Vehicle Standards Bulletin 14

NATIONAL CODE OF PRACTICE
for
LIGHT VEHICLE CONSTRUCTION
and
MODIFICATION

SECTION LB
TRANSMISSION

1st February 2006

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

Warning to Users

Users of the National Code of Practice for Light Vehicle Construction and Modification (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.

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 MODIFICATIONS NOT REQUIRING CERTIFICATION

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

1.2 MODIFICATIONS REQUIRING CERTIFICATION UNDER LB APPROVAL CODES

- Fitting a manual or automatic transmission from a different vehicle make or model.
- Changing gearbox or final drive gear ratios where speedometer accuracy is altered.
- Fitting a rear axle assembly (including differential and rear brakes) from a different make or model vehicle.

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

2 GENERAL REQUIREMENTS

This sub-section applies to all light vehicles and should be read in conjunction with the other sub-sections of the LB Code and the specific Approval Code for the modification or conversion.

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 cross-members must maintain the strength and stiffness of the original design.

Where the replacement gearbox rear mounting is in the same position along a transmission tunnel, existing tunnel mounting points can be used. Alternatively, where 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.

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

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 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 & 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 using a single piece tube. Butt-welding to join two tubes is not permitted.

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.

Permanently locking the differential, including the use of "spools" or welding, to prevent any difference in speed between the wheels on any axle is not permitted. Proprietor "Part-time" differential locking devices are permitted, provided that the driver can control it from the normal seating position.

2.4 REAR DRIVE AXLE ASSEMBLY

If a rear axle is being replaced, the replacement axle must have a load carrying capacity and gear ratio that is suitable for the loaded weight of the vehicle.

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 ADR 7 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.

2.5 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.

2.6 REVERSE LIGHTS

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

2.7 AUTOMATIC TRANSMISSION

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

2.8 FABRICATION

All work must be performed in accordance with good 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.

MATING PARTS

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

ELECTROPLATING

To prevent cracks forming in the parent metal under chromium plating or from hydrogen embrittlement of steel components, electroplating of suspension and brake components including bolts is not allowed, unless specifically designed and approved under Codes LG and LS.

3 AUSTRALIAN DESIGN RULES

The Australian Design Rules (ADRs) most likely to be affected by a transmission substitution or modification are those relating to speedometer accuracy, reversing lamps and automatic transmission controls.

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

A modified vehicle must continue to comply with the Australian Design Rules to which it was originally constructed, except as allowed for in the Road Transport Reform, Australian Vehicle Standards Rules.

The applicable ADRs are individually listed on the Identification Plate of 2nd Edition ADR vehicles. For 3rd Edition ADR vehicles, the Identification Plate contain 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*).

The following is a list of ADRs that may be affected by modifications covered in this section:

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

4 MODIFICATIONS WITHOUT CERTIFICATION

The following modifications may be carried out without obtaining approval under an LB Approval Code, provided that the vehicle continues to comply with relevant Australian Design Rules and Vehicle Standards Rules and provided that the vehicle meets the following general safety 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 management system for the engine/transmission combination is used;
- the installation is in accordance with the manufacturer's specifications;
- matching speedometer drive gears and/or sender units are used (where 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 is 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 APPROVAL CODES)

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

Each Code is supplemented with a checklist.

TRANSMISSION SUBSTITUTION

CODE LB1

SCOPE

The following is a summary of the modifications that may be approved under Code LB1 – *Transmission Substitution*.

Approvals are **allowed** under Code LB1 for:

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

Approvals are **not allowed** under Code LB1 for:

- 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).
- Suspension and braking system modifications (these are covered by Codes LG and LS).

Code LB1 does not apply to L-group vehicles (e.g. motorcycles).

COMPLIANCE WITH APPLICABLE VEHICLE STANDARDS

The modified vehicle must continue to comply with all applicable ADRs, AVSRs, VSBs, 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
Reversing lights	ADR 1
Automatic transmission controls	ADR 9
Speedometer accuracy	ADR 18
Tyre speed rating	ADR 24
Gaseous Emissions	ADR 37 , 79, 80
Prevent vehicle movement from starting	ADR 42

NOTE: To determine the ADRs that apply to the vehicle in question, refer to the Applicability Tables in Section LO. Vehicles manufactured 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.

FORM No: LB1

CHECKLIST

TRANSMISSION SUBSTITUTION

APPROVAL 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?			
	Reverse selection movement is upward.	N/A	Y	N
	Reverse selection movement is forward.	N/A	Y	N
	Reverse selection movement is 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

[Continued overleaf]

FORM No: LB1

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

3	**DRIVE SHAFT**			
3.1	Does the drive shaft comply with the requirements outlined in sub-section 2.3 of *General Requirements*?	N/A	Y	N
4	**FINAL DRIVE**			
4.1	The differential has not been locked.		Y	N
4.2	Does the final drive comply with the requirements outlined in sub-section 2.3 and 2.4 of *General Requirements*?	N/A	Y	N
5	**WORKMANSHIP**			
5.1	Is the quality of workmanship including welding to a satisfactory standard?		Y	N
5.2	Are replacement fasteners at least equivalent to original in strength and quantity?	N/A	Y	N
6	**ADR COMPLIANCE**			
6.1	Does 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 approved under Code LB1.

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

Chassis No. or VIN ..……..

Description of Modification ..…….

Vehicle Modified By ..…….

Vehicle Approved By (Signatory) ...……..

Signatory Employer (if applicable) ……

Signed ……... Date …….

REAR AXLE SUBSTITUTION

CODE LB2

SCOPE

The following is a summary of the modifications that may be approved under Code LB2 –*Rear Axle Substitution.*

Approvals are **allowed** under Code LB2 for:

- 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 approved under Codes LG1 and LG2).
- Fitting an alternative chassis mounted final drive differential assembly for an independent or de-Dion rear suspension.

Approvals are **not allowed** under Code LB2 for:

- 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).
- Rear suspension modifications (these are covered by Code LS5).

Code LB2 does not apply to L-group vehicles (e.g. motorcycles).

COMPLIANCE WITH APPLICABLE VEHICLE STANDARDS.

The modified vehicle must continue to comply with all applicable ADRs, AVSRs, VSBs, 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.

FORM No: LB2

CHECKLIST

REAR AXLE SUBSTITUTION

APPROVAL 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 Code 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 if mounted inboard?	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	**SUSPENSION**			
5.1	If the rear suspension has been modified, has it been approved 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 approved under Code LG1?	N/A	Y	N
6.2	Has the modified braking system on this vehicle been approved under Code LG2?	N/A	Y	N

[Continued overleaf]

FORM No: LB2

(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 approved under Code LB2.

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

Chassis No. or VIN ...……..

Description of Modification ...…….

Vehicle Modified By ...…….

Vehicle Approved By (Signatory) ...……..

Signatory Employer (if applicable) ..…….

Signed …….. Date ……