SLOVENSKI STANDARD
SIST EN 13480-3:2002/A5:2012

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

Metallic industrial piping - Part 3: Design and calculation

Industrielle metallische Rohrleitungen - Teil 3: Konstruktion und Berechnung

Tuyauteries industrielles métalliques - Partie 3: Conception et calcul

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Metallic industrial piping - Part 3: Design and calculation

Tuyauteries industrielles métalliques - Partie 3: Conception et calcul

Industrielle metallische Rohrleitungen - Teil 3: Konstruktion und Berechnung

This amendment A5 modifies the European Standard EN 13480-3:2002; it was approved by CEN on 31 December 2011.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 13480-3:2002/A5:2012) has been prepared by Technical Committee CEN/TC 267 “Industrial piping and pipelines”, the secretariat of which is held by AFNOR.

This Amendment to the European Standard EN 13480-3:2002 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2012, and conflicting national standards shall be withdrawn at the latest by November 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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 the EU Directive 97/23/EC.

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This document includes the text of the amendment itself. The corrected pages of EN 13480-3 will be delivered as issue 17 of the standard.

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

1 Modification to Clause 2

Add the following normative references:

EN 1515-2:2001, *Flanges and their joints - Bolting - Part 2: Classification of bolt materials for steel flanges, PN designated*

EN 1515-3:2005, *Flanges and their joints - Bolting - Part 3: Classification of bolt materials for steel flanges, class designated*

EN 1515-4:2010, *Flanges and their joints - Bolting - Part 4: Selection of bolting for equipment subject to the Pressure Equipment Directive 97/23/EC*

Replace

EN 25817:1992, *Arc-welded joints in steel - Guidance on quality levels for imperfections (ISO 5817:1992)*

by

EN ISO 5817:2007, *Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections (ISO 5817:2003, corrected version:2005, including Technical Corrigendum 1:2006)*

2 Modification to 3.2

Add the following line in the Table 3.2-1 "General symbols and units" between the symbols f_{cr} and p_c:

f_f	Design stress for flexibility analysis	MPa (N/mm²)

3 Modification to 4.1

In sub-clause 4.1, in the first sentence, replace "cold spring" by "cold pull". The sentence shall read as follows:

The calculation rules in this document shall apply for operating and testing conditions as well as preset, cold pull conditions, flushing and cleaning conditions.

4 Modification to 4.2.3.3

The sub-clause 4.2.3.3 shall read as follows:

The set (p_o, t_o) to be considered for the dimensioning of the elements of a piping system shall correspond to the most severe conditions of pressure and temperature which prevail simultaneously over a long time in the piping section under consideration. Thus for the thickness calculation of a component, the simultaneous conditions of pressure and temperature to be considered are the conditions which lead to the greatest thickness.

For all piping system elements, an allowable maximum pressure, based on

a) specified material (mechanical properties),

b) a given temperature,

can be easily determined by taking into account the applicable safety factors.

Temporary deviations e.g. due to pressure surge or operation of control release valve (safety valve) shall not be taken into account if the calculated stresses from such variations do not exceed the allowable stress by more than 10 % for less than 10 % of any 24 h operating period.

5 Modification to 4.2.3.4

The sub-clause 4.2.3.4 shall read as follows:

For all pressure temperature conditions (p_o, t_o) specified in 4.2.3.3 calculation pressures p_c shall be determined.

The calculation pressure p_c shall be not less than the associated operating pressure p_o, taking into account the adjustments of the safety devices. The conditions (p_o, t_o) resulting in the greatest wall thickness shall be considered with both of the following minimum conditions:

1) $p_c = p_o = PS$ with the associated t_c as defined in 4.2.3.5;

2) t_c as defined in 4.2.3.5 for $t_o = TS$ with the associated $p_c = p_o$.

NOTE If there is a condition where $p_o = PS$ and $t_o = TS$ only this condition has to be calculated.

When the calculation temperature t_c is such that the creep rupture strength characteristics are relevant for the determination of the nominal design stress, the calculation pressure shall be considered equal to the operating pressure (p_o) which is associated with the corresponding temperature (t_o).

6 Modification to 4.2.5

In sub-clauses 4.2.5.1, 4.2.5.2.3 and 4.2.5.4, the indent "cold spring" shall read as follows:

— cold pull.

7 Modification to 4.6

In the first paragraph, a second sentence shall be added and shall read as follows:

This may be completed or replaced by a "design by analysis" as described in EN 13445-3, Annex B and Annex C.

Clauses 6, 7, 8, 9, 10 and 11 describe the "design by rules" of piping components under static and cyclic loadings. The « design by rule » can be completed or replaced by a « design by analysis » as described in EN 13445-3, Annex B and Annex C, where applicable.

8 Modification to 5.2.2.1

In this sub-clause, the first indent shall read as follows:

— for $A \geq 35$ %

and the second indent shall read as follows:

— for 35 % > $A \geq 30$ %

9 Modification to 5.3.2.1

After the Table 5.3.2-1, the text shall read as follows:

If the design lifetime is not specified, the mean creep rupture strength at 200 000 h shall be used.

In cases where the 200 000 h values are not specified in the material Standards, the mean creep rupture strength at 150 000 h or 100 000 h shall be used.

If a design lifetime between 100 000 h and 200 000 h is specified, and a lifetime monitoring system is provided, divergent from Table 5.3.2-1, a safety factor SF_{CR} = 1,25 may be used.

In cases where design lifetimes shorter than 100 000 h are specified, one of the following methods shall be used:

a) If a lifetime monitoring System is not provided, the safety factor SF_{CR} shall be equal to 1,5 and shall be applied to the mean creep rupture strength at the relevant lifetime of at least 10 000 h;

b) If a lifetime monitoring system is provided, a safety factor of SF_{CR} = 1,25 may be specified with regard to the mean creep rupture strength at the relevant lifetime of at least 10 000 h. In no case shall the 1 % creep strain limit (mean value) at 100 000 h be exceeded.

The creep rupture strength associated to the specified lifetime shall be interpolated based on a logarithmic time axis as well as a logarithmic stress axis (double logarithmic interpolation scheme).

10 Modification to 6.4.2.1

Replace Figures 6.4.2-1 and 6.4.2-2 as follows:

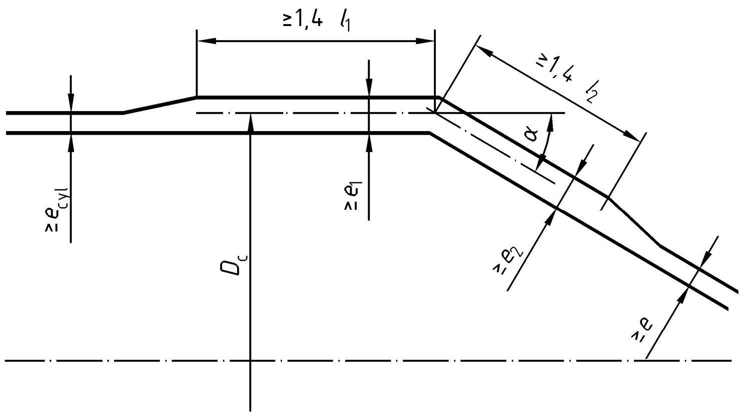

Figure 6.4.2-1 – Geometry of cone/cylinder intersection without knuckle – Large end

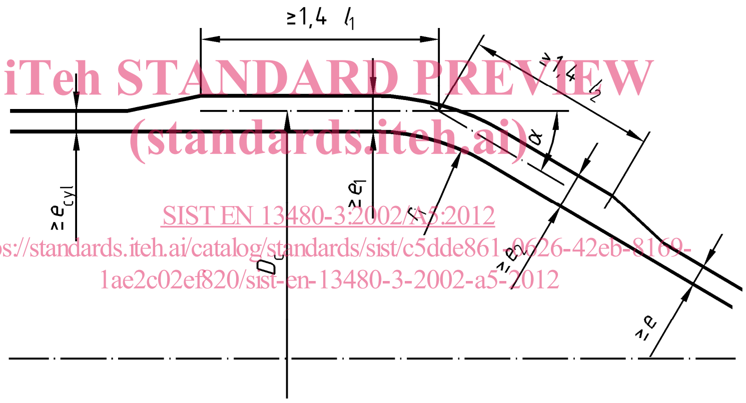

Figure 6.4.2-2 — Geometry of cone/cylinder intersection with knuckle – Large end

11 Modification to 6.4.5

After the equation (6.4.5-2), add the following text:

The length of the cone can be reduced to less than $2l_2$ if both of the following conditions are fulfilled:

— the wall thickness e_2, calculated in accordance with 6.4.6 or 6.4.7, is existent along the whole length of the cone;

— the junction at the small end of the cone is sufficiently dimensioned according to 6.4.8.

12 Modification to 6.4.6.1

The indent 2) shall read as follows:

2) the weld at the junction shall be subject to 100 % non-destructive examination, either by radiography or ultrasonic techniques, unless the design is such that the thickness at the weld exceeds 1,4e_j, in which case the normal rules for the relevant design shall be applied.

13 Modification to 6.4.7.2

After equation (6.4.7-1), correct equation (6.4.7-2) as follows:

$$\rho = \frac{0{,}028 r_i}{\sqrt{D_c\, e_j}} \; \frac{\alpha}{1 + 1/\sqrt{\cos\alpha}} \qquad (6.4.7\text{-}2)$$

14 Modification to 6.4.8.1

Replace Figure 6.4.8.1-1 as follows:

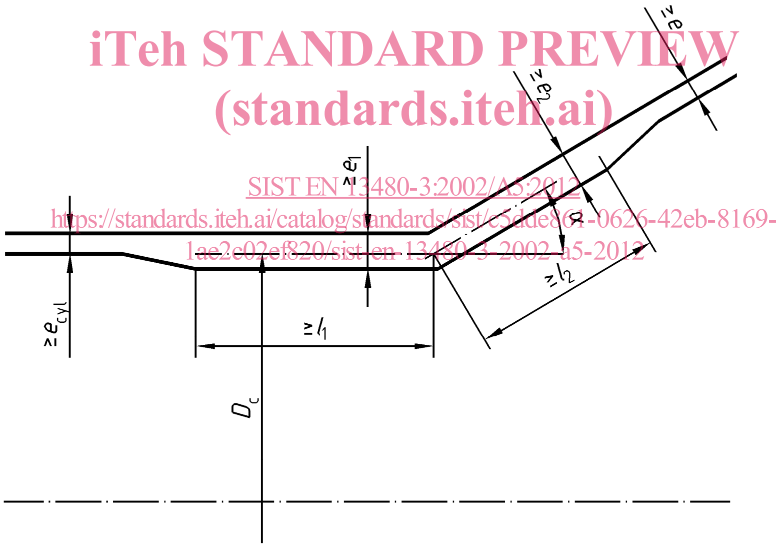

Figure 6.4.8.1-1 — Geometry of cone/cylinder intersection: small end

15 Modification to 6.4.10

After equation (6.4.10-4), add a new equation (6.4.10-5) as follows:

$$e_{r} = \max\{e_{cyl}; e_j\} \qquad (6.4.10\text{-}5)$$

With e_{cyl} according to 6.1 and e_j according to equation (6.4.7-4).

After the last sentence of clause 6.4.10, add the new Figures 6.4.10-1 and 6.4.10-2 as follows:

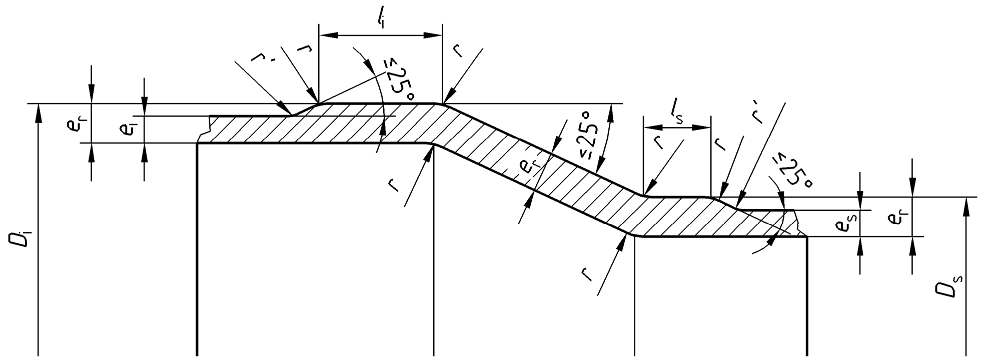

Figure 6.4.10-1 — Special forged reducer

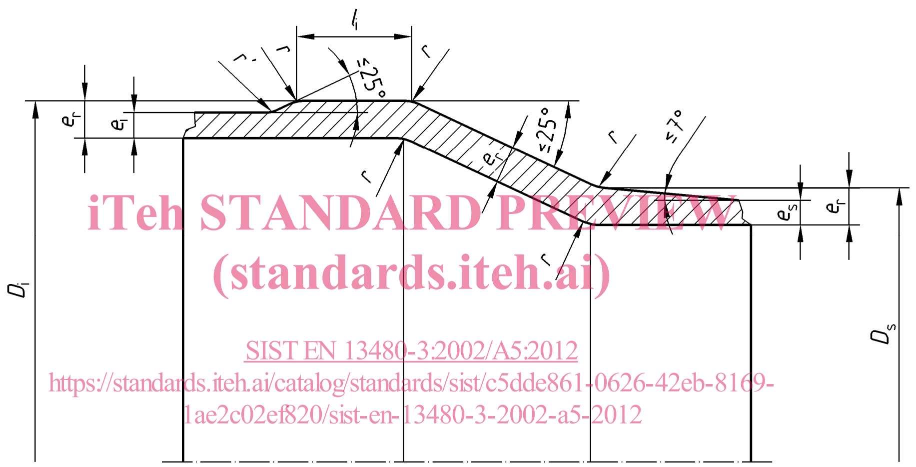

Figure 6.4.10-2 — Special forged reducer (alternative solution)

16 Modification to 6.6

The clause 6.6 shall read as follows:

6.6.1 General

The rules of this sub-clause are to check the mechanical resistance of the flange connection subjected to static loads. It is also in the responsibility of the designer to ensure the adequacy of the flange connection (gasket type and characteristics, etc) with the operating conditions, in particular with regards to any specific required tightness.

If there is a specific requirement on tightness for the flange connection, this shall be calculated in accordance with EN 1591-1, using Annex P.

The designer shall consider section loadings caused by the connected piping system.

The classification of material for flanges, bolts and nuts is given by EN 1515-2 (PN flanges) and EN 1515-3 (Class flanges). The selection of bolting shall comply with Annex D or Annex P and EN 1515-4.

6.6.2 Symbols

For the purposes of 6.6, the symbols given in Table 6.6.2-1 shall apply in addition to those given in Table 3.2-1.

Table 6.6.2-1 — Additional symbols for the purposes of 6.6

Symbol	Description	Unit
P_{eq}	Equivalent design pressure	MPa (N/mm^2)
P	Internal calculation pressure	MPa (N/mm^2)
F	Pulling axial force (to be a positive value in equation)	N
M	External bending moment	N mm
G	Diameter of gasket load reaction	mm

6.6.3 Standard flange

A standard steel flange connection in accordance with defined material requirements, giving the maximum allowable pressure with regards to the flange materials and the design temperature, may be used within the construction of piping subjected to internal pressure, without the necessity of carrying out a calculation to verify its resistance when the following conditions are met:

a) For each normal working condition, the design pressure shall not exceed the maximum allowable pressure specified.

b) For conditions where the flange connection is simultaneously subjected to internal pressure, axial load and bending moment, the equivalent design pressure, P_{eq}, according to equation (6.6.2-1) shall not exceed the limits specified in a).

$$P_{eq} = P + \frac{4F}{\pi G^2} + \frac{16|M|}{\pi G^3} \qquad (6.6.2\text{-}1)$$

Where:

G is the diameter of circle on which applies the compression load of the gasket (normally the mean diameter of the gasket).

c) The gasket types, for each PN, are specified in EN 1514-1 to EN 1514-8.

d) The strength of the bolting for the flange connection, for each PN, shall be as indicated in EN 1515-1 to 4.

e) The difference of temperature between the flanges and the bolting shall not exceed, 50 °C in any case.

f) If the design temperature is ≥ 120 °C, the thermal expansion coefficient of the flange material shall not exceed the thermal expansion coefficient of the bolt material by more than 10 %.

6.6.4 Non-standard flange

If a non-standard flange is used, the design shall be done by applying the calculation method in EN 1591-1, using for example Annex P, or by applying the algorithm shown in the Taylor-Forge method, using for example Annex D.

NOTE 1 The Taylor-Forge method does not ensure tightness.

NOTE 2 The algorithm given in EN 1591-1 includes a consideration of section loadings.

NOTE 3 The bolt torque should be specified by the designer. Attention should be paid in such cases to the method of tightening. Guidance of scatter band when applying the different methods of tightening are given in EN 1591-1.

17 Modification to 7.1.3

The beginning of the sub-clause 7.1.3 shall read as follows:

This sub-clause shall apply provided that the following conditions are simultaneously fulfilled:

$r_i \leq 0{,}2 D_i$

$r_i \geq 0{,}06 D_i$

$r_i \geq 2 e$

$0{,}001 D_i \leq e \leq 0{,}08 D_i$

$R_i \leq D_o$

After equation (7.1.3-8), the NOTE shall read as follows:

NOTE Where $e_{kn\ y} > 0{,}005\ D_i$, it is not necessary to calculate $e_{kn\ b}$ or $p_{kn\ b}$.

18 Modification to 7.2.3.3

Delete Equation (7.2.3-12).

Equation (7.2.3-15) shall read as follows:

$$F = \left(\frac{3}{8} U\ g + \frac{3}{16} \left(2g^2 - g^4 \right) \frac{D_i + e_{eq}}{e_{eq}} - 2J \frac{e_{eq}}{D_i + e_{eq}} \right) H^2 - 3 \left(2 - \nu \quad g \right) g \frac{e_{eq}}{D_i + e_{eq}} \qquad (7.2.3\text{-}15)$$

Equation (7.2.3-16) shall read as follows:

$$G = \left[\frac{3}{8} \left(2g^2 - g^4 \right) - 2J \left(\frac{e_{eq}}{D_i + e_{eq}} \right)^2 \right] H \qquad (7.2.3\text{-}16)$$

19 Modification to 7.2.3.4

After equation (7.2.3-28), the sentence shall read as follows:

The minimum wall thickness of the cylindrical part, e_{eq}, shall be in accordance with 6.1 and for nominal design stress $f = \min(f_1 ; f_2)$. The minimum radius of the stress-relief groove, r_i, shall be max (0,25 e_{eq}, 5 mm) (see Figure 7.2.3-5).