



SLOVENSKI STANDARD

SIST EN 10305-1:2003

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Steel tubes for precision applications - Technical delivery conditions - Part 1: Seamless cold drawn tubes

Präzisionsstahlrohre - Technische Lieferbedingungen - Teil 1: Nahtlose kaltgezogene Rohre

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Tubes de précision en acier - Conditions techniques de livraison - Partie 1: Tubes sans soudure étirés a froid

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EUROPEAN STANDARD
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Steel tubes for precision applications - Technical delivery conditions - Part 1: Seamless cold drawn tubes

Tubes de précision en acier - Conditions techniques de livraison - Partie 1: Tubes sans soudure étirés à froid

Präzisionsstahlrohre - Technische Lieferbedingungen - Teil 1: Nahtlose kaltgezogene Rohre

This European Standard was approved by CEN on 2 October 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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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EN 10305-1:2002 (E)**Foreword**

This document EN 10305-1:2002 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of an identical text or by endorsement, at the latest by May 2003, and conflicting national standards shall be withdrawn at the latest by May 2003.

EN 10305 consists of the following Parts under the general title : *Steel tubes for precision applications — Technical delivery conditions* :

- Part 1: *Seamless cold drawn tubes.*
- Part 2: *Welded cold drawn tubes.*
- Part 3: *Welded cold sized tubes.*
- Part 4: *Seamless cold drawn tubes for hydraulic and pneumatic power systems.*
- Part 5: *Welded and cold sized square and rectangular tubes.*
- Part 6: *Welded cold drawn tubes for hydraulic and pneumatic power systems.*

In this European Standard the annex A is normative and the annex B is informative.

This document includes a Bibliography. <https://standards.iteh.ai/catalog/standards/sist/0f9711a1-1590-4933-a040-92ced716693b/sist-en-10305-1-2003>

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.

1 Scope

This Part of EN 10305 specifies the technical delivery conditions for seamless cold drawn steel tubes of circular cross section for precision applications.

NOTE This Part of EN 10305 can also cover other types of cross section.

Tubes according to this Part of EN 10305 are characterized by having precisely defined tolerances on dimensions and a specified surface roughness. Typical fields of application are in the vehicle, furniture and general engineering industries.

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 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).

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

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

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

EN 10027-1, *Designation systems for steel — 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 10204, *Metallic products — Types of inspection documents.*

EN 10233, *Metallic materials — Tube — Flattening test.*

EN 10234, *Metallic materials — Tube — Drift expanding 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 10246-3, *Non-destructive testing of steel tubes — Part 3 : Automatic eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of imperfections.*

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 10246-7, *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 10256, *Non-destructive testing of steel tubes — Qualification and competence of level 1 and 2 non-destructive testing personnel.*

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

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

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

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

prEN 10266¹⁾, *Steel tubes, fittings and structural hollow sections — Definitions and symbols for use in product standards.*

EN ISO 4287, *Geometrical product specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters (ISO 4287:1997).*

CR 10260, *Designation systems for steel — Additional symbols.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 10020, EN 10021, EN 10052, prEN 10266 and the following apply.

3.1**employer**

organization for which a person works on a regular basis

NOTE The employer may be either the tube manufacturer or a third party organization providing non-destructive testing (NDT) services.

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4 Symbols

See prEN 10266.

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NOTE In this Part of EN 10305 T is the specified or the calculated wall thickness.

5 Classification and designation**5.1 Classification**

In accordance with the classification system in EN 10020 the steel grades given in Table 2 are non-alloy quality steels.

The steel grades given in Table A.1 are non-alloy quality steels (E255, E410, 26Mn5, 10S10, 15S10, 18S10 and 37S10), non-alloy special steels (C35E and C45E) and alloy special steels (26Mo2, 25CrMo4 and 42CrMo4).

5.2 Designation

For the tubes covered by this Part of EN 10305 the steel designation consists of:

— the number of this Part of EN 10305;

plus either:

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

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

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

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 (see 8.5);
- d) the designation of the steel grade in accordance with this Part of EN 10305 (see 5.2);
- e) the delivery condition including the surface condition (see 7.2.1 and 7.2.2);
- f) the type of tube length and, where applicable, the length (see 8.5.2).

6.2 Option

A number of options are specified in this Part of EN 10305 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) Specification of a steel grade not specified in this Part of EN 10305 (see 8.2);
- 2) specification of a sulphur range to support machinability (see 8.2);
- 3) surface condition for further processing (see 8.4.1.1);
- 4) measurement of surface roughness (see 8.4.1.5);
- 5) lower surface roughness (see 8.4.1.5);
- 6) defined removable substances on surface (see 8.4.1.6);
- 7) non-destructive testing for the detection of longitudinal imperfections (see 8.4.2);
- 8) non-destructive testing for verification of leak-tightness (see 8.4.2);
- 9) agreement on a cross section other than circular (see 8.5.1.1);
- 10) tubes specified by outside or inside diameter and wall thickness (see 8.5.1.1);
- 11) reduced diameter tolerances (see 8.5.1.2);
- 12) diameter tolerances unilateral (see 8.5.1.2);
- 13) reduced concentricity (see 8.5.1.3);
- 14) reduced wall thickness tolerance (see 8.5.1.4);
- 15) wall thickness tolerance unilateral (see 8.5.1.4);
- 16) agreement on a tolerance for exact lengths ≤ 500 mm or $> 8\ 000$ mm (see Table 7);
- 17) specified end finishing (see 8.5.4);

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- 18) specific inspection (see 9.1);
- 19) inspection certificates 3.1.A or 3.1.C (see 9.2.1);
- 20) flattening or drift expanding test (see Table 8);
- 21) test unit with tubes from one cast only (see 10.1);
- 22) alternative marking (see clause 12);
- 23) delivery without corrosion protection (see clause 13);
- 24) specified corrosion protection (see clause 13);
- 25) specified method of packaging (see clause 13).

6.3 Example of an order

12 000 m tube with an outside diameter of 60 mm and an inside diameter of 56 mm in accordance with this Part of EN 10305, made of steel grade E235 in the normalized condition, delivered in random lengths, with a 3.1.B inspection certificate in accordance with EN 10204 :

12 000 m tube - 60 x ID 56 - EN 10305-1 - E235 +N - random length - Option 18

7 Manufacturing process

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7.1 Steelmaking process

The steelmaking process is at the discretion of the manufacturer.

Steels shall be fully killed.

7.2 Tube manufacture and delivery conditions

7.2.1 The tubes shall be manufactured from hot finished seamless tubes by cold drawing or other suitable processes.

7.2.2 The tubes shall be supplied in one of the delivery conditions given in Table 1.

7.2.3 All non-destructive testing (NDT) activities shall be carried out by qualified and competent level 1, 2 and/or 3 personnel authorized 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 authorization issued by the employer shall be in accordance with a written procedure. NDT operations shall be authorized by a 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 EN 10256.

Table 1 — Delivery conditions

Designation	Symbol ^a	Description
Cold drawn / hard	+C	No heat treatment after the final cold drawing process.
Cold drawn / soft	+LC	After the final heat treatment there is a suitable drawing pass.
Cold drawn and stress relieved	+SR	After the final cold drawing process there is a stress relief heat treatment in a controlled atmosphere.
Annealed	+A	After the final cold drawing process the tubes are annealed in a controlled atmosphere.
Normalized	+N	After the final cold drawing operation the tubes are normalized in a controlled atmosphere.

^a Former frequently used corresponding heat treatment symbols are given in Table B.1.

8 Requirements

8.1 General

The tubes, when supplied in a delivery condition indicated in Table 1 and inspected in accordance with clauses 9, 10 and 11, shall comply with the requirements of this Part of EN 10305.

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

8.2 Chemical composition

The cast analysis reported by the steel producer shall apply and comply with the requirements of Table 2 (but see options 1 and 2 or Table A.1. A steel grade not specified in this Part of EN 10305 may be specified (see option 1).

Option 1: A steel grade not specified in this Part of EN 10305 with a maximum total content of alloying elements of 5 % is specified. Chemical composition, mechanical properties and delivery condition are specified by the purchaser.

NOTE When welding tubes are produced in accordance with this Part of EN 10305 account should be taken of the fact that the behaviour of the steel during and after welding is dependent not only on the steel and the delivery condition but also on the conditions of preparing for and carrying out the welding.

Table 2 — Chemical composition (cast analysis) ^a

Steel grade		% by mass					
Steel name	Steel number	C max.	Si max.	Mn max.	P max.	S ^b max.	Al min.
E215	1.0212	0,10	0,05	0,70	0,025	0,025	0,025
E235	1.0308	0,17	0,35	1,20	0,025	0,025	-
E355 ^c	1.0580	0,22	0,55	1,60	0,025	0,025	-

^a Elements not included in this Table (but see footnote c) shall not be intentionally added to the steel without the agreement of the purchaser, except for elements which may be added for finishing the cast. All appropriate measures shall be taken to prevent the addition of undesirable elements from scrap or other materials used in the steel making process.

^b See option 2.

^c Additions of Nb, Ti and V are permitted at the discretion of the manufacturer. The content of these elements shall be reported.

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Option 2: For the steel grades E235 and E355 a controlled sulphur content of 0,015 % to 0,040 % is specified to support machinability. It shall be obtained by resulphurising the steel after maximum desulphurisation or alternatively by using a low oxygen process.

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

Table 3 — Permissible deviations of the product analysis from the specified limits on cast analysis given in Table 2

Element	Limiting value for cast analysis in accordance with Table 2 in % by mass	Permissible deviation of the product analysis in % by mass
C	≤ 0,22	+0,02
Si	≤ 0,55	+0,05
Mn	≤ 1,60	+0,10
P	≤ 0,025	+0,005
S	≤ 0,040	±0,005
Al	≥ 0,025	-0,005

8.3 Mechanical properties

The mechanical properties of the tubes shall conform to the requirements of Table 4, Table A.3 and, if applicable, 11.2 or 11.3.

NOTE Subsequent processing (cold or hot) may change the mechanical properties.

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Table 4 — Mechanical properties at room temperature

Steel grade		Minimum values for the delivery condition ^{a,b}											
		+C ^c		+LC ^c		+SR			+A ^d		+N		
Steel name	Steel number	R_m MPa	A %	R_m MPa	A %	R_m MPa	R_{eH} MPa	A %	R_m MPa	A %	R_m MPa	R_{eH} MPa	A %
E215	1.0212	430	8	380	12	380	280	16	280	30	290 to 430	215	30
E235	1.0308	480	6	420	10	420	350	16	315	25	340 to 480	235	25
E355	1.0580	640	4	580	7	580	450 ^f	10	450	22	490 to 630	355	22

^a R_m : tensile strength ; R_{eH} : upper yield strength (but see 11.1) ; A: elongation after fracture. For symbols for the delivery condition see Table 1.

^b 1 MPa = 1 N/mm².

^c Depending on the degree of cold work in the finishing pass the yield strength may nearly be as high as the tensile strength. For calculation purposes the following relationships are recommended :

— for delivery condition +C : $R_{eH} \geq 0,8 R_m$;

— for delivery condition +LC : $R_{eH} \geq 0,7 R_m$.

^d For calculation purposes the following relationship is recommended : $R_{eH} \geq 0,5 R_m$.

^e For tubes with outside diameter ≤ 30 mm and wall thickness ≤ 3 mm the R_{eH} minimum values are 10 MPa lower than the values given in this Table.

^f For tubes with outside diameter > 160 mm: $R_{eH} \geq 420$ MPa.