BS ISO 683-6:2023

BSI Standards Publication

Heat-treatable steels, alloy steels and free-cutting steels

Part 6: Hot-rolled steels for quenched and tempered springs

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National foreword

This British Standard is the UK implementation of ISO 683-6:2023.

The UK participation in its preparation was entrusted to Technical Committee ISE/105, Steels for Heat Treatment, Alloy Steels, Free-Cutting Steels and Stainless Steels.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Part 6: Hot-rolled steels for quenched and tempered springs

Aciers pour traitement thermique, aciers alliés et aciers pour décolletage —

Partie 6: Aciers laminés à chaud pour ressorts trempés et revenus

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 4, *Heat treatable and alloy steels*.

This fourth edition cancels and replaces the third edition (ISO 683-14:2004), which has been technically revised.

The main changes are as follows:

— partial structure revision;

— editorial revision.

A list of all parts in the ISO 683 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Heat-treatable steels, alloy steels and free-cutting steels —

Part 6: Hot-rolled steels for quenched and tempered springs

1 Scope

This document specifies the technical delivery requirements for round and flat bars and wire rods manufactured from the alloyed steels listed in Table 4, intended for hot-formed and subsequently heat-treated springs or cold-formed and subsequently heat-treated springs. The products are supplied in one of the heat-treatment conditions given for the different types of products in Table 2 and in one of the surface conditions given in Table 3.

NOTE 1 Table 4 only considers steels that have gained certain international importance. This does, however, not mean that these are available in all industrial countries. In addition, a great number of other steels are specified in regional and national standards.

NOTE 2 Non-alloy steels also for the production of springs are covered by the wire rod specification in ISO 16120-4.

NOTE 3 International Standards relating to steels conforming with the chemical composition requirements in Table 4, but supplied in other product forms or other treatment conditions or intended for special applications, are given in the bibliography.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

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

ISO 642, *Steel — Hardenability test by end quenching (Jominy test)*

ISO 643, *Steels — Micrographic determination of the apparent grain size*

ISO 3887, *Steels — Determination of the depth of decarburization*

ISO 4885, *Ferrous materials — Heat treatments — Vocabulary*

ISO 4948-1, *Steels — Classification — Part 1: Classification of steels into unalloyed and alloy steels based on chemical composition*

ISO 4948-2, *Steels — Classification — Part 2: Classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics*

ISO 4967, *Steel — Determination of content of non-metallic inclusions — Micrographic method using standard diagrams*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method*

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ISO 6929, *Steel products — Vocabulary*

ISO 9443, *Surface quality classes for hot-rolled bars and wire rod*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

ISO 23825, *Method for evaluating the nodularity of spheroidal carbides — Steels for cold heading and cold extruding*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 377, ISO 643, ISO 3887, ISO 9443, ISO 4885, ISO 4948-1, ISO 4948-2, ISO 6929 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
hot-rolled steels for quenched and tempered springs
steels which are, because of their resilience in the quenched and tempered condition, particularly suitable for the manufacture of spring-like components of all kinds

Note 1 to entry: The resilience of the steel depends on their elastic deformability, which enables them to sustain loading within a given range without exhibiting any permanent deformation when the load is removed. The properties required of the steels for springs are obtained by increasing carbon contents and alloying constituents such as silicon, manganese, chromium, molybdenum and vanadium, and also by heat-treatment, i.e. hardening in oil with subsequent tempering.

3.2
alloy steel
as defined in ISO 4948-1

4 Classification and designation

4.1 Classification

The classification of the relevant steel grades is in accordance with ISO 4948-1 and ISO 4948-2. All steel grades covered by this document are alloy special steels.

4.2 Designation

For the steel grades covered by this document, the steel names given in the relevant tables are allocated in accordance with ISO/TS 4949.

NOTE Designation of steels covered by this document and of comparable grades covered in various other designation systems are given in Annex D.

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5 Information to be supplied by the purchaser

5.1 Mandatory information

The following information shall be supplied by the purchaser at the time of enquiry and order:

a) quantity to be delivered;

b) designation of the product form (round bar, flat bar, wire rod, etc.);

c) either the designation of the dimensional standard and the dimensions and tolerances selected from it (see 7.11) or the designation of the drawing or any other document covering the dimensions and tolerances required for the product;

d) a reference to this document, i.e. ISO 683-6:2023;

e) the designation of the steel type given in Table 4 and, where appropriate, the symbols for the core hardness grade (see 7.3 and Table 7) or the restricted hardenability grade (see 7.3 and Table 9);

f) standard designation for a test report 2.2 or, if required, any other type of inspection document in accordance with ISO 10474 or another equivalent standard, e.g. EN 10204 or JIS G 0415.

5.2 Supplementary or special requirements

A number of options are specified in this document and listed below.

a) if a heat-treatment condition other than the untreated condition is required, see the symbol for this other condition (see Table 2, column 2);

b) if a surface condition other than “hot-worked” or a special surface quality is required, see the surface condition (see Table 3) and the surface quality (see 7.5);

c) product analysis (see 7.2, 8.2.2 and 9.1);

d) any requirement concerning the verification of fine grain steel, see 7.6 and A.2;

e) any requirement for the verification of the non-metallic inclusions, see 7.7.1;

f) any requirements for non-destructive testing, see 7.8 and A.3;

g) any requirements for testing the depth of decarburization, see 7.9 and A.4;

h) any requirement for the verification of the carbide spheroidization, see 7.10 and A.5;

i) any requirements concerning special or additional marking, see Clause 10 and A.6.

5.3 Ordering example

EXAMPLE 50 t hot-rolled round bars according to ISO 1035-1 with a nominal diameter of 20,0 mm and a nominal length of 8 000 mm with a diameter tolerance of ±0,25 mm (= class S of ISO 1035-4) and a length tolerance of 0 mm to 100 mm (= class L2 of ISO 1035-4) and all other tolerances as given in ISO 1035-4 for normal cases, made of steel grade ISO 683-6, 51CrV4 in the heat-treatment condition soft annealed (symbol +A), surface blast cleaned (symbol +BC); with an inspection certificate 3.1 (see ISO 10474).

50 t round bars ISO 1035 – 20,0S × 8 000L2

ISO 683-6 – 51CrV4+A+BC

ISO 10474 – 3.1

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6 Manufacturing process

6.1 General

The manufacturing process for the steel and for the products is, with the restrictions given by the requirements in 6.2 to 6.4, left to the discretion of the manufacturer.

6.2 Deoxidation

All steels shall be fully killed.

6.3 Heat-treatment condition at delivery

6.3.1 Normal delivery condition

Unless otherwise agreed at the time of enquiry and order, the products shall be delivered in the untreated condition, i.e. as hot-worked.

6.3.2 Particular heat treatment condition

If so agreed at the time of enquiry and order, the products shall be delivered in one of the heat-treatment conditions given in Table 2, lines 3 to 6.

6.3.3 Particular surface condition

If so agreed at the time of enquiry and order, the products shall be delivered in one of the particular surface conditions given in Table 3, lines 3 to 6.

6.4 Traceability of the cast

The steels shall be delivered separated by casts.

7 Requirements

7.1 General

Table 2 gives a survey of combinations of usual heat-treatment conditions at delivery, product forms and requirements in accordance with Tables 4 to 9 (chemical composition, maximum dimensions for a minimum core hardness, maximum hardness, hardenability).

In special cases, variations in these technical delivery requirements or additions to them may form the subject of an agreement at the time of enquiry and order (see Annex A).

In addition to the special delivery condition of this document, the general technical delivery requirements of ISO 404 shall apply.

7.2 Chemical composition

The chemical composition determined by cast analysis shall conform with the values in Table 4.

Permissible deviations between the limiting values for cast analysis and the values for product analysis are given in Table 5.

If specified at the time of the enquiry and order, the product analysis shall be carried out.

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