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BRITISH STANDARD

BS EN
10305-4:2003

Steel tubes for precision applications — Technical delivery conditions —

Part 4: Seamless cold drawn tubes for hydraulic and pneumatic power systems

The European Standard EN 10305-4:2003 has the status of a British Standard

ICS 77.140.75

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National foreword

This British Standard is the official English language version of EN 10305-4:2003. BS EN 10305-4:2003, together with BS EN 10305-1:2002 supersedes BS 6323-4:1982 which is withdrawn on publication of both standards.

Also, BS EN 10305-4:2003 together with BS EN 10305-1, -2, -3, -5, -6, BS EN 10296-1 and -2 and BS EN 10297-1 supersedes BS 6323-1:1982 which will be withdrawn on publication of all standards in the series.

This standard does not conflict with BS 7416.

The UK participation in its preparation was entrusted to Technical Committee ISE/8, Steel pipes, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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This British Standard, was published under the authority of the Standards Policy and Strategy Committee on 30 July 2003

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EUROPEAN STANDARD

NORME EUROPÉENNE

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EN 10305-4

April 2003

ICS 77.140.75

English version

Steel tubes for precision applications - Technical delivery conditions - Part 4: Seamless cold drawn tubes for hydraulic and pneumatic power systems

Tubes en acier pour applications de précision - Conditions techniques de livraison - Tubes sans soudure étirés à froid pour circuits hydrauliques et pneumatiques

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This European Standard was approved by CEN on 28 February 2003.

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Foreword

This document (EN 10305-4:2003) 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 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(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

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 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, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This part of this European Standard specifies the technical delivery conditions for seamless cold drawn steel tubes of circular cross section used in hydraulic and pneumatic power systems.

Tubes according to this part of this European Standard are characterised 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 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 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 steel — Part 2: 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 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 10256, *Non-destructive testing of steel tubes — Qualification and competence of level 1 and 2 non-destructive testing personnel.*

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

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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.

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CR 10260, *Designation system 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 and prEN 10266 and the following apply.

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.

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 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) the quantity (mass or total length or number) ;

b) the term "tube" ;

c) the dimensions (outside diameter and inside diameter or other pair of dimensions) (see 8.5.1.1 and Table 4) ;

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

e) the type of tube length (see 8.5.2) ;

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f) the 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 8.4.1.5) ;

2: lengths other than 6 m (see 8.5.2) ;

3: alternative marking (see clause 12) ;

4: protection by phosphatization (see 13.1) ;

5: protection by galvanization and chromatization type blue-white (see 13.1) ;

6: protection by galvanization and chromatization type yellow (see 13.1) ;

7: protection by galvanization and chromatization type olive green (see 13.1) ;

8: protection of tube ends (see 13.1) ;

9: special packaging (see 13.2).

6.3 Example of an order

1000 m tubes with an outside diameter of 20 mm and an inside diameter of 15 mm in accordance with this part of EN 10305, made of steel grade E235, delivered in standard lengths with non-specific inspection and protected by phosphatization:

> 1000 m tubes - 20 x ID 15 - EN 10305-4 - E 235 – in standard lengths with non-specific inspection and testing – option 4.

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 hot finished seamless 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 the final cold drawing operation the tubes are normalized in a controlled atmosphere.

7.2.2 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.

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The operating 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.

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 and the delivery conditions, but also on the conditions of preparing for and carrying out the welding.

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

Steel grade		% by mass					
Name	Number	C max.	Si max.	Mn max.	P max.	S max.	Al_{tot} min.
E215	1.0212	0,10	0,05	0,70	0,025	0,015	0,025
E235	1.0308	0,17	0,35	1,20	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. The content of these elements shall be reported.

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

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Table 2 — Permissible deviations of the product analysis from the specified limits 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	≥ 0,025	- 0,005

8.3 Mechanical properties

The mechanical properties of the tubes shall conform to the requirements of Table 3 and 11.2 or 11.3.

Table 3 — Mechanical properties at room temperature

Steel grade		Yield strength [a]	Tensile strength	Elongation
Name	Number	R_{eH} min. MPa	R_m min. MPa	A min. %
E215	1.0212	215	290 to 430	30
E235	1.0308	235	340 to 480	25
E355	1.0580	355	490 to 630	22

[a] 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.

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

8.4 Appearance and soundness

8.4.1 Appearance

8.4.1.1 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.

8.4.1.2 Any surface imperfections, whose depth cannot be clearly identified (i.e. scales, overlaps) shall be either dressed in accordance with 8.4.1.3 or treated in accordance with 8.4.1.4.

8.4.1.3 It shall be permissible to dress, 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.

8.4.1.4 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.

8.4.1.5 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.

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Option 1 A reduced roughness of $R_a \leq 2$ µm is specified for the inner surface.

8.4.2 Internal soundness

The tubes shall pass a non-destructive test for verification of leak-tightness in accordance with 11.6.

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 inside diameter or outside diameter and wall thickness or inside diameter and wall thickness as specified by the purchaser.

Preferred outside diameters, inside diameters and wall thicknesses are given with tolerances in Table 4. Out-of-roundness is included in the tolerances on diameter.

Dimensions which are 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 For tubes specified by the outside and the inside diameter, the deviation from concentricity shall fulfil the following requirement :

$$\frac{T_{max} - T_{min}}{T_{max} + T_{min}} \leq 0{,}10,$$

where T_{max} and T_{min} are measured in the same cross section.

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 2 is specified.

5 % of shorter lengths may be supplied provided they are not shorter than 4 m and bundled separately.

Option 2 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.

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Table 4 — Sizes and tolerances

Dimensions in millimetres

Specified outside diameter with tolerance		Specified inside diameter with tolerance		Wall thickness
4	± 0,08	3	± 0,15	0,5
		2		1
5	± 0,08	3,5	± 0,15	0,75
		3		1
6	± 0,08	4	± 0,12	1
		3	± 0,15	1,5
		2		2
8	± 0,08	6	± 0,10	1
		5		1,5
		4	± 0,15	2
		3		2,5
10	± 0,08	8	± 0,08	1
		7	± 0,12	1,5
		6	± 0,15	2
		5		2,5
12	± 0,08	10	± 0,08	1
		9	± 0,10	1,5
		8	± 0,12	2
		7	± 0,15	2,5
		6		3
14	± 0,08	12	± 0,08	1
		11		1,5
		10	± 0,10	2
		9	± 0,12	2,5
		8	± 0,15	3
15	± 0,08	13	± 0,08	1
		12		1,5
		11	± 0,10	2
		10	± 0,12	2,5
		9	± 0,15	3

“continued”

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Table 4 *(continued)*

Specified outside diameter with tolerance		Specified inside diameter with tolerance		Wall thickness
16	± 0,08	14	± 0,08	1
		13		1,5
		12	± 0,15	2
		11	± 0,12	2,5
		10	± 0,15	3
18	± 0,08	16	± 0,08	1
		15		1,5
		14		2
		13	± 0,15	2,5
		12		3
20	± 0,08	17	± 0,08	1,5
		16		2
		15	± 0,15	2,5
		14		3
		13		3,5
		12		4
22	± 0,08	20	± 0,08	1
		19		1,5
		18		2
		17		2,5
		16	± 0,15	3
		15		3,5
		14		4
25	± 0,08	22	± 0,08	1,5
		21		2
		20		2,5
		19	± 0,15	3
		17		4
		16		4,5
		15		5

“continued”

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Table 4 *(continued)*

Specified outside diameter with tolerance		Specified inside diameter with tolerance		Wall thickness
28	± 0,08	25	± 0,08	1,5
		24		2
		23		2,5
		22	± 0,15	3
		20		4
		18		5
30	± 0,08	26	± 0,08	2
		25		2,5
		24	± 0,15	3
		22		4
		20		5
		18		6
35	± 0,15	31	± 0,15	2
		30		2,5
		29		3
		27		4
		25		5
		23		6
38	± 0,15	34	± 0,15	2
		33		2,5
		32		3
		30		4
		28		5
		26		6
		24		7
		22		8
42	± 0,20	38	± 0,20	2
		36		3
		34		4
		32		5
		30		6
		26		8

"continued"

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Table 4 *(concluded)*

Specified outside diameter with tolerance		Specified inside diameter with tolerance		Wall thickness
50	± 0,20	42	± 0,20	4
		40		5
		38		6
		34		8
		32		9
		30		10
55	± 0,25	47	± 0,25	4
		43		6
		39		8
		35		10
60	± 0,25	50	± 0,25	5
		44		8
		40		10
		35		12,5
70	± 0,30	60	± 0,30	5
		54		8
		50		10
		45		12,5
80	± 0,35	68	± 0,35	6
		64		8
		60		10
		55		12,5

8.5.3 Straightness

The deviation from straightness of any tube length *L* shall not exceed 0,0015 *L*. Deviations from straightness over any one metre length shall not exceed 3 mm.

8.5.4 Preparation of ends

The tubes shall be delivered with square cut ends. The ends shall be free from excessive burrs.

9 Inspection

9.1 Type of inspection

The compliance with the requirements of the order shall be checked by non-specific inspection or specific inspection. The type of inspection shall be specified at the time of enquiry and order.

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9.2 Inspection documents

9.2.1 Type of inspection documents

In the case of non-specific inspection a test report 2.2 in accordance with EN 10204 shall be issued.

When specific inspection is requested, an inspection certificate 3.1.B in accordance with EN 10204 shall be issued.

9.2.2 Content of inspection documents

9.2.2.1 The content of the inspection document shall be in accordance with prEN 10168 as shown in 9.2.2.2 and 9.2.2.3.

9.2.2.2 For tubes supplied with non-specific inspection the test report 2.2 shall contain the following codes and information :

A commercial transactions and parties involved ;

B description of products to which the inspection applies ;

C10 - C13 tensile test ;

C60 - C69 other tests ;

C71 - C92 chemical composition ;

D01 marking, surface appearance, shape and dimensional properties ;

D02 - D99 leak tightness test ;

Z validation.

9.2.2.3 For tubes supplied with specific inspection the inspection certificate 3.1.B shall contain the following codes and information :

A commercial transactions and parties involved ;

B description of products to which the inspection document applies ;

C10-C13 tensile test ;

C60-C69 other tests ;

C71-C92 chemical composition (cast analysis) ;

D01 marking, surface appearance, shape and dimensional properties ;

D02-D99 leak tightness test ;

Z validation.

9.3 Summary of inspection and testing

Inspection and testing shall be carried out as stated in Table 5.

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Table 5 — Summary of inspection and testing

Type of inspection or test	Frequency of testing[a]		Reference
	Non-specific inspection	Specific inspection	
Chemical analysis	M	M	8.2
Tensile test	M	One per test unit	8.3, 11.1
Flattening test or[b] Drift expanding test	M	2 per test unit	11.2 / 11.3
Dimensional inspection	M	M	8.5, 11.4
Visual examination	M	M	11.5
NDT for verification of leak tightness	Individual	Individual	8.4.2, 11.6

[a] M : according to manufacturer's procedure.

[b] The test method is at the discretion of the manufacturer.

10 Sampling

10.1 Test unit

A test unit is defined as a quantity of tubes of the same steel grade and dimensions, the same cast, manufactured by the same process and heat treated in the same batch[2)] and the same heat treatment facility.

A test unit shall comprise not more than 500 random lengths with a maximum of 10 000 m.

10.2 Preparation of samples and test pieces

10.2.1 General

Samples and test pieces shall be taken at the tube ends and in accordance with EN ISO 377 from one sample tube per test unit.

10.2.2Test piece for the tensile test

The test piece shall be prepared in accordance with EN 10002-1.

10.2.3Test piece for the flattening or drift expanding test

The test piece for the flattening test or drift expanding test shall consist of a full tube section, in accordance with EN 10233 or EN 10234 respectively.

11 Test methods

11.1 Tensile test

The test shall be carried out at room temperature in accordance with EN 10002-1 and the following determined :

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— the tensile strength (R_m) ;

— the upper yield strength (R_{eH}) ;

If a yield phenomenon is not present the 0,2 % proof strength ($R_{p0,2}$) shall be determined ;

— the percentage elongation after fracture with a reference to a gauge length L_o of 5,65 $\sqrt{S_o}$.

If a non-proportional test piece is used, the percentage elongation value shall be converted to the value for a gauge length L_o = 5,65 $\sqrt{S_o}$ using the conversion tables given in EN ISO 2566-1.

11.2 Flattening test

The test shall be carried out in accordance with EN 10233 provided the wall thickness is less than 15 % of the outside diameter. The tube section shall be flattened in a press until the distance *H* between the platens reaches the value given by the following formula :

$$H = \frac{(1 + C) \times T}{C + \frac{T}{D}}$$

where :

H is the distance between the plates to be measured under load, in mm ;

D is the specified outside diameter, in mm ;

T is the specified wall thickness, in mm ;

C is a constant, the value of which is :

— 0,09 for steel grades E215 and E235 ;

— 0,07 for steel grade E355.

After testing the piece shall be free from cracks or breaks. However, a slight incipient crack at the edges shall not be regarded as justification for rejection.

11.3 Drift expanding test

The test shall be carried out in accordance with to EN 10234 with a 60° conical mandrel. The tube section shall be expanded until the increase in diameter reaches the applicable values shown in Table 6.

Table 6 — Requirements for the drift expanding test

Steel grade		% increase of the diameter D for	
Name	Number	$T \leq 4$ mm	$T > 4$ mm
E215	1.0212	20	15
E235	1.0308	18	12
E355	1.0580	15	10

After testing, the test piece shall be free from cracks or breaks. However, a slight incipient crack at the edges shall not be regarded as justification for rejection.

11.4 Dimensional inspection

Specified dimensions shall be verified.

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11.5 Visual examination

Tubes shall be visually examined for compliance with the requirements of 8.4.1 and 8.5.3.

11.6 Leak tightness test

Non-destructive testing for verification of leak-tightness shall be carried out in accordance with EN 10246-1.

11.7 Retests, sorting and reprocessing

For retests, sorting and reprocessing EN 10021 applies.

12 Marking

The following marking shall, unless option 3 is specified, be applied indelibly on each tube. The marking shall be repeated continuously along a line parallel to the tube axis, with a maximum interval of 1,5 m between two sequences, 5 % of the tubes may contain only one mark.

When one of the options 5 to 7 is specified, marking may be applied on a label attached to the bundle or the box.

The marking shall include the following information :

— the manufacturer´s name or trade mark ;

— the specified dimensions ;

— the number of this European Standard ;

— the steel name ;

— in the case of specific inspection, an identification number (e. g. order or item number) which permits the correlation of the product or delivery unit to the related document.

Option 3 An agreed alternative marking is specified.

13 Protection and packaging

13.1 Protection

The tubes shall be delivered with a temporary protection against corrosion. The type of protection shall be at the discretion of the manufacturer, unless otherwise specified (see options 4 to 8). The manufacturer shall take appropriate measures to prevent ingress of foreign matter into the tube.

Option 4 The tubes shall be phosphatized before temporary protection.

Option 5 The external surface of the tubes shall be galvanized and chromatized type blue-white. The zinc thickness shall be specified by the purchaser.

Option 6 The external surface of the tubes shall be galvanized and chromatized type yellow. The zinc thickness shall be specified by the purchaser in accordance with an appropriate specification.

Option 7 The external surface of the tubes shall be galvanized and chromatized type olive. The zinc thickness shall be specified by the purchaser.

Option 8 The tube ends shall be protected with plugs or caps.

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13.2 Packaging

The tubes shall be delivered in bundles, with polygonal bundles for tubes of ≥ 12 mm outside diameter, unless option 9 is specified.

Option 9 The method of packaging shall be as specified by the purchaser.

Care shall be taken in handling and transportation to avoid surface and straightness damage.

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Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 97/23/EC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in table ZA confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA – Correspondence between this European Standard and Directive 97/23/EC

Clause(s)/sub-clause(s) of this EN	**Essential Requirements (ERs) of Directive 97/23/EC**	**Qualifying remarks/Notes**
All normative clauses	Section 4 of Annex I	

WARNING: Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 473, *Non-destructive testing - Qualification and certification of NDT personnel — General principles.*

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