



SLOVENSKI STANDARD
SIST EN 13480-2:2002
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Kovinski industrijski cevovodi - 2. del: Materiali

Metallic industrial piping - Part 2: Materials

Metallische industrielle Rohrleitungen - Teil 2: Werkstoffe

Tuyauteries industrielles métalliques - Partie 2: Matériaux

Ta slovenski standard je istoveten z: EN 13480-2:2002

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EUROPEAN STANDARD
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Metallic industrial piping - Part 2: Materials

Tuyauteries industrielles métalliques - Partie 2: Matériaux

Metallische industrielle Rohrleitungen - Teil 2: Werkstoffe

This European Standard was approved by CEN on 23 May 2002.

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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
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Foreword

This document (EN 13480-2:2002) has been prepared by Technical Committee CEN/TC 267 "Industrial piping and pipelines", 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of an identical text or by endorsement, at the latest by November 2002, and conflicting national standards shall be withdrawn at the latest by November 2002.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.

In this standard the Annexes A, B and C are normative.

This European Standard EN 13480 for metallic industrial piping consists of seven interdependent and not dissociable Parts which are:

— *Part 1: General.*

— *Part 2: Materials.*

— *Part 3: Design.*

— *Part 4: Fabrication and installation.*

— *Part 5: Inspection and testing.*

— *Part 6: Additional requirements for buried piping.*

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CEN/TR 13480-7, *Guidance on the use of conformity assessment procedures.*

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

EN 13480-2:2002 (E)
Issue 1 (2002-05)**1 Scope**

This Part of this European Standard specifies the requirements for materials (including metallic clad materials) for industrial piping and supports covered by EN 13480-1 manufactured from metallic materials. It is currently limited to steels with sufficient ductility. This Part of this European Standard is not applicable to materials in the creep range.

NOTE Other materials will be added later by amendments.

It specifies the requirements for the selection, inspection, testing and marking of metallic materials for the fabrication of industrial piping.

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 288-3, *Specification and approval of welding procedures for metallic material – Part 3: Welding procedure tests for the arc welding of steels.*

EN 764-3, *Pressure equipment – Terminology – Part 3: Definition of parties involved.*

EN 10028-1, *Flat products made of steels for pressure purposes – Part 1: General requirements.*

EN 10028-2, *Flat products made of steels for pressure purposes – Part 2: Non-alloy and alloy steels with specified elevated temperature properties.*

EN 10028-3, *Flat products made of steels for pressure purposes – Part 3: Weldable fine grain steels, normalized.*

EN 10028-4, *Flat products made of steels for pressure purposes – Part 4: Nickel alloyed steels with specified low temperature properties.*

EN 10028-5, *Flat products made of steels for pressure purposes – Part 5: Weldable fine grain steels, thermomechanically rolled.*

EN 10028-6, *Flat products made of steels for pressure purposes – Part 6: Weldable fine grain steels, quenched and tempered.*

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

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

EN 10164, *Steel products with improved deformation properties perpendicular to the surface of the product – Technical delivery conditions.*

EN 10204, *Metallic materials – Types of inspection documents.*

EN 10213-1, *Technical delivery conditions for steel castings for pressure purposes – Part 1: General.*

EN 10213-2, *Technical delivery conditions for steel castings for pressure purposes – Part 2: Steel grades for use at room temperature and elevated temperatures.*

EN 10213-3, *Technical delivery conditions for steel castings for pressure purposes – Part 3: Steel grades for use at low temperatures.*

EN 10213-4, *Technical delivery conditions for steel castings for pressure purposes – Part 4: Austenitic and austenitic-ferritic steel grades.*

EN 10216-1, *Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 1: Non-alloy steel tubes with specified room temperature properties.*

EN 10216-2, *Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties.*

EN 10216-3, *Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 3: Alloy fine grain steel tubes.*

EN 10216-4, *Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 4: Non-alloy and alloy steel tubes with specified low temperature properties.*

prEN 10216-5, *Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 5: Stainless steel tubes.*

EN 10217-1, *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 1: Non-alloy steel tubes with specified room temperature properties.*

EN 10217-2, *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties.*

EN 10217-3, *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 3: Alloy fine grain steel tubes.*

EN 10217-4, *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 4: Electric welded non-alloy steel tubes with specified low temperature properties.*

prEN 10217-5, *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 5: Submerged arc welded non-alloy and alloy steel tubes with specified elevated temperature properties.*

EN 10217-6 *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 6: Submerged arc welded non-alloy steel tubes with specified low temperature properties.*

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

EN 10222-1, *Steel forgings for pressure purposes – Part 1: General requirements for open die forgings.*

EN 10222-2, *Steel forgings for pressure purposes – Part 2: Ferritic and martensitic steels with specified elevated temperature properties.*

EN 10222-3, *Steel forgings for pressure purposes – Part 3: Nickel steels with specified low temperature properties.*

EN 10222-4, *Steel forgings for pressure purposes – Part 4: Weldable fine grain steels with high proof strength.*

EN 10222-5, *Steel forgings for pressure purposes – Part 5: Martensitic, austenitic and austenitic-ferritic stainless steels.*

prEN 10253-2, *Butt welding pipe fittings – Part 2: Wrought carbon and ferritic alloy steel with specific inspection requirements.*

EN 10269, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties.*

EN 10272, *Stainless steel bars for pressure purposes.*

EN 10273, *Hot rolled weldable steel bars for pressure purposes with specified elevated temperature properties.*

EN 12074, *Welding consumables – Quality requirements for manufacture, supply and distribution of consumables for welding and allied processes.*

prEN 13479-1, *Welding consumables – Test methods and quality requirements for conformity evaluation of consumables – Part 1: Primary methods and evaluation.*

EN 13480-1, *Metallic industrial piping – Part 1: General.*

EN 13480-3:2002, *Metallic industrial piping – Part 3: Design and calculation.*

EN 13480-4:2002, *Metallic industrial piping – Part 4: Fabrication and installation.*

EN 13480-5:2002, *Metallic industrial piping – Part 5: Inspection and testing.*

EN ISO 2566-1, *Steel – Conversion of elongation values – Part 1: Carbon and low alloy steels (ISO 2566-1:1984).*

EN ISO 2566-2, *Steel – Conversion of elongation values – Part 2: Austenitic steels (ISO 2566-2:1984).*

CR ISO 15608, *Welding – Guidelines for a metallic material grouping system (ISO/TR 15608:2000).*

3 Terms, definitions, symbols and units

3.1 Terms and definitions

For the purposes of this Part of this European Standard the terms and definitions given in EN 13480-1, EN 764-3, and the following definitions apply.

3.1.1**minimum metal temperature**

lowest temperature determined for any of the following conditions:

- normal operations;
- start up and shut down procedures;
- possible process upsets, such as flashings of fluid, which have an atmospheric boiling point below 0 °C;
- during pressure or leak testing.

NOTE see also 3.1.2 and 3.1.3

3.1.2**temperature adjustment term**

temperature relevant to the calculation of the design reference temperature t_R and dependent on the calculated tensile membrane stress at the appropriate minimum metal temperature.

NOTE 1 Values for temperature adjustment term t_s are given in Table B.2-3.

NOTE 2 For tensile membrane stress reference is made to EN 13480-3:2002, clause 12.

3.1.3**design reference temperature**

temperature used for determining the impact energy requirements and determined by adding the temperature adjustment t_s to the minimum metal temperature t_M .

3.1.4**impact test temperature**

temperature at which the required resistance to impact energy is achieved.

NOTE See B.3.

3.1.5**impact rupture energy**

energy absorbed by a sample of material when subjected to a Charpy-V-notch impact test in accordance with EN 10045-1.

3.1.6**reference thickness**

thickness of a component to be used to relate the design reference temperature t_R of the component with its required impact test temperature t_{KV} .

NOTE 1 See Table B.2-1 and Figures B.2.3.2-1 to B.2.3.2-5.

NOTE 2 the reference thickness e_B , defined in Table B.4-1, is based on the nominal thickness (including corrosion allowance). For butt welded components e_B is the nominal wall thickness of the component at the edge of the weld preparation.

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3.2 Symbols and units

For the purposes of this Part of this European Standard, the symbols and units of EN 13480-1 apply together with those given in Table 3.2-1.

Table 3.2-1 — Symbols and units

Symbol	Characteristic	Unit
a_K	Form factor	—
b	width	mm
C	constant	—
e_B	reference thickness	mm
G	shear modulus	N/mm ²
HB	Brinell hardness	—
HV	Vickers hardness	—
h	maximum permissible reinforcement of weld	mm
KV	Impact rupture energy	J
L_o	length (gauge length)	mm
P	pressure	bar
P_{LM}	parameter according to Larson-Miller	—
R_e	yield strength	N/mm ²
$R_{m T t}$	creep rupture strength for T in h at temperature t	N/mm ²
S_0	original cross section area	mm ²
t_M	minimum metal temperature	°C
t_{KV}	material impact test temperature	°C
t_R	design reference temperature	°C
t_S	temperature adjustment term	°C
α	linear expansion coefficient	K ⁻¹
ε	strain	%

NOTE 1 N/mm² = 1 MPa

4 Requirements for materials to be used for pressure containing parts in industrial piping

4.1 General

4.1.1 Materials to be used for pressure containing parts in industrial piping shall meet the general requirements of 4.1 and the special provisions of 4.2 if applicable. Materials for pressure containing parts shall be ordered complying with the technical delivery conditions in 4.3.

Marking of materials for pressure containing parts shall be performed in accordance with 4.4.

Materials shall be selected in accordance with Annex A.

Materials shall be selected to be compatible with anticipated fabrication steps and to be suitable for the internal fluid and external environment. Both normal operating conditions and transient conditions occurring during fabrication, transport, testing, commissioning and decommissioning shall be taken into account when specifying the materials.

NOTE 1 The requirements of 4.1 and 4.2 should also be fulfilled when technical delivery conditions are developed for European Standards for materials, European Approval of Materials or Particular Material Appraisals.

NOTE 2 When technical delivery conditions for pressure-containing parts are developed, the structure and requirements of EN 764-4 should be met. Exceptions should be technically justified.

The materials shall be grouped in accordance with CR ISO 15608 to relate manufacturing and inspection requirements to generic material types.

NOTE 3 Materials have been allocated into these groups in accordance with their chemical composition and properties in relation to manufacture and heat treatment after welding.

4.1.2 Materials for pressure containing parts compliant with the requirements of this European Standard shall be certified on the basis of EN 10204.

NOTE The certification should be in accordance with EN 764-5.

4.1.3 The products shall be free from surface and internal defects which might impair their usability.

4.1.4 The specified minimum elongation of the steel after fracture shall be:

— $\geq 14\%$ for the transverse direction; and

— $\geq 16\%$ for the longitudinal direction, or where this is the less critical direction, the transverse direction;

when measured on a gauge length, L_0 , calculated as follows:

$$L_0 = 5,65\sqrt{S_0} \quad (4.1-1)$$

where

S_0 is the original cross sectional area within the gauge length in order to fulfil formula 4.1-1.

However, lower elongation values than specified in 4.1 (e. g. for fasteners or castings) may also be applied, provided that appropriate measures shall be taken by the parties concerned to compensate for these lower values and that compliance with the specific requirements is verifiable.

NOTE Examples of appropriate measures:

— application of higher safety factors in design;

— performance of appropriate burst tests to demonstrate ductile material behaviour.

4.1.5 When measured on a gauge length other than that stated in 4.1.4, the minimum elongation after fracture shall be determined by converting the elongation given in 4.1.4 in accordance with:

— EN ISO 2566-1 for carbon and low alloy steels;

— EN ISO 2566-2 for austenitic steels.

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4.1.6 Steels shall have a specified minimum impact energy measured on a Charpy V-notch impact test specimen (EN 10045-1) that is:

- ≥ 27 J for ferritic and 1,5 % to 5 % Ni alloyed steels;
- ≥ 40 J for steels of material groups 8, 9.3 and 10,

at a test temperature in accordance with Annex B, but not higher than 20 °C. The other requirements of Annex B shall also apply.

4.1.7 The chemical composition of steels intended for welding or forming shall not exceed the values given in Table 4.1-1. Exceptions shall be technically justified.

Table 4.1-1 — Maximum carbon, phosphorus and sulphur content for steel intended for welding or forming

Material group (according to Table A.1)	Maximum content of cast analysis		
	% C	% P	% S
Steel (1 to 6 and 9)	0,23 ^a	0,035	0,025
Ferritic stainless steels (7.1)	0,08	0,040	0,015
Martensitic stainless steels (7.2)	0,06	0,040	0,015
Austenitic stainless steels (8.1)	0,08	0,045	0,015 ^b
Austenitic stainless steels (8.2)	0,10	0,035	0,015
Austenitic-ferritic stainless steels (10)	0,030	0,035	0,015

^a Maximum content of product analysis 0,25 %.

^b For products to be machined a controlled sulphur content of 0,015 % to 0,030 % is permitted by agreement provided the resistance to corrosion is satisfied for the intended purpose.

4.2 Special provisions

4.2.1 Special properties

4.2.1.1 General

Where the behaviour of a material can be affected by manufacturing processes or operating conditions, to an extent that would adversely affect the safety or service life of the piping system, this shall be taken into consideration when specifying the material.

Adverse effects can arise from:

- manufacturing processes: e.g. degree of cold forming, heat treatment;
- operating conditions: e.g. hydrogen embrittlement, corrosion, scaling, ageing behaviour after cold forming.

4.2.1.2 Lamellar tearing

Where lamellar tearing due to the joint design and loading needs to be addressed (see EN 13480-3:2002, 7.2.3.3), steels shall be used which have improved deformation properties perpendicular to the surface shall be specified and verified in accordance with EN 10164.

NOTE For guidance see prEN 1011-2.

4.2.2 Design temperature above 20 °C

4.2.2.1 A material shall only be used for pressure parts within the range of temperatures for which the material properties required by EN 13480-3 are defined in the technical specification for the material. If the technical delivery condition does not contain the specific material values required for the design temperature t_s the values required in EN 13480-3 for the design shall be determined by linear interpolation between the two adjacent values. Values shall not be rounded up.

For other than austenitic and austenitic-ferritic stainless steels, the specified value of R_{eH} ($R_{p0,2}$) at room temperature may be used for temperatures less than or equal to 50 °C. Interpolation for design temperatures between 50 °C and 100 °C shall be performed with the values of R_{eH} at room temperature and at 100 °C, and using 20 °C as the starting point for interpolation. Above 100 °C linear interpolation shall be performed between the tabulated values given in the appropriate material standards.

In the case of creep rupture strength values or strength values for plastic strain in a given time, linear interpolation shall be permissible only if the difference between the two temperatures serving as starting points for the interpolation is equal to or less than 10 °C.

4.2.2.2 Materials in the creep range shall not be used unless the creep rupture strength values or strength values for plastic strain needed for design are specified in the base material specification. The manufacturer of the piping system installation shall be assured by the material supplier that the material supplied is capable of complying with specified properties (within the normal scatter band) by a statement that the manufacturing processes have remained equivalent to those for the steel for which the test results were obtained.

4.2.3 Prevention of brittle fracture

The requirements given in Annex B shall apply.

4.2.4 Specific requirements for fasteners

Fasteners includes bolts, studs and nuts.

Free cutting steel shall not be used. Fasteners made of carbon steel or low alloyed ferritic steel with > 3,5 % nickel shall not be used above 300 °C.

The specified minimum tensile strength of bar material of ferritic and martensitic steel for bolts shall not exceed 1 000 N/mm². The minimum elongation after fracture of bar material shall be at least 14%.

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Impact requirements for ferritic steels shall be in accordance with in B.2.2.3.

Bolt material with a design temperature below -160 °C shall be impact tested at -196 °C .

Hydrogen embrittlement, fatigue or relaxation properties shall be taken into account where appropriate.

NOTE Detailed requirements on the surface condition and internal soundness of the bar can be necessary for some applications.

4.2.5 Lined piping

The pressure containing steel of lined industrial piping need not be suitable for the internal fluid if the lining provides leak tight containment during operation.

4.3 Technical delivery conditions

4.3.1 European Standards

The European Standards for plates, strip, bars, tubes, fittings, forgings, castings, flanges, valve bodies and other pressure accessories for pressure parts shall be used to the limitations specified in Table A.3, for the supply of materials for use in a piping system.

NOTE Table A.2 contains an informative summary of the European Standards for materials referred to.

Special provisions due to fabrication and operation shall be taken into account, if appropriate.

4.3.2 European Approval for Materials

A material specified in an EMDS for piping system shall only be used within its range of application.

4.3.3 Particular Material Appraisals

Materials other than those specified in 4.3.2 and 4.3.3 may also be used provided that they have been accepted by a particular material appraisal.

4.3.4 Clad products

Technical delivery conditions for clad products for pressure parts shall be in accordance with the requirements of Annex C.

NOTE 1 European Standards specifying technical delivery conditions for clad products for pressure purposes are not currently available.

NOTE 2 Examples of documents covering technical delivery condition for clad steels are given within the publications [2] to [4]

4.3.5 Technical delivery conditions for welding consumables

Technical delivery conditions for welding consumables used for the welding of pressure parts and attachments to pressure parts shall be in accordance with EN 12074 and prEN 13479-1

NOTE Equivalent national/international specifications are accepted which fulfil the same criteria with respect to the requirements for the Quality System and the requirements for manufacture, supply distribution, test methods and evaluation of consumables.

4.4 Marking

The marking of the products or delivery units shall ensure traceability between the product or delivery unit and the inspection documents.

For European standardized materials, the marking shall fulfil the requirements of the relevant standard. For materials not contained in a European standard the marking shall at least contain:

- the material specification (reference, material designation);
- the manufacturer's name or mark;
- the stamp of the inspection representative, if applicable.

For material supplied with specific inspection the marking shall include an identification which permits the correlation between the product or delivery unit and the relevant inspection document.

5 Requirements for materials to be used for non-pressure parts

For non-pressure parts, e.g. supporting lugs, skirts, baffles and similar parts welded to industrial piping, and for welding consumables, materials shall be used which are supplied to material specifications covering at least the requirements for the chemical composition and the tensile properties. These materials shall not limit the operating conditions of the material to which they are attached.

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