



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline
Engineering Standard

Category
Rolling Stock

Locomotive Specific Interface Requirements WOS 01.300

Applicability

ARTC Network wide	
New South Wales	✓
Western Jurisdiction	
Victoria	

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WOS 01.300 - Introduction

[1]

General

- 1.1 The 300 series of Rolling Stock Operation Standard contain specific interface requirements for locomotives operating on the Australian Rail Track Corporation network.
- 1.2 Interface requirements that are common with other types of rolling stock are included in the 200 series of Rolling Stock Operation Standard.
- 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 Standard. 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 Standard.

[2]

Authorisation of Vehicles

- 2.1 For all locomotives, the vehicle information pack in Appendix A1 (WOS 01.A1) shall be completed and submitted.

WOS 01.310 - Introduction

[1] General

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

[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] Axles

- 3.1 Refer to WOS 01.220 for common axle requirements

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

[4] Wheel and Axle Assembly

- 4.1 Refer to WOS 01.230 for common wheel and axle assembly requirements

[5] Axle Bearing Assemblies

- 5.1 Refer to WOS 01.240 for common axle bearing assembly requirements

[6] Bogie Frames and Associated Componentry

- 6.1 Refer to WOS 01.250 for common requirements for bogie frames and associated componentry

[7] Vehicle Suspension

- 7.1 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 01.320 - Brakes and Pneumatic Equipment

[1] Introduction

- 1.1 The braking systems and equipment fitted to locomotives must be compatible with the brake systems and equipment of vehicles being hauled by the locomotive to ensure that the brakes apply and release as required. Otherwise skidded or scaled wheels could occur.

[2] General Requirements

- 2.1 In general, locomotives shall comply with the requirements of the ROA Manual of Engineering Standards and Practices, Section 13.10.
- 2.2 The automatic brake valve shall:
- charge the brake pipe when in release
 - reduce the brake pipe pressure when applying brakes
 - fully exhaust the brake pipe when in emergency
- 2.3 Some earlier designs of locomotives may not fully comply with these requirements but will be assessed considering the type of brake equipment fitted and the proposed use of the locomotive.

[3] Location of End Equipment

- 3.1 Locomotives shall have coupling cocks located as shown in the ROA Manual of Engineering Standards and Practices, Diagrams 13-12 and 13-13 (see Appendix G [WOS 01.G] of this manual).

[4] Standard Pressures and Timings

- 4.1 Standard pressures shall comply with the requirements of the ROA Manual of Engineering Standards and Practices, Section 13.10.2.

[5] Brake Equipment

- 5.1 Refer to WOS 01.271 for common brake equipment.

[6] Identification of Cocks

- 6.1 All cut-out or isolation cocks shall be clearly identified and handles painted white. Refer to the ROA Manual of Engineering Standards and Practices, Section 13.16.3.

[7]

Air Dryers

- 7.1 It is recommended that air dryers be fitted to reduce the damage caused by water on brake equipment.
- 7.2 It is recommended that silencers be fitted to the air exhaust of the air dryers and that the exhaust be directed such that dust is not blown up around the locomotive.

WOS 01.321 - Dynamic/Regenerative Brake

[1]

General

- 1.1 It is recommended that locomotives, where practicable, have an operable dynamic or regenerative brake.

Refer to the ROA Manual of Engineering Standards and Practices, Section 13.5.6.6

[2]

Inoperative Dynamic Brake

- 2.1 Locomotives without an operative dynamic or regenerative brake will be subject to restrictions when operating as light locomotives on descending grades from Katoomba to Valley Heights or from Summit Tank to Unanderra.

Refer to Train Operations in the General Instruction Pages of the ARTC Train Operating Conditions Manual.

WOS 01.330 - Body and Underframe

[1] General

- 1.1 The locomotive body and underframe shall generally comply with the ROA Manual of Engineering Standards and Practices, Section 13.7.
- 1.2 Some earlier designs of locomotives may not fully comply with these requirements but will be assessed considering the equipment fitted and the proposed use of the locomotive.
- 1.3 New special purpose designed locomotives 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 locomotives are proposed to be used.

[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 13.8.
- 2.2 Coupler heights shall be within the following limits:

New condition, full provisions	880 to 890 mm.
In service condition	840 to 900 mm.

[3] Toilets

- 3.1 Where a toilet is fitted, it shall be in accordance with WOS 01.150 clauses 5.3 and 5.4.

[4] Cowcatcher or Pilot

- 4.1 Locomotives shall be fitted with a cowcatcher, pilot or wheel guard iron to deflect and prevent beasts or other objects on the track from passing under the locomotive.
- 4.2 The minimum height of the cowcatcher or pilot shall be 80 mm above rail with solid springs and wheels at condemn diameter. If spring packing is proposed at wheel turnings, then the minimum height shall be 80 mm with solid springs.
- 4.3 The height for wheel guard irons above rail under any condition of wear and dynamics shall not be less than 30 mm.

[5] Marking

- 5.1 Each locomotive shall have a unique identification code/number clearly marked on each side and each end of the locomotive. The minimum height of lettering shall be

125 mm. The colour of marking shall contrast with the background colour of the locomotive. Refer to the ROA Manual of Engineering Standards and Practices, Section 13.16.3.

- 5.2 It is recommended that locomotives be fitted with number lights. Refer to the ROA Manual of Engineering Standards and Practices, Section 13.12.9.4.
- 5.3 The ends of the locomotive should be painted in contrasting colours to enhance visibility by trackside personnel and motorists at level crossings.
- 5.4 To enhance visibility of locomotives from the side at level crossings, locomotives shall be fitted with reflective delineators (reflectors). Refer to Appendix I (WOS 01.I).
- 5.5 Locomotives shall have the fully provisioned mass, the tare mass and the coupled length stencilled on each side of the locomotive at or about underframe/solebar level.

[6] Vehicle Identification

- 6.1 All locomotives shall be fitted with standard AEI tags as specified in Appendix H (WOS 01.H).

[7] Cab Security

- 7.1 All locomotives should be fitted with a means of locking the cab when unattended. This is mandatory for locomotives used or proposed for driver only operation.

WOS 01.340 - Vehicle Performance

[1]

Introduction

- 1.1 The performance of the locomotive shall be in accordance with the requirements of the ROA Manual of Engineering Standards and Practices Section 13, 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 locomotive on the Australian Rail Track Corporation network. This section covers compatibility tests, adhesion and structural strength tests.

[2]

Test Requirements Summary

- 2.1 The following table summarises the test requirements for locomotives

Compatibility test	Reference
Static rolling stock outline test	WOS 01.281
Static vehicle weigh test	WOS 01.282 (see 2.5 below)
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 and WOS 01.342
Brake performance test	WOS 01.287 and WOS 01.342
Ride performance test	WOS 01.288 and WOS 01.343
Kinematic rolling stock outline test	WOS 01.289
Traction performance test	WOS 01.341
Rock & roll test	WOS 01.291
Environmental tests	WOS 01.292
Signal 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 locomotive is capable of withstanding loads imposed during vehicle recovery. Refer to the ROA Manual of Engineering Standards and Practices section 13.7.

2.3 Static End Compression Test

It is recommended that the owner/operator conduct a static end compression test to ensure that the locomotive is capable of withstanding the loads imposed during operation. Loads shall be commensurate with the proposed maximum duty of the locomotive. Refer to the ROA Manual of Engineering Standards and Practices section 13.7.

2.4 P2 force Determination

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

- 2.5 Locomotives shall be type tested to determine the fully provisioned mass, however, where any axle load can possibly exceed agreed limits each locomotive of that type shall be weighed to determine the load distribution across all axles.

NOTE: For maximum adhesive tractive effort, it is in the interest of owner/operators to have their locomotive axle load distribution on driven axles within the limits specified in Appendix C (WOS 01.C) of this Rolling Stock Operation Standard manual.

WOS 01.341 - Traction Performance

[1]

Introduction

- 1.1 Traction performance tests shall be carried out for each type of locomotives to determine the loads that the locomotive can be expected to haul under all weather conditions.
- 1.2 Traction performance tests shall be conducted with the locomotive having minimum supplies and ten per cent fuel capacity.
- 1.3 Following the completion of the above tests, the agreed locomotive loads and conditions, for operation on the Australian Rail Track Corporation network, will be published in the ARTC Train Operating Conditions manual.

[2]

Sand

- 2.1 Locomotives may use sand to enhance the adhesion capabilities in poor conditions.
- 2.2 Locomotives using sand shall have approved desanding equipment. Refer to the ROA Manual of Engineering Standards and Practices section 13.11.5.3.
- 2.3 Locomotives equipped with sanding equipment for adhesion enhancement shall have adequate measures in place to prevent sand leakage and abnormal sanding.

[3]

Wheelslip Control

- 3.1 It is recommended that all locomotives be fitted with a suitable wheelslip control system to prevent uncontrolled wheelslip.
- 3.2 For new or substantially modified locomotives, they shall be fitted with a suitable wheelslip control system to prevent uncontrolled wheelslip. Notwithstanding the above requirements, wheelslip detection shall be train lined to ensure that wheelslip on other locomotives in a multiple unit consist is capable of being monitored by the driver.

WOS 01.342 - Braking Performance

[1]

Introduction

- 1.1 Braking performance is specified to ensure that locomotives are compatible with spacing and overlaps of the current signalling systems. Refer to WOS 01.160.

[2]

Static Brake Tests

- 2.1 Static brake valve tests shall be conducted to ensure that the brakes apply and release and that the pressures and timings comply with the requirements of the ROA Manual of Engineering Standards and Practices Section 13.10.

[3]

Dynamic Brake Performance

- 3.1 Braking performance of the locomotive shall comply with the requirements of the ROA Manual of Engineering Standards and Practices Section 13.10.1.

[4]

Locomotives to be Hauled Dead Attached

- 4.1 Locomotives that are to be hauled dead attached on the rear of a train or within a train consist but not marshalled against the train locomotives shall be single car tested for sensitivity of the brake equipment. Refer to WOS 01.286 [4].

[5]

Spring parking brake or handbrake

- 5.1 The spring parking or handbrakes on locomotives shall be capable of holding the locomotive in the fully provisioned condition on a 1 in 30 grade indefinitely.

WOS 01.343 - Locomotive Ride Performance

[1]

Introduction

- 1.1 The following bogie related performance parameters are the minimum requirement for the operation of locomotives on the Australian Rail Track Corporation network.

[2]

Base Ride Performance Requirements

- 2.1 The base ride performance requirements are as specified for freight vehicles in WOS 01.288, section 3.
- 2.2 For locomotives equipped with vibration isolated cabs, the base ride performance specified shall be measured using accelerometers positioned outside the cab, but as near as possible to the locomotive trailing bogie centre.

[3]

Recommended Ride Performance Requirements

- 3.1 In the interests of crew comfort and safety, the ride quality specified in the ROA Manual of Engineering Standards and Practices, section 13.4.2 and 13.4.3 is

Speed (km/h)	Vertical Ride Index	Lateral Ride Index
Maximum Design Speed	3.2	3.0

- 3.2 These ride index values are recommended for wheels 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 For locomotives with vibration isolated cabs, it is recommended that the ride index be measured using accelerometers positioned inside the cab, as close as possible to the bogie centre.
- Hunting is assessed using a lateral accelerometer positioned on the underframe outside the cab, as near as possible to the trailing bogie centre.
- 3.5 These recommended ride performance requirements are in addition to the base ride performance requirements specified in WOS 01.288.

WOS 01.350 - Safety Equipment

[1]

Driver's Safety System

- 1.1 Each locomotive, except those covered in 1.2 or 1.3 below, shall be fitted with driver's safety systems as specified in Appendix D (WOS 01.D).
- 1.2 Some locomotives, eg shunting locomotives and shunting tractors which are confined to shunting yards, may be exempt from this requirement for shunting use only. Where such a locomotive may possibly be used on a train or travel light engine on the Australian Rail Track Corporation network it shall comply with the above requirements or operate under special conditions as determined by the Australian Rail Track Corporation.
- 1.3 Steam and heritage locomotives may be exempt from this requirement and operate under special conditions as determined by the Australian Rail Track Corporation.

[2]

Speed Indicating Device

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

[3]

Data Logger/Recorder

- 3.1 Each locomotive, except those covered in 3.5 below, shall be fitted with a data recording system to record at least the following functions:-
 - time
 - speed
 - brake pipe pressure
 - throttle position
- 3.2 It is desirable that the following critical driving functions be also recorded:-
 - vigilance acknowledgment
 - brake valve position
 - sanding operation
 - horn operation
 - headlight operation
- 3.3 The system shall have provision for identification of the driver.
- 3.4 Refer also to the ROA Manual of Engineering Standards and Practices section 13.14.2.1.
- 3.5 Some locomotives, eg shunting locomotives and shunting tractors, which are confined to shunting yards, may be exempt from this requirement for shunting use only. Where such a locomotive may possibly be used on a train or travel light engine on the Australian Rail Track Corporation network it shall comply with the above requirements.

[4]	Driver's Emergency Cock
------------	--------------------------------

- 4.1 Locomotives shall be fitted with an emergency cock or failsafe emergency brake pipe dump control near each driving position. The cock when opened shall directly vent the brake pipe.

[5]	Flowmeter
------------	------------------

- 5.1 Locomotives shall have a means of indicating both audibly and visually, that air is being fed to the brake pipe.

[6]	Emergency Equipment
------------	----------------------------

- 6.1 Each locomotive, except those covered in 6.2 below, shall be supplied with the emergency equipment as specified in SWU 141 [e].
- 6.2 Some locomotives, eg shunting locomotives and shunting tractors which are confined to shunting yards, may be exempt from this requirement for shunting use only. Where such a locomotive may possibly be used on a train or travel light engine on the Australian Rail Track Corporation network it shall comply with the requirements of 6.1.

[7]	Communications
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- 7.1 Locomotives, except those covered in 7.2 below, shall be fitted with a train radio system as specified in the ROA Manual of Engineering Standards and Practices section 13.5.3.6. Radio frequencies shall be approved by the Australian Rail Track Corporation.
- 7.2 Some locomotives, eg shunting locomotives and shunting tractors which are confined to shunting yards, may be exempt from this requirement for shunting use only. Where such a locomotive may possibly be used on a train or travel light engine on the Australian Rail Track Corporation network it shall comply with the requirements of 7.1.

[8]	Lights
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- 8.1 Each locomotive shall be fitted with headlights as specified in the ROA Manual of Engineering Standards and Practices section 13.12.9.1.
- 8.2 Each locomotive shall be fitted with marker/tail lights as specified in the ROA Manual of Engineering Standards and Practices section 13.12.9.4.
- 8.3 Each locomotive, except those covered in 8.4 below, shall be fitted with high visibility ditch lights (fog lights) as specified in the ROA Manual of Engineering Standards and Practices section 13.12.9.8. These lights shall be 100 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 locomotive centreline.
- 8.4 Some earlier designs of locomotives may not fully comply with, or may be exempt from, these requirements. In such cases, the design will be assessed considering

the equipment fitted and the proposed use of the locomotives.

[9]

Horns

- 9.1 Locomotives shall be fitted with a town and country horns (with high and low noise features).
- 9.2 The noise level shall comply with the following requirements: (Refer to the ROA Manual of Engineering Standards and Practices Table 13.2).

	High Noise Horn	Low Noise Horn
Speed	Stationary	Stationary
External location	200 m in front	100 m in front
External noise limit	88 dB(A) min	85 dB(A) min 90 dB(A) max
Driver's cab internal noise limit	85 dB(A) max	85 dB(A) max

WOS 01.360 - Locomotive Type Specific Requirements

[1]

Introduction

- 1.1 This section includes specific requirements for diesel/electric, diesel/hydraulic, electric and stem locomotives.

WOS 01.361 - Diesel/Electric or Diesel/Hydraulic Locomotives

[1]

Introduction

- 1.1 This unit covers specific requirements relating to diesel/electric or diesel/hydraulic locomotives.

WOS 01.362 - Electric Locomotives

[1]

Introduction

- 1.1 This unit covers specific requirements relating to electric locomotives.
- 1.2 Refer to WOS 01.130 for pantograph / wire interface requirements.

[2]

Pantograph isolation

- 2.1 Where two pantographs on a locomotive are electrically connected, a pantograph isolating switch shall be fitted to allow electrical separation of the two pantographs.

[3]

Use of multiple pantographs

- 3.1 Restrictions applying to the number of pantographs that are permitted to be simultaneously raised on locomotives are specified in the ARTC Train Operating Conditions manual.

WOS 01.363 - Steam Locomotives

[1] Introduction

- 1.1 This unit covers specific requirements relating to steam locomotives.

[2] Boiler Inspections

- 2.1 Each steam locomotive shall have a boiler inspection in accordance with the requirements of the WorkCover Authority.

[3] Adhesion Test

- 3.1 Each steam locomotive shall have an adhesion test conducted every two (2) years to confirm the all weather hauling capability of the locomotive.
- 3.2 Following the derating of the boiler capacity on any steam locomotive, an adhesion test shall be conducted to determine the all weather hauling capability of the locomotive.

[4] Locomotive Running Gear

- 4.1 Owner/operators shall follow proven industry standards and have procedures in place for maintenance activities. These procedures shall include but not be limited to the following:
- 4.1.1 Trammelling of bogie frames and underframes (where applicable)
 - 4.1.2 Non destructive testing
 - 4.1.3 Repair of bogie frames, underframes and associated componentry including welding, riveting, straightening and heat treatment
 - 4.1.4 Maintenance of pedestal opening and other component interface dimensions (where applicable)
 - 4.1.5 Inspection and lubrication of running gear.

[5] Bogie Frame/Underframe Defects

- 5.1 Owner/operators shall not place into service, or continue in service, bogie frames or underframes, including associated components, with the following defects:
- 5.1.1 Critically cracked frame and associated components.

Owner/operators shall follow proven industry standards and have procedures in place for the regular monitoring of cracks with due regard to their propagation rate to ensure that the components are removed from

service before the crack reaches a critical dimension.

- 5.1.2 Frames and associated components which are bent or distorted.
- 5.1.3 Loose, missing, or broken, rivets or huck bolts, locating bolsters, transoms, headstocks, W-guards or other major frame components, where applicable.
- 5.1.4 Timber components which have split, or are rotted, compromising their integrity.

[6] Action Required Following Derailments

- 6.1 Owner/operators shall follow proven industry standards and have procedures in place for bogie frame, running gear and underframe inspection and requalification following any derailment, in order to mitigate the risk of premature inservice failure or further derailments.

[7] Bearing Assemblies

- 7.1 Owner/operators shall follow proven industry standards and have procedures in place for the inspection, maintenance and lubrication of all bearing assemblies.

[8] Firebox Servicing

- 8.1 Owner/operators shall not discharge the firebox or ash pan onto the Australian Rail Track Corporation tracks.

WOS 01.364 - Driver Only Operation

[1]

Introduction

1.1 This unit covers specific requirements relating to locomotives used in driver only operation.

[2]

Additional Equipment

2.1 Lead locomotives of a Driver Only Operated train shall:-

- be fitted with a pressure maintaining brake valve
- be fitted with working 'on board' communications equipment which provides direct communications with the Train Control Centre
- have reduced vigilance control system timings in accordance with Rolling Stock Operation Standard Appendix D (WOS 01.D), Table D1.
- not be operated with long end leading in the case of single cab locomotives.
- be fitted with door locks to prevent illegal entry of cab while locomotive is unattended.

2.2 A Dump Valve Clamp (DVC) must be carried in the lead locomotive.

WOS 01.365 - Remote Controlled Locomotives

[1]

Introduction

- 1.1 This unit covers specific requirements relating to locomotives being operated by remote control from another locomotive.
- 1.2 Remote locomotives may be marshalled within a train consist or at the rear of the consist.
- 1.3 The remote locomotive can be controlled from the leading locomotive of a train through hard wiring or by radio signal.
- 1.4 Refer to Distributed Power in Locomotive Operations, General Instruction Pages of the ARTC Train Operating Conditions manual.

[2]

Radio Control

- 2.1 Radio control equipment must be approved by the Australian Rail Track Corporation.