
International Standard



1005/8

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

**Railway rolling stock material —
Part 8 : Solid wheels for tractive and trailing stock —
Dimensional and balancing requirements**

Matériel roulant de chemin de fer — Partie 8 : Roues monoblocs pour matériel moteur et matériel remorqué — Prescriptions dimensionnelles et d'équilibrage

STANDARD PREVIEW

First edition — 1986-11-15

(standards.iteh.ai)

ISO 1005-8:1986

<https://standards.iteh.ai/catalog/standards/sist/6f5116d6-5a1c-4629-8c3a-e0bb5a734bd2/iso-1005-8-1986>

UDC 629.4.027.4

Ref. No. ISO 1005/8-1986 (E)

Descriptors : railway equipment, railway rolling stock, steel products, wheels, specifications, dimensions, balancing, acceptance testing.

Price based on 10 pages

Preis: F

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 1005/8 was prepared by Technical Committee ISO/TC 17, *Steel*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Railway rolling stock material — Part 8 : Solid wheels for tractive and trailing stock — Dimensional and balancing requirements

1 Scope and field of application

1.1 This part of ISO 1005 specifies

- a) the dimensional requirements¹⁾ shown in table 3 and table 4 (see also 5.1);
- b) the surface roughness (see 5.2); and
- c) the residual unbalance (see 5.3)

of forged, rolled or cast solid wheels with curved or straight webs in various degrees of finish.

NOTE — The compilation of an International Standard for material testing and dimensional requirements of wheelset components and assembled wheelsets is difficult because of the different ways in which railways have developed, in both the commercial and the operating sense, in various parts of the world. These different forms of development are characterized, for example, by railway systems in which freight services are integrated with intensive and perhaps high-speed passenger services and by systems largely dedicated to the haulage of freight. The infrastructures of these two systems are normally different and this and commercial policy can determine the practice adopted in wheelset design in terms of both materials and physical characteristics.

The relevant parts of ISO 1005 acknowledge, or will in a future revision acknowledge, these differences by providing in the relevant clauses two categories of material and related quality testing requirements designated as testing categories A and B and two tolerance categories for dimensional requirements designated as Y and Z.

Category A corresponds to the material and quality testing requirements given in the present editions of ISO 1005/3 and ISO 1005/6. Category B will be considered in the revisions of ISO 1005/3 and 1005/6.

The most obvious difference between these categories A and B is that the mechanical properties are specified

- in the case of category A on the basis of tensile and impact tests;
- in the case of category B on the basis of hardness tests.

The differences between the values of the tolerance categories Y and Z are given

- for solid wheels in this part of ISO 1005 (see especially table 4);
- for wheelsets in ISO 1005/7.

Until now, within ISO/TC 17/SC 13, it was impossible to clarify in detail the conditions under which the one or the other testing and tolerance category is preferable. As a general guide, it shall, however, be noted

— that the combination of testing category A with tolerance category Y is principally applied on railway systems where frequent or high-speed passenger operation is predominant or where freight and passenger services are intensively integrated;

— that the combination of testing category B and tolerance category Z is principally applied on railway systems where freight operation is predominant and where freight and passenger services are less integrated;

— that the final combination of the categories shall be left to the discretion of the purchaser.

1.2 The quality requirements for solid wheels are given in ISO 1005/6.

1.3 In addition to the requirements of this part of ISO 1005, the general technical delivery requirements of ISO 404 apply.

2 References

ISO 404, *Steel and steel products — General technical delivery requirements*.

ISO 468, *Surface roughness — Parameters, their values and general rules for specifying requirements*.

ISO 1005, *Railway rolling stock material*

— *Part 6: Solid wheels for tractive and trailing stock — Quality requirements*.

— *Part 7: Wheelsets for tractive and trailing stock — Quality requirements*.

ISO 1101, *Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings*.

3 Information to be supplied by the purchaser

The purchaser shall, as partly indicated in ISO 1005/6, supply the following information regarding dimensional, roughness and unbalance requirements in his enquiry and order:

1) The term "dimensional requirements" covers machining allowances, dimensional tolerances and tolerances of form and position.

- a) the number of this part of ISO 1005;
- b) a dimensioned drawing;
- c) which tolerance category shall apply, i.e. either Y or Z, and in the case of Y category in which speed regime it is intended that the wheel will operate, i.e. normal (YN) or high speed (YH) (see tables 3 to 5);
- d) the degree of finish (see clause 4);
- e) the dimensional requirements and roughness values if they deviate from this part of ISO 1005;
- f) the roughness values if R_v is to be used (see 5.2.1);
- g) if balancing is required (see ISO 1005/6) and the speed range applicable (see 5.3.1), the values to be applied for tractive stock (see 5.3.2), and the values for trailing stock if different from 5.3.1;
- h) if specific geometrical tolerances are required (see 5.1.1.3.2);
- j) if one of the optional verifications is required (see tables 3 to 5 and 6.1).

4 Terms for the degree of finish

The various conditions of wheel and stages of manufacture referred to in this part of ISO 1005 are given in 4.1 to 4.5.

4.1 Unmachined

For forged or rolled wheels, "unmachined" indicates the "black" wheel with no subsequent machining other than that which may be carried out by the manufacturer to enable the wheel to conform to the required standard. For cast wheels, "unmachined" indicates the "as-cast" wheel without any subsequent machining other than any dressing carried out by the manufacturer to enable the wheel to conform to the required standard.

4.2 Rough machined

In accordance with ISO 1005/6, "rough machined" indicates a condition in which the wheel has received no final machining, but has been rough machined on all or only certain portions which have to be machined.

4.3 Half finished

In accordance with ISO 1005/6, "half finished" indicates a condition in which the wheel has received final machining on certain portions which have to be machined and are considered as finished, whereas other portions are unmachined or rough machined.

4.4 Finished

In accordance with ISO 1005/6, "finished" indicates the wheel condition in which all portions of the wheel which are required,

the order or drawing, to be machined have undergone all machining operations other than those normally carried out by the wheelset manufacturer immediately before mounting the wheel on the axle, for example, the final "finishing" operation on the bore. The latter restriction means that the requirements for the rough finished bore are covered in table 4 under the term "finished", whereas those for the finally finished bore are covered by the term "ready for assembly".

4.5 Ready for assembly

"Ready for assembly" indicates the wheel condition in which all necessary machining operations have been carried out.

5 Requirements

5.1 Dimensional requirements

5.1.1 For forged or rolled solid wheels, 5.1.1.1 to 5.1.1.3 shall apply:

5.1.1.1 For unmachined portions of wheels, the dimensional requirements shall be as indicated in table 3 [see also table 4, footnote 7)].

5.1.1.2 For rough machined portions of wheels, the dimensional requirements shall be agreed at the time of enquiry and order.

5.1.1.3 For finished portions of wheels (see 4.4) and for wheels in the condition "ready for assembly" (see 4.5), the dimensional requirements shall be as indicated in table 4 and in 5.1.1.3.1 or 5.1.1.3.2.

5.1.1.3.1 The manufacturer shall ensure that for all relevant geometrical characteristics not indicated in table 4 (for example for the geometrical characteristics given in table 5) the tolerances are maintained such that, when the wheels are assembled on to the axle (see ISO 1005/7), the tolerance values of the wheelset as required in ISO 1005/7 are achieved without further machining.

5.1.1.3.2 If in special cases, despite the difficulties mentioned in 6.1, instead of the requirements of 5.1.1.3.1 specific geometrical tolerances of the wheel are required for the compliance of the wheel with the order, this shall be agreed at the time of the enquiry and order. In this case the tolerances shown in table 5 shall apply, unless otherwise agreed.

5.1.2 For cast solid wheels, 5.1.2.1 and 5.1.2.2 shall apply.

5.1.2.1 For "finished" wheels and for wheels in the condition "ready for assembly", the dimensional requirements shall be as indicated for category Z in table 4.

5.1.2.2 For cast wheels, 5.1.1.3.1 or 5.1.1.3.2 also apply. In the latter case the geometrical tolerances shall comply with the requirements for category Z in table 5.

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5.2 Surface roughness

5.2.1 Unless otherwise agreed, the arithmetic mean deviation of the profile, R_a , for machined surfaces in the "finished" and "ready for assembly" conditions shall be as shown in table 1.

Table 1 — Surface roughness

Part	Condition	Arithmetic mean deviation of the profile, R_a (μm)
Bore	Finished	< 12,5
	Ready for assembly: — Wheels of category Y — Wheels of category Z	1,6 to 3,2
		< 12,5
All other parts	Finished or Ready for assembly	< 12,5

1) If the maximum height of the profile, R_v (see ISO 468), is used, the values shall be agreed between the interested parties.

5.2.2 For unmachined surfaces in the "finished" and "ready for assembly" conditions [see table 4, footnotes 3) and 7)], the surface quality shall be agreed at the time of enquiry and order.

5.3 Residual static unbalance

5.3.1 If a maximum static unbalance is required (see ISO 1005/6), the static unbalance for solid wheels for trailer stock other than freight stock in the conditions "finished" or "ready for assembly", unless otherwise agreed, shall not exceed the values in table 2.

Table 2 — Static unbalance

Operating speed, v (km/h)	Maximum static unbalance (g·m)
$v < 100$	—
$100 < v < 120$	125
$120 < v < 200$	75
$v > 200$	50

5.3.2 If required for solid wheels for tractive stock, maximum values of static unbalance shall be agreed at the time of enquiry and order.

5.4 Oil injection grooves

If an oil injection groove, in the bore of the "ready for assembly" wheel, is specified by the purchaser (see ISO 1005/7), this and the associated drilled and tapped hole for the oil pressure connection in the "finished" or "ready for assembly" conditions shall be machined to the requirements of the purchaser's drawing accompanying the order or enquiry. Special care shall be taken with the blending of the groove and the bore.

6 Inspection

6.1 Dimensional characteristics

Where in tables 3 to 5, last column, an "m" is indicated, the verification of the corresponding dimensional requirement is mandatory. Because of the practical difficulties of verification of certain dimensional values under production conditions, the dimensional characteristics for which an "o" is indicated in the last column of tables 3 to 5 shall only be verified if agreed at the time of enquiry and order (see also 5.1.1.3.2). Definition of the various geometrical tolerance terms is given in ISO 1101.

6.2 Surface roughness

If compliance with the requirements for the surface roughness is to be verified, the number of wheels to be inspected and all other necessary details shall be agreed at the time of enquiry and order.

6.3 Residual static unbalance

If a verification of the residual static unbalance is required, this shall be carried out in accordance with the requirements of ISO 1005/6.

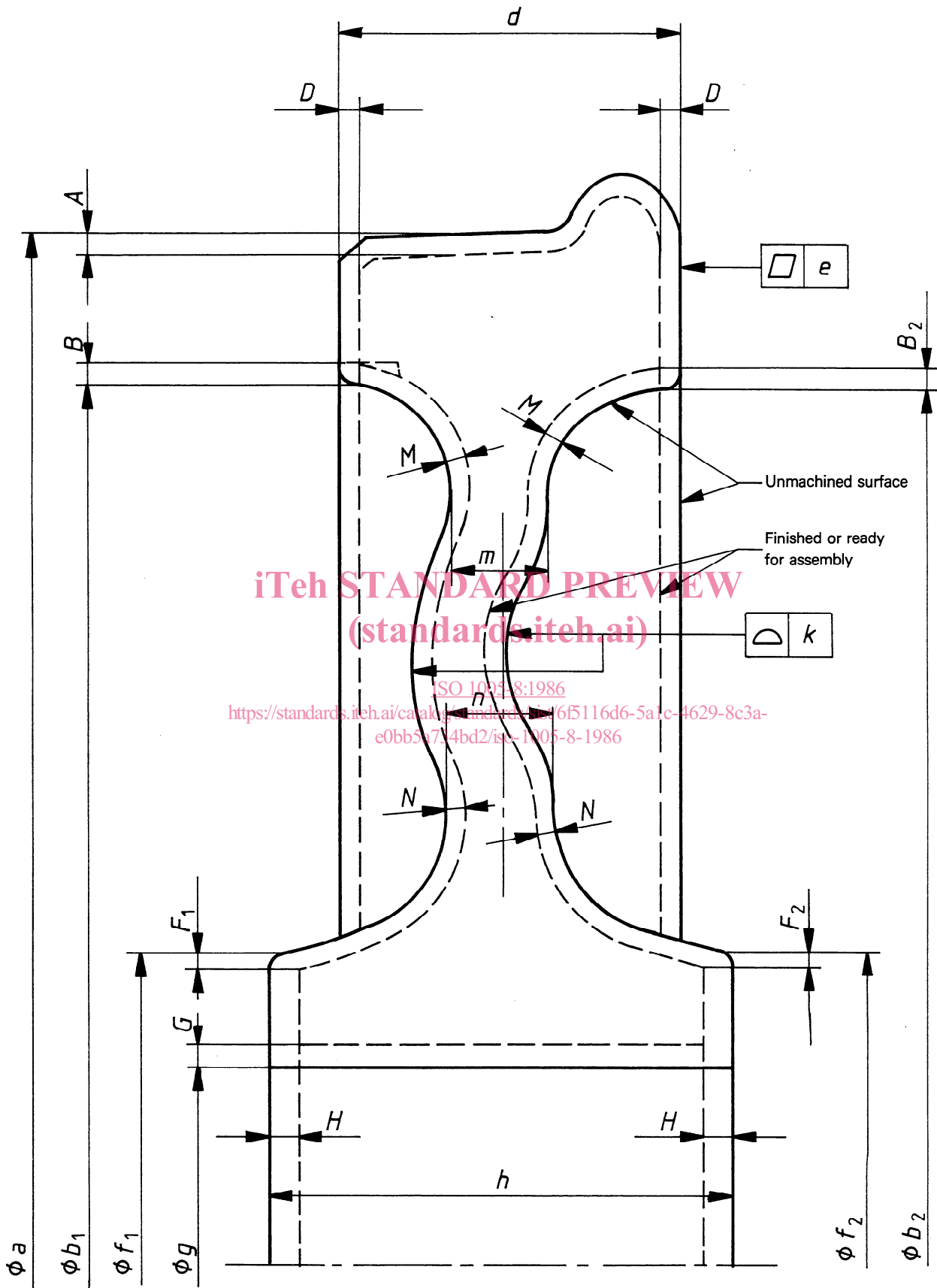


Figure 1 – Symbols for the dimensional characteristics, specified in table 3, for unmachined portions of forged or rolled solid wheels

Table 3 — Dimensional requirements for unmachined¹⁾ portions of forged or rolled solid wheels — category Y and Z²⁾

Designation		Symbol in figure 1 for		Machining allowance (mm)	Tolerance (mm)	Verifi- cation ⁴⁾
		dimen- sional	geomet- rical ³⁾			
Rim	External diameter	A		4		m
		a			+ 12 0	m
	Internal diameter (outer)	B_1		4 ⁵⁾		m
		b_1			0 - 10	m
	Internal diameter (inner)	B_2		4 ⁵⁾		m
		b_2			0 - 10	m
	Width	D		4		m
d				+ 8 0	m	
Flatness ⁶⁾		e		5	o	
Hub	External diameter (outer)	F_1		5 ⁵⁾		m
		f_1			+ 15 0 ⁷⁾	m
	External diameter (inner)	F_2		5 ⁵⁾		m
		f_2			+ 15 0 ⁷⁾	m
	Internal diameter (bore)	G		10		m
		g			0 - 20	m
Length	H		10		m	
	h			+ 10 0	m	
Web	Form		k		12	o
	Thickness at the connection with the rim	M		5 ⁵⁾		m
		m			+ 8 0	m
	Thickness at the connection with the hub	N		5 ⁵⁾		m
n				+ 10 0	m	

1) Term as defined in clause 4.

2) See note to 1.1.

3) See ISO 1101.

4) m is mandatory; o is optional.

5) For freight use, and normal operating speeds in other applications, the web, inner diameter of the rim and the outer diameter of the hub may, with the permission of the purchaser [see also table 4, footnote 7)], be left in the "finished" and "ready for assembly" conditions, in which case the machining allowance does not apply.

6) The unmachined wheel shall be placed wheel flange side down on a flat annular ring, the flatness dimension being measured by the maximum gap between the wheel flange and the ring.

7) + 25
0 for category Z wheels.

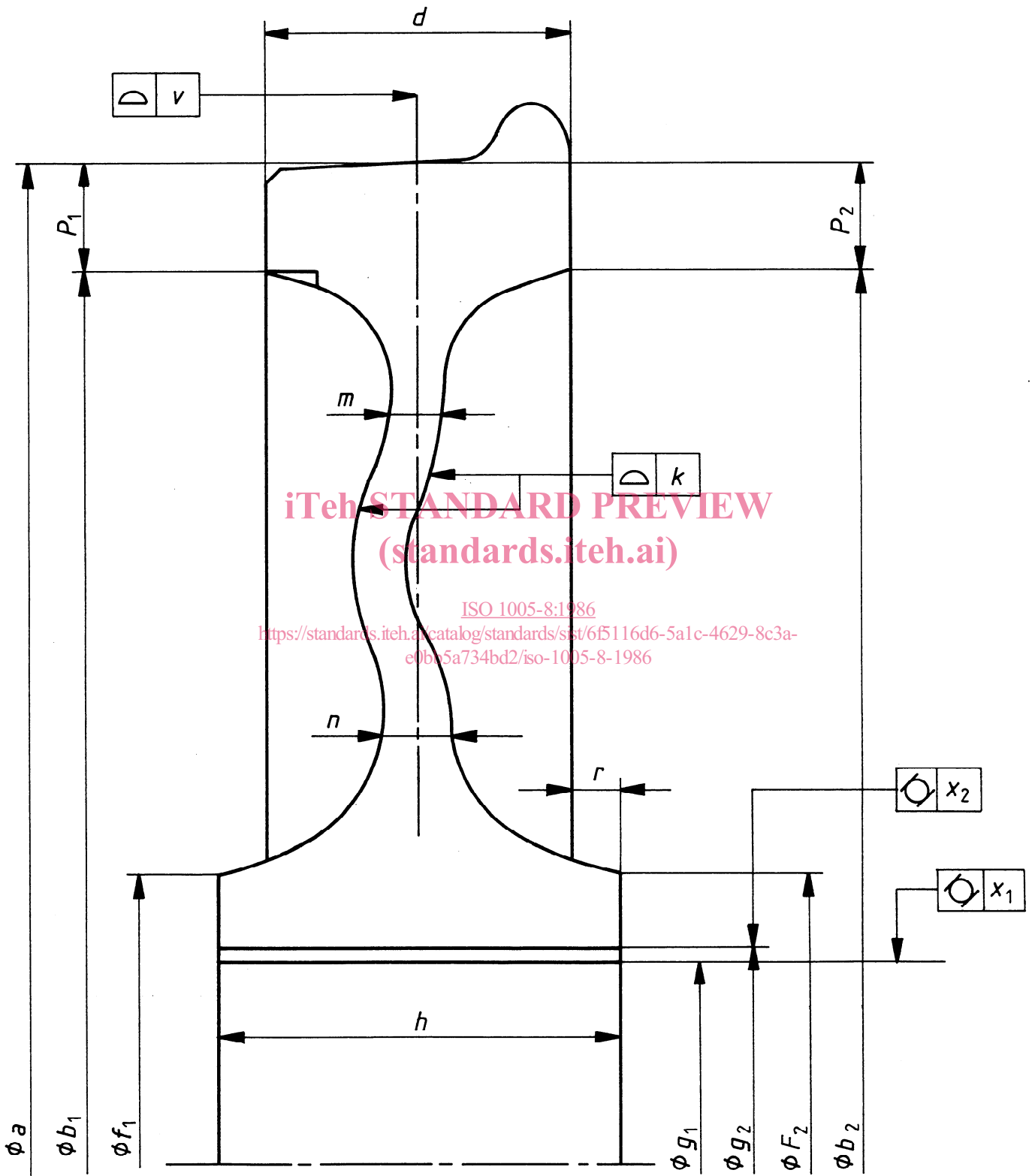


Figure 2 – Symbols for the dimensional characteristics, specified in table 4, for “finished” portions, and for the condition “ready for assembly”, of forged, rolled or cast solid wheels

Table 4 — Dimensional requirements for “finished” portions¹⁾ and for the condition “ready for assembly”¹⁾ of forged, rolled or cast solid wheels

Designation	Symbol in figure 2 for dimen- sionnal geomet- rical ²⁾ tolerances		Tolerances (mm)			Verification ⁴⁾	
			Wheels of		Category Z ³⁾		
			Category Y Normal speeds YN	Category Y High speeds YH			
Rim	External diameter	<i>a</i>	+ 4 ⁵⁾ 0	+ 4 ⁵⁾ 0	+ 14 - 5	m	
	Internal diameter (outer)	<i>b</i> ₁	0 - 6	0 - 6	6)	m	
	Internal diameter (inner)	<i>b</i> ₂	0 ⁷⁾ - 6	0 - 6	6)	m	
	Width	<i>d</i>	+ 1 - 1	+ 1 - 1	+ 3 - 3	m	
	Rim thickness variation (outer)	<i>p</i> ₁	1,5 ⁷⁾	1	3	m ⁸⁾	
	Rim thickness variation (inner)	<i>p</i> ₂	1,5 ⁷⁾	1	3	m ⁸⁾	
	Tread profile		<i>v</i>	The tolerance to be as indicated on the drawing			m
Others			See 5.1.1.3.1 or as an alternative 5.1.1.3.2				
Hub	External diameter (outer)	<i>f</i> ₁	+ 10 ⁷⁾ 0	+ 5 0	+ 25 0	m	
	External diameter (inner)	<i>f</i> ₂	+ 10 ⁷⁾ 0	+ 5 0	+ 25 0	m	
	Internal diameter (bore) — “finished” condition ¹⁰⁾	<i>g</i> ₁	0 ⁹⁾ - 2	0 ⁹⁾ - 1	+ 1 - 4	m	
	Internal diameter (bore) — “ready for assembly” condition ¹⁰⁾	<i>g</i> ₂	- 11)	- 11)	- 11)	m	
	Internal diameter (bore) cylindricity — “finished” condition ¹⁰⁾		<i>x</i> ₁	0,5	0,5	0,5	o
	Internal diameter (bore) cylindricity — “ready for assembly” condition ¹⁰⁾		<i>x</i> ₂	0,015 ¹²⁾	0,015 ¹²⁾	0,025 ¹²⁾	m
	Length	<i>h</i>	+ 3 0	+ 1 0	+ 6 - 6	m	
	Hub to wheel rim overhang	<i>r</i>	+ 3 ⁵⁾ 0	+ 3 ⁵⁾ 0	+ 3 - 3	m	
Others			See 5.1.1.3.1 or as an alternative 5.1.1.3.2				
Web	Form		<i>k</i>	g ⁷⁾ 13)	4 ¹³⁾	4 ¹³⁾	o
	Thickness at the connection with the rim	<i>m</i>		+ 5 ⁷⁾ 0	+ 2 0	+ 8 0	m
	Thickness at the connection with the hub	<i>n</i>		+ 5 ⁷⁾ 0	+ 2 0	+ 8 0	m

1) Terms as defined in clause 4.
 2) See ISO 1101.
 3) If for cast wheels the tolerances of this category are met by the manufacturing process, machining is not required.
 4) m is mandatory; o is optional.
 5) For tractive stock, other values may be necessary.
 6) Not applicable — governed by other rim dimensions.
 7) For normal operating speeds, the web, inner diameter of the rim and the outer diameter of the hub may, with the permission of the purchaser, be left unmachined in the “finished” and “ready for assembly” conditions, in which case, unless otherwise agreed, the tolerance values shown in table 3 are applicable.