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English Version

Railway applications - Wheelsets and bogies - Wheelsets - Product requirements

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Bahnanwendungen - Radsätze und Drehgestelle - Radsätze - Produktanforderungen

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Contents

Page

European foreword

This document (EN 13260:2020) was prepared by the CEN/TC 256 “Railway Applications” Technical Committee, the secretariat of which is held by the DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, by March 2021 at the latest, and all conflicting national standards shall be withdrawn no later than March 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights or similar rights. CEN and/or CENELEC shall not be held responsible for identifying all or some of these patent rights.

This document supersedes EN 13260:2009+A1:2010.

This document has been prepared within the framework of a mandate given to CEN by the European Commission and the European Free Trade Association and supports the essential requirements of Directive 2016/797/EC.

For the relationship with Directive 2016/797/EC, see informative Annex ZA, which forms an integral part of this document.

For a description of the technical changes made in this new edition, see the Introduction.

The informative annexes to this document provide additional guidance that is not mandatory but that helps to understand or use the document.

NOTE The informative annexes may contain optional requirements. For example, a test method that is optional, or presented as an example, may contain requirements, but it is not necessary to meet these requirements to be in compliance with the document.

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

Introduction

After several years of use of the first editions of this document (EN 13260:2003, EN 13260:2009 and EN 13260:2009+A1:2010), this new edition includes improvements and additional data.

The product requirements have been harmonised across all three standards for wheelsets, wheels and axles.

In addition, the annexes concerning the qualification of the product and the conditions of supply of the product, which were previously informative, have been modified taking the feedback into account and have become normative.

Due to significant in-service feedback on wheelsets in accordance with European Product Design and Qualification Standards, the fatigue test for the assembly is now limited in this revision to specific assembly designs and processes.

Annex A, with the press-fitting curves, contains much more detail than the previous version.

Annex C contains information for identifying wheelset components on the basis of standard EN 15313. Also, the “freight wagon” and “locomotive and passenger vehicle” TSIs require the existence of a production verification process.

1 Scope

This document specifies the characteristics of wheelsets for all track gauges.

This document applies to heavy railway vehicles but may also apply to other vehicles such as light railway vehicles, trams or undergrounds.

This document applies to wheelsets made from elements defined by the following European Standards:

— EN 13262 for wheels;

— EN 13261 for axles.

The requirements defined in this standard apply to cylindrical wheel seats. Most of the requirements also apply to wheelsets with conical wheel seats. Specific requirements for conical wheel seats (e.g. press-fitting curves, geometric dimensions...) are defined in the technical specification.

Some characteristics are given according to category 1 or category 2.

2 Normative references

The following documents referred to in the text constitute, for all or part of their content, requirements of this document. For dated references, only the cited edition applies. For undated references, the last edition of the reference document applies (including any amendments).

EN 13103-1, *Railway applications – Wheelsets and bogies – Part 1: Design method for axles with external journals*

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

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

3 Terms and definitions

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

ISO and IEC maintain terminology databases for standardisation, which can be accessed at the following addresses:

• IEC Electropedia: available at http://www.electropedia.org/

• ISO Online browsing platform: available at http://www.iso.org/obp

3.1
Technical specification
A document describing specific parameters and/or product requirements in addition to the requirements of this document

3.2
Axle categories
Classification of the component, based on operational aspects, which determines the list of requirements to be applied

Note 1 to clause: Category 1 is generally selected when the traffic speed is greater than 200 km/h. The wheelset is then composed of wheels and a category 1 axle, according to EN 13262 for wheels and EN 13261 for axles.

Note 2 to clause: Category 2 is divided into sub-categories (2a and 2b) to specify certain characteristics:

— 2a) max. speed ≤ 120 km/h;

— 2b) 120 < max. speed ≤ 200 km/h.

Note 3 to clause: These categories can also be defined in accordance with the technical specification.

4 Product definition

4.1 Assembly of components

4.1.1 General

Before assembly, the various components of the wheelset must fulfil the geometric requirements of the specific documents that define them. In particular, the axle and wheels must be in the “ready to assemble” state defined in EN 13262 for wheels and EN 13261 for axles.

The components of the wheelset can be shrink-fitted or press-fitted to the axle.

The wheels should be fitted with an oil injection hole.

The interference fits to be used must be defined by the technical specification, depending on the characteristics of the material used for this element and the forces and moments to be transmitted through the fit. This interference must be defined according to the geometric tolerances of the wheel seats whose interference values are given in 4.1.2.

In the case of shrink-fitting, the whole wheel should be heated and its temperature should not exceed 250°C. If a different heating method is used, proof must be provided that it has had no influence on the characteristics of the wheel, as defined in EN 13262.

If another fitting method is used, it must be defined in the technical specification. It must at least demonstrate that the characteristics of the axle and wheel as defined in EN 13261 and EN 13262 are not affected by the fitting. Then the mechanical resistance of the assembly (see 4.2.1) must be demonstrated and the traceability documents for each fitting must be defined to give the same type of information as that defined in E.6.

The static imbalance of the two wheels on each wheelset must be within the same diametric plane and on the same side of the axle. The static imbalance of the brake discs must be in the same plane as the wheels but on the opposite side of the axle.

4.1.2 Interference between wheel seat and wheel hub bore

If no other requirement is given in the technical specification, the interference values "*j*" to be adhered to are, in millimetres:

— for shrink-fitting: $0.0009\ dm \leq j \leq 0.0015\ dm$;

— for press-fitting: $0.0010\ dm \leq j \leq 0.0015\ dm + 0.06$;

where *dm* is the wheel seat mean diameter in millimetres.

4.1.3 Press-fitting curve

4.1.3.1 Results to be achieved

For press-fitting, the force-displacement curve ensures that the fitting has not damaged the contact surfaces and that the specified interference is effective.

The shape of the curve to be achieved is defined in Annex A.

The final fitting force F_f is a function of the force *F* defined in 4.2.1 and must be within the range:

$$0.85\ F < F_f < 1.45\ F$$

This range applies to:

— press-fitting of one-piece wheels;

— with L_f/dm 0.8 to 1.1, where dm is the mean diameter of the wheel seat, and L_f is the fitting length (in mm);

— molybdenum-based pastes (MoS_2) and tallow.

If other lubricants are used, they must be defined in the technical specification and verified with the product qualification in accordance with Annex D, including the dismantling test in accordance with subclause 4.2.1.

4.1.3.2 Measurement method

The press used for assembling must have a calibrated system to plot the diagram representing the force value at each position of the element to be fitted, obtained during the displacement of the element on the axle. The x-axis scale of the displacement must be at least 0.5 times the actual displacement of the element to be fitted. The y-axis scale of force must allow the force to be read at each point of the curve at an accuracy of 25 KN. The accuracy of the force sensor must be 10 KN. The x-axis and y-axis can be inverted.

In the case of point recording, at least one point must be plotted per millimetre of relative displacement of the parts to be fitted and per 25 KN variation in force.

4.2 Wheelset characteristics

4.2.1 Mechanical resistance of assemblies

4.2.1.1 General requirements

Annexes A and E define the need for this test.

4.2.1.2 Results to be achieved

In order to transmit moments and forces between the axle and the wheel, the assembly must be able to withstand an axial force *F* for 30 s, without displacement between one element and another.

This force *F* must be defined in the technical specification.

For wheels, if no specific requirement is given in the technical specification, the value of *F* is as follows:

$F = 4\ dm$

when

$0.8\ dm < L_f < 1.1\ dm$

where

dm is the mean diameter of the wheel seat in mm, L_f is the length of the fitting in millimetres and *F* is the force in KN.

4.2.1.3 Test method

The test must be performed on a press equipped with a device to record forces.

The force is applied gradually up to the value *F*, between one of the hub faces of the fitted element and the axle.

For press-fitted wheels, the dismantling test should be performed at least 48 hours after the fitting.

For shrink-fitted wheels, the test is to be done when the wheel and axle have returned to the same temperature after the fitting.

4.2.2 Fatigue characteristics

4.2.2.1 General

This subclause defines the fatigue limit values for rotational bending for 10^7 cycles. These values are used to calculate the maximum permissible axle seat stresses that are necessary for the application of EN 13103-1. These values are valid for "conventional" axle designs, wheels and the assembly process and do not need to be verified for product qualification.

NOTE 1 A design is considered "conventional" when the parameters defining the assembled parts fulfil the requirements of European Product and Design Standards for internal and external journals (e.g. roughness, geometry, interference adjustment, overflow, diameter ratios, steel grades, etc.).

For other types of design or assembly process (e.g. cooling a wheelset, specific diameter ratio, new materials, specific surface coating of the wheel seat, etc.), the following characteristics must be verified and tested at least once in the event of a new or modified set of parameters affecting the assembly.

These fatigue characteristics are not the same for a solid axle and a hollow axle. This is the result of the axle bore effect on stress distribution.

For a solid axis, only one fatigue limit (F_3) must be determined under the fitting surfaces.

For a hollow axle, given that the fitting effect is greater on journals than on other fitting surfaces due to the difference in metal thickness, two fatigue limits must be considered:

— under the wheel seat, excluding journals, limit F_4,

— under journal wheel seat, limit F_5.

If necessary, the fatigue limit F_3 or F_4 must be verified by testing during qualification (see Annex D). The fatigue limit F_5 can be calculated using the ratios $F_4/F_5 = 1.17$ and $F_3/F_5 = 1.28$.

NOTE 2 Fatigue characteristics F_1 and F_2 of the axle are defined in EN 13261.

4.2.2.2 Fatigue limits

The minimum fatigue limits for wheelset axles are given in Table 1.

Table 1 — Minimum fatigue limits for wheelset axles in MPa

Steel grade	F_3	F_4	F_5
EA1N/EA1T	120	110	94
EA4T	145	132	113

4.2.2.3 Fatigue test pieces

For fatigue testing of wheelsets, a wheel or test wheel with similar dimensions (especially the hub) must be press-fitted or shrink-fitted on the wheel seat. The interference must fulfil the requirements of 4.1.2.

The area of the test piece where the crack should initiate must have geometry, environment and surface characteristics representative of the axle.

Examples of test pieces are given in Annex B.

4.2.2.4 Test method

Tests must be carried out on machines that can create rotating bending stresses in the area where cracks initiate.

For each limit F_3 and F_4, it must be verified on three test pieces that no cracks spread after 10^7 cycles of a load creating a surface stress equal to F_3 or F_4. Indications with a depth of less than 0.5 mm should not be considered as crack propagations.

These stress levels must be calculated on the wheel seat according to the beam theory, without taking into account the interference stresses.

4.2.3 Electrical resistance

The electrical resistance of each wheelset, measured between the treads of the two wheels must not exceed 0.01 Ω.

The device and method used for this measurement must be defined in the technical specification.

4.2.4 Dynamic imbalance

4.2.4.1 Maximum permissible values

For the wheelset of a vehicle that can travel at speeds greater than 120 km/h, the maximum dynamic imbalance values are shown in Table 2. They are measured in the wheel plane.

For category 1 wheelsets, the dynamic imbalance must be measured individually.

For category 2 wheelsets (speed greater than 120 km/h), the dynamic imbalance must be measured individually, unless otherwise specified in the technical specification.

Table 2 — Maximum dynamic imbalance values

Speed km/h	**Imbalance** g·m
$120 < S \leq 200$	75
$S > 200$	50

For a powered wheelset, balancing is achieved after the proper placement and balancing of each component (wheels, brake discs and other components such as couplings and gears). Therefore, dynamic imbalance measurement is not necessary.

4.2.4.2 Test piece

The imbalance is measured on a fully assembled and machined wheelset.

4.2.4.3 Test method

The device and method used for this measurement must be defined in the technical specification.

4.2.5 Dimensions and tolerances

4.2.5.1 General

The dimensions of the wheelset must correspond to the design drawings, and the dimensional and geometrical tolerances to be applied when assembling the different parts of the wheelset are given in the following subclauses.

They depend on the category of the wheelset.

The values are given for measurements made without any load on the wheelset.

4.2.5.2 Wheels

Unless otherwise specified in the technical specification, the parameter tolerances defined in Figure 1 must be those given in Table 3.

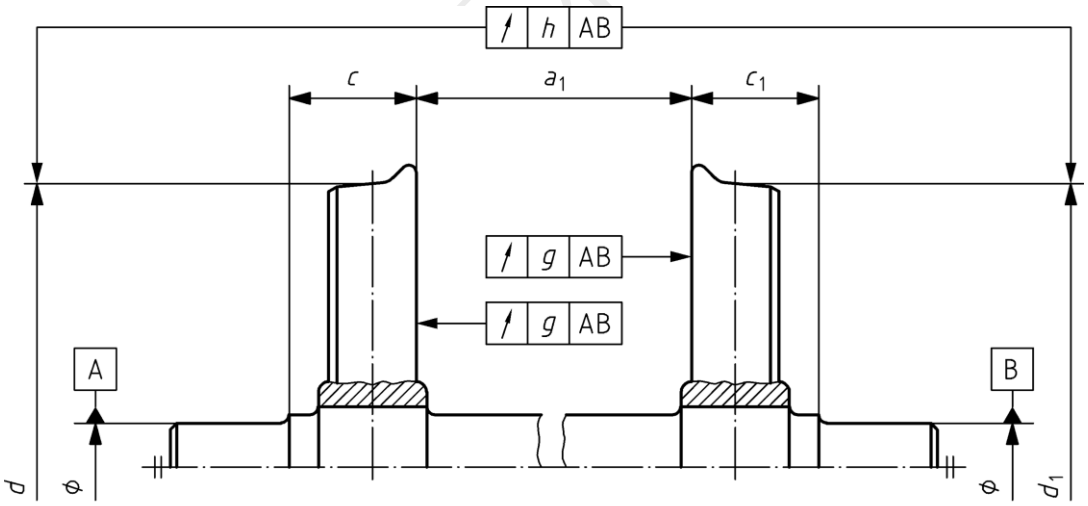


Figure 1 — Parameters for wheelsets

Table 3 — Parameter tolerances for wheels

Dimensions in millimetres

Description	Symbol	Category 2		Category 1
		2a	**2b**	
Distance between the internal wheel faces a	a_1	+ 2 b 0		+ 2 b 0
Difference in distances between the internal face of each wheel and the plane on the journal side defining the corresponding collar bearing surface	$c - c_1$ or $c_1 - c$	≤ 1		≤ 1
Difference in tread circle diameter	$d - d_1$ or $d_1 - d$	≤ 0.5	≤ 0.3	≤ 0.3
Radial run-out in tread circle	h	≤ 0.5	≤ 0.3	≤ 0.3
Axial run-out of the internal wheel face a	g	≤ 0.8	≤ 0.5	≤ 0.3

[a] Measures taken 60 mm beneath the top of the flange.

[b] Tolerances may vary depending on the specific design of the wheelset.

4.2.5.3 Brake Discs

4.2.5.3.1 General

The parameter tolerances defined in Figures 2 and 3 must be those given in Tables 4, 5 and 6.

Table 4 — Axial run-out of the internal face

Dimensions in millimetres

Description	**Symbol**	**Category 2a**	**Category 2b**	**Category 1**
Axial run-out of the internal face a	g_1	≤ 0.75	≤ 0.5	≤ 0.5

[a] See Figures 2 and 3, Measures taken 30 mm from the external diameter.

4.2.5.3.2 Single-seat axles for one or two brake discs

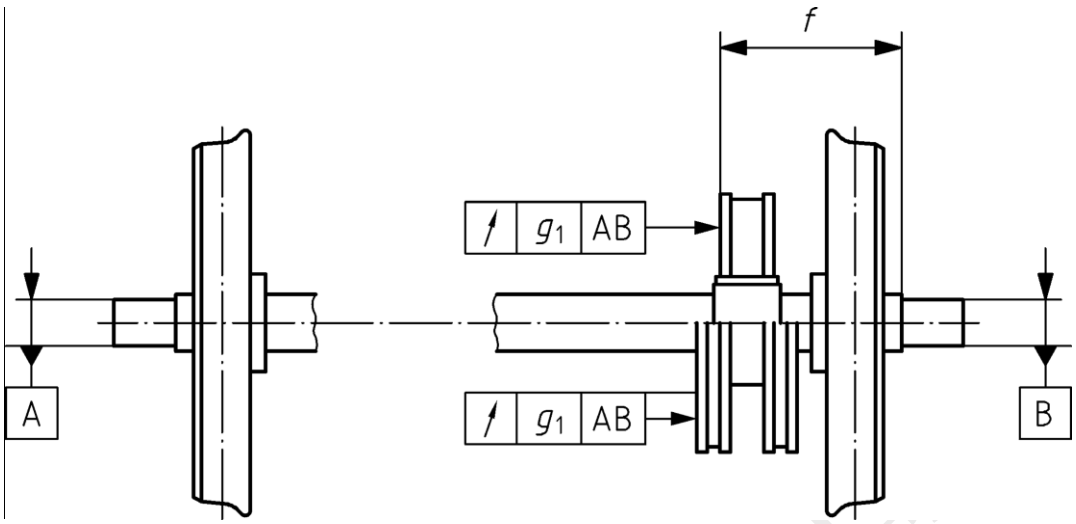


Figure 2 — Single-seat axles for one or two brake discs

Table 5 — Tolerances for single-seat axles for one or two brake discs

Dimensions in millimetres

Description	Symbol	Category 1 and 2
Distance between the internal face of the disc crown and the plane on the journal side defining the corresponding collar bearing surface	f	± 0.5

4.2.5.3.3 Double-seat axles for two or four brake discs

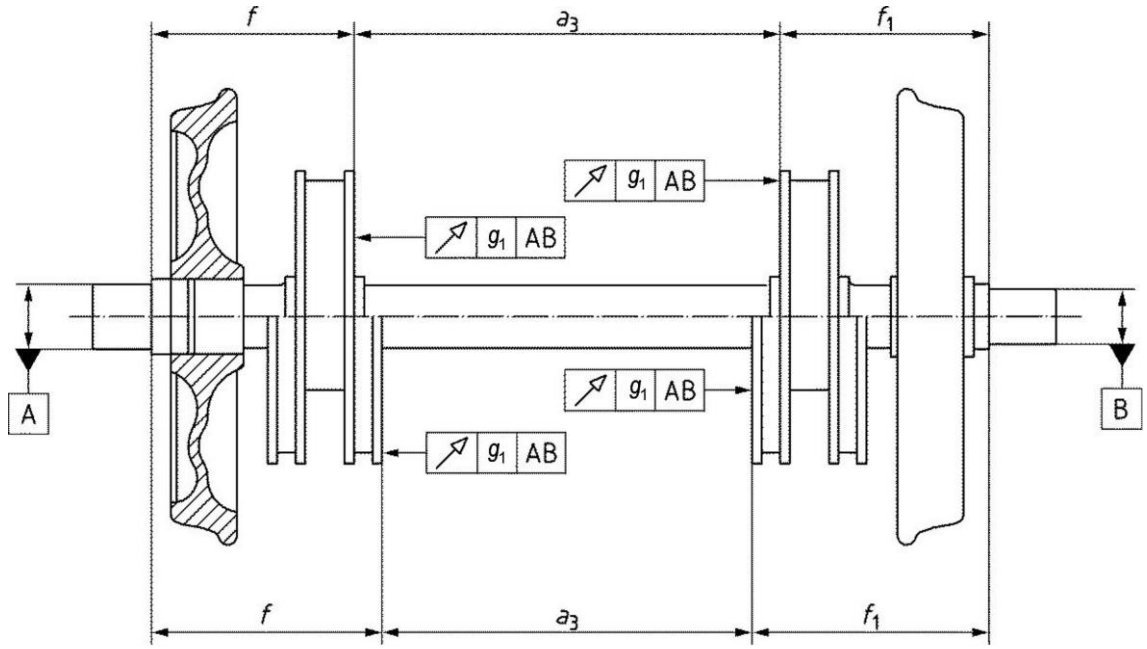


Figure 3 — Double-seat axles for two or four brake discs

Table 6 — Tolerances for double-seat axles for two or four brake discs

Dimensions in millimetres

Description	Symbol	Category 1 and 2
The distance between the internal faces of the disc crowns	a_3	± 0.5
Difference in the distances between the internal face of each disc and the plane on the journal side defining the corresponding collar bearing surface	$f - f_1$ or $f_1 - f$	≤ 1

4.2.5.3.4 More than two seats

If there are more than two seats for brake discs, tolerances for dimensions such as a_3 or $f - f_1$ (see Figure 3) are the same as in 4.2.5.3.3.

4.2.5.4 Cylindrical gear wheels for powered axle, reducing gears, etc.

The parameter tolerances defined in Figure 4 must be those given in Table 7.

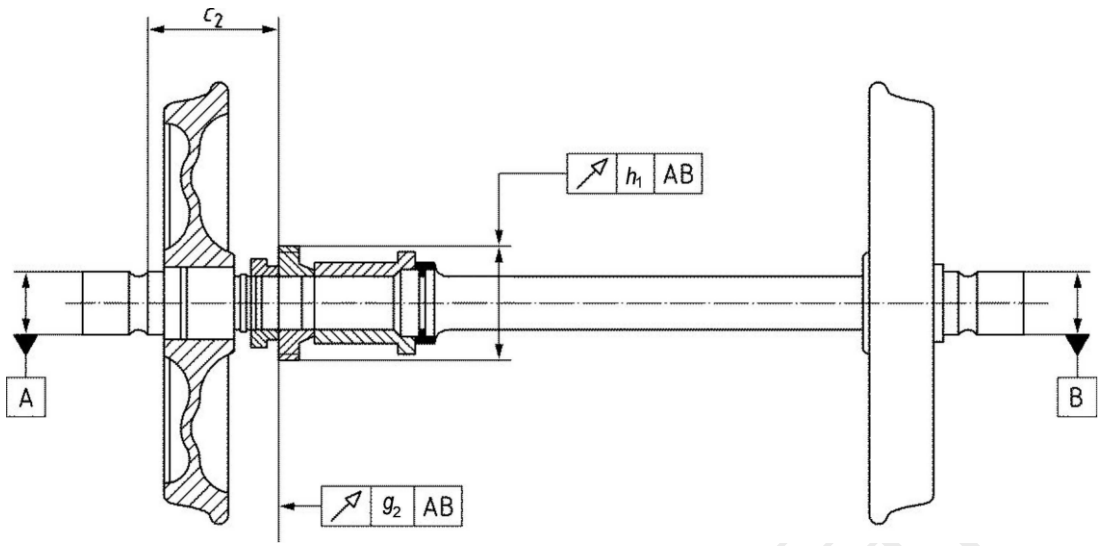


Figure 4 — Cylindrical gear wheels for powered axle, reducing gears, etc.

Table 7 — Tolerances for cylindrical gear wheels for powered axle, reducing gears, etc.

Dimensions in millimetres

Description	Symbol	Category 2	Category 1
Radial run-out a	h_1	b	b
Axial run-out a	g_2	b	b
Distance between the lateral reference surface of the gear wheel and the plane on the journal side defining the corresponding collar bearing surface a	c_2	± 0.5	± 0.2

a See Figure 4.

b In accordance with the technical specification.

4.2.6 Residual stresses on the wheel seats

The different manufacturing processes leading to the “ready to assemble” state of the axle should not create residual stresses that may cause fatigue crack initiation.

The requirements are given in EN 13261.

4.2.7 Protection against corrosion and mechanical damage

The components of the wheelset must be protected in accordance with the requirements of their respective standards.

Cavities caused by the overhang of the wheel hub on the wheel seats must be protected by an anti-corrosion product, which will be defined in the technical specification.

4.2.8 Marking

The constituent parts of the wheelset must be marked in accordance with the corresponding standards.

The wheelset must at least be identified by the following marks (in accordance with the technical specification):

1) type of wheelset,

2) order number,

3) assembler's marks ,

4) date of assembly,

5) owner’s marks.

These marks must be at the end of the journal that already bears the marks of the axle defined in EN 13261 and below these latter marks.

At the end of the other journal, half of the surface must be reserved for maintenance. The other half of this surface is free.

Marks must be permanent, for example by stamping, dot peen marking or engraving. The protruding burrs from stamping must be levelled to allow in-service ultrasonic examination.

5 Product qualification

Product qualification must be carried out in accordance with the requirements set out in Annex D.

6 Conditions of supply of the product

The conditions for the supply of the product must be carried out in accordance with the requirements set out in Annex E.

Annexe A
(normative)

Characteristics of the press-fitting curve

The characteristics of the press-fitting curve for cylindrical wheel seats are described in this Annex.

The *F(x)* curve must start in the first 30 mm before the theoretical start of the fitting and must be continuously increasing with a decreasing slope (see curve I in Figure A.1), with the following exceptions:

1) a decrease in the fitting force to the right of the dismantling groove by oil injection is allowed. The maximum force reached before the groove must be reached again within 25 mm of penetration (see curve II in Figure A.1). Crossing the lower limit of the curve is tolerated during this disruption;

2) a maximum decrease of 50 KN is allowed over the last 25 millimetres of displacement (see curve III in Figure A.1);

3) The press-fitting force may exceed the maximum press-fitting force F_{max} value by up to 10% (see curve IV in Figure A.1). In this case, the assembly must be verified through a dismantling test;

Press-fitting curves with level and/or concave profiles can be accepted under the following conditions:

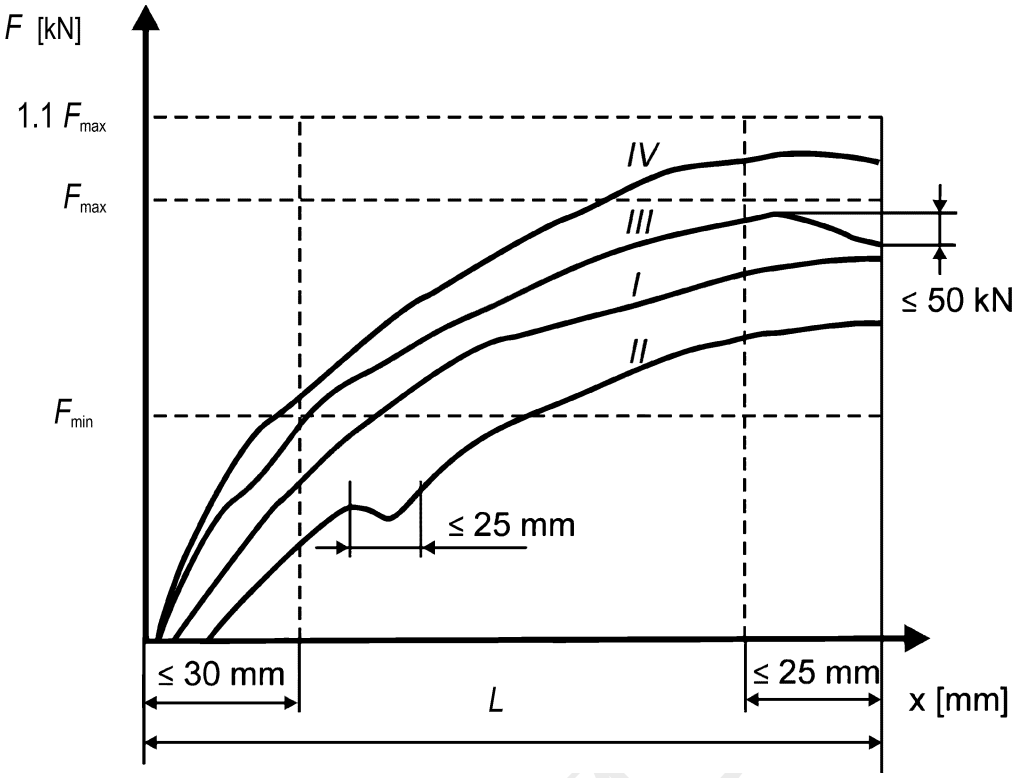
4) Curves above the line connecting the starting point of the curve with the point on the diagram corresponding to the minimum permissible force (see curve V in Figure A.2);

5) Curves above the line connecting the starting point of the curve with the point on the diagram corresponding to the minimum permissible force, the low value of the curve being due to discontinuity from the oil injection groove (see curve VI in Figure A.2);

6) When the sum of the lengths h_i of the levelling of the press-fitting curve (excluding areas where the discontinuity comes from the oil injection groove) is $\Sigma h_i \leq L/10$ as shown in curve VII in Figure A.2; In this case, the assembly must be verified by a dismantling test.

7) The positioning of the two contact surfaces at the beginning of the fitting (< 10% of the total length of diagram L) can cause a sudden but temporary increase in force at the beginning of the curve.

Other localised stresses must be defined in the technical specification and verified by a dismantling test.



Wheel rejected

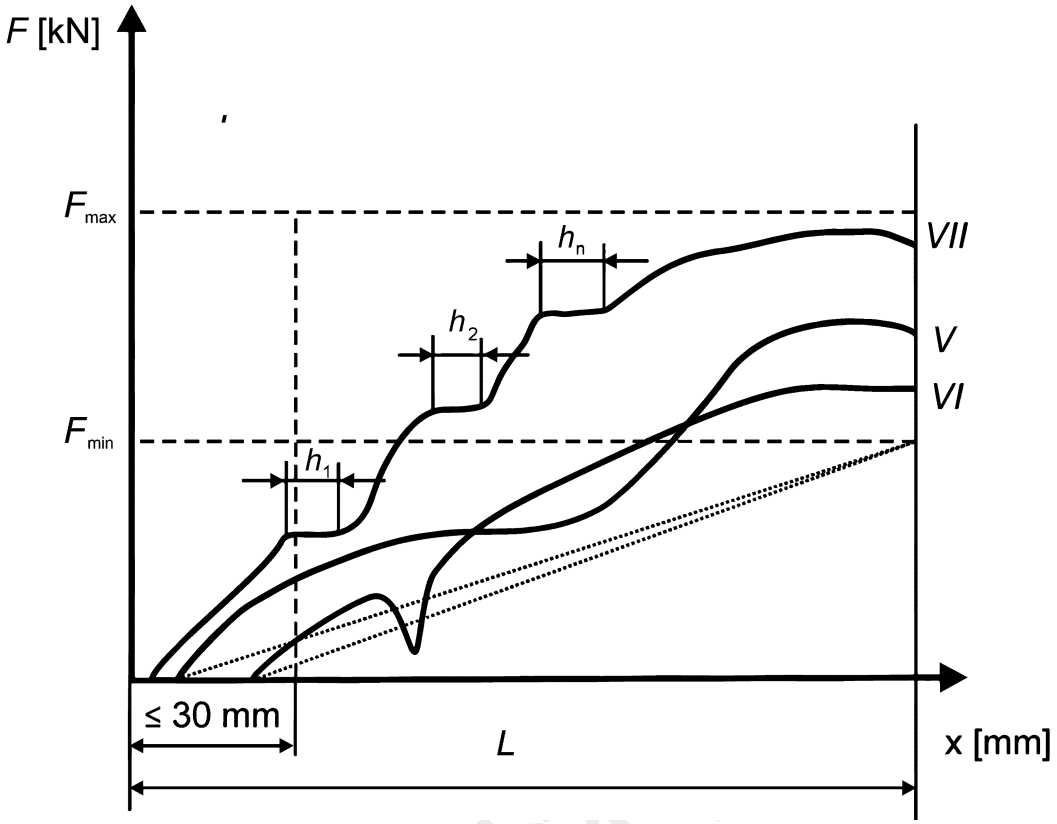
F_{min} Minimum fitting force (see 4.1.3.1)

F_{max} Maximum fitting force (see 4.1.3.1)

L Total length of displacement along the x-axis

NOTE The length hi is indicative and is not to scale.

Figure A.1 — Permissible press-fitting curves



Wheel rejected

F_{min} Minimum fitting force (see 4.1.3.1)

F_{max} Maximum fitting force (see 4.1.3.1)

L Total length of displacement along the x-axis

NOTE The length hi is indicative and is not to scale.

Figure A.2 — Tolerable decreases in press-fitting force

Annexe B
(informative)

Information about test pieces for fatigue tests

Examples of test piece drawings for fatigue tests are shown in Figure B.1 and Figure B.2.

The reference section for calculating the bending moment and the associated stress must be the edge of the wheel seat (internal side).

This test piece should be designed with a diameter ratio, Ø wheel seat (185)/Ø body (171) of 1.08 (see Figure B.1). This diameter ratio is chosen to ensure verification of the assembly against the fatigue resistance of the wheelset. If cracks appear, they will occur on the wheel seat, not on the body. This value may not be valid for high-alloy steels. Higher diameter ratios can be used for all steels defined in EN 13261, however:

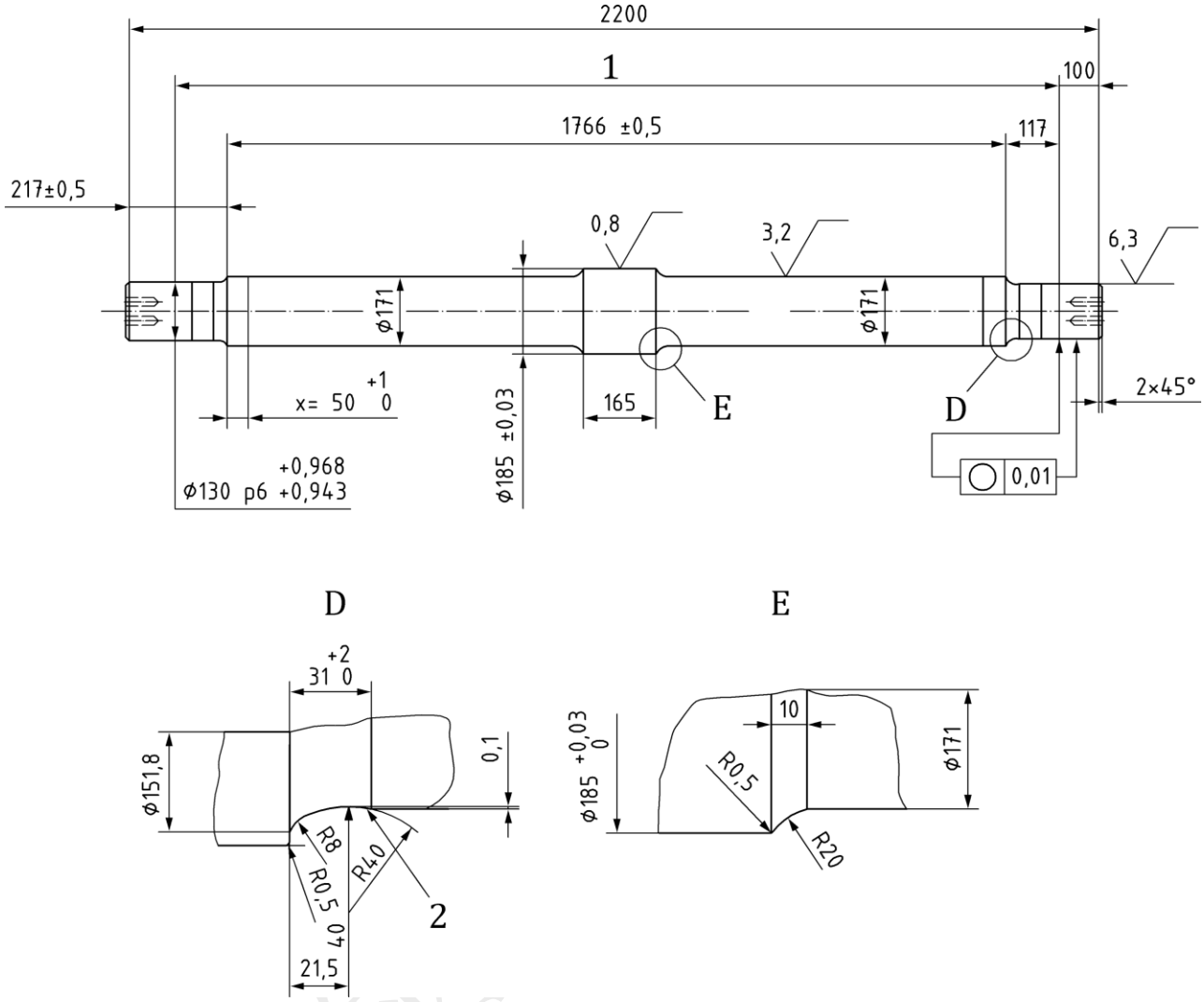
— with high diameter ratios, there is a risk that cracks will appear in the body fillet radius;

— with low diameter ratios, there is a risk that the required stress on the wheel seat cannot be achieved;

— if the ratio is greater than 1.12 (see Figure B.2), the transition zone should be inspected after the test to ensure that there are no cracks in this area.

If a crack is found, the test cannot be accepted for F3/F4 verification.

Dimensions in millimetres



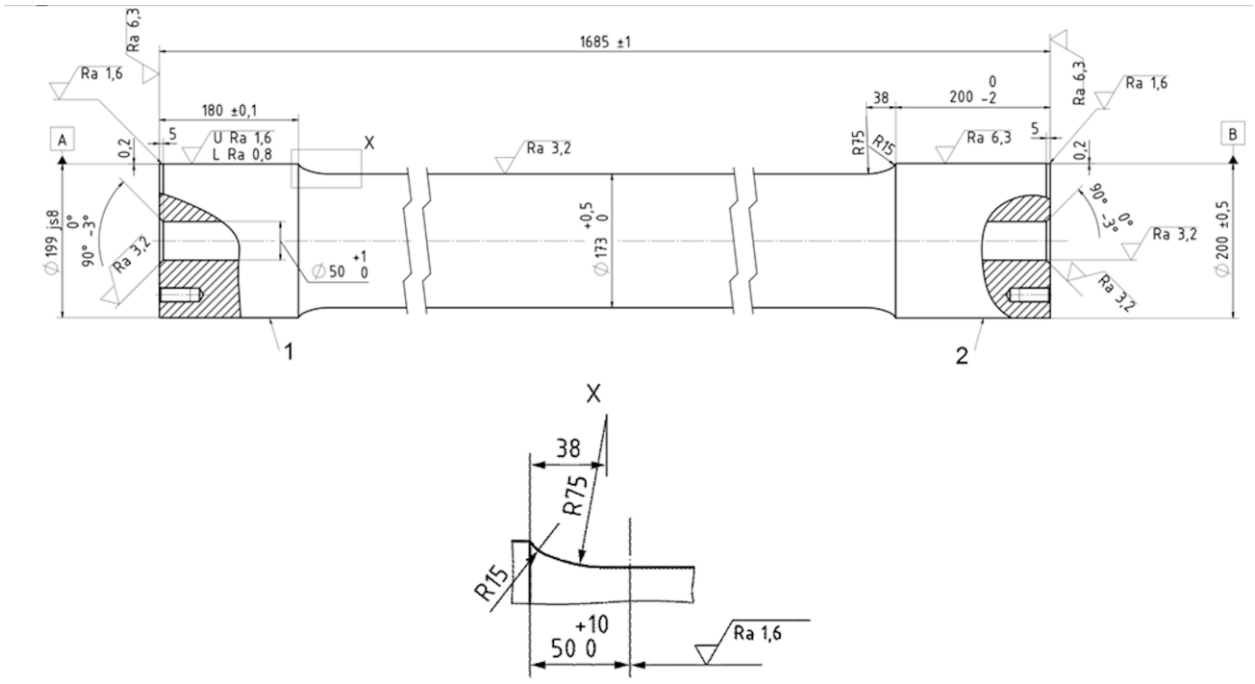
Wheel rejected

1 centre to centre of journals 2000

2 rounded edge

Figure B.1 — First example of a scale 1 test piece for fatigue tests

Dimensions in millimetres



Wheel rejected

1 wheel seat of the wheel or test wheel

2 wheel seat of motor for resonance

x detailed view of the transition area

Figure B.2 — Second example of a scale 1 test piece for fatigue tests

Annexe C
(informative)

Information to be provided to identify wheelset components

This document considers a wheelset mainly as the assembly of an axle and wheels.

However, the most common formations of a manufacturer-supplied wheelset also include bearings and axle boxes, as well as all components fitted between the two wheels (brake discs, transmission, etc.).

Table C.1 lists the information that should be provided for complete identification of the characteristics and constitution of a wheelset.

For each element, Table C.1 also includes a direct reference to the data for traceability according to EN 15313:2016, Annex A and Annex B.

Additional elements/information on components can be requested in the technical specification.

Table C.1 — Information on the characteristics of the wheelset

Elements	Identification	Reference in EN 15313:2016, Annexes A and B	Comment
Manufacturer of the wheelsets	Name and factory	**106**	In the event of intervention by another Manufacturer/Assembler for press-fitted components other than wheels (excluding bearings and seal rings), the Name and Factory of the latter must be registered (parameter 108 of EN 15313:2016, Annex A/B), with the Assembly Date (parameter 109 of EN 15313:2016, Annex A/B).
Customer order references	Plane reference	**NA**[a]	
	Wheelset type or alternative designation	**102**	
	Internal order number	**NA**	
	Reference of any annexes	**NA**	
	Customer name	**NA**	
	Customer order reference	**NA**	
	Name of inspector	**NA**	

Elements	Identification	Reference in EN 15313:2016, Annexes A and B	Comment
Axle identification	Cast no.	**206**	Unique axle number in batch after processing
	Serial no.	**201**	
	Steel grade	**207**	
	Month and year of production	**205**	
	Axle plane	**NA**	
	Axle type or alternative designation	**202**	
	Producer	**204**	
Wheel identification	Cast no.	**310**	If applicable
	Month and year of production	**308**	For each side of the wheelset
	Steel grade	**309**	For each side of the wheelset
	Fitting pressure	**NA**	For each side of the wheelset
	Wheel bore diameter	**NA**	For each side of the wheelset
	Wheel seat diameter (on axle)	**NA**	
	Interference (wheel assembly)	**NA**	
	Wheel diameter	**NA**	
	Wheel plane and markings	**NA**	
	Wheel type or alternative designation	**301**	
	Wheel manufacturer	**307**	
	Type of assembly (SF for shrink-fitting, PF for press-fitting)	**NA**	
	Lubricant type if PF, heating type if SF	**NA**	

Elements	Identification	Reference in EN 15313:2016, Annexes A and B	Comment
Bearing identification	Type of axle box bearings	**401**	Axle box type or alternative designation (month/year)
	Type of grease	**407**	For each side of the wheelset and each bearing if applicable
	Batch number of grease	**408**	For each side of the wheelset and each bearing
	Date of grease production	**409**	
	Bearing supplier	**403**	
	Bearing serial no.	**NA**	
	Date of manufacture (in clear or coded form)	**405**	
	Date of assembly	**NA**	
	Permissible bearing play	**NA**	
	Measured bearing play	**NA**	
	Weight of grease	**NA**	
Disc/brake identification	Plane	**NA**	
	Serial no.	**(All)**	
	Manufacturer		
	Delivery date		
	Disc interference tolerance		
	Measured disc interference value		
	Fitting force tolerance		
	Fitting pressure value		
Other fitted elements	Measured interference	**NA**	
	Measured fitting force	**(All)**	
Controls	See Annex E	**NA**	

Elements	Identification	Reference in EN 15313:2016, Annexes A and B	Comment
Delivery methods	Delivery references (weight, number, restrictions, etc.) Place of delivery Loading date	**NA** **(All)**	
Wheels and wheelsets	Imbalance Batch number Axial run-out/Radial run-out	**NA** **(All)**	
Other information on the wheelset	For wheelsets in accordance with the TSI: Declaration of conformity Including the CE certificate number and the notified body For other wheelsets (not in accordance with the TSI): Approval number and authorising or certifying body	**104**	If available
Other information on the wheelset	Maximum permissible load on the wheelset	**105**	Considering the components of the wheelset: axle, wheels and bearings

[a] **NA** = Not applicable to the traceability database for EN 15313:2016, Annex A and Annex B (''EWT'')

Annexe D
(normative)

Product qualification

D.1 Introduction

This annex describes the minimum requirements for product qualification and manufacturing.

Additional requirements can be defined in the technical specification.

D.2 General

This clause defines the requirements and procedures to be applied for the qualification of the product and its manufacture.

The qualification of a wheelset is directly related to the manufacturing process and a wheelset can only be qualified if the manufacturing process fulfils the requirements defined in D.3.

These requirements and procedures apply only to wheelset designs that have already been approved:

— either by prior use in European rail services;

— or by a recognised technical approval procedure.

The qualification of a product is based on the concept of product groups. Product groups are defined by a combination of the following requirements:

1) powered or non-powered wheelsets;

2) category 1 or 2 (category 1 includes category 2);

3) press-fitting or shrink-fitting;

4) steel grade;

The definition of a product group can be changed in the technical specification.

The qualification process must be applied if the wheelset does not belong to a product group of the manufacturer's qualified wheelsets.

Any changes in the manufacturing process, such as:

— the assembly process;

— machining and finishing processes;

— place of manufacture;

must be documented, communicated to the parties concerned and may lead to partial or complete re-qualification of the product, depending on the changes made.

D.3 Requirements

D.3.1 Requirements to be met by the manufacturing process

D.3.1.1 General

If the manufacture of a wheelset includes more than one manufacturer, the following requirements must be fulfilled by each of them.

D.3.1.2 Quality organisation

The manufacturer must implement a quality assurance system.

NOTE EN ISO 9001 is a means of achieving this requirement.

D.3.2 Staff qualification

D.3.2.1 General

Personnel responsible for non-destructive testing must be qualified.

NOTE EN ISO 9712 is a means of achieving this requirement.

D.3.2.2 Equipment

The equipment used by the manufacturer for manufacture, control and monitoring must be compliant with the requirements in this document.

D.3.3 Requirements to be met by the product

The product must comply with the product requirements defined in Clause 4.

The traceability of each component and their assembly must be established.

D.4 Qualification procedure

D.4.1 General

The qualification procedure has four successive stages as described below:

1) the provision of a file;

2) an assessment of the production facilities and processes;

3) laboratory tests;

4) product testing.

After each stage, a report must be written.

D.4.2 Documentation required

For qualification, a file must be provided that includes:

— a description of the wheelsets that require qualification;

— a description of the manufacturer including:

  — company size (number of employees, defining the proportion between manufacturing, control and quality assurance);

  - annual production of wheelsets;
  - List of all manufacturing and control equipment;
- Data on the organisation of the company, together with the corresponding organisational charts;
- A description of the manufacturing processes with explanations of the different stages of manufacturing;
- qualification documents for the different components of the product to be qualified;
- test results on the products subject to qualification.

If a file has already been provided by the manufacturer for the qualification of another wheelset, the file to be supplied by that manufacturer for the qualification of the new wheelset must only contain the elements specific to that product, or new to the company.

D.4.3 Evaluation of the manufacturing facilities and processes

This evaluation includes:

- an audit of the production facilities and monitoring of manufacturing processes;
- an audit of the production facilities and monitoring of the manufacturing processes related to the wheelset components;
- an assessment of the data provided by the manufacturer to confirm compliance with the requirements of Subclause D.3.1;
- an assessment of the information provided in the documents referred to in Subclause D.4.1.

At the end of this stage, a report must be written. It must identify all stages of manufacture, including those of the wheelset components. It should give assurance that the evaluation satisfies the requirements of Subclause D.3.1 for the qualification procedure to continue.

D.4.4 Laboratory tests

If necessary, this stage should verify that the minimum fatigue limits have been achieved as defined in 4.2.2.

At the end of this stage, a report must be written. It must specify the geometry and manufacturing process of the test pieces.

D.4.5 Finished product testing

All the characteristics in Clause 4 (except fatigue characteristics) must be verified on 10 wheelsets.

A report must be written describing the wheelsets being tested, the test run and its results. It should specify whether or not the wheelsets fulfil the requirements.

If the results are satisfactory, a provisional qualification certificate may be issued. After the issuance of this provisional qualification certificate, the same tests as those performed on the 10 wheelsets must be carried out on at least one out of every 30 wheelsets, until 300 wheelsets have been supplied.

The product is qualified if these tests do not show any repeated product defects.

Another report must be written. It must identify the wheelsets, the tests and their results.

If the number of wheelsets to be supplied in 2 years is less than 300, the status of qualification is given after testing the first 10 wheelsets. However, the same tests as those performed on the first 10 wheelsets must be carried out on one in every 30 of the following wheelsets supplied.

D.5 Validity of the qualification

D.5.1 Conditions of validity

The qualification must specify the conditions of validity of this qualification in relation to the product group (see Clause D.2).

D.5.2 Modification and extension

The scope can be modified or extended if:

— other products are to be considered;

— significant parameters have been modified (manufacturing processes, quality organisation, etc.).

Any modifications or changes in the scope of qualification must be approved and documented.

D.5.3 Transfer

In the event of a transfer of ownership, an existing qualification may, on request, be transferred to another company if the material content and prerequisites for the qualification have not been modified.

D.5.4 Expiry

A new assessment of production equipment and processes according to D.4.3 should be made in the following cases:

— if after 5 years, 300 wheelsets were not supplied following the provisional qualification;

— if, within a period of 2 years, no supply has been made within the scope of the product subject to qualification.

D.5.5 Withdrawal

If significant defects on the product have been found, the parts of the qualification procedure concerned must be repeated.

If the manufacturer has failed to meet important qualification conditions, qualification may be withdrawn.

D.6 Qualification record

For each qualified product, a qualification record must be created. It must contain the following documents:

— documents provided by the manufacturer (see D.4.2);

— evaluation reports (see D.4.3);

— laboratory test reports (see D.4.4);

— product test reports (see D.4.5);

— qualification reports (see D.5).

Annexe E
(normative)

Conditions of supply of the product

E.1 Introduction

This Annex describes the minimum conditions for the supply of the product.

Other requirements may be indicated in the technical specification.

E.2 General

The technical specification must set out:

— the geometry and dimensions of the wheelset components (drawings);

— the drawings for the wheelset;

— the wheelset category (1 or 2, see Clause 1);

— the requirements for press-fitting or shrink-fitting;

— the ultrasonic examination method used if this test is required (see E.4.2);

— the wheelset marking (see 4.2.8);

— the fitting method (see 4.1.1);

— the electrical resistance test method (see 4.2.3);

— the imbalance test method (see 4.2.4);

— the optional dimensional checks (see E.4.1).

For delivery, a few characteristics must be verified on each wheelset (see E.3). For the other characteristics defined in Clause 4, a manufacturing quality plan must be proposed and accepted.

Each axle must have traceability documents.

E.3 Unit checks

The following tests must be carried out on each wheelset:

— conformity of the press-fitting diagram (see 4.1.3);

— dimensions: d-d1, h, g, a1 (see 4.2.5.2).

For shrink-fitting, the resistance of the assembly must be verified on 100% of the supplied wheelsets (see 4.2.1). If other sampling rates are used, they must be defined in the technical specification and justified by statistical analyses.

The following information must be recorded and documented for each wheelset:

— interference for each fitted element;

— actual wheel bearing diameter (measured on the rolling plane);

— difference in bearing diameters (measured on the rolling plane) on sides A and B;

— spacing of internal faces;

— flange profile;

— distance between the internal (and corresponding external) face of each wheel and the plane of the journal collar;

— radial run-out on the rolling planes;

— axial run-out of the wheels and brake discs;

— residual imbalance in each balancing plane if required (see 4.2.4);

— wheel profile;

— press-fitting curve;

— result of the dismantling test if required, in accordance with Annex A or the technical specification;

— lubricant in the event of press-fitting;

— non-destructive testing according to Subclause E.4.2.

E.4 Optional controls

E.4.1 Dimensional check

If defined in the technical specification, other dimensions defined in 4.2.5 can be verified on each or part of the supplied wheelsets.

E.4.2 Ultrasonic examination

If defined in the technical specification, the wheel seats of the wheelset axle can be checked by ultrasound after assembly. For hollow axles, the examination must be carried out on the entire axle after assembly and painting.

The process must comply with an accepted procedure and the examination must be carried out by certified and authorised operators using approved equipment.

A calibration axle must be available to calibrate the equipment before the examination.

An individual permanent record of the examinations must be made.

The requirements for the bearing wheel seats must be defined in the technical specification.

E.5 Permissible repairs

Wheelset repairs are permitted if the following requirements are fulfilled:

a) excessive imbalance, dimensions and geometric tolerances beyond limits must be corrected by gentle machining or grinding within the tolerances and indications given in the drawings and standards for each component;

b) if the imbalance values are greater than the maximum permissible values, the excess mass on the solid wheels must only be eliminated by eccentric machining on the connection between the wheel plate and the rim on the side of the flange and not by drilling or welding an additional mass;

c) if indicated in the technical specification, balancing weights or balancing bolts can be screwed onto the wheel if specifically researched for this purpose (e.g. on wheels equipped for noise reduction);

d) defective assembly of one of the components can be corrected by dismantling and a new fitting of that component;

e) the different shapes of the fitting curves (in the case of press-fitting) are tolerated within the standard curve limits defined in the technical specification;

f) after machining, any defects that may have a detrimental effect on the stability of the wheelset must be removed;

g) corrosion protection damage can be repaired if, after repair, the characteristics of the repaired areas are the same as those of other areas;

h) if, during press-fitting, dismantling or an assembly resistance test, the fitted surfaces of the two touching components are damaged, reuse of these components is accepted under the following conditions:

   1) the components to be assembled can be reused with a new axle if it has two wheel seats with a diameter greater than the tolerances in the drawing, up to a maximum of +1.5 mm, so as to adjust the interference;

   2) in the event of damage causing scoring on the wheel seats during dismantling, the wheel seat can be machined to remove the scoring and another wheel can be fitted provided that it retains 50% of the thickness allowance used by maintenance and provided that the technical specification defines this;

   3) an approved method of metal spraying is tolerated to achieve the correct interference. It must be defined in the technical specification. Such a method must be qualified by a procedure that includes fatigue tests, in order to prove that the fatigue characteristics of such a repaired wheelset are the same as those of an unrepaired wheelset. Molybdenum coating is a recognised technique. The technical specification must specify the conditions under which the molybdenum coating can be applied.

   Any permitted repairs must be recorded in the repaired wheelset document.

E.6 Documents

E.6.1 Shrink-fitting

Each fitted element must have a document with the following indications:

a) the name of the supplier performing the fitting;

b) the date of the fitting;

c) wheelset identification;

d) fitted element (wheel, disc, etc.);

e) dimensions:

   1) mean diameter of the wheel seat;

   2) mean diameter of the hub bore of the fitted element;

   3) interference;

f) orientation "R" (right) or "L" (left) if two identical parts are fitted on one axle.

An example of this document is given in Annex C.

E.6.2 Press-fitting

Each fitted element must have a fitting diagram (see 4.1.3), which must contain the following indications:

a) the name of the supplier performing the fitting;

b) the date of the fitting;

c) wheelset identification;

d) fitted element (wheel, disc, etc.);

e) lubricant;

f) dimensions:

   1) mean diameter of the wheel seat;

   2) mean diameter of the hub bore of the fitted element;

   3) interference;

g) orientation "R" (right) or "L" (left) if two identical parts are fitted on one axle;

h) end of fitting force *F*.

This information can be collated in the document given in Annex C.

E.6.3 Components

For each wheelset, the identification of each component must be recorded in a document as described in Annex C.

E.7 Quality plan

E.7.1 General

If the products being supplied are monitored via a quality plan, this must be defined in the technical specification.

NOTE Quality plan as defined in EN ISO 9001 or equivalent.

This quality plan should refer to the manufacturer's quality manual and contain product-specific elements.

E.7.2 Objectives

This plan, which must be established in the technical specification, aims to:

— describe the provisions taken to obtain and control the quality of the products concerned, including justifications for the choices made;

— provide at least the same confidence in the conformity of the product as that obtained by the batch sampling tests.

This quality plan must specify the checks carried out during manufacture and on the products delivered. These tests can be compiled in a manufacturing control plan.

E.7.3 Quality Plan terms of application

Any changes to the quality plan must be documented.

In the event of non-compliance of supplied products, the terms of application of the quality plan must be questioned and if the results are not satisfactory, the quality plan may be suspended.

Annexe ZA
(informative)

Relationship between this European Standard and the essential requirements of Directive 2016/797/EC to be fulfilled

This European Standard has been developed in accordance with standardisation mandate M/483 given by the European Commission in order to provide a means to comply on a voluntary basis with the essential requirements of Directive 2016/797/EC on the interoperability of the rail system.

Once this Standard has been quoted in the Official Journal of the European Union (OJ) under the aforementioned Directive, compliance with the normative clauses of this Standard given in Table ZA.1 for freight wagons and Table ZA.2 for Locomotives and Passenger Vehicles, confers, within the scope of the Standard, a presumption of conformity with the essential requirements applicable to the aforementioned Directive and the associated EFTA Regulation.

Table ZA.1 — Correspondence between this European Standard, and European Commission EU Regulation No. 321/2013 dated 13 March 2013 (and its amendments 1236/2013 and 2015/924) regarding the technical specification for interoperability concerning the "rolling stock – freight cars" subsystem of the railway system in the European Union and repealing Decision 2006/861/EC (published in the OJ *L 104, 12.4.2013, p.1*) and Directive 2016/797/EC

Corresponding text, clauses/§/annexes to Directive 2016/797/EC	Chapters/§/points and annexes to the TSI	Clauses/subclauses of this European Standard	Comments
Annex III, Essential Requirements 1 General requirements 1.1 Safety Clauses 1.1.1, 1.1.2, 1.1.3 1.2 Reliability and availability 1.5 Technical compatibility 2 Essential requirements specific to each subsystem 2.4 Rolling stock 2.4.2 Reliability and availability Technical compatibility §3	4 Characterisation of the subsystem 4.2 Technical and functional specification of the subsystem 4.2.3 Interaction with the track and gauge 4.2.3.6 Running components § 4.2.3.6.2 Wheelset characteristics 5 Interoperability constituents 5.3 Specification of interoperability constituents § 5.3.2 Wheelsets 6 Conformity assessment and EC verification 6.1 Interoperability constituent 6.1.2 Assessment of conformity procedures § 6.1.2.2 Wheelsets	The entire standard is applicable.	Subclause 3.2.1 of EN 13260:2009 is referenced in the TSI and is therefore obligatory. Subclause 4.2.1 in this edition is equivalent to it. The symbols of the geometric parameters of the axles are those used by the axle maintenance experts and are not those used in the TSI.

Table ZA.2 — Correspondence between this European Standard and European Commission EU Regulation No. 1302/2014 dated 18 November 2014 regarding the technical specification for interoperability concerning the "rolling stock - locomotives and passenger vehicles" subsystem of the railway system in the European Union and repealing Decision 2006/861/EC (published in the OJ *L 356, 12.12.2014, p.228*) and Directive 2016/797/EC

Corresponding text, clauses/§/annexes to Directive 2016/797/EC	Chapters/§/points and annexes to the TSI	Clauses/subclauses of this European Standard	Comments
Annex III, Essential Requirements 1 General requirements 1.1 Safety Clauses 1.1.1, 1.1.2, 1.1.3 1.2 Reliability and availability 1.5 Technical compatibility 2 Essential requirements specific to each subsystem 2.4 Rolling stock 2.4.2 Reliability and availability Technical compatibility §3	4 Characterisation of the rolling stock subsystem 4.2 Technical and functional specification of the subsystem 4.2.3 Interaction with the track and gauge 4.2.3.5 Bearings 4.2.3.5.2 Wheelset § 4.2.3.5.2.1 Mechanical and geometric characteristics of wheelsets 6 Assessment of conformity or suitability for use and EC verification 6.2 Rolling stock subsystem 6.2.3 Special procedures for the evaluation of subsystems § 6.2.3.7 Mechanical and geometric characteristics of wheelsets	The entire standard is applicable.	Subclause 3.2.1 of EN 13260:2009 is referenced in the TSI and is therefore obligatory. Subclause 4.2.1 in this edition is equivalent to it. The symbols of the geometric parameters of the axles are those used by the axle maintenance experts and are not those used in the TSI.

WARNING 1 — The presumption of conformity remains valid as long as the reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult this list frequently.

WARNING 2 — Other EU regulations may apply to products within the scope of this standard.

Bibliography

[1] EN 12080, *Railway Applications - Axle Boxes - Rolling Bearings*

[2] EN 14535-1, *Railway Applications - Brake Discs for Railway Rolling Stock - Part 1: Brake Discs Pressed or Shrunk onto the Axle or Drive Shaft, Dimensions and Quality Requirements*

[3] EN 15313:2016, *Railway Applications - In-Service Wheelset Operation Requirements - In-Service and Off-Vehicle Wheelset Maintenance*

[4] EN ISO 9001, *Quality Management Systems- Requirements (ISO 9001)*

[5] EN ISO 9712, *Non-Destructive Testing - Qualification and Certification of NDT Personnel (ISO 9712)*