
**Nevarjene jeklene cevi za tlačne posode - Tehnični dobavni pogoji - 2. del:
Nelegirane in legirane jeklene cevi s specificiranimi lastnostmi za delo pri
povišanih temperaturah**

Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 2: Non
-alloy and alloy steel tubes with specified elevated temperature properties

Nahtlose Stahlrohre für Druckbeanspruchungen - Technische Lieferbedingungen - Teil 2:
Rohre aus unlegierten und legierten Stählen mit festgelegten Eigenschaften bei erhöhten
Temperaturen

Tubes sans soudure en acier pour service sous pression - Conditions techniques de
livraison - Partie 2: Tubes en acier non allié et allié avec caractéristiques spécifiées a
température élevée

Ta slovenski standard je istoveten z: EN 10216-2:2002

ICS:

23.020.30	Tlačne posode, plinske jeklenke	Pressure vessels, gas cylinders
77.140.75	Jeklene cevi in cevni profili za posebne namene	Steel pipes and tubes for specific use

SIST EN 10216-2:2003**en**

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 10216-2

May 2002

ICS 23.040.10; 77.140.75

English version

Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties

Tubes sans soudure en acier pour service sous pression -
Conditions techniques de livraison - Partie 2: Tubes en
acier non allié et allié avec caractéristiques spécifiées à
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Technische Lieferbedingungen - Teil 2: Rohre aus
unlegierten und legierten Stählen mit festgelegten
Eigenschaften bei erhöhten Temperaturen

This European Standard was approved by CEN on 25 April 2002.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 10216-2:2002) has been prepared by Technical Committee ECISS/TC 29, "Steel tubes and fittings for steel tubes", the secretariat of which is held by UNI.

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 November 2002, and conflicting national standards shall be withdrawn at the latest by November 2002.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

Other Parts of EN 10216 are:

Part 1: Non-alloy steel tubes with specified room temperature properties.

Part 3: Alloy fine grain steel tubes

Part 4: Non-alloy and alloy steel tubes with specified low temperature properties

Part 5: Stainless steel tubes

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Another European Standard series covering tubes for pressure purposes is:

EN 10217: Welded steel tubes for pressure purposes

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

EN 10216-2:2002 (E)**1 SCOPE**

This Part of EN 10216 specifies the technical delivery conditions in two test categories for seamless tubes of circular cross section, with specified elevated temperature properties, made of non-alloy and alloy steel.

NOTE This Part of EN 10216 may also be applied for tubes of non-circular cross section; necessary modification should be agreed at the time of enquiry and order.

2 NORMATIVE REFERENCES

This European Standard incorporates by date 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 date references, subsequent amendments to or revisions of, any of these 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 (including amendments).

The requirements of this European Standard rule when they differ from those in the standards and documents referred to below:

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

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

EN 10020, *Definitions and classification of grades of steel*.

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

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

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

EN 10045-1, *Metallic materials - Charpy impact test - Part 1: Test method*.

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

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

ENV 10220, *Seamless and welded steel tubes - Dimensions and masses per unit length*

EN 10233, *Metallic materials - Tubes - Flattening test*.

EN 10234, *Metallic materials - Tubes - Drift expanding test*.

EN 10236, *Metallic materials - Tubes - Ring expanding test*.

EN 10237, *Metallic materials - Tubes - Ring tensile test*.

EN 10246-1, *Non-Destructive Testing of steel tubes Part 1: Automatic electromagnetic testing of seamless and welded (except submerged arc welded) ferromagnetic steel tubes for verification of hydraulic leak-tightness*.

EN 10246-5, *Non-Destructive Testing of steel tubes – Part 5: Automatic full peripheral magnetic transducer/flux leakage testing of seamless and welded (except submerged arc-welded) ferromagnetic steel tubes for the detection of longitudinal imperfections*.

EN 10246-6, *Non-Destructive Testing of steel tubes - Part 6: Automatic full peripheral ultrasonic testing of seamless steel tubes for the detection of transverse imperfections*.

EN 10246-7, *Non-Destructive Testing of steel tubes - Part 7 : Automatic full peripheral ultrasonic testing of seamless and welded (except submerged arc welded) steel tubes for the detection of longitudinal imperfections.*

EN 10246-14, *Non-Destructive Testing of steel tubes - Part 14:Automatic ultrasonic testing of seamless and welded (except submerged arc welded) steel tubes for the detection of laminar imperfections.*

EN 10256, *Non-Destructive Testing of steel tubes - Qualification and competence of level 1 and level 2 NDT personnel.*

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

prEN 10168¹⁾, *Iron and steel products - Inspection documents - List of information and description.*

prEN 10266¹⁾, *Steel tubes, fittings and structural hollow sections - Symbols and definition of terms for use in product standards*

EN ISO 2566-1, *Steel - Conversion of elongation values – Part 1: Carbon and low-alloy steels (ISO 2566-1:1984)*

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

CR 10260, *Designation systems for steel - Additional symbols*

CR 10261, *ECISS Information Circular IC 11 - Iron and steel - Review of available methods of chemical analysis.*

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3 TERMS AND DEFINITIONS

For the purposes of this Part of EN 10216, the terms and definitions given in EN 10020, EN 10021, EN 10052 and prEN 10266 and the following apply:

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3.1

test category

classification that indicates the extent and level of inspection and testing

3.2

employer

organisation for which a person works on a regular basis.

NOTE The employer may be either the tube manufacturer or supplier or a third party organisation providing, Non-Destructive Testing (NDT) services.

4 SYMBOLS

For the purpose of this Part of EN 10216, the symbols given in prEN 10266 and the following apply:

- d specified inside diameter;
- d_{\min} specified minimum inside diameter;
- T_{\min} specified minimum wall thickness;
- D_c calculated outside diameter;
- d_c calculated inside diameter;

1) In preparation; until this document is published as a European Standard, the corresponding national standard(s) should be agreed at the time of enquiry and order.

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- T_c calculated wall thickness;
- TC test category

5 CLASSIFICATION AND DESIGNATION**5.1 Classification**

In accordance with the classification system in EN 10020, the steel grades P195GH, P235GH and P265GH are classified as non-alloy quality steels and the other steel grades are classified as alloy special steels.

5.2 Designation

5.2.1 For the tubes covered by this Part of EN 10216 the steel designation consists of:

- the number of this Part of EN 10216;

plus either:

- the steel name in accordance with EN 10027-1 and CR 10260;

or:

the steel number allocated in accordance with EN 10027-2.

5.2.2 The steel name of non-alloy steel grades is designated by:

- the capital letter P for pressure purposes;
- the indication of the specified minimum yield strength at room temperature for wall thickness less than or equal to 16 mm, expressed in MPa (see Table 4);
- the symbols GH for elevated temperature.

5.2.3 The steel name of alloy steel grades is designated by the chemical composition (see Table 2) and the symbols for the heat treatment, where specified in column 3 and footnote 3 of Table 1.

6 INFORMATION TO BE SUPPLIED BY THE PURCHASER**6.1 Mandatory information**

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

- a) the quantity (mass or total length or number);
- b) the term "tube";
- c) the dimensions (outside diameter D and wall thickness T or a set of dimensions covered by Option 11) (see Table 6);
- d) the designation of the steel grade in accordance with this Part of EN 10216 (see 5.2);
- e) the test category for non-alloy steel (see 9.3).

6.2 Options

A number of options are specified in this Part of EN 10216 and these are listed below. In the event that the purchaser does not indicate a wish to implement any of these options at the time of enquiry and order, the tubes shall be supplied in accordance with the basic specification (see 6.1).

- 1) Cold finishing (see 7.3.2).
- 2) Restriction on copper and tin content (see Table 2).
- 3) Product analysis (see 8.2.2).
- 4) Impact testing (see Table 4).
- 5) Longitudinal impact testing at -10° C for non-alloy steel grades (see Table 4).
- 6) Tensile testing at elevated temperature (see 8.3.2).
- 7) Selection of leak-tightness test method (see 8.4.2.1).
- 8) Non-Destructive Testing for test category 2 tubes for detection of transverse imperfections (see 8.4.2.2).
- 9) Non-Destructive Testing for test category 2 tubes for detection of laminar imperfections (see 8.4.2.2).
- 10) Special ends preparation (see 8.6).
- 11) Set of dimensions other than D and T (see 8.7.1).
- 12) Exact lengths (see 8.7.3).
- 13) The type of inspection document other than the standard document (see 9.2.1).
- 14) Test pressure for hydrostatic leak-tightness test (see 11.8.1).
- 15) Wall thickness measurement away from the ends (see 11.9).
- 16) Non-Destructive Testing method (see 11.11.1).
- 17) Additional marking (see 12.2).
- 18) Protection (see 13).

6.3 Examples of an order

6.3.1 Example 1

100 t of seamless tube with an outside diameter of 168,3 mm, a wall thickness of 4,5 mm, in accordance with EN 10216-2, made of steel grade P265GH, to test category 1 with a 3.1.C inspection certificate in accordance with EN 10204:

100 t - Tube - 168,3 x 4,5 - EN 10216-2 - P265GH - TC1 - Option 13: 3.1.C

6.3.2 Example 2

100 m of seamless tube with a minimum inside diameter of 240 mm, a minimum wall thickness of 40 mm in accordance with Part of EN 10216, made of steel grade 10CrMo9-10, with a 3.1.C inspection certificate in accordance with EN 10204:

100 m - Tube - d_{\min} 240 x T_{\min} 40 - EN 10216-2 - 10CrMo9-10 - Option 13: 3.1.C

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7 MANUFACTURING PROCESS

7.1 Steel making process

The steel making process is at the discretion of the manufacturer.

7.2 Deoxidation process

Steels shall be fully killed.

7.3 Tube manufacture and delivery conditions

7.3.1 All NDT activities shall be carried out by qualified and competent level 1,2 and/or 3 personnel authorised to operate by the employer.

The qualification shall be in accordance with EN 10256 or, at least, an equivalent to it.

It is recommended that the level 3 personnel be certified in accordance with EN 473 or, at least, an equivalent to it.

The operating authorisation issued by the employer shall be in accordance with a written procedure.

NDT operations shall be authorised by level 3 NDT individual approved by the employer.

NOTE The definition of level 1, 2 and 3 can be found in appropriate Standards, e.g. EN 473 and prEN 10256

7.3.2 The tubes shall be manufactured by a seamless process.

Unless option 1 is specified, the tubes may be either hot or cold finished at the discretion of the manufacturer. The terms " hot finished " and " cold finished " apply to the condition of the tube before it is heat treated in accordance with 7.3.3.

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Option 1: *The tubes shall be cold finished before heat treatment.*

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7.3.3 The tubes shall be supplied in the relevant heat treatment conditions as specified in Table 1.

8 REQUIREMENTS

8.1 General

When supplied in a delivery condition indicated in clause 7.3 and inspected in accordance with clauses 9, 10 and 11, the tubes shall conform to the requirements of this Part of EN 10216.

In addition, the general technical delivery requirements specified in EN 10021 shall apply.

Tubes shall be suitable for hot and cold bending provided the bending is carried out in an appropriate manner.

When tubes are specified in the order by d , d_{\min} or T_{\min} the following equations, with all terms in mm, shall apply for the calculation of outside diameter D_c , inside diameter d_c and wall thickness T_c , instead of D , d and T for the relevant requirements in clauses 8.4.1.4, 10.2.2.2, 11.3, 11.8.1, 11.9, 11.11.4, 12.1 and Table 1, footnote c, Tables 4, 5, 8, 10, 13 and 14:

$$D_c = d + 2T \quad (1)$$

$$D_c = d_{\min} + \frac{\text{tolerance} \cdot \text{of} \cdot d_{\min}}{2} + 2T \quad (2)$$

$$d_c = d_{\min} + \frac{\textit{tolerance} \cdot \textit{of} \cdot d_{\min}}{2} \quad (3)$$

$$T_c = T_{\min} + \frac{\textit{tolerance} \cdot \textit{of} \cdot T_{\min}}{2} \quad (4)$$

For tolerance see Tables 8, 9 and 10.

8.2 Chemical composition

8.2.1 Cast analysis

The cast analysis reported by the steel producer shall apply and conform to the requirements of Table 2.

NOTE When welding tubes produced in accordance with this Part of this EN 10216, account should be taken of the fact that the behaviour of the steel during and after welding is dependent not only on the steel, but also on the applied heat treatment and the conditions of preparing for and carrying out the welding.

8.2.2 Product analysis

Option 3 : *Product analysis for the tubes shall be supplied.*

Table 3 specifies the permissible deviations of the product analysis from the specified limits on cast analysis given in Table 2.

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Table 1 — Heat treatment conditions

Steel grade		Heat treatment ^a	Austenizing		Tempering	
Steel name	Steel number		Temperature °C	Cooling Medium	Temperature °C	Cooling medium
P195GH	1.0348	+N ^b	880 to 940	Air	-	-
P235GH	1.0345	+N ^b	880 to 940	Air	-	-
P265GH	1.0425	+N ^b	880 to 940	Air	-	-
20MnNb6	1.0471	+N ^b	900 to 960	Air	-	-
16Mo3	1.5415	+N ^b	890 to 950	Air	-	-
8MoB5-4	1.5450	+N ^b	920 to 960	Air	-	-
14MoV6-3	1.7715	+NT ^{b c}	930 to 990	Air	680 to 730	air
10CrMo5-5	1.7338	+NT ^{b c}	900 to 960	Air	650 to 750	air
13CrMo4-5	1.7335	+NT ^{b c}	900 to 960	Air	660 to 730	air
10CrMo9-10	1.7380	+NT ^{b c}	900 to 960	Air	680 to 750	air
11CrMo9-10	1.7383	+QT	900 to 960	Air or Liquid	680 to 750	air
25CrMo4	1.7218	+QT	860 to 900	Air or Liquid	620 to 680	air
20CrMoV13-5-5	1.7779	+QT	980 to 1030	Air or Liquid	680 to 730	air
15NiCuMoNb5-6-4	1.6368	+NT ^c	880 to 980	Air	580 to 680	air
X11CrMo5+I	1.7362+I	+I	890 to 950	Furnace Atmosphere	-	-
X11CrMo5+NT1	1.7362+NT1	+NT1	930 to 980	Air	730 to 770	air
X11CrMo5+NT2	1.7362+NT2	+NT2 ^c	930 to 980	air	710 to 750	air
X11CrMo9-1+I	1.7386+I	+I	950 to 980	Furnace Atmosphere	-	-
X11CrMo9-1+NT	1.7386+NT	+NT ^c	890 to 950	air	720 to 800	air
X10CrMoVNb9-1	1.4903	+NT ^c	1040 to 1090	air	730 to 780	air
X20CrMoV11-1	1.4922	+NT ^c	1020 to 1080	air	730 to 780	air

^a +N = Normalising, +NT = Normalising + Tempering, +QT = Quenching + Tempering (air or liquid), +I = Isothermal Annealing.

^b Normalising includes Normalising Forming.

^c For these steel grades it may be necessary in the case of wall thickness T above 25 mm or T/D > 0,15 to apply quenching and tempering in order to achieve the intended structure and material properties. The decision shall be left to the discretion of the manufacturer but shall be stated to the customer at the time of enquiry and order. Steel tubes treated in such a way shall be designated by the steel name supplemented by the symbol "+QT".

Table 2 — Chemical composition (cast analysis) ^a, in % by mass

Steel grade		C	Si	Mn	P max	S max	Cr	Mo	Ni	Al _{tot}	Cu	Nb	Ti max	V	Cr+Cu +Mo+Ni	Others
Steel name	Steel number															
195GH	1.0348	≤ 0,13	≤ 0,35	≤ 0,70	0,025	0,020	≤ 0,30	≤ 0,08	≤ 0,30	≥ 0,020 ^b	≤ 0,30 ^c	≤ 0,010 ^d	0,040 ^d	≤ 0,02 ^d	≤ 0,70	-
P235GH	1.0345	≤ 0,16	≤ 0,35	≤ 1,20	0,025	0,020	≤ 0,30	≤ 0,08	≤ 0,30	≥ 0,020 ^b	≤ 0,30 ^c	≤ 0,010 ^d	0,040 ^d	≤ 0,02 ^d	≤ 0,70	-
P265GH	1.0425	≤ 0,20	≤ 0,40	≤ 1,40	0,025	0,020	≤ 0,30	≤ 0,08	≤ 0,30	≥ 0,020 ^b	≤ 0,30 ^c	≤ 0,010 ^d	0,040 ^d	≤ 0,02 ^d	≤ 0,70	-
20MnNb6	1.0471	≤ 0,22	0,15 to 0,35	1,00 to 1,50	0,025	0,020	-	-	-	≤ 0,060	≤ 0,30 ^c	0,015 to 0,10	-	-	-	-
16Mo3	1.5415	0,12 to 0,20 ^e	≤ 0,35	0,40 to 0,90	0,025	0,020	≤ 0,30	0,25 to 0,35	≤ 0,30	≤ 0,040	≤ 0,30 ^c	-	-	-	-	-
8MoB5-4	1.5450	0,06 to 0,10	0,10 to 0,35	0,60 to 0,80	0,025	0,020	≤ 0,20	0,40 to 0,50	-	≤ 0,060	≤ 0,30 ^c	-	0,060	-	-	B = 0,002 to 0,006
14MoV63	1.7715	0,10 to 0,15	0,15 to 0,35	0,40 to 0,70	0,025	0,020	0,30 to 0,60	0,50 to 0,70	≤ 0,30	≤ 0,040	≤ 0,30 ^c	-	-	0,22 to 0,28	-	-
10CrMo5-5	1.7338	≤ 0,15	0,50 to 1,00	0,30 to 0,60	0,025	0,020	1,00 to 1,50	0,45 to 0,65	≤ 0,30	≤ 0,040	≤ 0,30 ^c	-	-	-	-	-
13CrMo4-5	1.7335	0,10 to 0,17 ^e	≤ 0,35	0,40 to 0,70	0,025	0,020	0,70 to 1,15	0,40 to 0,60	≤ 0,30	≤ 0,040	≤ 0,30 ^c	-	-	-	-	-
10CrM09-10	1.7380	0,08 to 0,14	≤ 0,50	0,30 to 0,70	0,025	0,020	2,00 to 2,50	0,90 to 1,10	≤ 0,30	≤ 0,040	≤ 0,30 ^c	-	-	-	-	-
11CrMo9-10	1.7383	0,08 to 0,15	≤ 0,50	0,40 to 0,80	0,025	0,020	2,00 to 2,50	0,90 to 1,10	≤ 0,30	≤ 0,040	≤ 0,30 ^c	-	-	-	-	-