



# SLOVENSKI STANDARD

## SIST EN 10302:2008

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Nadomešča:

SIST EN 10302:2003

SIST EN 10302:2003/AC:2005

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**Jekla ter nikeljeve in kobaltove zlitine, odporne proti lezenju**

Creep resisting steels, nickel and cobalt alloys

Warmfeste Stähle, Nickel- und Cobaltlegierungen

Aciers et alliages à base de nickel et de cobalt résistants au fluage

**Ta slovenski standard je istoveten z: EN 10302:2008**

**ICS:**

77.080.20	Jekla	Steels
77.120.40	Nikelj, krom in njune zlitine	Nickel, chromium and their alloys
77.120.70	Kadmij, kobalt in njune zlitine	Cadmium, cobalt and their alloys

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 10302**

March 2008

ICS 77.120.01; 77.140.01; 77.150.01

Supersedes EN 10302:2002

English Version

**Creep resisting steels, nickel and cobalt alloys**

Aciers et alliages à base de nickel et de cobalt résistant au fluage

Warmfeste Stähle, Nickel- und Cobaltlegierungen

This European Standard was approved by CEN on 10 February 2008.

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COMITÉ EUROPÉEN DE NORMALISATION  
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## Foreword

This document (EN 10302:2008) has been prepared by Technical Committee ECISS/TC 23 “Stainless steels”, 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of an identical text or by endorsement, at the latest by September 2008, and conflicting national standards shall be withdrawn at the latest by September 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 10302:2002.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, 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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**EN 10302:2008 (E)****1 Scope**

**1.1** This European Standard covers the grades of wrought steels and alloys listed in Table 1 and Table 2, which are usually employed for components and equipment, for which the main requirement is their creep resistance under mechanical long-time stressing at temperatures above 500 °C.

NOTE Heat resisting grades given in EN 10095 [9] may also be used for similar applications if so agreed.

**1.2** This European Standard specifies the technical delivery conditions for semi-finished products, for hot or cold rolled sheet/plate and strip, hot or cold formed (cold drawn) bars, rods, wire and sections.

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

**1.4** 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.

**1.5** This European Standard shall not be used for aerospace and pressure purposes.

**1.6** For steels and alloys with similar chemical composition, but intended for different applications, see the Bibliography.

**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.

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

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

EN 10020:2000, *Definition and classification of grades of steel*

EN 10021:2006, *General technical delivery conditions for steels products*

EN 10027-1, *Designation systems for steels - Part 1: Steel names*

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

EN 10052:1993, *Vocabulary of heat treatment terms for ferrous products*

EN 10079:2007, *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 10168:2004, *Steel products – Inspection documents – List of information and description*

EN 10204, *Metallic products - Types of inspection documents*

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

prCEN/TR 10261, *Iron and steel - Review of available methods of chemical analysis*

EN ISO 377:1997, *Steel and steel products - Location and preparation of samples and test pieces for mechanical testing (ISO 377:1997)*

EN ISO 14284:2002, *Steel and iron - Sampling and preparation of samples for the determination of chemical composition (ISO 14284:1996)*

### 3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 10020:2000, EN 10021:2006, EN 10052:1993, EN 10079:2007, EN ISO 377:1997 and EN ISO 14284:2002 and the following apply.

#### 3.1

##### **creep resisting materials**

steels, nickel- or cobalt-alloys with a minimum of 8 % chromium, which are characterised by good mechanical behaviour at temperatures above 500 °C under long-range service conditions; i.e. primarily by creep strength to 1 % plastic strain or creep rupture strength during long-time stressing

NOTE For supplementary information on creep resisting steels and alloys see Annex B.

### 4 Classification and designation

#### 4.1 Classification

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

- martensitic steels;
- austenitic steels;
- nickel alloys; and
- cobalt alloys.

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#### 4.2 Designation

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

NOTE Explanation on the designation of nickel and cobalt alloys (see Table 2).

- name: The preceding chemical symbols indicate the main alloy elements and the figure immediately following indicates the average content of these alloys which is subsequently followed by the symbol for the other important alloying elements added.
- 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.

**EN 10302:2008 (E)****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 (e.g. bar or rod, strip or plate);
- 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) type of material (steel, cobalt or nickel alloy);
- e) number of this European Standard (EN 10302:2008);
- f) name or number of the steel grade, nickel or cobalt alloy (see 4.2);
- g) if for the relevant material in the table more than one treatment condition for the mechanical properties is covered, the symbol for the desired heat treatment condition or work hardened condition;
- h) desired process route (see symbols in Table 5 and Table 6).

**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 any of these options, the supplier shall supply in accordance with the basic 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 condition (see 7.4);
- c) any requirement concerning tolerances on mass not specified in the dimensional standard (see 7.7.2);
- d) any requirement to determine the product analysis (see Table 11, footnote b);
- e) any requirement concerning the method of product analysis (see 8.4.1);
- f) any requirement concerning elevated temperature tensile testing (see 8.4.3);
- g) any requirement concerning special marking of the products (see 9.2, 9.3 and Table 12);
- h) any requirement concerning the issue of an inspection document (see 8.2).

**EXAMPLE**

10 t rounds of a steel grade with the name X6NiCrTiMoVB25-15-2 and the number 1.4980 as specified in EN 10302 of 50 mm diameter, dimensional tolerances as specified in EN 10060, in process route 1D (see Table 6).

10 t rounds EN 10060–50  
steel EN 10302 - X6NiCrTiMoVB25-15-2+1D

or

10 t rounds EN 10060–50  
steel EN 10302-1.4980+1D



## 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 Table 5 and Table 6 and to the treatment conditions given in Table B.1 and Table B.2.

## 7 Requirements

### 7.1 Chemical composition

**7.1.1** The chemical composition requirements given in Table 1 and Table 2 apply in respect to the cast analysis.

**7.1.2** The product analysis may deviate from the limiting values for the cast analysis given in Table 1 and Table 2 by the values listed in Table 3 and Table 4.

### 7.2 Mechanical properties

#### 7.2.1 Mechanical properties at room temperature

The mechanical properties at room temperature as specified in Table 7 and Table 8 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 7 and Table 8 shall be obtainable from reference test pieces which have received the appropriate heat treatment (simulated heat treatment).

#### 7.2.2 Mechanical properties at elevated temperatures

The mechanical properties at elevated temperature as specified in Table 9 and Table 10 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 9 and Table 10 shall be obtainable from reference test pieces which have received the appropriate heat treatment (simulated heat treatment).

### 7.3 Creep properties

The creep strength to 1 % plastic strain or creep rupture strength values as specified in Annex C 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.

### 7.4 Surface condition

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

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

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

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

**7.5 Internal soundness**

The products shall be sound and free from defects that preclude their intended use.

●● Where appropriate, requirements together with the conditions for their verification may be agreed at the time of enquiry and order.

**7.6 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.

**7.7 Calculation of mass and tolerances on mass**

**7.7.1** When calculating the nominal mass from the nominal dimensions, the values given in Tables D.1 and D.2 shall be used as a basis for the density of the grade concerned.

**7.7.2** ●● If the tolerances on mass are not specified in the dimensional standard listed in Annex A, they may be agreed at the time of enquiry and order.

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**8 Inspection and testing**

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**8.1 General**

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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:

- suitable frequency of verification of the dimensions of the products,
- adequate intensity of visual examination of the surface quality of the products,
- 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) information groups A, B and Z of EN 10168:2004;
- b) results of the cast analysis in accordance with the code numbers C71 to C92 in EN 10168:2004.

**8.2.3** If the issuing of an inspection certificate 3.1 or 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 EN 10168:2004:

- a) as under 8.2.2 a);
- b) as under 8.2.2 b);
- c) results of the mandatory tests marked in Table 11, second column, by an 'm';
- d) result of the optional tensile test at elevated temperature marked in Table 11, second column, by an "o" and of any other optional test or inspection agreed when ordering.

### 8.3 Specific inspection and testing

#### 8.3.1 Extent of testing

The tests to be carried out, either as mandatory (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 in Table 11.

#### 8.3.2 Selection and preparation of samples and test pieces

**8.3.2.1** The specifications of EN ISO 377 and EN ISO 14284 respectively shall be observed in sampling and sample preparation. 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 Figure 1 and Figure 2 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 annealing, hardening and tempering shall be agreed.

### 8.4 Test methods

**8.4.1** ●● The chemical analysis shall be carried out using the appropriate European Standard for the element being analysed. In the absence of an appropriate European Standard, the choice of a suitable physical or chemical analytical method for the analysis shall be at the discretion of the manufacturer. The manufacturer shall declare the test method used, if required.

The list of available European Standards on chemical analysis is given in prCEN/TR 10261.

**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 0,2 % proof strength, the tensile strength and elongation after fracture shall be determined.

**8.4.3** If agreed when ordering, the tensile test at elevated temperature shall be carried out in accordance with EN 10002-5, this generally being with 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 these test pieces shall be used. The temperature of testing is to be agreed.

The 0,2 % proof strength shall be determined.

**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.

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## 8.5 Retests

See EN 10021:2006.

## 9 Marking

9.1 Marking shall be durable.

9.2 ●● Unless otherwise agreed, the requirements listed in Table 12 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, the marking may be applied to the packaging, or to a tag securely attached to it.

Dimensions in millimetres

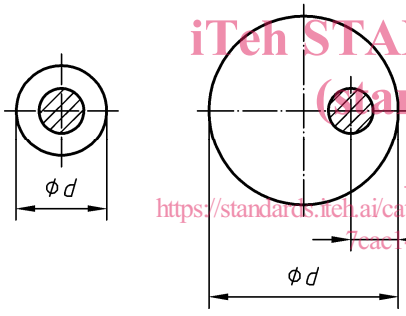
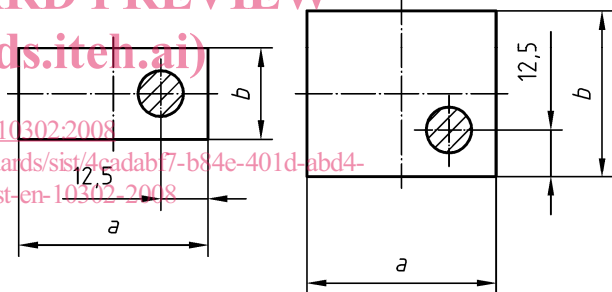
Type of test	Round cross-section products	Rectangular cross-section products
Tensile	$\phi d \leq 25^a$ $25 < \phi d \leq 160$ 	$b \leq 25$ $a \geq b$ $25 < b \leq 160$ $a \geq b$ 
<p><sup>a</sup> Samples of product may alternatively be tested unmachined, in accordance with EN ISO 377.</p>		

Figure 1 — Position of test pieces for steel bars and rods  $\leq 160$  mm diameter or thickness (longitudinal test pieces)

Type of test piece	Product thickness $t$ mm	Direction of the longitudinal axis of the test piece in relation to the principal direction of rolling at a rolled width of		Distance of test piece from the rolled surface
		< 300 mm	$\geq 300$ mm	
Tensile <sup>a</sup>	$\leq 30$	longitudinal	transverse	
	$> 30$			
<p><sup>a</sup> In cases of doubt or dispute the gauge length shall be <math>L_0 = 5,65 \sqrt{S_0}</math> for test pieces from products <math>t \geq 3</math> mm.</p> <p>For products with a thickness <math>t &lt; 3</math> mm, non-proportional test pieces with a gauge length of 80 mm and a width of 20 mm shall be used, but test pieces with a gauge length of 50 mm and a width of 12,5 mm may also be applied. For products with a thickness <math>3 \text{ mm} \leq t \leq 10 \text{ mm}</math> (or <math>t \leq 8</math> mm in case of alloys) flat proportional test pieces with two rolled surfaces and a maximum width of 30 mm shall be used. For products with a thickness <math>t &gt; 10</math> mm (or <math>t &gt; 8</math> mm in case of alloys), one of the following proportional test pieces may be used:</p> <ul style="list-style-type: none"> <li>- either a flat test piece with a maximum thickness of 30 mm; the thickness may be reduced to 10 mm by machining, but one rolled surface shall be preserved.</li> <li>- or a round test piece with a diameter of <math>d \geq 5</math> mm; the axis of which shall be located as near as possible to a plane in the outer third of half the product thickness.</li> </ul>				

**Key**

- 1 Rolling surface
- 2 Alternatives

Figure 2 — Position of the tensile test pieces in flat products