

# INTERNATIONAL STANDARD

**ISO**  
**1005-6**

Second edition  
1994-08-01

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## **Railway rolling stock material —**

### **Part 6:**

Solid wheels for tractive and trailing stock —  
Technical delivery conditions

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*Matériel roulant de chemin de fer —*

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*Partie 6: Roues monoblocs pour le matériel moteur et pour le matériel  
remorqué — Conditions techniques de livraison*



Reference number  
ISO 1005-6:1994(E)

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International Organization for Standardization  
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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## 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1005-6 was prepared by Technical Committee ISO/TC 17, Steel, Subcommittee SC 13, *Railway rolling stock material*.

This second edition cancels and replaces the first edition (ISO 1005-6:1982), of which it constitutes a technical revision.

ISO 1005 consists of the following parts, under the general title *Railway rolling stock material*:

- *Part 1: Rough-rolled tyres for tractive and trailing stock — Technical delivery conditions*
- *Part 2: Tyres, wheel centres and tyred wheels for tractive and trailing stock — Dimensional, balancing and assembly requirements*
- *Part 3: Axles for tractive and trailing stock — Quality requirements*
- *Part 4: Rolled or forged wheel centres for tyred wheels for tractive and trailing stock — Quality requirements*
- *Part 6: Solid wheels for tractive and trailing stock — Technical delivery conditions*
- *Part 7: Wheelsets for tractive and trailing stock — Quality requirements*
- *Part 8: Solid wheels for tractive and trailing stock — Dimensional and balancing requirements*
- *Part 9: Axles for tractive and trailing stock — Dimensional requirements*

Annex A forms an integral part of this part of ISO 1005. Annex B is for information only.

## Introduction

This second edition of ISO 1005-6 is the result of the efforts of ISO/TC 17/SC 13 to harmonize and rationalize further the differing regional and national practices of the technical delivery conditions for solid wheels for railway rolling stock.

In the negotiations for this purpose the following topics, in particular, were discussed:

- the selection of steel type;
- the heat-treatment condition; and
- the requirement and testing categories (see the following paragraph).

Although the term "requirement and testing category" is correct, for easy reference the term "testing category" is used in this part of ISO 1005.

During negotiations on the selection of steel types, it was intended to retain only four or five different steel grades and to harmonize these with those quoted in other International Standards. However, this has not yet been fully achieved, in particular for the direct-hardening steels in ISO 683-1, and for the time being the established grades will be retained. The specifications for the composition of similar grades were aligned with one another.

With reference to the selection of heat-treatment conditions, the chosen concept was to make full use, as far as possible, of the properties inherent in the individual steel grades. Consequently, for all grades the rim quenched and tempered condition (T) and the normalized condition (N) may be agreed upon. The immersion quenched and tempered condition (E)<sup>1)</sup> was of decreasing importance and is only retained for special cases (see table 1, footnote 13).

The considerations referring to testing categories are covered in note 1 in 1.1, together with those on tolerance categories.

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1) The symbol E may be changed at a later date.

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# Railway rolling stock material —

## Part 6:

## Solid wheels for tractive and trailing stock — Technical delivery conditions

### 1 Scope

**1.1** This part of ISO 1005 specifies requirements for the manufacture and supply of rolled, forged or cast solid wheels of unalloyed steels for tractive and trailing stock in accordance with table 1 and clause 4.

**NOTE 1** 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 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 by them in wheelset design in terms of materials and geometrical 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.

The most obvious difference between 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 ISO 1005-8:1986 (see especially table 4);

— for wheelsets in ISO 1005-7.

Until now, within ISO/TC 17/SC 13, it was possible to clarify in detail the conditions under which 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 usually applied on railway systems where frequent or high-speed passenger operation is predominant;
- that the combination of testing category B and tolerance category Z is usually applied on railway systems where freight operation is predominant; and
- that the final combination of the categories shall be left to the discretion of the purchaser.

**1.2** In addition to this part of ISO 1005, the requirements of ISO 404 are applicable.

### 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 1005. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 1005 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 83:1976, *Steel — Charpy impact test (U-notch)*.

ISO 377-1:1989, *Selection and preparation of samples and test pieces of wrought steels — Part 1: Samples and test pieces for mechanical test*.

ISO 377-2:1989, *Selection and preparation of samples and test pieces of wrought steels — Part 2: Samples for the determination of the chemical composition*.

ISO 404:1992, *Steel and steel products — General technical delivery requirements*.

ISO 1005-8:1986, *Railway rolling stock material — Part 8: Solid wheels for tractive and trailing stock — Dimensional and balancing requirements*.

ISO/TR 4949:1989, *Steel names based on letter symbols*.

ISO 4960:1986, *Cold-reduced carbon steel strip with a carbon content over 0,25 %*.

ISO 5948:1994, *Railway rolling stock material — Ultrasonic acceptance testing*.

ISO 6506:1981, *Metallic materials — Hardness test — Brinell test*.

ISO 6892:1984, *Metallic materials — Tensile testing*.

ISO 6933:1986, *Railway rolling stock material — Magnetic particle acceptance testing*.

ISO/TR 9769:1991, *Steel and iron — Review of available methods of analysis*.

ISO 10474:1991, *Steel and steel products — Inspection documents*.

### 3 Information to be supplied by the purchaser

The purchaser shall supply the following information in his enquiry and order:

- a) the number of this part of ISO 1005;
- b) the grade of steel (see 4.1 and table 1);
- c) the type of heat treatment (see 4.2 and 6.5);
- d) the testing category (see 4.3 and 7.3.1);
- e) the dimensions of the wheel (see 5.4);

- f) the degree of finish and the tolerance category (see 4.4 and 4.5).

Certain alternatives are permitted, and the purchaser may therefore state the following in his enquiry and order:

- g) if, for wheels to be delivered in the normalized or quenched and tempered condition, lower phosphorus and sulfur contents are required (see table 1, footnote 4);
- h) if the tape size shall be measured and marked (see 5.6 and 7.8.4);
- i) if any special marking is required (see 5.6);
- j) if, for cast wheels, any specific manufacturing process is required (see 6.2.2);
- k) if shot peening is required (see 6.8);
- l) whether optional tests and checks shall be carried out and, if so, which ones (see table 2), together with the following additional information:
  - in the case of hardness survey tests: whether the total wear depth is other than 35 mm (see 7.7.3.4);
  - in the case of static balancing tests: whether the amount and position of residual imbalance shall be marked (see 5.6) and whether, in the case of trailing stock, methods of correction other than those specified in 6.6 may be applied;
- m) if optional dimensional checks are required and, if so, the number of wheels to be inspected (see table 2, footnote 8);
- n) if, for the inspection of the manufacture and various quality requirements, the responsibility shall be other than that specified in 7.1.1, last paragraph;
- o) if protection against corrosion is required and, if so, the method to be used (see 8.1).

NOTE 2 The specific clauses or parts of clauses, or the requirements in tables 1 and 2, which leave a choice between two or more alternatives open for an agreement asked for by the purchaser at the time of enquiry and order are marked in italics. If no such agreement is made, the alternative indicated as normal shall apply.



## 4 Classification

The solid wheels are classified according to the grade of steel, the heat-treatment condition on delivery, the testing category, the degree of finish, the tolerance category and any optional requirements [see items g) to o) of clause 3].

### 4.1 Grades of steel

This part of ISO 1005 covers the following grades of steel in accordance with the properties given in table 1:

- a) rolled or forged wheels: C grades of table 1;
- b) cast wheels: GC grades of table 1.

### 4.2 Types of heat-treatment condition on delivery

Depending on the agreements of the order, the wheels are supplied

- a) normalized or normalized and tempered (symbol N); or
- b) rim quenched and tempered<sup>2)</sup> according to 6.5.2 (symbol T)<sup>3)</sup>.

In special less critical cases, forged or rolled wheels can also be delivered untreated (no symbol). In this case, the mechanical properties are to be agreed at the time of enquiry and order.

In special cases, immersion quenched and tempered wheels may also be supplied (symbol E, see second-last paragraph of the introduction).

### 4.3 Testing category

Wheels may be supplied according to testing categories A and B (for details see note 1 in 1.1 and table 2).

### 4.4 Degree of finish

See ISO 1005-8 for definitions of "unmachined", "rough machined", "half finished", "finished" and "ready for assembly".

2) In the first edition of ISO 1005-6:1982, this heat-treatment condition was covered under the term "surface treated". The term "tread hardened" is also frequently applied to this condition.

3) The symbol T may be changed at a later date.

## 4.5 Tolerance category

See ISO 1005-8 and the note 1 in 1.1.

## 5 Requirements

### 5.1 Chemical composition

**5.1.1** The chemical composition of the wheels shall comply with the requirements given in table 1.

**5.1.2** *Unless otherwise agreed, the requirements for the results of the product analysis, shall be considered to be complied with when the results of the cast analysis are in accordance with the relevant specifications in table 1.*

### 5.2 Mechanical properties

The mechanical properties of the wheels shall comply with the requirements given in table 1.

### 5.3 Appearance and soundness

#### 5.3.1 General

**5.3.1.1** The wheels shall be sound throughout and without any defects detrimental to their use.

**5.3.1.2** Those portions remaining black (unmachined) shall blend smoothly into any machined portions.

*The finish of the machined surfaces shall, unless otherwise specified in the order or its appended documents, be in accordance with ISO 1005-8.*

#### 5.3.2 Acceptance standard for magnetic particle test

When magnetic particle testing according to ISO 6933 is required (see table 2), the evaluation of magnetic particle discontinuity indications shall be based on an acceptance standard that is agreed upon when ordering. As far as possible, the position, shape, size, orientation and distribution of the discontinuities, and the service conditions for which the wheel is provided, shall be taken into account.

### 5.3.3 Acceptance standard for ultrasonic acceptance tests

When ultrasonic acceptance tests are required (see table 2), the acceptance standard specified in ISO 5948 shall apply, unless otherwise agreed at the time of enquiry and order.

### 5.4 Machining allowances and dimensional tolerances

For the machining allowances and dimensional tolerances, see ISO 1005-8.

### 5.5 Residual imbalance

When the residual imbalance is to be checked (see table 2), the results shall conform to the requirements of ISO 1005-8 and the imbalance shall be marked in accordance with 5.6.

### 5.6 Marking

Each wheel shall be supplied with marks as specified in the order or its appended documents.

Unless otherwise specified, each wheel shall receive the following marks:

- a) manufacturer's mark;
- b) cast number, or a serial number which can be identified with the specific cast;
- c) grade of steel and heat-treatment condition (see 4.2), including, if required, the testing and/or tolerance category;
- d) date of manufacture (month and last two figures of the year of manufacture);
- e) the inspector's mark, if the wheel is in accordance with 7.9;
- f) if the static imbalance is to be checked (see table 2); the position of imbalance and, if it is specified, the value of the residual imbalance;

g) the tape size, if this is to be measured (see 7.8.4).

Unless otherwise specified, the position and type of the marks shall be as follows (for examples, see figures 1 and 2).

The marks pertaining to a) to e) shall, in the case of stamping, be made on a face of the hub, unless otherwise specified in the order. Stamps with acute-angled character forms shall not be used (see 6.4). In the case of cast wheels, the marks pertaining to a) to d) may be cast and the inspector's mark stamped on the back (i.e. on the inside) of the web.

If static balancing tests were agreed upon at the time of enquiry and order, the position of the imbalance shall be indicated by suitably coloured paint in a radial stripe of about 15 mm width. When required, the imbalance value shall be given, in gram metres by painted numbers below the end of the stripe.

If measurement of the tape size has been agreed upon at the time of enquiry and order, the tape size shall be clearly painted on the web and in characters at least 25 mm in height.

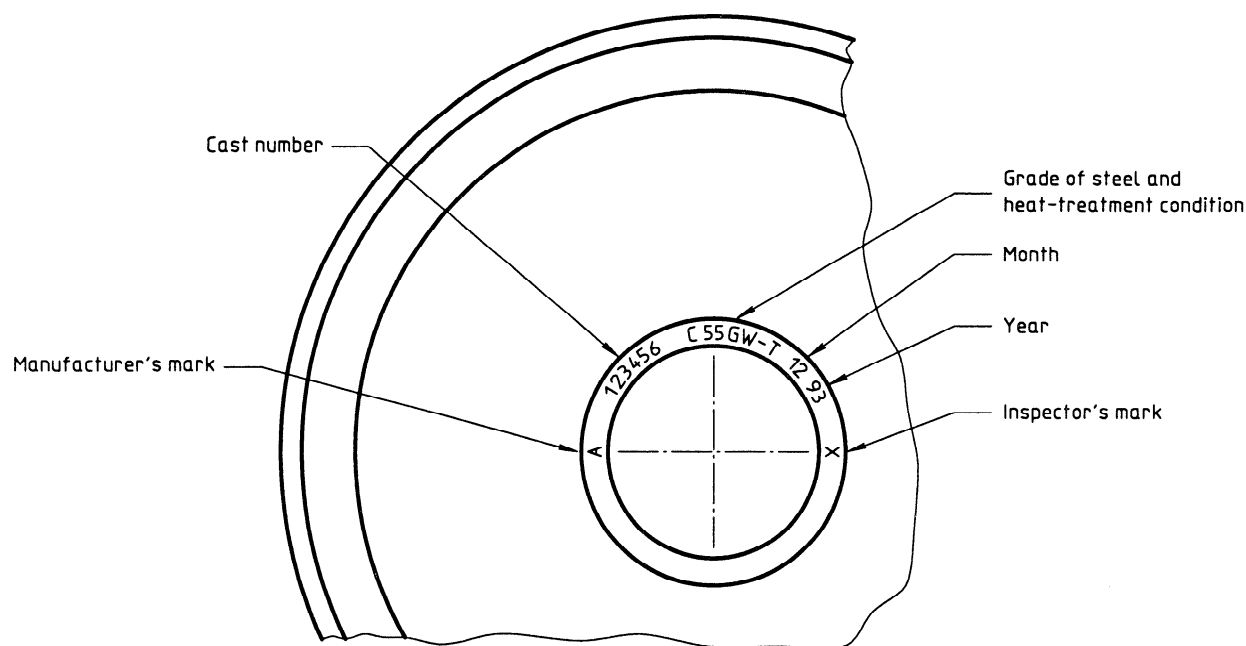
The surfaces of the wheel shall not have any marks in positions other than those specified in the order or its appended documents.

## 6 Manufacture

### 6.1 Steelmaking process

The wheels shall be made from steel produced by basic-oxygen, open-hearth, or electric-arc processes; other processes may be used by agreement between the manufacturer and the purchaser.

The steel shall be killed in the furnace or in the ladle and shall be bottom-poured or continuously cast, unless otherwise agreed.

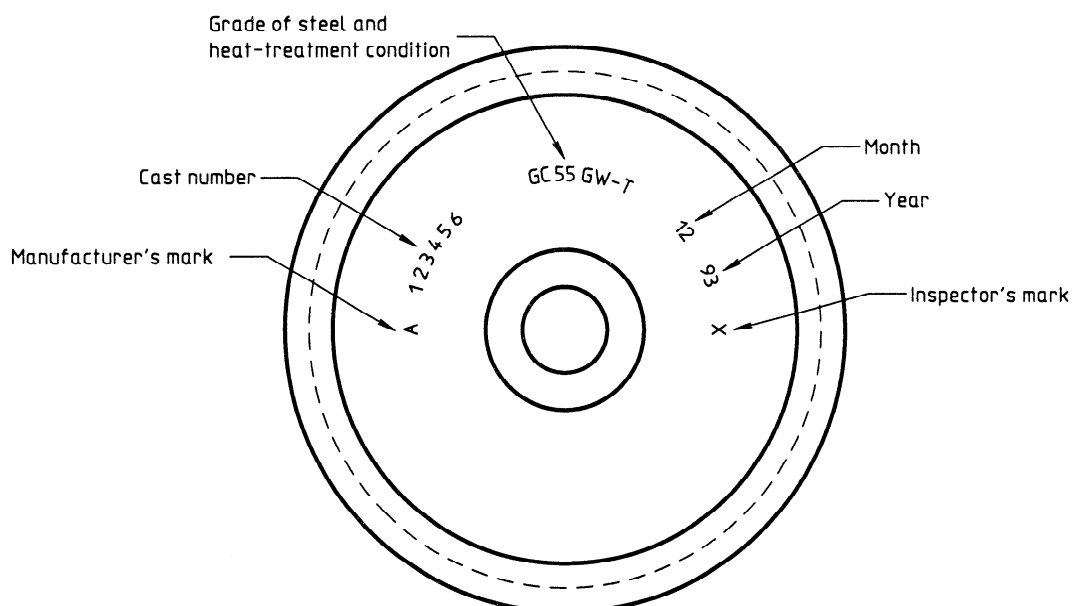


**Figure 1 — Example for marking of rolled, forged or cast wheels by stamping (see 5.6)**

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**Figure 2 — Example for alternative marking of cast wheels with cast-on characters (see 5.6)**