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Austenitic, austenitic-ferritic and ferritic longitudinally welded stainless steel tubes for the food and chemical industry

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English Version

Austenitic, austenitic-ferritic and ferritic longitudinally welded stainless steel tubes for the food and chemical industry

Tubes soudés longitudinalement en acier inoxydable austénitique, ferritique et austéno-ferritique pour l'industrie alimentaire et chimique

Austenitische, austenitisch-ferritische und ferritische längsnahtgeschweißte Rohre aus nichtrostendem Stahl für die Lebensmittel- und chemische Industrie

This European Standard was approved by CEN on 17 July 2022.

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European foreword

This document (EN 10357:2022) has been prepared by Technical Committee CEN/TC 459 "ECISS – European Committee for Iron and Steel Standardization"[1], the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by February 2023, and conflicting national standards shall be withdrawn at the latest by February 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 10357:2013.

The follow significant technical changes were made in comparison to the previous version:

— Subclause 4.1, Table 1: added new dimension;

— Subclause 4.1, Table 2: deleted series B, changed dimensions in series C;

— Clause 7, Table 3: modified surface characteristics and roughness and symbols.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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[1] Through its sub-committee SC 10 "Steel tubes, and iron and steel fittings" (secretariat: UNI),

1 Scope

This document specifies dimensions, tolerances, materials, internal and external surface characteristics, and marking of longitudinally fusion welded stainless steel tubes for the food and chemical industry.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10028-7:2016, *Flat products made of steels for pressure purposes - Part 7: Stainless steels*

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

EN 10217-7, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 7: Stainless steel tubes*

EN 10296-2, *Welded circular steel tubes for mechanical and general engineering purposes - Technical delivery conditions - Part 2: Stainless steel*

EN ISO 21920-3, *Geometrical product specifications (GPS) - Surface texture: Profile - Part 3: Specification operators (ISO 21920-3)*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Dimensions and tolerances

4.1 Dimensions and tolerances for tubes

Dimensions and tolerances for tubes are indicated in Table 1 and Table 2.

Table 1 — Preferred dimensions and tolerances [a] (mm)

Series A	**External tube diameter**	**13,00**	**19,00**	**23,00**	**29,00**	**35,00**	**41,00**	**53,00**	**70,00**	**85,00**	**104,00**	**129,00**	**154,00**	**204,00**	**254,00**
	External diameter tolerances	±0,10	±0,10	±0,12	±0,15	±0,18	±0,21	±0,27	±0,35	±0,43	±0,78	±0,97	±1,16	±1,53	±1,91
	Internal diameter (theoretical)	10,00	16,00	20,00	26,00	32,00	38,00	50,00	66,00	81,00	100,00	125,00	150,00	200,00	250,00
	Wall thickness	**1,50**	**1,50**	**1,50**	**1,50**	**1,50**	**1,50**	**1,50**	**2,00**	**2,00**	**2,00**	**2,00**	**2,00**	**2,00**	**2,00**
	Wall thickness tolerances	±0,15	±0,15	±0,15	±0,15	±0,15	±0,15	±0,15	±0,20	±0,20	±0,20	±0,20	±0,20	±0,20	±0,20

[a] For dimensions different from the ones listed above the tolerances are:
EN ISO 1127-D4 for external diameter ≤ 85,00 mm.
EN ISO 1127-D3 for external diameter > 85,00 mm.
In external diameter tolerances ovality is included.
For wall thickness ± 10 %.

Table 2 — Alternative dimensions and tolerances [a] (mm)

Series C	**External tube diameter**	**12,70**	**19,05**	**25,40**	**38,10**	**50,80**	**63,50**	**76,20**	**101,60**	**152,40**
	External diameter tolerances	±0,13	±0,13	±0,13	±0,20	±0,20	±0,25	±0,25	±0,38	±0,76
	Internal diameter (theoretical)	9,40	15,75	22,10	34,80	47,50	60,20	72,90	97,38	146,86
	Wall thickness	**1,65**	**1,65**	**1,65**	**1,65**	**1,65**	**1,65**	**1,65**	**2,11**	**2,77**
	Wall thickness tolerances	±0,17	±0,17	±0,17	±0,17	±0,17	±0,17	±0,17	±0,21	±0,28
Series D	**External tube diameter**	**25,00**	**32,00**	**38,00**	**51,00**	**63,50**	**76,10**	**101,60**		
	External diameter tolerances	±0,13	±0,16	±0,19	±0,25	±0,32	±0,38	±0,76		
	Internal diameter (theoretical)	22,60	29,60	35,60	48,60	60,30	72,90	97,60		
	Wall thickness	**1,20**	**1,20**	**1,20**	**1,20**	**1,60**	**1,60**	**2,00**		
	Wall thickness tolerances	±0,12	±0,12	±0,12	±0,12	±0,16	±0,16	±0,20		

[a] For dimensions different from the ones listed above the tolerances are:
EN ISO 1127-D4 for external diameter ≤ 76,20 mm.
EN ISO 1127-D3 for external diameter > 76,20 mm.
In external diameter tolerances ovality is included.
For wall thickness ± 10 %.

4.2 Straightness

Straightness deviation for a given length shall be determined by the following formula:

0,0015 × length

and shall not exceed 2 mm/m.

5 Information to be supplied by the purchaser

5.1 General

If product falls under PED, it is the responsibility of the purchaser to specify all relevant requirements as per 5.2 and 5.3.

5.2 Mandatory information

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

a) the quantity (total weight or total metres or number of tubes);

b) the reference to this document;

c) the term “tube”;

d) manufacturing process symbol (CL1 CC, CL1 CD, CL1 BC, CL1 BD, CL2 CC, CL2 CD, CL2 BC, CL2 BD) and surface characteristics (see Table 3);

e) the dimensions (outside diameter D and wall thickness T) (see Table 1 and Table 2);

f) single unit length and related tolerance;

g) the designation of the steel grade according to EN 10217-7 except for ferritic grades;

h) the designation of the steel grade according to EN 10028-7 only for ferritic;

i) production and testing according to EN 10217-7 TC1 or TC2; for ferritic grades the reference values shall be agreed;

j) other options according to EN 10217-7.

5.3 Options

If not specified at the time of the enquiry and order, the standard tubes are supplied in Class 1 (see Table 3).

Tubes according product class 2 (see Table 3) shall be requested at the time of the enquiry and order.

5.4 Example of an order

5.4.1 Example 1

1 000 m of welded tube according to EN 10357, manufacturing process and product class CL1 BC, external diameter = 41 mm, thickness = 1,5 mm, single unit length 6 000 mm (0/+100) mm test category 1 according to EN 10217-7, grade 1.4404 and inspection certificate 3.1 according to EN 10204:

1 000 m Tube EN 10357 — CL1 BC - 41 × 1,5 × 6 000 (0/+100) mm - TC1 – EN 10217-7/1.4404 - 3.1

5.4.2 Example 2

1 000 m of welded tube according to EN 10357, manufacturing process and product class CL2 BD, external diameter = 70 mm, thickness = 2 mm, single unit length 6 000 mm (0/+100) mm test category 1 according to EN 10217-7, grade 1.4404 and inspection certificate 3.1 according to EN 10204:

1 000 m Tube EN 10357 — CL2 BD - 70 × 2 × 6 000 (0/+100) mm - TC1 – EN 10217-7/1.4404 - 3.1

6 Materials

Materials used for tubes manufacturing according to this document shall be:

— austenitics and austenitic-ferritics according to EN 10028-7;

— ferritics according to EN 10028-7.

See also Annex A for information on selection of material.

7 Manufacturing process, requirements and surface characteristics

The tubes shall be manufactured from cold rolled plate, sheet or strip, longitudinally fusion welded, with or without the addition of filler metal.

Manufacturing process, requirements and surface characteristics are specified in Table 3.

Table 3 — Manufacturing process, requirements and surface characteristics

			Surface characteristics and roughness			
Product class	**Manufacturing process**	**Heat treatment**	**Internal surface**	**Internal weld bead**	**External surface and welding area**	**Symbol**
CL1 (0,80/1,60 µm)	From cold rolled material[a] Welded, welding bead rolled	Not heat treated	*Ra* ≤ 0,80 µm pickled and passivated	*Ra* ≤ 1,60 µm pickled and passivated	Pickled and passivated	CL1 CC
					Mech. polished, *Ra* ≤ 1,00 µm	CL1 CD
		Heat treated	*Ra* ≤ 0,80 µm pickled and passivated or bright annealed	*Ra* ≤ 1,60 µm pickled and passivated or bright annealed	Pickled and passivated or bright annealed	CL1 BC
					Mech. polished, *Ra* ≤ 1,00 µm	CL1 BD
CL2 (0,80/0,80 µm)	From cold rolled material[a] Welded, welding bead rolled	Not heat treated	*Ra* ≤ 0,80 µm pickled and passivated	*Ra* ≤ 0,80 µm pickled and passivated	pickled and passivated	CL2 CC
					Mech. polished, *Ra* ≤ 1,00 µm	CL2 CD
		Heat treated	*Ra* ≤ 0,80 µm pickled and passivated or bright annealed	*Ra* ≤ 0,80 µm pickled and passivated or bright annealed	Pickled and passivated or bright annealed	CL2 BC
					Mech. polished, *Ra* ≤ 1,00 µm	CL2 BD

[a] From cold rolled material according to EN 10028-7:2016, Table 6, finish 2B, 2D or 2R.

Tubes that are not bright annealed and not heat treated shall be internally and externally pickled and passivated. After rinsing, residual acid or welding discolouration shall not be present. Further cleanliness requirements shall be agreed upon in the order.

The weld shall be worked down so that it is flush with the tube wall and then smoothed. There shall be no overlapping of the weld metal and parent metal. There shall also be no protrusions, root gaps (lack of full penetration), overlapping or misalignment of edges, open pores (porosity) or traces of rolling.

The *Ra* roughness values shall be measured longitudinally, while the roughness measurement transversally to the welded bead may be agreed at the time of the order.

For tubes in execution CL1 BC, CL1 BD, CL2 BC and CL2 BD in the inspection certificate shall be specified if the tube is bright annealed or heat treated and pickled and passivated.

Tubes ends shall be smooth and free of burrs.

8 Testing and inspection documents

Tubes according to this document shall be tested according to:

— EN 10217-7 for test category TC1 or TC2 for austenitic and austenitic-ferritic materials;

— EN 10296-2 for ferritic materials.

Intergranular corrosion testing shall be performed in accordance with EN 10217-7 for austenitic and austenitic-ferritic grades; for ferritic grades the test procedure shall be agreed.

Roughness measurements shall be performed inside the tube at least 5 mm from the end, in accordance with EN ISO 21920-3 on at least one test run for every 20 tubes per production batch. The measurements shall be recorded.

Measurements shall be performed both on the welded bead and on the base material. The inspection certificate shall report the conformity of the executed measurements.

In the case of CL1 CD, CL1 BD, CL2 CD and CL2 BD manufacturing process, additional outside roughness measurements shall be performed at least at 100 mm from the tube end with the same frequency as for the internal one.

The following inspection documents shall be issued:

— Inspection certificate 3.1 according to EN 10204.

9 Marking

Each tube shall be marked, by suitable and durable methods, with the following information:

— Manufacturer's name or trademark;

— EN 10357 TC1 or TC2 for test categories 1 or 2, respectively, as in EN 10217-7;

— Symbol of the execution process according to Table 3;

— Steel grade;

— Dimensions;

— Heat number;

— For TC 2 tubes, the identification number (e.g. order or item number), according to EN 10217-7, which permits the correlation of the product or delivery unit to the related document;

— The mark of the inspection representative.

Different kind of marking and additional labelling shall be agreed at the time of the order.

10 Packaging and transport

Tubes shall be delivered dry. Ground tubes in CL1 CD, CL1 BD, CL2 CD and CL2 BD execution process shall be protected by PE sleeves, unless differently agreed at the time of enquiry and order.

Packaging and transport shall be agreed at the time of the order.

Annex A
(informative)

Responsibility on selection of material

The responsibility for material selection remains with the designer/end user. It is not in the scope of this document to give guidance for selecting the appropriate material for individual applications. Regulations for materials in contact with drinking water for human use, food and dairy applications apply which can vary across the European Union Member states. For guidance, the most commonly used materials are listed in Table A.1 below.

Table A.1 — Steel grades

Steel name	Material number
X5CrNi18–10	1.4301
X2CrNi18–9	1.4307
X2CrNiMo17–12–2	1.4404
X2CrNiMo17–12–3	1.4432
X2CrNiMo18–14–3	1.4435

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EN ISO 1127, *Stainless steel tubes - Dimensions, tolerances and conventional masses per unit length (ISO 1127)*

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