SLOVENSKI STANDARD
SIST EN 13480-3:2018/oprA5:2021

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Kovinski industrijski cevovodi - 3. del: Konstruiranje in izračun - Dopolnilo A5

Metallic industrial piping - Part 3: Design and calculation

Metallische industrielle Rohrleitungen - Teil 3: Konstruktion und Berechnung

Tuyauteries industrielles métalliques - Partie 3: Conception et calcul

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ICS:

23.040.10	Železne in jeklene cevi	Iron and steel pipes
77.140.75	Jeklene cevi in cevni profili za posebne namene	Steel pipes and tubes for specific use

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EUROPEAN STANDARD

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Metallic industrial piping - Part 3: Design and calculation

Tuyauteries industrielles métalliques - Partie 3: Conception et calcul

Metallische industrielle Rohrleitungen - Teil 3: Konstruktion und Berechnung

This draft amendment is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 267.

This draft amendment A5, if approved, will modify the European Standard EN 13480-3:2017. If this draft becomes an amendment, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for inclusion of this amendment into the relevant national standard without any alteration.

This draft amendment was established by CEN 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 CEN-CENELEC Management Centre has the same status as the official versions.

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European foreword

This document (EN 13480-3:2017/prA5:2021) has been prepared by Technical Committee CEN/TC 267 “Industrial piping and pipelines”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

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 part of EN 13480-3:2017.

This document includes the text of the amendment itself. The amended/corrected pages of EN 13480-3:2017 will be published as Issue 2 of the new Edition 2022 of the European Standard.

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1 Modification to Clause 2, Normative references

Add the following normative reference:

"EN 1993-1-8:2005, *Eurocode 3: Design of steel structures — Part 1-8: Design of joints*".

2 Modification to 3.2, Symbols and units

Table 3.2-1 shall read as follows:

Table 3.2–1 — General symbols and units

Symbol	Description	Unit
A	elongation at rupture	%
E	modulus of elasticity	MPa (N/mm²)
P_{max}	maximum pressure obtained from the design by formulae or relevant procedures for a given component	MPa (N/mm²)
PS[a]	maximum allowable pressure	bar
R, r [b]	radii	mm
R_{eH}	upper yield strength at room temperature	MPa (N/mm²)
$R_{eH\ t}$	upper yield strength at calculation temperature t [c]	MPa (N/mm²)
R_m	tensile strength at room temperature	MPa (N/mm²)
$R_{m\ t}$	tensile strength at calculation temperature t [c]	MPa (N/mm²)
$R_{p0,2}$	0,2 % proof strength at room temperature	MPa (N/mm²)
$R_{p0,2\ t}$	0,2 % proof strength at calculation temperature t [c]	MPa (N/mm²)
$R_{p1,0}$	1,0 % proof strength at room temperature	MPa (N/mm²)
$R_{p1,0\ t}$	1,0 % proof strength at calculation temperature t [c]	MPa (N/mm²)
S_1	mean value of the stress which leads to a 1 % creep elongation in 100 000 h	MPa (N/mm²)
S_2	mean value of the stress which leads to a 1 % creep elongation in 200 000 h	MPa (N/mm²)
$S_{R\ T\ t}$	Mean value of creep rupture strength according to the material standards, for material temperature t, and lifetime T (in hours) under consideration whereby the scatter band does not deviate by more than ± 20 % from the mean value.	MPa (N/mm²)
T	time	h

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t	temperature	°C
TS	maximum allowable temperature	°C
Z	section modulus for a pipe	mm^3
c_0	corrosion or erosion allowance (see Figure 4.3–1)	mm
c_1	absolute value of the negative tolerance taken from the material standard (see Figure 4.3–1)	mm
c_2	thinning allowance for possible thinning during manufacturing process (see Figure 4.3–1)	mm
e_a	analysis thickness of a component used for the check of the strength (see Figure 4.3–1)	mm
e_n	nominal thickness on drawings (see Figure 4.3–1)	mm
e_{ord}	ordered thickness (see Figure 4.3–1)	mm
e_r	minimum required thickness with allowances and tolerances (see Figure 4.3–1)	mm
f	design stress (see Clause 5)	MPa (N/mm^2)
f_{cr}	Design stress in the creep range	MPa (N/mm^2)
f_f	Design stress for flexibility analysis	MPa (N/mm^2)
p_c	calculation pressure (see 4.2.3.4)	MPa (N/mm^2)
p_o	operating pressure (see 4.2.3.1)	MPa (N/mm^2)
t_c	calculation temperature (see 4.2.3.5)	°C
t_o	operating temperature (see 4.2.3.2)	°C
z	joint coefficient (see 4.5)	-
ε	additional thickness resulting from the selection of the ordered thickness (see Figure 4.3–1)	mm

[a] All pressures for calculation purposes are in MPa (N/mm^2) and *PS* is in bar.

[b] The following subscripts apply:

i inside

m mean

o outside

[c] When t is greater than the room temperature.

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3 Modification to 4.5, Joint coefficient

At the end of 4.5, the paragraph shall read as follows:

See EN 13480-5:2017, Table 8.3-1. In case of the supply of a welded product, the joint coefficient for the wall thickness calculation should be taken equal to z = 1,0 if the material standard gives the appropriate requirements concerning destructive tests and non-destructive tests (e.g. EN 10217 series).

4 Modification to 6.1, Straight pipes

In 6.1, Formulae (6.1-1) and (6.1-2) shall read as follows:

— where $D_o/D_i \leq 1{,}7$:

$$e = \frac{p_c \, D_o}{2 f \, z + p_c} \qquad (6.1\text{-}1)$$

or

$$e = \frac{p_c \, D_i}{2 \, f \, z - p_c} \qquad (6.1\text{-}2)$$

5 Modification to 6.4.6.2, Design

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The 5th paragraph of 6.4.6.2 shall read as follows:

The required thickness e_2 of the cone adjacent to the junction is the greater of e_{con} and e_j. This thickness shall be maintained for a distance of at least 1,4l_2 from the junction along the cone, see Figure 6.4.2-1.

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6 Modification to 6.4.7.2, Design

The 6th paragraph of 6.4.7.2 shall read as follows:

The required thickness e_2 of the knuckle and the cone adjacent to the junction is the greater of e_{con} and e_j. This thickness shall be maintained for a distance of at least 1,4l_2 from the junction and 0,7l_2 from the cone/knuckle tangent line along the cone, see Figure 6.4.2-2.

7 Modification to 6.4.9, Offset reducers

The 5th sentence of 6.4.9 shall read as follows:

The greater of these shall apply to the cone section of the reducer.

8 Modification to 8.3.2, Openings in the vicinity of discontinuities

Indent b) of 8.3.2 shall read as follows:

b) Openings in conical shells connected to cylindrical shells shall have the distances x_L *and* x_S shown in Figure 8.3.2-2 as follows:

   — for the large end

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$$x_L \geq \max\left(0{,}2\sqrt{\frac{D_{mL}\ e_{as}}{\cos\alpha}}\ ;\ 3{,}0\ e_{as}\right) \tag{8.3.2-3}$$

— for the small end

$$x_S \geq \max\left(\sqrt{\frac{D_{mS}\ e_{as}}{\cos\alpha}}\ ;\ 3{,}0\ e_{as}\right) \tag{8.3.2-4}$$

where

D_{mL} is the mean diameter of cylindrical shell at the large end;

D_{mS} is the mean diameter of cylindrical shell at the small end.

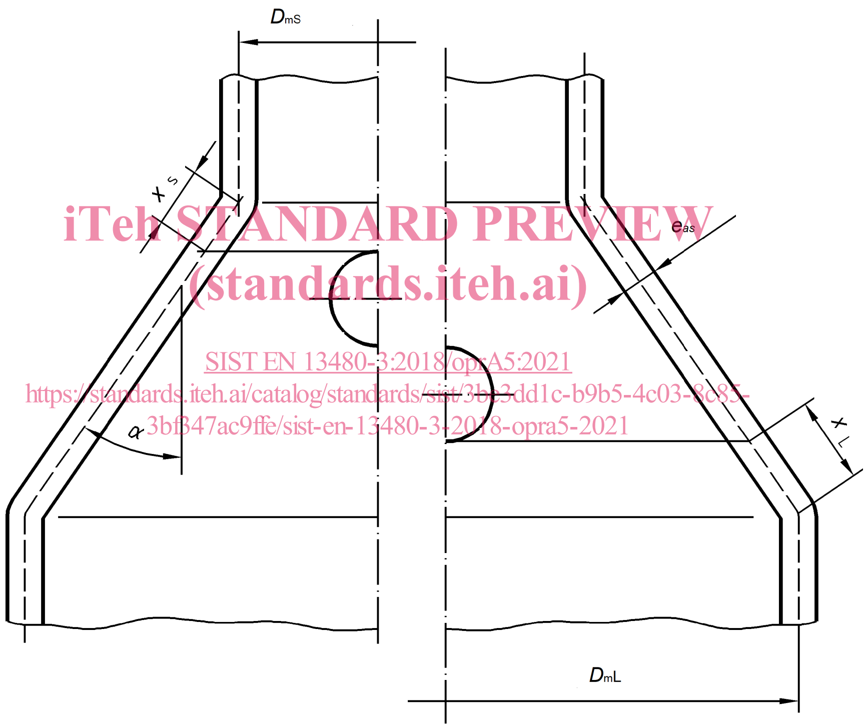

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Figure 8.3.2-2 — Opening in a conical shell

9 Modification to 8.4.3, Reinforced openings with $d_i/D_i < 0{,}8$

After Formula (8.4.3-2), the following sentence shall be added:

d_{eqb} is the equivalent diameter of the branch at the intersection calculated according to Formulas (8.4.1-3) and (8.4.1-4) using the dimensions of the branch instead of the shell.

Indent c), 2nd paragraph of subclause 8.4.3, Formula (8.4.3-8) shall be deleted, new Figure 8.4.3-3 *shall be inserted, and the paragraph shall read as follows:*

Formulae (8.4.3-3) or (8.4.3-6) and (8.4.3-7) shall apply.

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The maximum length of the shell considered as contributing to reinforcement shall be evaluated in accordance with the Formula (8.4.1-2) and for the branches in accordance with Formulae (8.4.3-1) and (8.4.3-2).

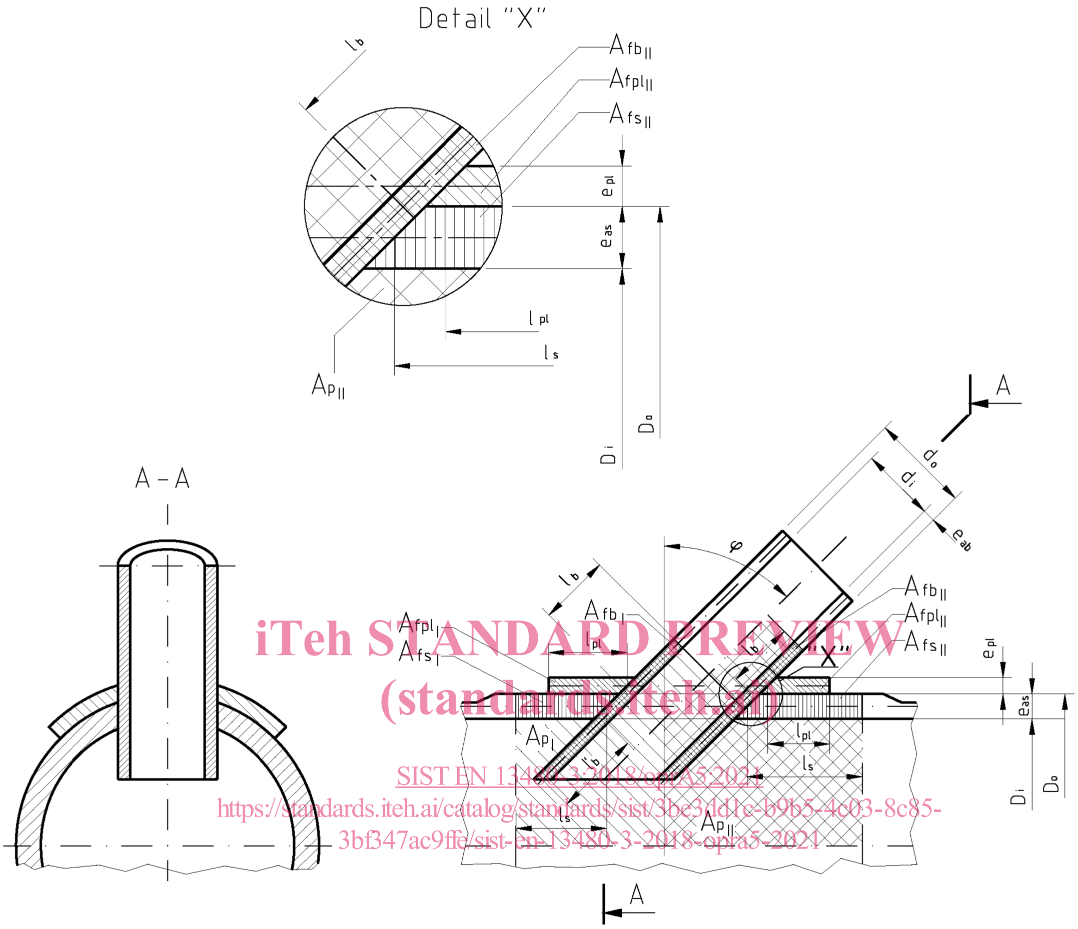

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Figure 8.4.3-3 — Reinforcement of oblique branch connection in cylindrical or conical shell

Indent d), 2nd and 3rd paragraph of subclause 8.4.3 shall read as follows:

The reinforcement shall be calculated in accordance with Formulae (8.4.3-3), (8.4.3-6) and (8.4.3-7).

The maximum length of the shell considered as contributing to reinforcement shall be evaluated in accordance with the Formula (8.4.1-2) and for the branches in accordance with Formulae (8.4.3-1) and (8.4.3-2).

10 Modification to 9.1, General

9.1 shall read as follows:

"9.1 General

The rules in Clause 9 shall take account of loading due to external pressure.

9.1.1 External calculation pressure

The external pressure to be taken into account for calculation purpose shall be the maximum external pressure under operating conditions, or test conditions whichever is the greater.

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Where internal pressure may decrease below atmospheric pressure due to fluid cooling, the external pressure to be used in calculation shall be equal to:

— 1 bar for single piping subject to external pressure; or

— the pressure between the two jackets, plus 1 bar for jacketed piping.

If pressure relief devices are fitted and where internal pressure may decrease below atmospheric pressure due to fluid cooling, the external pressure to be used in the calculation shall be at least the set pressure of the device.

9.1.2 Exception from verification against external pressure

For piping operating with external pressure not exceeding 1 bar, a check of design adequacy shall not be required where the following requirements are met:

— piping made of carbon steels or low alloy steels at a temperature less than or equal to 150 °C, or made of austenitic steel at a temperature less than or equal to 50 °C; and

— where $e/D_O \geq 0{,}01$; and

— where out-of-roundness, u (see EN 13480-4:2017, 7.4.1), is less than or equal to 1 %, and local flat deviation is less than or equal to *e*.

9.1.3 General acceptance criteria

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The thickness of a component under external pressure shall be not less than the thickness required by this standard for similar components under the same internal pressure using a joint coefficient of 1, (i.e. without any joint coefficient) or the thickness required by Clause 9 whichever is the greater.

There are two additional acceptability criteria which need to be checked for pipes / pressure vessels subjected to external pressure:

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a) Sufficient safety margin against linear buckling: The existing external pressure p shall be smaller than the theoretical limit of stability of the perfect shape of the piping p_m divided by a safety factor of k_m = 3.0.

$$p \leq p_m / k_m \qquad (9.1.3\text{-}1)$$

The pressure p_m may be calculated using the formulas given below for the piping elements or by linear buckling analysis (bifucation load).

b) Sufficient saftety against over-stresses due to imperfections (e.g. ovalization). The existing external pressure p shall be smaller than pressure p_{yo} at which the mean circumferential stress in the shell reaches yield point of material divided by a safety factor of k_y = 1.5.

$$p \leq p_{yo} / k_y . \qquad (9.1.3\text{-}2)$$

The pressure p_{yo} shall be calculated taking into account the initial out of roundness of the piping as well as the increase of the imperfections due to the external pressure. The calculation can be done using the provisions of this chapter or using a detailed (e.g FE) analysis including the effects of geometric distortion under pressure (geometric nonlinearity / large deformation) and the material nonlinearities in case of piping subject to external pressure in the creep range.

The allowable deviation from the design shape shall be specified on the drawing or in associated documents.

The joint coefficient of welds shall not be taken into account.