

SECTION 8

**RAIL FREIGHT VEHICLE UNDERFRAME
AND BODY STRUCTURES**

ROA MANUAL
SCHEDULE OF AMENDMENTS
SECTION 8

AMENDMENT NUMBER	PAGES AMENDED	AMENDMENT SUMMARY	DATE ISSUED

Portions of this Section of the ROA Manual highlighted by red text are superseded by the following RISSB Australian Standard:

- AS 7509 Railway rolling stock - Dynamic behaviour

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8.1 SCOPE

This Section covers the structural design requirements for rail freight vehicle underframes, body structures and componentry.

8.2 GENERAL PRINCIPLES AND REQUIREMENTS

- 8.2.1 The height of couplers and the related tolerances shall be as specified in the latest revision of the Manual of Standards of the Association of American Railroads (AAR), Section C, S-202. For ROA standardisation, the metric equivalent of the coupler height shall be 876 mm nominal (915 mm maximum) at tare in new condition.
- 8.2.2 Body side bearing wear plates and attachments shall comply with the latest revision of the AAR Manual of Standards, Section C, S-235.
- 8.2.3 Standard nominal dimensions shall be according to the latest revision of the AAR Manual of Standards, Section C, Part II.
- 8.2.4 The draft gear pocket dimensions shall comply with the latest revision of the AAR Manual of Standards, Section C, Part II, Clause 2.1.5.13.
- 8.2.5 Body centre plate design, including bolt patterns, shall be in accordance with the latest revision of the AAR Manual of Standards, Section C, or other internationally recognised design standards.
- 8.2.6 All freight vehicles shall be constructed to comply with the Maximum Rollingstock Outline appropriate to the routes over which they are intended to operate (refer to Section 18), and to negotiate the horizontal and vertical curves specified at 8.2.14.
- 8.2.7 The standard height of floor from rail level of covered, louvred and open freight vehicles shall be 1170 mm to 1200 mm at tare in new condition except when swing doors are fitted, when the floor height shall be 1250 mm. For the height of freight vehicle supports for container corner castings from rail level at tare refer to Section 11.
- 8.2.8 Structural design criteria shall be as set out in specification M-1001 of the latest revision of the AAR Manual of Standards, Section C, Part II, for freight vehicles other than tank cars. In the case of container restraint fittings, refer to Section 11.2.
Refer to Section 20 for requirements for load-securing components and to Section 21 for Specially Equipped Vehicles.
- 8.2.9 Where a superstructure is carried on an underframe, the superstructure shall be used, wherever possible, to act with the underframe as a load bearing component. Flooring shall be taken as a part of superstructure.
- 8.2.10 The design procedures for fatigue analysis shall comply with the latest revision of the AAR Manual of Standards, Section C, Part II. This does not preclude the use of procedures specified in AS 4100 (for steel), AS 1664 (for aluminium) or other internationally recognised design standards.
- 8.2.11 Structural welding shall be in accordance with AS 1554, Part I, for steel and AS 1665 for aluminium.
- 8.2.12 The distance from the centre line of the bogie to the face of the headstock shall be the practical minimum.
- 8.2.13 Each vehicle shall incorporate provision for safely lifting it when fully loaded by jacking at four points.
- 8.2.14 Each vehicle shall incorporate permanent lifting brackets designed for the attachment of lifting shackles. The lifting brackets shall consist of pairs of vertical plates preferably mounted at the ends of body bolsters and located to align with bolster web plates. Each pair of lifting plates shall be capable of lifting one half of the mass of the fully laden wagon and be positioned such that they are accessible without causing obstruction; there shall be clearance for shackle swing. Means shall be provided to prevent a straight bar from being simultaneously placed through both lifting holes of a lifting bracket pair. Features to be incorporated in each lifting bracket are shown in Diagram 8-1.

Section 8.2.15 superseded by AS 7509

- 8.2.15 All freight vehicles for general intersystem movements, regular or intermittent, shall be designed and constructed to negotiate the horizontal and vertical curves specified hereunder, without interference between body, underframe, bogies, brake rigging and any other fittings or attachments.
- 8.2.15.1 Each vehicle shall be capable of successfully negotiating:
- (a) A horizontal curve of 100 m radius while coupled to a base vehicle with a total lateral coupler offset (from the vehicle centre line) of 90 mm at the coupler line; the vehicle path shall be through the curve from tangent track.
 - (b) A reverse horizontal curve of 120 m radius, without transition between the two curves, while coupled to an identical vehicle.
 - (c) A vertical curve (both convex and concave) of 300 m radius, while coupled to a base vehicle fitted with an interlocking shelf coupler (426 mm shank length) shown on diagram 9.1 of Section 9, with no vertical displacement of the couplers in either vehicle. Allowance shall be made for a difference in coupler height between the two vehicles, on level track, of 75 mm, plus a vertical displacement at the coupling line of ± 35 mm due to deflection of the vehicle suspensions.
- 8.2.15.2 The base vehicle shall be:
- (a) Length over end sills: 12,600
 - (b) Length over coupling points: 13,490
 - (c) Bogie centres: 9,500
 - (d) Coupler length: 680 (centre of pin to coupling line)
- 8.2.15.3 Exchange vehicles and any other vehicle intended or liable to operate on both standard and broad gauge lines, shall comply with the above requirements when fitted with bogies of both rail gauges.

Section 8.2.16 superseded by AS 7509

- 8.2.16 The combination of bogie centres, end overhang and coupler length shall be so determined that the ratio between the total lateral force per bogie and the total vertical load per bogie (L/V) shall not exceed 0.82 under the specified conditions.
- 8.2.16.1 The L/V ratio for the vehicle shall be determined under the following conditions:
- (a) Draft force of 890 kN
 - (b) Coupled to a base car at the front (leading) end and a like car at the rear (trailing) end
 - (c) On a horizontal curve of 165 m radius
 - (d) The subject vehicle shall be unloaded (ie at tare)
- 8.2.16.2 The method for computing coupler angles and lateral forces shall be in accordance with Sections 2.1.6.2 to 2.1.6.5 inclusive of Section C-II of the AAR Manual of Standards and Recommended Practices, Specification M-1001.
- 8.2.16.3 The base car shall be as specified in 8.2.15.2.
- 8.2.16.4 The width of the opening in the striker casting/end sill shall be sufficient to accommodate the maximum coupler angular movement calculated under the conditions specified in 8.2.15 and 8.2.16.

8.3 BOGIE EXCHANGE - LIFTING BRACKETS

8.3.1 Vehicles suitable for bogie exchange service shall incorporate standardised provisions for lifting as detailed in the following:

- (a) Suitable lifting points or brackets are to be provided at the extremities of the freight vehicle body bolster, such that the minimum width over the freight vehicle body bolster and any lifting brackets is 2670 mm.
- (b) The strength of the lifting brackets (where fitted) and freight vehicle body bolsters must be sufficient to support with safety the appropriate share of the mass of a fully loaded vehicle when it is lifted on four such points.
- (c) A horizontal jacking area at least 75 mm wide by 230 mm long is to be provided by each lifting bracket alone or the lifting bracket in conjunction with the side sill to suit the pad of the lifting jack.
- (d) The height of the jacking area under all conditions of wear and loading must not be less than 740 mm above rail level.

Notes:

- 1. The dimensions detailed above are illustrated in Diagram 8-2.
- 2. The limit switch on the lifting jacks is set so that the lifting pad has a minimum height of 710 mm above rail level.
- 3. Under the above minimum conditions the width over the vehicle body or loading must not be greater than 3050 mm otherwise fouling of the top bearing of the jack lifting screw will occur.

8.4 SUPERSTRUCTURE, DOORS AND ASSOCIATED COMPONENTRY

8.4.1 DOORS

This standard is intended to cover all aspects of rail freight vehicle doors and door mechanisms.

Actual door designs have not been included in this manual. It is intended that when future requirements for the manufacture of vehicles utilising such doors arise, the subject will be fully researched and appropriate designs prepared which meet all task requirements and fully utilise the most up to date technologies in the field.

Following approval by the relevant sub-committee of this ROA Manual, these designs will then be inserted in the Manual as standards.

The AAR Manual of Standards and Recommended Practices Section C covers the general criteria for door design and shall form the basis of new door development.

8.4.2 FLOORING

All vehicles manufactured under this section shall preferably be constructed using steel or aluminium floor materials in accordance with the design requirements for the particular vehicle specification.

8.4.2.1 Should timber be used as an alternative material, then:

- (a) All such vehicles shall be fitted with underfloor spark protection plates applied to the underside of the wagon floor with a 25 mm air gap between the wagon floor and the protection plate
- (b) The plates shall not be less than 460 mm in width, and shall be above the wheels, centred approximately 560 mm from the longitudinal centre line of the vehicle and extending approximately 1830 mm on each side of the bogie centre line.

8.4.2.2 Where vehicular access to a rail freight vehicle is a requirement, floors shall be designed in accordance with the Association of American Railroads Manual, Section C, Part II, Sub Section 4.4, without exceeding allowable stresses.

8.5 ROOFS, ENDS AND SIDE PANELS

8.5.1 Major panel structures such as roofs, ends and sides shall be designed in accordance with the Association of American Railroads Manual Section C, Part II, Sub Section 4.4, without exceeding allowable stresses.

8.5.2 Panels should preferably be manufactured using standard pressing blocks. Alternatively, manufacture can be achieved by prefabricating sections using standard commercially available steel sections and flat plate cladding.

8.6 STANDARDS

The following standards should be used in conjunction with this section of the Manual:

- (a) Australian Standards
 - AS 1796 SAA Welders Certification Code
 - AS 1734 Aluminium and aluminium alloys - flat sheet, coiled sheet and plate
 - AS 1449 Wrought alloy steels - stainless and heat resisting steel plate, sheet and strip
 - AS 1554 Pt 1 SAA Structural Steel Welding Code
 - AS 1665 SAA Aluminium Welding Code

AS 2074	Steel Castings
AS 4100	Steel Structures Code
AS 1664	Aluminium Structures Code

- (b) Current issue of the Association of American Railroads Recommended Standards and Practices, Sections C and CII.

8.7 MATERIALS

All materials used in rail freight vehicle superstructure and door manufacture shall comply with the appropriate Australian Standards or their equivalent, listed in Clause 8.6 of this sub section.

DIAGRAM 8-1

LIFTING BRACKETS - BASIC DIMENSIONS

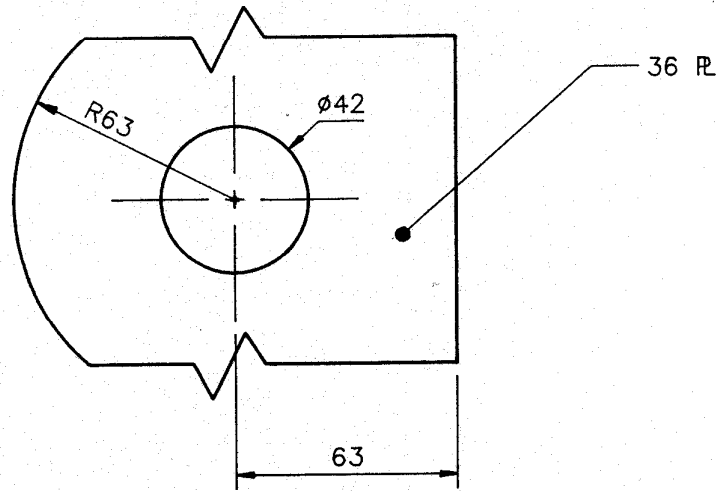
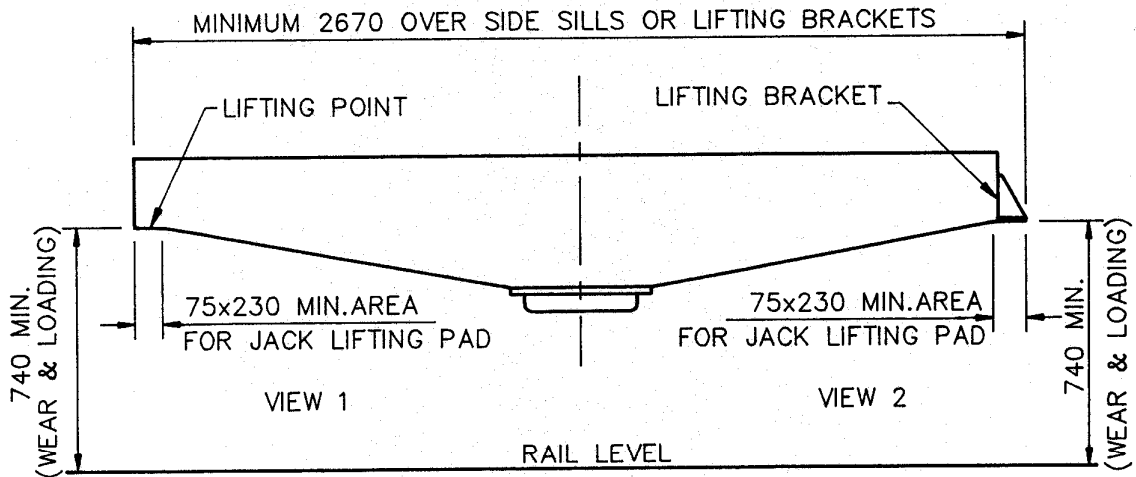


DIAGRAM 8-2

FREIGHT VEHICLES FOR BOGIE EXCHANGE
LIMITING DIMENSIONS FOR LIFTING BRACKETS



CROSS SECTION OF UNDER FRAME AT BODY BOLSTER