Note: This document still contains reference to Transnet and will be amended once the IM is fully established

RAIL SPECIFICATION

Privately Owned Wagons Interface with Transnet Rail Rolling Stock and Infrastructure

Design and In-Service Technical Requirements

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Schedule of Amendments

Version	Date	Scope
1	03 Sep 2010	Original document

Table of Contents

Summary

As part of Transnet Freight Rails transforming operations aligned to global industrial trends where railways operate multiple owned wagons resulted in the need for technical interface requirements between Transnet Freight Rails wagons and privately owned wagons to ensure smooth operations which is the basis of this document.

This specification guided by the Code of Federal Regulations Transportation Part 215 Railroad Freight Car Safety Standards, United States Department of Transportation [1] regulates the technical design and in-service requirements for privately owned empty and loaded freight wagons interfacing with Transnet Freight Rail owned rolling stock and infrastructure. Furthermore the requirements of this document are applicable not withstanding SANS 3000-1:2009 [4], SANS 3000-2-1:2008 [5] and SANS 3000-2-3:2008 [6].

According to ss. 6-35 of the National Railway Safety Regulator Act 2002,

"(1) If a railway safety inspector believes that a condition or activity is a threat or might be a threat to safe railway operations, the railway safety inspector may issue a directive to any person responsible for that condition or activity to the effect that-
(a) the activity be restricted or suspended and the inspector may place conditions; or
(b) action be taken within a specified time by the person concerned to remove the threat.

(2) Any person issued with a directive must, within the specified period, comply with it."

As the owner and operator of its network, Transnet Freight Rail is therefore obliged to operate its railway safely and to prescribe interface standards to non Transnet Freight Rail wagons that would interface with its wagons.

It should be noted where a non Transnet Freight Rail owned wagon is designed to a standard that differs from that which is specified such standards may be proposed for review to Transnet Freight Rail.

The wagon interface with rolling stock is categorised in this document as:

a. Wagon body
b. Bogies
c. Wheelset & Materials
d. Brakes
e. Couplers and draw gear

The wagon interface with infrastructure is categorised in this document as:

a. Wagon-Track

This document is not applicable to tank wagons, passenger coaches, on-track machines or locomotives.

A privately owned wagon shall only interface with Transnet Freight Rail wagons on its network after the requirements of this specification has been demonstrated in a satisfactory design review approved by Transnet Freight Rail: Information Communication and Technology Management.

1. Definitions & Abbreviations

1.1. Definitions

For the purposes of this specification the following definitions apply:

Rolling Stock
Locomotives and freight wagons

1.2. Abbreviations

TFR
Transnet Freight Rail

2. Wagon - Rolling Stock Interface

2.1. Wagon Body

2.1.1. The design and in-service requirements relating to the wagon body are tabulated in Table 2-1-1.

Table 2-1-1Wagon Body Matrix

	Description	Design	In-Service
1	Vehicle gauge	No part of the empty or loaded wagon shall move laterally outside the vehicle gauge as defined in drawing BE 97-02 (Appendix A) by more than 310 mm when negotiating a 91 m radius curve.	
2	Centre of mass	The centre of mass of the fully loaded and empty wagon, when in the vertical static condition, shall be as close as possible to the vertical centre line and shall not fall outside the area shown in Fig 1. The centre of mass shall not be higher than 1 829 mm above rail level.	
3	Maximum axle load	The wagon shall be designed to operate with an axle load not greater than the applicable track specific design capacity.	
4	Towing hooks	a. Each wagon shall be provided with four towing hooks in accordance with RS A026 001 503. b. The hooks shall be positioned between the bogie centre and headstocks on the underside of the outer longitudinal member of the under-frame. The open end of the hooks shall face towards the headstock.	
5	Label holders	a. Each wagon shall be provided with two label holders in accordance with RS A001 002 406 A; b. The holders shall be mounted on the side of the wagon at diagonally opposite corners, on the left when facing the wagon side.	
6	Vehicle identification system	a. All wagons shall be fitted with VIS tags for identification en-route; b. The position of the tags shall be in accordance with BBD 6353.	

	Description	Design	In-Service
7	Steps and handles	The steps and handles shall be designed in accordance with BBD 5162.	
8	Stencilling	a. The name of private wagon owner emblem shall be stencilled in clearly legible English letters on both length-wise sides of the wagon; b. The built date shall be stencilled in clearly legible English numerals on at least one length-wise side of the wagon; c. The next "scheduled maintenance date" shall be stencilled in clearly legible English numerals on both length-wise sides of the wagon; d. The tare and gross vehicle mass shall be stencilled in clearly legible English numerals at least one length-wise sides of the wagon.	
9	Warning boards / danger notices	Where applicable two electrical danger-warning notices shall be fitted to each wagon, adjacent to ladders.	
10	Running dynamics behaviour	The running safety, track loading and ride characteristics shall comply with BS EN 14363: 2005.	
11	Wagon length	The wagon length shall be such that there is no risk of exceeding the applicable track specific design capacity.	
12	Load distribution: Side to Side	Not applicable	12 % of the gross wagon mass in accordance with "BBD 7709 Limits for Unbalanced Loading of Freight Wagons".
13	Load distribution: Front to Rear	Not applicable	12 % of the gross wagon mass in accordance with "BBD 7709 Limits for Unbalanced Loading of Freight Wagons".
14	Loading procedure	Not application	A demonstration of the loading shall be witnessed by a Transnet designated representative.
15	Design speed	Wagon shall be designed to safely operate at a speed of at least 100 km/ hr	
16	Structural strength	The wagon structure shall be preferably designed to BS EN 12663:2000 or AAR Section C Part II standards. Proven compliance to the preferred standard or any other shall be submitted to TFR for review and approval.	
17	Gradient	The wagon shall be designed to be hauled on a 1:30 gradient with a minimum trailing tonnage of 40 x 18.5 tons / axle.	

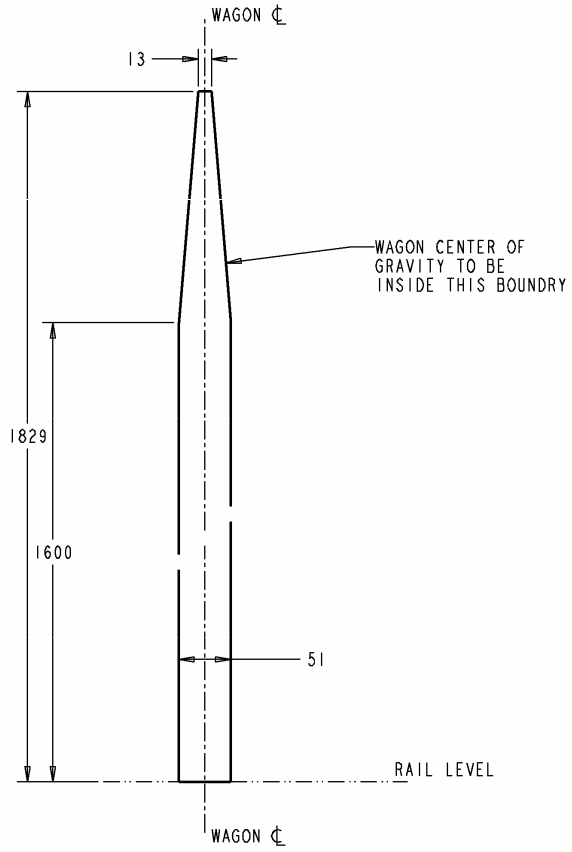


Figure 1 Centre of gravity envelope

2.2. Bogies

2.2.1. The design and in-service requirements relating to the bogie are tabulated in Table 2-2-1.

Table 2-2-1Bogie Matrix

	Description	Design	In-Service
1.	Bogie type	The wagon shall be designed with preferably a HS Mk VII bogie (up to 20 tons / axle) or a HS Mk V bogie.(up to 30 tons / axle) or a spoorbarber D (up to 18.5 tons / axle) For all non-TFR standard bogies a complete design shall be submitted to TFR for review and approval.	Not applicable
2.	Running dynamics behaviour	For all non-TFR standard bogie structures the running dynamics behaviour compliance to BS EN 14363: 2005 shall be demonstrated	Not applicable

According to [1] and further adapted a railway may not place or continue in service a wagon, if the wagon has—

(a) A side frame or bolster that—

(1) is broken; or cracked

(b) A bogie equipped with a snubbing device that is ineffective, as evidenced by—

(1) A bolster friction wedge that is worn beyond a wear indicator;

(2) A side frame bolster wedge wear plate that is loose, missing (except by design), or worn through;

(3) A broken or missing bolster wedge coil spring; or

(4) Snubber assembly unit that is broken, or in the case of hydraulic units, is broken or clearly leaking oil or other fluid.

(c) A side bearing in any of the following conditions:

(1) Part of the side bearing assembly is missing or broken;

(2) The bearing pad at one end of the wagon, on both sides, is in contact with the body bolster;

(3) The bearing gaps at one end of the wagon have a total clearance from the body bolster of more than 17 mm; or

(4) At diagonally opposite sides of the wagon, the bearing gaps have a total clearance from the body bolsters of more than 17 mm;

(d) Bogie springs—

(1) That does not maintain travel or load;

(2) That are compressed solid; or

(3) More than one outer coil spring of which is broken, or missing, in any spring nest;

(4) A type HS bogie primary rubber spring broken

(e) Interference between the bogie bolster and the centre plate that prevents proper bogie rotations; or

(f) Side frame brake beam pockets worn that it does not support the brake beam.

2.3. Wheelset and Materials

2.3.1. The design and in-service requirements relating to the wheelset and materials are tabulated in Table 2-3-1.

Table 2-3-1Wheelset Matrix

	Description	Design	In-Service
1	Wheel geometry	The design shall comply with document "RSE TE SPC 0045 Geometric Requirements for Wheelsets"	The in-service requirements shall comply with "RSE TE SPC 0045 Geometric Requirements for Wheelsets"
2	Wheel web	The design shall comply with document "UIC Leaflet 510 5 Technical Approval of Monobloc Wheels"	Not applicable
3	Wheel axle	The design shall comply with document "BS EN 13261:2003 BS EN 13261 Wheelsets and Bogies – Axle - Product Requirements"	Not applicable
4	Journal roller bearings	The design of the bearings shall be AAR approved.	Not applicable

According to [1] and further adapted, a railway may not place or continue in service a wagon if –

(a) An axle on the wagon has a crack or is broken;
(b) An axle on the wagon has a gouge in the surface that is—
    (1) Between the wheel seats; and
    (2) More than 1 mm in depth;
(c) An axle on the wagon, used in conjunction with a plain bearing, has an end collar that is broken or cracked;
(d) A journal on the wagon shows evidence of overheating, as evidenced by a pronounced blue black discoloration; or
(e) The surface of the plain bearing journal on the axle, or the fillet on the axle, has—
    (1) A ridge;
    (2) A depression;
    (3) A circumferential score;
    (4) Corrugation;
    (5) A scratch;
    (6) A continuous streak;
    (7) Pitting;
    (8) Rust; or
    (9) Etching.
(f) The wheelset has defects classified in "RSE TE PRO 0022 Wheel Defect Identification Chart";
(g) Any part of the wheelset has been welded on;
(h) The journal roller bearing, has -
    (1) Any visible rust on the cup of the roller bearing;
    (2) Seals which are not intact;
    (3) Has evidence of grease leakage around the seals of the roller bearing.

2.4. Brakes

2.4.1. The design and in-service requirements relating to the brake system are tabulated in Table 2-4-1 and table 2-4-2.

Table 2-4-1 Air Brake Interface Matrix

	Description	Design	In-Service
1	Brake pipe pressure	500 kPa empty and 550 kPa loaded	
2	Brake cylinder pressure	350 kPa to 410 kPa for full service	
3	Maximum train length	104 to 216 wagons	
4	Brake % loaded	20% to 22% with 80% brake efficiency	
5	Maximum brake % empty	79% with 80% brake efficiency	
6	Minimum handbrake brake % loaded	16%	
7	Brake block clearance	5mm to 8mm	
8	Stop distance from 60km/h, loaded on down gradient 1 in 91, and from 50km/h, loaded on down grade 1 in 71, and from 40km/h, loaded on down grade 1 in 56, and from 30km/h, loaded on down grade 1 in 55, and from 30km/h, loaded on down grade 1 in 40,	Less than or equal to 1000m	
9	AAR direct release air brake system	The design and in-service requirements shall comply with requirements specified in document AAR S 401.	
10	Composition brake block	The design and in-service requirements shall comply with requirements specified in document RS/W448/2004.	
11	Brake tests	The design and in-service requirements shall comply with requirements specified in document “X54/3”.	
12	Glad hand	FP-5 Type	
13	Slack adjuster compulsory	The design and in-service requirements shall comply with requirements specified in documents “AAR S419, S420 and S421”.	

Table 2-4-2 Vacuum Brake Interface Matrix

	Description	Design	In-Service
1	Maximum vacuum pressure	64kPa	
2	Minimum pressure at rear of train	51kPa	
3	Minimum pressure at front of train	58kPa	
4	Maximum train length	40 wagons	
5	Brake % loaded	22% to 24% with 80% brake efficiency	
6	Maximum brake % empty	79% with 80% brake efficiency	
7	Minimum handbrake brake % loaded	16%	
8	Brake block clearance	5mm to 8mm	

	Description	Design	In-Service
9	Stop distance from 60km/h, loaded on down gradient 1 in 91, and from 50km/h, loaded on down grade 1 in 71, and from 40km/h, loaded on down grade 1 in 56, and from 30km/h, loaded on down grade 1 in 55, and from 30km/h, loaded on down grade 1 in 40,	Less than or equal to 1000m	
10	Composition brake block	The design and in-service requirements shall comply with requirements specified in document “RS/W448/2004”.	
11	Vacuum pipe inside diameter	65mm	
12	Brake tests	The design and in-service requirements shall comply with requirements specified in document “South African Railways Carriage and Wagon Handbook 1983”.	
13	Slack adjuster compulsory	The design and in-service requirements shall comply with requirements specified in documents “AAR S419, S420 and S421”.	

2.4.2. Due regard must be taken to ensure the hand wheels are a safe distance away from any discharge or spillage areas which constitute a hazard to operating personnel, or expose the hand brake mechanism to damage.

2.4.3. Details of the proposed hand brake system design shall be submitted to TFR for review and approval.

2.5. Couplers and Draw Gear

2.5.1. The design and in-service requirements relating to the coupler and drawgear are tabulated in Table 2-5-1.

Table 2-5-1 Couplers and Draw Gear Interface Matrix

	Description	Design	In-Service
1	Coupler type	Profile compliant with AAR Standard S-106 (profile 10A) The minimum coupler design strength on general freight wagons is 1200 kN and 1600 kN on heavy haul wagons.	Within specified service limits of profile 10A
2	Coupler height	895 ± 6mm from top of rail to coupler centre line	910mm > coupler height > 825mm from top of rail to coupler centre line
3	Coupler angle	Coupler arrangement to accommodate a swing angle of up to 7˚ from centre line. Coupler opening should allow for a swing angle of at least 13˚.	
4	Coupler operation	Coupler operation to be semi-automatic	
5	Uncoupling method	Uncoupling to be effected without having to enter the space between vehicles	
6	Cushioning devices	Where more than 4 wagons are to be run together in the same train, an AAR specification M-901 - compliant cushioning unit must be installed	

According to [1] and further adapted, a railway may not place or continue in service a wagon, if—

(a) The wagon is equipped with a coupler shank that is bent out of alignment to the extent that the coupler will not couple automatically with the adjacent car;
(b) The wagon is equipped with a coupler that repeatedly fails to couple successfully with the adjacent vehicle
(c) The wagon has a coupler that has a visible crack in the highly stressed junction area of the shank and head as shown in the Fig 2.
(d) The wagon has a coupler that has a visible crack in the highly stressed puling area inside the head as shown in Fig 2.
(e) The wagon has a coupler that has a visible crack in the highly stressed butt area as in Fig 2.
(f) The wagon has a coupler knuckle that has a visible crack on the inside pulling face or the pulling lugs as shown in Fig 2.
(g) The wagon has a knuckle pin or knuckle thrower that is missing or inoperative.
(h) The locking device securing the coupler to yoke connection is incomplete or inoperative
(i) The wagon has a coupler that does not have anti-creep protection to prevent unintentional unlocking of the coupler
(j) The wagon has an uncoupling mechanism that is incomplete or inoperative
(k) The wagon has a drawgear or other cushioning device that is stuck, failed or otherwise inoperative

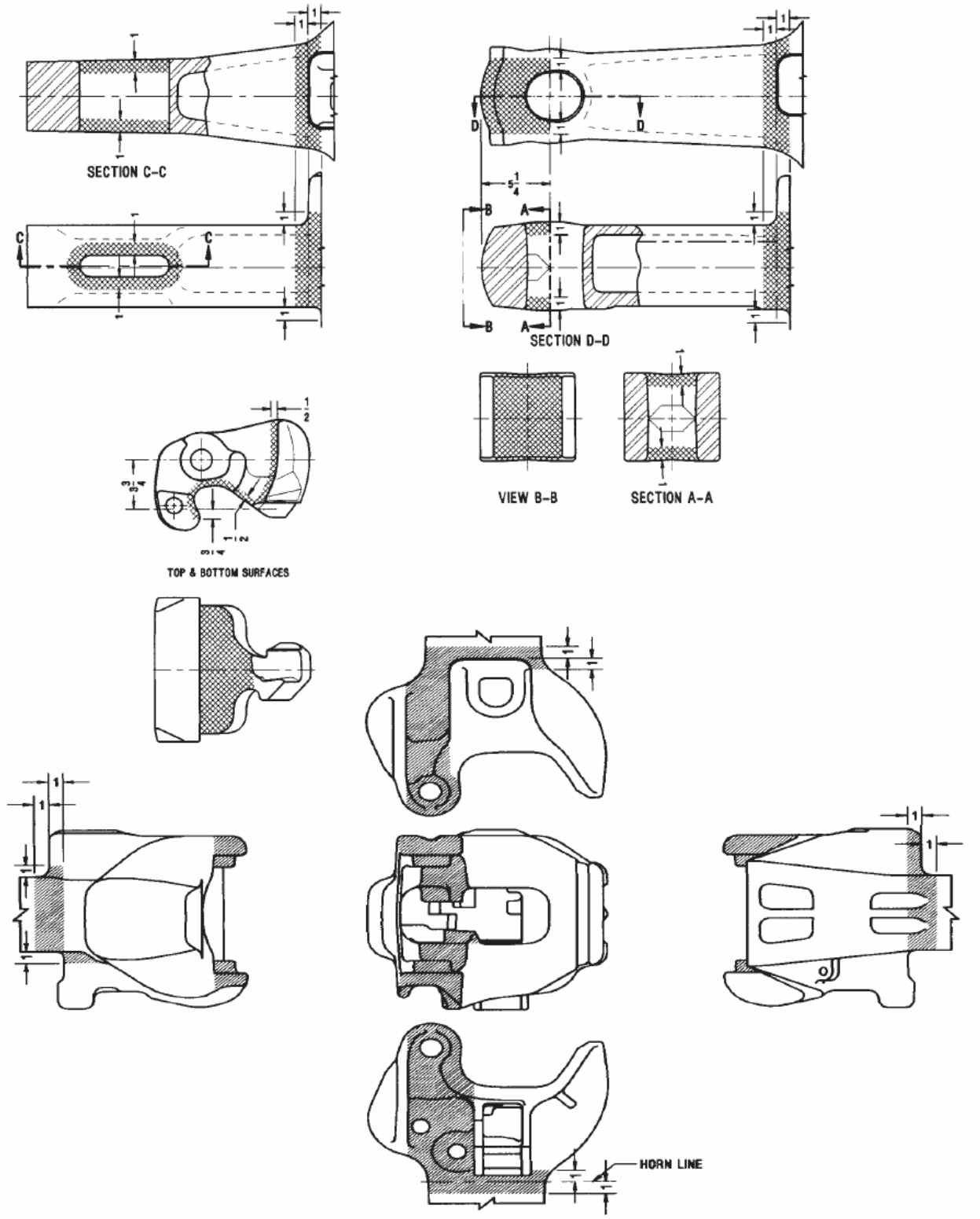


Figure 2 Diagrams showing typical areas that must be free of visible cracks on yokes, knuckles and couplers (dimensions in inches)

3. Wagon – Infrastructure Interface

3.1. Wagon-Track Interface

3.1.1. The empty as well as fully loaded wagon shall be able to safely and without any interference negotiate the following track features while running alone, coupled together, as well as coupled to any other wagon or locomotive:

a. Track gauge of 1 065mm.
b. A curve with a 85 m radius and no transition curve.
c. A parabolic vertical curve with grade changes of a rate of 1m/20m/20m convex and concave.
d. A 1 in 8 reverse turnout as well as a 1 in 8 cross over.

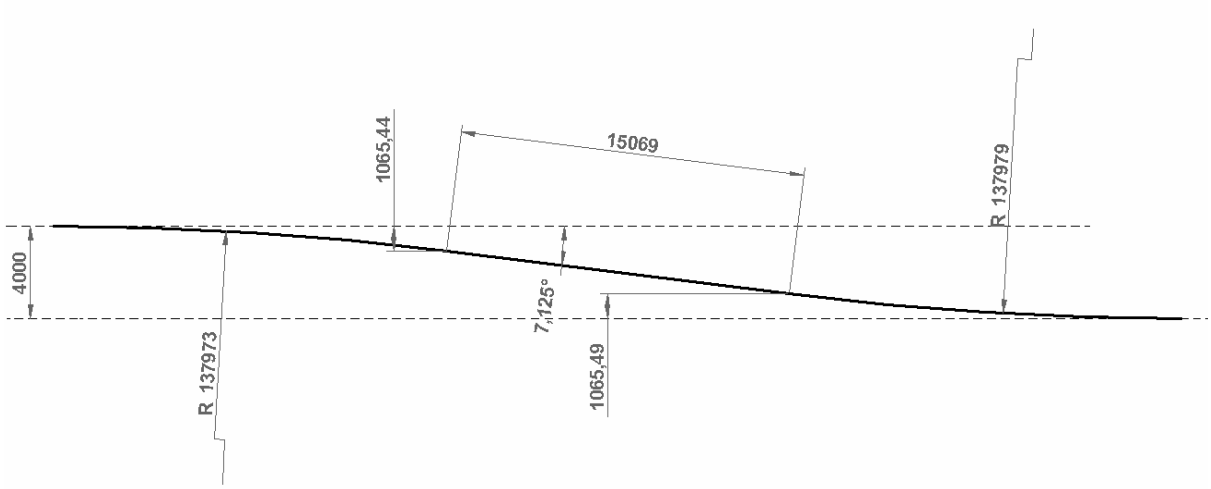


Figure 3 1:8 Cross over

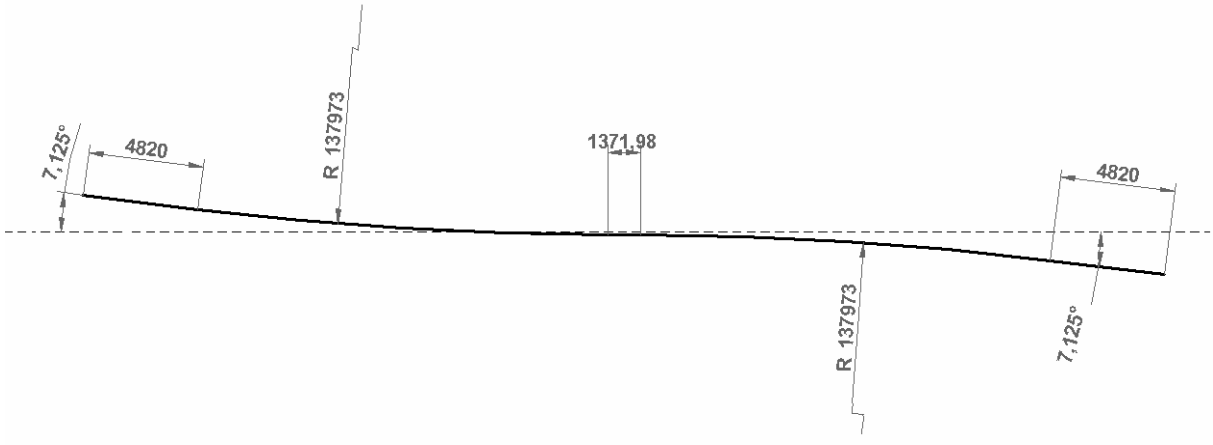


Figure 4 1:8 Reverse turnout

3.1.2. Calculations and/or drawings to confirm no interference under the above conditions shall be submitted to Transnet Freight Rail for approval.

4. Restricted Equipment

a) This section restricts the operation of any railway wagon that is-

1) Equipped with brass or aluminium brake piping on general freight wagons

5. Miscellaneous

5.1. Welding Repair

5.1.1. All welders and welding operators engaged in repairs of wagons and components shall be qualified to weld with appropriate wire and base metals in all the positions in which they are to work in accordance with ASME IX or relevant railway welding specifications.
5.1.2. Flame cutting of joint preparations for welding will be permitted, provided that the process is machine controlled. The surfaces so prepared shall be uniform and smooth.
5.1.3. After flame cutting, all slag, scale and detrimental discoloration of metal due to melting shall be removed.
5.1.4. All welding procedures used shall be qualified to ASME IX or relevant railway welding specifications.

5.2. Pre-Departure Inspections

5.2.1. According to [1] and further adapted, in addition to standard pre-departure TFR inspection procedures the non TFR owned wagon shall be subjected to the procedure outlined in Appendix B.

6. References

1. Federal Railroad Association 2009, *Title 49 Code of Federal Regulations Transportation Part 215 Railroad Freight Car Safety Standards*, United States Department of Transportation, United States of America
2. Rothman, H. W., Maree, J. S., and Barnard, D. A. 2000, *Manual for Track Maintenance*, (BBB0481 version1), Spoornet Infrastructure Maintenance, Pretoria.
3. South Africa 2002, *National Rail Safety Regulator Act No.16 of 2002,* Government Gazette No23712: 05 August 2001, Republic of South Africa
4. South African National Standard, *Railway Safety Management Part 1: General*, (SANS 3000-1:2009), SABS
5. South African National Standard, *Railway Safety Management Part 2-1: Technical Requirements for Engineering and Operating Standards – General* (SANS 3000-2-1:2008), SABS
6. South African National Standard, *Railway Safety Management Part 2-3: Technical Requirements for Engineering and Operating Standards – Rolling Stock* (SANS 3000-2-3:2008), SABS

7. Bibliography

7.1. Transnet Freight Rail Documents

7.1.1. RSE TE SPC 0045 Geometric Requirements for New, Re-Profiled and In-Service Wheelsets
7.1.2. RS W448 2004 Low Friction Composition Brake Blocks for Spoornet Freight Wagons
7.1.3. RSE TE PRO 0022 Wheel Defect Identification Chart
7.1.4. BBD 6353 Radio Frequency Tag Programming and Installation of Transnet Freight Rail Vehicles
7.1.5. BBD 7709 Limits for Unbalanced Loading of Freight Wagons
7.1.6. BBC 8782 Wheelset Heavy Maintenance Specification

7.1.7. BBD5162 Risk Management 2003, Wagon Ergonomics Report
7.1.8. South African Railways Carriage and wagon handbook 1983
7.1.9. X54/3 General Instructions for Working of Air Braked Trains
7.1.10. RS A026 001 503 Towing Hook Drawing
7.1.11. RS A001 002 406 A Label Holders Drawing

7.2. International Standards

Association of American Railroads (AAR)
AAR Manual of Standards and Recommended Practice,. Section E: Brakes and Brake Equipment: Slack Adjuster (S419), 2002

AAR Manual of Standards and Recommended Practices, Section E: Brakes and Brake Equipment: Slack Adjuster, Tension-Limiting Dimensions (S-420A), 2002

AAR Manual of Standards and Recommended Practices, Section E: Brakes and brake equipment: Slack adjuster, centre rod application (AAR S-421), 2002

AAR Manual of Standards and Recommended Practices, Section C – Part II: Design, Fabrication and Construction of Freight Cars (M-1001), 2007

AAR Manual of Standards and Recommended Practices, Section S – Part III: Coupler and Yoke Details (S-106), 2007

AAR Manual of Standards and Recommended Practices Section B: Draft Gear, Second-hand and Reconditioned (M-901), 2007

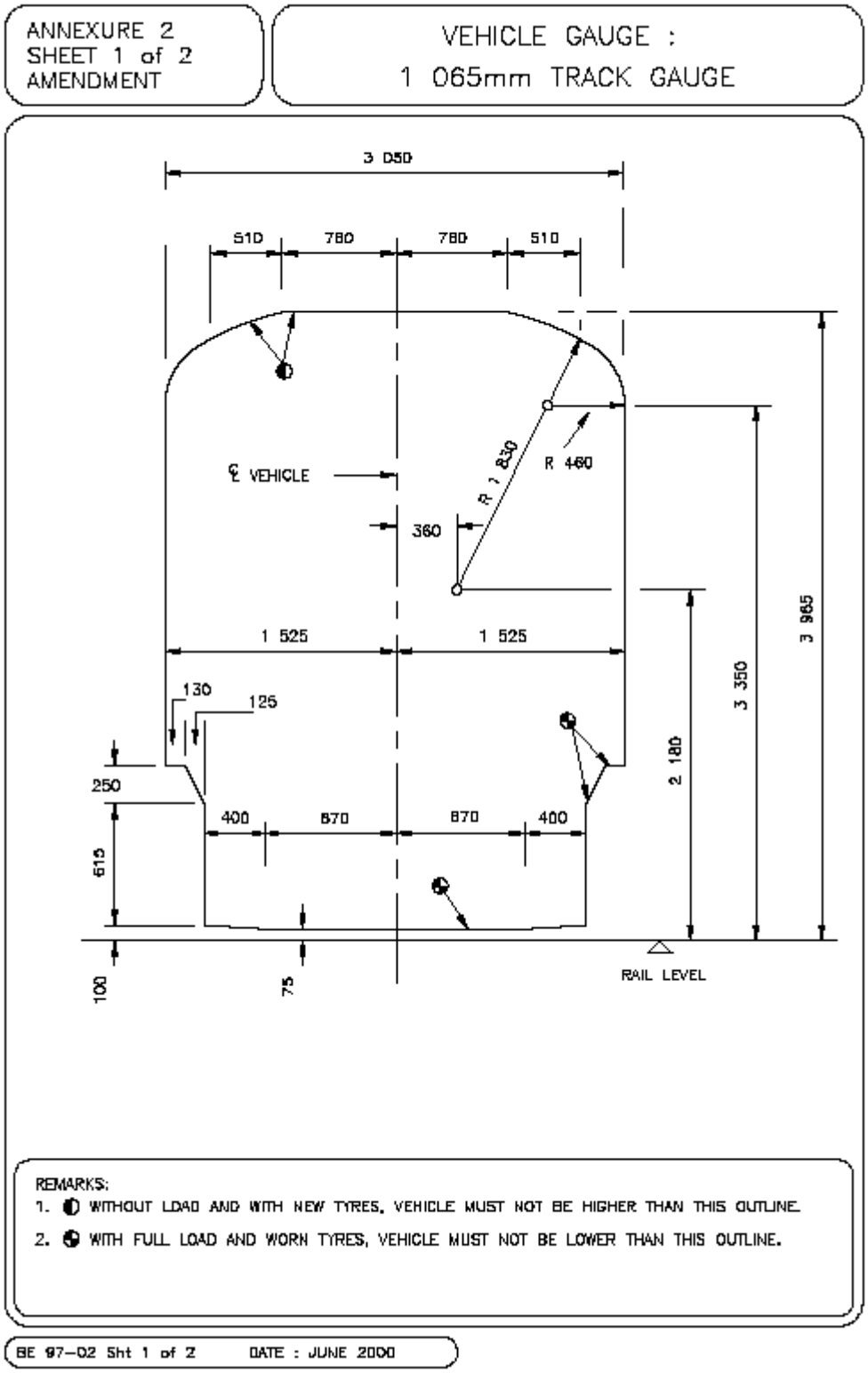
International Union of Railways (UIC)
UIC Leaflet 510_5 Technical Approval of Monobloc Wheels, 2nd edition, May 2007

European Standards (BS EN)
BS EN 14363:2005 Railway applications: Testing for the Acceptance of Running Characteristics of Railway Vehicles, 2005

BS EN 13261:2003 BS EN 13261 Wheelsets and Bogies – Axle - Product Requirements, January 2007

BS EN 12663:2000 Structural Requirements of Railway Vehicle Bodies Part 2: Freight Wagons, July 2000

Appendix A – 1065mm Vehicle Gauge BE-97-02 [3]



Appendix B – Pre-departure Inspection Procedure [1]

At each location where a freight wagon is placed in a train and a designated inspector is not on duty for the purpose of inspecting freight wagons, the freight wagon shall, as a minimum, be inspected for the imminently hazardous conditions listed below that are likely to cause an accident or casualty before the train arrives at its destination. These conditions are readily discoverable by a train crew member in the course of a customary inspection.

Item for Inspection	**Pass/Fail**
1. Wagon body:	
(a) Leaning or listing to side.	
(b) Sagging downward.	
(c) Positioned improperly on track.	
(d) Object dragging below.	
(e) Object extending from side.	
(f) Door insecurely attached.	
(g) Broken or missing safety appliance.	
2. Insecure coupling.	
3. Overheated wheel or journal.	
4. Broken or extensively cracked wheel.	
5. Brake that fails to release.	
6. Any other apparent safety hazard likely to cause an accident or casualty before the train arrives at its destination.	
Date:	
Wagon Number & Owner:	
Transnet Freight Rail Inspector:	

Note: This document still contains reference to Transnet and will be amended once the IM is fully established

	TRANSNET RAIL SPECIFICATION **ONCE OFF TRANSFER INTERFACE REQUIREMENTS FOR PRIVATELY OWNED WAGONS INTERFACING WITH TRANSNET FREIGHT RAIL ROLLING STOCK AND INFRASTRUCTURE** **DESIGN AND TEST TECHNICAL REQUIREMENTS**	**Document no:** BBG 8440 **Revision: 1** **Issue date:** 6 April 2016 **Page 1 of 6**

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Approved by: Dr. Robert Fröhling Principal Engineer (Mechanical Technology)	Signature:
Approved by: Marthin Mulder Principal Engineer (Train Design Technology)	Signature:

CONTENTS

Schedule of Amendments

Version	Date	Scope
1	6 April 2016	Original document

1 SCOPE

1.1 This specification defines the minimum technical interface compliance requirements for privately owned wagons to operate for a single “once-off” trip on Transnet Freight Rail’s rail network (thereby interfacing with Transnet Freight Rail owned rolling stock and infrastructure).

1.2 This specification is only valid for a maximum operating speed of 60km/h.

1.3 This specification is only valid for the movement/transfer of empty wagons.

2 VALIDATION AND VERIFICATION

2.1 It is a mandatory requirement that conformance to this specification shall be validated during scheduled design reviews with Transnet Freight Rail.

2.2 It is a mandatory requirement that the contractor shall demonstrate conformance to requirements to Transnet Freight Rail, via appropriate documentation and/or physical tests (and /or physical inspections).

2.3 If standard and/or service proven designs and/or equipment is proposed, an exemption from submitting detailed design and testing reports will be considered based on evidence provided.

3 GENERAL REQUIREMENTS

3.1 **Axle load (empty wagon):** It is a mandatory requirement that the axle load of the empty wagon be specified and be limited to the loading capacity of the applicable track(s) as stipulate in BBB4951 Rail Line Capacity.

3.2 **Centre of gravity (empty wagon):** It is a mandatory requirement that the centre of mass of the empty wagon shall be as close as possible to the vertical centreline and not be higher than 1829 mm above the top of the rail.

3.3 **General dimensions:** It is a mandatory requirement that the distance between bogie centres shall not be greater than 15m. In addition, the coupling length, body length, body width, body height, equipment attachment height, bogie centre to bogie centre distance etc. shall be specified on a wagon diagram.

4 INFRASTRUCTURE INTERFACE REQUIREMENTS

4.1 **Vehicle gauge (part 1):** It is a mandatory requirement that the dimensions of the empty wagon when centrally positioned on the track shall be within the vehicle gauge as shown in drawing BE 97-02 Sheet 1 of 2 (BBB0481) (Refer to Appendix A).

4.2 **Vehicle gauge (part 2):** It is a mandatory requirement that no part of the wagon shall move laterally outside the vehicle gauge as defined in drawing BE 97-02 Sheet 1 of 2 by more than 310 mm when negotiating a 91 m radius curve.

4.3 **Track characteristics:** It is an essential requirement that the empty wagon shall be able to safely negotiate the following track conditions when coupled together or coupled to any other Transnet Freight Rail rolling stock:

4.3.1 1 065 mm track gauge

4.3.2 85m radius curve (marshalling yards) and 91 m radius curve (mainline) without transition curves

5 COUPLERS AND DRAW GEAR

5.1 **Coupler rating:** It is essential that the couplers minimum continuous rating be specified.

5.2 **Coupling system:** It is a mandatory requirement that the coupling system complies with the basic requirements of AAR specifications M-201 and M-211.

5.3 **Draft gear system:** It is a mandatory requirement that the coupling and draft gear system shall comply with AAR specification M-901-E or M-901G.

5.4 **Coupler contour:** It is a mandatory requirement that the coupler contour conforms to the 10A head contour according to AAR Standard S-106.

5.5 **Uncoupling device:** It is a mandatory requirement that the wagon is fitted with a device to allow uncoupling without the need for personnel to enter the space between adjacent vehicles.

5.6 **Coupler height:** It is an essential requirement that the height from rail level to the centre line of the coupler with the wagon in the tare condition shall be 895 mm plus 6 mm minus 6 mm.

5.7 **Coupler swing:** It is an essential requirement that the coupler arrangement can accommodate a swing angle of up to 7˚ from centre line. The coupler opening should allow for a swing angle of at least 13˚.

5.8 **Emergency coupling:** It is an essential requirement that the wagon be fitted with an emergency coupling bracket. The emergency coupling bracket is to be utilised if/when the wagons are to be moved in the un-braked condition only.

6 BRAKE SYSTEM

6.1 **Brake system design:** It is an essential requirement that the brake system shall be an AAR Direct Release Air Brake System in accordance with AAR S-400 and S-401, or a Vacuum Brake System in accordance with W.400/GEN/1986.

6.2 **AAR Single Car Test:** It is an essential requirement that the air brake system shall pass the AAR Single Car Test (AAR S-486) and Brake Pipe Restriction Test (AAR S-471).

6.3 **Brake block force:** It is a mandatory requirement for brake block forces to be measured and to be reported on.

6.4 **Handbrake:** It is an essential requirement that details of the proposed hand brake system shall be submitted to Transnet Freight Rail for approval. This information shall amongst others include brake calculations and a diagram showing the brake system layout. The hand brake must keep a wagon stationary on a 1 in 40 gradient. It must be possible to apply and release the handbrake from both sides of the wagon.

7 BOGIES

7.1 **Bogie type:** It is a mandatory requirement that the bogie type be indicated.

7.2 **Running dynamics:** If the bogie type is not a Transnet Freight Rail standard bogie (HS MKVII, HS MKV, Spoorbarber etc.), running dynamics safety evaluation tests are mandatory to be conducted up to 66 km/h (60 km/h plus 10%).

8 WHEELSETS

8.1 **Back-to-back distance:** It is an essential requirement that the wheelset back-to-back distance be appropriate for Transnet Freight Rail's 1065mm track gauge.

8.2 **Wheel profile:** It is an essential requirement that the intended wheel profile be specified.

9 COMPLIANCE EVIDENCE REQUIRED

9.1 Compliance evidence shall be submitted to Transnet Freight Rail for approval. Tests required must be accompanied by a test report and physical inspections may be witnessed by a Transnet Freight Rail technical representative. The minimum compliance evidence required by Transnet Freight Rail is as follows:

Clause reference	Documentation required	Test(s) and/or physical inspection(s) required
Scope		
1.1	Information	
1.2	-	Yes
1.3	Information	
Validation and verification		
2.1	Information	
2.2	Information	
2.3	Information	
General requirements		
3.1 Axle load (empty)	Calculated mass (3D CAD model)	-
3.2 Centre of gravity (empty)	Calculation (3D CAD model)	-
3.3 General dimensions	Wagon diagram	-
Infrastructure interface requirements		
4.1 Vehicle gauge (part 1)	Drawing	May have to be confirmed by conducting a vehicle gauge test
4.2 Vehicle gauge (part 2)	Drawing	-
4.3 Track characteristics	-	Yes (bogie slew test for R85m curve)
Couplers and Drawgear		
5.1 Coupler rating	Drawing / coupler strength datasheet	-
5.2 Coupler system	Drawing	-
5.3 Draft gear system	Drawing	-
5.4 Coupler contour	Drawing	-
5.5 Uncoupling device	Drawing	Yes (functional test)
5.6 Coupler height	Drawing (Wagon diagram)	Yes (physical inspection)
5.7 Coupler swing	Drawing	Yes (physical inspection)
5.8 Emergency coupling	Drawing	Yes (physical inspection)
Brake system		
6.1 Brake system design	Report	-
6.2 AAR Single Car test	-	Yes (test)
6.3 Brake block force		Yes (test)
6.3 Handbrake	Calculation	-
Bogies		
7.1 Bogie type	Drawing / bogie datasheet	-
7.2 Running dynamics	-	Yes (if not a standard Transnet Freight Rail bogie)
Wheelsets		
8.1 Back to back distances	Drawing	
8.2 Wheel profile	Drawing	

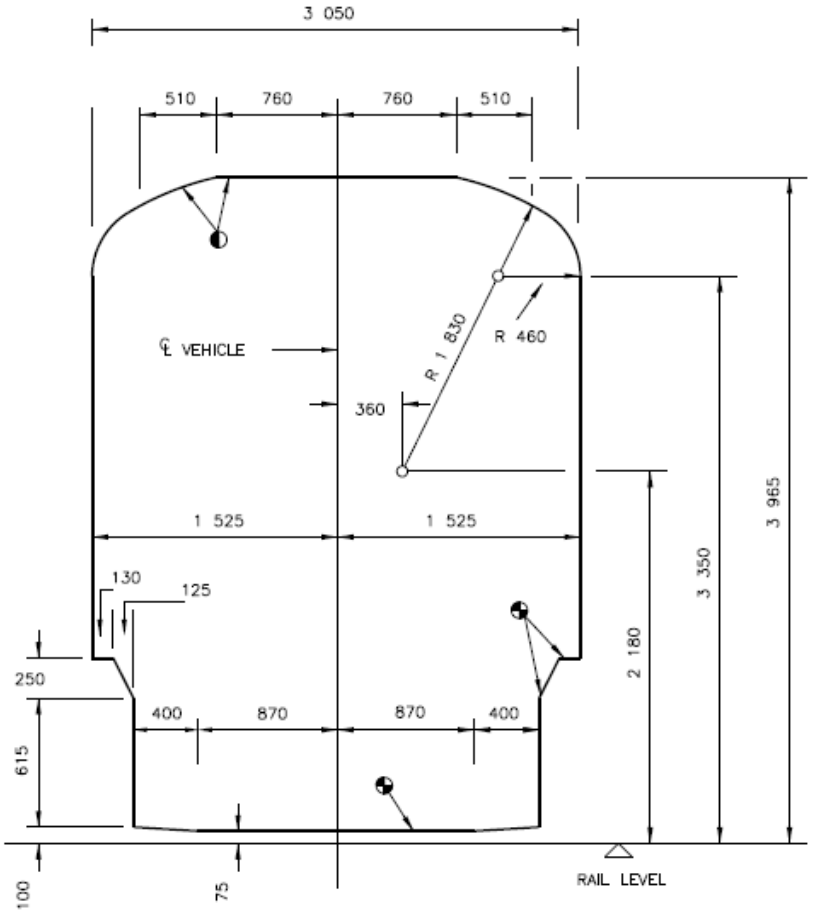
10 REFERENCES

[1] BBB0481, Rev. 2, 2012, Transnet Freight Rail Manual for Track Maintenance.
[2] BBB4951, Rail Line Capacity.
[3] South African Railways Carriage and Wagon Handbook 1983.
[4] RSE/TE/SPC/0045, Geometric requirements for new, re-profiled and in-service wheelsets.
[5] W.400/GEN/1986, South African Transport Services, Specification for Goods Vehicles, 1065 mm gauge

11 APPENDIX A – VEHICLE GAUGE BE-97-02

VEHICLE GAUGE :
1 065mm TRACK GAUGE

ANNEXURE 2
SHEET 1 of 2



REMARKS:
1. ◐ WITHOUT LOAD AND WITH NEW TYRES, VEHICLE MUST NOT BE HIGHER THAN THIS OUTLINE.
2. ◒ WITH FULL LOAD AND WORN TYRES, VEHICLE MUST NOT BE LOWER THAN THIS OUTLINE.

BE 97–02 Sht 1 Version 1

Note: This document still contains reference to Transnet and will be amended once the IM is fully established

	PRIVATELY OWNED PASSENGER COACHES INTERFACE WITH TRANSNET FREIGHT RAIL ROLLING STOCK AND INFRASTRUCTURE **DESIGN TECHNICAL REQUIREMENTS**	**Document no:** BBH 0359 **Revision: 00** **Issue date:** 12 September 2017 **Page 1 of 8**

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Approved by:	
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Mr J. M. Mulder **Principal Engineer (Train Design Technology)**	**Signature:** 13/09/2017
Dr R. D. Fröhling **Principal Engineer (Mechanical Technology)**	**Signature:** 13/9/2017

CONTENTS

1.0 SCOPE OF SPECIFICATION

1.1 This specification standardizes the technical design requirements for privately owned coaches (trainsets) interfacing with Transnet Freight Rail owned rolling stock and infrastructure.

1.2 This specification outlines the minimum technical requirements for privately owned coaches to operate on Transnet Freight Rail's rail network.

2.0 VALIDATION AND VERIFICATION

2.1 It is an essential requirement that conformance to this specification shall be validated during scheduled design reviews with Transnet Freight Rail.

2.2 It is an essential requirement that the contractor shall demonstrate conformance to requirements to Transnet Freight Rail, via physical tests.

2.3 If standard and/or service proven designs and/or equipment is proposed, an exception from submitting thorough design and testing reports will be deliberated based on evidence provided.

3.0 GENERAL REQUIREMENTS

3.1 It is an essential requirement that all coaches shall be able to operate safely at speeds up to 100 km/h on the rail network.

3.2 It is an essential requirement that the axle load of the loaded coach is limited to the loading capacity of the applicable track(s) as stipulated in BBB 4951 Rail Line Capacity.

3.3 It is an essential requirement that the centre of mass of the loaded coach shall be as close as possible to the vertical centreline and not be higher than 1829 mm above the top of the rail.

3.4 It is an essential requirement that the distance between bogie centres shall not be greater than 15 m.

3.5 The coach shall be able to safely operate at all curving speeds as defined in Transnet Freight Rail's drawing BE 97-09 Sheet 4 of 4 9 (June 2000).

3.6 It is an essential requirement that the measured weight and mass distribution of the coaches be in accordance with BS EN 15528:2008.

4.0 INFRASTRUCTURE INTERFACE REQUIREMENTS

4.1 It is an essential requirement that the dimensions of the empty or loaded (exceptional payload) coach when centrally positioned on the track shall be within the vehicle gauge as shown in drawing BE 97-02 Sheet 1 of 2 (BBB0481) (Refer to Appendix A).

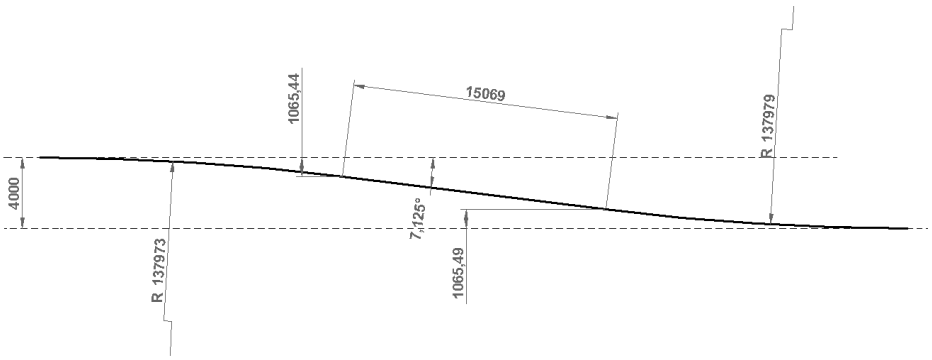
4.2 It is an essential requirement that no part of the coach shall move laterally outside the vehicle gauge as defined in drawing BE 97-02 Sheet 1 of 2 by more than 310 mm when negotiating a 91 m radius curve.

4.3 It is an essential requirement that the empty or fully loaded (exceptional payload) coach shall be able to safely negotiate the following track conditions when coupled together or coupled to any other Transnet Freight Rail rolling stock:

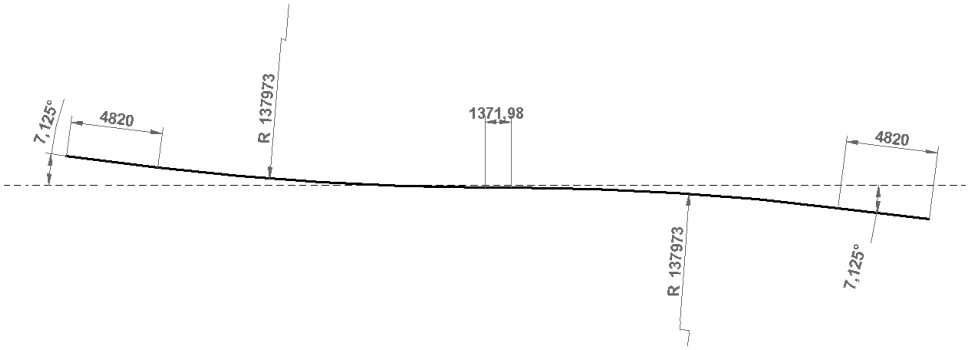
4.3.1 1 065 mm track gauge

4.3.2 85 m radius curve (marshalling yards) and 91 m radius curve (mainline) without a transition curve

4.3.3 1:8 cross-over



4.3.4 1:8 reverse turnout



4.3.5 Track geometry as per C-Standard as defined in Transnet Freight Rail's Manual for Track maintenance (BBB 0481)

5.0 BODY STRUCTURE

5.1 It is an essential requirement that all structural in-service loads, which include amongst others draft loads, buff loads, twist loads, lifting loads, jacking loads and equipment attachment loads as well as relevant stress limits shall be defined by the contractor and approved by Transnet Freight Rail.

5.2 It is an essential requirement that a report shall be provided describing the loads imposed during the design process together with detail on structural, Finite Element based design and fatigue calculations.

6.0 COUPLERS AND DRAW GEAR

6.1 It is essential that the couplers have a minimum continuous rating of 2000 kN.

6.2 It is an essential requirement that the coupling system complies with the basic requirements of AAR specifications M-201 and M-211.

6.3 It is an essential requirement that the coupling and draft gear system shall comply with AAR specification M-901-E or M-901G.

6.4 It is an essential requirement that the coupler contour conforms to the 10A head contour according to AAR Standard S-106.

6.5 It is an essential requirement that the coach is fitted with a device to allow uncoupling without the need for personnel to enter the space between adjacent vehicles.

6.6 It is an essential requirement that the height from rail level to the centre line of the coupler with the coach in the empty condition shall be 895 mm plus 6 mm minus 6 mm. The minimum allowable coupler centre line height from rail level shall not be less than 825 mm under any condition.

6.7 It is an essential requirement that the coupler arrangement can accommodate a swing angle of up to 7° from centre line. The coupler opening should allow for a swing angle of at least 13°.

6.8 It is an essential requirement that the coach be fitted with an emergency coupling bracket. The detail is to be verified with Transnet Freight Rail for approval.

7.0 BRAKE SYSTEM

7.1 It is an essential requirement that the brake system shall be an UIC-Brake System in accordance with UIC 541-1, UIC 541-3 and UIC 547, and/or a Vacuum Brake System in accordance with C.500/GEN/1981.

7.2 It is an essential requirement that for up to a 20 ton per axle vehicle, the maximum allowable stopping distance from:

- 100 km/h shall be 1020 m on 1 in 100 down grade;
- 90 km/h shall be 1020 m on a 1 in 81 down grade;
- 80 km/h shall be 1020 m on a 1 in 67 down grade;
- 70 km/h shall be 1020 m on a 1 in 51 down grade;
- 60 km/h shall be 1020 m on a 1 in 41 down grade;
- 50km/h shall be 1020 m on a 1 in 36 down grade

7.3 It is an essential requirement that technical details of the brake block type shall be submitted to Transnet Freight Rail for approval. The brake block preference is according to the specification RW_TE_SPC_0050, or have disc brakes according to UIC 541-3, type UIC 541 according to 2.2.2.1 Appendix A, A2: 175cm^2 24mm thick.

7.3 It is an essential requirement that the side clearances between the vacuum cylinder trunnions and the trunnion brackets must be between 3 mm minimum and 6 mm maximum per side.

7.4 It is an essential requirement that the brake block clearance is between 5 mm and 8mm.

7.5 It is an essential requirement that the wheels of an empty coach shall not skid on the rail during a full service brake application in wet conditions.

7.6 It is an essential requirement that the air brake system shall pass the UIC Coach Brake Test of Transnet Freight Rail document BBH 0356 and Brake Pipe Restriction Test (AAR S-471) or vacuum brake system test as per W 449 June 1997.

7.7 It is an essential requirement that the design and in-service requirements of the slack adjuster shall comply with or be equal to the DRV 2a or DRV 2a 10 slack adjuster.

7.8 It is a mandatory requirement for brake block forces to be measured and to be reported on.

7.9 It is an essential requirement that details of the proposed hand brake system shall be submitted to Transnet Freight Rail for approval. This information shall amongst others include brake calculations and a diagram showing the brake system layout. The hand brake must keep a fully loaded (exceptional payload) coach stationary on a 1 in 40 gradient. It must be possible to apply and release the handbrake from both sides of the coach.

7.10 It is an essential requirement for each coach to be fitted with an emergency passenger valve with a notice board (decal) next to it that stipulates an applicable fine and prosecution shall be enforced in the event of misuse. The exact detail of the notice board (decal) shall be agreed upon between the coach owner and contractor, and shall be approved by Transnet Freight Rail.

8.0 BOGIES

8.1 It is a preferred requirement for coaches to be fitted with Commonwealth bogies.

8.2 It is an essential requirement that if an alternative bogie design is not service proven, a detailed structural, Finite Element based, design report shall be submitted. Should the bogie be service proven, substantiating evidence shall be provided.

8.3 It is an essential requirement that if an alternative bogie design is chosen, that compliance to the running dynamics requirements of BS EN 14363:2005 or an equivalent international standard is demonstrated.

Where applicable, the contractor shall point out deviations from the standard due to the 1065 mm track gauge used in South Africa.

9.0 WHEELSETS

9.1 It is an essential requirement that geometric requirements shall be according to RSE/TE/SPC/0045.
9.2 It is an essential requirement that wrought steel wheels shall comply to the wheel supply specification RS/ME/SP021.
9.3 It is an essential requirement that the wheel centre shall be according to drawing RS A010_001_130_J.
9.4 It is an essential requirement that wheelsets shall be assembled in accordance with RS/ME/PR/021.
9.5 It is an essential requirement that axles shall comply to specification RS/ME/SP002.
9.6 It is an essential requirement that a suitable AAR approved roller bearing for the envisaged axle load shall be supplied.

10.0 WELDING

10.1 It is an essential requirement that all welding procedures used shall be qualified to ASME IX or relevant railway welding specifications.
10.2 It is an essential requirement that all welders and welding operators engaged in repairs of coaches and components shall be qualified to weld with appropriate wire and base metals in all the positions in which they are to work in accordance with ASME IX or relevant railway welding specifications.
10.3 It is an essential requirement that if flame cutting is used, that all slag, scale and detrimental discoloration of metal due to melting shall be removed.
10.4 During bending or straightening, the temperature should be carefully controlled and monitored to avoid overheating of the material.
10.5 Adequate surface preparation must be ensured prior to welding in accordance with specification RW/TE/SPC/0021

11.0 VEHICLE IDENTIFICATION

11.1 It is an essential requirement that vehicle identification system tags in accordance with BBD6353 shall be fitted.

12.0 TOWING HOOKS

12.1 It is an optional requirement that each coach is provided with four towing hooks in accordance with RS A026 001 503.
12.2 It is an optional requirement that the towing hooks shall be positioned between the bogie centre and headstocks on the underside of the outer longitudinal member of the under-frame. The open end of the hooks shall face towards the headstock.

13.0 JACKING PADS

13.1 It is an essential requirement that all coaches shall be provided with four jacking points for the purpose of lifting the body to run out the bogies.
13.2 It is an essential requirement that the jacking pads shall be positioned at least 500 mm away from each transverse bogie centre line and preferably inward of these points, i.e. towards the middle of the coach.

13.3 It is an essential requirement that the jacking pads shall accommodate a jack head of 150 mm diameter and be positioned not less than and as close as possible to 700 mm above rail level, and be provided with a non-skid surface.

13.4 It is an essential requirement that the train pipe and any other components adjacent to the jacking pad shall be positioned to permit the coach to be jacked up on the pads without having to remove any components.

14.0 STEPS AND HANDLES

14.1 If required, it is an essential requirement that steps and handles shall be designed in accordance with the ergonomic and geometric guidelines as stipulated in BBD 5162.

15.0 STENCILLING

15.1 It is an essential requirement that the name of private coach owner shall be stencilled in clearly legible letters on both length-wise sides of the coach.

15.2 It is an essential requirement that the built date shall be stencilled in clearly legible numerals on at least one length-wise side of the coach;

15.3 It is an essential requirement that the next “scheduled maintenance date” shall be stencilled in clearly legible numerals on both length-wise sides of the coach;

15.4 It is an essential requirement that the tare and gross vehicle mass shall be stencilled in clearly legible numerals at least one length-wise sides of the coach.

16.0 REFERENCES

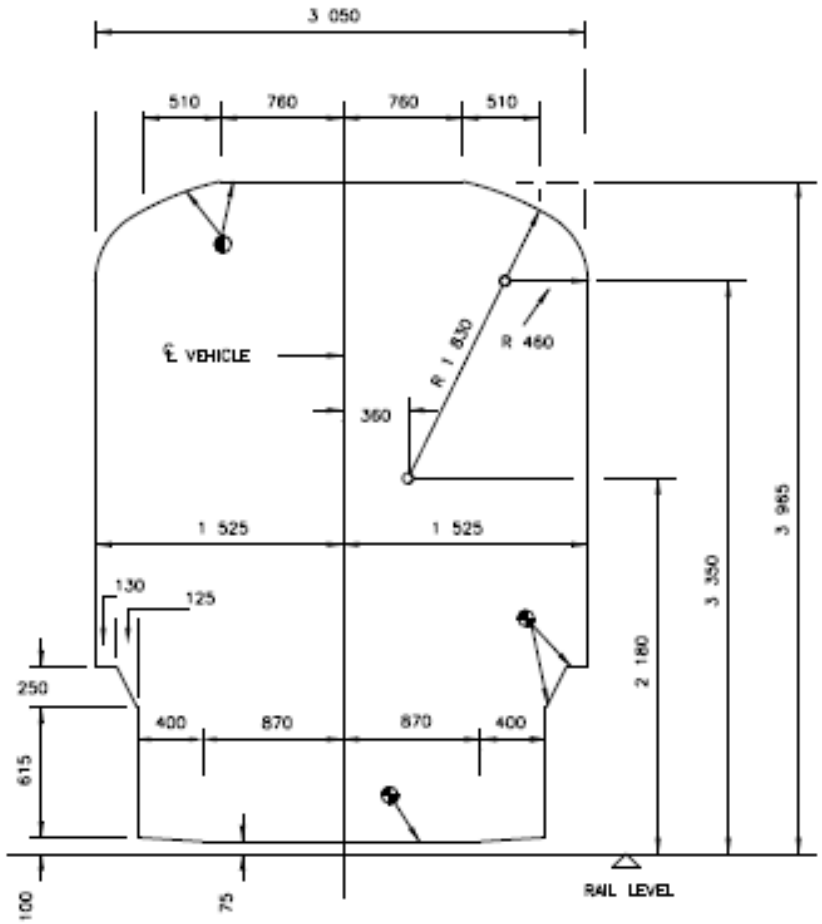
[1] BBB0481, Rev. 2, 2012, Transnet Freight Rail Manual for Track Maintenance.
[2] BBB4951, Rail Line Capacity.
[3] BBD5162, Risk Management: Wagons Ergonomic Report.
[4] BBD6353, Radio frequency identification TAG programming and installation on Transnet Freight Rail vehicles.
[5] South African Railways Carriage and Wagon Handbook 1983.
[6] RS/W448 Rev.1, 2006, Low friction composition brake blocks for Spoornet freight wagons.
[7] RSE/TE/SPC/0045, Geometric requirements for new, reprofiled and in-service wheelsets.
[8] RS/ME/PR/021, Wheelset assembly by press-fitting with boiled linseed oil.
[9] RS/ME/SP/002, Specification for the supply of axles for tractive and trailing stock.
[10] RS/ME/SP/008, Specification for the supply of cast steel wheels for trailing stock.
[11] RS/ME/SP/021, Specification for the supply of wrought wheels for tractive & trailing stock.
[12] AAR M-201, AAR Manual of Standards and Recommended Practices. Section B (Couplers and freight car draft components): Steel castings.
[13] AAR M-211, AAR Manual of Standards and Recommended Practices. Casting Details. Foundry and product approval requirements for the manufacture of couplers, coupler yokes, knuckles, follower blocks, and coupler parts.
[14] AAR M-901, AAR Manual of Standards and Recommended Practices Section B: Draft Gear, Second-hand and Reconditioned.
[15] AAR S-106, AAR Manual of Standards and Recommended Practices, Section S – Part III: Coupler and Yoke Details.
[16] AAR S-400, AAR Manual of Standards and Recommended Practices, Brake equipment - Installation specification.
[17] AAR S-401, AAR Manual of Standards and Recommended Practices, Brake design requirements.

[18] AAR S-419, AAR Manual of Standards and Recommended Practice, Section E: Brakes and Brake Equipment: Slack Adjuster.
[19] AAR S-420A, AAR Manual of Standards and Recommended Practices, Section E: Brakes and Brake Equipment: Slack Adjuster, Tension-Limiting Dimensions.
[20] AAR S-421, AAR Manual of Standards and Recommended Practices, Section E: Brakes and brake equipment: Slack adjuster, centre rod application.
[21] AAR S-486, AAR Manual of Standards and Recommended Practices, Code of air brake system tests for freight equipment – Single car test.
[22] BS EN 14363:2005 Railway applications: Testing for the Acceptance of Running Characteristics of Railway Vehicles, 2005
[23] AAR S-471, AAR Manual of Standards and Recommended Practices, Brake Pipe Restriction Test
[24] AAR M-901E, AAR Manual of Standards and Recommended Practices, Draft Gears with a Minimum Capacity of 36,000 ft.lb
[25] AAR M-901G, AAR Manual of Standards and Recommended Practices, Draft Gear Rated by Impact testing
[26] W.400/GEN/1986, South African Transport Services, Specification for Goods Vehicles, 1065 mm gauge

17.0 APPENDIX A

VEHICLE GAUGE :
1 065mm TRACK GAUGE

ANNEXURE 2
SHEET 1 of 2



REMARKS:
1. ◐ WITHOUT LOAD AND WITH NEW TYRES, VEHICLE MUST NOT BE HIGHER THAN THIS OUTLINE.
2. ◒ WITH FULL LOAD AND WORN TYRES, VEHICLE MUST NOT BE LOWER THAN THIS OUTLINE.

BE 97–02 Sht 1 Version 1

	TRANSNET RAIL SPECIFICATION **ONCE OFF TRANSFER INTERFACE REQUIREMENTS FOR PRIVATELY OWNED LOCOMOTIVES INTERFACING WITH TRANSNET FREIGHT RAIL ROLLING STOCK AND INFRASTRUCTURE** **TECHNICAL REQUIREMENTS**	**Document no:** BBH 3865 **Revision:** 1 **Issue date:** 1 September 2020 **Page 1 of 12**

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CONTENTS

Schedule of Amendments

Version	Date	Scope
1	1 September 2020	Original document

1 SCOPE

1.1 This specification defines the minimum technical interface compliance requirements for privately owned locomotives to be hauled for a single “once-off” trip on Transnet Freight Rail’s rail network, thereby interfacing with Transnet Freight Rail owned rolling stock and infrastructure.

1.2 This specification is only valid for a maximum haulage transfer speed of 60 km/h.

1.3 This specification is only valid for the movement/transfer of privately owned locomotives that are hauled dead (unpowered).

1.4 The braking system shall be AAR compliant and shall be configured for dead-in-train or dead-in-consist.

1.5 In the event that the locomotive cannot be hauled with a dead-in-train/dead-in-consist AAR compliant braking configuration, then the locomotive may be considered (though not recommended by Transnet Freight Rail) to be hauled un-braked subject to approval from Transnet Freight Rail, Capital Program (Technology Management). Un-braked haulage will only be considered if the locomotive is fitted with an emergency coupling point which allows for fitment of safety chains.

2 RESTRICTIONS

2.1 This specification is not applicable to locomotives hauled/operated/transferred under own power, regardless of the power source.

2.2 This specification is not applicable for haulage under 50 kV AC overhead catenary infrastructure.

2.3 If the locomotive is fitted with a pantograph(s) and/or any other power transmission device, then the pantograph(s) and/or other power transmission device shall not be used but shall be safely securely and earthed for the entire duration of the movement.

2.4 Locomotives having an axle load rating of more than 21.5 ton per axle, regardless of the number of axles, will not be permitted on the Transnet Freight Rail load network.

3 VALIDATION AND VERIFICATION

3.1 It is a mandatory requirement that conformance to this specification shall be validated during scheduled compliance reviews with Transnet Freight Rail (Capital Program – Technology Management).

3.2 It is a mandatory requirement that the contractor shall demonstrate conformance to requirements to Transnet Freight Rail (Capital Program – Technology Management)., via appropriate documentation and/or physical tests (and/or physical inspections).

3.3 If standard and/or service proven designs and/or equipment is proposed, an exemption from submitting detailed design and testing reports will be considered based on evidence provided to Transnet Freight Rail (Capital Program – Technology Management)..

4 GENERAL REQUIREMENTS

4.1 **Axle load:** It is a mandatory requirement that the axle load of the locomotive be specified and be limited to the loading capacity of the applicable track(s) as stipulated in BBB4951 Rail Line Capacity, and shall not exceed 21.5 ton per axle, regardless of the number of axles.

4.2 **Centre of gravity:** It is a mandatory requirement that the centre of mass of the locomotive shall be as close as possible to the vertical centreline and not be higher than 1829 mm above the top of the rail.

4.3 **General dimensions:** It is a mandatory requirement that the distance between bogie centres shall not be greater than 15m. In addition, the coupling length, body length, body width, body height, equipment attachment height, bogie centre to bogie centre distance etc. shall be specified on an official locomotive diagram.

5 INFRASTRUCTURE INTERFACE REQUIREMENTS

5.1 **Vehicle gauge (part 1):** It is a mandatory requirement that the dimensions of the locomotive when centrally positioned on the track shall be within the vehicle gauge as shown in drawing BE 97-02 Sheet 1 of 2 (BBB0481) and D350M (Refer to Appendix A).

5.2 **Vehicle gauge (part 2):** It is a mandatory requirement that no part of the locomotive shall move laterally outside the vehicle gauge as defined in drawing BE 97-02 Sheet 1 of 2 (BBB0481) and D350M (Refer to Appendix A) by more than 310 mm when negotiating a 91 m radius curve.

5.3 **Track characteristics:** It is an essential requirement that the locomotive shall be able to safely negotiate the following track conditions when coupled together or coupled to any other Transnet Freight Rail rolling stock:

5.3.1 1 065 mm track gauge

5.3.2 85m radius curve (marshalling yards) and 91 m radius curve (mainline) without transition curves

6 COUPLERS AND DRAW GEAR

6.1 **Coupler rating:** It is essential that the couplers minimum continuous rating be specified and shall not be less than 900 kN.

6.2 **Coupling system:** It is a mandatory requirement that the coupling system complies with the basic requirements of AAR specifications M-201 and M-211.

6.3 **Draft gear system:** It is a mandatory requirement that the coupling and draft gear system shall comply with AAR specification M-901-E or M-901G.

6.4 **Coupler contour:** It is a mandatory requirement that the coupler contour conforms to the 10A head contour according to AAR Standard S-106.

6.5 **Uncoupling device:** It is a mandatory requirement that the locomotive is fitted with a device to allow uncoupling without the need for personnel to enter the space between adjacent vehicles.

6.6 **Coupler height:** It is a mandatory requirement that the height from rail level to the centre line of the coupler shall be between 845 mm and 910 mm.

6.7 **Coupler swing:** It is an essential requirement that the coupler swing angle (and coupler opening detail) from centre line be specified and shall be adequate for traversing an R 85 m curve when coupled to any Transnet locomotive. Typically, coupler swing angles from the centreline in the 7^{o} to 20^{o} (degrees) range will be adequate, depending on the Transnet locomotive type that will be undertaking the haulage.

6.8 **Emergency coupling:** If Transnet Freight Rail granted permission to haul the locomotives un-braked, then the use of an emergency coupling / safety chain is mandatory, with the following additional mandatory requirements for the emergency coupling:

6.8.1 **Emergency coupling (fitment point):** It is a mandatory requirement for an emergency coupling fitting point to be installed on the vertical centre line of the buffer beam, at vertical distance of not less than 280 mm, nor more than 300 mm, below the coupler horizontal centre line.

6.8.2 **Emergency coupling (force requirement):** It is a mandatory requirement that the emergency coupling point shall be designed to withstand a continuous draft force of 333kN, without exceeding the yield point of the material.

6.8.3 **Emergency coupling (gear):** It is a mandatory requirement that the emergency coupling fitting points shall be able to accommodate emergency coupling gear to drawing no. CME 1347/13-000/B (Appendix B) and it shall be possible to fit this equipment in traffic, without any special facilities, whilst locomotives/rolling stock are coupled together and without dismantling the normal draw-gear or removing the coupler.

6.8.4 **Emergency coupling (quantity):** It is a mandatory requirement that the locomotive, with such an emergency coupling point (Clauses 6.8.1 to 6.8.4), be fitted to both leading and trailing ends of the locomotive.

7 BRAKE SYSTEM

7.1 **Brake system design:** It is a preferred requirement that the brake system of the locomotive shall allow for dead-in-train/dead-in-consist operation and shall be AAR compliant.

7.2 **Brake system alternative design:** The use of a non-compliant AAR brake system or haulage of the locomotive un-braked may be considered by Transnet Freight Rail, under certain exceptional circumstances, which would result in additional technical requirements that would have to be approved by Transnet Freight Rail.

7.3 **Dead-in-train operation:** It is an essential requirement that brakes be applied in a similar manner to a freight wagon due to brake pipe (BP) changes. The locomotive shall have an AAR compatible BP coupling and dead-in-train function.

7.4 **Brake block force:** It is an essential requirement for brake block forces to be measured and to be reported on.

7.5 **Dead-in-consist operation:** It is an essential requirement that independent brakes be applied to match the brake cylinder equalising pipe (BCEP). The locomotive shall have an AAR compatible BCEP coupling and dead-in-consist function.

7.6 **Park brake:** It is an essential requirement that the locomotive be fitted with a park brake and its holding ability capabilities shall be demonstrated by calculation and or tests.

7.7 **Park brake (manual vs. electronic):** It is an essential requirement that either a mechanical park brake or an electronically controlled spring-applied/pneumatically released park brake with a manual mechanical release shall be fitted to the locomotive. In either type of park brake, powering up of the locomotive will not be permitted, whilst on Transnet Freight Rail property.

7.8 **Un-braked operation:** Haulage of locomotives in the un-braked condition is not recommended by Transnet Freight Rail. However, under exceptional circumstances, Transnet Freight Rail may consider haulage of locomotives in the un-braked condition, provided the following additional requirements can be met:

7.8.1 **Emergency coupling:** For the haulage of locomotives in the un-braked condition, it is a mandatory requirement that an emergency coupling is fitted as stipulated in Clause 6.8.

7.8.2 **Non-AAR compliant**: If the locomotive does not have AAR compatible brake pipe couplings, it becomes a mandatory requirement to fit a temporary through-pipe to the locomotive, with compatible FP-5 type couplings at each end. This through-pipe shall further pass the AAR S-471 brake pipe restriction test.

7.8.3 **Locomotive position in consist:** If the locomotive is running at the rear of a locomotive consist (with trailing wagons) or in a train (with trailing wagons), the fitment of a BP through pipe is mandatory. If this locomotive(s) is hauled at the rear of the train (after the trailing wagons), then it cannot be un-braked.

8 BOGIES

8.1 **Bogie type:** It is a mandatory requirement that the bogie type be indicated.

8.2 **Running dynamics:** It is a mandatory requirement that running dynamics safety evaluation tests be conducted up to 66 km/h (60 km/h plus 10%).

8.3 **Track loading:** It is a mandatory requirement that the locomotive does not induce track loading damage to the Transnet Freight Rail load network.

9 WHEELSETS

9.1 **Back-to-back distance:** It is an essential requirement that the wheelset back-to-back distance be appropriate for Transnet Freight Rail's 1065mm track gauge.

9.2 **Wheel profile:** It is an essential requirement that the intended wheel profile be specified.

10 ELECTROMAGNETIC COMPATIBILITY

10.1 **EMC compliance**: Under conditions of dead (un-powered) haulage, electromagnetic compatibility should not be required for the locomotive. However, if for any reason, electromagnetic compatibility is required to be demonstrated, then Transnet Freight Rail and the contractor shall agree upon the method to prove electromagnetic compliance.

11 ROOF EQUIPMENT

11.1 **Housed position:** It is a mandatory requirement that all locomotive roof equipment shall be made safe by physically tying down all pantographs in the housed position (and not only by means of the locomotives pantograph "down" command).

11.2 **Electrical equipment:** It is a mandatory requirement that all locomotive roof equipment shall be made safe by ensuring all electrical equipment is "dead".

11.3 **Earthing:** It is a mandatory requirement that all locomotive roof equipment and electrical circuits are earthed.

12 LOCOMOTIVE EARTHING

12.1 It is a mandatory requirement that earthing of the metal parts of the locomotive and the locomotive to rail resistance be satisfied. Note that the ordinary running rail, which is not earthed, constitutes the negative return of the system and one (normally) or both rails may be used for this purpose.

13 COMPLIANCE EVIDENCE REQUIRED

13.1 Compliance evidence shall be submitted to Transnet Freight Rail (Capital Program – Technology Management) for review and approval. Tests required must be accompanied by a test report and physical inspections may be witnessed by a Transnet Freight Rail (Capital Program – Technology Management) technical representative. The minimum compliance evidence required by Transnet Freight Rail is as follows:

Clause reference	**Documentation required**	**Test(s) and/or physical inspection(s) required**
Scope		
1.1	Information	
1.2	-	Yes
1.3	Information	
1.4	Information	
1.5	Information	
Restrictions		
2.1	Information	
2.2	Drawing	-
2.3	Weighbridge certificate	-
Validation and verification		
3.1	Information	
3.2	Information	
3.3	Information	
General requirements		
4.1 Axle load	Calculated mass (3D CAD model)	-
4.2 Centre of gravity	Calculation (3D CAD model)	-
4.3 General dimen0sions	Locomotive diagram	-
Infrastructure interface requirements		
5.1 Vehicle gauge (part 1)	Drawing	May have to be confirmed by conducting a vehicle gauge test
5.2 Vehicle gauge (part 2)	Drawing	-
5.3 Track characteristics	-	Yes (bogie slew test for R85m curve)
Couplers and Draw-gear		
6.1 Coupler rating	Drawing / coupler strength datasheet	-
6.2 Coupler system	Drawing	-
6.3 Draft gear system	Drawing	-
6.4 Coupler contour	Drawing	-
6.5 Uncoupling device	Drawing	Yes (functional test)
6.6 Coupler height	Drawing (locomotive diagram)	Yes (physical inspection)
6.7 Coupler swing	Drawing	Yes (physical inspection)
6.8 Emergency coupling	Drawing	Yes (physical inspection)
6.8.1 Emergency coupling (fitment point)	Drawing	Yes (physical inspection)
6.8.2 Emergency coupling (force requirement)	Calculation	-
6.8.3 Emergency coupling (gear)	Drawing	Yes (physical inspection)

Clause reference	Documentation required	Test(s) and/or physical inspection(s) required
6.8.4 Emergency coupling (quantity)	-	Yes (physical inspection)
Brake system		
7.1 Brake system design	Report	Yes (brake tests)
7.2 Brake system alternative design	Report	Yes (brake tests)
7.3 Dead-in-train operation	Operation manual and drawing	Yes (brake tests)
7.4 Brake block force		Yes (test)
7.5 Dead-in-consist operation	Operation manual and drawing	Yes (brake tests)
7.6 Park brake	Calculation, operation manual, drawing	Yes
7.7 Park brake (manual vs. electronic)	Calculation, operation manual, drawing	Yes
7.8.1 Emergency coupling	Drawing	Yes (physical inspection)
7.8.2 Non AAR compliant	Drawing	Yes
7.8.3 Locomotive position in consist	-	-
Bogies		
8.1 Bogie type	Drawing / bogie datasheet	-
8.2 Running dynamics	-	Yes
8.3 Track loading	-	Yes
Wheelsets		
9.1 Back to back distances	Drawing	
9.2 Wheel profile	Drawing	
Electromagnetic compatibility		
10.1 EMC compliance	EMC test certificate (may be required)	-
Roof equipment		
11.1 House position	-	Yes (physical inspection)
11.2 Electrical equipment	-	Yes (physical inspection)
11.3 Earthing	-	Yes (physical inspection)
Locomotive earthing		
12.1 Locomotive earthing	Report, drawing	Yes (physical inspection)

14 REFERENCES

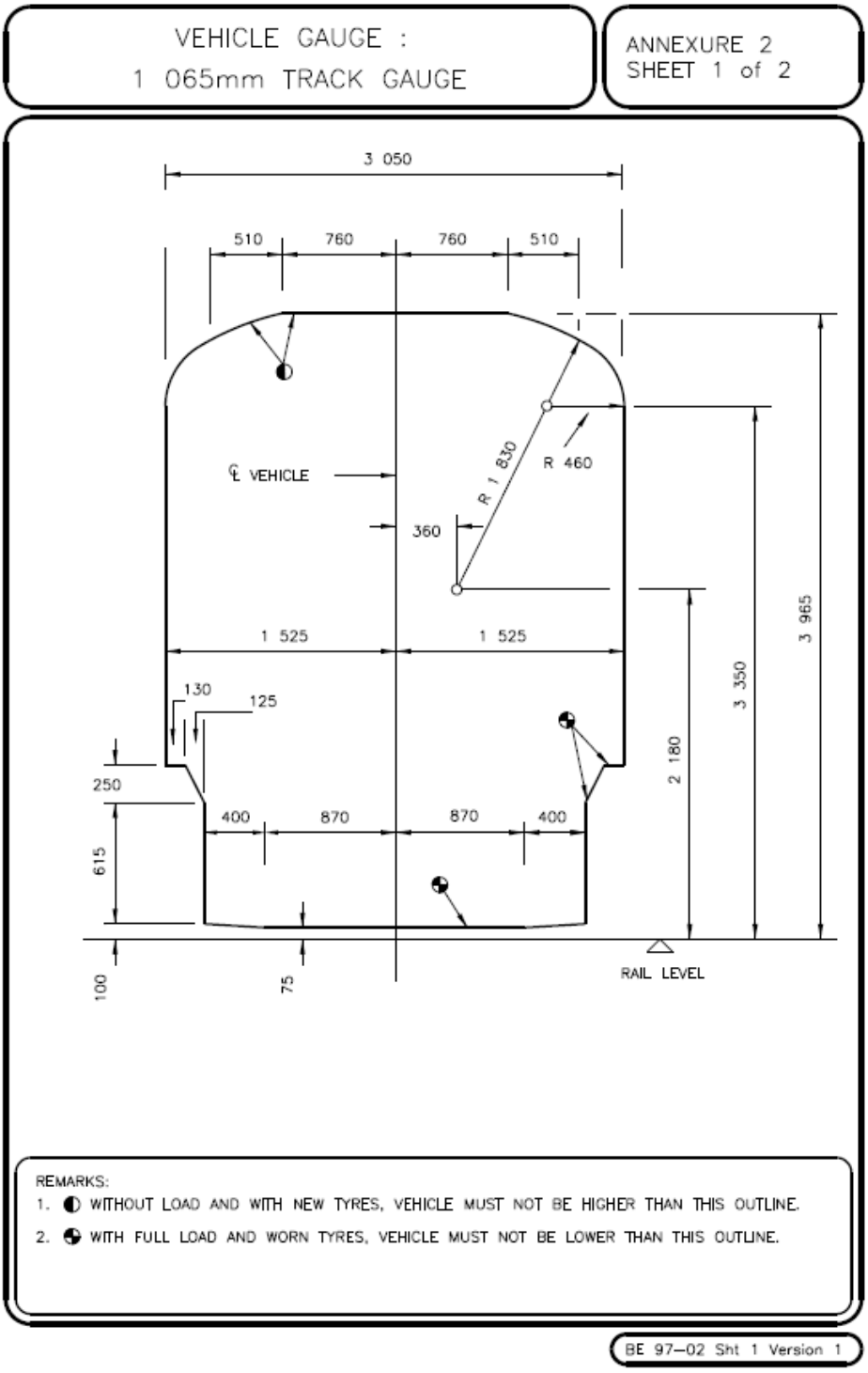
[1] BBB0481, Rev. 2, 2012, Transnet Freight Rail Manual for Track Maintenance.
[2] BBB4951, Rail Line Capacity.
[3] South African Railways Carriage and Wagon Handbook 1983.
[4] RSE/TE/SPC/0045, Geometric requirements for new, re-profiled and in-service wheelsets.
[5] W.400/GEN/1986, South African Transport Services, Specification for Goods Vehicles, 1065 mm gauge

15 RESPONSIBLE TRANSNET RAIL TECHNICAL REPRESENTATIVES

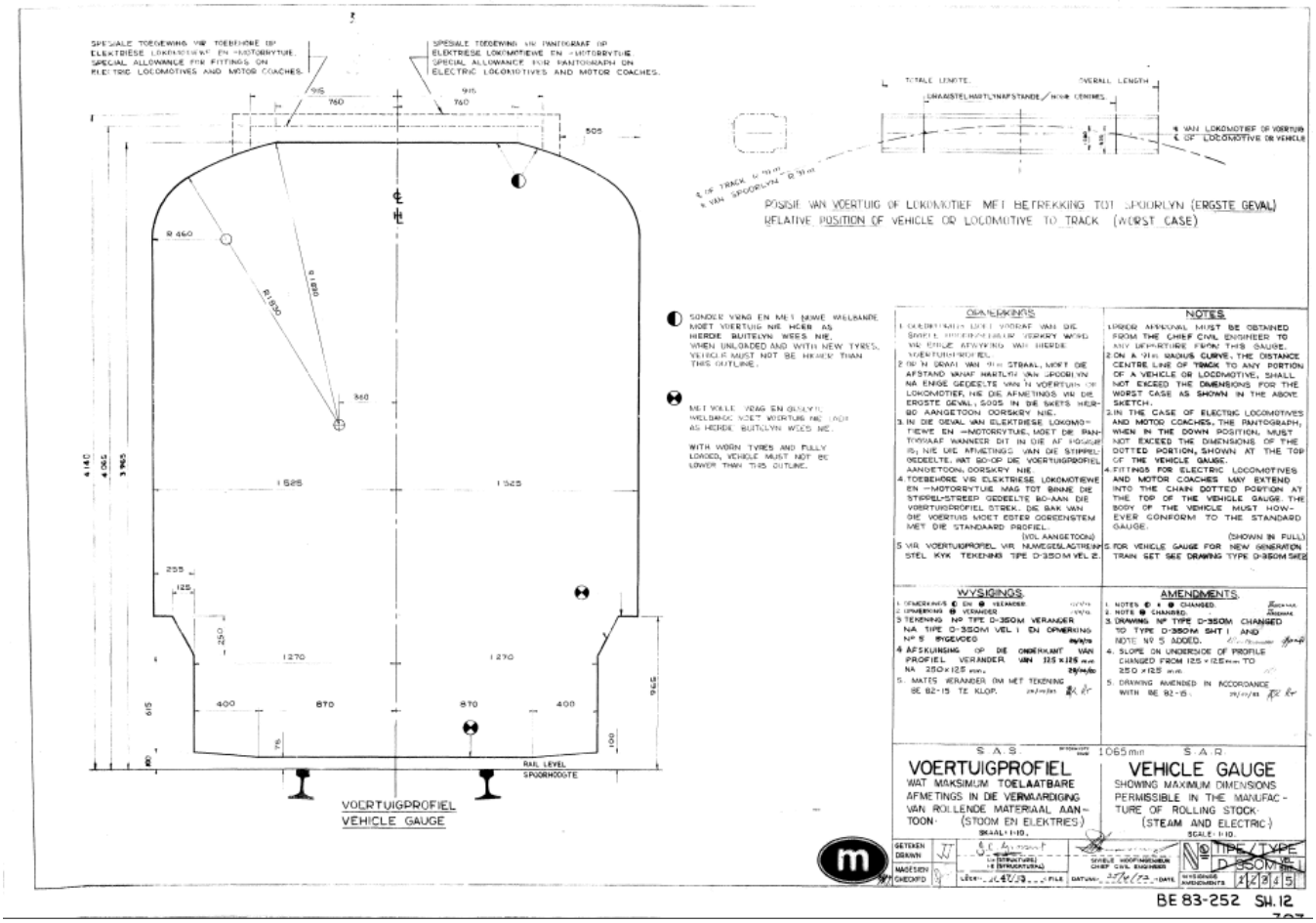
The following Transnet Freight Rail (Capital Program – Technology Management) technical representatives provided the requirements for this specification:

- Asheen Singh (Electrical Technology)
- Mesham Sivnarain (Mechanical Technology: Bogie Technology)
- Nikheil Singh (Train Design Technology: Brake System Technology)
- Lenard Kusel (Train Design Technology: Couplers and Draw-gear Technology)
- Ricus Coetzee (Electrical Technology)
- Sheraton Singh (Mechanical Technology: Vehicle Dynamics and Structural Mechanics)
- Sizwe Nkosi (Train Design Technology: Couplers and Draw-gear Technology)

APPENDIX A.1 – VEHICLE GAUGE BE-97-02



APPENDIX A.2 – D350M



APPENDIX B – EMERGENCY COUPLING CME 1347/13-000/B