

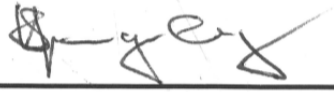



TRANSNET FREIGHT RAIL		
	GEOMETRIC REQUIREMENTS FOR NEW, REPROFILED AND IN-SERVICE WHEELSETS	Document no: RSE/TE/SPC/0045
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1 SCOPE

This document prescribes the geometric requirements for new, re-profiled and in-service wheelsets that must be adhered to, to ensure operational safety and efficiency. This standard is applicable to all wheelsets that run on Transnet Freight Rail tracks, irrespective of whether the rolling stock is owned or leased by the company or subject to an access agreement.

With reference to the geometric parameters captured in this document, this document supersedes all letters, instructions, codes of practice and handbooks issued before the date of this document.

The background to this specification, additional information and references are given in document BBH2475.

2 DEFINITIONS

For the purpose of this document the following definitions apply.

Axial run-out: The positional variation of the centre of the flange face in a direction perpendicular to the flange face during one revolution of the wheelset about its axle journals. (Dimension G in Figure 1)

Back-to-back distance: The distance between the flange back faces of a wheelset measured at rail level and parallel to the axle centre line with the wheelset assembly in the unloaded condition. (Dimension A in Figure 1)

Diameter differential: The difference in diameter between the two wheels on the same axle measured at the tread datum position. (Difference between D1 and D2 in Figure 1)

Facing: Machining the back of the wheel flange.

Flange angle: The angle of the flange face relative to a line perpendicular to the axle centreline. See Figure 5.

Flange height: The difference between the radius of the wheel at the tip of the flange and the radius of the wheel at the tread datum position. See Figure 5.

Flange thickness: The distance between the flange back and the flange face measured 14 mm from the flange tip. See Figure 5. Also referred to as "Flange width".

Heavy repair: A heavy repair on a wheelset is done when wheels are fitted to an axle to form a wheelset and includes all related activities. The wheels and / or the axle may be new or reclaimed. Also referred to as "new build".

Hollow wear: Wear on the central portion of the wheel tread causing the development of a "false flange" on the field side (and sometimes in the flange root) of the tread. See Figure 4.

Light repair: A light repair on a wheelset refers to maintenance activities that do not require fitting the wheels to the axle or removing the wheels from the axle. Also referred to as “wheelset refurbishment”.

Radial run-out: The radial variation of the tread datum position during one revolution of the wheelset about its axle journals. (Dimension H in Figure 1)

Re-profiling: Re-profiling is the activity which restores the wheel profiles on a wheelset that has been in service, by removing material from the wheel rim. This activity forms part of a light repair.

Tread datum position: A point on the tread section of the wheel, 82.5 mm from the back face of the flange of a correctly positioned wheel. The nominal distance between the tread datum positions of two wheels on the same axle is 1 152 mm. See Figure 2 and Figure 5. Also referred to as the “taping line”.

Tread wear: The total wear on the wheel tread including hollow wear measured at the tread datum position. Alternatively, the growth in flange height. See Figure 3.

Wheel profiling: The activity that shapes the wheel rim to the required geometry by removing material from the wheel rim.

Wheelset refurbishment: See “light repair”.

Wheelset symmetry: The position of the back of wheel flanges relative to the centre of the axle (Dimensions K_1 and K_2 in Figure 1)

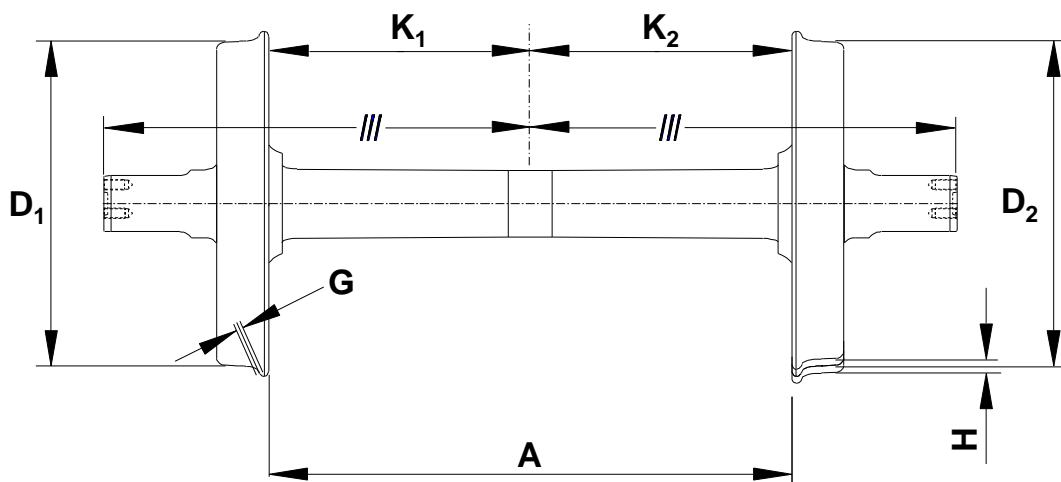


Figure 1

Figure 1: Wheelset dimensions and tolerances

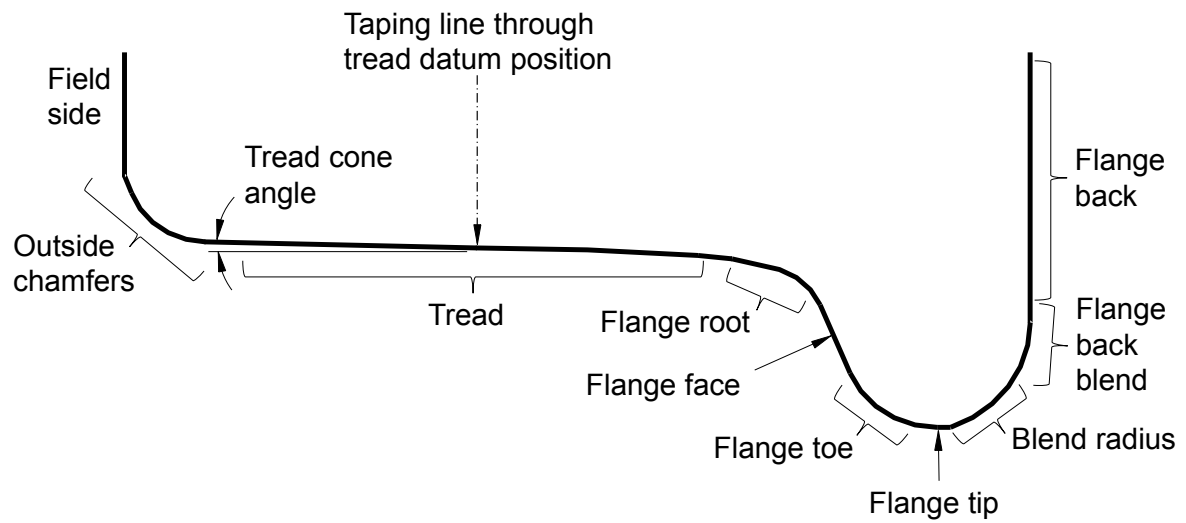


Figure 2: Wheel profile definitions

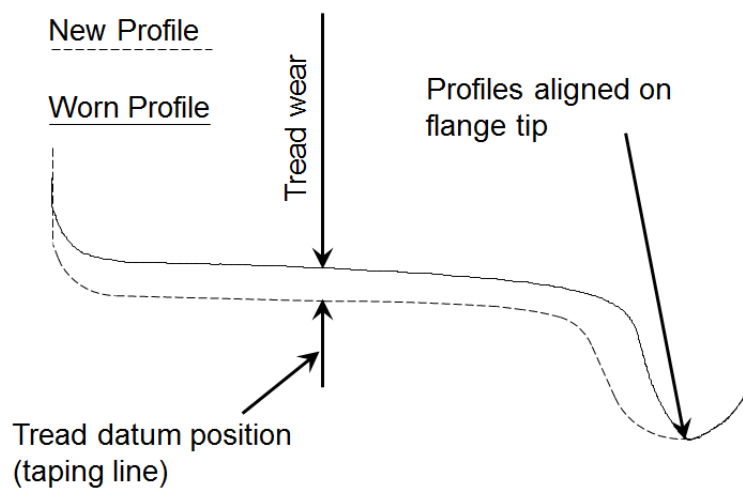


Figure 3: Tread wear

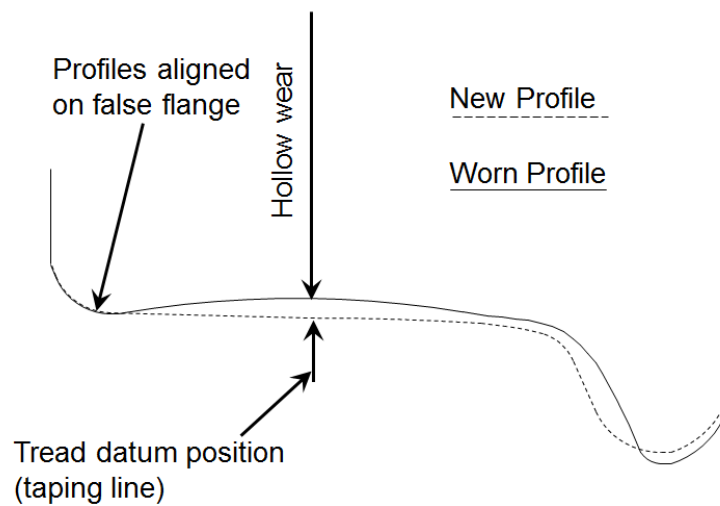


Figure 4: Hollow wear

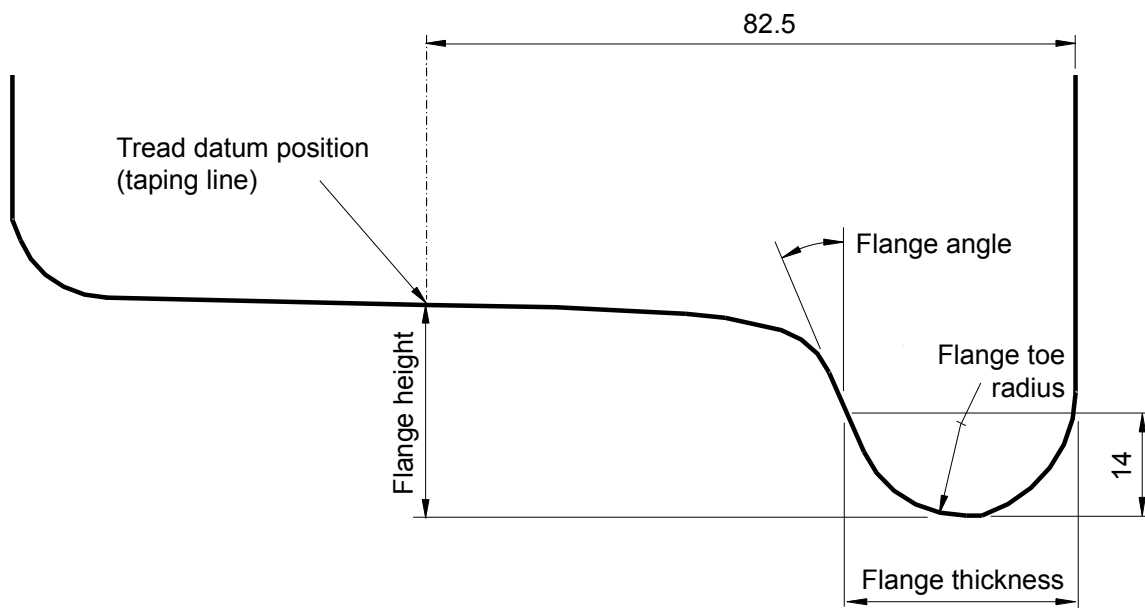


Figure 5: Wheel profile parameter definitions

3 NEW AND REPROFILED WHEELSET REQUIREMENTS

3.1 *Minimum Machined Wheel and Tyre Diameter*

The machined wheel diameter as measured at the tread datum position must not be less than the minimum diameter given in Table 1 and Table 2. This makes provision for wear so that the condemning wheel diameter will never be reached in-service.

The profile of the wheel tread is independent of the manufacturer or type of wheel. Any of the profiles mentioned in paragraph 4.1 can be cut on any of the wheel types in Table 1 and Table 2.

For wheel types not mentioned in Table 1 and Table 2, refer to Appendix C and / or the Wheelset and Materials Technology Owner.

Refer to document BBH2475 for more information about minimum machined wheel diameters and manufacturer condemning wheel diameters.

For limitations of wheel types on one axle see: "BBC8782 Specification for Heavy Maintenance of Wheelsets for Tractive and Trailing Stock"

For identification of different wheel types, refer to document PD_PDWL_NAT_PROC_041.

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Table 1: Minimum machined wheel diameters for trailing stock

Wheel type	Supplier / model	Production method	Page (PD_PDWL_N AT_PROC_041)	Nominal new wheel diameter (mm)	Condemning diameter (mm)	Minimum machined diameter (mm)	Axle load (tonnes)
36" (F type)	CAF	Forged	10	915	865	877	30
36" (F type)	CAF (rehabilitated corroded wheels - web reduction)	Forged		915	865	877	26
36" (F type)	Comsteel	Forged	16	913	870	882	
36" (F type)	Lucchini SA (original design)	Forged	9	915	880	885	30
36" (F type)	Lucchini SA (increased web thickness with rim groove)	Forged	8	915 +3 -0	870	882	30
36" (F type)	Lucchini SA (rehabilitated corroded wheels - web reduction)	Forged		915	880	892	26
36" (F type)	Lucchini SA (new design)	Forged		915 +3 -0	865	877	32.5
36" (F type)	Naledi Inhlanganiso	Forged		915 +2 -0	859.46	872	30
36" (F type)	Scaw (Cast Products South Africa (CPSA))	Cast	13	915 +2 -0	859	871	30
36" (F type)	Valdunes (without step on rim)	Forged	11	915 +2 -0	859.46	872	30
36" (F type)	Valdunes Black web wheels (with step on rim)	Forged		915 +2 -0	859.46	872	30
36" (F type)	Valdunes (without step on rim) (rehabilitated corroded wheels - web reduction)	Forged	11	915 +2 -0	859.46	872	26
36" (F type)	Valdunes Black web wheels (with step on rim) (rehabilitated corroded wheels - web reduction)	Forged		915 +2 -0	859.46	872	26
34" (D type)	Scaw (Cast Products South Africa (CPSA))	Cast	12	863 +4.7 -0	810	822	22
34" (D type)	Comsteel	Forged	15				
34" (D type)	Lucchini SA	Forged	9	863	812	824	22
34" (D type)	Naledi Inhlanganiso	Forged		863 +2 -0	814.2	827	20
34" (D type)	Valdunes	Forged		863 +2 -0	814.2	827	20
34" (D type)	Vecor (2-Wear)	Cast		863	816	828	
34" (D type)	Vecor (Multi-Wear)	Cast		863	776	788	
R6	Blue Train	Forged and tyred		863	808	820	
34"	Blue Train (Lucchini 34")	Forged		863	808	820	

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Table 2: Minimum machined wheel diameters, wheel diameter differences and wheel profiles for locomotives

Locomotive class	Wheel type	Nominal new wheel diameter (mm)	Minimum machined wheel diameter (mm)	Minimum machined rim thickness (mm)	Maximum diameter difference between wheels on one bogie (mm)	Maximum difference of average wheel diameter between bogies (mm)	Maximum diameter difference between wheels on one vehicle (mm)	Wheel profile (see note 1)
34-000, 34-400, 34-500, 34-900 (GE)	Solid	915	844	-	6.5	8	-	22
34-000, 34-400, 34-500, 34-900 (GE)	Tyred	915	850	44	6.5	8	-	22
34-200, 34-600, 34-800 (GM)	Solid	1015	927	-	6.5	8	-	22
34-200, 34-600, 34-800 (GM)	Tyred	1015	952	44	6.5	8	-	22
35-000, 35-400 (GE)	Solid	915	844	-	6.5	8	-	22
35-000, 35-400 (GE)	Tyred	915	850	44	6.5	8	-	22
35-200, 35-600 (GM)	Solid	915	844	-	6.5	8	-	22
35-200, 35-600 (GM)	Tyred	915	850	44	6.5	8	-	22
36-000, 36-100 (GE)	Solid	915	844	-	6.5	8	-	22
36-000, 36-100 (GE)	Tyred	915	850	44	6.5	8	-	22
36-200 (GM)	Solid	1015	927	-	6.5	8	-	22
36-200 (GM)	Tyred	1015	952	44	6.5	8	-	22
37-000 (GM)	Solid	1015	927	-	6.5	8	-	22
37-000 (GM)	Tyred	1015	952	44	6.5	8	-	22
38-000	Solid	1054	970	-	6	8	6	22
38-000	Tyred	1054	984	41	6	8	6	22
39-000 (GM/TRE)	Solid	1015	927	-	6.5	8	-	22
39-000 (GM/TRE)	Tyred	1015	952	44	6.5	8	-	22
39-200 (EMD)	Solid	1016 +4 -0	927	-	3	8	14	22
39-200 (EMD)	Tyred	1016 +4 -0	952	44	3	8	14	22
43-000 (GE)	Solid	1041	977	-	19	-	31	22
44-000 (GE)	Solid	1041	977	-	12	-	25	22
45-000 (CNR)	Solid	1041	977	-	6	-	12	22
6E, 6E1	Tyred	1219	1156	44.5	6.5	13	-	22
7E, 7E1, 7E2, 7E3, 7E4	Tyred	1219	1156	44.5	6.5	13	-	22
8E	Tyred	1219	1156	44.5	6.5	13	-	22
10E, 10E1, 10E2	Tyred	1219	1156	44.5	6.5	13	-	22
11E	Tyred	1219	1156	44.5	6.5	13	-	22
15E	Solid	1220 +4 -0	1152	-	13 (see note 2)	13	-	23
18E	Tyred	1219	1156	44.5	6.5	13	-	22
19E	Solid	1220 +4 -0	1152	-	3	6	-	23
20E	Solid	1220 +0.5 -0	1152	-	1	-	2	22
21E	Solid	1220 +0.5 -0	1152	-	1	-	2	23
22E	Solid	1220 +0.5 -0	1152	-	1	-	2	22
23E	Solid	1220 +2 -0	1148	-	6.5	-	13.5	22

Note 1: For more information about wheel profiles, see section 4.1.

Note 2: Actual diameter difference not to exceed 13mm before packing. The “equivalent diameter” difference between wheels in the same bogie shall not exceed 6mm after packing of primary springs.

Table 3: Allowable wheel diameter differences (at time of fitment)

Vehicle type	Maximum diameter difference between wheels in one bogie (mm)	Maximum difference of average wheel diameter between bogies (mm)
All Transnet freight wagons	6.5	25
Blue Train Coaches	4	8

Table 4: Allowable wheel widths

Class or type	Nominal wheel width (mm)	Minimum wheel width (mm)
Wheelsets previously pressed to a back-to-back distance of 990^{+2}_{-0} mm	127	125
All other wheelsets	135	132

3.2 Wheelset Tolerances

3.2.1 Wheel profiles

Wheel profiles must be machined to fit within an envelope of ± 0.25 mm around the nominal design profile. See Figure 6.

When checking machining accuracy, the measured profile may be moved vertically and/or horizontally to fit the tolerance envelope, but may not be rotated.

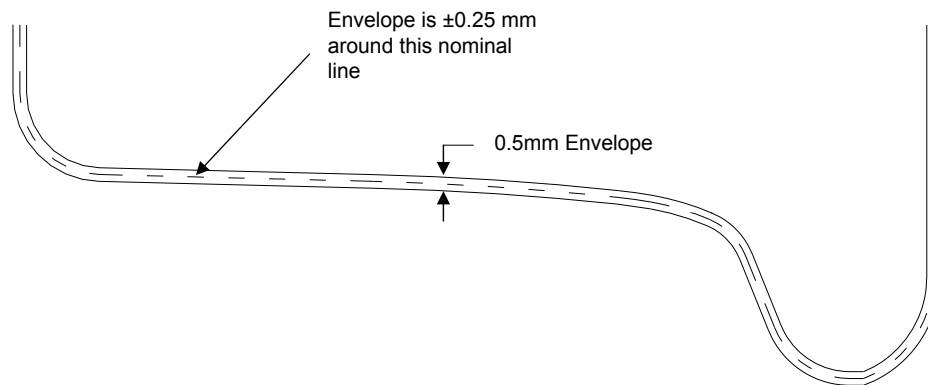


Figure 6: Wheel profile machining tolerances

Wheels have different widths, primarily depending on how the wheel was originally fitted to the axle (wheelset symmetry and back-to-back distance). To accommodate different wheel widths, the width of the design wheel profile shall be adapted to match the actual wheel width. This shall be done by shortening or lengthening (as may be required) the straight line (uniform conicity) area of the wheel profile on the field side of the wheel tread. This is the part of the profile that forms the tread cone angle. See document BBH2475.

3.2.2 Diameter differential

The diameter difference between wheels on the same axle (D1-D2 in Figure 1) for new and re-profiled wheels shall not exceed 0.5 mm. For Blue Train wheels the limit is 0.3 mm. These limits are not applicable to worn, in-service wheelsets.

3.2.3 Wheelset symmetry

3.2.3.1 Newly built wheelsets (new and heavy repairs)

For all newly built wheelsets the distance between the back of the flange and the axle transverse centreline shall not differ by more than 1.0 mm between the sides of one wheelset after the wheel profiles have been machined. With reference to Figure 1:

$$|K_1 - K_2| \leq 1.0 \text{ mm.}$$

The transverse axle centre is equidistant from the axle ends as shown in Figure 7. Referencing the axle ends is required to determine the lateral correction to be applied to each wheel profile in the machining process. Referencing the axle ends is also required to check the wheelset symmetry after profile machining or wheel pressing as may be relevant.

3.2.3.2 Refurbished wheelsets (light repairs / re-profiling)

No wheelset symmetry requirement is specified for light repair wheelsets. No “facing” is allowed when doing light repairs / re-profiling.

3.2.4 Back-to-back distance

3.2.4.1 Newly built wheelsets (new and heavy repairs)

Newly built wheelsets where pre-profiled wheels are pressed onto an axle shall have a back-to-back distance of 987 ± 1.0 mm. Profile machining shall only be done on these wheelsets if one or more geometric tolerance requirements are not achieved.

Newly built wheelsets where rough machined (supply size) wheels are pressed onto an axle or where new tyres are fitted, shall have the following back-to-back distance after the wheel profiles have been machined:

- a) 10E and 10E2 locomotive wheelsets: $991 \begin{smallmatrix} +1 \\ -0 \end{smallmatrix}$ mm
- b) All other wheelsets: 987 ± 1.0 mm

Where rough machined (supply size) wheels are fitted to an axle or new tyres are fitted onto wheelset centres, “facing” shall be done to achieve the correct wheelset symmetry and back-to-back distance.

3.2.4.2 Refurbished wheelsets (light repairs)

All wheelsets with a back-to-back distance between 986 mm and 989.5 mm (inclusive) and all 10E and 10E2 wheelsets shall be machined with a full flange where the reference surface for the wheel profiles is taken as the back of each flange, irrespective of the back-to-back distance. The distance between tapping lines may vary and will only be 1 152 mm when the back-to-back distance is 987 mm. Referencing the axle ends is not required and no “facing” is allowed.

Wheelsets with a back-to-back distance of more than 989.5 mm (except 10E and 10E2 wheelsets) shall be machined with a thin flange. The distance between tapping lines shall be maintained at 1 152 mm. The lateral correction to be applied to the profile position to maintain the tapping line distance shall be divided equally between the two wheels referencing the back of the flanges. Referencing the axle ends is not required. See Figure 7 and document BBG9107.

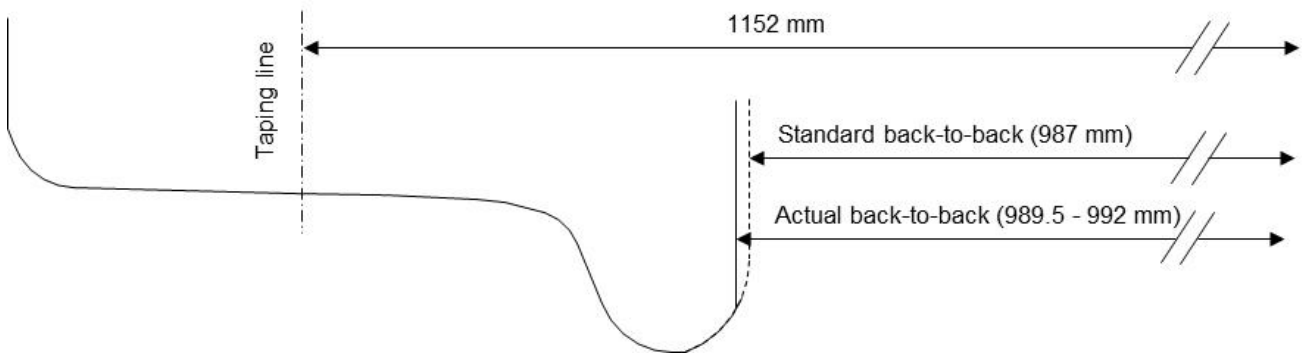


Figure 7: Artificially thin flange (solid line) on wheelsets with a back-to-back distance between 989.5 mm and 992 mm (except 10E and 10E2 wheelsets). (Full flange is indicated by the dotted line).

3.2.4.3 Scrapping based on back-to-back distance

All wheelsets with a back-to-back distance of more than 992 mm shall be scrapped.

3.2.5 Radial run-out

The radial run-out (dimension H in Figure 1) of the tread when measured at the tread datum line (taping line) must not exceed 0.5 mm (total gauge reading). This may be measured using a dial gauge as illustrated in Figure 8 while the wheelset is placed between centres in a measuring machine or portal lathe. Alternatively a wheelset fitted with bearings may be placed on a suitable stand and rotated. Note that a dial gauge with a flat foot should be used to eliminate the effect of machining grooves. Radial run-out may also be measured with a suitably equipped wheelset measuring machine, under floor lathe or measuring portal lathe.

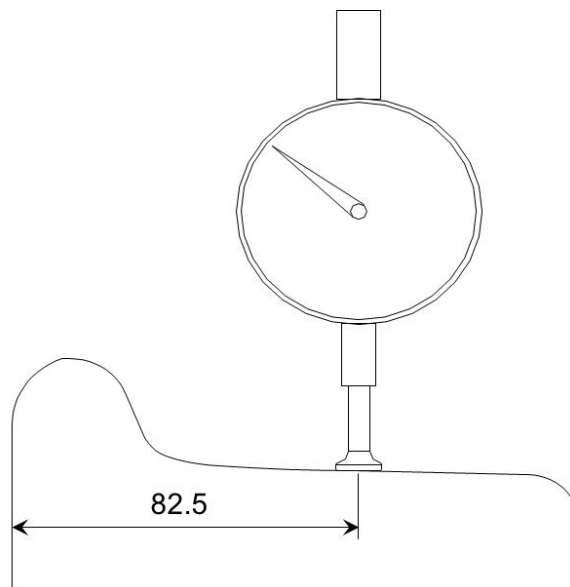


Figure 8: Position of dial gauge to measure radial run-out

3.2.6 Axial run-out

The axial run-out (G in Figure 1) of the flange face of the wheel when measured perpendicularly to the flange face 14 mm below the flange tip, must not exceed 0.5 mm (total gauge reading). This may be measured using a dial gauge as illustrated in Figure 9 while the wheelset is placed between centres in a measuring machine or portal lathe. Alternatively a wheelset fitted with bearings may be placed on a suitable stand and rotated. Note that a dial gauge with a flat foot should be used to eliminate the effect of machining grooves. Axial run-out may also be measured with a suitably equipped wheelset measuring machine, under floor lathe or measuring portal lathe.

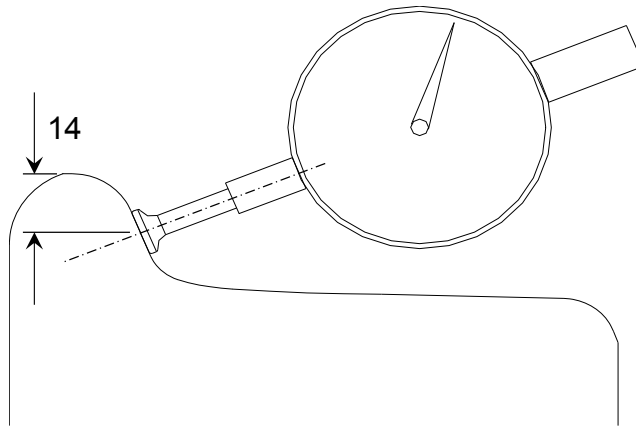


Figure 9: Position of dial gauge to measure axial run-out

3.2.7 Witness marks

After profile machining, a “witness” mark may be visible on the flange face. This mark shall only be allowed in the area between 8 mm and 19 mm below the flange tip (see Figure 10), and may not exceed 1 mm in depth. The witness mark shall be uniform (not intermittent or irregular) around the circumference of the wheel. These marks occur when profiling wheels with thin flanges and indicate that as little material as possible was removed during the profiling action. Considerable wheel-life can be saved by allowing this “witness” mark. In the presence of witness marks, flange thickness dimensional requirements shall be relaxed to make provision for the effect of the witness marks.

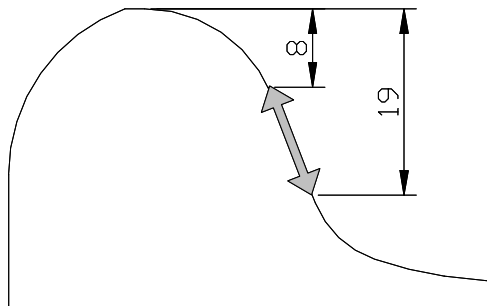


Figure 10: Position of allowable witness marks on the wheel flange

After machining, no “witness” marks (or steps) bigger (deeper) than 0.5 mm are to be visible on the field side radius or on the back of the flange as shown in Figure 11.

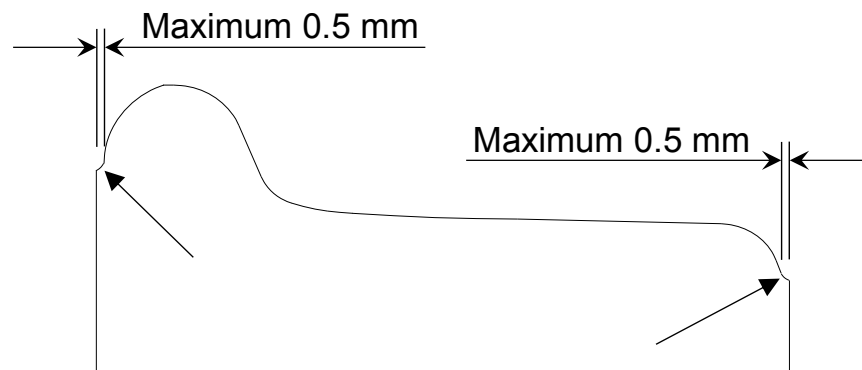


Figure 11: No witness marks (steps) bigger (deeper) than 0.5 mm are allowed on the field side radius or on the back of the flange

3.2.8 Surface roughness

No wheel profile surface roughness limit is specified. Surfaces are to be machined as smooth as possible. Wheel profile machining feed rates may not exceed 1.5 mm per revolution.

3.2.9 Wheelset stencilling

After manufacturing or refurbishment by a wheel workshop or on an Under Floor Lathe (UFL), all loose Transnet owned tractive and trailing wheelsets shall be stencilled as described in specification BBF3378, "Wheelset Stencilling Specification" latest revision. Wheelsets that stay fitted to a vehicle during the refurbishment intervention need not be stencilled.

4 REQUIREMENTS WHEN FITTING NEW OR RE-PROFILED WHEELSETS TO VEHICLES

4.1 *Wheel profile requirements*

The wheel profiles for new or re-profiled wheels are:

- a) No. 21 wheel profile (Drawing RSA007_001_234_Latest) (Appendix A, Figure A1)
 - All wagons and coaches with self-steering (HS type) bogies except those mentioned under (c).
 - All heavy haul diesel locomotives operating on the Iron Ore Export Line.
- b) No. 22 wheel profile (Drawing RSA008_001_234_Latest) (Appendix A, Figure A2)
 - All wagons and coaches with conventional (non self-steering) bogies.
 - All locomotives except those mentioned under (a) and (c).
 - Blue Train coaches.
 - Heavy, rail-bound infrastructure maintenance machines such as tampers, screeners, grinders and sleeper replacement machines.
- c) No. 23 wheel profile (Drawing RSA011_001_234_Latest) (Appendix A, Figure A3)
 - 26 tonne per axle export coal (Jumbo) wagons running on the Coal Export Line.
 - Class 15E, class 19E and class 21E electric locomotives.
- d) MTV 173 wheel profile (Drawing MTV 00173) (Appendix A, Figure A4)
 - Light rail-bound vehicles such as inspection trolleys.
 - Road-rail vehicles such as the Ultrasonic Measurement Car (UMC).

Only wheelsets with the same wheel profile shall be fitted to a vehicle.

New and worn wheel profiles may not be installed together on one bogie. In cases where one or more wheelset(s) needs to be replaced on a bogie, the other wheelset(s) should also either be replaced or re-profiled. This applies to all vehicle types.

On vehicles, one bogie may have worn wheel profiles while the other bogie has new wheel profiles.

4.2 *Diameter difference requirements (in and between bogies)*

Refer to Table 2 and Table 3. These limits all apply when wheelsets are installed or exchanged. These limits do not apply in-service and do not need to be checked, in-service.

5 IN-SERVICE WHEELSET REQUIREMENTS

All in-service wheel profiles must be within the limits specified. Conformance must be checked with the field gauge as per Drawing RSA128_001_100 (See Appendix A Figure A5) or another measurement instrument or system that has been approved for this purpose. A comprehensive list of approved wheel profile measurement instruments and systems is given in appendix B.

5.1 *Wheel profile parameter wear limits*

The following wheel profile wear limits are applicable:

- 1) The maximum permissible flange height is 35 mm.
- 2) The minimum allowable wheel flange thickness measured 14mm below the tip of the flange is 19 mm.
- 3) The maintenance hollow wear limit is 2 mm. Wheels reaching this limit may complete their trip but should then be prioritized for immediate maintenance.

The absolute hollow wear limit of 2.5 mm is applicable for all wheels. No vehicle which has one or more wheels exceeding 2.5 mm hollow shall be allowed to operate.

The following exceptions and conditions are applicable to the hollow wear limit specification:

- a) Fleets that are managed using data from an automated wheel profile monitoring system (WPMS) or for which all wheels are measured at least once every two months and measurements are stored and analysed, may run 8% of the wheels of the fleet between 2 mm and 2.5 mm hollow.
- b) Where data from a Wheel Profile Monitoring System is being used, appropriate data filtering and smoothing algorithms (Document: WRI/2011/006, "Integrated Train Condition Monitoring System data processing and analysis model for Wheel Condition monitoring") should be used to obtain reliable, representative measurements.
- c) Further clarification on hollow wear measurements is given in BBG9963.

- 4) If the flange angle is less than or equal to 15° and the toe radius is less than 6 mm, the wheelset must be re-profiled.

- 5) No limits are placed on in-service wheel diameters and wheel diameter differences. Wheel diameter and wheel diameter difference specifications are only applicable when new or re-furbished wheelsets are fitted to vehicles. The omission of in-service wheel diameter and wheel diameter difference limits is because these are not measurable in-service to meaningful accuracies. See document BBH2475.

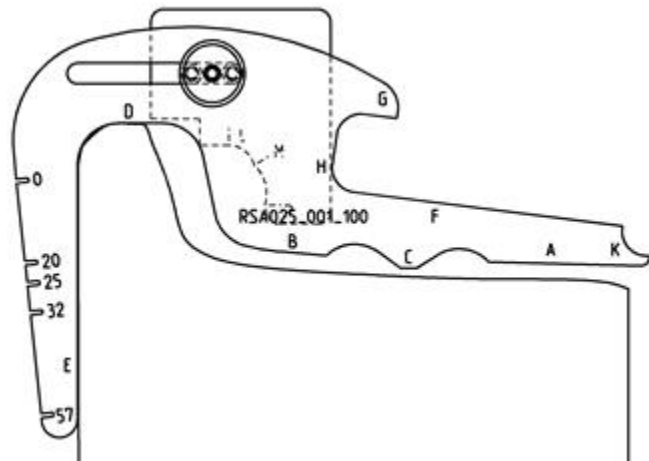
The following section explains how to use the field gauge to determine whether a wheel profile has reached the wear limits and must be re-profiled.

5.1.1 Flange Height

The maximum permissible flange height is 35 mm.

Measurement Method

Surface "E" must be held firmly against the wheel inner face. If point "D" or points "C" and "D" together touch the profile, the maximum allowable flange height has been reached and the wheelset must be re-profiled. If only point "C" touches the profile the flange height is below the limit of 35 mm and the wheel may remain in service.



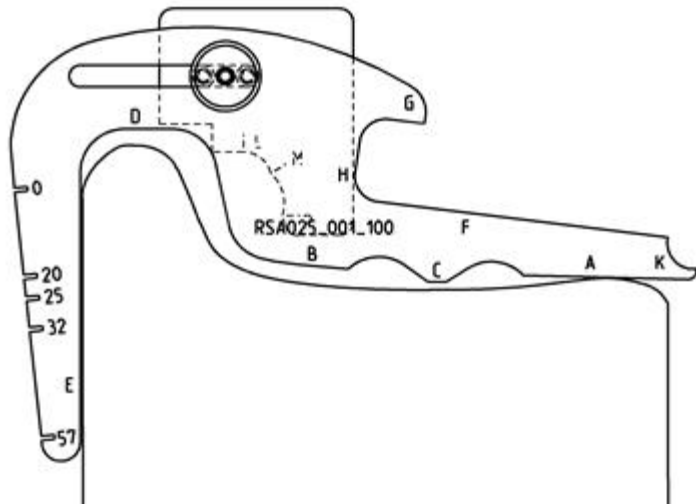
5.1.2 Hollow Wear

The maintenance hollow wear limit is 2 mm. Wheels reaching this limit may complete their trip but should then be prioritized for immediate maintenance.

The absolute hollow wear limit of 2.5 mm is applicable for all wheels. No vehicle which has one or more wheels exceeding 2.5 mm hollow shall be allowed to operate.

Measurement Method

Surface "E" must be held firmly against the wheel inner face while shifted in towards the axle until either Points "A", "B" or "C" touch the wheel tread. If either or both Points "A" and "B" touch the wheel and "C" does not touch the wheel profile, hollow wear is above 2 mm and the wheelset must be prioritised for maintenance. If a 0.5 mm feeler gauge fits in between the wheel tread and point "C", hollow wear is above 2.5 mm and the wheelset must be removed from service immediately.



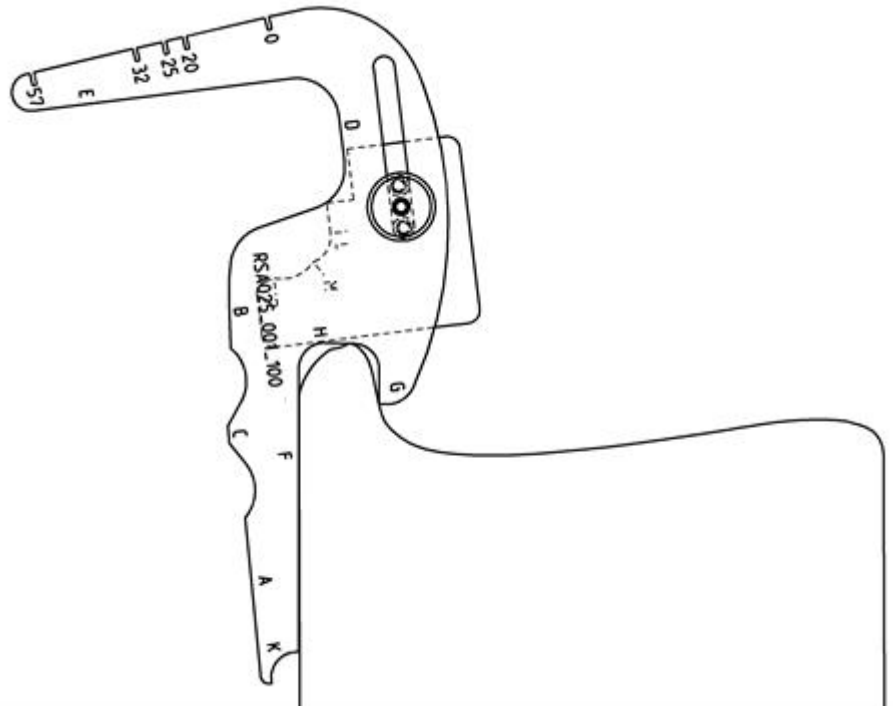
5.1.3 Flange Wear

5.1.3.1 Flange Thickness

The minimum allowable wheel flange thickness measured 14 mm below the tip of the flange is 19 mm.

Measurement Method

Hold surface "F" firmly against the wheel inner face and slide the gauge towards the axle centre line. If Point "H" touches, the minimum allowable flange thickness has been reached and the wheelset must be re-profiled.



5.1.3.2 Flange Angle and Flange Toe Radius

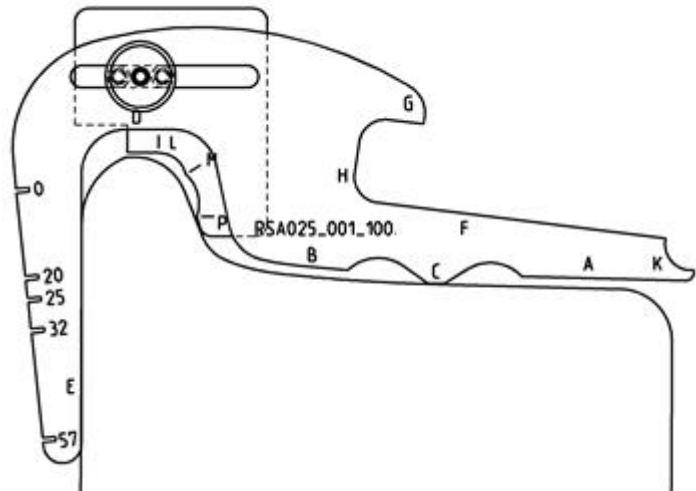
If the flange angle is less than or equal to 15° and the toe radius is less than 6 mm, the wheelset must be re-profiled.

Measurement Method

To check the flange angle and toe radius, the slide on the gauge must be moved to make contact with the wheel flange.

- i) If only Point P touches the flange, the **flange angle is greater than 15°** .

Under this condition, it is not necessary to measure the toe radius and the wheel can remain in service.

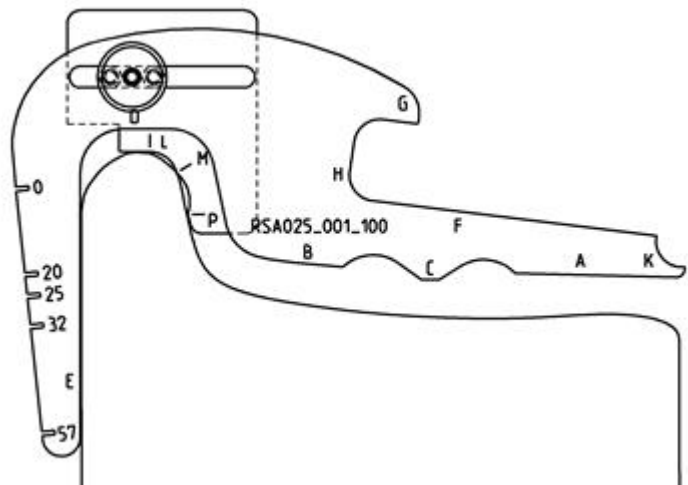


- ii) If both Points M and P touch the flange the **flange angle is 15°** and the toe radius must be checked.

If only the Points L and M make contact with the flange toe, the radius is greater than 6 mm and the wheel can remain in service.

If the whole radial portion between L and M makes contact with the flange toe, the toe radius is 6 mm and the wheel can remain in service.

If only the radial portion between L and M touches the flange toe radius the toe radius is less than 6 mm and the wheel must be re-profiled.

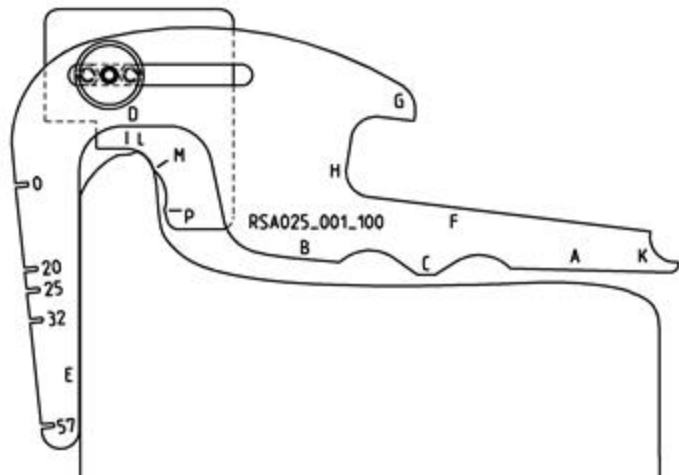


- iii) If only Point M or the radius portion between L and M makes contact with the flange, the **flange angle is less than 15°** and the flange toe radius must be checked.

If only the Points L and M make contact with the flange toe, the radius is greater than 6 mm and the wheel can remain in service.

If the whole radial portion between L and M makes contact with the flange toe, the toe radius is 6 mm and the wheel can remain in service.

If only the radial portion between L and M touches the flange toe radius the toe radius is less than 6 mm and the wheel must be re-profiled.



5.1.4 Skid Marks

No wheels with skid marks shall be allowed to leave a maintenance workshop or depot. A roll-by test shall be conducted to ensure that there are no skid marks.

During in-service inspections skid marks shall be measured in the circumferential direction using the field gauge shown in Appendix A Figure A5. Any locomotive, wagon or coach with a wheel having a skid mark exceeding 32 mm shall be removed from the train prior to the departure of the train and be forwarded to the wheel shop for attention.

Stricter regional skid mark length limitations may be applied at the discretion of the regional maintenance engineer.

Impact loads as measured by the Weigh-In-Motion, Wheel Impact Monitor (WIM-WIM) wayside measuring systems shall take precedence over skid length measurements. All rolling stock shall be subject to limits laid down in BBD5249 "Alarm limits for the measurements of weighbridges, wheel-impact monitors and skew bogie detectors. In other words, impacts exceeding the specification as measured by the WIM-WIM system shall be acted upon as laid down in the specification, irrespective of skid length measurements.

Measurement Method

The length of the skid mark is measured circumferentially and not across the wheel tread.



5.2 Wheel Defects

Refer to Transnet Freight Rail Document No. RSE/TE/PRO/0022 entitled “Wheel and axle defect identification chart” (Latest Revision) to identify wheel and axle defects and the applicable action that is prescribed for each defect.

5.3 Internationally accepted wheel profile parameters

qR, a linear measure of the flange angle, and Sd a measure of the flange thickness referenced to the tapping line are internationally accepted measures of wheel tread wear. In the South African context, “flange angle” and flange thickness have been used to describe similar profile parameters. To be more closely aligned with international standards qR and Sd will be phased into Transnet and flange angle and flange thickness will be phased out over the coming years. The advantage of using internationally accepted parameters is the standardisation of measuring equipment, the ability to compare performance and the ability to use standard gauges. See Figure 12 for definitions of these parameters.

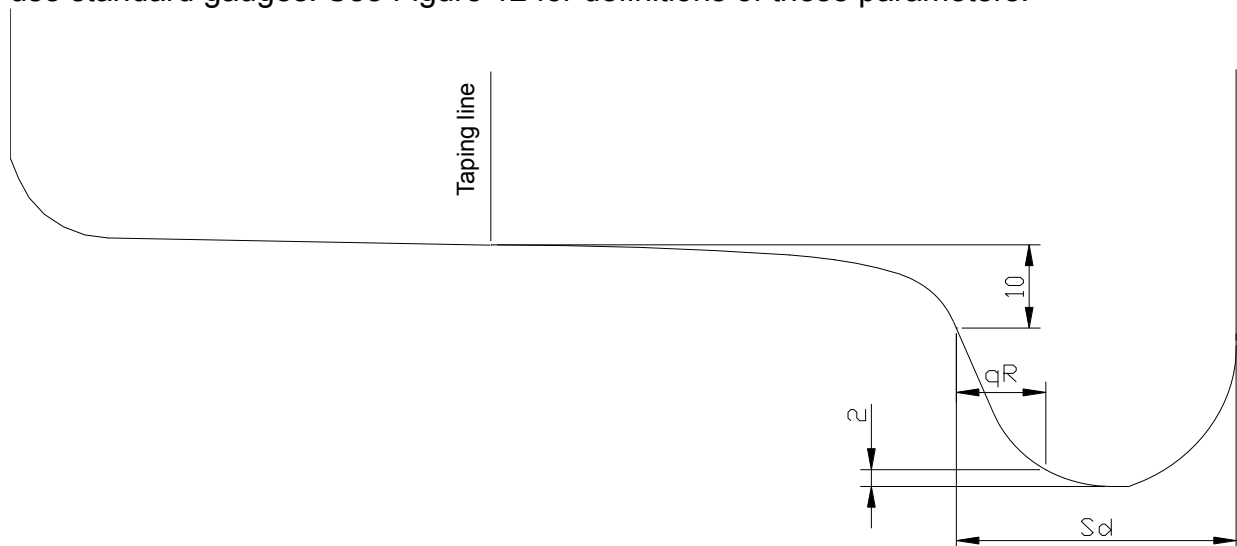


Figure 12: Internationally accepted wheel profile parameters

Internationally accepted limits are currently:

The minimum permissible qR is 6.5 mm.

The minimum allowable Sd measured 10 mm above the tread datum line is (to be determined) mm.

6 APPROVED GAUGES AND MEASURING SYSTEMS

Appendix B contains a list of measuring systems and gauges that are approved for use to measure wheelset and wheel profile geometries prescribed in this specification. All gauges and measuring systems intended for use to test compliance with this specification must be approved for use by the Wheel / Rail Interaction Technology Owner.

7 EXCEPTIONS AND CONCESSIONS

Exceptions to specific clauses and / or conditions specified in this document may be allowed for a limited time period or number of components under exceptional conditions. Such exceptions and concessions shall only be authorised by a Principal or Senior Engineer in the Wheel / Rail Interaction section of Technology Management who is registered as a Professional Engineer with the Engineering Council of South Africa (ECSA). Applications for exceptions and concession shall be in writing and shall include all supporting information that may be requested. No post-dated applications shall be entertained. Exceptions and concessions shall only be granted in writing and at the sole discretion of the applicable Principal or Senior Engineer.

8 RELATED DOCUMENTS AND REFERENCES

- BBH2475: Explanation, reference and companion document to RSE/TE/SPC/0045 "Geometric Requirements for New, Re-profiled and In-Service Wheelsets"
- BBC8782: Specification for Heavy Maintenance of Wheelsets for Tractive and Trailing Stock"
- PD_PDWL_NAT_PROC_041: Identification of different wheel types
- BBG9107: "Back-to-back distance specification rationale
- BBF3378: "Wheelset Stencilling Specification"
- WRI/2011/006: "Integrated Train Condition Monitoring System data processing and analysis model for Wheel Condition monitoring")
- BBG9963: "Measuring hollow wear in Transnet"
- BBD5249: "Alarm limits for the measurements of weighbridges, wheel-impact monitors and skew bogie detectors
- RSE/TE/PRO/0022: "Wheel and axle defect identification chart"

APPENDIX A: WHEEL PROFILE AND GAUGE DRAWINGS

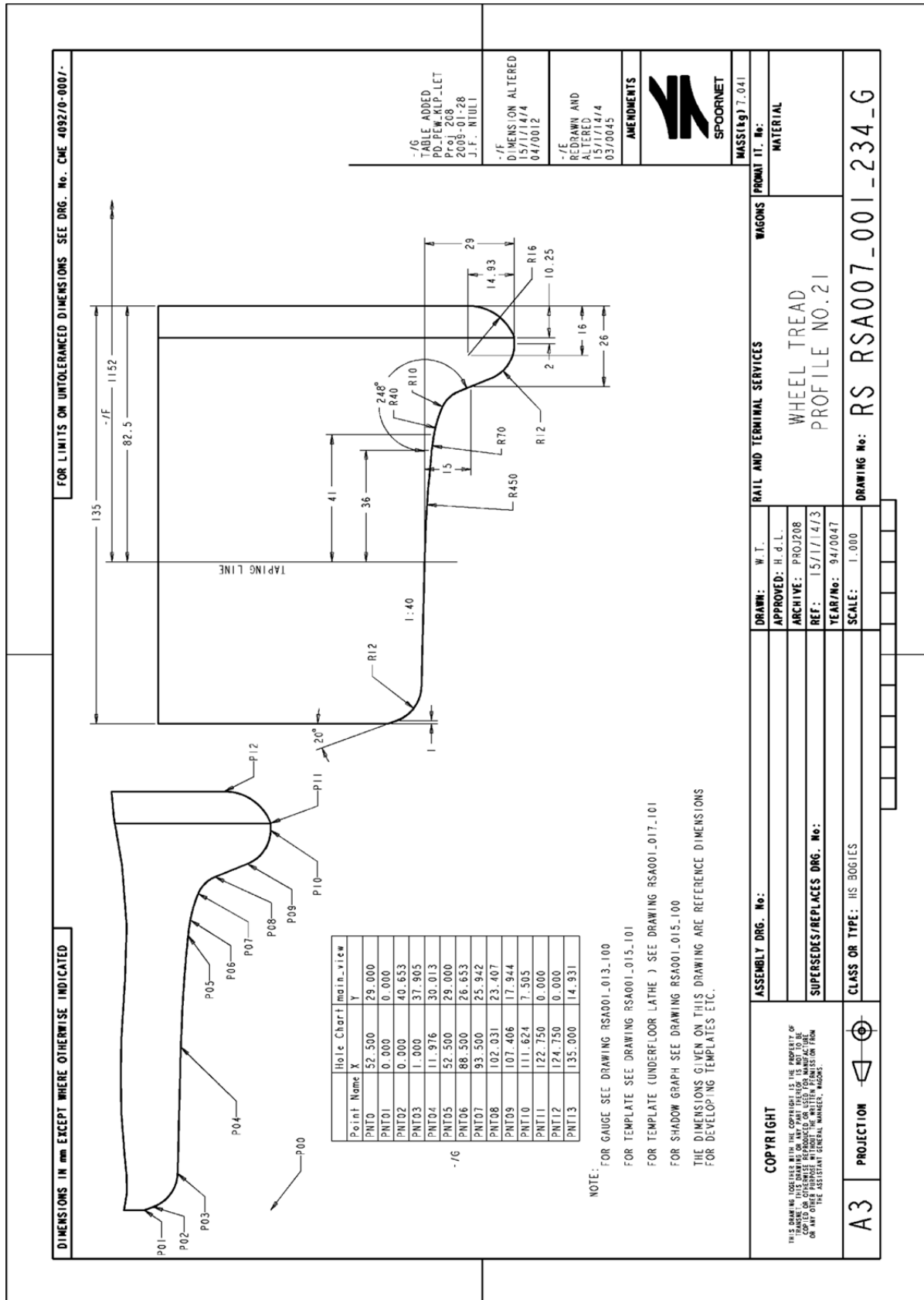
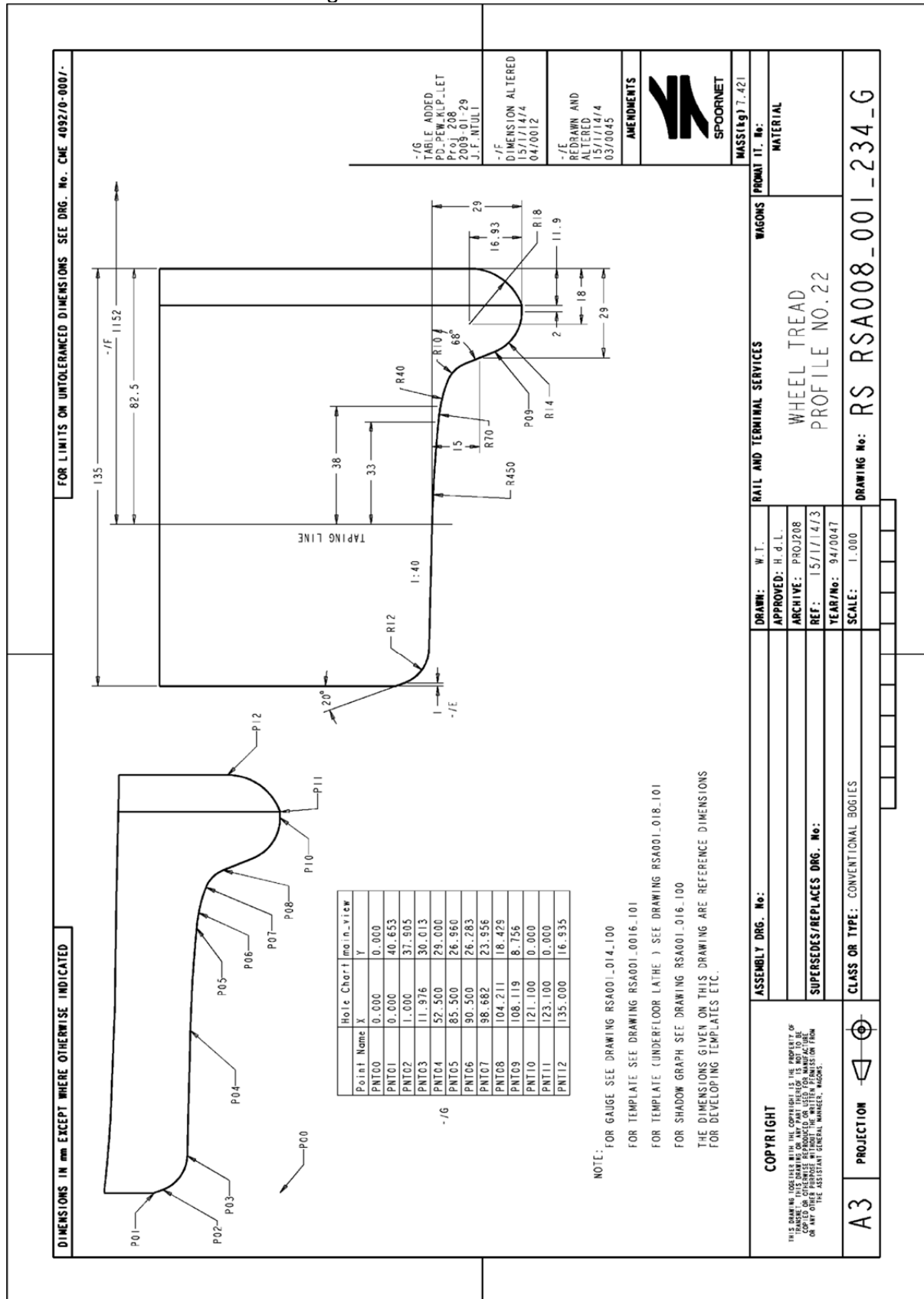


Figure A2: No. 22 Wheel Profile



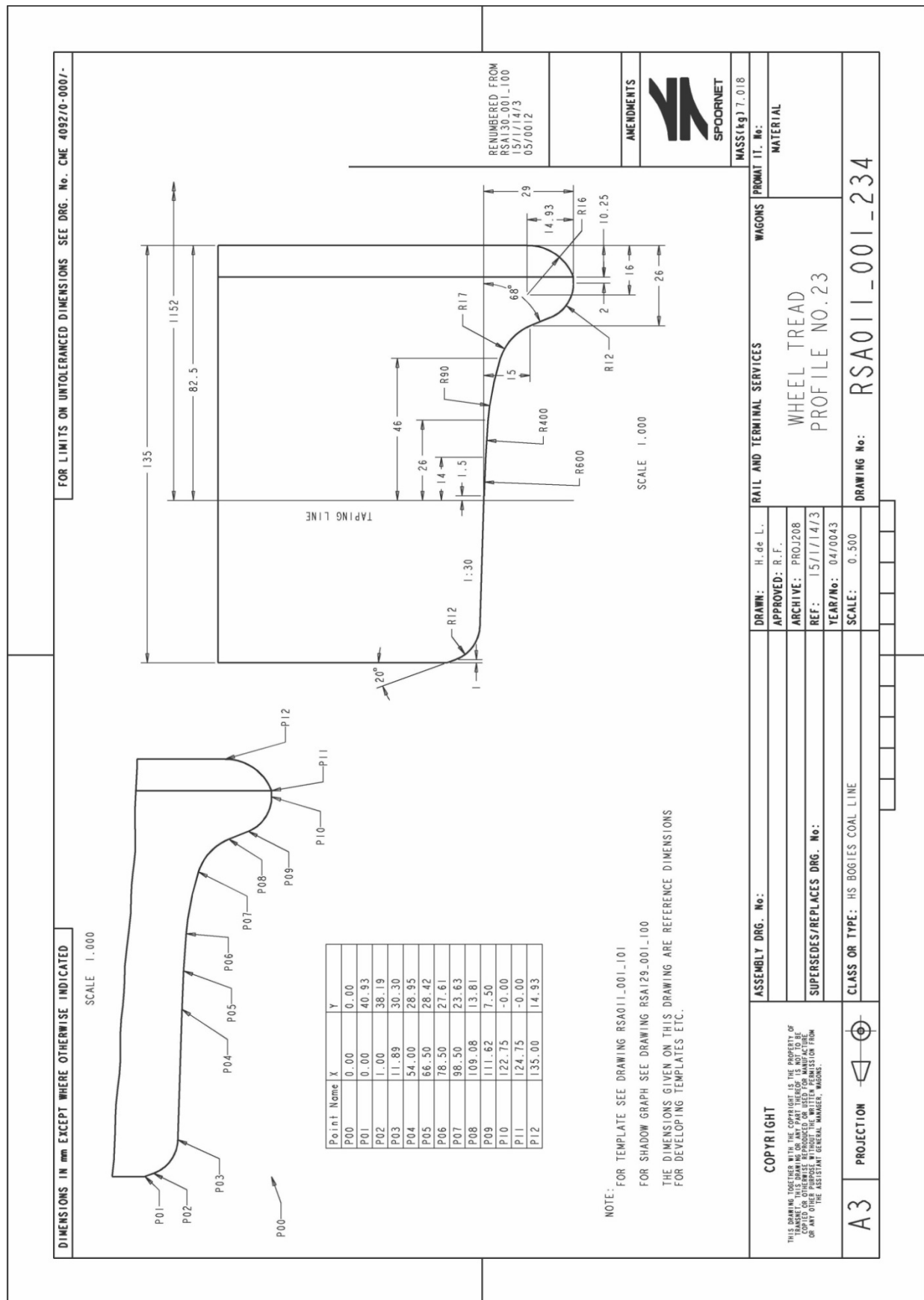


Figure A3: No. 23 Wheel Profile

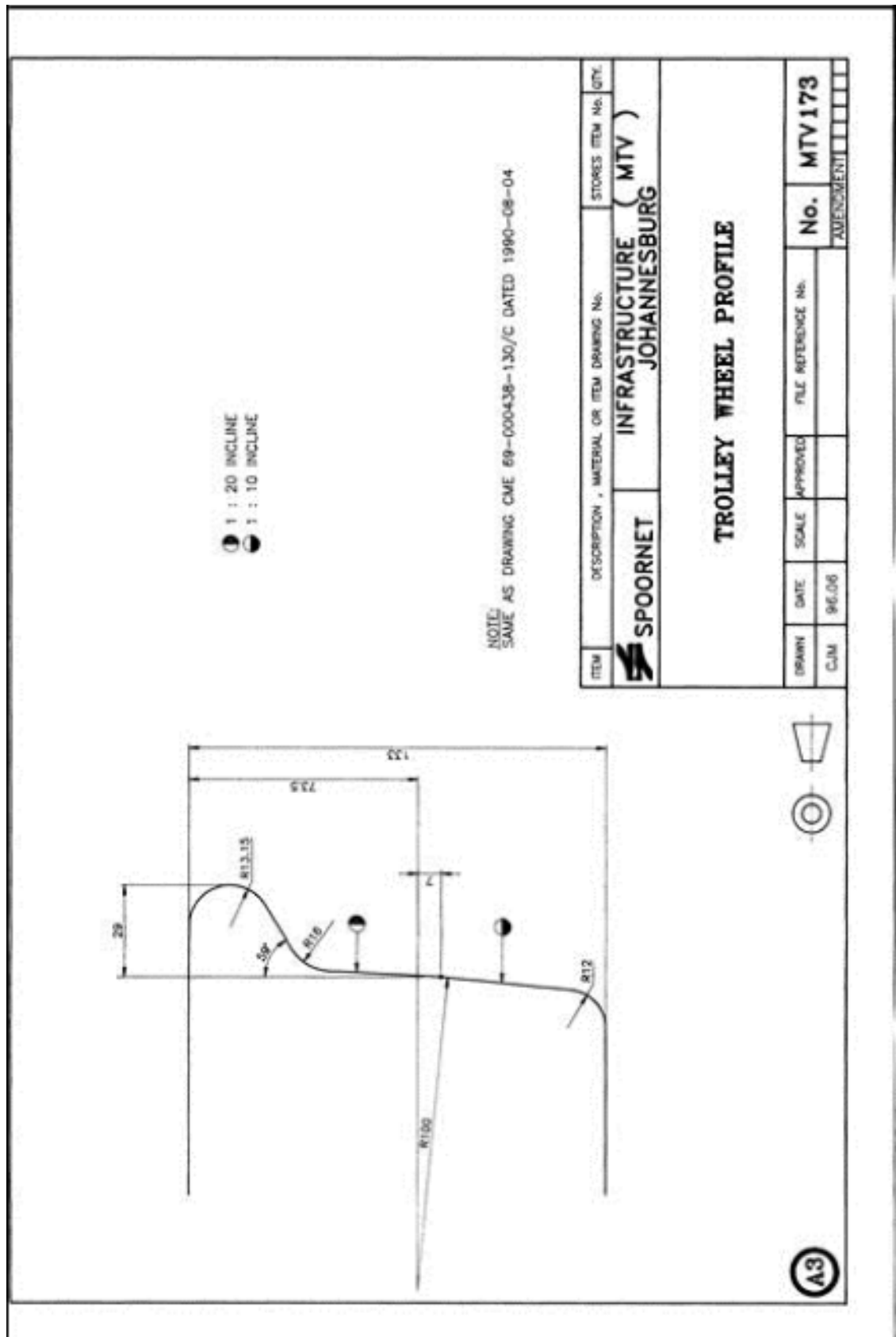
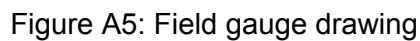


Figure A4: Trolley and road / rail vehicle wheel profile



APPENDIX B: Gauges approved for measuring wheelset geometry and wheel profiles

Measurement systems and gauges approved for use for wheel profile related measurements				
Name / description of measuring device	Document / Drawing number	Purpose description	Approved for measuring	Measurement limitations
Shadowgraph wheelset measuring machine		Accurate measurements of all wheelset parameters in wheel workshops before and after wheelset re-profiling. Also used to accurately determine wheel diameters after derailments, etc.	All wheelset parameters applicable to this document.	Must be correctly calibrated and used.
Laser-based wheelset measuring machine		Accurate measurements of all wheelset parameters in wheel workshops before and after wheelset re-profiling. Also used to accurately determine wheel diameters after derailments, etc.	All wheelset parameters applicable to this document.	Must be correctly calibrated and used.
Under Floor Lathe with measuring system	PD_PDWL_NAT_URS_039	Measuring and machining of wheelsets on and off the vehicle. Normally used to re-profile locomotive wheels.	All wheelset parameters applicable to this document.	Must be correctly calibrated and used.
Portal wheelset lathe with measuring system		Measuring and machining of wheelsets. Portal lathe with the ability to accurately measure all wheelset parameters in wheel workshops before and after wheelset re-profiling. Also used to accurately determine wheel diameters after derailments, etc.	All wheelset parameters applicable to this document.	Must be correctly calibrated and used.
Field gauge	RSA128_001_100	Test track-worthiness of wheels on a Go-NoGo basis. Used during train pre-departure inspections to check that wheel profile parameters are still within limits as specified in this document.	May only be used for rail-worthiness checks on Flange Height, Flange Thickness, Hollow Wear, Flange Angle, Flange Toe Radius, Skid Length	Cannot be used to measure wheel profile parameters and thus cannot be used to determine wear rates.
Wheel wear monitoring gauges	RSE_TE_PRO_0099	Monitor wear of wheels by measuring Flange Height, Flange Thickness and Hollow Wear. Can be used in the field or in a workshop environment to monitor wheel wear rates.	Flange Height, Flange Thickness, Hollow Wear	Must be correctly calibrated and used.
MRX Wheel Profile Monitoring System	BBB2029 BBF7934 WRI2011006	Wayside in-motion wheel profile measurement system. Is used to accurately measure wheel profiles and determine profile parameters while vehicles are in motion. Primarily used to monitor wheel profile condition and wheel wear rates on high production vehicle fleets.	All wheelset parameters, including full profile but excluding run-outs. Wheel diameter measurements ± 2 mm.	Multiple measurements should be used to determine dimensions.
MiniProf wheel profile measurement system		Wheel profile measuring system. Used in the field and in the workshop setting for wheel profile condition assessment and wheel wear monitoring. Is used as a research tool. Is accurate enough to be used to assess accuracy of other systems.	Full wheel profile and all profile parameters. Does not measure run-outs or back-to-back distance. Wheel diameter measurement accuracy ± 2 mm.	May only be used to determine wheel diameters for wheelset matching purposes when the results of a minimum of three measurements spaced around the wheel circumference are evaluated.
Back-to-Back gauge	TWK12427	Used to measure wheelset back-to-back distance in the wheel workshop.	Wheelset back-to-back distance	
Wheel diameter comparator gauge	TWK21435 or similar	Comparing the diameter of wheels on the same wheelset normally after re-profiling in the wheel workshop.	Checking wheel diameter difference of wheels on the same wheelset after profiling and re-profiling.	May only be used by a relevantly experienced operator.
Standard vernier calliper		Used to measure wheel rim widths in the wheel workshops and at UFL's as an input to profiling requirements.	Wheel rim width.	Must be correctly calibrated and used.
Tyre thickness gauge	BBD 5242 RS A069.001.100	To measure locomotive tyre thickness as an indication of wheel diameter. Used when one or more wheelsets are replaced on a locomotive to ensure that wheelset diameter difference limits are adhered to.	Tyre thickness accuracy ± 1 mm Wheel Diameter accuracy ± 2 mm	At least three measurements spaced around the circumference of the wheel should be evaluated to determine a representative tyre thickness / wheel diameter.
Wheel rim thickness gauge	TWK17138	To measure wagon wheel rim thickness (specifically Vecor wheels). Designed specifically to identify Vecor wheel for scrapping.	Rim thickness accuracy ± 2 mm	Indicative rim thickness measurement only
Tyre thickness and wheel diameter gauge for 15E and 19E locomotives	RSA152_01_001_100_1	To measure 15E and 19E rim thickness as an indicator of wheel diameter. Used to ensure the wheel diameter difference limits are adhered to when one or more wheelsets are replaced on a locomotive.	Tyre thickness accuracy ± 2 mm Wheel Diameter accuracy ± 4 mm	At least three measurements spaced around the circumference of the wheel should be evaluated to determine a representative rim thickness / wheel diameter.
Wheel Profile Gauges	TWK20267, TWK20268 and TWK 20270	Gauges to check machined wheel profile compliance.	Newly machined wheel profiles.	To be used in conjunction with a taper gauge or feeler gauges

Table B1 Approved gauges and measuring systems for wheelset geometry and wheel profile related measurements

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APPENDIX C: Minimum wheel diameters for phased-out wheels (extract from revision 7)

Class or Type	Nominal diameter (mm)	Solid wheels				Tyred wheels	
		Cast steel		Wrought steel		Minimum machined wheel diameter (mm)	Minimum machined tyre thickness (mm)
		Minimum machined wheel diameter (mm)	Minimum rim thickness (mm)	Minimum machined wheel diameter (mm)	Minimum rim thickness (mm)		
Journal bearing wheelsets							
6½ x 3¼	508	444	31.5	444	31.5	470	25.5
9 x 4¼	863	-	-	772	30.5	800	31.5
10 x 4½	863	-	-	772	30.5	800	31.5
10 x 5, 11 x 5½ (Multi-wear)	863	772	30.5	772	30.5	830	46.5
12 x 6, 11 x 5½	863	-	-	-	-	830	46.5
All Purpose “C” (APC) wheelsets							
MW	863	772	30.5	772	30.5	800	31.5
Vecor 34” (Multi-wear)	863	772	30.5	-	-	-	-
Vecor 34” (2-wear)	863	812	25.5	-	-	-	-
All Purpose “D” (APD) wheelsets							
MW	863	772	30.5	772	30.5	-	-
2W	863	812	25.5	-	-	-	-
Smorgon 34”	863	-	-	812	25.5	-	-
All motor car wagons	813	772	30.5	772	30.5	-	-
Vecor 34” (2-wear) over 20t axle load (eg.CGR)	863	820	29.5	-	-	-	-
All Purpose “E” (APE) wheelsets							
2W	863	812	25.5	-	-	-	-
Vecor 34“ (2-wear)	863	820	29.5	-	-	-	-
Passenger coaches							
6½ x 3¼	508	444	31.5	444	31.5	470	25.5
10 x 4½	863	-	-	772	30.5	800	31.5
R3, 11 x 5½	863	-	-	772	30.5	800	31.5
R3 Air conditioned	863	-	-	772	30.5	810	36.5
R3 Drakensberg	863	-	-	838	63.5	840	51.5
R6, R6 Air conditioned	863	-	-	787	38	800	31.5
Old Scaw	863	820	56	-	-	-	-
Motorcoaches							
4M1, 4M2, 4M2X	1054	-	-	-	-	984	41
5M2, 5M2A	1054	-	-	-	-	984	41
6M, 7M	915	-	-	844	-	-	-
8M	915	878	-	-	-	-	-

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Locomotive class	Wheel type	Nominal new wheel diameter (mm)	Minimum machined wheel diameter (mm)	Minimum machined rim thickness (mm)	Maximum diameter difference between wheels on one bogie (mm)	Maximum difference of average wheel diameter between bogies (mm)	Maximum diameter difference between wheels on one vehicle (mm)	Wheel profile (see note 1)
33-000, 33-400 (GE)	Solid	915	844	-	6.5	8	-	22
33-000, 33-400 (GE)	Tyred	915	850	44	6.5	8	-	22
33-200 (GM)	Solid	915	844	-	6.5	8	-	22
33-200 (GM)	Tyred	915	850	44	6.5	8	-	22
91-000	Tyred	838	770	32.5	6.5	-	-	22
9E	Tyred	1219	1156	44.5	6.5	13	-	21
14E, 14E1	Tyred	1250	1170	51.5	5	5	-	22

APPENDIX D: Responsibility, Accountability, Consult and Inform (RACI) matrix for this document

Activity	Role			
	Author: Senior Engineer, Wheel / Rail Interaction (Georg Hettasch)	Reviewers: Senior Engineers, Wheel / Rail Interaction (Danie Fourie Ulrich Spangenberg)	Authoriser: Principle Engineer, Mechanical Technology (Robert Fröhling)	Transnet Freight Rail, Track Technology, Transnet Freight Rail, Wheelsets and Materials Transnet Engineering Product development. Transnet Engineering Locomotive Business. Transnet Engineering Wagon Business.
Draft compilation and checking	Accountable	Consult	Consult	Consult
Distribution for comment	Accountable	Inform	Inform	Inform
Comments on document	Inform	Responsible	Responsible	Accountable
Evaluation of editing comments	Consult	Consult	Accountable	Inform
Final document editing	Responsible	Consult	Accountable	Inform
Document approval	Responsible	Responsible	Accountable	Inform
Document issue	Responsible	Consult	Accountable	Inform

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APPENDIX E: Schedule of amendments

Amd. no.	Section amended	Summary of amendments	Rev.	Date issued
1	3.1	AP 'C' & 'D' (MW) Vecor 34": Minimum wheel diameter changed to 772mm AP 'C' & 'D' (2W) Vecor 34": Minimum wheel diameter changed to 812mm AP 'E' (HS) (2W) Vecor 34": New addition AP 'D' (HS) (2W) Vecor 34" over 20t axle load: New addition (Memorandum from J J Marais dated 20/09/2004)	2	25/10/2004
2	3	Reference to the new No.23 wheel profile was added.	3	26/04/2005
3	3.1	R6 Blue Train: Values now as in Code of Practice No.2.	3	26/04/2005
4	3.1	5M2, 5M2A: Values now as in Code of Practice No.2.	3	26/04/2005
5	3.1	8M: Values now different from 5M2 and 5M2A.	3	26/04/2005
6	3.1	"EMD" replaced by "GM" and Classes of GM and GE locomotives given.	3	26/04/2005
7	3.2.1	Figure 4 was added for clarity.	3	26/04/2005
8	4.2.3.1	Moved the required actions into the Measurement Method table.	3	26/04/2005
9	3.1	Updated diesel locomotive wheel diameters in Table 1.	4	28/12/2005
10	3.2.4	Changed 10E1 to 10E2.	4	28/12/2005
11	2	Updated Tread datum position definition	5	24/08/2009
12	3	Added 15E and 19E to WP23.	5	24/08/2009
13	3.1	Changed format of tables 1a to 1e.	5	24/08/2009
14	3.1	Added MW and 2W explanation.	5	24/08/2009
15	3.1	Tables 1a to 1f, changed "Rolled steel" to "Wrought steel".	5	24/08/2009
16	3.1	Added 39-000 and 39-200 locomotive to table 1d.	5	24/08/2009
17	3.1	Added Class 15E and Class 19E to table 1e.	5	24/08/2009
18	3.1	Added table 1f: Wheel widths.	5	24/08/2009
19	3.2.6	Changed axial run-out to be measured on flange face and not back of flange.	5	24/08/2009
20	3.2.7	Added paragraph 3.2.7 Witness Marks.	5	24/08/2009
21	4.1.1	Added Class 15E, 19E and 39-200.	5	24/08/2009
22	4.1.2	Added Class 15E, 19E and 39-200.	5	24/08/2009
23	4.1.3	Added paragraph 4.1.3	5	24/08/2009
24	5	Removed "Code of Practice 2" all parts of "RS/ME/PR/042" and added "Procedure for the Profiling and Re-Profiling of Wheelsets", "UFL Policy for GFB Locomotives", "Specification for Heavy Maintenance of Wheelsets for Tractive and Trailing Stock", "Specification of the Wheelset Qualification for Roller Bearing Only (RBO) Repair", "Wheel and axle defect identification chart", "Instruction for Use of Tyre Thickness Gauge", "Wheel Wear Monitoring Gauges".	5	24/08/2009
25	2	Changed Figure 3 to clarify tread wear and hollow wear	6	11/03/2010
26	2	Added Figure 4 to clarify profile parameter measuring	6	11/03/2010
27	3.1	Class 38-000 wheel diameter corrected as per WRI/2009/036	6	11/03/2010
28	3.2.7	Witness mark clarified	6	11/03/2010
25	4.2.4	Redefined skid mark limits.	6	11/03/2010
26	3.1	Reformatted table 1a to group wheelset types	7	05/09/2011
27	3.1	Added Class 43-000 to table 1d	7	05/09/2011
28	3.1	Changed 15E and 19E nominal wheel size to match OEM drawings "GEAR SIDE SMLPW00124-0" and "Non-Gearside Wheel 66L253_1_rev1"	7	05/09/2011
29	3.1	Added minimum wheel width to table 1f	7	05/09/2011

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Amd. no.	Section amended	Summary of amendments	Rev.	Date issued
30	3.2.4	Added class 43-000 back-to-back specification	7	05/09/2011
31	3.2.4	Clarified back-to-back distance applicable to reclaimed "990 back-to-back" wheelsets	7	05/09/2011
32	3.2.5 & 3.2.6	Added dial gauge explanation to run-out specification	7	05/09/2011
33	3.2.7	Expanded witness mark explanation	7	05/09/2011
34	4	Inserted "Requirements when fitting wheelsets to vehicles" to differentiate from "In-service" requirements	7	05/09/2011
35	4	Profile specification was moved from "New and reprofiled wheelset requirements" to "requirements when fitting wheelsets to vehicles"	7	05/09/2011
36	4.2	Change to 15E wheel diameter difference specification	7	05/09/2011
37	5.1	Added summary to wheel profile limits	7	05/09/2011
38	5.1	Removed revision number from all the field gauge illustrations	7	05/09/2011
39	5.1.4	Added "circumferential direction" to the skid mark section	7	05/09/2011
40	5.3	Added international profile specification definitions	7	05/09/2011
41	6	Added section on approved gauges and measuring systems	7	05/09/2011
42	4.1	Added the requirement that wheelsets on one vehicle must all have the same profile	7	05/09/2011
43	Fig. A1	Additional information on drawing and change to version RSA007_001_234_G. No change in profile geometry or dimensions.	7	05/09/2011
44	Fig. A2	Additional information on drawing and change to version RSA008_001_234. No change in profile geometry or dimensions.	7	05/09/2011
45	B1	Added table with approved gauges and measuring systems	7	05/09/2011
46	1	An "Explanation, reference and companion document to RSE/TE/SPC/0045 "Geometric Requirements for New, Re-profiled and In-Service Wheelsets"" (BBH2475) was compiled to explain the background and reasoning behind the specified requirements.		2019/07/22
47	2	Several new definitions were added	8	2019/07/22
48	2	The tread wear and hollow wear diagram was split into two diagrams for clarity	8	2019/07/22
49	3.1	A reference was added to the wheel type identification documents.	8	2019/07/22
50	3.1	The minimum machined wheel diameter tables were comprehensively reviewed and the format changed. New wheel types and new locomotive classes were added.	8	2019/07/22
51	3.1	A table was added for wheel diameter differences in and between bogies.	8	2019/07/22
52	3.2.1	The wheel profile accuracy requirement was described in more detail.	8	2019/07/22
53	3.2.3	The wheelset symmetry requirement was described in more detail.	8	2019/07/22
54	3.2.4	The back-to-back requirement was changed and described in more detail.	8	2019/07/22
55	3.2.4.3	A back-to-back distance based scrapping clause was added.	8	2019/07/22
56	3.2.5 3.2.6	Additional details were added to the radial and axial run-out requirements for clarification.	8	2019/07/22
57	3.2.7	Field side and back-of-flange witness marks are limited to a maximum depth of 0.5 mm. Previously no depth was specified.	8	2019/07/22
58	3.2.9	A clause was added to enforce wheelset stencilling.	8	2019/07/22

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Amd. no.	Section amended	Summary of amendments	Rev.	Date issued
59	4.1	The section describing which profiles to fit to which vehicles was rewritten and expanded to include new locomotives, on-track machines and light rail-bound and road-rail vehicles	8	2019/07/22
60	5	In-service requirements were enhanced to allow for the use of approved gauges and systems other than the field gauge.	8	2019/07/22
61	5.1	The informal hollow wear requirement that has been in place for some time has been formalised and added to the existing requirement.	8	2019/07/22
62	5.1	Requirements for in-service wheel diameter measurements (none) have been clarified.	8	2019/07/22
63	7	A section dealing with the process to be followed for exceptions and concessions has been added.	8	2019/07/22
64	8	All related documents and references have been moved to document BBH2475.	8	2019/07/22
65	Appendix A	The light rail (trolley) and road-rail vehicle wheel profile drawing has been added.	8	2019/07/22
66	Appendix B	Gauges TWK20267, TWK20268 and TWK20270 were added to the approved gauges and measuring systems table	8	2019/07/22
67	Appendix C	The table for minimum diameters of phased out wheels has been moved to the appendix.	8	2019/07/22
68	Appendix D	A Responsibility, Accountability, Consult and Inform (RACI) matrix has been added to the document. Document reviewers have been added.	8	2019/07/22
69	Appendix E	The schedule of amendments has been moved to the appendix.	8	2019/07/22
70	All	Various grammatical changes were made to enhance clarity.	8	2019/07/22