

**FRONZ / ONTRACK  
APPROVED CODE OF PRACTICE  
FOR  
HERITAGE NETWORK OPERATORS**

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<p><b>Mechanical Code B3.1.1.01</b></p> <p><b>MECHANICAL CODE OF PRACTICE</b></p>
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Issue	Prepared (P), Reviewed (R), Amended (A)	Approved by	Effective Date
Draft	P McCallum (P)		22 Dec 2005
1	P McCallum (A)	Heritage Technical Committee	27 June 2006
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**Reference Material**

Source	Description	Date	Reference
Toll Rail	Mechanical Code M2000 – Issue 6	1/5/2001	1
NZ Railways	Mechanical Codes (various)	---	2
Tranz (Toll) Rail Inspectors	Current practice		3
Heritage Operators	Current practice	---	4
Industry	Good practice		5
NRSS (6 & 11)	National Rail System Standard		6

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### Amendment History

Version	Section	Amendment
Draft		Released 22/12/2005
1.0	3.14 - Glass	Changed requirement to remove anomaly.
	3.26.4 – Wheel Profiles	Revised para (h). Added explanation of tread and tyre thickness limits. Amended and expanded tread and tyre thickness limits chart to comply with Plan Y/X 7601/4, Toll Rail Code M6000 and current Toll Rail practice
	General	Reminder notes removed
	3.4.3 (b) – Liners etc	Keep clearances for 25140 and 25330 bogies confirmed.
	3.6 (t) - Bogies	Need for para confirmed.
	3.8 (f) - Brakes	Loco handbrake turns specified.
	3.8 (g) - Brakes	Reference to code B3.2.1.01 added
	Various	References to B3.1.3.01 - Maintenance Schedule Guidelines amended
	Various	References to Supplementary Codes corrected
2.0	3.62.4	Corrected errors in wheel tread condemning (Z) limits

New amendments are marked thus.

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## 1 INTRODUCTION

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### 1.1 Purpose

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The purpose of this Mechanical Code is to provide the framework of a maintenance and inspection regime for Heritage Rail Vehicles operating on the National Rail System (NRS) and ensure that these vehicles:-

- are in a fit and safe condition for operation and
  - comply with
    - applicable National Rail System Standards (NRSS)
    - the Railways Act 2005
    - the Health and Safety in Employment Act and the associated regulations
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### 1.2 Scope

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This Mechanical Code (and associated codes and manuals) applies to maintenance of all locomotives, passenger rolling stock (including service wagons) and associated equipment operated on the National Rail Network by Heritage Network Operators (HNO's) or external parties contracted to maintain such equipment.

It includes the standards and practices that are generally applicable to all HNO's, but does not include codes that are specific only to individual operators.

This code recognises

- The age of equipment operated
- The infrequent use of the equipment
- The limitation on operating speeds.
- The use of untrained staff under supervision for maintenance tasks.

It is assumed that this code only applies to vehicles operating less than 75,000 km per year. Some elements of this code will need modification for more frequent use.

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### 1.3 Additions and Variations

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In addition to this code, Operators must add codes and manuals applicable to their equipment that is not covered here.

Operators may modify this code to their own circumstances provided that:-

- Such variations do not increase the risks of operation.
  - They are in accordance with good railway practice.
  - They have been reviewed in accordance with *B3.1.1.02 - Engineering Change Process* or the operators Engineering Change Process.
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### 1.4 Application

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The provisions of this Code apply

- whenever a vehicle or item undergoes a scheduled inspection or check or scheduled maintenance.
  - whenever any evidence of non-compliance can be reasonably noticed.
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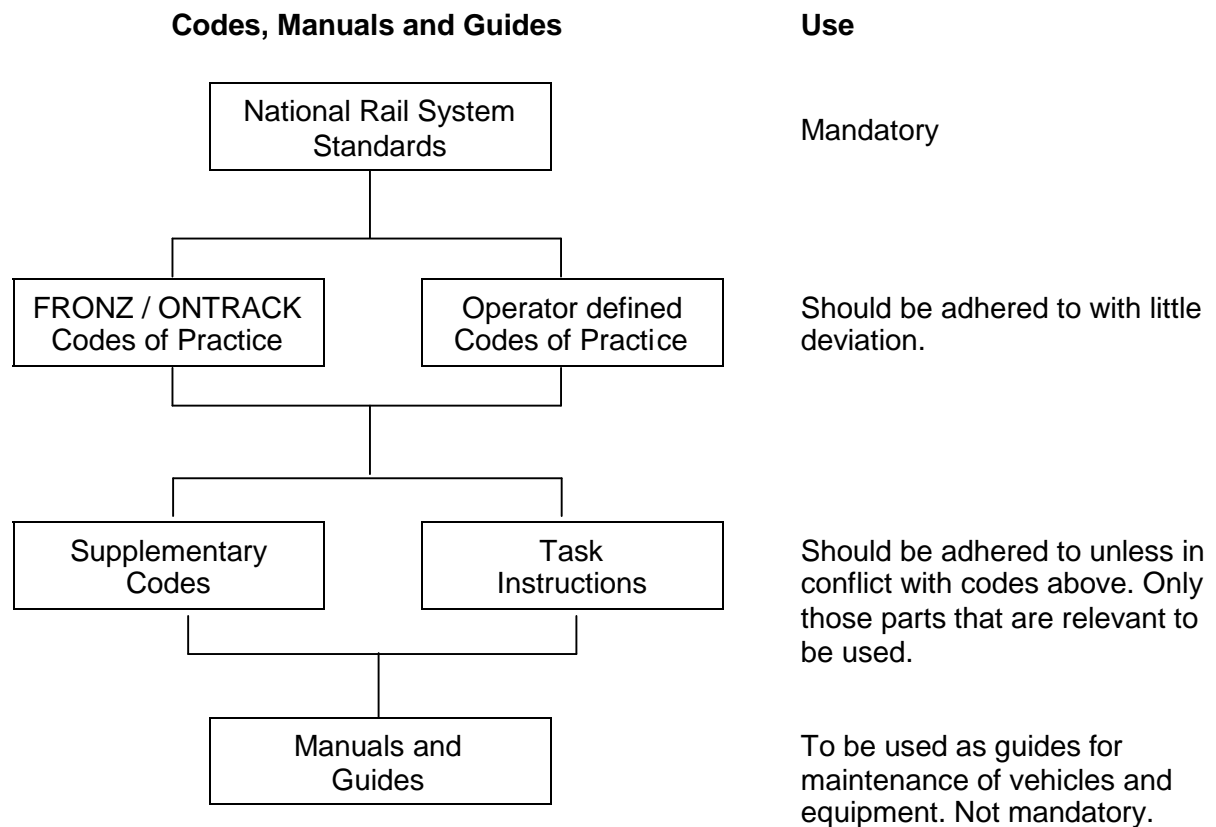
### 1.5 Associated Codes and Manuals

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Codes, supplementary codes, schedules, task instructions, guides and manuals associated with this Mechanical Code are listed in *B3.0.0.01 – Index to Mechanical Codes*.

## 1.6 Code Hierarchy

The codes and practices used in preparation of this maintenance and inspection regime have been drawn from a variety of sources and eras. As standards and methods have changed over the years there may be conflict between different codes. To avoid confusion the following hierarchy applies:-



## 1.7 Non Conformance Policy

This code (and its supporting documents) states wear or damage limits beyond which vehicles are not permitted to operate. These limits are set at levels which allow a vehicle to operate safely in general service without any special instructions. Inspectors and maintenance staff using this code must apply these limits as stated.

Authority for continued operation of vehicles beyond these general wear limits may be granted where restrictions or a special inspection regime can be applied to maintain safety margins. Continued operation beyond Code limits will be allowed where:

- This can be achieved with safety (special restrictions to be applied if appropriate)
- Those operating the vehicle are made aware of the restrictions that apply.
- A timeframe is set for rectification of the non-complying item.

These conditions only being satisfied where the operation is properly authorised by means of the Mechanical Engineering Non Conformance system and approved by an authorised person.

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## 1.8 Movement for Repair of Non Conforming Vehicles

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Any vehicle which cannot be allowed to run to destination, because of the nature of the damage or defect may still be moved to another location for repair under the following conditions:

- (a) The vehicle must be inspected by an approved person who can verify if the vehicle can run and under what conditions.
- (b) If on the NRS the Network Control Centre must be advised of the defect, any restrictions on the movement and the proposed journey; and
- (c) Where necessary a Bulletin or other advice must be issued to operating staff noting any specific hazards. Refer to the ONTRACK Rail Operating Code.

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## 1.9 Modifications or Alterations to Equipment (ECP process)

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An Engineering Change is defined as any alteration to the

- materials; or
- design; or
- construction methods; or
- maintenance methods

of any rail vehicle or equipment.

Such changes may have safety consequences beyond the understanding of the person making the change. Such consequences can include changes to strength, ride characteristics, fatigue life, passenger safety etc

All proposed changes must be evaluated and approved in terms of the operators Engineering Change Process before implementation.

A recommended ECP is included in *B3.1.1.02 - Engineering Change Process*

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## 1.10 Responsibility

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It is the responsibility of all staff engaged in the maintenance and repair of mechanical equipment to ensure that all work undertaken by them, or people under their supervision, meets the requirements of this Code or the operator's codes, supporting documents and sound railway engineering practice.

### **Authorities for Actions:**

Only staff authorised by the operator or ONTRACK may undertake certain tasks. It is the operator's responsibility to define these authorities and ensure that all staff engaged in the maintenance and repair of mechanical equipment are aware of these.

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## 1.11 Inspection Philosophy

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The inspection and maintenance intervals provided in *B3.1.3.01 - Maintenance Schedule Guidelines* and *B3.1.3.02 - Inspection Schedule* are based on

- Practices applying when the equipment was in regular railway operation.
- The known reliability of mechanical equipment gained from normal operational experience.
- The age of the equipment
- The frequency of use.



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## 2 SCHEDULED INSPECTIONS AND MAINTENANCE

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### 2.1 Inspection Frequency

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Rail vehicles and equipment are to be inspected in accordance with *B3.1.3.02 - Inspection Schedule*.

**IMPORTANT**

***Inspection of equipment not identified within B3.1.3.02 is the responsibility of the operator.***

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### 2.2 Inspection Standards

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All rail vehicles and equipment will be inspected in accordance with this code and specific task instructions and check sheets as per the Inspection Schedule.

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### 2.3 Revocation

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Any Approved Person appointed by the operator, 3<sup>rd</sup> party inspector, or external auditor may revoke a Certificate of Inspection if there is evidence that the vehicle does not comply with this code.

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### 2.4 Maintenance Frequency

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Rail vehicles and equipment are to be inspected and maintained in accordance with the principles described in *B3.1.3.01 - Maintenance Schedule Guidelines*.

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### 2.5 Maintenance Standards

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All rail vehicles and equipment will be maintained in accordance with this code and specific task instructions and check forms as per *B3.1.3.01 - Maintenance Schedule Guidelines* or the operator's Maintenance Schedule.

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### 2.6 Fault Identification and Reporting

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Operators must have a regime for the recording and follow up of faults identified during the operation of vehicles by operating staff, contract operators and other operators staff (for joint operations).

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### 2.7 Reporting & Records

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Records must be made of all maintenance and inspections using the forms included with this code or as listed in the operator's forms register.

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### 3 LOCOMOTIVES, RAILCARS, PASSENGER VEHICLES AND WAGONS

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#### 3.1 Air Compressors

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- (a) All air compressors must be tested after overhaul or major repairs or at intervals specified in *B3.1.3.02 - Inspection Schedule*. The test procedures are as specified in *B3.2.1.01 - Air Brake System Test Codes*.<sup>4</sup>
- (b) Air compressors should be maintained as specified *B3.2.3.01 - Brake Service Schedule* and manufacturers instructions.<sup>4</sup>
- (c) Steam driven air compressors are to be overhauled in accordance with *B3.2.7.01 - Operation and Maintenance of Steam Driven Air Pumps*. Other compressors should be maintained in accordance with manufacturers instructions.<sup>4</sup>

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#### 3.2 Air Reservoirs

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- (a) Air reservoirs should be installed in accordance with *B3.2.2.01 - Westinghouse Brake Air-Reservoirs (NZR Code 28; Issue 4 of 1/3/73)*.<sup>2</sup>
- (b) An annual visual inspection must be made of all fittings, safety valves, support brackets, pipework and reservoir surface especially around support brackets.<sup>5</sup>
- (c) Reservoirs must also be inspected in accordance with *B3.1.3.02 - Inspection Schedule*.<sup>4</sup>

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#### 3.3 Axles

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- (d) No axle may be cracked or broken;<sup>1</sup>
- (e) No axle may have a gouge in the surface that is between the wheels and is more than 3 mm deep;<sup>1</sup>
- (f) No axle may be metal sprayed, welded or gas cut.<sup>1</sup>
- (g) Wheelsets that have been in a severe derailment must be examined in a workshop before being placed back into service.<sup>1</sup>
- (h) An axle that has been derailed must be checked to ensure it has not been bent. This may be measured using the appropriate "back to back" gauge at four equidistant positions around the circumference of the wheels. On axles that are under vehicles, measure the back-to-back dimension at the 9 o'clock and 3 o'clock positions then turn the wheel a quarter of a turn and repeat the measurements. Gauge Y/X 4603/10<sup>1</sup>  
Repairs and replacements shall conform to *B3.4.2.01- Axles (NZR Code 3; Issue 3 of 1/5/47 and Issue 4 of 1/7/73)* as applicable.<sup>2</sup>
- (i) Plain journals shall not be turned below the condemning sizes shown in <sup>2</sup>  
*B3.4.2.01- Axles*
  - *NZR Code 3, Issue 4, Clause 6* for cars and wagons.
  - *NZR Code 3, Issue 3, Clause 19* for steam locomotives.Manufacturers' specification for other vehicles.
- (j) Axle mounted pulleys must be secure on their axles and aligned with the generator pulley.<sup>3</sup>
- (k) Axles shall be ultrasonically tested at intervals specified in the *B3.1.3.02 - Inspection Schedule* and *B3.1.4.01- Task Instruction – Corrosion crack and structural inspection of vehicle components*.<sup>4</sup>

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### 3.4 Axleboxes and Bearings

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#### 3.4.1 Axleboxes and Roller Bearings

- (a) Unless otherwise instructed below axleboxes and bearings should be maintained in accordance with *B3.4.2.09 - Axle Boxes For Locomotives And Rolling Stock (NZR Code 37; Issue 4 and Issue 5)* as applicable. <sup>2</sup>
- (b) A bearing that leaks wet grease must have the grease wiped away with a cloth or wire brush and the end cap painted blue. <sup>1</sup>
- This indicates that leaked grease has been removed. If a bearing with a blue cover is found to be leaking grease it must be removed from service. <sup>1</sup>
- (c) Oil lubricated axleboxes must be filled to the correct level and the drain plug secured by locking wire. <sup>2</sup>
- (d) A package roller bearing must not have; <sup>1</sup>
- a loose or missing cap screw
  - a damaged, missing, or improperly applied locking tab
  - cracked or chipped outer cup
  - or a loose backing ring;
- (e) A package roller bearing must not have a seal that is <sup>1</sup>
- loose
  - damaged
  - leaking grease, as indicated by excessive build up of dry grease or continuous seepage of wet grease (other than normal leakage from new bearings.)
- (f) A roller bearing axlebox must have a secure cover, must not show signs of overheating and must be greased in accordance with the appropriate maintenance schedule. <sup>1</sup>
- (g) Axleboxes must not show signs of cracking, loose bolts or excessive leakage (as per package bearing in (b) above) or bearing collapse. <sup>1</sup>
- (h) Main driving wheel axleboxes fitted with crown brasses and side liners must not allow continuous or heavy rubbing of the wheels on the frames. Possible causes are:- <sup>3</sup>
- Axlebox brass side liners badly worn.
  - Axle box horn guides worn.
  - Broken axle box.
  - Crown brass worn out or broken.
- (i) A bearing adapter must not be <sup>1</sup>
- Cracked or broken;
  - Out of its design position;
  - Worn on the crown of the adapter to the extent that the frame bears on the relief portion of the adapter.
- (j) When fitted to a bearing a bearing adapter must not rock or pitch under hand pressure. <sup>1</sup>
- (k) Each bearing keep must be held securely in place. <sup>1</sup>

#### 3.4.2 Plain Bearings

- (a) Plain bearings must be free from damage. Axle boxes must be free from water, dirt or other foreign material and correctly lubricated. <sup>2</sup>
- (b) Plain bearing axleboxes shall be packed with wool and flax or tow in accordance with instructions (See *B3.1.4.02 - Care and Packing of Axleboxes*) <sup>2</sup>

### 3.4.3 Liners, Keeps and Clearances

- (a) Axle box and horn liners must be secure (no cracked welds or loose screws) and such that lateral (across the vehicle) and longitudinal (along the vehicle) clearances do not exceed the following: <sup>2</sup>

Type	Longitudinal		Lateral	
	Min after overhaul	Max in service	Min after overhaul	Max in service
Bogie vehicles				
- Plain bearings	3 mm	8 mm	3 mm	10 mm
- Roller bearings	1.5 mm	6 mm	5 mm	10 mm
Articulated railcars	1.5 mm	6 mm	8 mm	12 mm

All other vehicles must be to the manufacturer's instructions.

- (b) Axlebox keeps shall be secure and the clearance between axlebox and keep must not be less than <sup>2</sup>

X28020 – car	40mm
X28020 - van	25mm
X25330	15 mm
X25140	15 mm
Others	As specified on plans or manufacturers instructions.

- (c) All driving wheel axle boxes must move freely in the horn guides and wedges must not be adjusted so tightly as to prevent this. <sup>3</sup>

### 3.4.4 Overheating

- (a) A roller bearing must not show signs of having been overheated. Indicators include burning of paint, formation of rust on the cap, adapter, and wheel, or melted seals. <sup>1</sup>
- (b) Axleboxes must not be allowed to exceed normal running temperature in service. This is defined as: <sup>2</sup>
- Roller bearings – greater than 50 °C (such that a bare hand cannot be held on the bearing cap.)
  - Plain bearings - to such an extent that repacking is necessary.
- (c) Any axlebox that runs hot must be allowed to cool (*water must not be used*) and re-lubricated to allow it to run to a depot. The wheelset must then be examined before placing back into service. <sup>2</sup>

(See also Clause 3.26.5 for limits of wheel overheating.)

### 3.4.5 Derailment Damage

- (a) Before being returned to service roller bearings on a bogie involved in a derailment must be inspected and tested by: <sup>1</sup>
- visual examination to determine that it shows no sign of damage.
  - roll-by to ensure it makes no unusual noise.
- If in doubt remove the bearing from the service
- (b) Any bearings which have been subject to repeated severe impact must be overhauled in a workshop, e.g. wheelsets that have been dragged for some distance over sleepers. <sup>1</sup>
- (c) Any wheelset with a defective roller bearing must be replaced before the vehicle is returned to service. <sup>1</sup>

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### 3.5 Body (including liquid containers)

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#### 3.5.1 Vehicle bodies - exterior

- (a) Knees holding body to underframe shall be intact, have no cracks or welds and not corroded more than 10 % of original thickness. <sup>3,4</sup>
- (b) Weather proofing items including roof, walls, curtains, canopy and doors must be in place and operate as intended. <sup>1</sup>
- (c) Framing and structural members must be in good condition. Wooden framing replacements should use rimu or other hardwood of similar or better properties. <sup>4</sup>
- (d) All body panels or cladding is to be intact, secure and free from rot or corrosion. <sup>3</sup>
- (e) All exterior doors must open and close easily from both sides, latch and lock securely in the closed position. <sup>3</sup>
- (f) All windows shall be made of approved safety glass, unbroken, open and close smoothly and latch securely in open and closed positions <sup>3</sup>
- (g) Platform railings shall be secure and in good condition. <sup>3</sup>
- (h) Platform gates must open and close easily and latch securely in closed and open positions. Gate must not be able to be lifted to such an extent that the latch lever can be lifted out of its latch plate. <sup>3</sup>
- (i) Inter-car gangways must have no damage or cracks and the anti-skid surface must be intact. The pivot pin must be secure in apron plate such that it cannot come free when the gangway is in the normal down position. Unless otherwise instructed gangways shall conform to *B3.1.2.02 - Car Gangways (NZR Code 58; Issue 4)*. <sup>2,3</sup>
- (j) Canopies must latch securely; <sup>1</sup>
- (k) Load securing devices must all operate as intended and must not be worn or damaged to the extent that they could fail;
- (l) Rust or damage must not be such as to pose a threat to human safety or to the condition of goods or equipment carried on or within the vehicle. <sup>1</sup>
- (m) No part may be bent or damaged so as to render the vehicle overgauge. <sup>1</sup>
- (n) Stencilled lettering of warning notices or signage, vehicle class and Identification, tare weight, and where applicable, load restrictions, must be legible. <sup>1</sup>

#### 3.5.3 Handrails, hand grabs, footsteps, etc.

- (a) Handrails, hand grabs, footsteps, ladders, walkways and guards must be in place, structurally secure, not bent or deformed such as to render them unsafe or unserviceable, clear of all obstructions and clearly visible. Fasteners must be tight, secure, and free of rust deeper than light surface rust. <sup>1</sup>
- (b) Wooden footsteps must not have any rot or cracks extending the length of the step or through more than one bolthole. <sup>4</sup>
- (c) All welding only be undertaken by people certified and approved to New Zealand Standard 4711 - testing of welders in the position they use, or <sup>1</sup>
  - NZS 1554 part 1,
  - AWS or ASME.
- (d) The upper surface of all footsteps must be free of all paint, contaminants or lubricants that may make the footstep slippery. Footstep tread plates must not be painted. Anti-skid coverings must be intact and secure <sup>1,3</sup>

- (e) Telescopic handrails must be intact, slide freely and free of sharp edges. Latch clips must drop freely into the latched position, but not pass the hook when pressure is applied.<sup>3</sup>
- (f) Any vehicles with ladders, handholds or any other facility allowing access higher than 1.8 metres above rail level must be fitted with clearly legible labels or lettering with the wording "Danger Live Wires Above" and carrying the electricity hazard symbol (equivalent to transfer E009A or name plate E009B specified in the Access Providers document CSG/107).<sup>6</sup>
- (g) Tender and tank ladders must be fitted with a cover over the ladder that can be locked in position.<sup>3</sup>

### 3.5.3 Vehicles bodies - Interior

- (a) Interior doors must open and close easily from both sides and latch securely in closed position.<sup>3</sup>
- (b) Flooring must be smooth, free from cracks, peeling, tears or protuberances that may cause trips.<sup>3</sup>
- (c) Seats must be secure to the floor and wall, seat squabs securely fastened to frames and armrests secure. Reversible seats should turn smoothly. Seats must not have sharp edges, screw heads etc.<sup>3</sup>
- (d) Luggage racks must be secure with the webbing intact.<sup>3</sup>
- (e) The interior must be free of loose equipment, sharp protrusions, and other potential hazards.<sup>2</sup>

### 3.5.4 Locomotive Cabs

- (a) Cab seats must be secure.
- (b) Cab floors should be free of all paint, contaminants or lubricants that may make the floor slippery.
- (c) Side and slide windows should be intact and operate freely.
- (d) Apron plate hinges should be secure.

### 3.5.5 Liquid Containers

Must be free from:-

- (a) Cracks.<sup>1</sup>
- (b) Weepage at discharge valves or any other fittings apart from safety valves.<sup>1</sup>
- (c) Manhole cover or seal that is not in good order and functioning correctly.<sup>1</sup>
- (d) Joints in cladding that are not correctly secured and sealed.<sup>1</sup>
- (e) Cracks or tears in tank supporting saddles or cradles.<sup>1</sup>
- (f) Cracks or breaks in base frame members or welds or in corner castings.<sup>1</sup>

### 3.5.6 Plant on Rail Vehicles

- (a) Plant and equipment must be secure to the rail vehicle.<sup>5</sup>
- (b) Plant and equipment must have no weepage of fuel systems, pipe fittings, connections etc.<sup>5</sup>
- (c) No plant or equipment is permitted to operate without adequate guards covering every part of any transmission, and every dangerous part of any machine.<sup>1</sup>

- (d) The cleaning, examination, lubrication, or adjustment of machinery in motion that requires the removal of any guard is prohibited. <sup>1</sup>
- (e) Not with-standing (d), maintenance staff may undertake inspection or adjustment with guard(s) removed provided they are competent people. <sup>1</sup>
- (f) Where the frequent removal of a guard is required for the purpose of cleaning, examination, lubrication, or adjustment of machinery the guard may be hinged or fixed in such a manner that permits ready removal, however, such a system must include provision for the “shut-down” or the prevention of “start-up” while the guard is removed. <sup>1</sup>
- (g) All equipment must be fitted with adequate provision for the stopping of the machine in an emergency. Where equipment is of sufficient size, multiple “stop” controls must be provided. <sup>1</sup>
- (h) All internal combustion and combustion ignition engines must be fitted with exhaust systems and mufflers approved by the manufacturer or designer, vented to the outside of the vehicle. <sup>1</sup>
- (i) Electrical generators operating at higher than extra-low voltage shall comply with the NZ Electrical Regulations for installation and inspection. <sup>5</sup>

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### 3.6 Bogies

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- (a) All bogies should sit level and at the correct height for the type of bogie. <sup>3</sup>
- (b) All bogies with king pins must have secure cotters. <sup>1</sup>
- (c) Each bogie frame and bolster must be intact, with no crack of 10 mm or more. Welds must not be cracked and rivets not show signs of looseness. All cracks must be reported. <sup>1,3,4</sup>
- (d) Bogie frames, bolsters and other major components should be grit blasted and crack tested at overhaul. <sup>1,3,4</sup>
- (e) Friction wedge height of bogies must not be such that the applicable gauge indicates NO GO. <sup>1</sup>
- (f) No friction wedge element may be worn beyond specified limits or the wear indicator if provided. <sup>1</sup>
- (g) No friction wear plate may be missing, broken or worn through; <sup>1</sup>
- (h) No friction-wear activating spring may be broken or missing. <sup>1</sup>
- (i) Hydraulic dampers (if fitted) must have no oil leaks, secure mountings and dust covers. <sup>1,3</sup>
- (j) No brake beam shelf support may be so excessively worn or broken that it does not support the brake beam or prevent the brake from applying. <sup>1</sup>
- (k) Swing links must be secure and holes and pins must not be worn by more than 25% of the original size. <sup>1</sup>
- (l) All bogie components, including upper centres, must be secure. <sup>1</sup>
- (m) Upper bolsters should be level and at the correct height for the type of bogie. Guides (end stops) shall be secure and not worn excessively. <sup>3</sup>
- (n) Bogie centres must not be excessively worn as evidenced by centres hitting fastenings, excessive lateral movement, etc. Packings must be a minimum of 6mm thick and there shall be no more than 3 under any centre. <sup>3</sup>
- (o) Liners must not be worn more than 50% of original thickness and must be secure. <sup>1</sup>

- (p) Total maximum clearance between bolster bowl and top bogie centre on a wagon shall be no greater than 10 mm in any direction. <sup>1</sup>
- (q) The minimum clearance between any part of a bogie and the vehicle underframe shall not be less than <sup>2</sup>

Passenger car bogies	At tare	70 mm
	Fully loaded	45 mm
Other bogies	At tare	35 mm
	Fully loaded	12 mm

- (r) Anti-rolling (torsion) bar (if fitted) must have mounts that are secure, correctly lock wired, no excessive wear, cracking or other damage and properly fitted dust covers. <sup>3</sup>
- (s) Bogie safety chains must be fitted to all passenger car bogies and service wagons. (### Mandatory fitting to be reviewed by HTC.) Wear should not exceed 25% of original cross sectional area. <sup>3,4</sup>
- (t) Freight bogies must not have gib lateral clearances between bolster and sideframe greater than those shown in the table below. The total shown is the sum of the inside and outside clearances of one sideframe, except as indicated for Scheffel bogies T16 A,E, T18 A. <sup>1</sup>

Bogie Type	Total Gib Lateral Clearance
T14	25 mm
T16 A, E, T18 A	22 mm * measured at outside only
T16 B, T18 B	28 mm
T22	38 mm

- (u) Bogies that have been in a severe derailment must be clearly labelled 'DERAILED' and sent to a workshop for examination. <sup>1</sup>

### 3.7 Boilers and Fittings

#### 3.7.1 Certification

- (a) All boilers shall be inspected in accordance with *B3.1.3.02 - Inspection Schedule* and *B3.3.3.01 - Boiler Service Schedule*.
- (b) No boiler shall be operated in steam unless displaying a current boiler certificate, unless under the directions of an approved Boiler Inspector.

#### 3.7.2 Repairs

- (a) Boiler repairs shall be in accordance with *B3.3.1.01 - FRONZ Boiler Code* or other recognised standard. <sup>4</sup>

#### 3.7.3 Renewing Portions of Boilers

- (a) When any portion of boiler plating is to be renewed, full details of the proposed repair, procedures and materials are to be submitted to an approved Boiler Inspector for approval. <sup>4</sup>

#### 3.7.4 Ashpans and Firepans

- (a) Ashpan and firepan doors must close with no gaps and the ashpan doors must lock securely. <sup>3</sup>



- (b) Ashpans should be sealed with no holes or gaps. <sup>3</sup>

### 3.7.5 Fireboxes

- (a) **Brick arches** must be serviceable. When locomotive boilers are undergoing major repairs, all brick arch carrying bosses or studs shall be inspected and renewed if required. Replacement bosses may be fillet welded to the firebox plates, rather than threaded. <sup>2,3,4</sup>
- (b) **Brick linings** on oil burning locomotives must be serviceable. <sup>3</sup>
- (c) **Drop grates** must close correctly and must be able to be secured. <sup>3</sup>
- (d) **Firebars** must have no gaps, missing bars or sagging deadbars. <sup>3</sup>

### 3.7.6 Fusible Plugs

- (a) The design of and materials used for fusible plugs and bushes shall be in accordance with former NZ Railways specifications as shown on *Drawings Z6607 or Y21538*. (See also *B3.3.2.02 - Fusible Plugs (NZR Code 18; Issue 4)*). <sup>2</sup>
- (b) Fusible plugs (and bushes where necessary) shall be removed and examined annually. <sup>2,4</sup>
- (c) In the event of a fused plug the operator shall undertake an investigation to identify the factors leading to the fusing of the plug. (Such an inquiry shall not supplant any investigation undertaken by TAIC or LTNZ into the event.)

The boiler shall not be put back into steam until authorised by the Boiler Inspector.

### 3.7.7 Injectors

- (a) Shall be maintained and inspected in accordance with *B3.3.2.01 - Injectors (NZR Code 8; Issue 3 of 1/5/47)* and manufacturers' instructions as applicable. <sup>2</sup>

### 3.7.8 Hydrostatic and Mechanical Lubricators

- (a) To be maintained in accordance with *B3.3.2.03 - Hydrostatic And Mechanical Lubricators (NZR Code 49; Issue 2 of 30/7/36)* and manufacturers' instructions. <sup>2</sup>

### 3.7.9 Pipework

- (a) Seamless pipe must be used for all steam piping other than non pressurised drains. <sup>4</sup>
- (b) Steam pipework must be free of leaks. <sup>3,4</sup>
- (c) Pipework must be secured to prevent vibration. <sup>3,4</sup>
- (d) Pipework lagging should be serviceable. <sup>3,4</sup>

### 3.7.10 Setting of Safety Valves

- (a) The setting of safety valves must be carried out under the direct supervision of an authorised person, who will record in the boiler file the opening pressure of each valve, together with its location on the boiler. <sup>4</sup>
- (b) The first safety valve shall be set to open at the boiler's rated maximum pressure. Subsequent safety valves shall be adjusted to open at pressure steps of between 2 psi and 5 psi [15 kPa and 35 kPa] above the previous valve setting. <sup>4</sup>
- (c) See also Section 3.18.3 re safety valves.

### 3.7.11 Smokeboxes

- (a) Smokeboxes must be sound with no leaks. <sup>3,4</sup>
- (b) Internal steam pipes must be sound with no leaks. <sup>3,4</sup>
- (c) Blast nozzle and blower ring should be clean and free of carbon. <sup>3,4</sup>
- (d) Superheaters and elements must be sound with no leaks. <sup>3,4</sup>

### 3.7.12 Spark Arrestors

- (a) Spark arrestors must be serviceable, with no cracks or corrosion holes and of adequate thickness. <sup>3</sup>
- (b) Plate type arrestors must have no more than 3mm clearance gaps with adequate sealing at the exhaust pipe and element bolts. <sup>3</sup>
- (c) Drum type arrestors must be locked in position with no movement. They must be sealed at the base and at the base of the funnel. Locking clips and locking clamps should be function correctly. <sup>3</sup>

### 3.7.13 Stays

- (a) Locomotives may be allowed to operate with large numbers of Extra Row stays broken, as failure of these stays is not considered critical. <sup>4</sup>
- (b) After two or more broken adjacent stays have been detected, the boiler shall not be steamed until repairs have been effected, unless a dispensation has been granted by the Boiler Inspector. <sup>4</sup>
- (c) When flexible stays are installed, they shall be backed off by the amount specified in the catalogue published by the Flannery Stay Company. <sup>4</sup>
- (d) Stays may be welded inside the firebox. <sup>4</sup>

### 3.7.14 Tubes and Flues

- (a) Unless otherwise approved by the Boiler Inspector, new tubes and flues shall comply with BS3059, Part II. <sup>4</sup>
- (b) Tubes and flues shall be annealed at both ends before being expanded into tube-plates. <sup>4</sup>

### 3.7.15 Piecing of Tubes and Flues

Subject to an inspection for condition, tubes and flues may be piece-ended at the firebox end only. Such piece-ending shall be to the following requirements: <sup>2,4</sup>

- (a) **Tubes** shall have at least 75mm cut from the smokebox end and at least 150mm cut from the firebox end.

A new piece of tube of matching diameter shall be pieced to the firebox end of the shortened tube by a butt weld using the electric arc process.

- (b) **Flues** must be pieced in accordance with the following:
  - From the **firebox** end of the flue, remove at least 155 mm but no more than 250 mm, according to requirements.
  - Replace the portion removed by welding on a length of piecing tube 75 mm longer than the discarded piece (ie a length in the range from 230 mm to 325 mm).
  - Crop 75 mm from the large (smokebox) end of the flue to bring it to its correct, original length.

Flues may be pieced twice, but **only** if the minimum length of 155 mm was removed at the first piecing operation.

Piecing must **not** be carried out at the large (smokebox) end of the flue.

### 3.7.16 Washout Plugs

The design of and materials used for washout plugs shall not deviate from that of the former NZ Railways. <sup>4</sup>

Reference material can be sourced at

Source	Reference
B3.3.1.01 - Boiler Code	Drawing Z2945 – NZR Standard Mud Plugs; Gunmetal
B3.1.2.03 - Non-Ferrous Castings (NZR Code 60; Issue 5 of 1/7/72 )	Symbol B – Leaded Gunmetal

## 3.8 Brakes

- (a) The brakes on each vehicle, at all servicing and testing, shall conform with the requirements in the appropriate vehicle brake test instructions. (See *B3.2.1.01 - Air Brake Systems Testing*). <sup>1,2</sup>
- (b) Air brake equipment shall be serviced in accordance with *B3.2.3.01- Brake Service Schedule*. <sup>2</sup>
- (c) Brake blocks must not be worn beyond the wear limits shown on the blocks or have excessive uneven wear. <sup>1</sup>
- (d) Brake hoses and tubing must be connected and secured correctly and not be split, torn or show other signs of distress and must not leak air when pressurised. <sup>1</sup>
- (e) Cocks and valves, including emergency brake valves, must operate effectively without difficulty. <sup>1</sup>
- (f) Handbrake adjustment must be within allowable limits and when the handbrake is applied the brake blocks must engage correctly on the wheels. <sup>1</sup>

Allowable limits are

Cars - automatic slack adjuster	6- 8 turns <sup>2</sup>
Cars – manual slack adjuster	5 –10 turns, depending on brake block wear <sup>4</sup>
Vans (FM)	1 – 6 turns <sup>2</sup>
Steam locomotives	9 turns maximum <sup>3</sup>
Other locomotives	As specified in operating manual
Wagons (lever type)	Lever must not bottom <sup>2</sup>

- (g) Locomotive brake piston travel must be adjusted as specified in *B3.2.1.01 - Air Brake Systems Testing*. <sup>2</sup>
- (h) VTA valve adjustment must be such as to leave 10 mm gap with the vehicle empty. The plunger and stop must be in line. <sup>1</sup>


## 3.9 Cow Catchers

Cowcatchers must comply with NRSS 6, Section 12.5. The lowest point of any locomotive or railcar cowcatcher must be between 100 mm and 175 mm above the top of the rail. <sup>6</sup>

### 3.10 Drawgear

- (a) Drawbar height: The distance from rail level to drawbar centre must be between the following limits measured at tare: <sup>6</sup>

Class	Minimum Height at Tare	Maximum Height at Tare
All locomotives	710 mm	760 mm
Cars, vans and wagons running on passenger services	735 mm	767 mm
All other rail vehicles	725 mm	767 mm

- (b) Couplers: Wear of an Automatic Coupler must not exceed that allowed by the use of Gauge 12050054 B1 and 12050054 B2; cracks must not exceed limits in Code M9200/25. <sup>1</sup>
- (c) Coupler knuckle: Wear must not exceed that tolerated by the use of a Gauge 12050054/A. <sup>1</sup>
- (d) Bridle: Must be serviceable and prevent the corresponding hook from lifting. <sup>1</sup>
- (e) Draft lugs: Must be intact. No debris between draft lugs and sole bars that could cause corrosion <sup>1,4</sup>
- (f) Wear plates: Must be secure and not worn through. <sup>1</sup>
- (g) Janney yokes must have no cracks or other damage. Key retaining bolt to be secure and not excessively worn. <sup>3,4</sup>
- (h) Drawbar packing must be 3 mm minimum thickness and secured by welding to yoke or bent into  shape (preferable). One plate only if secured by welding. <sup>2,3,4</sup>
- (i) Spring packs must show no signs of deterioration, no coils broken (spring type) and the yoke guide pins must be intact. <sup>3,4</sup>
- (j) Drawhooks must not be cracked and the hole must not exceed 48 mm in any direction. <sup>1</sup>
- (k) Drawbar coupling pins: The diameter on any portion of a pin must not be worn below 36 mm. <sup>1</sup>
- (l) Drawbars must not be bent more than 25 mm from the centreline measured at the buffer face. <sup>1</sup>
- (m) Transition heads and kidney links: Coupling holes must not be worn to more than 55 mm in any direction. <sup>1</sup>
- (n) Operating gear and safety devices: All operating gear and safety devices must be serviceable. <sup>1</sup>
- (o) Drawbar sideplay must not include more than 100 mm free slack from one side to the other measured at the headstock. <sup>1</sup>
- (p) There should be no appreciable drawbar endplay on passenger cars. <sup>4</sup>
- (q) Flash butt welded buffers must be crack tested as shown in *B3.1.3.02 - Inspection Schedule* and *B3.1.4.01 - Task Instruction – Corrosion and crack inspection of vehicle components*. <sup>4</sup>

### 3.11 Emissions

No Vehicle may have any abnormal fuel, oil, water or exhaust leaks. <sup>1</sup>

### 3.12 Electrical Equipment

- (a) Electrical systems on rail passenger and service vehicles shall be installed, maintained and tested in accordance with the operators Electrical Code of Practice. (See *B3.5.1.01- Recommended Electrical COP* for an example.)<sup>4</sup>
- (b) Each rail passenger or service vehicle with an electrical system operating at low or medium voltage must have a current Electrical Warrant of Fitness.<sup>1</sup>
- (c) Each rail passenger or service vehicle with an electrical system operating at extra-low voltage shall be inspected annually in accordance with the operators Electrical Code of Practice.<sup>5</sup>
- (d) All installation, maintenance and inspection work on electrical systems operating at low or medium voltage may only be undertaken by an approved person.<sup>5</sup>
- (e) Electrical appliances and fittings must be intact, secure and operate properly, or else be repaired or disconnected.<sup>1</sup>
- (f) Wiring or fittings showing exposed wires, frayed cables and signs of arcing must be repaired or isolated.<sup>1</sup>

### 3.13 Float

- (a) For vehicles without constant contact side bearers the float dimensions specified for the various types of vehicles shall be the clearance provided on each side of each bogie when the vehicle is in normal running condition and standing truly vertical on a stretch of level track.<sup>1,2</sup>

		Minimum mm	Maximum mm
Cars and vans		3	6
Wagons; handbrake end		3	5
Wagons; non-handbrake end		6	8
66ft. standard railcars		1	3
EC and EO locomotives		5	7
Locomotive tenders			
A, AB, B, BA, BB, C, U, and UC	Leading bogie	12	15
	Trailing bogie	3	6
K, KA, KB, UB	Leading bogie	18	20
	Trailing bogie	5	7
J, JA, JB	Leading bogie	8	10
	Trailing bogie	3	6
DE locomotives	Radiator End	10	12
	Cab End	5	7
DA locomotives		3	6
DG, DH locomotives	Radiator End	5	7
	Cab End	10	12
Twin Car Sets	Outer bogies	18	20
	Inner bogies	3	6
Ew locomotives	Outer bogies	6	9
	Inner bogies	2	4
DF locomotives main truck	Truck Pivot Float Blocks	6	9
	Side Bearer Plungers	27	26

Alternatively, if the vehicle is not standing truly vertical on a stretch of level track then the float can be measured on both sides and added together. The float should be even on both sides of the vehicle and the total float must be within twice the limits listed above.<sup>1</sup>

- (g) Packings used under float blocks must:-<sup>2</sup>
- Not exceed four under any one block and the total height must not exceed 25 mm.
  - Must be made of flat steel.
  - Must not be slotted so as to allow them to be slipped under the float blocks.

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### 3.14 Glass

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All glass in a rail vehicle must be approved safety glass to a recognised standard for transport glass for forward or side facing situations as applicable.<sup>1,3,5</sup>

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### 3.15 Instruments & Monitoring Equipment

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#### 3.15.1 Event Recorder

- (a) Event recorders shall comply with NRSS 6. They must be re-certified annually. Installation and certification shall only be done by people approved for these tasks. Correct functioning of event recorders must be verified before each days operation.<sup>4</sup>

#### 3.15.2 Pressure Gauges

- (a) Pressure gauges shall be tested at the frequencies shown below. Testing shall be done by comparison with a certified test gauge and shall agree with the test gauge within the following limits:-<sup>2,4</sup>

Gauges	Test Frequency	Limits
Locomotive & Railcar air brake gauges	Annually	As specified in the relevant Air Brake Test Codes
Boiler pressure gauges	Annually	± 2½ per cent of nominal reading between 90 per cent and 110 per cent of working pressure.
Other gauges	When associated equipment is overhauled or 5 yearly, whichever comes first	± 2½ per cent of nominal reading between 90 per cent and 110 per cent of working pressure.

Maximum pressures applying to air brake equipment for the different classes of stock are shown in *B3.6.2.01 - Pressure Gauges (NZR Code 33; Issue No 4 of 1/12/62)*.

#### 3.15.3 Radio Equipment

- (a) All locomotives and railcars must be fitted with radios for communication with ONTRACK Train Control.<sup>6</sup>
- (b) Radios equipment must be specified, installed and maintained in accordance with B3.6.1.01 - Radio Equipment (or Comm Spec 7 in the interim).<sup>6</sup>

### 3.15.4 Speed Indicators

- (a) Speed indicators must be accurate to within  $\pm 5$  km/h of actual speed at all speeds between 25 km/h and the maximum authorised speed, and within  $\pm 10$  km/h of actual speed for speeds below 25 km/h. They must be illuminated. <sup>1,6</sup>
- (b) Accuracy of speed indicators shall be checked at the intervals specified in *B3.1.3.02 - Inspection Schedule*.

### 3.15.5 Vigilance Devices

- (a) The driving cabs of all vehicles, except double-crewed steam locomotives, must be equipped with a vigilance system acceptable to the Access Provider.
- (b) Correct operation of vigilance devices is to be verified before each days operation and annually.

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## 3.16 Locomotive Motion

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### 3.16.1 General

- (a) New brasses are to be fitted in such a manner that when a film of locomotive bearing oil is applied to the bearing surface, the brasses will revolve freely without signs of slackness or binding. <sup>2</sup>
- (b) When new side and connecting-rod brasses are fitted, the side play must not exceed 0.8mm, the only exception being the brass in the knuckle joints which must be a floating fit. The side play in any brass in service must not at any time exceed 4mm. <sup>2</sup>
- (c) Motion brackets and top and bottom expansion brackets (where fitted) must be secure. <sup>3</sup>
- (d) All motion valve gear pins must have free movement with no binding. <sup>3</sup>

### 3.16.2 Steam Locomotives fitted with split side rod brasses, buckle straps and securing bolts.

- (a) Buckle bolts must be secure and split pins in position. Brasses must be a tight fit in buckles (loose brasses may fracture). <sup>3</sup>
- (b) All tapered wedges must be secured by locking set screws, with wedge nuts secure. Knuckle pins must be secure in side rods and end pins secure in the cross heads.
- (c) Wear in split brasses must be taken up immediately it develops, and must not at any time exceed 1.5 mm. Brasses should move freely across crank pins without binding. <sup>2</sup>
- (d) The slack in knuckle pin bushes must not exceed 1.5 mm. <sup>2</sup>

### 3.16.3 Steam Locomotives with circular brasses and roller bearings.

- (a) End caps must be secure. <sup>3</sup>
- (b) Knuckle pins must be secure in side rods. <sup>3</sup>
- (c) The slack in connecting rod brasses must not exceed 2 mm at the big end or 1.5 mm at the little end, and the total lost motion must not exceed 3mm. <sup>2</sup>
- (d) Both intermediate brasses on Ja locomotives should be inspected regularly for fractures. <sup>3</sup>

### 3.16.4 Crank Pins

- (a) Shall conform with the wear limits as specified in *B3.4.2.03 - Crank Pins (NZR Code 10; Issue 3 of 31/3/67)* and the condemning sizes on *plans Y21194* (steam locomotives) and *Y21875* (diesel shunting locomotives and tractors).<sup>2</sup>
- (b) Cranks pins shall be ultrasonically tested at intervals specified in the *B3.1.3.02 - Inspection Schedule* and *B3.1.4.01 - Task Instruction – Corrosion and crack inspection of vehicle components*.<sup>4</sup>

### 3.16.5 Eccentric Rods

- (a) Eccentric rod brasses shall be secure and the slack must not exceed 1.5 mm.<sup>2,3</sup>

### 3.16.6 Guide Bars

- (a) Guide bars must be secure with no loose liners.<sup>3</sup>
- (b) Steam locomotive guide bars shall be maintained in accordance with the standards and limits of *B3.4.2.07- Guide Bars (NZR Code 56; Issue 3 of 1/5/47)*.<sup>2</sup>
- (c) Crossheads having removable slippers are to be relined when the working clearance exceeds 3 mm.<sup>2</sup>
- (d) The guide bars on closed type guide bars are to be closed when clearance due to slipper wear exceeds 3 mm.<sup>2</sup>
- (e) Old type cross head slippers must be locked tight in cross head with no slack allowed.<sup>3</sup>

### 3.16.7 Piston Rods

- (a) Shall be manufactured and maintained to the standards and limits of *B3.4.2.04 - Piston Rods (NZR Code 13; Issue 3 of 1/5/47)* and *Drawing Y.21195*.<sup>2</sup>

### 3.16.8 Power Reversing Gear

- (a) Steam locomotive power reversing gear shall be maintained in accordance with the standards and limits of *B3.4.2.08 - Power Reversing Gear (NZR Code 70; Issue 2 of 30/12/36)*.<sup>2</sup>

### 3.16.9 Side Rods

- (a) Steam locomotive side rods shall be maintained in accordance with the standards and limits of *B3.4.2.06 - Side And Connecting Rods (NZR Code 54; Issue 2 of 23/10/35)*.<sup>2</sup>

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## 3.17 Materials

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Materials used in maintenance or renewals should conform to the manufacturers specifications, relevant drawings or approved Engineering Change. In the absence of this information materials should, in general, conform to that specified (or modern equivalent) in the NZR Codes quoted in relevant sections of this Mechanical Code or to:-

- *B3.1.2.03 - Non-Ferrous Castings (NZR Code 60; Issue 5 of 1/7/72)*
- *B3.1.2.04 - Branding And Storing Manufacturing Steels (NZR Code 72; Issue 2 of 15/1/36)*



- *B3.1.2.05 - Carbon Steel Castings (NZR Code 91; Issue 2 of 29/4/60)*
- *B3.1.2.06 - High Tensile Steel Castings For Transition Heads to Drawing No.28148 (NZR Code 91, B; Issue 1)*

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### 3.18 Rigging

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- All rigging including safety straps and chains must be secure and correctly positioned.<sup>1</sup>
- Any lever, rod, brake beam or hanger, or any pin or pin hole or chain link may not be worn by more than 25% of its cross sectional area, cracked, broken, or missing.<sup>1</sup>
- Brake spreader beams on X25330 and X25140 bogies should not lift more than 10 mm.<sup>3</sup>
- All spring hangers and holding links shall be secure, not fouling any part of the vehicle and without excessive wear in pins and link eyes
- Compensating beams shall move freely and be adequately lubricated.
- All pins shall be secured in place by welding, or with cotters, nuts, split pins or R-clips, and all replacement split pins shall have each leg splayed at least 20° and preferably 45°. <sup>1</sup>
- Brake blocks shall be fastened with a spear or pin and aligned in relation to the wheel. <sup>1</sup>
- R-clips should only be used where frequent removal is anticipated and where they are readily viewed during train examination. They must not be used where they are likely to be dislodged by flying ballast or track debris or may foul as the pin turns. R-Clips must not be permanently splayed during fitting and must be a neat fit in the hole. Where possible pins should be positioned so the R-clip faces outwards for easy inspection. <sup>1,4</sup>

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### 3.19 Safety Devices

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#### 3.19.1 Lighting

- All headlights, sidelights, and rear lights must be maintained in working order. <sup>1</sup>
- Electric headlights, generators and equipment on steam locomotives shall be maintained in accordance with *B3.5.2.01 - Electric Headlights, Generators, and Equipment on Steam Locomotives (NZR Code 23; Issue 3 of 1/5/47)*.
- Ditch lights, where fitted, shall conform to NRSS 6, Section 12.7. <sup>6</sup>

#### 3.19.2 Warning Devices

- All horns and whistles must be maintained in working order. They should be capable of being operated from both sides of cabs. <sup>1,3</sup>

#### 3.19.3 Safety Valves

- Safety valves must be tested in accordance with the *B3.1.3.02 - Inspection Schedule* to ensure that
  - Valves operate at the correct pressure
  - There are no leaks or other signs of abnormal operation.
- Alteration to the settings of safety valves may only be carried out by an approved person.

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### 3.20 Sanding Equipment

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Sanding equipment must be operational, correctly aligned with the railhead and not be fouled by brake rigging when brakes are applied. <sup>1,3</sup>

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### 3.21 Springs

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- (c) No spring may be cracked, missing or broken. <sup>1</sup>
- (d) Coil springs must not be displaced, coil bound or compressed solid. <sup>1</sup>
- (e) Leaves of leaf springs must not be broken, loose, dislodged, or worn by more than 5% of the original thickness. <sup>1,2</sup>
- (f) Springs shall be manufactured and repaired in accordance with *B3.4.2.05 - Laminated Elliptical And Coil Springs (NZR Code 32; Issue 2 of 16/3/1934)*. <sup>2</sup>

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### 3.22 Test Equipment

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Equipment used for testing of rail vehicles must have a current test certificate before use. Testing and certification is to be done at the intervals specified in the Inspection Schedule. Such equipment includes <sup>3</sup>

- Test pressure gauge(s)
- Single car brake tester
- Wheel gauges
- Buffer height gauge
- Alliance coupler gauges

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### 3.23 Underframe

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- (a) Underframe main solebar members must not be broken or have cracks longer than 25 mm. Cracks in other members must not extend across 25% of any face. <sup>1</sup>
- (b) The central longitudinal members must not be permanently bent or buckled more than 70 mm in any 2 m length. <sup>1</sup>
- (c) Rivets in frames must not show signs of looseness.
- (d) Welding of underframe members must only be undertaken by persons certified and approved to New Zealand Standard 4711 - testing of welders in the position they use, or <sup>4</sup>
  - NZS 1554 part 1,
  - AWS or ASME.
- (e) Underframes and anti-collision ends must be examined at the frequencies specified in the *B3.1.3.02 - Inspection Schedule* and in accordance with *B3.1.4.01 - Task Instruction – Corrosion and crack inspection of vehicle components*. <sup>4</sup>

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### 3.24 Vehicle Emergency Equipment

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- (a) Every locomotive cab shall have a certified fire extinguisher. <sup>1</sup>
- (b) Passenger Rolling Stock must carry certified fire extinguishers in accordance with the operators safety system. Locations should be marked by suitable signs. <sup>1,4</sup>

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### 3.25 Weighing of Locomotives

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Any locomotive that has been overhauled, adjustments made to the spring gear or other work carried out which will clearly make a difference in wheel loading, must be

weighed before being released into service in accordance with B3.1.2.01- Weighing of Locomotives (NZR Code 36; Issue 3 of 1/5/47 and Issue 4 of 1/4/83).

### 3.26 Wheelsets

#### 3.26.1 Wheel centres

Replacement centres should be manufactured in accordance with manufacturers specifications, B3.4.2.02 - Wheels, Wheel Centres and Tyres (NZR Code 4; Issue 3 of 1/5/47 and NZR Code 15; Issue 4 of 1/6/72).

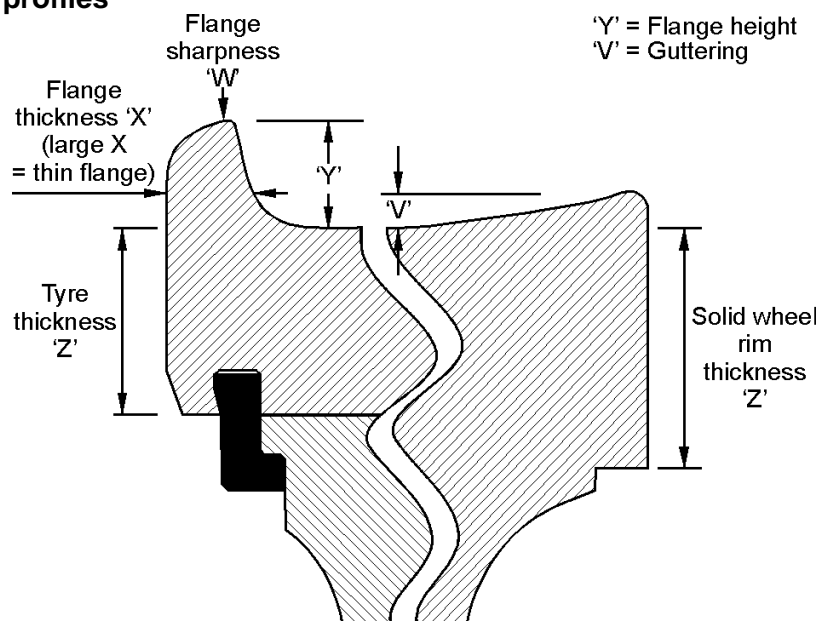
#### 3.26.2 Repairs

In the absence of other specifications, repair of wheels and tyres shall conform to B3.4.2.02 - Wheels, Wheel Centres and Tyres (NZR Code 4; Issue 3 of 1/5/47 and NZR Code 15; Issue 4 of 1/6/72).

#### 3.26.3 Wheel Diameter

- (a) The diameters of two wheels on the same axle must not differ by more than 1 mm, as measured on a wheel lathe comparator (Z gauges are not used for this purpose). The difference in wheel diameter is only checked after wheel lathe attention. <sup>6</sup>
- (b) Unless allowed for in the vehicle design, the diameters of unpowered wheels on the same bogie must not differ by more than 20 mm. <sup>1</sup>
- (c) The diameters of driving wheels on the same vehicle must not differ by more than 13 mm. <sup>1</sup>
- (d) The diameters of wheels connected by rods or drive-shafts must not differ by more than 1 mm, as measured on a wheel lathe comparator (Z gauges are not used for this purpose). <sup>6</sup>

#### 3.26.4 Wheel profiles



- (a) When wheels are turned profiles must conform to NRSS 6; Clause 8.2 and Appendix A. <sup>6</sup>

- (b) A wheel flange must not show an 'X' reading of more than 40 as indicated by Gauge 13090426 or PD100766;<sup>6</sup>
- (c) To avoid wastage of material, vehicles with a 'Z' reading greater than last turning size and with a flange thickness 'X' reading greater than 24 as measured by Gauge 13090426 or PD100766 should be programmed for attention at a wheel lathe.<sup>1</sup>
- (d) Locomotive wheelsets should not have a difference in 'X' readings from side to side of more than 10.<sup>1</sup>
- (e) A wheel must not have flange height, 'Y' reading or guttering 'V' reading, of more than 6 mm as indicated by Gauge 13090426 or PD100766, or PD100766/4.<sup>6</sup>
- (f) Passenger wheels should be programmed for attention when "V" is 3mm or greater in the interest of ride comfort.<sup>1</sup>
- (g) A wheel flange must not show sharpness that allows rocking as indicated by Gauge 13090426 or shows 'W' reading more than 14 on gauge PD 100991.<sup>6</sup>
- (h) Tread or tyre thickness as measured by the Z reading shall not to be less than the tread condemning limits specified in the following table as measured by Gauge 13090426 or Y/X 7601/13 or Y/X 7601/12.<sup>6</sup>
  - (i) For tyred wheelsets the thickness ['Z' reading] of both tyres on an axle must be checked before turning since discs of different diameters may be fitted to the same axle. The wheelset condition is then determined by the smaller of the two Z readings. Likewise some passenger car wheel centres have been turned off centre and the tyre thickness varies around the wheel. The wheelset condition is then determined by the smallest Z reading.<sup>1,4</sup>
  - (ii) A number of classes of steam locomotives have shrink fit tyres without Gibson rings to secure tyres to the wheels. On these the inside of the wheel has to be scraped and cleaned with emery paper to show the joint between the wheel and the tyre. Extreme care is required when measuring the Z reading on these tyres as the lathe tool turning marks on the back of the tyre require good lighting and eye sight to pick out the tyre and wheel joint.<sup>3</sup>
  - (iii) Tread or tyre thickness limits are determined by either (1) the safe operating thickness, or (2) limits on brake rigging travel with worn brake blocks. (This applies on Da /Dc / Dbr locomotives and type 25140 car bogies, unless the brake rigging has been modified, and may also apply to other vehicles.)

<b>Tread Condemning Limits (Z Reading in mm)</b>				
<b>Vehicle</b>	<b>Wheel or Bogie Type</b>		<b>Tyres</b>	<b>Solid Discs</b>
Steam Locomotives	A, Aa, B, Ba, Bb, C, F, Fa, H, Q, U, Ub, Uc, W, Wa, Wb, We, Wf, Ww, X, Y	Leading bogies	29	
		Driving wheels	32	
		Trailing bogies	29	
	Ab, J, Ja, Jb, K, Ka, Kb, Wab	Leading bogies	29	
		Driving wheels	35	
		Trailing bogies	32	
Tenders		32		
Electric	Ea, Ec, Eo, Ew		32	
	Ed		29	
	D, Dm		35	
Diesel Locomotives	Da, Dc, Dbr - driving		32	40
	Da, Dc, Dbr - idling		32	32
	De		32	
	Df (original) – driving, Dg, Dh (original)		32	
	Df (original) – bogie		29	
	Di		32	29
	Dj		32	
	Ds, Dsa, Dsb		32	
	Dsc		32	29
	Tr		29	
Railcars	49 Seater Railcar (Ld'g & rear wheels)		29	
	66 ft, Vulcan & Twin Car Railcars			38
	Vulcan Railcar Power Bogie Carrying Wheel		29	
Cars & Vans	25140*, 25330 bogies (Type 75A tyres)		32	38
	28020 (Type 75 tyres)		32	44
	X27250			44
	X28250			44
Wagons	Bogie wagons on passenger trains ‡		32	29
	Other bogie wagons (50 km/h max on passenger trains) ‡		29	16
	4 wheel		19	16

\* See para (iii) above

‡ Not type 16, 18, 22

Note 1 –The above limits have been sourced from:-  
Drawing Y/X 7601/4 - Standard Tyres; Last Turning and Condemning Sizes  
NZ Rail Wear & Tyre Limits chart stamped 29/8/1991  
Tranz Rail Wheelset Manual, 10 June 1997  
Tranz Rail M6000 Wheelset Manual, Issue 3 (9/5/2001)  
Current Toll Rail practices.

Note 2 – The above limits have been determined by the Heritage Technical Committee as being applicable to rail vehicles used by National Rail System Heritage Operators. Other rail operators, operating at lower speeds and

weights, may wish to adopt lower limits that reflect their operating conditions. Attention is drawn to Plan Y 21192 (Revised 7/10/1966), which permitted lower limits for steam locomotives at the end of the steam era.

### 3.26.5 Overheating

- (a) A wheel must not show signs of having been overheated as evidenced by a reddish brown discoloration, on the face of the rim, i.e., extending on the face more than 100 mm into the plate area measured from the inner edge of the rim. <sup>6</sup>
- (b) A tyred wheel that shows signs of overheating must not run in service before the tyre is inspected and
  - Confirmed as secure and
  - The back-to-back measurement between wheels on the wheelset is between 997 mm and 998 mm, as checked with back to back gauge Y/X 4603/10. <sup>6</sup>

### 3.26.6 Visible defects

- (a) No wheel rim, flange, or tread may have a break. Cracking shall be limited to the following; <sup>6</sup>

Description of defect	Action
Wheels with any crack; <ul style="list-style-type: none"> <li>• Less than 25mm long in tread area, or</li> <li>• Not extending onto the chamfer area or front face of the rim, or</li> <li>• Less than 10mm and located partially or totally within the flange area or chamfer area</li> </ul>	Okay to run
Wheels with any crack; <ul style="list-style-type: none"> <li>• Greater than 25mm long, or</li> <li>• Extending onto the chamfer area or front face of the rim, or</li> <li>• Greater than 10mm and located partially or totally within the flange area or chamfer area</li> </ul>	Not to run

Note – applicable definitions for table are;

- Flange area – extends 30mm from back face of the wheel
  - Chamfer area – extends 12mm from the front face of the wheel
  - Tread area – area contained between flange and chamfer areas
- (c) No wheel plate, or hub area may have a crack or break. <sup>6</sup>
  - (d) No wheel or tyre may have a chip or gouge in the flange that is greater than 2 mm deep and that is also greater than 40 mm in length and greater than 12 mm in width. <sup>6</sup>
  - (e) No wheel or tyre may have a skid flat, shelled spot or spalling that is more than 40 mm in length. <sup>6</sup>
  - (f) No wheel may show evidence of being loose on the axle. <sup>6</sup>
  - (g) No wheel or tyre may have any groove running circumferentially that is greater than 3 mm deep. <sup>6</sup>
  - (h) No wheel or tyre may have been welded or gas cut. <sup>6</sup>
  - (i) No wheel or tyre may show a build up of metal on the tread. <sup>6</sup>
  - (j) No tyre may show any clear evidence of having moved on the wheel. <sup>6</sup>

Where such recent movement is suspected on wheel, but without clear evidence: <sup>1,4</sup>

- The tyre and wheel centre must be marked.
- The vehicle must be clearly labelled.

- The wheel must be inspected before each journey.
  - The vehicle must be stopped if any clear evidence of movement is found.
- (k) Except for certain steam locomotives, every tyre must be secured by a Gibson ring that is not loose. A low pitched or dull ring from a hammer tap indicates a loose Gibson ring. If there is any suspicion of movement between a tyre and disk the wheel must be removed from service. <sup>1,3</sup>
- (l) Locking screws securing locomotive tyres must secure. <sup>3</sup>
- (m) No wheel spoke shall be cracked. <sup>3</sup>

### **3.26.7 Derailments**

Wheelsets that have been in a severe derailment must be examined in a workshop before being placed back into service. <sup>1,4</sup>