

Heat resisting steels and nickel alloys

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National foreword

This British Standard is the English language version of EN 10095:1999. It supersedes BS 1449-2:1983, which is withdrawn, and the requirements for heat resisting steel 310S S31 detailed in BS 970-1 (Section 5):1996

The two steel specifications which were listed BS 1449-2 may be cross-referenced with their equivalents in BS EN 10095 as follows:

Steels in BS 1449-2		Nearest equivalent steel in BS EN 10095	
309S24	Cr Ni 23/14	X12CrNi23-13	1.4833
310S24	Cr Ni 24/20	X8CrNi25-21	1.4845

The UK participation in its preparation was entrusted to Technical Committee ISE/30, Stainless steels, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 26, an inside back cover and a back cover.

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English version

Heat resisting steels and nickel alloys

Aciers et alliages de nickel réfractaires

Hitzebeständige Stähle und Nickellegierungen

This European Standard was approved by CEN on 1 March 1999.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 23, Steels for heat treatment, alloy steels and free-cutting steels — Qualities and dimensions, the Secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 1999, and conflicting national standards shall be withdrawn at the latest by September 1999.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association. This European Standard is considered to be a supporting standard to those application and product standards which in themselves support an essential safety requirement of a New Approach Directive and which make reference to this European Standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

NOTE The clauses marked with a point (•) contain information relating to agreements which are to be made at the time of ordering. The clauses marked with two points (••) contain information relating to agreements which may be made at the time of ordering.

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1 Scope

1.1 This European Standard covers the grades of wrought steels and nickel alloys listed in Tables 1 to 3 which are usually employed for products, for which the main requirement is their resistance to the effects of hot gases and products of combustion at temperatures above 550 °C.

1.2 This EN 10095 specifies the technical delivery conditions for semi-finished products, for hot or cold rolled sheet/plate and strip, hot or cold formed bars, rods and sections of heat resisting steels and nickel alloys.

1.3 Some grades from EN 10088-1 and prEN 10028-7 may be used as heat resisting steels. These grades are listed in the informative annex D.

1.4 The general technical delivery conditions specified in EN 10021 apply in addition to the specifications of this European Standard, unless otherwise specified in this standard.

1.5 This European Standard does not apply to components manufactured by further processing the product forms listed in 1.2 with quality characteristics altered as a result of such further processing.

1.6 This European Standard is not intended for pressure purposes.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 10002-1, *Metallic materials — Tensile testing — Part 1: Method of testing (at ambient temperature)*.

EN 10002-5, *Metallic materials — Tensile testing — Part 5: Method of test at elevated temperature*.

EN 10003-1, *Metallic materials — Hardness test — Brinell — Part 1: Test method*.

EN 10021, *General technical delivery requirements for steel and iron products*.

EN 10027-1, *Designation systems for steels — Part 1: Steel names, principal symbols*.

EN 10027-2, *Designation systems for steels — Part 2: Numerical system*.

EN 10052, *Vocabulary of heat treatment terms for ferrous products*.

EN 10079, *Definition of steel products*.

EN 10163-2, *Delivery requirements for surface condition of hot rolled steel plates, wide flats and sections — Part 2: Plate and wide flats*.

EN 10204, *Metallic products — Types of inspection documents*.

EN 10221, *Surface quality classes for hot-rolled bars and rods — Technical delivery conditions*.

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

EN ISO 9001, *Quality systems — Model for quality assurance in design/development, production, installation and servicing*.

EN ISO 9002, *Quality systems — Model for quality assurance in production, installation and servicing*.

EU 168-86¹⁾, *Iron and steel products — Inspection documents — Contents*.

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

3 Definitions

For the purpose of this European Standard, the following definition applies in addition to the definitions given in EN 10021, EN 10052, EN 10079, EN ISO 377 and ISO 14284.

3.1

heat-resistance

property of materials that are used at above 550 °C (for steels: wustite point) due to their excellent resistance to the effects of hot gases and products of combustion as well as their resistance to the influence of molten salts and molten metals but also showing good mechanical properties during short and long-term stressing

¹⁾ •• It may be agreed at the time of ordering, until this Euronorm has been adopted as a European Standard, that either this Euronorm or a corresponding national standard should be applied.

4 Classification and designation

4.1 Classification

Materials covered in this European Standard are classified according to their structure into:

- ferritic steels;
- austenitic-ferritic steels;
- austenitic steels; and
- austenitic nickel alloys.

4.2 Designation

The names and numbers of the steels (see Table 1 and 2) were formed in accordance with EN 10027-1 and EN 10027-2 respectively.

NOTE Explanation on the designation of nickel alloys (see Table 3).

- name: The preceding chemical symbols indicate the main alloy elements and the figure immediately following indicates the average content of these alloys subsequently followed by the symbol for the other added important alloy elements.
- material number: The structure is set out according to EN 10027-2 with the number 2 for the material group number. This material group comprises chemically resistant and high temperature or heat resistant nickel and cobalt alloys.

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) the quantity to be delivered;
- b) the designation of the product form (e.g. bar or rod, strip or sheet);
- c) where an appropriate dimensional standard is available (see annex A) the number of the standard and the indications required by this, also the nominal dimensions and tolerances;
- d) the type of material (steel or nickel alloy);
- e) the number of this European Standard (EN 10095);
- f) the name or number of the steel grade or nickel alloy (see 4.2);
- g) if for the relevant grade in the table more than one treatment condition for the mechanical properties is covered, the symbol for the desired heat treatment condition or cold worked condition;
- h) the desired process route (see symbols in Tables 7 and 8).

EXAMPLE

10 t rounds of a steel grade with the name X10NiCrAlTi32-21 and the number 1.4876 as specified in EN 10095 of 50 mm diameter, dimensional tolerances as specified in EURONORM 60, in process route 1D.

10 t rounds EURONORM 60 – 50
steel EN 10095 – X10NiCrAlTi32-21 + 1D

or

10 t rounds EURONORM 60 – 50
steel EN 10095 – 1.4876 + 1D

5.2 •• Options

A number of options are specified in this European Standard and listed below. If the purchaser does not indicate his wish to implement one of these options, the supplier shall supply in accordance with the basis specification of this European Standard (see 5.1):

- a) any requirement concerning a special melting or forming process (see 6.1);
- b) any requirement relating to surface quality (see 7.4);
- c) any requirement concerning the issue of an inspection document (see 8.2);
- d) any requirement concerning the method of analysis to determine the product analysis (see 8.4.1);
- e) any requirement concerning special marking of the products (see 9.2, 9.3 and Table 10).

6 Manufacturing process

6.1 •• General

Unless a special melting or forming process is agreed when ordering, the production process for steels and alloys conforming to this European Standard shall be at the discretion of the manufacturer.

6.2 • Delivery condition

The products shall be supplied in the delivery condition agreed in the order by reference to the process route given in Tables 7 and 8 and to the treatment conditions given in Table B.1.

7 Requirements

7.1 General

The supplier shall operate and certify a quality system in accordance with EN ISO 9002²⁾.

7.2 Chemical composition

7.2.1 The chemical composition requirements given in Tables 1 to 3 apply with respect to the cast analysis.

7.2.2 The product analysis may deviate from the limiting values for the cast analysis given in Tables 1 to 3 by the values listed in Tables 4 and 5.

7.3 Mechanical properties

The mechanical properties at room temperature as specified in Table 6 apply for each specified heat treatment condition. This does not apply to the process route 1U (hot rolled, not heat treated, not descaled) and to semi-finished products.

- If by agreement at the time of ordering, the products are to be supplied in a non-heat-treated condition, the mechanical properties specified in Table 6 shall be obtainable from reference test pieces which have received the appropriate heat treatment (simulated heat treatment).

7.4 Surface quality

Slight surface imperfections, inherent in the production process, are permitted.

- If more exact requirements for the surface quality are necessary, these shall be agreed at the time of enquiry and order.

When products are delivered in coil form, the degree and extent of such imperfections may be expected to be greater due to the impracticality of removing short lengths of coil. For hot rolled quarto-plates, the specification in EN 10163-2 class A3 applies unless otherwise stated.

For long products, where appropriate, the requirements shall be on the basis of EN 10221.

7.5 • Dimensions and tolerances on dimensions

The dimensions and the tolerances on dimensions are to be agreed at the time of enquiry and order, as far as possible with reference to the dimensional standards listed in annex A.

7.6 Calculation of mass and tolerances on mass

7.6.1 When calculating the nominal mass from the nominal dimensions the values given in Table B.5 shall be used as a basis for the density of the steel concerned.

7.6.2 • If the tolerances on mass are not specified in the dimensional standard listed in annex A, they shall be agreed at the time of enquiry and order.

8 Inspection and testing

8.1 General

The manufacturer shall carry out appropriate process control, inspection and testing to assure himself that the delivery complies with the requirements of the order.

This includes the following:

- a suitable frequency of verification of the dimensions of the products;
- an adequate intensity of visual examination of the surface quality of the products;
- an appropriate frequency and type of test to ensure that the correct grade is used.

The nature and frequency of these verifications, examinations and tests is determined by the manufacturer in the light of the degree of consistency that has been determined by the evidence of the quality system. In view of this, verifications by specific tests for these requirements are not necessary unless otherwise agreed.

8.2 •• Types and contents of inspection documents

8.2.1 At the time of ordering the issue of one of the inspection documents in accordance with EN 10204 may be agreed for each delivery.

8.2.2 If it is agreed to issue a test report 2.2 in accordance with EN 10204 it shall indicate the following information:

- a) the information groups A, B and Z of EU 168;
- b) the results of the cast analysis in accordance with the code numbers C71 to C92 in EU 168.

8.2.3 If the issuing of an inspection certificate 3.1.A, 3.1.B or 3.1.C according to EN 10204 or of an inspection report 3.2 according to EN 10204 has been agreed, specific inspections according to **8.3** are to be carried out and the following information shall be given in the inspection document with the code numbers and details required by EU 168:

- a) as under **8.2.2** a) and b);
- b) the results of the mandatory tests marked in Table 9, second column, by an “m”;
- c) the result of any optional test or inspection agreed when ordering.

²⁾ This requirement is also fulfilled by a quality system in accordance with EN ISO 9001.

8.3 Specific inspection and testing

8.3.1 Extent of testing

The tests to be carried out, either mandatorily (m) or by agreement (o) and the composition and size of the test units, and the number of sample products, samples and test pieces to be taken are given on Table 9.

8.3.2 Selection and preparation of samples and test pieces

8.3.2.1 The specifications of EN ISO 377 and ISO 14284 shall be observed in sampling and sample preparation respectively. The stipulations in 8.3.2.2 apply additionally for the mechanical tests.

8.3.2.2 The test samples for the tensile test shall be taken in accordance with Figures 1 to 4 in such a way that for flat products, they are located half-way between the centre and a longitudinal edge.

The samples shall be taken from products in the delivery condition. If agreed, the samples may be taken before flattening for flat products or before straightening for bars. For samples to be given a simulated heat treatment the conditions for heat treatment shall be agreed with reference to Table B.1.

8.3.2.3 Samples for the hardness test, where requested, shall be taken from the same locations as those for the tensile test.

8.4 Test methods

8.4.1 •• Unless otherwise agreed when ordering, the choice of a suitable physical or chemical method of analysis to determine the product analysis is at the discretion of the manufacturer. In cases of dispute the analysis shall be carried out by a laboratory approved by the two parties. The method of analysis to be used shall be agreed, where possible with reference to appropriate European Standards or EURONORMS.

8.4.2 The tensile test at room temperature shall be carried out in accordance with EN 10002-1. Generally, this means using proportional test pieces having a gauge length $L_0 = 5,65 \sqrt{S_0}$ (S_0 = cross-section of the test piece). In cases of doubt and in referee testing this type of test piece shall be used.

The tensile strength and elongation after fracture shall be determined and additionally for ferritic and austenitic-ferritic steels and for alloys the 0,2 % proof strength and for austenitic steels the 0,2 % and 1 % proof strength.

8.4.3 The Brinell hardness test shall be carried out in accordance with EN 10003-1.

8.4.4 Dimensions and dimensional tolerances of the products shall be tested in accordance with the requirements of the relevant dimensional standards, where available.

8.5 Retest

See EN 10021.

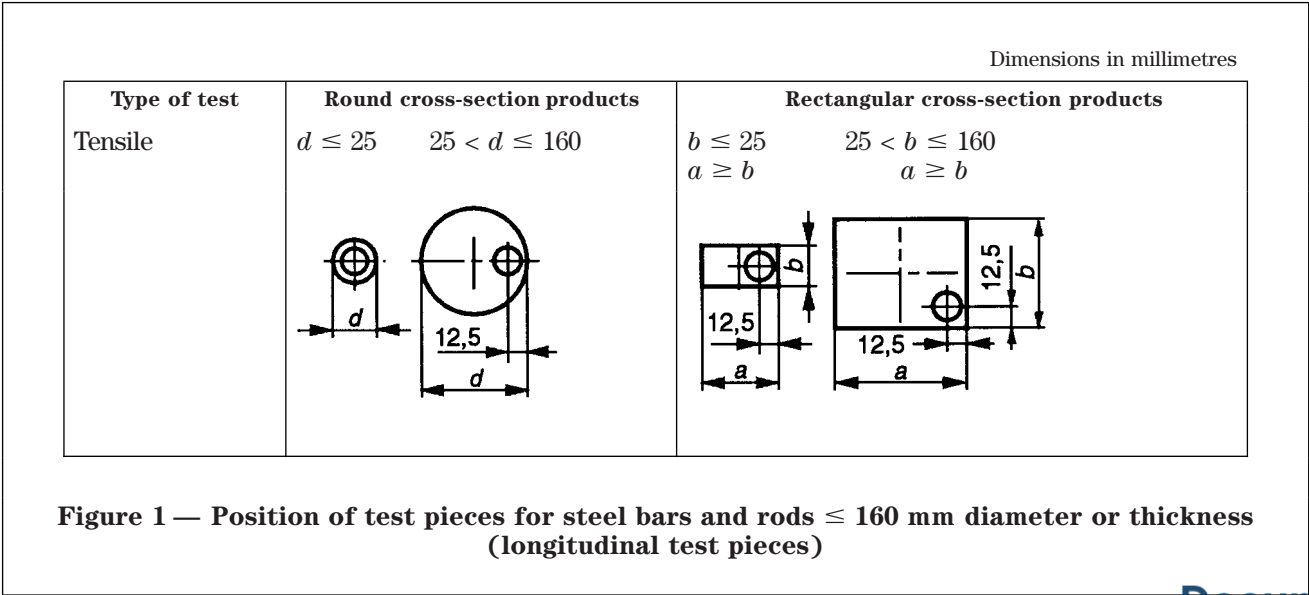
9 Marking

9.1 Marking shall be durable.

9.2 •• Unless otherwise agreed, the requirements listed in Table 10 apply.

9.3 •• The method and the extent of marking and the material of marking shall, unless otherwise agreed, be at the option of the manufacturer.

9.4 As an alternative for items that are wrapped, bundled or boxed, or where the surface is ground or polished, the marking may be applied to the packaging, or to a tag securely attached to it.



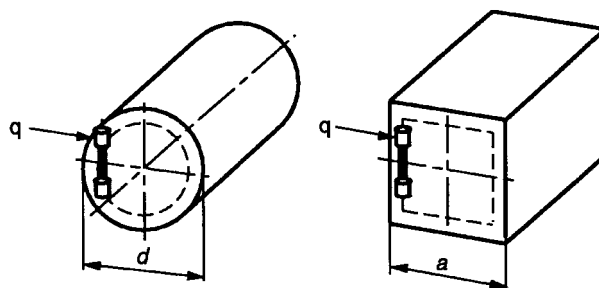
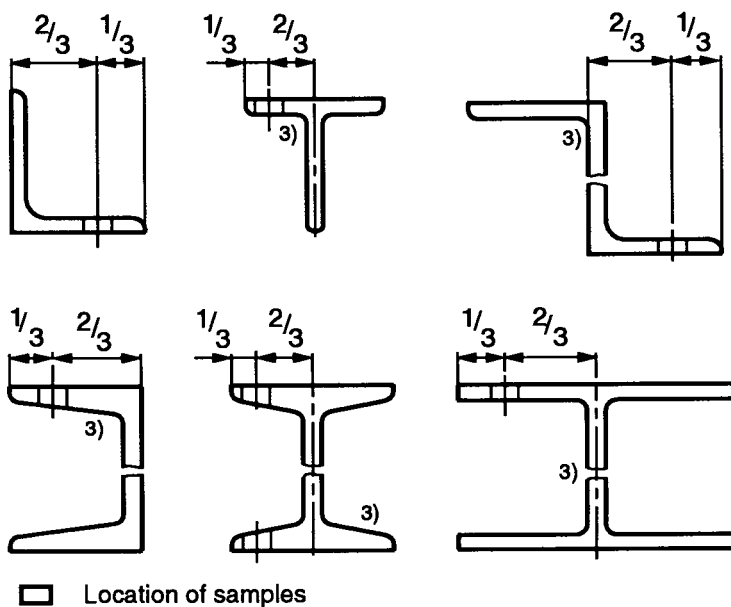


Figure 2 — Position of test pieces for steel bars > 160 mm diameter or thickness
[transverse test pieces (q)]



³⁾ By agreement, the sample can be taken from the web, at a quarter of the total height.

Figure 3 — Position of test pieces for beams, channels, angles, T sections and Z sections