Vehicle Standards Bulletin 14

NATIONAL CODE OF PRACTICE
for
LIGHT VEHICLE CONSTRUCTION
and
MODIFICATION

SECTION LB
TRANSMISSION

Version 2.0 November 2009

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 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 Federal Department of Infrastructure, Transport, Regional Development and Local Government in Canberra about VSB 14. VSS provides the website as a service only.

Document Amendments by Version

Version	Amendments
Version 2 **Published November 2009**	Clause 2.5 *Engine Control Unit* has been added. This document has also a number of editorial amendments that have had no affect on its technical content.

CONTENTS

1 SCOPE

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

1.1 BASIC MODIFICATIONS NOT REQUIRING CERTIFICATION

- Fitting a manufacturer's optional manual or automatic gearbox; and
- Fitting a manufacturer's optional differential or final drive gear set.

1.2 MODIFICATIONS REQUIRING CERTIFICATION UNDER LB CODES

- Fitting a manual or automatic transmission from a different vehicle make or model;
- Changing a gearbox or final drive gear ratio if speedometer accuracy is altered;
- Fitting a rear axle assembly (including differential and rear brakes) from a different make or model vehicle; and
- Fitting an alternative transmission tunnel.

Note: The underlying design installation and fabrication requirements for all of the above modifications are contained in sub-section 2 *General Requirements*.

2 GENERAL REQUIREMENTS

This subsection applies to all light vehicles and must be read and applied in conjunction with all the LB Codes applicable to the proposed modifications.

Modified vehicles must continue to comply with the Australian Design Rules (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 TORQUE CAPACITY

Any replacement gearbox or driveline components should have adequate torque capacity based on the output of the vehicle's engine.

2.2 TRANSMISSION MOUNTINGS

Automotive type mountings that have sufficient strength for the application must be used.

Sub frames, chassis, cross-members or body members must not be removed or weakened when fitting a replacement gearbox. Modified or replacement cross-members must maintain the strength and stiffness of the original design.

If the replacement gearbox rear mounting is in the same position along a transmission tunnel, existing tunnel mounting points can be used. Alternatively, if the centre of the gearbox mounting is offset forwards or rearwards of all existing vehicle mounting points, new vehicle

mounting points should be fitted, with stiffening plates on the inside of the floor or transmission tunnel.

The transmission tunnel may be replaced with the transmission tunnel from the same model vehicle's automatic (or manual) variant, using an equivalent method of attachment, or alternatively an individually constructed tunnel may be used. If a transmission tunnel has been formed as integral part of the floor panel the replacement tunnel must be fully welded in place and in accordance with good engineering practice.

Openings in floor panels necessary for the gearshift controls must be adequately sealed to prevent entry of exhaust gases into the vehicle cabin. Transmission tunnels must be similarly sealed.

The edges of any holes cut in the floor or transmission tunnel for gearshift controls should be reinforced to compensate for the loss in strength and stiffness due to the cut-out. Reinforcing material welded into the floor or tunnel should be no more than twice the thickness of the original material.

2.3 DRIVE SHAFTS, AXLES AND DIFFERENTIALS

All drive shaft and axle universal and constant velocity joint flanges must be mated correctly and driveline items must be correctly balanced. Hollow drive shafts must only be lengthened or shortened using a single piece tube. Two or more tubes must not be butt welded.

The driveline must be correctly designed regarding torque capacity, drive shaft length, intermediate bearing position and support, rotational speed limitations, slip joint travel and engagement and driveline angles. Unequal length or unequal angled front drive shafts can exaggerate torque-steer on driven front wheels.

The differential must not be locked either by the use of spools or welding to prevent any difference in speed between the wheels on any axle. A proprietary part-time differential locking device may be utilised, provided that the driver can control it from the normal seating position.

2.4 REAR DRIVE AXLE ASSEMBLY

A modified or replacement rear axle assembly must have a load carrying capacity and gear ratio that is suitable for the loaded weight of the modified vehicle. (The *Gross Vehicle Mass* (GVM) and *Gross Combination Mass* (GCM) of the modified vehicle may be considerably different from original; particularly if there are other modifications that may affect the capacity.)

The axle must be installed to minimise drive shaft operating angles and avoid driveline vibrations.

If changes to the original braking system are carried out when a replacement axle is fitted, the modifications must comply with the appropriate requirements of Code LG. Brake hoses (including braided stainless steel types) must comply with ADRs 7 or 42/ where applicable.

If changes to the rear suspension are required to fit a replacement axle assembly, the modifications must comply with the appropriate requirements of Code LS.

To ensure the rear wheel track meets the requirements of Code LS, the width between the wheel mounting faces of the replacement axle should be checked and if necessary, modified to suit. Spacers must not be used to achieve the modification.

2.5 ENGINE CONTROL UNIT

If the original vehicle manufacturers' transmission was equipped with sensors, then all sensors must be fitted and connected to any replacement transmission or differential using the appropriate manufacturers' components and operate as initially intended. Equivalent adaptors or connectors may be used to connect the sensors providing they allow the transmission to operate as intended.

2.6 SPEEDOMETER

Speedometer drive cables or sensors should be connected to any replacement transmission using the manufacturers' components or equivalent adaptors or connectors.

The accuracy of the vehicle's speedometer must be maintained and continue to comply with the applicable ADR. If the vehicle's original overall gearing or speedometer drive system has been changed, the speed indicated by the speedometer should be no less than the vehicle's actual speed and no more than 10% above the actual speed.

2.7 REVERSE LIGHTS

All reverse lights must operate only with the ignition *ON* and reverse gear selected (refer ADR 1).

2.8 AUTOMATIC TRANSMISSION

The engine starter must be inoperative when the transmission is in any forward or reverse drive position (refer ADR 42/...).

2.9 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, 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*.

Mating Parts

Standard features such as splines, tapers and keyways must conform to published standards and their mating parts must conform to matching standards.

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 1 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.

Compliance with the ADRs may be detrimentally affected by transmission substitution or modifications relating to speedometer accuracy, reversing lamps and automatic transmission controls.

Certain transmission changes can detrimentally affect compliance with other ADRs such as braking (rear axle assembly substitution) and gaseous emissions (engine management systems).

Table 1 Summary of items that if modified, may detrimentally affect compliance with applicable ADRs

ADR	Title & Comments
1, 1/…	Reversing Lamps (includes automatic switching)
7, 7/…, 42/…	Brake Hoses
9	Standard Controls for Automatic Transmission
18x, 18/…	Instrumentation (speedometer accuracy)
24x, 24/…	Tyre and Rim Selection (speed rating)
31, 31/… 35x, 35/…	Braking Systems
37, 37/…,79/…,80/…	Gaseous Emissions
42/…	General Safety Requirements (prevent movement when starting)

The applicable ADRs are individually listed on the Identification (Compliance) Plate of 2nd Edition ADR vehicles. For 3rd Edition ADR vehicles, the Identification Plate contains the vehicle category and the date of manufacture, from which the applicable ADRs can be determined (refer to the applicability tables in Section LO Vehicle Standards Compliance).

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

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

4 BASIC MODIFICATIONS WITHOUT CERTIFICATION

The following *Basic Modifications* may be carried out without certification provided they are in conformity with the relevant clauses of sub-section 2 *General Requirements*, they do not affect compliance with applicable ADRs or AVSRs and provided they meet the following requirements:

4.1 OPTIONAL TRANSMISSION

The fitting of a manufacturer's optional manual or automatic transmission (gearbox or transaxle) and associated controls is allowed, provided that:

- the transmission and all other associated components are from the same make and model as the vehicle to which they are being fitted;
- the correct engine/powertrain management system for the engine/transmission combination is connected and utilised as originally intended;
- the installation and its operation are in accordance with the manufacturer's specifications;
- matching speedometer drive gears and/or sender units are used (if applicable); and
- all components used are unmodified.

4.2 OPTIONAL DIFFERENTIAL

The fitting of a manufacturer's optional differential or final drive gear set is allowed, provided that:

- the differential or gear set is from the same make and model as the vehicle to which it is being fitted;
- the installation and its operation are in accordance with the manufacturer's specifications;
- matching speedometer drive gears and/or sender units are used; and
- all components used are unmodified.

5 CERTIFIED MODIFICATIONS (LB CODES)

This section specifies particular requirements and covers limitations on work carried out under individual LB Codes.

Each Code is supplemented with a checklist. (Refer Table 2).

Table 2 LB Code Directory

TRANSMISSION SUBSTITUTION

CODE LB1

SCOPE

Code LB1 provides for the fitting of alternative transmissions, conversions from automatic to manual or vice versa and for changes to final gear ratios.

Code LB1 does not apply to ADR category L-group vehicles and motorcycles.

MODIFICATIONS COVERED UNDER CODE LB1

The following is a summary of the modifications that may be performed under Code LB1:

- Fitting an alternative transmission (gearbox or transaxle);
- Conversion from automatic to manual or vice versa; and
- Changing final drive gear ratios outside manufacturer's optional specifications.

MODIFICATIONS NOT COVERED UNDER CODE LB1

The following is a summary of the modifications that may not be performed under Code LB1 – *Transmission Substitution*:

- Fitting an alternative live rear axle assembly (this is covered by Code LB2);
- Fitting an alternative chassis-mounted final drive differential assembly (this is covered by Code LB2); and
- Suspension and braking system modifications (these are covered by Codes LG and LS).

COMPLIANCE WITH APPLICABLE VEHICLE STANDARDS

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 3 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 3 Summary of items that if modified, may detrimentally affect compliance with applicable ADRs

DETAIL	REQUIREMENTS
Reversing lights	ADR 1, 1/...
Automatic transmission controls	ADR 9
Speedometer accuracy	ADR 18x, 18/...
Tyre speed rating	ADR 24x, 24/..., 42/...
Gaseous Emissions	ADR 37, 37/..., 79/..., 80/...
Prevent vehicle movement from starting	ADR 42/...

To determine the ADRs that apply to the vehicle in question, refer to the Applicability Tables in Section LO. Vehicles manufactured on or after 1January 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.

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

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

CHECKLIST LB1

TRANSMISSION SUBSTITUTION

CODE LB1

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

1	**GENERAL**			
1.1	Does the replacement gearbox have adequate torque capacity for the output of the vehicle's engine?		Y	N
1.2	Has the replacement gearbox been fitted without the removal or weakening of sub-frames, chassis, cross-members or body members?		Y	N
1.3	Are all openings in the vehicle for gear selection controls sealed to prevent entry of exhaust gases?		Y	N
1.4	If overall gearing or speedometer drive is modified, does the vehicle's speedometer accuracy comply with relevant ADR requirements?	N/A	Y	N
1.5	Are automotive type gearbox mountings used on adequate support brackets?		Y	N
1.6	Do the reversing lights (if fitted) only operate when reverse gear is selected with the ignition *ON*?	N/A	Y	N
1.7	Does the conversion comply with all the relevant requirements of sub-section 2 *General Requirements*?		Y	N
2	**AUTOMATIC TRANSMISSION (if applicable)**			
2.1	Does the transmission selection mechanism have a neutral position located between the reverse and forward drive positions?	N/A	Y	N
2.2	Is a "Park" position located adjacent to the reverse drive position?	N/A	Y	N
2.3	Is the reverse selection movement upward, forward or to the left side?	N/A	Y	N
2.4	Is the transmission selection position displayed and illuminated within the vehicle's driver compartment?	N/A	Y	N
2.5	Is the starter mechanism inoperative when the transmission is in any position that can drive the vehicle? (Required by AVSR).		Y	N
3	**ENGINE CONTROL UNIT (If applicable)**			
3.1	Are all sensors appropriately connected and operating as originally intended?	N/A	Y	N

[Continued overleaf]

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

4	**DRIVE SHAFT**			
4.1	Does the drive shaft comply with the requirements outlined in sub-section 2.3 of *General Requirements*?	N/A	Y	N
5	**FINAL DRIVE**			
5.1	Has the differential been left unlocked?		Y	N
5.2	Does the final drive comply with the requirements outlined in sub-sections 2.3 and 2.4 of *General Requirements*?	N/A	Y	N
6	**WORKMANSHIP**			
6.1	Is the quality of workmanship including welding to a satisfactory standard?		Y	N
6.2	Are replacement fasteners at least equivalent to original in size, strength and quantity?	N/A	Y	N
6.3	Are all other fasteners of sufficient size, strength and quantity?	N/A	Y	N
7	**ADR COMPLIANCE**			
7.1	Does the converted vehicle continue to comply with applicable ADRs?	N/A	Y	N

Note: If the answer to any question is **N (No),** the modification cannot be certified under Code LB1.

[Continued overleaf]

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**					

REAR AXLE SUBSTITUTION

CODE LB2

SCOPE

Code LB2 covers modifications relating to rear axle substitution and/or modification.

Code LB2 does not apply to ADR category L-group vehicles and motorcycles.

MODIFICATIONS COVERED UNDER CODE LB2

The following is a summary of the modifications that may be performed under Code LB2:

- Fitting an alternative or modified rear live axle assembly using the vehicle's standard braking system;
- Fitting an alternative or modified rear live axle assembly using a modified braking system (the braking system modifications must be certified under Codes LG1 and LG2); and
- Fitting an alternative chassis mounted final drive differential assembly for an independent or de-Dion rear suspension.

MODIFICATIONS NOT COVERED UNDER CODE LB2

The following modifications may not be performed under Code LB2:

- Fitting alternative final drive gears or crown wheel and pinion (this is covered by Code LB1);
- Braking system modifications (these are covered by Code LG1 and LG2); and
- Rear suspension modifications (these are covered by Code LS5).

COMPLIANCE WITH APPLICABLE VEHICLE STANDARDS.

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 4 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 4 Summary of items that if modified, may detrimentally affect compliance with applicable ADRs

DETAIL	REQUIREMENTS
Brakes	ADR 7, 7/..., 31, 31/..., 35x, 35/...
Speedometer Accuracy	ADR 18x, 18/...
Tyre speed rating	ADR 24x, 24/..., 42/...

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.

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.

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

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

CHECKLIST LB2

REAR AXLE SUBSTITUTION

CODE LB2

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

1	**REAR AXLE REPLACEMENT**			
1.1	Is the load carrying capacity and gear ratio of the replacement axle suitable for the range of loads of the vehicle?		Y	N
1.2	Does the width between the axle flange faces ensure that the axle and wheel assembly complies with the requirements of Section LS?		Y	N
1.3	Has the replacement rear axle been fitted without heating or welding of the axle shafts?		Y	N
2	**CHASSIS-MOUNTED FINAL DRIVE**			
2.1	Are the chassis mountings and brackets capable of resisting the torque from traction and braking?	N/A	Y	N
3	**DRIVE SHAFT**			
3.1	Does the drive shaft comply with the requirements outlined in sub-section 2.4 of *General Requirements*?		Y	N
4	**SPEEDOMETER**			
4.1	If overall gearing or speedometer drive is modified, does the vehicle's speedometer accuracy comply with relevant ADR requirements?	N/A	Y	N
5	**ENGINE CONTROL UNIT (If Applicable)**			
5.1	Are all sensors appropriately connected and operating as originally intended?	N/A	Y	N
5	**SUSPENSION**			
5.1	If the rear suspension has been modified, has it been certified under Code LS5?	N/A	Y	N
6	**BRAKING SYSTEM (if braking system modified)**			
6.1	Has the design of the modified braking system been certified under Code LG1?	N/A	Y	N
6.2	Has the modified braking system on this vehicle been certified under Code LG2?	N/A	Y	N

[Continued overleaf]

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

7	**WORKMANSHIP**			
7.1	Is the quality of workmanship including welding to a satisfactory standard?		Y	N
7.2	Are replacement fasteners at least equivalent to original in strength and quantity?		Y	N
8	**ADR COMPLIANCE**			
8.1	Does the converted vehicle continue to comply with applicable ADRs?	N/A	Y	N

Note: If the answer to any question is **N (No)**, the modification cannot be certified under Code LB2.

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**						