BS 5892-8:2012

BSI Standards Publication

Railway rolling stock materials

Part 8: Railway applications — Wheelsets and bogies — Powered and non-powered wheelsets with inboard bearings — Product requirements

bsi.

...making excellence a habit.™

Publishing and copyright information

Published by BSI Standards Limited 2012

ISBN 978 0 580 70803 9

ICS 45.040

The following BSI references relate to the work on this standard:
Committee reference RAE/3
Draft for comment 11/30217674 DC

Publication history

First published June 2012

Amendments issued since publication

Date	Text affected

Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 24, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 June 2012. It was prepared by Technical Committee RAE/3, *Railway rolling stock material*. A list of organizations represented on this committee can be obtained on request to its secretary.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

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

Compliance with a British Standard cannot confer immunity from legal obligations.

0 Introduction

This British Standard specifies the wheelset assembly and finished product characteristics that do not arise from a choice of design parameters, such as diameters, interferences, materials – they are verified during either qualification or delivery of the product (see Clause **4**). It also gives guidance and recommendations on:

a) qualification procedures (see Annex C); and

b) delivery conditions (see Annex D).

1 Scope

This British Standard specifies requirements for the assembly of powered and non-powered wheelsets with inboard bearings comprising elements conforming to the following standards.

a) BS 8535 for axle design.

b) BS EN 13261 or BS 5892-1 for axles.

c) BS EN 13262 or BS 5892-3 for wheels.

NOTE Some characteristics are specified as a function of Category 1 or of Category 2.

- *Category 1 is applicable for wheelsets whose operating speed is to exceed 200 km/h.*
- *Category 2 is applicable for wheelsets whose operating speed is not to exceed 200 km/h, and comprises two sub-categories:*
  - *Category 2a is applicable when the operating speed is to be up to and including 120 km/h;*
  - *Category 2b is applicable when the operating speed is to exceed 120 km/h, but is not to exceed 200 km/h.*

2 Normative references

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

BS 5892-1, *Railway rolling stock materials – Part 1: Specification for axles for traction and trailing stock*

BS 5892-3, *Railway rolling stock materials – Part 3: Specification for monobloc wheels for traction and trailing stock*

BS 5892-6, *Railway rolling stock materials – Part 6: Specification for wheelsets for traction and trailing stock*

BS 8535, *Railway applications – Wheelsets and bogies – Powered and non-powered axles with inboard bearings – Design method*

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

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

3 Assembly of components

3.1 General

All elements which are to comprise the assembled wheelset shall meet the geometric requirements of the applicable standards (see Scope); and the wheels and the axle shall be in the "ready for assembly" condition.

The elements comprising the wheelset can be shrink-fitted or press-fitted. The interferences to be used for fitting shall be as specified by the designer of each element to be fitted and shall be a function of the characteristics of the element material and the forces and torque to be transmitted by the fitting. This interference shall be specified according to the geometric tolerances of the axle seats specified in the axle product standard (see Scope).

During assembly of components prior to fitting wheels on the axle:

a) allowance shall be made for shrinkage at axle seats due to other nearby interference fits (e.g. gearwheels and other bearings); and

b) the level of interference between bearings and their shafts or housings shall be checked to ensure that it is within the specified tolerances.

Unless otherwise specified by the wheel designer, the interference values for wheel fittings specified in **3.2** shall be used.

For shrink-fitting, the whole of each wheel shall be heated to a temperature not exceeding 250 °C. If a different heating method is used, proof shall be provided that there has been no effect on the wheel characteristics as defined in BS EN 13262 or BS 5892-3.

If a different heating method is used, this shall be the subject of an agreement between the customer and the supplier. As part of this agreement, the supplier shall demonstrate at least that the axle and wheel characteristics as defined in the wheel and axle standards (see Scope) are not modified by the fitting. Then, the mechanical resistance of the assembly (see **4.1**) shall be demonstrated and the traceability documents for each fitting shall be defined so as to give the same type of information as recommended in **D.5**.

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

3.2 Interference between axle wheel seat and wheel hub bore

Unless otherwise specified by the wheel designer, the following interference values j shall be met:

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

b) for press-fitting: $0.0010\ dm \leq j \leq 0.0015\ dm + 0.06$

where dm is the mean diameter in mm.

3.3 Press-fitting diagram

3.3.1 Results to be achieved

NOTE For press fitting, the force-displacement curve gives confidence that the fitting has not damaged the contact surfaces and that the specified interference has been effective.

The shape of the press fitting curve to be obtained shall be as specified in Annex A.

The final fitting force, in MN, is a function of the force *F* specified in **4.1.1** and shall be within the range:

0.85 *F* < final fitting force < 1.45 *F*

This force shall be independent of any special pressing force to secure inboard components, i.e. bearings.

If there is any anomaly in the press-fitting diagram (See Annex A) or the final fitting-on force achieved exceeds the maximum value specified (1.45 *F*) by not more than by 10%, then mechanical resistance shall be tested in accordance with **4.1**.

3.3.2 Measurement method

The press used for the wheelset assemblies shall have a calibrated system to plot the diagram of the force value at each position of the element to be fitted obtained during the displacement of the latter on the axle.

The abscissa scale of displacement shall be at least equal to 0.5 times the actual displacement of the element to be fitted. The ordinate scale of force shall allow the force to be read at each point of the curve with an accuracy of 0.025 MN, using a force sensor with an accuracy of 0.01 MN. The abscissae and ordinates can be reversed.

In the case of point recording, at least one point shall be plotted per mm of relative displacement of the elements to be fitted and per 0.025 MN variation in force.

4 Wheelset characteristics

4.1 Mechanical resistance of the assemblies

4.1.1 Results to be achieved

In order to be able to transmit forces and torques between the fitted elements, the assemblies shall, when tested in accordance with **4.1.2**, withstand an axial force *F* for 30 s without any displacement between one element and another.

This force *F* shall be as specified by the designer of the element to be fitted.

Unless otherwise specified by the designer, the value of the force *F* in MN for wheels shall be:

$F = 4 \times 10^{-3}\ dm$

when $0.8\ dm < L < 1.1\ dm$

where:

dm is the mean diameter of the seat in mm; and

L is the length of the fitting in mm.

4.1.2 Test method

The test shall be carried out on a press equipped with a device to record forces.

The force shall be applied gradually up to *F* between one of the faces of the fitted component hub and the axle.

For press-fitted wheels, the test shall be carried out at least 48 h after fitting.

For shrink-fitted wheels, the test shall be carried out when the wheels and axle have returned to the same temperature after the fitting.

For shrink-fitted wheels where the wheel is used to retain the bearing, the test shall be carried out before the final location of the wheel (e.g. within 10 mm of final position of the wheel) (see note).

NOTE This is to prevent the bearing being affected by the heated wheel prior to the mechanical resistance test and then prior to the subsequent final press assembly.

4.2 Fatigue characteristics

4.2.1 General

The rotational bending fatigue limit value shall be demonstrated for the approval process (see Annex C) to ensure the permissible axle seat stresses are achieved for application of BS 8535.

NOTE 1 These fatigue characteristics are not the same for a solid axle as for a hollow axle. This is the result of the axle bore effect on stress distribution.

The tests shall be carried out on machines capable of creating rotating bending stresses in the area where it is necessary to initiate a crack.

For each limit F_3 and F_4, it shall be verified on three test pieces that no crack has appeared after 10^7 cycles of a load creating a surface stress equal to F_3 or F_4.

NOTE 2 The fatigue limit F_4 is verified by testing during qualification. The fatigue limit F_5 can be calculated using the ratios $F_4 / F_5 = 1.17$ and $F_3 / F_5 = 1.276$.

NOTE 3 The fatigue characteristics F_1 and F_2 of the axle are specified in BS 8535.

4.2.2 Fatigue test pieces

4.2.2.1 The area of the test piece where any crack initiates shall have a geometry, environment and surface condition representative of the axle under consideration.

For the fatigue testing of a wheelset, one wheel or test piece with similar dimensions (particularly the hub) shall be press-fitted or shrink-fitted on the wheel seat. The interference shall conform to **3.2**.

NOTE 1 It is not mandatory to use a wheelset as the test piece. An example test piece is shown in Figure 1 and Figure 2.

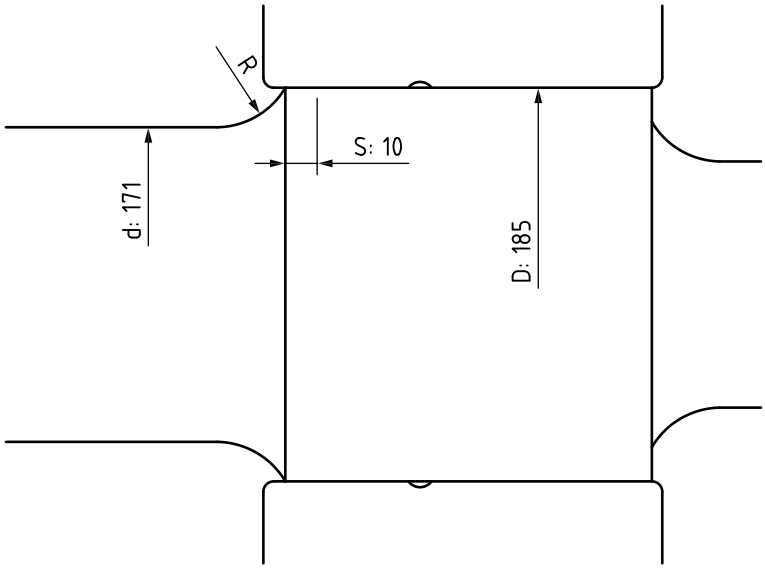
NOTE 2 This test piece is designed with a diameter ratio, Ø wheel seat (185)/Ø body (171) of 1.08. This diameter ratio is chosen in order to ensure verification of the assembly against fatigue resistance of the wheelset. If ever cracks occur, they will appear on the wheel seat and not on the body. Higher diameter ratios (lower than 1.12) can be used for all steel grades in this British Standard, but there is a risk that the cracks appear in the body radius:

- *with high ratios, there is a risk that the cracks appear in the body radius;*
- *with low ratios, there is a risk that the required stress on the wheel seat might not be reached.*

This ratio value might not be valid for other steels not identified in this British Standard.

Figure 1 **Drawing of the test piece geometry required for fatigue tests**

Dimensions in mm

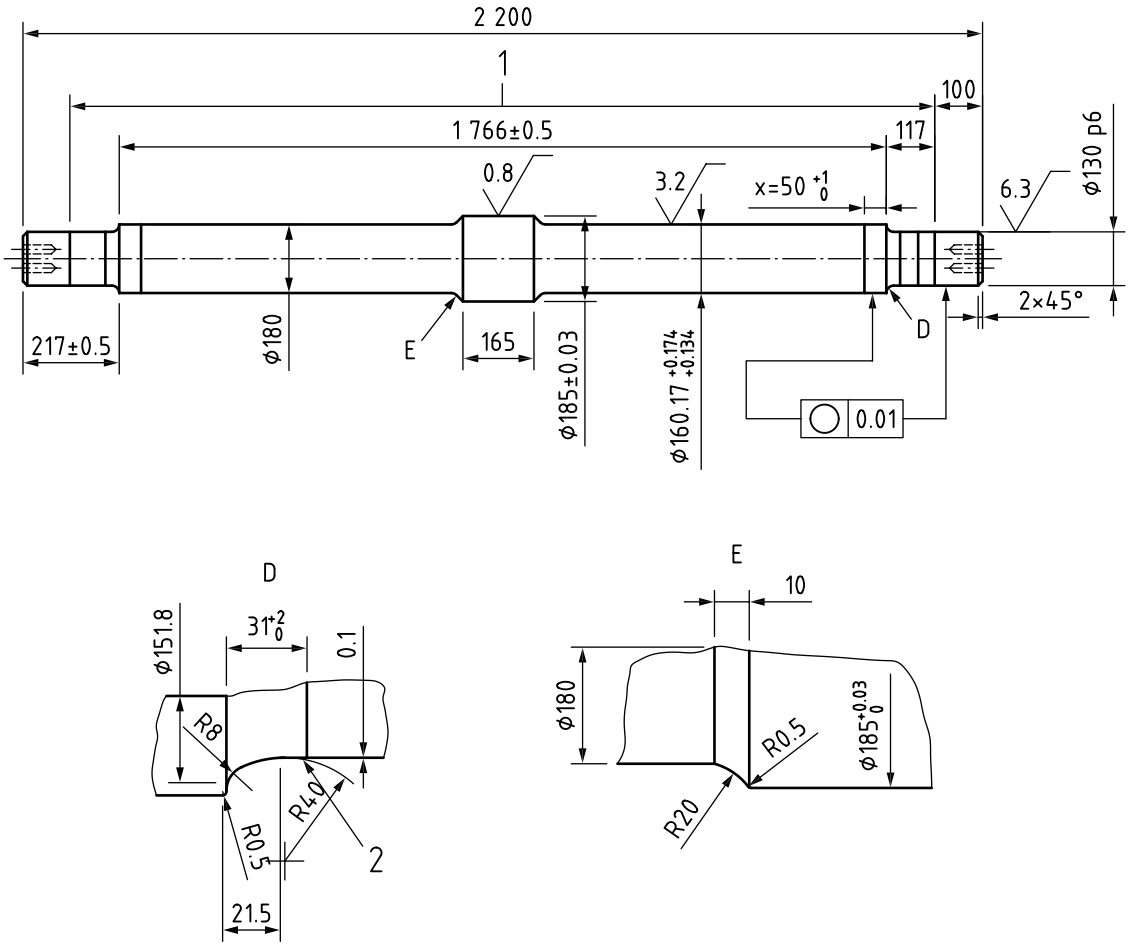


Key

S Reference section 10 mm from the end of the wheel seat

R Radius according to the geometry specified in BS EN 8535

Figure 2 **Example of a test piece**



Key

1 Centre-to-centre dimension of journals: 2000

2 Rounded edge

4.2.2.2 The tests shall be carried out on machines capable of creating rotating bending stresses in the area where it is necessary to initiate a crack.

For each limit F_3, and F_4, it shall be verified on three test pieces that no crack has appeared after 10^7 cycles of a load creating a surface stress equal to F_3 or F_4.

These stress levels shall be calculated on the seat (see **4.2.2.1**), in accordance with the beam theory, disregarding the interference stresses.

4.3 Electrical resistance

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

The test voltage shall be in the range 1.8 V – 2.0 V DC.

During the measurement of electrical resistance the wheelset shall be supported in an insulated manner so as not to influence the results. The means and method used for this measurement shall be defined in an agreement between the customer and the supplier (see Annex D).

4.4 Imbalance

4.4.1 Values to be achieved

When the requirement is specified, the dynamic imbalance in the plane of the wheel for each wheel shall be within the limits shown in Table 1.

Table 1 **Maximum permissible dynamic imbalance for non-powered wheelsets**

Maximum speed (*V*) of wheelset km/h	**Passenger rolling stock** g.m	**Freight rolling stock** g.m
$V \leq 120$	125	–
$120 < V \leq 200$	75	75
$V > 200$	50	50

NOTE Permissible dynamic imbalance values for powered wheelsets to be agreed between the customer and supplier.

4.4.2 Test piece

The imbalance shall be assessed on a fully assembled and machined wheelset.

4.4.3 Assessment method

The assessment method shall be appropriate to the configuration of the wheelset either by test or alternative calculated value subject to agreement between the customer and supplier.

4.5 Dimensions and tolerances

4.5.1 General

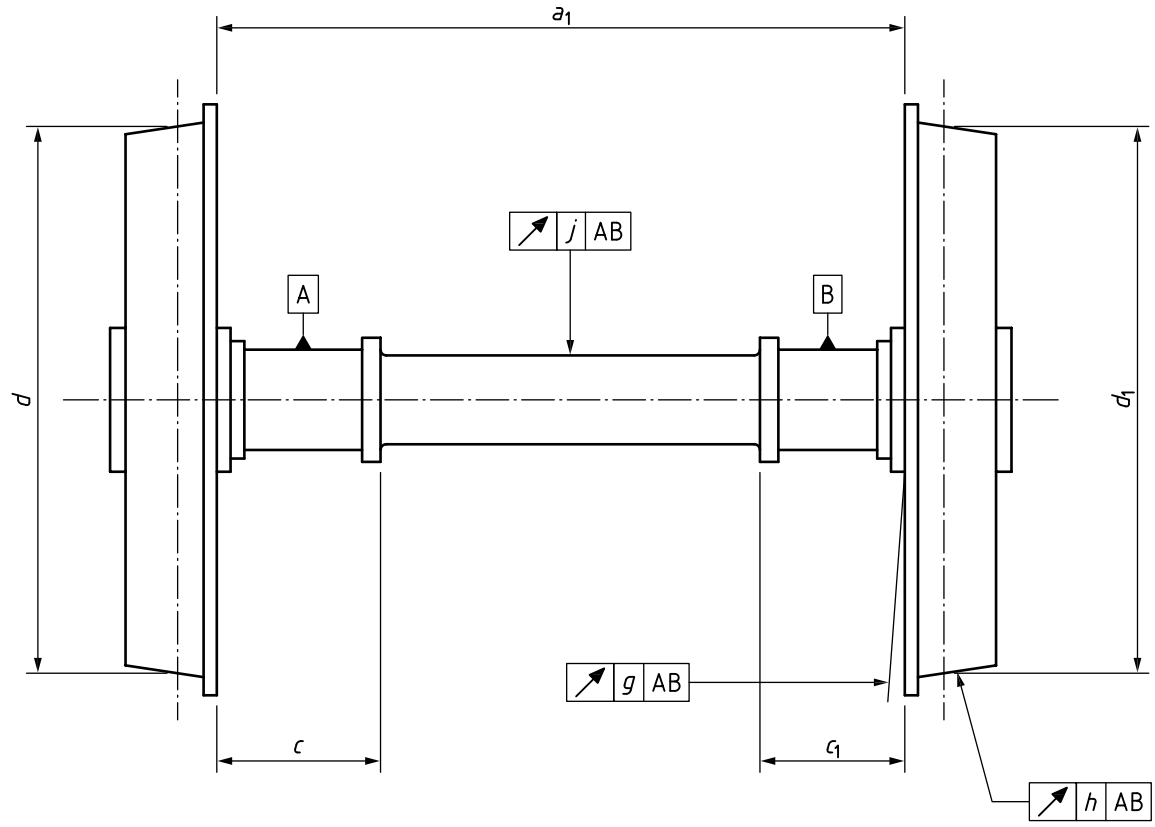
The dimensions of the wheelset shall conform to the design drawings, and the dimensional and geometric tolerances to be applied when assembling the different parts of the wheelset shall conform to **4.5.2** to **4.5.4**.

NOTE The values are dependent on the category of the wheelset and are given for measurements taken with no load on the wheelset.

4.5.2 Wheels

Wheel parameters shall conform to Figure 3, with the tolerances given in Table 2.

Figure 3 **Wheel parameters**



NOTE Bearing assemblies omitted for clarity.

Table 2 **Tolerances on wheel parameters**

Description	**Symbol**	**Category 2** mm		**Category 1** mm
		a	**b**	
Distance between the internal wheel faces [A]	a_1	+2 [B]		+2 [B]
		0		0
Difference in distances between the internal face of each wheel and the outside of the bearing abutment flange on the axle	$c - c_1$ 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] Measurement at 60 mm beneath the top of the flange.

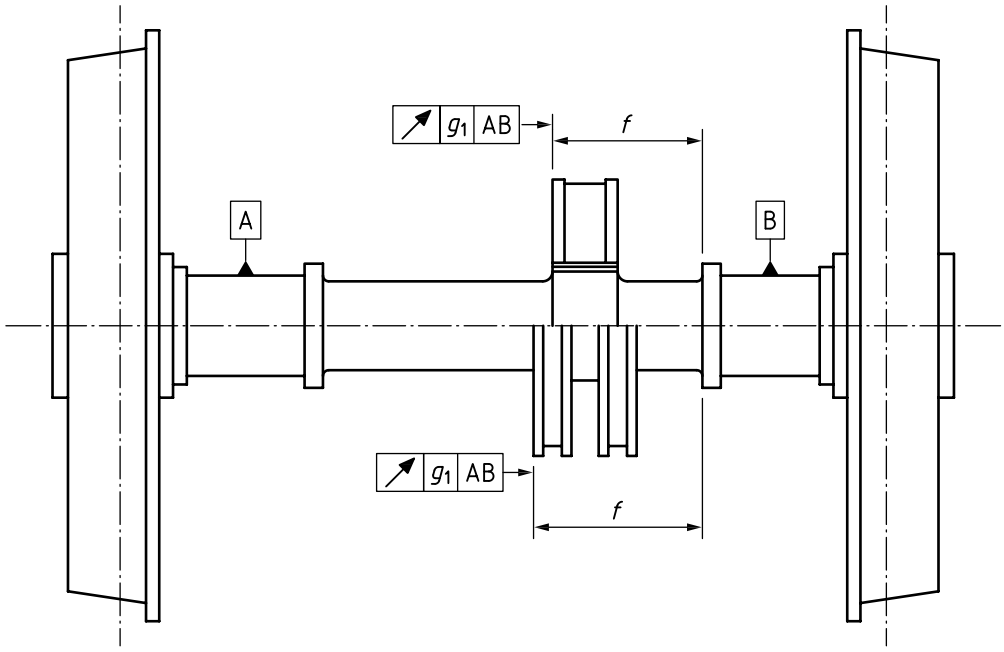
[B] The tolerances may be changed for special designs of wheelsets.

4.5.3 Brake discs

4.5.3.1 One or two seats

Brake disc parameters shall conform to Figure 4 and Figure 5, with the tolerances given in Table 3, Table 4 and Table 5.

Figure 4 **Single-seat axle for one or two brake discs**



NOTE Bearing assemblies omitted for clarity.

Table 3 **Axial run-out of the internal face**

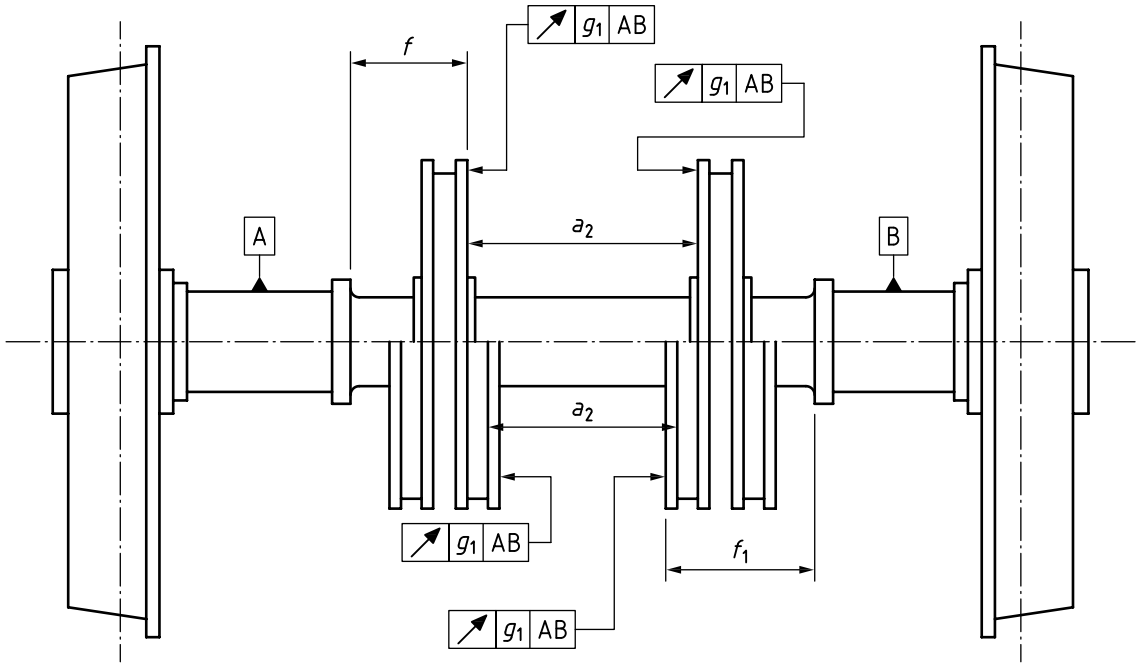
Description	**Symbol**	**Category 2a** mm	**Category 2b** mm	**Category 1** mm
Axial run-out of the internal face [A)]	g_1	≤0.75	≤0.5	≤0.5

[A)] See Figure 4 and Figure 5. Measurements at 30 mm from the external diameter.

Table 4 **Tolerances for single-seat axles for one or two brake discs: Description Symbol Category 1 and 2**

Description	**Symbol**	**Category 1 and 2** mm
Distance between the internal faces of the disc periphery and the outside of the bearing abutment flange on the axle	f	±0.5

Figure 5 **Double-seat axles for two or four brake discs**



NOTE Bearing assemblies omitted for clarity.

Table 5 **Tolerances for double-seat axles for two or four brake discs**

Description	**Symbol**	**Category** **1 and 2** mm
Distance between the internal faces of the disc peripheries	a_2	±0.5
Difference in distances between the internal face of each disc periphery and the outside of the bearing abutment flange on the axle.	$f - f_1$ or $f_1 - f$	≤1

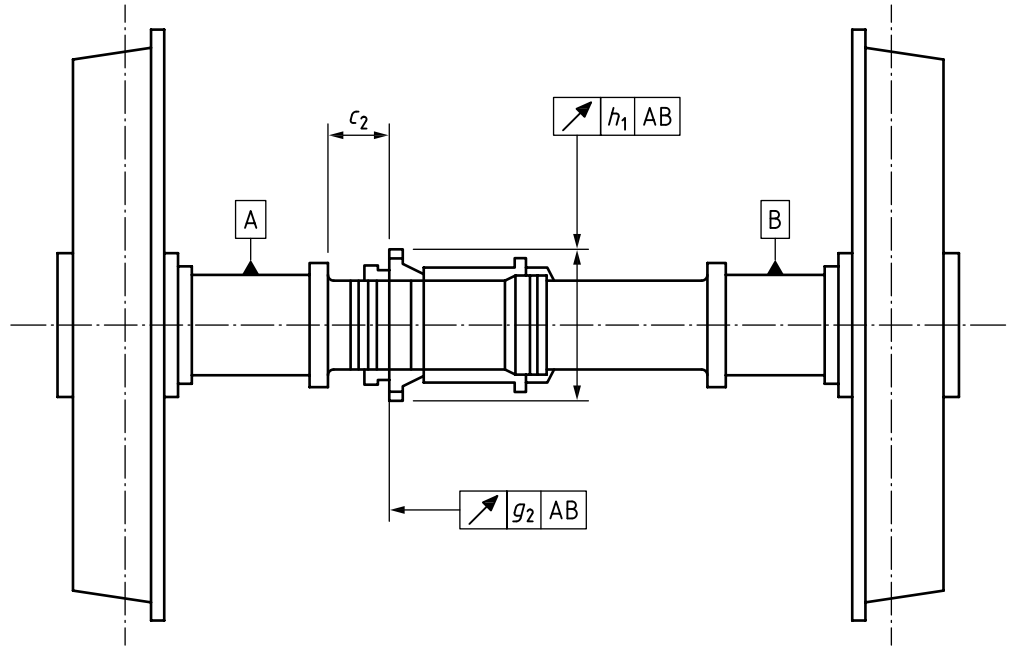
4.5.3.2 More than two seats

If there are more than two seats for the brake discs, the tolerances on the dimensions such as a_2 or $f - f_1$ (see Figure 5) shall be as given in Table 5.

4.5.4 Cylindrical gear wheels for motor axle, reducing gears, etc.

The tolerances of the parameters in Figure 6 shall be as given in Table 6.

Figure 6 **Cylindrical gear wheels for motor axle, reducing gears, etc.**



NOTE Bearing assemblies omitted for clarity.

Table 6 **Tolerances for cylindrical gear wheels for motor axle, reducing gears, etc.**

Description	Symbol	Category 2 mm	Category 1 mm
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 outside of the bearing abutment flange on the axle [A)]	c_2	±0.5	±0.5

[A)] See Figure 6.
[B)] In accordance with the specifications of the designer.

4.6 Protection against corrosion and impacts

The wheelset components shall be protected against corrosion and impacts in accordance with the applicable standards (see Scope).

Cavities arising from the overhang of the wheel hub on the wheel seats shall be protected or filled with an anticorrosion product.

4.7 Marking

The constituent parts of the wheelsets shall be marked in accordance with the applicable standards (see Scope).

The wheelset shall (in accordance with the purchase order) be identified as a minimum by the following:

a) assembler's marks;

b) serial number.

These marks shall be located at the end of the axle which already bears the axle marks specified in BS EN 13261.

At the other end of the axle, one half of the surface shall be left free of any marks to permit maintenance identification and the other half for any other marking.

The marks shall be stamped. Any protruding burrs resulting from the stamping shall be levelled to allow ultrasonic examination to be carried out in service.

Annex A (normative) Characteristics of the press-fitting curve

The characteristics of the press-fitting curve shall be as specified in Figure A.1.

The fitting force shall start to increase before the wheel seat displacement onto the wheel hub reaches 30 mm.

The force shall then increase continuously without falling outside the limit curve values given by the curves specified by the designer of the component to be fitted, though the following are permitted:

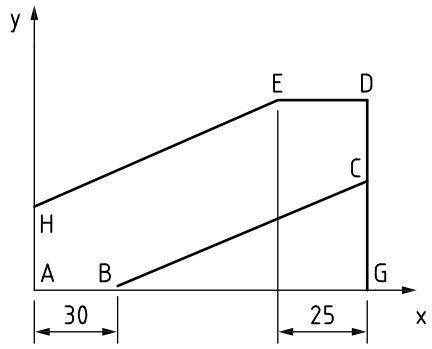
a) a decrease in the fitting force at the groove for removal by oil injection, in which case the maximum force reached before the groove is reached again within a further displacement of 25 mm;

NOTE During this decrease, the fitting force value can be lower than that specified by the lower curve.

b) a maximum decrease of 0.05 MN over the last 25 mm of displacement;

c) curves showing local deviation, if previously agreed between the customer and supplier, or on qualification of the product.

Figure A.1 **Characteristics of the press-fitting curve**



NOTE

- AB, BC, HE and ED are portions of a straight line, AG is equal to the length of the seat;

- for the wheels, the positions of the different points are as follows:

$Y_H = 1.3\ Ø;\ Y_C = 0.85\ F;\ Y_D = Y_E = 1.45$ F

where:

Ø is the nominal diameter of the wheel seat, in metres

F *is the fitting force specified by the designer of the component to be fitted (wheel, disc, gear wheel, etc.)*

Key

x Distance in mm

y Fitting force *F* (MN)

Annex B (informative) Documents for the identification of wheelset components

Figure B.1 shows the document to be used for a single wheelset, usually of Category 1 or of a powered wheelset.

Figure B.2 shows the document that can be used for a number of wheelsets.

A summary of the information contained in Figure B.1 and Figure B.2 is given in Table B.1.

Figure B.1 **Document for identification of components of a single wheelset, usually of Category 1 or of a powered wheelset**

Wheelset	Type	22
	Serial number	4
	Ownership mark	

1- Constituent elements

	Axle	LH wheel	RH wheel
Drawings	34	36	
Wheel ref.		36	36
Supplier	35	37	37
Grade	7	11	11
Cast no./serial no.	5/6	9	9
Delivery date	8	10	10
Wheel dia.		14	14
		LH disc	RH disc
Drawing		40	40
Disc ref.		46	46
Supplier		47	47
Delivery date		48	48

Axle box bearings	LH	RH
Type	30	
Supplier	41	
Serial no.	42	42
Date of manufacture	43	43
Assembly date	44	

Grease	31	
Batch no.	31	31
Date of manufacture	31	31
Date of greasing	44	44

Other components

	Motor axle	Transmission
Drawing		
Serial no.		
Supplier		
Delivery date		

2 - Assembly characteristics

		Wheels			Discs			Gear wheels	
		Allow.	LH meas.	RH meas.	Allow.	LH meas.	RH meas.	Allow.	Meas.
Assembly		29	13	13	49	50	50	56	57
Fitting force		28	12	12	51	52	52	58	59
Assembly condition	PF/SF	45			45			45	
	Cter.	53			53			53	

Bearing play				
Allowable				Weight of grease
max	53	min	53	
LH meas.		RH meas.		
54		54		55

3 - Controls

	Wheels			Discs			Gear wheels	
	Allow.	LH meas.	RH meas.	Allow.	LH meas.	RH meas.	Allow.	Meas.
Radial run-out	60	61	61	60	61	61	60	67
Axial run-out	69	61	61	60	61	61	60	67

Imbalance		Electrical resistance	
Allow.	Meas.	Allow.	Meas.
63	64	63	65

4 - Corrosion protection

Type of paint: 66

Type of coating: 66

5 - Distance between inside faces

	Free
Allowed	67
A	67
B	67
C	67
D	67

Name of inspector	Company	Date	Signature	Order No.
33	1			16
1 - Representative of wheelset manufacturer				

Figure B.2 **Document for identification of components of several wheelsets**

14

1			Wheelset report Components			Subject of report No. 15										Annex 17 Internal reference 16			
			Axle grade 7			LH wheel steel grade 11			Interference				RH wheel steel grade 11			Interference			
2 Works no.	3 Ownership mark	4 Serial number	5 Cast no.	6 Serial no.	8 Date	9 Cast no.	10 Date	14 Wheel diameter	13a Wheel bore diameter	13b Axle seat diameter	13c Inter-ference	12 Fitting force	9 Cast no.	10 Date	14 Wheel diameter	13a Wheel bore diameter	13b Axle seat diameter	13c Inter-ference	12 Fitting force
Balancing 18 Axial run-out Radial run-out 20					Allowable min. Allowable max.				29							29			
												28							28

Bearing type 30

Wheelset 22 Grease 31 Batch no. 19

Customer name 21 Customer order no. 24 Destination 25

Customer order no. 24 Tare 26 Loading date 27

Table B.1 **Information on the characteristics of the wheelsets**

Element of the wheelset	Reference	Identification
Wheelset manufacturer	1	Name and production plant
	(2,3,4)	
Axle identification	5	Cast number
	6	Serial number
	7	Steel grade
	8	Month and year of manufacture
	34	Axle drawing
	35	Manufacturer
Wheel classification	9	Cast number
	10	Month and year of manufacture
	11	Steel grade
	12	Fitting pressure
	13a	Wheel bore diameter
	13b	Wheel bearing diameter
	13c	Assembly
	14	Wheel diameter
	28	Tolerance on fitting pressure
	29	Tolerance on interference
	32	Type of lubricant
	36	Wheel drawing and markings
	37	Wheel manufacturer
	45	Type of assembly (SF for shrink-fitting; PF for press-fitting)
	53	Type of lubricant if PF; type of heating temperature if SF
Bearing identification	30	Type of axle and box bearings
	31	Type of grease, batch number, date of manufacture
	41	Supplier
	42	Bearing serial number
	43	Date of manufacture
	44	Date of assembly
	53	Allowable bearing play
	54	Measured bearing play
	55	Weight of grease
Disk/brake identification	40	Drawing
	46	Serial number
	47	Manufacturer
	48	Delivery date
	49	Tolerance on disc interference
	50	Measured value of disc interference
	51	Tolerance on fitting force
	52	Fitting pressure value
Other suitable elements	56	Imposed interference
	57	Measured interference
	58	Imposed fitting force
	59	Measured fitting force
Controls	60	Allowable axial run-out
	61	Measured axial run-out
	63	Maximum allowable imbalance

Table B.1 **Information on the characteristics of the wheelsets**

Element of the wheelset	Reference	Identification
Controls	64	Measured maximum imbalance
	65	Good or bad
	66	Type of paint
	67	Measurement of internal faces of free wheelset
Wagon reference	23/26	Vehicle references (weight, number, etc.)
	25	Delivery site
	27	Loading date
Wheels and wheelset	18	Imbalance
	19	Batch number
	20	Axial run-out/radial run-out

Annex C (informative) Product qualification

NOTE The text of this annex is reproduced with appropriate modifications from BS EN 13261 and BS EN 13262 as an example qualification procedure, and is included for the convenience of the user of the standard.

C.1 General

A wheelset should be qualified before being used on the Railway Network.

This clause specifies the requirements and procedures to be applied for product qualification.

Qualification of a wheelset is directly linked to the supplier and a wheelset can only be qualified if the supplier meets the requirements specified in **C.2.1**.

These requirements are to be applied in the following cases:

a) any wheelset from a new supplier;

b) any change in the assembly of qualified wheelset.

C.2 Requirements

C.2.1 Requirements to be met by the supplier

C.2.1.1 General

Where manufacture of a wheelset involves more than one supplier, the following requirements should be met by all concerned.

C.2.1.2 Quality organization

The supplier should operate a quality assurance system conforming to BS EN ISO 9001.

C.2.2 Qualification of personnel

The personnel responsible for non-destructive testing should be qualified according to BS EN 473.

C.2.2.1 General

C.2.2.1.1 Equipment

The equipment used by the supplier for manufacture, control and monitoring should allow the requirements of this standard to be met.

C.2.2.1.2 Requirements to be met by the product

The product should meet the product requirements specified in Clause **4**.

The traceability of each component and its assembly should be established.

C.3 Qualification procedure

C.3.1 General

The qualification procedure comprises four successive stages:

a) supply of file by the supplier;

b) evaluation of the manufacturing equipment and the manufacturing processes;

c) laboratory tests;

d) product testing.

C.3.2 Documentation required

When a request for qualification is submitted, the supplier should provide a file comprising:

a) a description of the products that are the subject of the request;

b) a description of the company stating:

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

2) annual production of all the products;

3) a list of all the means of production and control;

c) data about the company organization, with the relevant organization charts;

d) a description of the manufacturing processes with explanations of the different stages of manufacture;

e) qualification documents for the various components of the product to be qualified;

f) results of tests on the products submitted for qualification.

If a file has already been provided by the supplier for the qualification of a different wheelset, the file to be provided by this supplier for qualification of a new wheelset should only include elements specific to this product or new to the company.

C.3.3 Evaluation of the manufacturing plant and processes

This evaluation comprises:

a) inspection of the manufacturing plant and examination of the production processes;

b) inspection of the wheelset components manufacturing plant and examination of their production processes;

c) auditing of the manufacturing organization to confirm whether the requirements of **C.2.1** have been met;

d) auditing of the information supplied in the documents referred to in **C.3.1**.

At the end of this stage, a report should be produced. It should identify all the production processes including those of the wheelset components. It should give an assurance that the evaluation satisfies the requirements of **C.2.1** for the qualification procedure to continue.

C.3.4 Laboratory tests

This stage shall verify that the fatigue limits defined in **4.2** have been achieved.

At the end of this stage, a report shall be produced. It shall confirm the geometry and the production process of the test pieces.

C.3.5 Testing of finished products

All the characteristics defined in Clause **4** (except for fatigue) are to be verified on 10 wheelsets.

A report should be issued describing both the wheelsets subjected to the test and the test procedures and results. It should specify whether or not the wheelsets meet the requirements.

If the outcome is satisfactory, a provisional qualification certificate may be issued.

Once this provisional qualification certificate has been awarded, the same verifications as carried out on the 10 wheelsets should be carried out on at least one wheelset in each 30 wheelsets until 300 wheelsets have been delivered.

The product is qualified if these verifications do not show any repeated defects in the product.

Another report should be issued identifying the wheelsets, the verifications and their results.

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

C.4 Qualification certificate

C.4.1 Condition of validity

The certificate of qualification should specify the limits of validity for:

a) the diameters and lengths of the seats;

b) the steel grades and the geometry of the different components of the wheelset;

c) the level of residual stresses induced in the hub by the fitting.

C.4.2 Modification and extension

At the request of the supplier, the scope of the certification validity can be modified or extended if:

a) other products are to be considered;

b) important parameters have been modified (manufacturing processes, quality organization, etc.).

C.4.3 Transference

In the case of a change in ownership, an existing qualification may, if requested, be transferred to another company if the relevant content and conditions prior to the qualification have not been modified.

C.4.4 Lapsed certification

The manufacturing equipment and processes described in **C.3.3** should be reassessed in the following cases:

a) if, after 5 years, 300 wheelsets have not been supplied following the provisional qualification;

b) if, in a period of 2 years, no wheelsets have been supplied within the scope of the product that was the subject of the qualification.

C.4.5 Cancellation

If the customer registers significant defects in the product, the parts of the qualification procedure concerned shall be repeated.

If the supplier has not ensured that important conditions of the qualification were met, it may be cancelled.

C.5 Qualification file

A qualification file should be prepared for each qualified product containing the following documents:

a) the application request from the supplier;

b) the documents provided by the supplier (see **C.3.2**);

c) the evaluation reports (see **C.3.3**);

d) the laboratory test reports (see **C.3.4**);

e) the product test reports (see **C.3.5**);

f) the qualification certificate (see **C.4**).

Annex D (informative) Product delivery

D.1 General

The customer should specify the following in the order:

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

b) the drawings of the wheelset;

c) the category of the wheelset;

d) the press-fitting or shrink-fitting requirements;

e) the ultrasonic test method, if this test is required (see **D.3.2**);

f) the marking of the wheelset (see **4.7**);

The customer and the supplier should agree on the following points:

1) the fitting method (see **3.1**);

2) the electrical resistance test method (see **4.3**);

3) the imbalance test method (see **4.4**);

4) the optional dimensional controls (see **D.3.1**).

For delivery, some characteristics are verified on each wheelset (see **D.2**). For the other characteristics specified in Clause **4**, the supplier should propose a product quality plan which should be agreed with the customer.

Each wheelset should have documents which record its traceability.

D.2 Specific verifications

The following checks should be carried out on each wheelset:

a) conformity of the fitting diagram for press-fitting (see **3.3**);

b) dimensions: $d - d_1$, h, g, a_1 (see **4.5**).

For shrink-fitting, the resistance of the assembly should be verified on 100% of the wheelsets supplied (see **4.1**).

D.3 Optional checks

D.3.1 Dimensional check

Following agreement between the customer and the supplier, other dimensions specified in **4.5** may be verified on all or a proportion of the wheelsets delivered.

D.3.2 Ultrasonic examination

If required by the operator's maintenance policy, the axles of the assembled wheelsets can be subject to an ultrasonic examination in order to detect any defects of a critical size resulting from the assembly.

The process should conform to an agreed procedure and should be carried out by certified and authorized operators using approved equipment.

An authorized calibration axle should be available to calibrate the equipment prior to the examination.

An individual permanent record should be made of each test.

D.4 Allowable rectification

Repairs to wheelsets are authorized if the following conditions are met:

a) excessive imbalance, dimensions or geometrical tolerances beyond allowable limits can be corrected by machining or grinding within the dimensions and tolerances given in the drawings and standards for each component;

b) a defective assembly of one of the components can be corrected by dismantling and reassembly;

c) different shapes of the fitting curves (in the case of press-fitting) are tolerated within the limits of the standard diagrams that have been agreed between the customer and the supplier;

d) after machining, any defect that could have an adverse effect on the integrity of the wheelset is removed;

e) damage to the corrosion protection can be repaired if, after repair, the characteristics of the repaired zones are the same as those of the other zones.

If, during press-fitting, dismantling or a proof-loading operation, the fitted surfaces of the two components in contact are damaged, reuse of these components is allowed under the following conditions.

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

2) If the damage involved scoring of the wheel seat during dismantling, the seat can be machined to remove the scoring and another wheel can

be fitted as long as 50% of the thickness allowance used for maintenance purposes remains and this has been agreed with the customer.

3) An approved method of metal spraying to obtain the correct interference is allowed if agreed beforehand with the customer. In addition, this method should be qualified by a procedure that includes fatigue testing in order to prove that the fatigue characteristics of such a repaired wheelset are the same as those of a non-repaired wheelset.

Whenever an allowable rectification is used, it should be described in the traceability documents for the rectified wheelset.

D.5 Documents

D.5.1 Shrink-fitting

For each shrink-fitted element, there should be assigned a document with the following information.

a) Name of the supplier carrying out the fitting operation.

b) Date of the fitting operation.

c) Identification of the wheelset.

d) Fitted element (wheel, disc, etc.).

e) The following dimensions.

1) Mean diameter of the seat.

2) Mean diameter of the bore of the fitted element hub.

3) Interference.

f) Position "R" (right) or "L" (left) if two identical elements are fitted to one axle.

g) Mechanical resistance record.

Examples of the documents are given in Annex B.

D.5.2 Press-fitting

For each press-fitted element, there should be assigned a press-fitting diagram record (see **3.3**) containing the following information.

a) Name of the supplier carrying out the fitting operation.

b) Date of the fitting operation.

c) Identification of the wheelset.

d) Fitted element (wheel, disc, etc.).

e) The following dimensions.

1) Mean diameter of the seat.

2) Mean diameter of the bore of the fitted element hub.

3) Interference.

f) Position "R" (right) or "L" (left) if two identical elements are fitted to one axle.

g) Final fitting force *F*.

This information can be listed in the documents given in Annex B.

D.5.3 Components

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

D.6 Quality plan

D.6.1 General

The quality plan should be drawn up by the supplier and be agreed with the customer.

This quality plan should refer to the quality manual and contain the elements specific to the product.

D.6.2 Objectives

The plan, which should be drawn up at the time of the offer, should describe the arrangements made by the supplier to achieve and control the quality of the products involved. Where optional requirements have been selected, these should be justified.

This quality plan should specify the inspection required during manufacture and on the delivered products. The inspection requirements may be listed in a manufacturing control plan.

D.6.3 Validity

Any modification to the quality plan should be made known to, and agreed with, the customer.

If any nonconformity is detected by the customer on the delivered product, the quality plan should be reviewed.

Bibliography

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 473, *Non-destructive testing – Qualification and certification of NDT personnel – General principles*

BS EN ISO 9001, *Quality management systems – Requirements*

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™