

Seamless steel tubes for pressure purposes — Technical delivery conditions —

Part 3: Alloy fine grain steel tubes

The European Standard EN 10216-3:2002, with the incorporation of amendment A1:2004 has the status of a British Standard

ICS 23.040.10; 77.140.75

National foreword

This British Standard is the official English language version of EN 10216-3:2002, including amendment A1:2004.

The UK participation in its preparation was entrusted by Technical Committee ISE/73, Steels for pressure purposes, to Subcommittee ISE/73/1, Steel tubes for pressure purposes, 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.

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**Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 3: Alloy fine grain steel tubes
(includes amendment A1:2004)**

Tubes sans soudure en acier pour service sous pression -
Conditions techniques de livraison - Partie 3: Tubes en
acier allié à grain fin
(inclut l'amendement A1:2004)

Nahtlose Stahlrohre für Druckbeanspruchungen -
Technische Lieferbedingungen - Teil 3: Rohre aus legierten
Feinkornbaustählen
(enthält Änderung A1:2004)

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Foreword

This document (EN 10216-3:2002) 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of an identical text or by endorsement, at the latest by November 2002, and conflicting national standards shall be withdrawn at the latest by November 2002.

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.

Other Parts of EN 10216 are:

- Part 1 : Non-alloy steel tubes with specified room temperature properties
- Part 2 : Non-alloy and alloy steel tubes with specified elevated temperature properties
- Part 4 : Non-alloy and alloy steel tubes with specified low temperature properties
- Part 5 : Stainless steel tubes

Another European Standard series covering tubes for pressure purposes is:

EN 10217: Welded steel tubes for pressure purposes

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Foreword to amendment A1

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1 SCOPE

This Part of EN 10216 specifies the technical delivery conditions in two test categories for seamless tubes of circular cross section, made of weldable alloyed fine grained steel.

2 NORMATIVE REFERENCES

This European Standard incorporates by date 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 date 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).

The requirements of this European Standard rule when they differ from those in the standards and documents referred to below:

EN 10002-1, *Metallic materials - Tensile testing - Part 1: Method of test (at ambient temperature)*.

EN 10002-5, *Metallic materials - Tensile testing - Part 5: Method of testing (at elevated temperature)*.

EN 10020, *Definitions and classification of grades of steel*.

EN 10021, *General technical delivery requirements for steel and iron products*.

EN 10045-1, *Metallic materials - Charpy impact test - Part 1: Test method*.

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

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

EN 10027-1, *Designation systems for steels - Part 1 : Steel names, principle symbols*.

EN 10027-2, *Designation systems for steels Part 2 : Numerical systems*.

ENV 10220, *Seamless and welded steel tubes - Dimensions and masses per unit length*

EN 10233, *Metallic materials - Tubes - Flattening test*.

EN 10234, *Metallic materials - Tubes - Drift expanding test*.

EN 10236, *Metallic materials - Tubes - Ring expanding test*.

EN 10237, *Metallic materials - Tubes - Ring tensile 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 10246-5, *Non-Destructive Testing of steel tubes – Part 5: Automatic full peripheral magnetic transducer/flux leakage testing of seamless and welded (except submerged arc-welded) ferromagnetic steel tubes for the detection of longitudinal imperfections*.

EN 10246-6, *Non-Destructive Testing of steel tubes - Part 6: Automatic full peripheral ultrasonic testing of seamless steel tubes for the detection of transverse imperfections*.

EN 10246-7, *Non-Destructive Testing of steel tubes - Part 7 : Automatic full peripheral ultrasonic testing of seamless and welded (except submerged arc welded) steel tubes for the detection of longitudinal imperfections*.

EN 10246-14, *Non-Destructive Testing of steel tubes - Part 14: Automatic ultrasonic testing of seamless and welded (except submerged arc welded) steel tubes for the detection of laminar imperfections.*

EN 10256, *Non-Destructive Testing of steel tubes - Qualification and competence of level 1 and level 2 NDT personnel.*

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)*

prEN 10168¹⁾, *Iron and steel products - Inspection documents - List of information and description*

prEN 10266¹⁾, *Steel tubes, fittings and structural hollow sections - Symbols and definition of terms for use in product standards*

EURONORM 103²⁾, *Microscopic determination of ferritic grain size of steel.*

ISO 14284, *Steel and iron - Sampling and preparation of samples for the determination of chemical composition*

CR 10260, *Designation systems for steel - Additional symbols*

CR 10261, *ECISS Information Circular IC 11 - Iron and steel - Review of available methods of chemical analysis.*

3 TERMS AND DEFINITIONS

For the purposes of this Part of EN 10216, the terms and definitions given in EN 10020, EN 10021, EN 10052, prEN 10266 and the following apply:

3.1

test category

classification that indicates the extent and level of inspection and testing.

3.2

employer

organisation for which a person works on a regular basis.

NOTE The employer may be either the tube manufacturer or supplier or a third party organisation providing Non-Destructive Testing (NDT) services.

3.3

fine grain steel

steel having a ferritic grain size equal to or finer than 6 in accordance with EURONORM 103

1) In preparation; until this document is published as a European Standard, the corresponding national standard(s) should be agreed at the time of enquiry and order.

2) Until this EURONORM is transformed into an a European Standard, it can be implemented or the corresponding national standard may be agreed at the time of enquiry and order.

4 SYMBOLS

For the purpose of this Part of EN 10216, the symbols given in prEN 10266 and the following apply:

- d specified inside diameter;
- $d_{\min}$ specified minimum inside diameter;
- $T_{\min}$ specified minimum wall thickness;
- D_c calculated outside diameter;
- d_c calculated inside diameter;
- T_c calculated wall thickness;
- TC test category

5 CLASSIFICATION AND DESIGNATION

5.1 Classification

5.1.1 This Part of EN 10216 covers steel grades in four qualities (see Tables 2 and 4):

- the basic quality (P ... N, Q);
- the elevated temperature quality (P ... NH, QH);
- the low temperature quality (P ... NL1, QL, QL1);
- the special low temperature quality (P ... NL2, QL2).

5.1.2 In accordance with the classification system in EN 10020, the steel grades P275NL1, P355N, P355NH and P355NL1 are classified as alloy quality steels and the other steel grades are classified as alloy special steels.

5.2 Designation

5.2.1 For the tubes covered by this Part of EN 10216 steel the designation consists of:

- the number of this Part of EN 10216;

plus either:

- the steel name in accordance with EN 10027-1 and CR 10260;

or :

- the steel number allocated in accordance with EN 10027-2.

5.2.2 The steel name is designated by:

- the capital letter P for pressure purposes;
- the indication of the specified minimum yield strength for the lowest applicable wall thickness group expressed in megapascals, (Table 4);
- one of the additional symbols N, NH, NL1, NL2, Q, QH, QL, QL1 or QL2 (see 5.1.1, Tables 2 and 4).

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 D and wall thickness T or a set of dimensions covered by option 10) (see Table 7);
- d) the designation of the steel grade in accordance with this Part of EN 10216 (see 5.2);
- e) the test category, except for P620 and P690 (see 9.3).

6.2 Options

A number of options are specified in this Part of EN 10216 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) Cold finishing (see 7.3.2).
- 2) Restriction on copper and tin content (see Table 2).
- 3) Product analysis (see 8.2.2).
- 4) Verification of elevated temperature properties of NH-grades (see 8.3.2).
- 5) Verification of elevated temperature properties of NL- and QL-grades (see 8.3.2).
- 6) Selection of leak-tightness test method (see 8.4.2.1).
- 7) Non-Destructive Testing for test category 2 tubes for detection of transverse imperfections (see 8.4.2.2)
- 8) Non-Destructive Testing for test category 2 tubes for the detection of laminar imperfections (see 8.4.2.2).
- 9) Special ends preparation (see 8.6).
- 10) Set of dimensions other than D and T (see 8.7.1).
- 11) Exact lengths (see 8.7.3).
- 12) The type of inspection document other than the standard document (see 9.2.1).
- 13) Additional impact test at test temperature different from standard test temperature (see Table 16).
- 14) Test pressure for hydrostatic leak-tightness test (see 11.8.1).
- 15) Wall thickness measurement away from the ends (see 11.9)
- 16) Non-Destructive Testing method (see 11.11.1)
- 17) Additional marking (see 12.2).
- 18) Protection (see clause 13).

6.3 Examples of an order

500 m of seamless tube with an outside diameter of 168,3 mm, a wall thickness of 4,5 mm in accordance with EN 10216-3, made of steel grade P355N, test category 1, with a 3.1.C inspection certificate in accordance with EN 10204:

500 m – Tube – 168,3 x 4,5 – EN 10216-3 – P355N – TC1 – Option 12: 3.1.C

7 MANUFACTURING PROCESS

7.1 Steelmaking process

The steelmaking process is at the discretion of the manufacturer.

7.2 Deoxidation process

Steels shall be fully killed and be made to a fine grain practice (see 3.3).

7.3 Tube manufacture and delivery conditions

7.3.1 All 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 operating authorisation issued by the employer shall be in accordance with a written procedure.

NDT operations shall be authorised by 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

7.3.2 The tubes shall be manufactured by a seamless process.

Unless option 1 is specified, the tubes may be either hot or cold finished at the discretion of the manufacturer. The terms “ hot finished ” and “ cold finished ” apply to the condition of the tube before it is heat treated in accordance with 7.3.3.

Option 1: *The tubes shall be cold finished before heat treatment.*

7.3.3 The tubes shall be supplied in the relevant heat treatment conditions as specified in Table 1 and Table 4.

Table 1 — Forming operation and delivery condition

Forming operation	Heat treatment condition	Symbol for the delivery condition
Hot finished	Normalised ^{a b}	+N
	Quenched and tempered	+QT
Hot rolled + cold finished	Normalised ^b	+N
	Quenched and tempered	+QT
^a See 7.3.4		
^b See 7.3.5		

7.3.4 In case of steel grade P355N and P355NH normalising may be replaced by normalising forming.

7.3.5 For steel grade P460 it may be necessary to apply delayed cooling or additional tempering after normalising. For N-steel grades accelerated cooling after austenitizing may be necessary in order to achieve the intended structure and material properties in case of wall thickness above 25 mm or $T/D > 0,15$

In both cases, the decision shall be left to the discretion of the manufacturer but shall be stated to the customer at the time of enquiry and order. Steel tubes treated with accelerated cooling shall be designated by the steel name supplemented by the symbol "+QT".

8 REQUIREMENTS

8.1 General

When supplied in a delivery condition indicated in clause 7.3 and inspected in accordance with clauses 9, 10 and 11, the tubes shall conform to with the requirements of this Part of EN 10216.

In addition, the general technical delivery requirements specified in EN 10021 shall apply.

Tubes shall be suitable for hot and cold bending provided the bending is carried out in an appropriate manner.

When tubes are specified in the order by d , $d_{\min}$ or $T_{\min}$ the following equations, with all terms in mm, shall apply for the calculation of outside diameter D_c , inside diameter d_c and wall thickness T_c , instead of D , d and T for the relevant requirements in clauses 7.3.5, 8.4.1.4, 10.2.2.2, 11.3, 11.8.1, 11.9, 11.11.4, 12.1 and Table 1, footnote c, Tables 4, 5, 6, 7, 10, 12, 15 and 16:

$$D_c = d + 2T \quad (1)$$

$$D_c = d_{\min} + \frac{\text{tolerance} \cdot \text{of} \cdot d_{\min}}{2} + 2T \quad (2)$$

$$d_c = d_{\min} + \frac{\text{tolerance} \cdot \text{of} \cdot d_{\min}}{2} \quad (3)$$

$$T_c = T_{\min} + \frac{\text{tolerance} \cdot \text{of} \cdot T_{\min}}{2} \quad (4)$$

For tolerance see Tables 10, 11 and 12.

8.2 Chemical composition

8.2.1 Cast analysis

The cast analysis reported by the steel producer shall apply and conform to the requirements of Table 2.

NOTE When welding tubes produced in accordance with this Part of EN 10216, 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 applied heat treatment and the conditions of preparing for and carrying out the welding.

8.2.2 Product analysis

Option 3: A product analysis for the tubes shall be supplied.

Table 3 specifies the permissible deviations of the product analysis from the specified limits on cast analysis given in Table 2.

8.3 Mechanical properties

8.3.1 The mechanical properties of the tubes shall conform to the requirements in Tables 4, 5, 6, 7, Annex A, and in clauses 11.3, 11.4, 11.5 and 11.6.

8.3.2 The elevated temperature properties given in Tables 5 and 6 shall be verified for steel grade P620QH and P690QH at 300 °C.

Option 4: *Elevated temperature properties given in Tables 5 and 6 shall be verified for NH-grades at 400 °C.*

The properties at elevated temperature given in Tables 5 and 6 for steel grades P355NH, P460NH, P620QH and P690QH, apply for the corresponding low and special low temperature quality steels if option 5 is specified.

The properties at the elevated temperature given in Annex A for steel grades P275NL1 and P275NL2 apply, if option 5 is specified

Option 5: *Elevated temperature properties given in Tables 5, 6 and Annex A shall be verified for NL- and QL-grades at the highest temperature for which a value is given.*