SLOVENSKI STANDARD
SIST EN 14208:2004

01-september-2004

Premiļne plinske jeklenke - Specifikacija za varjene tlaļne sode z zmogljivostjo do 1000 litrov za prevoz plinov - Oblikovanje in izdelava

Transportable gas cylinders - Specification for welded pressure drums up to 1000 litre capacity for the transport of gases - Design and construction

Ortsbewegliche Gasflaschen - Spezifikation für geschweißte Druckfässer mit einem Fassungsraum bis zu 1000 liter für den Transport von Gasen - Gestaltung und Konstruktion

Bouteilles a gaz transportables - Spécification pour les futs soudés de capacité inférieure ou égale a 1000 litres destinés au transport des gaz - Conception et fabrication

Ta slovenski standard je istoveten z: **EN 14208:2004**

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23.020.30	Tlaļne posode, plinske jeklenke	Pressure vessels, gas cylinders

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English version

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This European Standard was approved by CEN on 4 December 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 14208:2004) has been prepared by Technical Committee CEN/TC 23 “Transportable gas cylinders”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by August 2004, and conflicting national standards shall be withdrawn at the latest by August 2004.

This European Standard has been submitted for reference into the RID and/or in the technical annexes of the ADR. Therefore in this context the standards listed in the normative references and covering basic requirements of the RID/ADR not addressed within the present standard are normative only when the standards themselves are referred to in the RID and/or in the technical annexes of the ADR.

Annex A is normative and annexes B and C are informative.

This document includes a bibliography.

For relationships with EC directives, RID and ADR see informative annex C, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

The purpose of this European Standard is to provide a specification for the design, manufacture, inspection and approval of welded steel pressure drums.

The specifications given are based on knowledge of and experience with, materials, design requirements, manufacturing processes and control during manufacture of steel drums in common use in the countries of the CEN members.

1 Scope

This European Standard specifies the minimum requirements for the material, design, construction and workmanship, inspection and testing at manufacture of refillable welded steel pressure drums, hereafter referred to as drums, of volumes of 150 litres up to 1 000 litres for compressed and liquefied gases. Cylindrical and spherical containers are covered.

2 Normative references

This Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate place in the text and 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 287-1, *Approval testing of welders — Fusion welding — Part 1: Steels*

EN ISO 15607, *Specification and qualification of welding procedures for metallic materials - General rules (ISO 15607:2003)*

EN 288-3, *Specification and approval of welding procedures for metallic materials — Part 3: Welding procedure tests for the arc welding of steels*

EN 462-3, *Non-destructive testing — Image quality of radiographs — Part 3: Image quality classes for ferrous metals*

EN 629-1, *Transportable gas cylinders — 25 E taper thread for connection of valves to gas cylinders — Part 1: Specification*

EN 895, *Destructive tests on welds in metallic materials — Transverse tensile test*

EN 910, *Destructive tests on welds in metallic materials — Bend tests*

EN 970, *Non-destructive examination of fusion welds — Visual examination*

EN 1435, *Non-destructive examination of welds — Radiographic examination of welded joints*

EN 1714, *Non destructive examination of welds — Ultrasonic examination of welded joints*

EN 10002-4, *Metallic materials — Tensile test — Part 4: Verification of extensometers used in uniaxial testing*

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 alloy 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 10028-7, *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 10088-1, *Stainless steels — Part 1: List of stainless steels*

EN 10088-2, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip for general purposes*

EN 10088-3, *Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods and sections for general purposes*

EN 12517, *Non-destructive examination of welds - Radiographic examination of welded joints - Acceptance levels*

EN 13445-2, *Unfired pressure vessels — Part 2: Materials*

EN 22063, *Metallic and other inorganic coatings — Thermal spraying — Zinc, aluminium and their alloys (ISO 2063:1991, modified)*

EN ISO 5817:2003, *Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections (ISO 5817:2003*

EN ISO 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings (ISO 8501-1:1988)*

EN ISO 11114-1, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials (ISO 11114-1: 1997)*

EN ISO 11114-2, *Transportable gas cylinders –Compatibility of cylinder and valve materials with gas contents – Part 2: Non-metallic materials (ISO 11114-2:2000)*

EN ISO 11116-1, *Gas cylinders — 17E taper thread for connection of valves to gas cylinders — Part 1: Specifications (ISO 11116-1:1999)*

3 Terms, definitions and symbols

For the purposes of this standard, the following terms, definitions and symbols apply:

3.1 Terms and definitions

3.1.1
yield stress
value corresponding to the lower yield stress or, for steels that do not exhibit a defined yield point, the 0,2 % proof stress (1% proof stress for austenitic stainless steel)

3.1.2
normalizing
heat treatment given to the steel by heating to a uniform temperature above the upper critical point (AC_3) of the steel and then cooled in a controlled atmosphere

3.1.3
stress relieving
heat treatment given to reduce the residual stresses of the steel

3.1.4
batch
quantity of finished drums made consecutively during the same or consecutive working days to the same design, size and material specifications; using the same welding procedures; and heat-treated under the same conditions of temperature and duration

3.1.5
test pressure
pressure applied to the drum after completion of all fabrication; it is the parameter used to design the drum

3.1.6
finished drum
drum which is fully assembled and appropriately stampmarked, but without any external coatings

3.2 Symbols

a_1 Minimum thickness of the cylindrical part of the drum based on pressure criteria, in mm

a_2 Minimum thickness of cylindrical shell or dished end based on handling criterion, in mm

B Area to be compensated, in mm^2

b_1 Calculated minimum thickness of dished ends, in mm

c_1 Calculated minimum thickness of a spherical shell or hemispherical dished ends, in mm

D_d Diameter of valve protection dome, in mm

D_o Maximum outside diameter of the drum, in mm

D_i Internal diameter

f_c Maximum allowable stress for the cylindrical section of the drum, in MPa

f_e Maximum allowable stress for the dished ends of the drum, in MPa

f_p Maximum allowable stress for the pad material of the drum, in MPa

f_s Maximum allowable stress for the spherical section of the drum, in MPa

H Height of the dished end

H_0 External height of the domed part of the end, in mm

H_e Equivalent height of a dished end for determining the shape factor, in mm

k Minimum length of the edge on the shroud or of the drum, in the case of dished ends convex to pressure, to ensure compatibility with hooks (see Figure 5)

K Shape factor of the dished ends

L The dimension between the external surface of the shroud or of the drum, in the case of dished ends convex to pressure, and the internal surface of the edge (see Figure 5)

N Largest dimensioning of an opening, in mm

P Maximum dimension of pads that can be considered as compensation, in mm

p_h Test pressure, in bar [1)] above atmospheric pressure

Q Radius of equivalent sphere when calculating compensation, in mm

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1) 1 bar = 10^5 Pa = 0,1 MPa = 0,1 N/mm^2

R_0 External radius of the crown of a torispherical dished end, in mm

r_0 External radius of the knuckle of a torispherical dished end, in mm

R_m Actual value of tensile strength, in MPa

S Thickness of shell in area to be compensated, in mm

S_f Length of straight flange on a torispherical or ellipsoidal dished end, in mm

s_1 Minimum thickness of spherical section, in mm

S_f Length of a straight flange on a torispherical or ellipsoidal dished end, in mm

T Minimum value of tensile strength, in MPa

t_e Thickness of un-pierced end in location of opening, in mm

Y Minimum guaranteed value of yield stress of the material in the relevant part of the finished drum, in MPa

4 Materials

4.1 General provisions

4.1.1 Materials for the pressure envelope shall conform to EN 10028-1 to –5 for carbon steels and for austenitic stainless steels either EN 10028-7 or EN 10088-1 to –3.

4.1.2 The materials used for the drum shall be compatible with the intended gas service e.g. corrosive or embrittling gases. See EN ISO 11114-1 and EN ISO 11114-2.

NOTE Particular attention should be paid to the specification for bolts, studs and other components, which are in contact with the gas where the use of high strength materials may be incompatible with embrittling gases.

4.1.3 All parts welded to the drum shall be made of material that is compatible with respect to weldability and strength.

4.1.4 The welding consumables shall be such that they are capable of giving consistent welds with minimum tensile strength at least equal to that specified for the parent material in the finished drum.

4.1.5 The manufacturer shall obtain and provide certificates proving conformance to the material specifications for the steel used for the construction of pressure retaining parts of the drum. If the minimum values of the yield stress of the material guaranteed by the steel manufacturer is greater than the minimum specified in the material standard, then this higher figure may be used in the design calculations, up to a maximum enhancement of 15 %. It shall be ensured that the heat treatment (if any) will not affect this minimum guaranteed value.

The manufacturer shall be able to identify all pressure bearing parts of the drum with the cast(s) of steel from which it is made.

4.2 Heat treatment

If the steel used, or the steel specification requires it, the drums shall be heat treated or stress relieved. The manufacturer shall produce certificates for the applied heat treatment. The temperature and process time shall be continuously recorded during the heat treatment. Localized heat treatment is not permitted.

5 Design

5.1 Design stress

The design stress *f*c, *f*e, *f*p and *f*s at the test pressure shall not exceed 0,77 *Y*.

5.2 Calculation of thickness

5.2.1 Cylindrical wall

The minimum thickness a_1 of a wall of cylindrical section shall be not less than the thickness calculated using the equation:

$$a_1 = \frac{Ph \times Do}{20\,fc + Ph} \qquad (1)$$

5.2.2 Spherical shell

The minimum thickness s_1 of a wall of spherical section shall be not less than the thickness calculated using the equation:

$$s_1 = \frac{Ph \times Do}{40\,fs + Ph} \qquad (2)$$

5.2.3 Dished ends concave to pressure

5.2.3.1 General

For a drum with ends concave to pressure, the minimum thickness b_1 of the wall of a torispherical sphere or ellipsoidal dished end shall be not less than $b_1 = K.a_1$ where the value of *K* varies with the shape of the ends, as shown in Figure 1. The value of *K* shall not be taken as less than 1,0. If a drum is made of two dished ends, the thickness of the straight cylindrical part shall be not less than a_1 as calculated according to **5.2.1**. If a drum is made of two hemispherical ends, their thickness shall be calculated according to **5.2.2**.

5.2.3.2 Shape factor

The shape factor *K* is determined and taken from Figure 1, using the appropriate values of H_e/D_0 and b_1/D_o. The value for H_e is determined as follows:

— for an ellipsoidal end $H_e = H_0$,

— for a torispherical end H_e = the least of : H_0, or $D_0^2 / 4R_0$, or $(D_0 r_0/2)^{0,5}$.

NOTE The external height of the domed end for a torispherical end may be calculated as

$$H_0 = R_0 - \{(R_0 - D_0/2)(R_0 + D_0/2 - 2\,r_0)\}^{0,5}$$

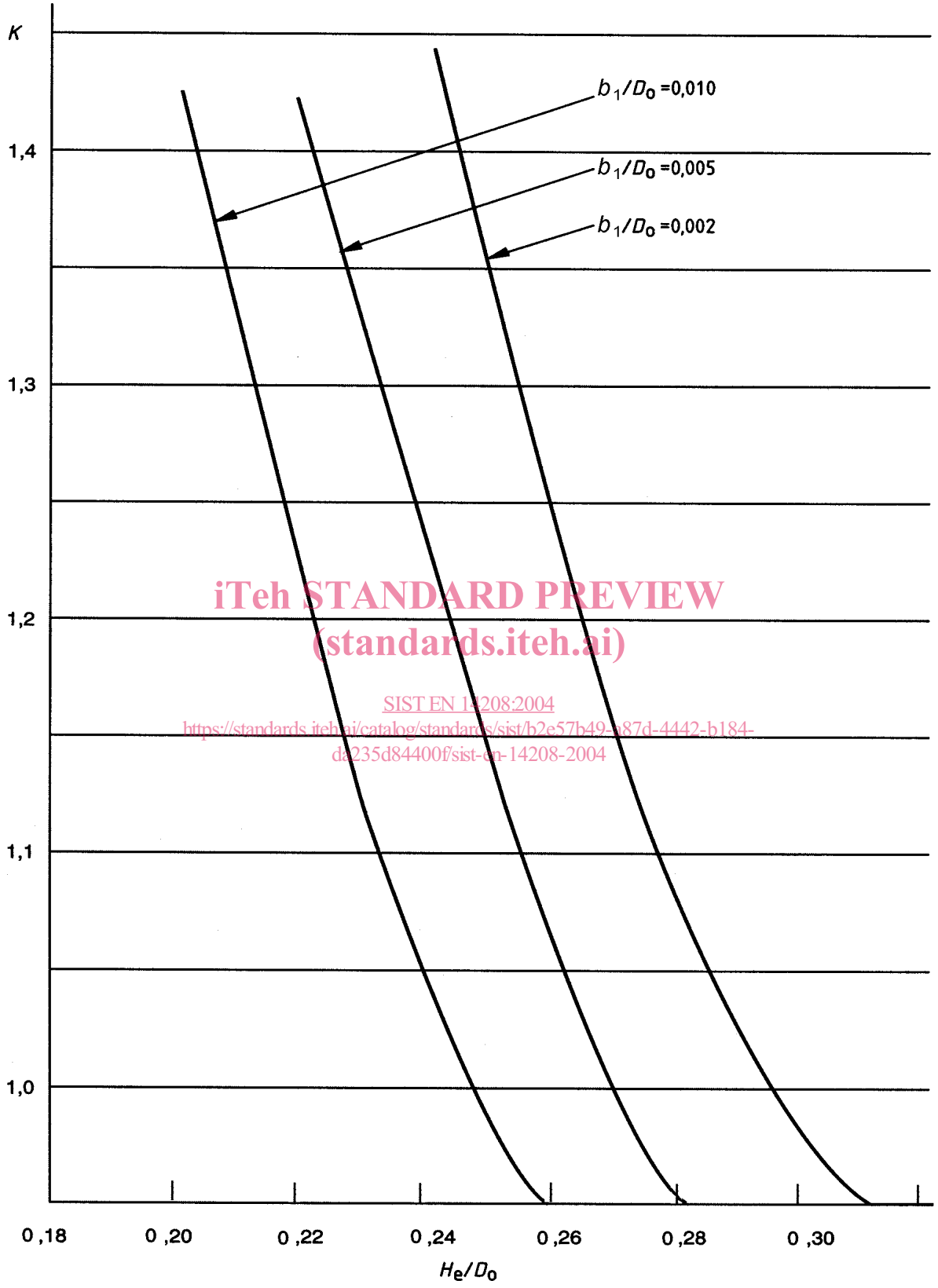

Figure 1 — Shape factor *K*

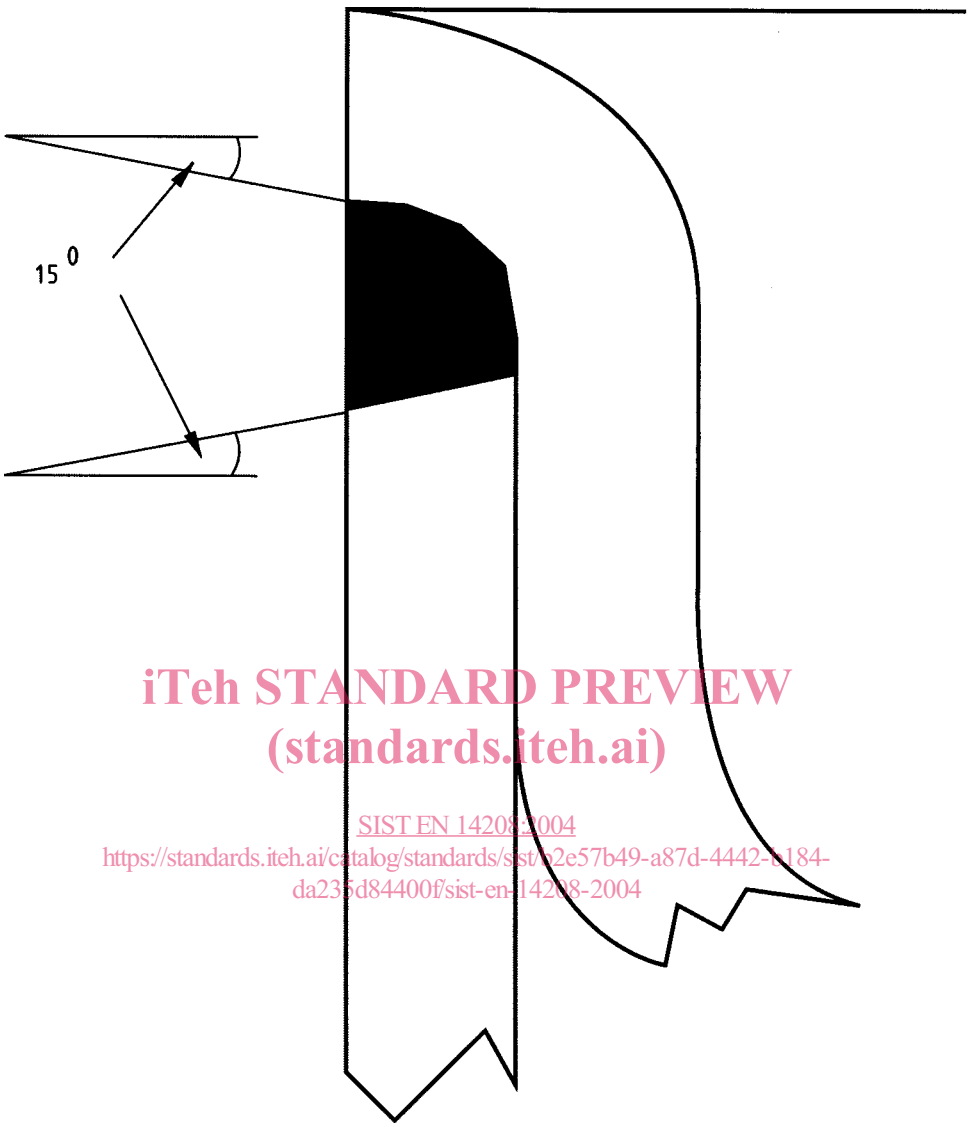

Figure 2 — Weld detail for dished-in ends

5.2.3.3 Limitations of shape

a) In a torispherical end R_0 shall not be greater than D_0;

b) In a torispherical end r_0 shall not be less than 0,1 D_0 nor less than four times the thickness of the dished end as manufactured;

c) In an ellipsoidal end the ratio H_e/D_O shall be not less than 0,192;

d) S_f shall be not less than 0,3 $(D_o t_e)^{0.5}$

5.2.4 Dished ends convex to pressure

In the case of dished ends convex to pressure, the design shall be confirmed by a burst test and a pressure cycling test (see clause **15**). The arrangement of the end weld shall be such that it can be inspected by radiography or an equivalent NDT method. Figure 2 gives one example.

Dished ends convex to pressure shall not be used for vessels designed to contained corrosive substances.