AS 7517:2022

Australian STANDARD®

Wheelsets

RISSB
RAIL INDUSTRY SAFETY AND STANDARDS BOARD

Rolling Stock Standard

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This Australian Standard® AS 7517 Wheelsets was prepared by a Rail Industry Safety and Standards Board (RISSB) Development Group consisting of representatives from the following organisations:

Kiwi rail	Pacific National	Bluefield
Fortescue Metals Group Limited	Sydney Trains	CQU
Bradken	Public Transport Authority of WA.	Metrotrains
ETI		

The Standard was approved by the Development Group and the Enter Standing Committee Standing Committee in Select SC approval date. On Select Board approval date the RISSB Board approved the Standard for release.

Choose the type of review

Development of the Standard was undertaken in accordance with RISSB's accredited process. As part of the approval process, the Standing Committee verified that proper process was followed in developing the Standard

RISSB wishes to acknowledge the positive contribution of subject matter experts in the development of this Standard. Their efforts ranged from membership of the Development Group through to individuals providing comment on a draft of the Standard during the open review.

I commend this Standard to the Australasian rail industry as it represents industry good practice and has been developed through a rigorous process.

Deb Spring
Chief Executive Officer
Rail Industry Safety and Standards Board

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Wheelsets

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This Standard was prepared by the Rail Industry Safety and Standards Board (RISSB) Development Group AS 7517 Wheelsets. Membership of this Development Group consisted of representatives from the organisations listed on the inside cover of this document

This AS 7517:2022 Wheelset Standard wholly supersedes AS 7517:2014 Wheelsets.

Objective

The objective of this Standard is to reduce the risk of derailment due to incorrect wheelset assembly.

This paragraph is used to indicate this Standard's relationship to other standards … only change this paragraph if it is applicable

This paragraph is used to provide statement about this Standard's significant technical changes from any previous edition of the document and/or objective for the revision. … only change this paragraph if it is applicable

Compliance

There are four types of provisions contained within Australian Standards developed by RISSB:

1. Requirements.
2. Recommendations.
3. Permissions.
4. Constraints.

Requirements – it is mandatory to follow all requirements to claim full compliance with the Standard. Requirements are identified within the text by the term 'shall'.

Recommendations – do not mention or exclude other possibilities but do offer the one that is preferred. Recommendations are identified within the text by the term 'should'.

Recommendations recognise that there could be limitations to the universal application of the control, i.e. the identified control is not able to be applied or other controls are more appropriate or better.

Permissions – conveys consent by providing an allowable option. Permissions are identified within the text by the term 'may'.

Constraints - provided by an external source such as legislation. Constraints are identified within the text by the term 'must'.

For compliance purposes, where a recommended control is not applied as written in the standard it could be incumbent on the adopter of the standard to demonstrate their actual method of controlling the risk as part of their WHS or Rail Safety National Law obligations. Similarly, it could also be incumbent on an adopter of the standard to demonstrate their method of controlling the risk to contracting entities, or interfacing organisations where the risk may be shared.

RISSB Standards address known hazards within the railway industry. Hazards, and clauses within this Standard that address those hazards, are listed in Appendix A

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1 Scope and general

1.1 Scope

This Standard applies to new and existing rolling stock.

This Standard covers the assembly, maintenance, actions following a derailment, reassemble and overhaul and interface requirements of rolling stock.

Operation of rolling stock, wheelsets with independent wheels is not covered.

This Standard is not specifically intended to cover rolling stock used on light rail, cane railways and monorail networks, but items from this Standard may be applied to such systems as deemed appropriate by the relevant Railway Infrastructure Manager (RIM).

This Standard applies to wheelsets for operating speeds up to and including 200 km/h.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document:

- AS 7505 Railway rolling stock – Signalling detection
- AS 7514 Railway rolling stock – Wheel
- AS 7515 Railway rolling stock – Axles
- AS 7516 Railway rolling stock – Axle bearings

1.3 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

1.3.1
axial run-out
amount by which a rotating component is out of parallel with the axis of rotation.

1.3.2
radial run-out
amount by which a rotating component is running off the ideal centre of rotation.

General rail industry terms and definitions are maintained in the RISSB Glossary: https://www.rissb.com.au/products/glossary/

1.4 Abbreviations

(a) ***BS***
British Standard

(a) ***ISO***
International Organisation for Standardisation

(b) ***RIM***
Rail infrastructure manager

2 Wheelset assembly

Wheelsets shall be assembled so that all components remain attached for the service period of the wheelset or component.

Components shall be rated for the intended purpose of the wheelset.

Components other than wheels should be fitted onto wheelsets in accordance with the component manufacturer's instructions.

C 2 Commentary

It is usual for the manufacturers of brakes discs, gearboxes, bearings etc to specify the installation requirements but these may be modified or produced by a technically competent authority.

These components are not always interference fits. Some designs of gears and brake discs are bolted onto flanges on the axle.

Wheels may be press fitted or shrink fitted onto axles.

Wheels fitted to a wheelset assembly shall be of the same geometry and material and from the same manufacturer.

The method for assembling wheels onto axles should address the following:

(a) Required wheel type to be fitted to the axle[1].
(b) Confirmation of wheel bore and wheel seat geometric requirements.
(c) Required temperature of components.
(d) Lubricants to be used.
(e) Measurement equipment requirements.
(f) Avoiding damage to wheelset component surfaces.
(g) Wheel mounting peak press force limits (if press fitted).
(h) Wheel mounting press force curve characteristics (if press fitted).
(i) Proof load testing (if required).

The type of lubricant being used should consider that some lubricants are affected by increased wheel temperatures due to braking, allowing relative movement between wheel and axle.

Methods of achieving a suitable assembly of wheels and axles for specific applications include the following:

(a) BS 5892-6 Sections 4 and 5.
(b) EN 13260.
(c) ISO 1005 -7.
(d) JIS E 4504.
(e) AAR S-659 Rule 1.4 and RP-631 Section 2.3.

For bearing installation refer to AS 7516.

[1] i.e. to ensure correct specification and size of wheel is fitted (to both ends of a conventional wheelset)

3 Geometric tolerances

3.1 General

The geometric tolerances below are to be measured on a fully assembled conventional wheelset with bearings fitted.

3.1.1 Measurement of wheelsets

The following dimensions shall be measured at three points 120 degrees apart around the wheelset circumference:

(a) Wheel back-to-back (Figure 1 dimension A1) shall be measured at a point 40 mm towards the centre of the wheel from the outer circumference of the wheel flange.

(b) Wheels to axle alignment by either;

i. Wheel back to bearing abutment difference (Figure 1 dimension C minus C1 or C1 minus C); or

ii. Wheels centre to axle centre difference (Figure 1 dimension D).

The following dimensions shall be measured around the entire circumference of both wheels whilst the wheelset is rotated on the bearings:

(c) Tread radial run-out on the tread line (Figure 1 dimension H).

(d) Flange back axial run-out (Figure 1 dimension G).

(e) Tread diameter difference on the tread line (Figure 1 dimension L minus L1 or L1 minus L).

For the steps above, the bearing journals may be supported by the bearings or axleboxes, in a workshop jig or on similar apparatus.

3.1.1.1 Locations for measuring wheelsets

The locations for the measurements of geometric tolerances on a conventional wheelset are shown in Figure 1.

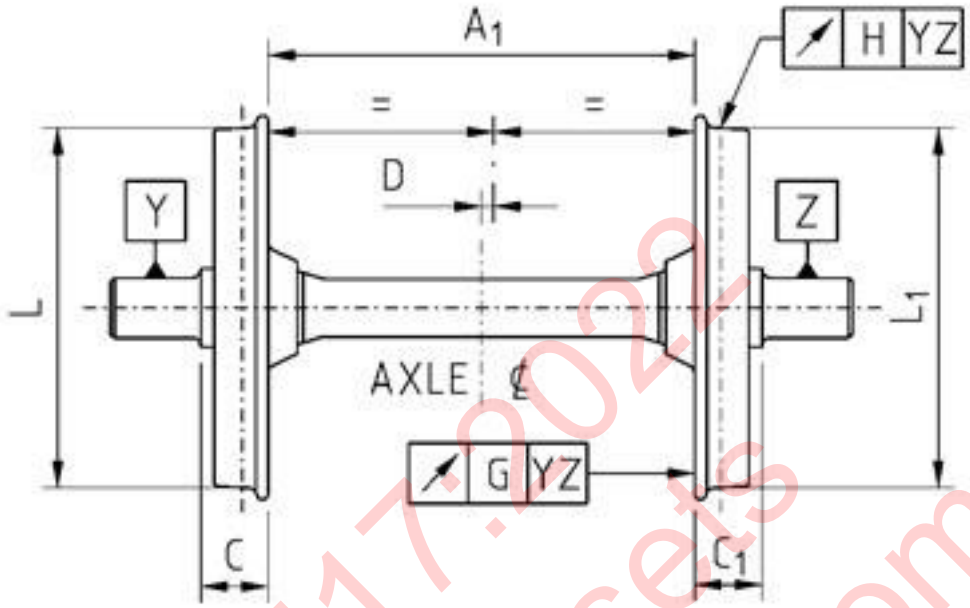

Figure 1 - Wheelset measurements

3.1.2 Back to back dimensions

All three-wheel back-to-back dimensions shall comply with the applicable range given in Table 1 for free standing newly assembled wheelsets.

Table 1 Back-to-back dimensions - as assembled free standing

Network Gauge	A1 (mm)
Standard gauge track (except standalone heavy haul systems)	1357 to 1360
Broad gauge track	1522 to 1525
Queensland and Tasmanian narrow gauge track	990 to 992
West Australia narrow gauge track	992 to 993
South Australia narrow gauge track	988 to 991

C 3.1 Commentary

All wheelset back-to-back dimensions are applicable for approved wheel profiles for each network gauge.

Back-to-back dimensions can vary due to load and temperature variations for in-service wheelsets.

In-service back-to-back limit dimensions should adhere to the RIM's specifics limits where stated.

Wheels to axle alignment on a conventional wheelset should comply with either of the following recommendations.

(a) The difference in wheel back to bearing abutment measurements do not exceed 1 mm.

(b) The difference in wheels centre to axle centre measurements do not exceed 2.4 mm.

Wheel back-to-back dimension and axial run out should be checked whenever a wheelset is in a wheel shop.

Accuracy and repeatability of wheelset assembly and re-profiling machines should be verified by sampling.

Geometric requirements for wheels are given in AS 7514.

Geometric requirements for axles are given in AS 7515.

3.2 Locomotives

Tread radial run-out on the tread line for each wheel on a wheelset (Figure 1 dimension H) should comply with the applicable tolerance given in Table 2.

Flange back axial run-out (Figure 1 dimension G) should comply with the applicable tolerance given in Table 2.

The difference in tread diameter measurements (Figure 1 dimension L minus L1 or L1 minus L) taken at the tread line, between both wheels should not exceed the applicable tolerance given in Table 2.

Table 2 As assembled tolerance dimensions for wheelsets on locomotives

Dimension	Service Speed (km/h)	
	≤ 120	> 120 to ≤ 200
Predominately passenger traffic H (mm)	≤ 0.5	≤ 0.3
Predominately freight traffic H (mm)	≤ 0.75	-
Predominately passenger traffic G (mm)	≤ 0.5	≤ 0.4
Predominately freight traffic G (mm)	≤ 1.5	-
Predominately passenger traffic L-L1 or L1-L (mm)	≤ 0.5	≤ 0.25
Predominately freight traffic L-L1 or L1-L (mm)	≤ 1.0	-

The difference in tread diameter measurements between the wheelsets under a vehicle should be in accordance with the vehicle manufacturer's instructions.

It is usual for the vehicle manufacturer to specify wheelset diameter tolerance across a vehicle but it may be modified or produced by a technically competent authority.

Tread radial run-out and tread diameter difference should be checked after wheels on a wheelset are re-profiled.

3.3 Freight vehicles

Tread radial run-out on the tread line for each wheel on a wheelset (Figure 1 dimension H) should be less than or equal to 0.75 mm.

Flange back axial run-out for each wheel on a wheelset (Figure 1 dimension G) should be less than or equal to 1.5 mm.

The difference in tread diameter measurements (Figure 1 dimension L minus L1 or L1 minus L) taken at the tread line, between both wheels on a wheelset should be less than or equal to 1 mm.

The difference in tread diameter measurements between the wheelsets under a vehicle should be in accordance with the vehicle manufacturer's instructions.

It is usual for the vehicle manufacturer to specify wheelset diameter tolerance across a vehicle but it may be modified or produced by a technically competent authority.

Table 3 provides typical wheelset diameter tolerances across a freight vehicle fitted with conventional bogies.

Table 3 Wheelset diameter difference across a freight vehicle

Wheelset Diameter Difference	Wheelset 1 L - Wheelset 2 L (mm)
Across a bogie	25
Across a vehicle	60

3.4 Passenger vehicles

Tread radial run-out on the tread line for each wheel on a wheelset (Figure 1 dimension H) should comply with the applicable tolerance given in Table 4.

Flange back axial run-out for each wheel on a wheelset (Figure 1 dimension G) should comply with the applicable tolerance given in Table 4.

The difference in tread diameter measurements (Figure 1 dimension L minus L1 or L1 minus L) taken at the tread line, between both wheels on a wheelset should not exceed the applicable tolerance given in Table 4.

Table 4 As assembled tolerance dimensions for wheelsets on passenger vehicles

Dimension	Service Speed (km/h)	
	≤ 120	> 120 to ≤ 200
H (mm)	≤ 0.5	≤ 0.3
G (mm)	≤ 0.5	≤ 0.4
L-L1 or L1-L (mm)	≤ 0.5	≤ 0.25

The difference in tread diameter measurements between the wheelsets under a vehicle should be in accordance with the vehicle manufacturer's instructions.

It is usual for the vehicle manufacturer to specify wheelset diameter tolerance across a vehicle but it may be modified or produced by a technically competent authority

Tread radial run-out and tread diameter difference should be checked after wheels on a wheelset are re-profiled.

3.5 Infrastructure vehicles

Tread radial run-out on the tread line for each wheel on a wheelset (Figure 1 dimension H) should be less than or equal to 0.75 mm.

Flange back axial run-out for each wheel on a wheelset (Figure 1 dimension G) should be less than or equal to 1.5 mm.

The difference in tread diameter measurements (Figure 1 dimension L minus L1 or L1 minus L) taken at the tread line, between both wheels on a wheelset should be less than or equal to 1 mm.

The difference in tread diameter measurements between the wheelsets under a vehicle should be in accordance with the vehicle manufacturer's instructions.

It is usual for the vehicle manufacturer to specify wheelset diameter tolerance across a vehicle, but it may be modified or produced by a technically competent authority

4 Electrical resistance

Requirements for wheelset electrical resistivity are given in AS 7505.

5 Balancing

Wheels shall be balanced according to AS 7514.

Wheelsets should be balanced.

Static balancing of wheelsets may be achieved by:

(a) controlled machining and assembly of components, typically sufficient for vehicles operating at 120 km/h or less.

(b) aligning the static imbalances of the wheels in the same orientation and the static imbalances of other components (such as brake discs) diametrically opposite to the wheel imbalance, where required by the vehicle manufacturer.

Dynamic balancing, where required by the vehicle manufacturer, shall be carried out according to the manufacturer's instructions.

6 Identification and records

Operators shall ensure that each of their wheelsets has a unique identification.

The unique axle identification required by AS 7515 may be used as the unique identification for the assembled wheelset.

Operators shall ensure that wheelset assembly records are retained until wheelset disposal.

Wheelset assembly records shall include the following:

(a) Wheelset assembly facility.
(b) Assembly date.
(c) Wheelset unique identity.
(d) Axle unique identity.
(e) Wheels unique identity.
(f) Wheel to axle interference fits.
(g) Wheel pressing on force curves if press fitted.
(h) Lubricant used if press fitted and a choice permitted by the design.
(i) Wheel test loads if shrink fitted.
(j) Package bearing numbers if fitted.
(k) Wheelset back-to-back dimension.
(l) Wheel bore diameter.
(m) Wheel seat journal diameter.
(n) Wheel tread diameter difference across the wheelset.
(o) Tread radial runout, Figure 1 dimension H.
(p) Flange back axial runout, Figure 1 dimension G.

7 Action following derailments

7.1 General

This section should be read in conjunction with AS 7514, AS 7515 and AS 7516 “Action following derailments”.

Minor and major derailment definition can be found in the RISSB Glossary: https://www.rissb.com.au/products/glossary/

7.2 Minor derailment

Post-derailment axle checks shall involve an assessment of bending or distortion using a three-point test of the wheelset back-to-back distance, or by measuring the axial runout of each wheel of the wheelset as the axle is revolved between centres or on its own bearings.

If the axle is kept under a vehicle for assessment following a derailment, the assessment shall be performed a second time after rotating the wheelset through 180 degrees.[2]

Wheelsets shall comply with the geometric tolerances in section 3.

7.3 Major derailment

Any axle identified as or suspected of having been in a major derailment should be checked on centres or rollers using a dial indicator near the end of the journal and near the journal fillet.

The spacing between dial indicators shall be at least 140 mm.

Both journals should be checked. If on either journal the total dial indicator readings at the end and at the fillet differ by more than 0.001 mm per mm of separation in one complete revolution, the axle shall be scrapped.

Assembled wheelsets may alternatively be checked for bending of the axle by supporting the axleboxes or package bearing cups on blocks and measuring the radial run-out on the dust guard seat or the exposed part of the wheel seat using a suitable dial indicator. The same run out limit applies as when revolved on centres.

Wheelsets shall comply with the geometric tolerances in section 3.

[2] This is done to account for the deflection imposed on the axle due to the mass of the vehicle.

Appendix A Hazard register

(Informative)

Hazard register table

Hazard number	Hazard
5.2.1.9	Mismatched wheel and rail profiles causing excessive rail wear and deterioration
5.2.1.10	Mismatched wheel and rail profiles causing Rolling Contact Fatigue resulting in excessive rail wear and deterioration
5.4.1.47	Mismatched wheel and rail profiles causing excessive wheel wear
5.4.1.54	Excessive diameter difference between wheels on an axles causing excessive wheel wear
5.4.1.55	Misaligned wheels or bearings causing excessive wheel wear
5.5.1.46	Manufacturing deficiency causing the inability to operate trains
5.5.1.47	Maintenance deficiencies causing the inability to operate trains
5.5.1.49	The absence of (unique) components identification causing the inability to trace or identify (suspected) faulty components
5.13.1.9	Wheelset diameter variation across bogies or vehicles outside traction system limits
5.13.1.10	Wheelset diameter variation across bogies or vehicles outside brake or WSP system limits
5.19.1.32	Thin flanges and narrow wheel back-to-back dimensions (Derail at turnout)
5.19.1.35	Wheelsets being excessively unbalanced resulting in bogie unbalance causing wheel unloading
5.19.1.37	Wheels being out of round thus bogie geometry causing wheel climb or unloading
5.19.1.38	Wheels not being the same size on a wheelset thus bogie geometry causing wheel climb or unloading
5.24.1.9	Freight bogies pop out of centreplates due to train compressive forces and excessive diameter difference between bogies' wheelsets causing excessive friction at bogie pivot point
5.25.1.6	Axlebox clearance not being maintained (Frame cracking or bending – Frame failure)
5.25.1.9	Out of balance wheelsets (Frame cracking or bending - Frame failure)
5.25.1.10	Out of balance wheelsets (Spring failure - Suspension)
5.25.1.28	Excessive difference in wheelset diameters across a 3-piece freight bogie (Damper failure - Suspension failure)
5.26.1.2	Incorrect wheel bore and axle seat surface roughness causing wheels to move on the axle (Wheel failure)
5.26.1.3	Wheel bore being too large or axle seat too small causing wheels to move on the axle (Wheel failure)

Hazard number	Hazard
5.26.1.5	Wheel bore and axle seat not parallel causing wheels to move on the axle (Wheel failure)
5.26.1.14	Fretting at wheels, brake discs or gear seats causing a cracked axle (Axle failure)
5.26.1.30	Increased stress at shrunk or press fitted components causing a cracked axle (Axle failure)
5.26.1.39	Cracks initiated at ‘intentional’ stress raisers e.g.. mounting holes creating stamping causing cracked wheels (Wheel failure)
5.26.1.40	Incorrect or excessive lubricant used during wheel fitment causing wheels to move on the axle (Wheel failure)
5.26.1.44	Components being at the wrong temperature during wheel fitment (Wheel moves on axle - Wheel failure)
5.27.1.9	Wheels being mounted too wide making wheel to rail conicity too high
5.48.1.26	Out of balance wheelset
6.14.1.33	Thin flanges and narrow wheel back-to-back dimensions
6.14.1.42	Wheelsets being excessively unbalanced
6.14.1.45	Wheels not the same size on a wheelset

Appendix B Bibliography

(Informative)

The following referenced documents are cited in this Standard for information only:

- ISO 1005-7 Railway rolling stock material – Part 7: Wheelsets for tractive and trailing stock – Quality requirements
- AAR Manual of Standards and Recommended Practices – Section G-II – Wheel and axle manual
- BS 5892-3 Railway rolling stock materials – Part 3: Specification for monobloc wheels for traction and trailing stock
- BS 5892-6 Railway rolling stock materials – Part 6: Specification for wheelsets for traction and trailing stock
- EN 13260 Railway applications – Wheelsets and bogies – Wheelsets – Products requirements
- JIS E 4504 Wheelsets for railway rolling stock – Quality requirements

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The Standards development process is rigorous and transparent.

Authors work with RISSB's Standards Development Managers and Development Groups to ensure that products are acceptable to industry. Standing Committees oversee this work and ensure that proper governance and process is followed. The products are exposed to the public and industry for comment and validated by an independent validator.

Once agreed by the Development Groups, Standing Committees and Validator, the drafts are passed to the RISSB Board for approval.

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