MODIFICATIONS COVERED UNDER CODE LM1

The following is a summary of the modifications that may be performed under Code LM1:

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

MODIFICATIONS NOT COVERED UNDER CODE LM1

Modifications not covered under Code LM1:

- Fitting an alternative fuel system (refer to a Queensland Licensed Gas Fitter).

COMPLIANCE WITH REGULATIONS

Modified vehicles must continue to comply with the ADRs to which they were originally constructed, except as allowed for in the AVSR. These modified vehicles must also comply with the applicable in-service requirements of the AVSR.

Modified pre-ADR vehicles must continue to comply with the AVSR.

Compliance with the AVSR also means compliance with the equivalent regulations of a State or Territory of Australia.

Outlined below in Table LM3 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. This is not an exhaustive list and other modifications may also affect ADR compliance.

Table LM3 Summary of items that if modified, may detrimentally affect compliance with applicable ADRs

ADRS	DETAIL
ADR 26, 27x	Vehicle Engine Emission Control
ADR 37, 37/...	Vehicle Emission Control
ADR 40	Light Duty Vehicle Emissions Control
ADR 41, 41/...	Mandatory Operation on Unleaded Petrol, Evaporative emission controls.
ADR 42/...	General Safety Requirements, The requirements for positioning of exhaust outlets.
ADR 43/...	Vehicle Configuration and Dimensions (Includes provisions for ground clearance).
ADR 44/...	Specific Purpose Vehicle Requirements (Includes provisions for LP Gas installation).

ADR 79/...	Vehicle Emission Control. This vehicle standard is applicable to all M1 and N1 category vehicles with a GVM less than or equal to 3.5 tonnes and with an engine that operates on petrol, liquefied petroleum gas or natural gas.
ADR 80/...	Emission Control for Heavy Vehicles. (This ADR applies to vehicles of the M and N ADR categories, with a GVM greater than 3.5 tonnes).

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

CHECKLIST LM1

FUEL TANK ALTERATION

CODE LM1

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

1.	**GENERAL**			
1.1	Are all fuel lines used suitable for the fuel and fuel system?		Y	N
1.2	Are all fuel lines securely fastened with clamps or clips?		Y	N
1.3	Has the circuit been checked for leaks and any leaks have been repaired?		Y	N
1.4	Are fuel lines at least 100mm from 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	Are lines adequately protected from chafing, road damage or crushing?		Y	N
1.7	Does the location of the tank meet the vehicle's clearance requirements including departure angle?		Y	N
1.8	Are the fuel tank and components at least 100mm inboard of OEM permanent bodywork?		Y	N
1.9	Is 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 (25% or more) than the original and uses the original mountings, has their strength been checked and shown to be adequate by a Signatory.	N/A	Y	N
1.12	Does the replacement fuel tank have no adverse affect on the controllability, handling or stability of the vehicle when road tested?		Y	N
1.13	Are the fuel filler inlet and cap located outside of the vehicle?	N/A	Y	N
1.14	Where the inlet is located inside the vehicle, is it not inside the passenger compartment and is the inlet separately sealed from the rest of the vehicle?	N/A	Y	N
1.15	Is the fuel tank and filler so arranged that any overflow or leakage of fuel cannot accumulate nor contact the exhaust or electrical systems?		Y	N

FORM No: LM1

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

1.16	Are all apertures created to allow for the installation of the fuel tanks suitably sealed so as to prevent the entry of exhaust, road or petrol fumes into the cabin of the vehicle?		Y	N
2.	**ADDITIONAL REQUIREMENTS FOR VEHICLES FITTED WITH EMISSION CONTROL SYSTEMS.**			
2.1	Are all of the fuel tank evaporative controls for ventilation of the tank 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, has an additional or larger canister of sufficient capacity been fitted to vehicles equipped with evaporative emission control systems?	N/A	Y	N
2.3	If the vehicle was originally equipped with an independent liquid/vapour separator has either an additional separator been fitted or that provision built into the new tank?	N/A	Y	N
3.	**WORKMANSHIP**			
3.1	Is all work including welding performed in accordance with recognised engineering standards?		Y	N
4.	**ADR COMPLIANCE**			
4.1	Does the converted vehicle continue to comply with applicable ADRs?		Y	N
5.	**INSPECTION**			
5.1	Has an inspection been carried out on the installation and all modified components and found to be satisfactory?		Y	N
6.	**RECORDS**			
6.1	Have complete records of vehicle conversion/modifications details been retained in a manner suitable for auditing as requested by the Registration Authority?	N/A	Y	N

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

CERTIFICATION DETAILS																		
Make						**Model**						**Year of Manufacture**						
VIN																		
Chassis Number (If applicable)																		
Brief Description of Modification/s																		
Vehicle Modified By																		
Certificate Number (If applicable)																		
Vehicle Certified By (*Print*)																		
Signatory's Employer (If applicable)																		
Signatory's Signature												**Date**						