SLOVENSKI STANDARD
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Jeklene cevi za precizno uporabo – Tehnični dobavni pogoji – 6. del: Hladno vlečene varjene cevi za hidravlične in pnevmatične tlačne vode

Steel tubes for precision applications - Technical delivery conditions - Part 6: Welded cold drawn tubes for hydraulic and pneumatic power systems

Präzisionsstahlrohre - Technische Lieferbedingungen - Teil 6: Geschweißte kaltgezogene Rohre für Hydraulik- und Pneumatik-Druckleitungen

Tubes de précision en acier - Conditions techniques de livraison - Partie 6 : Tubes soudés étirés a froid pour circuits hydrauliques et pneumatiques

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Steel tubes for precision applications - Technical delivery conditions - Part 6: Welded cold drawn tubes for hydraulic and pneumatic power systems

Tubes de précision en acier - Conditions techniques de livraison - Partie 6 : Tubes soudés étirés à froid pour circuits hydrauliques et pneumatiques

Präzisionsstahlrohre - Technische Lieferbedingungen - Teil 6: Geschweißte kaltgezogene Rohre für Hydraulik- und Pneumatik-Druckleitungen

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Foreword

This document (EN 10305-6:2005) has been prepared by Technical Committee ECISS/TC 29 “Steel tubes and fittings for steel tubes”, the secretariat of which is held by UNI/UNSIDER.

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of an identical text or by endorsement, at the latest by November 2005, and conflicting national standards shall be withdrawn at the latest by November 2005.

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 (97/23/EC).

For relationship with EU Directive (97/23/EC), see informative Annex ZA, which is an integral part of this document.

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

This document includes a bibliography.

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 sized square and rectangular tubes

— Part 6: Welded cold drawn tubes for hydraulic and pneumatic power systems

1 Scope

This Part of EN 10305 specifies the technical delivery conditions for welded cold drawn tubes of circular cross section for use in hydraulic and pneumatic power systems.

Tubes according to this Part of EN 10305 are characterized by having precisely defined tolerances on dimensions and a specified surface roughness.

The allowed pressure rates and temperatures are the responsibility of the customer in accordance with the state of the art and in the application of the safety coefficients specified in the applicable regulations, codes or standards.

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 those 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 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 10168, *Steel products – Inspection documents – List of information and description.*

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

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

EN 10266, *Steel tubes, fittings and structural hollow sections – Symbols and definitions of terms for use in product standards.*

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).*

EN ISO 8492, *Metallic materials - Tube - Flattening test (ISO 8492:1998)*

EN ISO 8493, *Metallic materials - Tube - Drift-expanding test (ISO 8493:1998)*

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, EN 10266 and the following apply.

3.1
employer
organisation for which a person works on a regular basis

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

4 Symbols

For the purposes of this Part of EN 10305 the symbols given in EN 10266 and the following apply.

C1, C2 category conformity indicators (see 7.2.2 and 7.2.3)

5 Classification and designation

5.1 Classification

In accordance with the classification system in EN 10020, the steel grades given in Table 1 are non-alloy quality steels.

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

— 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) quantity (mass or total length or number of pieces);

b) term “tube”;

c) dimensions [outside diameter and wall thickness] (see 8.5.1.1 and Table 4);

d) designation of the steel grade in accordance with this Part of EN 10305 (see 5.2);

e) type of tube length (see 8.5.2);

f) type of inspection (see 9.1).

6.2 Options

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 his 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) Reduced internal roughness of ≤ 2 µm (see 8.4.2.5);

2) leak tightness test method (see 8.4.3);

3) supply to inside diameter and wall thickness or outside diameter and inside diameter (see 8.5.1.1);

4) lengths other than 6 m (see 8.5.2);

5) Enhanced straightness (see 8.5.3);

6) higher test pressure for hydrostatic test (see 11.4.1);

7) alternative marking (see clause 12);

8) protection by phosphatization (see 13.1);

9) protection by electrolytical zinc coating (see 13.1);

10) protection of tube ends (see 13.1);

11) specified method of packaging (see 13.2).

6.3 Example of an order

1 000 tubes with an outside diameter of 20 mm and a specified wall thickness of 2,5 mm in accordance with this Part of EN 10305, made of steel grade E235, delivered in standard lengths:

1 000 tubes – 20 x 2,5 – EN 10305-6 – E235 – standard length

7 Manufacturing process

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 electric welded tubes by cold drawing. Other suitable methods of cold working are permitted.

The tubes shall be delivered in the delivery condition +N, which means that after final cold drawing (or other processing) the tubes are normalized in a controlled atmosphere.

7.2.2 Welding shall be carried out by suitably qualified personnel according to suitable operating procedures.

For tube to be used for pressure equipment in categories II, III, and IV (of Directive 97/23/EC), the operating procedures and the personnel shall be approved by a competent third-party. Tubes not processed according to this requirement shall be marked "C 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 the appropriate standards, e.g. EN 473 and EN 10256.

For tube to be used for pressure equipment in categories III and IV (of Directive 97/23/EC) the NDT personnel shall be approved by a recognised third-party organisation. Tubes not processed according to this requirement shall be marked "C 2", unless a requirement to mark "C 1" (see 7.2.2) applies.

8 Requirements

8.1 General

The tubes, when 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 1.

NOTE When welding tubes 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, but also on the conditions of preparing for and carrying out the welding.

Table 1 — Chemical composition (cast analysis) [a]

Steel grade		in % by mass				
Steel name	Steel number	C max	Si max	Mn max	P max	S max
E155	1.0033	0,11	0,35	0,70	0,025	0,015
E195	1.0034	0,15	0,35	0,70	0,025	0,015
E235	1.0308	0,17	0,35	1,20	0,025	0,015
E275	1.0225	0,21	0,35	1,40	0,025	0,015
E355 [b]	1.0580	0,22	0,55	1,60	0,025	0,015

[a] Elements not included in this Table (but see footnote [b]) 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] Additions of Nb, Ti and V are permitted at the discretion of the manufacturer. If added, the content of these elements shall be reported.

Table 2 specifies the permissible deviations of the product analysis from the specified limits on cast analysis given in Table 1.

Table 2 — Permissible deviations of the product analysis from the specified limits on cast analysis given in Table 1

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	≤ 0,015	+ 0,003

8.3 Mechanical properties

The mechanical properties of the tubes shall comply with the requirements of Table 3 and 11.2 or 11.3.

Table 3 — Mechanical properties at room temperature

Steel grade		Yield strength [a] R_{eH}	Tensile strength R_m	Elongation A
Steel name	Steel number	MPa [b] min	MPa [b]	% min
E155	1.0033	155	270 to 410	28
E195	1.0034	195	300 to 440	28
E235	1.0308	235	340 to 480	25
E275	1.0225	275	410 to 550	21
E355	1.0580	355	490 to 630	22

NOTE The steel grades defined in this Part of EN 10305 have an intrinsic minimum transverse impact energy *KV* of 27 J at 0 °C.

[a] For tubes with outside diameter ≤ 30 mm and wall thickness ≤ 3 mm, the minimum permitted values of R_{eH} are 10 MPa lower than given in this Table.

[b] 1 MPa = 1 N/mm²

8.4 Appearance and internal soundness

8.4.1 General

The weld area shall be free from cracks and lack of fusion (cold weld).

8.4.2 Appearance

8.4.2.1 The internal and external surface finish of the tubes shall be typical of the manufacturing process and the heat treatment, and it shall be such that any surface imperfections such as ridges, dents or shallow grooves requiring dressing can be identified.

8.4.2.2 Any surface imperfections, whose depth cannot be clearly identified (i.e. scales, overlaps) shall be either dressed in accordance with 8.4.2.3 or treated in accordance with 8.4.2.4.

8.4.2.3 It shall be permissible to dress, only by grinding or machining, surface imperfections provided that, after doing so, the dimensions are within the specified tolerances. All dressed areas shall blend smoothly into the contour of the tube.

8.4.2.4 Surface imperfections which encroach on the specified minimum wall thickness shall be considered defects and tubes containing these shall be deemed not to conform to this Part of EN 10305.

8.4.2.5 The tubes shall have smooth outer and inner surfaces with a roughness $R_a \leq 4$ µm, unless option 1 is specified.

NOTE In the case of the inner surface this requirement applies to inner diameters ≥ 15 mm.

Option 1 *A specified reduced roughness of $R_a \leq 2$ µm applies for the inner and/or outer surface of the tube.*

8.4.3 Internal soundness

The tubes shall pass a test for verification of leak-tightness in accordance with 11.4.1 (Hydrostatic test) or 11.4.2 (Electromagnetic test).

The choice of the test method shall be at the discretion of the manufacturer, unless option 2 is specified.

Option 2 *The test method for verification of leak-tightness according to 11.4.1 or 11.4.2 is specified by the purchaser.*

8.5 Dimensions and tolerances

8.5.1 Outside diameter, inside diameter and wall thickness

8.5.1.1 The tubes shall be supplied by outside diameter and wall thickness, unless option 3 is specified. Preferred outside diameters, wall thicknesses and inside diameters are given in Table 4.

Option 3 *Tubes shall be supplied to inside diameter and wall thickness or outside diameter and inside diameter as specified by the purchaser.*

Dimensions different from those in Table 4 may be agreed at the time of enquiry and order. In this case, the tolerances shall also be agreed.

8.5.1.2 The diameter tolerances of tubes specified by outside and inside diameter shall be within the tolerance limits given in Table 4. When the D/T ratio is ≥ 20 the tolerances are increased by a factor 1,5.

Out-of-roundness is included in the tolerances on diameter.

8.5.2 Lengths

The type of tube lengths shall be specified at the time of enquiry and order by either

— a standard length of 6 m $^{+50}_{0}$ mm; or

— an exact length of 6 m $^{+10}_{0}$ mm,

unless option 4 is specified.

Up to 5% of an order for standard lengths may be supplied shorter than 6m, provided that the tubes are not less than 4 m long and that they are bundled separately.

Option 4 *The tubes shall be delivered in a length other than 6 m. The length and the tolerances shall be agreed at the time of enquiry and order.*