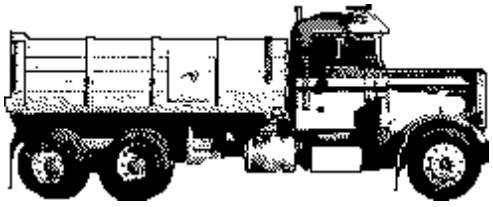
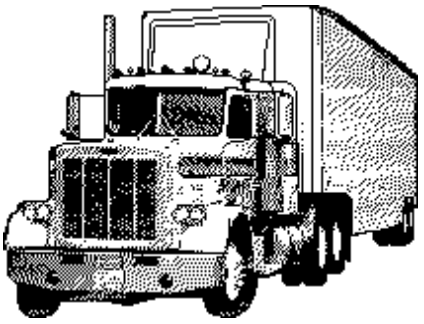
Section J

BODY MOUNTING





HEAVY VEHICLE MODIFICATIONS

1. SCOPE

This Section relates to the installation of bodies to chassis frame mountings for heavy vehicles.

This Section does not include omnibus body mounting.

The mounting of fifth wheels/turntables is the subject of Section P - Tow Couplings/Fifth Wheels.

This Section does not include recommendations for truck body design.

This Section does not include body-related requirements for ADR etc. compliance, for the completed vehicle.

2. GENERAL INFORMATION

As most vehicle manufacturers issue body building instructions for their range of vehicles, it is recommended that these guidelines be adopted to achieve the maximum performance and serviceability from the vehicle. In the case of specialised bodies, primarily tanks and in particular aluminium tanks, the body manufacturer will provide mounting guidelines that should be adhered to along with the chassis manufacturer's guidelines. The intent of this Section is to assist body builders installing equipment on to vehicles where the manufacturer's recommendations are not available and also to highlight some requirements that may not be addressed in the manufacturer's instructions.

3. ADR's AFFECTED

This Section does not cover any ADR related modifications. It is possible, however, that during body mounting, some ADR compliance may be affected. The completed vehicle must be surveyed to ensure that all ADR compliance is still valid.

4. AFFECTING MODIFICATIONS

Modifications that could affect the body mounting system include:

- Change of body type.
- Change of body size.
- Extended or shortened wheelbase.
- Fitment of an additional axle.
- Fitment of chassis reinforcements and/or adaptions.
- Chassis extension, such as increased rear overhang.

5. GENERAL REQUIREMENTS

5.1 Overall Vehicle Considerations

Before proceeding with the manufacture or fitting of a truck body, an analysis of the vehicle, in conjunction with the required payload (size and weight) should be performed to establish whether the nominated vehicle has the capacity to satisfy the requirements. Items that must be checked include:

- Axle loads do not exceed the axle capacities.
- Distribution of axle loads by the position of the body and payload (this may be dependent on the vehicle's wheelbase and rear overhang).
- Chassis strength.
- Overall dimensions of the vehicle.

  Note: The rear overhang and loading space must comply with ADR requirements. Refer Appendix 1 for Recommended Dimensional Limits - NA and NB Vehicles.
- Departure angle must not be less than eleven (11) degrees. The Load Space must not 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.
- Position of Centre of Gravity - refer Figure 1. There is a point, on a cab chassis vehicle, at which the mass is effectively centred. This is termed the centre of gravity. If the vehicle is to be stable when cornering, the centre of gravity of a bodied vehicle should be as low and as near to the centre of the vehicle as possible. Any part of the body or equipment placed above the original centre of gravity will cause the new centre of gravity to be higher. Raising the centre of gravity is inevitable when mounting a body or adding equipment, but all possible steps should be taken to minimise this effect by mounting heavy parts of the body or equipment as low and as symmetrically about the chassis frame as possible.

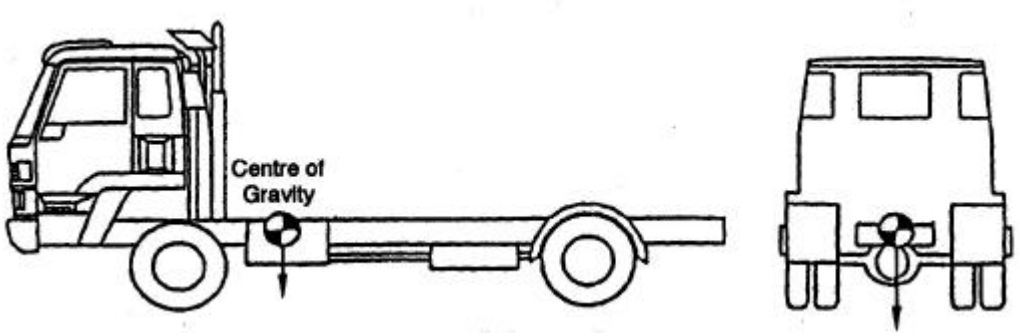


Figure 1

Care should be taken to ensure that the functional capabilities of the vehicle are not inhibited and that sufficient clearance to allow accessibility for maintenance is provided when a body is installed.

5.2 Basic Structural Considerations

It is recommended that the manufacturer's Body Builder's Manual be consulted to obtain specific details which are applicable to that vehicle. If possible, the standard manufacturer's mountings and method of attachment must be used. The following requirements should be met:

- The attachment of the body must be capable of supporting the maximum loads imposed by the payload and the body weight at the extreme conditions (i.e. braking, overturning moment etc.) while still evenly distributing the load throughout the chassis.

- The majority of the body loads should be transmitted directly to the web of the chassis frame rail.

- The minimum acceptable factor of safety for body mounting components when exposed to the maximum load conditions would be 3 times static load without exceeding the yield of the material.

- On a conventional cab chassis with a rigid body, there is a gross discontinuity in total structure stiffness at the front of the body, leading to high stresses in the chassis members immediately in front of the body.

- This effect should be minimised by ensuring that the sub frame of a body extends for the entire length of the body without any breaks or joins. The front end of the sub frame should offer a progressive load bearing transition to the chassis frame rail. Refer Figure 2 for two methods of preventing stress concentration.

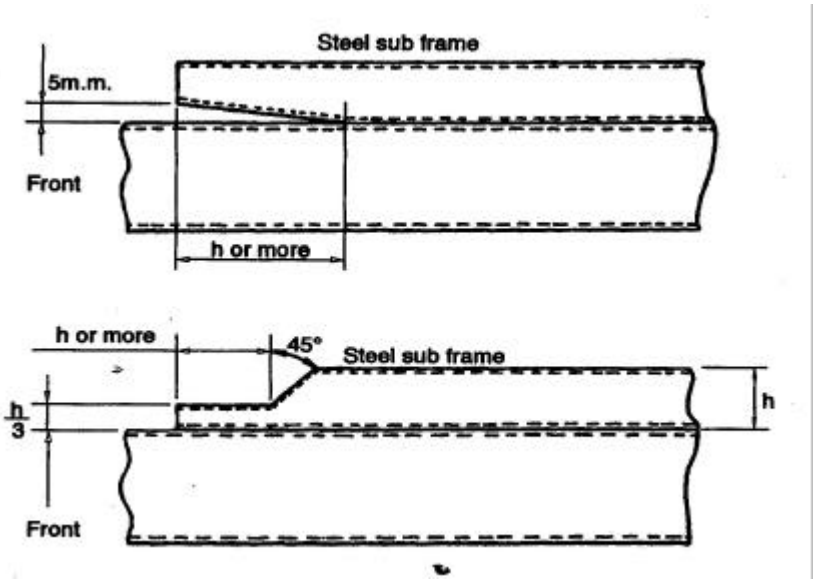


Figure 2

Typical spacing for body mounting brackets is 900mm.

- Soft spacing material such as wood or reinforced rubber should be used as a vibration deadening material on body mounts. It should be placed between the faces of the chassis frame bracket and the body mounted bracket, and will take up any slight misalignment of body brackets. It may also find application in prevention of noise intrusion into cab. The body mounting attachments should not be located within the shaded areas of Figures 3 and 4.

  NOTE: Manufacturer's recommendations in this area should be observed.

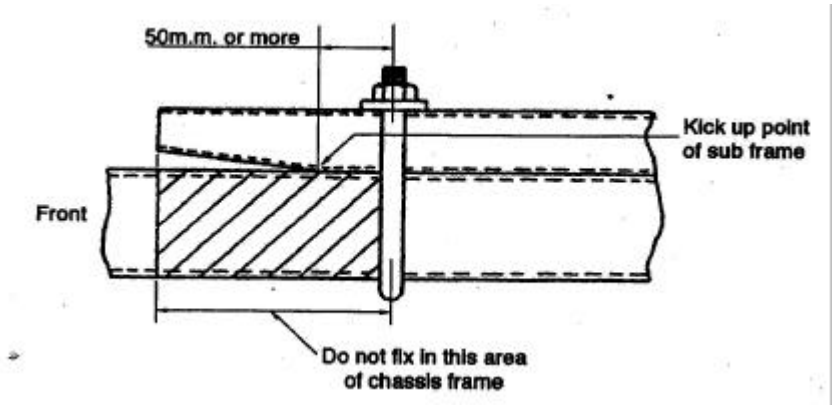


Figure 3 - Attachment Front End of Sub Frame

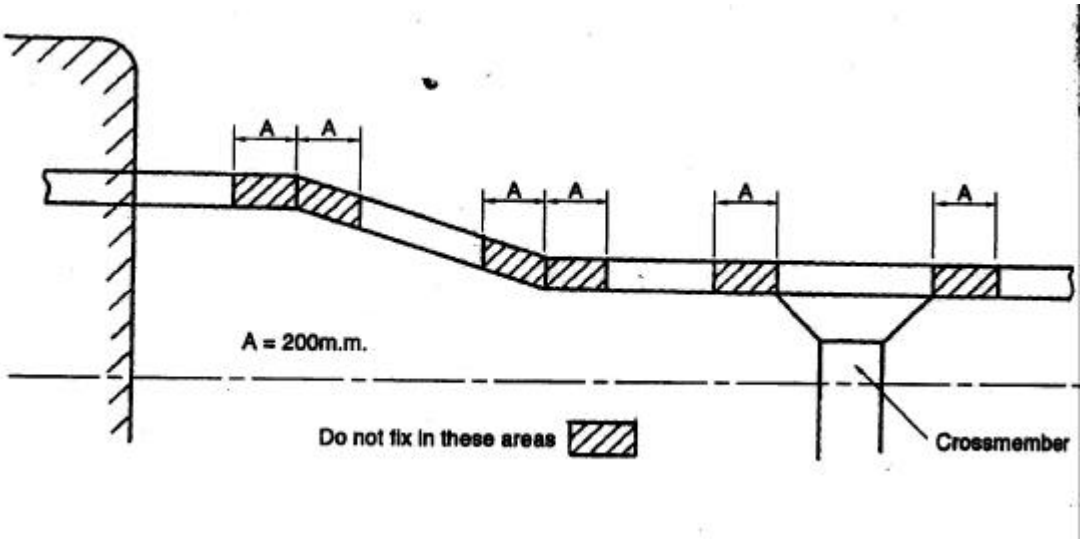


Figure 4 - Attachment Locations Chassis Frame

(Refer manufacturer's body mounting directives when the above guidelines cannot be met).

5.3 Detail Structural Considerations

The following detail requirements should be met:

- The lower attachment hole on all body mounting brackets should be well below the neutral axis of the chassis frame rail. The bottom edge of the bracket should be as near as possible to the web of the frame rail to prevent frame cracking.

- Body mountings should be so located that:

  - In relation to changes in the frame side member section, suspension mounting points and other frame attachments, stress concentrations in the frame are kept to a minimum.

  - Regular inspection and maintenance can be readily carried out on the mounting and adjacent vehicle parts.

  - There is sufficient clearance of mountings from moving parts such as propeller shafts, suspension links, etc.

- Metric standard bolts grade 10.9 or 8.8 (SAE Grade 8 or 5) must be used with the appropriate grade nuts for fastening body mounting to the chassis frame. Refer Australian Standard AS 1110.

- Drilling of frame side members for attachment of body mounting brackets must be in accordance with Section H - Chassis Frames - of the National Code of Practice for Heavy Vehicle Modifications.

- When components of dissimilar metal are bolted together, lead oxide or similar isolating compound or other approved means of preventing corrosion due to electrolysis, must be employed.

5.3 Selection of Mount Types

An important factor in the choice of body mounting type to be used is the rigidity of the body structure. Mounting types commonly used with flexible, rigid and semi rigid bodies are described in the following sections.

6. 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 "Fishplate" systems. The "U - Bolt" mounting system is not preferred but where it is adopted for its simplicity, the preparations listed below must be followed. See also Section 6.3.

6.1 Outrigger Type Mounts

It is recommended that all flexible bodies be attached by "outrigger" type mounting brackets. These brackets must be securely attached to the web of the chassis frame rail. Some typical examples of this style of body mounting are shown in Figure 5.

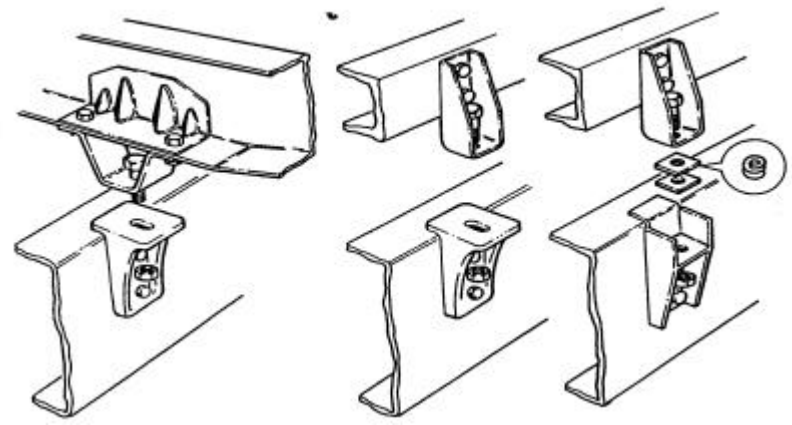


Figure 5. Typical Body Mounting Brackets

When outrigger brackets are fitted:

- A clearance space must be provided between the frame and the body longitudinals and cross members.
- To prevent flexing of the web, the bracket should extend at least half way down the web of the frame.
- To facilitate body fitting, one pair of brackets can have plain holes to provide fore and aft body location, the remaining brackets can have slotted holes.
- In addition, the frame brackets can be designed to engage with the body bracket so that the bolts joining them do not carry shear loads due to braking, etc. Refer the type shown on the right of figure 5.

6.2 Fish-Plate Mounts

If the space available along the side of the chassis frame precludes the use of outrigger brackets, the body may be attached in these areas with “fish-plates”. A spacer must be placed between the chassis frame and body. Refer Figure 6.

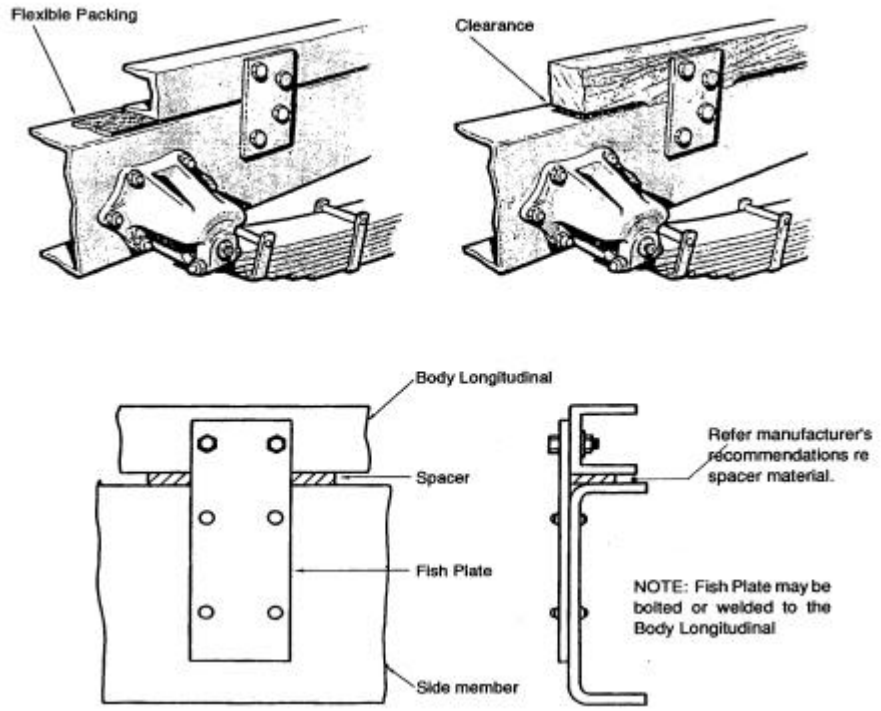


Figure 6. Details of Typical Fish Plate Attachment

6.3 "U - Bolt" Mounting

A simple method that is frequently used for attaching the body is U-Bolts. This is not a recommended method for body mounting because:

- The load is carried on the top flange, not the web.
- The runner stiffens the frame thus reducing the flexibility along part of the frame length.
- The U-bolts holding the runners are often over tightened causing the frame flange to buckle. Once buckled, the flanges have their strength greatly reduced.
- When wood or metal spacers are positioned between top and bottom flanges to stop the flange buckling, local stiffening occurs with resultant loss of flexibility.
- Fixing of the body relies on friction and high clamping forces, with no positive location. However tight the U-Bolts are when fitted, they work loose, or the wooden runners shrink and the body is then free to slide on the frame.
- Runner shrinkage and wear over a period of time can occur and the body mounting becomes loose. Often U-bolts are over tightened at this time to prevent recurrence and frame distortion results.

If U-bolt mounting is to be used, then the installation must satisfy the following conditions:

- The frame (particularly the flanges) must not be distorted. If the vehicle does not have a box type frame, metal spacers must be inserted between the top and bottom flanges of the chassis frame rail to prevent distortion when the U-bolts are tightened. The spacers should be secured in place by the U-bolts as shown in Figure 7. Do not use spacers made from hardwood as these can shrink and drop out.

- When wooden runners are used, they must be protected from the direct pressure of the U-bolts either by a steel capping under the bolt or by a shaped spacer, as shown in Figure 7.

- The body must be located fore and aft on the frame and prevented from moving during violent braking by the use of at least four (4) outrigger brackets or fishplates. A bracket or fishplate must be located at the front and rear of the body on both sides of the vehicle.

- A minimum of three U bolts per side of chassis shall be used with the maximum pitch spacing of 1750mm.

- Minimum U bolt diameters shall be:

    - Bodies to 2 tonne capacity - 12mm

    - Bodies over 2 tonne capacity – 16mm.

- Class 4.6 steel U bolts are recommended.

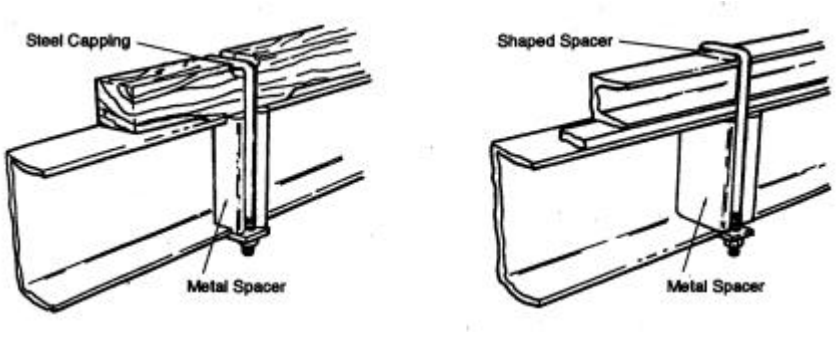


Figure 7. Typical U-Bolt Body Mountings

7. TIPPER BODIES

Short, rigid bodies mounted on short wheelbase vehicles, such as tippers, should have a sub-frame mounted securely on the chassis by means of fishplate or outrigger brackets to provide a strong integral structure for mounting hoist and tipper body pivots, 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 rails. Figure 8 shows a typical installation where the ram force F acts at a distance L from the centre of the bolting configuration and causes torsional moment (F x L), which must be resisted in the main by the attaching bolts. As the number of bolts is increased or the spacing of these mounting bolts (b and d) is increased, the resistance offered by the joint is increased. Fewer

bolts and larger spacings can be used with the result that the load is spread over a greater area of the frame. A reduction in dimension L will also reduce the torsional moment about the mounting.

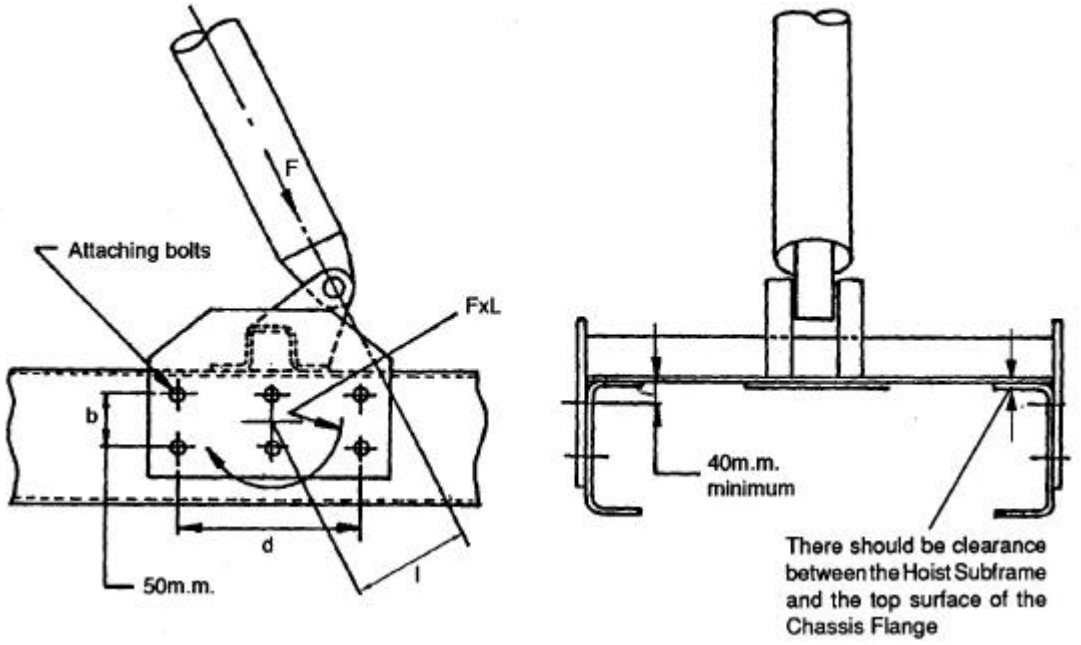


Figure 8

Longitudinal packers should be used on the chassis to distribute tipper body loads, wherever practicable. For tipper bodies without longitudinals, the supports on the chassis for each body cross member should be a minimum of 450mm in length. Vertical adjustment and/or resilient bearer blocks should be provided to ensure even distribution of load between all supports. A correctly designed support bracket allows the centre line of the body-runners to pass through the centre of the bracket. A typical support bracket is shown in Figure 9.

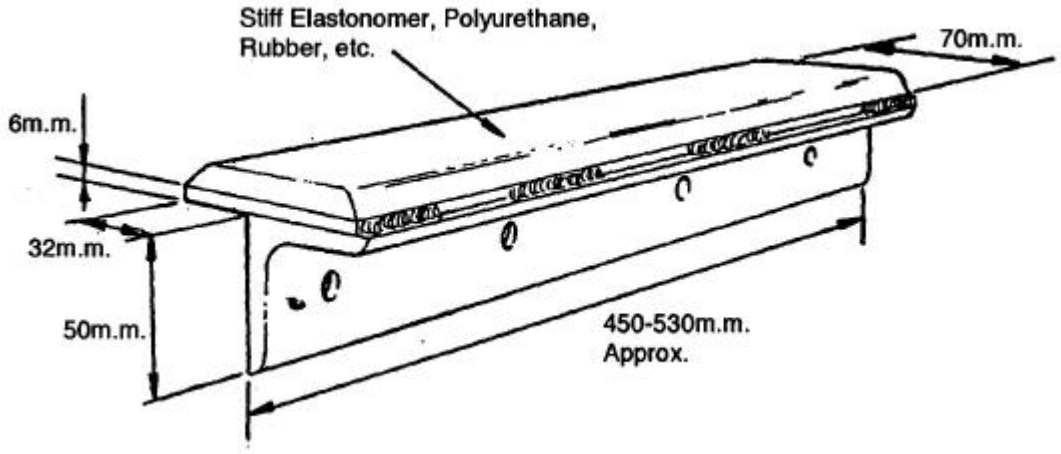


Figure 9

The brackets for the tipping pivot must be mounted in a manner that evenly distributes the loads into the chassis. These pivots should be mounted as near as practicable to the rear suspension to reduce the loads applied to the chassis during the tipping operation. The forward section of the tipping body must be transversely restrained by suitable guides.

8. TANKER BODIES

8.1 Recommended System

Long and rigid bodies, such as tankers, may require greater provision for relative movement between the body and frame while still retaining the chassis frame flexibility. A 3 or 5 point resilient mounting system is the recommended mounting configuration. A typical example is shown in Figure 10.

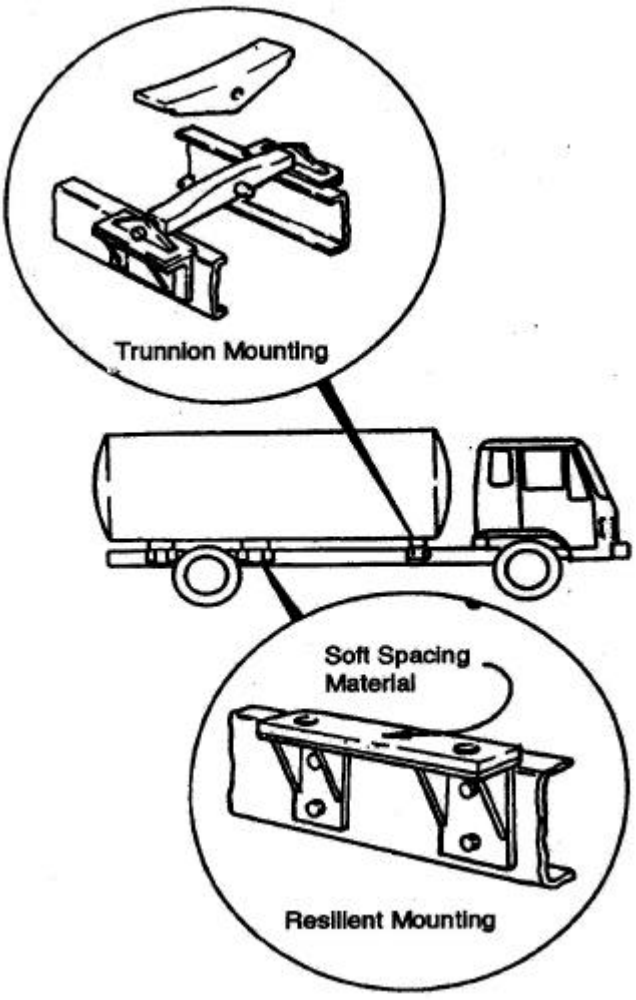


Figure 10

The brackets must be of sufficient strength to safely support the load. The front mounting should be a special cross member with a centrally located trunnion to support the tank. This front mounting should be located as far forward as possible. The second pair of mounting brackets should be placed as close as possible to the foremost rear suspension hanger bracket. A smaller pair of mounting brackets should also be positioned adjacent to the rearmost rear suspens ion hanger bracket.

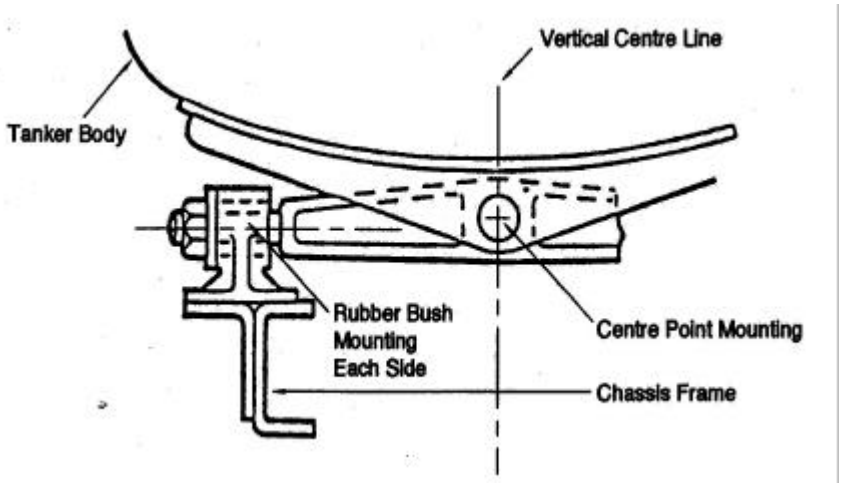


Figure 11. Details of a Typical Front Mounting Bracket

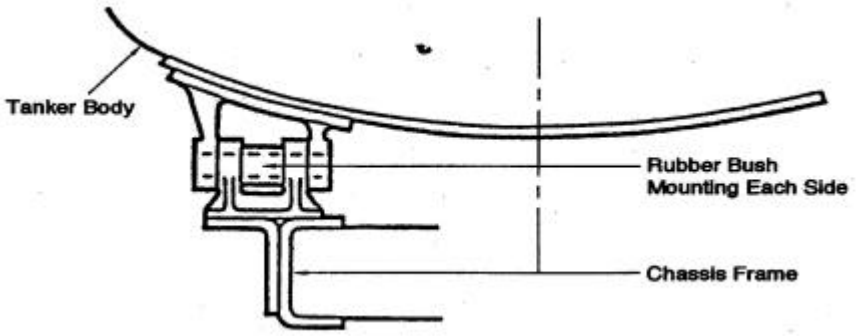


Figure 12. Details of a Typical Rear Mounting Bracket

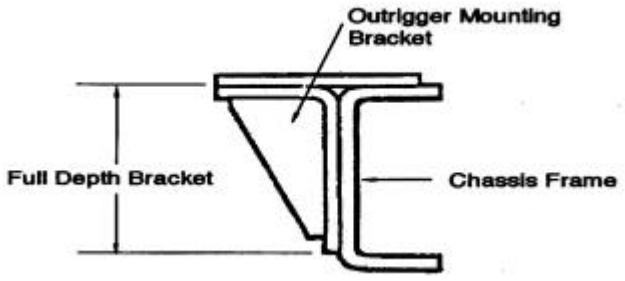


Figure 13. Details of a Typical Chassis Mounting Bracket

8.2 Alternative Mounting for Tankers

Rigid type mountings system may be used provided that the mounts are sufficiently flexible and suitably located so as to allow the chassis to flex. If such mountings are arranged in a 3 point layout (refer to Figure 14) or a 4 point diamond plan (refer to Figure 15), the chassis is free to deflect torsionally with no undue stress concentrations in either the chassis or the body. Due to the large concentrated loads that result from these mounting methods, substantial load bearing cross members must be used.

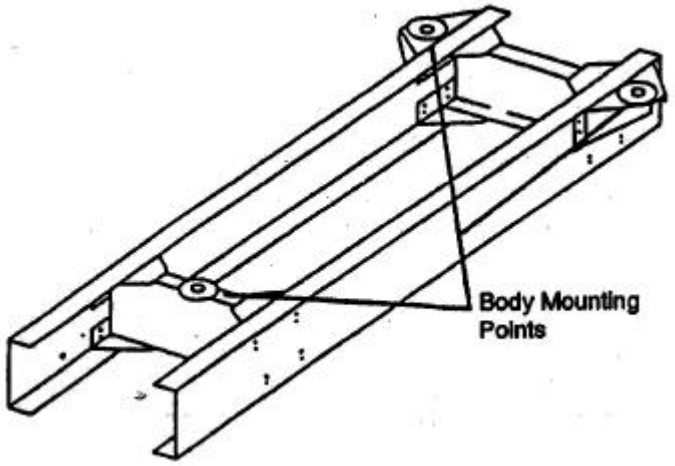


Figure 14. Typical 3 Point Mounting

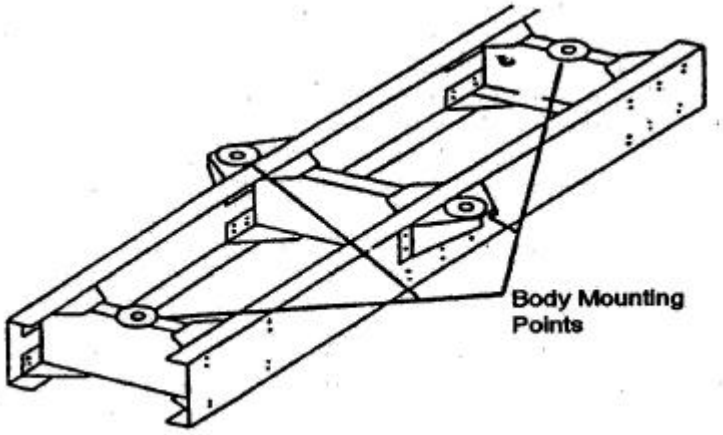


Figure 15. Typical 4 Point Mounting

8.3 Tankers for Dangerous Liquids

If a tank is to carry liquid dangerous goods, the road tank vehicle must satisfy special requirements as outlined in Australian Standard AS 2809 - Parts 1 to 5. A short summary of some of these requirements is given below. If the tanker may be used to carry dangerous goods, modifiers are urged to consult officers of the State or Territory authority controlling transport of such goods.

- Tank Attachment. The method of tank attachment must be sufficient to withstand an applied horizontal force equal to twice the combined weight of the tank, its accessories, and its cargo.

- Rear Impact Protection. The tanker must be provided with a bumper system for rear impact protection in accordance with a number of requirements:

    - The impact surface shall be not less than 150mm behind the rearmost vertical projection of the tank, and the inner face of the bumper shall allow at least 150mm clearance from the tank or any components or fitting.

    - The width of the system shall not be less than the width over the extremities of the tank.

    - The system shall be attached to the sub-frame of the tanker or the chassis of the vehicle. It shall not be attached directly to the tank.

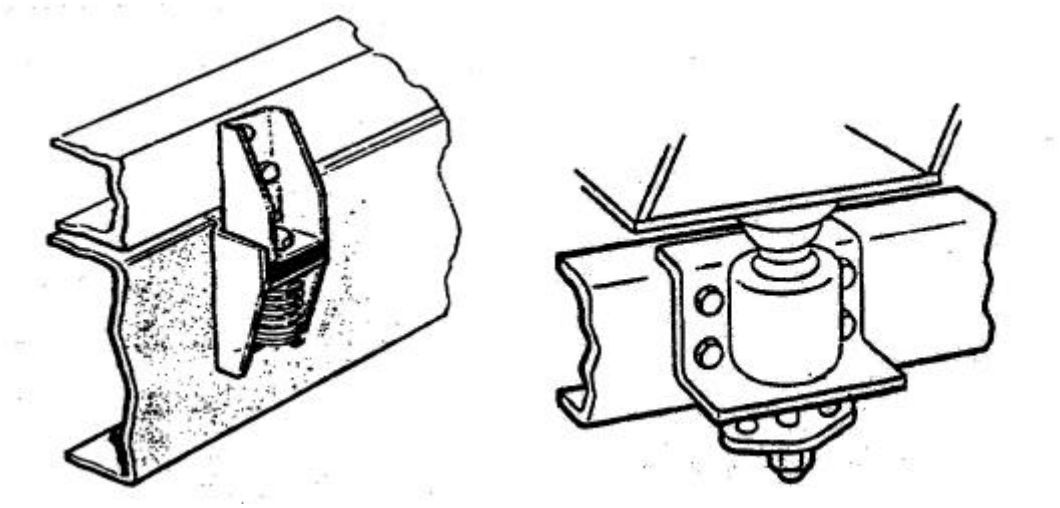
    - The design of the bumper system shall be calculated using a design load equal to 40t or twice the weight of the fully loaded tanker, whichever is the lesser, uniformly distributed over the bumper, and a stress equal to the yield stress of the material.

- General Note: General Dangerous Goods Cargo (including tankers) require rollover protection to prevent damage to fittings, which may result in escape of cargo. Tankers carrying flammable cargo (dangerous goods of Class 3) require special tank fittings, vehicle wiring, and exhaust system. Pumps, piping and auxiliary engines are specified in AS 2809 and must be selected and installed as specified.

9. SEMI-RIGID BODIES

When it is considered that a body might be too rigid to withstand the beaming and twisting of the frame expected in service, some vertical compliance must be provided in the body mountings. This can be obtained 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 (refer Figure 16). In some cases, brackets or "lugs" engaging frame side rails and/or cross members must be provided for body location and to resist horizontal forces (refer Figure 17).



Spring Type Mounting **Proprietary Type Mounting**

Figure 16 – Typical Resilient Mountings

- Mountings which are especially suited to occasional large beaming or torsional frame deflections, 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 (refer Figure 18).

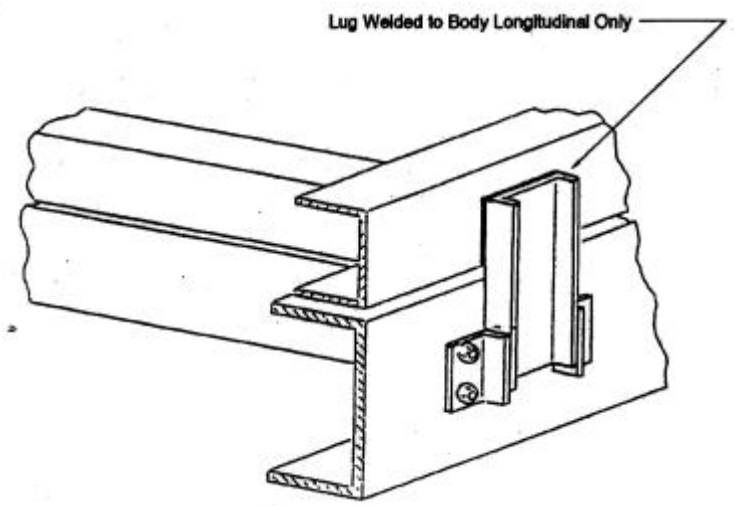


Figure 17. Additional Horizontal Restraint used with some body mountings

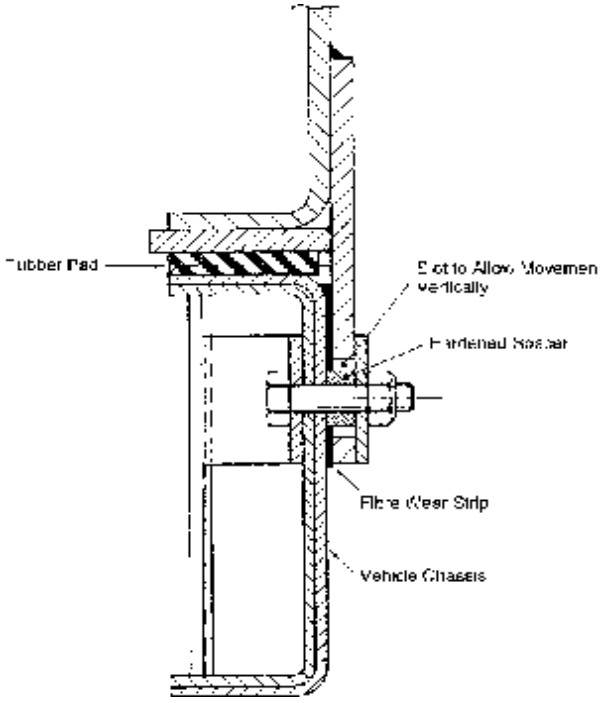


Figure 18. Body Mounting with Vertical Compliance and Friction Damping

10. RECORDING

The Appendices of this document are:

- Appendix 1 - Recommended Dimensional Limits - NA and NB Vehicles
- Appendix J1 which:
    - Summarises the scope of modification work which may be certified under this Modification Code; and
    - Includes a list of Sections of the National Code of Practice covering other areas of the vehicle which may have been affected by the modification and which should be analysed to determine whether they, too, require re-certification.
    - Includes a checklist appropriate to the Modification Code J1 that should be completed.

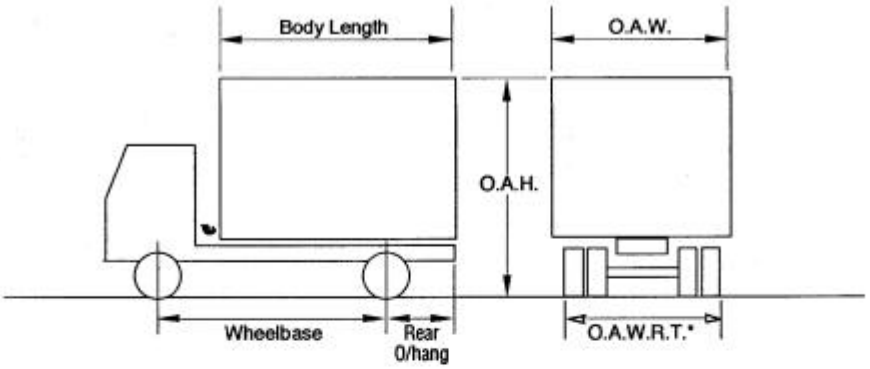
It is suggested that analysis work records, sketches and other vehicle data, together with copies of the Calculation Sheet and completed Checklists, be retained by the Certifying Officer for at least the period specified in Part A of this National Code of Practice.

HEAVY VEHICLE MODIFICATIONS

Appendix 1

Recommended Dimensional Limits NA & NB Vehicles

These limits are to maintain the safety & integrity of the vehicle with body fitment.



Maximum Recommended Dimensional Limits

1. Body Overall Width — Both Vans & Trays = O.A.W.R.T. + 300mm

2. Overall Height — Both Vans & Trays = 1.85 x O.A.W.R.T.

3. Lengths — Vans Only = Manufacturers Max. Wheelbase Option + 20%

Notes: 1. * OAWRT = Overall width across rear tyres

2. Wheelbase, Rear Overhang, therefore body length must be determined by load distribution calculations based on water level load condition

3. Refer Paragraph 5.1 of this Modification Code re body overhang beyond chassis rail

4. Legal maximum width, height and length dimensions must not be exceeded

Examples

				Vans Only	
O.A.W.R.T.	Max. Recom. O.A.W.	Max. Recom. O.A.H.	Manfrs STD w/base	Max. w/base allowed	
1610	1910	2978	2490	2988	
1635	1935	3024	2490	2988	
1670	1970	3089	2515	3006	
1855	2155	3431	3360	4032	
1890	2190	3496	3335	4002	
1940	2240	3589	3940	4728	
2000	2300	3700	3815	4578	
2095	2395	3875	4850	5820	
2140	2440	3959	4800	5760	
2152	2452	3981	4850	5820	

HEAVY VEHICLE MODIFICATIONS

Appendix J1

Modification Code J1

BODY MOUNTING

Modifications that are covered under the Modification Code are:

1. Mounting of bodies of all types other than omnibus bodies to commercial vehicles.
2. Modification or replacement of body mountings.
3. Fitting of body equipment - hoists etc.

Modifications that are **not** covered under this Modification Code are:

1. Mounting of bodies in a manner that is likely to lead to failure of the vehicle chassis.
2. Mounting of bodies in a manner that provides insufficient restraint of the body and any possible load under any operational conditions.
3. Fitting of omnibus bodies.

NOTE: The modified vehicle/modifications must continue to comply with all applicable ADR's, Australian Standards or Regulations/Acts.

Outlined below are areas of the vehicle that may have been affected by the modifications and that may require recertification, testing and/or data to show compliance for the modified vehicle.

DETAIL	REQUIREMENTS
Lights	Australian Design Rule 13/..
Mudguards	Australian Design Rule 42/..
Exhaust Repositioning	Modification Code A4

HEAVY VEHICLE MODIFICATIONS

Checklist J1

BODY MOUNTING

(Y=Yes N=No)
delete if not applicable

1.0	**General**		
1.0	Is the vehicle within the maximum allowable dimensions as stated by the relevant State or Territory Regulations?	Y	N
2.0	**Body Trucks**		
2.1	Is the attachment of the body capable of supporting the maximum loads imposed by the payload and the body weight at the extreme conditions, while evenly distributing the load throughout the chassis?	Y	N
2.2	If body mounting brackets are used, is the lower attachment bolt on all body mounting brackets below the neutral axis of the chassis frame?	Y	N
2.3	If body mounting brackets are used, are they bolted to the web of the chassis rail?	Y	N
2.4	Does the sub-frame of the body extend for the entire length of the body without any breaks or joins?	Y	N
2.5	Does the front end of the sub-frame give a progressive load bearing transition to the chassis frame rail?	Y	N
2.6	Are the body mounting brackets in appropriate locations and spacing along the chassis rail and body sub-frame?	Y	N
2.7	If "fishplates" are used, are spacers positioned between the chassis frame and body?	Y	N
2.8	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?	Y	N
2.9	If wooden runners are used, are they protected from damage by the U-bolts by steel capping or shaped spacers under the bolts?	Y	N
2.10	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?	Y	N
3.0	**Tippers**		
3.1	Is the design and installation of the ram mounting sufficient to withstand the maximum ram force and the torsional moment from the ram force?	Y	N
3.2	Are longitudinal packers used on the chassis or are the supports on the chassis for each body cross member at least 450mm in length?	Y	N
3.3	Is there provision to ensure even distribution of load between all supports?	Y	N
3.4	Are the brackets for the tipping pivot mounted in a manner that evenly distributes the loads into the chassis?	Y	N
3.5	Is the forward section of the tipping body transversely restrained by guides?	Y	N

4.0 Tankers

4.1	Does the mounting system for the tank accommodate the torsional stiffness of the tank while still retaining the chassis frame flexibility?	Y	N
4.2	Are the mounting brackets of sufficient strength to safely support the load?	Y	N

5.0 Tankers Carrying Liquid Dangerous Goods

5.1	Does the tanker meet the requirements of Australian Standard AS 2809 - *Road Tank Vehicles for Dangerous Goods, Part 1- General Requirements* and any other applicable parts?	Y	N

6.0 General

6.1	Are the modifications in accordance with this National Code of Practice or the manufacturer's recommendations for modifications of this nature?	Y	N
6.2	Does the modified vehicle comply with the requirements of the applicable ADR's?	Y	N
6.3	Does the modified vehicle comply with the requirements of the State or Territory Regulations?	Y	N
6.4	Is the quality of workmanship to a satisfactory standard?	Y	N
6.5	Have all of the modification details and all calculations applicable to the modification been recorded in accordance with this Modification Code?	Y	N

NOTE: If the answer to any relevant question is "NO", the modification is not acceptable.

Vehicle Chassis No/VIN:.....

Vehicle Modifier:.....

Examined by:.....

Company (if applicable):.....

Certifying Officer No:…… Modification Certificate No:.....……..

Modification Plate No:……..

Signed:……..... Date:.....