BS EN 15313:2016

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 It supersedes BS EN 15313:2010 which is withdrawn.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.

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When speeds in km/h require unit conversion for use in the UK, users are advised to use equivalent values rounded to the nearest whole number. The use of absolute values for converted units should be avoided in these cases. Please refer to the table below for agreed conversion figures:

INS, RST and ENE speed conversions	
km/h	**mph**
10	5
25	15
60	40
80	50
100	60
120	75
160	100
200	125

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

A list of organizations represented on this subcommittee 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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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

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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of an identical text or by endorsement, by October 2016 at the latest, and conflicting national standards shall be withdrawn at the latest by October 2016.

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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.

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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 tyred 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 tyred 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
heavy 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.

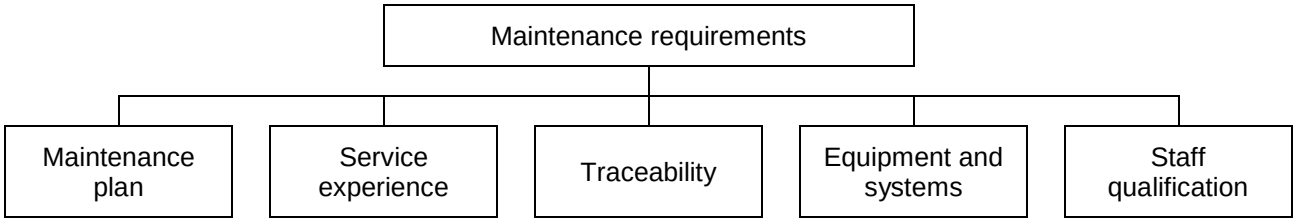


Figure 1 — General maintenance organization

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.

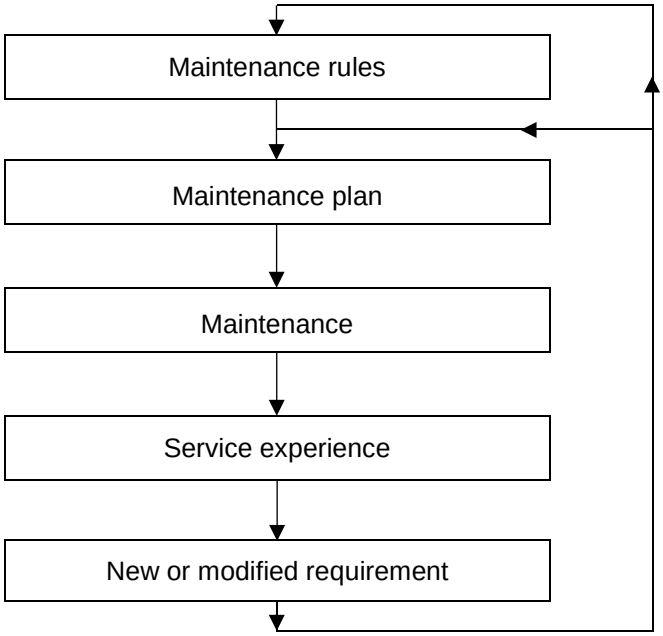


Figure 2 — Service experience

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.

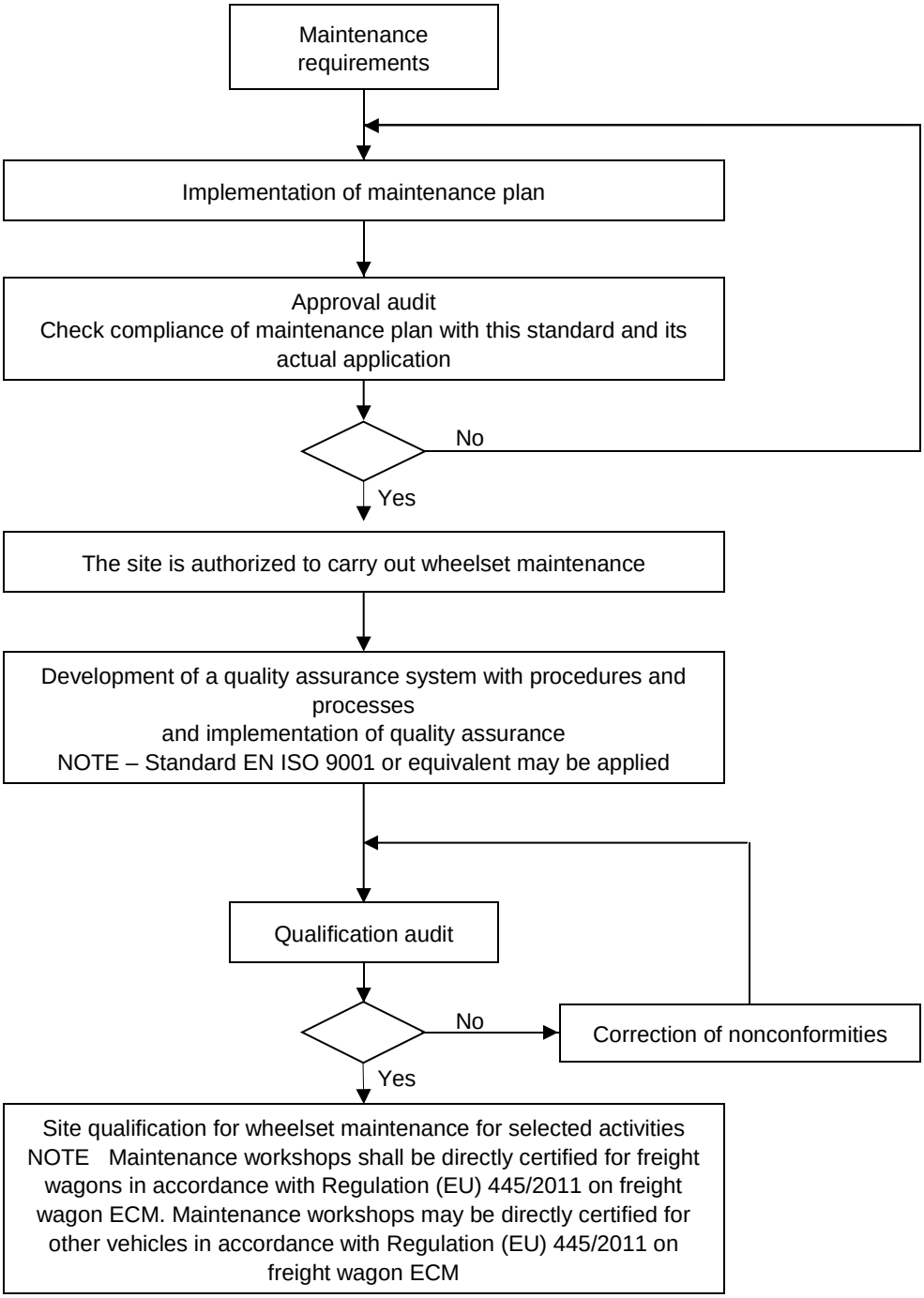


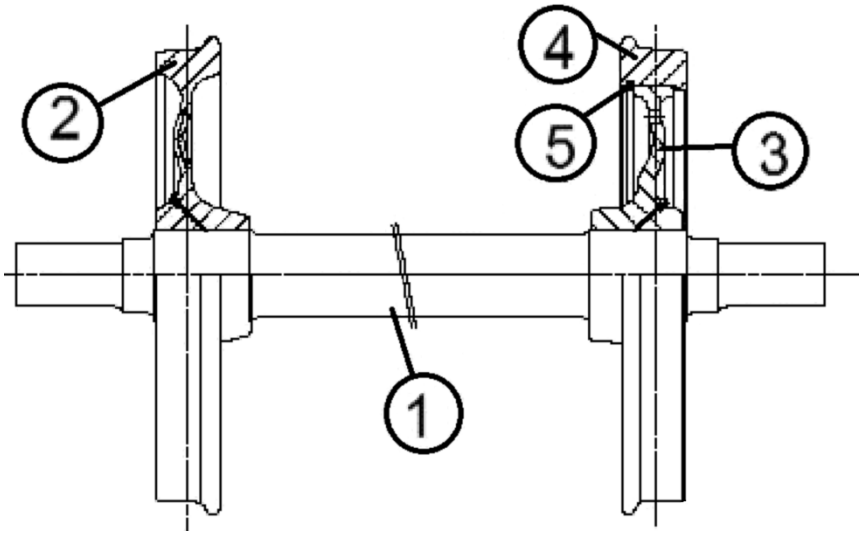
Figure 3 – Flow chart for qualification of a maintenance undertaking

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

5.1 Definition and illustrations of a wheelset

5.1.1 Wheelset

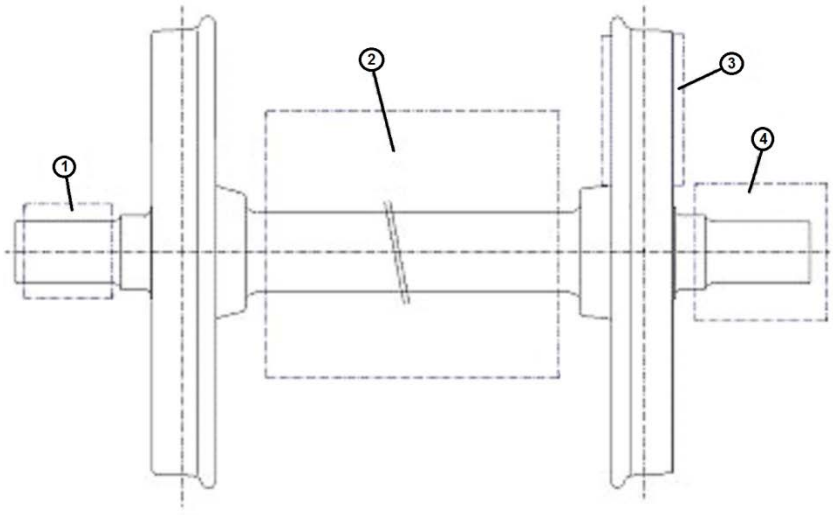
The various components of a wheelset are shown in Figures 4a and 4b.



Key

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

a) Wheelset - principal components



Key

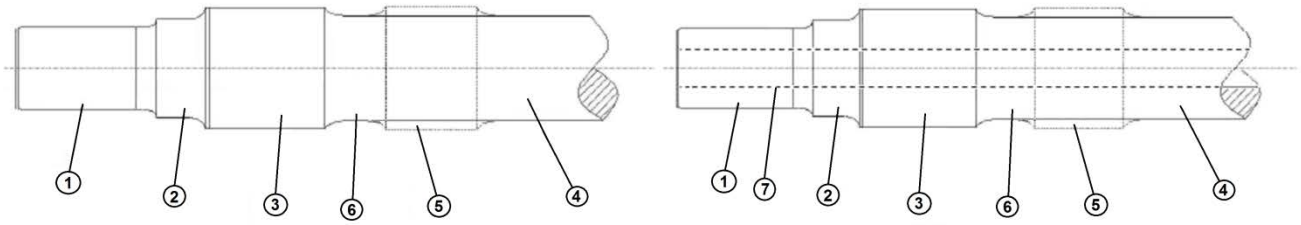
1 bearings
2 brake disc, transmission or final drive
3 wheel-mounted brake disc
4 axle box with bearings

b) Wheelset - other components

Figure 4 – Wheelset

5.1.2 Axle

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



Key

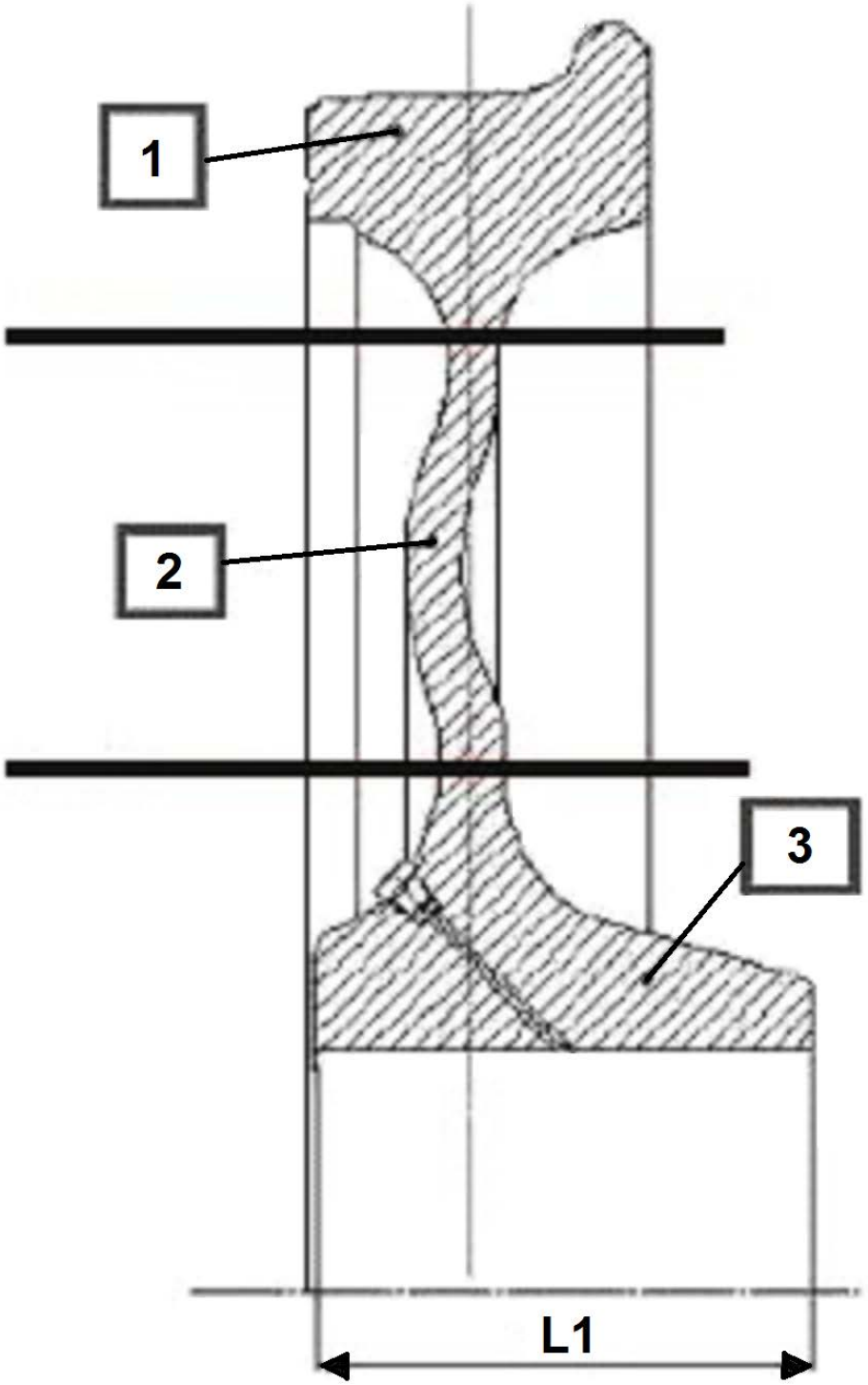
1 journal
2 abutment surface
3 wheel seat
4 axle body
5 seat for brake disc, transmission or final drive
6 transition zone between seats
7 axle bore

Figure 5 – Axle

NOTE Axles may be solid or hollow.

5.1.3 Wheel

The monobloc wheel is shown in Figure 6.



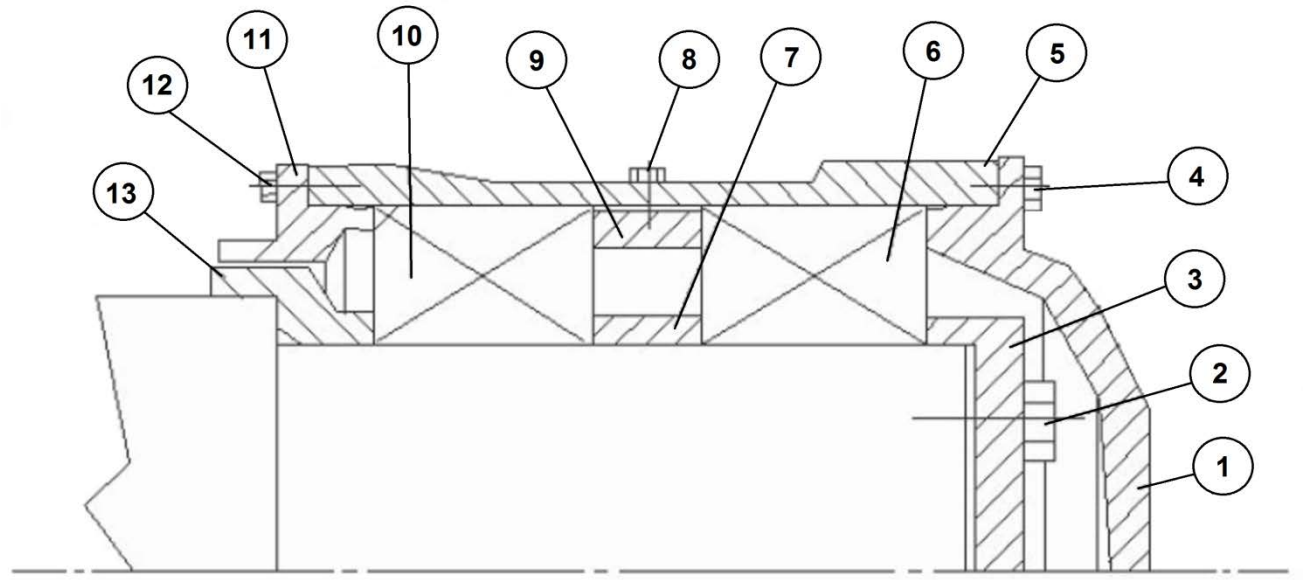
Key

1 rim
2 web
3 hub
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 lock
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

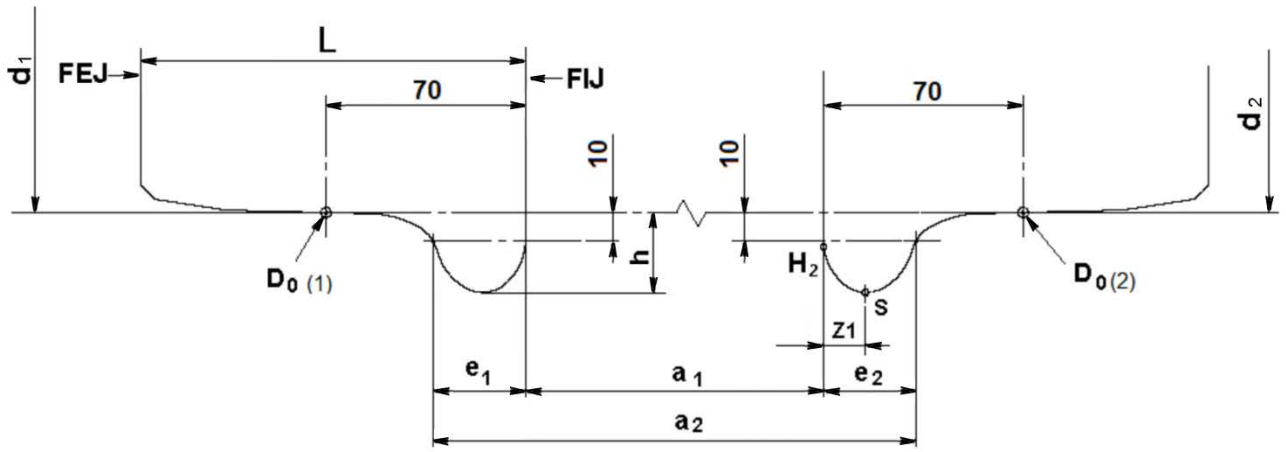
5.2 Functional references of the rail-wheel interface

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

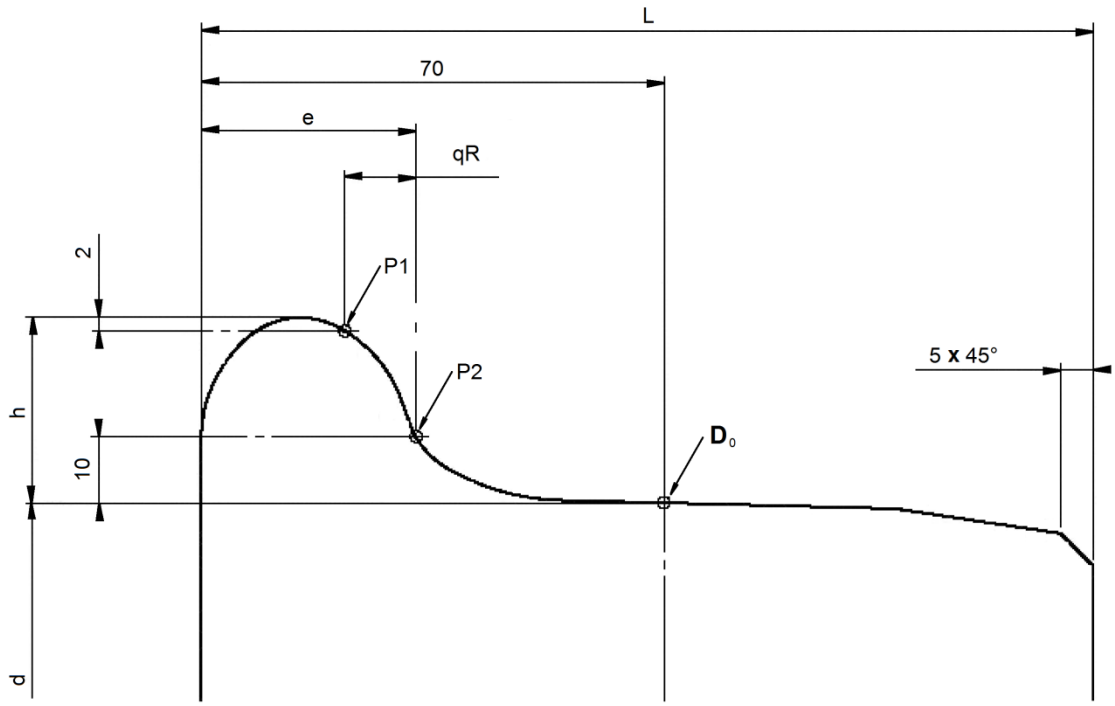
a_1	back-to-back dimension
a_2	front-to-front dimension (a1 + e1 + e2)
D_0	location of the wheel tread, 70 mm from its internal face. (1) wheel 1, (2) wheel 2
e_1, e_2	flange thicknesses
h	flange height
L	rim nominal width
*Z*1	internal zone of flange (H2 – S)
FEJ	external face of the rim
FIJ	internal 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. It shall be described 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* ≤ 630	630 < *d* ≤ 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* ≤ 760	760 < *d* ≤ 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 "a_1"

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

Table 3 — Back-to-back dimension "a_1"

d [a] (mm)	*d* ≤ 760	760 < *d* ≤ 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, the FIJ surface, 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 derailment or a loose wheel.

6.2.1.6 Front-to-front dimension "a_2"

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).

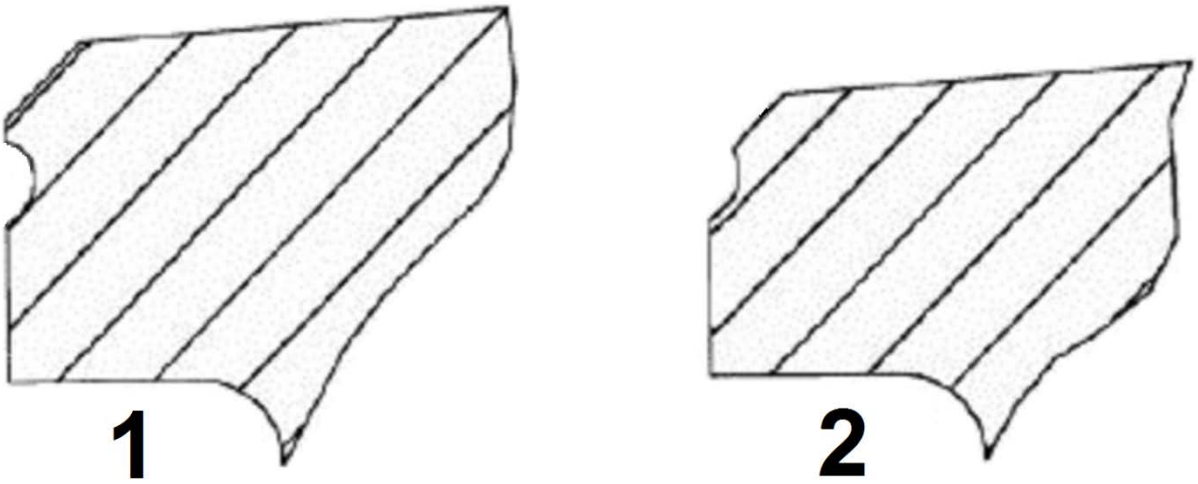
The following condition shall be met:

$$a_2 \text{ min} \leq a_1 + e_1 + e_2 \leq a_2 \text{ max}$$

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 decision criteria are 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 × 45°.

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 ≤ 20,6	Inside design limits, validated by service	No special requirements
Type A-III (2)	20,6 < M ≤ 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 ≤ 22	Limited mileage between medium or heavy maintenance: 200,000 km or the equivalent time in service	
Type B	22,5 < M ≤ 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* ≤ 18			18 < *M* ≤ 22.5				22.5 < *M*		
V (km/h)		*V* ≤ 160	160 < *V* ≤200	200<*V*	*V* ≤120	120 < *V* ≤160	160 < *V* ≤ 200	200 < *V*	*V* ≤ 100	100 < *V* ≤ 120	120 < *V*
D (mm)	1 000 < *d*	80	60	40	80	60	50	35	X	X	X
	840 < *d* ≤ 1 000	60	50	30	60	50	35	25	60	50	30
	630 < *d* ≤ 840	40	30	25	40	30	25	20	40	X	X
	550 < *d* ≤ 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 (FEJ), see Figure 8), 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 edge) 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 Damages 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 edge or burr 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, bore hole on the hub, 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 wheels 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.

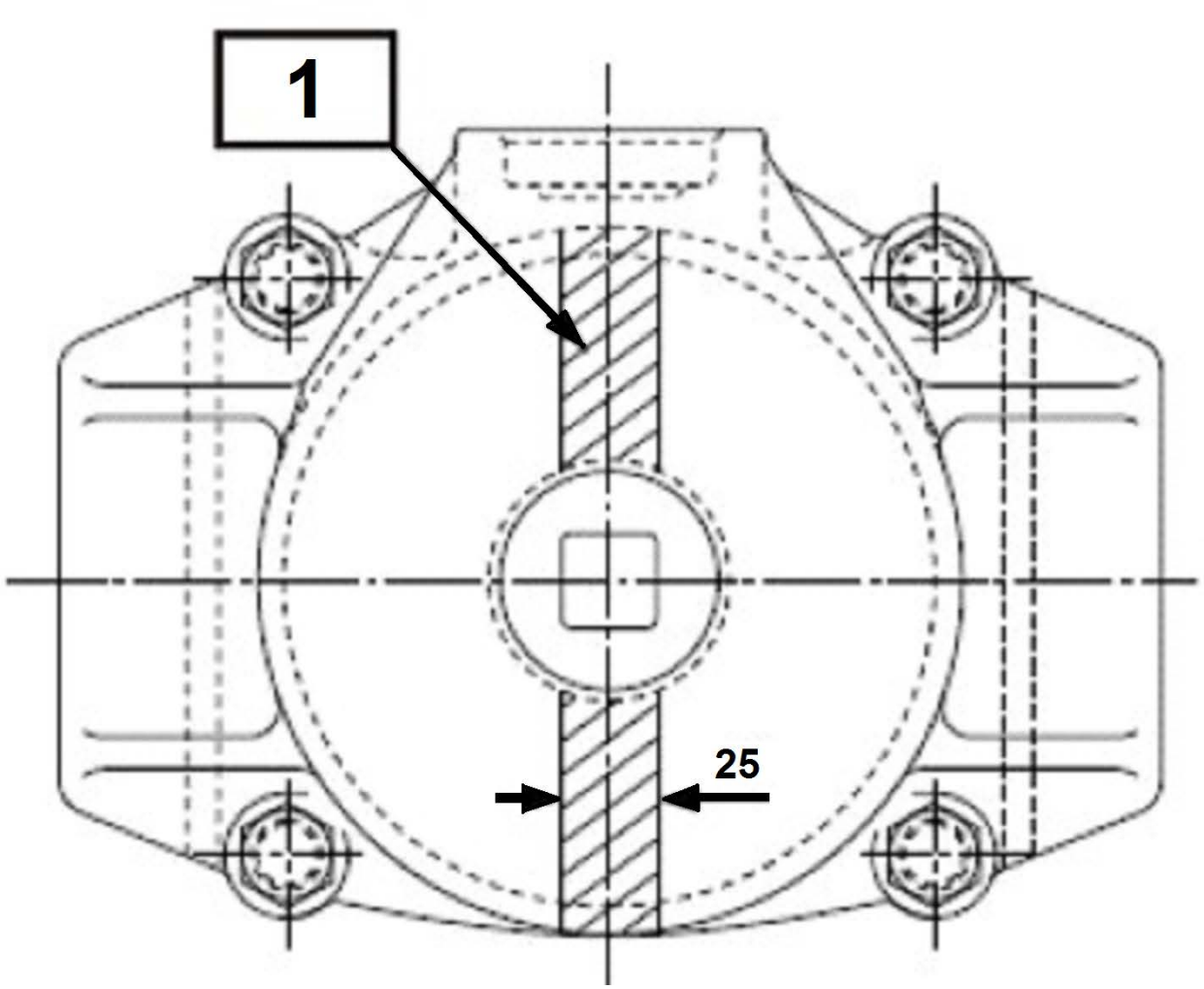
For angular movement of the wheel, specific requirements shall be applied in the maintenance plan, on the basis of service experience.

Movement of other components assembled on the axle shall be defined in the maintenance plan base 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.

Dimensions in mm



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 tyred wheels and resilient wheels

Specific requirements shall be defined in the maintenance plan.

These requirements shall at least reject:

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

- loose tyre;
- insertion of plate 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. They 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 Reprofiling operation

Wear on the profile and tread defects which exceed the requirements of this standard or of the maintenance plan shall when possible be remedied 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.).

6.4 If any defect is present in a wheel, a reprofiling operation shall be planned on the basis of service experience so that dimensions of the damage do not exceed the criteria specified in Table 7.Dimensions and conditions after reprofiling

6.4.1 Front-to-front dimension "a_2"

The requirements concerning the value of the front-to-front dimension shall conform to paragraph 6.2.1.6 of this standard, or the maintenance plan when they are based on experience.

6.4.2 Diameter difference between wheels on the same axle

The maximum allowable differences between diameters of wheels on the same axle are given in Table 8.

Table 8 — Diameter difference between wheels on the same axle

V (km/h)	$V \leq 200$	$200 < V$
$\lvert d_1 - d_2 \rvert$ maximum (mm)	0,5	0,3

6.4.3 Limit values of radial run-out as a function of the maximum operating speed authorized for the vehicle

The maximum allowable values of the radial run-out of wheels on the same axle, as a function of the maximum authorized speed of the vehicle, are given in Table 9.

Table 9 — Radial run-out

V (km/h)	$V \leq 120$	$120 < V$
Radial run-out (mm)	0,5	0,3

It is recommended that a maximum value of 0,2 mm run-out be adopted when the axle box is clamped, e.g. when reprofiled in a ground lathe, rather than the axle machining centre. This recommended value is derived from service experience and is more restrictive than that given in the product standard EN 13260. For the definition of radial run-out see EN 13260.

6.4.4 Wheel axial run-out as a function of the maximum operating speed authorized for the vehicle

This value shall be applied at 10 mm below the top of the rail (point D_0, see Figure 8).

The maximum allowable values of the wheel axial run-out, as a function of the maximum authorized speed of the vehicle, are given in Table 10.

Table 10 — Wheel axial run-out

V (km/h)	$V \leq 120$	$120 < V \leq 160$	$160 < V \leq 200$	$200 < V$
Wheel axial run-out	1	0,8	0,5	0,3

NOTE For the definition of axial run-out, see EN 13260.

6.4.5 Parts of the tread that are not re-profiled

Tread profiles may be machined to remove the minimum amount of metal to restore the profile. Parts of the tread that are not re-profiled (also called “witness marks”) between P1 and the outer chamfer of the rim (see Figure 9) are permissible within the limits of the tread profile. However all visible cracks, cavities and hard spots shall be machined out during reprofiling.

6.4.6 Radial marks and radial defects on the internal side of the rim

Radial marks on the inner face of the rim are allowed.

Radial defects on the inner face of the rim shall be eliminated when the wheelset is removed for maintenance.

Radial defects are not permitted:

— when their depth exceeds 0,5 mm (see Figure C.23 b)) or

— when indicated on the MT or

— when these are located in the rim-wheel transition (see Figure C.23 c)).

This kind of defect shall be eliminated by turning or localized action in accordance with the maintenance plan.

A localized increase front to front dimension (a2) or a reduction in the thickness of the rim (maximum of 1 mm) is permitted.

6.5 Maintenance operations, examinations and inspections

6.5.1 General

To promote safe operation in the wheelset, the following actions shall be carried out.

For the rectification of defects, when the acceptance criteria or corresponding values are not unique and defined in this standard, it is necessary that they are specified in the maintenance plan on the basis of service experience.

Unless otherwise specified, the detection method for all the defects shall be:

— manual;

— visual; or

— automatic, including trackside detection equipment.

The inspection methods shown are given for example purposes; other appropriate methods may be used.

Certain non-destructive tests may be carried out even in service. The method to be used for carrying out these tests shall be indicated in the maintenance plan.

6.5.2 Detection of tread defects

Detection methods may include:

- visual examination;
- acoustic detection;
- trackside detection equipment;
- measurement of circularity.

6.5.3 Detection of thermal damage on the wheel rim or tyre

The following areas of the wheel shall be checked for defects:

a) on the external face of the wheel rim;

b) on the tread;

c) on the flange tip.

Detection methods may include visual examination.

6.5.4 Detection of wheel tread roll-over

Detection methods may include:

- include visual examination;
- trackside detection equipment;
- measurement of roll-over.

6.5.5 Detection of damage to chamfered corner and flange

Detection methods may include:

- include visual examination;
- trackside detection equipment.

6.5.6 Detection of damage resulting from identification markings

If service experience shows the likelihood of this type of damage, then non-destructive testing, e.g. magnetic particle or ultrasonic tests, may be carried out.

6.5.7 Detection of defects on the external and internal face of the rim

Detection methods may include:

- include visual examination;
- NDT, e.g. UT.

6.5.8 Verification of web integrity

Verification of the web integrity shall be carried out for all the defects specified in this standard.

This verification covers the web, the web hole contours and the mechanical or thermal contact areas.

Particular attention shall be paid to the detection of defects (cracks) in the web holes or in the mechanical or thermal contact areas.

The choice of the inspection method is determined on the basis of accessibility.

Detection methods may include:

- include visual examination;

- NDT.

6.5.9 Verification of hub integrity

Verification shall be carried out on hubs (e.g. wheel, gears) if service experience indicates the need for this to ensure that this type of defect does not exist.

Detection methods may include:

- include visual examination;
- NDT.

6.5.10 Verification of rim integrity - Detection of deep sub-surface tread defects

If service experience shows a symptom of this type of damage e.g. local tread collapse, then non-destructive testing shall be carried out.

6.5.11 Detection of thermal defects on the web of a wheel used as a braking surface

Detection methods may include:

- examination with the naked eye
- NDT

The thermal defect criteria shall be defined in the maintenance plan.

6.5.12 Detection of overheating affecting the wheel rim-web transition on monobloc wheels

The overheating of the transition zone can be detected visually. Geometric conformity of affected wheelsets shall be checked in accordance with this document.

The measurement of the residual stresses can be done by NDT (for example UT).

6.5.13 Verification of axle surface integrity

6.5.13.1 General

The axle surface integrity shall be verified by non-destructive testing in compliance with the requirements specified in the maintenance plan. These requirements shall specify the practical arrangements for removal of the defects (e.g. depth, rectification method, etc.).

For freight wagon wheelsets, during Medium Wheelset Maintenance, NDT (excluding VT) shall be performed on all axle sections.

For freight wagon wheelsets, during Heavy Wheelset Maintenance, MT shall be performed on the total axle surface.

6.5.13.2 Visual inspection with the naked eye of axle surface integrity of wheelsets for freight wagons

These requirements could also be applied to other types of vehicle.

In order to visually inspect axles against corrosion and mechanical damage on their uncovered areas and treat or remove from service the ones in worst conditions, criteria shall be given for performing the inspections and for the evaluation of the defects.

The aim of these visual inspections is to detect all the defects that are not permissible in-service. Axle bodies with inadmissible forms of damage are to be repaired *in situ* according to the maintenance plan, if possible. Otherwise, the axles shall be replaced.

An axle removed from service shall be handed over to medium or heavy wheelset maintenance.

Visual inspection of the axle shall be performed each time the wagon is in a workshop (not mobile team) and if one of the following conditions is fulfilled:

- the wagon is on a pit;
- the wagon is lifted.

NOTE The requirements for these inspections are not applicable if a wheelset is replaced in order to comply with a change in gauge.

Visual inspections of the axle shall also be performed at wagon heavy maintenance.

Visual inspections can be carried out without removing the wheelsets from the wagon.

The inspection is to be applied to all the visible area of the axle body.

Normally, the area between wheel and bearing (abutment area) cannot be inspected sufficiently for wheelsets mounted under the wagon. Nevertheless, only if there is a clear visual indication of mechanical or corrosion damage, the same criteria as for visible areas of the axle should be applied.

If the condition of the abutment area is not assessable, it is permissible to leave the wheelset in service.

For these visual inspections it is not normally necessary to clean the axle. However if there is doubt over the evaluation, local cleaning of the axle should be performed to allow examination.

In the case of damage to the coating (bubbles, partial detachment, etc.) that does permit clear assessment of the surface condition beneath the coating then the coating shall be removed as necessary.

If natural light intensity is too poor, a supplementary white light source shall be used in order to obtain an adequate visibility of the axle.

An example for an adequate position for the staff conducting the visual inspection is given in the Figure 12.

Dimensions in mm

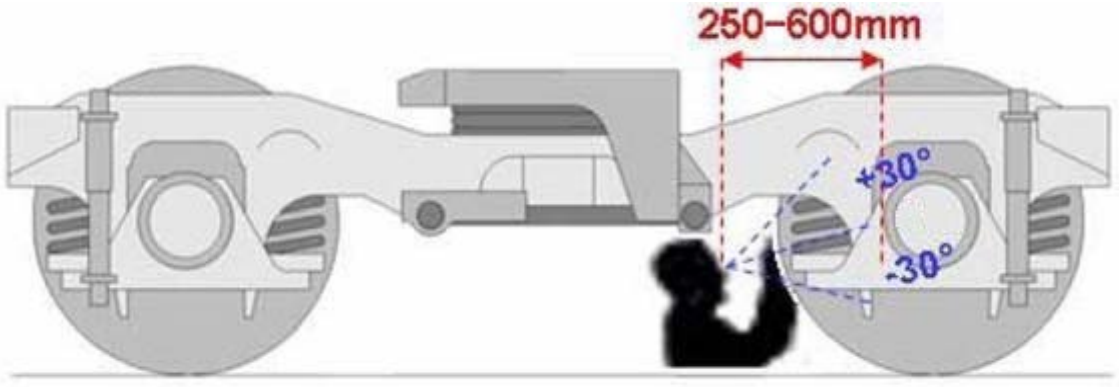


Figure 12 — Example of a recommended position of personnel performing the Visual Inspection

If the wheelset cannot be rotated (if the wagon is not lifted up), the visibility of the full surface of the axle shall be assured in a different way.

Table 11 defines the criteria and actions that shall be applied during the visual inspections.

Table 11 - Overview on damage categories and following actions

Clause of the EN and/or name of the damage	Number from the EVIC (Informative)	Damage limits	Actions to be taken after inspection (categories)
Annex C.4.3.1	31 (41 for unpainted axles)	sharp edged circumferential fluting	category A
Annex C.4.3.1	32 (42 for unpainted axles)	smooth edged circumferential groove	Depth < 1 mm: category B Depth > 1 mm: case A
Annex C.4.4	33 (43 for unpainted axles)	sharp edged notching	category A
Annex C.4.3.2	34 (44 for unpainted axles)	cracks (when visible with naked eye)	category A
Annex C.4.2	35 (45 for unpainted axles)	large and heavily corroded areas	category B
Annex C.4.2	36 (46 for unpainted axles)	single, deeply pitted corrosion scars	category B
Annex C.4.1	37 (Not applicable to unpainted axles)	coating damage with or without corrosion	category C [a]
Damage on abutment area	50 (for both painted/ unpainted axles)	(depending on the kind of damage, same action as above)	
[a] For wheelsets operated in wagons under heavy corrosive conditions, only categories A and B are permitted.			

The actions to be taken after inspection (cases A, B and C) are described below:

— Category A: Remove the wheelset from service without delay;

— Category B: Remove the wheelset from service after unloading the wagon and/or sending the wagon to its nominated workshop;

— Category C: Leave wheelset in service until the next maintenance of the wagon where it will be removed from service or repair the damage in situ on the wheelset.

6.5.14 Detection of damage caused by corrosion

Damage caused by corrosion of wheelsets can be detected visually.

6.5.15 Detection of circumferential defects around the whole circumference

These defects can be detected visually.

6.5.16 Detection of circumferential defects in a singular section of the circumference

These defects shall be detected with NDT, e.g. UT; only very large defects are evident visually.

6.5.17 Detection of notches and impact damage

The damage caused by notches and impact on the wheelset can be detected visually.

6.5.18 Detection of longitudinal defects on axles

These defects shall be detected with NDT, e.g. UT; only very large defects are evident visually.

6.5.19 Detection of damage in interference fit zones

The damage in the interference fit zones can be detected:

- visually before the assembly;
- using the press-fit diagram after the assembly if made by a press-fit operation;
- with NDT.

6.5.20 Verification after rectification

After the authorized operations for removing the defects, it shall be demonstrated that no defects remain that do not conform to the permitted limit value. When non-destructive testing is specified as being required to detect the defect, a new non-destructive test shall be performed to demonstrate compliance.

6.5.21 Verification of residual magnetism

Following MT, or assembly of parts by induction heating etc. no residual magnetism shall remain. If necessary, a demagnetization process shall be used.

6.5.22 Lubrication operation

There are different types of lubrication operations that involve the various systems and components and shall be specified in the maintenance plan:

a) Lubrication during medium and heavy maintenance. The type of lubricant, its quantity and distribution shall meet the requirements given in the drawing or on a specific document during approval of the bearing. Distribution shall be adjusted on the basis of service experience.

b) Lubricant top-ups in service. The quantity and frequency shall be specified and may be adjusted on the basis of service experience;

c) Verification of lubricant loss or leakage. The wheel web shall be examined for signs of lubricant losses or leakages. A distinction shall be made between authorised and non-authorised grease losses and leaks (see Annex C 5.2).

NOTE EN 15427 applies for the operation of the flange lubricators.

6.5.23 Checking for axle box defects

The maintenance plan shall define the axlebox characteristics to be verified, as described in Annex C.5.

These requirements shall be defined on the basis of service experience.

6.5.24 Verification of wheelset electrical resistance after heavy maintenance of wheelsets

The electrical resistance shall be verified. A qualified statistical test method may be used on a representative sample for monobloc wheels.

6.6 Requirements for additional maintenance equipment and operations

The following requirements shall be met:

a) the electrical resistance check shall be carried out in accordance with the requirements of Standard EN 13260, paragraph 3.2.3;

b) the MT shall be carried out according to the requirements of EN ISO 9934-1, EN ISO 9934-2 and EN ISO 9934-3;

NOTE A standard relating to NDT in railway applications is in the process of being developed and will be the reference for NDT carried out on wheelsets after its publication;

c) The maximum temperature of the bearings for their fitting shall be determined taking into account the stabilization temperature of the bearing inner ring as well as indications in the maintenance plan.

d) for assembly of the axle box, preheating of the axle box is not permitted.

7 In-service wheelset maintenance

7.1 Maintenance plan

The maintenance plan shall include:

a) the periodicity of and criteria for dimensional checks;

b) the periodicity of and criteria for non-destructive tests;

c) the periodicity and criteria for the mandatory in-service maintenance operations;

d) any periodicity and criteria and specifics for equipment not subject to Directive 2008/57/EC.

7.2 Wheelset protection during vehicle and bogie cleaning

Specific requirements shall be defined in the maintenance plan to protect the transmission components, the axle box and bearings from cleaning fluid penetration during vehicle and bogie cleaning.

8 Off-vehicle wheelset maintenance

8.1 Maintenance plan

The maintenance plan shall specify:

a) qualified procedures and intervals for non-destructive tests;

b) any special procedures (e.g. demagnetization of the bearings, etc.);

c) cleaning instructions;

d) criteria for the rejection of the bearings and their protection after the overhaul;

e) approval criteria for different constituent parts (e.g. dimensions, etc.);

f) list of work to be carried out to restore the wheelset to comply with the requirements of this standard;

g) list of tests to be carried out;

h) specific values resulting from service experience.

8.2 Key operations for off-vehicle wheelset maintenance

The key operations are as follows:

a) wheelset cleaning with protection of the individual component, if required;

b) general inspection;

c) complete inspection of the wheelset components (e.g. axle, wheel, bearing, axle box, lubrication, etc.);

d) overhaul of the axle boxes (e.g. dimensions, manganese wear plate, etc.);

e) reprofiling, if required;

f) assembly of wheels, if required, according to EN 13260;

g) assembly of bearings, if required: only processes qualified by the technical expert of the owner undertaking shall be used;

h) protection against corrosion;

i) final check for conformity of the wheelset to the requirements of this standard;

j) drafting of a report to ensure traceability of all the operations and including the wheel assembly press-fit force displacement diagrams (cold assembly) or mechanical resistance test confirmation following shrink fitting (hot assembly).

8.3 Off-vehicle wheelset cleaning

The maintenance plan shall specify the requirements associated with the cleaning of wheelsets and their components.

The following cleaning procedures can be used:

a) high-pressure water jet;

b) brushing;

c) mechanical scouring (e.g. plastic shot blasting, etc.) provided it does not change the fatigue limit characteristics of the components (e.g. axle, etc.) and does not risk concealing any cracks by deforming the component surfaces.

Any other cleaning method shall be defined in the maintenance plan.

The axle box protection shall be specified in the maintenance plan.

8.4 NDT Interval

The NDT interval of the various elements of a wheelset shall be defined taking into consideration the design, the application type and the service experience. A general rule applicable to axles and to wheels is presented in informative Annex J.

9 Action to be taken on any wheelset after an incident in service or when not covered by the maintenance plan

9.1 Wheelset bearings subject to water ingress

Any wheelset that has been subject to water ingress shall be removed for medium wheelset maintenance.

9.2 Wheelsets having been subjected to a short circuit current (e.g. from falling overhead line equipment, etc.)

When wheelsets or vehicles show marks (e.g. holes, etc.) resulting from the passage of a short-circuit current, the wheelset shall be subject to a damage check, including the bearings

9.3 Detection by a trackside facility of a wheel circularity defect

If any wheelset defect is detected in service and its size is greater than an acceptable value based on the calibration of the trackside detection facility, the wheelset shall be inspected as soon as possible by a technical expert who, in order to make a decision, shall refer to:

a) Table 7 of this standard;

b) subclauses 6.2 and 6.4 of this standard for any reprofiling.

9.4 Wheelsets loaded over the allowed limit

Any wheelset supporting a load greater than its permissible load limit shall be the subject of an appraisal in accordance with the assessment presented below. One result of overloading can be a bent axle (Annex C.6.4)

For freight wagons, the following requirements shall be applied:

— Occasional overload: wagon in operation or before train departure, overload detected by VT or incoherencies in consignment note or on-track weighing device.

— In all detection cases, a numerical value of the load “L” should be assessed taking into account the accuracy of weighing device “a”. The percentage of overload is calculated according to the formula:

Overload % = 100 x ((L (1- a) / Wheelset design load) – 1)

Table 12 indicates the wheelset maintenance actions according to the percentage of overload.

Table 12 - Maintenance action after occasional overloading of freight wagon wheelsets

	Overload %	**Wheelset maintenance actions**
1	From 0% to 2% inclusive	• No action
2	From 2% to 10% inclusive	• This information has to be recorded as traceability data (n° 609 in Annex A Table A.6) • Perform VT on axle and wheels
3	From 10% to 20% inclusive	• Information in traceability has to be inserted (n° 609 in Annex A Table A.6) • Perform NDT on axle (not only VT) • Measurement of the geometry • Perform VT of the wheels
4	Greater than 20%	• Scrap the wheelset

9.5 Hot axle box detection

9.5.1 General

The maintenance procedure to be applied after hot box detection shall be defined in the maintenance plan. It is recommended that at least one medium wheelset maintenance be performed.

9.5.2 Technical procedure

A technical procedure after detection of a hot axle box in service shall be established.

Technical investigation and corrective action to the off-vehicle wheelsets shall only be performed by a competent body defined in the procedure.

9.6 Derailment

After a derailment, non-acceptable defects shall be identified (e.g. rail/wheel interface dimensions, flange marks, condition of axle boxes, bent axle etc.) before releasing the vehicle. The requirements of this standard shall be applied unless derogation is granted by a competent technical expert

It is recommended that the wheelset(s) should be removed for inspection of the bearings if the derailment speed is known to have exceeded 10 km/h.

Inspection and the conditions for vehicle transfer to a depot facility shall be specified in accordance with the specific procedures of the applicable infrastructure manager.

9.7 Head-on collision

After a collision, non-acceptable defects shall be identified (e.g. rail/wheel interface dimensions, flange marks, condition of axle boxes, etc.) before releasing the vehicle. The requirements of this standard shall be applied unless a derogation is granted by a competent technical expert.

It is recommended that the wheelset(s) should be removed for inspection of the bearings if the total collision speed is known to have exceeded 25 km/h.

9.8 Lubricant leakage or loss from the axle box

If there is a small leak of lubricant (for instance oil marks on the web) the wheelsets shall be examined. If there is other damage, for instance, indications of overheating or abnormal noise, the bearing shall be replaced.

9.9 Brake incident (detection of seized brake or discoloration)

For a wheelsets subjected to a seized brake incident, the actions to be undertaken are defined in 6.2.4.3.

9.10 Reporting after detection of a wheelset irregularity outside the maintenance plan

Wheelset irregularities detected outside of the scheduled maintenance plan shall be taken into consideration during the review of the maintenance plan.

10 Equipment not subject to Directive 2008/57/EC

For equipment not subject to Directive 2008/57/EC, specific limit values or requirements may be applied (e.g. for tyred wheels, etc.). These limits or requirements shall be formally established in the maintenance plan.

11 Summary table of requirements of this standard

Annex K lists the in-service wheelset limits specified in this standard and references to the sub-clauses in which the dimensions are defined. These values shall be taken into account when preparing the maintenance plan.

Annex A
(normative)

Minimum database content for freight wagon wheelset traceability

A.1 Data categories for storage time

a) Collected maintenance data of category “I” for the wheelset shall be stored as minimum until the next maintenance operation on the respective component (e. g. bearing overhaul to bearing overhaul).

b) Data of the category “II” shall be stored over the lifetime of the respective component.

c) Data of the category “III” shall be stored over the lifetime of the wheelset.

NOTE It is considered as a good practice to store all the information for 5 years after scrapping the components (wheelset, axle, wheel).

A.2 Minimum data to be collected

A.2.1 Wheelset

Data shall be collected as stated in Table A.1

Table A.1 — Data to be collected for the wheelset

No	Designation	Remark	Application		Category
			Freight wagon		
101	Wheelset serial number	Current practice involves using the axle number	x		III
102	Wheelset design type or alternative designation		x		III
103	All known keeper(s) of the vehicle(s) where the wheelset was mounted	If applicable (if the keeper of the vehicle has changed) Data has to be stored from the first known change of the keeper onwards This information will not be needed when the whole information of this database is known from the first entry in service of the wheelset	x		III
104	Certificate number and notified body from EC-declaration of conformity (TSI compliant wheelsets) Approval number and approval or certifying body (other wheelsets)	If available	x		III
105	Maximum authorized axle load	Considering the entire wheelset (axle, wheels and bearings)	x		III
106	Assembler of wheels on axle (manufacturer if first assembly)	For existing wheelsets already in service: if available For new wheelsets: mandatory	x		III
107	Date of assembly of wheels (month/ year)	For existing wheelsets already in service: if available For new wheelsets: mandatory	x		III
108	Assembler of other interference fit components (excluding bearings and sealing rings) (manufacturer if first assembly)	For existing wheelsets already in service: if available For new wheelsets: mandatory	a		III
109	Date of assembly of other interference fit components (excluding bearings and sealing rings) (month/ year)	For existing wheelsets already in service: if available For new wheelsets: mandatory	a		III
110	Date when wheelset is taken out of the fleet of the keeper(s) of the vehicle(s) (scrapped, selling, etc.)		x		III

a This parameter is not mandatory for database

A.2.2 Wheelset axle

Data shall be collected as stated in Table A.2

Table A.2 — Data to be collected for the wheelset axle

No	Designation	Remark	Application		Category
			Freight wagon		
201	Unique number of the axle in the batch following treatment		x		III
202	Wheelset axle design type or alternative designation		x		III
203	Certificate number and notified body from EC-declaration of conformity (TSI compliant axles) Approval number and approval or certifying body (other axles)	If available	x		II
204	Manufacturer	For existing wheelsets already in service: if available For new wheelsets: mandatory	x		II
205	Manufacturing date (month/year)	For existing wheelsets already in service: if available For new wheelsets: mandatory	x		II
206	Cast Number	For existing wheelsets already in service: if available For new wheelsets: mandatory	x		II
207	Grade of steel (state of heat treatment)	For existing wheelsets already in service: if available For new wheelsets: mandatory	x		II
208	Maximum permissible axle load	Considering the axle limit only	x		II
209	Manufacturing standard of the axle	For existing wheelsets already in service: if available For new wheelsets: mandatory The manufacturing standard is directly related to the manufacturing date; (UIC; EN)	x		II

A.2.3 Wheels

Data shall be collected as stated in Table A.3

Table A.3 — Data to be collected for the wheelset wheels

No	Designation	Remark	Application		Category
			Freight wagon		
301	Design type or alternative designation		x		III
302	Tyred wheels	Yes/ No	x		II
303	Rubber-cushioned wheels	Yes/ No	N/A		II
304	Assembler of rubber-cushioned wheel elements (manufacturer if first assembly)	For existing wheelsets already in service: if available For new wheelsets: mandatory	N/A		II
305	Date of assembly of rubber-cushioned wheel elements (month/ year)	For existing wheelsets already in service: if available For new wheelsets: mandatory	N/A		II
306	Certificate number and notified body from EC-declaration of conformity (TSI compliant wheels) Approval number and approval or certifying body (other wheels)	If available	x		II
307	Manufacturer	For existing wheelsets already in service: if available For new wheelsets: mandatory	x		II
308	Manufacturing date (month/ year)	For existing wheelsets already in service: if available For new wheelsets: mandatory	x		II
309	Grade of steel (state of heat treatment)	For existing wheelsets already in service: if available For new wheelsets: mandatory	x		II
310	Cast Number	For existing wheelsets already in service: if available For new wheelsets: mandatory	x		II
311	Maximum authorized wheel load	Considering the wheel only	x		II

A.2.4 Bearings

Data shall be collected as stated in Table A.4

Table A.4 — Data to be collected for the bearings

No	Designation	Remark	Application		Category
			Freight wagon		
401	Design type of axle box or alternative designation		x		II
402	Bearing roller type	Cylinder roller bearing, spherical bearing, etc.	x		II
403	Original manufacturer of the bearing	Component contains outer ring, cage and rollers	x		II
404	Organization modifying the bearing (e.g. conversion to synthetic cage)	If applicable	x		I
405	Manufacturing date of the bearing in clear or coded form	For existing wheelsets already in service: if available For new wheelsets: mandatory	x		I
406	Cage design type	Material polyamide, brass with steel rivet, steel	x		I
407	Type of lubricant		x		I
408	Lubricant batch number		x		I
409	Lubricant manufacturing date (month/year)		x		I

A.2.5 Medium and heavy wheelset maintenance

Data shall be collected as stated in Table A.5

Table A.5 — Data to be collected for medium and heavy wheelset maintenance

No	Designation	Remark	Application		Cat
			Freight wagon		
501	Date of maintenance		x		II
502	Applicable maintenance plan	Number of the document	x		II
503	Maintenance level	Code defined in the maintenance plan	x		II
504	Maintenance workshop / site		x		II
505	Last maintainer of the bearing	If different from maintenance workshop	x		I
506	Date of next planned maintenance of the wheelset		x		I

A.2.6 Vehicle in which the wheelset is mounted (not applicable for bogies with variable gauge) and in-service incidents (since applying traceability system)

Data shall be collected as stated in Table A.6

Table A.6 — Data to be collected for vehicle in which the wheelset is mounted and in-service incidents

No	Designation	Remark	Application		Cat
			Freight wagon		
601	Keeper of the vehicle		x		III
602	Vehicle number		x		III
603	Vehicle TSI/UIC letter code	(e.g.Shimmns)	x		III
604	Vehicle class	If available (e.g. 708)	x		III
605	Maximum authorized axle load	For the vehicle	x		III
606	Date of wheelset installation in the vehicle		x		III
607	Date of wheelset removal from the vehicle		x		III
608	Mileage of the wheelset since installation in the vehicle	When available (or otherwise estimated)	x		III
609	In-service incidents	Special examinations in the event of significant unusual damage (e.g. derailment, overload, short-circuit via the axle-bearing, high water, broken wheel, broken axle, wagon collision) (description of the cause, workshop, date)	x		III

A.3 Measures to be applied resulting from lack of traceability

At the first wheelset maintenance level examination corresponding to the possible entry of the wheelset in the database (with axle boxes covers removed), if one or more of the following designations for an individual wheelset is/are missing:

- manufacturer of the axle (Table A.2, No 204),
- manufacturing date (Table A.2, No 205),
- manufacturing standard (Table A.2, No 209),
- axle serial number (Table A.2, No 201),

the ECM has to decide according to experience with the corresponding axle population what measures shall be applied. As a minimum, the axle has to be subject to immediate NDT corresponding to the requirements for the medium maintenance level.

If 3 of the 4 designations are missing, the axle shall be scrapped.

If the existence of the following data for an individual wheelset cannot be proven on paper file, on electronic databases, or their identification collar (detected during the acquisition according to this Annex or on special request):

- workshop of last maintenance activity (Table A.5, No 504),
- date of last maintenance activity (Table A.5, No 501),
- type of last maintenance activity (Table A.5, No 503).

When the axle shall be subject to immediate NDT corresponding to the requirements for the medium maintenance level.

Moreover, at the first entry of the wheelset in the database it has to be decided according to experience with the operational conditions of the axle, if this wheelset has been used in accordance with its design or with enhance loading parameters.

If this is not identifiable, the axle shall be considered as having enhanced loading operated and clause 6.2.2 applies.

Annex B
(informative)

Database content for the tractability of wheelsets of vehicles in the scope of TSI “Rolling stock - Locomotive and passenger rated vehicles” (TSI Loc & Pas)

B.1 Data categories for storage time

a) Collected maintenance data of category “I” for the wheelset should be stored as minimum until the next maintenance operation on the respective component (e. g. bearing overhaul to bearing overhaul).

b) Data of the category “II” should be stored over the lifetime of the respective component.

c) Data of the category “III” should be stored over the lifetime of the wheelset.

NOTE It is considered as a good practice to store all the information for 5 years after scrapping the components (wheelset, axle, wheel).

B.2 Minimum data to be collected

B.2.1 Wheelset

Data should be collected as stated in Table B.1

Table B.1 — Data to be collected for the wheelset

No	Designation	Remark	Application		Category
				TSI Loc & Pas vehicle	
101	Wheelset serial number			x	III
102	Wheelset design type or alternative designation			x	III
103	All known keeper(s) of the vehicle(s) where the wheelset was mounted	If applicable (if the keeper of the vehicle has changed) Data has to be stored from the first known change of the keeper onwards This information will no longer be needed when the whole information of this database is known since the first entry in service of the wheelset		x	III
104	Certificate number and notified body from EC-declaration of conformity (TSI compliant wheelsets) Approval number and approval or certifying body (other wheelsets)	If available		x	III
105	Maximum authorized load	Considering the entire wheelset (axle, wheels and bearings)		x	III
106	Assembler of wheels (manufacturer if first assembly)	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	III
107	Date of assembly of wheels (month/ year)	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	III
108	Assembler of other interference fit components (excluding bearings and sealing rings) (manufacturer if first assembly)	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	III
109	Date of assembly of other interference fit components (excluding bearings and sealing rings) (month/ year)	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	III
110	Date when wheelset is taken out of the fleet of the keeper(s) of the vehicle(s) (scrapped, selling, etc.)			x	III

B.2.2 Axle

Data should be collected as stated in Table B.2

Table B.2 — Data to be collected for the axle

No	Designation	Remark	Application		Category
				TSI Loc & Pas vehicle	
201	Unique identification number of the axle in the batch following treatment			x	III
202	Axle design type or alternative designation			x	III
203	Certification number and organization notified for the CE compliance declaration (for TSI compliant wheelsets) Approval number and approval or certifying body (for other wheelsets)	If available		x	II
204	Manufacturer	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	II
205	Manufacturing date (month/year)	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	II
206	Cast number	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	II
207	Grade of steel (state of heat treatment)	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	II
208	Maximum permissible axle load	Considering the axle limit only		x	II
209	Manufacturing standard of the axle	For existing wheelsets already in service: if available For new wheelsets: mandatory The manufacturing standard is directly related to the manufacturing date; (UIC; EN)		x	II

B.2.3 Wheels

Data should be collected as stated in Table B.3.

Table B.3 — Data to be collected for a wheel

No	Designation	Remark	Application		Category
				TSI Loc & Pas vehicle	
301	Design type or alternative designation			x	III
302	Tyred wheels	Yes/ No		x	II
303	Rubber-cushioned wheels	Yes/ No		x	II
304	Assembler of rubber-cushioned wheels (manufacturer if first assembly)	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	II
305	Date of assembly of rubber-cushioned wheels (month/ year)	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	II
306	Certificate number and notified body from EC-declaration of conformity (TSI compliant wheels) Approval number and approval or certifying body (other wheels)	If available		x	II
307	Manufacturer	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	II
308	Manufacturing date (month/ year)	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	II
309	Grade of steel (state of heat treatment)	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	II
310	Cast number	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	II
311	Maximum authorized axle load	Considering the wheel only		No	II

B.2.4 Bearings

Data should be collected as stated in Table B.4.

Table B.4 — Data to be collected for the wheelset bearings

No	Designation	Remark	Application		Category
				TSI Loc & Pas vehicle	
401	Design type of axle box or alternative designation			No	II
402	Bearing roller type	Cylinder roller bearing, spherical bearing, etc.		x	II
403	Original manufacturer of the bearing	Ring, cage and rollers		x	II
404	Organization modifying the bearing (e.g. conversion to synthetic cage)	If applicable		x	I
405	Manufacturing date of the bearing in clear or coded form	For existing wheelsets already in service: if available For new wheelsets: mandatory		x	I
406	Cage design type	Polyamide, brass with steel rivet, steel		x	I
407	Type of lubricant			x	I
408	Lubricant batch number			x	I
409	Lubricant manufacturing date (month/year)			x	I

B.2.5 Medium and heavy wheelset maintenance

Data should be collected as stated in Table B.5.

Table B.5 — Data to be collected for medium and heavy wheelset maintenance

No	Designation	Remark	Application		Category
				TSI Loc & Pas vehicle	
501	Date of maintenance			x	II
502	Applicable maintenance plan	Number of the document		x	II
503	Maintenance level	Code defined in the maintenance plan		x	II
504	Maintenance workshop / site			x	II
505	Last maintainer of the bearing	If different from maintenance workshop		x	I
506	Date of next planned maintenance of the wheelset			x	I

B.2.6 Vehicle in which the wheelset is mounted (not applicable for bogies with variable gauge) and in-service incidents (since applying traceability system)

Data should be collected as stated in Table B.6.

Table B.6 — Data to be collected for vehicle in which the wheelset is mounted and in-service incidents

No	Designation	Remark	Application		Category
				TSI Loc & Pas vehicle	
601	Keeper of the vehicle			x	III
602	Vehicle number			x	III
603	Vehicle TSI/UIC letter code	e.g. Shimmns		N/A	III
604	Vehicle class	If available (e.g. 708)		N/A	III
605	Maximum authorized axle load	For the vehicle		N/A	III
606	Date of wheelset installation in the vehicle			x	III
607	Date of wheelset removal from the vehicle			x	III
608	Mileage of the wheelset since installation in the vehicle	When available (or otherwise estimated)		x	III
609	In-service incidents	Special examinations in the event of significant unusual damage (e.g. derailment, overload, short-circuit via the axle-bearing, high water, broken wheel, broken axle, wagon collision) (description of the cause, workshop, date)		x	III

B.3 Measures to be applied resulting from lack of traceability

At the first wheelset maintenance level examination corresponding to the possible entry of the wheelset in the database (with axle boxes covers removed), if one or more of the following designations for an individual wheelset is/are missing:

- manufacturer of the axle (Table B.2, No 204);
- manufacturing date (Table B.2, No 205);
- manufacturing standard (Table B.2, No 209);
- axle serial number (Table B.2, No 201),

it has to be decided according to experience with the corresponding axle population what measures have to be applied. As a minimum, the axle should be subject to immediate NDT corresponding to the requirements for the medium maintenance level.

If 3 of the 4 designations are missing, the axle should be scrapped.

If the existence of the following data for an individual wheelset cannot be proven on paper file, on electronic databases, or their identification collar (detected during the acquisition according to this Annex or on special request):

- workshop of last maintenance activity (Table B.5, No 504),
- date of last maintenance activity (Table B.5, No 501),
- type of last maintenance activity (Table B.5, No 503),

then the axle should be subject to immediate NDT corresponding to the requirements for the medium maintenance level.

Annex C
(normative)

Definition and illustration of defects

C.1 General

The description of defects is detailed in various documents and the illustrations in this annex are representative examples.

NOTE For the defects identified in this standard, further description is given in ERRI B 169 DT 405 and RSSB RGS GM/GN2497.

C.2 Defects for all types of wheel

C.2.1 Wheel flat

The tread is flattened and one or more oval zones are visible. The transition at the edge of the flat can be sharp (recently formed wheel flat) or it may be rounded (old wheel flat). Wheel flats can occur in isolation or there may be a number of them around the circumference of the wheel. Where such flats are observed, corresponding damage would be expected to be found on the other wheel of the wheelset. Sometimes just one of the wheels exhibits flats (e.g. dragging brake at one position) (see Figures C.1 and C.2).

Figure C.1 — Wheel flat

Figure C.2 — Multiple wheel flat

C.2.2 Metal build-up

The tread exhibits accumulations of material in the form of a build-up of welded metal originating either from the brake blocks or from the rail. Metal build-up can occur in isolation or it can be distributed (often at regular intervals) around the circumference of the tread. These build-ups indicate excessive thermal stressing of the wheels (see Figure C.3).

Figure C.3 — Metal build-up

C.2.3 Shelling, cavities

Particles of material become separated from the tread as a result of material fatigue or excessive stresses. Individual defects can develop and form deeper shelling or cavities. Shelling generally occurs in the central part of the tread, at a single point or around the whole circumference. Cavities can develop from shelling and in areas of other damage such as wheel flats or local tread collapse (see Figure C.4).

Figure C.4 — Shelling − cavity

C.2.4 Scaling

This defect usually occurs over the whole circumference of the wheel, in the wheel-rail contact area, and is characterized by chevron or C-shaped fissures. When it progresses, it can lead to welded metal shells which can then become detached from the rolling surface. These exfoliated shells are sometimes welded and

superposed on each other and can form clusters on the brake blocks. In the final stage, the damage caused by exfoliation is similar to that of shelling (see Figure C.5).

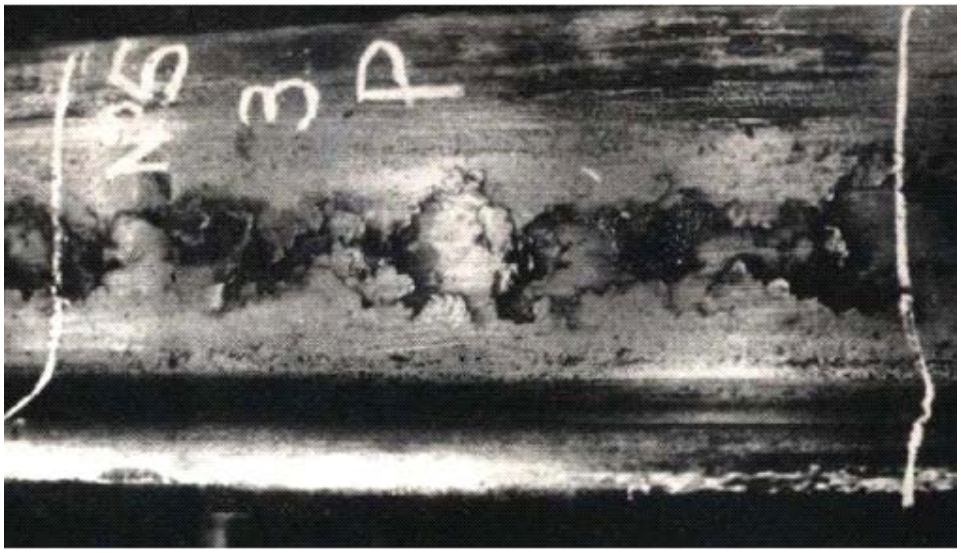


Figure C.5 — Scaling

C.2.5 Tread indentation

These indentations on the wheel tread can be straight or irregular in form. These can occur in isolation, but they also often appear around the whole circumference of the wheel (see Figure C.6).

a) Spherical indentation **b) Straight indentation**

Figure C.6 —Tread indentation

C.2.6 Isolated transverse cracking

The tread exhibits cracks at an angle of approximately 90° to the circumference of the wheel. Transverse cracks generally develop at the surface in either straight or slightly crooked lines and can penetrate radially (usually of thermal origin in these cases) or branch out in a circumferential direction (usually of mechanical origin in this case). They occur individually and can be distributed at several points around the circumference (see Figure C.7).

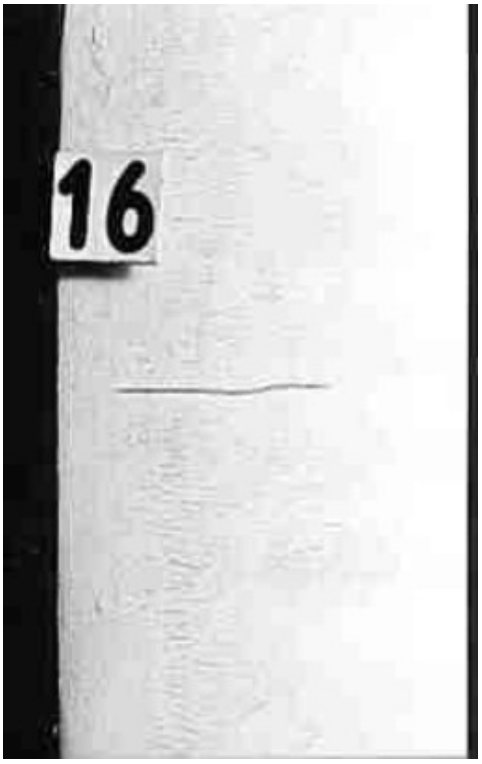
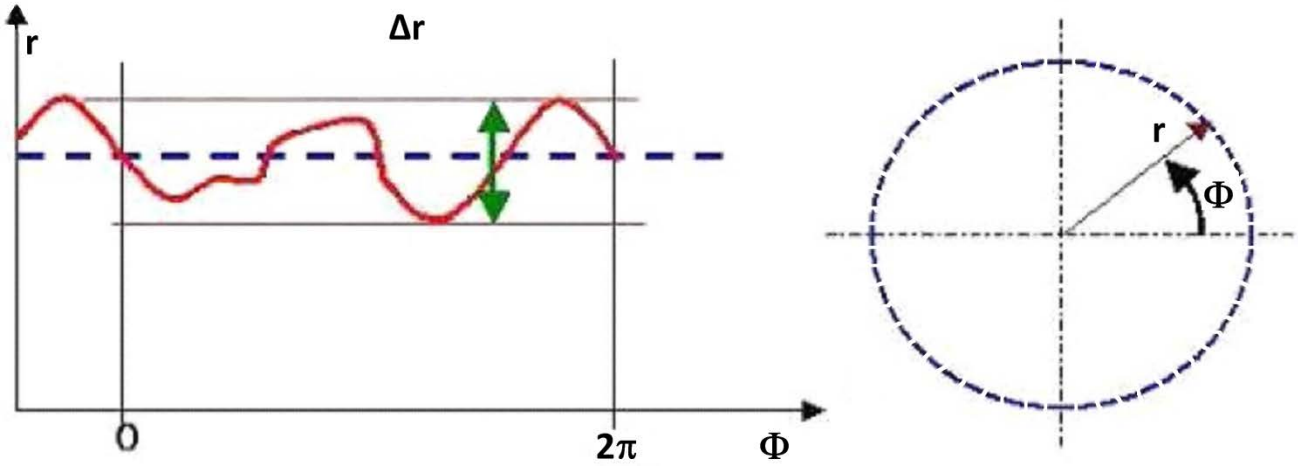


Figure C.7 — Transverse crack revealed by magnetic particle testing

C.2.7 Circularity defect

C.2.7.1 General

The circularity defect includes all in-service permanent changes to the shape of the tread contact zone of the wheel (e.g. multiple circularity defects (polygonisation) with one or more defects around the circumference of the wheel, local tread collapse, etc.). The reference plane is taken on the running circle and includes point D_0, as shown in Figure 8. The general circularity defect is shown in Figure C.8.



Key

Circularity variation at the wheel tread surface
Theoretical circle at wheel tread surface
Definition of circularity defects, Δr

Figure C.8 — General circularity defect

C.2.7.2 Local tread collapse

The tread is rolled over the outer rim surface. This damage is located in a small area of the rim and not around the whole circumference. Local tread collapse can originate from the presence of roundness defects or indicate deep subsurface rolling contact fatigue or local material deficiencies (see Figure C.9).

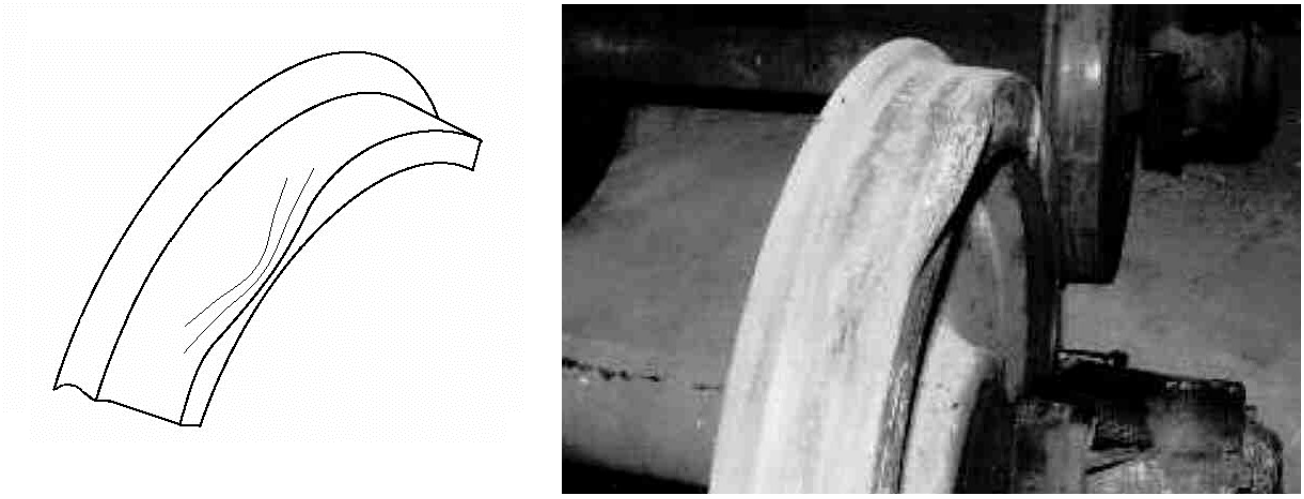
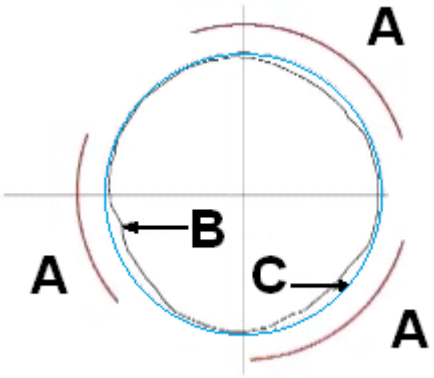


Figure C.9 — Local tread collapse

C.2.7.3 Periodic or stochastic out-of-round

Periodic out of round tends to be a circularity defect in a regular shape, as an eccentric circumference or with a higher order periodicity, that results in oval, triangular or multi-angular shapes (polygonisation) (see Figure C.10).

Stochastic out of round occurs when the pattern cannot be determined or is random.



Key

A designates the circularity defect zone
B designates the actual tread shape
C designates the reference wheel tread

Figure C.10 — Polygonisation

C.2.8 Spalling (thermal effects due to tread braking)

Spalling is the term used to describe a pattern of fine superficial thermal cracks resulting from thermal input possibly combined with tangential ratcheting effects at the wheel/rail interface; these develop on the tread in the wheel/brake block contact zone. They can form a multidirectional mosaic (see Figure C.11.a). Wheels that use brake blocks that result in a higher temperature on the tread can also present a pattern as shown in Figure C.11.b.

a) Mosaic **b) Regularly spaced radial pattern**

Figure C.11 — Spalling

C.2.9 Rolling contact fatigue

These are created due to the repeated fatigue loading in the plane of the tread as it rolls both along tangent track and steers around curves. Initially the damage appears as a network of fine cracks similar in appearance to the thermal effects of tread braking. However, rolling contact fatigue (RCF) cracks tend to be positioned at

an angle across the tread (Figure C.12 a). As the cracks propagate, surface defects are generated as shown in Figure C.12 b.

a) Initial stage of RCF **b) Advanced stage of RCF**

Figure C.12 — Rolling contact fatigue

C.2.10 Thermal cracks

Thermal cracks as shown in Figure C.13 are linear axial defects located:

a) at the interface between the brake block and the wheel, including the external face of the wheel rim (or of the tyre) in the case of flanging brake blocks (Figure C.14 a);

b) at the flange tip in the case of brake blocks that contact both the flange and the tread (Figure C.14 b).

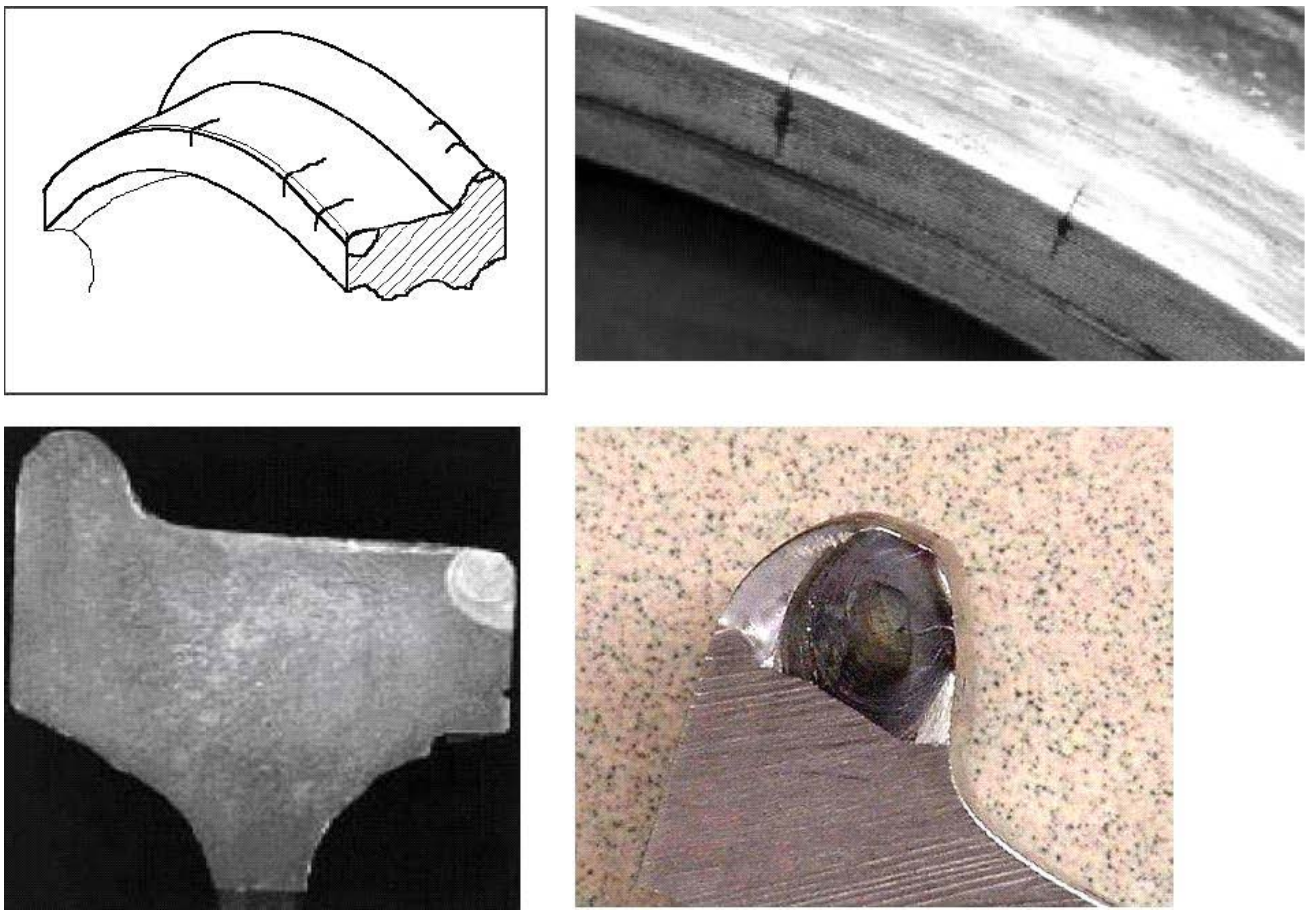
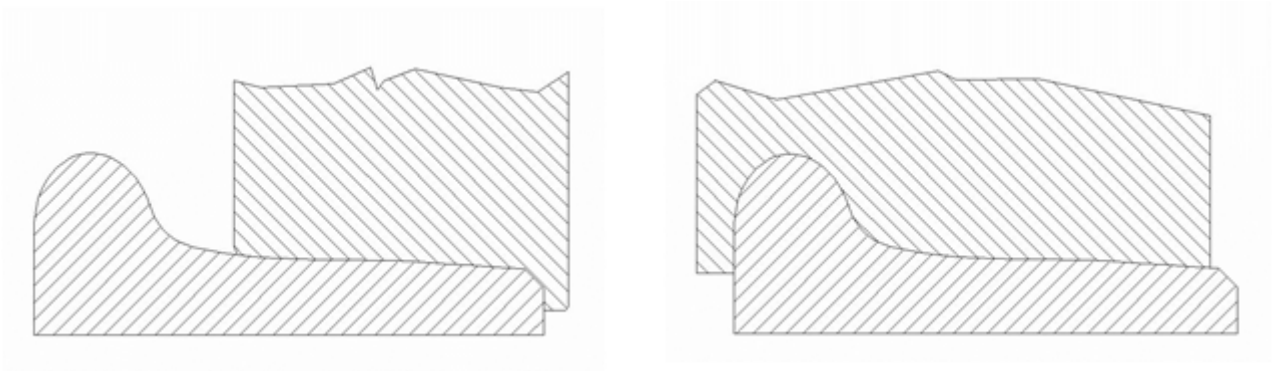


Figure C.13 — Thermal cracks



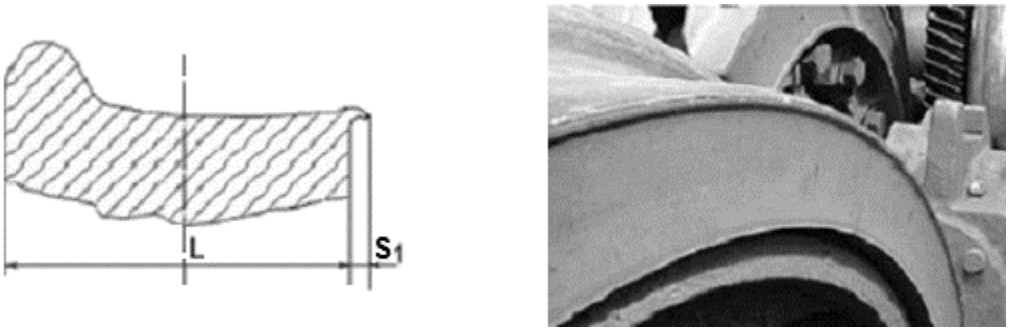
a) — Flanging brake blocks

b) — Brake blocks that contact both the flange and the tread

Figure C.14 — Brake blocks

C.2.11 Wheel tread roll-over

Wheel tread roll-over, of dimension S_1, is a continuous defect around the wheel tread corner circumference. It is shown in Figure C.15.



Key

L rim width

S_1 dimension of wheel tread roll-over

Figure C.15 — Wheel tread roll-over

C.2.12 Damage to chamfered corner

The rim or the tyre exhibits signs of circumferential wear (spalling/ridges) on the outer face next to the chamfered corner and sometimes cracks running in the circumferential direction or a loss of material (see Figure C.16).

Figure C.16 — Damage to the chamfered corner

C.2.13 Wheel tread – grooves and channels (or smooth edged circumferential grooves and sharp edged circumferential fluting)

Grooves and channels occur over the whole circumference of the wheel and may affect the whole width of the tread (see Figures C.17 and C.18).

Grooves are rounded in form and have no sharp edges. They occur over part of the width of the tread and are generally no more than 40 to 50 mm wide.

Channels are characterized by sharp edges.

Metal can build up in successive layers on the contact surface of the brake block. Grooves and channels can occur with all types of brake block materials, although they are more common in conjunction with composite and sintered materials.

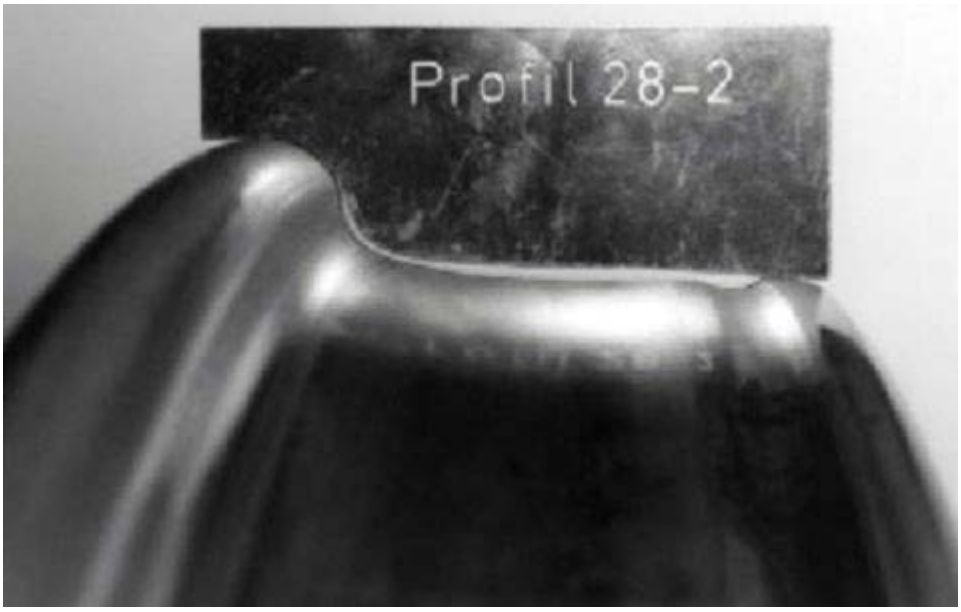


Figure C.17 — Grooves on the tread

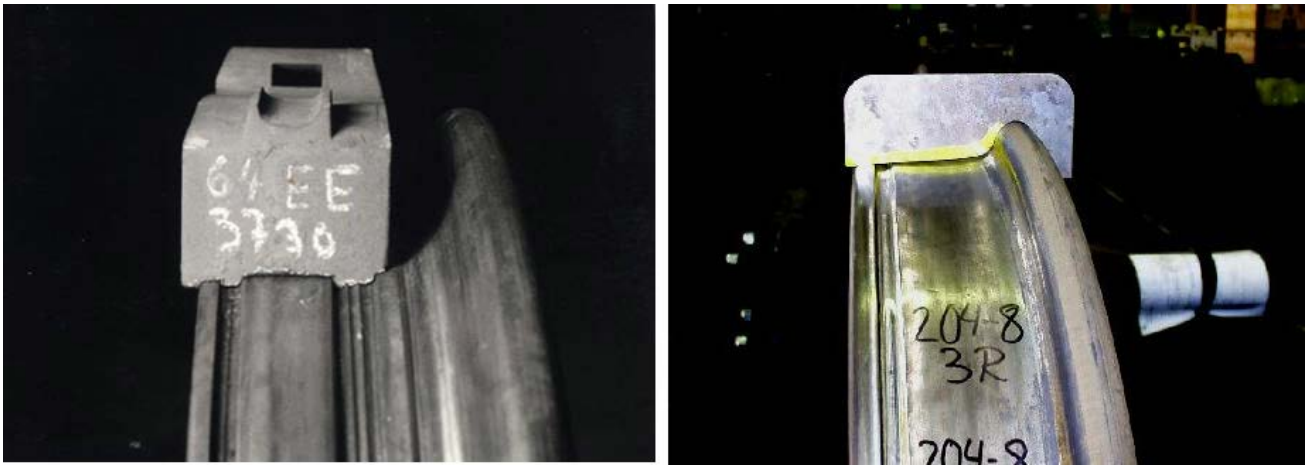


Figure C.18 — Channels on the tread

C.2.14 False flange

False flange is formed when the rim-face side of the tread is raised above the nominal tread running band. A false flange can be formed when significant tread wear is concentrated at the running band (see Figure C.19 and Figure C.20).

Dimensions in mm

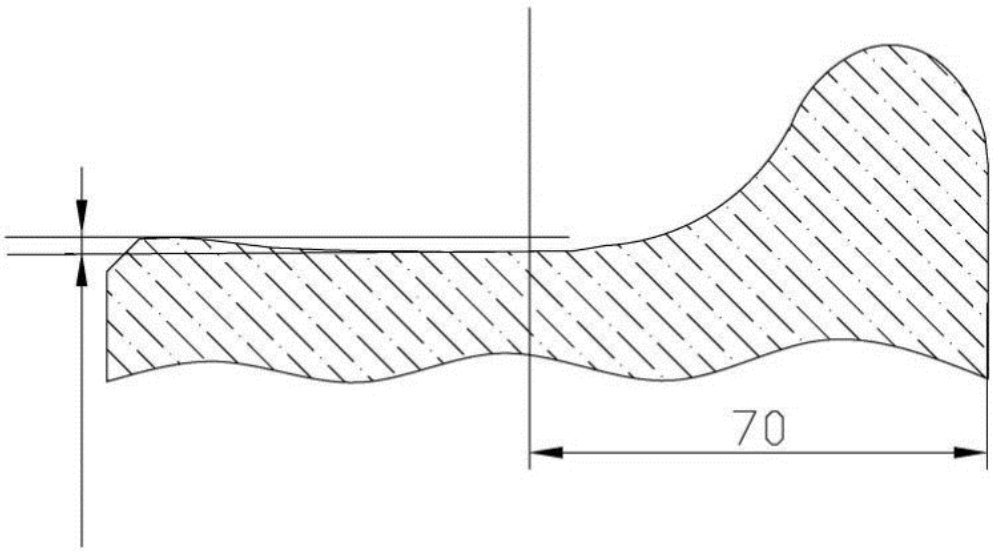


Figure C.19 — Definition of false flange

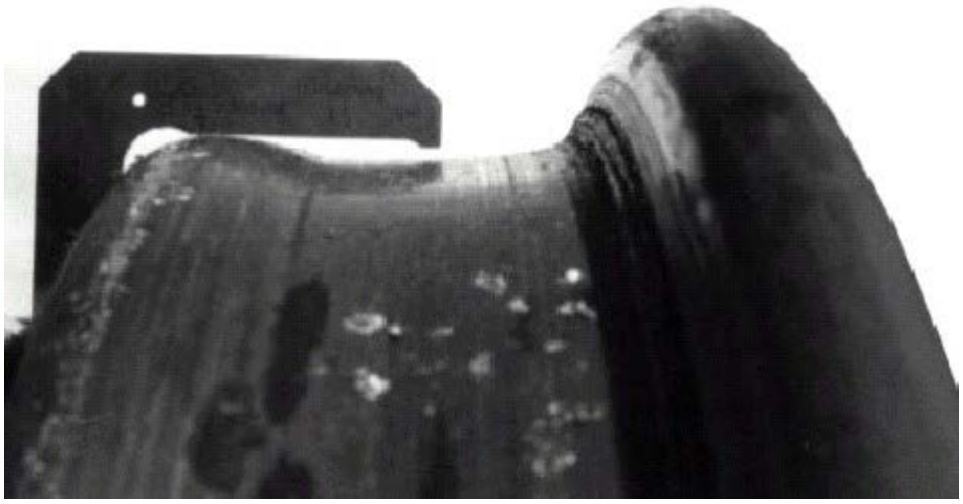


Figure C.20 — Picture of false flange

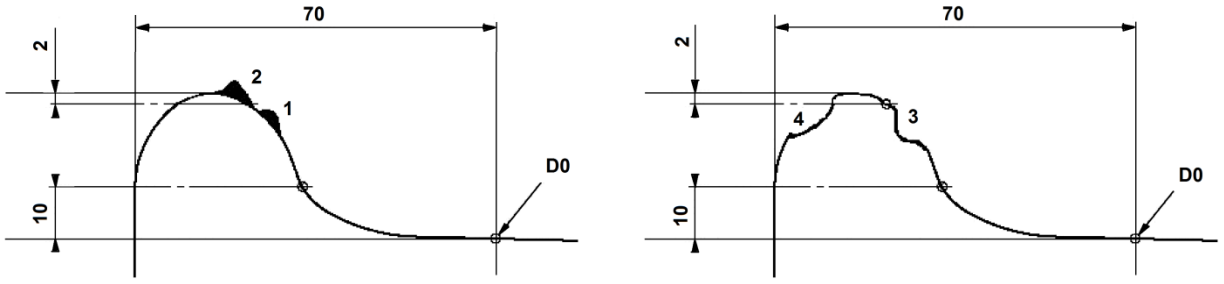
C.2.15 Damage on the flange

Gouges or other damage may be present on the flange tip. This damage is generally caused by the flange tip contacting a solid obstruction, or running derailed, and may be singular or circumferential (see Figure C.21).

Figure C.21 — Damage on the flange

Defects of this type, continuous or not, are shown in Figure C.22.

Dimensions in mm



Key

1, 2 defect after metal flow

3, 4 material loss

Figure C.22 — Metal flow or material loss from flange

C.2.16 Sharp-edged radial marks and radial defects on the internal face of the rim (FIJ)

These incipient marks can be either isolated or repeated all the way around the circumference of the wheel.

Radial marks are characterized by a bright metallic aspect and small imprints on the internal face of the rim (see Figure C.23 a)).

Radial defects (see Figures C.23 b) and C.23 c) are characterized by:

— a depth > 0,5 mm or

— the presence of sharp edges (for example indicated on the MT).

a) Radial marks on the internal side of the rim

b) Radial defects on the internal side of the rim

c) Radial defects in the rim/wheel plate transition

Figure C.23 – Radial marks and defects on the internal face of the wheel

C.2.17 Damage resulting from identification markings

Cracks can originate from notches made on the inside and outside faces of the wheel for the purposes of marking and run across the rim or tyre in a transverse direction (see Figure C.24).

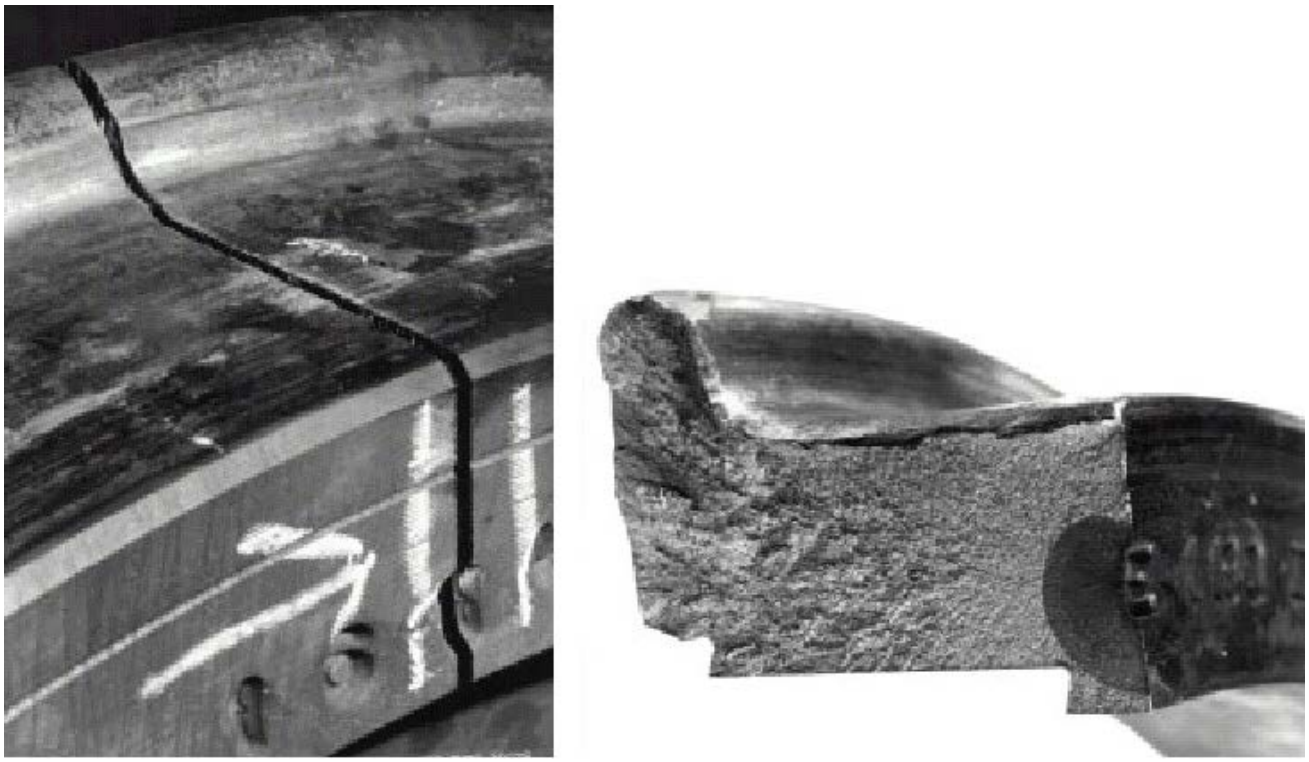
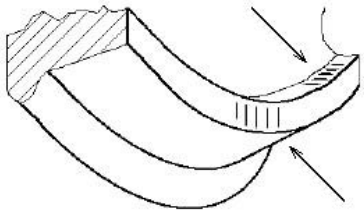


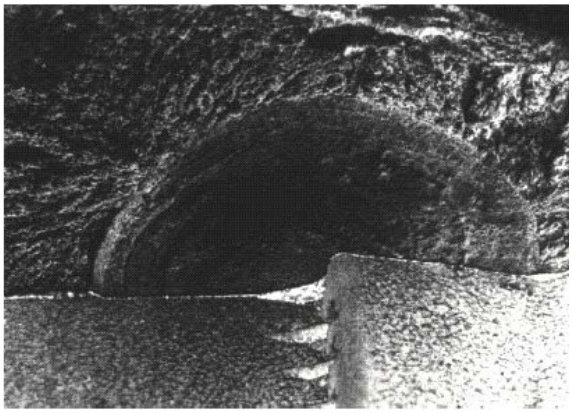
Figure C.24 — Damage resulting from markings

C.2.18 Damage from lathe driving tools

Wheelset reprofiling lathes have chucks with sharp-angled jaws and these can leave marks on the lower surface of the rim. Such notch marks may constitute crack-initiation areas (see Figure C.25).



a) Damage from lathe driving tools

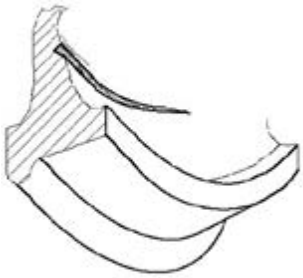


b) Evolution of a fatigue crack initiated from a lathe driving tool mark

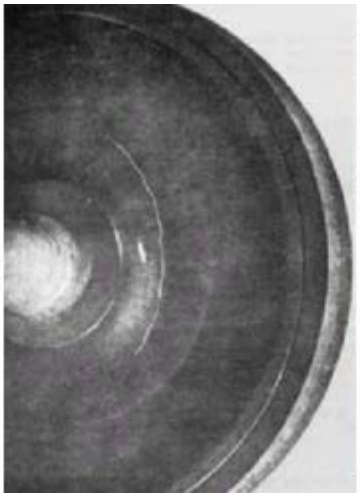
Figure C.25 — Damage from lathe driving tools

C.2.19 Sharp-edged circumferential defects on the web or wheel centre

These cracks run in the direction of the wheel circumference (see Figure C.26, from a to c).



a) — Pictorial representation



b) — Circumferential cracking near the hub

c) — Circumferential cracking below the rim

Figure C.26 — Sharp-edged circumferential defects

C.2.20 Sharp-edged radial defect on the web

These defects lie at an angle of 45° to 90° to the circumference of the wheel (see Figure C.27).

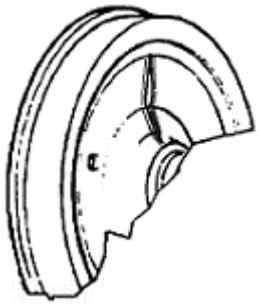


Figure C.27 — Sharp-edged radial defect

C.2.21 Wheel web hole defects

These are radial and/or tangential cracks starting from drilled holes in the wheel centre (see Figure C.28).

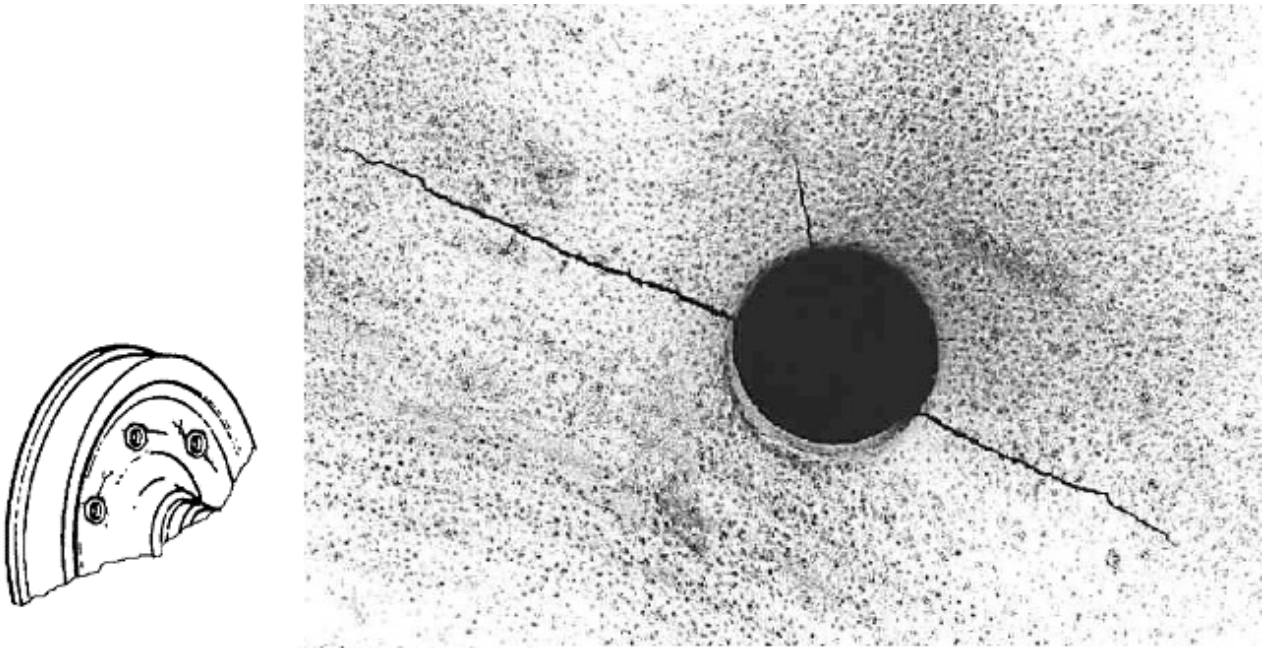


Figure C.28 — Wheel web hole defects

C.2.22 Cracks in the wheel hub

These cracks generally extend radially from the bore hole in the hub (see Figure C.29). Some can also run in the circumferential direction.

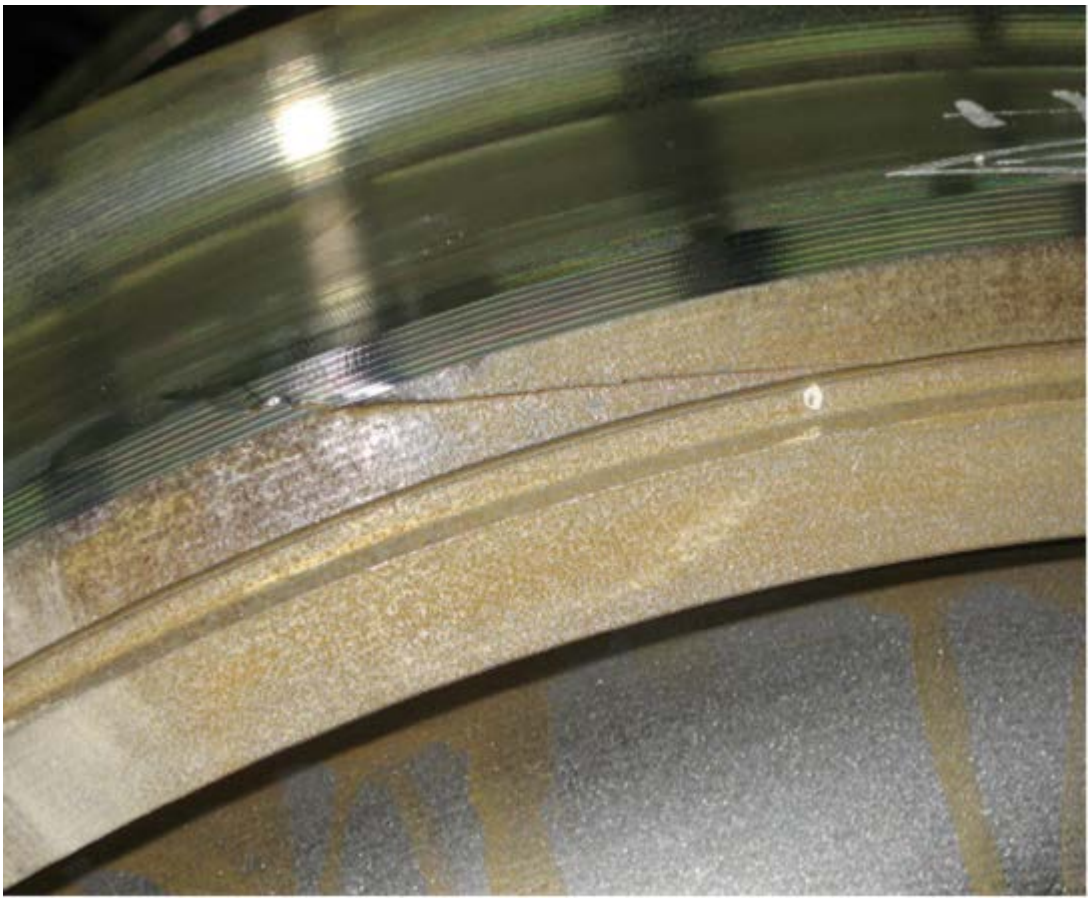
Figure C.29 — Cracks in the hub

C.3 Defects specific to wheel types

C.3.1 Deep sub-surface tread defect on monobloc wheels

This type of defect is shown in Figure C.30. Its progression in the rim is parallel to the tread. A defect developing beneath the tread can also be seen on the internal or external faces of the rim (see Figure C.30 b).

a) A defect beneath the tread following the loss of a part of the tread



b) A defect developing beneath the tread

Figure C.30 — Deep sub-surface tread defect

C.3.2 Wheel web defects on monobloc wheels

C.3.2.1 Defects on the web of a wheel used as braking surface

Cracks can develop on both sides of wheel centres that are used as braking surfaces (e.g. wagons used for “rolling road” traffic). Fine latticework cracks may develop on the braking surfaces, including pronounced individual cracks generally running in a radial direction (see Figure C.31).

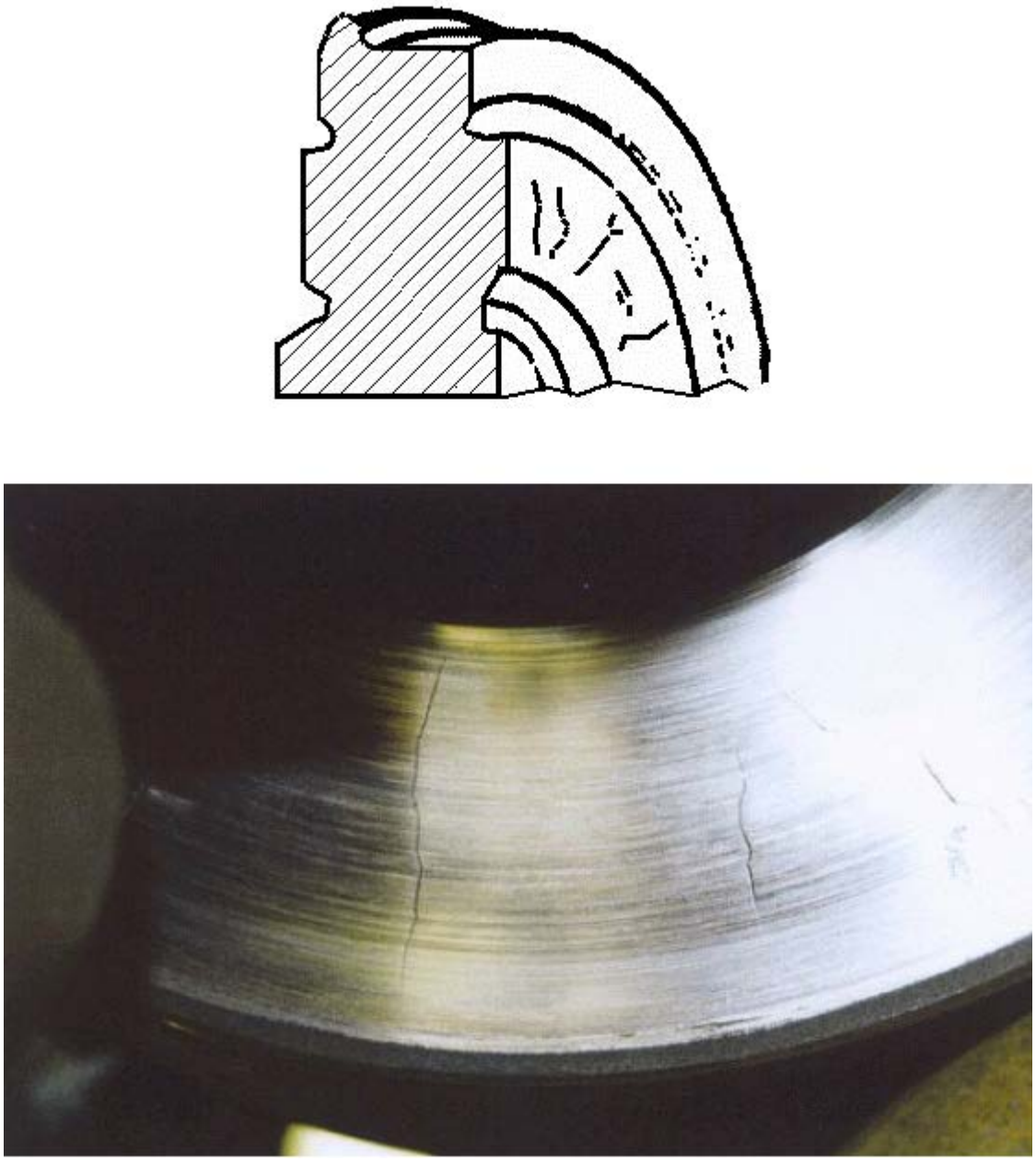


Figure C.31 — Example of defects on the web of a wheel used as a braking surface

C.3.2.2 Overheating affecting the wheel rim/web transition

This type of defect occurs only in tread-braked wheels. When appropriate coatings are used, the paint becomes clearly burnt in the rib/web transition radius when the temperature exceeds approximately 300 °C. The paint in this area then becomes cracked and peeling. The brake blocks are often melted to some extent. Build-up of metal and characteristic colouring can be seen on the tread. The rim may also become a bluish colour.

If the problem is not detected immediately the rim/web transition can gradually assume a rusty appearance with shades between greyish-brown and brown covering the whole circumference.

The circular zone involved is shown in Figure C.32.

Figure C.32 — Overheating of the rim/web transition zone

C.3.3 Exceptional thermomechanical stressing in tyred wheels

This type of defect occurs only in tread-braked wheelsets. The tyre may have become twisted. The brake blocks are often partially melted. Build-up of metal and characteristic colouring can be visible on the wheel tread (see Figure C.33).

Figure C.33 — Overheating of the tyre

C.4 Axle defects

C.4.1 Axle protection defect – Damage on the painting/coating

Minor lack of anti-corrosion coating may occur on painted axles; in the affected areas, oxidation on the surface of the axle may or may not occur, depending on the period of exposure of the area and environmental conditions (see Figure C.34).

Figure C.34 — Damages of painting/coating

C.4.2 Corrosion

Damage from corrosion in the form of rust pitting may be found on the axle surface. This may be only partial (i.e. in the form of single, deeply pitted corrosion scars) and/or can affect large areas, with loss of parent material (corrosion craters) and strong surface deviation. Examples of corrosion are given Figure C.35.

Figure C.35 — Corrosion

C.4.3 Circumferential defects

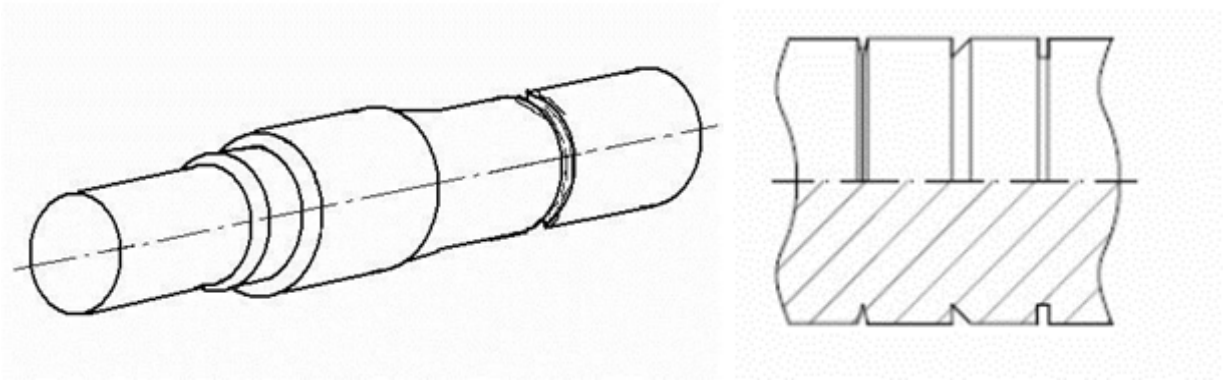
C.4.3.1 Around the whole circumference

Grooves and channels occur around the whole circumference of the axle and may affect its whole width. Grooves and channels that have occurred in service are visible on account of damaged paintwork and the shiny steel or rusty surface that is revealed beneath.

Grooves are rounded in form and exhibit no sharp edges. They occur over part of the width of the axle and are generally no more than 40 to 50 mm wide.

Channels are characterized by sharp edges.

These types of defect are shown in Figure C.36.



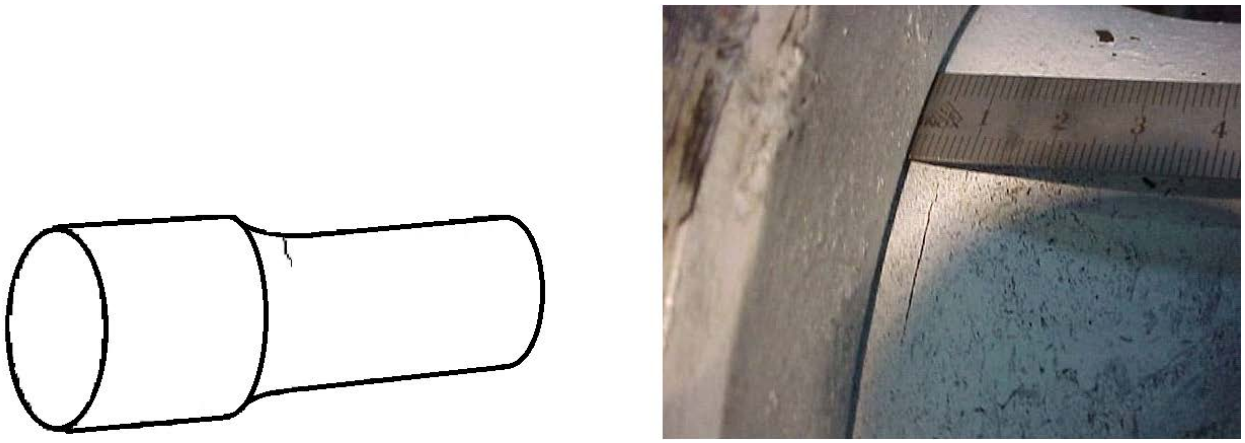
a) — Circumferential scoring/grooving Pictorial representation

b) — Channel; Sharp edged circumferential damage Pictorial representation

Figure C.36 — Circumferential defects

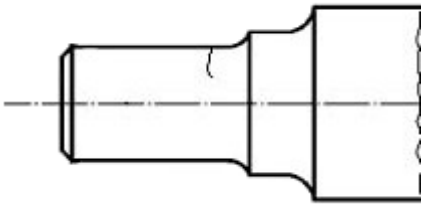
C.4.3.2 Circumferential defects on a singular zone

Circumferential defects on a singular zone develop at right-angles to the longitudinal centreline of the axle (see Figure C.37 a to c).



a) — In the shaft

b) — In the seat

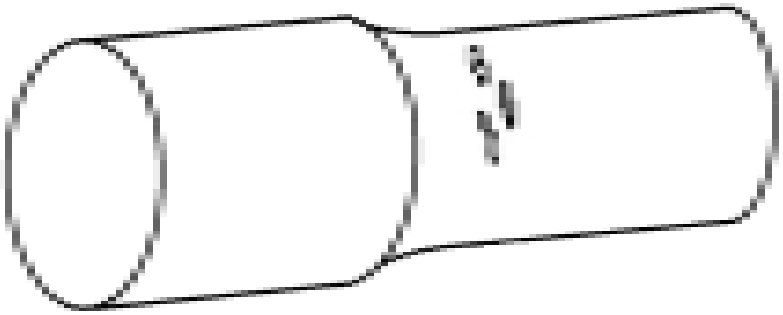


c) — In the journal

Figure C.37 — Circumferential defect on a singular zone

C.4.4 Notches and impact damage

Notches are sharp edged irregular cavities on the axle body, generally occurring in isolation (see Figure C.38).



a) Notches (sharp-edged)
Pictorial representation

b) Photographs

Figure C.38 — Notches and impact damage

C.4.5 Longitudinal defects

Longitudinal cracks generally develop in a lengthwise direction along the axle. Sometimes they may branch out at their ends in a transverse direction.

Longitudinal defects are shown in Figure C.39. They may look like cracks.

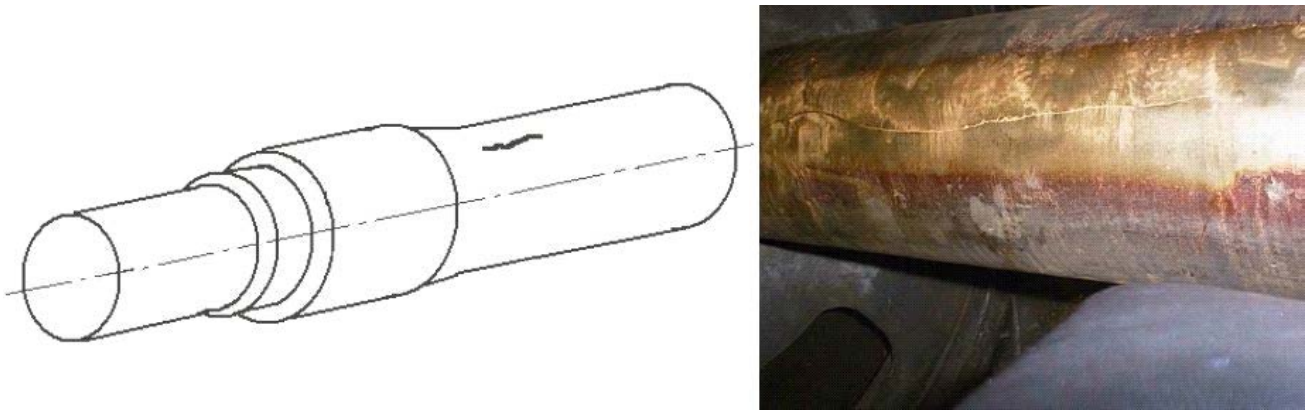


Figure C.39 — Longitudinal defect

C.4.6 Damage in the interference fit zones

Separation or displacement of material may appear as longitudinal striations on the wheel seats (see Figure C.40). In addition, some surface stripping can lead to localized joins between the parts involved. Such damage may occur when wheels, hubs, transmission components or brake discs are being fitted or removed.

Such damage is no longer visible once the component is in position, and can only be seen when it is removed. Examination of the recorded press-fit data can sometimes reveal the presence of a defect.

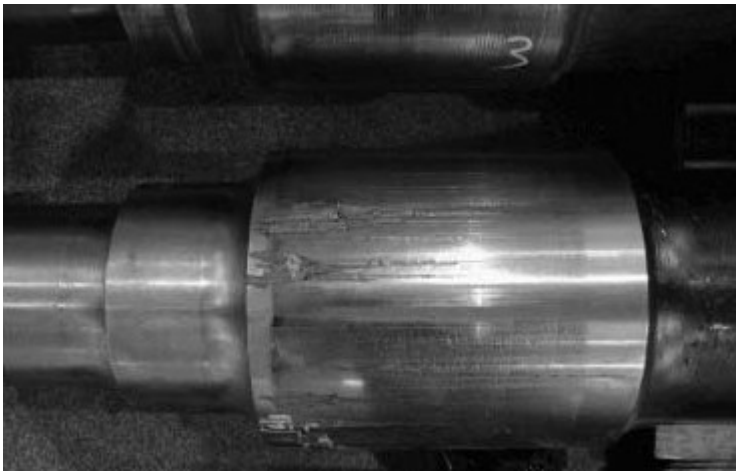


Figure C.40 — Damage in the interference fit zones

C.5 Axle box defects

The main axle box defects concern:

— the axle box body (cracking or failure);

— thermal damage to the axle box;

— damage at the weld seams of the manganese wear plates;

— the state of the bearing housing bore;

— out-of-roundness of the bore of the wheelset bearing housing;

— damage allowing water or dust to penetrate;

— missing or loose locking pieces;

— missing or loose locking and mounting bolts;

— excessive wear of the bearing housing;

— axial and radial clearance depending on the axle box type;

— internal damage (for example due to running noise);

— disconnected, missing or damaged constituent elements or cables;

— disconnected, missing or damaged wheelset guidance elements;

— traces of lost grease/oil projected regularly over the entire circumference of the central portion of the wheel (see Figure C.41).

Figure C.41 — Traces of lost grease/oil projected onto the wheel plate

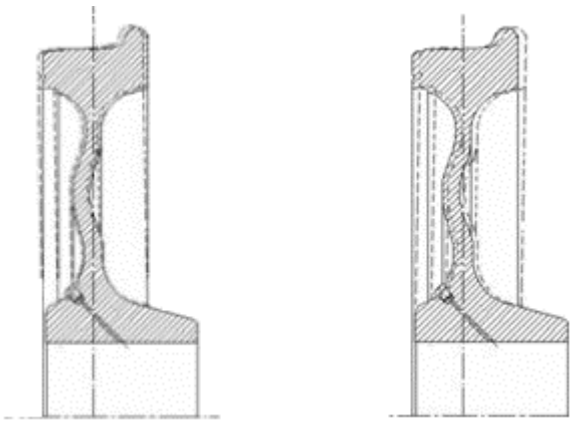
C.6 Wheelset defects

C.6.1 General

The main wheelset defects result from displacement of components relative to their bearing surface (e.g. wheel distortion/loosening, etc.). In addition, defects exist on transmission gear or braking equipment.

C.6.2 Wheel distortion

The defect results from a wheel rim axial movement relative to the wheel hub. The distortion can be on the external part of the wheelset as shown in Figure C.42 a) or its internal part shown in Figure C.42 b).



a) External distortion **b) Internal distortion**

Figure C.42 — Wheel distortion

C.6.3 In service axial or angular movement of a wheel or of one of the other components

C.6.3.1 Axial movement

Axial displacement is the axial movement of a part relative to its bearing surface. This type of defect is shown in Figure C.43 that illustrates the example of a wheel.

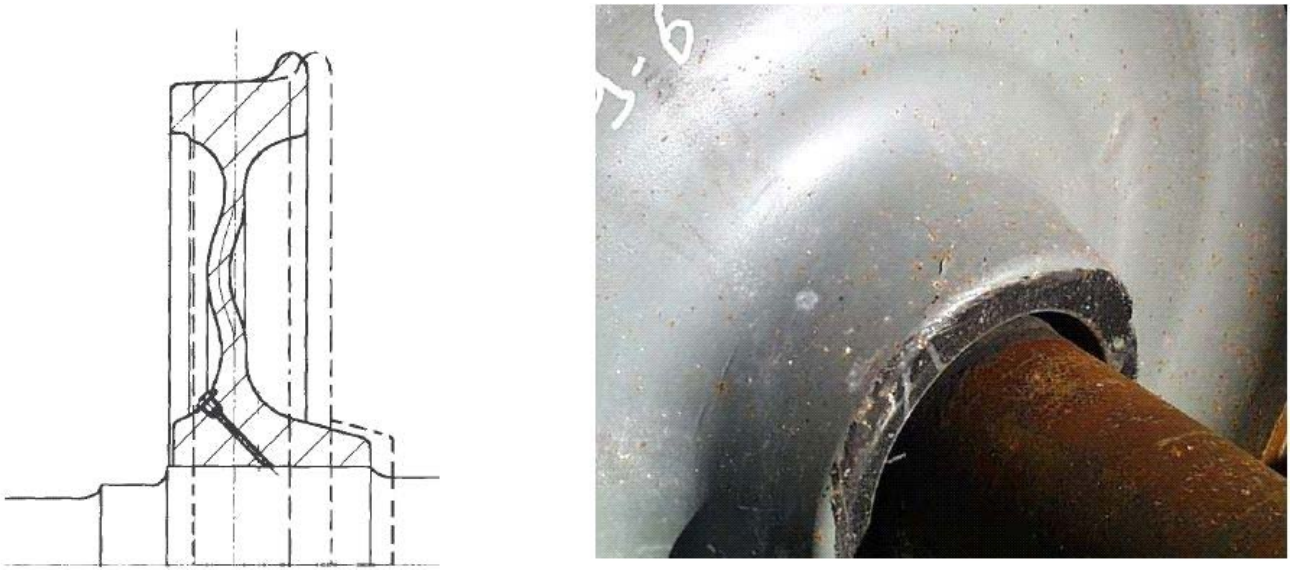


Figure C.43 — Axial movement

C.6.3.2 Angular movement

Rotational displacement results from a rotation of a component relative to its bearing surface. This type of defect is shown in Figure C.44 that illustrates the example of a wheel.

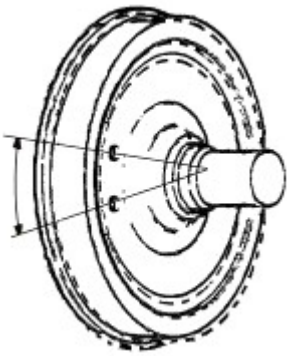
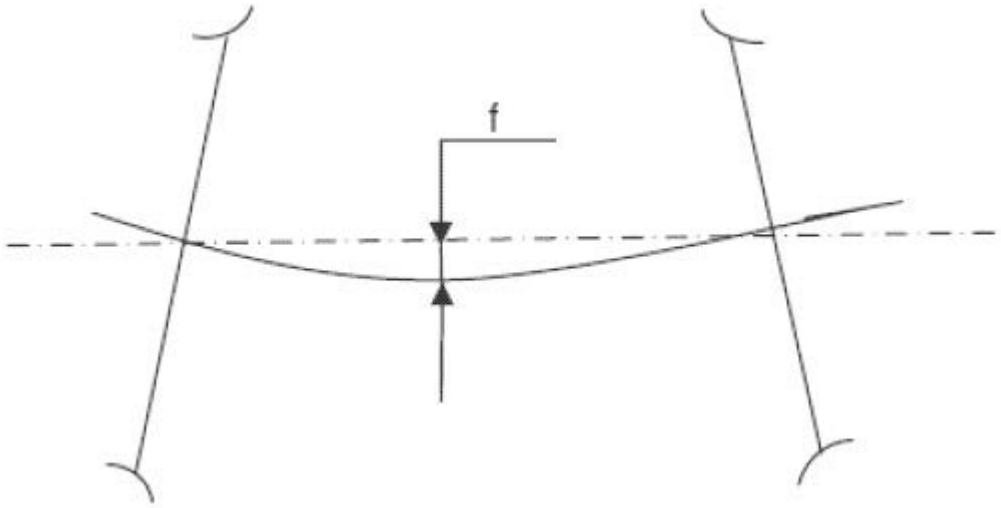


Figure C.44 — Angular movement

C.6.4 Bent axle

The deformation of an axle is indicated by its non-linearity as shown in Figure C.45, with the sag "f" relative to the position of the original symmetrical axle.



Key

f: sag relative to the position of the original symmetrical axle.

Figure C.45 — Bent axle

Annex D
(normative)

Freight stock

The limit value for freight stock with two axles suitable for 22.5 t maximum is given in Table D.1.

Table D.1

Type of vehicle	a_2 minimum (mm)
Freight stock with two axles suitable for 22,5 t/axle maximum	1 418 mm

Annex E
(informative)

Rim size without roll-over for equipment not subject to Directive 2008/57/EC

The various specific nominal rim widths are given in Table E.1.

Table E.1

R	*L (mm)*	
1	Minimum	127
	Maximum	148

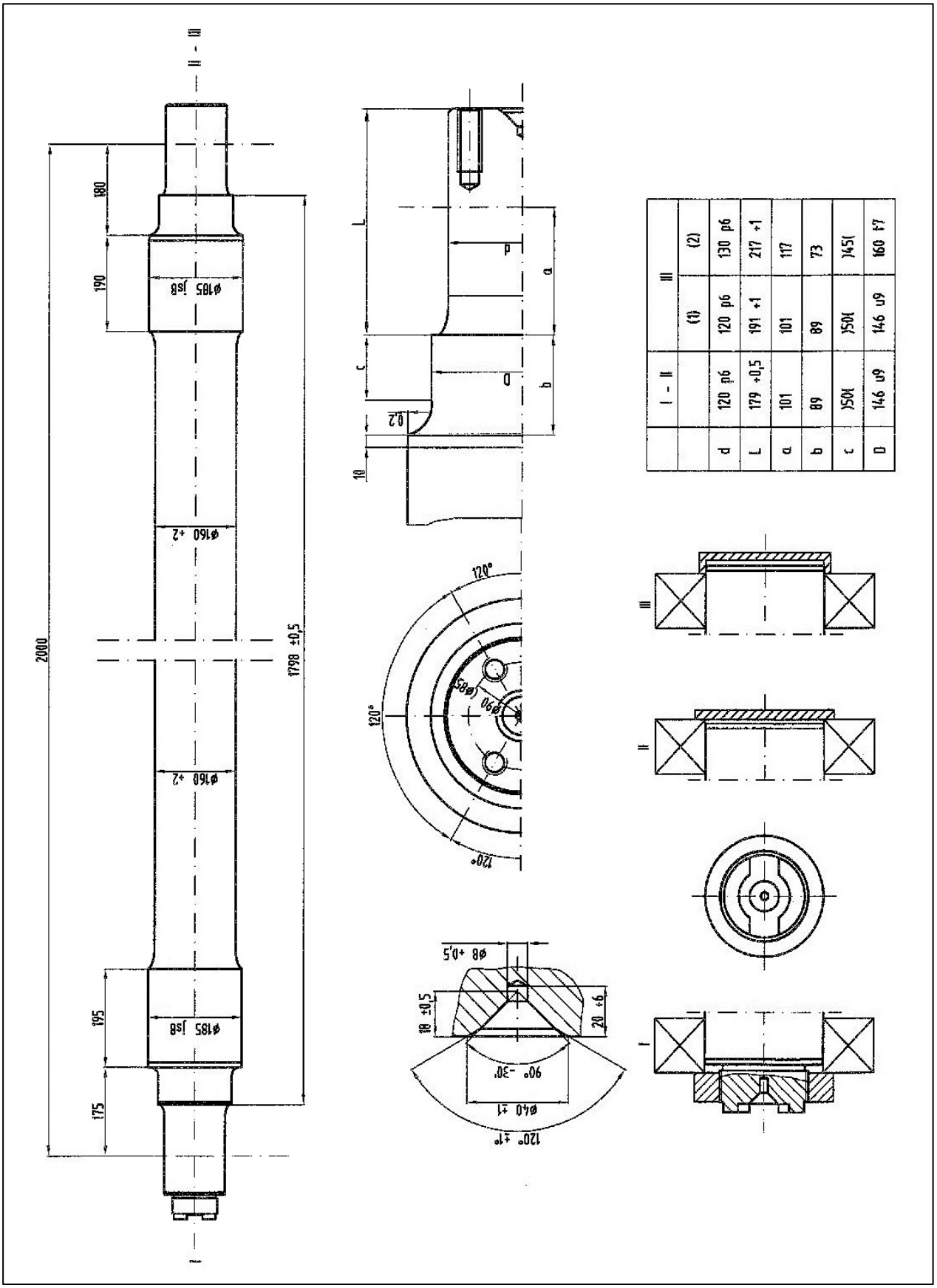
R former network
1 UK railway network
L nominal width

Annex F
(normative)

Definitions of Type A and B axles

Dimensions of type A and type B axles are defined in Figure F.1 and F.2.

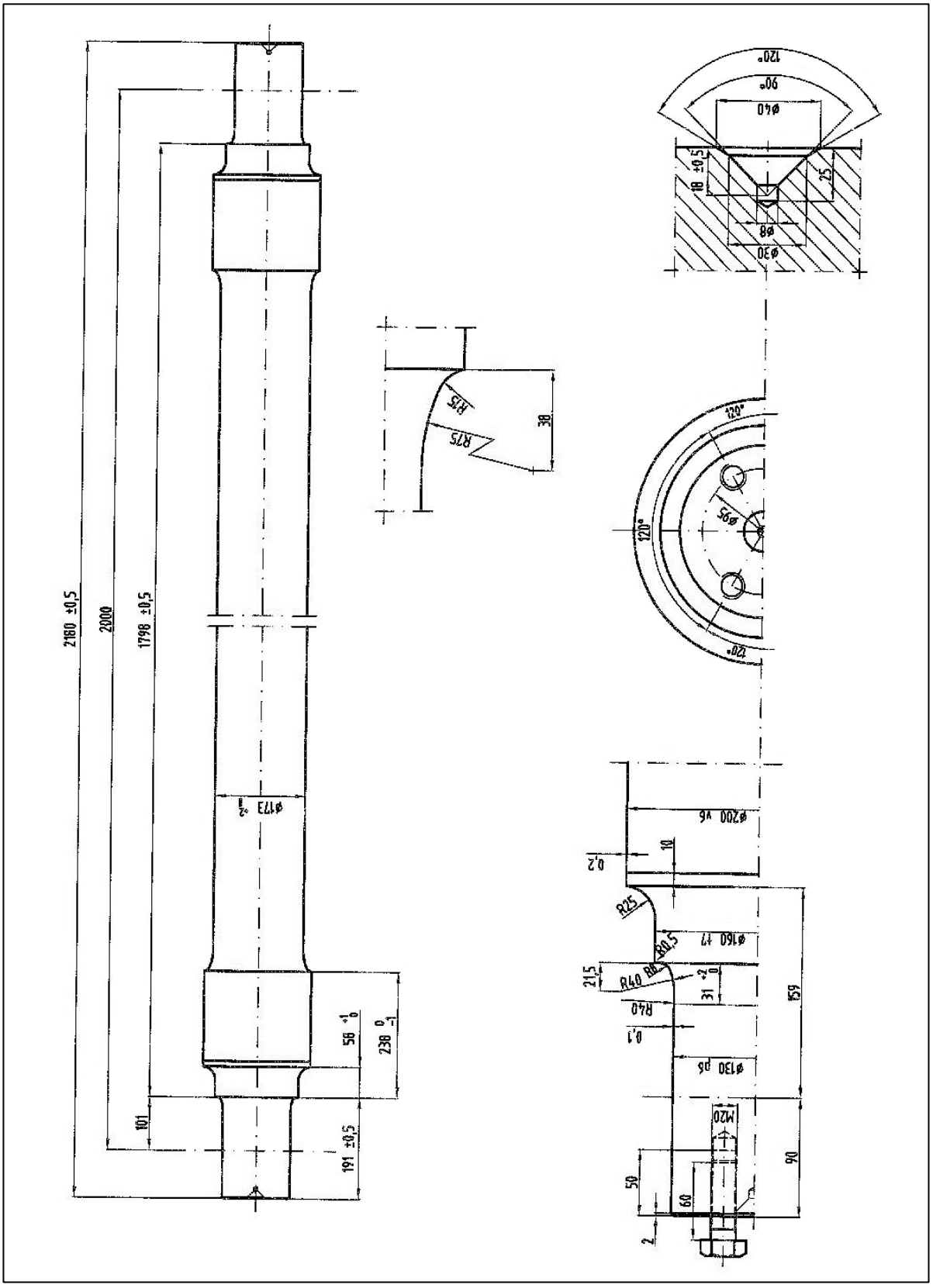
NOTE Derived from UIC Leaflet 510-1, Annex 1 and 2.



		III	
	I - II	(10)	(2)
d	120 p6	120 p6	130 p6
L	179 +0,5	191 +1	217 +1
a	101	101	117
b	89	89	73
c	1504	1504	1451
D	146 u9	146 u9	160 f7

Dimensions in mm

Figure F.1 — Type A axle



Dimensions in mm

Figure F.2 — Type B axle

Annex G
(informative)

Permissible circularity defects

Permissible circularity defects are given in Table G.1.

Table G.1 — Permissible circularity defects

Wheel diameter d (mm) Speed range v (km/h)	Permissible circularity defects (Δr) (mm)
d> 840	
• $v_{max} \leq 60$	1,5
• 60 km/h < $v_{max} \leq 160$	1,0
• 160 km/h < $v_{max} \leq 200$	0,7
• $v_{max} > 200$	0,5
380 < d ≤ 840	
• $v_{max} \leq 200$	0,7
• $v_{max} > 200$	0,5
d ≤ 380	0,3

Annex H
(informative)

Tyred wheels and resilient wheels

H.1 General

Requirements for tyred wheels are specified in the following UIC leaflets: UIC 810-1, UIC 810-2, UIC 810-3, UIC 812-1, UIC 812-4, UIC 812-5 and UIC 813.

The requirements for tyred wheels for domestic traffic in the United Kingdom are specified in the following documents: BS 5892-2, BS 5892-4, BS 5892-5 and BS 5892-6.

H.2 Marking of tyred wheels and resilient wheels

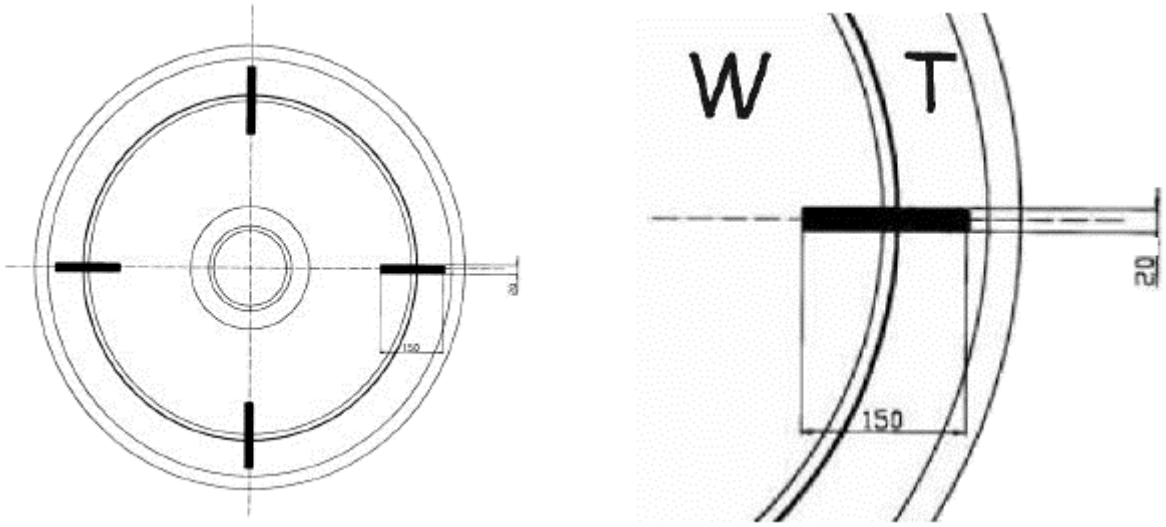
H.2.1 General

Tyred wheels and resilient wheels should be marked with white lines on the tyre and on the centre of the wheel. Their positions are shown in Figure H.1a).

For resilient wheels, specific requirements relating to markings for tyre rotation may be indicated in the maintenance plan, on the basis of service experience.

Tyred wheels should not have any wear groove.

The dimensions of the white lines are specified in Figure H.1b).



Dimensions in mm

a) Position of white lines **b) Definition of white lines**

Key

W wheel centre

T tyre

Figure H.1 — Marking of tyred wheels and resilient wheels

H.2.2 Tyre thickness of tyred wheels

The minimum tyre thickness for the type of vehicle are given in Table H.1

Table H.1 — Tyre thickness of tyred wheels

Type of vehicle	***V* (km/h)**	**Thickness *Sc*** [a] (mm)
Coaches	> 160 ≤ 160	Not permitted 35
Wagons [b]	>120 ≤ 120 ≤ 100	Not permitted 35 30 [c]
Other vehicles	As specified in the maintenance plan	

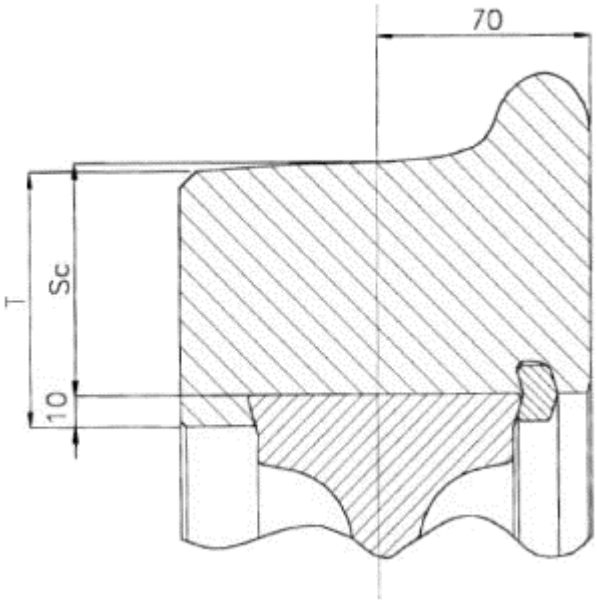
a) For definition: see Figure H.2

b) For wagons braked on the tread with vmax > 80 km/h, specific requirements may be defined in the maintenance plan

c) 120 km/h unloaded

The tyre thickness Sc is specified in Figure H.2.

Dimensions in mm



Key
Sc tyre thickness
T tyre

Figure H.2 — Definition of tyre thickness Sc

H.3 Defects specific to tyred wheels

The defects specific to tyred wheels are indicated below:

— Loose tyre. This type of defect is characterized by the tyre rotation around the wheel centre (misalignment between the white lines on the centre of the wheel and those on the tyre). It is shown in Figure H.3;

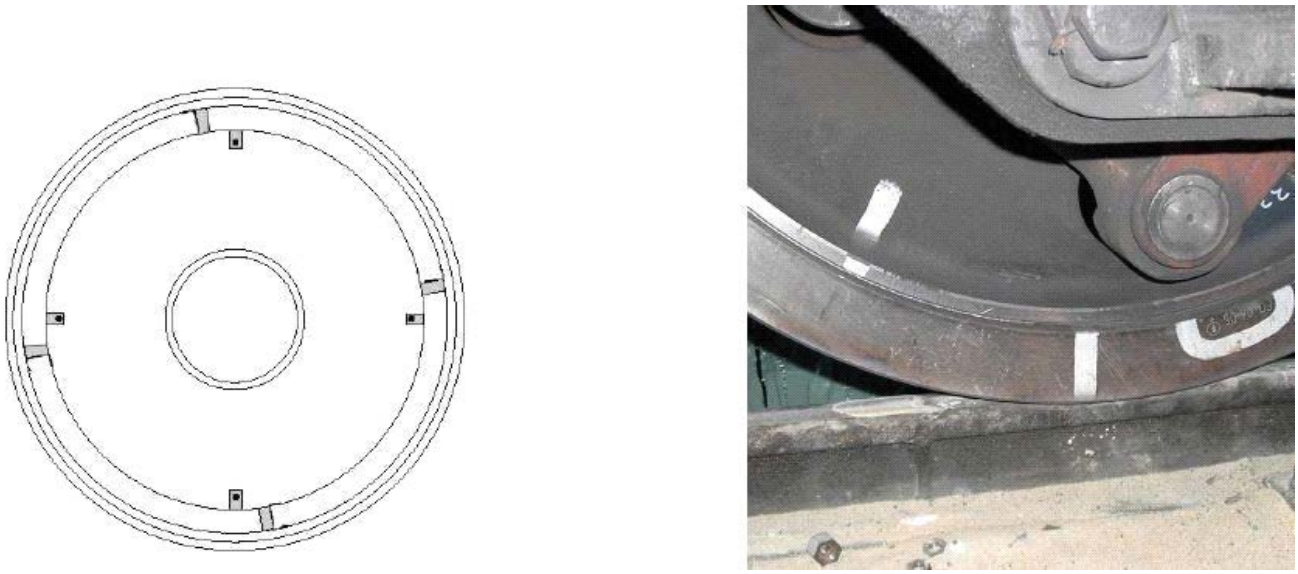


Figure H.3 — Loose tyre

— loose retaining ring. This type of defect is characterized by a ring becoming loose in its housing (possibility of loss);

— overheating of tyre;

— incorrect tyre thickness;

— tyre failure or cracking;

— wheel centre cracking;

— corrosion between tyre and wheel centre.

If a loose tyre is detected, this should result in the removal of the wheelset.

NOTE For powered wheelsets, particular prescriptions for angular displacement of the tyre may be applied in the maintenance plan, subject to service experience.

H.4 Verification of the electrical resistance during medium and heavy maintenance

The electrical resistance of wheelsets with tyred wheels and resilient wheels should be verified for each wheelset.

The maximum resistance value should be:

- 0,1 Ω for existing tyred wheels and resilient wheels, after medium maintenance;
- 0,01 Ω for new and re-tyred wheels and resilient wheels, after heavy maintenance.

Annex I
(normative)

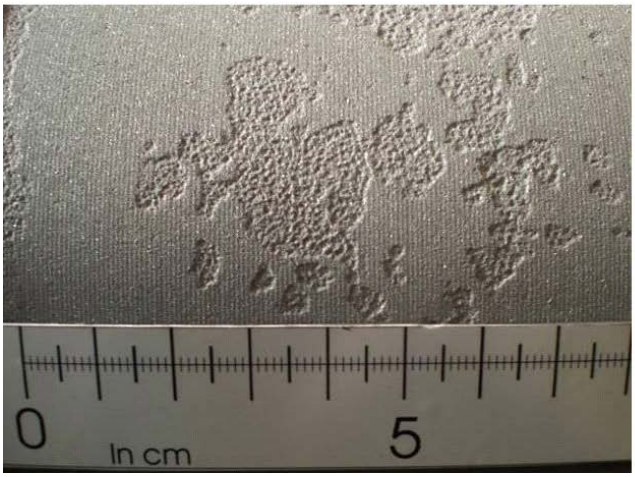
Reference images for axle surface condition limits for off vehicle wheelset maintenance

I.1 General

This Annex shows images of some typical in service corrosion damage which is to be rectified at the earliest medium maintenance operation.

I.2 Local and severe defect

Mechanical defects, corrosion pits, losses of material are present locally, repeated or spread and effective surface roughness is locally greatly increased.



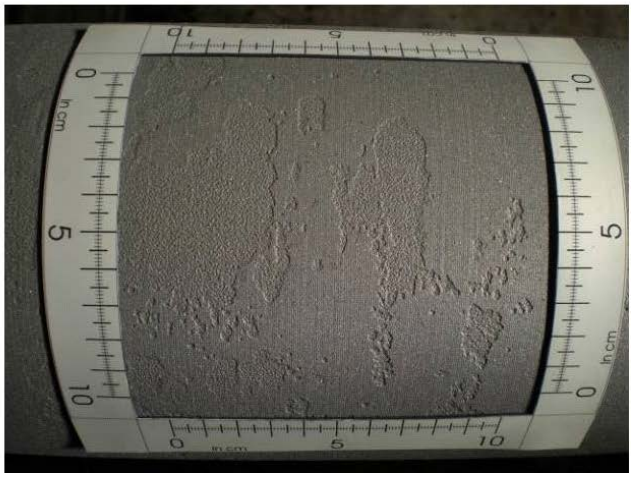


Figure I.1 — Localized and severe defects on the axle surface

I.3 Large and heavily corroded areas, strongly and uniformly pitted surface

Mechanical defects, corrosion pits, losses of material are present on large areas of the surface and effective surface roughness is greatly increased.

Figure I.2 — Large heavily corroded and uniformly pitted areas

I.4 Corrosion defects in abutment area and transition radii

Mechanical defects, corrosion pits, losses of material are present on the surface of the abutments and transitions and effective surface roughness is increased.

Figure I.3 — Corrosion defects in abutment area and transition radii

Annex J
(informative)

NDT interval

J.1 General

The general rule for axles which comply with the requirements of European standards is to perform the NDT during medium or heavy maintenance of the wheelsets. This represents the highest level of safety according to European prior art.

This rule can be adapted on the basis of service experience, and more specifically on the results of the NDT, and can lead to the time interval between two NDTs being increased or reduced.

J.2 Axle

For Type A or B axles (see Annex F) fitted to freight wagons, the following requirements are applicable:

- performing the NDT on all sections of the axle during medium maintenance;
- performing the NDT by MT on the entire surface of the axle during heavy maintenance.

J.3 Wheel

The time interval between two NDTs on the tread or the rim may be defined on the basis of the braking system (with or without friction on the tread), of the wheel type and on the basis of service experience.

Annex K
(informative)

Summary of the requirements of this standard for in-service boxed wheelsets

Table K.1 — Summary of the requirements of this standard for in-service boxed wheelsets

Elements	Dimension	Sub-clause	Diameter (mm)	Limits (mm)	
Flange	Height	6.2.1.2	d ≤ 630	31,5	
			630 < d ≤ 760	29,5	36
			760 < d	27,5	
	Thickness	6.2.1.3	d ≤ 760	27,5	
			760 < d ≤ 840	25	33
			840 < d	22	
	qR dimension	6.2.1.4		6,5	Min. values
Wheelset or tyre rim	Back-to-back	6.2.1.5	d ≤ 760	1 359	
			760 < d ≤ 840	1 358	1 363
			840 < d	1 357	
	Front-to-front	6.2.1.6	d ≤ 760	1 415	
			760 < d ≤ 840	1 412	1 426
			840 < d	1 410	
	Rim width	6.2.1.10		135 140	Tolerance: -2/+1
Wheel	Defects on the running surface	6.2.3.1 6.2.3.2 6.2.3.3		See Table 7 See text	
	Thermal cracks	6.2.3.4		Not authorized	
	Additional overthrows	6.2.3.5		≤ 5	
	Defects on the chamfer	6.2.3.6		Authorized without cracking	
	Grooves on the running surface	6.2.3.7		≤ 2	
	Channels on the running surface	6.2.3.7		Not authorized	
	False flange	6.2.3.8		≤ 2	
	Defects on the flange	6.2.3.9		See text	
	Defects on the internal face of the rim (FIJ)	6.2.3.10		Not authorized on the radial	

	Defects arising from marking	6.2.3.11		See text
	Tooling marks	6.2.3.12		No sharp edge
	Defects on the external face of the rim (FIJ)	6.2.3.13		Not authorized on the radial No brake block–FEJ friction
	Defects on the wheel plate or the hub	6.2.3.14		See text
	Overheating affecting the wheel rim-web transition	6.2.4.3		See text
Axle	Corrosion	6.2.5.1		See text
	Circular defects	6.2.5.2 6.2.5.3		Non-authorized sharp-edged groove Non-authorized crack
	Notches and impacts	6.2.5.4		No sharp edge
	Longitudinal defects	6.2.5.5		See text
	Interface fit zone	6.2.5.6		See text
Axle box	See text	6.2.6		See text
Wheelset	Axial or radial displacement of a wheel or of other components	6.2.7.1		See text
	Ohm resistance after overhaul	6.2.7.3		In accordance with EN 13260

Annex L
(informative)

Characteristics of narrow gauge wheelsets

This point will be covered in an informative annex when this standard is revised.

Annex M
(informative)

Characteristics of Spanish and Portuguese gauge wheelsets

This point will be covered in an informative annex when this standard is revised.

Annex N
(informative)

Characteristics of Finnish and Baltic Country Gauge Wheelsets

This point will be covered in an informative annex when this standard is revised.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57

This European Standard has been prepared under a mandate given to CEN by the European Commission to provide a means of conforming to the essential requirements of the New Approach Directive 2008/57/EC [1)].

Once this standard is cited in the Official Journal of the European Union (OJEU) under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 for Freight Wagons and Table ZA.2 for Locomotives and Passenger Rolling Stock, confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

1) Directive 2008/57/EC passed on 17 June 2008 is a reworking of previous Directives 96/48/EC on the “interoperability of the trans-European high-speed rail system” and 2001/16/EC on the “interoperability of the trans-European conventional rail system”, and their revision by European Parliament Council Directive 2004/50/EC dated 29 April 2004 amending Directive 96/48/EC on the “interoperability of the trans-European high-speed rail system” and Directive 2001/16/EC on the “interoperability of the trans-European conventional rail system”.

Table ZA.1 – Correspondence between this European Standard, the TSI Freight wagons and Directive 2008/57/EC

Clauses/subclauses of this European Standard	Chapters/§/subclauses and annexes of the TSI.	Corresponding text, clauses/§/annexes of Directive 2008/57/EC	Comments
The whole standard is applicable	4. Characterisation of the sub-system 4.2 Technical and functional specification of the sub-system 4.2.3 Track interaction and gauging 4.2.3.6 Running gear 4.2.3.6.2 Wheelset characteristics 4.2.3.6.3. Wheel characteristics 4.2.6.4 Axle characteristics 4.2.6.5 Axle box and running gear characteristics 4.5 Maintenance rules 4.5.1 General documentation 4.5.2 Maintenance option justification file 4.5.3 Description of the maintenance plan	Annex III, Essential Requirements 1 General requirements 1.1 Safety Articles 1.1.1, 1.1.2, 1.1.3 1.2 Reliability and availability 1.4 Environmental protection Articles 1.4.4, 1.4.5 1.5 Technical compatibility 2 Essential requirements specific to each sub-system 2.4 Rolling stock 2.4.2 Reliability and availability 2.4.3 Technical compatibility §3 2.6 Operation and traffic management 2.6.1 Safety §1 and 2 2.6.2 Reliability and availability	For track gauges other than 1,435 mm, the geometric parameter values for the axle are not given in the EN. The geometric parameter symbols for the axles are those used by axle maintenance experts and are not those used in the TSI

Table ZA.2 – Correspondence between this European Standard, the TSI Locomotives and Passenger rolling stock and Directive 2008/57/EC

Clauses/subclauses of this European Standard	Chapters/§/subclauses and annexes of the TSI.	Corresponding text, clauses/§/annexes of Directive 2008/57/EC	Comments
The whole standard is applicable.	4 Characterisation of the sub-system 4.2 Technical and functional specification of the sub-system 4.2.3 Track interaction and gauging 4.2.3.5 Bearings 4.2.3.5.2 Wheelset 4.2.3.5.2.1 Wheelset mechanical and geometric characteristics 4.2.12 Documentation for use and maintenance 4.2.12.1 General 4.2.12.2 General documentation 4.2.12.3 Documentation relating to maintenance 4.2.12.3.1 Maintenance option justification file 4.2.12.3.2 Description of the maintenance plan 4.5 Maintenance rules	Annex III, Essential Requirements 1 General requirements 1.1 Safety Articles 1.1.1, 1.1.2, 1.1.3 1.2 Reliability and availability 1.4 Environmental protection Articles 1.4.4, 1.4.5 1.5 Technical compatibility 2 Essential requirements specific to each sub-system 2.4 Rolling stock 2.4.2 Reliability and availability 2.4.3 Technical compatibility §3 2.6 Operation and traffic management 2.6.1 Safety §1 and 2 2.6.2 Reliability and availability	For track gauges other than 1 435 mm, the geometric parameter values for the axle are not given in the EN. The geometric parameter symbols for the axles are those used by axle maintenance experts and are not those used in the TSI

WARNING Other requirements and EU Directives may be applicable to products relevant to the scope of this standard.

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[2] BS 5892-4, *Specification for forged and rolled tyres*

[3] BS 5892-5, *Specification for steel bars for retaining rings for tyred wheels*

[4] BS 5892-6, *Specification for wheelsets for traction and trailing stock*

[5] EN 15427, *Railway applications — Wheel/rail friction management — Flange lubrication*

[6] EN ISO 9001, *Quality management system — Requirements (ISO 9001)*

[7] ERRI B 169 DT 405, *Catalogue of wheel /wheelset /axle defects*[2]

[8] ERRI B 169/RP6, *Standardization of wheelsets, ultrasonic method for the non-destructive determination of residual stresses in monobloc wheel rims*

[9] UIC 510-1, *Wagons — Running gear — Normalisation*

[10] UIC 510-2, *Trailing stock: wheels and wheelsets — Conditions concerning the use of wheels of various diameters*

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[12] UIC 810-2, *Technical specification for the supply of rough tyres for tractive and trailing stock — Tolerances*

[13] UIC 810-3, *Technical specification for the supply of non-alloy flat and sectional steel for tyre retention springs*

[14] UIC 812-1, *Technical specification for the supply of rolled or forged wheel centres for tyred wheels for trailing stock — Quality requirements*

[15] UIC 812-4, *Technical specification for the supply of tyred wheels for tractive and trailing stock — Type fitting and tolerances*

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[17] UIC 813, *Technical specification for the supply of wheelsets for tractive and trailing stock — Tolerances and assembly*

[18] EN 12080, *Railway applications — Axle boxes — Rolling bearings*

[19] EN 12081, *Railway applications — Axle boxes — Lubricating greases*

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[2] The UIC and ERRI leaflets can be obtained from Editions Techniques Ferroviaires (ETF): 16 rue Jean Rey, F-75015 Paris, Internet: http://www.uic.asso.fr

[21] EN 13103, *Railway applications — Wheelsets and bogies — Non-powered axles — Design method*

[22] EN 13104, *Railway applications — Wheelsets and bogies — Powered axles — Design method*

[23] EN 15085-3, *Railway applications — Welding of railway vehicles and components — Part 3: Design requirements*

[24] RSSB RGS GM/GN2497, *Guidance on railway wheelsets tread gauging and damage identification*[3]

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[4] Available on annex 10 appendix 3 of GCU January 2012 (www.gcubureau.org)

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