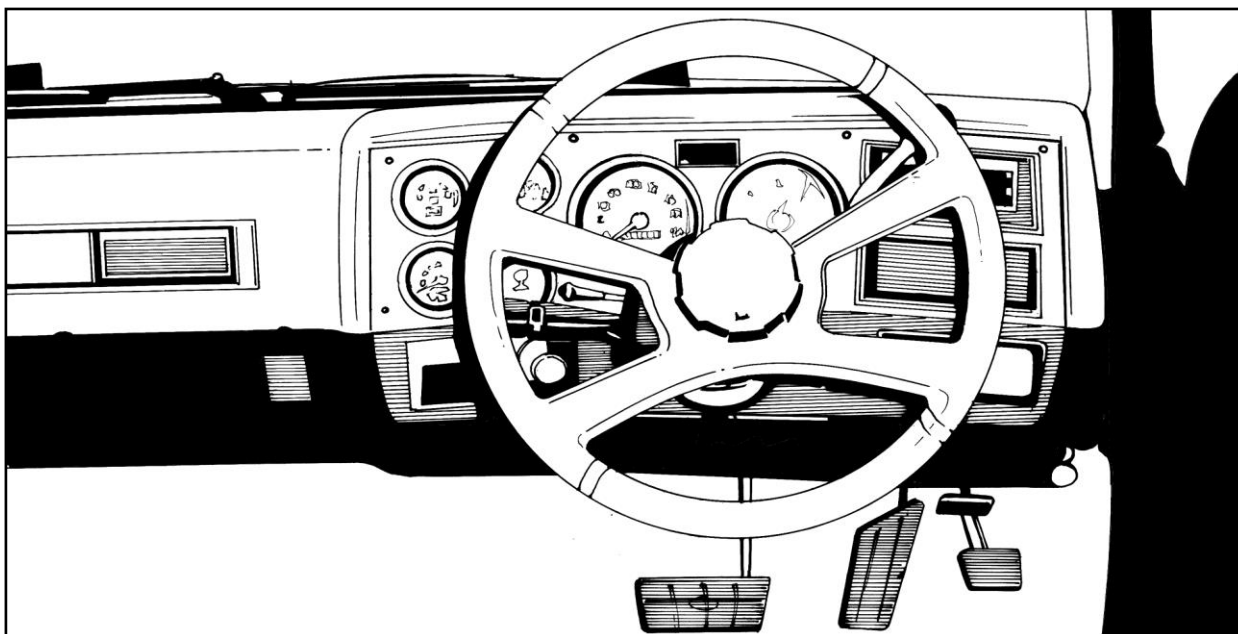


**Low Volume Vehicle Technical Association Incorporated**  
**Low Volume Vehicle Standard**  
**190-70(03)**  
**(Right-hand Drive Steering Conversions)**

*This Low Volume Vehicle Standard corresponds with: Land Transport Rule 32003/3 (Steering Systems), and replaces New Zealand Transport Agency Policy Statement No. 11*



**3<sup>rd</sup> Amendment – effective from: 25 October 2016**

Signed in accordance with clause 1.5 of the Low Volume Vehicle Code, on.....by:  
 on behalf of the **New Zealand Transport Agency:** ..... on behalf on the Low Volume Vehicle Technical Association(Inc):  
 .....

**LVV Standard 190-70 Amendment Record:**

No:	Detail of amendments:	Version:	Issue date:	Effect date:
1	Initial issue – original version	190-70(00)	1 August 2000	1 August 2000
2	1 <sup>st</sup> Amendment	190-70(01)	1 September 2004	1 September 2004
3	2 <sup>nd</sup> Amendment	190-70(02)	1 July 2016	1 July 2016
4	3 <sup>rd</sup> Amendment	190-70(02)	25 October 2016	25 October 2016

Note that highlighted text shows amendments that have been made subsequent to the document’s previous issue, and a grey vertical stroke to the left of the text denotes information that is of a technical (rather than a formatting) nature.

# Overview

## Background

The Low Volume Vehicle Technical Association Incorporated (LVVTA) represents ten specialist automotive groups who are dedicated to ensuring that vehicles, when scratch-built or modified, meet the highest practicable safety standards. The information in these standards has stemmed from work undertaken by LVVTA founding member organisations that commenced prior to 1990 and has been progressively developed as an integral part of NZ Government safety rules and regulations by agreement and in consultation with the New Zealand Transport Agency. As a result, the considerable experience in applied safety engineering built up by LVVTA and the specialist automotive groups over the past twenty years can be of benefit to members of the NZ public who also wish to build or modify light motor vehicles.

## Availability of low volume vehicle standards

Low volume vehicle standards are developed by the LVVTA, in consultation with the New Zealand Transport Agency, and are printed and distributed by the LVVTA. The standards are available to the public free of charge from the LVVTA website; [www.lvvtta.org.nz](http://www.lvvtta.org.nz)

Further information on the availability of the low volume vehicle standards may be obtained by contacting the LVVTA at [info@lvvtta.org.nz](mailto:info@lvvtta.org.nz).

## Copyright

The content of this document remains the property of the Low Volume Vehicle Technical Association (Inc.), and no part of it may be reproduced without the prior written consent of the copyright holder.

## Associated information

Other associated information relevant to the subject matter contained in this low volume vehicle standard, which in the interest of comprehensiveness, should be read in conjunction with this standard, includes:

Document	Page #/Section/Chapter
• LVVTA News January-July 2014 Issue 49	Page 3 No Joke (Pulley-driven Conversion)
• LVVTA News August-December 2014 Issue 50	Page 3 The Complexities of Right-hand Drive Conversions Today
• New Zealand Car Construction Manual	Chapter 7 Steering Systems

Note that all documents referred to in this table, with the exception of the [NZ Car Construction Manual](#), can be accessed from [www.lvvtta.org.nz](http://www.lvvtta.org.nz) free of charge. For information on obtaining the [NZ Car Construction Manual](#), contact [info@lvvtta.org.nz](mailto:info@lvvtta.org.nz)

Note also that paper copies of documents can become out of date and as such should not be relied upon, therefore LVVTA advises users of this standard to check to ensure that the Associated Information listed here is current, by going to [www.lvvtta.org.nz/standards.html](http://www.lvvtta.org.nz/standards.html)

# Contents

Purpose of this standard		<b>Page 4</b>
<b>Section 1</b>	<b>Scope and application of this standard</b>	<b>4</b>
1.1	Scope of this standard	4
1.2	Application of this standard	5
<b>Section 2</b>	<b>Technical requirements of this standard</b>	<b>6</b>
2.1	General safety requirements	6
2.2	Approved standards compliance requirements	7
2.3	Steering configuration requirements	7
2.4	Steering system requirements	8
2.5	Second-hand, modified, custom-manufactured, re-manufactured & reconditioned component requirements	11
2.6	Body & chassis modification requirements	13
2.7	Braking system requirements	15
2.8	Interior & electrical system requirements	18
2.9	Other requirements	20
2.10	Road-test requirements	22
<b>Section 3</b>	<b>Exclusions to this standard</b>	<b>22</b>
3.1	Brake cross-shaft and linkage transfer system exclusions	23
<b>Section 4</b>	<b>Vehicles not required to be certified to this standard</b>	<b>23</b>
4.1	Vehicles not covered by this standard	23
4.2	Vehicles that pre-date legal requirements	23
4.3	Vehicles converted by high-volume manufacturers	24
<b>Section 5</b>	<b>Terms and definitions within this standard</b>	<b>24</b>
<b>Appendix 1</b>	<b>List of vehicles converted by high-volume manufacturers</b>	<b>26</b>

# Right-hand Drive Steering Conversions

**(190-70[03])**

## Purpose of this standard

The purpose of this low volume vehicle standard is to specify requirements for steering systems and other affected systems and components, which must be met when a light motor vehicle is modified by conversion from left to right-hand drive configuration for use on roads in New Zealand.

**Particular** caution is required with a left-hand drive motor vehicle which has been designed and manufactured to meet a frontal impact standard specified in Land Transport Rule 32006 Vehicle Standards (Frontal Impact), to ensure that any adverse influence on the designer's package of safety systems relating to frontal impact protection is minimised as a result of the right-hand drive conversion.

## Section 1 Scope and application of this standard

### 1.1 Scope of this standard

1.1(1) This low volume vehicle standard applies to all light vehicles other than those specified in 1.1(2), that have undergone a right-hand drive steering conversion:

- (a) in New Zealand after 1 March 1999; or
- (b) in New Zealand between 1 August 1990 and 1 March 1999, which do not have a recognised conversion company's plate affixed to the vehicle that records:
  - (i) the company name of the conversion agent; and
  - (ii) the chassis number or VIN of the vehicle that has been converted; and
  - (iii) a traceable sequential conversion number allocated by the conversion agent to the vehicle that has been converted;

or

- (c) overseas, and were first registered in New Zealand after 1 August 2000.

**NOTE 1:** The date referred to in 1.1(1) of 1 March 1999 is the date specified (from the NZTA *In-Service VIRM*) by NZTA as the date at which recognised New Zealand Right-hand Drive Conversion Agents were required to adopt the LVV certification process, and 1 August 2000 is the introduction date of this LVV standard.

NOTE 2: A vehicle first registered in New Zealand after the implementation date of this standard that has undergone a right-hand drive steering conversion outside New Zealand is required to comply with all of the requirements of this low volume vehicle standard, irrespective of date of modification.

1.1(2) This low volume vehicle standard does not apply to:

- (a) powered bicycles of Class AB; or
- (b) motorcycles and mopeds of Class LA, LB, LC, or LD; or
- (c) light trailers of Class TA or TB; or
- (d) those vehicles specified in *section 4*.

1.1(3) This low volume vehicle standard does not apply to:

- (a) vehicles that are modified in such a way as to incorporate major changes to the vehicle structure, or a complete steering system configuration change; or
- (b) scratch-built vehicles.

NOTE: Because of the relevance of the *New Zealand Car Construction Manual* to complex modifications, a vehicle specified in 1.1(3) must have the applicable requirements of the *New Zealand Car Construction Manual* applied, rather than the requirements of this low volume vehicle standard. This standard is based around the use of OEM systems, and applies to straight-forward 'mirror-image' conversions, therefore its scope does not cover non-OEM system based conversions.

## 1.2 Application of this standard

1.2(1) A light vehicle that undergoes a right-hand drive steering conversion becomes a low volume vehicle, and must:

- (a) be certified in accordance with the procedures specified in *chapter 2* of the *Low Volume Vehicle Code*; and
- (b) unless *section 3* applies, comply with all applicable technical requirements contained in *section 2* of this standard.

NOTE: Where a light vehicle first registered in New Zealand after 1 August 1990 is required to be certified to the *Low Volume Vehicle Code*, but the modification date precedes the date upon which this standard takes effect (1 August 2000), an LVV Certifier must ensure that the vehicle meets the general safety requirements contained in 2.1 of this standard, and should use the applicable technical requirements of *section 2* of this standard as a guideline upon which to base his judgements on the safety of the vehicle.

Note however that an LVV Certifier must apply his judgement at a very high level when assessing any part of a steering system upon which the vehicle's directional control relies.

## Section 2      **Technical requirements of this standard**

---

### 2.1              **General safety requirements**

- 2.1(1)              A low volume vehicle must:
- (a)              be designed and constructed using materials and components that are fit for their purpose; and
  - (b)              be safe to be operated on the road.

NOTE: The requirements specified in 2.1(1) are selected from 2.3 of *Part 2* of the *Low Volume Vehicle Code*, reproduced here in the interest of convenience, and are over-riding requirements which make it clear that, regardless of what technical requirements are or are not in place, every vehicle certified to the *Low Volume Vehicle Code* must be fit for its purpose, and must be safe.

- 2.1(2)              A steering system on a low volume vehicle, and associated systems and components that could directly or indirectly affect the directional control of the vehicle, must be:
- (a)              sound and in good condition, and must provide the vehicle with safe, efficient, convenient, and sensitive control; and
  - (b)              strong, durable, and fit for their purpose, taking into account whether adverse effects have resulted from a loss of integrity of any protective system used by a relevant component.
- 2.1(3)              The condition of interior fittings, controls, and surfaces in the passenger compartments of a low volume vehicle must be maintained so that the likelihood of injury to occupants is minimised.
- 2.1(4)              For a low volume vehicle manufactured on or after 1 March 1998, or whose interior fittings, controls, and surfaces have been modified on or after 1 March 1998, the fittings, controls and surfaces in the passenger compartments of that vehicle must be designed, as well as maintained, so that the likelihood of injury to occupants is minimised.
- 2.1(5)              The performance of a low volume vehicle in relation to protecting occupants in a frontal collision must not be reduced below a safe tolerance of its state when manufactured or modified, by any factors, including corrosion, structural damage, material degradation, inadequate repair, the fitting of additional equipment, or the removal of equipment.

NOTE 1: The requirements specified in 2.1(2) to 2.1(5) are the applicable general safety requirements (slightly amended for consolidation) from 2.1 and 2.2 of *Land Transport Rules 32002/1, 32003/1, and 32006/1* which are required as part of this low volume vehicle standard, and are reproduced here in the interest of convenience.

NOTE 2: The requirements specified in 2.1(5) necessitate that in order to comply with this low volume vehicle standard, it must be established whether or not the vehicle was originally manufactured to comply with a frontal impact standard specified in *Land Transport Rule 32006/1: Vehicle Standards (Frontal Impact)*. Where vehicles which undergo a right-hand drive conversion were originally manufactured to comply with a frontal impact standard specified in the rule, continued compliance with the frontal impact standard for the purpose of this low volume vehicle standard must be achieved.

2.1(6) All wearing brake components used in a low volume vehicle which undergoes a right-hand drive conversion, such as pads, linings, disc rotors and drums, must be in good condition.

2.1(7) All components, systems, and methods of attachment within a right-hand drive conversion carried out on a low volume vehicle must be of equivalent or greater strength and durability than that of the corresponding original vehicle manufacturer's being replaced.

## 2.2 Approved standards compliance requirements

### Approved vehicle standards

2.2(1) In order to ensure continuing compliance with all applicable safety-related legal requirements, a low volume vehicle which undergoes a right-hand drive conversion must:

(a) wherever possible, comply with all of the approved vehicle standards contained within the rules or regulations applicable at the date of manufacture of the vehicle; or

(b) where continued compliance with an approved vehicle standard specified in 2.2(1)(a) is not possible or practicable, comply with the corresponding low volume vehicle standards and applicable chapters of the *New Zealand Car Construction Manual*.

## 2.3 Steering configuration requirements

### Maintaining OE steering configurations

2.3(1) Unless 2.3(2) applies, a low volume vehicle which undergoes a right-hand drive conversion must have the conversion carried out by:

- (a) the reversal, or mirror-imaging, of the steering system in its original position and configuration, over to the right-hand side of the vehicle; and
- (b) replicating the relationship between the steering column and the steering box in their original positions, across to the right-hand side of the vehicle; and
- (c) correctly replicating the relationship between the steering box drop arm and the drag link in their original positions, across to the right-hand side of the vehicle.

### Steering configuration for non-OE systems

- 2.3(2) The steering system in a low volume vehicle which undergoes a right-hand drive conversion may be upgraded to a steering configuration that incorporates more modern componentry, provided that both the objective and the result of the upgrade is improved system quality and safety over that of the original vehicle manufacturer's.

NOTE: 2.3(2) means that a component, or system, can be changed or substituted on the grounds of improved quality and safety, such as the case of upgrading the steering system in an older vehicle from a manual steering box to a power rack and pinion system.

- 2.3(3) A low volume vehicle which undergoes a right-hand drive conversion as in 2.3(2), or where modifications have been carried out to any of the vehicle's steering components, must have all affected components and systems checked for compliance with the design and construction requirements specified in the applicable sections of Chapter 7 Steering Systems of the New Zealand Car Construction Manual.

## 2.4 Steering system requirements

### Steering box or rack & pinion suitability

- 2.4(1) Except where 2.3(2) applies, a steering box or rack & pinion, or related component, used within a right-hand drive conversion carried out on a low volume vehicle must be the vehicle manufacturer's original or approved substitute component, unless such a component is unavailable in right-hand drive form.

NOTE: 2.4(1) means that a component, or system, cannot be changed or substituted for a component or system other than that specifically designed by the vehicle manufacturer for the right-hand drive conversion of the vehicle in question, based purely on economic reasons.

- 2.4(2) A steering box or rack & pinion used in a low volume vehicle which undergoes a right-hand drive conversion, must be able to withstand no less input and output torque than that of the steering box or rack & pinion fitted by the original vehicle manufacturer.



- 2.4(3) A steering box or rack & pinion, or related component, within a low volume vehicle which undergoes a right-hand drive conversion must:
- (a) be installed so as to replicate an original right-hand drive variant's attachment method; and
  - (b) incorporate not less than the same number, size, and grade of fasteners as originally used to attach the components by the vehicle manufacturer.

### Steering ratios

- 2.4(4) A steering box or rack & pinion used in a low volume vehicle which undergoes a right-hand drive conversion must provide:
- (a) in the case of a manual steering system, either:
    - (i) the same steering ratio as that of the steering box or rack & pinion fitted by the original vehicle manufacturer; or
    - (ii) where this is not practicable, a ratio that is matched to that of the original as closely as possible;
- or
- (b) in the case of a manual steering box or rack & pinion being replaced by a power steering box or rack & pinion, no greater steering effort than that required for the original system as a result of any change in the steering ratio.

### Steering geometry

- 2.4(5) Except where 2.3(2) applies, a low volume vehicle which undergoes a right-hand drive conversion must replicate the original vehicle manufacturer's steering geometry and performance requirements, which may be achieved by either:
- (a) utilising an unmodified right-hand drive steering system applicable for that make and model supplied by the original vehicle manufacturer, and fitted to that manufacturer's specifications; or
  - (b) in the case of a system which necessitates any modifications that may affect the steering geometry or its performance, inspection of the system to ensure that:
    - (i) bump-steer is limited to no more than that provided by the original vehicle manufacturer, and

- (ii) the original steering geometry and measurements are maintained.

2.4(6) An idler arm used on a low volume vehicle which undergoes a right-hand drive conversion, must be mounted so as to provide the correct location and angle of the idler arm in relation to the drag link.

2.4(7) The original vehicle manufacturer's provision for steering geometry adjustment must be retained on a low volume vehicle that has undergone a right-hand drive conversion.

2.4(8) The original vehicle manufacturer's provision for adjustment for wear must be retained on a low volume vehicle that has undergone a right-hand drive conversion.

### Steering stops

2.4(9) A low volume vehicle that incorporates a steering box which undergoes a right-hand drive conversion must have steering stops that:

- (a) are positioned so that at full lock in either direction:
  - (i) the steering lock is not limited by external stops whilst substantial travel remains in the box; and
  - (ii) the steering stops come into effect before the limit of steering box travel is achieved;

and

- (b) in the case of a vehicle equipped with a power-steering system, are positioned and adjusted so that the steering box relief valves operate correctly.

### Steering columns

2.4(10) A steering column used within a low volume vehicle which undergoes a right-hand drive conversion, that is not the column originally fitted to the vehicle must be disassembled and thoroughly inspected for damage, wear, or modifications.

NOTE: The requirement contained in 2.4(10) is because some steering columns sourced from overseas steering conversion specialists have been discovered, when pulled apart, to have been lengthened or shortened by means of cutting, butt-welding, and then flush-grinding smooth. These columns must be subjected to an especially high degree of inspection.

2.4(11) A steering column used within a low volume vehicle which undergoes a right-hand drive conversion must:

- (a) as closely as possible, replicate the original vehicle manufacturer's installation; and
- (b) be repositioned so as to provide the best possible alignment with the positioning of the driver's seat; and
- (c) be attached in the new position with no less strength and rigidity than provided in the original installation by the vehicle manufacturer; and
- (d) utilise where practicable all original mounting points and bracketry provided by the vehicle manufacturer.

## **2.5 Second-hand, modified, custom-manufactured, re-manufactured & reconditioned components**

### **Re-manufactured components in new vehicles**

2.5(1) A new low volume vehicle which undergoes a right-hand drive conversion must not incorporate a used component that performs a critical function within the conversion, unless the necessary component is unavailable new, in which case either:

- (a) a re-manufactured unit may be used; or
- (b) where a re-manufactured unit is also unavailable, a second-hand unit may be used provided that the components are reconditioned in accordance with the requirements specified in 2.5(2).

### **Reconditioned components in new vehicles**

2.5(2) A second-hand component that performs a critical function within a new low volume vehicle which undergoes a right-hand drive conversion must:

- (a) be reconditioned to the component manufacturer's service specifications, by a person who either:
  - (i) holds a trade certificate in automotive engineering or a trade equivalent to automotive engineering; or
  - (ii) has demonstrated to the low volume vehicle certifier, a satisfactory level of competence in the method of inspection and work being undertaken;

and

- (b) a report is supplied by the person who undertakes the inspection and work, which verifies that the requirements of 2.5(2)(a) have been met.

### Second-hand components in used vehicles

2.5(3) A used low volume vehicle which undergoes a right-hand drive conversion may incorporate a second-hand component that performs a critical function within the conversion if:

- (a) the component is inspected and restored as necessary to the component manufacturer's service specifications, by a person who either:
  - (i) holds a trade certificate in automotive engineering or a trade equivalent to automotive engineering; or
  - (ii) has demonstrated to the low volume vehicle certifier, a satisfactory level of competence in the method of inspection and work being undertaken;

and

- (b) a report is supplied by the person who undertakes the inspection and work, which verifies that the requirements of 2.5(3)(a) have been met.

### Non-destructive testing of second-hand components

2.5(4) A low volume vehicle which undergoes a right-hand drive conversion, and which incorporates a second-hand component within the conversion, may only use such a component if, in addition to 2.5(2) or 2.5(3):

- (a) any second-hand rotating component within the steering box or rack and pinion assembly within a steering system are non-destructively tested and comply with the requirements specified for non-destructive testing in form F008 'LVVTA Non-destructive Test Request Form'; and
- (b) a report, together with a completed and signed F008 'LVVTA Non-destructive Test Request Form', is supplied by the person who undertakes the non-destructive testing.

### Custom-manufacture and modification of components

2.5(5) Welding may only be carried out within a right-hand drive conversion of a low volume vehicle if:

- (a) the welding is carried out by a person who either:

- (i) holds a relevant current qualification or trade certification for the type of welding being undertaken; or
- (ii) has demonstrated to the low volume vehicle certifier, a satisfactory level of competence in the method of welding being undertaken;

and

- (b) for the purpose of confirming compliance with 2.5(5)(a), either:
  - (i) a report is supplied by the person who undertakes the welding to verify that the requirements of 2.5(5)(a)(i) have been met; or
  - (ii) the Low Volume Vehicle Certifier verifies that the requirements of 2.5(5)(a)(ii) have been met;

and

- (c) in the case of a welded steering component or any other critical function component, the requirements for welding of steering system components specified in 7.41 of Chapter 7 of the *New Zealand Car Construction Manual* have been met.

- 2.5(6) A cast or forged component that is original equipment on a low volume vehicle which undergoes a right-hand drive conversion, that performs a critical function or will be used in a critical location, must not be modified by heating, bending, or welding during the process of the conversion.
- 2.5(7) A custom-manufactured component that performs a critical function or will be used in a critical location incorporated within a right-hand drive conversion, and that involves a forging process during its manufacture, must meet the same non-destructive testing requirements specified for second-hand components in 2.5(4).
- 2.5(8) A steering track-rod or drag-link requiring modification as a result of a right-hand drive conversion in a low volume vehicle, may not be lengthened, but must be replaced by a one-piece item, custom-manufactured from a material of an equivalent or better size and material specification than the original component.

## 2.6 Body & chassis modification requirements

### Floor and body modifications

- 2.6(1) A modification to the floor, body structure, or front panel area of a low volume vehicle which undergoes a right-hand drive conversion must:

- (a) be carried out and reinforced in such a way so as to result in no less strength in the affected area than originally provided by the vehicle manufacturer; and
- (b) be such that there is no interference between steering components, suspension components, wheels and tyres, floor and body structure, or outer body panels; and
- (c) be carried out so as to minimise any effects on the vehicle's frontal impact protection systems.

NOTE: Where any effect may have occurred to the vehicle's frontal impact protection system as a result of the right-hand drive conversion, the requirements of the *Low Volume Vehicle Standard 155-30 (Frontal Impact)* must be met.

### Chassis and sub-frame modifications

2.6(2) A modification to the chassis or sub-frame of a low volume vehicle which undergoes a right-hand drive conversion must:

- (a) be carried out so as not to reduce the level of strength and rigidity of the affected area of the chassis or sub-frame; and
- (b) incorporate reinforcement tubes where the steering box and idler arm attaches to prevent the fastener loading from crushing the chassis or sub-frame section; and
- (c) either:
  - (i) replicate on the right-hand side chassis rail or sub-frame any strengthening or reinforcement originally provided by the vehicle manufacturer to the left side chassis or sub-frame; or
  - (ii) where mounting arrangements substantially differ due to non-symmetrical front chassis rail sections or sub-frames, meet the applicable requirements in Chapter 5 (Chassis Modification & Construction) of the *New Zealand Car Construction Manual*;

and

- (d) be carried out so as to minimise any effects on the vehicle's frontal impact protection systems.

NOTE: Where any effect may have occurred to the vehicle's frontal impact protection system as a result of the right-hand drive conversion, the requirements of the *Low Volume Vehicle Standard 155-30 (Frontal Impact)* must be met.

- 2.6(3) The clearances between the chassis, sub-frame sections, or body structure, and mechanical componentry of a low volume vehicle which undergoes a right-hand drive conversion, must be maintained so as not to obstruct the performance of any collapsibility designed by the vehicle manufacturer in the event of a collision.

### **Firewall and bulkhead modifications**

- 2.6(4) A modification to the firewall or bulkhead area of a low volume vehicle which undergoes a right-hand drive conversion must:
- (a) be such that a permanent partition is maintained between the engine and passenger compartment to prevent any fire, smoke, vapour or liquids from entering the passenger compartment; and
  - (b) incorporate mounting points for a relocated brake master cylinder, or any other braking or steering components which are of no less strength and rigidity than that originally provided by the vehicle manufacturer; and
  - (c) utilise at least the same number and grade of fasteners as provided by the original vehicle manufacturer for the relocation of any brake or steering components.

## **2.7 Braking system requirements**

### **Brake master cylinder systems**

- 2.7(1) A brake master cylinder used on a low volume vehicle which undergoes a right-hand drive conversion must retain the same:
- (a) brake master cylinder stroke travel as originally provided by the vehicle manufacturer; and
  - (b) brake pedal ratio as originally provided by the vehicle manufacturer.

- 2.7(2) Brake fluid used on a low volume vehicle which undergoes a right-hand drive conversion, must be replaced using the vehicle manufacturer's specified hydraulic brake fluid.

### **Brake pedals and push-rods**

- 2.7(3) A brake pedal used on a low volume vehicle which undergoes a right-hand drive conversion, where the original left-hand drive brake pedal in unmodified form is not retained, must meet the applicable requirements in *Chapter 8 Braking Systems of the New Zealand Car Construction Manual*.

- 2.7(4) A brake pedal push-rod used on a low volume vehicle which undergoes a right-hand drive conversion, where the original brake pedal push-rod in unmodified form is not retained, must meet the applicable requirements in Chapter 8 Braking Systems of the New Zealand Car Construction Manual;

### Brake pipes

- 2.7(5) A brake-pipe used on a low volume vehicle which undergoes a right-hand drive conversion must:
- (a) incorporate only automotive steel Bundy or copper-nickel brake pipe tubing, and be correctly double or ball-flared; and
  - (b) be protected from any wearing, abrasion; and heat effects; and
  - (c) be secured at intervals of no more than either:
    - (i) those intervals originally provided by the vehicle manufacturer; or
    - (ii) 300 mm;
- and
- (d) where rubber mounts are fitted between a body and a chassis, incorporate flexibility within the brake pipe.

### Brake master cylinder cross-shaft and linkage transfer systems

- 2.7(6) Where space limitations preclude the relocation of a brake master cylinder to the right-hand side of a low volume vehicle during a right-hand drive conversion, a cross-shaft and linkage system may be utilised to transfer the braking force from a relocated brake pedal to the master cylinder positioned in its original location, provided that a Chartered Automotive Engineer's detailed report with calculations is provided to substantiate that the system incorporates:
- (a) mountings for the cross-shaft and linkage system which:
    - (i) are sufficiently strong for their intended purpose; and
    - (ii) will prevent the shaft from binding in its bearings under maximum loading;

and



- (b) a cross-shaft, linkages, pivots and push-rods which are sufficiently strong enough to:
  - (i) withstand the sustained maximum loadings of such a system; and
  - (ii) limit any deflection of the shaft at maximum loading that may reduce the full master cylinder stroke travel;

and

- (c) operating levers and pedals of sufficient size to allow the full diameter of the cross-shaft to pass through, and where attachment is by welding, leaving sufficient additional material to accept a 360-degree circumferential weld to securely attach the cross-shaft to the lever or pedal; and
- (d) suitable self-aligning and self-lubricating bearings and bushes which are securely located to the cross-shaft longitudinally, with a combination of retaining collars or spacers and fasteners which will prevent any axial movement; and
- (e) properly designed and retained pivot pins which either:
  - (i) are manufactured from a hardened material; or
  - (ii) use self-lubricating bushes or bearings.

### **Parking brake systems**

- 2.7(7) A parking brake system used in a low volume vehicle, which undergoes a right-hand drive conversion, must, together with its means of attachment, result in a parking brake system that incorporates no less strength and rigidity than that originally provided by the vehicle manufacturer.
- 2.7(8) The handle, pedal, and other mechanisms used to apply and release a parking brake system in a low volume vehicle which undergoes a right-hand drive conversion, must be:
- (a) conveniently located for the use of the driver; and
  - (b) positioned so as to provide sufficient space between the park-brake pedal and the primary control pedals, such that the likelihood of unintentional application of the primary control pedals whilst applying the park-brake is minimised; and

- (c) able to be applied and released without unreasonable force or effort.

**2.7(9)**

A parking brake system used in a low volume vehicle which undergoes a right-hand drive conversion must:

- (a) in the case of a vehicle fitted with a manual transmission, be applied by either:
  - (i) a hand-operated lever; or
  - (ii) a foot-operated pedal positioned to the left of the clutch, brake, and accelerator pedals;

or

- (b) in the case of a vehicle fitted with an automatic transmission, be applied by either:
  - (i) a hand-operated lever; or
  - (ii) a foot-operated pedal that may be positioned to the left or right side of the brake and accelerator pedals.

NOTE: Where any effect may have occurred to the vehicle's braking system, or performance of the braking system, as a result of the right-hand drive conversion, the requirements of *Low Volume Vehicle Standard 35-00 (Braking Systems)* must be met.

## **2.8**                      **Interior & electrical system requirements**

### **Dash panels, controls & instruments**

**2.8(1)**

A dashboard panel used in a low volume vehicle which undergoes a right-hand drive conversion must:

- (a) be manufactured, joined, or replaced, such that the strength and rigidity of the dashboard panel replicates as closely as practical the original unit; and
- (b) maintain the energy absorbing characteristics of the original dashboard panel as closely as possible.

- 2.8(2) Dashboard controls and instruments in a low volume vehicle which undergoes a right-hand drive conversion must be positioned to the right-hand side of the vehicle, duplicating as closely as practicable the relationship between the dashboard controls, instruments, and driver in their original locations.

NOTE: Where any effect may have occurred to the vehicle's interior fittings, surfaces, or controls, as a result of the right-hand drive conversion, the requirements of *Low Volume Vehicle Standard 155-40 (Interior Impact)* must be met.

### Airbags

- 2.8(3) A low volume vehicle which undergoes a right-hand drive conversion, that is equipped by the original vehicle manufacturer with airbags as part of its occupant restraint system, must:
- (a) be equipped with a label visible to all affected occupants, warning that the level of safety provided by the airbag system may be reduced as a result of the right-hand drive conversion; and
  - (b) where a passenger-side airbag is installed by the vehicle manufacturer together with an occupant seat sensor to govern airbag deployment, have the sensor transferred from side to side together with its corresponding airbag.

NOTE: Where any effect may have occurred to any part of the vehicle's occupant protection systems as a result of the right-hand drive conversion, the requirements of *Low Volume Vehicle Standard 155-30 (Frontal Impact)* must be met.

### Electrical systems

- 2.8(4) Repositioned or modified demisting, ventilating, or air conditioning equipment in a low volume vehicle which undergoes a right-hand drive conversion must be not substantially less effective and efficient than originally provided by the vehicle manufacturer.
- 2.8(5) Electrical circuits for brake fluid level, and circuit failure sensors, when fitted to a low volume vehicle which undergoes a right-hand drive conversion, must continue to operate correctly.
- 2.8(6) A modification to the original vehicle manufacturer's electrical wiring loom on a low volume vehicle which undergoes a right-hand drive conversion, must incorporate suitable joins and connections, and be adequately insulated, supported, and protected.

## Lighting systems

- 2.8(7) A head lamp fitted to a low volume vehicle which undergoes a right-hand drive conversion must be either:
- (a) a lamp specifically manufactured for the make and model of vehicle which does not dip to the right-side of the vehicle's longitudinal center-line; or
  - (b) where such lamps are unavailable, the original lamp must be modified so as to prevent the lamp from dipping to the right-side of the vehicle's longitudinal center-line.

## Windscreen washing and wiping equipment

- 2.8(8) Windscreen wiping and washing equipment fitted to a low volume vehicle which undergoes a right-hand drive conversion must:
- (a) be no less effective and efficient than originally provided by the vehicle manufacturer; and
  - (b) provide to the driver adequate forward vision by incorporation of an acceptable swept area, by:
    - (i) the reversal or mirror-imaging of the wiper arms and pivot points so that the swept area of the right side of the windscreen duplicates the previously swept area of the left side; or
    - (ii) complying with the applicable requirements of 15.11 to 15.13 inclusive of Chapter 15 Glazing and Vision of the New Zealand Car Construction Manual.

## 2.9 Other requirements

### Accelerator and clutch systems

- 2.9(1) A remounted or modified accelerator or clutch system used on a low volume vehicle which undergoes a right-hand drive conversion must be such that:
- (a) there is no less strength and rigidity in the systems and their attachments than that originally provided by the vehicle manufacturer; and
  - (b) in the case of the accelerator system, the accelerator control is designed so as to ensure:
    - (i) reliable throttle return; and

- (ii) that no part of the control system can over-centre and jam in the open position.

### **Gear selection indicator**

2.9(2)

A low volume vehicle which undergoes a right-hand drive conversion and is equipped with an automatic transmission must incorporate a means by which to provide to the driver an accurate indication of the selected gear.

### **Rear seat access**

2.9(3)

A two-door two-row seating low volume vehicle which undergoes a right-hand drive conversion, which was designed to facilitate rear seat entry and exit by roll-forward operation of the right-side front passenger seat, must have this function transferred to the left-side front passenger seat.

### **General items**

2.9(4)

Where any brake, steering, or electrical component is positioned closer to any part of a low volume vehicle's exhaust system, or for any reason may be subjected to a greater degree of heat as a result of a right-hand drive conversion, the affected components must be adequately heat-shielded.

2.9(5)

Fasteners incorporated in high load or critical locations on a low volume vehicle which undergoes a right-hand drive conversion, must either:

- (a) be of a quantity, size, type, and grade of equal or greater specification than that used by the original vehicle manufacturer; or
- (b) meet all applicable requirements of sections 18.2 to 18.6 of Chapter 18 Attachment Systems of the [New Zealand Car Construction Manual](#).

2.9(6)

A low volume vehicle that is required to comply with this standard must, where any of the vehicle's original configuration, components, systems, and attachment mechanisms, have not undergone a mirror-imaged assimilation of the vehicle in its as-manufactured condition, also meet the applicable requirements of:

- (a) 2.3 of the LVVTA Low Volume Vehicle Standard 155-40 (Interior Impact); and
- (b) 2.3 and 2.4 of the LVVTA Low Volume Vehicle Standard 175-00 (Seatbelt Anchorages); and
- (c) 2.3 of the LVVTA Low Volume Vehicle Standard 200-30 (Rear View Mirrors); and

(d) 2.3 of the LVVTA Low Volume Vehicle Standard 185-00 (Seats and Seat Anchorages); and

(e) 15.11 to 15.13 of Chapter 15 (Glazing & Vision) of the New Zealand Car Construction Manual.

NOTE: As specified in 1.1(3), this standard is based around the use of OEM components and systems, and applies to straight-forward 'mirror-image' conversions, therefore any deviations from 'mirror-imaging' as provided for in 2.9(6) are restricted to only those of a minor or cosmetic nature.

2.9(7) Where an engine has been repositioned within a low volume vehicle as a consequence of a right-hand drive steering conversion, the requirements of the LVVTA Low Volume Vehicle Standard 85-40 (Engine and Drive-train Conversions), or where applicable Chapter 9 (Engine & Drive-train) of the New Zealand Car Construction Manual, must be met.

## 2.10 Road-test requirements

- 2.10(1) A floor-pan area within the driver's compartment of a low volume vehicle which undergoes a right-hand drive conversion, must maintain floor space area for the feet of the driver, which enables each foot control to be operated safely without the risk of unintended interference by any adjacent pedal.
- 2.10(2) A low volume vehicle which undergoes a right-hand drive conversion, must perform in a manner which preserves at least the quality of steering, handling, and braking control which could be reasonably expected when the vehicle was originally manufactured.
- 2.10(3) A low volume vehicle which undergoes a right-hand drive conversion must handle in a manner which allows good steering control in all normal driving conditions, including:
- (a) well controlled ride on uneven surfaces without excessive pitch movement, or direction change upon full suspension compression; and
  - (b) progressive and positive feel with no kick-back through the steering wheel during turn-in and turn-out; and
  - (c) no excessive under-steer or over-steer tendencies during constant radius cornering, including when encountering mid-corner bump disturbances; and
  - (d) directional stability with immediate self-centering after sharp minor steering inputs; and

- (e) immediate and easy controllability when encountering direction change as a result of road camber changes or surface irregularities; and
- (f) no tendency to climb the road camber toward the opposing lane.

## Section 3 Exclusions to this standard

---

### 3.1 Brake cross-shaft and linkage transfer system exclusions

#### 3.1(1)

A low volume vehicle which undergoes a right-hand drive conversion, incorporating as part of the conversion a cross-shaft and linkage system to transfer the braking force from a repositioned brake pedal to the master cylinder positioned in its original location, is not required to comply with 2.7(6) in cases where:

- (a) the cross-shaft and linkage system is manufactured and supplied as original equipment by the manufacturer of the vehicle to which the system is fitted; and
- (b) documentation is supplied by the vehicle manufacturer to verify that the requirements of 3.1(a) have been met.

## Section 4 Vehicles not required to be certified to this standard

---

### 4.1 Vehicles not covered by this standard

#### 4.1(1)

A light vehicle is not required to be certified to this low volume vehicle standard, if the vehicle is modified for the purposes of law enforcement or the provision of emergency services.

#### 4.1(2)

A light vehicle is not required to be certified to this low volume vehicle standard, if the vehicle is identified as having been modified by an approved second-stage vehicle manufacturer, and complies with a recognised overseas standard that is listed in Annex 6 of the *Low Volume Vehicle Code*.

### 4.2 Vehicles that pre-date legal requirements

#### 4.2(1)

A vehicle is not required to be certified to this standard, if the vehicle was first registered in New Zealand before 1 March 1999, and converted to right-hand drive either:

- (a) before 1 August 1990; or
- (b) between 1 August 1990 and 1 March 1999, and has a recognised conversion company's plate affixed which records:
  - (i) the company name of the conversion agent; and
  - (ii) the chassis number or VIN of the vehicle that has been converted; and
  - (iii) a traceable sequential conversion number allocated by the conversion agent to the vehicle that has been converted.

### 4.3 Vehicles converted by high-volume manufacturers

4.3(1) A vehicle that has been converted to right-hand drive by a high-volume vehicle manufacturer is not required to be certified to this standard, provided that either:

- (a) the vehicle is included on *Appendix 1 of this low volume vehicle standard 'LVVTA-recognised vehicles converted to right-hand drive by high-volume vehicle manufacturers'*; or
- (b) documented evidence is provided to verify that, whilst the vehicle is not included on the list referred to in 4.3(1)(a), it has been converted to right-hand drive by the manufacturer of the vehicle.

## Section 5 Terms and definitions within this standard

<b>Bump steer</b>	means the change in steering geometry of the steered wheels that can occur, as the steered suspension of the vehicle moves throughout its range of extension and compression.
<b>Critical component</b>	means a component, that, upon its failure, could lead to a total loss of either braking control or directional control.
<b>Critical function</b>	has the corresponding meaning as 'critical component'.
<b>Custom-manufactured</b>	means a manufacturing process carried out by a person or company on a one-off basis, rather than during a production run.
<b>Drag link</b>	means the link in a steering system that connects the steering box Pitman arm to the stub axle steering arm.



<b>Drop arm</b>	means the same as a Pitman arm.
<b>Idler arm</b>	means the part of a parallelogram steering linkage that duplicates the movement of the Pitman arm.
<b>mm</b>	is an abbreviation for millimeters.
<b>OEM</b>	is an abbreviation for original equipment manufacturer, which is a reference to a high volume manufacturer, or its assigned product manufacturer.
<b>Pitman arm</b>	means the levering arm in a steering system that connects the steering box output shaft to the drag link.
<b>Primary control pedals</b>	means the pedals used to operate the clutch, braking system, and accelerator.
<b>Rack &amp; pinion</b>	means a type of steering gear that uses a pinion gear to drive a toothed horizontal bar, the ends of which operate the tie rods.
<b>Reconditioned</b>	means the process of returning a component back to within the operating specifications of the original component manufacturer.
<b>Re-manufactured</b>	means a reconditioning process that is carried out by the original manufacturer of the component.
<b>Steering box</b>	means a device that translates the rotary motion of the steering shaft into rotary motion of a steering arm connected to a parallelogram steering linkage.
<b>Steering stop</b>	means a device which prevents the steering components from being turned further than the system was designed to operate at.
<b>Track rod</b>	means a transverse rod that connects the steering arms of the steered wheels.
<b>VIN</b>	is an abbreviation for 'vehicle identification number' which is a 17-digit numbering system used world-wide as a primary means of individually identifying motor vehicles.
<b>Wheel track</b>	means the distance between the vertical centerlines of the tyre tread on two tyres fitted at opposite ends of the same axle.

NOTE: The terms and definitions found in section 5 are limited to those terms and definitions that are unique to this low volume vehicle standard, and are not necessarily contained within the terms and definitions section of the *Low Volume Vehicle Code*.

# **Appendix 1**

to Low Volume Vehicle Standard **190-70(02)** Right-hand Drive Steering Conversions:

## **LVVTA-recognised vehicles converted to right-hand drive by high-volume vehicle manufacturers**

The following listed vehicles are those that have been identified as having been converted to right-hand drive by their respective parent manufacturers, and are excluded from Low Volume Vehicle Certification by *exclusion 4.2 of LVV Standard 190-70(02) Right-hand Drive Steering Conversions*, as at 1 September 2004:

- Cadillac Seville 1998 - 2001
  - Chevrolet Blazer V6 1998 - on
  - Chevrolet (Toyota) Cavalier 1996 - 2001
  - Chrysler Crossfire 2003 - on
  - Chrysler Neon 1998 - on
  - Chrysler PT Cruiser (all years)
  - Ford Explorer 1986 - on
  - Ford Probe (all years)
  - Jeep (all models) 1996 - on
  - Holden Suburban 1998 - on
-