



## Section R

# Vehicle Mounted Lifting Systems

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# Section R — Overview

## 1. Description

This section of Vehicle Standards Bulletin 6 (VSB6) relates to the fitting of vehicle mounted lifting systems (VMLS) and of wheelchair loaders.

VMLS covered by this section include but are not limited to:

- vehicle mounted cranes with a rated capacity between 1 mt and 150 mt, including slewing and non-slewing systems
- elevating platforms
- concrete pump assemblies
- hook lifts
- side lifts
- side or rear operated platform loaders
- wheelchair loaders.

It does **not** cover the fitting of lifting systems designed to tow or transport vehicles (except where a VMLS is intended for all-up operation) which must be installed and certified in accordance with VSB6 Section T — Tow trucks.

This section consists of the following modification codes:

### R1 Installation of vehicle mounted lifting systems

- reinforcement of a vehicle chassis for the purpose of fitting a VMLS
- installation of a VMLS certified as complying with the requirements of Australian Standard AS/NZS 1418 Cranes, hoists and winches
- installation of a type of VMLS where there is no Australian Standard, but where the system and installation complies with all relevant sections of this code.

### R2 Wheelchair loader installation

- installation of a wheelchair loader designed for automotive use.

## 2. Related Australian Design Rules

The Australian Design Rules (ADRs) relevant to this section include:

ADR no.	Title
13/..	Installation of Lighting and Light-Signalling Devices on Other than L-Group Vehicles
14/..	Rear Vision Mirrors
42/..	General Safety Requirements
43/..	Vehicle Configuration & Dimensions
58/..	Requirements for Omnibuses Designed for Hire and Reward
62/..	Mechanical Connections Between Vehicles
92/..	External Projections
AS/NZS 1418	Cranes, hoists and winches Set
AS/NZS 1418.11	Cranes, hoists and winches — Part 11: Vehicle-loading cranes
AS/NZS 3856	Hoists and ramps for people with disabilities — Vehicle-mounted

## 3. Record keeping

The person responsible for certifying the modification should:

- collate complete records, including drawings, calculations, test results and copies of the appropriate issue of Australian Standards and ADRs
- retain the records for a minimum of seven years after the commissioning of the modified vehicle
- make the records available upon request for inspection by officers of the relevant federal, state or territory authority or heavy vehicle regulator.

### Reports and checklists

The person responsible for certifying the modification must complete and record the following reports and checklists as applicable:

R1 Checklist	Installation of vehicle mounted lifting systems
R1 Assessment Report	Vehicle mounted lifting systems
R2 Checklist	Wheelchair loader installation

✎ The R1 Assessment Report must be completed for all vehicles certified under the R1 modification code.

## 4. Types of VMLS

There are two types of VMLS that may be fitted to a vehicle:

### VMLS for which there is an Australian Standard

- There are Australian Standards that apply to the design, construction and installation of many common types of VMLS. For example, vehicle mounted slewing cranes are provided for by Australian Standard AS/NZS 1418 and can only be fitted if they comply with that standard.

### VMLS for which there is not an Australian Standard

- For some types of VMLS there is no Australian Standard that applies.
- For example, hook bin lift devices are a type of VMLS that are not provided for by any Australian Standard. A hook bin lift system may be installed to a vehicle only if the system, and its installation, complies with the requirements of this section of VSB6.

## 5. Design requirements

### Advanced braking systems

Advanced braking systems are an important safety feature fitted to many new vehicles.

Advanced braking systems are programmed by the vehicle manufacturer and are specific to the vehicle to which they are fitted. Changes made to the vehicle, such as engine, tyre size, steering control, suspension characteristics, vehicle mass and its distribution, may impact the performance of the advanced braking system.

Exercise extra caution when modifying vehicles fitted with advanced braking systems. Electric braking systems may be known as:

- electronic stability control (ESC)
- electronic stability program (ESP)
- vehicle stability control (VSC)
- dynamic stability control (DSC)
- vehicle stability assist (VSA)
- roll stability control (RSC)
- roll control system (RCS)
- electronic braking system (EBS)
- trailer electronic braking system (TEBS).

- Advanced braking systems and their components may be easily damaged by common modification, maintenance and servicing techniques, such as the use of rattle guns within one metre of the sensors. When undertaking any work on a vehicle fitted with an advanced braking system, ensure all modifiers are familiar with these systems and the precautions that must be taken.
- Ensure that before undertaking any modification on a vehicle that is fitted with an advanced braking system the modifier and approved vehicle examiner (AVE) consult with the vehicle manufacturer to determine the impact on the system.

# Modification Code R1 — Installation of vehicle mounted lifting systems

## 1. Scope

This modification code covers installation of VMLS such as cranes, elevating platforms, concrete pump assemblies, hook lifts, skip bin loaders, side lifts, hoists and winches to a vehicle.

Modifications covered under this code:

### Covered

- reinforcement of a vehicle chassis for the purpose of fitting a VMLS
- installation of a VMLS certified as complying with the requirements of AS/NZS 1418 Cranes, hoists and winches
- installation of a type of VMLS where there is no Australian Standard, but where the system and installation complies with all relevant sections of this code.

### Not covered

- cutting of the chassis to facilitate the installation of a VMLS (see VSB6 Section H — Chassis)
- installation of a type of VMLS for which there is an Australian Standard, but the system and installation does not comply with the standard
- installation of a type of VMLS for which there is not an Australian Standard, and where the system and installation does not comply with this code
- fitting equipment that is not suitable for automotive use
- installation of a body (see VSB6 Section J — Body)
- conversion of a motor vehicle into a dedicated self-propelled mobile crane (specific modification application to the relevant heavy vehicle regulator required).

## 2. Related standards

Modified vehicles must comply with all ADRs, Australian Standards, acts and regulations. Below are some but not all of the areas that may be affected by the modifications in this code and require certification testing or evidence to demonstrate compliance.

The certifier must ensure that the modified vehicle continues to comply with all related Australian Design Rules.

This...	Must comply with...
Chassis alterations	VSB6 Modification Code H4
Power take-off fitting	VSB6 Modification Code G6
Remounting of body	VSB6 Modification Code J1

## 3. Certification procedure

The certification procedure for this modification code is as follows:

1.	Modifier	Determine if the modification is within manufacturer specifications. <ul style="list-style-type: none"> <li>• If <b>yes</b>, the modification will need to be done in accordance with manufacturer specifications.</li> <li>• If <b>no</b>, the modification will need to be done in accordance with this modification code.</li> </ul>
2.	Modifier	Consult with an accredited R1 AVE for guidance on how to perform the modification.
3.	Modifier	Perform modification in accordance with AVE advice and this code.

4.	Modifier	Organise approval inspection by an accredited R1 AVE.
5.	R1 AVE	Perform inspection, complete R1 checklist (checklist required for all lifting system installations) and determine if compliance has been achieved: <ul style="list-style-type: none"> <li>• If <b>yes</b>, proceed to step 6.</li> <li>• If <b>no</b>, do not proceed, advise modifier rework is required to ensure compliance. Return to step 2.</li> </ul>
6.	R1 AVE	Issue modification certificate, affix modification plate, and submit paperwork as required by the relevant AVE registration scheme.

AVEs must be satisfied that the vehicle modification requirements are being met. It is advised that before modifications are carried out they are discussed with the certifying AVE.

## 4. Compliance requirements

### Required:

- Where an Australian Standard exists, ensure all systems of that type comply with the relevant Australian Standard as well as VSB6 Section R requirements.
- Where an Australian Standard does not exist, the requirements of VSB6 Section R apply and the VMLS is to be fully tested, evaluated and certified as appropriate for the application.
- If the requirements of the Australian Standard and this section are inconsistent, the requirements of the Australian Standard take precedence.
- Ensure all vehicles having a VMLS with a capacity of between 1 mt and 150 mt installed, are modified and certified in accordance with this modification code.
- Ensure all vehicles being modified with a VMLS are modified and certified in accordance with this modification code.
- Ensure a VMLS is certified to the relevant Australian standard (if applicable), by a professional engineer registered with a professional engineer registration body, or by a certificate issued by the VMLS manufacturer.

➤ AS/NZS 1418.11 – 2014 is a modified version of European Standard EN 12999:2011. As such, VMLS certified to the European Standard are likely to be equivalent to an AS/NZS 1418.11 crane but may require modifications.

- If a type of VMLS is not covered by AS/NZS 1418, for example bin hook lifts, install the VMLS in accordance with this modification code, including stability requirements, vehicle loading, attachment to the chassis and testing.
- Do not modify the VMLS platform, linkages or structure without written approval of the lifting system manufacturer.
- Additional requirements applicable to the modifications certifiable under this code may be found within the relevant parts of AS/NZS 1418, including Part 11. Obtaining a copy of the relevant parts of these Australian Standards is strongly recommended.
- Ensure all modifications made to the vehicle are performed and certified in accordance with the relevant modification code/s of VSB6.

**Recommended:**

- Before starting modifications consult with the vehicle, body and VMLS manufacturers or suppliers to establish suitability of the vehicle for the selected loader type, capacity and size.
- For VMLS manufactured outside of Australia and not built in accordance with AS/NZS 1418, ensure that it provides equivalent or superior results to AS/NZS 1418 if it is covered by AS/NZS 1418.

⚠ Note that VMLS may be required to comply with additional requirements outside of VSB6 such as registration with workplace health and safety regulators.

**5. Design requirements**

For most vehicles, guidelines for the installation of VMLS will be available from the VMLS or vehicle manufacturer. Where manufacturers guidelines have been produced, ensure that the installation complies with these guidelines rather than VSB6.

**Recommended:**

- Consult the vehicle manufacturer's manual or VMLS instructions as the first source of information for modifying the vehicle. If possible, use the standard manufacturer's mountings and method of attachment.
- If these are unavailable then, prior to installation, use calculations to ensure that the vehicle has sufficient chassis reinforcement within the chassis design limits to withstand the load moment induced by all dynamic forces imposed during operation.

**Mass and dimensions requirements****Required:**

- Ensure that all equipment, when not deployed, does not protrude from the vehicle and thereby increase risk of injury.
- If an object protrudes from the vehicle but is technically essential, ensure it is designed, positioned and constructed so as to minimise risk of injury.
- When not in operation, ensure that no part of the VMLS and associated components protrudes more than 150 mm past the vehicle's outer extremity on either side and the maximum overall width does not exceed regulatory limits.
- If a VMLS or associated component protrudes more than 150 mm either side of the vehicle, and is less than 500 mm thick from top to bottom, ensure the vehicle has:
  - a warning light attached to the vehicle
  - a delineator attached to the front and rear of the projection on each side of the vehicle so that its reflective surface is facing forward for the front delineator and rearwards for the rear delineator.

⚠ A delineator is a yellow, rigid piece of material that is at least 300 mm long and at least 300 mm wide; and complies with Class 400 or 2 of Australian Standard AS 1906 *Retro-reflective Materials and Devices for Road Traffic*.

- Ensure all regulations concerning mass and dimension are complied with.
- If an installation results in a vehicle's dimensions exceeding regulatory limits, do not perform or certify the installation using this section of VSB6.
- For modifications where mass or dimension limits are exceeded, seek modification approval from the relevant heavy vehicle regulator before starting work. The regulator will likely require the installation to comply with this section.

**Recommended:**

- Ensure the rear departure angle of the vehicle with the lifting system fitted is not less than 11 degrees.

**VMLS location****Required:**

- Install all non-slewing platform type VMLS (for example, tailgate loaders) at either the rear or the left side of the vehicle.
- Locate the VMLS to ensure adequate clearance from the vehicle's moving parts, such as axles, brakes and suspension.
- Ensure in-cab controls, where fitted, do not interfere with the driver's control of the vehicle.
- Ensure safety devices incorporated in the design of the lifting system are operational.

**Recommended:**

- Fit all other types of VMLS that are not platform type to the left or the rear of the vehicle.
- For operator safety, install external vehicle mounted controls on the left or rear of the vehicle.

**Load distribution requirements**

Before any VMLS is mounted on to a vehicle, a weight distribution calculation is required to:

- Ensure that axles will not be overloaded by the fitting.
- Establish the available payload at which both stability and loading limitations are met.

**Required:**

- Perform load distribution as outlined in VSB6 Section H — Overview 'calculations' to verify that, with the vehicle in any load condition and with the loader in its non-operating (travel) position, the minimum front axle load is suitable to allow effective steering and braking.
- Ensure that adequate front axle loads are maintained to provide effective steering and braking. If this information is not available from the vehicle manufacturer, consult with a qualified engineer or refer to the performance-based standard (PBS) standard for steer tyre friction demand.
- Ensure that the location of the VMLS on the vehicle does not result in a load on the vehicle that makes the vehicle unstable or unsafe.
- Ensure that when the tailgate loader is extended and at maximum load it does not cause the chassis stress limit to be exceeded.

**Lights and markers requirements****Required:**

- Ensure all lamps and marker plates on the vehicle meet visibility requirements of all applicable ADRs and relevant heavy vehicle standards while the vehicle is in travel mode.
- If the VMLS or associated components diminish the visibility of any lamp or marker plate, restore compliance, possibly through fitting supplementary lamps or plates.

**Vehicle rating requirements****Required:**

- When selecting a VMLS, ensure the vehicle it will be fitted to does not exceed any of its ratings for gross vehicle mass (GVM), axle and suspension capacity.
- If fitting the intended VMLS is likely to cause the vehicle to exceed any of its ratings, select a more suitable vehicle or upgrade it in accordance with VSB6 Section S — Vehicle rating before installing and certifying the VMLS.
- When assessing if the vehicle is likely to exceed any of its ratings, take into consideration capacity to carry goods.

## 6. Installation requirements

### Chassis installation requirements

#### Required:

- Assure chassis strength for static loads, loads during lifting operations and loads during travel by performing assessment calculations in accordance with VSB6 Section H — Chassis.
- If the chassis requires reinforcing to accommodate lifting system mounts, carry out the reinforcing in accordance with the vehicle manufacturer's recommendations or VSB6 Section H — Chassis.
- Do not allow the vehicle manufacturer's maximum allowable chassis stress level to be exceeded by operation of the loader at its nominated rated capacity. If there is no vehicle manufacturer's maximum allowable stress level ensure the factor of safety (FoS) is not less than three, and is appropriate for the installation.
- Install the VMLS such that it is held securely in place on the chassis or body against forces resulting from accelerations generated by the motion of the vehicle of at least:
  - 0.8 g longitudinal
  - 0.5 g lateral
  - 0.2 g vertical (in excess of the acceleration generated by gravity).
- Apply an appropriate FoS to the stresses calculated for these forces and ensure the factored stresses do not exceed the yield strength of the materials being used.
- Drill chassis members to attach mounting brackets in accordance with VSB6 Section H — Chassis.

### Fittings requirements

#### Required:

- Apply an insulating compound, or other approved means to prevent corrosion due to electrolysis when components of dissimilar metal are bolted together.
- Ensure additional or substitute hydraulic hoses, fittings and components meet the hydraulic standard and flow/pressure ratings of the existing equipment.
- Locate hydraulic parts and fittings away from the brakes and exhaust.
- Ensure all electrical and hydraulic service lines are secured adequately to prevent chafing, kinking or other mechanical damage under normal motion of the parts to which they are attached.
- Ensure all hydraulic VMLS contain burst protection that will prevent movement of any loadbearing hydraulic cylinders as required by AS/NZS 1418.11 in the event of hose rupture or pipe fracture.

#### Recommended:

- Locate the mounting position of VMLS so that regular inspection and maintenance can be carried out readily on the mounting and adjacent vehicle parts.

### VMLS attachment requirements

#### Required:

Install all VMLS in accordance with the manufacturer's recommendations/instructions where available, and ensure all installations comply with the following:

- Ensure VMLS meet requirements of AS/NZS 1418, as applicable.

- Ensure VMLS to sub-frame/chassis mounting bolts, or studs, are at least ISO Grade 8.8 (SAE Class 5) bolts, unless a lower grade is specified by the VMLS manufacturer.
- Ensure that all bolts are tightened to the manufacturer's recommended torque, or if this is not available, the relevant Australian Standard.
- Attach brackets to the chassis in front of the rearmost suspension bracket by bolting and not by welding.
- Ensure the loader and all associated components can withstand rated capacity without causing permanent deformation or excessive deflection.
- Perform all chassis modifications in accordance with VSB6 Section H — Chassis.

#### Recommended:

- Brackets attached to the chassis forward of the last 30% of the rear overhang are attached by bolting not welding.
- Brackets within 30% of the rear overhang are attached to the chassis with bolts at least ISO Grade 8.8 (SAE Class 5) and vibration proof self-locking nuts or by welding (see VSB6 Section H — Chassis).
- Do not allow fastener tensile stress, induced by the VMLS load moment, to exceed 20% of the material yield stress.

#### Sub-frame to chassis attachments

If a sub-frame is to be fitted between the VMLS and chassis to spread the load moment of the VMLS along the chassis side members, the following applies:

#### Required:

- Ensure that sub-frames have full continuous contact with the vehicle chassis, where the chassis fastening method inhibits this, ensure suitable alternative methods are used (e.g., install additional strips of material either side of the rivets to allow for contact with the sub-frame).

#### Recommended:

- Fit the sub-frame so that it, along with its attachment to the chassis, does not excessively reduce chassis flexibility.

➡ The use of rigid sub-frames may be prohibited by some vehicle manufacturers. Before commencing the installation of a VMLS discuss the installation with the vehicle manufacturer.

- Follow the crane manufacturer's installation instructions with regards to the design of the sub-frame and its attachment to the vehicle chassis.
- Try to use a full-length sub-frame, starting from above the rear mounting bracket of the front suspension, especially for rear mounted VMLS (see Figure 1).

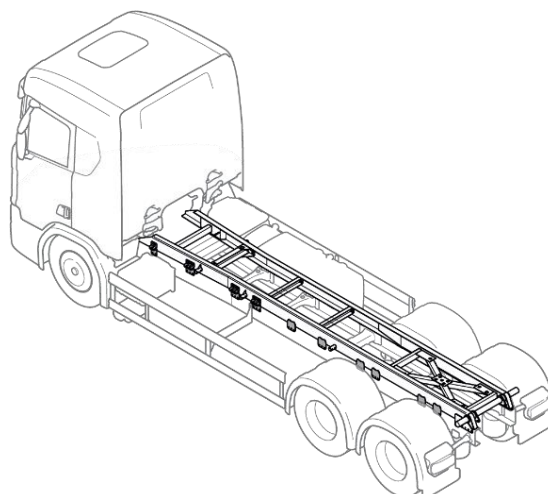


Figure 1: Full length sub-frame examples

- If mounting a suitably light VMLS on heavy or reinforced sections, such as a chassis used with a tandem rear axle group, a short sub-frame can be used with provided stress calculations for the chassis are performed to ensure requirements are addressed (see Figure 2).

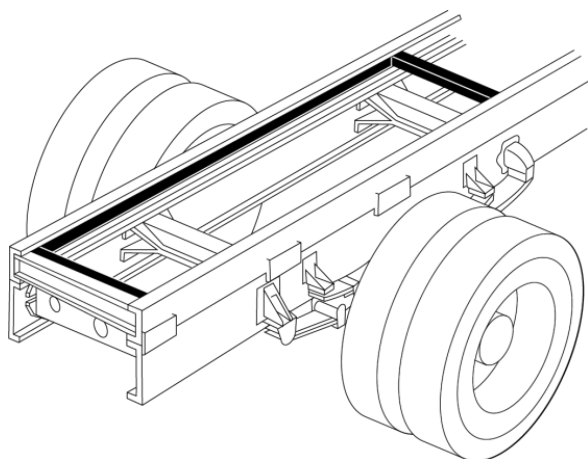


Figure 2: Short sub-frame example

- Reinforce open section sub-frame rails in the vicinity of their attachments to the chassis (see Figure 3).

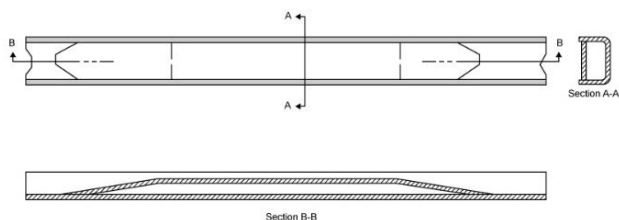


Figure 3: Sub-frame reinforcement under mounting

- Where the ends of the sub-frame finish on the chassis top flange, taper the end to avoid abrupt changes in section stiffness.
- Chamfer the underside of the sub-frame end or provide suitable radius to prevent digging in to the chassis top flange.
- Ensure protruding weld beads on the sub-frame do not contact the top flange of the chassis when operating (see Figure 4).

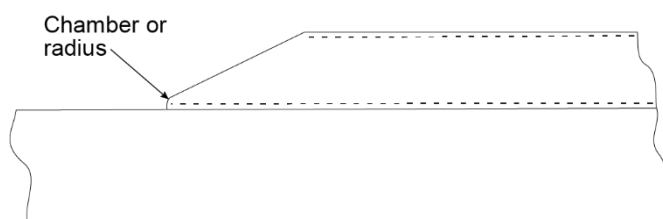


Figure 4: Sub-frame end on chassis top flange

- Construct the sub-frame so the combined chassis and sub-frame has a FoS of three at the maximum load moment induced by all dynamic forces imposed during operation.

Most commercially available channel and rolled section material has a yield limit of 250 MPa.

### VMLS to sub-frame attachment

The method of attaching a VMLS attachment to the sub-frame can vary according to sub-frame design and its position on the chassis. The following requirements for fitting sub-frames to a chassis apply equally to VMLS installation on trucks and other vehicles, such as tractors and trailers:

### Required:

- Attach the VMLS to the sub-frame/chassis with the mounting bolt layout according to the VMLS manufacturer's technical guidelines.
- Ensure a single layout is used. Mixing or matching multiple alternative layouts is not permitted.
- Use non-collapsing washers with the fasteners and self-locking nuts, or vibration-proof fasteners, to prevent loosening.
- Prevent longitudinal and transverse movement between the VMLS and sub-frame, for example by attaching blocks, or stops (see example in Figure 5).

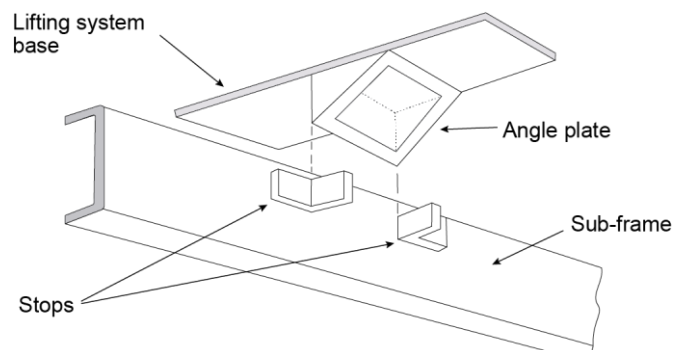


Figure 5: Example of locating stops on sub-frame

### Recommended:

- Ensure cross-members included in the sub-frame meet the requirements of VSB6 Section H — Chassis. Avoid using cross-members made from large sections of rectangular hollow section (RHS) or pipe unless recommended by the VMLS manufacturer (see Figure 6).

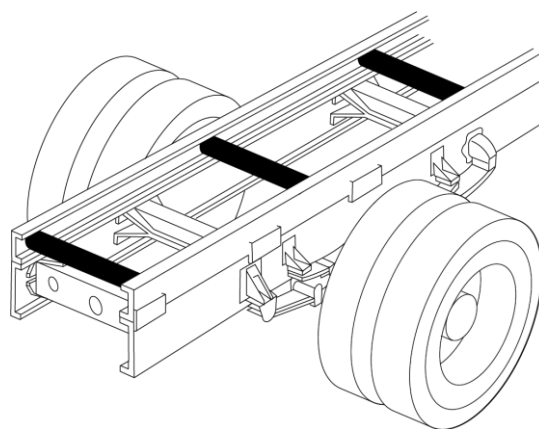


Figure 6: Sub-frame with pipe cross-members

- Attach the VMLS to the sub-frame in accordance with VSB6 Section H — Chassis so that it imparts forces into the chassis webs and isolates the chassis flange from stress raisers (see method shown in Figure 7).
- Avoid utilising an attachment method that imparts forces onto the chassis flange (see Figure 8).
- Avoid utilising an attachment method that imparts a loading similar to U-bolt attachment. Figure 9 utilises the same attachment method as that in Figure 8 but lacks metal spacers between the top and bottom flanges of the chassis. Avoid using this method as it is likely to damage the chassis rail.
- Where these methods are used, ensure the chassis has reinforcing or spacers added, creating a boxed-in section to eliminate chassis flange bending.

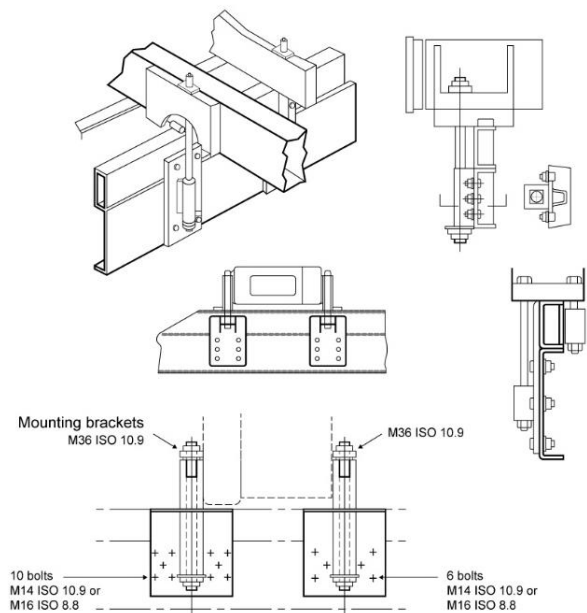


Figure 7: Lifting system attachment to chassis — recommended practices

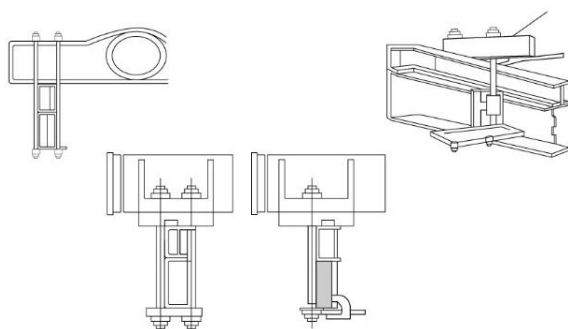


Figure 8: Discouraged lifting system mounting attachment to chassis

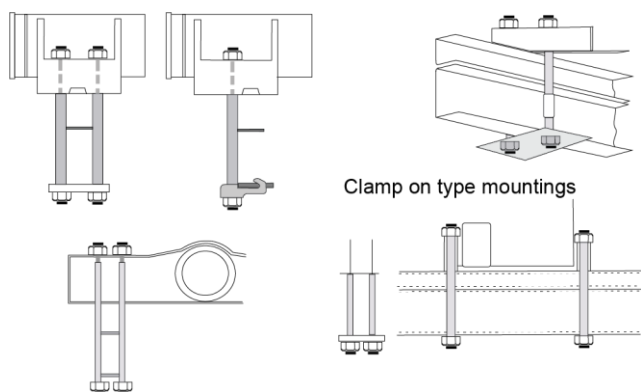


Figure 9: Prohibited lifting system mounting attachment to chassis

### Stability and axle loading requirements

If a VMLS needs to comply with the requirements of AS/NZS 1418.11, the stability requirements of AS/NZS 1418.11 take precedence over this section. For all non-AS/NZS 1418 VMLS, assess installation and stability in accordance with the following:

### Approval of VMLS fitting

#### Required:

- Ensure the safe working load is not greater than 80% of the tipping load: the load which, if applied at the hook, tips the VMLS over.
- Vehicle loading VMLS normally has a VMLS column and boom or jib arrangement that rotates to facilitate loading or unloading from positions around the vehicle. Ensure that stability is satisfied for all positions of VMLS operation.
- For a non-slewing VMLS, test stability only for the positions in which the VMLS is able to be used.
- Ensure a qualified and accredited AVE certifies and approves the installation of the VMLS in accordance with this modification code and includes appropriate stability testing.

### VMLS at front of vehicle body

#### Required:

- Where the VMLS is positioned at the front of the vehicle body (considered the worst-case loading scenario in relation to tipping), this is likely to be one of the three positions:
  - forward
  - side, in front of outrigger
  - side, rear of outrigger.
- Where the VMLS is offset to one side, typically the worst-case loading scenario will be towards the side of the vehicle where the VMLS is installed. For guidance, see Figure 10.

#### Crane behind cab

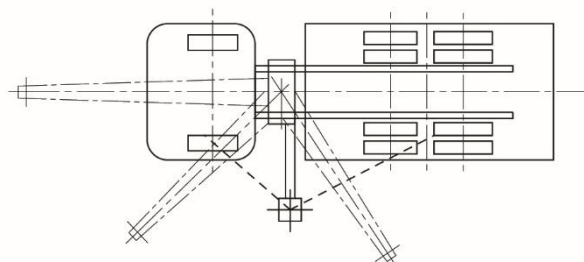


Figure 10: VMLS behind cab — positions where stability is to be considered

### VMLS at Rear of Vehicle Body

#### Required:

- If positioning the VMLS at the rear of the vehicle, consider these two tipping positions (see Figure 11):
  - side, in front of outrigger
  - rearwards.
- Where the VMLS is offset to one side, typically the worst-case loading scenario will be towards the side to which the VMLS is offset.



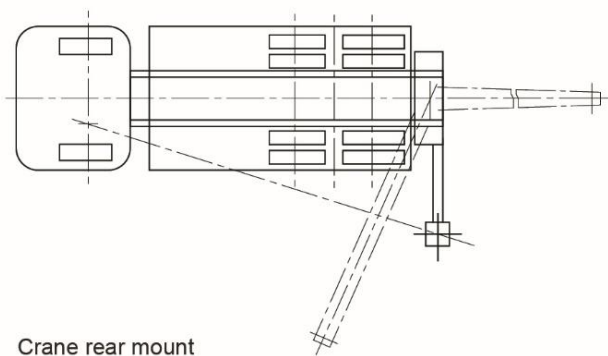


Figure 11: VMLS at rear — positions where stability is to be considered

### VMLS in other positions

#### Required:

- If VMLS are in positions other than those listed above, analyse the stability of the vehicle with extended VMLS boom in all configurations and critical situations to establish vehicle stability.

## 7. Testing requirements

Test the installation stability of all VMLS in accordance with the testing requirements outlined in the relevant parts of AS/NSZS 1418

## R1 Checklist — Installation of vehicle mounted lifting systems (example)

## R1 Checklist — Installation of vehicle mounted lifting systems

🔍 This checklist is for use by approved vehicle examiners (AVEs) when certifying the installation of vehicle mounted lifting systems (VMLS).

## Vehicle and modifier details

Vehicle make:	Vehicle model:	Month and year of manufacture:
VIN (if applicable):	Vehicle chassis no. (if applicable):	Vehicle modifier (company name):

## Advanced braking systems

Braking systems	Check Yes, No, N/A as applicable:	Yes	No	N/A
1 Is the advanced braking system (where fitted) un-affected or re-certified after the vehicle modification?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Modification details

Modification criteria	Check Yes or No as applicable:	Yes	No
1 Has the modification been performed in accordance with the manufacturer's guidelines?		<input type="checkbox"/>	<input type="checkbox"/>

## VMLS specifications

Make:	Model no./designation:	Serial no.:	Capacity:
Tested 125% stability:	metres	Kg	Tested 110% overload and swing:
			metres
			Kg

## Installation details

Hydraulics	Check Yes, No, N/A as applicable:	Yes	No	N/A
1 Are all the hydraulic hoses secure and clear of all moving components and do they have satisfactory ground clearance?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Is the hydraulic system free from fluid leaks?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mounting	Check Yes, No, N/A as applicable:	Yes	No	N/A
3 Are all chassis alterations made in accordance with VSB6 Section H — Chassis?		<input type="checkbox"/>	<input type="checkbox"/>	
4 Is the stress level in the chassis, when the loader is operated at its rated capacity, less than one-third the yield stress of the chassis material?		<input type="checkbox"/>	<input type="checkbox"/>	
5 Are all platform lifting systems installed at the rear or left-hand side of the vehicle?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Is the mounting method approved by the vehicle chassis manufacturer?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 Is the mounting method approved by the VMLS manufacturer?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 Is the VMLS mounted on a suitably designed sub-frame?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9 Does all welding conform to all relevant Australian Standards?		<input type="checkbox"/>	<input type="checkbox"/>	
10 Are all mounting bolts correctly torqued?		<input type="checkbox"/>	<input type="checkbox"/>	
11 If a body, including demountable, is fitted, are all other modifications performed in accordance with VSB6 Section J — Body Mounting?		<input type="checkbox"/>	<input type="checkbox"/>	
12 Do all safety devices operate correctly?		<input type="checkbox"/>	<input type="checkbox"/>	
13 Is all equipment, when not deployed, free from protrusions so as to minimise the risk of injury to any person?		<input type="checkbox"/>	<input type="checkbox"/>	
14 Does the method used to install the loader to the chassis or sub-frame conform to the vehicle manufacturer's instructions, or, if these are not available, has the modifier ensured, before installation, that the vehicle has sufficient chassis reinforcement within the chassis frame design limits so as to withstand the load moment induced by lifting?		<input type="checkbox"/>	<input type="checkbox"/>	
15 Can the loader and its associated components withstand a load to its rated capacity without causing any permanent deformation or excessive deflection?		<input type="checkbox"/>	<input type="checkbox"/>	
16 Does the VMLS meet the relevant testing requirements of AS/NZS 1418?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Vehicle chassis no./VIN:	Date:	Signed:

## R1 Checklist — Installation of vehicle mounted lifting systems

📌 This checklist is for use by approved vehicle examiners (AVEs) when certifying the installation of vehicle mounted lifting systems (VMLS).

### Compliance

Modification	Check Yes or No as applicable:	Yes	No
		<input type="checkbox"/>	<input type="checkbox"/>
1 Does this modification meet all the requirements of the manufacturer's guidelines / Modification Code R1?		<input type="checkbox"/>	<input type="checkbox"/>
2 Is the quality of the work to an accepted industry standard?		<input type="checkbox"/>	<input type="checkbox"/>
3 Have all relevant modification details and calculations been recorded in line with VSB6 record keeping requirements?		<input type="checkbox"/>	<input type="checkbox"/>
4 Does the vehicle continue to comply with ADRs and heavy vehicle standards regulations affected by the modification?		<input type="checkbox"/>	<input type="checkbox"/>

### Authorisation

Other than modification criteria, if the answer to any relevant question is NO the modification is not acceptable.			
Comments:			
Examined by:		Company (if applicable):	
AVE no.:			
Signed:		Modification certificate no.:	Date:
		Modification plate no.:	

Vehicle chassis no./VIN:	Date:	Signed:

## R1 Assessment report — Vehicle mounted lifting systems (example)

## R1 Assessment report — Vehicle mounted lifting systems

📌 This checklist is for use by approved vehicle examiners (AVEs) when assessing modifications to vehicle mounted lifting systems (VMLS).

<b>Vehicle details</b>		Report no.:
Vehicle make:	Vehicle model:	Month and year of manufacture:
VIN (if applicable):	Vehicle chassis no. (if applicable):	Vehicle modifier (company name):

## VMLS details

Type (i.e. platform, slewing crane):	Make:	Serial no.:
Manufacturer's capacity:	No. of stabilisers:	Chassis material:
Reinforcing/sub-frame material:	Reinforcing/sub-frame material yield stress: Mpa	
Weld strength:	Loader capacity: kg	Chassis material yield stress: Mpa

## Comments:

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## Basis for calculation

<b>Units</b>	
WB = Wheelbase (mm)	MVLS = Mass of vehicle lifting system (kg)
MT = Mass total of body and payload excluding MVLS (kg)	MB = Mass of body only (kg)
MF = Mass of body and payload of front (kg)	LF1 = Length forward of load centre of body load to front axle centre line (mm)
MR = Mass of body and payload on the rear axle (kg)	LF2 = Length forward of centre of gravity of vehicle lifting system (mm)
<b>Formulae</b>	
For body and load [MF1 = MT - MR1] $MR1 = \frac{MT \times LF1}{WB}$	For vehicle lifting system [MF2 = MVLS - MR2] $MR2 = \frac{MVLS \times LF2}{WB}$

## Load distribution

Load distribution	Front axles	Rear axles	Total
Cab chassis mass      kg			
Equipment, body & payload    MT    kg	MF1 =	MR1 =	MT =
Vehicle lifting system      MVLS    kg	MF2 =	MR2 =	MTGL =
Total      A    kg			

Vehicle chassis no./VIN:	Date:	Signed:

## R1 Assessment report — Vehicle mounted lifting systems

➤ This checklist is for use by approved vehicle examiners (AVEs) when assessing modifications to vehicle mounted lifting systems (VMLS).

### Calculations

#### Load reactions

Loader stowed:	kNm	Critical stresses:	MPa
Loader fully extended (at max. capacity load):	kNm	Factor of safety on yield:	
Section modulus distribution:	mm	Location of welded joints*:	
Max. bending moment:	kNm	Stress at welded joints:	MPa

\*description OR distance (mm)

#### Vehicle rating

Load distribution			Front axles	Rear axles	Total
Manufacturer's rating	B	kg			
Tyre capacity	C	kg			
Legal load limit	D	kg			
Unladen distribution			Front axles	Rear axles	Total
Cab chassis mass		kg			MFT =
Body		kg			WB =
Vehicle loading system		kg	MF2 =	MR2 =	MTGL =
Total		kg			

- Total A must not exceed ratings B, C or D.
- Neither the laden nor unladen mass distribution should cause the vehicle to become unstable or unsafe. The front axle mass should not be less than the manufacturer's front axle tare mass under any loading.

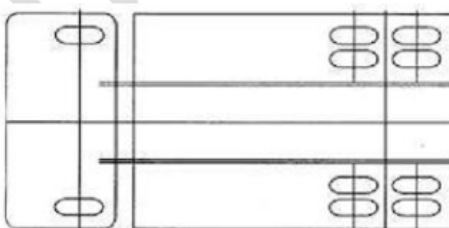
#### Combined section modulus distribution

x 10<sup>3</sup>mm<sup>3</sup>

#### On-road chassis loadings

Bending moment distribution:	kNm	Critical stress:	MPa
Bending moment at critical section:	kNm	Factor of safety on yield:	

Illustrate chassis loadings here:



### Authorisation

Other than modification criteria, if the answer to any relevant question is NO the modification is not acceptable.

Comments:			
Examined by:	Company (if applicable):		AVE no.:
Signed:	Modification certificate no.:	Modification plate no.:	Date:

Vehicle chassis no./VIN:	Date:	Signed:
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# Modification Code R2 — Wheelchair loader installation

## 1. Scope

Modifications covered under this code:

Covered
<ul style="list-style-type: none"> <li>installation of a wheelchair loader designed for automotive use.</li> </ul>
Not covered
<ul style="list-style-type: none"> <li>fitting wheelchair loaders not designed for automotive use</li> <li>fitting of vehicular wheelchair restraints (see VSB6 Section K — Cabin)</li> <li>manufacturing and fitting of an automotive type door</li> <li>fitting of a wheelchair loader resulting in the loader protruding (internally or externally) in a way that is likely to increase the risk of injury to a person.</li> </ul>

## 2. Related standards

Modified vehicles must comply with all ADRs, Australian Standards, acts and regulations. Below are some but not all of the areas that may be affected by the modifications in this code and require certification testing or evidence to demonstrate compliance.

The certifier must ensure that the modified vehicle continues to comply with all related Australian Design Rules.

This...	Must comply with...
Installation of wheelchair loader	VSB6 Section R — Vehicle mounted lifting systems Good engineering practice
Relocation of wheelchair restraints	VSB6 Section K — Cabin Good engineering practice

This modification code may also be subject to additional regulations and Australian Standards, including:

- AS/NZS 3856.1: Hoists and ramps for people with disabilities - Vehicle-mounted - Product
- AS/NZS 3856.2: Hoists and ramps for people with disabilities - Vehicle-mounted - Installation
- AS 1428 Design for Access and Mobility.

## 3. Certification procedure

The certification procedure for this modification code is as follows:

1.	Modifier	Determine if the modification is within manufacturer specifications. <ul style="list-style-type: none"> <li>If <b>yes</b>, the modification will need to be done in accordance with manufacturer specifications.</li> <li>If <b>no</b>, the modification will need to be done in accordance with this modification code.</li> </ul>
2.	Modifier	Consult with an accredited R2 AVE for guidance on how to perform the modification.
3.	Modifier	Consult with an AVE who is accredited to certify any other modification for guidance on how any modification is required to be performed. Follow the certification procedure in each applicable modification code.  <i>For example, where a wheelchair occupant restraint system has been installed, refer to an accredited K5 AVE and VSB6 Modification Code K5.</i>

4.	Modifier	Perform modification in accordance with AVE advice and this code.
5.	Modifier	Organise approval inspection by an accredited R2 AVE.
6.	R2 AVE	Perform inspection, complete R2 checklist and determine if compliance has been achieved: <ul style="list-style-type: none"> <li>If <b>yes</b>, proceed to step 6.</li> <li>If <b>no</b>, do not proceed, advise modifier rework is required to ensure compliance. Return to step 2.</li> </ul>
7.	R2 AVE	Issue modification certificate, affix modification plate, and submit paperwork as required by the relevant AVE registration scheme.

AVEs must be satisfied that the vehicle modification requirements are being met. It is advised that before modifications are carried out they are discussed with the certifying AVE.

## 4. Compliance requirements

### Required:

- Ensure wheelchair loaders and attachments comply with requirements advised in:
  - AS/NZS 3856.1: Hoists and ramps for people with disabilities - Vehicle-mounted - Product
  - AS/NZS 3856.2: Hoists and ramps for people with disabilities - Vehicle-mounted - Installation.
- Ensure all vehicles having a wheelchair loader installed are modified and certified in accordance with this modification code.
- Ensure all vehicles being modified with a wheelchair loader, including new or used vehicles being installed with a new or used wheelchair loader, are modified and certified in accordance with this modification code.
- If a wheelchair loader is installed so that the non-operating (travel) position is internal to the vehicle, ensure the installation does not result in protrusions inside the cabin that increase the risk of injury to the vehicle occupants.
- If the loader is installed in close proximity to, or directly behind seating positions, focus on preventing or reducing the likelihood of head impact.
- If a wheelchair loader installation results in or requires modifications to parts of the vehicle outside of the scope of this modification code, perform and certify these in accordance with the relevant sections of VSB6.
- Do not modify the wheelchair loader platform, linkages or structures without written approval of the wheelchair loader manufacturer.
- Ensure, where fitted, all wheelchair occupant restraint systems are certified in accordance with VSB6 Modification Code K5.

## 5. Design requirements

### Mass and dimensions requirements

#### Required:

- All equipment, when not deployed, must not protrude from the vehicle so that it is likely to increase the risk of injury to any person. Where an object protrudes from the vehicle but is technically essential, it must be designed, positioned and constructed to reduce the risk of injury to a minimum.

- When not in operation, no part of the loader appliance and associated components may extend laterally beyond the maximum width of the vehicle.
- If an installation results in a vehicle's dimensions exceeding regulatory limits, do not perform or certify the installation using this section of VSB6.
- For modifications where mass or dimension limits are exceeded, seek modification approval from the relevant heavy vehicle regulator before starting work. The regulator will likely require the installation to comply with this section.
- Ensure that once the wheelchair loader is fitted, the vehicle does not exceed any of the vehicle's ratings including the gross vehicle mass (GVM), axle capacity and suspension capacity.
- If fitting the wheelchair loader is likely to cause the vehicle to exceed any vehicle ratings, upgrade the vehicle in accordance with VSB6 Section S — Vehicle rating before installing and certifying the wheelchair loader.

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#### Recommended:

- Consider the vehicle's capacity for carrying goods when assessing whether it is likely to exceed any of its ratings.
- Consult vehicle, body and wheelchair loader manufacturers or suppliers on special mounting requirements before starting modifications in relation to the suitability of the vehicle with the loader type and its capacity or size.
- Make the rear departure angle of the vehicle with the loader fitted, no less than 11 degrees.

#### Location of loader

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##### Required:

- Place all wheelchair loaders:
  - of platform type at either the rear or the left side of the vehicle
  - other than platform type, except where the wheelchair loader is fitted exclusively for the use of the vehicle's driver, on the left side or rear of the vehicle.
- Locate the loading system to ensure adequate clearance from the vehicle's moving parts, such as axles, brakes and suspension.
- Ensure that safety devices incorporated in the design of the loader are operational.
- Ensure the vehicle, when fitted with a wheel chair loader, continues to meet the requirements of ADR 44/.. , 58/.. or state or territory passenger transport requirements for emergency exits by assessing the following:
  - wheelchair loader installation does not obscure or obstruct emergency exits, unless the vehicle complies with emergency exit requirements in excess of / in addition to the obstructed exit
  - all other emergency exits remain free of obstructions and can be opened from both inside and outside the vehicle.

#### Control system

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##### Required:

- For operator safety, place external vehicle mounted controls on the left or rear of the vehicle wherever reasonably practical.
- Ensure in-cab controls, where fitted, do not interfere with the driver's control of the vehicle.
- Ensure the controls, including an emergency stop button, are operable by an attendant.
- Ensure the loader is operable from the left side of the vehicle.

#### Lights and markers

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##### Required:

- Ensure all lamps and marker plates on the vehicle meet the visibility requirements of all applicable ADRs and relevant heavy vehicle standards while the vehicle is in travel mode.
- If the wheelchair loader or associated components diminish the visibility of any lamp or marker plate, restore compliance, possibly through fitting supplementary lamps or plates.

## 6. Installation requirements

#### Attachment to chassis

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##### Required:

- Ensure the method for installing the wheelchair loader to the body, chassis or sub-frame complies with the vehicle manufacturer's recommendations. Where these are not available, ensure there is sufficient body or chassis reinforcement so that the load moment induced by all dynamic forces imposed during operation is within the body or chassis design limits.
- Assure chassis strength for static loads, loads during loading operations and loads imposed during travel by performing assessment calculations in accordance with VSB6 Section H — Chassis.
- If the chassis requires reinforcing to accommodate the wheelchair loader mounts, carry out the reinforcing in accordance with the vehicle manufacturer's recommendations or VSB6 Section H — Chassis.
- Do not exceed the vehicle manufacturer's maximum allowable chassis stress level by the operation of the loader at its nominated rated capacity.
- If the vehicle manufacturer's maximum allowable stress level is not available, ensure its FoS is not less than three and that it is appropriate for the installation.
- Install the wheelchair loader so that it is held securely in place on the chassis or body against forces resulting from accelerations generated by the motion of the vehicle of at least:
  - 0.8 g longitudinal
  - 0.5 g lateral
  - 0.2 g vertical (in excess of the acceleration generated by gravity).
- Apply a FoS of at least 1.5 to the stresses calculated for these forces and do not let the factored stresses exceed the yield strength of the materials being used.
- Drill chassis members to attach mounting brackets in accordance with VSB6 Section H — Chassis.
- If installing a hoist or ramp for the disabled is likely to cause a high load, fit anchorage plates to support the loader and attach it to the chassis of the vehicle.
- If installing a hoist or ramp for the disabled is likely to cause only a low load and is attached to panel steel, attach it using rivet nuts, equivalent expanding inserts or anchorage plates.

#### Fittings requirements

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##### Required:

- Apply an insulating compound, or other approved means of preventing corrosion due to electrolysis, when bolting together components of dissimilar metal.
- Ensure additional and substitute hydraulic hoses, fittings and components meet the hydraulic standard and flow/pressure ratings of the manufacturer of the existing equipment.

- Locate hydraulic parts and fittings away from the rear axle brakes and exhaust.
- Secure all electrical and hydraulic service lines adequately to prevent chafing, kinking or other mechanical damage under the normal motion of the parts to which they are attached.

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#### Recommended:

- Locate wheelchair loader mountings so that inspection and maintenance of the mounting and adjacent parts can be carried out easily.
- If an additional door is required for a loading device, use or reproduce a door from the vehicle manufacturer or, where this is unavailable or not practical, manufacture a door ensuring the door complies with *ADR 29/.. Side Door Strength*, does not have sharp edges and is fitted with a compliant automotive type safety catch.

#### Wheelchair loader to chassis attachments

- Complete all wheelchair loader installations in accordance with the manufacturer's recommendations/instructions if available.
- Ensure all installations also comply with the following:
  - The wheelchair loader meets the requirements of the relevant sections of AS/NZS 3856 and AS 1428.
  - The wheelchair loader to sub-frame/chassis mounting bolts, or studs, are at least ISO Grade 8.8 (SAE Class 5), unless a lower grade is specified by the wheelchair loader manufacturer.
  - Ensure that all bolts are tightened to the manufacturer's recommended torque, or if this is not available, the relevant Australian Standard.
  - The tensile stress in the fastener, as induced by the wheelchair loader load moment, does not exceed 20% of the material yield stress.
  - Brackets attached to the chassis forward of the last 30% of the rear overhang are attached by bolting not welding.
  - Brackets within 30% of the rear overhang are attached to the chassis with bolts at least ISO Grade 8.8 (SAE Class 5) and vibration proof self-locking nuts or by welding (see *VSB6 Section H: Chassis*).
- Ensure the wheelchair loader and all associated components can withstand rated capacity without causing permanent deformation or excessive deflection.
- Ensure all chassis modifications are performed in accordance with *VSB6 Section H: Chassis*.

#### Sub-frame to chassis attachments

As well as the above requirements, if a sub-frame is to be fitted between the wheelchair loader and chassis to spread the load moment of the wheelchair loader along the chassis side members, apply the following:

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#### Required:

- Do not allow sections used for the sub-frame and its attachment to the chassis to excessively reduce chassis flexibility.
- Do not let any protruding weld beads on the sub-frame to contact the top flange of the chassis when operating.

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#### Recommended:

- Reinforce open section sub-frame rails in the vicinity of their attachments to the chassis.
- If the ends of the sub-frame finish on the chassis top flange, make the end taper to avoid abrupt changes in section stiffness.
- Chamfer or provide suitable radius to the underside of the sub-frame end to prevent digging-in to the chassis top flange.
- Construct the sub-frame so the combined chassis and sub-frame has a FoS of three at the load moment induced by all dynamic forces imposed during operation.

➤ Most commercially available channel and rolled section material has a yield limit of 250 MPa.

#### Wheelchair loader to sub-frame attachments

The method of attaching a wheelchair loader to the sub-frame can vary according to the sub-frame design and its position on the chassis.

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#### Required:

- Attach the wheelchair loader to the sub-frame/chassis with the mounting bolt layout according to the wheelchair loader manufacturer's technical guidelines.
- Use a single layout and do not mix or use multiple alternative layouts.
- Use non-collapsing washers with the fasteners and self-locking nuts, or vibration-proof fasteners, to prevent loosening.
- Prevent longitudinal and transverse movement between the wheelchair loader and sub-frame for example by attaching blocks or stops.

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#### Recommended:

- Ensure cross-members included in the sub-frame comply with the requirements of *VSB6 Section H — Chassis*.
- Attach the wheelchair loader to the sub-frame in accordance with *VSB6 Section H — Chassis*.
- Ensure the attachment imparts the forces into the chassis webs and isolate the chassis flange from stress raisers.
- Avoid any attachment of the sub-frame that imparts forces onto the chassis flange.



## R2 Checklist — Wheelchair loader installation (example)

## R2 Checklist — Wheelchair loader installation

This checklist is for use by approved vehicle examiners (AVEs) when certifying the installation of a wheelchair loader.

## Vehicle and modifier details

Vehicle make:	Vehicle model:	Month and year of manufacture:
VIN (if applicable):	Vehicle chassis no. (if applicable):	Vehicle modifier (company name):

## Advanced braking systems

Braking systems	Check Yes, No, N/A as applicable:	Yes	No	N/A
1 Is the advanced braking system (where fitted) un-affected or re-certified after the vehicle modification?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Modification details

Modification criteria	Check Yes or No as applicable:	Yes	No
1 Has the modification been performed in accordance with the manufacturer's guidelines?		<input type="checkbox"/>	<input type="checkbox"/>

## Installation details

Loader details	Check Yes, No, N/A as applicable:	Yes	No	N/A
1 Has the loader and its installation been shown to meet the requirements of Australian Standard AS3856 Part 1 and Part 2?		<input type="checkbox"/>	<input type="checkbox"/>	
2 Is the wheelchair loader installed as per the manufacturer's specifications?		<input type="checkbox"/>	<input type="checkbox"/>	
3 Excepting loaders installed for the dedicated use of the driver, is the loader installed at the rear or left-hand side of the vehicle?		<input type="checkbox"/>	<input type="checkbox"/>	
4 Have all practical and reasonable steps been taken to install any external controls on the left or rear side of the vehicle?		<input type="checkbox"/>	<input type="checkbox"/>	
5 Do all safety devices operate correctly?		<input type="checkbox"/>	<input type="checkbox"/>	
6 Is all equipment, when not in use, free from protrusions which are likely to increase the risk of injury to any person?		<input type="checkbox"/>	<input type="checkbox"/>	
7 Are anchorage plates fitted to support the upper section of the loader and attached to the frame of the vehicle?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Compliance

Modification	Check Yes or No as applicable:	Yes	No
1 Does this modification meet all the requirements of the manufacturer's guidelines / Modification Code R2?		<input type="checkbox"/>	<input type="checkbox"/>
2 Is the quality of the work to an accepted industry standard?		<input type="checkbox"/>	<input type="checkbox"/>
3 Have all of the modification details and all calculations applicable to the modification been recorded in accordance with the record keeping requirements of VSB6?		<input type="checkbox"/>	<input type="checkbox"/>
4 Does the vehicle continue to comply with ADRs and heavy vehicle standards regulations affected by the modification?		<input type="checkbox"/>	<input type="checkbox"/>

## Authorisation

Other than modification criteria, if the answer to any relevant question is NO the modification is not acceptable.

Comments:

Examined by:	Company (if applicable):	AVE no.:	
Signed:	Modification certificate no.:	Modification plate no.:	Date:

Vehicle chassis no./VIN:	Date:	Signed:
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