SLOVENSKI STANDARD
SIST EN 286-3:1998
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Enostavne neogrevane tlaļ ne posode, namenjene za zrak ali duģik - 3. del: Tlaļ ne posode iz jekla za zraļ ne zavore in pomoģno pnevmatsko opremo na tirnih vozilih

Simple unfired pressure vessels designed to contain air or nitrogen - Part 3: Steel pressure vessels designed for air braking equipment and auxiliary pneumatic equipment for railway rolling stock

Einfache unbefeuerte Druckbehälter für Luft oder Stickstoff - Teil 3: Druckbehälter aus Stahl für Druckluftbremsanlagen und pneumatische Hilfseinrichtungen in Schienenfahrzeugen

Récipients a pression simples, non soumis a la flamme, destinés a contenir de l'air ou de l'azote - Partie 3: Récipients a pression en acier destinés aux équipements pneumatiques de freinage et aux équipements pneumatiques auxiliaires du matériel roulant ferroviaire

Ta slovenski standard je istoveten z: **EN 286-3:1994**

ICS:

23.020.30	Tlaļ ne posode, plinske jeklenke	Pressure vessels, gas cylinders

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EUROPEAN STANDARD

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EUROPÄISCHE NORM

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Descriptors: Railway rolling stock, pneumatic equipment, pneumatic brakes, pressure vessels, unalloyed steels, grades : quality, welded joints, computation, design, production control, tests, assembling, certification

English version

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

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Foreword

This European Standard was prepared by the Technical Committe CEN/TC 54 "Unfires pressure vessels" of which the secretariat is held by BSI.

CEN/TC 54 has decided to submit the final draft for formal vote by its resolution.
The result was positive.

This Part is one of a series of four. The other parts are:

Part 1: Design, manufacture and testing.

Part 2: Pressure vessels for air braking and auxiliary systems for motor vehicles and their trailers.

Part 4: Aluminium alloy pressure vessels designed for air braking equipment and auxiliary pneumatic equipment for railway rolling stock.

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 March 1995, and conflicting national standards shall be withdrawn at the latest by March 1995.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

1 Scope

1.1 This Part of this European Standard is applicable to simple unfired steel pressure vessels, referred to as "vessel" in this standard, designed for air braking equipment and auxiliary pneumatic equipment for railway rolling stock (see 1.6).

It defines three types of vessel A, B and C (see table 1) corresponding to the current practice of European railway networks.

1.2 The vessels to this standard are:

a) made from a single shell;

b) made from non-alloy steel;

c) fabricated by welding;

d) used at a maximum working pressure of 10 bar;

e) the product of the maximum working pressure (in bar) and the volume (in litre):

$$50 \text{ bar litres} < PV \leq 10\,000 \text{ bar litres};$$

f) made of a cylindrical part of circular cross-section called the shell with two outwardly dished torispherical ends, that is two dished ends with the same axis of rotation. This standard therefore does not apply to vessels with one or two flat ends or those made up of several compartments;

g) calculated with a design pressure P (see 5.1.4.1.2);

h) designed for a working temperature of between −40 °C and +100 °C;

j) fastened to the vehicles:

1) by straps for types A and B vessels;

2) by welded brackets for types B and C vessels.

1.3 In normal service, a momentary overpressure of 1 bar of the maximum working pressure is permitted (10 % of PS).

1.4 This Part of this European Standard applies to the vessel proper, from the inlet connection to the outlet connection and to all other connections and fittings belonging to the vessel.

1.5 This Part of this European Standard gives the requirements to be met for the calculation, design, fabrication, inspection during fabrication and certification of the vessel, and fittings for assembly to the vehicle.

These requirements cannot be written in sufficient detail to ensure good workmanship or proper construction. Each manufacturer is therefore responsible for taking every necessary step to make sure that the quality of workmanship and construction is such as to ensure compliance with good engineering practice.

This Part of this standard gives:

a) in annex F, recommendations for assembly to the vechicles;

b) in annex G, recommendations for the service surveillance of type A vessels;

c) in annex H, recommendations for the service surveillance of types B and C vessels.

1.6 The requirements of this Part of this European Standard apply to vessels designed to be fitted to rail vehicles used on the main national networks, urban networks, underground railways, trams, private networks (regional railways, company railways, ...).

Table 1: Definitions of types of vessel

Criterion	Type A	Type B	Type C	Reference clause in this standard
Nominal design stress f	0,6 R_{eT} or 0,3 R_m		0,6 R_{eT} or 0,3 R_m	5.1.4.1
		0,3 R_m/1,4 with $R_m \leq$ 360 N/mm²		5.1.4.2
Radii of curvature of the end	R = D_o r = 0,1D_o		R = D_o r = 0,1D_o	5.1.3.1.1
		R = D_o r ≥ 0,06D_o		5.1.3.1.2
Shell ring/ end assembly	Butt weld or swaged end. Full penetration weld		Butt weld or swaged end. Full penetration weld	5.1.5.2.1
		Inserted end		5.1.5.2.2
Thread of inspection, branch and drainage boss	ISO 228-1 ISO 261	ISO 7-1 ISO 228-1 ISO 261	ISO 7-1 ISO 228-1 ISO 261	5.2.1
Weld of drainage boss	Full penetration weld of the vessel wall for penetrating boss	Full penetration weld of the vessel wall for penetrating boss Convex weld for surface mounted boss	Full penetration weld of the vessel wall for penetrating boss Convex weld for surface mounted boss	5.2.4.2
Method of fixing to the vehicle	Fixing by steel straps	Fixing by straps or welded brackets	Fixing by welded brackets	Annex F
Service surveillance	Annex G	Annex H	Annex H	

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.

EN 287-1 Approval testing of welders - fusion welding - Part 1: Steels

EN 288-1 Specification and approval of welding procedures for metallic materials - Part 1: General rules for fusion welding

EN 288-2 Specification and approval of welding procedures for metallic materials - Part 2: Welding procedure specification for arc welding

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

EN 10025 Hot rolled products of non-alloy structural steels - Technical delivery conditions

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

EN 10207 Steels for simple pressure vessels - Technical delivery requirements for plates, strips and bars

EN 26520 Classification of imperfections in metallic fusion welds, with explanations

ISO 7-1 Pipe threads where pressure-tight joints are made on the threads - Part 1: Designation, dimensions and tolerances

ISO 228-1 Pipe threads where pressure-tight joints are not made on the threads - Part 1: Designation, dimensions and tolerances

ISO 261 ISO general purpose metric screw threads - General plan

ISO 1101 Technical drawings - Geometrical tolerancing - Tolerancing of form, orientation, location and run-out - Generalities, definitions, symbols, indications on drawings

ISO 1106-1 Recommended practice for radiographic examination of fusion welded joints - Part 1: Fusion welded butt joints in steel plates up to 50 mm thick

ISO 1106-3 Recommended practice for radiographic examination of fusion welded joints -
Part 3: Fusion welded circumferential joints in steel pipes of up to 50 mm wall thickness

ISO 5173 Fusion welded butt joints in steel -
Transverse root and face bend test

3 Symbols

For the purpose of this standard, the following symbols apply:

A	Elongation at rupture	%
A_{fb}	Cross sectional area effective as compensation of the boss	mm^2
A_{fp}	Cross sectional area effective as compensation of the reinforcing plate	mm^2
A_{fs}	Cross sectional area effective as compensation of the shell	mm^2
A_p	Area of the pressurized zone	mm^2
c	Absolute value of the minus rolling tolerance for sheets as quoted in the standard	mm
D_o	Outside diameter of the shell of the vessel	mm
d_{ib}	Internal diameter of the boss	mm
d_{ob}	Outside diameter of the boss	mm
e	Nominal wall thickness	mm
e_c	Calculated thickness	mm
e_{ch}	Calculated thickness of the end	mm
e_{cs}	Calculated thickness of the shell	mm
e_h	Nominal thickness of the end	mm
e_{rb}	Wall thickness of the boss contributing to reinforcement	mm
e_{rp}	Wall thickness of the reinforcing plate contributing to reinforcement	mm
e_{rs}	Wall thickness of the shell contributing to reinforcement	mm

f	Nominal design stress at the design temperature .....N/mm²
f_b	Permitted stress of the boss .....N/mm²
g	Throat thickness of a weld .....mm
h	External height of the dished part of an end .....mm (see figure 4)
h_1	Height of the cylindrical part of the end ...mm (see figure 4)
h_2	Internal height of a dished part of the end .....mm (see figure 4)
K_c	Design coefficient which is a function of the welding process .....-
KV	Impact energy at break (V-notch test piece) .....J
L	Total length of the vessel .....mm
L_1	Distance between the axis of a drainage opening and the end of the vessel .....mm
l_{rb}	Length of the boss contributing to reinforcement .... π
l_{rbi}	Length of inward projecting boss contributing to reinforcement .....mm
l_{rp}	Length of the reinforcing plate contributing to reinforcment, measured along the mid surface .....mm
l_{rs}	Length of the shell contributing to reinforcement, measured along the mid surface .....mm
P	Design pressure[1)] which is a function of the maximum working pressure, the welding process and inspection used .....bar
PS	Maximum working pressure[1)] .....bar
R	Internal radius of the spherical part of the end .....mm
R_{eT}	Minimum yield point at the maximum working temperature .....N/mm²
R_i	Local internal radius at the location of the opening in question .....mm
R_m	Minimum tensile strength specified by the manufacturer or by the standard defining the steel ...N/mm²

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1) All pressures are gauge pressures.

r	Internal radius of the torispherical part of the end	mm
S	Corrosion allowance	mm
T_{min}	Minimum working temperature	°C
T_{max}	Maximum working temperature	°C
T*	Temperature at which the mean value of the energy absorbed at break (V-notch), KV ≥ 28 J, is guaranteed longitudinally	°C
V	Volume of the vessel	litre

4 Materials

4.1 Pressurized parts

4.1.1 Shell and ends

The shell and ends shall be made of steel sheet grade SPH 235 or SPH 265 as specified in EN 10207.

These steels shall be accompanied by a test report drawn up by the material manufacturer.

The mean value of energy absorbed at break KV determined on three longitudinal test pieces shall be at least 28 J at the minimum working temperature T_{min}.

This essential safety requirement may be met as follows:

a) For types A, B and C vessels

- by carrying out impact bending tests at the minimum temperature of -40 °C, at the responsibility of the material manufacturer;

- or by using steels for which the appropriate guarantee of energy absorbed at break at the minimum temperature of -40 °C is given by a particular standard;

- or at a temperature T* equal to or less than that obtained by extrapolation using the graph from figure 1.

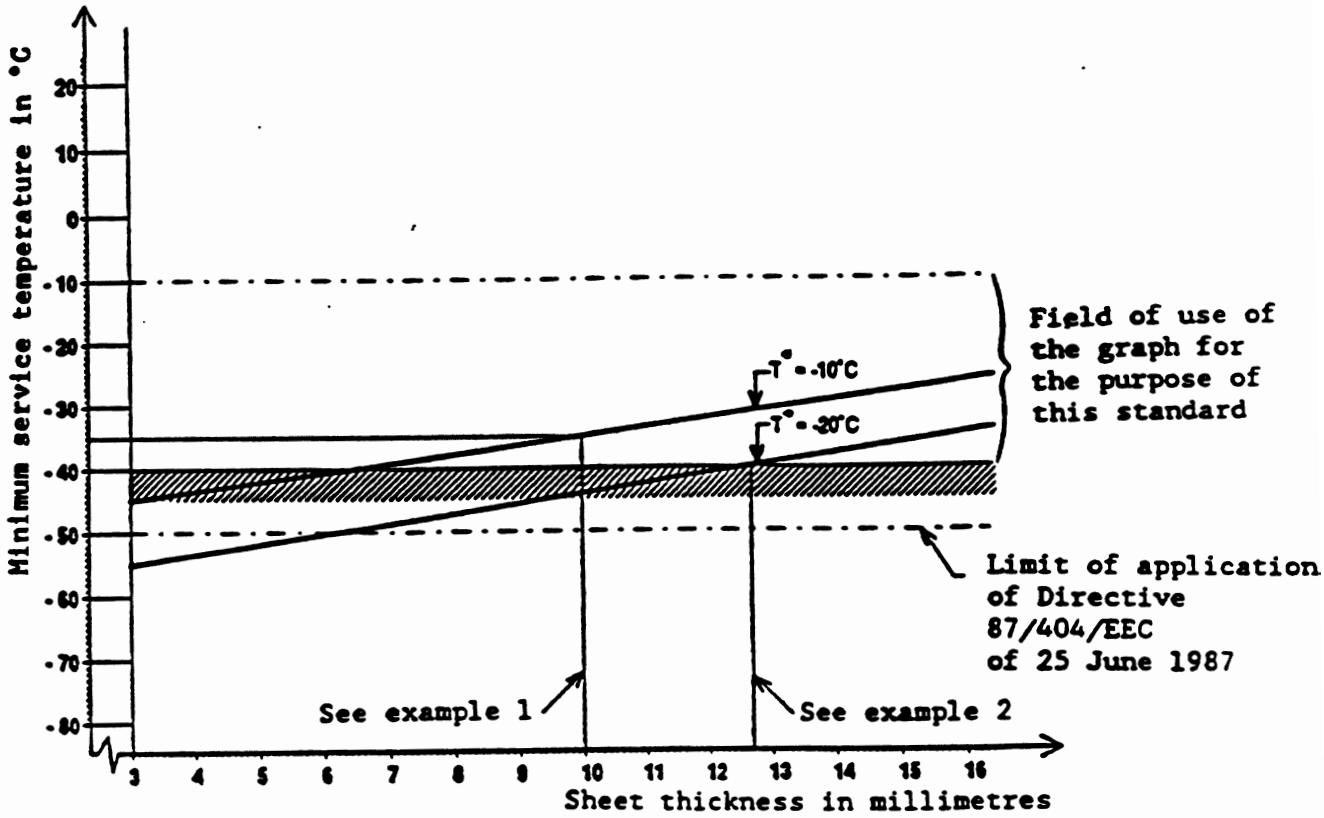

Figure 1: Extrapolation of the guaranteed energy absorbed at break at temperature T_{min}

Examples of use:

- example no. 1: if e = 10 mm and T* = -10 °C, T_{min} = -35 °C;
- example no. 2: if T* = -20 °C and T_{min} = -40 °C, e_{max} = 12,7 mm.

b) For type B vessels only

by ensuring that brittle fracture does not occur at the minimum service temperature -40 °C, using the fracture mechanics theory through the use of a recognized standard or code and by applying knowledge of the physical and metallurgical properties at the temperature T of a steel defined in a specific standard, whilst taking into account the stresses (primary and secondary stresses) and the thickness of the materials of the vessel.

4.1.2 Inspection bosses, pipe connection branches and drainage bosses

The bosses shall be manufactured from bar or tube of a steel grade compatible with the grades of steel sheet comprising the vessel and shall be of weldable quality. The product analysis of this steel shall meet the following requirements:

- R_m < 580 N/mm²;

- C < 0,25 %, S < 0,05 % and P < 0,05 %.

4.2 Non pressurized parts

Accessories to be welded to the vessel, but which do not contribute to its strength, shall be made of steel grades compatible with the grades of steel sheet comprising the vessel and shall be of weldable quality.

The product analysis of this steel shall meet the following requirements:

- R_m ≤ 580 N/mm²;

- C ≤ 0,25 %, S ≤ 0,05 % and P ≤ 0,05 %.

4.3 Welding materials

The filler materials used for welding onto the vessels or welding the vessels themselves shall be suitable and compatible with the parent materials.

They shall correspond to EN ... (in preparation).

5 Design

5.1 Shell and ends

5.1.1 General

The vessels are of simple geometrical form, composed of a cylindrical body of circular cross-section and two outwardly dished torispherical ends.

The design of the vessels shall take into account the installation and maintenance conditions. The installation and maintenance conditions shall be given by the manufacturer or the user (see clause 13).

NOTE: Examples of installation and maintenance requirements are given in informative annexes F, G and H.

5.1.2 Design of the shell

Shells are generally made from a single sheet. If the shell is made of several welded parts, the number of circular welds shall be kept to a minimum.

Longitudinal weld seams of parts of the shell shall:

- not be located on the lower part of the vessel defined by an angle of 30° on either side of the vertical axis (see figure 2);

- be sufficiently far apart such as to form an angle greater than 40 ° (see example in figure 3).

All welds, even of a temporary nature, located outside the designed seams are prohibited.

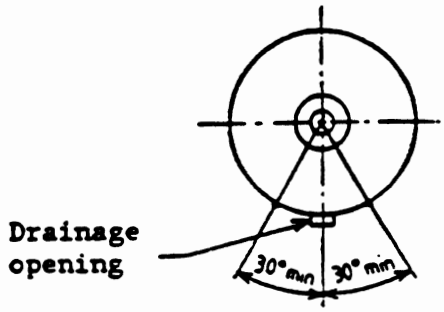

Figure 2: Position of longitudinal welds on the bottom of the shell

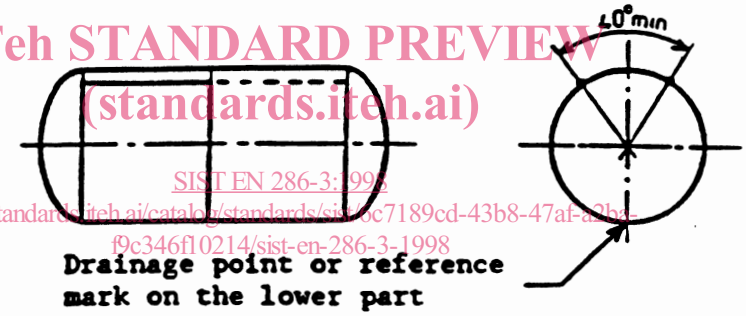

Figure 3: Position of longitudinal welds on the shell