



BSI Standards Publication

Railway applications - In-service wheelset operation requirements - In-service and off-vehicle wheelset maintenance

National foreword

This British Standard is the UK implementation of EN 15313:2016. It supersedes BS EN 15313:2010 which is withdrawn.

The UK committee draws users' attention to the distinction between normative and informative elements, as defined in Clause 3 of the CEN/CENELEC Internal Regulations, Part 3.

Normative: Requirements conveying criteria to be fulfilled if compliance with the document is to be claimed and from which no deviation is permitted.

Informative: Information intended to assist the understanding or use of the document. Informative annexes do not contain requirements, except as optional requirements, and are not mandatory. For example, a test method may contain requirements, but there is no need to comply with these requirements to claim compliance with the standard.

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INS, RST and ENE speed conversions	
km/h	mph
5	3
10	5
20	10
30	20
80	50
160	100
190	120

The UK participation in its preparation was entrusted to Technical Committee RAE/3/-/1, Railway Applications - Wheels and Wheelsets.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

**Railway applications - In-service wheelset operation
requirements - In-service and off-vehicle wheelset
maintenance**

Application ferroviaires - Exploitation des essieux en
service - Maintenance des essieux en exploitation ou
déposés

Bahnanwendungen - Radsätze und Drehgestelle -
Radsatzinstandhaltung

This European Standard was approved by CEN on 3 December 2015.

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European foreword

This document (EN 15313:2016) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, by October 2016 at the latest, and conflicting national standards shall be withdrawn at the latest by October 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of intellectual property or similar rights. CEN and CENELEC shall not be held responsible for not having identified such property rights and notifying of their existence.

This document supersedes EN 15313:2010.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Germany, Former Yugoslav Republic of Macedonia, Austria, Belgium, Bulgaria, Cyprus, Croatia, Denmark, Spain, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, the Netherlands, Poland, Portugal, Czech Republic, Romania, United Kingdom, Slovakia, Slovenia, Sweden, Switzerland and Turkey.

Introduction

The objectives of this amendment to EN 15313:2010 are to:

- Incorporate the appropriate results of the ERA TF “Maintenance of freight wagons” established following the Viareggio accident of June 2009:
 - Common criteria for the inspection of freight wagon axles (European Visual Inspection Catalogue) (see 6.5.13.2);
 - A system to ensure the traceability of in-service wagon axles (see 4.2.4.3.2 and Annex A);
 - Specific maintenance action according to axle load (see 6.2.2);
- Improve the standard in the light of experience acquired during its application;
- Resolve the outstanding issues from the “Comments Resolution Meeting” and the Formal Voting process, and in particular the maintenance action to be taken for axles loaded over the allowed limit (see 9.4);
- Recommend the use of a traceability system for in-service locomotive and passenger vehicle axles based on that for freight wagons (see 4.2.4.3.3 and Annex B);
- Provide requirements for tired wheels and resilient wheels (see 6.2.8).

1 Scope

To ensure safety and interoperability, this Standard gives:

- the limits for in-service and off-vehicle wheelsets;
- the operations to be carried out for which the specific values (and/or criteria) remain to be defined in the maintenance plan.

This European Standard applies to wheelsets and axle boxes complying with the following European Standards:

- EN 13103, EN 13104;
- EN 13260, EN 13261, EN 13262;
- EN 13979-1;
- EN 13715;
- EN 13749.

that comprise:

- the axle fitted with wheels of diameters greater than or equal to 330 mm;
- axle boxes with bearings and grease.

This European Standard is also applicable to wheelsets:

- fitted with brake discs, final drive, transmission or noise-damping systems, as appropriate;
- not complying with the above European Standards, but complying with the international requirements in force, for example in UIC leaflets, before the approval of these standards;
- with tired wheels;
- with resilient wheels.

For equipment not covered by Directive 2008/57/EC, this European Standard may be applied, noting that different values may be used.

All dimensions in this Standard are in millimetres (mm).

It is necessary to describe in a specific document the tasks to be performed in order to maintain wheelsets within the limits defined therein.

NOTE The specific values and criteria are defined in an appropriate maintenance plan.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13260, *Railway applications — Wheelsets and bogies — Wheelsets — Product requirements*

EN 13261, *Railway applications — Wheelsets and bogies — Axles — Product requirements*

EN 13262, *Railway applications — Wheelsets and bogies — Wheels — Product requirements*

EN 13715, *Railway applications — Wheelsets and bogies — Wheels — Tread profile*

EN 13979-1:2003+A2:2011, *Railway applications — Wheelsets and bogies — Monobloc wheels — Technical approval procedure — Part 1: Forged and rolled wheels*

EN 15085-2, *Railway applications. Welding of railway vehicles and components — Part 2: Quality requirements and certification of welding manufacturer*

EN ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel (ISO 9712)*

EN ISO 9934-1, *Non-destructive testing — Magnetic particle testing — Part 1: General principles (ISO 9934-1:)*

EN ISO 9934-2, *Non-destructive testing — Magnetic particle testing — Part 2: Detection media (ISO 9934-2:)*

EN ISO 9934-3, *Non-destructive testing — Magnetic particle testing — Part 3: Equipment. (ISO 9934-3:)*

NOTE A standard relating to NDT in railway applications is currently being prepared and may be used as a reference in NDT performed on wheelsets following its publication.

3 Terms and definitions

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

3.1

operation

normal use of wheelsets in service on the track or during routine planned maintenance

NOTE 1 to entry This term also includes any in-service problems and their treatment.

3.2

competent technical department

department having experience in the wheelset maintenance field having already written the rules

3.3

technical expert

technical expert competent in the maintenance of wheelsets

3.4

ECM

Entity in Charge of Maintenance

- 3.5**
reprofiling only level
maintenance performed in-service or off-vehicle with reprofiling of the wheels only
- 3.6**
maintenance plan
structured and documented set of tasks comprising the activities, instructions, resources and the length of time necessary in order to perform the maintenance (EN 13306; Maintenance — Maintenance terminology)
- 3.7**
medium wheelset maintenance
off-vehicle wheelset maintenance without change of wheels, combined with bearing overhaul
- 3.8**
In service wheelset maintenance
maintenance of in-service wheelsets comprises all of the operations which are performed on wheelsets between medium and/or heavy maintenance levels
- 3.9**
heavy wheelset maintenance
off-vehicle wheelset maintenance with change of wheels, combined with bearing overhaul
- 3.10**
NDT
non-destructive testing
- 3.11**
MT
magnetic particle testing
- 3.12**
UT Testing
ultrasonic testing
- 3.13**
VT
visual testing
- 3.14**
resilient wheels
wheels that contain rubber elements between the tyre and the web
- 3.15**
witness mark
area of unmachined material which can remain after reprofiling to demonstrate that the minimum of material has been removed
- 3.16**
wagon overhaul
planned heavy maintenance operation on a wagon

4 Maintenance

4.1 General

Maintenance involves:

- maintenance of in-service wheelsets/axle boxes;

- maintenance of off-vehicle wheelsets/axle boxes;
- special maintenance attention after in-service incidents (e.g. overloads, hot axle box detection, wheelset bearings subject to water ingress, etc.).

An in-service wheelset shall be maintained by a maintenance undertaking qualified in this type of wheelset.

For maintenance of wheelsets, as a minimum, the following shall be utilized:

- a maintenance plan;
- service experience;
- an organization for component and production management;
- specific wheelset maintenance tools;
- qualified staff for non-destructive testing and welding.

4.2 Maintenance organization

4.2.1 Maintenance organization plan

The general maintenance of the wheelsets is organized as shown in Figure 1.

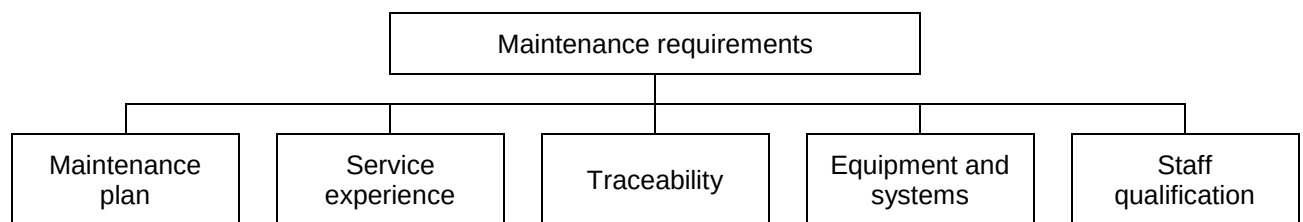


Figure 1 — General maintenance organization

4.2.2 Maintenance plan

For wheelset maintenance, it is necessary to have a maintenance plan for the wheelsets when in-service and off-vehicle.

The maintenance plan shall specify:

- the actions to be performed to meet the requirements and mandatory operations listed in this standard;
- the maintenance intervals;
- any specific measures to be implemented.

The maintenance plan shall be written by a competent technical department in the railway field and approved by the technical expert for the owner undertaking.

4.2.3 Service experience

The maintenance plan shall be reviewed to include:

- the service experience based on the performance of parts in service;

- the corrective actions necessary for dealing with defects:
- remedial actions for criteria detected outside of the limits specified in the maintenance plan;
- corrective actions for limits based on data from in-line monitoring devices.

The principle for revising the maintenance plan based on service experience is presented in Figure 2.

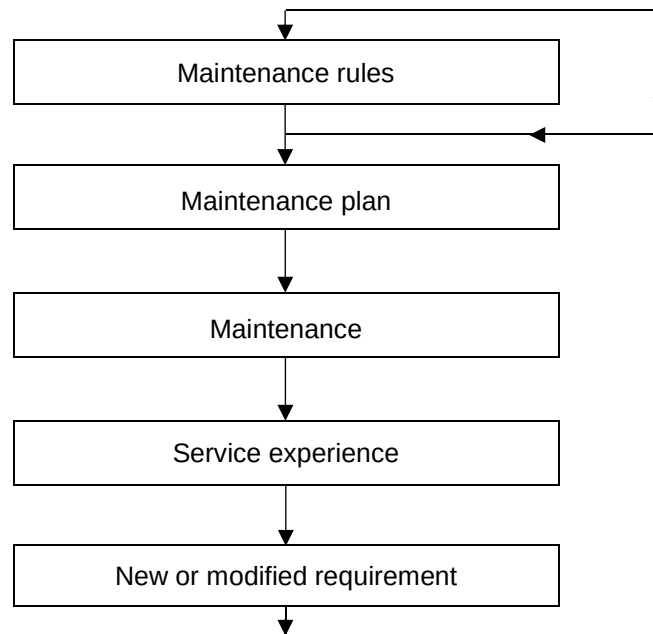


Figure 2 — Service experience

4.2.4 Traceability – storage – transportation

4.2.4.1 Wheelset identification

In order to ensure traceability, in-service wheelsets shall have marks complying with the requirements of EN 13260, EN 13261 and EN 13262.

It is recommended to have:

- the owner's mark on the wheel (e.g. on the hub, with the same requirement as for the other marks, as specified in EN 13262; painted on the web, etc.);
- external identification on wheelset with axle boxes mounted (e.g. tag or metal plate on the axle box, collar on the axle, radio frequency identification (RFID) etc.).

None of the external identification marks shall adversely affect the axle or its components.

All the identification marks shall be described in a specific document to support the management of the wheelsets during their service lives.

The markings are to be applied to the wheelsets when the latter are subject to medium and heavy maintenance.

NOTE 1 It is recommended, where possible, for these markings to be applied retrospectively, even when the wheelset components were not manufactured in accordance with EN 13261 or EN 13262.

NOTE 2 When transponders are used for identification, the procedures and instructions are given in Chapter 4 "Guideline for MRO identification" of the document "RFID in RAIL – European Guideline for the Identification of Railway Assets using GS1 Standards".

4.2.4.2 Traceability of operations and transfers

The traceability shall be ensured throughout the life of the in-service wheelset and its components by recording its maintenance life history (e.g. various operations and property transfers).

4.2.4.3 Database

4.2.4.3.1 General

The traceability of the original data and maintenance life history shall be recorded in a database.

The contents of the database and process for capturing information shall be described in a specific procedure.

The consistency of the records shall be checked on a regular basis.

4.2.4.3.2 Freight wagons

For freight wagon wheelsets, the minimum content of the database, the time period to store the data and the measures resulting from lack of traceability are given in Annex A. The data shall be recorded in an electronic database.

For new freight wagon wheelsets, the data in Tables A.1 to A.6 shall be collected before the wheelset is placed in service.

For in service freight wagon wheelsets, the data shall be collected at the earliest opportunity according to the maintenance plan (see clause 7.1).

Collected maintenance data is identified in categories I, II and III in Annex A, according to the minimum time for retaining the information.

In the event of a change of owner and/or ECM, all available wheelset data shall be transferred to the new owner and/or ECM.

4.2.4.3.3 Non-freight vehicles

For non-freight vehicles, the content of Annex B may be taken into consideration in ensuring adequate traceability.

4.2.4.4 Storage

Component parts, equipment, consumables etc. are to be protected against damage, as well as against environmental degradation according to manufacturer's recommendations, if applicable.

For the wheelsets in store for at least 24 months, there is a need to rotate the bearings fitted to the wheelsets based on service experience.

4.2.4.5 Handling and transportation conditions for new or maintained wheelsets

The processes and means of handling, transporting and storing shall not be the cause of damage to wheelsets, their components and their protective covers. The handling, transportation and storage shall not damage the most stressed areas, such as the wheel seat transitions.

The bearings, journals and other exposed equipment shall be protected against corrosion and mechanical damage.

Written procedures specifying how these objectives will be reached shall be available.

4.3 Equipment and systems

All railway-specific tools, gauges and systems for wheelset maintenance (e.g. checking for circularity defect, stresses in the wheel rim, non-destructive testing, etc.) shall be approved to ensure that requirements of this standard are met.

A reference file shall be created for all railway-specific equipment in order to ensure that it meets the specifications.

This file shall indicate that the equipment or railway-specific system has the appropriate levels of sensitivity and repeatability in line with the desired objective. Performance sustainability shall be demonstrated by means of calibrated reference equipment.

In addition, when new methods are used, it shall be ensured that the results achieved with the new equipment or system are at least equivalent to those obtained with the former (e.g. differentiation between parts with or without defects, etc.).

4.4 Staff certification and competence

Certification is necessary for staff carrying out:

a) non-destructive testing:

the staff shall be qualified according to EN ISO 9712 (Industrial Sector: Railway Maintenance) or equivalent and authorized to work on specific processes;

b) welding operations:

the staff shall be qualified according to EN 15085-2 or equivalent for components where welding is authorized.

NOTE An EN standard relating to the use of NDT in wheelset maintenance is currently being prepared and may be used as a reference for the training of operators following its publication.

4.5 Qualification of an undertaking for the maintenance of in-service or off-vehicle wheelsets

The qualification principle shown in Figure 3 applies to each of the following activities:

- a) maintenance of in-service wheelsets;
- b) maintenance of off-vehicle wheelsets;
- c) maintenance activity component (example: reprofiling).

The qualification shall be reviewed before its extension to a new type of wheelset/axle box.

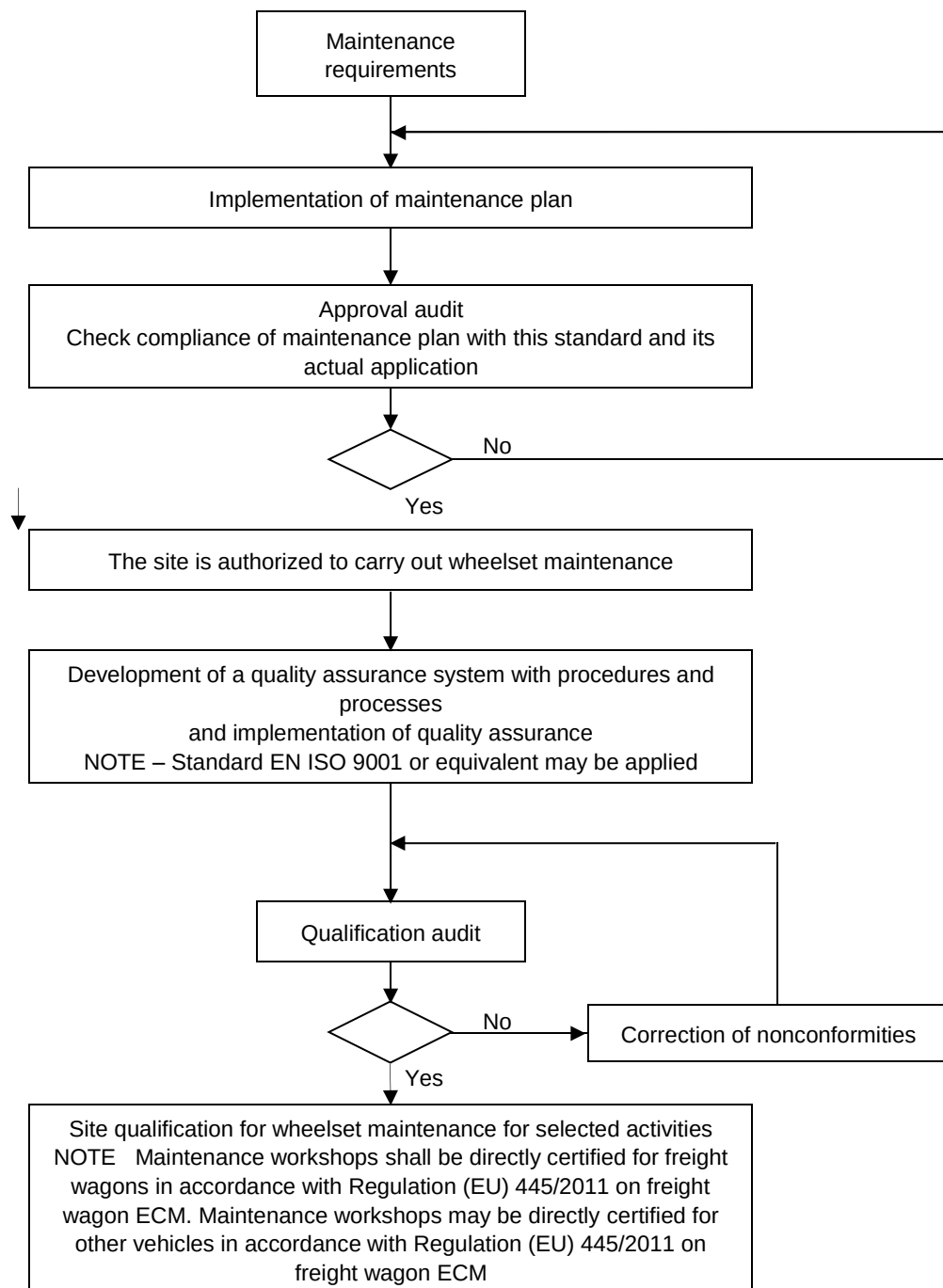


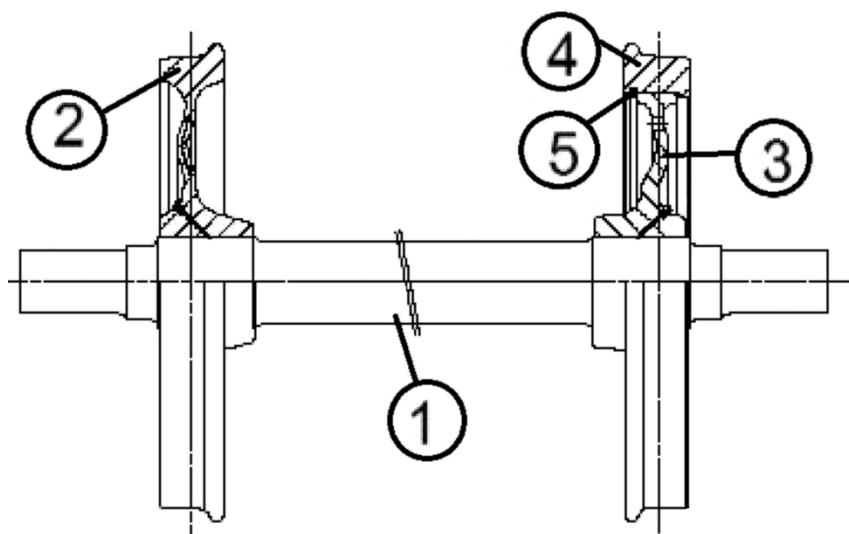
Figure 3 – Flow chart for qualification of a maintenance undertaking

5 Definition and illustrations of a wheelset, its associated components and defects

5.1 Definition and illustrations of a wheelset

5.1.1 Wheelset

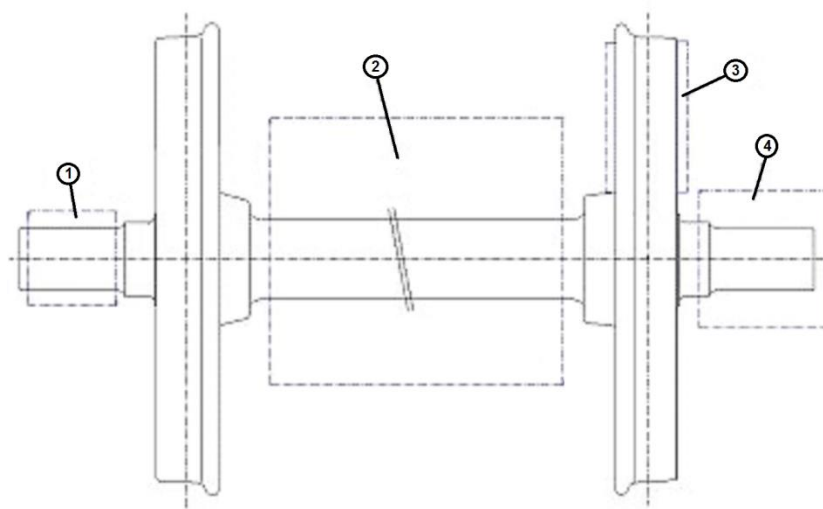
The various components of a wheelset are shown in Figures 4a and 4b.



Key

- 1 axle
- 2 monobloc wheel
- 3 wheel centre
- 4 tyre
- 5 retaining ring

a) Wheelset - principal components



Key

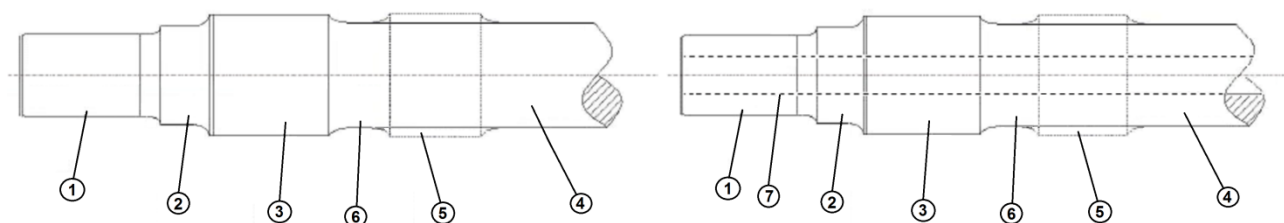
- 1 bearings
- 2 brake disc, transmission or final drive
- 3 wheel-mounted brake disc
- 4 axle box with bearings

b) Wheelset - other components

Figure 4 – Wheelset

5.1.2 Axle

The axle for all types of wheelset is shown in Figure 5.



Key

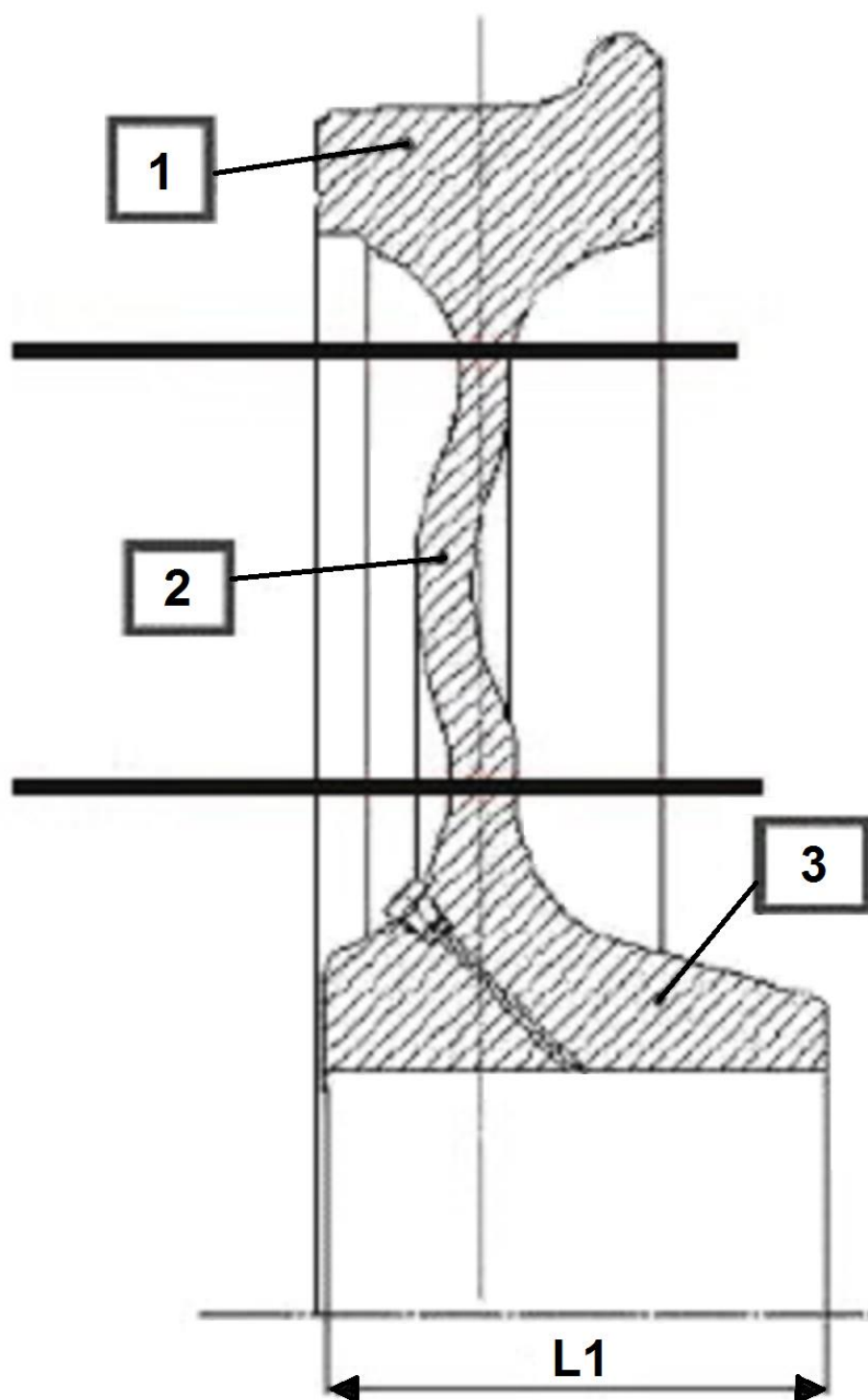
- 1 journal
- 2 abutment
- 3 wheel seat
- 4 axle body
- 5 seat for brake disc, transmission or final drive
- 6 transition zone between seats
- 7 axle bore

Figure 5 – Axle

NOTE Axles may be solid or hollow.

5.1.3 Wheel

The monobloc wheel is shown in Figure 6.



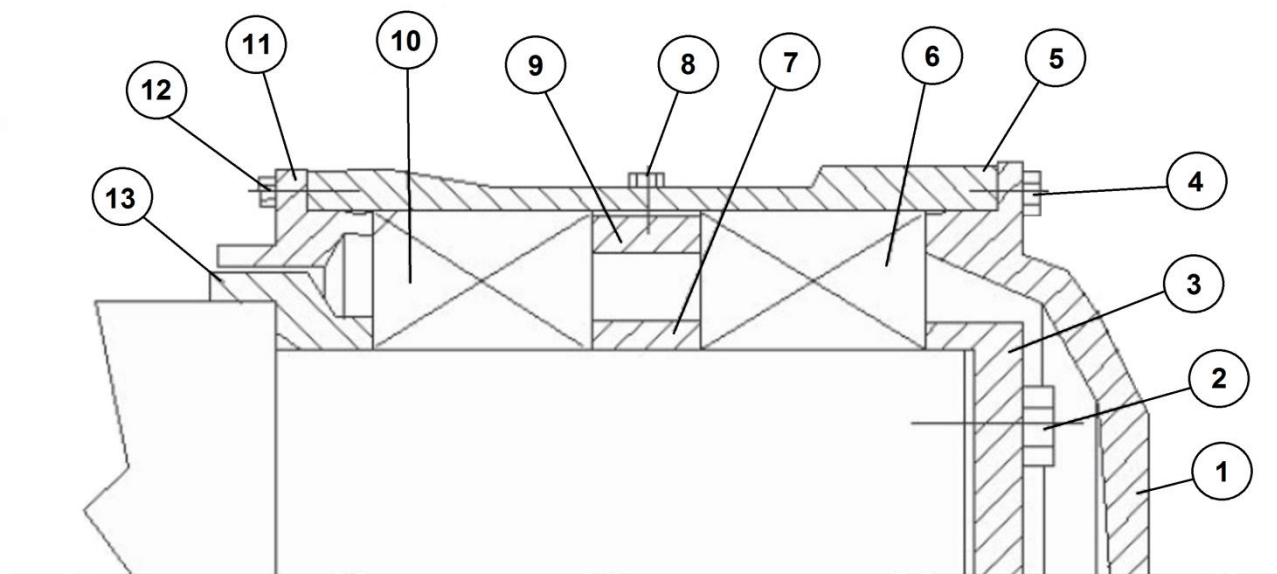
Key

- 1 rim
- 2 web
- 3 hub length
- L1 hub width

Figure 6 – Monobloc wheel

5.1.4 Axle box

The basic axle box is shown in Figure 7.



Key

- 1 front cover
- 2 end cap bolt and locking device
- 3 end cap
- 4 front cover bolt and locking device
- 5 axle box body
- 6 outer bearing
- 7 internal spacer
- 8 lubrication point
- 9 external spacer
- 10 inner bearing
- 11 rear cover
- 12 rear cover bolt and locking device
- 13 abutment ring

NOTE Components 6 – 7 – 9 and 10 may be replaced by a "cartridge" bearing

The different types of sealing system are to be added as a function of the type of bearing

Figure 7 – Basic axle box

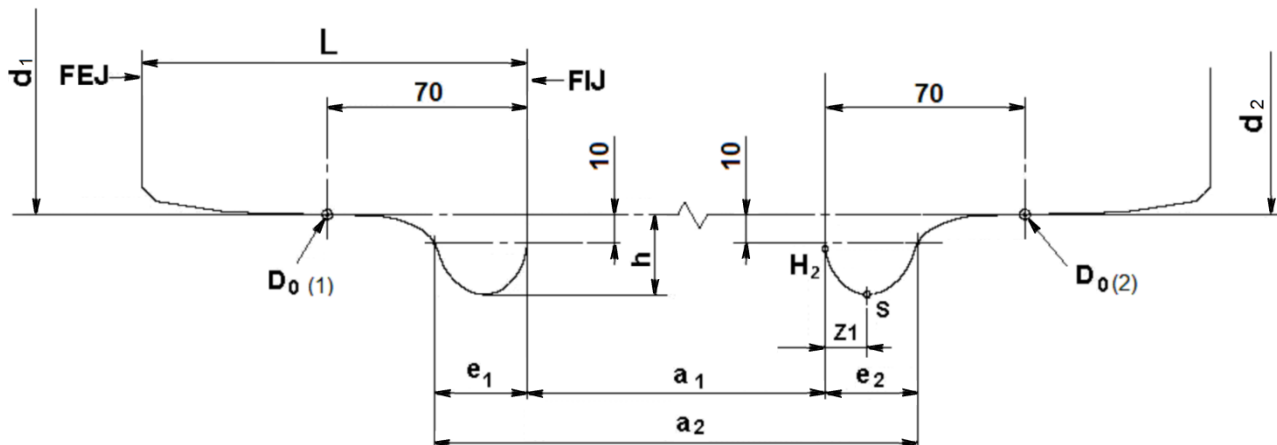
5.2 Functional references of the rail-wheel interface

5.2.1 Wheelset functional references

The essential dimensional references of the interface are defined in Figure 8.

The tread profile is defined in EN 13715.

Dimensions in mm

**Key**

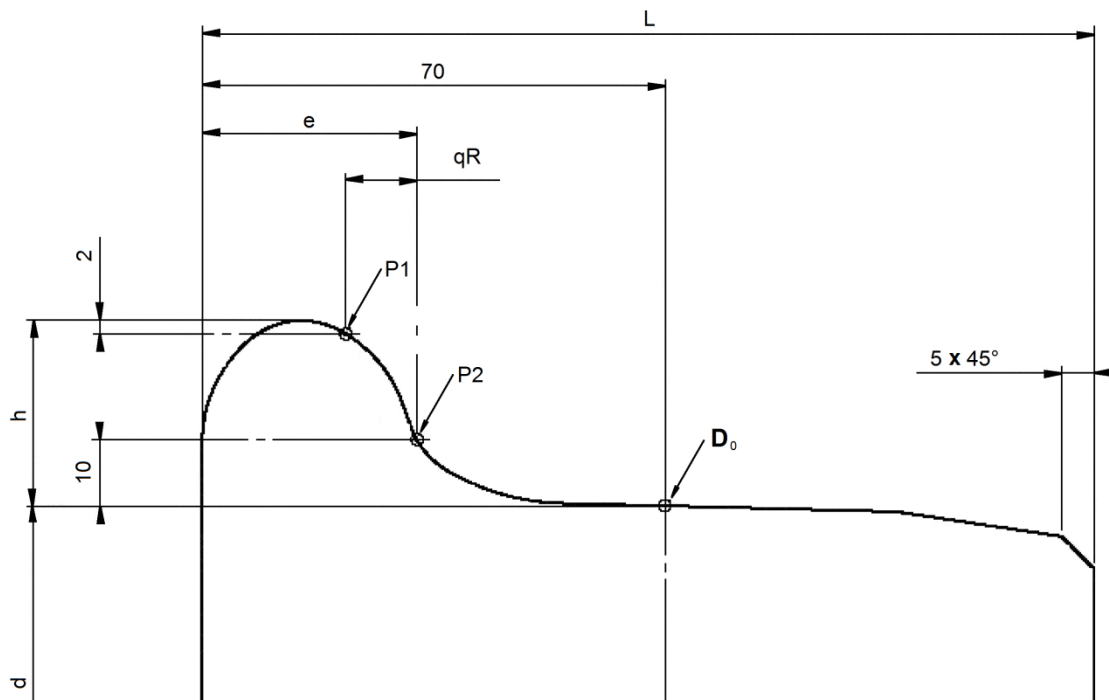
- a_1 back-to-back dimension
- a_2 front-to-front dimension ($a_1 + e_1 + e_2$)
- D_0 location of the wheel tread, 70 mm from its internal face. (1) wheel 1, (2) wheel 2
- e_1, e_2 flange thicknesses
- h flange height

- L rim nominal width
- Z_1 internal zone of flange ($H_2 - S$)
- FEJ external face of the rim
- FIJ internal face of the rim
- S connection at the tip of the flange
- d_1, d_2 wheel diameters

Figure 8 – Interface dimensions – Wheelset functional references**5.2.2 Wheel functional references**

The essential dimensional references of the wheel are defined in Figure 9.

Dimensions in mm



Key

- d wheel diameter
- D_0 location of the wheel tread, 70 mm from its internal face
- h flange height
- L rim nominal width
- e flange thickness
- qR flange angle dimension between P1 and P2
- 5 x 45° Nominal chamfer

Figure 9 – qR value and wheel functional references

NOTE The terms listed in Figures 8 and 9 conform to EN 13715 (Tread profile) and EN 13260 (Wheelsets).

5.3 Definition and illustrations of defects

Definitions and illustration of defects are given in Annex C.

6 Requirements and operations

6.1 General

As indicated in the Introduction, this standard defines:

- a) requirements for all owners/undertakings (e.g. maximum and minimum dimensions, rail interface dimensions, etc.);
- b) maintenance to be carried out, but in which the criteria values are to be specified in the maintenance plan on the basis of service experience.

The requirements defined in 6.2 and 6.4 shall be assessed in accordance with the maintenance plan.

The tread profile and wheel dimensions after reprofiling shall be defined on the basis of:

- c) the results of vehicle acceptance testing (e.g. stability verification, etc.);
- d) the service experience.

The criteria shall be either as defined in 6.2 and 6.4 (allowable limits for safe operation) or as defined in the maintenance plan based on service experience.

The detection method for defects shall include:

- e) manual;
- f) visual; or
- g) automatic.

6.2 Requirements

6.2.1 In-service limit dimensions and positions

6.2.1.1 General

The maximum and minimum values are given in Tables 1 to 6. The different interface dimensions are given in Figure 8.

In the case of wheels where the actual diameter passes from one category to another, it is permissible to use either of the values. This shall be documented in the maintenance plan.

6.2.1.2 Flange height "*h*"

The limit values as a function of the diameter are specified in Table 1.

Table 1 — Flange height "*h*"

d^a (mm)	$d \leq 630$	$630 < d \leq 760$	$760 < d$
h minimum (mm)	31,5	29,5	27,5
h maximum (mm)	36,0		
^a Wheel diameter (actual dimension)			

6.2.1.3 Flange thickness "*e*"

The limit values as a function of the diameter are specified in Table 2.

Table 2 — Flange thickness "e"

d^a (mm)	$d \leq 760$	$760 < d \leq 840$	$840 < d$
e minimum ^{b, c} (mm)	27,5	25,0	22,0
e maximum ^b (mm)	33,0		
^a Wheel diameter (actual dimension).			
^b This does not apply to wheelsets having reduced wheel flanges or wheelsets without wheel flanges that are not involved in track guidance.			
^c In all cases, the value of "a ₂ " shall be within the tolerances.			

6.2.1.4 "qR" dimension

The minimum value of qR is 6.5 mm.

6.2.1.5 Back-to-back dimension "a₁"

The limit values as a function of the diameter are specified in Table 3.

Table 3 — Back-to-back dimension "a₁"

d^a (mm)	$d \leq 760$	$760 < d \leq 840$	$840 < d$
a_1 minimum (mm)	1 359	1 358	1 357
a_1 maximum (mm)	1 363		
a Wheel diameter (actual dimension)			

This value shall be checked with the wheelset under load on the internal face of the rim close to the top of rail.

The resumption/recovery of the a₁ dimension is permitted if the width of the rim after reprofiling is within the tolerances required by this Standard.

No correction is permitted after a derailment or detection of a loose wheel.

6.2.1.6 Front-to-front dimension "a₂"

The limit values as a function of the diameter are specified in Table 4.

Table 4 — Front-to-front dimension

d^a (mm)	$d \leq 760$	$760 < d \leq 840$	$840 < d$
a_2 minimum ^b (mm)	1 415	1 412	1 410
a_2 maximum (mm)	1 426		
^a Wheel diameter (actual dimension).			
^b This does not apply to wheelsets having reduced wheel flanges or wheelsets without wheel flanges that are not involved in track guidance.			

This value shall be checked with the wheelset under load at the point on the flange front equivalent to the point 10 mm below D_0 (top of rail).

Specific values can be defined after stability testing of the vehicles (Annex D gives the front-to-front dimension characteristics for the wheelsets of two-axle wagons loaded at 22,5 t per axle).

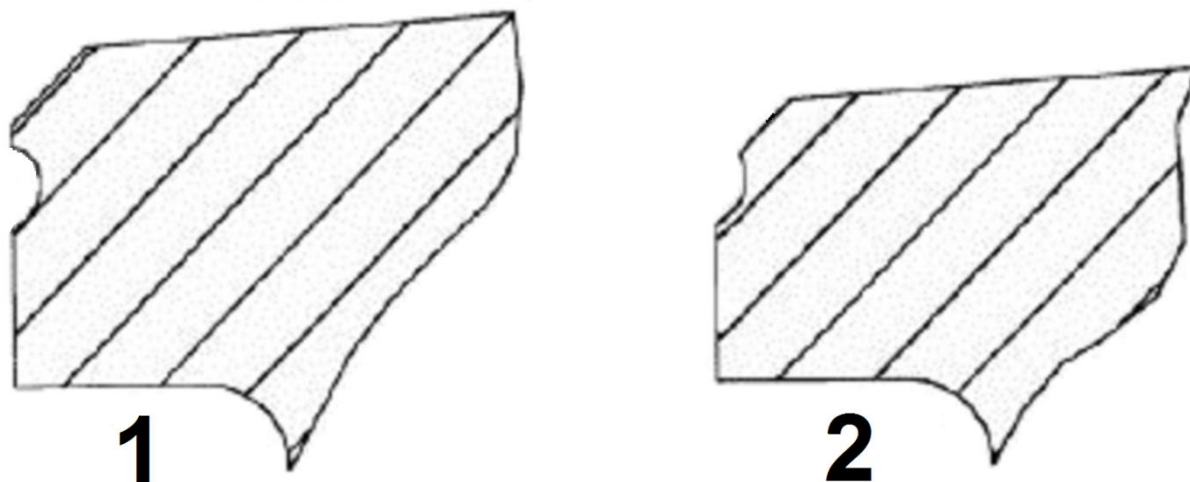
The following condition shall be met:

$$a_2 \min \leq a_1 + e_1 + e_2 \leq a_2 \max$$

NOTE The front-to-front dimension may be calculated from the value of the back-to-back dimension and the flange thickness of the two wheels.

6.2.1.7 Wear groove

The wear groove, when mandatory, shall always be fully visible after reprofiling or in service. The acceptance criteria is shown in Figure 10.



Key

- 1 permitted
- 2 not permitted

Figure 10 — Wear groove

6.2.1.8 Wear limit and last reprofiling diameters

The wear limit and last reprofiling diameters shall be specified. The difference between these two diameters is as follows:

- a) The wear limit diameter is defined at the wheel design stage.
- b) The last reprofiling diameter shall be defined relative to the wear limit diameter so that it does not have a lower value in service.

The wear limit diameter and last reprofiling diameter are defined in standard EN 13979-1.

6.2.1.9 Chamfer

The chamfer is defined in Figure 9. The nominal dimensions are: $5 \times 45^\circ$.

The tolerance on each dimension is ± 2 .

6.2.1.10 Rim width "L" without roll-over

The nominal rim widths and their tolerances are given in Table 5.

Table 5 — Nominal rim width "L" without roll-over and tolerances

Nominal rim width "L" (mm)	Tolerance (mm)
135	- 2 / +1
140	

NOTE Specific values from certain former state railways are given in Annex E for vehicles not subject to Directive 2008/57/E.

6.2.2 Special maintenance action for freight wagon axles according to axle load

Many European freight wagon wheelsets are currently equipped with axles designated as types A and B (see Annex F). For the enhanced loading operation, with constant use at high axle load, additional maintenance actions are required.

NOTE 1 The definitions of Type A and B come from UIC 510-1.

Table 6 lists the maintenance intervals and maintenance actions that have to be applied to ensure safe operational conditions for these axle types corresponding to the axle loads.

NOTE 2 These values have been derived from experience gained by users in applications in European operation.

Table 6 — Special maintenance actions for freight wagon axles according to axle load

Axle type	Axle load M (t)	Additional criteria	Corresponding additional maintenance action
For type A-I; A-II; A-III(1) axles operated from 20 t up to 21 t axle load in standard maintenance plan and re-classified back to 20 t operation:		Re-integrate axle in standard maintenance plan with UT of the wheel seat at the next reprofiling, medium or heavy maintenance level of the wheelset	
Type A-I; A-II; A-III(1)	$21 < M$	Not covered by this EN	Scrap
Type A-III (2)	$20 < M \leq 20,6$	Inside design limits, validated by service	No special requirements
Type A-III (2)	$20,6 < M \leq 21$	Limited mileage between medium or heavy maintenance: 400,000 km or the equivalent time in service	NDT with mounted wheels — UT at wheel seat — UT or MT at transition radii
Type A-III (2)	$21 < M \leq 22$	Limited mileage between medium or heavy maintenance: 200,000 km or the equivalent time in service	
Type B	$22,5 < M \leq 23,5$	Inside design limits but use to be checked case by case in accordance with wagon parameters and permitted infrastructure axle load	No special requirements

6.2.3 Maintenance decision criteria for in-service wheels for all types of wheel

6.2.3.1 Limit lengths of wheel tread defects (e.g. flats, metal build-up, shelling, cavities, scaling, tread indentation, isolated transverse cracking, material loss etc.) (Annexes C.2.1 to C.2.6) and circularity defects (Annex C.2.7)

Limit values for defects in service relative to the axle load, speed and wheel diameter are given in Table 7.

Table 7 — Limit lengths of wheel tread defects

M (t)		$M \leq 18$			$18 < M \leq 22.5$				$22.5 < M$		
V (km/h)		$V \leq 160$	$160 < V \leq 200$	$200 < V$	$V \leq 120$	$120 < V \leq 160$	$160 < V \leq 200$	$200 < V$	$V \leq 100$	$100 < V \leq 120$	$120 < V$
D (mm)	$1\,000 < d$	80	60	40	80	60	50	35	X	X	X
	$840 < d \leq 1\,000$	60	50	30	60	50	35	25	60	50	30
	$630 < d \leq 840$	40	30	25	40	30	25	20	40	X	X
	$550 < d \leq 630$	35	25	X	X	X	X	X	X	X	X
	$d < 550$	30	X	X	X	X	X	X	X	X	X
M: axle load in tonnes (t). d: actual wheel diameter X: reserved (no application known)											

The values given in Table 7 are the maximum allowable values in service for the largest defect found on the wheel tread.

Different values for equipment not subject to Directive 2008/57/EC may be used according to service experience.

If defects exceed the dimensions of Table 8, the defects shall be eliminated by reprofiling and the axle bearings shall be checked according to service experience.

Permissible values for circularity defects, Δr , shall be defined in the maintenance plan. Indicative values are given in Annex G. Circularity defects may be detected during medium and heavy maintenance.

6.2.3.2 Spalling (Thermal effects due to tread braking) (Annex C.2.8)

Acceptable if it is the only defect on the tread.

6.2.3.3 Rolling contact fatigue (Annex C.2.9)

Acceptable if it is the only defect on the tread.

6.2.3.4 Thermal cracks (Annex C.2.10)

Thermal cracks (linear defect) are not permitted.

In cases where a flanging brake block is detected (friction between the brake block and the external lateral face of the rim, the area of the wheel tread affected shall be examined for thermal cracks.

NOTE Where a flanging brake block is detected, it is recommended that the position of the tread brake unit/brake equipment is checked.

6.2.3.5 Wheel tread roll-over (Annex C.2.11)

The maximum permitted value for the wheel tread roll-over is 5 mm.

6.2.3.6 Damage to chamfered corner (Annex C.2.12)

This defect is permitted if the damage has not evolved into a crack.

6.2.3.7 Wheel tread – grooves and channels (Annex C.2.13)

Grooves with a depth more than 2 mm are not permitted.

Channels (shape edges) are not permitted.

6.2.3.8 False Flange (Annex C.2.14)

A false flange with a depth more than 2 mm is not permitted

6.2.3.9 Damage on the flange (Annex C.2.15)

The metal flow in zone P1–flange tip, defined in Figure 9, is acceptable if the representative qR dimension is greater than 6.5 mm. Damage, sharp edges or burrs N° 1, 3 or 4 defined in Annex C.2.15 Figure C.22 are not accepted.

There shall be no radial surface marks that exhibit a notch effect (e.g. crack, NDT indication, etc.).

6.2.3.10 Radial marks and radial defects on the internal side of the rim (FIJ) (Annex C.2.16)

Radial marks on the internal side of the rim are permitted. (Figure C.23 a)).

There shall be no radial surface marks that exhibit a notch effect (e.g. crack, NDT indication, etc.) (Figures C.23 b and c).

Radial defects associated with the presence of thermal effects at the rim-web transition are not permitted.

6.2.3.11 Damage resulting from identification markings (Annex C.2.17)

Cracks from any marking are not permitted.

6.2.3.12 Damage from lathe driving tools (Annex C.2.18)

Axial or radial sharp-edged marks are not acceptable on the external face of the rim (FEJ).

6.2.3.13 Defects on the external face of the rim (FEJ)

There shall be no marks or radial cracks.

6.2.3.14 Defects on the web and the hub of a wheel (Annexes C.2.19 to C.2.22)

The web and hub shall not have any:

- a) cracks, sharp-edged notches or any other irregularity;
- b) marks resulting from the removal of defects by means of a procedure not included in the maintenance plan;
- c) cracks of mechanical or thermal origin around any fixing holes, for example the holes on the transmission gear or other noise and/or vibration damping devices and brake discs mounted on the wheel web, wheel web holes, etc.

6.2.4 Maintenance decision criteria for in-service wheels for specific wheel types

6.2.4.1 Deep sub-surface tread defect on monobloc wheel (Annex C.3.1)

If service experience shows damage originating from wheel tread defects, the inspection and maintenance requirements to be met shall be defined in the maintenance plan.

6.2.4.2 Defects on the web of a wheel used as a braking surface (Annex C.3.2.1)

The requirements to be met by wheels where a web is used as a braking surface shall be defined in the maintenance plan.

6.2.4.3 Overheating affecting the wheel rim/web transition on monobloc wheels (Annex C.3.2.2)

Overheating of the transition zone can result in a wheel distortion defect (Annex C.6.2), variation of residual stresses and thermal cracks.

When overheating of the transition zone is identified (e.g. by burnt paint or by any automatic device or by measuring the back to back distance before reprofiling), the following requirements shall be applied:

- a) wheels conforming to EN 13979-1 (freight wagons using these wheels are identified with white marks on the axle box, see Figure 11) shall be dealt with in line with service experience as defined in the maintenance plan;
- b) wheels not conforming to EN 13979-1, measures shall be taken to ensure geometric conformity of the wheelset to this standard, or be checked for residual stresses as specified in the maintenance plan. If conditions are met, a check shall be made for thermal cracks.

NOTE 1 For ER6 or ER7 monobloc wheels, the current values determined are as follows:

- maximum: 300 MPa for monobloc wheels of unknown fracture toughness of the rim;
- maximum: 400 MPa for monobloc wheels of fracture toughness of the rim as specified in EN 13262.

NOTE 2 The methods for measuring the residual stress of the wheel rims are given in EN 13979-1:2003+A2:2011 Annex B, 2.3.2.1.

6.2.4.4 Tyred wheel defects (Annex C.3.3)

The requirements for tyred wheels are defined in Annex H.

6.2.5 Damage acceptance limits for axle bodies

6.2.5.1 Damage caused by corrosion (Annexes C.4.1 and C.4.2)

Corrosion pitting that is greater than what service experience shows acceptable is inadmissible.

Axles, where the condition of the surface according to the illustrations in Annex I requires a treatment process, shall be rectified (depending on geometric limits) or removed from service in order to prevent potential crack propagation. This intervention shall be undertaken no later than during medium maintenance for wheelsets in accordance with the requirements of the maintenance plan.

NOTE The treatment process may be turning, grinding, blasting, etc.

The treated areas shall be subjected to NDT (excluding VT).

In the case of the presence of damage to the coating (bubbles, partial detachments, etc.) that does not permit a clear evaluation of the surface condition under the coating, then the coating is to be removed until the surrounding area is clear of corrosion.

6.2.5.2 Circumferential defects around the whole circumference (Annex C.4.3.1)

Channels are not permitted.

6.2.5.3 Circumferential defect on a singular zone (Annexes C.4.3.2)

Circumferential cracks are not permitted.

6.2.5.4 Notches and impact damage (Annex C.4.4)

Sharp-edged notches are not permitted.

Criteria and limits of repairs shall be defined in the maintenance plan.

6.2.5.5 Longitudinal defects (Annex C.4.5)

Limit criteria shall be defined in the maintenance plan on the basis of service experience.

6.2.5.6 Damage in the interference fit zones (Annex C.4.6)

Limits shall be defined in the maintenance plan. This damage can only be detected during heavy maintenance.

6.2.6 Criteria for axle box (Annex C.5)

Criteria shall be defined in the maintenance plan.

6.2.7 Criteria on wheelsets

6.2.7.1 In-service axial or angular movement of a wheel or of one of the other components (Annex C.6.3)

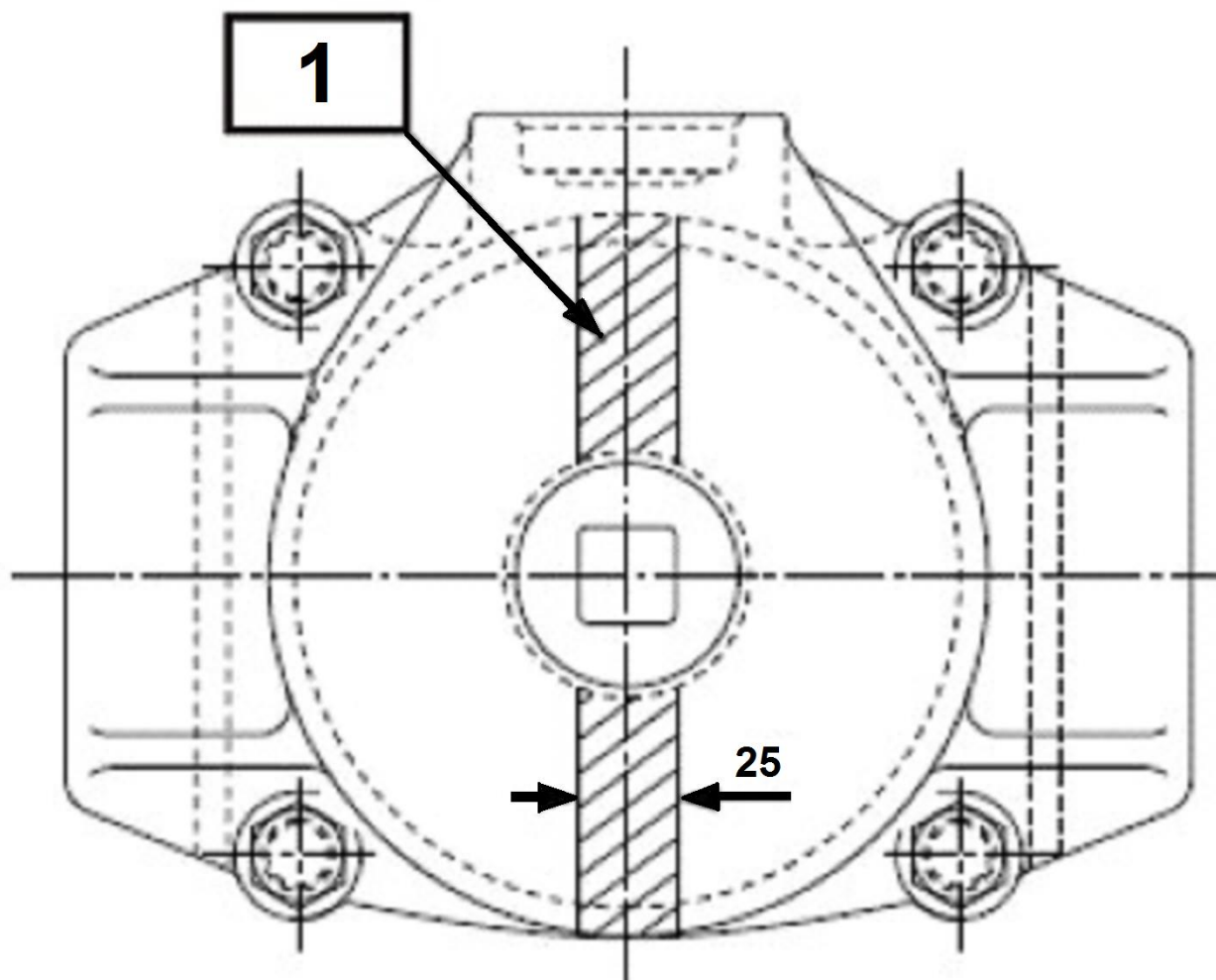
No axial movement of a wheel is permitted.

For angular movement of the wheel, specific requirements shall be applied in the maintenance plan, on the basis of service experience.

Movement of other components assembled on the axle shall be defined in the maintenance plan based on service experience.

6.2.7.2 Marking of wheelsets with wheels according to EN 13979-1

Axle boxes of freight vehicles with outboard journals and fitted with EN 13979-1 compliant wheels shall be marked with a vertical white line on their outer cover. This marking is shown in Figure 11.

**Key**

1 white mark and width

Figure 11 — White mark on axle box – Wheel marking according to EN 13979-1**6.2.7.3 Electrical resistance of wheelsets after heavy maintenance**

After heavy maintenance, the electrical resistance of wheelsets equipped with monobloc wheels shall meet the requirements of EN 13260.

6.2.8 Specific requirements for tired wheels and resilient wheels

Specific requirements shall be defined in the maintenance plan.

These requirements shall at least reject:

- cracked or broken tyres;
- thin tyres;
- damage to the retaining ring (loose, cracked or broken ring);
- lateral movement of the tyre;

- loose tyre;
- make up pieces between the wheel centre and the tyre;
- discontinuous non-monobloc ring.

A tyre is considered to be loose if at least one of the following conditions is met:

- tyre rotation on the wheel centre that can be indicated by the white lines painted on the components. For powered wheelsets, specific requirements relating to the radial offset of the tyre shall be indicated in the maintenance plan, on the basis of service experience;
- does not ring true when tapped;
- loose retaining ring;
- corrosion between tyre and wheel centre over more than 1/3 of the circumference.

Additional requirements for resilient wheels shall be defined in the maintenance plan. These shall include, as a minimum:

- inspection of the integrity of the rubber elements;
- inspection of the earth-braids and the mechanical connections at the tyre and web;
- a procedure to confirm the electrical continuity;
- verification of the required clearances between rim and the wheel centre.
- a tyre concentricity check during major maintenance operations.

An example of requirements for tyred wheels and resilient wheels is presented in Annex H.

6.2.9 Limit value for axle wheel seat diameter

The minimum diameter of the axle wheel seat shall be defined in the maintenance plan.

Minimum wheel seat diameter for all Type A axles (see annex F) shall be limited to 182 mm when operated at 20 t.

NOTE This value has been derived from experience gained by users in applications in European operation.

6.3 Reprofilng operation

Wear on the profile and tread defects which exceed the requirements of this standard or of the maintenance plan shall when possible be repaired by means of reprofiling.

Before performing any reprofiling operation, the following data shall be obtained from the technical expert for the owner undertaking:

- the reprofiling site;
- the profile to be taken into account according to EN 13715;
- the reprofiling dimensions (e.g. flange thickness, front-to-front dimensions, etc.).