



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline
Engineering Standard

Category
Rolling Stock

Freight Vehicle Specific Interface Requirements

WOS 01.400

Applicability

ARTC Network wide	
New South Wales	✓
Western Jurisdiction	
Victoria	

Primary Source
(RIC Standard RSU 400 Series Version 2.0)

Document Status Record

Status	Date	Prepared	Reviewed	Endorsed	Approved
Issue 1 Revision 0	Dec 05	Standards & Systems (refer to Primary Source)	Standards & Technical Services Engineer	GM Infrastructure Strategy & Performance M Owens	Safety Committee 12/08/2004

List of Amendments

Issue	Date	Clause	Description
1.0	07/12/2005	All	Reformatting to ARTC Standard and combining all 400 Series into one document

Disclaimer

This document is for internal use by the Australian Rail Track Corporation Ltd ("ARTC") only and may **not** be relied on by any other party. ARTC:
1. does not accept any liability or responsibility whatsoever for this Document in respect of any use or reliance upon it by any other party; and
2. does not provide any warranty as to the accuracy or reliability of this Document.

Contents

WOS 01.400 - Introduction	4
[1] General	4
[2] Authorisation of Vehicles	4
WOS 01.410 - Bogie Components.....	5
[1] Introduction	5
[2] Wheels	5
[3] Wheel Profiles	5
[4] Axles	6
[5] Wheel and Axle Assembly	6
[6] Axle Bearing Assemblies.....	6
[7] Bogie Frames and Associated Componentry.....	6
[8] Vehicle Suspension	6
WOS 01.420 - Brakes and Pneumatic Equipment	8
[1] Introduction	8
[2] General Requirements	8
[3] Location of End Equipment.....	8
[4] Standard Pressures and Timings.....	8
[5] Brake Equipment.....	8
[6] Identification of Cocks	9
WOS 01.430 - Body and Underframe	10
[1] General	10
[2] Couplers and Draftgear	10
[3] Towing Fixtures, Jacking and Lifting Points	10
[4] Steps and Handrails	10
[5] Doors	10
[6] Container Fixings	11
[7] Marking	11
[8] Carrying Containers in Open Wagons	11
WOS 01.440 - Vehicle Performance.....	12
[1] Introduction	12
[2] Test Requirements Summary.....	12
WOS 01.441 - Braking Performance.....	14
[1] Introduction	14
[2] Net Brake Ratio.....	14
[3] Air Brake	14
[4] Spring Parking Brake or Handbrake	15
[5] Single Car Air Test	15
WOS 01.442 - Freight Vehicle Ride Performance.....	16
[1] Introduction	16
[2] Vehicle Test Configuration.....	16
[3] Curve Stability	16
WOS 01.450 - Non-Conventional Vehicles	17
[1] Introduction	17
WOS 01.451 - Articulated or Permanently Coupled Vehicles.....	18
[1] Vehicle Types.....	18

[2] Air Brake Equipment.....	18
[3] Parking Brake/Handbrake	18
[4] Vehicle configuration	18
WOS 01.452 - Rail Compatible Road Trailers.....	19
[1] Description	19
[2] Design.....	19
[3] Brake Retention.....	19
WOS 01.460 - Vehicle Specific Requirements.....	20
[1] General	20
WOS 01.461 - Tank Wagons.....	21
[1] Introduction	21
[2] Design.....	21
[3] Tank inspections	21

WOS 01.400 - Introduction

[1]

General

- 1.1 The 400 series of Rolling Stock Operation Standards (WOS 01.400) contain specific interface requirements for freight vehicles operating on the Australian Rail Track Corporation network.
- 1.2 Requirements that are common with other types of rolling stock are included in the 200 series of Rolling Stock Operation Standards (WOS 01.200).

[2]

Authorisation of Vehicles

- 2.1 For all freight vehicles, the vehicle information pack in Appendix A2 (WOS 01.A2) shall be completed and submitted.

WOS 01.410 - Bogie Components

[1]

Introduction

- 1.1 This section contains bogie related requirements which are specific to freight vehicles. All requirements in WOS 01.200 which are common requirements also apply to freight vehicles.

[2]

Wheels

- 2.1 Refer to WOS 01.210 for common wheel requirements.

WOS 01.211 Wheels, design & manufacture.
WOS 01.212 Wheels, minimum operational requirements.

2.2 W-37 Type Freight Wheels

2.2.1 The 920 mm diameter wheel design designated W37 originating in NSW is prone to failure circumferentially around the web, and may be found fitted to 9R and 18R type roller bearing axlebox equipped wheelsets with wheels produced for the PTC of NSW and manufactured between 1975 and 1981. This wheel design can be readily identified by the presence of a recessed chucking groove around the inner circumference of the wheel rim. Suspect wheels can be identified by the following heat numbers, and must be scrapped when found, regardless of the year. Regular inspection of wheels is required to cull suspect wheels from service.

2.2.2 Suspect Heat Numbers

1975	H1066
1976	H2570, H2866, H2868, H2870, H2872, H2956, H2990, 3014, H3045, H3054, H3070
1977	H3050, H3074, H3078, H3113, H3155, H3159, H3164, H3231, H3439, H3480

[3]

Wheel Profiles

- 3.1 The standard ANZR profile is the base wheel profile. (see Appendix G [WOS 01.G] of this manual)

3.2 ROA Intersystem Worn Wheel Profile (also known as the QR modified or ANZR-2 profile)

This wheel profile is not recommended for future application to freight vehicles operating on the Australian Rail Track Corporation network. See clause 3.5.

3.3 Worn Wheel Profile (MOD 2)

This wheel profile is not recommended for future application to freight vehicles operating on the Australian Rail Track Corporation network. See clause 3.5.

3.4 Worn Wheel Profile (MOD 3)

This profile is depicted on drawing 206-931, (see Appendix G [WOS 01.G] of this manual), and is mandatory for freight vehicles operating exclusively on the Hunter Valley coal network and having standard three piece bogies.

The MOD 3 profile may be utilised on vehicles operating outside the Hunter Valley coal network subject to approval by the Australian Rail Track Corporation.

3.5 Intersystem Profile

The profile depicted as WRP 2000 in Appendix G (WOS 01.G) of this manual is the recommended wheel profile for future wheel replacement and reprofiling on all locomotives, freight and passenger vehicles operating on the Australian Rail Track Corporation network.

[4] Axles

4.1 Refer to WOS 01.220 for common axle requirements.

WOS 01.221	Axles, design & manufacture
WOS 01.222	Axles, minimum operational requirements

[5] Wheel and Axle Assembly

5.1 Refer to WOS 01.230 for common wheel and axle assembly requirements.

[6] Axle Bearing Assemblies

6.1 Refer to WOS 01.240 for common axle bearing assembly requirements.

[7] Bogie Frames and Associated Componentry

7.1 Refer to WOS 01.250 for common requirements for bogie frames and associated componentry.

[8] Vehicle Suspension

8.1 Refer to WOS 01.260 for common vehicle suspension requirements.

WOS 01.261	Suspension springs
WOS 01.262	Suspension damping
WOS 01.263	Resilient suspension components

8.2 **Suspension Damping Defects**

Vehicles shall comply with the ROA Manual of Engineering Standards and Practices, section 24.2.7.

8.3 **Reclamation of Friction Wedge Assemblies**

Friction wedges shall not be reclaimed by welding under any circumstances.

Where friction wedge pockets are reclaimed by welding, all welding shall be ground to form a flat surface with no pronounced ridges. Undressed weld beads shall not be permitted in wedge pockets.

8.4 **Operation of Vehicles with Defective Suspension Damping.**

If it is desired to continue moving vehicles with the defects stated in WOS 01.262 section 2, the load must be transhipped and the empty vehicle may proceed to the nearest repair location at the prevailing track speed limit not exceeding 50 km/h.

WOS 01.420 - Brakes and Pneumatic Equipment

[1] Introduction

- 1.1 The braking systems fitted to freight vehicles must be compatible with the brake systems on locomotives to ensure that the brakes apply and release as required. Otherwise skidded or scaled wheels could occur.

[2] General Requirements

- 2.1 Freight vehicles shall generally comply with the requirements of the ROA Manual of Engineering Standards and Practices, Section 7.
- 2.2 Some older vehicles may not fully comply with these requirements but will be assessed considering the brake equipment fitted and the proposed use of the vehicle.

[3] Location of End Equipment

- 3.1 Freight vehicles shall have coupling cocks located on the terminal ends as follows:-
- 3.1.1 Brake pipe
- The brake pipe coupling cocks shall be located as shown in the ROA Manual of Engineering Standards and Practices, Diagram 7-12 (see Appendix G [WOS 01.G] of this manual).
- 3.1.2 Main reservoir pipe and independent brake control pipe (optional)
- Main reservoir and independent brake control hoses and cocks shall be located such that they can couple to a locomotive or adjacent vehicle without causing damage or kinking hoses.
- 3.2 Vehicles not fitted with standard automatic couplers, shall have emergency couplers provided, with standard coupling hoses, which will couple with standard vehicles.
- 3.3 Freight vehicles with long overhang beyond the bogie centre may require bifurcation of the brake pipe and the hose connections.

[4] Standard Pressures and Timings

- 4.1 Standard pressures shall comply with the requirements of the ROA Manual of Engineering Standards and Practices, Section 7.4.

[5] Brake Equipment

- 5.1 Refer to WOS 01.271 for common brake equipment.

- 5.2 All freight vehicles operating in NSW shall be fitted with grade control valves or fixed exhaust chokes.
- 5.2.1 Regulations regarding the use of grade control valves are contained under Train Operations in the General Instruction Pages of the ARTC Train Operating Conditions manual. Vehicles with fixed exhaust chokes are counted as having operable grade control valves.
- 5.2.2 If a train has 80% or more of vehicles/load with fixed exhaust chokes then a HP grade examination is not required.

[6]

Identification of Cocks

- 6.1 All cut-out or isolation cocks shall be clearly identified and handles painted white, or other contrasting colour. Refer to the ROA Manual of Engineering Standards and Practices, Section 7.5.10.

WOS 01.430 - Body and Underframe

[1]

General

- 1.1 The vehicle body and underframe shall generally comply with the ROA Manual of Engineering Standards and Practices, Section 8.

[2]

Couplers and Draftgear

- 2.1 Automatic couplers and draftgear shall comply with the requirements of the ROA Manual of Engineering Standards and Practices, Section 9.
- 2.2 Coupler heights shall be within the following limits: New condition 870 to 880 mm. In service condition 780 to 915 mm.

[3]

Towing Fixtures, Jacking and Lifting Points

- 3.1 Vehicles shall be fitted with towing fixtures in accordance with the requirements of the ROA Manual of Engineering Standards and Practices, Section 10.2.9.
- 3.2 Suitable jacking points shall be supplied at the junction of the underframe side sill and the bolster adjacent to each bogie centre and also under the drawgear pocket, as specified in the ROA Manual of Engineering Standards and Practices, Section 8.2.13.
- 3.3 Vehicles shall have suitable lifting points or brackets to insert lifting hooks and shackles, as specified in the ROA Manual of Engineering Standards and Practices, Section 8.2.14.

[4]

Steps and Handrails

- 4.1 Steps and handrails, if required by the operator, shall generally comply with the requirements of ROA Manual of Engineering Standards and Practices, Section 10.
- 4.2 Steps and handrails shall comply with the appropriate Rolling Stock Outline. Refer to WOS 01.110.

[5]

Doors

- 5.1 Doors shall generally comply with the requirements of the ROA Manual of Engineering Standards and Practices, Section 8.4.
- 5.2 All doors, (including bottom discharge doors), on freight vehicles shall be fitted with a positive latching system to prevent accidental or premature opening in service.
- 5.3 All bottom discharge doors of bulk commodity wagons shall be designed and maintained to prevent leakage of the commodity onto the track.

[6]

Container Fixings

- 6.1 Container fixings shall comply with the requirements of ROA Manual of Engineering Standards and Practices, Section 11.2.
- 6.2 Alternate container fixings must be approved by the Australian Rail Track Corporation.

[7]

Marking

- 7.1 Each vehicle shall have a unique identification code/number as specified in section 23 of the ROA Manual of Engineering Standards and Practices.
- 7.2 Freight vehicles shall be stencilled and marked as specified in section 22 of the ROA Manual of Engineering Standards and Practices.
- 7.3 To enhance visibility of freight vehicles from the side at level crossings, all freight vehicles shall be fitted with reflective delineators (reflectors). Refer to Appendix I (WOS 01.I).
- 7.4 All freight vehicles shall be fitted with standard AEI tags as specified in Appendix H (WOS 01.H) of this manual.

[8]

Carrying Containers in Open Wagons

- 8.1 Containers must not be carried in open wagons unless the wagon is fitted with fixed internal locating brackets to position the container along the longitudinal centreline of the wagon.
- 8.2 Tyres and dunnage must not be used to position containers laterally in an open wagon.

WOS 01.440 - Vehicle Performance

[1]

Introduction

- 1.1 The performance of the vehicle shall be in accordance with the requirements of the ROA Manual of Engineering Standards and Practices Section 3, and any other requirements contained in this Rolling Stock Operation Standard Manual.
- 1.2 The performance specified in this Unit relates to the operation of the freight vehicle on the Australian Rail Track Corporation network. This section covers compatibility tests and structural strength.

[2]

Test Requirements Summary

- 2.1 The following table summarises the test requirements for freight vehicles:

Compatibility test	Reference
Static rolling stock outline test	WOS 01.281
Static vehicle weigh test	WOS 01.282
Static vehicle twist test	WOS 01.283 (see WOS 01.440, clause 2.2)
Vehicle/bogie swing test	WOS 01.284
Vehicle/vehicle swing test	WOS 01.285
Static brake test	WOS 01.286 and WOS 01.441
Vehicle ride performance test	WOS 01.288 and WOS 01.442 (see WOS 01.440, clause 2.2)
Kinematic rolling stock outline test	WOS 01.289 (see WOS 01.440, clause 2.2)
Pitch & bounce test	WOS 01.290
Curve stability test	WOS 01.442
Rock & roll test	WOS 01.291
Environmental tests	WOS 01.292
Electrical safety inspection	WOS 01.296

- 2.2 Vehicles equipped with standard three piece bogies, and gapped sidebearers having 10 - 14 mm clearance, may be exempt from certain tests (see table in section 2.1 above), subject to written approval from the Australian Rail Track Corporation, for operation up to 80 km/h. Torsionally stiff vehicles such as tank vehicles, and high centre of gravity vehicles may not necessarily be exempt and may require testing.

2.3 Jacking Point Vertical Load Test.

It is recommended that the owner/operator conduct jacking point vertical load tests to ensure that the vehicle is capable of withstanding loads imposed during vehicle recovery. Refer to the ROA Manual of Engineering Standards and Practices section 3.3.7.

2.4 Static End Compression Test

It is recommended that the owner/operator conduct a static end compression test to ensure that the vehicle is capable of withstanding the loads imposed during operation. Loads shall be commensurate with the proposed maximum duty of the vehicle. Refer to the ROA Manual of Engineering Standards and Practices section 3.3.9.

2.5 Single Vehicle Impact

It is recommended that the owner/operator conduct single vehicle impact tests to ensure that the vehicle is capable of withstanding the loads imposed during operation. Refer to the ROA Manual of Engineering Standards and Practices section 3.3.10.

2.6 P2 force Determination.

The P2 force shall not exceed the limits specified in WOS 01.120.

WOS 01.441 - Braking Performance

[1]

Introduction

- 1.1 Braking performance is specified to ensure that freight trains are able to brake within the current signalling requirements. Refer to WOS 01.160.

[2]

Net Brake Ratio

- 2.1 The net brake ratio is the ratio of the sum of the measured actual brake block forces in kilograms divided by the total vehicle mass, in kilograms, at rail. Refer to WOS 01.286 section 3.
- 2.2 Brake block forces are measured with the air brake in both empty and loaded conditions for a brake pipe reduction of 150 kPa. When measuring the brake block forces for the air brake, the rigging pins shall be tapped with a hammer to overcome static friction of the brake rigging.
- 2.3 Handbrake forces are measured at the brake block with a 560 Newton tangential force applied to the rim of the handbrake wheel, or the handbrake arm. When measuring the brake block forces for the handbrake or spring parking brake, the rigging pins must not be tapped.

[3]

Air Brake

- 3.1 The following net brake ratios are recommended in order to provide effective braking without skidding wheels.

- 3.2 Vehicles fitted with low friction brake blocks.

Vehicle condition	Net brake ratio
At tare or empty	55 % maximum
Fully loaded	28 % minimum

- 3.3 Vehicles fitted with medium friction brake blocks.

Vehicle condition	Net brake ratio
At tare or empty	55 % maximum
Fully loaded	20 % minimum

- 3.4 Vehicles fitted with high friction brake blocks.

Vehicle condition	Net brake ratio
At tare or empty	35 % maximum
Fully loaded	13% minimum

- 3.5 Vehicles fitted with cast iron brake blocks.

Vehicle condition	Net brake ratio
At tare or empty	55 % maximum
Fully loaded	28 % minimum

[4] Spring Parking Brake or Handbrake

- 4.1 The spring parking or handbrakes shall be able to hold the loaded vehicle on a 1 in 30 grade indefinitely.
- 4.2 The following net brake ratios are recommended in order to provide an effective parking brake.,
- 4.3 Vehicles fitted with low friction brake blocks.

Vehicle condition	Net brake ratio
Fully loaded	28 % minimum

- 4.4 Vehicles fitted with medium friction brake blocks.

Vehicle condition	Net brake ratio
Fully loaded	20 % minimum

- 4.5 Vehicles fitted with high friction brake blocks.

Vehicle condition	Net brake ratio
Fully loaded	13 % minimum

- 4.6 Vehicles fitted with cast iron brake blocks.

Vehicle condition	Net brake ratio
Fully loaded	13 % minimum

[5] Single Car Air Test

- 5.1 Each freight vehicle shall have a single car air test carried out prior to entering service. Refer to WOS 01.286 section 4.

WOS 01.442 - Freight Vehicle Ride Performance

[1]

Introduction

- 1.1 Refer to WOS 01.288 for the requirements regarding freight vehicle ride performance.

[2]

Vehicle Test Configuration

- 2.1 Refer to the ROA Manual of Engineering Standards and Practices section 3, diagram 3.1 (see Appendix G [WOS 01.G] of this manual), for a typical field worn test wheel profile. It should be noted, however, that this profile may not reflect the final field worn profile of the vehicle under test.
- 2.2 Where it is possible for a freight vehicle to be unevenly loaded, the vehicle shall be tested under the worst condition of loading. This is in addition to WOS 01.288 clause 4.5.
- 2.3 For articulated vehicles, accelerometers shall also be placed as near as practicable to the articulated bogie centre, toward the trailing end of the vehicle.

[3]

Curve Stability

- 3.1 The Australian Rail Track Corporation reserves the right to request and have a vehicle tested by the owner/operator, where in the Australian Rail Track Corporation's opinion, there is doubt regarding the stability of the vehicle during curve negotiation under draft and/or buff forces.
- 3.2 Where required, curve stability shall be tested in accordance with section 3.3.8 of the ROA Manual of Engineering Standards and Practices.

WOS 01.450 - Non-Conventional Vehicles

[1]

Introduction

- 1.1 This section specifies the minimum design and performance requirements for non-conventional rolling stock, the operation of which require that some sections of these units are not applicable.
- 1.2 Refer to the ROA Manual of Engineering Standards and Practices, Section 16.

WOS 01.451 - Articulated or Permanently Coupled Vehicles

[1]

Vehicle Types

1.1 These vehicles include:

- 1.1.1 Permanently coupled conventional vehicles with separate air brake equipment and handbrakes for each vehicle.

These vehicles shall meet the requirements of conventional vehicles with the exception of vehicle coupling and air brake connections between vehicles within the permanently coupled rake. Terminal vehicles shall have conventional couplings and air brake connections on terminal ends.

- 1.1.2 Permanently coupled conventional vehicles with shared air brake equipment and handbrakes.

- 1.1.3 Permanently coupled articulated vehicles with shared air brake equipment and handbrakes.

[2]

Air Brake Equipment

2.1 The air brake shall operate on all axles on the vehicle.

[3]

Parking Brake/Handbrake

3.1 The parking brake or handbrake shall operate on not less than 40% of the total number of axles.

3.2 The force applied by the parking brake/handbrake shall be reasonably evenly distributed over each of the handbraked axles.

[4]

Vehicle configuration

4.1 For new proposed articulated vehicles with three or more platforms, no platform shall be employed which has a male articulated connector at each end. That is, each intermediate platform shall be fitted with a male and female connector at each end, respectively.

WOS 01.452 - Rail Compatible Road Trailers

[1] **Description**

- 1.1 These vehicles use the road trailer as the vehicle underframe/body on both road and rail.
- 1.2 For use on rail, the trailer is raised to allow a rail bogie to be fitted under a special rear subframe, the front of the trailer is supported on the rear of the trailer in front. The road wheels slide forward when in rail mode.
- 1.3 A transition vehicle may be used to couple units to conventional rolling stock.

[2] **Design**

- 2.1 The trailer shall comply with the ROA Manual of Engineering Standards and Practices, Section 16.3.1.

[3] **Brake Retention**

- 3.1 These vehicles have spring applied parking brakes on the rail bogies. When the brake pipe pressure is dropped to zero, the internal spring applies the parking brake. During train inspection/examination, a brake retention test is not required.

WOS 01.460 - Vehicle Specific Requirements

[1]

General

1.1 This section covers requirements for specific types of freight rolling stock.

WOS 01.461 - Tank Wagons

[1]

Introduction

- 1.1 Tank wagons can be used to carry various commodities, some of which are under pressure. Special conditions apply to the design and operation of tank wagons.

[2]

Design

- 2.1 Tank wagons shall be designed to the requirements specified in the ROA Manual of Engineering Standards and Practices, Section 1.5.

[3]

Tank inspections

- 3.1 Tank wagons shall be inspected to the requirements specified in Australian Standard 3788.