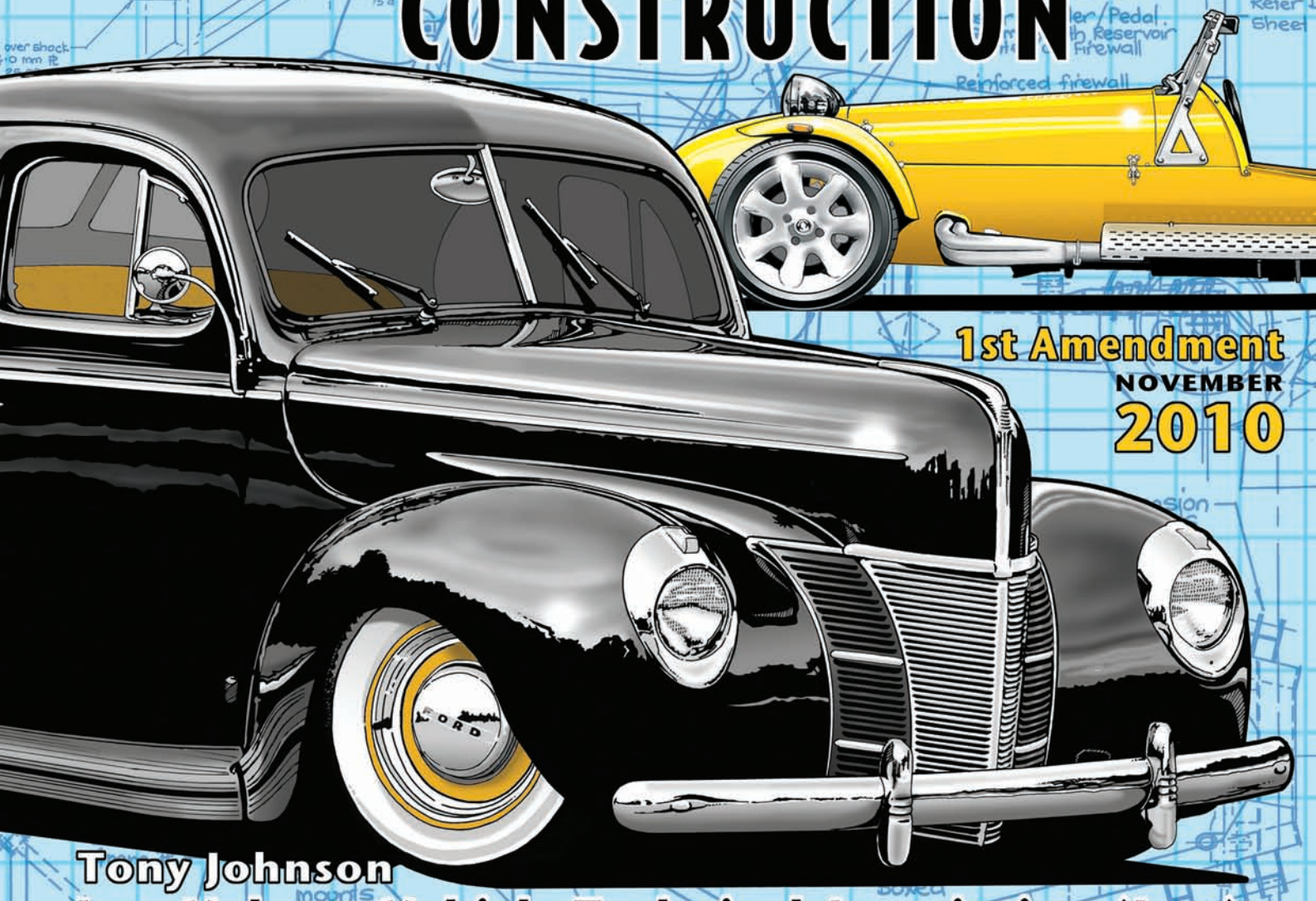
THE NEW ZEALAND

CAR CONSTRUCTION MANUAL

CHAPTER 13

BODY MODIFICATION & CONSTRUCTION



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Tony Johnson

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CAR
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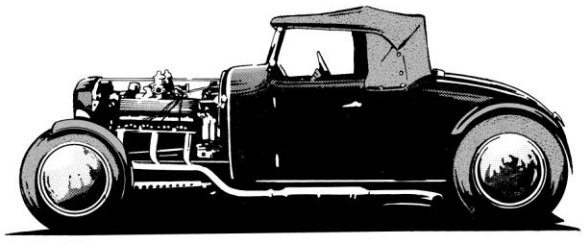

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The New Zealand Car Construction Manual is published and owned by the Low Volume Vehicle Technical Association Incorporated (LVVTA). LVVTA is an incorporated society and was established in 1992, and represents approximately 50,000 motor vehicle enthusiasts throughout New Zealand.

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The New Zealand Car Construction Manual was written by Tony Johnson of Auckland New Zealand, for the NZHRA, who originally commissioned the development of the Manual in 2002. Tony has continued to take responsibility for the on-going amendments to the Manual for NZHRA, and for LVVTA since LVVTA took ownership of the Manual in October 2010.

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NZHRA, and its key personnel, have, and continue to since the inception of LVV certification, form the back-bone of the LVV certification system in New Zealand. LVVTA is very appreciative of NZHRA's on-going commitment and integrity.

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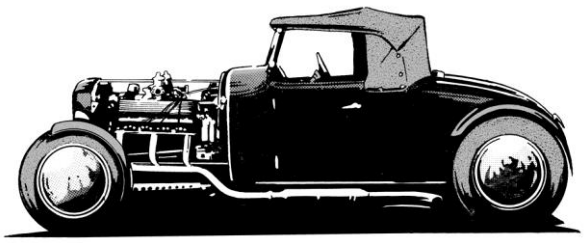

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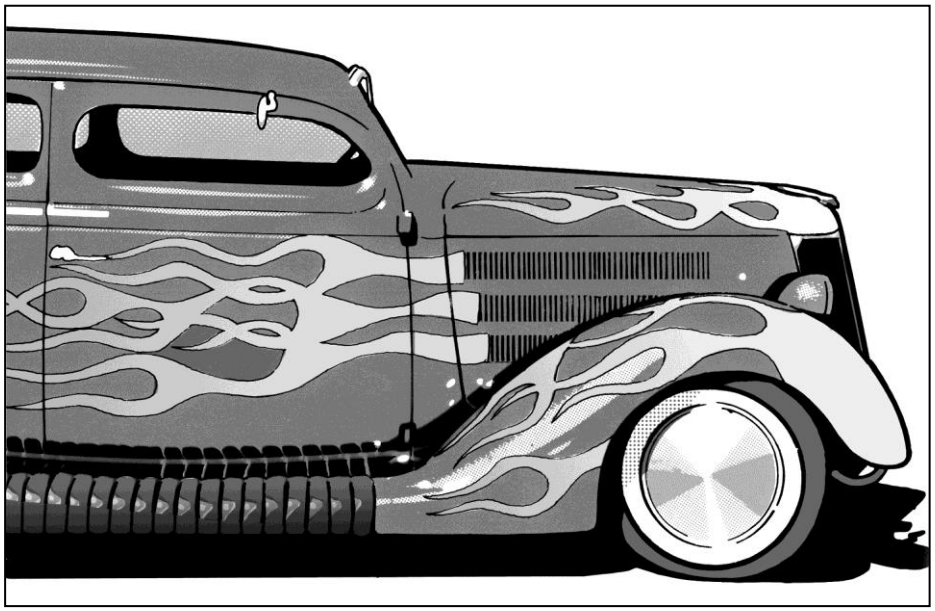
Chapter 13:

BODY MODIFICATION & CONSTRUCTION



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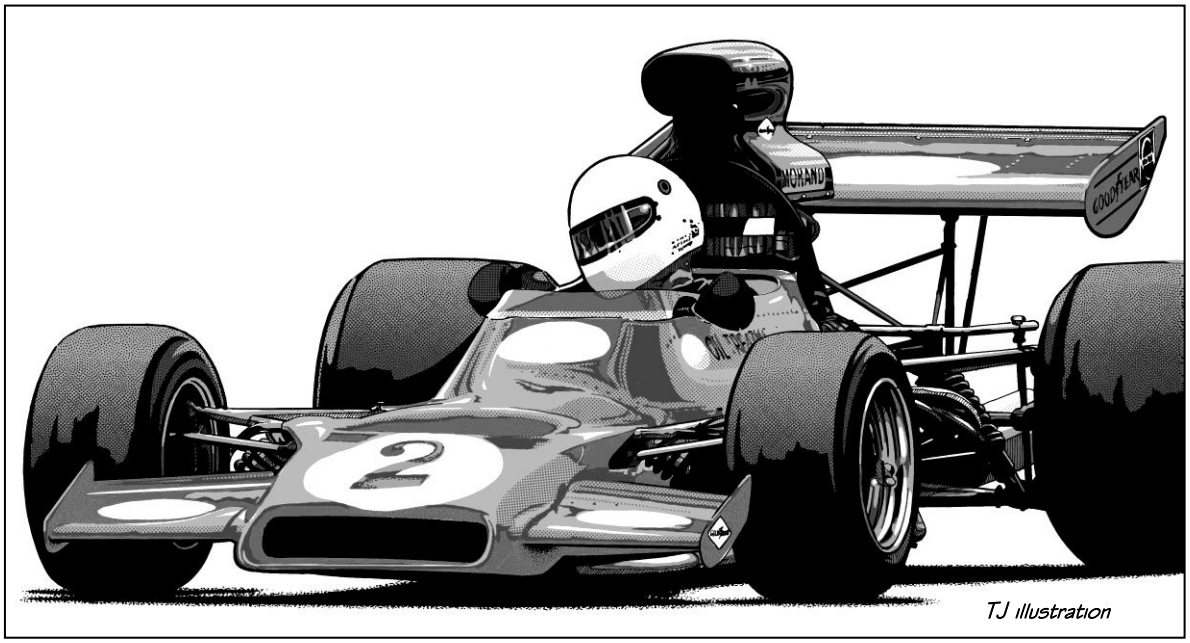
Chapter 13 Contents:

Key: (for full key details, refer to 'Chapter 2 – About this Manual')

Normal type: Provisions of the NZ Car Construction Manual for all vehicles
Normal type in shaded box: Special provisions of the NZ Car Construction Manual for vehicles built or modified before specified dates
Italic type: *Extracts from any relevant LVVTA Low Volume Vehicle Standards*
Script type: Helpful hints, tips, explanations, clarifications, and interpretations
Shaded text & dotted vertical stroke in margin: Latest amendments since previous version



CHAPTER 13: BODY MODIFICATION & CONSTRUCTION

Introduction:

This body modification and construction chapter is an interim chapter, containing for the most part the regulatory requirements relating to components and systems covered by Land Transport rules, that we have to comply with, via the low volume vehicle alternative standards. These systems and components include frontal impact, door retention systems, and external projections. After the publication of this Car Construction Manual, over time this chapter will be added to substantially, to cover issues such as roof-chops, roof removals, recessed firewalls, tubbed rear sections, tilt-fronts, and other common body-related modifications.

Note that where original or authentic reproduction parts are fitted to a production vehicle, the requirements in this chapter do not apply.

Body structure and panel requirements:

13.1 General body requirements

13.1.1

A low volume vehicle must not have any structural part of its body weakened by rust, corrosion, cracking, or other damage.

13.1.2

A low volume vehicle which has a body built from composite materials must meet the requirements specified for composite construction in 5.15 to 5.18 in 'Chapter 5 - Chassis Modification and Construction'.

13.2 Floor and front bulkhead requirements

13.2.1

A low volume vehicle must incorporate:

(a) a floor-pan that is strong enough to support, during all normal and impact loads:

(i) the weight of any occupants; and

(ii) any components attached to it;

and

(b) an engine bulkhead that forms a permanent firewall capable of preventing fire, smoke, liquids, and vapour, from entering the passenger compartment from the engine bay.

13.2.1(b)

Fibre-glass is an acceptable material for a bulkhead to be made from.

13.3 Body attachment requirements

13.3.1

A low volume vehicle must incorporate:

(a) body mounts that meet the attachment requirements specified in 5.23 of 'Chapter 5 – Chassis Modification and Construction'; and

(b) in the case of a low volume vehicle with a fibre-glass body and a wooden floor, steel reinforcing plates for the body mounting points fibre-glassed into the floor, or welded directly to the steel body framing.

13.4 Roll-bar and framing requirements

13.4.1

A low volume vehicle that does not have a fixed roof must incorporate roll-bar mounting points within the chassis, suitable for a minimum of 38 mm x 2.5 mm (1 1/2" x 1/8") tubing.

13.4.1

An open vehicle does not have to have a roll-bar, but it must have provision for one, so that a roll-bar can be easily added later on.

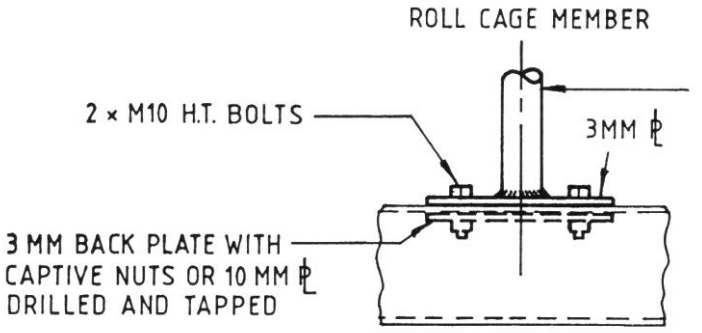
13.4.2

A roll-bar fitted to a low volume vehicle must be attached to the vehicle structure by either:

(a) using one of the methods specified in Diagram 13.1 or 13.2 (as applicable); or

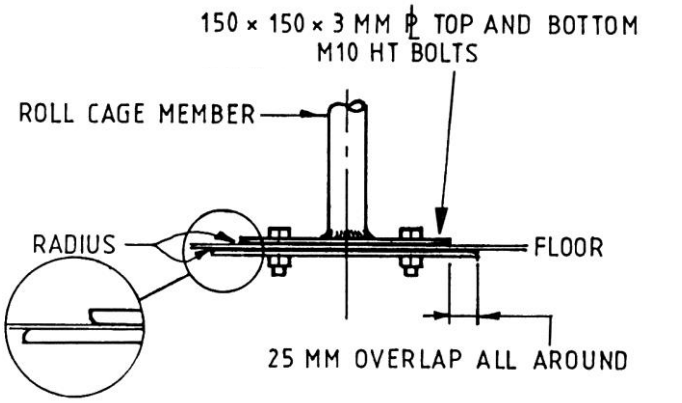
(b) welded to the chassis or body structure in accordance with the requirements specified in 18.7 and 18.8 of 'Chapter 18 - Attachment Systems'.

While this specification is legal for road use, it should be noted that NZDRA require a minimum wall thickness of 3 mm (1/8") for main bars in a roll-cage.



GW diagram

Diagram 13.1 Roll-bar attachment for body/chassis vehicles



GW diagram

Diagram 13.2 Roll-bar attachment for unitary constructed vehicles

13.5 Body panel requirements

13.5.1

An engine hood, if fitted to a low volume vehicle must be secured into its closed position with either:

(a) a latching system that incorporates a primary and a secondary latching mechanism; or

(b) two separate latching devices, such as engine hood pins, clips, or straps.

13.5.2

A low volume vehicle, other than one specified in 13.5.3, must be fitted with a mudguard that covers no less than the full width of the tread, and one-third of the circumference, of each tyre, positioned in such a way as to minimise the displacement of spray and debris to the rear of the vehicle. (see Diagram 13.3)

13.5.1

Two or more engine hood pins, or two or more suitable over-hood straps, such as those typically found on pre-war vehicles, are acceptable systems.

The TAC reminds builders and modifiers about the ease with which an engine hood secured with hood pins can be mistakenly left unsecured – with hood pins not inserted, the engine hood still appears at a glance to be 'in position'. Be careful out there!

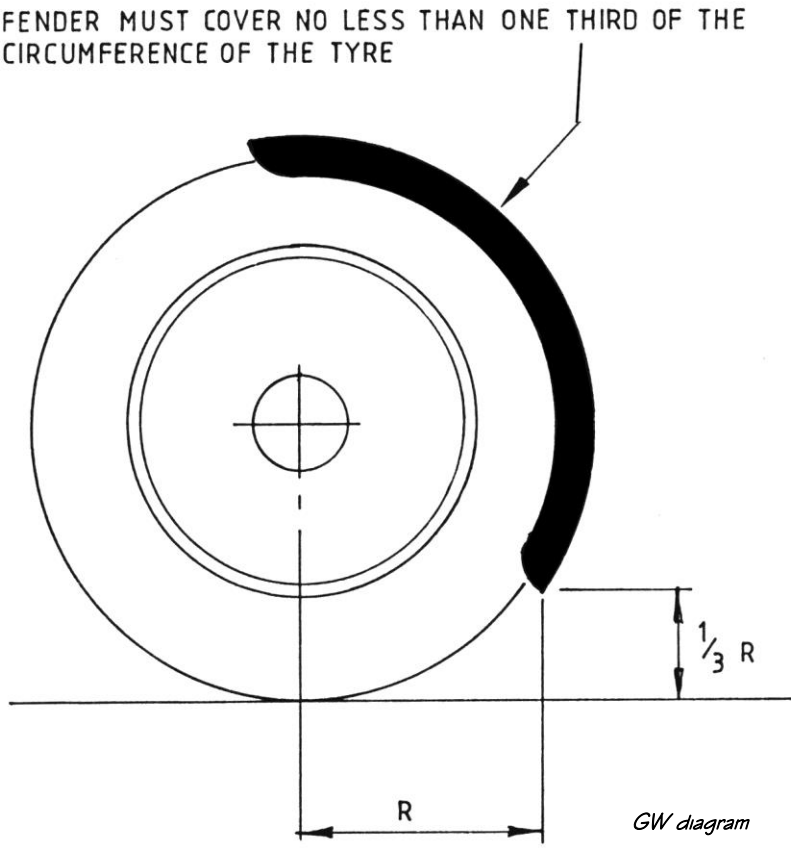


Diagram 13.3 Mudguard positioning

13.5.3

A low volume vehicle that is issued with a valid and current LVV Authority Card applicable to a fenderless vehicle, issued by the New Zealand Hot Rod Association (Inc) as specified in 'Chapter 3 – LVV Authority Cards', is not required to be fitted with mudguards.

13.5.3

The Authority Card only provides for vehicles that have no fenders fitted – it does not apply to vehicles with fenders of insufficient width.

See the 'Useful Information' section at the back of this chapter for more information on LVV Authority cards.

Frontal impact requirements:

13.6 Modified production low volume vehicles

13.6.1

A production low volume vehicle must not feature any modifications to any crumple zones or other energy-absorbing measure incorporated by the vehicle manufacturer within the frontal impact protection system.

A modified production low volume vehicle modified before 2002 is not required to comply with 13.6.1.

13.6

For more information on the frontal impact subject, see the 'Useful Information' section at the back of 'Chapter 5 – Chassis Modification and Construction'.

13.6.2

A modification to the body of a production low volume vehicle must be carried out in such a way as to:

(a) *minimise any longitudinal stiffening of the vehicle structure forward of the occupant cell; and*

(b) *minimise the risk of deformation of the occupant cell during a frontal impact; and*

(c) *minimise the likelihood of penetration of the engine or transmission into the occupant cell during a frontal impact.*

A modified production low volume vehicle modified before 2002 is not required to comply with 13.6.2.

13.6.3

This is a general safety requirement from Land Transport Rule 32006/1, which is reproduced here in the interest of convenience. This is the rule that prevents bull-bars being fitted to cars, occupant protection airbags being removed, and many other modifications that used to happen regularly some years ago.

13.6.3

The performance of a low volume vehicle, in relation to protecting occupants in a frontal impact 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.

13.7 Scratch-built low volume vehicles

13.7

For more information on the frontal impact subject, see the 'Useful Information' section at the back of 'Chapter 5 – Chassis Modification and Construction'.

13.7.1

The body of a scratch-built low volume vehicle must be constructed in such a way as to:

(a) *minimise the likelihood of penetration of the engine, transmission, suspension, body structure or parts into the passenger compartment as a result of a frontal collision; and*

(b) *maximise the likelihood that the section of the vehicle forward of the passenger compartment will progressively absorb impact energy without significant deformation of the occupant cell, by featuring design characteristics forward of the passenger compartment consistent with those expected of contemporary high volume production vehicles.*

13.7.1

Where possible, materials should be used in the firewall and gearbox tunnel area to try and assist deflection of the engine and gearbox downwards, rather than straight backward into the vehicle interior, in an impact.

A scratch-built low volume vehicle constructed before 2002 is not required to comply with 13.7.1.

Door opening requirements:

13.8 General door opening requirements

13.8.1

A door fitted to a low volume vehicle must:

(a) *open and close easily; and*

(b) *remain secure in a closed position during operation of the motor vehicle; and*

(c) *be operable at all times by any occupant seated by the door, from inside the vehicle.*

13.9 Door opening from inside the vehicle

13.9.1

A door fitted to a low volume vehicle must be fitted with a mechanically operated interior handle or other mechanically-operated opening device, which can be easily accessed and operated at all times from inside the vehicle.

13.10 Door opening from outside the vehicle

13.10.1

A door fitted to a low volume vehicle is not required to be able to be opened from outside the vehicle by a mechanical means.

13.10.2

An exterior door handle or other opening device may be positioned in a hidden location on a low volume vehicle, provided that either:

(a) *the location is such that the handle or opening device is shielded or protected to prevent unintentional activation by contact from road debris; or*

(b) *the handle or opening device is positioned in such a way so as not to be able to be unintentionally activated.*

13.10.3

A door fitted to a low volume vehicle may be opened from outside the vehicle by:

(a) *a fixed electrically-operated unlatching device; or*

(b) *a remote electrically-operated unlatching device, provided that a fail-safe inter-lock system is incorporated to prevent unlatching of the doors unless either:*

(i) *the ignition system is switched off; or*

(ii) *in the case of a vehicle equipped with an automatic transmission, a gearbox inhibitor switch operating only in neutral and park is engaged.*

Door retention system requirements:

13.11 General door retention system requirements

13.11.1

A door retention system and its mountings fitted to a low volume vehicle must be safe, and structurally sound.

13.11.2

A burst-proof door retention system that meets 13.11 to 13.20 must be fitted to any:

(a) scratch-built low volume vehicle; or

(b) modified production low volume vehicle which has had its front-hinged doors converted to a rear-hinged mounting system.

A low volume vehicle built or modified before January 1992 is not required to comply with 13.11.2.

13.12 Door latch and striker assembly design

13.12.1

A door latch and striker plate assembly fitted to a low volume vehicle must:

(a) be designed for automotive use; and

(b) be of a burst-proof design; and

(c) incorporate two latching positions, comprising:

(i) a primary latching position; and

(ii) a secondary latching position.

A low volume vehicle built or modified before January 1992 is not required to comply with 13.12.1.

13.11

The intention of having door retention system requirements is to maximise the chances of doors remaining closed in an impact, in order to prevent occupants from being thrown from the vehicle.

13.11.2

A vehicle built or modified before January 1992 is not required to meet any of the requirements in this Chapter for door latching or hingeing, other than for 13.11.1.

13.11.2(b)

This means that the door on a production vehicle - say, a steel Model-A Coupe – never has to be retro-fitted with burst-proof door latches, unless the original front-hinged doors have been 'suicided' (hinged from the rear), in which case a burst-proof door retention system is required to be installed.

13.12.1

A 'burst-proof' latch will, when engaged, completely encircle the striker pin, so that the latch and the pin cannot become disengaged, whether pulled in the fore-aft, up-down, or inward-outward directions.

13.13 Door latch and striker assemblies from production vehicles

13.13.1

A door latch and striker plate assembly sourced from a production motor vehicle may be fitted to a low volume vehicle, provided that the vehicle to which the assembly was originally fitted was manufactured in either:

(a) *the United States of America on or after 1 January 1968; or*

(b) *Europe or the United Kingdom on or after 1 January 1970; or*

(c) *Japan on or after 1 January 1983; or*

(d) *Australia on or after 1 January 1988.*

A low volume vehicle built or modified before January 1992 is not required to comply with 13.13.1.

13.14 Aftermarket door latch and striker assemblies

13.14.1

A door latch and striker plate assembly sourced from an aftermarket manufacturer may be fitted to a low volume vehicle, provided that:

(a) it meets the door latch and striker assembly design requirements specified in 13.12; and

(b) the latch tongue is not electroplated; and

(c) the latch tongue, striker pin, and other principle components within the assembly are comparable to the same components found in a door latch and striker plate assembly specified in 13.13, in relation to:

(i) component size; and

(ii) component design; and

(iii) material specification.

13.14.1(b)

Tongues on aftermarket latches must remain in an un-plated black tempered state - any aftermarket latches with electroplated tongues that have been tested by LVVTA, have failed.

A low volume vehicle built or modified before January 1992 is not required to comply with 13.14.1.

13.15 Door latch and striker assemblies from other sources

13.15.1

In the case of an alternative door latch and striker plate assembly fitted to a low volume vehicle that is not specified in 13.13 or 13.14, practical calculation or testing must be applied to prove the system's ability to withstand a force that may deform the components but not result in ultimate failure or its inability to function as intended, of:

(a) *in the primary latching position, applied individually:*

(i) *11 kN applied in the longitudinal direction; and*

(ii) *8.9 kN applied in the lateral direction;*

and

(b) *in the secondary latching position, applied individually, 4.4 kN applied in both the longitudinal and lateral directions.*

A low volume vehicle built or modified before January 1992 is not required to comply with 13.15.1.

13.16 Door hinge assembly design

13.16.1

A door hinge assembly fitted to a low volume vehicle must incorporate not less than two hinge assemblies for each door, unless a single hinge is designed with sufficient strength so as to be no less strong than a conventional pair of hinges.

A low volume vehicle built or modified before January 1992 is not required to comply with 13.16.1.

13.17 Door hinge assemblies from production vehicles

13.17.1

A door hinge assembly sourced from a production motor vehicle may be fitted to a low volume vehicle, provided that:

(a) *the door to which the hinge assembly is fitted is of similar or lower mass than that of the door to which the hinge assembly was originally fitted; and*

(b) *the hinge assembly is positioned such that the loads to which it is subjected are no greater than in the original application of the hinge assembly; and*

(c) *the vehicle to which the assembly was originally fitted was manufactured in either:*

(i) *the United States of America on or after 1 January 1968; or*

(ii) *Europe or the United Kingdom on or after 1 January 1970; or*

(iii) *Japan on or after 1 January 1983; or*

(iv) *Australia on or after 1 January 1988.*

A low volume vehicle built or modified before January 1992 is not required to comply with 13.17.1.

13.18 Aftermarket or custom door hinge assemblies

13.18.1

A hinge assembly that is custom-built or sourced from an aftermarket manufacturer may be fitted to a low volume vehicle, provided that the assembly comprises:

(a) in the case of a hinge pin used in a single-shear situation, either:

(i) a dowel-pin or cap-screw of equal or greater size and strength than 4 mm grade-10.9 metric (5/32" grade-8 imperial); or

(ii) a high-tensile bolt of equal or greater size and strength than 6 mm grade-8.8 metric (1/4" grade-5 imperial);

or

(b) in the case of a hinge pin used in a double-shear situation, either:

(i) a dowel-pin or cap-screw of equal or greater size and strength than 3 mm grade-10.9 metric (1/8" grade-8 imperial); or

(ii) a high-tensile bolt of equal or greater size and strength than 5 mm grade-8.8 metric (3/16" grade-5 imperial);

or

(c) in the case of mounting plates bolted through panel steel, four high-tensile bolts of equal or greater size and strength than 4 mm grade-10.9 metric (5/32" grade-8 imperial), attaching a 40 mm x 40 mm x 2 mm (1 ¾" x 1 ¾" x 5/64") plate that has:

13.17.1(c)

A door hinge assembly can be used from a production vehicle other than those specified in 13.17.1(c) provided that the LVV Certifier is satisfied, on the basis of a thorough visual inspection, that the design and strength of the hinge assembly (the pin especially) being used is comparable to a hinge assembly from a vehicle specified in 13.17.1(c) or 13.18.1.

Where the LVV Certifier is in any doubt about the above, calculation or testing, as specified in 13.19.1, must be applied.

(i) a radius of 5 mm (13/64″) applied to all corners; and

(ii) chamfering applied to all internal edges; and

(iii) been shaped to conform with the panel section; and

(iv) a centrally-positioned locating pin;

or

(d) in the case of mounting plates welded to chassis or body frame sections, a full penetration weld the full length of two sides of each 40 mm x 40 mm x 2 mm (1 ¾″ x 1 ¾″ x 5/64″) plate.

A low volume vehicle built or modified before January 1992 is not required to comply with 13.18.1.

13.19 Door hinge assemblies from other sources

13.19.1

In the case of an alternative door hinge assembly fitted to a low volume vehicle that is not specified in 13.17 or 13.18, practical calculation or testing must be applied to prove the hinge assembly's ability to withstand a force that may deform the components but not result in ultimate failure or its inability to function as intended, of 11 kN, applied individually, in both the longitudinal and lateral directions.

A low volume vehicle built or modified before January 1992 is not required to comply with 13.19.1.

13.20 Body and door structure strength requirements

13.20.1

The door structure to which a latch and striker plate assembly, and hinge assembly is fitted must be of such a design, or be suitably reinforced, to ensure that the door is sufficiently strong to withstand the same loads required of the latch, striker, and hinge assemblies specified in 13.15 and 13.19.

A low volume vehicle built or modified before January 1992 is not required to comply with 13.20.1.

13.20.2

The body structure to which each end of a door is attached by the latch, striker, and hinge assembly must be of such a design, or be suitably reinforced, to ensure that the body pillars and surrounding structure are sufficiently strong to withstand the same loads required of the latch, striker, and hinge assemblies specified in 13.15 and 13.19.

A low volume vehicle built or modified before January 1992 is not required to comply with 13.20.1.

External projection requirements:

13.21 General external projection requirements

13.21.1

All low volume vehicles must comply with the following general safety requirements:

(a) *ornamental objects and fittings must not protrude from the motor vehicle if they could injure any person; and*

(b) *protruding objects and fittings which have a functional purpose must, if installed and operated on vehicles that are used on any public road, be such that their risk of causing injury to any person is minimised; and*

(c) *protruding objects and fittings must not adversely affect driver vision or driver control; and*

(d) *components of the vehicles, including damaged or corroded body panels must be such that their risk of hooking any vehicle, or hooking or grazing any person is minimised.*

13.22 Non-functional external projections

13.22.1

Protruding external objects or fittings that do not have a functional purpose may not be fitted to low volume vehicles if they are likely to increase the risk of injury to any person, including the following three requirements for non-functional items:

(a) *ornamental hood emblems must be designed and attached in such a way that they will fold back or break off in the event of contact, without leaving any sharp edges; and*

(b) *protruding bumper bars must have a radius on all edges and corners of no less than 3 mm (1/8"); and*

(c) *wheel hubs or centres which extend beyond the external line of the body of the vehicle must have a radius on any exposed edges of no less that 3 mm (1/8").*

13.21

The intention behind having external projection requirements is to try and minimise the additional injuries that could be sustained by a pedestrian, in the event of coming into contact with the vehicle, and also to reduce the chances of a pedestrian being entrapped or hooked by something protruding from a vehicle.

13.21.1

The requirements specified in 13.21.1 are the applicable general safety requirements from the Land Transport Rule 32008, reproduced here in the interest of convenience.

13.23 Functional external projections

13.23.1

Protruding external objects or fittings that have a functional purpose, not including those items on the underside of the vehicle, may not be fitted to low volume vehicles unless their design, construction, condition, and manner in which they are affixed to the vehicle is such that the risk of causing injury to any person is minimised, including the following five requirements for functional items:

(a) *free-standing lamps must protrude no further from the vehicle body than is necessary for their effective operation; and*

(b) *items such as door handles, engine hood latches, and fuel filler caps must protrude no further from the vehicle body than is necessary for their effective operation; and*

(c) *engine hood scoops or engine components protruding beyond the original external line of the engine hood which are contactable by a 165 mm (6 ¾") head-sphere, must have a radius on all such exposed contactable edges of no less than 3 mm (1/8"); and*

(d) *exposed moving mechanical objects including drive pulleys and belts must be protected by a guard or cover, and the guard or cover must have a radius on all edges and corners of no less than 3 mm (1/8"); and*

(e) *external exhaust systems which extend beyond the outer longitudinal extremity of the vehicle or the outer sidewall of the tyres, must:*

(i) *have a radius of no less than 3 mm (1/8") on any sections facing toward the front of the vehicle; and*

(ii) *have any sections of exposed exhaust contactable from the front of the vehicle or adjacent to points of occupant entry and exit adequately heat-shielded.*

13.24 Other external projection requirements

13.24.1

All contactable exterior sheet-metal edges must fold back by not less than 90 degrees.

13.24.2

Any contactable exterior cosmetic or aerodynamic attachments must not extend laterally beyond the widest part of the vehicle body.

Other requirements:

13.25 Registration plate requirements

13.25.1

A low volume vehicle must be fitted with two registration plates of a type specified by the Ministry of Transport:

(a) one of which is fitted at the front of the vehicle, and one of which is fitted at the rear of the vehicle; and

(b) each of which is attached in an upright position, and displayed in such a way that each letter and figure is easily visible.

13.25.1

Note that this is a requirement under the Transport (Vehicle & Driver Registration & Licensing) Notice 1995, and a vehicle with a plate obscured by grille bars or similar, could be considered to be in breach of this requirement. Home-made plates, including decals, are not allowed.

Plates may be offset to one side of the vehicle providing they are still clearly visible from the front or the rear.

Exclusions:

13.26 General safety requirement exclusions

13.26.1

A low volume vehicle that is not a passenger service vehicle, is not required to comply with 13.8.1(c) and may incorporate on a door to the rear of the driver's seat a safety device that can be temporarily engaged to prevent the door from being opened from inside the vehicle, provided that:

(a) *the device is designed as a 'kiddie-lock'; and*

(b) *there is some means for a rear seat occupant to exit the vehicle in the event of an emergency.*

13.27 Non-structural door exclusions

13.27.1

A modified production low volume vehicle is not required to comply with 13.11 to 13.20 if the vehicle was designed by the manufacturer to operate safely with readily removable lightweight flexible doors functioning as weather protection.

13.28 Design criteria exclusions

13.28.1

A scratch-built low volume vehicle that does not have a permanent roof structure is not required to comply with 13.11 to 13.20 if the vehicle:

(a) *can be operated safely without doors fitted; and*

(b) *is fitted with a web-clamp retractor lap-and-diagonal seatbelt, or another type of seatbelt that exceeds the performance requirements of a web-clamp retractor lap-and-diagonal seatbelt, in the driver and outboard occupant seating positions; and*

(c) *has high-sided sills (between the occupant and outer side of the vehicle) which extend to a point no lower than the H-point, determined by either:*

(i) *an LVVTA body frame; or*

(ii) *measured from an LVVTA H-point template, as shown in Diagram 13.4.*

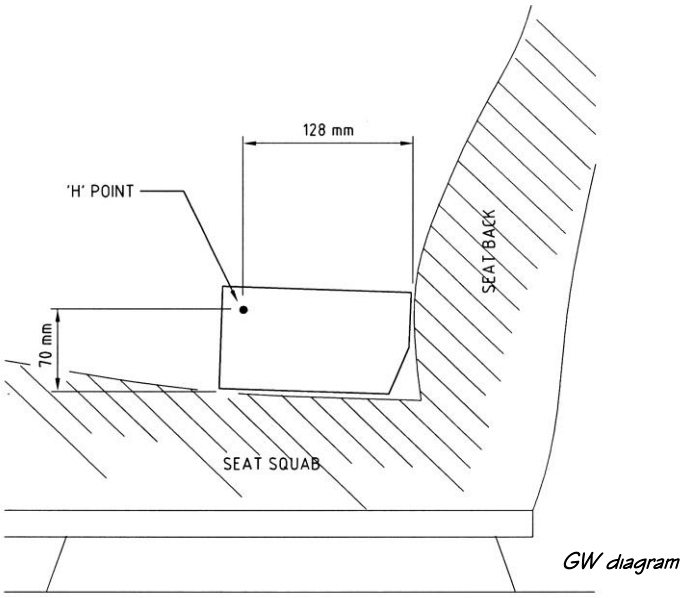


Diagram 13.4 LVVTA H-point template

13.29 Original equipment external projection exclusions

13.29.1

An object or fitting fitted to a modified production low volume vehicle is not required to meet 13.21 to 13.23 provided that the object or fitting is either:

(a) a standard or optional item supplied by the vehicle manufacturer, or an item which is an authentic reproduction of such equipment; or

(b) an item which was available as after-market equipment at the time the vehicle was manufactured.

Useful Information:

LVV Authority cards

A low volume vehicle authority card is only available for a vehicle that is modified for a particular purpose, in order to meet the specific needs of the person nominated on the authority card. LVV Authority Cards can be issued only by the New Zealand Hot Rod Association, and by MotorSport New Zealand. New Zealand Hot Rod Association's Authority Card covers fenderless vehicles, and vehicles that are required by NZHRA's and the New Zealand Drag Racing Association's safety requirements to have a roll-cage. MotorSport New Zealand can issue LVV Authority Cards for various types of equipment that are applicable to their competition vehicles, such as roll-cages, navigational equipment, and hydraulic park brakes. See 'Chapter 3 – LVV Authority Card Process' for all of the details on the NZHRA LVV Authority Card system.

Note that the operator of a vehicle for which an LVVTA-approved authority card is issued, must, when requested by an enforcement officer or LVV certifier, produce the authority card for that vehicle.

TJ illustration