SLOVENSKI STANDARD
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Jeklene cevi za precizno uporabo ï Tehniļ ni dobavni pogoji ï 5. del: Varjene in hladno kalibrirane kvadratne in pravokotne cevi

Steel tubes for precision applications - Technical delivery conditions - Part 5: Welded and cold sized square and rectangular tubes

Präzisionsstahlrohre - Technische Lieferbedingungen - Teil 5: Geschweißte und maßumgeformte Rohre mit quadratischem oder rechteckigem Querschnitt

Tubes de précision en acier - Conditions techniques de livraison - Partie 5: Tubes soudés et calibrés de section carrée ou rectangulaire

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

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This European Standard was approved by CEN on 14 February 2003.

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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
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 10305-5:2003) 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of an identical text or by endorsement, at the latest by October 2003, and conflicting national standards shall be withdrawn at the latest by October 2003.

This European Standard 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*

Annex A is informative.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This part of this European Standard specifies the technical delivery conditions for welded and sized steel tubes of square and rectangular cross section for precision applications.

Tubes according to this part of this European Standard are characterised by having precisely defined tolerances on dimension 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 references, 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 — Part1: Steel names, principal symbols.*

EN 10027-2, *Designation systems for steel — Part2: Numerical system.*

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

prEN 10168[1)], *Steel products - Inspection documents - List of information and description.*

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

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 10246-8, *Non-destructive testing of steel tubes - Part 8: Automatic ultrasonic testing of the weld seam of electric welded steel tubes for the detection of longitudinal imperfections.*

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

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

prEN 10266[1)], *Steel tubes, fittings and structural hollow sections — Definitions and symbols 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).*

[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.

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

3 Terms and definitions

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

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

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

3.2
parent coil
coil originating from the hot rolling process prior to any further operation (pickling, slitting, cold rolling or coating)

4 Symbols

See prEN 10266.

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.

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.

NOTE A list of corresponding former national designations (of similar steel grades) is given in Table A.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 of pieces);

b) the term "tube“;

c) the dimensions (see 8.5);

d) the designation of the steel grade in accordance with this part of this European Standard (see 5.2);

e) the delivery condition including the surface condition (see 7.2.1 and 7.2.2).

6.2 Options

A number of options are specified in this part of this European Standard 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) suitability for hot dip galvanizing (see 7.2.1);

2) specification of a steel grade not specified in this part of this European Standard (see 8.2);

3) surface condition for further processing (see 8.4.1.1);

4) position of the weld line (see 8.4.1.5);

5) removal of internal weld bead (see 8.4.1.6);

6) measurement of surface roughness (see 8.4.1.7);

7) lower surface roughness (see 8.4.1.7);

8) non-destructive testing of the weld seam for the detection of longitudinal imperfections (see 8.4.2);

9) reduced wall thickness tolerance (see 8.5.3);

10) wall thickness tolerance unilateral (see 8.5.3);

11) exact length (see 8.5.5);

12) another specified length and/or tolerance (see 8.5.5);

13) special end finishing (see 8.5.10);

14) specific inspection (see 9.1);

15) test unit with tubes from one cast only (see 10.1.1);

16) alternative marking (see clause 12);

17) delivery without corrosion protection (see clause 13);

18) specified corrosion protection (see clause 13);

19) specified method of packaging (see clause 13).

6.3 Example of an order

12 000 m tube, size 50 mm × 30 mm with a wall thickness of 3 mm in accordance with EN 10305-5, made of steel grade E235 in the normalized condition with strip surface condition S2 (pickled) with a 3.1.B inspection certificate in accordance with EN 10204:

12 000 m tube – 50 × 30 × 3 - EN 10305-5 - E235+N - S2 - Option 14.

7 Manufacturing process

7.1 Steelmaking process

The steels shall be produced by the electric process or by one of the basic oxygen processes. The 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 steel strip by electric welding. The tubes shall not include welds used for joining lengths of flat rolled strip prior to forming the tube.

Possible surface conditions are:

— S1 (black);

— S2 (pickled);

— S3 (cold rolled);

— S4 (coated to an agreed condition).

NOTE The surface conditions S1 and S3 apply for the strip. The surface condition S2 and S4 can apply for the strip or the tube ; the purchaser should, where necessary, indicate the required condition at the time of enquiry and order.

Option 1: *The tubes shall be suitable for hot dip galvanizing.*

7.2.2 Tubes made of the steel grades E155, E195, E235, E275 and E355 shall be supplied in one of the delivery conditions given in Table 1, except +CR2. Tubes made of the grades E190, E220, E260, E320, E370 and E420 shall be supplied in the delivery condition +CR2.

7.2.3 All non-destructive testing (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 operation authorisation issued by the employer shall be in accordance with a written procedure. NDT operations shall be authorised 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
Welded and cold sized	+CR1 [b]	Normally not heat treated, but suitable for final annealing.
	+CR2 [c]	Not intended for heat treatment after the welding and sizing process.
Annealed	+A	After the welding and sizing process the tubes are annealed in a controlled atmosphere.
Normalized	+N	After the welding and sizing process the tubes are normalized in a controlled atmosphere. This delivery condition can be reached via direct processing.

[a] Former frequently used corresponding heat treatment symbols are given in Table A.1.

[b] NOTE 1 After annealing or normalizing, the mechanical properties given in Table 4 for the delivery condition +A or +N, respectively are normally obtained.

[c] NOTE 2 If further heat treatment is applied, the resulting mechanical properties may be outside the specified requirements.

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. A steel grade not specified in this part of EN 10305 may be specified (see option 2).

Option 2: *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 1 Precautions regarding the silicon content should be taken if option 1 is specified.

NOTE 2 When subsequently welding tubes produced according to 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 2 — Chemical composition (cast analysis)[a]

Steel grade		% by mass max.				
Name	Number	C	Si	Mn	P	S
E155	1.0033	0,11	0,35	0,70	0,025	0,025
E190	1.0031	0,10				
E195	1.0034	0,15	0,35	0,70	0,025	0,025
E220	1.0215	0,14				
E235	1.0308	0,17	0,35	1,20	0,025	0,025
E260	1.0220	0,16				
E275	1.0225	0,21	0,35	1,40	0,025	0,025
E320	1.0237	0,20				
E355[b]	1.0580	0,22	0,55	1,60	0,025	0,025
E370[b]	1.0261	0,21				
E420[b]	1.0575	0,16	0,50	1,70	0,025	0,025

[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. The content of these elements shall be reported.

Table 3 specifies the permissible 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 given in Table 2

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	≤ 1,70	+ 0,10
P	≤ 0,025	+ 0,005
S	≤ 0,025	+ 0,005

8.3 Mechanical properties

The mechanical properties of the tubes covered by this part of EN 10305 shall conform to the requirements of Tables 4 or 5.

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

Table 4 — Mechanical properties at room temperature for the delivery conditions +CR1, +A and +N

Steel grade		Minimum values for the delivery condition [a, b]						
		+CR1 [c]		+A		+N		
Name	Number	R_m MPa	A %	R_m MPa	A %	R_m MPa	R_{eH} MPa	A %
E155	1.0033	290	15	260	28	270 to 410	155	28
E195	1.0034	330	8	290	28	300 to 440	195	28
E235	1.0308	390	7	315	25	340 to 480	235	25
E275	1.0225	440	6	390	21	410 to 550	275	21
E355	1.0580	540	5	490	22	490 to 630	355	22

NOTE The mechanical properties and technological properties of the weld zone may, in the case of the delivery conditions +CR1 and +A, differ from those of the base material.

[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/mm^2

[c] Depending on the degree of cold forming the strip material and sizing the as welded tube, the yield strength may nearly be as high as the tensile strength. For calculation purposes yield strength values of $R_{eH} \geq 0,7\ R_m$ are recommended in the +CR1 condition.