



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 à froid pour circuits hydrauliques et pneumatiques

Ta slovenski standard je istoveten z: EN 10305-6:2016

ICS:

77.140.75	Jeklene cevi in cevni profili za posebne namene	Steel pipes and tubes for specific use
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EUROPEAN STANDARD

EN 10305-6

NORME EUROPÉENNE

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English Version

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

This European Standard was approved by CEN on 18 January 2016.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 10305-6:2016) has been prepared by Technical Committee ECISS/TC 110 “Steel tubes and iron and steel fittings”, 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of an identical text or by endorsement, at the latest by September 2016 and conflicting national standards shall be withdrawn at the latest by September 2016.

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 10305-6:2005.

In comparison with the previous edition, the following technical changes have been made:

- a) References were adapted;
- b) The options were renumbered in such a way that now throughout all parts the number of options are the same;
- c) Precision tubes will now be preferably ordered according to outer diameter and wall thickness;
- d) The drift expanding test is now beside the tensile test the second test for the verification of the mechanical properties;
- e) Editorial updates.

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 Directive 2014/68/EU.

For relationship with Directive 2014/68/EU, see informative Annex ZA, which is an integral part of this document.

EN 10305, *Steel tubes for precision applications - Technical delivery conditions* consists of the following parts:

- *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 cold sized square and rectangular tubes*
- *Part 6: Welded cold drawn tubes for hydraulic and pneumatic power systems*

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

EN 10305-6:2016 (E)**1 Scope**

This European Standard 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 upper temperatures are the responsibility of the customer in accordance with the state of the art and in application of the safety coefficients specified in the applicable regulations, codes or standards. Concerning the lower temperature range applicability the impact energy requirements are given at 0 °C.

NOTE Once this standard is published in the Official Journal of the European Union (OJEU) under Directive 2014/68/EU, presumption of conformity to the Essential Safety Requirements (ESRs) of Directive 2014/68/EU is limited to technical data of materials in this standard and does not presume adequacy of the material to a specific item of equipment. Consequently, the assessment of the technical data stated in this material standard against the design requirements of this specific item of equipment to verify that the ESRs of the Pressure Equipment Directive are satisfied, needs to be done.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

EN 10021:2006, *General technical delivery conditions for steel 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 10168:2004, *Steel products - Inspection documents - List of information and description*

EN 10204:2004, *Metallic products - Types of inspection documents*

EN 10266:2003, *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 377:2013)*

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

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

EN ISO 6892-1, *Metallic materials - Tensile testing - Part 1: Method of test at room temperature (ISO 6892-1)*

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

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

EN ISO 10893-1, *Non-destructive testing of steel tubes - Part 1: Automated electromagnetic testing of seamless and welded (except submerged arc-welded) steel tubes for the verification of hydraulic leaktightness (ISO 10893-1)*

EN ISO 10893-2, *Non-destructive testing of steel tubes - Part 2: Automated eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of imperfections (ISO 10893-2)*

EN ISO 10893-3, *Non-destructive testing of steel tubes - Part 3: Automated full peripheral flux leakage testing of seamless and welded (except submerged arc-welded) ferromagnetic steel tubes for the detection of longitudinal and/or transverse imperfections (ISO 10893-3)*

EN ISO 10893-10, *Non-destructive testing of steel tubes - Part 10: Automated full peripheral ultrasonic testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of longitudinal and/or transverse imperfections (ISO 10893-10)*

ISO 11484:2009, *Steel products - Employer's qualification system for non-destructive testing (NDT) personnel*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 10020:2000, EN 10021:2006, EN 10052:1993, EN 10266:2003 and the following apply.

3.1

employer

organization for which a person works on a regular basis

Note 1 to entry: The employer can be either the tube manufacturer or a third party organization providing services, such as non-destructive testing (NDT).

3.2

manufacturer

party to produce and to deliver tubes in accordance with this document

Note 1 to entry: Where tubes are delivered by an intermediary, see EN 10021:2006, Clause 6.

3.3

imperfection

discontinuity in the wall or on the pipe surfaces detectable by methods described in this document

Note 1 to entry: Imperfections with a size complying with the acceptance criteria specified in this document are considered to have no practical implication on the intended use of the product.

3.4

defect

imperfection of a size not complying with the acceptance criteria specified in this document

Note 1 to entry: Defects are considered to adversely affect or limit the intended use of the product.

EN 10305-6:2016 (E)**4 Symbols**

For the purposes of this part of EN 10305, the symbols given in EN 10266:2003 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 document, the steel designation consists of the number of this document (EN 10305-6) plus either:

- a) the steel name in accordance with EN 10027-1; or
- b) the steel number in accordance with EN 10027-2.

6 Information to be supplied by the purchaser**6.1 Mandatory information**

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The following information shall be obtained by the manufacturer at the time of enquiry and order:

- a) quantity (mass or total length or number);
- b) term "tube";
- c) dimensions, preferably by outside diameter D and wall thickness T (or other pair of dimensions), (see 8.5.1.1 and Table 4);
- d) steel designation (see 5.2);
- e) type of tube length (see 8.5.2);
- f) type of inspection certificate (see 9.1).

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6.2 Options

A number of options are specified in this document 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).

- Option 7: Reduced internal roughness of $\leq 2 \mu\text{m}$ (see 8.4.3);
- Option 8: Measurement of surface roughness (see 8.4.4);
- Option 12: Non-destructive testing for the detection of longitudinal imperfections (see 8.4.7);
- Option 21: another specified length and/or tolerance (see 8.5.2);
- Option 22: Reduced maximum deviation from straightness (see 8.5.3);

- Option 24: higher test pressure for hydrostatic test (see 11.6.2);
- Option 28: alternative marking (see Clause 12);
- Option 31: protection by phosphatization (see 13.1);
- Option 32: protection by electrolytical zinc coating (see 13.1);
- Option 37: protection of tube ends (see 13.1);
- Option 38: unbundled tubes or specific method of packaging (see 13.2).

6.3 Example of an order

1 000 tubes with an outside diameter of $D = 20$ mm and a specified wall thickness of $T = 2,5$ mm in accordance with this document, made of steel grade E235, delivered in standard lengths with an inspection certificate 3.1 in accordance with EN 10204:2004:

1 000 tubes – $D 20 \times T 2,5$ – EN 10305-6 – E235 – standard length – inspection certificate 3.1

7 Manufacturing process

7.1 Steelmaking process

The steel making process is at the discretion of the manufacturer with the exception that the open hearth (Siemens-Martin) process shall not be employed unless in combination with a secondary steelmaking or ladle refining process.

Steels shall be fully killed.

NOTE This excludes the use of rimming, balanced or semi-killed steel.

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 2014/68/EU), 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 ISO 11484:2009 or, at least, an equivalent to it.

It is recommended that the level 3 personnel be certified in accordance with EN ISO 9712 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.

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NOTE The definition of level 1, 2 and 3 can be found in the appropriate standards, e.g. EN ISO 9712 and ISO 11484:2009.

For tubes to be used for pressure equipment in categories III and IV (of Directive 2014/68/EU) the NDT personnel shall be approved by a recognized third-party organization. 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 subsequently welding tubes produced in accordance with this document, it is important to take account of the fact that the behaviour of the steel during and after welding is dependent not only on the steel composition and the delivery condition but also on the conditions of preparing for and carrying out the welding.

Table 1 — Chemical composition (cast analysis)

Steel grade		% by mass					
Steel name	Steel number	C max.	Si max.	Mn max.	P max.	S max.	Al ^{total a} min.
E155	1.0033	0,11	0,35	0,70	0,025	0,015	0,015
E195	1.0034	0,15	0,35	0,70	0,025	0,015	0,015
E235	1.0308	0,17	0,35	1,20	0,025	0,015	0,015
E275	1.0225	0,21	0,35	1,40	0,025	0,015	0,015
E355	1.0580	0,22	0,55	1,60	0,025	0,015	0,020
Elements not quoted in this table (but see footnote ^a) shall not be intentionally added to the steel without the agreement of the purchaser, except for elements which may be added for the purposes of deoxidation and/or nitrogen binding. All appropriate measures shall be taken to prevent the addition of undesirable elements from scrap or other materials used in the steel making process.							
^a This requirement is not applicable provided the steel contains a sufficient amount of other nitrogen binding elements, such as Ti, Nb or V. If added, the content of these elements shall be reported in the inspection document. When using titanium, the manufacturer shall verify that $(Al + Ti/2) \geq 0,020$.							

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 the cast analysis given in Table 1

Element	Specified limit of the cast analysis % by mass	Permissible deviation of the product analysis % 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
Al	≥ 0,015	- 0,005

8.3 Mechanical properties

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

Table 3 — Mechanical properties at room temperature

Steel name	Steel grade Steel number	Yield strength ^a	Tensile strength	Elongation
		R_{eH} MPa b min	R_m MPa	A % 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
The steel grades defined in this document have an intrinsic minimum transverse impact energy 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.				

8.4 Appearance and soundness

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

8.4.2 The internal and external surface finish of the tubes shall be typical of the manufacturing process and, where applicable, the heat treatment employed. Normally, the finish and surface condition shall be such that any surface imperfections requiring dressing can be identified. Any surface imperfections, which in accordance with the manufacturer's experience might be considered defects as specified in 8.4.5, shall be dressed in accordance with 8.4.6, or the tube or part of tube shall be rejected.

8.4.3 The tubes shall have smooth outer and inner surfaces with a roughness R_a ≤ 4 μm, unless option 7 is specified.

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