



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline  
Engineering Standard

Category  
Rolling Stock

# Multiple Unit Train Specific Interface Requirements

## WOS 01.600

### Applicability

ARTC Network wide	
New South Wales	✓
Western Jurisdiction	
Victoria	

Primary Source  
(RIC Standard RSU 600 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 600 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 01.600 - Introduction .....	4
[1] General .....	4
[2] Authorisation of Vehicles .....	4
WOS 01.610 - Bogie Components.....	5
[1] Introduction .....	5
[2] Wheels .....	5
[3] Wheel Profiles .....	5
[4] Axles .....	5
[5] Wheel and Axles Assembly .....	5
[6] Axle Bearing Assemblies.....	5
[7] Bogie Frames and Associated Componentry.....	6
[8] Vehicle Suspension.....	6
WOS 01.620 - Brakes and Pneumatic Equipment .....	7
[1] Introduction .....	7
[2] Brake Systems .....	7
[3] Brake Equipment.....	7
[4] Identification of Cocks .....	7
WOS 01.630 - Body, Underframe and Appointments.....	8
[1] Introduction .....	8
[2] Couplers and Draftgear .....	8
[3] Jacking and Lifting Points .....	8
[4] Doors .....	9
[5] Marking .....	9
[6] Wooden Bodied Vehicles .....	9
[7] Toilets .....	9
WOS 01.640 - Vehicle Performance.....	10
[1] Introduction .....	10
[2] Test Requirements Summary .....	10
WOS 01.641 - Braking Performance.....	12
[1] General .....	12
[2] Spring parking brake or handbrake.....	12
[3] Disc brakes .....	12
WOS 01.642 - Vehicle Ride Performance.....	13
[1] Introduction .....	13
[2] Base ride performance requirements.....	13
[3] Recommended ride performance requirements.....	13
WOS 01.650 - Safety Equipment.....	14
[1] Driver's Safety System .....	14
[2] Speed Indicating Device .....	14
[3] Data Logger/Recorder .....	14
[4] Emergency Equipment .....	14
[5] Emergency Cock.....	15
[6] Communications.....	15
[7] Lights .....	15
[8] Horns .....	15

---

WOS 01.660 - Electric Train Specific Requirements .....	16
[1] Introduction .....	16
[2] Pantograph Isolation.....	16
WOS 01.670 - Diesel Train Specific Requirements.....	17
[1] Introduction .....	17

---

## WOS 01.600 - Introduction

---

### [1]

### General

- 1.1 Multiple unit trains are self propelled passenger trains made up of similar diesel or electric powered cars.
- 1.2 Some cars may be non-powered.
- 1.3 For the purposes of interpretation of this Rolling Stock Operation Standard, power cars which do not carry passengers shall be treated as a locomotive and meet the requirements specified in the 300 series of Rolling Stock Operation Standards (WOS 01.300). Dedicated trailer cars which operate in conjunction with the above mentioned power cars shall be treated as locomotive hauled passenger cars and meet the requirements of the 500 series of Rolling Stock Operation Standards (WOS 01.500).
- 1.5 Requirements that are common with other types of rolling stock are included in the 200 series of Rolling Stock Operation Standards (WOS 01.200).
- 1.6 Some earlier designs of multiple unit trains may not fully comply with these requirements but will be assessed considering the equipment fitted and the proposed use of the vehicles.
- 1.7 New special purpose multiple unit trains may not need to meet the requirements of the ROA Manual of Engineering Standards and Practices, but due regard shall be given to the application and the operation in which these vehicles are proposed to be used.

### [2]

### Authorisation of Vehicles

- 2.1 For all multiple unit trains, the vehicle information pack in Appendix A4 (WOS 01.A4) of this manual shall be completed and submitted.

---

## **WOS 01.610 - Bogie Components**

---

### **[1] Introduction**

---

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

### **[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

### **[3] Wheel Profiles**

---

- 3.1 The standard ANZR profile is the base wheel profile. Refer to WOS 01.211.
- 3.2 The Intersystem 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 multiple unit vehicles operating on the Australian Rail Track Corporation network.
- 3.3 Australian Rail Track Corporation reserves the right to request and have the owner/operator conduct an evaluation and/or tests to demonstrate the performance of any operator proposed alternate wheel profile, in accordance with WOS 01.288.

### **[4] Axles**

---

- 4.1 Refer to WOS 01.220 for common axle requirements.

WOS 01.221    Axles, Design and Manufacture  
WOS 01.222    Axles, Minimum Operational Requirements

### **[5] Wheel and Axles 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

---

## **WOS 01.620 - Brakes and Pneumatic Equipment**

---

### **[1]**

### **Introduction**

- 1.1 Multiple unit trains generally operate in sets consisting of two or more similar type vehicles.
- 1.2 The braking system shall be suitable to allow for the operation of multiple sets joined together to clear a section.

### **[2]**

### **Brake Systems**

- 2.1 Multiple unit trains shall have at least a failsafe automatic air brake system that can be operated from a hauling vehicle with a brake pipe pressure set at 500kPa.

### **[3]**

### **Brake Equipment**

- 3.1 Refer to WOS 01.271 for common brake equipment.

### **[4]**

### **Identification of Cocks**

- 4.1 All cut-out or isolation cocks shall be clearly identified and handles painted white, or other contrasting colour.

---

## **WOS 01.630 - Body, Underframe and Appointments**

---

### **[1]**

### **Introduction**

- 1.1 The vehicle body, underframe and appointments shall generally comply with the ROA Manual of Engineering Standards and Practices, Section 12.
- 1.2 Vehicle owners/operators shall have controlled rail industry accepted standards which govern the operation of vehicles with damaged body or structure.
- 1.3 Some earlier designs of multiple unit trains may not fully comply with these requirements but will be assessed considering the equipment fitted and the proposed use of the vehicles.
- 1.4 New special purpose designed multiple unit trains may not need to meet the requirements of the ROA Manual of Engineering Standards and Practices, but due regard shall be given to the application and the operation in which these vehicles are proposed to be used.

### **[2]**

### **Couplers and Draftgear**

- 2.1 Standard automatic couplers may be used on multiple unit trains provided that they are fitted with a vertical interlocking feature to prevent vehicle overriding and/or telescoping in the event of collision.

Coupler heights shall be within the following limits:

New condition	890 to 900mm
In Service condition	875 to 915mm

- 2.2 Multifunction couplers may be used in place of standard automatic couplers.
- 2.3 Where a non-standard coupler is fitted to terminal vehicles, an emergency coupler adaptor shall be provided to match up with a standard 10A contour.

### **[3]**

### **Jacking and Lifting Points**

- 3.1 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 generally specified in the ROA Manual of Engineering Standards and Practices, Section 8.2.13.
- 3.2 Vehicles shall have suitable lifting points or brackets to insert lifting hooks and shackles, as generally specified in the ROA Manual of Engineering Standards and Practices, Section 8.2.14.

---

**[4]** **Doors**

---

- 4.1 Passenger entry doors shall be fitted with a positive latching system to prevent doors being opened accidentally whilst train is in motion.

---

**[5]** **Marking**

---

- 5.1 Each vehicle of a multiple unit train shall have a unique identification code/number clearly marked on each side of the vehicle.
- 5.2 The vehicle code and number shall be readable from trackside, on station platforms and from signal boxes.
- 5.3 To enhance visibility of passenger vehicles from the side at level crossings, all passenger vehicles shall be fitted with reflective delineators (reflectors). Refer to Appendix I (WOS 01.I).
- 5.4 All multiple unit vehicles shall be fitted with standard AEI tags as specified in Appendix H (WOS 01.H) of this manual.

---

**[6]** **Wooden Bodied Vehicles**

---

- 6.1 A self propelled wooden-bodied vehicles shall be fitted with approved hazard warning lights at each terminal end and approved impact resistant barriers on the front and rear windows.
- 6.2 It is recommended that wooden bodied vehicles be fitted with approved steel collision posts at each end of the underframe to provide protection against vehicle overriding and/or telescoping in the event of a collision.
- 6.3 It is also recommended that double shelf couplers be provided as added protection against vehicle overriding and/or telescoping in the event of a collision.
- 6.4 Any self propelled wooden bodied vehicle not fitted with the above collision protection will only be permitted to move on the Australian Rail Track Corporation network under complete block working in accordance with the Train Marshalling section in the General Instruction Pages of the ARTC Train Operating Conditions manual.

---

**[7]** **Toilets**

---

- 7.1 Toilet facilities on passenger vehicles shall have either holding tanks and decanting facilities, or, as a minimum, waste processing facilities. Refer to WOS 01.150 [5].

## WOS 01.640 - Vehicle Performance

[1]

### Introduction

- 1.1 The performance specified in this Unit relates to the operation of the multiple unit self propelled trains on the Australian Rail Track Corporation network.

[2]

### Test Requirements Summary

- 2.1 The following table summarises the test requirements for multiple unit trains:

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
Vehicle/bogie swing test	WOS 01.284
Vehicle/vehicle swing test	WOS 01.285
Static brake test	WOS 01.286
Brake performance test	WOS 01.287 and WOS 01.641
Ride performance test	WOS 01.288 and WOS 01.642
Kinematic rolling stock outline test	WOS 01.289
Traction performance test	WOS 01.341
Pitch and bounce test	WOS 01.290
Rock and roll test	WOS 01.291
Noise and vibration test	WOS 01.292
Visibility test	WOS 01.293
Electrical safety inspection	WOS 01.294
Signal compatibility test	WOS 01.295
Signal interference test	WOS 01.296

### 2.2 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.

### 2.3 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.

#### 2.4 **P2 Force Determination**

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

---

## **WOS 01.641 - Braking Performance**

---

### **[1]**

### **General**

- 1.1 Braking performance is specified to ensure that multiple unit trains are able to stop within the current signalling system spacings.
- 1.2 Refer to WOS 01.160

### **[2]**

### **Spring parking brake or handbrake**

- 2.1 The spring parking or handbrakes on multiple unit trains shall be able to hold the train in crush load condition on a 1 in 30 grad indefinitely.

### **[3]**

### **Disc brakes**

- 3.1 For vehicles fitted with disc brakes, the vehicle shall be tested in a train consist for stopping distance. Refer to WOS 01.160 [4].

---

## **WOS 01.642 - Vehicle Ride Performance**

---

### **[1]**

### **Introduction**

- 1.1 The following bogie related performance parameters are the minimum requirement for the operation of multiple unit self propelled trains on the Australian Rail Track Corporation network.

### **[2]**

### **Base ride performance requirements**

- 2.1 The base ride performance requirements are specified in WOS 01.288.
- 2.2 For bogies equipped with air springs, the base ride performance also applies for vehicles with deflated air springs. A reduction in design speed may be required to achieve this.

### **[3]**

### **Recommended ride performance requirements**

- 3.1 In the interests of passenger/crew comfort and safety, the ride quality specified in the ROA Manual of Engineering and Practices, section 12.10 is recommended. In addition, hunting is not permitted. Refer to clause 3.3.

Note: The ride index algorithm in section 12.10.5 of the ROA Manual of Engineering Standards and Practices shall be replaced with that shown in section 13.4.2.2 of the ROA Manual of Engineering Standards and Practices.

- 3.2 These ride index values are recommended for wheel profiles up to the fully worn condition.
- 3.3 Sustained hunting is not permitted. In this case, hunting shall be defined as sinusoidal lateral oscillations of the wheelset resulting in greater than 0.5 Hz sinusoidal lateral body accelerations measured at the bogie centre of greater than 0.15 g sustained for 10 seconds or longer.
- 3.4 The recommended rider performance requirements are in addition to the base ride performance requirements.
- 3.5 For bogies equipped with air springs, the above ride performance also applies for vehicles with deflated air springs. A reduction in design speed may be required to achieve this.

---

## **WOS 01.650 - Safety Equipment**

---

### **[1] Driver's Safety System**

---

- 1.1 Each driven vehicle shall be fitted with driver safety systems as specified in Appendix D (WOS 01.D).

### **[2] Speed Indicating Device**

---

- 2.1 Each driving position shall have an operative speed indicating device.

### **[3] Data Logger/Recorder**

---

- 3.1 Multiple unit trains shall be fitted with a data recording system to record at least the following:

- Time
- Speed
- Brake pipe or brake cylinder pressure

- 3.2 It is desirable that the following critical driving functions be also recorded:

- Vigilance acknowledgment (where fitted)
- Throttle position
- Brake valve position
- Horn operation
- Headlight operation
- Distance

- 3.3 The system shall have provision for identification of driver. If this is not possible, train crew rosters shall be kept to enable drivers to be identified.

- 3.4 Some earlier designs of multiple unit trains currently operating do not have data loggers or Hasler recorders. In such cases, the design will be assessed considering the equipment fitted and the proposed use of the train.

### **[4] Emergency Equipment**

---

- 4.1 Each multiple unit train shall be supplied with the following emergency equipment:

- 4.1.1 Detonator box contents
- 4.1.2 Rope
- 4.1.3 Air hose spanners
- 4.1.4 Fire extinguisher
- 4.1.5 Air hoses
- 4.1.6 Emergency coupler (where applicable)

---

**[5] Emergency Cock**

---

- 5.1 Multiple unit train shall be fitted with an emergency cock or failsafe emergency brake pipe dump control near each crew position. The cock when opened shall directly vent the brake pipe.

---

**[6] Communications**

---

- 6.1 Multiple unit trains shall be fitted with a train radio system.

---

**[7] Lights**

---

- 7.1 Each terminal multiple unit car shall be fitted with marker/tail lights.
- 7.2 Each terminal multiple unit car operating outside the Sydney or Newcastle metropolitan areas shall be fitted with headlights.
- 7.3 Each terminal multiple unit car operating outside the Sydney or Newcastle metropolitan areas shall be fitted with high visibility ditch lights (fog lights). These lights shall be 70 watt combination driving/fog lights and shall be positioned such that the beam of light is at an angle of 7.5 degrees from and crossing the vehicle centreline.

---

**[8] Horns**

---

- 8.1 Multiple unit trains shall be fitted with a town and country horns (with high and low noise features).
- 8.2 The noise level shall comply with the following requirements (refer to the ROA Manual of Engineering Standards and Practices Table 13.2):

	<b>Main Horn</b>	<b>Low Horn</b>
Speed	Stationary	Stationary
External location	200m in front	100m in front
External noise limit	88dB(A) min	85dB(A) min 90dB(A) max
Driver's cab internal noise limit	85dB(A) max	85dB(A) max

---

## **WOS 01.660 - Electric Train Specific Requirements**

---

**[1]**

### **Introduction**

---

1.1 This unit covers specific requirements relating to electric multiple unit trains.

**[2]**

### **Pantograph Isolation**

---

- 2.1 Pantographs on electric trains should be electrically separated such that one pantograph raised will not provide power to the lowered pantographs.
- 2.2 Where the pantographs on an electric train are not electrically separated, a pantograph isolating switch shall be fitted to allow electrical separation of the pantographs.

---

## **WOS 01.670 - Diesel Train Specific Requirements**

---

**[1]**

**Introduction**

---

1.1 This unit covers specific requirements relating to diesel multiple unit trains.