Section J

Body Mounting

Contents

Section J — Overview

1. Description

This section of Vehicle Standards Bulletin 6 (VSB6) relates to the design and installation of bodies to vehicle chassis. It specifies the minimum design and performance requirements for the installation of a body onto a vehicle. Modifications that could affect the body mounting system include:

- change of body type
- change of body size
- extended or shortened wheelbase
- fitting of an additional axle
- fitting of chassis reinforcements or adaptions
- chassis extension, such as increased rear overhang.

It consists of the following modification codes:

J1	**Body mounting** • mounting of bodies of all types to a motor vehicle or trailer • modification or replacement of body mountings • fitting of body equipment (e.g., roll-over tarps) not covered by other sections of VSB6 • installation of approved truck-bus body (J2) to motor vehicle • installation of approved external roll-over protection system (ROPS) and/or falling object protection system (FOPS) (J3) to a motor vehicle • installation of approved tipper body (J4) to a motor vehicle • installation of an OEM tipper body (including a modified OEM tipper body) to the OEM's design requirements (see VSB6 Modification Code J1)
J2	**Truck-bus body (design)** • design of a bus body (i.e., a passenger carrying pod) for fitment onto a truck cab-chassis
J3	**Roll-over or falling object protection system (design)** • design of external roll-over protection system (ROPS or falling object protection system (FOPS) on a motor vehicle.
J4	Tipper Bodies (design) • design of tipper bodies for motor vehicles.

Most vehicle manufacturers issue instructions or recommendations for body building and mounting, (typically called body builders guide). The vehicle manufacturer's recommendations are to be the primary source for modifications. This section of VSB6 is intended for use only when the vehicle manufacturer's recommendations are no longer available or applicable.

For bodies of specialised vehicles, such as aluminium tanks, the body manufacturer will provide mounting guidelines that are the primary source for installation instructions and are to be adhered to, along with the chassis manufacturer's guidelines.

A bus body must be installed on a motor vehicle chassis in accordance with both Modification Code J1 and certified for bus related requirements in accordance with Modification Code J2.

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
42/..	General Safety Requirements
43/..	Vehicle Configuration & Dimensions
92/..	External Projections
93/..	Forward Field of View

3. Dimension limits

Ensure all dimensions of a vehicle, including internal (where applicable) and external, are in accordance with the limits specified by the applicable heavy vehicle regulations. When considering compliance with dimension limits, loading of the vehicle must be taken into account. For example, loading of a vehicle fitted with a tipper body may result in bulging of the sides that result in the vehicle exceeding width limits. To prevent this, less flexible materials or structures that support the body may need to be used.

Some allowances may be made to be exceeded dimensions under certain circumstances through notices or permits. Consult your heavy vehicle regulator for further advice.

➘ The installation of a body or body equipment that exceeds the dimension limits may only be certified under this Section of VSB6 where a valid dimension exemption has been issued.

4. 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 commissioning of the modified vehicle
- make the records available upon request for inspection by officers of the relevant federal, state or territory authority or relevant heavy vehicle regulator.

Reports and checklists

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

J1 Checklist	Body mounting
J2 Checklist	Truck-bus body (design)
J3 Checklist	Roll-over or falling object protection system (design)
J4 Checklist	Tipper bodies (design)

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 J1 — Body mounting

1. Scope

Modifications covered under this code:

Covered

- mounting of bodies of all types to a motor vehicle or trailer
- modification or replacement of body mountings
- fitting of body equipment (e.g., roll-over tarps, toolboxes) not covered by other sections of VSB6
- mounting of a complying truck-bus body in accordance with a J2 approved design
- fitting of a complying roll over or falling object protection system in accordance with a J3 approved design
- mounting of complying tipper body in accordance with a J4 approved design
- mounting of OEM tipper body in accordance with OEM's design requirements.

Not covered

- mounting of bodies in a manner that is likely to lead to failure of the vehicle chassis
- mounting of bodies in a manner that provides insufficient restraint of the body and any possible loading under any operational conditions
- fitting of omnibus bodies that are not also certified using Modification Code J2
- mounting of bodies for specific vehicle category ADR compliance, e.g., bus roll-over protection
- fitting of any body intended for the carriage of people, except when installed in accordance with Modification Code J2
- fitting of any roll over or falling object protection systems, except when designed and certified in accordance with Modification Code J3
- fitting of any tipper body, except when installed in accordance with Modification Code J4 or OEM design requirements.
- mounting of fifth wheels/turntables (see VSB6 Section P — Tow couplings)
- installation of vehicle mounted lifting systems (see VSB6 Section R — Vehicle mounted lifting systems).

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…
Lights	ADR 13/..
Mudguards	ADR 42/..
Vehicle dimensions	ADR 43/..
Exhaust repositioning	ADR 42/.. VSB6 Modification Code A4
External Projections	ADR 92/..
Forward Field of View	ADR 93/..

3. Certification procedure

The certification procedure for this modification code is as follows:

1.	Modifier	Determine if the modification is within manufacturer specifications. • If **yes**, the modification will need to be done in accordance with manufacturer specifications. • If **no**, the modification will need to be done in accordance with this modification code.
2.	Modifier	Determine if the installation is either a: • General body installation (proceed to step 3) • Truck-bus body (proceed to step 4) • Roll over or falling object protection (proceed to step 4); or • Tipper body with previous design approval or in accordance with the OEM's design requirements (proceed to step 3) • Tipper body without previous design approval or not in accordance with the OEM's design requirements (proceed to step 4)
3.	Modifier	Consult with an accredited J1 AVE for guidance on how to perform the modification. Proceed to step 5
4.	Modifier	Contact an accredited J2/J3/J4 AVE and provide them vehicle specifications and organise a vehicle inspection to design the body/system. Proceed to step 6
5.	Modifier	Perform modification in accordance with AVE advice and this code. Proceed to step 7
6	Modifier	Perform modification in accordance with the AVE's J2/J3/J4 design instructions.
7.	Modifier	Organise approval inspection by an accredited J1 AVE.
5.	J1 AVE	Perform inspection, complete J1 checklist and determine if compliance has been achieved. • If **yes**, proceed to step 6. • If **no**, do not proceed, advise modifier rework is required to ensure compliance. Return to step 2.
6.	J1 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 all modifications are performed and certified in accordance with the relevant sections of VSB6.
- Ensure axle loads do not exceed the lesser of the manufacturer's prescribed axle capacities or jurisdictional legal load limits (unless exempted by the relevant heavy vehicle regulator).

↘ The rear overhang and loading space must comply with ADR and jurisdictional dimension and loading requirements. See section *5. Design requirements* below for more information.

Recommended:

- Obtain the correct axle loading for general freight bodies that are configured for loading other than water level loading:
  - mark the body clearly with a securely mounted marker at the longitudinal point for the load centre of gravity at maximum legal GVM
  - use this load centre of gravity marker to indicate the point about which the vehicle's payload is to be evenly distributed.
- Ensure markers used to indicate the permissible load at points are highly visible and designed to last the life of the body.
- Ensure the body is marked with maximum payload capacity.

5. Design requirements

Before fabricating or fitting a truck body, consider how the vehicle will operate following the proposed modification, and how changes to size and weight might affect its safety or performance.

For the vehicle to be as stable as possible when cornering, the centre of gravity of a vehicle should be as low and as near to the centre of the vehicle as possible. The centre of gravity is the point about the cab chassis at which the mass is centred. Any part of the body or equipment added or removed from the vehicle will affect the centre of gravity.

Required:

- Use the vehicle manufacturer's manual as the main source of information for modifying the vehicle body.
- Apply a design factor of safety of three to body mounting components.
- When designing the modification consider the following:
  - distribution of the loads across the axle and group(s), refer to VSB6 Section H — Overview
  - chassis strength, refer to VSB6 Section H — Overview
  - where the body modifications require GVM re-rating, ensure the modifications are certified in accordance with VSB6 Section S — Vehicle rating
  - the overall dimensions of the modified vehicle.
- Do not let the body project beyond the end of the chassis by more than 1.5 times final chassis depth unless the body structure is self-supporting at full load.
- Ensure the modification achieves optimal centre of gravity of (see Figure 1).
- Endeavour to mount heavy parts of the body or equipment as low and symmetrically about the chassis as possible. This will assist in minimising the centre of gravity height.
- Ensure the body attachment can withstand and evenly distribute forces imposed by payload and body weight during worst case conditions such as full braking and overturning moments.
- Ensure protruding weld beads do not make contact with the top flange of the chassis when in operation. This includes components such as body sub-frames or the bottom side of caps welded to body longitudinals.

Recommended:

- Ensure that the body sub-frame extends for the entire length of the body without breaks or joins.
- Use standard manufacturer mountings and attachment methods.
- Where point load situations occur, (e.g., vehicles fitted with cells/scales), install the body in accordance with manufacturer guidelines.
- Ensure the front end of the sub-frame offers progressive load bearing transition to the chassis (see Figure 2 for two methods of preventing stress concentration).

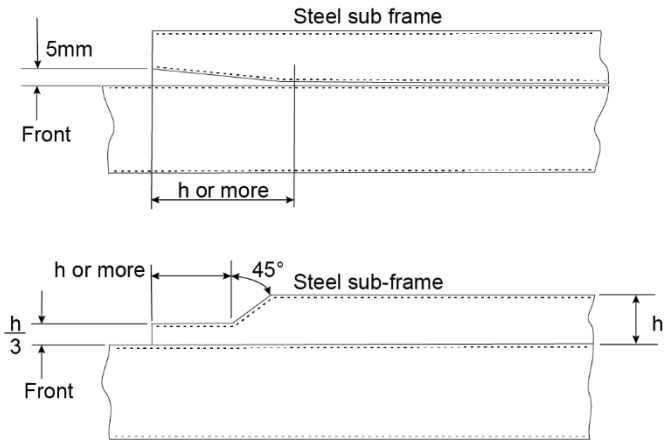


Figure 2: Examples of progressive load bearing transition

- Unless stated otherwise in the vehicle manufacturer manual, ensure that body loads are transmitted directly to the web of the chassis.
- Allocate spacing of 900 mm for body mount including but not limited to outrigger mounts, fish plates and U-bolts, but consider altering this to suit the installation if need be.
- Do not allow the body mounting attachment, including welding or bolts, to be closer than 50 mm to any spring hanger bolt or rivet.
- Use suitably designed vibration isolators between the body and chassis mounting brackets to reduce noise and vibration within the cab and allow for slight misalignment at the body brackets.
- Avoid using U-bolts for body/sub-frame attachments as outlined below in '6. Body mount installation requirements'.
- Do not locate body mounting attachments within the shaded areas of Figures 3 and 4, unless the manufacturer's recommendations state otherwise.
- Ensure the design and installation of the body does not negatively impact on vehicle functions access for maintenance purposes.

Figure 1: Example of centre of gravity

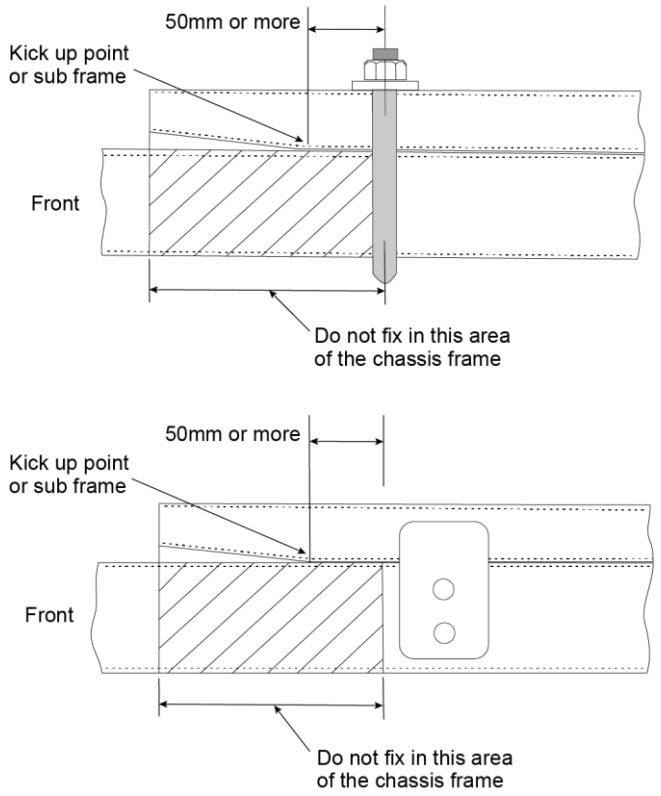


Figure 3: Attachment front end of sub- frame

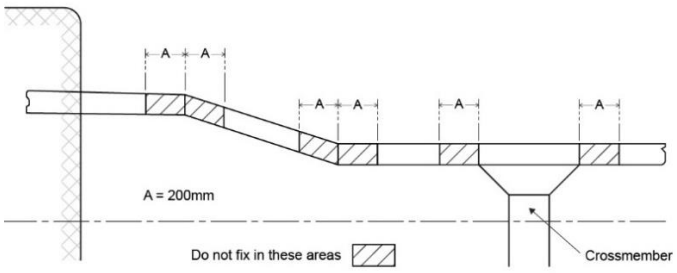


Figure 4: Attachment locations chassis

Wheelbase, rear overhang

Use load distribution calculations and intended use to determine wheelbase, rear overhang and overall body length. Where these calculations cannot be determined use water level load conditions.

Water level loading is calculated assuming a homogenous load evenly distributed over the load space until the vehicle reaches GVM. Axle loads can then be calculated in this condition.

6. Installation requirements

Required:

- When components made of dissimilar metal are bolted together, use an isolating compound or other approved means to prevent corrosion.
- Drill frame side members for body mount attachment in accordance with VSB6 Section H — Chassis.
- Use standard bolts with a minimum ISO Grade 8.8 (or SAE Class 5) and appropriate grade nuts for fastening body mounts to the chassis (see AS 1110.1). The use of vibration-proof fasteners such as Huck bolts is acceptable, provided the bolt manufacturer's specifications ensure that they are of equivalent strength and toughness.

Recommended:

- Ensure the lower attachment hole on all body mountings is below the neutral axis of the chassis.
- Ensure the bottom edge of the body mount is as near as possible to the web of the chassis to prevent frame cracking.
- Locate the body mountings so that:
  - stress concentrations are kept to a minimum in relation to changes in chassis section, suspension mountings and chassis attachments
  - regular inspection and maintenance can be carried out on mountings and adjacent vehicle parts
  - sufficient clearance of mountings between moving parts such as tail shafts, suspension links, etc.

U-bolt mounting

Where U-bolts are used as the method of fixing the body to the chassis there is no positive location. This means friction and high clamping forces are relied on to prevent movement.

Ensure the manufacturer guidelines are referred to as the use of U-bolts may not be endorsed, particularly for use in conjunction with heat treated chassis rails.

Avoid using a U-bolt to attach a body to the chassis for the following reasons:

- U-bolts work loose over time.
- Runner shrinkage and wear over time can occur, resulting in body movement and damage.
- The load is carried on the top and bottom of the flange of the chassis, rather than the web.
- The body longitudinals stiffen the frame thus reducing the flexibility along part of the frame length.
- U-bolts holding body longitudinals are often over tightened causing:
  - buckling of the frame flange
  - reduced chassis strength
  - frame distortion.
- Positioning metal spacers between top and bottom flanges prevents the flange being buckled, causing localised:
  - loss of flexibility
  - stiffening
  - increased stress.

If U-bolt mountings are unavoidable, ensure the following:

Required:

- Use a minimum of three U-bolts per side of the chassis with a maximum pitch spacing of 1.2 m and a minimum U-bolt diameter of:
  - bodies up to 2 t load-carrying capacity = 12 mm
  - bodies over 2 t load-carrying capacity = 16 mm.
- Use ISO Grade 4.6 steel U-bolts in preference to others.
- Do not distort the frame, particularly the flanges.
- If the vehicle does not have a box type frame, insert metal spacers between the top and bottom flanges of the chassis to prevent distortion when U-bolts are tightened.
- Do not use wooden spacers as these can shrink and drop out.
- Secure spacers in place using the U-bolts as shown in Figure 5.
- If wooden runners are used, protect them from direct pressure of the U-bolts either by steel capping under the bolt or by a shaped spacer, as shown in Figure 5.

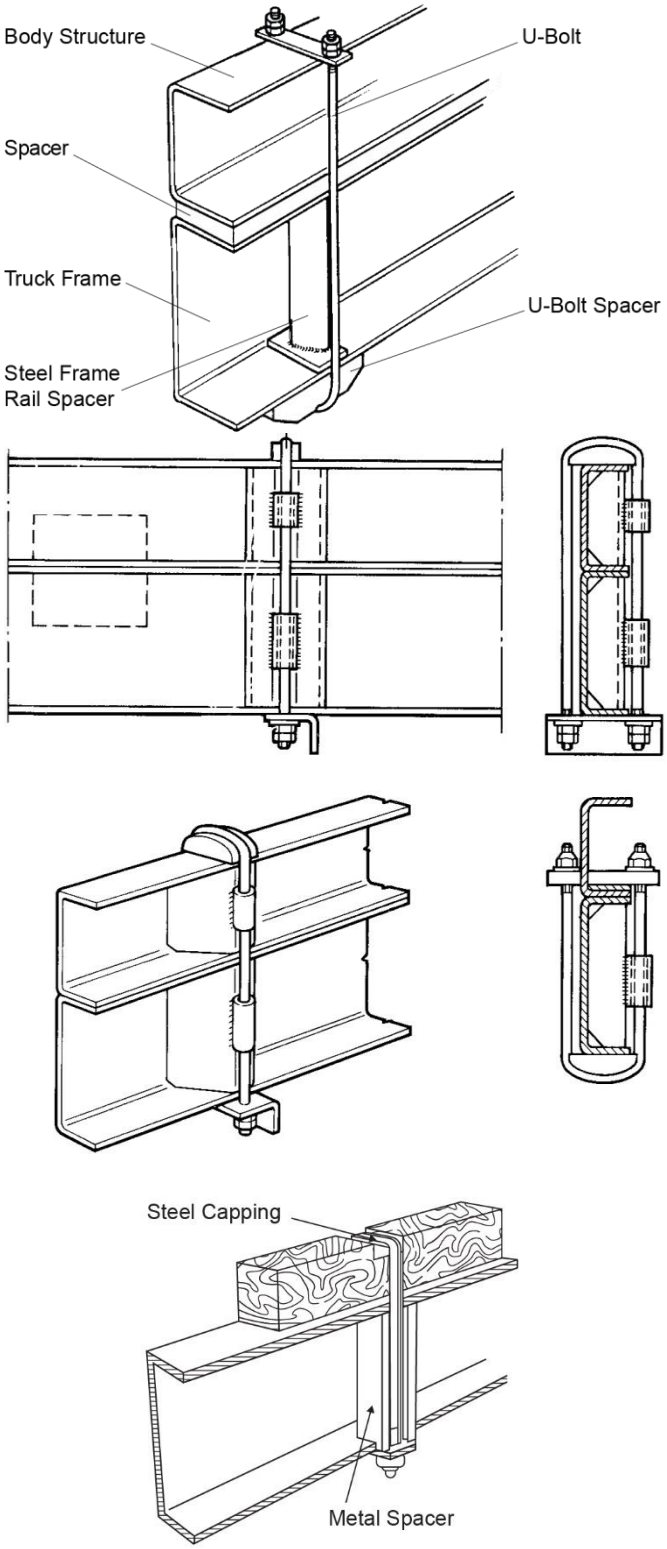


Figure 5: Typical U-bolt body mountings

- Locate the body on the chassis to prevent it from moving during violent braking by using at least four (4) outrigger mounts or fish plates.
- Locate a bracket or fish plate at the front and rear of the body on both sides of the vehicle.

Recommended:

- Allocate spacing of 900 mm between U-bolts, but consider altering this to suit the installation if need be.

Body mount type requirements

It is important to use the correct body mount type in relation to chassis construction and body type. When selecting mounts for platform and tanker type bodies seek or apply the manufacturer's recommendations and if these are unavailable, adhere to the following guidelines.

If the method of body mounting differs from that recommended by the vehicle or body manufacturer or VSB6, obtain suitable engineering designs from a professional engineer registered with a professional registration body and retain these designs with the modification certification.

Flexible bodies — platform bodies

When a body that is relatively flexible under beaming and torsional loads is fitted to a conventional ladder-type chassis for operation on normal road surfaces, mountings that firmly attach the body to the chassis can be used.

The two preferred mounting systems are outrigger mount and fish plate systems, with the best option for flexible bodies being outrigger mounting brackets (see examples in Figure 6).

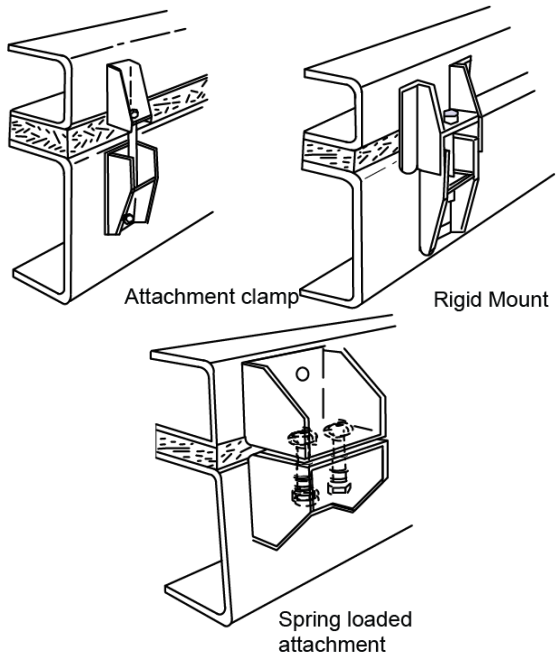


Figure 6: Typical body mounting outrigger brackets, specific to outrigger type mounts

Outrigger mounts

Required:

- Attach outrigger mounts securely to the web of the chassis.
- Provide a clearance space between the frame and the body longitudinals and cross-members.
- Prevent flexing of the web by extending the bracket at least half-way down the web of the frame.
- Ensure bolts joining the frame brackets to the body bracket do not carry shear loads by using brackets designed to limit movement under acceleration and braking (see Figure 6).
- Use bolts with a minimum ISO Grade 8.8 (or SAE Class 5) and appropriate grade nuts (see AS 1110.1). The use of vibration-proof fasteners of equivalent strength such as Huck bolts are an acceptable alternative.
- If using alternative fasteners, check the bolt manufacturer's specifications to ensure that they are of equivalent strength and toughness.

Recommended:

- To facilitate body fitting, enable one pair of mounts to have plain holes to provide fore and aft body location. The remaining mounts may have slotted holes.
- Bolt mounts to the chassis at intervals of 900 mm (this may be altered to suit the installation).

Fish plate mounts

If space available along the side of the chassis precludes the use of outrigger brackets, the body may be attached using fish plates (see Figure 7).

Required:

- Attach fish plate mounts securely to the web of the chassis.
- Prevent flexing of the web by extending the bracket at least half-way down the web of the frame.
- Where attached using bolts, use bolts with a minimum ISO Grade 8.8 (or SAE Class 5) and appropriate grade nuts (see AS 1110.1). The use of vibration-proof fasteners of equivalent strength such as Huck bolts are an acceptable alternative.
- If using alternative fasteners, check the bolt manufacturer's specifications to ensure that they are of equivalent strength and toughness.

Recommended:

- To facilitate body fitting, enable one pair of mounts to have plain holes to provide fore and aft body location. The remaining mounts may have slotted holes.
- Bolt mounts to the chassis at intervals of 900 mm (this may be altered to suit the installation).
- Provide a clearance space between the frame and the body longitudinals and cross-members.
- If necessary, place a spacer between the chassis and body.

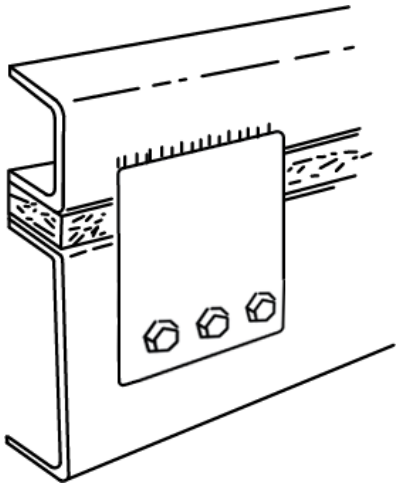


Figure 7: Typical fish plate attachment

Short rigid bodies

Short-rigid bodies mounted on short wheelbase vehicles, should have a sub-frame mounted securely on the chassis. The sub-frame should be mounted by outrigger or fish plate mounts, this is to provide a strong integral structure for mounting attachments such as hoist, guide brackets, etc.

All loads should be distributed over the maximum possible length of the chassis. For a front mounted hoist, the base of the cylinder should be pin-jointed to a cross-member that is attached to the side rails with bolts through drilled and reamed holes in the vertical webs of the chassis.

Long and rigid bodies — road tank vehicles

Long and rigid bodies, such as road tank vehicles, may need greater relative movement between body and frame while retaining chassis flexibility. A mounting system with three or five point resilience is preferred (see Figure 8).

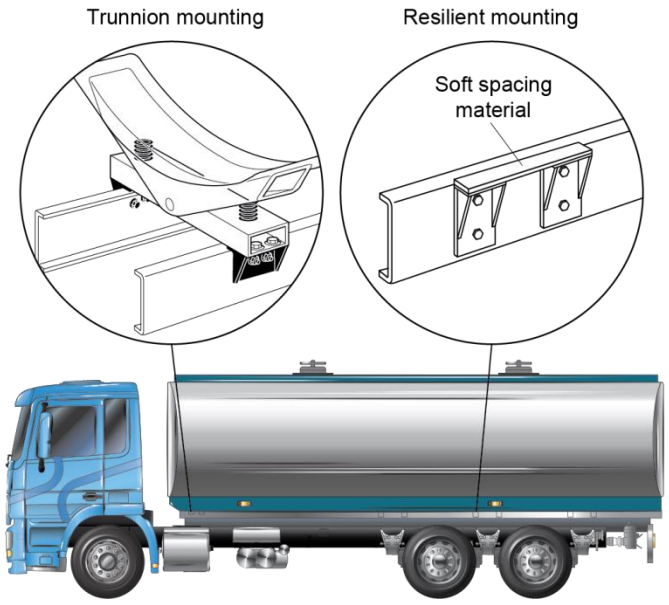


Figure 8: Typical example of tanker mounting

Recommended:

- Ensure brackets are strong enough to support the load safely.
- Ensure the front mounting is a special cross-member with a centrally located trunnion to support the tank and that the mounting is located as far forward as possible (see figure 9).
- Place the second pair of mounting brackets as close as possible to the foremost rear suspension bracket. A smaller pair of outrigger mounting brackets should also be positioned adjacent to the rearmost rear suspension hanger bracket (see Figure 10 and 11).

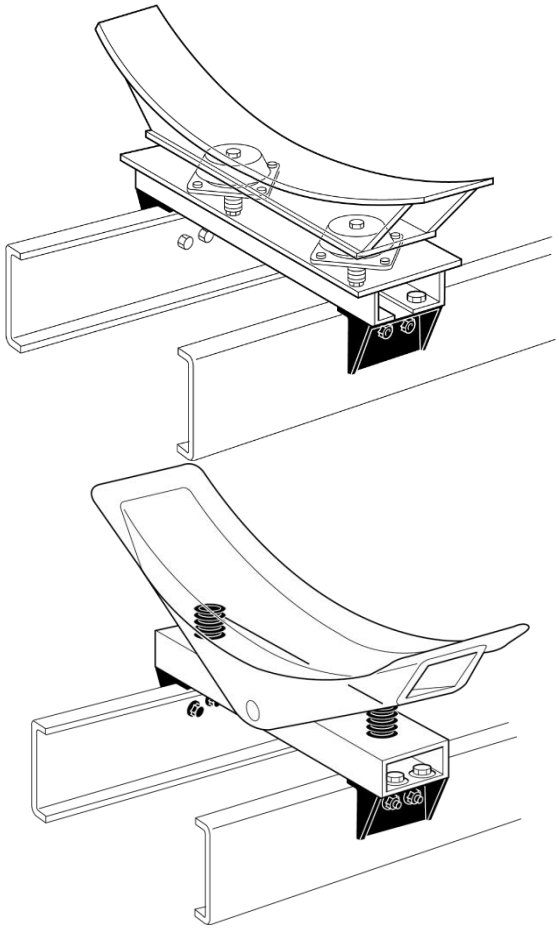


Figure 9: Details of a typical front mounting bracket

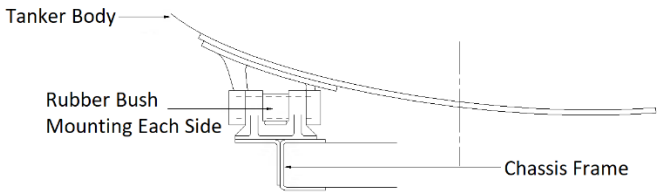


Figure 10: Details of a typical rear mounting bracket

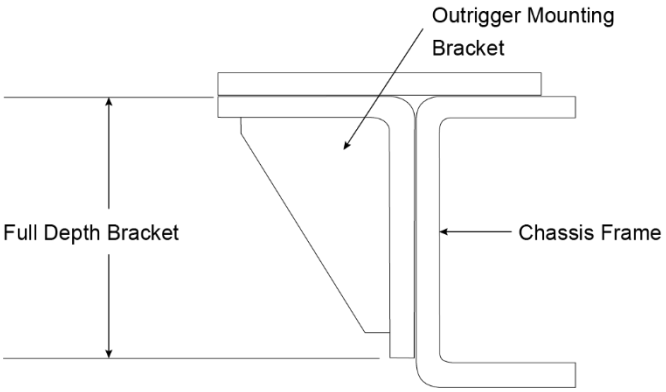


Figure 11: Details of a typical chassis mounting bracket

Alternative mounting for road tank vehicles

Rigid type mounting systems may be used, provided that the attachments are sufficiently flexible and suitably located to allow the chassis to flex. If these mountings are arranged in a three-point layout (see Figure 12, Typical three-point mounting) or a four-point diamond plan (see Figure 13, Typical four-point mounting), the chassis is free to deflect torsionally with no undue stress concentrations in either the chassis or the body.

Required:

Due to large concentrated loads that result from these mounting methods, use substantial load bearing cross-members.

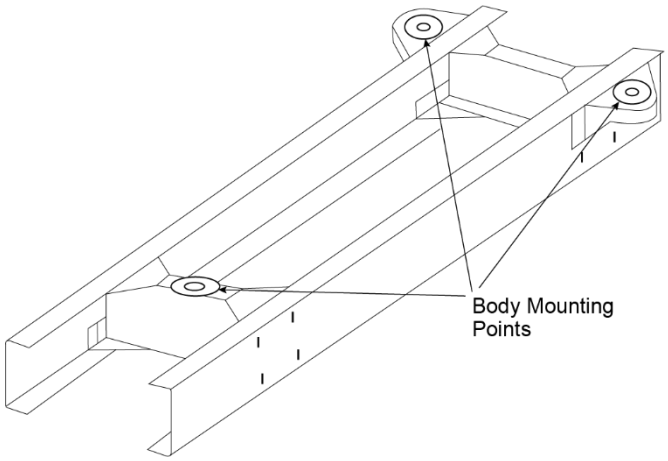


Figure 12: Typical three-point mounting

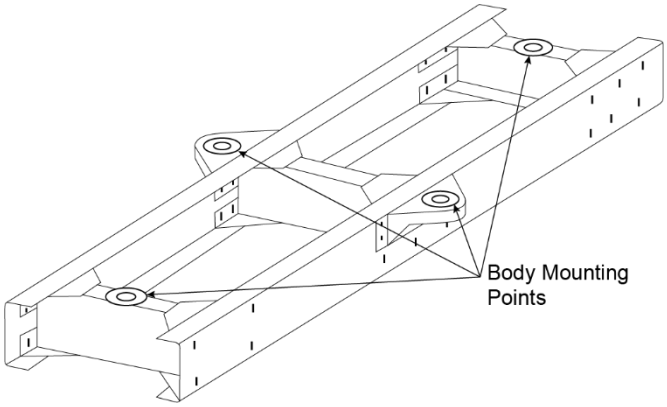


Figure 13: Typical four-point mounting

Road tank vehicles (dangerous goods)

Required:

- If a road tank vehicle is to carry liquid dangerous goods, ensure it satisfies the special requirements outlined in the Australian Code for the Transport of Dangerous Goods by Road and Rail.

Recommended:

- Consult officers of the relevant state or territory authority controlling transport of the particular dangerous goods.

Semi-rigid bodies

Required:

- Ensure vertical compliance allowances are provided in the body mountings of vehicles where rigidity limits the ability of the frame to resist beaming and twisting. This can be achieved by fitting resilient mountings or mountings with slotted holes and friction inserts. Resilient mountings may comprise a steel spring or a rubber bush and are usually used in conjunction with outrigger brackets (see Figure 14).

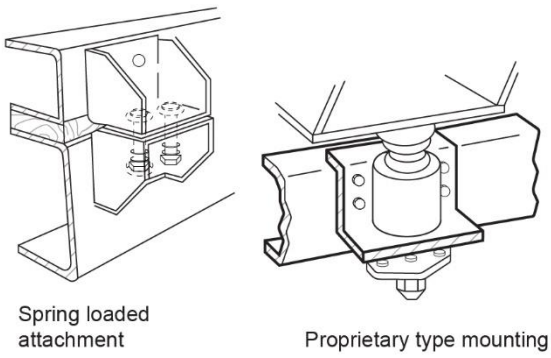


Figure 14: Typical resilient mountings

- If necessary, provide brackets or lugs engaging frame side rails or cross-members for body location and to resist horizontal forces (see Figure 15).

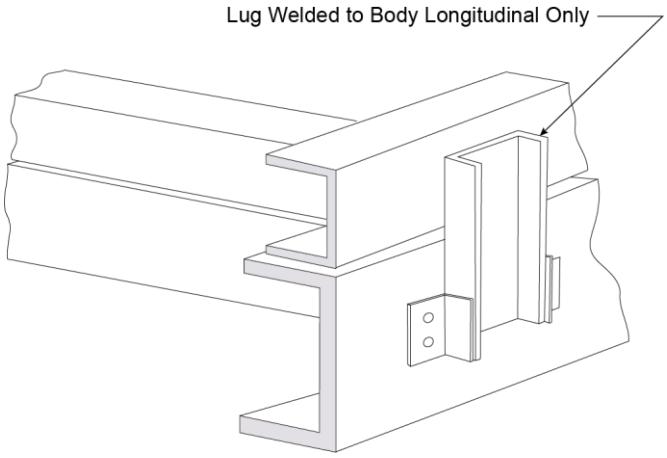


Figure 15: Additional horizontal restraint used with some body mountings

- Use mountings suited to occasional large beaming or torsional frame deflections to carry the body load on the top of the frame or bracket and allow the retaining bolts to move vertically upwards in a slotted hole against the resistance of a friction pad clamped between the frame and the bracket (see Figure 16).

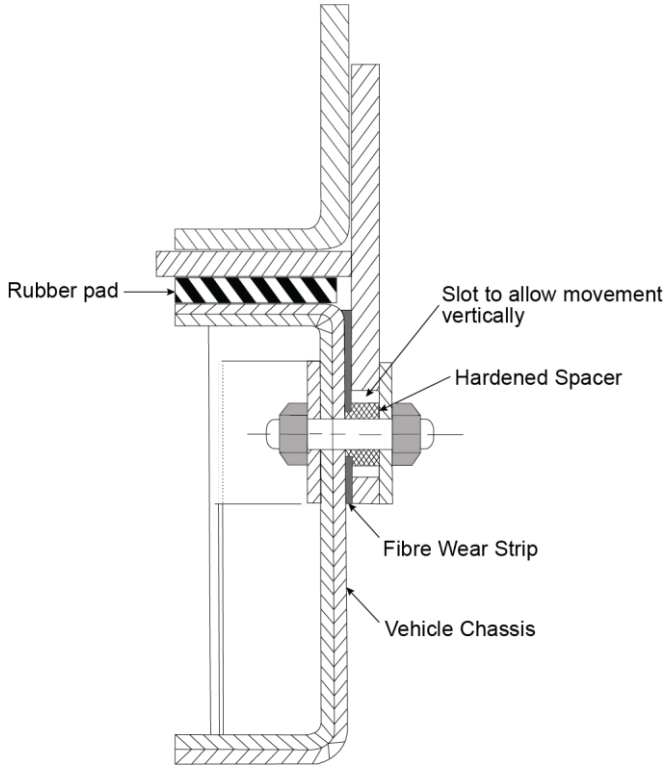
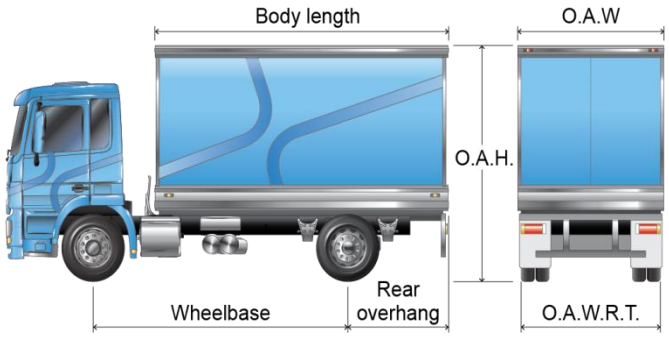


Figure 16: Body mounting with vertical compliance and friction clamping

Recommended dimensions — NB2 and NC vehicles

Outlined below are recommended dimensions to maintain the safety and integrity of the vehicle after the body is fitted and if the original vehicle manufacturer's advice is not available.



O.A.W.: Overall width
O.A.H.: Overall height
O.A.W.R.T.: Overall width across rear tyres

Figure 17: Maximum recommended dimensional limits

Dimensions

Required:

- Ensure all dimensions of a vehicle, including internal (where applicable) and external, are in accordance with the limits specified by the applicable in-service heavy vehicle regulator (see Figure 17).

Body overall width	Do not allow width to exceed 2.5 m, unless exempted by the relevant regulator.
Overall height	Do not allow height to exceed 4.3 m, unless exempted by the relevant regulator.
Rear overhang	Must be the lesser of 3.7 m or 60% wheelbase, unless exempted by the relevant regulator.
Overall length	Must not exceed 12.5 m, unless exempted by the relevant regulator.

Recommended:

- Dimensions limits stated in the table below should be followed when mounting a body.

Body overall width	≤ O.A.W.R.T. + 300 mm, unless specified otherwise by the manufacturer. If body width exceeds maximum recommended dimension of OAWRT + 300 mm, seek the advice of the vehicle manufacturers on recommended tyre pressures and record this on modification records.
Overall height	≤ 1.85 x O.A.W.R.T., unless specified otherwise by the manufacturer.

J1 Checklist — Body mounting (example)

J1 Checklist — Body mounting

This checklist is for use by approved vehicle examiners (AVEs) when assessing modifications relating to body mounting.

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?	☐	☐	☐

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?	☐	☐

Installation details

General body installation	Check Yes, No, N/A as applicable:	Yes	No	N/A
1	Is the vehicle within the maximum allowable dimensions as prescribed by the Australian Design Rules (ADRs), relevant mass, dimension and loading regulation or applicable dimension exemption?	☐	☐	
2	Is the attachment of the body capable of supporting the maximum loads imposed by the payload and the body weight during worst case conditions, while evenly distributing the load throughout the chassis?	☐	☐	
3	If body mounting brackets are used, are they bolted to the chassis rail web as required by this modification code or otherwise done in accordance with the vehicle manufacturer's guidelines or in accordance with a suitable engineering design?	☐	☐	☐
4	Does the front end of the body sub-frame give a progressive load bearing transition to the chassis?	☐	☐	☐
5	Are the body mounting attachments (fish plates, U-bolts etc.) in appropriate locations and spacing along the chassis and body sub-frame?	☐	☐	☐
6	If U-bolts are used, and the vehicle does not have a box type frame, are metal spacers inserted between the top and bottom flanges of the chassis rail to prevent distortion of the flanges below the U-bolts?	☐	☐	☐
7	If U-bolts are used with wooden runners, are the runners protected from U-bolt damage by steel capping or shaped spacers under bolts?	☐	☐	☐
8	If U-bolts are used, are at least four (4) outrigger brackets or fishplates used, one on each side of the vehicle at the front and rear?	☐	☐	☐
9	Do all bolts used meet a minimum SAE Class 5 or ISO Grade 8.8?	☐	☐	☐
Rigid type body installation (i.e., road tank vehicles)	Check Yes, No, N/A as applicable:	Yes	No	N/A
10	Does the mounting system for the tank accommodate the torsional stiffness of the tank while still retaining the chassis frame flexibility?	☐	☐	☐
11	Are the mounting brackets of sufficient strength to safely support the load?	☐	☐	☐
Road tank vehicles carrying liquid dangerous goods	Check Yes, No, N/A as applicable:	Yes	No	N/A
12	Does the road tank vehicle meet requirements of the Australian Code for the Transport of Dangerous Goods by Roads and Rail?	☐	☐	☐
Truck-bus body installation	Check Yes, No, N/A as applicable:	Yes	No	N/A
13	Is the installation in accordance with a certified J2 design?	☐	☐	☐
14	If ADR 59/.. applies, does the bus-body and its attachment to the chassis designed to meet the strength and performance requirements of ADR 59/.. ?	☐	☐	☐
15	Was the J1 document package provided with the J2 design certification followed?	☐	☐	☐
16	If the bus body installed has been re-fitted from a previous vehicle, does the SSM approval plate (if fitted) or manufacturer's plate remain fitted to the vehicle?	☐	☐	☐
17	If applicable, does the vehicle meet the requirements of ADR 44/.. and/or ADR 58/.. ?	☐	☐	☐
18	Does the vehicle meet the braking requirements of Australian Design Rule (ADR) 35/.. at the applicable category (i.e., ME, MD)?	☐	☐	☐

Vehicle chassis no./VIN:	Date:	Signed:

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J1 Checklist — Body mounting

This checklist is for use by approved vehicle examiners (AVEs) when assessing modifications relating to body mounting.

	Roll-over or falling object protection system installation — Check Yes, No, N/A as applicable:	Yes	No	N/A
19	Is the installation in accordance with a J3 design?	☐	☐	☐
20	Does the ROPS or FOPS mounting plate extend at least 2H either end of the ROPS or FOPS or alternatively, does the design provide a load bearing transition of stress into the chassis?	☐	☐	☐
21	Have non-collapsing washers be used with fasteners and self-locking nuts, or vibration-proof fasteners?			
22	Have any holes drilled into the vehicle's chassis by the ROPS or FOPS been certified to Section H — Chassis?	☐	☐	☐
23	Have holes required to be drilled in a chassis by the ROPS or FOPS design allow for compliance with Section H — Chassis?	☐	☐	☐
24	Have a copy of calculations or test results for the chassis stress and fatigue which have been supplied by the ROPS or FOPS manufacturer been kept with the certification?	☐	☐	☐
	Tipper body installation — Check Yes, No, N/A as applicable:	Yes	No	N/A
25	Is the installation in accordance with a certified J4 or OEM design?	☐	☐	☐
26	Are mounting brackets fitted in accordance with the approved design?	☐	☐	☐
27	Is a body prop fitted in accordance with the approved deign?	☐	☐	☐
28	Are all hydraulics, pneumatics and controls fitted in accordance with the approved design?	☐	☐	☐
29	Was the J1 document package provided with the J2 design certification followed?	☐	☐	☐

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 J1?	☐	☐
2	Is the quality of the work to an accepted industry standard?	☐	☐
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?	☐	☐
4	Does the vehicle continue to comply with ADRs and heavy vehicle standards regulations affected by the modification?	☐	☐

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:

Modification Code J2 — Truck-bus body (design)

1. Scope

A truck-bus is a composite vehicle consisting of truck cab-chassis fitted with a specifically constructed bus body for carrying passengers. The composite vehicle must therefore meet the safety standards (including ADRs) that also apply to an omnibus.

Modifications covered under this code:

Covered

- Certification of a bus body design (i.e., a passenger carrying pod for a truck cab-chassis)

Not covered

- fitting of a bus body (i.e., a passenger carrying pod) onto a truck cab-chassis (see VSB6 Modification Code J1)
- certification of an omnibus body
- certification of a body fitted to a rolling chassis based on a bus chassis component type approval.

➘ If a SSM RAV entry holder retrofits a bus body to an in-service truck for which the fitting would be covered by the RAV entry at the SSM, only perform the modification in accordance with this code if it is also performed in accordance with that SSM RAV entry.

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.

Truck-chassis

This…	Must comply with…
Installation of lighting and light-signalling devices on other than L-group vehicles	ADR 13/..
Commercial vehicle brake systems	ADR 35/..
Maximum road speed limiting for heavy goods vehicles and heavy omnibuses	ADR 65/..
Emission control for heavy vehicles	ADR 80/..
External noise	ADR 83/..

Bus body

This…	Must comply with…
Seatbelts	ADR 4/..
Anchorages for seatbelts	ADR 5/..
Installation of lighting and light-signalling devices on other than L-group vehicles	ADR 13/..
Child restraint anchorages and child restraint anchor fittings	ADR 34/..
General safety requirements	ADR 42/..
Specific purpose vehicle requirements	ADR 44/..
Requirements for omnibuses designed for hire and reward	ADR 58/..
Standards for omnibus rollover strength	ADR 59/..
Seat strength, seat anchorage strength and padding in omnibuses	ADR 66/..
Occupant protection in buses	ADR 68/..
External Projections	ADR 92/..
Forward Field of View	ADR 93/..

3. Certification procedure

The certification procedure for this modification code is as follows:

1.	Modifier	Determine if the modification is within manufacturer specifications. • If **yes**, the modification will need to be done in accordance with manufacturer specifications. • If **no**, the modification will need to be done in accordance with this modification code.
2.	Modifier	Consult with an accredited J2 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 J2 AVE.
5.	J2 AVE	Perform inspection, complete J2 checklist and determine if compliance has been achieved: • If **yes**, proceed to step 6. • If **no**, do not proceed, advise modifier rework is required to ensure compliance. Return to step 2.
6.	J2 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. Certification requirements

Required:

- Develop and provide a package of documentation (J1 document package) that provides all necessary information to allow a J1 AVE to:
- verify that a particular cab-chassis and bus body is covered by a design
- ensure a complete truck-bus complies with all relevant regulatory requirements, including this section.
- detail any change in the vehicle's ADR category that may occur (see ADR applicability tables for guidance).
- ensure the design will comply to all applicable ADRs (including ADRs resulting from any category change)
- Ensure the body design meets the requirements of VSB6 modification codes J1 and J2.
- Ensure the design results in the modified vehicle complying with all relevant ADR requirements.
- The body design may result in a vehicle category change which would require compliance with an additional vehicle category, such as MD or ME (see ADR applicability tables for guidance). This should be explicitly detailed in the J1 document package.
- Where the design involves a vehicle changing category, ensure that all applicable standards to the new vehicle category are met. For example, an NC category vehicle fitted with a truck bus body must meet ME requirements and therefore the higher braking requirement of ME vehicles.
- Ensure the body design complies with the emergency exit requirements of either ADR58/.. or ADR44/.. (as applicable).

- Ensure a report or other evidence of compliance with ADRs, Australian Standards and public transport requirements is included in the J1 document package.
- Retain evidence of compliance with all related ADRs.
  - Statements of assurance are not acceptable.
  - Additional jurisdictional requirements may also apply, in particular if the truck-bus is to be used for public transport.
- While it is acceptable to detach a truck-bus driver's cabin from the passenger compartment (bus body), ensure the design provides effective communication can be maintained between the driver and passengers at all times. This can be achieved either directly or by use of audio/visual technologies.

Date of manufacture issue

Because a truck-bus body may have different dates of manufacture, the component (truck or bus body) with the most recent date of manufacture is accepted for determining the safety standards that apply to the vehicle, including anti-theft and emissions requirements. For example, if a 1/1990 truck is fitted with a 1/2000 bus body the completed truck-bus must comply with all applicable vehicle safety standards that apply to a bus supplied to market in 1/2000.

Many road agency / state or territory transport authorities accept the date of manufacture shown on the vehicle's RAV entry or compliance/identification plate of the truck cab-chassis as the date of manufacture of the truck-bus for registration purposes.

If the vehicle is imported, the road agency / state or territory transport authority may instead reference the build date as date of manufacture (or in some cases the date that the vehicle entered Australia). The final decision in this matter rests with the relevant heavy vehicle regulator.

J2 Checklist — Truck-bus body (design) (example)

J2 Checklist — Design of truck-bus body

This checklist is for use by approved vehicle examiners (AVEs) when certifying fitting of a truck-bus body.

Vehicle and modifier details

Chassis		
Vehicle make:	Vehicle model:	Month and year of manufacture:
VIN (if applicable):	Vehicle chassis no. (if applicable):	Register of Approved Vehicle (RAV) entry / Identification plate approval (IPA) / Second stage of manufacture (SSM) RAV entry or SSM IPA number:
Bus body/pod		
Vehicle make:	Vehicle model:	Month and year of manufacture:
VIN (if applicable):	Vehicle chassis no. (if applicable):	Register of Approved Vehicle (RAV) entry / Identification plate approval (IPA) / Second stage of manufacture (SSM) RAV entry or SSM IPA number:
Modifier		
Vehicle modifier (company name):	Modifier address:	

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?	☐	☐	☐

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?	☐	☐

Installation details

Body	Check Yes, No, N/A as applicable:	Yes	No	N/A
1	Does the design meet requirements in relation to operation and visibility of passenger exits and entrances?	☐	☐	☐
2	Has the body been designed to allow attachment to the chassis in accordance with Modification Code J1?	☐	☐	☐

Compliance

Modification	Check Yes or No as applicable:	Yes	No	
1	Does the design meet all the requirements of the manufacturer's guidelines / Modification Code J2?	☐	☐	
2	If applicable, does the design meet the requirements of ADR 44/.. and/or ADR 58/.. ?	☐	☐	☐
3	If ADR 59/.. applies, is the bus-body and its attachment designed to meet the strength and performance requirements of ADR 59/.. ?	☐	☐	☐
4	Does the vehicle continue to comply with ADRs and heavy vehicle standards regulations affected by the modification, including any additional standards relevant to the new category of vehicle?	☐	☐	
5	Have all of the design details and all applicable calculations been recorded in accordance with the record keeping requirements of VSB6?	☐	☐	☐
6	Have the engineering report(s) or other evidence and details called for in Modification Code J2 been obtained and kept with the vehicle file?	☐	☐	

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 J3 – Roll over or falling object protection system (design)

1. Scope

This code provides the standards that must be met when designing a roll-over protection system (ROPS) or a falling object protection system (FOPS) for an in-service vehicle. It advises the precautions needed to provide a distributed load over the vehicle chassis in order to protect the chassis from point loading and fatigue stresses.

➘ Note that where the vehicle manufacturer has guidelines on the installation of ROPS/FOPS, these guidelines take precedence over and above this section of VSB6. Where the vehicle manufacturer's guidelines do not cover the installation of ROPS/FOPS, the requirements of this section of VSB6 prevail.

- Warning: Ensure that ROPS/FOPS designs are suitable for use in automotive applications.
- Poorly designed ROPS/FOPS are unlikely to provide the desired protection of a ROPS/FOPS and may increase the risk of injury and/or death in the event of an incident.
- Poorly designed ROPS/FOPS to a vehicle chassis is likely to increase the stress on the chassis and may induce fatigue cracking. This fatigue cracking is likely to be more prevalent in vehicles which are used off-road or on unsealed roads. The design of the ROPS/FOPS mountings should take into consideration the inputs likely to occur in off-road use when conducting fatigue calculations on the ROPS/FOPS and vehicle chassis.
- Unless explicitly permitted by the vehicle manufacturer's guidelines, under no circumstances should ROPS/FOPS be welded directly to the chassis.

Modifications covered under this code:

Covered
• Certification of an external ROPS/FOPS design.
Not covered
• installation of an external ROPS/FOPS (see VSB6 Modification Code J1) • installation of a ROPS/FOPS internal to the cabin compartment

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.Truck-chassis

This…	Must comply with…
Installation of lighting and light-signalling devices on other than L-group vehicles	ADR 13/..
Rear vision mirrors	ADR 14/..
General safety requirements	ADR 42/..
Vehicle configuration and dimensions	ADR 43/..
External Projections	ADR 92/..
Forward Field of View	ADR 93/..

It is recommended that the certifier ensures the ROPS/FOPS device is constructed so it is fit for purpose.

Some work sites such as building, or mining sites, may require the ROPS/FOPS to be built and certified in accordance with recognised standards such as the following:

- AS 2294
- ISO3471
- ISO3449
- ADR 59/..
- an equivalent international standard.

3. Certification procedure

The certification procedure for this modification code is as follows:

1	Modifier	Determine if the ROPS/FOPS has been previously J3 certified. • If **yes**, proceed to step 2 • If **no**, proceed to step 3
2	Modifier	Contact an accredited J1 AVE to organise the vehicle to be inspected and the ROPS/FOPS installation certified.
3	Modifier	Consult with an accredited J3 AVE to ensure the proposed ROPS/FOPS is design in accordance with AVE advice and this code.
4	Modifier	Organise approval inspection by an accredited J3 AVE.
5	J3 AVE	Review ROPS/FOPS design, complete J3 checklist and determine if compliance has been achieved: • If **yes**, proceed to step 6. • If **no**, do not proceed, advise modifier rework is required to ensure compliance. Return to step 3.
6	J3 AVE	J3 AVE issues modification certificate, and submits paperwork as required by the relevant AVE registration scheme.
7	J1 AVE	J1 AVE inspects installation and if acceptable, issues modification certificate, affixes modification plate, and submits paperwork as required by the relevant AVE registration scheme.

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

4. Certification requirements

Required:

- Obtain a copy of evidence provided from the ROPS/FOPS manufacturer, in the form of calculations, data, testing results.
- Develop and provide a package of documentation (J1 document package) that provides all necessary information to allow a J1 AVE to:
- verify that a particular cab-chassis and ROPS/FOPS is covered by a design
- ensure the installation complies with all relevant regulatory requirements, including this section.
- ensure the installation meets the specified design (installation instructions).
- retain a copy of the J3 modification certificate and associated paperwork.

5. Design requirements

Required:

- Ensure the manufacture's design of the ROPS/FOPS is in accordance with this modification code.
- Ensure that the manufacturer's mounting method is not likely to cause un-reasonable stress in the chassis and cause the chassis to fatigue during the recommended service life of the vehicle
- Ensure a progressive load bearing transition to the chassis.

➘ Typically, this is done by extending the sub-frame or mounting plates as far as practical so that it ends in front of the steer axle rear spring hanger and extends at least the same distance rearward of the spring hanger. The ends of the sub-frame or mounting plates should also taper to assist in the load bearing transition (see Figures 18 and 19).

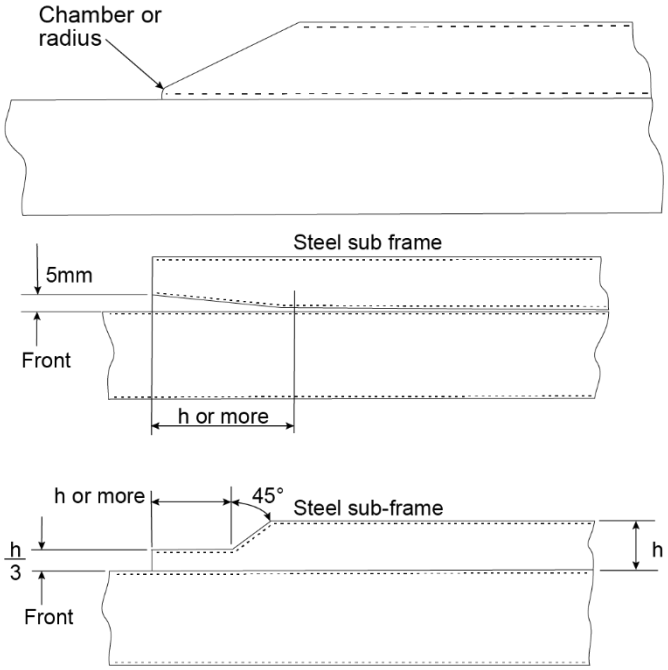

Figure 18: Examples of progressive load bearing transition

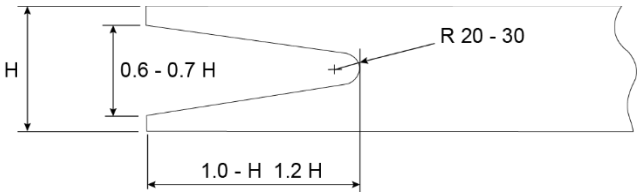

Figure 19: Typical frog-mouth tapering

Recommended:

- Consider using a square hollow section (SHS) or rectangular (RHS) sub-frame design in preference to any other.
- Ensue that the ROPS/FOPS design will not cause the modified vehicle to exceed GVM or axle loading requirements when in operation.
- When designing the ROPS/FOPS consider the effect it will have on the vehicle's weight distribution and overall load carrying capacity.

6. Installation design requirements

The method of attaching ROPS/FOPS to the sub-frame can vary according to sub-frame design and its position on the chassis. When designing the ROPS/FOPS it is important to consider the following items and include detailed instructions in the J1 document package.

Required:

- Do not design the ROPS/FOPS sub-frame to be welded to the vehicle chassis.
- Ensure that where the design has more than one mounting bolt layout available, that the instructions clearly specify which layout is used and where.
- Ensure ROPS/FOPS mounting plate extends at least 2H in both directions of the ROPS/FOPS, where H is the height of the chassis, or otherwise provides a load bearing transition of stress into the chassis.
- Ensure that the installation design of the ROPS/FOPS also meets the mounting requirements of VSB6 Modification Code J1.
- Ensure that where additional holes in the chassis are specified they are in accordance with VSB6 Section H — Chassis.
- Specify non-collapsing washers with the fasteners and self-locking nuts, or vibration-proof fasteners, to prevent loosening.

Recommended:

- Ensure bolts are no greater than 19 mm in diameter.
- Ensure ROPS/FOPS to sub-frame/chassis mounting bolts or studs are at least ISO Grade 10.9 (SAE Class 8), unless a lower grade is specified by the ROPS/FOPS manufacturer.
- Use fish plates which are bolted or welded to the ROPS/FOPS sub-frame to attach the vehicle chassis (see Figure 20).

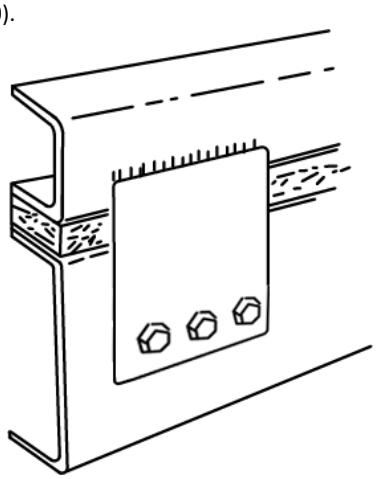

Figure 20: Typical fish plate attachment

Do not allow the fastener tensile stress, induced by the ROPS/FOPS load moment, to exceed 20% of the material yield stress.
The load moment includes the moment created by the forces imparted from the movement/vibration/wind loading of the ROPS/FOPS in operation.

J3 Checklist — Fitting of roll-over or falling object protection system (example)

J3 Checklist — Fitting of roll-over or falling object protection system

This checklist is for use by approved vehicle examiners (AVEs) when certifying fitting of a roll-over protection system (ROPS) or falling object protection system (FOPS) to a motor vehicle chassis.

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?	☐	☐	☐

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?	☐	☐

Installation details

ROPS or FOPS	Check Yes, No, as applicable:	Yes	No
1	Has a mounting bolt layout, detailing how the ROPS or FOPS is attached to the chassis or sub-frame, been provided?	☐	☐
2	Does the ROPS or FOPS mounting plate design extend at least 2H either end of the ROPS or FOPS or alternatively, does the design provide a load bearing transition of stress into the chassis?	☐	☐
3	Does the design specify non-collapsing washers used with fasteners and self-locking nuts, or vibration-proof fasteners?	☐	☐
4	Have any holes specified by the ROPS or FOPS design that require drilling into a chassis been assessed in accordance with Section H — Chassis?	☐	☐
5	Have a J1 document package been developed and supplied for J1 certification?	☐	☐

Compliance

Modification	Check Yes or No as applicable:	Yes	No
1	Does the design meet all the requirements of the manufacturer's guidelines / Modification Code J3?	☐	☐
2	Is the quality of the work to an accepted industry standard?	☐	☐
3	Does the vehicle continue to comply with ADRs and heavy vehicle standards regulations affected by the modification?	☐	☐

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 J4 —Tipper Bodies (Design)

1. Scope

This modification code provides the standards that must be met when designing tipper bodies. It provides standards relating to all aspects of tippers such as safety, hydraulic, warning devices, etc.

➘ These standards are to be followed when designing a tipper body for a motor vehicle. When certifying a motor vehicle OEM tipper body (including a modified OEM tipper body) to the OEM's design requirements only J1 certification is required

Modifications covered under this code:

Covered

- Certification of a motor vehicle tipper body design.

Not covered

- Fitment of a tipper body (see VSB6 Modification Code J1)
- Fitment of an OEM tipper body (including a modified OEM tipper body) to the OEM's design requirements (see VSB6 Modification Code J1)
- Fitment of non-tipping bodies (see VSB6 Modification Code J1)
- Design of tilt slide bodies (see VSB6 Modification Code T2)
- Fitment of tilt slide bodies (see VSB6 Modification Code T1)
- Fitting a tipper body to a trailer

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 and VSB6 codes.

This…	Must comply with…
Installation of lighting and light-signalling devices on other than L-group vehicles	ADR 13/..
Rear vision mirrors	ADR 14/..
General Safety Requirements	ADR 42/..
Vehicle dimensions.	ADR 43/..
External Projections	ADR 92/..
Chassis modification	VSB6 Modification Code H
Exhaust repositioning	VSB6 Modification Code A4

3. Certification procedure

The certification procedure for this modification code is as follows:

1	Modifier	Determine if the tipper body has had previous J4 certification or is an OEM design. • If **yes**, proceed to step 2**.** • If **no**, proceed to step 3.
2	Modifier	Contact an accredited J1 AVE to organise the vehicle to be inspected and the tipper body installation certified. Proceed to step 7
3	Modifier	Consult with an accredited J4 AVE for guidance on J4 requirements.
4	Modifier	Design the body in accordance with the J4 design code.
5	J4 AVE	Certify design meets J4 requirements and issue a modification certificate and associated documentation.
6	Modifier	Construct the body and perform modification to the vehicle in accordance with J4 design.
7	Modifier	Contact an accredited J1 AVE to organise the vehicle to be inspected and the tipper body installation certified.
7	J1 AVE	J1 AVE issues modification certificate, affixes modification plate, and submits 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 design or modifications begin the modifier discusses the design/modification with the certifying AVE.

4. Certification requirements

Required:

- Develop and provide a package of documentation (J1 document package) that provides all necessary information to allow a J1 AVE to:
- identify the make and model/s the tipper body design covers
- ensure the design complies with all relevant regulatory requirements, including this section.
- ensure the installation meets the specified design (installation instructions).
- a circuit diagram for the hoisting system, indicating test points where fitted
- provide the customer with any required maintenance schedule for the tipper body systems (hydraulic, etc)

4. Design requirements

In addition to designing the tipper body in accordance with the mounting requirements of VSB6 Modification Code J1, the below section is to be followed.

➘ Some work sites may require tippers to meet additional Australian Standards or workplace health and safety requirements. It is recommended that operators ascertain operating conditions, standards applicable, or other procedures applicable to the tipping body, and discuss with the Approved Vehicle Examiner prior to the start of manufacturing.

Tipper bodies should have a continuous sub-frame mounted securely on the chassis. The sub-frame should be mounted by outrigger or mounting (fish) plates that provide a strong integral structure for mounting attachments such as hoist, tipper body pivots and guide brackets. (see Figure 21)

All loads should be distributed over the maximum possible length of the chassis.

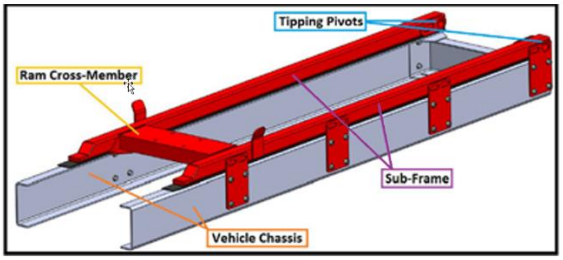


Figure 21- Basic Tipper Sub-Frame

Required:

- Where a sub-frame is used, the leading edge must provide a progressive load bearing transition to prevent truck chassis damage as outlined in J1
- Where a sub-frame is used, it must be appropriately mounted to sustain loads encountered during tipping operations.
- A suitable means of preventing the front of the body from moving side to side must be fitted.
- The hoist ram cross-member must be of adequate strength to support the tipping hoist ram without deforming under all loading conditions.

➘ One method of strengthening ram cross-members is by adding strengthening ribs (see figure 22).

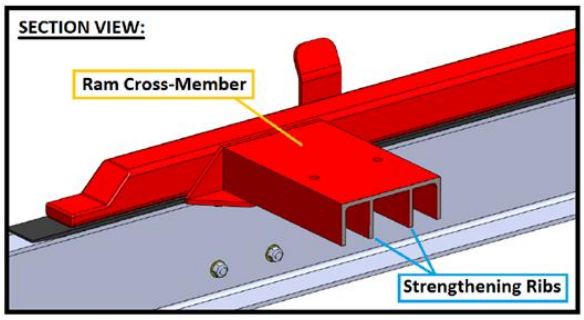


Figure 22 - Cross Section of Ram cross-member w/ strengthening ribs

- Ensure forces experienced on pivots during tipping do not overstress the chassis
- If support brackets (Figure 23) are used, ensure they are designed to allow the centre line of the body-runners pass through the centre of any support structure and evenly distribute the load.

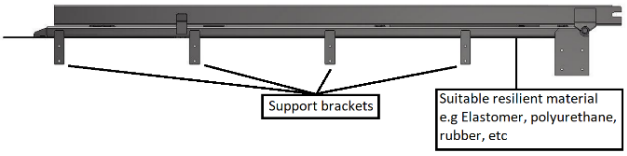


Figure 23 – Example of Support Bracket configuration

- In the absence of truck manufacturers body mounting guidelines, all fasteners must be a minimum ISO Grade 8.8 bolts (or SAE Class 5), hardened washers and self-locking locking nuts. (refer Section H for drilling of chassis)
- Where appropriate, the original truck cross-member should be retained and/or re installed if the rear cross-member overhang is shortened.

➘ Some rear cross-members fitted by OEMs may not be for structural purposes. To determine if these members can be removed guidance should be sought from the vehicle manufacturer.

Recommended:

- Body guides (guide vanes) are one method to prevent the front of body from moving side to side (see Figure 24).

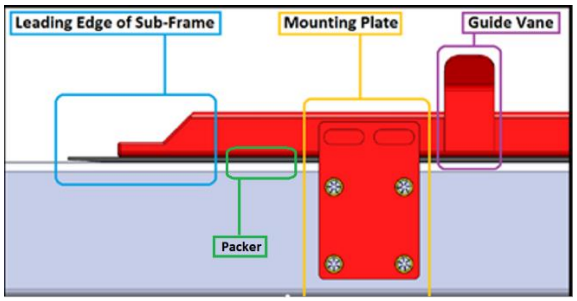


Figure 24 - Example of a suitable sub-frame leading edge, mounting Plate and Body guide (Guide Vane). Note additional examples in Modification code Section J (J1)

- For steel bodies, it is recommended that the body guides (guide vanes) be manufactured from steel, flared out at the top to guide the body into place and welded to the sub-frame. For aluminium bodies, guides should be of a suitable material that minimises damage (e.g., rubber guides).
- Mounting plates should be suitably attached to the sub-frame near the hoist ram cross-member to provide restraint during tipping operations and affixed to the truck chassis as per the truck manufacturers' body builders guide (where available).

➘ It is preferred that mounting plates are welded to the sub-frame. However, were bolted the AVE must ensure the attachment is suitably design (crush tube, self-locking nuts, etc)

- Tipping pivot sleeves should be incorporated into the rear mounting plates to prevent tearing out of the pivot walls of the sub-frame. Where a longer single pivot passing through both pivot sleeves is used, reinforcing is not generally required. However, where two separate pivot pins are used (one for each pivot) reinforcing is typically required.
- Use longitudinal packers (of a suitable material) on the chassis to distribute tipper body loads evenly wherever practicable (see Figure 24).
- For tipper bodies without longitudinal packers, the design should distribute tipper body loads evenly wherever practicable.
- The base of the hoist cylinder should be pin-jointed to a cross-member that is attached to the side rails with bolts through drilled and reamed holes in the vertical webs of the chassis. (see Figure 25)
- Pivots should be supported by the vehicle's chassis.
- To further evaluate the strength of the body Finite Element Analysis (FEA) software may be used.

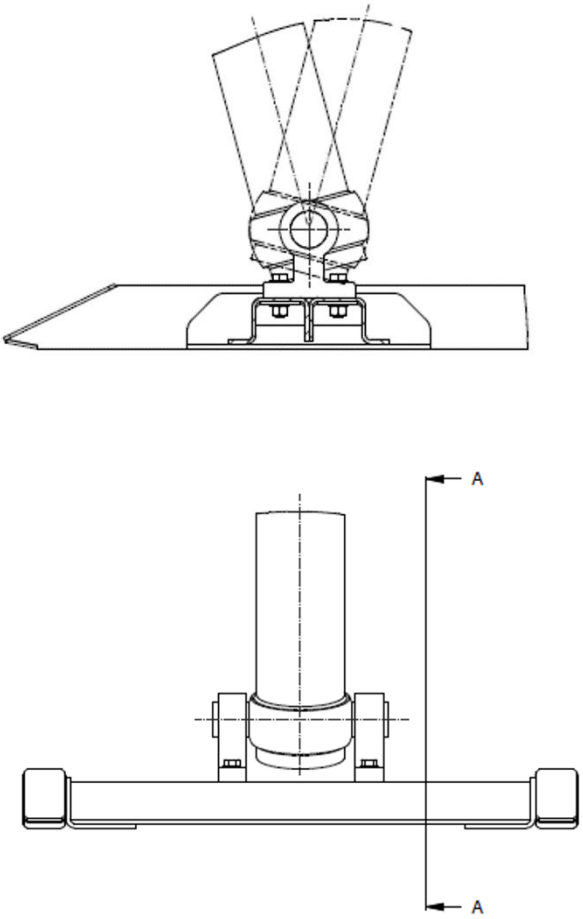


Figure 25 - Typical installation of the hoist cylinder.

5. Body Props

A body prop must be fitted to provide, when necessary, a safe operating environment when the empty tipping body is lifted. Such as when the vehicle is undergoing routine maintenance.

- The body prop is not intended to be deployed when the tipping body is loaded.
- In the event of hydraulic failure during operation, and the tipping body cannot be unloaded, specialist equipment and appropriate work procedure must be used to conduct repairs in a safe manner.

💣 A body prop forms part of a system that ensures a safe working environment under the tipping body during service, maintence and repairs.

💣 Failure of a body prop poses significant and fatal risk to persons working under the tipper body. It is essential that the prop is secured (at both ends) and fit for purpose.

Required:

- A body prop must be fitted that:
  - along with its associated hardware, is designed so that strength calculations account for a minimum factor of safety of 2 with respect to the empty weight of the unladen tipping body.
  - can be deployed when the tipping body is at an appropriate angle to facilitate such activities as servicing of the body hoisting system, etc.
  - ensure that it is not possible to mistakenly place the prop in a location at which it is not effective.
  - allows easy deployment, without having to excessively reach under the tipping body.
  - is secured against accidental dislodgement when in use.

- when not in use, can be securely stowed either to the tipping body or the vehicles chassis (it is not required to store the prop adjacent to the hoisting ram).

Recommended:

- The body prop is permanently connected to the vehicle

6. Tail Gates, Grain, and Inspection Chutes.

Required:

- The tailgate and its locking mechanism must be designed to withstand the forces and operate without loss of function (such as spillage or the tailgate opening) when tipping.
- If the tailgate includes an auxiliary door (grain chute, viewing portal etc.), then the locking mechanisms of the auxiliary door (as a system) must be designed to withstand the forces and operate without loss of function when tipping.

Recommended:

- When designing the tailgate and locking mechanism to operate without loss of function it is recommended that it is designed to accommodate, at least, the following conditions:
  - the tipping body is loaded to its maximum design carrying capacity (loaded to GVM) plus 25%
  - the tipping body is at its maximum design tilt angle (or the tilt angle it is restricted to by other means).
  - the vehicle is on level ground.

↘ Consideration for the loading conditions that the tailgate will be subjected to will be dependent upon the material the tipper has been designed and must also take into account partial loading of the tipper body, or mixed loads.

7. Load Cells

Load cells are often incorporated into ram and tipping pivots between the ram cross-member and the ram itself. Therefore, the nature of the loading experienced by the ram cross-member is generally unchanged. However, care must be taken to integrate the load cells into the sub-frame to prevent point loading the rear of the truck chassis.

↘ Some designs include suspension-based load sensing systems. These systems are not required to be certified under the J code. However, depending on their design may require certification under alternative VSB 6 codes.

Required:

- Where load cells are incorporated into the tipping pivot, load cells must be mounted in a manner that maintains the structural integrity.

  Examples of acceptable load cell incorporation include, but are not limited to the following:

  - **Example 1:** Tipping pivot/load cell must be mounted onto brackets of adequate strength with a suitable cross-member installed between the brackets (see Figure 26)

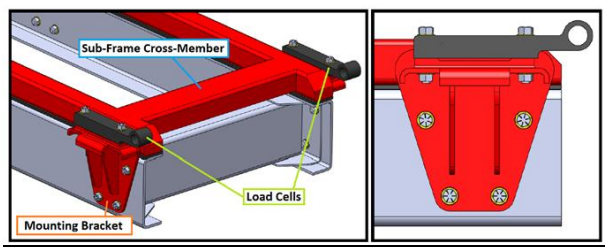


Figure 26 -Option 1 Example: Load cells w/ integrated pivot mounted on brackets & integrated into sub-frame

  - **Example 2:** A portion of the rear sub-frame can be removed to accommodate the load cell and modified to maintain structural integrity. (see Figure 27 and 28)

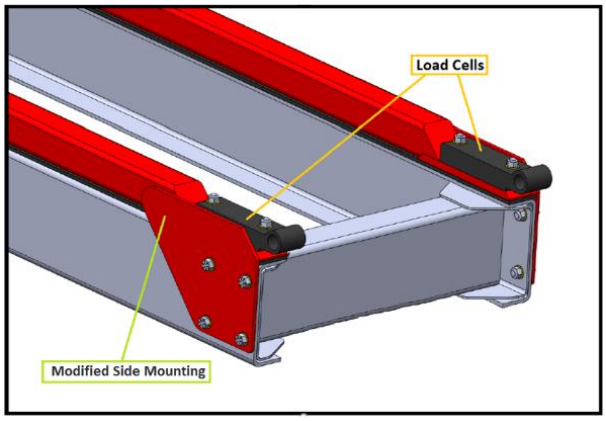


Figure 27 - Example of load cells mounted to modified sub frame that maintains structural integrity. In this example, by enlarged and thickened mounting plates with upside down countersunk fasteners to prevent bolting through chassis flange)

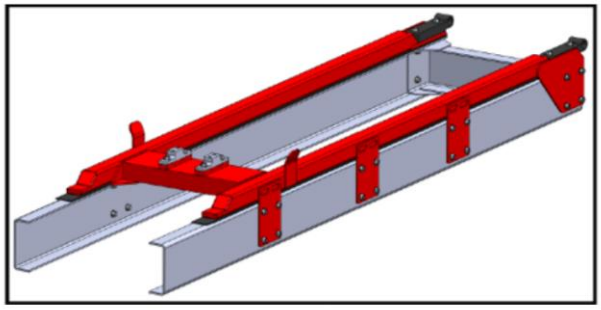


Figure 28 - Tipper sub-frame with integrated load cells

- Drilling of top or bottom chassis flange to mount load cell is not permitted.

Recommended:

- Load cells should be mounted using upside down countersunk fasteners with a minimum ISO Grade 8.8 (or SAE Class 5), appropriate grade washers and self-locking nuts (see AS 1110.1). (see Figure 29)

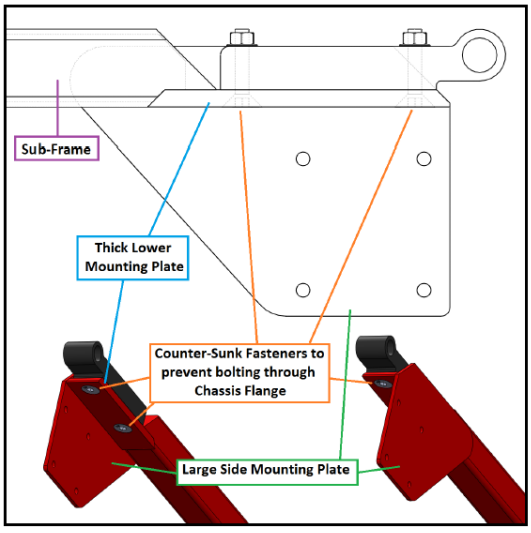


Figure 29 - Countersunk fasteners to prevent bolting through chassis frame

- Lower mounting plates should be integrated into the sub-frame.
- Side mounting plates should extend forward of the region where the sub-frame was removed.
- Edges of the sub-frame, lower mounting plates and side mounting plates should overlap

8. Hydraulics/Pneumatics

Required:

- The general design principles of AS2671 must be followed, with the following specific design considerations for tippers.
- When there is a complete loss of pressure in the hydraulic system (hose burst etc.), the lifting hoist must either:
  - immediately stop moving; or
  - the lifting command on the control be disabled or made ineffective. Lowering of the body can be achieved in a controlled manner by applying the usual lowering command on the control, provided the operator can stop and restart the descent of the body at any point.
- Where a system is designed to immediately stop moving in the event of complete loss of pressure and the release mechanism is in a position that may put operators in an unsafe position, a label must be affixed in a visible location(s) on the side of the body immediately adjacent to the release mechanism advising such. (refer to Section 12 Marking for requirements and guidance)
- Where the power supply of an accessory, such as a powered tailgate or its lock, is interrupted through electrical or mechanical failure, the accessory must not continue to operate in an uncontrolled manner. (e.g., powered tailgate must not automatically close (or move) when de-energised).
- An accessory may return to a neutral position automatically when de-energised only if it would not pose a safety risk.
- Tipping bodies or accessories which use the truck's compressed air for their operation, must be designed to be compatible with the normal nominal operating pressure of the truck's pneumatic system.
- Air supply must be taken from a pressure protected supply as per the requirements of VSB6 Section G.
- Hoses and fittings must be sized accordingly, or appropriate pressure reducers fitted as required to prevent cavitation, starvation and undue temperature rises of the fluid in the system.
- Hoses and fittings must meet recognised standards.
- Components, gauges, pressure test points or any other item requiring daily monitoring or adjustment, must not be placed in locations which put the operator at risk.
- Hydraulic components must operate within component manufacturer's rated specifications.
- Where a pressure relief valve is used it must have adequate flow to prevent overload under every engine operating condition.

Recommended:

- Pneumatic and hydraulic lifting systems should incorporate over pressure protection set to at least 10% below the lowest rated component in the hydraulic/pneumatic system but sufficient for the maximum operating hydraulic circuit flow rate.
- Once hydraulic pressure, corresponding to the tipping body (including an acceptable overpressure) is reached, the tipping mechanism should stop operating.
- Unless the air supply is derived from the pneumatic system, air pneumatic filter/separators should be provided and be sized to provide at least 1000 hours operation between services (preferably with condition indicators).
- Provision to bleed air from the system/hoist is provided if applicable.
- Hydraulic tanks:
  - have a level indicator (e.g., a decal, dip stick, plates or marking) next to the filling position showing maximum and minimum levels under operational conditions.
  - hold a minimum amount of oil for full ram displacement plus 30%.
  - provide adequately protected and accessible provisions to facilitate emptying of the tank without spillage, complete cleaning or requiring pumping out of fluid.
- The hydraulic tank return circuit is designed in a way that minimises the possibility of oil aeration.
- A red tell-tale light in the vehicle cab which indicates when the overpressure set point is reached.
- Hoses should be shielded to reduce direct exposure to personnel in the event of failure where:
  - fluid pressure is above 5 MPa (726 PSI); or
  - fluid temperature is above 50°C.

↘ Protection may be via a shielding provided by body work or the vehicle chassis, metal shielding, anti-burst sleeves (or anti burst socks) designed for this purpose, or a combination of any of the above.

- Where hydraulic components are fitted that are sensitive to debris in the system, hydraulic filters should be fitted.
- If hydraulic filters are fitted they should have the ability to be changed without disturbing hoses or emptying the hydraulic tank.

9. Alarms, warnings and lockout features

Recommend:

- Tailgates fitted with positive locking mechanisms (mechanical, air or electric) should be fitted with a visible and/or audible tell-tale located at the tipper controls which warns the operator when:
  - the tailgate is locked, and the front of the tipping body is in the raised condition (50mm or more above its transport position); or
  - automatically unlock the tailgate when the body begins to rise.

10. Controls

Required:

- Control systems must provide fail-safe operation at all times (including during a failure the system, power supply, etc.)
- If the tipping body is not designed to tip in motion the control device must:
  - be positive in motion hold-to-run type; and
  - return to neutral when released
- If the tipping body is designed to tip in motion must be designed in a way that minimises operational risks and accidental operation of the tipping body.

➘ It is understood that in many cases return to neutral and hold to operate controls in certain tipper applications is not practical or safe. For example:

- Side tipping applications where the operation of other equipment requires hydraulic flow to remain established and additional controls must be used to operate hydraulic powered equipment (e.g., side gates).
- Tipping in motion where the vehicle must continue to move while tipping and driver must continue to steer the vehicle.

Section J4 permits the fitting of controls that are not "return to neutral", or "hold to operate" provided that the operational risks of accidental activation of controls (while the vehicle is in motion) have been assessed and sufficient mitigation included.

Examples of methods to minimise operational risk include, but are not limited to the following:

- a body interlock system should be fitted that stops the vehicle moving at a speed greater than 20km/h if the body is not in its transport position; or
- A body up visual warning in the cab, that activated when the body is not in its transport position.

- If controls are fitted in multiple locations, interlocks must be fitted to ensure only one set of controls can be used at once.
- If external mechanical controls or the controls designed to allow operation from outside the cab are fitted, they must:
  - be able to be secured from accidental operation by a locking mechanism when not in use.
  - not operate the tipping body whilst the vehicle is in motion; and
  - not be located in a position hazardous to the operator when used.
- If a pendant or remote control is fitted, they must:
  - be fitted in an appropriate enclosure with no less than IP55 rating
  - return to the off position if the control is released, detached, or broken
  - not allow unintended movement due to failure of the controls (monitored outputs)
  - have an emergency stop
  - shutdown the system within 550ms if no valid signal is received from the transmitter
  - have key-stop to 'off' position
  - shut down if transmitter is out of range
  - have battery life indicator (if fitted with a battery) that gives warning at least 5 minutes prior to turning off
  - turn off if no functions have been used for 5 minutes; and
  - not be able to be initiated unless all motion actuators are in the 'off' position (buttons/switches/ hydraulic valves, etc.)

11. Marking

Required:

- The hoisting system shall display, at a readily accessible and prominent location/s and on permanent and legible notices, the following information, as appropriate:
  - Name or mark of the manufacturer or distributor of the hoisting system.
  - Model designation of the hoisting system.
  - A notice stating that 'PERSONS SHALL NOT WORK UNDER THE RAISED TIPPING BODY UNLESS THE BODY HAS BEEN SECURELY CHOCKED OR OTHERWISE SECURED'; and
  - Where applicable, a notice stating 'PERSONNEL SHALL NOT RIDE ON THE TIP TRUCK'
- A permanent and legible label in a prominent location/s near the controls must be fitted advising the operator to 'ENSURE THE AREA AROUND THE TRUCK IS CLEAR DURING TIPPING OPERATIONS'.

12. Stability

Recommended:

A truck fitted with a tipping body should have an overturn angle of 7° or more when the tipping body is raised to the full stroke of the tipping hoist. This can be met in a variety of ways, some of which are included below.

➘ It is impossible to foresee all operating conditions that a vehicle fitted with a tipping body due to the broad range of environmental factors such a vehicle will encounter. This may include:

- Construction sites with uneven and soft ground
- Wet and muddy work sites
- Hard uneven surfaces
- Hard level surfaces

➘ When assessing the design, the best-case scenario should be considered to provide a baseline pro-forma criterion. They will not result in a safe vehicle in all operating conditions.

Equipment

- The vehicle maybe fitted with a device, such as an inclinometer, that:
  - is interconnected with the tipping mechanism and will prevent the body from raising any further if loss of lateral stability is detected.
  - The inclinometer outputs a signal to a buzzer or other sound generator within the vehicle cabin which may also incorporate a tell-tale.

➘ Many electronic brake systems have a stability function incorporated with an output that can be utilised to activate a warning signal (buzzer, light etc) or interlock. This signal may be used in lieu of a dedicated inclinometer if performed in accordance with the brake manufacturer's requirements.

Calculation

- The vehicle's design should be assessed using calculations to ensure an overturn angle of at least 7°.
- One calculation method is provided in Section 13, however suitably qualified AVEs may choose to use alternate stability calculation methods. These calculations assume:
  - the tipping body is loaded with a simulated water load to the trucks' maximum GVM
  - the body is in its fully tipped position.
  - Wind loads are considered for the purposes of AS1418.8 Clause 4.3, unless the lifting ram accepts only axial loads.

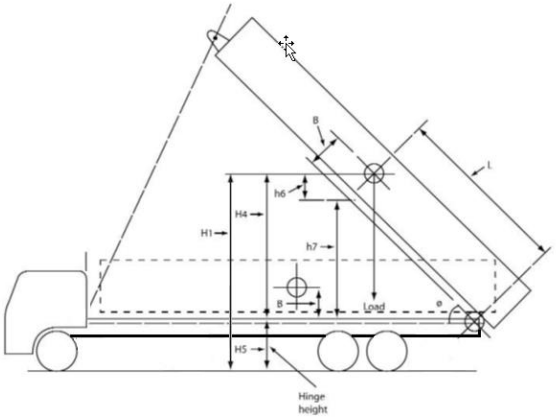
13. Stability calculations

Calculation of stability follows a similar methodology that is used to determine static roll threshold (SRT) under the Performance Based Standard scheme. The example and methodology explained below demonstrates a rear acting tipping body. A similar methodology can be used to determine stability on a side tipping body.

Recommended:

- The RST threshold value that corresponds to a 7° overturning angle or side slope is 0.123g.
- To determine if the tipper design conforms to the stability values, the following data is required:
  - Torsional resistance of the chassis frame rear hinge point to the rear suspension centreline.
  - Roll stiffness of the suspension at the point of wheel lift on one side
  - Width of effective spring base
  - Height of suspension roll centre

Dimensional Data:



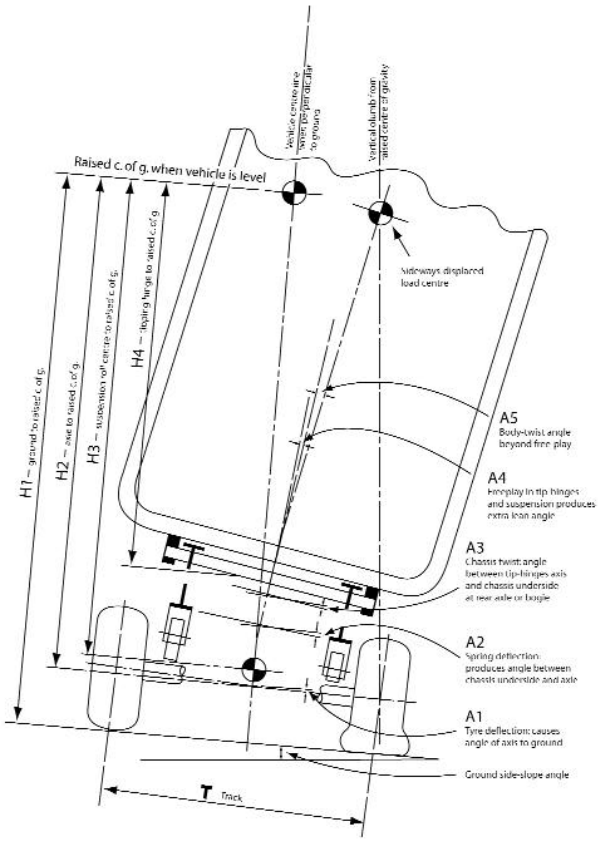


Figure 30 – Values to determine tipper stability

H1 – the height from the ground to the centre of gravity of a fully-raised load in the body when

the vehicle is standing on level ground.

H2 – the height of that level ground centre of gravity above the centre line of the rear axle.

H3 – the height of that level-ground centre of gravity above the roll centre of the rear suspension.

H4 – the mean height of the centre of gravity of the load in the raised body above the tipping hinges

H5 – height of tip hinge above ground level

A1 – Angle of axle to the ground caused by tyre deflection

A2 – Angle of axle and chassis underside cause by spring deflection

A3 – Chassis twist angle between tip hinge axis and chassis underside at the rear axle or at bogie centre

A4 – Angle due to free play in tip hinges and suspension

A5 – angle due to tip body twist beyond free play of tip hinges

B – the height of the centre of gravity above the hinge point

L – the distance between the centre of gravity and the hinge point

T – Track (for dual tyre track is taken from the centre of the two tyres)

* Thanks to the Institute of Road Transport Engineers (UK) for providing authorisation to use stability calculations and figures published in the Guide to Tipper Stability 2nd edition.

Simulated load:

The simulated load is taken to be where:

- The mass loaded in the bin takes the truck to its maximum rated GVM.
- The load is taken to occupy the entire volume of the bin. Therefore, the centre of gravity of the load will be located at the mid points of the width, length, and height of the body.

Calculation of height of the raised centre of gravity:

To calculate the height of the raised centre of gravity (H1) (see Figure 30):

$$h6 = B \cos \emptyset$$

$$h7 = L \sin \emptyset$$

$$H4 = h6 + h7 = B \cos \emptyset + L \sin \emptyset$$

$$H1 = H4 + H5$$

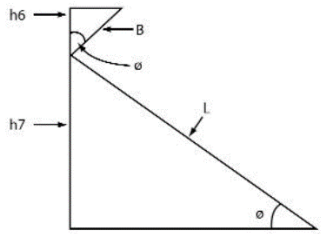


Figure 31 – Height of centre of gravity

Calculation of overturn angle:

The overturning angle (OA) can be a calculated as follows (See Figure 30 and 31):

$$OA = \sin^{-1}\left\{\frac{(T \div 2) - (H2 \times \sin A1) - (H3 \times \sin A2) - (H3 \times \sin A3) - (H4 \times \sin A4) - (H4 \times \sin A5)}{H1}\right\}$$

UK Institute of Road Transport Engineers, Guide to Tipper Stability, Second Edition 2004

Side tipping and multi tipping bodies:

Side tipping bodies – the stability calculation on a side tipping body follows the same methodology as a rear tipping body. If the side tipper has the ability to tip on either side of the vehicle, the stability calculation should be performed in each operating condition if the tilting mechanism geometry differs from side to side.

Multi tipping bodies – the stability calculations should be performed in all tipping configurations. If the geometry of the side tipping function between left and right is different, separate calculations must be done.

J4 Checklist — Tipper (design) (example)

J4 Checklist — Tipper bodies (Design)

This checklist is for use by approved vehicle examiners (AVEs) when certifying the design of a tipper body.

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?	☐	☐	☐

Modification details

Modification criteria	Check Yes, No as applicable:	Yes	No
1	Has the modification been performed in accordance with the manufacturer's guidelines (body builders guide, etc)?	☐	☐

Installation details

Tipper design	Check Yes, No, as applicable:	Yes	No
1	Does the leading edge of the sub-frame provide a progressive load bearing transition?	☐	☐
2	Is the subframe appropriately mounted to sustain loads encountered during tipping?	☐	☐
3	Does the design specify that all bolts are required to be a minimum SAE Class 5 or ISO Grade 8.8?	☐	☐
4	Do the tipper body mounting brackets ensure the load is evenly distributed across the chassis?	☐	☐
5	Does the design incorporate a complying body prop?	☐	☐
6	Is the tailgate and auxiliary door (if fitted) designed to meet all force and operating requirements when tipping?	☐	☐
7	If the lifting hoist experiences a complete loss of hydraulic pressure does it: – immediately stop moving; or – disable the lifting command on the control but continue to allow controlled lowering of the body?	☐	☐
8	Are control systems designed to provide fail-safe operation at all times?	☐	☐

Compliance

Modification	Check Yes or No as applicable:	Yes	No
1	Does this design meet all the requirements of the manufacturer's guidelines / Modification Code J4?	☐	☐
2	Does the vehicle continue to comply with ADRs and heavy vehicle standards regulations affected by the modification?	☐	☐

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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Section J — Body
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